Faculty of Engineering Ain Shams University International credit hours education program (ICHEP) Mechatronics senior 1



Automation – Major Task 2

### MCT313

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# Full production line system

#### 1.0. INTRODUCTION

This report offers a comprehensive overview of a fully integrated production line, meticulously designed and simulated using TIA Portal and Factory I/O. The production line encompasses a spectrum of sophisticated machinery, including a Pick and Place Robot, a CNC Machine, a Sorting Station, and an Assembly Robot. Each component plays a pivotal role in the seamless operation of the manufacturing process, aimed at optimizing efficiency, accuracy, and productivity.

Through the utilization of TIA Portal, an advanced engineering framework, and Factory I/O, a powerful simulation software, this report explores the intricate interplay between digital design and real-world application. By simulating the production line in a virtual environment, engineers can anticipate potential challenges, fine-tune operational parameters, and refine automation strategies before deployment in the physical realm.

The integration of diverse elements within the production line underscores the complexity of modern manufacturing systems. From the precise movements of the Pick and Place Robot to the intricacies of CNC machining and the intricately choreographed actions of the Assembly Robot, every facet of the process is meticulously orchestrated to achieve optimal performance.

Throughout this report, we delve into the specific functionalities of each component, examining their individual contributions to the overall workflow and elucidating the synergies that exist between them. Additionally, we explore the benefits of employing TIA Portal and Factory I/O in the development and optimization of such production lines, highlighting their role in driving innovation and enhancing operational efficiency.

By elucidating the inner workings of this fully realized production line, this report aims to provide valuable insights into the evolving landscape of industrial automation, offering practical guidance for engineers and stakeholders seeking to harness the transformative potential of advanced manufacturing technologies.

#### 2.0. OBJECTIVE

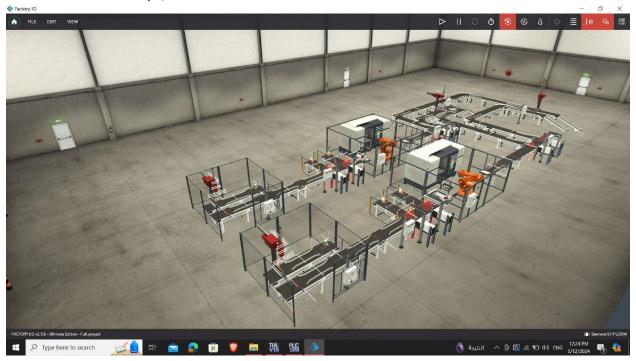
In groups of 3 students each, you are required to:

- (a) Design a full functioning production line on a simulation platform (ex. FACTORY I/O)
- (b) Use Siemens TIA portal software in order to control the simulated production line while incorporating the studied functions in the design process of such application.
- (c) Design a suitable HMI module in order to monitor and visualize the various states of the simulated production line and supply supervisory control commands
- (d) Utilize field-related alarms for the detection of hardware and sequence faults.

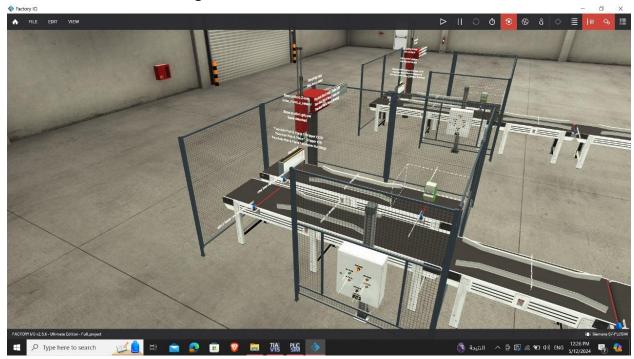
The mentioned production line performs the tasks of machining, sorting and assembly starting from raw materials to finished assembled products.

### 3.0. SIMULATION

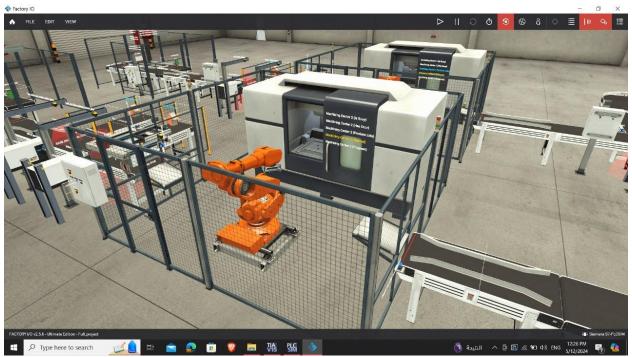
### 3.1. Factory I/O



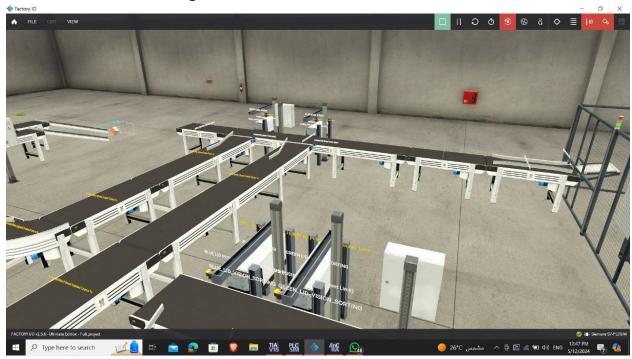
### 3.1.1. Feeding station



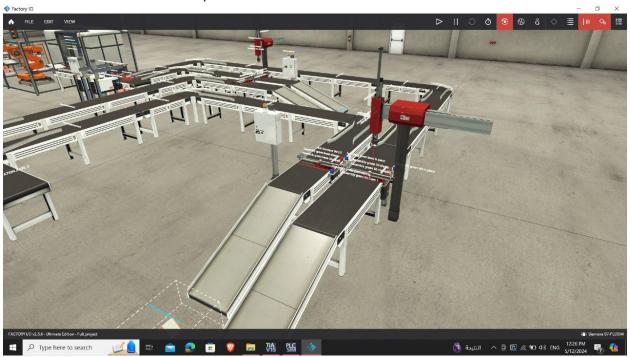
### 3.1.2. CNC machine



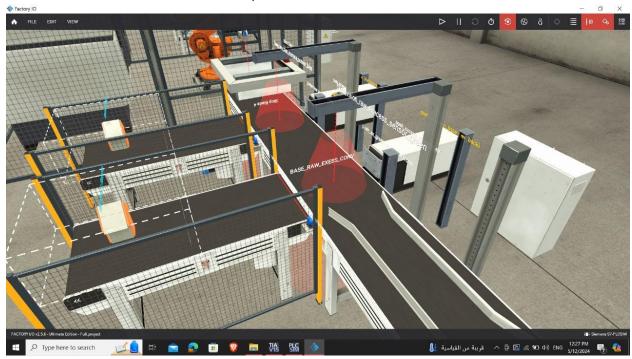
3.1.3. Sorting



3.1.4. Assembly

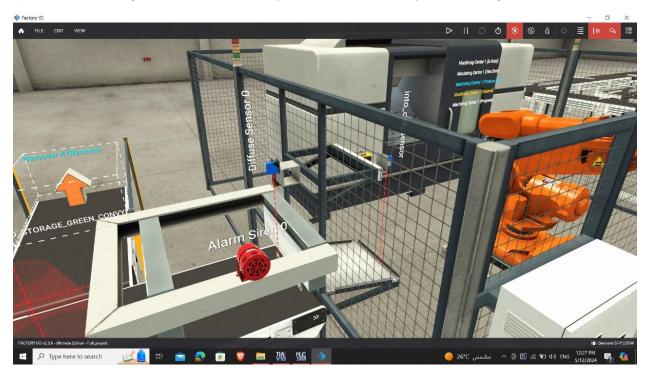


### 3.1.5. Remove excess products

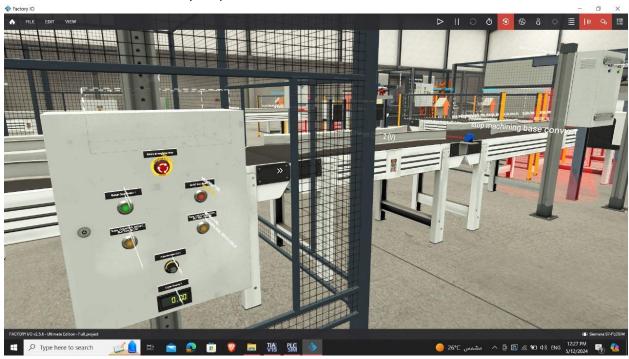


### 3.1.6. Warning alarm

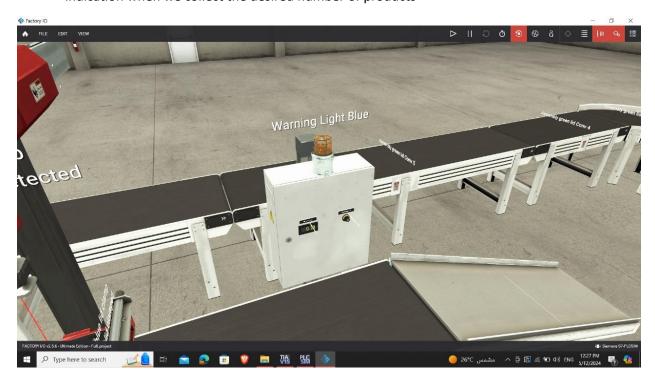
- This warning alarm turned on when product stuck on conveyor and can't go to CNC machine



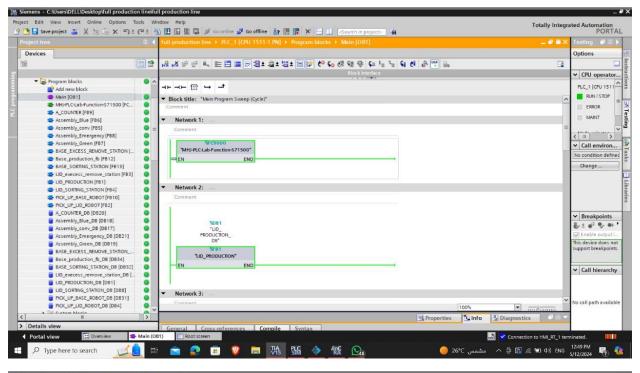
### 3.1.7. Conveyor speed control

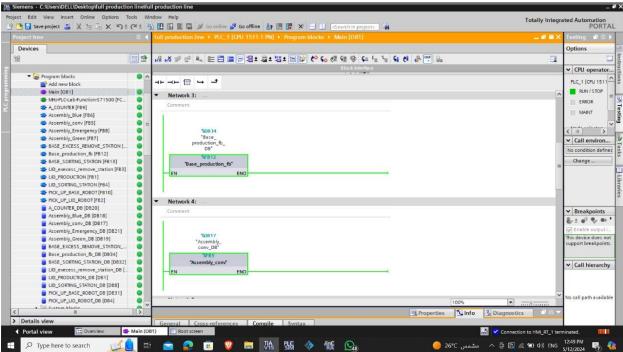


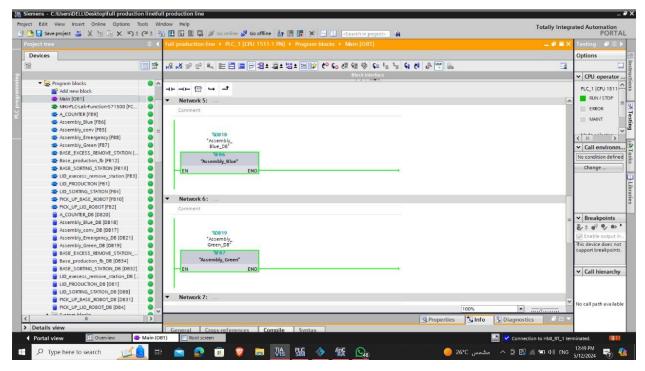
- This Control panel that controls assembly conveyor speed and the light on the top turned on as indication when we collect the desired number of products

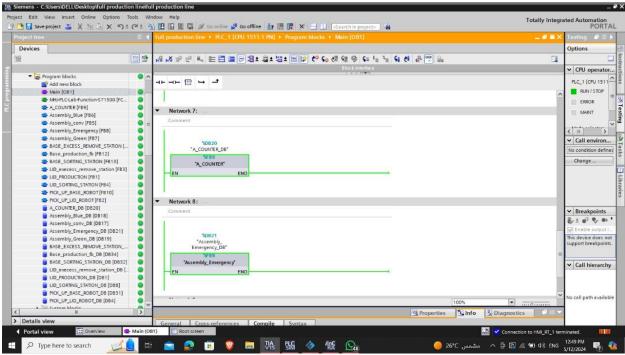


#### 4.0. TIA PORTAL

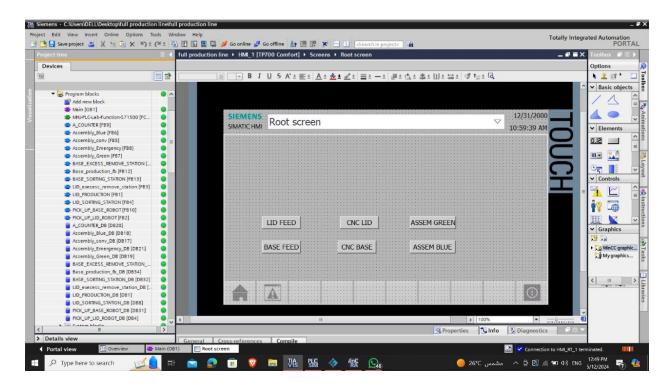






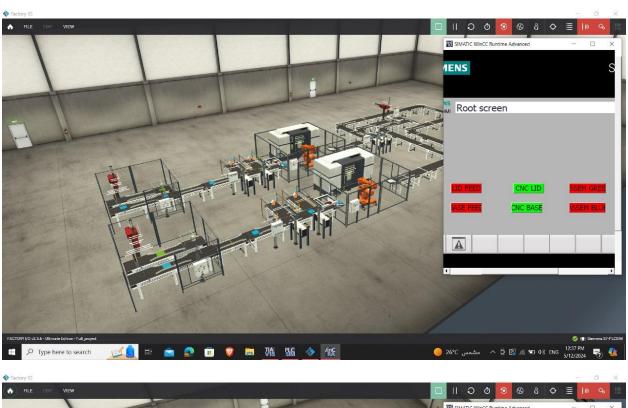


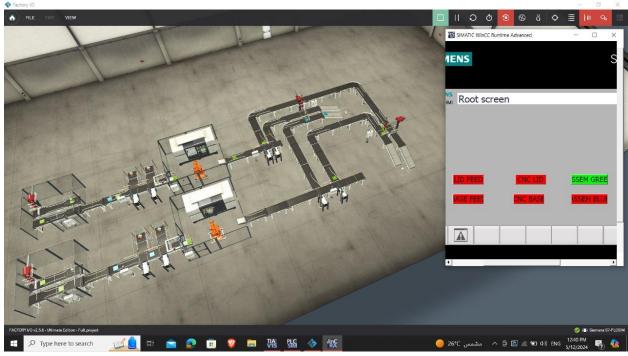
#### 4.1. HMI



### 5.0. SIMULATION ON









### 6.0. DRIVE LINK

https://drive.google.com/drive/folders/1sitQrSa1rtfIVeYHHvGqFQ9XMLrEQeaJ?usp=drive\_link

- this link include:
- TIA portal file
- factory i/o file
- simulation video

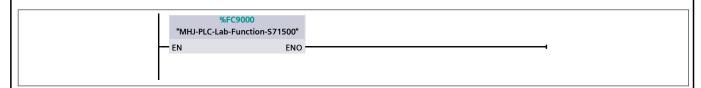
|--|

## Main [OB1]

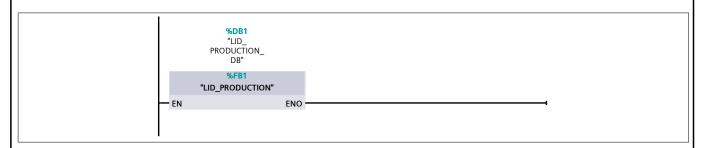
Main Propert	Main Properties							
General	General							
Name	NameMainNumber1TypeOB							
Language	Language LAD Numbering Manual							
Information								
Title	"Main Program Sweep (Cycle)"	Author		Comment				
Family		Version	0.1	User-defined ID				

Main				
Name	Data type	Offset	Default value	Comment
<b>▼</b> Temp				
OB1_EV_CLASS	Byte	0.0		Bits 0-3 = 1 (Coming event), Bits 4-7 = 1 (Event class 1)
OB1_SCAN_1	Byte	1.0		1 (Cold restart scan 1 of OB 1), 3 (Scan 2-n of OB 1)
OB1_PRIORITY	Byte	2.0		Priority of OB Execution
OB1_OB_NUMBR	Byte	3.0		1 (Organization block 1, OB1)
OB1_RESERVED_1	Byte	4.0		Reserved for system
OB1_RESERVED_2	Byte	5.0		Reserved for system
OB1_PREV_CYCLE	Int	6.0		Cycle time of previous OB1 scan (milliseconds)
OB1_MIN_CYCLE	Int	8.0		Minimum cycle time of OB1 (milliseconds)
OB1_MAX_CYCLE	Int	10.0		Maximum cycle time of OB1 (milliseconds)
OB1_DATE_TIME	Date_And_Ti me	12.0		Date and time OB1 started
Constant				

### Network 1:



#### Network 2:



#### Network 3:

## Totally Integrated Automation Portal %DB34 "Base\_ production\_fb\_ DB" %FB12 "Base\_production\_fb" - EN ENO Network 4: %DB17 "Assembly\_ conv\_DB" %FB5 "Assembly\_conv" - EN ENO · Network 5: %DB18 "Assembly\_ Blue\_DB" %FB6 "Assembly\_Blue" - EN ENO · Network 6: **%DB19**"Assembly\_ Green\_DB" %FB7 "Assembly\_Green" - EN ENO Network 7: %DB20 "A\_COUNTER\_DB" %FB9 "A\_COUNTER" ENO · - EN Network 8:

Totally Integrated Automation Portal		
Automation Portal		
	"Assembly_ Emergency_DB"  %FB8 "Assembly_Emergency"  EN ENO	•

|--|

## A\_COUNTER [FB9]

A_COUNTER F	A_COUNTER Properties								
General	General								
Name	Name A_COUNTER 9 Type FB								
Language	Language   LAD   Numbering   Automatic								
Information									
Title		Author		Comment					
Family		Version	0.1	User-defined					
				ID					

A_COUNTER							
Name	Data type	Default value	from HMI/OP	ta- ble	in HMI engi- neer-	Super- vision	Comment
Input							
Output							
InOut							
Static							
Temp							
Constant							

#### Network 1:

Totally Integrated Automation Portal			
Network 3:	•		
	<b>%M5.7</b> "Tag_2"	%M6.1 "Tag_4" ———{ s }	-
Network 4:			
	%M5.6 "Tag_1"	%M6.2 "Tag_5" ( S )	-
Network 5:			
	%M6.2 %M6.1 "Tag_5" "Tag_4"	<b>%M6.0</b> "Tag_3" <b>(</b> S <b>)</b>	-
Network 6:			
	1		

Totally Integrated Automation Portal		
Network 6: (1.1 / 2.1)		
%M6.0 "Tag_3"	<b>%M0.0</b> "state_of_ start_base"  ———————————————————————————————————	
	%M0.1 "state_of_ start_LID" 	
	<b>%M4.3</b> "move_green_ lid_conv" ——{ R }	
	%M4.5 "move_blue_ lid_conv" ————————————————————————————————————	
	%M4.4 "move_green_ base_conv"  ——•	
	%M4.6 "move_blue_ base_conv"  ———	
	%Q10.4 "B_clamp_lid" ————————————————————————————————————	
	%Q10.5  "B_clamp_base"  { R }  %Q10.6  "B_move Z"	
	%Q11.0 "B_move X"  ( R )	
	%Q9.6 "G_clamp_lid" ————————————————————————————————————	
	%Q9.7 "G_clamp_base"  { R }	
	%Q10.0 "G_move Z"	
	"G_move X"	
	2.1 ( Page1 - 4)	

Totally Integrated Automation Portal			
Network 6: (2.1 / 2.1)			
	1.1 ( Page1 - 3)  %Q10.7  "B_grab"	~~~~~	~~_
	"B_grab"  (R)		
	<b>%Q10.1</b> "G_grab"		
	G_grab		
	<b>%M6.5</b> "Tag_8"		
	(		

Totally Integrated Automation Portal		
Network 7:		
	%I6.3  "base_ %I3.5  COUNTER_ "LID_COUNTER_ RESET_BUTTON_ RESET_BUTTON_ MM6.3  BLUE" BLUE" "Tag_6"	_
Network 8:		
	%I6.4  "base_ COUNTER_ "LID_COUNTER_ RESET_BUTTON_ RESET_BUTTON_ GREEN"  "Tag_7"	

|--|

## Assembly\_Blue [FB6]

Assembly_Bl	ue Properties				
General					
Name	Assembly_Blue	Number	6	Туре	FB
Language	LAD	Numbering	Automatic		
Information					
Title		Author		Comment	
Family		Version	0.1	User-defined	
				ID	

Assembly_Blue								
Name	Data type	Default value	Retain	from HMI/OP	ta- ble	in HMI engi- neer- ing	Super- vision	Comment
Input								
Output								
InOut								
Static								
Temp								
Constant								

#### Network 1:

```
"B_lid in place"

CLK

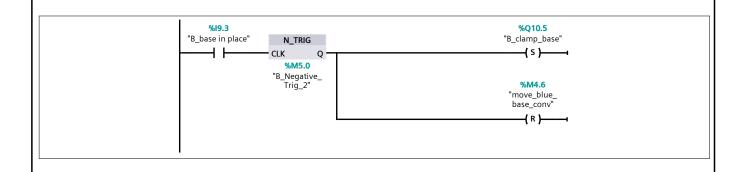
WM4.7

"B_Negative_Trig_1"

WM4.5

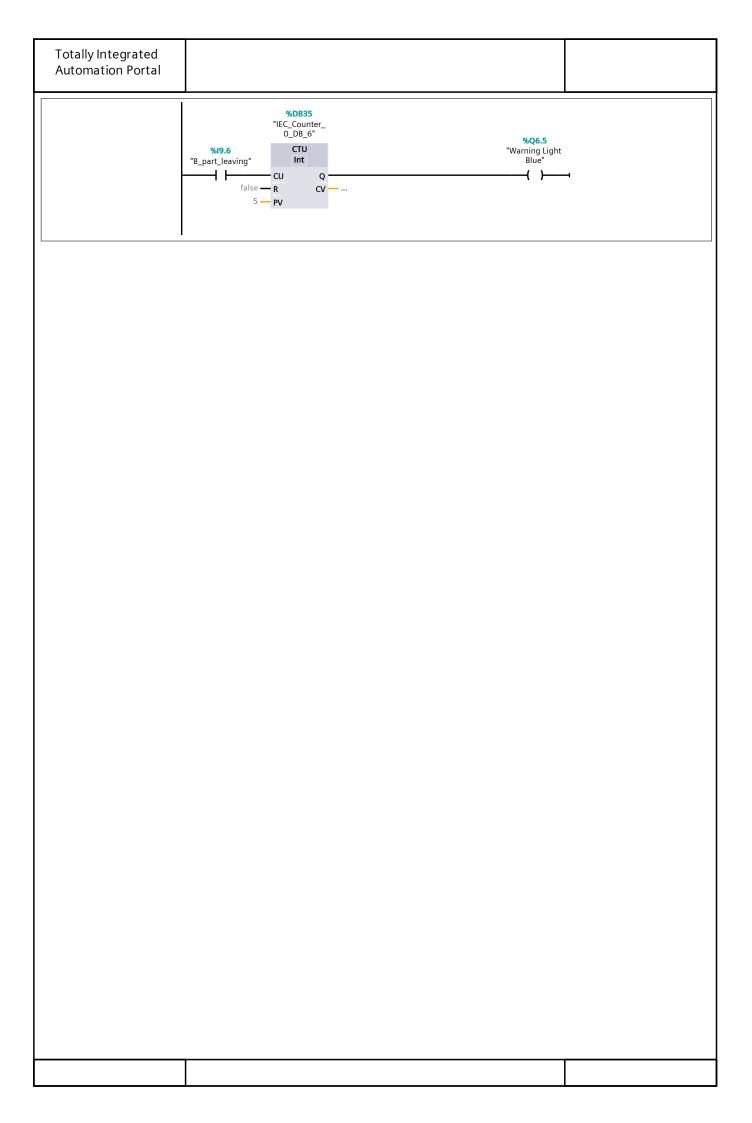
"move_blue_lid_conv"

(R)
```



```
Totally Integrated
  Automation Portal
Network 3:
                                                       %19.5
                                                     "B_base_
clamped"
                                      %19.4
                                                                                                           %Q10.6
                                 "B_lid_clamped"
                                                                                                          "B_move Z"
                                                                                                            (s)
                                                                                                           %Q10.7 "B_grab"
                                                                                                            -( s )-
Network 4:
                                                                                                         %Q10.4
"B_clamp_lid"
                                     %19.7
                                 "B_item_detect"
                                      -| |-
                                                                                                            -( R )-
                                                                                                           %Q10.5
                                                                                                        "B_clamp_base"
                                                                                                            -( R )-
                                                                                                           %Q10.6
                                                                                                          "B_move Z"
                                                                                                            -( R )−
                                                                                                           %Q11.0
                                                                                                          "B_move X"
                                                                                                            -( s )-
                                                                                                           %M5.4
                                                                                                         "B_Detected_
Memory"
                                                                                                            -( s )-
Network 5:
                                                    %T3
"B_Timer_1"
                                     %M5.4
                                   "B_Detected_
                                                                                                           %Q10.6
                                    Memory"
                                                   S_ODT
                                                                                                          "B_move Z"
                                                                                                            -( s )-
                                          S5T#3S — TV
                                                            ВІ — ...
                                                            BCD — ...
                                     %M5.5
                                    "B_Reset"
                                      +
Network 6:
```

#### Totally Integrated **Automation Portal %T4** "B\_Timer\_2" %M5.4 "B\_Detected\_ %Q10.7 Memory" S\_ODT "B\_grab" -( R )-Q· S5T#5S — TV ВІ — ... %Q10.6 %M5.5 BCD — ... "B\_Reset" "B\_move Z" +-( R )-**%Q11.0**"B\_move X" **-(** R **)**-Network 7: %T5 %M5.4 %M4.6 "B\_Timer\_3" "move\_blue\_ base\_conv" "B\_Detected\_ Memory" S\_ODT -( s )-Q <del>-</del> BI -**-** s S5T#6S — TV **%M5.5**"B\_Reset" BCD -%M4.5 "move\_blue\_ lid\_conv" $\vdash$ -( s )-%Q11.1 "B\_pos.Raise\_ bases" -( s )-Network 8: %Q11.1 %19.6 "B\_pos.Raise\_ "B\_part\_leaving" N\_TRIG bases" $\dashv \vdash$ -( R )-· CLK Q %M5.1 "B\_Negative\_ Trig\_3" %M5.4 "B\_Detected\_ Memory" -( R )-%M5.5 "B\_Reset" **-( )**-Network 9:



|--|

### Assembly\_conv [FB5]

Assembly_co	onv Properties				
General					
Name	Assembly_conv	Number	5	Туре	FB
Language	LAD	Numbering	Automatic		
Information					
Title		Author		Comment	
Family		Version	0.1	User-defined	
				ID	

Assembly_conv							
Name	Data type	Default value	from HMI/OP	ta- ble	in HMI engi- neer- ing	Super- vision	Comment
Input							
Output							
InOut							
Static							
Temp							
Constant							

#### Network 1:

```
%T6
                                                           "Green_Lid_
conv_timer"
                                          %M5.2
                                                                                 %M4.3
                                                                              "move_green_
lid_conv"
                       %18.6
                                       "G_Detected_
green lid start"
                  "G_lid_clamped"
                                         Memory"
                                                          S_ODT
                                                                                  (s)
                                                                     Q-
                                                S5T#3S — TV
                                                                     ВІ — ...
   %M5.3
                                                                    BCD -
  "G_Reset"
```

```
%T7
                                                                    "Blue_Lid_
conv_timer"
     %18.1
                                                 %M5.4
                                                                                             %M4.5
"Assembly blue
lid start"
                     %I9.4
"B_lid_clamped"
                                              "B_Detected_
Memory"
                                                                                          "move_blue_
lid_conv"
                                                                   S_ODT
                                                                                               (s)-
                                                                               Q-
                                                       S5T#3S — TV
                                                                                ВІ — ...
                                                                              BCD -
    %M5.5
   "B_Reset"
     + +
```

Network 3:						
	%I8.2 "Assembly green base start"	%I8.7 "G_base_ clamped"	%M5.2 "G_Detected_ Memory"  VI- S5T#3S		%M4.4 "move_green_ base_conv"  ( S )	
	<b>%M5.3</b> "G_Reset"			BCD ── R	<b>-</b>	
Network 4:						
	%I8.3 "Assembly blue base start"  %M5.5 "B_Reset"	%I9.5 "B_base_ clamped"	%M5.4 "B_Detected_ Memory"  SST#3S	"Blue_Base_conv_timer"  S_ODT  S Q T  TV BI BCD T	%M4.6 "move_blue_base_conv"  ( S )	
Network 5:						
	%M4.3 "move_green_ lid_conv"				%Q7.0 "G_lids_conv_1"	
					%Q7.2 "G_lids_conv_3"	
					"G_lids_conv_4"	
					%Q7.4 "G_lids_conv_5"	
					"G_lids_conv_5"	

Totally Integrated Automation Portal		
Network 6:		•
	%M4.4 "move_green_ base_conv"	%Q8.4 "G_base_conv_1" 
		%Q8.5 "G_base_conv_2"  ( )
	-	%Q8.6 "G_base_conv_3"
		%Q8.7 "G_base_conv_4"
		"G_base_conv_5"  ( )  %Q9.1  "G_base_conv_6"
Network 7:		
	%M4.6 "move_blue_ base_conv"	%Q9.2 "B_base_conv_1" 
		%Q9.3 "B_base_conv_2"
	-	%Q9.4  "B_base_conv_3"
		"B_base_conv_4"  ( )
Network 8:		
	T	

#### Totally Integrated **Automation Portal** %M4.5 %Q8.0 "move\_blue\_ lid\_conv" "B\_lids\_conv\_1" **+** + **(** )-%Q8.2 "B\_lids\_conv\_3" **⊣** )– %Q8.3 "B\_lids\_conv\_4" Network 9: SCALE\_X NORM\_X Real to Int Int to Real EN ENO · MIN MIN %MD30 %QD20 -- "SCREEN\_G" %ID16 OUT - "Tag\_10" %MD30 OUT -"POT\_SP\_G" — VALUE "Tag\_10" - VALUE 10 — MAX 10 — MAX Network 10: **%M3.2** "Tag\_11" MOVE EN - ENO %QD20 %QD16 "SCREEN\_G" — IN 🍓 OUT1 — "G\_lids\_conv\_2" Network 11: SCALE\_X NORM\_X Real to Int Int to Real 0 — MIN 0 — MIN %MD40 %QD28 OUT \_\_ "Tag\_12" OUT — "SCREEN\_B" %ID20

```
%MD40
"Tag_12" — VALUE
"POT_SP_B" — VALUE
       10 — MAX
                                                                               10 — MAX
```

```
"Tag_11"
           MOVE
           EN - ENO
   %QD28
                        %QD24
 "SCREEN_B" — IN 🔞 OUT1 — "B_lids_conv_2"
```

#### Network 13:

```
NORM_X
Int to Real
                       SCALE_X
                      Real to Int
                                     ENO •
             EN -
                                                                                · EN -
                                                                                                         ENO .
        0 — MIN
                                            %MD41
                                                                            0 — MIN
                                                                                                                %QD36
                                                                                                         OUT — "SCREEN_LID"
                                      OUT Z— "Tag_13"
    %ID24
                                                                       %MD41
"POT_SP_LID" — VALUE
                                                                      "Tag_13" — VALUE
       10 — MAX
                                                                           10 — MAX
```

#### Network 14:

```
*M3.6
"Tag_16"
EN ENO

*QD36
"SCREEN_LID"
IN *QD32
"lid-machinning_
conveyr"
```

#### Network 15:

#### Network 16:

```
*M3.6
"Tag_16"

EN ENO

*QD44
"SCREEN_BASE"

IN

*QD40
"base_to_
machinning_
conveyr"
```

Assembly_Em General	ergency P	roperties									
Name	Assembly	_Emergenc	у	Number	8			Туре		FB	
anguage	LAD			Numbering	Automatic						
nformation											
itle .,				Author	0.4			Comm			
amily				Version	0.1			User-de ID	efined		
ssembly_Em ame	ergency	Data type	Defa	ult value	Retain	Acces-	W/ri	Visible	Set-	Super-	Comment
						from HMI/OP C UA	ble fro	in HMI engi- neer- ing			
Input											
Output											
InOut											
Static											
Temp Constant											
Temp											
Temp Constant											
Temp Constant											
Temp Constant											
Temp Constant											
Temp Constant											
Temp Constant											
Temp Constant											

Totally Integrated Automation Portal			
	%I2.1 "base_ emergency"	<b>%M4.3</b> "move_green_ lid_conv"	
	%I1.6	( R ) %M4.5 "move blue	
	"lid_emergency_ button"	"move_blue_ lid_conv" 	
		%M4.4 "move_green_ base_conv"  { R }	
		<b>%M4.6</b> "move_blue_ base_conv"	
		base_conv*  { R }  ——•	
		"B_clamp_lid"  ———————————————————————————————————	
		%Q10.5 "B_clamp_base"  { R }	
		%Q10.6 "B_move Z" 	
		%Q11.0 "B_move X"  { R }	
		<b>%Q9.6</b> "G_clamp_lid"	
		<b>%Q9.7</b> "G_clamp_base"	
		(R) %Q10.0 "G_move Z"	
		"G_move Z"  { R }  %Q10.2	
		"G_move X"  { R }	
		%Q10.7 "B_grab"	
		%Q10.1 "G_grab" 	

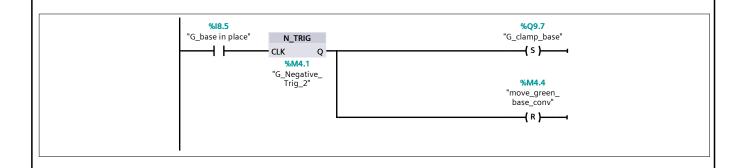
|--|

### Assembly\_Green [FB7]

Assembly_Green Properties											
General											
Name	Assembly_Green	Number	7	Туре	FB						
Language	LAD	Numbering	Automatic								
Information											
Title		Author		Comment							
Family		Version	0.1	User-defined							
				ID							

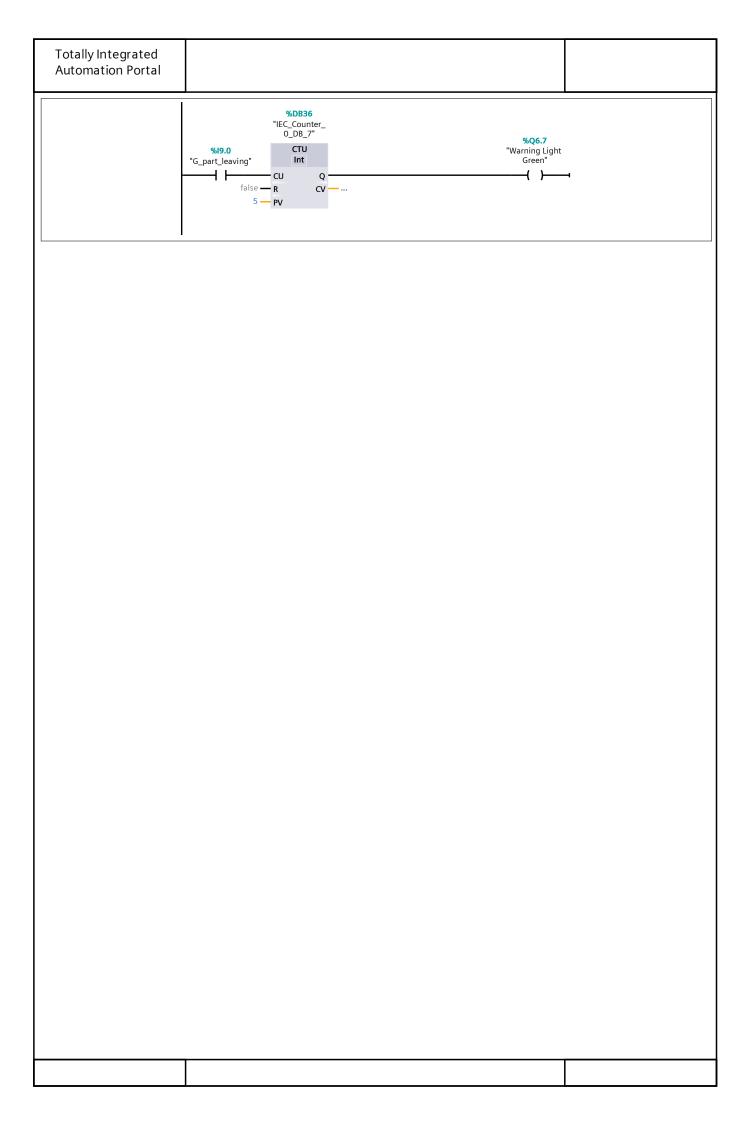
Assembly_Green										
Name	Data type	Default value		Acces- sible from HMI/OP C UA	ta- ble	in HMI engi- neer-		Super- vision	Comment	
Input										
Output										
InOut										
Static										
Temp										
Constant										

#### Network 1:



```
Totally Integrated
   Automation Portal
Network 3:
                                                           %18.7
                                                          "G_base_
clamped"
                                         %18.6
                                                                                                                    %Q10.0
                                    "G_lid_clamped"
                                                                                                                  "G_move Z"
                                                                                                                     (s)_
                                                            - | |-
                                                                                                                   %Q10.1
"G_grab"
                                                                                                                    _( s )_
Network 4:
                                    %I9.1
"G_item_detect"
                                                                                                                 %Q9.6
"G_clamp_lid"
                                         -| |-
                                                                                                                    -( R )-
                                                                                                                    %Q9.7
                                                                                                                "G_clamp_base"
                                                                                                                     -( R )-
                                                                                                                   %Q10.0
                                                                                                                  "G_move Z"
                                                                                                                    -( R )−
                                                                                                                  %Q10.2
"G_move X"
                                                                                                                    -( s )-
                                                                                                                    %M5.2
                                                                                                                 "G_Detected_
Memory"
                                                                                                                    -( s )-
Network 5:
                                                        %T0
"G_Timer_1"
                                        %M5.2
                                     "G_Detected_
Memory"
                                                                                                                   %Q10.0
                                                       S_ODT
                                                                                                                  "G_move Z"
                                                                                                                    -( s )-
                                             S5T#3S — TV
                                                                ві — ...
                                                                BCD — ...
                                        %M5.3
                                       "G_Reset"
                                         <del>|</del> | |-
Network 6:
```

#### Totally Integrated **Automation Portal %T1** "G\_Timer\_2" %M5.2 "G\_Detected\_ %Q10.1 Memory" S\_ODT "G\_grab" -( R )-Q· S5T#5S — TV ВІ — ... %M5.3 BCD — ... %Q10.0 "G\_Reset" "G\_move Z" -( R )-**%Q10.2**"G\_move X" \_( R )\_ Network 7: %T2 %M5.2 %M4.4 "G\_Detected\_ Memory" "G\_Timer\_3" "move\_green\_ base\_conv" S\_ODT **-(** s **)**-Q <del>-</del> **-** s S5T#6S — TV BCD -%M5.3 %M4.3 "G\_Reset" "move\_green\_ lid\_conv" $\vdash$ -( s )-%Q10.3 "G\_pos.Raise\_ bases" -( s )-Network 8: %Q10.3 %19.0 "G\_pos.Raise\_ "G\_part\_leaving" N\_TRIG bases" $\dashv \vdash$ -( R )-· CLK Q %M4.2 "G\_Negative\_ Trig\_3" %M5.2 "G\_Detected\_ Memory" -( R )-%M5.3 "G\_Reset" **-( )**-Network 9:



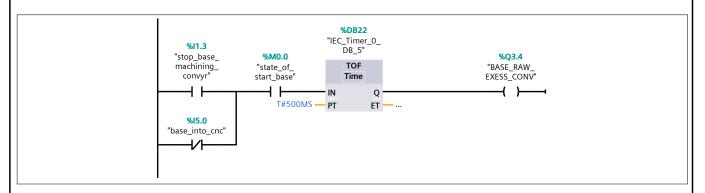
|--|

## BASE\_EXCESS\_REMOVE\_STATION [FB11]

BASE_EXCESS_REMOVE_STATION Properties								
General								
Name	BASE_EXCESS_RE- MOVE_STATION	Number	11	Туре	FB			
Language	LAD	Numbering	Automatic					
Information								
Title		Author		Comment				
Family		Version	0.1	User-defined ID				

BASE_EXCESS_REMOVE_STATION									
Name	Data type	Default value		from HMI/OP C UA	ta- ble	in HMI engi- neer-		Super- vision	Comment
Input									
Output									
InOut									
Static									
Temp									
Constant									

## Network 1: LID\_BELT\_EXCESS\_CONVEYOR\_HANDLER



**Network 2: COUNTING NUMBER OF BLUE MATERIAL** 

#### Totally Integrated **Automation Portal** %DB23 "IEC\_Counter\_ %15.3 %M2.3 0\_DB\_4" "Are\_we\_ there\_base\_ "base\_raw\_ blue\_exes\_ CTU vision" raw\_blue" Int CU Q CV · %16.3 "base COUNTER\_ RESET\_BUTTON\_ BLUE" - PV Network 3: PUSH\_FORWARD\_EXCESS\_BLUE **%I6.2** "pusher blue %M2.3 %15.3 "base\_raw\_ blue\_exes\_ "Are\_we\_ %Q3.7 there\_base\_ raw\_blue" base raw ( back)" "push\_excess\_ blue\_base" vision" -(s) Network 4: PUSH\_RETURN\_EXECESS\_BLUE %M2.3 %16.1 "Are\_we\_ "pusher blue %Q3.7 there\_base\_ raw\_blue" base raw ( front)" "push\_excess\_ blue\_base" (R)-<del>|</del> | | %16.3 "base\_ COUNTER\_ RESET\_BUTTON\_ BLUE" 4 F %M0.0 "state\_of\_ start\_base" Network 5: RETURN\_EXCESS\_BLUE\_TO\_STORAGE %DB24 "IEC\_Timer\_0\_ DB\_6" %15.5 "to\_blue\_base\_ %M0.0 %Q4.1 raw\_storage\_ sensor" "state\_of\_ start\_base" TOF "base\_raw\_ excess\_blue" Time · IN Q T#3s — PT ET -



#### **Network 6: COUNTING NUMBER OF GREEN MATERIAL**

```
%DB25
"base_vision_
raw_execess_
sensor_green"

CTU
Int

WI6.4
"base_
COUNTER_
RESET_BUTTON_
GREEN"

R

6 — PV
```

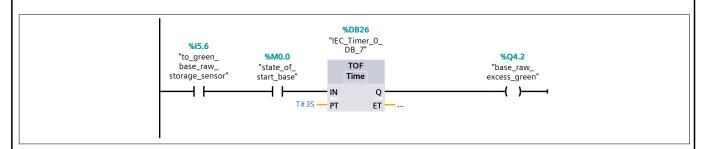
## Network 7: PUSH\_FORWARD\_ECESS\_GREEN

```
%M2.4 %I6.5 %I6.0

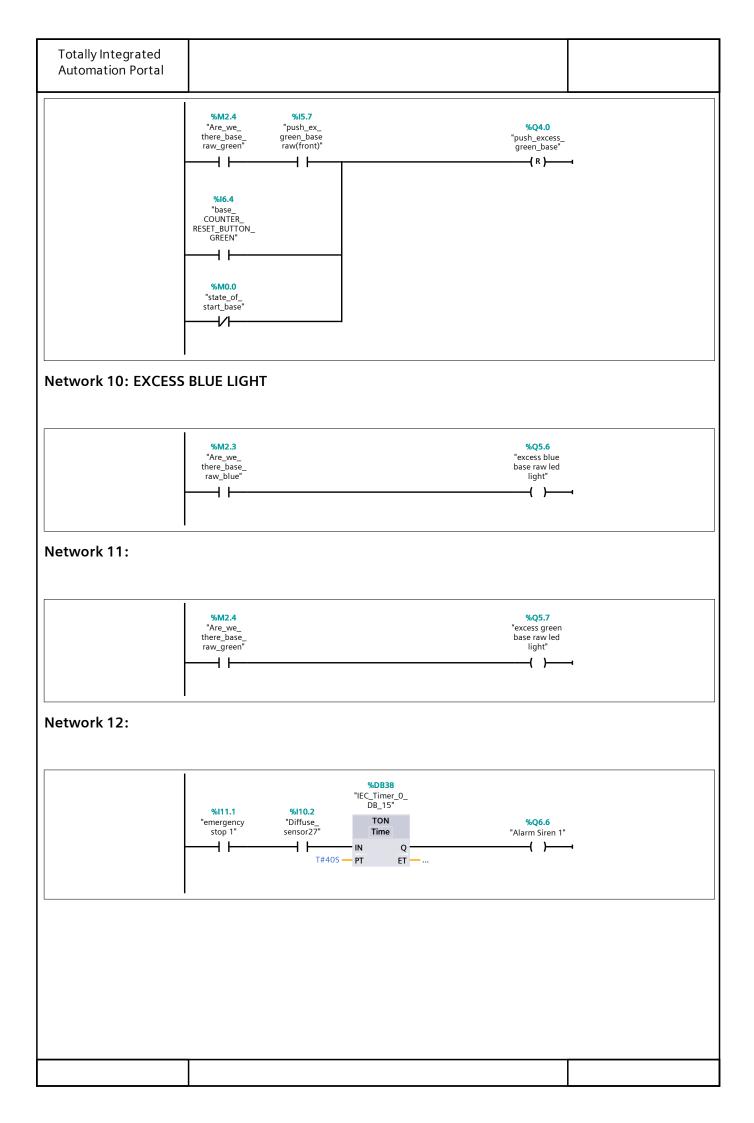
"Are_we_ "base_vision_ "push_ex_ %Q4.0
there_base_ raw_execess_ green_base "push_excess_
raw_green" sensor_green" raw (back)" green_base"

(S)
```

## Network 8: RETURN\_EXCESS\_GREEN\_TO\_STORAGE



Network 9: OUSH\_RETURN\_GREEN



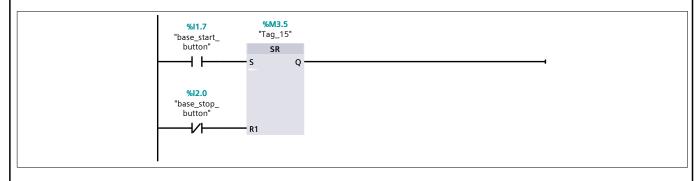
|--|

# Base\_production\_fb [FB12]

Base_production_fb Properties								
General								
Name	Base_production_fb	Number	12	Туре	FB			
Language	LAD	Numbering	Automatic					
Information								
Title		Author		Comment				
Family		Version	0.1	User-defined				
l				ID				

Base_production_fb									
Name	Data type	Default value		from HMI/OP	ta- ble	in HMI engi- neer-		Super- vision	Comment
Input									
Output									
InOut									
Static									_
Temp									
Constant									

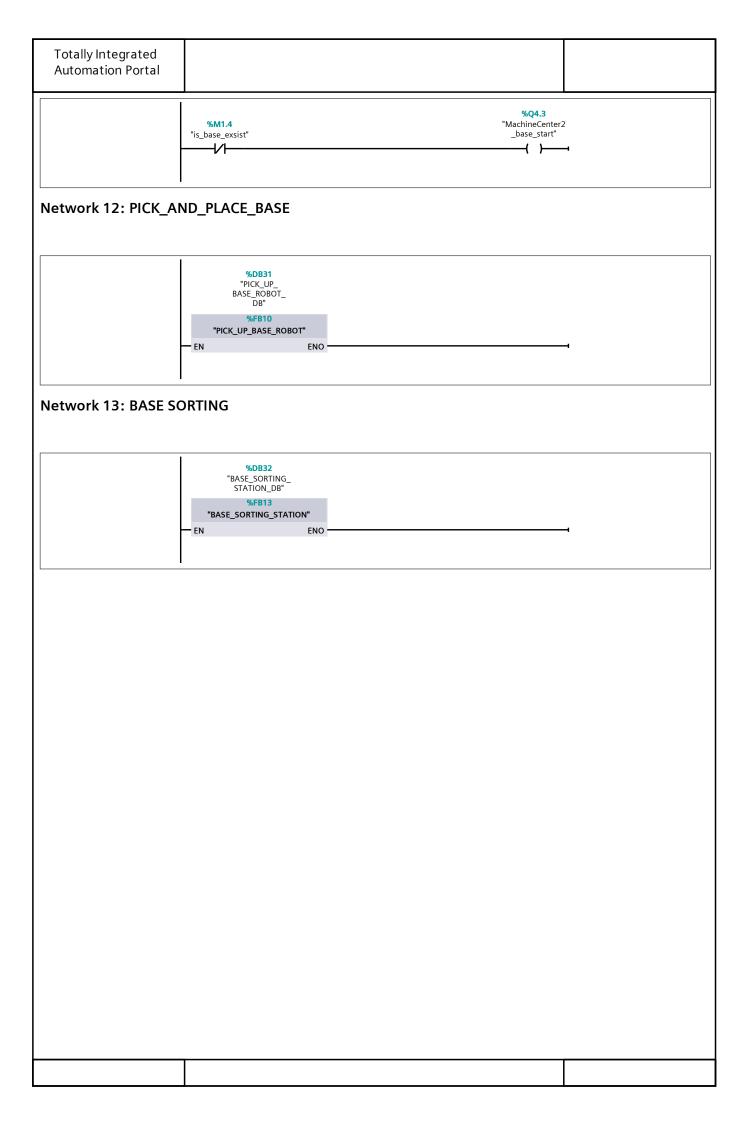
#### Network 1:



Network 2: base\_production\_station

#### Totally Integrated **Automation Portal %I2.1** %11.6 %01.4 %M3.5 "lid\_emergency\_ "base\_ "base\_start\_ "Tag\_15" button" emergency" button\_1\_light" 4 F ( )-%M0.0 %M0.0 "state\_of\_ start\_base" "state\_of\_ start\_base" ( )-%Q1.5 "base\_stop\_ button\_1\_light" NOT | **(** )-Network 3: base\_begin\_conveyor %10.7 %Q0.6 %M0.0 "base\_ beginning\_ "stop\_base\_ "state\_of\_ start\_base" begininning\_ %M1.4 convyr" "is\_base\_exsist" conveyr" Network 4: emit\_base\_handler %DB27 "IEC\_Timer\_0\_ DB\_8" %10.7 "stop\_base\_ begininning\_ %M0.0 %10.6 "state\_of\_ start\_base" "base\_Raw\_ counter\_start" TOF %M1.5 convyr" Time "to\_emit\_base" · IN Q· T#600MS — PT ET -Network 5: EMITTING\_BASE %DB28 "IEC\_Timer\_0\_ DB\_11" **%I1.7** TOF %M3.1 "base\_start\_ button" Time "Emit\_set\_base" IN T#500MS -- PT ET · %M1.5 "to\_emit\_base" Network 6: EMIT\_EMERGENCY\_HANDLER\_BASE

## Totally Integrated **Automation Portal** %M0.0 %Q2.0 "state\_of\_ start\_base" "base\_raw\_ material" %M3.1 "Emit\_set\_base" <del>(</del> )-4 F Network 7: FEEDING\_CONVEYOR\_HANDLER\_BASE %Q0.7 "base\_raw\_ feeding\_ conveyr" %M0.0 "state\_of\_ start\_base" %M1.4 %M1.4 "is\_base\_exsist" "is\_base\_exsist" **H** F **-( )**-%Q0.7 "base\_raw\_ feeding\_ conveyr" Network 8: BASE\_RAW\_INTO\_CNC %DB29 "IEC\_Timer\_0\_ DB\_12" TOF %15.0 %M1.4 "base\_into\_cnc" Time "is\_base\_exsist" <del>(</del> )-- IN T#500MS — PT ET --- ... Network 9: BASE\_KEEP\_DISTANCE %Q4.4 %Q4.5 %M1.4 "is\_base\_exsist" "Stop\_blade4" "Stop\_blade5" **(** )-<del>(</del> )-Network 10: BASE\_EXCESS %DB30 "BASE\_EXCESS\_ REMOVE\_ STATION\_DB" %FB11 "BASE\_EXCESS\_REMOVE\_ STATION" - EN ENO · Network 11: CNC\_BASE



## BASE\_SORTING\_STATION [FB13]

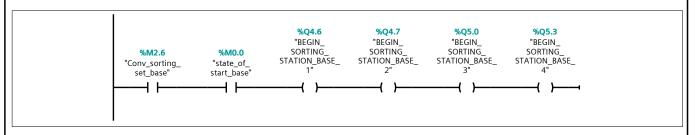
BASE_SORTING_STATION Properties								
General								
Name	BASE_SORTING_STATION	Number	13	Type	FB			
Language	LAD	Numbering	Automatic					
Information								
Title		Author		Comment				
Family		Version	0.1	User-defined				
				ID				

BASE_SORTING_STATION										
Name	Data type	Default value	Retain	from HMI/OP	ta- ble	in HMI engi- neer- ing		Super- vision	Comment	
Input										
Output										
InOut										
Static										
Temp										
Constant										

#### **Network 1: BEGIN SORTING CONVEYOR**

```
%DB33
     %17.0
                                             "IEC_Timer_0_
DB_13"
  "BEGIN_
SORTING_
                          %M0.0
                                                                                             %M2.6
STATION_BASE_
                                                                                         "Conv_sorting_
set_base"
                         "state_of_
   SENSOR"
                        start_base"
                                                                                              \leftarrow
                                             IN
                                                          Q
                                  T#20S — PT
                                                         ET -
```

#### **Network 2: CONV BASE SORTING HANDLE**



#### **Network 3: GREEN BASE PUSH FRONT**

## Totally Integrated **Automation Portal %17.4** "Pusher\_green\_ base (Back Limit)" **%I7.1** %Q5.1 "Pusher\_green\_ base\_sorter" "Green\_base\_ sorting\_vision" 4 6 -( s )-4 H **Network 4: GREEN PUSHER SORTING RETURN** %17.3 "Pusher\_green\_ base (Front Limit)" %Q5.1 "Pusher\_green\_ base\_sorter" -(R)-%M0.0 "state\_of\_ start\_base" **Network 5: BLUE PUSHER SORTING PUSH %I7.6** "Pusher\_blue\_ base (Back %17.2 %Q5.2 "Pusher\_blue\_ base\_sorter" "Blue\_base\_ sorting\_vision" Limit)" 1 H <del>|</del> | | (s)-**Network 6: BLUE PUSHER SORTING RETURN** %I7.5 "Pusher\_blue\_base (Front Limit)" %Q5.2 "Pusher\_blue\_ base\_sorter" -( R )-%M0.0 "state\_of\_ start\_base" **Network 7: LIGHT BLUE** %Q5.2 %Q6.2 "Pusher\_blue\_ base\_sorter" "blue base sorting light" ( )-

		1
Totally Integrated Automation Portal		
Network 8: LIGHT GR	EEN	
	%Q5.1 %Q6.3	
	"Pusher_green_ "green base base_sorter" "green big sorting light"	
		<b>-</b>
I		

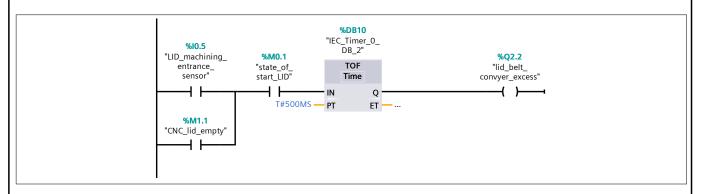
|--|

## LID\_execess\_remove\_station [FB3]

LID_execess_remove_station Properties								
General								
Name	LID_execess_remove_station	Number	3	Туре	FB			
Language	LAD	Numbering	Automatic		·			
Information								
Title		Author		Comment				
Family		Version	0.1	User-defined ID				

LID_execess_remove_station										
Name	Data type	Default value	Retain	from HMI/OP	ta- ble	in HMI engi- neer-		Super- vision	Comment	
Input										
Output										
InOut										
Static										
Temp										
Constant										

## ${\bf Network~1:LID\_BELT\_EXECESS\_CONVEYOR\_HANDLER}$

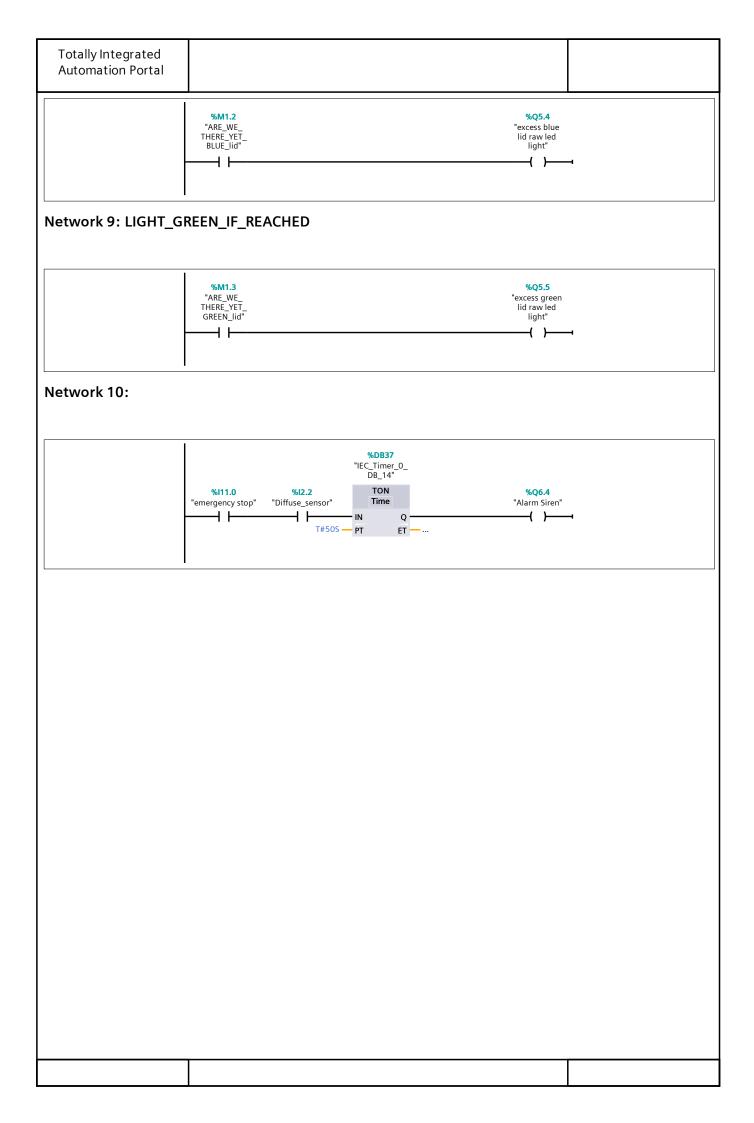


**Network 2: COUNTING NUMBER OF BLUE MATERIAL OF EXECES** 

## Totally Integrated **Automation Portal** %DB11 "IEC\_Counter\_ 0\_DB" %M1.2 "ARE\_WE\_ THERE\_YET\_ BLUE\_lid" CTU **%I2.6** "Blue\_vision\_lid" Int CU Q CV -%13.5 "LID\_COUNTER\_ RESET\_BUTTON\_ BLUE" 1 PV Network 3: PUSH\_FORWARD\_EXECESS\_BLUE %M1.2 "ARE\_WE\_ THERE\_YET\_ BLUE\_lid" **%I3.1** %Q2.3 "back\_blue\_ push\_lid" "push\_excess\_ blue\_lid" %I2.6 "Blue\_vision\_lid" 4 1 (s)-+%DB12 "IEC\_Timer\_0\_ DB\_3" %Q2.7 "TO\_STORAGE\_ BLUE\_CONVYER\_ lid" TOF Time **()** IN Q · T#3S — PT ET · Network 4: PUSH\_RETURN\_EXECESS\_BLUE %M1.2 "ARE\_WE\_ THERE\_YET\_ BLUE\_lid" %I3.0 %Q2.3 "front\_blue\_ push\_lid" "push\_excess\_ blue\_lid" <del>|</del> | | -(R)-%13.5 "LID\_COUNTER\_ RESET\_BUTTON\_ BLUE" %M0.1 "state\_of\_ start\_LID" Network 5: COUNTING\_NUMBER\_OF\_GREEN

## Totally Integrated **Automation Portal** %DB13 "IEC\_Counter\_ 0\_DB\_1" %M1.3 "ARE\_WE\_ THERE\_YET\_ GREEN\_lid" %12.7 CTU "green\_vision\_lid" Int CU Q CV -%14.0 "LID\_COUNTER\_ RESET\_BUTTON\_ GREEN" <del>|</del> | | PV Network 6: PUSH\_FORWARD\_EXCESS\_GREEN %M1.3 "ARE\_WE\_ THERE\_YET\_ GREEN\_lid" %13.3 %Q2.4 "back\_green\_ push\_lid" "push\_excess\_ green\_lid" **%I2.7** "green\_vision\_lid" 4 1 (s)-4 F %DB14 "IEC\_Timer\_0\_ DB\_4" %Q3.0 "TO\_STORAGE\_ GREEN TOF Time CONVYER\_lid" **(** )-IN Q · T#3S — PT ET · Network 7: PUSH\_RETURN\_GREEN %M1.3 "ARE\_WE\_ THERE\_YET\_ GREEN\_lid" **%I3.2** %Q2.4 "front\_green\_ push\_lid" "push\_excess\_ green\_lid" 4 F -(R)-%I4.0 "LID\_COUNTER\_ RESET\_BUTTON\_ GREEN" %M0.1 "state\_of\_ start\_LID"

Network 8: LIGHT\_BLUE\_IF\_REACHED



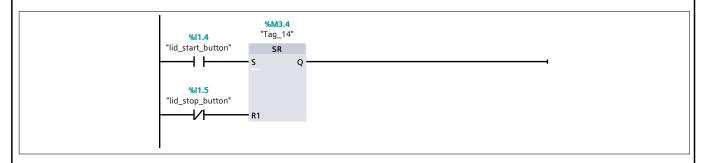
|--|

# LID\_PRODUCTION [FB1]

LID_PRODUCTION Properties									
General									
Name	LID_PRODUCTION	Number	1	Туре	FB				
Language	LAD	Numbering	Automatic						
Information									
Title		Author		Comment					
Family		Version	0.1	User-defined					
l				ID					

LID_PRODUCTION									
Name	Data type	Default value		from HMI/OP	ta- ble	in HMI engi- neer-		Super- vision	Comment
Input									
Output									
InOut									
Static									
Temp									
Constant									

## Network 1:



**Network 2: LID STARTING GANDLE** 

#### Totally Integrated **Automation Portal** %I1.6 **%I2.1** "lid\_emergency\_ %M3.4 "base\_ %I1.5 %Q1.6 "Tag\_14" button" emergency" "lid\_stop\_button" "lid\_start\_light" 4 F 4 F 1 H ( )-%M0.1 %M0.1 "state\_of\_ start\_LID" "state\_of\_ start\_LID" **4** F ( )-%Q1.7 "lid\_stop\_ button\_1\_light" H NOT H **-( )**-Network 3: LID\_BEGINNING CONVEYOR %10.1 "stop\_ beginning\_lid\_ sensor" %M0.1 %Q0.0 "state\_of\_ start\_LID" "Lid\_beginning\_ %M1.1 "CNC\_lid\_empty" conveyr" Network 4: LID\_EMITTER\_HANDLER %DB3 "IEC\_Timer\_0\_ DB\_9" **%I0.1** "stop\_ beginning\_lid\_ %M0.1 TOF "state\_of\_ start\_LID" %10.0 %M0.4 sensor' "lid\_detection" Time "To\_emit\_lid" · IN Q· ( )-T#500ms — PT ET --- ... **Network 5: FIRST LID TO EMIT** %DB5 "IEC\_Timer\_0\_ DB\_10" TOF %11.4 %M3.0 "lid\_start\_button" Time "Emit\_set\_lid" IN ( )-T#600MS -- PT ET -%M0.4 "To\_emit\_lid" **Network 6: EMIT EMERGENCY HANDLE LID**

## Totally Integrated **Automation Portal** %M0.1 "state\_of\_ start\_LID" %M3.0 %Q2.1 "Emit\_set\_lid" "lid\_raw\_emit" $\dashv \vdash$ ┨┞ ( )-Network 7: LID\_PICKUP\_ROBOT %DB4 "PICK\_UP\_LID\_ ROBOT\_DB" %FB2 "PICK\_UP\_LID\_ROBOT" ENO Network 8: FEEDING\_CONVEYOR\_HANDLER\_LID %M0.1 **%Q0.1**"lid\_feeding\_ conveyr" "state\_of\_ start\_LID" %M1.1 "CNC\_lid\_empty" Network 9: %DB6 "IEC\_Timer\_0\_DB" **%I3.4** TOF "into\_cnc\_lid\_ sensor" %M1.1 Time "CNC\_lid\_empty" **(** )-- IN Q T#500MS — PT ET -Network 10: LID\_KEEP\_DISTANCE %M1.1 %Q2.6 "CNC\_lid\_empty" "KEEP\_DISTANCE" %Q2.5 "ONE\_OBJECT\_IN" <del>(</del> )-( )-Network 11: LID\_execess\_station

# Totally Integrated Automation Portal **%DB7**"LID\_execess\_ remove\_station\_ DB" "LID\_execess\_remove\_station" - EN Network 12: CNC %Q3.6 "MachineCenter1 \_\_lid\_\_ produceLids" %Q3.5 "MachineCenter1 \_lid\_start" %M1.1 "CNC\_lid\_empty" <del>(</del> )-<del>-</del>1/1-<del>(</del> )-Network 13: %DB8 "LID\_SORTING\_ STATION\_DB" %FB4 "LID\_SORTING\_STATION" ENO - EN

|--|

## LID\_SORTING\_STATION [FB4]

LID_SORTING_STATION Properties									
General									
Name	LID_SORTING_STATION	Number	4	Туре	FB				
Language	LAD	Numbering	Automatic						
Information									
Title		Author		Comment					
Family		Version	0.1	User-defined					
				ID					

LID_SORTING_STATION										
Name	Data type	Default value		from HMI/OP	ta- ble	in HMI engi- neer-		Super- vision	Comment	
Input										
Output										
InOut										
Static									_	
Temp										
Constant										

#### **Network 1: BEGIN SORTING CONVEYOR**

```
#IEC_Timer_O_
DB_1"

*M0.1

SORTING_ "state_of_ TOF "Conv_sorting_ set_lid"

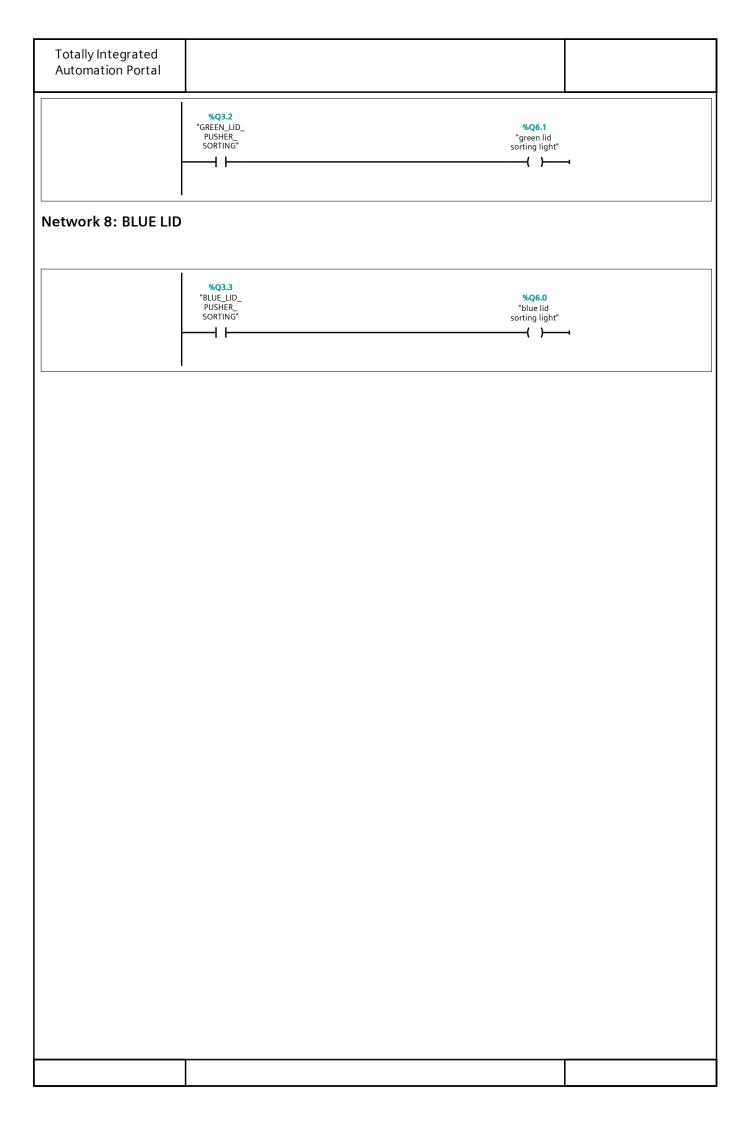
IN Q
T#10S PT ET ...
```

#### Network 2:



#### **Network 3: GREEN LID PUSH FRONT**

# Totally Integrated **Automation Portal %I4.2** "GREEN\_LID\_ PUSHER\_ %Q3.2 "GREEN\_LID\_ %14.7 "GREEN\_LID\_ SORTING(BACK LIMITT)" VISION\_ SORTING" PUSHER\_ SORTING" -( s )-**Network 4: GREEN PUSHER SORTING RETURN %I4.1** "GREEN\_LID\_ PUSHER\_ SORTING(FRONT LIMIT)" %Q3.2 "GREEN\_LID\_ PUSHER\_ SORTING" -( R )-4 H %M0.1 "state\_of\_ start\_LID" **Network 5: BLUE PUSHER SORTING PUSH %I4.4 %I4.6**"BLUE\_LID\_ **%Q3.3**"BLUE\_LID\_ "BLUE\_LID\_ PUSHER\_ SORTING(BACK LIMIT)" VISION\_ SORTING" PUSHER\_ SORTING" Network 6: BLUE\_PUSHER\_SORTING\_RETURN %I4.3 "BLUE\_LID\_ PUSHER\_ %Q3.3 "BLUE\_LID\_ PUSHER\_ SORTING" SORTING(FRONT LIMIT)" **+** + -( R )-%M0.1 "state\_of\_ start\_LID" **Network 7: GREEN LID IF BLUE**



|--|

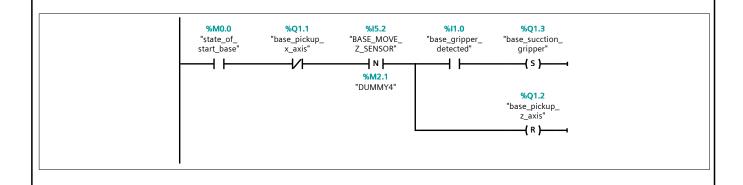
## PICK\_UP\_BASE\_ROBOT [FB10]

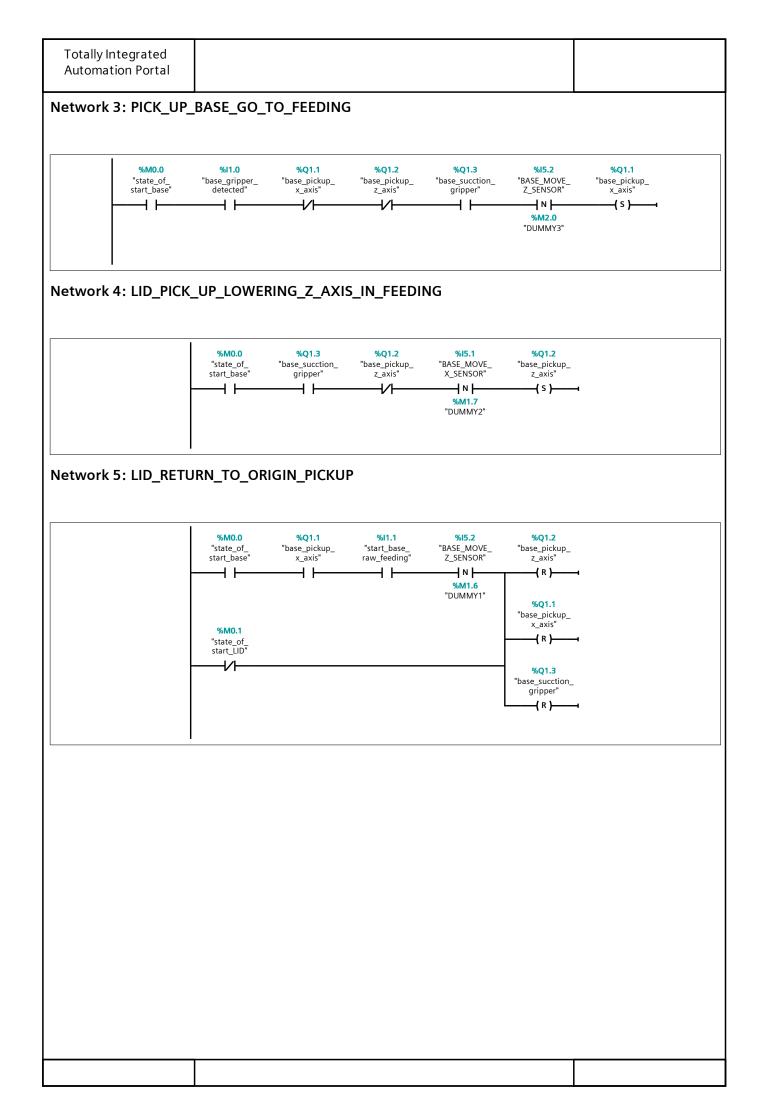
PICK_UP_BASE_ROBOT Properties									
General									
Name	PICK_UP_BASE_ROBOT	Number	10	Туре	FB				
Language	LAD	Numbering	Automatic						
Information									
Title		Author		Comment					
Family		Version	0.1	User-defined					
				ID					

PICK_UP_BASE_ROBOT								
Name	Data type	Default value	Retain	from HMI/OP	ta- ble	in HMI engi- neer-	Super- vision	Comment
Input								
Output								
InOut								
Static								_
Temp								
Constant								

## Network 1: BASE\_PICKUP\_ROBOT\_LOWEING\_Z\_AXIS

## Network 2: BASE\_PICKUP\_OPERATE\_SUCTION





|--|

## PICK\_UP\_LID\_ROBOT [FB2]

PICK_UP_LID_ROBOT Properties									
General									
Name	PICK_UP_LID_ROBOT	Number	2	Туре	FB				
Language	LAD	Numbering	Automatic						
Information									
Title		Author		Comment					
Family		Version	0.1	User-defined					
				ID					

PICK_UP_LID_ROBOT									
Name	Data type	Default value	Retain	from HMI/OP	ta- ble fro	in HMI engi- neer- ing		Super- vision	Comment
Input									
Output									
InOut									
Static									
Temp									
Constant									

#### Network 1:

```
%M0.1 "stop_ "state_of_ beginning_lid_ sensor" "lid_pickup_z_ axis"

| P | (S) | (S)
```

#### Network 2:

