Experiment (5)
FESTO MPS Distribution System

Introduction

A production line in a factory can be made up of individual production cells. Each cell has a specific function in the process (distribution, testing, processing, handling, assembly, storage). You can select an application or process that meets your requirements from a range of individual stations. In this experiment we are going to control the sequence of operation of FESTO MPS distribution system using Siemens S7-300 PLC.

Objectives

This experiment aims to:
1- Introduce the distribution system and vacuum technology.
2- Use the pneumatic actuators (linear and rotary drives).
3- Program the operation of distribution system using ladder logic programming.
4- Be able to perform sequence dependent operations on real systems.

Theory

Function of FESTO MPS distribution system
The Distributing station separates workpieces. Up to eight workpieces are stored in the magazine tube of the stacking magazine. A double-acting cylinder pushes the workpieces out one at a time. The Changer module grips the separated workpiece via a suction gripper. The swivel arm of the changer, which is driven by a rotary actuator, moves the workpiece to the transfer point of the downstream station. See figure 1.
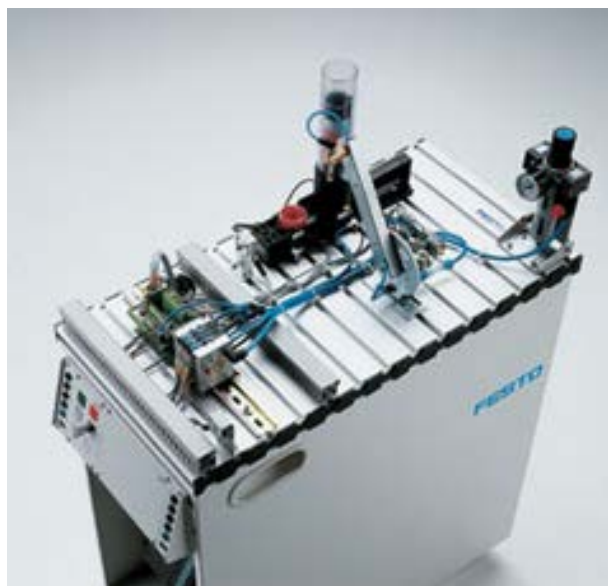

Figure 1: FESTO MPS distribution system

Special technology: Semi-rotary actuator

The distributing station utilizes various actuators, all of which are industrial components. The rotary actuator of the swivel arm can be set to various angles between 90° and 270°. The end positions are sensed by means of micro switches. A double-acting linear cylinder pushes workpieces out of the stacking magazine. The end positions are sensed using proximity sensors.

Special grippers: Suction gripper

The suction gripper of the Changer module grips the workpiece. The vacuum is generated in the vacuum slice of the CP valve terminal by means of the Venturi principle and is monitored by a pressure switch. The switching point of the pressure switch is adjustable.

Pneumatic schematic diagram

Figure 2 shows the pneumatic diagram of the FESTO MPS distribution system. You can notice that there are five outputs for the system:

1) SOL_A and SOL_B: Control the movement of the cylinder.
2) SOL_C and SOL_D: Control the movement of the pneumatic motor.
3) SOL_E: Controls the suction operation for the pneumatic system.

Also, the schematic diagram shows the limit switches and proximity switches that connected to the system. The pressure switch detects if the object is stuck to the suction cup of the distribution system.
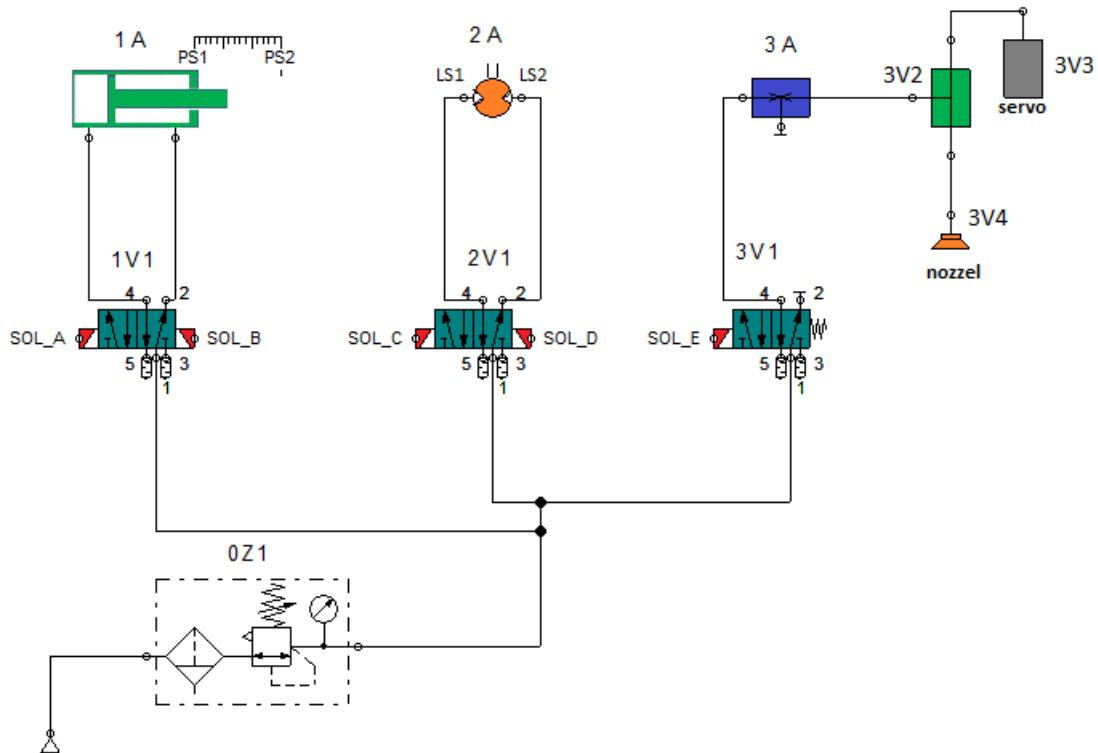

Figure 2: Pneumatic schematic diagram

Equipment

1- FESTO MPS distribution system.
2- Computer with SIMATIC software.
3- Siemens S7-300 PLC

Procedures

Part 1: Program the sequence of operation of the distribution system

The following sequence of operation should be applied:

- Optical sensor: check if object exists.
- 1A + until PS2
- 2A + until LS2
- Turn on SOL_E (Vacuum technology)
- Pressure switch: check for object is attached.
- 1A- until PS1
- 2A- until LS1
-Turn off SOL_E
- Repeat the sequence

Discussion and Conclusions

1) Identify the connection of the solenoids to the digital output module and the switches to the digital input module, then write the appropriate address for each input and output on the following PLC diagram:
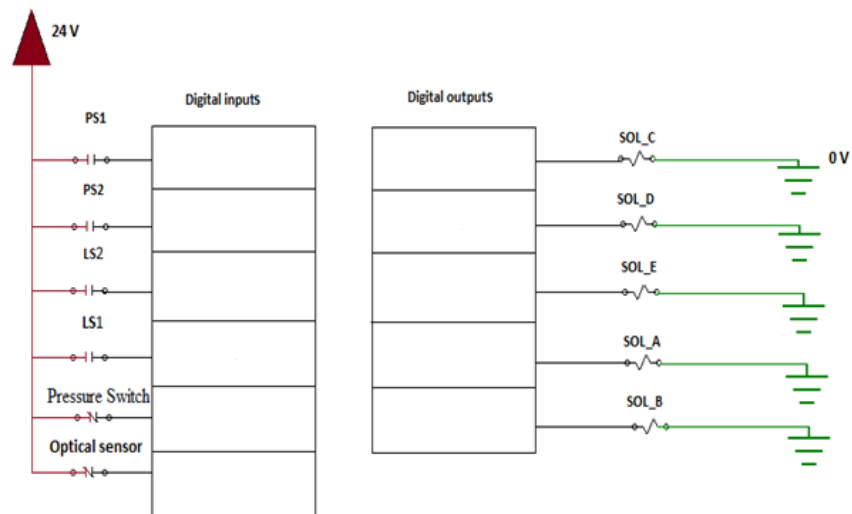
Figure 3: Question 1 – PLC schematic diagram