Real Time System

Third Level

8155/8156 Multipurpose Programmable Devices

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Goals
Up-on completing this lecture, the student should be able to:

1- Identify the concepts behind programmable devices
2- Utilize the programmable devices into the RT designs.

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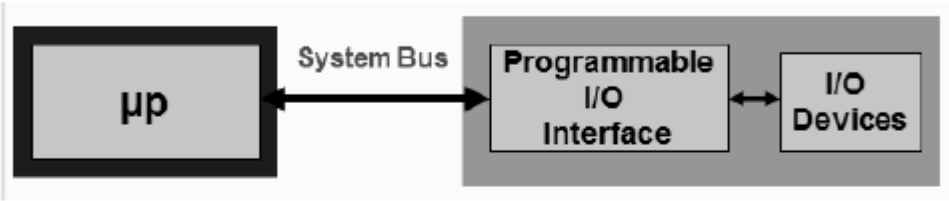
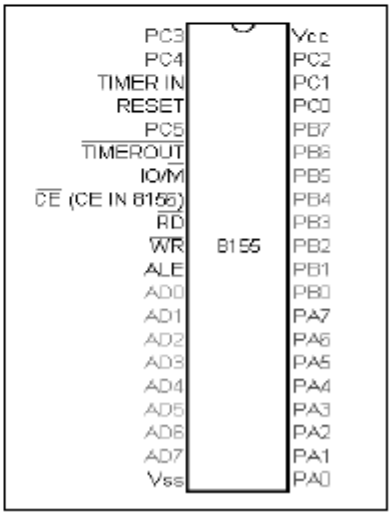
Programmable Interface Devices

- Used to interface an I/O device to the microprocessor.
- Can be programmed/configured to perform various I/O functions by writing software instructions.



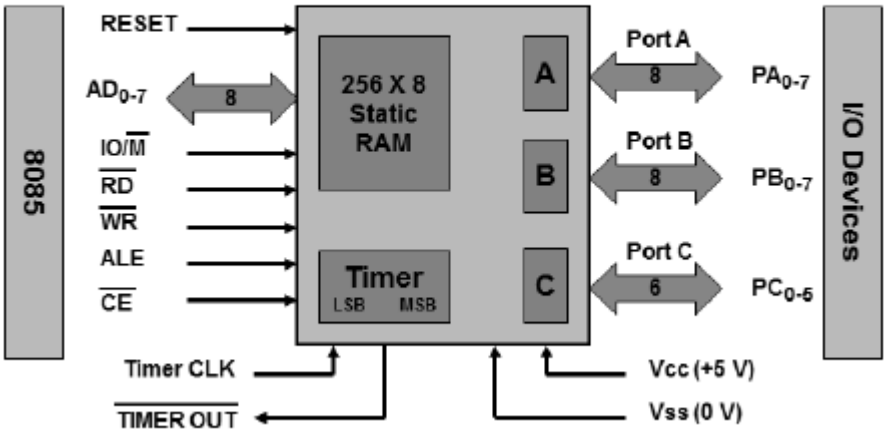
8155/8156 – A Multipurpose Programmable Interface

Its programmable interface device used to interface I/O device to µP, its multifunction device, contain RAM, I/O ports, and timer.



- Designed to be compatible with 8085.
- It includes:
  - 256 bytes of Read/Write memory.
  - Three I/O ports (programmable I/O):
    - Port A (8-bit).
    - Port B (8-bit).
    - Port C (6-bit).
  - A 14-bit timer.

BLOCK DIAGRAM - 8155

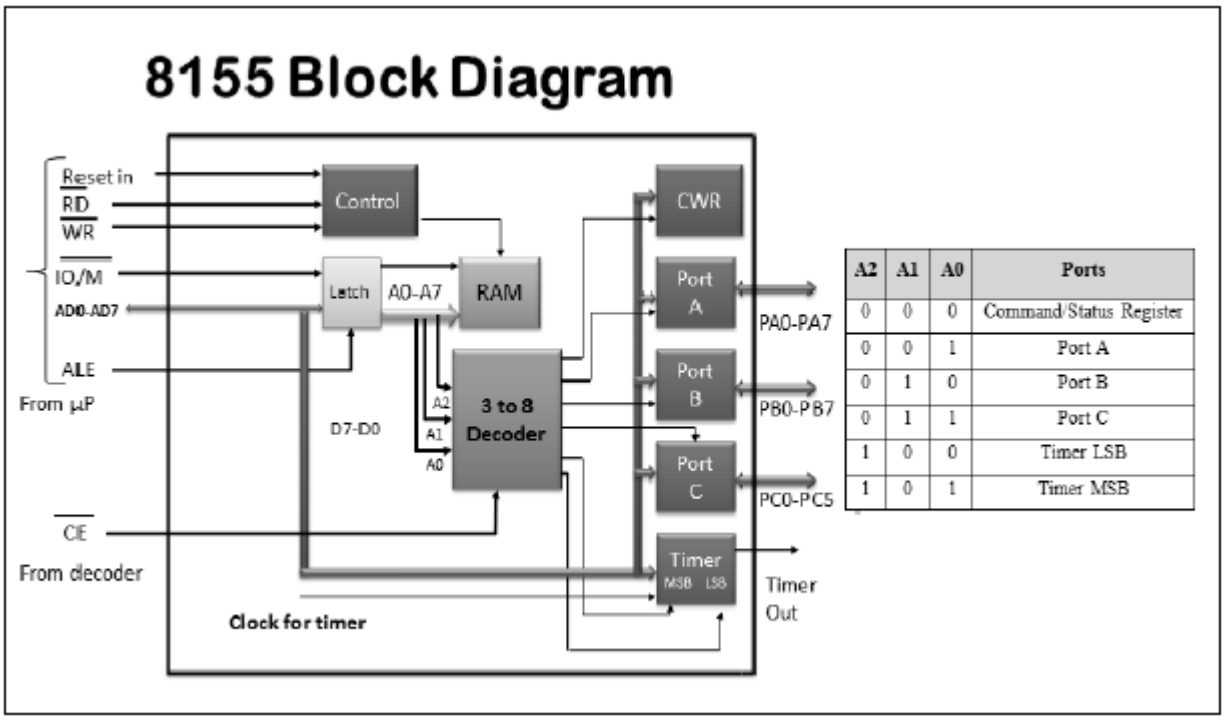


The 8155/8156 is a device with two sections:

- The first is 256 byte static memory (RAM).
- The second is programmable I/O ports.

Functionally the two sections is used as two independence chips, the I/O section include two 8 bit parallel I/O ports (A, B), and one 6 bit port (C), and bit timer, all ports can be simply configured as I/O ports.

- 8155 block diagram shows 5 control signals, all except ($\overline{CE}$) are input signal directly generated by the processor; the ($\overline{CE}$) is input from decoder.
  - $\overline{CE}$: chip enable, connected to the decoder.
  - IO/$\overline{M}$: specify whether the memory section is selected, or I/O section (include timer) is selected.
  - ALE: address latch enable.
  - $\overline{RD}$ and $\overline{WR}$
  - RESET: connect to the RESET out of processor used to reset the chip and initializes I/O ports as input.
- In 8155 we have control register, 3 I/O ports, and 2 register for timer, so we need 3 address lines to decode there register.

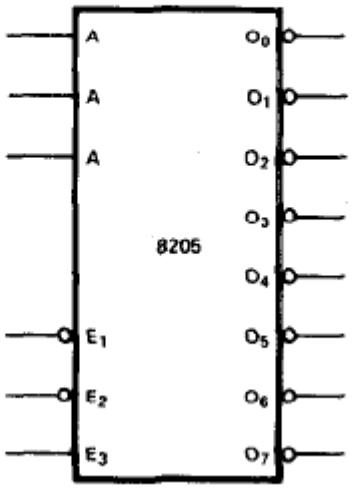


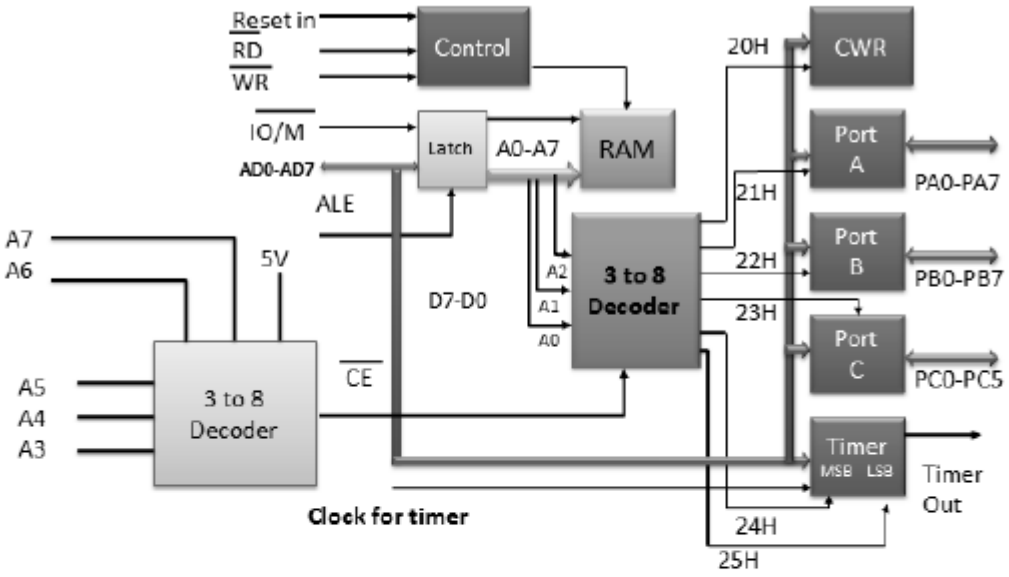
A2	A1	A0	Ports
0	0	0	Command/Status Register
0	0	1	Port A
0	1	0	Port B
0	1	1	Port C
1	0	0	Timer LSB
1	0	1	Timer MSB

How to Calculate Address of control register and I/O Ports of 8155?

By using 3 to 8 decoder 8205 which have 3 enables.

Why and How?





Ex: design (draw) and determine the address of the control/status, I/O ports and timer register of the 8155 if the output of decoder O2?

Application design with 8155:

- Interfacing 8155 with 8085.
- Programming 8155.

Ex: design a full system contains microprocessor and 8155 and I/O device with its connections and shows how can any output of the decoder active the interfacing proses by using 8205?

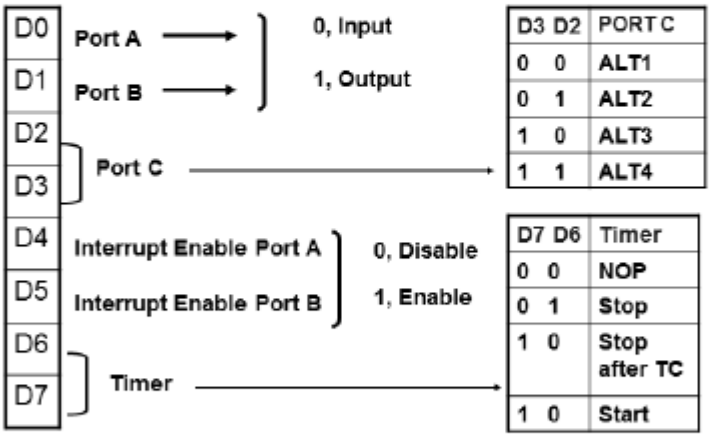
- Timer registers of 8155.
- Instruction/Command word for 8155.

- Commands for 8155 are stored in an 8-bit Control Register inside 8155.

Control word for 8155:-

- A command/instruction for 8155 is also called control word.
- This control word is written to control register of 8155.
- Control word of 8155 is of 8-bits.

Control word (command reg) format



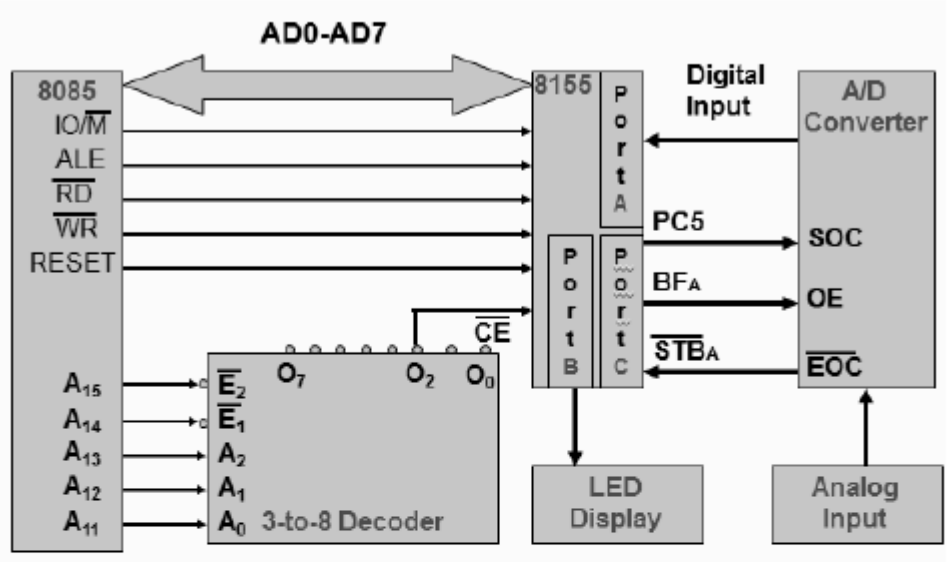
D3	D2	PORT C
0	0	ALT1
0	1	ALT2
1	0	ALT3
1	1	ALT4

D7	D6	Timer
0	0	NOP
0	1	Stop
1	0	Stop after TC
1	0	Start

- 00: No effect
- 01: Stop if running else no effect
- 10: Stop after terminal count (TC) if running, else no effect
- 11: Start if not running.

I/O functions of Port C

Ex: Design an interfacing circuit to read data from an A/D converter using the 8155A in the peripheral mapped I/O.



Chip Selection

A7 A6 A5 A4 A3

0 0 0 1 0

A2	A1	A0	Port	
0	0	0	Control/Status Register	= 10H
0	0	1	Port A	= 11H
0	1	0	Port B	= 12H
0	1	1	Port C	= 13H
1	0	0	LSB Timer	= 14H
1	0	1	MSB Timer	= 15H