



2018

SCNC

SKILLS CANADA
NATIONAL COMPETITION

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OLYMPIADES CANADIENNES
DES MÉTIERS ET
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SkillsCompétences
Canada
Edmonton2018

TEST PROJECT DAY 1 / PROJET D'ÉPREUVE JOUR 1

MECHATRONICS MÉCATRONIQUE

POST - SECONDARY/
NIVEAUX POSTSECONDAIRE



TASK 1

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

Dismantle, re-assemble, wire and plumb the components on the profile plate according to the documentation and reference station provided.

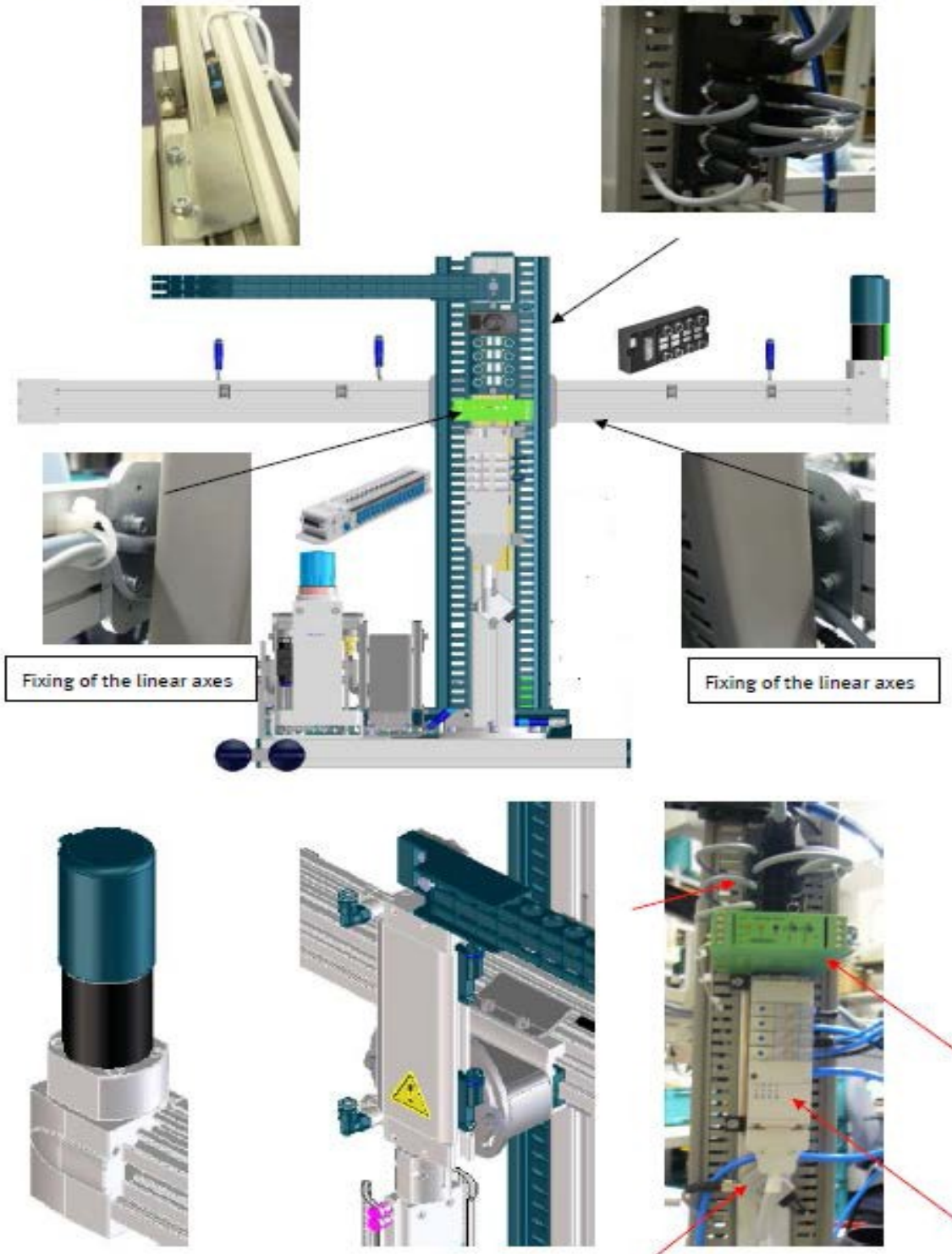
Develop a program and commission the production line.

- 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 (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:



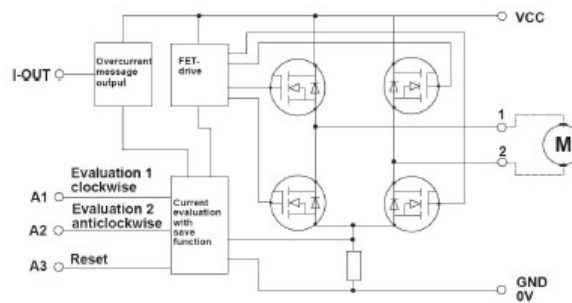
Wiring Allocation for Motor Controller

Motor controller:

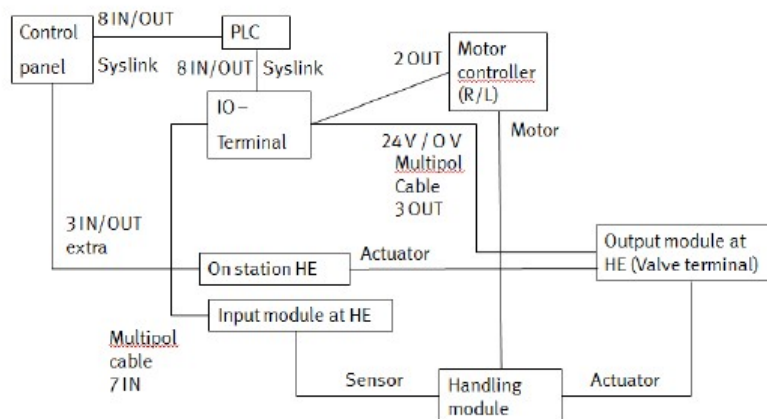
A1 : move to right side / A2 : move to left side
 1, 2 : Motor
 VCC: 24 V / GND: 0V
 A3 and I-OUT are not used



Block diagram



Control Layout



Pin Allocation for Valve terminal and Distributed I/O Block

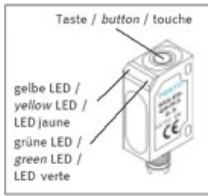
PIN	Core Colour	Coil	Function	
1	White	0	O2	Close Gripper
2	Brown-green	1	O3	Open Gripper
3	Green	2	O4	Gripper Arm Extend (Down)
4	Yellow	3	O5	Gripper Arm Retract (Up)
5-13	-	-	-	No used
14	Brown-green	0 V		
15	White-yellow	0V		

PIN	Core Colour	M8 Socket	Function	
1	White	0	I1	Handling at upstream position (far right)
2	Brown	1	I2	Handling at sorting position 1 (slide 1 furthest from 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
3	Blue	0 VDC
4	Black	Output

PIN	Core Colour	Function
		1
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.) Analogue 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

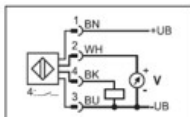
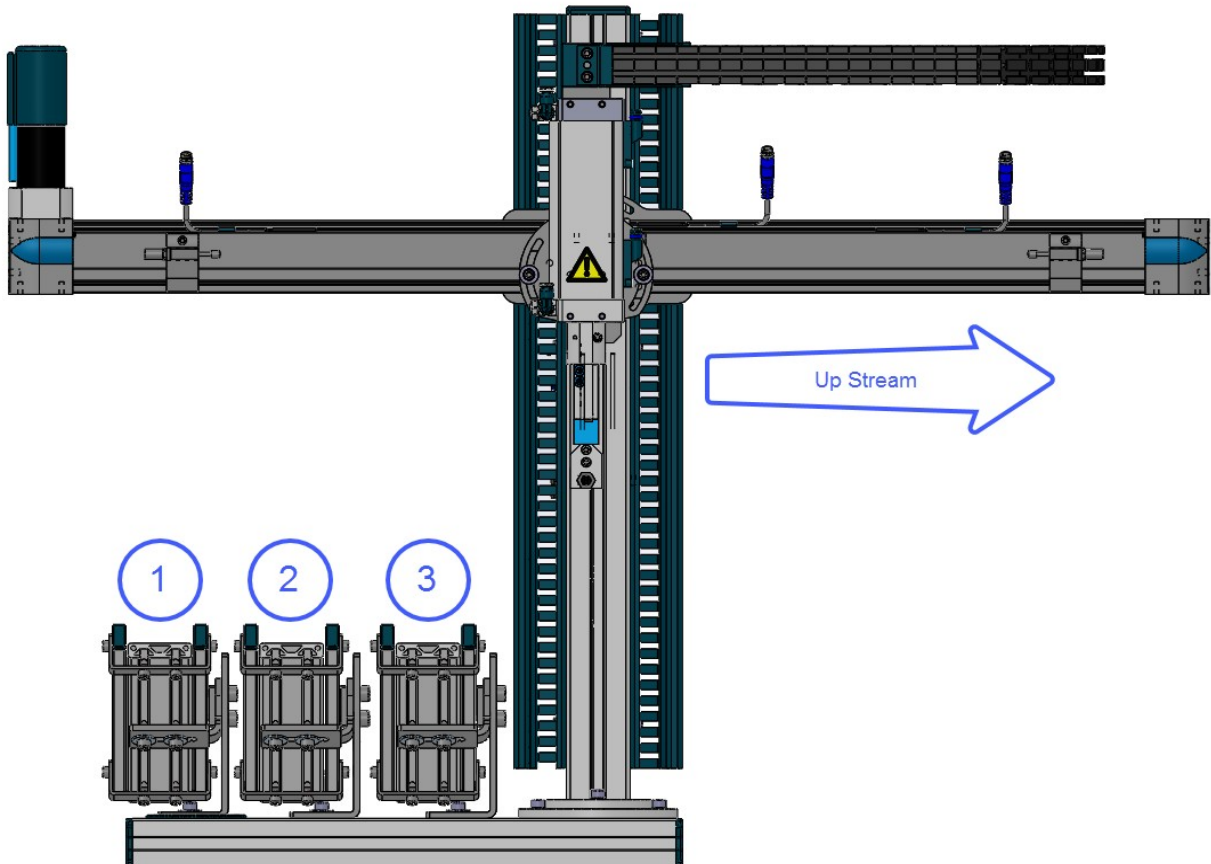


Bild 1 / fig. 1 / figure 1

+U₀: 15 ... 30 V DC
 Out: PNP Out max. 100 mA
 Analog: 0 ... 10 V DC max. 3 mA
 -U₀: 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.




Evaluation sheet for task:


Assembly, programming and commissioning of a station Distribution Station


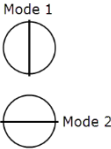

Description	Evaluation	Maximum
<p>Function to be checked using simulation box</p> 	Done	Max. Points
<p>Preparation: Connect the simulation box to the I/O terminal.</p>		
I0 Swivel arm left (magazine pick up side)		.2
I1 Swivel arm right (drop off side)		.2
I2 Stacking magazine cylinder retract		.2
I3 Stacking magazine cylinder extend		.2
I4 Vacuum present (work piece gripped)		.25
I5 Magazine empty		.2
O0 Swivel arm left (magazine pick up side)		.2
O1 Swivel arm right (drop off side)		.2
O2 Stacking magazine cylinder extend		.2
O3 Vacuum On		.2
O4 Blow-off air On		.2
Correct Coils Pneumatic Valves		.5
Simulation box total		3.25

Separating Station

Description	Evaluation	Maximum
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		.2
I1 Black/ Non black functionality (test with two colours)		.2 5
I2 Height discrimination (test with cylinder and meter body work pieces)		.25
I3 Inductive sensor (for metallic / non-metallic)		.2
I4 Part presence at end of conveyor A (ON when no parts)		.2 5
I5 Part Presence Conveyor B (ON when no parts)		.2
I6 Inductive sensor (for gate retracted)		.2
O0 Conveyor A (main) Forward (to right)		.2
O2 Conveyor B On		.2
O3 Gate extend		.2
O4 Stopper extend (conveyor A)		.2
Solenoid Valve Coils Correct		.50
Simulation box total		3.25

Electrical Handling Station

Description	Evaluation	Maximum
Function to be checked using simulation box 	Done	Max. Points
Preparation: Connect the simulation box to the I/O terminal.		
I1 Handling at upstream position (far right)		.2
I2 Handling at sorting position 1 (slide 1 furthest from main pillar)		.2 5
I3 Handling at sorting position 2 (slide 2)		.2
I4 Gripper arm retracted (Up)		.2
I5 Gripper arm extended (Down)		.2
I6 Work piece present in gripper		.2
O0 Handling at upstream station		.2
O1 Handling at downstream station		.2
O2 Close Gripper		.2
O3 Open Gripper		.2
O4 Gripper Arm Extend (Down)		.2
O5 Gripper Arm Retract (Up)		.2
Correct Coils Pneumatic Valves		.5
Simulation box total		3.5

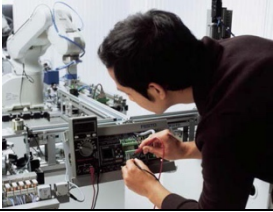
Description	Evaluation	Maximum
Function to be checked using PLC board (MODE1, MODE2) 	Done	Max. Points
Preparation: Connect the PLC board to the I/O terminal (PLC must be in RUN or Monitor mode). Put the station in the desired mode (Mode1 = Key in vertical position), turn power ON. *** Make sure PLC is ready to run, Place work pieces* one at a time on nest.		
<p>1. After power-up all stations return to home conditions.</p> <p>Keys on both stations must be in the vertical position (Mode 1).</p> <p>Distributing Station</p> <ul style="list-style-type: none"> • Swivel Arm right (drop off side) • Stacking magazine cylinder retracted • Vacuum off • Blow off air off • Start light is off • Reset light off • Q1 light flashes (1 hz) • Q2 light is off <p>Separating Station:</p> <ul style="list-style-type: none"> • Conveyor A off • Conveyor B off • Stopper extended (main conveyor) • Diverter gate is retracted • Start light is off • Reset light off • Q1 light is off • Q2 light flashes (1hz) <p>Electrical Handling Station:</p> <ul style="list-style-type: none"> • Gripper unit in downstream position (Slide 1/ far left) • Gripper arm up 	 	2

<p>2. Stacking magazine is filled with a variety of parts. A part is detected in the magazine, but nothing happens. **if a part is placed onto the beginning of the main conveyor nothing happens</p>		2
<p>3. On the Distributing station: Press the RESET button, RESET light begins to flash @ 1 hz, Start light turns on solid. Press the START button, START light begins to flash @ 1 hz, reset light turns off, Q1 continues to flash @ 1 hz.</p>		2
<p>4. On the Separating Station: Press the RESET button, RESET light begins to flash @ 1 hz, Start light turns on solid. Press the START button, START light begins to flash @ 1 hz, reset light turns off, Q1 and Q2 lights both turn solid.</p>		2
<p>5. On the Distributing station: Q1 and Q2 lights both turn on solid.</p> <p>6. On the Electrical Handling Station: Q1 and Q2 lights both turn on solid and the start light begins to flash.</p>		2
<p>7. The staking magazine advances a part, the swivel arm picks up a part from the magazine and transfers it to the beginning of the main conveyor A of the separating station.</p>		1
<p>8. When the part is detected at the beginning of conveyor A, conveyor A turns on and conveys the part to the extended stopper.</p> <p>9. At the stopper part discrimination is carried out.</p>		1

<p>10. Depending on the result of the discrimination the part is sorted as follows:</p> <ul style="list-style-type: none"> • Red meter bodies: The diverter gate extends, conveyor B turns on, the stopper cylinder then retracts and the Red meter body is conveyed to the end of conveyor B. When the part reaches the end of conveyor B, the electrical handling station picks up the part and transfers it to Slide 2 of the electrical handling station (the middle slide). All stations return to their home positions. • Red cylinder bodies: The stopper of the main conveyor retracts. The red cylinder bodies continue on the main conveyor and off the end of the main conveyor. All stations return to their home positions. • Black meter bodies: The diverter gate extends, conveyor B turns on, the stopper cylinder then retracts and the black meter body is conveyed to the end of conveyor B. When the part reaches the end of conveyor B, the electrical handling station picks up the part and transfers it to Slide 1 of the electrical handling station (slide furthest from the main pillar). All stations return to their home positions. • Black cylinder bodies: The stopper of the main conveyor retracts. The black cylinder bodies continue on the main conveyor and off the end of the main conveyor. All stations return to their home positions. • Silver meter bodies: The diverter gate extends, conveyor B turns on, the stopper cylinder then retracts and the silver meter body is conveyed to the end of conveyor B. When the part reaches the end of conveyor B, the electrical handling station picks up the part and transfers it to Slide 3 of the electrical handling station (slide closest to the main pillar). All stations return to their home positions. • Silver cylinder bodies: The stopper of the main conveyor retracts. The silver cylinder bodies continue on the main conveyor and off the end of the main conveyor. All stations return to their home positions. 		6
<p>11. Once all stations reach their home position, the stacking magazine automatically indexes the next part and the process begins again. (see step 7) **After each part is sorted, the part will be manually removed from the slide or conveyor.</p>		1
<p>12. After two meter bodies of each colour are properly sorted to the handling station, Q1 and Q2 on all stations begin to flash alternately at 1 hz. And the start lights of all stations turn off.</p>		1

<p>13. To resume accepting parts, the stop button of handling electrical station must be pressed. All parts are manually removed from the handling station.</p> <p>On the Distributing station:</p> <ul style="list-style-type: none"> • Start light is off • Reset light off • Q1 light flashes (1 hz) • Q2 light is off <p>On the Separating Station:</p> <ul style="list-style-type: none"> • Start light is off • Reset light off • Q1 light is off • Q2 light flashes (1hz) <p>On the Electrical Handling Station:</p> <ul style="list-style-type: none"> • Start light is off • Reset light off • Q1 and Q2 lights both flash (1 hz) <p>The procedure can now be resumed starting at step 3 above.</p>		
PLC board total		2

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