I/O – 4
8279 Programmable keyboard/display interface
PHY 4635/5635
Spring 2009
8279 Programmable keyboard/display interface

- Scans and encodes up to a 64-key keyboard and controls up to a 16-digit numeric display.
- KB – Built-in FIFO (first-in, first-out) buffer (stores up to 8 keystrokes)
- Display – 16 x 8 RAM that stores coded display info.
8279 Functionality
8279 Programmable keyboard/display interface

- **A0**: (INPUT) Selects data (=0) or control/status (=1) for WR/RD between CPU & 8279
- **BD**: (OUTPUT) Blank - clears the displays
- **CLK**: (INPUT) Clock generates internal timing for the 8279.
  - Max frequency=3.125 MHz (8279-5)
- **CN/ST**: (INPUT) Control/strobe is an input connected to CONTROL key on KB
- **CS**: (INPUT) Chip select enables 8279 for programming, reading KB and status, and writing control and display data.
8279 Programmable keyboard/display interface

- **DB7-DB0**: (BI) Connects to data bus of CPU
- **IRQ**: (OUTPUT) =1 whenever a key is pressed – indicates to CPU that KB data is available
- **OUTA3-OUTA0**: (OUTPUT) Sends data to the displays (MSBs)
- **OUTB3-OUTB0**: (OUTPUT) Sends data to the displays (LSBs)
- **RD**: (INPUT) Connects directly to the IORC or RD lines…when \(\overline{CS}=0\), causes data to be read from data registers or status register.
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- **RESET**: (INPUT) Connects to the RESET line of the system
- **RL7-RL0**: (INPUT) senses any key depression in the KB
- **SHIFT**: (INPUT) Connects to the SHIFT key on KB
- **SL3-SL0**: (OUTPUT) Scans both KB and displays
- **WR**: (INPUT) Connects write strobe logic. Causes data to be written to the data or control registers
- **Vcc/Vss**: +5V/GND
8279 – 8088 Interfacing

2 wait states are generated for use with 8Mz CPU

A0 selects either data (10h) or control (11h)

PAL selects 8-bit I/O addresses 10h and 11h

Use of IRQ discussed in Ch 12
Keyboard Interface

- KB matrix range: 2x2 (4 keys) – 8x8 (64 keys)
- A “pressed key” connects one row with one column
- RL0-7 and SL0-2 are continuously and sequentially “queried” internally – looking for a “closed” switch
- Pull-up resistors are internal to the 8279
Programming the KB interface

- Prior to “run mode”, the 8279 must be programmed to operate as described...

- Eight control words must be programmed – the control word is chosen based on the 3 MSBs of number sent to control port (11h).

<table>
<thead>
<tr>
<th>$D_7$</th>
<th>$D_6$</th>
<th>$D_5$</th>
<th>Function</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Mode set</td>
<td>Selects the number of display positions, left or right entry, and type of keyboard scan</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Clock</td>
<td>Programs the internal clock and sets the scan and de-bounce times</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Read FIFO</td>
<td>Selects the type of FIFO read and the address of the read</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Read display</td>
<td>Selects the type of display read and the address of the read</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Write display</td>
<td>Selects the type of write and the address of the write</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Display write inhibit</td>
<td>Allows half-bytes to be blanked</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Clear</td>
<td>Clears the display or FIFO</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>End interrupt</td>
<td>Clears the IRQ signal to the microprocessor</td>
</tr>
</tbody>
</table>
000DDMMM – Mode Set

- **DD** – selects mode of operation of a display
  - Left/right entry means data is scrolled in from the left/right
- **MMM** – selects mode of operation for the KB
  - 2-key lockout prevents 2 keys to be pressed together
  - N-key rollover will accept all keys pressed simultaneously, from first to last.
  - Decoded means SL outputs are active low and only one is low at a time (1110, 1101, ...)
  - Strobed means CN/ST can be strobed to queue RL inputs.

### DD

<table>
<thead>
<tr>
<th>DD</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>8-digit display with left entry</td>
</tr>
<tr>
<td>01</td>
<td>16-digit display with left entry</td>
</tr>
<tr>
<td>10</td>
<td>8-digit display with right entry</td>
</tr>
<tr>
<td>11</td>
<td>16-digit display with right entry</td>
</tr>
</tbody>
</table>

### MMM

<table>
<thead>
<tr>
<th>MMM</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Encoded keyboard with 2-key lockout</td>
</tr>
<tr>
<td>001</td>
<td>Decoded keyboard with 2-key lockout</td>
</tr>
<tr>
<td>010</td>
<td>Encoded keyboard with N-key rollover</td>
</tr>
<tr>
<td>011</td>
<td>Decoded keyboard with N-key rollover</td>
</tr>
<tr>
<td>100</td>
<td>Encoded sensor matrix</td>
</tr>
<tr>
<td>101</td>
<td>Decoded sensor matrix</td>
</tr>
<tr>
<td>110</td>
<td>Strobed keyboard, encoded display scan</td>
</tr>
<tr>
<td>111</td>
<td>Strobed keyboard, decoded display scan</td>
</tr>
</tbody>
</table>
Other Control Words

- **001PPPPP** – Divides the clock input (CLK) by the value PPPPP to obtain internal clock rate
  - Input clock of 1MHz / 01010b = 100kHz internal
- **010Z0AAA** – Read FIFO control: selects address of keystroke (000-111) from internal FIFO buffer; Z selects auto-increment.
- **011ZAAAA** – Display read control: selects read address from one of the display RAM positions; Z selects auto-increment – used is info in display RAM must be read.
- **100ZAAAA** – Display write control: AAAA addresses the position in RAM to be written
- **1010WWBB** – Display write inhibit: inhibits writing to either half of the display RAM location.
- **1100CCFA** – Clear control.
- **111E000** – Clear IRQ pin.