CMPE 310
Systems Design and Programming

L10: Chapter 11 – BASIC I/O Interface

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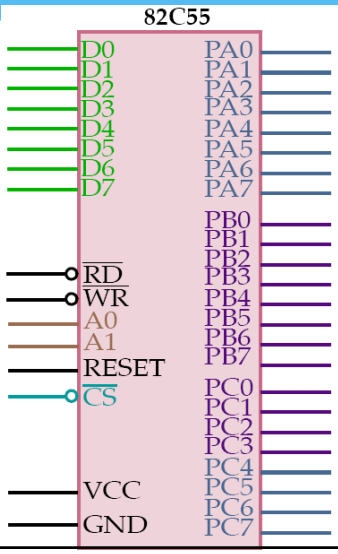
L10 Objectives

* Describe the function of each pin of the 82C55
  * Diagram how the 82C55 is connected to the x86/88 PC
  * Program the 82C55

Programmable Peripheral Interface

* The 82C55 is a popular interfacing component, that can interface any TTL-compatible I/O device to the microprocessor.
* It is used to interface to the keyboard and a parallel printer port in PCs (usually as part of an integrated chipset).
* Requires insertion of wait states if used with a microprocessor using higher that an 8 MHz clock.
* PPI has 24 pins for I/O that are programmable in groups of 12 pins and has three distinct modes of operation.
* In the PC, an 82C55 or its equivalent is decoded at I/O ports 60H-63H.

Pinout of 82C55 PPI



Group A

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

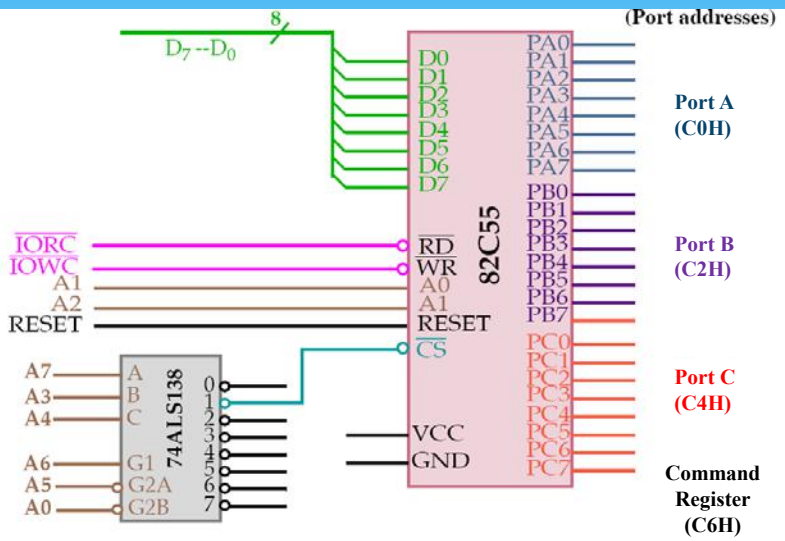
Group B

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

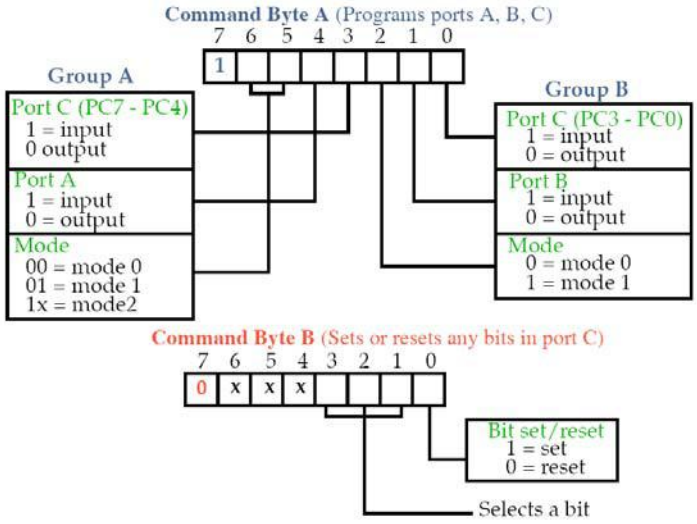
I/O Port Assignments

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

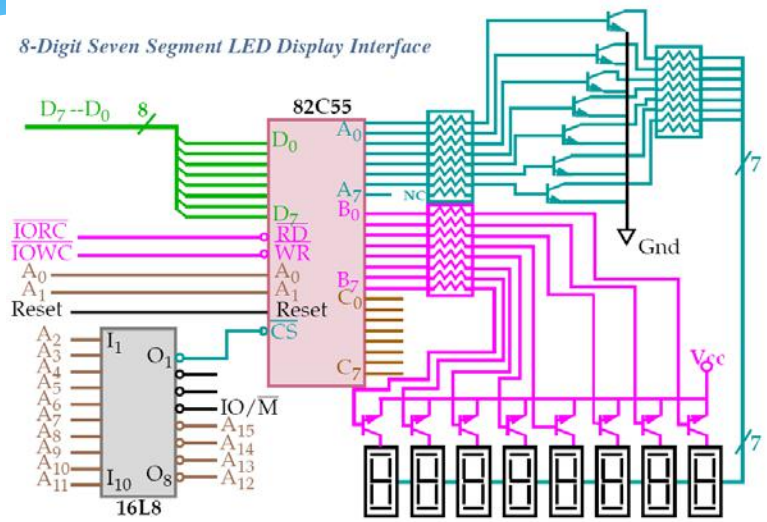
Interfacing the 82C55 PPI to the low bank of the 80386SX



Programming the 82C55



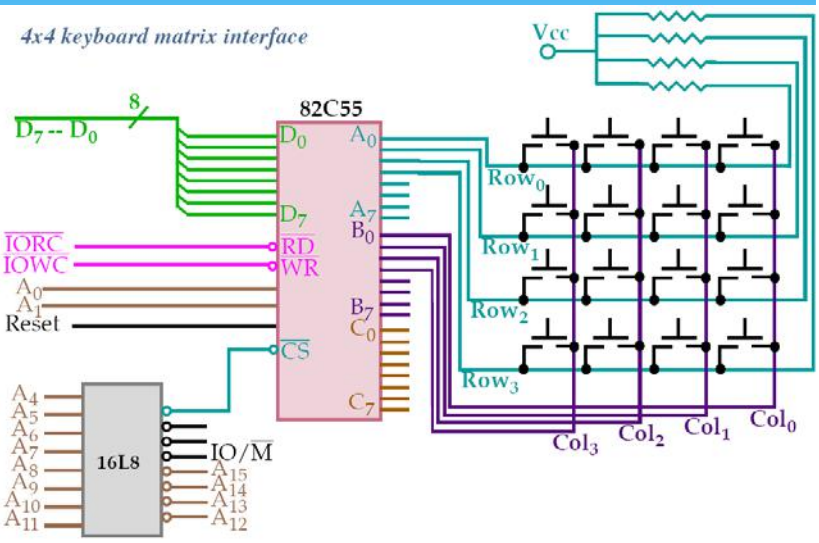
82C55: Mode 0 operation



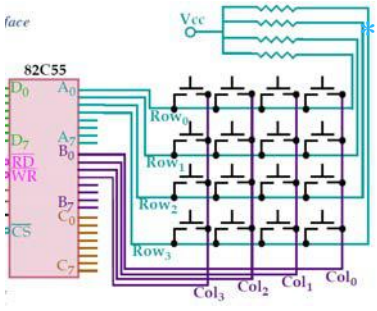
82C55: Mode 0 operation

- Mode 0 operation causes the 82C55 to function as a buffered input device or as a latched output device.
- In previous example, both ports A and B are programmed as (mode 0) simple latched output ports.
- Port A provides the segment data inputs to display and port B provides a means of selecting one display position at a time.
  - Different values are displayed in each digit via fast time multiplexing.
- The values for the resistors and the type of transistors used are determined using the current requirements (see text for details).
- Textbook has the assembly code fragment demonstrating its use.
- Examples of connecting LCD displays and stepper motors are also given.

82C55: Mode 0 Operation

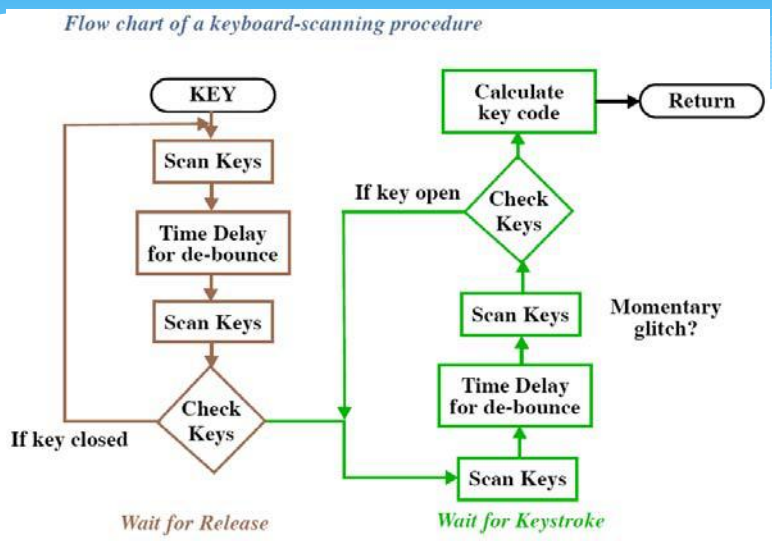


Example



If Port B is programed to output 1110; what column is selected for a read and which keys/ switches can be read by Port A?

82C55: Mode 0 Operation

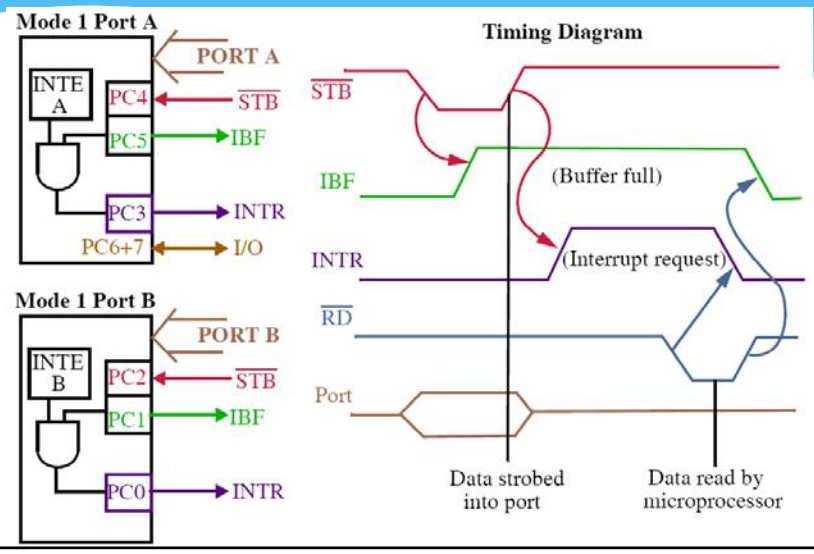


82C55: Mode 1 strobed input

* Port A and/or port B function as latching input devices. External data is stored in the ports until the microprocessor is ready.
* Port C used for control or handshaking signals (cannot be used for data).

* **Signal definitions for Mode 1 Strobed Input**
  * $\overline{\textbf{STB}}$ The **strobe** input loads data into the port latch on a 0-to-1 transition
  * **IFB Input buffer full** is an output indicating that the input latch contain information
  * **INTR Interrupt request** is an output that requests an interrupt
  * **INTE** The **interrupt enable signal** is neither an input nor an output; it is an internal bit programmed via the PC4(port A) or PC2(port B) bits.
  * **PC7, PC6** The port C pins 7 and 6 are general-purpose I/O pins that are available for any purpose.

82C55: Mode 1 strobed input

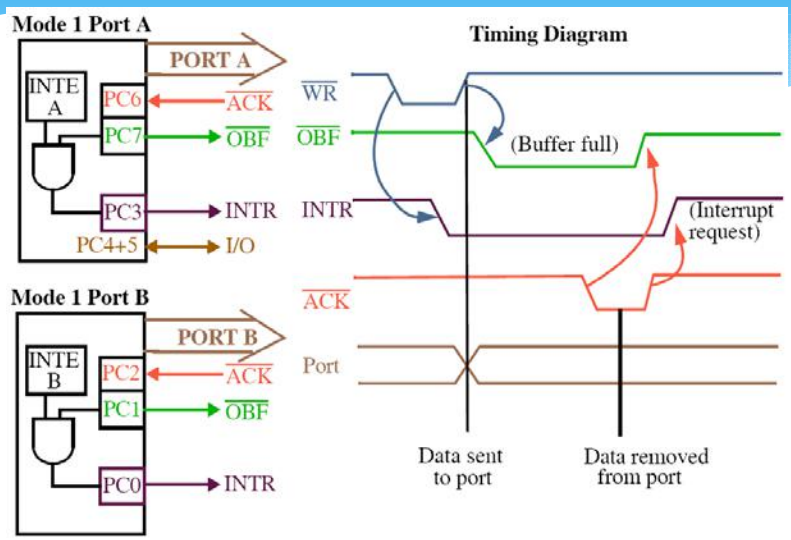


82C55: Mode 1 strobed output

* Similar to Mode 0 output operation, except that handshaking signals are provided using port C.

* **Signal Definitions for Mode 1 Strobed Output**
* $\overline{\text{OBF}}$ **Output buffer full** is an output that goes low when data is latched in either port A or port B.
* $\overline{\text{ACK}}$ The **acknowledge** signal causes the $\overline{\text{OBF}}$ pin to return to 1. This is a response from an external device.
* **INTR Interrupt request** is an output that requests an interrupt
* **INTE** The **interrupt enable signal** is neither an input nor an output; it is an internal bit programmed via the PC6(port A) or PC2(port B) bits.
* **PC5, PC4** The port C pins 5 and 4 are general-purpose I/O pins that are available for any purpose.

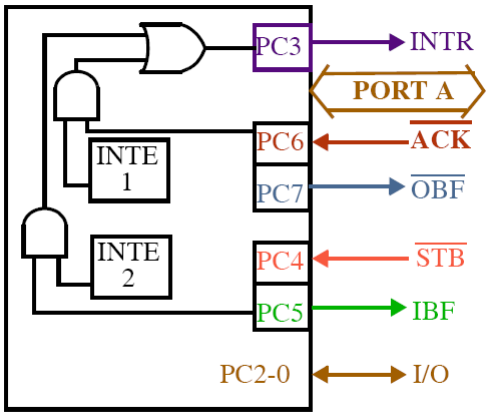
82C55: Mode 1 strobed output



82C55: Mode 2 Bi-directional operation

- Only allowed with port A. Bi-directional bused data used for interfacing two computers, GPIB interface etc.
- **INTR Interrupt request** is an output that requests an interrupt
- **$\overline{\text{OBF}}$ Output buffer full** is an output indicating that the output buffer contains data for the bi-directional bus
- **$\overline{\text{ACK}}$ Acknowledge** is an input that enables tri-state buffers which are otherwise in their high-impedance state
- **$\overline{\text{STB}}$** The strobe input loads data into the port A latch
- **IFB Input buffer full** is an output indicating that the input latch contains information for the external bi-directional bus
- **INTE Interrupt enable** are internal bits that enable the INTR pin. Bit PC6(INTE1) and PC4(INTE2)
- **PC2, PC1 and PC0** Theses port C pins are general-purpose I/O pins that are available for any purpose.

82C55: Mode 2 Bi-directional Operation



* Timing diagram is a combination of the Mode 1 Strobed Input and Mode 1 Strobed Output Timing diagrams.

Next Time

* Programmable Keyboard/Display Interface

STOP