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Controlling The Real World With Computers

Address Lines and Ports

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Data inside a computer is accessed by means of metallic conductors called **address lines**. Each of them carries a bit of information, the same as a data line. A group of address lines is called an **address buss**. Just as with data, a bit can be on or off, and addresses can be represented on paper as a series of ones and zeros.

Addresses are seldom represented in binary, however. They are almost always shown in HEX with the **0x** prefix. An exception is in the schematic diagram. Individual lines are often drawn and labeled with abbreviations using the capital A -- A0, A1, A2, etc.

Any time a variable or constant is accessed in the C language, the appropriate address lines are activated. This is not readily apparent since variables and constants are almost always referenced by name. It's a lot easier to work with words than with obscure memory addresses. There is a way to more directly access address space in C. It's through the powerful concept of pointers, and you can read about it in the tutorials offered in the software section of the technology education sites links. We are concerned here with another use of address lines.

The PC actually has two memory systems. One deals with variables and constants as noted above. The other addresses what are called **ports**. Ports provide access to outside-world devices. The printer, serial communications, disk drives and sound cards, among others, all use ports for monitoring and control. A typical PC uses A0 through A9 as the bases for addressing ports, with A9 always high. That means that the range of port addresses is 0X200 through 0X3FF:

```
A9 A8   A7 A6 A5 A4   A3 A2 A1 A0
 1  0    0  0  0  0    0  0  0  0 = 0X200 minimum port address



A9 A8   A7 A6 A5 A4   A3 A2 A1 A0
 1  1    1  1  1  1    1  1  1  1 = 0X3FF maximum port address
```

The board used in the examples is capable of using all of these addresses in 64 byte blocks. Subdivisions within each block allow access to several sub-systems on the board. All of them will be covered in detail in the hardware and experiments sections.

Port read or write status depends on the state of the **Input/Output Read and Write** lines, which are dedicated to port activities. The appropriate line must be low. If both are high, then port I/O will not take place. The Input/Output Read line is abbreviated **IOR**, and the Input/Output Write line is abbreviated **IOW** . In addition to IOR or IOW, a line called **Address Enable (AEN)** must be low for port access.

The following is a self-test over this section. It would be a very good idea to make sure you know the answers to all of the questions since the sections that follow will build on this one.

1) Data inside computers is accessed by metallic conductors. These conductors are called **__1__**. A group of them is called a **__2__** .

A) Data Lines, Data Buss
B) Address Lines, Address Buss
C) Data Buss, Address Lines
D) Address Buss, Data Lines

2) _____ provide access to outside-world devices, such as printers and disk drives.

A) Ports
B) Address Enable (or AEN)
C) Input/Output Write (or IOW)
D) 0x

Answers

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