Pneumatic Information

Some history

For thousands of years, man has used air as an aid in doing various tasks, e.g.a bellows for lighting fires.

In the year 260 BC, a Greek called Ctesibios built the first air gun. In addition to a tight sinew, he used air compressed in a cylinder to increase the range of projectiles. So it is not surprising that "pneuma", the Greek word for "air", has given its name to the technology known as pneumatics.

During the industrialisation process in the 19th century, machines powered by compressed air were used for mining and building roads. Pneumatic technology has become indispensable in modern industry. Pneumatically powered machines and robots are to be found in numerous industrial processes such as assembling or arranging components, or packing finished goods.

"Pneumatic Robots" from fischertechnik

As fischertechnik is capable of modelling (almost) anything on a small scale, small pneumatic drive units are also to be found in its program. These consist of pneumatic cylinders, manual valves and a mini compressor.

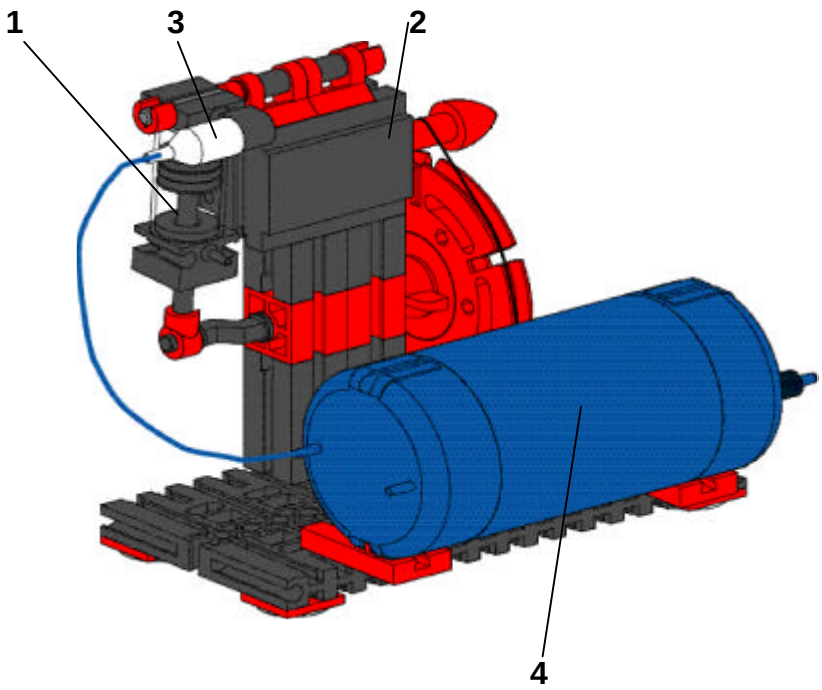
And this is not all. It is even possible to program and control these machines with a computer. Electromagnetic valves, which are connected to the fischertechnik interface now make it possible to control pneumatic cylinders using a computer program written with a special software package LLWin.

Thus, "Pneumatic Robots“ combines two fascinating areas of technology, pneumatics and computing in one single kit. Pneumatically controlled fischertechnik models - the possibilities are virtually unlimited.

The pneumatic components and their functions

The compressor

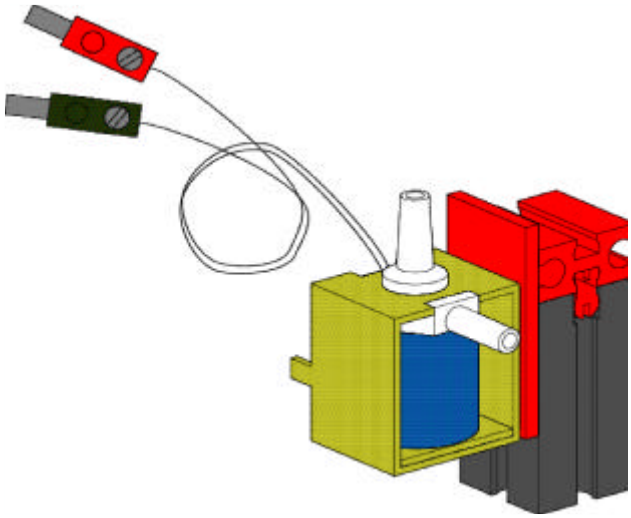
The compressor is constructed using fischertechnik components. It supplies the compressed air required to move the cylinders in and out.
The compressor is the same for every model and therefore only has to be constructed once, as described in the instructions provided.



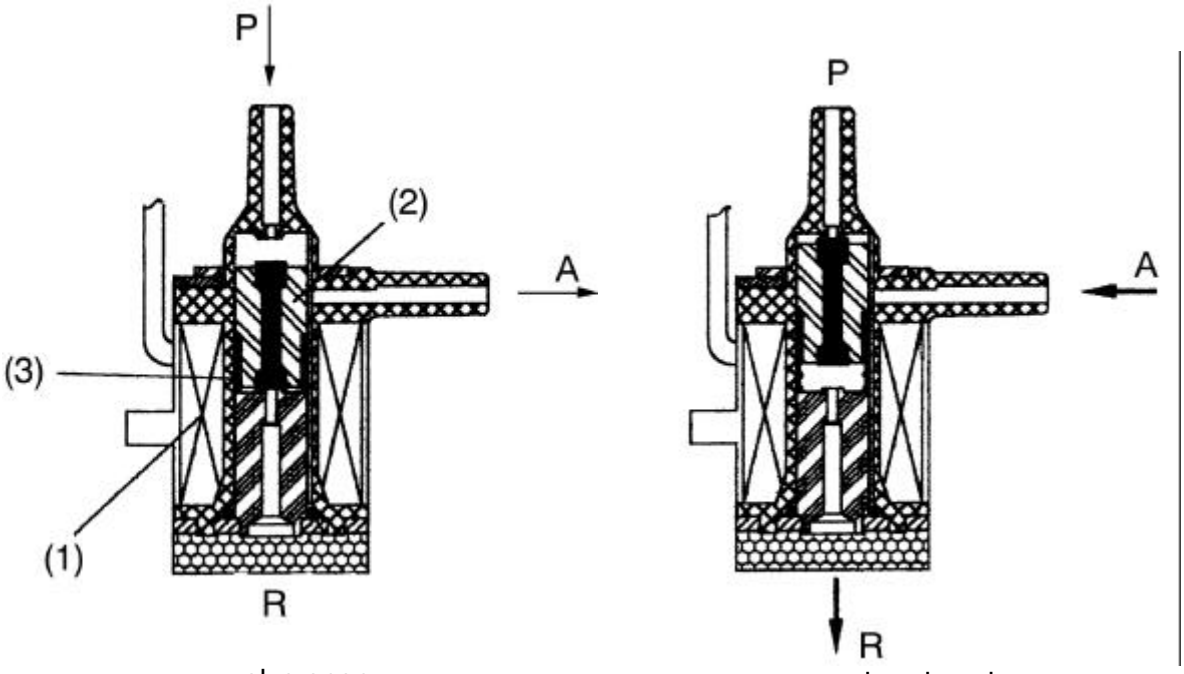
Method of function:
The compressor cylinder (1) is powered by a fischertechnik motor (2). When the piston rises, air is sucked in from outside through the non-return valve (3). When the piston moves downwards, the air is compressed and forced into the air chamber (4). The non-return valve now ensures that the compressed air cannot flow back. The air chamber always contains enough compressed air to operate the pneumatic cylinder. The pressure generated by the compressor is around 0.5 bars. The piston of the compressor cylinder must always be able to move freely. If necessary it can be lubricated slightly with a small drop of acid-free oil (e.g. silicon oil).
If the compressor is not being used for some length of time, it is advisable to remove the drive belt as it may stretch and then slip when the machine is started again.

The electromagnetic valve

In pneumatics, the purpose of a valve is to control the current of air to the pneumatic cylinder in such a way that the cylinder moves either inwards or outwards. Such a valve can either be operated by hand, pneumatically, or (in the case of the fischertechnik valve) electromagnetically.
Technical data:
3/2-way valve
9V DC/130mA
When connecting to power source, it is **not** necessary to ensure correct polarity.



The fischertechnik valve functions as follows:



valve open

valve closed

The explanation now becomes a little more complicated:
When electric current passes through the coil (1), a magnetic field is created with pulls the core (2) downwards. The valve opens and air flows from connection "P" via connection "A" to the cylinder. If no current flows, the core is pushed up by the spring (3) thereby closing the valve.

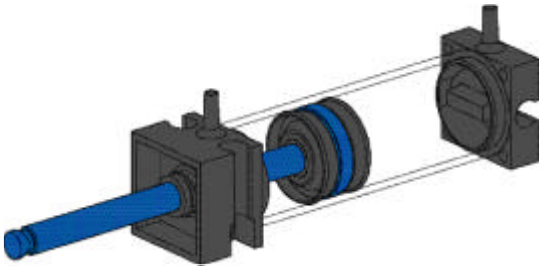
In its closed state, connection "A" is linked to vent "R". This vent allows air to escape from the cylinder. The reason for this is explained in the next section. By the way, the connections

P = compressed-air connection
A = connection for cylinder
R = vent

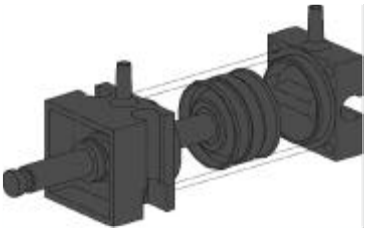
are always given these initials in pneumatic technology. For those who are very interested in technical matters, the valve used here is a so-called "3/2-way valve". This means that the valve has three connections (P, A, R) and two switch positions (open, closed).

Operation of a pneumatic cylinder

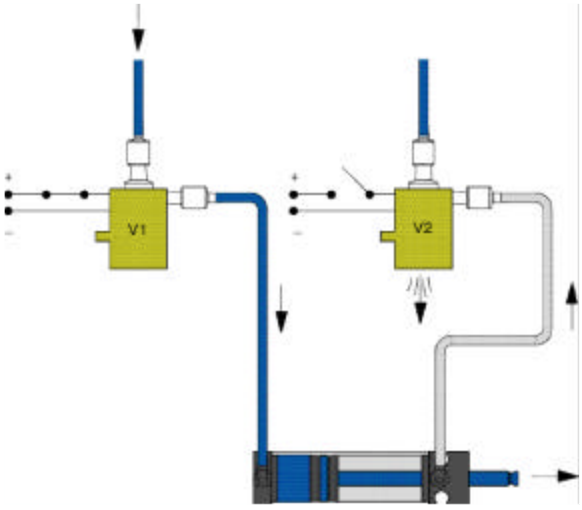
fischertechnik pneumatic cylinders can be moved both inwards and outwards by compressed air. Cylinders of this type are called "double-action cylinders".



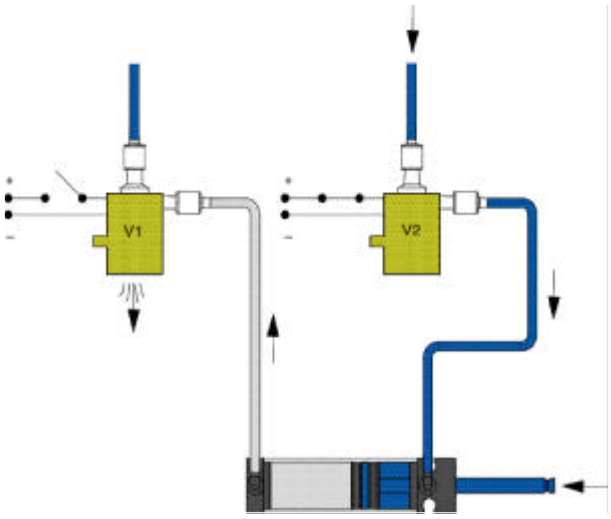
Cylinders also exist which can only be moved pneumatically in one direction. The return movement is caused by a spring. Cylinders of this type are called "single-action cylinders". The compressor cylinder is a single-action cylinder.



In order to move a fischertechnik cylinder in both directions, two of the valves contained in the kit are required.



To move the cylinder outwards, valve V1 must be open (the coil is supplied with electric current) and valve V2 closed (no current flowing).

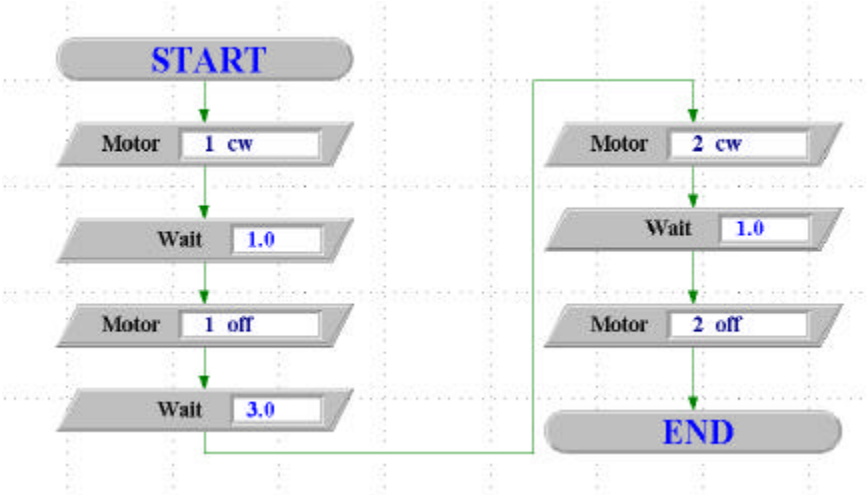


To move the cylinder inwards, valve V2 is open and valve V1 closed.

The diagram also makes it clear why vent "R" on the valve is required. Without this vent, the cylinder would be unable to move as the same pressure would be exerted on both sides of the piston and the air would not be able to escape.

Controlling the valves with interface and software LLWin 2.1

Each valve is connected to a motor output M1-M4 of the fischertechnik interface. If a cylinder has to be moved out, valve 1 (motor output M1) is switched on for approx. 1-2 seconds and then off again. To move it inwards, valve 2 is switched on and then off again after 1-2 seconds. In the program LLWin, the process is as follows:



The enclosed CD-ROM has an example program for every model in this kit. The programs can be displayed and started very easily. The simplest way is to copy all the example programs into the directory LLWin on the hard disk and to open them from there.

If you are using the program LLWin 2.1 for the first time, you are advised to consult the manual first. The online manual is also on the CD-ROM "Software LLWin 2.1" and is automatically installed along with the program. It is entitled "Acrobat LLWin Manual" and contains a detailed description of the program LLWin with examples for practice.

Let's get started...

After so much theory, it is now high time to start using fischertechnik "Pneumatic Robots". The model "door" is the simplest and most suitable for getting started. Build this model first before you proceed to the more complicated ones. Have fun!