

“Tell me and I forget,
teach me and I may remember,
involve me and I learn.”

-Benjamin Franklin

eliwell

by **Schneider** Electric

Freeway Exercise

Solutions for OEMs, FreeStudio
Thermostat exercise



eliwell

by **Schneider** Electric



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I have graduated as electrical engineer.

I have started to work in Schneider Electric since 2006 as:

- OEM sales engineer
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- Industry product manager

After working for seven years in Iran' Schneider Electric, by winning the Edison Solution Architect level 1 award in OEM & Water/Waste Water treatment applications I found the opportunity to join Machine Solution team based in Marktheidenfeld/ Germany.

My hobbies are: Swimming, Playing Canoepolo & working on new idea as patenting inventions.

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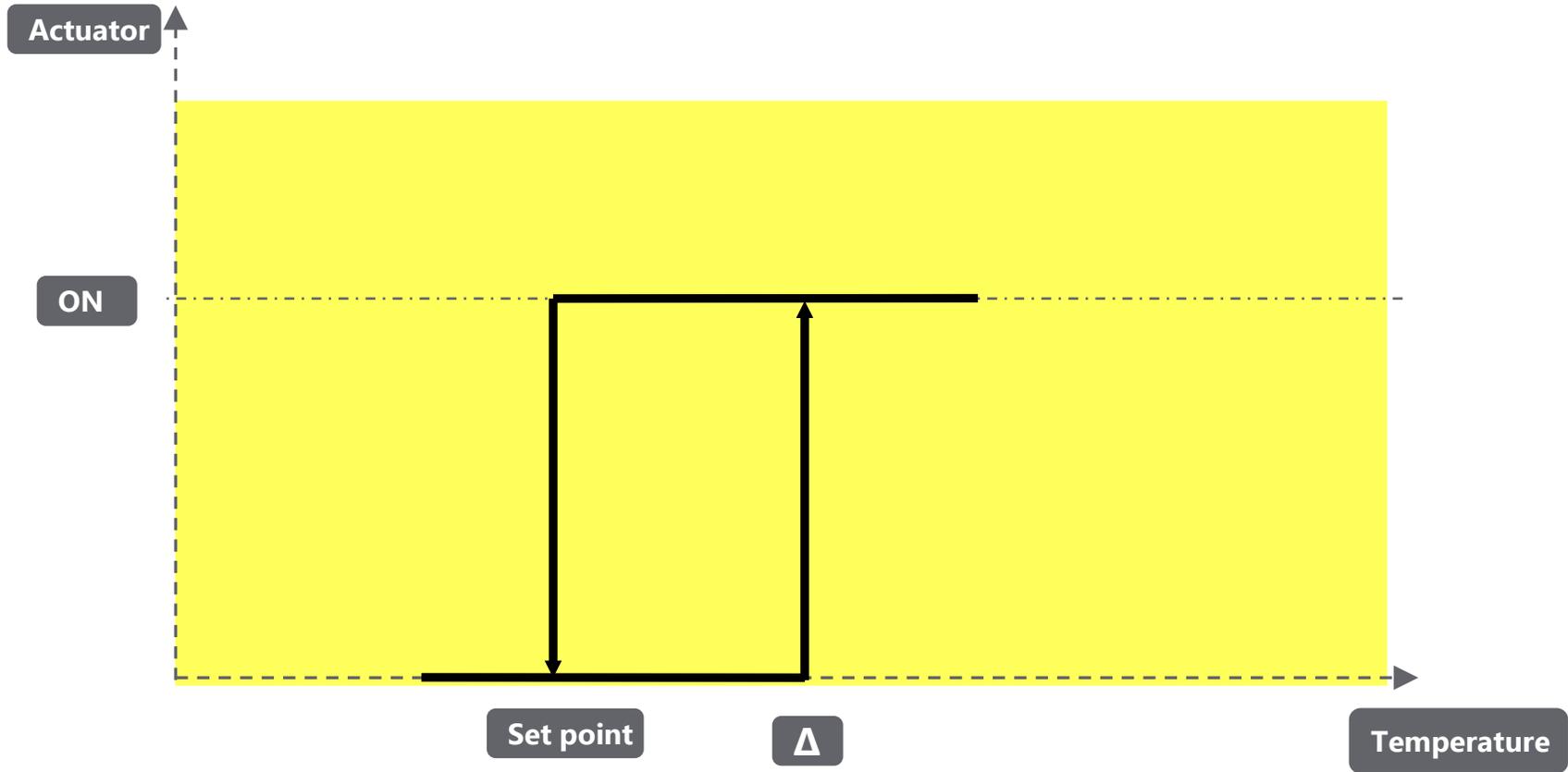
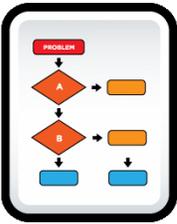
Chapter 1

Function Description

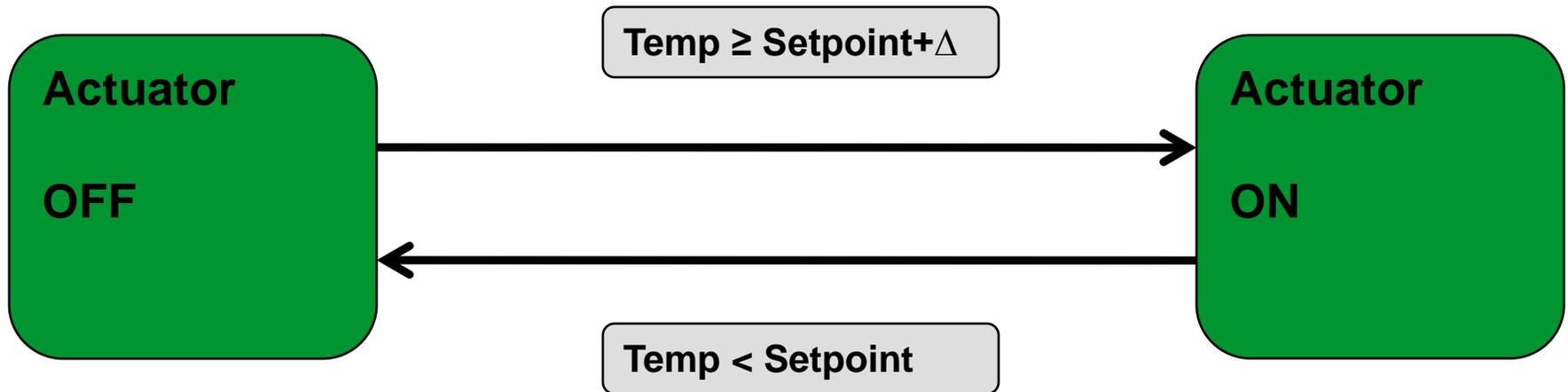
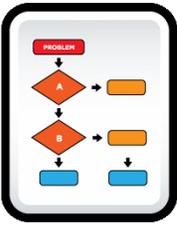
Goal:

Describe thermostat flow chart

Thermostat cycle



Thermostat states (function description)



Chapter 2

Programming

Goal:

- Familiarizing with programming environment
- Creating Thermostat Function Block

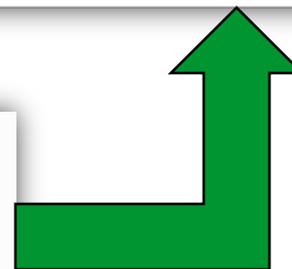
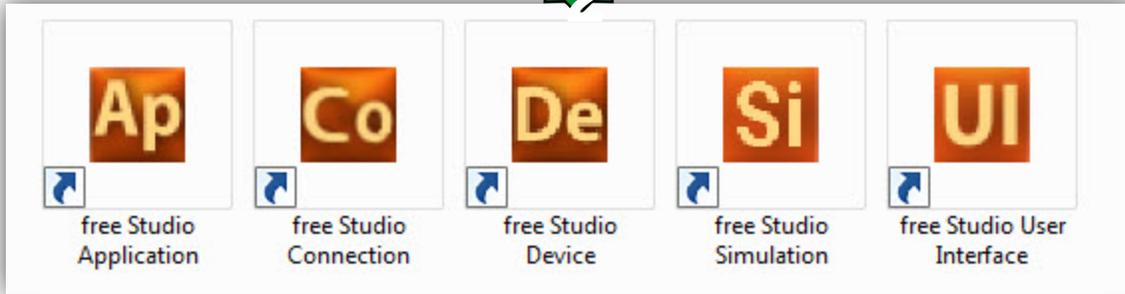
Creating New project



2*click



2*click



Creating New project



The screenshot shows the 'Welcome to Application' dialog in the Eliwell Free Studio. The 'Name' field is set to 'HVAC_Exercise' and the 'Directory' is 'C:\TrainingExercises'. A 'Target selection' table is displayed below, with 'FreeSmart' highlighted. A 'Case sensitive' checkbox is at the bottom left. The interface includes a menu bar, a toolbar, and several panels: 'Watch', 'Oscilloscope', 'Output', and 'Library'. The status bar at the bottom indicates 'EDIT MODE' and 'NOT CONNECTED'.

Target selection		
	FreeEvolution EVD	423
	FreeEvolution EVC	477
	FreeEvolution EVP	489
	FreeSmart	412
	FreeSmart Modbus Master	542
	FreeAdvance	596

Creating New project



The screenshot displays the 'FreeSmart Configuration' software interface. The main window is titled 'FreeSmart Configuration' and contains several configuration sections:

- Display:** Fundamental state display: **ADR1**
- Execution time:** Set execution time: Execution time (ms):
- Data export:** Select XSLT export filter:

In the center, there is a diagram of a hardware keypad with the following layout:

- Top row: F1 (up arrow), F2 (esc)
- Second row: F5 (down arrow), F4 (set)
- Bottom row: F3 (down arrow), F4 (set)
- Bottom edge: 7 numbered buttons (1-7)
- Right edge: Prg button

On the right side, there is a 'Watch' window with a table structure:

Symbol	Value	Type	Loc
--------	-------	------	-----

At the bottom right, there is an 'Oscilloscope' window showing a grid with a horizontal axis ranging from -5000 to 0.

The bottom status bar shows 'Ready' on the left and 'EDIT MODE' and 'NOT CONNECTED' on the right.

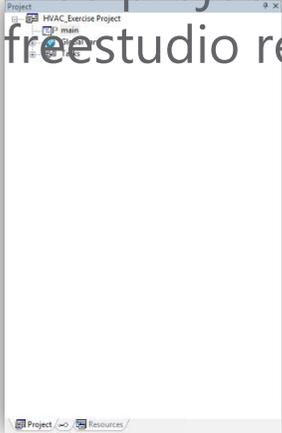
Output
Preprocessing Modbus_cfg completed.
Preprocessing basic completed.
0 warnings, 0 errors.

Name	Type	Group	Description
ABS	Function	Arithmetic	Absolute value Computes the abs...
ACOS	Function	Arithmetic	Arc cosine Computes the principa...
ADD	Operator	Arithmetic	Arithmetic addition
ADR	Operator	Standard	Address of

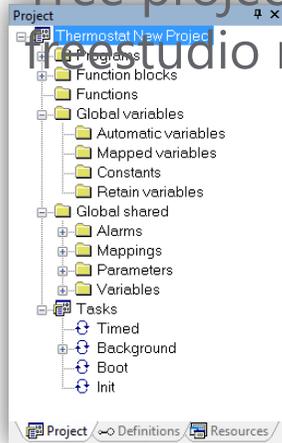
Compatibility with old release



Tree project in last freestudio release

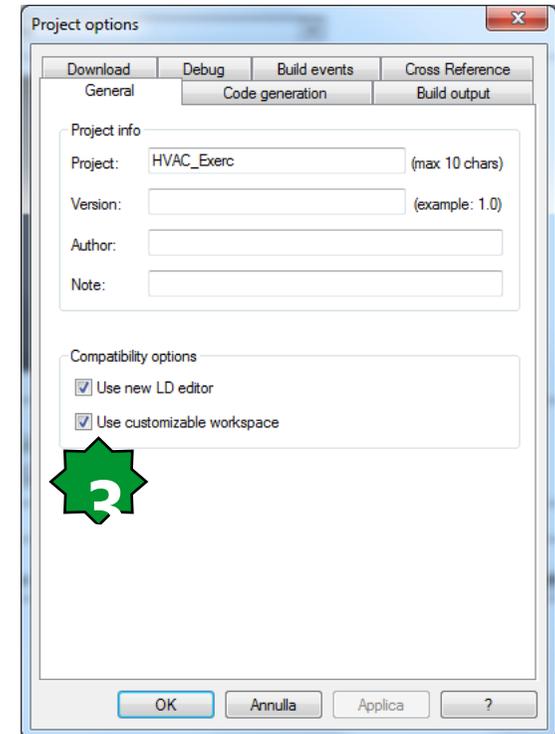


Tree project in old freestudio release



We can change display tree option in order to have full compatibility with follow slides of exercise

1. Project menu
2. Option command
3. Unselect Use customizable workspace
4. Click OK when required



Programming environment



Project

- Thermostat New Project
 - Programs
 - Function blocks
 - Functions
 - Global variables
 - Automatic variables
 - Mapped variables
 - Constants
 - Retain variables
 - Global shared
 - Alarms
 - Mappings
 - Parameters
 - Variables
 - Tasks
 - Timed
 - Background
 - Boot
 - Init

Project Definitions Resources

Resources

- Configuration
 - FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menu Prg
 - Cfg
 - Menu set
 - Setting Menu
 - I/O Mapping
 - Local
 - Extended
 - Remote
 - Alarms
 - Help

Project Definitions Resources

File Edit View Project On-line Debug Variables Window Tools Developer Help

Project

- Thermostat Project
 - Programs
 - main
 - Function blocks
 - Functions
 - Global variables
 - Automatic variables
 - Mapped variables
 - Constants
 - Retain variables
 - Tasks
 - Timed
 - Background
 - Boot
 - Init

Local variables

Name	Type	Address	Array	Init value	Attribute	Description
0001						
0002						
0003						

Match

Symbol	Value	Type
--------	-------	------

Oscilloscope

Track Um Min value

Output

```
Preprocessing module TARGET completed.  
Preprocessing module MAIN completed.  
Preprocessing basic completed.  
  
0 warnings, 0 errors.
```

Library

<input checked="" type="checkbox"/> ABS	<input checked="" type="checkbox"/> DIV	<input checked="" type="checkbox"/> LN	<input checked="" type="checkbox"/> MLX	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/> TAN	<input checked="" type="checkbox"/> TO_USINT
<input checked="" type="checkbox"/> ACOS	<input checked="" type="checkbox"/> EO	<input checked="" type="checkbox"/> LOG	<input checked="" type="checkbox"/> NE	<input checked="" type="checkbox"/> SEL	<input checked="" type="checkbox"/> TO_BOOL	<input checked="" type="checkbox"/> XOR
<input checked="" type="checkbox"/> ADD	<input checked="" type="checkbox"/> EXP	<input checked="" type="checkbox"/> LT	<input checked="" type="checkbox"/> NOT	<input checked="" type="checkbox"/> SHL	<input checked="" type="checkbox"/> TO_DINT	
<input checked="" type="checkbox"/> AND	<input checked="" type="checkbox"/> GE	<input checked="" type="checkbox"/> MAX	<input checked="" type="checkbox"/> OR	<input checked="" type="checkbox"/> SHR	<input checked="" type="checkbox"/> TO_INT	
<input checked="" type="checkbox"/> ATAN	<input checked="" type="checkbox"/> GT	<input checked="" type="checkbox"/> MIN	<input checked="" type="checkbox"/> R	<input checked="" type="checkbox"/> SIN	<input checked="" type="checkbox"/> TO_REAL	
<input checked="" type="checkbox"/> COS	<input checked="" type="checkbox"/> JMP	<input checked="" type="checkbox"/> MOD	<input checked="" type="checkbox"/> RET	<input checked="" type="checkbox"/> SIZEOF	<input checked="" type="checkbox"/> TO_SINT	
	<input checked="" type="checkbox"/> LE	<input checked="" type="checkbox"/> MOVE	<input checked="" type="checkbox"/> ROL	<input checked="" type="checkbox"/> SQR	<input checked="" type="checkbox"/> TO_UDINT	
	<input checked="" type="checkbox"/> LIMIT	<input checked="" type="checkbox"/> MUL	<input checked="" type="checkbox"/> ROR	<input checked="" type="checkbox"/> SUB	<input checked="" type="checkbox"/> TO_UINT	

Operator and standard blocks Target variables Target blocks basic

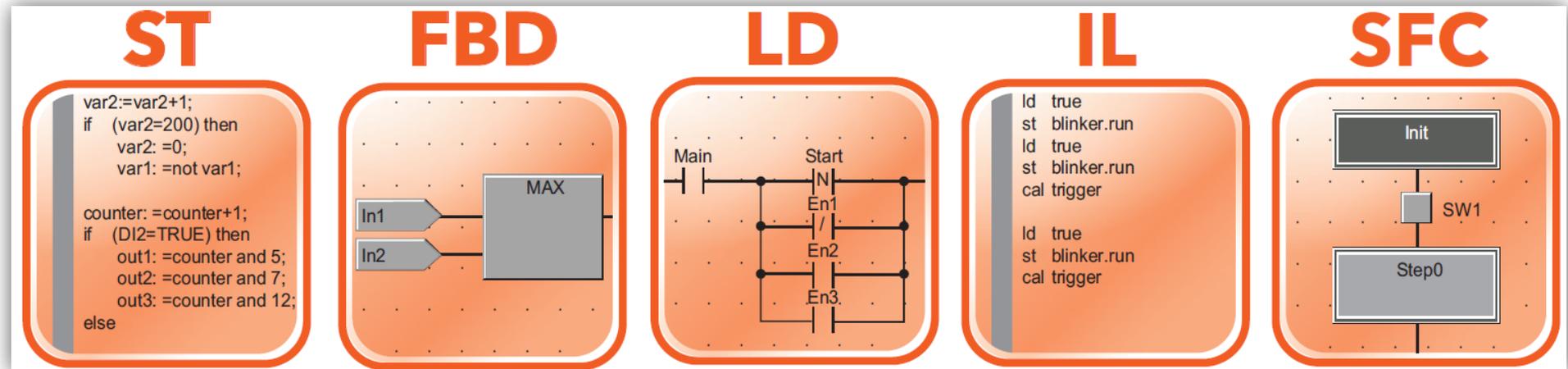
Ready

EDIT MODE NOT CONNECTED

Programming Languages



The **FREE STUDIO** platform is compatible with all 5 standard programming languages (IEC 61131-3).



5 programming languages, 2 text-based and 3 graphics-based:

- **ST, Structured Text, language text**
- **FBD, Functional Block Diagram language graphical**
- **LD, Ladder language graphical**
- **IL, Instruction List language text**
- **SFC, Sequential Function Chart language graphical**

Thermostat program

1. Right click on the programs
 2. New program
 3. Select language
 4. Name it
 5. Assign it to the background or timer task
- Note: The main (default) program can be deleted if not used (Rename is possible, Editing language is not possible).

The screenshot shows the 'Lesson01 Project' tree on the left with the 'Programs' folder selected. The 'New program' dialog is open, showing the 'Language' section with 'FBD' selected, the 'Name' field containing 'Thermostat', and the 'Task' section with 'Background' selected. A 'Delete the selected PLC Object?' dialog is also open, asking to delete the 'main' program. A green callout box at the bottom of the 'New program' dialog says 'See the next slide for Task detail'.



Associating a program to a task

For a program to run, it must be associated to a task.

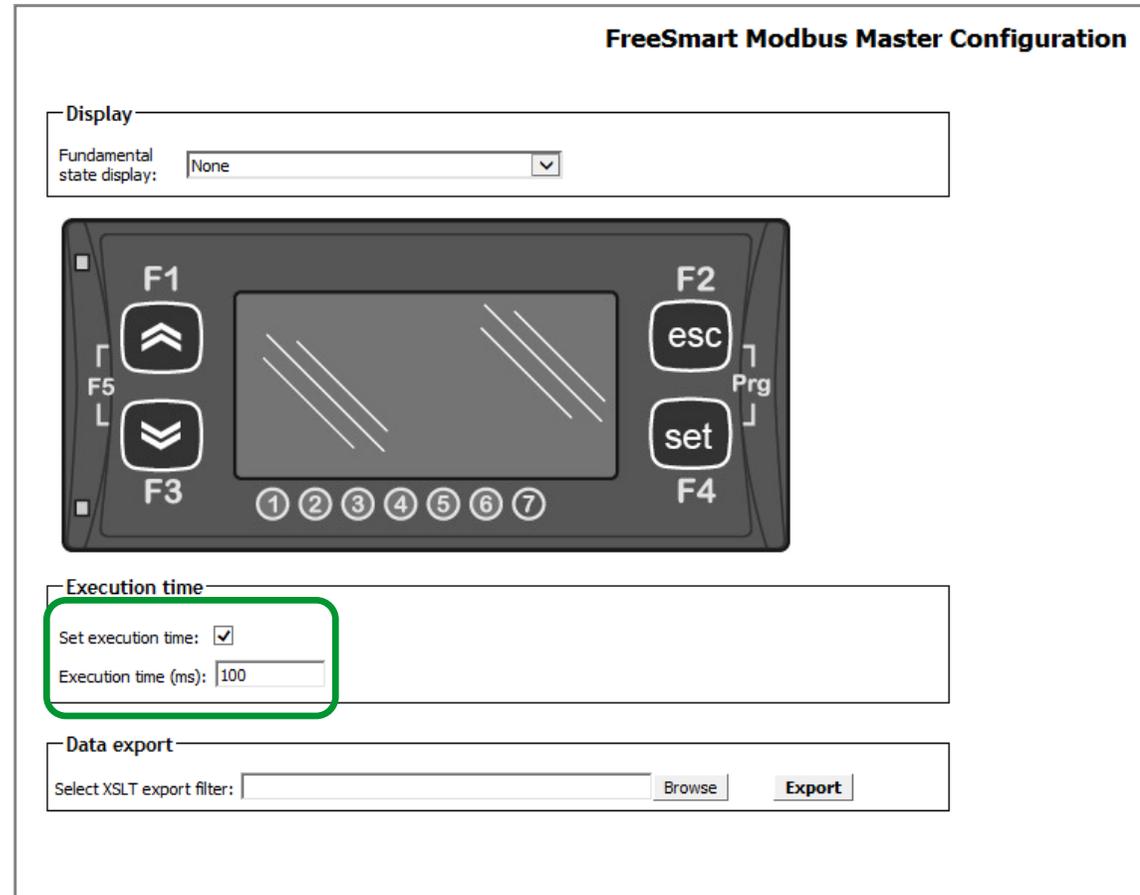
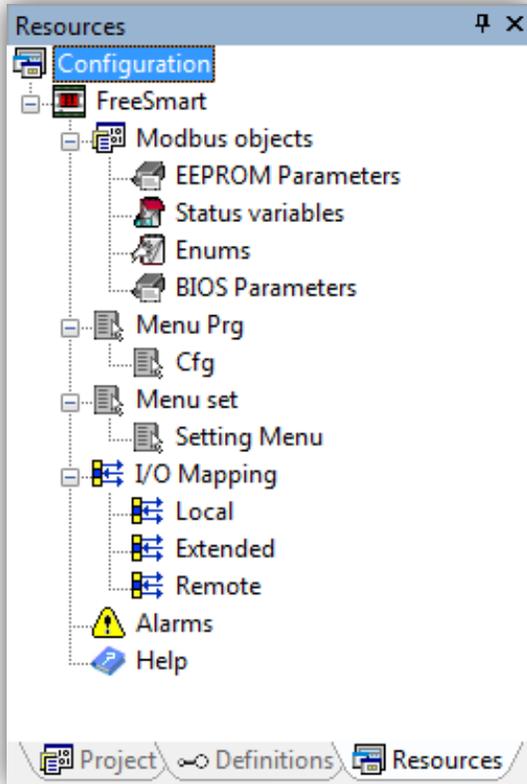
There are various types of tasks:

- **BOOT Task** runs once only at system start-up.
- **Init. Task** runs each time the application is downloaded and after **BOOT**.
- **Timed. Task** runs at regular intervals which can be set by the developer. The default setting is 100ms.
- **Background. Task** runs with low priority after the Timed tasks (between the end of one Timed task and the start of the next), it can be interrupted in case of long execution or executed more than 1time in case short execution.

Note Each new project has the main program associated to the background task (the main program can still be eliminated and/or associated to other tasks).

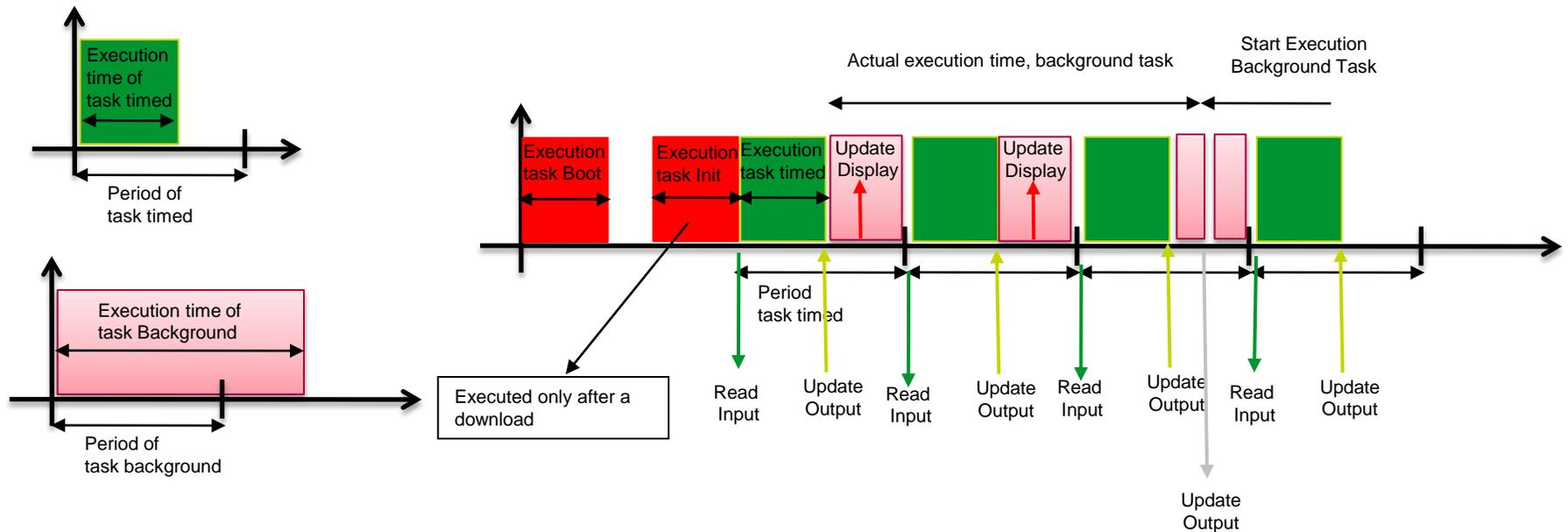
To activate a task, go to the task you want, right-click and select Add program

Timed Task setting



Tasks

- **BOOT Task** runs once only at system start-up.
- **Init. Task** runs each time the application is downloaded and after **BOOT**.
- **Timed. Task** runs at regular intervals which can be set by the developer. The default setting is 100ms.
- **Background. Task** runs with low priority after the Timed tasks (between the end of one Timed task and the start of the next).



Assigning program to the task



Project

- Thermostat Project
 - Programs
 - Thermostat
 - Function blocks
 - Functions
 - Global variables
 - Automatic variables
 - Mapped variables
 - Constants
 - Retain variables
 - Tasks
 - Timed
 - Background
 - Thermostat
 - Boot
 - Init

Tasks > Background > right click > add program

Output
Preprocessing module TARGET completed.
Preprocessing module MAIN completed.
Preprocessing basic completed.

0 warnings, 0 errors.

ABS	DIV	LN	MUX	S	TAN
ACOS	EQ	LOG	NE	SEL	TO_BOOL
ADD	EXP	LT	NOT	SHL	TO_DINT
ADR	GE	MAX	OR	SHR	TO_INT
AND	GT	MIN	R	SIN	TO_REAL
ASIN	JMP	MOD	RET	SIZEOF	TO_SINT
ATAN	LE	MOVE	ROL	SORT	TO_UDINT
COS	LIMIT	MUL	ROR	SUB	TO_UINT

View FBD toolbar



The screenshot shows the software interface with the 'View' menu open. The 'FBD bar' option is selected, and a callout box provides instructions on how to view it. The 'FBD bar' is highlighted in the toolbar, and the 'SFC bar' is highlighted in the 'View' menu.

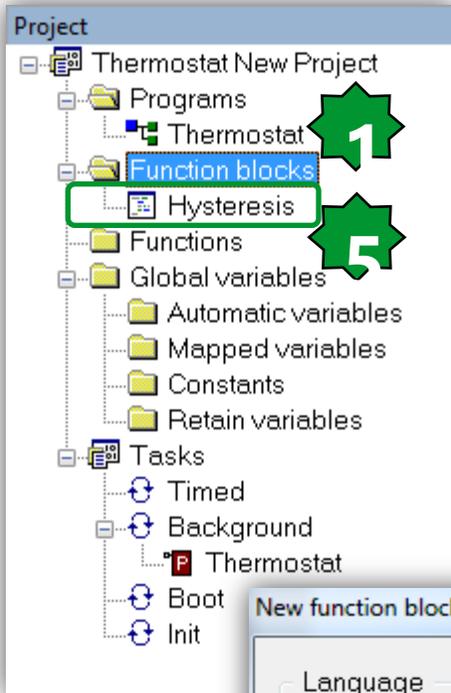
1. View
2. Toolbars ► FBD bar

View	Project	On-line	Debug	Variables	Window
Toolbars			<input checked="" type="checkbox"/>		
Tool windows			<input checked="" type="checkbox"/>		
Full screen	Ctrl+U		<input checked="" type="checkbox"/>	Ctrl+B	
Grid			<input checked="" type="checkbox"/>	Ctrl+D	
				Ctrl+A	
				Ctrl+Q	
				Ctrl+J	
				Ctrl+N	
				Ctrl+M	

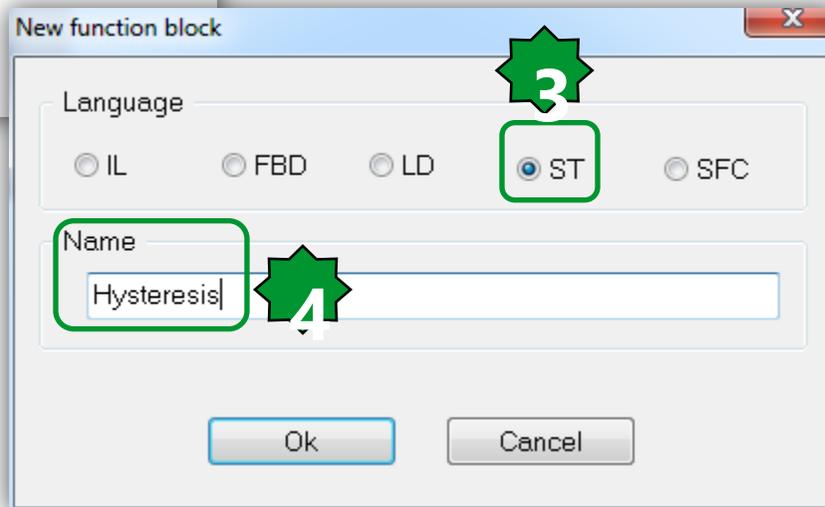
Type	Address	Array

View	Project	On-line	Debug	Variables	Window
Toolbars			<input checked="" type="checkbox"/>		
Tool windows			<input checked="" type="checkbox"/>		
Full screen	Ctrl+U		<input checked="" type="checkbox"/>	Ctrl+B	
Grid			<input checked="" type="checkbox"/>	Ctrl+D	
				Ctrl+A	
				Ctrl+Q	
				Ctrl+J	
				Ctrl+N	
				Ctrl+M	

New function block creation



1. Right Click
2. New function block
3. Select the language
4. Assign a name
5. Double click on the Hysteresis to open the editor related to the selected language.



Note: Try to create function if the block does not require static RAM, it will optimize the RAM usage. a function use RAM stack, which is allocate when you call the function and released just after the call execution.

A function block instance instead allocate a static RAM equal to all the Vars declared in the function block, between one call and the following the RAM value is maintained.

So if don't need this feature, i.e. your block doesn't have internal states, it is better to implement it as a function.

PID must be a FB because of the integral time.

SUM could be implemented as function or FB (but it is better to implement it as a function).

Insert record

1

2

3

4

5

6

5 & 6. Optional

Class	Pin	Name	Type	Array	Init value	Attribute	Description
VAR		Temperature	INT	No			Analogue Input 1

Object browser

Objects filter

- Programs
- Function Blocks
- Functions
- Variables
- User types
- Operators
- Standard functions
- Local variables
- Basic types

Check all Check none

Other filters

Name: * OK

Location: All

Library: All

Vars type: All

Cancel OK

Name

- BOOL
- BYTE
- DINT
- DWORD
- INT
- REAL
- SINT
- STRING
- UDINT
- UINT
- USINT
- WORD

4

For more information about different data types please visit Appendix 1.



Inside Hysteresis FBD

Local variables								
	Class	Pin	Name	Type	Array	Init value	Attribute	Description
1	VAR_INPUT	0	Temperature	INT	No		..	Analogue Input 1
2	VAR_INPUT	1	Setpoint	INT	No		..	Set point
3	VAR_INPUT	2	Differentiation	INT	No		..	Δ
4	VAR_OUTPUT	0	Alarm	BOOL	No		..	Probe Alarm
5	VAR_OUTPUT	1	Output	BOOL	No		..	Actuator

```
0001 (* Hysteresis FBD *)
0002
0003 if Temperature >= Setpoint + Differentiation then
0004     Output := TRUE;
0005 end_if;
0006
0007 if Temperature < Setpoint then
0008     Output := FALSE;
0009 end_if;
0010
0011 (* Probe disconnection detector *)
0012
0013 if Temperature = -32768 then
0014     Alarm := TRUE;
0015 else Alarm := FALSE;
0016 end_if;
0017
0018
```

Compile result is valid as soon as FBD used in the program

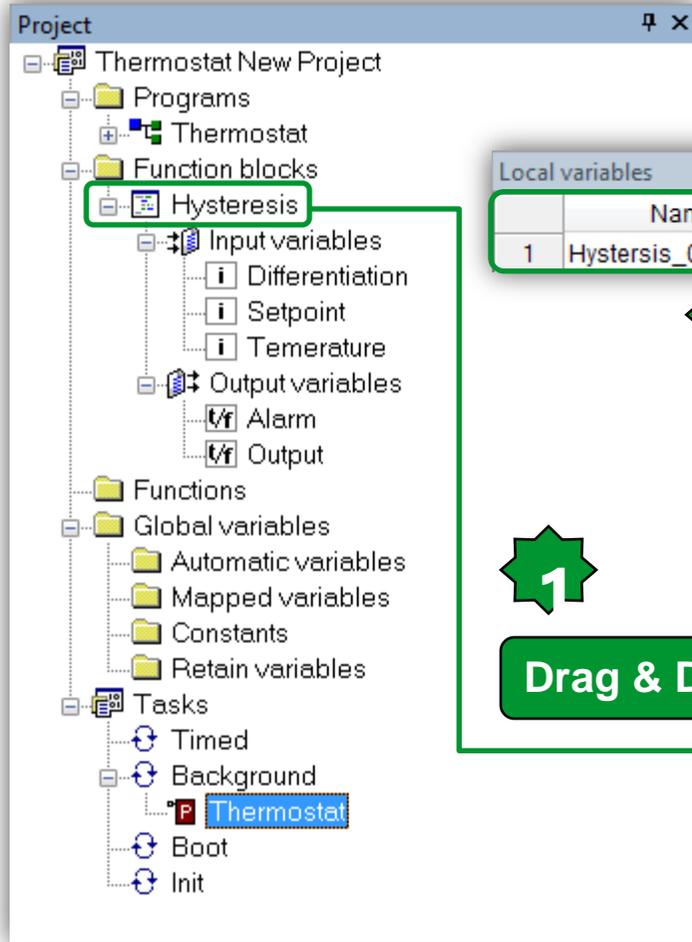
Output		
Free code space:	2F1E0h	(188 KByte)
Data space:	8C0h	(2 KByte)
Free data space:	8ABh	(2 KByte)

0 warnings, 0 errors.

Build Find in project Debug Resources

FBD in Background

1. Double click on the Thermostat program to open the editor that is related to the program
2. drag & drop
3. Name it
4. Add new network

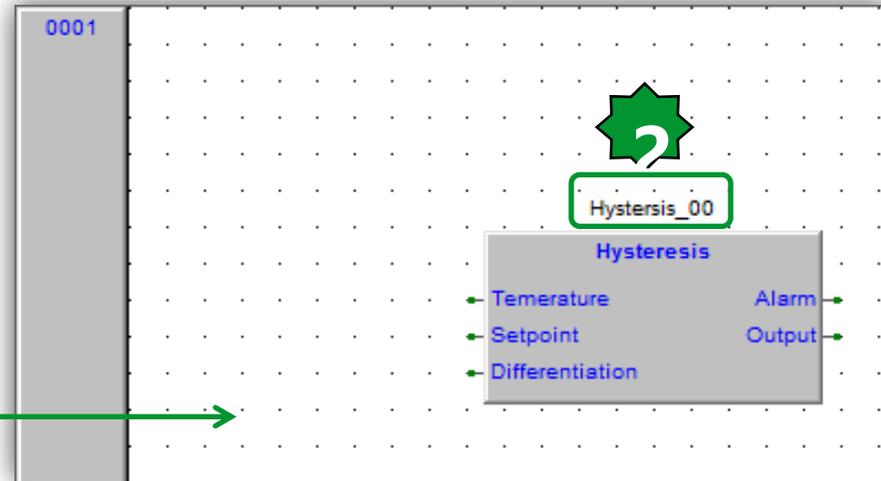


Project

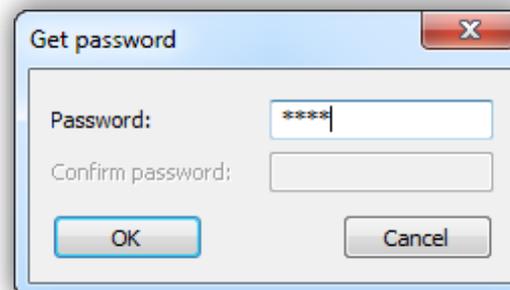
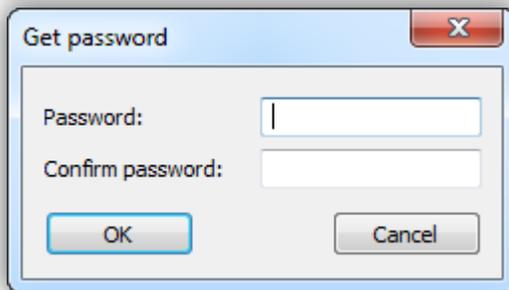
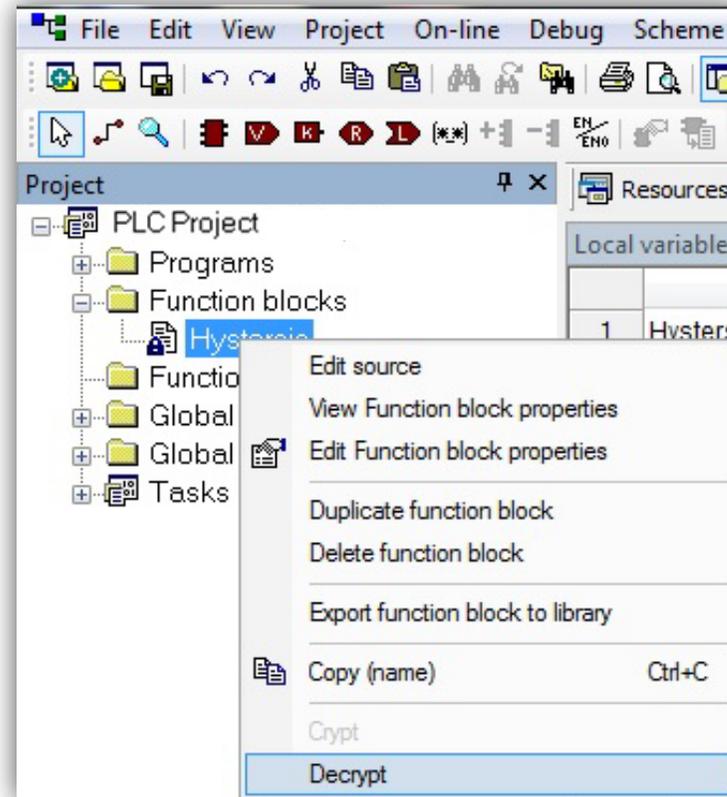
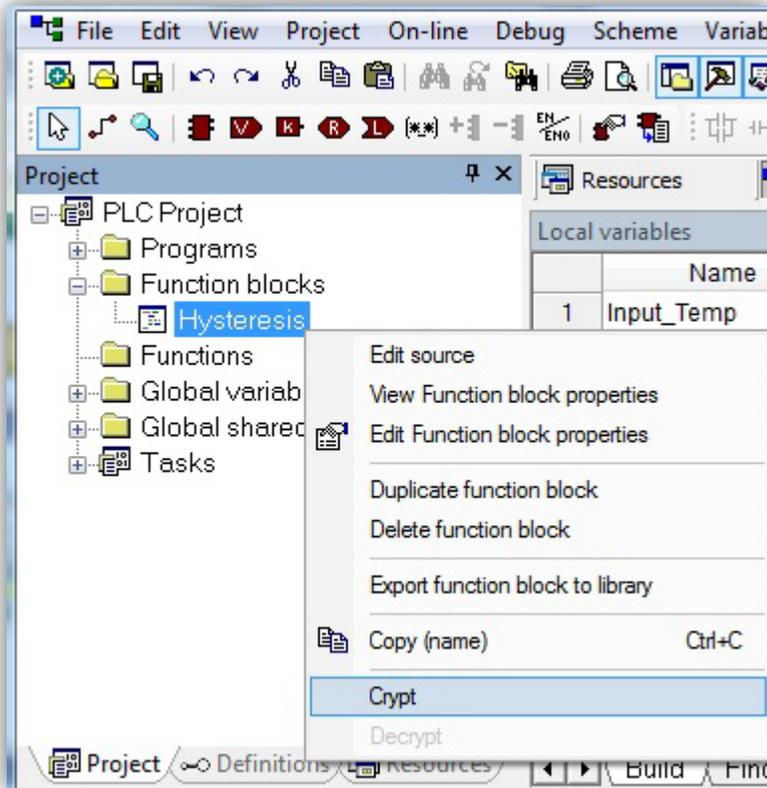
- Thermostat New Project
 - Programs
 - Thermostat
 - Function blocks
 - Hysteresis
 - Input variables
 - Differentiation
 - Setpoint
 - Temperature
 - Output variables
 - Alarm
 - Output
 - Functions
 - Global variables
 - Automatic variables
 - Mapped variables
 - Constants
 - Retain variables
 - Tasks
 - Timed
 - Background
 - Thermostat
 - Boot
 - Init

Local variables							
	Name	Type	Address	Array	Init value	Attribute	Description
1	Hystersis_00	Hysteresis	Auto	No		..	

1
Drag & Drop



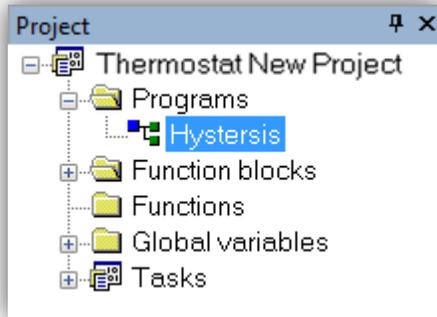
Set password for written FB



You can prevent access to your written codes inside of FBD by cript.



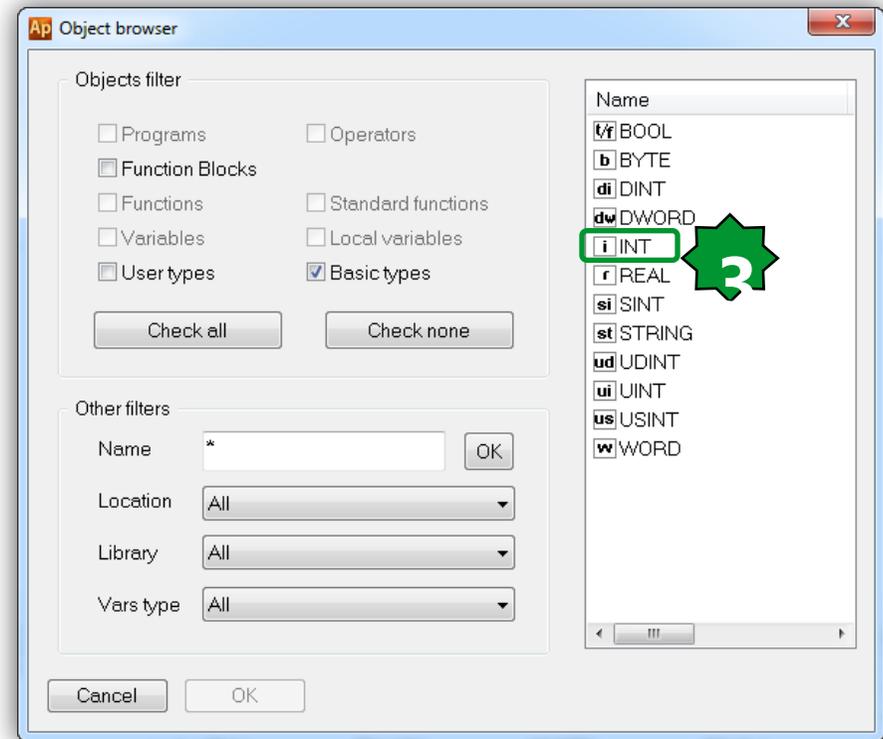
Assigning local variable to the FBD



	Name	Type	Address	Array	Init value	Attribute	Description
1	Hysteresis_00	Hysteresis	Auto	No		..	
2	Input_Temp	INT	Auto	No		..	



- 1. Add new record
- 2. Name it
- 3. Define the type from object browser



Connecting Variables to the FBD

Local variables							
	Name	Type	Address	Array	Init value	Attribute	Description
1	Input_Temp	INT	Auto	No		..	
2	Input_Setpoint	INT	Auto	No		..	
3	Input_Differentiation	INT	Auto	No		..	
4	Output_Alarm	BOOL	Auto	No		..	
5	Output_Output	BOOL	Auto	No		..	
6	Hysteresis_00	Hysteresis	Auto	No			

Drag & Drop

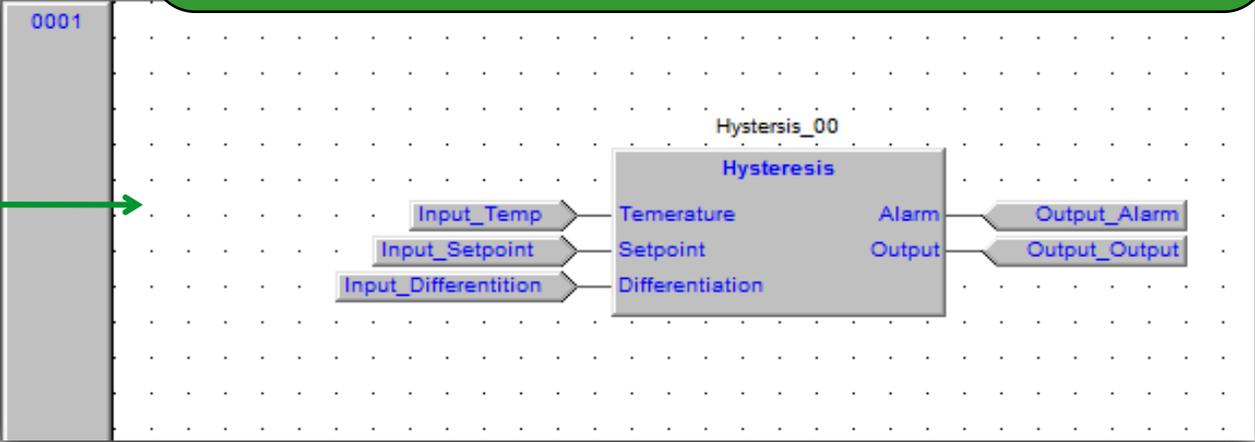
Shortcuts:
 Space: Connecting Mode ◀ ▶ Insert/Move Mode
 Ctrl+Shift+Left Mouse Button: Multiple Selection
 Ctrl+Shift+F: Find in project

Var type

Input OK

Output Cancel

Select Input/output

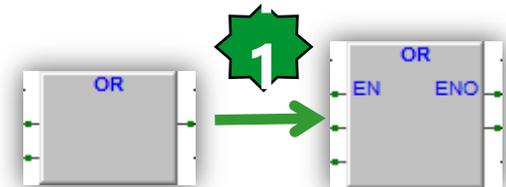


FBD toolbar...



1. Connection
2. Watch
3. New block
4. Variable
5. Constant
6. Return
7. Jump
8. Comment
9. Increase number of pins
10. Decrease number of pins
11. Display enable I/O pins
12. FBD properties
13. View source

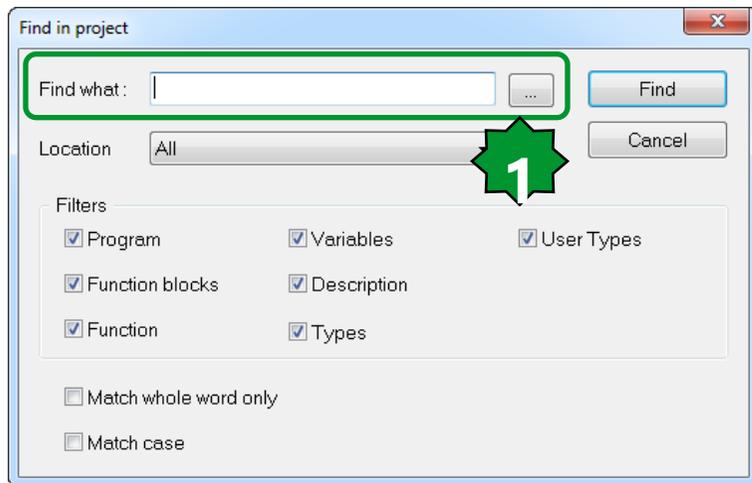
11. The output will not update if En=False



Cross Reference



1. Find in project (cross reference)



Tools Configuration



The screenshot shows the main application window with the 'Tools' menu open. The menu items are 'Calculator' and 'Command'. The project tree on the left shows a 'Global vars' folder selected. The project name is 'Thermostat New Project'.

- File
- View
- Project
- On-line
- Debug
- Tools
- Developer
- Help

Resources

Configuration

- FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Local
 - Field
 - Alarms
 - Web Site
 - BACnet Objects
 - Device
 - Analog Value Objects
 - Binary Value Objects
 - Calendar Objects
 - Multi State Value Objects
 - Schedule Objects
 - Notification Class Objects
 - LON Profile

- Thermostat New Project
- ATV_Control
- CAN_Monitoring
- Fan_Management
- Hystersis
- Language_Switching
- LED_Mgmt
- Moves
- Thermostat
- USB_Device
- Global vars
- Tasks
 - Timed
 - Background
 - Boot
 - Init

The 'Program options' dialog box is shown with the 'Tools' tab selected. It contains a list of tools with 'Command' selected. Below the list are fields for 'Command', 'Arguments', and 'Menu string'. The 'Command' field contains 'C:\Windows\System32\cmd.exe'. There are 'Add', 'Delete', and 'Modify' buttons. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Program options

General | Graphic Editor | Text Editors | Language | Tools | Merge

- Calculator
- Command

Command: C:\Windows\System32\cmd.exe

Arguments:

Menu string: Command

Add Delete Modify

OK Cancel Help

The Windows Calculator application is shown in the foreground. It is in the 'Standard' mode. The display shows '0'. The interface includes a menu bar (View, Edit, Help) and a numeric keypad with various mathematical and conversion functions.

Calculator

View Edit Help

0

Hex Dec Oct Qword Dword Word Byte

Mod A MC MR MS M+ M-

() B ← CE C ± √

RoL RoR C 7 8 9 / %

Or Xor D 4 5 6 * 1/x

Lsh Rsh E 1 2 3 - =

Not And F 0 . +

Compile/Build



Compile



```
Output
Preparing for PLC application download .. done.
Downloading file C:\Users\SESA94552\Thermostat New\Thermostat New.cod .. completed.
Booting PLC application .. done.
0 warnings, 0 errors.
```

```
Output
Generating program THERMOSTAT
Generating program DISPLAYALARMLED
Generating program APPLICATIONMENU
Generating unresolved
aborted.
THERMOSTAT(1$FB:HYSTERSIS_00) - error G0008: ST => Invalid access to variable
0 warnings, 1 errors.
```

Double click on the error to refer to the error source

Chapter 3

Simulation/Debugging – Part 1

Goal:

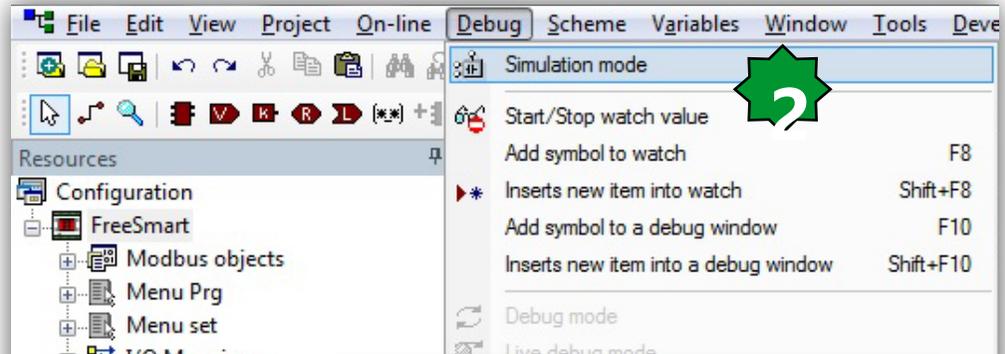
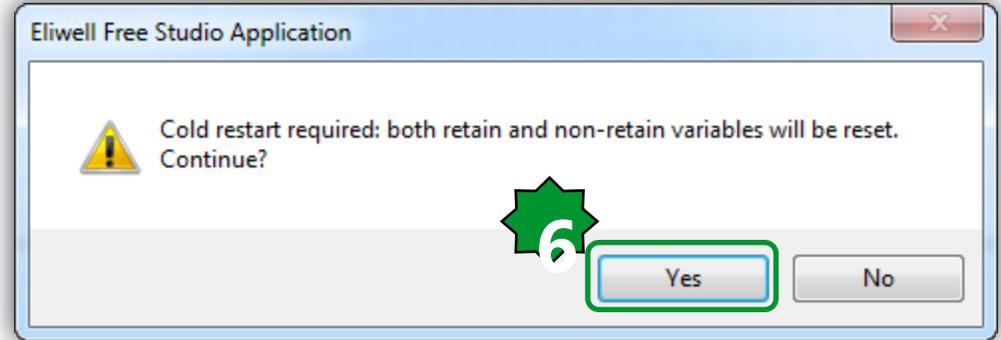
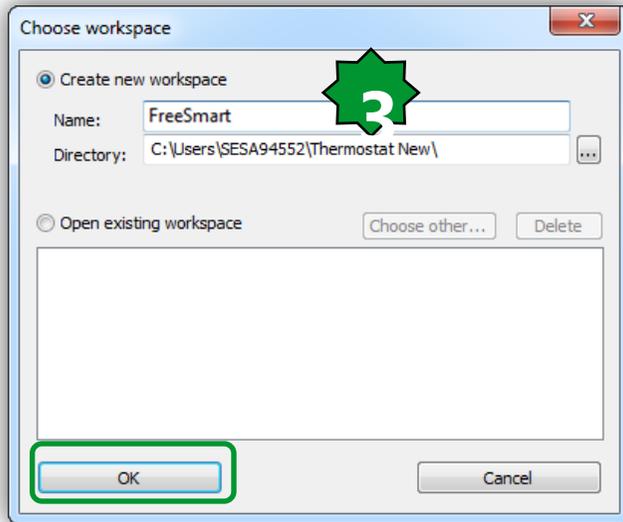
Debugging created FB by different off-line simulation tools such as Watch or Oscilloscope



Off line simulation mode



Debug ► Simulation mode ►



1. Debug
2. Simulation mode
3. Name it ► OK
4. If differs or no code
5. Download the code, OK
6. Reset Variables

On-Line Status / Application Status



The state of communication is shown in a small box next to the right border of the **Status bar**.

If you have not yet attempted to connect to the target, the state of communication is set to **Not connected**.

NOT CONNECTED

When you try to connect to the target device, the state of communication becomes one of the following:

-Error: the communication cannot be established. You should check both the physical link and the communication settings.

ERROR

-Connected: the communication has been established

CONNECTED



On-Line Status / Application Status

Next to the communication status there is another small box which gives information about the status of the application currently executing on the target device.

When the connection status is Connected, the application status takes on one of the following values.

-No code: no application is executing on the target device.

NO CODE

--Diff. code: the application currently executing on the target device is not the same as the one currently open in the IDE; moreover, no debug information consistent with the running application is available: thus, the values shown in the watch window or in the oscilloscope are not reliable and the debug mode cannot be activated.

DIFF. CODE



On-Line Status / Application Status

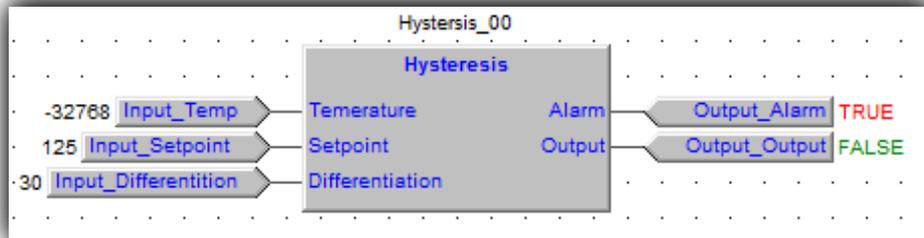
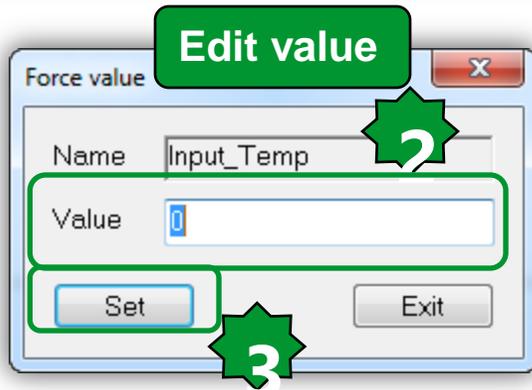
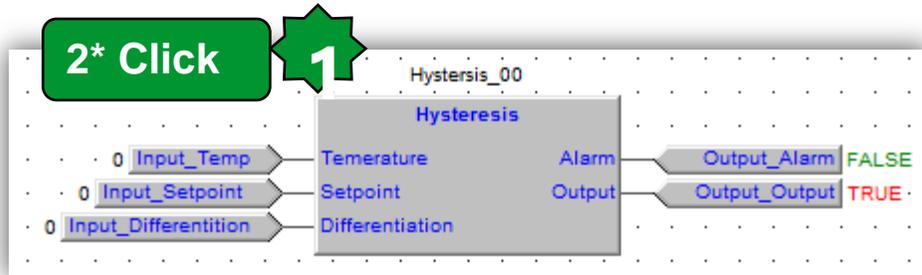
--Diff. code, Symbols OK: the application currently executing on the target device is not the same as the one currently open in the IDE; however, some debug information consistent with the running application is available (for example, because that application has been previously downloaded to the target device from the same PC): the values shown in the watch window or in the oscilloscope are reliable, but the debug mode still cannot be activated.

DIFF. CODE (SYM)

-Source OK: the application currently executing on the target device is the same as the one currently open in the IDE: the debug mode can be activated.

SOURCE OK

Debug mode/Changing values



1. 2*click on required variable
2. Edit the value
3. Set the values
4. Check the Output status
5. Check the Alarm status
In probe disconnection, short circuited or broken the value= - 32768
6. Debug mode (optional)
7. Live (continuous) debug mode (optional)





Watch configuration

Local variables							
	Name	Type	Address	Array	Init value	Attribute	Description
1	Hystersis_00	Hysteresis	Auto	No	..		
2	Input_Temp	INT	Auto	No	..		
3	Input_Setpoint	INT	Auto	No	..		
4	Input_Differentition	INT	Auto	No	..		
5	Output_Alarm	BOOL	Auto	No	..		
6	Output_Output	BOOL	Auto	No	..		

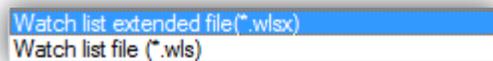
Watch list is independant from live debug mode

Drag & Drop

Watch			
Symbol	Value	Type	Location
— INPUT_TEMP	179	INT	@BACKGROUND:THERMOSTAT
— INPUT_SETPOINT	125	INT	@BACKGROUND:THERMOSTAT
— INPUT_DI...	30	INT	@BACKGROUND:THERMOSTAT
■ OUTPUT_ALARM	FALSE	BOOL	@BACKGROUND:THERMOSTAT
■ OUTPUT_OUTPUT	TRUE	BOOL	@BACKGROUND:THERMOSTAT



Save watch list



Watch list formats

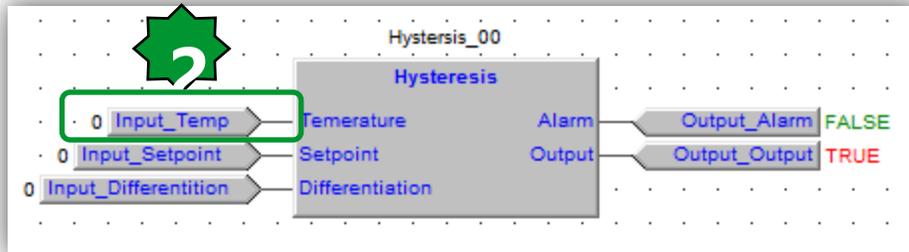


Watch/ drag & drop

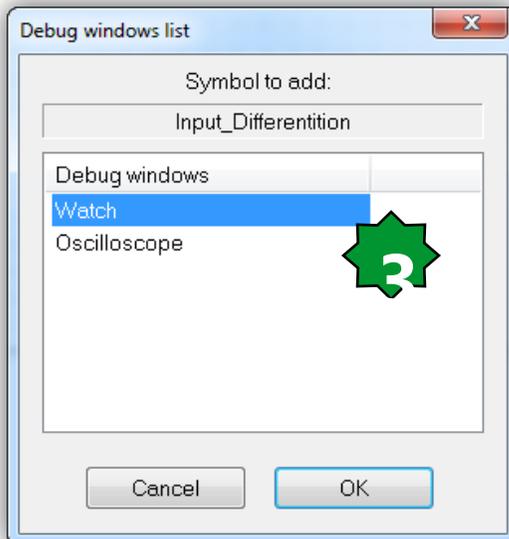
1



2



1. Select watch icon
2. Select the variable
3. Select the watch
4. ► OK
5. It adds to watch list



4

Symbol	Value	Type	Location
— INPUT_TEMP	0	INT	@BACKGROUND:THERMOSTAT

Watch Configuration/ST language

```

0001 (* Hystersis FBD *)
0002
0003 if Temperature >= Setpoint + Differentiation then
0004     Output := TRUE;
0005 end_if;
0006
0007 if Temperature < Setpoint then
0008     Output := FALSE;
0009 end_if;
0010
0011 (* Probe disconnection detector *)
0012
0013 if Temperature = -32768 then
0014     Alarm := TRUE;
0015     else Alarm := FALSE;
0016 end_if;
0017
0018
  
```



1. Select the variable
2. Double click
3. Drag & drop it directly to the watch properties

```

0001 (* Hystersis FBD *)
0002
0003 if Temperature >= Setpoint + Differentiation then
0004     Output := TRUE;
0005 end_if;
0006
0007 if Temperature < Setpoint then
0008     Output := FALSE;
0009 end_if;
0010
0011 if Temperature = -32768 then
0012     Alarm := TRUE;
0013     else Alarm := FALSE;
0014 end_if;
0015
  
```

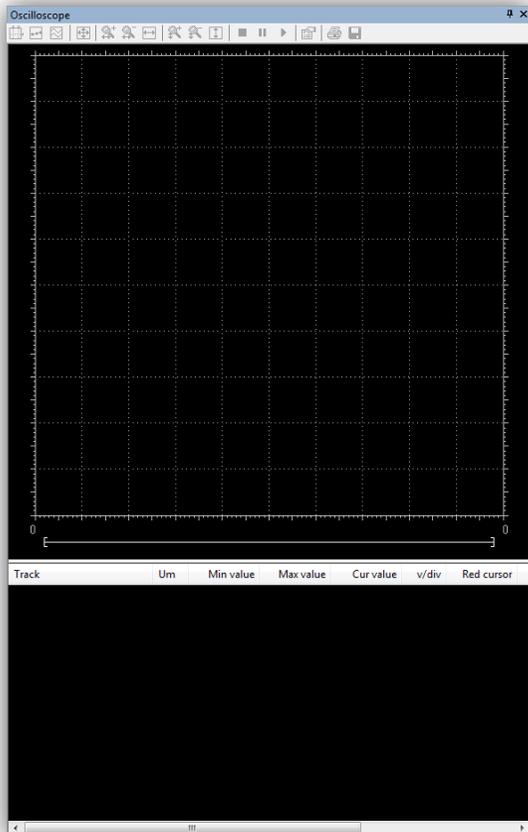
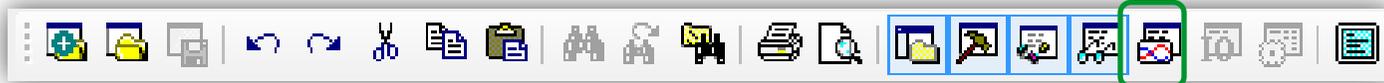


Symbol	Value	Type	Location
— HYSTERESIS_00.TEMPERATURE	0	INT	@BACKGROUND:THERMOSTAT



Oscilloscope

View ► Tool windows ► Async graphic windows ►



Assigning variable to the oscilloscope



Local variables

	Name	Type	Address	Array	Init value	Attribute	Description
1	Hysteresis_00	Hysteresis	Auto	No			
2	Input Temp	INT	Auto	No	..		
3	Input_Setpoint	INT	Auto	No	..		
4	Input_Differentiation	INT	Auto	No	..		

Oscilloscope

ms/div: 5000.00

629616 679616

Track	Um	Min value	Max value	Cur value	v/div	Red cursor	Blue cursor	Horz cursor	Note
@BACKGROUND:THERMOSTAT.INPUT_SETPOINT		0.000	125.000	125.000	1	...	...	...	@BACKGROUND:THERMOSTAT
@BACKGROUND:THERMOSTAT.INPUT_DIFFERENTIATION		0.000	25.000	25.000	1	...	...	...	@BACKGROUND:THERMOSTAT
@BACKGROUND:THERMOSTAT.OUTPUT_ALARM		0.000	1.000	0.000	1	...	...	...	@BACKGROUND:THERMOSTAT
@BACKGROUND:THERMOSTAT.OUTPUT_OUTPUT		0.000	1.000	0.000	1	...	...	...	@BACKGROUND:THERMOSTAT
@BACKGROUND:THERMOSTAT.INPUT_TEMP		-32768.000	150.000	110.000	1	...	...	...	@BACKGROUND:THERMOSTAT

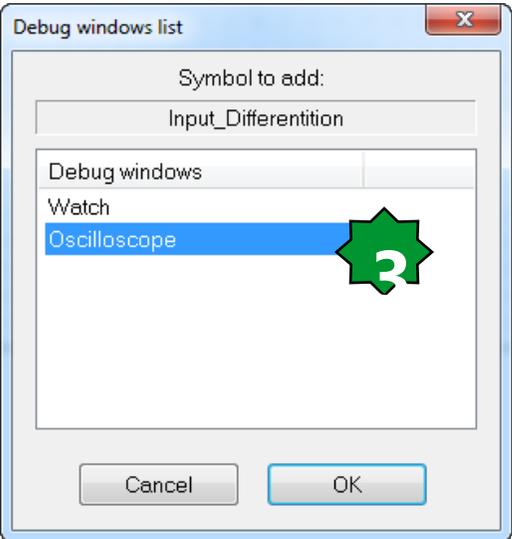
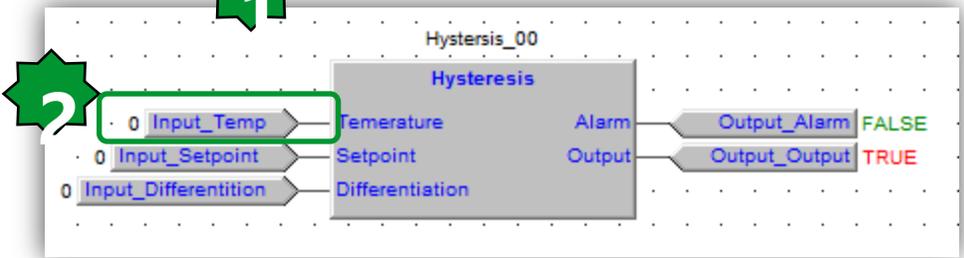
Drag & Drop

Up to 8 channels could be traced simultaneously



Assigning variable to the oscilloscope

- 1. Select watch icon
- 2. Select the variable
- 3. Select the Oscilloscope
- 4. It adds to oscilloscope list



Oscilloscope tools/starting & stopping data acquisition



When you add a variable to the Oscilloscope, data acquisition begins immediately.

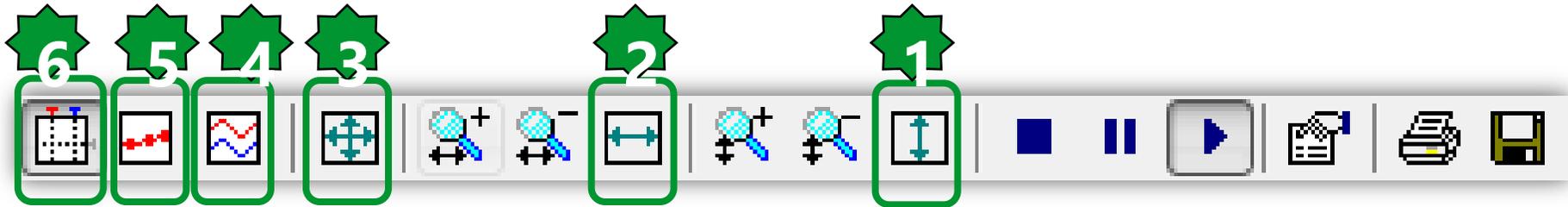
However, you can suspend the acquisition by clicking on **Pause acquisition**.

The curve freezes (while the process of data acquisition is still running in background), until you click on **Restart acquisition**.

In order to stop the acquisition you may click on **Stop acquisition**.

In this case, when you click on **Restart acquisition**, the evolution of the value of the variable is plotted from scratch.

Oscilloscope tools/ Vertical split



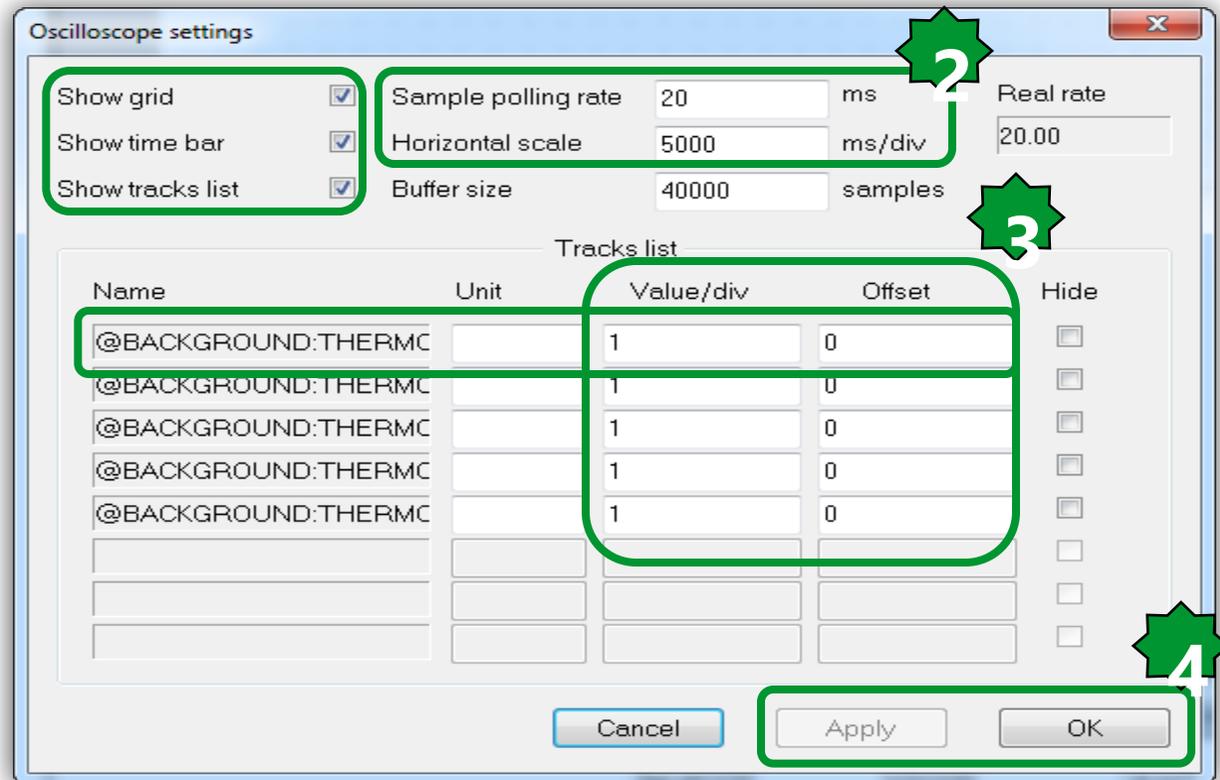
1. Selected track's vertical show all
2. Horizontal show all
3. Show all values
4. When you are watching the evolution of two or more variables, you may want to split the respective tracks.
5. The tool highlights the single values detected during data acquisition.
You can click on the same item again, in order to go back to the default view mode.
6. The Oscilloscope includes two measure bars, which can be exploited to take some measures on the chart.

Oscilloscope tools/ Setting the scale of the axes

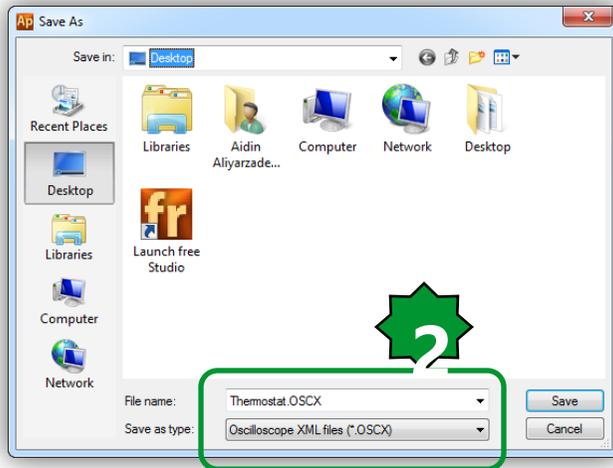


When you open the Oscilloscope, Application applies a default scale to the axes. However, if you want to set a different scale, you may follow this procedure:

- 1) Open the graph properties
- 2) Set the scale of the horizontal axis & sampling polling rate
- 3) Specify a distinct scale for the vertical axis.
- 4) Confirm your settings.



Oscilloscope/export



Available formats

- Oscilloscope XML files (*.OSCX)
- Oscilloscope files (*.OSC)
- All files (*.*)

1. Save icon
2. Name & format defining
 - OSC: simple plain-text file, containing time and value of each sample
 - OSCX: XML file, that includes more complete information
3. Open it via Excel (OSCX)

	A	B	C	D	E	F	G	H	I	J
1	hscale	triggerpos	name	um	vscale	offset	color	note	sample	time
2	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870186
3	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870205.9
4	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870226.2
5	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870246.1
6	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870266.2
7	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870286.2
8	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870306.1
9	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870326
10	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870346.1
11	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870366
12	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870386.2
13	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870406.1
14	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870426.2
15	55536.85563	1.79769313486232E+308	@BACKGROUND:THERMOSTAT.NTC_PROBE		25323.57143	111271.0714	65535	@BACKGROUND:THERMOSTAT	0	232870445.9

Chapter 4

Resources

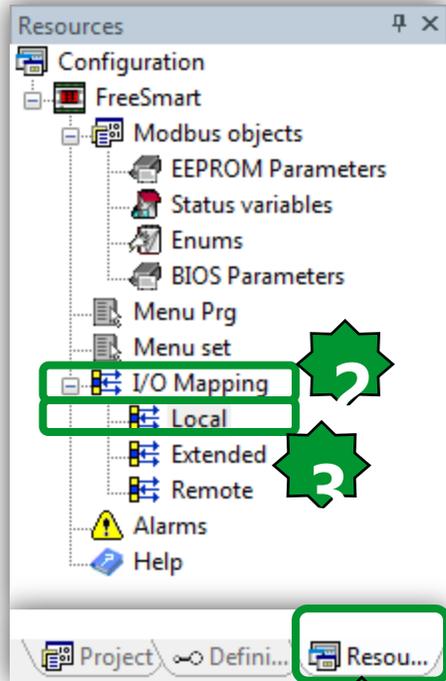
Goal:

Defining the resources:

- Assigning physical Input/output
- EEPROM parameters
- Status variables
- Menu definition and navigation



Physical I/O Mapping (Base Unit)...



FreeSmart Local I/O Mapping

#	Name	Variable	Type	Description
1	AIL1	NTC_Probe	INT	AIL1 analogue input
2	AIL2		INT	AIL2 analogue input
3	AIL3		INT	AIL3 analogue input
4	AIL4		INT	AIL4 analogue input
5	AIL5		INT	AIL5 analogue input
6	DIL1		BOOL	DIL1 digital input
7	DIL2		BOOL	DIL2 digital input
8	DIL3		BOOL	DIL3 digital input
9	DIL4		BOOL	DIL4 digital input
10	DIL5		BOOL	DIL5 digital input
11	DIL6		BOOL	DIL6 digital input
12	DOL1	Output_Cooling	BOOL	DOL1 digital output
13	DOL2	Alarm	BOOL	DOL2 digital output
14	DOL3		BOOL	DOL3 digital output
15	DOL4		BOOL	DOL4 digital output
16	DOL5		BOOL	DOL5 digital output
17	DOL6		BOOL	DOL6 digital output
18	AOL1		INT	AOL1 analogue output
19	AOL2		INT	AOL2 analogue output
20	AOL3		INT	AOL3 analogue output
21	AOL4		INT	AOL4 analogue output
22	AOL5		INT	AOL5 analogue output
23	TCL1		INT	TCL1 analogue output

2. I/O Mapping definition:

Local: Base I/O
Extend: Expansion
Remote: Keyboard

1. Resources
2. I/O mapping
3. Local
4. Name variables

...Physical I/O Mapping (Base Unit)...

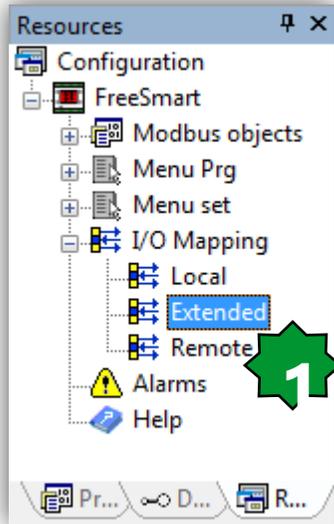


The screenshot displays the FreeSmart software interface. On the left, the Project tree shows a folder named 'Mappings' containing 'NTC_Probe', 'Output_Cooling', and 'Alarm'. A green arrow points to the 'Output_Cooling' folder. The main window shows a table titled 'FreeSmart Local I/O Mapping'. A green arrow points to the 'Output_Cooling' entry in the table. A green callout box on the right contains text explaining that after saving the project, defined resources will be available under the Global shared folder.

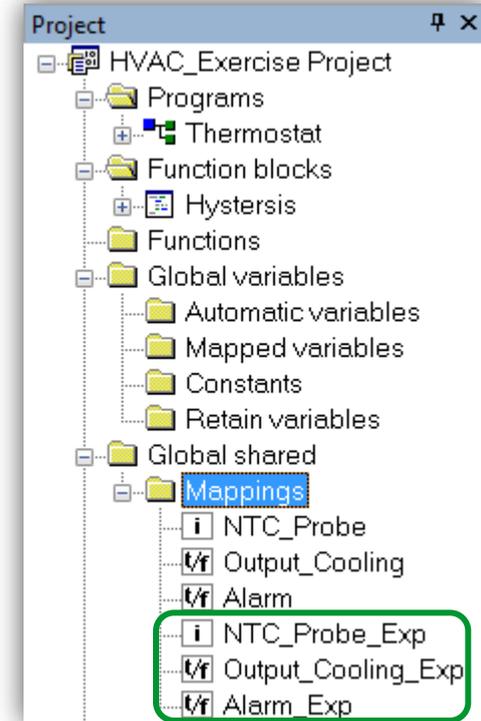
#	Name	Variable	Type	Description
1	AIL1	NTC_Probe	INT	AIL1 analogue input
2	AIL2		INT	AIL2 analogue input
3	AIL3		INT	AIL3 analogue input
4	AIL4		INT	AIL4 analogue input
5	AIL5		INT	AIL5 analogue input
6	DIL1		BOOL	DIL1 digital input
7	DIL2		BOOL	DIL2 digital input
8	DIL3		BOOL	DIL3 digital input
9	DIL4		BOOL	DIL4 digital input
10	DIL5		BOOL	DIL5 digital input
11	DIL6		BOOL	DIL6 digital input
12	DOL1	Output_Cooling	BOOL	DOL1 digital output
13	DOL2	Alarm	BOOL	DOL2 digital output
14	DOL3		BOOL	DOL3 digital output
15	DOL4		BOOL	DOL4 digital output
16	DOL5		BOOL	DOL5 digital output
17	DOL6		BOOL	DOL6 digital output
18	AOL1		INT	AOL1 analogue output
19	AOL2		INT	AOL2 analogue output
20	AOL3		INT	AOL3 analogue output
21	AOL4		INT	AOL4 analogue output
22	AOL5		INT	AOL5 analogue output
23	TCL1		INT	TCL1 analogue output

After saving the project, all the defined resources will be available under Global shared folder; Mappings in case of I/O

...Physical I/O Mapping (Expansion)



#	Name	Variable	Type	Description
1	AIE1	NTC_Probe_Exp	INT	AIE1 analogue input
2	AIE2		INT	AIE2 analogue input
3	AIE3		INT	AIE3 analogue input
4	AIE4		INT	AIE4 analogue input
5	AIE5		INT	AIE5 analogue input
6	DIE1		BOOL	DIE1 digital input
7	DIE2		BOOL	DIE2 digital input
8	DIE3		BOOL	DIE3 digital input
9	DIE4		BOOL	DIE4 digital input
10	DIE5		BOOL	DIE5 digital input
11	DIE6		BOOL	DIE6 digital input
12	DOE1	Output_Cooling_Exp	BOOL	DOE1 digital output
13	DOE2	Alarm_Exp	BOOL	DOE2 digital output
14	DOE3		BOOL	DOE3 digital output
15	DOE4		BOOL	DOE4 digital output
16	DOE5		BOOL	DOE5 digital output
17	DOE6		BOOL	DOE6 digital output
18	AOE1		INT	AOE1 analogue output
19	AOE2		INT	AOE2 analogue output
20	AOE3		INT	AOE3 analogue output
21	AOE4		INT	AOE4 analogue output
22	AOE5		INT	AOE5 analogue output
23	TCE1		INT	TCE1 analogue output



After saving the project, all the defined resources will be available under Global shared folder; Mappings in case of I/O

How to configure I/O types, range?



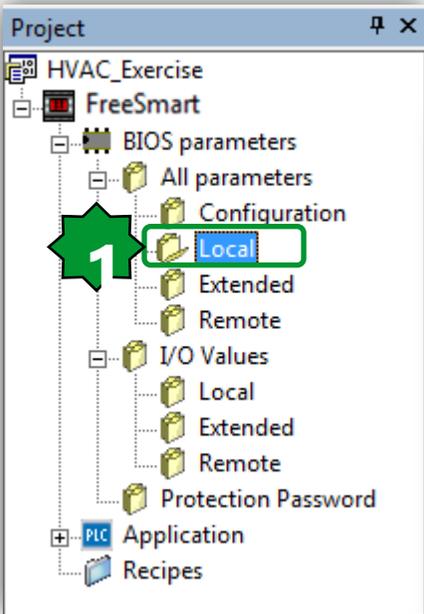
The screenshot shows the software interface with the 'Developer' menu open. The 'Open with Device' option is highlighted, and a green arrow points to it. The interface includes a project tree on the left, a central panel with a thermostat UI, and a Watch/Oscilloscope panel on the right.

1. Menu Developer ► Open with free studio device

Note: BIOS parameters are also available on the installation manual



Check FS Device parameters description...



Local								
Address	Name	Value	Um	Default	Min	Max	Description	
53304	CL00	2=NTC	num	2=NTC	0	8	AIL1 analogue input type	
53305	CL01	2=NTC	num	2=NTC	0	8	AIL2 analogue input type	
53306	CL02	2=NTC	num	2=NTC	0	7	AIL3 analogue input type	
53307	CL03	2=NTC	num	2=NTC	0	7	AIL4 analogue input type	
53308	CL04	2=NTC	num	2=NTC	0	8	AIL5 analogue input type	
15649	CL10	500	°C/Bar	500	-9999	9999	AIL3 analogue input full scale value	
15655	CL11	0	°C/Bar	0	-9999	9999	AIL3 analogue input start of scale value	
15650	CL12	500	°C/Bar	500	-9999	9999	AIL4 analogue input full scale value	
15656	CL13	0	°C/Bar	0	-9999	9999	AIL4 analogue input start of scale value	
53334	CL20	0	°C	0	-120	120	AIL1 analogue input differential	
53335	CL21	0	°C	0	-120	120	AIL2 analogue input differential	
53336	CL22	0	°C/Bar	0	-120	120	AIL3 analogue input differential	
53337	CL23	0	°C/Bar	0	-120	120	AIL4 analogue input differential	
53338	CL24	0	°C	0	-120	120	AIL5 analogue input differential	
53344	CL60	0=0-20mA	num	0=0-20mA	0	2	AOL5 analogue output type	
53346	CL70	0=Disable	num	0=Disable	0	2	Enable TCL1 analogue output	
53347	CL71	0=Disable	num	0=Disable	0	2	Enable AOL1 analogue output	
53348	CL72	1=Enable	num	1=Enable	0	2	Enable AOL2 analogue output	
53349	CL73	27	Deg	27	0	90	Phase shift TCL1 analogue output	
53350	CL74	27	Deg	27	0	90	Phase shift AOL1 analogue output	
53351	CL75	27	Deg	27	0	90	Phase shift AOL2 analogue output	
53352	CL76	10	69 µsec	10	5	40	TCL1 analogue output pulse length	
53353	CL77	10	69 µsec	10	5	40	AOL1 analogue output pulse length	
53354	CL78	10	69 µsec	10	5	40	AOL2 analogue output pulse length	

...and define the Application BIOS Default



FreeSmart BIOS Parameters

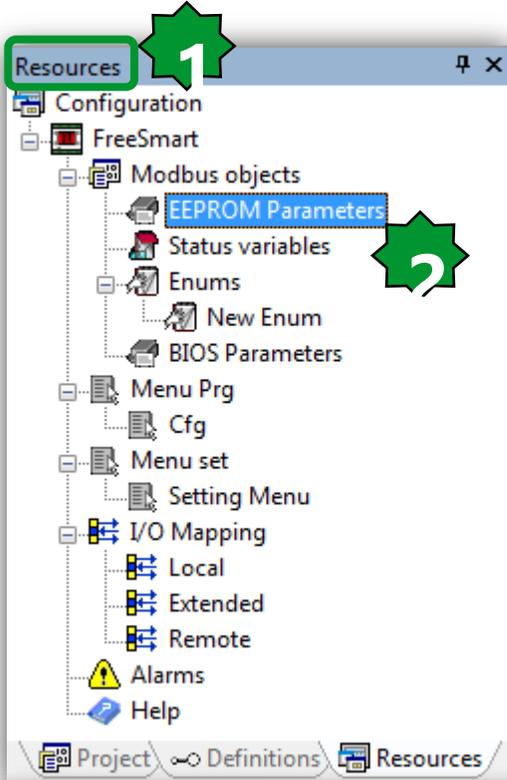
Resources Configuration
FreeSmart
Modbus objects
EEPROM Parameters
Status variables
Enums
BIOS Parameters
Menu Prg
Cfg
Menu set
Setting Menu
I/O Mapping
Local
Extended
Remote
Alarms
Help

FreeSmart BIOS Parameters

#	Name	Default value	Description
1	CL00	2=NTC	AIL1 analogue input type
	CL00	0=None	
	CL01	1=DI	
	CL02	2=NTC	
	CL03	8=PT1000	
	CL04		
	CL10		
	CL11		
	CL12		
	CL13		
	CL20		
	CL21		
	CL22		
	CL23		
	CL24		
	CL60		
	CL70		
	CL71		
	CL72		
	CL73		
	CL74		
	CL75		
	CL76		
	CL77		
	CL78		
	CR00		

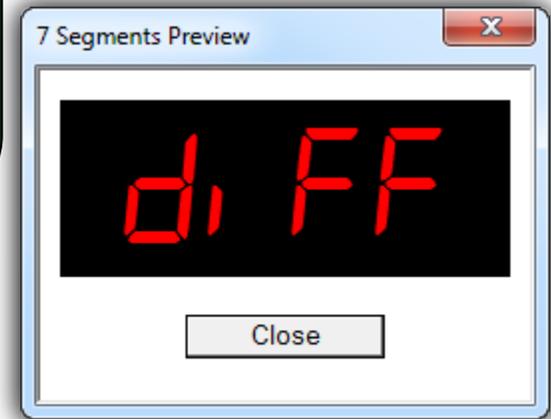
1. BIOS parameters
2. Add
3. Select the name
4. Select the type

EEPROM parameters



1. Resources
 2. EEPROM parameters
 3. Add
 4. Define required „retain“ data
 5. 1% resolution
- Format XXX.Y
- Note: Default values are written to the target only by Free Studio Device

App. Type : IEC variable type
 Device Type : FS Device / Display type
 App. Type = Scale x Device Type + Offset



FreeSmart EEPROM Parameters

Add
 Remove
 Recalc

#	Address	Name	Display label	Device type	Application type	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel	Description	Note
1	16384	Setpoint	SetP	Signed 16-bit	INT	180	150	300	1	0	°C	XXX.Y	Always visible		
2	16385	Differentiation	Diff	Signed 16-bit	INT	20	5	50	1	0	°C	XXX.Y	Always visible		

EEPROM Properties



FreeSmart EEPROM Parameters

Add Remove Recalc



#	Address	Name	Display label	Device type	Application type	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel	Description
1	16384	Setpoint	SetP	Signed 16-bit	INT	180	150	300	1	0	°C	XXX.Y	Always visible	
2	16385	Differentiation	Diff	Signed 16-bit	INT	20	5	50	1	0	°C	XXX.Y	Always visible	



Message from webpage

Invalid address value! Must be in 16384..16895 range

OK



- °C
- bar
- %R.H.
- °F
- °C/°F
- Psi
- Pa
- %



- XXX.Y
- XX.YY
- %04x
- HH:MM



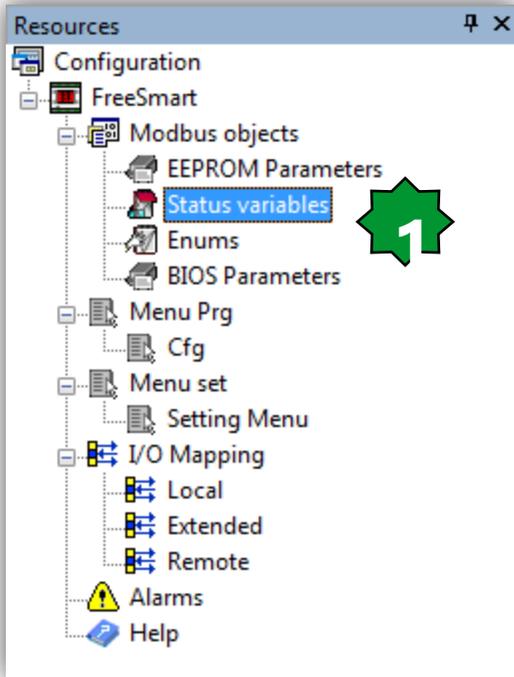
- Never visible
- Level 1
- Level 2
- Always visible

EEPROM Parameters:

App. Type : IEC variable type
 Device Type : FS Device / Display type
 App. Type = Scale x Device Type + Offset

Note.
 Dynamic setpoint by the other parameters
 Min/Maxis possible.

Status Variables



1. Resources ▶ Status variable
 2. Add new record
 3. Define required RAM data
 4. Valid range
- Note: Same properties as EEPROM + read only**



App. Type : IEC variable type
Device Type : FS Device / Display type
App. Type = Scale x Device Type + Offset

FreeSmart Status Variables

Add

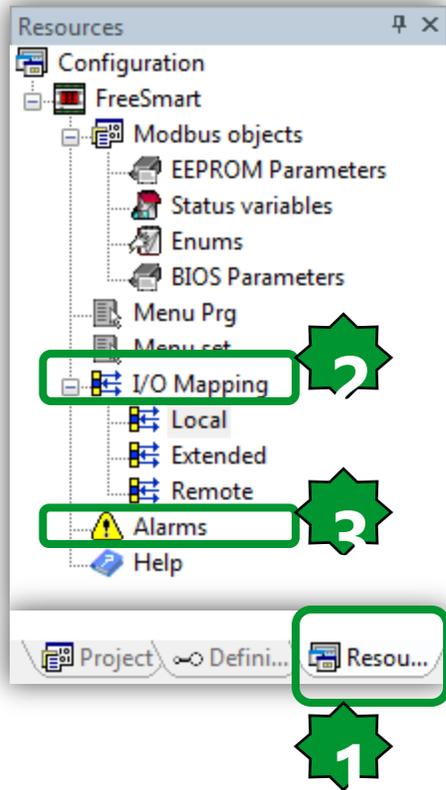
 Remove

 Recalc

#	Address	Name	Display label	Dev. type	Applic. type	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel	Read only	Description	Note

False
 True

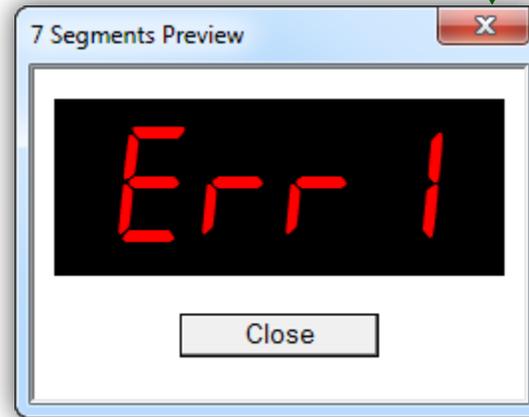
Alarms



FreeSmart Alarms

Add Remove

#	Name	Short name	Description
1	Temperature_Probe_Error	Err1	



1. Resources
2. I/O mapping
3. Alarm
4. Add

4.1 Name

4.2 without short name

4.3 7 segments preview

4.4 with short name

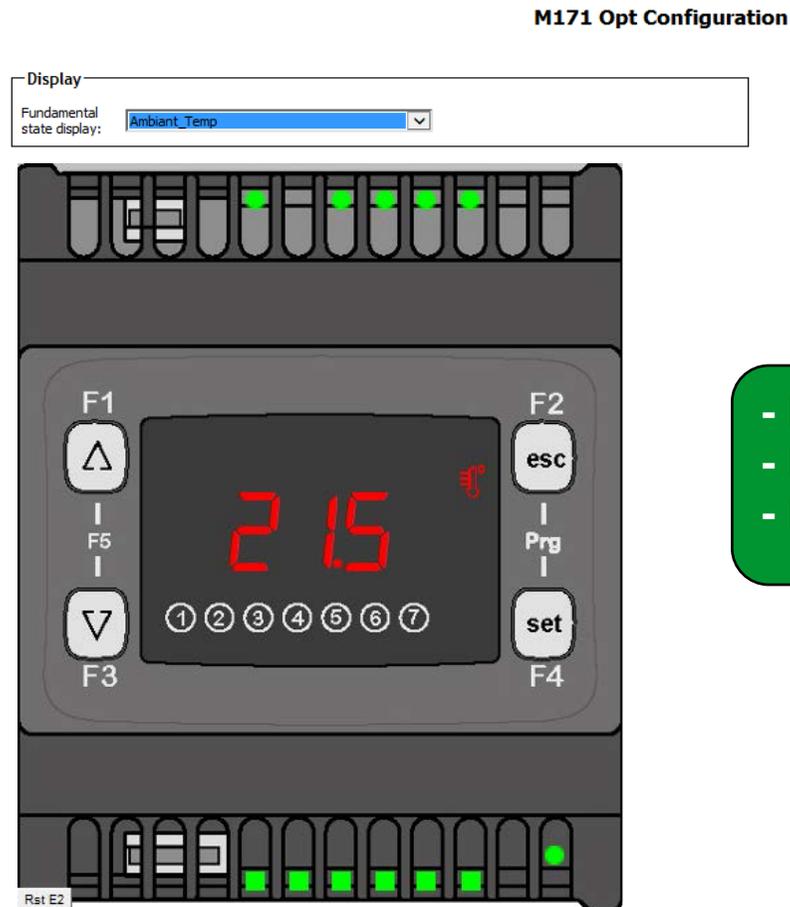
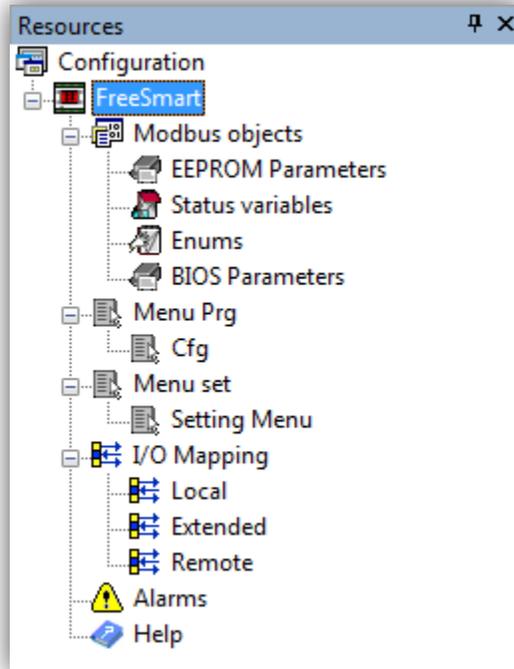
4.5 7 segments preview

- It is automatic folder which display the Alarms, if value is 0, no display In AL folder if alarm value is 1, displays the short name.

blinks if value > than 1.

- In case of any alarms, the red triangle icon in the display is on.

Fundamental state display configuration

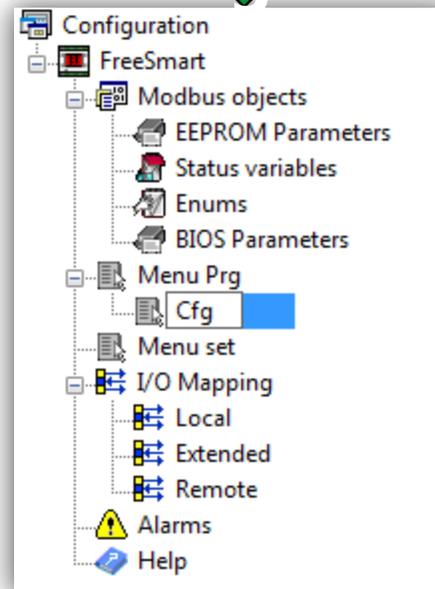
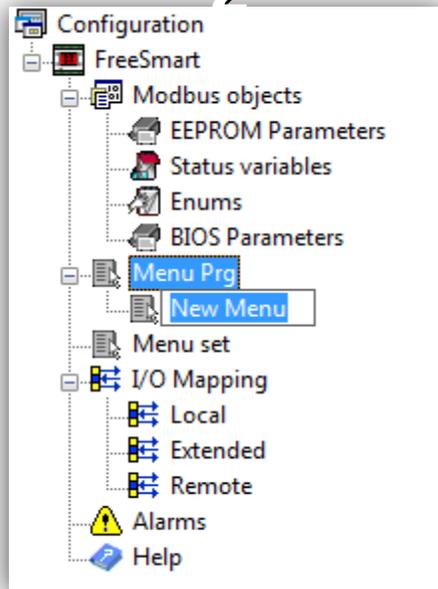
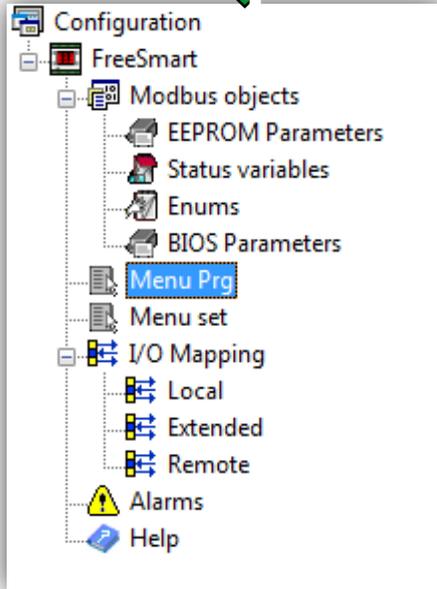


- Display
- Fundamental state display
- Desired variable in the display



Menu Program – Add Folder

Resources

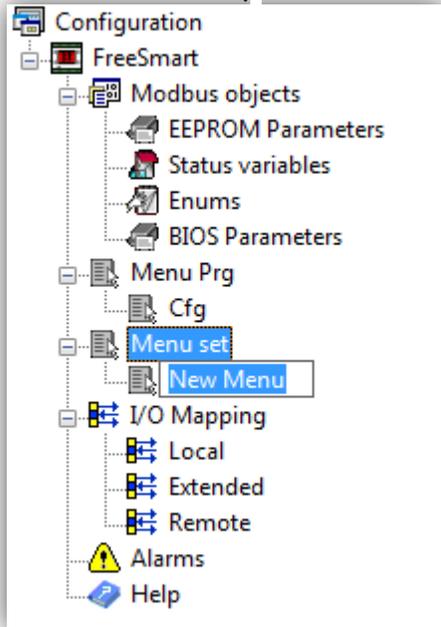


1. Menu Prg.
2. Add Menu
3. New Menu, name it (Cfg)
4. 7 segment preview

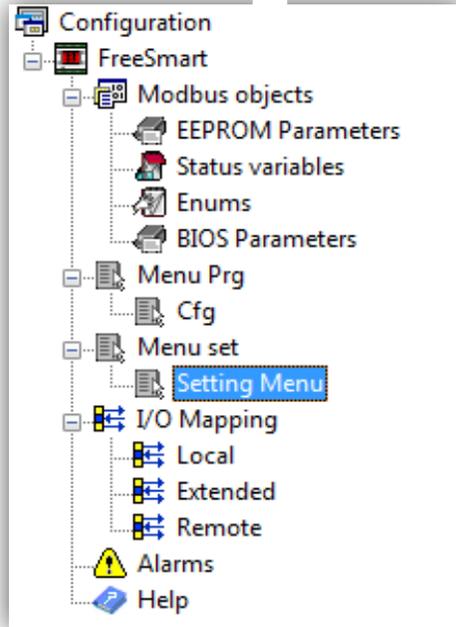
Menu Set – Add Folder

Resources

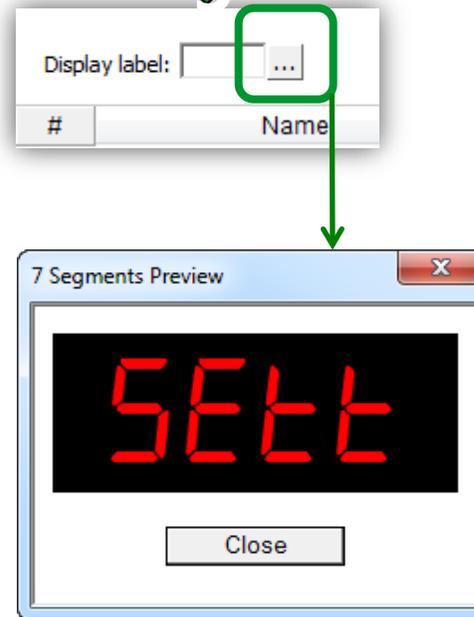
1



2



3



1. Menu Set, Right Click Add Menu
2. New Menu, name it (Setting Menu)
3. 7 segments preview



Add/Remove elements to folder

FreeSmart 'Cfg' Menu

Display label: ... Add Remove Up Down

#	Name	Description
1	Setpoint	

1

2

3

4

Setpoint
Differentiation

CF01
CF20
CF21
CF30
CF31
CF32
CF60
CF61
CL00
CL01
CL02
CL03
CL04
CL10
CL11
CL12
CL13
CL20
CL21
CL22
CL23
CL24
CL60
CL70
CL71
CL72
CL73
CL74
CL75
CL76

FreeSmart 'Cfg' Menu

Display label: ... Add Remove Up Down

#	Name	Description
1	Setpoint	
2	Differentiation	

1. Add
Open the list sorted by names
2. Select the parameter
3. Add again
4. Select the other parameter



Add/Remove elements by drag & drop



Resources

- Configuration
 - FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menu Prg
 - Cfg
 - Menu set
 - Setting Menu
 - I/O Mapping
 - Alarms
 - Help

Drag & Drop

FreeSmart 'Cfg' Menu

Display label: ... Add Remove Up Down

#	Name	Description
1	Setpoint	
2	Differentiation	

FreeSmart 'Setting Menu' Menu

Display label: ... Add Remove Up Down

#	Name	Description
1	Setpoint	
2	Differentiation	
3	Ambient_Temperator	

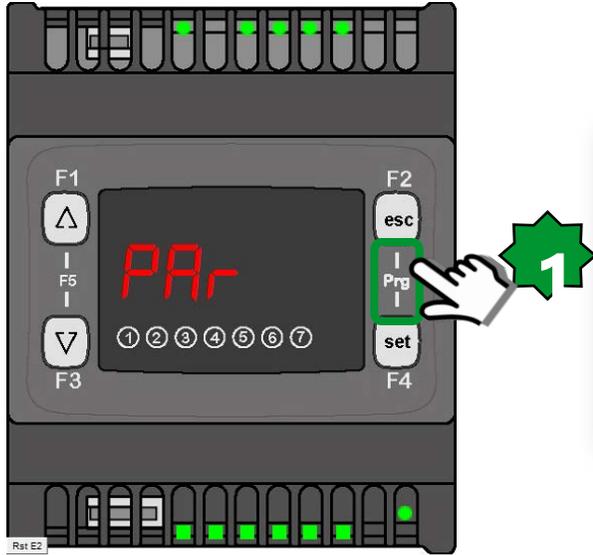
FreeSmart EEPROM Parameters

Add Remove Recalc

#	Address	Name	Display label	Device type	Application type	Default value	Min	Max	Scale	Offset	Format	AccessLevel
1	16384	Setpoint	SetP	Signed 16-bit	INT	180	150	300	1	0	XXX.Y	Always visible
2	16385	Differentiation	Diff	Signed 16-bit	INT	20	5	50	1	0	XXX.Y	Always visible

Menu Program – How to Access

Simulation



Resources

- Configuration
 - FreeSmart
 - Modbus objects
 - Menu Prg (highlighted with a green box and arrow pointing to the table)
 - Cfg
 - Menu set
 - I/O Mapping
 - Alarms
 - Help

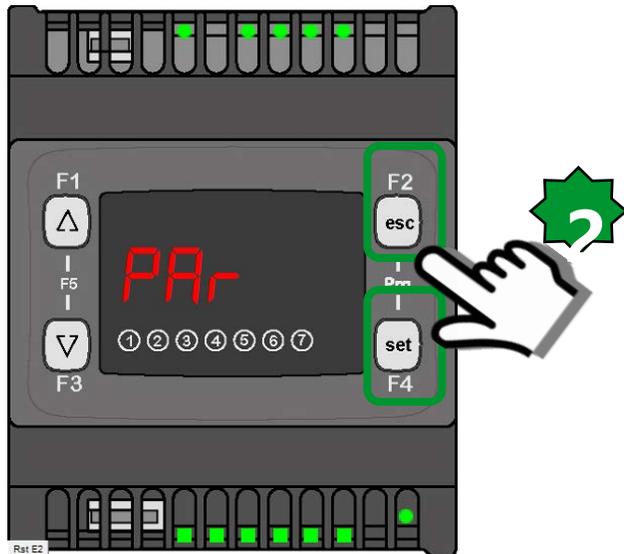
Display label: ...

Add Remove Up Down

#	Name	Description
1	Setpoint	
2	Differentiation	

A green star with the number 3 is positioned below the table.

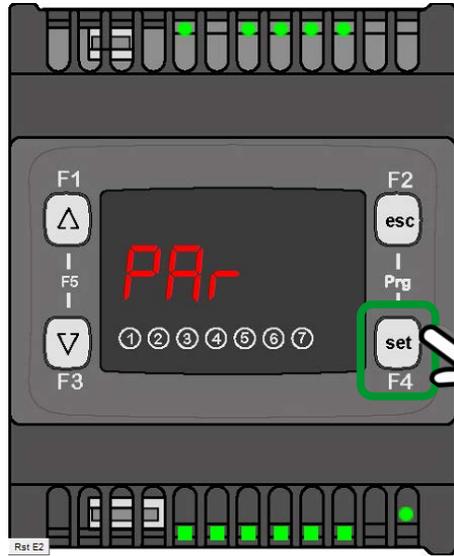
Target



- To form & define the program button function:
1. Menu Prg, access by pressing Prg button in simulation
 2. Menu Prg, access by pressing esc.& set buttons simultaneously on the product
 3. Scroll up or down into the defined variables ▲ ▼

Menu Set – How to Access

Simulation



Resources

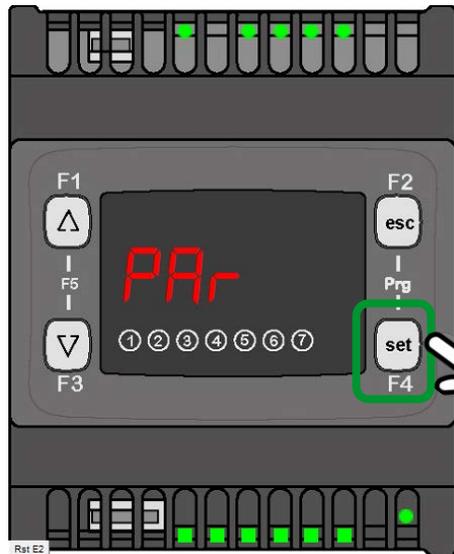
- Configuration
 - FreeSmart
 - Modbus objects
 - Menu Prq
 - Menu set
 - Setting Menu
 - I/O Mapping
 - Alarms
 - Help

Display label: ... Add Remove Up Down

#	Name	Description
1	Setpoint	
2	Differentiation	
3	Ambient_Temperator	

A green star with a question mark is next to the table.

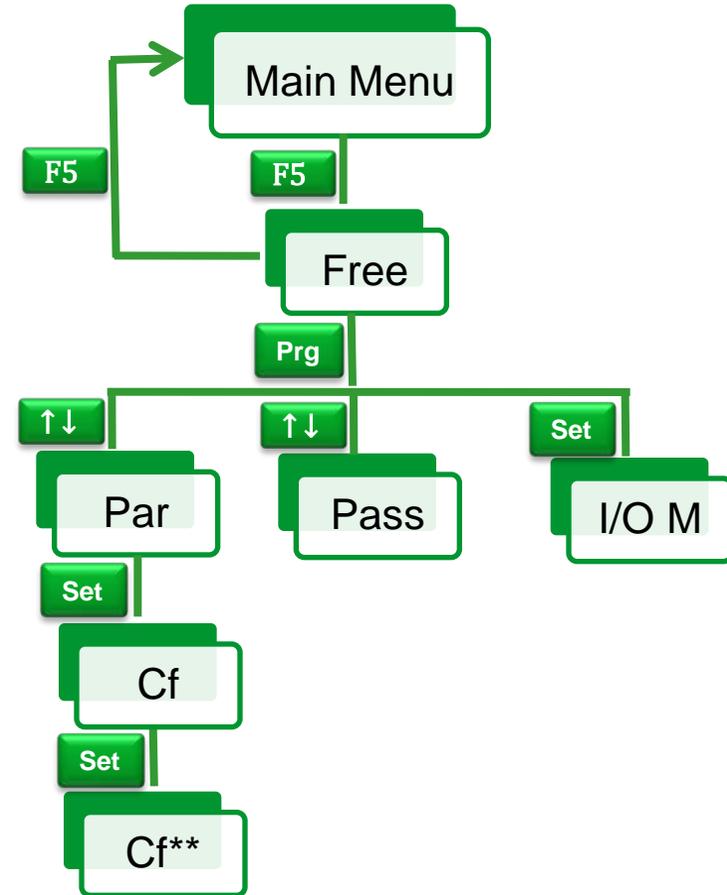
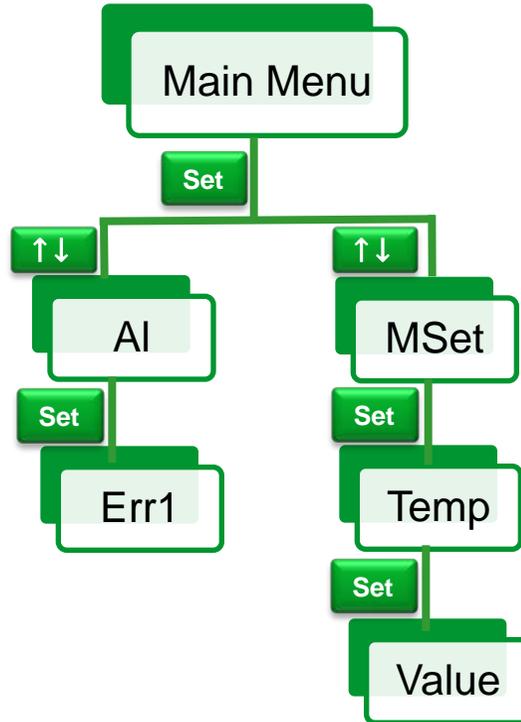
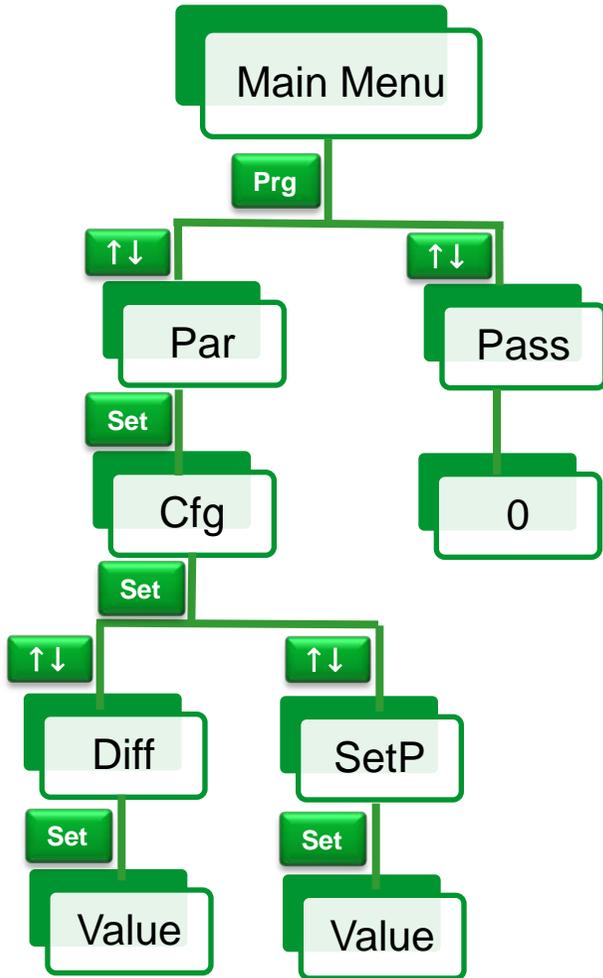
Target



To form & define the set button function:

1. Access to the set menu by pressing set in simulation
2. Access to the set menu by pressing set on the product
3. Scroll up or down into the defined variables ▼ ▲

Menu architecture



Project / Global Shared



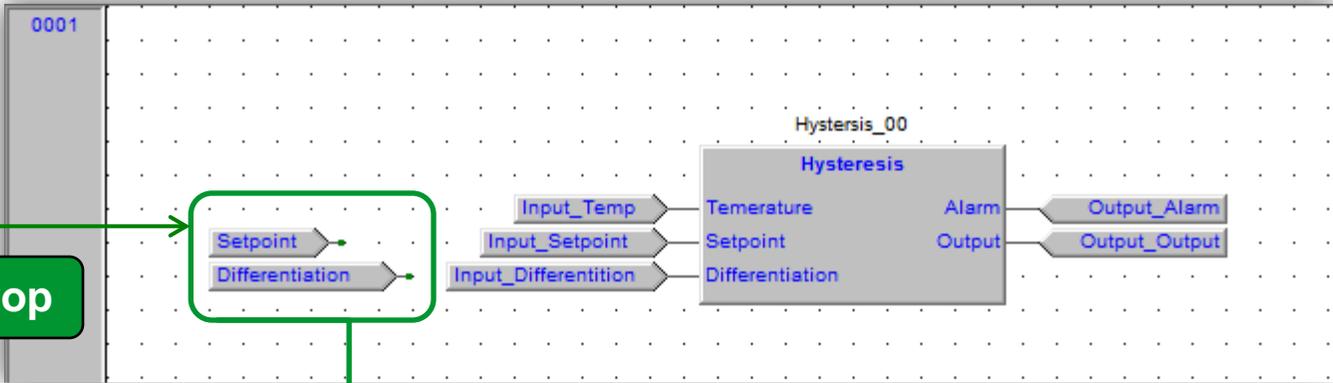
Project

- Thermostat Exercise rev.1 Project
 - Thermostat
 - Function blocks
 - Functions
 - Global variables
 - Global shared
 - Alarms
 - Mappings
 - Parameters
 - Setpoint
 - Differentiation
 - Variables
 - Tasks
 - Timed
 - Background
 - Thermostat
 - Boot
 - Init

Project Definitions Resources

All the resources are available in the project tab under Global Shared folder (after saving or compiling the project)

Drag & Drop

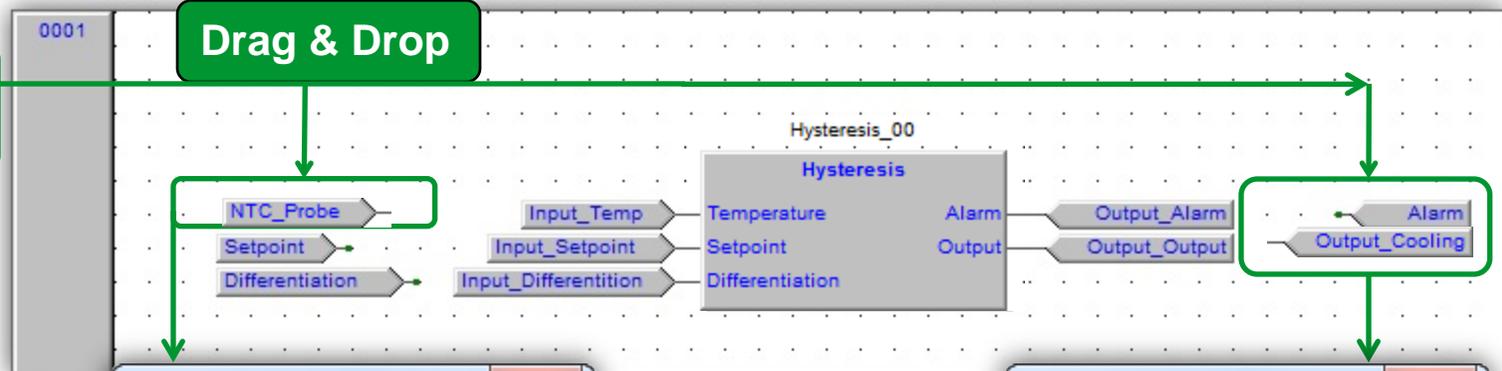
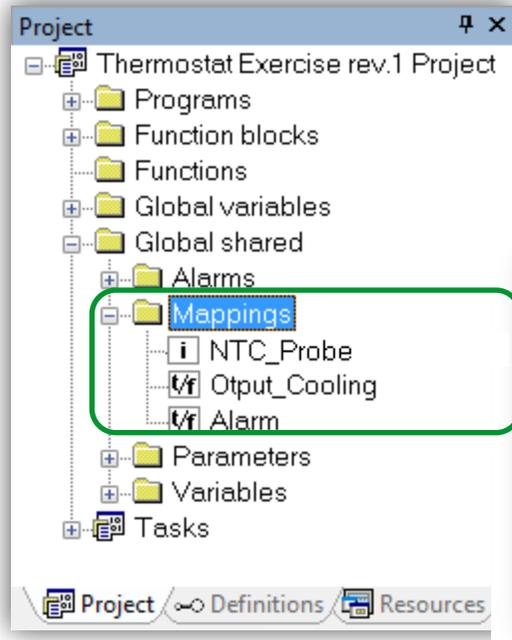


Var type

Input Output

OK Cancel

Using physical I/O



Var type

Input Output

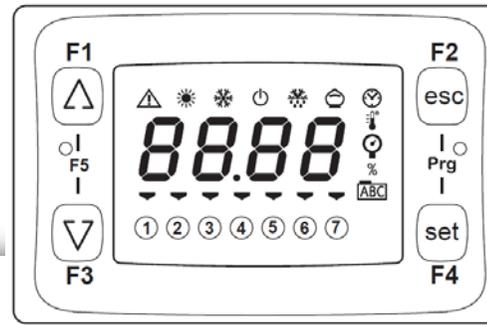
OK Cancel

Var type

Input Output

OK Cancel

System LED setting

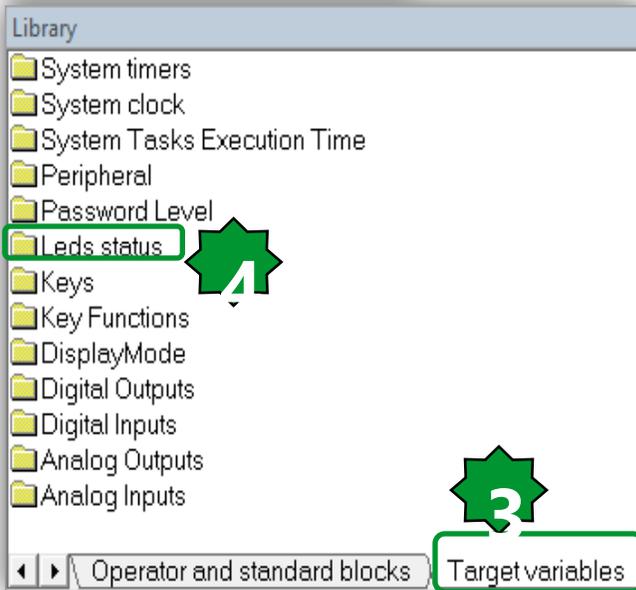
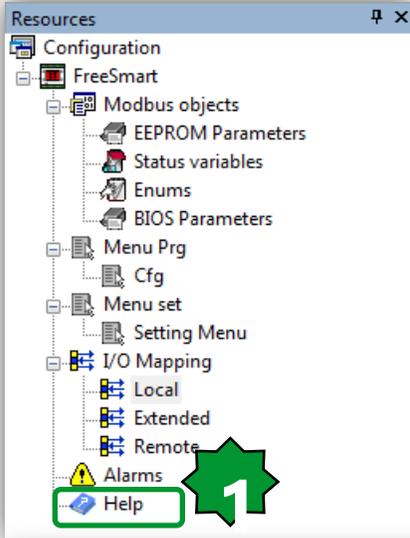


LED reference for the developer

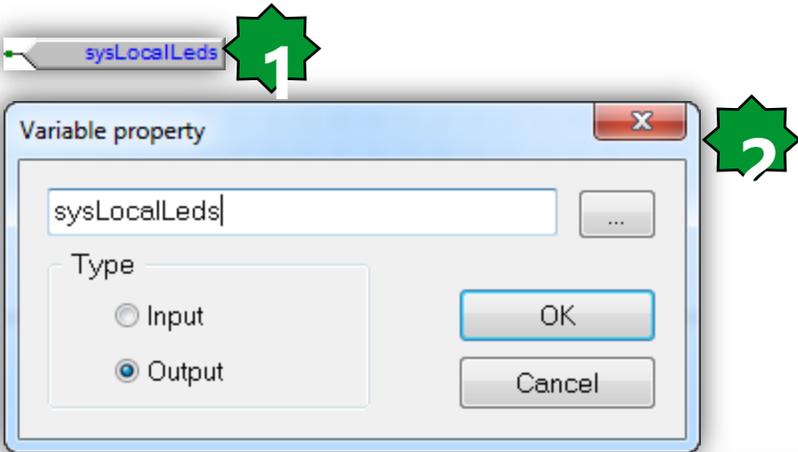
The IEC developer can turn on (either steady or blinking) and off the whole range of local display LEDs, by properly setting the array SYSLED.

LED number	Symbol or icon	Description	Off	On (steady)	On (blinking)
0	:	Colon	SYSLED[0]=0	SYSLED[0]=1	SYSLED[0]=2
1	%R.H.	%RH	SYSLED[1]=0	SYSLED[1]=1	SYSLED[1]=2
2		Defrost	SYSLED[2]=0	SYSLED[2]=1	SYSLED[2]=2
3	Bar	Bar	SYSLED[3]=0	SYSLED[3]=1	SYSLED[3]=2
4		Stand-by	SYSLED[4]=0	SYSLED[4]=1	SYSLED[4]=2
5	°C	°C	SYSLED[5]=0	SYSLED[5]=1	SYSLED[5]=2
6		Cooling	SYSLED[6]=0	SYSLED[6]=1	SYSLED[6]=2
7		Clock (RTC)	SYSLED[7]=0	SYSLED[7]=1	SYSLED[7]=2
8		Heating	SYSLED[8]=0	SYSLED[8]=1	SYSLED[8]=2
9		User-defined 1	SYSLED[9]=0	SYSLED[9]=1	SYSLED[9]=2
10		User-defined 2	SYSLED[10]=0	SYSLED[10]=1	SYSLED[10]=2
11		User-defined 3	SYSLED[11]=0	SYSLED[11]=1	SYSLED[11]=2
12		User-defined 4	SYSLED[12]=0	SYSLED[12]=1	SYSLED[12]=2
13		User-defined 5	SYSLED[13]=0	SYSLED[13]=1	SYSLED[13]=2
14		User-defined 6	SYSLED[14]=0	SYSLED[14]=1	SYSLED[14]=2
15		User-defined 7	SYSLED[15]=0	SYSLED[15]=1	SYSLED[15]=2
16		Alarm	SYSLED[16]=0	SYSLED[16]=1	SYSLED[16]=2
17	ABC	Menu	SYSLED[17]=0	SYSLED[17]=1	SYSLED[17]=2
18		Economy	SYSLED[18]=0	SYSLED[18]=1	SYSLED[18]=2

Some of the LEDs - for example, LED number 0, 1, 3, 5, and 7 (in green) - cannot be used by the IEC developer when BIOS menu is active.



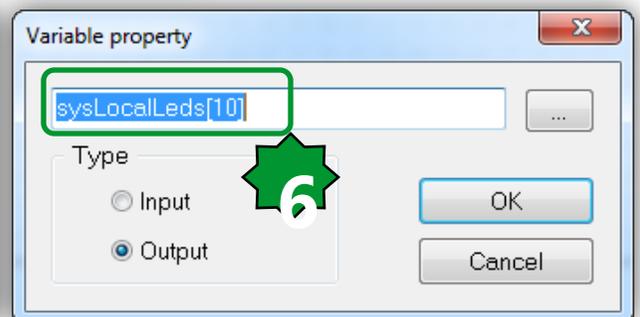
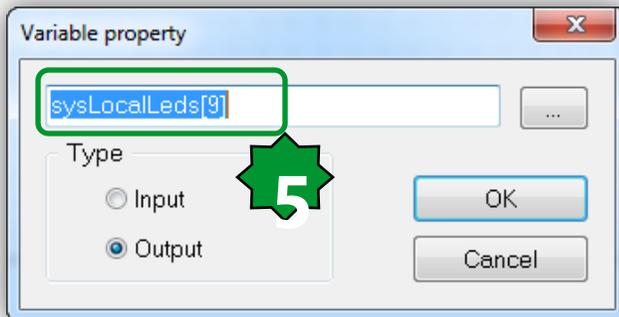
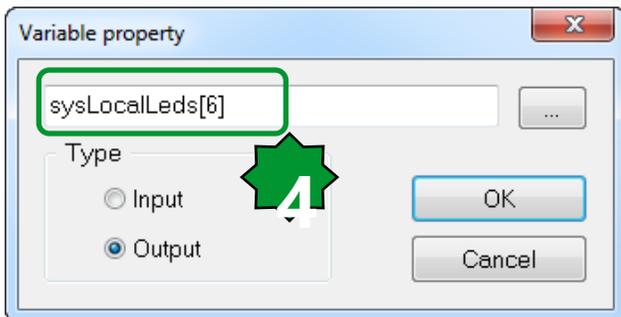
System local LED assigning



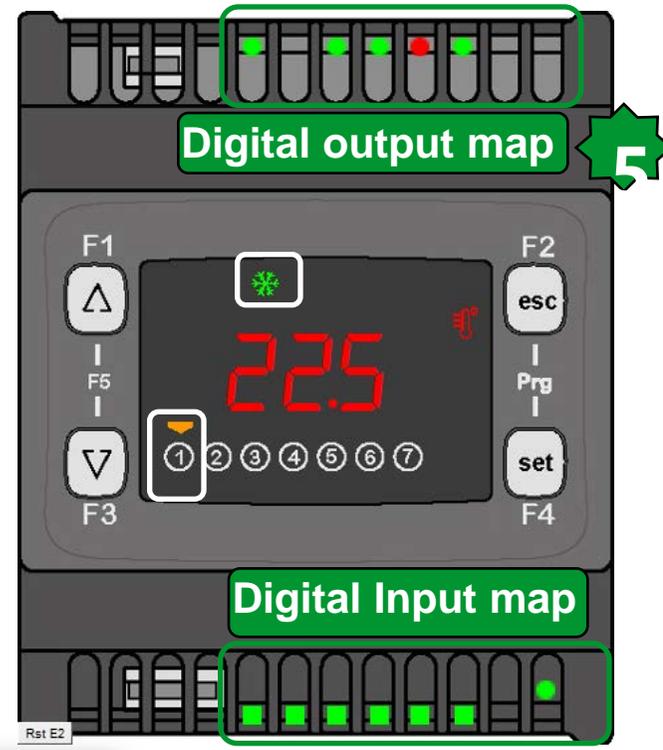
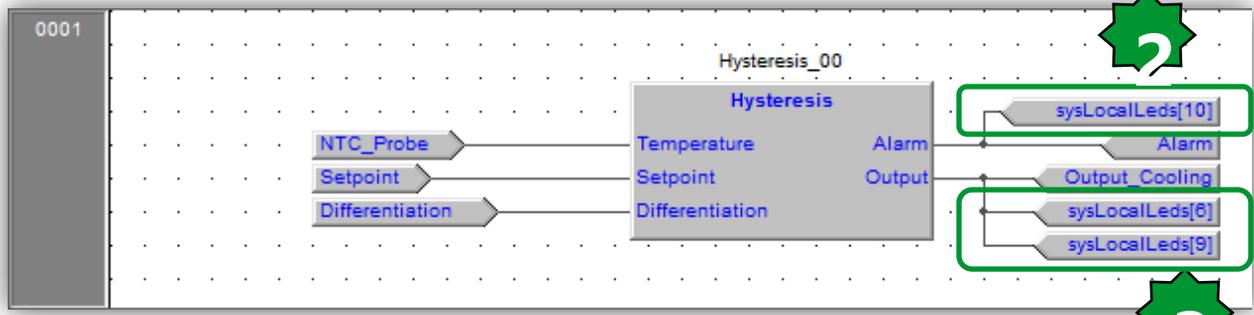
1. 2*click
2. Variable property
3. Dedicate required LED
4. Type [6] ▶ Output ▶ OK
5. Type [9] ▶ Output ▶ OK
6. Type[10] ▶ Output ▶ OK
7. Dedicated LED's



LED number	Symbol or icon	Description	Off	On (steady)	On (blinking)
6		Cooling	SYSLED[6]=0	SYSLED[6]=1	SYSLED[6]=2
9		User-defined 1	SYSLED[9]=0	SYSLED[9]=1	SYSLED[9]=2
10		User-defined 2	SYSLED[10]=0	SYSLED[10]=1	SYSLED[10]=2



Connecting dedicated LED's to the FBD



Step 4

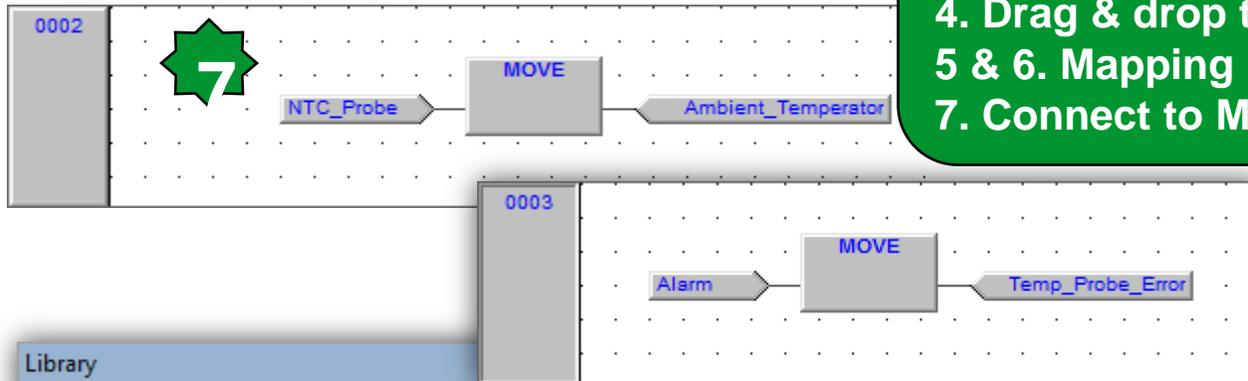
LED number	Symbol or icon	Description	Off	On (steady)	On (blinking)
6		Cooling	SYSLED[6]=0	SYSLED[6]=1	SYSLED[6]=2
9		User-defined 1	SYSLED[9]=0	SYSLED[9]=1	SYSLED[9]=2
10		User-defined 2	SYSLED[10]=0	SYSLED[10]=1	SYSLED[10]=2

Step 4

Valorize Fundamental State Display



1. Insert bottom (new network)
2. Adding new network
3. Select Move block
4. Drag & drop to new network
- 5 & 6. Mapping ◀▶ Variables
7. Connect to Move block



Library

ABS	DIV	LN	POW	SIZEOF
ACOS	EQ	LOG	R	SQRT
ADD	EXP	LT	REPLACE	SUB
ADR	FIND	MAX	RET	TAN
AND	FLOOR	MID	RIGHT	TANH
ASIN	GE	MIN	ROL	TO_BOOL
ATAN	GT	MOD	ROR	TO_DINT
ATAN2	INSERT	MOVE	S	TO_INT
CEIL	JMP	MUL	SEL	TO_REAL
CONCAT	LE	MUX	SHL	TO_SINT
COS	LEFT	NE	SHR	TO_UDINT
COSH	LEN	NOT	SIN	TO_UINT
DELETE	LIMIT	OR	SINH	TO_USINT

Operator and standard blocks | Target variables | Target blocks | basic

Project

- Thermostat New Project
 - Programs
 - Function blocks
 - Functions
 - Global variables
 - Automatic variables
 - Mapped variables
 - Constants
 - Retain variables
 - Global shared**
 - Alarms
 - Mappings
 - NTC_Probe
 - Output_Heating
 - Alarm
 - Parameters
 - Variables
 - Ambient_Temperatur
 - Tasks
 - Timed
 - Background
 - Thermostat
 - Boot
 - Init

* Move command is mandatory to connect two variables.

Compile/Build



Compile

```
Output
Preparing for PLC application download .. done.
Downloading file C:\Users\SESA94552\Thermostat New\Thermostat New.cod .. completed.
Booting PLC application .. done.
0 warnings, 0 errors.
```

```
Output
Generating program THERMOSTAT
Generating program DISPLAYALARMLED
Generating program APPLICATIONMENU
Generating unresolved
aborted.
THERMOSTAT(1$FB:HYSTERSIS_00) - error G0008: ST => Invalid access to variable
0 warnings, 1 errors.
```

**Double click on
the error to refer to
the error source**

Chapter 5

Simulation and Debugging – Part 2

Goal:

On-Line simulation mode, testing of:

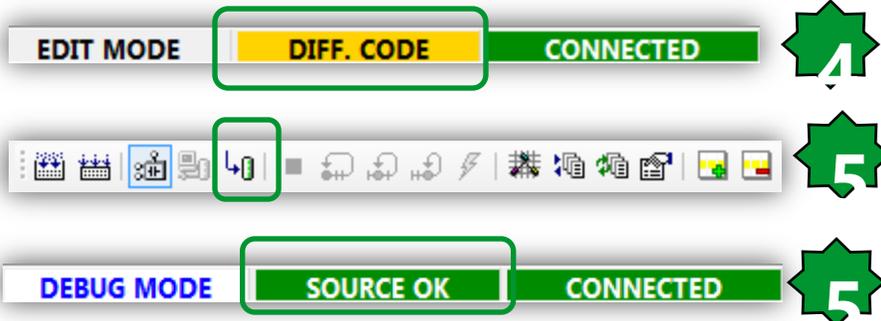
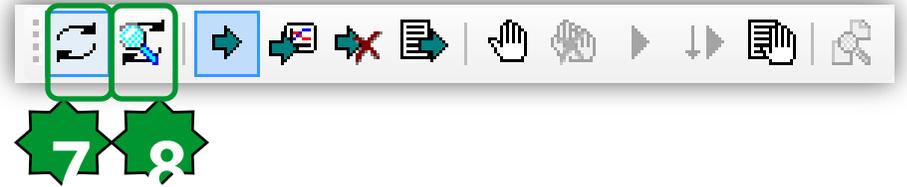
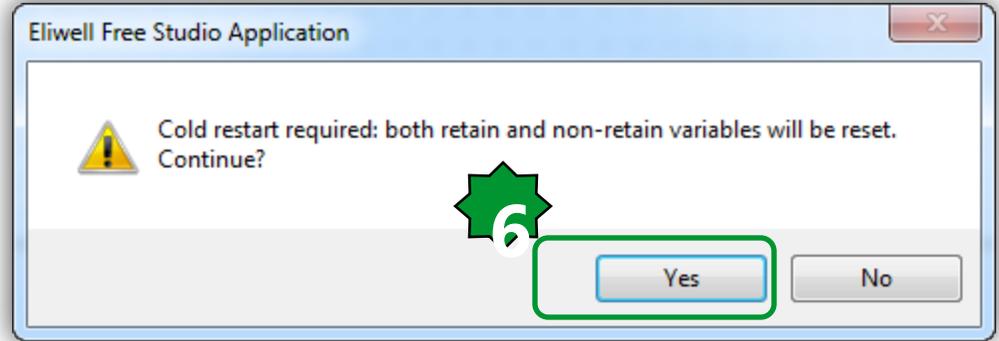
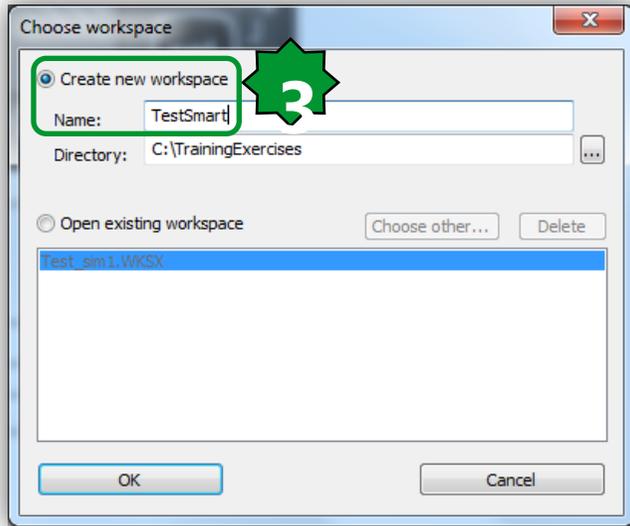
- Physical I/O
- 7 segment display



Off line simulation mode

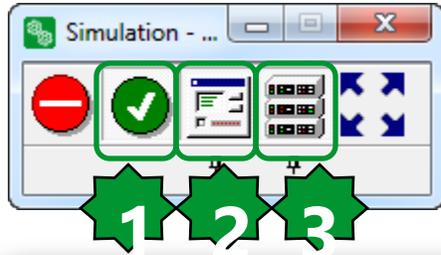


Debug ► Simulation mode ►



1. Debug
2. Simulation mode
3. Name it ► OK
4. If differs or no code
5. Download code, OK
6. Reset Variables
7. Debug mode (optional)
8. Live debug (Continuous) mode (optional)

Simulation tools



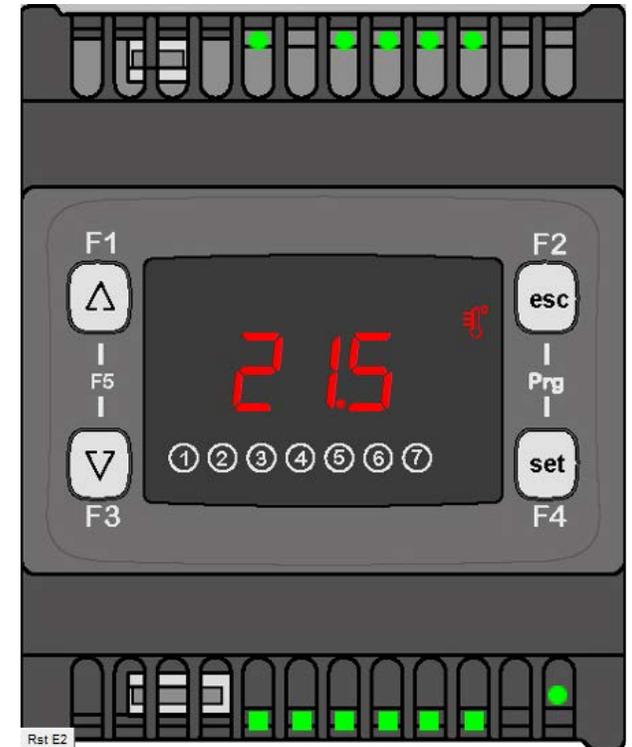
1. Active code execution
2. Show I/O panels
3. Show HMI window

Digital Inputs	
DIL1	<input checked="" type="checkbox"/>
DIL2	<input checked="" type="checkbox"/>
DIL3	<input checked="" type="checkbox"/>
DIL4	<input checked="" type="checkbox"/>
DIL5	<input checked="" type="checkbox"/>
DIL6	<input checked="" type="checkbox"/>

Analogue Inputs	
AIL1	<input type="text" value="0"/>
AIL2	<input type="text" value="0"/>
AIL3	<input type="text" value="0"/>
AIL4	<input type="text" value="0"/>
AIL5	<input type="text" value="0"/>

Digital Outputs	
DOL1	<input checked="" type="checkbox"/>
DOL2	<input checked="" type="checkbox"/>
DOL3	<input checked="" type="checkbox"/>
DOL4	<input checked="" type="checkbox"/>
DOL5	<input checked="" type="checkbox"/>
DOL6	<input checked="" type="checkbox"/>

Analogue Outputs	
AOL1	<input type="text" value="0"/>
AOL2	<input type="text" value="0"/>
AOL3	<input type="text" value="0"/>
AOL4	<input type="text" value="0"/>
AOL5	<input type="text" value="0"/>
TCL1	<input type="text" value="0"/>



Opening Device from Application



The screenshot shows the FreeSmart Configuration software interface. The 'Developer' menu is highlighted with a green box, and the 'Open with Free Studio Device' option is selected. A green arrow with the number '1' points to this option. Below the menu, the 'FreeSmart Configuration' window is visible, showing various settings like 'Display' (Fundamental state display: Ambient_Temporator) and 'Execution time' (Set execution time: , Execution time (ms): 100). A 'Data export' section is also present with a 'Select XSLT export filter' field and 'Browse' and 'Export' buttons. In the bottom left, there is an image of a handheld device with buttons labeled F1, F2, F3, F4, F5, and Prg, and a screen displaying diagonal lines.

1. Developer ► Open with Free Studio Device

Free Studio Device (Simulation Target)



FreeSmart 412 Configuration

General
Name: FreeSmart
File version: 412.15

Communication
Protocol: GDB [Settings]
Address: 127.0.0.1
Port: TCP/IP:5000
Baud rate: []
 Disable communication

Information
Status: NOT CONNECTED
Firmware version: []

Project
Thermostat Exercise rev.1
FreeSmart
BIOS parameters
All parameters
Configuration
Local
Extended
Remote
I/O Values
Local
Extended
Remote
Protection Password
Application
Thermostat Exercise rev.1
Cfg
Setting Menu
Recipes

Catalog
Device name | Version | Max versi... | Description

Connection Status
Device name | Description
✗ FreeSmart | Not connected

Watch
Device | Name | Value | Um | Description

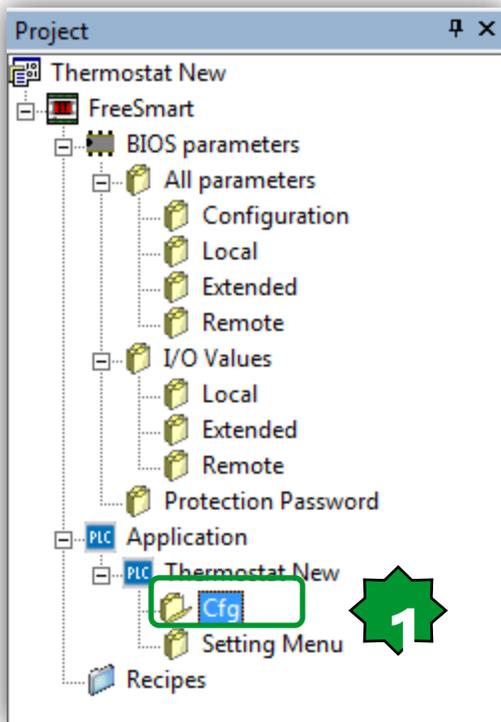
Output

CONNECTED

Connect to the target ► Connected feedback

Note: Free Studio Device does not download the code in Simulation, it is used only for setting EEPROM parameters and check Status

Read / Write Values



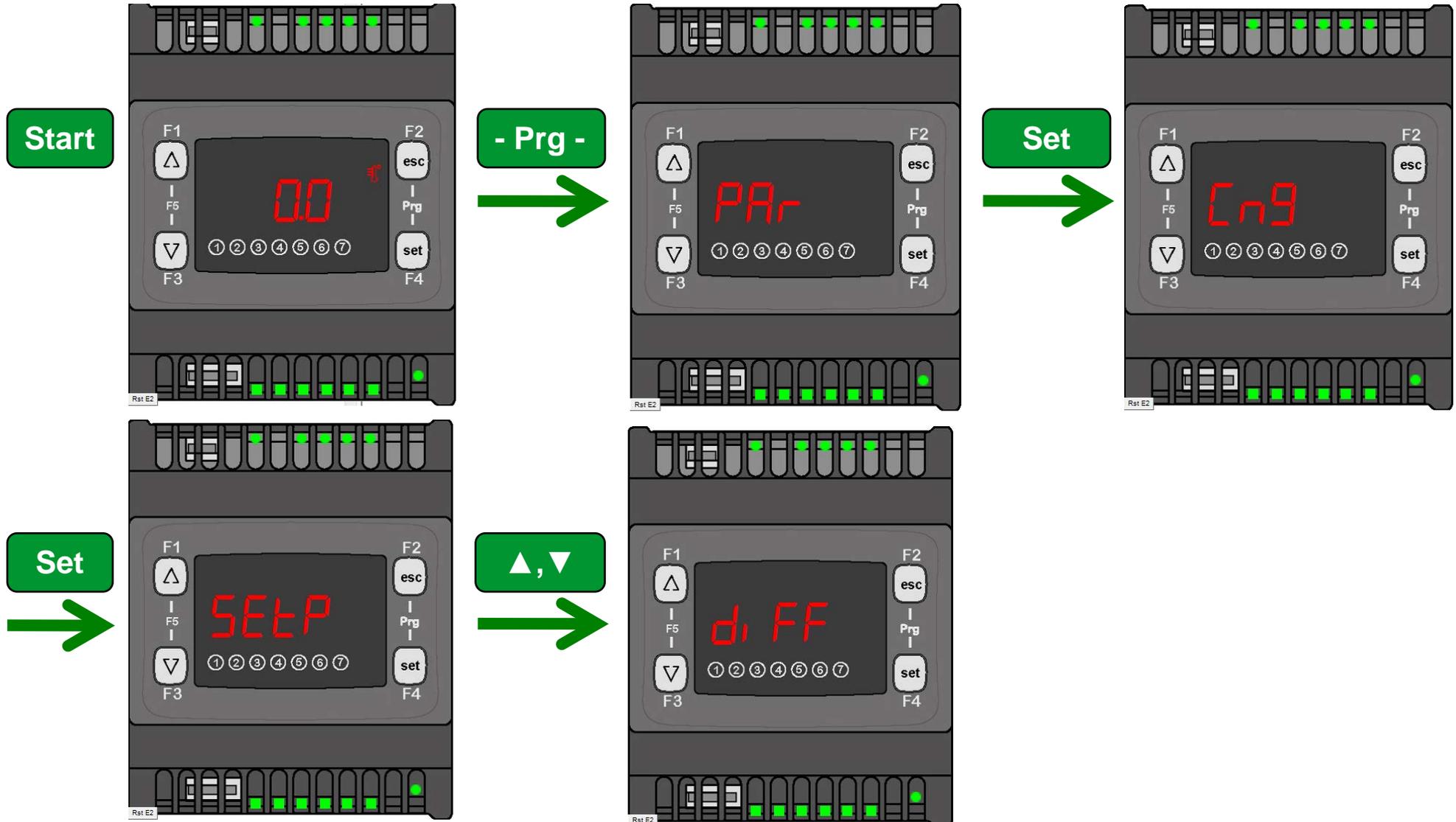
CONNECTED

Connection Status	
Device name	Description
FreeSmart	Connected

1. Connect to the target ▶ Connected feedback
2. Application ▶ Project ▶ Cfg
3. Cfg menu ▶ non aligned value with target (Red)
4. Auto refresh mode (optional)
5. Select all parameters (or selective)
6. Write parameter (all or selective)+ download all
7. Aligned values with the target (black)

Cfg							
Address	Name	Value	Um	Default	Min	Max	Description
16384	Setpoint	180.0	°C	180.0	150.0	300.0	
16385	Differentiation	20.0	°C	20.0	5.0	50.0	

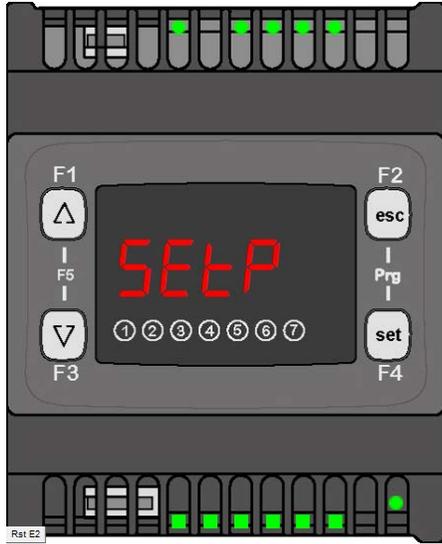
Menu Navigation



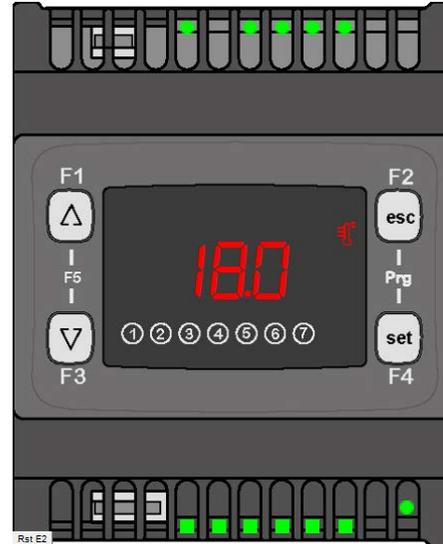
Setting the setpoint



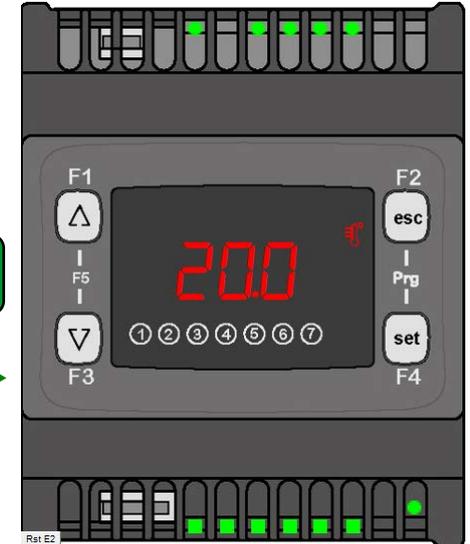
Start



Set



Default value aligned with the Free Studio Device

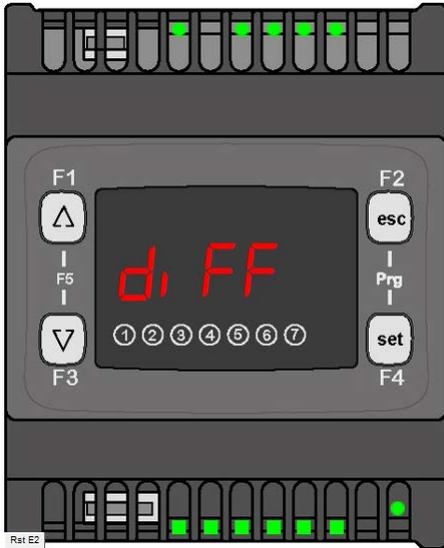


Press Set to validate
Press esc to cancel

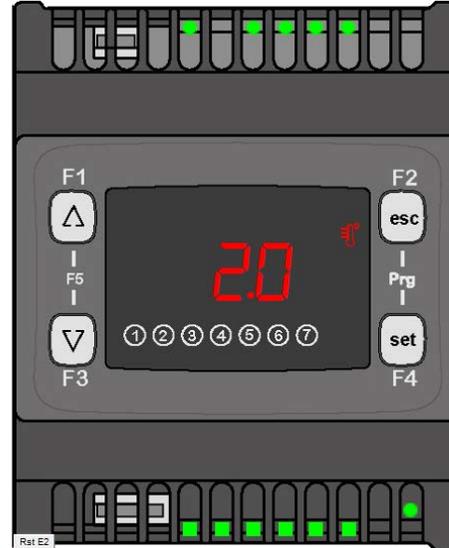
Setting the differentiation



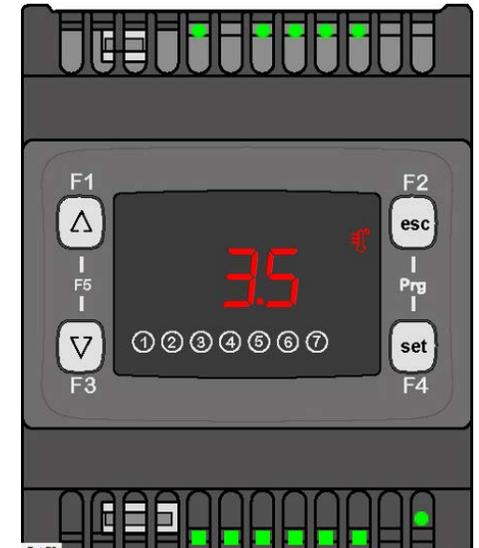
Start



Set

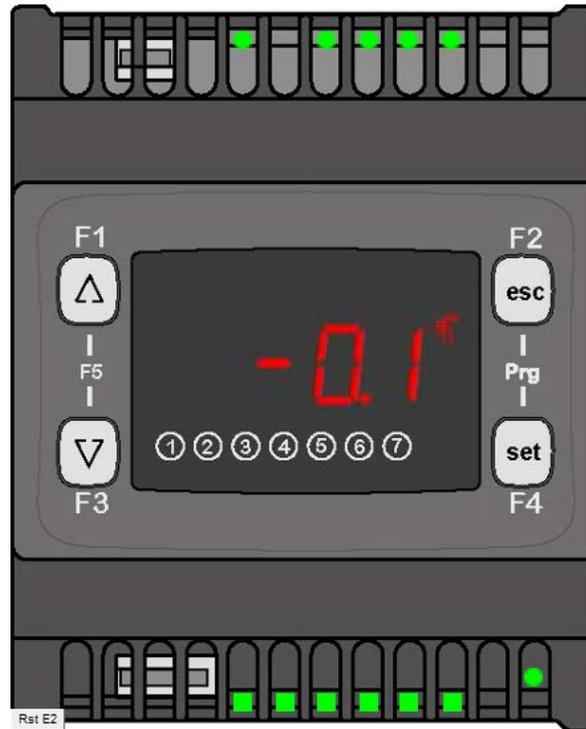
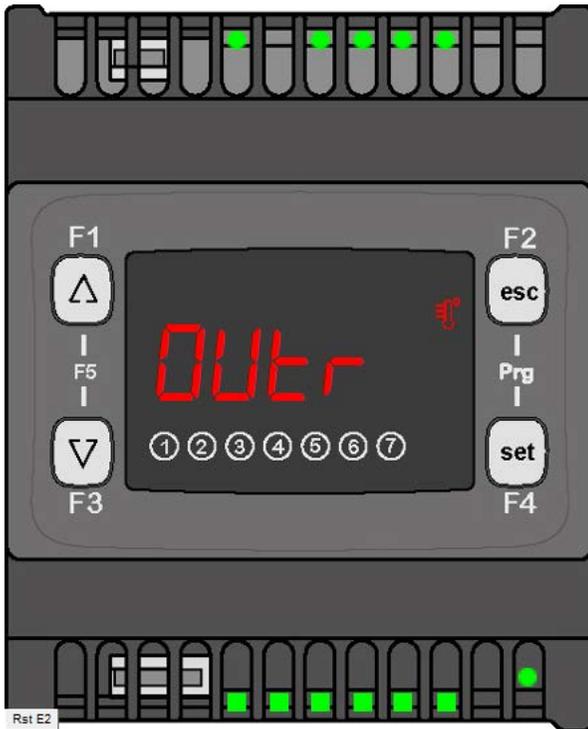


Default value aligned with the Free Studio Device



Press Set to validate
Press esc to cancel

Message



Out of range message
Only can display:
- 99.9.....999.9

Device does not write
default values



Testing program/applying values

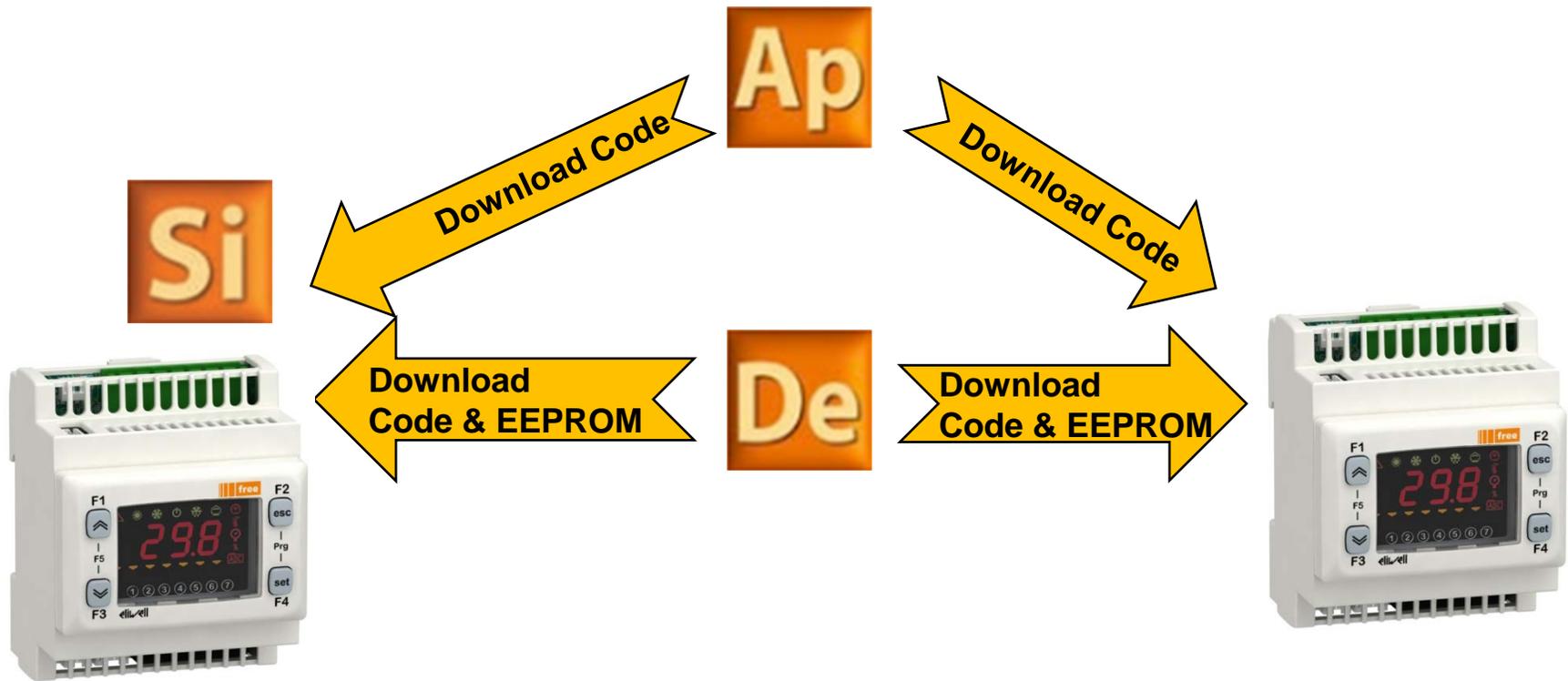
- Setpoint=26.0, Differentiation=10.0 & Ambient_Temperature =37.0
⇒ DOL1= ON & ☀ = ON
- Setpoint=26.0, Differentiation=10.0 & Ambient_Temperature =25.0
⇒ DOL1= OFF & ☀ = OFF
- Setpoint=26.0, Differentiation=10.0 & $26.0 < \text{Ambient_Temperature} < 36.0$
⇒ DOL1= ON & ☀ = ON
- Ambient_Temperature =-32768
⇒ DOL1= OFF , ☀ = OFF & DOL2= ON (probe disconnection alarm= ON)

SMART Project Architecture



- Application is the programming starting point.
- Device is used to download the overall compiled project and it is the only tool able to write EEPROM parameters.
- From Application it will always be possible to open Device directly without having to launch the program using the FREE Studio icon.

Tools workflow/Optimized

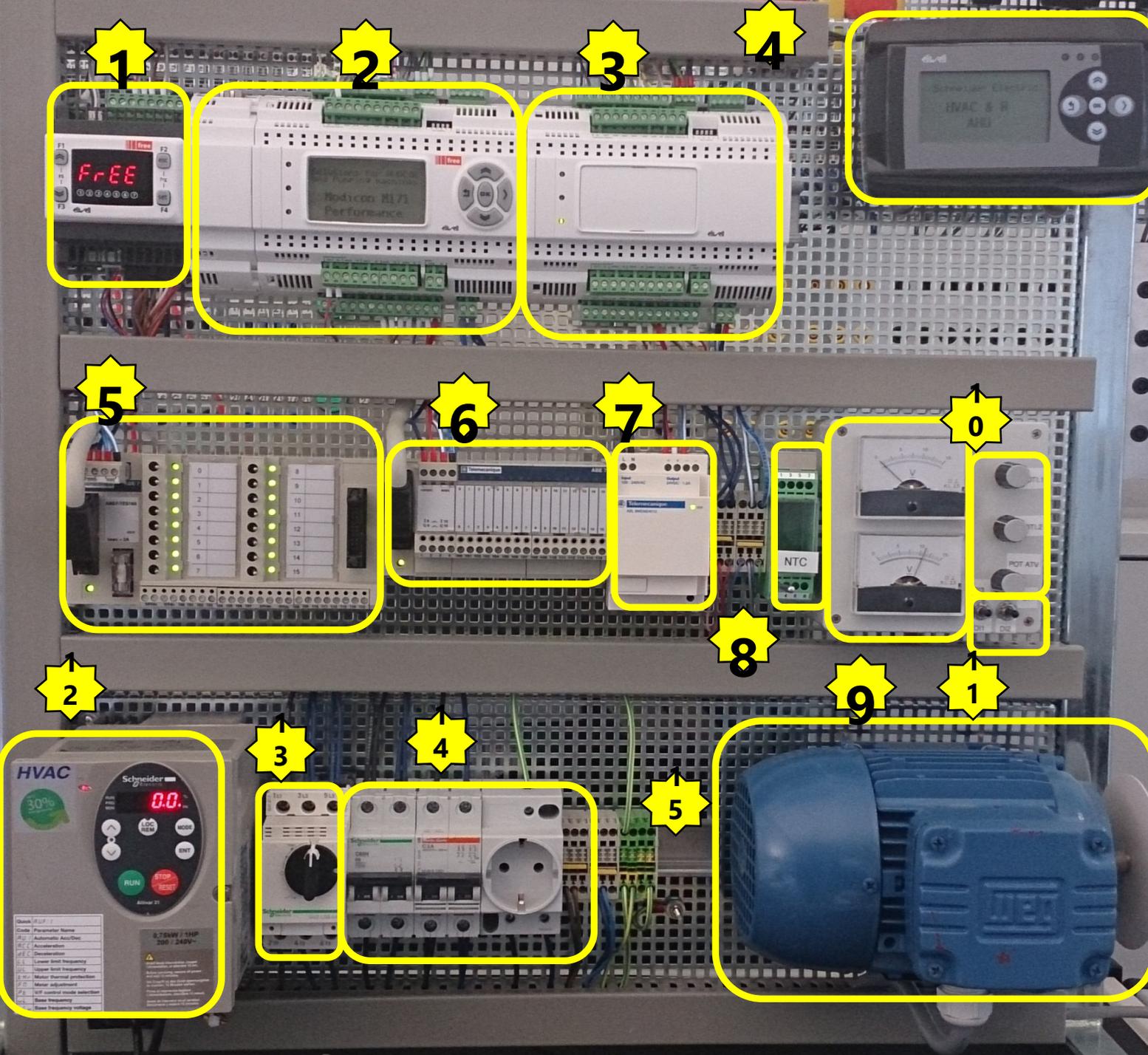


Chapter 6

Hardware

Goal:

Introduction of products that are used in training stand and target pin-out



1. SMART
2. EVOLUTION
3. Expansion Module
4. Remote Keyboard
5. Digital input
I0-I7 ▶ EVP3300
I8-I15 ▶ EVE*
6. Digital Output
Q0-Q3 ▶ SMART
Q4-Q9 ▶ EVOLUTION
Q10-Q15 ▶ EVE*
7. 24VDC power supply
8. NTC probes (AI1*)
9. Analogue Output
AO1 ▶ SMART
AO2 ▶ EVOLUTION
10. Analogue Input
AI1 ▶ SMART
AI2 ▶ EVOLUTION
AI3 ▶ ATV21
11. Digital input
I0 & I1(level) ▶ SMART
I2 & I3 (edge) ▶ EVOLU.
12. Variable Speed Drive
ATV21 (1 to 3 phases)
13. Short circuit
protection (GV3P)
14. LV distribution &
protection
15. Asynchronous motor

Training Stand I/O wiring diagram



M171O	Description	Label
DI1	Switch DI 1 (level)	DI0-O
DI2	Switch DI 2 (Level)	DI1-O
DI3	Switch DI 3 (Pulse)	DI2-O
DI4		
DI5		
DI6		
AI 1	NTC 1	AI1-O
AI 2		
AI 3	Potentiometer 1	AI3-O
AI 4		
AI 5		
DO 1	Telefast DO 0	DO0-O
DO 2	Telefast DO 1	DO1-O
DO 3	Telefast DO 2	DO2-O
DO 4		
DO 5		
DO 6		
AO 1		
AO 2		
AO 3	Meter 1	AO1-O
AO 4		
AO 5		

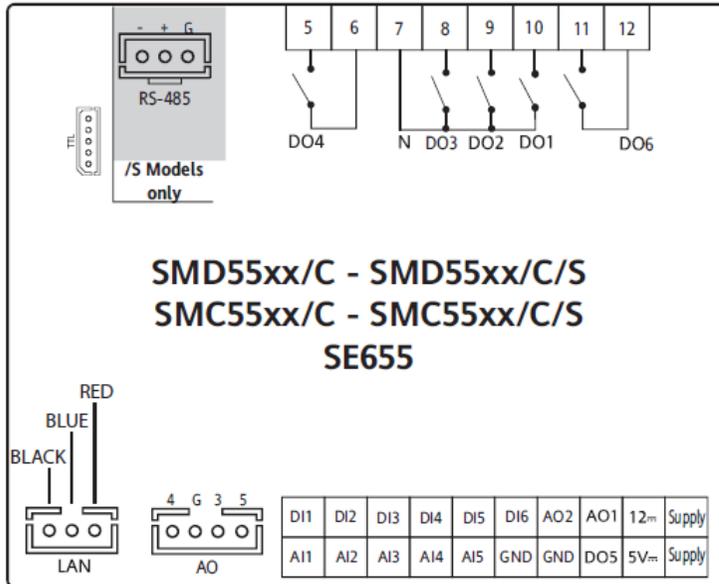
M171P	Description	Label
DI 1	Telefast DI 0	DI1-P
DI 2	Telefast DI 1	DI2-P
DI 3	Telefast DI 2	DI3-P
DI 4	Telefast DI 3	DI4-P
DI 5	Telefast DI 4	DI5-P
DI 6	Telefast DI 5	DI6-P
DI 7	Telefast DI 6	DI7-P
DI 8	Telefast DI 7	DI8-P
AI 1	NTC 2	AI1-P
AI 2		
AI 3	Potentiometer 2	AI3-P
AI 4		
AI 5		
AI 6		
DO 1		
DO 2		
DO 3	Telefast DO3	DO3-P
DO 4	Telefast DO4	DO4-P
DO 5	Telefast DO5	DO5-P
DO 6	Telefast DO6	DO6-P
DO 7	Telefast DO7	DO7-P
AO 1	Meter 2	AO1-P
AO 2		
AO 3		
AO 4		
AO 5		

M171E	Description	Label
DI 1	Telefast DI 8	DI1-E
DI 2	Telefast DI 9	DI2-E
DI 3	Telefast DI 10	DI3-E
DI 4	Telefast DI 11	DI4-E
DI 5	Telefast DI 12	DI5-E
DI 6	Telefast DI 13	DI6-E
DI 7	Telefast DI 14	DI7-E
DI 8	Telefast DI 15	DI8-E
AI 1	NTC 3	AI1-E
AI 2		
AI 3		
AI 4		
AI 5		
AI 6		
DO 1	Telefast DO9	DO1-E
DO 2	Telefast DO10	DO2-E
DO 3	Telefast DO11	DO3-E
DO 4	Telefast DO12	DO4-E
DO 5	Telefast DO13	DO5-E
DO 6	Telefast DO14	DO6-E
DO 7	Telefast DO15	DO7-E
AO 1		
AO 2		
AO 3		
AO 4		
AO 5		

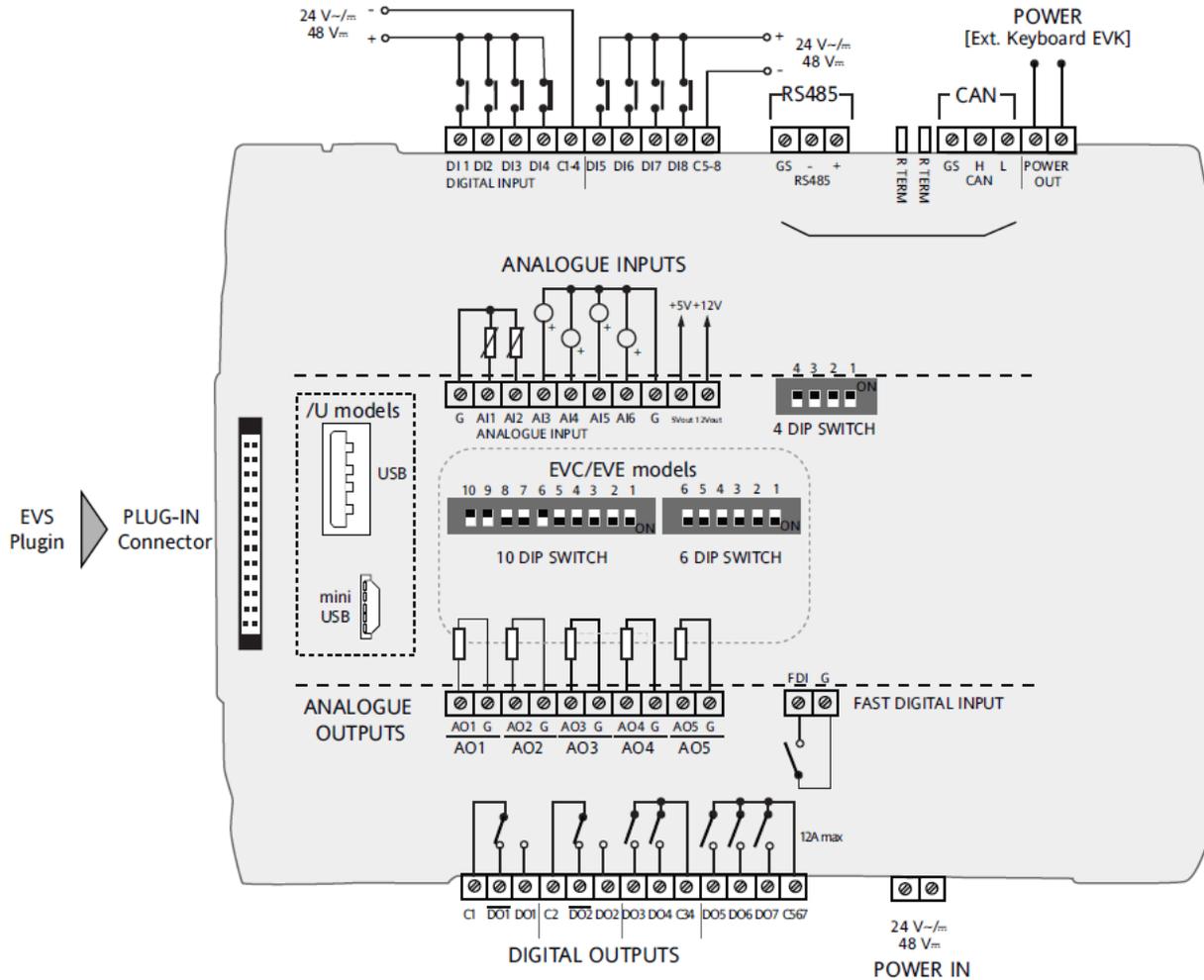
Wiring Diagram



SMD5500/C/S

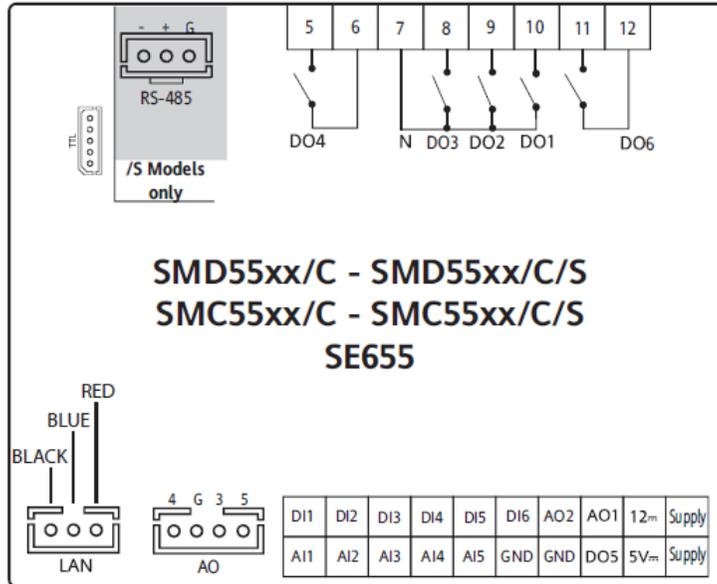


EVD7500/C/U

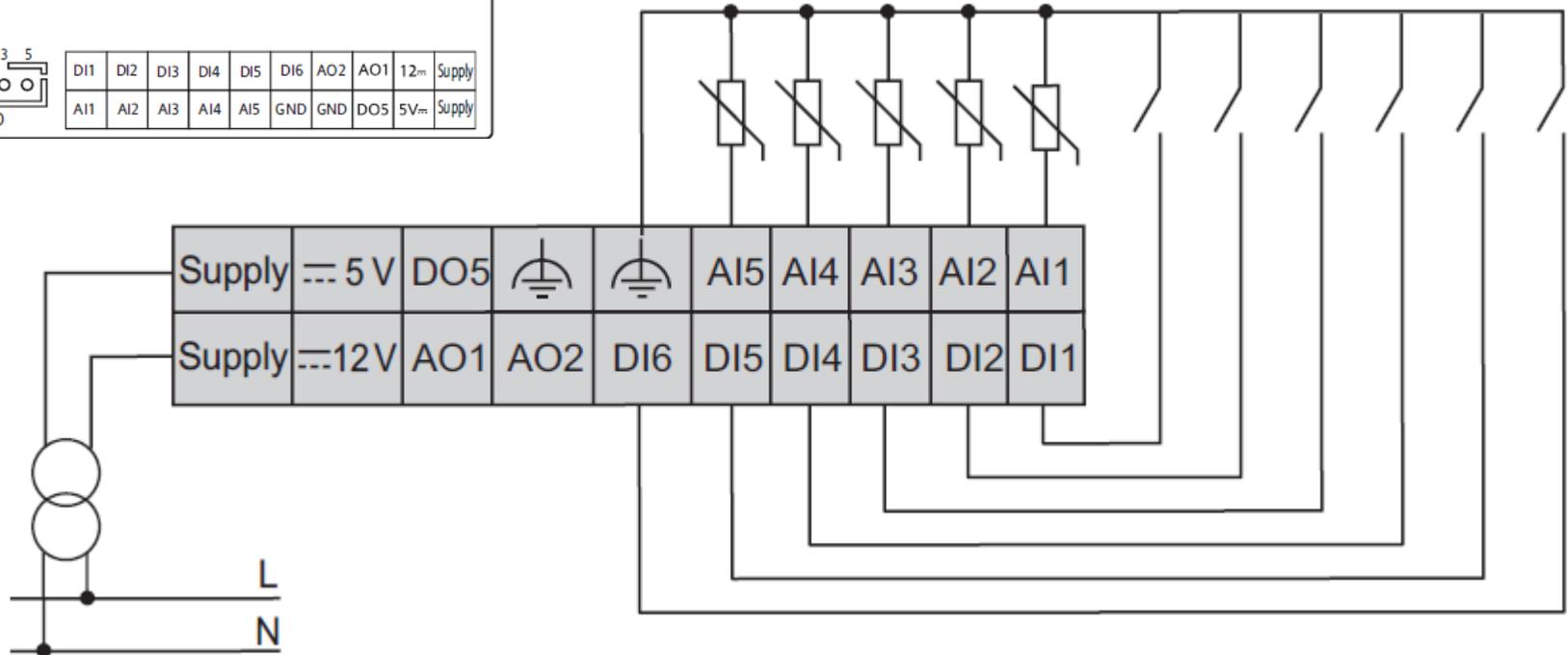


EVS Plug-in
 PLUG-IN Connector

SMART Pin-out



SMD5500/C/S



SKW22 and SKP22 Remote Display

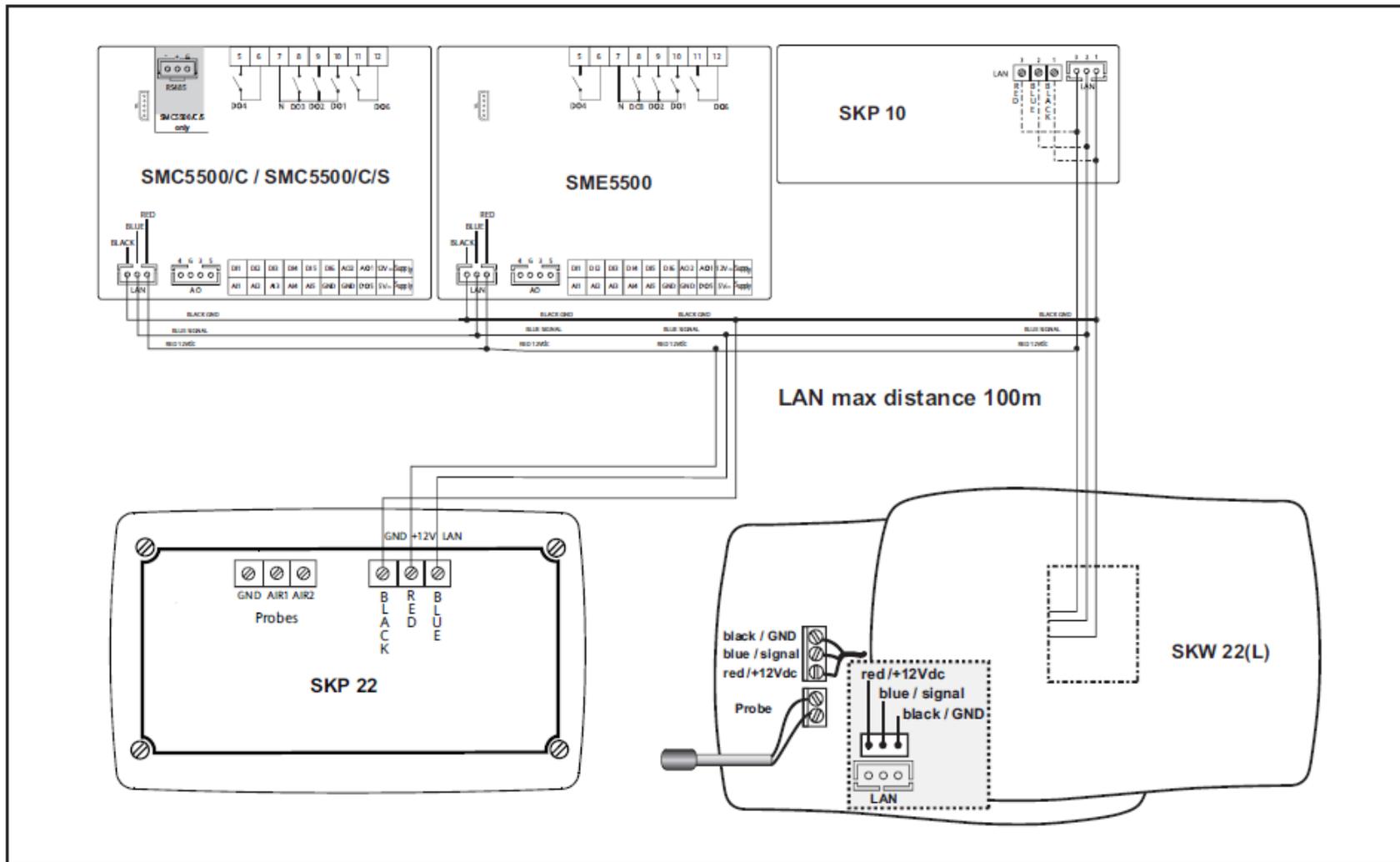


Fig. 44. SMC / SME / SKP 10 / SKW 22(L) connection

NOTE: Only 1 Display module (SKW 22(L)) can be connected at time.

SKP10 Remote Display

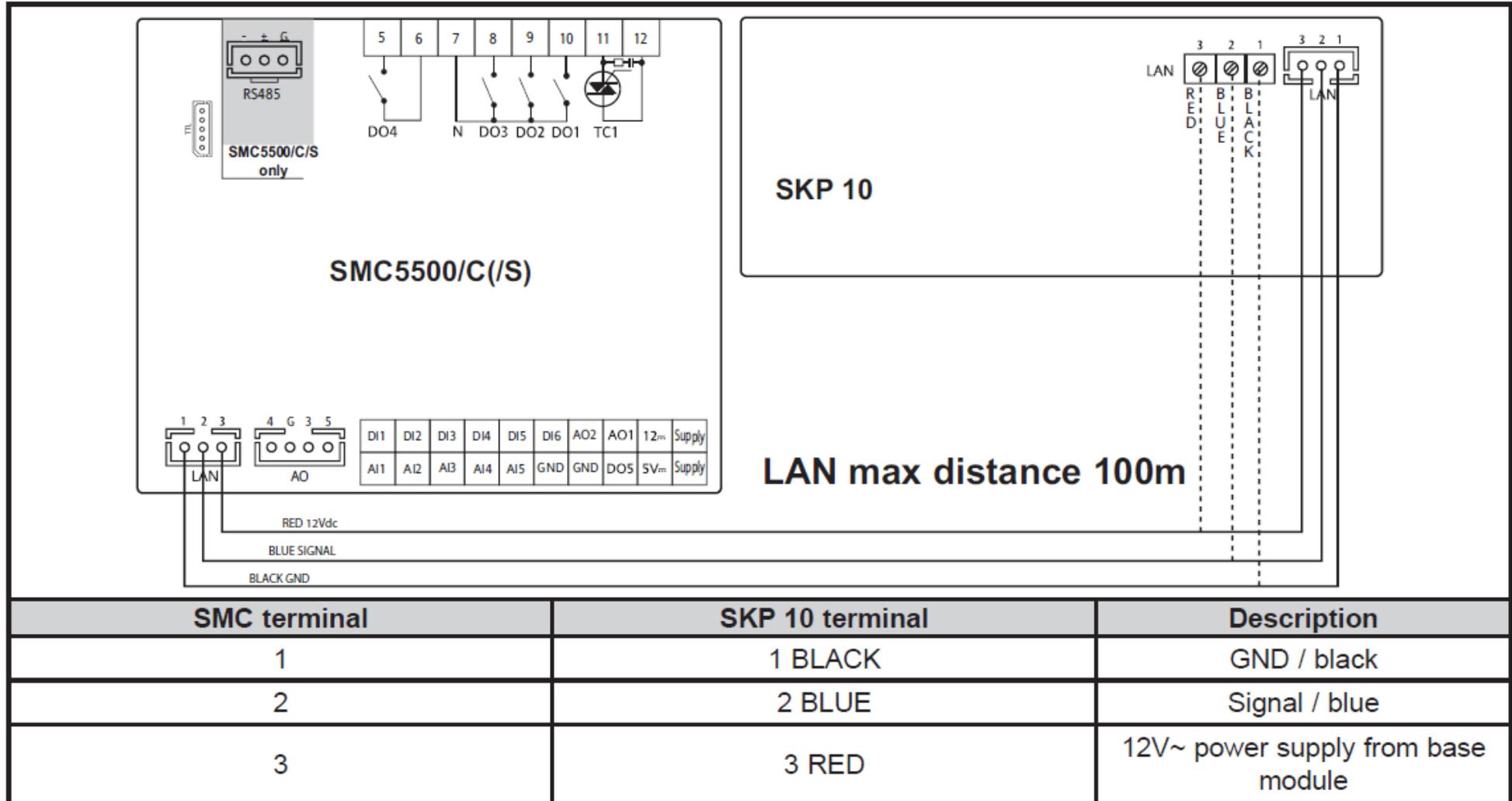
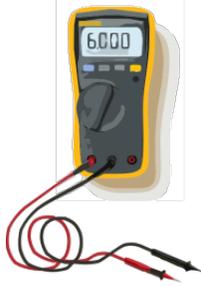


Fig. 43. SMC / SKP 10 connection

NTC probe, Type: 103AT/NTCNK103



Temperature probes (*) 	SN691150	NTC 103AT probe, 1.5m (plastic cap, 2-wire cable)
	SN8DED11502C0	NTC103AT 5X20 1.5mt TPE IP68
	SN8DED13002C0	NTC103AT 5X20 3mt TPE IP68
	SN8DAD11502C0	NTC103AT 6X20 1.5mt TPE IP68
	SN8DAD13002C0	NTC103AT 6X20 3mt TPE IP68

	NTC* -50...+100°C	0/4...20 mA	0-10V	0-5V	0-1V	DI
Resolution	0.1°C	0.1	0.1	0.1	0.1	
Accuracy	1%	1% e.o.s. 1% f.s.	1% e.o.s. 1% f.s.	1% e.o.s. 1% f.s.	2% e.o.s. 2% f.s.	
Impedence		100Ohm	21KOhm	110KOhm	110KOhm	

	NTC* -50...+100°C	0/4...20 mA	0-10V	0-5V	0-1V	DI
AI1	✓	-	-	-	-	✓
AI2	✓	-	-	-	-	✓
AI3	✓	✓	✓	✓	✓	✓
AI4	✓	✓	✓	✓	✓	✓
AI5	✓	-	-	-	-	✓

AT THERMISTOR

AT THERMISTOR

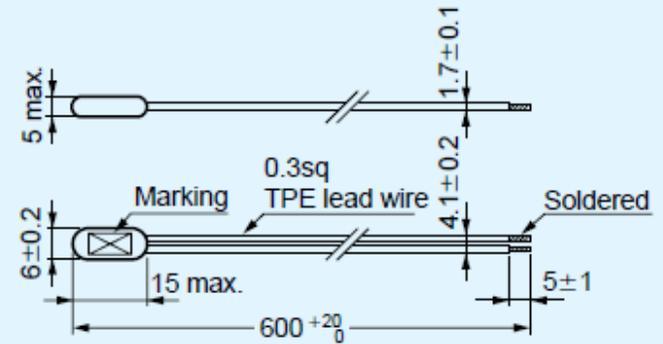
The AT thermistor is a high-precision thermal sensing device featuring an extremely small B-value tolerance and resistance.

When used as a temperature gauge, the AT thermistor requires no adjustment between the control circuit and the sensor.

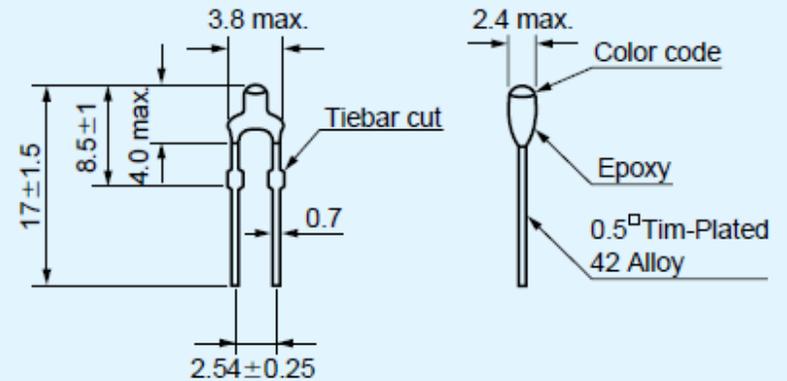
102 AT-2

Shape
High-precision AT thermistor
Rated zero-power
Resistance at 25°C 102 : 1(kΩ)

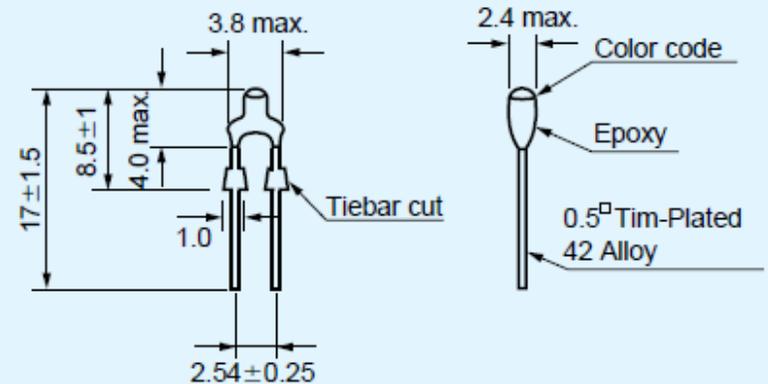
AT-11



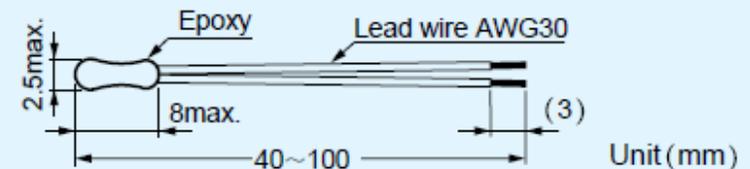
AT-2



AT-3



AT-4

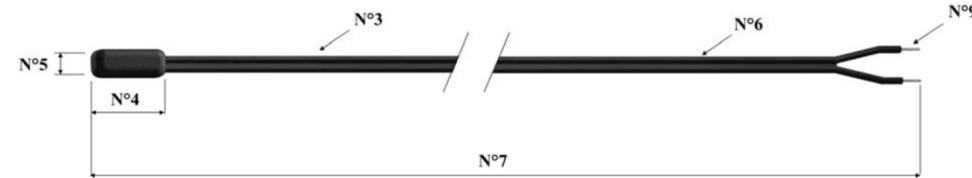


Probe Properties

SN691150

NTC - Probe over moulded with IP67 flat cable
 NTC - Sonda costampata con piattina IP67

Sensor internal / Interno capsula



Nr.	General Probe Data		Tolerance (mm)	Dati generali sonda		Tolleranza (mm)
	P/N	SN691150		Codice	SN691150	
1	Description	NTC – Probe over moulded with IP67 flat cable		Descrizione	NTC - Sonda costampata con piattina IP67	
2	Sensor Type	NTC 10K 1% Beta 3435		Tipo elemento	NTC 10K 1% Beta 3435	
3	Capsule Material	Thermoplastic rubber - Black		Materiale capsula	Gomma termoplastica - Nera	
4	Capsule Lenght	15mm	+/- 1.5%	Lunghezza capsula	15mm	+/- 1,5%
5	Capsule Diameter	5x6mm	+/- 1.5%	Diametro capsula	5x6mm	+/- 1,5%
6	Cable Type	Flat cable Thermoplastic rubber		Tipo di cavo	Piattina in Gomma termoplastica	
	Colour	Black		Colore	Nero	
	Diameter	3.60 x 1.65mm Ø2x0.25 mm ²	+/- 1%	diametro	3,60 x 1,65mm Ø 2x0,25 mm ²	+/- 1%
7	Probe Lenght	1.5	+/- 3%	Lunghezza sonda	1,5	+/- 3%
8	Cable / Hose Coupling	None		Raccordo cavo/tubo	Nessuno	
9	Terminals	Soldered		Terminali	Stagnati	
10	Filler	Thermoplastic rubber		Riempitivo	Gomma termoplastica	
	Options	wrapped		Opzioni	avvolta	
Technical Data			Caratteristiche tecniche			
	Temperature Range	-50...+110°C		Campo di lavoro	-50...+110°C	
	Accuracy	±1%		Precisione	±1%	
	Protection Rating	IP 67		Grado di protezione	IP 67	
	Response Time	K = 10" liquid V = 2 m/s		Tempo di risposta	K = 10" in liquido V = 2 m/s	
Tests			Collaudi			
	Traction Test	2Kg		Test trazione	2Kg	
	Insulation Resistance	20Mohm @ 500 V _m		Resistenza di isolamento	20Mohm @ 500 V _m	
	Dielectric Rigidity	1'500V~		Rigidità dielettrica	1.500V~	

Chapter 7

Connection to SMART

Goal:

DMI interface driver installation and connect to the target



eliwell

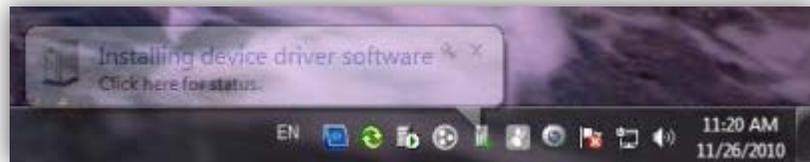
by **Schneider** Electric

DMI interface setup WIN 7



- As soon as the DM interface is connected, the Windows 7 operating system recognizes the newly connected hardware. The steps to be followed are described below.

1. Once the hardware is connected, the message shown in the figure will appear:

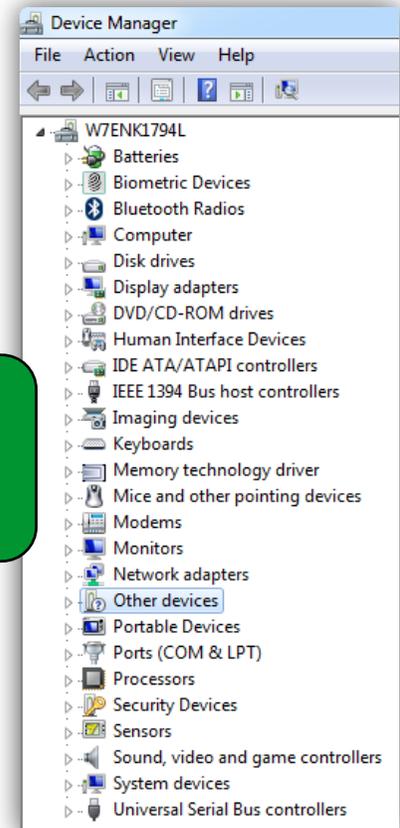


Click on the message to start the Guided installation procedure
Or you can manually find it at:

Note: Connection procedure:
Connection: first USB then TTL
Disconnection: first TTL then USB

Control Panel ► All Control Panel Items ► System

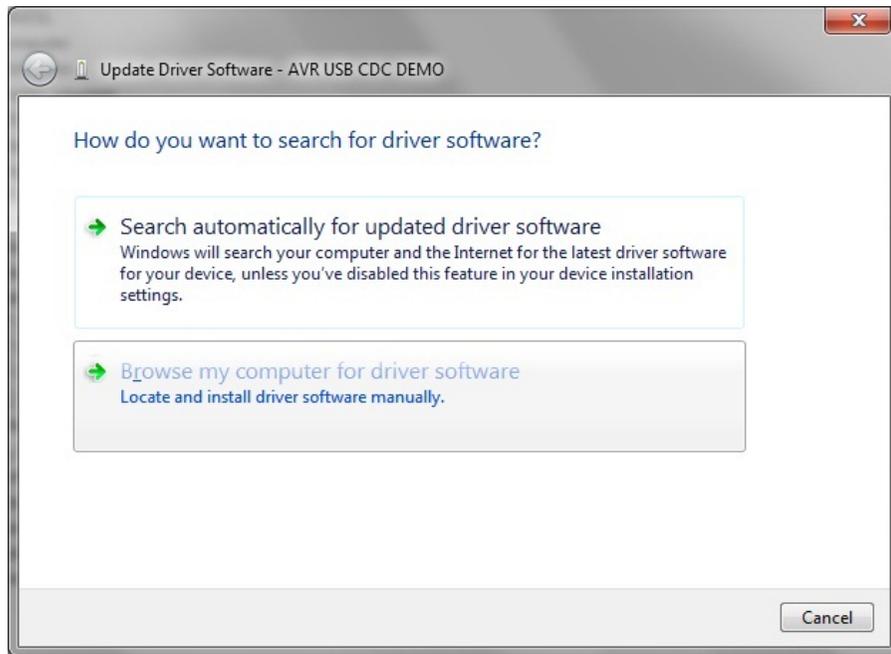
Device manager ► other devices ►



Update driver software



2. The screen shown below will appear: select the second option to identify the driver

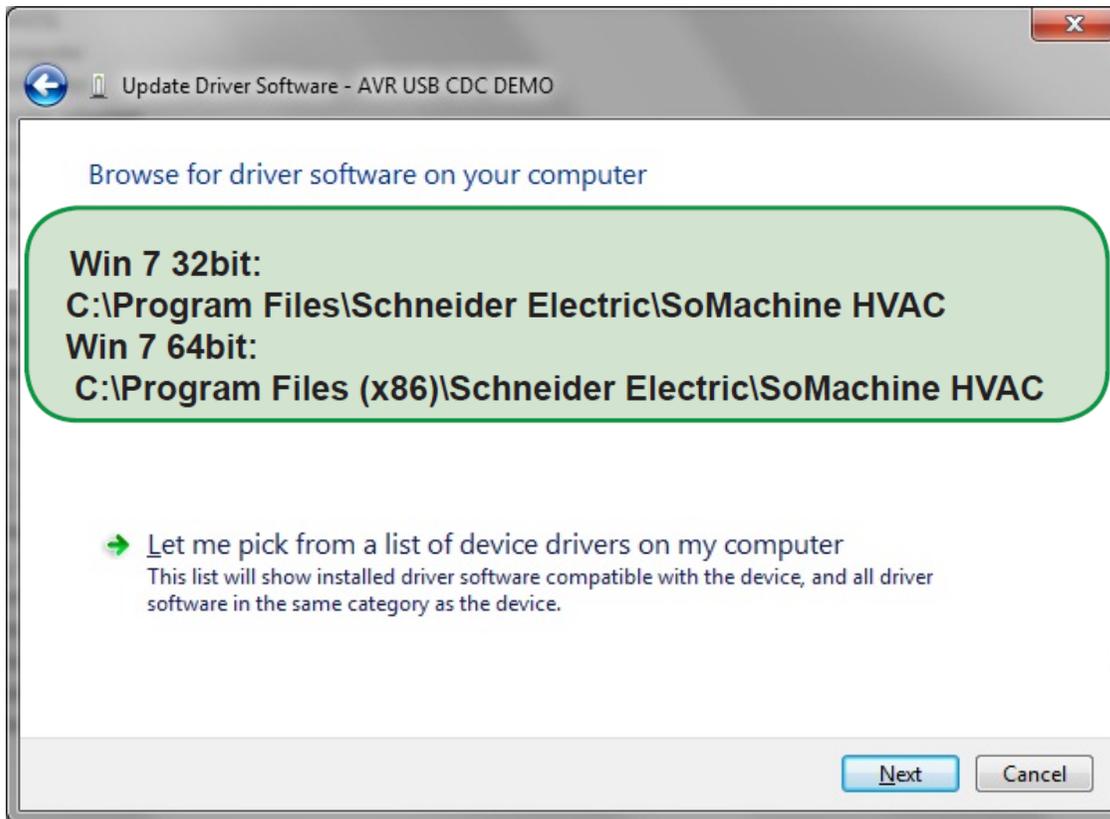


3. In the next screen, select the installation path for the FREE Studio program. Unless changed during installation, the path will be as shown in the next figure.

Update driver software



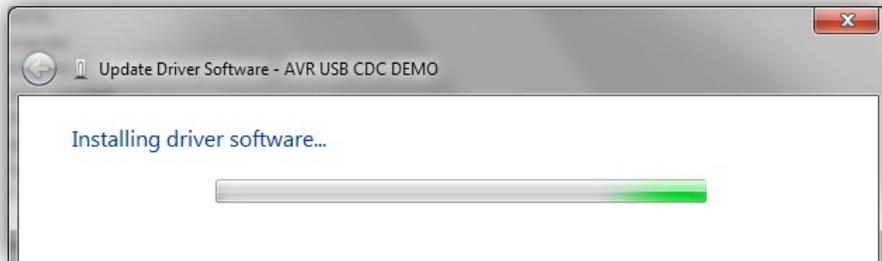
4. Once you have selected the correct path, the screen shown below will appear: select **Install this driver software anyway**



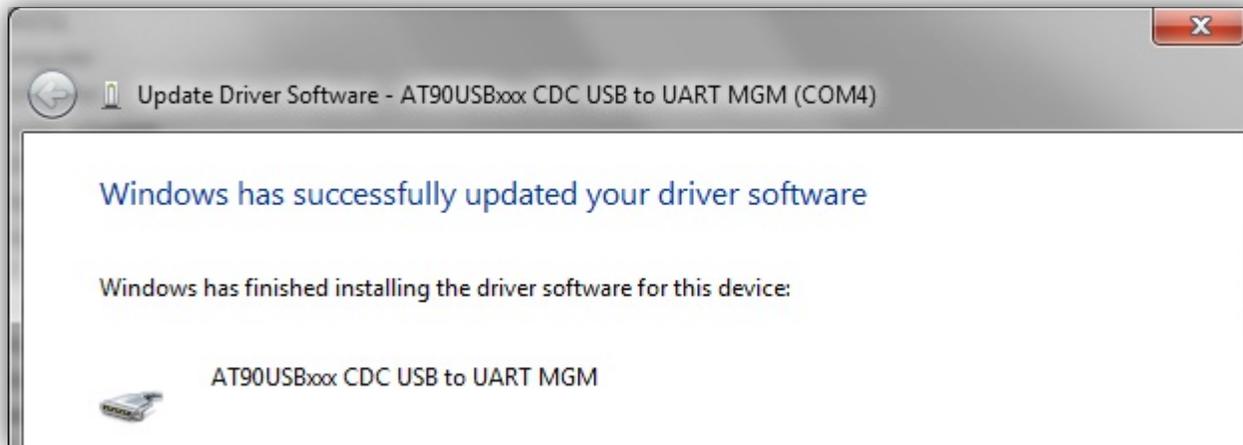
Update driver software



5. The screen shown below will appear, indicating that the action has been performed.



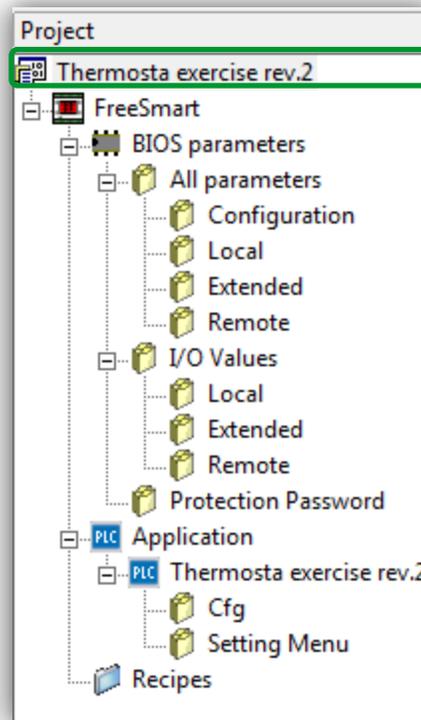
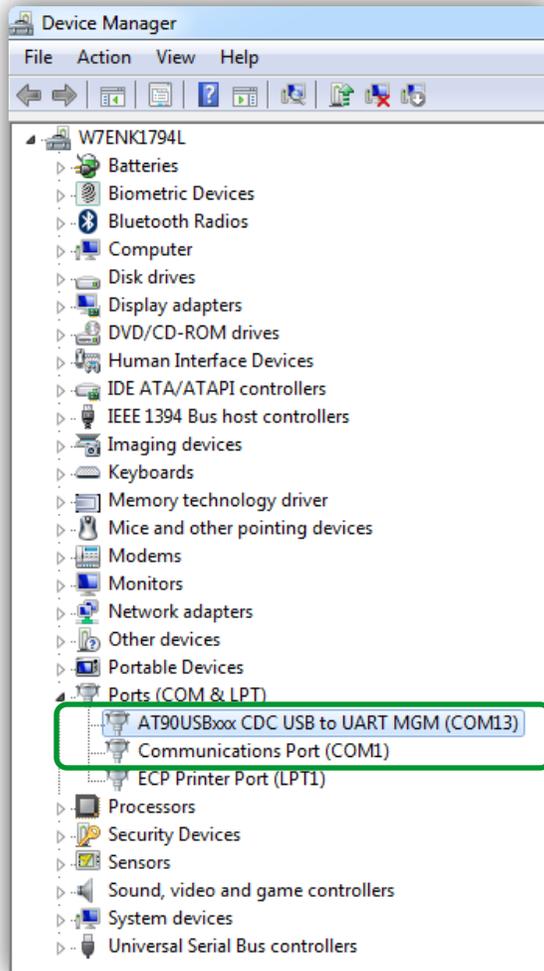
6. On completion of the process, the screen shown below will appear, then close.



DMI Test via FS Device



To check correct installation of the driver and the port to which the hardware has been allocated, check the Windows screens shown below:



Project Thermosta exercise rev.2.CFN

Most recent projects

- C:\Electrical\Solution Architect\Eliwell\Exercise\Thermostat Exercise\rev.2\Thermosta exercise rev.2.CFN
- C:\Users\SESA94552\Thermostat New\Thermostat New.CFN
- C:\Users\SESA94552\Thermostat\Thermostat.CFN

Add new device to project		
	FreeEvolution EVD	423
	FreeEvolution EVC	477
	Keyboard EVK	476
	FreeEvolution EVP	489
	Expansion EVE	460
	FreeSmart	412
	FreeSmart Modbus Master	542

Default Address range is between 1 to 5

Network scan

Advanced <<

Protocol: EwDMI
Port: COM 13
Baud range: 9600 57600
Address range: 1 1
Line conf: E,8,1

Start Scan Stop Scan

Device	Version	Application	Version	Address	Baud rate
--------	---------	-------------	---------	---------	-----------

Connection to M1710

To download the IEC applications of **STUDIO** from the **PC** to the **SMART**:

Programming Stick / Programmable cable PC → ← Progr. Stick		
use blue TTL cable		
Data direction	→	←
Parameter map	-	-
IEC application	✓	-
BIOS	✓	-

Programming Stick Progr. Stick → ← M1710		
Use yellow TTL cable		
Data direction	→	←
Parameter map	✓	✓
IEC application	✓	-
BIOS	✓	-

Direct PC → ← M1710		
Use yellow TTL cable		
Data direction	→	←
Parameter map	✓	✓
IEC application	✓	-
BIOS	✓	-

Note: in “Direct”, **SMART** must not **BE** connected to earth

- it can switch on SMART without external power supply

Connection to SMART

SMART

Preliminary operations

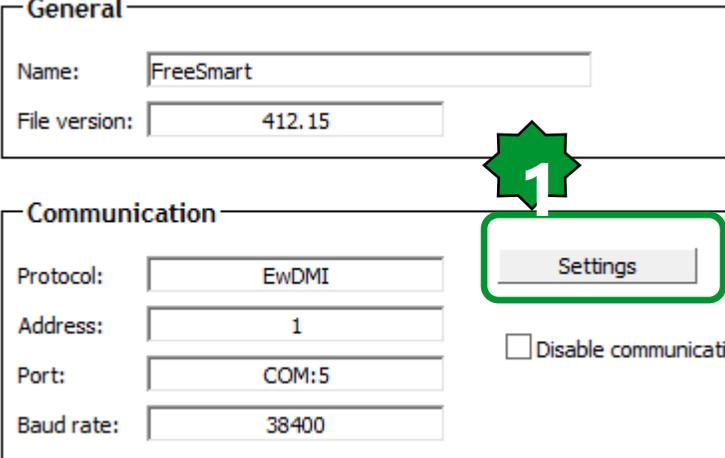
In order to download the application correctly:

1. connect the DMI hardware interface to the PC.
2. Make sure that the driver is installed

Press **Settings**

The COM port must previously have been read/set in “Peripherals Management” (see Reading the DMI interface COM port) to be recognized. If there are errors, refer to the paragraph “**DMI interface connection error**”.

* the COM settings must be set on all of the workspaces: Application, Device and User Interface



General

Name: FreeSmart

File version: 412.15

Communication

Protocol: EwDMI

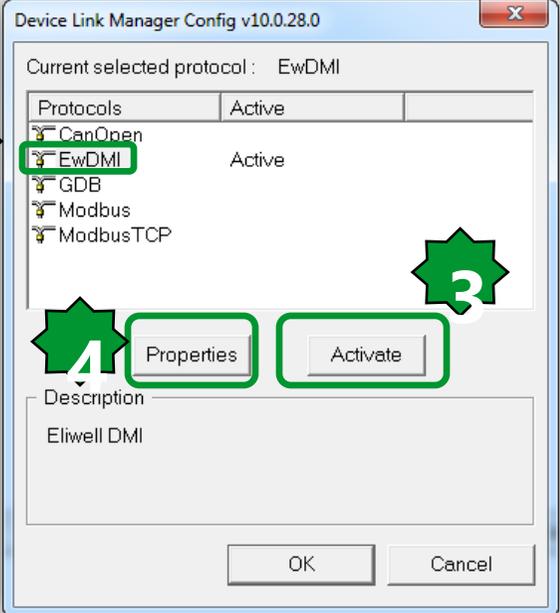
Address: 1

Port: COM:5

Baud rate: 38400

Disable communication

Settings



Device Link Manager Config v10.0.28.0

Current selected protocol : EwDMI

Protocols	Active
CanOpen	
EwDMI	Active
GDB	
Modbus	
ModbusTCP	

Properties

Activate

Description

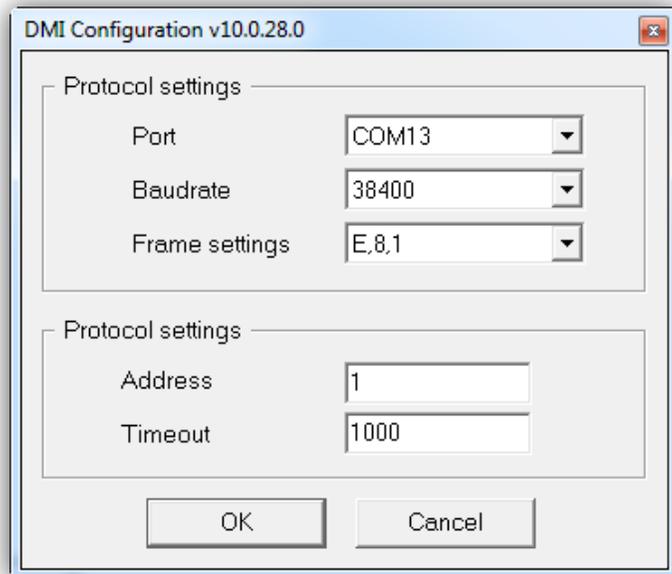
Eliwell DMI

OK

Cancel

Protocol Configuration

- For **SMART** select **EWDMI** or **Modbus***. If the protocol is not activated press the **Activate** button
- The value selected for the COM port will be saved and will reappear each time the program is accessed, until it is changed.
- The properties are visible and can be edited from the panel **Communication > Settings > Properties****



- * in the case of Modbus for /S models only with maximum speed 19200 baud. TTL not for use. NOT POSSIBLE TO UPDATE the BIOS.
- ** obviously, the protocol must be activated beforehand

Factory default configuration:

Address:1, Baud rate: 9600
E,8,1 (CF30=1, CF31=3, CF32=1)

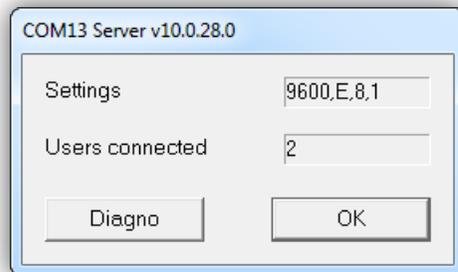


DMI interface connection error

Error opening serial port

If the “Error opening serial port” message appears, proceed as follows:

1. Check that the COM port setting in the program is the same as one read in the COM port reading by the DMI interface.
2. Check if Com Server is opened when you try to connect to Smart. If not disconnect TTL cable, USB port and reconnect **first USB and then TTL.**



3. Repeat the DMI Detection function.



Target and Free Studio

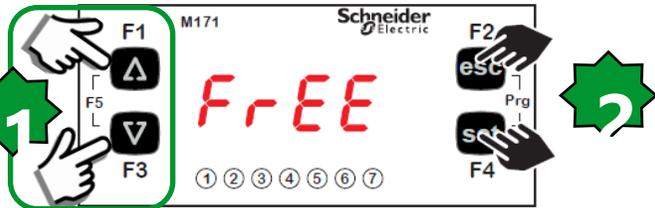
Parameters needed for correct connection between the **SMART target and Free Studio.**

parameter	description	values	default	visibility	notes
CF30	Modbus protocol controller address	1...255	1	3	Check that the set values correspond to those defined by the panel Communication > Settings > Properties
CF31**	Modbus protocol baud rate	0,1, 2 = not used 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 57600 baud 7 = 115200 baud	3	3	
CF32	Modbus protocol controller parity	1 = EVEN 2 = NONE 3 = ODD	1	3	
*COM1 = TTL / RS485 (/S models only): cannot be used simultaneously					
**CF31			5=38400 baud (RS485: not supported) 6=57600 baud (RS485: non supported) 7=115200 baud (RS485: non supported)		

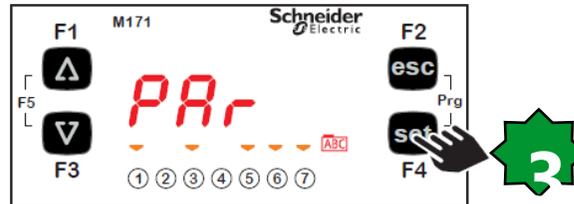
Customize SMART Baud Rate



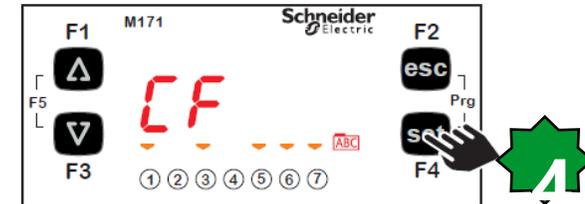
SMART parameters in the CF folder manages the connection between the target and Studio
If the target is “empty”, i.e. there is no IEC application on the device, SMART will display the message FrEE, otherwise fundamental state is displayed (Press F5 to switch to FrEE menu)



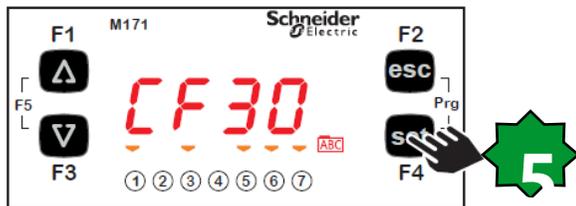
To view the parameter menu, press the Esc and Set keys at the same time. This will open the PAr menu.



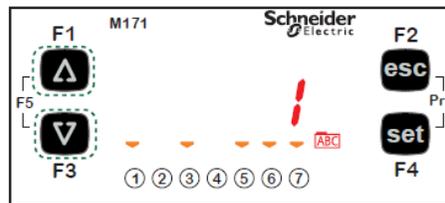
The parameters menu PAr contains all controller folders. Press the set key to view folders.



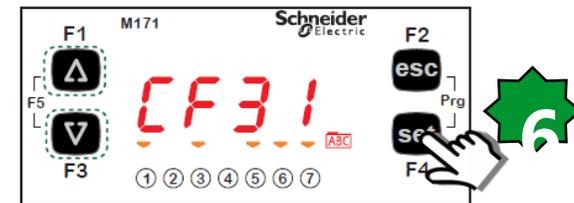
The first folder shown is the CF configuration folder. Press the set key to view the folder parameters.



The first parameter shown is CF30. To view the value of the parameter press the set key.

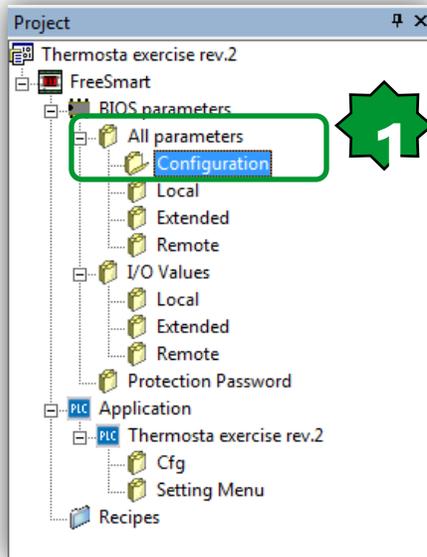


Use the UP and DOWN keys to change the value if necessary. To confirm the value press the set key. To exit press Esc



Use the UP and DOWN keys to scroll the other parameters and repeat the procedure to view the values and - if necessary - edit them.

Customize SMART Baud Rate by FS Device



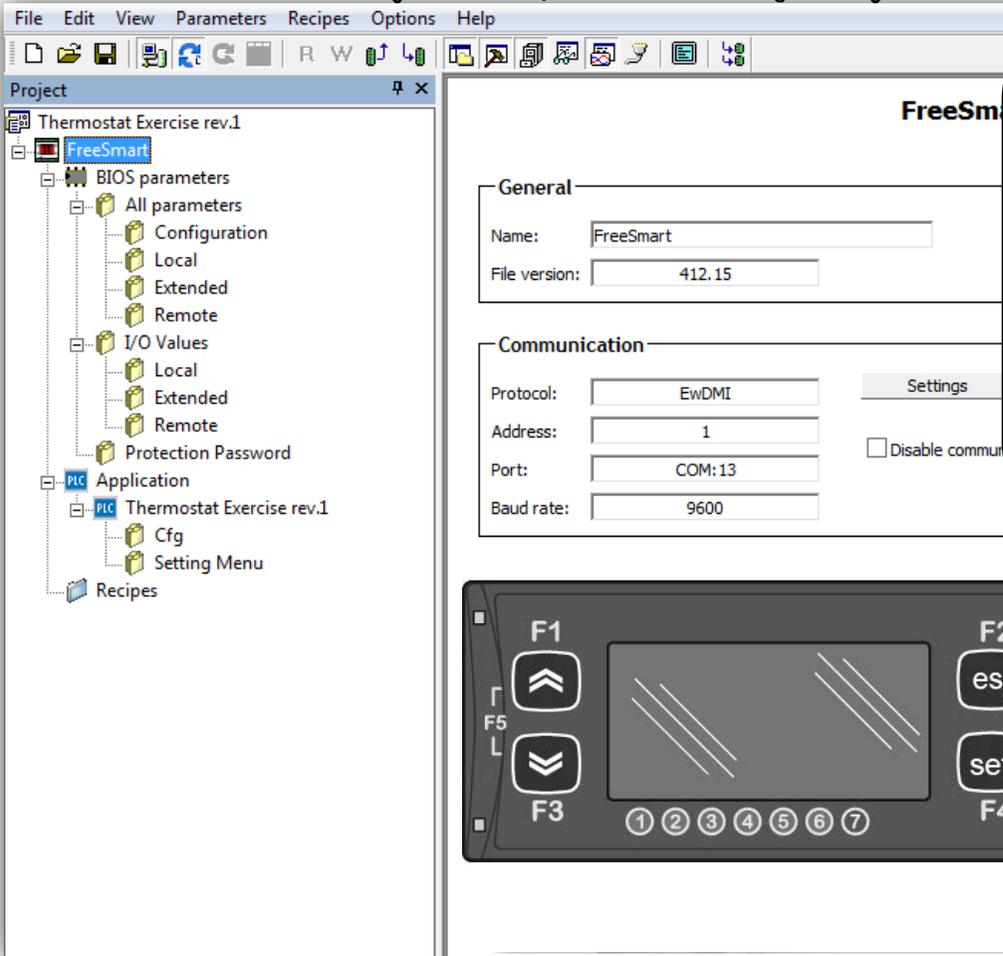
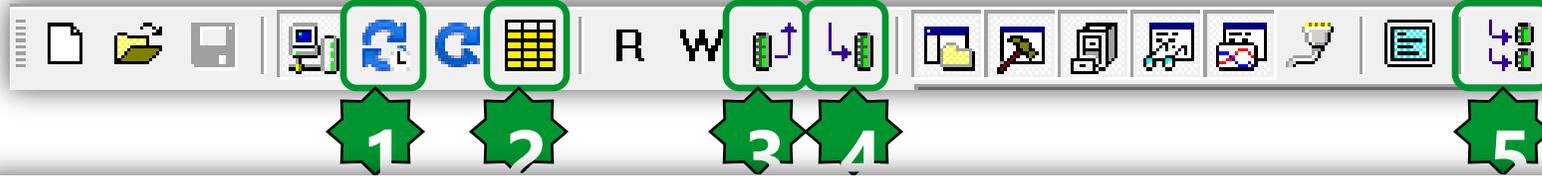
Only After Connection has been established:

1. Project ► BIOS parameters ► All parameters ► Configuration
2. CF31 editing ► 38400 bits/Sec.

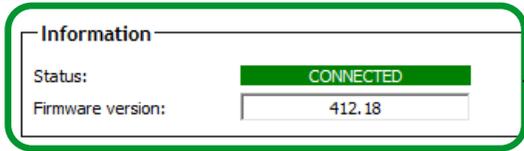
Protocol parameters are loaded at power up, remember to switch off controller after changing them.

Configuration							
Address	Name	Value	Um	Default	Min	Max	Description
53265	CF01	1	num	1	0	1	Select COM1 protocol
53272	CF20	0	num	0	0	14	Eliwell protocol controller address
53273	CF21	0	num	0	0	14	Eliwell protocol controller family
53274	CF30	1	num	1	1	255	Modbus protocol controller address
53275	CF31	5=38400	num	3=9600	0	7	Modbus baud rate protocol
53276	CF32	1=2400 2=4800	num	1=Even	1	3	Modbus parity protocol
15639	CF60	3=9600	num	0	0	999	Customer code 1
15640	CF61	4=19200	num	0	0	999	Customer code 2
53456	CF50	5=38400	num	1=Present	0	1	RTC present
15715	Ui26	6=57600 7=115200	4ms	350	0	999	Key hold time to enable function
15744	Ui27	1	num	1	0	255	Installation engineer password
15745	Ui28	2	num	2	0	255	Manufacturer password
15636	Par_POLI	1026	num	0	0	65535	Polycarbonate code

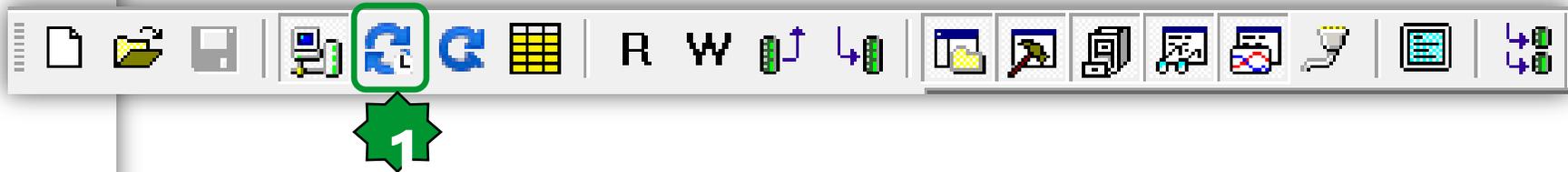
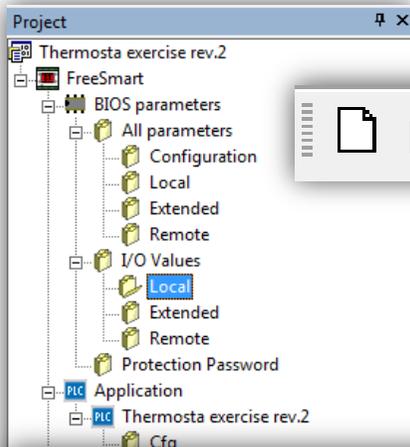
Device Tool- Main icons



1. Continuous read/write by toggle auto refresh mode. As soon as value changes, it will automatically align with the target.
2. Select all variables
3. Read all device parameters
4. Write all device parameter
5. Download all (PLC & parameter)
6. It is possible to check the firmware version via information.



Free Studio Device - Colors



1. If the auto refresh is on the column value is continuously updated and values are written as soon as you change them.

Local							
Address	Name	Value	Um	Default	Min	Max	
8336	AIL1	0.0		0.0			AIL1 analogue input
8337	AIL2	0.0		0.0			AIL2 analogue input
8338	AIL3	0.0		0.0			AIL3 analogue input
8339	AIL4	0.0		0.0			AIL4 analogue input
8340	AIL5	0.0		0.0			AIL5 analogue input
8192	DIL1	False		False			DIL1 digital input
8193	DIL2	False		False			DIL2 digital input
8194	DIL3	False		False			DIL3 digital input
8195	DIL4	False		False			DIL4 digital input
8196	DIL5	False		False			DIL5 digital input
8197	DIL6	False		False			DIL6 digital input
8528	DOL1	False		False			DOL1 digital output
8529	DOL2	False		False			DOL2 digital output
8530	DOL3	False		False			DOL3 digital output
8531	DOL4	False		False			DOL4 digital output
8532	DOL5	False		False			DOL5 digital output
8533	DOL6	False		False			DOL6 digital output
8448	AOL1	0.0		0.0			AOL1 analogue output
8449	AOL2	0.0		0.0			AOL2 analogue output
8450	AOL3	0.0		0.0			AOL3 analogue output
8451	AOL4	0.0		0.0			AOL4 analogue output
8452	AOL5	0.0		0.0			AOL5 analogue output
8453	TCL1	0.0		0.0			TCL1 analogue output

Color meanings:

Red: not aligned with the target

Grey: read only data

Blue: value is different from default

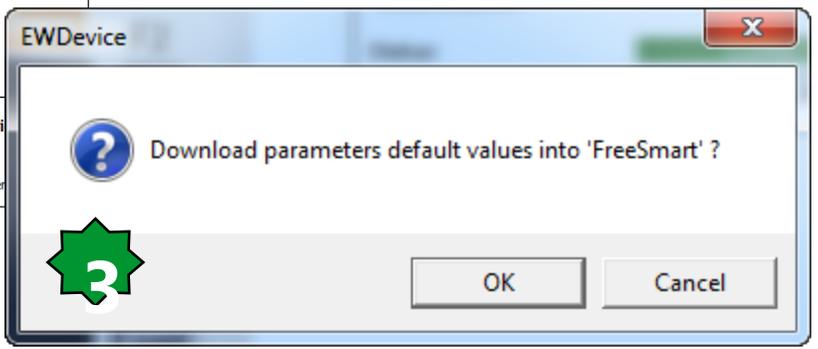
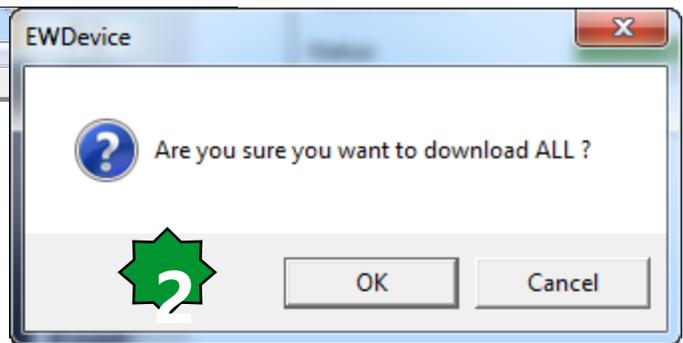
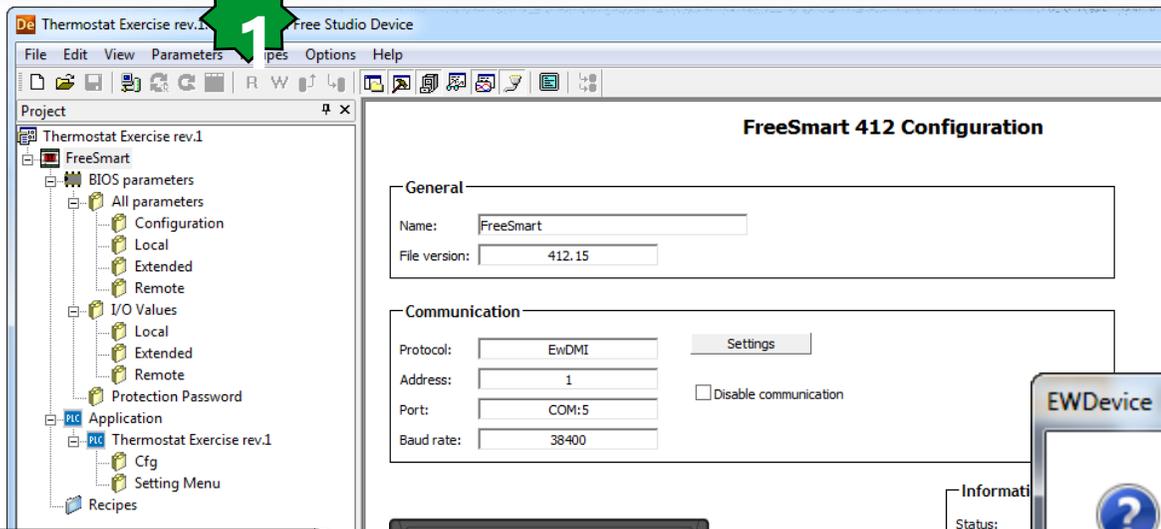
Green: data is not visible in the target

Black: aligned with the target

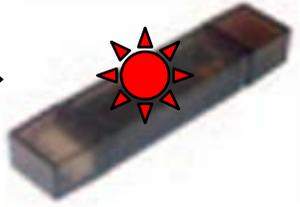
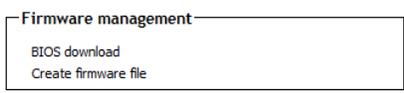
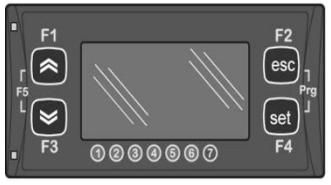
(if auto refresh is enabled)



Connect to the target and Download All



- 1. Connect
- 2. Download All
- 3. Write the default parameter values
- 4. DMI Blink: Communicating



Editing value

1. Be sure to be Connected
2. Set or change the value (Red, not applied)
3. Write the parameter (Black, applied)



CONNECTED



Setting Menu

Address	Name	Value	Um	Default	Min	Max
16384	Setpoint	21.0	°C	18.0	15.0	30.0
16385	Differentiation	2.0	°C	2.0	0.5	5.0
8960	Ambient_Temperator	22.9	°C			



Setting Menu

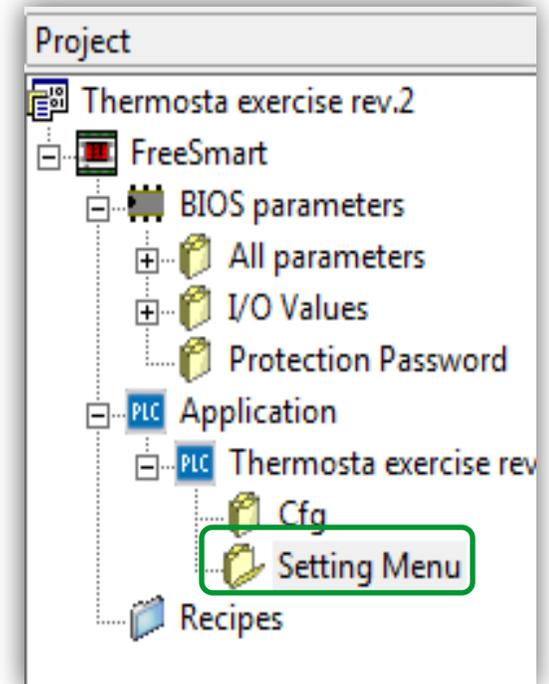
Address	Name	Value	Um	Default	Min	Max
16384	Setpoint	23.0	°C	18.0	15.0	30.0
16385	Differentiation	2.0	°C	2.0	0.5	5.0
8960	Ambient_Temperator	22.9	°C			



Setting Menu



Address	Name	Value	Um	Default	Min	Max
16384	Setpoint	23.0	°C	18.0	15.0	30.0
16385	Differentiation	2.0	°C	2.0	0.5	5.0
8960	Ambient_Temperator	26.3	°C			

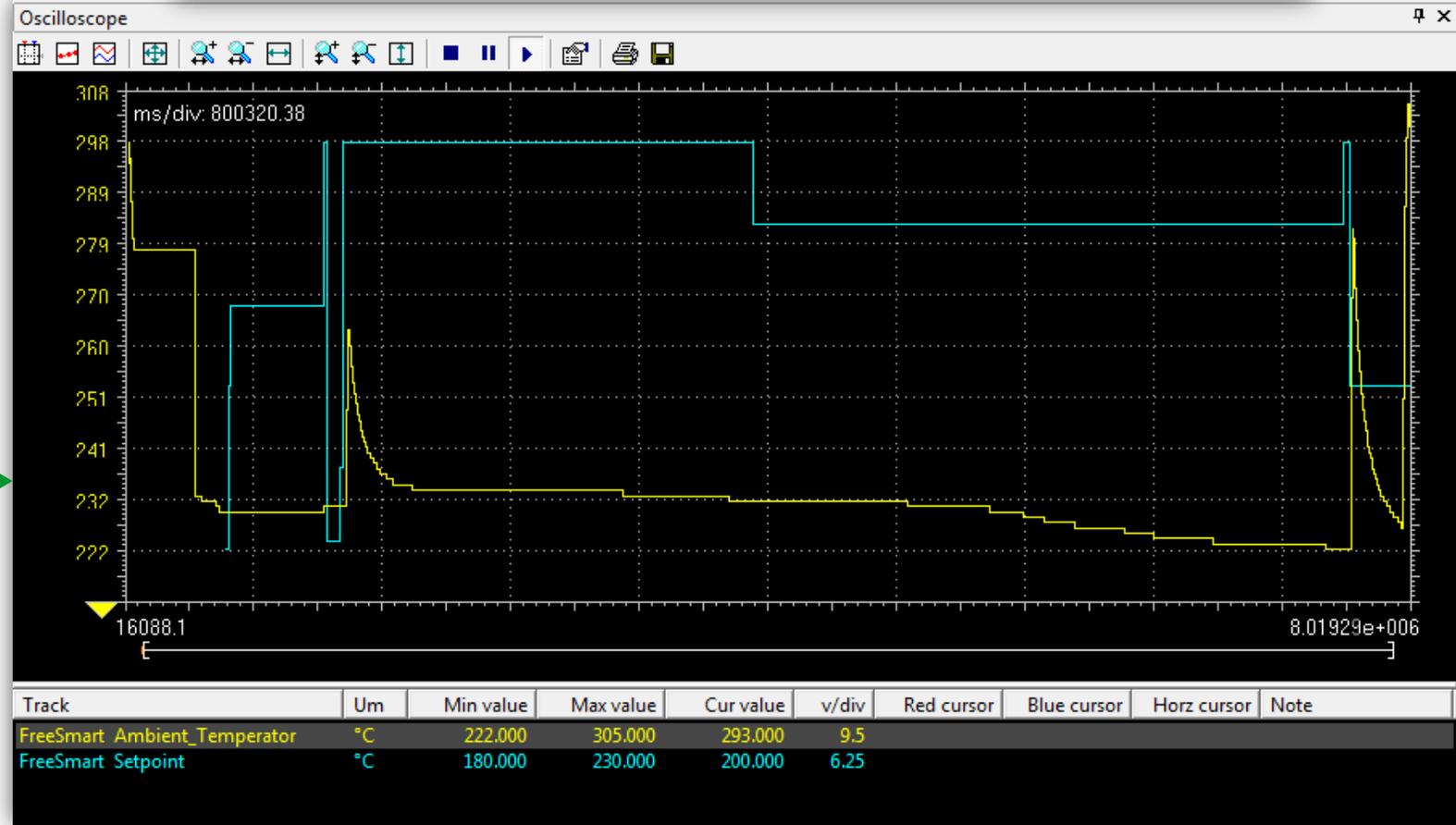


Oscilloscope

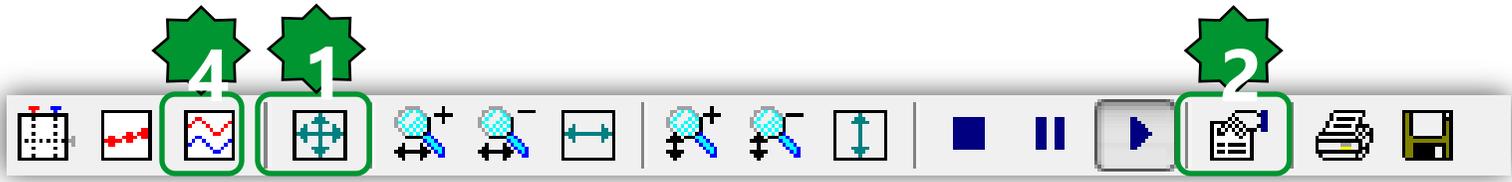


Drag & Drop

Address	Name	Value	Um	Default	Min	Max
16384	Setpoint	20.0	°C	18.0	15.0	30.0
16385	Differentiation	2.0	°C	2.0	0.5	5.0
8960	Ambient_Temperator	23.1	°C			



Oscilloscope



Oscilloscope settings

Show grid Sample polling rate 20 ms Real rate
Show time bar Horizontal scale 24685.8 ms/div 20.00
Show tracks list Buffer size 40000 samples

Tracks list

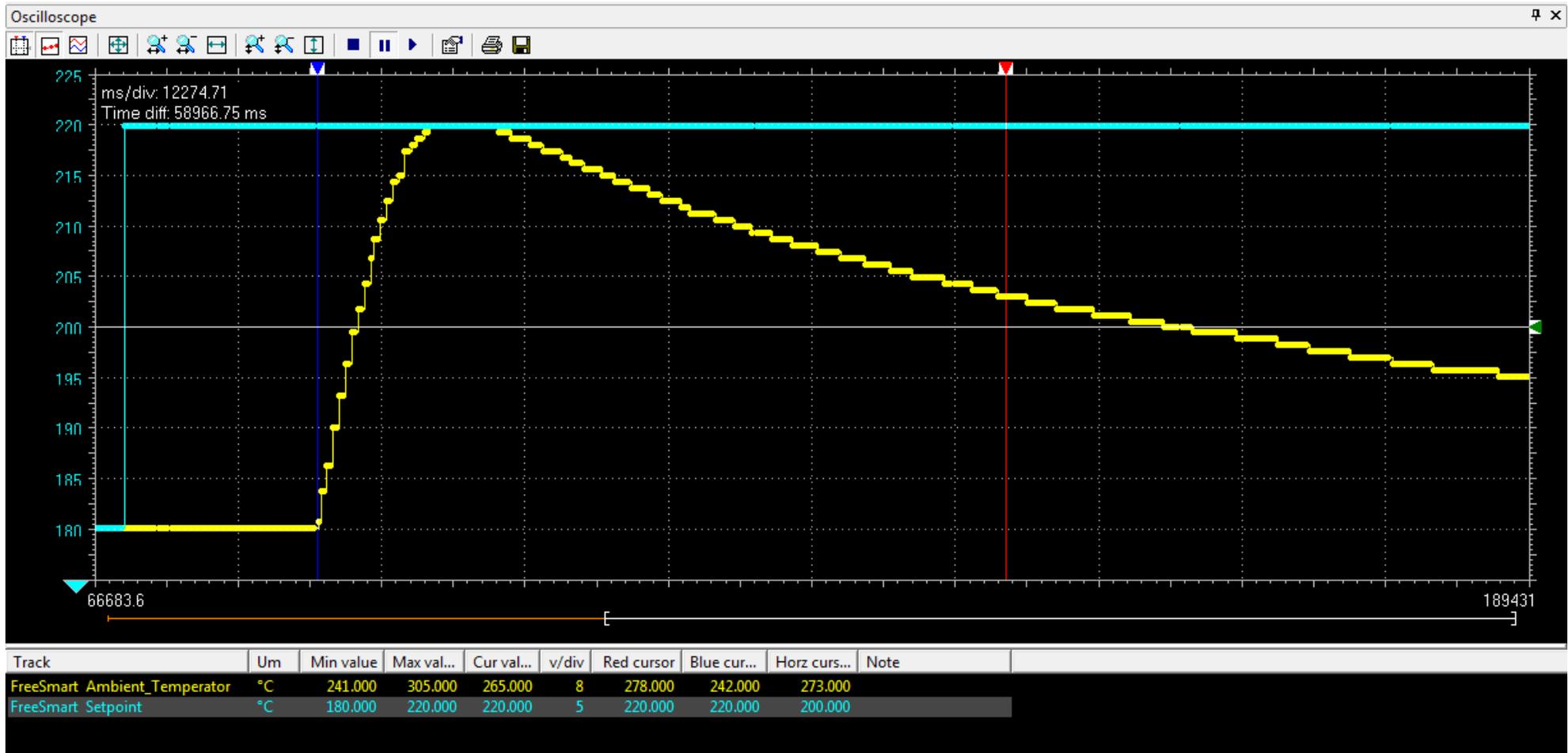
Name	Unit	Value/div	Offset	Hide
@BACKGROUND:THERMC		20	0	<input type="checkbox"/>
				<input type="checkbox"/>

Cancel Apply **OK**

- 1. Show all values
- 2. Graph properties
- 3. Value/div=20 ► OK
- 4. Vertical split



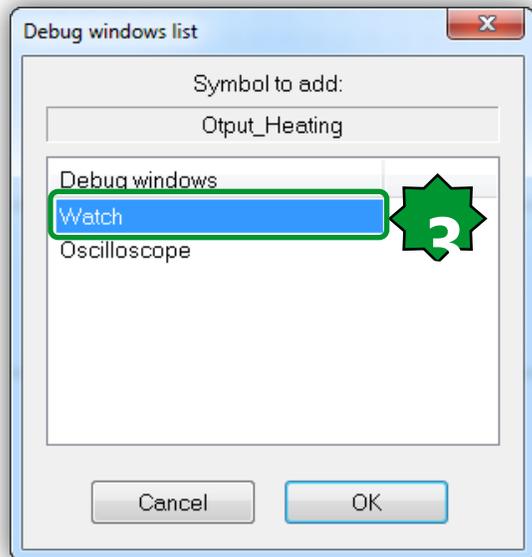
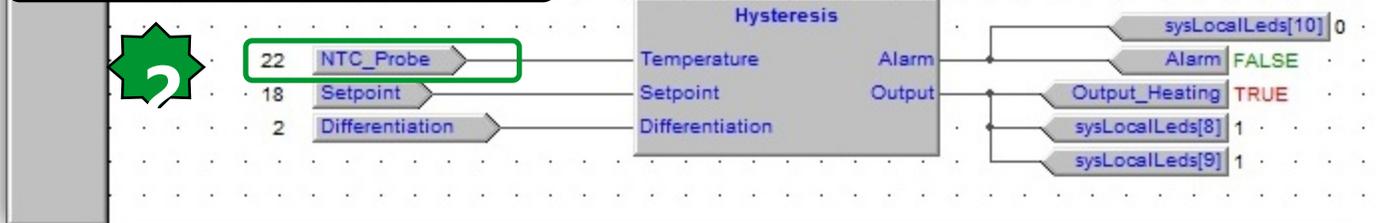
Oscilloscope



Debug on-line/Watch



Select variable to watch



Symbol	Value	Type	Location
NTC_PROBE	22	INT	global
OUTPUT_HEATING	TRUE	BOOL	global
ALARM	FALSE	BOOL	global
SETPOINT	18	INT	@BACKGROUND:THERMOSTAT
DIFFERENTIATION	2	INT	@BACKGROUND:THERMOSTAT

System Local physical I/O watching



Library

- sysExpStatus
- sysKeyFunctions
- sysLCDAnalogInputs
- sysLCDLeds
- sysLCDStatus
- sysLocalADCs
- sysLocalAnalogInputs
- sysLocalAnalogOutputs
- sysLocalDigitalInputs
- sysLocalDigitalOutputs

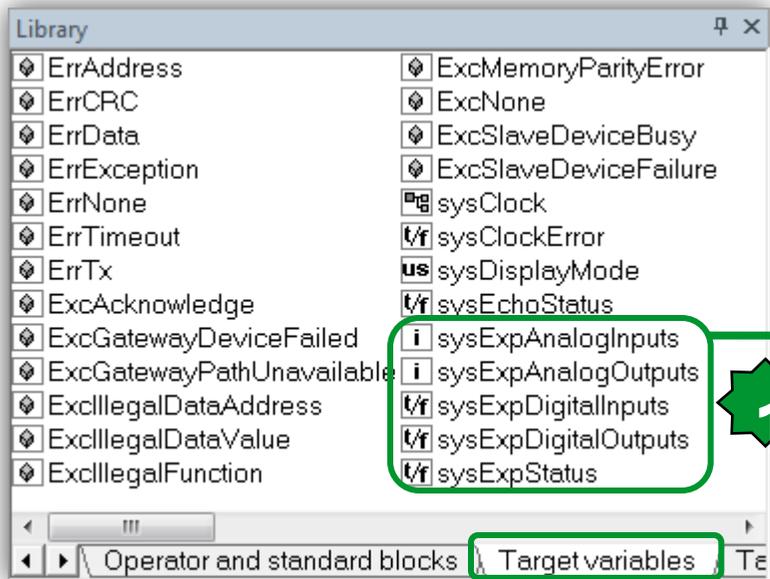
Operator and standard blocks Target variables Tar

Drag & Drop

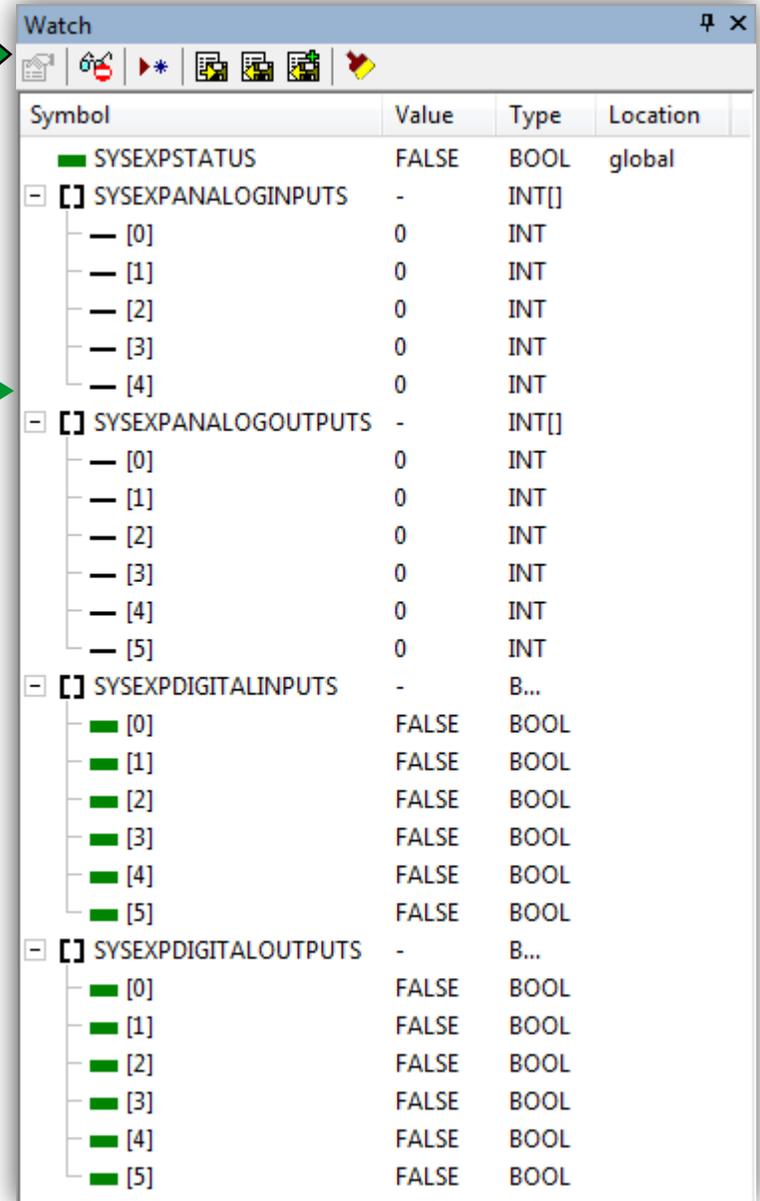
Watch

Symbol	Value	Type
SYSLOCALDIGITALINPUTS	-	BOOL[]
[0]	TRUE	BOOL
[1]	TRUE	BOOL
[2]	FALSE	BOOL
[3]	FALSE	BOOL
[4]	FALSE	BOOL
[5]	FALSE	BOOL
SYSLOCALDIGITALOUTPUTS	-	BOOL[]
[0]	FALSE	BOOL
[1]	FALSE	BOOL
[2]	FALSE	BOOL
[3]	FALSE	BOOL
[4]	FALSE	BOOL
[5]	FALSE	BOOL
SYSLOCALANALOGINPUTS	-	INT[]
[0]	226	INT
[1]	-32768	INT
[2]	0	INT
[3]	-32768	INT
[4]	-32768	INT
SYSLOCALANALOGOUTPUTS	-	INT[]
[0]	0	INT
[1]	0	INT
[2]	0	INT
[3]	0	INT
[4]	0	INT
[5]	0	INT

Watching Expansion Status & I/O



Drag & Drop



Symbol	Value	Type	Location
SYSEXPSTATUS	FALSE	BOOL	global
SYSEXPANALOGINPUTS	-	INT[]	
[0]	0	INT	
[1]	0	INT	
[2]	0	INT	
[3]	0	INT	
[4]	0	INT	
SYSEXPANALOGOUTPUTS	-	INT[]	
[0]	0	INT	
[1]	0	INT	
[2]	0	INT	
[3]	0	INT	
[4]	0	INT	
[5]	0	INT	
SYSEXPDIGITALINPUTS	-	B...	
[0]	FALSE	BOOL	
[1]	FALSE	BOOL	
[2]	FALSE	BOOL	
[3]	FALSE	BOOL	
[4]	FALSE	BOOL	
[5]	FALSE	BOOL	
SYSEXPDIGITALOUTPUTS	-	B...	
[0]	FALSE	BOOL	
[1]	FALSE	BOOL	
[2]	FALSE	BOOL	
[3]	FALSE	BOOL	
[4]	FALSE	BOOL	
[5]	FALSE	BOOL	

Note. In case of loosing communiucation between Base & expansion:

All DO's = 0

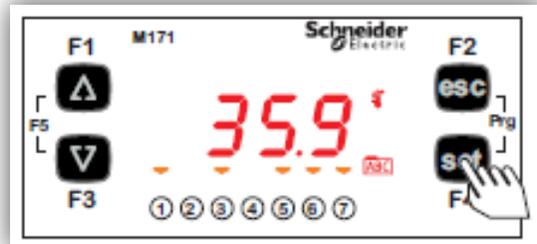
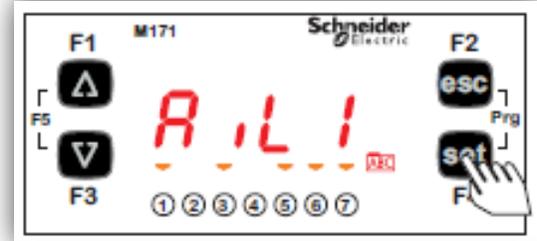
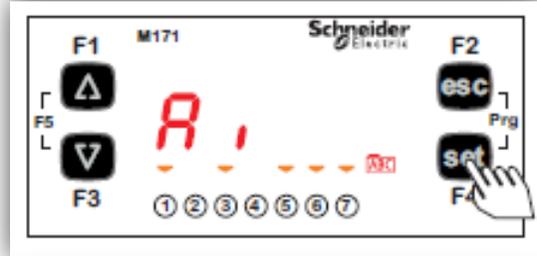
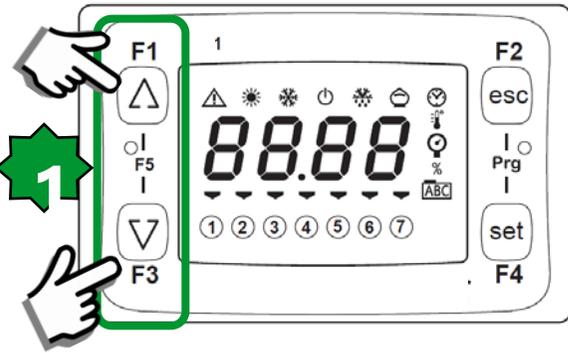
All DI's = False

All Probes = -32768

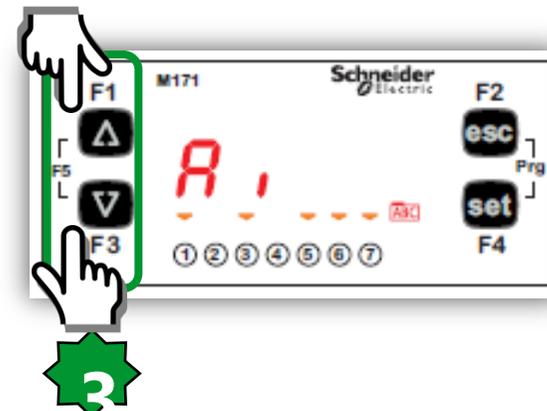
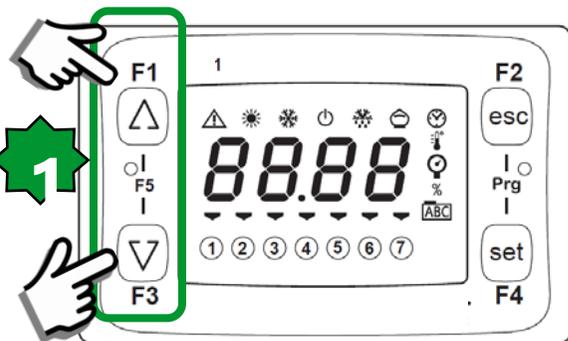
1. It can use as communication alarm variable

2. They can only use in watch

Physical I/O monitoring via

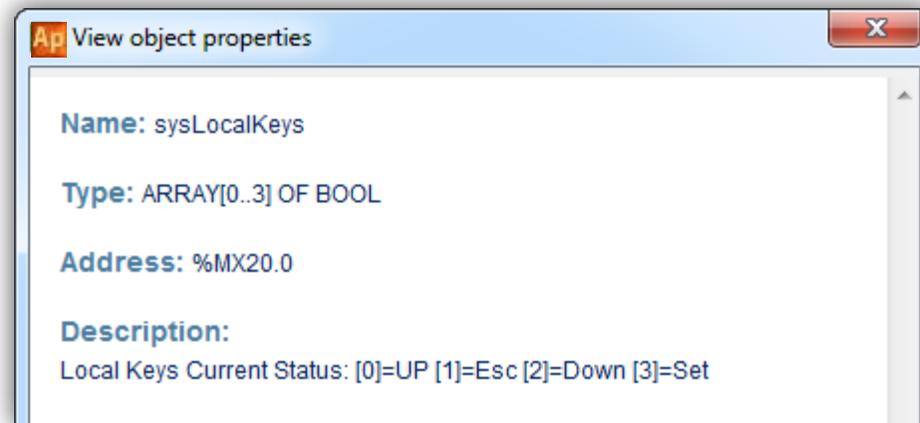
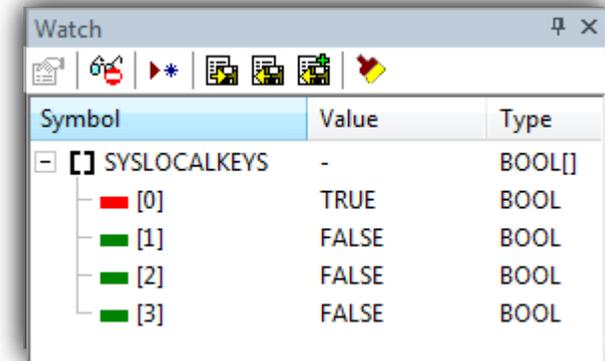
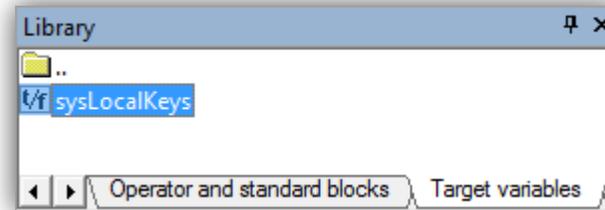
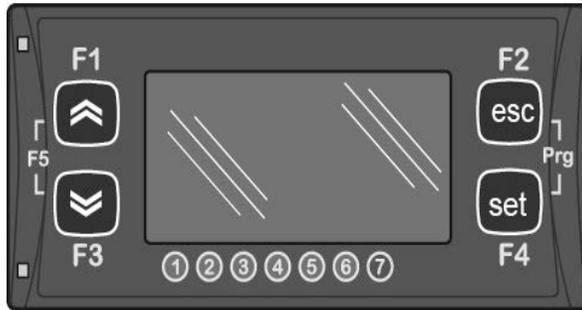


"States" menu



Label							Description	Change
Ai	AIL1	AiL2	AIL3	AIL4	AIL5		CONTROLLER analog inputs	//
Ai	AIE1	AiE2	AIE3	AIE4	AIE5		EXPANSION analog inputs(\$)	//
Ai	Air1	Air2					DISPLAY analog inputs	//
di	diL1	diL2	diL3	diL4	diL5	diL6	CONTROLLER digital inputs	//
di	diE1	diLE2	diE3	diE4	diE5	diE6	EXPANSION (\$) digital inputs	//
AO	tCL1	AOL1	AOL2	AOL3	AOL4	AOL5	CONTROLLER analog outputs	//
AO	tCE1	AOE1	AOE2	AOE3	AOE4	AOE5	EXPANSION (\$) analog outputs	//
dO	dOL1	dOL2	dOL3	dOL4	dOL5	dOL6	CONTROLLER digital outputs	//
dO	doE1	doE2	doE3	doE4	doE5	doE6	EXPANSION (\$) digital outputs	//
CL	HOUr	dAtE	YEAr				Clock	YES
AL	Er45	Er46					Alarms	//

System Local Keys



Definitions



Resources

- Configuration
- FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables**
 - Enums
 - BIOS Parameters

#	Address	Name	Display label	Device type	Application type	Unit	Format	Read only
1	8960	Upcounter_Trigger	UTGR	Boolean	BOOL			False

Status Variables

Add
 Remove
 Recalc

#	Address	Name	Display label	Device type	Application type	Default value	Unit	Format	AccessLevel	Read only
1	8960	Ambiant_Temp	ATmp	Signed 16-bit	INT		°C	XXX.Y	Always visible	True
2	8961	Counter_Current_Value	CCV	Signed 16-bit	INT				Always visible	True
3	8962	Pulse_Generator_Period	PGP	Signed 16-bit	UINT	5			Always visible	False

Resources

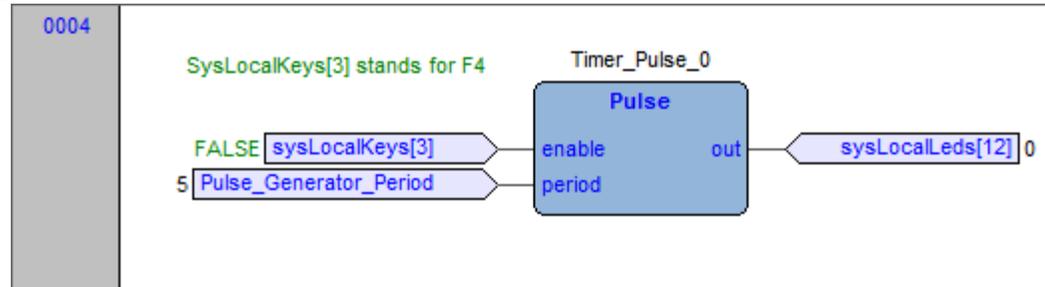
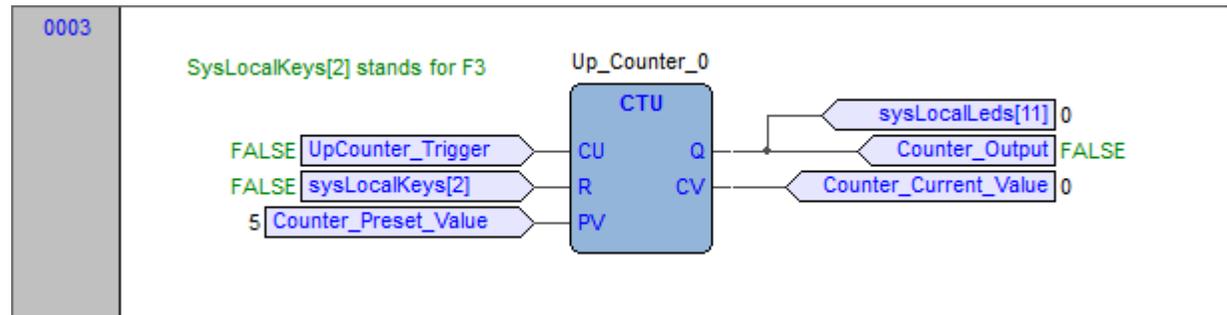
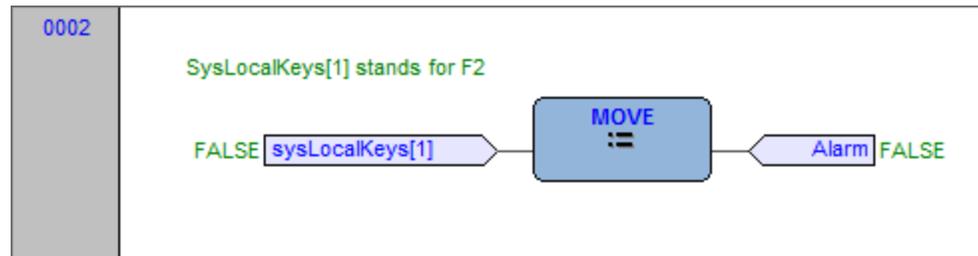
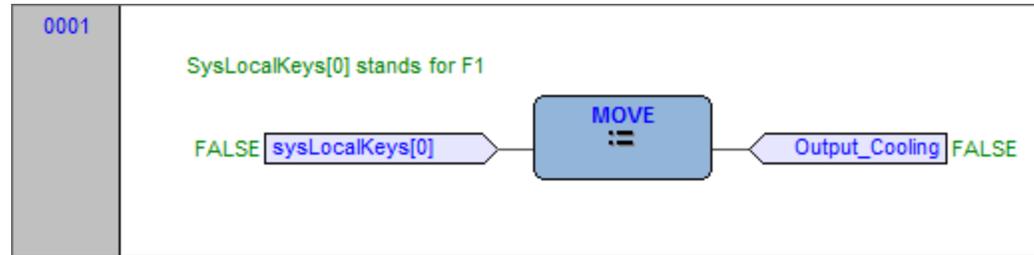
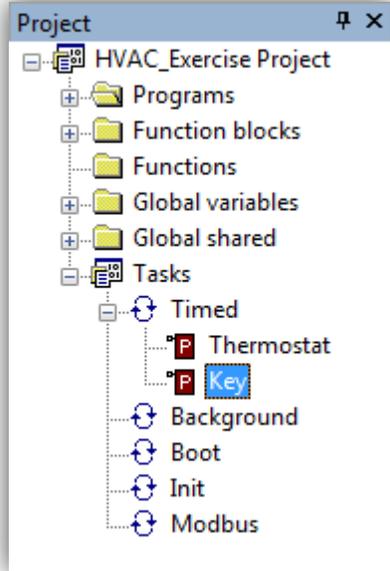
- Configuration
- FreeSmart
 - Modbus objects
 - EEPROM Parameters**
 - Status variables
 - Enums
 - BIOS Parameters

EEPROM Parameters

Add
 Remove
 Recalc

#	Address	Name	Display label	Device type	Application type	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel
1	16384	SetPoint	SetP	Signed 16-bit	INT	180	150	300	1	0	°C	XXX.Y	Always visible
2	16385	Differentiation	Diff	Signed 16-bit	INT	20	5	50	1	0	°C	XXX.Y	Always visible
3	16386	Counter_Preset_Value	CPV	Signed 16-bit	INT	5	1	10	1	0			Always visible

System Local Key Program



Chapter 8

Remote LCD Display

Goals:

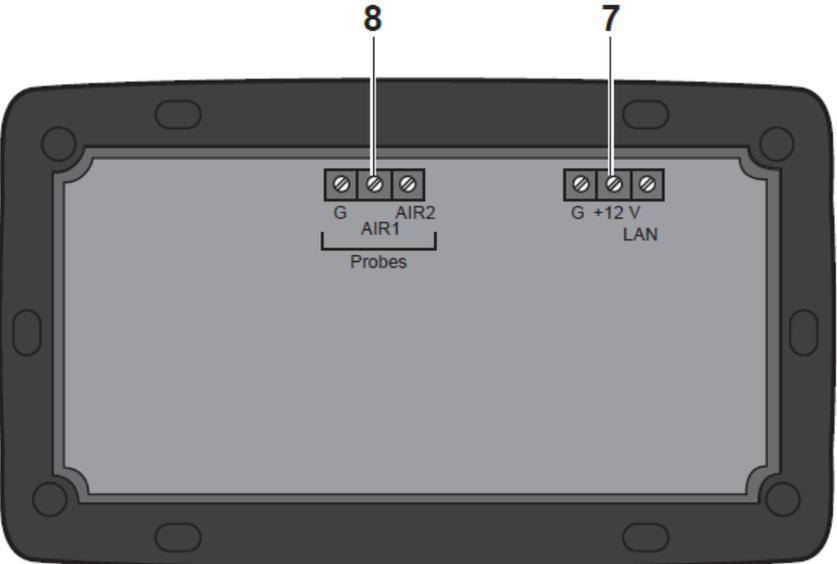
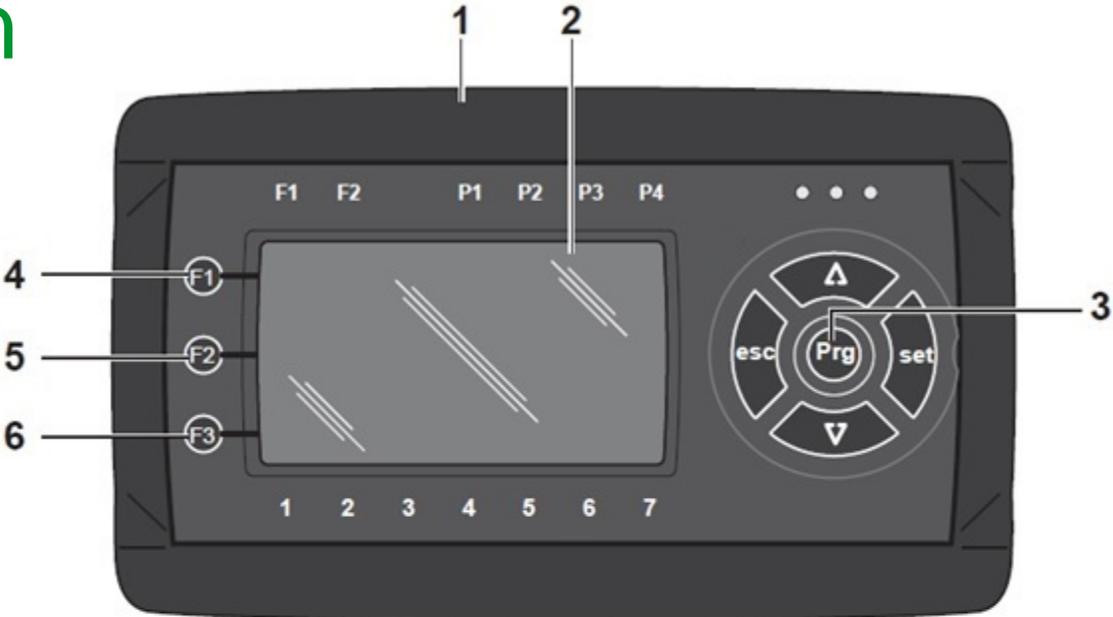
Mirror Ambient temperature & Set point in LCD

Icons activation

Monitor LAN

Configure embedded analogue Inputs

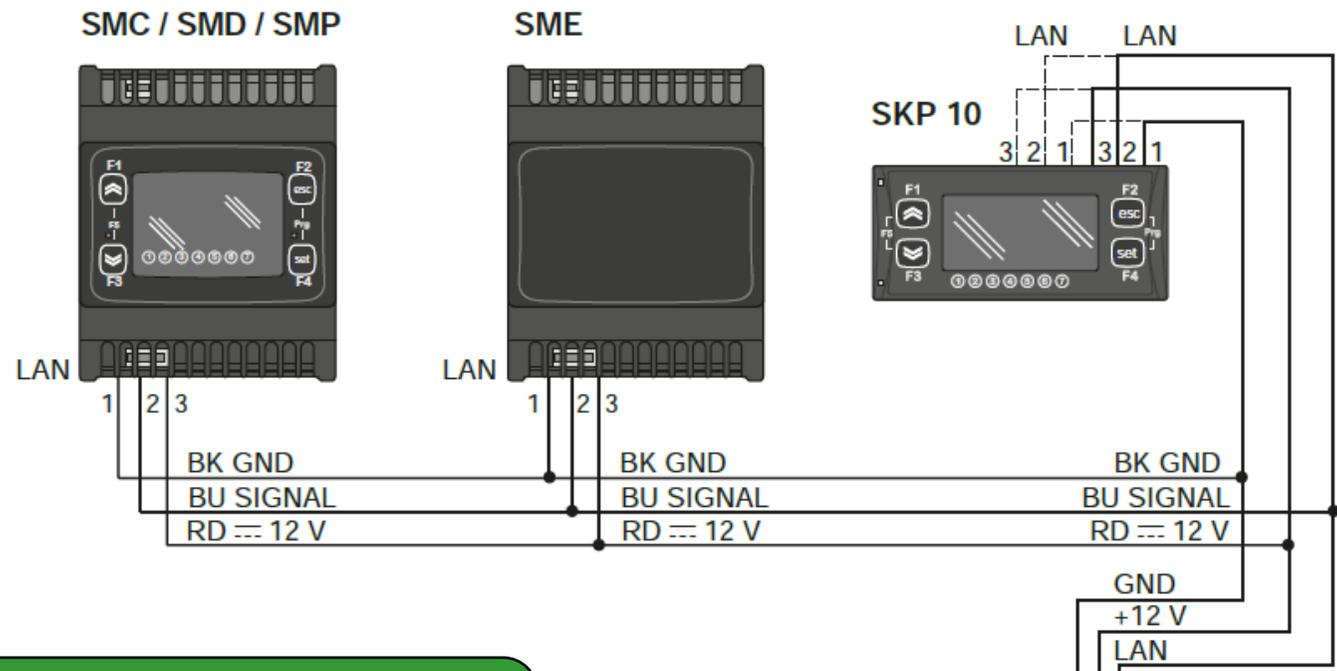
Hardware Description



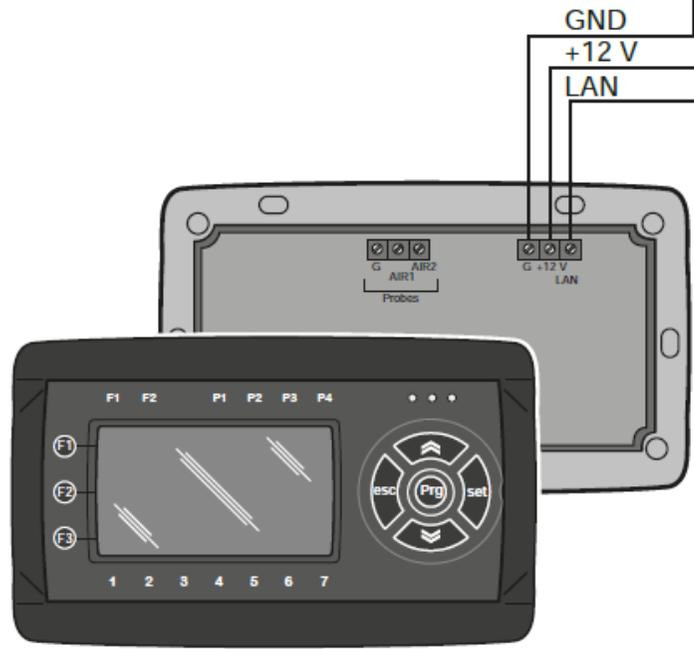
- 1 - Front frame
- 2 - LCD graphic without backlight
- 3 - 5 Configurable function keys
- 4 - F1: equivalent to long press on UP arrow key
- 5 - F2: equivalent to long press on esc key
- 6 - F3: equivalent to long press on DOWN arrow key
- 7 - LAN Expansion bus
- 8 - Configurable analog inputs port
- 9 - Cable access

- 1 - Châssis
- 2 - Affichage sans rétroéclairage
- 3 - 5 touches configurables
- 4 - F1: équivalent à une longue pression sur la touche de la flèche vers le haut
- 5 - F2: équivalent à une longue pression sur la touche esc
- 6 - F3: équivalent à une longue pression sur la touche de la flèche vers le bas
- 7 - Bus d'expansion LAN
- 8 - Port d'entrée analogique configurable
- 9 - Accès au câble

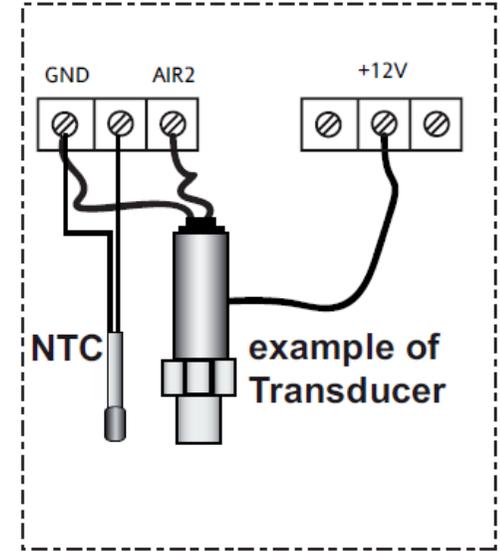
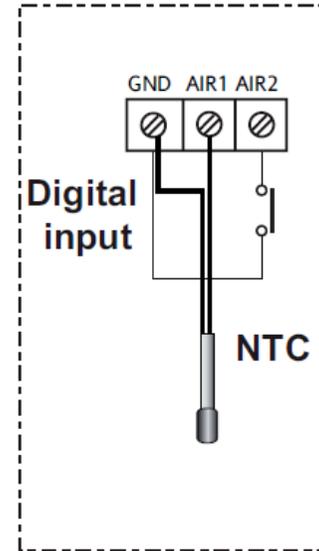
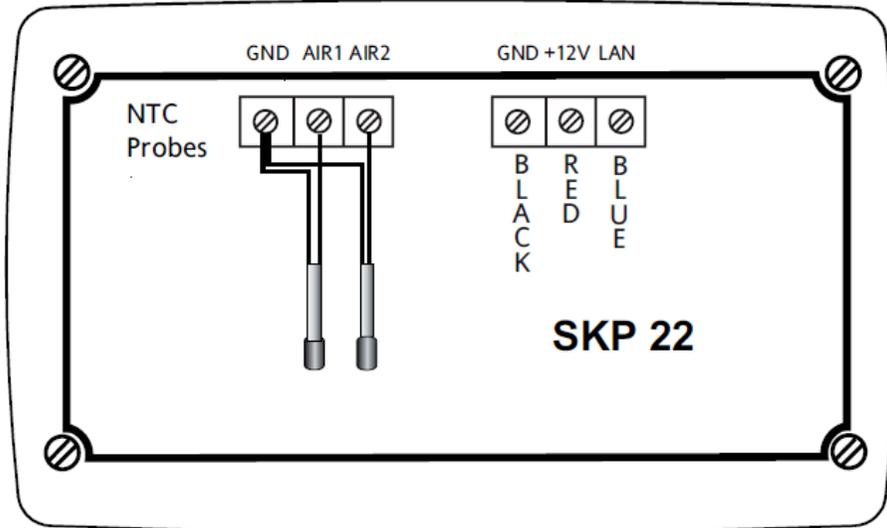
Architecture



Maximum configuration : 1 CPU + 1 Expansion (SME__) + 1 LED display (SKP10) + 1 display (SKP22 or SKW22)



Pin-out description



	TM171DLCD2U	Description
AIR1	AIR1	NTC/DI on-board analog input
AIR2	Remote Probe	Remote analog input configurable as NTC* / 4...20mA / DI
	GND	Ground
1	GND / black	GND / black
2	Signal / Blue	Signal / blue
3	+12Vdc / red	12V power supply from Controller (the transducer can be powered from the +12Vdc terminal)

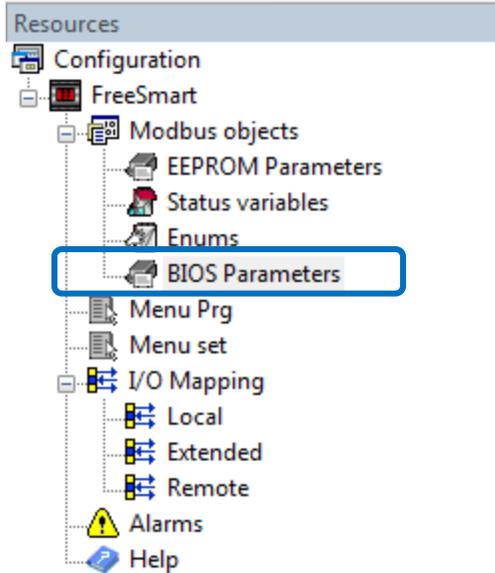
* SEMITEC 103AT (10Kohm / 25°C) type

Remote I/O Cfg.



FOLDER	LABEL	VAL PAR ADDRESS	DATA SIZE	CPL	EXP	VIS PAR ADDRESS	VIS PAR VALUE	RW	DESCRIPTION	RANGE	DEFAULT	U.M.
CE	CE73	53837	WORD			53633	0	RW	Analog output TCE1 phase shift	0 ... 90	27	Deg
CE	CE74	53838	WORD			53634	2	RW	Analog output AOE1 phase shift	0 ... 90	27	Deg
CE	CE75	53839	WORD			53635	2	RW	Analog output AOE2 phase shift	0 ... 90	27	Deg
CE	CE76	53840	WORD			53636	0	RW	Analog output TCE1 pulse time	5 ... 40	10	89 µsec
CE	CE77	53841	WORD			53637	2	RW	Analog output AOE1 pulse time	5 ... 40	10	89 µsec
CE	CE78	53842	WORD			53638	2	RW	Analog output AOE2 pulse time	5 ... 40	10	89 µsec
Cr	Cr00	53760	WORD			53609	2	RW	Type of local analog input Air1 <ul style="list-style-type: none"> • 0= Probe not configured • 1 = Not used • 2 = NTC 	0 ... 2	0	num
Cr	Cr01	53761	WORD			53610	2	RW	Type of local analog input AIR2 <ul style="list-style-type: none"> • 0= Probe not configured • 1= DI • 2 = NTC • 3 = 4..20mA • 4...6 = Not used • 7 = 0..20mA 	0 ... 7	0	num
Cr	Cr10	15874	WORD	Y	-1	53611	1	RW	Local analog input AIR2 full-scale value	Cr11 ... 9999	0	num
Cr	Cr11	15876	WORD	Y	-1	53612	1	RW	Local analog input AIR2 start of scale value	-999 ... Cr10	0	num
Cr	Cr20	53770	WORD	Y	-1	53613	1	RW	Local analog input AIR1 differential	-12.0 ... 12.0	0.0	°C
Cr	Cr21	53771	WORD	Y	-1	53614	1	RW	Local analog input AIR2 differential	-12.0 ... 12.0	0.0	°C/Bar

Remote LCD display BIOS Param.



BIOS Parameters			
 Add  Remove			
#	Name	Default value	Description
1	CR00	2=NTC	AIR1 analogue input type
2	CR01	3=4-20mA	AIR2 analogue input type

Remote I/O mapping+EEPROM



Resources

- Configuration
 - FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menu Prg
 - Menu set
 - I/O Mapping
 - Local
 - Extended
 - Remote
 - Alarms
 - Help

Resources

- Configuration
 - FreeSmart
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters

Remote I/O Mapping

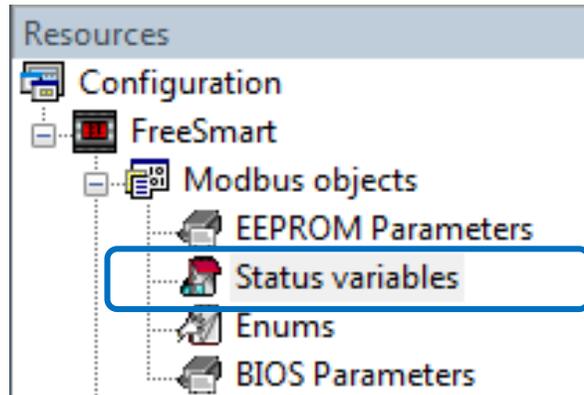
#	Name	Variable	Type	Description
1	AIR1		INT	AIR1 analogue input
2	AIR2	Humidity_Sensor	INT	AIR2 analogue input

EEPROM Parameters

Add
 Remove
 Recalc

#	Address	Name	Display label	Device type	Application type	Default value	Min	Max	Unit	Format	AccessLevel
1	16384	SetPoint	SeP	Signed 16-bit	INT	180	150	300	°C	XXX.Y	Always visible
2	16385	Delta	Dlta	Signed 16-bit	INT	20	15	50	°C	XXX.Y	Always visible

Status Variable declaration

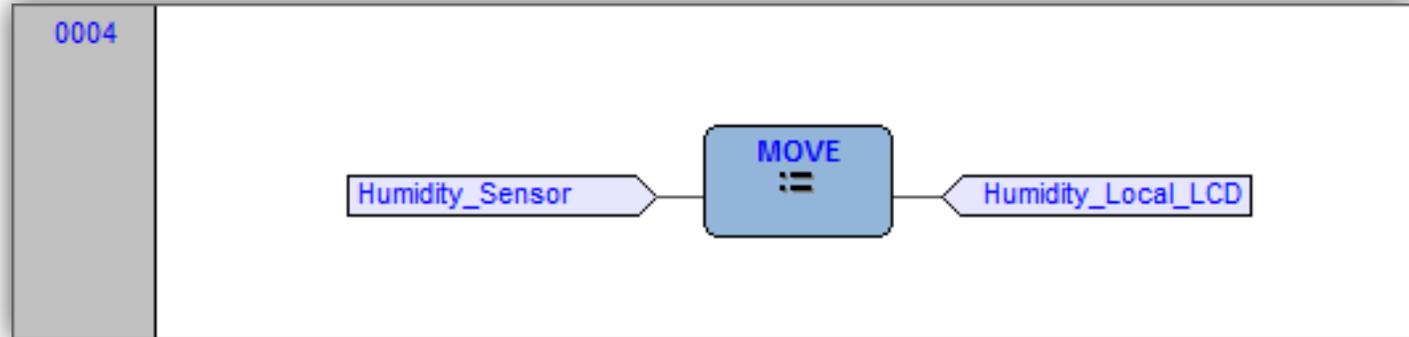
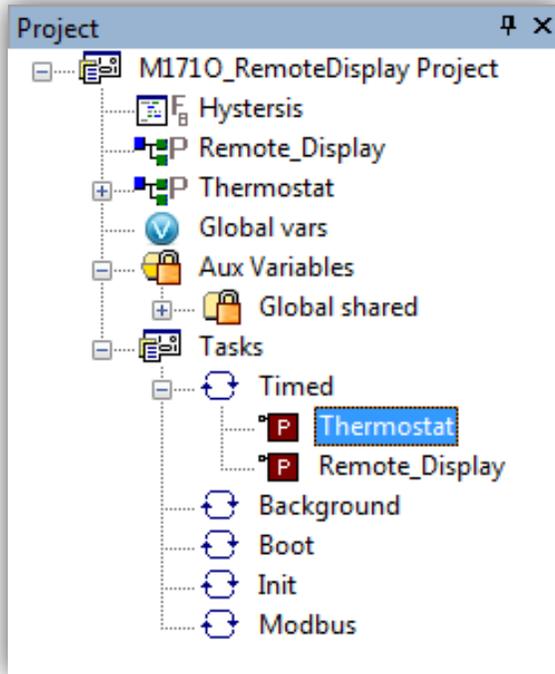


Status Variables

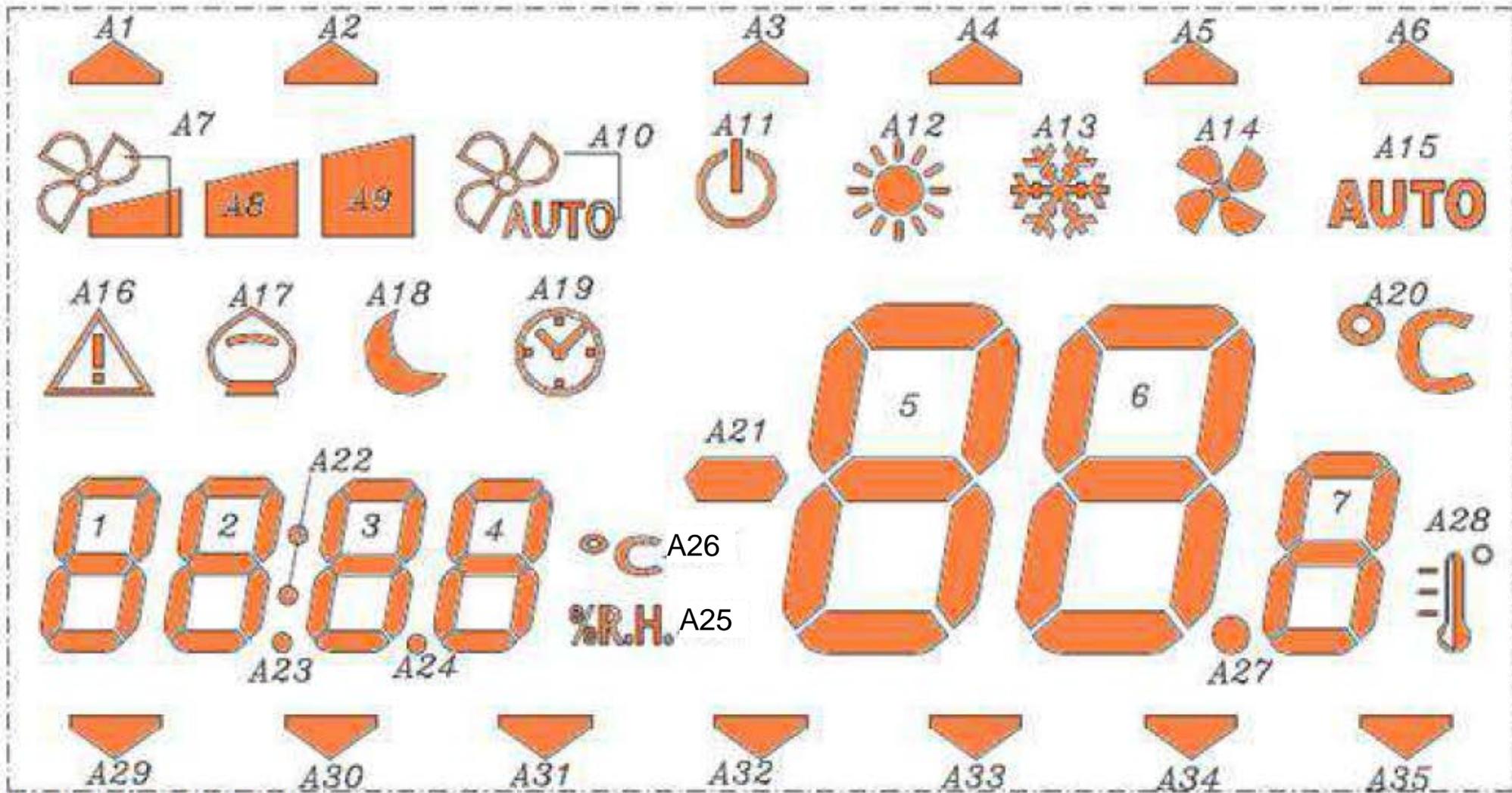
Add Remove Recalc

#	Address	Name	Display label	Device type	Application type	Unit	Format	Read only
1	8960	Ambiant_Temp	ATMP	Signed 16-bit	INT	°C	XXX.Y	True
2	8961	Humidity_Local_LCD	HUMD	Signed 16-bit	INT	%	XX.YY	True
3	8962	Temp_Probe_Error		Signed 16-bit	BOOL			True

Assigning Physical Input 2 Status Var.



Remote Display Icons



!!! %RH=A25 °C=A26 !!!!

Icons Vector



A19 has priority on A25/A26, i.e. if A19 is on the other two are forced off.

Simbolo / icone	Colore	Acceso	Acceso lampeggiante
A1	Nero	SYSLCDLED[0]=1	SYSLCDLED[0]=2
A2	Nero	SYSLCDLED[1]=1	SYSLCDLED[1]=2
A3	Nero	SYSLCDLED[2]=1	SYSLCDLED[2]=2
A4	Nero	SYSLCDLED[3]=1	SYSLCDLED[3]=2
A5	Nero	SYSLCDLED[4]=1	SYSLCDLED[4]=2
A6	Nero	SYSLCDLED[5]=1	SYSLCDLED[5]=2
A7	Nero	SYSLCDLED[6]=1	SYSLCDLED[6]=2
A8	Nero	SYSLCDLED[7]=1	SYSLCDLED[7]=2
A9	Nero	SYSLCDLED[8]=1	SYSLCDLED[8]=2
A10	Nero	SYSLCDLED[9]=1	SYSLCDLED[9]=2
A11	Nero	SYSLCDLED[10]=1	SYSLCDLED[10]=2
A12	Nero	SYSLCDLED[11]=1	SYSLCDLED[11]=2
A13	Nero	SYSLCDLED[12]=1	SYSLCDLED[12]=2
A14	Nero	SYSLCDLED[13]=1	SYSLCDLED[13]=2
A15	Nero	SYSLCDLED[14]=1	SYSLCDLED[14]=2
A16	Nero	SYSLCDLED[15]=1	SYSLCDLED[15]=2
A17	Nero	SYSLCDLED[16]=1	SYSLCDLED[16]=2
A18	Nero	SYSLCDLED[17]=1	SYSLCDLED[17]=2
A19	Nero	Managed by WriteClockLCD	NOT USED
A20	Nero	SYSLCDLED[19]=1	SYSLCDLED[19]=2
A21	Nero	RESERVED	RESERVED
A22	Nero	Managed by WriteClockLCD	Managed by WriteClockLCD
A23	Nero	Managed by WriteNumLCD	Managed by WriteNumLCD
A24	Nero	Managed by WriteNumLCD	Managed by WriteNumLCD
A25	Nero	SYSLCDLED[25]=1	SYSLCDLED[25]=2
A26	Nero	SYSLCDLED[24]=1	SYSLCDLED[24]=2
A27	Nero	Managed by WriteNumLCD	Managed by WriteNumLCD
A28	Nero	SYSLCDLED[27]=1	SYSLCDLED[27]=2
A29	Nero	SYSLCDLED[28]=1	SYSLCDLED[28]=2
A30	Nero	SYSLCDLED[29]=1	SYSLCDLED[29]=2
A31	Nero	SYSLCDLED[30]=1	SYSLCDLED[30]=2
A32	Nero	SYSLCDLED[31]=1	SYSLCDLED[31]=2
A33	Nero	SYSLCDLED[32]=1	SYSLCDLED[32]=2
A34	Nero	SYSLCDLED[33]=1	SYSLCDLED[33]=2
A35	Nero	SYSLCDLED[34]=1	SYSLCDLED[34]=2

WriteNumLCD



View object properties

Name: WriteNumLCD

Type: Function

Return Value: USINT

Language Type:

Description:
Write string to LCD

Input:

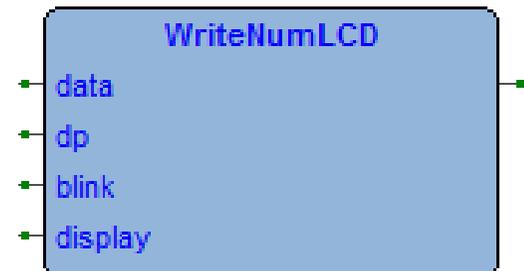
Name	Type	Description
data	DINT	Number to be displayed
dp	USINT	Format: 0=XXX 1=XX.Y 2=X.YY
blink	USINT	Blink: 0=Off 1=On
display	USINT	Display: 1=Left 2=Right

Close

Library

Name	Type	Group	Description
WriteClockLCD	Function		Convert a number expressed as ...
WriteNumLCD	Function		Write string to LCD
WriteStringLCD	Function		Write string to LCD

Operator and standard blocks | Target variables | Target blocks | basic | Regul and Control | Application



WriteClockLCD



View object properties

Name: WriteClockLCD

Type: Function

Return Value: USINT

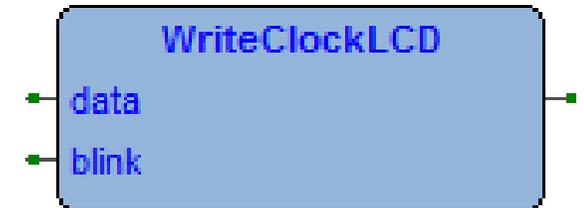
Language Type:

Description:
Convert a number expressed as minutes into format hh:mm and write it on left display of LCD

Input:

Name	Type	Description
data	DINT	Number to be shown with format hh:mm
blink	USINT	Blink: 0=Off 1=On

Close



Library

Name	Type	Group	Description
WriteClockLCD	Function		Convert a number expressed as minutes into format hh:mm and write it on left display of LCD
WriteNumLCD	Function		Write string to LCD
WriteStringLCD	Function		Write string to LCD

Operator and standard blocks | Target variables | Target blocks | basic | Regul and Control | Application

WriteStringLCD



View object properties

Name: WriteStringLCD

Type: Function

Return Value: BOOL

Language Type:

Description:
Write string to LCD

Input:

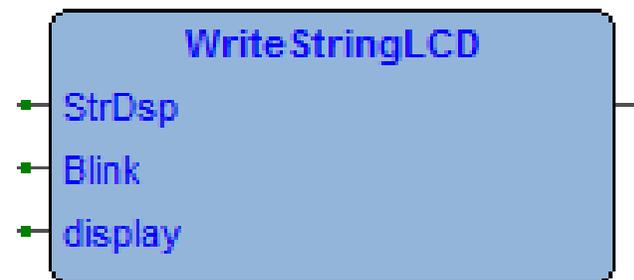
Name	Type	Description
StrDsp	STRING	String to be displayed
Blink	USINT	Blink: 0=Off 1=On
display	USINT	Display: 1=Left 2=Right

Close

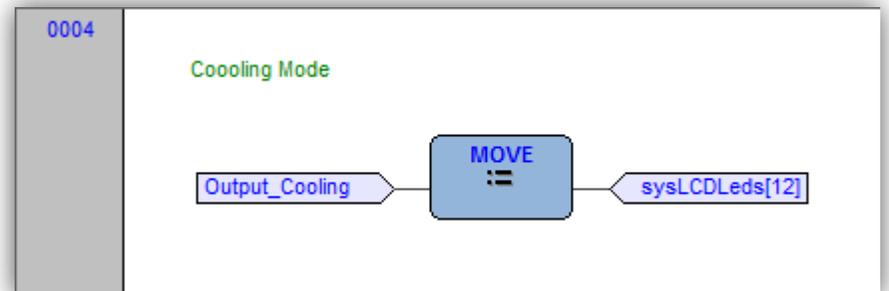
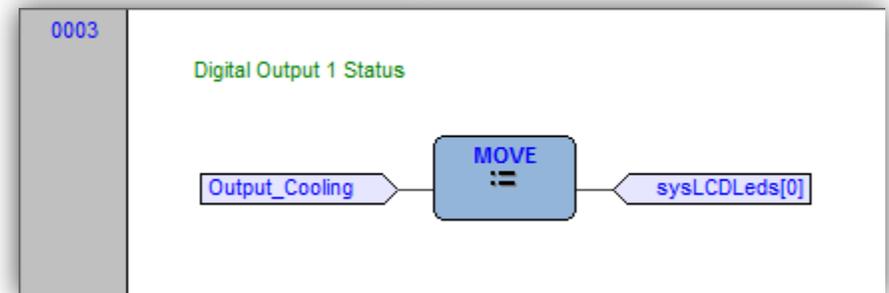
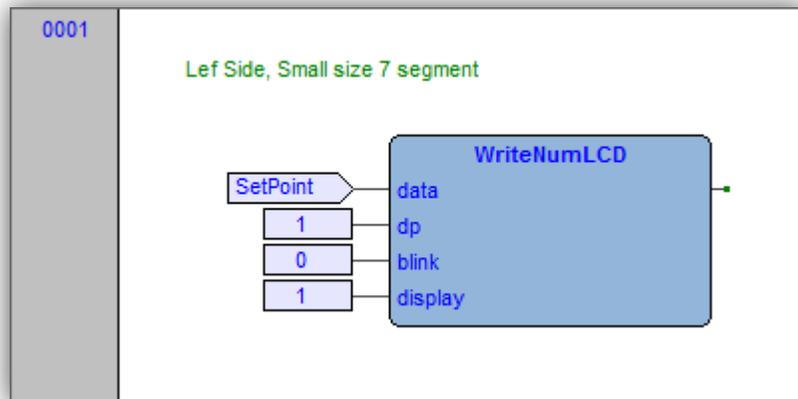
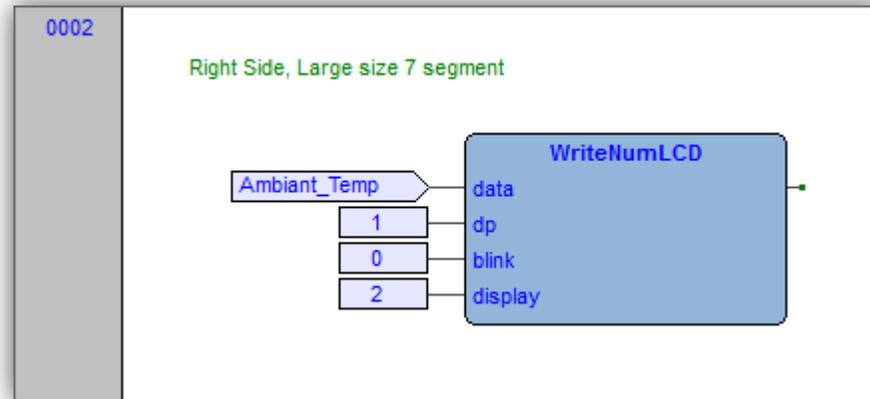
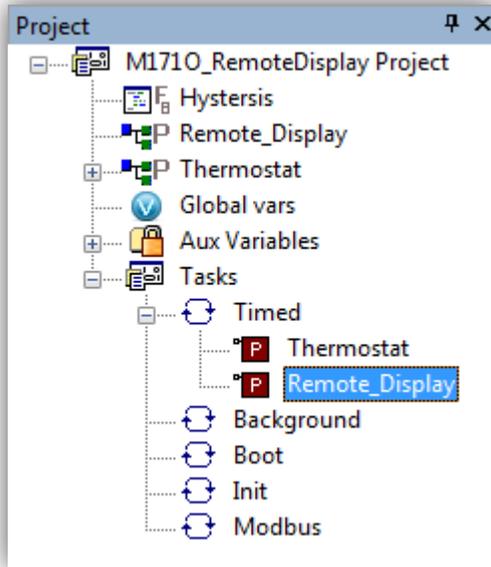
Library

Name	Type	Group	Description
WriteClockLCD	Function		Convert a number expr
WriteNumLCD	Function		Write string to LCD
WriteStringLCD	Function		Write string to LCD

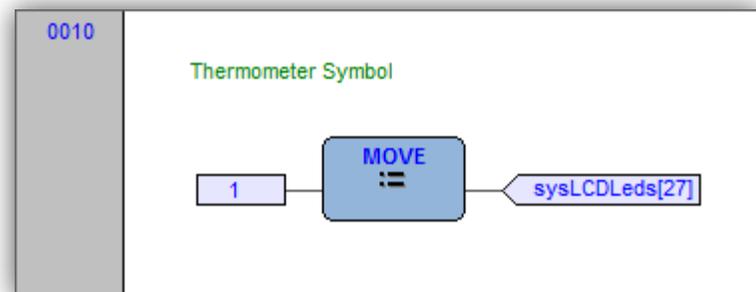
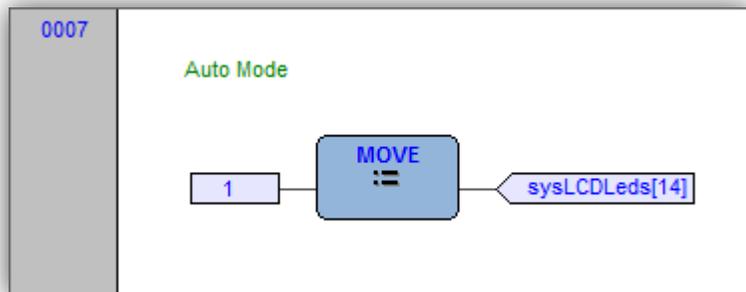
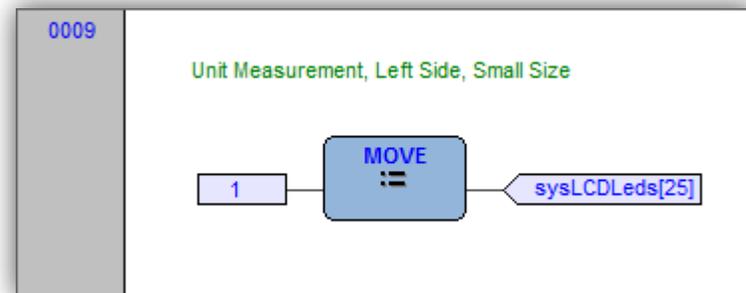
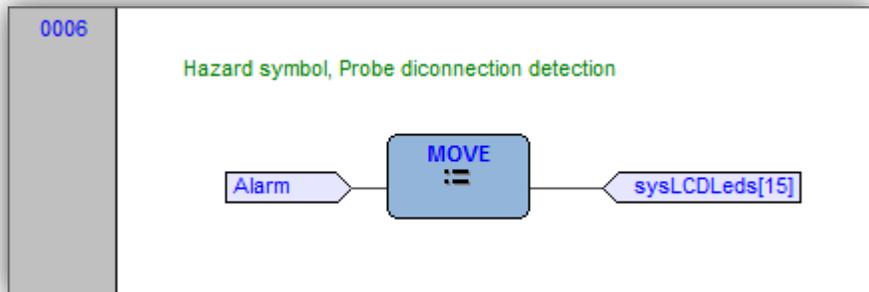
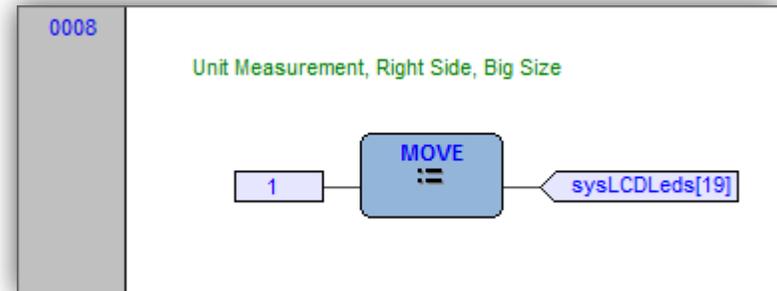
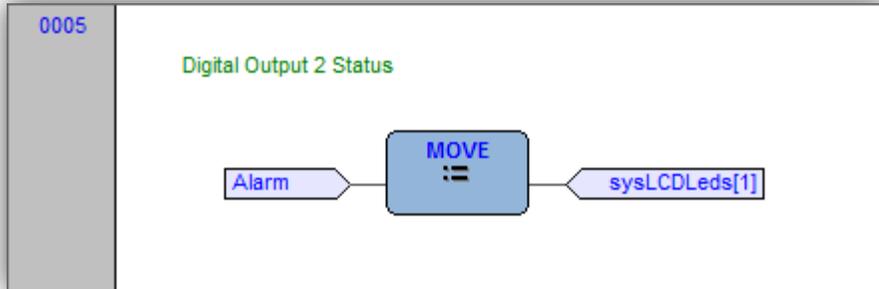
Operator and standard blocks | Target variables | Target blocks



LCD Icon's assignment...



...LCD Icon's assignment



Watching/Monitoring LCD icons

Name	Type	Address	Size	Group	Description
sysLCDAnalogInputs	INT	%IW21.0	2	Analog Inputs	LCD Analog Inputs
sysLCDLeds	USINT	%QB20.0	35	Leds status	LCD Leds Status
sysLCDStatus	BOOL	%MX7.0	1	Peripheral	LCD peripheral status

Operator and standard blocks | Target variables | Target blocks | basic | Regul and Control | Application

1
Drag & Drop

View object properties

Name: sysLCDLeds

Type: ARRAY[0..34] OF USINT

Address: %QB20.0

Description:
LCD Leds Status

Symbol	Value	Type	Location
SYSLCDLEDS	-	USINT[]	
[0]	1	USINT	
[1]	0	USINT	
[2]	0	USINT	
[3]	0	USINT	
[4]	0	USINT	
[5]	0	USINT	
[6]	0	USINT	
[7]	0	USINT	
[8]	0	USINT	
[9]	0	USINT	
[10]	0	USINT	
[11]	0	USINT	
[12]	1	USINT	
[13]	0	USINT	
[14]	1	USINT	
[15]	0	USINT	
[16]	0	USINT	
[17]	0	USINT	
[18]	0	USINT	
[19]	1	USINT	
[20]	0	USINT	
[21]	0	USINT	
[22]	0	USINT	
[23]	0	USINT	
[24]	0	USINT	
[25]	1	USINT	
[26]	0	USINT	
[27]	1	USINT	
[28]	0	USINT	
[29]	0	USINT	
[30]	0	USINT	
[31]	0	USINT	
[32]	0	USINT	
[33]	0	USINT	
[34]	0	USINT	

Watching/Monitoring remote I/O



Library

Name	Type	Address	Size	Group	Description
sysLCDAnalogInputs	INT	%IW21.0	2	Analog Inputs	LCD Analog Inputs
sysLCDLeds	USINT	%QB20.0	35	Leds status	LCD Leds Status
sysLCDStatus	BOOL	%MX7.0	1	Peripheral	LCD peripheral status

Operator and standard blocks | Target variables | Target blocks | basic | Regul and Control | Applicator

Watch

Symbol	Value	Type	Location
[] SYSLCDANALOGINPUTS	-	INT[]	
-- [0]	-32768	INT	
-- [1]	-32768	INT	

View object properties

Name: sysLCDAnalogInputs

Type: ARRAY[0..1] OF INT

Address: %IW21.0

Description:
LCD Analog Inputs

Watch

Symbol	Value	Type	Location
[] SYSLCDANALOGINPUTS	-	INT[]	
-- [0]	-32768	INT	
-- [1]	957	INT	

Watching/Monitoring LAN communication



Name	Type	Address	Size	Group	Description
sysLCDAnalogInputs	INT	%IW21.0	2	Analog Inputs	LCD Analog Inputs
sysLCDLeds	USINT	%OB20.0	35	Leds status	LCD Leds Status
sysLCDStatus	BOOL	%MX7.0	1	Peripheral	LCD peripheral status



Symbol	Value	Type	Location
 SYSLCDSTATUS	TRUE	BOOL	global

Symbol	Value	Type	Location
 SYSLCDSTATUS	FALSE	BOOL	global

Ap View object properties

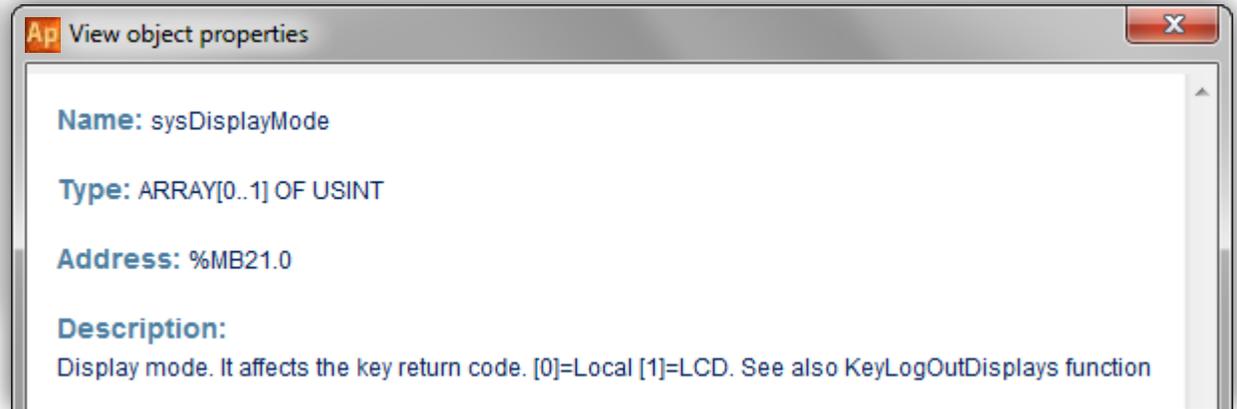
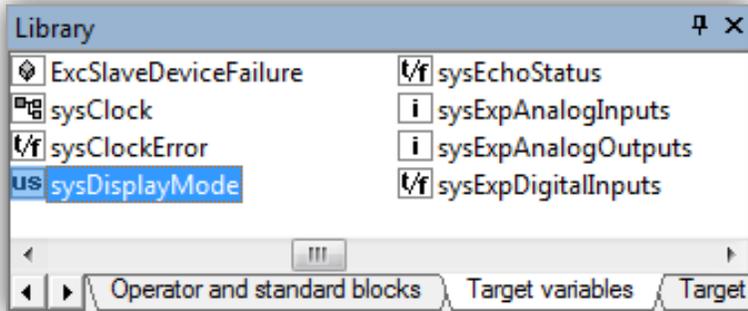
Name: sysLCDStatus

Type: BOOL

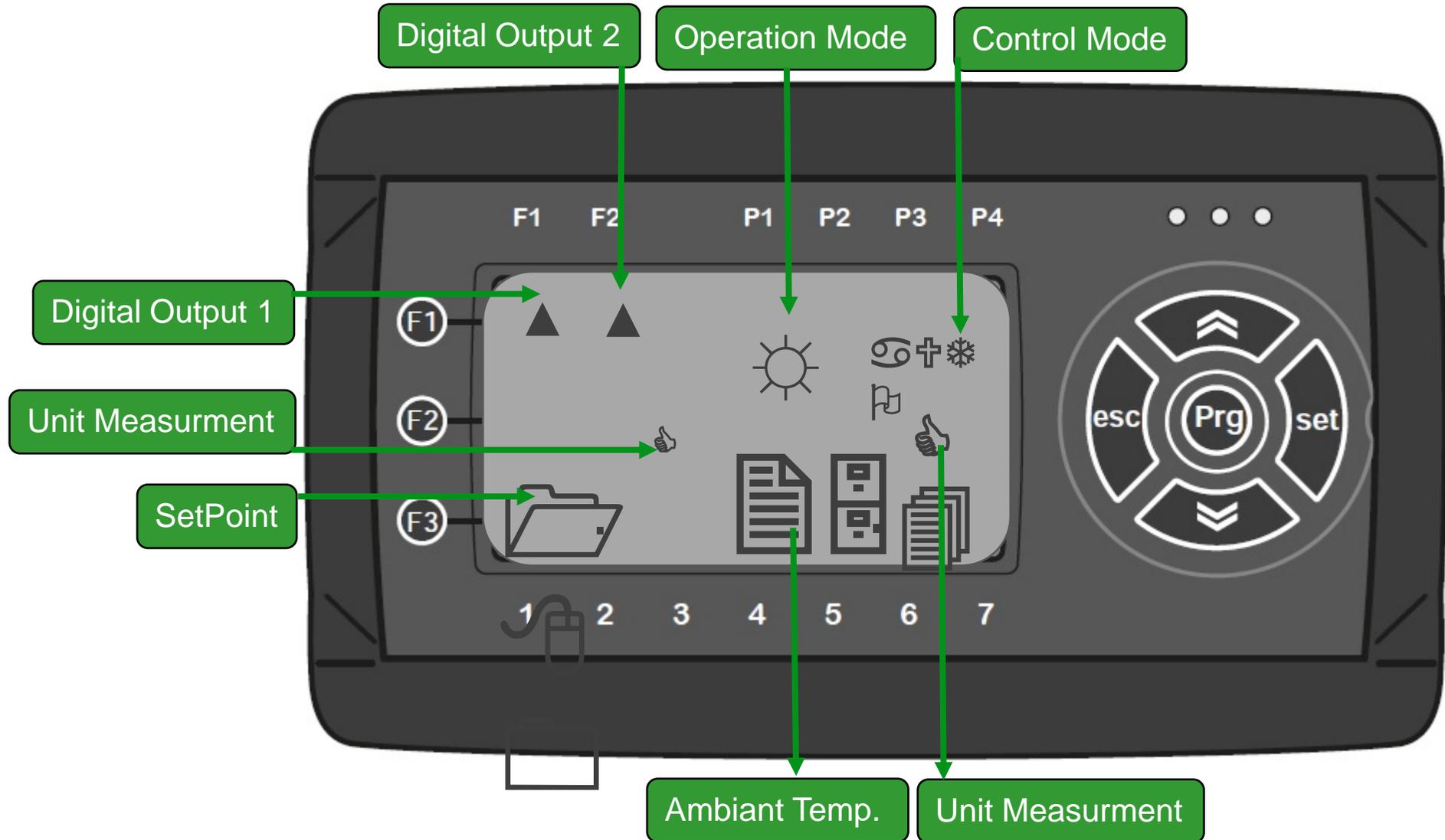
Address: %MX7.0

Description:
LCD peripheral status

SysDisplayMode



Dashboard



Chapter 9

Target conversion and code import

Goal:

Reuse of existing code and libraries

Convert project from Smart to EVOLUTION



- 1. Project ► Select target
- 2. EVD
- 3. Change
- 4. Save the project

By target conversion, it is possible to reuse the existing projects.



The screenshot shows the Eliwell Free Studio Application interface. The main window displays the 'FreeSmart Configuration' dialog, which includes sections for 'Display' (Fundamental state display: ALL1), 'Execution time' (Set execution time: checked, Execution time (ms): 100), and 'Data export' (Select XSLT export filter: Browse). A 'Select target' dialog is overlaid on the main window, showing a list of 'Available Targets':

Target Name	Value
FreeAdvance 596.2	596.2
FreeEvolution EVC 477.23	477.23
FreeEvolution EVD 423.23	423.23
FreeEvolution EVP 489.16	489.16
FreeSmart 412.20	412.20
FreeSmart Modbus Master 542.6	542.6

The 'FreeEvolution EVD 423.23' target is selected. A 'Change' button is highlighted. Below the 'Select target' dialog, an 'Eliwell Free Studio Application' dialog box is shown with the message: 'This operation requires to save the project. Continue the operation?'. The 'Yes' button is highlighted.

The screenshot shows the Eliwell Free Studio Application interface. The 'Project' menu is open, showing options like 'New object', 'Copy Object', 'Paste object', 'Duplicate object', 'Delete object', 'PLC Object properties', 'Object Browser', 'Compile', 'Recompile all', 'Generate redistributable source module', 'Import object from library', 'Export object to library', 'Library manager', 'Refresh all libraries', 'Macros', 'Select target...', 'Refresh current target', and 'Options...'. The 'FreeSmart Configuration' dialog is visible in the background, showing the 'Display' section with 'Fundamental state display' set to 'ALL1'. The 'Execution time' section has 'Set execution time' checked and 'Execution time (ms)' set to 100. The 'Data export' section has 'Select XSLT export filter' set to 'Browse'.

The 'Select target' dialog box is shown, displaying a list of 'Available Targets'. The 'FreeEvolution EVD 423.23' target is selected. A 'Change' button is highlighted.

The 'Eliwell Free Studio Application' dialog box is shown, displaying the message: 'This operation requires to save the project. Continue the operation?'. The 'Yes' button is highlighted.

Converted project from M171O to M171P



The screenshot displays the 'FreeEvolution Configuration' software interface. The main window shows a detailed diagram of a thermostat with various sensors and controls. Below the diagram, there are configuration fields for 'Execution time' and 'Data export'. The 'Execution time' section includes a 'Set execution time' checkbox and an 'Execution time (ms)' input field. The 'Data export' section has a 'Select XSLT export filter' dropdown, a 'Browse' button, and an 'Export' button.

A prominent green callout box contains the following text:

Conversion between Evolution to Smart is not fully supported (all resources are deleted).

The interface also features a 'Project' tree on the left, a 'Watch' window on the right, and an 'Oscilloscope' window at the bottom right. The 'Output' window at the bottom left shows the following text:

```
Preprocessing module TARGET completed.
Preprocessing module MAIN completed.
Preprocessing Global shared completed.
Preprocessing Menu completed.
Preprocessing basic completed.

0 warnings, 0 errors.
```

The 'Library' window at the bottom right lists various mathematical and logical functions such as ABS, ACOS, ADD, AND, ASIN, ATAN, ATAN2, CEIL, COS, COSH, DIV, EQ, EXP, FLOOR, GE, GT, JMP, LE, LIMIT, LN, LOG, LT, MAX, MIN, MOD, MOVE, MUL, MUX, NE, NOT, OR, POW, RET, ROL, ROR, S, SEL, SHL, SHR, SIN, SINH, SIZEC, SQRT, SUB, TAN, TANH, TO_BI, and TO_D.



Import Objects from library (or Project)

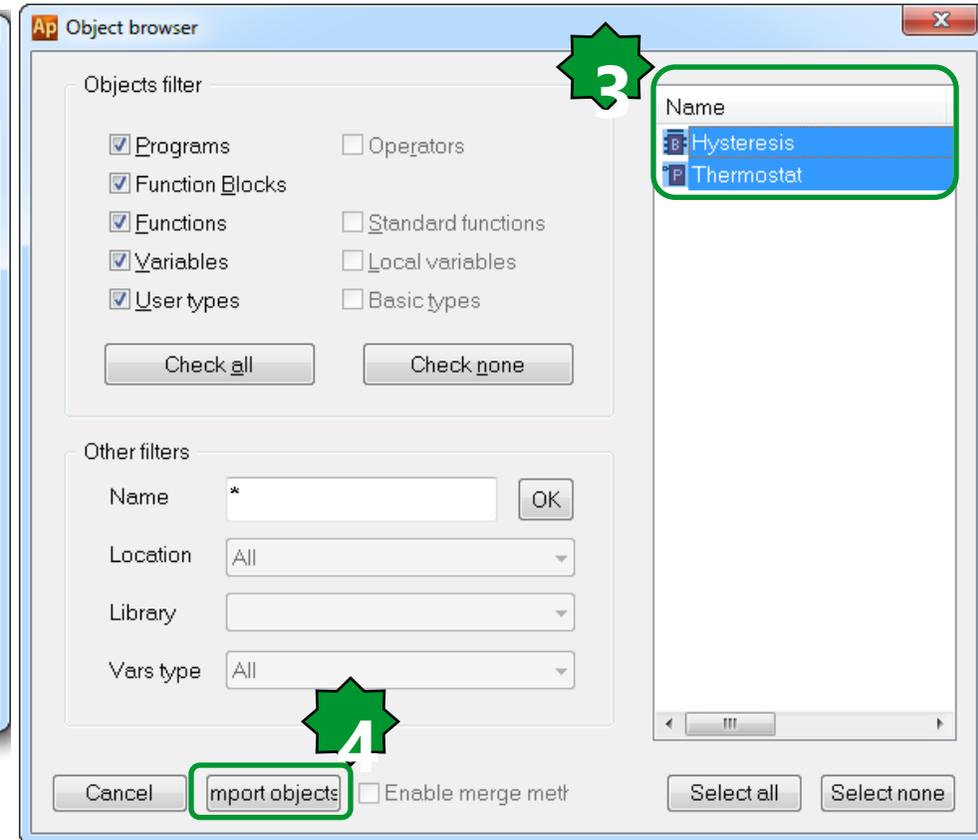
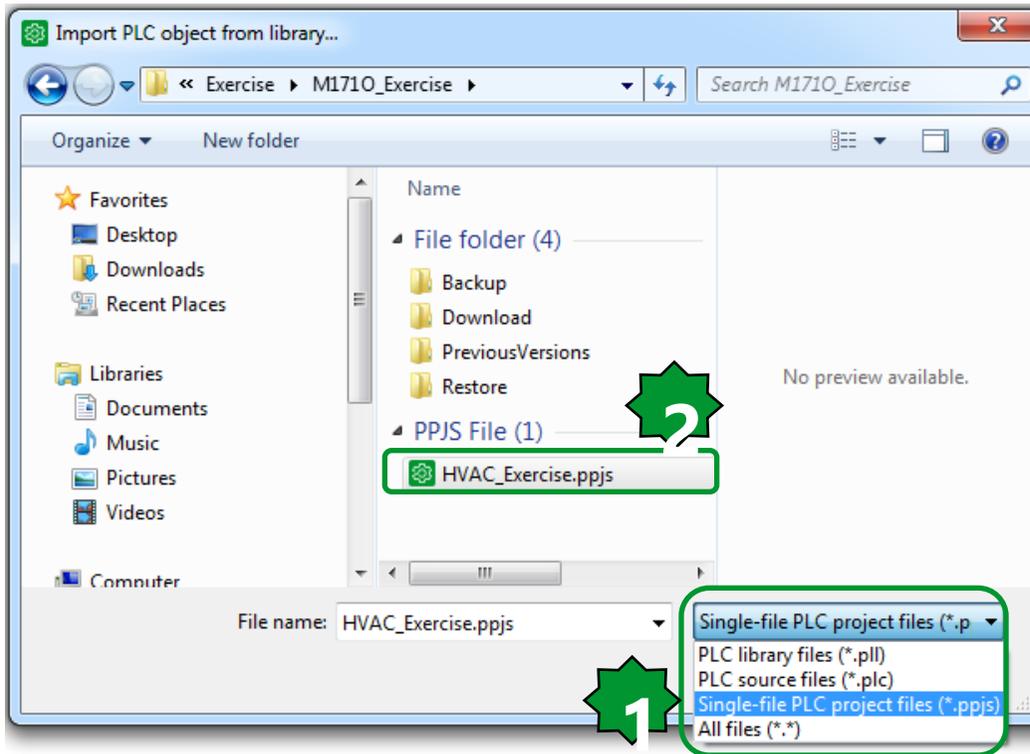
The screenshot displays the software's 'Project' menu, which includes options such as 'New object', 'Copy Object', 'Paste object', 'Duplicate object', 'Delete object', 'PLC Object properties', 'Object Browser', 'Compile', 'Recompile all', 'Generate redistributable source module', 'Import object from library', 'Export object to library', 'Library manager', 'Refresh all libraries', 'Macros', 'Select target...', 'Refresh current target', and 'Options...'. The 'Import object from library' option is currently selected.

The background window, titled 'FreeEvolution Configuration', shows a detailed diagram of a hardware device with various ports and connectors. Below the diagram, there are configuration options for 'Execution time' (with a checkbox for 'Set execution time') and 'Data export' (with a dropdown for 'Select XSLT export filter').

**Both directions, upgrade & downgrade are possible, from:
SMART ► EVOLUTION
EVOLUTION ► SMART**

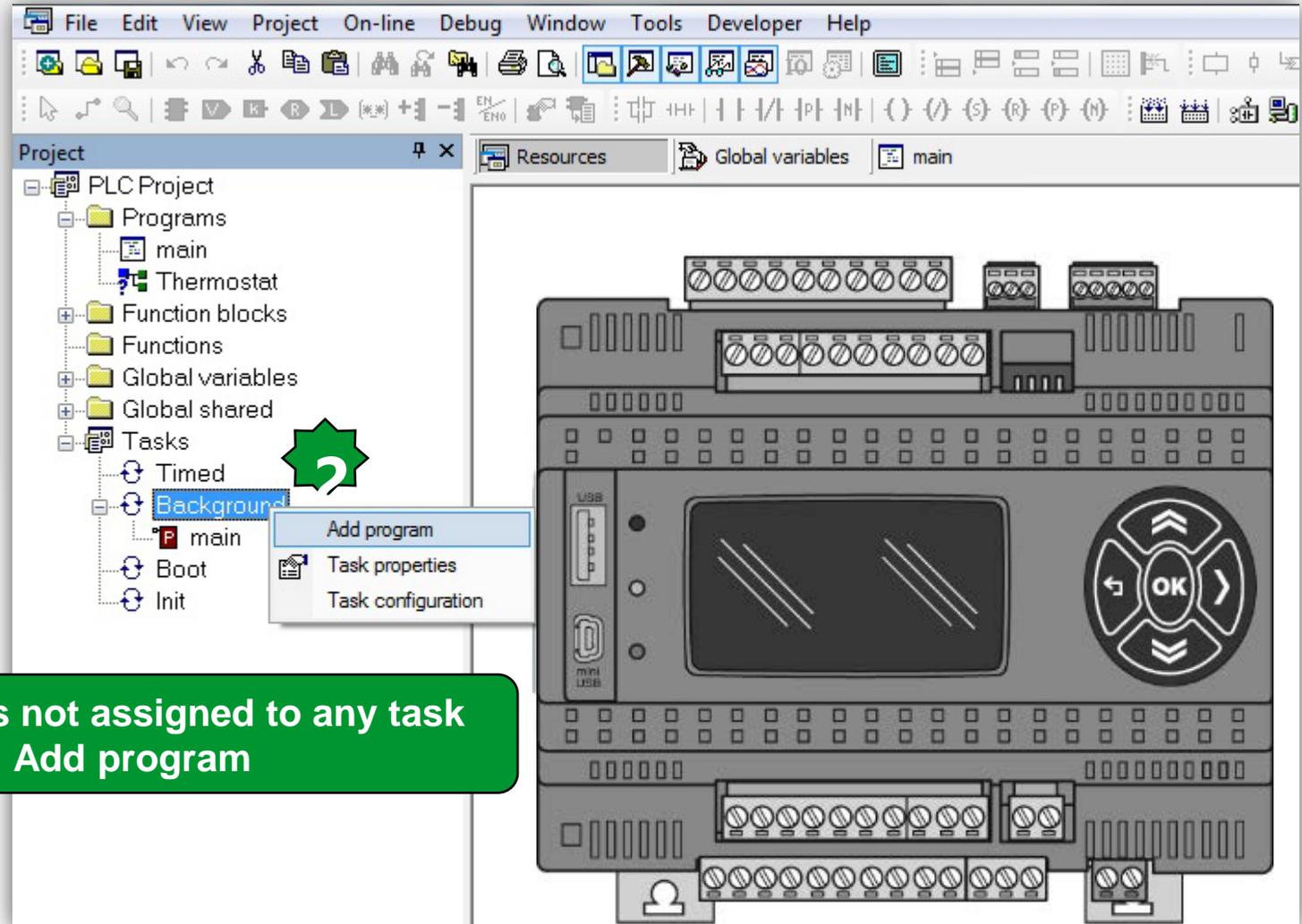
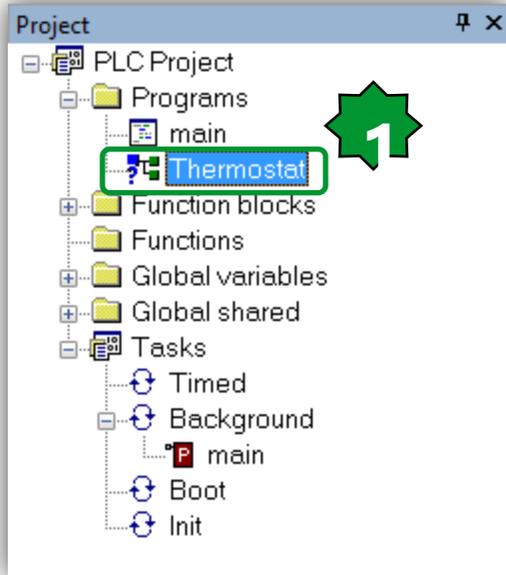
It allows also to import programs, FB, functions from other projects regardless the related target.

Import Objects from Project...



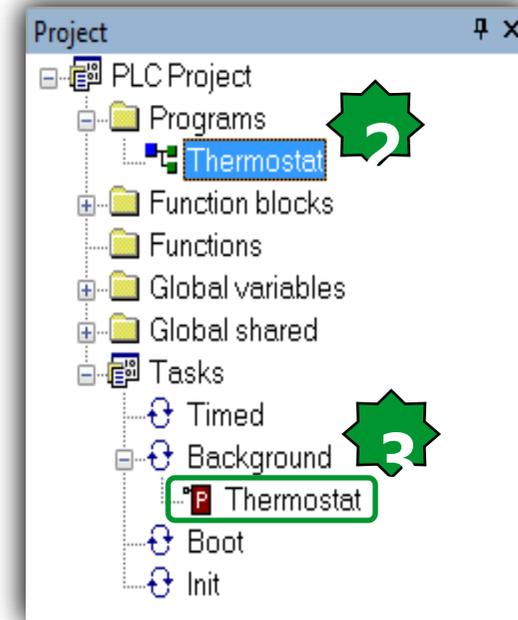
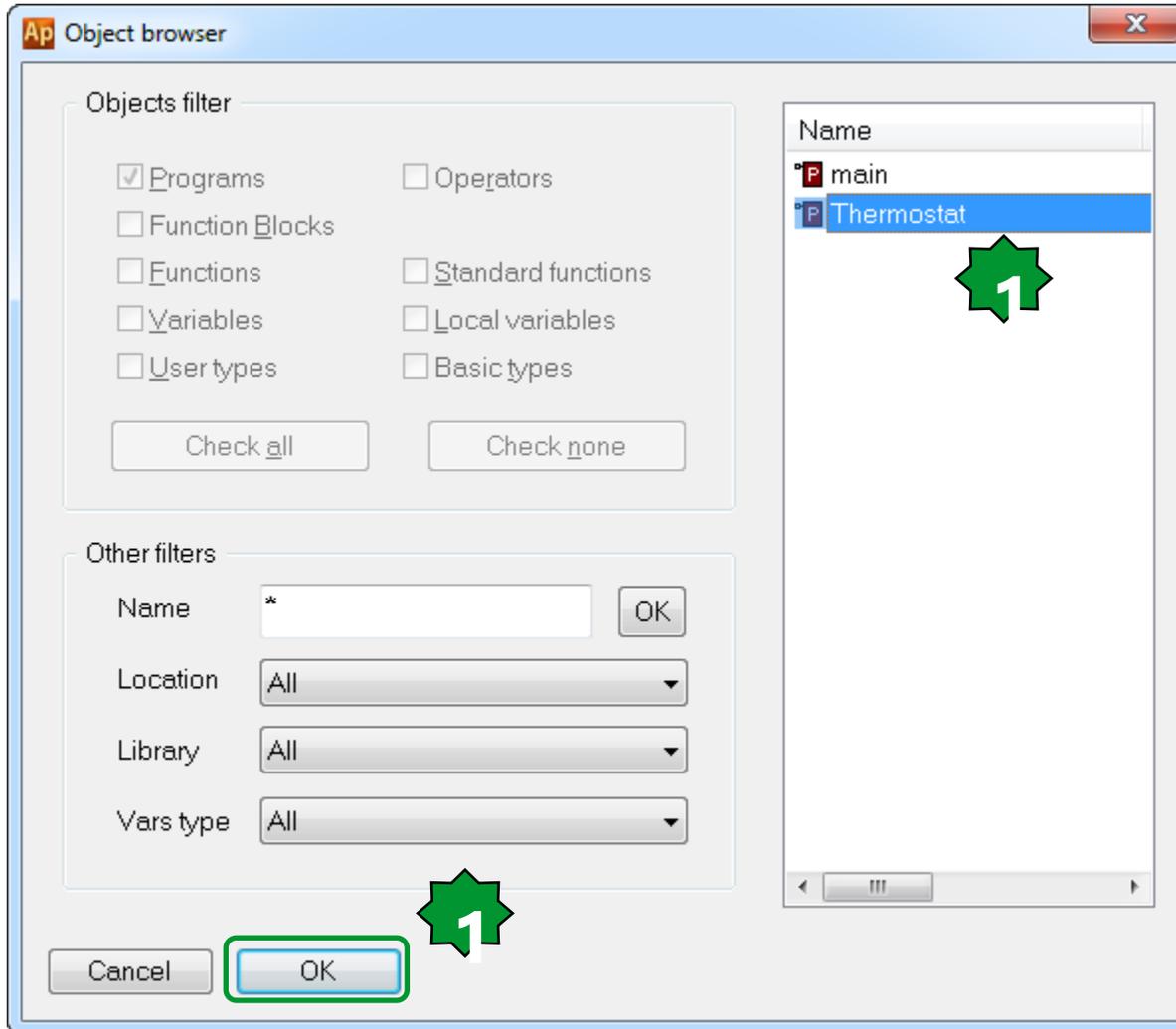
1. Select *.ppjs file type
2. Select desired project (SMART)
3. Select desired program & FBD
4. Import Objects

...Assign to Task (in case of program)



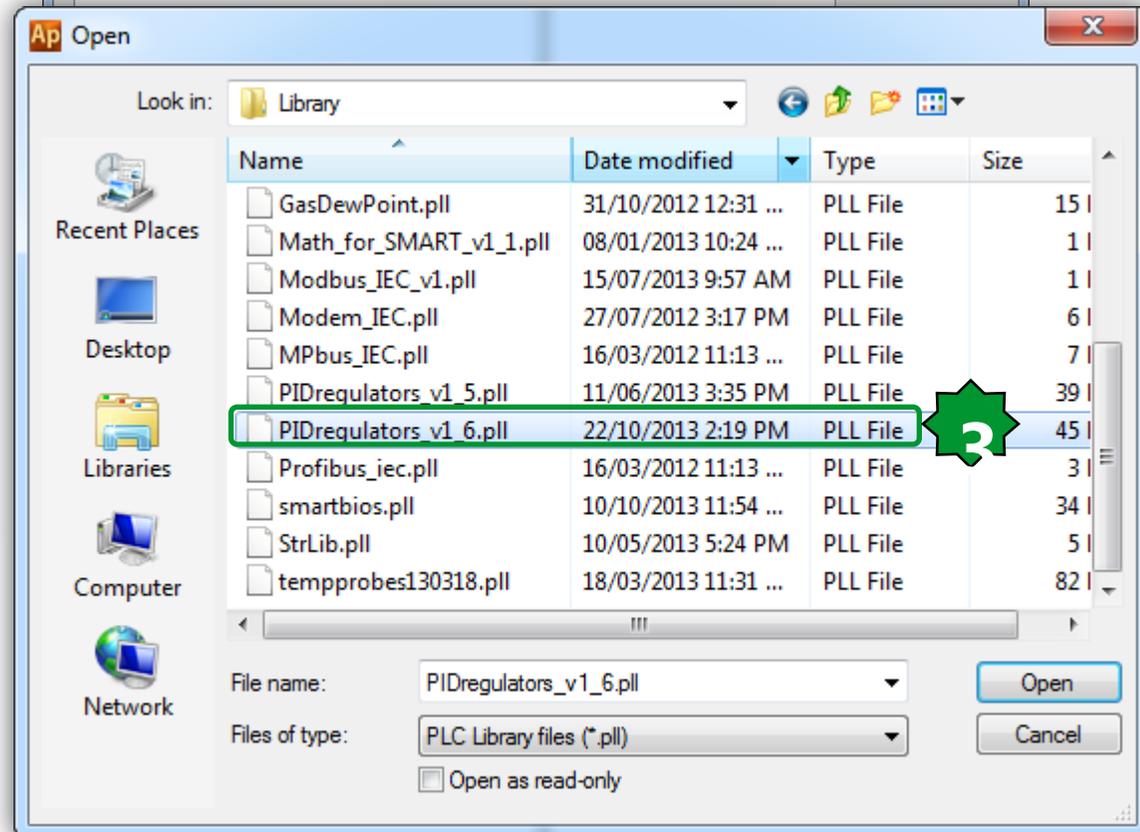
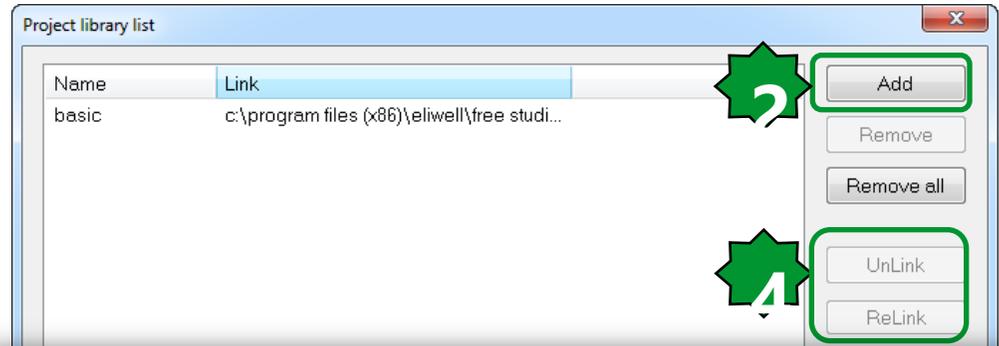
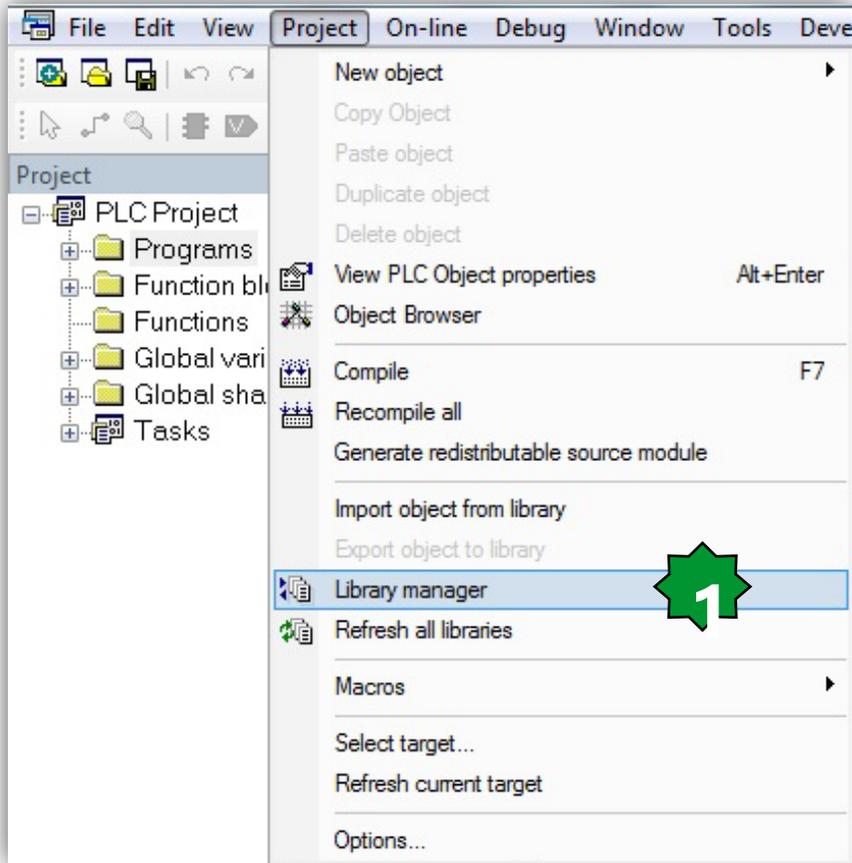
- 1. ? Means that program is not assigned to any task
- 2. Tasks ▶ Background ▶ Add program

Assigning imported program to the task



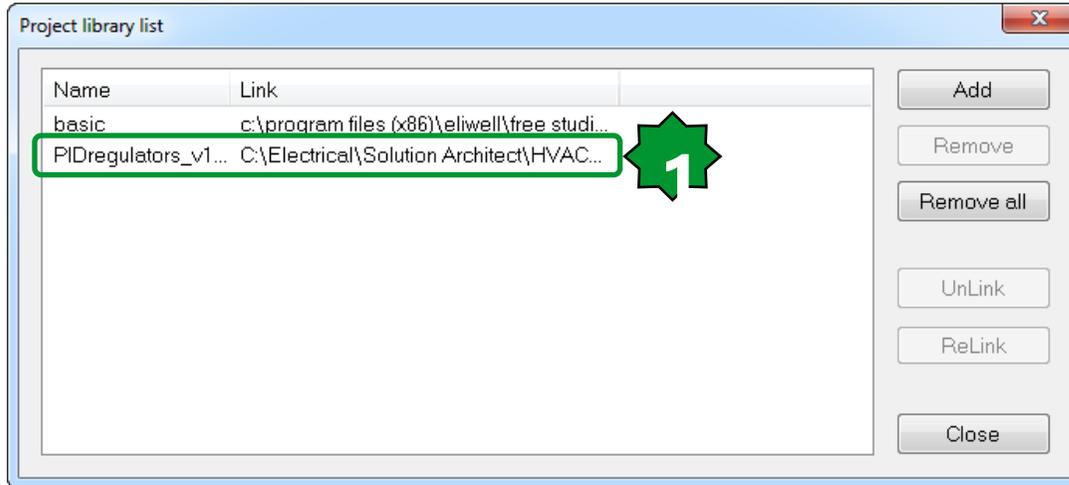
1. Select the desired program name ► OK
2. The ? Disapeares in prgrams
3. It will assign to to desired task (delete non-required programmes)

Link libraries...



1. Project ► Library Manager
2. Project Library list
3. add/remove
4. Unlink/Relink

...Link Libraries



Chapter 10

Methodology:

Goal:

Navigation between the SW, application, device, connection & familiarizing with their abilities

Free studio/unique programming software



In Unique software suite for Smart and Evolution



The screenshot displays the Free Studio software interface. On the left, there is a project tree and a table of components. The central area shows a graphical ladder logic diagram. On the right, there is a 'FreeEvolution 423 Configuration' dialog box with various settings. In the center, there is a button with the 'fr' logo and the text 'Launch free Studio'.



Smart



Evolution



Software suite presentation

Smart+Evolution

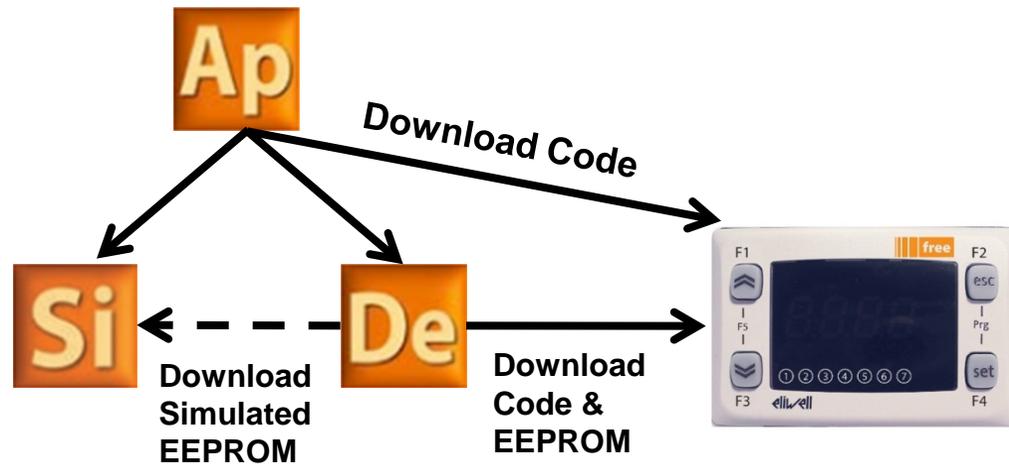
Evolution

icon (link)	description	icon (link)	description
	Application development tool for Smart & Evolution		Connection development tool for Evolution
	Device development tool for Smart & Evolution		User Interface development tool for Evolution
	Simulation development tool for Smart & Evolution		

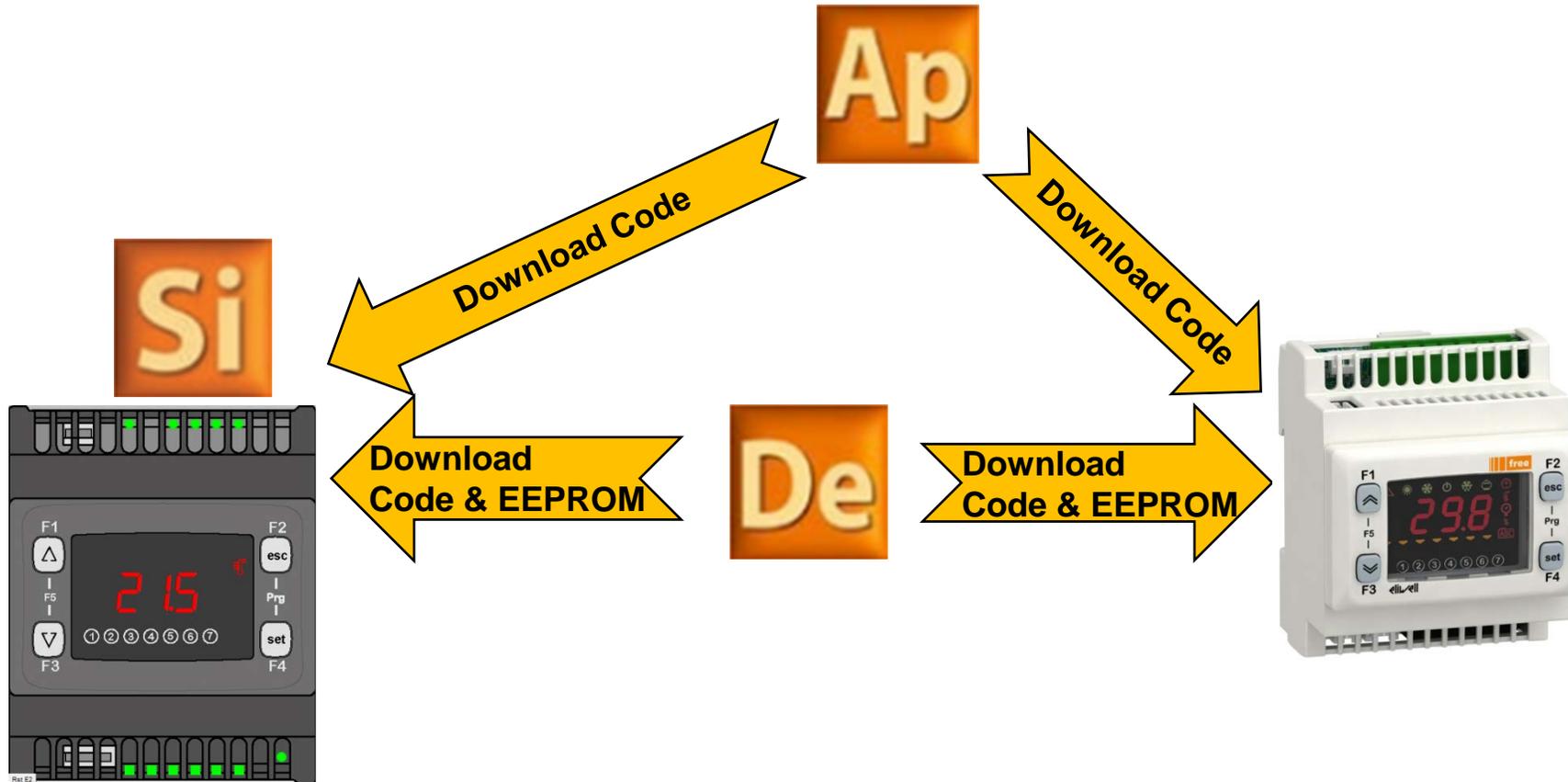
Smart Project Architecture



- Application is the programming starting point.
- Device is used to download the overall compiled project and it is the only tool able to write EEPROM parameters.
- From Application it will always be possible to open Device directly without having to launch the program using the FREE Studio icon.



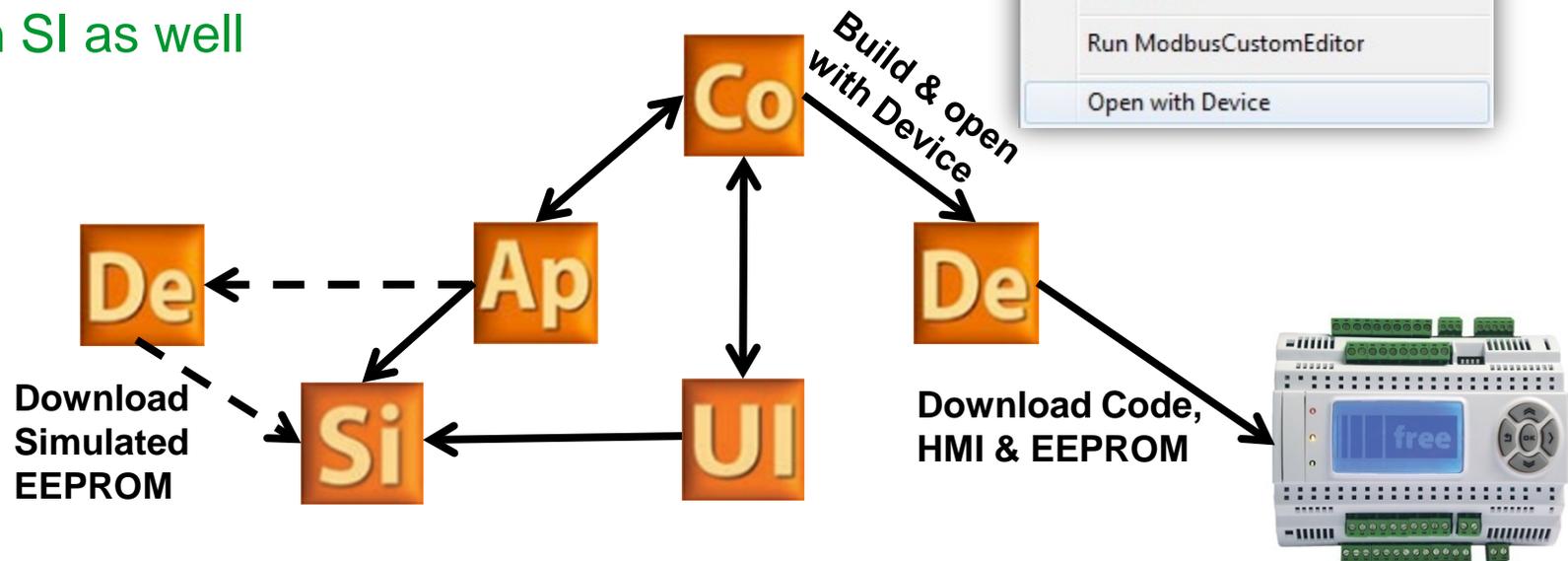
Tools workflow/Optimized



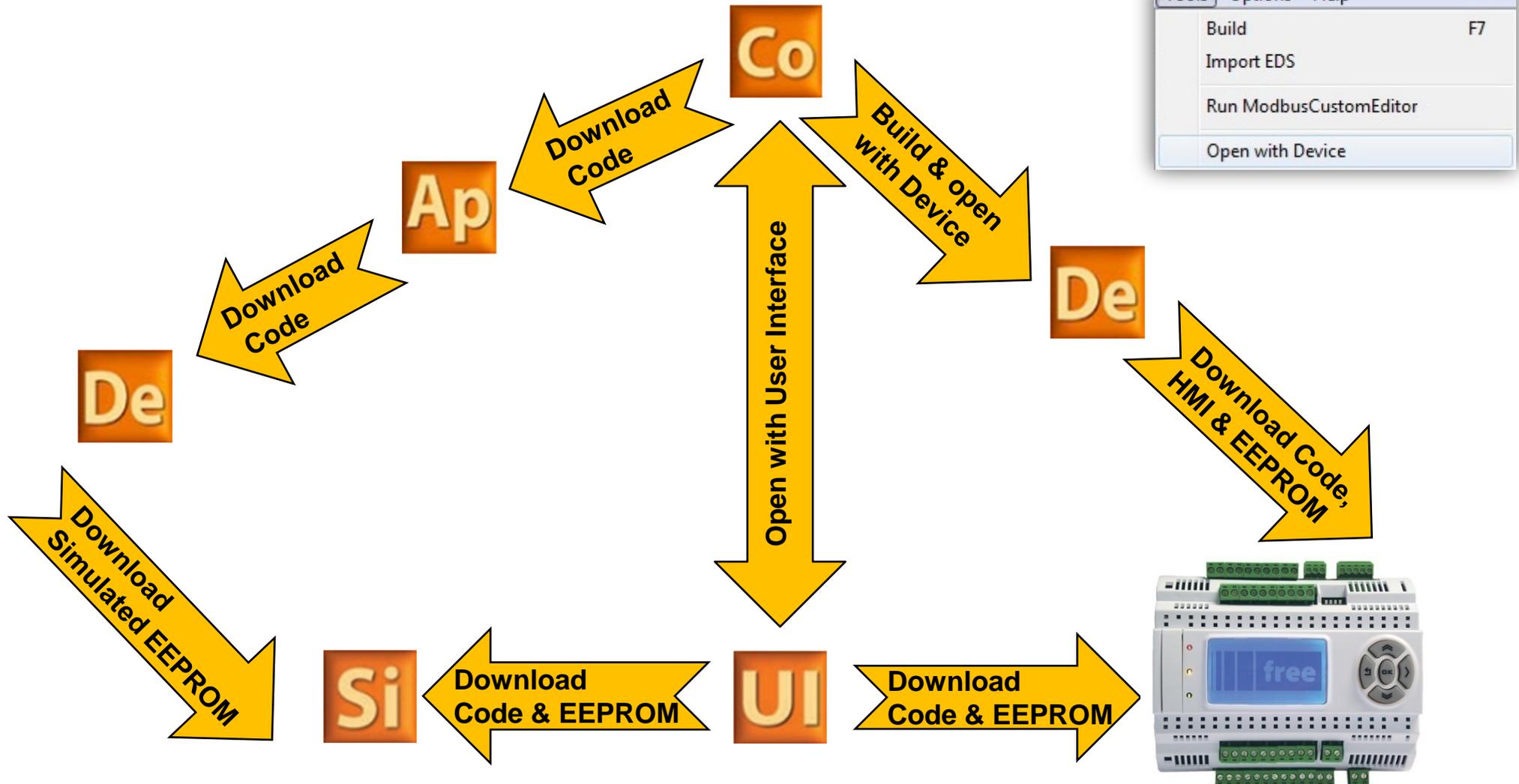
Evolution Project Architecture



- Connection is the entry point for all development activities.
- Device is used to download the overall compiled project and it is the only tool able to write EEPROM parameters and the master connectivity configuration
- Application can download only the algorithm and the EEPROM parameters and Status Variable definition.
- UI can download only the HMI to EVD
- UI can open SI as well



Tools workflow/Optimized



Chapter 11

Fan Management

Goal:

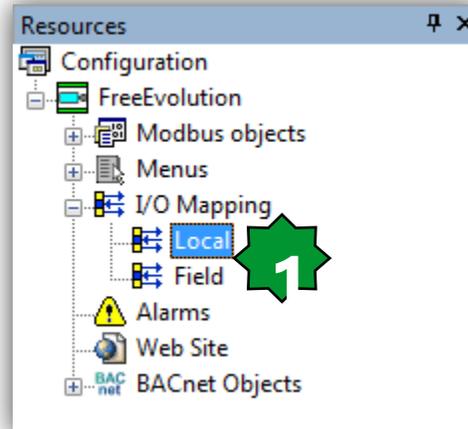
Manage 3 fans base on analogue input configuration

Physical I/O assignment

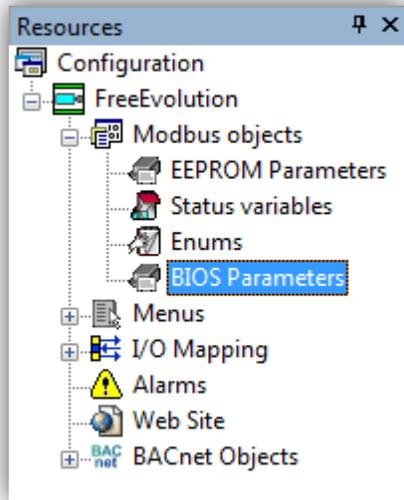
Fan Management Function Description:
 Fan Management enable by DIL1=True
 If AI3P <= 3.3 V => Fan1=ON
 If 3.3 V < AI3P <=6.6 V => Fan1 & 2 = ON
 If AI3P > 6.6 V => Fan1,2 & 3 =ON
 If AI3P = - 32768 => Alarm=ON & Fans=False
 Monitoring AI3P by the gauge that is connected to the AO1P (0-10 V).

Local I/O Mapping

#	Name	Variable	Type	Description
1	AIL1	NTC_Probe	INT	AIL1 analogue input
2	AIL2		INT	AIL2 analogue input
3	AIL3	Potentiometer_AI3P	INT	AIL3 analogue input
4	AIL4		INT	AIL4 analogue input
5	AIL5		INT	AIL5 analogue input
6	AIL6		INT	AIL6 analogue input
7	DIL1	Fan_Start_Stop	BOOL	DIL1 digital input
8	DIL2		BOOL	DIL2 digital input
9	DIL3		BOOL	DIL3 digital input
10	DIL4		BOOL	DIL4 digital input
11	DIL5		BOOL	DIL5 digital input
12	DIL6		BOOL	DIL6 digital input
13	DIL7		BOOL	DIL7 digital input
14	DIL8		BOOL	DIL8 digital input
15	DOL1	Output_Cooling	BOOL	DOL1 digital output
16	DOL2	Alarm	BOOL	DOL2 digital output
17	DOL3	Fan_Alarm	BOOL	DOL3 digital output
18	DOL4	Fan1	BOOL	DOL4 digital output
19	DOL5	Fan2	BOOL	DOL5 digital output
20	DOL6	Fan3	BOOL	DOL6 digital output
21	DOL7		BOOL	DOL7 digital output
22	AOL1	Gauge_AO1P	INT	AOL1 analogue output
23	AOL2		INT	AOL2 analogue output
24	AOL3		INT	AOL3 analogue output
25	AOL4		INT	AOL4 analogue output
26	AOL5		INT	AOL5 analogue output
27	FDI_counter		UDINT	FDI Input counter
28	FDI_frequency		UDINT	FDI Input frequency
29	FDI_value		BOOL	FDI Input value
30	FDI_reset_counter		BOOL	FDI reset input counter value



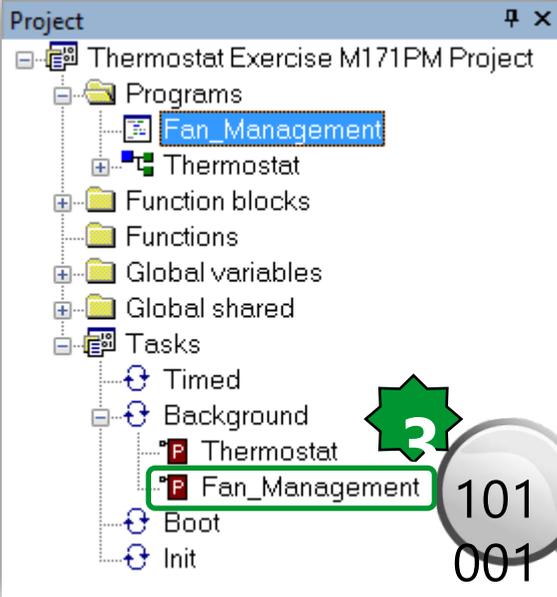
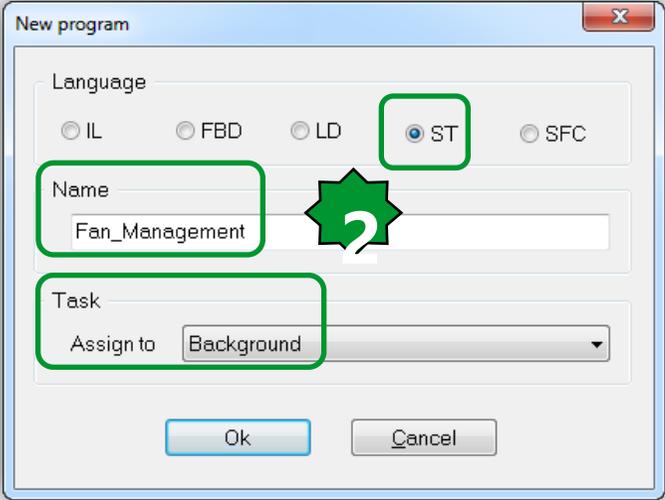
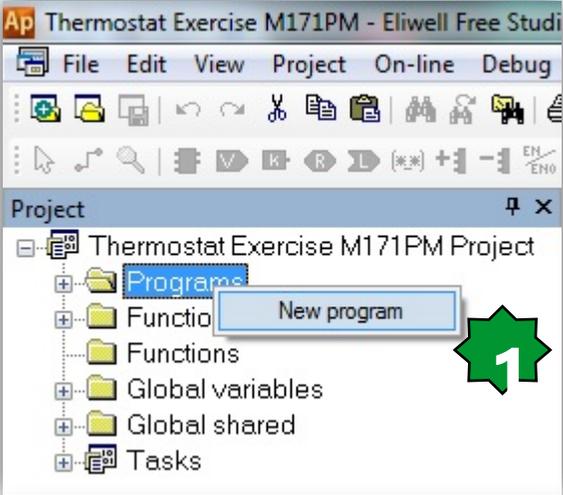
BIOS Parameters/AI* Configuration



BIOS Parameters			
#	Name	Default value	Description
1	Cfg_AI3	4=0÷10V	Type of analogue input AI3
2	FullScaleMin_AI3	0	First value analogue input AI3 scale
3	FullScaleMax_AI3	1000	Last value analogue input AI3 scale
4	Cfg_AO1_AO5	2=Voltage modulation	Type of analogue output AO1/AO5
5	Cfg_AI1	2=NTC(103AT)	Type of analogue input AI1



New program creation



Click on the magnifying-glass to write the codes.



```
0001 (* Enable/Disable of Fan management by Start/Stop the digital Input (DIL1) *)
0002 If Fan_Start_Stop = False then
0003     Fan3:= FALSE;
0004     Fan2:= FALSE;
0005     Fan1:= FALSE;
0006 end_if;
0007
0008
0009 (* If the AI3P value is less than 3.33 volts, then Fan1=ON *)
0010
0011 if Potentiometer_AI3P <= 333 and Fan_Start_Stop = True then
0012     Fan1:= True;
0013     else Fan1 := FALSE;
0014 End_If;
0015
0016 (* If the AI3P value is less or equal than 6.66 volts or greater than 3.33 Volts, then Fan1=ON & Fan2=ON*)
0017
0018 if Potentiometer_AI3P <= 666 and Potentiometer_AI3P > 333 and Fan_Start_Stop = True then;
0019     Fan2:= True;
0020     Fan1:= True;
0021     else Fan2 := FALSE;
0022 End_If;
0023
0024 (* If the AI3P value is grater than 6.66 volts, then Fan1=ON & Fan2=ON & Fan3=ON*)
0025
0026 if Potentiometer_AI3P >666 and Fan_Start_Stop = True then;
0027     Fan3:= True;
0028     Fan2:= True;
0029     Fan1:= True;
0030     else Fan3 := FALSE;
0031 End_If;
0032
0033 (* AI3P disconnection detector *)
0034
0035 if Potentiometer_AI3P = -32768 then
0036     Alarm:= TRUE;
0037     Fan3:= FALSE;
0038     Fan2:= FALSE;
0039     Fan1:= FALSE;
0040     else Alarm := FALSE;
0041 end_if;
0042
0043 (* Monitoring AI3P by A01P via the 0-10 Volts gauge *)
0044
0045 Gauge_A01P := Potentiometer_AI3P;
```

**Fan Management,
Enable/Disable Outputs,
AI monitoring by AO (0-10 V),
AI disconnection detection codes.**

Debugging/Watch



Project

- Thermostat Exercise M171PM Project
 - Programs
 - Function blocks
 - Functions
 - Global variables
 - Global shared
 - Alarms
 - Mappings
 - NTC_Probe
 - Potentiometer_AI3P
 - Fan_Start_Stop
 - Output_Cooling
 - Alarm
 - Fan1
 - Fan2
 - Fan3
 - Guage_AO1P
 - Parameters
 - Variables
 - Tasks



Output

```
Preparing for PLC application download .. don  
Downloading file C:\Electrical\Solution Archi  
Booting PLC application ..  
done.
```

0 warnings, 0 errors.

Build Find in project Debug Resources

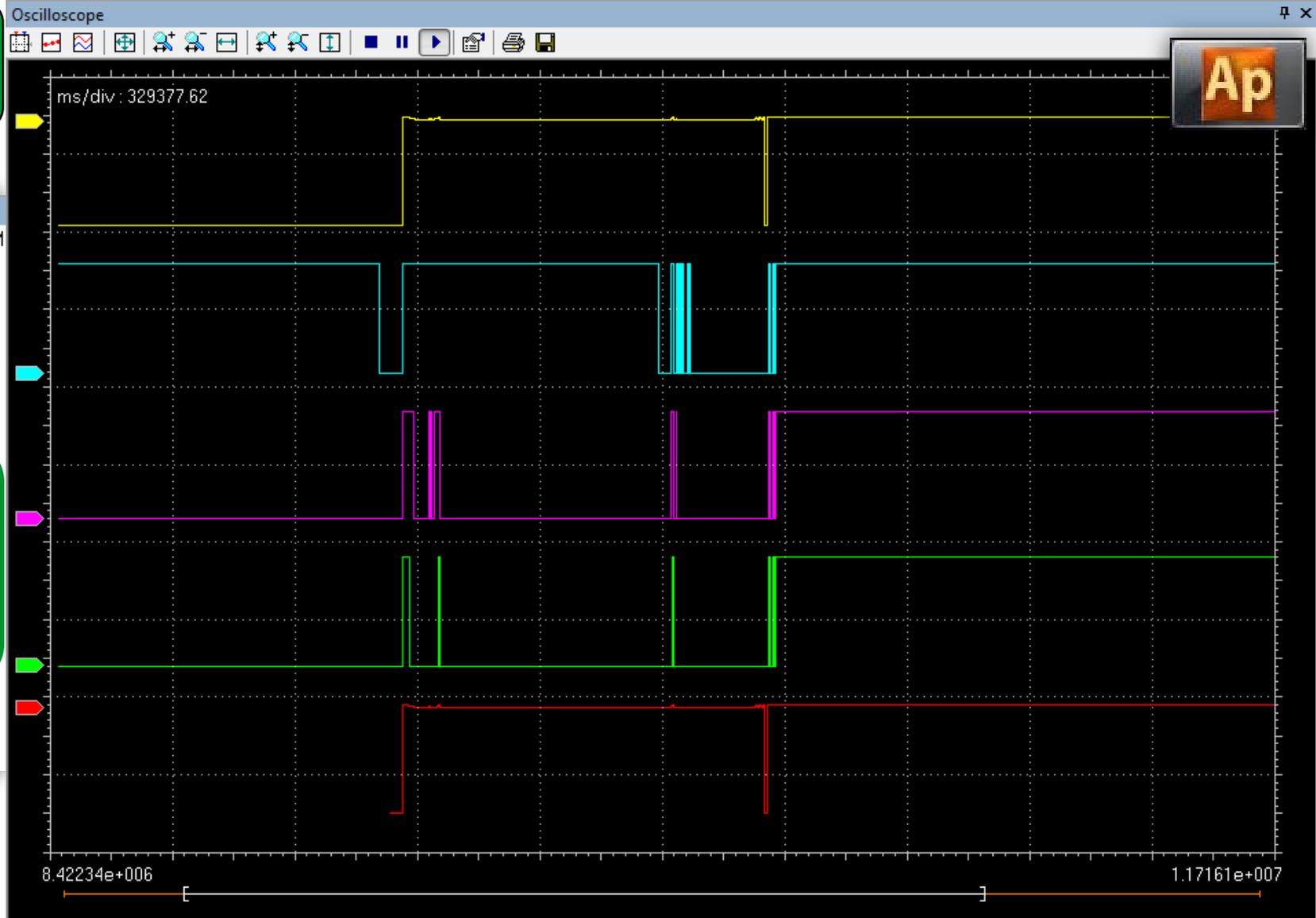


Watch

Symbol	Value	Type	Location
POTENTIOMETER_AI3P	643	INT	@BACKGROUND:FAN_MANAGEMENT
FAN1	TRUE	BOOL	@BACKGROUND:FAN_MANAGEMENT
FAN2	TRUE	BOOL	global
FAN3	FALSE	BOOL	global
ALARM	FALSE	BOOL	global
GUAGE_AO1P	643	INT	global
FAN_START_STOP	TRUE	BOOL	global

3. Drag & Drop the mappings into the watch window.

Debugging /Oscilloscope:



- Project
- Thermostat Exercise M171PM
 - Programs
 - Function blocks
 - Functions
 - Global variables
 - Global shared
 - Alarms
 - Mappings
 - NTC_Probe
 - Potentiometer_AI3P
 - Fan_Start_Stop
 - Output_Cooling
 - Alarm
 - Fan1
 - Fan2
 - Fan3
 - Guage_A01P
 - Parameters
 - Variables
 - Tasks

Track	Um	Min value	Max value	Cur value	v/div	Red ...	Blue...	Horz cursor	Note
@BACKGROUND:FAN_MANAGEMENT.POTENTIOMETER_AIBP		-32768.000	1048.000	643.000	2415...	...	...	...	@BACKGROUND:...
@BACKGROUND:FAN_MANAGEMENT.FAN1		0.000	1.000	1.000	0.714...	...	...	...	@BACKGROUND:...
@BACKGROUND:FAN_MANAGEMENT.FAN2		0.000	1.000	1.000	0.714...	...	...	...	@BACKGROUND:...
@BACKGROUND:FAN_MANAGEMENT.FAN3		0.000	1.000	0.000	0.714...	...	...	...	@BACKGROUND:...
@BACKGROUND:FAN_MANAGEMENT.GUAGE_A01P		-32768.000	1022.000	643.000	2413...	...	...	...	@BACKGROUND:...



Analogue Input Configuration

Project: Thermostat Exercise M171PM

- FreeEvolution
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs**
 - Analogue Outputs V/I
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC
 - Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes

Address	Name	Value	Um	Default	Min	Max	Description
15725	Temp_UM	0=°C	num	0=°C	0	1	Unit of temperature measurement
15726	Cfg_AI1	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI1
15727	Cfg_AI2	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI2
15728	Cfg_AI3	4=0÷10V	num	3=4÷20mA	0	8	Type of analogue input AI3
15729	Cfg_AI4	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI4
15730	Cfg_AI5	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI5
15731	Cfg_AI6	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI6
15736	FullScaleMin_AI3	0	digit	0	-9999	9999	First value analogue input AI3 scale
15737	FullScaleMax_AI3	1000	digit	1000	-9999	9999	Last value analogue input AI3 scale
15738	FullScaleMin_AI4	0	digit	0	-9999	9999	First value analogue input AI4 scale
15739	FullScaleMax_AI4	1000	digit	1000	-9999	9999	Last value analogue input AI4 scale
15740	FullScaleMin_AI5	0	digit	0	-9999	9999	First value analogue input AI5 scale
15741	FullScaleMax_AI5	1000	digit	1000	-9999	9999	Last value analogue input AI5 scale
15742	FullScaleMin_AI6	0	digit	0	-9999	9999	First value analogue input AI6 scale
15743	FullScaleMax_AI6	1000	digit	1000	-9999	9999	Last value analogue input AI6 scale
15748	Calibration_AI1	0	°C/10, °F/10	0	-180	180	Analogue input AI1 differential
15749	Calibration_AI2	0	°C/10, °F/10	0	-180	180	Analogue input AI2 differential
15750	Calibration_AI3	0	digit	0	-1000	1000	Analogue input AI3 differential
15751	Calibration_AI4	0	digit	0	-1000	1000	Analogue input AI4 differential
15752	Calibration_AI5	0	digit	0	-1000	1000	Analogue input AI5 differential
15753	Calibration_AI6	0	digit	0	-1000	1000	Analogue input AI6 differential



Analogue Output Configuration

Project

- Thermostat Exercise M171PM
 - FreeEvolution
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs
 - Analogue Outputs V/I**
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes

Address	Name	Value	Um	Default	Min	Max	Description
15758	Cfg_AO1_AO5	2=Voltage modulat	num	0=Current modulation	0	2	Type of analogue outputAO1/AO5
15759	Cfg_AO2	0=Current modulation	num	0=Current modulation	0	2	Type of analogue outputAO2
15760	Cfg_AO3	0=Current modulation	num	0=Current modulation	0	2	Type of analogue outputAO3
15761	Cfg_AO4	0=Current modulation	num	0=Current modulation	0	2	Type of analogue outputAO4
15762	SubCfg_AO5	0	num	0	0	1	Subtype of analogue outputAO5

Chapter 12

Network

Goal:

Expansion connection to the base unit via CAN
BUS

M171P Networking Exercise

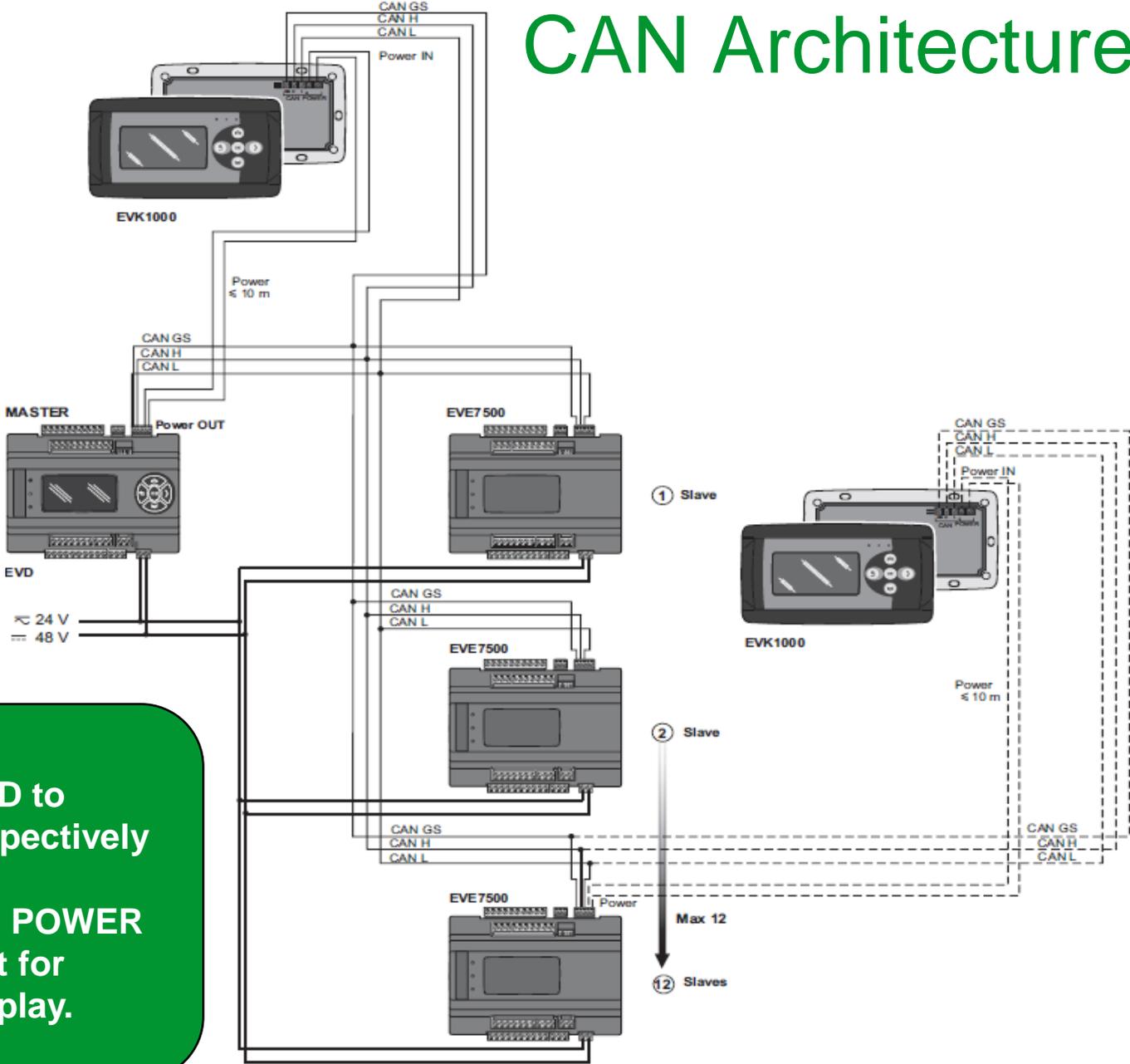


Goals:

- Connect an expansion module to Can Bus,
- Configure the physical I/O
- Read/write Digital & analogue I/O
- Monitor the communication between base unit & expansion

NOTE: Leave the CanOpen end resistor jumpers only to the endline Devices, in this case EVD1 and EVE1

CAN Architecture



Note: Connect GS,H,L of EVD to GS,H,L of Expansion respectively

DO NOT CONNECT together POWER OUT, POWER OUT is just for powering the remote display.

Creating New project's connection



2*click



2*click



Connection Configuration

The screenshot shows the 'Eliwell Free Studio Connection' interface. The 'Project' tree on the left lists 'FreeEvolution EVD_1' with sub-items: PLC, HMI, HMI Remote, CANopen, RS485, and Plugins. The main window is in the 'Networks list' tab, showing a table of devices to be added to the project. A green box highlights the 'FreeEvolution EVD' row, with a green star containing the number '1' below it. A dialog box on the right asks 'Add a new 'FreeEvolution EVD' to project?' with 'OK' and 'Annulla' buttons. A green star containing a question mark is next to the dialog box.

Project: Untitled

File Edit View Tools Options Help

Project: Untitled

General Networks list

Most recent projects

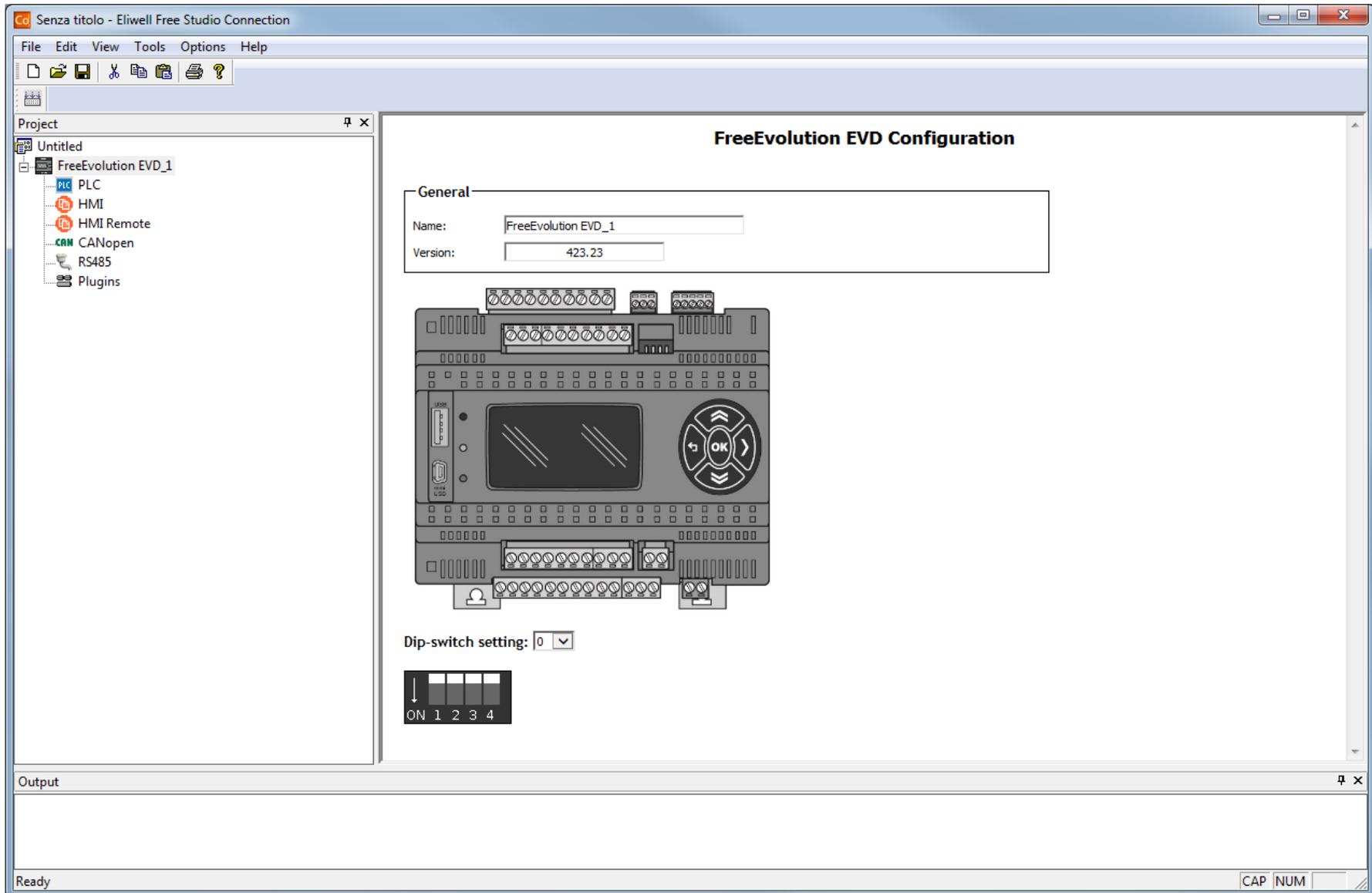
Add new device to project		
	FreeEvolution EVD	423
	FreeEvolution EVC	477
	Keyboard EVK	476
	FreeEvolution EVP	489

Dialog: Add a new 'FreeEvolution EVD' to project?

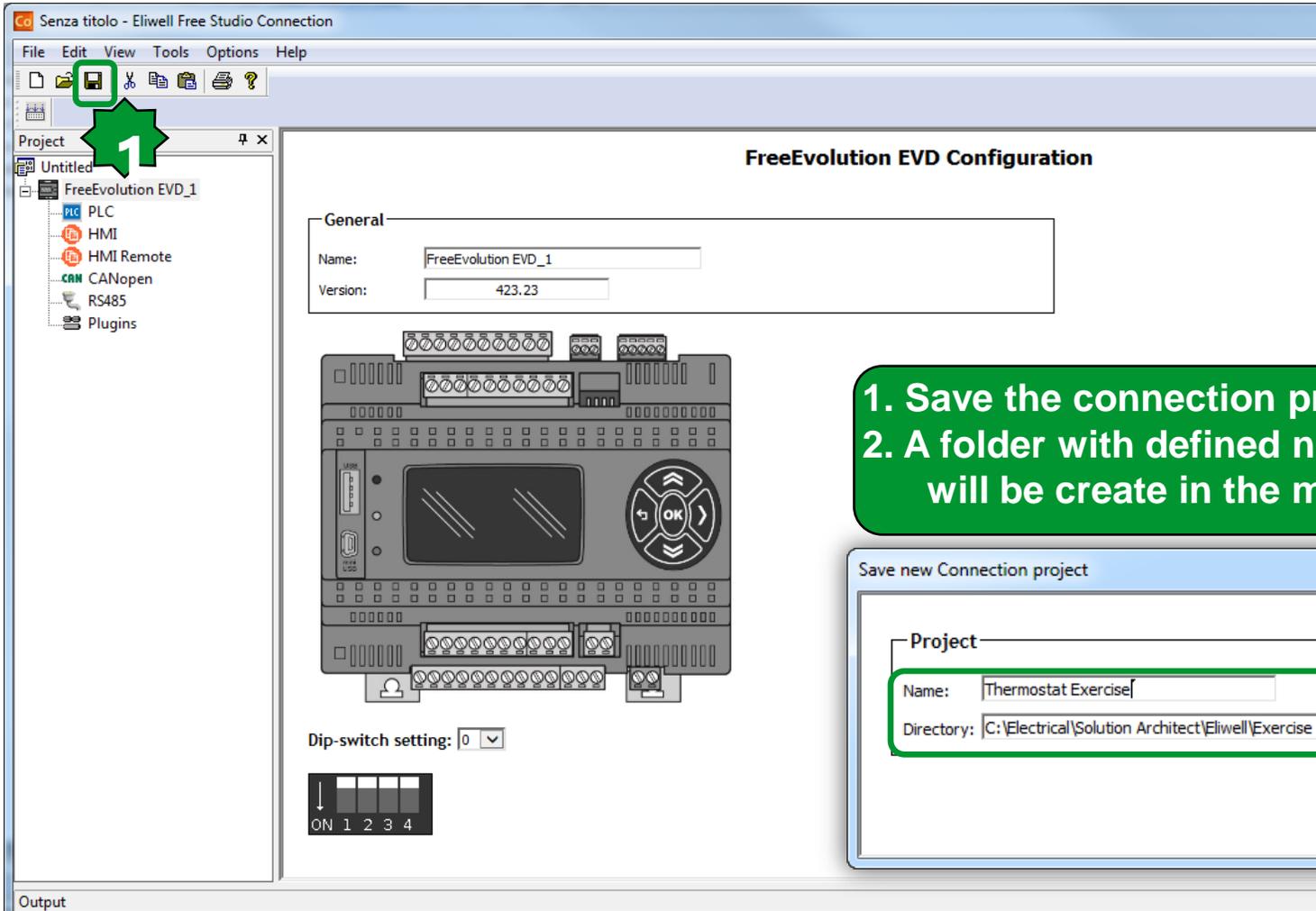
Buttons: OK, Annulla

1. Select the base unit, FreeEvolution EVD
2. Validate adding the controller

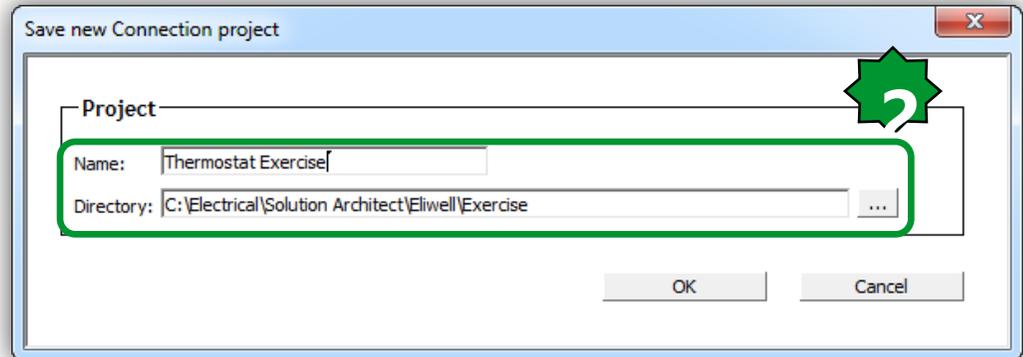
Define the Project Architecture



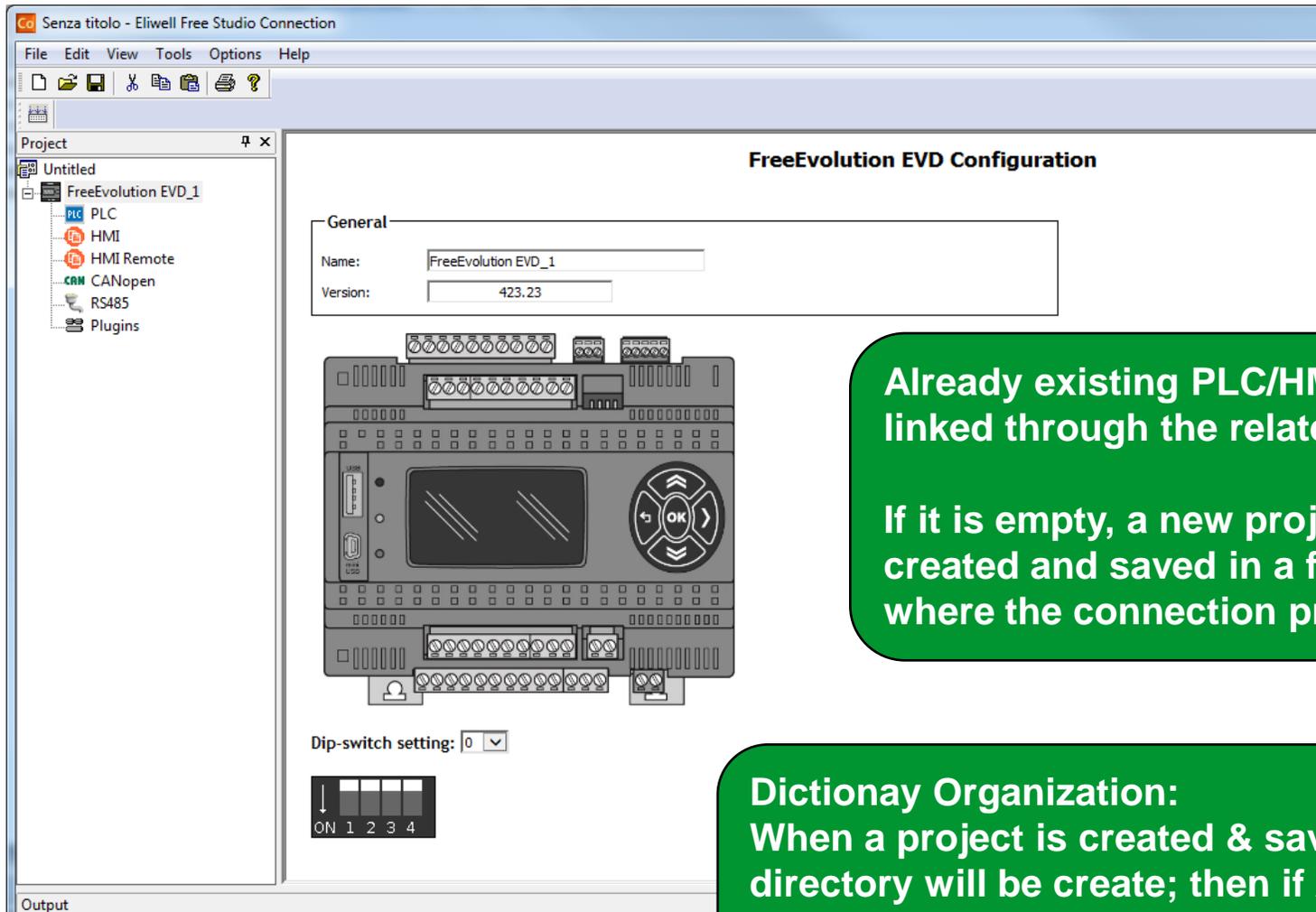
Saving Connection project



1. Save the connection project
2. A folder with defined name & *Name.CON* file will be create in the mentioned directory



Saved Project



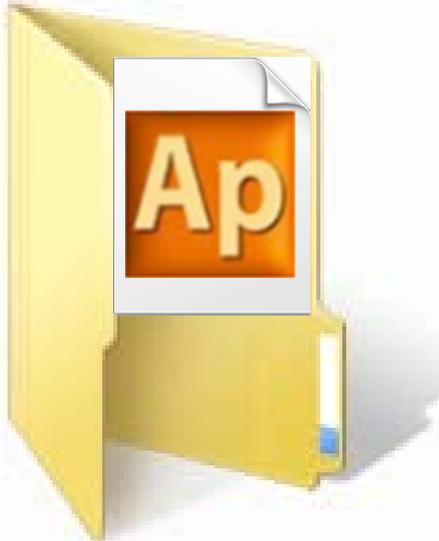
Already existing PLC/HMI project can be linked through the related project field.

If it is empty, a new project will be created and saved in a folder placed where the connection project is saved

Dictionary Organization:

When a project is created & saved from CO a directory will be create; then if AP created by new from CO; a directory of the project is created inside the CO directory

Project foldering & Saving Procedure



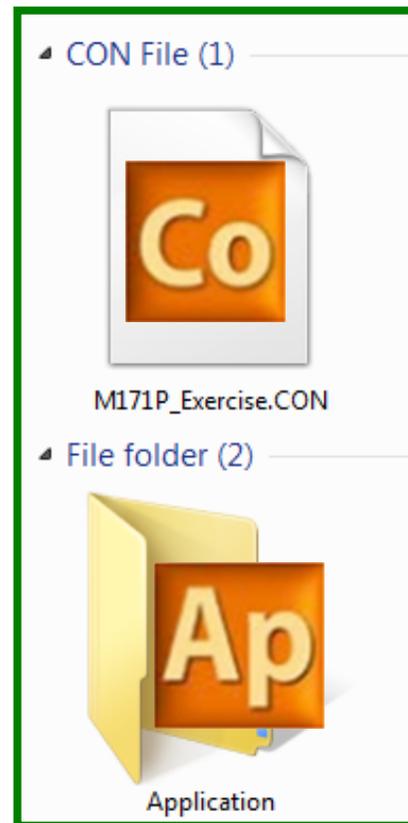
Application Folder
Projects name.PPJS



Connection Folder
Projects name.CON

**Copy/Cut & paste the application
folder inside the connection folder**

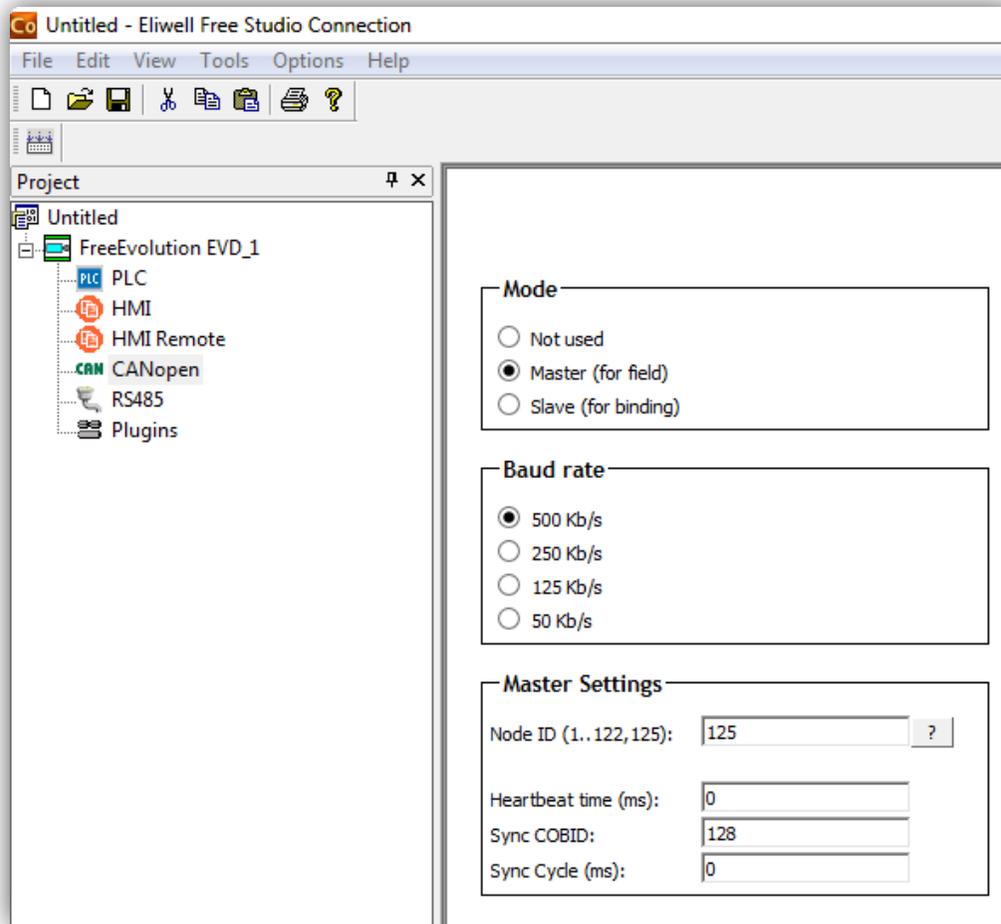
Project Folder



**Projects name.CON
must be locate in the
projects folder's root**

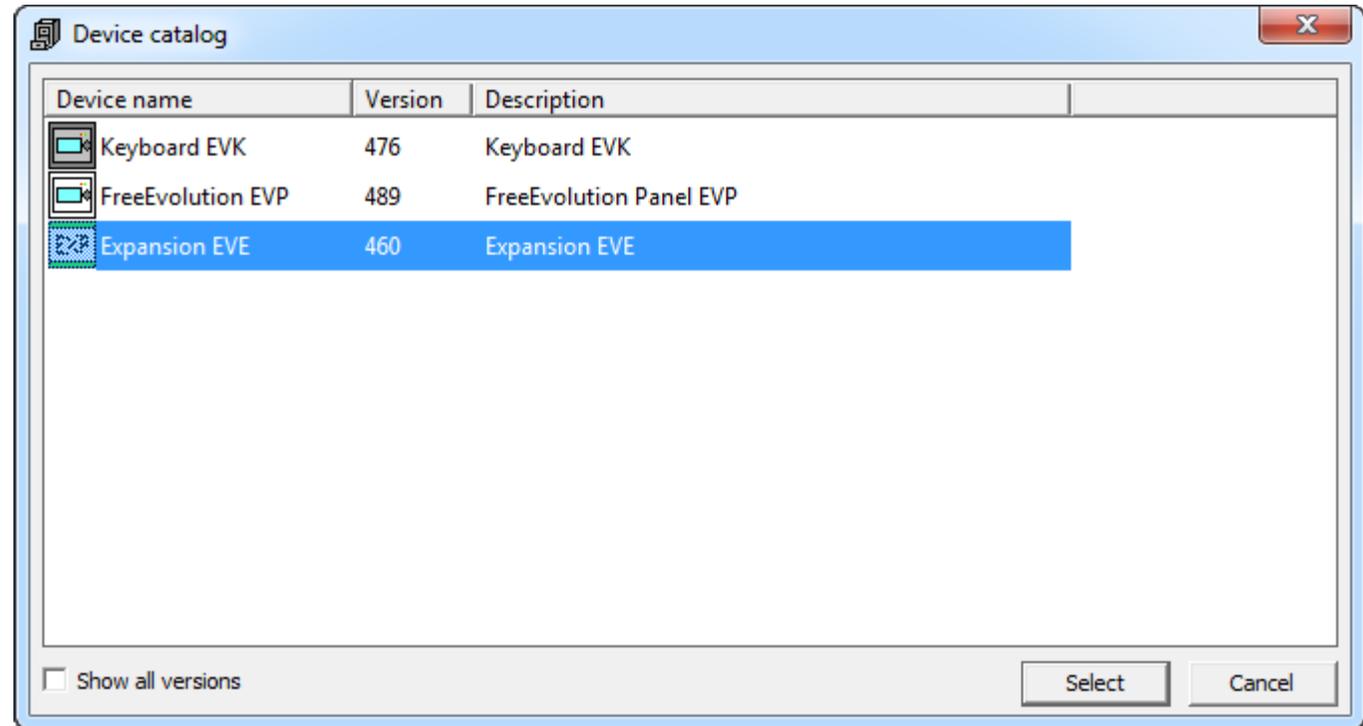
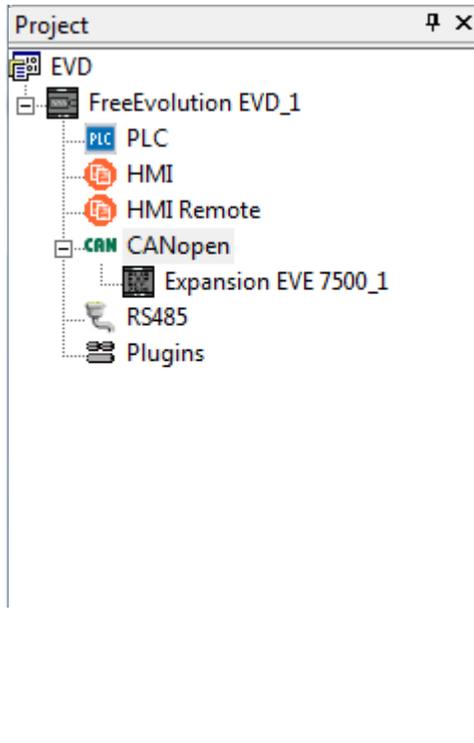


CANopen configuration



- The CanOpen address of EVD is 125, it will be written in the CONNEC.PAR file, CAN On Board parameters are not valid if the Evolution is Master on CAN.
- EVE must be set at the speed defined here (if changed the devices must be restarted, Factory default is 500Kb/s)

Add an expansion



Drag & drop from device catalogue to the CANopen
Or
CANopen ► Add ► Device catalogue ► Select the target



Expansion configuration

Expansion EVE 7500 Configuration

General | SDO Set | PDO Tx - Input | PDO Rx - Output

Network settings

Node number (1..122)	<input type="text" value="1"/>
Node Guard Period (ms)	<input type="text" value="200"/>
Life time Factor	<input type="text" value="3"/>
Boot time elapsed (ms)	<input type="text" value="2000"/>
Node heartbeat producer time (ms)	<input type="text" value="0"/>
Node heartbeat consumer time (ms)	<input type="text" value="0"/>
Master heartbeat consumer time (ms)	<input type="text" value="0"/>
Identity object check	<input type="checkbox"/>

PDO Tx communication settings

USER DEFINED Mode
 SYNC Mode
 EVENT Mode
 CYCLIC Mode ms

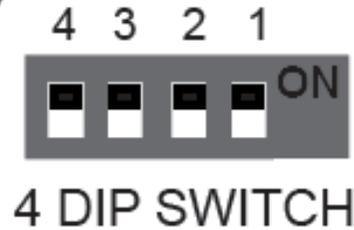
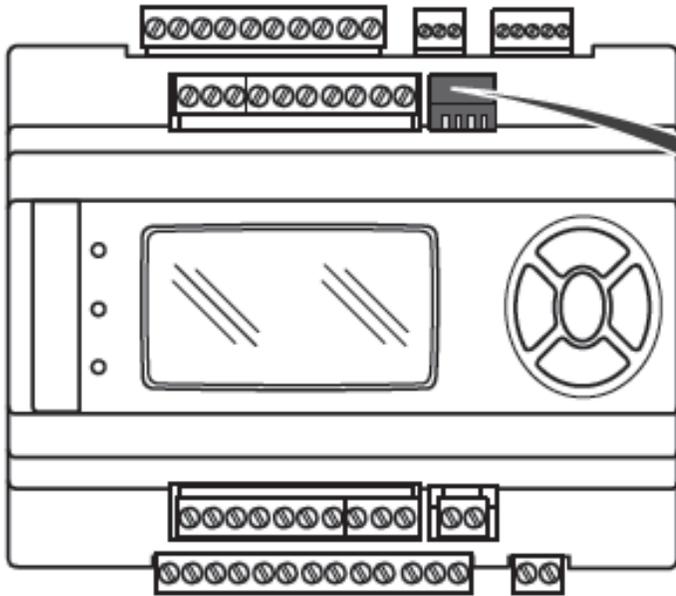
PDO Rx communication settings

USER DEFINED Mode
 SYNC Mode
 EVENT Mode

- Node Number is the address to be set on **Expansion Module via Dip Switch.**

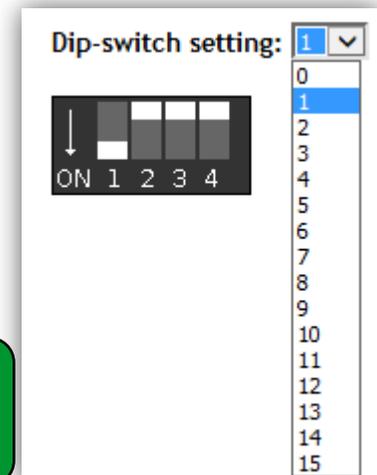
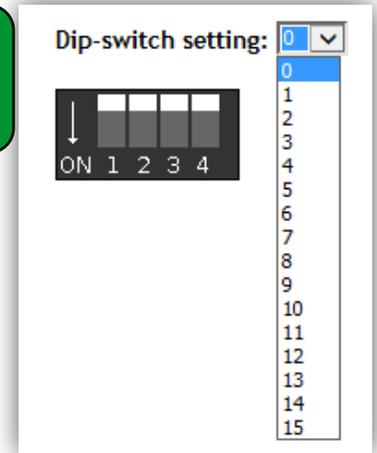
Expansion Dip switch setting ► Addressing

Node Number=Dip switch +1
1=0+1

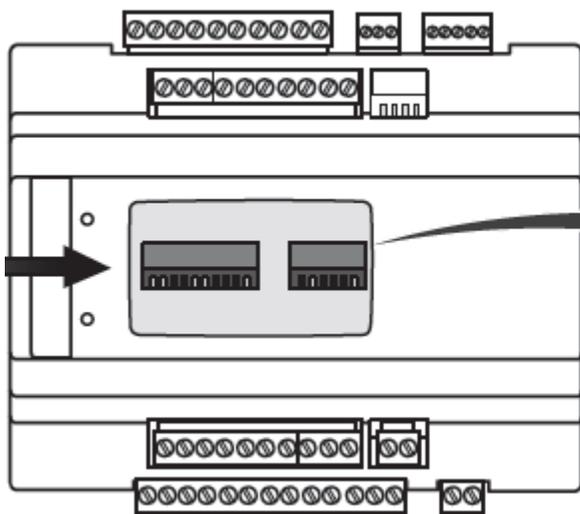


It is possible to connect up to 12 expansion+2 keyboard

Node Number=Dip switch +1
2=1+1



Expansion Module Dip Switches

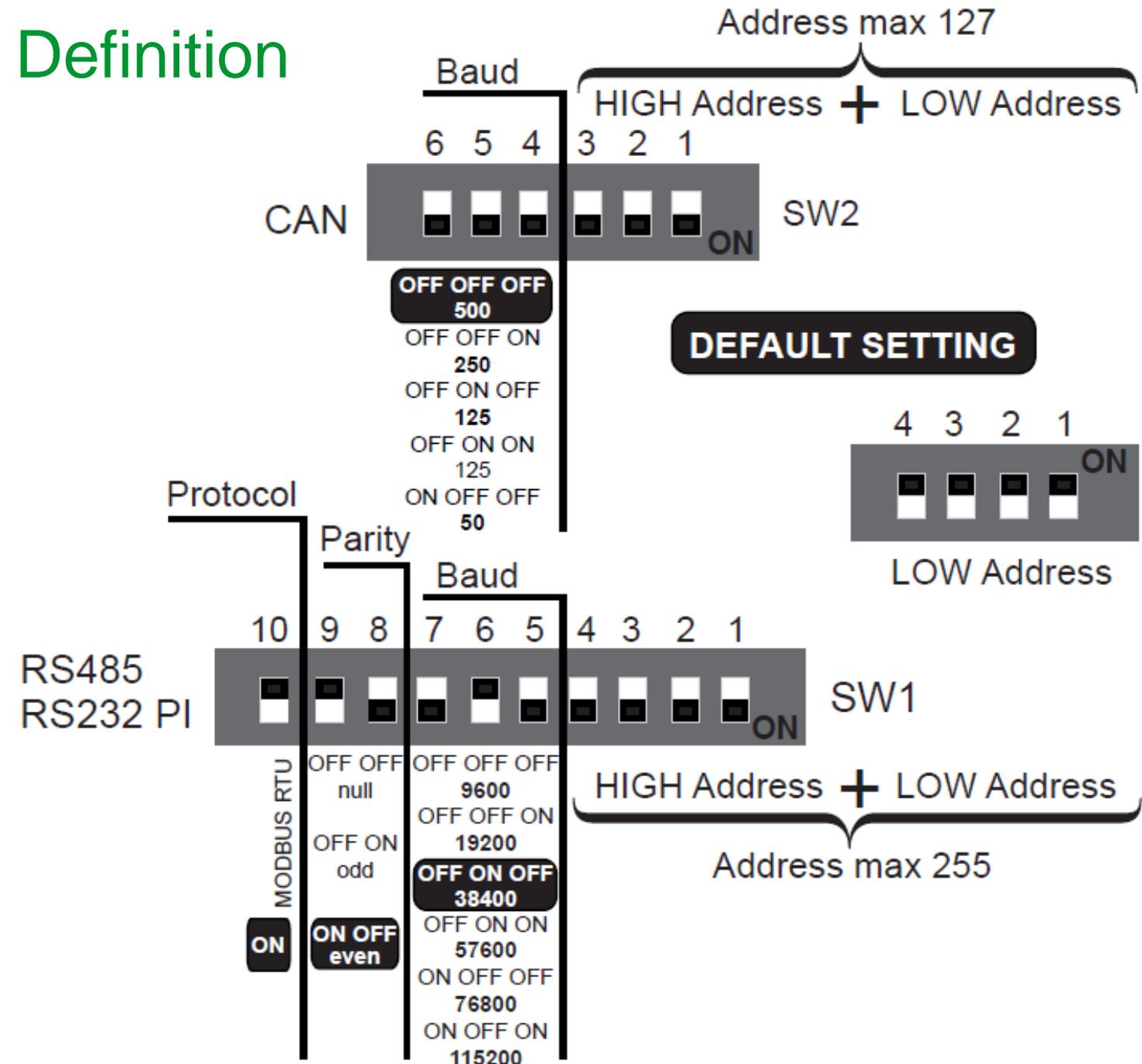


10 DIP SWITCH



6 DIP SWITCH

Dip Switches Definition



Linking Application Project

The screenshot illustrates the process of linking an application project in EVD.CON. The main window, titled "EVD.CON - Eliwell Free Studio Connection", shows a "Project" tree on the left with "FreeEvolution EVD_1" expanded to "PLC". The "PLC" item is highlighted with a green box and a green star with the number 1. The "PLC Configuration" dialog is open, showing the "General" tab. The "From Project" radio button is selected. The "PLC Project" field contains the path "C:\TrainingExercises\HVAC_Exercise\HVAC_Exercise.plcprj", and the "Browse..." button is highlighted with a green box and a green star with the number 2. An "Open" file dialog is overlaid on the "Browse..." button. The "Look in:" field shows "HVAC_Exercise". The file list contains "File folder (1)", "Download", "PPJS File (1)", and "HVAC_Exercise.ppjs" (2,636 KB), which is selected with a green box and a green star with the number 4. The "File name:" field at the bottom of the dialog contains "HVAC_Exercise.ppjs" and is highlighted with a green box and a green star with the number 3. The "Files of type:" field is set to "IEC61131 project files (*.PPJS)".

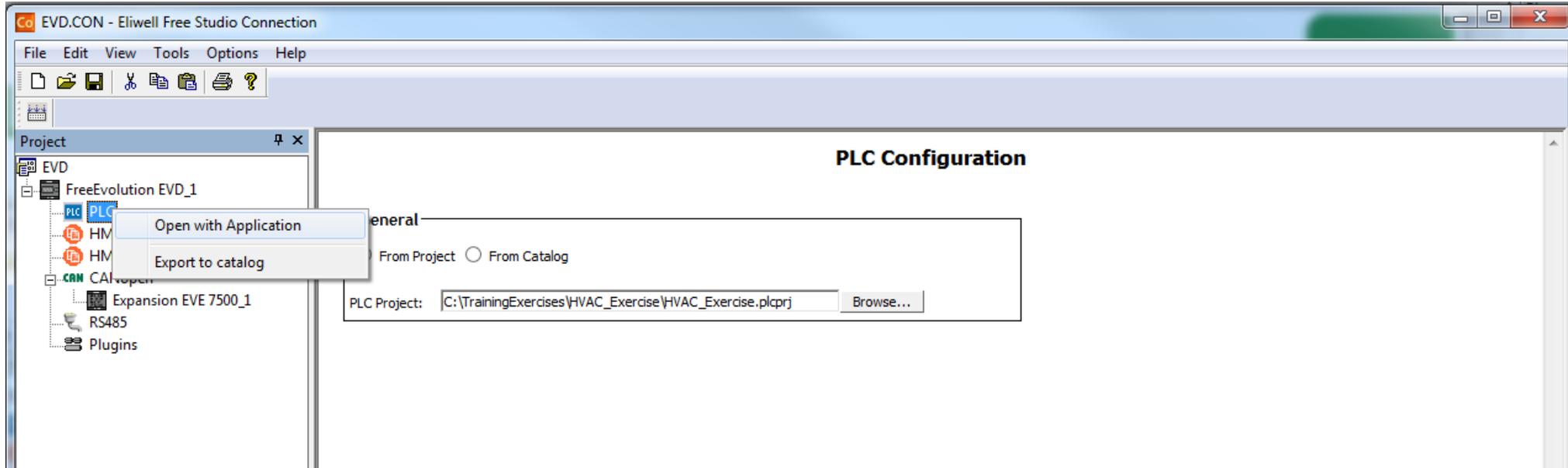
1

2

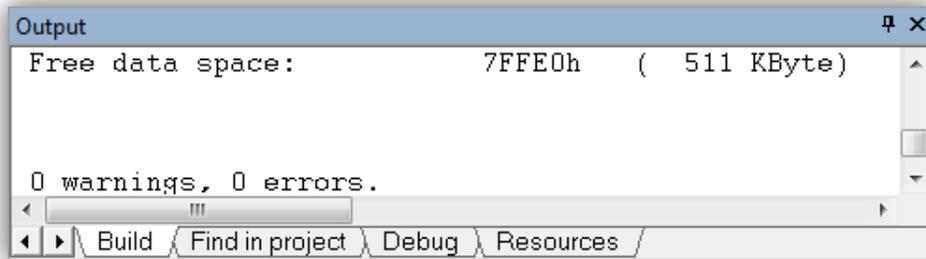
3

4

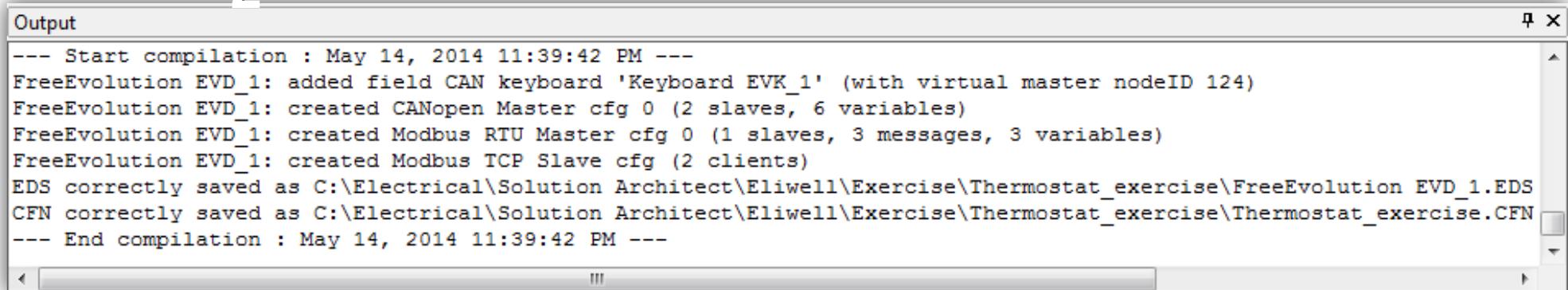
Launch Application via Connection



Build the connection



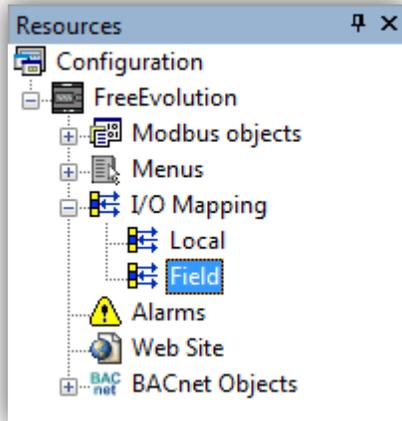
Note:
To apply the changes to the network,
free studio asks you to reboot.



Define Application Variables to be linked to Physical I/O of Expansion module

The set of PLC objects you can read or write is made of:

- Status variables, created with FREE Studio Application (not BIOS).
- Field variables, created with FREE Studio Application.



Field I/O Mapping

Buttons: Add, Remove, Up, Down

#	Name	Type	In/Out	Description
1	NTC_Probe_Exp	INT	Input	AIE1 analogue input
2	Output_Cooling_Exp	BOOL	Output	DOE1 digital output
3	Alarm_Exp	BOOL	Output	DOE2 digital output
4	Enable_Exp	BOOL	Input	DI1 digital input
5	FB_Status_Exp	BOOL	Output	DOE3 digital output

Callouts: 1 (Add button), 2 (Name column), 3 (Type column), 4 (In/Out column)

1. Add
2. Name it
3. Define the type
4. Define the In/Out

- **NOTE:** If the Status Variables is defined in order to be linked to an Expansion Module input it must be set as not READ ONLY

Expansion module configuration

Expansion EVE 7500 Configuration

General			SDO Set			PDO Tx - Input		PDO Rx - Output		
#	Idx	Sub	PDO	Bit	COBID	Object Name	Type	Size	Label	DataBlock
1	6000	1	1	0	181	Read Input 1h to 8h	BOOL	1		
2	6000	1	1	1	181	Read Input 1h to 8h	BOOL	1		
3	6000	1	1	2	181	Read Input 1h to 8h	BOOL	1		
4	6000	1	1	3	181	Read Input 1h to 8h	BOOL	1		
5	6000	1	1	4	181	Read Input 1h to 8h	BOOL	1		
6	6000	1	1	5	181	Read Input 1h to 8h	BOOL	1		
7	6000	1	1	6	181	Read Input 1h to 8h	BOOL	1		
8	6000	1	1	7	181	Read Input 1h to 8h	BOOL	1		
9	6000	2	1	8	181	Read Input 9h to 16h	BOOL	1		
10	6000	2	1	9	181	Read Input 9h to 16h	BOOL	1		
11	6000	2	1	10	181	Read Input 9h to 16h	BOOL	1		
12	6000	2	1	11	181	Read Input 9h to 16h	BOOL	1		
13	6401	1	2	0	281	Analogue Input 1	INT	16		
14	6401	2	2	16	281	Analogue Input 2	INT	16		
15	6401	3	2	32	281	Analogue Input 3	INT	16		
16	6401	4	2	48	281	Analogue Input 4	INT	16		
17	6401	5	3	0	381	Analogue Input 5	INT	16		
18	6401	6	3	16	381	Analogue Input 6	INT	16		
19	2230	0	5	0	481	Counter	UDINT	32		
20	2232	0	5	32	481	Frequency	UDINT	32		

Digital Inputs

Dip switches

Analogue Inputs

Fast Digital Input

- Select the Analogue Input 1 of Exp_1, PDO Tx – Input
 - Press Assign
 - Link the Physical input to the desired Application variable
 - Repeat this for each Exp Input used in your project
 - Use PDO Rx – Output for Exp Output

Assign/UnAssign of physical I/O

Expansion EVE 7500 Configuration

General

SDO Set

PDO Tx - Input

PDO Rx - Output



Assign UnAssign

1. PDO Tx-Input
2. Choose PLC variable DI
3. Choose PLC variable AI
4. Assign

#	Idx	Sub	PDO	Bit	COBID	Object Name	Type	Size	Label	DataBlock
1	6000	1	1	0	181	Read Input 1h to 8h	BOOL	1	DI1_E	IX10.0
2	6000	1	1	1	181	Read Input 1h to 8h	BOOL	1	DI2_E	IX10.1
3	6000	1	1	2	181	Read Input 1h to 8h	BOOL	1		
4	6000	1	1	3	181	Read Input 1h to 8h	BOOL	1		
5	6000	1	1	4	181	Read Input 1h to 8h	BOOL	1		
6	6000	1	1	5	181	Read Input 1h to 8h	BOOL	1		
7	6000	1	1	6	181	Read Input 1h to 8h	BOOL	1		
8	6000	1	1	7	181	Read Input 1h to 8h	BOOL	1		
9	6000	2	1	8	181	Read Input 9h to 16h	BOOL	1		
10	6000	2	1	9	181	Read Input 9h to 16h	BOOL	1		
11	6000	2	1	10	181	Read Input 9h to 16h	BOOL	1		
12	6000	2	1	11	181	Read Input 9h to 16h	BOOL	1		
13	6401	1	2	0	281	Analogue Input 1	INT	16	AI1_E	IW11.0
14	6401	2	2	16	281	Analogue Input 2	INT	16		
15	6401	3	2	32	281	Analogue Input 3	INT	16	AI3_E	IW11.1
16	6401	4	2	48	281	Analogue Input 4	INT	16		
17	6401	5	3	0	381	Analogue Input 5	INT	16		
18	6401	6	3	16	381	Analogue Input 6	INT	16		
19	2230	0	5	0	481	Counter	UDINT	32		
20	2232	0	5	32	481	Frequency	UDINT	32		



Choose PLC variable

Filter:

FreeEvolution EVD_1: DI1_E (BOOL)

FreeEvolution EVD_1: DI2_E (BOOL)

Choose PLC variable

Filter:

FreeEvolution EVD_1: AI1_E (INT) - NTC Probe

FreeEvolution EVD_1: AI3_E (INT)

FreeEvolution EVD_1: Ambient_Temperature (INT)

Assign/UnAssign of physical I/O

Expansion EVE 7500 Configuration

4

General SDO Set PDO Tx - Input **PDO Rx - Output**

Assign UnAssign

1

#	Idx	Sub	PDO	Bit	COBID	Object Name	Type	Size	Label	DataBlock
1	6200	1	1	0	201	Write Output 1h to 8h	BOOL	1		
2	6200	1	1	1	201	Write Output 1h to 8h	BOOL	1		
3	6200	1	1	2	201	Write Output 1h to 8h	BOOL	1	Output_Cooling_Exp	QX11.0
4	6200	1	1	3	201	Write Output 1h to 8h	BOOL	1	Alarm_Exp	QX11.1
5	6200	1	1	4	201	Write Output 1h to 8h	BOOL	1		
6	6200	1	1	5	201	Write Output 1h to 8h	BOOL	1		
7	6200	1	1	6	201	Write Output 1h to 8h	BOOL	1		
8	6411	1	2	0	301	Analogue Output 1	INT	16		
9	6411	2	2	16	301	Analogue Output 2	INT	16		
10	6411	3	2	32	301	Analogue Output 3	INT	16		
11	6411	4	2	48	301	Analogue Output 4	INT	16		
12	6411	5	3	0	401	Analogue Output 5	INT	16		
13	21c0	0	5	0	501	LED1	USINT	8		
14	21c1	0	5	8	501	LED2	USINT	8		
15	21c2	0	5	16	501	LED3	USINT	8		

2

3

1. PDO Rx-Output
2. Choose PLC variable DO
3. Choose PLC variable AO
4. Assign

5

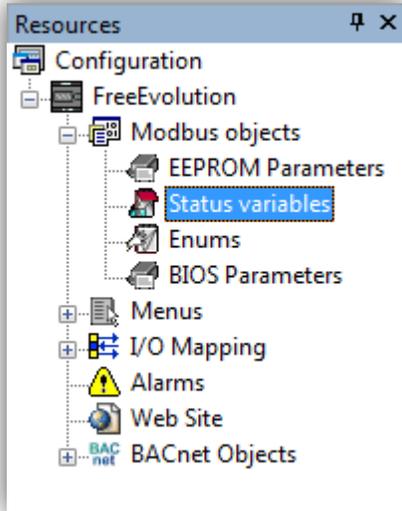
Choose PLC variable

Filter:

FreeEvolution EVD_1: OutputCoolingExp (BOOL) - DO1_E
 FreeEvolution EVD_1: Alarm_Exp (BOOL) - DO2_E
 FreeEvolution EVD_1: FB_Status_Exp (BOOL) - DO3_E

Status Variable

- Create Status Variables readable via Modbus

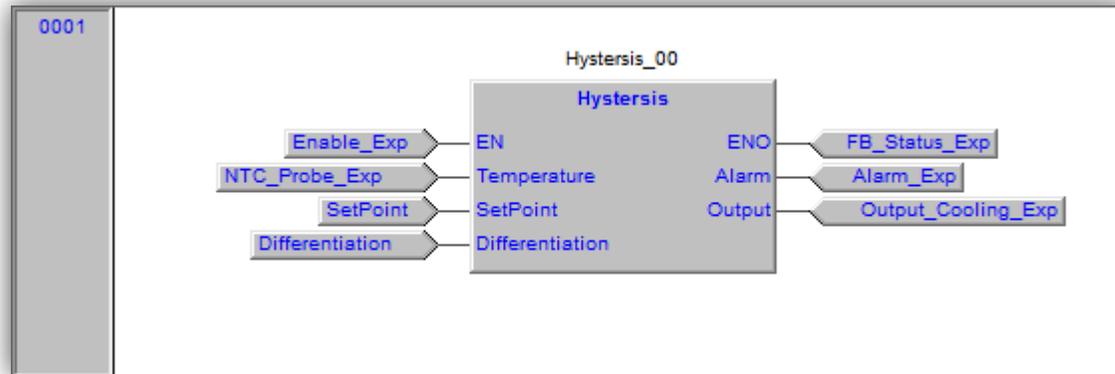
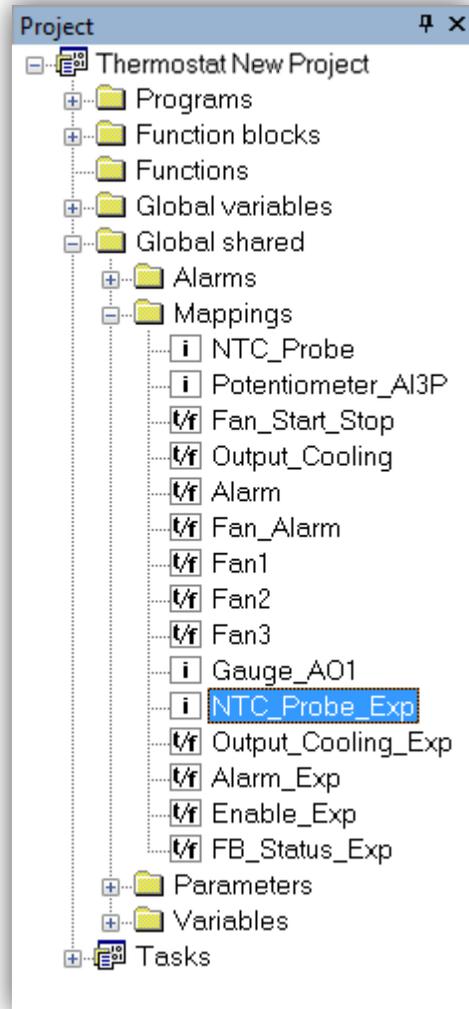


Status Variables

 Add
  Remove
  Recalc

#	Address	Name	Device type	Application type	Default value	Min	Max	Scale	Offset	Unit	Form...	AccessLevel	Read only
1	8960	Ambiant_Temp	Signed 16-bit	INT				1	0	°C	XXX.Y	Always visible	True
2	8961	Hystersis_FB_Status	Boolean	BOOL				1	0			Always visible	True
3	8962	EXP1_CAN_Status	Boolean	BOOL				1	0			Always visible	True
4	8963	Probe_EXP1_Err	Signed 16-bit	INT				1	0			Always visible	True

Communication Alarm Checking, Link Exp's I/O



```

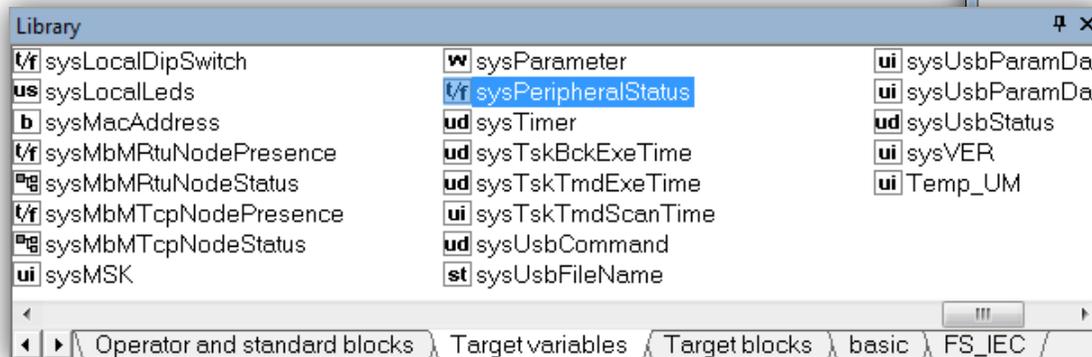
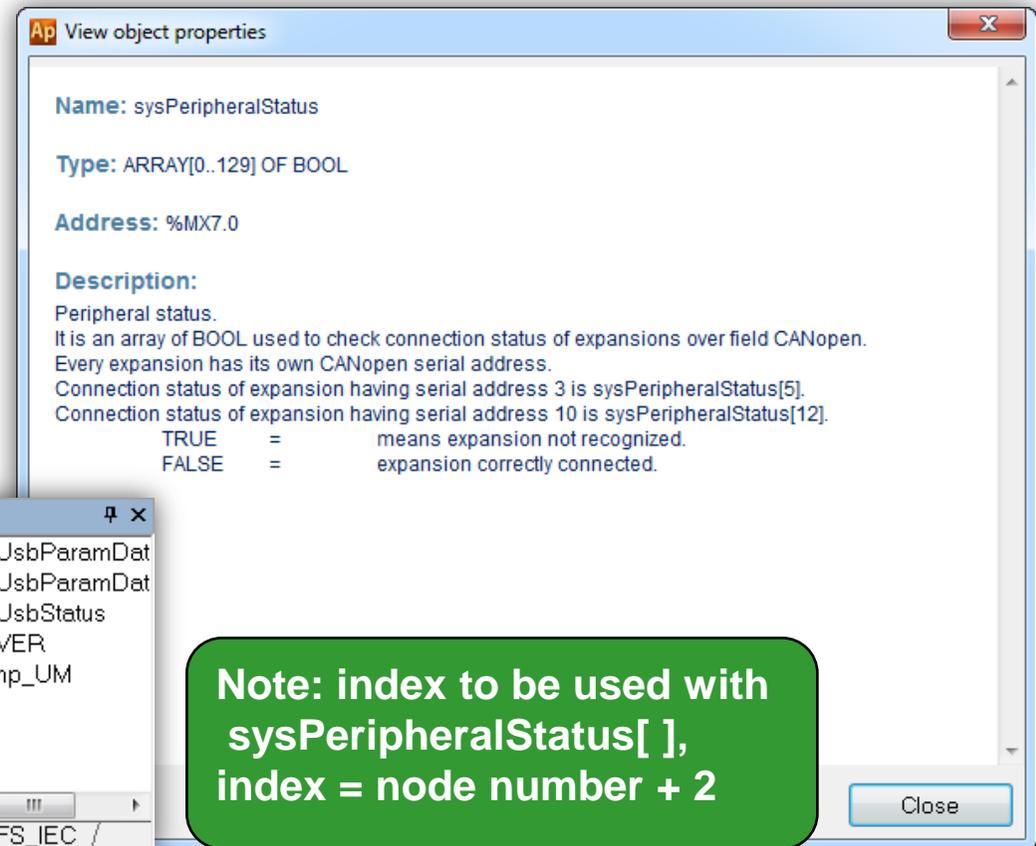
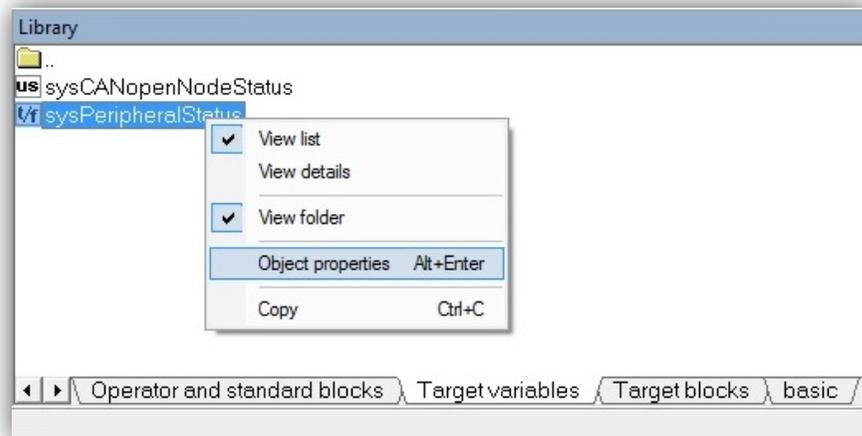
0001  (* Hysteresis FBD *)
0002
0003  if Temperature >= Setpoint + Differentiation then
0004      Output := TRUE;
0005  end_if;
0006
0007  if Temperature < Setpoint then
0008      Output := FALSE;
0009  end_if;
0010
0011  (* Probe disconnection detector *)
0012
0013  if Temperature = -32768 then
0014      Alarm := TRUE;
0015      else Alarm := FALSE;
0016  end_if;
0017
0018
  
```

Application Project

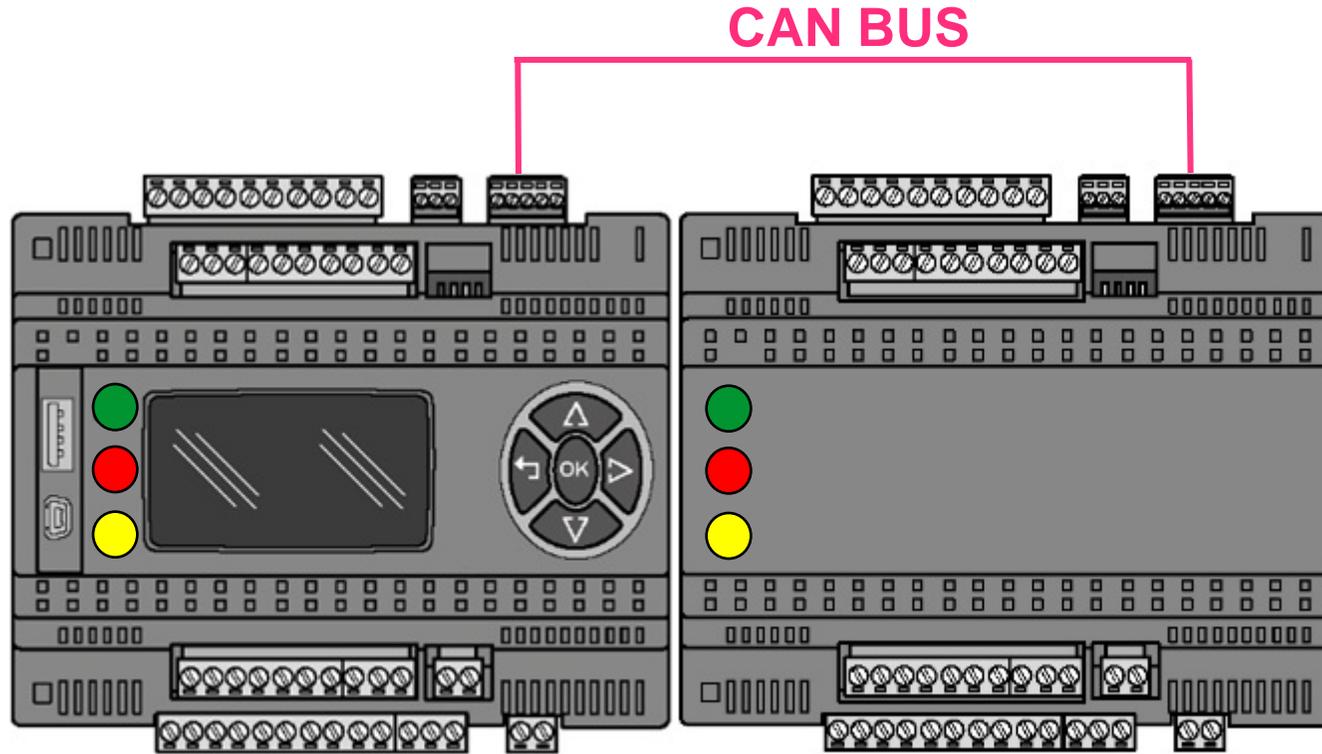


You can create your Application project in the usual way using local and field I/O

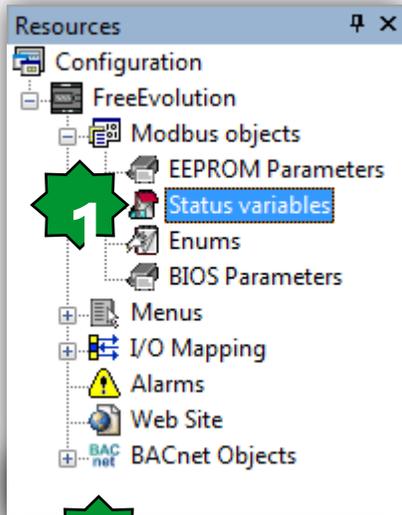
- `sysPeripheralStatus[3]` tells the communication status with `EVE_1`



Physical architecture & monitoring CAN Bus



LED management



1. Resources ► Status variables
2. Add
3. Define: Name, device & application types



Status Variables

 Add
  Remove
  Recalc

#	Address	Name	Device type	Application type	Unit	Format	AccessLevel	Read only
1	8960	Ambiant_Temp	Signed 16-bit	INT	°C	XXX.Y	Always visible	True
2	8961	Hystersis_FB_Status	Boolean	BOOL			Always visible	True
3	8962	EXP1_CAN_Status	Boolean	BOOL			Always visible	True
4	8963	Probe_EXP1_Err	Signed 16-bit	INT			Always visible	True
5	8965	Expansion_Alarm	Boolean	BOOL			Always visible	True
6	8964	Green_LED_EXP1	Unsigned 8-bit	USINT			Always visible	True
7	8966	Red_LED_EXP1	Unsigned 8-bit	USINT			Always visible	True





Expansion Module LED Values/Colors

- FreeEvolution EVD_1
 - BIOS parameters
 - All parameters
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes
- Expansion EVE 7500_1
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs
 - Analogue Outputs V/I
 - I/O Values
 - Dip Switch Values
 - Led Values

Led Values							
Address	Name	Value	Um	Default	Min	Max	Description
8640	LED1	0=Off	num	0=Off	0	2	Led green
8641	LED2	0=Off	num	0=Off	0	2	Led red
8642	LED3	0=Off	num	0=Off	0	2	Led yellow



LED assignment

Expansion EVE 7500 Configuration

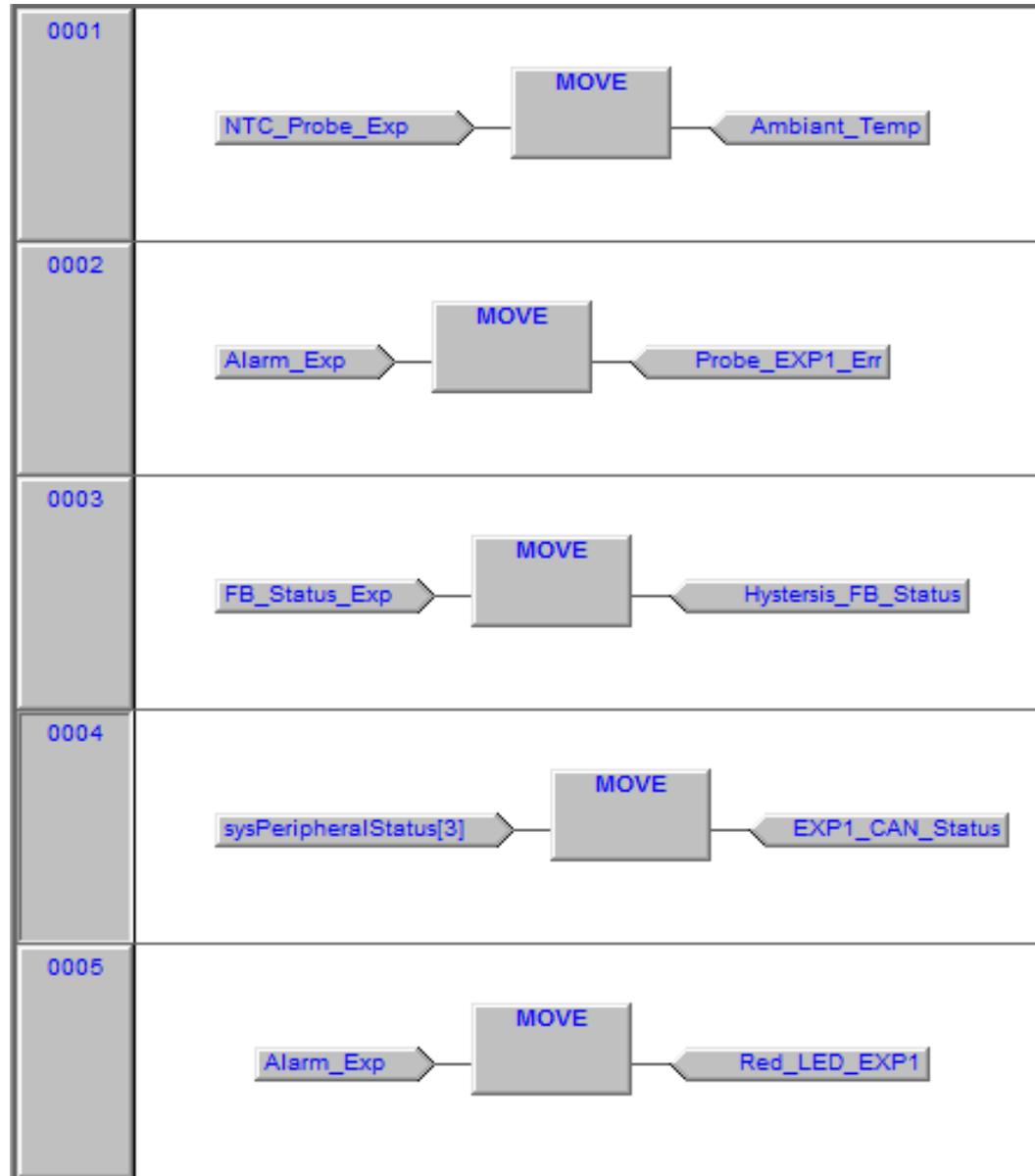
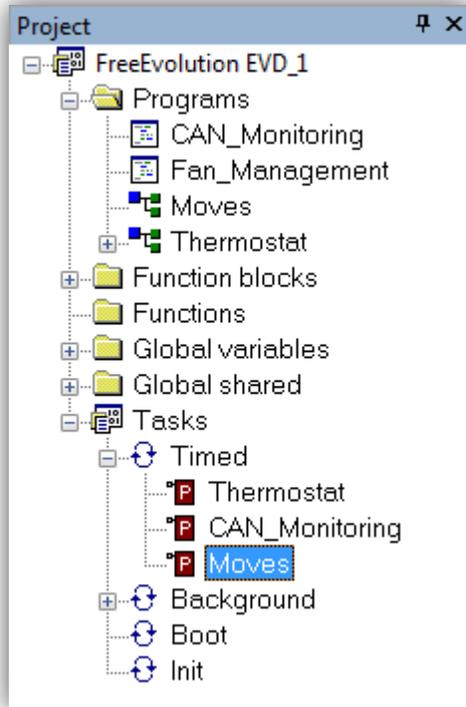
General		SDO Set		PDO Tx - Input		PDO Rx - Output				
Assign		UnAssign								
#	Idx	Sub	PDO	Bit	COBID	Object Name	Type	Size	Label	DataBlock
1	6200	1	1	0	201	Write Output 1h to 8h	BOOL	1		
2	6200	1	1	1	201	Write Output 1h to 8h	BOOL	1		
3	6200	1	1	2	201	Write Output 1h to 8h	BOOL	1	Output_Cooling_Exp	QX11.0
4	6200	1	1	3	201	Write Output 1h to 8h	BOOL	1	Alarm_Exp	QX11.1
5	6200	1	1	4	201	Write Output 1h to 8h	BOOL	1		
6	6200	1	1	5	201	Write Output 1h to 8h	BOOL	1		
7	6200	1	1	6	201	Write Output 1h to 8h	BOOL	1		
8	6411	1	2	0	301	Analogue Output 1	INT	16		
9	6411	2	2	16	301	Analogue Output 2	INT	16		
10	6411	3	2	32	301	Analogue Output 3	INT	16		
11	6411	4	2	48	301	Analogue Output 4	INT	16		
12	6411	5	3	0	401	Analogue Output 5	INT	16		
13	21c0	0	5	0	501	LED1	USINT	8	Green_LED_EXP1	MW110.4
14	21c1	0	5	8	501	LED2	USINT	8	Red_LED_EXP1	MW110.6
15	21c2	0	5	16	501	LED3	USINT	8		

Choose PLC variable

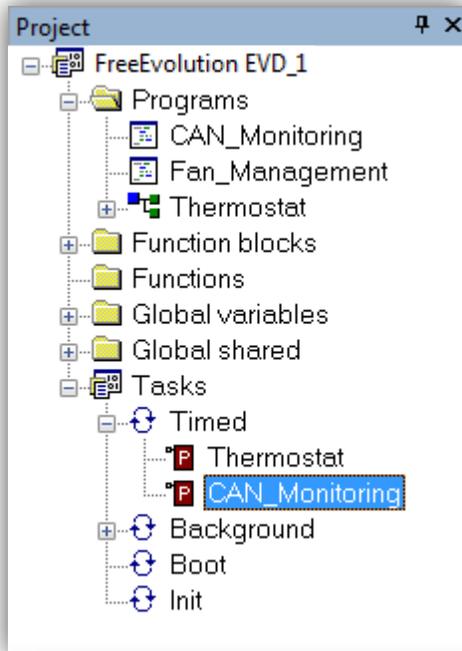
Filter:

FreeEvolution EVD_1: Green_LED_EXP1 (USINT)
FreeEvolution EVD_1: Red_LED_EXP1 (USINT)

Status/Move function



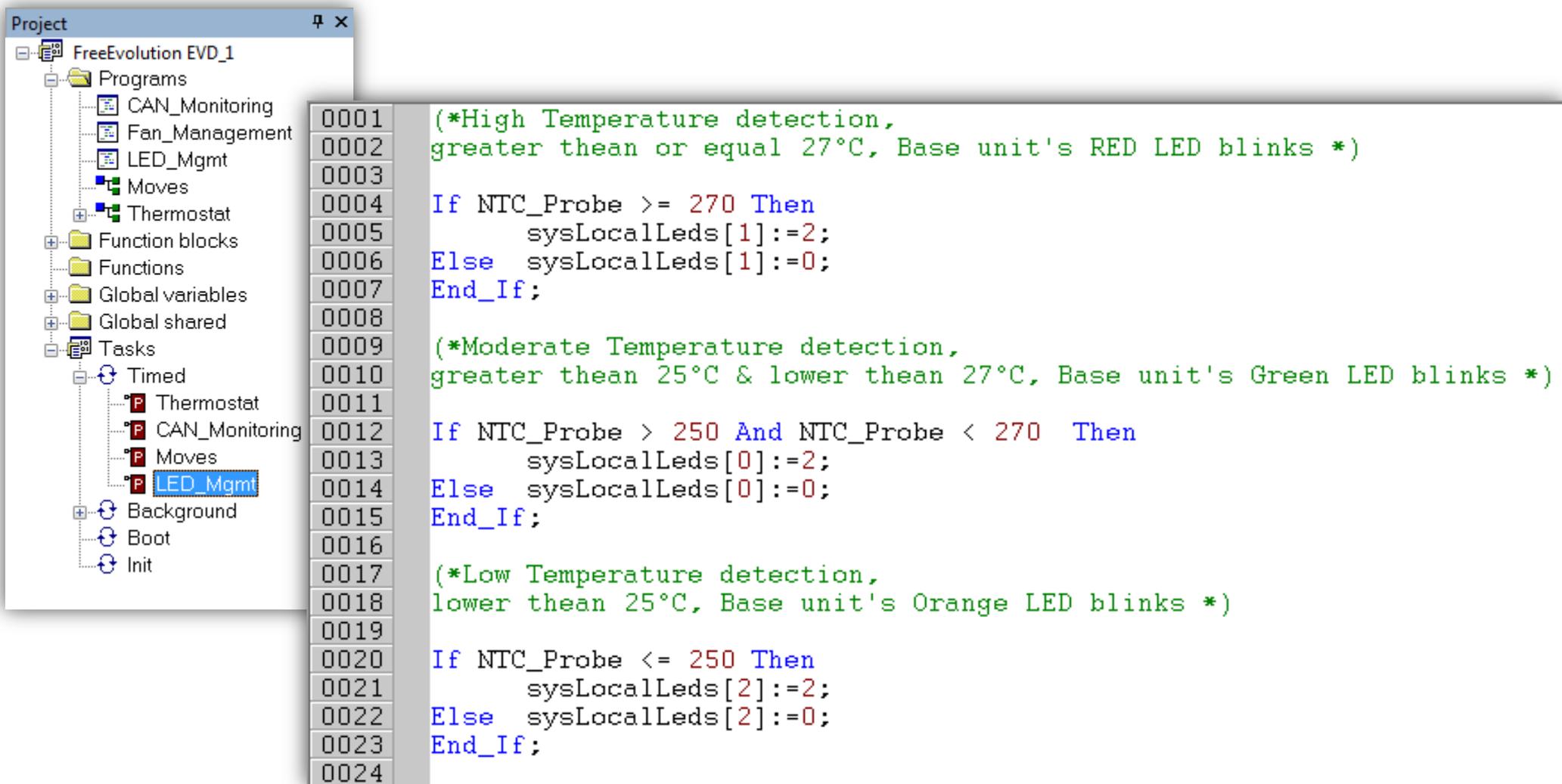
CAN monitoring program



1. Project ► Programs ► new program
2. Name it as: EVE_Comm
3. Assign it to the timed task
4. Program
5. Communication configuration ► OK

```
0001
0002 (*Green LED blinks when the communication is working*)
0003
0004 Green_LED_EXP1:=2;
0005
0006 (* To Monitor the status of the CAN communication between the base unit and first expansion module*)
0007
0008 Expansion_Alarm:=sysPeripheralStatus[3];
0009
```

Base Unit LED management



The screenshot displays a project editor interface. On the left, a 'Project' window shows a tree view for 'FreeEvolution EVD_1'. The tree includes folders for 'Programs', 'Function blocks', 'Functions', 'Global variables', and 'Global shared', and tasks for 'Timed', 'Background', 'Boot', and 'Init'. Under 'Programs', there are sub-folders for 'CAN_Monitoring', 'Fan_Management', 'LED_Mgmt', 'Moves', and 'Thermostat'. Under 'Timed' tasks, there are sub-tasks for 'Thermostat', 'CAN_Monitoring', 'Moves', and 'LED_Mgmt', with 'LED_Mgmt' highlighted in blue.

The main code editor shows the following script:

```
0001 (*High Temperature detection,  
0002 greater than or equal 27°C, Base unit's RED LED blinks *)  
0003  
0004 If NTC_Probe >= 270 Then  
0005     sysLocalLeds[1]:=2;  
0006 Else sysLocalLeds[1]:=0;  
0007 End_If;  
0008  
0009 (*Moderate Temperature detection,  
0010 greater than 25°C & lower than 27°C, Base unit's Green LED blinks *)  
0011  
0012 If NTC_Probe > 250 And NTC_Probe < 270 Then  
0013     sysLocalLeds[0]:=2;  
0014 Else sysLocalLeds[0]:=0;  
0015 End_If;  
0016  
0017 (*Low Temperature detection,  
0018 lower than 25°C, Base unit's Orange LED blinks *)  
0019  
0020 If NTC_Probe <= 250 Then  
0021     sysLocalLeds[2]:=2;  
0022 Else sysLocalLeds[2]:=0;  
0023 End_If;  
0024
```

LED management by Enumerators

Resources

- Configuration
 - FreeEvolution EVD_1
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - LEDenums**
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects

Resources

- Configuration
 - FreeEvolution EVD_1
 - Modbus objects
 - EEPROM Parameters
 - Status variables**
 - Enums
 - LEDEnum
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects

FreeEvolution 'LEDenums' Enumerator

Add Remove

#	Value	Description
1	0	0=off
2	1	1=on
3	2	2=blink

Status Variables

Add Remove Recalc

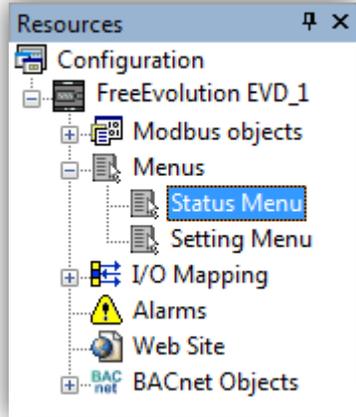
#	Address	Name	Device type	Application type	Unit	Format	AccessLevel	Read only
1	8960	Ambiant_Temp	Signed 16-bit	INT	°C	XXX.Y	Always visible	True
2	8961	Hystersis_FB_Status	Boolean	BOOL			Always visible	True
3	8962	EXP1_CAN_Status	Boolean	BOOL			Always visible	True
4	8963	Probe_EXP1_Err	Signed 16-bit	INT			Always visible	True
5	8965	Expansion_Alarm	Boolean	BOOL			Always visible	True
6	8964	Green_LED_EXP1	LEDEnum	USINT			Always visible	True
7	8966	Red_LED_EXP1	LEDEnum	USINT			Always visible	True

- Signed 16-bit
- Signed 32-bit
- Unsigned 16-bit
- Unsigned 32-bit
- Real
- Boolean
- Signed 8-bit
- Unsigned 8-bit
- String
- LEDEnum**



Menus/Status

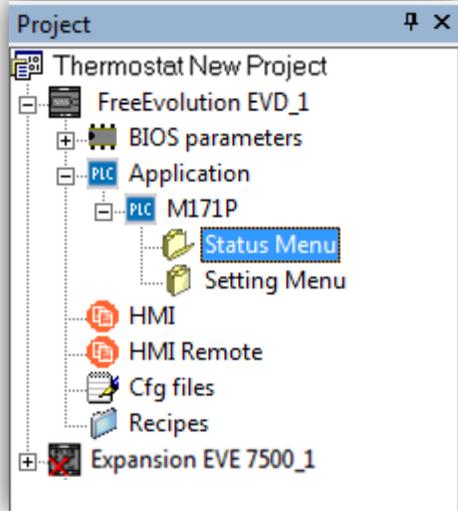
Create folder to be shown on Device



'Status Menu' Menu

Add Remove Up Down

#	Name	Description
6	Red_LED_EXP1	
5	Green_LED_EXP1	
4	Probe_EXP1_Err	
3	EXP1_CAN_Status	
2	Hystersis_FB_Status	
1	Ambiant_Temp	



Status Menu

Address	Name	Value	Um	Default	Min	Max	Description
8960	Ambiant_Temp	0.0	°C				
8961	Hystersis_FB_Status						
8962	EXP1_CAN_Status						
8963	Probe_EXP1_Err						
8964	Green_LED_EXP1						
8966	Red_LED_EXP1						



Menus/Setting

Create folder to be shown on Device

Resources

- Configuration
 - FreeEvolution EVD_1
 - Modbus objects
 - Menus
 - Status Menu
 - Setting Menu
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects

'Setting Menu' Menu

Add
 Remove
 Up
 Down

#	Name	Description
1	SetPoint	
2	Differentiation	

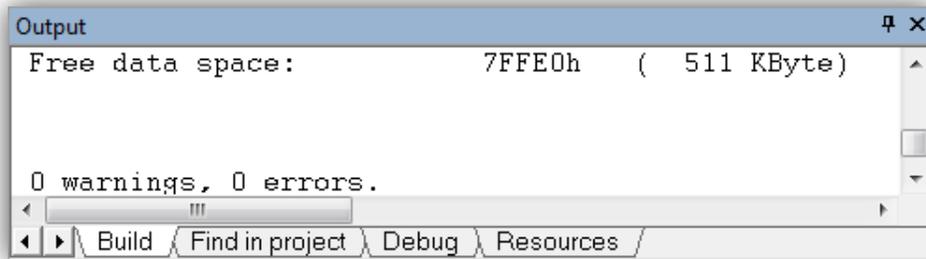
Project

- Thermostat New Project
 - FreeEvolution EVD_1
 - BIOS parameters
 - PLC Application
 - PLC M171P
 - Status Menu
 - Setting Menu
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes
 - Expansion EVE 7500_1

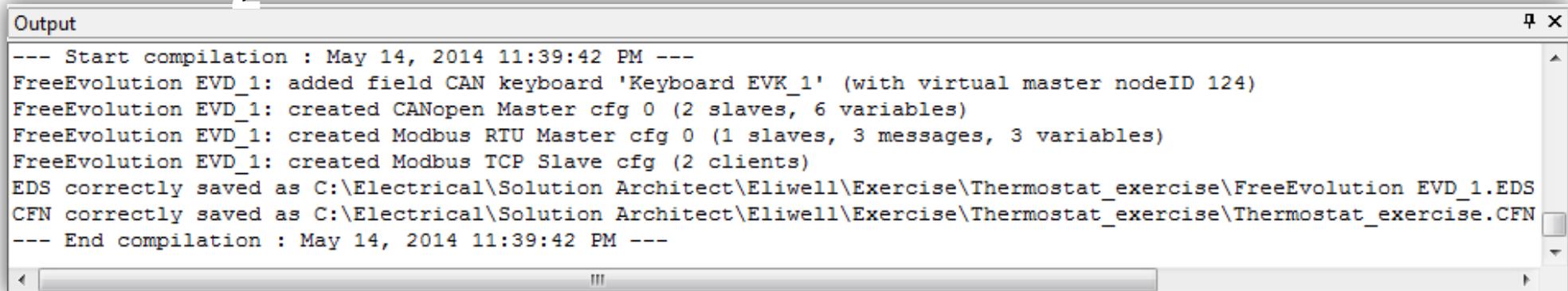
Setting Menu

Address	Name	Value	Um	Default	Min	Max	Description
16384	SetPoint	18.0	°C	18.0	15.0	30.0	
16385	Differentiation	2.0	°C	2.0	0.5	5.0	

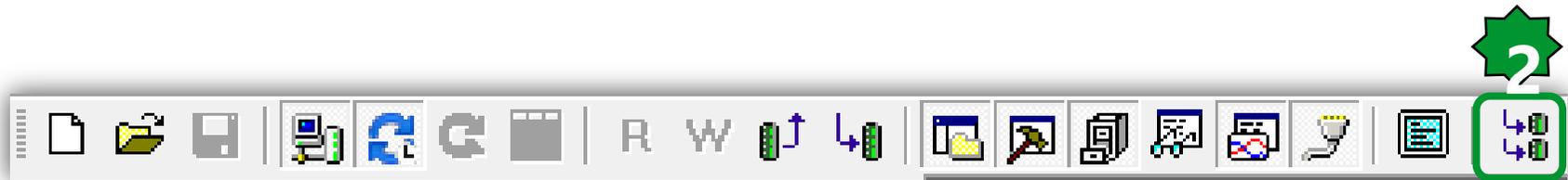
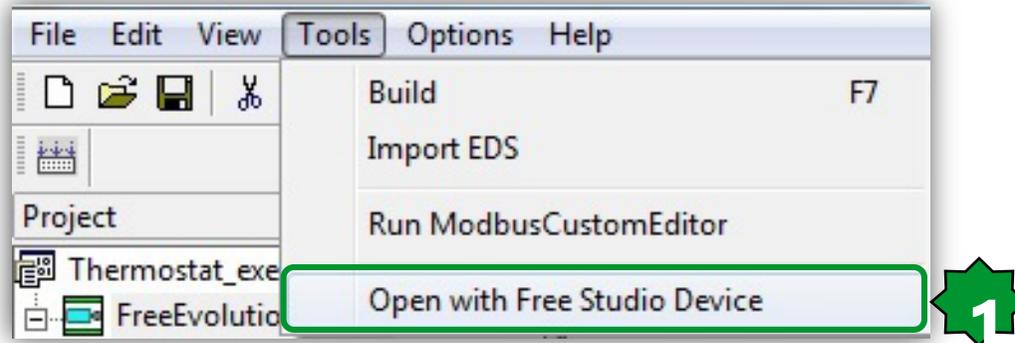
Build the connection



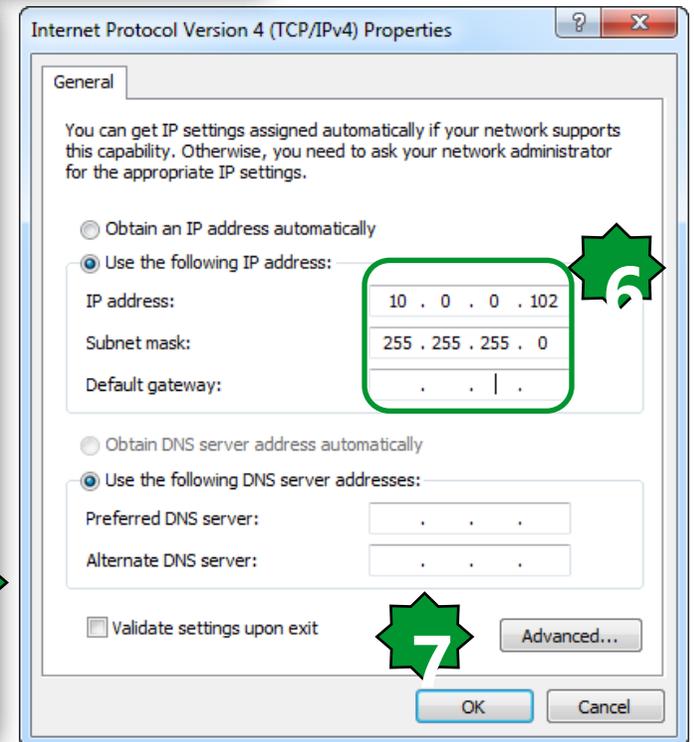
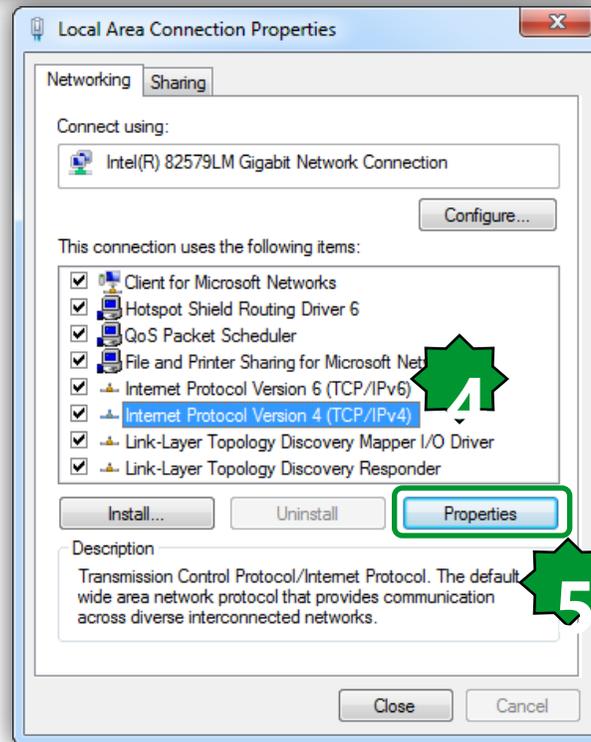
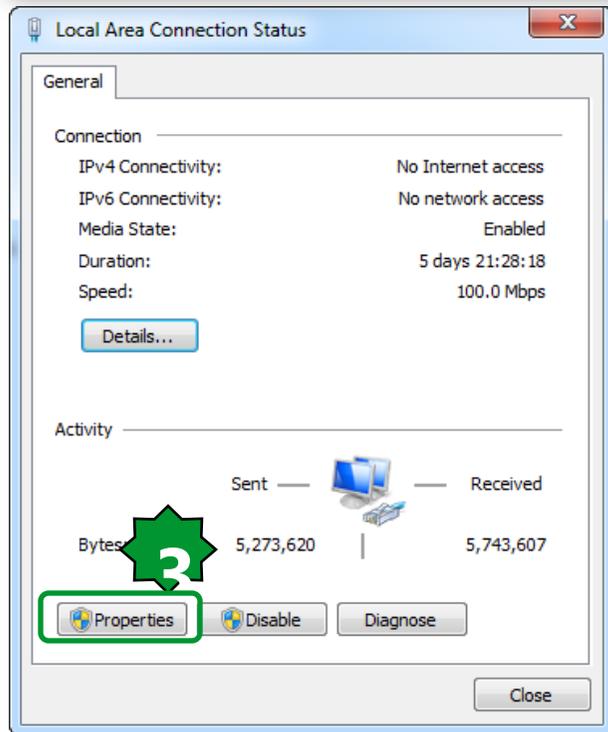
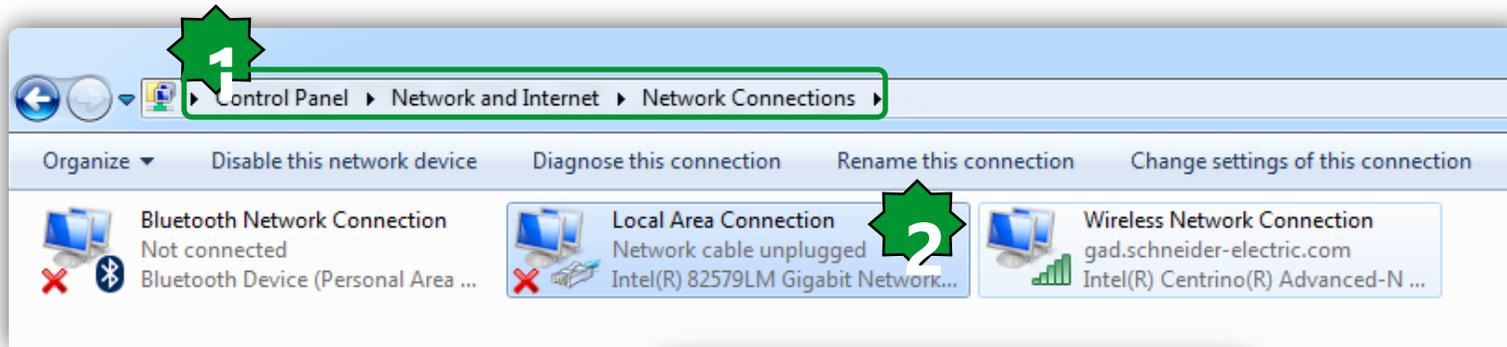
Note:
To apply the changes to the network,
free studio asks you to reboot.



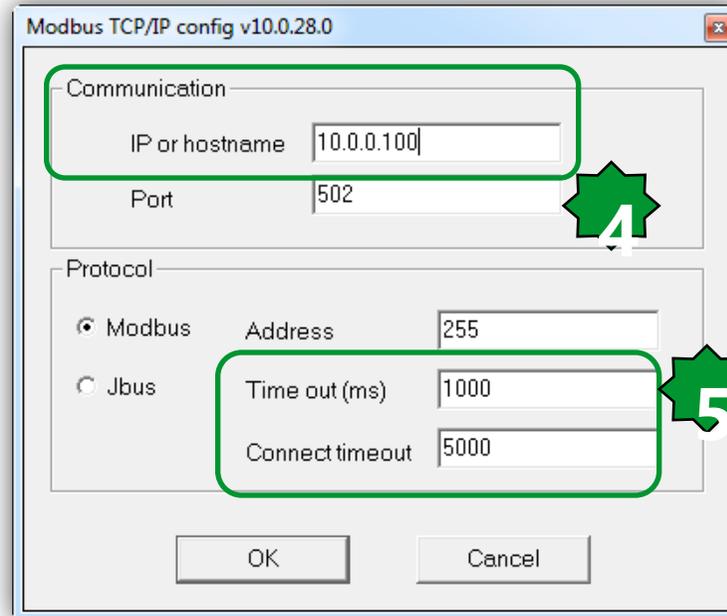
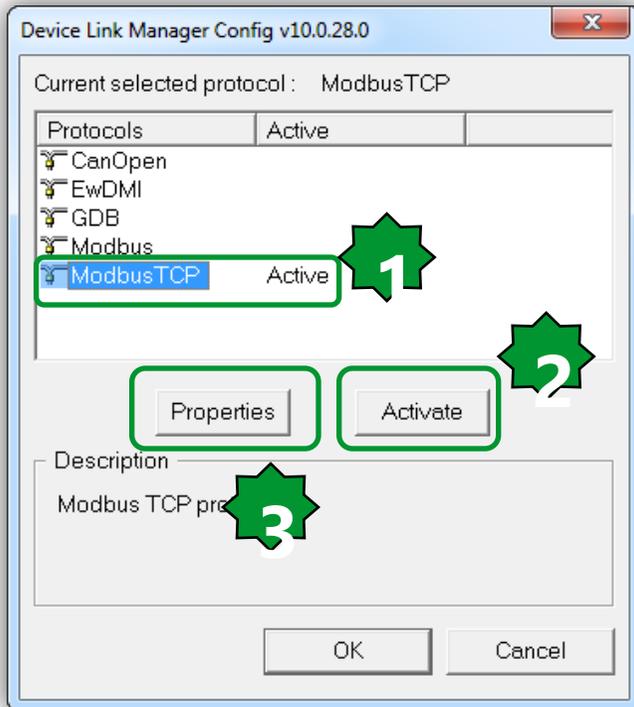
Open with free studio device



PC TCP/IP configuration

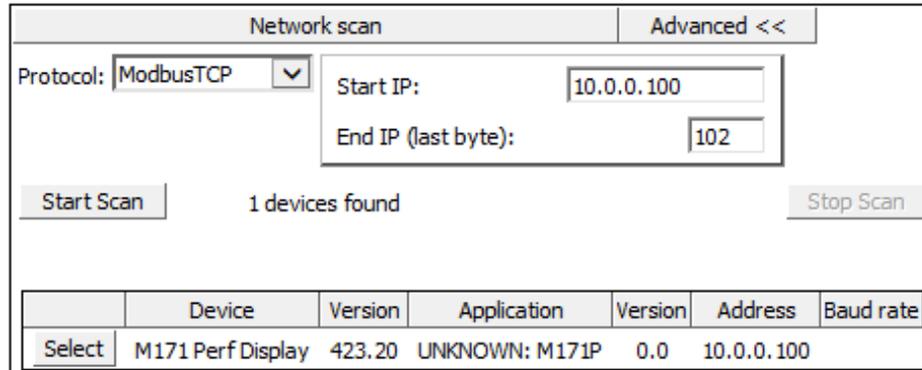
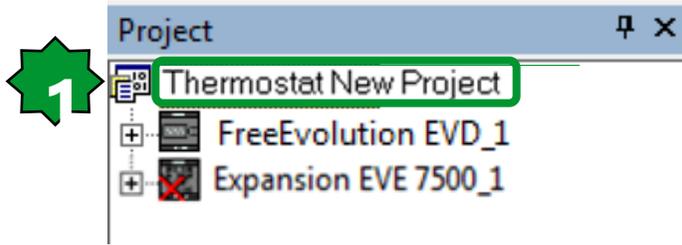


Modbus TCP/download

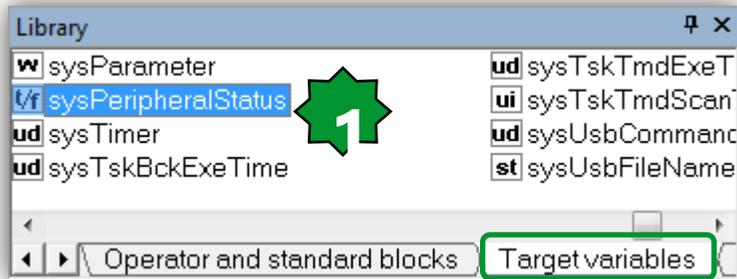


5.change Timeout and Connect Timeout based on the Ethernet band available. If the connection it is not direct it is better to increase both of them 10000-20000

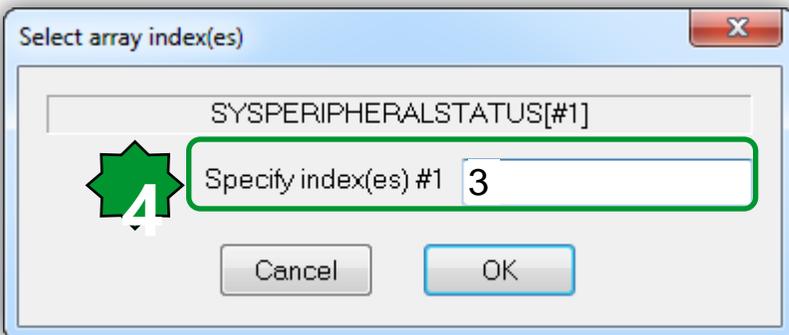
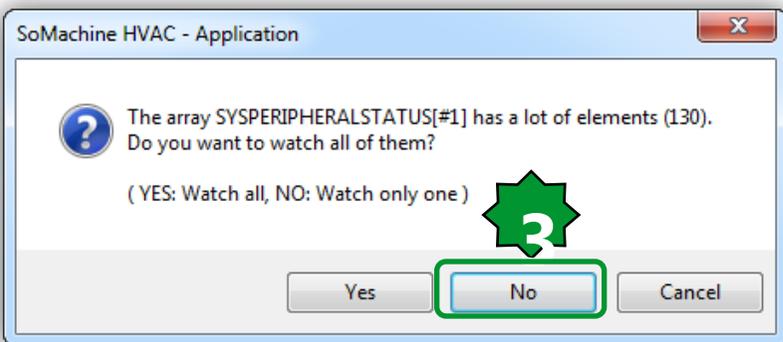
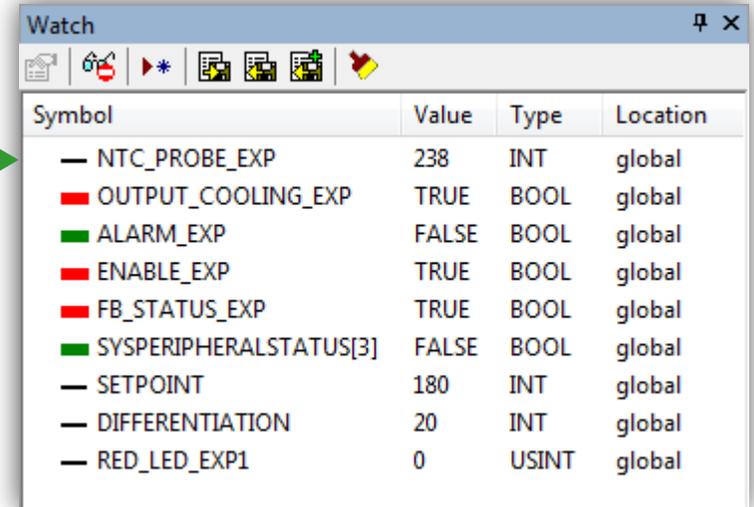
Port Scan tool



On-Line CAN Bus monitoring



Drag & Drop





Device's parameter Configuration/Base

- FreeEvolution EVD_1
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs**
 - Analogue Outputs V/I
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes
 - Expansion EVE 7500_1

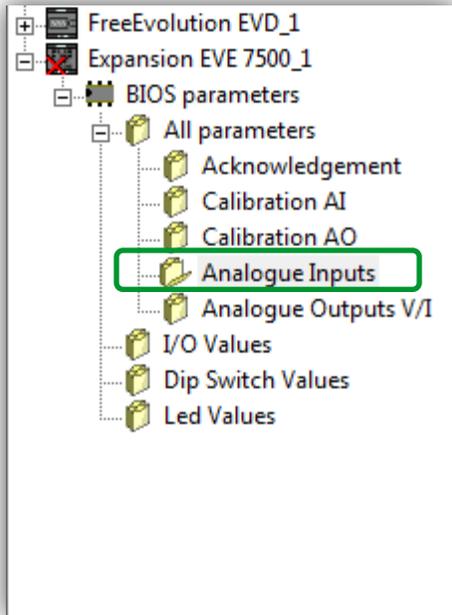
Analogue Inputs							
Address	Name	Value	Um	Default	Min	Max	Description
15725	Temp_UM	0=°C	num	0=°C	0	1	Unit of temperature measurement
15726	Cfg_AI1	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI1
15727	Cfg_AI2	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI2
15728	Cfg_AI3	4=0÷10V	num	4=0÷10V	0	8	Type of analogue input AI3
15729	Cfg_AI4	2=NTC(103AT)	num	3=4÷20mA	0	8	Type of analogue input AI4
15730	Cfg_AI5	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI5
15731	Cfg_AI6	4=0÷10V	num	3=4÷20mA	0	8	Type of analogue input AI6
15736	FullScaleMin_AI3	5=0÷5V	digit	0	-9999	9999	First value analogue input AI3 scale
15737	FullScaleMax_AI3	6=PT1000	digit	1000	-9999	9999	Last value analogue input AI3 scale
15738	FullScaleMin_AI4	7=hO(NTC)	digit	0	-9999	9999	First value analogue input AI4 scale
15739	FullScaleMax_AI4	8=daO(PT1000)	digit	1000	-9999	9999	Last value analogue input AI4 scale
15740	FullScaleMin_AI5	1000	digit	0	-9999	9999	First value analogue input AI5 scale
15741	FullScaleMax_AI5	0	digit	1000	-9999	9999	Last value analogue input AI5 scale
15742	FullScaleMin_AI6	1000	digit	0	-9999	9999	First value analogue input AI6 scale
15743	FullScaleMax_AI6	0	digit	1000	-9999	9999	Last value analogue input AI6 scale
15748	Calibration_AI1	1000	°C/10,°F/10	0	-180	180	Analogue input AI1 differential
15749	Calibration_AI2	0	°C/10,°F/10	0	-180	180	Analogue input AI2 differential
15750	Calibration_AI3	0	digit	0	-1000	1000	Analogue input AI3 differential
15751	Calibration_AI4	0	digit	0	-1000	1000	Analogue input AI4 differential
15752	Calibration_AI5	0	digit	0	-1000	1000	Analogue input AI5 differential
15753	Calibration_AI6	0	digit	0	-1000	1000	Analogue input AI6 differential



Device's parameter Configuration/Exp

Analogue Inputs

Address	Name	Value	Um	Default	Min	Max	Description
15725	Temp_UM	0=°C	num	0=°C	0	1	Unit of temperature measurement
15726	Cfg_AI1	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI1
15727	Cfg_AI2	2=NTC(103AT)	num	2=NTC(103AT)	0	2	Type of analogue input AI2
15728	Cfg_AI3	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI3
15729	Cfg_AI4	2=NTC(103AT)	num	3=4÷20mA	0	8	Type of analogue input AI4
15730	Cfg_AI5	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI5
15731	Cfg_AI6	4=0÷10V 5=0÷5V	num	3=4÷20mA	0	8	Type of analogue input AI6
15736	FullScaleMin_AI3	6=PT1000	digit	0	-9999	9999	First value analogue input AI3 scale
15737	FullScaleMax_AI3	7=hO(NTC)	digit	1000	-9999	9999	Last value analogue input AI3 scale
15738	FullScaleMin_AI4	8=daO(PT1000)	digit	0	-9999	9999	First value analogue input AI4 scale
15739	FullScaleMax_AI4	1000	digit	1000	-9999	9999	Last value analogue input AI4 scale
15740	FullScaleMin_AI5	0	digit	0	-9999	9999	First value analogue input AI5 scale
15741	FullScaleMax_AI5	1000	digit	1000	-9999	9999	Last value analogue input AI5 scale
15742	FullScaleMin_AI6	0	digit	0	-9999	9999	First value analogue input AI6 scale
15743	FullScaleMax_AI6	1000	digit	1000	-9999	9999	Last value analogue input AI6 scale
15748	Calibration_AI1	0	°C/10,°F/10	0	-180	180	Analogue input AI1 differential
15749	Calibration_AI2	0	°C/10,°F/10	0	-180	180	Analogue input AI2 differential
15750	Calibration_AI3	0	digit	0	-1000	1000	Analogue input AI3 differential
15751	Calibration_AI4	0	digit	0	-1000	1000	Analogue input AI4 differential
15752	Calibration_AI5	0	digit	0	-1000	1000	Analogue input AI5 differential
15753	Calibration_AI6	0	digit	0	-1000	1000	Analogue input AI6 differential



Expansion module configuration

- Pressing Add you can eventually define the I/O configuration of Expansion that Base unit will send at powerup.
- For example: Expansion AI3 is set as 0-10V.

Expansion EVE 7500 Configuration


General | SDO Set | PDO Tx - Input | PDO Rx - Output




#	Label	Index	SubIndex	Type	Value	Timeout
1	COB-ID	1404	1	UDINT	\$NODEID+0x40000500	1000
2	COB-ID	1804	1	UDINT	\$NODEID+0x40000480	1000
3	Transmission Type	1800	2	USINT	255	100
4	Event Timer	1800	5	UINT	0	100
5	Transmission Type	1801	2	USINT	255	100
6	Event Timer	1801	5	UINT	0	100
7	Transmission Type	1802	2	USINT	255	100
8	Event Timer	1802	5	UINT	0	100
9	Transmission Type	1804	2	USINT	255	100
10	Event Timer	1804	5	UINT	0	100
11	Transmission Type	1400	2	USINT	255	100
12	Transmission Type	1401	2	USINT	255	100
13	Transmission Type	1402	2	USINT	255	100
14	Transmission Type	1404	2	USINT	255	100
15	Cfg_AI3	3d70	0	UINT	4	100
16	FullScaleMin_AI3	3d78	0	INT	0	100
17	FullScaleMax_AI3	3d79	0	INT	1000	100

Variables List

Filter: AI3

- 3d70.0 Cfg_AI3 (UINT)
- 3d78.0 FullScaleMin_AI3 (INT)
- 3d79.0 FullScaleMax_AI3 (INT)
- 3d86.0 Calibration_AI3 (INT)

OK Cancel

Chapter 13

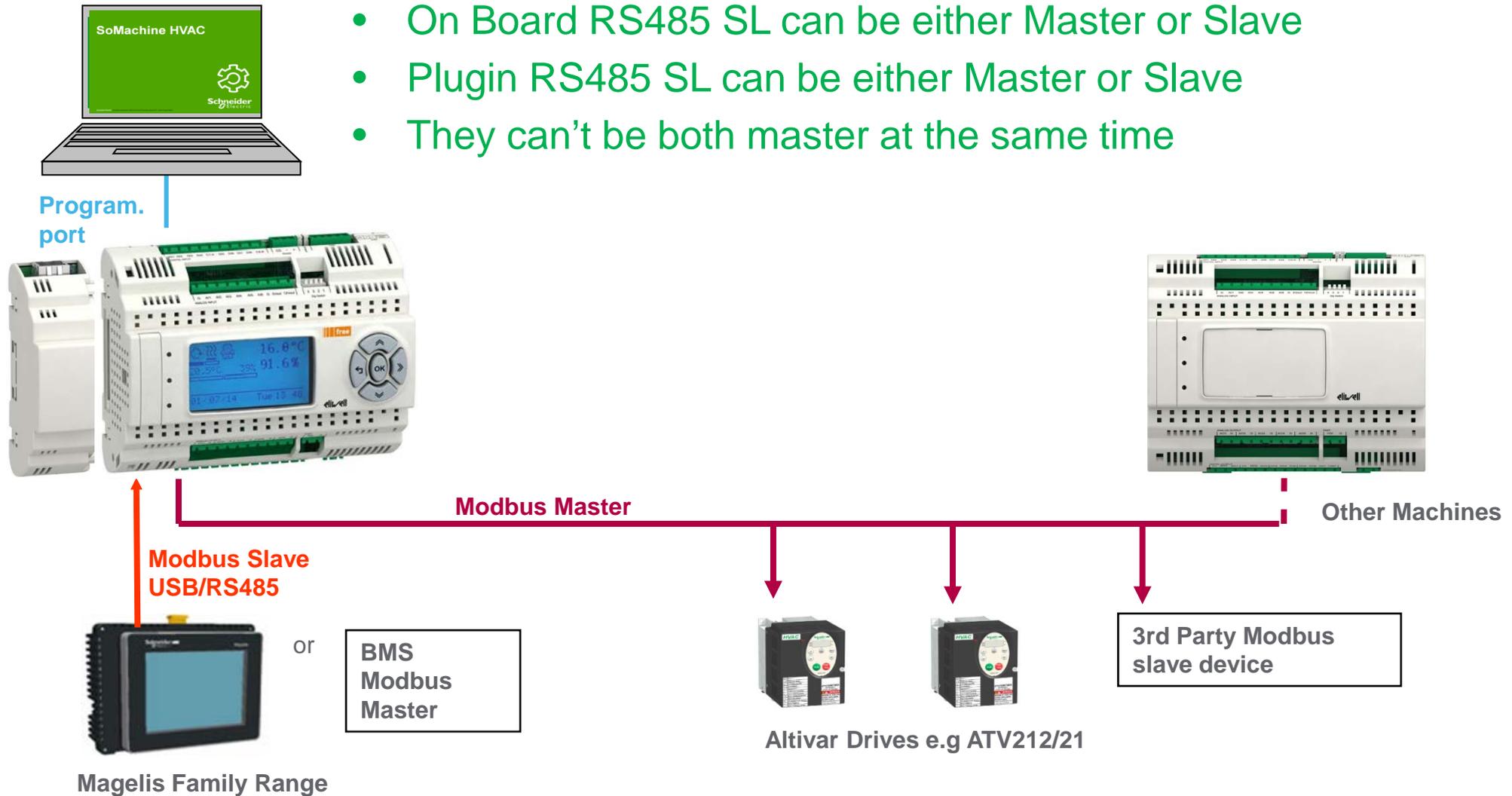
Modbus Communication

Goal:

Connection ATV21/212 to the EVOLUTION via Modbus serial line, write the command + speed reference and read the output frequency

Machines architecture

- On Board RS485 SL can be either Master or Slave
- Plugin RS485 SL can be either Master or Slave
- They can't be both master at the same time



ATV 21/212 via Modbus



Set ups at ATV21:

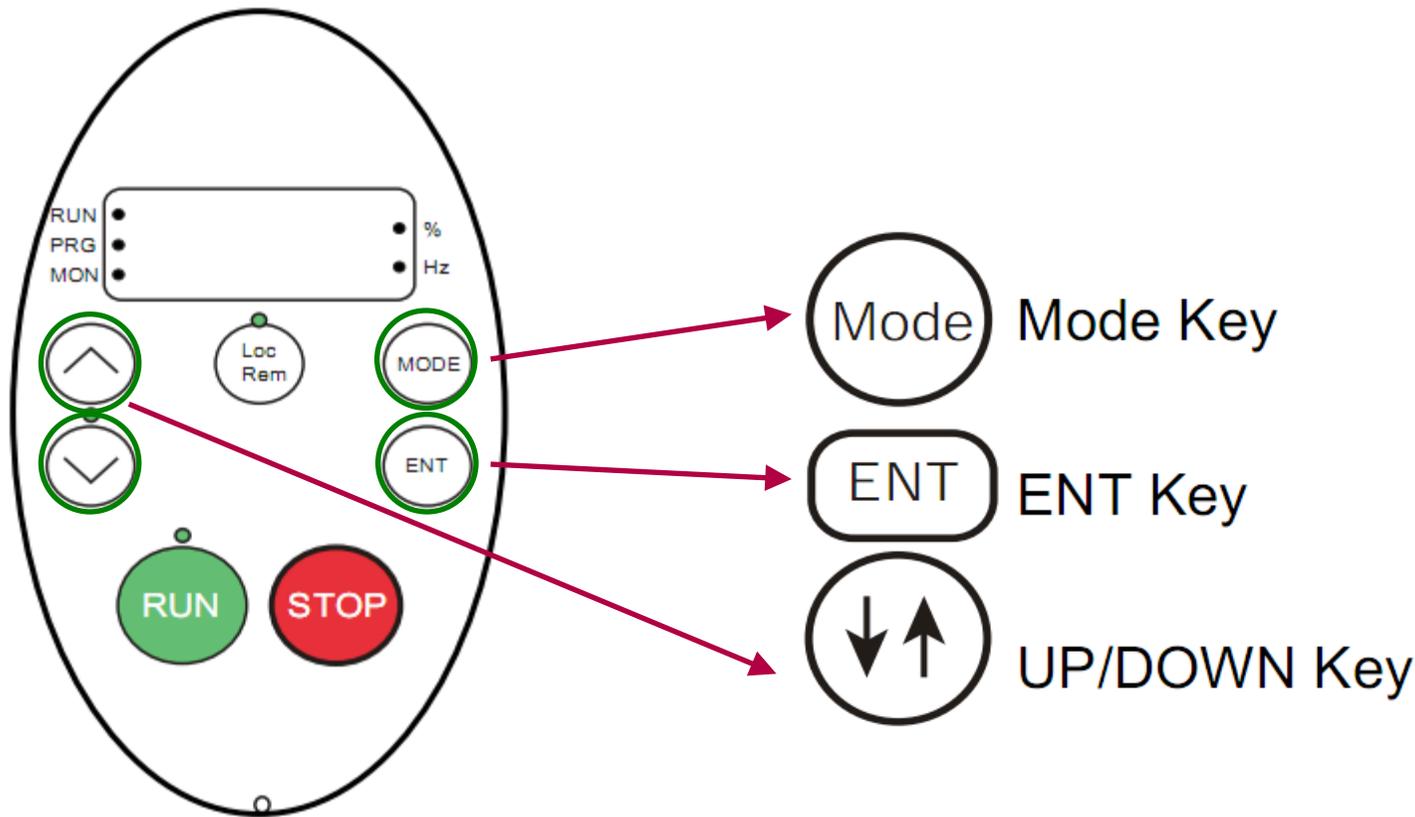
- LOC / REM = off
- CN0d = 2 Enables Start / Stop control via network
- FN0d = 4 Enables frequency reference to be Controlled by network.
- F800: 1 (default) = 19200bps
- F801: 1 (default) = even parity
- F802: 1 = Address of ATV21
- F803: 4 = Timeout in seconds
- F829: 1 (default) = Protocol Modbus RTU
- F851: 1 = Communication fault setting
- (Last commanded operation continues)

Modbus – ATV21/212

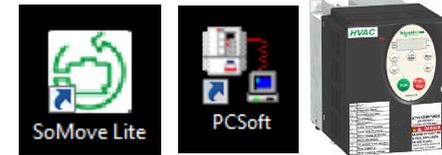


- Drive (slave)

- use Drive Keypad for setting Modbus parameters

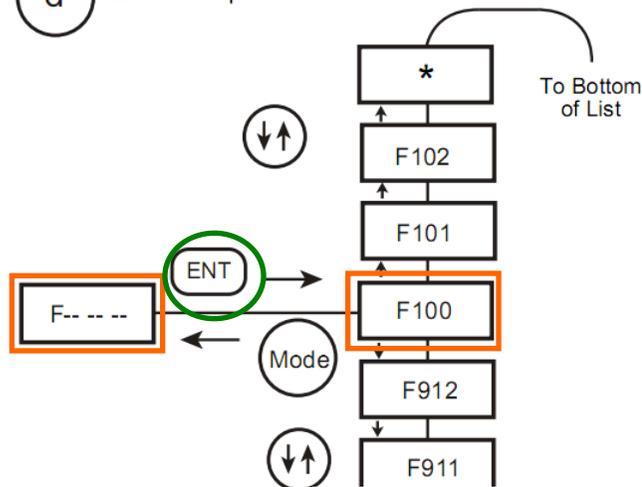


Modbus – ATV21/212 configuration



● Drive (slave)

d ● Drive Menu Extended parameters



1. Press **DOWN** key repeatedly advance to **F829**
2. press **ENTER** key to change setting
3. with **UP/DOWN** keys change value
4. press **ENTER** to confirm and exit
5. repeat for parameters listed

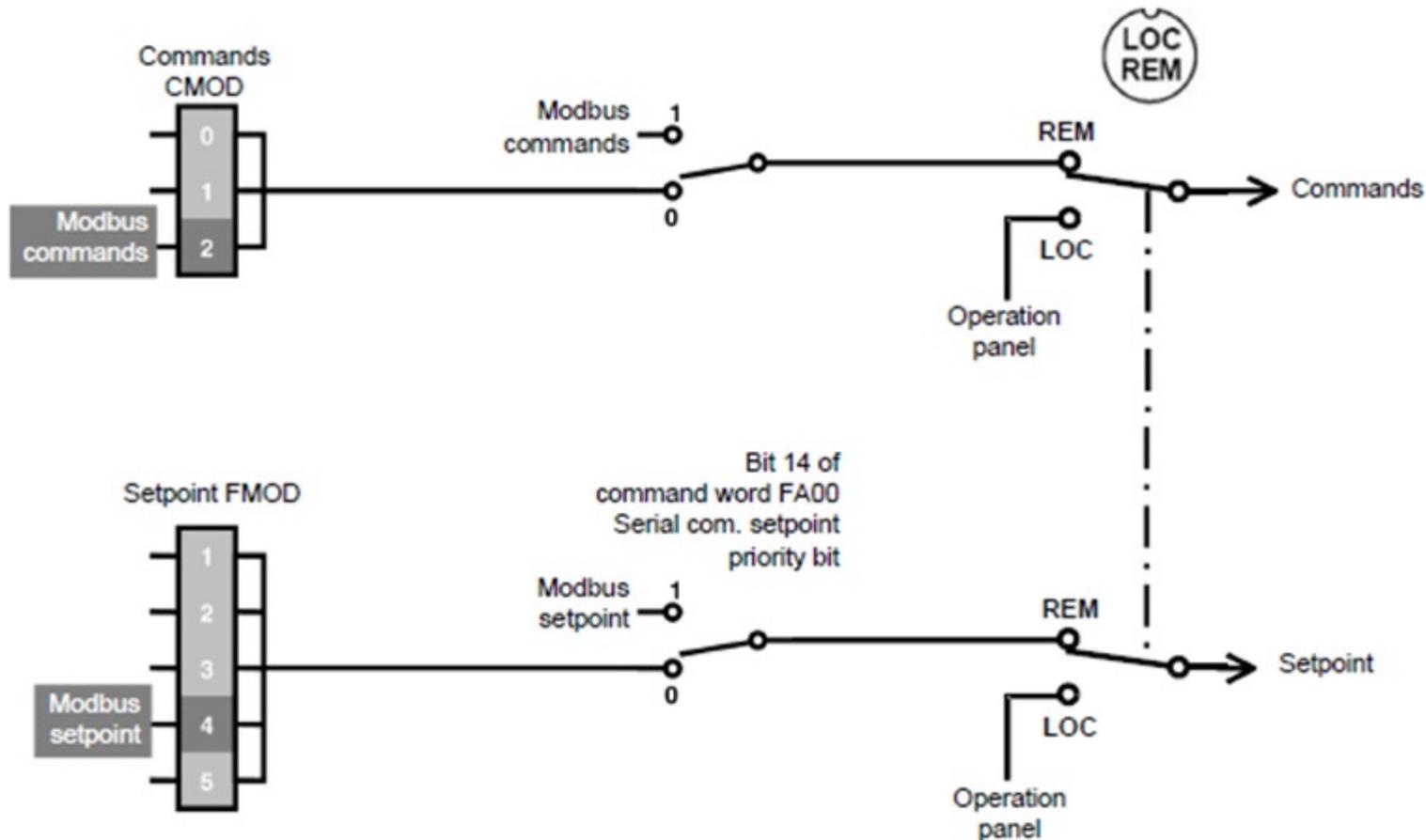
Title	Communication Number	Function	Adjustment range	Unit	Default setting	Valid
F829	0829	Selection of communication protocol	0 ... 4 1: Modbus-RTU protocol	-	1 <input type="text" value="1"/>	After reset
F800	0800	Baud rate	0: 9600 bps 1: 19200 bps	-	1 <input type="text" value="1"/>	After reset
F801	0801	Parity	0: NON (No parity) 1: EVEN (Even parity) 2: ODD (Odd parity)	-	1 <input type="text" value="1"/>	After reset
F802	0802	Modbus address	0 ... 247	-	1 <input type="text" value="1"/>	After setting

Important: Cycle power on drive after changing Modbus settings for changes to become effective.

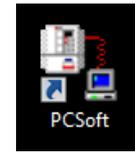
Modbus – ATV21/212 configuration Command & Speed Reference



Parameter title	Function number	Function description
CNOO	2	Serial communication
FNOO	4	Serial communication



Modbus – ATV21/212 configuration Command & Speed Reference

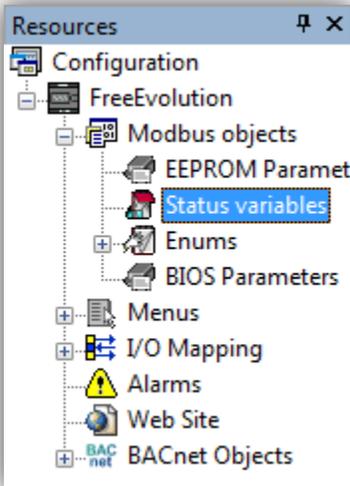


Code	Name/Description	Adjustment range	Factory setting
<div style="border: 1px solid green; padding: 2px; display: inline-block; color: green;">C P O d</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">1</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">2</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">3</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">4</div>	<p><input type="checkbox"/> Remote Mode Start/Stop Control</p> <p>The setting of parameter C P O d determines the source of start, stop, forward, and reverse operation commands when the drive is in remote mode.</p> <p>The drive must be stopped to make changes to parameter C P O d.</p> <p>See diagram on page 31 for more information on the source of the drive's operation commands.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Control terminal logic inputs. <input type="checkbox"/> Graphic display terminal. <input type="checkbox"/> Serial communication 	-	0
<div style="border: 1px solid green; padding: 2px; display: inline-block; color: red;">F P O d</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">3</div> <div style="text-align: center; font-size: 2em; color: green; margin: 10px 0;">4</div>	<p><input type="checkbox"/> Remote Mode Primary Speed Reference Source</p> <p>The setting of parameter F P O d determines the source of the drive's speed reference when the drive is in remote mode.</p> <p>The drive must be stopped to make changes to parameter F P O d.</p> <p>See diagram on page 31 for more information on the source of the drive's speed reference.</p> <ul style="list-style-type: none"> <input type="checkbox"/> VIA <input type="checkbox"/> VIB <input type="checkbox"/> Graphic display terminal <input type="checkbox"/> Serial communication <input type="checkbox"/> +/- Speed 	-	1

Mode ▶ AUF ▶ 4*▲ ▶ cmod ▶ ENT
 ▶ edit value ▶ ENT to validate

Mode ▶ AUF ▶ 5*▲ ▶ fmod ▶ ENT
 ▶ edit value ▶ ENT to validate

Modbus link



- Developer must define a set of variables corresponding to what he wants to read or write via Modbus using Status Variables.

Registers:

- Command= 64000+1 (W ▶ FC16)
- Speed Reference = 64001+1 (W▶ FC16)
- Output Frequency = 64768+1 (R▶ FC03)

Message for ATV command:

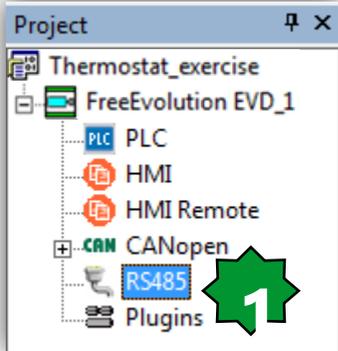
- Start Command= 50176
- Stop Command= 49152

Status Variables

 Add
  Remove
  Recalc

#	Address	Name	Device type	Application type	Unit	Format	AccessLevel	Read only	Description
1	8960	Ambiant_Temp	Signed 16-bit	INT	°C	XXX.Y	Always visible	True	
2	8961	Hystersis_FB_Status	Boolean	BOOL			Always visible	True	
3	8962	EXP1_CAN_Status	Boolean	BOOL			Always visible	True	
4	8963	Probe_EXP1_Err	Signed 16-bit	INT			Always visible	True	
5	8965	Expansion_Alarm	Boolean	BOOL			Always visible	True	
6	8964	Green_LED_EXP1	Unsigned 8-bit	USINT			Always visible	True	
7	8966	Red_LED_EXP1	LEDenum	USINT			Always visible	True	
8	8967	ATV_Command	Unsigned 16-bit	UINT			Always visible	False	
9	8968	ATV_Speed_Reference	Signed 16-bit	INT	Hz		Always visible	False	0-5000 (0.01 Hz)
10	8969	ATV_Output_Frequency	Signed 16-bit	INT	Hz		Always visible	True	

Modbus Master Configuration



RS485 Configuration

Mode

Modbus Slave
 Modbus Master (for field)

Baud rate

9600 b/s
 19200 b/s
 38400 b/s
 57600 b/s
 115200 b/s

Serial Mode

E,8,1 (Even parity, 8 data bits, 1 stop bit) ▼

Catalog		
Device name	Version	Description
EXP Expansion EVE	460	Expansion EVE
Generic Modbus	1	Generic Modbus RTU node

1. Project ► RS485
2. Modbus configuration
3. Select Generic Modbus from the catalogue list
4. Drag & Drop it into the RS485

RS485 On Board parameters



Project

- Thermostat_exercise
 - FreeEvolution EVD_1
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs
 - Analogue Outputs V/I
 - RS485 On Board**
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes
 - Expansion EVE 7500_1

RS485 On Board							
Address	Name	Value	Um	Default	Min	Max	Description
15774	Addr_RS485_OB	1	num	1	0	255	RS485 On Board address
15775	Proto_RS485_OB	3=Modbus/RTU	num	3=Modbus/RTU	2	3	Select RS485 On Board protocol
15776	DataBit_RS485_OB	8	num	8	8	8	RS485 On Board Data bit number
15777	StopBit_RS485_OB	1	num	1	1	2	RS485 On Board stop bit number
15778	Parity_RS485_OB	2=Even	num	2=Even	0	2	RS485 On Board parity protocol
15779	Baud_RS485_OB	1=19200	num	1=19200	0	5	RS485 On Board baud rate protocol

Generic Modbus



Generic Modbus RTU node

General

Settings

Name:

Modbus address: (0 .. 247, 0=broadcast)

Node number: (0 .. 127)

Catalog

Device name	Version	Description	DeviceID
Modbus FC-01	1	Read Coils - Function 01 (0x01)	FC01
Modbus FC-02	1	Read Discrete Inputs - Function 02 (0x02)	FC02
Modbus FC-03	1	Read Holding Register - Function 03 (0x03)	FC03
Modbus FC-04	1	Read Input Registers - Function 04 (0x04)	FC04
Modbus FC-06	1	Write Single Register - Function 06 (0x06)	FC06
Modbus FC-15	1	Write Multiple Coils - Function 15 (0x0F)	FC15
Modbus FC-16	1	Write Multiple Register - Function 16 (0x10)	FC16

1. After drag & drop
2. Name it & define the Modbus address.
It is recommended to set the Node number the same as the Modbus address
3. Select the desired function code from catalogue

* Note: Vectors `sysMbRtu*` in the folder `Modbus Master` are addressed by node number



Library

- USB-Host handling
- System Timers
- System Tasks Execution Time
- System Parameters: Parameters image in RAM (read)
- System Parameters: EEPROM image in RAM (read)
- System Impulse Counter Input
- System Clock
- System BIOS version
- Plug-In identification
- Peripheral
- Modbus Master
- MAC Address
- Led & Backlight Status
- General purpose Data Blocks
- Dip Switch
- Digital Outputs
- Digital Inputs
- Analog Outputs
- Analog Inputs

Operator and standard blocks | Target variables | Target blocks | basic





Modbus Function Code

Device name	Version	Description	DeviceID
Modbus FC-01	1	Read Coils - Function 01 (0x01)	FC01
Modbus FC-02	1	Read Discrete Inputs - Function 02 (0x02)	FC02
Modbus FC-03	1	Read Holding Register - Function 03 (0x03)	FC03
Modbus FC-04	1	Read Input Registers - Function 04 (0x04)	FC04
Modbus FC-06	1	Write Single Register - Function 06 (0x06)	FC06
Modbus FC-15	1	Write Multiple Coils - Function 15 (0x0F)	FC15
Modbus FC-16	1	Write Multiple Register - Function 16 (0x10)	FC16



1. Select the required function code
2. Drag & drop it into the Project
 - ▶ RS485 ▶ Generic Modbus 1
3. Do the general settings

Registers:

Command= 64000+1 (W → FC16)

Speed Reference = 64001+1 (W → FC16)

Output Frequency = 64768+1 (R → FC03)

Message for ATV command:

Start Command= 50176

Stop Command= 49152

The screenshot shows the software interface with a project tree on the left and a configuration window for 'Modbus FC 16(0x10) - Write Multiple Register'. The project tree includes 'Thermostat_exercise' with sub-items like 'FreeEvolution EVD_1', 'PLC', 'HMI', 'HMI Remote', 'CANopen', 'Expansion EVE_1', 'Keyboard EVK_1', 'RS485', 'Generic Modbus_1', and 'Modbus FC-16_1'. The configuration window has two tabs: 'General' and 'Multiple Reg.'. The 'Settings' section is highlighted with a green box and contains the following fields:

Start address:	64001	(1 .. 65536)
Polling time:	0	ms (0 = write on variation)
Time out:	1000	ms
Wait before send:	10	ms



Important: Some slave devices requires an offset of one to register Address: ATV requires it, EVOLUTION doesn't need it.

Modbus Function Code/Settings

Modbus FC 16(0x10) - Write Multiple Register

General **Multiple Reg.**

Settings

Start address: (1 .. 65536) **1**

Polling time: ms (0 = write on variation) **2**

Time out: ms

Wait before send: ms **4**

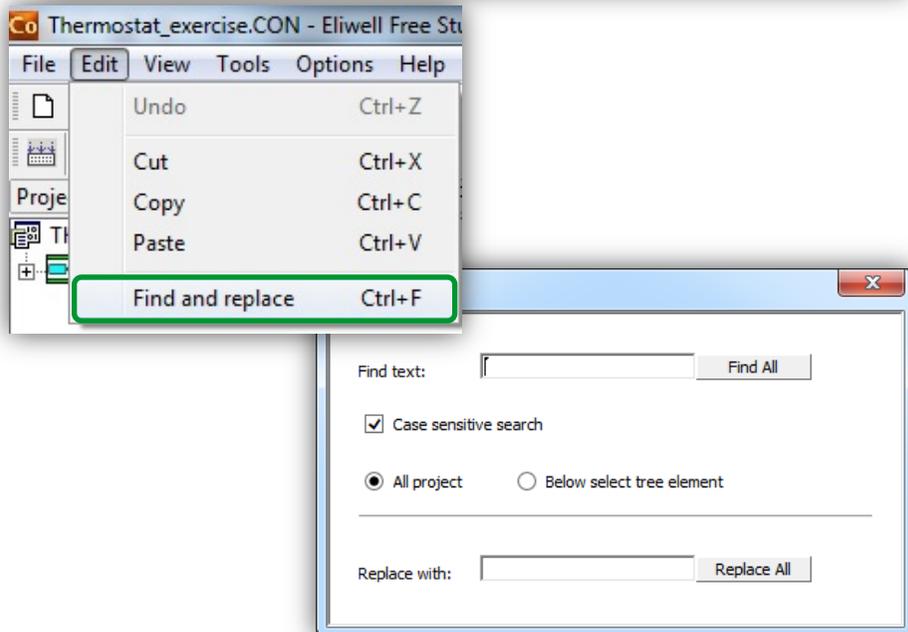
1. Start address: address of the first modbus object to read or write (1..65536).
2. Polling time: minimum waiting period between 2 message processing (ms); for writing operations, 0 means to write it only on variation of the value, for reading operations 0 means maximum speed.
3. Timeout: the operation will fail when this time-out expires (ms).
4. Wait before send: Waiting time after end of previous message response (suggested time ≥ 10 ms).

3. Timeout: the operation will fail when this time-out expires (ms).

4. Wait before send: Waiting time after end of previous message response (suggested time ≥ 10 ms).

Note: Follow below order in Modbus:

1. Write (FC16)
2. Read (FC3)



Multiple Reg.

Modbus FC 16(0x10) - Write Multiple Register

General **Multiple Reg.**

 Add  Remove  Assign  UnAssign

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	ATV_Command	64001	MW110.1	

Choose PLC variable

Filter:

- FreeEvolution EVD_1: AO1_P (INT)
- FreeEvolution EVD_1: DO4_P (BOOL)
- FreeEvolution EVD_1: DO3_P (BOOL)
- FreeEvolution EVD_1: Ambient_Temperature (INT)
- FreeEvolution EVD_1: ATV_Command (INT)**
- FreeEvolution EVD_1: ATV_Speed_Reference (INT)
- FreeEvolution EVD_1: ATV_Output_Frequency (INT)



OK Cancel

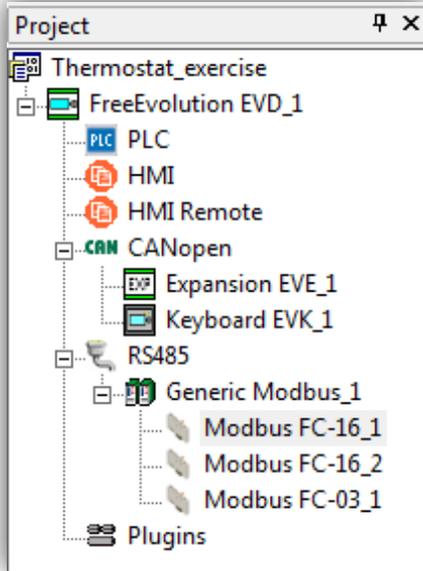
1. Press Add/Remove in order to define how many registers should be written
2. Assign
3. Choose PLC variable ► OK

Note:

- ATV does not support more than 1 read/ write register with the same message
- Waiting time after end of previous message response (suggested time $\geq 10\text{ms}$)



Generic Modbus\Register



If a status variable is used to write a value on variation and to read the same value, the related write message must be listed in Connection before the corresponding read message

Modbus FC 16(0x10) - Write Multiple Register

General | **Multiple Reg.**

Add Remove Assign UnAssign

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	ATV_Command	64001	MW110.1	

Modbus FC 16(0x10) - Write Multiple Register

General | **Multiple Reg.**

Add Remove Assign UnAssign

#	Name	ObjType	Label	Type	Address	DataBlock	Description
1	Register	WORD	ATV_Speed_Reference	INT	64002	MW110.8	

Modbus FC 03(0x03) - Read Holding Register

General | **Holding Reg.**

Add Remove Assign UnAssign

#	Name	ObjType	Label	Type	Address	DataBlock	Description
1	Register	WORD	ATV_Output_Frequency	INT	64769	MW110.3	

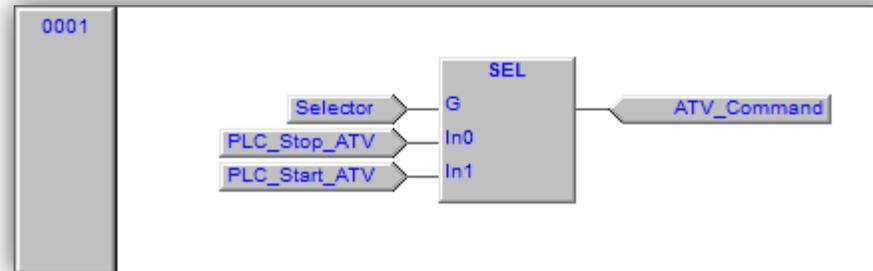


ATV control, Local variable definition

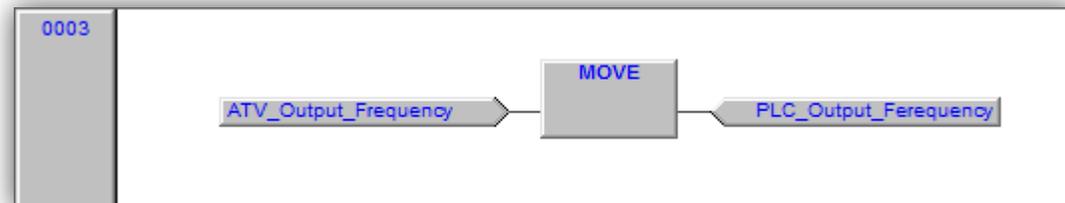
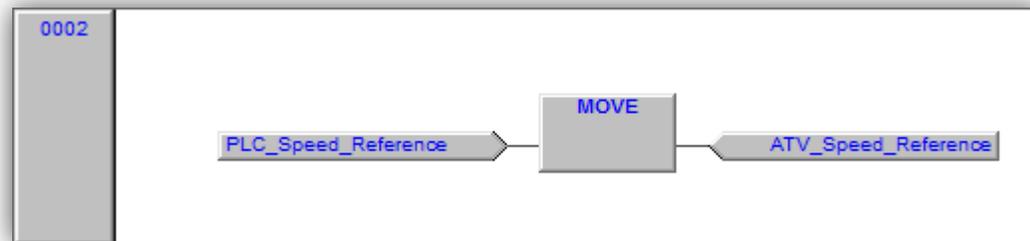
Project M171P Project

- Programs
- Function blocks
- Functions
- Global variables
- Global shared
 - Alarms
 - Mappings
 - Parameters
 - Variables
 - Ambiant_Temp
 - Hystersis_FB_Status
 - EXP1_CAN_Status
 - Probe_EXP1_Err
 - Expansion_Alarm
 - Green_LED_EXP1
 - Red_LED_EXP1
 - ATV_Command**
 - ATV_Speed_Reference
 - ATV_Output_Frequency
- Tasks
 - Timed
 - Thermostat
 - CAN_Monitoring
 - Moves
 - LED_Mgmt
 - Fan_Management
 - ATV_Control
 - Background
 - Boot
 - Init

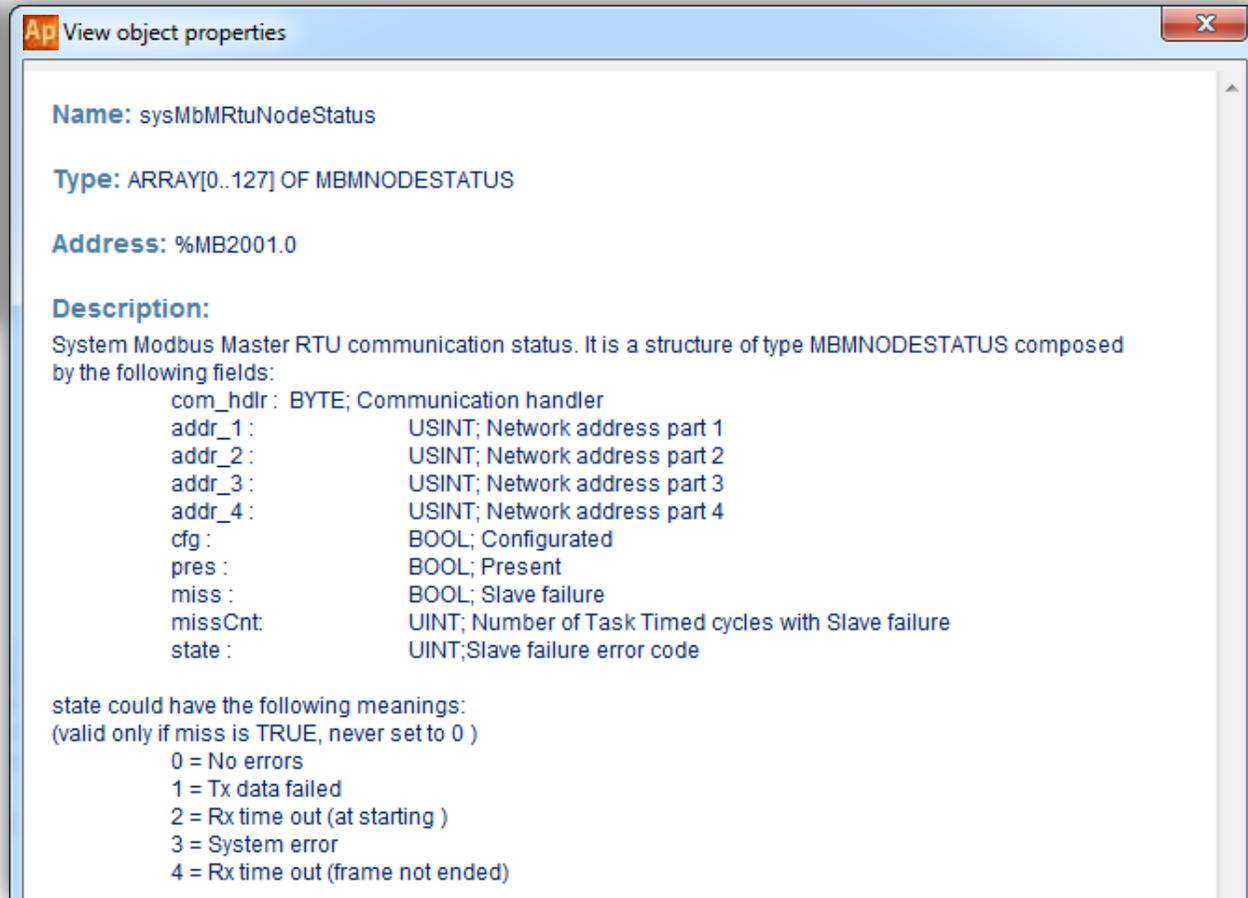
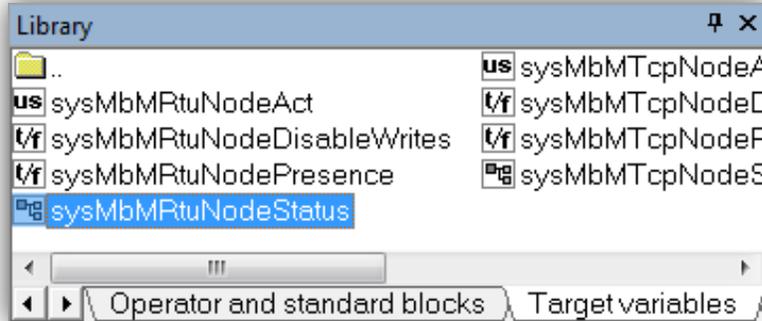
Local variables							
	Name	Type	Address	Array	Init val...	Attribute	Description
1	Selector	BOOL	Auto	No	False	..	
2	PLC_Speed_Reference	INT	Auto	No		..	
3	PLC_Output_Ferequency	INT	Auto	No		..	
4	PLC_Start_ATV	UINT	Auto	No	50176	CONSTANT	
5	PLC_Stop_ATV	UINT	Auto	No	49152	CONSTANT	



Note: Two independant group of blocks must be place in two separate networks



System Modbus RTU Node Status

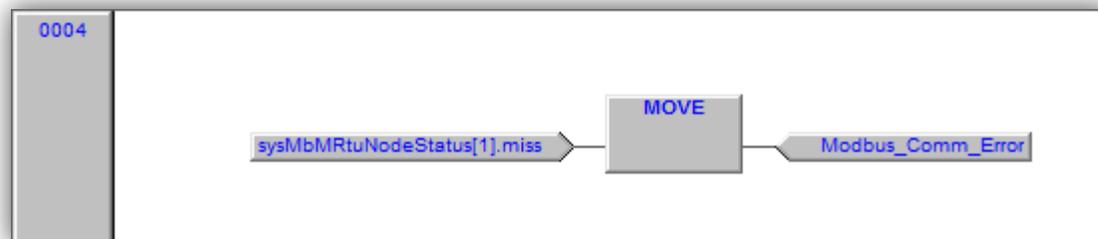


Modbus Communication Alarm

Status Variables

Add
 Remove
 Recalc

#	Address	Name	Device type	Application type	Unit	Format	AccessLevel	Read only	Description
1	8960	Ambiant_Temp	Signed 16-bit	INT	°C	XXX.Y	Always visible	True	
2	8961	Hystersis_FB_Status	Boolean	BOOL			Always visible	True	
3	8962	EXP1_CAN_Status	Boolean	BOOL			Always visible	True	
4	8963	Probe_EXP1_Err	Signed 16-bit	INT			Always visible	True	
5	8965	Expansion_Alarm	Boolean	BOOL			Always visible	True	
6	8964	Green_LED_EXP1	Unsigned 8-bit	USINT			Always visible	True	
7	8966	Red_LED_EXP1	LEDEnum	USINT			Always visible	True	
8	8967	ATV_Command	Unsigned 16-bit	UINT			Always visible	False	
9	8968	ATV_Speed_Reference	Signed 16-bit	INT	Hz		Always visible	False	0-5000 (0.01 Hz)
10	8969	ATV_Output_Frequency	Signed 16-bit	INT	Hz		Always visible	True	
11	8970	Modbus_Comm_Error	Boolean	BOOL			Always visible	True	



Variable property

sysMbMRtuNodeStatus[1].m

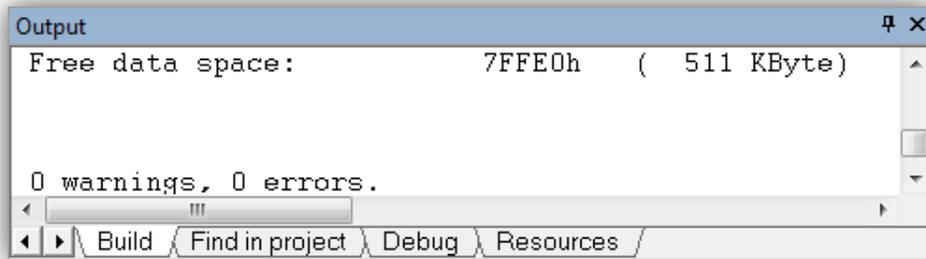
Type

Input
 Output

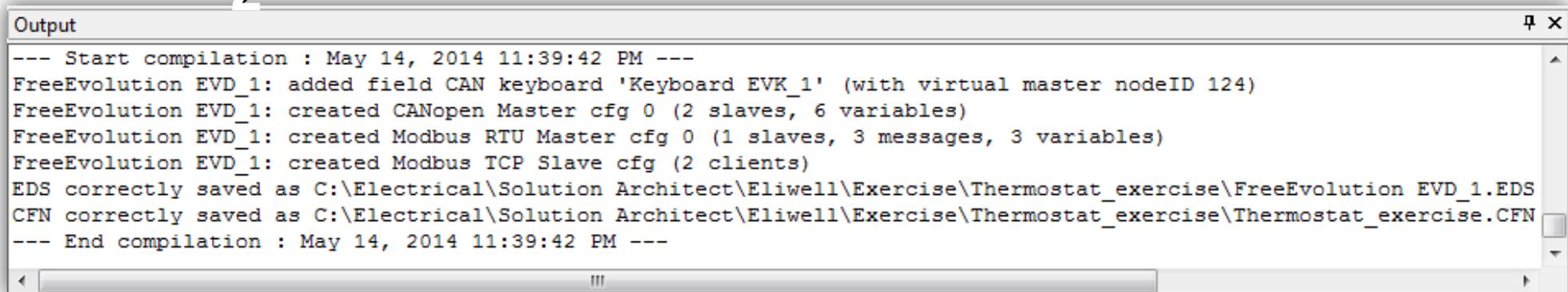
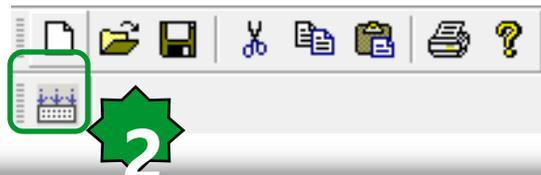
- addr_2
- addr_3
- addr_4
- cfg
- com hdlr
- miss**

BOOL Slave failure

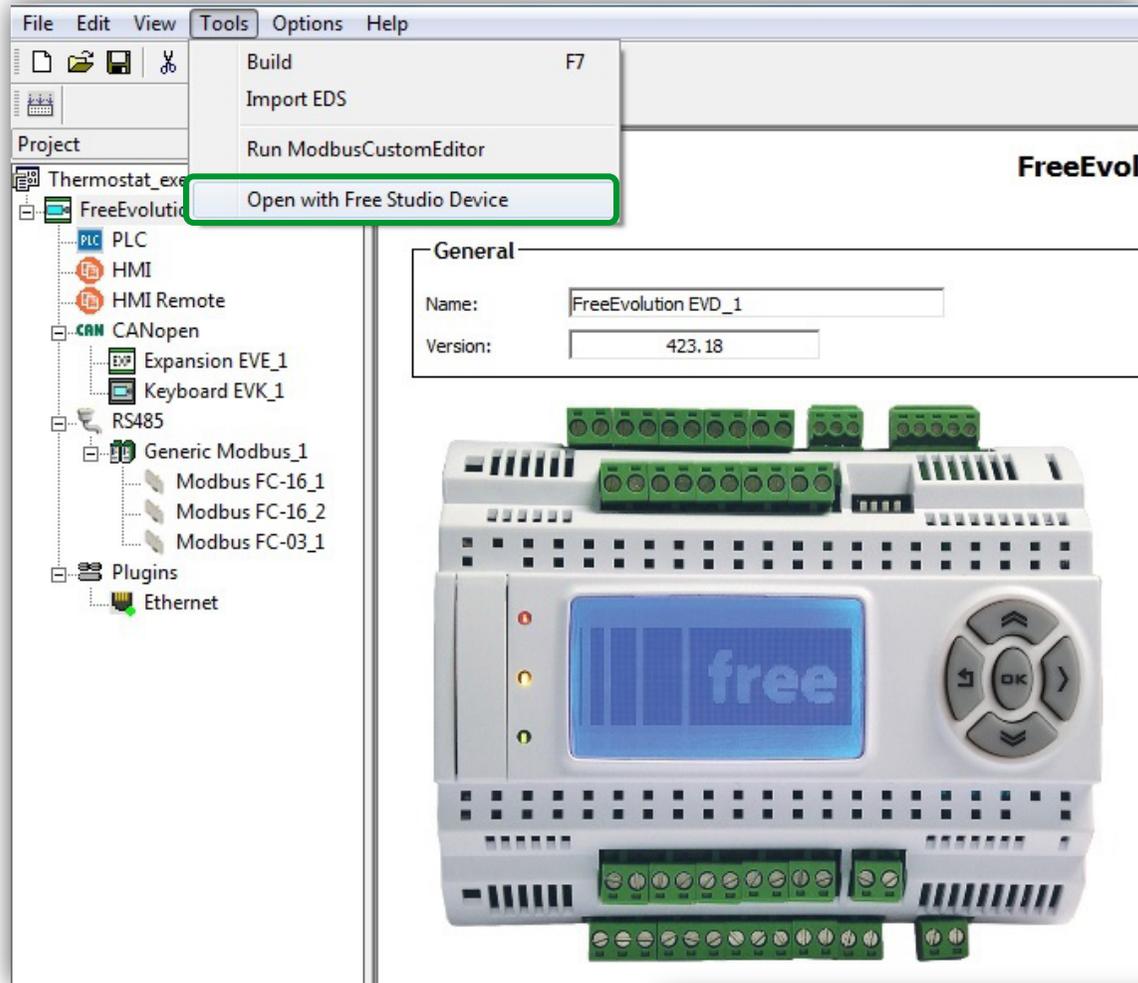
Recompile & Build



Note:
To apply the changes to the network,
free studio asks you to reboot.
Yes: if you want to validate it.
Cancel: if you want to dismiss



Open with free studio device



See next chapter for further details on download via TCP



Modbus Monitoring



Library

sysMbMRtuNodeDisableWrites	sysMbMTcpNodeDisableWrites
sysMbMRtuNodePresence	sysMbMTcpNodePresence
sysMbMRtuNodeStatus	sysMbMTcpNodeStatus
sysMbMTcpNodeAct	sysMSK

Operator and standard blocks | **Target variables** | Target blocks

1

2

Drag & Drop

Watch

Symbol	Value	Type
SYMSBMRRTUNODESTATUS[1]	-	MBMNODESTATUS
COM_HDLR	16#00	BYTE
ADDR_1	1	USINT
ADDR_2	0	USINT
ADDR_3	0	USINT
ADDR_4	0	USINT
CFG	TRUE	BOOL
PRES	TRUE	BOOL
MISS	FALSE	BOOL
MISSCNT	17	UINT
STATE	2	UINT

SoMachine HVAC - Application

? The array SYMSBMRRTUNODESTATUS[#1] has a lot of elements (128). Do you want to watch all of them?
(YES: Watch all, NO: Watch only one)

3

Yes | **No** | Cancel

Generic Modbus RTU node

General

Settings

Name: ATV21

Modbus address: 1 (0 .. 247, 0=broadcast)

Node number: 1 (0 .. 127)

4

Select array index(es)

SYMSBMRRTUNODESTATUS[#1]

4 Specify index(es) #1 | 1

Cancel | OK



SysMbMRtuNodeStatus properties

View object properties

Name: sysMbMRtuNodeStatus

Type: ARRAY[0..127] OF MBMNODESTATUS

Address: %MB2001.0

Description:
System Modbus Master RTU communication status. It is a structure of type MBMNODESTATUS composed by the following fields:

- com_hdr: BYTE; Communication handler
- addr_1: USINT; Network address part 1
- addr_2: USINT; Network address part 2
- addr_3: USINT; Network address part 3
- addr_4: USINT; Network address part 4
- cfg: BOOL; Configured
- pres: BOOL; Present
- miss: BOOL; Slave failure
- missCnt: UINT; Number of Task Timed cycles with Slave failure
- state: UINT; Slave failure error code

state could have the following meanings:
(valid only if miss is TRUE, never set to 0)

- 0 = No errors
- 1 = Tx data failed
- 2 = Rx time out (at starting)
- 3 = System error
- 4 = Rx time out (frame not ended)

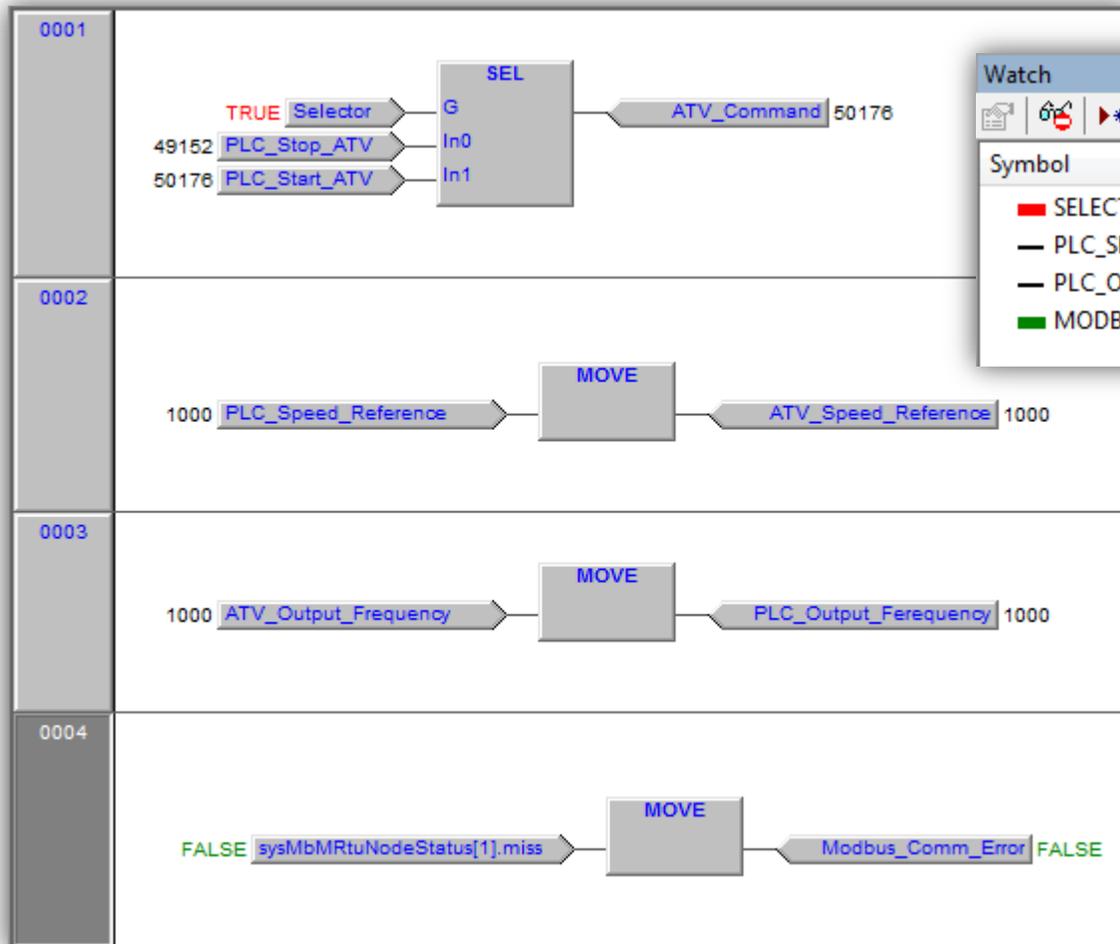
Close

Watch

Symbol	Value	Type
SYSMBMRUNODESTATUS[1]	-	MBMNODESTATUS
COM_HDLR	16#00	BYTE
ADDR_1	1	USINT
ADDR_2	0	USINT
ADDR_3	0	USINT
ADDR_4	0	USINT
CFG	TRUE	BOOL
PRES	TRUE	BOOL
MISS	FALSE	BOOL
MISSCNT	17	UINT
STATE	2	UINT



Live debugge ATV* control



Watch

Symbol	Value	Type	Location
SELECTOR	TRUE	BOOL	@TIMED:ATV_CONTROL
PLC_SPEED_REFERENCE	1000	INT	@TIMED:ATV_CONTROL
PLC_OUTPUT_FEREQUENCY	1000	INT	@TIMED:ATV_CONTROL
MODBUS_COMM_ERROR	FALSE	BOOL	global

Force value

Name: Selector

Value: True

Set Exit

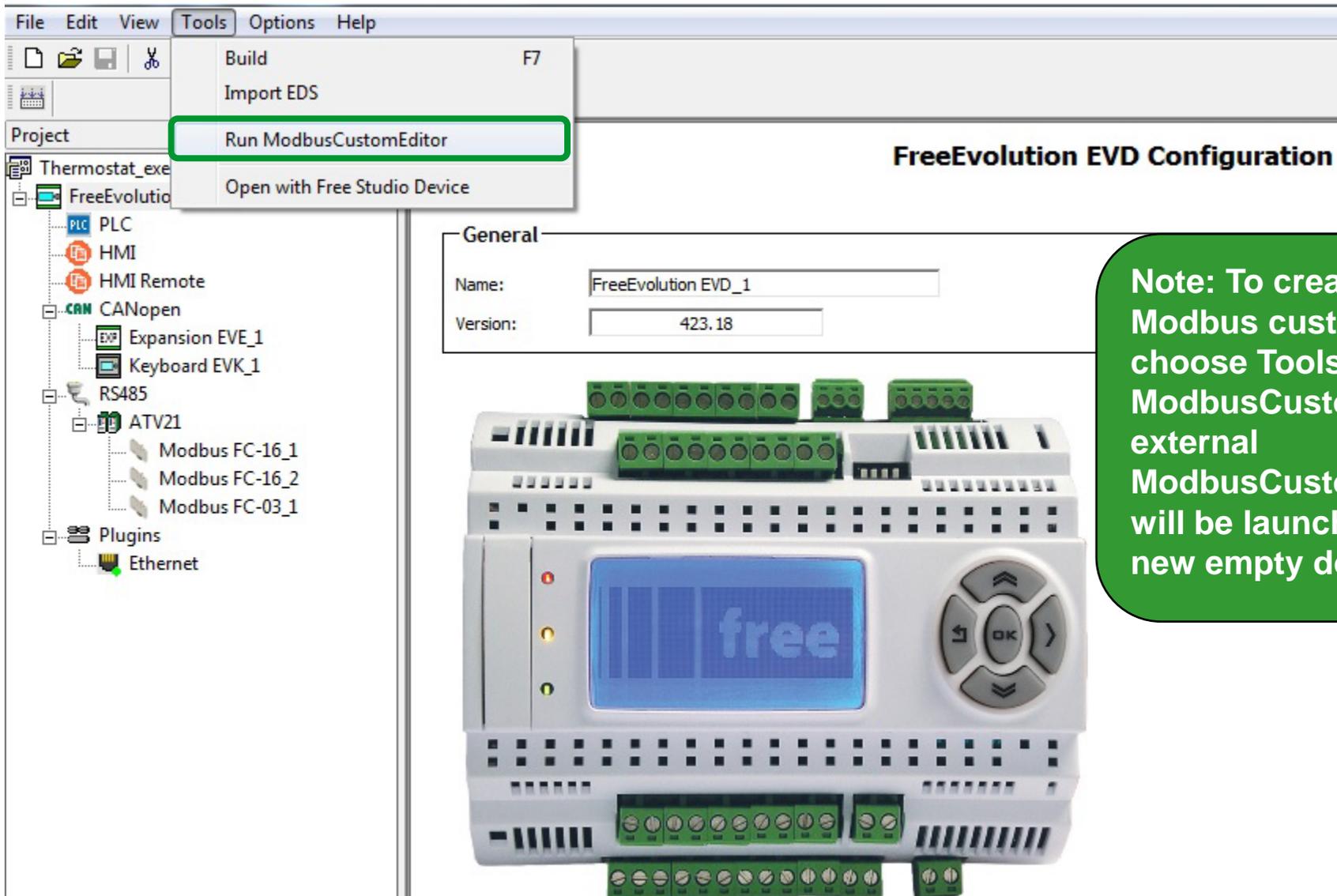
Force value

Name: PLC_Speed_Reference

Value: 1000

Set Exit

...Creating a new Modbus custom device



The screenshot shows the FreeStudio software interface. The 'Tools' menu is open, and 'Run ModbusCustomEditor' is highlighted. The main window displays the 'FreeEvolution EVD Configuration' dialog with the following fields:

- Name: FreeEvolution EVD_1
- Version: 423.18

Below the dialog, a physical FreeEvolution EVD device is shown. The device has a blue screen displaying the 'free' logo and a navigation pad with an 'OK' button. The device is connected to a terminal block with green terminals.

Note: To create a new Modbus custom device, choose Tools / Run ModbusCustomEditor; the external ModbusCustomEditor tool will be launched, with a new empty document.

Creating a new Modbus custom device...



Note:
Advantage: Easier to be used in Connection
Disadvantage: Message are not optimized & common polling time for all messages

VSD_Control_ATV21_1p0 - ModbusCustomEditor

File **3** View Tools Help

File Explorer Save Cut Copy Paste

Name: VSD_Control_ATV21 **1**

Description: VSD control via Modbus Serial Line **2**

Version: 1.0

Max message size (bit): 2000

Max message size (reg.): 120

Allow objects with the same address

Add Remove Up Down

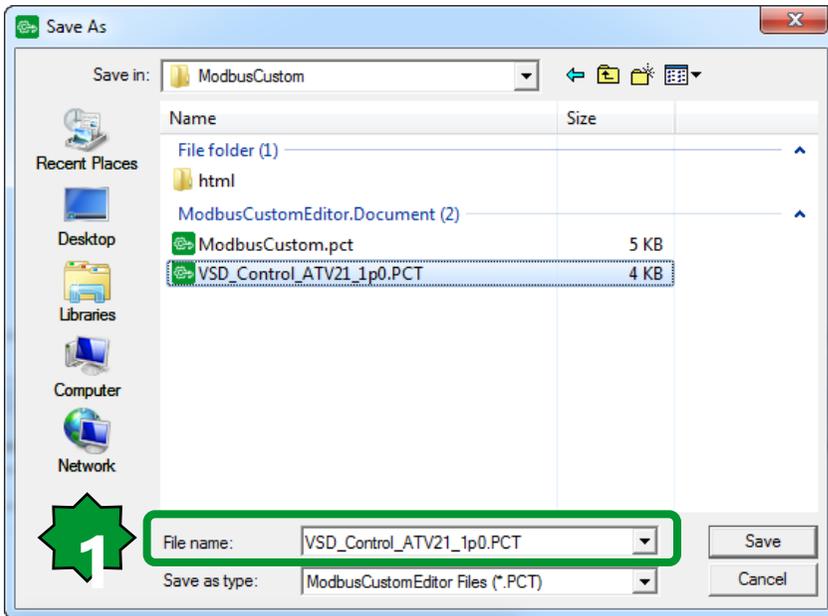
#	Address	Label	Type	Read only	Modbus type	Description
2	64002	VSD_Speed_Reference	INT	False	Holding Register (16 bit)	
3	64769	VSD_Output_Frequency	INT	True	Input Register (16 bit)	
1	64001	VSD_Command	INT	False	Holding Register (16 bit)	

Ready NUM

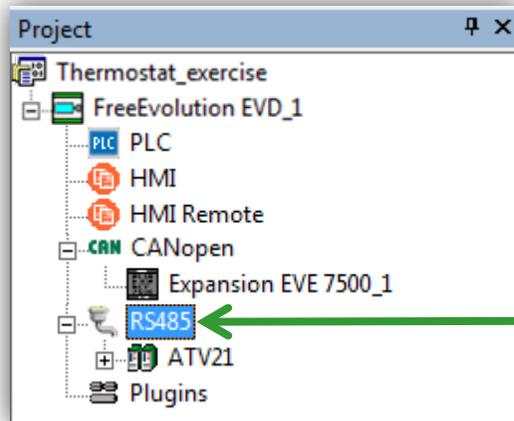
Custom Editor/Saving & Implementation



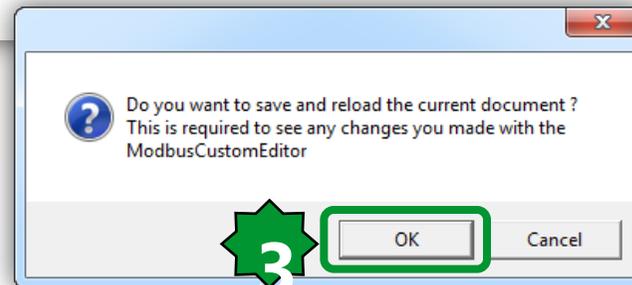
Computer > Disco locale (C:) > Programmi (x86) > Eliwell > free Studio > Catalog > ModbusCustom



Device name	Version	Description
ATV12	1	Modbus registers R/W for ATV12
ATV212	1	Modbus registers R/W for ATV212
ATV21	1	Modbus registers R/W for ATV21
ATV312	1	Modbus registers R/W for ATV312
ATV31	1	Modbus registers R/W for ATV31
ATV32	1	Modbus registers R/W for ATV32
ATV61	1	Modbus registers R/W for ATV61
ATV71	1	Modbus registers R/W for ATV71
EEU M171 EEV Driver	497	M171 EEV Driver
EXP M171 Perf Expansion ...	460	M171 Perf Expansion 27 I/Os
VSD_Control_ATV21	1	VSD control via Modbus Serial Line
Generic Modbus	1	Generic Modbus RTU node

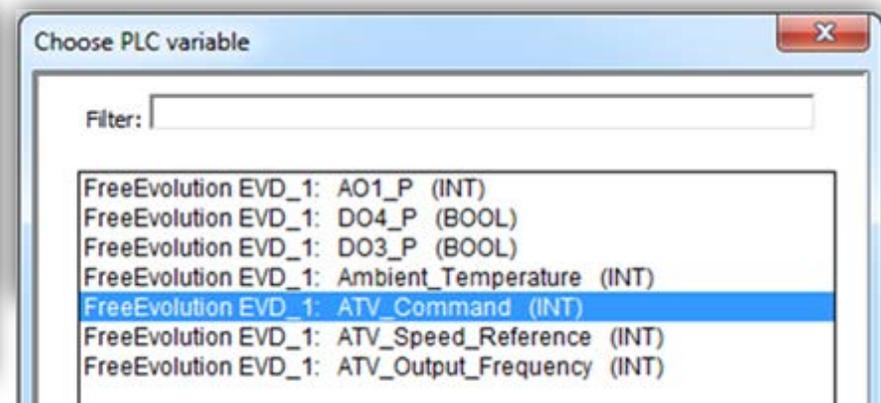
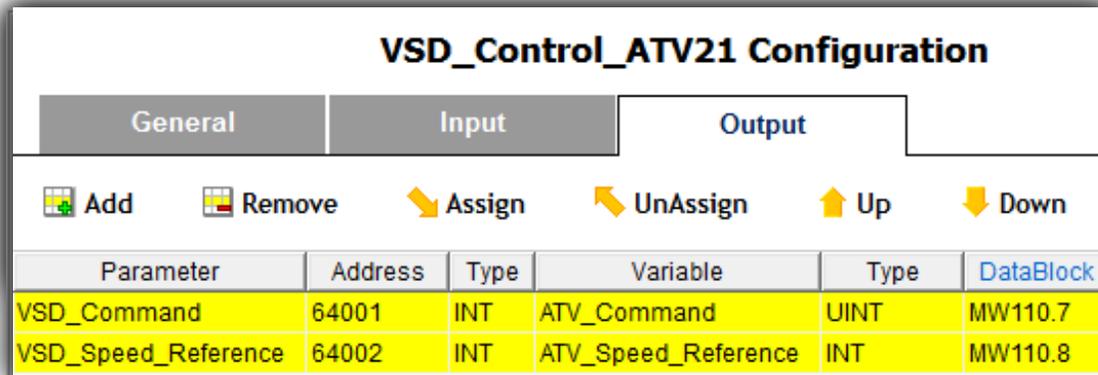
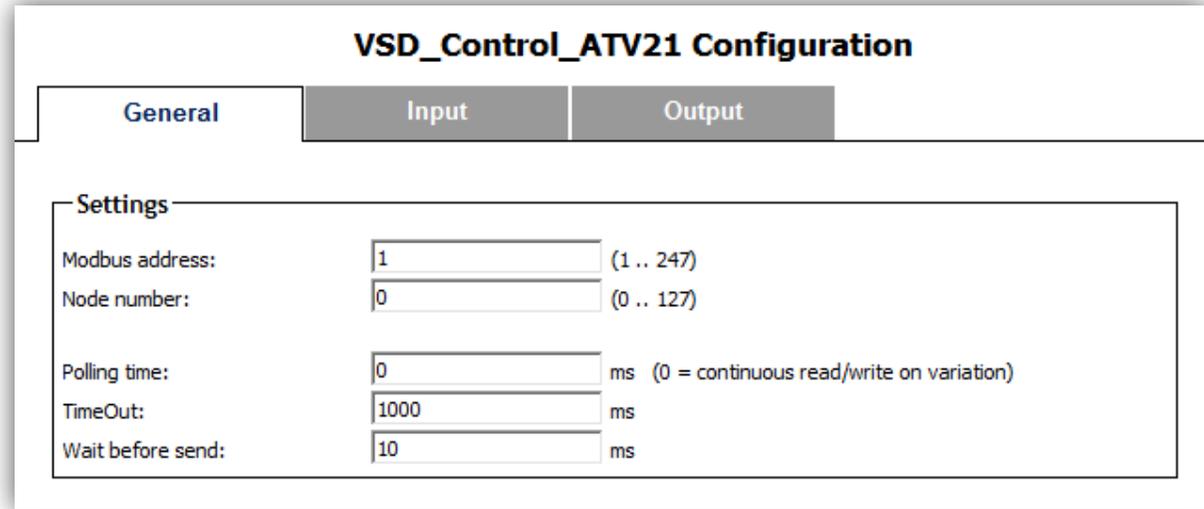
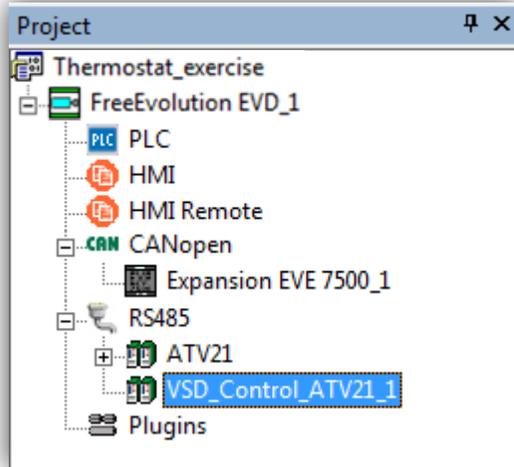


5
Drag & Drop



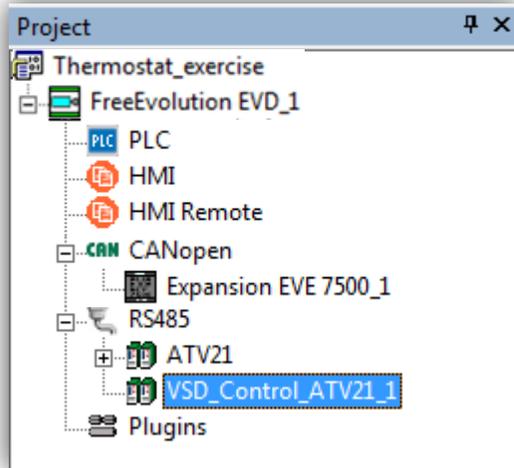


Custom Editor/Output Configuration





Custom Editor/Input Configuration



VSD_Control_ATV21 Configuration

General

Input

Output

Add Remove Assign UnAssign Up Down

Parameter	Address	Type	Variable	Type	DataBlock
VSD_Output_Frequency	64769	INT	ATV_Output_Frequency	INT	MW110.9

Choose PLC variable

Filter:

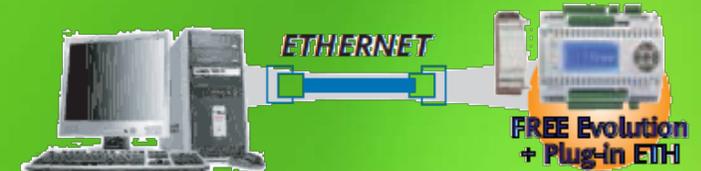
FreeEvolution EVD_1: AI1_E (INT)
FreeEvolution EVD_1: AI3_E (INT) - NTC Probe
FreeEvolution EVD_1: DI1_E (BOOL)
FreeEvolution EVD_1: DI2_E (BOOL)
FreeEvolution EVD_1: Ambient_Temperature_DY (INT)
FreeEvolution EVD_1: Green_LED_EXP1 (USINT)
FreeEvolution EVD_1: Red_LED_EXP1 (USINT)
FreeEvolution EVD_1: ATV_Command (UINT)
FreeEvolution EVD_1: ATV_Speed_Reference (INT)
FreeEvolution EVD_1: ATV_Output_Frequency (INT)

Chapter 14

Modbus TCP

Goal:

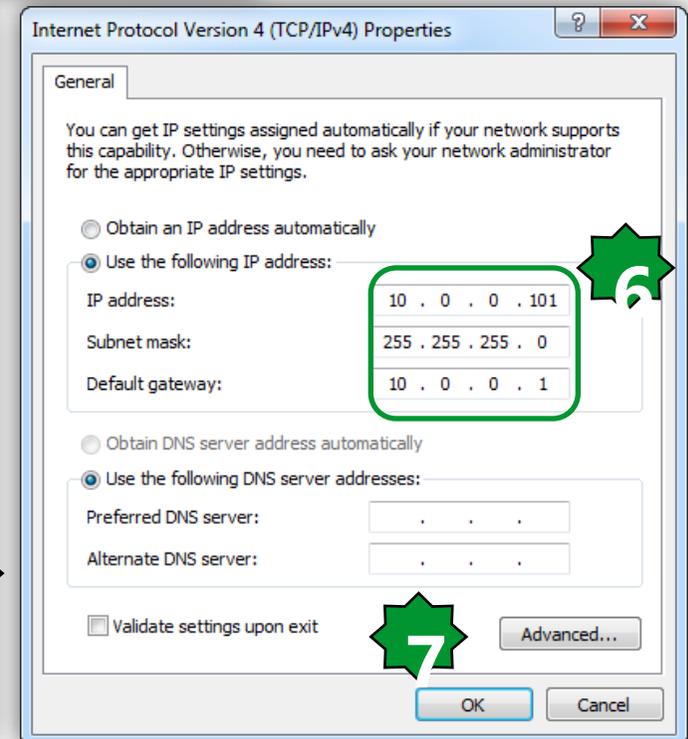
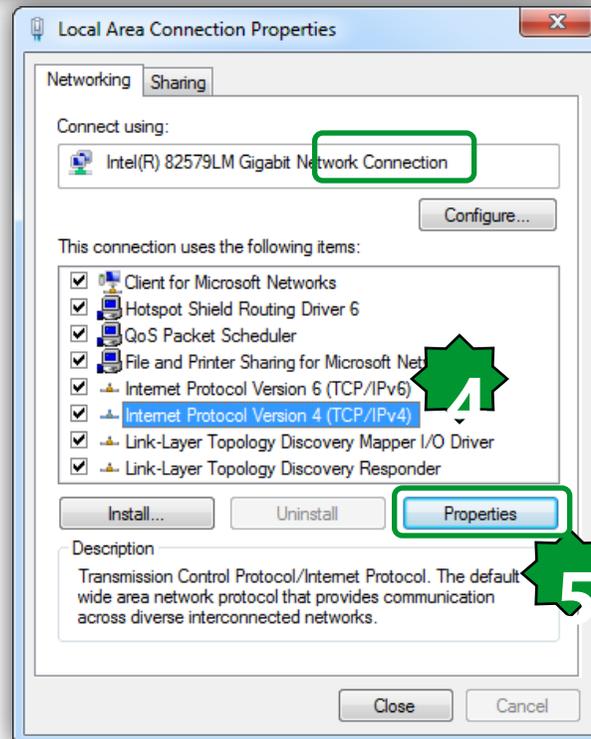
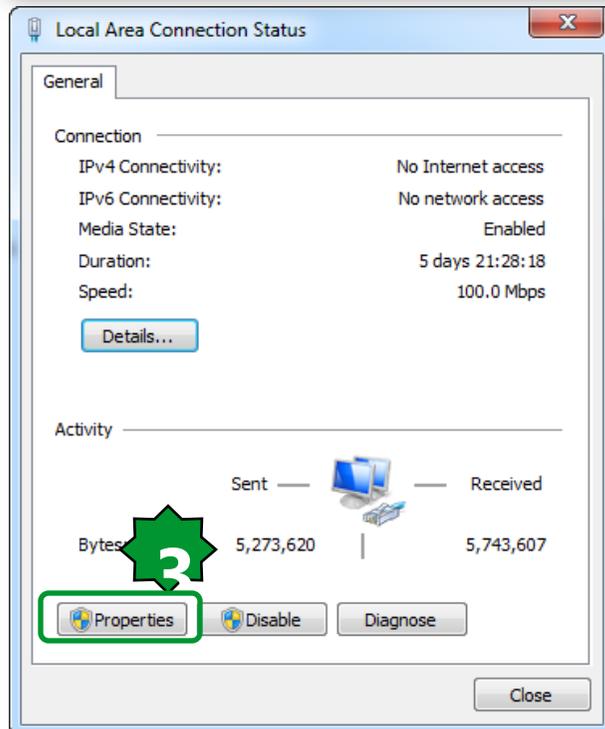
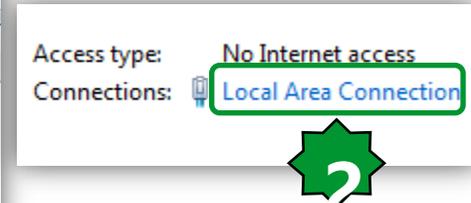
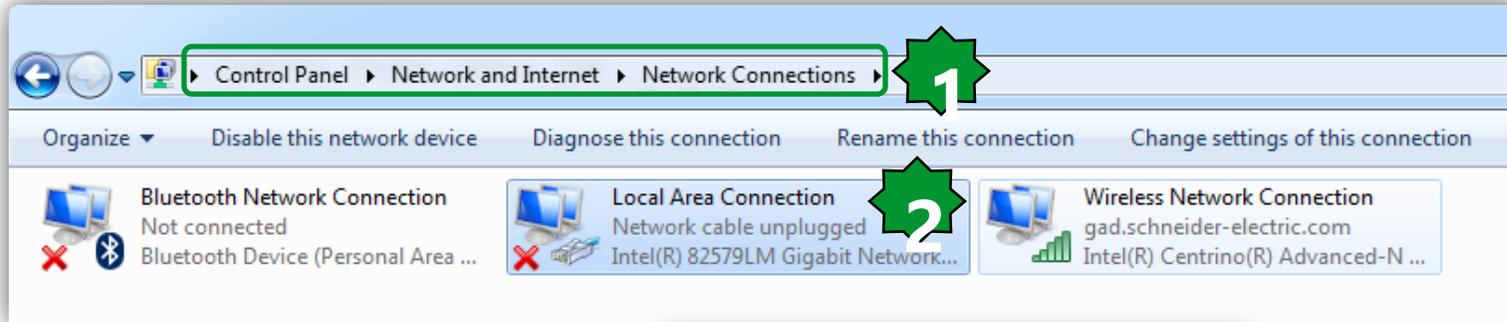
Modbus TCP configuration, project download
and socket management



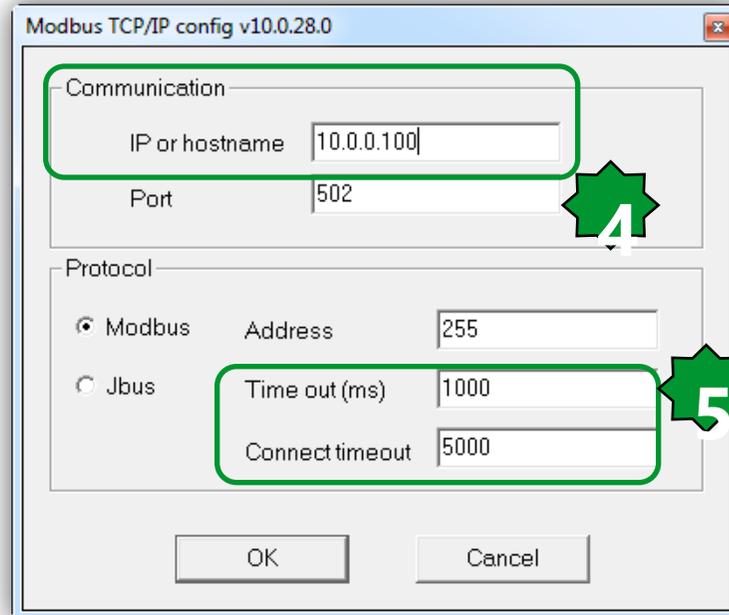
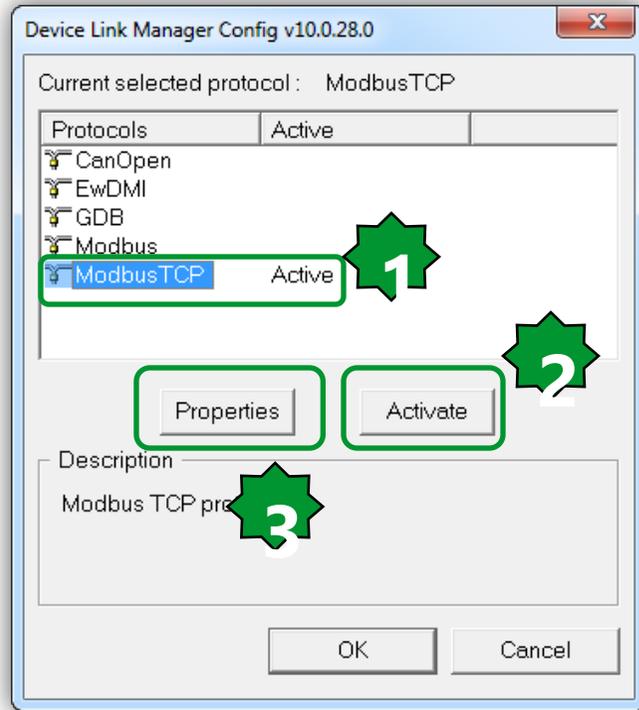
eliwell

by **Schneider** Electric

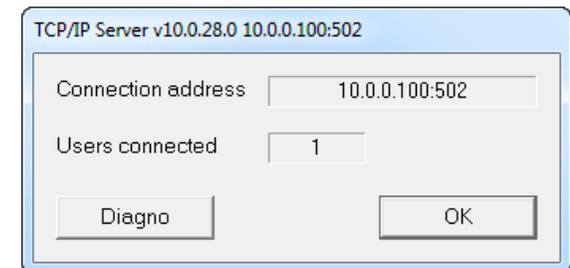
PC TCP/IP configuration



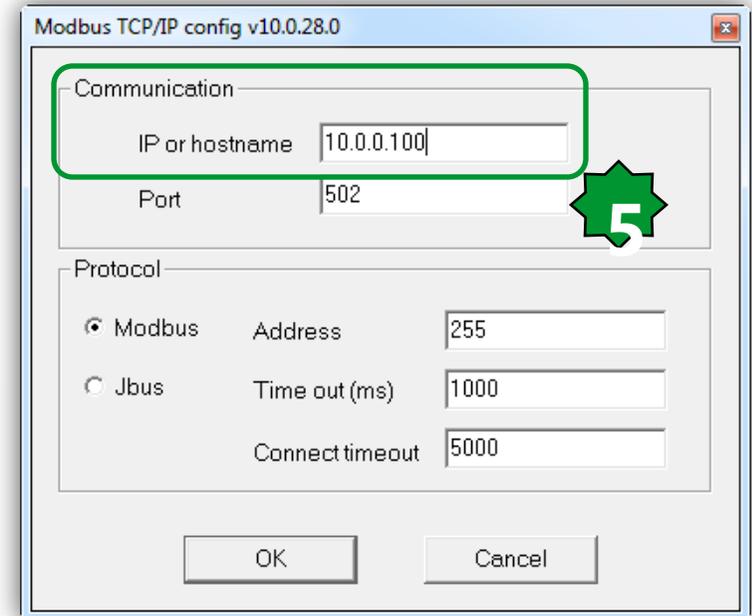
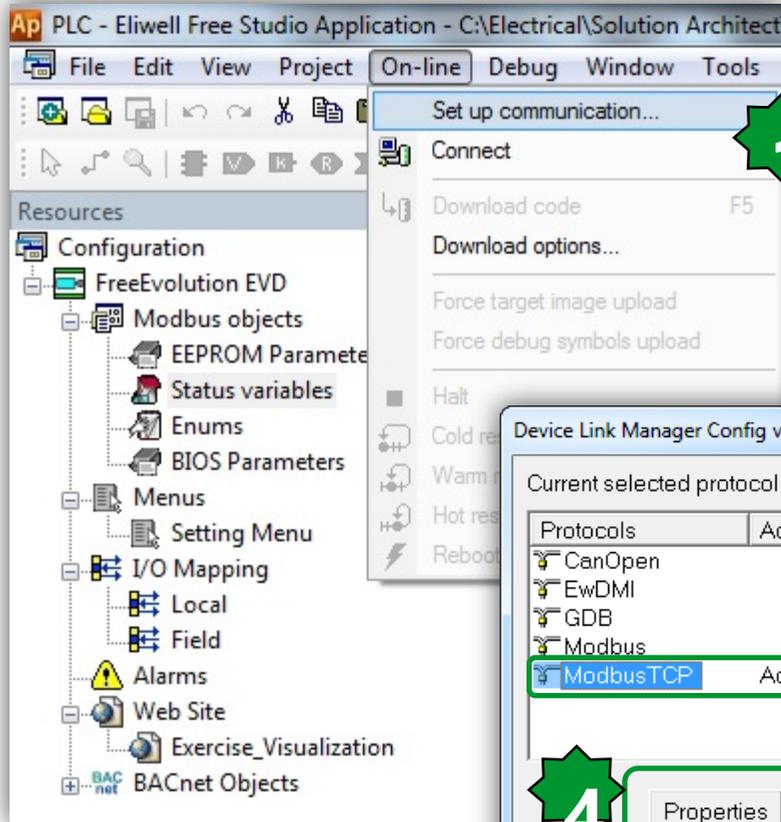
Modbus TCP/download



5.change Timeout and Connect Timeout based on the Ethernet band available. If the connection it is not direct it is better to increase both of them 10000-20000



Modbus TCP/debugging



Chapter 15

Modbus Slave

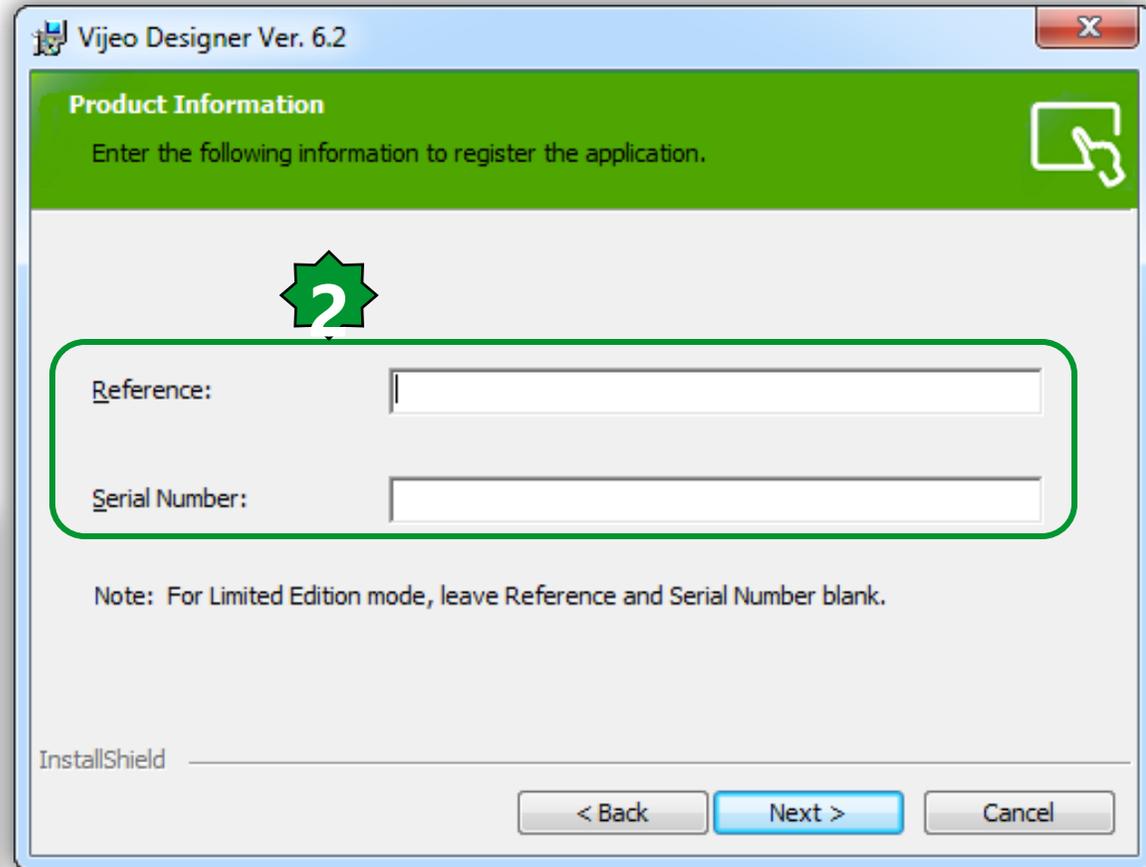
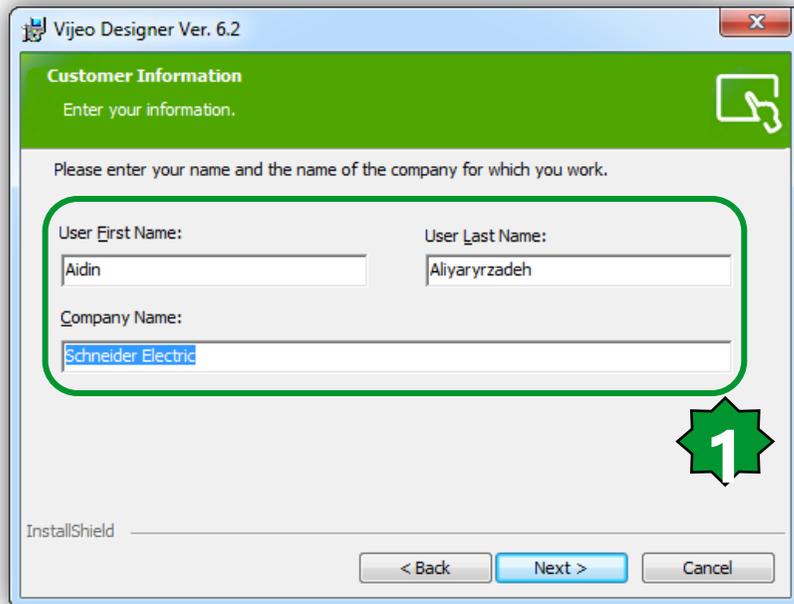
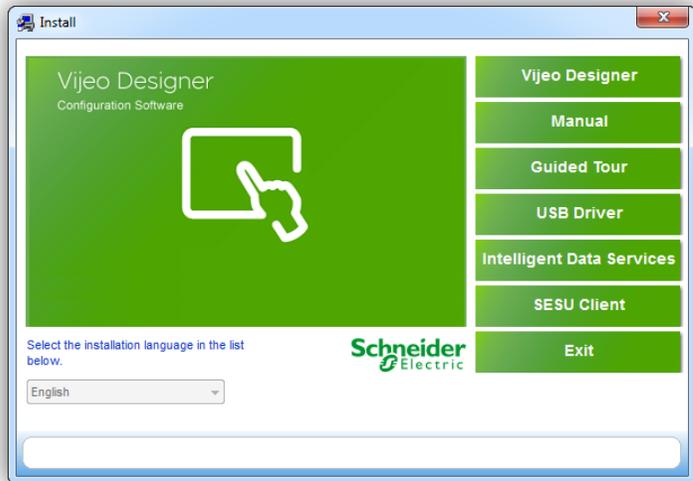
Goal:

Configuration of Free Studio to establish connection between

Vijeodesigner & EVOLUTION via:

- 1.Modbus TCP/IP – Vijeodesigner off line simulation
- 2.Modbus RTU – Megalis target

Vijeo Designer Installation





New Project creation/Modbus TCP-IP

Create New Project

Project Name to Create

Project Name

Target : 1/1

Target Setup

Assign the following IP Address

IP Address

Subnet Mask

Default Gateway

Enable Audit Trails

Additional setup is required to use this feature. Please click on help and review configurations necessary.

[Help](#)

< Back **Next >** Finish Cancel





General Settings

1

2

HVAC Simulation

- Monitoring_HVAC
 - Graphical Panels
 - Forms & Reports
 - Actions
 - Environment
 - Resource Library
 - Alarms & Events
 - Recipes
 - Data Logging
 - Variables
 - IO Manager

General

- Network
- Hardware
- Options
- Remote Access
- Multimedia
- Keys
- Alarm

3

General

Name: Monitoring_HVAC

Description:

Type: HMISTU Series

Model: HMISTU655 (320x240)

Target Color: 64K Colors

Initial Panel ID: 1: Panel 1

Download: USB

Target IP Address: 10 . 0 . 0 . 120

Host Name

COM Port:

Baud Rate:

User Application: Main Drive

Include Editor Project

Preserve Run-Time Data

Use NAT



I/O manager definition

1. Right Click ▶ insert new driver

2. Select the driver

3. Select the equipment

4. Set the equipment address

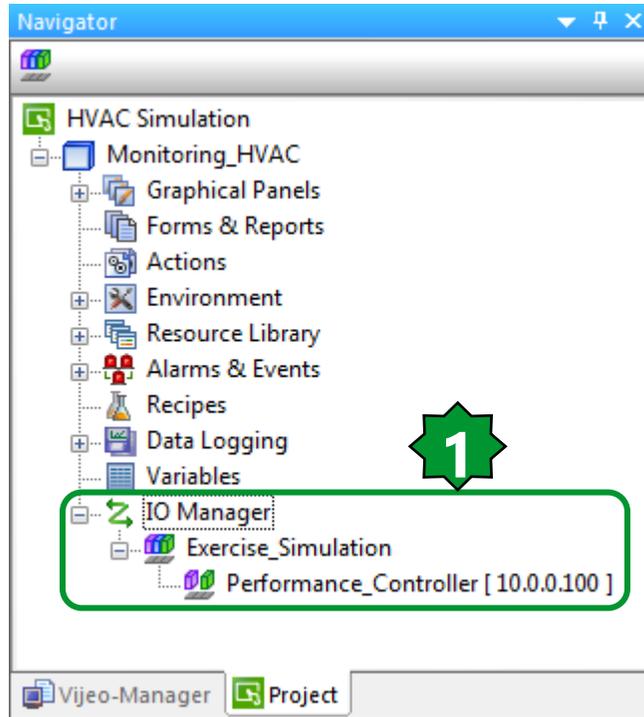
5. Use the IEC syntax

6. Validate

The image displays the I/O manager software interface. On the left, the 'Navigator' pane shows a project tree with 'IO Manag' selected. A context menu is open over 'IO Manag', with 'New Driver...' and 'Insert' options visible. A green star with the number '1' is placed over the 'New Driver...' option. The 'New Driver' dialog box is open, showing 'Schneider Electric Industries SAS' in the 'Manufacturer' dropdown. The 'Driver' list includes 'Jbus (RTU)', 'Modbus (RTU)', 'Modbus Slave', 'Modbus TCP/IP', 'PacDrive - Ethernet', 'Uni-Telway', and 'XWAY TCP/IP'. 'Modbus TCP/IP' is selected, with a green star and the number '2' next to it. The 'Equipment' list includes 'Modbus Equipment' and 'Modbus USB Equipment'. 'Modbus Equipment' is selected, with a green star and the number '3' next to it. The 'Equipment Configuration' dialog box is open, showing 'Modbus Equipment' as the selected equipment. The 'Equipment Address' section is highlighted with a green box and a green star with the number '4'. It contains 'IP Address' (10 . 0 . 0 . 100) and 'Unit ID' (255 / 255). The 'IEC61131 Syntax' checkbox is checked, and the 'Addressing Mode' is set to '1-based (Unity Quantum)'. The 'Variables' section shows 'Double Word word order' set to 'High word first' and 'ASCII Display byte order' set to 'Low byte first'. The 'Communication Optimization' section shows 'Preferred Frame Length' set to 'Custom' (120 bytes). The 'Data Dictionary Management' section has the 'Preload Data Dictionary for online modifications' checkbox checked. The 'OK' button is highlighted with a green box and a green star with the number '6'.



Renaming created driver & equipment





External Variable Definition

The screenshot illustrates the steps to define an external variable in a simulation environment:

1. In the **Navigator** window, the **Variables** folder is selected.
2. In the **Monitoring_HVAC - Variable Editor** window, the **INT 16 Bits Signed** data type is selected from the dropdown menu.
3. The **INT 16 Bits Signed** data type is confirmed in the dropdown menu.

Data Type	Data Source	Scan Group	Device Address	Alarm Group
er.				



Variable Properties/Addressing

FreeEvolution Status Variables

Add Remove Recalc

1

#	Address	Name	Device type	Application type	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel	Read only
1	8960	Ambient_Temperature	Signed 16-bit	INT				1	0	°C	XXX.Y	Always visible	True

Modbus TCP/IP

Address: %MWi

Offset (i): 8960

Bit (j):

Preview: %MW8960

OK Cancel Help

2

Note: No 1 bit shifting is needed

3

Name	Data Type	Data Source	Scan Group	Device Address	Alarm Group	Logging Group
Amb_Temp	INT	External	Performance_Controller	%MW8960	Disabled	None

1. Check the status variable address defined in controller
2. Define an external variable in HMI side

Assigning the variable to the Numeric disp.



The screenshot displays the Vijeo-Manager software interface. The top menu bar includes File, Edit, Build, HMI, Arrange, Variable, Report, View, Draw, Tools, Window, and Help. Below the menu is a toolbar with various icons for file operations, navigation, and editing. The main workspace is a grid with a black background and a grey patterned background. A context menu is open over the grid, listing the following options: Numeric Display (highlighted), String Display, Date Display, and Time Display. A green starburst with the number '2' is placed over the 'Numeric Display' option. In the Navigator panel on the left, the 'HVAC' folder is expanded, showing 'HVAC_Exercise' and its subfolders: Graphical Panels, Base Panels, Popup Windows, and Master Panels. The '1: Temp_Cntrl' object is highlighted under 'Base Panels' with a green starburst and the number '1'. The status bar at the bottom shows 'Vijeo-Manager' and 'Project'.



Numeric Display Properties

Numeric Display Settings

General | Input Mode | Color | Visibility | Advanced

Name: NumericDisplay01 Style: 00037

Data Type: Integer Float

Variable: Amb_Temp Zero Suppress Enable Input Mode

Display Digits: 2 . 1 Display Zero(s)

Format: Dec. Digit Grouping

Font Resource: <Use Local Settings>

Language: 1: Language1

Font: Vijeo Modern 8x13 Font Width: 8

Font Style: Normal Font Height: 13

12°C

Alignment: [Left] Unit: °C

OK Cancel Help

Expression Editor Pad

Expression: [Empty]

Variable List: Amb_Temp

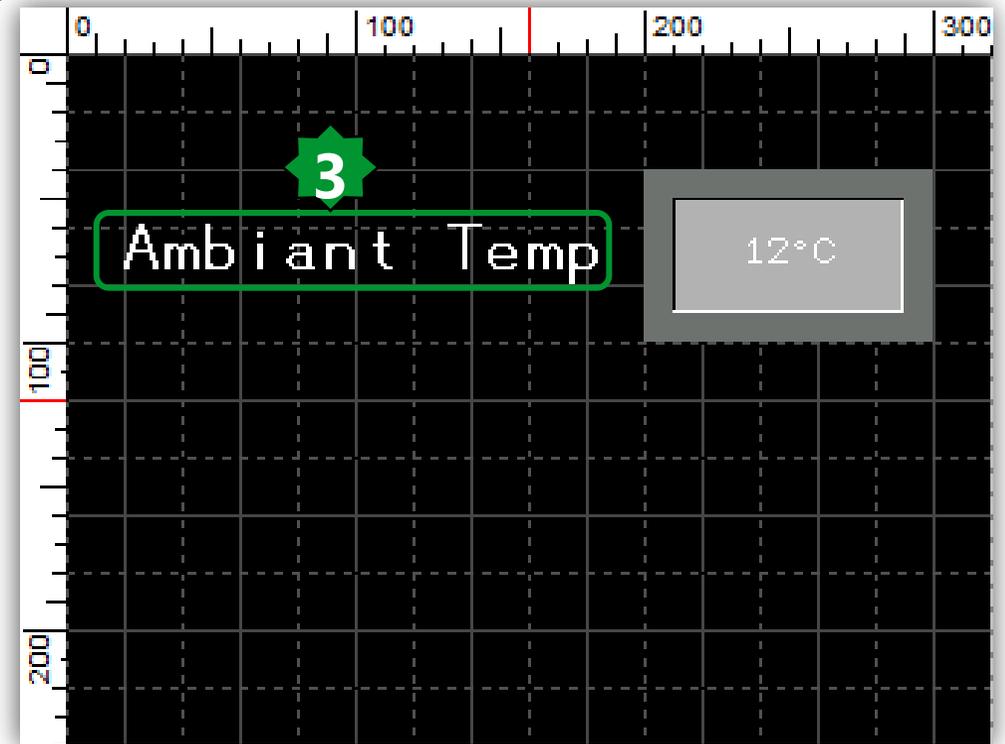
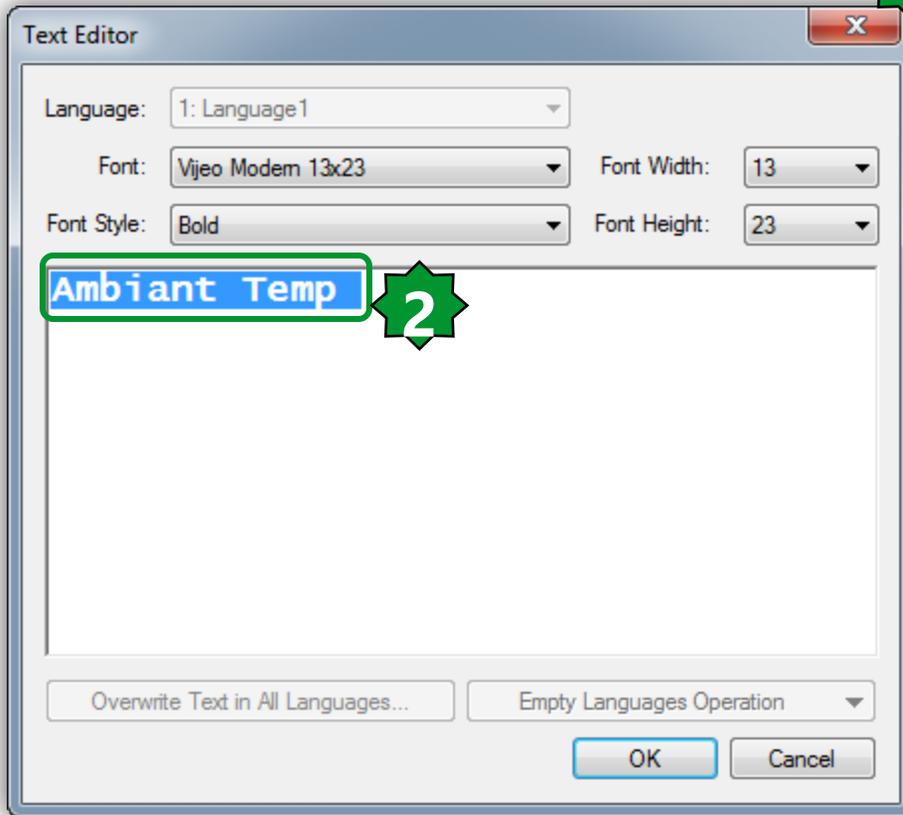
HVAC_Exercise
 Amb_Temp [%MW8960]

Vijeo

OK Cancel Help

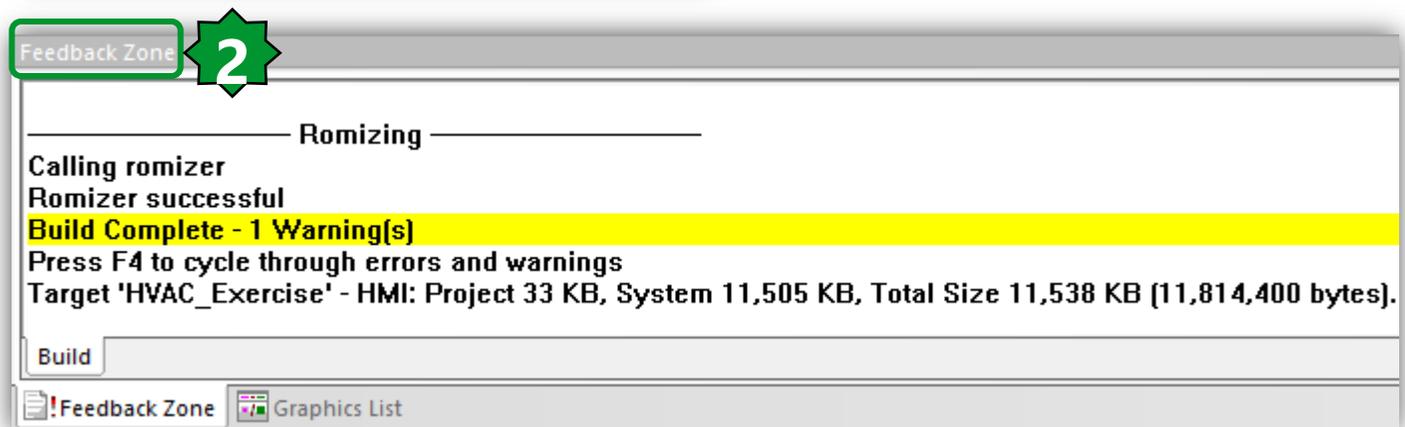
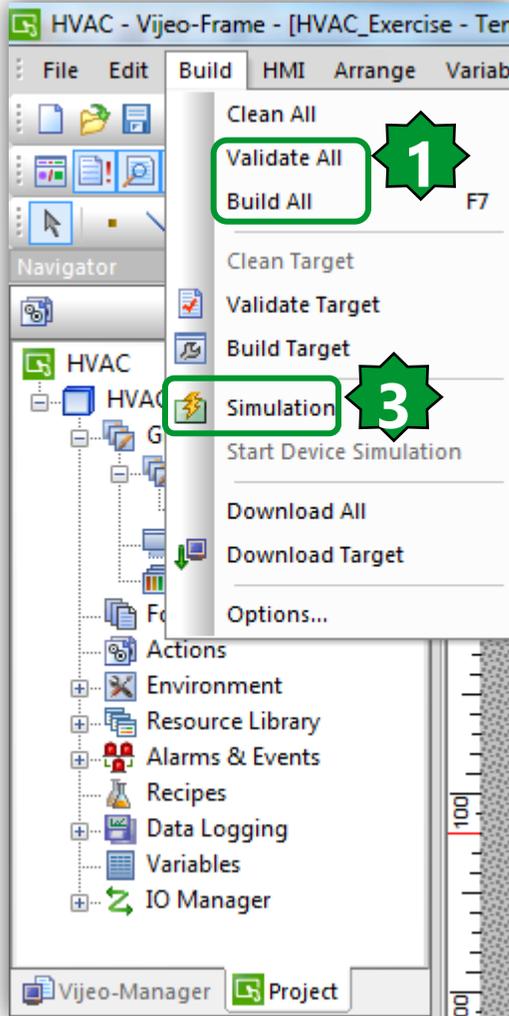


Forming the Panel





Running Simulation





EEPROM parameters assigning

FreeEvolution EEPROM Parameters

Add
 Remove
 Recalc

1

#	Address	Name	Device type	Application type	Size	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel
1	16384	SetPoint	Signed 16-bit	INT		180	150	300	1	0	°C	XXX.Y	Always visible
2	16385	Differentiation	Signed 16-bit	INT		20	5	50	1	0	°C	XXX.Y	Always visible

	Name	Data Type	Data Source	Scan Group	Device Address	Alarm Group	Logging Group
1	Amb_Temp	INT	External	Performance_Controller	%MW8960	Disabled	None
2	Setpoint	INT	External	Performance_Controller	%MW16384	Disabled	None
3	Delta	INT	External	Performance_Controller	%MW16385	Disabled	None

2



Numeric Display settings/Enable Input

The image shows the 'Numeric Display Settings' dialog box with five numbered callouts indicating key configuration steps:

- 1**: Variable is set to 'Setpoint'.
- 2**: 'Setpoint [%MW16384]' is selected in the Variable List of the Expression Editor Pad.
- 3**: Display Digits are set to 2 and 1.
- 4**: Unit is set to '°C'.
- 5**: 'Enable Input Mode' is checked in the Input Mode tab.

The dialog box is divided into several tabs: General, Input Mode, Color, Visibility, and Advanced. The 'General' tab shows the following settings:

- Name: NumericDisplay02
- Data Type: Integer (selected), Float
- Variable: Setpoint
- Display Digits: 2 (integer), 1 (decimal)
- Format: Dec.
- Font Resource: <Use Local Settings>
- Language: 1: Language 1
- Font: Vijeo Modern 8x13
- Font Width: 8
- Font Style: Normal
- Font Height: 13
- Unit: °C

The 'Input Mode' tab shows the following settings:

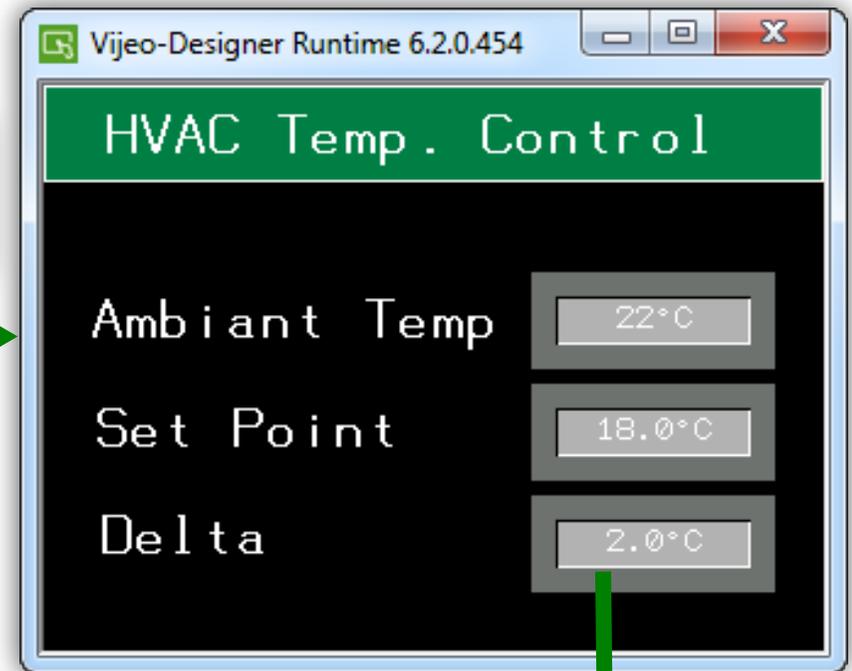
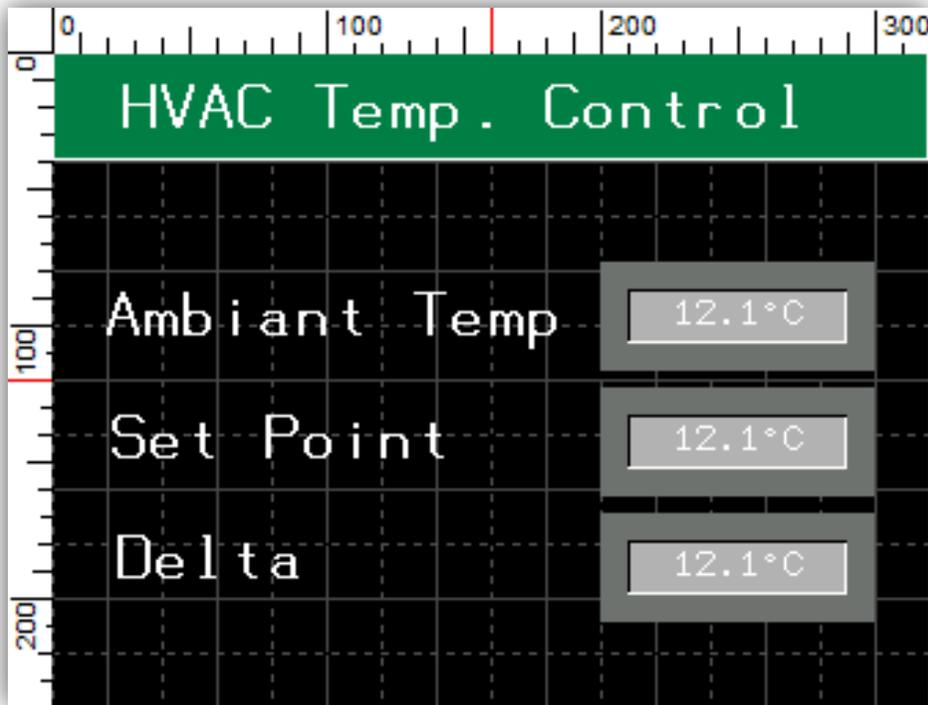
- Enable Input Mode:
- Field ID: 0
- Display Popup Keypad:
- Overwrite Variable's Input Range:

The 'Expression Editor Pad' shows the following settings:

- Expression: Setpoint
- Variable List: Setpoint
- Variable List: HVAC_Exercise
 - Amb_Temp [%MW8960]
 - Delta [%MW16385]
 - Setpoint [%MW16384] (selected)



Panel forming & Simulation



2*Click

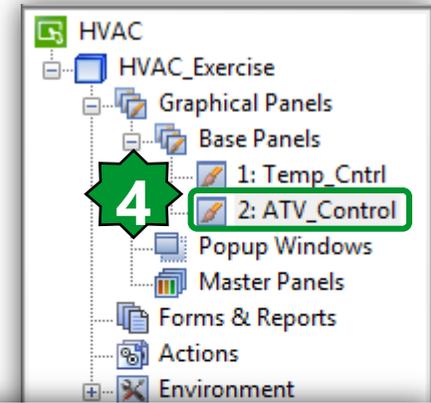
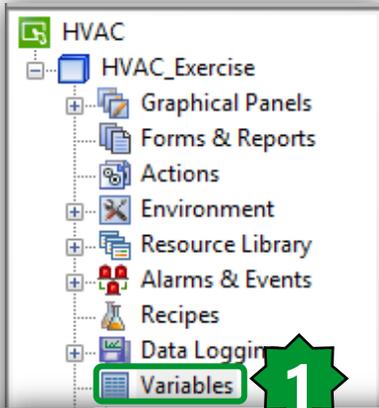


ATV control/ final goal





ATV Ctrl./Variable & Panel declaration



8	8967	ATV_Command	Unsigned 16-bit	UINT						Always visible	False	
9	8968	ATV_Speed_Reference	Signed 16-bit	INT				Hz		Always visible	False	0-5000 (0.01 Hz)
10	8969	ATV_Output_Frequency	Signed 16-bit	INT				Hz		Always visible	True	
11	8970	Modbus_Comm_Error	Boolean	BOOL						Always visible	True	
12	8971	Web_ATV_Comd	Boolean	BOOL						Always visible	False	
13	8972	Web_ATV_Speed_Ref	Signed 16-bit	INT	0	0	5000	Hz	XX.YY	Always visible	False	0-50 Hz
14	8973	Web_ATV_Output_Frq	Signed 16-bit	INT				Hz	XX.YY	Always visible	False	0-50 Hz

	Name	Data Type	Data Source	Scan Group	Device Address	Alarm Group	Logging Group
1	Amb_Temp	INT	External	Performance_C...	%MW8960	Disabled	None
2	ATV_Command	BOOL	External	Performance_C...	%MW8971:X0	Disabled	None
3	ATV_Output_Freq	INT	External	Performance_C...	%MW8973	Disabled	None
4	ATV_Speed_Ref	INT	External	Performance_C...	%MW8972	Disabled	None
5	Delta	INT	External	Performance_C...	%MW16385	Disabled	None
6	Setpoint	INT	External	Performance_C...	%MW16384	Disabled	None



ATV Ctrl./Command & Status



1

Switch Settings

General Color Label Visibility Advanced

Mode Switch Switch with Lamp Category Bitmap

Name Switch03

State [Up]

Lamp Enter a valid Condition Expression. It

Style 00003

Reverse On Touch

When Touch While Touch When Release

Operation Bit

Operation

Set

Reset

Toggle

Momentary ON

Momentary OFF

Destination ATV_Command

Bit Reset [ATV_Command]

Apply Add >

OK Cancel Help

3

Lamp Settings

General Color Label Visibility

Name Lamp01

Variable ATV_Command

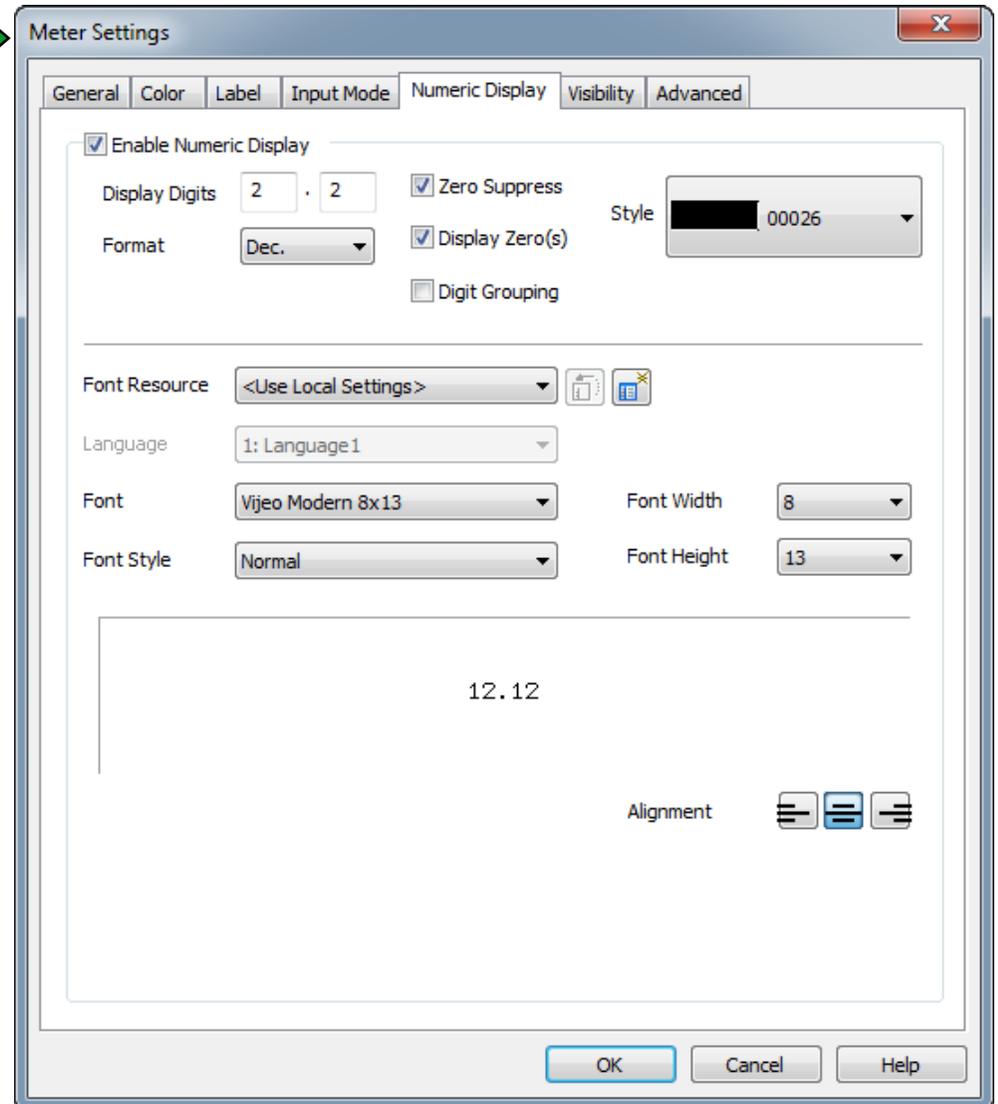
State [Off]

Category Primitive

Style 20052



ATV Ctrl./Output Freq.





ATV Ctrl./Speed Reference

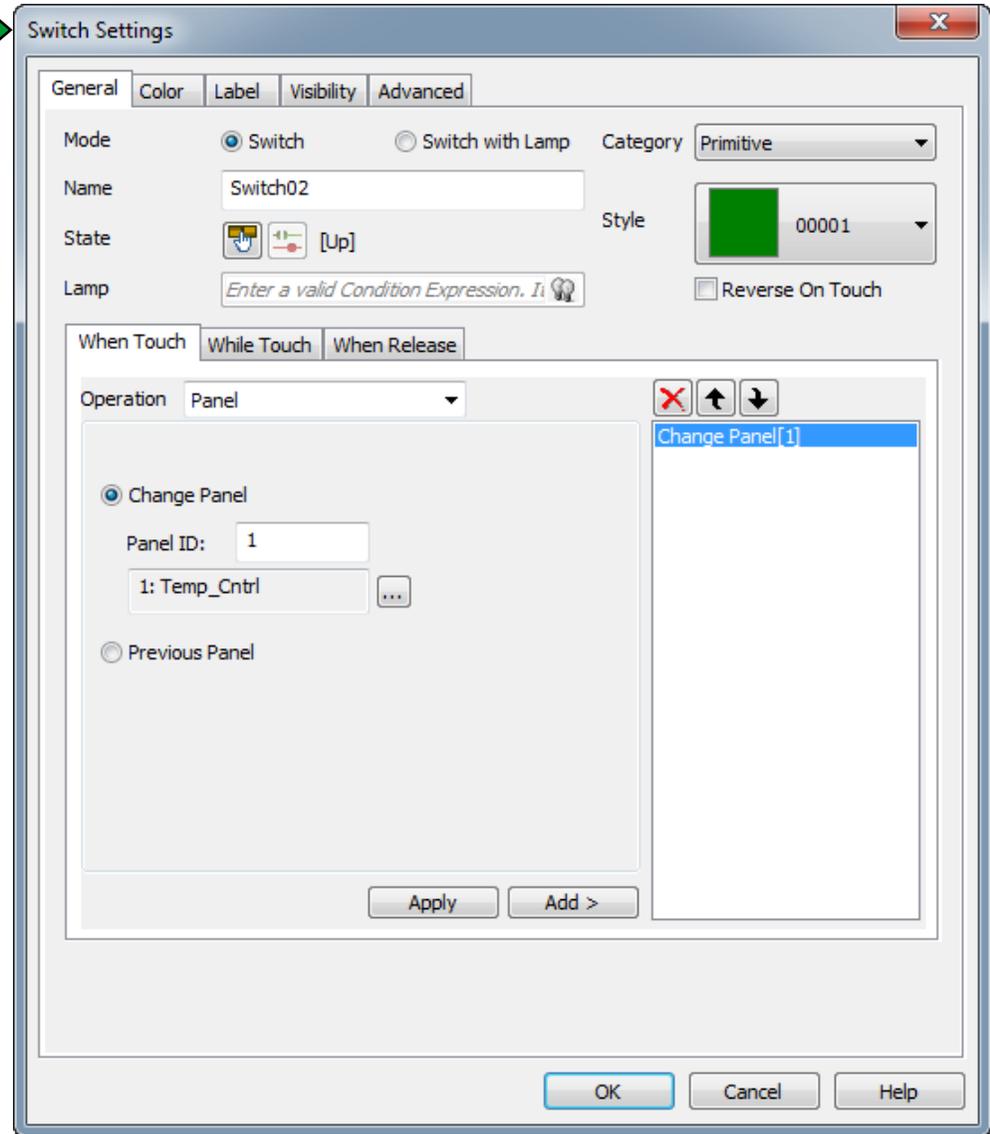
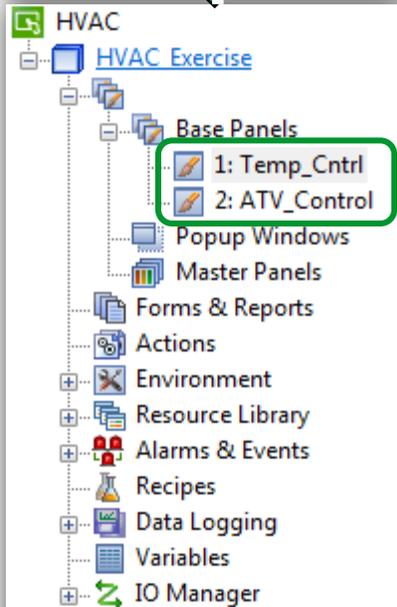


The screenshot shows the "Numeric Display Settings" dialog box. The "General" tab is selected. The "Name" field is "NumericDisplay01". The "Data Type" is set to "Integer". The "Variable" is "ATV_Speed_Ref". The "Display Digits" are set to "2" for the integer part and "2" for the decimal part. The "Format" is set to "Dec.". The "Font Resource" is "<Use Local Settings>". The "Language" is "1: Language1". The "Font" is "Vjeco Modern 8x13 Bold". The "Font Style" is "Bold". The "Font Width" is "8" and the "Font Height" is "13". The "Unit" is "Hz". The "Alignment" is set to "Center". The "Zero Suppress" and "Enable Input Mode" checkboxes are checked. The "Display Zero(s)" checkbox is also checked. The "Digit Grouping" checkbox is unchecked. The "OK", "Cancel", and "Help" buttons are at the bottom.



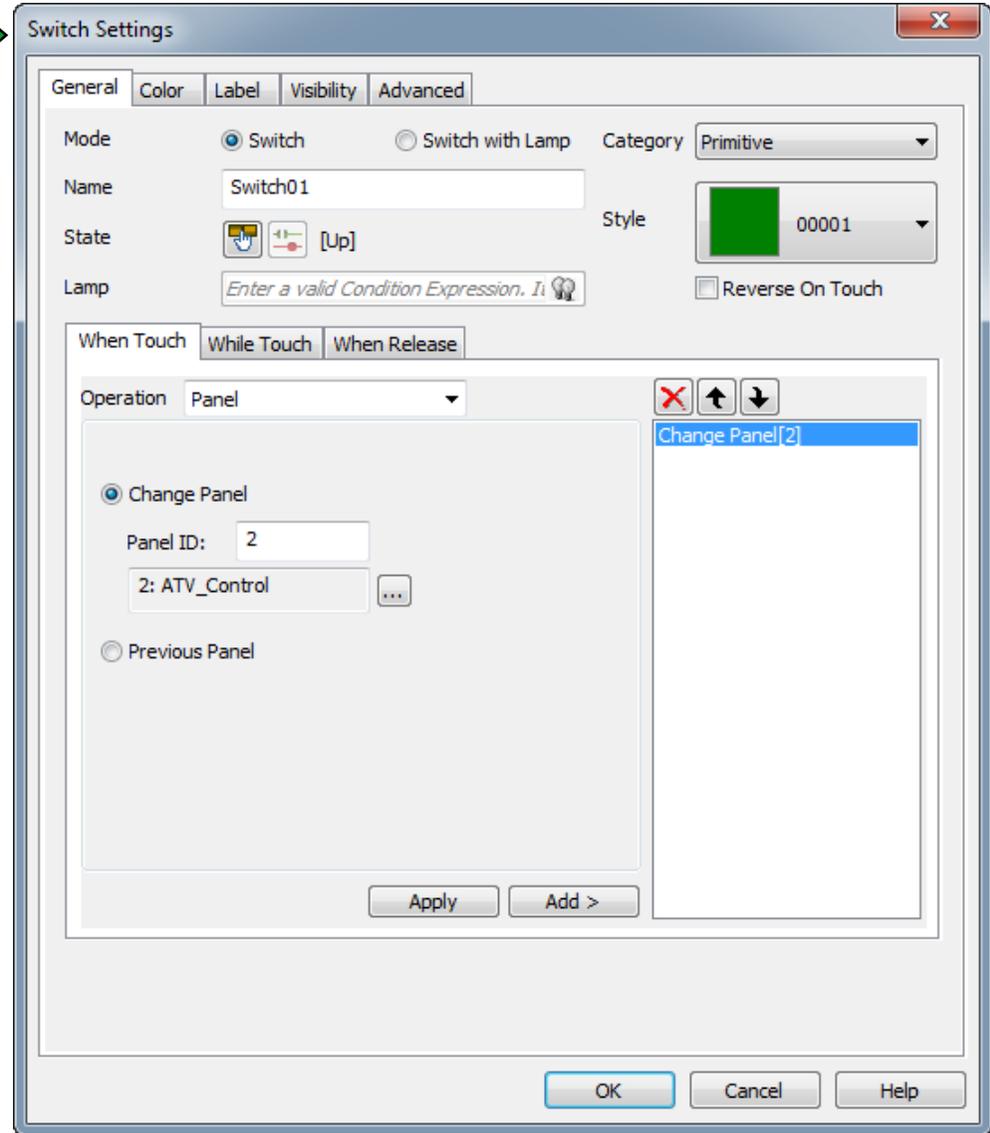
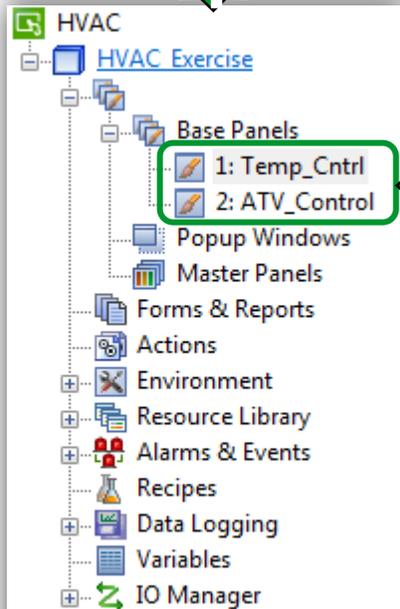
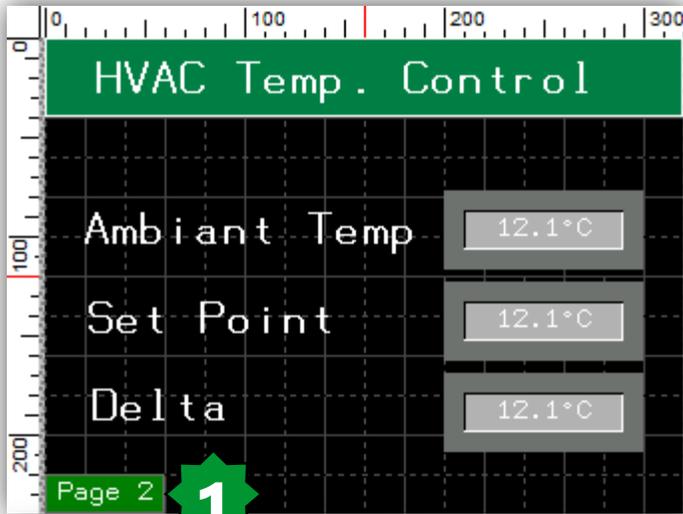


ATV Ctrl./Page switching

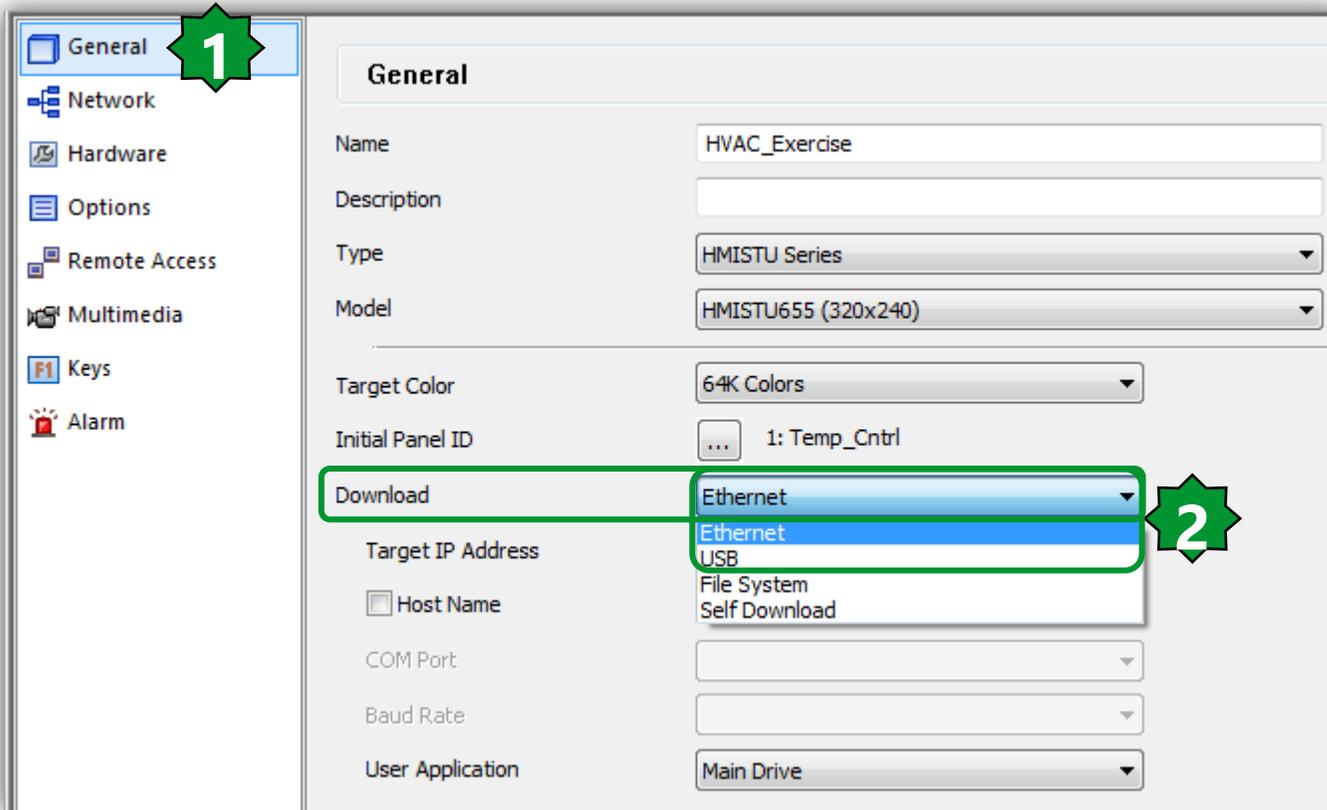




ATV Ctrl./Page Switching



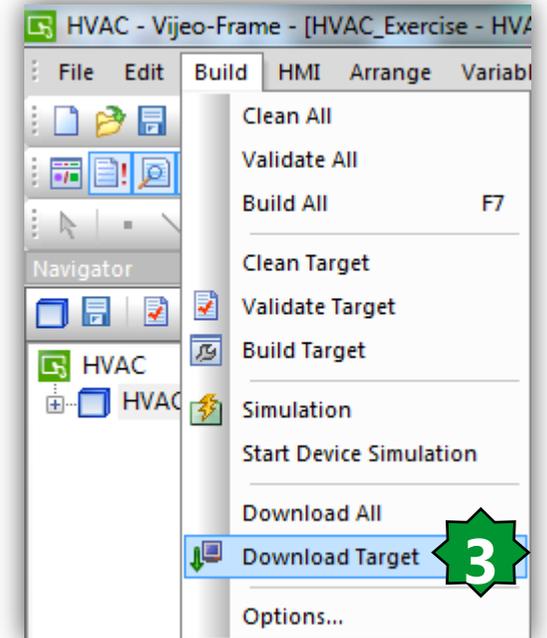
Target Download via USB or Ethernet



The screenshot shows the 'General' configuration window for a project named 'HVAC_Exercise'. The 'General' tab is selected, indicated by a green star with the number '1'. The configuration fields are as follows:

Field	Value
Name	HVAC_Exercise
Description	
Type	HMISTU Series
Model	HMISTU655 (320x240)
Target Color	64K Colors
Initial Panel ID	1: Temp_Cntrl
Download	Ethernet
Target IP Address	
<input type="checkbox"/> Host Name	
COM Port	
Baud Rate	
User Application	Main Drive

The 'Download' dropdown menu is open, showing options: Ethernet, USB, File System, and Self Download. A green star with the number '2' is placed next to the 'Ethernet' option.



The screenshot shows the 'Build' menu in the software interface. The menu items are:

- Clean All
- Validate All
- Build All (F7)
- Clean Target
- Validate Target
- Build Target
- Simulation
- Start Device Simulation
- Download All
- Download Target (indicated by a green star with the number '3')
- Options...

Modbus Slave

- Status variables and EEPROM parameters have a modbus address and they are all Holding Registers, regardless the type of variable defined into Device Type

FreeEvolution Status Variables

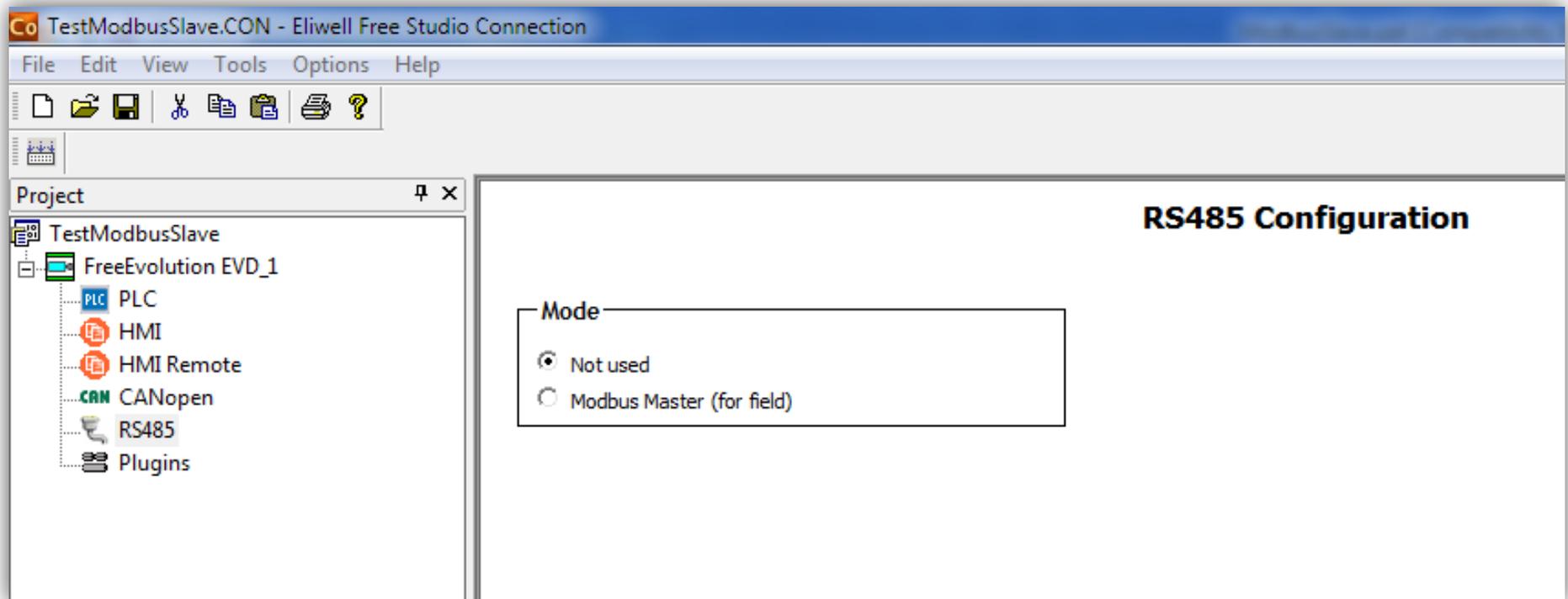
 Add  Remove  Recalc

#	Address	Name	Device type	Application type	Size	Offset	Unit	AccessLevel	Read only
1	8960	TestWord	Unsigned 16-bit	UINT		0		Always visible	False
2	8961	TestBit	Boolean	BOOL		0		Always visible	False

- EEPROM parameters are always R/W
- Status Variables are RO by default
 - Set to False Read Only in case of R/W Status Variable

Modbus Slave

- In Free Studio Connection, set the Mode of RS485 of the controller to Not used
 - It means that the RS485 on board is configured as a slave port





Modbus Slave

- In Free Studio Device, in Bios parameters, click on RS485 On Board
- Configure the Modbus communication:
 - Address of the controller
 - Baudrate
 - Stop bits
 - Parity

The screenshot shows the 'RS485 On Board' configuration window in Free Studio Device. The window title is 'TestModbusSlave.CFN - Eliwell Free Studio Device'. The left sidebar shows the project tree with 'FreeEvolution EVD_1' selected, and 'BIOS parameters' > 'All parameters' > 'RS485 On Board' expanded. The main area displays a table of parameters:

Address	Name	Value	Um	Default	Min	Max	Description
15774	Addr_RS485_OB	1	num	1	0	255	RS485 On Board address
15775	Proto_RS485_OB	3=Modbus/RT	num	3=Modbus/RT	2	3	Select RS485 On Board protocol
15776	DataBit_RS485_OB	8	num	8	8	8	RS485 On Board Data bit number
15777	StopBit_RS485_OB	1	num	1	1	2	RS485 On Board stop bit number
15778	Parity_RS485_OB	2=Even	num	2=Even	0	2	RS485 On Board parity protocol
15779	Baud_RS485_OB	1=19200	num	2=38400	0	5	RS485 On Board baud rate protocol

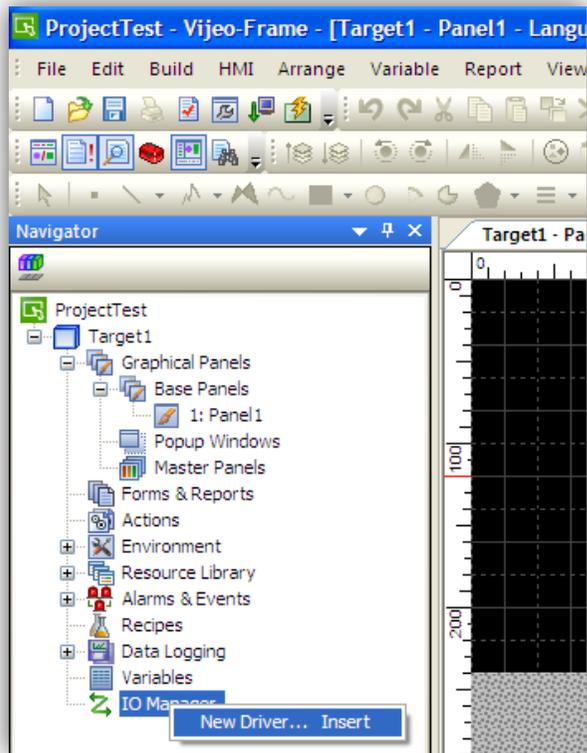
A red box highlights the 'Value' column for the first row (Addr_RS485_OB).

- Change to communication settings require a controller restart



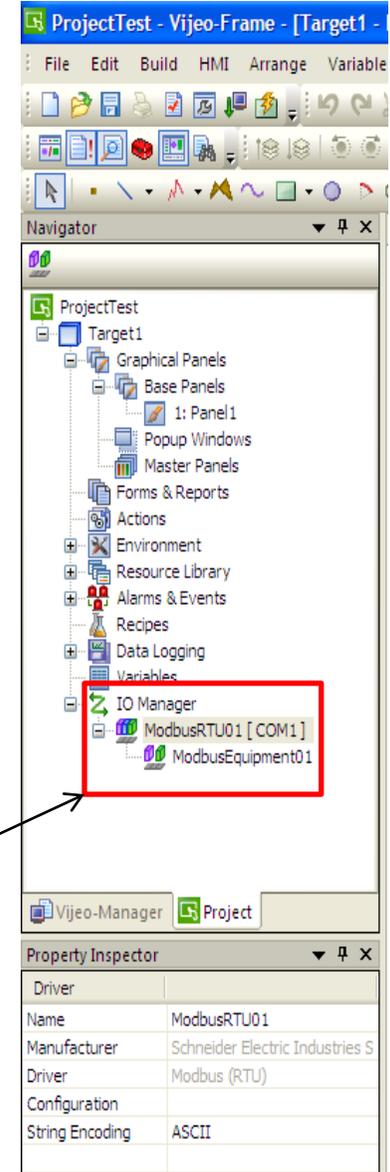
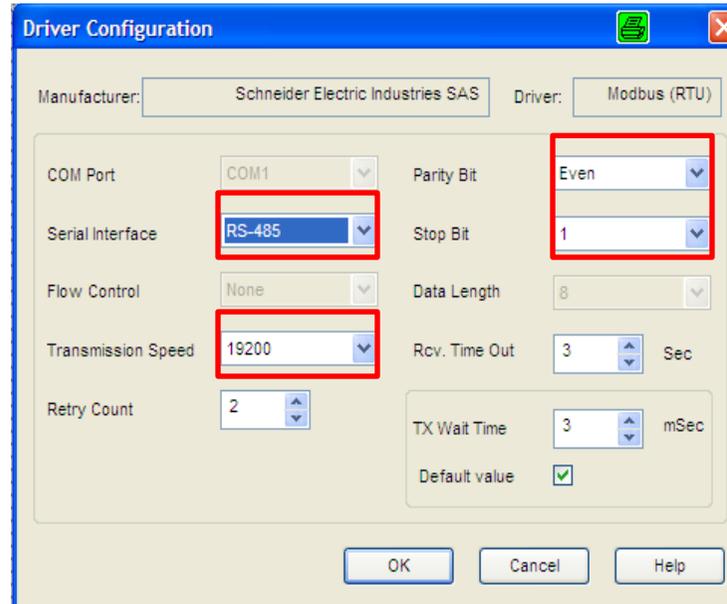
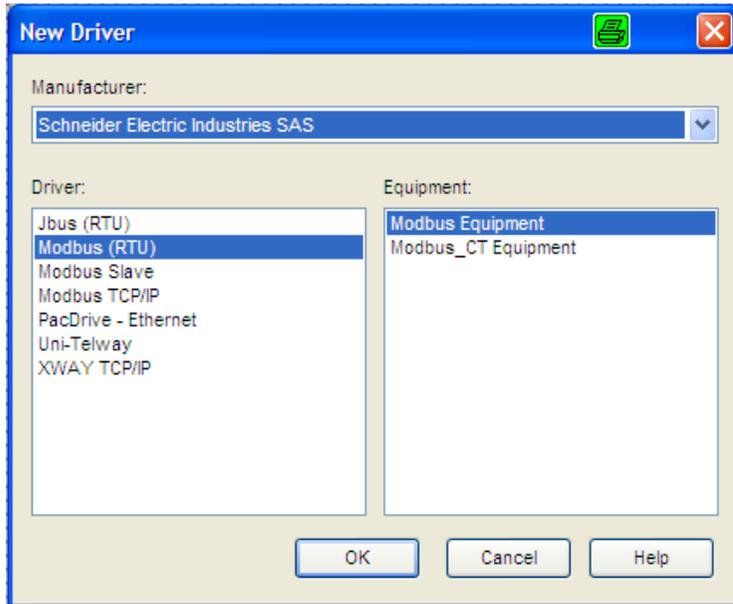
How to connect EVOLUTION to Megalis target via RS485

- Create a new driver



Vijeo Designer

- Configure the driver as configured in Free Studio

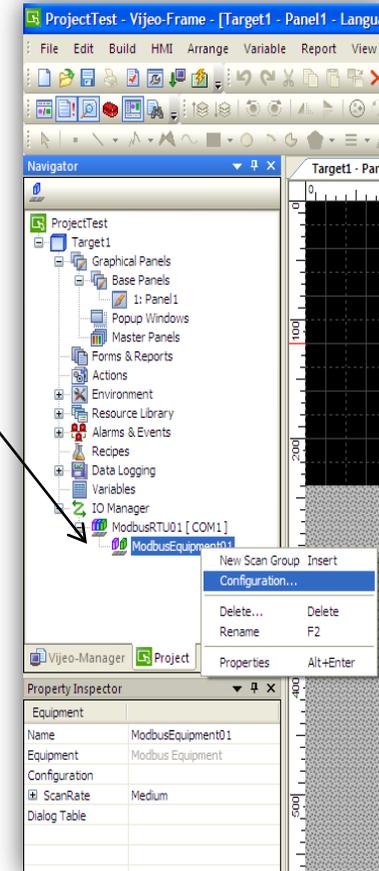
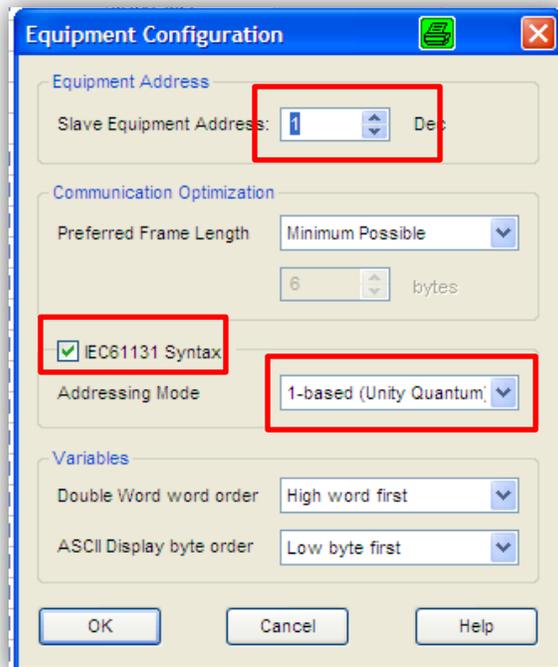


- A new Modbus equipment has been created

Property Inspector	
Driver	
Name	ModbusRTU01
Manufacturer	Schneider Electric Industries S
Driver	Modbus (RTU)
Configuration	
String Encoding	ASCII

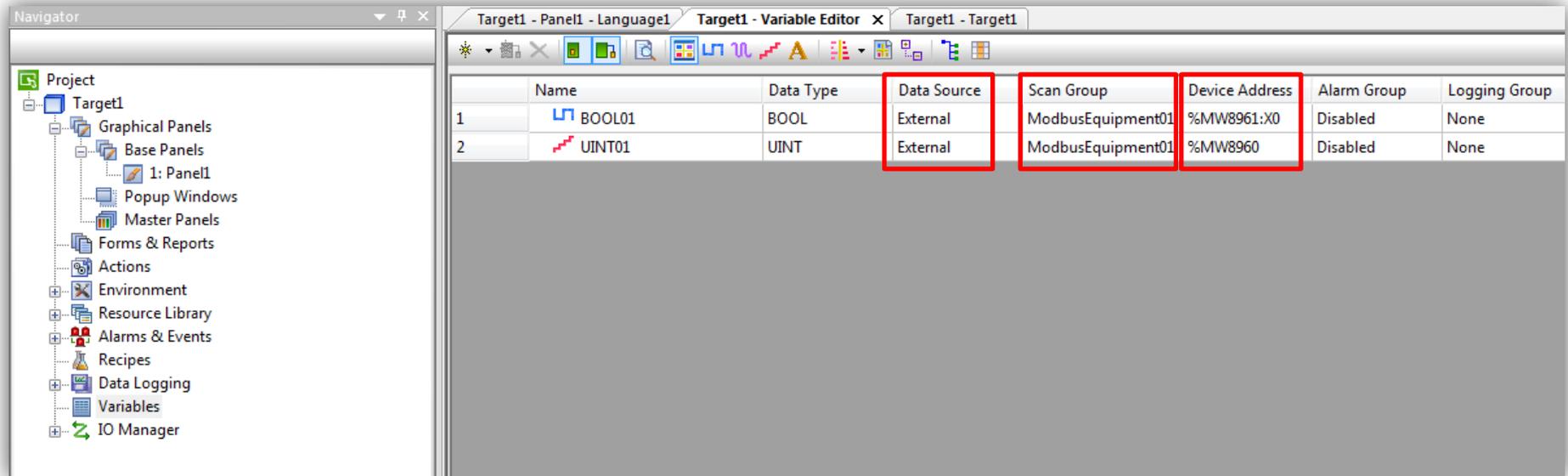
Vijeo Designer

- Configure the Modbus equipment (right click):
 - Enter the address as set in Free Studio
 - Select IEC61131 Syntax
 - Addressing mode: 1-based (Unity Quantum)



Vijeo Designer

- Create your variables:



The screenshot shows the 'Target1 - Variable Editor' window. On the left is a 'Navigator' pane with a tree view of the project structure, including 'Project', 'Target1', 'Graphical Panels', 'Base Panels', '1: Panel1', 'Popup Windows', 'Master Panels', 'Forms & Reports', 'Actions', 'Environment', 'Resource Library', 'Alarms & Events', 'Recipes', 'Data Logging', 'Variables', and 'IO Manager'. The main area displays a table with the following data:

	Name	Data Type	Data Source	Scan Group	Device Address	Alarm Group	Logging Group
1	BOOL01	BOOL	External	ModbusEquipment01	%MW8961:X0	Disabled	None
2	UINT01	UINT	External	ModbusEquipment01	%MW8960	Disabled	None

- Define the Data Source: External
- Define the Scan Group: name of your Modbus equipment you have created
- Specify the register address of the variable

Chapter 16

Web server

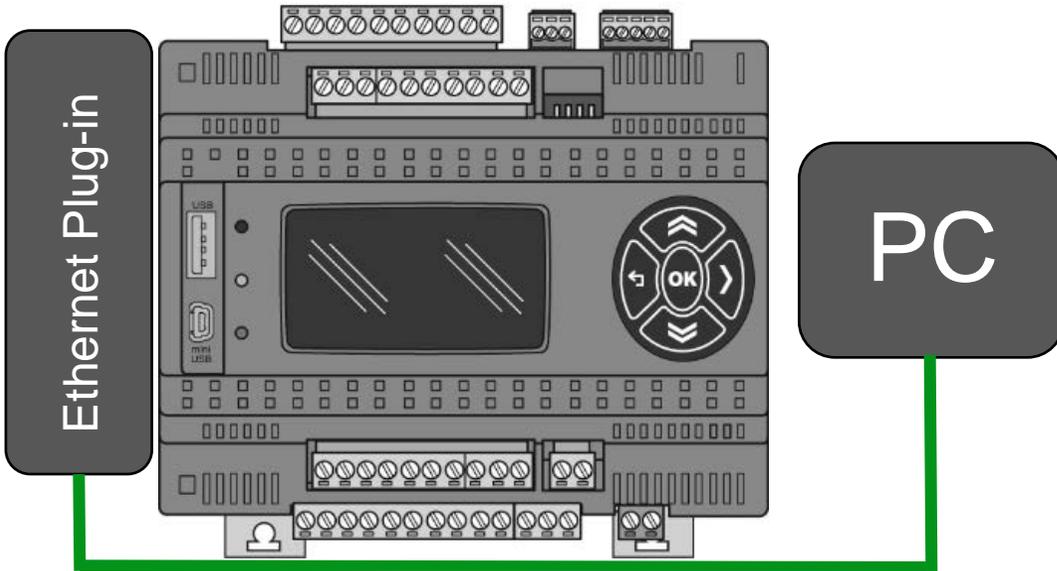
Goal:

Embedded & customized web pages creation

1.Text Base Web Pages

2.Graphical animated Web Pages

Web visualization



1. Open internet browser (Google Chrome)
2. Type 10.0.0.100 in the address bar
3. In the windows security pop-up:
Default Username: administrator
Default Password: password
▶ OK

Embedded web pages/Home



Customized Web page takes higher priority and If it already is up-loaded to the controller, takes place of the embedded one.

Use below address to return back to the embedded page:
<http://10.0.0.100/evoindex.htm>

otherwise just typing IP address is sufficient.

 free Evolution

- free Evolution embedded Web server -

[Click here to enter site](#)

 free Evolution [Home](#)

- free Evolution embedded Web server -

[Human Interface]

[Dip-Switch & Leds](#)

[System Clock \(read\) & System Clock \(adjust\)](#)

[I/O Values]

[Analogue Inputs](#)

[Digital Inputs](#)

[Analogue Outputs V/I](#)

[Digital Outputs](#)

[Parameters]

[Ethernet Plugin Passive](#)

[Analogue Inputs](#)

[Analogue Outputs V/I](#)

Embedded web pages



free Evolution [Index](#)

Dip-Switch Status (read) & Leds Status (read/write)

Item	Status
SW1:	<input type="checkbox"/> 0
SW2:	<input type="checkbox"/> 0
SW3:	<input type="checkbox"/> 0
SW4:	<input type="checkbox"/> 0

Item	Status/Setting
LED1 (green):	Off ▾
LED2 (red):	Off ▾
LED3 (yellow):	Off ▾
BACKLIGHT:	Off ▾

free Evolution [Index](#)

Digital Outputs Status (read/write)

Item	Status/Setting
DOL1:	Open ▾
DOL2:	Open ▾
DOL3:	Open ▾
DOL4:	Open ▾
DOL5:	Open ▾
DOL6:	Open ▾
DOL7:	Open ▾

free Evolution [Index](#)

System Clock Adjust

Item	Value
Time [hh:mm:ss]:	0 : 0 : 0
Date [dd/mm/yy]:	11 / 6 / 13
Day week:	2
Adjust	FALSE ▾

free Evolution [Index](#)

Analogue Outputs V/I Status (read/write)

Item	Value [%]
AOL1:	0.0
AOL2:	0.0
AOL3:	0.0
AOL4:	0.0
AOL5:	0.0

free Evolution [Index](#)

Analogue Inputs Status (read)

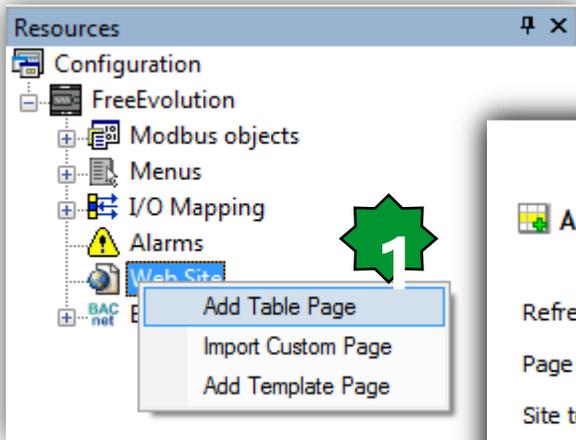
Item	Value
AIL1:	-3276.8
AIL2:	-3276.8
AIL3:	-3276.8
AIL4:	-3276.8
AIL5:	-3276.8
AIL6:	-3276.8

free Evolution [Index](#)

Digital Inputs Status (read)

Item	Status
DIL1:	<input type="checkbox"/>
DIL2:	<input type="checkbox"/>
DIL3:	<input type="checkbox"/>
DIL4:	<input type="checkbox"/>
DIL5:	<input type="checkbox"/>
DIL6:	<input type="checkbox"/>
DIL7:	<input type="checkbox"/>
DIL8:	<input type="checkbox"/>

Web visualization/Customized page



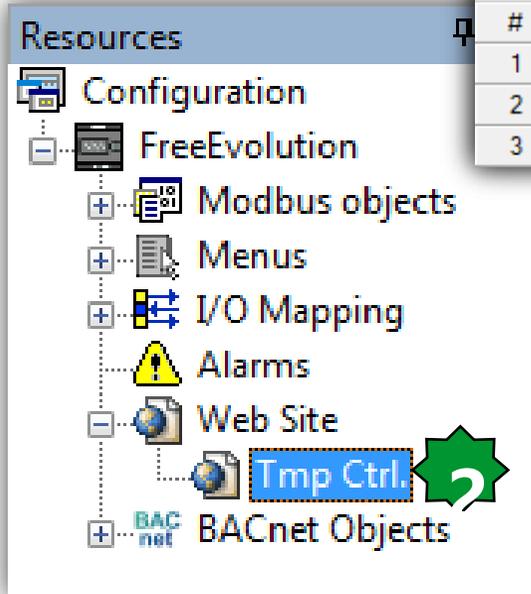
'Tmp Ctrl.' Web table page

Refresh (ms): (0=disable refresh)
 Password:

Page title:
 Filename:

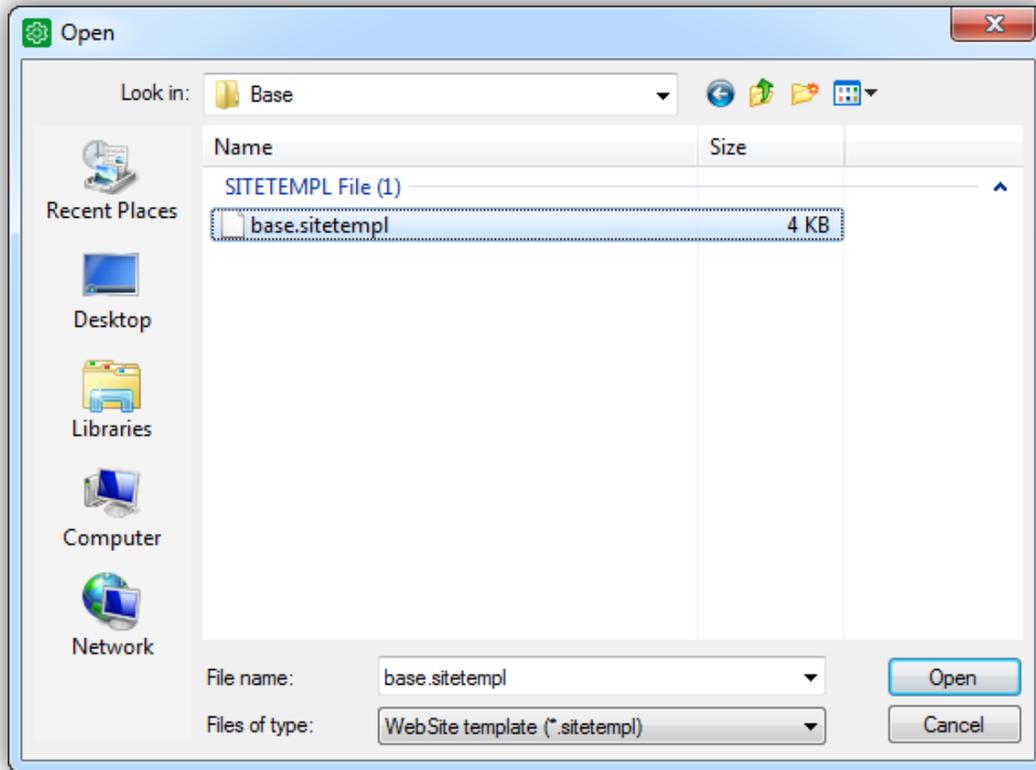
Site template:

#	Name	Control	Label	Section	Text size	Img filename	Img X	Img Y	Enum values
1	Ambiant_Temp	Text		Read Only	10				
2	SetPoint	Text		Read/Write	10				
3	Differentiation	Text			10				



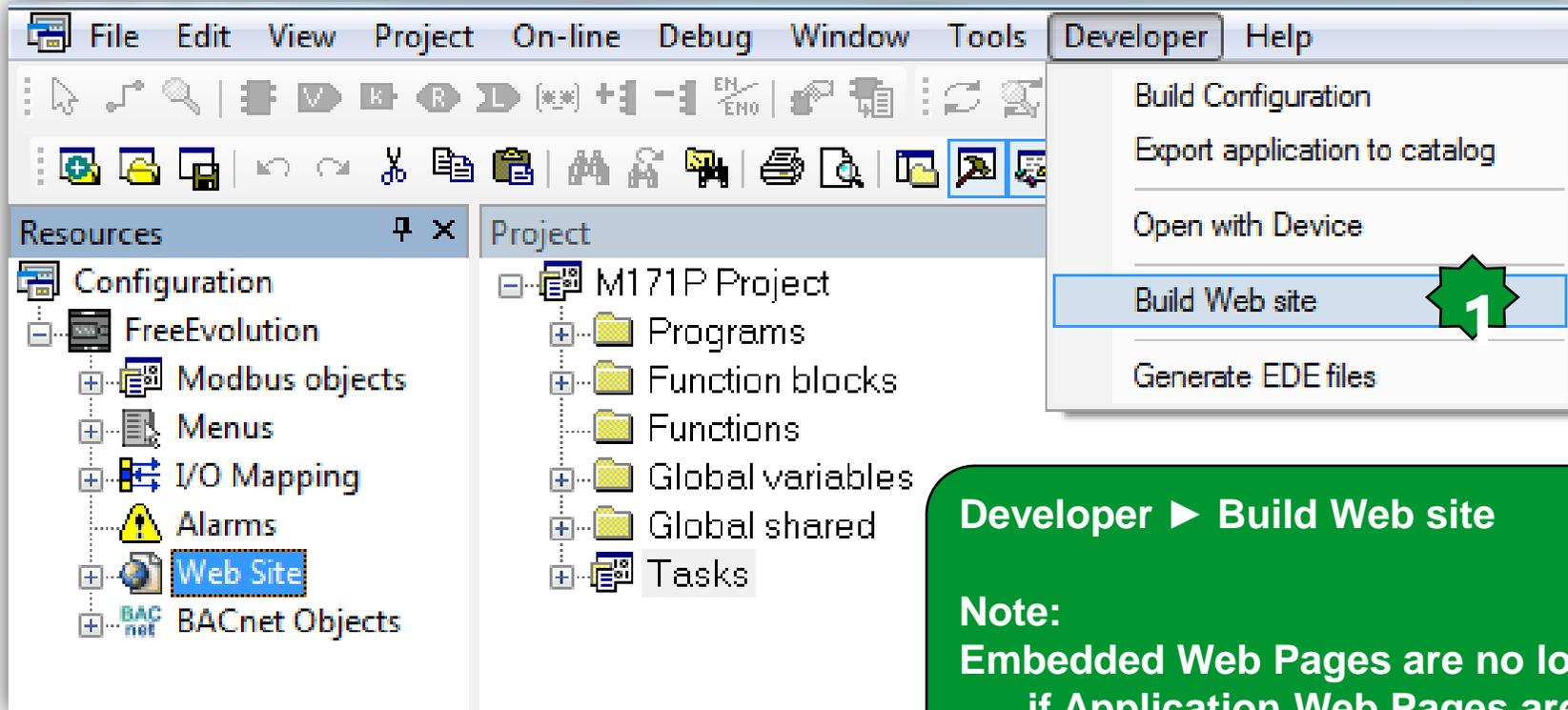
1. Resources ► Web site ► Add table page
2. Name it
3. Add a new record
4. Select the desired parameter from list
5. Title the page & Select the site basic template
6. Define the control type & Label it

Basic Template



Web folder is located in PLC
▶ **Web to edit the header**

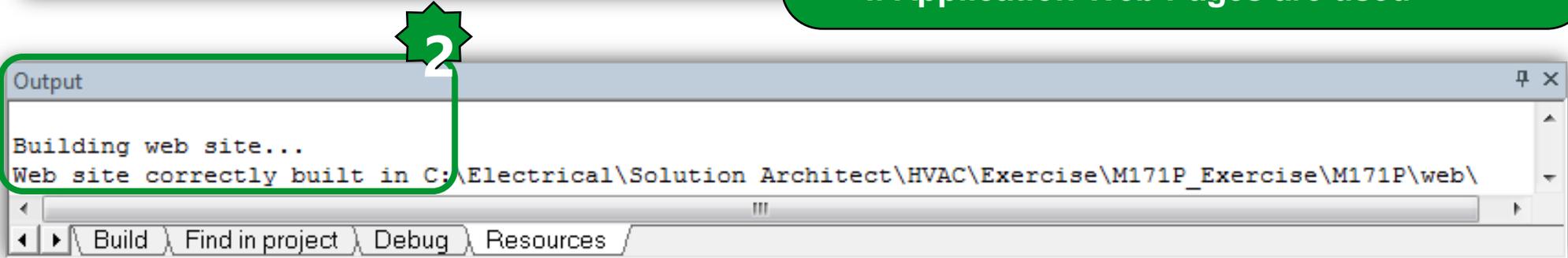
Web site building



The screenshot shows the software interface with the 'Developer' menu open. The 'Build Web site' option is highlighted, and a green star with the number '1' is placed over it. The 'Resources' pane on the left shows a tree view with 'Web Site' selected. The 'Project' pane on the right shows a tree view for 'M171P Project' with sub-items like 'Programs', 'Function blocks', 'Functions', 'Global variables', 'Global shared', and 'Tasks'.

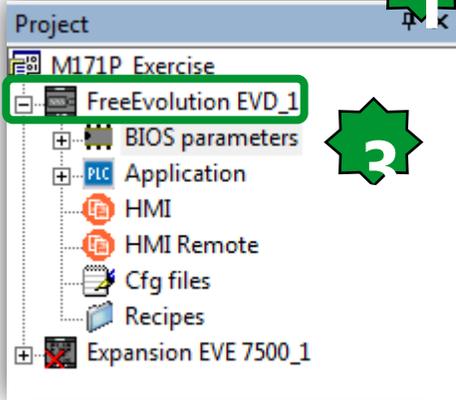
Developer ► Build Web site

Note:
Embedded Web Pages are no longer available if Application Web Pages are used



The screenshot shows the 'Output' window with the following text: 'Building web site...' and 'Web site correctly built in C:\Electrical\Solution Architect\HVAC\Exercise\M171P_Exercise\M171P\web\'. A green star with the number '2' is placed over the output text. The window title is 'Output' and it has standard window controls. The bottom of the window shows a navigation bar with 'Build', 'Find in project', 'Debug', and 'Resources' tabs.

Web site download/preview



General

Name: ID:

File version:

Communication

Protocol:

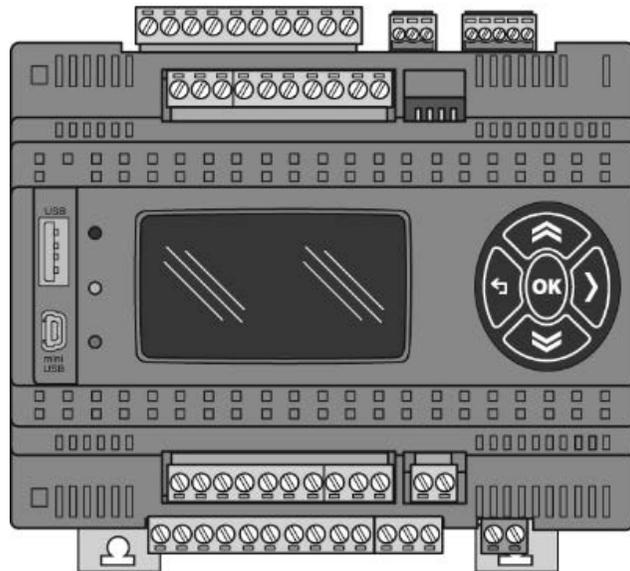
Address:

Port:

Baud rate:

Disable communication

Device ▶ Connect
▶ Target Configuration
Web site download
Web site preview



Information

Status:

Firmware version:

Other operations

BIOS download

Open file browser



Customized pages/Preview



```
Output
File download OK !
Downloading file page1.htm ...
Download progress: 100% (2463 / 2463 bytes)
File download OK !
--- Finished downloading web site
```



TempCtrl. 

TempCtrl.

 Temperature control, Base unit

Read Only

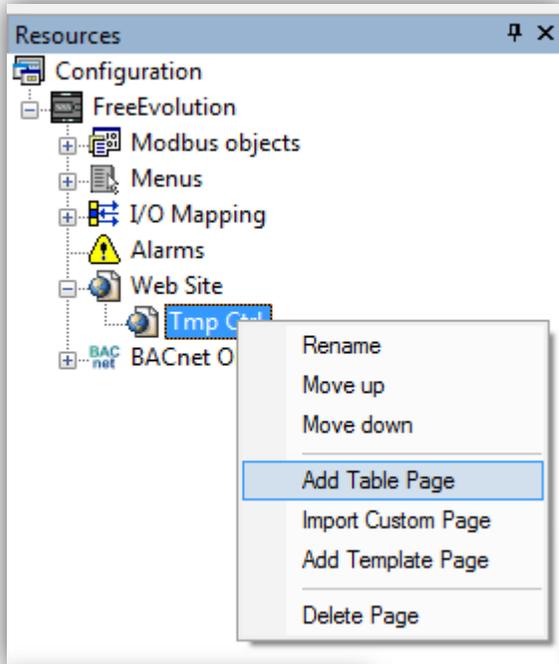
Address	Name	Value	Um
8960	Ambient_Temperature_DY	<input type="text" value="23.8"/>	°C

Read/Write

Address	Name	Value	Um
16384	Setpoint	<input type="text" value="18.0"/>	°C
16385	Differentiation	<input type="text" value="2.0"/>	°C



Customized page inside another page



'Man Ctrl' Web table page

Add Remove Up Down

Refresh (ms): (0=disable refresh) Password:

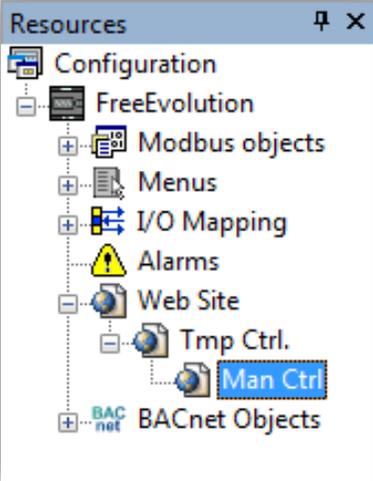
Page title: Filename:

Site template:

#	Name	Control	Label	Section	Text size	Img filename	Img X	Img Y	Enum values
1	LED1	Radio	Green	LED					
2	LED2	Button	Red						
3	LED3	Select	Yellow						
4	BACKLIGHT	Button	Blue	Backlight					

Control dropdown menu for BACKLIGHT:

- Text
- Select
- Button**
- Image
- Radio



If the device type is Boolean or Enums other types of control are selectable.

Customized pages/Preview & download



TmpCtrl. 

TmpCtrl.

Temperature control, Base unit

Read Only

Address	Name	Value	Um
8960	Ambient_Temperature_DY	<input type="text" value="23.8"/>	°C

Read/Write

Address	Name	Value	Um
16384	Setpoint	<input type="text" value="18.0"/>	°C
16385	Differentiation	<input type="text" value="2.0"/>	°C

TmpCtrl. 

TmpCtrl. > Man Ctrl

Manual Control, System

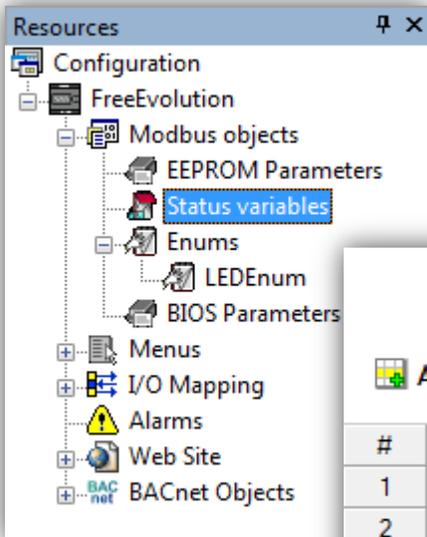
LED

Address	Name	Value	Um
8640	Green	<input type="radio"/> 0=Off <input type="radio"/> 1=On <input checked="" type="radio"/> 2=Blink	num
8641	Red	<input type="button" value="0=Off"/> <input type="button" value="1=On"/> <input type="button" value="2=Blink"/>	num
8642	Yellow	<input type="text" value="1=On"/> ▾	num

BACKLIGHT

Address	Name	Value	Um
8720	Blue	<input type="button" value="0=Off"/> <input type="button" value="1=On"/> <input type="button" value="2=Blink"/> <input type="button" value="3=Timed"/> <input type="button" value="4=Timed running"/>	num

Status Variable defenotion for Web Ctrl.



#	Address	Name	Device type	Application type	Unit	Format	AccessLevel	Read only	Description
1	8960	Ambiant_Temp	Signed 16-bit	INT	°C	XXX.Y	Always visible	True	
2	8961	Hystersis_FB_Status	Boolean	BOOL			Always visible	True	
3	8962	EXP1_CAN_Status	Boolean	BOOL			Always visible	True	
4	8963	Probe_EXP1_Err	Signed 16-bit	INT			Always visible	True	
5	8965	Expansion_Alarm	Boolean	BOOL			Always visible	True	
6	8964	Green_LED_EXP1	Unsigned 8-bit	USINT			Always visible	True	
7	8966	Red_LED_EXP1	LEDEnum	USINT			Always visible	True	
8	8967	ATV_Command	Unsigned 16-bit	UINT			Always visible	False	
9	8968	ATV_Speed_Reference	Signed 16-bit	INT	Hz		Always visible	False	0-5000 (0.01 Hz)
10	8969	ATV_Output_Frequency	Signed 16-bit	INT	Hz		Always visible	True	
11	8970	Modbus_Comm_Error	Boolean	BOOL			Always visible	True	
12	8971	Web_ATV_Comd	Boolean	BOOL			Always visible	False	
13	8972	Web_ATV_Speed_Ref	Signed 16-bit	INT	Hz	XX.YY	Always visible	False	0-50 Hz
14	8973	Web_ATV_Output_Frq	Signed 16-bit	INT	Hz	XX.YY	Always visible	False	0-50 Hz



ATV control via customized web page

Resources

- Configuration
- FreeEvolution
 - Modbus objects
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - Tmp Ctrl.
 - Man Ctrl
 - ATV21 Ctrl**
 - BACnet Objects

'ATV21 Ctrl' Web table page

Add Remove Up Down

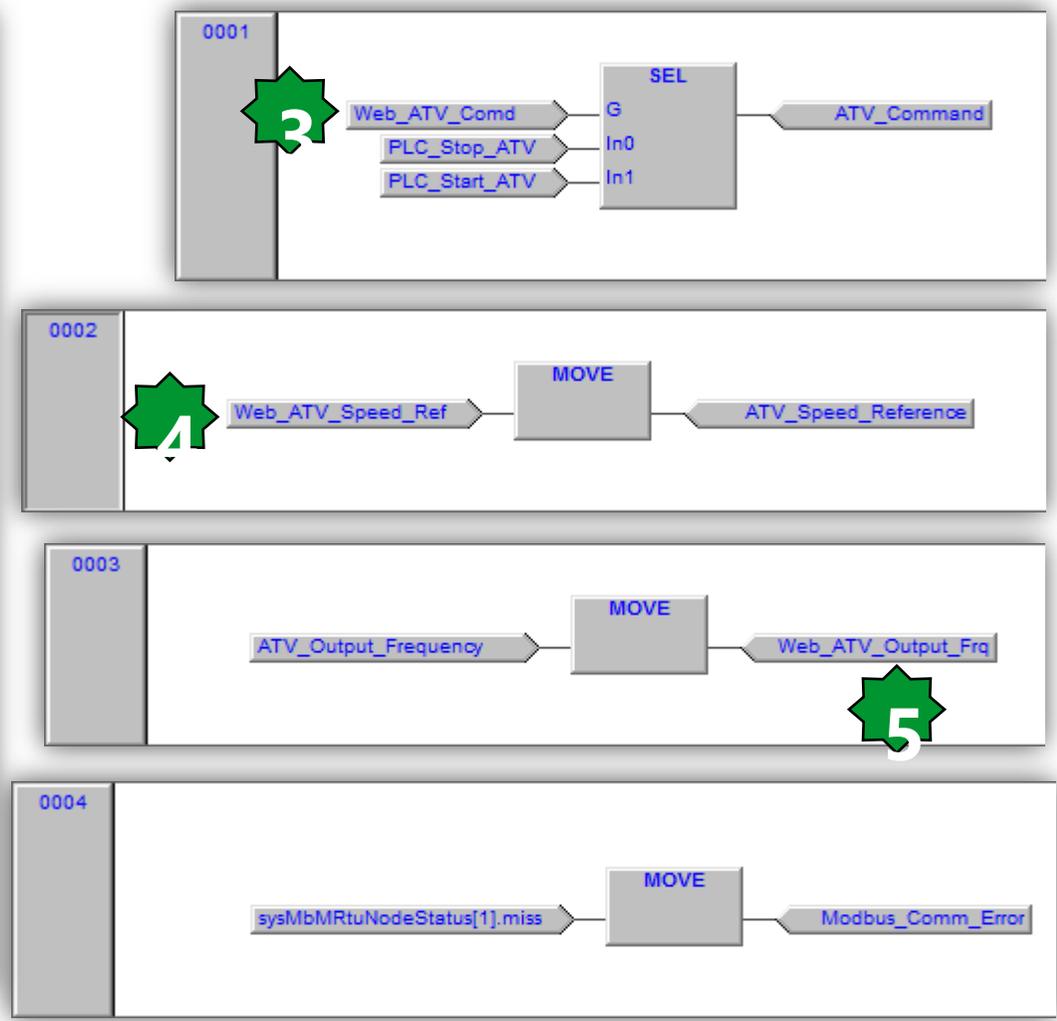
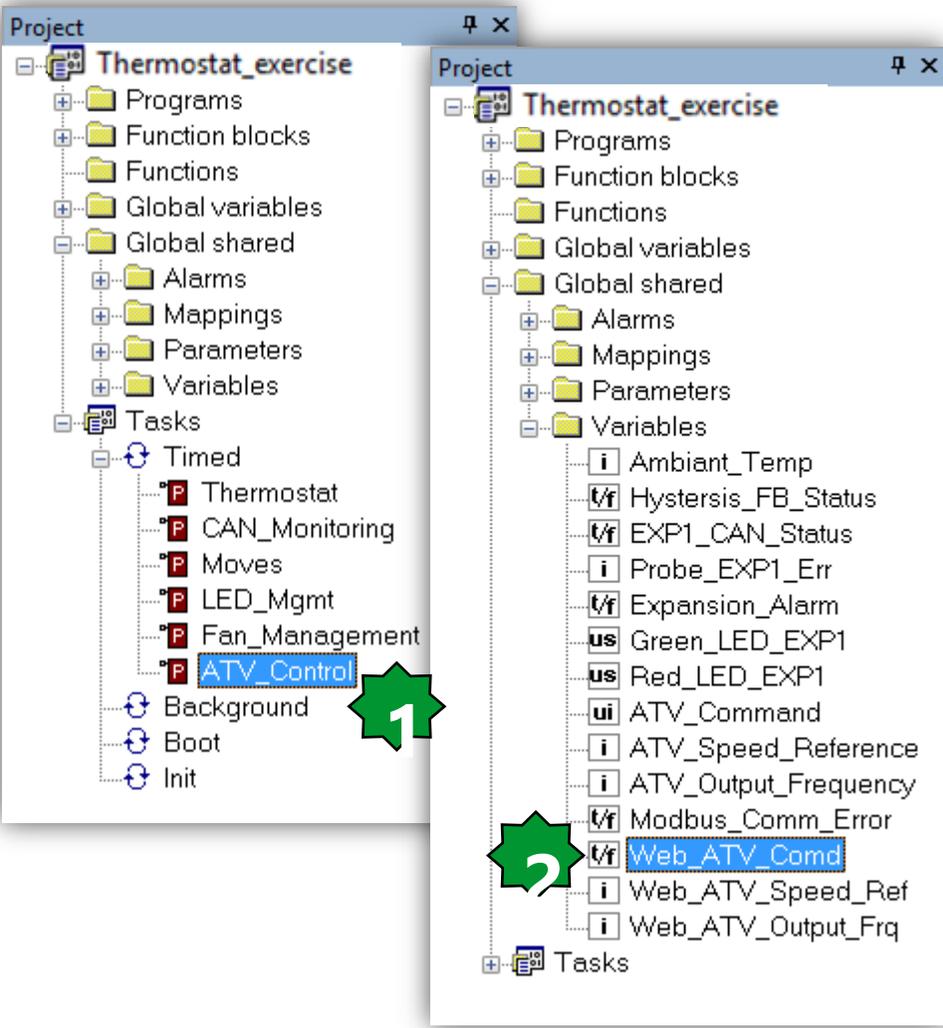
Refresh (ms): (0=disable refresh) Password:

Page title: Filename:

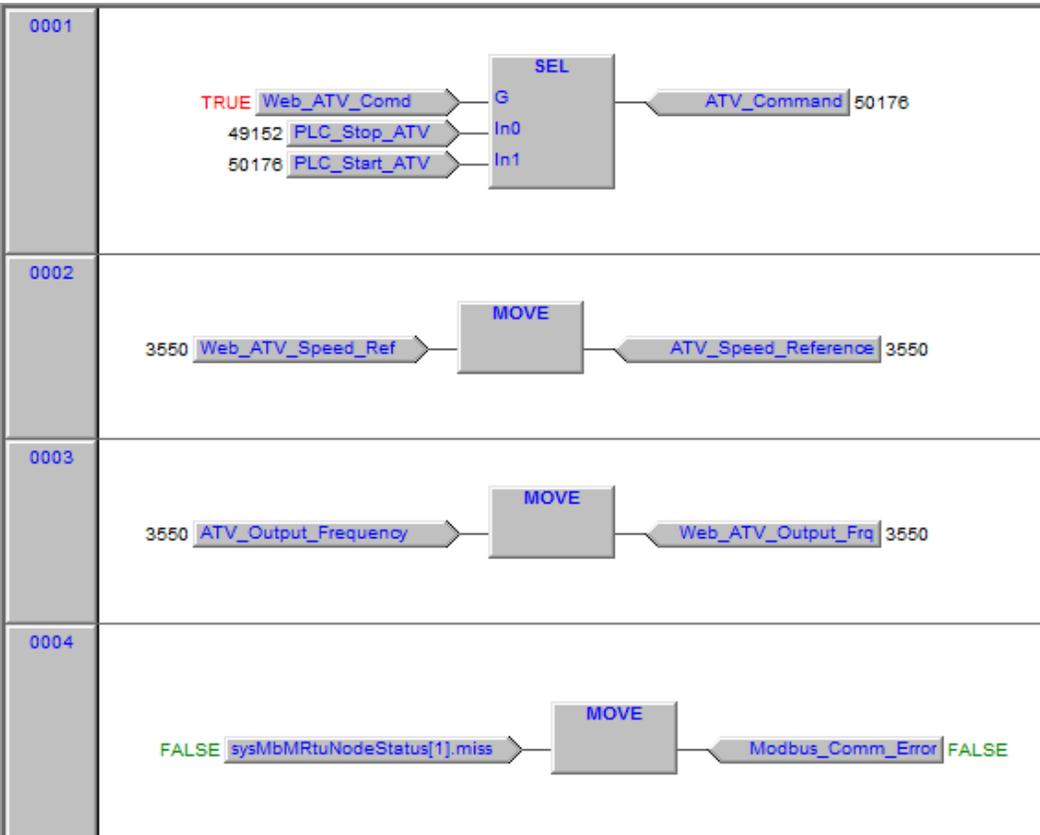
Site template:

#	Name	Control	Label	Section
1	Web_ATV_Output_Frq	Text	Output Frequency	Read Only
2	Modbus_Comm_Error	Radio	PLC-ATV Modbus Comm Err	
3	Web_ATV_Cmd	Radio	Srat/Stop	Read/Write
4	Web_ATV_Speed_Ref	Text	Speed Reference	

Assigning Status Variables to FB



Test the Web visualization



TmpCtrl. ATV21 Ctrl

ATV21 Ctrl

ATV21 Control

Read Only

Address	Name	Value	Um
8968	OutputFrequency	<input type="text" value="36"/>	Hz
8969	PLC-ATV Modbus Comm Err	<input checked="" type="radio"/> False <input type="radio"/> True	

Read/Write

Address	Name	Value	Um
8966	Start/Stop	<input type="radio"/> False <input checked="" type="radio"/> True	
8967	Speed Reference	<input type="text" value="36"/> x	Hz

Graphical/Status Variable definition

Resources

- Configuration
 - M172P
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enum (selected)
 - Add Enum
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects
 - LON Profile

1

Resources

- Configuration
 - M172P
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - Enum_Status (selected)
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects
 - LON Profile

3

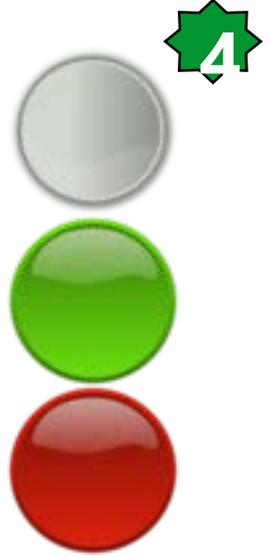
2

'Enum_Status' Enumerator

Add Remove

#	Value	Description
1	0	Grey
2	1	Green
3	2	Red

4



4

Resources

- Configuration
 - M172P
 - Modbus objects
 - EEPROM Parameters
 - Status variables (selected)
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects
 - LON Profile

5

Status Variables

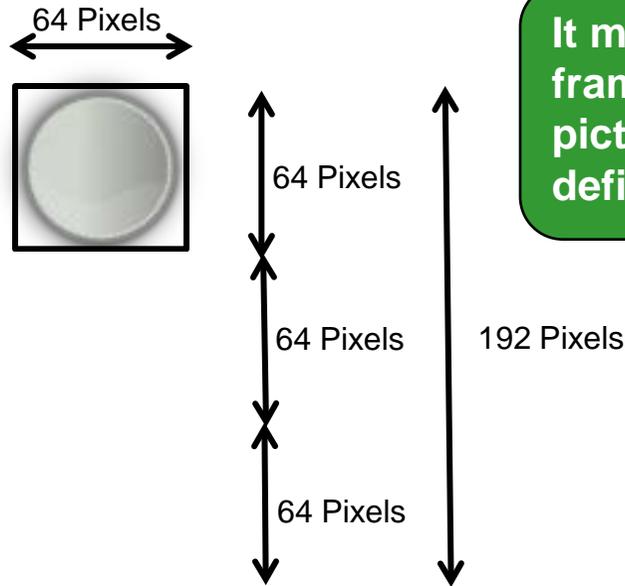
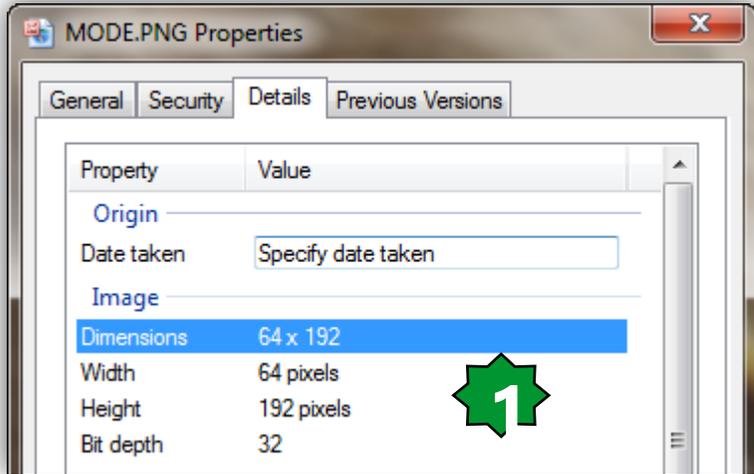
Add Remove Recalc

#	Address	Name	Device type	Application type	Read only
1	8960	Status	Enum_Status	USINT	True
2	8963	CMD_LED	Enum_Status	USINT	False

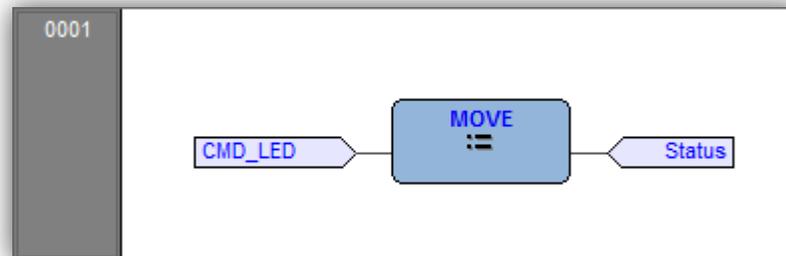
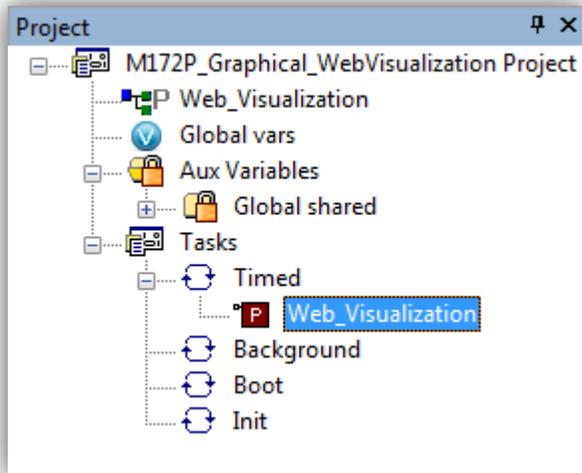
6

If the device type is Boolean or Enums other types of control are selectable.

Graphical Animation principles



It moves a fix defined frame to the assign picture regarding defined Enumerators.



Project & image foldering



CON File (1)



M171P_Exercise.CON

File folder (2)



Application



User Interface



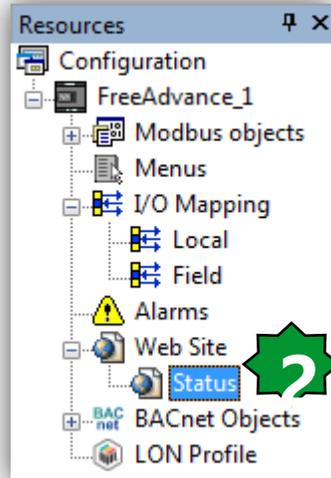
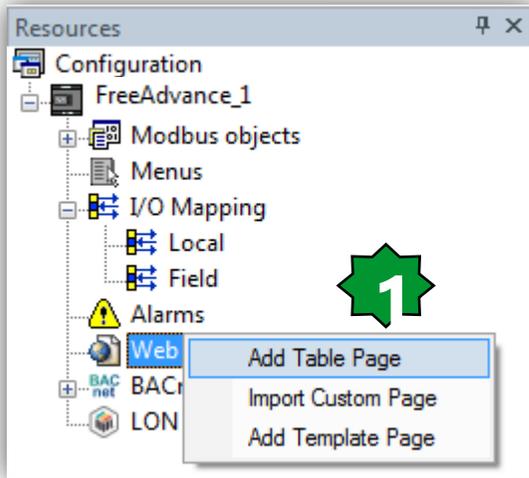
Web

MODE.PNG



Please copy/ cut and paste desired image file to the web folder located in the applicatio folder.

Graphical page configuration



Note.
Do not forget to write the image file name in capital letter.

'Status' Web table page

Enable build

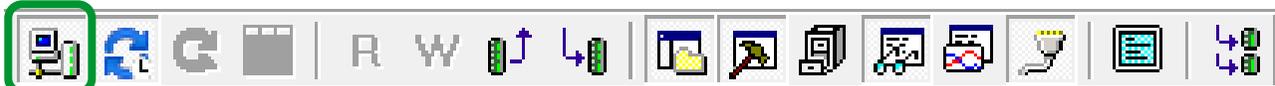
Refresh (ms): (0=disable refresh)
 Password:

Page title:
 Filename:

Site template:

#	Name	Control	Label	Section	Text size	Img filename	Img X	Img Y	Enum values
1	CMD_LED	Radio	Signal Lamp Command	Read/Write					
2	Status	Image	Animated Signal Lamp	Read Only (Status)		MODE.PNG	64	64	

Web site download/preview



Project

- Thermostat New Project
 - FreeAdvance_1**
 - BIOS parameters
 - PLC Application
 - HMI
 - HMI Remote for EVK and EVP
 - Cfg files
 - Recipes

FreeAdvance 596 Configuration

General

Name: ID:

File version:

Communication

Protocol:

Address:

Port: Disable communication

Baud rate:



Information

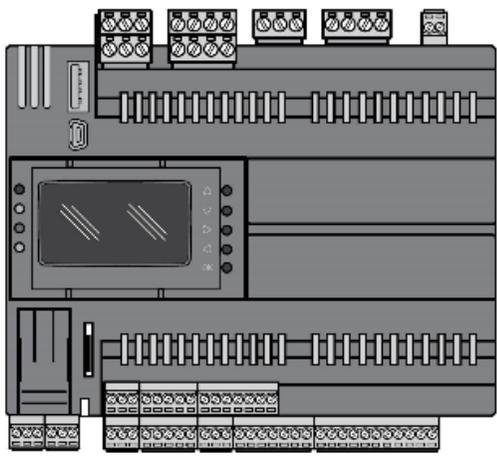
Status:

Firmware version:

Model:

Other operations

- BIOS download
- Open file browser
- Web site download**
- Web site preview**
- Generate XIF file



Download settings

	NOR	SD
PLC	<input checked="" type="radio"/>	<input type="radio"/>
HMI	<input checked="" type="radio"/>	<input type="radio"/>
HMI Remote	<input checked="" type="radio"/>	<input type="radio"/>
Cfg files	<input checked="" type="radio"/>	<input type="radio"/>
Web site	<input checked="" type="radio"/>	<input type="radio"/>

Graphical Status Page Test



Status 

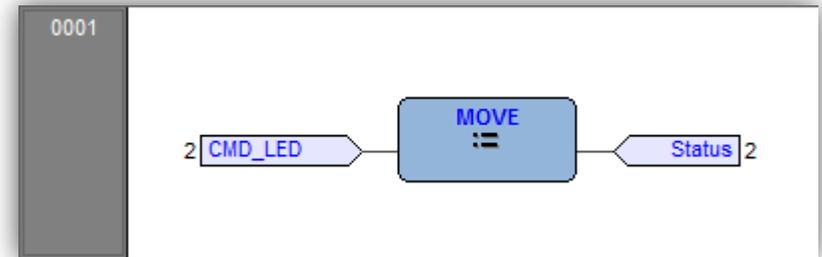
Graphical Status

Read/Write

Address	Name	Value	Um
8963	Signal Lamp Command	<input type="radio"/> Grey <input type="radio"/> Green <input checked="" type="radio"/> Red	

Read Only (Status)

Address	Name	Value	Um
8960	Animated Signal Lamp		



Watch

Symbol	Value	Type	Location
— CMD_LED	2	USINT	global
— STATUS	2	USINT	global

Graphical Alarm Page Config.

Resources

- Configuration
 - FreeAdvance_1
 - Modbus objects
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - Status
 - Alarm
 - BACnet Objects
 - LON Profile

'Alarm' Web table page

Add Remove Up Down Enable build

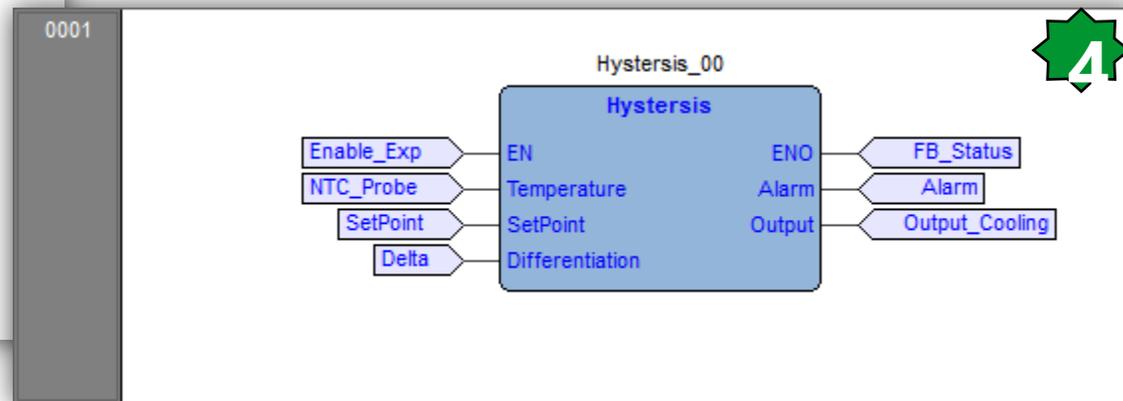
Refresh (ms): (0=disable refresh) Password:

Page title: Filename:

Site template:

#	Name	Control	Label	Section	Text size	Img filename	Img X	Img Y	Enum values
1	Alarm	Image	Probe Disconnection	GenericAlarm		ALARMS.PNG	64	64	

- Hysteresis
- Thermostat
- Web_Visualization
- Global vars
- Aux Variables
- Tasks
 - Timed
 - Web_Visualization
 - Thermostat
 - Background
 - Boot
 - Init



Graphical Alarm Page Test



Status Alarm **eliwell**

Alarm

Alarm

Generic Alarm

Address	Name	Value	Um
8964	Probe Disconnection		

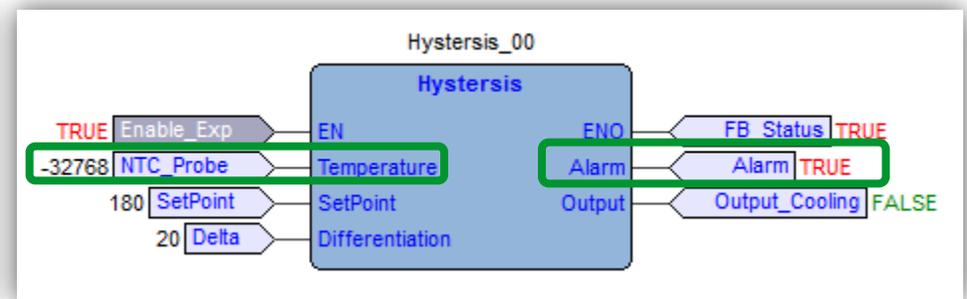
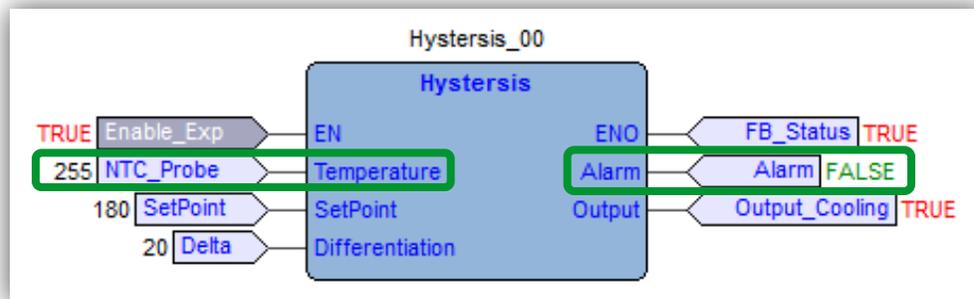
Status Alarm **eliwell**

Alarm

Alarm

Generic Alarm

Address	Name	Value	Um
8964	Probe Disconnection		





Changing default IP address via Device

Project M172P_Graphical_WebVisualization

- FreeAdvance_1
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue I/O
 - RS485-1 On Board
 - RS485-2 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet** 
 - Modem 
 - Display
 - BACnet
 - FileSystem Volumes
 - Miscellaneous
 - I/O Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - USB-Host and microSD
 - Battery Handling
 - PLC Application
 - HMI
 - HMI Remote for M171DGRP and M171PF
 - Cfg files
 - Recipes

Ethernet

Address	Name	Value	Um	Default	Min	Max	Description
15796	Port_HTTP_PI	0	num	0	0	65535	HTTP Port number, 0 is equal to default port 80
15797	Port_ETH_PI	502	num	502	0	65535	TCP/IP Port number
15798	Ip_1_ETH_PI	10	num	10	0	255	Ethernet IP address (1 st part)
15799	Ip_2_ETH_PI	0	num	0	0	255	Ethernet IP address (2 nd part) 
15800	Ip_3_ETH_PI	0	num	0	0	255	Ethernet IP address (3 rd part)
15801	Ip_4_ETH_PI	100	num	100	0	255	Ethernet IP address (4 th part)
15802	DefGtwy_1_ETH_PI	10	num	10	0	255	Default Gateway (1 st part)
15803	DefGtwy_2_ETH_PI	0	num	0	0	255	Default Gateway (2 nd part)
15804	DefGtwy_3_ETH_PI	0	num	0	0	255	Default Gateway (3 rd part)
15805	DefGtwy_4_ETH_PI	1	num	1	0	255	Default Gateway (4 th part)
15806	NetMsk_1_ETH_PI	255	num	255	0	255	Net mask (1 st part)
15807	NetMsk_2_ETH_PI	255	num	255	0	255	Net mask (2 nd part)
15808	NetMsk_3_ETH_PI	255	num	255	0	255	Net mask (3 rd part)
15809	NetMsk_4_ETH_PI	0	num	0	0	255	Net mask (4 th part)
15810	PriDNS_1_ETH_PI	8	num	8	0	255	Primary DNS server (1 st part)
15811	PriDNS_2_ETH_PI	8	num	8	0	255	Primary DNS server (2 nd part)
15812	PriDNS_3_ETH_PI	8	num	8	0	255	Primary DNS server (3 rd part)
15813	PriDNS_4_ETH_PI	8	num	8	0	255	Primary DNS server (4 th part)
15814	SecDNS_1_ETH_PI	8	num	8	0	255	Secondary DNS server (1 st part)
15815	SecDNS_2_ETH_PI	8	num	8	0	255	Secondary DNS server (2 nd part)
15816	SecDNS_3_ETH_PI	4	num	4	0	255	Secondary DNS server (3 rd part)
15817	SecDNS_4_ETH_PI	4	num	4	0	255	Secondary DNS server (4 th part)
15818	EnableDHCP_ETH_PI	False	flag	False	0	1	Enable DHCP
16130	MAC_1_ETH_PI	0	num	0	0	0	MAC address (1 st part)
16131	MAC_2_ETH_PI	24	num	24	0	24	MAC address (2 nd part)
16132	MAC_3_ETH_PI	187	num	187	0	187	MAC address (3 rd part)
16133	MAC_4_ETH_PI	0	num	0	0	255	MAC address (4 th part)
16134	MAC_5_ETH_PI	0	num	0	0	255	MAC address (5 th part)
16135	MAC_6_ETH_PI	0	num	0	0	255	MAC address (6 th part)

Changing default IP address via Web



Controller embedded Web server

Home

[Human Interface]

- Leds
- System Clock (read) & System Clock (adjust)

[I/O Values]

- Analogue Inputs
- Digital Inputs
- Analogue Outputs V/I/PWM
- Digital Outputs

[Parameters]

- Ethernet**
- Analogue Inputs
- Analogue Outputs V/I/PWM



Ethernet parameters

Index

Ethernet parameters

Name	Value
Port_HTTP_PI	0
Ip_ETH_PI	10 . 0 . 0 . 100
DefGtwy_ETH_PI	10 . 0 . 0 . 1
NetMsk_ETH_PI	255 . 255 . 255 . 0
PriDNS_ETH_PI	8 . 8 . 8 . 8
SecDNS_ETH_PI	8 . 8 . 4 . 4
EnableDHCP_ETH_PI	FALSE
MAC_ETH_PI	0 . 24 . 187 . 0 . 47 . 149



View object properties

Name: sysHTTP_Authentication

Object Type: Function

Return Value: USINT

Language Type:

Description:
 Configure Web server authentication parameters.
 Calling this function Web server realm, user name and password will be reloaded with the requested values. If this function is not called realm, user name and password will be loaded as follow: 'Web server', 'administrator', 'password'.

The function return a USINT which could have the following meanings:

- 0 = Parameters correctly reloaded.
- 255 = Realm string too long, no parameters reloaded.
- 254 = User name string too long, no parameters reloaded.
- 253 = Password string too long, no parameters reloaded.

Input:

Name	Type	Description
realm	STRING	Web server realm string, max 19 chars
user	STRING	Web server user name string, max 15 chars
psw	STRING	Web server password string, max 19 chars

Library

MBMNODESTATUS	sysDNS_GetIpByName	sysPlugInRelay
STRUCTIMPULSECOUNTER	sysDNS_Reset	sysPwmDO
sysAnswerDelayIncTime	sysExecutionPassword	sysSetDI_SamplingMode
sysBridge	sysHmi_Message	sysSMTP_Reset
sysClockWrite	sysHTTP_Authentication	sysSMTP_SendEmail
sysDataPush_Reset	sysHTTP_ListableFilesExt	sysSTRCAT
sysDataPush_Start	sysINT_TO_STRING	sysSTREQU

Operator and standard blocks Target variables Target blocks basic Regul and



File Edit **View** Project On-line Debug Variables Window Tools Developer Help

Toolbars
Tool windows
Full screen Ctrl+U

Resources

- Configuration
 - FreeAdvance_1
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - Enum_Status
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Local
 - Field
 - Alarms
 - Web Site
 - Status
 - Alarm
 - BACnet Objects
 - LON Profile

Workspace Ctrl+W
Library Ctrl+L
Output Ctrl+R
Oscilloscope Ctrl+K
Watch Ctrl+T
Force I/O bar
PLC run-time status
Cross Reference
Aux Variables
Tasks

- Timed
- Background
 - Password
- Boot
- Init

Definitions

- M172P_Graphical_WebVisualization Definitions
 - TypeDefs
 - Structures
 - Enumerations
 - SubRanges
 - Macro

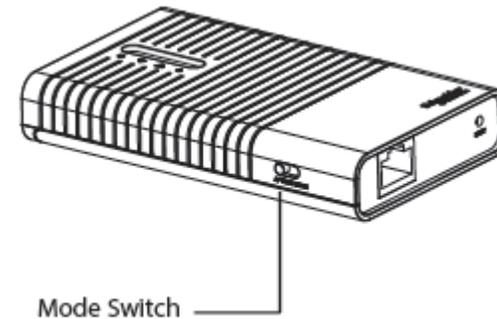
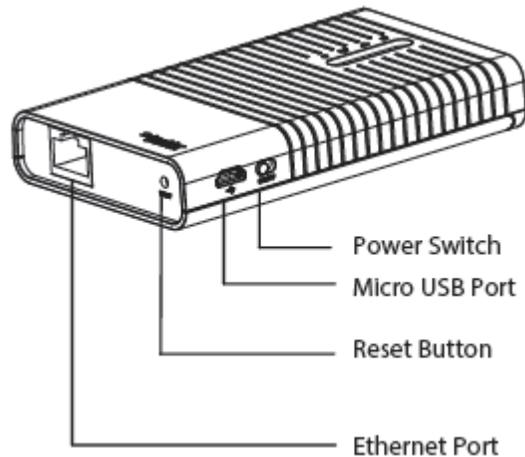
Chapter 17

Wifer Configuration

Goal:

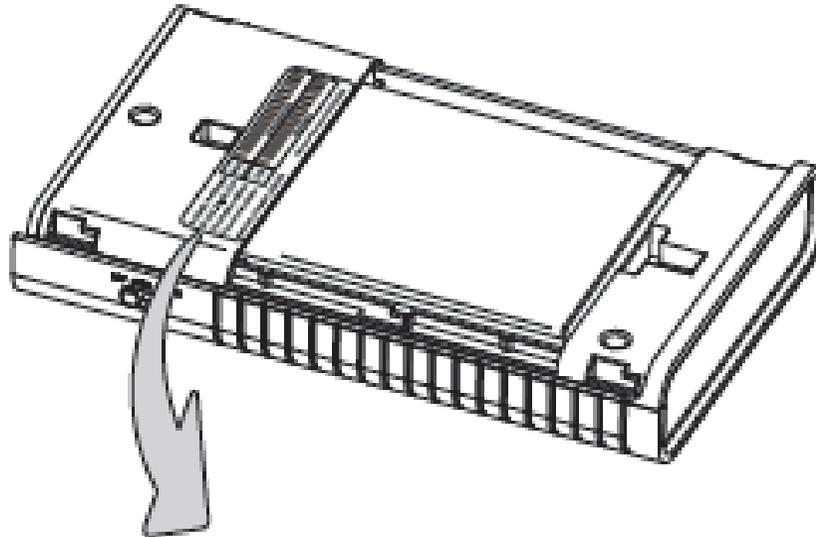
- Wifer Configuration & Connection
- Set the Wifer IP address in the range of Controller

Physical Description



Item	Description
Power Switch	This switch is used to power on the WIFER.
Micro USB Port	This port is used to connected to be the provided power adapter.
Reset Button	With the WIFER powered on, press and hold the Reset button for at least 10 seconds, and then the WIFER will restore to the default setting.
Ethernet Port	This port is used to wire directly a device or through a switch.
Mode Switch	Keep switch at AP mode. Other modes are reserved.

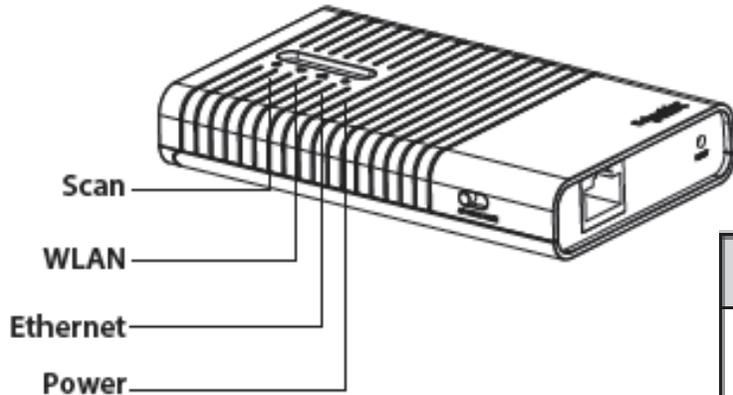
Default settings



Default Settings:	
IP:223.22.33.223	
Username:admin	
Password:admin	
SSID:SE_TCSEGW_XXXXXX	Wireless Password:XXXXXXXX
MAC	 XXXXXXXXXXXXXX
PIN	 XXXXXXXXXX

- * **SSID: SE_TCSEGW_XXXXXX**
Wireless Network name
- * **Wireless Password: Number with 8 digits**
Pre-encryption Wireless Password

LED Description



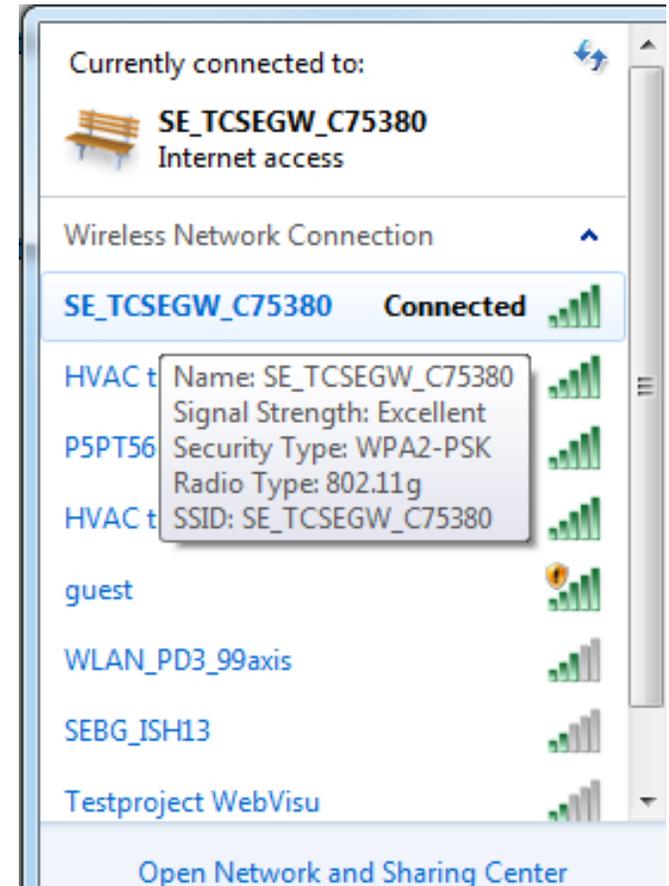
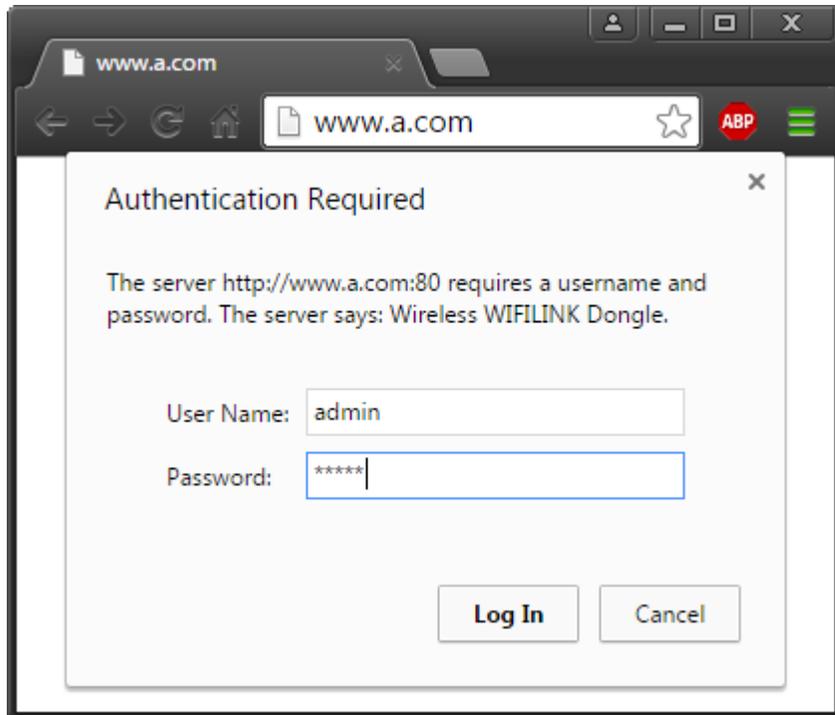
LED	Status	Description
 Power	Solid (Green)	The battery is full or the power supply is normal.
	Solid (Orange)	The battery is being charged.
	Solid (Red)	The battery power is low, you need to charge it.
	Flashing (Red)	The battery is abnormal.
 Ethernet	Flashing	The Ethernet port is transferring data.
	Off	No device is linked to the LAN port.
 WLAN	On	The wireless function is enabled.
	Flashing	There is data being transferred through wireless.
	Off	The wireless function is disabled due to internal error.
 Scan	On	Scan is working and at least one device is detected.
	Flashing	Scan is working and no device is detected.
	Off	Scan is not started.

WIFER Configuration



Access to WIFER WEB site by www.a.com

- User Name: **admin**
- Password: **admin.**



Wifer Default IP address



SE-WIFIdongle x +

www.a.com

Schneider Electric

- Devices List
- Status
- WPS
- Network**
- LAN
- Wireless
- DHCP
- System Tools

LAN

MAC Address: 6C-FD-B9-C7-53-80

Type: Static IP

IP Address: 223.22.33.223

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Save

Wireless network renameing



Connecting... x +

www.a.com

Schneider Electric

- Devices List
- Status
- WPS
- Network
- Wireless**
 - Wireless Settings
 - Wireless Security
 - Wireless MAC Filtering
 - Wireless Advanced
 - Wireless Statistics
- DHCP
- System Tools

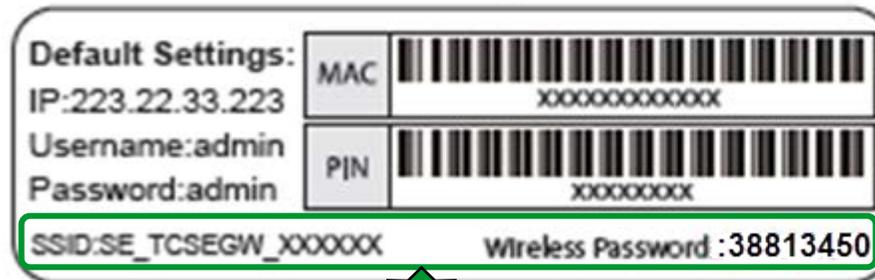
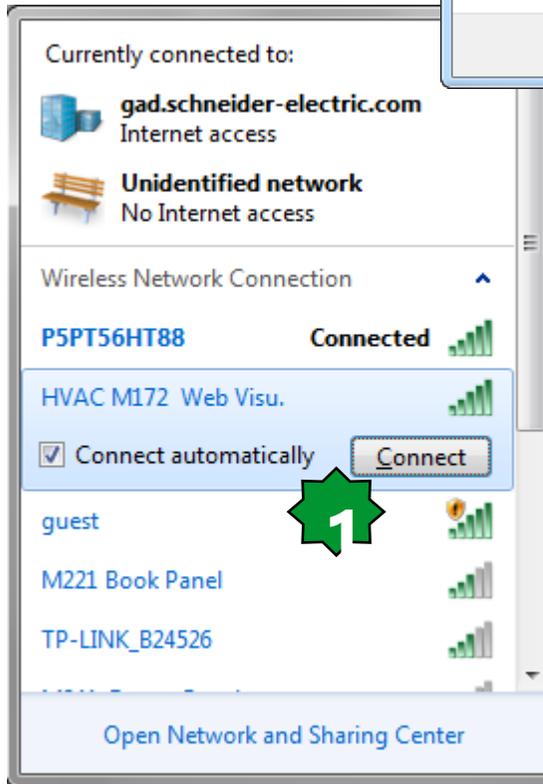
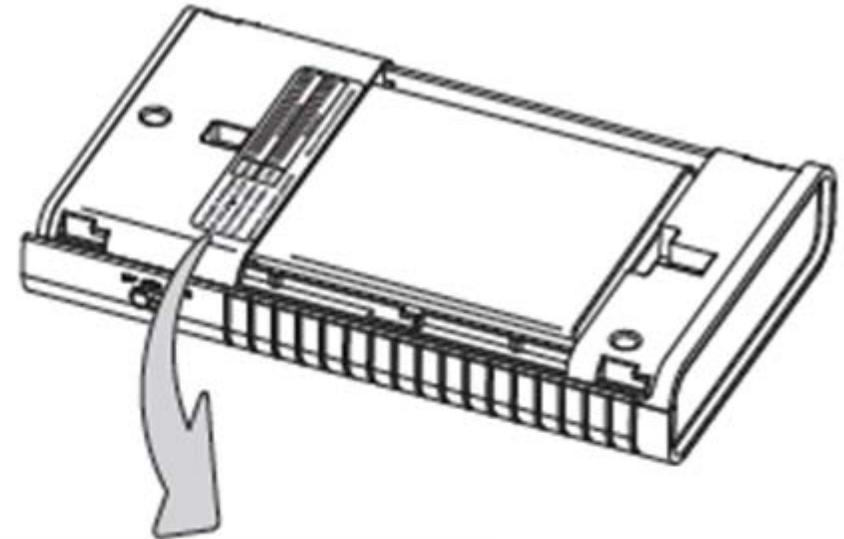
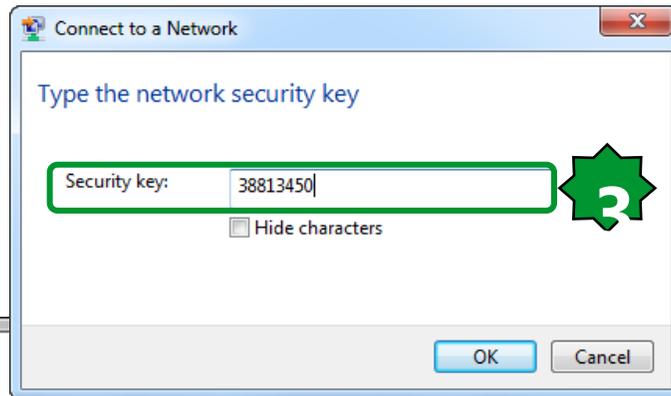
Restart

Completed!

100% 

Please wait a moment, if the browser does not refresh automatically, click Refresh on the top of your browser.

Connect to the Wireless Network



SSID: SE
W
Wireless
Pre

Adding a device/Controller



SE-WIFIdongle x +

www.a.com

Schneider Electric

- Devices List
- Status
- WPS
- Network
- Wireless
- DHCP
- System Tools

Devices List

ID	Product Name	Manufacturer	IP Address	MAC Address
1	011F_0807	INVENSYS	10.0.0.100	00-18-BB-00-2F-E2

Refresh OK

Information

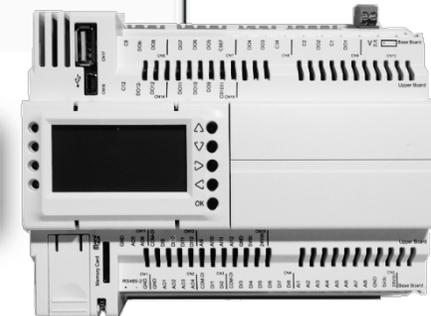
Status: **CONNECTED**

Firmware version: 596.600

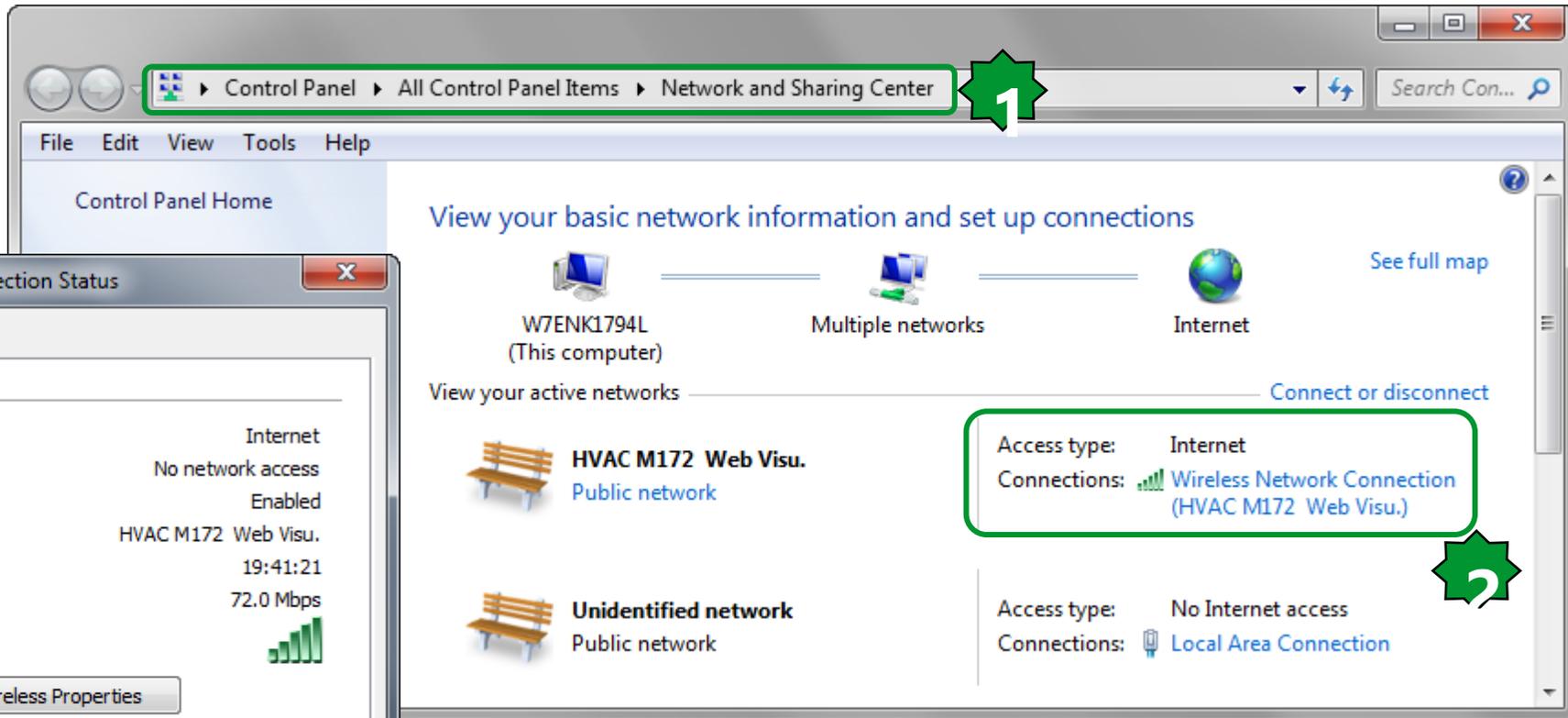
Model: Display 42 IOs



MAC Address
00-18-BB-00-2F-E2



Network status/properties...



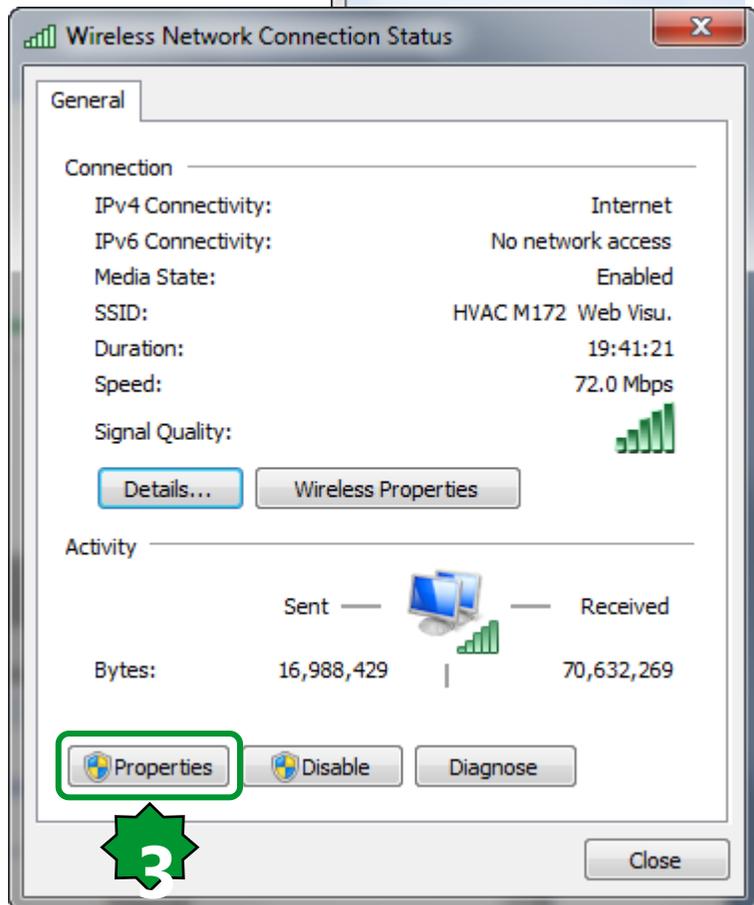
Control Panel > All Control Panel Items > Network and Sharing Center

View your basic network information and set up connections

W7ENK1794L (This computer) | Multiple networks | Internet

View your active networks

- HVAC M172 Web Visu.**
Public network
Access type: Internet
Connections: Wireless Network Connection (HVAC M172 Web Visu.)
- Unidentified network**
Public network
Access type: No Internet access
Connections: Local Area Connection



Wireless Network Connection Status

General

Connection

IPv4 Connectivity:	Internet
IPv6 Connectivity:	No network access
Media State:	Enabled
SSID:	HVAC M172 Web Visu.
Duration:	19:41:21
Speed:	72.0 Mbps
Signal Quality:	

Details... | Wireless Properties

Activity

Sent	Received
Bytes: 16,988,429	70,632,269

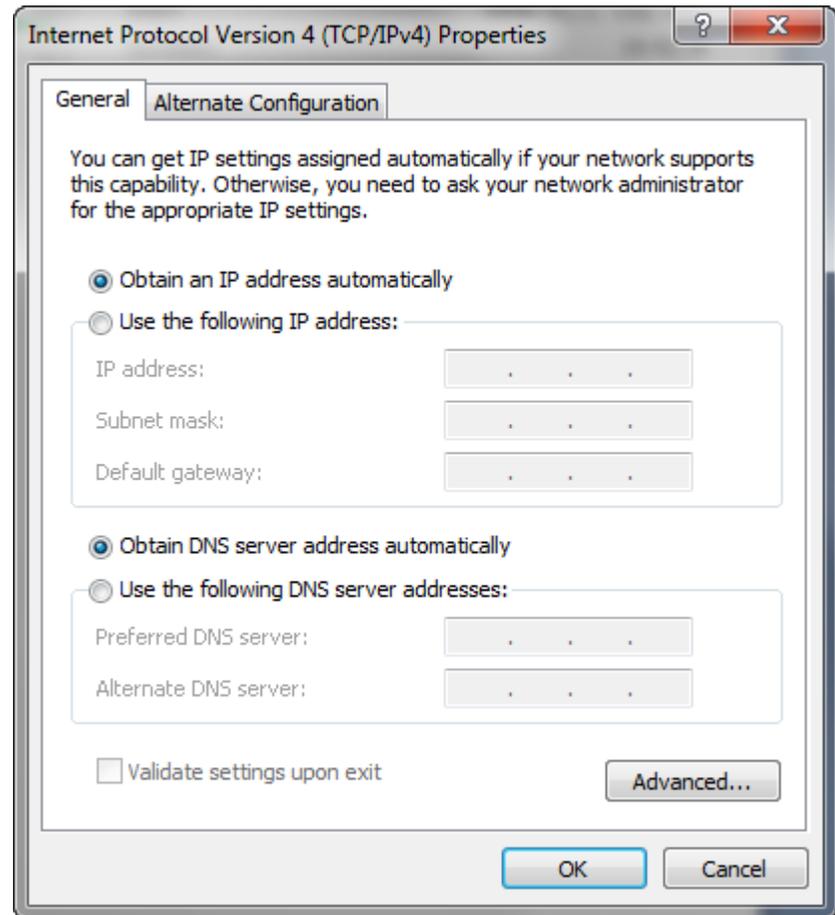
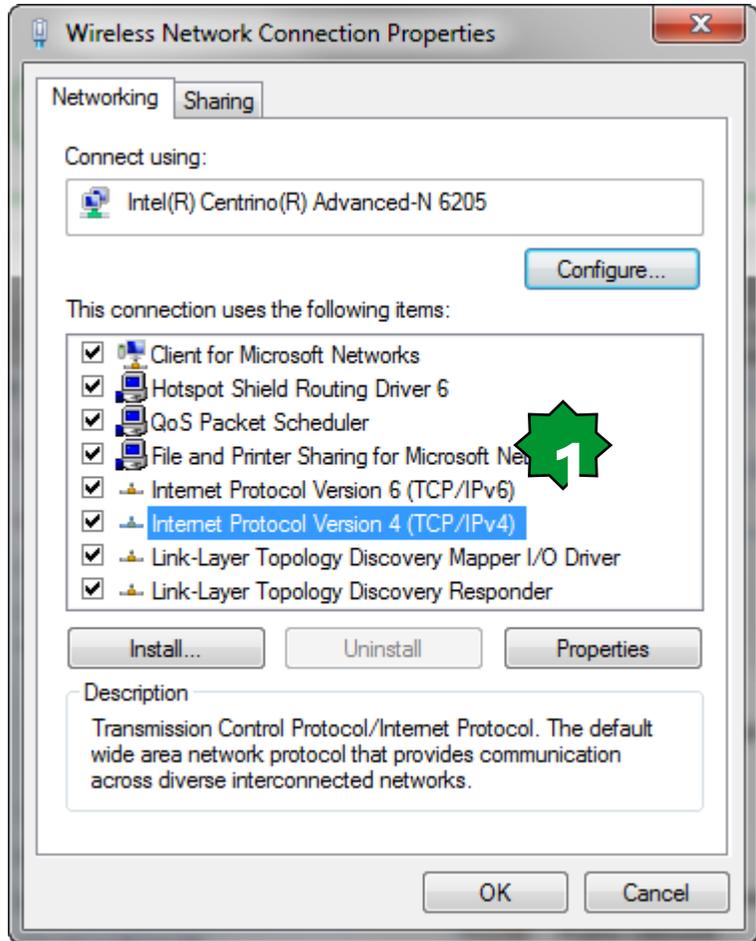
Properties | Disable | Diagnose

Close

... Network status/properties



As shown no needed to set the Wifer IP address in the controller address range.



Enabling DHCP/Wifer side



SE-WIFIdongle

223.22.33.223/?_sm_byp=iVVFWMv0f4S0255r

Schneider Electric

ConneXium WIFER
Model No. TC SEGWB13FA0

Devices List

Status

WPS

Network

Wireless

DHCP

- DHCP Settings

- DHCP Clients List

- Address Reservation

System Tools

DHCP Settings

DHCP Server: Disable Enable

Start IP Address: 223.22.33.100

End IP Address: 223.22.33.199

Address Lease Time: 10 seconds

Default Gateway: 223.22.33.223 (Optional)

Default Domain: (Optional)

Primary DNS: 0.0.0.0 (Optional)

Secondary DNS: 0.0.0.0 (Optional)

Save

DHCP Settings Help

The Device is set up by default as a DHCP (Dynamic Host Configuration Protocol) server, which provides the TCP/IP configuration for all the PCs that are connected to the Device in the LAN.

- **DHCP Server - Enable or Disable** the server. If you disable the Server, you must have another DHCP server within your network or else you must configure the IP address of the computer manually.
- **Start IP Address** - This field is the first address in the IP Address pool.
- **End IP Address** - This field is the last address in the IP Address pool.
- **Address Lease Time** - The **Address Lease Time** is the length of time a network user will be allowed to keep connecting to the Device with the current DHCP Address. The default value is 10



Enabling DHCP/Controller side

Project M171P_Exercise

- M171 Perf Display_1
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs
 - Analogue Outputs V/I
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive**
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - PLC Application
 - HMI
 - HMI_M171P
 - HMI Remote
 - HMI_M171P
 - Cfg files
 - Recipes
- M171 Perf Expansion 27 I/Os_1
- Display for M171 Perf_1

Ethernet Plugin Passive

Address	Name	Value	Um	Default	Min	Max	Description
15772	Port_TFTP_IP	0	num	0	0	65535	TFTP Port number, 0 is equal to default port 69
15796	Port_HTTP_PI	0	num	0	0	65535	HTTP Port number, 0 is equal to default port 80
15797	Port_ETH_PI	502	num	502	0	65535	TCP/IP Port number
15798	Ip_1_ETH_PI	10	num	10	0	255	Ethernet passive Plug-In IP address (1 st part)
15799	Ip_2_ETH_PI	0	num	0	0	255	Ethernet passive Plug-In IP address (2 nd part)
15800	Ip_3_ETH_PI	0	num	0	0	255	Ethernet passive Plug-In IP address (3 rd part)
15801	Ip_4_ETH_PI	100	num	100	0	255	Ethernet passive Plug-In IP address (4 th part)
15802	DefGtwy_1_ETH_PI	10	num	10	0	255	Default Gateway (1 st part)
15803	DefGtwy_2_ETH_PI	0	num	0	0	255	Default Gateway (2 nd part)
15804	DefGtwy_3_ETH_PI	0	num	0	0	255	Default Gateway (3 rd part)
15805	DefGtwy_4_ETH_PI	1	num	1	0	255	Default Gateway (4 th part)
15806	NetMsk_1_ETH_PI	255	num	255	0	255	Net mask (1 st part)
15807	NetMsk_2_ETH_PI	255	num	255	0	255	Net mask (2 nd part)
15808	NetMsk_3_ETH_PI	255	num	255	0	255	Net mask (3 rd part)
15809	NetMsk_4_ETH_PI	0	num	0	0	255	Net mask (4 th part)
15810	PriDNS_1_ETH_PI	194	num	194	0	255	Primary DNS server (1 st part)
15811	PriDNS_2_ETH_PI	25	num	25	0	255	Primary DNS server (2 nd part)
15812	PriDNS_3_ETH_PI	2	num	2	0	255	Primary DNS server (3 rd part)
15813	PriDNS_4_ETH_PI	129	num	129	0	255	Primary DNS server (4 th part)
15814	SecDNS_1_ETH_PI	194	num	194	0	255	Secondary DNS server (1 st part)
15815	SecDNS_2_ETH_PI	25	num	25	0	255	Secondary DNS server (2 nd part)
15816	SecDNS_3_ETH_PI	2	num	2	0	255	Secondary DNS server (3 rd part)
15817	SecDNS_4_ETH_PI	130	num	130	0	255	Secondary DNS server (4 th part)
15818	EnableDHCP_ETH_PI	True	flag	False	0	1	Enable DHCP

Devices List

Status

WPS

Network

Wireless

DHCP

System Tools

- Time Settings

- Diagnostic

- Firmware Upgrade

- Factory Defaults

- Backup & Restore

- Reboot

- Password

- System Log

- Statistics

Diagnostic Tools

Diagnostic Parameters

Diagnostic Tool: Ping Traceroute

IP Address/ Domain Name:

Ping Count: (1-50)

Ping Packet Size: (4-1472 Bytes)

Ping Timeout: (100-2000 Milliseconds)

Traceroute Max TTL: (1-30)

Diagnostic Results

Pinging 10.0.0.100 with 64 bytes of data:

```
Reply from 10.0.0.100: bytes=64 time=1 TTL=128 seq=1
Reply from 10.0.0.100: bytes=64 time=3 TTL=128 seq=2
Reply from 10.0.0.100: bytes=64 time=1 TTL=128 seq=3
Reply from 10.0.0.100: bytes=64 time=1 TTL=128 seq=4
```

Ping statistics for 10.0.0.100

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milliseconds:
Minimum = 1, Maximum = 3, Average = 1

Start

Chapter 18

Firmware update

Goal:

Updating SMART & EVOLUTION firmwares by Free Studio Device

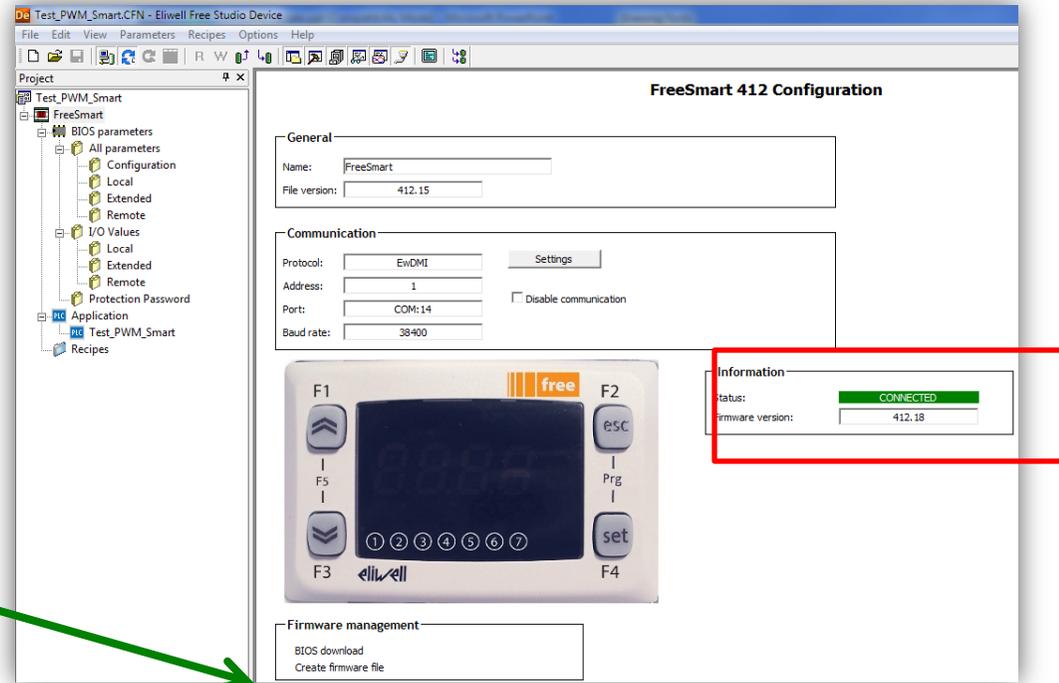
Firmware update

In Free Studio Device

- Click on “Connects to Target”
- Once the device is connected,
- Check the firmware version

- If the firmware version is not the last one, click on BIOS download

Note.
Smart: Application Lost
Evolution: Application kept

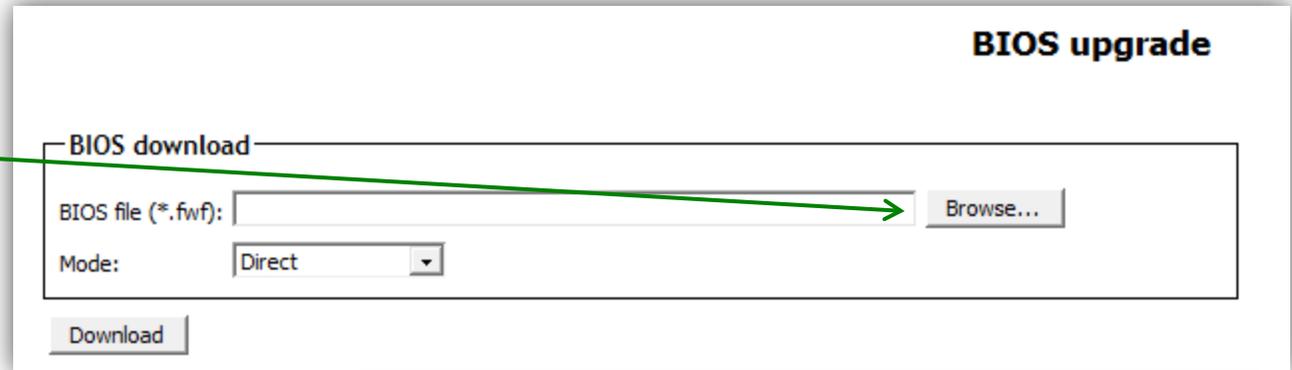


Note: Smart, the controller must be powered only by DMI.

Firmware update



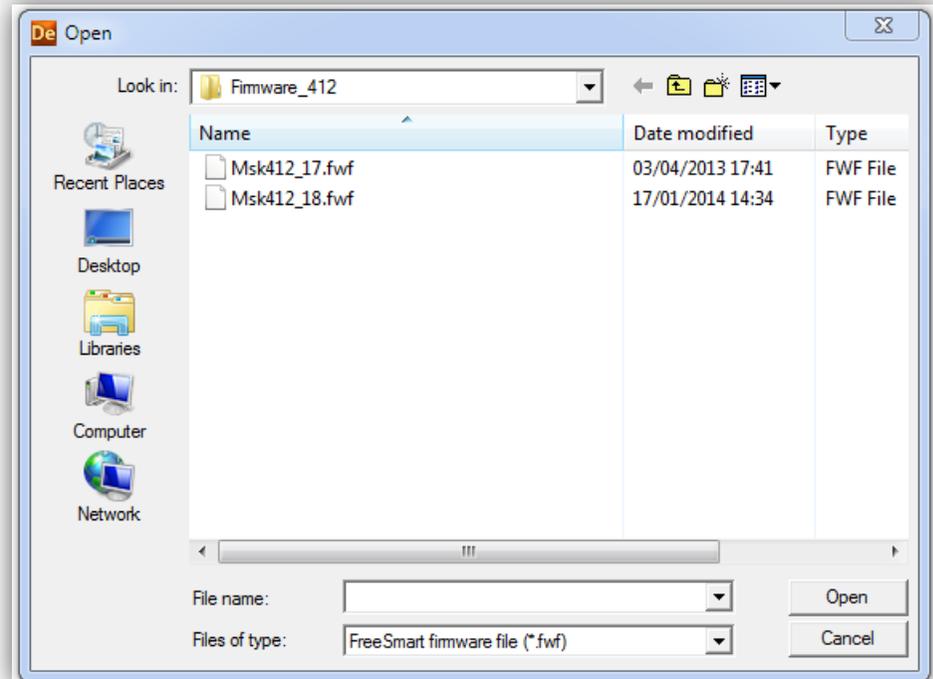
- Click on Browse



- The default folder opened contains the last firmware version released with the software.

➔ Select the last firmware version

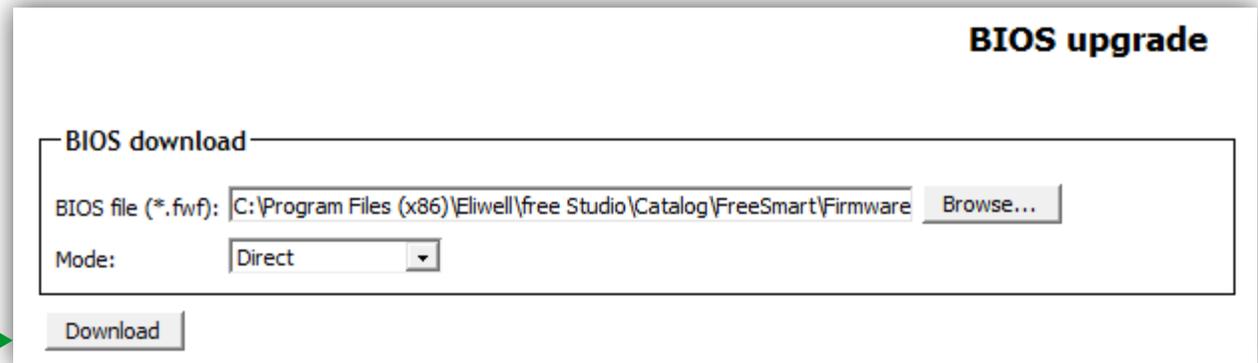
➔ Click on Open



Firmware update

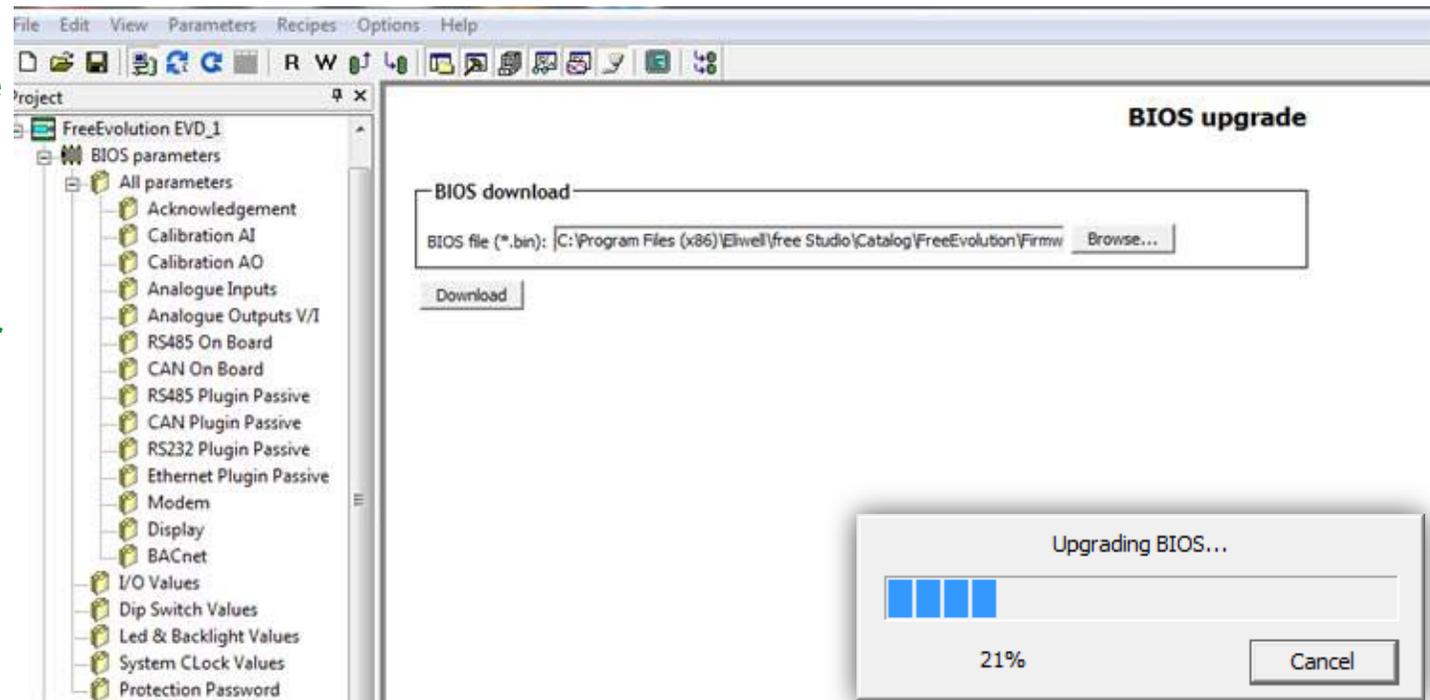


- Select Direct Mode

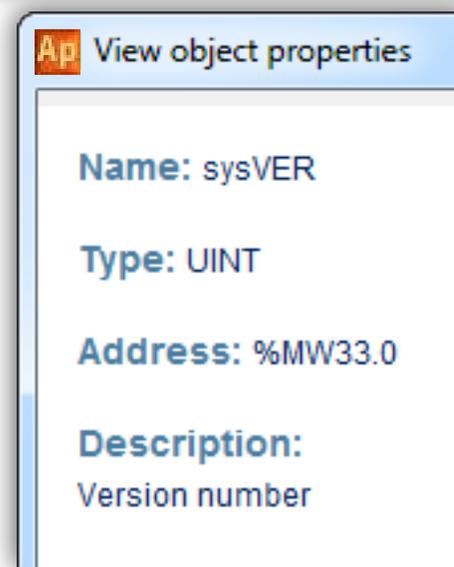
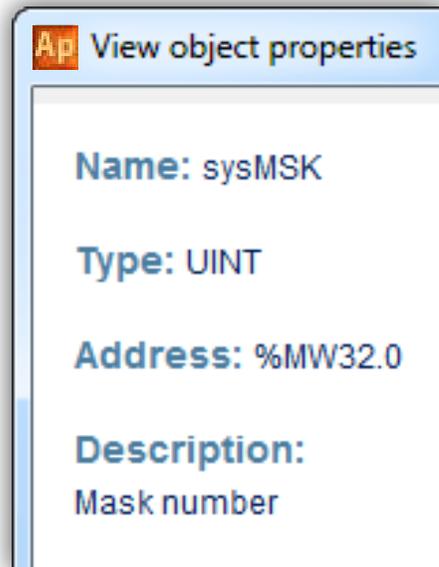
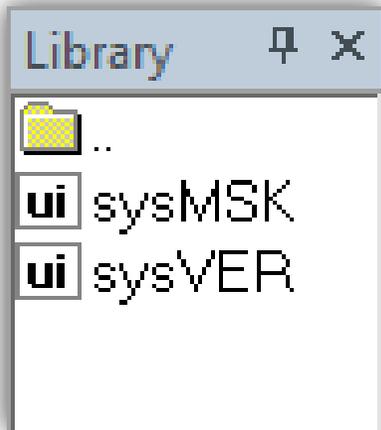
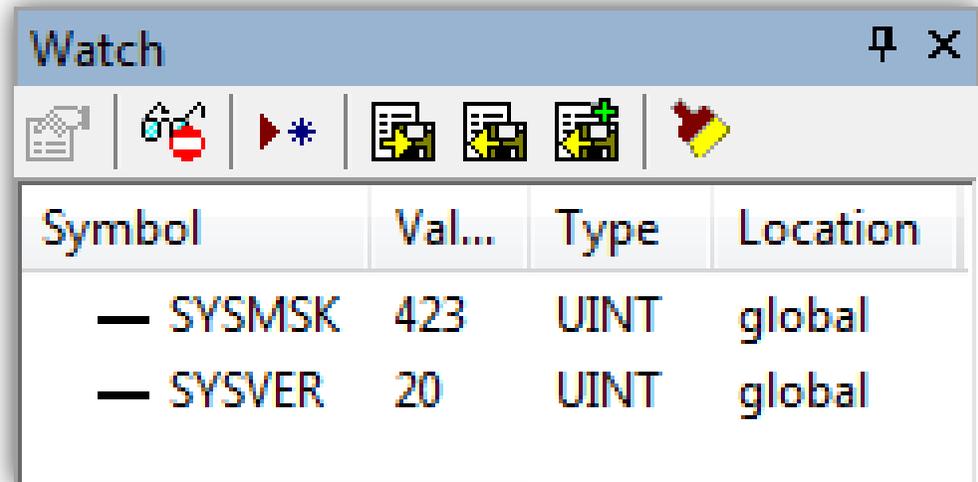
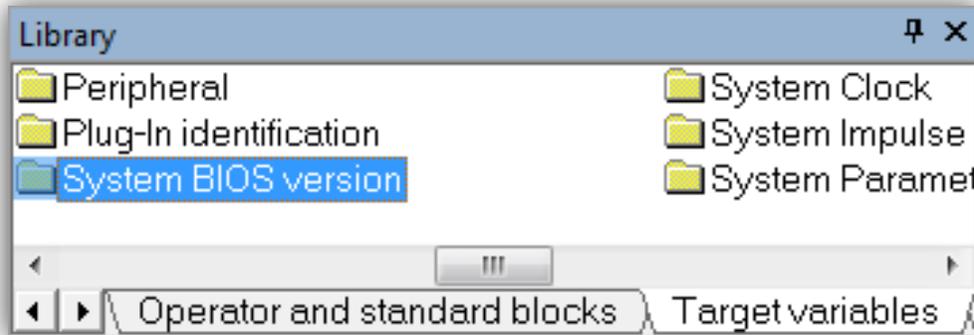


- Click on Download

- The same procedure can be applied to Evolution except for Mode selection (not available) and power supply to be provided.



System BIOS version



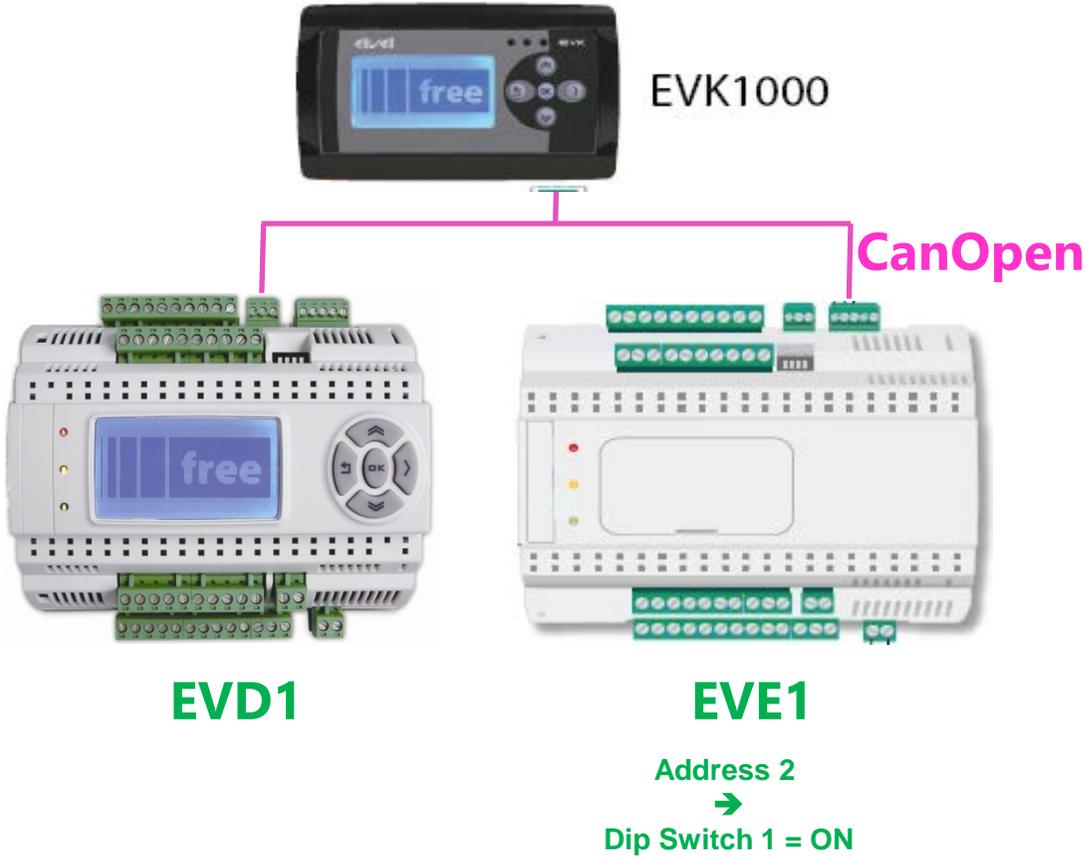
Chapter 19

User Interface

Goal:

Local & Remote display programming by User Interface

DemoField Example



NOTE: Leave the CanOpen end resistor jumpers only to the endline Devices, in this case EVD and EVE1

Can Bus wiring recommendations



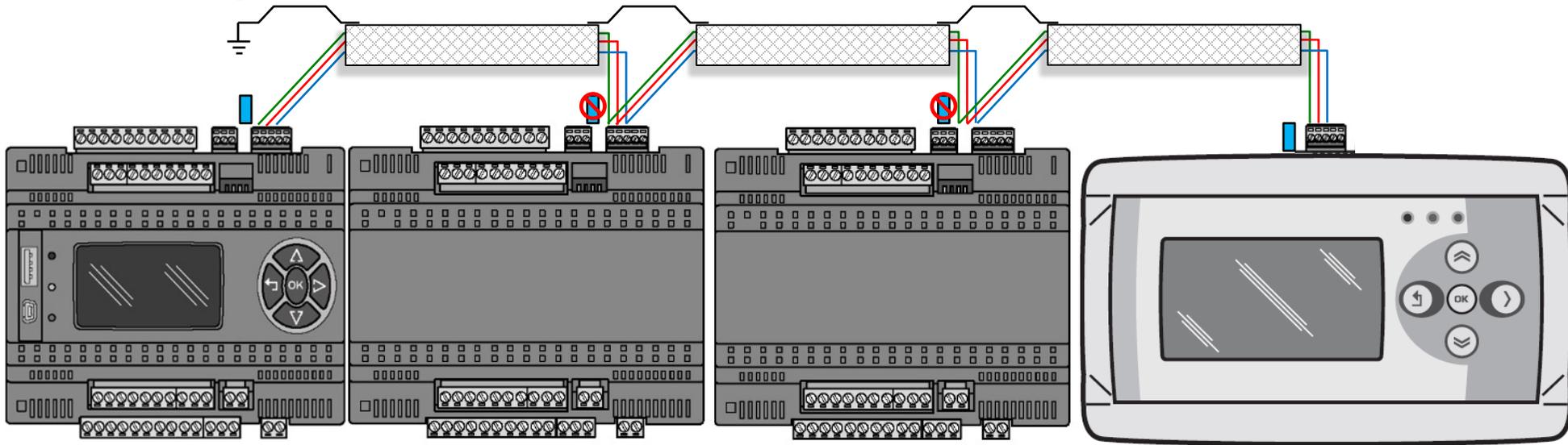
Use a shielded and "twisted pair" cable with two 0.5 mm² section conductors (AWG 22), plus braid such as Belden cable reference 3105A (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shielding 68 pF/m.

kb/s (kbaud)	On-board CAN (m) - FREE Evolution	CAN Communication module (m)
50	1000	1000
125	500	500
250	200	250
500	30	60

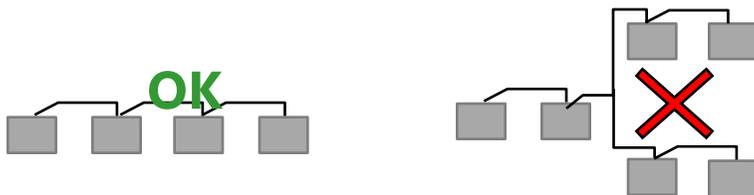
CAN Termination Jumper



- CAN bus jumper mounted
- ⊘ CAN bus jumper NOT mounted

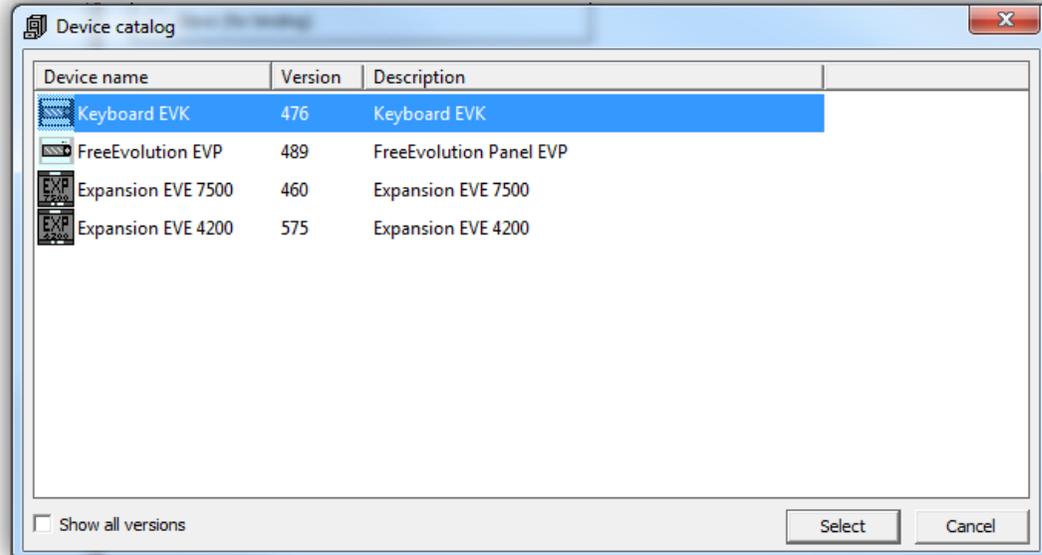
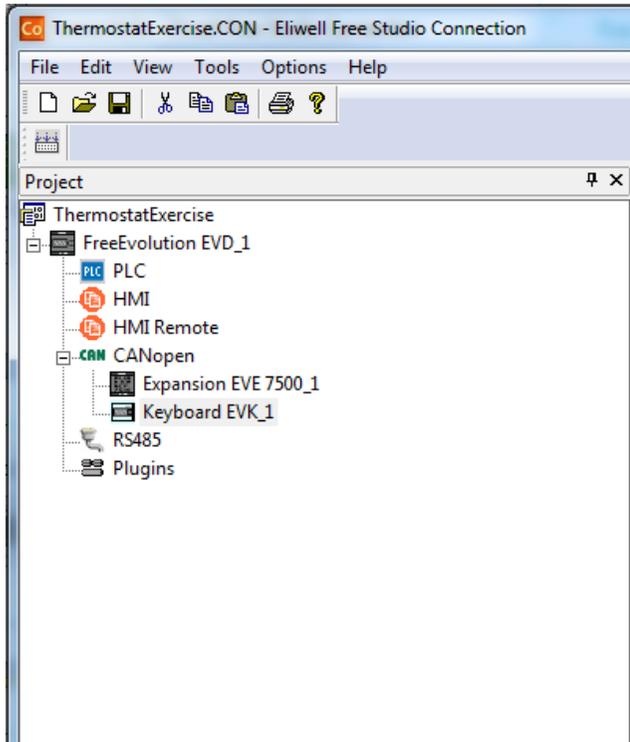


Note: the termination shall be placed at the beginning and at the end of the Can Bus



Note: Star connection are not allowed

Adding a remote display



Drag & drop from device catalogue to the CANopen
Or
CANopen ► Add ► Device catalogue ► Select the target



CANopen configuration

- 124 or 123 are the addresses to be used in the HMI management menu of EVK



- 124 is the factory default

1 keyboard to communicate with base ► set the channel=124
Second keyboard to communicate with base ► set the channel=123

Keyboard EVK configuration

Thermostat_exercise.CON - Eliwell Free Studio Connection

File Edit View Tools Options Help

Project

- Thermostat_exercise
 - FreeEvolution EVD_1
 - PLC
 - HMI
 - HMI Remote
 - CAN CANopen
 - Expansion EVE_1
 - Keyboard EVK_1**
 - RS485
 - Plugins

Keyboard EVK Configuration

General

Name:

Version:

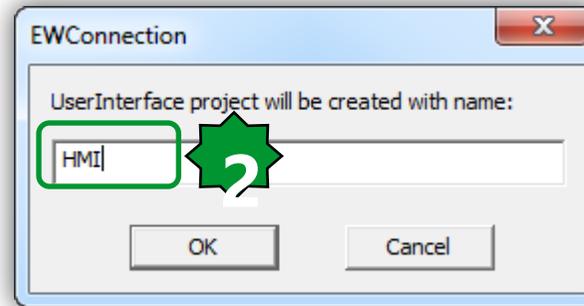
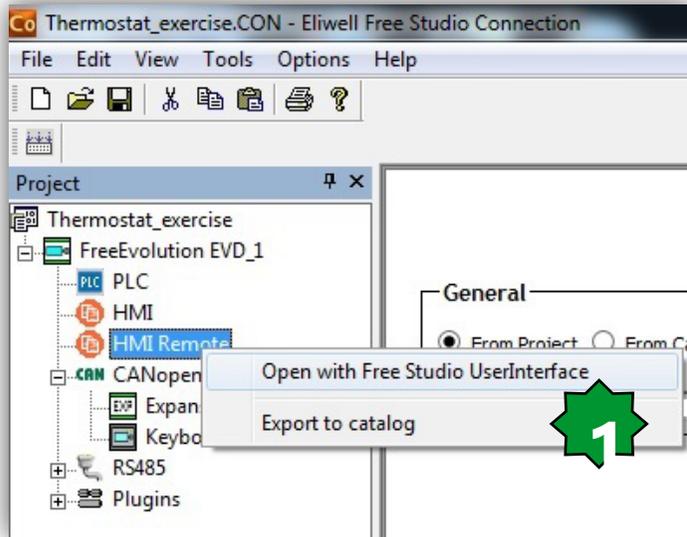
Network settings

Node number (126,127):



Network settings should be aligned to the real address of the EVK (127 is the factory default).

Launching User Interface



Local HMI might not work on remote display
 Local & Remote displays (Identical) ► HMI remote
 Local & remote displays as future option ► HMI remote

HMI:Local Display
 HMI Remote: Remote Display

2. Name it ► OK
 3. User Interface project
 starts automatically



Project foldering

CON File (1)



Thermostat_exercise.CON

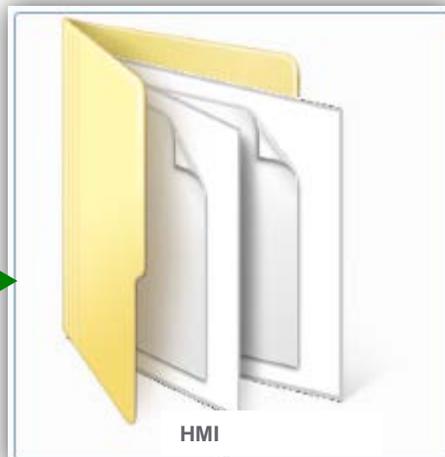
File folder (2)



Application



User Interface



HMI

HMI Remote Configuration

General

From Project From Catalog

HMI Remote Project: HMI\HMI.PAJX

Browse...

HMI:Local Display
HMI Remote: Remote Display

2. Name it ► OK ► User Interface project starts automatically
- 3 & 4. Local display will have the same HMI of the remote one.

Local & Remote HMI

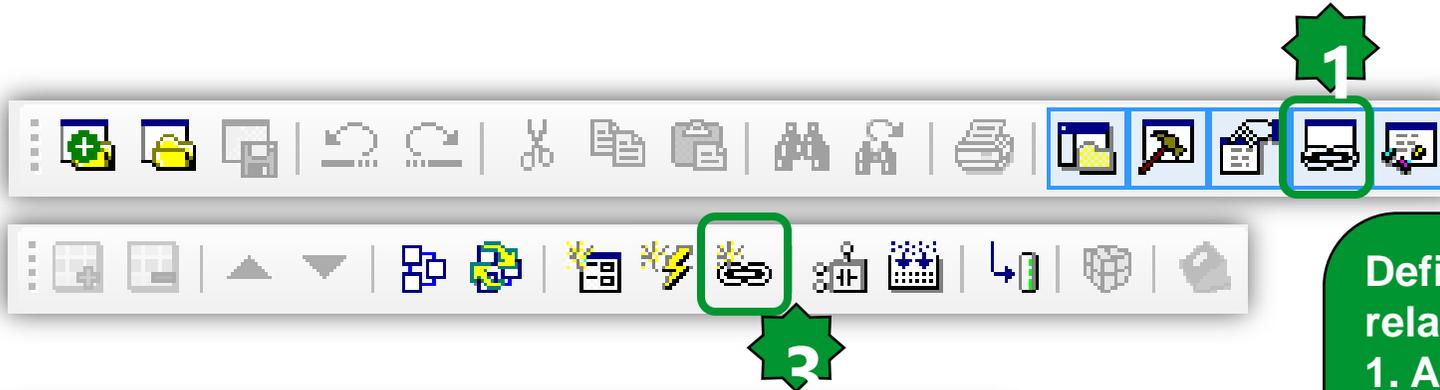
The image shows a software interface for HMI configuration. On the left is a 'Project' tree view with a green star and the number '1' pointing to the 'HMI Remote' component. The tree includes: Thermostat_exercise, FreeEvolution EVD_1, PLC, HMI, HMI Remote, CANopen, Expansion EVE_1, Keyboard EVK_1, RS485, and Plugins. On the right is the 'HMI Configuration' dialog box. It has a 'General' tab with a green star and the number '2' pointing to the 'Use remote project' button. Below this, there are radio buttons for 'From Project' (selected) and 'From Catalog', with a green star and the number '3' pointing to the 'From Project' option. A text field labeled 'HMI Project:' contains 'HMI\HMI.PAJX' and is highlighted with a green box. To its right is a 'Browse...' button. Below the text field is a 'Reload device list' button. At the bottom of the dialog is a table with columns: Name, ID, Protocol, and Address.

Name	ID	Protocol	Address
------	----	----------	---------

HMI:Local Display
HMI Remote: Remote Display

2 & 3. Local display will have the same HMI of the remote one.

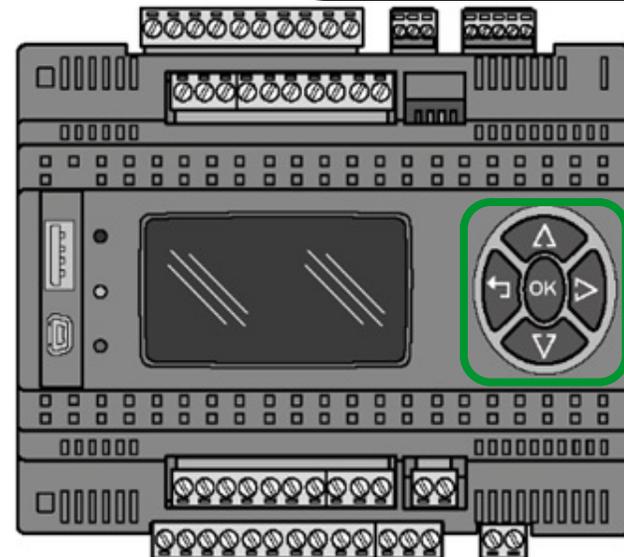
Preliminary: Actions



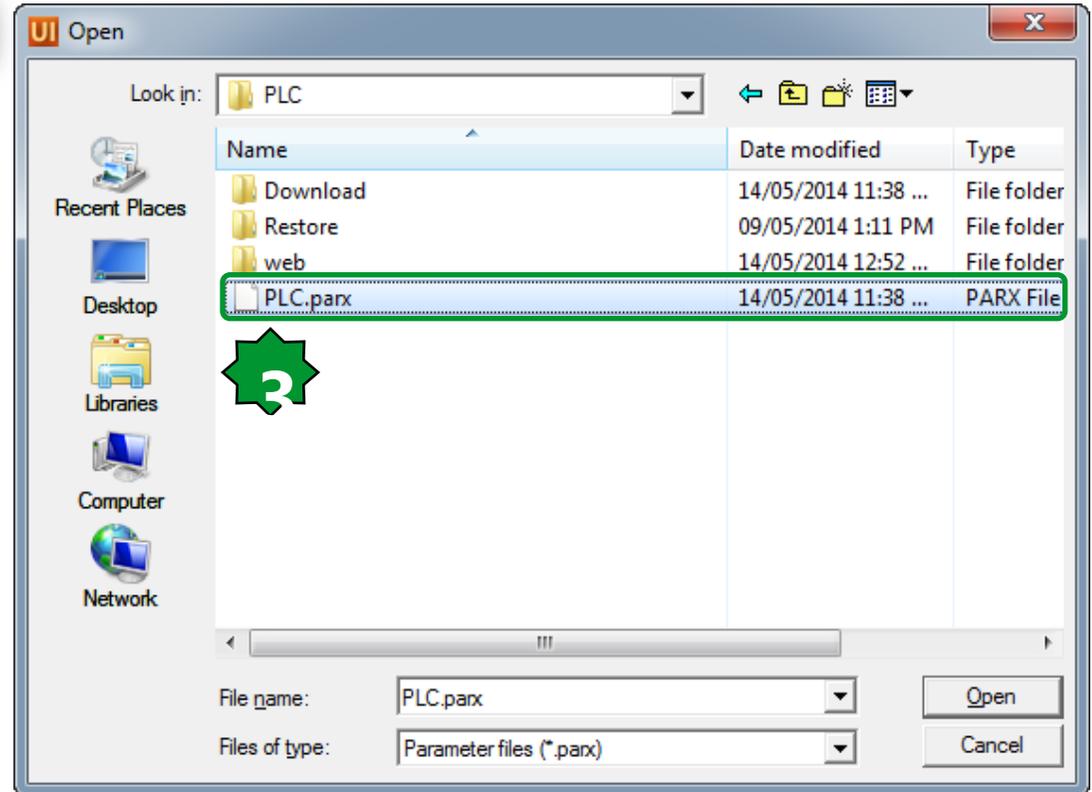
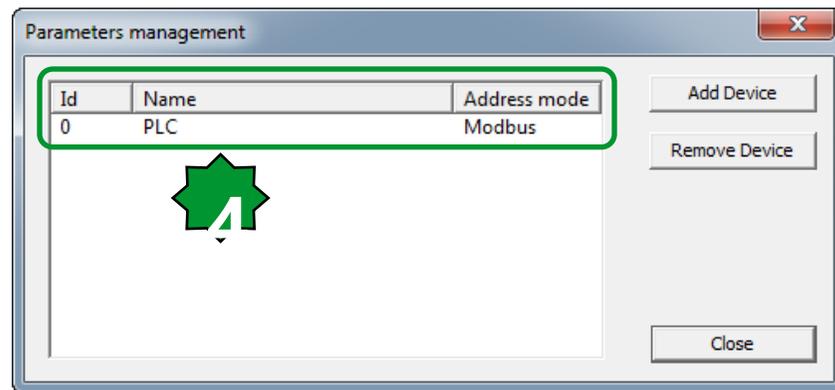
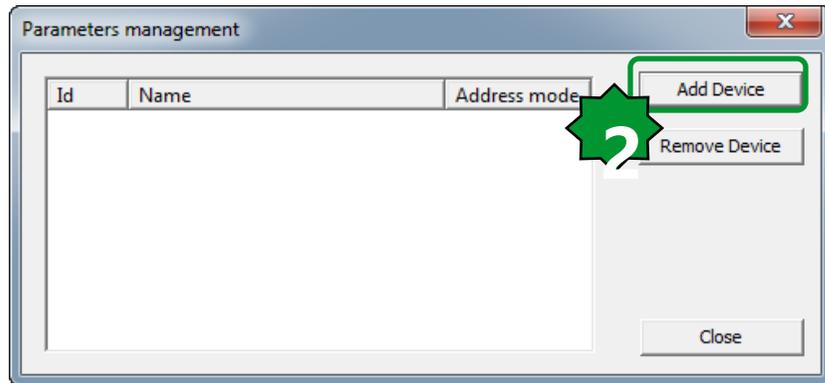
Define the global action related to the buttons

1. Activate action bar icon
2. Global actions
3. New action
3. Define the Key
4. Define the Action

Actions		
Local actions		Global actions
Key	Action	Link
Enter	Edit	
Left	PrevField	
Right	NextField	
Up	PrevField	
Down	NextField	
LongLeft	Close	

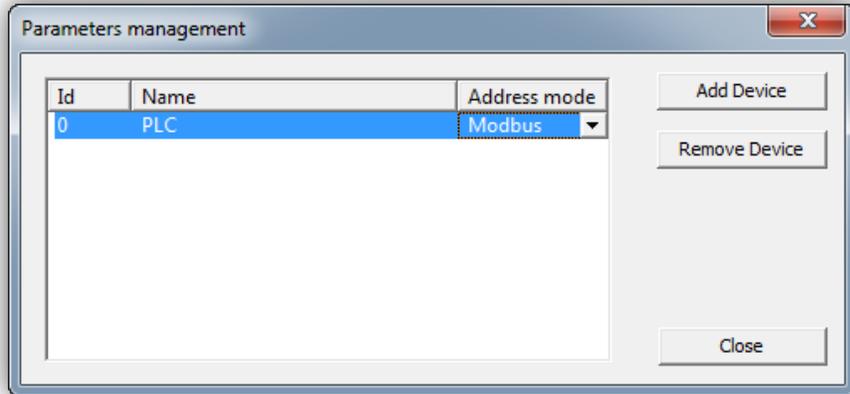


Preliminary: Link parameter file



- Link the parameters file of your application project.
- Select short name to prevent long variable names

Target Vars & parameters

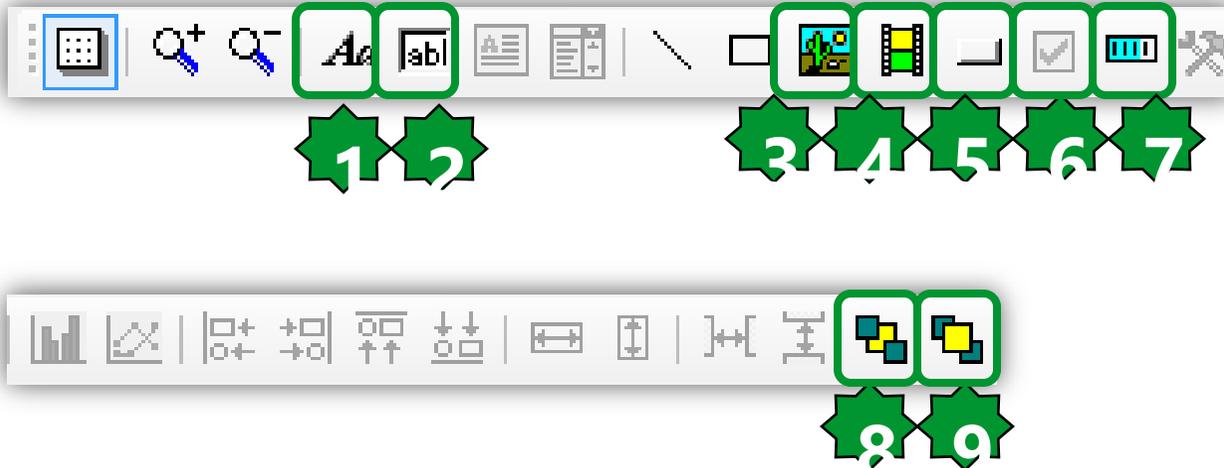


Name	Type	Address	Min	Max	Um	Description
sysClockSet_dayweek	USINT	Modbus:8747:0	0	6	num	Day of week value (write)
sysClockSet_daymonth	USINT	Modbus:8748:0	1	31	num	Day of the month value (write)
sysClockSet_month	USINT	Modbus:8749:0	1	12	num	Month value (write)
sysClockSet_year	USINT	Modbus:8750:0	10	99	num	Year value (write)
sysClockSet_Upload	BOOL	Modbus:8751:0	0	1	flag	RTC upload
PASSWORD	UDINT	Modbus:24320:0	0	4294967295	num	Numeric Password for Applicatio...
Load_BACnet_E2_Defaults	BOOL	Modbus:15766:0			flag	Load default values for BACnet pa...
Port_BACnet_IP	UINT	Modbus:15768:0	0	65535	num	BACnet/IP Port number, 0 is equa...



- Name can be eventually changed manually in order to adapt the same UI to different project without changing the set already defined (@ syntax)
- The list of parameters/status variables will appear
- Note: Remember to refresh parameters file every time you change the related Application project

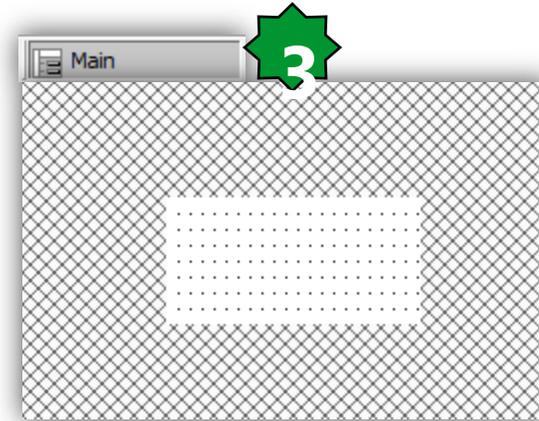
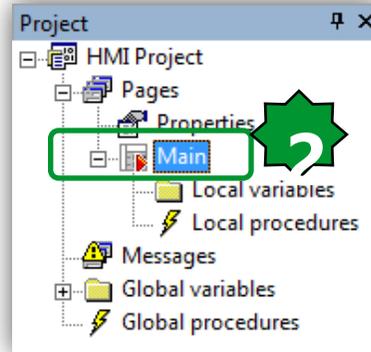
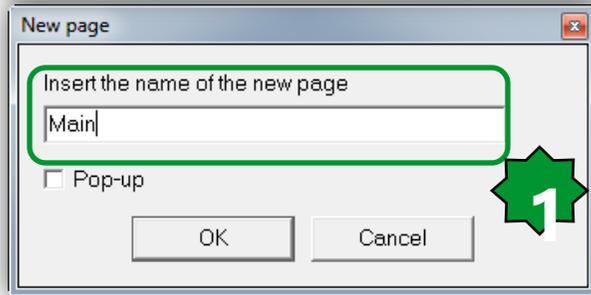
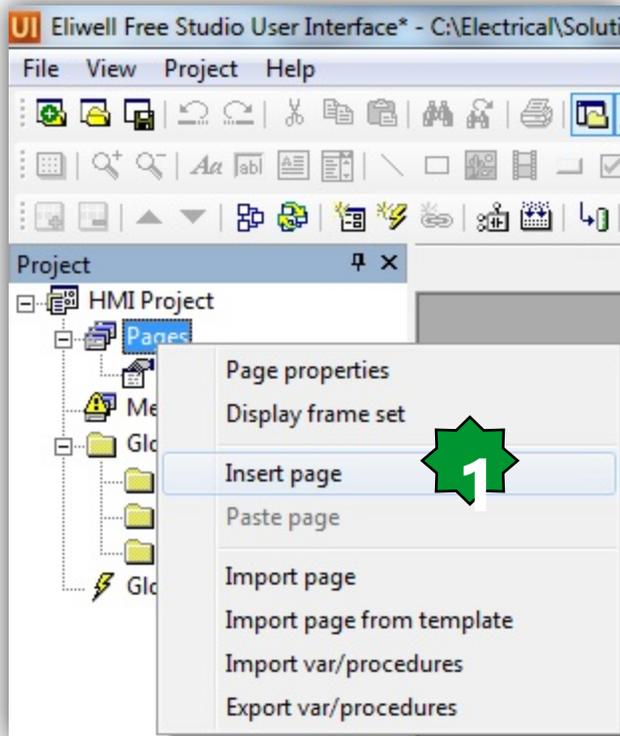
Toolbar description



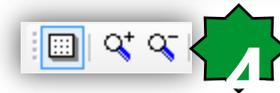
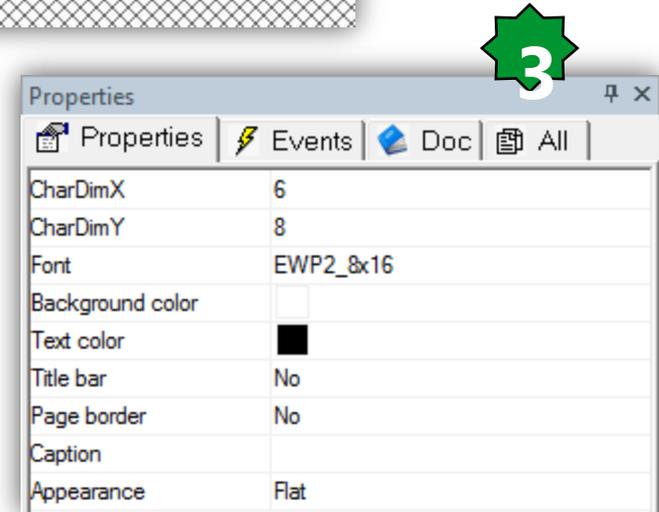
1. Insert static
2. Insert new edit
3. Insert new image
4. Insert new animation
5. Insert new button
6. Insert new check box
7. Insert new progress
8. Bring to front
9. Sent to back

We will see how to manage all these objects...

Page creation & page properties



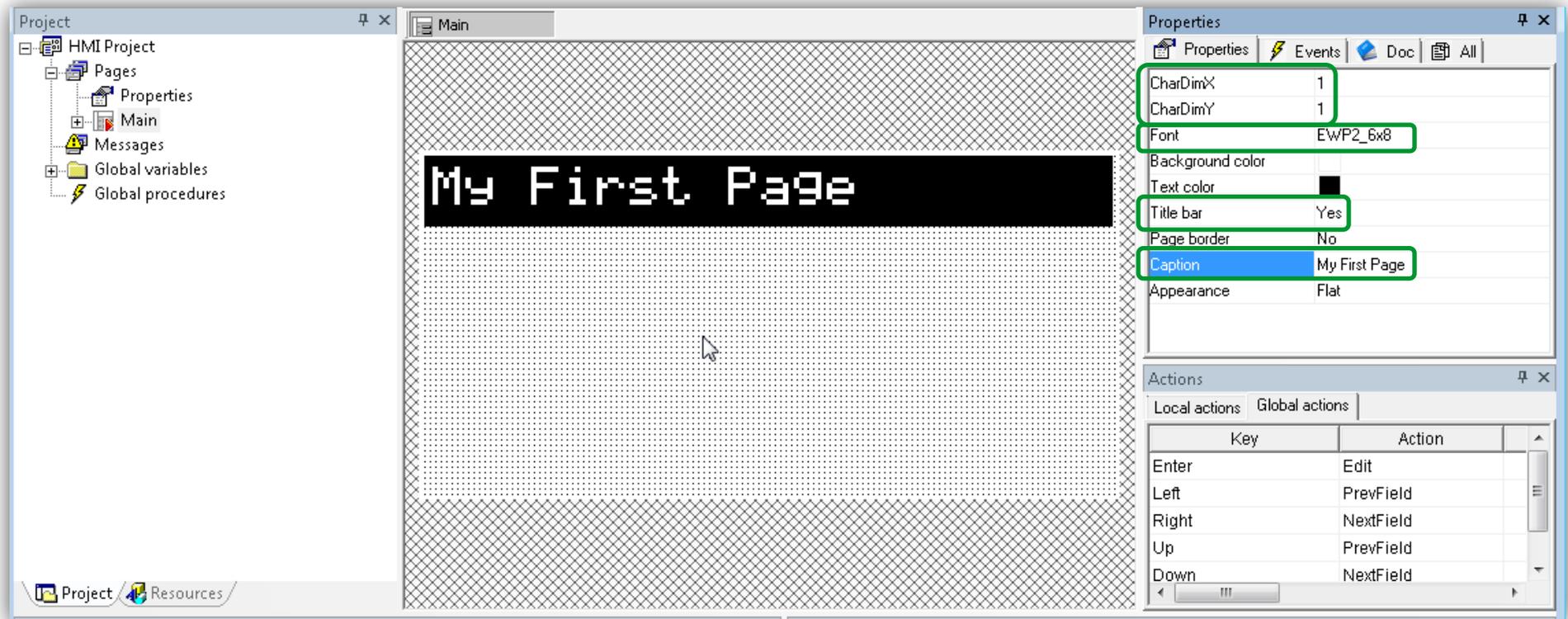
Note.
Press Enter to apply the changes otherwise it will be lost.



Page Customization

• Main Page Properties

- Customize grid
- Insert Title Bar
- Define Font size
- Define Title



The screenshot shows the 'Main' page in an HMI design tool. The main canvas features a grid background with a black title bar at the top containing the text 'My First Page'. The Properties panel on the right is open, showing the following settings:

- CharDimX: 1
- CharDimY: 1
- Font: EWP2_6x8
- Background color: (empty)
- Text color: (empty)
- Title bar: Yes
- Page border: No
- Caption: My First Page
- Appearance: Flat

The Actions panel is also visible, showing the following key bindings:

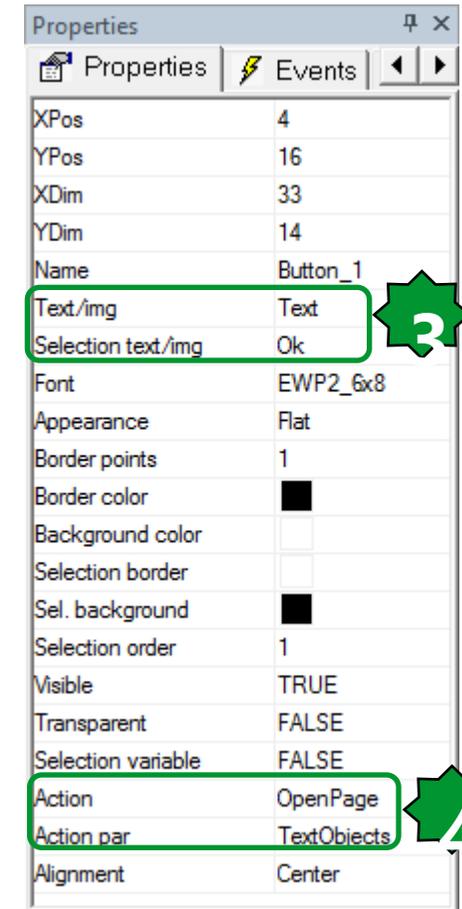
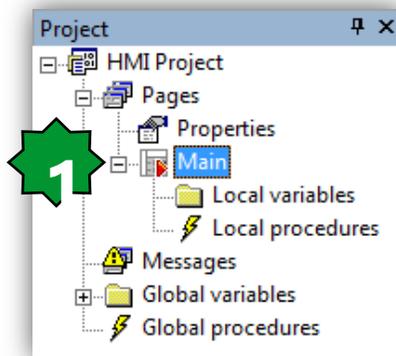
Key	Action
Enter	Edit
Left	PrevField
Right	NextField
Up	PrevField
Down	NextField

Page Navigation by Graphic Button

1. Define a new page
2. Create a button in the source page



3. Text/img can be changed base on selection status
4. Define the Action and Action Par properties of the button



Main/My First Page...

Project

- HMI_M171P Project
 - Pages
 - Properties
 - SliderObjects
 - DynamicAlarmObjects
 - TextObjects
 - Main_Page**
 - EditObjects
 - ImageObjects
 - DynamicSetObjects
 - AnimationObjects
 - ATV21Control
 - SystemObjects
 - Messages
 - Global variables
 - Global procedures

Main Page 1

Text Edit Image ATV21

Dyn. Alarm Animation

Dyn. Set Slider Sys

CharDimX	1
CharDimY	1
Font	EWP2_8x16
Background color	<input type="text"/>
Text color	<input type="text"/>
Title bar	Yes
Page border	No
Caption	Main Page
Appearance	Flat

Text Objects



Text Objects

Big Text

Small Text

Properties	
Properties	Events
XPos	3
YPos	17
Name	String_1
Text	Big Text
Font	EWP2_8x16
Background color	
Text color	■
Sel. background	■
Sel. foreground	■
Appearance	Flat
Border points	0
Border color	■
Number of chars	0
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	TRUE



Close

Properties	
Properties	Events
XPos	3
YPos	35
Name	String_2
Text	Small Text
Font	EWP2_6x8
Background color	
Text color	■
Sel. background	■
Sel. foreground	■
Appearance	Flat
Border points	0
Border color	■
Number of chars	0
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	TRUE



Properties	
Properties	Events
XDim	34
YDim	13
Name	Button_4
Text/img	ID_Close
Selection text/img	ID_Close
Font	EWP2_6x8
Appearance	Flat
Border points	1
Border color	■
Background color	
Selection border	
Sel. background	■
Selection order	1
Visible	TRUE
Transparent	FALSE
Selection variable	FALSE
Action	Close
Action par	
Alignment	Center



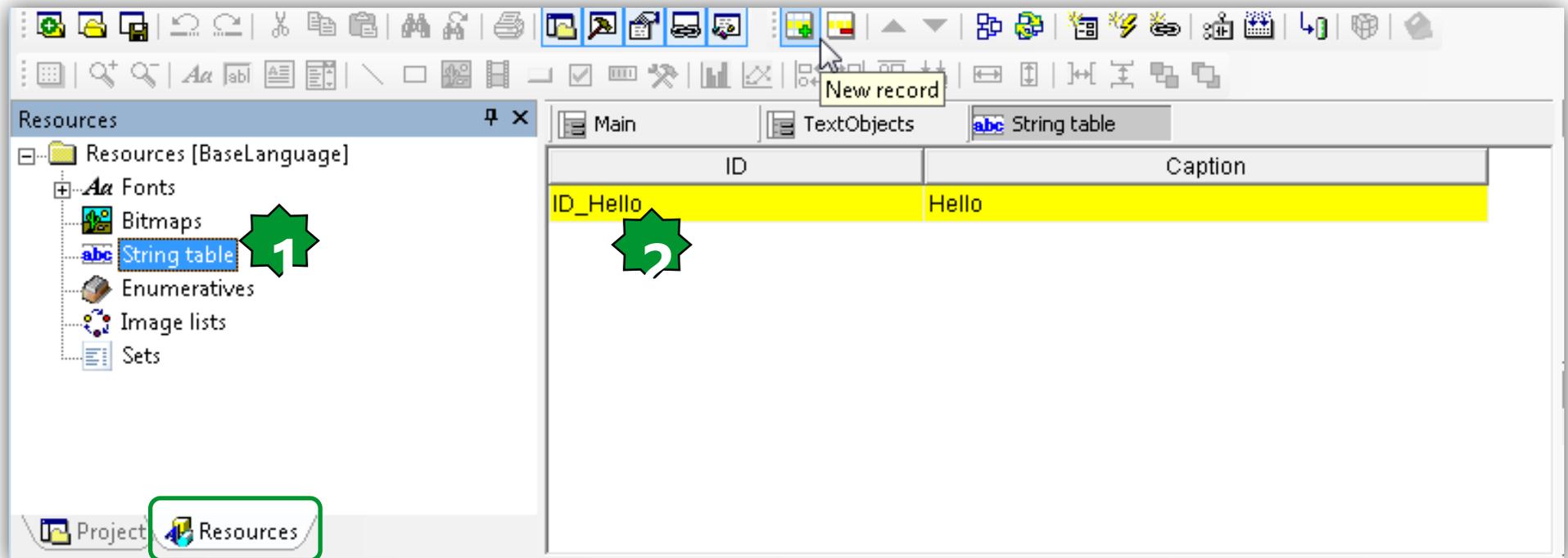
1. Insert static text

Define the required font size
(2 sizes are available)

Text Objects...

- Text to be translated:

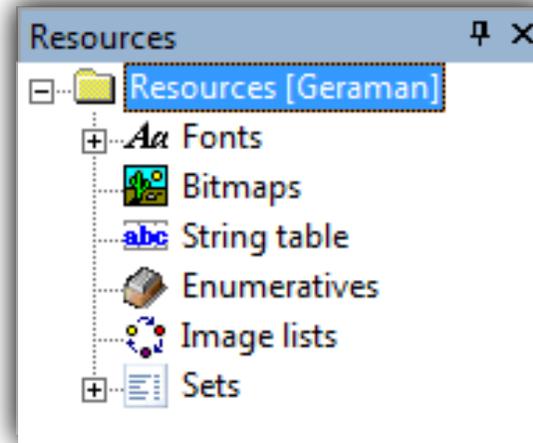
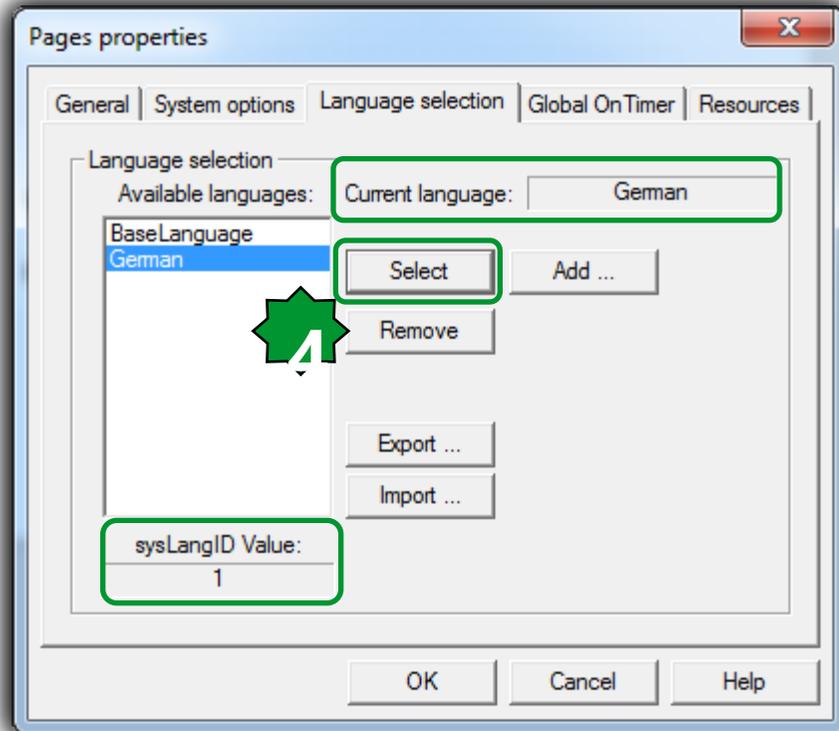
1. Define the string ID and the string in the current language
2. Use the ID instead of static string



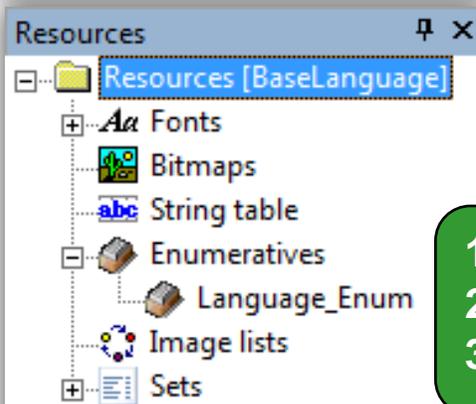
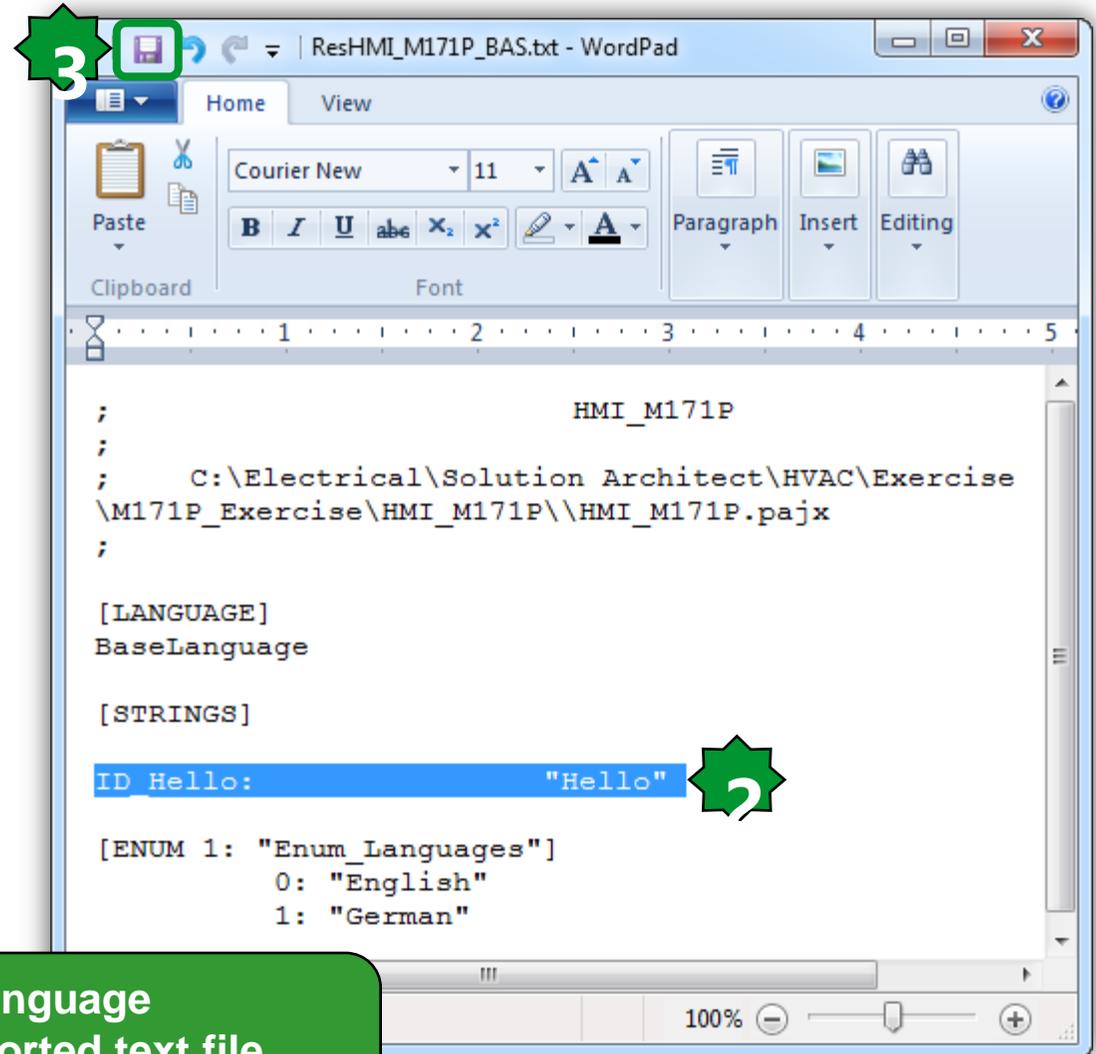
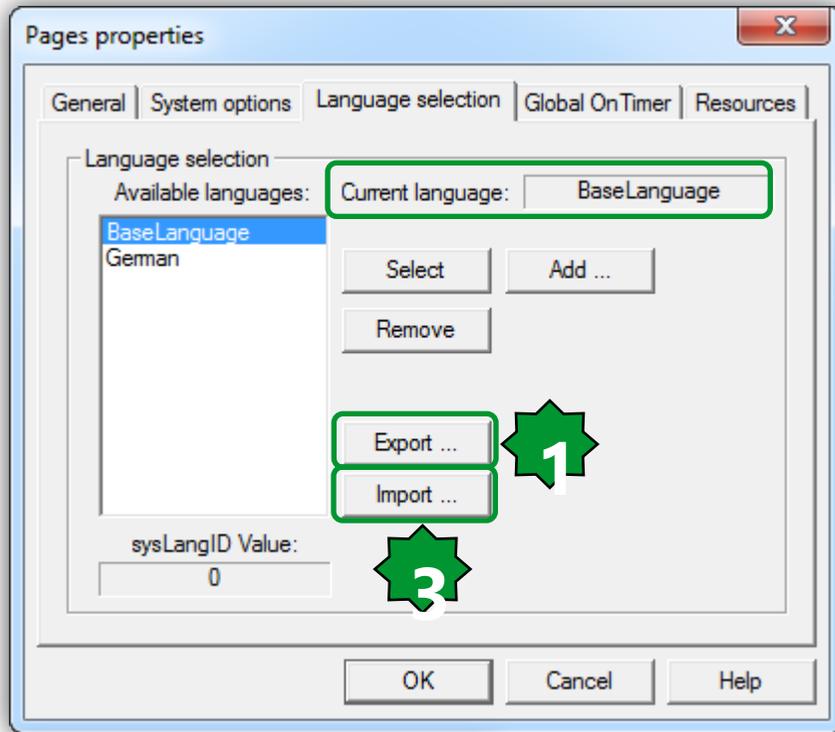
Adding 2nd language

- Text to be translated:

1. Languages are defined in the language selection tab
2. String table can be exported/imported and translated

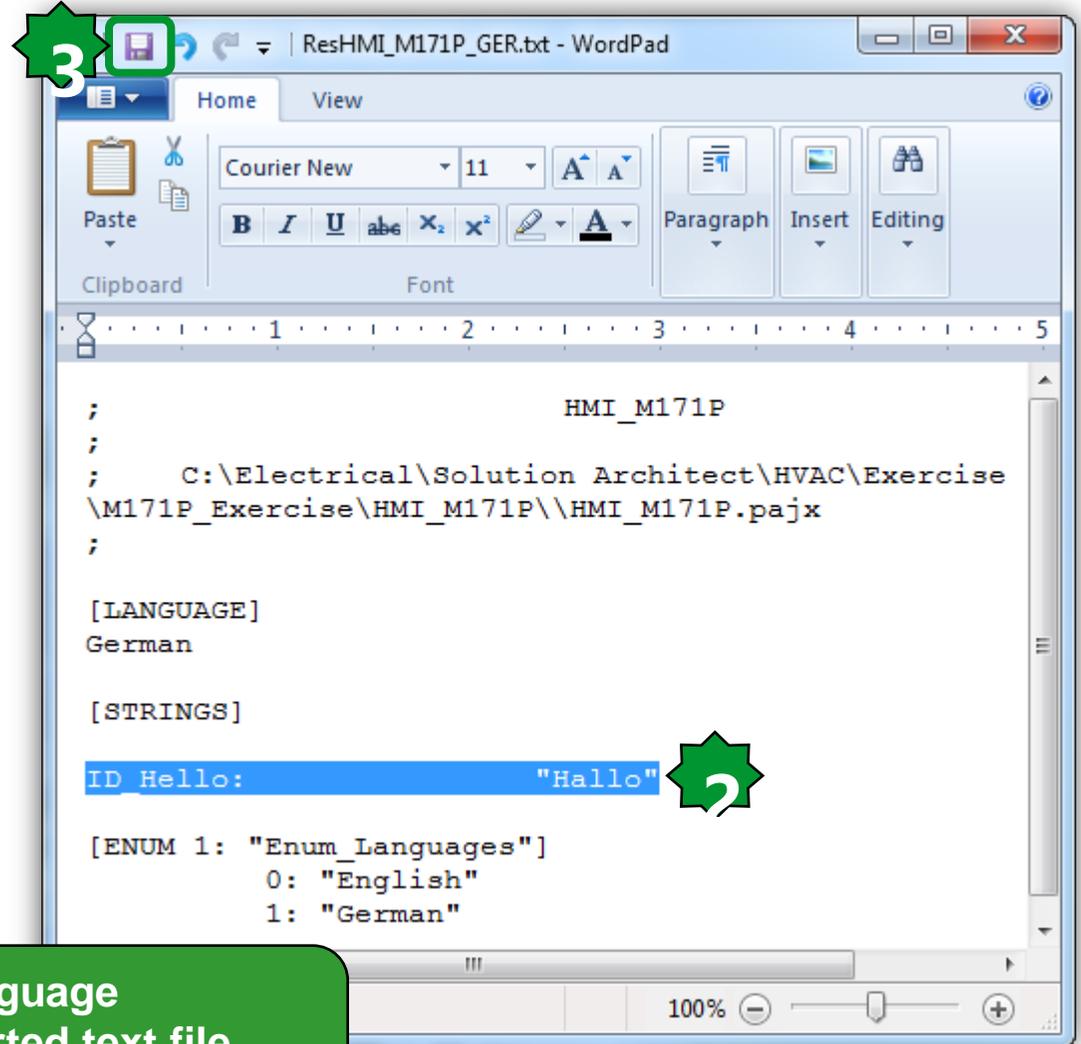
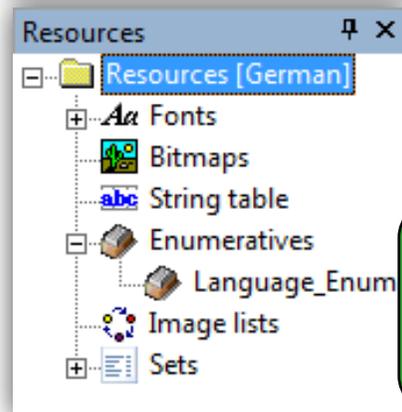
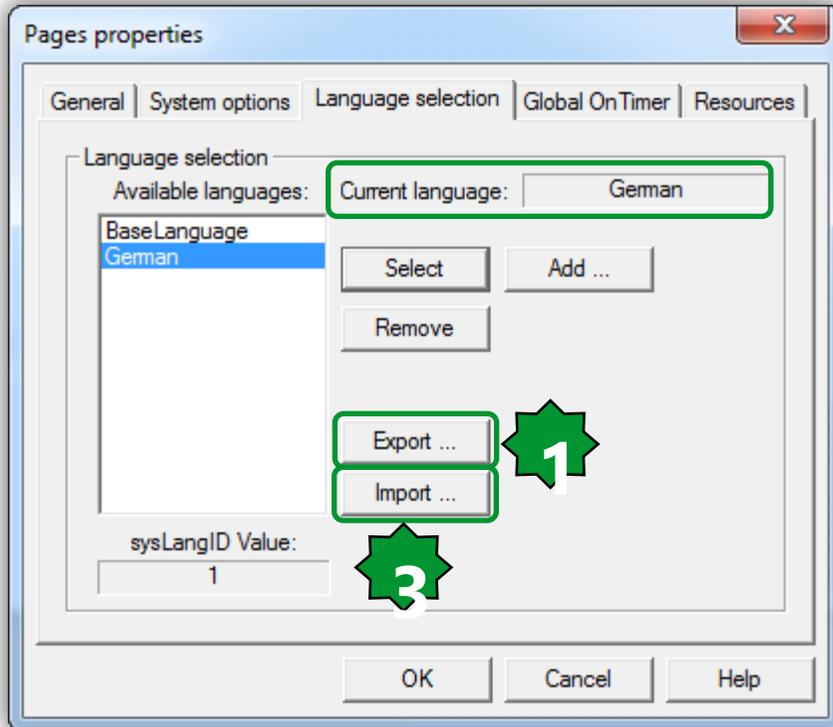


Base Language Import/Export



1. Export the basic language
2. Open/Edit the exported text file
3. Save & Import the edited version

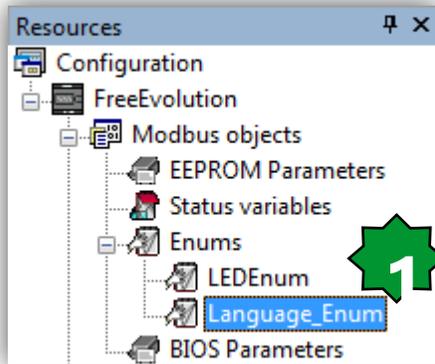
2nd language Import/Export



1. Export the basic language
2. Open/Edit the exported text file
3. Save & Import the edited version



Language switching variable definition

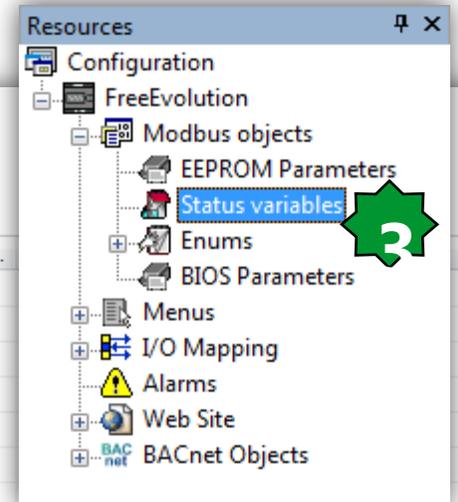


'Language_Enum' Enumerator

Add Remove

#	Value	Description
1	0	English
2	1	German

Status Variables

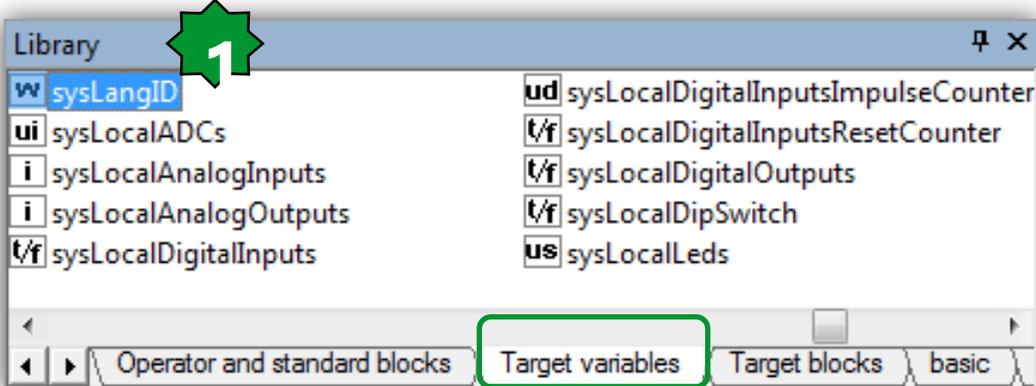


Add Remove Recalc

#	Address	Name	Device type	Application type	Default value	Min	Max	Unit	Format	AccessLevel	Read o...	
1	8960	Ambiant_Temp	Signed 16-bit	INT				°C	XXX.Y	Always visible	True	
2	8961	Hystersis_FB_Status	Boolean	BOOL						Always visible	True	
3	8962	EXP1_CAN_Status	Boolean	BOOL						Always visible	True	
4	8963	Probe_EXP1_Err	Signed 16-bit	INT						Always visible	True	
5	8965	Expansion_Alarm	Boolean	BOOL						Always visible	True	
6	8964	Green_LED_EXP1	Unsigned 8-bit	USINT						Always visible	True	
7	8966	Red_LED_EXP1	LEDEnum	USINT						Always visible	True	
8	8967	ATV_Command	Unsigned 16-bit	UINT						Always visible	False	
9	8968	ATV_Speed_Reference	Signed 16-bit	INT				Hz		Always visible	False	0-5000 (0.01 Hz)
10	8969	ATV_Output_Frequency	Signed 16-bit	INT				Hz		Always visible	True	
11	8970	Modbus_Comm_Error	Boolean	BOOL						Always visible	True	
12	8971	Web_ATV_Comd	Boolean	BOOL						Always visible	False	
13	8972	Web_ATV_Speed_Ref	Signed 16-bit	INT	0	0	5000	Hz	XX.YY	Always visible	False	0-50 Hz
14	8973	Web_ATV_Output_Frq	Signed 16-bit	INT				Hz	XX.YY	Always visible	False	0-50 Hz
15	8974	Language_Switch	Language_Enum	BOOL	English					Always visible	False	Switches between German & English languages

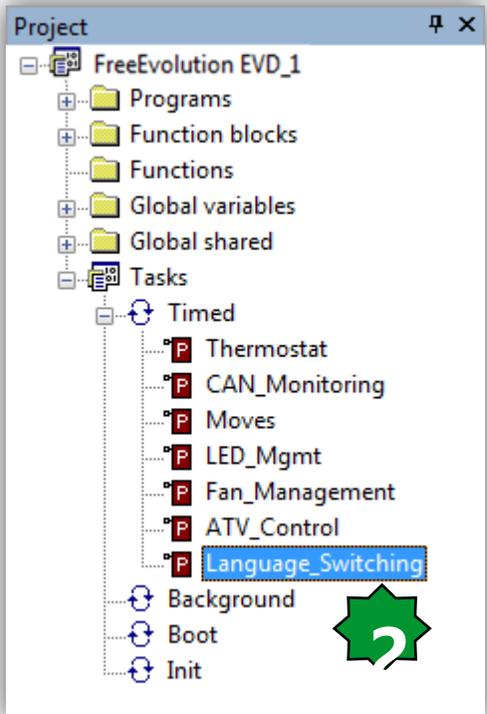


Language switching program



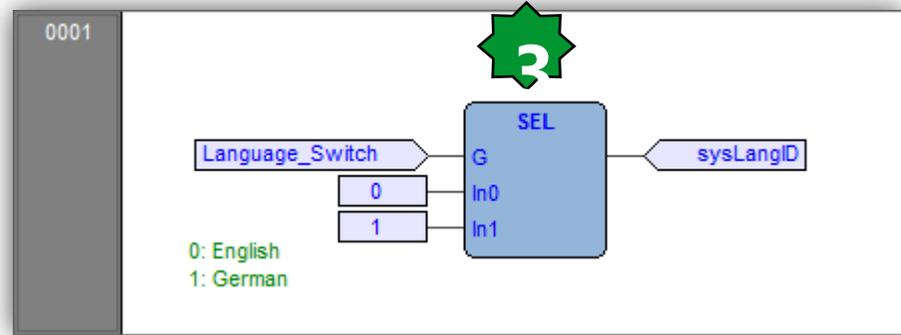
Library window showing a list of system blocks. The block `sysLangID` is selected and highlighted in blue. A green star with the number 1 is placed over the selection. Below the list, the 'Target variables' tab is highlighted with a green box.

<code>w</code>	<code>sysLangID</code>	<code>ud</code>	<code>sysLocalDigitalInputsImpulseCounter</code>
<code>ui</code>	<code>sysLocalADCs</code>	<code>t/f</code>	<code>sysLocalDigitalInputsResetCounter</code>
<code>i</code>	<code>sysLocalAnalogInputs</code>	<code>t/f</code>	<code>sysLocalDigitalOutputs</code>
<code>i</code>	<code>sysLocalAnalogOutputs</code>	<code>t/f</code>	<code>sysLocalDipSwitch</code>
<code>t/f</code>	<code>sysLocalDigitalInputs</code>	<code>us</code>	<code>sysLocalLeds</code>



Project tree view showing the hierarchy of the project. The 'Language_Switching' task is selected and highlighted in blue. A green star with the number 2 is placed over the selection.

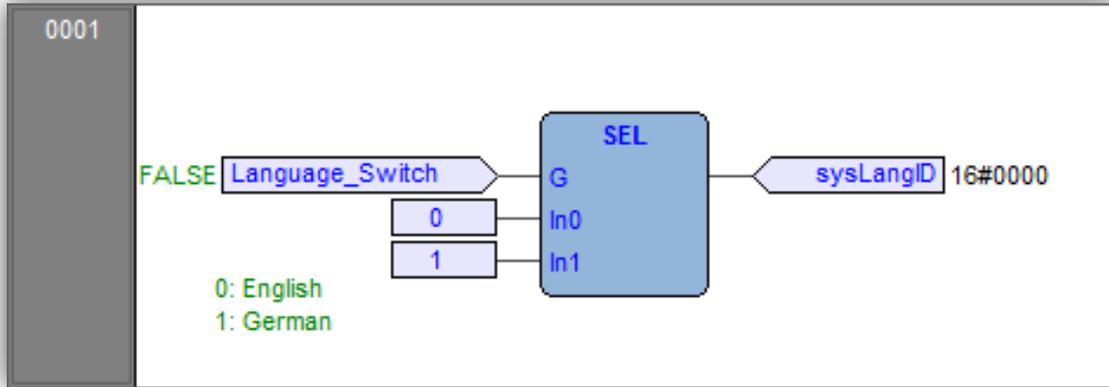
- FreeEvolution EVD_1
 - Programs
 - Function blocks
 - Functions
 - Global variables
 - Global shared
 - Tasks
 - Timed
 - Thermostat
 - CAN_Monitoring
 - Moves
 - LED_Mgmt
 - Fan_Management
 - ATV_Control
 - Language_Switching
 - Background
 - Boot
 - Init



Toolbar showing various icons. The 'Run' button (a blue square with a white play symbol) is highlighted with a green box. A green star with the number 4 is placed over the 'Run' button.

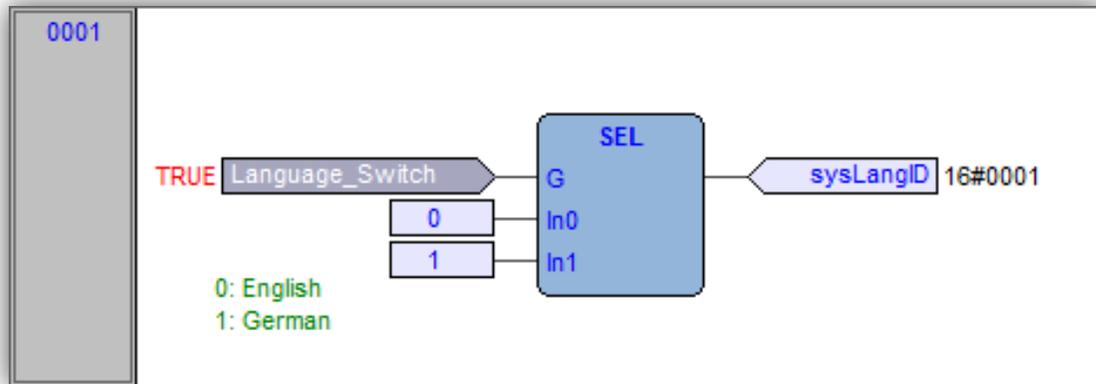


Translator/On-Line



Watch

Symbol	Value	Type	Location
SYSLANGID	16#0000	WORD	global



Watch

Symbol	Value	Type	Location
SYSLANGID	16#0001	WORD	global

Forming page/Translation

Text Objects

Big Text

Small Text

Language: **English**

Text: Hello

Close

Resources

- Resources [BaseLanguage]
 - Fonts
 - Bitmaps
 - String table
 - Enumeratives
 - Language_Enum**
 - Run_Stop_Enum
 - Mode_Enum
 - Speed_Enum
 - Backlight_Enum
 - Image lists
 - Sets

Value	Description
0	English
1	German

Max = 19 Chars

Properties

- XPos: 59
- YPos: 42
- Name: Edit_6
- Appearance: Flat
- Font: EWP2_6x8
- Background color: [dropdown]
- Text color: [dropdown]
- Sel. background: [dropdown]
- Sel. foreground: [dropdown]
- Border points: 1
- Border color: [dropdown]
- Number of chars: 7**
- Format: Language_Enum**
- Alignment: Center
- Access: RW
- Selection order: 1
- Variable: @M171P.Language_Switch**
- Data type: BOOL
- Low limit: 0
- High limit: 1
- Refresh: TRUE
- Visible: TRUE
- Selectable: TRUE
- Label: [empty]



Formaing page/Translation

Text Objects

Big Text

Small Text

Language: English

Text: **Hello** 

Close 

Properties

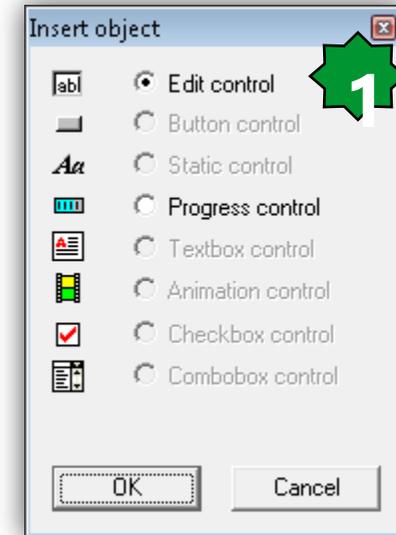
Properties | Events | Doc

XPos	34
YPos	53
Name	String_2
Text	ID_Hello 
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
Border points	0
Border color	<input type="text"/>
Number of chars	5 
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	TRUE

2. Max = 19 Chars

Edit Objects - Values

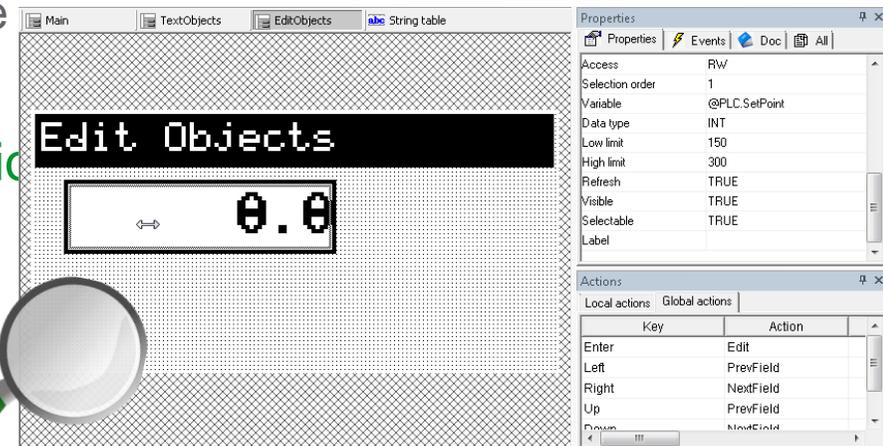
1. Select object or Drag and drop desired variable from from PLC tab



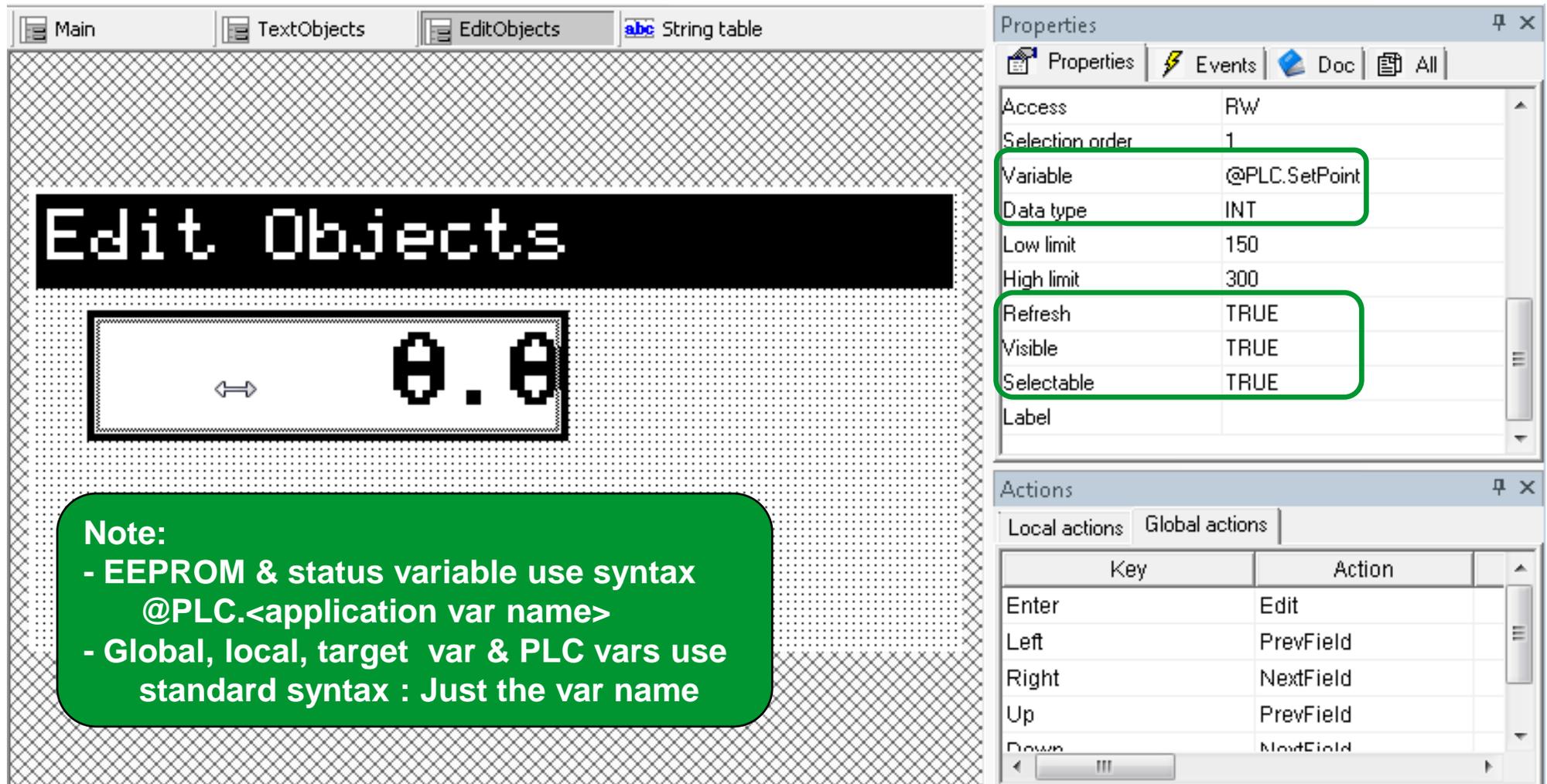
- Main Properties

- Variable: syntax used is: @PLC.<application var name>
- Format
- Selectable: True for R/W, False for RO
- Refresh
- High/Low Limit: shows ----- outside the range

- Select the @PLC.<var> desired
- Default Properties comes from Ap definition
- Selectable: False means, not editable.



Edit Objects - Values



The screenshot shows the 'Edit Objects' window with a grid background. A black bar at the top contains the text 'Edit Objects' in a pixelated font. Below it is a white rectangular object with a double-headed arrow on the left and the text '@.@' on the right. To the right of the main window is a 'Properties' panel with a table of settings. Below the properties panel is an 'Actions' panel with a table of key actions.

Note:

- EEPROM & status variable use syntax `@PLC.<application var name>`
- Global, local, target var & PLC vars use standard syntax : Just the var name

Properties Panel:

Access	RW
Selection order	1
Variable	@PLC.SetPoint
Data type	INT
Low limit	150
High limit	300
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

Actions Panel:

Key	Action
Enter	Edit
Left	PrevField
Right	NextField
Up	PrevField
Down	NextField

Edit Objects...

Edit Objects

Ambiant Temp: 0.0 °C

Set Point: 0.0 °C

Delta: 0.0 °C

Close

XPos	84	
YPos	17	
Name	Edit_8	
Appearance	Flat	
Font	EWP2_6x8	
Background color	<input type="text"/>	
Text color	<input type="text"/>	
Sel. background	<input type="text"/>	
Sel. foreground	<input type="text"/>	
Border points	1	
Border color	<input type="text"/>	
Number of chars	4	
Format	%.1d	
Alignment	Right	
Access	RW	
Selection order	2	
Variable	@M171P.Ambiant_Temp	
Data type	INT	
Low limit		
High limit		
Refresh	TRUE	
Visible	TRUE	
Selectable	FALSE	
Label		

...Edit Objects...

Edit Objects

Ambiant Temp: 0.0 °C

Set Point: 0.0 °C

Delta: 0.0 °C

Close

XPos	43	
YPos	41	
Name	Edit_10	
Appearance	Flat	
Font	EWP2_6x8	
Background color	<input type="text"/>	
Text color	<input type="text"/>	
Sel. background	<input type="text"/>	
Sel. foreground	<input type="text"/>	
Border points	1	
Border color	<input type="text"/>	
Number of chars	4	
Format	%.1d	
Alignment	Right	
Access	RW	
Selection order	4	
Variable	@M171P.Differentiation	
Data type	INT	
Low limit	5	
High limit	50	
Refresh	TRUE	
Visible	TRUE	
Selectable	TRUE	
Label		

...Edit Objects

Edit Objects

```

Ambiant Temp: 0.0 °C
Set Point: 0.0 °C
Delta: 0.0 °C
Backlight: Off Close
    
```

Property definition

Variable selection

@M171P_StopBit_RS485_PI	@M171P_sysClockSet_dayweek	sy
@M171P_SubCfg_A05	@M171P_sysClockSet_hours	sy
@M171P_SW1	@M171P_sysClockSet_minutes	sy
@M171P_SW2	@M171P_sysClockSet_month	sy
@M171P_SW3	@M171P_sysClockSet_seconds	
@M171P_SW4	@M171P_sysClockSet_Upload	
@M171P_sysClock_daymonth	@M171P_sysClockSet_year	
@M171P_sysClock_dayweek	@M171P_Temp_UM	
@M171P_sysClock_Error	@M171P.Web_ATV_Comd	
@M171P_sysClock_hours	@M171P.Web_ATV_Output_Frq	
@M171P_sysClock_minutes	@M171P.Web_ATV_Speed_Ref	
@M171P_sysClock_month	sysBacklight	
@M171P_sysClock_seconds	sysCurrentSelectedPosition	
@M171P_sysClock_year	sysKeyPressed	
@M171P_sysClockSet_daymonth	sysLangID	

Filter: All

Value selection

None
Variable

OK Cancel

Resources

- Resources [BaseLanguage]
 - Aa Fonts
 - Bitmaps
 - String table
 - Enumeratives
 - Language_Enum
 - Run_Stop_Enum
 - Mode_Enum
 - Speed_Enum
 - Backlight_Enum
 - Image lists
 - Sets

Integer format

Integers (1-31) 1

Decimals (1-7) 1

Hexadecimal Uppercase (...00H)

Hexadecimal Lowercase (...00h)

Fill with zeroes

View always sign

Password

Target metric

Target custom format

HH:MM

Enumerative

Language_Enum

Run_Stop_Enum

Mode_Enum

Speed_Enum

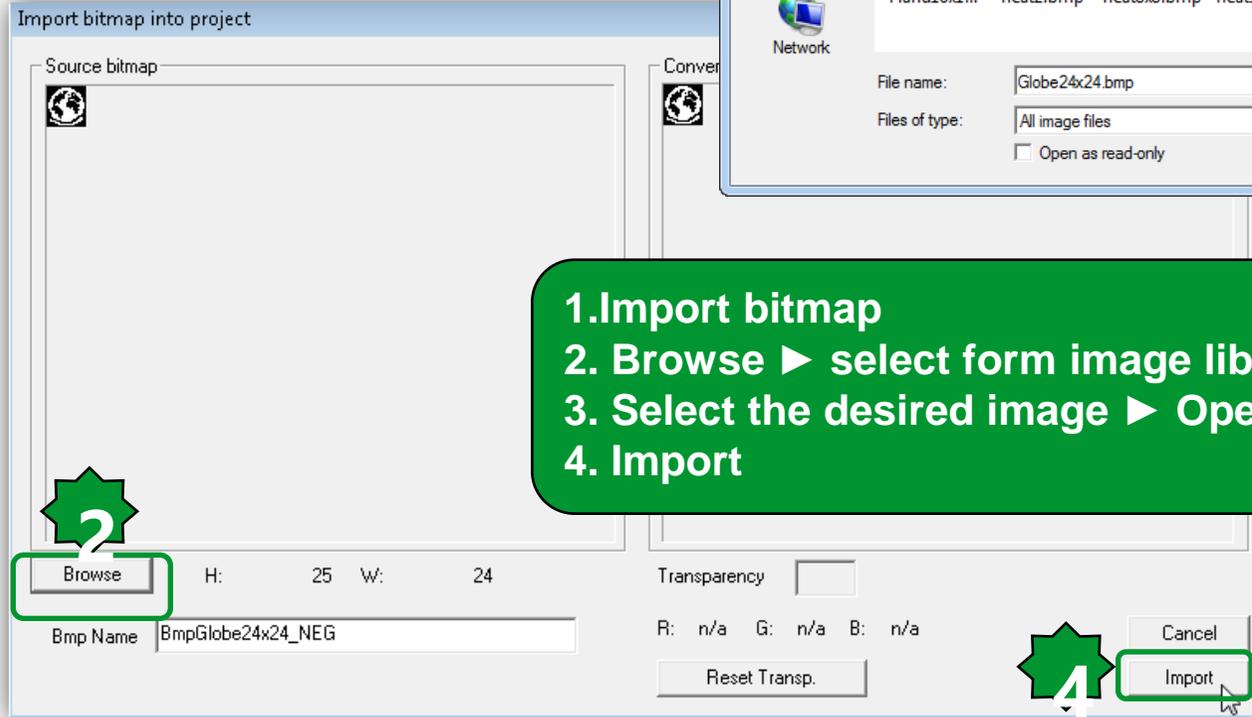
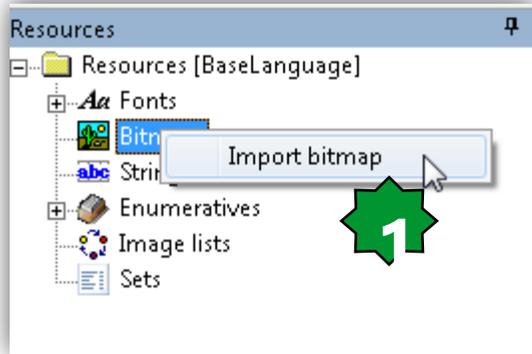
Backlight_Enum

OK Cancel

Value	Description
0	Off
1	On
2	Blink

XPos	61
YPos	53
Name	Edit_12
Appearance	Flat
Font	EWP2_6x8
Background color	
Text color	
Sel. background	
Sel. foreground	
Border points	1
Border color	
Number of chars	5
Format	Backlight_Enum
Alignment	Right
Access	RW
Selection order	5
Variable	sysBacklight
Data type	USINT
Low limit	0
High limit	2
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

Image Object



1. Import bitmap
2. Browse ► select form image library
3. Select the desired image ► Open
4. Import

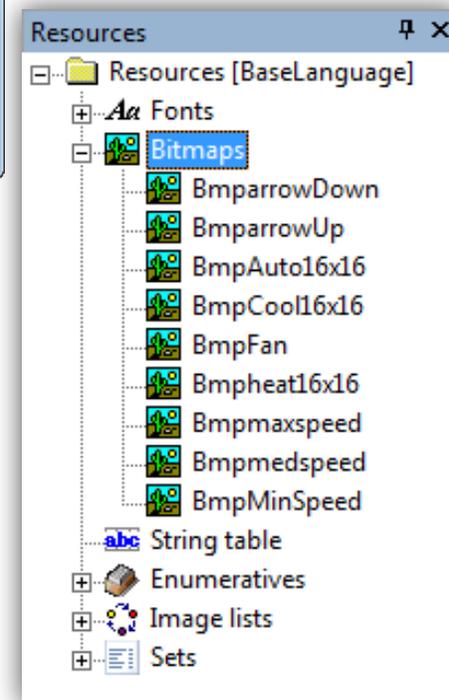
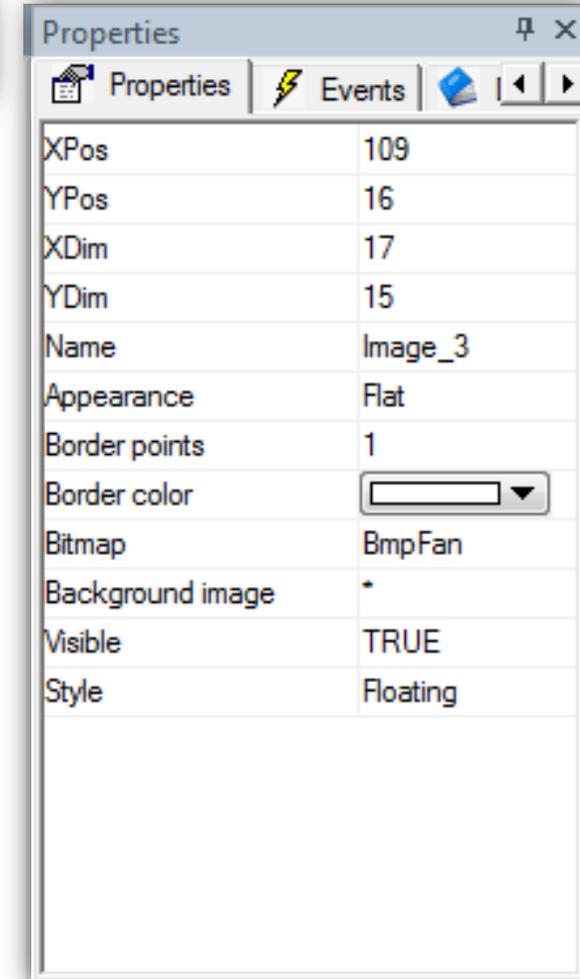


Image Object



1. Inset new image
2. Properties ► Bitmap ► select the desired image from imported list

Local Variables

The screenshot illustrates the process of creating a local variable in an HMI project. It shows the Project tree, the Variable dialog box, the Project tree with the new variable added, and a table of global variables.

	Name	Type	Array	Init value	Description
1	ListIndex	USINT	No	0	

1. Double click on Page ► Local variables (or on Global variables)
2. Add new
3. Define name & type
4. Added to the list
5. Added to the Local variable tree

Animation-Image lists

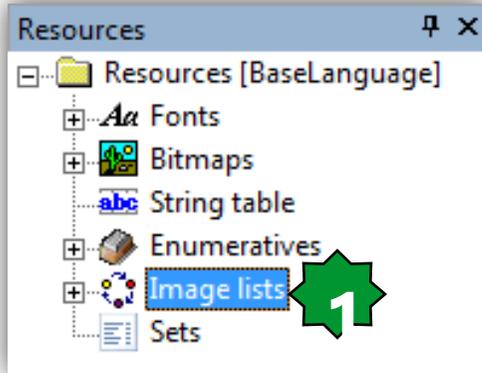
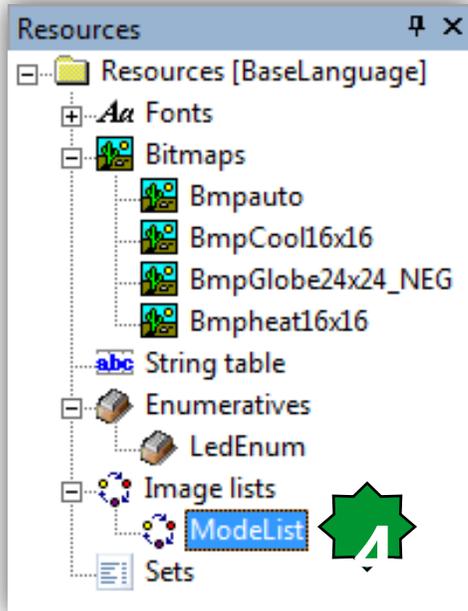


Image lists ★ 2

Init Value	End Value	Bitmap
0	0	BmpCool16x16
1	1	Bmpheat16x16
2	2	BmpAuto16x16



1. Resources ► Image lists
2. Add new
3. Name/Rename it
4. Image lists tree

Animation/Enum definition

Project HMI Project

- Pages
 - Properties
 - SliderObjects
 - DynamicAlarmObjects
 - TextObjects
 - Main_Page
 - EditObjects
 - ImageObjects
 - DynamicSetObjects
 - AnimationObjects
 - Local variables
 - ListIndex
 - Local procedures
 - ATV21Control
 - SystemObjects
 - Messages
 - Global variables
 - Global procedures

Resources Resources [BaseLanguage]

- Fonts
- Bitmaps
- String table
- Enumeratives
 - Language_Enum
 - Run_Stop_Enum
 - Mode_Enum
 - Speed_Enum
- Image lists
- Sets

Value	Description
0	Heat
1	Cool
2	Auto

Property definition

Variable selection

@PLC.sysClock_dayweek	@PLC.Temp_UM
@PLC.sysClock_Error	ListIndex
@PLC.sysClock_hours	sysBacklight
@PLC.sysClock_minutes	sysCurrentSelectedPosition
@PLC.sysClock_month	sysKeyPressed
@PLC.sysClock_seconds	sysLangID
@PLC.sysClock_year	sysLocalLeds
@PLC.sysClockSet_daymonth	sysMSK
@PLC.sysClockSet_dayweek	sysTimer
@PLC.sysClockSet_hours	sysVER
@PLC.sysClockSet_minutes	
@PLC.sysClockSet_month	
@PLC.sysClockSet_seconds	
@PLC.sysClockSet_Upload	
@PLC.sysClockSet_year	

Filter: All

Add variable

Value selection

- None
- Variable

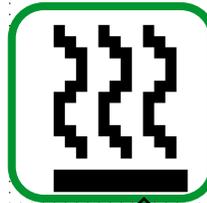
OK Cancel

- Insert new animation
- Rename it if needed (optional)
- Select from Image list
- Select from property definition
- Filter variables as page locals

Animation/Manual Mode

Animation Objects

Manual Mode: **Heat**



XPos	110
YPos	17
XDim	16
YDim	16
Name	Animation_3
Appearance	Flat
Border points	1
Border color	<input type="text"/>
Image list	ModeList
Animation variable	ListIndex
Data type	USINT
Visible	TRUE

Property definition

Variable selection

@PLC.sysClock_dayweek	@PLC.Temp_UM
@PLC.sysClock_Error	ListIndex
@PLC.sysClock_hours	sysBacklight
@PLC.sysClock_minutes	sysCurrentSelectedPosition
@PLC.sysClock_month	sysKeyPressed
@PLC.sysClock_seconds	sysLangID
@PLC.sysClock_year	sysLocalLeds
@PLC.sysClockSet_daymonth	sysMSK
@PLC.sysClockSet_dayweek	sysTimer
@PLC.sysClockSet_hours	sysVER
@PLC.sysClockSet_minutes	
@PLC.sysClockSet_month	
@PLC.sysClockSet_seconds	
@PLC.sysClockSet_Upload	
@PLC.sysClockSet_year	

Filter: All

Value selection

None
Variable

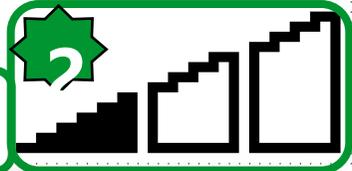
OK Cancel

XPos	77
YPos	23
Name	Edit_4
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	4
Format	Mode_Enum
Alignment	Right
Access	RW
Selection order	2
Variable	ListIndex
Data type	USINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

Animation/Speed Level

Animation Objects

Manual Mode: Heat 

Speed Level: Min 

XPos	94
YPos	35
XDim	32
YDim	14
Name	Animation_8
Appearance	Flat
Border points	1
Border color	<input type="text"/>
Image list	SpeedList
Animation variable	ListSpeed
Data type	USINT
Visible	TRUE

Property definition

Variable selection

@M171P.StopBt_RS485_PI	@M171P.sysClockSet_dayweek	sy
@M171P.SubCfg_AO5	@M171P.sysClockSet_hours	sy
@M171P.SW1	@M171P.sysClockSet_minutes	sy
@M171P.SW2	@M171P.sysClockSet_month	sy
@M171P.SW3	@M171P.sysClockSet_seconds	sy
@M171P.SW4	@M171P.sysClockSet_Upload	sy
@M171P.sysClock_daymonth	@M171P.sysClockSet_year	sy
@M171P.sysClock_dayweek	@M171P.Temp_UM	
@M171P.sysClock_Error	@M171P.Web_ATV_Comd	
@M171P.sysClock_hours	@M171P.Web_ATV_Output_Frq	
@M171P.sysClock_minutes	@M171P.Web_ATV_Speed_Ref	
@M171P.sysClock_month	ListIndex	
@M171P.sysClock_seconds	ListSpeed	
@M171P.sysClock_year	sysBacklight	
@M171P.sysClockSet_daymonth	sysCurrentSelectedPosition	

Filter: All

Add variable

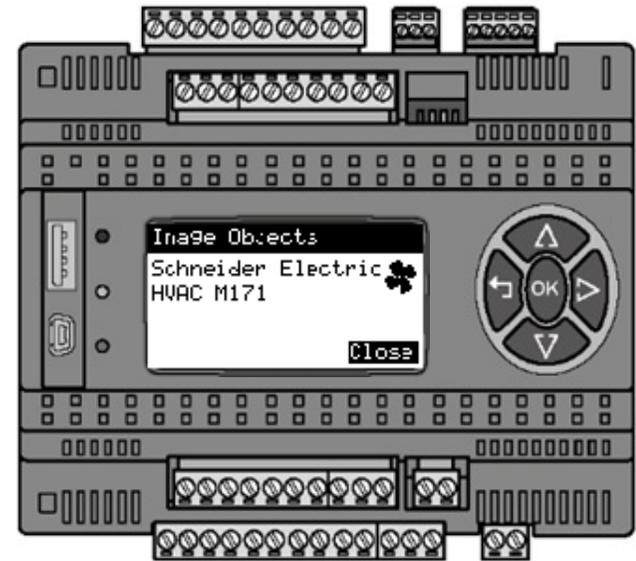
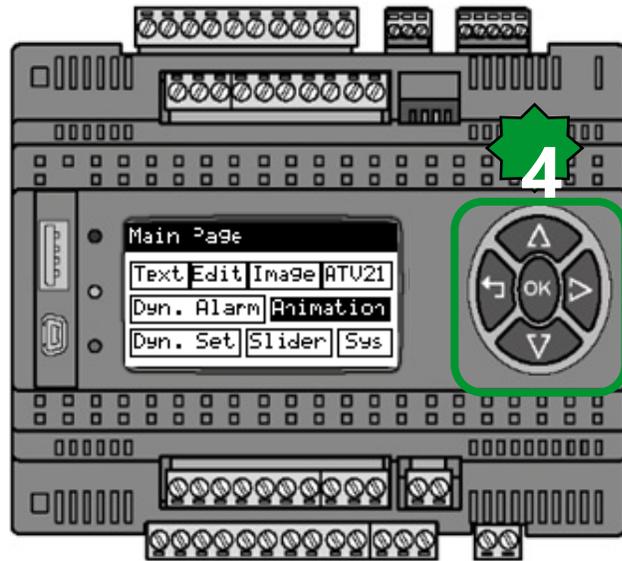
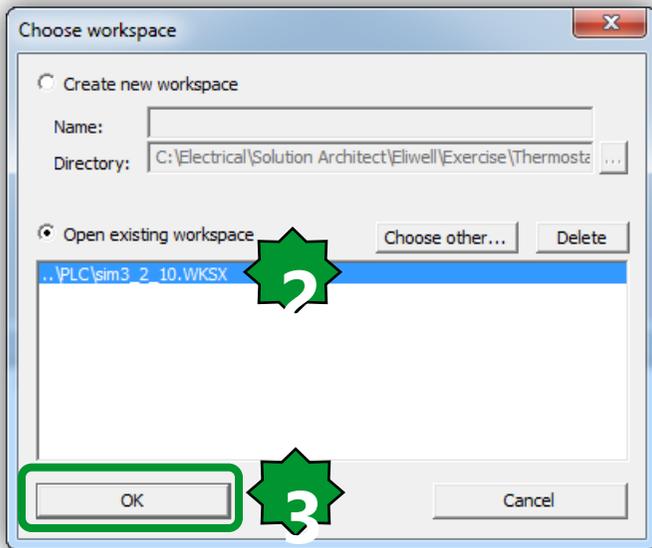
Value selection

None
Variable

OK Cancel

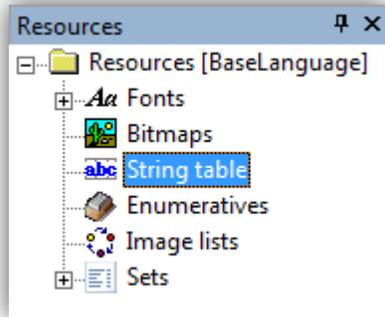
XPos	75
YPos	42
Name	Edit_9
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	3
Format	Speed_Enum
Alignment	Right
Access	RW
Selection order	3
Variable	ListSpeed
Data type	USINT
Low limit	0
High limit	2
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

UI simulation

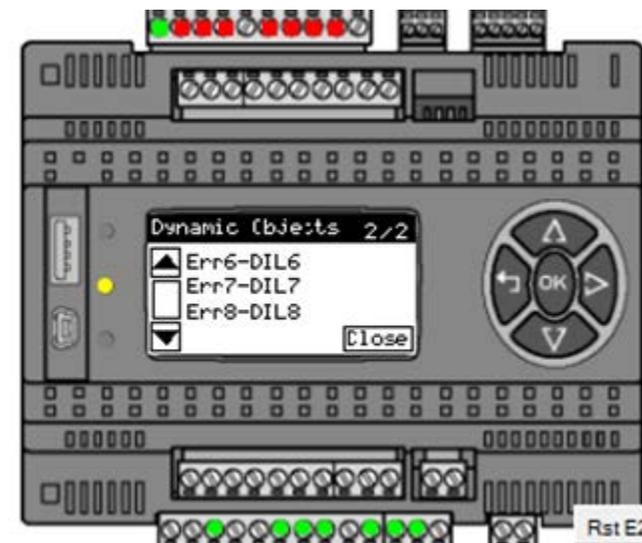
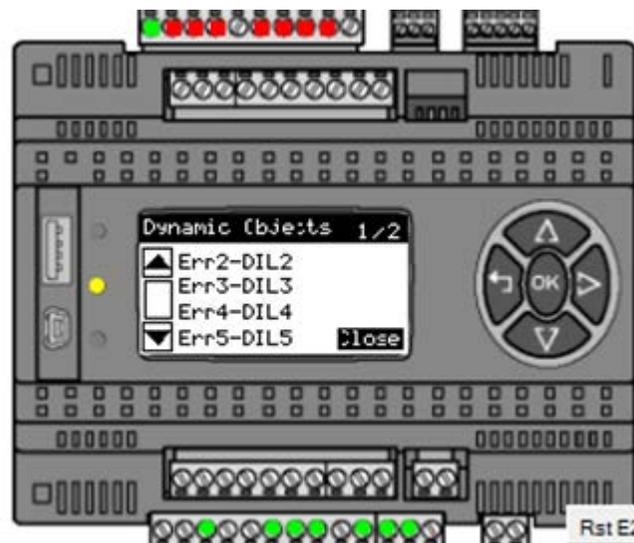
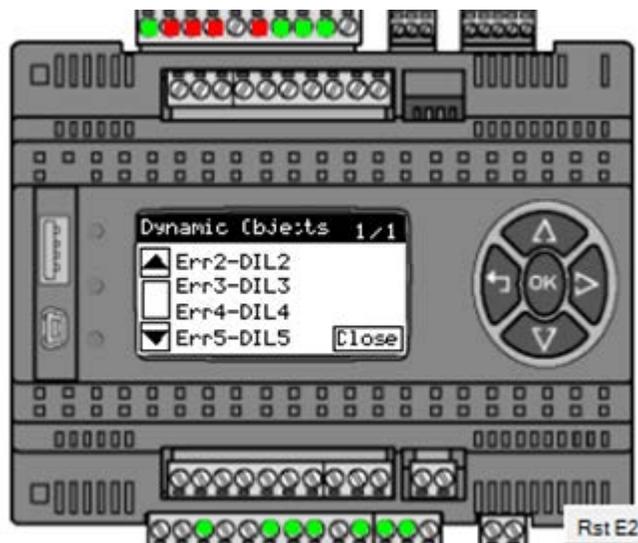
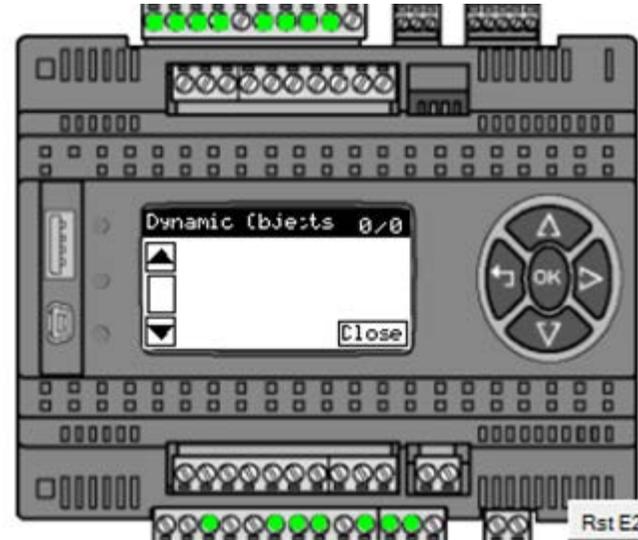


There are two parallel, identical ways to simulate, via UI or Ap

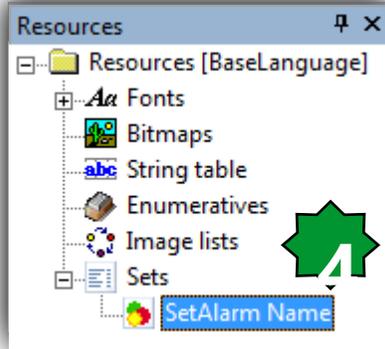
String Table creation



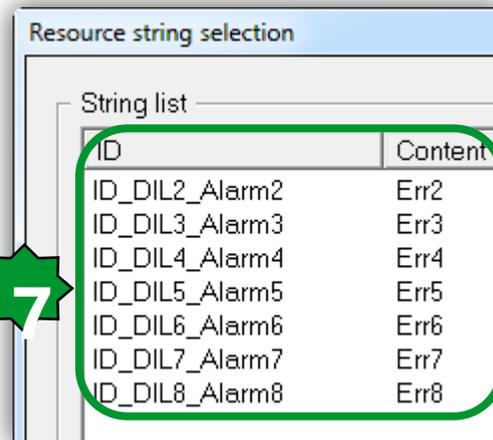
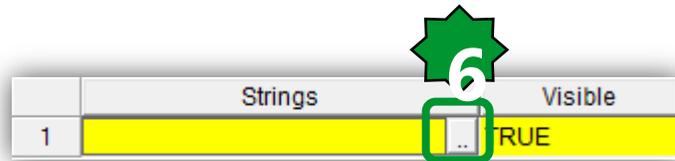
ID	Caption
ID_DIL2_Alarm2	Err2-DIL2
ID_DIL3_Alarm3	Err3-DIL3
ID_DIL4_Alarm4	Err4-DIL4
ID_DIL5_Alarm5	Err5-DIL5
ID_DIL6_Alarm6	Err6-DIL6
ID_DIL7_Alarm7	Err7-DIL7
ID_DIL8_Alarm8	Err8-DIL8



Set creation

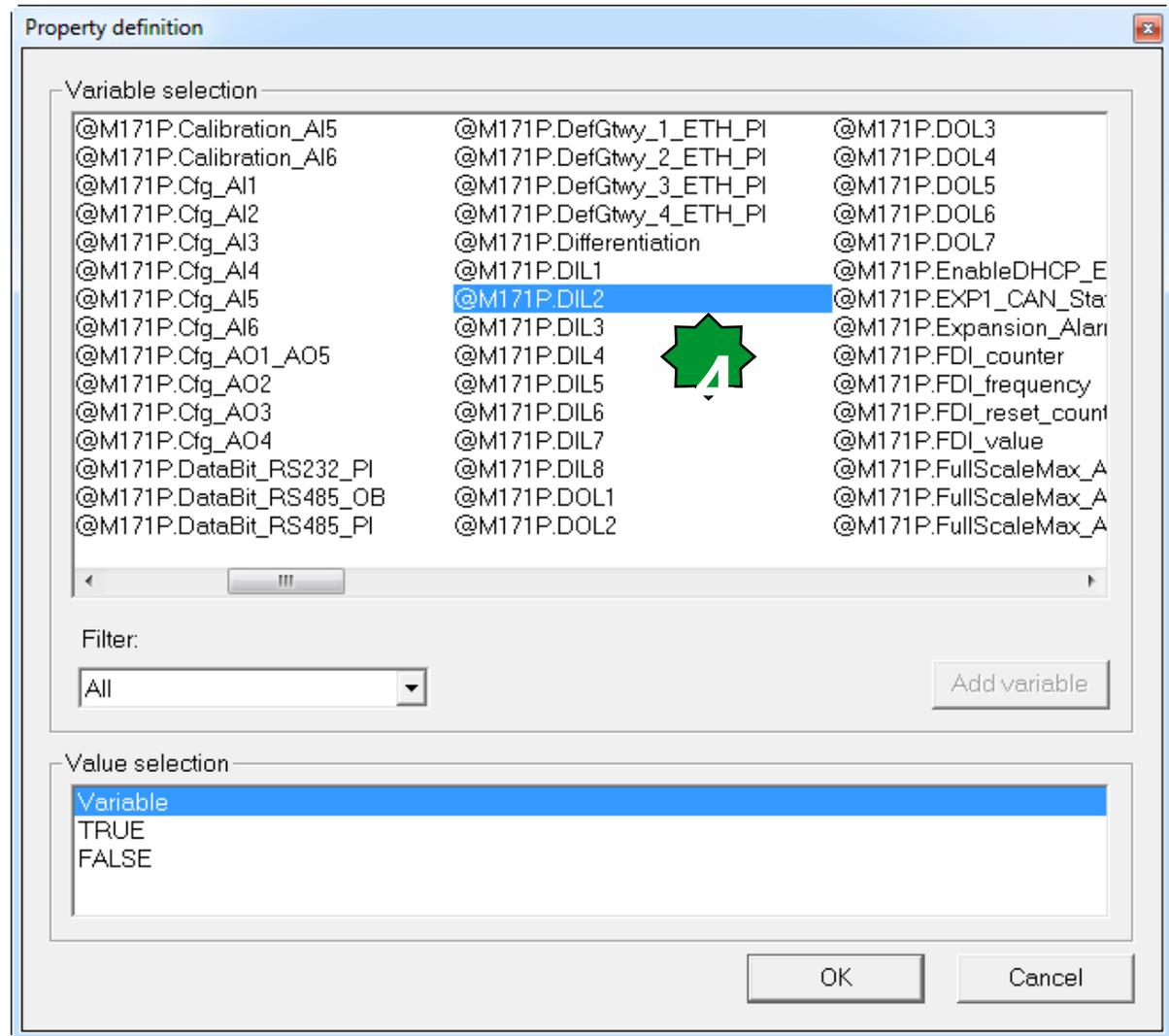
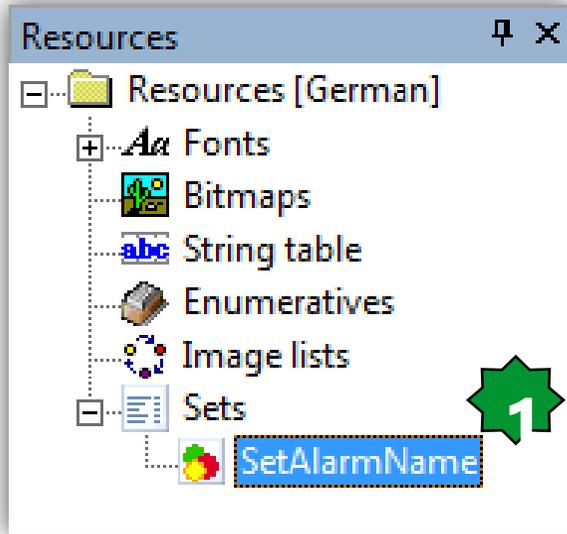


	Name	Type	Dynamic	Array
1	SetAlarm Name	STRINGS	YES	NO



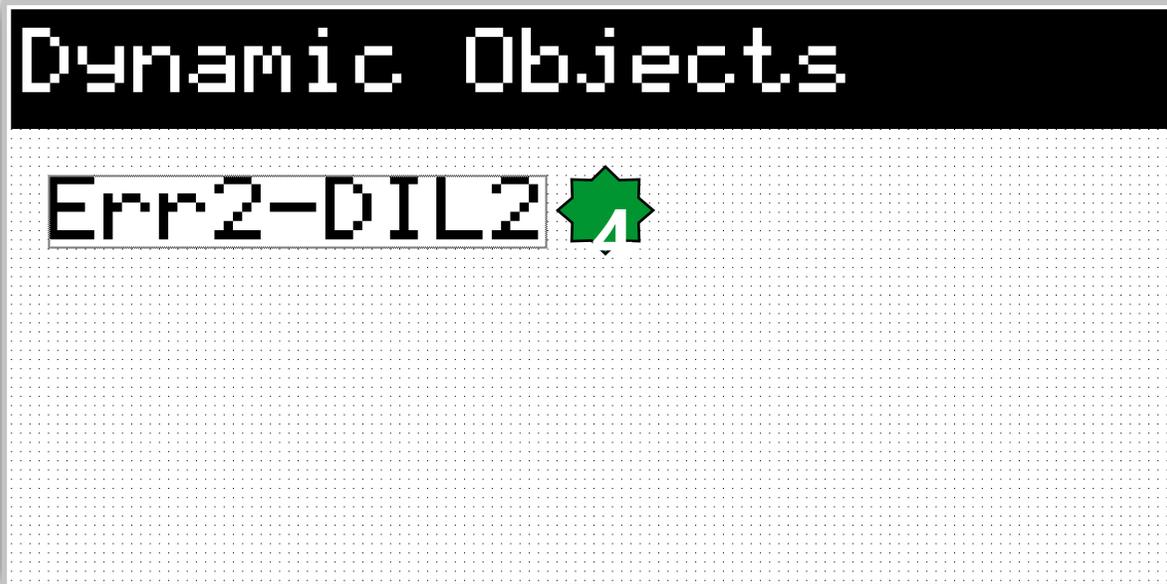
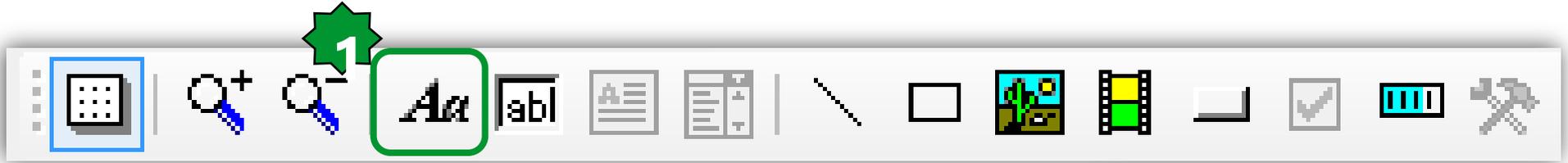
1. Double click
2. Add new record
3. Name it, define the type & Dynamic
4. Double click
5. Add new record
6. Browse
7. Select from string list

Strings & v ariables matching



	Strings	Visible
1	ID_DIL2_Alarm2	@M171P.DIL2
2	ID_DIL3_Alarm3	@M171P.DIL3
3	ID_DIL4_Alarm4	@M171P.DIL4
4	ID_DIL5_Alarm5	@M171P.DIL5
5	ID_DIL6_Alarm6	@M171P.DIL6
6	ID_DIL7_Alarm7	@M171P.DIL7
7	ID_DIL8_Alarm8	@M171P.DIL8

Dynamic page creation



Note: the item is displayed only if Visible field is TRUE

Properties

Properties | Events

XPos	5
YPos	19
Name	String_1
Text	#SetAlarmName(0)
Font	EWP2_6x8
Background color	<input type="color"/>
Text color	<input type="color"/>
Sel. background	<input type="color"/>
Sel. foreground	<input type="color"/>
Appearance	Flat
Border points	0
Border color	<input type="color"/>
Number of chars	9
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	@M171P.DIL2

Strings properties

Dynamic Objects 0/0

- Err2-DIL2
- Err3-DIL3
- Err4-DIL4
- Err5-DIL5

Close

XPos	3
YPos	29
Name	String 5
Text	#SetAlarmName(1)
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
Border points	0
Border color	<input type="text"/>
Number of chars	9
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	@M171P.DIL3

XPos	3
YPos	40
Name	String 6
Text	#SetAlarmName(2)
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
Border points	0
Border color	<input type="text"/>
Number of chars	9
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	@M171P.DIL4

XPos	3
YPos	51
Name	String 7
Text	#SetAlarmName(3)
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
Border points	0
Border color	<input type="text"/>
Number of chars	9
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	@M171P.DIL5

Page numbering

Dynamic Objects  

Err2-DIL2  

Err3-DIL3

Err4-DIL4

Err5-DIL5

Close

XPos	104
YPos	4
Name	Edit_2
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="color"/>
Text color	<input type="color"/>
Sel. background	<input type="color"/>
Sel. foreground	<input type="color"/>
Border points	1
Border color	<input type="color"/>
Number of chars	1
Format	%d
Alignment	Right
Access	RW
Selection order	1
Variable	\$PagIndex
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

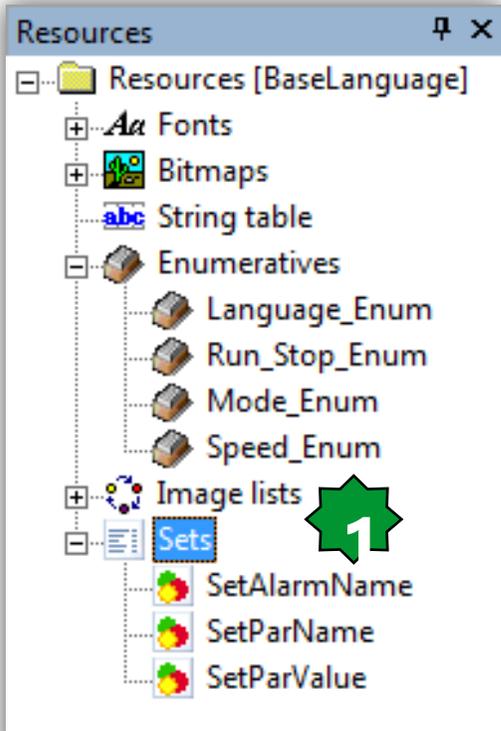
XPos	119
YPos	4
Name	Edit_4
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="color"/>
Text color	<input type="color"/>
Sel. background	<input type="color"/>
Sel. foreground	<input type="color"/>
Border points	1
Border color	<input type="color"/>
Number of chars	1
Format	%d
Alignment	Right
Access	RW
Selection order	2
Variable	\$PagNumber
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	

Note:

Data type will be define automatically as soon as variable recognized, if not there is a mistake in the variable name.

1. \$PagIndex=Current Page Number
2. \$PagNumber= Total pages number

Set creation

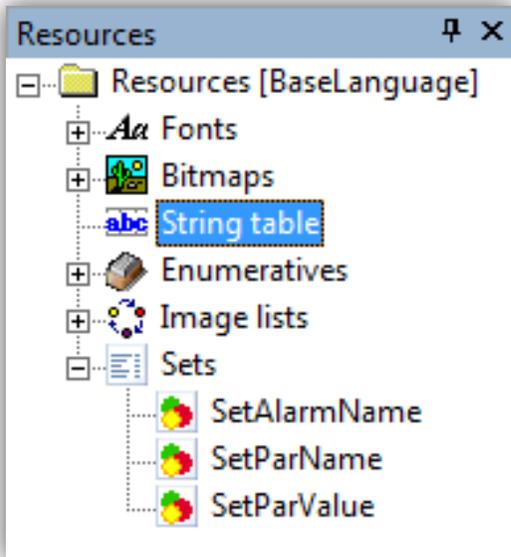


Goal: creating a list of variables & strings with scroll up/down ability

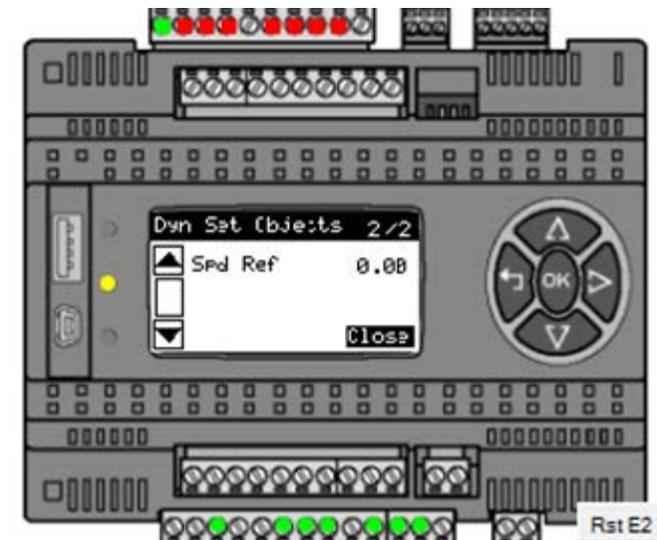
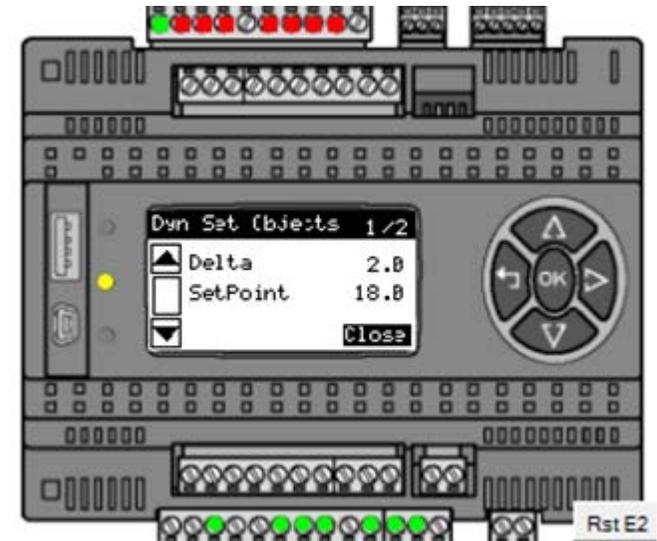
	Name	Type	Dynamic	Array
1	SetAlarmName	STRINGS	YES	NO
2	SetParName	STRINGS	NO	NO
3	SetParValue	VARIANT	YES	NO

1. Double clicks
2. Add
3. Type
 - 3.1 Variant: Variable/parameter sets even of not equal type
 - 3.2 Strings: text
4. Dynamic: compresses the list when invisible variable/parameter are used

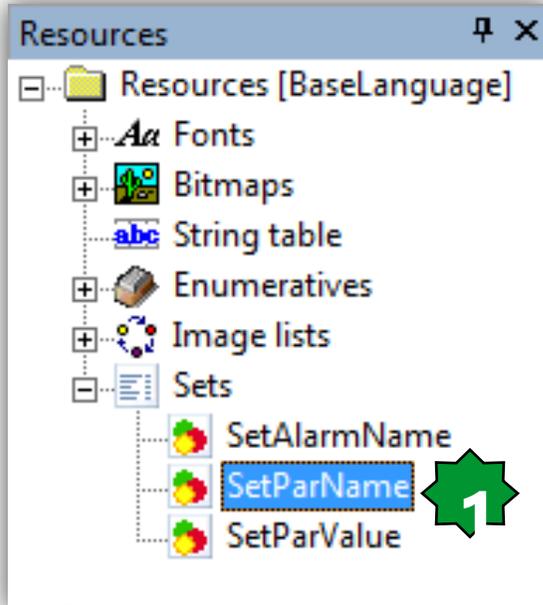
Strings Set filling



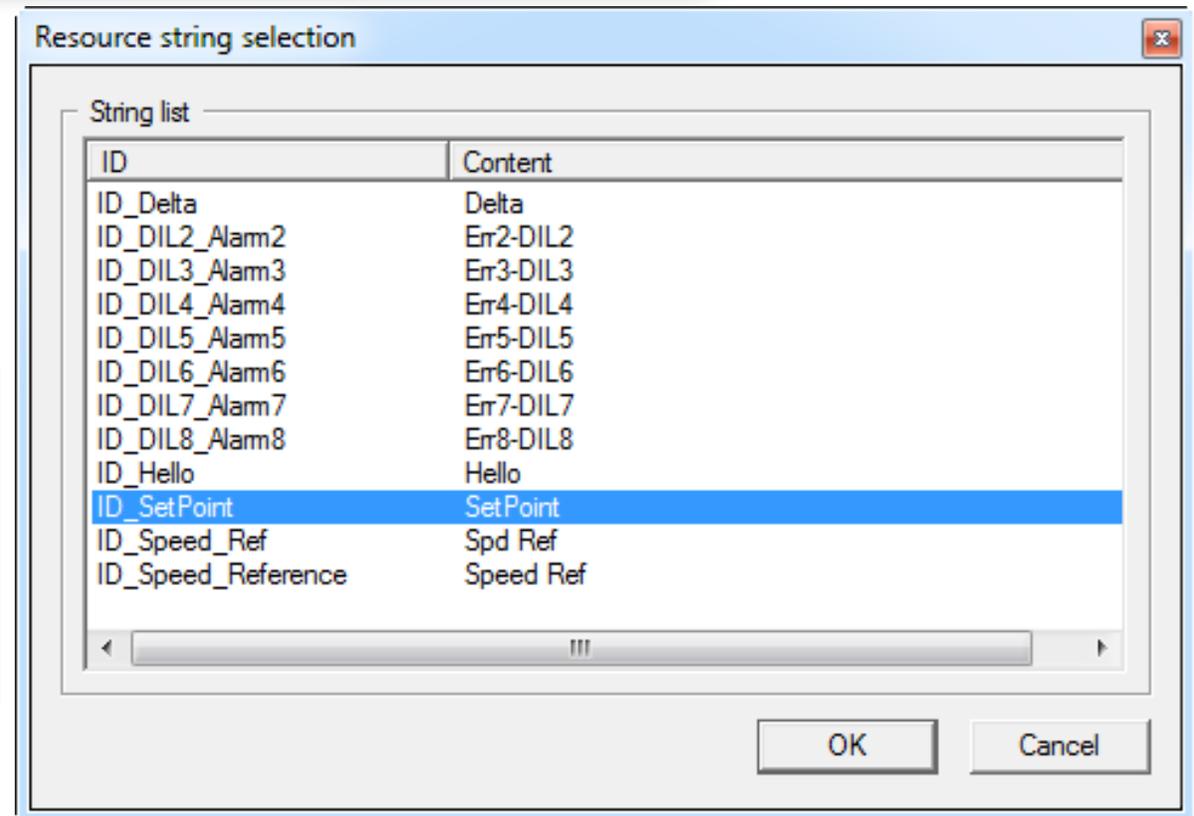
ID	Caption
ID_DIL2_Alarm2	Err2-DIL2
ID_DIL3_Alarm3	Err3-DIL3
ID_DIL4_Alarm4	Err4-DIL4
ID_DIL5_Alarm5	Err5-DIL5
ID_DIL6_Alarm6	Err6-DIL6
ID_DIL7_Alarm7	Err7-DIL7
ID_DIL8_Alarm8	Err8-DIL8
ID_Hello	Hello
ID_SetPoint	SetPoint
ID_Delta	Delta
ID_Speed_Ref	Spd Ref



Set Parameter Name



	Strings	Visible
1	ID_Delta	TRUE
2	ID_Speed_Reference	TRUE
3	ID_SetPoint	TRUE

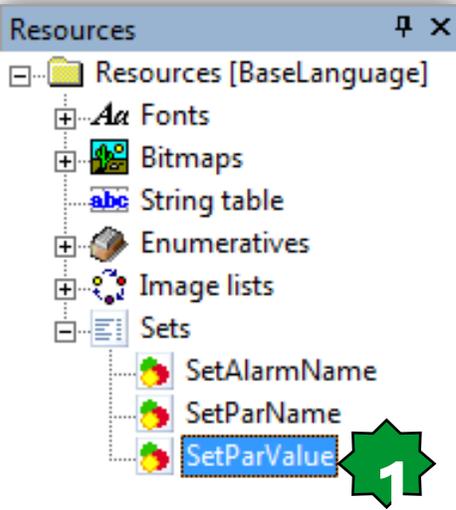


1. Double clicks
2. Select the string form the list
3. Define the visible field

Dynamic visibility:

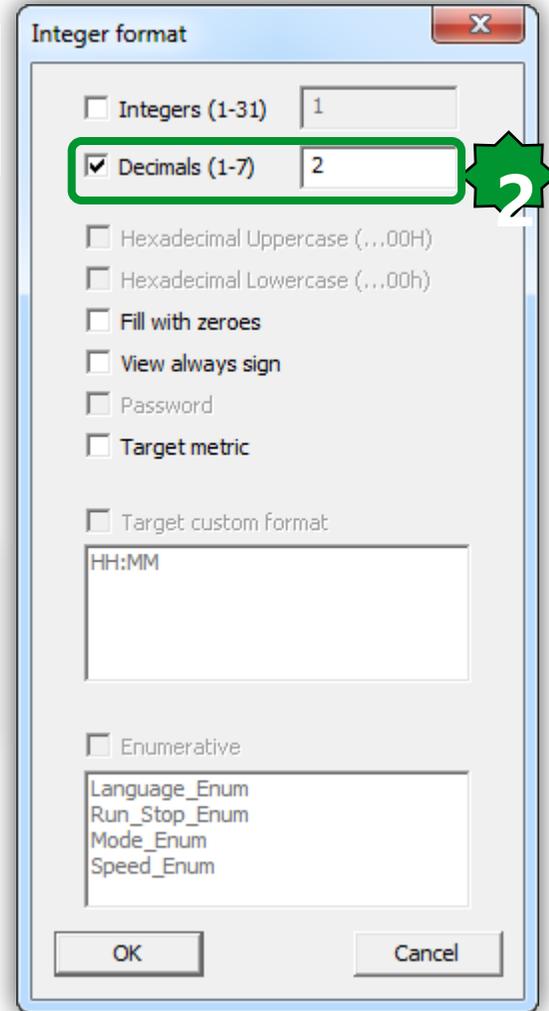
If the visible field is False, then empty parameter's rows will be removed from the list and the list could be shrink pack.

Set Parameter Value

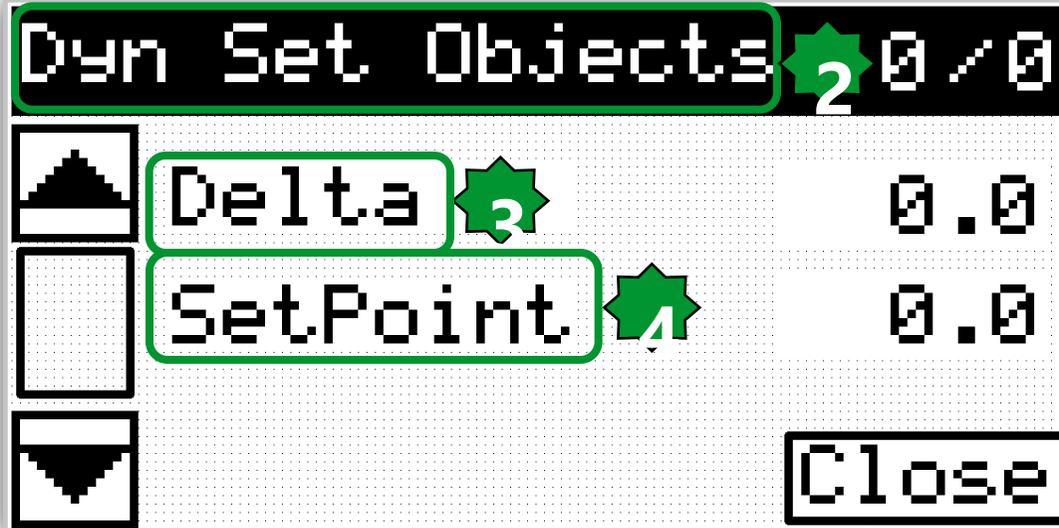
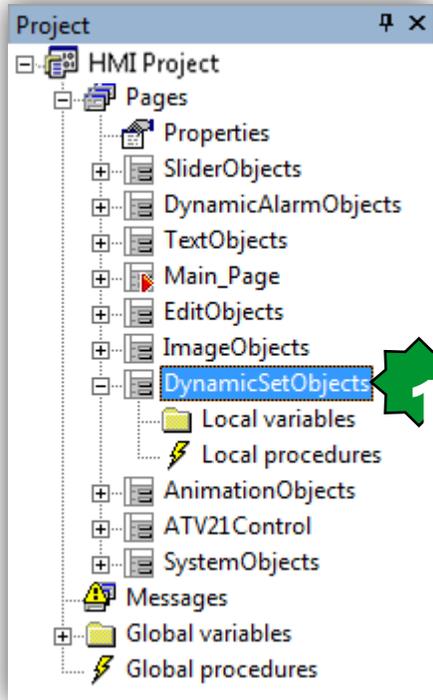


1. Sets
2. Format: One decimal point
3. Selectable False in case of RO elements

	Variable/Parameter	Format	Text align	Min	Max	Visible	Selectable
1	@M171P.Differentiation	%.1d	Right	5	50	TRUE	TRUE
2	@M171P.SetPoint	%.1d	Right	150	300	TRUE	TRUE
3	@M171P.Web_ATV_Speed_Ref	%.2d	Right	0	5000	TRUE	TRUE



Set Objects/ParName...



XPos	20
YPos	20
Name	String_3
Text	#Setpamame(0).
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
XPos	20
YPos	34
Name	String_6
Text	#Setpamame(1).
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Appearance	Flat
Border points	0
Border color	<input type="text"/>
Number of chars	8
Alignment	Left
Refresh	FALSE
Select	FALSE
Visible	TRUE

Note: The number of elements of the sets shown in the same page should be equal

Syntax:

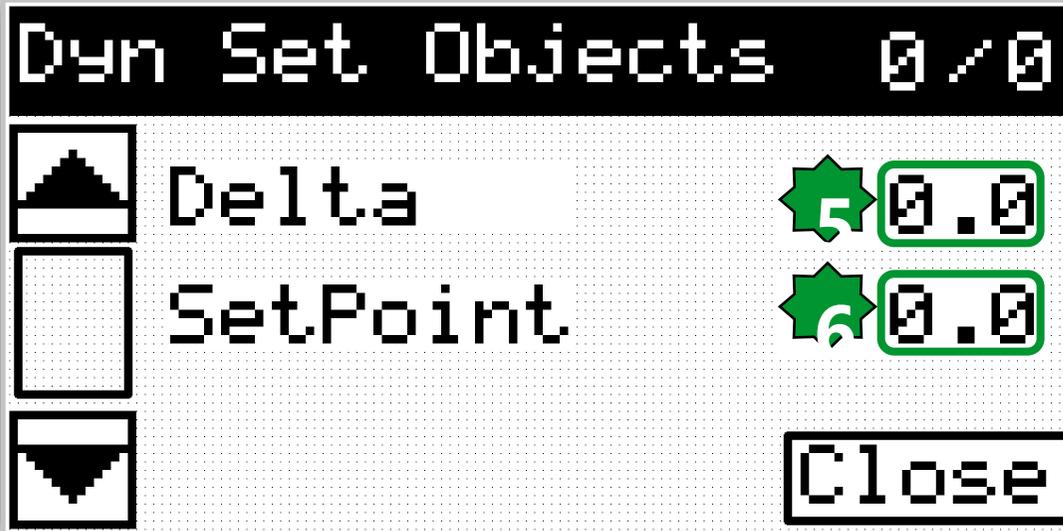
String:

#Setparname(0), #Setparname(1), ..., #Setparname(element x page -1)

Variant:

#Setparvalue(0), #Setparvalue(0), ..., #Setparvalue(element x page -1)

Set Objects/ParValue...



Syntax Variant:

`#Setparvalue(0)`, `#Setparvalue(0)`, ...,
`#Setparvalue(element x page -1)`

- Size the text dimension based on the longest string to be displayed
- Size the Edit dimension base on the biggest digits to be displayed

XPos	93
YPos	21
Name	Edit_2
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	5
Format	%.1d
Alignment	Right
Access	RW
Selection order	2
Variable	#Setparvalue(0)
Data type	INT
Low limit	5
High limit	50
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

XPos	93
YPos	34
Name	Edit_9
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	5
Format	%.1d
Alignment	Right
Access	RW
Selection order	3
Variable	#Setparvalue(1)
Data type	INT
Low limit	150
High limit	300
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

Set/Objects/Page x out of Y

Dyn Set Objects 1 0 / 0

	Delta	0.0
	SetPoint	0.0

Close

Note:

Data type will be define automatically as soon as variable recognized, if not there is a mistake in the variable name.

1. \$PagIndex=Current Page Number
2. \$PagNumber= Total pages number

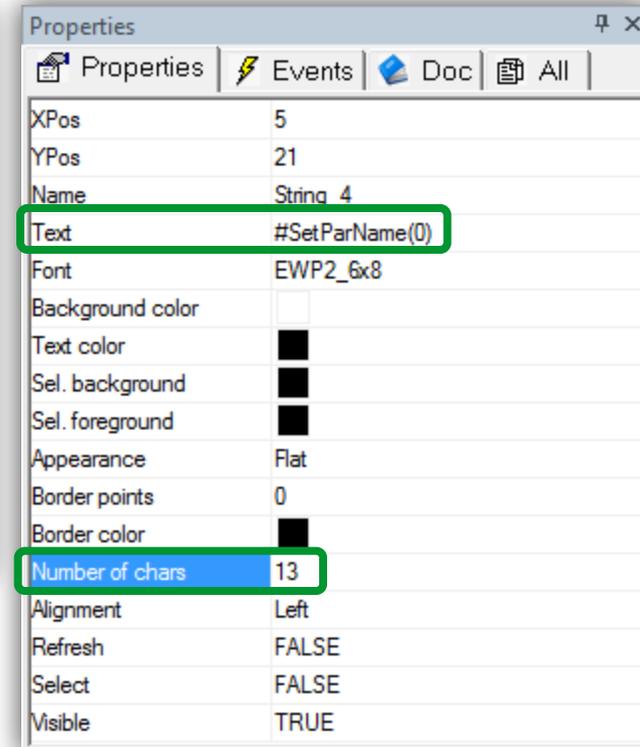
Properties

XPos	99
YPos	4
Name	Edit_2
Appearance	Flat
Font	EWP2_6x8
Background color	■
Text color	
Sel. background	■
Sel. foreground	
Border points	0
Border color	■
Number of chars	2
Format	%d
Alignment	Right
Access	RO
Selection order	2
Variable	\$PagIndex
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	

Properties

XPos	114
YPos	4
Name	Edit_1
Appearance	Flat
Font	EWP2_6x8
Background color	■
Text color	
Sel. background	■
Sel. foreground	
Border points	0
Border color	■
Number of chars	2
Format	%d
Alignment	Right
Access	RO
Selection order	1
Variable	\$PagNumber
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	

Maximum number of characters



Number of Chars:

If you do not resize the related window will be 0, and you might face with refresh problem. It is possible to set it maximum 21 characters (>21 Chars=> out of display)

Set Objects/up & down arrows

Dyn Set Objects 0 / 0

Delta 0.0

SetPoint 0.0

Close






Properties

XPoS 5

YPos 48

XDim 13

YDim 12

Name Image_9

Appearance Flat

Border points 0

Border color

Bitmap BmparrowUp

Background image *

Visible TRUE

Style Docking



Properties

XPoS 21

YPos 48

XDim 13

YDim 12

Name Image_10

Appearance Flat

Border points 0

Border color

Bitmap BmparrowDown

Background image *

Visible TRUE

Style Docking



Bitmap

- 1. BmparrowDown:
- 2. BmparrowUp:
- 3. Bmpauto:
- 4. BmpCool 16*16:
- 5. BmpGlobe 24*24:
- 6. Bmpheat 16*16:

BmparrowDown

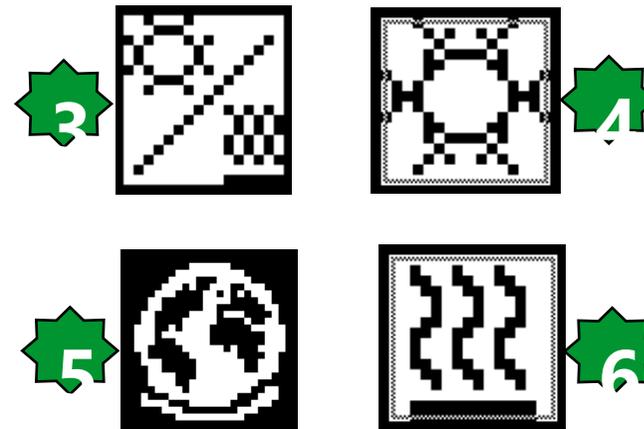
BmparrowUp

Bmpauto

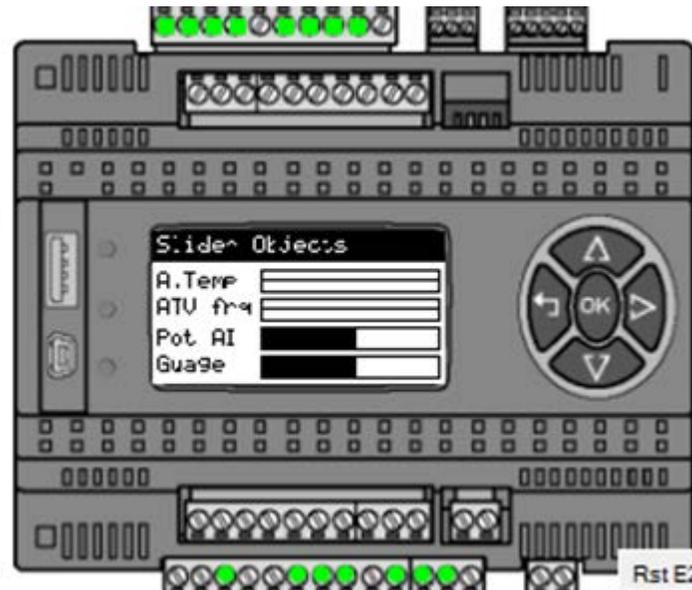
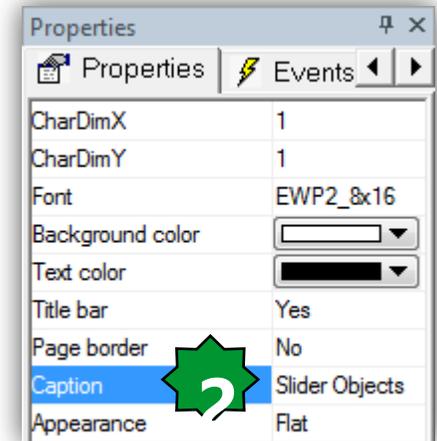
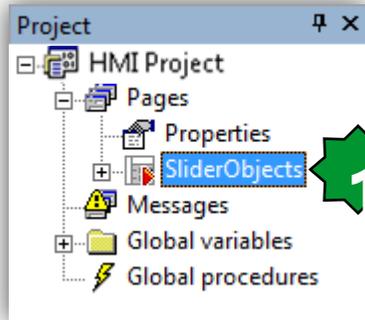
BmpCool16x16

BmpGlobe24x24

Bmpheat16x16



Slider Objects



1. Creat new page
2. Configure the page
3. Insert new progress

Sliders Object's properties

XPos	48
YPos	17
XDim	77
YDim	8
Name	Progress_1
Appearance	Flat
Border points	1
Border color	<input type="color"/>
Bar color	<input type="color"/>
Background color	<input type="color"/>
Visible	TRUE
Refresh trigger	TRUE
Progress variable	@M171P.Ambiant_Temp
Data type	INT
Low limit	0
High limit	300
Orientation	Horizontal



XPos	48
YPos	29
XDim	77
YDim	8
Name	Progress_4
Appearance	Flat
Border points	1
Border color	<input type="color"/>
Bar color	<input type="color"/>
Background color	<input type="color"/>
Visible	TRUE
Refresh trigger	TRUE
Progress variable	@M171P.Web_ATV_Output_Frq
Data type	INT
Low limit	0
High limit	5000
Orientation	Horizontal



XPos	48
YPos	41
XDim	77
YDim	8
Name	Progress_6
Appearance	Flat
Border points	1
Border color	<input type="color"/>
Bar color	<input type="color"/>
Background color	<input type="color"/>
Visible	TRUE
Refresh trigger	TRUE
Progress variable	@M171P.AIL3
Data type	INT
Low limit	0
High limit	1000
Orientation	Horizontal



XPos	48
YPos	53
XDim	77
YDim	8
Name	Progress_7
Appearance	Flat
Border points	1
Border color	<input type="color"/>
Bar color	<input type="color"/>
Background color	<input type="color"/>
Visible	TRUE
Refresh trigger	TRUE
Progress variable	@M171P.Analogue_Output_AOL1
Data type	INT
Low limit	0
High limit	1000
Orientation	Horizontal



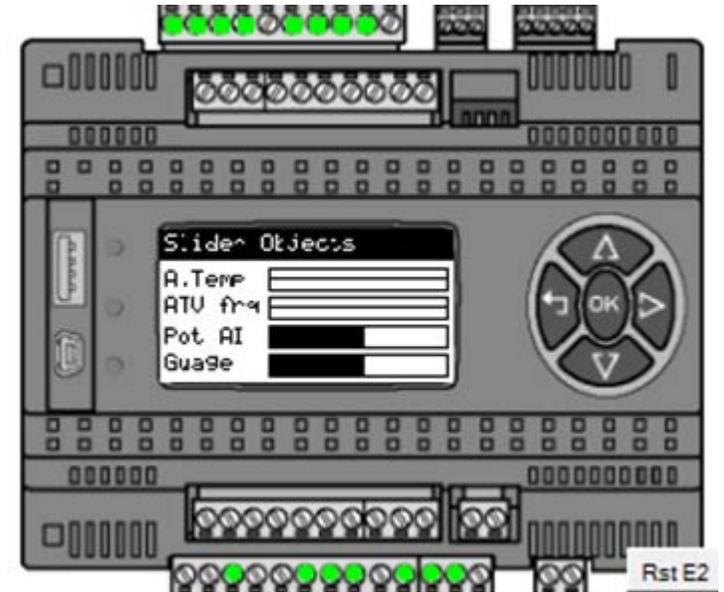
A.Temp

ATV frq

Pot AI

Gauge

Slider Objects preview



ATV Control

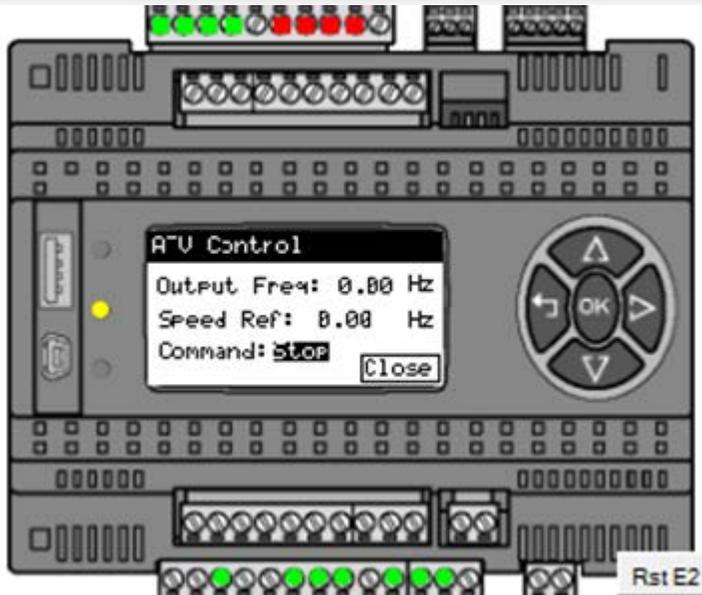
ATV Control

Output Freq: 0.00 Hz

Speed Ref: 0.00 Hz

Command: Stop

Close



XPos	68
YPos	33
Name	Edit_8
Appearance	Flat
Font	EWP2_6x8
Background color	
Text color	
Sel. background	
Sel. foreground	
Border points	1
Border color	
Number of chars	5
Format	%.2d
Alignment	Right
Access	RW
Selection order	3
Variable	@M171P.Web_ATV_Speed_Ref
Data type	INT
Low limit	0
High limit	5000
Refresh	TRUE
Visible	TRUE
Selectable	TRUE
Label	

XPos	77
YPos	19
Name	Edit_7
Appearance	Flat
Font	EWP2_6x8
Background color	
Text color	
Sel. background	
Sel. foreground	
Border points	1
Border color	
Number of chars	5
Format	%.2d
Alignment	Right
Access	RW
Selection order	2
Variable	@M171P.Web_ATV_Output_Frq
Data type	INT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	

ATV Control



ATV Control

Output Freq: 0.00 Hz

Speed Ref: 0.00 Hz

Command: Stop 

Close

XPos	55	
YPos	46	
Name	Edit_9	
Appearance	Flat	
Font	EWP2_6x8	
Background color	<input type="text"/>	
Text color	<input type="text"/>	
Sel. background	<input type="text"/>	
Sel. foreground	<input type="text"/>	
Border points	1	
Border color	<input type="text"/>	
Number of chars	4	
Format	Run_Stop_Enum	
Alignment	Right	
Access	RW	
Selection order	4	
Variable	@M171P.Web_ATV_Cmd	
Data type	BOOL	
Low limit		
High limit		
Refresh	TRUE	
Visible	TRUE	
Selectable	TRUE	
Label		

Resources

- Resources [BaseLanguage]
 - Fonts
 - Bitmaps
 - String table
 - Enumeratives
 - Language_Enum
 - Run_Stop_Enum 
 - Image lists
 - Sets

Value	Description
0	Stop 
1	Run

System Information...



System Information

BIOS Ver: .

Clock: : 0 : 0

Date: 0 . 0 . 0

Close

Property definition

Variable selection

@M171P.PriDNS_2_ETH_PI	@M171P.StopBit_RS485_PI
@M171P.PriDNS_3_ETH_PI	@M171P.SubCfg_AO5
@M171P.PriDNS_4_ETH_PI	@M171P.SW1
@M171P.Probe_EXP1_Err	@M171P.SW2
@M171P.Proto_RS232_PI	@M171P.SW3
@M171P.Proto_RS485_OB	@M171P.SW4
@M171P.Proto_RS485_PI	@M171P.sysClock_daymonth
@M171P.Red_LED_EXP1	@M171P.sysClock_dayweek
@M171P.SecDNS_1_ETH_PI	@M171P.sysClock_Error
@M171P.SecDNS_2_ETH_PI	@M171P.sysClock_hours
@M171P.SecDNS_3_ETH_PI	@M171P.sysClock_minutes
@M171P.SecDNS_4_ETH_PI	@M171P.sysClock_month
@M171P.SetPoint	@M171P.sysClock_seconds
@M171P.StopBit_RS232_PI	@M171P.sysClock_year
@M171P.StopBit_RS485_OB	@M171P.sysClockSet_daymonth

Filter: All Add variable

Value selection

None
Variable

OK Cancel

XPos	59
YPos	16
Name	Edit_1
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	3
Format	%d
Alignment	Right
Access	RW
Selection order	1
Variable	sysMSK
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	

XPos	85
YPos	16
Name	Edit_2
Appearance	Flat
Font	EWP2_6x8
Background color	<input type="text"/>
Text color	<input type="text"/>
Sel. background	<input type="text"/>
Sel. foreground	<input type="text"/>
Border points	1
Border color	<input type="text"/>
Number of chars	3
Format	%d
Alignment	Right
Access	RW
Selection order	2
Variable	sysVER
Data type	UINT
Low limit	*
High limit	*
Refresh	TRUE
Visible	TRUE
Selectable	FALSE
Label	



... System Information

Project FreeEvolution EVD_1

- FreeEvolution
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs
 - Analogue Outputs V/I
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes

```

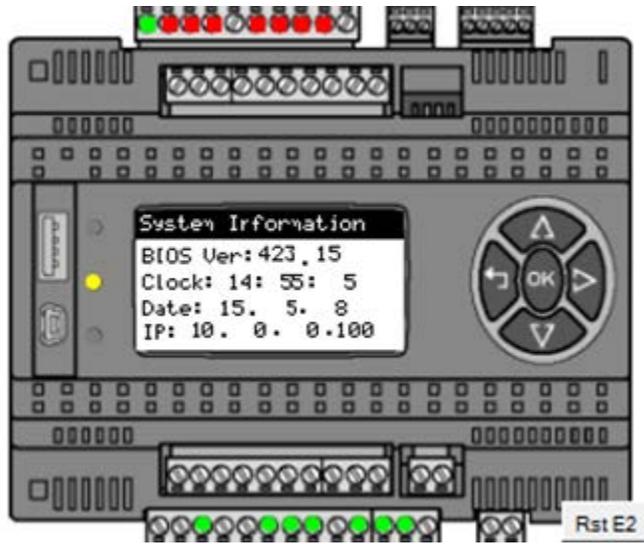
System Information
BIOS Ver:  0 . 0
Clock:    0 : 0 : 0
Date:    0 . 0 . 0
IP:    0 . 0 . 0 . 0
  
```

XPos	20
YPos	51
...	...
Appearance	Flat
Font	EWP2_6x8
Background color	[Dropdown]
Text color	[Dropdown]
Sel. background	[Dropdown]
Sel. foreground	[Dropdown]
Border points	1
Border color	[Dropdown]
Number of chars	3
Format	%d
Alignment	Right
Access	RW
Selection order	10
Variable	@M171P.lp_1_ETH_PI
Data type	UINT
Low limit	0
High limit	255

Address	Name	Value	Um	Default	Min	Max	Description
15772	Port_TFTP_IP	0	num	0	0	65535	TFTP Port number, 0 is equal to default port 69
15796	Port_HTTP_PI	0	num	0	0	65535	HTTP Port number, 0 is equal to default port 80
15797	Port_ETH_PI	502	num	502	0	65535	TCP/IP Port number
15798	Ip_1_ETH_PI	10	num	10	0	255	Ethernet passive Plug-In IP address (1 st part)
15799	Ip_2_ETH_PI	0	num	0	0	255	Ethernet passive Plug-In IP address (2 nd part)
15800	Ip_3_ETH_PI	0	num	0	0	255	Ethernet passive Plug-In IP address (3 rd part)
15801	Ip_4_ETH_PI	100	num	100	0	255	Ethernet passive Plug-In IP address (4 th part)



Simulation



Remember to align Ap UI and Co projects



- “Recompile all” the Application Project



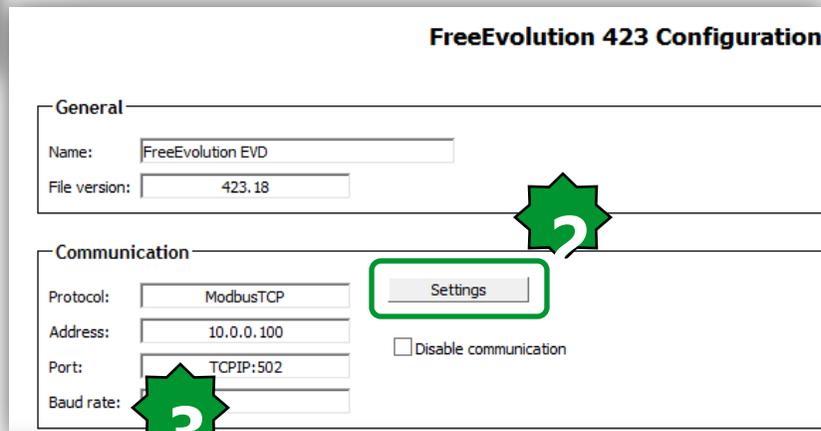
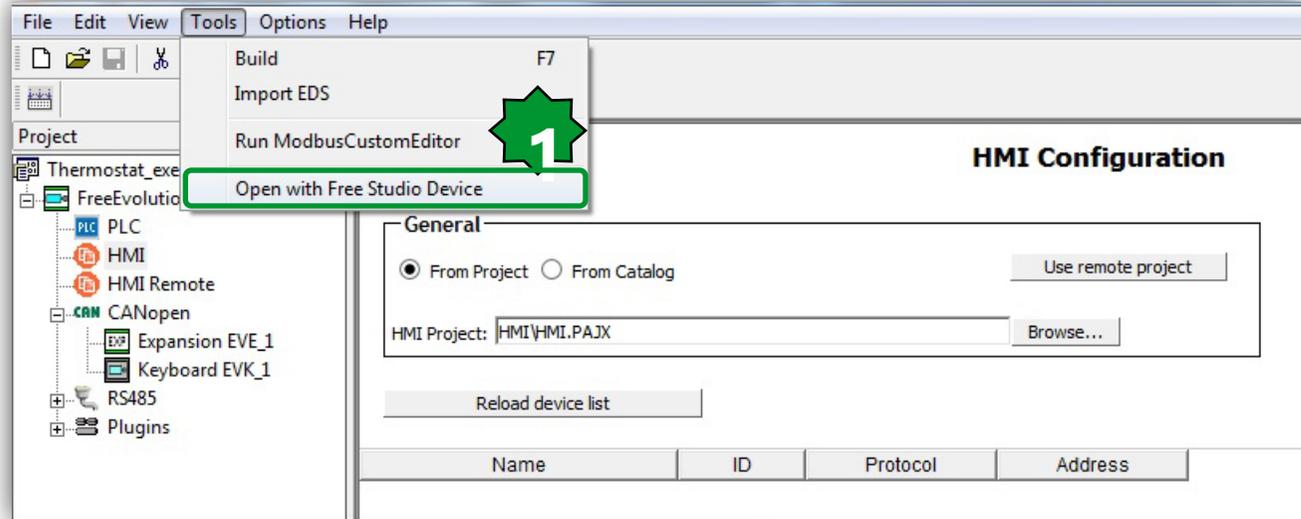
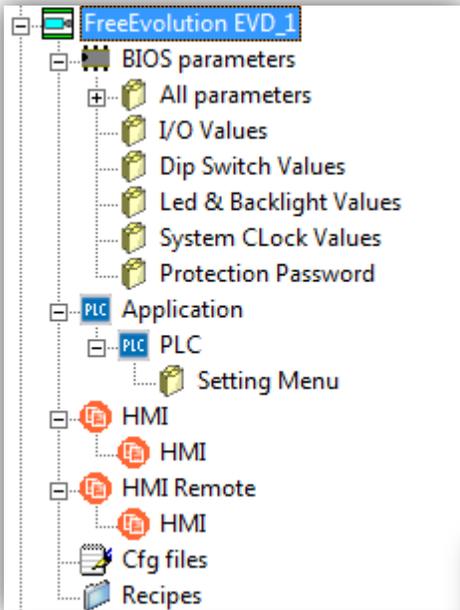
- Compile the User Interface project



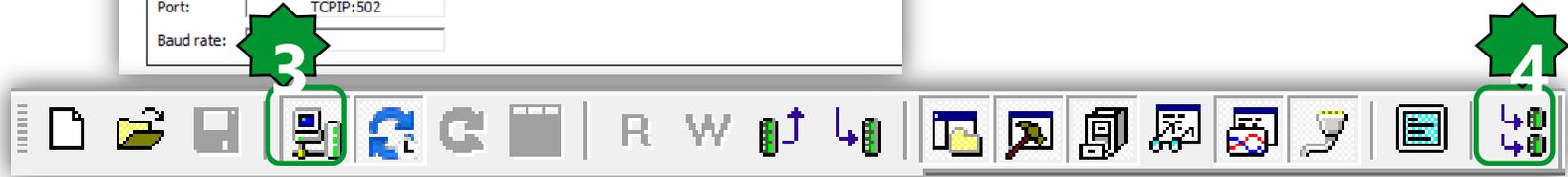
- Build the Connection project in order to align it to the linked Ap and UI project



Open Free Studio Device



- 1. Tools ► Open with free Studio Device
- 2. Define settings
- 3. Connect to the EVD
- 4. Download all



Upload HMI from Base to Keyboard...



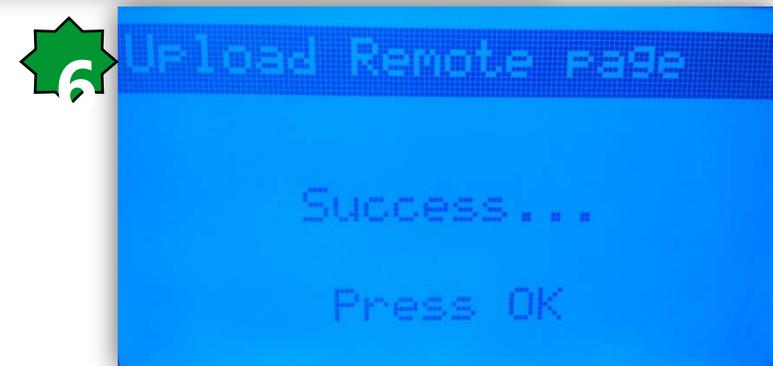
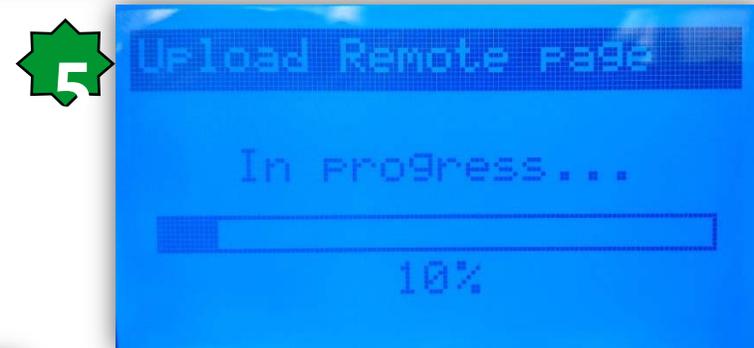
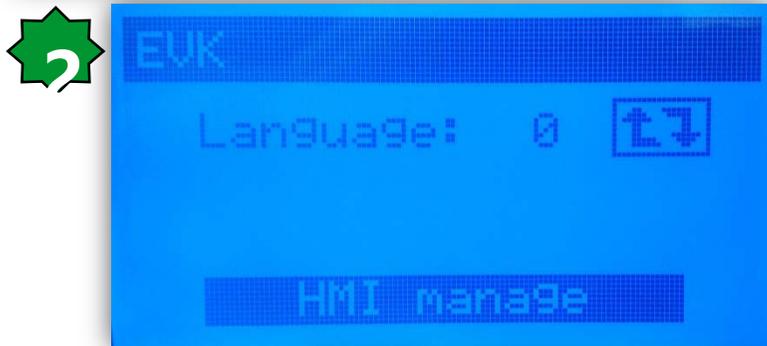
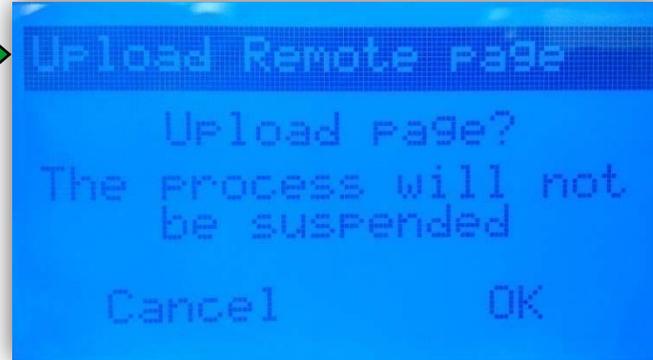
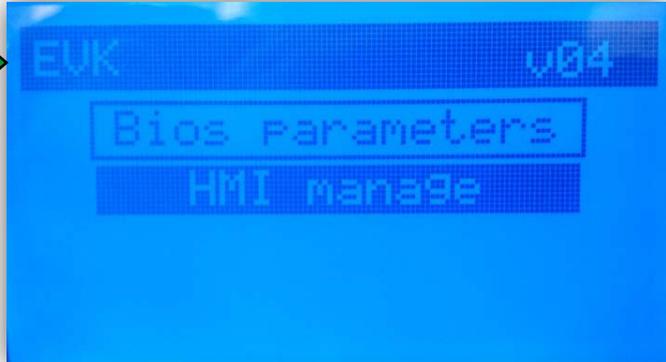
In the BIOS Menu of EVK (Long press of down + left if a HMI is already loaded).

In order to run HMI:

1. Select HMI Manage
2. upload
3. Press OK to confirm
4. Press to run HMI



Upload HMI from Base to Keyboard...



Chapter 20

EVOLUTION USB

Goal:

- DownLoad/UpLoad via USB
- Retain variable configuration

USB device (PC ◀ ▶ target)



- **Type A USB (HOST).** Used to connect a standard USB to download the application/BIOS.
- **Type B mini USB (DEVICE).** Used to connect FREE Evolution to a PC or third party device via mini A/B USB cable to up/download the application, files or documentation. This can be done from a PC or other device. ¹ **USB Formated FAT32**

CASE 1
USB Host
USB → ← FREE

Data downloading direction	→	←
Parameter map	✓	✓
IEC application	✓	-
HMI application	✓	-
Data file	✓	✓
BIOS	✓	-

CASE 2
USB device
PC → ← FREE

Data downloading direction	→	←
Parameter map	-	-
IEC application	✓	✓
HMI application	✓	✓
Data file	✓	✓
BIOS	-	-

CASE 3
USB-RS485 /USB-CANOpen
ETHERNET + Plugin
PC → ← FREE

Data downloading direction	→	←
Parameter map	✓	✓
IEC application	✓	-
HMI application	✓	-
Data file	✓	✓
BIOS	✓	-

What is inside Evolution Filesystem or USB ?



Inside both Evolution/USB Pen Drive:

- PLCIEC.COD** : Application binary file
- HMIIEC.COD** : User Interface binary file (not mandatory)
- HMIREM.KBD** : Remote User Interface binary file (not mandatory)
- CONNEC.PAR** : Master Connectivity settings (not mandatory)

Inside Evolution:

- Webserver files
- Logging file
- Others...

Inside USB Pen Drive:

- PARAM.DAT (.RAW)** : Parameter Map file

Parameter map file



PARAM.DAT file includes a set of Evolution BIOS& IEC parameter values.

PARAM.DAT can be renamed as PARAM.raw in order to skip parameters' range limit check (used in case of par limited by other pars).

PARAM.DAT file can be created via IEC code using the target var (see next slides)

PARAM.DAT (.RAW) can be manually created/modified in order to contain even a subset of the full map.

Use USB host from IEC code



- Upload an application from the pen drive to Evolution
- Upload/Download a parameter map from evolution to the pen drive.

sysUSBCommand is the system command to upload/download to/from USB-Host:

7 = load PARAM.BIN from USBH

8 = load PLCIEC.COD from USBH

9 = load HMIIEC.COD from USBH

10 = load PARAM.DAT from USBH

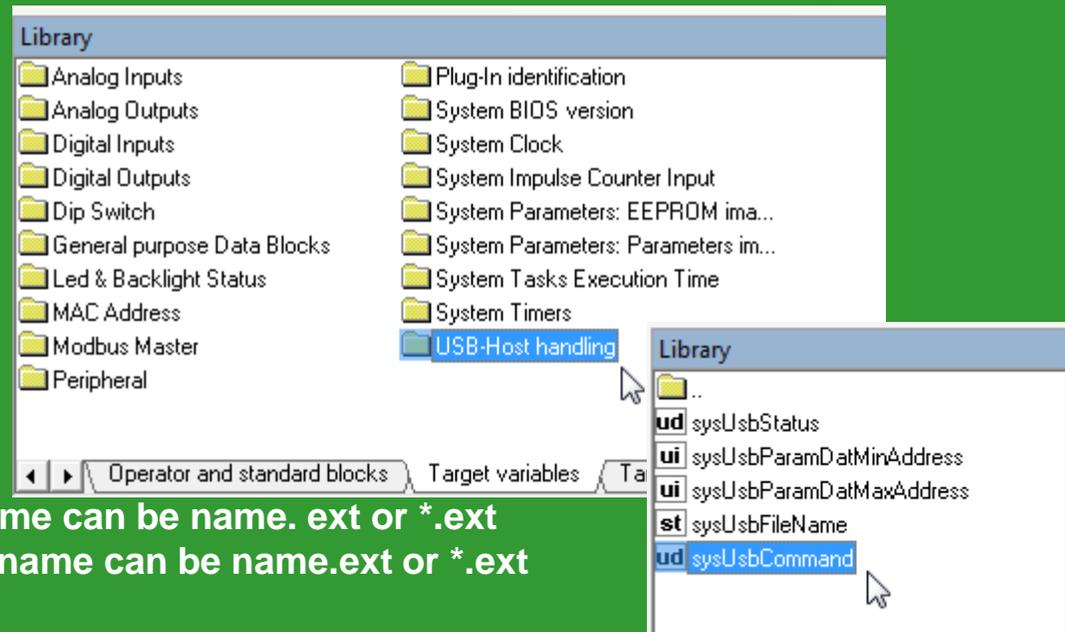
11 = save PARAM.DAT to USBH

12 = load CONNEC.PAR from USBH

13 = load HMIREM.KBD from USBH

14 = save sysUsbFileName file to USBH, file name can be name. ext or *.ext

15 = load sysUsbFileName file from USBH, file name can be name.ext or *.ext





USB data upload workflow...

EDIT MODE SOURCE OK **CONNECTED** 1

View object properties

Name: sysUsbCommand
Type: UDINT
Address: %MD30.0

Description:
System command to upload/download to/from USB-Host

7	=	load PARAM.BIN from USBH
8	=	load PLCIEC.COD from USBH
9	=	load HMIIEC.COD from USBH
10	=	load PARAM.DAT from USBH
11	=	save PARAM.DAT to USBH
12	=	load CONNEC.PAR from USBH
13	=	load HMIREM.KBD from USBH
14	=	save sysUsbFileName file to USBH, file name can be name.ext or *.ext
15	=	load sysUsbFileName file from USBH, file name can be name.ext or *.ext
16	=	load file sysUsbFileName from filesystem, file must have PARAM.DAT format and filename name.DAT or name.RAW

Library

ud	sysLocalDigitalInputsImpulseCounter	w	sysParameter
t/f	sysLocalDigitalInputsResetCounter	t/f	sysPeripheralStatus
t/f	sysLocalDigitalOutputs	ud	sysTimer
t/f	sysLocalDipSwitch	ud	sysTskBckExeTime
us	sysLocalLeds	ud	sysTskTmdExeTime
b	sysMacAddress	ui	sysTskTmdScanTime
t/f	sysMbMRTuNodePresence	ud	sysUsbCommand
g	sysMbMRTuNodeStatus	st	sysUsbFileName
t/f	sysMbMTcpNodePresence	ui	sysUsbParamDatMaxAddress
g	sysMbMTcpNodeStatus	ui	sysUsbParamDatMinAddress
ui	sysMSK	ud	sysUsbStatus

Target variables Target blocks basic FS_IJC

- 1. Connect to the target via Ap
- 2. Drag & drop sysUsbCommand into the watch window
- 3. Write value=11

Watch

Symbol	Value	Type	Location
- SYSUSBCOMMAND	11	UDINT	global



...USB data upload workflow

View object properties

Name: sysUsbStatus

Type: UDINT

Address: %MD31.0

Description:
System status of operation on USB-Host

0	=	command completed
1	=	command processing
255	=	command failed
254	=	file not present
253	=	file too long
252	=	USBH not connected
251	=	file not compatible
250	=	some parameters fails
249	=	write file failed
248	=	open file in write failed

**To monitor the USB-Host status:
Drag & drop sysUsbStatus into the watch window**

Close

Library

w	sysParameter	ui	sysUsbParamDatMaxAddress
t/f	sysPeripheralStatus	ui	sysUsbParamDatMinAddress
ud	sysTimer	ud	sysUsbStatus
ud	sysTskBckExeTime	ui	sysVER
ud	sysTskTmdExeTime	ui	Temp_UM
ui	sysTskTmdScanTime		
ud	sysUsbCommand		
st	sysUsbFileName		

Operator and standard blocks | Target variables | Target blocks | basic | FS_IEC

Watch

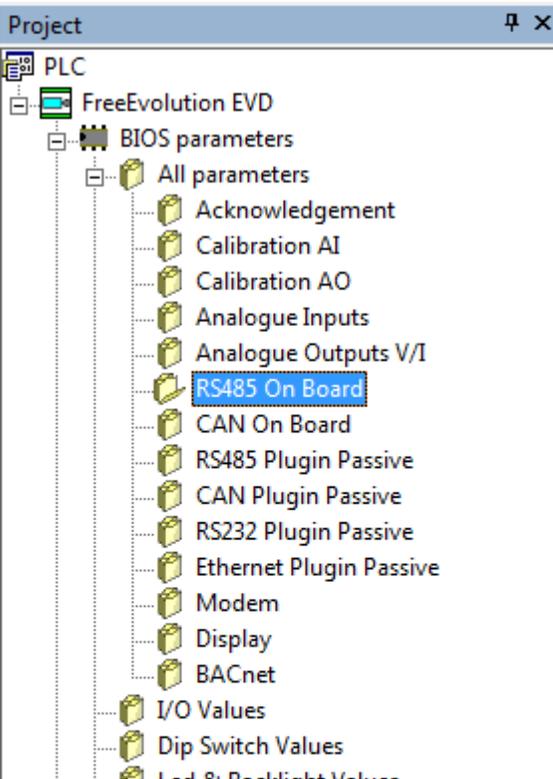
Symbol	Value	Type	Location
— SYSUSBSTATUS	0	UDINT	global
— SYSUSBCOMMAND	11	UDINT	global

Watch

Symbol	Value	Type	Location
— SYSUSBSTATUS	0	UDINT	global
— SYSUSBCOMMAND	0	UDINT	global



PARAM.DAT/Protocol Setting



```
00PARAM.DAT - Notepad
File Edit Format View Help
Model=42302049
CopyCardCode=174
15716=0
15717=2049
15718=161
15719=1
15720=1
15721=1
```

```
00PARAM.DAT - Notepad
File Edit Format View Help
15782=1
15783=3
15784=8
15785=1
15786=2
15787=2
```

RS485 Plugin Passive

Address	Name	Value	Um	Default	Min	Max	Description
15782	Addr_RS485_PI	1	num	1	0	255	RS485 passive Plug-In address
15783	Proto_RS485_PI	3=Modbus/RTU	num	3=Modbus/RTU	2	4	Select RS485 passive Plug-In protocol
15784	DataBit_RS485_PI	8	num	8	8	8	RS485 passive Plug-In Data bit number
15785	StopBit_RS485_PI	1	num	1	1	2	RS485 passive Plug-In stop bit number
15786	Parity_RS485_PI	2=Even	num	2=Even	0	2	RS485 passive Plug-In parity protocol
15787	Baud_RS485_PI	2=38400	num	2=38400	0	5	RS485 passive Plug-In baud rate protocol



PARAM.DAT/EEPROM

Resources

- Configuration
 - FreeEvolution
 - Modbus objects
 - EEPROM Parameters**
 - Status variables
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects

```
00PARAM.DAT - Notepad
File Edit Format View Help
15821=""
15831=""
15841=""
15851=""
16384=190
16385=25
```

EEPROM Parameters

Add Remove Recalc

#	Address	Name	Device type	Application type	Size	Default value	Min	Max	Scale	Offset	Unit	Format	AccessLevel
1	16384	SetPoint	Signed 16-bit	INT		180	150	300	1	0	°C	XXX.Y	Always visible
2	16385	Differentiation	Signed 16-bit	INT		20	5	50	1	0	°C	XXX.Y	Always visible

Firmware Update By USB



How To Update:

- Copy the relevant .bin file into a USB pen drive (e.g. msk423_18.bin)
- Connect USB pen drive to Evolution
- Firmware will be downloaded into Evolution
- Yellow LED will blink during download.
- Remove USB pen drive as soon as Yellow LED will switch off
- Evolution will automatically reset and will reboot

BIOS are available @<C:\Programs>\Eliwell\free Studio\Catalog\FreeEvolution\<firmware>
<firmware> = msk423 for EVD, msk477 for EVC.

Please Note: a SYSTEM FAULT message will appear - DO NOT CONSIDER -
BIOS upgrade has been completed successfully

Note: Evolution make a filter based on the filename in order to prevent user mistakes



Automatic Upload via USB pen drive

Uploading automatically an application via USB pen drive

- Copy into a pen drive the COD/PAR/DAT files
- Edit an UPLOAD.TXT file containing the list of the files to be uploaded

Note. PARAM.DAT (.RAW) file can be uploaded only if FREE Evolution has been rebooted with related application, therefore PARAM.DAT (.RAW) cannot be uploaded at the same time of PLCIEC.COD

The upload file can have a prefix from 00 to 15, for example 03UPLOAD.TXT:

- Copy into a pen drive the UPLOAD.TXT (03UPLOAD.TXT) files as well
- Files with numeric prefix are uploaded only if the Evolution dip-switches match the prefix; in this way it is possible to store on the same USB pen drive one or more Evolution applications.

USB-LED status during upload



The upload process starts when the pen drive is plugged and can be monitored through the led status which, during the upload process, are controlled directly by Evolution bios.

The process results which will switch on the red led are the ones related to a value of `sysUsbStatus>1`.

After the process, Evolution must be restarted in order to run the new application. File PARAM.DAT is uploaded by an Evolution only if the Bios Mask and Par_POLI7 of the Evolution that has generated the PARAM.DAT are the same as the destination Evolution.

The parameters' map update does not require to switch off Evolution.

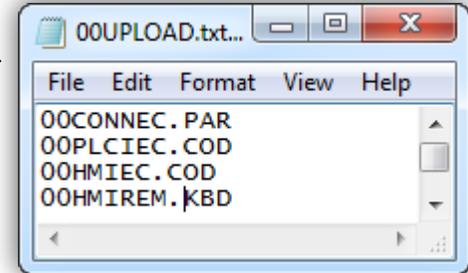
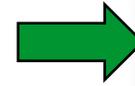
LED		Upload
RED	Blinking 2 seconds	Failed
YELLOW	On	Underway
GREEN	Blinking	Completed successfully



USB application download workflow

↓
Cfg_Node name.par @ project root

Create Text file as shown



Rename it as 00CONNEC.PAR

Copy them to the USB stick

Project name(PLC).bin @project root ▶ PLC ▶ Download

Rename it as 00PLCIEC.COD

Power cycle to apply them into the RAM

Project name(HMI).bin @project root ▶ HMI ▶ Download

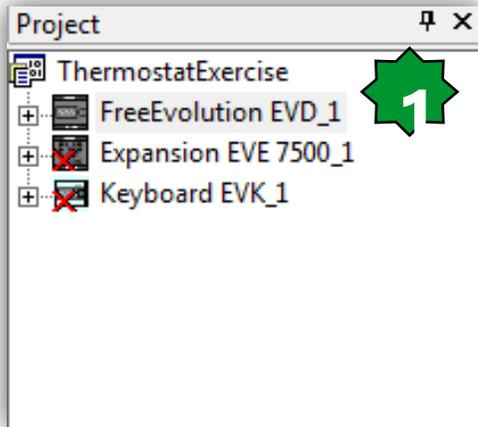
Rename it as 00HMIIEC.COD

Project name(HMI).bin @project root ▶ HMI ▶ Download

Rename it as 00HMIREM.KBD

Note.
Always use Capital letter in renaming TXT files

File Browser Opening



FreeEvolution 423 Configuration

General

Name: ID:

File version:

Communication

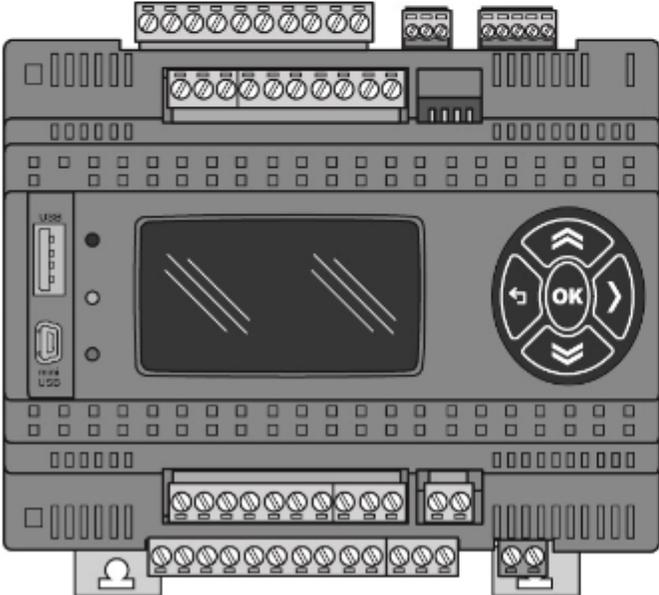
Protocol:

Address:

Port:

Baud rate:

Disable communication



Information

Status: CONNECTED

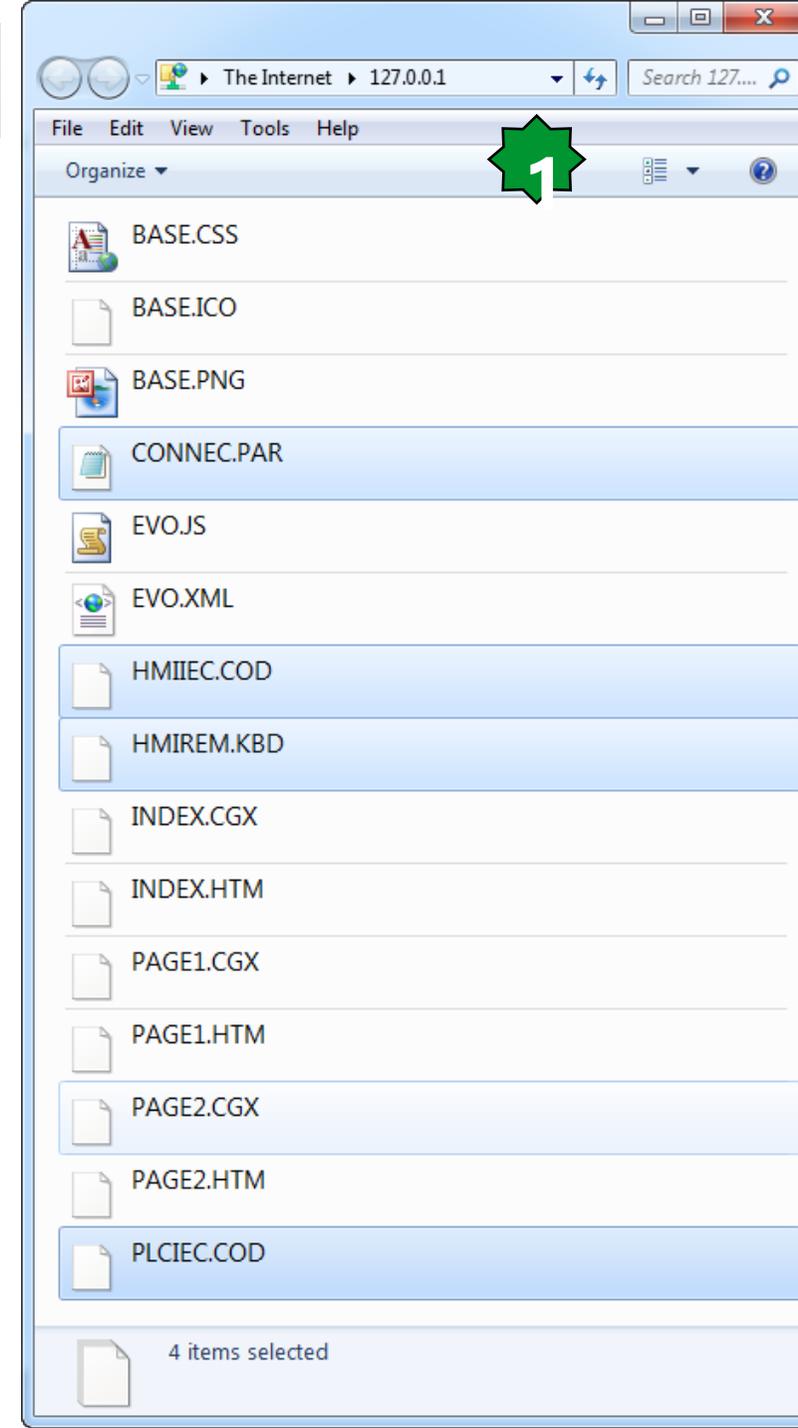
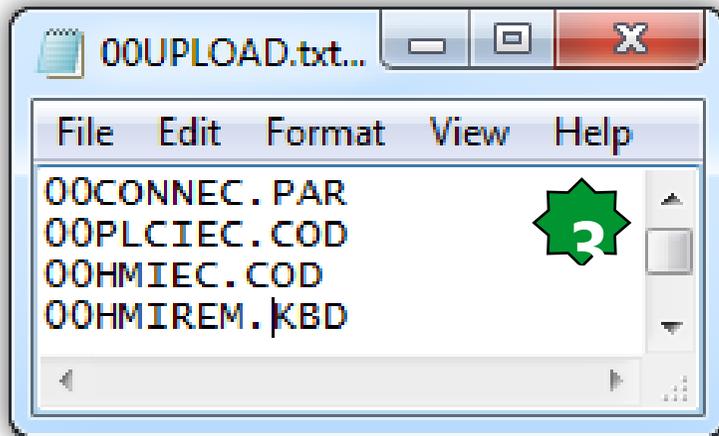
Firmware version:

Other operations

- BIOS download
- Open file browser
- Web site download
- Web site preview



File browser



1. Copy the selected file from browser into the USB stick
2. Set the address by renaming (00PLCIEC.COD) them
3. Open an TXT file, save it as **UPLOAD.TXT
4. Write/type the commands
5. Set the cursor at last alphabet
6. Enter
7. Save the .TXT file in USB stick



Using the USB Device - Adding library

PLC - Eliwell Free Studio Application - C:\Electrical\Solution Architect\Eliwell

File Edit View Project On-line Debug Window Tools Deve

Project

- New object
- Copy Object
- Paste object
- Duplicate object
- Delete object
- PLC Object properties Alt+B
- Object Browser
- Compile F7
- Recompile all
- Generate redistributable source module
- Import object from library
- Export object to library
- Library manager 1**
- Refresh all libraries
- Macros
- Select target...
- Refresh current target
- Options...

- sys_F_CLOSE
- sys_F_EOF
- sys_F_FILELENGTH
- sys_F_REMOVE
- sys_F_ROPEN
- sys_F_WOPEN
- sys_F_WOPENA
- sys_FA_READ
- sys_FA_WRITE
- sys_FM_READ
- sys_FM_WRITE
- sys_USBD_Command 4**
- sys_USBD_Status 4**

Project library list

Name	Link
basic	c:\program files (x86)\eliwell\free studi...

2

Add Remove

Windows (C:) > Program Files (x86) > Eliwell > free Studio > Catalog > FreeEvolution > PLC

Project library list

Name	Link
basic	c:\program files (x86)\eliwell\free studi...
FS_IEC 4	C:\Program Files (x86)\Eliwell\free Stu...

Add Remove Remove all UnLink ReLink

IMPORTANT NOTE:

1. USB Device is disabled by default
2. Do not forget: safe to remove the target
3. Do not access EVOLUTION through USB device meanwhile any application is accessing EVOLUTION filesystem



Enable/Disable PC host access to file System Function

Ap View object properties

Name: sys_USBD_Command 

Type: Function

Return Value: USINT 

Language Type:

Description:
Enable/disable PC host access to File System.
The function return a USINT which could have the following meanings:

0	=	Command accepted.
1	=	Command executed but failed.
2	=	Command code non valid.
3	=	Command not executed, function called into task timed.



Input:

Name	Type	Description
cmd	USINT	Command: 0=disable, 1=enable 

Close

Sys_USBD_Command (USINT Command)

PC host connection status function

Ap View object properties

Name: sys_USBD_Status 

Type: Function

Return Value: USINT 

Language Type:

Description:
 PC host connection status.
 The function return a USINT which could have the following meanings:

0	=	USB device Disconnected.
1	=	USB device Connected.
2	=	USB device Suspended.
3	=	Command not executed, function called into task timed.



Input:

Name	Type	Description
dummy	USINT	Dummy input 

Sys_USBD_status (USINT dummy)

Close



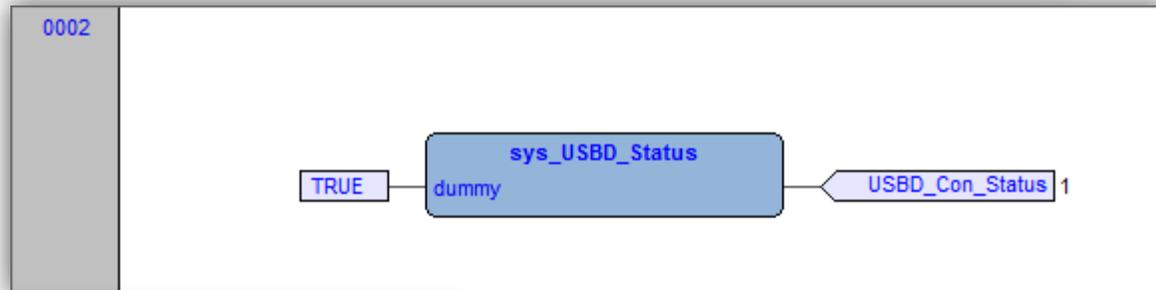
USB device activation

Project FreeEvolution EVD_1

- Programs
- Function blocks
- Functions
- Global variables
- Global shared
- Tasks
 - Timed
 - Background
 - USB_Device**
 - Boot
 - Init

Local variables

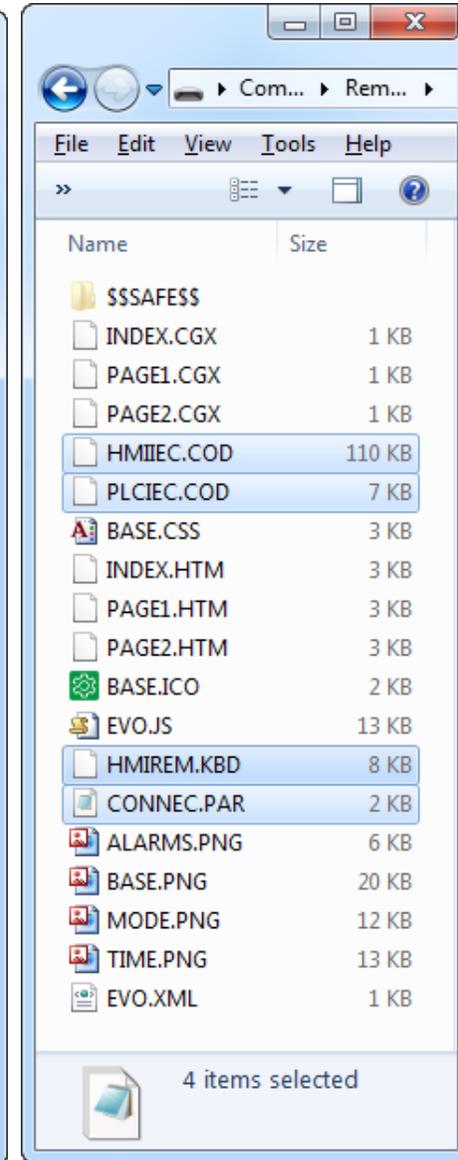
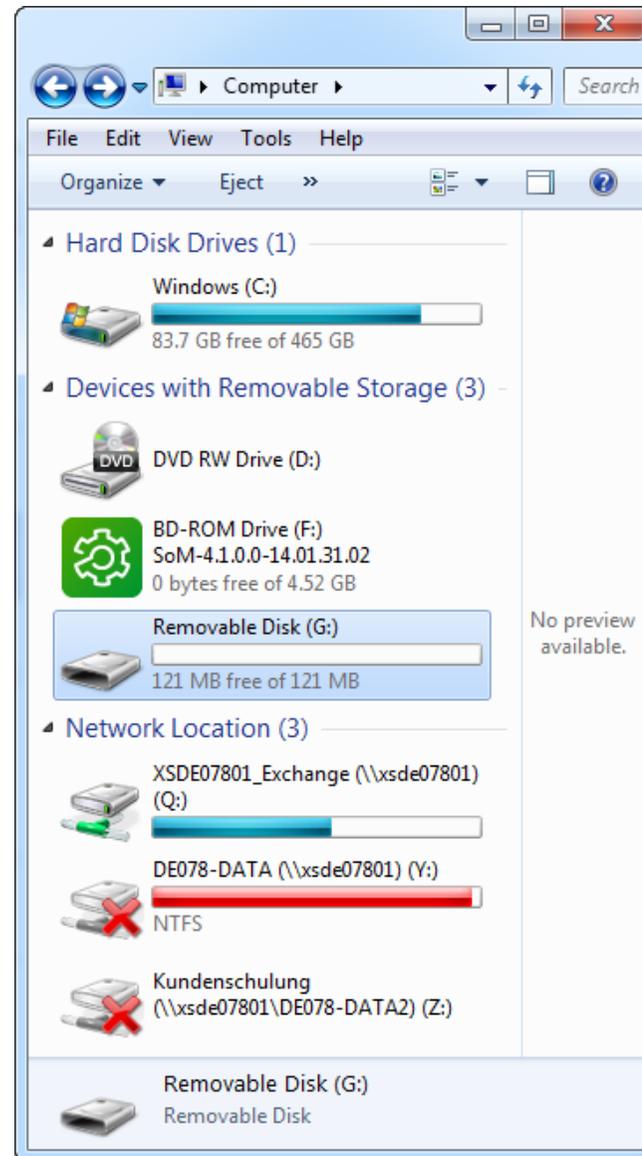
	Name	Type	Address	Array	Init value	Attribute	Description
1	USBD_Cmd	USINT	Auto	No		..	Enable/Disable
2	USBD_Cmd_Status	USINT	Auto	No		..	Command Status
3	USBD_Con_Status	USINT	Auto	No		..	PC host connection status



Watch

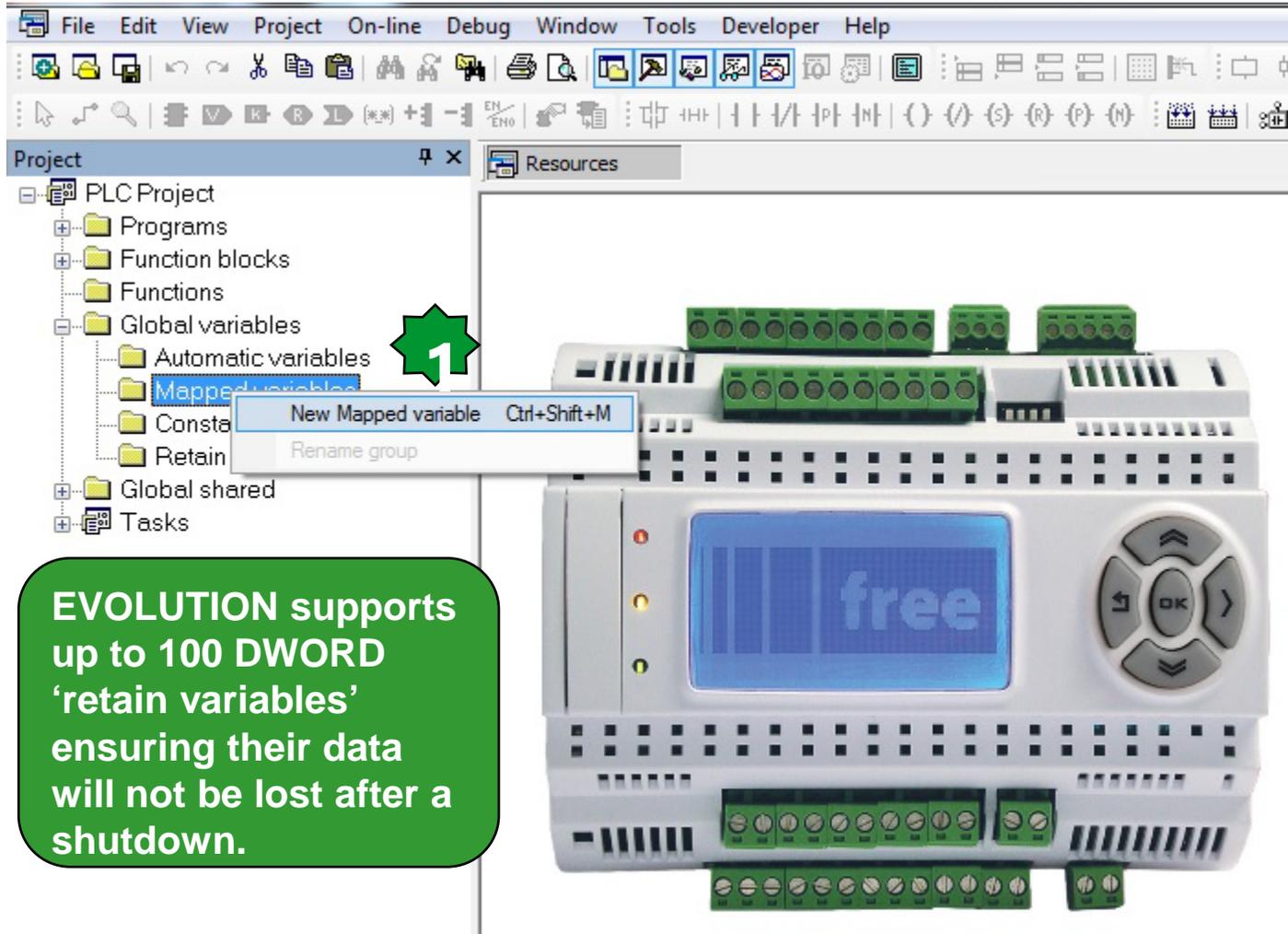
Symbol	Val...	Type	Location
— USBD_CMD	1	USINT	@BACKGROUND:USB_DEVICE
— USBD_CMD_STATUS	0	USINT	@BACKGROUND:USB_DEVICE
— USBD_CON_STATUS	1	USINT	@BACKGROUND:USB_DEVICE

USB-D-Controller





M171P - Retain Variables



EVOLUTION supports up to 100 DWORD 'retain variables' ensuring their data will not be lost after a shutdown.

A RETAIN variable indicates that the variables within the structuring elements are retentive, i.e. they keep their value even after the target device has been reset or switched off.

Retain variable values can be changed several times without affecting internal memory performance.

Note: RETAIN variables cannot be displayed in the Watch window

M171P - Retain Variables



Mapped variable declaration

Name: Retain0 **1** Data type: DWORD **2**

Group: [] Size: No

Data block: M.D 102 **3** Subindex: 0

Location: **4**

I/O data block	Base addr.	Size	Unused
Backlight Status. 0 = Off...	%QB3.0	1	1
Expansion Digital Inputs	%IX10.0	96	96
Expansion Digital Outputs	%QX11.0	84	84
Local ADC values	%IW2.0	6	6
Local Analog Inputs	%IW1.0	6	6
Local Analog Outputs	%QW0.0	5	5
Local Digital Inputs	%IX0.0	8	8
Local Digital Inputs Imp...	%MD55.0	8	8

Description: []

Ok **1** Cancel

Variable address

Automatic address

Size

Bit

Byte (8 bit)

Word (16 bit)

Double word (32 bit) **6**

Location

Input

Output

Memory

Data block: 102 Index: 0 **5**

Cancel OK

Object browser

Objects filter

Programs Operators

Function Blocks Standard functions

Functions Local variables

Variables Basic types **3**

User types

Check all Check none

Other filters

Name: * OK

Location: All

Library: All

Vars type: All

Cancel OK

Name
f BOOL
b BYTE
di DINT
dw DWORD
i INT
r REAL
si SINT
st STRING
ud UDINT
ui UINT
us USINT
w WORD

- Set as variable address size DW (double WORD) and data block 102.0.xx where xx=0,...99

Chapter 21

ADVANCE micro SD Card

Goal:

- Mounting micro SD card
- Program storage location settings

Controller's Filesystems Features

The Controller has three possible volumes. Internal NOR flash (8Mb), microSD and USB pen drive. Max dimension of the transferred files involving USB pen drive is 2Mbyte.

Via this three volumes is possible to:

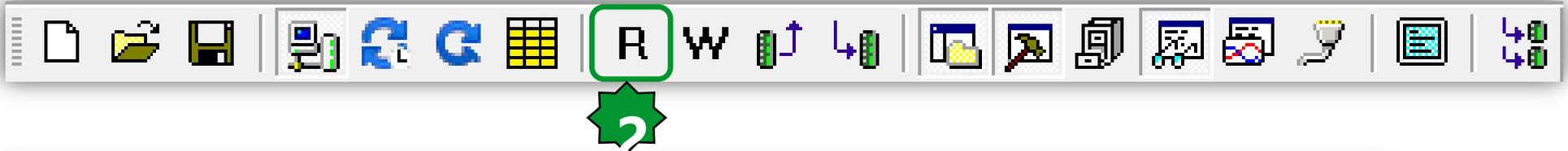
- Parameters update into the Controller via USB pen drive, NOR Flash or microSD.
- Copy files from USB pen drive to NOR Flash or microSD and vice versa
- Handling files in Applications
- Read, write, delete files in NOR Flash or microSD via serial communication:
"file browsing"

micro SD Presense & Mounting

If the microSD card is presented at boot is automatically mounted.

USB-Host and microSD

Address	Name	Value	Um	Default	Min	Max	Description
8717	microSD command	0=No command	num	0=No command	0	2	microSD Command
8718	microSD status	0=Command completed	num	0=Command completed	0	255	Result of microSD command
8719	microSD presence	False	flag	False	0	1	microSD presence
8756	USB-Host command	0=No command	num	0=No command	0	21	USB-Host Command
8758	USB-Host status	0=Command completed	num	0=Command completed	0	255	Result of USB-Host command



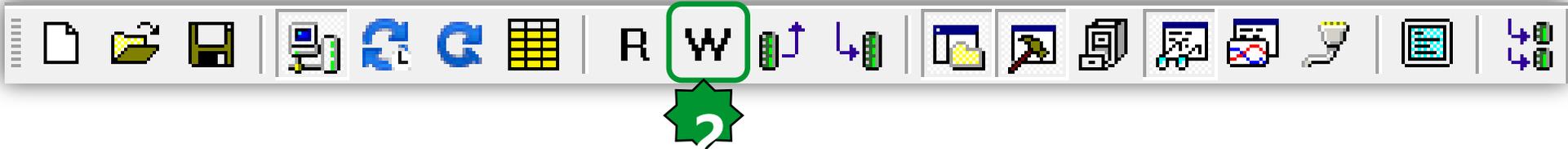
USB-Host and microSD

Address	Name	Value	Um	Default	Min	Max	Description
8717	microSD command	0=No command	num	0=No command	0	2	microSD Command
8718	microSD status	0=Command completed	num	0=Command completed	0	255	Result of microSD command
8719	microSD presence	True	flag	False	0	1	microSD presence
8756	USB-Host command	0=No command	num	0=No command	0	21	USB-Host Command
8758	USB-Host status	0=Command completed	num	0=Command completed	0	255	Result of USB-Host command

micro SD Command

USB-Host and microSD

Address	Name	Value	Um	Default	Min	Max	Description
8717	microSD command	1=Mount microSD, after plugged the microSD	num	0=No command	0	2	microSD Command
8718	microSD status	0=Command completed	num	0=Command completed	0	255	Result of microSD command
8719	microSD presence	True	flag	False	0	1	microSD presence
8756	USB-Host command	0=No command	num	0=No command	0	21	USB-Host Command
8758	USB-Host status	0=Command completed	num	0=Command completed	0	255	Result of USB-Host command

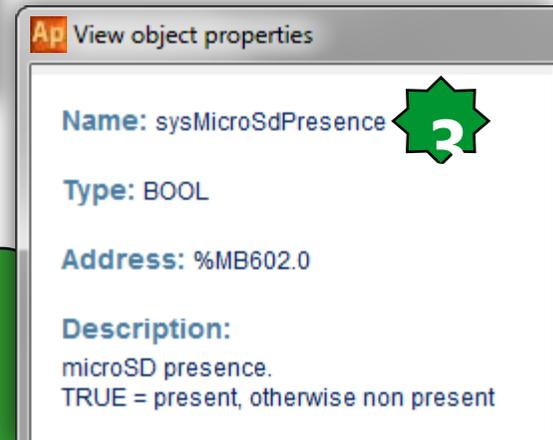
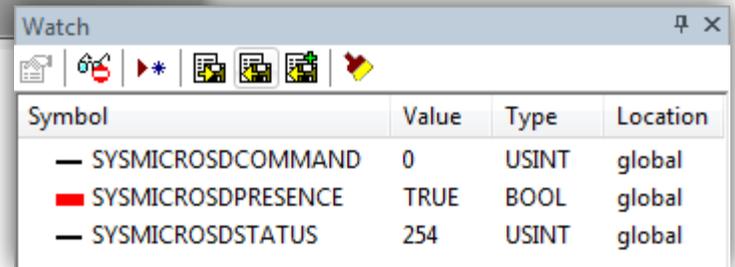
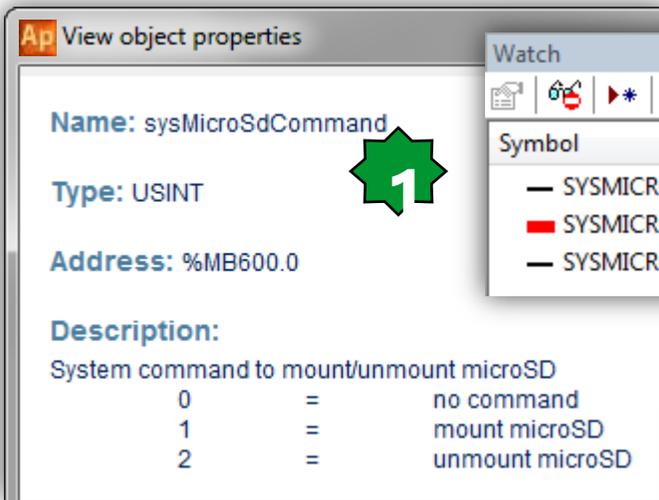
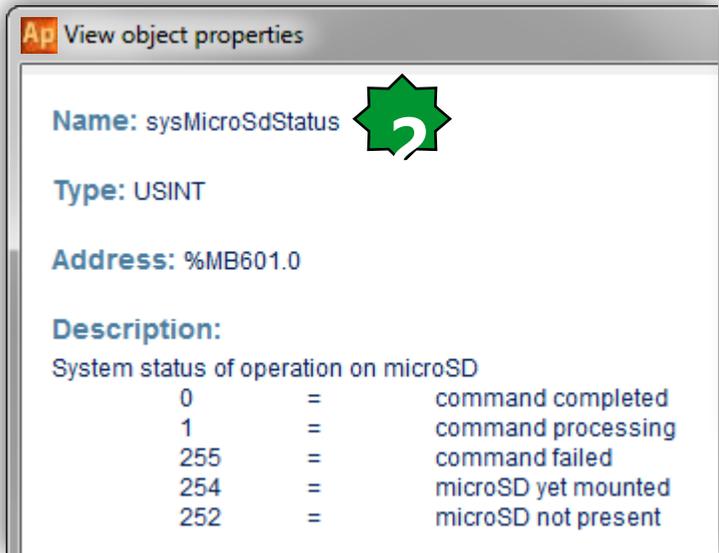
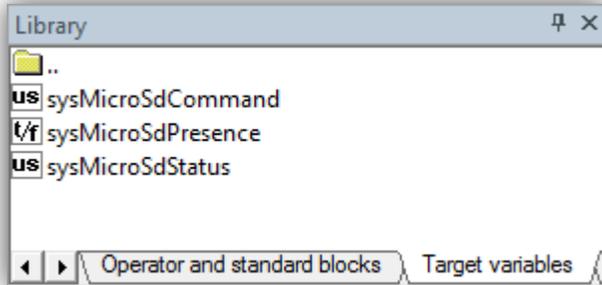


USB-Host and microSD

Address	Name	Value	Um	Default	Min	Max	Description
8717	microSD command	1=Mount microSD, after plugged the microSD	num	0=No command	0	2	microSD Command
8718	microSD status	0=Command completed	num	0=Command completed	0	255	Result of microSD command
8719	microSD presence	True	flag	False	0	1	microSD presence
8756	USB-Host command	0=No command	num	0=No command	0	21	USB-Host Command
8758	USB-Host status	0=Command completed	num	0=Command completed	0	255	Result of USB-Host command

micro SD handling

In parallel way you can write desired command via Application tool by using sysMicroSdCommand in watch window.

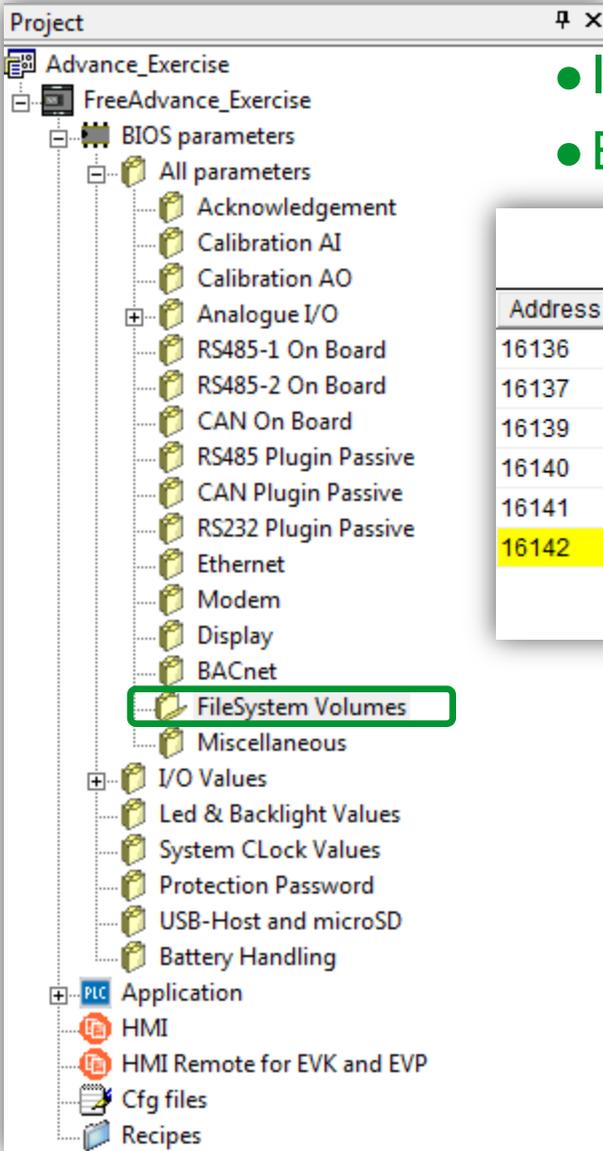


Plug and unplug notices:

1. sysMicroSdCommand to request an action.
2. sysMicroSdStatus to monitor the progress of the required action.
3. sysMicroSdPresence to detect the presence of the microSD.

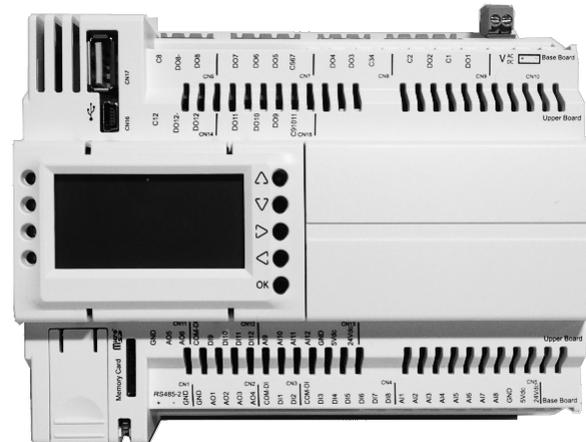
Storage selection

- It is possible to download files on different media
- Each kind of file type will be loaded from the selected media



Address	Name	Value	Um	Default	Min	Max	Description
16136	HTTP_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of HTTP files
16137	DAT_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of *.DAT and *.RAW files,
16139	PLC_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of PLC file
16140	HMI_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of HMI file
16141	REM_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of HMI Remote file
16142	PAR_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of CONNEC.PAR file

0=NOR Flash
1=microSD card



Download settings

Use manual settings

	NOR	SD
PLC	<input type="radio"/>	<input checked="" type="radio"/>
HMI	<input type="radio"/>	<input checked="" type="radio"/>
HMI Remote	<input type="radio"/>	<input checked="" type="radio"/>
Cfg files	<input type="radio"/>	<input checked="" type="radio"/>
Web site	<input type="radio"/>	<input checked="" type="radio"/>



Download settings

General

Name: ID:

File version:

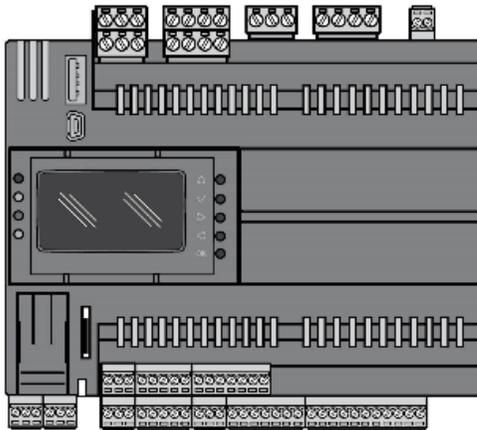
Communication

Protocol:

Address: Disable communication

Port:

Baud rate:



Download settings

Use manual settings

	NOR	SD
PLC	<input type="radio"/>	<input checked="" type="radio"/>
HMI	<input type="radio"/>	<input checked="" type="radio"/>
HMI Remote	<input type="radio"/>	<input checked="" type="radio"/>
Cfg files	<input type="radio"/>	<input checked="" type="radio"/>
Web site	<input type="radio"/>	<input checked="" type="radio"/>



1. Please note that by changing the download settings from NOR to SD the data file storage location remains on the NOR flash.

2. If you want to change DATA Parameters storage location you have to handle it via Device tool as it shown.

Information

Status:

Firmware version:

Model:

Other operations

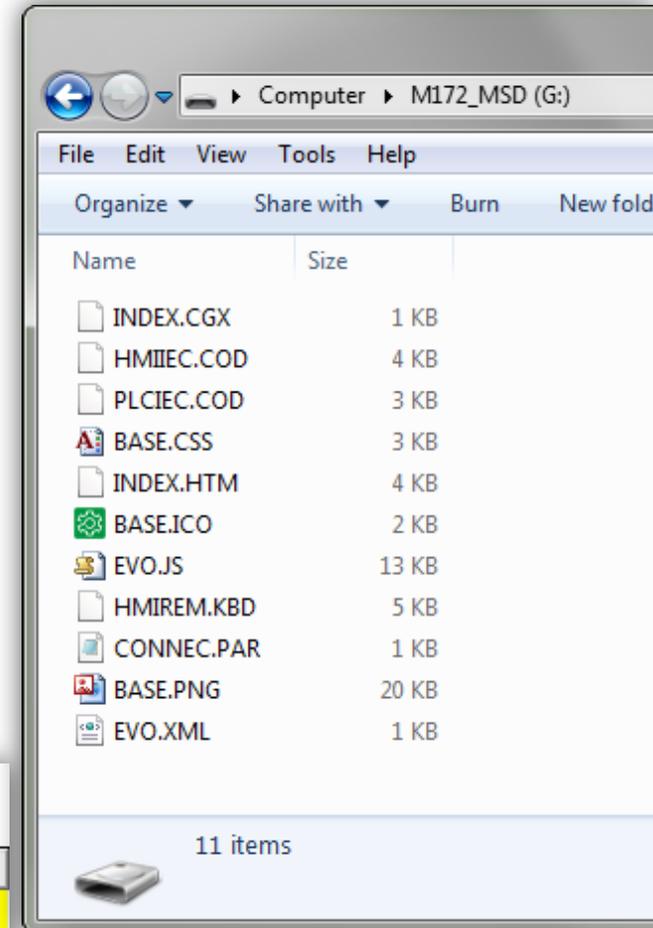
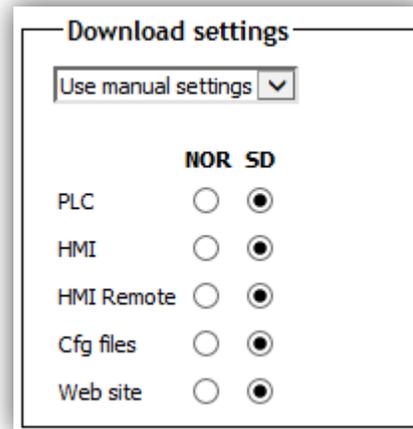
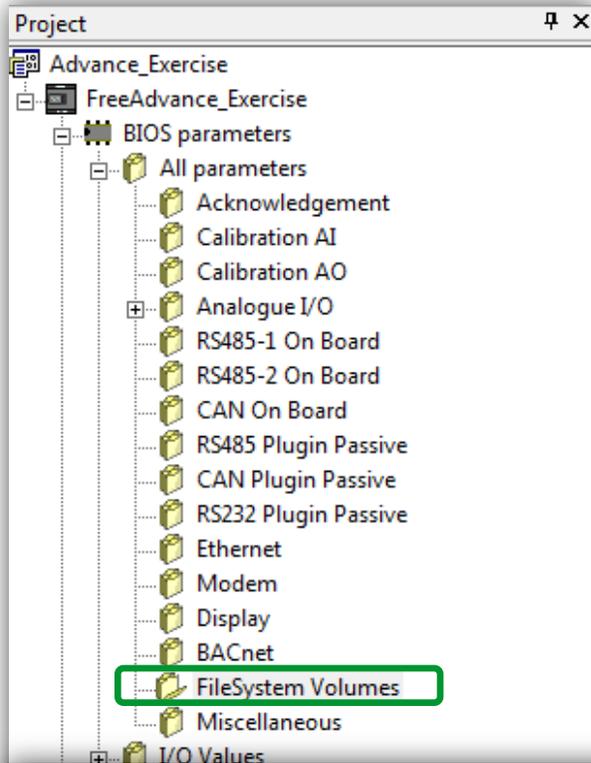
- BIOS download
- Open file browser
- Web site download
- Web site preview
- Generate XIF file

FileSystem Volumes

Address	Name	Value	Um	Default	M...	M...	Description
16136	HTTP_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HTTP files
16137	DAT_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of *.DAT and *.RAW files,
16139	PLC_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of PLC file
16140	HMI_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HMI file
16141	REM_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HMI Remote file
16142	PAR_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of CONNEC.PAR file



Programm volumes/My Computer



FileSystem Volumes

Address	Name	Value	Um	Default	M...	M...	Description
16136	HTTP_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HTTP files
16137	DAT_volume	0=NOR Flash	num	0=NOR Flash	0	1	Volume of *.DAT and *.RAW files,
16139	PLC_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of PLC file
16140	HMI_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HMI file
16141	REM_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of HMI Remote file
16142	PAR_volume	1=microSD card	num	0=NOR Flash	0	1	Volume of CONNEX.PAR file

Programm volumes / File browser



File browser window 1 (left):
Address: 127.0.0.1 | mmc:0: (4)
Items: BASE.CSS, BASE.ICO, BASE.PNG, CONNEX.PAR, EVO.JS, EVO.XML, HMIIEC.COD, HMIREM.KBD, INDEX.CGX, INDEX.HTM, JOURNAL.DAT, PLCIEC.COD (12 items)

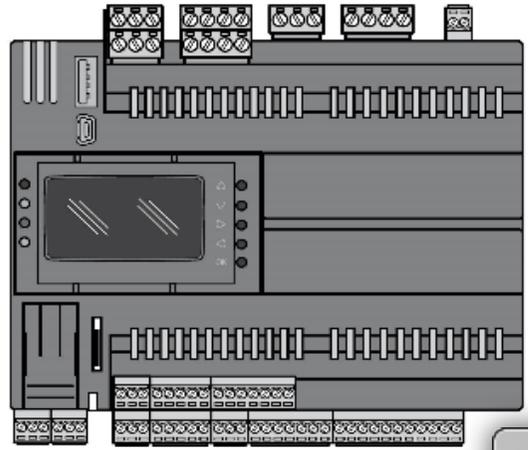
File browser window 2 (right):
Address: 127.0.0.1 | nor:0: (5)
Items: BASE.CSS, BASE.ICO, BASE.PNG, CONNEX.PAR, EVO.JS, EVO.XML, HMIIEC.COD, HMIREM.KBD, INDEX.CGX, INDEX.HTM, JOURNAL.DAT, PLCIEC.COD, TEST_SD.TXT (13 items)

General

Name: FreeAdvance_Exercise ID: 1
 File version: 596.2

Communication

Protocol: Modbus [Settings]
 Address: 1
 Port: COM:1 Disable communication
 Baud rate: 38400



Download settings

Use manual settings

	NOR	SD
PLC	<input type="radio"/>	<input checked="" type="radio"/>
HMI	<input type="radio"/>	<input checked="" type="radio"/>
HMI Remote	<input type="radio"/>	<input checked="" type="radio"/>
Cfg files	<input type="radio"/>	<input checked="" type="radio"/>
Web site	<input type="radio"/>	<input checked="" type="radio"/>

Information (1)

Status: **CONNECTED**
 Firmware version: 596.2
 Model: Undefined IOs

Other operations (2)

BIOS download
 Open file browser
 Web site download
 Web site preview
 Generate XIF file

File browser window 3 (3):
 Address: The L... | 127.0...
 Items: mmc:0:
 nor:0:

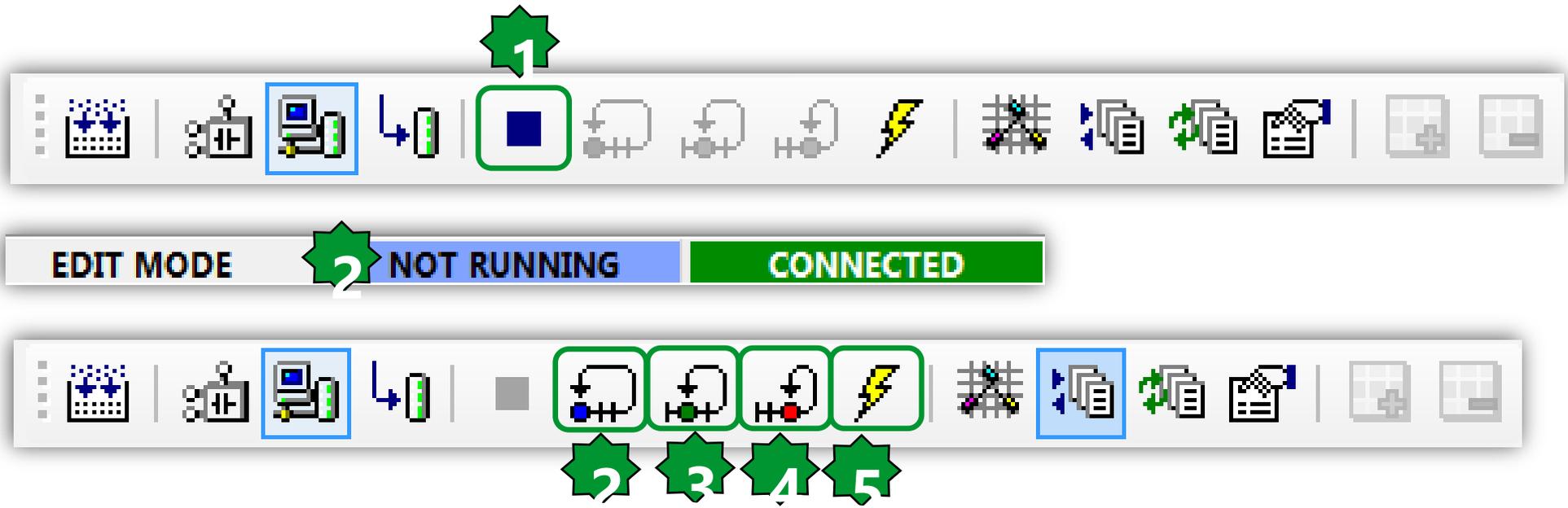
Chapter 22

ADVANCE new features

Goal:

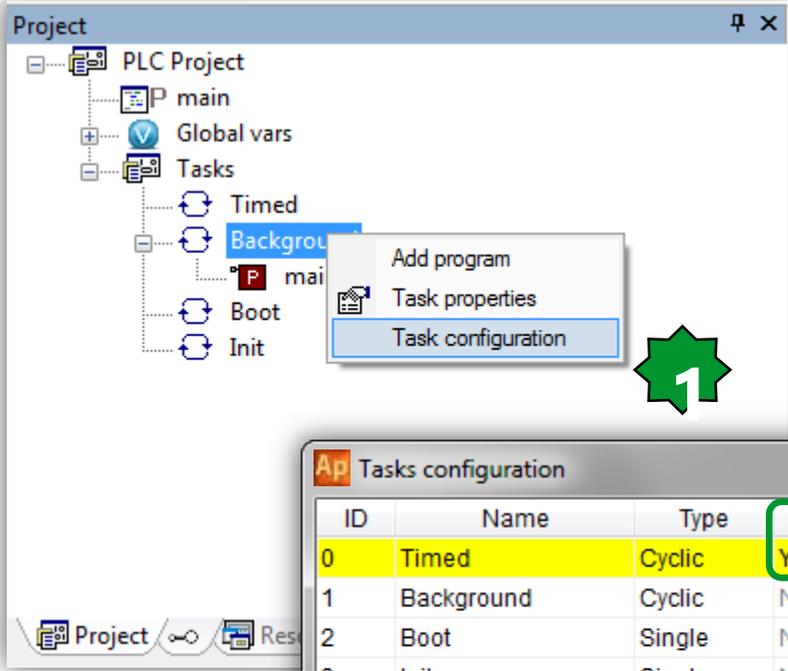
- Halt & Restart Modes
- Cycling time settings & monitoring as run time status
- Analogue I/O configuration
- Virtual Dip Switch setting
- Battery Handling

Running Modes

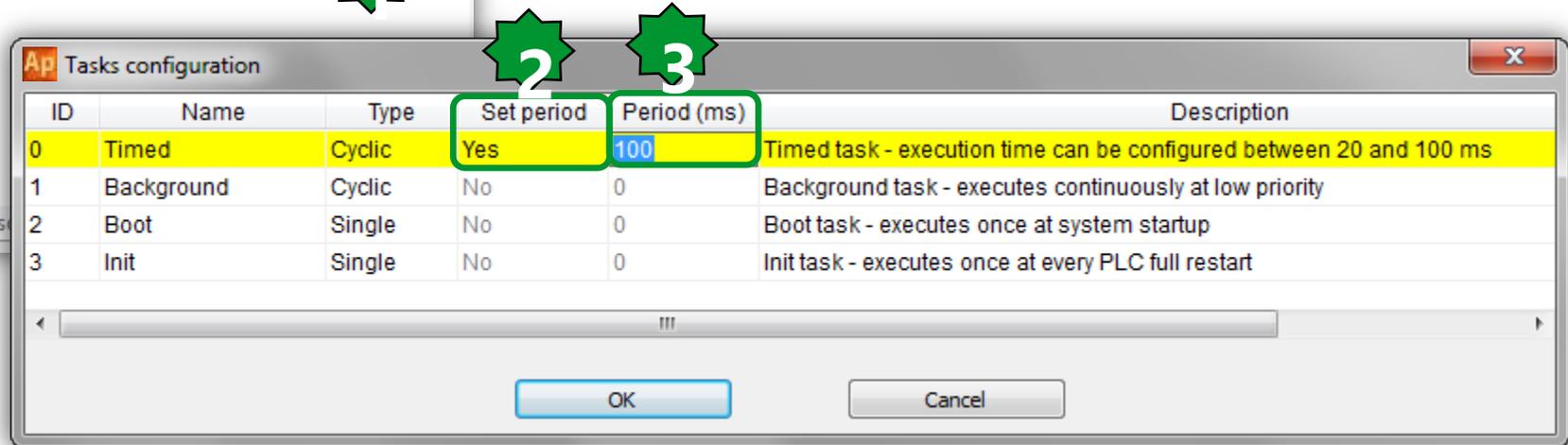


1. **HALT** : You can stop the PLC execution
2. **COLD RESTART** : The PLC application execution will be restarted and both retain and non-retain variables will be resetted.
3. **WARM RESTART** : The PLC application execution will be restarted and only non-retain variables will be resetted.
4. **HOT RESTART** : The PLC application execution will be restarted and no variables will be resetted.
5. **REBOOT TARGET** : You can reboot the target

Cycling time setting



It is only possible to set the Timed task period and background task executes in lower priority after Timed task execution.



PLC Run time status



PLC run-time status

OK

task	ready	period [ms]	time [ms]	count
Timed	Yes	100	0.007	n/a
Background	No			
Boot	No			
Init	Yes	0	0.018	n/a

AI Configuration



In particular, we have that couples (AI1, AI2) and (AI3, AI4) and ... (AI11, AI12) must be complied with this truth table where:

0=NTC(NK103)

1=DI

2=NTC(103AT)

3=4÷20mA

4=0÷10V

5=0÷5V (Ratiometric)

6=PT1000

7=hOhm (pull-up 10K)

8=daOhm (pull-up 2K)

9=PTC

10=0÷5V

11=0÷20mA

		Cfg_AI1										
		0	1	2	3,11	4	5	6	7	8	9	10
Cfg_AI2	0	x	x	x					X			
	1	x	x	X					X			
	2	x	x	X					X			
	3,11				x							
	4					x						
	5						X					X
	6							X		X	x	
	7	x	x	X					x			
	8							X		X	X	
	9							X		X	X	
	10						X					x

The cells marked with X indicate combinations of Cfg_AI1 and Cfg_AI2 eligible. Choices outside causing the error indication 0x8003 field value of the two probes. Same table when you consider the other couples.



Analogue I/O configuration

Address	Name	Value	Um	Default	Min	Max	Description
15725	Temp_UM	0=°C	num	0=°C	0	1	Unit of temperature measurement
15726	Cfg_AI1	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI1
15727	Cfg_AI2	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI2
15728	Cfg_AI3	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI3
15729	Cfg_AI4	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI4
15730	Cfg_AI5	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI5
15731	Cfg_AI6	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI6
16100	Cfg_AI7	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI7
16101	Cfg_AI8	2=NTC(103AT)	num	2=NTC(103AT)	0	11	Type of analogue input AI8

(*) Cfg_AIx = 7 Resistance value read, expressed in hΩ, for a resistance applied to the input using the controller in NTC configuration, i.e. creating a divider with pull-up resistance of 10k.

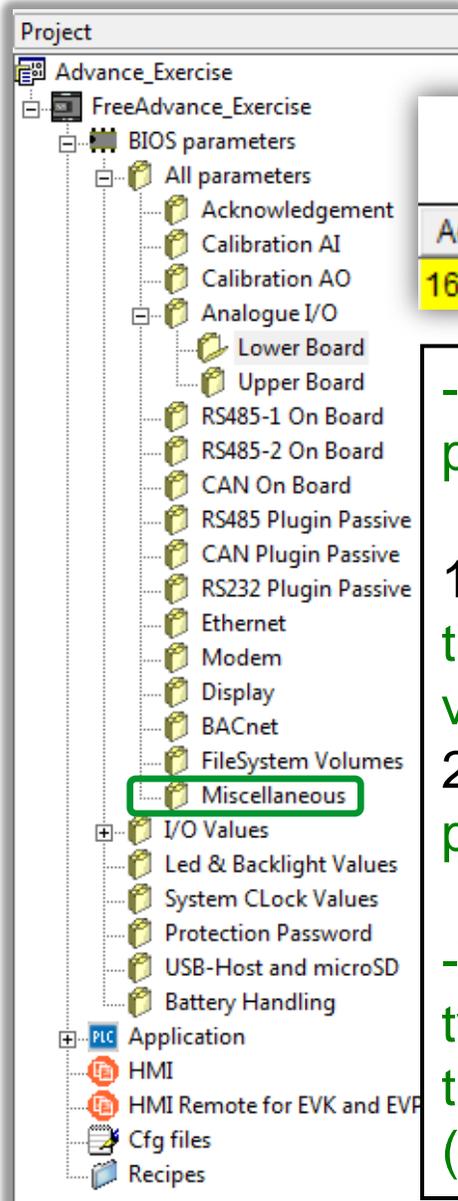
(**) Cfg_AIx = 8 Resistance value read, expressed in daΩ, for a resistance applied to the input using the controller in PT1000 configuration, i.e. creating a divider with pull-up resistance of 2k.

Analogue I/O notes



- Note: Typically used with potentiometer at input.
- The resistance range for the $h\Omega$ (NTC) configuration is up to 150K, and up to 30K for the $da\Omega$ (PT1000) configuration.

Virtual Dip Switch...



Miscellaneous

Address	Name	Value	Um	Default	Min	Max	Description
16143	virtualDipSwitch	7	num	0	0	7	Nemeric prefix for system files name

-USB files may provide numerical prefix from 00,01,02 ..., **07**. In particular, when the files are in the USB stick:

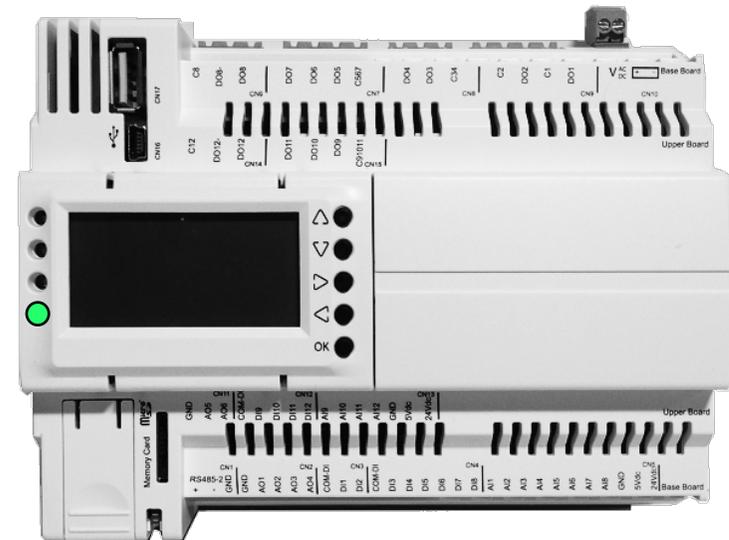
1. if you did not have prefix that these can be downloaded from the stick to the Controller regardless of the value of the virtualDipSwitch parameter of the Controller.
2. if they have prefix they are downloaded to Controller only if the prefix is equal to virtualDipSwitch parameter of the controller.

-This allows you to get on the same USB stick files of the same type on a different Controllers. For example if virtualDipSwitch of the Controller has value 7 the file with prefix 07 (eg: 07CONNEC.PAR) will be considered by this Controller.

...Virtual Dip Switch



- virtualDipSwitch can be identified also via green led at Controller power-on/reset immediately after the "USB-Host: OK" indication.
- The green led blink as the value of virtualDipSwitch.
- If the green led stay on it means that the value is 0. This phase spend 4 seconds.
- For instance if the value is 0 the green led stay ON 4 seconds, if the value is 2 the green led flash 2 times and wait OFF for 3 seconds



Battery Handling



- The Controller has a BR2032 battery inside. To guarantee 10 years life there is a procedure to follow before put the Controller in storage.
- This procedure works only if the Controller is NOT powered by USB-device connector.

Battery Handling

Address	Name	Value	Um	Default	Min	Max	Description
8716	Deep-PowerDown keyword	0	num	0	0	65535	Put keyword 12345 to enable deep power down mode at power-off

- Before power-off the Controller the 16bit register 8716 has to be set at 12345. Then the Controller can be switched-off. This procedure guarantee that the microcontroller go into Deep-Power Down Mode when the power is switched off.
- This is to solve a bug in the microcontroller silicon (5% of microcontrollers).
- Battery can be removed, it is closed to microSD slot

Chapter 23

Documentation

Goal:

Creating document and exporting by Application,
Device & User Interface as report or as using them
by other products such as Vijeodesigner

Available Resources

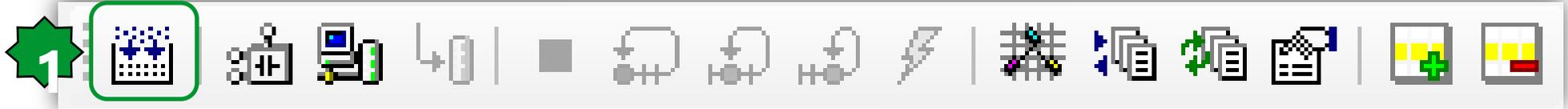
EVOLUTION

CPU	72 MHz, 32MB RAM
Available memory for Application	1 MByte
Available memory for User Interface	1.5 MByte
FLASH memory data	128 MByte
RAM memory - automatic mapping	512 KByte
RAM memory - Modbus mapping	5000 word
EEPROM variables	4000 word

SMART

CPU	14.7 MHz
Available memory for Application	190 KByte
RAM memory - automatic mapping	2300 Byte
RAM memory - Modbus mapping	1024 Byte
EEPROM variables	1024 Byte

Used Resources



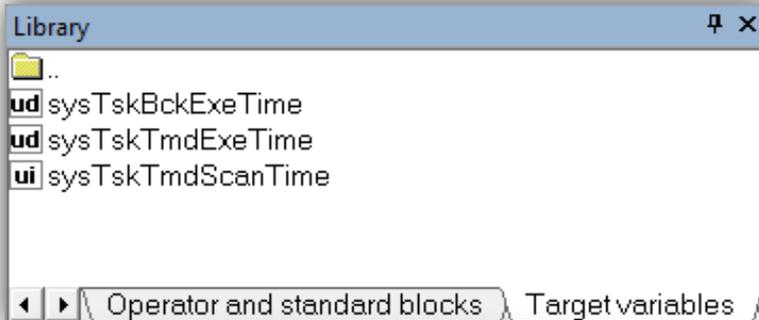
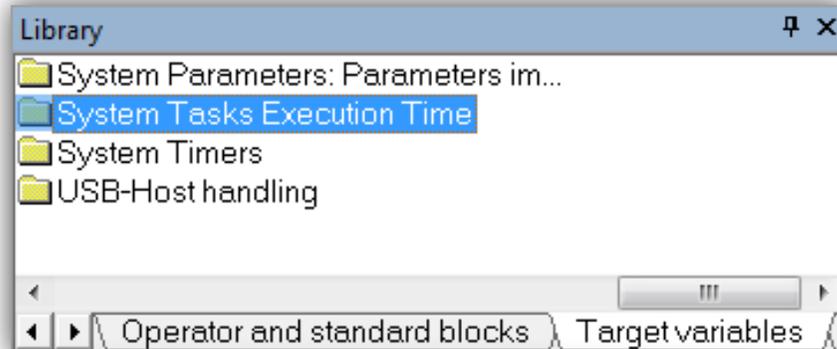
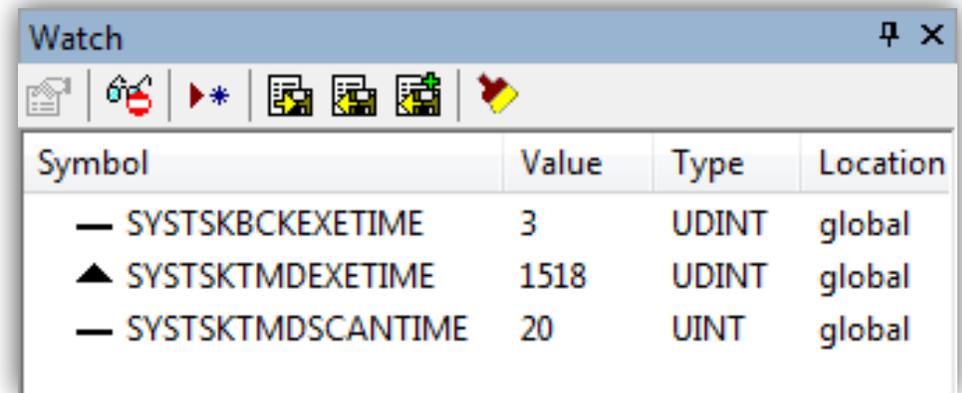
```
Output
```

Code size:	4C0h	(	1 KByte)
Free code space:	2F140h	(	188 KByte)
Data space:	800h	(	2 KByte)
Free data space:	7E6h	(	1 KByte)

0 warnings, 0 errors.

Build Find in project Debug Resources

System Task Execution Time

Symbol	Value	Type	Location
— SYSTSKBCKEXETIME	3	UDINT	global
▲ SYSTSKTMDEXETIME	1518	UDINT	global
— SYSTSKTMDSCANTIME	20	UINT	global

Ap View object properties

Name: sysTskBckExeTime

Type: UDINT

Address: %MD3.0

Description:
System Background's Task Execution Time (us)

Ap View object properties

Name: sysTskTmdExeTime

Type: UDINT

Address: %MD4.0

Description:
System Timed's Task Execution Time (us)

Ap View object properties

Name: sysTskTmdScanTime

Type: UINT

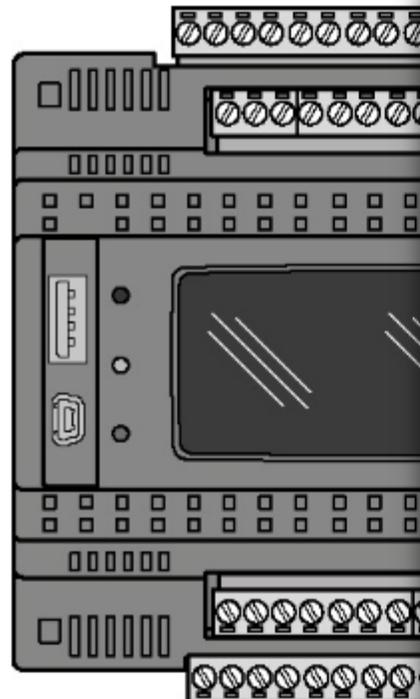
Address: %MW3002.0

Description:
System Timed's Task Scan Time (ms)

Application - Export to Excel...

Resources

- Configuration
 - FreeEvolution EVD**
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menus
 - Setting Menu
 - I/O Mapping
 - Local
 - Field
 - Alarms
 - Web Site
 - Exercise_Visualization
- BACnet Objects
 - Device
 - Analog Value Objects
 - Binary Value Objects
 - Calendar Objects
 - Multi State Value Objects
 - Schedule Objects
 - Notification Class Objects



FreeEvolution Configuration

Open

Look in: ExportFilters

Name	Date modified	Type
Alarms_CSV.xslt	14/05/2014 1:59 PM	XSLT File
Enums_CSV.xslt	14/05/2014 1:59 PM	XSLT File
FieldVars_CSV.xslt	14/05/2014 1:59 PM	XSLT File
IOMappings_CSV.xslt	14/05/2014 1:59 PM	XSLT File
Menus_CSV.xslt	14/05/2014 1:59 PM	XSLT File
Parameters_CSV.xslt	14/05/2014 1:59 PM	XSLT File
StatusVariables_CSV.xslt	14/05/2014 1:59 PM	XSLT File

File name: FieldVars_CSV.xslt

Files of type: XSLT files

Open Cancel

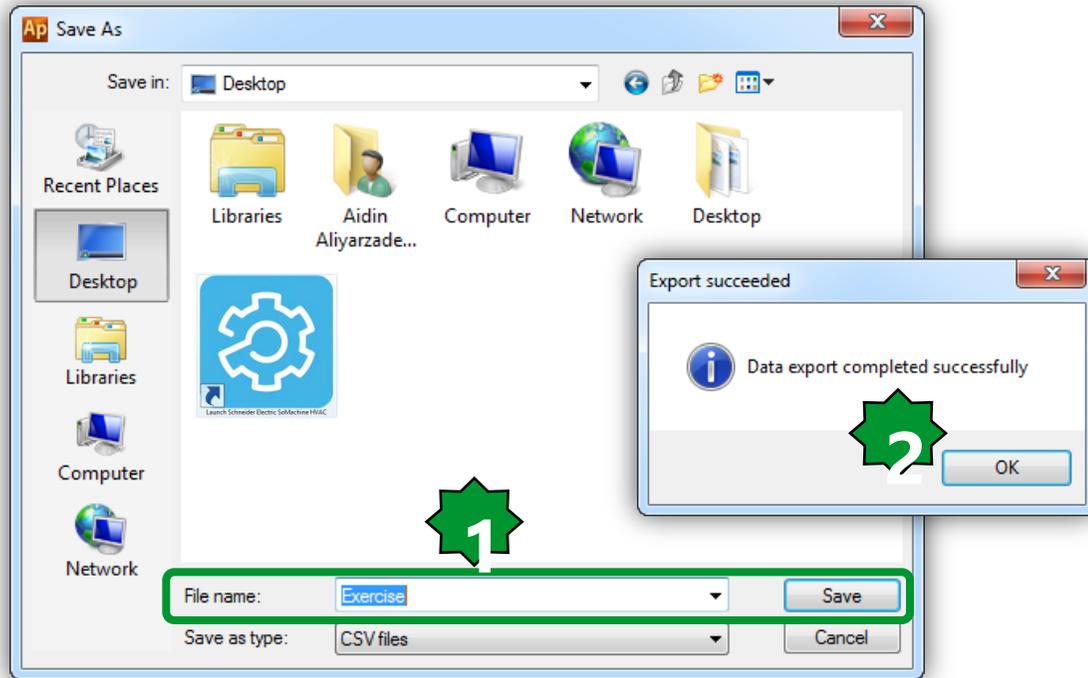
Execution time

Set execution time:

Data export

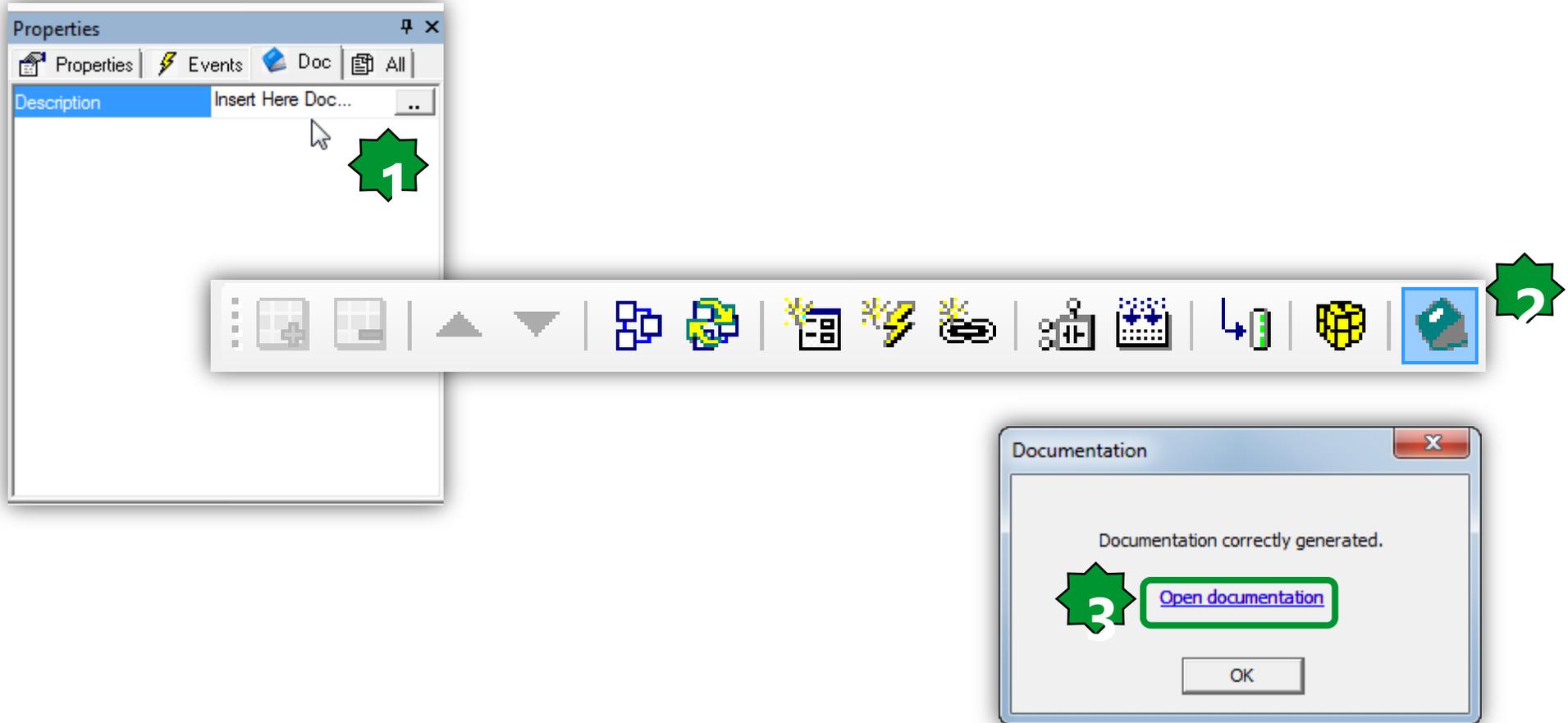
Select XSLT export filter: Browse Export

... Export to Excel



Name	Type	In/Out	Description
AI1_E	INT	in	
DI1_E	BOOL	in	
DI2_E	BOOL	in	
DO1_E	BOOL	out	
DO2_E	BOOL	out	

User Interface - Documentation



User Interface - Documentation



User Interface Project: HMI_M171P

Last update: 13/05/2015 - 13:54:37

Project infos:

Number of pages: 10

Languages:

- German
- BaseLanguage

Start page: Main_Page

Page Infos:

TextObjects

```
Text Objects
Big Text
Small Text
Language:English
Text:Hello      Close
```

Edits: 1

Edit_6

Min: 0

Max: 1

Var: @M171P.Language_Switch

Main_Page

```
Main Page
Text Edit Image ATU21
Dyn. Alarm Animation
Dyn. Set Slider Sys
```

EditObjects

```
Edit Objects
Ambiant Temp: 0.0 °C
Set Point: 0.0 °C
Delta: 0.0 °C
Backlight: Off Close
```

Edits: 4

Edit_8

Min: *

Max: *

Var: @M171P.Ambiant_Temp

Edit_9

Min: 150

Max: 300

Var: @M171P.SetPoint

Edit_10

Min: 5

Max: 50

Var: @M171P.Differentiation

Edit_12

Min: 0

Max: 2

Var: sysBacklight



Device - Export to Text file...

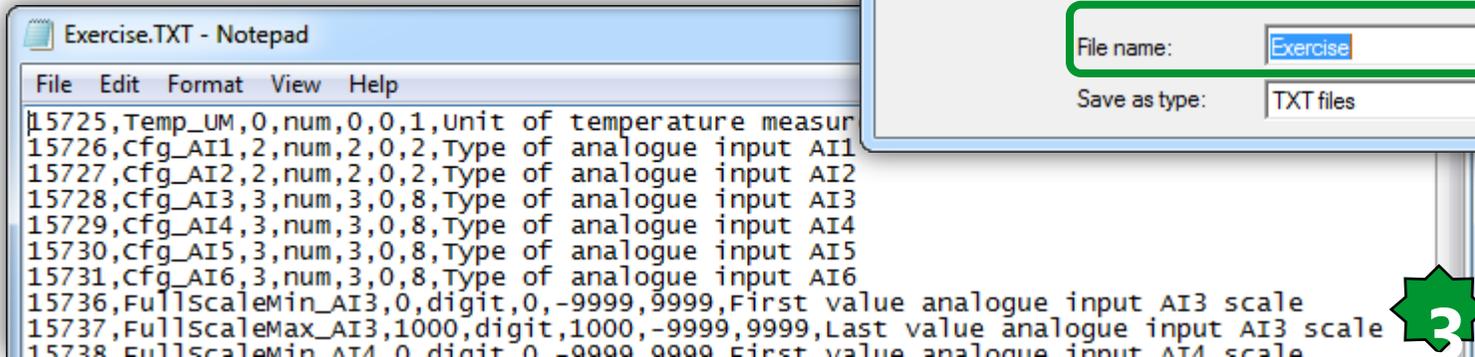
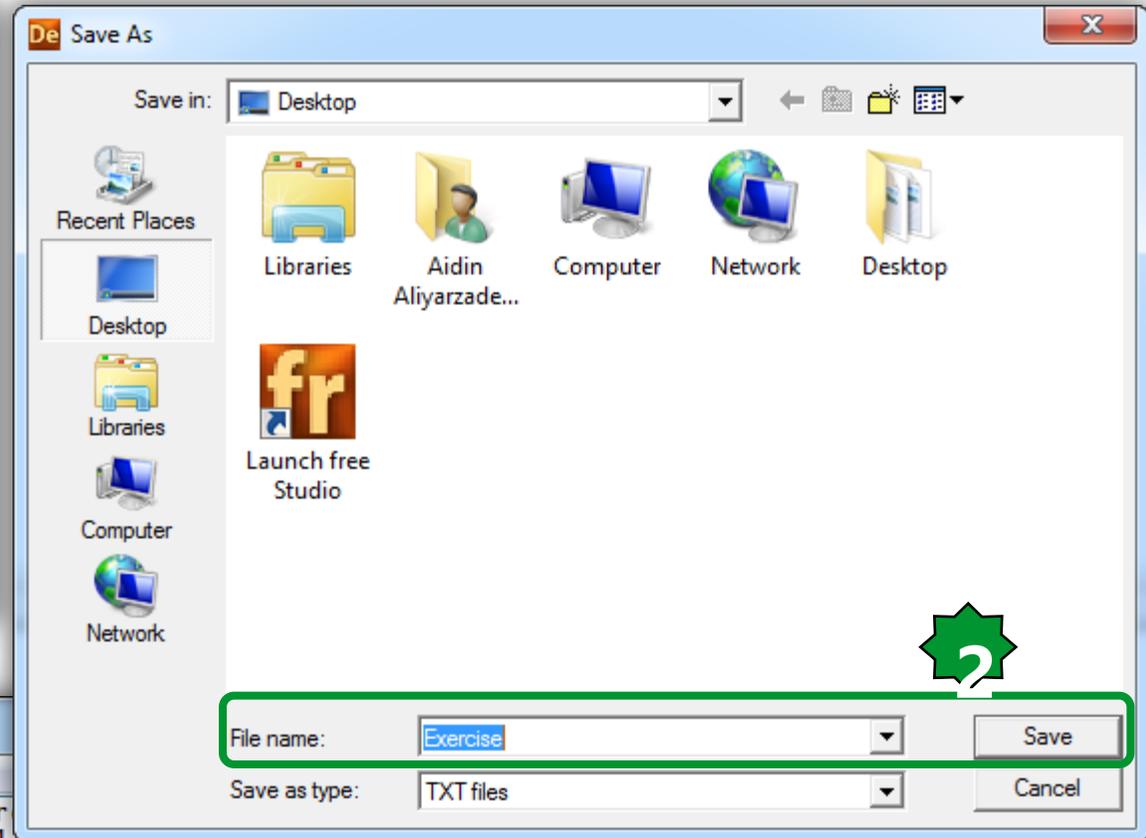
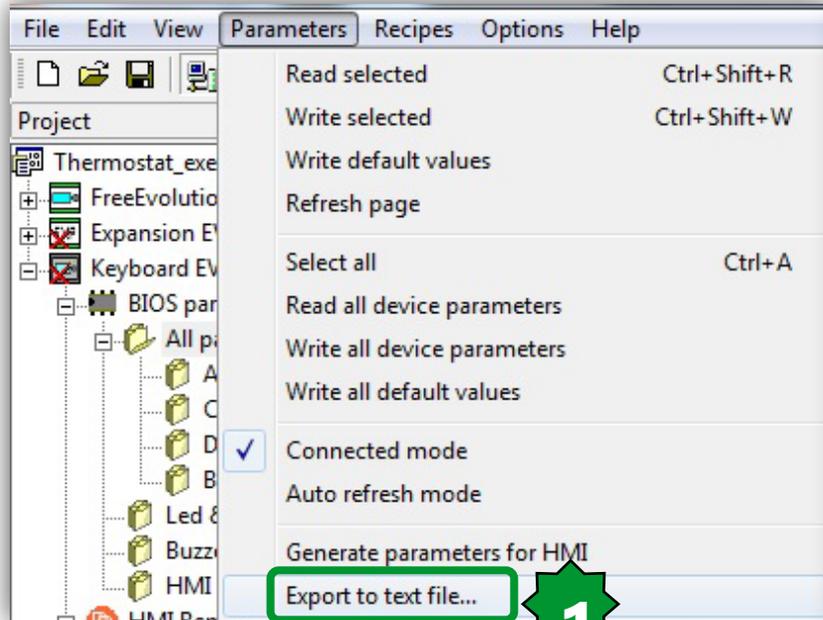
Project

- PLC
 - FreeEvolution EVD
 - BIOS parameters
 - All parameters
 - Acknowledgement
 - Calibration AI
 - Calibration AO
 - Analogue Inputs**
 - Analogue Outputs V/I
 - RS485 On Board
 - CAN On Board
 - RS485 Plugin Passive
 - CAN Plugin Passive
 - RS232 Plugin Passive
 - Ethernet Plugin Passive
 - Modem
 - Display
 - BACnet
 - I/O Values
 - Dip Switch Values
 - Led & Backlight Values
 - System CLock Values
 - Protection Password
 - Application
 - HMI
 - HMI Remote
 - Cfg files
 - Recipes

Select a Table

Address	Name	Value	Um	Default	Min	Max	Description
15725	Temp_UM	0=°C	num	0=°C	0	1	Unit of temperature measurement
15726	Cfg_AI1	2=NTC(103AT	num	2=NTC(103AT	0	2	Type of analogue input AI1
15727	Cfg_AI2	2=NTC(103AT	num	2=NTC(103AT	0	2	Type of analogue input AI2
15728	Cfg_AI3	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI3
15729	Cfg_AI4	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI4
15730	Cfg_AI5	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI5
15731	Cfg_AI6	3=4÷20mA	num	3=4÷20mA	0	8	Type of analogue input AI6
15736	FullScaleMin_AI3	0	digit	0	-9999	9999	First value analogue input AI3 scale
15737	FullScaleMax_AI3	1000	digit	1000	-9999	9999	Last value analogue input AI3 scale
15738	FullScaleMin_AI4	0	digit	0	-9999	9999	First value analogue input AI4 scale
15739	FullScaleMax_AI4	1000	digit	1000	-9999	9999	Last value analogue input AI4 scale
15740	FullScaleMin_AI5	0	digit	0	-9999	9999	First value analogue input AI5 scale
15741	FullScaleMax_AI5	1000	digit	1000	-9999	9999	Last value analogue input AI5 scale
15742	FullScaleMin_AI6	0	digit	0	-9999	9999	First value analogue input AI6 scale
15743	FullScaleMax_AI6	1000	digit	1000	-9999	9999	Last value analogue input AI6 scale
15748	Calibration_AI1	0	°C/10,°F/10	0	-180	180	Analogue input AI1 differential
15749	Calibration_AI2	0	°C/10,°F/10	0	-180	180	Analogue input AI2 differential
15750	Calibration_AI3	0	digit	0	-1000	1000	Analogue input AI3 differential
15751	Calibration_AI4	0	digit	0	-1000	1000	Analogue input AI4 differential
15752	Calibration_AI5	0	digit	0	-1000	1000	Analogue input AI5 differential
15753	Calibration_AI6	0	digit	0	-1000	1000	Analogue input AI6 differential

Device - Export to Text file...



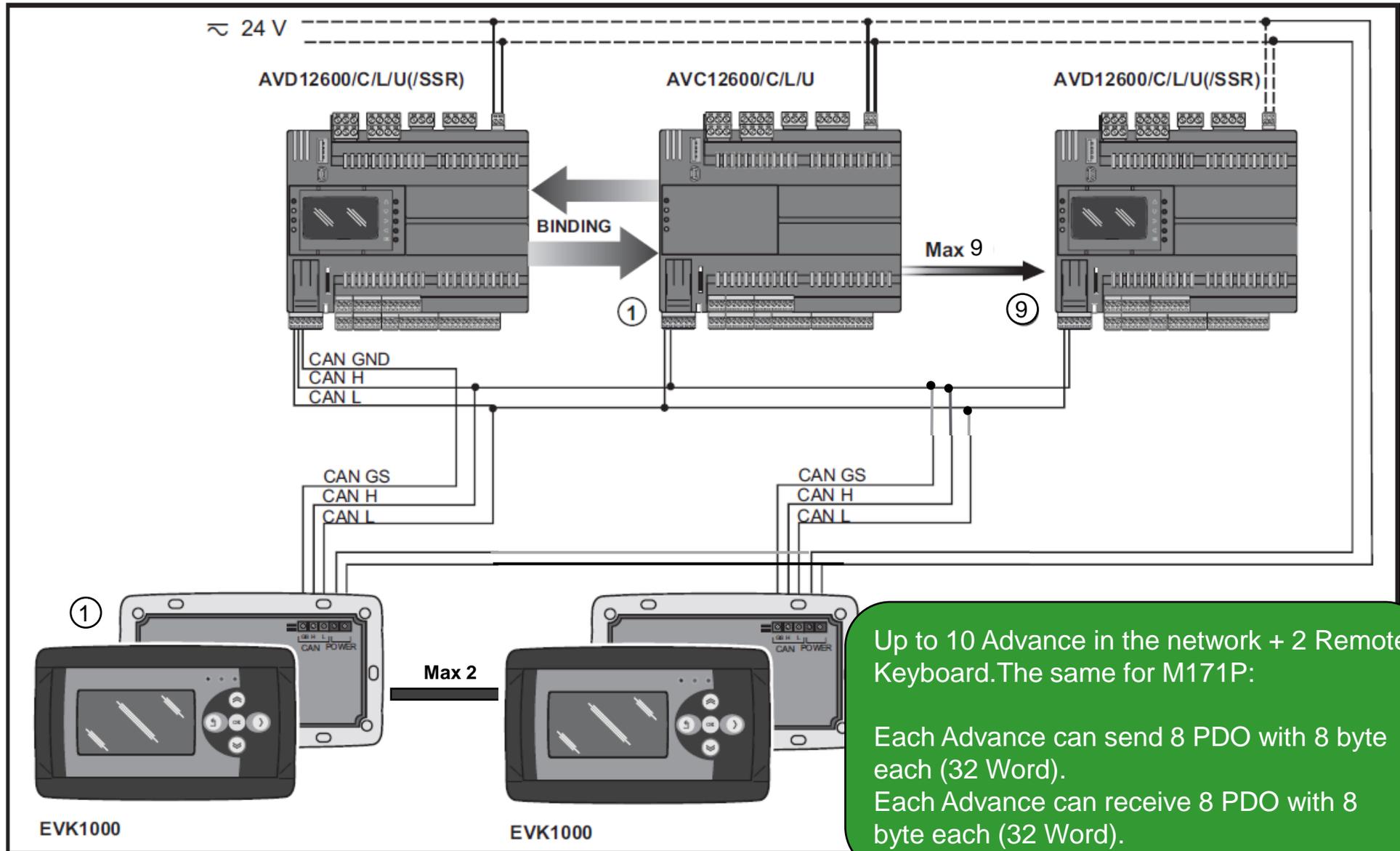
Chapter 24

CAN Binding

Goal:

Reading an Integer value in both directions PLC1 ◀▶ PLC2

CAN Binding architecture



Can Bus wiring recommendations



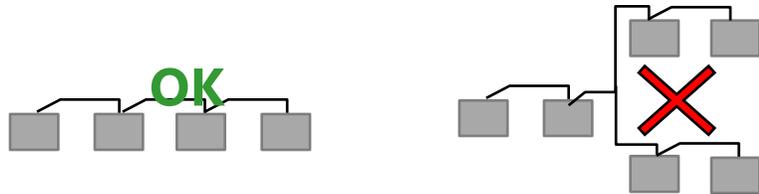
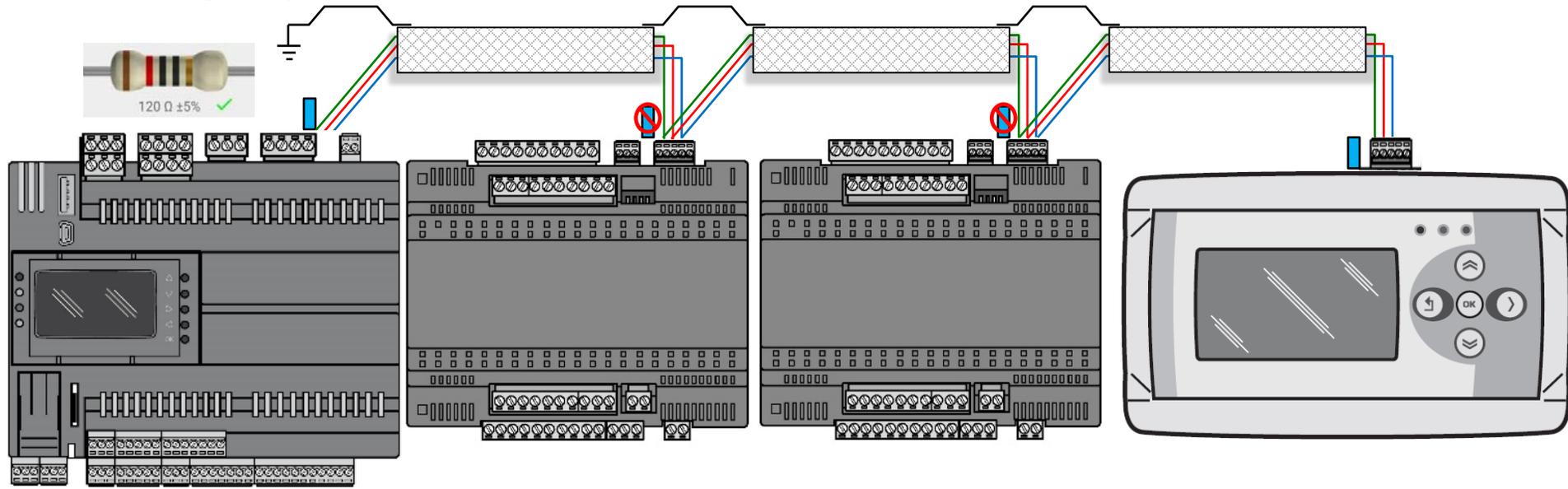
Use a shielded and "twisted pair" cable with two 0.5 mm² section conductors (AWG 22), plus braid such as Belden cable reference 3105A (characteristic impedance 120 Ω) with PVC sleeve, nominal capacity between conductors 36 pF/m, nominal capacity between conductor and shielding 68 pF/m.

Kb/s (kbaud)	On-board CAN (m) - FREE Advance	CAN Communication Module (m)
50	1000	1000
125	500	500
250	200	250
500	30	60

CAN Termination Resistor & Jumper



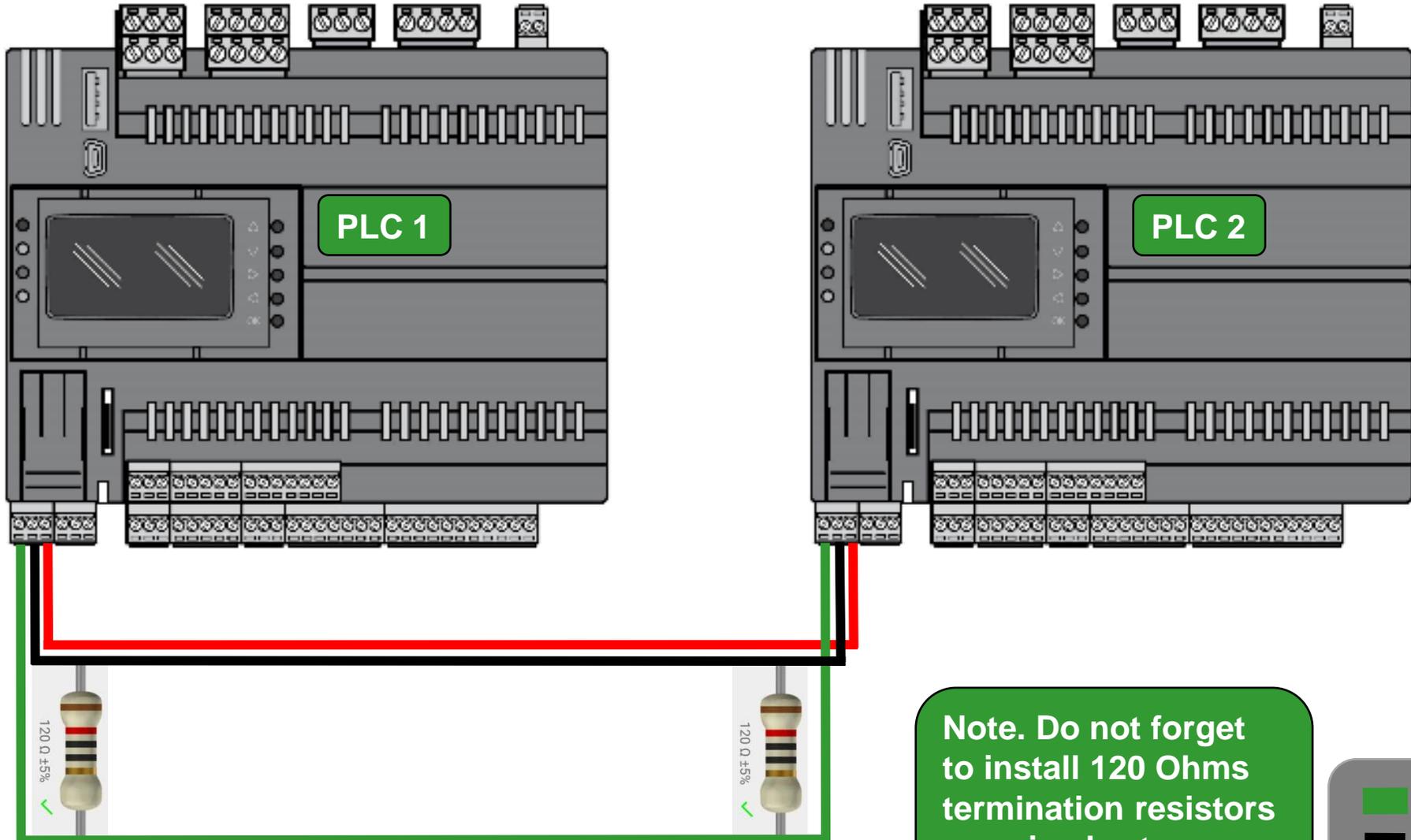
- CAN bus jumper mounted
- ⊘ CAN bus jumper NOT mounted



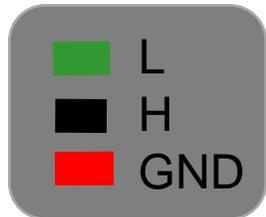
Note: Star connection are not allowed

Note: the termination shall be placed at the beginning and at the end of the Can Bus

CAN Binding Hardware Wiring



Note. Do not forget to install 120 Ohms termination resistors even in short wire/cable distance.



CAN Configuration



Advance_Exercise.CON - Eliwell Free Studio Connection

File Edit View Tools Options Help

Project

- Advance_Exercise
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote for EVK and EVP
 - CAN CANopen**
 - Binding**
 - RS485-1
 - RS485-2
 - Ethernet
 - Plugins

CANopen Configuration

Mode

- Not used
- Master (for field)
- Slave (for binding)

Baud rate

- 500 Kb/s
- 250 Kb/s
- 125 Kb/s
- 50 Kb/s

Slave Settings

Node ID (1..41): ?

Network: ▾

Catalog

Device name	Version	Description
Binding	1	Binding

3

3. Drag & Drop it to the CANopen link

Note:
As CANopen port configured as Binding, Expansion module/s or Remote Keyboard/s connection/s is/are not possible any more.

4

Add 2nd controller & applications

Project
Advance_Exercise
FreeAdvance_1
PLC
HMI
HMI Remote for EVK and EVP
CANopen
RS485-1
RS485-2
Ethernet
Plugins
FreeAdvance_2
PLC
HMI
HMI Remote for EVK and EVP
CANopen
Binding
RS485-1
RS485-2
Ethernet
Plugins

Project
Advance_Exercise
FreeAdvance_1
PLC
HMI
HMI Remote for EVK and EVP
CANopen
RS485-1
RS485-2
Ethernet
Plugins
FreeAdvance_2
PLC
HMI
HMI Remote for EVK and EVP
CANopen
Binding
RS485-1
RS485-2
Ethernet
Plugins

Note. Only one connection link is needed.
5 & 8. Automatically opens related Application tool

EWConnection
Application project will be created with name:
PLC_1
OK Cancel

EWConnection
Application project will be created with name:
PLC_2
OK Cancel

8

5

3

6

1

2

Project foldering



CON File (1)



CANBinding.CON

File folder (2)



PLC1 Application



PLC2 Application



PLC1 User Interface



PLC2 User Interface

Only one connection link for both controllers is needed.



Network Definition

PLC 1

PLC 2

CANopen Configuration

Mode

- Not used
- Master (for field)
- Slave (for binding)

Baud rate

- 500 Kb/s
- 250 Kb/s
- 125 Kb/s
- 50 Kb/s

Slave Settings

Node ID (1..41): ?

Network: ?



CANopen Configuration

Mode

- Not used
- Master (for field)
- Slave (for binding)

Baud rate

- 500 Kb/s
- 250 Kb/s
- 125 Kb/s
- 50 Kb/s

Slave Settings

Node ID (1..41): ?

Network:



CANopen Configuration

Mode

- Not used
- Master (for field)
- Slave (for binding)

Baud rate

- 500 Kb/s
- 250 Kb/s
- 125 Kb/s
- 50 Kb/s

Slave Settings

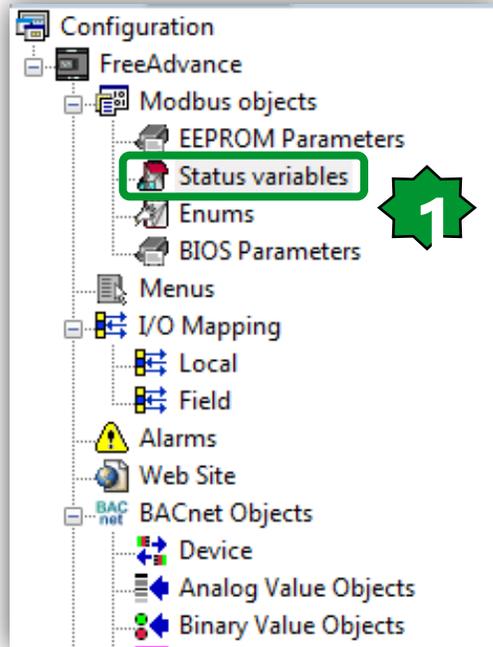
Node ID (1..41): ?

Network:



They should communicate in the same network

PLC 1, Status variable definition



Status Variables

 Add
  Remove
  Recalc

#	Address	Name	Device type	Application type	Default value	Unit	Format	AccessLevel	Read only
1	8966	NTC1_PLC1	Signed 16-bit	INT		°C	XXX.Y	Always visible	False
2	8967	NTC2_PLC2_CANBinding	Signed 16-bit	INT		°C	XXX.Y	Always visible	False



PLC 1, I/O mapping

Resources

- Configuration
 - FreeAdvance
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Local** (1)
 - Field
 - Alarms
 - Web Site
- BACnet
 - Device
 - Analog Value Objects
 - Binary Value Objects
 - Calendar Objects
 - Multi State Value Objects
 - Schedule Objects
 - Notification Class Objects
 - LON Profile

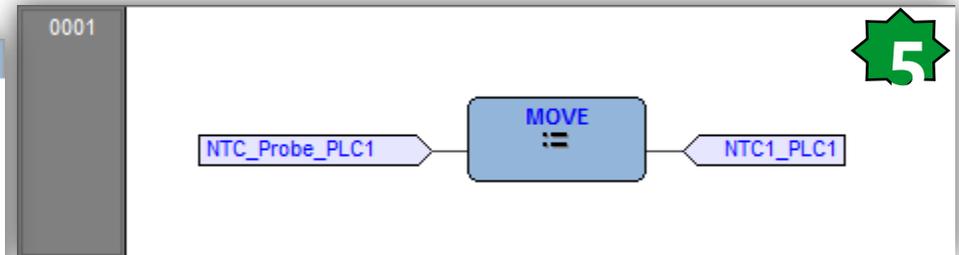
Project Resources

Local I/O Mapping

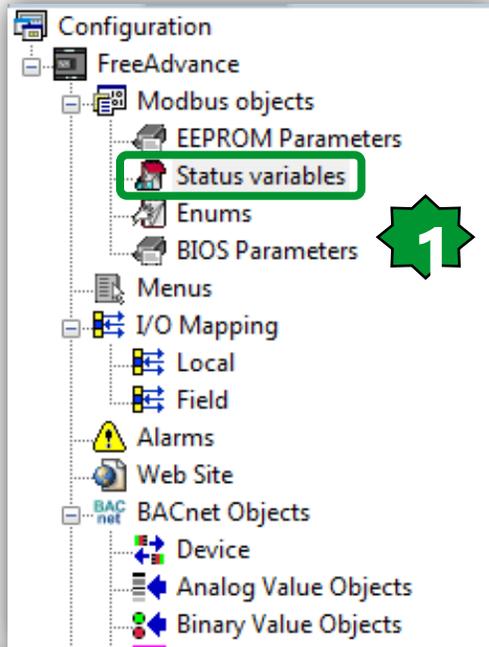
#	Name	Variable	Type	Description
1	AIL1	NTC_Probe_PLC1	INT	AIL1 analogue input
2	AIL2		INT	AIL2 analogue input
3	AIL3		INT	AIL3 analogue input
4	AIL4		INT	AIL4 analogue input
5	AIL5		INT	AIL5 analogue input

Project

- PLC 1 Project
 - CAN_Binding** (3)
 - main
 - Global vars
 - Aux Variables
 - Tasks
 - Timed
 - CAN_Binding** (4)
 - Background
 - Boot
 - Init



PLC 2, Status variable definition



Status Variables

 Add
  Remove
  Recalc

#	Address	Name	Device type	Application type	Default value	Unit	Format	AccessLevel	Read only
1	8966	NTC2_PLC2	Signed 16-bit	INT		°C	XXX.Y	Always visible	False
2	8967	NTC1_PLC1_CANBinding	Signed 16-bit	INT		°C	XXX.Y	Always visible	False



PLC 2, I/O mapping

Resources

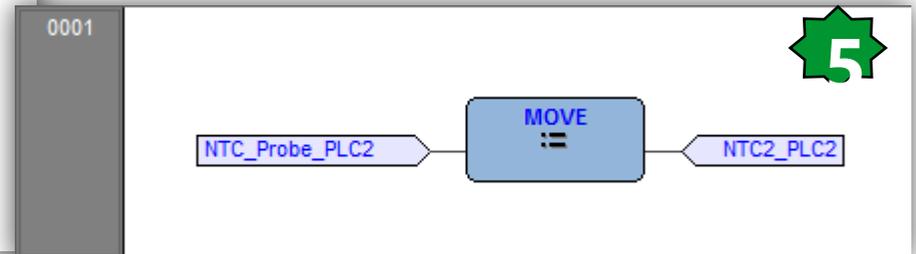
- Configuration
 - FreeAdvance
 - Modbus objects
 - EEPROM Parameters
 - Status variables
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Local **1**
 - Field
 - Alarms
 - Web Site
 - BACnet Objects
 - Device
 - Analog Value Objects
 - Binary Value Objects
 - Calendar Objects
 - Multi State Value Objects
 - Schedule Objects
 - Notification Class Objects
 - LON Profile

Local I/O Mapping

#	Name	Variable	Type	Description
1	AIL1	NTC_Probe_PLC2	INT	AIL1 analogue input
2	AIL2		INT	AIL2 analogue input
3	AIL3		INT	AIL3 analogue input
4	AIL4		INT	AIL4 analogue input
5	AIL5		INT	AIL5 analogue input

Project

- PLC 2 Project
 - P CAN Binding **3**
 - P main
 - Global vars
 - Aux Variables
 - Tasks
 - Timed
 - P CAN_Binding **4**
 - Background
 - Boot
 - Init



PLC 1, Assigning Status Variables

Project

- FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - Binding
 - RS485-1
 - RS485-2
 - Ethernet
 - Plugins
- FreeAdvance_2
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - Binding
 - RS485-1
 - RS485-2
 - Ethernet
 - Plugins

Binding Configuration

Add Remove

Source Device	Source Parameter	Address	Type	Dest Parameter	Address	Type	Period
FreeAdvance_2	NTC2_PLC2	8960	INT	NTC2_PLC2_CANBinding	8961	INT	500

Binding Vars

Filter:

- FreeAdvance_2: 8960 NTC2_PLC2 (INT)
- FreeAdvance_2: 8961 NTC1_PLC1_CANBinding (INT)

Binding Configuration

Add Remove

Source Device	Source Parameter	Address	Type	Dest Parameter	Address	Type	Period
FreeAdvance_2	NTC2_PLC2	8960	INT	<div style="border: 1px solid gray; padding: 2px;"> NTC1_PLC1 NTC2_PLC2_CANBinding </div>	0		500

PLC 2, Assigning Status Variables

Project

- Advance_Exercise
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - Binding
 - RS485-1
 - RS485-2
 - Ethernet
 - Plugins
 - FreeAdvance_2
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - Binding
 - RS485-1
 - RS485-2
 - Ethernet
 - Plugins

Binding Configuration

Add
 Remove

Source Device	Source Parameter	Address	Type	Dest Parameter	Address	Type	Period
FreeAdvance_1	NTC1_PLC1	8960	INT	NTC1_PLC1_CANbind	8961	INT	500

Binding Vars

Filter:

- FreeAdvance_1: 8960 NTC1_PLC1 (INT)
- FreeAdvance_1: 8961 NTC2_PLC2_CANBinding (INT)

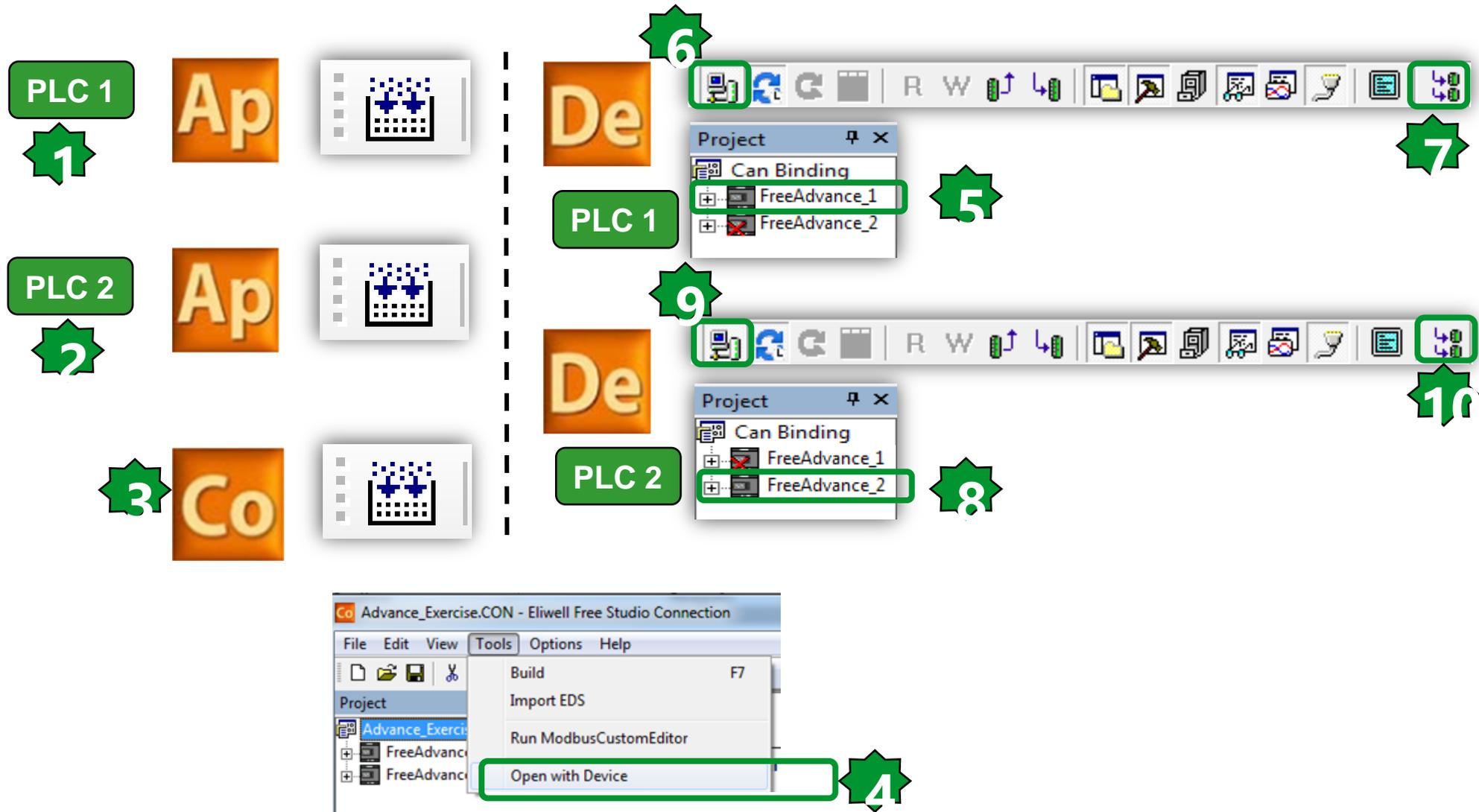
Binding Configuration

Add
 Remove

Source Device	Source Parameter	Address	Type	Dest Parameter	Address	Type	Period
FreeAdvance_1	NTC1_PLC1	8960	INT		0		500

NTC2_PLC2
 NTC1_PLC1_CANbind

Project Compilation



PLC 1, On-Line Debugging Mode

Project

- PLC_1 Project
 - P CAN_Binding
 - P main
 - Global vars
 - Aux Variables
 - Tasks
 - Timed
 - CAN_Binding**
 - Background
 - Boot
 - Init

1

0001

```

    graph LR
      NTC1[267 NTC_Probe_PLC1] --> MOVE[MOVE :=]
      MOVE --> NTC2[NTC1_PLC1 267]
  
```

2

Project

- PLC_1 Project
 - P CAN_Binding
 - Global vars**
 - Aux Variables
 - Global shared
 - Mappings
 - Variables
 - NTC1_PLC1
 - NTC2_PLC2_CANBinding**
 - Tasks

3

Watch

Symbol	Value	Type	Location
— NTC_PROBE_PLC1	267	INT	global
— NTC2_PLC2_CANBINDING	272	INT	global

4

Library

- ..
- us sysCANopenNodeStatus
- sysPeripheralStatus**

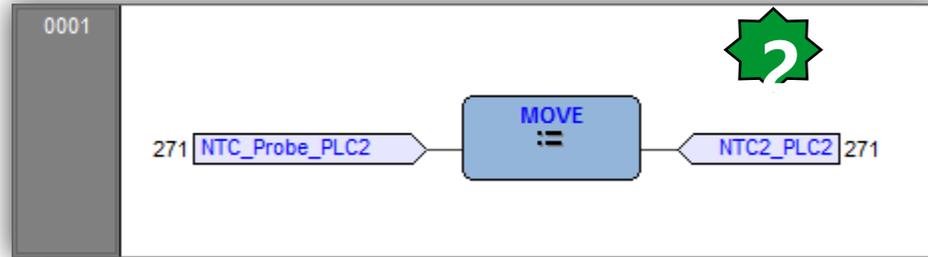
Operator and standard blocks Target variables

5

Note. Peripheral vectors are only used for expansion modules monitoring not CAN Binding

PLC 2, On-Line Debugging Mode

Project Explorer showing the structure of the PLC_2 Project. The CAN_Binding task is highlighted with a green box and a green arrow labeled '1'.



Project Explorer showing the variable declaration for NTC1_PLC1_CANbinding. A green box highlights the variable name and a green arrow labeled '3' points to it.

Symbol	Value	Type	Location
— NTC1_PLC1_CANBINDING	267	INT	global
— NTC_PROBE_PLC2	271	INT	global

Library window showing the selection of sysPeripheralStatus. A green arrow labeled '5' points to the variable name.

Note. Peripheral vectors are only used for expansion modules monitoring not CAN Binding

Chapter 25

Modbus Master Communication via iEM3155 Energy Meter

Goals:

Connection Energy Meter to the ADVANCE via
Modbus serial line

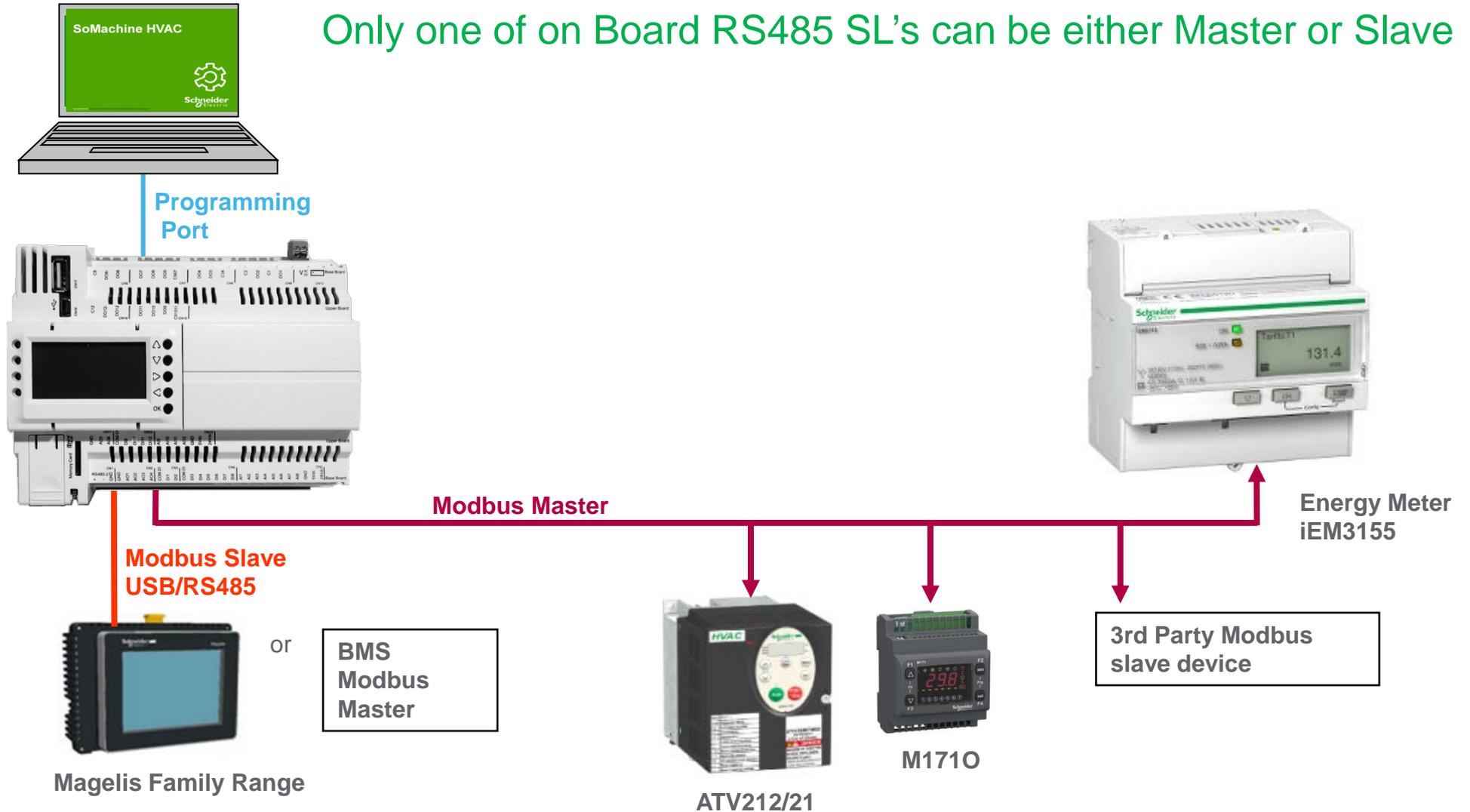
Read Energy, Power, Voltage, Current &
Frequency values

FLOAT32 conversion to UINT

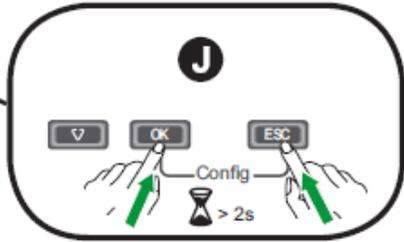
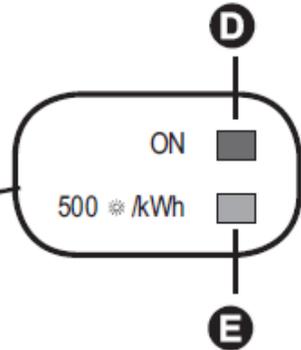
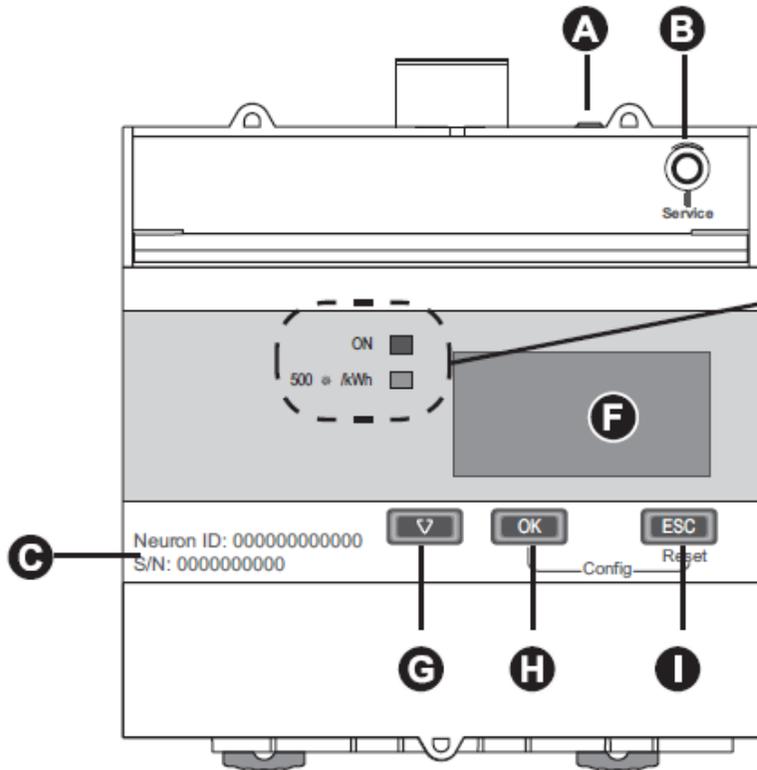
RS485 communication Error Detection

Machines architecture

Only one of on Board RS485 SL's can be either Master or Slave

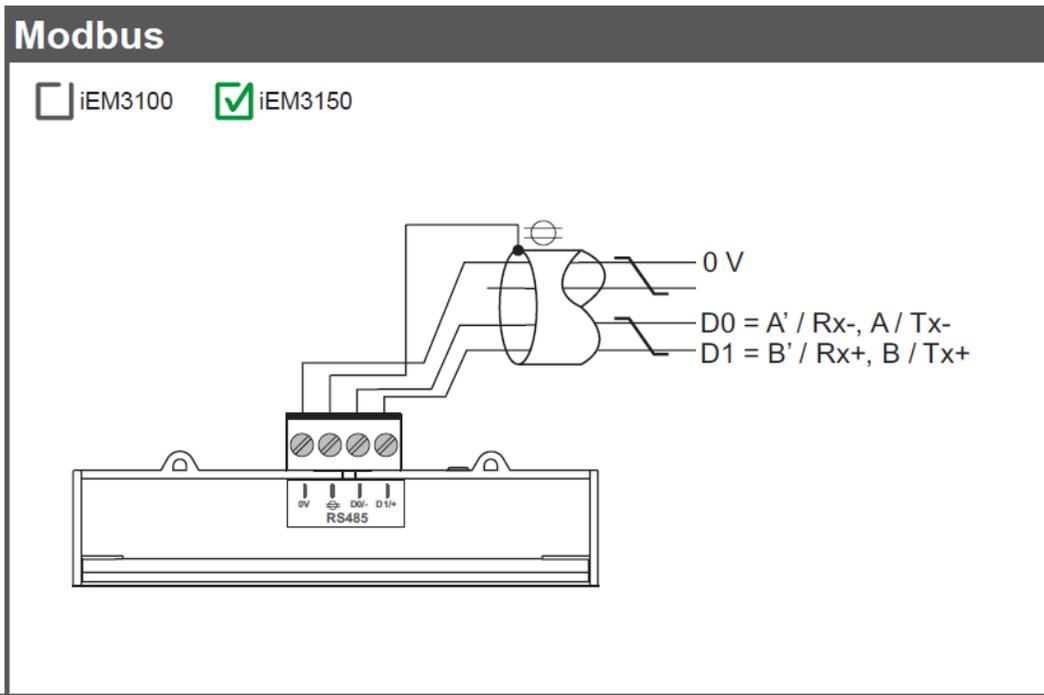


Display overview



- A** Communications LED
- B** LonWorks service pin (iEM3175)
- C** LonWorks NeuronID / M-Bus secondary ID
- D** Status LED: on / off / error
- E** Energy pulse LED (500 flashes / kWh)
- F** Display for measurement and configuration
- G** Scroll through screens or a list of options
- H** Confirm entry or access more screens
- I** Cancel and go back to previous screen
- J** Press and hold **OK + ESC** to enter configuration mode
- K** Measurement / Parameter
- L** Ea / Er = active / reactive energy
- M** Value / Setting
- N** Active tariff
- O** Icon indicating date / time are not set (iEM3110)
- P** Date and time
- Q** Units
- R** Configuration mode icon
- S** Indicates that the setting impacts Multi Tariffs

Modbus Wiring & Status LED



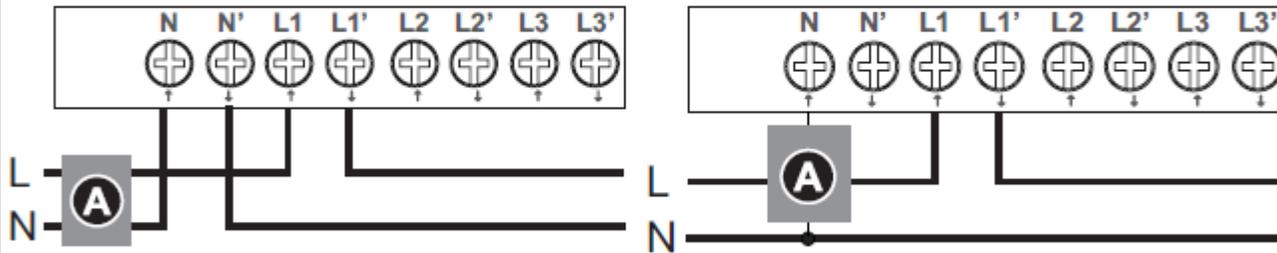
A Modbus	
	en
	Off: inactive
	Flashing: active

Power Wiring/Single Phase...

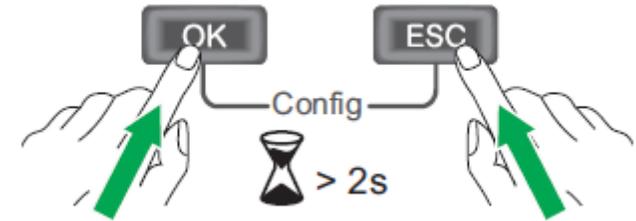


1PH

1PH2W L-N



≤ 277 V L-N



Wiring

Type

Frequency

Frequency

Date

Date

Time

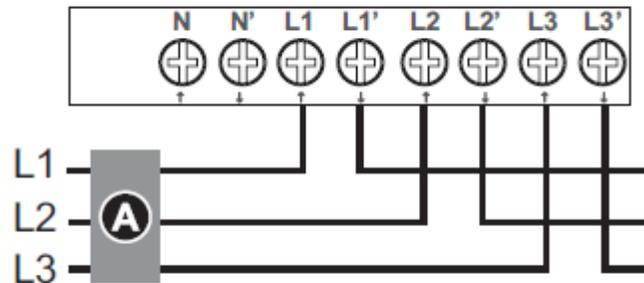
Time

Section	Parameter	Options	Description
Wiring	Type	3PH4W 1PH2W L-N 1PH2W L-L 1PH3W L-L-N 3PH3W 1PH4W Multi L-N	Select the power system type the meter is wired to.

Power Wiring/Three Phases

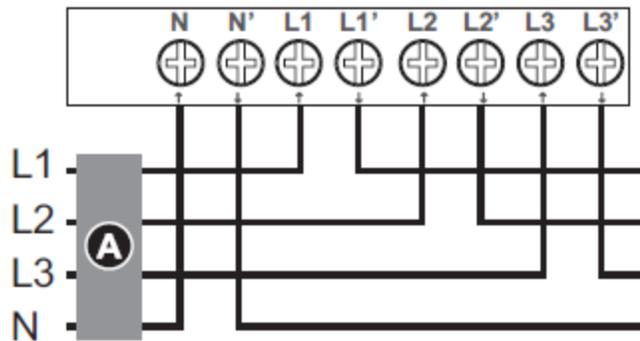


3PH3W



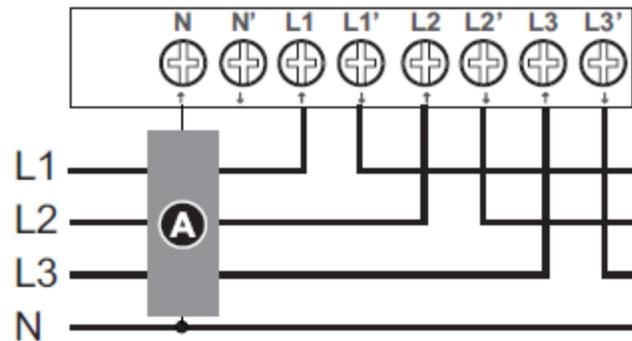
$\leq 480 \text{ V L-L}$

3PH4W

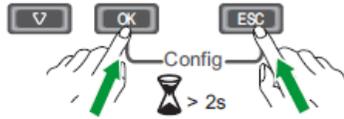


$\leq 277 \text{ V L-N}$

$\leq 480 \text{ V L-L}$



Basic Configurations/Clock settings



Enter configuration mode and configure basic metering, communications, and security settings (see section 7 for instructions).

Settings	Possible values
Baud rate	9600 Baud 19 200 Baud 38 400 Baud
Parity	Odd Even None
Address	1-247

These instructions only apply on initial power up.

Wiring → Type

Frequency → Frequency

A Communication → MAC Addr., Baud Rate, Device ID

B Communication → Slave Address, Baud Rate, Parity

C Communication → Primary Addr., Baud Rate

- A** iEM3135
- B** iEM3155
- C** iEM3165
- D** iEM3135 / iEM3155 / iEM3165 / iEM3175
- E** Default password = 0010

1
19200
Even

Schneider Electric → OK → Date & Time Set? → OK → ESC

Password 0010 → OK → Date 01-Jan-2000 DD-MM-YYYY → OK

D Com.Protection → Com.Protection → Enable / Disable

E Password → Password

Time 00:00 hh:mm → OK → Date & Time Save Settings? → OK → Total Active E 1234.5 kWh

Meter Data...



Energy values – 32-bit floating point

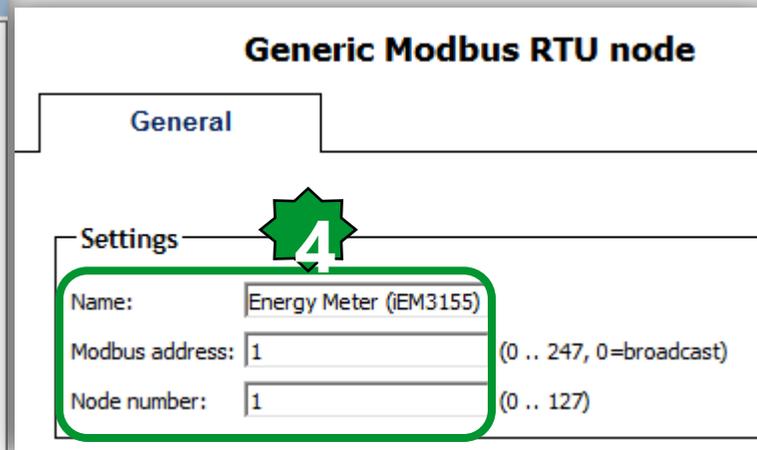
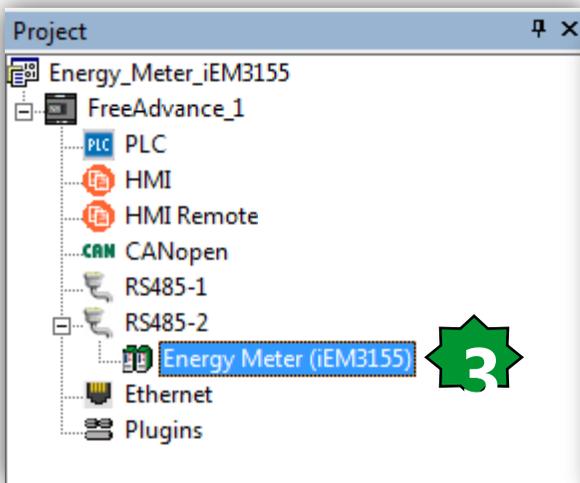
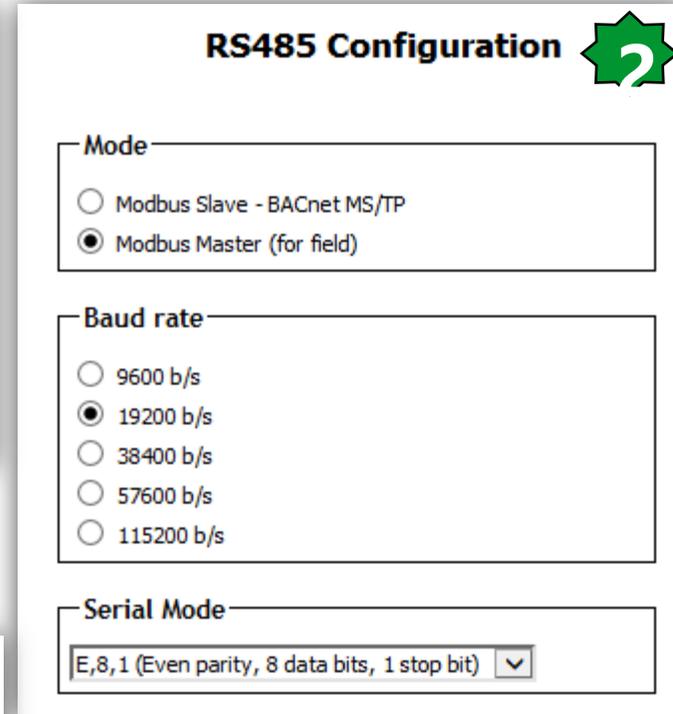
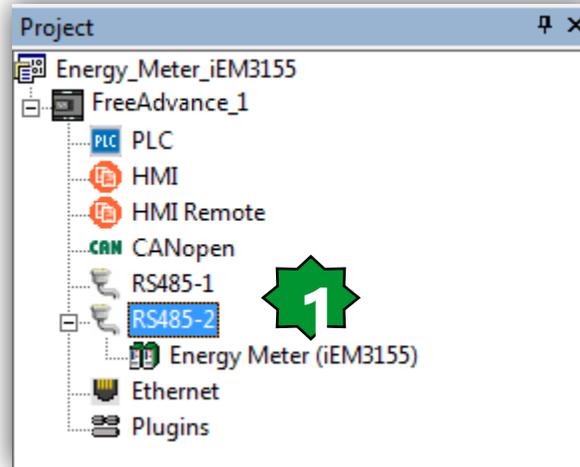
Register Address	Action (R/W/WC)	Size	Type	Units	Description
Total Energy (cannot be reset)					
45100	R	2	Float32	Wh	Total Active Energy Import

Meter Data

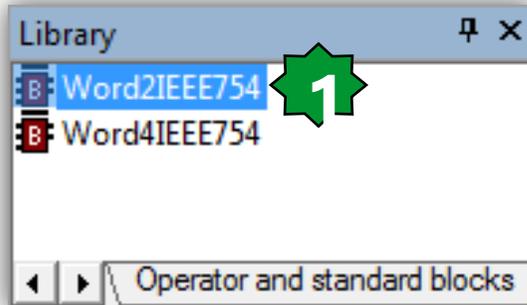
Register Address	Action (R/W/WC)	Size	Type	Units	Description
Current					
3000	R	2	Float32	A	I1: phase 1 current
3002	R	2	Float32	A	I2: phase 2 current
3004	R	2	Float32	A	I3: phase 3 current
3010	R	2	Float32	A	Current Avg
Voltage					
3020	R	2	Float32	V	Voltage L1-L2
3022	R	2	Float32	V	Voltage L2-L3
3024	R	2	Float32	V	Voltage L3-L1
3026	R	2	Float32	V	Voltage L-L Avg
3028	R	2	Float32	V	Voltage L1-N
3030	R	2	Float32	V	Voltage L2-N
3032	R	2	Float32	V	Voltage L3-N
3036	R	2	Float32	V	Voltage L-N Avg
Power					
3054	R	2	Float32	kW	Active Power Phase 1
3056	R	2	Float32	kW	Active Power Phase 2
3058	R	2	Float32	kW	Active Power Phase 3
3060	R	2	Float32	kW	Total Active Power
3068	R	2	Float32	kVAR	Total Reactive Power Not applicable for iEM3150 / iEM3250 / iEM3350
3076	R	2	Float32	kVA	Total Apparent Power Not applicable for iEM3150 / iEM3250 / iEM3350
Power Factor					
3084	R	2	Float32	-	Total Power Factor: -2 < PF < -1 = Quad 2, active power negative, capacitive -1 < PF < 0 = Quad 3, active power negative, inductive 0 < PF < 1 = Quad 1, active power positive, inductive 1 < PF < 2 = Quad 4, active power positive, capacitive
Frequency					
3110	R	2	Float32	Hz	Frequency

RS485 Configuration

1. Configure the desired Modbus Port.
2. Set the Modbus properties aligned with Master
3. Drag & Drop generic Modbus link and rename it
4. Set the Modbus address and related node number for further monitoring/debugging



Link IEEE754 library



1. Used for conversion
Word2IEEE754:
Converts 2 words to Real

Ap View object properties

Name: Word2IEEE754

Type: Function block

Language Type: ST

Description:
Conversion of 2 Word into a REAL value using IEEE754 32bit format

Input:

Name	Type	Description
WORDH	WORD	High Word
WORDL	WORD	Low Word

Output:

Name	Type	Description
IEEE754	REAL	Real Value

Close

Status Variable Declaration

Resources

- Configuration
 - M172P
 - Modbus objects
 - EEPROM Parameters
 - Status variables**
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects
 - LON Profile



Status Variables

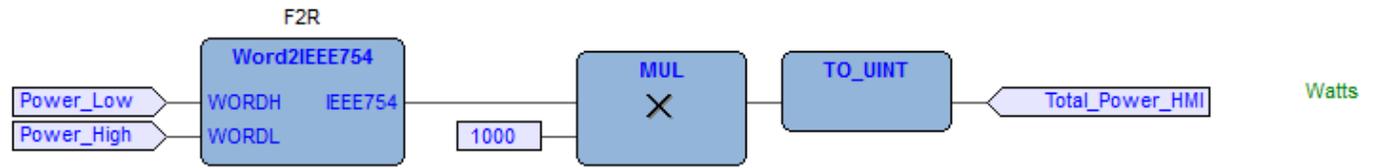


Add
 Remove
 Recalc

#	Address	Name	Device type	Application type	Unit	Format	Read only
1	8960	Power_Low	Unsigned 16-bit	UINT			True
2	8961	Power_High	Unsigned 16-bit	UINT			True
3	8964	Total_Power_HMI	Unsigned 16-bit	UINT	W		True
4	8965	Current_Low	Unsigned 16-bit	UINT			True
5	8966	Current_High	Unsigned 16-bit	UINT			True
6	8969	Total_Current_HMI	Unsigned 16-bit	UINT	mA		True
7	8970	Voltage_Low	Unsigned 16-bit	UINT			True
8	8971	Voltage_High	Unsigned 16-bit	UINT			True
9	8974	Total_Voltage_HMI	Unsigned 16-bit	UINT	V		True
10	8975	Energy_Low	Unsigned 16-bit	UINT			True
11	8976	Energy_High	Unsigned 16-bit	UINT			True
12	8979	Total_Energy_HMI	Unsigned 16-bit	UINT	wh		True
13	8980	Frequency_Low	Unsigned 16-bit	UINT			True
14	8981	Frequency_High	Unsigned 16-bit	UINT			True
15	8984	Total_Frequency_HMI	Unsigned 16-bit	UINT	Hz		True

Conversion

0001

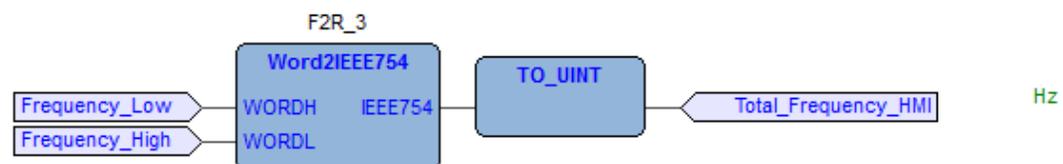
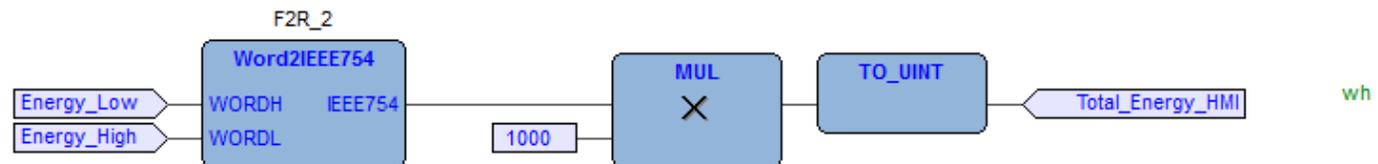
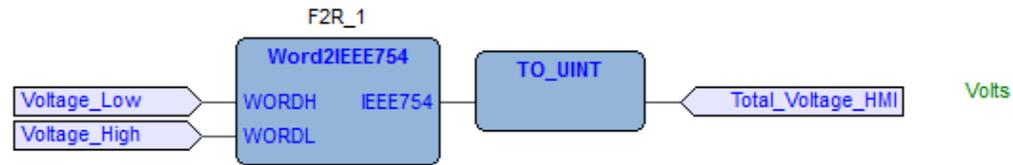
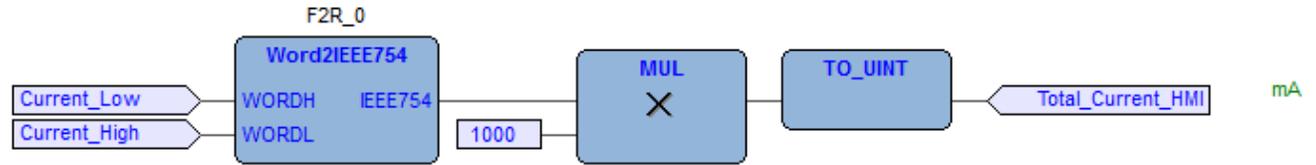


Project

- PLC Project
 - Energy_Meter_iEM3155
 - ModBus_Monitoring
 - Global vars
 - Aux Variables
 - Tasks
 - Timed
 - Energy_Meter_iEM3155
 - Background
 - Boot
 - Init



0004



Word2IEE754:
Converts 2 words to Real

To_UINT:
Converts Real to UINT

Energy addresses & Assignments

Project

- Energy_Meter_iEM3155
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - RS485-1
 - RS485-2
 - Energy Meter (iEM3155)
 - Modbus FC-03_Energy** 1
 - Modbus FC-03_Power
 - Modbus FC-03_Voltage
 - Modbus FC-03_Current
 - Modbus FC-03_Frequency
 - Ethernet
 - Plugins

Modbus FC 03(0x03) - Read Holding Register

General Holding Reg.

2

Settings

Start address: (1 .. 65536)

Polling time: ms (0 = Continuous Read)

Time out: ms

Wait before send: ms

Modbus FC 03(0x03) - Read Holding Register

General Holding Reg. 3

+ Add - Remove → Assign ← UnAssign

4

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	Energy_Low	45100	MW110.17	
2	Register	WORD	Energy_High	45101	MW110.18	

Power addresses & Assignments

Project

- Energy_Meter_iEM3155
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - RS485-1
 - RS485-2
 - Energy Meter (iEM3155)
 - Modbus FC-03_Energy
 - Modbus FC-03_Power**
 - Modbus FC-03_Voltage
 - Modbus FC-03_Current
 - Modbus FC-03_Frequency
 - Ethernet
 - Plugins

Modbus FC 03(0x03) - Read Holding Register

2 General **Holding Reg.**

Settings

Start address: (1 .. 65536)

Polling time: ms (0 = Continuous Read)

Time out: ms

Wait before send: ms

Modbus FC 03(0x03) - Read Holding Register

General **Holding Reg.** **3**

4

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	Power_Low	3060	MW110.0	
2	Register	WORD	Power_High	3061	MW110.1	

Voltage addresses & Assignments

Project

- Energy_Meter_iEM3155
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - RS485-1
 - RS485-2
 - Energy Meter (iEM3155)
 - Modbus FC-03_Energy
 - Modbus FC-03_Power
 - Modbus FC-03_Voltage**
 - Modbus FC-03_Current
 - Modbus FC-03_Frequency
 - Ethernet
 - Plugins

Modbus FC 03(0x03) - Read Holding Register

2 General **Holding Reg.**

Settings

Start address: (1 .. 65536)

Polling time: ms (0 = Continuous Read)

Time out: ms

Wait before send: ms

Modbus FC 03(0x03) - Read Holding Register

General **Holding Reg.** **3**

4

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	Voltage_Low	3028	MW110.11	
2	Register	WORD	Voltage_High	3029	MW110.12	

Current addresses & Assignments

Project

- Energy_Meter_iEM3155
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - RS485-1
 - RS485-2
 - Energy Meter (iEM3155)
 - Modbus FC-03_Energy
 - Modbus FC-03_Power
 - Modbus FC-03_Voltage
 - Modbus FC-03_Current**
 - Modbus FC-03_Frequency
 - Ethernet
 - Plugins

Modbus FC 03(0x03) - Read Holding Register

General Holding Reg.

Settings

Start address: (1 .. 65536)

Polling time: ms (0 = Continuous Read)

Time out: ms

Wait before send: ms

Modbus FC 03(0x03) - Read Holding Register

General **Holding Reg.**

Add Remove **Assign** UnAssign

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	Current_Low	3000	MW110.5	
2	Register	WORD	Current_High	3001	MW110.6	

Frequency addresses & Assignments

Project

- Energy_Meter_iEM3155
 - FreeAdvance_1
 - PLC
 - HMI
 - HMI Remote
 - CANopen
 - RS485-1
 - RS485-2
 - Energy Meter (iEM3155)
 - Modbus FC-03_Energy
 - Modbus FC-03_Power
 - Modbus FC-03_Voltage
 - Modbus FC-03_Current
 - Modbus FC-03_Frequency**
 - Ethernet
 - Plugins

Modbus FC 03(0x03) - Read Holding Register

2 General Holding Reg.

Settings

Start address: (1 .. 65536)

Polling time: ms (0 = Continuous Read)

Time out: ms

Wait before send: ms

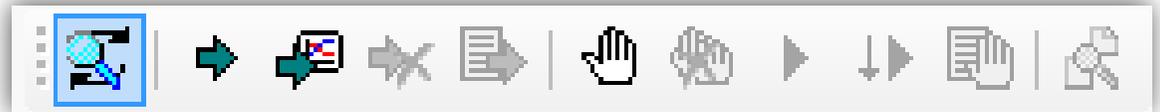
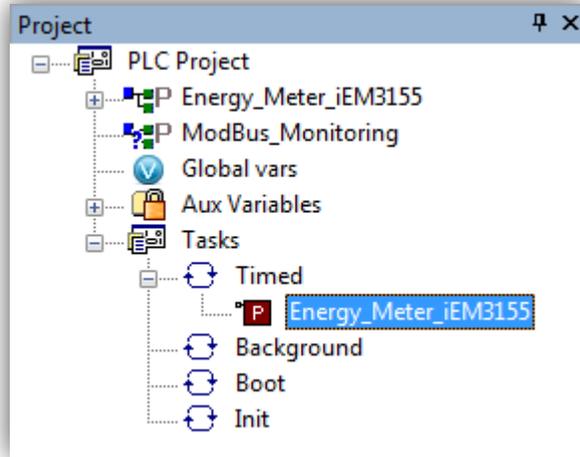
Modbus FC 03(0x03) - Read Holding Register

General Holding Reg. **3**

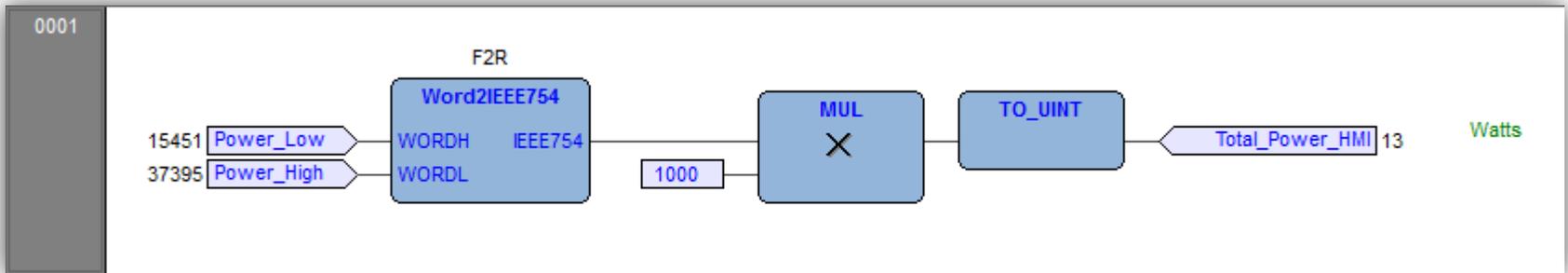
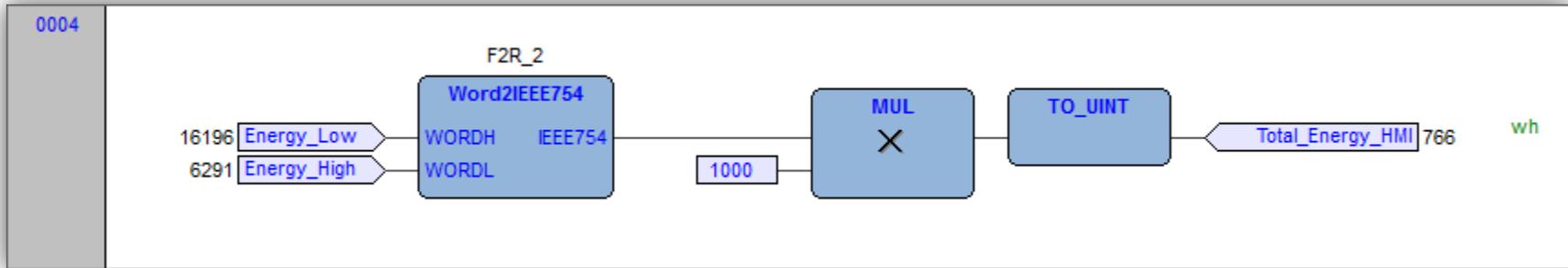
4 Add Remove Assign UnAssign

#	Name	ObjType	Label	Address	DataBlock	Description
1	Register	WORD	Frequency_Low	3110	MW110.23	
2	Register	WORD	Frequency_High	3111	MW110.24	

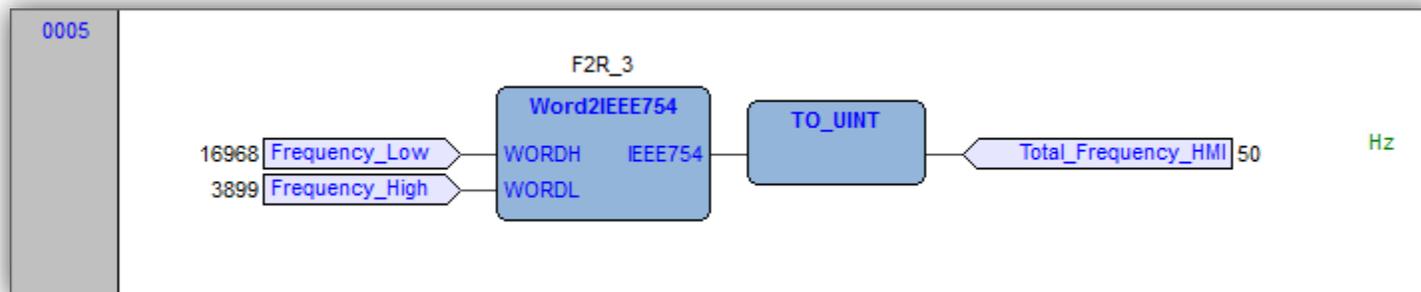
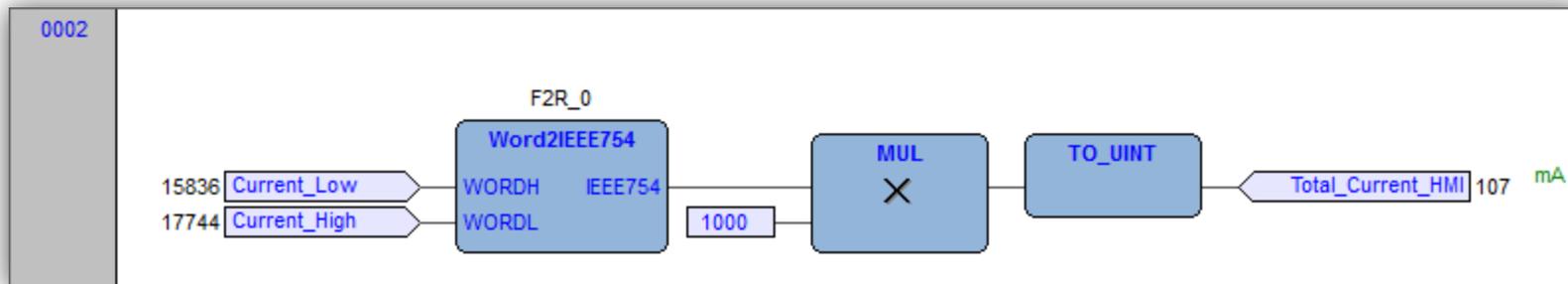
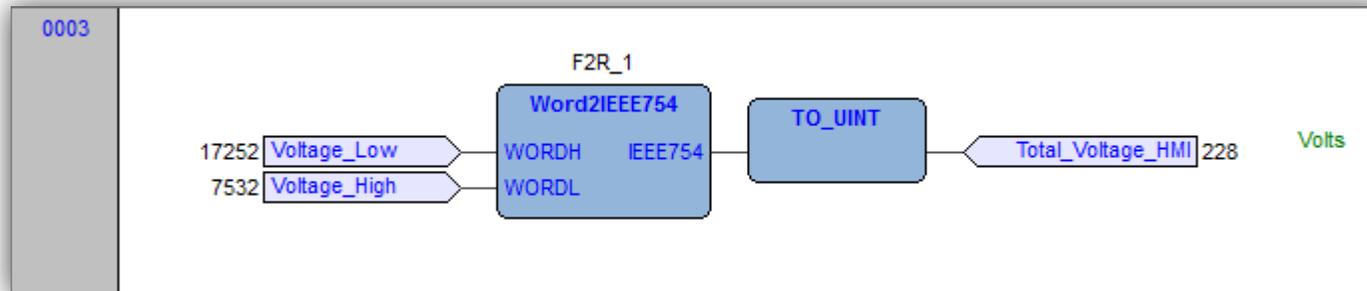
Live Debug Mode...



Activate Live debug mode



...Live Debug Mode



Live Debug Mode/Watch Window

Project Explorer

- PLC Project
 - Energy_Meter_iEM3155
 - ModBus_Monitoring
 - Global vars
 - Aux Variables
 - Global shared
 - Variables
 - Power_Low
 - Power_High
 - Total_Power_HMI
 - Current_Low
 - Current_High
 - Total_Current_HMI
 - Voltage_Low
 - Voltage_High
 - Total_Voltage_HMI
 - Energy_Low
 - Energy_High
 - Total_Energy_HMI
 - Frequency_Low
 - Frequency_High
 - Total_Frequency_HMI

Drag & Drop

Watch

Symbol	Value	Type	Location
TOTAL_ENERGY_HMI	767	UINT	global
TOTAL_POWER_HMI	14	UINT	global
TOTAL_VOLTAGE_HMI	227	UINT	global
TOTAL_CURRENT_HMI	112	UINT	global
TOTAL_FREQUENCY_HMI	49	UINT	global

sysMbMRtuNodeStatus

View object properties

Name: sysMbMRtuNodeStatus

Type: ARRAY[0..127] OF MBMNODESTATUS

Address: %MB2001.0

Description:
 System Modbus Master RTU communication status. It is a structure of type MBMNODESTATUS composed by the following fields:

- com_hdr : BYTE; Communication handler
- addr_1 : USINT; Network address part 1
- addr_2 : USINT; Network address part 2
- addr_3 : USINT; Network address part 3
- addr_4 : USINT; Network address part 4
- cfg : BOOL; Configured
- pres : BOOL; Present
- miss : BOOL; Slave failure
- missCnt: UINT; Number of Task Timed cycles with Slave failure
- state : UINT; Slave failure error code

state could have the following meanings:
 (valid only if miss is TRUE, never set to 0)

- 0 = No errors
- 1 = Tx data failed
- 2 = Rx time out (at starting)
- 3 = System error
- 4 = Rx time out (frame not ended)

Close

Library

b sysMacAddress	t/f sysMbMTcpNodeDisableWrites
us sysMbMRtuNodeAct	t/f sysMbMTcpNodePresence
t/f sysMbMRtuNodeDisableWrites	mg sysMbMTcpNodeStatus
t/f sysMbMRtuNodePresence	us sysMicroSdCommand
mg sysMbMRtuNodeStatus	t/f sysMicroSdPresence
us sysMbMTcpNodeAct	us sysMicroSdStatus

Operator and standard blocks | Target variables | Target blocks | bas

Modbus Communication Error detection

Resources

- Configuration
 - FreeAdvance_1
 - Modbus objects
 - EEPROM Parameters
 - Status variables** 1
 - Enums
 - BIOS Parameters
 - Menus
 - I/O Mapping
 - Alarms
 - Web Site
 - BACnet Objects
 - LON Profile

Status Variables

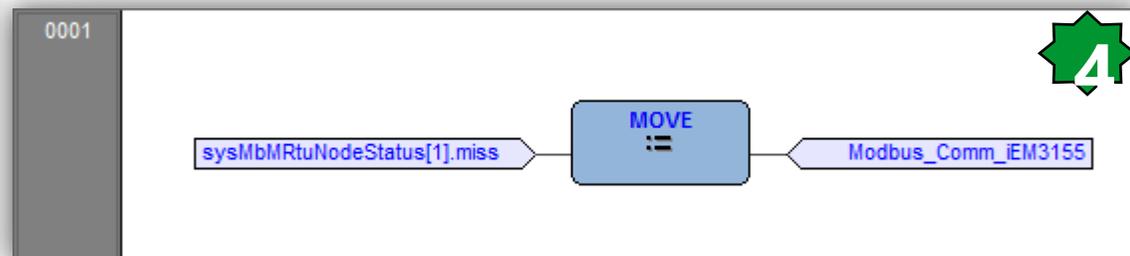
➕ Add ➖ Remove 📄 Recalc

#	Address	Name	Device type	Application type	Unit	Format	Read only
1	8960	Power_Low	Unsigned 16-bit	UINT			True
2	8961	Power_High	Unsigned 16-bit	UINT			True
3	8964	Total_Power_HMI	Unsigned 16-bit	UINT	W		True
4	8965	Current_Low	Unsigned 16-bit	UINT			True
5	8966	Current_High	Unsigned 16-bit	UINT			True
6	8969	Total_Current_HMI	Unsigned 16-bit	UINT	mA		True
7	8970	Voltage_Low	Unsigned 16-bit	UINT			True
8	8971	Voltage_High	Unsigned 16-bit	UINT			True
9	8974	Total_Voltage_HMI	Unsigned 16-bit	UINT	V		True
10	8975	Energy_Low	Unsigned 16-bit	UINT			True
11	8976	Energy_High	Unsigned 16-bit	UINT			True
12	8979	Total_Energy_HMI	Unsigned 16-bit	UINT	wh		True
13	8980	Frequency_Low	Unsigned 16-bit	UINT			True
14	8981	Frequency_High	Unsigned 16-bit	UINT			True
15	8984	Total_Frequency_HMI	Unsigned 16-bit	UINT	Hz		True
16	8962	Modbus_Comm_iEM3155	Boolean	BOOL			True

2

Project

- PLC Project
 - Energy_Meter_iEM3155
 - ModBus_Monitoring
 - Global vars
 - Aux Variables
 - Global shared
 - Tasks
 - Timed
 - Energy_Meter_iEM3155
 - ModBus_Monitoring** 3
 - Background
 - Boot
 - Init



Live Debug Mode

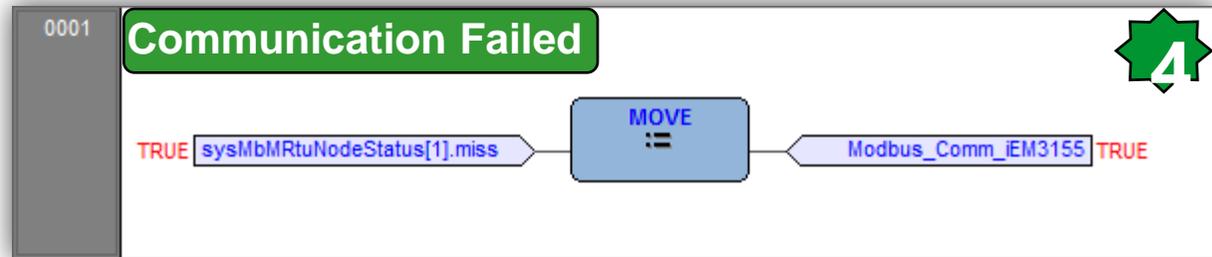
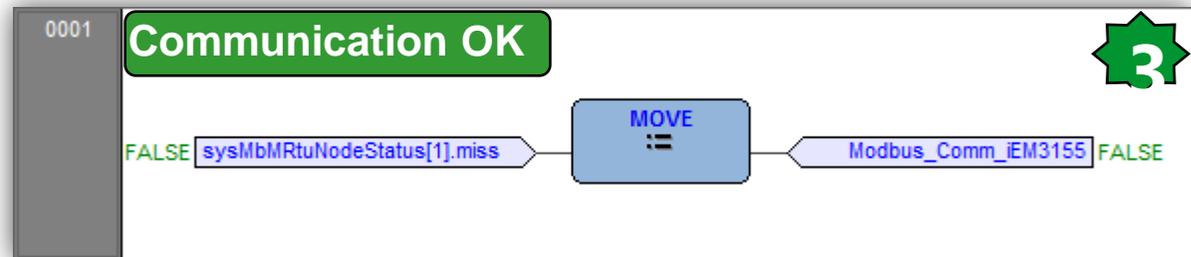
Project

- PLC Project
 - Energy_Meter_iEM3155
 - ModBus_Monitoring
 - Global vars
 - Aux Variables
 - Global shared
 - Variables
 - Power_Low
 - Power_High
 - Total_Power_HMI
 - Current_Low
 - Current_High
 - Total_Current_HMI
 - Voltage_Low
 - Voltage_High
 - Total_Voltage_HMI
 - Energy_Low
 - Energy_High
 - Total_Energy_HMI
 - Frequency_Low
 - Frequency_High
 - Total_Frequency_HMI
 - Modbus_Comm_iEM3155**
- Tasks



Watch

Symbol	Value	Type	Location
MODBUS_COMM_IEM3155	FALSE	BOOL	global

Troubleshooting

Experience sharing

M171 Optimized

Driver DMI (Only SMART)

- Problem:

- The customer cannot find the driver for the DMI to install it on his PC

- Solution:

- The driver is automatically installed in the SoMachineHVAC folder
f.e. C:\Program Files (x86)\Eliwell\free Studio

->atmel_avr_mega_cdc.inf

Name ^	Änderungsdatum	Typ	Größe
Application	30.10.2014 15:48	Dateiordner	
Catalog	30.10.2014 15:48	Dateiordner	
CatalogMng	30.10.2014 15:48	Dateiordner	
Common	30.10.2014 15:48	Dateiordner	
Connection	30.10.2014 15:48	Dateiordner	
Device	30.10.2014 15:48	Dateiordner	
Docs	30.10.2014 15:48	Dateiordner	
DriverGenerator	30.10.2014 15:48	Dateiordner	
Simulation	30.10.2014 15:48	Dateiordner	
UserInterface	30.10.2014 15:48	Dateiordner	
atmel_avr_mega_cdc.cat	25.09.2014 17:37	Sicherheitskatalog	8 KB
atmel_avr_mega_cdc.inf	25.09.2014 17:37	Setup-Information...	4 KB
unins000.dat	30.10.2014 15:48	DAT-Datei	321 KB
unins000.exe	30.10.2014 15:48	Anwendung	1.169 KB

Connection PC<->SMART Mbm Master

- Problem:

- The customer cannot connect in SoMachine HVAC to the controller

- Solution:

- If the customer is using SMART Modbus Master, he is not able to connect to the controller anymore if the controller is running.
- You can connect during the booting of the controller and disable Master function

SMART Bios upgrade is not working

- **Problem:**

- The upgrading of the BIOS of the SMART is not working. Starts correctly but ends with error message.

- **Solution:**

- Take care that you supply the SMART only with power from the DMI and no external power supply is connected. Because the DMI must switch off and on the controller during the update and if external power supply is connected this is not possible.



SMART electrical isolation - DMI

- **Problem:**

- The M171 optimized have no galvanic isolation of the power supply – I/O's

- **Solution:**

- Take care when you connect the DMI to the SMART, if the SMART is supplied also with external power supply.
- If the external power supply or a GND pin is connected to ground and you connect at the same time the DMI, the DMI or USB port or Controller can be burnt. So remove external supply before connection DMI or remove the Ground from the external supply and the GND pin.

SMART electrical isolation - AO

- Problem:

- The SMART have no galvanic isolation of the power supply – I/O's

- Solution:

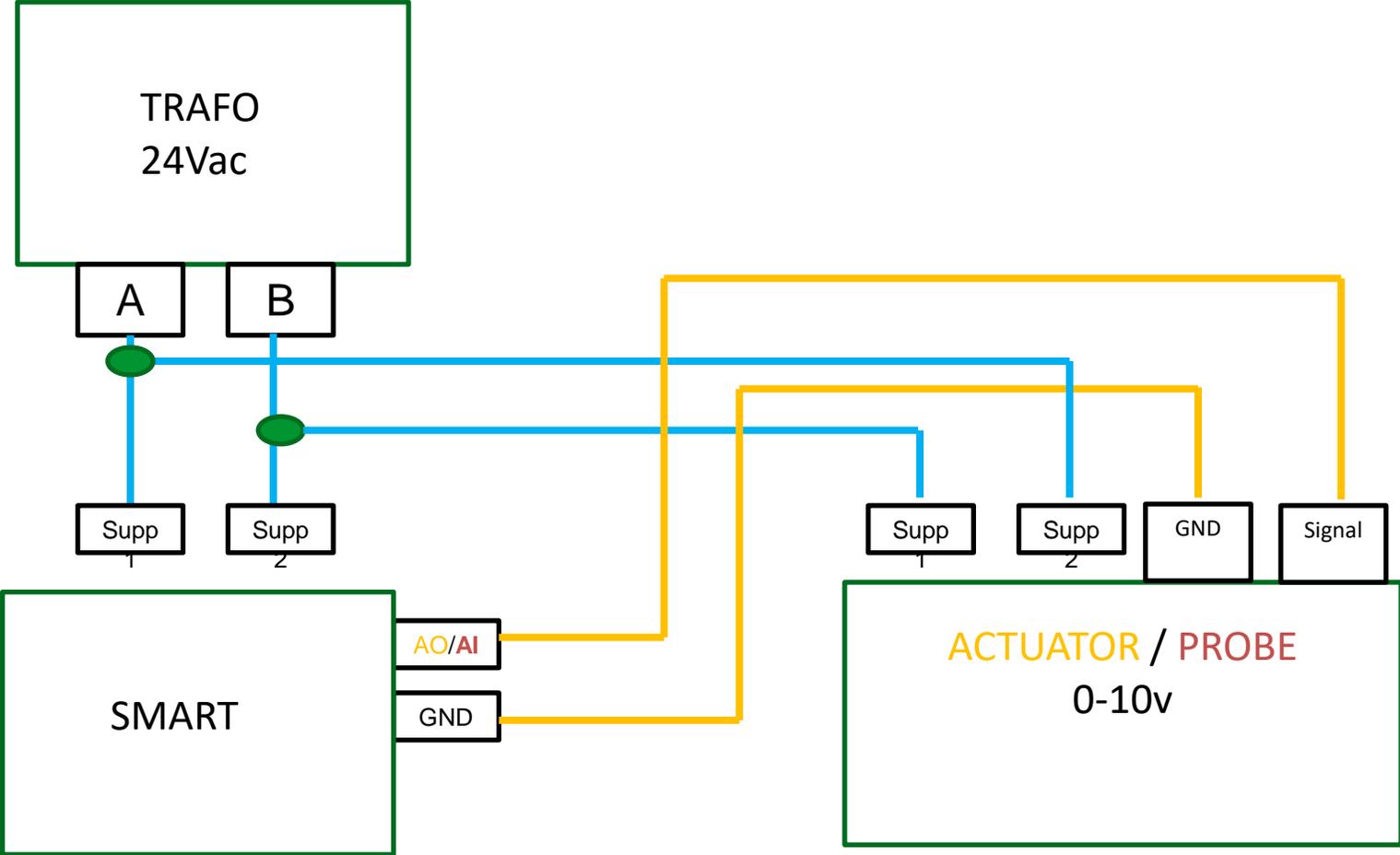
- Take care when you have AC power supply and using a actuator on analog output with same *Common* pin, then you need second power supply for the actuator.
- If you use DC power supply, this is not a problem and you need only one DC power supply.

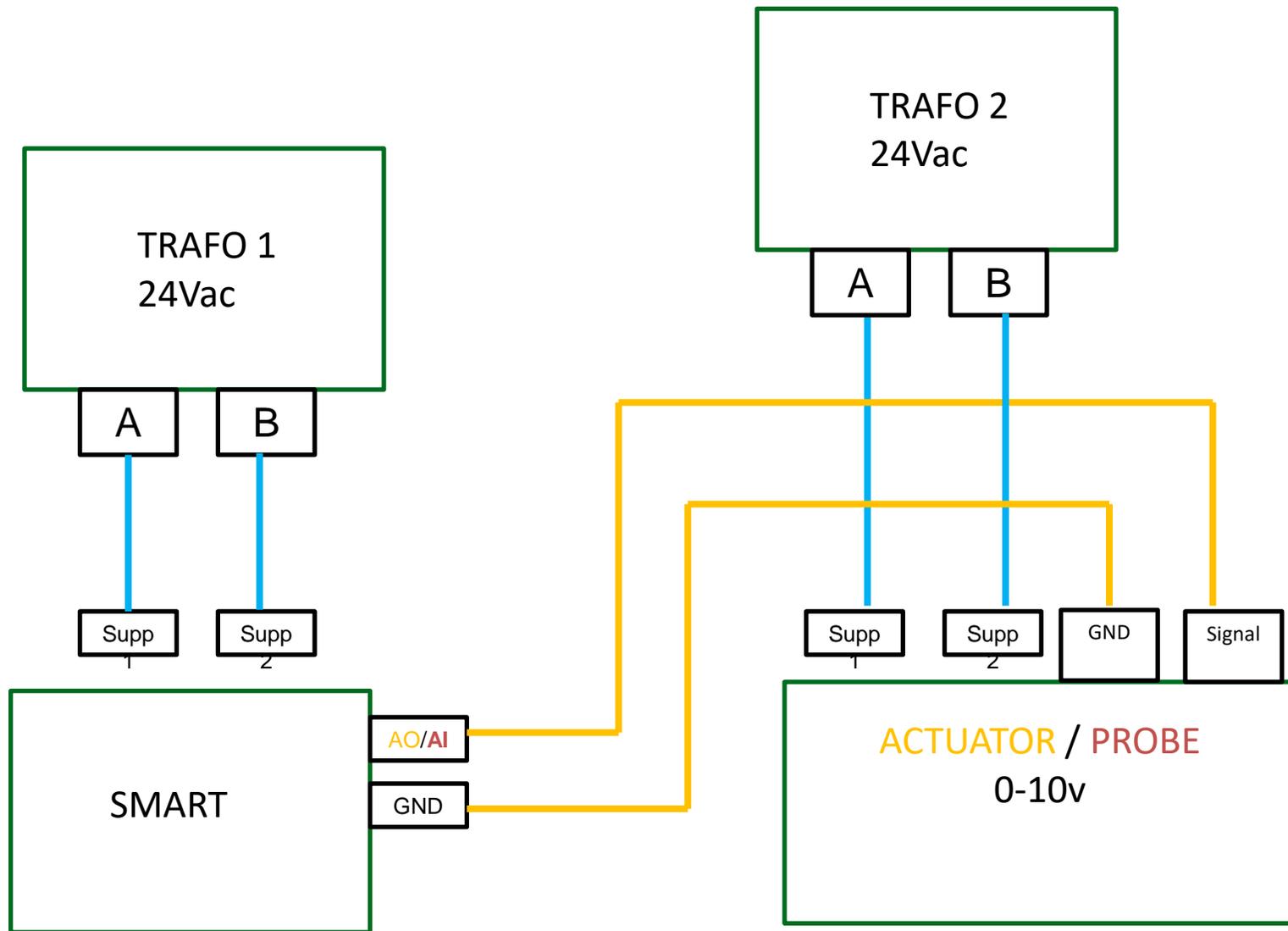
SMART Power Supply connection notes

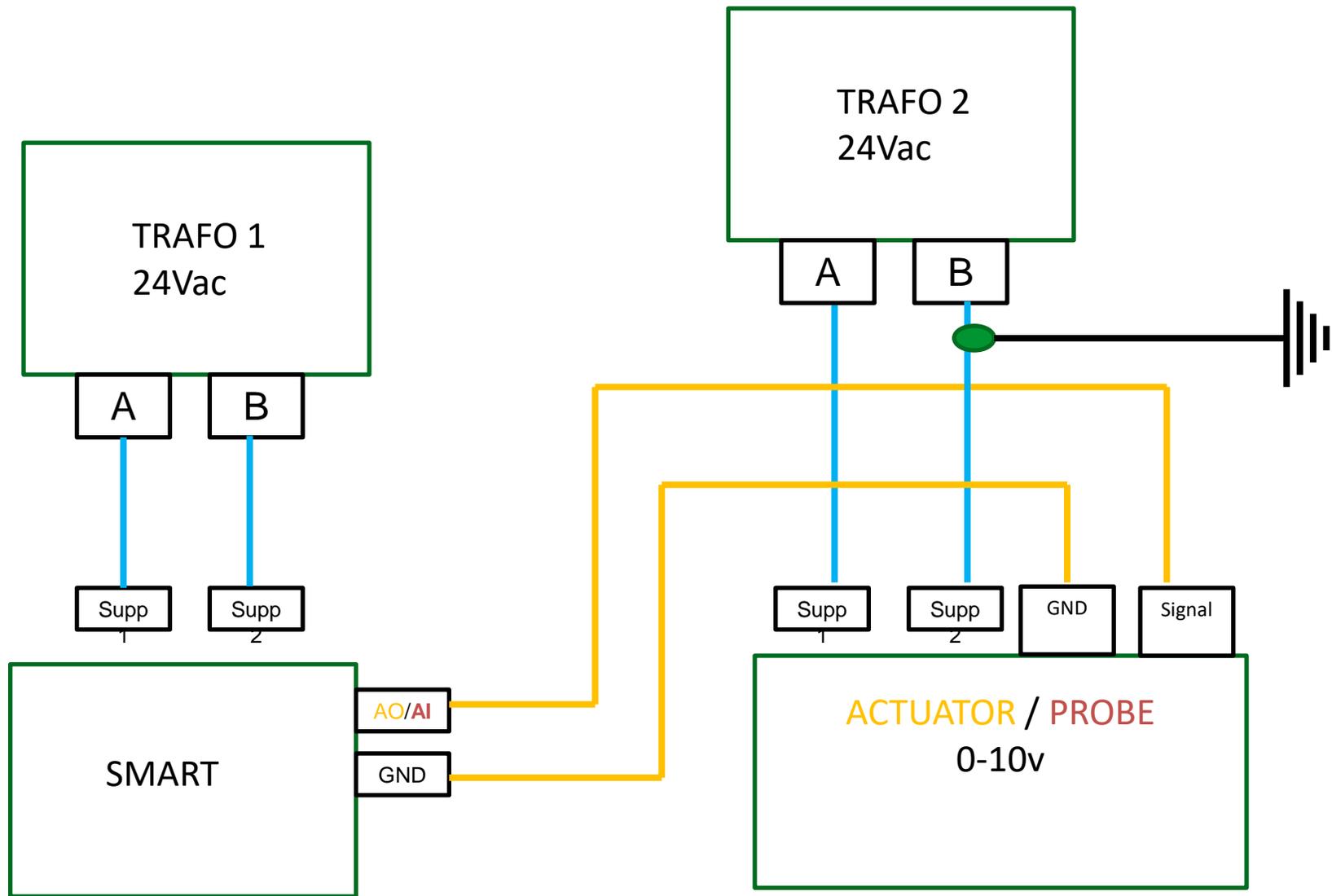
Particular attention has to be placed when connecting an uninsulated 0-10 active probe with a SMART device.

In the following pages has been highlighted some **WRONG** and the **CORRECT** connection scenario.

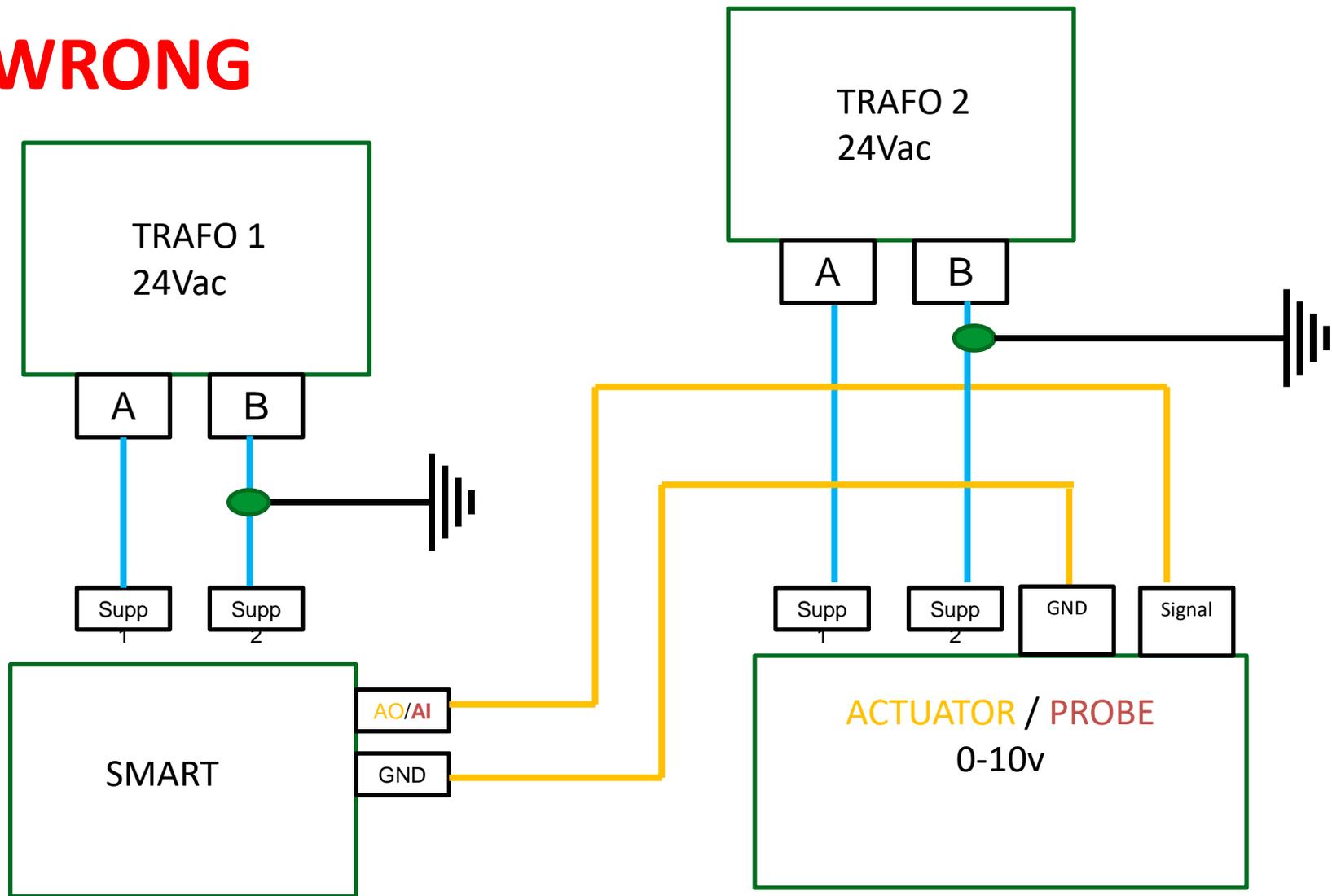
WRONG

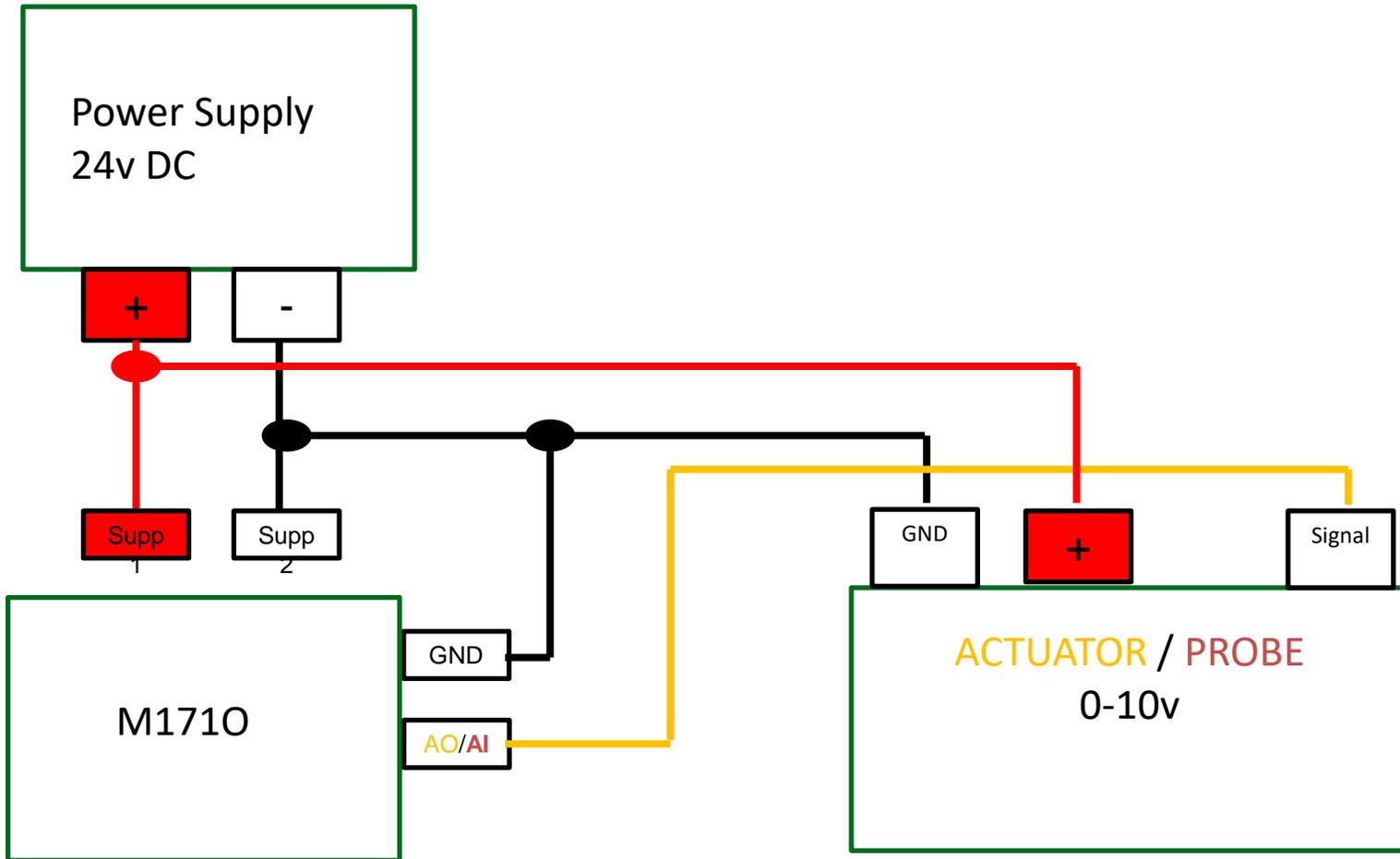






WRONG





EVOLUTION



Connection PC<->EVOLUTION Mbm Master

- Problem:

- The customer cannot connect in SoMachine HVAC to the Evolution, via the USB-RS485 Converter

- Solution:

- If the customer is using Evolution Modbus Master, he is not able to connect to the RS485 port anymore, which is set as Master, if he is using USB-RS485 converter.
- You can connect via other communication port (CAN, Plug-in), or you download a CONNEC.PAR via USB where the RS485 port is set as slave.
- Access via USB to the controller and delete the file CONNEC.PAR

FLASH data storage on EVOLUTION

- Problem:

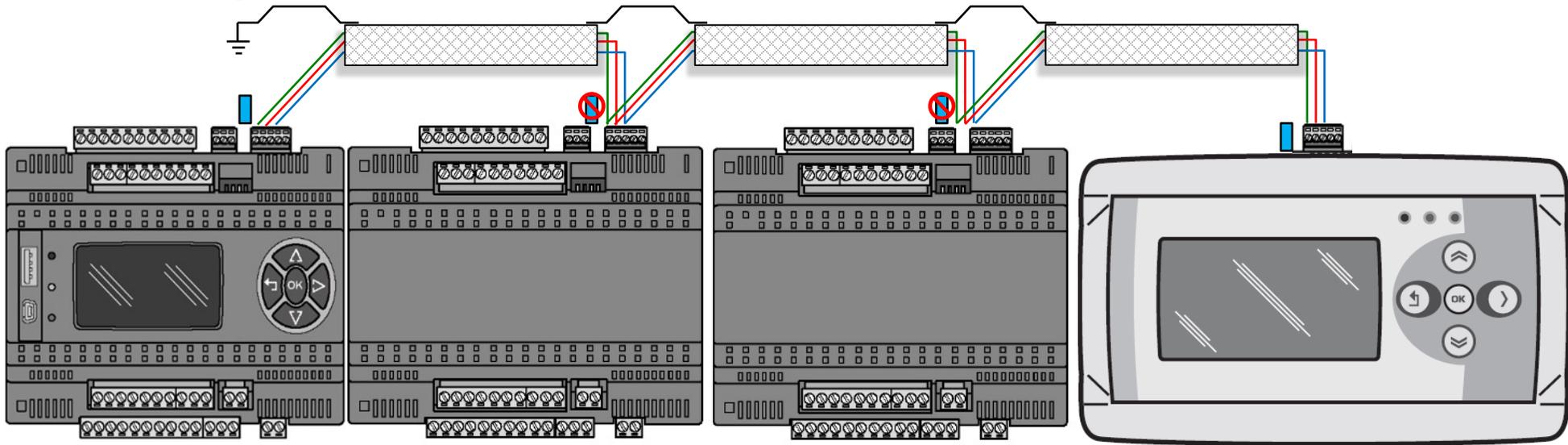
- If you write too often into the FLASH of the Evolution, this could create problem.

- Solution:

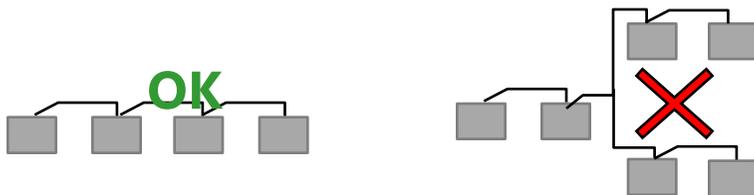
- Take care, that you are not more often than every 10 minutes writing something into the FLASH. If you have to store in shorter cycle values, you can f.e. write the values in local vars or Retain (only Evolution) and save these data every 10 minutes to FLASH.

CAN Termination Jumper

- CAN bus jumper mounted
- ⊘ CAN bus jumper NOT mounted



Note: the termination shall be placed at the beginning and at the end of the Can Bus



Note: Star connection are not allowed

EVOLUTION general

Connection PC<->EVOLUTION

- Problem:

- The customer cannot connect in SoMachine HVAC to the controller

- Solution:

- Check the COM-Port of the DMI/RS485 converter in Windows Device Manager or IP-Address (only Evolution)
- Make the “Network scan” in SoM HVAC *Device* to find the correct settings

Network scan | Advanced <<

Protocol: EwDMI | Port: COM 11

Baud range: 9600 | 115200

Address range: 1 | 1

Line conf: E,8,1

Start Scan | 1 devices found | Stop Scan

	Device	Version	Application	Version	Address	Baud rate
Select	FreeSmart	412.18	UNKNOWN: TE_TG135	0.12	1	9600

FREE Studio HVAC - general

«Warning » in FS HVAC Application

- Problem:

- Compiler shows warning: Signed/unsigned mismatch

- Solution:

- Change datatype of variables that both have the same datatype
f.e. INT:=INT;
 - Use standard block f.e. TO_INT to convert the datatype
INT_VAR:=TO_INT(UINT_VAR);
- Pay attention, because you could have an overflow

```
Output
Data space:      8C0h ( 2 KByte)
Free data space: 8A2h ( 2 KByte)

MAIN(3) - warning G2561: ST => Signed/unsigned mismatch

1 warnings, 0 errors.
```

« Warning » in FS HVAC Application

● Problem:

- Compiler shows warning: Accumulator extension

● Solution:

- Change datatype of variables that both have the same datatype
f.e. `BOOL:=BOOL;`
- Use standard block f.e. `TO_BOOL` to convert the datatype
`INT_VAR:=TO_INT(BOOL_VAR);`

```
Output
Data space:          8C0h ( 2 KByte)
Free data space:    8A3h ( 2 KByte)

MAIN(3) - warning G0015: ST => Accumulator extension

1 warnings, 0 errors.
```

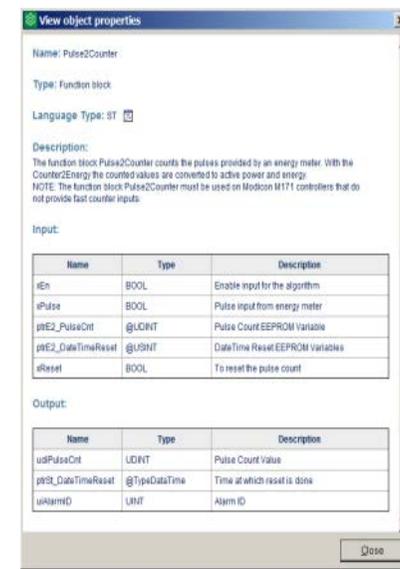
Correct data type for FC/FB + description

- **Problem:**

- You are not sure which data type is requested at which input of the Function or Function Block.

- **Solution:**

- Make a right mouse click on the FC/FB and choose **Object properties**. There you can see which data type at the in/output is requested and a short description of this block.



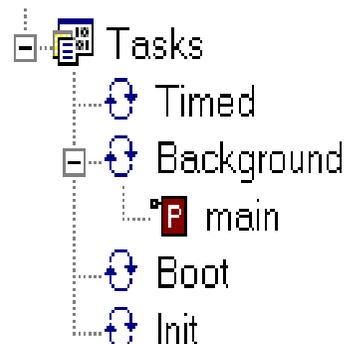
Application – program is doing nothing

- **Problem:**

- A program is developed and downloaded to the controller, but it is doing nothing.

- **Solution:**

- Forgot to assign the program to a Task. You can assign it afterwards.



EEPROM default values are not written

- Problem:

- The Default values of the EEPROM parameters are not written into the controller

- Solution:

- Remember, that you can only write the Default values of the EEPROM Parameters in FS HVAC - **Device**

EEPROM Parameters limited write access

- **Problem:**

- If the EEPROM Parameters are saved more than 100.000 times, the EEPROM get defect.

- **Solution:**

- Take care, that you are not storing EEPROM parameters too often (very bad every cycle!!!). You can f.e. example let the working hours counter run in local variables and save only once per hour the value in EEPROM. Or in case of Evolution you can also use the Retain variables.

Overlapping address

- **Problem:**

- Compiler gives an error message - *ERROR: Duplicate or overlapping parameter address: xxxx*
- Changed the *application type* of a EEPROM parameter or status variable afterwards when already other parameters/variables exists in the table

- **Solution:**

- Mark all the parameters/variables and push the button « Recalc », the the addresses will be new assigned.

Status Variables

 Add  Remove  Recalc

#	Address	Name	Display la...	Device type	Application type
1	8960	a		Signed 16-bit	DINT
2	8961	b		Signed 16-bit	INT

Invalid variable name

- Problem:

- Compiler gives an error message - *ERROR: (GeneratePlc) Invalid PLC variable name: äüö*

- Solution:

- Never use *space character* or *special character* (f.e. *äöü! »§\$%&...)* when you are creating a Variable, Parameter, IO Mapping, Programm...

Status Variables – Min/Max/Default

- **Problem:**

- You cannot write a value into the Min, Max and Default of a Status Variables.

- **Solution:**

- If you create a new Status Variable, it is as standard created as ***Read only***. In that case it's clear that you cannot create a Min, Max and Default value. Change to *Read only* - FALSE

Status Variables

Format	AccessLevel	Read only
	Always visible	True
		False
		True

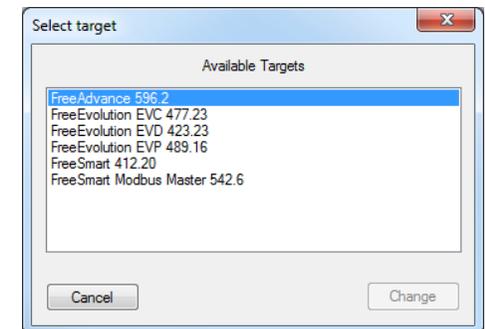
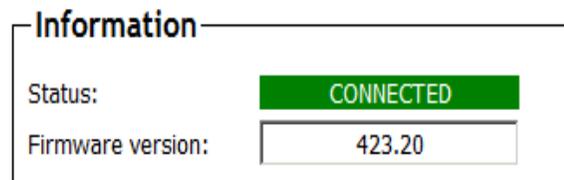
Check software and firmware version

- **Problem:**

- If the controller shows abnormal behavior, check the software version and also the firmware BIOS of the controller. And always when a new FS HVAC version is released, and you work on old project you have to update.

- **Solution:**

- Check software version in *Application -> Project -> Select target...* and also for HMI in *User Interface and Connection (right click on Device -> Change)*
- Check Firmware/BIOS of the controller. Therefore connect in Device to the controller and see in Mainscreen.



Change BIOS parameter

- **Problem:**

- You changed BIOS parameter, but the change is not active.

- **Solution:**

- If you change any BIOS parameter, you have to switch OFF and ON the controller that the change will be applied. (Remember, that at Optimized the controller is also powered via the DMI, so disconnect also the DMI for reboot.)

EVOLUTION User Interface

- Problem:

- Compiler gives an error message - *PAGE:main\$EDIT>Edit_1 - error V2308: * => Associated variable does not exist*

- Solution:

- In an edit field is a wrong variable name assigned or no variable is assigned.

```
Declaring global variables...
aborted
PAGE:main$EDIT>Edit_1 - error V2308: * => Associated variable does not exist
0 warnings, 1 errors.
```

Thank you



Q & A



It's QUESTION TIME!!

Thanks



Appendix 1

Data Types

IEC Data type	Description	Range
SINT	Short integer	-128 ... +127
INT	Integer	-32768 ... +32767
DINT	Double integer	$-2^{31} \dots +2^{31}-1$
LINT	Long integer	$-2^{63} \dots +2^{63}-1$
USINT	Unsigned short integer	0 ... +255
UINT	Unsigned integer	0 ... $+2^{16}-1$
UDINT	Unsigned double integer	0 ... $+2^{32}-1$
ULINT	Unsigned long integer	0 ... $+2^{64}-1$

The logo for eliwell, featuring the word "eliwell" in a stylized, lowercase, orange font. The letters are bold and have a slight shadow effect.

by Schneider Electric

Data Types/Integer

BYTE, WORD, DWORD, SINT, USINT, INT, UINT, DINT, and UDINT are all integer data types. Each of the different number types covers a different range of values. The following range limitations apply to the integer data types:

Type	Lower limit	Upper limit	Memory space
BYTE	0	255	8 Bit
WORD	0	65535	16 Bit
DWORD	0	4294967295	32 Bit
SINT:	-128	127	8 Bit
USINT:	0	255	8 Bit
INT:	-32768	32767	16 Bit
UINT:	0	65535	16 Bit
DINT:	-2147483648	2147483647	32 Bit
UDINT:	0	4294967295	32 Bit

Data Types/Bool

- BOOL type variables may be given the values TRUE and FALSE.
8 bits of memory space will be reserved.

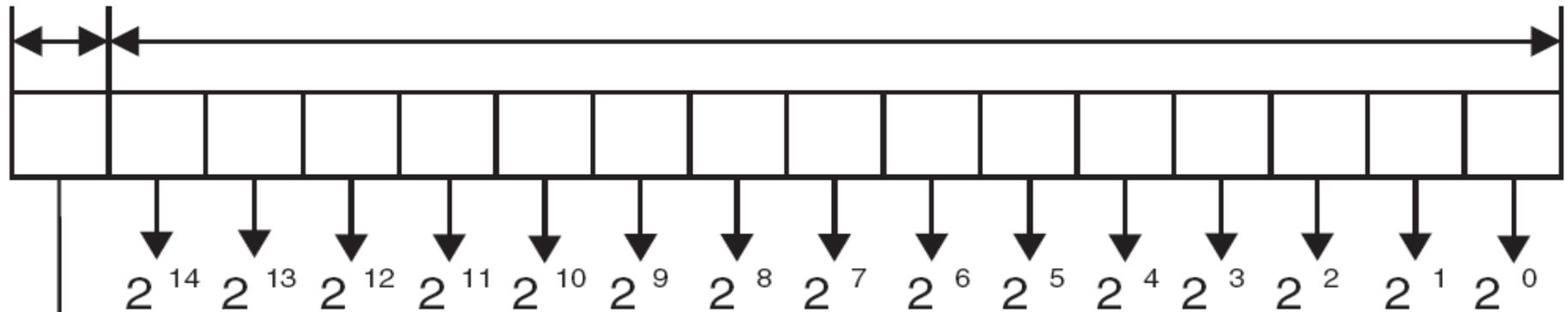
Data Types/Integer (INT)

Signed type with a 16-bit format.
This table shows the range in each base.

Base	from...	to...
Decimal	-32768	32767
Binary	2#1000000000000000	2#0111111111111111
Octal	8#100000	8#077777
Hexadecimal	16#8000	16#7FFF

Data Types/16 bit data registers

16 bit data



0:= positive number
1:= negative number

16 bit data range:

0000h – FFFFh (Hex)

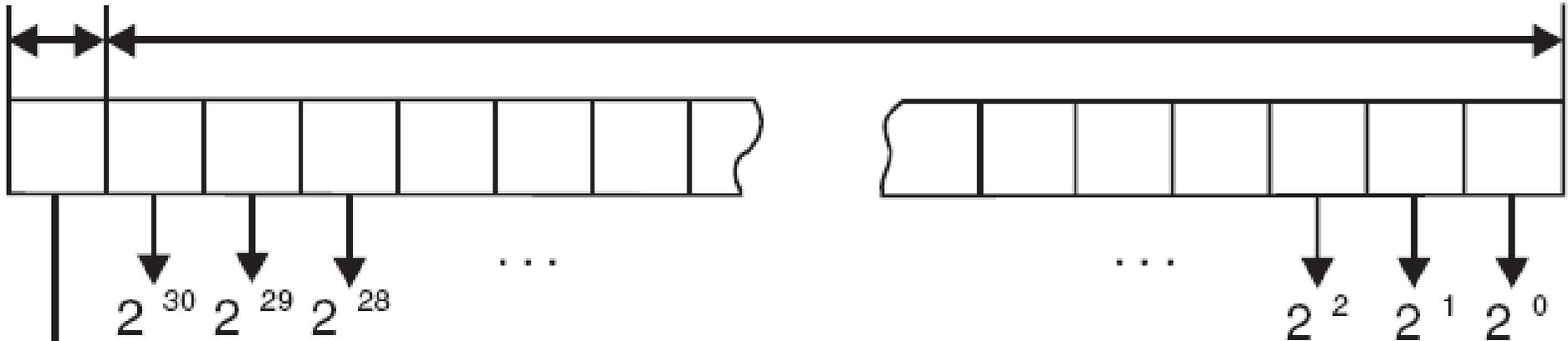
0-65535 (Decimal)

Data Types/Double Integer (DINT)

Signed type with a 32-bit format.
This table shows the range in each base.

Base	from...	to...
Decimal	-2147483648	2147483647
Binary	2#10000000000000000000000000000000 00000	2#01111111111111111111111111111111 11111
Octal	8#200000000000	8#177777777777
Hexadecimal	16#80000000	16#7FFFFFFF

Data Types/32 bit data registers



0:= positive number
1:= negative number

32 bit data range:

00000000h –
FFFFFFFFh (Hex)
0-4 billion (Decimal)

Data Types/Unsigned Integer (UINT)

Unsigned type with a 16-bit format.
This table shows the range in each base.

Base	from...	to...
Decimal	0	65535
Binary	2#0	2#1111111111111111
Octal	8#0	8#177777
Hexadecimal	16#0	16#FFFF

Data Types/Unsigned Double Integer (UDINT)

Unsigned type with a 32-bit format.
This table shows the range in each base.

Base	from...	to...
Decimal	0	4294967295
Binary	2#0	2#11111111111111111111111111111111
Octal	8#0	8#3777777777
Hexadecimal	16#0	16#FFFFFFFF

Data Types/Examples

Example of coding using a 16 bit format:

Decimal value 2450	2	4	5	0
Binary value	0010	0100	0101	0000

Example of coding using a 32 bit format:

Decimal value 78993016	7	8	9	9	3	0	1	6
Binary value	0111	1000	1001	1001	0011	0000	0001	0110

Data Types/Byte Type

The Byte type is coded in 8 bit format.

This table shows the lower/upper limits of the bases which can be used.

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FF
Octal	8#0	8#377
Binary	2#0	2#11111111

Example

Data content	Representation in one of the bases
00001000	16#8
00110011	8#63
00110011	2#110011

Data Types/Word Type

The Word type is coded in 16 bit format.

This table shows the lower/upper limits of the bases which can be used.

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FFFF
Octal	8#0	8#177777
Binary	2#0	2#1111111111111111

Example

Data content	Representation in one of the bases
0000000011010011	16#D3
1010101010101010	8#125252
0000000011010011	2#11010011

Data Types/Dword Type

The Dword type is coded in 32 bit format.

This table shows the lower/upper limits of the bases which can be used.

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FFFFFFFF
Octal	8#0	8#3777777777
Binary	2#0	2#11111111111111111111111111111111

Example

Data content	Representation in one of the bases
00000000000010101101110011011110	16#ADCDE
00000000000000010000000000000000	8#200000
00000000000010101011110011011110	2#10101011110011011110

Data Types/Float:Real & LReal

- REAL and LREAL are so-called floating-point types. They are required to represent rational numbers.

32 bits of memory space is reserved for REAL and 64 bits for LREAL.

IEC Data type	Description	Range
REAL	Real numbers	$\pm 10^{\pm 38}$
LREAL	Long real numbers	$\pm 10^{\pm 308}$

Data Types/String

- A STRING type variable can contain any string of characters. The size entry in the declaration determines how much memory space should be reserved for the variable. It refers to the number of characters in the string and can be placed in parentheses or square brackets. If no size specification is given, the default size of 80 characters will be used.

IEC Data type	Description	Examples
STRING	Character strings	'Hello world' ''

Data Types/Time & Date

The Time type **T#** or **TIME#** is represented by an unsigned double integer (**UDINT**), It expresses a duration in milliseconds, which approximately represents a maximum duration of 49 days.

The units of time authorized to represent the value are:

- days (**D**)
- hours (**H**)
- minutes (**M**)
- seconds (**S**)
- milliseconds (**MS**)

IEC Data type	Description	Examples
TIME	The duration of time after an event	T#18d7h19m7s7ms TIME#18h7s
DATE	Calendar date	D#1977-07-18 DATE#1977-07-18
TIME_OF_DAY	Time of day	TOD#18:07:19 TIME_OF_DAY#23:59:59.99
DATE_AND_TIME	Date and time of day	DT#1977-07-18-18:07:19.77 DATE_AND_TIME#1977-07-18-12:00:00

A data item can be:

- signed. Here the highest ranking bit is the sign bit:
 - 0 indicates a positive value
 - 1 indicates a negative value

The range of values is:

$$[-2^{\langle Bits - 1 \rangle}, 2^{\langle Bits - 1 \rangle} - 1]$$

- unsigned. Here all the bits represent the value
The range of values is:

$$[0, 2^{Bits} - 1]$$

Arrays

What Is an Array?

It is a data item that contains a **set of data of the same type, such as:**

for example:

- a group of BOOL words,
- a group of UINT integer words,
- etc.

Characteristics

An array is characterized by two parameters:

- a parameter which defines its organization (array dimension(s)),
- a parameter that defines the type of data it contains.

Entry	Comments
Tab_1: ARRAY[1..2] OF BOOL	1 dimensional array with 2 Boolean words
Tab_2: ARRAY[-10..20] OF WORD	1 dimensional array with 31 WORD type structures (structure defined by the user)

Structures

What is a Structure?

It is a data item containing a **set of data of a different type, such as:**

- a group of BOOL, WORD, UNINT, etc.
- a group of tables
- a group of REAL, DWORD, tables, etc.

Characteristics

A structure is composed of data which are each characterized by:

- a type,
- a name, which enables it to be identified,
- a comment (optional) describing its role.

Special data registers: constants

Notation: K

Role: decimal constant values

Types: 16 (-32768 - +32767) and
32 (-2147483648 - +2147483647) bit

Usage: in counters, timers, instruction
parameters

Notation: H

Role: Hexadecimal constant values

Types: 16 (0 - FFFF) and
32 (0 – FFFF FFFF) bit

Usage: in counters, timers,
instruction parameters

Data Types

SINT	short integer	1 byte
INT	integer	2 bytes
DINT	double integer	4 bytes
LINT	long integer	8 bytes
USINT	unsigned short integer	1 byte
UINT	unsigned integer	2 bytes
UDINT	unsigned double integer	4 bytes
ULINT	unsigned long integer	8 bytes
REAL	real	4 bytes
LREAL	long real	8 bytes
BOOL	boolean	1 bit
BYTE	byte	1 byte
WORD	16 bit bit string	16 bits
DWORD	32 bit bit string	32 bits
LWORD	64 bit bit string	64 bits



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