Our automated system, in the medical field, is designed to fill and cap vials with medical syrup, as well as to label packages and vials

Raw materials :

200ml empty medical bottles

empty packets

the traffic jam

Syrup in the tank

The 2 semi-finished products:

200 ml bottles filled with Syrup only

The 200 ml bottles filled with Syrup and capped

2 final products:

- A: 200 ml bottles filled, capped and labeled
- B: labeled packets

System components:

The system is composed of 3 workstations:

Filling machine (m1):

This machine fills vials to a precise level in a set time. It is equipped with a reservoir containing the medical syrup and a**nozzle**filling station with a**solenoid valve**which opens when a bottle is detected by a presence sensor.

Capping machine (m2):

This machine is used to cap the bottles with pressure caps. It is composed of an arm which takes the caps along the y axis then, to close the bottles when the associated sensor detects the presence of the bottle.

Labeling machine (m3):

This machine is designed to apply the self-adhesive labels to the filled and capped vials and to the packages arriving from conveyor 4. It uses another arm to fix the two semi-final products when they are detected in place during the application of the label. by operator

Entry stocks:

Stock of 200ml empty bottles: 1000 bottles

Stock of empty packets: 500 packets

Intermediate stock:

Syrup

Stock of pressure caps: 2000 caps

Outlet stocks:

Stock of filled, capped and labeled boxes of 200 ml: 1000 boxes

Stock of labeled packets: 500 packets

Delivery method:

6 conveyors:first from input stock to M1, second from M1 to M2, third from M2 to M3

The speed of the conveyor is**0.2m/s.**

Product lines :

The range of A is defined by:

box filling operation (m1, 10s)

The time required for the operation is 8 seconds of which the assembly of the equipment requires a wait of 1 second to detect the box and open the solenoid valve. Also, disassembly takes 1 second to close the solenoid valve.

Box capping (m2, 10s)

The operating time is 6 seconds, the assembly time is 2 seconds to prepare the closing heads, and the dismantling time is 2 seconds for the return of the cylinder which presses the closing heads.

box labeling (m3, 10s)

Operation time: 6s to perform the necessary operation

Assembly time: 2s to prepare the fixing of the box using the jacks

Dismantling time: 2s for the return of the cylinders which fixed the box in place.

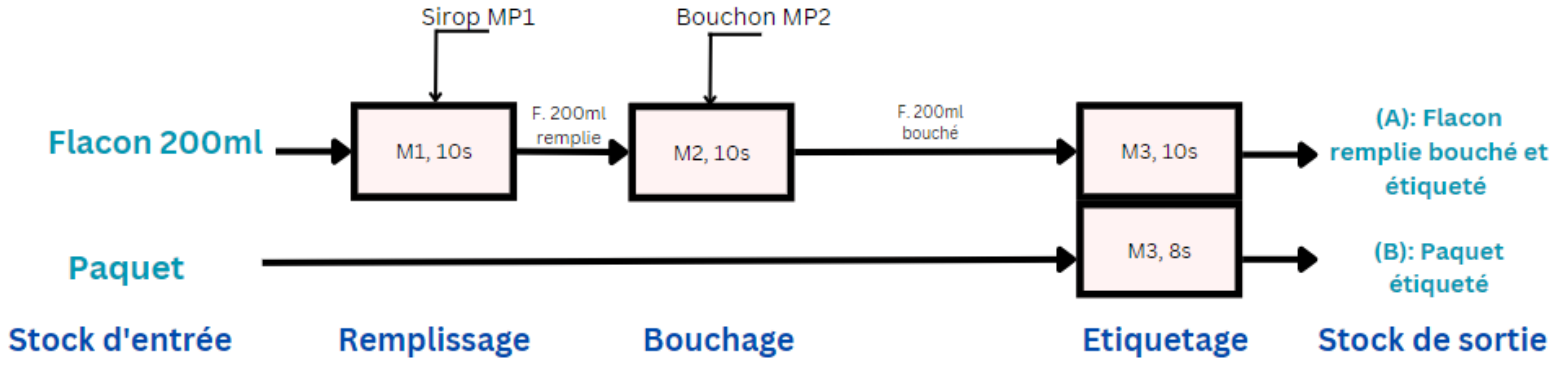
The range of B is defined by

box labeling (m3, 8s)

Operation time: 6s to perform the necessary operation

Assembly time: 2s to prepare the fixing of the box using the jacks

Dismantling time: 2s for the return of the cylinders which fixed the box in place.



specifications of the control part:

- **Links between the operational part, the control part (Siemens S71500) and the HMI**

❖ **system entries:**

at the level of each machine i we find 3**presence sensors:**

❖ **filling machine:**

- presence sensor: bottle presence detector at M1
- level sensor to detect the level of Syrup in the tank

❖ **capping machine:**

- bottle presence sensor
- vertical presence sensor

❖ **labeling machine:**

- presence sensor

❖ **system outputs:these are the pre-actuators and actuators which are:**

- the solenoid valve
- conveyor motors
- production line status indicator lamps (red at the start of the cycle, blue at the end of M1
  green at the end of M2
  yellow at the end of M3
- pick-and-place arm
- two-axis pick-and-place arm

Human Machine Interface:

We chose the desk**HMI SIMATIC HMI Basic Panels**:
Basic desks**SIMATIC HMI**feature user-friendly touch screens and buttons **particularly**practical and freely configurable.

- Digital display counter of bottles and packets treated on the screen.

-**Orders :**the HMI displays commands to start and stop

- Emergency stop button.

- Led indicatrices a la fin de chaque machine

Phase 1: Filling

- With bottle presence detection, With bottle presence detection, the solenoid valve opens and bottle filling begins and a timer is triggered.

- Filling continues for the time specified for each type of bottle, then the solenoid valve closes.
- after 10s The platter rotates forward by 1/3 turn to the next step.

Phase 2: Capping

- With the presence of the bottle and a cork, the corking cylinder descends and pushes the cork into the bottle;
- The ram goes up;
- A mechanism with a cork filler guarantees the presence of a cork in succession for the bottles;
- The rotary table advances 1/3 of a turn.

Phase 3: Labeling

- When a proximity sensor detects the presence of the bottle, the 2 opposing cylinders come out and fix the bottle.
- an employee is in charge of placing the labels on the bottles.

shutdown in initial state:

- Pressing the “m” push button puts the system on hold.

emergency stop:

- Pressing the “AU” emergency stop button cuts off the power supply to the entire system and flashes an orange “VO” indicator light.

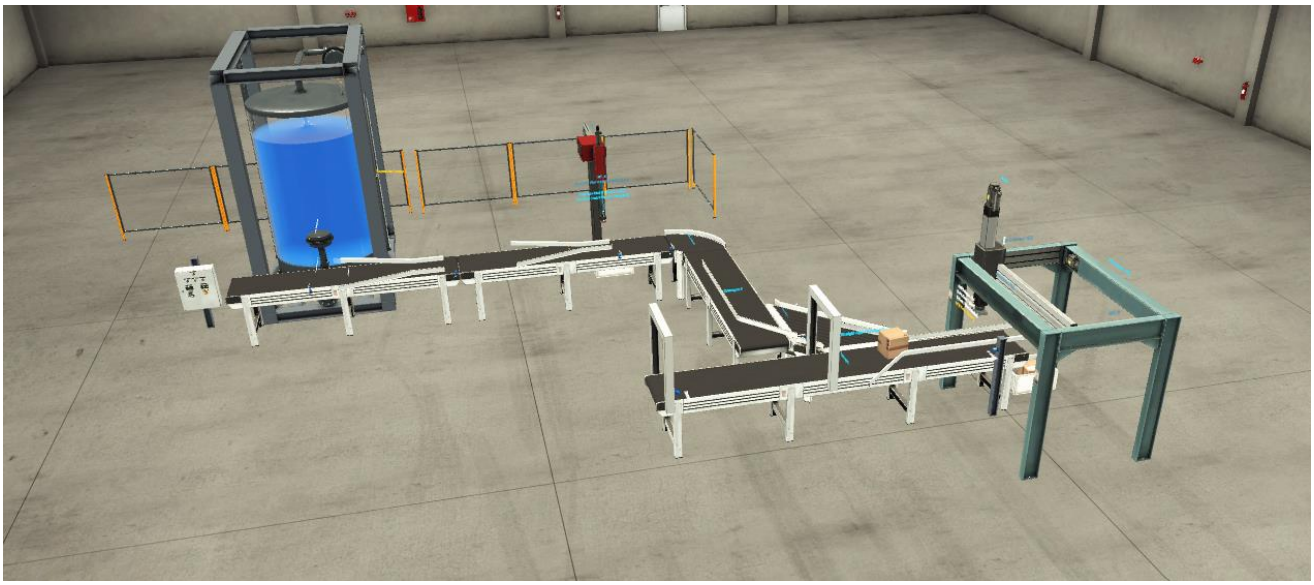
put PO in determined state:

Pressing the "MR" button causes the flashing orange LED to go out and the preparation for system start-up.

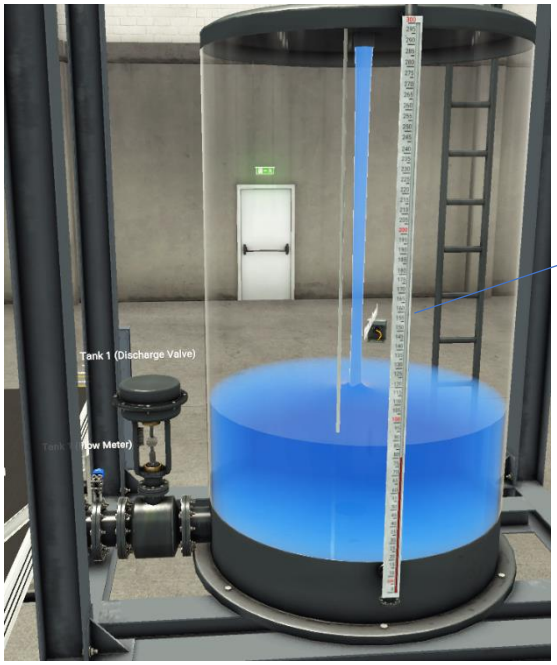
Factory IO

With the factory I/O software, we have created and simulated our industrial systems with a high degree of realism. The simulation is carried out via 3D scenarios very close to reality. The operative parts thus designed will be able to interface with real automatons , we chose (Siemens).

EXPLANATIONS OF OUR SYSTEMS:



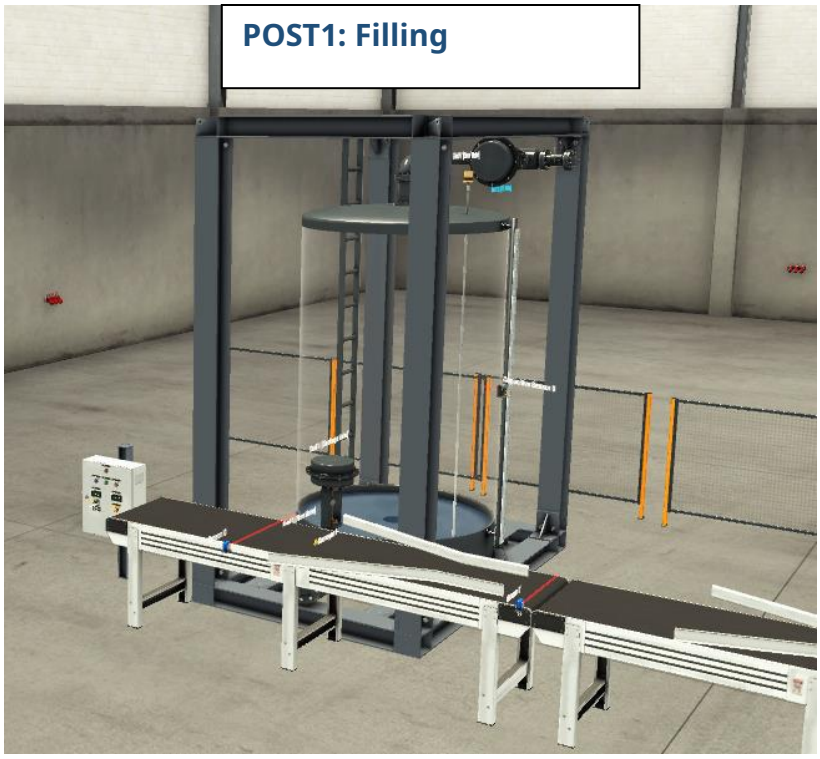
The pulpit



Capacitive sensor

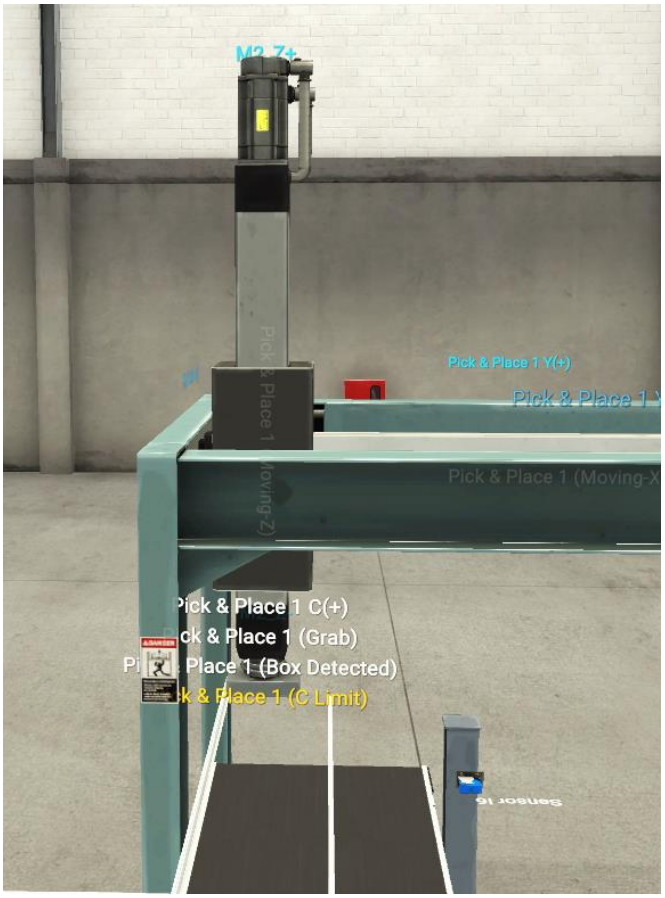
(Level)

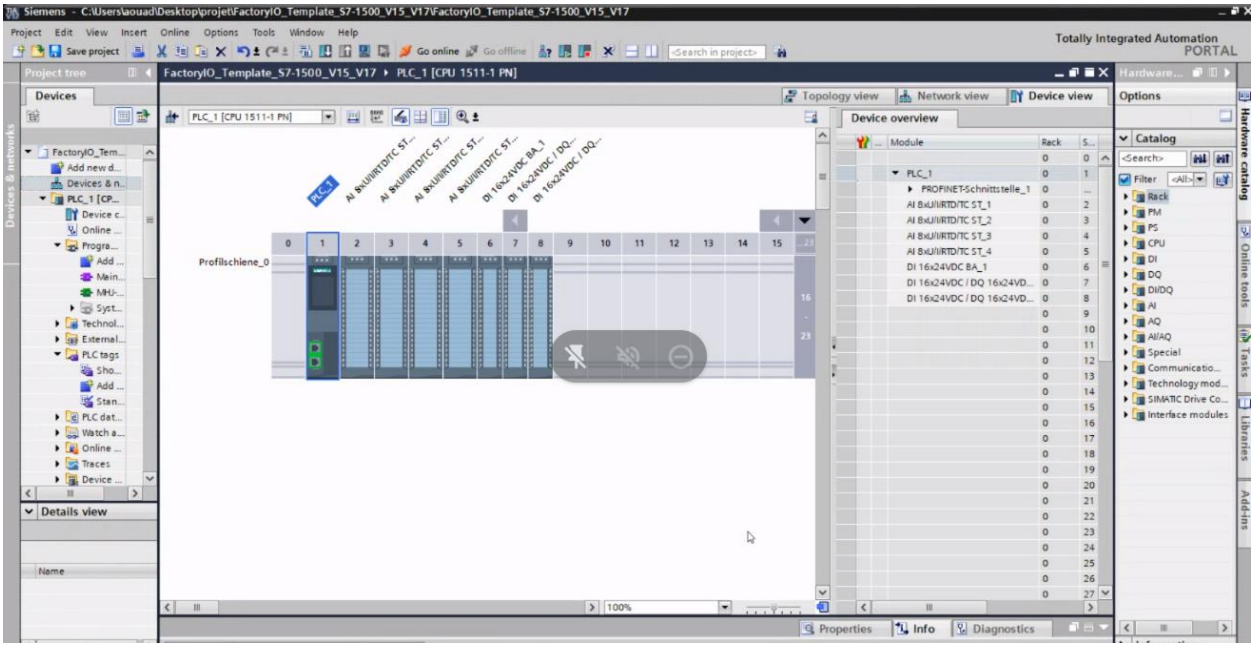
POST1: Filling

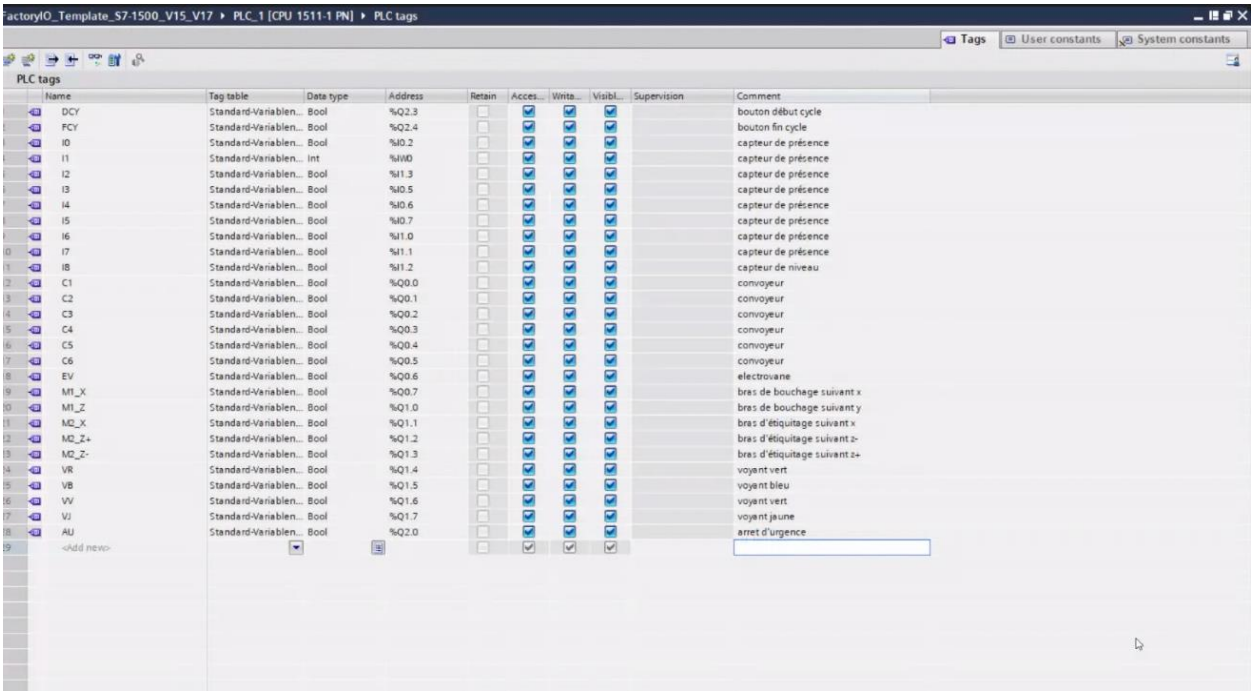


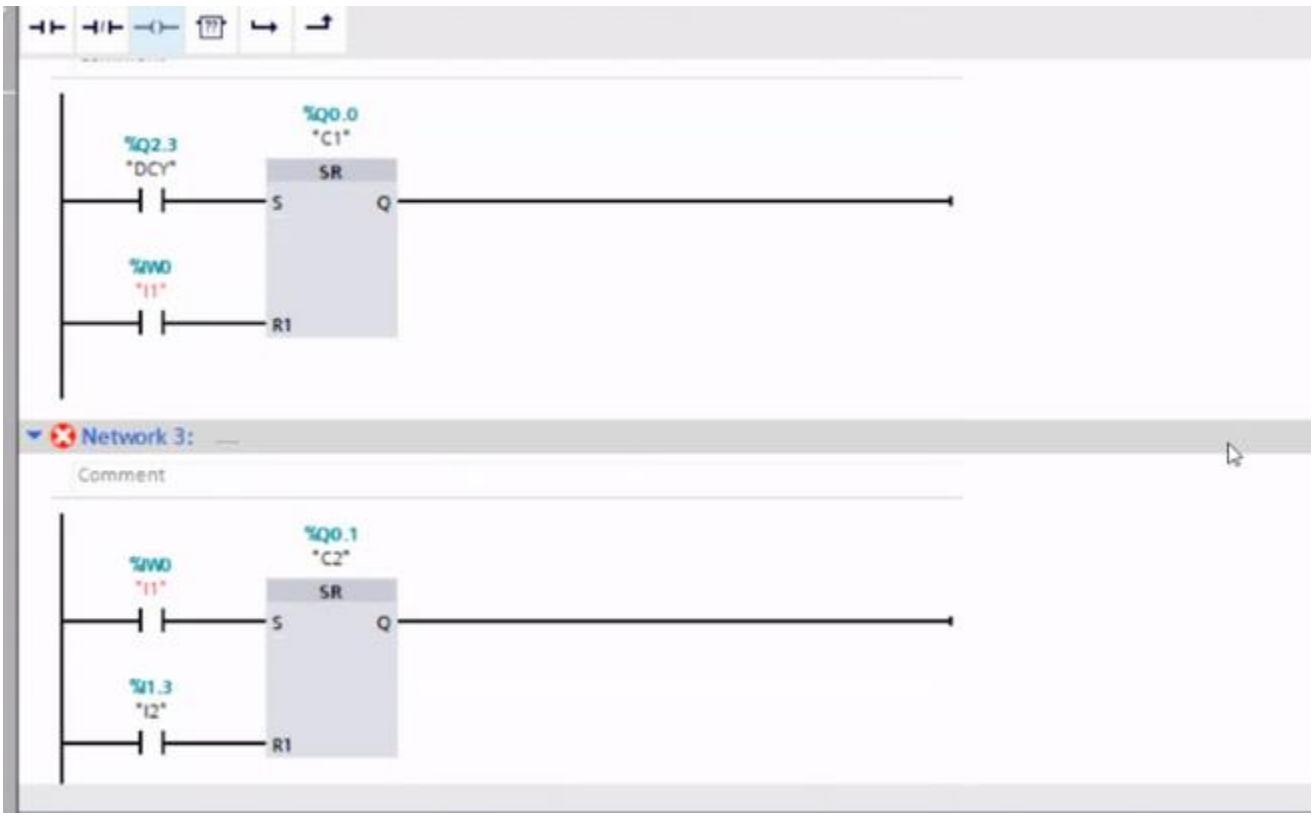
POST2: Closing

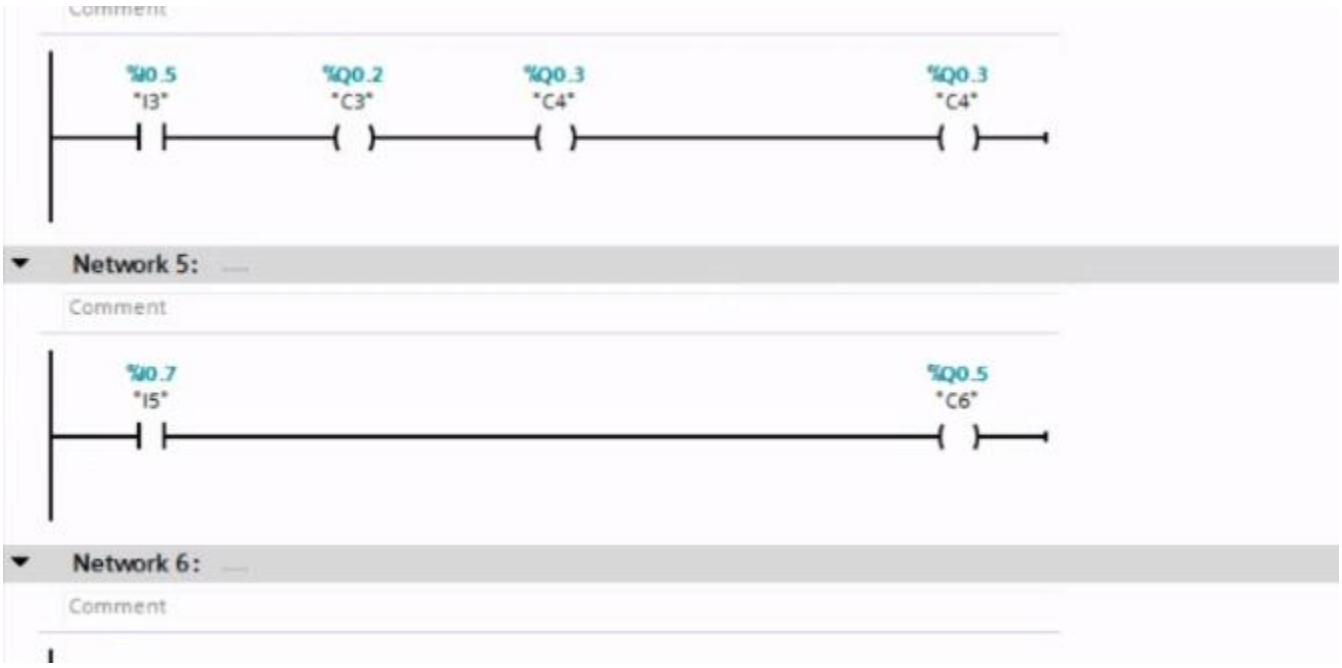
POST3: Labeling




Siemens - C:\Users\aouad\Desktop\projet\FactoryIO_Template_S7-1500_V15_V17\FactoryIO_Template_S7-1500_V15_V17
Totally Integrated Automation PORTAL
Project tree
Devices
FactoryIO_Template_S7-1500_V15_V17 ▸ PLC_1 [CPU 1511-1 PN]
Topology view
Network view
Device view
Hardware...
Options
Catalog
Device overview
Module
Rack
PLC_1
PROFINET-Schnittstelle_1
AI 8xU/I/RTD/TC ST_1
AI 8xU/I/RTD/TC ST_2
AI 8xU/I/RTD/TC ST_3
AI 8xU/I/RTD/TC ST_4
DI 16x24VDC BA_1
DI 16x24VDC / DQ 16x24VD...
Profilschiene_0
Details view
Name
100%
Properties
Info
Diagnostics

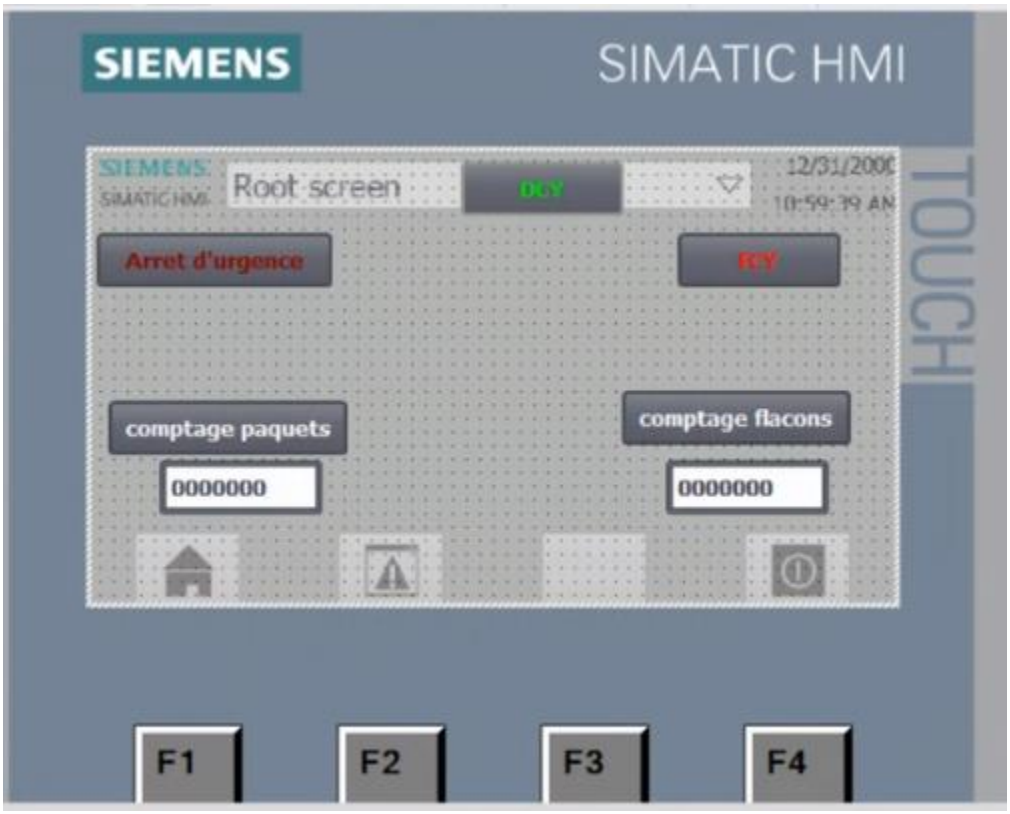

FactoryIO_Template_S7-1500_V15_V17 ▸ PLC_1 [CPU 1511-1 PN] ▸ PLC tags
Tags
User constants
System constants
PLC tags
Name
Tag table
Data type
Address
Retain
Acces...
Write...
Visibl...
Supervision
Comment
DCY Standard-Variablen... Bool %Q2.3 bouton début cycle
FCY Standard-Variablen... Bool %Q2.4 bouton fin cycle
I0 Standard-Variablen... Bool %I0.2 capteur de présence
I1 Standard-Variablen... Int %IW0 capteur de présence
I2 Standard-Variablen... Bool %I1.3 capteur de présence
I3 Standard-Variablen... Bool %I0.5 capteur de présence
I4 Standard-Variablen... Bool %I0.6 capteur de présence
I5 Standard-Variablen... Bool %I0.7 capteur de présence
I6 Standard-Variablen... Bool %I1.0 capteur de présence
I7 Standard-Variablen... Bool %I1.1 capteur de présence
I8 Standard-Variablen... Bool %I1.2 capteur de niveau
C1 Standard-Variablen... Bool %Q0.0 convoyeur
C2 Standard-Variablen... Bool %Q0.1 convoyeur
C3 Standard-Variablen... Bool %Q0.2 convoyeur
C4 Standard-Variablen... Bool %Q0.3 convoyeur
C5 Standard-Variablen... Bool %Q0.4 convoyeur
C6 Standard-Variablen... Bool %Q0.5 convoyeur
EV Standard-Variablen... Bool %Q0.6 electrovane
M1_X Standard-Variablen... Bool %Q0.7 bras de bouchage suivant x
M1_Z Standard-Variablen... Bool %Q1.0 bras de bouchage suivant y
M2_X Standard-Variablen... Bool %Q1.1 bras d'étiquitage suivant x
M2_Z+ Standard-Variablen... Bool %Q1.2 bras d'étiquitage suivant z-
M2_Z- Standard-Variablen... Bool %Q1.3 bras d'étiquitage suivant z+
VR Standard-Variablen... Bool %Q1.4 voyant vert
VB Standard-Variablen... Bool %Q1.5 voyant bleu
VV Standard-Variablen... Bool %Q1.6 voyant vert
VJ Standard-Variablen... Bool %Q1.7 voyant jaune
AU Standard-Variablen... Bool %Q2.0 arret d'urgence
<Add new>


%Q0.0
"C1"
%Q2.3
"DCY"
SR
S
Q
%W0
"I1"
R1
Network 3:
Comment
%Q0.1
"C2"
%W0
"I1"
SR
S
Q
%I1.3
"I2"
R1


%I0.5
"I3"
%Q0.2
"C3"
%Q0.3
"C4"
%Q0.3
"C4"
Network 5:
Comment
%I0.7
"I5"
%Q0.5
"C6"
Network 6:
Comment

HMI


DRIVER
Siemens S7-PLCSIM
CONNECT
CONFIGURATION
CLEAR
SENSORS
ACTUATORS


SIEMENS
SIMATIC HMI
Root screen
DCY
Arret d'urgence
RCY
comptage paquets
comptage flacons
0000000
0000000
TOUCH
F1
F2
F3
F4