AN ADDITION OF FUNCTIONALITIES IN AN INTEGRATED ROBOT COMPLEX FOR ASSEMBLING ELECTRONIC PRODUCTS

M.Sc. Tsenev V. PhD.
UniPOS Ltd, Pleven, Bulgaria

valio@unipos-bg.net

Abstract: *Robot assembling is flexible and it enables a stable and high-quality assembly. It enables a constant improvement and an easy multiplication. This report represents an idea for adding functionalities in a robot complex for assembling flame detectors in the firm "UniPOS" and it analyses the benefits of this. The main aims for a development of the existing robot complex for assembling are: decreasing the production prime cost; reducing the manual labor that is connected to loading components; increasing the use of the robot complex; reducing the cycle time and increasing the productivity of the robot complex; increasing the quality of the manufactured products. The additional functionalities are accomplished in parallel with the main ones in assembling and they are at the expense of running all robots in the complex and their use only for assembling (not for loading the components).*

KEYWORDS: ROBOT, ASSEMBLY, REWORK, CYCLE TIME, PRODUCTIVITY

1. Introduction

In the course of one year by observation, analysis and using Lean Manufacturing [1] we came to a conclusion that loading the robot complex with components for assembling for producing flame detectors can be changed, as the trays with components are replaced by stacks of components on the analogy of the line with machinery conveyor assembling [2]. Additionally built conveyors will put the component for assembling at a certain place. The component will be taken from the stack by an isolated gate driver. This will enable the robots to work efficiently [3], as they will only assemble and there will be no need of a change of the trays which carry the components. The robots will work simplified because they will always take a component from one and the same place. This will lead to a stabler and faster work. It will lead to a simplified programming of the robots, too.

On fig. 1 it is shown the scheme of the complex with the described change.

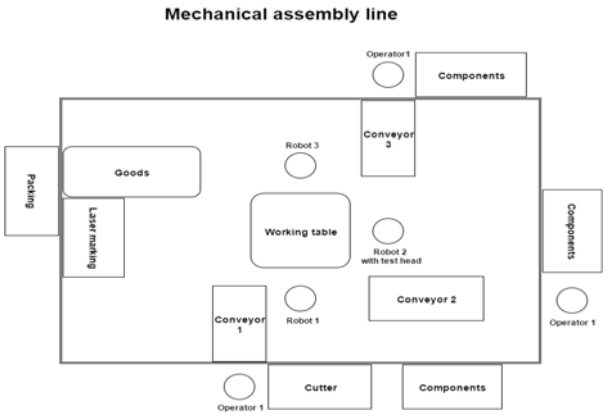

Fig.1. *Robot complex with stacks*

The operator will load a few stacks with components, which will enable a decrease in its work. In the production of the components (they are usually plastic details which are produced by syringing) their package will be able to be automated by introducing robots which will load stacks. In this way the production of the components will be able to be automated flexibly. The stacks have high density. They are easily transported and the process of separating the components for assembling is simplified and assured by isolated gate drivers.

2. Robot complex

On fig. 2 it is shown the robot complex which works with trays with components.

Fig.2. *Robot complex with trays*

The robot complex currently works with trays with components which are loaded by an operator. The components are in panels or in bulk.

On fig. 3,4,5 trays which are loaded with different components are shown.

Fig.3. *Trays with corpuses*

Fig.4. *Trays with bottoms*

Fig.5. *Trays with PCBA*

3. Robot complex with additional functionalities

The idea is a replacement of these trays with large space and little density with components by appropriate stacks which will be loaded out of the dimensions of the robot complex. They will be firmed strongly with components. By an isolated gate driver they will pass a component by component through a small conveyor to a certain place (with a stopper) where the corresponding robot will take it for assembling.

This whole automation works in parallel with the robot complex and has enough time to accomplish the process. The synchronization in time is easy because it only depends on starting the assembly of the robots.

The use of stacks enables automation of the production and the package of the components. This type of packing has high density.

Passing the components will be safer and less risky. Then the possibility of stopping the complex is minimal.

4. Results

The results of the described additional functionalities are:

- direct – reducing the cycle time and the productivity of the robot complex for assembling due to a lack of work in changing the trays with components by the robots and a lack of pauses because of wrongly positioned components;

- indirect, connected to the reduced labor in production and package of the components, their transport and loading the robot complex;

- reduced rework because of the better quality of the components and their excellent positioning.

On fig. 6 it is shown a table with the results.

Production line	Cycle time, s	Productivity, pcs/shift	Man power, min	Rework, %
Manual assembly	18	1600	3,6	11,8
Conveyor	12	2400	1,8	5,2
Tact conveyor	11	2600	0,73	0,57
Machine conveyor	10	2880	0,67	0,42
Robot complex	10	2880	0,33	0,1
Robot complex with extra functionalities	8	3600	0,04	0,02

Fig.6. *Table with results*

5. Conclutions

The conclusions of the additional functionalities in the robot complex for assembling are:

- The cycle time reduces and the productivity of the robot complex increases;
- The labor considerably reduces directly and indirectly, which considerably decreases the prime cost of the product;
- The rework rate considerably decreases, which guarantees a lack of refusals among the clients;
- By the stacks conditions for POKA JOKE are created(there is no possibility that the error will become a defect) regarding the quality of the components because the stacks appear as gauges that are used for packing the components (the component will not be able to be put in the stack if there is a diversion from the shape and the dimensions);
- The possibility of stopping the work of the robot complex decreases.

Acknowledgement

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References

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