

Project 5: Optimization of a production line including Handling station and Sorting station

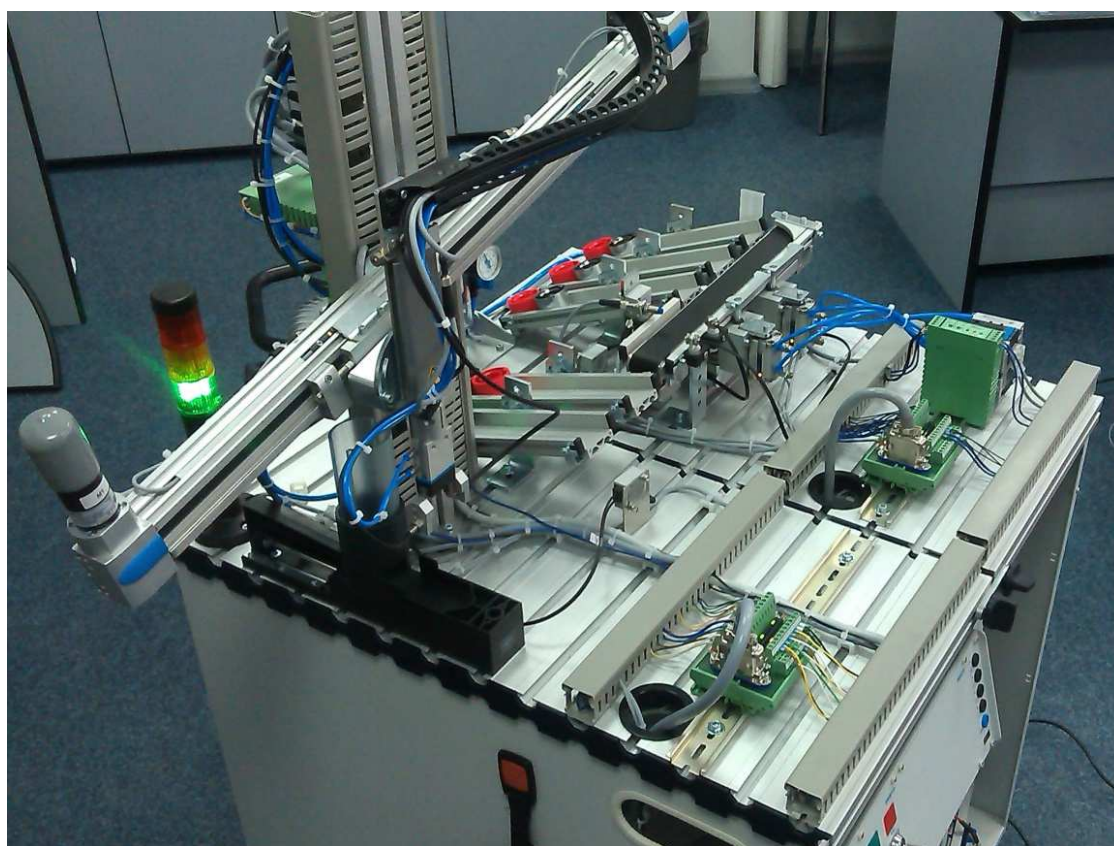
Weighting (points out of total) 16/100

t max 90 min

All big pictures are also on USB-Stick

■ Scenario

The production line needs to be optimized and you have to plan and test this optimization to reduce the production time and to find the most energy efficient production process



■ Task

Your task is to add components for the measurement of airflow and electrical energy and to optimize the production process to produce 5 workpieces in the shortest possible time and with most air efficiency

Your task is complete when:

1. Correct execution of the program with PLC activation (based on evaluation/PLC board) is guaranteed.
2. The system meets the specifications (in accordance with the 'Agreement on Professional Practice').

You will have no opportunity to make improvements later.

■ Procedure of optimization:

Safety:

You are not allowed to work at the stations while the stations are running!

You have 90 Minutes to work on a concept, test the Flow meter, modifications on the PLC program is allowed and to realize the optimization.

Target:

Fast, energy efficient and dependable production line

Conditions:

- It is allowed to modify the PLC – program
- You have to assemble a Flow meter in the main tube to the system and do the wiring and tubing (see images).
- You have to assemble the Flow meter into the Handling E Station.
- The focus on energy consumption is on air
- 5 workpieces from the magazine will be sorted on corresponding slides
- Max. 6 bar working pressure
- Max. 24 Volt power supply
- No collisions are allowed (Workpiece on workpiece side by side is not a collision)
- During your commissioning evaluation and testing you can stop the calculation of the sensor via the stop function in the RECORDER mode.
- It is allowed to change the position of sensors within the station but the function must remain the same.
- It is not allowed to use tape in the process line.

Exceptions:

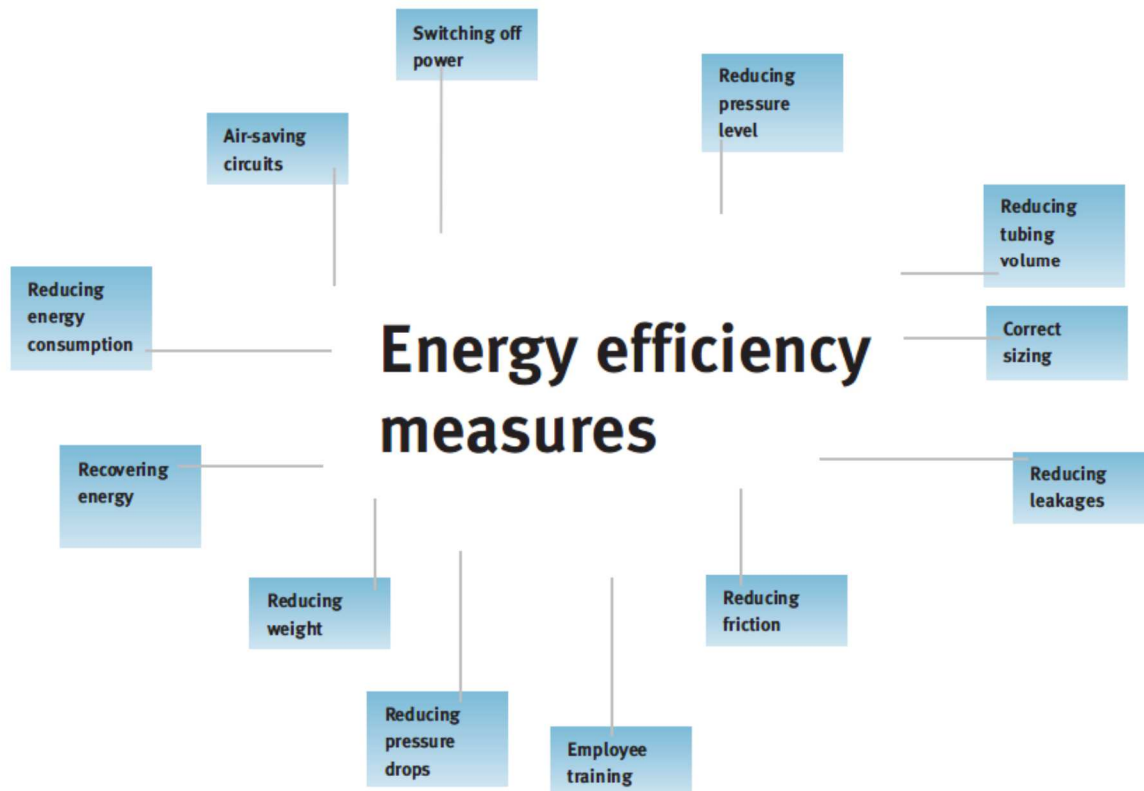
- More than 1 workpiece on the process is allowed
- Press start only one time (5 workpieces are running automatically)
- The workpiece are moving without manual help
- No evaluation about behaviour of the lamps except start lamp at beginning of evaluation and signal lamps at the end.
- Switch on the Q1 and Q2 lamps after the 5th workpiece placed on slide
- The timing stops when the Q1 and Q2 lamps ON and the 5th workpiece is placed on slide

After a max. of 90 Minutes the system has to be prepared to run:


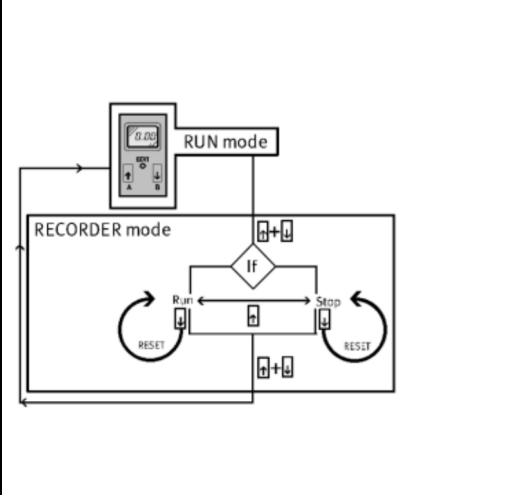
- There are no points for the preparation time
- All modules and components are fixed and adjusted.
- The station layout must be the same as in the tasks before.
- The Stations are ready to get the Start signal via the Control Panel; therefore the Start Lamp must be ON.

After the optimization time 3 members of the evaluation team will take the production time and note the air consumption. The average of these 3 times will be calculated.

■ Your guide to energy efficiency:



■ Energy measurement for air consumption with SFAB:


	<p>Measure the air flow for the whole system. Connect only the 24V/0V to the I/O-Terminal in the station Don't cut the cable short (keep it as ring)</p>
 <pre> graph TD Start(()) --> RunMode[RUN mode] RunMode --> RecorderMode[RECORDER mode] RecorderMode --> If{If} If --> Run[Run] Run --> Stop[Stop] Stop --> If If --> Reset1[RESET] Stop --> Reset2[RESET] Reset1 --> RecorderMode Reset2 --> RecorderMode </pre>	<p>Select RECORDER mode Start / Stop and RESET the measurement via the Sensor buttons</p> <p>In the RECORDER mode, a manual accumulated air consumption measurement can be performed.</p> <ol style="list-style-type: none"> 1. Press the A button and B button at the same time. The SFAB is in the RECORDER mode. The status of the air consumption measurement [Run] or [Stop] is displayed. 2. If [Stop] is displayed, press the A button. [Run] and a running light is displayed. The air consumption measurement is started. 3. Press the A button again. [Stop] is displayed. The air consumption measurement is stopped. <p>Note Resetting measurement value to zero.</p> <ul style="list-style-type: none"> • Press the B button in the RECORDER mode to reset a measurement value to zero.

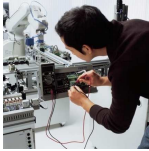
Evaluation sheet for Project 5: Optimization of a production line including Handling station and Sorting station

Team: _____ Time (s) 1 _____ Air (l) _____
2 _____
3 _____

Verification of acceptance by experts (names, signatures): _____

Maximum time: 90 min. / Maximum points: 16

Description / checked using PLC	Evaluation	
	Done	Max points
		
Preparation: Connect the PLC board with the I/O terminal and the control panel, switch key to the position AUTO, start the PLC, no programming cable and no communication between PC and PLC, valve for air opened. Put 5 workpieces into the magazine (to be announced) Start from the initial position (competitors allowed to reach it manually or via control panel) Key is in position AUTO (HS). Attention: When the function stops with one of the workpieces then the evaluation is finished. (no manual help allowed)		
Start lamp is ON		0,1
Press Start Button only once on the at Handling station: The same process like in Project 3 or 4	-	-
Distributing workpiece (1), transporting, placing in corresponding slide (1/3 marks for each aspect)		1,5
Distributing workpiece (2), transporting, placing in corresponding slide (1/3 marks for each aspect)		1,5
Distributing workpiece (3), transporting, placing in corresponding slide (1/3 marks for each aspect)		1,5
Distributing workpiece (4), transporting, placing in corresponding slide (1/3 marks for each aspect)		1,5
Distributing workpiece (1), transporting, placing in corresponding slide, lamps Q1 and Q2 ON (1/5 marks for each aspect)		2
PLC board total		8,1

Description		Evaluation	Max points
Professional Practice 		List of Professional Practice will be checked in samples	
PP item No	Description	-	-
*			0,5
*			0,5
*			0,5
*			0,5
*			0,5
Professional Practice total			2,5

* Each deviation will result in 0,5 points being deducted

Description	Evaluation	Max points
Time evaluation (only if the maximum number of points is achieved for PLC board function and at least 1,5 points for Professional Practice)	-	-
Points for time = [(longest time – actual time) x 2,7 / (longest time – shortest time)]	_____	
Total points for time	_____	2,7

Description	Evaluation	Max points
Energy efficiency evaluation (only if the maximum number of points is achieved for PLC board function and at least 1,5 points for Professional Practice)	-	-
Points for air consumption = [(highest air consumption – actual air consumption) x 2,7 / (highest air consumption – lowest air consumption)]	_____	
Total points for EE	_____	2,7

Total evaluation Project 5:

Description / points for	Evaluation	Max points
Points for operation based on PLC board	_____	8,1
Professional Practice	_____	2,5
Points for Production time	_____	2,7
Points for air consumption	_____	2,7
Total points Project 5	_____	16