CMPE 310
Systems Design and Programming

L12: Chapter 11 – BASIC I/O Interface

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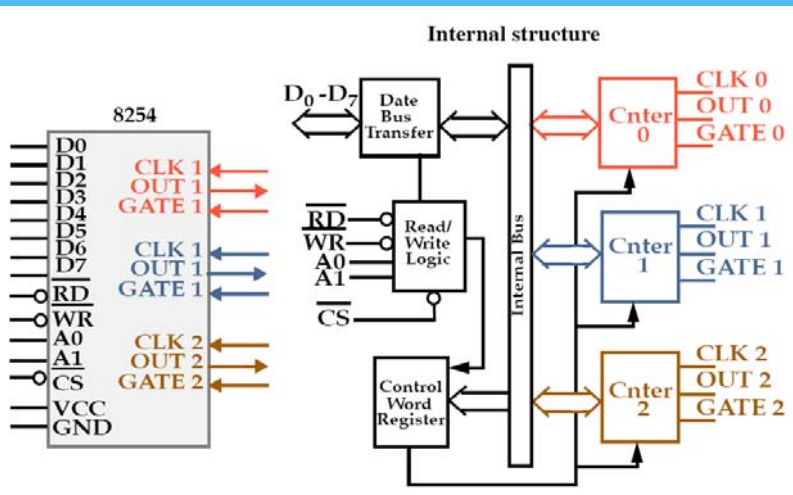
L12 Objectives

* Describe the function of each pin of the 8254 PIT
  * Diagram how the 8254 PIT is connected to the x86/88 PC
  * Program the three counters of the 8254 PIT by use of the chip control word

Programmable Interval Timer: 8254

* Three independent 16-bit programmable counters (**timers).**
  * Each capable of counting in binary or BCD with a maximum frequency of 10MHz.
* Used for controlling real-time events such as real-time clock, events counter, and motor speed and direction control.
* Usually decoded at port address 40H-43H
* Main functions:
  * Generates a basic timer interrupt that occurs at approximately 18.2Hz.
    * Interrupts the microprocessor at interrupt vector 8 for a clock tick.
  * Causes DRAM memory system to be refreshed.
    * Programmed for 15 us on PC to request DMA action
  * Provides a timing source to the internal speaker and other devices.

8254 Functional Description



8254 Pin Definitions

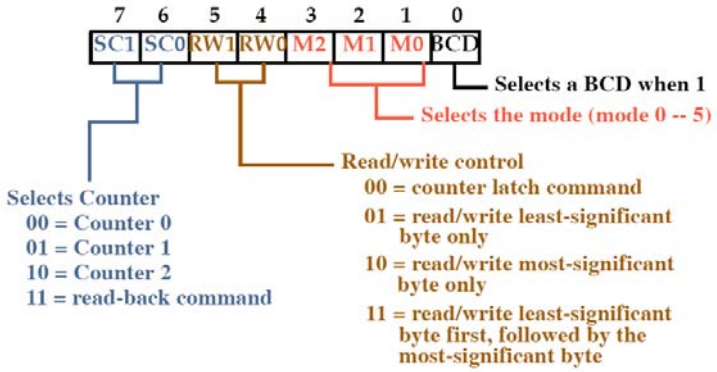
* ***A_1, A_0:*** The ***address inputs*** select one of the four internal registers with the 8254

A_1	A_0	Function
0	0	Counter 0
0	1	Counter 1
1	0	Counter 2
1	1	Control Word

* ***CLK:*** The ***clock*** input is the timing source for each of the internal counters.
  * It is often connected to the PCLK signal from the bus controller.
* ***$\overline{CS}$: Chip Select*** enables the 8254 for programming, and reading and writing.
* ***G:*** The ***gate input*** controls the operation of the counter in some modes.
* ***OUT:*** A ***counter output*** is where the wave-form generated by the timer is available.
* ***$\overline{RD}$/$\overline{WR}$: Read/Write*** causes data to be read/written from the 8254 and often connects to the $\overline{IORC}$/$\overline{IOWC}$.

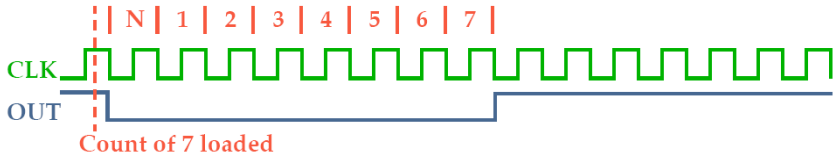
8254 Programming

* Each counter is individually programmed by writing a control word, followed by the initial count.
* The control word allows the programmer to select the counter, mode of operation, binary or BCD count and type of operation (read/write).



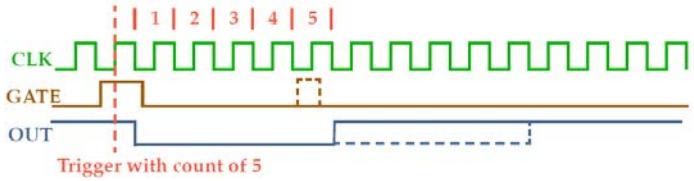
8254 Programming

- Each counter may be programmed with a count of 1 to FFFFH.
  - Minimum count is 1 all modes except 2 and 3 with minimum count of 2.
- Each counter has a program control word used to select the way the counter operates.
  - If two bytes are programmed, then the first byte (LSB) stops the count, and the second byte (MSB) starts the counter with the new count.
- There are 6 modes of operation for each counter:
  - ***Mode 0:*** An events counter enabled with G.
    - The output becomes a logic 0 when the control word is written and remains there until N plus the number of programmed counts.

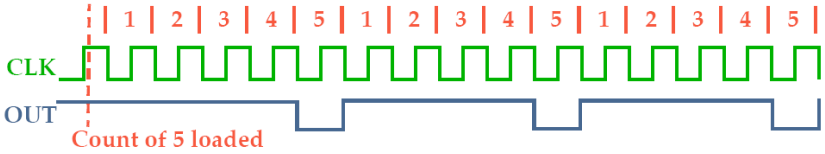


8254 Modes

- ***Mode 1:*** One-shot mode.
  - The G input triggers the counter to output a 0 pulse for the duration of the count.
  - Counter reloaded if G is pulsed again.

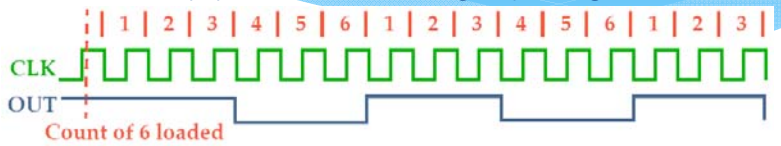


- ***Mode 2:*** Counter generates a series of pulses that are 1 clock pulse wide.
  - The separation between pulses is determined by the count.
  - The cycle is repeated until reprogrammed or G pin set to 0.

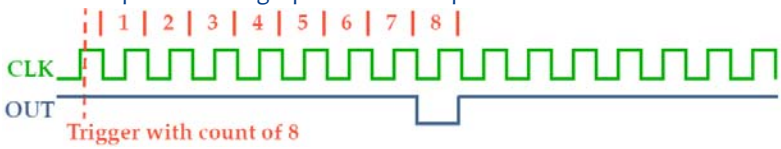


8254 Modes

* ***Mode 3:*** Generates a continuous square-wave with G set to 1.
  * If count is even, 50% duty cycle otherwise OUT is high 1 cycle longer.



* ***Mode 4:*** Software triggered one-shot (G must be 1).
  * Count to be decremented by 1 clock pulse
  * Allow counter to produce a single pulse at the output



* ***Mode 5:*** Hardware triggered one-shot. G controls similar to Mode 1
  * Functions as Mode 4 except counting is started by a trigger pulse on G.
  * Strobe pulse is output after the count is decrement to 0

Next Time

* Programmable Communications Interface

STOP