Lecture 25
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Control Word of 8255

- **Group B**
  - Port C Lower PC3-PC0
    - 1 = input, 0 = output
  - Port B
    - 1 = input, 0 = output
  - Mode Selection
    - 0 = Mode0, 1 = Mode1

- **Group A**
  - Port C Upper PC7-PC4
    - 1 = input, 0 = output
  - Port A
    - 1 = input, 0 = output
  - Mode Selection
    - 00 = Mode0, 01 = Mode1
    - 1x = Mode 2
    - 1 = I/O Mode
    - 0 = BSR Mode

8255 Design Example

- **System Address Bus**
  - A2
  - A9
- **Device**
  - D0 to D7
  - B
  - CL
  - CH
Interface DAC to a PC

- DAC (Digital-to-Analog Converter)
  - Device used to convert digital pulses to analog signals
  - Two methods of making the DAC
    - Binary weighted
    - R/2R ladder
    - The vast majority of IC use R/2R since it can achieve a much high degree of precision

Criterion for Judging a DAC: Resolution

- Resolution is a function of the number of binary inputs. common ones are 8, 10, 12 pins
- The number of analog output levels is equal to $2^n$, where $n$ is the number of data inputs
  - 8-input DAC (MC1408) gives 256 discrete voltage/current levels of output
  - 12-input DAC gives 4096 voltage/current levels
  - 16-input DAC gives 65,536 voltage/current levels

MC1480 DAC (or DAC 808)

- In MC1480, the digital inputs are converted to current ($I_{\text{out}}$) and by connecting a resistor to the $I_{\text{out}}$ pin, we convert the result to voltage.
- The current provided by $I_{\text{out}}$ is a function of binary numbers at D0-D7 and the reference current.
- $I_{\text{ref}}$ is generally set to 2.0 mA.
- $I_{\text{out}} = I_{\text{ref}} \cdot (D_7/2 + D_6/4 + D_5/8 + D_4/16 + D_3/32 + D_2/64 + D_1/128 + D_0/256)$. 
Interface DAC to PC

• Example 1
  – Interface MC1480 to Microprocessor through PPI 8255
• Example 2
  – Interface AD558 directly to Microprocessor

MOV AL, 80H
OUT PCtrl, AL
MOV AL, 0
Cont: OUT PA, AL
INC AL
CMP AL, 0
JZ Stop
MOV CX, 0FFFFH
Here: LOOP Here
JMP Cont
Stop: INT 6
Interface AD558 to 8088
8-bit DAC Voltage Output

• AD558 is configured as “write only”
• VCC range +4.5V ~ +16.5 V, normally +5V
• Vout Range: 0 ~ 2.56 V, or 0 ~ 10 V
• Digital Input Code Output Voltage

<table>
<thead>
<tr>
<th>Binary</th>
<th>Hex</th>
<th>Decimal</th>
<th>2.56V</th>
<th>10V</th>
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<tbody>
<tr>
<td>00000000</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00000001</td>
<td>01</td>
<td>1</td>
<td>0.010V</td>
<td>0.039V</td>
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<tr>
<td>00001111</td>
<td>0F</td>
<td>15</td>
<td>0.150V</td>
<td>0.586V</td>
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<tr>
<td>11111111</td>
<td>FF</td>
<td>255</td>
<td>2.55V</td>
<td>9.961V</td>
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</tbody>
</table>

Interface ADC and Sensors to a PC

- | Address Select | 8088  |
- | Data Bus      | AD 558|
- | Address Bus   |       |

<table>
<thead>
<tr>
<th>(LSB) DB₀</th>
<th>1</th>
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</thead>
<tbody>
<tr>
<td>DB₁</td>
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<tr>
<td>DB₂</td>
<td>3</td>
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<tr>
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<td>DB₆</td>
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<tr>
<td>(MSB) DB₇</td>
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</tbody>
</table>
0 ~ 2.56 V Range

( LSB) \( DB_0 \) 1 16 Vout
DB_1 2 15 Vout (Sense)
DB_2 3 14 Vout (Select)
DB_3 4 13 GND
DB_4 5 12 GND
DB_5 6 11 +VCC
DB_6 7 10 CS
( MSB) DB_7 8 9 CE

AD 558

0 ~ 10 V Range