


I/O Methods

- 3 methods so far...
 - Read/write at any time ("Asynchronous" I/O – memory, LEDs, etc.)
 - Polling (keypad)
 - Simple strobed input and output
 - simple displays and actuators (vent in HVAC system)
 - 2 signals (data ready and data [1 or more bits])
 - 1 device controls the communication (ready or not, here come the data)


1



Full Handshaking I/O

- Use when both the sender and receiver must agree on when data is sent
 - PORTCL for data (1 to 8 bits)
 - Signals to coordinate (synchronize) sender/receiver
 - STRA (input to HC11)
 - STRB (output from HC11)

2



Full Input Handshaking – Overview

- Example: temperature sensor
- 1-8 bits of data input to HC11
- STRB – output from HC11 to device indicating ready to receive
- STRA – input to HC11 from device indicating data is ready to be read

3

Full Input Handshaking – Details

- STRB tells device “ready to receive more data” when HC11 reads PORTCL
- STRA set by external device when data is ready
 - HC11 sees this via STAF (strobe A flag – PIOC[7])
- Using STAF
 - Program polls STAF (like polling keypad)
 - Or STAF can be configured to generate interrupts (more later...)

4

Full Input Handshaking – Setup

- Set up input bit(s) in DDRC
- HNDS (handshaking mode) bit to 1 (PIOC 0x1002 bit 4)
- OIN (output/input handshake select) bit to 0 (PIOC bit 3)
- PLS (pulse mode for STRB) (PIOC bit 2)
 - 0 – level active (active from read until external write)
 - 1 – pulsed (active from read for 2 clocks)
- INVB (PIOC bit 0) – active level of STRB

5

Full Output Handshaking – Overview

- Ex.: Set voltage on variable power supply
- 1-8 bits of data output from HC11
- STRB – output from HC11 to device indicating that data are ready for the device
- STRA – input to HC11 from device indicating data have been read

6

Full Output Handshaking – Details

- STRB indicates “output data ready” when HC11 writes PORTCL
- STRA set by external device when data have been accepted
 - Check by polling or interrupts (similar to input handshaking)

7

Full Output Handshaking – Setup

- Set up output bit(s) in DDRC
- HNDS (handshaking mode) bit to 1 (PIOC 0x1002 bit 4)
- OIN bit to 1
- PLS – STRB level active or pulsed (as for input handshaking)
- INVB – same as for input handshaking

8
