



**POLYTECH**

Peter the Great  
St. Petersburg Polytechnic  
University

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# Project Presentation – Summer School 2021

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Group 5

Smart manufacturing and digital future



# Introduction

- As the part of the summer school programme, we have been taught with the usage of the latest principles which have been used in the latest industrial revolution named as Industrial Version 4.0.

After the completion of the practical and training classes conducted by our esteemed professors and the guest professors from other universities and the industrial expert, we had a great experience in the learning new principles and acquired a broader perspective towards the real life industrial process.

So as the part of the completing the programme, we are being assigned with the project work for the completion of the tasks assigned.



# Objectives

- To analyze of the cyber-physical system using advanced technologies combined in the Industry 4.0 concept
- To develop a diagram of the production process
- To determine the parameters of the products that require control.
- To develop a scenario of interaction and a diagram of synchronization of all stations and modules of the automated line
- To propose a concept and present the functional and structural diagrams of the MES system, including cloud storage and other elements of Industry 4.0 digital technology.



# Contents



**Introduction**



**Transport System Station**



**Material flow**



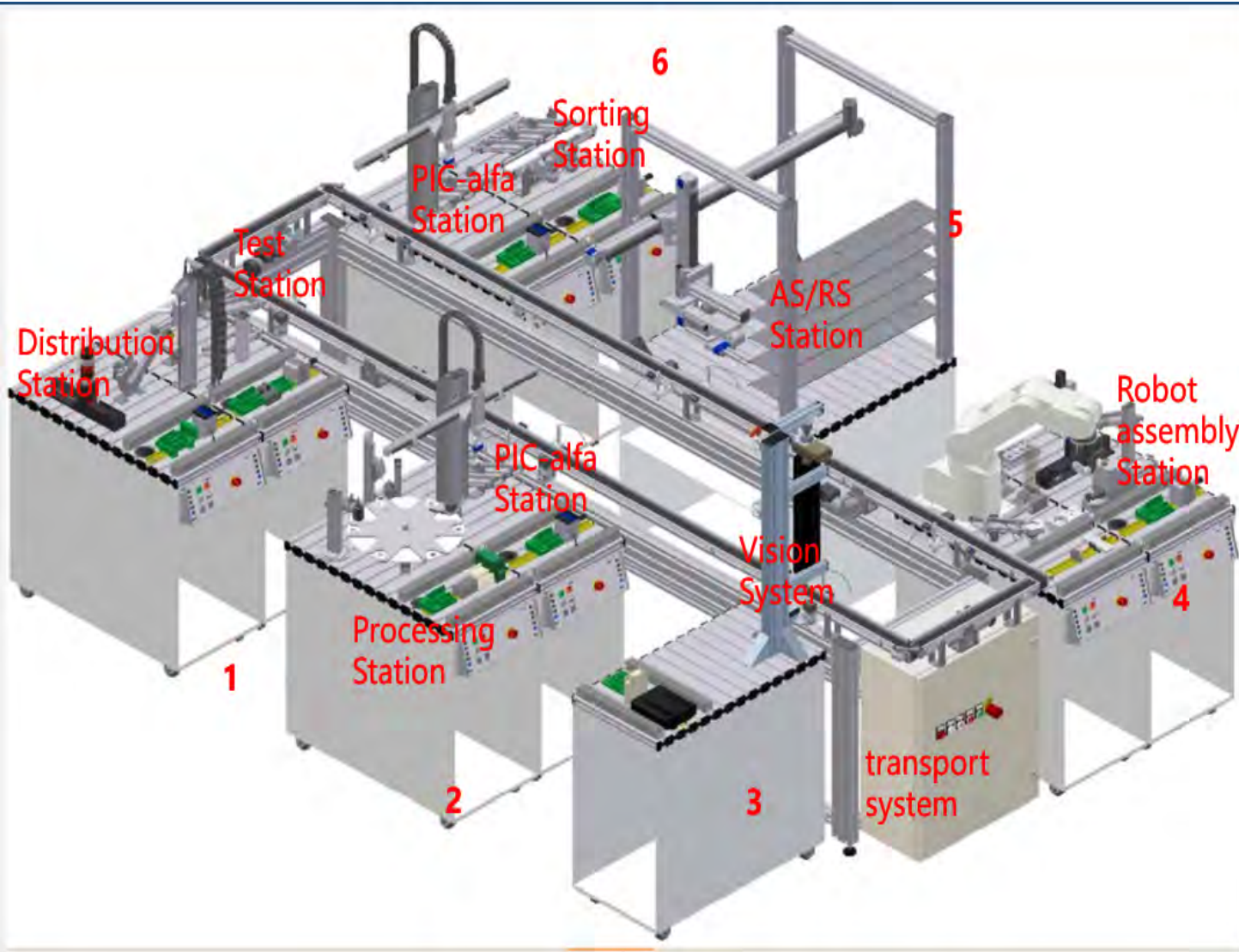
**Technology**



# *Introduction* to MES system



# Introduction to MES system

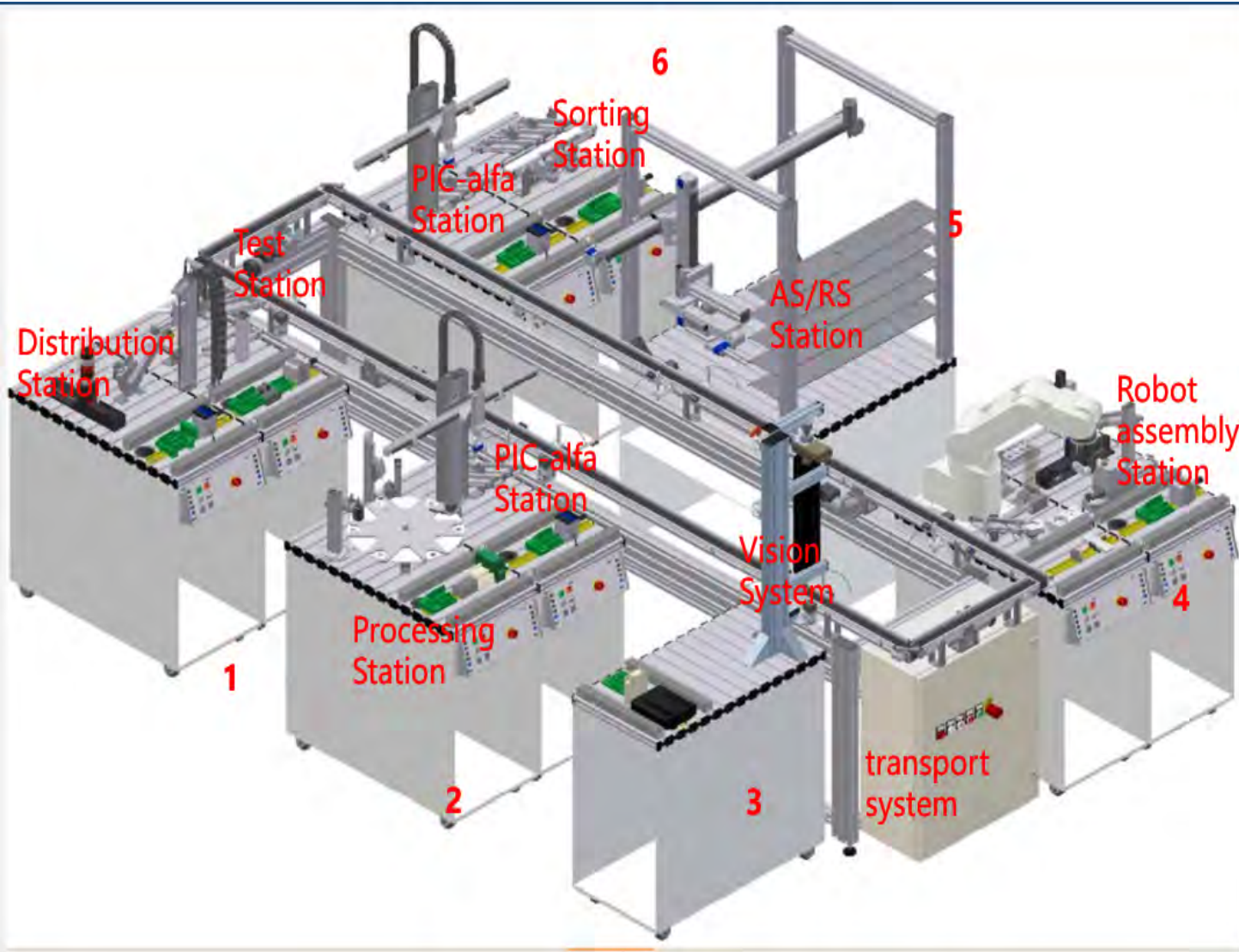


MES system is a set of production information management system for the executive level of the manufacturing enterprise workshop.

MES is an information system that connects, monitors and controls complex manufacturing systems and data flows on the factory floor. The main goal of an MES is to ensure effective execution of the manufacturing operations and improve production output.



# Introduction to MES system



The MPS500 system is designed in such a way, that the amount and kind of MPS stations attached is of no importance. A complete processing cycle of the work-piece is always warranted. For this, the transport system is required under any circumstances.

Operation is not dependant on the operating position the material flow is being started from. Still, the sequential order of the stations require adherence, as it is pre-defined in the PLC-program.



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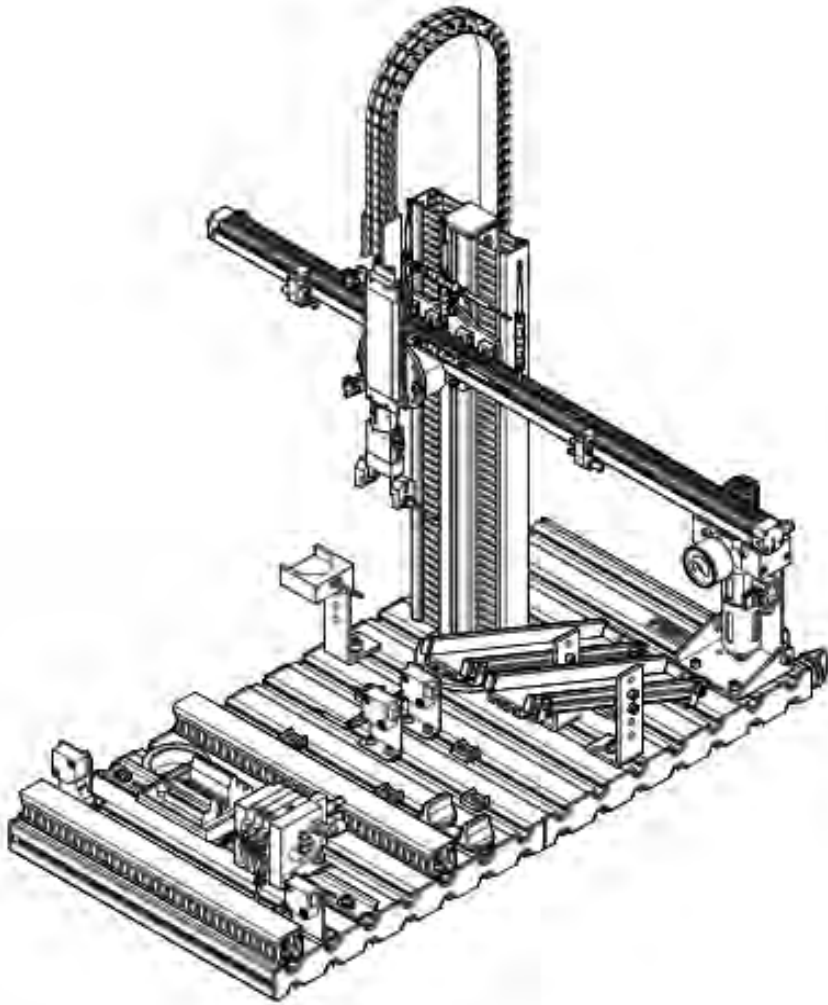
# System Station



# System Station



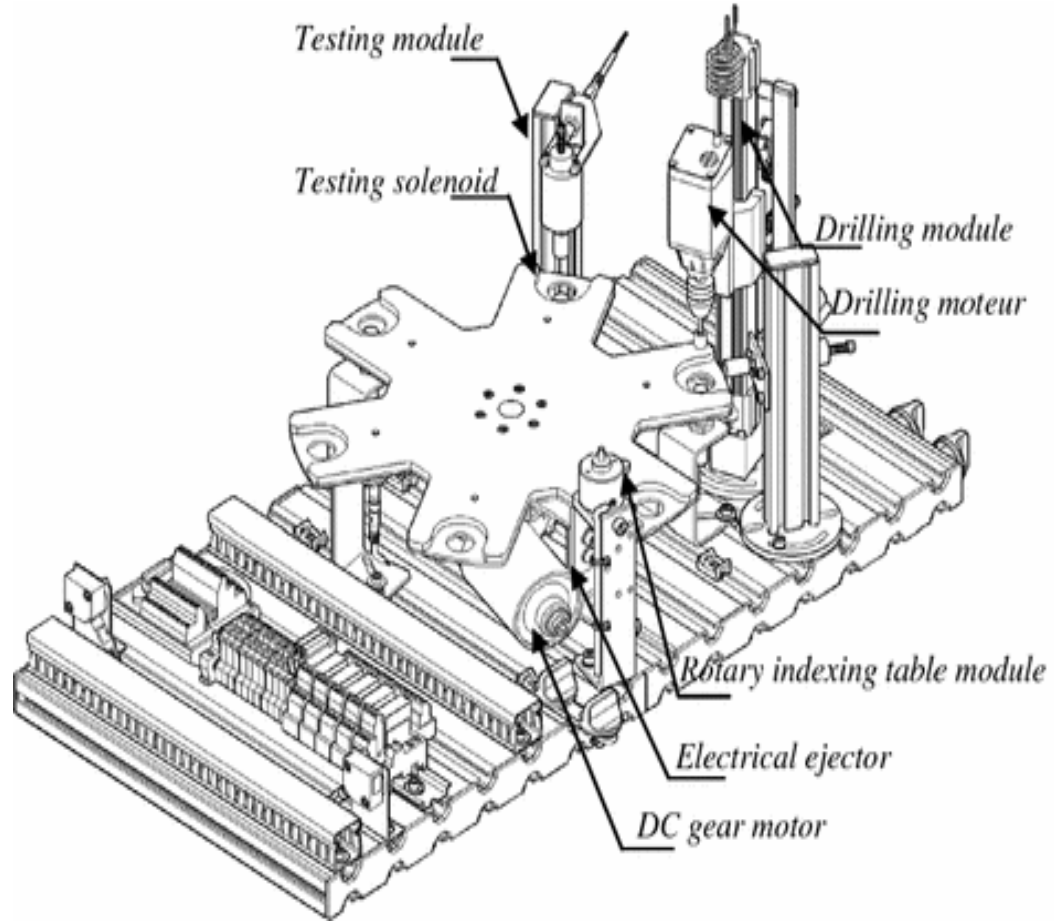
# Handling Station



The function of the handling station is :

- to determine the material characteristic of a workpiece
- to remove workpieces from a receptacle
- to deposit the workpieces on the metal rack
- to pass on the workpiece to a subsequent station

# Processing Station



The function of the processing station is :

- to rotate the plate and stop at the right moment
- to machine the workpiece



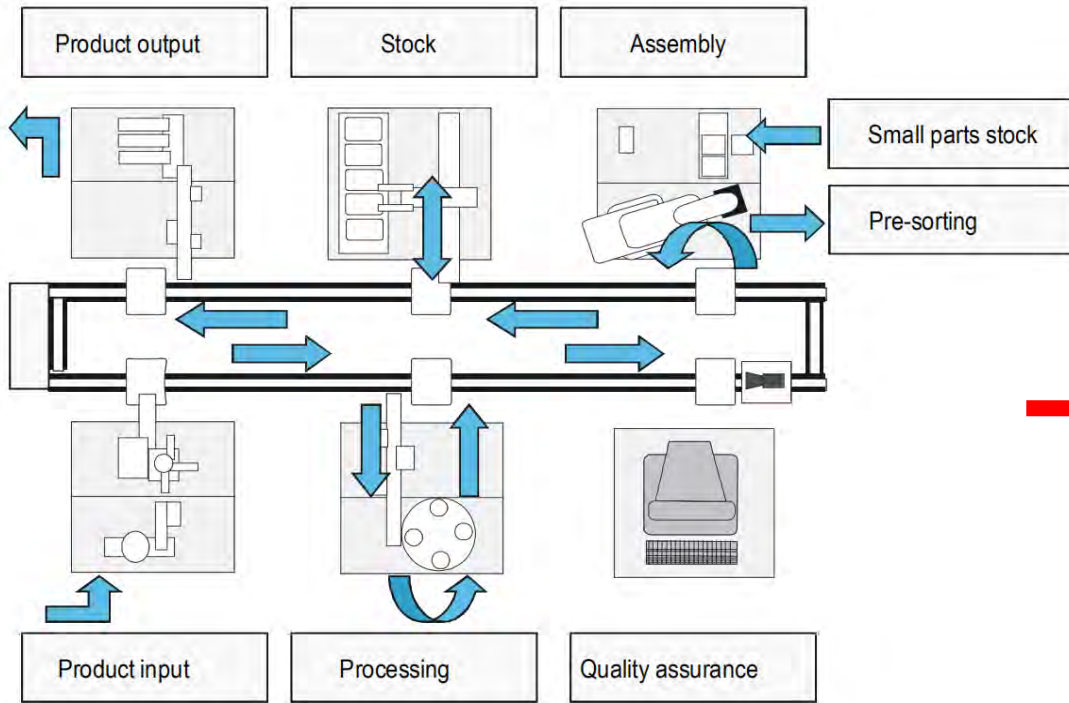
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# Material Flow

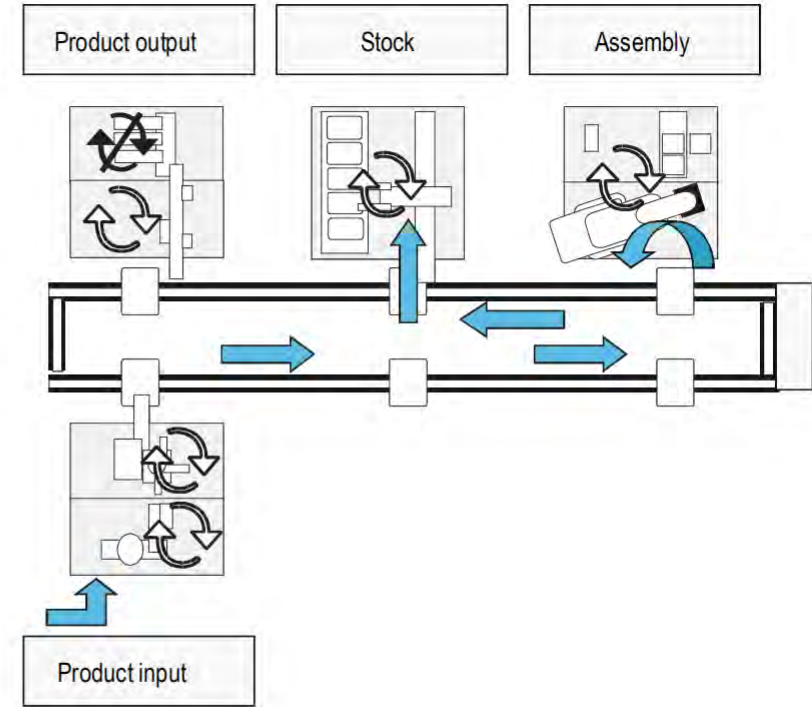


# Material Flow

# Material Flow



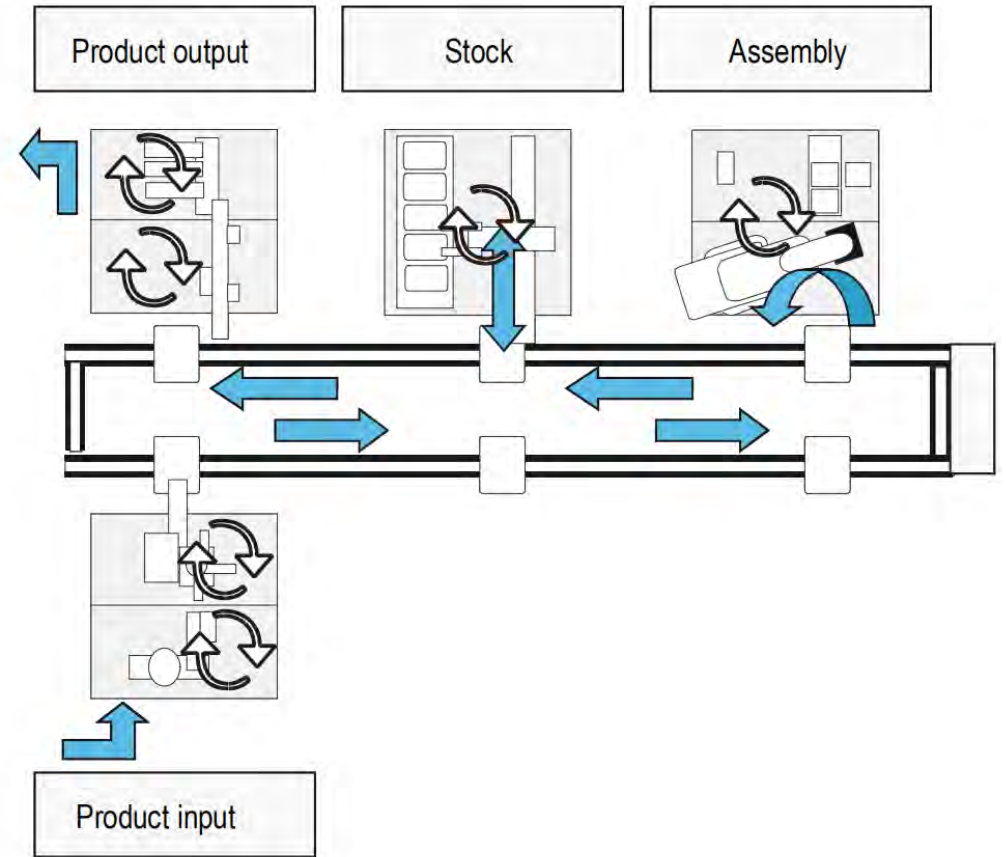
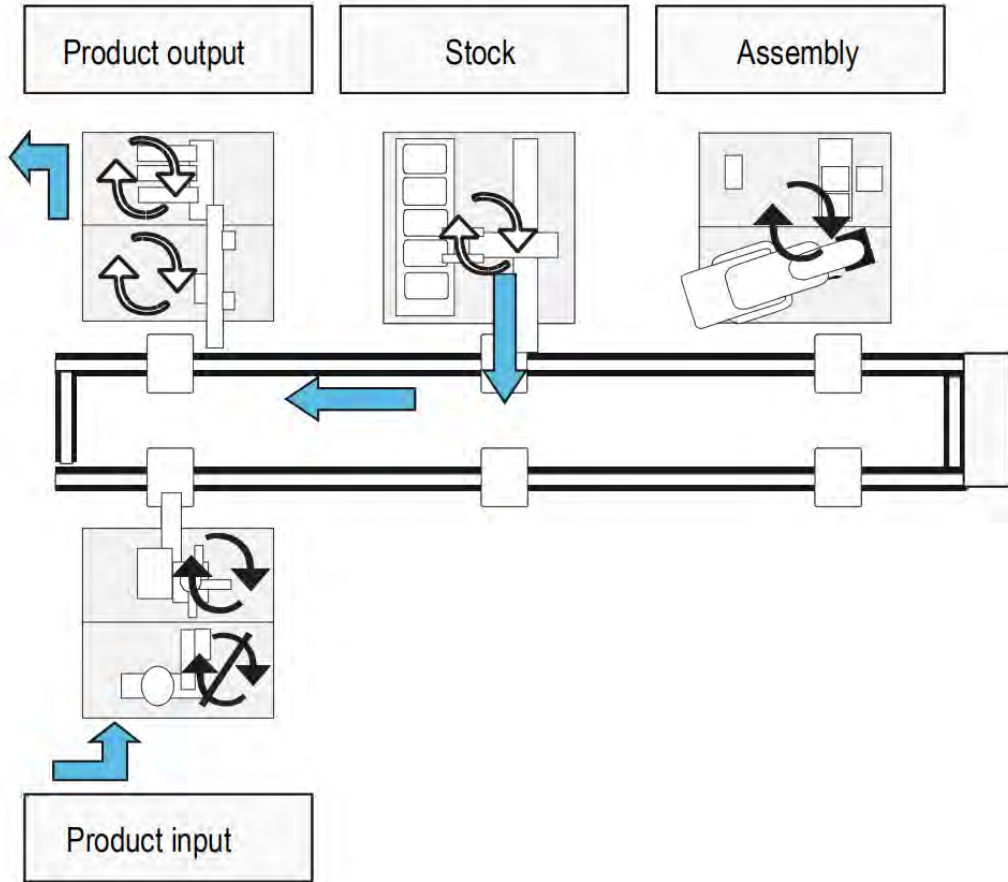
**material flow from product input to product output**



**material flow from product input to stock**



# Material Flow



**material flow from stock to product output**

**material flow mixed operation**



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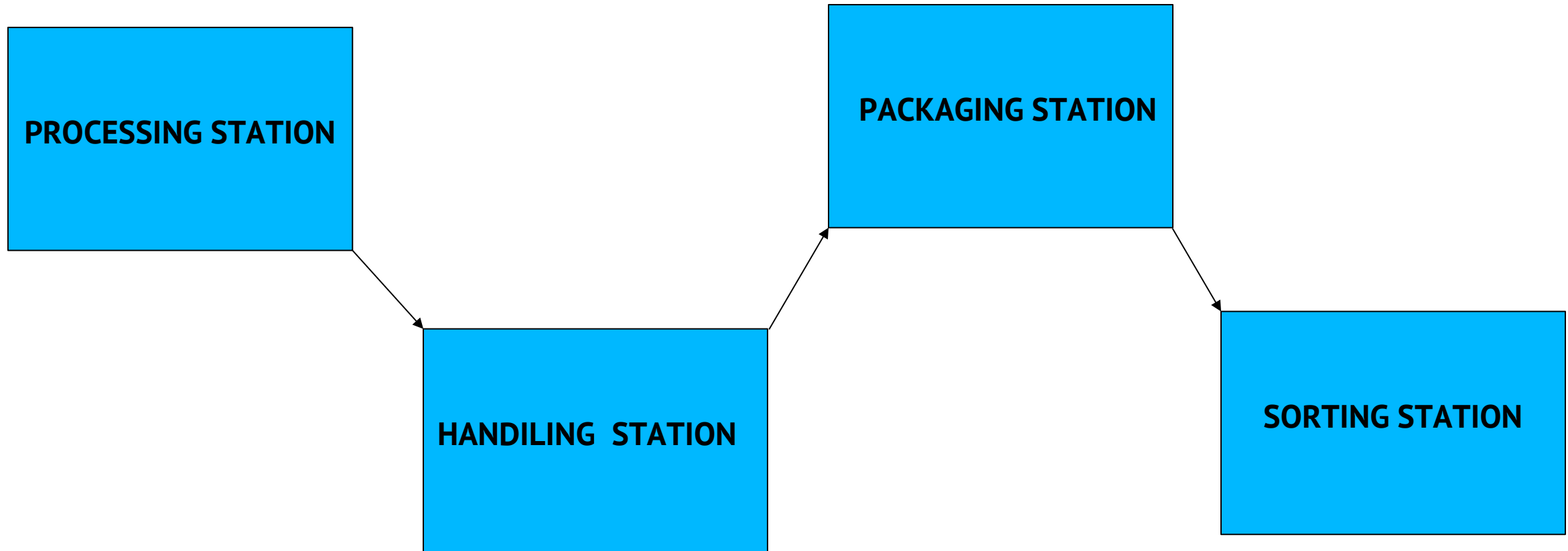
# Technology



# Technology

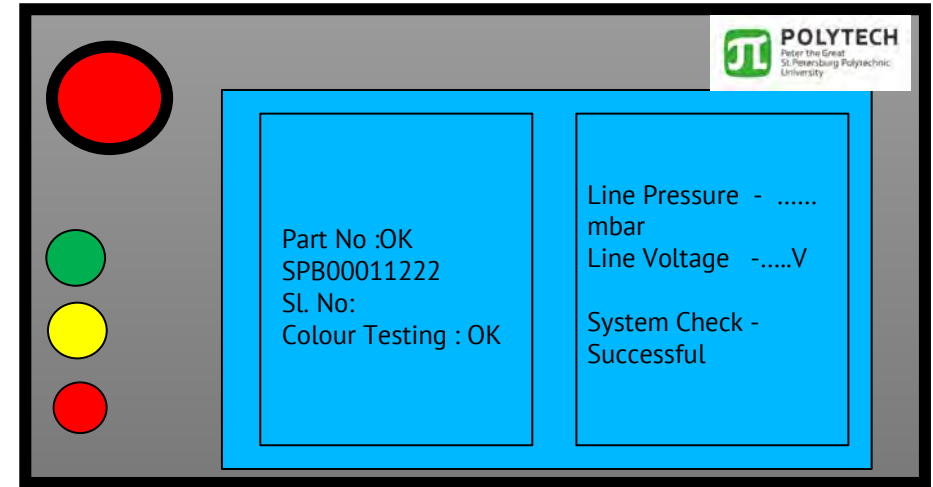
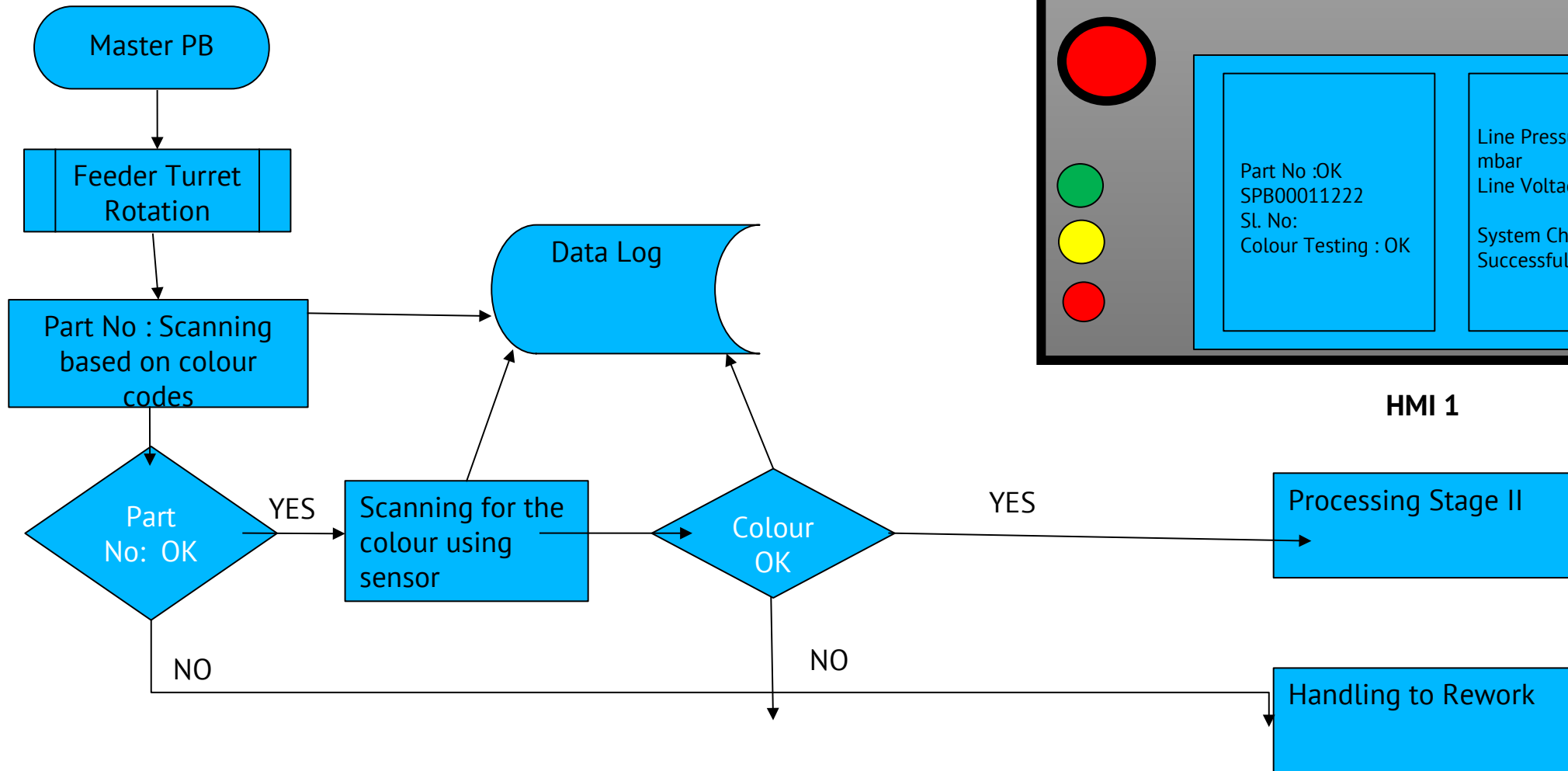


# Proposed production automation process – Initial





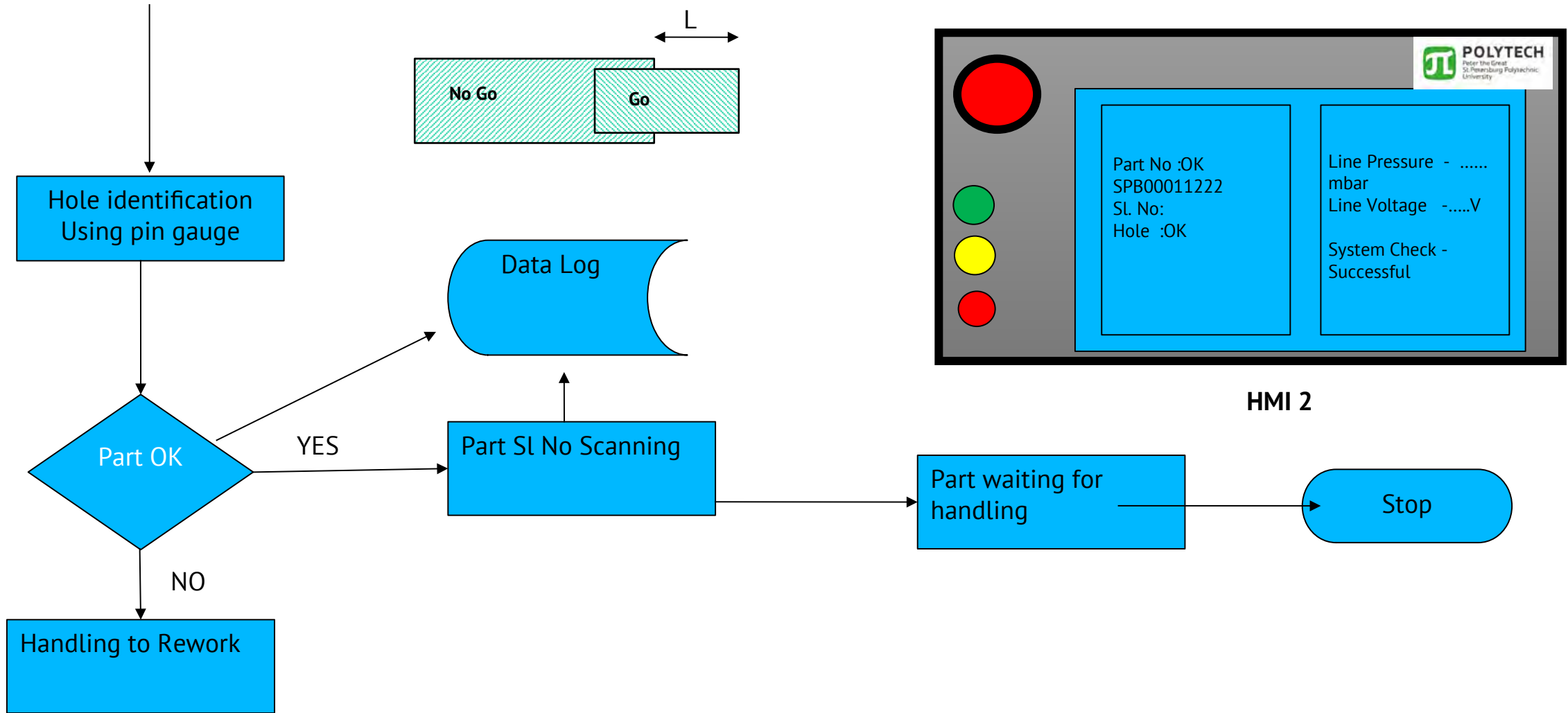
# Proposed architecture for each station – Processing I



HMI 1



# Proposed architecture for each station – Processing II







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# Processing Station

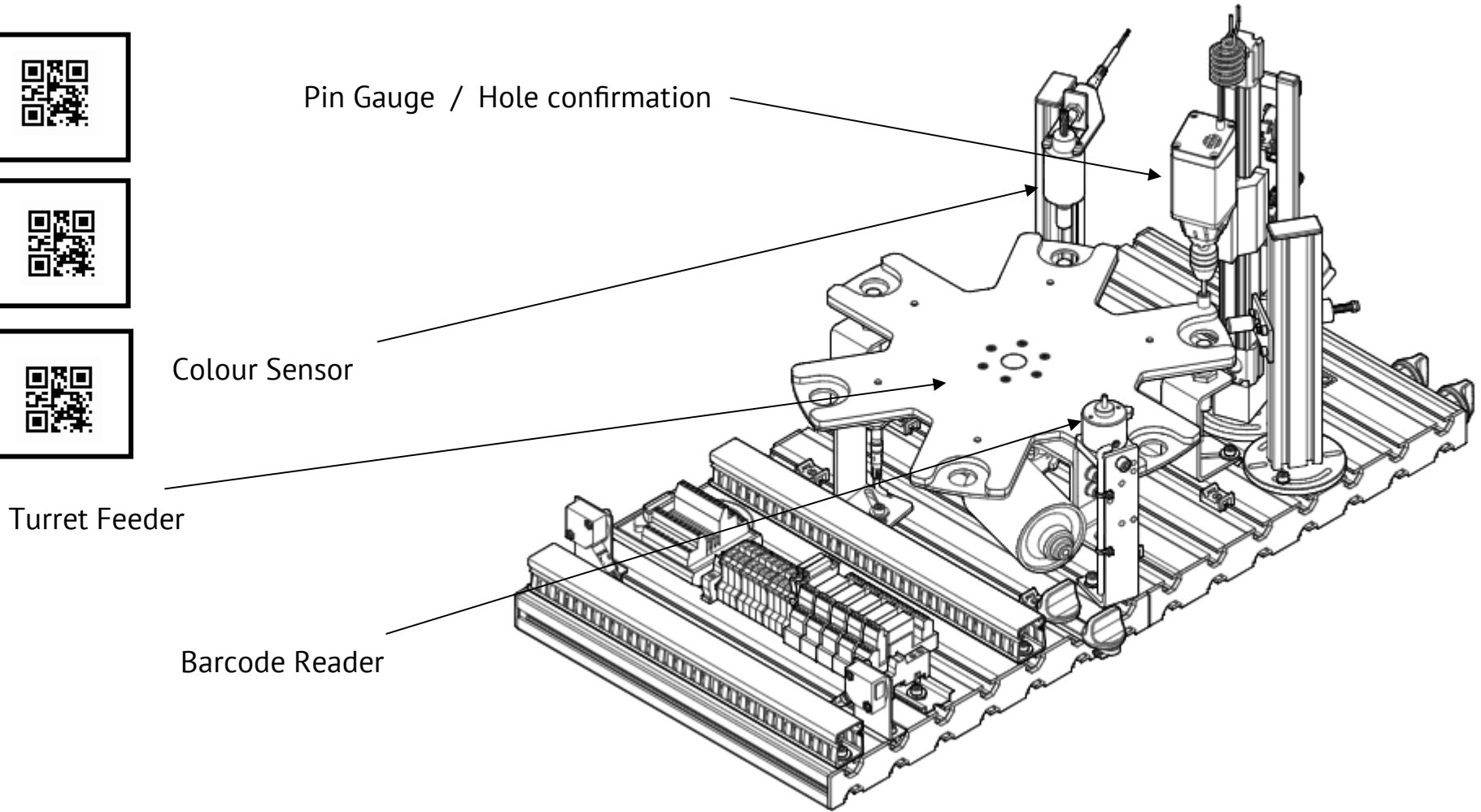

SPBPU  
PART NO : SPB00142350  
Serial No : 00000000001



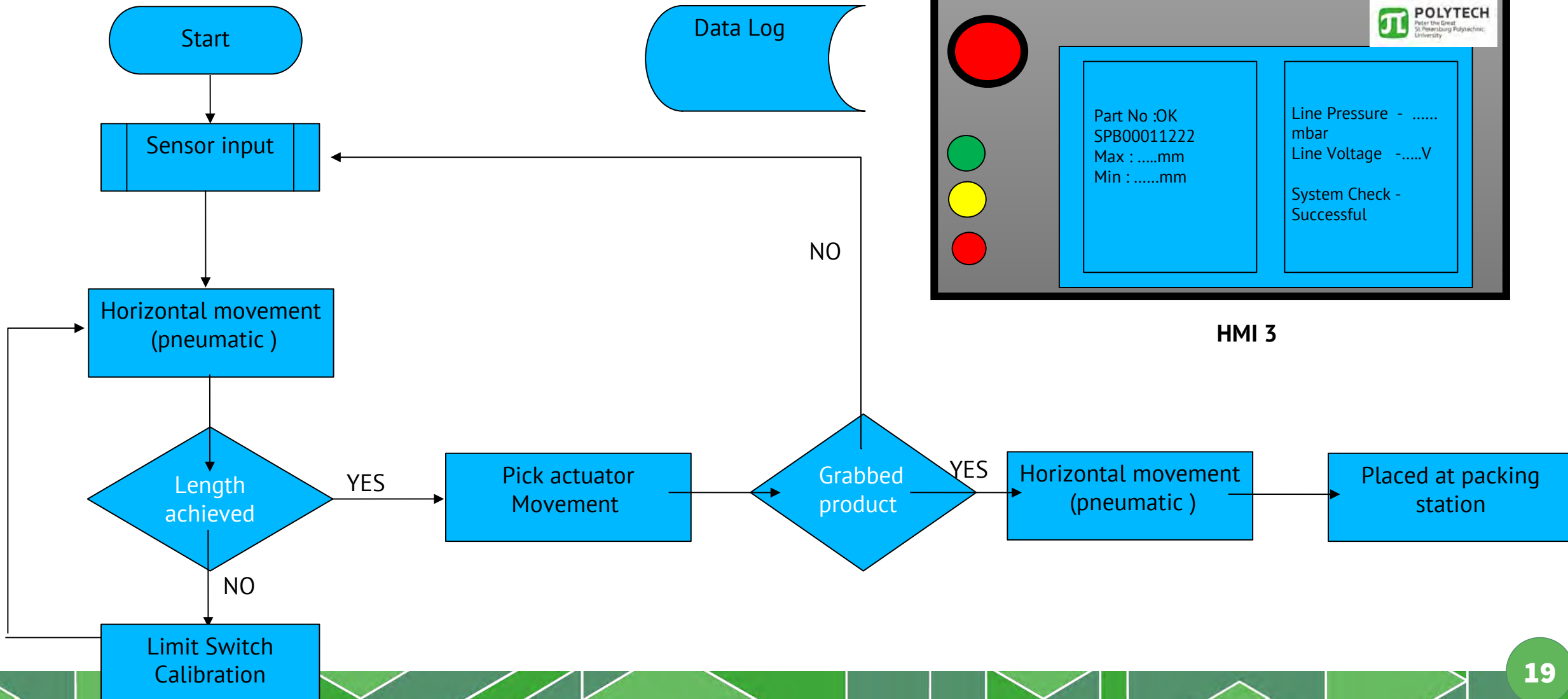
SPBPU  
PART NO : SPB00142360  
Serial No : 00000000001



SPBPU  
PART NO : SPB00142370  
Serial No : 00000000001



# Proposed architecture for each station – Handling





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# Proposed architecture for each station – Handling

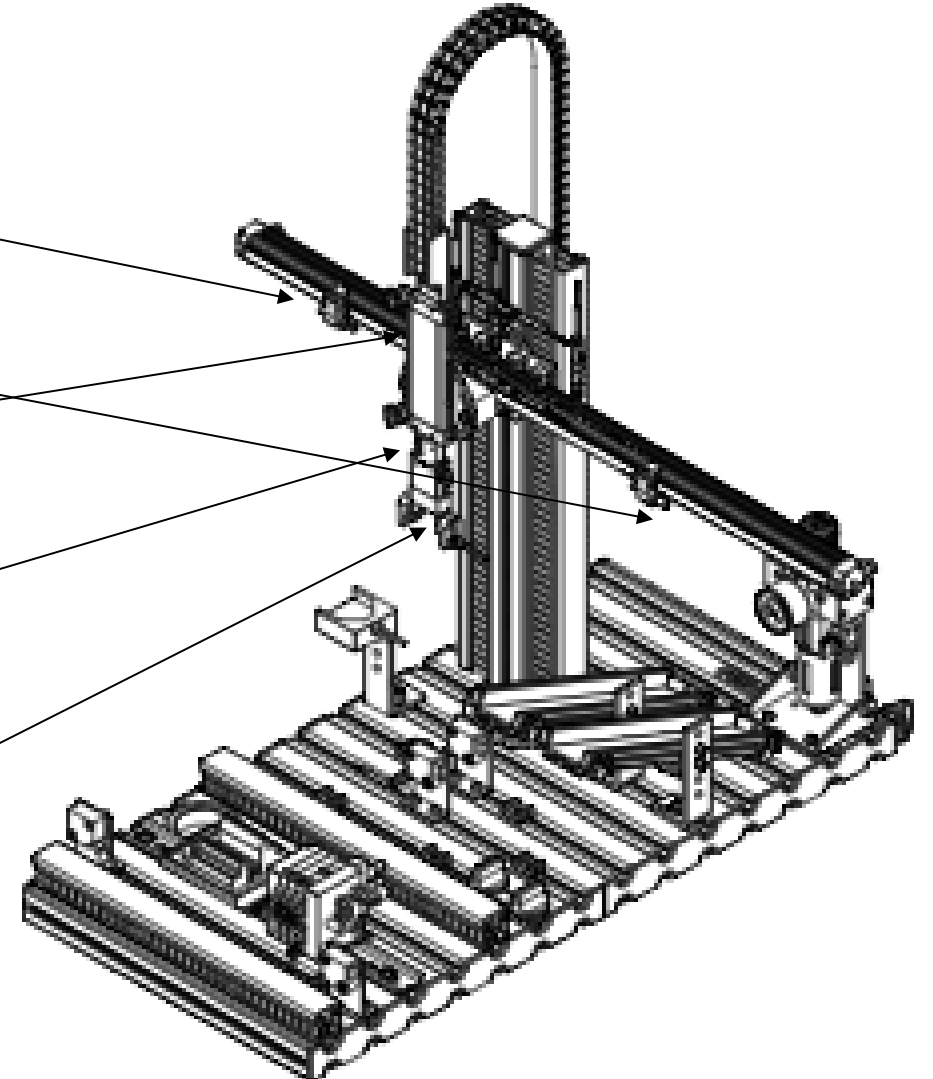
Limit Switch (Hmin)

Limit Switch (Hmax)

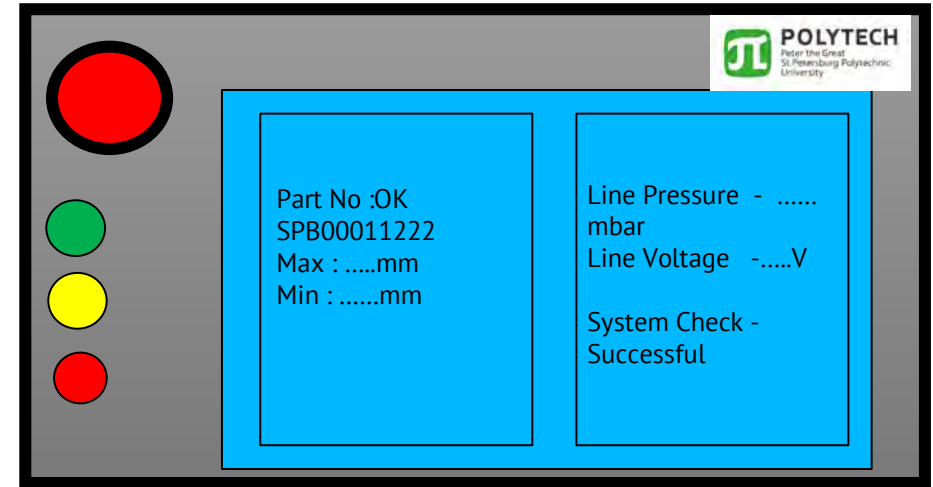
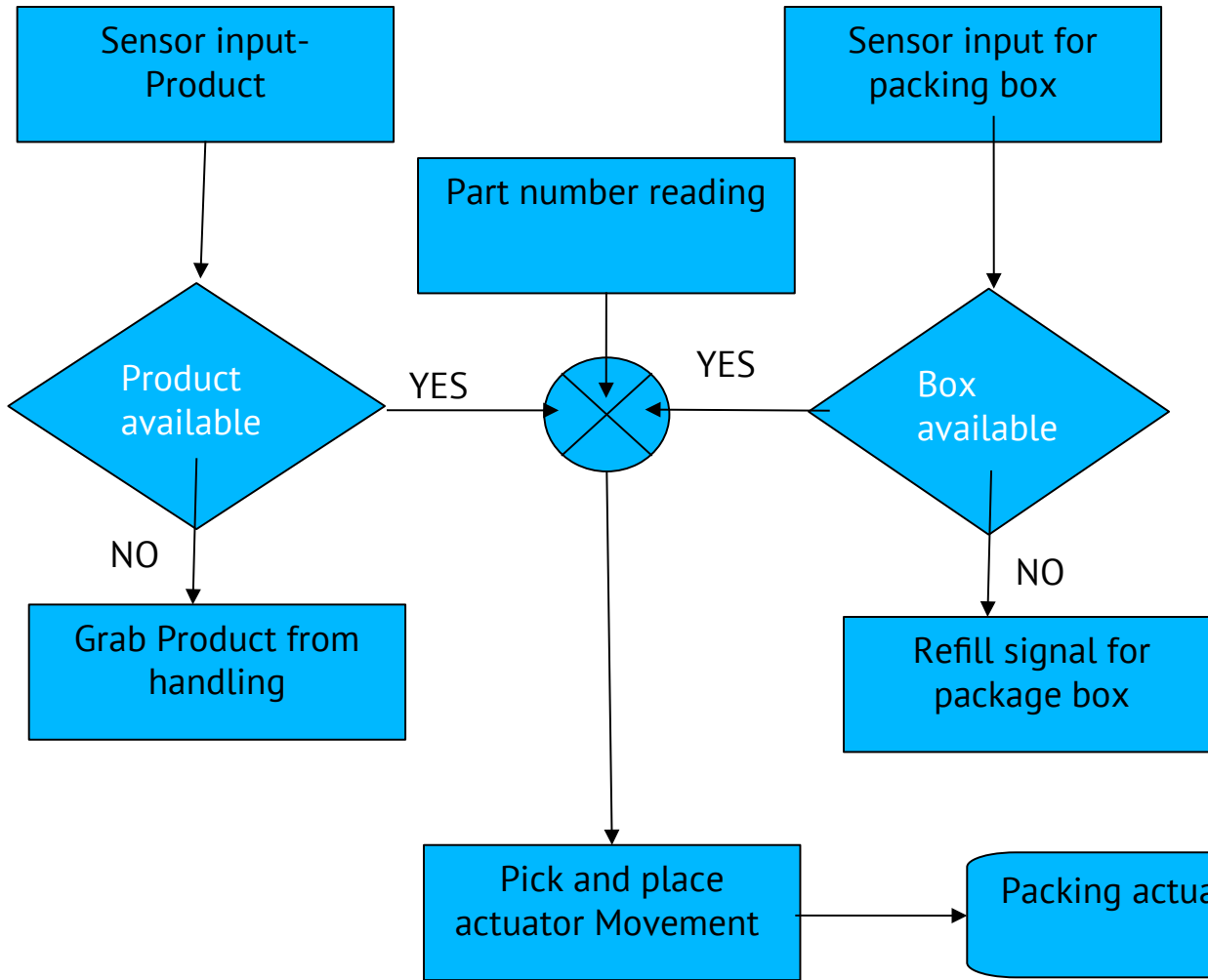
Limit Switch (Vmin)

Limit Switch (Vmax)

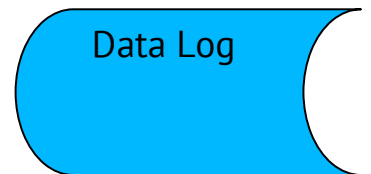
Grab Gripper



# Proposed architecture for each station – Packing Station



HMI 4





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# Proposed architecture for each station – Handling

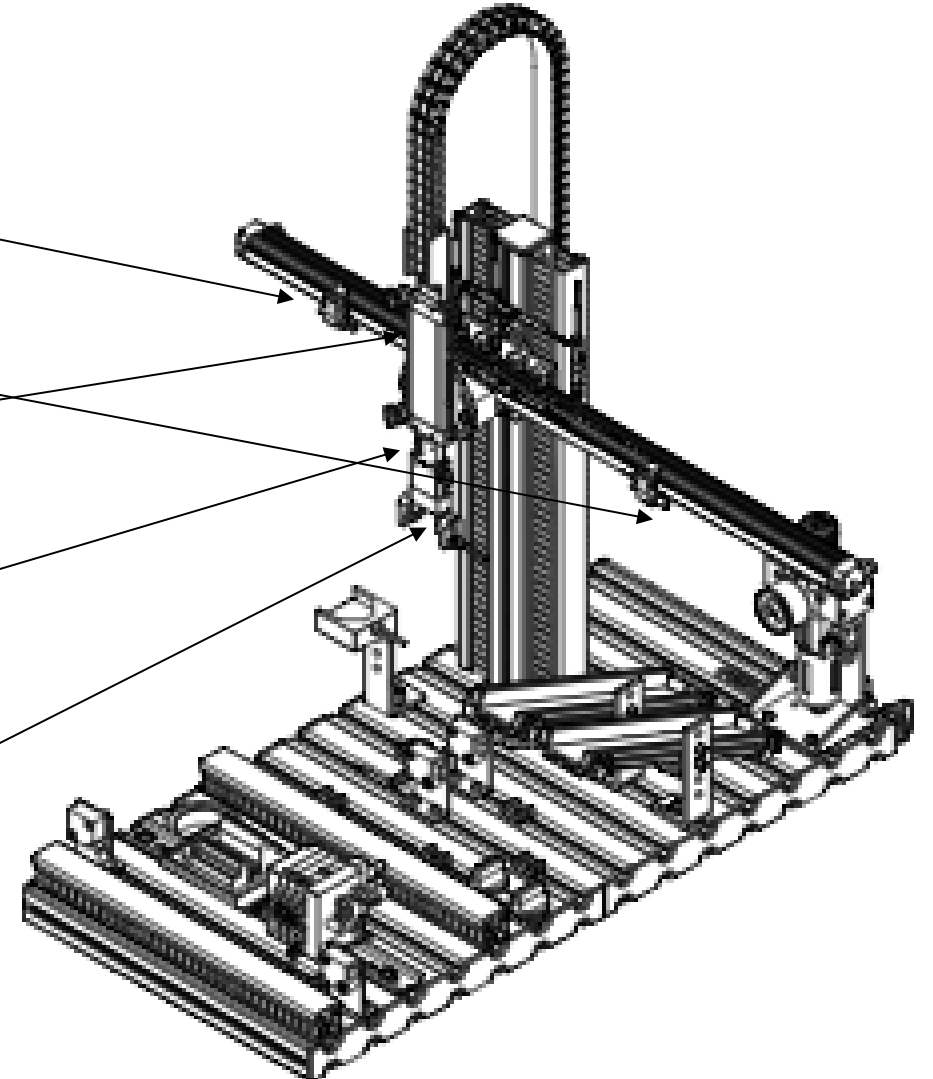
Limit Switch (Hmin)

Limit Switch (Hmax)

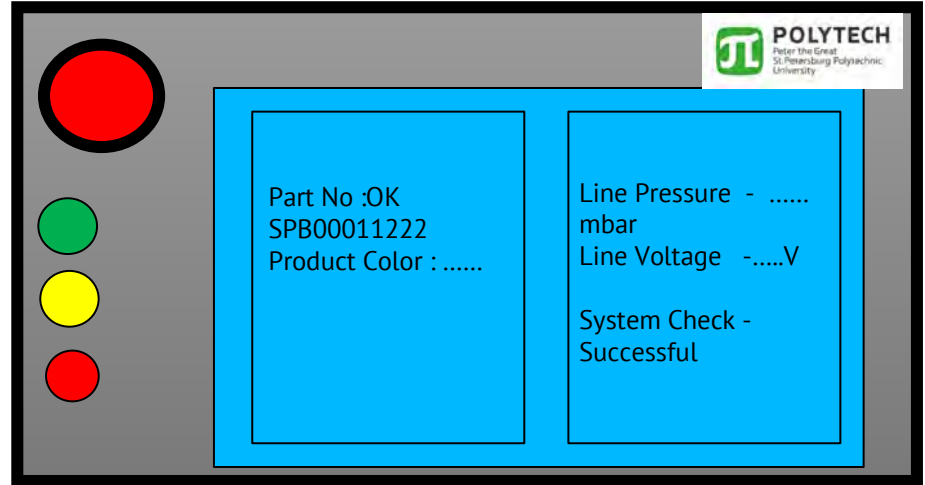
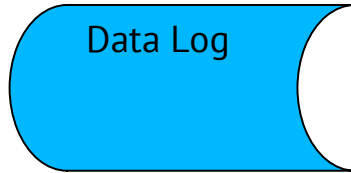
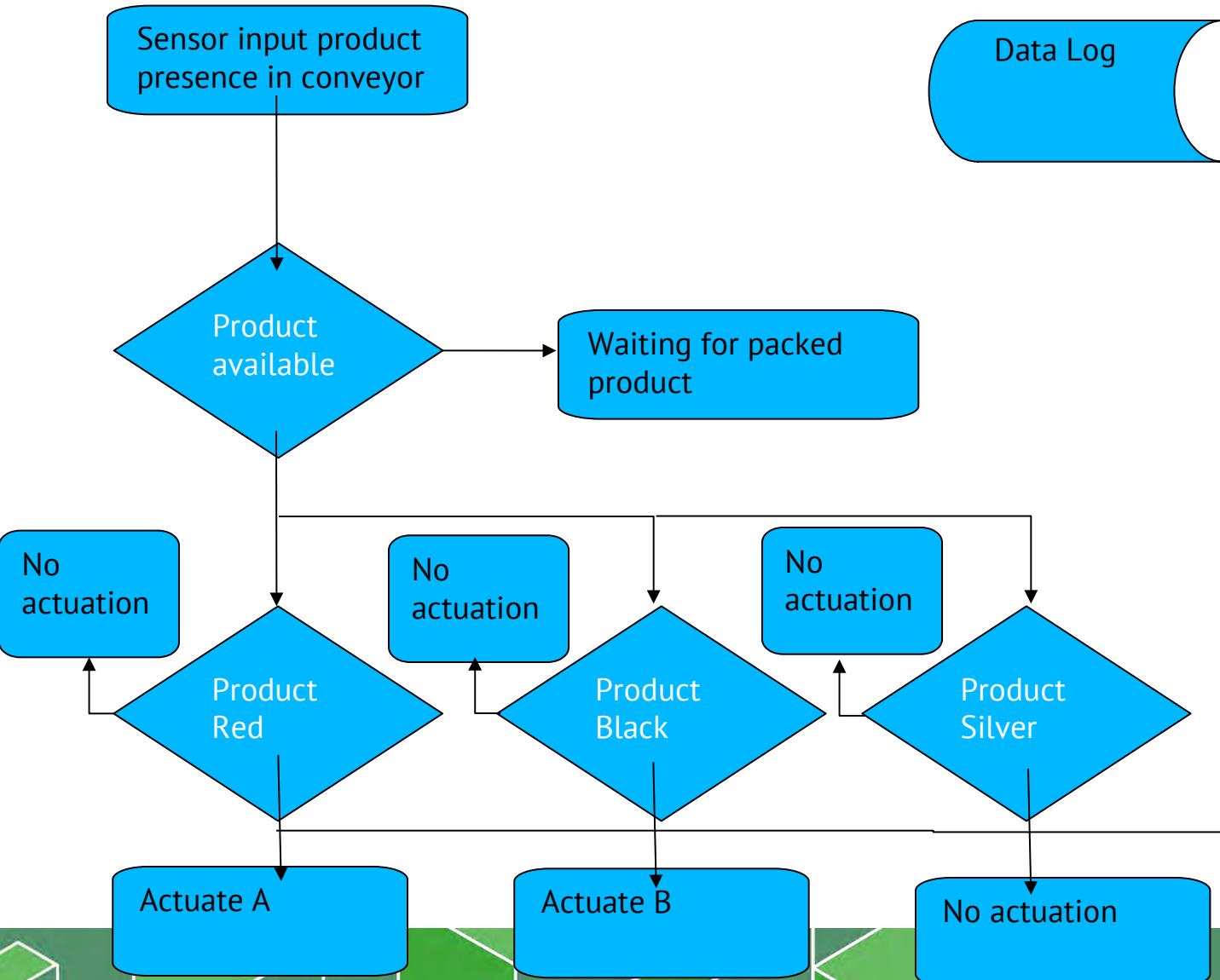
Limit Switch (Vmin)

Limit Switch (Vmax)

Grab Gripper



# Proposed architecture for each station – Sorting Station

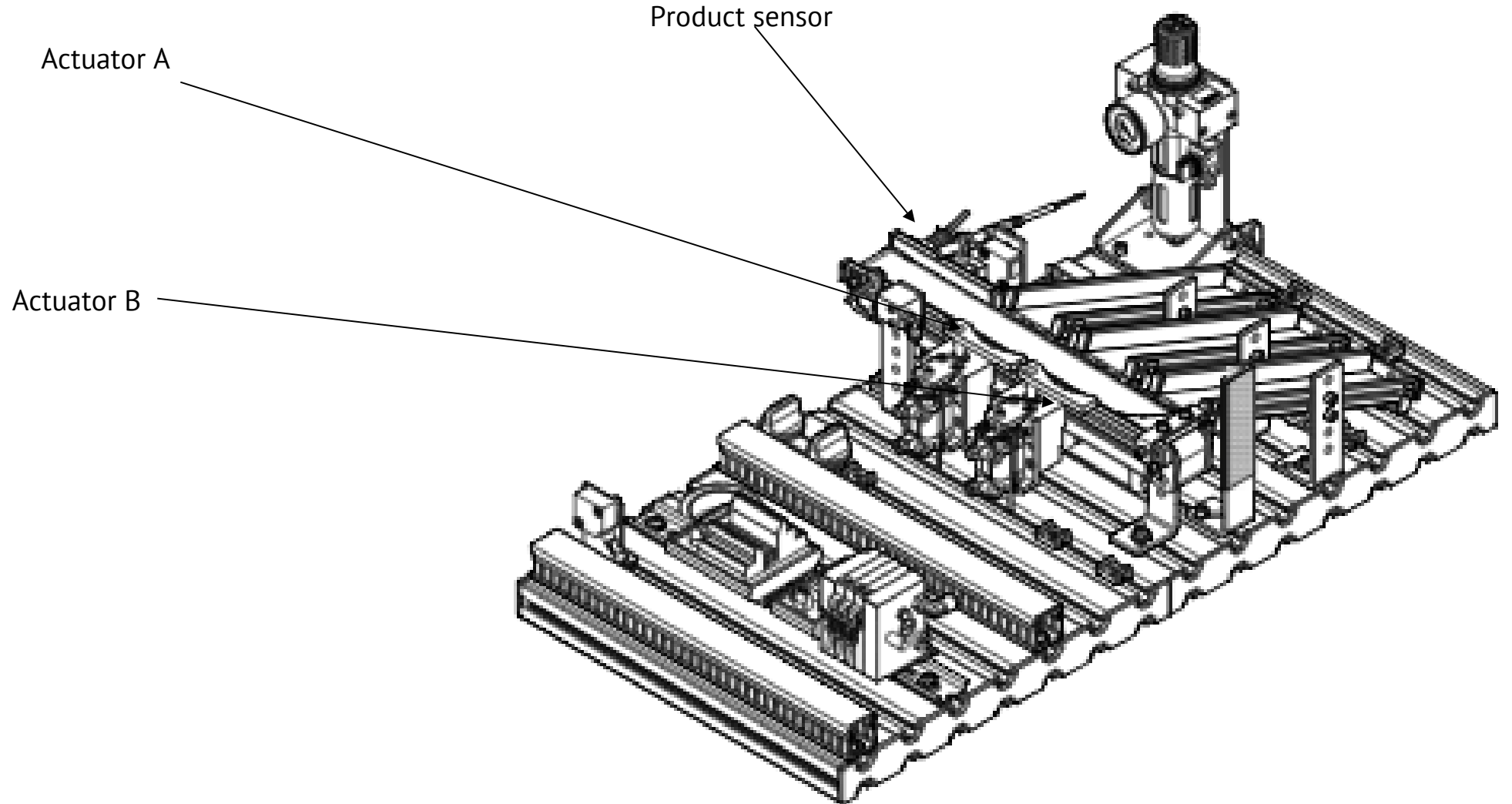


HMI 5



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# Proposed architecture for each station – Sorting







## Product parameters

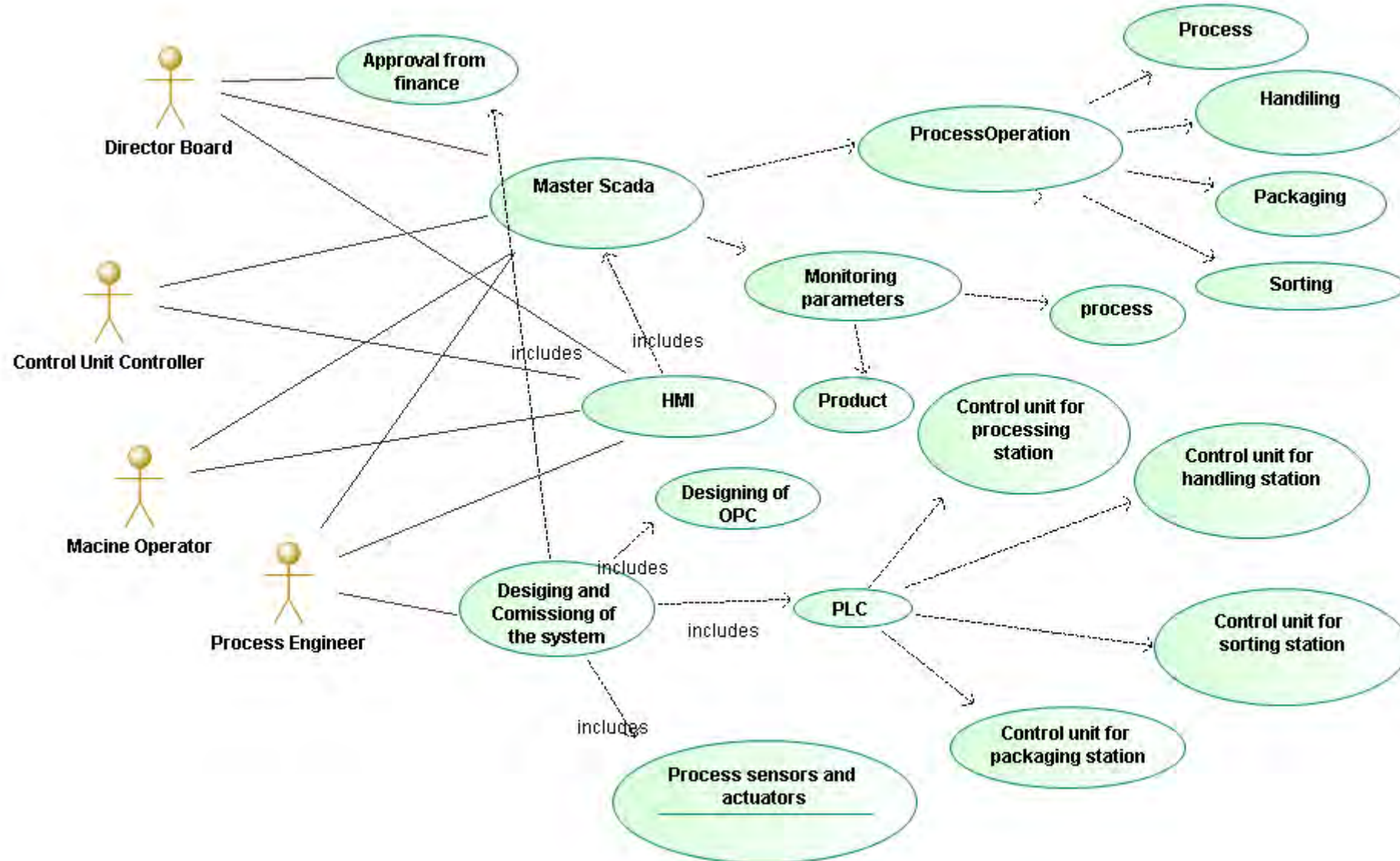
- Colour – Red, Black, Silver
- Part Number : SPB00142350 / 60 / 70
- Hole customer fitment diameter :  $D \pm \text{Tolerance}$
- Hole Depth :  $L \pm \text{Tolerance}$



## Process parameters -

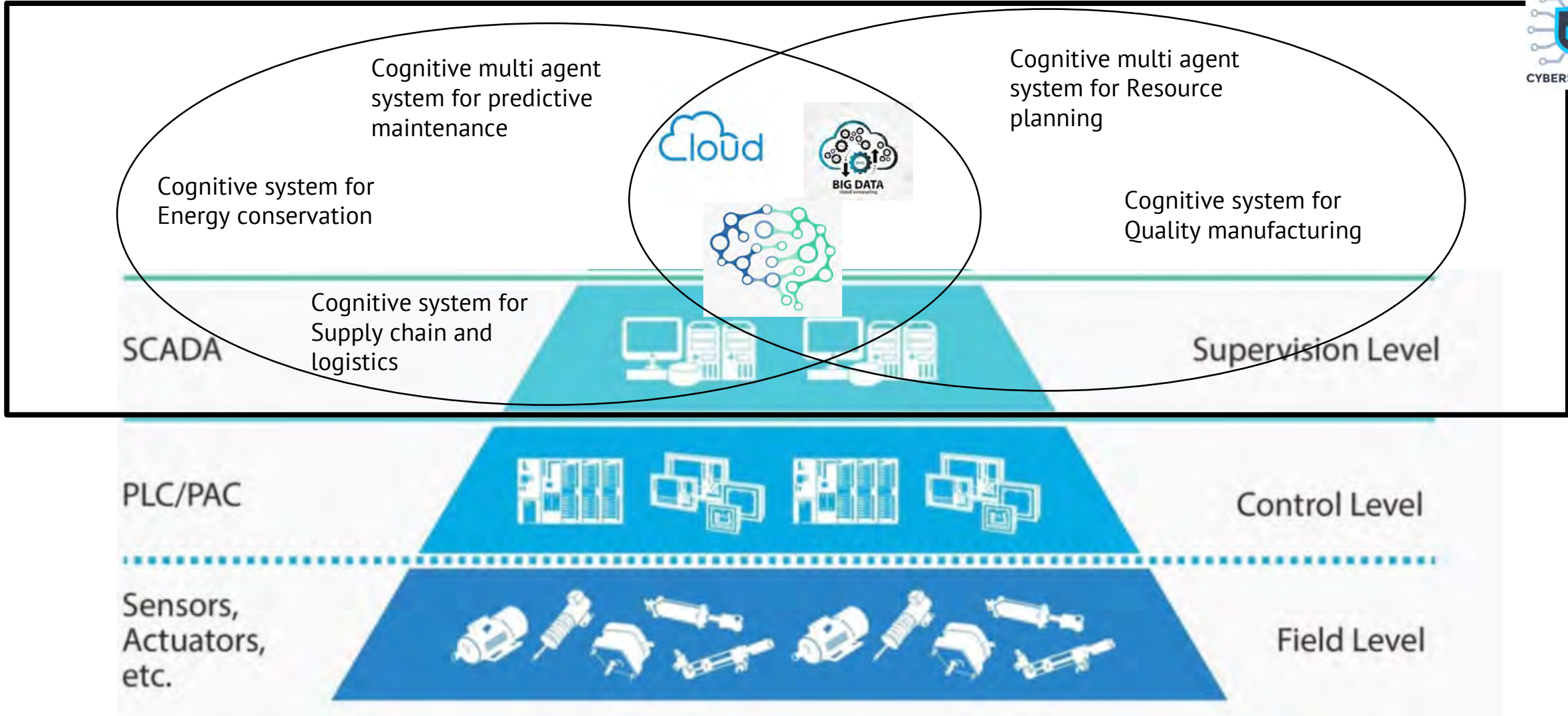
- Sensor performance – V
- Line Pressure – Max – Min (mbar)
- Line Voltage – Max –Min (V)
- Limit Switch length – Max – Min (mm)
- Code Scanner accuracy

# Use case diagram

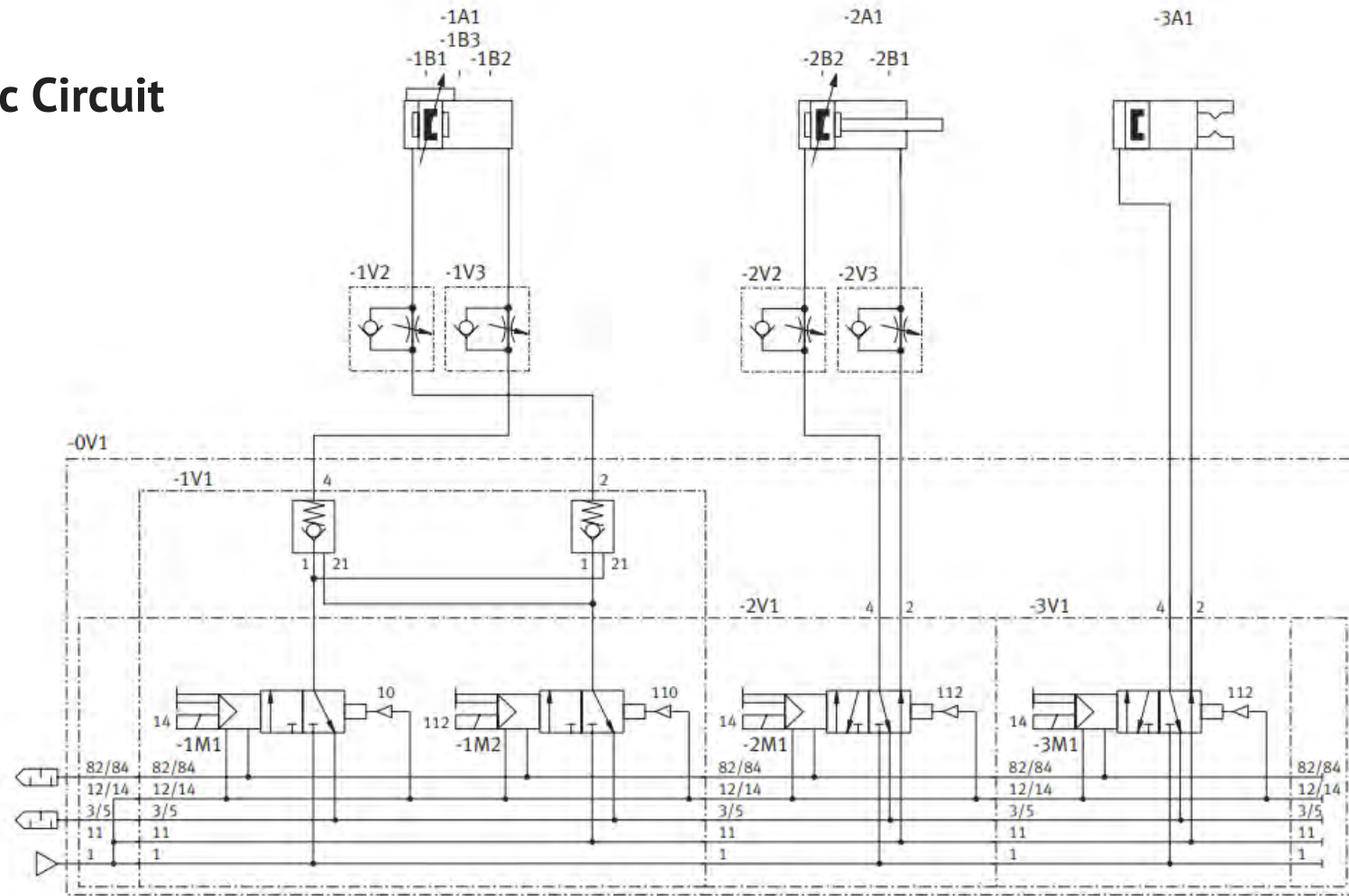




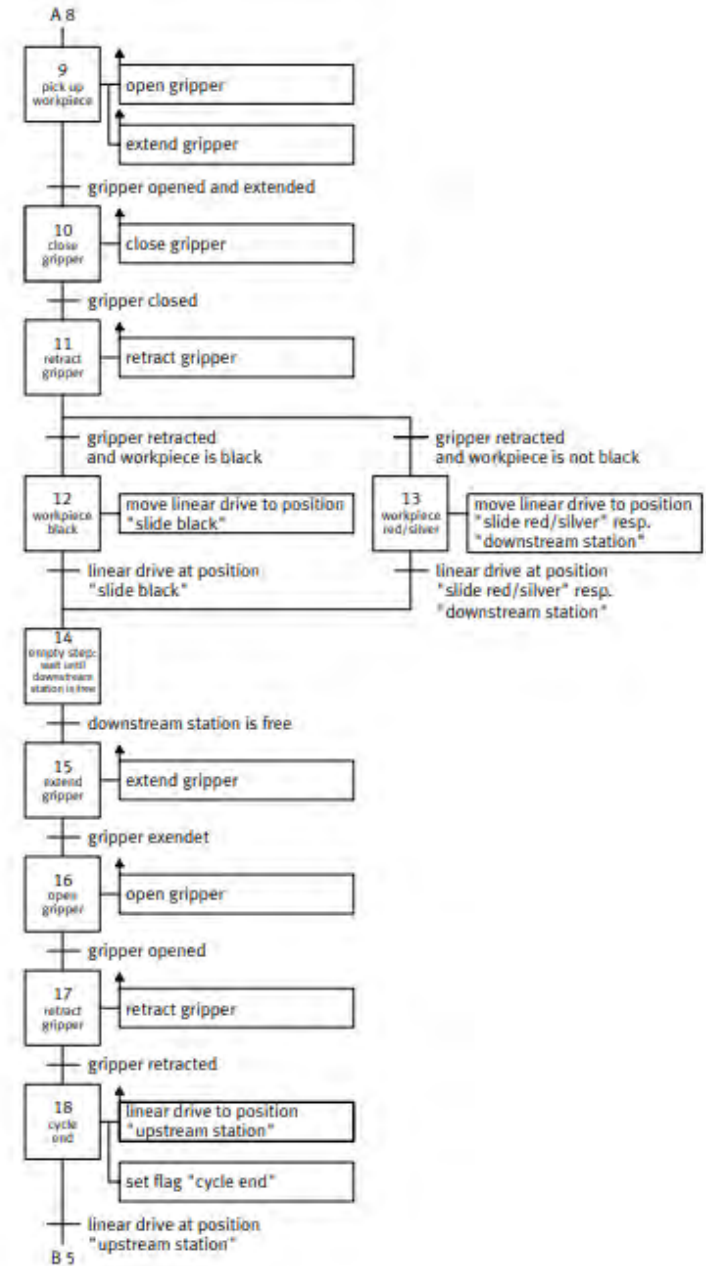
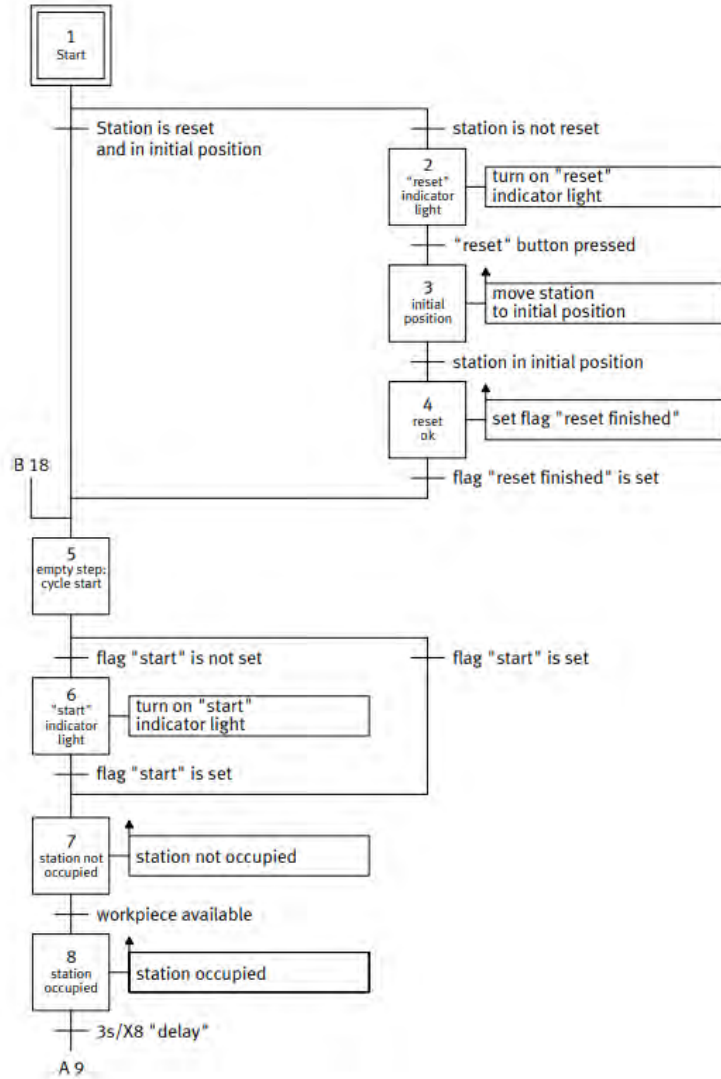
# MES IV4.0 PROPOSED CONCEPT



## Pneumatic Circuit



## SFC





## LD

### Inputs:

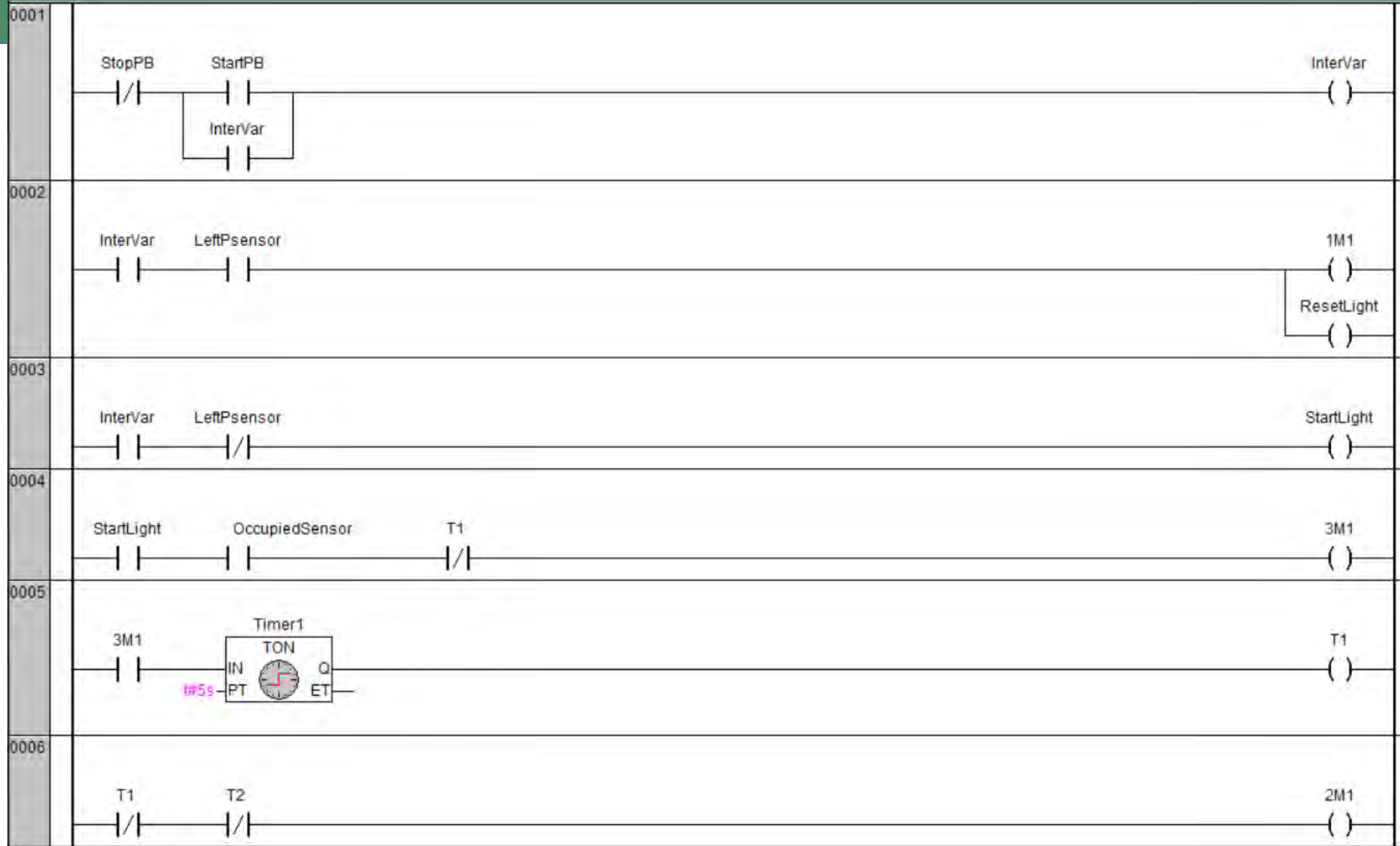
- 1 、 StopPB
- 2 、 StartPB
- 3 、 Left P sensor
- 4 、 Right P sensor
- 5 、 Station Occupied
- 6 、 Color Sensor

### Outputs:

- 1 、 Reset indicator light
- 2 、 Start indicator light
- 3 、 Gripper open 3M1
- 4 、 Gripper retract 2M1
- 5 、 Gripper move left 1M1
- 6 、 Gripper move right 1M2

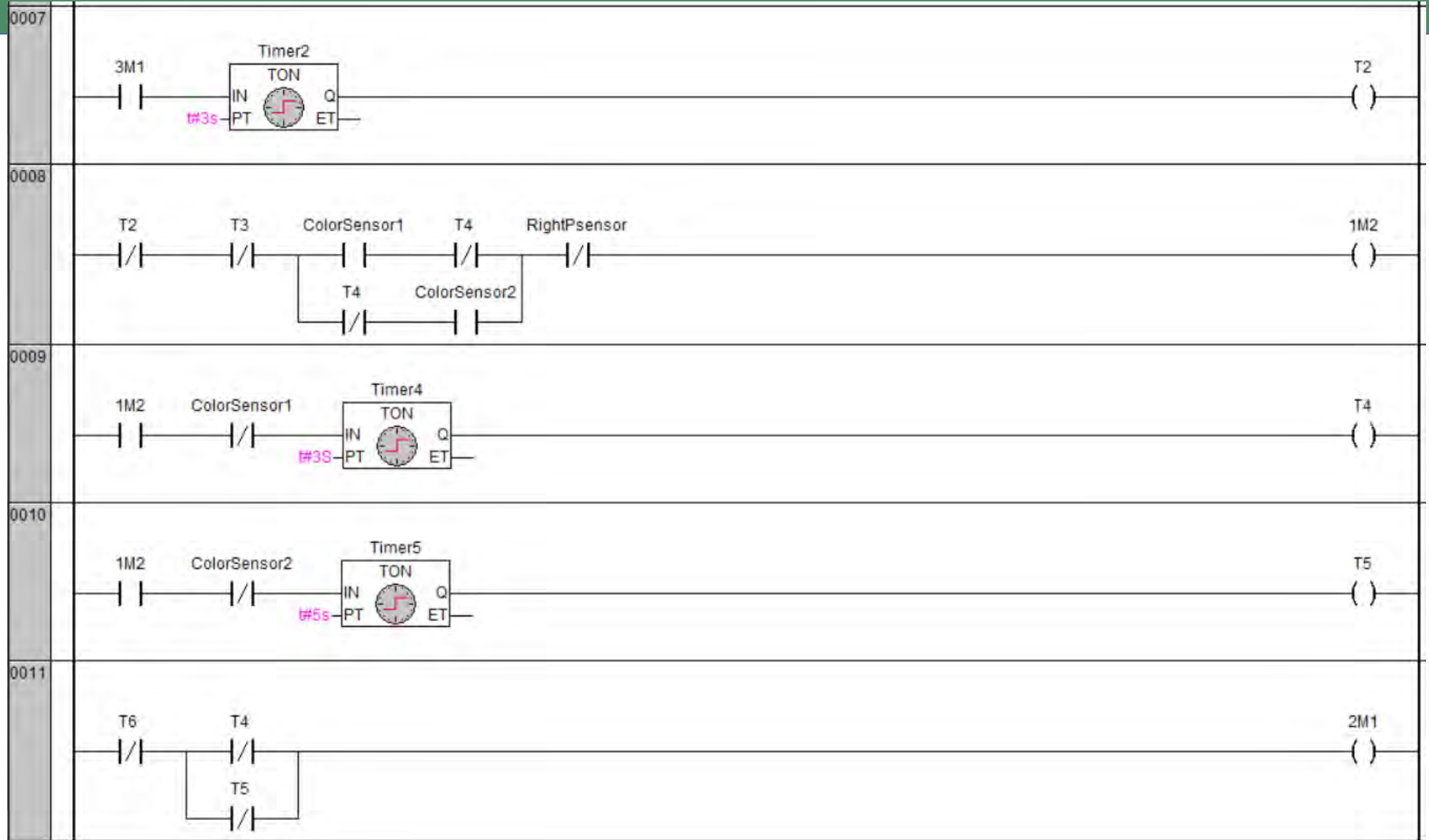


LD





LD



LD

