

# Rockwell Studio5000 SCADA

Software Instructions

V1.0

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# 1) **Overview**

Studio 5000 Logix Emulate is a software application that can simulate the behavior of Logix5000<sup>™</sup> controllers. Studio 5000 Logix Emulate allows user to experiment with and debug the application code in a controlled environment without the need to invest in Logix5000 controllers and I/O modules. Studio 5000 Logix Emulate also allows the testing of HMI applications.

The emulated controller can be programmed and accessed directly from the computer on which Studio 5000 Logix Emulate is installed or remotely through FactoryTalk Linx Gateway.

The simulated controller behaves similar to an actual Logix5000 controllers in most cases.

Instruction consists of 2 parts:

Simple project for PLC and HMI with basic blocks (Analog inputs, Digital inputs, pumps etc.) and instruction bases on DWG. NO SPM-720-001 (Advanced Distillation-Feed system);

Control system for advanced process with Process library by Rockwell Automation bases on DWG. NO. SPM-720-001(Advanced Distillation-Distillation Column and Feed system).

Links:

Studio 5000 Logix Emulate Guide:

https://literature.rockwellautomation.com/idc/groups/literature/documents/gr/lgem5k-gr016\_-en-p.pdf

FactoryTalk View Site Edition User's Guide:

https://literature.rockwellautomation.com/idc/groups/literature/documents/um/viewse-um006\_-en-e.pdf

FactoryTalk View Machine Edition User's Guide

https://literature.rockwellautomation.com/idc/groups/literature/documents/um/viewme-um004\_-en-e.pdf

Logix 5000 Controllers General Instructions Reference Manual:

https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/1756-rm003\_-en-p.pdf

Rockwell Automation Library of Process Objects

https://literature.rockwellautomation.com/idc/groups/literature/documents/pp/proces-pp008\_-en-e.pdf

PlantPax Application Configuration

https://literature.rockwellautomation.com/idc/groups/literature/documents/um/proces-um003\_-en-p.pdf

Process library (PlantPax):

https://compatibility.rockwellautomation.com/pages/search.aspx?crumb=117&q=PlantPAx%20Library



# 2) **Emulate**

## 2.1 Create a new project in Studio5000

Step 1. Start Studio5000 and create a new project using the Studio 5000 Logix Emulate controller type.

Rockwell Softw Stuck Recent Projects	Arre® <b>Side Solution</b> Create New Project From Import From Sample Project Prom Sample Project Create Cr	olore
👌 New Project		? ×
Project Types	Search	×
Architect	Compact GuardLogix® 5370 Safety Controller	<b>^</b>
FactoryTalk View	Compact GuardLogix® 5380 Safety Controller	
	CompactLogix™ 5370 Controller	
S Logix	<ul> <li>CompactLogix<sup>™</sup> 5360 Controller</li> <li>CompactLogix<sup>™</sup> 5480 Controller</li> </ul>	
🕥 View	<ul> <li>ControlLogix® 5570 Controller</li> </ul>	
	ControlLogix® 5580 Controller	
	GuardLogix® 5570 Safety Controller	
	<ul> <li>GuardLogit S580 Safety Controller</li> </ul>	
	<ul> <li>Studio 5000 © Logix Emulate™ Controller</li> <li>Emulate 5570 Studio 5000 ® Logix Emulate™ Controller</li> </ul>	
	Name:	
	Location: C:\Users\EIT\Documents\Studio 5000\Projects ~	Browse
	Cancel Back Next	Finish



 $Step \ 2. \ {\sf Name your new project ``{\sf EIT_Rockwell\_1''}}.$ 

🕝 New Project					?	×
Project Types			Search			×
Architect         FactoryTalk View         Logix         View	<ul> <li>Compa</li> <li>Compa</li> <li>Compa</li> <li>Compa</li> <li>Compa</li> <li>Compa</li> <li>Contro</li> <li>Contro</li> <li>Contro</li> <li>GuardI</li> <li>GuardI</li> <li>Studio</li> <li>Emi</li> <li>Name:</li> <li>Location:</li> </ul>	ct GuardLogix® 5 ct GuardLogix® 5 ctLogix™ 5370 Co ctLogix™ 5380 Co ctLogix™ 5480 Co lLogix® 5570 Con lLogix® 5570 Con lLogix® 5580 Con .ogix® 5580 Con .ogix® 5580 Safet; 5000® Logix Emu ulate 5570 Studic EIT_Roclevell_1 C:\Users\EIT\Doc	370 Safety Contro 380 Safety Contro ntroller ntroller troller troller y Controller y Controller late™ Controller o 5000 © Logix Em	ulate™ Controlle 00\Projects ~	er Browsi	÷
		Cancel	Back	Next	Finis	h
O New Project					?	×
Emulate 5570 Studi EIT_Rockwell_1	o 5000⊛ Logi	x Emulate™ Co	ntroller			
Revision: 3	2 *					
Chassis: 1	756-A10 10-5	Slot ControlLogix	Chassis	v	1	
Slot: 2						
Security Authority:	lo Protection				$ \alpha $	
	Use only the si authorization	elected Security A	uthority for authe	ntication and		
Secure With:	Logical Name	<controller name<="" td=""><td>&gt;</td><td></td><td>in.</td><td></td></controller>	>		in.	
Description	Permission Set					
		ii 🖍				
		Cancel	Back	Next	Finis	sh



#### Step 3. Controller Organization in LogixDesigner



We have project with configuration for simulation in LogixDesigner. Before we start simulation, we need to start emulator and create HW configuration for our simulation.



## 2.2 Create a new HW configuration in Studio5000 Logix Emulate

**Step 1**. Click Start > All Programs > Rockwell Software > Studio 5000 Logix Emulate. The Studio 5000 Logix Emulate window opens.



Step 2. Create a new plc in a Rack. Select Emulate 5570 Controller in Module type list.







Leave all setting as it is and press "Finish"



Slots 9-16 can be hidden as they are not in use, to make the virtual chassis take up less screen space.



# 2.3 Downloading project from Logix Designer to Logix Emulate

Downloading a new project will overwrite the existing program in the CPU (real CPU or simulator). One should be careful during this step and make sure that the correct program is being downloaded to the correct CPU.

There are some important rules which you have to follow:

- RSLinks drivers should be configured correctly with the correct path to the CPU
- Configure the Studio 5000 Logix Designer project to match the configuration of the virtual chassis

Before the program is downloaded to PLC the software will compile the program and check for errors, if program compiles successfully without errors then downloading to the PLC is possible.

Before downloading we need to configure our driver for Studio 5000 Logix Emulate and then check the path to CPU.

Step 1. Open RSLinx. Start > All Programs > Rockwell Software > RSLinx Classic. The Studio 5000 Logix Emulate window opens. Create new driver for our simulator. Select "Configure driver"



Choose "Virtual Backplane" from Available driver types and add it. Leave all settings as they are.

	<ul> <li>Add New</li> </ul>	Help
1784-020HP for DH+ devices RS-232 DF1 devices		Trap
EtherNet/IP Driver 1784-PKTX[D]/PCMK for DH+/DH-485 devices DE1 Bolico Master Driver	Status	0.0
1784-PCIC(5) for ControlNet devices		Configure
DH 1 Stave Diver	_	Startup.
DeviceNet Drivers (1770-KFD,SD, CT drivers) SLC 500 (DH485) Emulator driver		Start
Remote Devices via Linx Gateway		Stop
		Delete



Step 2. Choose correct CPU and click "Go online"



Step 3. Go ahead and download your program



Step 4. Change the mode of CPU. Switch CPU to run mode.







Now we are online and can see how our program works.



# 3) LogicDesigner

### 4.1 Create project in LogixDesigner

Step 1. Go offline. Add customs library to the project.



Go to "Controller organizer", select "Add-On Instructions", right-click -> "Import Add-On Instructions". We need to add P\_Ain, P\_Din, P\_Motor, P\_PIDE and P\_ValceC instructions. You can read more about these instructions here:

P\_Ain -https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/syslib-rm001\_-en-e.pdf

P\_Din https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/syslib-rm003\_-en-e.pdf

P\_Motor <u>https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/syslib-rm006</u> -ene.pdf

P\_PIDE

https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/syslib-rm045\_-en-p.pdf

P\_ValveC

https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/syslib-rm034\_-en-p.pdf





Select the folder containing the Process library. Select elements which you want to add. Go to

folder /Files/Process Objects Library/ProcessAdd-on Instruction and click "Open".

« Proc	ess Lik	orary v4.0-02  Files  Process Objects Library  Proce	ss Add-On Instructions	•
New	folder			
	<b>_</b>	Name	Date modified	Туре
р		I_1794IF8IHNFXT_4.00.01_RUNG.L5X	12/6/2018 4:53 AM	Logix Des
bads		I_1794OF8IH_4.00.01_AOI.L5X	8/29/2018 2:55 PM	Logix Des
Places		I_1794OF8IH_4.00.01_RUNG.L5X	12/6/2018 4:53 AM	Logix Des
		P_AIChan_4.00.00_AOI.L5X	7/26/2018 3:31 PM	Logix Des
	≡	P_AIn_4.00.01_AOI.L5X	8/29/2018 2:55 PM	Logix Des
ients		P_AInAdv_4.00.01_AOI.L5X	8/29/2018 2:56 PM	Logix Des

Now we have some elementary blocks in our program.



#### Step 2. Add variables. Controller Tags -> Edit Tags



Create tag "TI\_001" and choose P\_Ain as Data Type for this tag.

Controller Tags - EIT_Rockwei	l_1(controller) ×				
Scope: DEIT_Rockwell_1 ~	Show: All Tags				
Name	=≣ ▲ Base Tag	Data Type	Description	External Access	Constant
▶ TI_001		P_Aln	Analog Input	Read/Write	
<i>•</i>		63			

#### Step 3. Create task and program.

Create the task for TI\_001. Go to "Controller organizer", select "Tasks", right-click -> New Task. Call it "FEED SYSTEM". Leave all setting as it is.





Create program for "TI\_001". Go to "Controller organizer -> Tasks->FEED SYSTEM", select "FEED SYSTEM", right-click -> New program. Call it "Sensors".

New Program			×
Name:	Sensors		OK.
Description:		^	Cancel
		~	Help
Parent:	<none></none>	~	
Use as folder			
Schedule in:	FEED_SYSTEM	~	
🗌 Inhibit prog	ram		
Open propertie	\$		

Now we need to create main routine for all routines of our tasks and routine for TI\_001.

Name:	MainRoutine		OK
Description		^	Cancel
		~	
Туре:		~	Help
In Program or Phase:	b Sensors	~	
	Assignment: 🗈 Main	~	

For TI\_001 we need to select FBD Type.

Name:	TI_001		OK
Description		^	Cancel
		~	
Туре:	Struction Block Diagram	~	Help
In Program or Phase:	b Sensors	~	
	Assignment: <none></none>	~	



Add JSR control element and select "TI\_001" routine there.

BD Element: JSF	1	Instruction Help >>
lame	Description	
BAND	Boolean And	^
- 🕞 BOR	Boolean Or	
- BXOR	Boolean Exclusive Or	
BNOT	Boolean Not	
- DFF	D Flip Flop	
-OF JKFF	JK Flip Flop	
SETD	Set Dominant	
- RESD	Reset Dominant	
- 🔄 Program Ci	ontrol	
	Jump to Subroutine	~
Show Language	Elements By Groups	OK
		Cancel
law Add On Inste	otion	Halo



In TI\_001 program add block P\_Ain from "Add\_on". Select P\_Ain TI\_001.





🔨 Enter Name Filter		~ S	www. All Tags	
Name	== Data Type	Usage	Description	
P_Aln_01	P_AIn	Local	Analog input	
∎ ▶ TI_001 N	P_AIn	<controller></controller>	Analog input	
μď				
Ъŝ				
] Show controller tags				

## 4.2 Downloading project from Logix Designer to Logix Emulate

Step 1. Verify and download the program.





r40	Same?	
T_001	100	
np_PV	Va p	
Ci <u>'g_</u> HiHiLim	Val_inpPV D	
Cfg_HiLim	Sts_Er 🖻 🚆	
Cfg_LoLim	Sts_HiH D 💭	
Cig_LoLoLim	Sts_H D	[
	Sts_Lo D	Downloading
	Ste_LoLo D	Varifying routine 'MainBoutine' of program 'Sensors'
	Sts_Fall	verying tourie main tourie of program sensors
1	Sts_FailShelved	
		Cancel

Step 2. Change controller mode to Remote Run.







Now we can debug and correct our program in online mode.



# 4) **FactoryTalk**

#### 5.1 Create a new project in FactoryTalk

 $Step \ 1. \ {\tt Start \ Factory Talk \ and \ create \ a \ new \ project \ (Site \ Edition).}$ 

🕝 New Project				? ×
Project Types		Search		×
Architect	View ME		-	
D FactoryTalk View	<ul> <li>View SE</li> <li>Distributed</li> </ul>			
💰 Logix	Local Station		View SE Lo	ocal Station
🕥 View			9701-VWSB0 9701-VWSB0 9701-VWSB0 9701-VWSB1 9701-VWSB2	IDDAENE 11 SAENE 12 SAENE 12 SAENE 12 SOAENE
6				
l.	Name:			
	Cancel	Back	Next	Finish

Step 2. Name your new project "EIT\_Rockwell\_1".

Name: Location:	EIT_Rockwell_1			
	Cancel	Back	Next	Finish

**Step 3.** Add new server. Go to "EIT\_Rockwell\_1", right-click -> Add New Server. Select Rockwell Automation Device Server (FactoryTalk Linx)



Explorer		×	
EIT Rockwell	LIC3DBJ)		
	Delete		
⇒ ⊑ Ell_Koc ⇒ ⊆ Syste	Add New Server	>	Rockwell Automation Device Server (FactoryTalk Linx)
	Security		OPC DAServer
🗸 🧷 Ta	Properties		OPC UA Server
🖨 듴 Graphics			

**Step 4.** Add connection to the plc. Open communication server and add new plc. Find and select online plc for this project (it can be emulator or real plc). Both real and simulated PLC will show up in the list and the user can select any PLC which he wants to connect with.







l	Device Shortcuts	Primary
l	Add Remove Apply	E- FactoryTalk Linx - Desktop, DESKTOP-LIC3DBJ
l	PLC S	😑 📾 1789-A17, Backplane
l		🔋 0, RSLinx, RSLinx Server
l		👜 - 🗾 2, 1756-Lx/Em, EIT_Rockwell_1
l		⊕-器 EtherNet, AB_ETH-1
l		효-器 EtherNet, AB_ETHIP-1
		🗄 📲 EtherNet, Ethernet

As shown above we have selected the emulated PLC here. Apply changes

FactoryTalk Linx
Save the following changes to the shortcut 'PLC'?
Primary path changed - Old: - New: Backplane.RSLogix 5000 Emulator 1
Click Yes to apply changes. Click No to discard changes.
Yes No

Select your plc project, verify and apply.

fine Tag File	Droraeen				Bro
and the	Processi				
	EIT_Rockwell_1.AB-ES.Engin.BAK005.acd	2/13/2020 9:47 PM	Logix Designer Pr	1,767 KB	
	EIT_Rockwell_1.AB-ES.Engin.BAK006.acd	2/13/2020 10:26 PM	Logix Designer Pr	1,771 KB	
	EIT_Rockwell_1.AB-ES.Engin.BAK007.acd	2/14/2020 6:24 AM	Logix Designer Pr	1,997 KB	
	<pre> @ EIT_Rockwell_1.ACD </pre>	2/14/2020 6:30 AM	Logix Designer Pr	1,977 KB	
	13				
		Mode: Online N	ot Browsing		

Offline Tag File	: Projects EIT_	ockwell_1.ACD	 
Shortcut Type	Processor	ß	 OK Cancel Verity Help
			NUM



Shortcut Verifie	r i i i i i i i i i i i i i i i i i i i	
Application type	: FactoryTalk View Site Edition (Local).	^
CPR: 9 Server: 'RNA://	<pre>\$Local/EIT_Rockwell_1/FactoryTalk Linx' on 'localhost'.</pre>	
Shortcut 'PLC': - Note:	Path to Primary device is assigned [Logix Device].	
4		
How to use the	Shortcut Verifier	Close
	FactoryTalk Linx	
	Save the following changes to the shortcut 'PLC'?	
	- Old: - New: C:\Projects\EIT_Rockwell_1.ACD	
	Click Yes to apply changes. Click No to discard changes.	
	Y S No	

**Step 5.** Create display for your application. Make simple background for display acc. P&ID. (Advanced Distillation. FEED SYSTEM SPM-720-001. Appendix A)



Create new display with the name "FEED\_SYSTEM"







roperties	Behavior	
Dis	splay Type Peplace Overlay Keep at Back On Top	Size Use Current Size Specify Size in Pixels Width: 3840 Height: 990
Ca	Ilow Multiple Running Copies che After Displaying No Yes Always Updating	Resize
T	itle Bar	Position © Use Current Position © Specify Position in Pixels
S N S S	Insert Variable Animize Button Assimize Button Size to Main Window at Runtime Show Last Acquired Value	X: 0     Y: 170       Security Code:     •       Background Color:     Image: Use Gradient Style
Maxi	mum Tag Update Rate: 1 v seconds Screen Statistics	Track Screen for Navigation Navigation History Screen Name: Overview





Step 6. Add background wallpapers in "SYSTEM\_FEED" screen.



mage Browser		X
Select image:	Preview:	
Arrow Down Arrow Left Arrow Right Arrow Up Backspace End Enter FEED SYSTEM Home D Page Down Page Up		Add from File Launch Library Paste from Library Delete
Image attributes Type: Width x Height: Format:	ОК	Cancel Help



General Common				
Size Height	Width:	Position Top:	Left	
010	1500	0	4	
Other				
Name:				
Image1				
Visible				
Toonp text.				
			-	
			Insert Variable	



Properties	
Connections	
VBA Code	
ActiveX Events	
Methods	
Object Keys	
Arrange	•
Animation	•
Convert to <u>W</u> allpaper	
Tag Substitution	
<ul> <li>Property Panel</li> </ul>	
✓ Object Explorer	
Cut	
⊆opy	
Paste	
Paste without localized strings	
Delete	
Duplicate	
Copy Animation	
Paste Animation	
Global Object Defaults	
Global Object Parameter Values	
Global Object Parameter Definitions	
Edit Base Object	
Break Link	

## Step 7. Numeric object

Use the Numeric Display tools in to create objects an operator can use to view tag or expression data at run time. In the Numeric Display or String Display Properties dialog box, specify the tag or expression to display, and the appearance of the display object





eneral	Common	1					
Expr	ession						
1							
	lf	Logical	Relational	Arithmetic	Bitwise	Functions	Tags
	Check Syntax						Alarms
Num	eric					Justification	
Form	nat: De	cimal	✓ Overf	low: Show ex	ponent v	C Left	
Field	Length:	11	R 🗐	now Digit Groupi	ng	<ul> <li>Center</li> <li>Right</li> </ul>	
0	Fixed deci	mal places	0			Leading Cha	aracter
		lecimal places				Blanks	Zeroes

Step 8. Make connection between Numeric display and plc tags.



 ${\sf EIT\_Rockwell\_Studio5000\_SCADA\_Software\_Instructions\_new}$ 

In tag browser refresh all folders and select online tags, which we want to connect.

elect Tag			
olders			
B- 👘 ETT_Rockwe	4 <u>1</u>		
Refresh All Folders	Tag Blar	(Nones	
elected Tag	B		
ome area:	2		
			_
Folders			



	PLC     Diagnostic Items     Offline     Opline
	Program:MainProgram     Program:Sensors     TI_001
ate v	ReadUniy
	ReadOnly
t 🗧	ReadOnly
lumeric D	Nicolay Properties
General	Common
General	Common
General Expr	Common ression C[TI_001.Val]
General Expr	Common ression C[11_001.Val]
General Expr	Common ression  II Logical Relational Arithmetic Bitwise Functions Tags

Folders

#### Step 9. Text object

Use the Text tool to draw a text object. You can then create the text and set up its appearance in the Text Properties dialog box.





Seneral Common		
Text		
TI_001		~
Font:	Size:	Insert Variable
Arial 👻	10 💌	B Z U
Back color	Alignment	Back style:
Fore color Size to fit Word wrap	000 000	Transparent 👻

Our application has simple HMI with numeric and text fields. Numeric field connects to plc tag (TI\_001.Val) and Text field shows us tag name. In the second part of the laboratory, we will know how to create a process object with name and value automatically with PlantPax library.





Step 10. Runtime in FactoryTalk.

We can check our connection between numeric object and plc tag in FactoryTalk. We need to start "Test display" mode.



Step 11. Make runtime application.

Start "Launch SE client"







Call your runtime, in our laboratory our application calls "EIT\_Rockwell\_1"

FactoryTalk View SE Client Wizard			
1. File name and location	File name and location	on	0
	Client file name:	EIT_Rockwell_1	
	Store location:	C:\Users\Engin\Desktop	
			Continue
			Conti



Select application type, choose FactoryTalk application and language for our runtime. Select initial display and click "run" to start runtime application.

2. Startup components       Application type:       Network Distributed       Network Station       Iscal Station         Connect to the application       Ell_Bockwell_1            Initial lenguage:       Englah (United States), en-U5           Startup components       Hill server name:           Initial display:       ESE0_SYSTEM           Initial display:       ESE0_SYSTEM           Startup nazor:             Shutdown macro:             3. Advanced settings
2. Startup components     Connect to the application     EIT_BockeelL1       Initial language:     English (United States), en-US      Startup components     HMI server name:     //IT_RockeelL1     ··     Initial display:     EEG_SYSTEM     ··     Display parameters:     Initial display:     Startup nacro:     Shutdown macro:     ··     Shutdown macro:     ··
Contect to the application     III peckwell_1     •       Initial inguage:     English (United States), en-U5     •       Startup components     Hill server name:     •       /ATT, Rockwell_1     •     •       Initial display:     FED_SYSTEM     •       Display parameters:     •     •       Initial client kay:     •     •       Shutdown macro:     •     •
Initial inguage:       English (United States), en-US       ~         Startup components:       Hill sever name:       ~         Aff. Rockwell 1       ~       ~         Initial display:       FEE0_SYSTEM       ~         Display parameters:       ~       ~         Initial diserters:       ~       ~         Startup macroi       ~       ~         Sturtup macroi       ~       ~         Sturtup macroi       ~       ~         Sturtup macroi       ~       ~         Sturtup macroi       ~       ~
Startup components         Hill savor name:         /ETI Rodovel_1         Initial display:         Itial display:         Display parameters:         Initial display:         Startup macroi:         Startup macroi:         Startup macroi:         Startup macroi:         Startup macroi:         Startup macroi:
Hill server name:         AET_Rockwell_1         Initial display:         EED_SYSTEM         Display parameters:         Initial display:         Startup macro:         Startup macro:         Shutdown macro:
Advanced settings
Initial display:       FEED_SYSTEM       ~         Display parameters:
3. Advanced settings
3. Advanced settings
3. Advanced settings
Shutdown macro: •
Shutdown macro: ~
3. Advanced settings
Back to home     Advanced     Save     Run
H at



Cen DenAt

11\_001 D

From off-Spec R

Display FEED\_SYSTEM

Hot oil a

