C13. INTERFATA PARALELA PROGRAMABILA (PPI) I8255A (PIO)

1.Descriere PIO
2. Arhitectura PIO
3. Programare PIO
4. PIO in PC
5. Aplicatii

http://www.advancedmsinc.com/iocards/8255.htm
http://www.eisti.fr/~ga/phy/iitr/ii05/tr.pdf

1. Descriere PIO

- I8255A implementeaza o interfata paralela programabila pentru operatii I/O
- I8255A are 24 I/O care se pot programa in 2 grupuri
- PIO opereaza in urmatoarele 3 moduri:

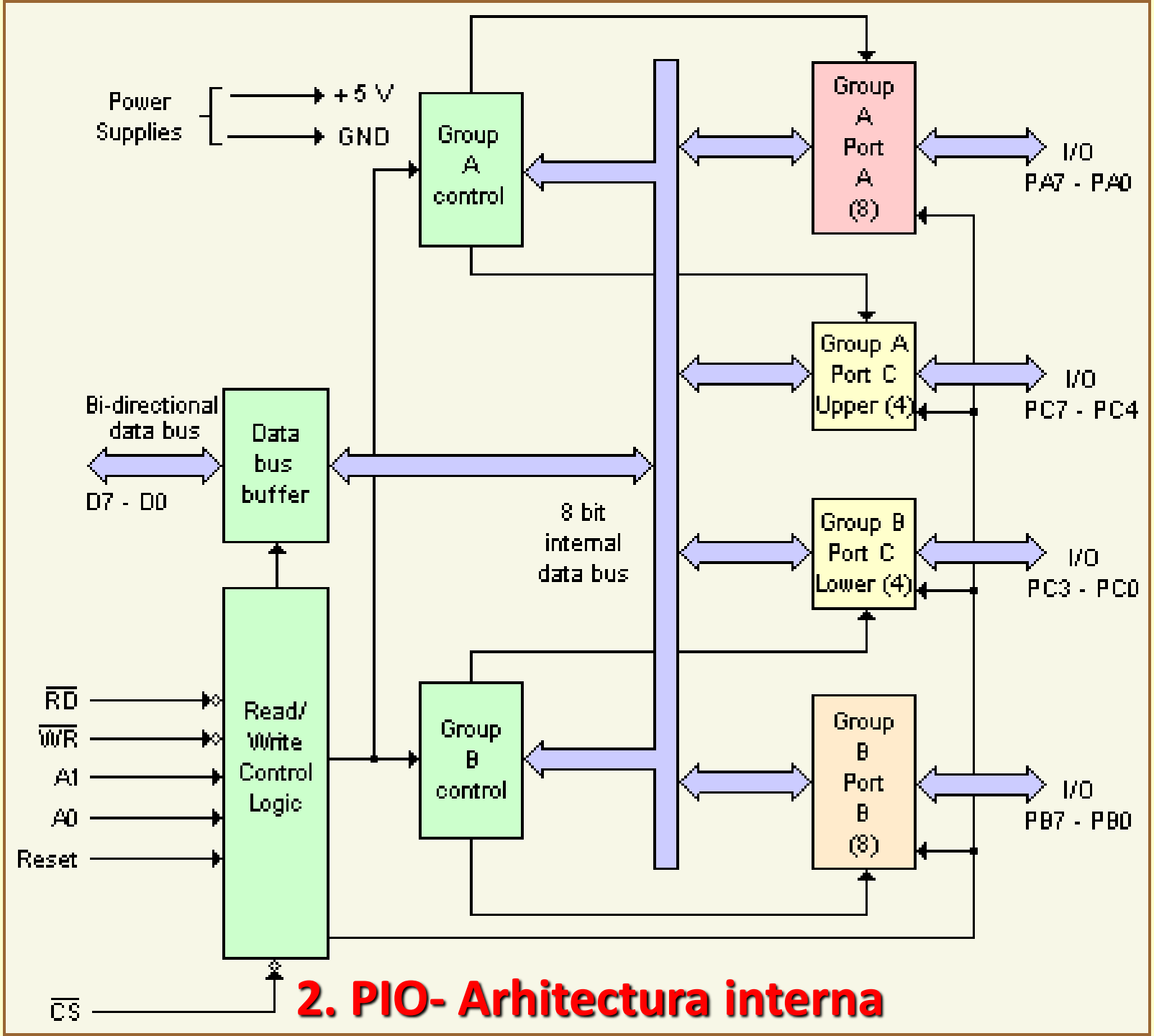
Mod 0: Basic Input/Output —Port A, port B, port C (H&L) pot fi configurate independent ca I/O pentru citire sau pastrare date (iesirile sunt pe registre intrarile nu)

Mod 1: Strobed Input/Output —Port A si port B

Pot fi independent configurate ca busuri de intrare sau iesire strobate

Semnalele de la portul C sunt rezervate ptr. semnale de control (handshake)

Mod 2: Bidirectional Bus —Port A poate fi configurat ca bus bidirectional, port C furnizeaza semnalele de control; portul B poate lucra in mod 0 sau mod 1.

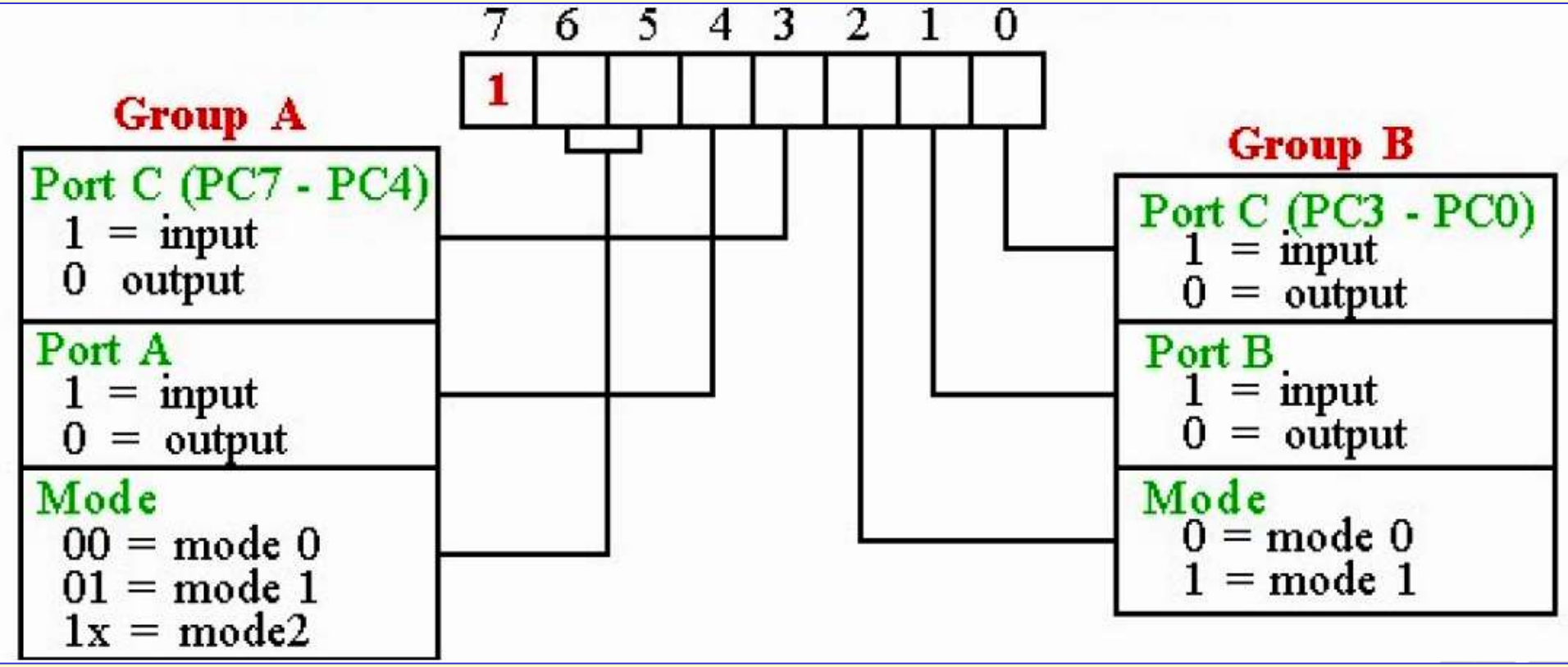


2. PIO- Arhitectura interna

Adrese		Registre
A1	A0	Registru/Port
0	0	Port A data (all modes)
0	1	Port B data (all modes)
1	0	Port C data (mode 0) and status (modes 1 and 2)
1	1	Control register mode definition and port C bit set/reset

- **adresele PIO rezervate in PC: 60h-63h ;**
- **La PC-AT PIO inlocuit cu microcontroler , adr. 60h-64h**

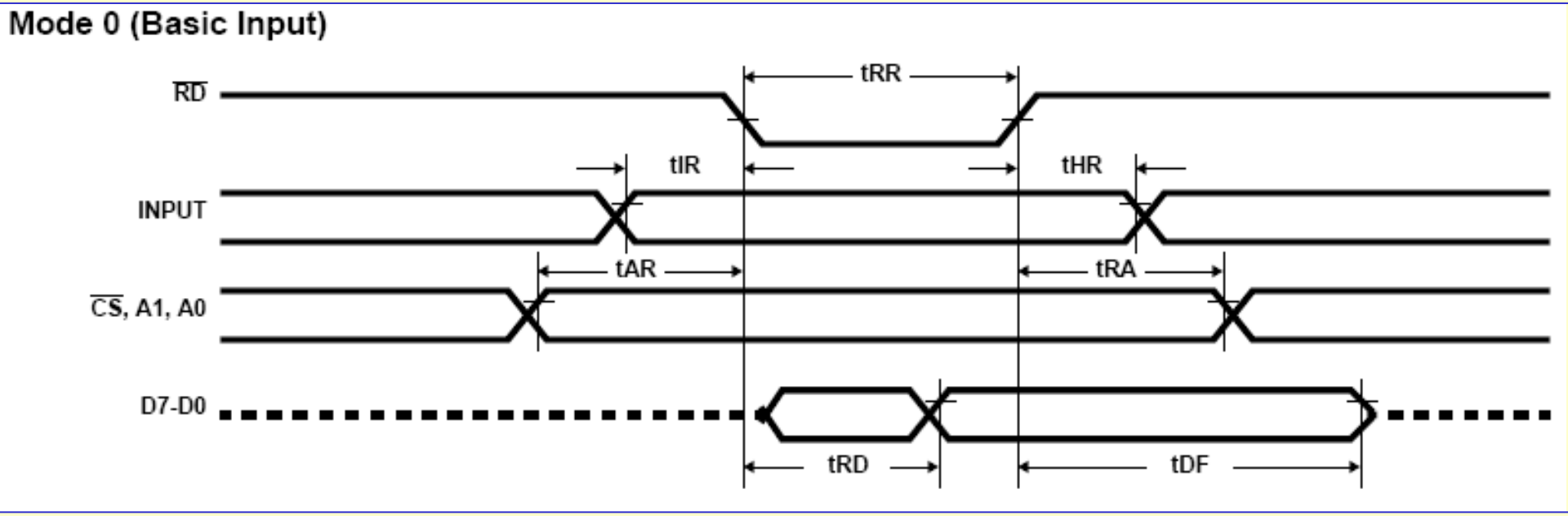
3. Programare PIO

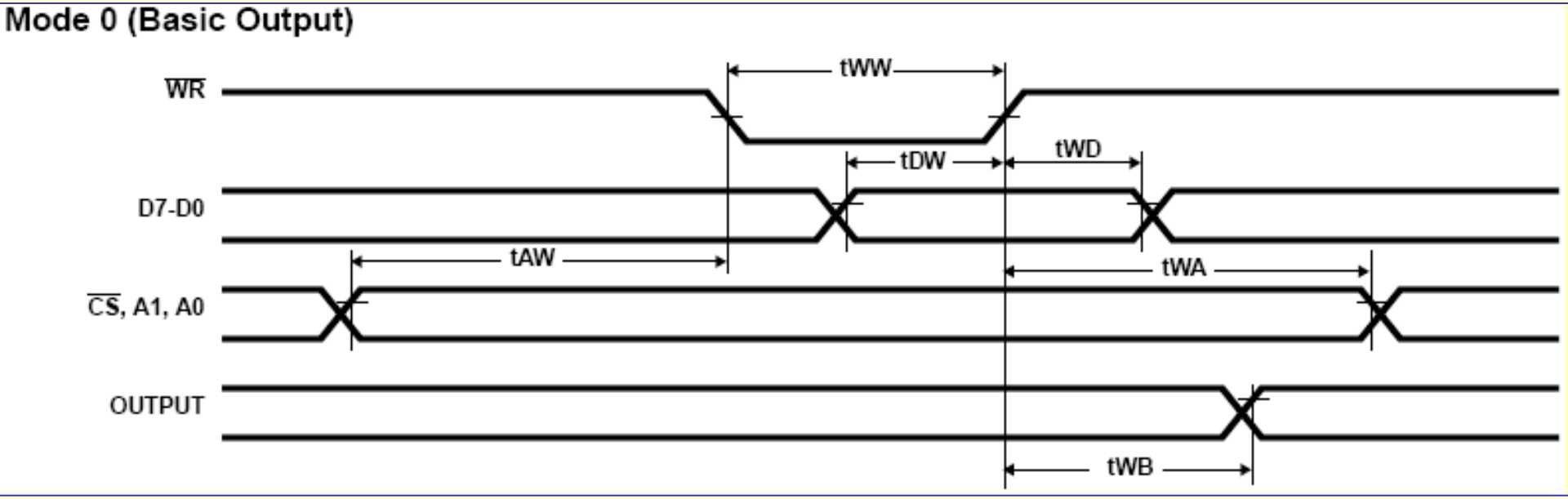


1 = I / O Mode

0 = BSR Mode

Mode 0: Basic Input/Output (D7=1, D6=D5=D2=0)

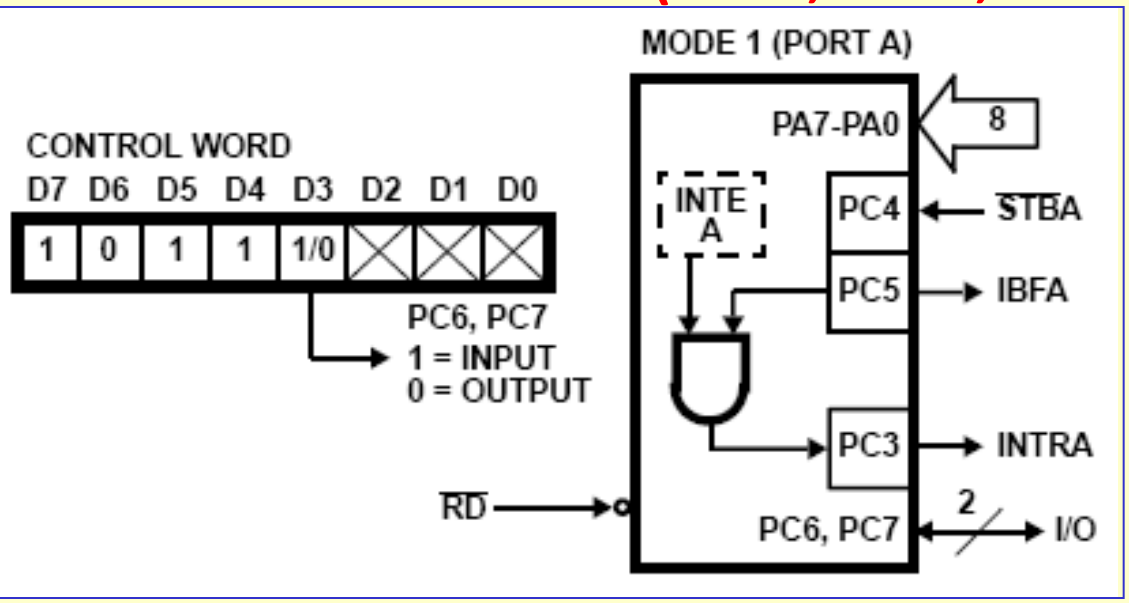


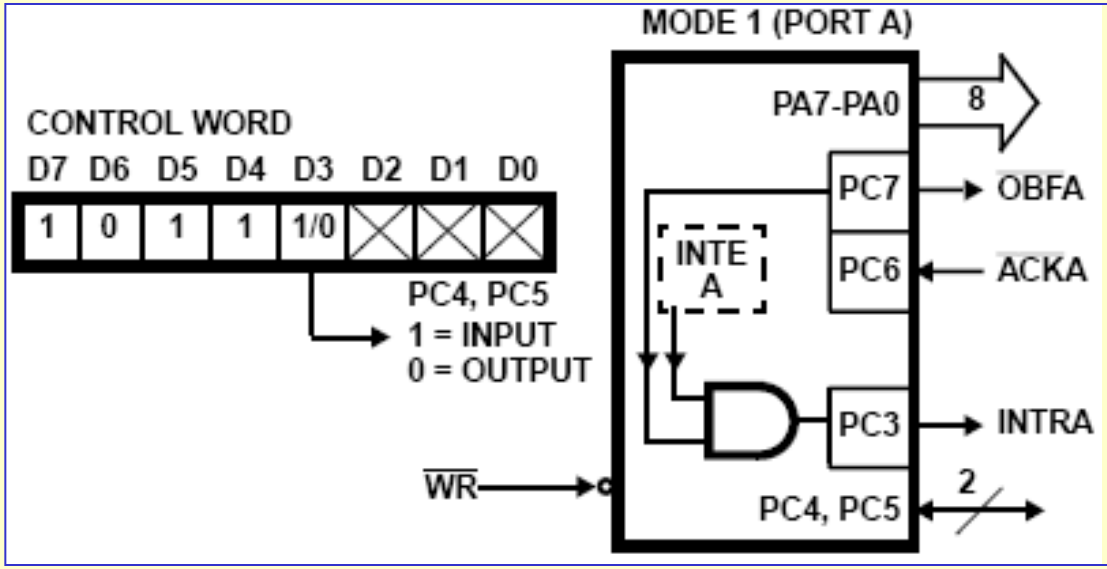


Mode 0. Formele de unda pentru operatiile de I/O

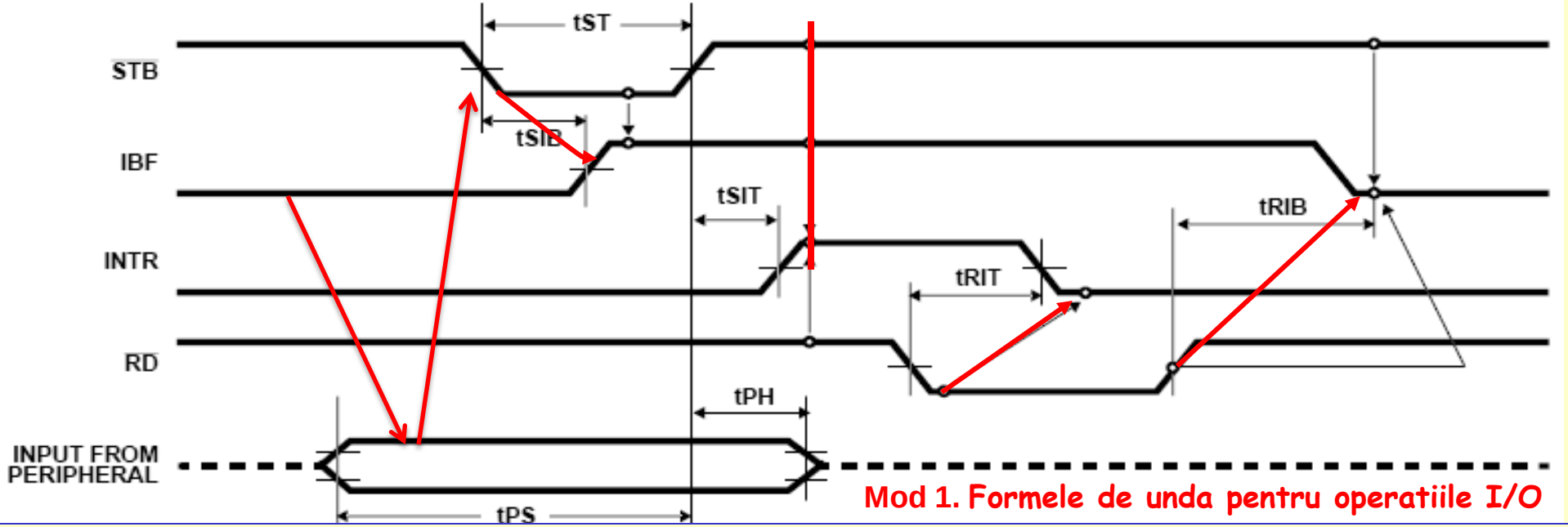
Mode 1: Strobed Input/Output

(D7=1, D6=0, D5=D2=1)





Configurarea porturilor A,C ca IN/OUT



Mod 1. Formele de unda pentru operatiile I/O

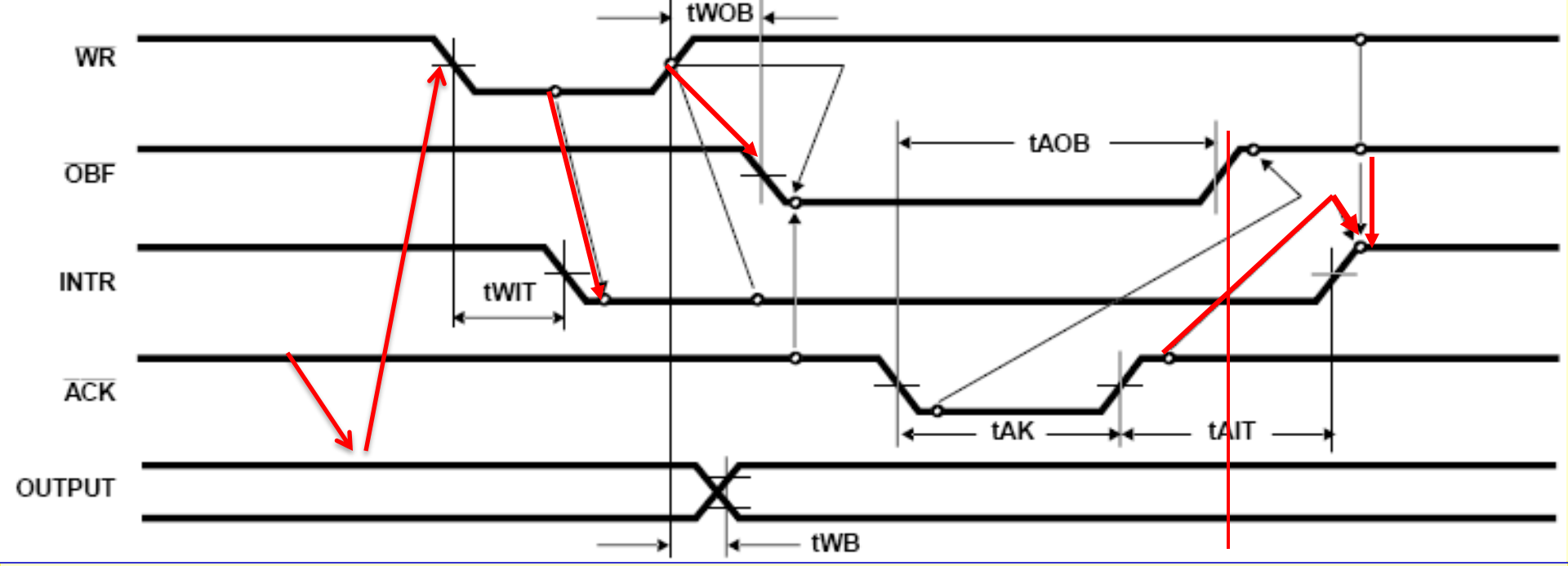
Input Control Signal Definition

STB (Strobe Input)
A “low” on this input loads data into the input latch

IBF (Input Buffer Full F/F)
A “high” on this output indicates that the data has been loaded into the input latch: in essence, and acknowledgement. IBF is set by STB input being low and is reset by the rising edge of the RD input.

INTR (Interrupt Request)
A “high” on this output can be used to interrupt the CPU when and input device is requesting service. INTR is set by the condition: STB is a “one”, IBF is a “one” and INTE is a “one”. It is reset by the falling edge of RD. This procedure allows an input device to request service from the CPU by simply strobbing its data into the port.

INTE A Controlled by bit set/reset of PC4.
INTE B Controlled by bit set/reset of PC2.



Output Control Signal Definition

-OBF – (Output Buffer Full F/F) The OBF output will go “low” to indicate that the CPU has written data out to the specified port. This does not mean valid data is sent out of the part at this time since OBF can go true before data is available. Data is guaranteed valid at the rising edge of OBF. The OBF F/F will be set by the rising edge of the WR input and reset by ACK input being low.

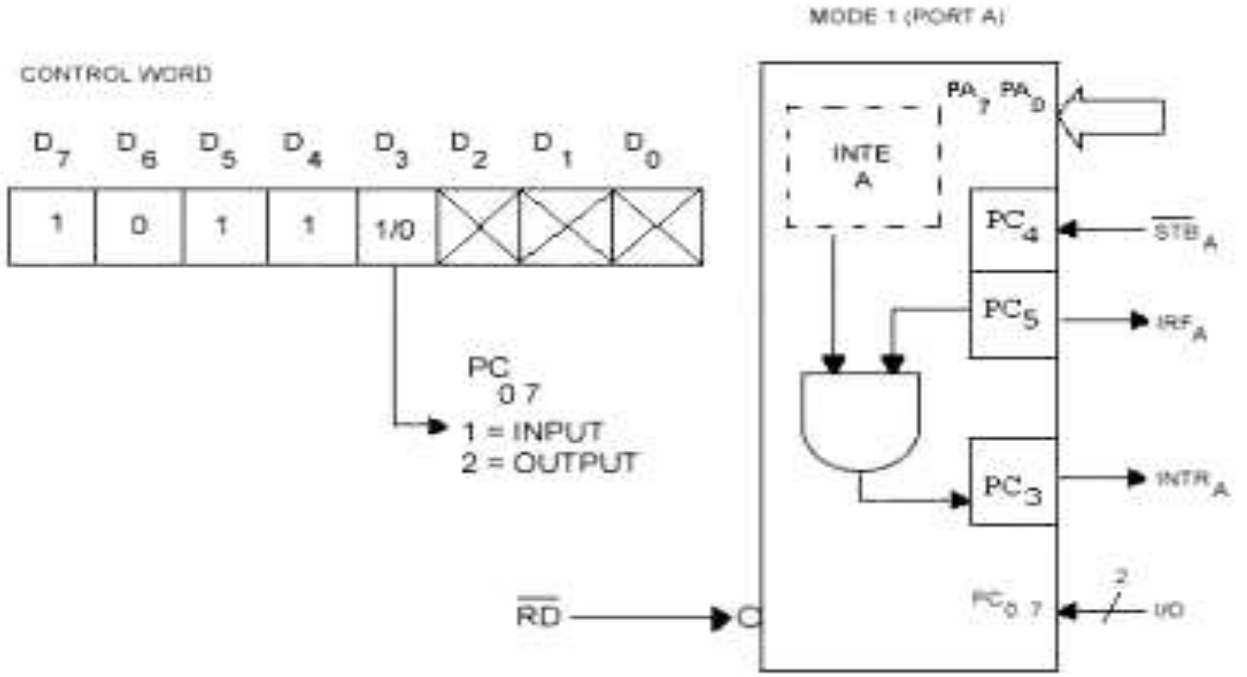
-ACK – (Acknowledge Input). A “low” on this input informs the 8255A that the data from Port A /Port B is ready to be accepted. In essence, a response from the peripheral device indicating that it is ready to accept data.

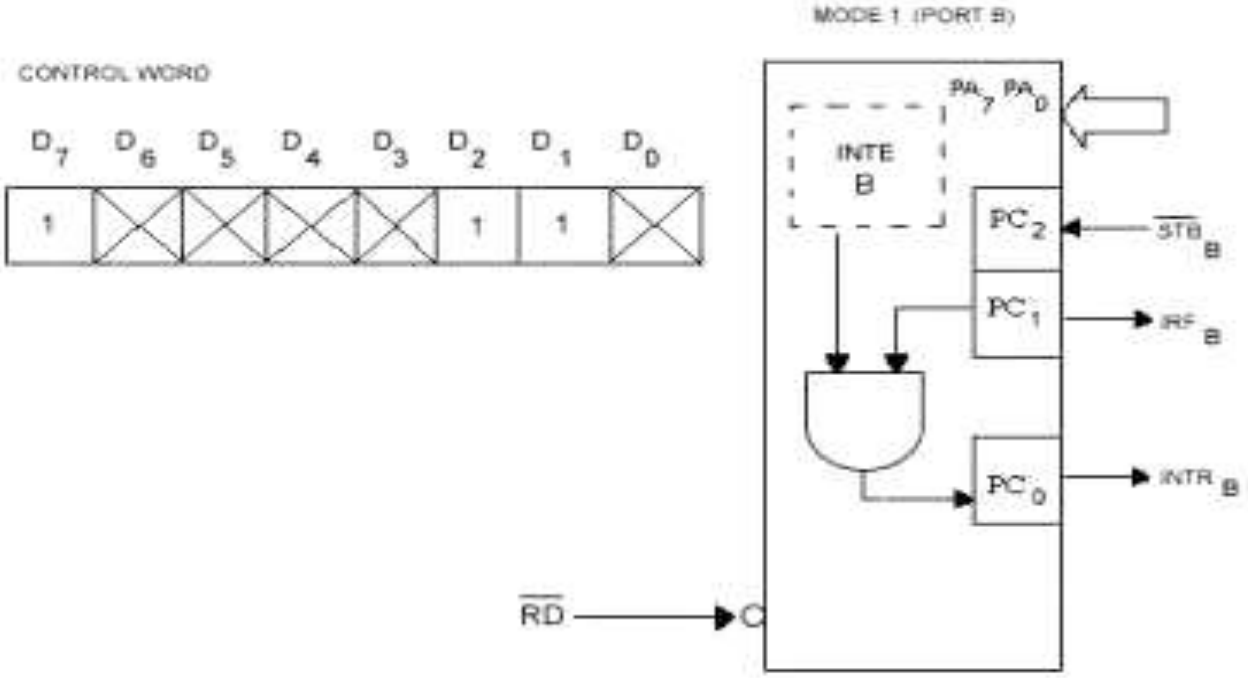
INTR - (Interrupt Request). A “high” on this output can be used to interrupt the CPU when an output device has accepted data transmitted by the CPU. INTR is set when ACK is a “one”, OBF is a “one” and INTE is a “one”. It is reset by the falling edge of WR.

INTE A Controlled by Bit Set/Reset of PC6.
INTE B Controlled by Bit Set/Reset of PC2.

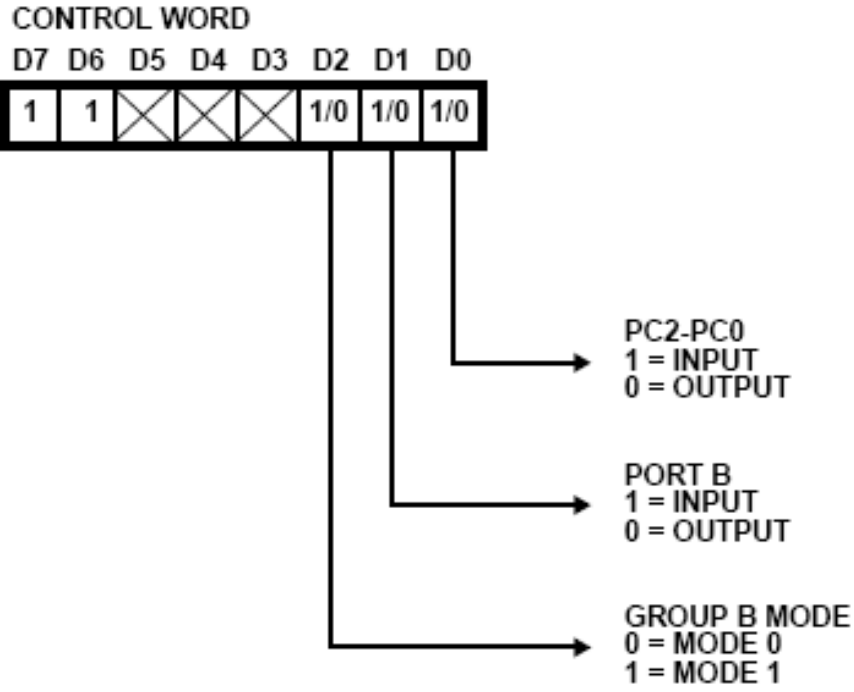
Port C with Port A & Port B Both Configured as Mode 1

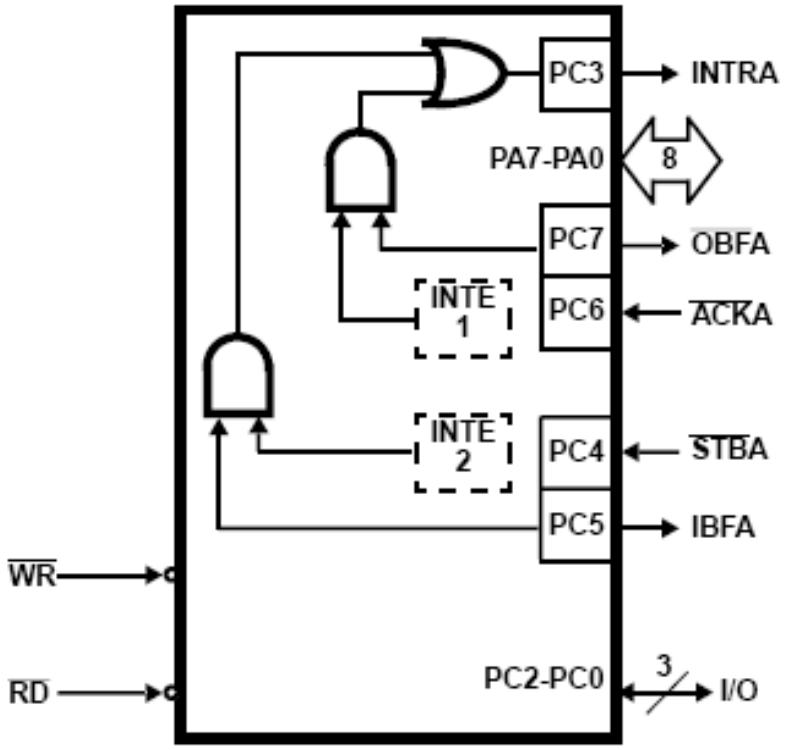
Bit	Mode 1 Input	Mode 1 Output	Description
PC0	intrb	intrb	Always output.
PC1	ibfb	-obfb	Always output.
PC2	-stbb	-ackb	Always input.
PC3	intra	intra	Always output.
PC4	-stba	I/O	I/O direction configured by bit 3 of the control register in “mode 1 output.”
PC5	ibfa	I/O	I/O direction configured by bit 3 of the control register in “mode 1 output.”
PC6	I/O	-acka	I/O direction configured by bit 3 of the control register in “mode 1 input.”
PC7	I/O	-obfa	I/O direction configured by bit 3 of the control register in “mode 1 input.”

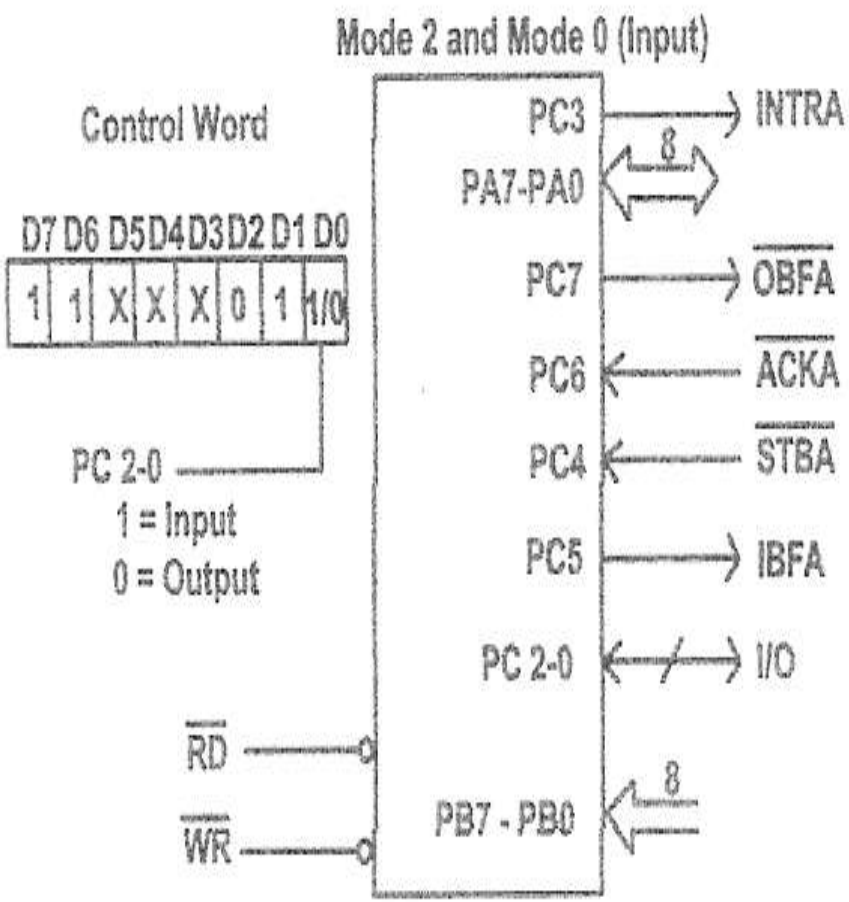

MODE 1 (PORT A)
CONTROL WORD
D7 D6 D5 D4 D3 D2 D1 D0
1 0 1 1 I/O
PC 0 7
1 = INPUT
2 = OUTPUT
INTE A
PA7 PA0
PC4
STBA
PC5
IBFA
PC3
INTRA
RD
C
PC0 7
2
I/O

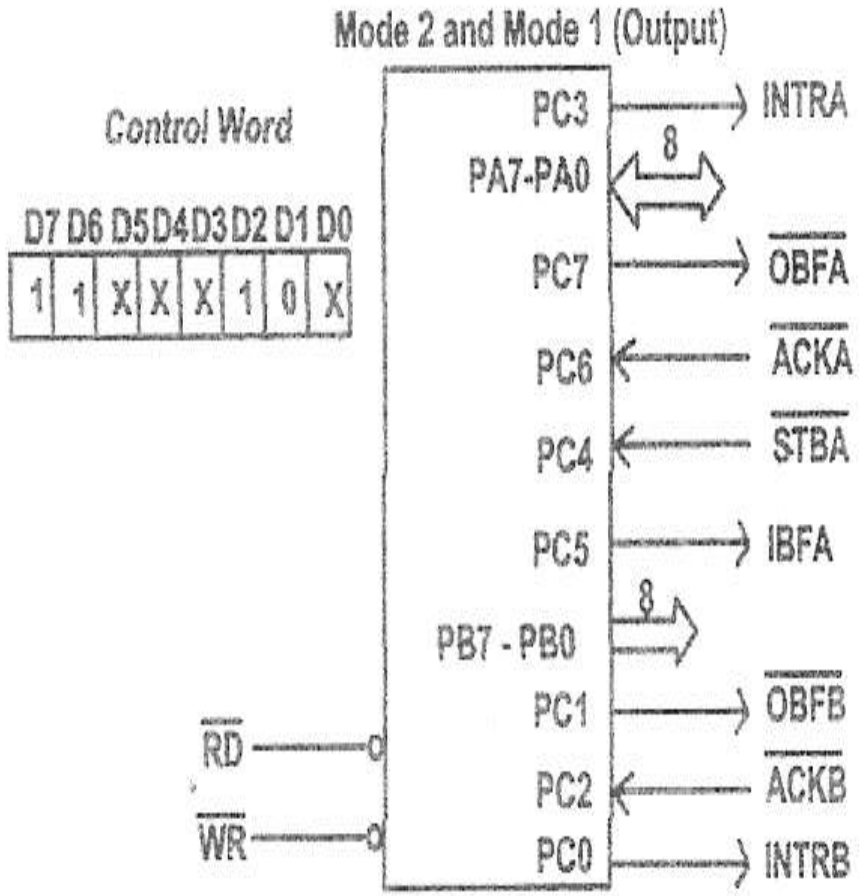

MODE 1 (PORT B)
CONTROL WORD
D7 D6 D5 D4 D3 D2 D1 D0
1 1 1
INTE B
PA7 PA0
PC2
STBB
PC1
IBFB
PC0
INTRB
RD
C

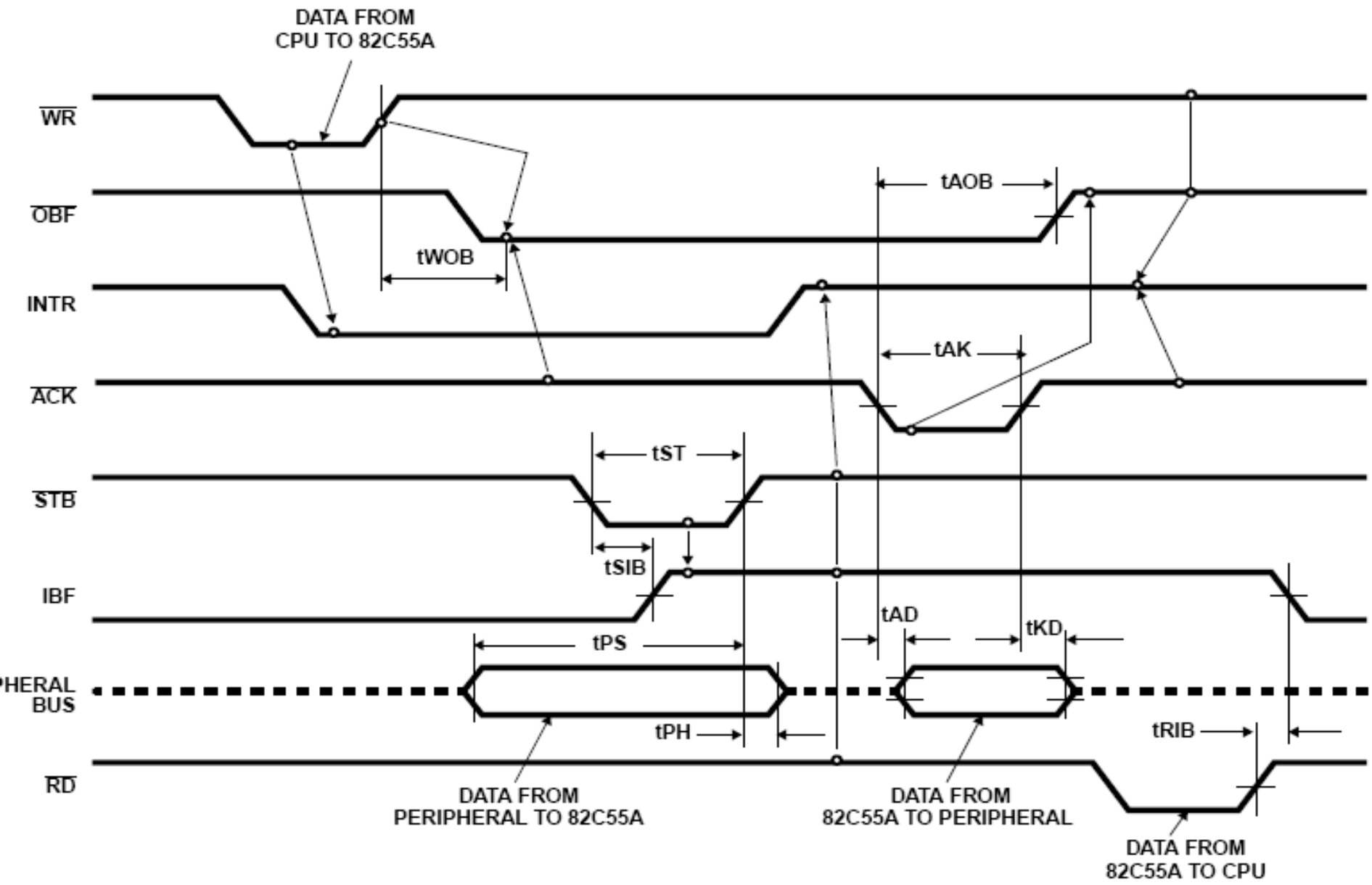
Mode 2: Strobed Bidirectional Bus
(D7=1, D6=1, D5=D2=XX)





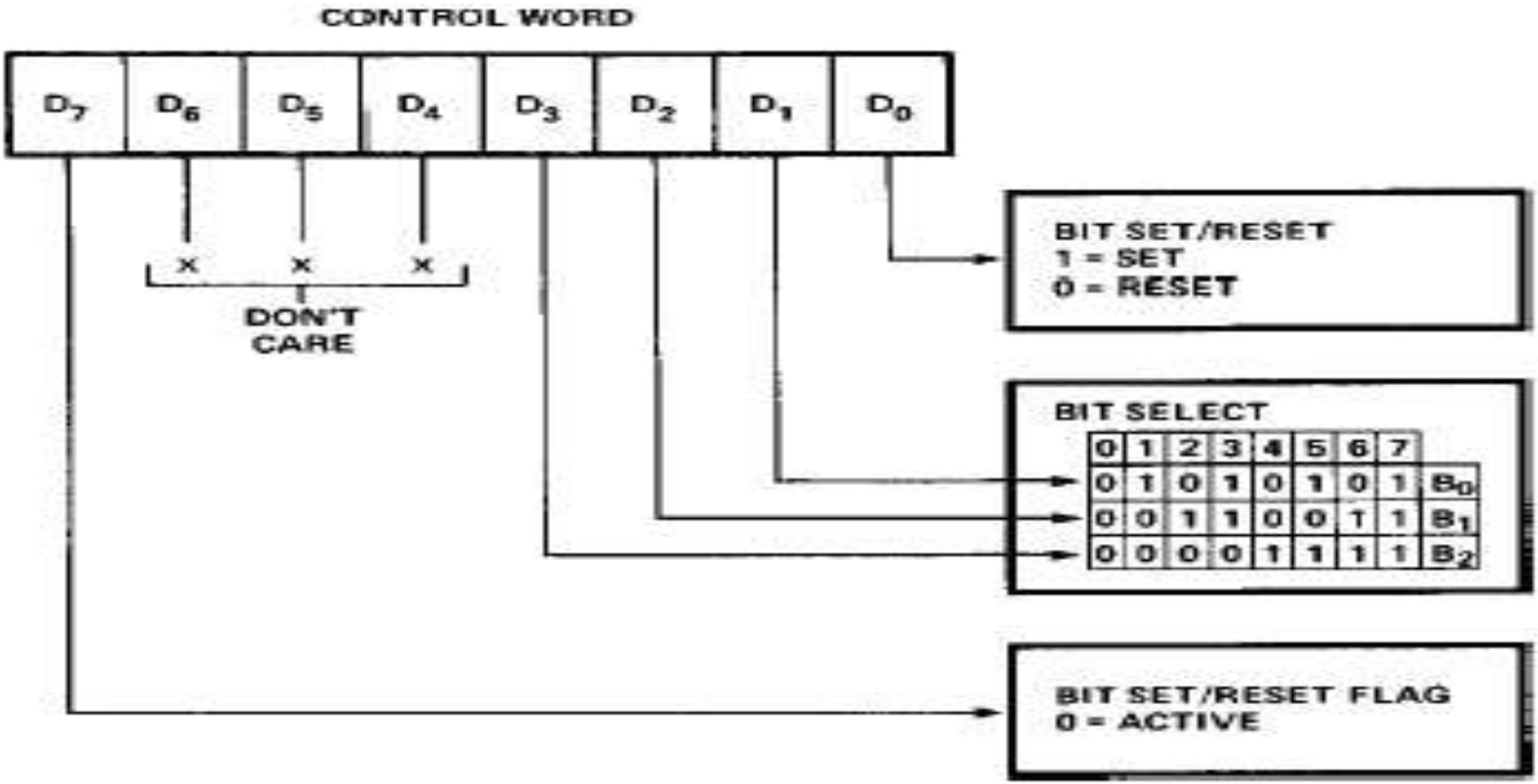

Mode 2 and Mode 0 (Input)
Control Word
D7 D6 D5 D4 D3 D2 D1 D0
1 1 X X X 0 1 1/0
PC 2-0
1 = Input
0 = Output
PC3
INTRA
8
PA7-PA0
PC7
OBFA
PC6
ACKA
PC4
STBA
PC5
IBFA
PC 2-0
I/O
RD
WR
PB7 - PB0
8


Mode 2 and Mode 1 (Output)
Control Word
D7 D6 D5 D4 D3 D2 D1 D0
1 1 X X X 1 0 X
PC3
INTRA
8
PA7-PA0
PC7
OBFA
PC6
ACKA
PC4
STBA
PC5
IBFA
8
PB7 - PB0
PC1
OBFB
PC2
ACKB
PC0
INTRB
RD
WR



Any sequence where $\overline{WR}$ occurs before $\overline{ACK}$ and $\overline{STB}$ occurs before RD is permissible. (INTR = IBF • MASK • $\overline{STB}$ • $\overline{RD}$ + $\overline{OBF}$ • MASK • $\overline{ACK}$ • $\overline{WR}$)

Mod 2. Formele de unda pentru operatiile I/O

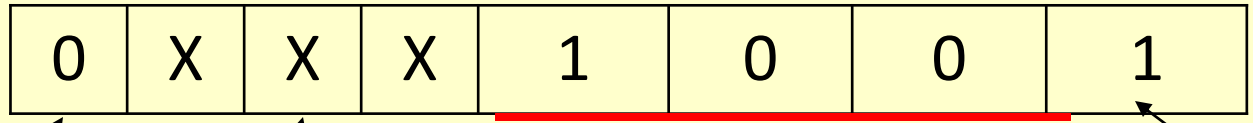


C port bits set/reset

1 = I / O Mode

0 = BSR Mode

Ex. 1: Setez bitul 4 al Portului C la 1 (Adr port A 7Ch)



= 09H,…

Bit set / reset mode

Don’t cares

Bit 4 al C

Set to 1

MOV AL, 09H

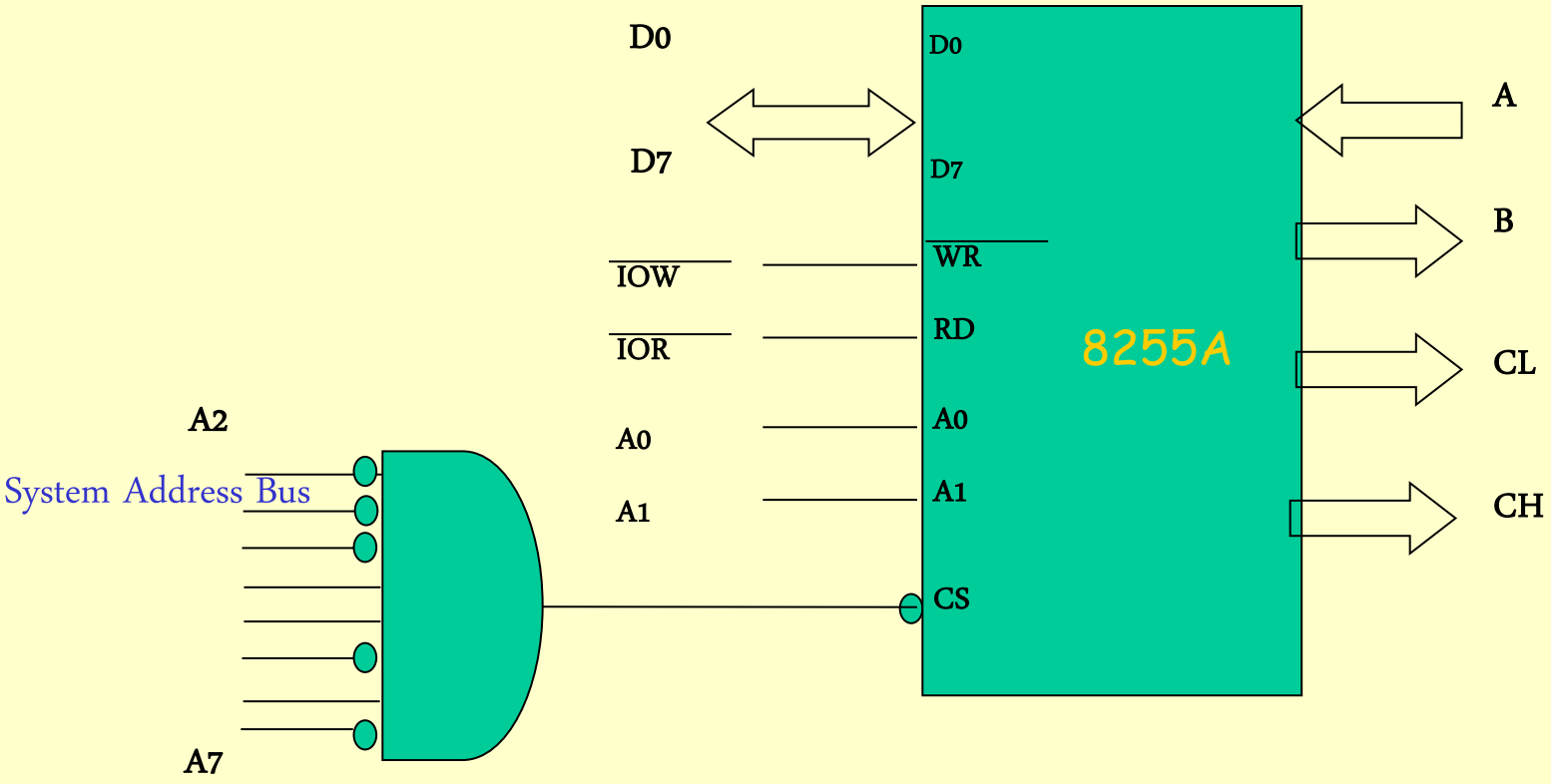
OUT 7FH, AL

8255 Modurile de lucru -rezumat

	MODE 0		MODE 1		MODE 2
	IN	OUT	IN	OUT	GROUP A ONLY
PA_0	IN	OUT	IN	OUT	↔
PA_1	IN	OUT	IN	OUT	↔
PA_2	IN	OUT	IN	OUT	↔
PA_3	IN	OUT	IN	OUT	↔
PA_4	IN	OUT	IN	OUT	↔
PA_5	IN	OUT	IN	OUT	↔
PA_6	IN	OUT	IN	OUT	↔
PA_7	IN	OUT	IN	OUT	↔
PB_0	IN	OUT	IN	OUT	—
PB_1	IN	OUT	IN	OUT	—
PB_2	IN	OUT	IN	OUT	—
PB_3	IN	OUT	IN	OUT	—
PB_4	IN	OUT	IN	OUT	—
PB_5	IN	OUT	IN	OUT	—
PB_6	IN	OUT	IN	OUT	—
PB_7	IN	OUT	IN	OUT	—
PC_0	IN	OUT	$INTR_B$	$INTR_B$	I/O
PC_1	IN	OUT	IBF_B	$\overline{OBF}_B$	I/O
PC_2	IN	OUT	$\overline{STB}_B$	$\overline{ACK}_B$	I/O
PC_3	IN	OUT	$INTR_A$	$INTR_A$	$INTR_A$
PC_4	IN	OUT	$\overline{STB}_A$	I/O	$\overline{STB}_A$
PC_5	IN	OUT	IBF_A	I/O	IBF_A
PC_6	IN	OUT	I/O	$\overline{ACK}_A$	$\overline{ACK}_A$
PC_7	IN	OUT	I/O	$\overline{OBF}_A$	$\overline{OBF}_A$

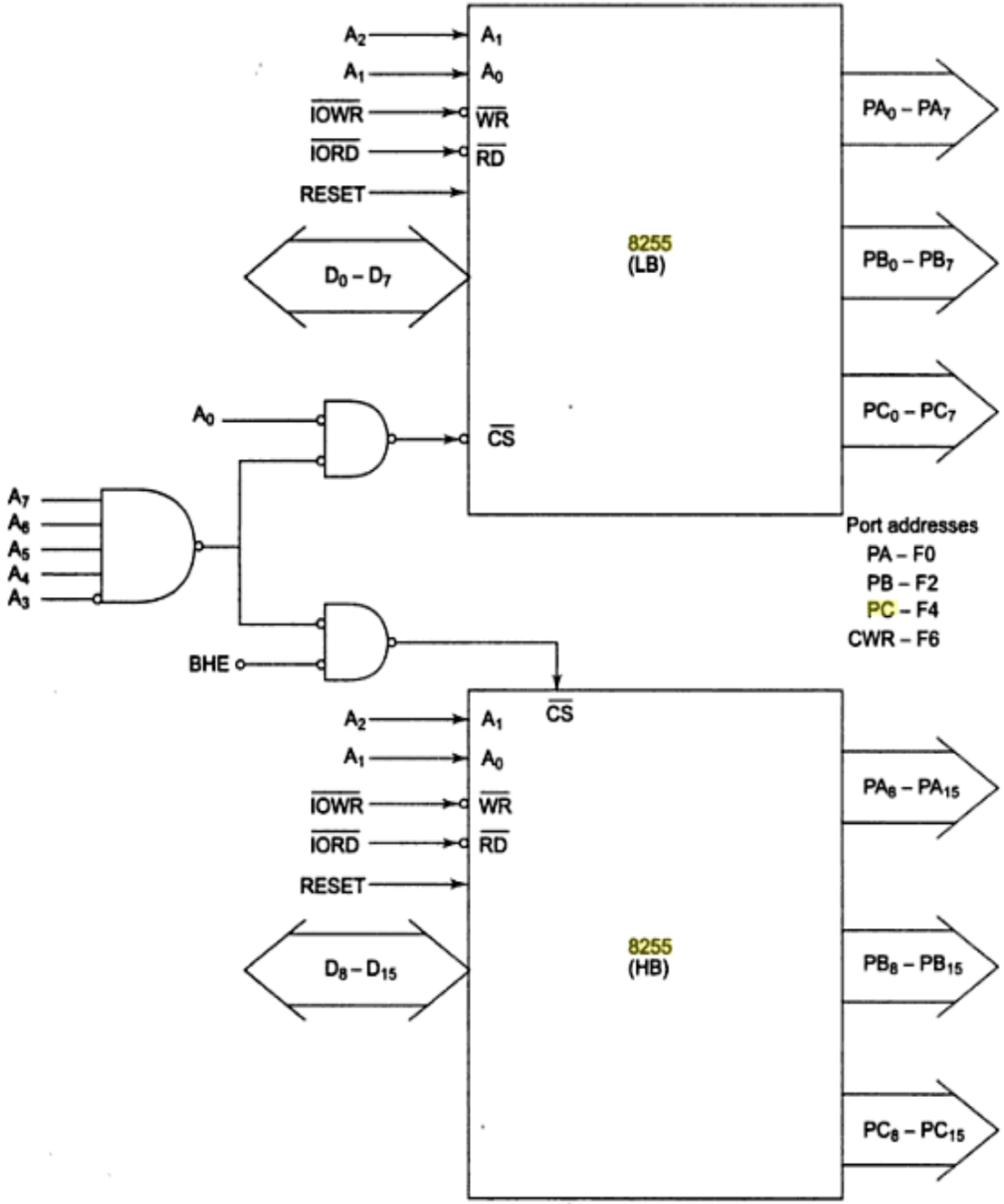
4. Aplicatii cu PIO.

Implementarea porturilor pe 16 biti

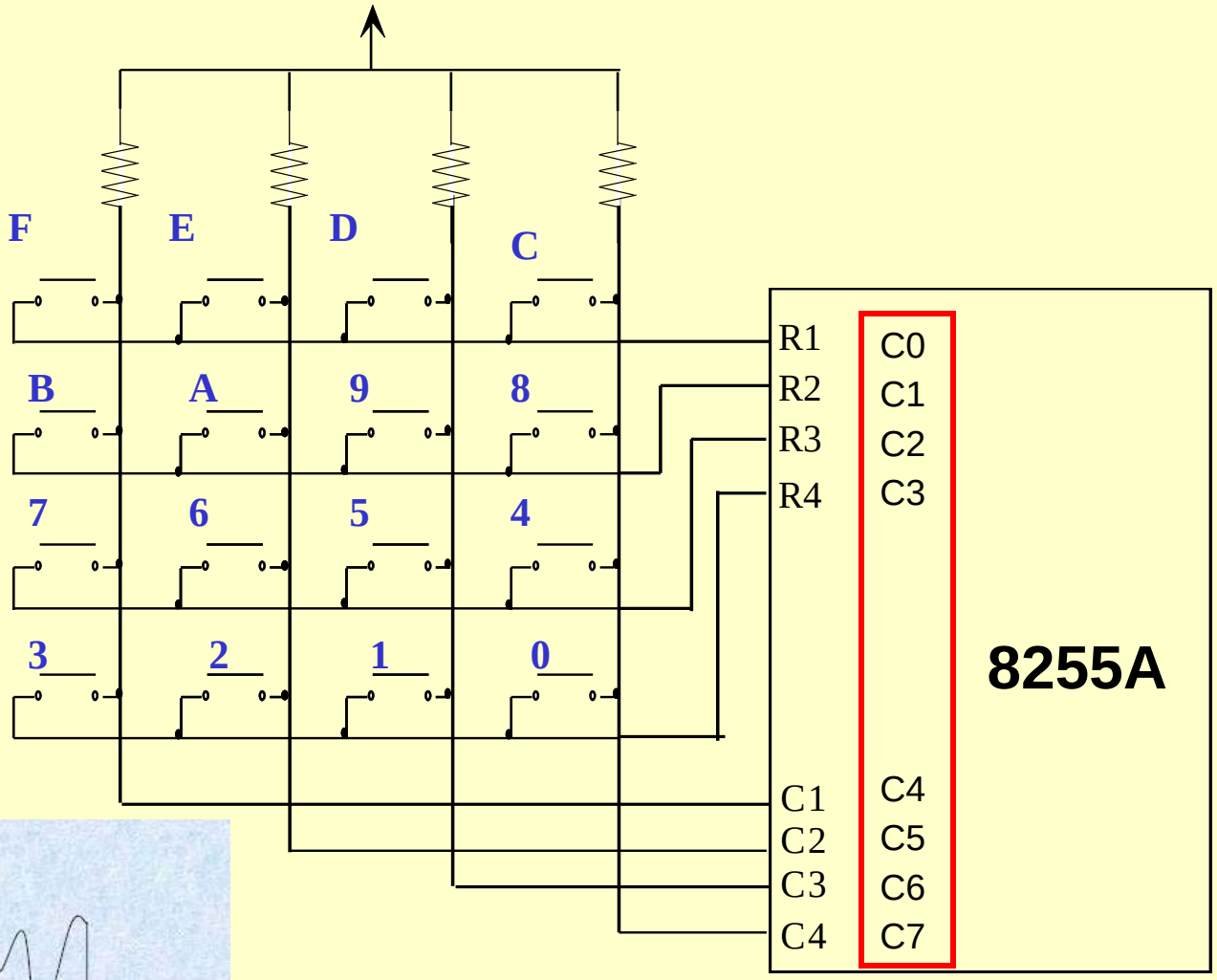


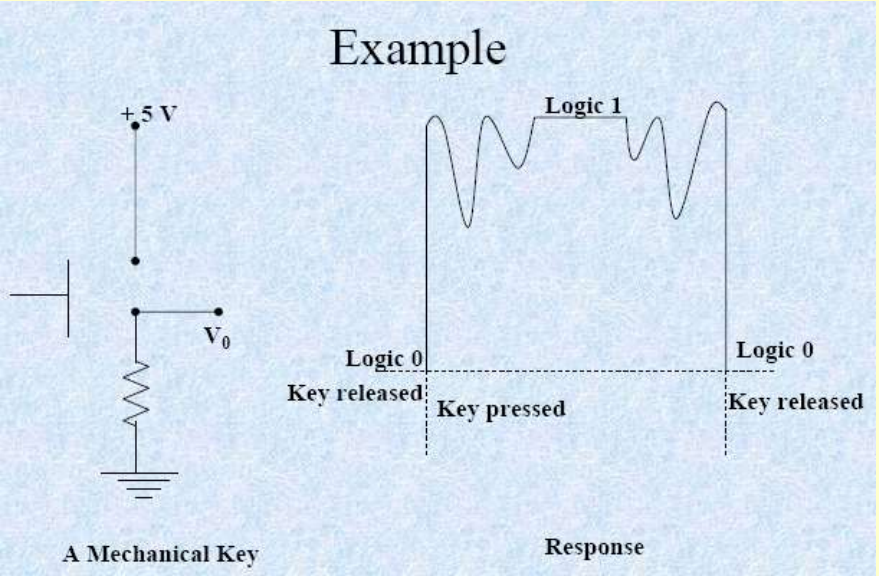
Problema.
Interfatati un port pe 16-biti cu 8255 ports la 8086.
Adresa portului A este F0h.

Solutie. Pentru implementarea unui port de 16biti se folosesc 2x8255. Unul pe partea L a DBUS (D0-D7) , iar celalalt pe partea H a DBUS (D8-D15). Fig. urmatoare.

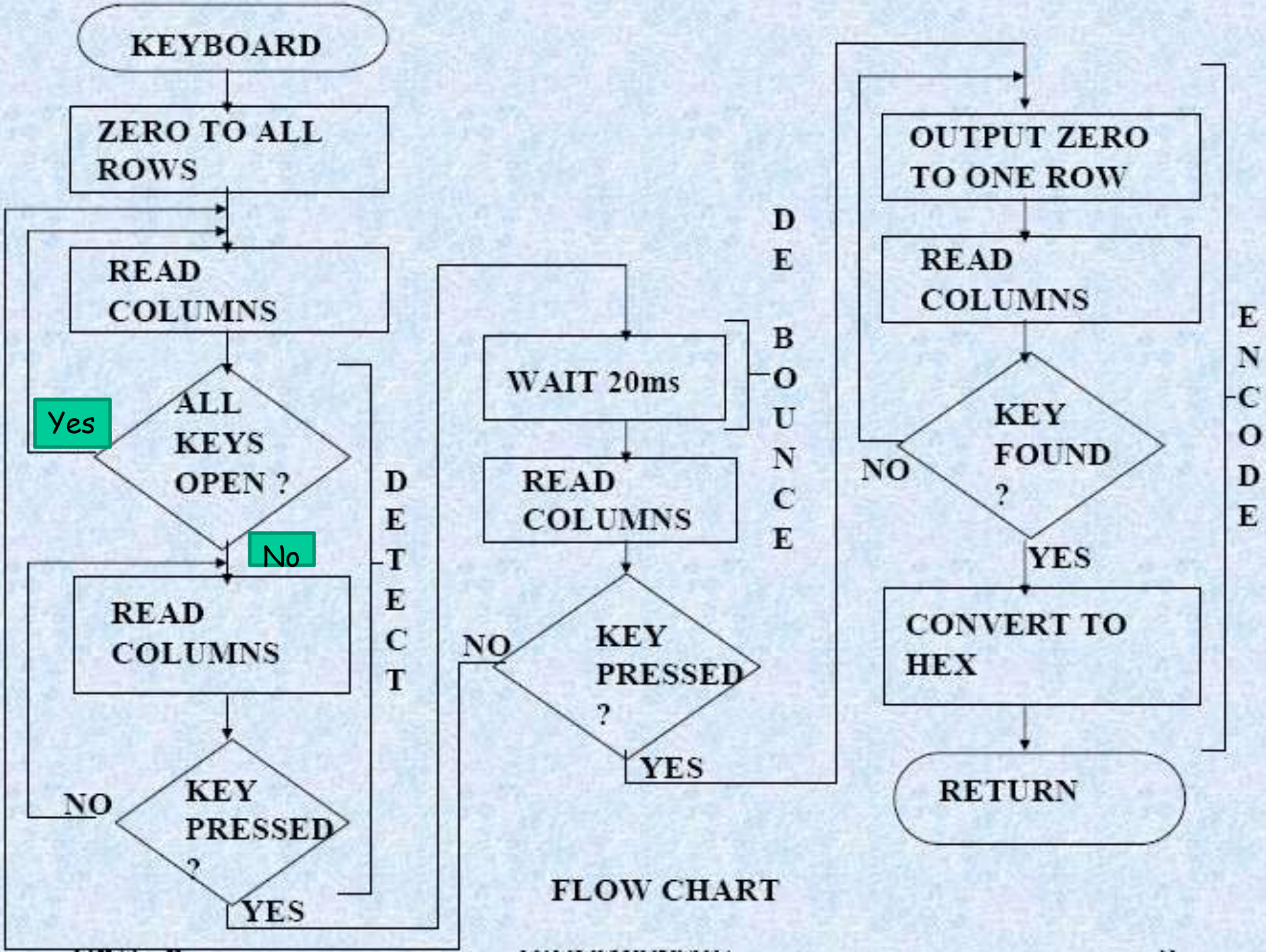


Interfacing 16-bit 8255 Ports with 8086

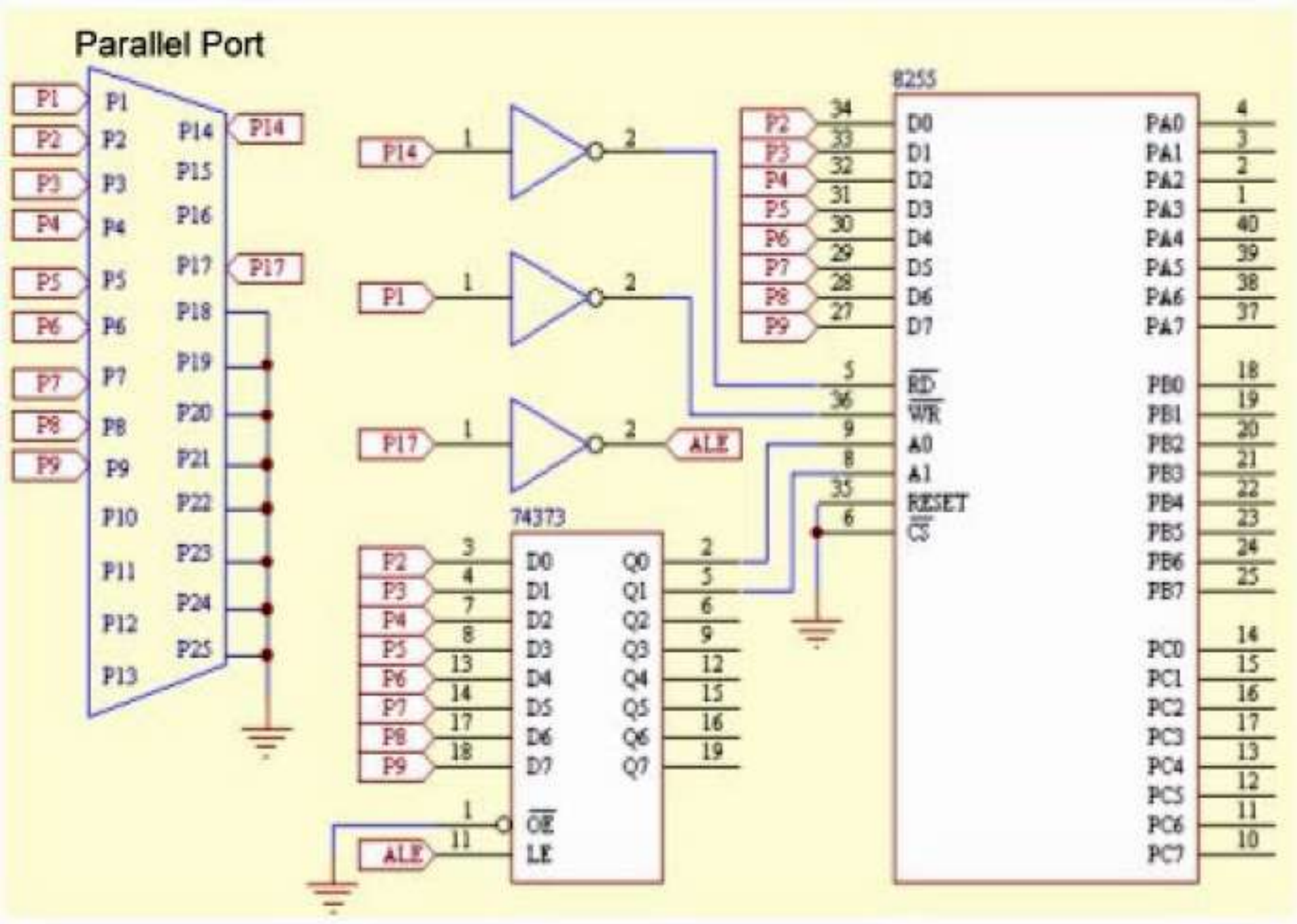




Tema1. Scrieti o aplicatie care furnizeaza in AL codul hexa al tastei apasate.

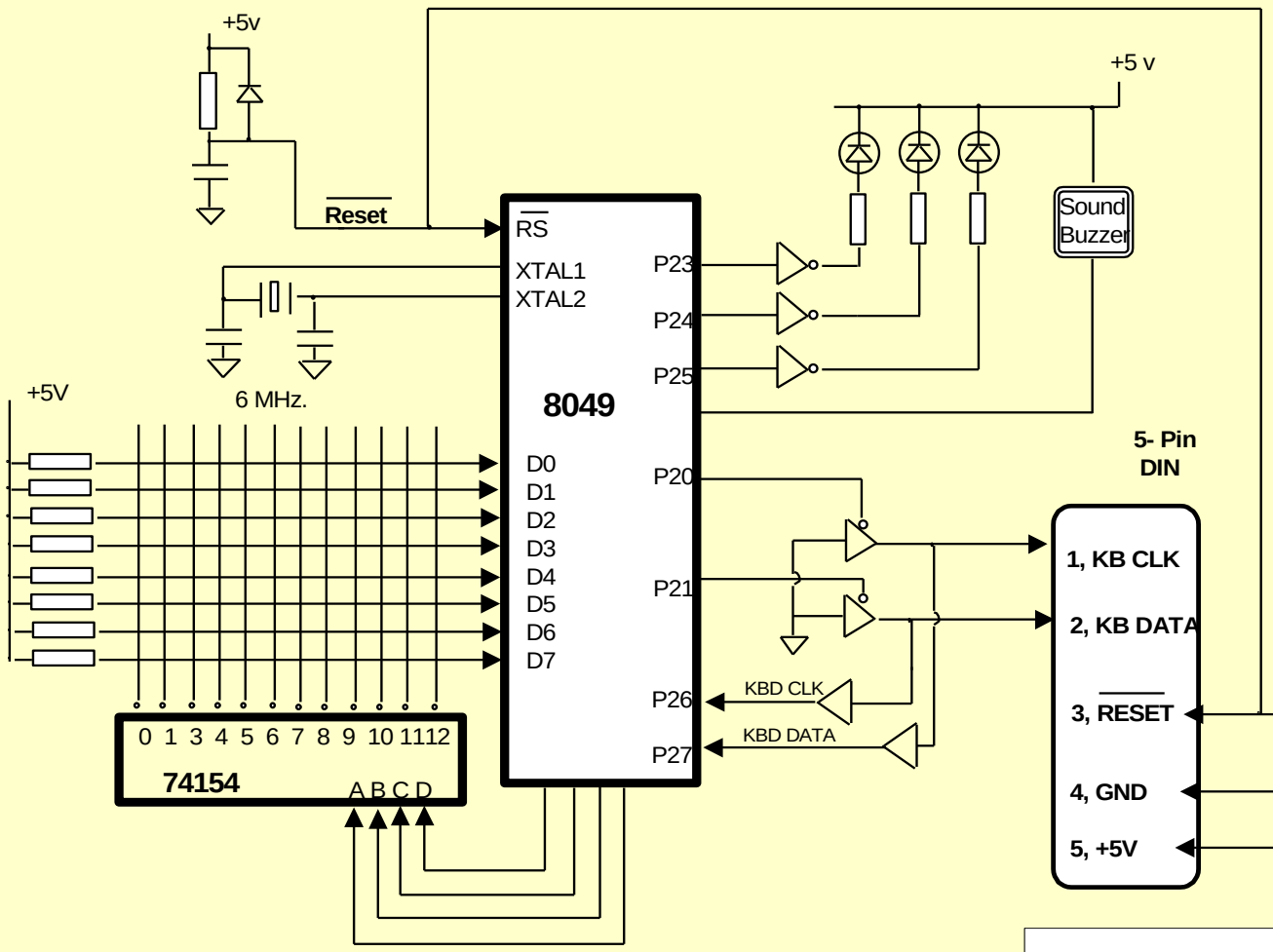

KEYBOARD
ZERO TO ALL ROWS
READ COLUMNS
ALL KEYS OPEN ?
Yes
No
READ COLUMNS
KEY PRESSED ?
NO
YES
DETECT
WAIT 20ms
READ COLUMNS
KEY PRESSED ?
NO
YES
DEBOUNCE
OUTPUT ZERO TO ONE ROW
READ COLUMNS
KEY FOUND ?
NO
YES
CONVERT TO HEX
RETURN
ENCODE

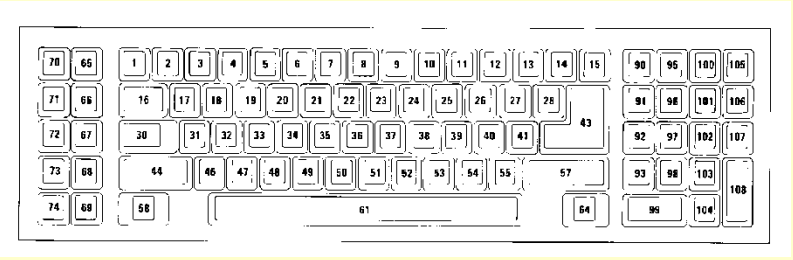
FLOW CHART

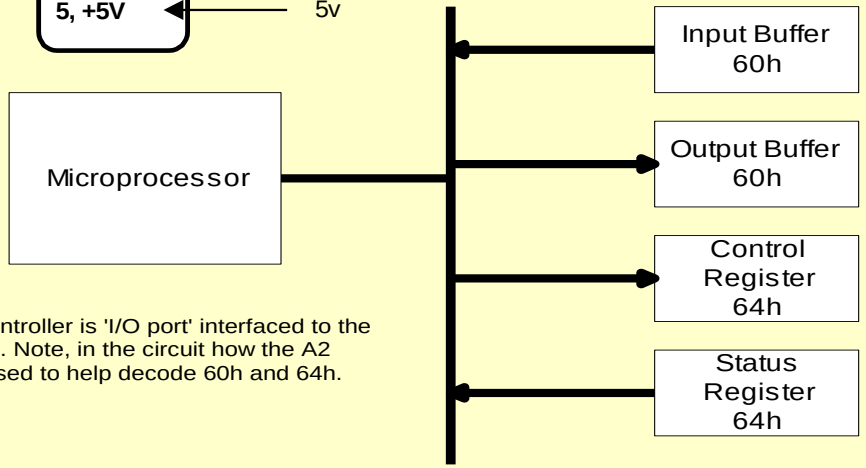


Tema2. Analizati schema si stabiliti functionarea ei.

The Keyboard Circuit

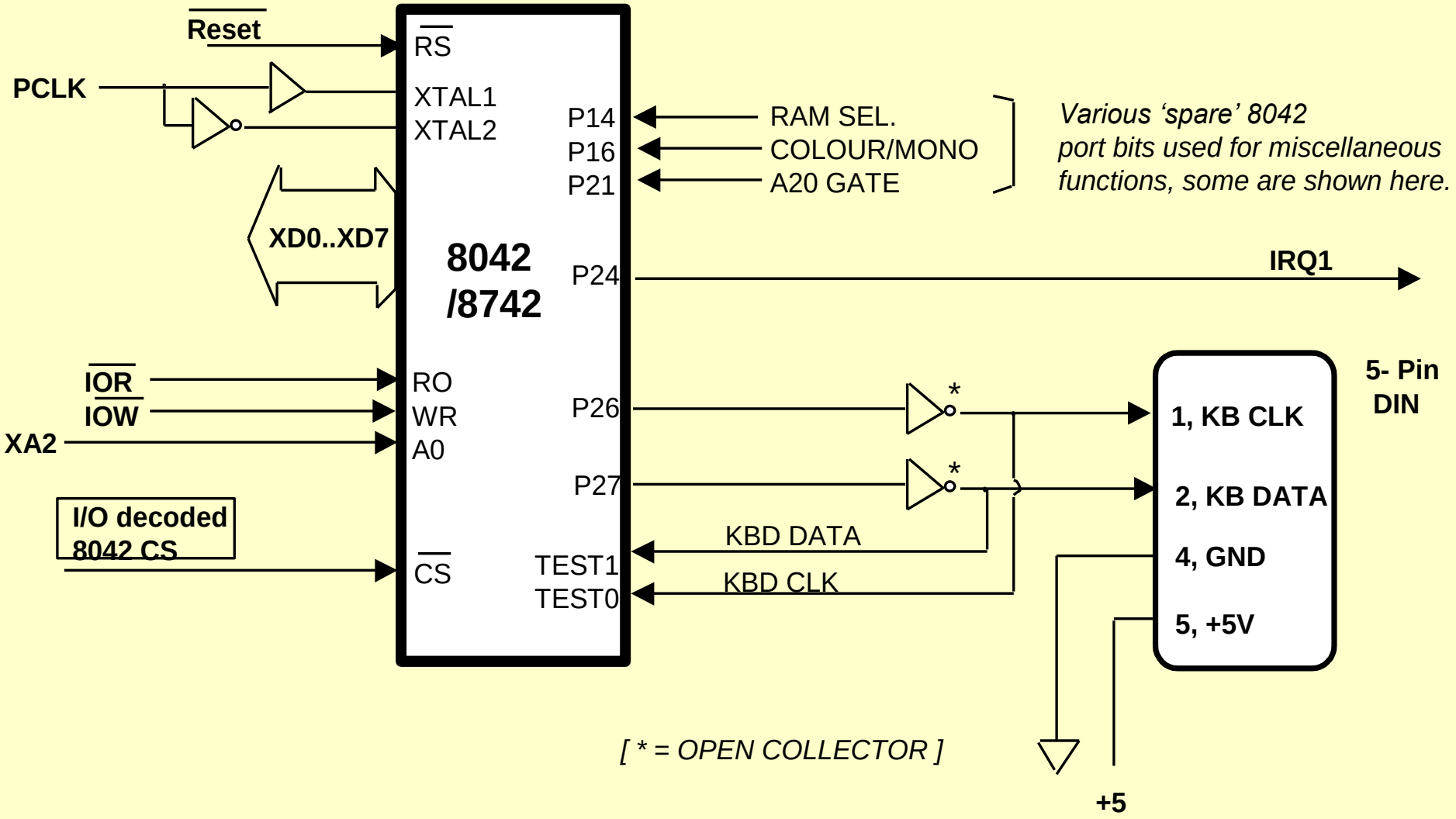






The keyboard controller is 'I/O port' interfaced to the PC/AT as shown. Note, in the circuit how the A2 address line is used to help decode 60h and 64h.

The Key Board Controller



DISTR, DOSTR = Data Input and Data Output Strobes.