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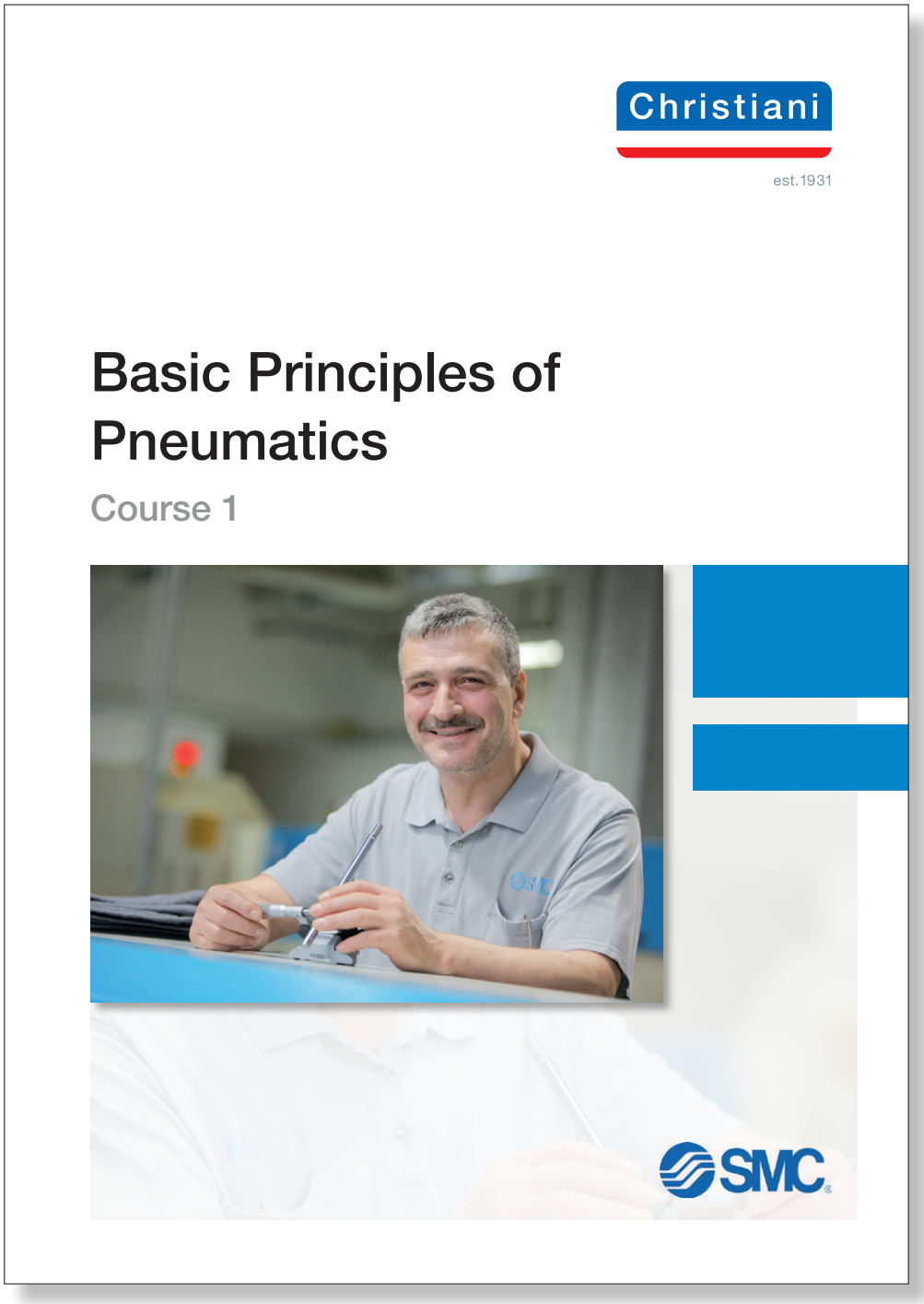

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Ronny Balmer | Basic Principles of Pneumatics
Course 1
1. Auflage 2014
Artikelnr.: 97353 | ISBN 978-3-86522-836-9

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Preface

Industrial automation combines many different systems and components. Movements and forces are generally secured through mechanical, electrical, hydraulic and pneumatic elements. Pneumatic systems excel through their ease of use, price-performance, high degree of safety and low environmental impact. Systems of this type are today used in virtually all industrial sectors.

The field of pneumatics is prevalent in new, advanced areas. However, pneumatic systems can also be found in long-established operations (for example in the machine tool, food, automotive and electronics sectors). Semiconductors and integrated circuits for which pneumatic systems are used in all manufacturing phases are examples of the latest technologies. To cater to the ever stricter and rapidly changing requirements, SMC continually develops new components.

The speed with which technological progress is being made requires us to constantly expand our understanding and knowledge of new technologies. Good training is the fundamental prerequisite for using pneumatic components safely and efficiently.

This book deals with the fundamentals of pneumatics. The training materials are up-to-date with the latest technologies and describe the most important pneumatic elements in a way that is easy to understand. An overview of pneumatic symbols and circuit diagrams is also provided. It is also possible to work through the basics of all of the training materials independently without a trainer.

We have intentionally dispensed with unnecessary calculations, primarily to highlight the key concepts in the field of pneumatics. The "Course 2" book goes into greater detail regarding the criteria for selecting pneumatic components.

Weisslingen, October 2010

The author
Ronny Balmer
Product Manager / Trainer

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4.5 Pressure regulation

Pressure regulators maintain constant working pressure (secondary pressure), irrespective of mains pressure fluctuations (primary pressure) and air consumption. The primary pressure must always be greater than the secondary pressure.

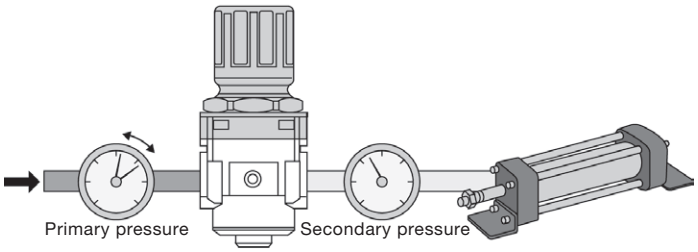

Fig. 4.10: Main task of a pressure regulator

4.5.1 Standard regulators

The diaphragms and valves are wearing parts

Most pressure regulators employ a piston-based or diaphragm-based design. These allow the forces of the output pressure which act on the adjusting spring to be compensated. The adjusting spring is pre-loaded to a various degree by the adjusting spindle. This preload causes the spring force to act downwards "*F*" (Fig. 4.11) and move the valve out of its seat. The compressed air flows from the import, via the opened valve and to the output.

The pressure that is built up downstream of the output is applied to the underside of the diaphragm. This increasing compression force (= diaphragm surface x output pressure) counteracts the spring force. As soon as the forces between the adjusting spring and output pressure have been equalised, the valve no longer moves.

If the air consumption at the output increases, the pressure p_2 drops. The spring force is now stronger than the compression force provided by the output pressure p_2. The valve opens until the forces are once again balanced. During continuous compressed air usage, the valve constantly opens and closes to equalise the forces.

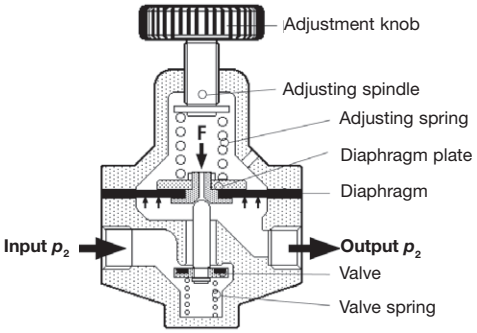

Fig. 4.11: Principle of a pressure regulator

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6.3.4 Solenoid actuation

For directional valves, the electrical actuation method is the most important. These valves are referred to as "solenoid valves". Small, directly actuated solenoid valves work with electromagnetic force. When a current flows through the coil, the anchor is pulled upwards against the spring force and the valve opens. As soon as the power supply is interrupted, the spring then presses the anchor and the valve plate back into its seat. The valve is closed (Fig. 6.19a). If the anchor has a valve seat on both sides, it is a 3/2 valve that is vented upwards (Fig. 6.19b).

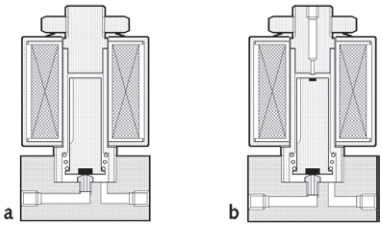

Fig. 6.19: directly controlled (a) 2/2 solenoid valves and (b) 3/2 valves with spring reset

Pre-controlled solenoid valve = low power consumption

Valves with pre-control are generally used when controlling high flow rates as a way of keeping down the power consumption and size of the magnets. The slide of the main valve is pneumatically actuated via a small solenoid valve with low power consumption (Fig. 6.20). You can find more information on this from page 116 onwards.

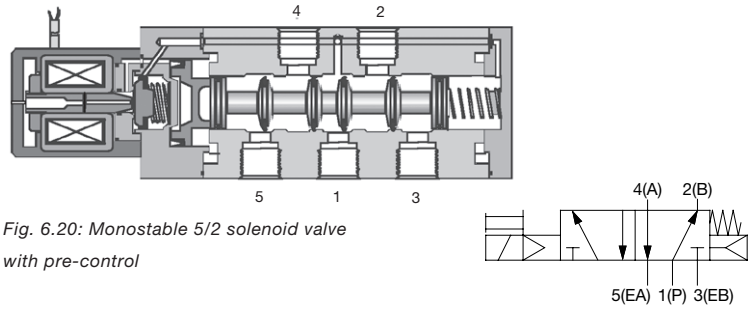

Fig. 6.20: Monostable 5/2 solenoid valve with pre-control

Bistable and three-position valves required two magnetic coils. For the 5/3 function, the slide is centred in its home position using two springs.

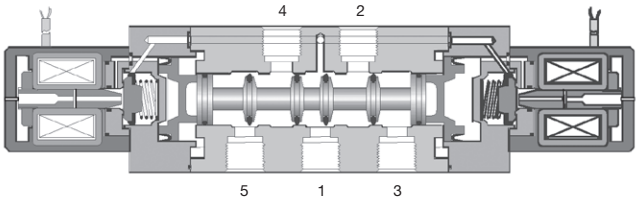

Fig. 6.21: Bistable 5/2 valve with pre-control