301 Controller Protocols
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Joystick Controller

Ports

- From bus:
    - AddressFromBus[25:0]
    - WEFromBus
    - (ignore DataFromBus)
- From joystick:
    - X[3:0]
    - Y[3:0]
- To bus:
    - DataToBus[31:0]
    - WriteToBus

Addresses

- 0x3FFFF50 → X ADDRESS (read X input)
- 0x3FFFF54 → Y ADDRESS (read Y input)

Address compare

- 26-bit unsigned compare to the constants above.

Behavior

- Read X: if (Address==0x3FFFF50) & (~WEFromBus)
    - DataToBus = zero_extend(X[3:0])
    - WriteToBus = 1
- Read Y: if (Address==0x3FFFF54) & (~WEFromBus)
    - DataToBus = zero_extend(Y[3:0])
    - WriteToBus = 1
- Writes (WEFromBus=1) to either address are ignored (WriteToBus=0).
- Otherwise idle: WriteToBus=0.

LED Controller

Ports

- From bus: AddressFromBus[25:0], DataFromBus[31:0], WEFromBus
    - To device: DataToLED (1 bit) ← drives the Logisim LED/wire
    - To bus (optional readback): DataToBus[31:0], WriteToBus

Address

- 0x3FFFF40 → LED_CTRL

Address compare

- 26-bit unsigned compare to the constants above.

Behavior

- Write (set LED): if (Address==0x3FFFF40) & WEFromBus
    - led_reg = DataFromBus[0]
    - DataToLED = led_reg
    - WriteToBus = 0
- Read (optional status): if (Address==0x3FFFF40) & ~WEFromBus
    - DataToBus = zero_extend(led_reg)
    - WriteToBus = 1
- Otherwise idle: WriteToBus=0.

Hex Controller

Ports

- From bus: AddressFromBus[25:0], DataFromBus[31:0], WEFromBus
    - To device: DataToShow (4 bits) ← drives the Hex digit display
    - To bus (optional readback): DataToBus[31:0], WriteToBus

Address

- 0x3FFFF30 → HEX_DISPLAY_CTRL

Address compare

- 26-bit unsigned compare to the constants above. (0x3FFFF30)

Behavior

- Write (updates the display): if (Address==0x3FFFF30) & WEFromBus
    - hex_reg = DataFromBus[3:0] (stores the lower 4 bits)
    - DataToShow = hex_reg[3:0]
    - WriteToBus = 0
- Read (optional status): if (Address==0x3FFFF30) & ~WEFromBus
    - DataToBus = zero_extend(hex_reg)
    - WriteToBus = 1
- Otherwise idle: WriteToBus=0, DataToShow will maintain the previous value (hex_reg)