Universidad de las Américas Puebla

Department of Computation, Electronics and Mechatronics

Evaluation #4

LIR4071

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Resumen

The knowledge acquired throughout the course, such as the realization of the functional diagram, the ladder language program, and the animation of the process in an HMI, was used in order to automate the process of a chemical reaction of two different ingredients in the tank system.

1. Instructions

A chemical reaction process needs to be automatized for a system of tanks, where three different types of mixtures that can be done by varying the quantity of liters from the two ingredients. The chemical reactor's diagram is shown below.

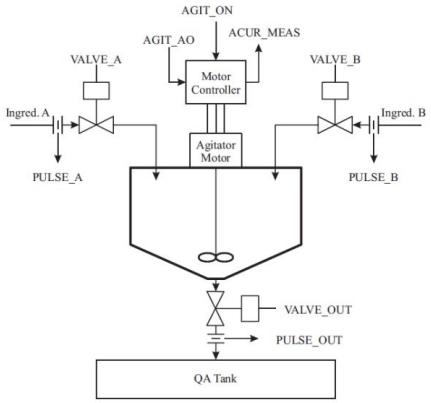


Figura 1: Chemical reactor's diagram

For the main process, the type of mixture is selected if there is a new tank in the system by the operator, and if non is selected it is assumed that the last mixture is the required one. Then, a Run button is pressed to begin the mixture. The valve of the ingredient A is opened to fill the tank with a certain quantity of liters. After the valve of the ingredient A closes the valve for B opens, following the same procedure, while the mixer works at 100 rpm. When the valve of the ingredient B closes the mixer works at 500 rpm for 10 minutes, and then decreases the mixing velocity linearly from 500 rpm to 260 rpm for 40 minutes. After the 40 minutes, the mixture is sent to the QA tank, still mixing at 260 rpm, until the sensor indicates that it is full.

For the alarm process, a sensor is measuring the current flowing through the mixer. If the current is 15 A or more, but less than 18 A, a warning lamp will be blinking every 400 ms. If the current is 18 A or more, an alarm lamp will be blinking every 400 ms.

2. Development

2.1. Functional Card

The functional card designed for the process can be found in the section Appendix A in its original size, it describes two parallel processes; the main process of mixing the two ingredients, which consist on five steps plus the turning on the reactor, and the process for the alarms of the current required by the mixer, which consists on two OR steps plus the turning on the reactor.

2.2. Variables used

The variables used in TIA Portal are shown below and in the Appendix A, after the Functional Diagram. The variables from the program blocks DB1, DB2 and DB3 are shown below and in the Appendix A, after the PLC tags.

Name	Data Type	Adress
New Tank	Bool	%I124.5
Counter Reactor	Int	%MW22
Run	Bool	%M6.6
Ready	Bool	%M6.0
Counter Out	Int	%MW18
Start	Bool	%I124.3
Pause	Bool	%I124.4
Reset	Bool	%M7.6
S1	Bool	%M6.1
S2	Bool	%M6.2
S3	Bool	%M6.3
S4	Bool	%M7.2
S5	Bool	%M7.3
Counter A Value	Int	%MW8
Pulse A	Int	%MW0
Counter B Value	Int	%MW10
Pulse B	Int	%MW2
Timer Count	Int	%MW30
Fake Input	Int	%MW24
Tick 400 ms	Bool	%M5.2
CA	Counter	%C0
CB	Counter	%C1
Slowing RPM	Int	%MW32
COut	Counter	%C2
RPM Fake	Real	%MD26
AGIT ON	Bool	%M7.7

Name	Data Type	Adress
ManualScaling	Bool	%I124.6
AutoScaling	Bool	%I124.7
Manual	Bool	%M34.0
10mA	Bool	%I125.2
16mA	Bool	%I125.0
18mA	Bool	%I125.1
Switching Input	Int	%MW36
ACUR MEAS	Int	%IW256
CURR WARN	Bool	%Q124.3
CURR ALARM	Bool	%Q124.4
Bipolar	Bool	%M6.7
Code Error	Int	%MW16
Current Value	Real	%MD12
AGIT AO	Int	%QW256
Valve A	Bool	%Q124.0
Valve B	Bool	%Q124.1
Valve Out	Bool	%Q124.2
Selection Available	Bool	%M34.1
Mix Selected	Bool	%M34.2
Tick	Int	%MW4
Mem Valv A	Bool	%M6.4
Mem Valv B	Bool	%M6.5
Pulse Out	Int	%MW20
Tick 100 ms	Bool	%M5.0
10MinDone	Bool	%M7.4
40MinDone	Bool	%M7.5
Push MA	Bool	%I124.0
Push MB	Bool	%I124.1
Push MC	Bool	%I124.2
M-MixA	Bool	%M34.3
M-MixB	Bool	%M34.4
M-MixC	Bool	%M34.5
M-10mA	Bool	%M34.6
M-16mA	Bool	%M34.7
M-18mA	Bool	%M35.0
M-AutoScaling	Bool	%M35.1
M-ManualScaling	Bool	%M35.2
M-Start	Bool	%M35.3
M-Pause	Bool	%M35.4
M-NewTank	Bool	%M35.5
M-Timer-anim	Int	%MW54
M-A-animation	Int	%MW42
M-IngredientA	Int	%MW38
M-B-animation	Int	%MW44
M-IngredientB	Int	%MW40
M-QA-Animation	Int	%MW48
M-QA	Int	%MW46
M-FillingReactor	Int	%MW56
M-FillReactor-Anim	Int	%MW58
M-ReactorFake-Anim	Bool	%M35.6
M-Motor-Anim	Bool	%M35.7

Block	Name	Data type	Start value
Mezcla A [DB1]	Pulso A	Int	180
	Pulso B	Int	20
Mezcla B [DB2]	Pulso A	Int	160
	Pulso B	Int	40
Mezcla C [DB3]	Pulso A	Int	140
	Pulso B	Int	60

2.3. Ladder diagram

The complete ladder diagram can also be found in Appendix A, where each network has their description, after the Functional Diagram, and are divided in a main block, two function blocks, and a cyclic interrupt block.

- **Main [OB1]:** Contains the main program, corresponding to the main branch (left branch) in the Functional Diagram. It includes turning the reactor on, the counter for the ingredients, the velocity of the mixer's motor, the control for the current's motor, and the animations for the HMI.
- **Move Mix Times [FC1]:** Moves the values from the selected mix to the memories for the Pulse A and B.
- **Activate Mixes [FC2]:** Selects the required mix depending on the users input.
- **CYC_INT5 [OB35]:** Generates the ticks necessary for the cyclic instructions, for controlling the mixing time, and for the linear decrease of the velocity of the motor.

2.4. Test realized in the program

The video demonstrating the correct functionality of the program is shown in the following link.
`https://youtu.be/pxs6VbCDIPA`

2.5. HMI

For the HMI, 11 different animations where design. In order shown in Appendix A, after the Cyclic interrupt block, the panels are

1. **Main:** It's the main panel, it has the Start, Pause and New QA Tank buttons, shows if the reactor and the motor are running, and has the
2. **Select Mix:** It allows the user to select the required mix, and shows the quantity on litters of both ingredients that the mixture requires.

3. **Ingredient A:** It shows how the ingredient A is poured in the reactor for the mixing, it has a Start and Pause button in case of emergency, and it shows if the reactor or the motor are running.

4. **Ingredient B:** It shows how the ingredient B is poured in the reactor for the mixing, it has a Start and Pause button in case of emergency, and it shows if the reactor or the motor are running.

5. **Reactor tank:** It shows how many liters are in the reactor. It also shows if the reactor and the motor are running, and have the Start and Pause buttons for emergency.

6. **QA Tank:** It shows how many liters are in the reactor and how many have been poured in the tank. It also shows if the reactor and the motor are running, and have the Start and Pause buttons for emergency.

7. **Current level:** It allows two different modes to simulate the current in the motor; manual and auto. Manual is to check that the current warning and alarm work correctly with the buttons 10 mA, 16 mA, and 18 mA, while the auto uses the slide track of TIA Portal. For all cases, the value of the current is displayed.

8. **Motor:** It shows the motor of the mixer working and if the reactor is running, the RPM value of the motor's speed and the time that it has passed. Also, it has de Start and Pause buttons in case of emergency.

9. **Project information:** Presents the project information.

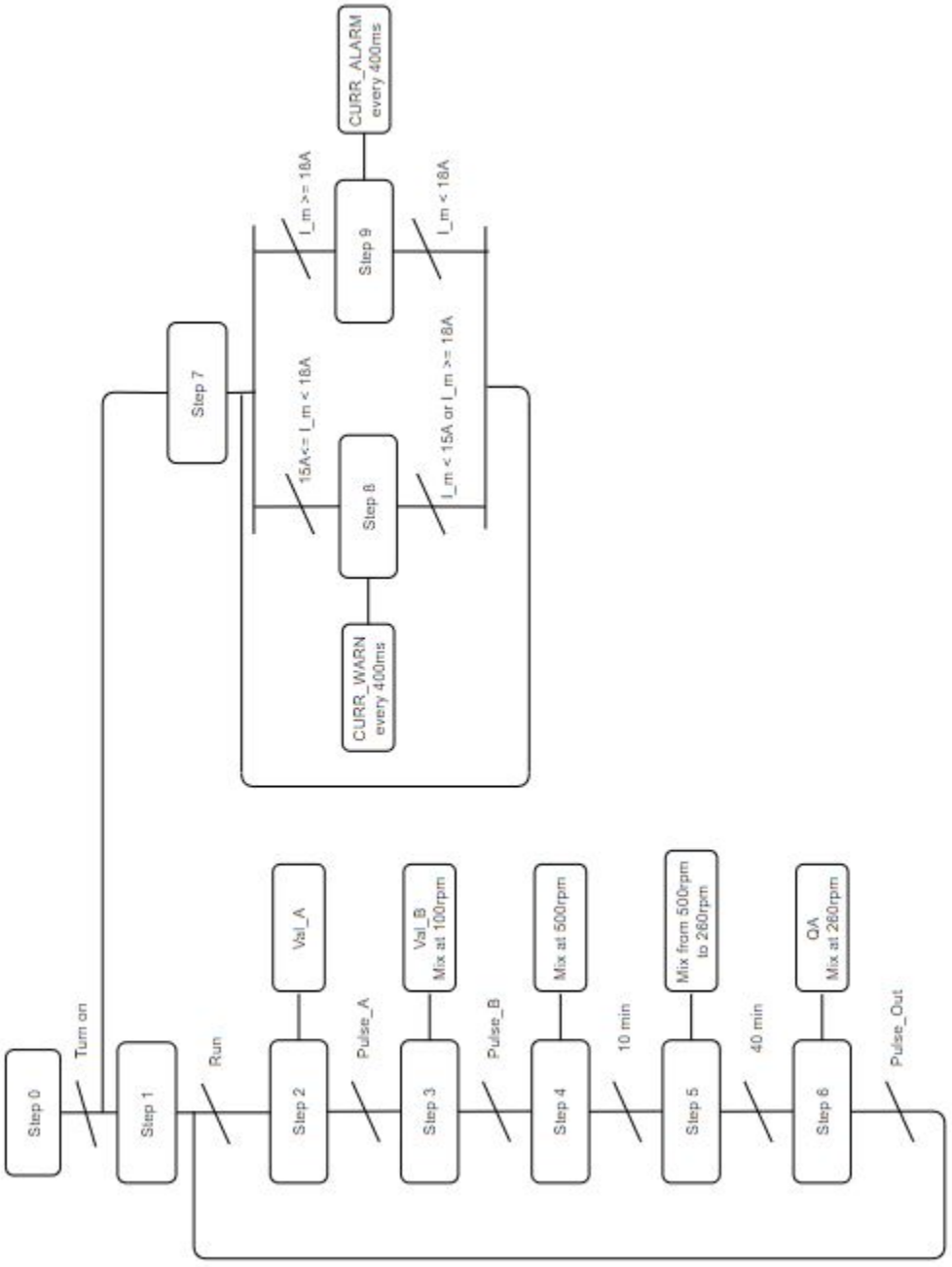
10. **System:** It is the access panel for the project information.

11. **Project information:** Contains the project information

3. Conclusions

The process was automated successfully, observing that every mix selected functioned as the instructions requested. The integration between the different blocks for the programming of the process was also correct, as well as the HMI programming and animation. Thanks to TIA Portal and its capability of receiving analogue signals to be converted into digital signals is very useful and allow the programmer to include outputs based on several conditions from the same signal. The scale and unscale blocks are very helpful to make the interface more easy to comprehend to a user. Also, the ability of incorporating more programming blocks (data, functions or cyclic interruptions) can make easy to control and programming a process that could be more difficult to do using only a main block (OB1). Finally, the HMI is a very important tool that allows the user to observe different variables from the process into several interactive screens.

Appendix A: Functional Card and Ladder Diagram



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PLC_1 [CPU 312C] / PLC tags / Default tag table [79]

PLC tags

PLC tags

	Name	Data type	Address	Retain	Accessible from HMI/OPC UA	Writable from HMI/OPC UA	Visible in HMI engineering	Supervision	Comment
	Pulse A	Int	%MW0		True	True	True		
	Pulse B	Int	%MW2		True	True	True		
	Tick	Int	%MW4		True	True	True		
	Push MA	Bool	%I124.0		True	True	True		
	Push MB	Bool	%I124.1		True	True	True		
	Push MC	Bool	%I124.2		True	True	True		
	Start	Bool	%I124.3		True	True	True		
	Ready	Bool	%M6.0		True	True	True		
	CA	Counter	%C0		True	True	True		
	Counter A Value	Int	%MW8		True	True	True		
	Tick 400 ms	Bool	%M5.2		True	True	True		
	S1	Bool	%M6.1		True	True	True		
	Pause	Bool	%I124.4		True	True	True		
	Counter B Value	Int	%MW10		True	True	True		
	CB	Counter	%C1		True	True	True		
	S2	Bool	%M6.2		True	True	True		
	S3	Bool	%M6.3		True	True	True		
	Mem Valv A	Bool	%M6.4		True	True	True		
	Mem Valv B	Bool	%M6.5		True	True	True		
	Valve A	Bool	%Q124.0		True	True	True		
	Valve B	Bool	%Q124.1		True	True	True		
	Valve Out	Bool	%Q124.2		True	True	True		
	NewTank	Bool	%I124.5		True	True	True		
	Run	Bool	%M6.6		True	True	True		
	ACUR_MEAS	Int	%IW256		True	True	True		
	Current Value	Real	%MD12		True	True	True		
	Code Error	Word	%MW16		True	True	True		
	Bipolar	Bool	%M6.7		True	True	True		
	AGIT AO	Int	%QW256		True	True	True		
	Fake Input	Int	%MW24		True	True	True		
	Pulse Out	Int	%MW20		True	True	True		
	COut	Counter	%C2		True	True	True		
	Counter Reactor	Int	%MW22		True	True	True		
	RPM Fake	Real	%MD26		True	True	True		
	Tick 100 ms	Bool	%M5.0		True	True	True		
	Timer Count	Int	%MW30		True	True	True		
	S4	Bool	%M7.2		True	True	True		
	S5	Bool	%M7.3		True	True	True		
	10MinDone	Bool	%M7.4		True	True	True		
	40MinDone	Bool	%M7.5		True	True	True		
	SlowingRPM	Int	%MW32		True	True	True		
	Counter Out	Int	%MW18		True	True	True		
	Reset	Bool	%M7.6		True	True	True		
	AGIT ON	Bool	%M7.7		True	True	True		
	CURR WARN	Bool	%Q124.3		True	True	True		
	CURR ALARM	Bool	%Q124.4		True	True	True		
	ManualScaling	Bool	%I124.6		True	True	True		
	Manual	Bool	%M34.0		True	True	True		
	AutoScaling	Bool	%I124.7		True	True	True		
	Switching Input	Int	%MW36		True	True	True		
	16mA	Bool	%I125.0		True	True	True		
	18mA	Bool	%I125.1		True	True	True		
	10mA	Bool	%I125.2		True	True	True		
	Selection Available	Bool	%M34.1		True	True	True		
	Mix Selected	Bool	%M34.2		True	True	True		
	M-MixA	Bool	%M34.3		True	True	True		

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Name	Data type	Address	Retain	Accessible from HMI/OPC UA	Writable from HMI/OPC UA	Visible in HMI engineering	Supervision	Comment
M-MixB	Bool	%M34.4		True	True	True		
M-MixC	Bool	%M34.5		True	True	True		
M-10mA	Bool	%M34.6		True	True	True		
M-16mA	Bool	%M34.7		True	True	True		
M-18mA	Bool	%M35.0		True	True	True		
M-AutoScaling	Bool	%M35.1		True	True	True		
M-ManualScaling	Bool	%M35.2		True	True	True		
M-Start	Bool	%M35.3		True	True	True		
M-Pause	Bool	%M35.4		True	True	True		
M-NewTank	Bool	%M35.5		True	True	True		
M-IngredientA	Int	%MW38		True	True	True		
M-IngredientB	Int	%MW40		True	True	True		
M-A-animation	Int	%MW42		True	True	True		
M-B-animation	Int	%MW44		True	True	True		
M-ReactorFake-Anim	Bool	%M35.6		True	True	True		
M-Motor-Anim	Bool	%M35.7		True	True	True		
M-QA	Int	%MW46		True	True	True		
M-QA-Animation	Int	%MW48		True	True	True		
M-Reactor	Int	%MW50		True	True	True		
M-Reactor-Animation	Int	%MW52		True	True	True		
M-Timer-anim	Int	%MW54		True	True	True		
M-FillingReactor	Int	%MW56		True	True	True		
M-FillReactor-Anim	Int	%MW58		True	True	True		

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PLC_1 [CPU 312C] / Program blocks

Mezcla A [DB1]

Mezcla A Properties							
General							
Name	Mezcla A	**Number**	1	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Start value	Retain	Accessible from HMI/OPC UA	Writable from HMI/OPC UA	Visible in HMI engineering	Setpoint	Supervision	Comment
▼ Static										
Pulso A	Int	0.0	180	True	True	True	True	False		
Pulso B	Int	2.0	20	True	True	True	True	False		

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PLC_1 [CPU 312C] / Program blocks

Mezcla B [DB2]

Mezcla B Properties							
General							
Name	Mezcla B	**Number**	2	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Start value	Retain	Accessible from HMI/OPC UA	Writable from HMI/OPC UA	Visible in HMI engineering	Setpoint	Supervision	Comment
▼ Static										
Pulso A	Int	0.0	160	True	True	True	True	False		
Pulso B	Int	2.0	40	True	True	True	True	False		

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PLC_1 [CPU 312C] / Program blocks

Mezcla C [DB3]

Mezcla C Properties							
General							
Name	Mezcla C	**Number**	3	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Start value	Retain	Accessible from HMI/OPC UA	Writable from HMI/OPC UA	Visible in HMI engineering	Setpoint	Supervision	Comment
▼ Static										
Pulso A	Int	0.0	140	True	True	True	True	False		
Pulso B	Int	2.0	60	True	True	True	True	False		

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PLC_1 [CPU 312C] / Program blocks

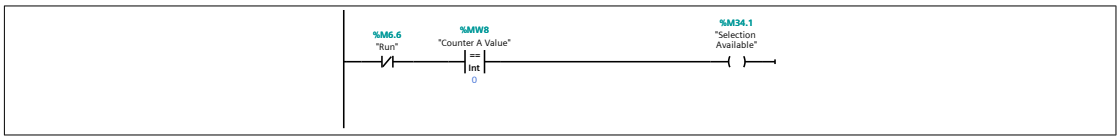
Main [OB1]

Main Properties							
General							
Name	Main	**Number**	1	**Type**	OB	**Language**	LAD
Numbering	Manual						
Information							
Title	"Main Program Sweep (Cycle)"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Default value	Comment
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_Time	12.0		Date and time OB1 started
Constant				

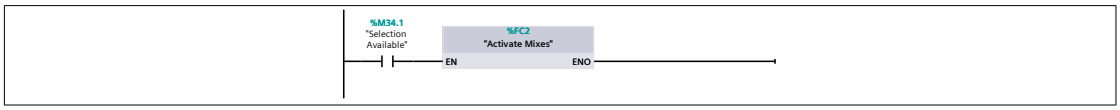
Network 1: Available Mix Selection Network

This network enables the selection of a new mix. It can onlyh be activated while the process isn't working and no liquid from the ingredient A has been poured into the reactor tank.



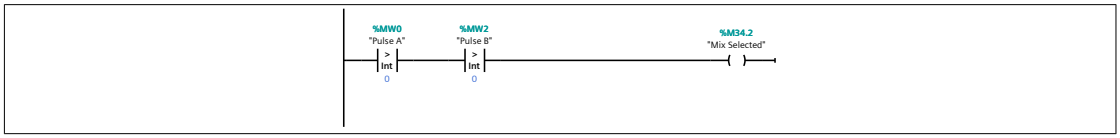
Network 2: Funcion FC2 Call Network

This network calls the function FC2 (Activate Mix). This network indicates that a mix has been selected. It requires the selection available memory to be on.



Network 3: Mix Selected Network

This network indicates that a mix has been selected at least one time, the value for the memories Pulse A and Pulse B are 0 the first time the program is debugging.



Network 4: Ready Network

This Network describes how to set the Ready memory . To do it, first you have to push the Input I124.5 (NewTank). This "empties" the filled QA tank and puts a new one. Then, the either the state 5 must be active or the process must be stopped (Run deactivated). Finally, the value of the Counter Reactor must be equal to 0, meaning that the process has already begun or being restarted. The ready memory keeps on while the value of the Output counter (Counter Out) is equal to zero or while the State 05 is on but liters at the QA tank are less than the liters at the reactor tank.

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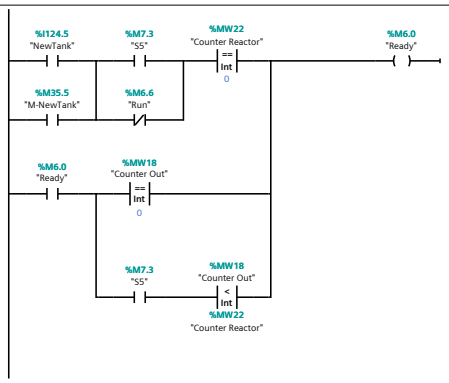
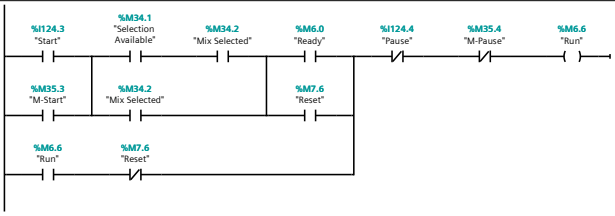


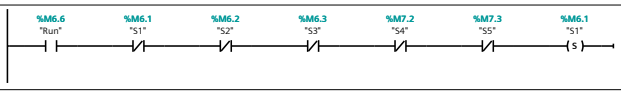
Network 5: Run Network

This network describes how to activate the Run memory. To activate it, first you have to push the input I124.3 (Start button), while the memories "Selection Avalable" and "Mix Selected" are on. The second branch will always be active once a mix has been selected for the first time. As you can see, you can not activate the Run memory if the input I124.4 is on (Pause). The reset memory under the ready memory closes whenever the Reset signal has been triggered. Finally, the Run memory will keep working until the Reset signal (M7.6) has been activated.



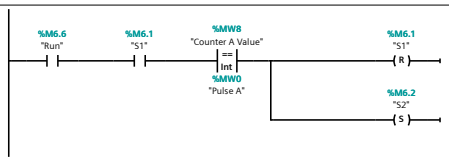
Network 6: Activate state 01 Network

This network describes how to active the state 01. To activate it, the process must be running (run memory on), and all the States must be deactivated.



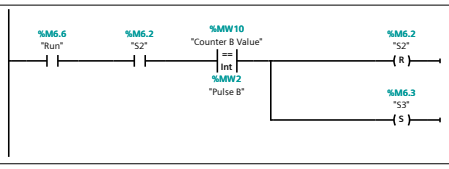
Network 7: Reset State 01 and Set State 02 Network

This network describes how to set the state 02 and reset the sate 01. To do it, both the State 01 and the process must be active (Run memory on), and the value of Counter A Value must be equal to the value in the memory Pulse A.



Network 8: Reset State 02 and Set State 03 Network

This network describes how to set the state 03 and reset the sate 02. To do it, both the State 02 and the process must be active (Run memory on), and the value of Counter B Value must be equal to the value in the memory Pulse B.



Network 9: Reset State 03 and Set State 04 Network

This network describes how to set the state 04 and reset the sate 03. To do it, both the State 03 and the process must be active (Run memory on), the State 4 must be deactivated, and the value of Timer Count must be greater or equal to 6000. When the conditions are achieved, a 0 passes to the Timer Count memory in order to restart its value (count start from 0 again).

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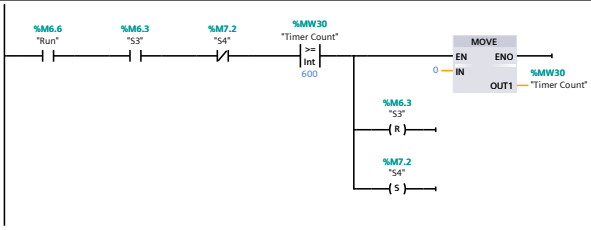
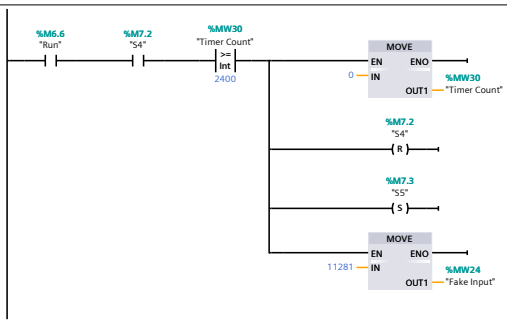


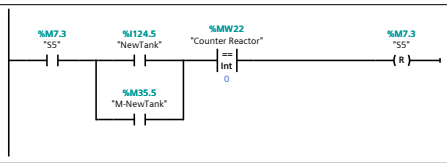
Network 10: Reset State 04 and Set State 05 Network

This network describes how to set the state 04 and reset the sate 05. To do it, both the State 04 and the process must be active (Run memory on), , and the value of Timer Count must be greater or equal to 24000. When the conditions are achieved, a 0 passes to the Timer Count memory in order to restart its value (count start from 0 again), and a value of 11281 passes to the Fake Input (equivalent to 260 RPM) so it can be converted to RPM and sent to the analog output Q256.



Network 11: Reset State 05 Network

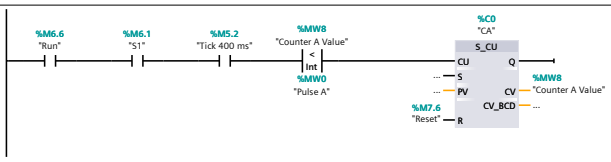
This network shows how to reset the State 05. In order to reset this network, the state 05 must be active, the liters at the Reactor container must be 0 and the input I124.5 (New Tank) must be pressed.



Network 12: State 01 Actions: Increase the Counter A Value - Network

This network describes how the pulses from the the A Valve are increasing (the ingredient A is being poured into the reactor container). To do it so, first the process must be running, the State 01 must be active, and the counter "Counter A Value" must be less than the value in form the "Pulse A" memory. Also, to create the pulses effect, the 400 ms Tick is added into this branch.

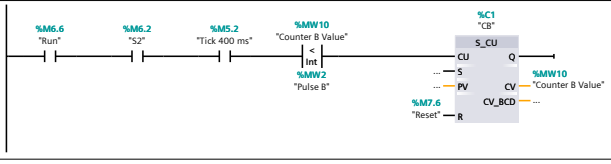
Note: The value of the counter is reset when the "Reset" memory is active (This occus at the end of the process)



Network 13: State 02 Action: Increase the Counter B Value - Network

This network describes how the pulses from the the B Valve are increasing (the ingredient B is being poured into the reactor container). To do it so, first the process must be running, the State 02 must be active, and the counter "Counter B Value" must be less than the value in form the "Pulse B" memory. Also, to create the pulses effect, the 400 ms Tick is added into this branch.

Note: The value of the counter is reset when the "Reset" memory is active (This occus at the end of the process)



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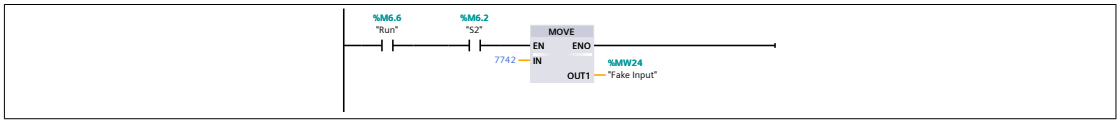
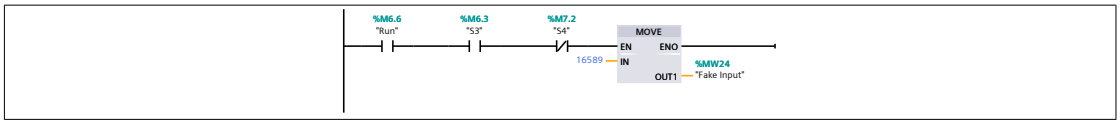
Network 14: State 02 Action: 100 RPM Network

This network accoomplishes the requirement for the consrant 100 RPM measured from the motor while the ingredient B is being poured into the reactor container. A fake input was created because the real analog measurement could not be modified as desired. The analog value for the 100 RPM is 7742.



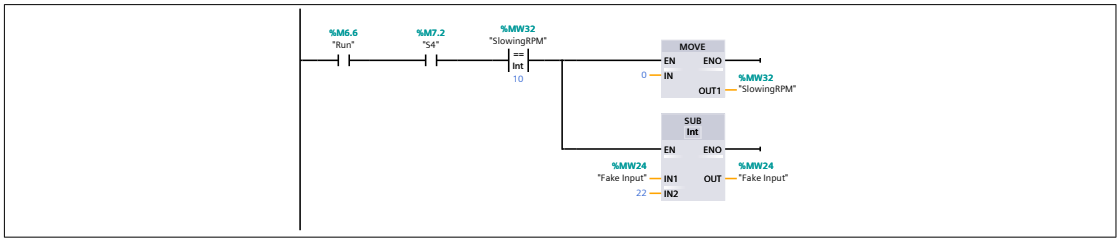
Network 15: State 03 Action: 500 RPM Network

This network accoomplishes the requirement for the consrant 500 RPM measured from the motor for 10 minutes when the ingredient B has already been poured into the reactor container. A fake input was created because the real analog measurement could not be modified as desired. The analog value for the 500 RPM is 16589.



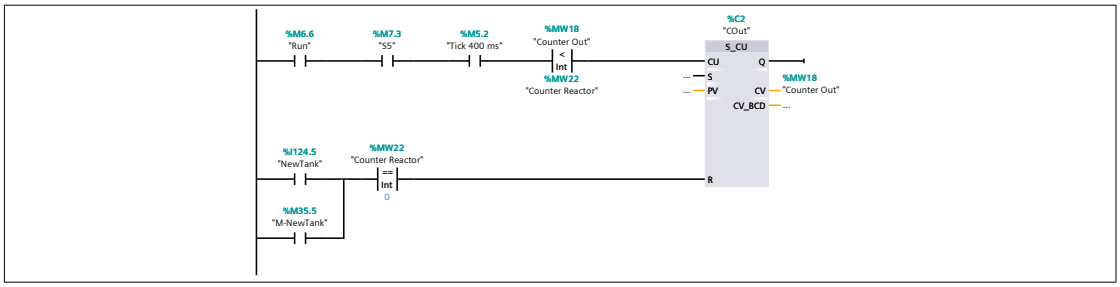
Network 16: State 04 Action: Slowing the RPM from 500 down to 260 - Network

This Network shows how to decreases the RPM value from 500 down to 260. In order to accomplish this goal, the process should be working (Run memory on), while the State 04 is active. The memory "Slowing RPM" increases its value every 100 ms and when it reaches the value of 100 (10 seconds elapsed) it resets its value while decreases the Fake Input's value. This allows to decrease the RPM by 10 every second.



Network 17: State 05 Action: Pouring the reactor mix into the QA Tank - Network

This network indicates how the pouring process from the reactor tank into the WA tank is done. First, the process must be active (Run memory on), the State 05 must be on, and the value of the counter "Counter Out" must be less that the value of "Counter Reactor". The value of Counter Out will increases each 400 ms thanks to the programmed Tick. This thick indicates the pulses or the liters that are being poured into the WA tank. To reset its count the liters in the reactor (Counter Reactor) must be 0 and the the input I124.5 must be pressed, indicating that a Nwe QA tank is ready.



Network 18: State 05 Action: Reset the values - Network

When the liters at the QA tank are already the ones that were at the reactor tank (200 liters), this branch resets the values from several counters by passing the value of 0 or by turning on the Reset memory.

Note: this branch will be activated only once because it requieres to both counters have the same value, and this branch does not turn to 0 the value of the Counter Out (the mix is at the QA tank).

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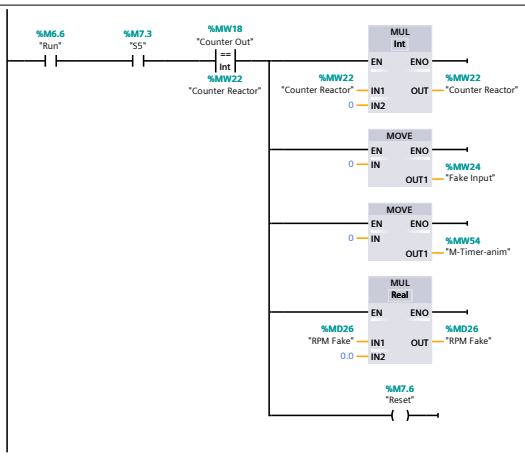
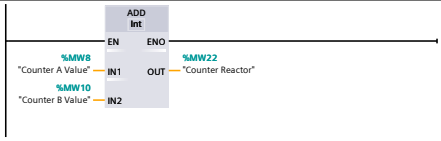


Network 19: Liters at the reactor -Network

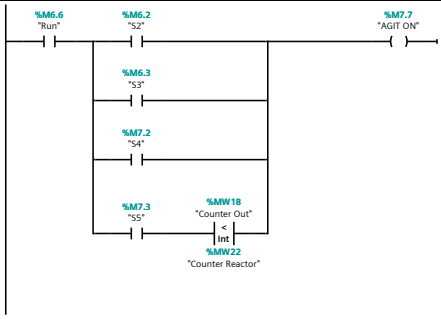
This network indicates how many liters of both ingredients have already been poured into the reactor container. This network adds the value from both counters (poured ingredient A and the poured ingredient B).



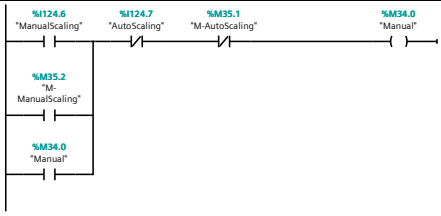
Network 20: AGIT ON Network

This Network describes when the AGIT ON signal is active. This is while the following conditions and the run memory are active:

State 02: Puring the ingredient B and shaking.
State 03: 10 min shake.
State 04: 40 min shake.
State 05 and Counter Out < Counter Reactor: Pouring the mix into the QA tank



Network 21: Manual Scaling Network



Network 22: Manualy Scaling Values

This Network describes the 3 puttons I125.0, I125.1, and I125.2 corresponding to three different current values: 10mA, 16mA, and 18 mA. These swtiches send the analog input value requires to obtain those current outputs.

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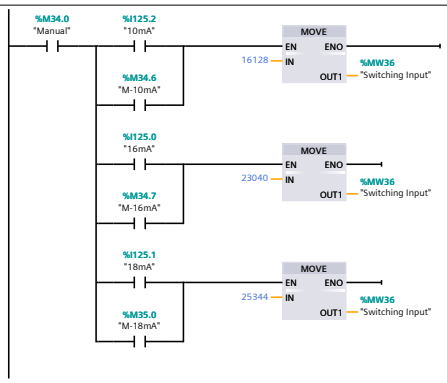
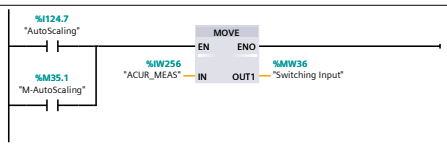


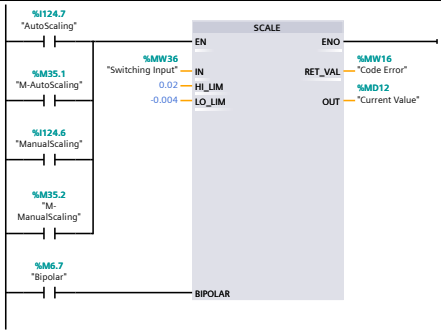
Network 23: Auto Scaling Network

This network moves the value from the analog input !W256 to the memory M@36 (Switching Input) as long as the AutoScaling button is on.



Network 24: Scale with Real Input (ACUR_MEAS) -Network

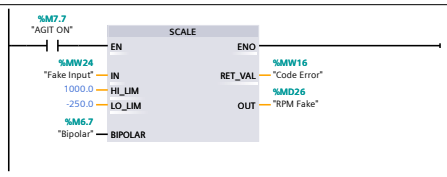
This network scales the input from either the IB125 inputs or the IW256 to obtain range of values that vary from 0.8 mA (the 8u ampers is due to conversion) up to 20 mA.



Network 25: Scale with Fake Input - Network

This network describes the parameters required to scale the input to have a RPM value that goes from 0 up to 1000 RPM within a range that goes from 5530 to 27648. The parameters were obtained from the straight line equation. The lowest limit is -250 and the highsest limit is 1000.

This network imitates the analog samplig procedure. The real analog input is used as a alarm detector.



Network 26: Unscale with Fake RPM - Network

This network describes the parameters required to scale the fake RPM input to have an analog value that goes from 0 up to 1000 RPM within a range that goes from 5530 to 27648. The parameters were obtained from the straight line equation. The lowest limit is -250 and the highsest limit is 1000.

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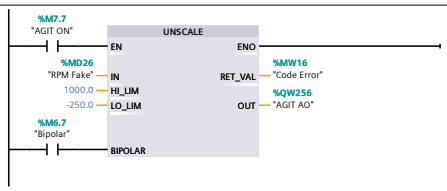
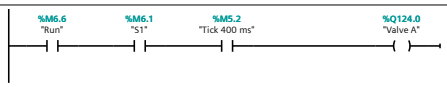


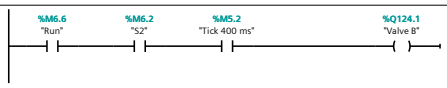
Network 27: Output Valve A - Network

This network indicates how to activate the Valve A output.



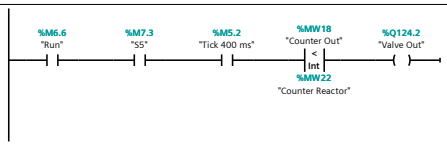
Network 28: Output Valve B - Network

This network indicates how to activate the Valve B output.



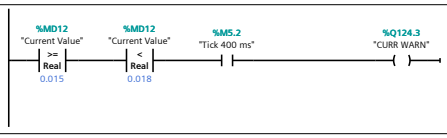
Network 29: Output Valve Out - Network

This network indicates how to activate the Valve Out output.



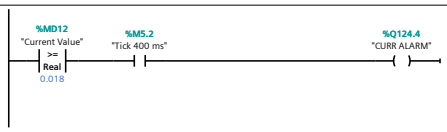
Network 30: 15 mA Warning Network

This Neworks turns on a visual alarm indicating a warning signal. This warning signal is turned on whenever the Current value is grater than 15mA but less than 18mA. This warning signal turns on and off every 400 ms due to the 400 ms Tick.



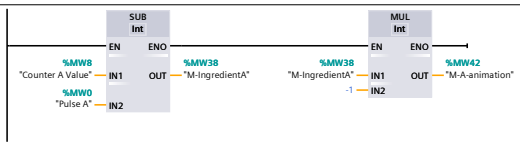
Network 31: 18 mA Alarm Network

This Neworks turns on a visual alarm indicating an alarm signal. This alarm signal is turned on whenever the Current value is grater than 18mA. This alarm signal turns on and off every 400 ms due to the 400 ms Tick.



Network 32: Animation: Pouring Ingredient A - Network

This network describes how to animate the pouring process of the ingredient A into the Reactor Tank.



Network 33: Animation: Pouring Ingredient B - Network

This network describes how to animate the pouring process of the ingredient B into the Reactor Tank.

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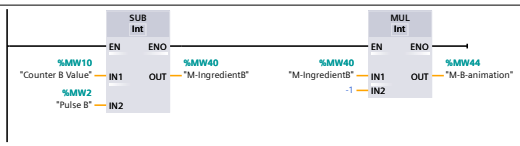
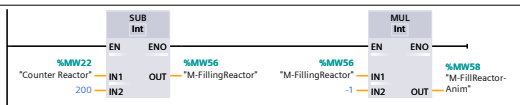


Network 34: Animation: Pouring the Reactor Tank into the QA tank - Network

This network describes how to animate the pouring process of the Reactor Tank into the QA Tank.

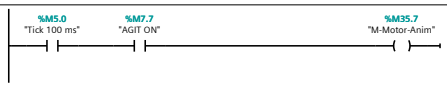
Network 35: Animation: Pouring Ingredient A and Ingredient B into the Reactor Tank - Network

This network describes how to animate the pouring process from both ingredients into the Reactor Tank.



Network 36: Animation: Motor spinning - Network

This network describes how to animate the rorational movement of the motor.

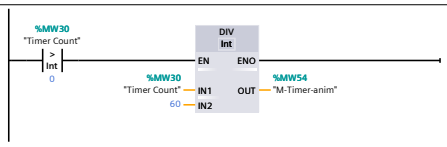


Network 37: Animation: Appear/Disappear Reactor - Network

This network describes when to appear and disappear the reactor Tank in the HMI for two different visual effects.

Network 38: Animation: Elapsed Minutes - Network

This netowork show the elapsed time in minutes in the HMI



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PLC_1 [CPU 312C] / Program blocks

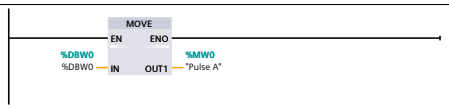
Move Mix Times [FC1]

Move Mix Times Properties							
General							
Name	Move Mix Times	**Number**	1	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Default value	Comment
Input				
Output				
InOut				
Temp				
Constant				
▼ Return				
Move Mix Times	Void			

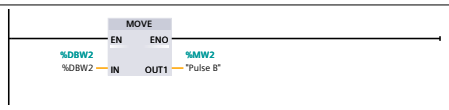
Network 1: Pulse A Move Network

This network moves the value stored from the selected Data Block to the memory Pulse A.



Network 2: Pulse B Move Network

This network moves the value stored from the selected Data Block to the memory Pulse B.



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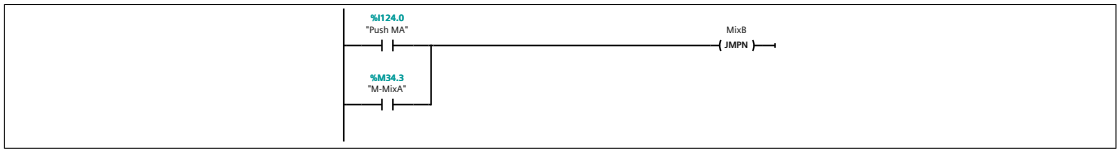
PLC_1 [CPU 312C] / Program blocks

Activate Mixes [FC2]

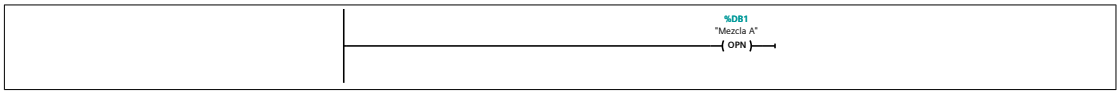
Activate Mixes Properties							
General							
Name	Activate Mixes	**Number**	2	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Offset	Default value	Comment
Input				
Output				
InOut				
Temp				
Constant				
Return				
Activate Mixes	Void			

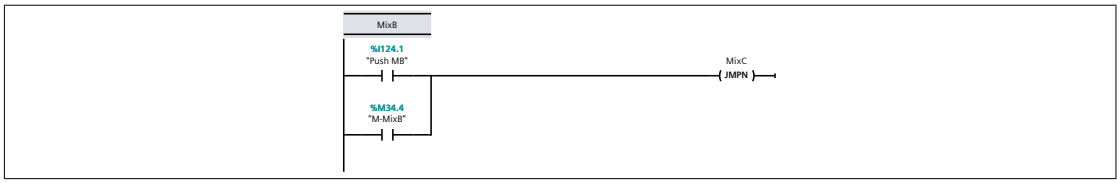
Network 1:



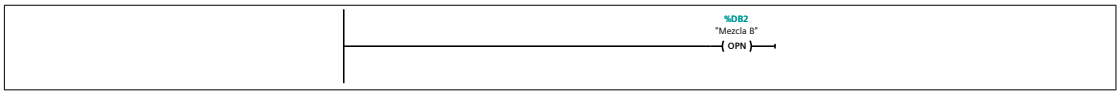
Network 2:



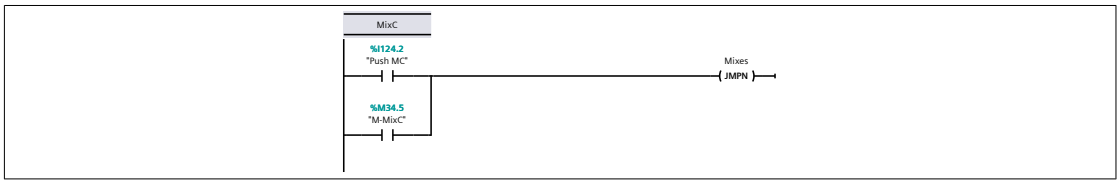
Network 3:



Network 4:



Network 5:



Network 6:

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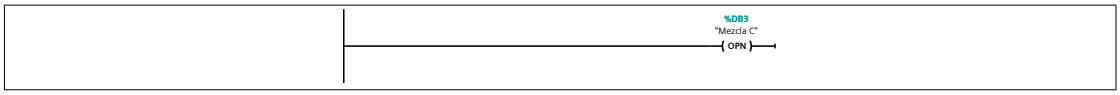
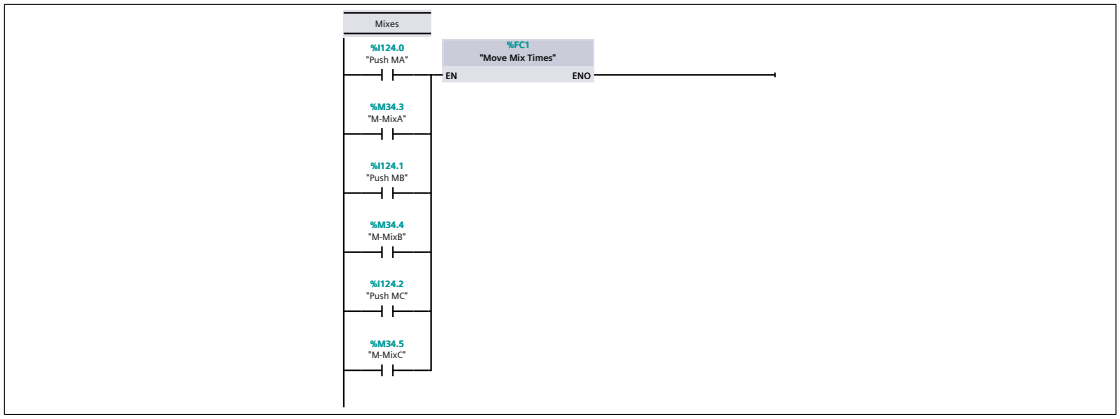


Network 7:



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PLC_1 [CPU 312C] / Program blocks

CYC_INT5 [OB35]

CYC_INT5 Properties							
General							
Name	CYC_INT5	**Number**	35	**Type**	OB	**Language**	LAD
Numbering	Manual						
Information							
Title	"Cyclic Interrupt"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

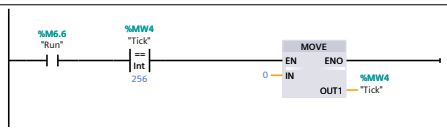
Name	Data type	Offset	Default value	Comment
Temp				
OB35_EV_CLASS	Byte	0.0		Bits 0-3 = 1 (Coming event), Bits 4-7 = 1 (Event class 1)
OB35_STRT_INF	Byte	1.0		16#36 (OB 35 has started)
OB35_PRIORITY	Byte	2.0		Priority of OB Execution
OB35_OB_NUMBR	Byte	3.0		35 (Organization block 35, OB35)
OB35_RESERVED_1	Byte	4.0		Reserved for system
OB35_RESERVED_2	Byte	5.0		Reserved for system
OB35_PHASE_OFFSET	Word	6.0		Phase offset (msec)
OB35_RESERVED_3	Int	8.0		Reserved for system
OB35_EXC_FREQ	Int	10.0		Frequency of execution (msec)
OB35_DATE_TIME	Date_And_Time	12.0		Date and time OB35 started
Constant				

Network 1: Tick Network

This network generates a tick every 100 ms, the value of tick is increased by 1.

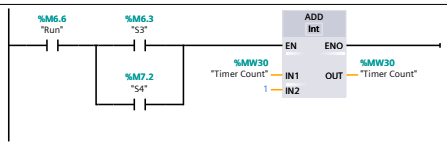
Network 2: Reset Tick Network

This network resets the value of the tick. If Tick has reached 256, its moves a 0 o the memory that stores the Tick.



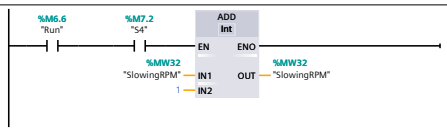
Network 3: Timer Count Network

This network work as a timer for the time elapsed within the State 03 and the State 04. It's required that the process is working (Run memory on).



Network 4: Slowing RPM network

This network increases the value of the memory "SlowingRPM" by 1 each 100 ms. It is required that the process is working (Run memory on)



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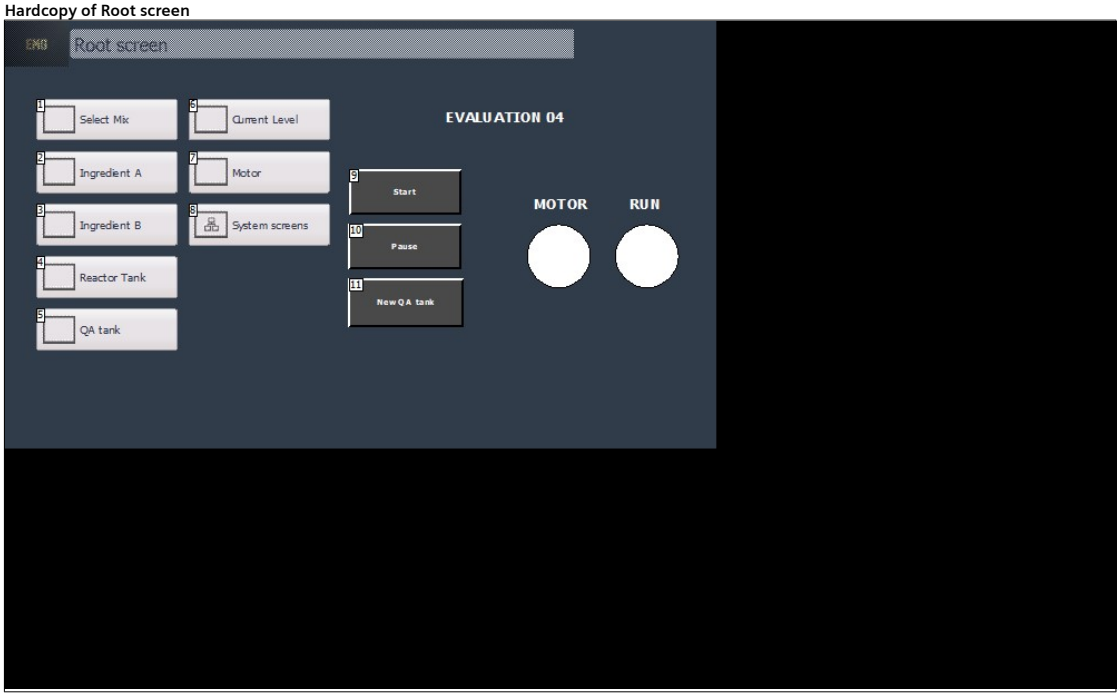
HMI_2 [KTP700 Basic DP] / Screens

Root screen

Hardcopy of Root screen



General					
Name	Root screen	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	1	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

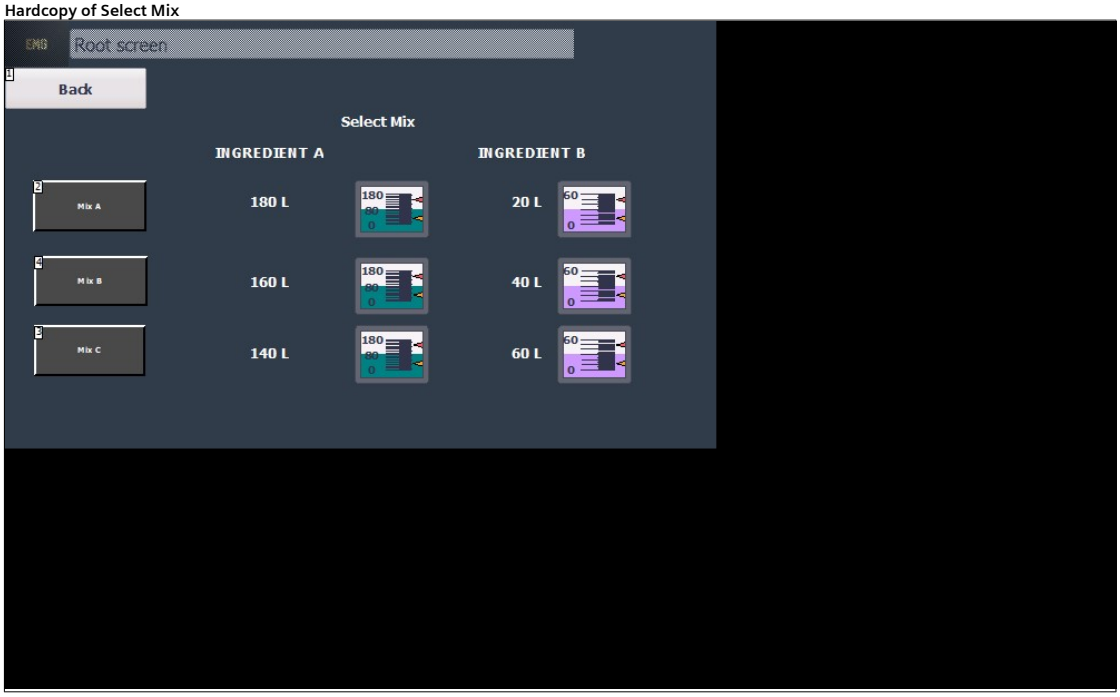
Dynamizations\Event	
Event name	Loaded

Totally Integrated Automation Portal		

HMI_2 [KTP700 Basic DP] / Screens

Select Mix

Hardcopy of Select Mix



General					
Name	Select Mix	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	2	**Template**	Template_1	**Tooltip**	

Layers	
Active layer	0

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

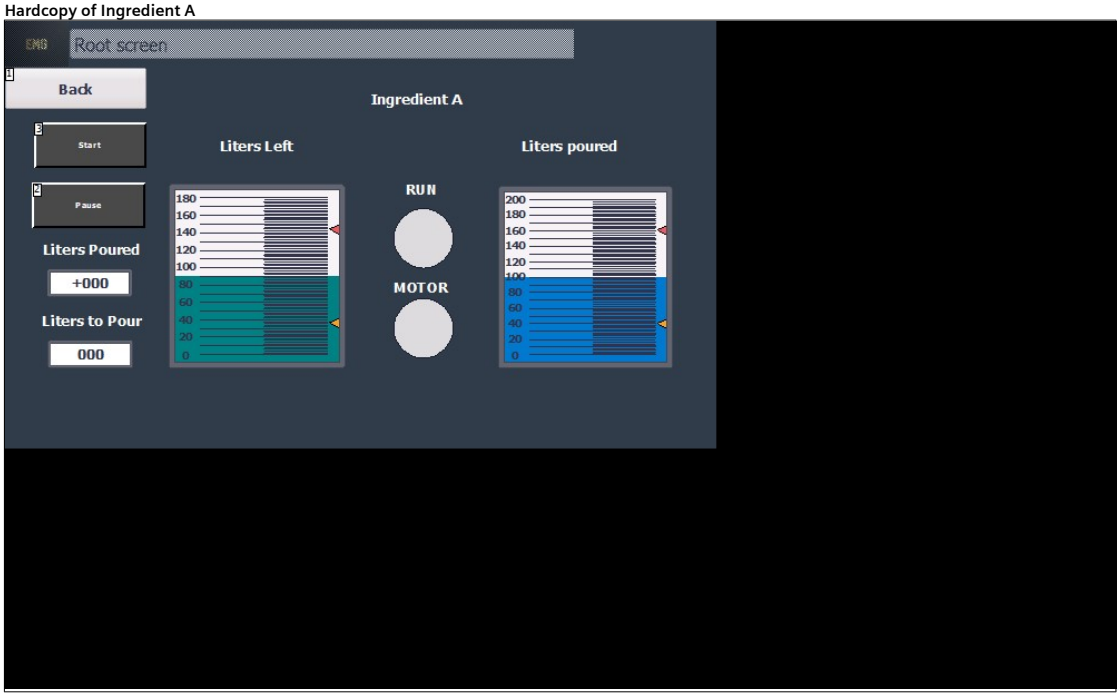
Dynamizations\Event	
Event name	Loaded

Totally Integrated Automation Portal		

HMI_2 [KTP700 Basic DP] / Screens

Ingredient A

Hardcopy of Ingredient A



General					
Name	Ingredient A	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	3	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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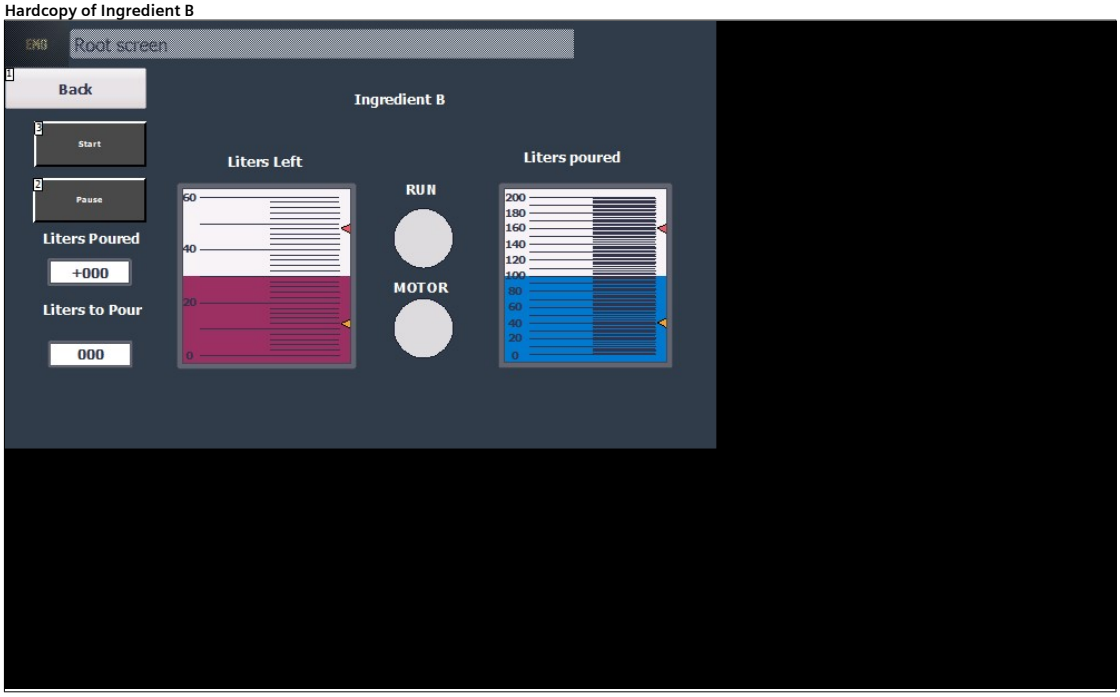
Ingredient B

Hardcopy of Ingredient B



General					
Name	Ingredient B	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	4	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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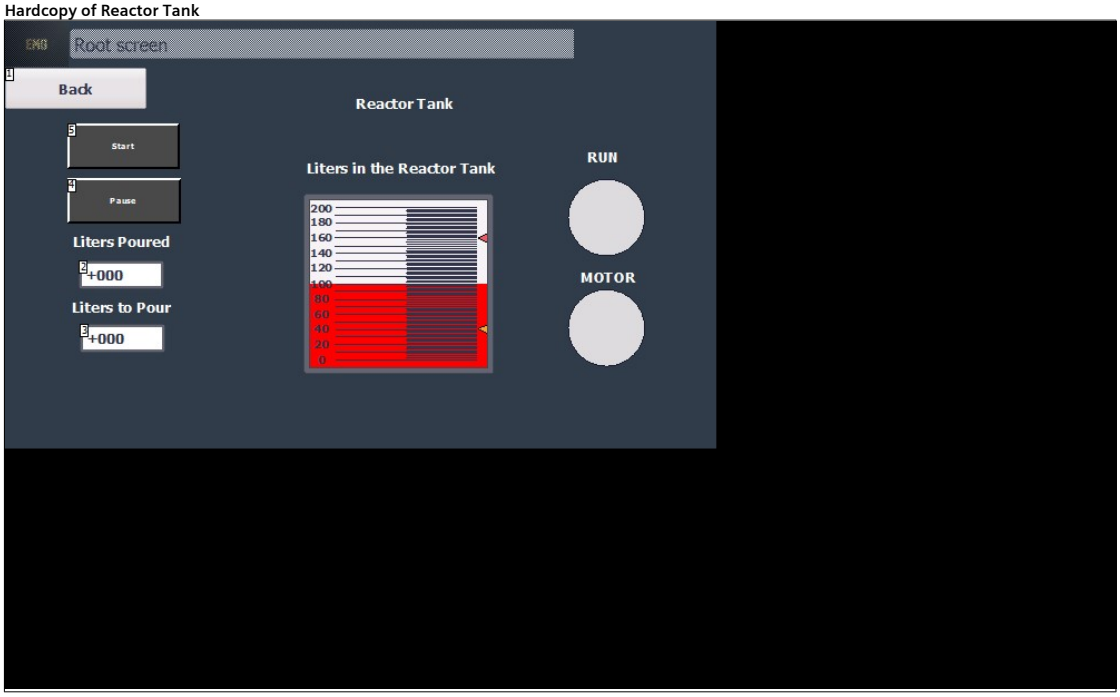
Reactor Tank

Hardcopy of Reactor Tank



General					
Name	Reactor Tank	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	5	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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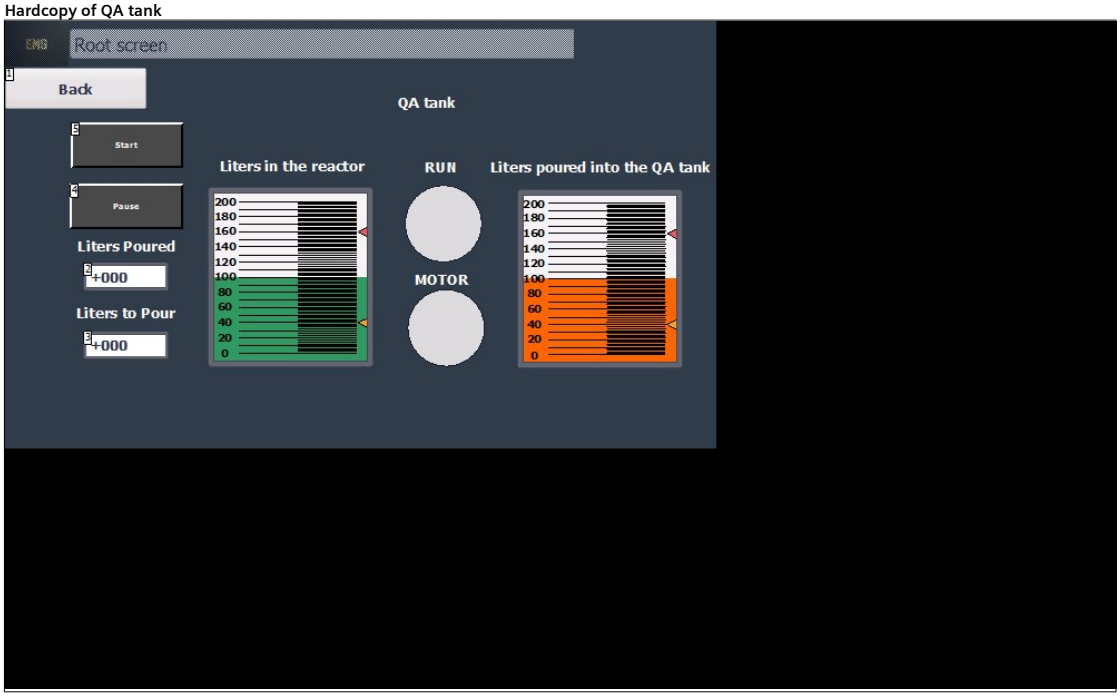
QA tank

Hardcopy of QA tank



General					
Name	QA tank	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	6	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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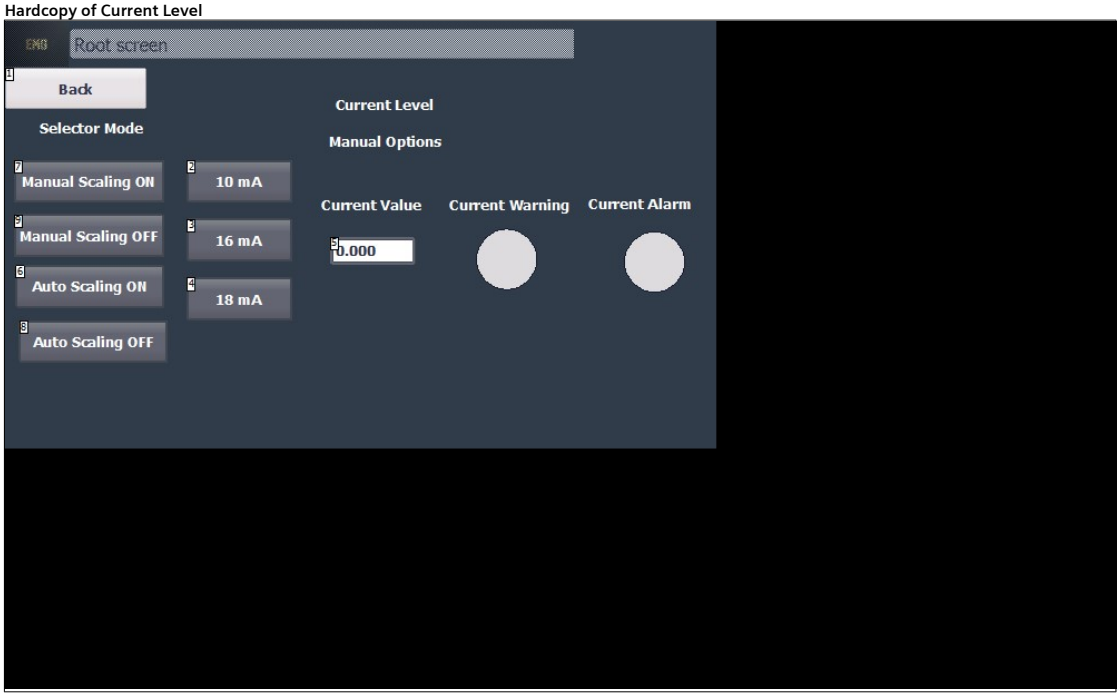
Current Level

Hardcopy of Current Level



General					
Name	Current Level	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	7	**Template**	Template_1	**Tooltip**	

Layers	
Active layer	0

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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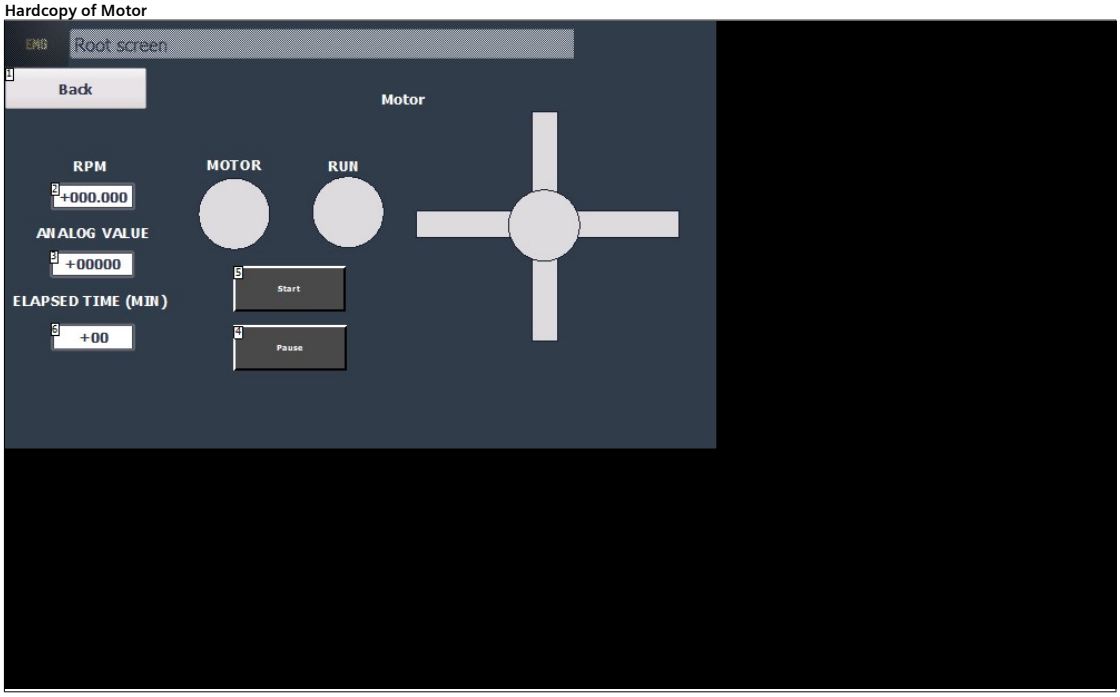
Motor

Hardcopy of Motor



General					
Name	Motor	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	8	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
Layer_9	Checked
Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
Layer_13	Checked
Layer_14	Checked
Layer_15	Checked
Layer_16	Checked
Layer_17	Checked
Layer_18	Checked
Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
Layer_22	Checked
Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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HMI_2 [KTP700 Basic DP] / Screens

System screens

Hardcopy of System screens

General					
Name	System screens	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	9	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
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Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
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Layer_14	Checked
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Layer_16	Checked
Layer_17	Checked
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Layer_19	Checked
Layer_20	Checked
Layer_21	Checked
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Layer_23	Checked
Layer_24	Checked
Layer_25	Checked
Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded

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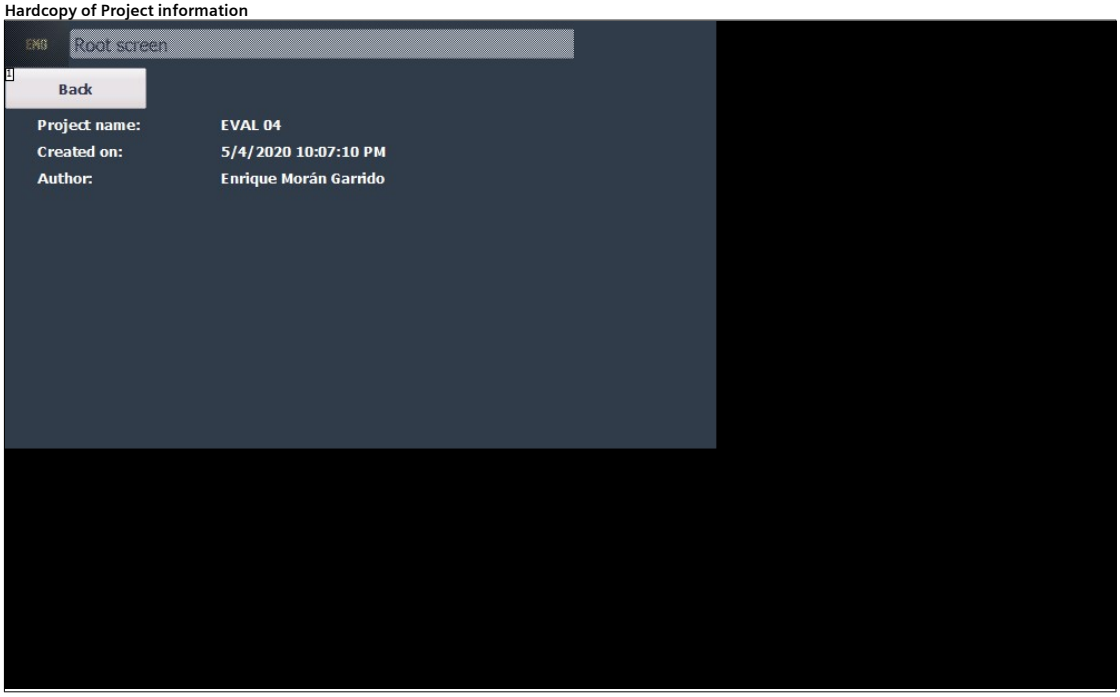
HMI_2 [KTP700 Basic DP] / Screens

Project information

Hardcopy of Project information



General					
Name	Project information	**Background color**	49, 60, 74	**Grid color**	0, 0, 0
Number	10	**Template**	Template_1	**Tooltip**	
Layers					
Active layer	0				

Layer_0	Checked
Layer_1	Checked
Layer_2	Checked
Layer_3	Checked
Layer_4	Checked
Layer_5	Checked
Layer_6	Checked
Layer_7	Checked
Layer_8	Checked
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Layer_10	Checked
Layer_11	Checked
Layer_12	Checked
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Layer_23	Checked
Layer_24	Checked
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Layer_26	Checked
Layer_27	Checked
Layer_28	Checked
Layer_29	Checked
Layer_30	Checked
Layer_31	Checked

Dynamizations\Event	
Event name	Loaded