Conveyor station

Exercise 1: Learning about components and their function

Learning objective

Upon completing this exercise, you should

- be familiar with the most important components in the conveyor station

Problem description

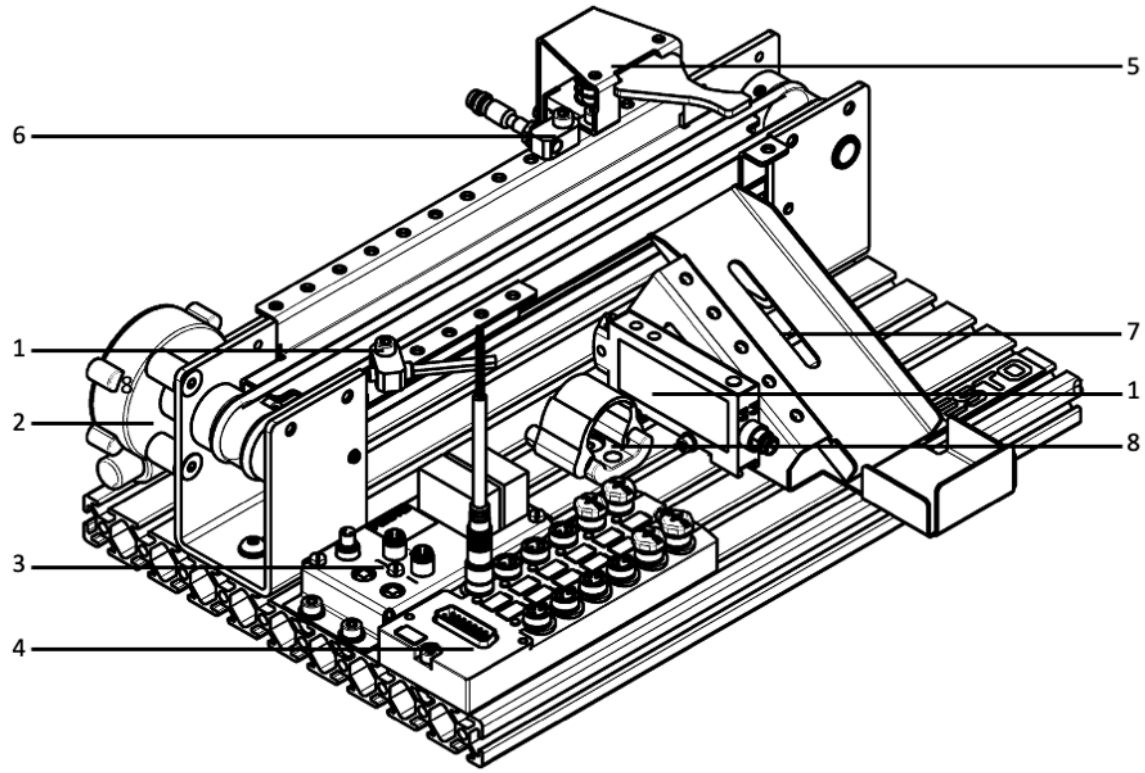
All automated systems use a range of components such as sensors, valves, motors, etc. It is important to be familiar with the function of the components in a system.

Task

1. Match the components with their correct designation and describe their purpose within the station.

Aids

- Theory book
- FluidSIM® online help
- Data sheets



Name: Class: Date:

1. Match the components with their correct designation and describe their purpose within the station.

No.	Designation	Function within the station
1		
2		
3		
4		
5		
6		
7		
8		

Conveyor station

Exercise 2: Learning about components, symbols and designations

Learning objective

Upon completing this exercise, you should

- be familiar with the symbols and designations of key pneumatic components

Problem description

All automated systems use a range of components such as sensors, valves, motors, etc. It is important to describe the function of the system clearly and simply to all involved. This is done using, among other things, electrical, pneumatic and hydraulic circuit diagrams.
To understand these circuit diagrams, you must be familiar with the symbols used.

Task

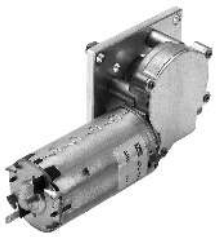
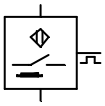
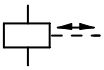
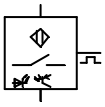
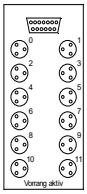
1. Match the components with the correct symbols and designations. Draw lines between the components, symbols and designations.

Aids

- Theory book
- FluidSIM® online help
- Data sheets

Name: Class: Date:

1. Match the components with the correct symbols and designations. Do this by entering the number assigned to the component in the correct fields in the "Symbol" and "Designation" columns.

Component	Symbol	Designation
1 	[ ] 	[ ] Solenoid
2 	[ ] 	[ ] Inductive sensor
3 	[ ] 	[ ] DC motor
4 	[ ] 	[ ] Multi-pin plug distributor
5 	[ ] 	[ ] Opto sensor

Conveyor station

Exercise 3: Learning about the structure of symbols

Learning objectives

Upon completing this exercise, you should

- be familiar with the symbol and designation of key pneumatic components
- be familiar with the structure of the symbols

Problem description

All automated systems use a range of components such as sensors, valves, motors, etc. It is important to describe the function of the system clearly and simply. This is done using, among other things electrical, pneumatic and hydraulic circuit diagrams.
To understand these circuit diagrams, you must be familiar with the symbols used. This exercise is designed to teach you about the symbols.

Task

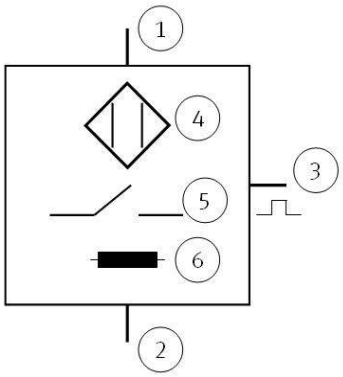
1. Shown below are a number of circuit symbols. Enter the name of the component as well as the description of the numbered symbols in the tables.

Aids

- Theory book
- FluidSIM® online help
- Data sheets

Name:	Class:	Date:

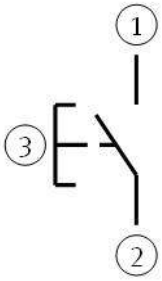
1. Shown below are a number of circuit symbols. Enter the name of the component as well as the description of the numbered symbols in the tables.



Name of the component

Function of the symbols

1
2
3
4
5
6

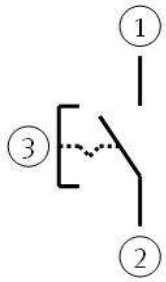


Name of the component

Function of the symbols

1
2
3

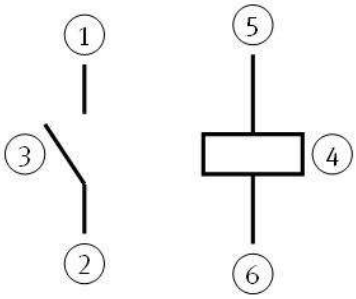
Name:	Class:	Date:



Name of the component

Function of the symbols

1
2
3



Name of the component

Function of the symbols

1
2
3
4
5
6

Conveyor station

Exercise 4: Using sensors

Learning objectives

Upon completing this exercise, you should

- be familiar with the mode of operation and range of applications of opto and inductive sensors
- be able to incorporate the sensors into circuit diagrams
- be able to read the sensors in the conveyor station using FluidSIM®

Problem description

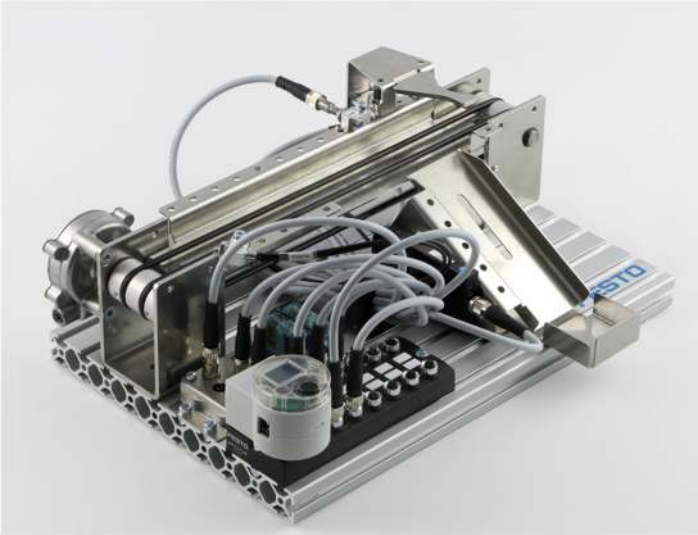
Sensors are used in automated systems to monitor the status of the system. The conveyor station uses so-called proximity sensors that are most often used to detect the presence or position of objects.

Task

1. Connect the opto and inductive sensors to the multi-pin plug distributor of the conveyor station. Connect the EasyPort to the multi-pin plug distributor and to the power supply. The sensors are now functional. This is indicated by the LEDs on the sensors and/or multi-pin plug distributor. Bring various objects close to the sensors and study their behaviour. Mark in the table the objects to which the sensor responds. What else do you notice? What could the sensors be used for?
2. In FluidSIM®, create a circuit where the sensors switch on a lamp when activated.

Aids

- Theory book
- FluidSIM® online help
- Data sheets
- Conveyor station



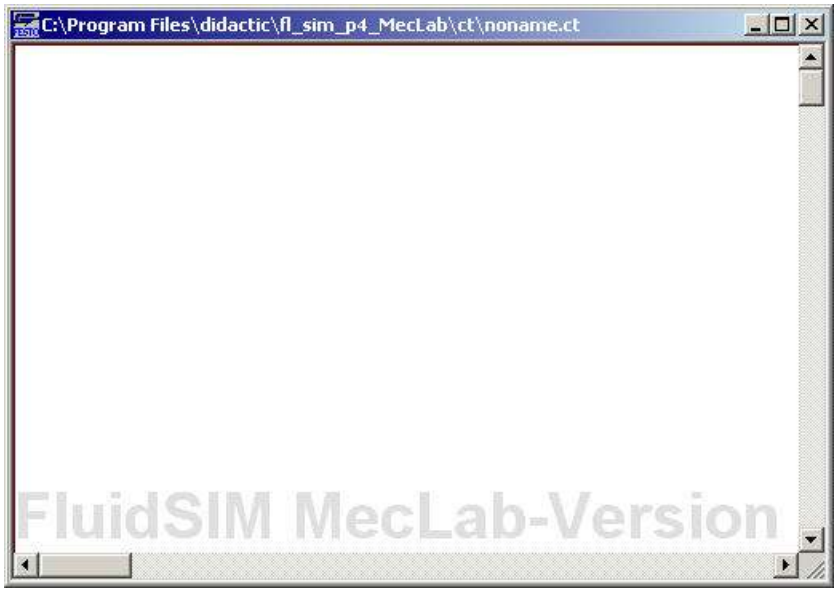
Picture of the station

Name: Class: Date:

1. Connect the opto and inductive sensors to the multi-pin plug distributor of the conveyor station. Connect the EasyPort to the multi-pin plug distributor and to the power supply. The optical sensor may still have to be calibrated, see data sheet SOE4).The sensors are now functional. This is indicated by the LEDs on the sensors and/or multi-pin plug distributor. Bring various objects close to the sensors and study their behaviour. Mark in the table the objects to which the sensor responds. What else do you notice? What could the sensors be used for?

Object	Opto sensor	Inductive sensor
		
Red workpiece		
Black workpiece		
Silver workpiece		
Coin		
Finger		
Paper		

2. In FluidSIM®, create a circuit where the sensors switch on a lamp when activated.



Conveyor station

Exercise 5: Actuating DC motors

Learning objectives

Upon completing this exercise, you should

- be familiar with the mode of operation of DC motors
- be able to incorporate DC motors into circuit diagrams
- be able to change the direction of motion of a DC motor

Problem description

Generally speaking, the DC motor is one of the most important drives. It is used in many electronic entertainment devices, household devices, toys and industrial machines. This exercise involves developing an actuator for this motor type.

Tasks

1. In the theory section or the FluidSIM® online help, read up about the mode of operation of the DC motor.
   - What do you need to do to change the motor's direction of motion?
   - Can the solenoid's direction of motion also be changed?
2. In the theory section, read up about pushbuttons, switches, N/O contacts, N/C contacts and changeover switches. What are these components used for?
3. In FluidSIM®, create a circuit that can be used to switch the DC motor on and off manually as well as change the direction of motion.
4. In the theory section, read up about relays. Describe their method of operation and fields of application.
5. Extend the circuit from Exercise 3 so that the DC motor is switched on and off and has its polarity reversed indirectly via relays.
6. Extend your program to include the multi-pin plug symbol, set all necessary labels and connect the PC and conveyor station to the EasyPort. Test your program using the station.

Aids

- Theory book
- FluidSIM® online help
- Conveyor station

Name: Class: Date:

1. In the theory section or the FluidSIM® online help, read up about the mode of operation of the DC motor.

What do you need to do to change the motor's direction of motion?

_____

_____

_____

Can the solenoid's direction of motion also be changed?

_____

_____

_____

2. In the theory section, read up about pushbuttons, switches, normally open contacts, normally closed contacts and changeover switches. What are these components used for?

Symbol	Designation	Function
		
		
		
		
		
		

Name:	Class:	Date:

3. In FluidSIM®, create a circuit that can be used to switch the DC motor on and off manually as well as change the direction of motion.

4. In the theory section, read up about relays. Describe their method of operation and fields of application.

_____

_____

_____

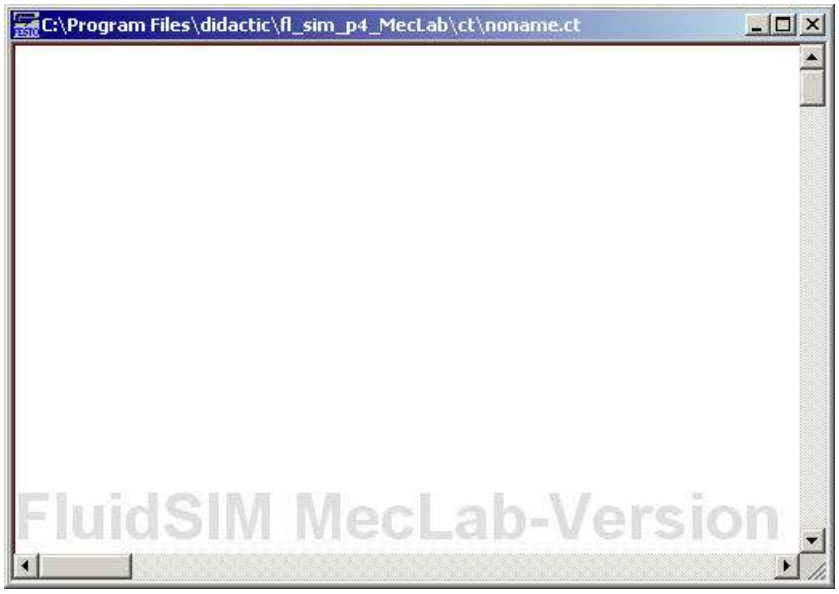
_____

_____

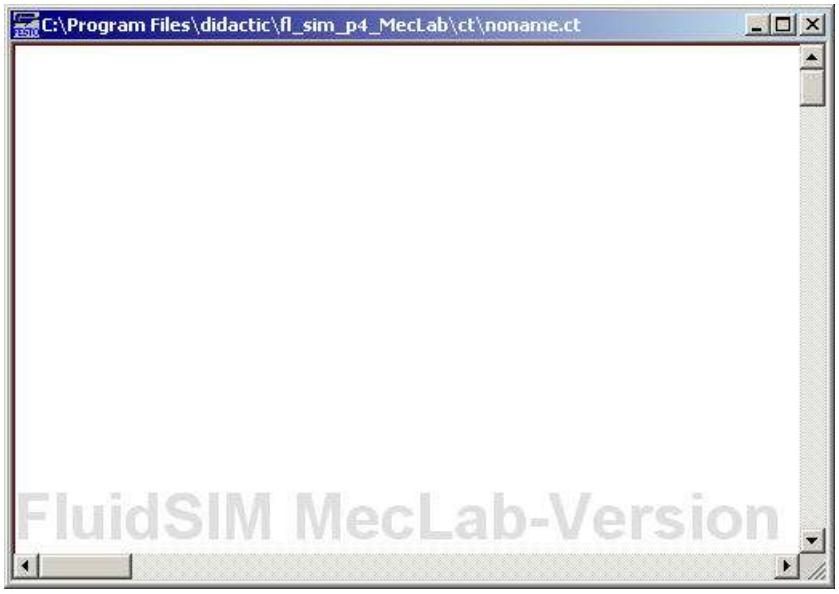
_____

Name:	Class:	Date:

5. Extend the circuit so that the DC motor is switched on and off and has its polarity reversed indirectly via relays.



6. Extend your program to include the multi-pin plug symbol, set all necessary labels and connect the PC and conveyor station to the EasyPort. Test your program using the station.



Conveyor station

Exercise 6: Learning about logic operations

Learning objectives

Upon completing this exercise, you should

- be familiar with the most important logic operations
- be able to create logic programs in FluidSIM®
- be able to solve simple control tasks using logic operations

Problem description

Logic operations are an important basis of control technology. In the FluidSIM® logic module, inputs and outputs are linked using logic operations. This exercise deals with the most important logic operations.

Task

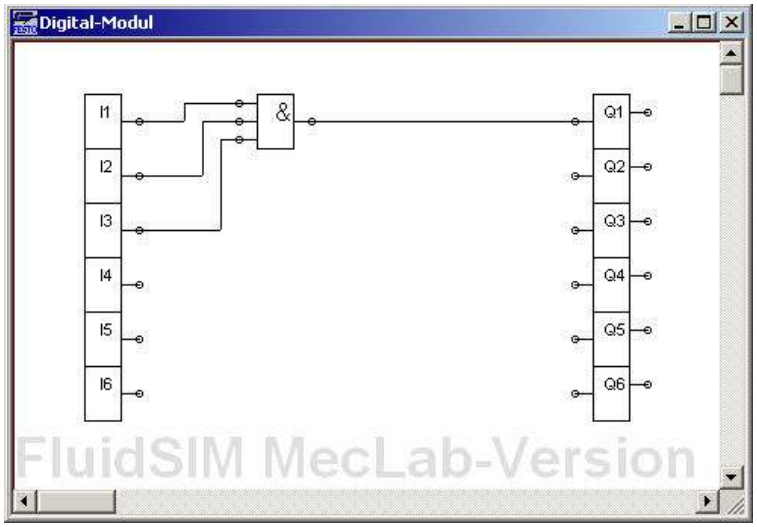
1. Transfer the following logic circuits to FluidSIM® and study the circuit's behaviour by setting the input channels I1 through I3 to the status 'high' by clicking on them. Complete the truth table. In each case specify an example of a control task that can be solved using this logic operation.
2. Create the logic circuit shown below in FluidSIM®, test its behaviour and describe it. What control tasks can this so-called latching element be used for?
3. Create the circuit shown below in FluidSIM®.
   Open the logic module and create a program with the following characteristics:
   - Lamp P1 should light up when the two pushbuttons T1 and T2 are pressed (and stay on after pushbuttons T1 and T2 have been released).
   - The lamp should switch off when pushbuttons T3 or T4 are actuated.
4. Extend the circuit from Exercise 3 so that an electric motor is switched on and off instead of the lamp.

Aids

- Theory book
- FluidSIM®
- FluidSIM® online help

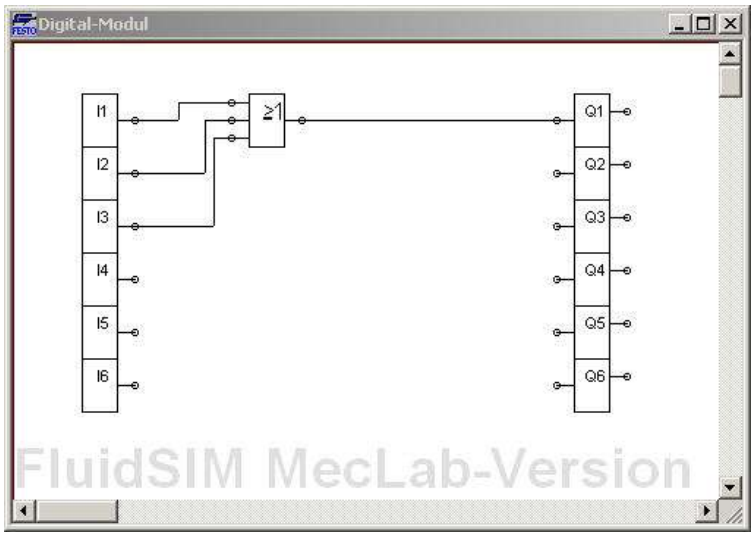
Name:	Class:	Date:

1. Transfer the following logic circuits to FluidSIM® and study the circuit's behaviour by setting the input channels I1 through I3 to the status 'high' by clicking on them. Complete the truth table. In each case specify an example of a control task that can be solved using this logic operation.



I1	I2	I3	Q1
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	1	1	
1	1	0	
1	0	1	
1	0	0	

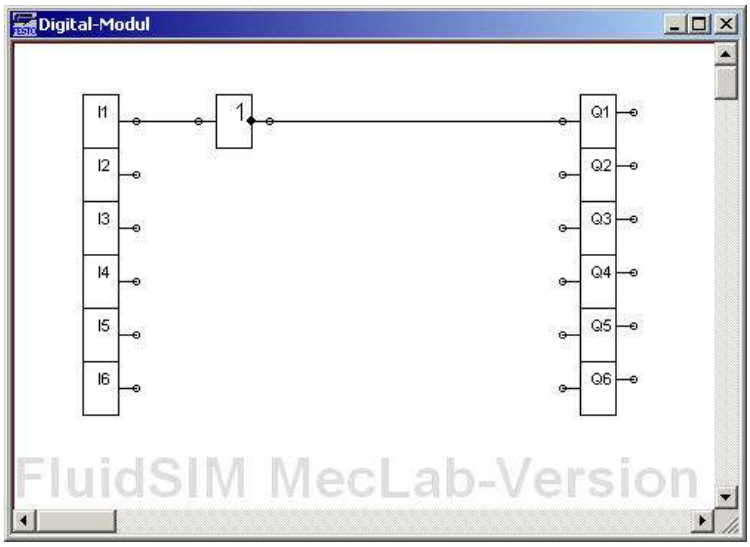
Example of a control task:



I1	I2	I3	Q1
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	1	1	
1	1	0	
1	0	1	
1	0	0	

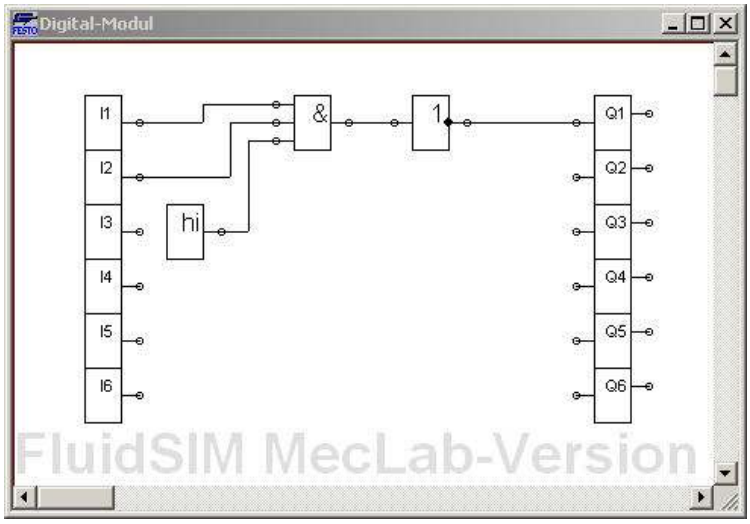
Example of a control task:

Name:	Class:	Date:



I1	Q1
0	
1	

Example of a control task:

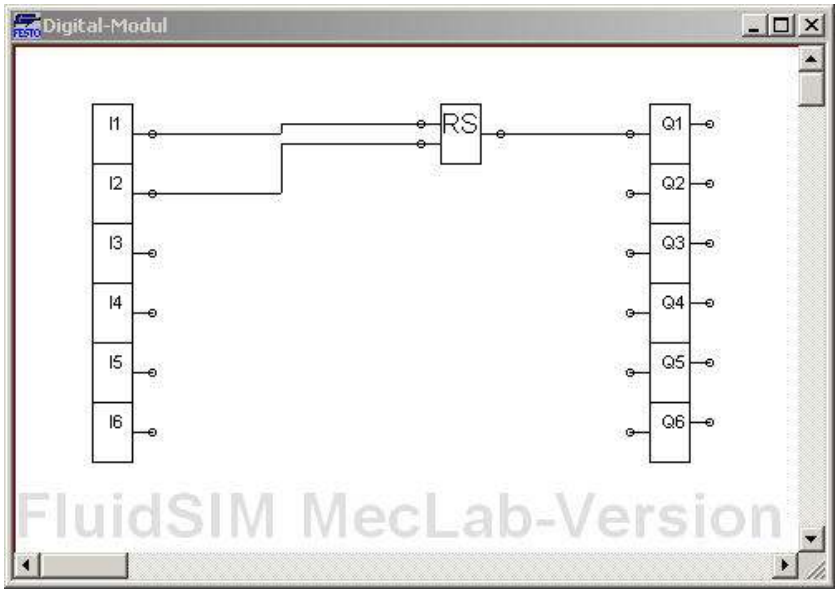


I1	I2	Q1
0	1	
0	1	
1	1	
1	0	

Example of a control task:

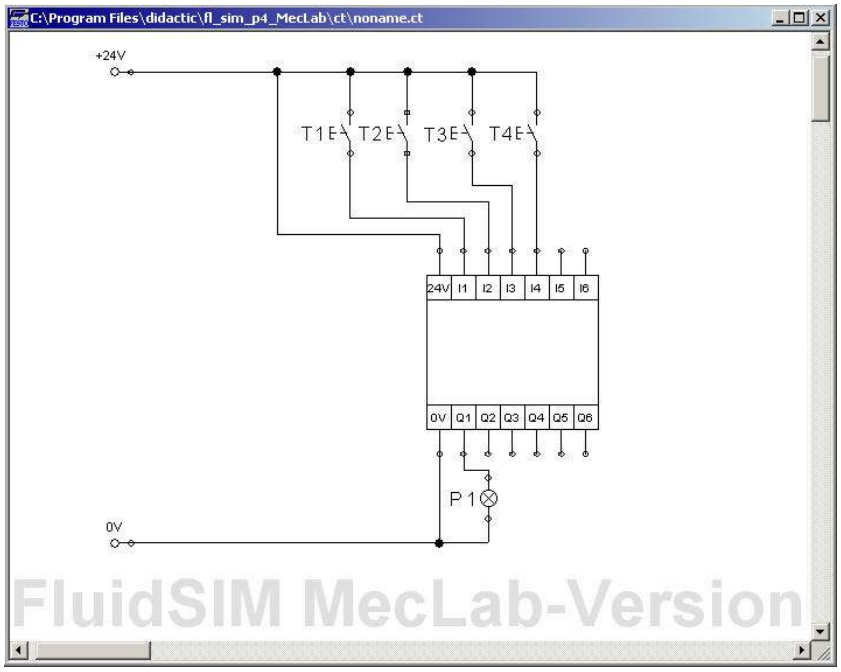
Name:	Class:	Date:

2. Create the logic circuit shown below in FluidSIM®, test its behaviour and describe it. What control tasks can this so-called latching element be used for?

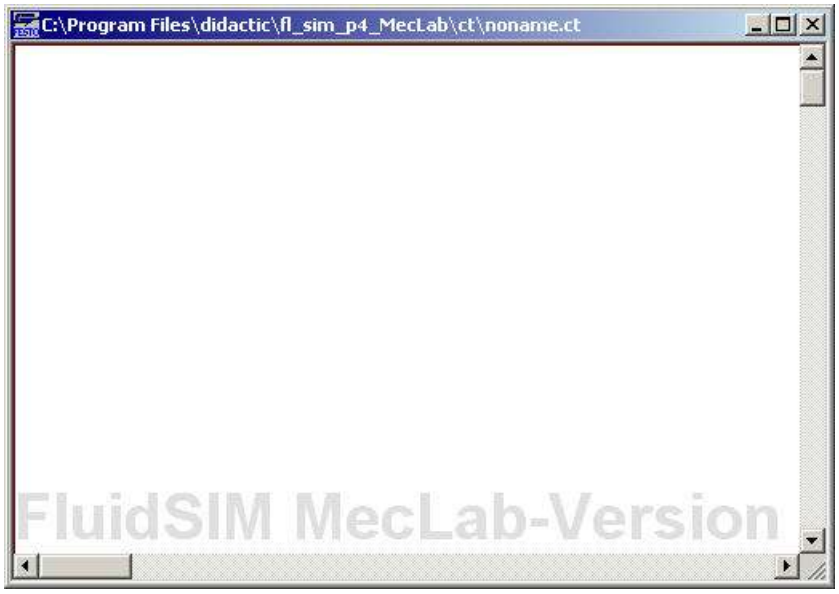


Name:	Class:	Date:

3. Create the circuit shown below in FluidSIM®.



– Open the logic module and create a program with the following characteristics:
  - Lamp P1 should light up when the two pushbuttons T1 and T2 are pressed (and stay on after pushbuttons T1 and T2 have been released).
  - The lamp should switch off when pushbuttons T3 or T4 are actuated.



Name:	Class:	Date:

4. Extend the circuit so that an electric motor is switched on and off instead of the lamp.

Conveyor station

Exercise 7: Realising control tasks

Learning objectives

Upon completing this exercise, you should

- be able to create schematic diagrams
- be able to realise simple control tasks using the logic module

Problem description

Conveying of workpieces is a requisite in all automated assembly systems. MecLab provides a conveyor for this. To save energy, the conveyor should not run continuously. The conveyor should therefore switch on whenever a workpiece is placed at the start of the conveyor and stop once the conveying task has been completed. The workpieces can be any colour.

Task

1. How can you arrange it so that the conveyor only functions when a workpiece is placed on it? What components are needed and how must they be arranged? Create a schematic diagram of the setup.
2. Create the accompanying circuit diagram for the schematic diagram in FluidSIM® and the allocation list for the pins on the multi-pin plug distributor. Use the logic module.
3. Next, plan the control program. What logic components can be used to arrange it so that the motor keeps running until the workpiece is conveyed to the end of the conveyor? Test your solution via simulation.
4. Test your solution using the conveyor station. Do this by setting up the station as per the schematic diagram, connect all components as per the allocation list and connect your PC to the station via the EasyPort.

Aids

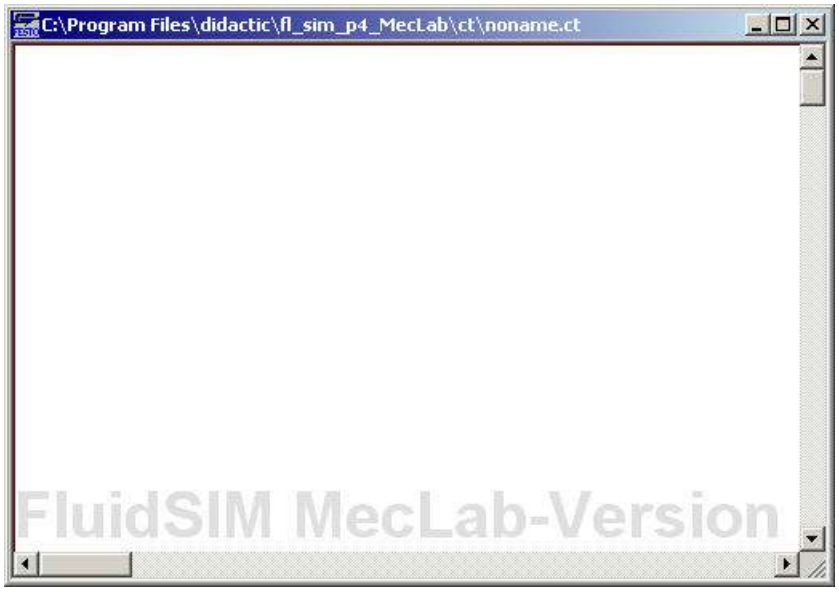
- Theory book
- FluidSIM® online help
- Data sheets

Name: Class: Date:

1. How can you arrange it so that the conveyor only functions when a workpiece is placed on it? What components are needed and how must they be arranged? Create a schematic diagram of the setup.

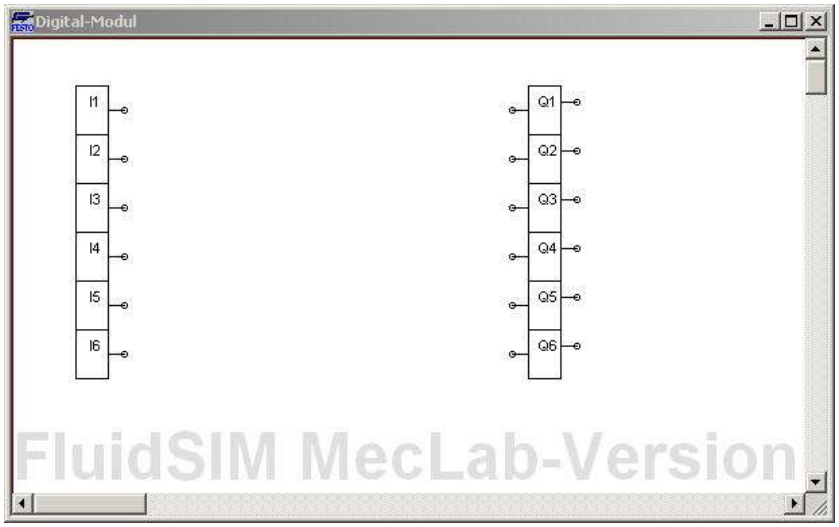
2. Create the accompanying circuit diagram for the schematic diagram in FluidSIM® and the allocation list for the pins on the multi-pin plug distributor. Use the logic module.

Slot	Designation	Explanation
0		
1		



Name:	Class:	Date:

3. Next, plan the control program. What logic components can be used to arrange it so that the motor keeps running until the workpiece is conveyed to the end of the conveyor? Test your solution via simulation.



4. Test your solution using the conveyor station. Do this by setting up the station as per the schematic diagram, connect all components as per the allocation list and connect your PC to the station via the EasyPort.

Conveyor station

Exercise 8: Sorting workpieces

Learning objectives

Upon completing this exercise, you should

- be familiar with the function of inductive and opto sensors
- be able to realise control circuits using sensors
- be able to realise simple control systems using FluidSIM®

Problem description

Conveying and sorting tasks are important functions in all production. This exercise consists of designing a conveyor and an accompanying control program with the following characteristics:
the workpieces (containers and lids in red or black) are to be conveyed from the start to the end of the conveyor.
Conveying should start when a workpiece is placed at the start of the conveyor and stop once the workpiece has left the conveyor at the other end.
Silver workpieces should be rejected onto the slide.

Task

1. What conveyor setup is needed to realise the specified functions? Create a schematic diagram of the setup showing the arrangement of each component and specify meaningful designations for the components.
2. Create an allocation list that shows which slot on the multi-pin plug distributor the electrical components are plugged into.
3. Set up the conveyor as per the schematic diagram and wire in accordance with the allocation list.
4. Develop a control program using FluidSIM® to monitor the specified functions. Provide an ON/OFF switch. Test the program via simulation.
5. Extend the FluidSIM® program to include the multi-pin plug distributor, set the labels as per the allocation list and test your program using the conveyor station.

Aids

- Theory book
- FluidSIM®
- Conveyor station

Name: Class: Date:

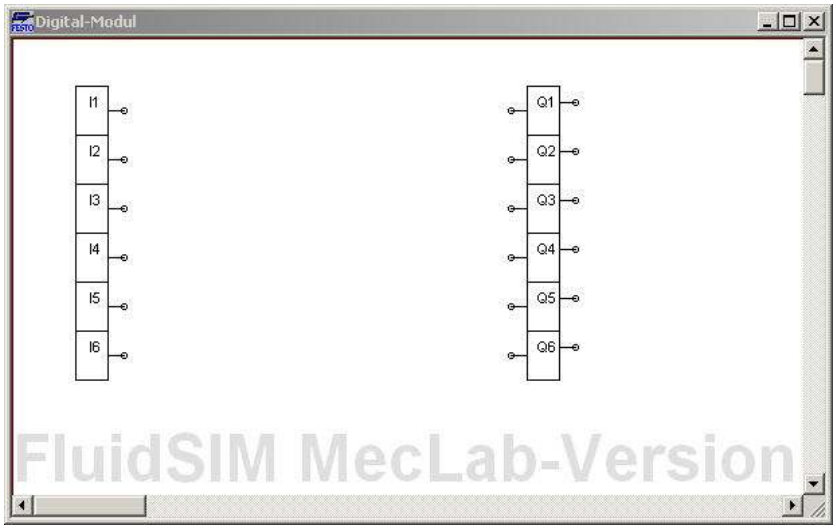
1. What conveyor setup is needed to realise the specified functions? Create a schematic diagram of the setup showing the arrangement of each component and specify meaningful designations for the components.

2. Create an allocation list that shows which slot on the multi-pin plug distributor the electrical components are plugged into.

Slot	Designation	Explanation
0		
1		
2		
3		

Name:	Class:	Date:

3. Develop a control program using FluidSIM® to monitor the specified functions. Provide an ON/OFF switch. Test the program via simulation.



Name:	Class:	Date:

4. Set up the station as per the schematic diagram, install tubing between all pneumatic components and connect the electrical components to the multi-pin plug distributor. Carry out a functional test of the controller using the station.