AUTOMATED MONITOR PRODUCTION LINE (NOKIA DISPLAY PRODUCTS)

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ABSTRACT: Paper contains a short presentation of a production line used in NOKIA DISPLAY PRODUCTS PECS HUNGARY. Author works in a NOKIA team for design and building up the presented line. In the presented case the line was designed for monitor production, the line is flexible and can be easily redesigned for other products. Control of the line is made using PC and PLC systems. In the second part of the paper, author present in some words the control of the transport AGV. AGV has the duty to take the monitors from the pre-assembly section and put it to 6 different burning conveyors according to the request from the control system. The control of the AGV is made with a PC and an on-board PLC connected via radio waves.

Key words: production control, AS-i, AGV control, correlation between PC and PLC control

1. INTRODUCTION

This part presents the principal parts of NOKIA monitor production line [1].

Testing place for monitors presented in figure 1:

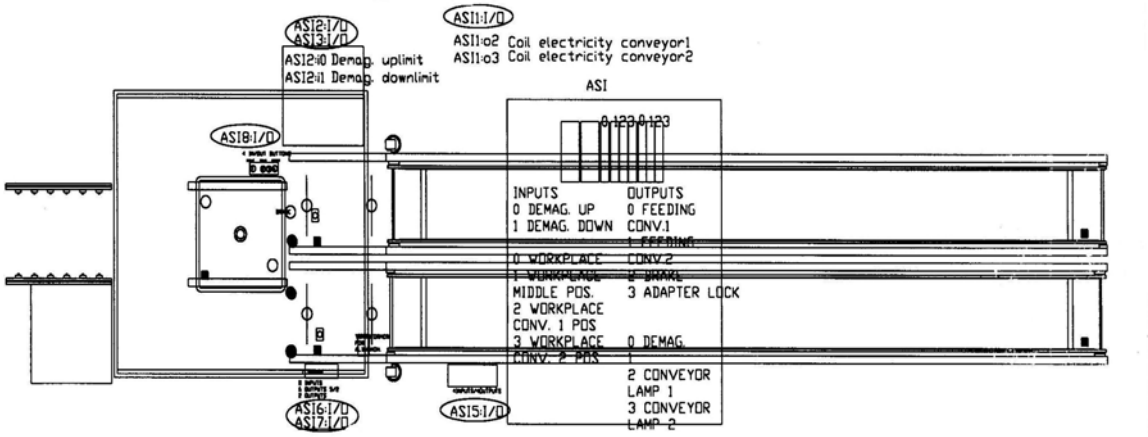

Figure 1 – Testing place layout

General layout for the simplified version of the production line [1]:

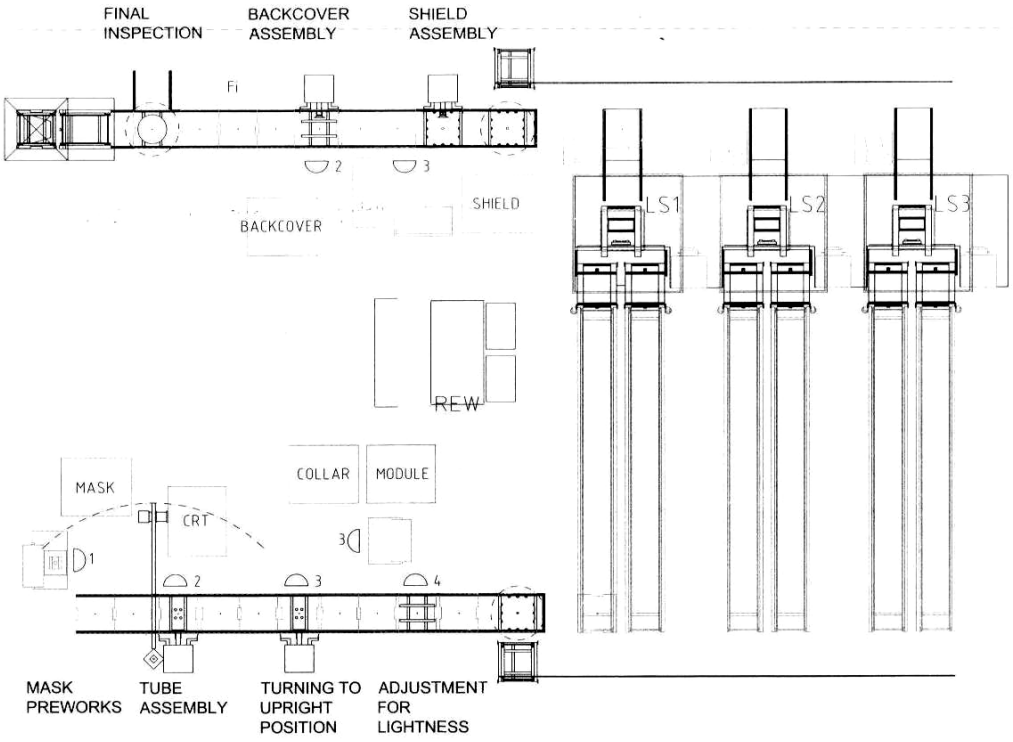

Figure 2 – General Layout

According to the production process, monitors have to stay on conveyor 1 and 2 around 320 minutes. Conveyor 1 and 2 are the so called burning conveyors, because monitors staying there with power on such a long time, if one monitor have some errors it will burn out on that conveyor and the errors could be find out in time. Each presented line has an ASISYS control system. Basic unit of control system is a different number of ASI – slaves, those slaves has the direct control of the sensors, cylinders and other input and output devices. ASI – masters represents next level, each line is controlled by one master, ASI – slaves are connected to the master via profibus [5].

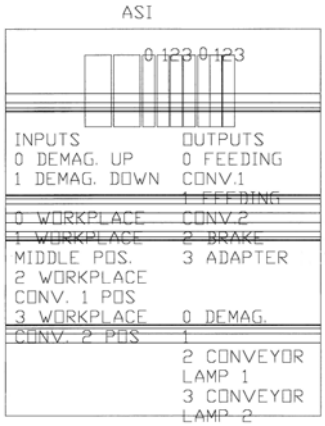

Figure 3 – ASI – master

In figure 3 there is an example for ASI – master. PLC represents the next level, ASI – masters are connected to the PLC via Device Net. The higher control level is a control PC where is the control program for the entire production line, PC and PLC communicates via NET.

Image below presents one screen of the general control system [2].

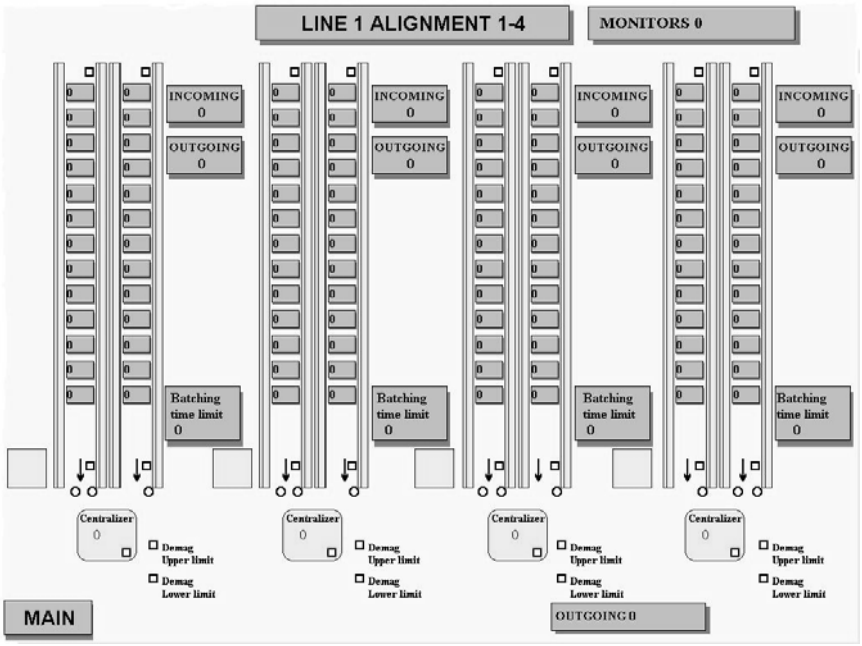

Figure 4 – Control Software

Control software is realized in machine software developed by OMRON for their systems, called SYSMAC-SCS. For the control there is a special interface developed also by OMRON, this interface manages the communication between PC and PLC. [5]

All the other parts from the production line presented in figure 2 are the pre – assembly stations, the transportation from the testing places and the assembly stations. Those parts are also controlled via ASI – masters and Device Net from the PLC software, but the function of these units are not presented graphically on the control screen [4].

Monitors moving inside the production line on pallets. On pallets there are implemented code carrier memory chips. At each station the system writes automatically the data from the station to the memory. During the line there are some places where the memory can be read out in order to have all the information about the specified monitor also to know if the monitor is good or bad. In the line exits also a special place called repairing place where the bad monitors are directed automatically by the system. There are 2 places inside the system where the monitors can be directed to the repair place, one place before the testing with burning conveyors and one place after this testing before the final assembly places.

2. AGV TRANSPORTATION SYSTEM

Figure 5 represents the station where the pre – assembled monitor is taken by the AGV [1]:

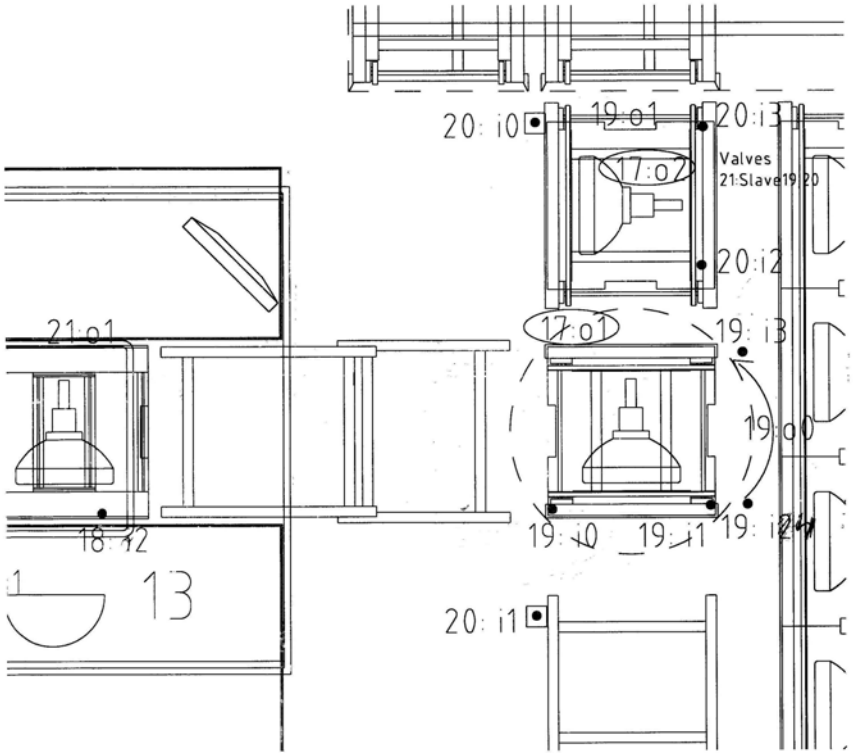

Figure 5 – Monitor to AGV

In the control computer there is also control software for the AGV movement. Production control software tells to the AGV, where are empty places for monitors or on which conveyor exists the less number of monitors at a time. AGV control software contains also the exact design of the production line, with dimensions.

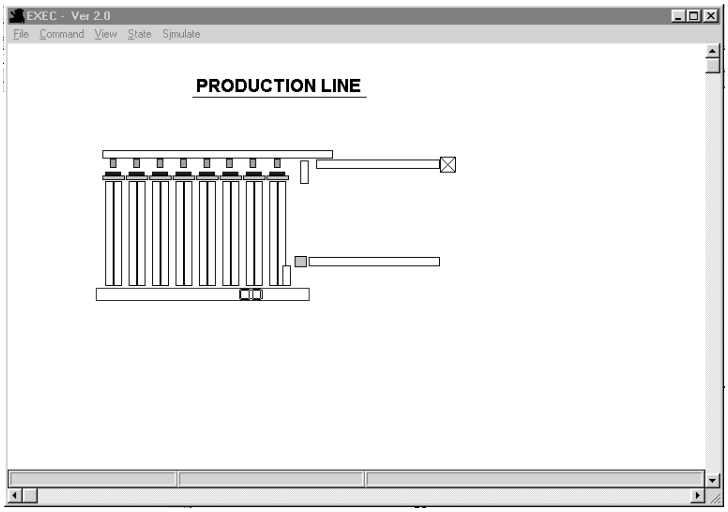

Figure 6 – AGV control

AGV control software directs the AGV through radio waves (com1) to the exact place, where the monitor must be putted. AGV has an OMRON PLC on – board. Communication channels are directly between PC and PLC. [2]

AGV has ultrasonic sensors, proximity sensors and encoders on – board. Character codes transmitted by the PC to AGV contain the distance in mm – s, for AGV

moving. Home position for the AGV is the place presented in figure 5, where the AGV takes the monitor.

PLC has a memory place where the mm – s are transformed in number of rotations for the encoder. In order to have a better positioning behind the conveyors, system use 2 ultrasonic sensors for measuring the distance between AGV and conveyor sides, when the pre – programmed distance is reached, the positioning is good. AGV control system has double side communication through the radio waves; the AGV moving can be followed on the control program. [2]

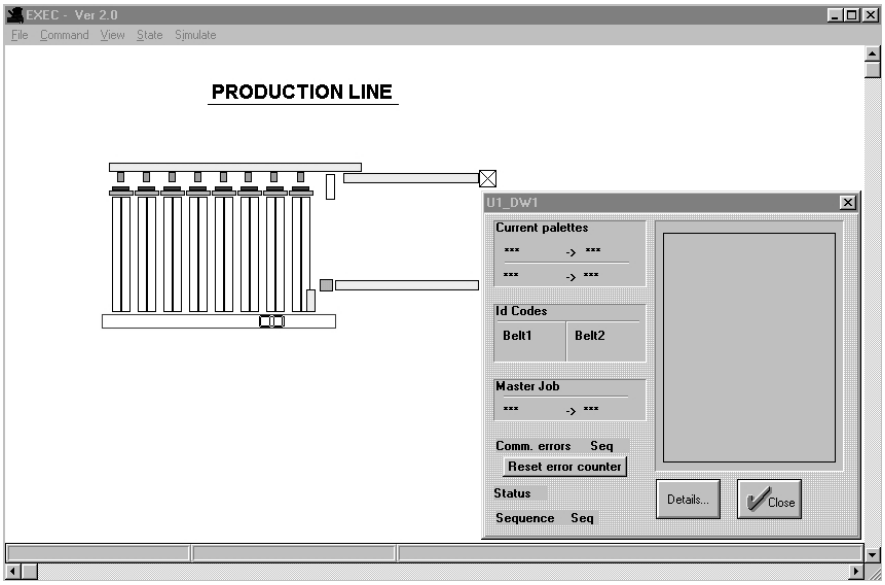

Figure 7 – AGV control feedback

3. CONCLUSIONS

The system gives good results in mass production. Those types of production lines are used around 2 years in Pecs, Hungary.

The systems don't work anymore because NOKIA decide to close its display production business and continue only with the telecommunication business.

In Pecs factory NOKIA builds, 4 production lines of the presented type. One thing, which was a bad, the system was to big and complicate and it was difficult some time to repair something in it in a very short time.

For the future, principle idea is to find a solution to simplify the control system.

4. REFERENCES

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