



TRAINING BENCH FOR EXERCISES
Electropneumatic version - 9000762
Pneumatic version - 9000763

TRAINING BENCH

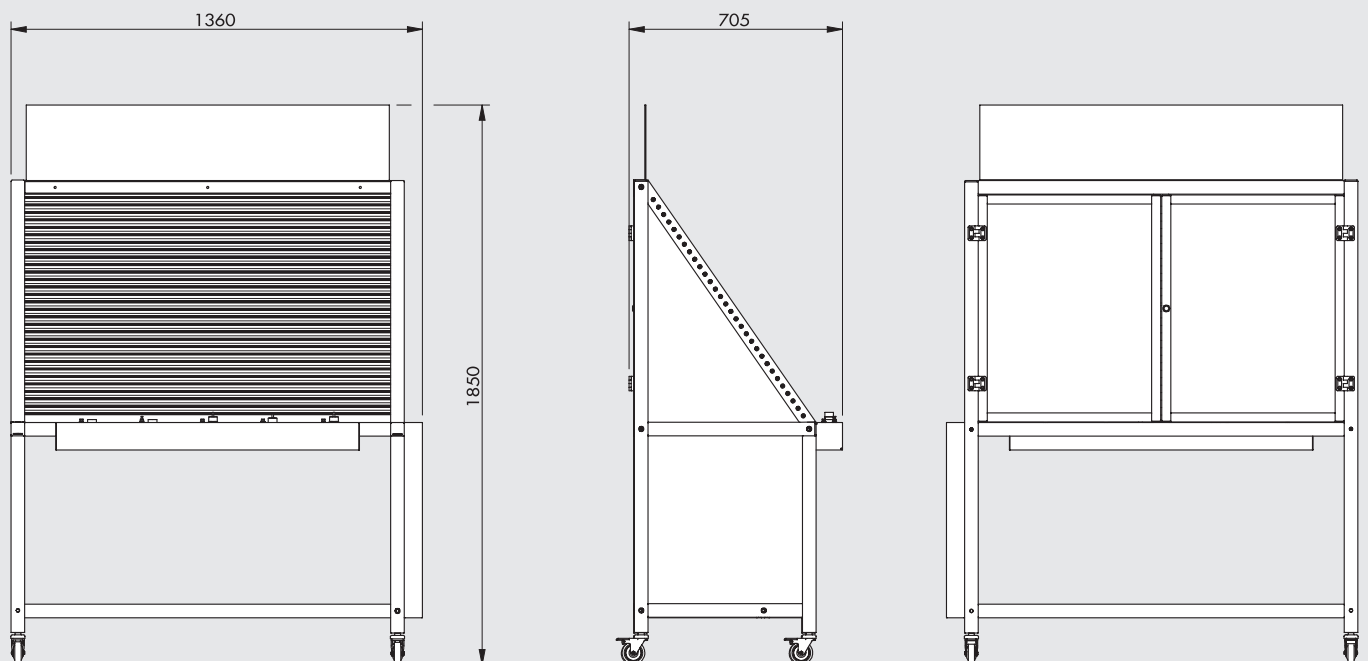
Metal Work's training benches have been designed to enable users to complete practical and theoretical exercises, facilitating the implementation of various types of pneumatic or electropneumatic circuits.

Built on a mobile anodised aluminium frame, the benches have a support rack for positioning various components using brackets to secure them, supplied with the benches. Each circuit can therefore be reconfigured as required, in line with the practice steps suggested by Metal Work or any other training requirements.

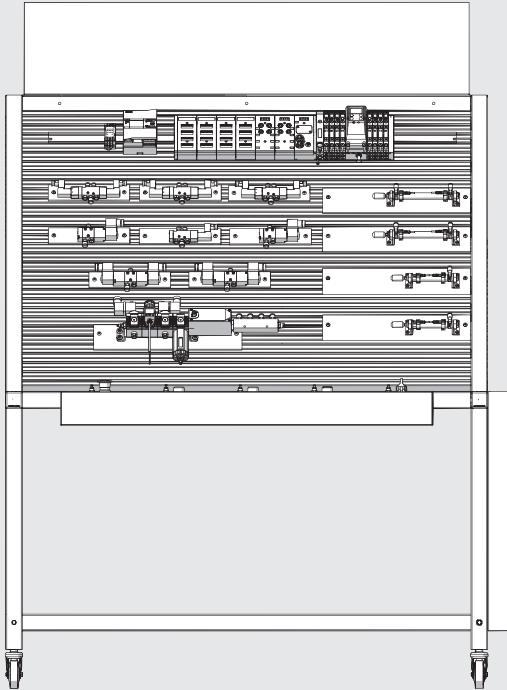
Two standard versions are available - one is purely for pneumatic practice and the other is for practice that also involves electropneumatic components, which can be controlled thanks to the presence of a PLC. Different versions can be designed according to specific requirements.



BENCH DIMENSIONS



ELECTROPNEUMATIC VERSION - CODE 9000762

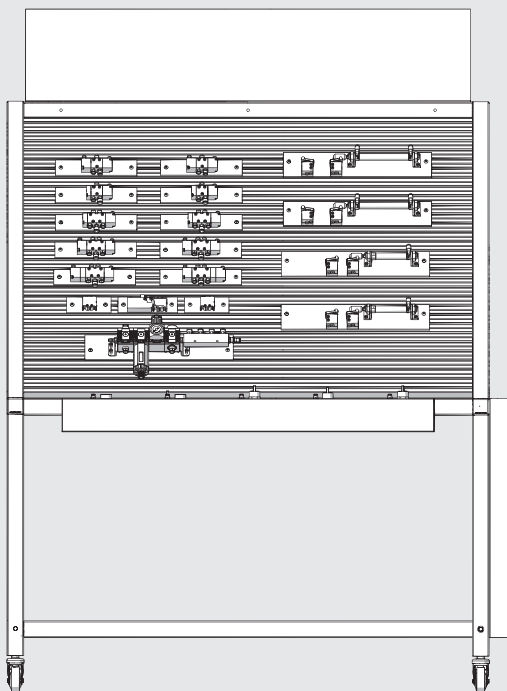


MAIN STANDARD PRODUCTS SUPPLIED WITH THE BENCH

Code	Description	Quantity
	PLC	1
7062020112	Mach 16 solenoid pneumatic valve 1/8" 5/2 bistable 24VDC	1
7062020312	Mach 16 solenoid pneumatic valve 1/8" 5/3 OC 24VDC	1
7062020212	Mach 16 solenoid pneumatic valve 1/8" 5/3 CC 24VDC	1
7062020132	Mach 16 solenoid pneumatic valve 1/8" 5/2 monostable 24VDC	1
7010020100	70 series solenoid pneumatic valve 1/8" 3/2 bistable	2
7010020200	70 series solenoid pneumatic valve 1/8" 3/2 monostable NC	2
112V160100CP	Cylinder ISO 6432 double acting Ø16 stroke 100	2
106V160050CP	Cylinder ISO 6432 single acting Ø16 stroke 50	2
08065100308020001 EB 80 island		1
02282507	Module 16 digital outputs EB 80	2
02282506	Module 16 digital inputs EB 80	2
02282505	Module 4 analog outputs M8 EB 80	1
02282504	Module 4 analog inputs M8 EB 80	1
02282P11Z00	Compressed air supply with silenced relief Ø8	1
02282B4086666	Base 4 positions 8 commands Ø6	2
708203I1	Valve I, NC-NC 3/2 manual control bistable	2
708203W1	Valve W, NO-NO 3/2 manual control bistable	2
708203L1	Valve L, NC-NO 3/2 manual control bistable	2
708203V1	Valve V, 5/2 monostable manual control bistable	1
02282A411Z00	Proportional pressure regulator with series regulation	1
02282C2	Closed end-plate	1
Syntesi unit		1
5610V700	V3V SY1 elpn without bushings	1
5610R140	REG SY1 08 without bushings	1
5610A700	APR SY1 ELPN without bushings	1
5610F500	FIL SY1 20 RA without bushings	1
9000640	640 series digital pressure switch	1
9000991511	Flux1 1/2 PNP 0-10V,4-20 mA, dis. sen. pr. WF	1
W0502111007	Distributor with 4 output input couplings 1/4 output 1/8	1

Note: the bench is supplied complete with all the accessories necessary for use, including: cables, plates for fixing the products, fittings, pipes, etc.

PNEUMATIC VERSION - CODE 9000763





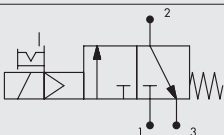

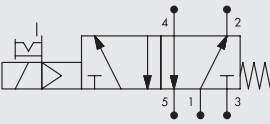

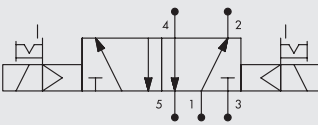

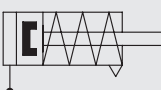

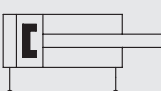


MAIN STANDARD PRODUCTS SUPPLIED WITH THE BENCH

Code	Description	Quantity
7010010100	Valve series 70 pneumatic 1/8" 3/2 bistable	2
7010010200	Valve series 70 pneumatic 1/8" 3/2 NC	2
7010011100	Valve series 70 pneumatic 1/8" 5/2	2
7010011200	Valve series 70 pneumatic 1/8" 5/2 bistable	2
7010012200	Valve series 70 pneumatic 1/8" 5/3 OC	1
7010012100	Valve series 70 pneumatic 1/8" 5/3 CC	1
W3604000002	Logic element AND logical product	1
W3604000001	Logic element OR logical sum	1
W3604000006	Logic element TIMER	1
113V160100CP	Cylinder ISO 6432 double acting Ø16 stroke 100	2
106V160050CP	Cylinder ISO 6432 single acting Ø16 stroke 50	2
W3501000200	Valve VME1-02 roller NC Ø4	4
Syntesi unit		1
5610V100	V3V SY1 manual without bushings	1
5610B100	FR SY1 5 02 RMSA without bushings	1

Note: the bench is supplied complete with all the accessories necessary for use, including: cables, plates for fixing the products, fittings, pipes, etc.

ELECTROPNEUMATIC SYMBOLS AND CONVENTIONS USED

Pneumatic circuit:		Electric circuit:	
- NC valve closed, no air flow - NO valve open, air flowing		- NC contact closed, current flowing - NO contact open, no current flowing	
	Air supply source		Electrical connection
	Air outlet		Pushbutton contact NO (normally open)
	Solenoid valve (E.V.) 3/2 monostable normally closed (NC)		Sensor contact NO (normally open)
	Solenoid valve (E.V.) 5/2 monostable		Coil
	Solenoid valve (E.V.) 5/2 bistable		Limit switch sensor switched on when the rod is retracted
	Single-acting cylinder (SE) magnetic retracted rod		Limit switch sensor switched on when the rod is extended
	Double-acting cylinder (DE) magnetic		

An electropneumatic circuit is made up of two distinct circuits:

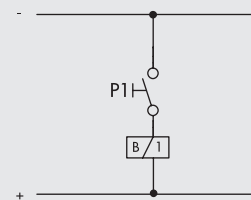
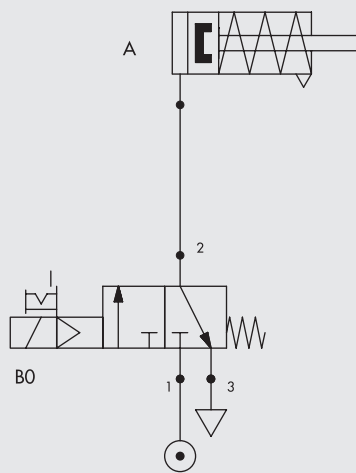
- 1) **Power circuit** (pneumatically powered): includes cylinders, valves and components for connecting it to the pneumatic supply.
- 2) **Control circuit** (electrically powered): includes buttons, range of limit switches, valve coils and components for connecting to the electricity supply.

APPLICATION EXAMPLES ELECTROPNEUMATIC VERSION - 9000762

EXAMPLE EP01

Sequence A+/A-

- **Pneumatic circuit:** the cylinder rest position is obtained with a spring that acts in the front chamber, keeping the rod retracted (A-).
- **Electric circuit:** button P1 has a NO contact; by operating P1, the solenoid valve switches and sends air to the rear cylinder chamber which goes to A+ (rod extended) and stays there while P1 is engaged; on releasing it the spring returns the cylinder to the starting position, discharging the air from the rear chamber by connecting 2 with 3 on the solenoid valve



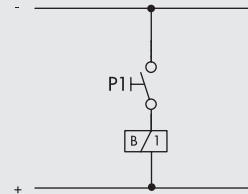
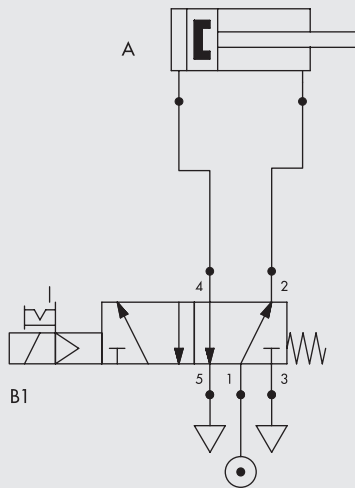
EXAMPLE EP02

It is possible to move the same type of cylinder using two types of valves, monostable or bistable.

EXAMPLE EP02.1

Sequence A+/A- with monostable valve

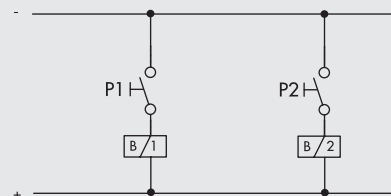
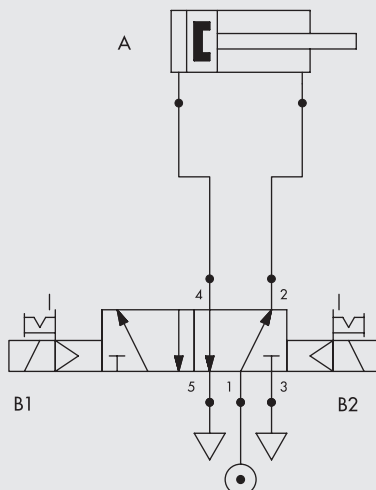
- **Pneumatic circuit:** the solenoid valve is a 5/2 monostable valve; with the circuit powered it is the front chamber which is pressurised (rod retracted);
- **Electric circuit:** the P1 contact is operated by an unstable button device; when pressed, the electric circuit closes and the B1 coil is excited, enabling the cylinder to move to the A+ position (rod extended). To make it stay in this position operators must keep the button pressed; on releasing it the cylinder returns to its starting position and stops to await a new operation.



EXAMPLE EP02.2

Sequence A+/A- with bistable valve

- **Pneumatic circuit:** the solenoid valve is bistable therefore the cylinder rest position is determined by the last coil that is excited in each cycle;
- **Electric circuit:** with two control devices, two circuits are required: the first to obtain the A+ work range by briefly operating P1 (due to solenoid valve stability the cylinder stops at A+ until the operation of P2); the second to obtain the return stroke by briefly operating P2, due to solenoid valve stability the cylinder stops at A- to await the next operation on P1.



EXAMPLE EP03

A sequence is defined as "single cycle" when every operation of the control button to start the cylinder cycle completes the work range and automatically returns to the starting position to await the next command.

A single cycle can be obtained in two ways:

- 1) Without a safe start: the cylinder starts solely by operator commands - this action may be effective even if the cylinder is not in the starting position.
- 2) With a safe start: the cylinder starts only if the button has the consent of the sensor detecting the cylinder starting position.

EXAMPLE EP03.1

Without safe start

There are 2 control elements:

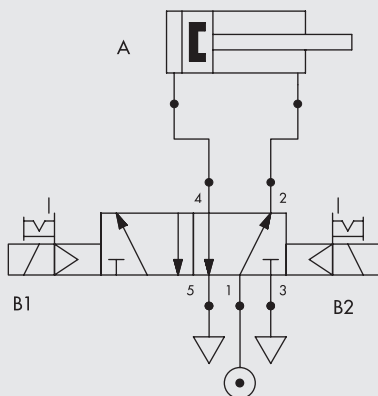
- Button P1 which operates coil B1.
- Sensor a1 which operates coil B2 automatically for the cylinder stroke return time.

The logical equations for the range of motion are as follows: $A+= B1$ and $A-= B2$

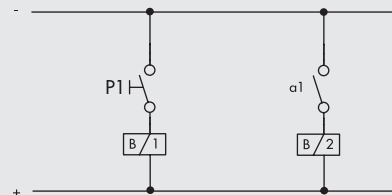
The logical equations for the electrical circuit are as follows: $B1=P1$

The B1 coil equation shows that the P1 command:

- May block the a1 command i.e. if P1 is kept pressed the signal prevents a1 from performing its function: there are two opposite signals on the solenoid valve.
- May operate during the cylinder return phase (because a1 is not present) and have it set off again before it has completed its cycle.



a1



EXAMPLE EP03.2

With safe start

There are 3 control elements: the previous 2 are accompanied by sensor a0, which detects the cylinder rest position (rod retracted).

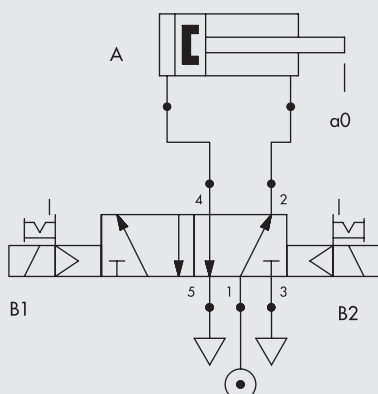
The logical equations for the range of motion are as follows: $A+= B1$ and $A-= B2$

The logical equations for the electrical circuit are as follows: $A+=P1*a0$ and $A-= a1$

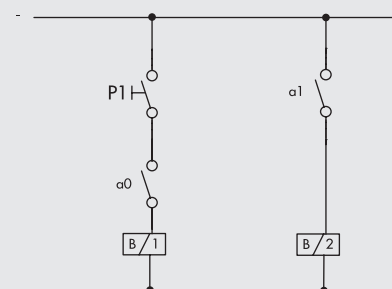
The B1 coil equation shows that the cycle start depends on the AND operation between contacts P1 and a0.

Supposing prolonged P1 operation:

- Coil B1 cannot block B2 because a0 'disappears' immediately after the cycle starts.
- Supposing operation of P1 during the motion of A-, the B1 coil is not excited because there is no a0 signal: this means that it will not be possible to restart the cycle until the rod is fully retracted.



a1



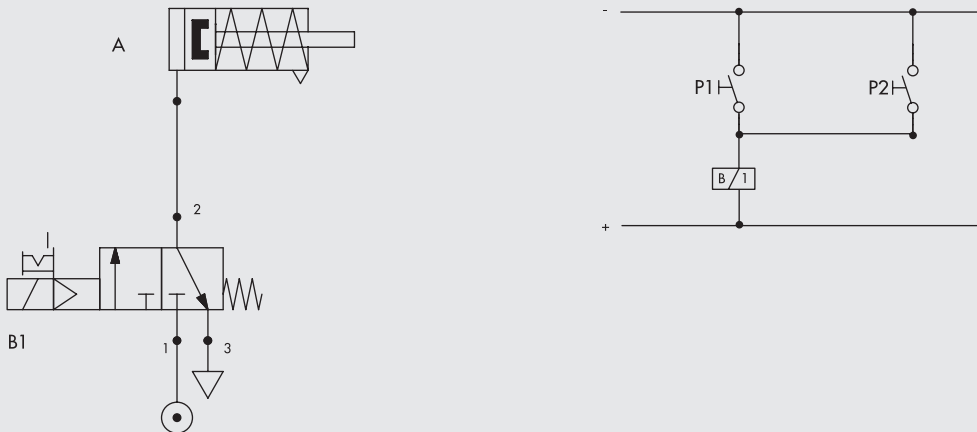
EXAMPLE EP04

The electrical signal that reaches the coil of a solenoid valve can be determined by a single contact or by one or more logical operations between several independent contacts.

EXAMPLE EP04.1

Logical equation OR

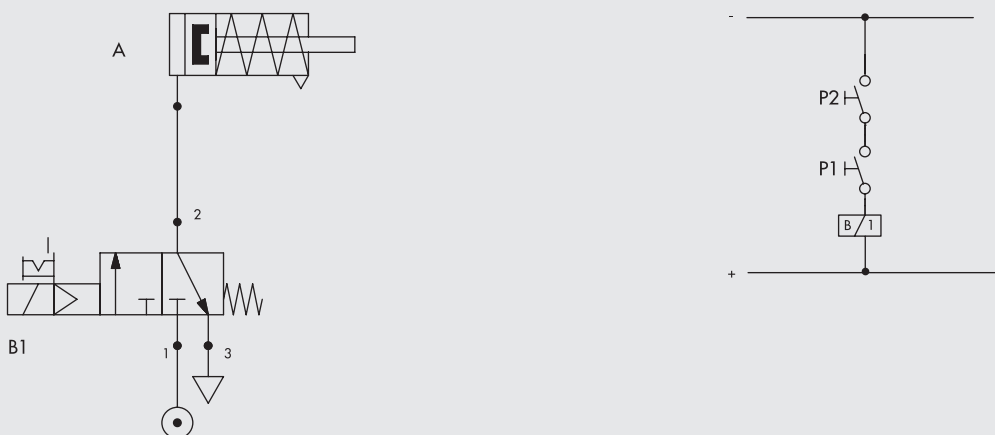
- **Pneumatic circuit:** pneumatic circuit the same as that of EP01 operation.
- **Electric circuit:** the coil that switches the valve bringing the cylinder to position A+ (rod extended) can be excited through button P1 or P2 i.e. when at least one of the 2 contacts is closed. The logical sum operation is defined as OR (either P1 or P2) and the related connection is defined as 'in parallel'.



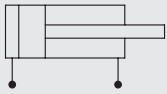

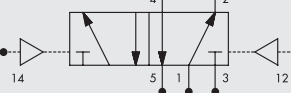
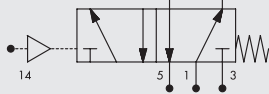
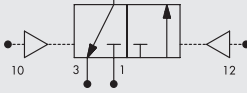
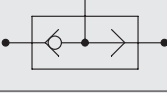
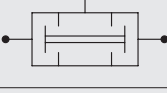
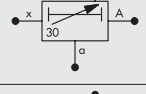

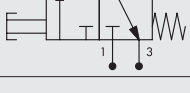


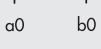
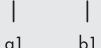
EXAMPLE EP04.2

Logical equation AND

- **Pneumatic circuit:** pneumatic circuit the same as that of EP01 operation.
- **Electric circuit:** the coil that switches the valve bringing the cylinder to position A+ (rod extended) can only be excited by pressing buttons P1 and P2 simultaneously i.e. when both of the 2 contacts are closed. The logical sum operation is defined as AND (P1 and P2) and the related connection is defined as 'in series'.



PNEUMATIC SYMBOLS AND CONVENTIONS USED

	Double-acting cylinder
	Single-acting cylinder
	5/2 bistable pneumatic valve
	5/2 monostable pneumatic valve
	3/2 bistable pneumatic valve
	OR valve
	AND valve
	Timer
	3/2 monostable valve – roller lever (pneumatic limit switch)
	3/2 monostable valve – pushbutton control
	Air supply
	Relief
	Pneumatic limit switch switched on when the rod is retracted (respectively for cylinder A and B)
	Pneumatic limit switch switched on when the rod is extended (respectively for cylinder A and B)

APPLICATION EXAMPLES PNEUMATIC VERSION - 9000763

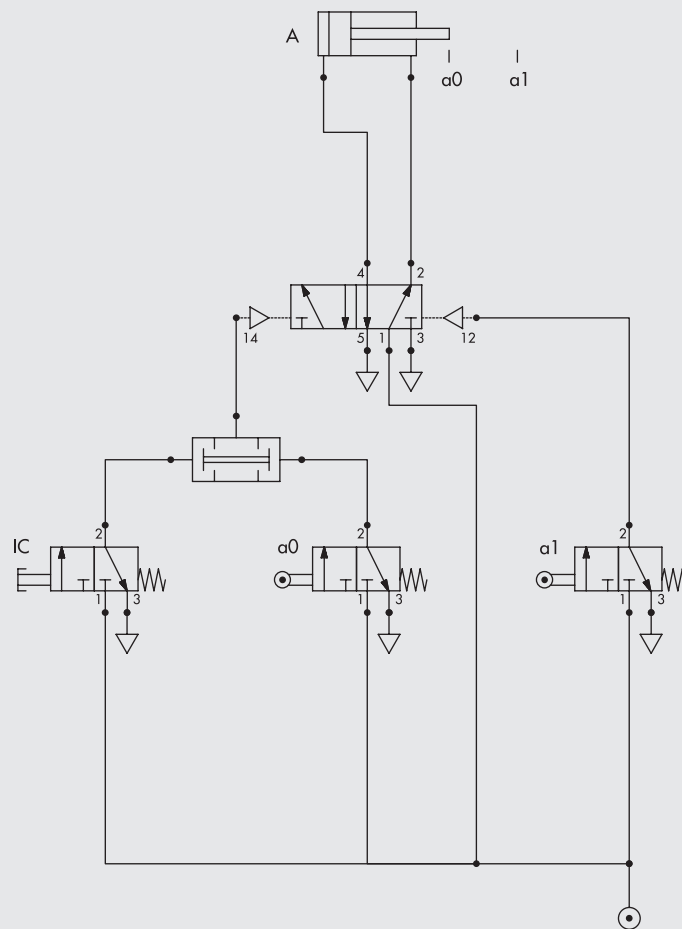
EXAMPLE PN01

Single cycle with safe start

This circuit demonstrates how the rod can exit if, and only if, it is fully retracted once the IC rod extension command is given.

- With the circuit at rest one of the two stop valves is operated (a0).
- In this situation it is possible to have the rod exit by pressing button IC.
- On reaching the a1 stop the rod will return automatically.

The presence of the AND valve stops the cycle from restarting before the rod has returned fully, toggling the limit switch a0 again.



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