# pbsHMI Concepts

Version: 4.1

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**Update Date: June 2025** 

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## **1 – Introduction**

pbsHMI is a SCADA/HMI platform based on Dot Net X64 bits technology. To use pbsHMI you need to read this document.

pbsHMI supports following functionalities :

- Object oriented graphic pages and symbols with different dynamics and events
- Modbus RTU/TCP Master Driver
- DNP3 Master Driver over TCP and RS232 with IEC62351
- IEC870-5-104 Master Driver with IEC62351
- MQTT Driver
- S7 Driver
- Vestas Wind turbine VMP Protocol.
- Beckhoff ADS Protocol.
- OPC UA Client /Server
- Alarm / Event Management
- C# Scripting
- Scheduling
- SQL Server Data logging
- Offline and Online Trending
- Different type of dynamics for graphic objects
- Reusable graphics symbols
- Web Server function
- Power grid network tools for simulation and estimation
- Machine learning modules for forecasting , anomaly detection , network learning
- Smart Battery management module

pbsHMI is designed for rapid development of HMI/SCADA applications. You can easily create graphical pages and connect them to external signals.

pbsHMI requires the following software components to function properly:

- Microsoft Dot Net Framework 4.7.2 Runtime , 64 Bit
- Microsoft SQL Server for data logging on SQL Server
- Visual C Runtime. you can find it in Utility Directory of pbsHMI
- Microsoft Office for data logging on Access database and generating excel reports

You can download pbsHMI from www.pbscontrol.com

Download and unzip it to any folder you want.

You can find following files in the pbsHMI folder:

• pbsHMIEditor.exe : development environment of pbsHMI . All configurations will handle by pbsHMIEditor application .



• pbsHMIView.exe : runtime version of pbsHMI



- pbsHMITrend.exe : Historical Trend Utility .
- Option.xml : option file of pbsHMI
- GLIB\_x.dll Symbole definition file . pbsHMIEditor and pbsHMIview will load dynamically all GLIB\_x.dll file and startup . You can compile new GLIB\_X.dll symbol file by symbol Editor but it will not affect on system until you restart pbsHMI View.
- All Other files are system files and must be in pbsHMI Directory.

You can define multiple projects and select one of them as the active project.

You can run multiple instances of the pbsHMI IDE and runtime simultaneously with different active projects.

## 2 - Basic concepts, Development and Runtime Modules

pbsHMI has a development IDE and a core or runtime viewer. When you run pbsHMIEditor, you can see



In the right panel, you can see the various pbsHMI modules as follows:

- Channels : pbsHMI Communication Drivers
- Tags : pbsHMI Device , Global , Alarm and event Tags
- Database : Database configuration
- Scheduling : running C# scripts by scheduling
- Utilities : Set Active project , runtime parameters , users
- SoftLogic : Write Function Block Programs
- Networks : define Power grid network , handle Power flow and state estimation function and run ML for network ,GNN
- Pages : Define Graphic pages
- Scripts : Writ C# scripts
- Symbols : Define new Graphic Symbol
- Machine Learning : Define ML Modules for forecasting , anomaly detection, Smart Batter management

In the left panel you can see different tools like graphic symbols for pages or network elements for network module.

In the middle you can see the content like graphic page.

Explorer and tools windows are docking panels and you can set them as auto hide.

You can change Explorer and tools window as float panel. Click on top part of window and drag it.



- Menu Item with bold font is default (Double Click) function. For all component default function is open component.
- "Explorer" menu item is for opening component directory. For deleting, renaming and copy/paste component you should use windows explorer.
- "Refresh" menu item will refresh component list.
- You can see Graphic symbols properties in properties tab of explorer window.



- All graphic dynamics and events are configured by properties window.
- In Draw Tab of Tools window, you can see Pen, Brush, Color and pen Tools for easy configuration of graphics symbols.

File Help						
Draw 유	DEOP	ant.pgp				
Pen Brush Color Text 9    Solid	File	Edit	View	Format	Tools	
			Screen Text	Test		T3
				Text		P3 0 mb S10

File Help			
Draw 유	DEOP	ant.pgp	1_Sc
Pen Brush Color Text	File	Edit	View
$\times$			



File Help				
Draw 🖗	DEOPI	ant.pgp	1_Scr	eens.pgp
Pen Brush Color Text	File	Edit	View	Forma
RGB #6666666 OLD #6666666 A				
Basic System Web Custom				
				PV-401

File Help				
Draw 용	DEOP	ant.pgp	1_Scr	een
Pen Brush Color Text	File	Edit	View	F
Microsoft Sans Serif 🗸 11 🗸				
₿ / U \$ ≌ ₩ <b>■</b> ∎ ≞ ≣				
				1
				+

You can setup project settings by "Utilities" panel .Double click on "Settings" item, you can see following page:

📁 pbsHMI I	Editor Ver 4.1.0 RC1 User = Active Project	Path=C:\LynasHMIX64			- o ×
File H	elp				
Tools	÷	SLD.pgp AlenCon.cs Setting	s		× Explorer 😵
GLib	_Boilers •	Basic Network OPC UA Serve	er Gateway Web Server		💋 💋 Pages 🔮 Scripts 💾 Symbols
Figures	Basic Tools GLib_Boilers	Activo Project Path			Channels  Tags  Database Machine Learning
	🔜 🥼 🚮	Runtime Startup Page S	SLD.pgp	Runtime Instance Lynas	SoftLogic Networks
Boiler 0	Boiler1 Boiler10 Boiler11	pbsHMI View Always on To	op 🛛 🖉 pbsHMIView Cont	rol Box 📃 Utility Page Float	Scheduling go Othitles
Boiler 1 2	Boiler 13 Boiler 14 Boiler 15	Load Events	Load Alarms	🗹 Load Trends	Settings
		Load Diagnostic	🗆 Load SoftLogic	Load Network	
Boiler 1 6	Boiler 17 Boiler 18 Boiler 19	Load Machine Learning			
		pbsHMIView tools Visual Styl	le Office2010	<b>*</b>	
Boner 2		pbsHMIView Content Visual	Style Office2010	•	
Boiler 2 3	Boiler 2 4 Boiler 2 5 Boiler 2 6	Automatic User Logout Time(	(min) O		
Boiler 2 7	Eciler 28 Eciler 29 Eciler 3	EnableCommandAtStartup	SoundISEnable	System Log Enable	
Boiler 3 0	Boiler 31 Boiler 32 Boiler 33				
Boiler 3 4	Eciler 3 5 Eciler 4 Eciler 5				
Boiler 6	Boiler 7 Boiler 8 Boiler 9				
Tools	Draw				Properties Explorer

You can set a new or defined project path by "Active Project Path" text. Type a new path and right click and save new configuration.

SLD.pg	gp AlenC	on.cs 🚦	Settings				
Basic	Network	OPC UA	Server	Gateway	Web Server		
Acti	ve Project	Path	C:\	_ynasHMI>	(64		
Run	itime Starti	up Page	SLI	Э.рдр		<ul> <li>Runtime Insta</li> </ul>	ance Lynas
🗆 pl	bsHMI Vie	w Always	s on Top	🔽 pb	sHMIVie <del>w</del> Co	ntrol Box	Utility Page Float
	oad Events	5		Lo	ad Alarms	Save	Load Trends
🗹 Lo	oad Diagn	ostic		🗆 Lo	ad SoftLogic		Load Network
	oad Machi	ne Learn	ing				

If you set a new path, you need to exit application and run pbsHMIEditor.exe. At startup if project path is new, pbsHMIEditor create all folders and necessary files at specified project path.

pbsHMI project folder has following structure :



Channels: Communication driver settings

Database: Data Logging Settings

Htmls: exported html files for pbsHMI Web Server.

ML : Machine learning modules and settings

Networks : Power grid configurations and modules

Pages : Graphic pages

Psle : Function Block files . SoftPLC

Scheduling : running C# Scripts by user defined schedules

Scripts : user C# Scripts

Svgs : Exported graph pages to SVG format for Web Server

Tags : Defined device , Global , alarms and event tags

TrendGroups : user defined Trends

Option.xml : project settings and parameters

pbsHMIUserScript.dll : generated by pbsHMIEditor at compile time of C# Scripts

For running pbsHMI Project, you need to run pbsHMIViewer.exe, runtime application. pbsHMI runtime, open active project and load drivers, alarms, events, Database modules and shows startup page.



You can see following page structure when pbsHMI runtime is loaded:

At the left side you can see list for visible pages, updating runtime and utility menu. At the right side you can see startup page or selected page by user. Also trends, alarms, Events and Diagnostic pages can be shown based on project settings.

If diagnostic is loaded in the setting page, then you can see a Diagnostic tab in the pbsHMI runtime. Like following image:

Tools	ß	Pages Trends 🍨 Diagnostic		
Pages	*	Diagnostic Errors		
AlenCon.pgp ComAP.pgp		pbsHMIView Start Time 14	4 June 2025 09:56:18	
JohnR.pgp Reports.pgp		Number of Device Tags 76	51	
ShanesCastleC1.pgp SLD.pgp		Number of Alarm Tags 0		
WilsonPotato_SLD.pgp		Number of Global Tags 29	3	
Channels	*	Current User A	dmin	
Iltility	*	Number of License Tag 50	000	
Login		Free Ram(MB)	4416	4816
Change Password		CPU usage(%)	1	
Disable Commands		Current Physical Threads	41	45
Enable Declutring		Current Logical Threads	43	5
Shut Down				
		Private MBytes	115.0977	115.8672
		MBytes on All Heaps(Managed)	15.83589	25.62985
		Unmanaged memory	99.26176	90.23734
		pa	rameters at first 300 sec	parameters at Current Time

This is showing when runtime is started, is there license for pbsHMI or not, number of device tags, number of global and alarm tags and information about memory and system resources.

If pbsHMI is running without license you will see -1 for number of license tags and system will stop updating tags after 30 min.

# 3 - Quick startup project

In this section , we will define a simple project based on Modbus TCP protocol and define a graphic page with a few dynamics and events .

Step 1: run pbsHMI Editor, go to Settings panel and double click on settings item.

Type new project path for example "C:\pbsHMIprojects\QuickMTCP" as following:

Settings					
Basic Network OPCUA Server Gateway Web Server					
Active Project Path C:\pbs	HMIprojects\QuickMTCP				
Runtime Startup Page	▼ Runtime	Instance Main			
pbsHMI View Always on Top	pbsHMIView Control Box	Utility Page Float			
Load Events	Load Alarms	Load Trends			
Load Diagnostic	CLoad SoftLogic	Load Network			
Load Machine Learning					
pbsHMIView tools Visual Style	Office2010 🔹				
pbsHMIView Content Visual Style	Office2010 🔹				
Automatic User Logout Time(min)	0				
EnableCommandAtStartup	🗹 SoundISEnable 🛛 🔽 Syst	em Log Enable			

Right click on the page and save setting. Because active project name is changed, you need to restart pbsHMI editor.

Settings		
Basic Network OPC UA Server	Gateway Web Server	
Active Project Path C:	\pbsHMlprojects\QuickMTCP	
Runtime Startup Page	<ul> <li>Runtime Inst</li> </ul>	tance Main
pbsHMI View Always on Top	o 🔽 pbsHMIView Control Box	Utility Page Float
Load Events	Load Alarms	Load Trends
Load Diagnostic	Load SoftLogic	Load Network
Load Machine Learning		
pbsHMIView tools Visual Style	, X	
pbsHMIView Content Visual S	tyle You Should Restart pbsHMI editor.	
Automatic User Logout Time(n	nin)	
EnableCommandAtStartup	Counciernation Counciernation Counciernation	Log Enable

After executing pbsHMI Editor, you can see following screen:

pbsHMI Editor Ver 4.1.0 RC1 User = Active Project Path=C:\pbsHMIprojects\QuickMTCP	-	o ×
File Help		
Tools O	Explorer Machine Learning	- <b>₽</b>
Figures Basic Tools	ing s and s	mbols
And Date Anow Asterisk Line		
Bpmn Activity Ad Hoc Bpmn Activity Compensatio		
Bpmn Activity Loop Bpmn Activity Parallel		
Bpm Activity Sequential Bpmn Event Conditional		
Bpmr Evert Error Bpmn Event Estation		
Bpm Fiver Timer Bpm Task Message		
Bpmn Task Person Head Bpmn Task Person Shirt		
Bpmn Task Skript BpmTTask User Buffer		
Tools Draw	Properties Explorer	

pbsHMI is created necessary folders and setting files at startup .

Click on "Channels"; right click on the list area, you can see following items:

Expl P Mac S S S S S S	orer
	Open Channel
	New ModbusTCP/RTU Channel
	New DNP3 Channel
	New IEC870-5-104 Channel
	New TwinCAT ADS Channel
	New MQTT Client
	New Redis Client
	New S7-Channel
	New ModbusTCP Slave Driver
	New Vestas Driver
	New OPC-UA Channel
	Explorer
	Pafrach

Click on "New Modbus TCP Channel", a new channel with "NewChannel1.xml" name is created in the "channels" panel.

NewChannel1.xml				×	Explorer 🕀
Channel Devices					💋 Pages 🔮 Scripts 💾 Symbols
✓ Enable     Parameters			Protocol	Modbus	Machine Learning ▣ Scheduling ಈ Utilities ፼ SoftLogic Networks
Modbus I	RTH Enable	Modbus TCP Enable			Channels Viags Jutabase
- Modbus I					
Serial Port	COM1	Baud Rate	9600	•	
Address	0	Parity	None	•	
		Save Import from pbsSo	oftLogic		

Right click in the channel setting page and save settings. Close "NewChannel1.xml" Setting page and right click on the channel list panel and run "Explorer" item. This will open channels folder in the project folder.

Explorer Pages Machine L Schedu SoftLog Channe NewChar	Scripts L Symbols earning ling 10 Utilities ic Networks ls 10 Tags 8 Database nnel1.xml
	Open Channel
	New ModbusTCP/RTU Channel
	New DNP3 Channel
	New IEC870-5-104 Channel
	New TwinCAT ADS Channel
	New MQTT Client
	New Redis Client
	New S7-Channel
	New ModbusTCP Slave Driver
	New Vestas Driver
	New OPC-UA Channel
	Explorer
	Refresh

Rename the "NewChannel1.xl" to any name based on your project and refresh channel list. For example we change channel name to "MTCP1Ch.xml".

Double click on the "MTCP1Ch.xml" channel and change physical layer to Modbus TCP.

MTCP10	Ch.xml				×	Explorer &
Channe	Devices					ø Pages 🔮 Scripts 💾 Symbols
	Enable			Protocol	Modbus	Machine Learning 🦻 Scheduling 🤫 Utilities
	Parameters					🚪 SoftLogic Networks
						🛋 Channels 💫 Tags 🗿 Database
	🗆 Modbus F	TU Enable	Modbus TCP Enable			MTCP1Ch.xml
	Serial Port	СОМ1	Baud Rate	9600	•	
	Address	0	Parity	None	-	

Go to "Devices" tab, you can see default Modbus Blocks that are defined at channel definition time.

Device Na	A	ddress	IP	Port	Time Ou	t Off Line	e Count	Active
D	-		197.0.0.1	500	1000	10		-
Device I			127.0.0.1	3UZ	IUUU	IU		<u>v</u>
Block Nam	ie	Туре			Start Address	Channels	Wait	Active
DII-DI		DID	01-1 5/	<b>`</b> a	0		200	
BlockAl		Al-Read I	nput Status Fi	∠=∠ FC= <b>4</b>	U N	32	200	V 
BlockDO		DO-Write	Output Coils F	C=5/15	0	32	200	v V
BlockAO		AO-Write	, Holding Regi	ster FC=6/	0	32	200	<b>v</b>
BlockFl		FI-Read Ir	nput Register	as float F	33	8	200	1
BlockAOS		AOS-Rea	d Holding Reg	gister Stat	0	32	200	<b>V</b>
Diag		SYS-Syst	em Block -Re	ad Slave	0	8	200	1

I already defined a pbsSoftLogic project for a RTU with IP 192.168.1.225 and modbus TCP Slave Driver with ID = 3 and with following simple logic:



Changing "MTCP1CH.xml" parameters based on slave configuration as following:

мп	CP1Ch ymL									
Ch	annel Devi	ce	5							
	Device Na	A	ddress	IP	Port		Time Out	Off Line	Count	Active
• [	Device1	3		192.168.1.2	. 502		1000	10		V
	Block Nam	e	Туре			Sta	rt Address	Channels	Wait	Active
	BlockDI		DI-Read	Input Status FC:	=2	0		32	200	<b>v</b>
	BlockAl		Al-Read	nput Register F	C=4	0		32	200	<b>V</b>
	BlockDO	DO-Write	Output Coils FO	C=5/15	0		32	200	<b>V</b>	
	BlockAO		AO-Write	Write Holding Register FC=6/		0		32	200	<b>V</b>
	BlockFl		FI-Read I	Input Register as float F		64		8	200	V
	BlockAOS		AOS-Rea	d Holding Regi	ster Stat	0		32	200	V
	Diag		SYS-Syst	tem Block -Rea	d Slave	0		8	200	<b>V</b>

For Read/Write Modbus tags , you need to define modbus blocks . Set Block Name , Type , Start Address and number of channels .

The first Block that is defined is reading input Status FC = 2 from address 0 for 32 channels. pbsHMI Modbus TCP Driver ,sends proper command to read input status , wait for 200 msec and then expecting for answer from Slave Device . So 200 msec is not timeout, it is time that slave should answer to the master.

Second Block is reading input register from address 0 for 32 channels.

The third block is for writing to the Slave Driver. It is writing from address 0 for 32 channels.

The next block is writing Holding Register from address 0 for 32 holding registers.

The next block is reading floating input from device from address 64 for 8 channels. This command read input register from address 64 and read 16 channels. Then each 2 Registers are considered as one float input channel.

The last Block is for diagnostic, it shows driver is online or offline, how many frames send and how many answer is received from salve device.

You can delete these blocks and define new ones based on slave device address and parameters.

In the sample pbsSoftLogic RTU project, we used FITag64 tag and link it to a sin generator FB. This tag defined by 2 input registers with address 64 and 65, so for reading this tag in pbsHMI, I changed BlockFI start address to 64.

Save channel by right click on the driver page and use "Save" menu.

In the following figure, you can see pbsHMI channels and device tags relation. There is one and only one device tag over each channel. pbsHMI channels handle communication with external devices and will pass signals to device tags. For each protocol, there is a Channel with different parameters but Device tags for all protocols have same structure.

Device Tag	Device Tag	Device Tag	Device Tag
Modbus Channel	DNP Channel	IEC104 Channel	MQTT Channel
pb	sHMI Channe	els and Device	Tags

For defining device tag over Modbus Channel, in the "Tags" panel, right click on the list are and define a "New Device Tag".



Select Channel that you want to define tag from the list. For our example select "MTCP1Ch.xml" channel.



Click on New Button, pbsHMI will generate Tags for selected device. Open Defined Device tag. You can see following image:

pbsHMI Editor Ver 4.1.0 RC1 User = Active Project File Help	ct Path=C:\pbsHMlprojec	ts\QuickMTCP						- 0 ×
Tools 유	MTCP1Ch.xml	NewPage1.pgp	NewTag	Group1.xml				× Explorer
-	Params Filter							💋 Pages 🕋 Scripts 💾 Symbols
		Tag Gr	оир Туре	Device				Machine Learning
Figures Basic Lools	🛛 Enable	Channe		MTCP1Ch.xml				🧧 Scheduling 🤫 Utilities
Button		Databa	<u>.</u>					🛃 SoftLogic Networks
Button Cube Cylinder Diamond	Ovelie Are	bive Period (Se	se vc)	10				🔳 Channels 💫 Tags 🗿 Database
	Oyelle Alt		,					NewTagGroup1.xml
Ellipse Hexagon Image	Device Na							
$\cap \square = \square$	Device1							
	Block Name	e Tag Name	Address	Туре	Writable	Archive	Cyclic	
Cotagon Paraneogram Pie Rectangle	BlockDI	BlockDI_0	0	bool			0	
Text Text	BlockDI	BlockDI_1	1	bool				
Ro Text Round Restande Simple Text	BlockDI	BlockDI_2	2	bool				
	BlockDI	BlockDI_3	3	bool				
	BlockDI	BlockDI_4	4	bool				
Tapazold	BlockDI	BlockDI_5	5	bool				
( opened	BlockDI	BlockDI_6	6	bool				
	BlockDI	BlockDI_7	7	bool				
	BlockDI	BlockDI_8	8	bool				
	BlockDI	BlockDI_9	9	bool				
	BlockDI	BlockDI_10	10	bool				
	BlockDI	BlockDI_11	11	bool				
	BlockDI	BlockDI_12	12	bool				
	BlockDI	BlockDI_13	13	bool				
	BlockDI	BlockDI_14	14	bool				
	BlockDI	BlockDI_15	15	bool				
	BlockDl	BlockDI_16	16	bool				
	BlockDI	BlockDI_17	17	bool				
	BlockDI	BlockDI_18	18	bool				
Tools Draw	BlockDI	BlockDI 19	19	hool				Properties Explorer

You can change Tag Names based on your Site Tag List, Log Tag by changes or cyclic , scale tag and set unit and Alias for the tag .

Change device tag name to a proper name. Suppose we change it to "MTCP1\_Tags.xml".

Device Tags will be used in Graphic pages, alarms, events, scripts, ...

Right Click on the Tag that you want to use. You can copy tag properties:

Params Filter				
	Tag Gro	ир Туре	Device	
🗹 Enable	Channe	I	MTCP1Ch.xml	
	Databas	se		
Cyclic Arch	ive Period (Se	c)	10	
Device Na				
Device1				
Block Name	Tag Name	Address	Туре	Writabl
BlockDl	BlockDl_(	Save		
BlockDl	BlockDI_1			
BlockDl	BlockDI_2	Copy Tag		
BlockDI	BlockDI_3	Copy Tag V	alue	
BlockDI	BlockDI_4	Copy Tag T	ime	
BlockDI	BlockDI_	Copy Tag T	ime Str	
BlockDl	BlockDI_6	Copy Tag U	nit	
BlockDI	BlockDI_i	Copy Tag A	lias	
BlockDI	BlockDI_{	Copy Tag C	uality	
BlockDl	BlockDI_	1.10	-	
BlockDl	BlockDI_1	LIST VIEW		C
BlockDl	BlockDI_1	Card View		C
BlockDl	BlockDI_12	12	bool	C
BlockDI	BlockDI 13	13	bool	

Suppose we want to monitor value of "BlockDI\_0" in a graphic page. Right Click on the "BlockDI\_0" tag and select "Copy Tag Value".

Select "Pages" Tab and create a new page by right click on the page list area:

xplo	rer 🕀					
Mach	nine Learning					
Cł	Channels 🔖 Tags 🗿 Database					
So	Scheduling 🧌 Utilities					
So	oftLogic Networks					
🛓 Pa	ages 🔮 Scripts 💾 Symbols					
Nev	wPage1.pgp					
	New Page					
	Open					
	Explorer					
	Refresh					
	Sort Asc					
	Sort Des					
	No Sort					
	Export to html					
	Publish to WebServer					

ools & MTCP1Ch.xml NewPage1.pgp MTCP1_Tags.xml NewPage2.pgp	× Explorer
Image: Sector Cost         Batton         Data         Data	Machine Learning Channels Tags Database Scheduling Utilities SoftLogic Networks Page1.pgp NewPage1.pgp NewPage2.pgp

Because a page with name "NewPage1.pgp" is defined before, pbsHMI create a new page with name "NewPage2.pgp". pbsHMI graphic page extension is "pgp" but it an xml file.

You can change graphic page name by going to the page folder in the project folder and change name and refresh page list same as changing channels name. I changed "NewPage2.pgp" to "Startup.pgp".

Open "Startup.pgp" page and drag and drop a "Text" object from "Basic Tools "to the "Satrtup.pgp" page.

	MTCPTCh.xml NewPageT.pgp MTCPT_Tags.xml Startup.pgp	~ Properties	
•	File Edit View Format Tools	21 24 12	
Figures Basis Tools	59.03027	<ul> <li>Appearance</li> </ul>	
Figures Basic roots		Alignment	2
		BackgroundColor	White
Cube Cylinder Diamond		Bold	False
$\sim$ $\sim$		Bordered	False
	obsHMI Modbus Test	Clipping	False
Elipse Hexagon Image		FamilyName	Microsoft Sans Serif
$\frown \Box$		FontSize	26.9
		GdiCharSet	1
Dotagon Parallelogram Pie Réctangle		Italic	False
Text. Text		LineCount	1
TOXE TOXE		Multiline	False
Ro Text Round Rectangle Simple Text		RightToLeft	False
		RightToLeftFromView	True
		SelectionObject	pbsHMIToolsMng.pbsSimp
Trapezoid		Shadowed	False
		StrikeThrough	False
		StringTrimming	None
		Text	pbsHMI Modbus Test
		TextColor	Black
		TransparentBackgrou	n True
		Underline	False
		Wrapping	False
		WrappingWidth	150
		Behavior	

Select "Text" Object and open "Properties" for the selected object. Go to "Text" property and change it to "pbsHMI Modbus Test".

Select "Draw" panel and select "Text". You can change text size, Color, Format and other properties here.

en Brank-Caker Text crosselt Sam Serif 7 U 6 55 W 1000 10 11 12 13 14 15 16	File Edit View Format Tools	st
rooteft Sans Serif ✓ (115 ) 7 U 6 55 V 100 10 11 12 13 14 15 16	<sup>590097</sup> jobsHMI Modbus Te	st
/ U 6 55 ₩ <b>1 1 1 1 1 1 1 1 1 1</b>	jobsHMI Modbus Te	stå
18 20 24 38 39 30 30 30 40 56 56 54 72		

Change Size to 36, and make it bold and text color to blue.

File Help	
Draw 🖗	MTCP1Ch.xml NewPage1.pgp MTCP1_Tags.xml Startup.pgp
Pen Brush Color Text	File Edit View Format Tools
<u> </u>	59.03027
B / ∐ \$ ≌ ₩ ≧ ≅ ≝	
	phoHMI Medbuo Teet



#### Select a "Circle" object and drop it to the page. Go to "BrushDynamic", click on "Add" Button.

#### Paste, copied Tag to Signal part:

ColorDynamicsCls Collection Editor		?	×
Members:	xml version="1.0" encoding="utf-16"?	ockDI_(	D. v
		Canc	el 📄

As you can see tag structure is {DeviceTag}.{DeviceName}.{TagName}

By default tag name has value property. Example: MTCP1\_Tags.Device1.BlockDI\_0

Tag Value: {DeviceTag}.{DeviceName}.{TagName}.v . Example: MTCP1\_Tags.Device1.BlockDI\_0.v

Click on "Colors" and Add color for Tag Value 0 (False).

ColorsCls Collection Editor		? ×	
Members:           D         pbsHMIGE ngine. ColorsCls           1         pbsHMIGE ngine. ColorsCls	<ul> <li>★</li> </ul>	pbsHMIGEngine.ColorsCls properties:	
Add Remove			
		OK Cancel	]

Add another color for value 1(True).

ColorsCls Collection Editor	? ×
Members:          0       pbsHMIGEngine.ColorsCls         1       pbsHMIGEngine.ColorsCls	pbsHMIGEngine.ColorsCls properties:
Add Remove	
	OK Cancel

Drag another "Text" object and put it under circle object and paste "MTCP1\_Tags.Device1.BlockDI\_0.v" to "TextDynamic" property.

ITCPTCh.xml NewPageT.pgp	· ^	Properties	
File Edit View Format Tools		1 2 I   E	
03027		Width	70
		<ul> <li>ContextMenu</li> </ul>	
	_	pbsMenu	(Collection)
		<ul> <li>Dynamics</li> </ul>	
		BackColorDynamic	(Collection)
phcHMI Modbuc Tost		FontBlinkDynamic	(Collection)
pusi ini mounus resi		FontColorDynamic	(Collection)
		HideDynamic	
		LeftDynamic	
( )		pbsWriteSignal	
		SwitchDynamic	(Collection)
Text		TextDynamic	MTCP1_Tags.Device1.BlockDl_0.v
		TextListDynamic	(Collection)
		ToolTipDynamic	
		TopDynamic	
		✓ Event	
	-	pbsEvent	Pulse
		pbsEventConfiMessage	Are You sure?
		pbsEventConfirmation	False
		pbsEventPageLoad	
		pbsEventPopupBaseID	
		pbsEventPopupNewID	
		pbsEventPulseWidth	2000
		pbsEventScript	
		pbsEventSecurityLevel	0
	_	TextDynamic TextDynamic	

Save Page and open "Settings" page in the "utilities" tools. Select "Startup.pgp" as startup page and save settings.

MTCP1Ch.xml NewPage1.pgp M	TCP1_Tags.xml Startup.pgp	Settings	×	Explorer 문
Basic Network OPC UA Server (	Gateway Web Server			ø Pages 🕋 Scripts 💾 Symbols
				🔜 Channels 🔖 Tags
Active Project Path C:\pl	bsHMlprojects\QuickMTCP	···· ·		🗿 Database 🧧 Scheduling
Runtime Startup Page Start	tup.pgp 🔻 Runt	time Instance Main		Networks Machine Learning
pbsHMI View Always on Top	pbsHMIView Control Box	🗆 Utility Page Float		SortLogic
Load Events	Load Alarms	Load Trends		
Load Diagnostic	Load SoftLogic	Load Network		
Load Machine Learning				
pbsHMIView tools Visual Style	Office2010	•		
pbsHMIView Content Visual Styl	le Office2010	•		
Automatic User Logout Time(min	ı) O			
EnableCommandAtStartup	SoundISEnable	System Log Enable		

In this stage, we can run the project by pbsHMIViewer and connect to RTU by Modbus protocol.

pbsHMIView		
Tools	ß	Pages Trends 🔮 Diagnostic
Pages	*	
NewPage1.pgp		
Startup.pgp		
Channels	*	DDSHMI Modbus Test
Update System		
Utility	*	
Login		
Logout		
Change Password		
Enable Commands		
Enable Declutring		Тпре
		IIUC
Shut Down		
pbsHMIView		
Tools	ß	Pages Trends P Diagnostic
Pages	*	
NewPage1.pgp		
Startup.pgp		· · · · · · · · · · · · · · · · · · ·
Channels	*	DDSHMI Modbus Lest
Update System		
Ittility	\$	
Login		
Logout		
Change Password		
Enable Commands		
Enable Declutring		False
Shut Down		

In the RTU logic , "TagAIO" is linked to a Up Counter .



Suppose we want to monitor this tag . Select "TagAIO" from "MTCP1\_Tags.xml" and copy tag value.

Drag a new "Text" object to the page and link "MTCP1\_Tags.Device1.BlockAI\_0.v" to New Text "TextDynamic" property.

Я	rams Finter					
		Tag Gro	оир Туре	Device		
🗹 Enable		Channe	I	MTCP1Ch.xn		
	Databas		90		-	
	Cyclic Archive Period (Sec)		c)	10		
	Cyclic Arci	ive Fellou (Se	<b>(</b> )			
1	Device Na					
	Block Name	Tag Name	Address	Туре	Writable	Archive
	BlockDl	BlockDI_23	ockDI_23 23			
	BlockDl	BlockDI_24	24	bool		
	BlockDl	BlockDI_25	25	bool		
	BlockDl	BlockDI_26	26	bool		
	BlockDl	BlockDI_27	27	bool		
	BlockDl	BlockDI_28	28	bool		
	BlockDl	BlockDI_29	29	bool		
	BlockDl	BlockDI_30	30	bool		
	BlockDl	BlockDI_31	31	bool		
	BlockAl	BlockAl_0				
	BlockAl	BlockAl_1	Save			
	BlockAl	BlockAl_2	Copy Tag			
	BlockAl	BlockAl_3	Copy Tag	Value		
	BlockAl	BlockAl_4	Copy Tag	Time		
	BlockAl	BlockAl_5	Copy Tag	Time Str		
	BlockAl	BlockAl_6	ConvTag	Unit		0
	BlockAl	BlockAl_7		Aliaz		0
	BlockAl	BlockAl 8	Copy lag	Allas	Ω	

MTCP1Ch.xml NewPage1.pgp MTCP1_Tags.xml	< + ×	Pr	operties		
File Edit View Format Tools					
59.03027			Width	70	
		~	ContextMenu		
			pbsMenu	(Collection)	
			Dynamics		
			BackColorDynamic	(Collection)	
pbsHMI Modbus Test			FontBlinkDynamic	(Collection)	
			FontColorDynamic	(Collection)	
			HideDynamic		
			LeftDynamic		
······································			pbsWriteSignal		
			SwitchDynamic	(Collection)	
Text			TextDynamic	MTCP1_Tags.Device1.BlockAl_0.v	
O O			TextListDynamic	(Collection)	
"Text			ToolTipDynamic		
0.0.0			TopDynamic		
		~	Event		
			pbsEvent	Pulse	
			pbsEventConfiMessage	Are You sure?	
			pbsEventConfirmation	False	

Save page and in the pbsHMIViewer click on "Startup" page. This will update page online.

obsHMIView		
Tools	ß	Pages Trends 🔮 Diagnostic
Pages	*	
NewPage1.pgp		
Startup.pgp		a had that has allow a Track
Channels	*	DDSHIMI MOODUS TEST
Update System		
Utility	*	
Login		
Logout Change Recoverd		
Enable Commands		
Enable Declutring		True
Shut Down		
		631
		001

Suppose we want to show time of "BlockAI\_0" tag in the page. You can copy "Tag Time Str" and link it to a "TextDynamic" of a new "Text" Object.

NewPage1.pgp	MTCP1_Tags.	xml Start	up.pgp	Settings	↔ ×	Pro	
Params Filter							
	Tag Gro	оир Туре	Device	;		١	
🗹 Enable	Channe	MTCP	Ch.xml		~ (		
Database							
Cyclic Archive Period (Sec) 10							
						t r	
Device Na							
Block Name	Tag Name	Address	Ту	pe	Writabl	i i	
BlockDl	BlockDI_29	29	bo	ol	C		
BlockDl	BlockDI_30	30	bo	ol	C	H	
BlockDl	BlockDI_31	31	bo	ol	CI		
BlockAl	BlockAl_0	0	int	c2			
BlockAl	BlockAl_1	1	int		ve		
BlockAl	BlockAl BlockAl_2 2 int Copy Tag						
BlockAl	BlockAl_3	3	int	Co	opy Tag Value		
BlockAl	BlockAl_4	4	int Copy Tag Time				
BlockAl	BlockAl_5	5	int Copy Tag Time Str				
BlockAl	BlockAl 6	6	int	C (	ny Tao Unit		

		Width	70
	 ~	ContextMenu	
		pbsMenu	(Collection)
pholdMI Modbuo Toot	~	Dynamics	
positivit woodus rest		BackColorDynamic	(Collection)
		FontBlinkDynamic	(Collection)
		FontColorDynamic	(Collection)
		HideDynamic	
		LeftDynamic	
Text		pbsWriteSignal	
		SwitchDynamic	(Collection)
Text		TextDynamic	MTCP1_Tags.Device1.BlockAl_0.ts
Tevť		TextListDynamic	(Collection)
		ToolTipDynamic	
0 0 0		TopDynamic	
	~	Event	

By adding ".ts" to the tag name, it will show tag change time in string format.

Change "pbsCharNum" to 32 to show more characters. Save page and update page at runtime.



In the RTU logic, "DOTag0" signal is linked to trigger input of Sin generator Function Block and output is linked to FITag64 signal.



Suppose we want to Write DOTagO Signal by pbsHMI and monitor value of FITg64 .

For DOTag0, modbus address is 0 and for FITag64, modbus address is 64.

Drag a new "Button" in the page and change "Text" Property to "Toggle DOO". Change Font Size to 20.



Select "BlockDO\_0" tag and copy Tag.

NewPag	je1.pgp	MTCP1_Tags.x	ml Startup.pgp		Settings			
Params	Filter							
_		Tag Gro	roup Type Device					
🗹 Ei	nable	Channel	Channel					
Databas			e	-				
С	yclic Arc	hive Period (Sea	c)	10				
Devic	e Na							
Blo	ck Name	Tag Name	Address	Ту	/pe	Writable		
Blo	ckAl	BlockAl_27	27	int	t			
- Blo	ckAl	BlockAl_28	28	int				
- Blo	ckAl	BlockAl_29	29	int				
- Blo	ckAl	BlockAl_30	30	int				
- Blo	ckAl	BlockAl_31	31	int				
- Blo	ckDO	BlockDO_ *	C					
- Blo	ckDO	BlockDO_	Save					
- Blo	ckD0	BlockDO_	Copy Tag					
- Blo	ckDO	BlockDO	Copy Tag Va	lue				
- Blo	ckD0	BlockDO_	Copy Tag Ti	me				
Blo	ckDO	BlockDO	Conv Tag Tu	me Str				

Note : for writing Tags , only tag Signal should be used

Select Button object in the page and change pbsEvent to "Toggle" and link "MTCP1\_Tags.Device1.BlockDO\_0" to pbsEventSignal .

	✓ Event	
	pbsEvent	Toggle
nheHMI Modhue Test	pbsEventConfiMessage	Are You sure?
	pbsEventConfirmation	False
	pbsEventPageLoad	
	pbsEventPopupBaseID	
	pbsEventPopupNewID	
	pbsEventPulseWidth	2000
lext	pbsEventScript	
	pbsEventSecurityLevel	0
I ext	pbsEventSetValue	
Text		MTCP1_Tags.Device1.BlockDO_0
	pbsEventValidationSignal	
•ToggleDO0	✓ Misc	
	Background	Northwoods.Go.GoRectangle
	ChildNames	

2025

Update page at runtime.

Tools	ß	Pages Trends 🔮 Diagnostic
Pages	*	
NewPage1.pgp Startup.pgp		
Channels	*	nhsHMI Modhus Test
Update System		
Utility	*	
Login Logout Change Password		
Enable Commands		
Enable Declutring		False
Shut Down		
		956
		15/06/2025-21:03:48
		ToggleDO0

Writing Tag in pbsHMI need two steps. First in the Tag List "Writeable" property should be selected and second in the pbsHMI runtime "Enable commands" should be enabled.

Device Na...

Block Name	Tag Name	Address	Туре	Writable	Archive
BlockAl	BlockAl_27	27	int		0
BlockAl	BlockAl_28	28	int		
BlockAl	BlockAl_29	29	int		
BlockAl	BlockAl_30	30	int		
BlockAl	BlockAl_31	31	int		
BlockDO	BlockDO_0	0	bool		
BlockDO	BlockDO_1	1	bool		

Drag a new Text object to the page and link "TextDynamic" to the "BlockFI\_64" Signal value.

Now if you update page and runtime and click on "ToggleDOO" button, that value of "BlockFI\_64" is showing on the page.

	_	
Pages	*	
Startup.pgp		
Channels	*	nhsHMI Modbus Test
Update System		
Utility	*	
Login		
Change Password		
Disable Commands Enable Declutring		True
		The
Shut Down		
		24
		15/00/2025 21.15.10
		15/06/2025-21:15:10
		T L DOO 0 0007070
		ToggleDO0 0.3387379

## 4 - Modbus Driver Configuration and Global Tags

pbsHMI Supports Modbus Master Driver for communication with different Modbus slave devices .

ModbusRTU and ModbusTCP are supported for communication.

Following Modbus Function codes are supported:

```
FC_ReadCoilStatus = 0x1,
FC_ReadInputStatus = 0x2,
FC_ReadHoldingRegisters = 0x3,
FC_ReadInputRegisters = 0x4,
FC_ForceSingleCoil = 0x5,
FC_PreSetSingleRegister = 0x6,
FC_ReadExceptionStatus = 0x7,
FC_ForceMultiCoils = 0xf,
FC_PreSetMultiRegisters = 0x10
```

pbsHMI Modbus Block types:

```
BI or DI = 1,// Boolean Input
BO or DO = 2,//Boolean Output(Write)
AI = 3, //Analog input
AO = 4, //Analog Output (Write)
BOS or DOS=5,// Boolean Output Status
AOS=6, // Analog output Status
FI=7, // float input
SFI=8, // swap float input
FO=9, // float output(Write)
SFO = 10, // swap float output(Write)
SYS =11, // System Diagnostic Block
FOS = 12, // Float Output Status
SFOS = 13 // Swap Float Output Status
```

Modbus Channel: pbsHMI driver modeling is based on channel and device Tag configuration.

You need to define a new Modbus channel and define Device Tags based on channel.

In channels, you will configure communication parameters and in Device Tags, you will define Driver tags.

Defining new MODBUS channel: right click on channels tab and select New MODBUS Channel.



Open Channel
New ModbusTCP/RTU Channel
New DNP3 Channel
New IEC870-5-104 Channel
New TwinCAT ADS Channel
New MQTT Client
New Redis Client
New S7-Channel
New ModbusTCP Slave Driver
New Vestas Driver
New OPC-UA Channel
Explorer
Refresh

pbsHMI will define a new MODBUS channel as following page :

MTCP1	Ch.xml				×	Explorer &
Channe	el Devices					季 Pages 🔮 Scripts 💾 Symbols
	🗹 Enable			Protocol	Modbus	Machine Learning 🥃 Scheduling 🤫 Utilities
	Parameters					📕 SoftLogic Networks
						💻 Channels 💫 Tags 🗿 Database
	O Modbus	RTU Enable	Modbus TCP Enable			MTCP1Ch.xml
	Serial Port	COM1	Baud Rate	9600	•	
	Address	0	Parity	None	•	

Channel Tab: Select Serial or Ethernet for communication. By default Serial is Enable. Select COM port and other communication parameters.

Device Tab: Define Modbus Devices and data Blocks.

Ch	annel <mark>Devic</mark>	es							
Dr	ag a column h	leader here t	o group by that co	olumn.					
C	Device Na	Address	IP	Port	Time O	ut	Tell Number	Off Line Count	Active
• C	)evice1	1	192.168.1.100	502	1000			10	<b>V</b>
	Device Na	. Block Nar	ne Type	Start Addr	channels	Wai	it Act	ive	
				-					
	Device1	Block1	וט	U _	64	200		<u>_</u>	
	Device1	Block2	Al	0	64	200		<b>V</b>	
	Device1	Block3	DO	0	64	200		<b>V</b>	
	Device1	Block4	AO	0	64	200		<b>v</b>	
	Device1	Block5	FI	100	63	200			
	Device1	Diag	SYS	0	8	200		<b>V</b>	

Any Modbus Slave device by default has four tables inside:



Based on MODBUS standard, maximum MODBUS address for each table is 65535, but it depends on Slave implementation. Normally slave devices are not supports whole address range.

pbsHMI Supported function codes for MODBUS protocol:

```
FC_ReadCoilStatus = 0x1 = Read Status of DO Table
FC_ReadInputStatus = 0x2 = Read DI Table
FC_ReadHoldingRegisters = 0x3 = Read Status of AO Table
FC_ReadInputRegisters = 0x4 = Read AI Table
FC_ForceSingleCoil = 0x5=Write one DO Tag
FC_PreSetSingleRegister = 0x6 = Write one Ao Tag
FC ForceMultiCoils = 0xf = Write multiple DO Tags
```

#### FC PreSetMultiRegisters = 0x10 = Write Multiple AO Tags

MODBUS Data types: MODBUS Supports Digital (0-1) and Analog (unsigned 16 bit integer) Data types.

We can transfer other data types based on analog type. pbsHMI Supports floating point data type for reading and writing floating point values .

FI = Float Input. FI is using AI table. Each FI tag gets two AI addresses. pbsHMI will read FI tags from Slave device.

FO = Float Output. FO is using AO table. Each FO tag gets two AO addresses. pbsHMI will Write FO tags to Slave device.

FOS = Float Output Status. pbsHMI will read Status of FO tags by FOS Data type .

SFI = Swap Float Input. Same FI but AI tags order is reveres.

SFO = Swap Float Output .Same FO but AO tags order is reveres.

SFOS = Swap Float Output Status. Same FOS but AO tags order is reveres.

Any pbsHMI modbus Blocks contains many Modbus tags.

pbsHMI read Modbus input tags (DI, AI, FI, FOS, DOS, SFOS) by sending modbus commands (based on Block definition) and will write outputs (DO, AO, FO, SFO) when it detect changes in Block tags value.

SYS Block contains 3 tags: Online Status, Send Command number and receive Commands number.

Start Address and Number of channels in SYS block are dummy value. So you can keep them as default.

At top of Devices page, you need to set following parameters:

Address: Modbus Slave ID (from 1 to 254)

IP: IP address of Modbus TCP Slave Device

Port: Port Number for ModbusTCP Slave Device. By default its value is 502.

Active: Shows Device is active or not.

Note : When you use ModbusRTU , you can define multiple devices for a channel . But when you use ModbusTCP , just one device is allowed in pbsHMI . You need to define one channel for each ModbusTCP Device.

For defining new Block, type Block name, Block Type, Start Address, Channels, wait time (msec) and checked active box then press Enter at top blank record area.

For saving Block data, right click on blocks area and select save menu.

You can change Blocks by any XML editor. At channels panel, Right click and select explorer menu.

It will open pbsHMI channels directory. Open channel file by any XML editor (Like Notepad++)



You can change or add new Blocks by copy /paste/ modify <Block> tags.

Note: When define Blocks you need to carful about channels:

For AI and AOS maximum channel Is 127. (Modbus frame format limitation)

For FI, FOS, SFI maximum channels is 63. (Modbus frame format limitation)

If number of Analog and Float tags are more than maximum value, then you need to define multiple blocks.

Wait Time is time (msec) that driver will read Modbus Frame after sending command to slave device.

With modifying Wait Time you can change driver operation performance.

#### **Defining Modbus Tags:**

Select pbsHMI tags Panel and right click there. Select "New Device Tag Group". Select channel that you want to made device tag and click on new Button.

pbsHMI will automatically generate Modbus tags . The new Device tag has NewTagGroupx.xml name format. You can change name to any name you want by windows facility and refresh tags Panel.

Using of device tags is same for all channels and devices. So please refer to chapter 3 for using Device tags.

### global tags

Global tag is internal tag in pbsHMI. You can use global tags in Pages , Scripts and everywhere in pbsHMI .

For defining a new global tag group , right click on "Tags" tab in project explorer . You will see following context menu:



Click on "New Global Tag Group". You can define unlimited global tag groups and global tags in pbsHMI.

Global tags have following fields:
e Help									
GTag1.xml									× Explorer
Params Filter									💋 Pages 🔮 Scripts 💾 Symbols
Enable	Tag Group Type	ſ	Global						Scheduling 90 Utilities
	Database	[			*				
	Database	L	TayDo.xmi						AAlarm.xmi
	Cyclic Archive Pe	riod (Sec)	10						Events.xml
Tag Name	Туре	Init Value	e unit	Alias	Active	Archive	Cyclic	Log	
									view ragoroup 1.xm
Dynamics_Brush	int	0							
Dynamics_Hide	bool	false							
Dynamic_MoveX	float	810							
Dynamic_MoveY	float	658							**
Dynamic_Move_Enat	ble bool	false							
Dynamic_Level	float	50							
Dynamic_ImageList	int	0							
Dynamic_ImageSeq	bool	false							
Events_Set	int	0							
Events_Toggle	bool	false							
Events_Pulse	bool	false							
Events_Script	int	0							
Pump_101_I	float	101.2			$\checkmark$				
Pump_101_V	float	400				$\checkmark$			
Pump_101_RHS	int	101							
Pump_101_Run	bool	false							
Pump_101_Fault	bool	false							
Pump_101_Start_cmd	d bool	false							
Pump_101_Stop_cmd	i bool	false							
Pump_101_Reset_cm	nd bool	false							
Pump_101_Name	string	P101							

Tag name : it should be unique in the Tag Group

#### Type : C# type

- int = Signed 32-bit integer , -2,147,483,648 to 2,147,483,647
- uint = Unsigned 32-bit integer, 0 to 4,294,967,295
- long = Signed 64-bit integer , -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
- ulong = Unsigned 64-bit integer, 0 to 18,446,744,073,709,551,615
- double = 64-bit signed floating-point value
- float= 32-bit signed floating-point value.
- bool = one of two possible values, true or false
- string = Represents a string of Unicode characters.
- Init Value : Initialize value of tag

Unit : unit of tag

Alias : alias of tag

Active : if checked tag is enabled

Archive : if checked tag changes will archive in Database which is selected in Tag Group Database field .

Cyclic = When checked, pbsHMI will log signal cyclic . For Cyclic logging, normal logging should be enabled too. Cyclic time is a parameter (cyclic Archive Period (Sec))

Log = When Checked, will make signal persistence. It means pbsHMI will save last value of signal in HDD and it will read signal value when pbsHMI load at startup.

#### **Using tags**

For using tags in pbsHMI, right click on tag which you want to use and click on "Copy tag xxx".

Tag Name	Туре	Init Value	unit	Alias	Active	Archive
Tag1	bool	False		Tag1		
Tag2 int		0	0		<b>V</b>	
P1_Star		se		P1_Start	<b>V</b>	
P1_Trip	Save	se		P1_Trip	<b>V</b>	
P1_C	Copy Tag Value			P1_Trip	<b>V</b>	
P2_Star	Copy Tag Time	se		P1_Start	<b>V</b>	
P2_Trip	Conv Tag Time Str	se		P1_Trip	<b>V</b>	
P2_C	Copy rag time su			P1_Trip	<b>V</b>	
P3_Star	Copy Tag Unit	se		P1_Start	<b>V</b>	
P3_Trip	Copy Tag Alias	se		P1_Trip	<b>V</b>	
P3_C	Copy Tag. Quality			P1_Trip		
Tag3		se		Tag3	<b>V</b>	

It will copy full tag name in the clipboard for using in pages, scripts, trends,...

"FullTagName" : tag Value

"FullTagName" .v : tag Value

"FullTagName" .V: tag Value

"FullTagName".t : tag Time in numeric format

"FullTagName".T : tag Time in numeric format

"FullTagName".ts: tag Time in string format

"FullTagName".TS: tag Time in string format

"FullTagName".q: tag quality

"FullTagName".Q: tag quality

"FullTagName".u:tag unit

"FullTagName".U: tag unit

"FullTagName".A: tag Alias

"FullTagName".a: tag Alias

Any global tag and device tag has following attributes :

- Tag Value
- Tag Time (Numeric)
- Tag Time (String)
- Tag Quality
- Tag alias
- Tag Unit

You can use tag attributes everywhere in pbsHMI.

#### **5 - Graphics Pages**

pbsHMI is using XML format with PGP file extension for saving Graphic page .

In project explorer click on "Pages" tab. you can see list of all graphic pages. Right click in "Pages" tab , you will see following menu :



New Page Command: Create a new Page. By default its name is NewPage\_x.pgp.

Open Command: open a created page.

Explorer: Shows Graphic Pages directory for delete, Cut/paste and rename operation.

Refresh: refresh page list with latest Graphic Page Directory changes.

After you make a new page, you will see a blank page with NewPage\_x.pgp adds to content area.

File Help		
Tools &	05-Figuers.pgp NewPage1.pgp ×	Explorer 🗘
GLib_HVACs •	File Edit View Format Tools 47.50201	📱 SoftLogic 🐌 Tags 🔗 Database 🔎 Scheduling 💜 Utilities
Figures Basic Tools GLib_HVACs		00-Welcome.pgp     DS191.pgp       01-Structure.pgp     FlowPopup.pgp       02-Licensing.pgp     KDrive1Popup.pgp       03-Structure.pgp     Main.pgp       04-BasicOhiects page     Main.pgp
		06-Figuers.pgp     Network.pgp       06-Figuers.pgp     Network.pgp       06-Dynamics.pgp     Page1.pgp       06-Dynamics.pgp     PenPopup.pgp       07-Dynamics.pgp     PMPopup.pgp
HVACTS HVACT7 HVACTS HVACT9		09-Events.pgp     SCADAC4g.pgp       109-Events.pgp     SCADAC4g.pgp       11-Meters.pgp     SCEOPlant.pgp       11-Meters.pgp     SCADAC4g.pgp       12-Popups.pgp     SimpleCfg.pgp
		14-Alarms.pgp     SLUSKV_S.1.pgp       14-Scheduling.pgp     SOverview.pgp       15-Reports.pgp     SScreens.pgp       16-Scripts.pgp     SWetWell.pgp       17-Tags.pgp     W2.pgp       18-Tags.pgp     W2.pgp
HVAC30 HVAC31 HVAC32 HVAC3		19-Drivers.pgp         WW1.pgp           219-Drivers.pgp         WW2.pgp           20-DataLogging.pgp         WW3.pgp           21-SampleRages.pgp         WW3.pgp           22-NewsV1_5_2_5.pgp         WW6.pgp
		AHU_GR_16_01 - 30.pgp AHU_GR_16_01.pgp BurjKhalifah.pgp ClientServerCfg.pgp ≤
Tools Draw	<pre></pre>	Properties Explorer

From Tools Panel, select a tool group and click on a component. Drag and Drop component to graphic page.



# **5-1 Graphics Pages properties**

Click on Page area and open properties window:



There are following properties for a page:



Description: Page description.

Developer: Developer Name.

Page Color: Page background color.

Page Size: Page size in pixel.

Version: Page Version.

Visible: if True, page will show in Runtime at Page list. For popup pages you should change visibility to false.

SecurityLevel : Value between 0 to 1000 . Users with security level more than this value can see the page.

#### **5 -2 Dynamics**

For providing dynamic operation (Blinking, Brushing, Movement, Rotation, and Visibility) for graphic components, you can see Dynamic Part in property window. There are different dynamic groups for each component.

Dynamics for a rectangle:



#### Dynamic for a figure:



#### **5-2-1 Brush Dynamics**

With Brush dynamic you can brush a component with different color at runtime with different value of a signal.

Members: xml version="1.0" encoding="utf-16"? O xml version="1.0" encoding="utf</td	ColorDynamicsCls Collection Editor	2 X
Misc         Colors       (Collection)         Signal       Gtags.P1_Start.v         Add       Remove         OK       Cancel	Members:          Image: Consection Editor         Image: Consection Editor	xml version="1.0" encoding="utf-16"? Image: Colors   Image: Colors

- At Dynamic part in properties window click on BrushDynamic
- Click on "Add" Button to add a new Brush Dynamic

- Click on "colors" Collection
- Click on "Add" Button to add a new Color .Select color and value of signal. Suppose you want to have following brush Dynamics :
  - If Signal Value == 0 then Brush color =Yellow
  - If Signal Value == 1 then Brush color =Red
  - If Signal Value == 2 then Brush color =Blue

Then you should add 3 colors as following:

Members: 0 pbsHMIGEngine.ColorsCls	•	pbsHMIGEngine	.ColorsCls pr	operties:	
2 pbsHMIGEngine.ColorsCls	►	Misc     mColor     mValue	<mark>—</mark> Ү О	ellow	
Add Remove					
			ОК	Cancel	]

	The second is made at 1
Members:	pbsHMIGEngine.ColorsCls properties:
Add Remove	OK Cancel

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ColorsCls Collection Editor	8 ×
Members:          0       pbsHMIGEngine.ColorsCls         1       pbsHMIGEngine.ColorsCls         2       pbsHMIGEngine.ColorsCls         4       Remove	pbsHMIGEngine.ColorsCls properties:
	OK Cancel

Click on "Ok" button and save page.

If Signal Type is digital (Boolean), true is equal to 1 and false is equal to 0.

#### **5 -2-2 Blink Dynamics**

With Blink Dynamic you can make a blink on an object when signal is activated.

BlinkDynamicsCls Collection Editor		? ×
Members: O vml version="1.0" encoding="utf<br * Add Remove	xml version="1.0" encoding="utf-16"?	(Collection) 1000 GT ag1.Dynamics_Blink.v
		OK Cancel

Signal : Device or Global tag for activating Blink

Duration (msec) : Blink Duration

Colors : Sequence of colors that object with blink at Duration time

In following example object will change its color by Yellow, Red, Green and purple.

# pbsHMI Concepts

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ColorsCls Collection Editor	? <b>×</b>
Menbers: 9 gbHMIGErgine ColorCls 1 pbHMIGErgine ColorCls 2 pbHMIGErgine ColorCls 3 pbHMIGErgine ColorCls •	pbsHMGEngine Colos/Dis properties:
	OK Cancel

ColorsCls Collection Editor		_		? ×
Member: 0 pbdHMGErgine ColorsCts 1 pbdHMGErgine ColorsCts 2 pbdHMGErgine ColorsCts 3 pbdHMGErgine ColorsCts 4 pbdHMGErgine ColorsCts Add Remove	•	pbsHMIGEngine.Cc	olorsCle proper	0, 0
			ОК	Cancel



fembers:	pbsHMIGEngine.ColorsCls properties:
a pori-Milisergne Coordis both-Milisergne Coordis both-Milisergne Coordis both-Milisergne Coordis	A 4     Misc      mColor     mValue      3
	OK Cancel

Signal Value :

Bool (True), int (not equal to 0) : start to blink

Bool (False) , int ( 0) : stop blink , set brush to default brush of element .

## 5-2-3 Hide Dynamics

With hide dynamics, you can hide an object by signal value.

Dynamics	
BlinkDynamic	(Collection)
BrushDynamic	(Collection)
HideDynamic	GTag1.Dynamics_Hide.v
LeftDynamic	
RotationDynamic	
SwitchDynamic	(Collection)
TopDynamic	

Signal Value :

Bool (True), int (not equal to 0) : Object Hide

Bool (False), int (0) : Object Visible

# **5-2-4 Switch Dynamics**

With switch dynamic, you can show one object and hide other objects with one signal. Switch Dynamic is operating on multiple objects.

SwitchDynamicsCls Collection Editor		? ×
Members:	xml version="1.0" encodi</td <td>ng="utf-16"?&gt;</td>	ng="utf-16"?>
0 xml version="1.0" encoding="utf</td <td>2↓</td> <td></td>	2↓	
	🗆 Misc	
	Signal	GTag1.Dynamics_Switch
	SwitchLevel	1
4 III >		
Add Remove		
		OK Cancel

Switch dynamic is very powerful tool for page configuration.

Switch Level : Value of Signal that Object is visible,

Signal : int signal with different value . Object will show when Value of Signal and Signal level is identical otherwise will hide.

In following sample, three objects has same Switch dynamic signal with different Switch Value.



SwitchDynamicsCls Collection Editor ? Members: (?xml version="1.0" encoding="uff-16"?> Misc Signal GTag1.ATag2 SwitchLevel 2 OK Cance OK Cance OK Cance Struiteb = 0 Switch = 1 Switch = 2						
Members: xml version="1.0" encoding="utf-16"? <td>DynamicsCls Collection Editor</td> <td></td> <td></td> <td></td> <td>?</td> <td>×</td>	DynamicsCls Collection Editor				?	×
Signal GTag1.ATag2 SwitchLevel 2 Add Remove OK Cance Switch = 0 Switch = 1 Switch = 2	bers: ?xml version="1.0" encoding="uti	xml</td <td>version="1.0" ∈ 2↓  </td> <td>ncoding="utf</td> <td>-16"?&gt;</td> <td></td>	version="1.0" ∈ 2↓	ncoding="utf	-16"?>	
Add Remove OK Cance OK OK Cance OK OK CANCE OK		9	Signal SwitchLevel	GTag1.A1 2	Tag2	
OK Cano	Add Remove					
Switch = 0 Switch = 1 Switch = 2			(	ЭК	Cance	
Switch = 0 Switch = 1 Switch = 2	51	1				
Switch = 0 Switch = 1 Switch = 2	Switch = 0 Switc	h = 1	Swi	itch =	2	

At runtime when value of GTag1.Tag2 is 0, only object with Switch signal equal to 0 is visible and two other objects are hide .

At runtime when value of GTag1.Tag2 is 1, only object with Switch signal equal to 1 is visible and two other objects are hide .



At runtime when value of GTag1.Tag2 is 2, only object with Switch signal equal to 2 is visible and two other objects are hide .



When GTag1.Tag2 is not equal to 0 or 1 or 2 all three objects will be hide .

#### 5-2-5 Left /Top Dynamics

You can use Left and Top Dynamics for moving an object in the page. Unit Is pixel .

	r naebynanne	
0	LeftDynamic	GTag1.Dynamic_MoveX.v
U	RotationDynamic	
	SwitchDynamic	(Collection)
	TopDynamic	GTag1.Dynamic_MoveY.v
	🗉 Event	
	pbsEvent	Pulse
	pbsEventPageLoad	
	pbsEventPopupBaseID	
	pbsEventPopupNewID	

Following script is used to move above start in an ellipse shape.



above script is run every sec with following schedule object.

NewPage1.pgp	GTag1.xml	Dynamic_Move_script.cs	Move_ellipse_Sch.xml	×	Explorer 8
🗹 Enable					Pages Scripts Symbols     Channels Tags Database     Scheduling Utilities     CalCuShamsiDT.xml     CheckAlarmsSch.xml     Move ellipse Sch xml
Cyclic					RunReporSch.xml
Script	Dynamic_	Move_Ellipse			E Script_Sch.xml E ShowDTSch.xml
	very day at very hour at	23:50 hh:mm	nm		
• E	very msec	1000			
O La	ading				
ଁ ସ	hutdown				

This schedule object is calling Dynamic\_Move\_Ellipse Function every sec .

In Dynamic\_Move\_Ellipse , because Ellipse\_Alpha is defined as public variable , so its value will keep every time Dynamic\_Move\_Ellipse is calling by schedule object .

At each execution of Dynamic\_Move\_Ellipse , Ellipse\_Alpha will increase by 10 and calculate TmpX and TmpY in pixel based on ellipse formula .

SetTag Function will set value of a pbsHMI Tags .

SetTag("GTag1.Dynamic\_MoveX", TmpX);

SetTag("GTag1.Dynamic\_MoveY", TmpY);

SetTag ( string pTagName , object pValue ) ;

Note : In pbsHMI you don't have direct access to Graphic page objects properties . Suppose you want to move an object , then you should do following :

- Define a global Tag to show current Location of Object (Tag1\_X)
- Write a script to change value of Tag1\_X based on your movement
- Link Tag1\_X to Left Dynamic of Object

# **5-2-6 Rotate Dynamics**

For all pbsHMI graphic objects you can use RotationDynamics for rotating object at runtime by a signal value.



Any Object has Angle property for static rotation of Object in pbsHMI Editor.



Rotation direction is clockwise when Angle Value is Positive.

#### 5-2-6 Text Dynamics

With text dynamic you can show numerical or string values on the page.

	ppsvvriteSignai	
	SwitchDynamic	(Collection)
_	TextDynamic	GTag1.Dynamic_ImageList.v
	TextListDynamic	(Collection)
	TopDynamic	

pbsCharNum : by default is 10 . It shows number of characters at runtime.

Observers	Northwoods.Go.GoC
pbsCharNum	10
pbsHasSubNode	False
nheleltEditMada	True

## **5-2-7 Text List Dynamics**

You can show strings which is mapped to signal value.

Suppose if value of signal = 1 it will show "One"

If Value of Signal is 2 it will show "Two"

TextListDynamicsCls Collection Editor	? ×
Members: mi versions"1.0" encodings"\uti-16"? C?mi versions"10" encodings"\uti-16"?>       Signal       G Tag1 Dynamics_Brush.v       Signal       G Tag1 Dynamics_Brush.v       Feelbard       (Collection)	

Then you need following TextList :

Members: 1 pbsHMIGEngine.TextListCls 2 pbsHMIGEngine.TextListCls 3 pbsHMIGEngine.TextListCls 	pbsHMIGEngine. TextListCls properties: Text Zero mValue 0
TextListCls Collection Editor	OK Cancel
Members:	nhsHMIGEnaine TextListCls properties:
pbsHMIGEngine. TextListCls     pbsHMIGEngine. TextListCls     pbsHMIGEngine. TextListCls	Misc mText One mValue 1

TextListCls Collection Editor	2 <mark>×</mark>
Members: 0 pbsHMIGE ngine. TextListCls 1 pbsHMIGE ngine. TextListCls 2 pbsHMIGE ngine. TextListCls 3 pbsHMIGE ngine. TextListCls	pbsHMIGEngine. TextListCls properties:
Add Remove	
	OK Cancel

## 5 -2-8 Image List Dynamics

With Image List dynamic you can show different Images with different signal value. For defining Image List Dynamics , Drag and Drop Image Object from Basic Tools and link a static image to it by Image property .



Click on Image property and select image. pbsHMI will integrate Image in page and no need to copy original image in target computer .



Select image and click on Open Button.



Select ImageListDynamic and click on ... Button .



#### Click on add Button :

-	ImageListDynamicsCls Collection Editor			?	×
	Members:           OpbsHMIGEngine.ImageListDynamit	pbs	HMIGEngine.ImageListDynamicsCls properties:		
	*	~	Misc ImageList (Collection) Signal GTag1.Dynamic_Imag	jeList.v	,
	Add Remove		ОК	Cance	1

Signal: pbsHMI Global Signal or Device signal for changing Image . Based on Value of Signal , Image will changed .

Click on ImageList Collection and add One by One all images that you want to change by Signal Value.

For each image you need to set one Value. When Value of Image is equal to Signal Value, image will show.



#### **5-2-9 Image Sequence Dynamics**

With Image Sequence Dynamic, you can show sequence of images when signal is active. Signal can be int or bool.

Value of image is not valid for image sequence dynamic.

Configuration of ImageSequnceDynamics is same as ImageListDynamics only different is when value of Signal is True or not equel to 0, then it is start to show Image Sequence based on Image sequence that you defined in configuration.



### 5-2-10 Font Color Dynamics

With Font Color Dynamic, you can change Text font color by value of signal.



# **5 -2-11 Font Blink Dynamics**

With Font Blink Dynamic, you can blink a text when Signal is activate.



### 5 -2-12 Font Back Color Dynamics

With Font Back Color Dynamic, you can change back color of a text with signal value. TransparentBackground should be false.

#### 5-3 Events

In pbsHMI , each graphic object has Events and context menu . Events will activate by left click and Context Menu Is right click menu.

There are following Events in pbHMI :

- Set Event : Set Event Signal to predetermine value
- Toggle Event : Toggle value of signal
- Pulse Event : make a pulse
- Script Event : run a script
- Load Event :load a graphic page
- Popup Event : load a popup page

You can use same events for context menu.

There are Event and Context Menu section in properties of a graphic symbol.

	ContextMenu				
	pbsMenu	(Collection)			
⊡	Dynamics				
	BlinkDynamic	(Collection)			
	BrushDynamic	(Collection)			
	HideDynamic				
	LeftDynamic				
	RotationDynamic				
	SwitchDynamic	(Collection)			
	TopDynamic				
	Event				
	pbsEvent	Set			
	pbsEventPageLoad				
	pbsEventPopupBaseID				
	pbsEventPopupNewID				
	pbsEventPulseWidth	2000			
	pbsEventScript				
	pbsEventSecurityLevel	0			
	pbsEventSetValue	10			
	pbsEventSignal	GTag1.Events_Set			

pbsEvent : Select one of pbsHMI events .

pbsEventPageLoad : name of page which will load by Load event .

pbsEventPopupBaseID : refer to popup pages

pbsEventpopupNewID : refer to popup pages

pbsEventpulseWidth : pulse width for Pulse Event In msec .

pbsEventScript : name of c# function (without ()) for running by script event .

pbsSecurity Level: a number between 0 to 1000 . this event will be activated for users with higher security level .

pbsEventSetValue : fix value for Set Event .

pbsEventSignal : name of signal which will link to Event for Set , Toggle and Pulse Events .

Context menu: in Contextmenu Groups open pbsMenu and add any number of menu item as following :

pbsCMCIs Collection Editor	lext :	2 X
Members:	xml version="1.0" encoding:</td <td>="'utf-16"?&gt;</td>	="'utf-16"?>
0 xml version="1.0" encoding="uti<br 1 xml version="1.0" encoding="uti</td <td><b>2↓</b> □</td> <td></td>	<b>2↓</b> □	
2 xml version="1.0" encoding="utf 🛛 🕹</td <td>🗆 Misc</td> <td></td>	🗆 Misc	
	Key	
	pbsEvent	Set
	pbsEventPageLoad	
	pbsEventPopupBaseID	
	pbsEventPopupNewID	
	pbsEventPulseWidth	2000
	pbsEventScript	
	pbsEventSecurityLevel	0
	pbsEventSetValue	12
	pbsEventSignal	GTag1.Events_Set
4 III >	Text	Set to 12
Add Remove		
		OK Cancel

Key : unique ID for changing menu properties by Script in symbols . like Enable/Disable and checked menu . This functionality is just valid in symbols .

Text: text which will show on Context menu.

Members:	xml version="1.0" encodin</th <th>ng="'utf-16"?&gt;</th>	ng="'utf-16"?>
0 xml version="1.0" encoding="utf</td <td><b>₽</b>↓   ■</td> <td></td>	<b>₽</b> ↓   ■	
2 xml version="1.0" encoding="utf</td <td>🗆 Misc</td> <td></td>	🗆 Misc	
	Key	
	pbsEvent	Toggle
	pbsEventPageLoad	
	pbsEventPopupBaseID	
	pbsEventPopupNewID	
	pbsEventPulseWidth	2000
	pbsEventScript	
	pbsEventSecurityLevel	0
	pbsEventSetValue	
	pbsEventSignal	GTag1.Events_Toggle
4 III +	Text	Toggle
Ada Hemove		

pbsCMCIs Collection Editor	lext :	? ×		
Members:	xml version="1.0" encoding="utf-16"? 			
2 xml version="1.0" encoding="uti</td <td colspan="3">E Misc</td>	E Misc			
	pbsEvent	Set		
	pbsEventPageLoad			
	pbsEventPopupBaseID			
	pbsEventPopupNewID	2000		
	pbsE ventPulseWidth	2000		
	pbsElventSecuritul evel	0		
	nbsEventSetValue	23		
	pbsEventSignal	OPCSimu2Tags.Device1.DM2		
4 III >	Text	OPC Tag		
Add Remove				
		OK Cancel		

When you run pbsHMIView , for a graphic object with above context menu configuration , when you right click on object , you can see following menu :



When you click on any context menu, configured Event will be activating.

For changing Context menu properties, please refer to User Designed Symbol section.

# **User Designed Symbols**

pbsHMI supports symbols for fast development of Graphic pages . Symbols have following specifications:

- Reusable graphic objects
- Symbols will add to whole platform and it is not for a specific project
- Symbol is an object with graphic, Script and dynamics.
- You can define Public and Private Properties for Symbols.
- You can link signals to Public Properties and Private properties are local for Symbol.
- You can define Context menu for Symbols and change menu properties by Script

pbsHMI includes Symbol editor internally for making new symbols by user .

Symbol group: you can define many symbols inside a symbol group.

In pbsHMIEditor , click on Symbol tab and right click for making a new Symbol . You can open existing Symbol libraries. In following figure, BMS Library is opened:



You can change functionality of each symbol and compile symbol again.

Final output of Symbol Editor is a Dot Net DLL which will load automatically by pbsHMI at next booting.

Limitation: Symbol elements are basic pbsHMI elements and it is not possible to use symbol inside symbol. You can use basic elements, figures, polygon, strok and free hand tools for designing symbols.

Tools

pbsControl HMI Editor Ver 1.0.0.0 User = ba File Help Explorer NewLibrary1.plp Figures Basic Tools 👂 Database 🤘 Scheduling 👒 Utilities 🖈 Pages 🖀 Scripts 📙 Symbols 💷 Ch File Edit View Format Tools Pages & Scripts 
 Gib, BNS, pip
 Glub, BNS, pip
 Glub, BurjKhalifah, pip
 Glub, BurjKhalifah, pip
 Glub, Burtons, pip
 Glub, Dattons, pip
 Glub, Dattons, pip
 Glub, Chang, pip
 Glub, Chang, pip
 Glub, Valves, pip
 Glub, Valves, pip
 Glub, Valves, pip
 MokLibrary1, pip Rome Activity Ad Ho  $\mathbb{M}$ 9 Ω S <u>L</u> 

Making new symbol group: in pbsHMI Editor, select Symbol Tab, right click and select make new library.

pbsHMI Editor will make a blank library with name newLibrary{n}.plp

Save library and close it. Rename Library to any name you want. Based on pbsHMI standard, it is better to start library by "Glib\_" prefix.

Change new library to "GLib\_Cooling.plp" and refresh Library list.

Open Glib Cooling.plp by double click on Glib Cooling.plp name.

Symbol #1: Cool Pump.

 $\mathcal{L}$  $\triangle$  $\sum$ )

Suppose we want to make following symbol as Cool Pump.



Cool Pump has following properties: State : Public , type = int , Init Value = 0 When state=0, pump is off, color = gray

When state=1 , pump is ON , color = green

When state = 2 , pump fault , Color = Red , blink

Use basic elements and strok tool for making above symbol.

Step 1 : with help of circle , rectangle and strok tool you can draw above figure like following shape :



Step 2 : In Basic tool, use Function tool and drag it inside the pump shape.

With Function element, you can define properties and write script for symbol.



You can put Function element everywhere in pump symbol because it will be hiding at runtime.



Step 3 : Click on Function Element and define symbol properties at Property List :



Open PropertyList and define state property as following L

PbsPropertyStruct Collection Editor	60 5		? ×
Members: pbsHMIGEngine.PbsPropertyStrue     Add     Remove	bsHMIGEngine.PbsProperty Description: bsPropertyAccessType pbsPropertyInitValue pbsPropertyIname pbsPropertyType	Struct properties: Public 0 state int	
		ОК	Cancel

Step4 : define another private property as following :

PbsPropertyStruct Collection Editor	and an and the state of the local day in	? ×
Members: O pbsHMIGEngine.PbsPropertyStrue 1 pbsHMIGEngine.PbsPropertyStrue Add Remove	bsHMIGEngine.PbsPropertyStruct properties:	
	ОК С	ancel

Step5 : open CyclicFunction property of Function element and write following C# Code there :



Object GetTag(string pNameofPublicProperty)

With GetTag Function you can read value of a Public property. Return value is object.

Now we can use state and blink in pump symbol dynamic.

Step 6 : click on main circle of pump and define following brush dynamic :

olorDynamicsCls Collection Editor	₹ <mark>₹</mark>
Members:	xml version="1.0" encoding="uff-16"? < 2 4 1 3 Misc Colors (Collection) Signal state
	OK Cancel

When state = 0 then brush color = gray

When state = 1 then brush color = green

When state = 2 then brush color = red

Step7 : for the same element define Blink dynamic as following :

When blink is true, start to change color of circle with this sequence Gray  $\rightarrow$  red  $\rightarrow$  Yellow  $\rightarrow$  Gray

BlinkDynamicsCls Collection Editor	? ×
Members:	xml version="1.0" encoding="utf-16"?
	OK Cancel

Step 8:Select all pump elements and make them group . In Group properties , change pbsName to "CoolPump"

Step 9: Save library and from File menu compile library.



Step 10: you can see Glib\_Cooling.DLL in c:\pbsHMI Directory.

Step 11 : Close pbsHMI and run it again . Now Glib\_Cooling is loaded to pbsHMI Editor .



Step 12 : open a page and f=drag and drop CoolPump symbol to page .



Step 13 : open properties of CoolPump Symbol, you can see "state" is added to Dynamics group and you need to link signal to it.

Step14: Link @I#1 to state signal . @I#1 is constant value , with type int and value 1 .

Step15 :run pbsHMI View and see status of CoolPump .



Step 16 : change state signal value to @I#0 and check status of CoolPump .



Step 17: change value of state to @I#2 and check status of CoolPump. It will start to blink.

## 6 - SQL Server and data logging

pbsHMI has built in facilities for logging data in Microsoft MS Access , SQL Server and My SQL databases . In this section we will see how you can configure and archive data in databases.

#### 6 - 1 SQL Server Configuration and data logging

pbsHMI is using MS SQL Server for data , event and alarm archiving .

Defining MS SQL Server connection in pbsHMI : Click on Database tab and right click on Database area .



Then select "New SQL Connection".

pbHMI will make a Database configuration file in Database directory .

Name of Database connection is NewDatabase{x}.xml.

You need to Open database directory by click on explorer and change NewDatabase{x}.xml to any proper name based on your project.

You will use Database configuration file name in Device Tags, Global Tags, Alarms and Event configuration for setting data logging.

Double click on SQL Server configuration file you can see following page:

ewDatabase1.xml					
🗹 Enable	Protocol	SqlServer	]		
Connection String Data Source=KAMJ001	420\MSSQLSERVER20	14:Initial Cataloq=pbsHI	Al;Integrated Security=	False;User ID=sqlite	Password=psle
		rr, initial Catalog-posi in	m, megraled becamy-	alse,Oser ID-squite,	assword-pare
You should set SQL Connection String for connecting to MS SQL Server.

Typical SQL Connection strings:

When using windows authentication:

Data Source=WIN-L5NJDOC7R6I\MSSQLSERVER2014;Initial Catalog=pbsHMI;Integrated Security=True

When using SQL Server user name and password:

Data Source=WIN-L5NJDOC7R6I\MSSQLSERVER2014;Initial Catalog=pbsHMI;Integrated Security=False;User ID=sqlite;Password=xyziiii

There is a simple application (GetSQLConnStr.exe) in utility directory to find your server Connection String. Copy GetSQLConnStr.exe to your SQL Server Computer and run it.

🔜 pbsControl Find SQL Server Conection string	
Server Name	
Get SQL Instance	
WIN-L5NJD0C7R6I/SQLEXPRESS WINJ 5NJD0C7R6I/MSSQL SEBVER 2014	Security
	Use windows NT Integrated Security
	O Use Specific User Name and Password
	User Name
	Password
List of Databases	
master tempdb	Connection OK
model	
ReportServer\$MSSQLSERVER2014 BeportServer\$MSSQLSERVER2014TempDB	OK Test Connection
pbsHMI	
Connection String	
Data Source=WIN-L5NJD0C7R6I\MSSQLSERVER2014;Initial C	atalog=pbsHMI;Integrated Security=True

Click on Get SQL Instance, you can see list of installed SQQL Server .Select your SQL Server Instance, you can see name of databases In this instance .Select pbsHMI Database and select security .you can select windows Integrated Security or SQL Server User . At final step , click on Test Connection . Security is correct you can see Connection String with Connection OK Message . Copy Connection string and paste it in pbsHMI SQL Server Database configuration file in connection String part . In database directory of pbsHMI, you can see six sql script files to make pbsHMI Tables in SQL Server.

Make a new database in SQL Server and name it pbsHMI.

You should make two tables for Alarm Logging by following sql scripts in pbsHMI Database:

SQLServerAlarmIndex.sql

SQLServerAlarmData.sql

For Global and Device Tags archiving you need to use following scripts to make two tables:

SQLServerIndex.sql

SQLServerData.sql

And you need to use following scripts to make two tables for event logging:

SQLServerEventIndex.sql

SQLServerEventData.sql



dbo.Index and dbo.Data tables are used for global tags and device tags logging.

dbo.AlarmIndex and dbo.AlarmData tables are used for Alarms data logging

dbo.EventIndex and dbo.EventData Tables are used for logging Events

Using Database configuration file in General and device tags:

GTag1.xml							
Params Filte	r						
⊠ Enable	e Ta Da Cy	g Group Type Itabase clic Archive Period (Sec	Global TagDB.xml AlarmDB.xm NewDataba NewDataba TagDB.xml	r 11 se1.xml se2.xml			
Tag Name	Туре	Init Value unit	Alias	Active	Archive	Cyclic	Log
Tag2	bool	false	Tag1				
Tag3	bool	false	Tag1				
Tag4	bool	false	Tag1				
Figuers_R	int	0					
Meters_Va	float	0					
Dynamics	bool	false					
Dynamics	int	0			$\checkmark$		
Dynamics	bool	false					
Dynamic	float	810			$\checkmark$		
Dynamic	float	<b>658</b>					
Dynamic	bool	false					
Dynamic_L	float	50					
Dynamic_l	int	0					
Dynamic_I	bool	false					
Events_Set	int	0		$\checkmark$			
Events_To	bool	false					
Events_Pul	bool	false					
Events_Sc	int	0					
Pump_101_I	float	101.2					
Pump_101_V	float	400					

In global and device tag files you can see database combo box to select proper database connection. you can use one database configuration file for different resources .

Logging Data by changes: if you select Archive option for a tag , pbsHMI will archive all tag value changes in database .

Logging Data Cyclic : If you select Cyclic option for a tag , pbsHMI will log value of tag every "Cyclic Archive Period " in database .

For Alarm and Events you couldn't select specific Alarm or Events and pbsHMI will log all Events and Alarms.

MS SQL Server setting : you need to define pbsHMI Database in SQL Server at control room and define one User with password to use in Client/server Structure inpbsHMI . Please do following steps :

- 1- Make a new database in SQL Server , name it pbsHMI. (You did it before )
- 2- Use SQL Script that is in SQLite Directory of pbsSoftLogic or use Database directory of pbsHMI (You did it before)
- 3- Run SQLServerData.sql and SQLServerIndex.sql to make data and index tables in pbsHMI Databse (You did it before)
- 4- In SQI Server Management studio, Use "Security" item and open "Login" segment.
- 5- Right click in Login and select New Login



6 – In Login Properties page type user name for example "sqlite" and set password .Remove pass policy, expiration and user should change password in next login. you will use this user and password in SQLite driver options.

7 – select pbsHMI as default database .

🔋 Login Properties - sqlite				-		×
Select a page	🖾 Script 🔻 🚺 Help					
I serverRoles UserMapping Securables I status	Login gane:	eatte			Sgard	h
Connection	Map to Credential					
Server: KAMJOOT420WSSQLSERVER2 Connection: kamjooT420Vkamjoo-T420 View connection properties	Mapped Credentials	Credential	Provider			
Progress						ve
Ready	Default <u>d</u> atabase: Default language:	pbsHMI English		~		
			0	ĸ	Canc	el

8 – select pbsHMI Database , Select Security and open Users and right click on user to make new user.



9 – use same user that you make for SQL server "sqlite" and redefine it here.

## pbsHMI Concepts

间 Database User - New				_		×
Select a page Page General	🛒 Script 🔻 🛐 Help					
🚰 Owned Schemas 🚰 Membership	User type:					
I Securables	SQL user with login					$\sim$
	User name:					_
	Login name:					
	sqlite Default scheme:					
Connection						
Server: KAMJOOT420\MSSQLSERVER2						
Connection: kamjooT420\kamjoo-T420						
View connection properties						
Progress						
Ready						
		[	OK		Car	ncel

10 - Click on ok to define user .

11 - Select properties of pbsHMI Database



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12 – select permissions Page and Grant Connect, Execute, Insert, Update, Delete and select functionality to sqlite user. In this stage SQL Server is ready for proper operation Client/server Structure.

间 Database Properties - pbsHN	И					-		×
Select a page Providential	<u> Script</u> 🔻 🚺 Help							
Fiercours     Fiercours     Options     Dottons     Conage Tracking     Formisions     Fermisions     Fermisions     Fermisions     Transaction Log Shipping	Server name: View server permissions Database name: Users or roles: Name Salite		KAMJOOT pbsHMI	420\MSSQLSI	ERVER2014	Type User	Search.	
Connection	Permissions for sqlite:							
Server	Explicit Effective							
KAMJOOT420\MSSQLSERVER2	Permission	Grantor		Grant	With Grant	Der	ny.	^
Connection: kamjooT420\kamjoo-T420 <u>View connection properties</u>	Execute Insert References							
Progress	Show plan						H	
C Ready	Subscribe query no Take ownership							~
					OK		Cance	el

13 – Check pbsHMI Database collation is not Arabic , Persian , ... and only Latin like SQL\_Latin1\_General\_CP1\_CI\_AS will communicate with RTU

14 – Check SQL Server Authentication is SQL Server and Windows

🚦 Server Properties - KAMJOC	T420\MSSQLSERVER2014		-	-		×
Select a page	🔄 Script 👻 🚺 Help					
Memory     Memory     Connections     Database Settings     Advanced     Permissions	Server authentication           Windows Authentication           Windows Authentication           Image: SQL Server and Window           Login auditing           None           Failed logins only           Successful logins only           Both failed and success           Server proxy account           Enable server proxy account	mode vs Authentication mode ful logins ount				
Connection	Password:	*********				
Server: KAMJOOT420\MSSQLSERVER2 Connection: sqifte If View connection properties Progress Ready	Options Difions Enable Common Criteria Enable C2 audit tracing Cross database ownersh	compliance lip chaining				
			OK		Cance	el

15 – Check in Windows Firewall. TCP Port 1433 should be allowed in both inbound and outbound rules.

16 – Check in Windows Firewall. SQLBrowser.exe utility should be in Allowed programs List .you can find SQLBrowser.exe Path from C:\Program Files (x86)\Microsoft SQL Server\90\Shared\sqlbrowser.exe

Check SQL Server and SQL Server Browser Services are started properly.

17 – Open SQL Server Configuration Utility and open SQLServer Network Configuration.



Check Named Pipes and TCP/IP protocols are enabled. You can Make Them Enable by Right Click on each Item and select Enable Option.

Double click on TCP/IP Protocol and select IP Tab.



Scroll Down to IPALL and write TCP Port 1433.

18 – Open property page of main SQL server instance and select Connections.

Object Explorer	Server Properties - WIN-LS	NDUC/R01(PISQUSERVER2014	
Connect - 📑 📑 🔲 🏹 🛃	Select a page	Script - 🚺 Help	
Distance     Distance	Menoy     Menoy     Menoy     Sourty     Dotabase Settings     Advanced     Pemissions	Connections Maximum number of concurrent connections (0 = unlimited):	
D: an analyzine in a services Catalogs     D: bigs along services Catalogs     D: bigs SQL Server Agent		miplet transactione     curror ocie on commt     anai warninge     mai warninge     mai padding     NSI NULLS     artimetic abot     arthmetic ignore	•
	Connection Server: WINLENNDOC7R6IVMSSQLSER Connection: WINLENNDOC7R6IVAdministrator Yev connection properties Progress Ready	Remote server connections         If we remote connections to this server         Remote query timeout (in seconds, 0 = no timeout):         If 00         If Require distributed transactions for server-to-server communication         If Configured values         If Require distributed transactions for server-to-server communication	
4		OK Cano	el

Check Allow Remote Connections to this server is checked.

19 – Restart SQL Server Service.

If you are using SQL Server Express database, there is a 10 GB limitation for maximum database fie size.

When you reach to this limit, pbshMI cannot archive data.

For fixing this problem, you need to define a new pbsHMI2 database and generate all tables for this database and change in "pbsHMI" Database name in pbsHMI configuration files to "pbsHMI2".

## 7 – C# Scripting

pbsHMI supports C# Scripting for data manipulations . You can communicate with Database systems, Microsoft office, ... by C# Scripting .

All C# codes that is developing by user is compiled in one Dll . pbsHMIUserScript.dll

pbsHMIUserScript.dll has its own thread and it is communicating with pbsHMI Runtime kernel Ram Based RDBMS.

There are two functions for reading and writing to all pbsHMI Tags in C# Scripting

SetTag(string pName , object pValue )

SetTag writes to pbsHMI Tag.

pName = Full name of a pbsHMI Tag

pValue = Value of Tag in object format

-----

Object GetTag(string pName )

Read pbsHMI Tag

pName = Full name of a pbsHMI Tag

All pbsHMI script files are located in c:\pbsHMI\scripts directory.

# There is a system script file in scripts directory. UserScripts.cs Please do not delete or do any modification in this file.

For developing C# Scripts you need to know C# programming language. There are many samples in c:\pbsHMI\Scripts directory for your quick reference.

You can define public tag in scripts. pbsHMI will keep value of signal In each execution of script .

pbsHMI Scripts can be run by pbsHMI Scheduling or by events .

You can see all scripts in Scripts tab of pbsHMI Explorer .

📁 pbsControl HMI Editor Ver 1.5.1 User = baran		– o ×
File Help		
Tools 🖗	AccessDBScript.cs ×	Explorer 8
Figures Basic Tools Figures Basic Tools Acvetage Source Abor Active Acvetage Source Abor Active Acvetage Source Abor Active Acvetage Source Abor Active Acvetage Source Abor Active Born Actively Loop Born Actively Parallel Born Actively Sequential Born EvertCondonal Born Evert Time Born EvertCondonal Born Evert Time Born Task Message Born Task Reson Head Born Task Message Born Task Reson Head Born Task Message Born Task Reson Head Born Task Message	AccessIDEscripts          File Edit Sarch View         2       ystem.Collections;         3       ystem.Collections;         4       ystem.Collections;         5       ystem.Data.         6       ystem.Data.         7       ystem.Data.         10       ystem.Data.         11       ce pbsHHIVserScript         12       ystem.Vindows.Forms;         10       inited loops or threads         14       ystem.United loops or threads         15       Sample Function for calling by Buttons         16       bot use unlinted loops or threads         17       use schduling for cyclic events         18       if         19       ublic void AccessDBScript_Insert2DB()         20       (         21       (         22       (         23       OleDbConnection DB_Conn = new OleDbConnection();         24       .         25       OleDbConnection DB_Conn = new OleDbConnection();         26       .         27       string TmpTagName = "iconicsOPC_tags.Devicei.Numeric_Sine";         31       .         32       .         33       .         34       .	Explorer       Image: Second Sec
Tools Draw		Properties Explorer

For defining new script, right click on Scripts tab area and select new script.



New script has following format:

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🗏 using System; 2 using System.Collections; 3 using System.ComponentModel; 4 using System.IO; 5 using System.Xml; 6 using System.Data; 7 using System.Windows.Forms; 8 9 📮 namespace pbsHMIUserScript 10 { 11 ¢. public partial class pbsHMIUserClass 12 13 14 🖨 //Sample Function for calling by Buttons 15 //Do not use unlimited loops or threads 16 //use schduling for cyclic events 17 public void NewScript1() 18 { 19 20 } 21 } 22 }

Please do not change namespace and class name. You can only change name of Function.

Suppose you want to increase value of a pbsHMI Tag at each runtime of script .

```
1 🖂 using System;
2
    using System.Collections;
3
    using System.ComponentModel;
4
    using System. IO;
    using System.Xml;
5
6
   using System.Data;
7
8
  📮 namespace pbsHMIUserScript
9
    {
10 白
      public partial class pbsHMIUserClass
11
      {
12 白
         //Sample Function for calling by Buttons
13
         //Do not use unlimited loops or threads
14
         //use schduling for cyclic events
15
16 白
          public void Dynamic_Brush_Change()
17
          {
18
                 int TmpBrushValue = int.Parse(GetTag("GTag1.Dynamics_Brush").ToString());
19
                TmpBrushValue++;
20
                 if(TmpBrushValue > 3)
21
                 {
22
                     TmpBrushValue = 0;
23
                SetTag("GTag1.Dynamics_Brush", TmpBrushValue);
24
2.5
          }
26
      }
   []}
27
```

pbsHMI will load all functions dynamically at startup . pbsHMI will call functions by scheduling or by user events .

You couldn't change any graphic object properties by scripting directly. For this scenario you need to do following steps:

- 1- define one global tag
- 2- Link global tag to graphic object dynamics
- 3- Change value of global tag in script.

#### 8 – Scheduling

pbsHMI supports different types of Scheduling for doing automatic tasks .You can define new schedule in scheduling tab of pbsHMI explorer .

📁 pbsControl HMI Editor Ver 1.5.1 User = baran		- 0 ×
File Help		
Tools 🌣	Script_Sch.xml	× Explorer
Actor Actor Actor Actor Actor	Cyclic Script Figuers_Rotate_With_Enable	CheckAlarmsSch.xml Chove_ellipse_Sch.x CRunReporSch.xml Csript_Sch.xml ShowDTSch.xml Explorer Refresh
Born Activity Ad Hoe Born Activity Compensato Born Activity Loop Born Activity Parallel Born Activity Sequential Born Event Conditional Born Event Enco Born Event Timer Born Task Message	Run Every day at 23:50 hh:mm Every hour at 0 mm Every msec 1000 Loading Shutdown	
Bomn Task Person Head Bomn Task Person Shirt		Properties Explorer

Right click on scheduling area and define a new schedule.

Script = Name of script function for execution in schedule

Following scheduling is defined in pbsHMI :

- Every Day at hh:mm = It will run Script for one time every day at hh:mm
- Every Hour at mm = It will run script every hour at mm min.if mm is 10 as an example, then it will run script every hour at 10 min.
- Every msec : will run script every msec . you can use this schedule for executing script in cyclic mode .
- Loading : run script at load time
- Shutdown : Load script at pbsHMI shutdown

Schedules are global in pbsHMI. Schedules are not running in clients applications. Schedules are running only in pbsHMI Server application. When value of a pbsHMI tag is changed in script, then all changes will publish to clients automatically and no need to run schedule in clients.

Suppose you want to run an excel report every day at 8 am . At first stage you need to define a new script to provide execl file. Look at following script as an example:

# 2025



Define a new schedule and run pbsExcelTest function every morning at 08:00

Ena	ole			
Cyclic				
Script	pbsExcelT	est		
Fun	Every day at	08:00 hh:mr	n	
	○ Every hour at ○ Every msec	0	mm	
	○ Loading ○ Shutdo <del>w</del> n			

Save schedule by right click on schedule header form and select save.

Tuni oporocitaria postadorocitarios	
Save	
Cyclic	
Script pbsExcelTest	
- Due	
Fun	
Every day at     08:00     hh:mm	
O Every hour at 0 mm	
O Every msec 1000	
○ Loading	
○ Shutdown	

pbsHMI Runtime will execute pbsExcelTest function every day at 08:00 am .

in the following code we read current and voltage from different Solar panels and calculate Active Power and set value on a global tag.



We want to run this script every 5 sec, so we need to define following scheduling:

AlenCon.cs	Report.cs AlenConSch.xml
🗹 Enabl	e
Cyclic	
Script	AlenConKW
(	Every day at 23:50 hh:mm
(	Every hour at 0 mm
	Every msec 5000
(	CLoading
(	⊃ Shutdown

You can define multiple scheduling for a project and all will execute independent from each other.