2018

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TEST PROJECT DAY2 / PROJET D'ÉPREUVE JOUR2

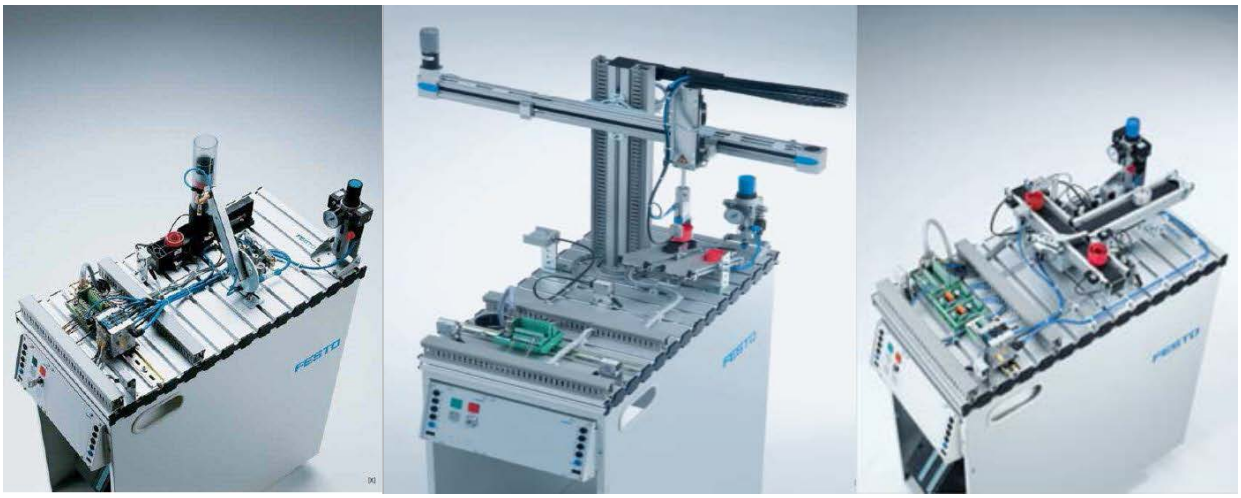
MÉCHATRONICS
MÉCATRONIQUE

POST-SECONDARY /
NIVEAUX POSTSECONDAIRE

Dismantle, re-assembly, programming and commissioning of the distribution, separating and electrical handling stations

Scenario

You are an OEM responsible for building a separating machine. You will need to mechanically assemble, wire, connect, program and commission the distribution, separating and electrical handling stations and integrate all three for your customer.



Task

Assemble, wire and plumb the components on the profile plate according to the documentation and reference station provided.

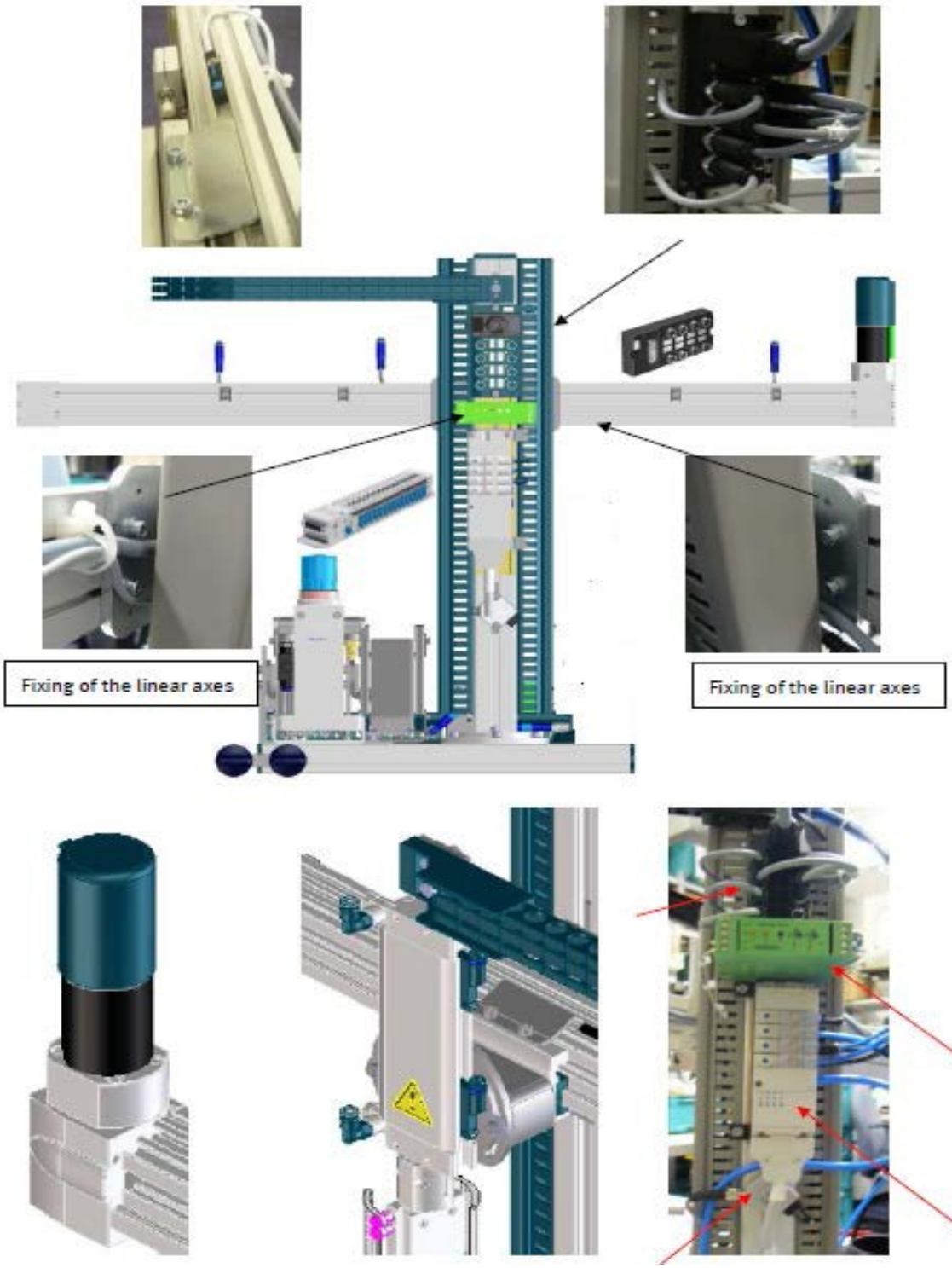
Develop a program and commission the production line.

- You need to completely assemble the station and conform to the professional practices.

Your task is complete when:

- The production line has been mechanically re-assembled, correctly wired and plumbed and its correct operation is guaranteed operation is guaranteed (based on evaluation using the simulation box). Please refer to IO allocation evaluation sheet.
- Correct execution of the program with PLC activation (based on evaluation/PLC board) is guaranteed.
- The system meets the specifications (in accordance with the 'Professional Practice Document'). The system will be sent to your customer's plant as soon as you are finished. You will have no opportunity to make improvements later.

Back side of the Handling unit



Work Pieces

Two different kinds (families) of work pieces will be used. Cylinder body:

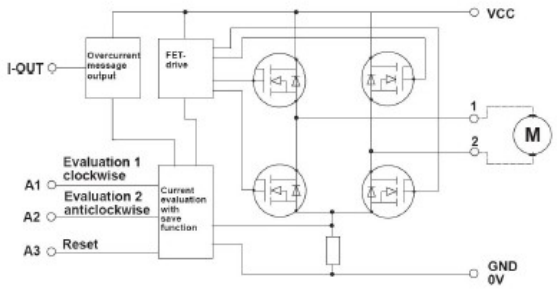
Meter body:

Wiring Allocation for Motor Controller

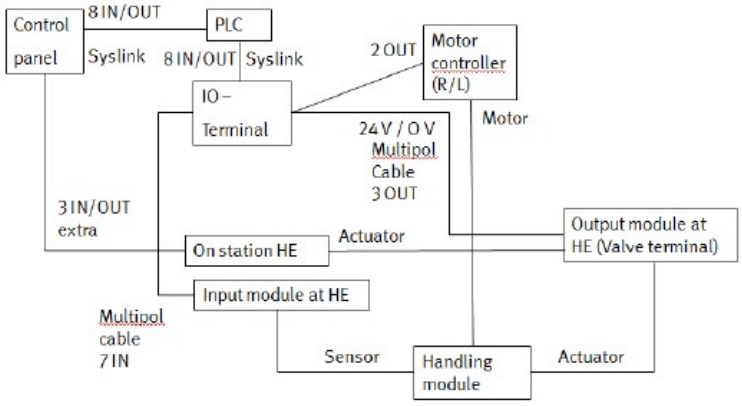
Motor controller:

A1 : move to right side / A2 : move to left side
1, 2 : Motor
VCC: 24 V / GND: 0V
A3 and I-OUT are not used

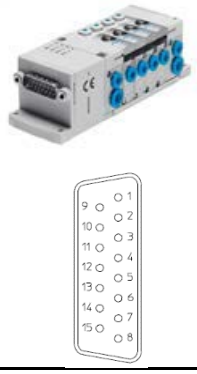
Block diagram



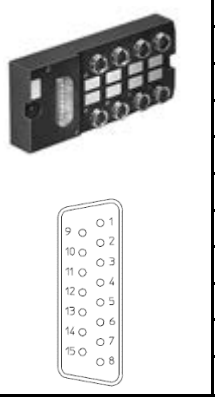
Control Layout



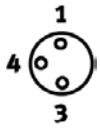
Pin Allocation for Valve terminal and Distributed I/O Block



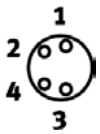
PIN	Core Colour	Coil	Function	
1	White	0	O2	Gripper Arm retract (Up)
2	Brown-green	1	O3	Gripper Arm extend (Down)
3	Green	2	O4	Close Gripper
4	Yellow	3	O5	Open Gripper
5-13	-	-	-	No used
14	Brown-green	0 V		
15	White-yellow	0V		



PIN	Core Colour	M8 Socket	Function	
1	White	0	I1	Handling at upstream position (at nest / far right)
2	Brown	1	I2	Handling at sorting position 1 (slide 1 closest to main
3	Green	2	I3	Handling at sorting position 2 (slide 2)
4	Yellow	3	I4	Gripper arm retracted (Up)
5	Grey	4	I5	Gripper arm extended (Down)
6	Pink	5	I6	Work piece present in gripper
7	Blue	6	I7	Not Used
8	Red	7	-	Not Used
9-12	-	-		Not Used
13	White-green	0-7 / 1	24 VDC	
14	Brown-green	0-7 / 3	0 V	
15	White-yellow	0-7 / 3	0V	

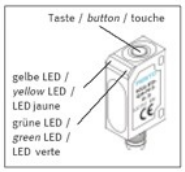


PIN	Core Colour	Function
1	Brown	24 VDC
3	Blue	0 VDC
4	Black	Output



PIN	Core Colour	Function
1	Brown	24 VDC
2	White	Output
3	Blue	0 VDC
4	Black	Output

Height sensor:



- ***Analogue output 0 ... 10 V***
- ***Adjustable screening function***
- ***Adjustable foreground and background suppression***
- ***Measuring range 20 ... 80 mm adjustable***
- ***Teach in***
- ***Red light 660 nm***
- ***Contamination indicator***
- ***N.O. - N.C. selectable***

The Sensor has 2 outputs

a:) Analog output 0 ... 10 V (pin 3 – white)
The analogue output is factory preset for a range of 20 ... 80 mm and can not be changed.

b:) Digital output PNP, 100 mA (pin 4 – black)
The digital output can be used with a screening function.
The detection limits (switching on and switching off) can be set by pressing a button.

N.O./N.C. setup

1.) *Press the button for 13 s. Both LED´s are flashing alternately.*
2.) *Release the button: the green LED is on.*
3.) *During the green LED is on, the output is inverted by pressing the button. If the button is not pressed during 10 s the present output function is saved, the sensor is ready to operate.*

Anschluss / *wiring* / Raccordement

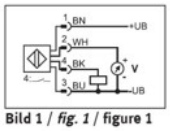
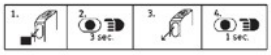


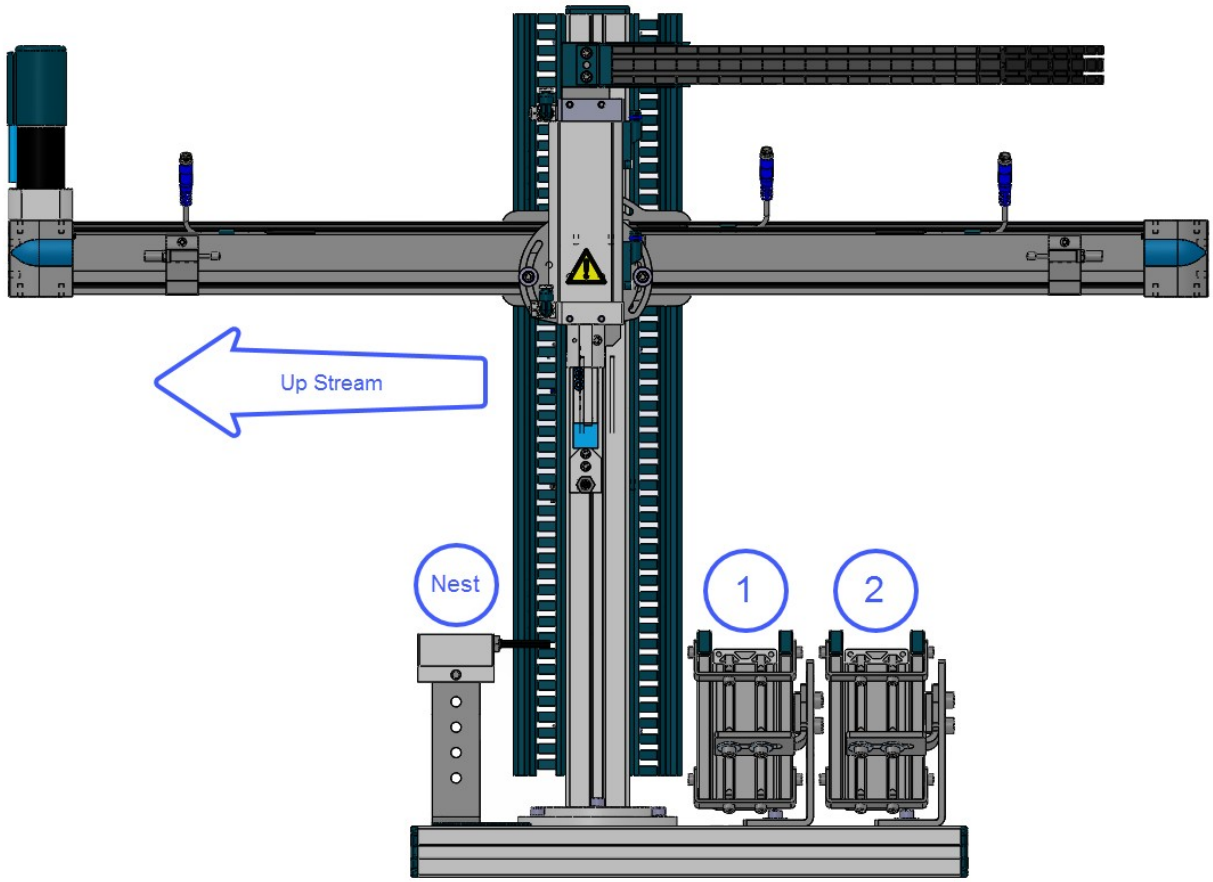
Bild 1 / *fig. 1* / figure 1

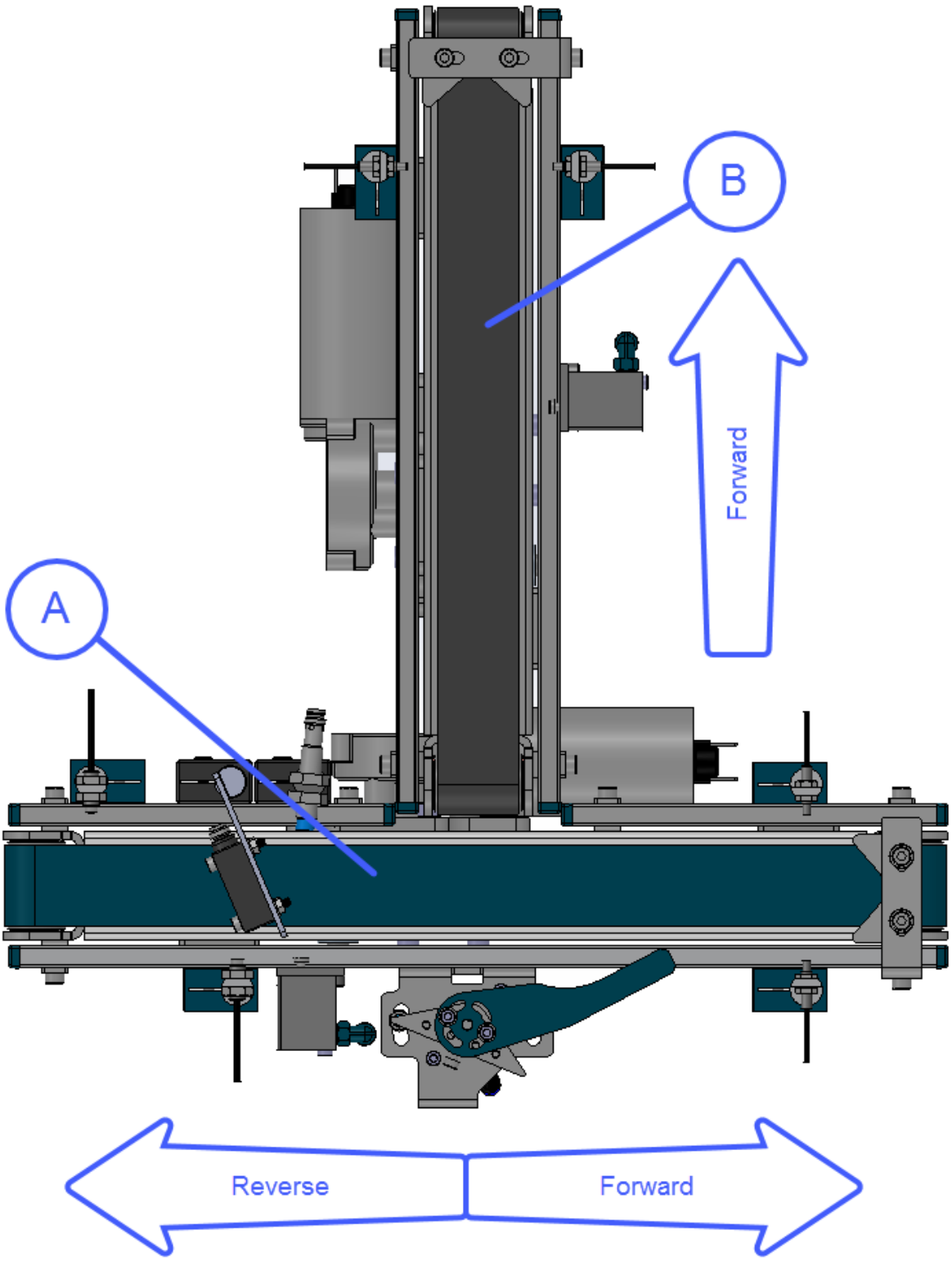
$+U_B$:	15 ... 30 V DC
Out:	PNP Out max. 100 mA
Analog:	0 ... 10 V DC max. 3 mA
$-U_B$:	Gnd



Screening range setting

1.) *"Switching on" point:*
Line up the sensor to the "switching on" point.
Press the button 3 s until both LED´s are flashing synchronously.
The "switching on" point is teached
2.) *"Switching off" point:*
Move the object to the "switching off" point.
Press the button 1 s.
The "switching off" point is set.




B
Forward
A
Reverse
Forward

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Evaluation sheet for task:

Assembly, programming and commissioning of a station Distribution Station

Description	Evaluation	Maximum evaluation
Function to be checked using simulation box 	**Done**	**Max. Points**
Preparation: Connect the simulation box to the I/O terminal.		
I0 Swivel arm left (magazine pick up side)		.25
I1 Swivel arm right (drop off side)		.25
I2 Stacking magazine cylinder retract		.25
I3 Stacking magazine cylinder extend		.25
I4 Vacuum present (work piece gripped)		.25
I5 Magazine empty		.25
O0 Swivel arm left (magazine pick up side)		.25
O1 Swivel arm right (drop off side)		.25
O2 Stacking magazine cylinder extend		.25
O3 Vacuum On		.25
O4 Blow-off air On		.25
Correct Coils Pneumatic Valves		.25
Simulation box total		**3**

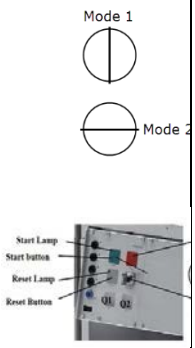
Electrical Handling Station

Description	Evaluation	Maximum evaluation
Function to be checked using simulation box 	**Done**	**Max. Points**
Preparation: Connect the simulation box to the I/O terminal.		
I0 Work piece present in nest		.25
I1 Handling at upstream position (at nest / far		.25
I2 Handling at sorting position 1 (slide 1 / closest to main pillar)		.25
I3 Handling at sorting position 2 (slide 2)		.25
I4 Gripper arm retracted (Up)		.25
I5 Gripper arm extended (Down)		.25
I6 Work piece present in gripper		.25
O0 Handling at upstream station		.25
O1 Handling at downstream station		.25
O2 Gripper arm retract (Up)		.25
O3 Gripper arm extend (down)		.25
O4 Close Gripper		.25
O5 Open Gripper		.25
Correct Coils Pneumatic Valves		.25
Simulation box total		**3.5**

Separating Station

Description	Evaluation	Maximum evaluation
Function to be checked using simulation box 	**Done**	**Max. Points**
Preparation: Connect the simulation box to the I/O terminal.		
I0 Part available at beginning of conveyor A		.25
I1 Black/ Non black functionality (test with two colours)		.25
I2 Height discrimination (test with cylinder and meter body work pieces)		.25
I3 Inductive sensor (for metallic / non-metallic)		.25
I4 Part presence at end of conveyor A (ON when no parts)		.25
I5 Part Presence Conveyor B (ON when no parts)		.25
I6 Inductive sensor (for gate retracted)		.25
O0 Conveyor A (main) Forward (to right)		.25
O1 Conveyor A (main) Reverse (to left)		.25
O2 Conveyor B on		.25
O3 Gate extend		.25
O4 Stopper extend (conveyor A)		.25
05 Stopper extend (conveyor B)		.25
Solenoid Valve Coils Correct		.25
Simulation box total		**3.5**

Description	Evaluation	Maximum evaluation
Function to be checked using PLC board (MODE1, MODE2) 	**Done**	**Max. Points**
Preparation: Connect the PLC board to the I/O terminal (PLC must be in RUN or Monitor mode). Put the station in the desired mode (Mode1 = Key in vertical position), turn power ON. *** Make sure PLC is ready to run, Place work pieces one at a time on nest.		

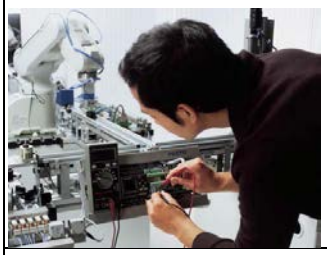
1. After power-up all three stations return to home conditions. Keys on both stations must be in the vertical position (Mode 1). Distributing Station: • Swivel Arm right (drop off side) • Stacking magazine cylinder retracted • Vacuum is off • Blow off air is off • Start light is off • Reset light is flashing (1 Hz) • Q1 and Q2 Lights are off. Handling Station: • Gripper unit in Upstream position (at Nest / far left) • Gripper arm up • Gripper open • Start light is off • Reset light is flashing (1 Hz) • Q1 and Q2 lights are off Separating Station: • Conveyor A is off • Conveyor B is off • Stopper extended (conveyor A / main conveyor) • Stopper retracted (conveyor B) • Diverter gate is retracted • Start light is off • Reset light flashing (1 Hz) • Q1 and Q2 lights are off		2
2. Nothing happens if a part is placed in the nest or onto the main conveyor.		1
3. **On the Distribution Station:** Press the RESET button, RESET light turns on solid, Start light begins to flash (1 Hz). Press the START button, START light turns on solid and the reset light turns off. ** The stacking magazine does not index a part, If a part is placed on the nest or the main conveyor nothing happens.		1

4. **On the Handling Electrical Station:** Press the RESET button, RESET light turns on solid, Start light begins to flash (1 Hz). Press the START button, START light turns on solid and the reset light turns off. **On the Distribution Station only:** Q1 light begins to flash (1Hz). ** The stacking magazine does not index a part, If a part is placed on the nest or the main conveyor nothing happens.		1
5. **On the Separating Station:** Press the RESET button, RESET light turns on solid, Start light begins to flash (1 Hz). Press the START button, START light turns on solid and the reset light turns off. **On the Distribution Station only:** Q1 and Q2 lights flash 3 times (1Hz).		1
6. After three flashes of the Q1 and Q2 lights on the distribution station, the Q1 and Q2 lights of **all three stations** turn on solid.		1
7. A part is indexed by the stacking magazine, picked up by the swivel arm and transferred to the nest of the handling electrical station.		1
8. The part is detected in the nest, and the handling electrical station transfers the part to the beginning of conveyor A (the main conveyor) of the separating station.		1
9. The part is detected by the separating station and the part is conveyed by conveyor A to the stopper cylinder of conveyor A for part discrimination.		1

10. Depending on the result of the discrimination the part is sorted as follows: • **Red meter bodies**: Red meter bodies are reversed on conveyor A, and are again picked up by the handling electrical axis and deposited onto slide 1 (closest to the main pillar on the handling electrical station). • **Red cylinder bodies**: Red bodies are reversed on conveyor A, and are again picked up by the handling electrical axis and deposited onto slide 2 (on the electrical handling station). • **Black meter bodies**: The stopper cylinders of conveyor A retracts. The black meter body continues forward on conveyor A and is diverted to conveyor B via the diverter gate. The part continues, unobstructed by the stopper of conveyor B and off the end of conveyor B. • **Black cylinder bodies**: The stopper on conveyor B Extends and the stopper cylinder of conveyor A retracts. The black cylinder body continues forward on conveyor A and are diverted to conveyor B via the diverter gate. The part is stopped at the stopper cylinder on conveyor B. After 2 seconds the stopper retracts and the part continues off the end of the conveyor B. • **Silver meter bodies**: The stopper of conveyor A retracts. The silver meter bodies continue forward on conveyor A and off the end of the conveyor A. • **Silver cylinder bodies**: The stopper of conveyor A retracts. The silver meter bodies continue forward on conveyor A and off the end of the conveyor A.		6

11. After the part is sorted, all three stations must return to their home position before a new part will be indexed by the stacking magazine. **Distributing Station**: • Swivel Arm right (drop off side) • Stacking magazine cylinder retracted • Vacuum off • Blow off air off **Handling Station**: • Gripper unit in Upstream position (at Nest / far left) • Gripper arm up • Gripper open **Separating Station**: • Conveyor A off • Conveyor B off • Stopper extended (conveyor A / main conveyor) • Stopper retracted (conveyor B) • Diverter gate is retracted		1
12. After 2 parts are sorted into each slide (1 & 2). No additional parts are indexed from the stacking magazine of the distribution station. The start lights of **all three stations** turn off. The Q1 & Q2 lights of **all three stations** turn on solid. The reset light of **all three stations** begin to flash (1 Hz)		2
13. To resume accepting parts, the parts are manually removed from the two slides and both conveyors. The stop button of **all three stations** must be pressed (one at a time). Q1 and Q2 lights of **all three stations** turn off. The procedure can now be resumed starting at step 3 above.		1
PLC board total		**20**

Professional Practice

Description	Evaluation	Maximum evaluation
Professional practice 		
Not done:		
		2
		2
		2
		2
		2
Professional practice total		**10**

Time evaluation

Description	Evaluation	Maximum evaluation
Time evaluation (only if 80% of points is achieved for PLC board and simulation box function and at least 6 points for professional practice)		
Points for time = (max. time – actual time) x max. points /(max. time – min. time) = (240.0 - .....) x 10 Points / (240.0 - .....)	Actual time =	**10**

Total evaluation

Description	Evaluation	Maximum evaluation
Points for operation based on simulation box		10
Points for operation based on PLC board		20
Points for professional practice		10
Points for time evaluation		10
Total		**50**