Fischertechnik production line programming

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Abstract -- *This document presents the development of the programming of 5 different stations of a didactic production line of the FischerTechnik company. For this it was necessary to program each one in the ROBOPro software, taking into account that the stations are part of a sequence using a PLC for each station and programming sequentially so that each operation in the process of each station is fulfilled.*

Abstract -- *This document presents the development of the programming of 5 different stations of a didactic production line of the company FischerTechnik. So that it is necessary to program a software in ROBOPro taking into account that the stations are part of a sequence using a PLC for each station and programming sequentially so that each time with the operation in the process of each station.*

Keywords -- *Pneumatics, Logic, Process, Industrial, Delays.*

INTRODUCTION

A programmable logic controller is a digital electronic device that uses a programmable memory to save instructions and carry out logical, sequence configuration, synchronization, counting and arithmetic functions, for the control of machinery and processes, in this process it is mainly to implement logical functions as a first step for learning programming[1].

MATERIALS

- ROBOPro
- software FluidSim Pneumatics software
- Fischertechnik stations

PROCEDURE

For each station, the characterization of both digital and analog sensors arranged and of the actuators that act in the process of each station was carried out. The following tables show the result of the recognition of each station.

Characterization:

The input (sensors) and output (actuators) components for each of the Fischertechnik stations are presented below.

Station 1 - Distribution		
Inputs		
I1	Limit switch	Retracted cylinder
I2	Limit switch	Extended cylinder
I3	Optical sensor	Object detection
I4	Limit switch button	Arm move to same station
I5	Limit switch button	Arm move to next station
Outputs		
O1	Motor 1	Compressor
O2	Motor 2	Compressor
O3	Motor 1 arm	Arm move to same station
O4	Motor 2 arm	Arm move to next station
O5	Motor 3 Pump	Suction cup
O6	Light	Object detection
O7	Double effect cylinder	Retracts cylinder
O8	Double effect cylinder	Extendeds cylinder

Table 1: Characterization station 1

Station 2 - Transport		
Inputs		
I1	Optical sensor	Object detection
I2	Magnetic limit switch	Platform inclined
I3	Magnetic limit switch	Platform steady
I4	Magnetic limit switch	Blocked track
I5	Button	Platform up
I6	Button	Platform down
Outputs		
O1	Motor 1	Compressor
O2	Motor 2	Compressor
O3	Motor 1 Platform	Platform goes up
O4	Motor 2 Platform	Platform goes down
O5	Light	Turn on light, object detection
O6	Double effect cylinder	It inclines the platform
O7	Double effect cylinder	Retracts so the platform is horizontal
O8	Simple effect cylinder	Blocking cylinder, allows pass to next station

Table 2: Characterization station 2

Station 3 - Process		
Inputs		
I1	Optical sensor	Object detection
I2	Magnetic limit switch	Cylinder, mid position
I3	Magnetic limit switch	Cylinder, down
I4	Magnetic sensor	Push piece out of the station
I5	Encoder	Detects every 90° turn by the platform
Outputs		
O1	Motor 1	Compressor
O2	Motor 2	Compressor
O3	Motor 1 Clockwise turn	Transport of object, forward
O4	Motor 2 CCW turn	Transport of object, backward
O5	Motor 3	Conveyor belt, next station
O6	Motor 3	Conveyor belt, same station
O7	Simple effect cylinder	Simulate a process
O8	Light	Activates light for the optical sensor (detection)

Table 3: Characterization station 3

Station 4 - Verification		
Inputs		
I1	Optical sensor	Before verification sensor
I2	Optical sensor	After verification sensor
I3	Magnetic limit switch	Blocks the piece while is in the station
I4	Sensor	Detects a feature of the piece (product)
I5	Magnetic limit switch	Allows the piece to continue moving
Outputs		
O1	Motor 1	Compressor
O2	Motor 2	Compressor
O3	Motor 2	Activates conveyor belt
O4	Light 1	Turns light on before verification
O5	Light 2	Turn light on after verification
O6	Double effect cylinder	Retracts, blocks passing on conveyor belt
O7	Double effect cylinder	Extends, allow passing on the conveyor belt
O8	Simple effect cylinder	In case the product doesnt pass the checks, takes the piece out of the line

Table 4: Characterization station 4

Station 5 - Classification		
Inputs		
I1	Optical sensor	Before verification sensor
I2	Limit switch button	After verification sensor
I3	Limit switch button	Blocks the piece while is in the station
I4	Magnetic limit switch	Detects a feature of the piece (product)
Outputs		
O1	Motor 1	Compressor
O2	Motor 1	Compressor
O3	Motor 2 CCW	Linear actuator, move manipulator to left
O4	Motor 3 CW	Linear actuator, move manipulator to right
O5	Light 2	Turn light on for object detection
O6	Double effect cylinder	Manipulator that holds the piece
O7	Motor 3 Pump, suction	Allos to grab and hold the piece

Table 5: Characterization station 5

Algorithm:

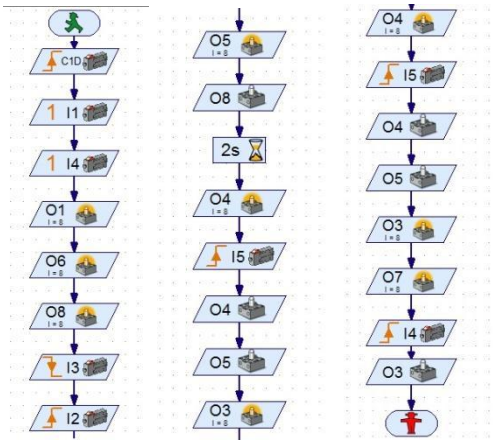


Figure 1: Algorithm station 1

For station 1 the initial conditions are that the cylinder that supplies parts to the manipulator is inside the sleeve, and that the manipulator that transports the part from one station to another is in station 1.

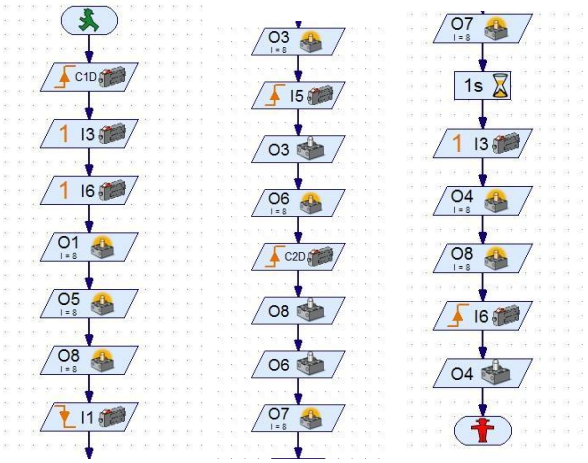


Figure 2: Algorithm station 2

In the transport station, station 2, you must start the process by having the platform that transports the piece in a horizontal position and that it is down ready to receive the piece coming from the previous station.

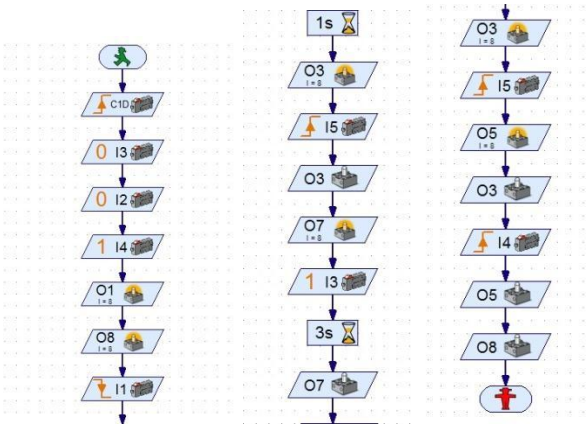


Figure 3: Station 3 algorithm

For station 3, which corresponds to the main process, it is taken into account in order for it to come into operation that the single-acting cylinder must be inside the sleeve, completely in reverse, and that the band that pushes the piece

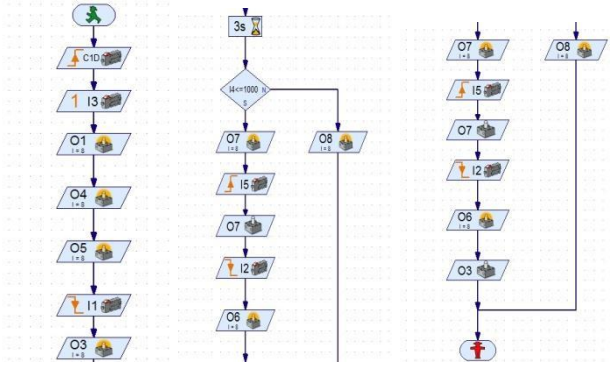


Figure 4: Station 4 Algorithm

At station 4 verification, the only initial condition for the start of the process is that the passage of the piece on the conveyor belt is blocked, in order not to allow those pieces that are not verified to pass to the next station, which in this case corresponds to the color selection.

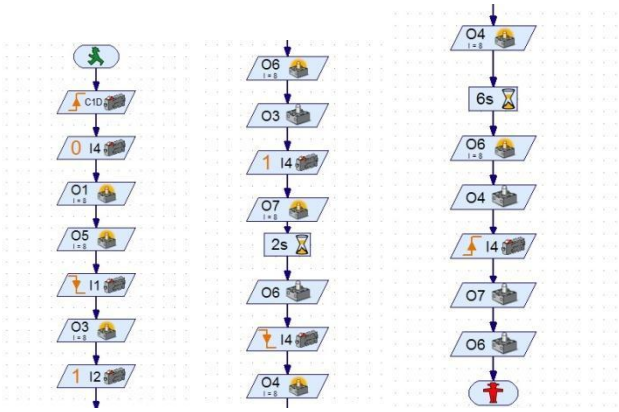


Figure 5: Algorithm station 5

And finally, the initial condition to carry out this classification process is that the manipulator (single-acting cylinder) is inside the sleeve, since this will allow it to move along the deposits of the pieces. without colliding with the station support.

Plans:

The plans of each of the stations are attached at the end of this document.

RESULTS

The correct operation of each of the stations is obtained, programmed sequentially so that from the beginning it can only work if certain conditions are met in a certain station, so that conflicts with the electronic components do not occur and so that the process is carried out correctly. out without problems.

CONCLUSIONS

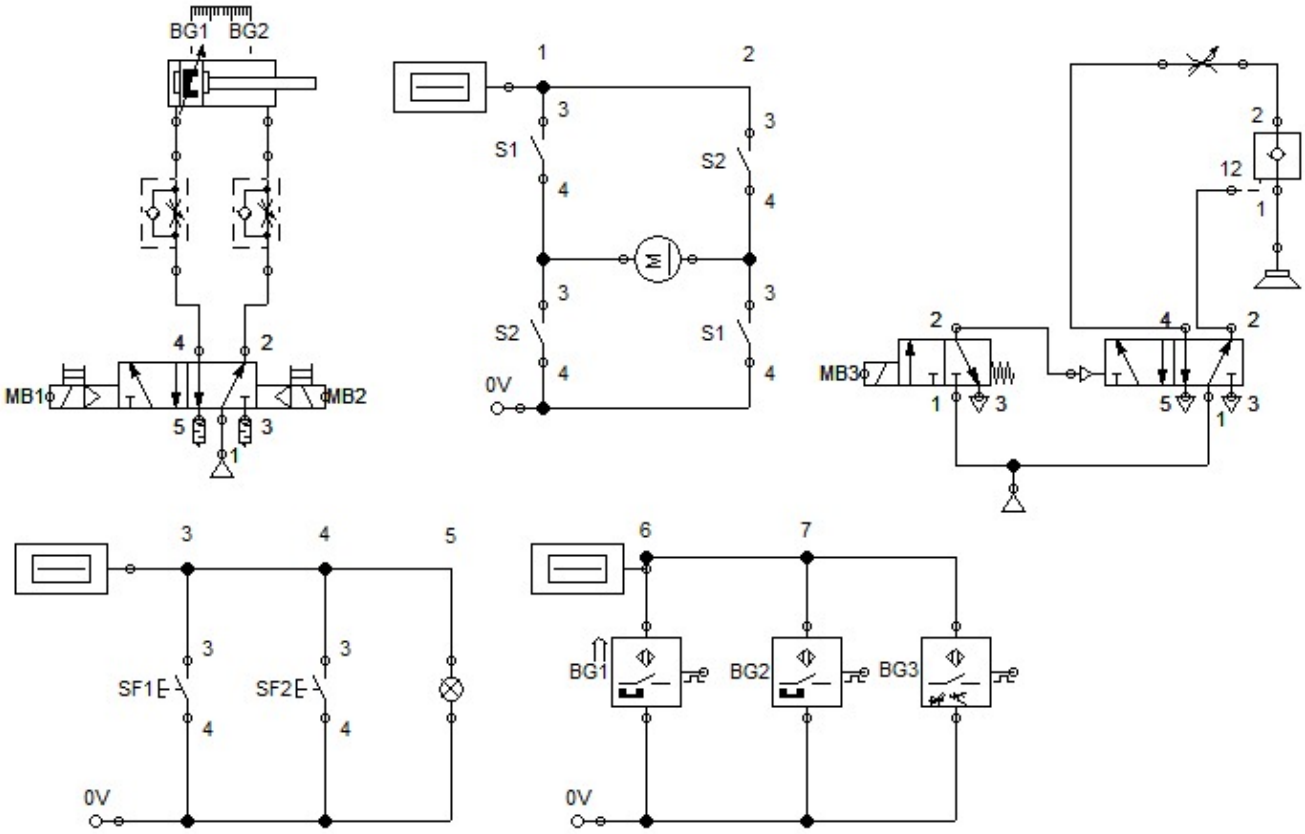
In industrial processes it is vitally important to know each of the field elements found, for example, in a production line, which is why characterization is the first and fundamental step before putting machinery into operation, since you can know the operating characteristics of the elements such as the present actuators and sensors.

In industrial processes, the use of dedicated software such as fischertechnik's RoboPro is of great help, which has an interface that acts as a link between the computer and the model for easy application and implementation.

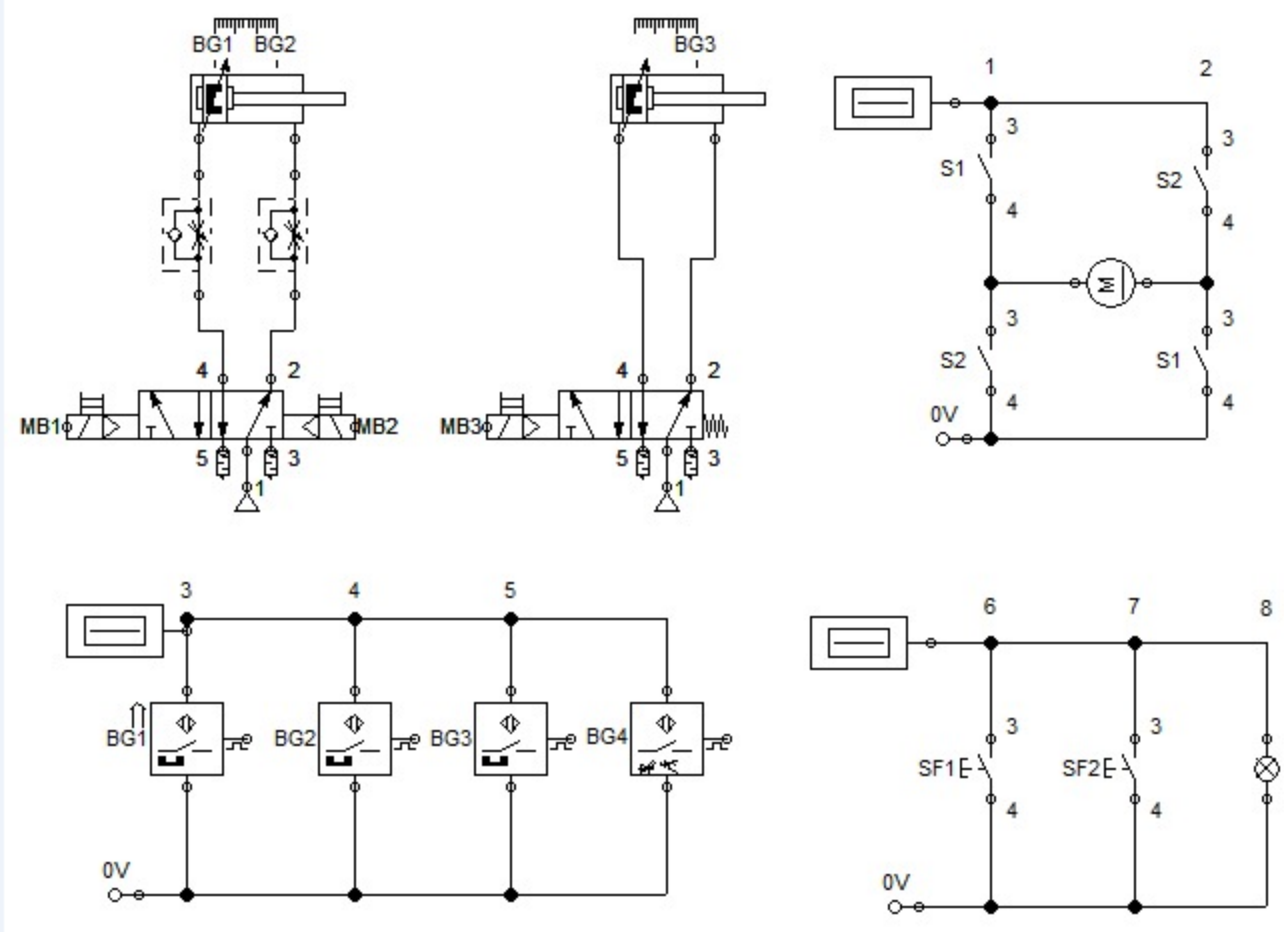
REFERENCES

[1]W. Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, Editorial Alfaomega, 2 ed, pp 423 - 431.

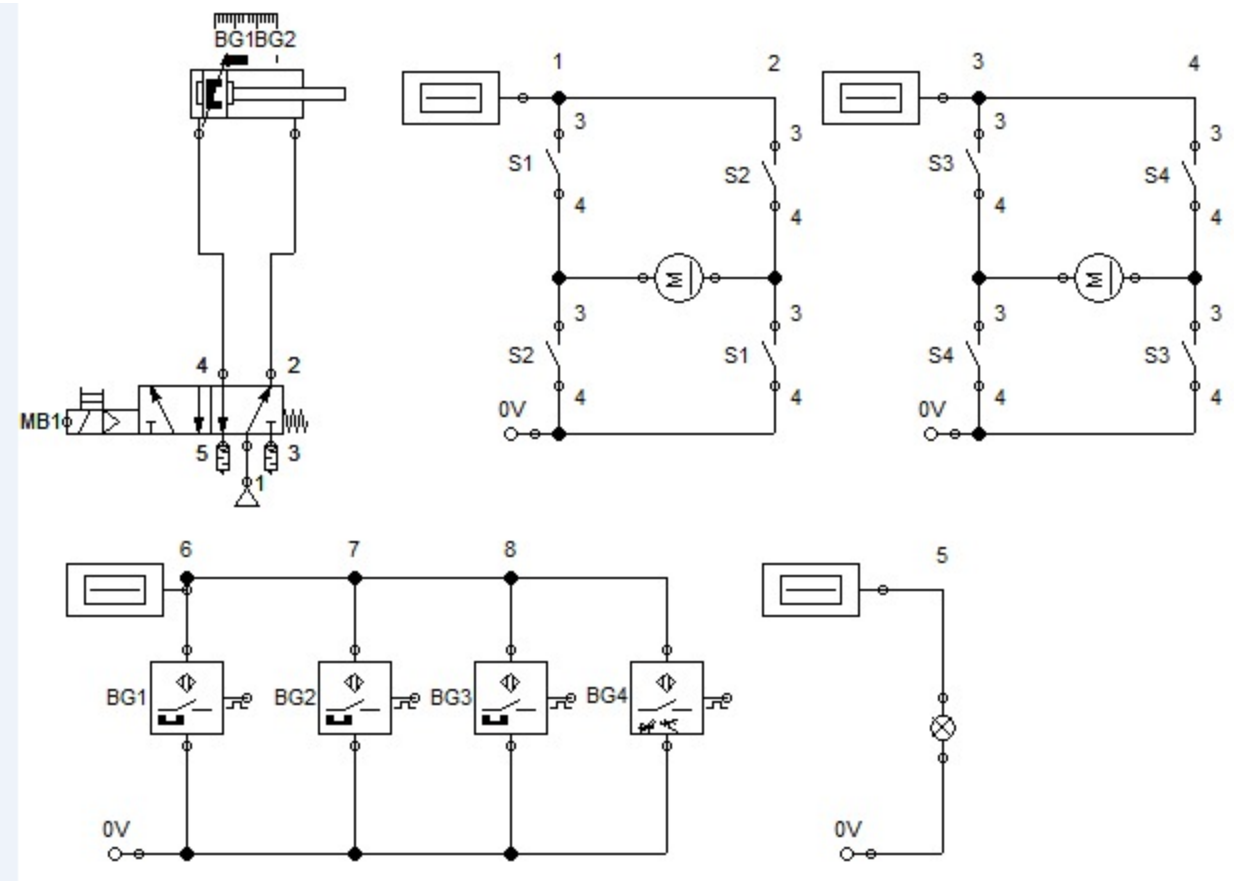
Station 1



Station 2



Station 3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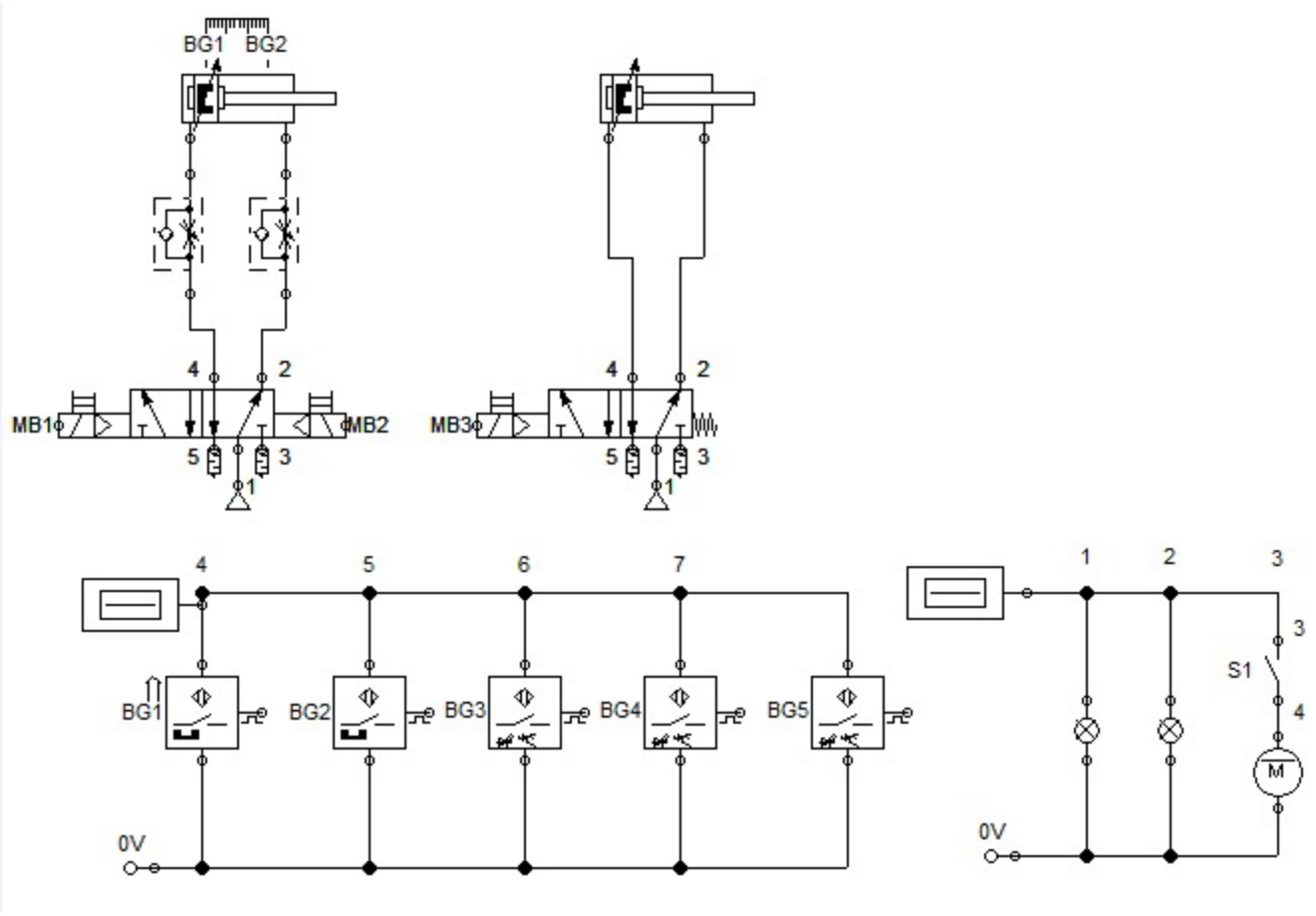
Station 4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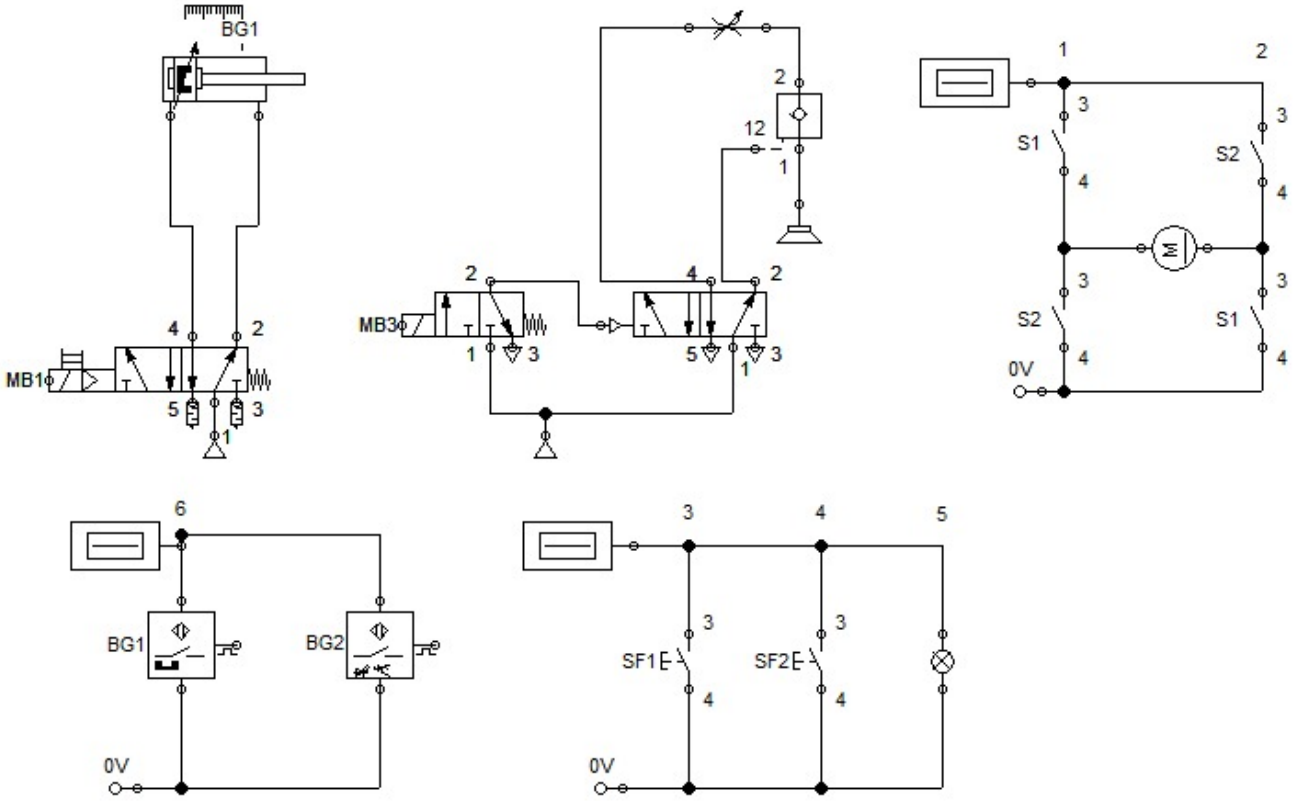
Station 5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