

### (System) buses

**(System) buses** are used in computers as parallel transmission components; each wire in the bus transmits one bit of data. There are three common buses used in the von Neumann architecture known as: address bus, data bus and control bus.

#### Address bus

As the name suggests, the **address bus** carries addresses throughout the computer system. Between the CPU and memory, the address bus is **unidirectional** (i.e. bits can travel in one direction only); this prevents addresses being carried back to the CPU, which would be an undesirable feature.

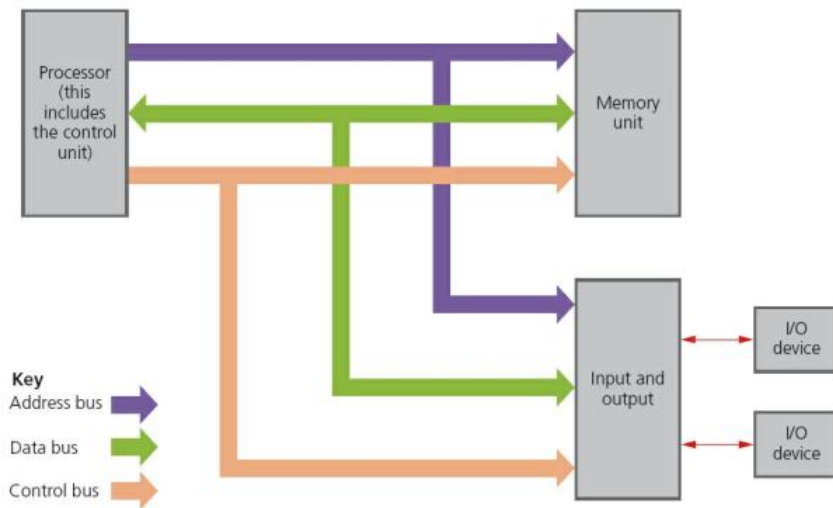
The width of a bus is very important. The wider the bus, the more memory locations that can be directly addressed at any given time, e.g. a bus of width 16bits can address  $2_{16}$  (65536) memory locations whereas a bus width of 32bits allows 4294967296 memory locations to be **simultaneously** addressed. However, even this isn't large enough for modern computers but the technology behind even wider buses is outside the scope of this book.

#### Data bus

The **data bus** is **bidirectional** (allowing data to be sent in both directions along the bus). This means data can be carried from CPU to memory (and vice versa) and to and from input/output devices. It is important to point out that data can be an address, an instruction or a numerical value. As with the address bus, the width of the data bus is important; the wider the bus the larger the **word length** that can be transported. (A **word** is a group of bits which can be regarded as a single unit e.g. 16-bit, 32-bit or 64-bit word lengths are the most common.) Larger word lengths can improve the computer's overall performance.

#### Control bus

The **control bus** is also bidirectional. It carries signals from the control unit (CU) to all the other computer components. It is usually 8-bits wide. There is no real need for it to be any wider since it only carries control signals.



**Figure 4.3**

**Table 4.1**

Type of bus	Description of bus	Data/signal direction
<b>address bus</b>	carries signals relating to addresses (see later) between the processor and the memory	<b>unidirectional</b> (signals travel in one direction only)
<b>data bus</b>	sends data between the processor, the memory unit and the input/output devices	<b>bi-directional</b> (data can travel in both directions)
<b>control bus</b>	carries signals relating to the control and coordination of all activities within the computer (examples include: the read and write functions)	<b>unidirectional</b> (signals travel in one direction only)

Control bus is bidirectional