SIEMENS

Application Example • 02/2017

Visualizing Energy Data of a SITOP PSU8600

SIMATIC STEP 7 Professional V14, WinCC Comfort / Advanced V14,
SITOP PSU8600, SIMATIC S7-1500

https://support.industry.siemens.com/cs/ww/en/view/109738082

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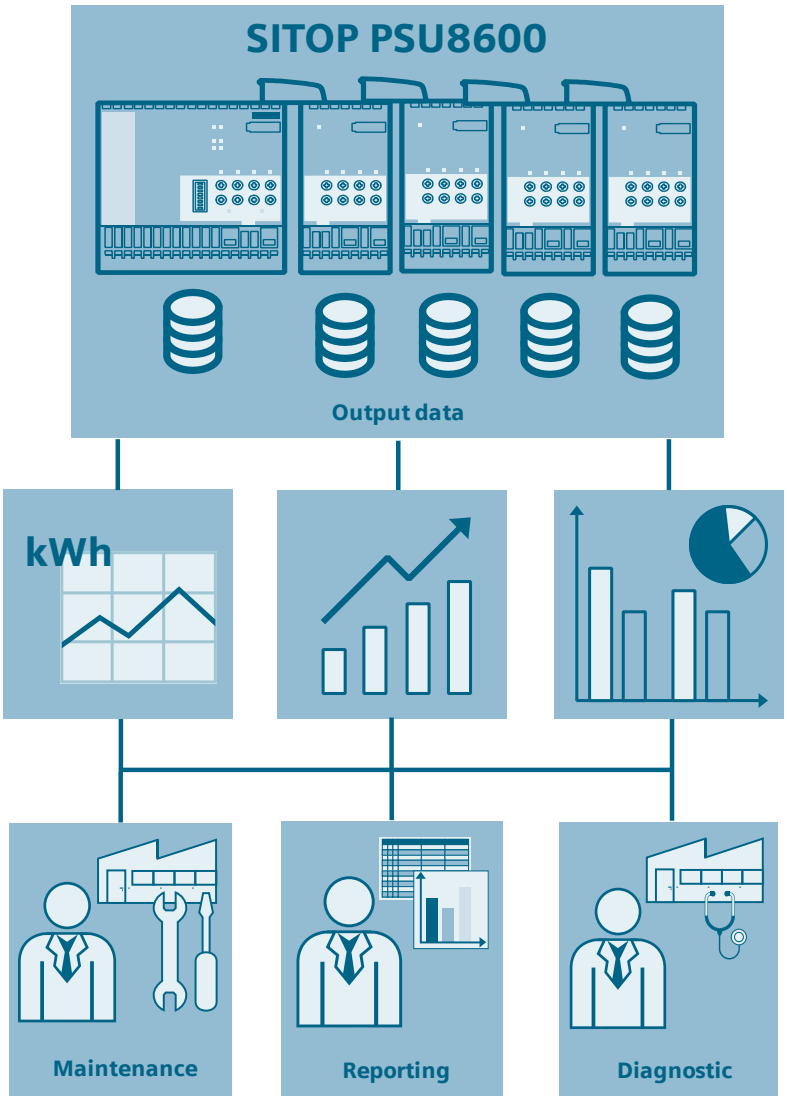
1 Introduction

1.1 Overview

Introduction

Many consumers in an automation network are supplied by a power supply. Considerations of the energy distribution so far, frequently include a rough analysis of the primary feed and of the consumption. However, for maintenance, analysis and evaluation purposes, total transparency of the energy distribution is required down to the smallest consumer of a plant.

Figure 1-1



The application example shows how you can calculate and visualize the specific data of the outputs of the basic device and expansion modules from the device data of the SITOP PSU8600.

The required PLC and HMI components are provided via a library.

The calculation is done separately for each output. Among the specific data of an output are:

- minimum, maximum and current voltage value
- minimum, maximum and current current value
- minimum, maximum and current power value
- minimum, maximum and current power value on the output (uses the option packet "SIMATIC Energy Suite")

Below, this data is called “energy data”.

Advantages

The application example offers you the following advantages:

- Time and cost savings during engineering
- No additional hardware required (for example, measuring device)
- No additional wiring effort
- Simple display of output-specific voltage, current and power data of the SITOP PSU8600

Topics not covered by this application

This application example does not contain a description of:

- SIMATIC S7-1500 programming
- Handling TIA Portal
- Configuring and reading device-specific data of a SITOP PSU8600
- Basic knowledge of SIMATIC components

Basic knowledge of these topics is assumed.

Validity

This application example is valid for:

- SIMATIC STEP 7 Professional V14 or higher
- SIMATIC WinCC Comfort / Advanced V14 or higher
- SIMATIC S7-1500
- SIMATIC Energy Suite V14 or higher

Prerequisites

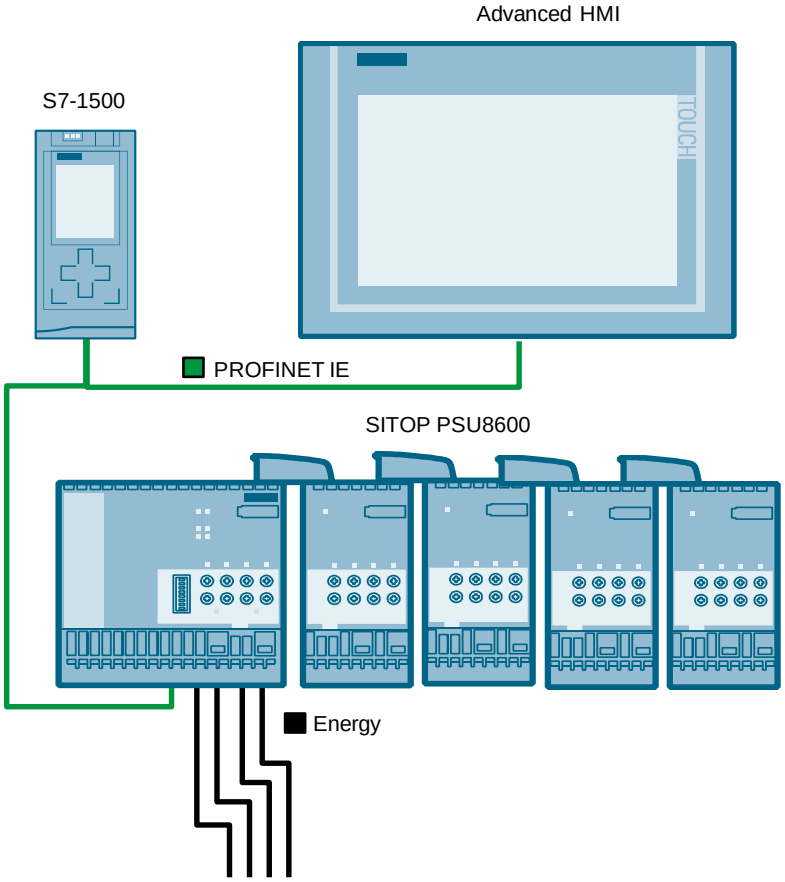
You have already implemented a project that uses the communication blocks from the application example "SITOP PSU8600: Faceplates and Communication Bocks (TIA Portal, STEP 7 and WinCC)" to read the device data from the SITOP PSU8600.

Note The communication blocks as well the appropriate documentation can be downloaded for free using the following link:

https://support.industry.siemens.com/cs/ww/en/view/102379345

1.2 Mode of operation

1.2.1 General overview



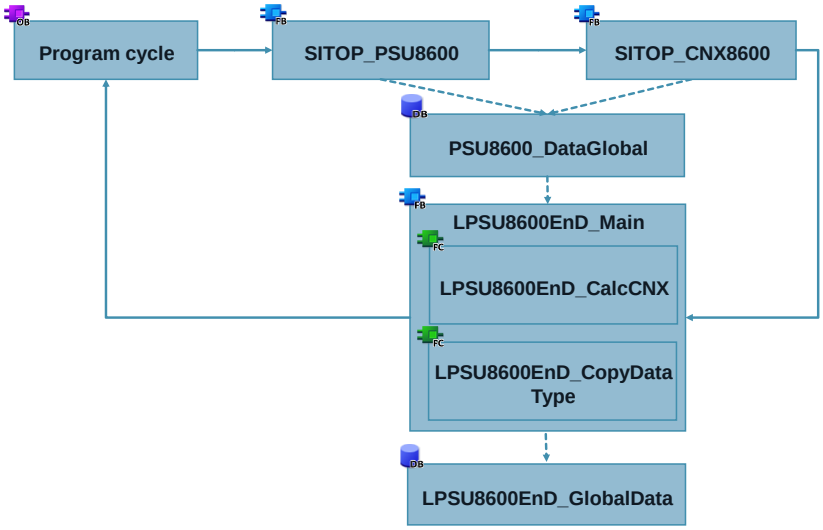
The SIMATIC S7-1500 Controller reads the device data of the SITOP PSU8600 with the communication blocks and calculates the energy data of the individual outputs from it. The controller then provides the data to the Advanced HMI (Comfort Panel).

The Comfort Panel visualizes the data of the S7-1500 clearly and neatly.

1.2.2 Function blocks used

The "LPSU8600EnD" library is available to you with the application example. The library provides program blocks in order to calculate the "energy data" of the outputs.

Figure 1-2



Function block "SITOP_PSU8600" (FB1)

The function block "SITOP_PSU8600" reads the device data of the basic device. The data writes the function block into the global data block “PSU8600_DataGlobal”.

Function block "SITOP_CNX8600" (FB2)

The function block "SITOP_CNX8600" reads the device data of the "expansion module". The data writes the function block into the global data block “PSU8600_DataGlobal”.

Note

More information on the function blocks “SITOP_PSU8600” (FB1) and "SITOP_CNX8600" (FB2) as well as the description of the appropriate parameters can be found in the application example "SITOP PSU8600: Faceplates and Communication Bocks (TIA Portal, STEP 7 and WinCC)":

https://support.industry.siemens.com/cs/ww/en/view/102379345

Function block “LPSU8600EnD_Main” (FB3)

The function block "LPSU8600EnD_Main" calculates all voltage, current and power data of the outputs of basic device and expansion modules.
The data determines the function block in dependence of the hardware configuration of the SITOP PSU8600 and writes it into the global data block "LPSU8600EnD_GlobalData".

To do this, the function block uses the device data from the global data block "PSU8600_DataGlobal".

The function block furthermore prepares the data for further processing.

1.2.3 Visualizing voltage, current and power data

The "LPSU8600EnD" library is available to you with the application example. The library provides HMI components in order to visualize the "energy data" of the outputs.

The energy data is visualized via predefined HMI screens.

You can change dynamically between the display of voltage, current and power values. The values can also be displayed by you as number values in a trend.

Figure 1-3

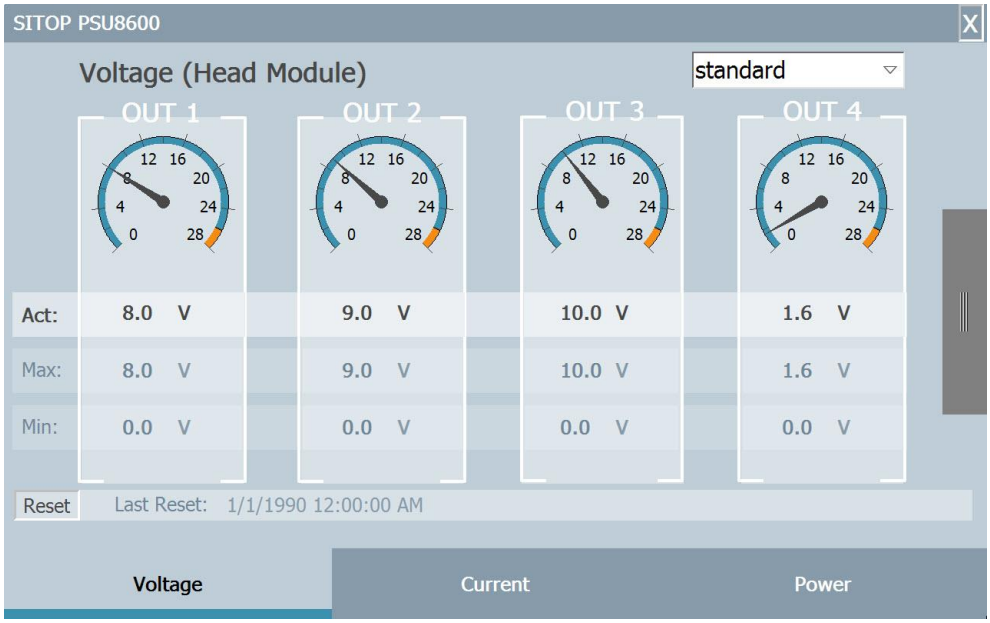
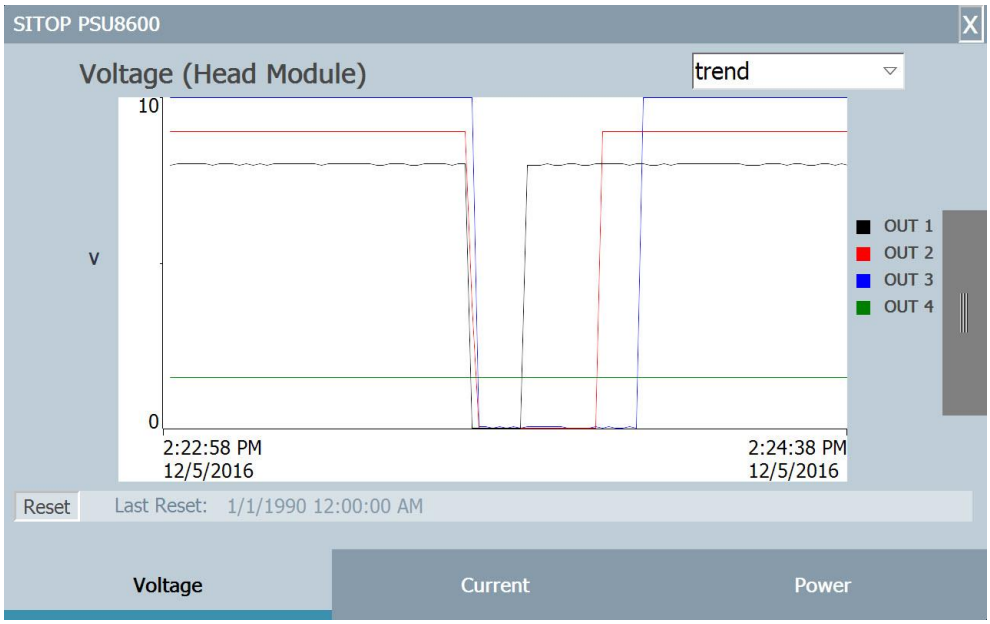


Figure 1-4



1.3 Components used

The application example was created with the following hardware and software components:

Table 1-1

Component	Number	Article number	Note
SIMATIC S7-1515-2 PN	1	6ES7515-2AM00-0AB0	You can also select a different variant of the S7-1500.
SITOP PSU8600 DC 24 V/40 A/4×10A PN	1	6EP3437-8SB00-2AY0	You can also use a different variant of the basic device (firmware V1.1 or higher).
SITOP CNX8600 DC 24 V/40 A/4×10A PN	4	6EP4437-8XB00-0CY0	You can also select a different variant of the expansion module. You can also combine the variants as desired. Up to 4 modules can be used per basic device (firmware V1.1 or higher).
TP1200 Comfort	1	6AV2124-0MC01-0AX0	You can also use a different Comfort Panel. You may need to adjust the screens.
SIMATIC WinCC Comfort V14	1	6AV2101-0AA04-0AH5	You can also use SIMATIC WinCC Advanced V14.
SIMATIC STEP 7 Professional V14	1	6ES7822-1..04-..	-
SIMATIC Energy Suite V14	1	6AV2108-0AA04-0AH5	Required for chapter 3.
SIMATIC Energy Suite S7-1500, 5 energy objects (1x 5 EnO)	4	6AV2108-0CF00-0BB0	You can also select use other license packets. 20 EnO are required.
SITOP PSU8600 Library – Faceplates and Communication Blocks for TIA-Portal			Entry ID: 102379345
Global library “EnS_Visu” for the Energy Suite visualization			Entry ID: 109739775.

This application example consists of the following components:

Table 1-2

Component	File name	Note
Documentation	109738082_PSU8600EnD_DOC_en.pdf	Documentation of the projects.
STEP 7 / WinCC Comfort V14 project “Visualizing energy data"	109738082_PSU8600EnD_V14_PRJ.zip	Project with standard visualization of voltage, current and power data.
STEP 7 / WinCC Comfort V14-Projekt “Visualizing energy data with SIMATIC Energy Suite V14"	109738082_PSU8600EnD_EnS_V14_PRJ.zip	Project with standard visualization of voltage, current and electricity data. The power and energy data is determined via the "SIMATIC Energy Suite".
Library	109738082_PSU8600EnD_LIB.zip	Library with data types, faceplates and screens.

2 Engineering

2.1 Description of the function block LPSU8600EnD_Main

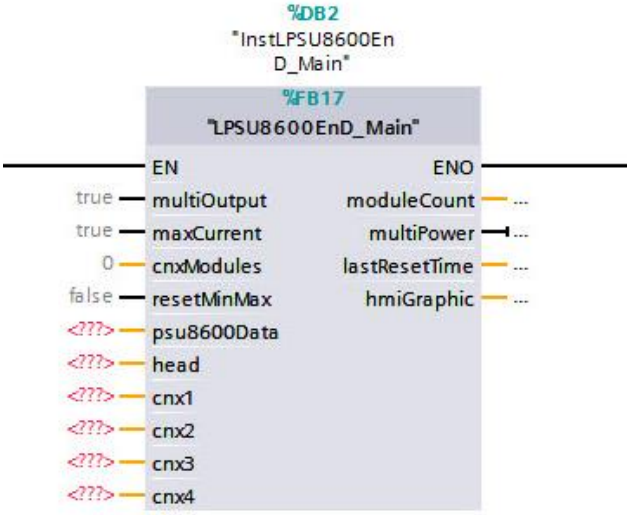
Function description

The "LPSU8600EnD_Main" function block reads the device data of the SITOP PSU8600 from the global data block. The function block calculates the data of the following “energy data” during runtime:

- Voltage (minimum, maximum, current value)
- Current (minimum, maximum, current value)
- Power (minimum, maximum, current value)

The function block calculates the energy data depending on the hardware. Information of the hardware configuration is passed on to the function block via input parameters.
You can reset the minimum and maximum values of the current output value of current, voltage and power at runtime via an input tag.

Figure 2-1



Input parameters (In)

Table 2-1

Parameter	Data type	Comment
psu8600Data	Variant	Global data block with the data of PSU8600.
multiOutput	Bool	true = 4 Outputs false = 1 Output
maxCurrent	Bool	true = 40 A false = 20 A
cnxModules	Int	Number of CNX8600 modules
resetMinMax	Bool	Resetting of the minimum and maximum values

Input and output parameters (InOut)

Table 2-2

Parameter	Data type	Comment
psu8600Data	UDT_PSU8600_Data	Global data block with the data of PSU8600.
head	LPSU8600Energy_typeModule	Energy data of the basic device.
cnx1	LPSU8600Energy_typeModule	Energy data of the first CNX8600 module.
cnx2	LPSU8600Energy_typeModule	Energy data of the second CNX8600 module.
cnx3	LPSU8600Energy_typeModule	Energy data of the third CNX8600 module.
cnx4	LPSU8600Energy_typeModule	Energy data of the fourth CNX8600 module.

Output parameters (OUT)

Table 2-3

Parameter	Data type	Comment
moduleCount	Int	Number of CNX8600 modules.
multiPower	Bool	Specifies whether the basic device has one or four outputs.
lastResetTime	Date_And_Time	Time stamp of the last reset process.
hmiGraphic	Int	Specifies what graphic is shown on the basic device.

2.2 Integration into the user project

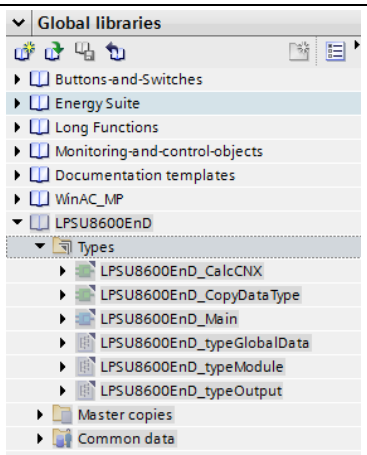
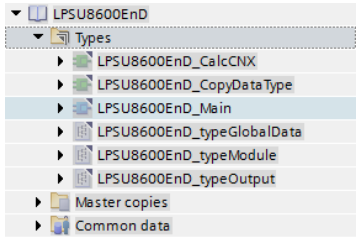
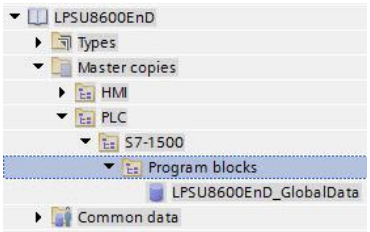
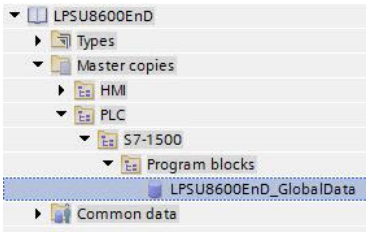
Prerequisites

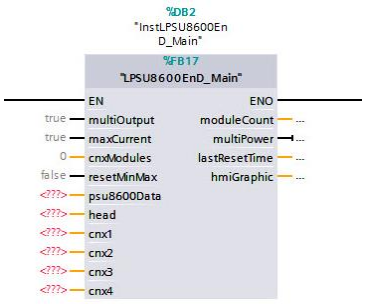
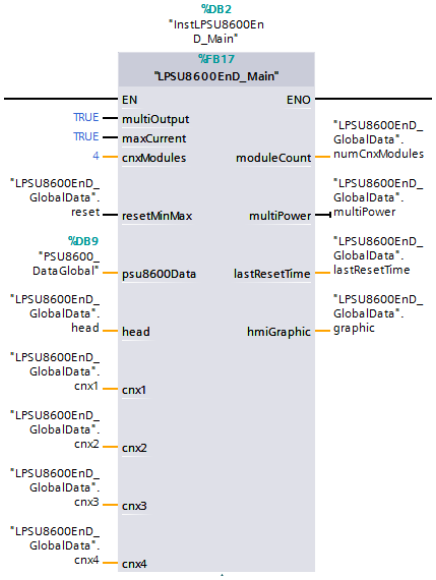
- Your project is opened in the TIA Portal.
- You have downloaded the "LPSU8600EnD" library for the visualization of current, voltage and power data on the entry page and unzipped it in a folder of your choice.
- You have already configured the hardware with a SIMATIC S7-1500 Software Controller, a SITOP PSU8600 and a SIMATIC Comfort Panel.
- A program in an operation block already exists that reads the data records of the basic device and of the expansion modules and writes it in a global data block.

Integrating PLC components

Perform the following steps to integrate the required PLC components into the project.

Table 2-4

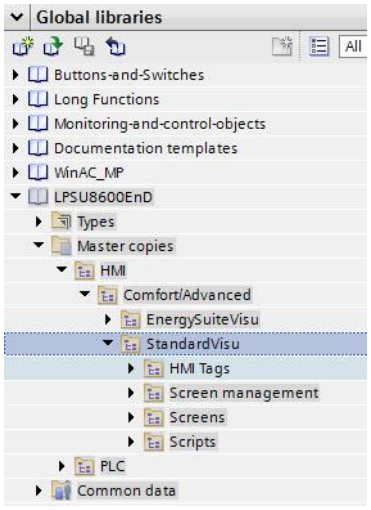
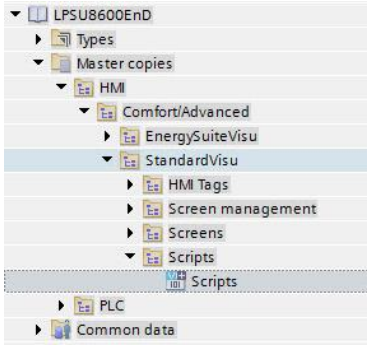
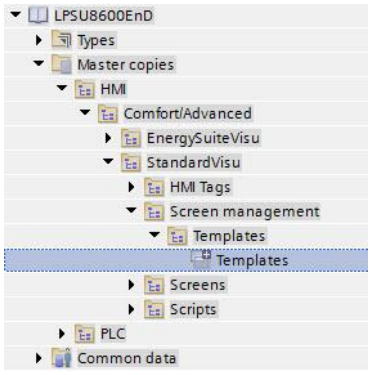
No.	Instruction	Comment
1.	Download the global library "LPSU8600EnD". Unzip it into a folder of your choice and then open it.	Download in entry ID 109738082.
2.	Open the “Types” folder.	
3.	Drag the “LPSU8600EnD_Main” FB into the “program blocks” folder of the project tree, using drag-and-drop. **Note:** The required UDTs and the required function are automatically created in the project and the project library.	
4.	Open the folder "Master copies > PLC > S7-1500 > Program blocks".	
5.	Drag the “LPSU8600EnD_GlobalData” data block into the “Program blocks” folder of the project tree, using drag-and-drop.	

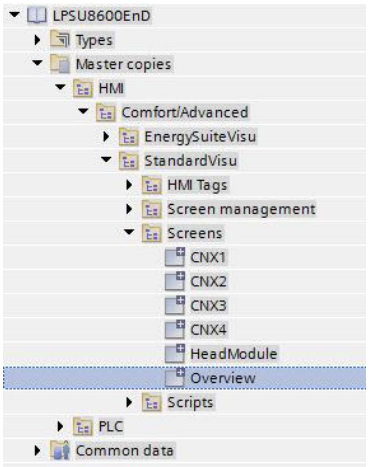
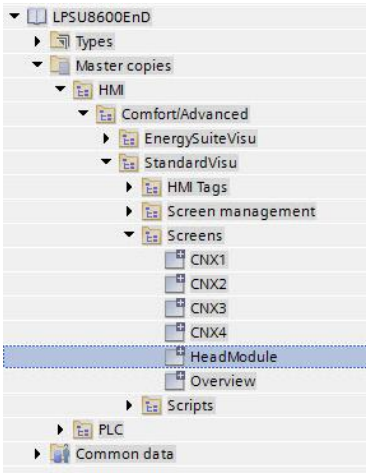
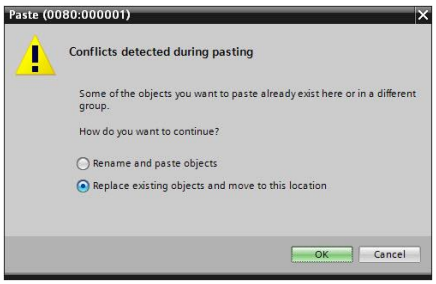
No.	Instruction	Comment
6.	Open the "program blocks" folder in the project tree and open the organization block in which the function block is to be executed.	In this application example: OB1
7.	Call the "LPSU8600EnD_Main" function block in the opened organization block as single instance. **Note** The dialog for instance DB creation opens. Assign the instance data block the name "InstLPSU8600EnD_Main" and confirm the entry with OK.	
8.	Interconnect all parameters of the function block "LPSU8600EnD_Main" as shown in the figure. **Note:** A description of the inputs and outputs can be found in chapter 2.1. Your data block for the global data of the SITOP PSU8600 can be called differently. In this application example the name is "PSU8600_DataGlobal".	
9.	Compile the program and download it to the controller.	

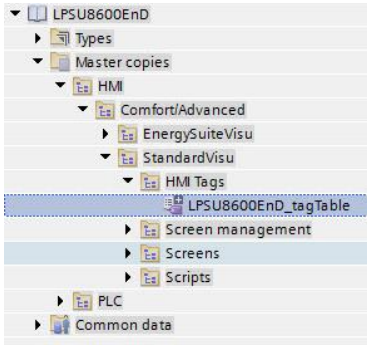
Integrating HMI components

Perform the following steps in order to integrate the required HMI components into the project.

Table 2-5

No.	Instruction	Comment
1.	Download the global library "LPSU8600EnD". Unzip it into a folder of your choice and then open it.	Download in entry ID 109738082.
2.	Open the folder "Master Copies > HMI > Comfort/Advanced > StandardVisu".	
3.	Drag the VBS scripts “Scripts” using drag-and-drop from the library to the "Scripts > VB scripts" folder of the operator panel.	
4.	Drag the “Templates” to the “Screen management > Templates” folder of the operator panel, using drag-and-drop.	

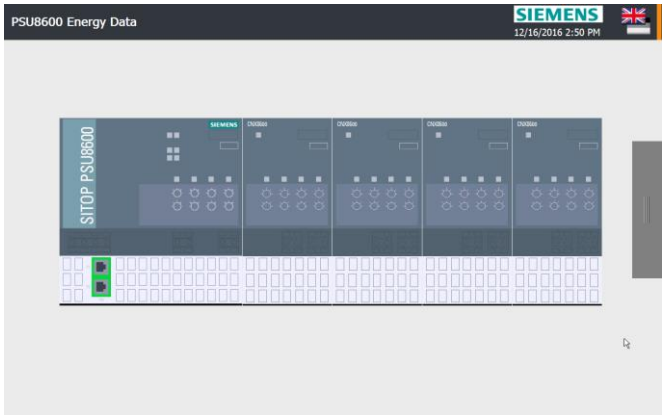
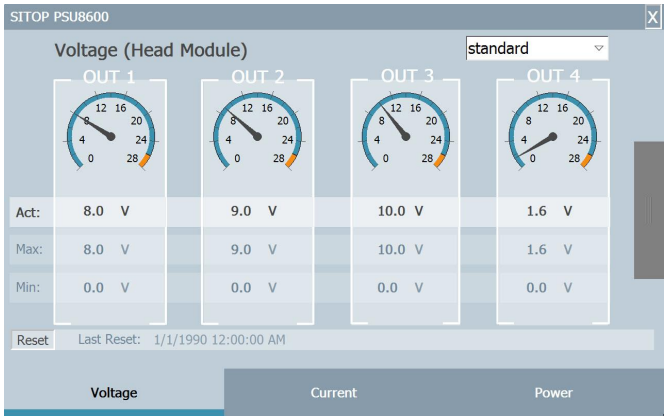
No.	Instruction	Comment
5.	Drag the "Overview" screen from the "Screens" folder, using drag-and-drop into the "Screens" folder of the operator panel. **Note:** Through the "Overview" screen, the screens for the basic module and the expansion modules are called.	
6.	Drag the "Head Module" screens from the "Screens" folder, using drag-and-drop into the "Screens" folder of the operator panel. **Note:** The "Paste" dialog is opened. Enable the "Replace existing objects and move to this location" option box and confirm the dialog with "OK". The screens of the basic module are integrated in the folder of the "Overview" screen.	 
7.	Drag the respective screens from the "Screens" folder for each CNX8600 module into the "Screens" folder of the operator panel, using drag-and-drop. **Note:** The "Paste" dialog is opened. Follow the instructions from step no. 6.	If, for example, two CNX8600 modules are built-in in your PSU8600, drag the screens "CNX1" and "CNX2" into your project.

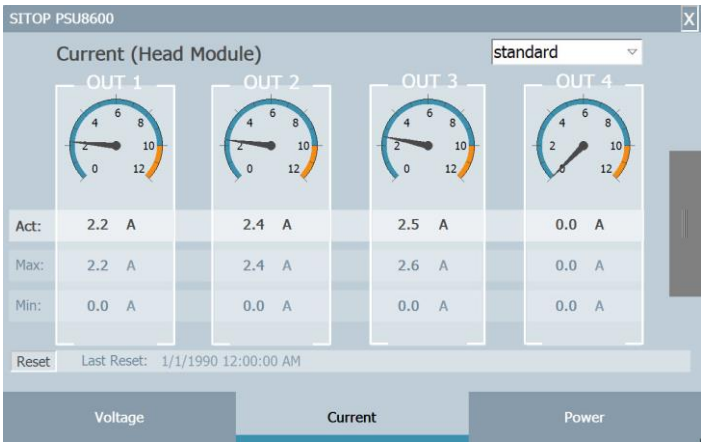
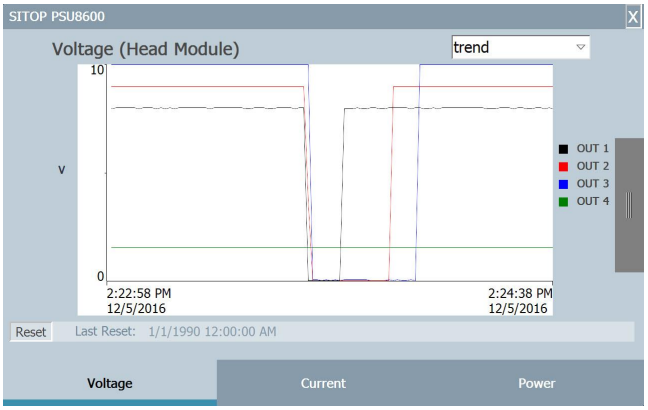
No.	Instruction	Comment
8.	Drag the tag table "LPSU8600EnD_tagTable" from the library into the "HMI tags" folder of the operator panel using drag-and-drop.	
9.	Open the tag table "PSU8600Energy" in "HMI tags" in the project tree and check the HMI connection. If required, adjust the HMI connection. Reconnect the tags with the appropriate data block "PSU8600EnergyData".	-
10.	If you are using a panel with a different screen resolution, check whether you have to adjust the objects in the screens manually.	You can skip this step if you are using a TP1200 Comfort.
11.	Compile the software and download it to the operator panel.	

2.3 Operating the user projects

Table 2-6

No.	Action
1.	Start the Runtime on the operator panel. 

No.	Action
2.	In order to open the right "Slide-In" window, click the grey handle button. Then click the "PSU8600" button. 
3.	The overview screen of the PSU8600 is opened. **Note:** Four CNX8600 modules are active by default in the example project. The number of the CNX8600 modules in the overview screen depends on your hardware configuration. 
4.	Tap onto a module in order to open the view of the voltage, current and power data. 

No.	Action
5.	Tap the buttons "Current" or "Power" to change from the voltage to the current or power values.  
6.	You can change from the default view to the trend view of the values via the drop-down list. 
7.	Via the "X" button in the right top corner, you get back to the overview of the PSU8600.

3 Valuable Information – Calculating and Visualizing Energy Data with SIMATIC Energy Suite

3.1 Overview

This chapter shows you how you can calculate and visualize the energy data of the outputs with the help of the "SIMATIC Energy Suite" in addition to the voltage, current and power data.

The templates of the "SIMATIC Energy Suite" are used for the visualization. The appropriate library and description can be found in the application example "SIMATIC Energy Suite – Visualization Examples":

https://support.industry.siemens.com/cs/ww/en/view/109739775

3.2 Basics of SIMATIC Energy Suite

From TIA Portal V14 onward Siemens offers the "SIMATIC Energy Suite" in the energy evaluation field. With the "SIMATIC Energy Suite" you can acquire, prepare and archive your energy data. The simplified configuration and the automatic generation of the energy program reduce the configuration effort considerably.

For more information on the application options, please refer to the "SIMATIC Energy Suite - Getting Started" application example:

https://support.industry.siemens.com/cs/ww/en/view/109739102

3.3 Mode of operation of SIMATIC Energy Suite

The **"**SIMATIC Energy Suite**"** works with energy objects. A more detailed description on the energy objects can be found in the manual:

https://support.industry.siemens.com/cs/ww/en/view/109741977/90835748491

An energy program is created from the energy objects. Based on the current power values the "SIMATC Energy Suite" calculates different types of energy values. The calculation depends on the configuration of the energy object. Possible calculations are:

- Current energy consumption
- Periodic average of the power
- Periodic average of the energy consumption

The data is available via the data blocks of the energy program and can therefore be used for the visualization.

However, each energy object can only process one power value. For the calculation, an individual energy object is therefore required for each output.

Note

The licensing depends on the number of energy objects. The licenses can be bought in license packets of 5 or 10.

Only use the energy data calculation for the outputs where you require the energy data for further processing. For the pure visualization of the current power of an output, the above listed application example is sufficient.

3.4 Integrating the energy program and visualization in the user program

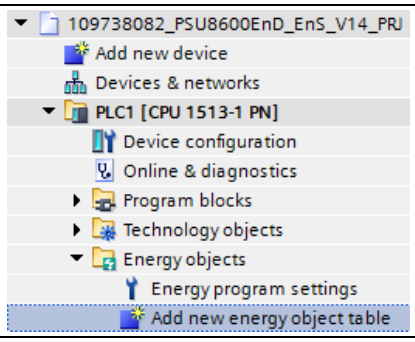
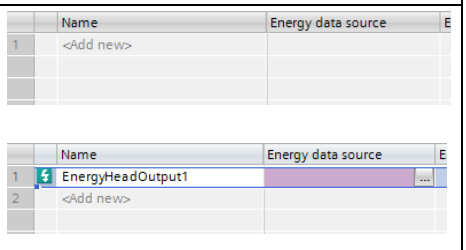
Prerequisite

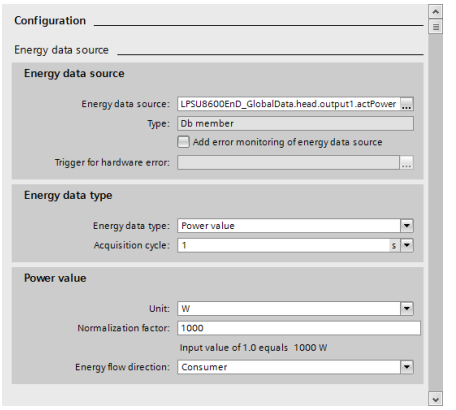
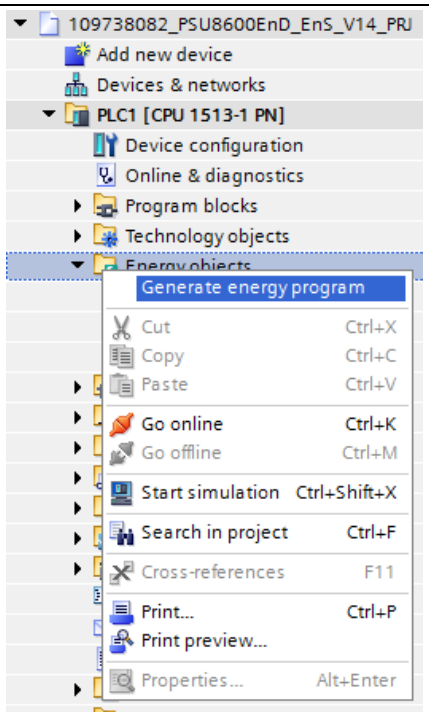
- The "SIMATIC Energy Suite" option is installed with a valid license packet on your computer.
- Open an independent project, in which you have completed the integration of the PLC and HMI components from chapter 2.2 or use the STEP 7 / WinCC Comfort V14 project “Visualizing energy data" from this application example.
- Use a SIMATIC S7-1500 controller with firmware version V2.0 or higher.

Integrating PLC components

Perform the following steps to integrate the required PLC components into the project.

Table 3-1

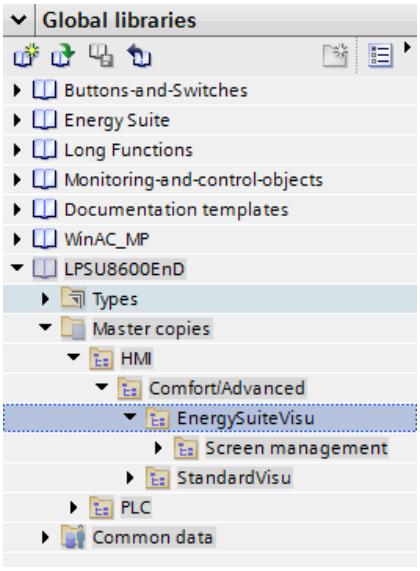
No.	Instruction	Comment
1.	Open the project.	-
2.	Create a new energy object table "Energy objects psu8600" via "Energy objects > Add new energy object table" . Open the energy object table.	
3.	Create a new energy object with "Add new" with the name "EnergyHeadOutput1" for output 1 of the main module. Select the energy object. Enter an archiving period in "Archiving period". In this application example the period "Period_15min" is used.	

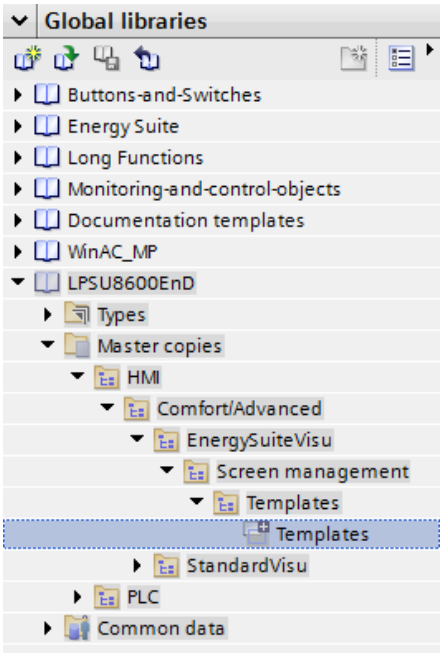
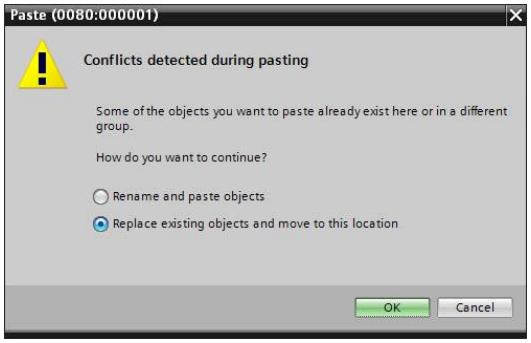
No.	Instruction	Comment
4.	Open the properties of the energy object via the tab "Properties > Configuration > Energy data source" and make the following settings: • Energy data source: Present power value of output 1 of the basic module • Energy data type: "Power value" • Acquisition cycle: "1" • Unit: "W" • Normalization factor: "1000" • Energy flow direction: "Consumer"	
5.	Repeat step no. 3 and 4 for other outputs of the basic device and the expansion modules from which you would like to visualize the power and energy data via the "SIMATIC Energy Suite". Name the energy objects as follows: Energy<Module>Output<output no.>	The “Energy data source” is always the current power value from data block "LPSU8600EnD_GlobalData" that belongs to the output.
6.	Generate the energy program for the controller via the context menu “Generate energy program". The energy program can be found in the project tree in "Program blocks > Energy Suite – program". **Note:** Observe the correct runtime licensing of the energy objects in the Energy Suite before you generate the energy program. A detailed description can be found in the "SIMATIC Energy SuiteV14.0" function manual in chapter "Runtime Licenses for Energy Suite" in the appropriate manual: https://support.industry.siemens.com/cs/ww/en/view/109741977/89885263499 Missing or insufficient runtime licenses lead to cancellation of the program generation.	
7.	Download the control program to your SIMATIC S7-1500 Software Controller.	

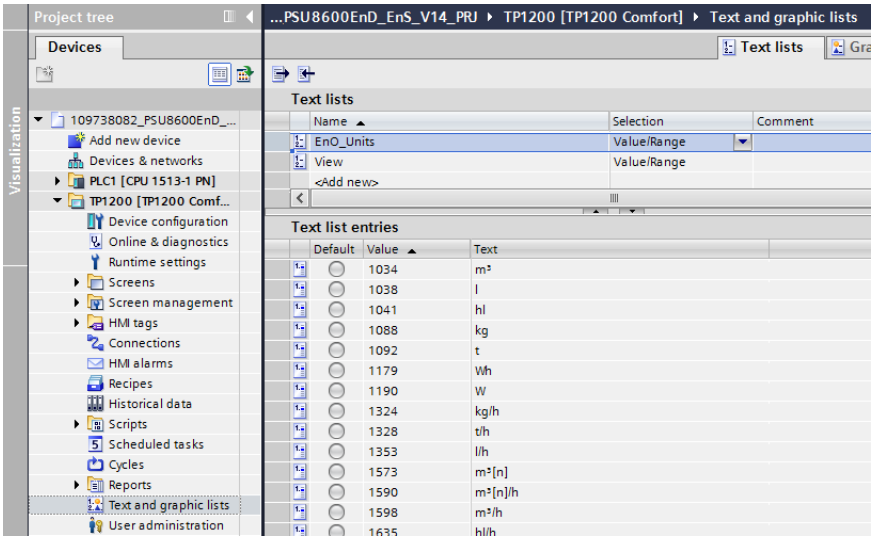
Integrating HMI components

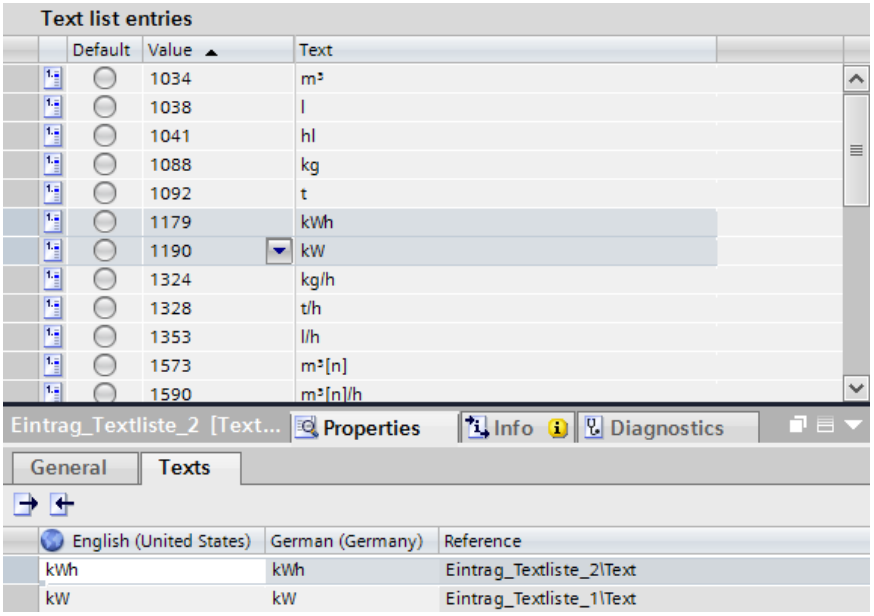
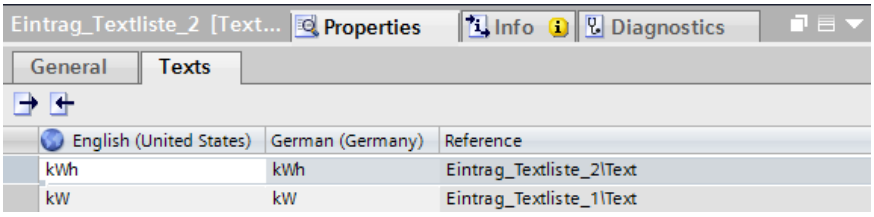
Perform the following steps to integrate the required HMI components into the project.

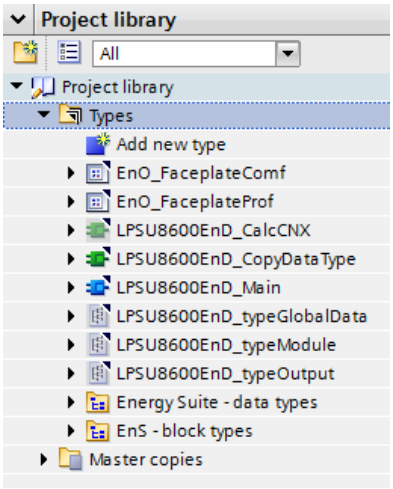
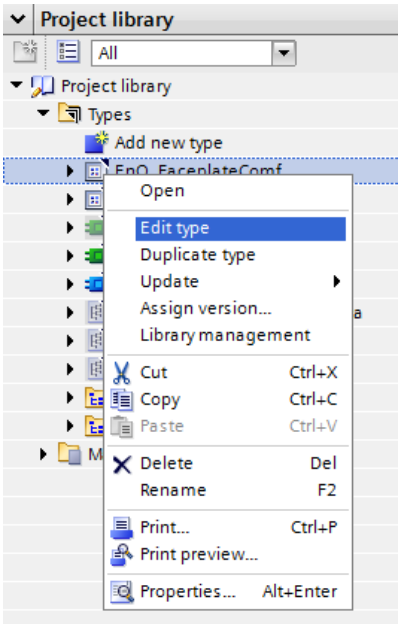
Table 3-2

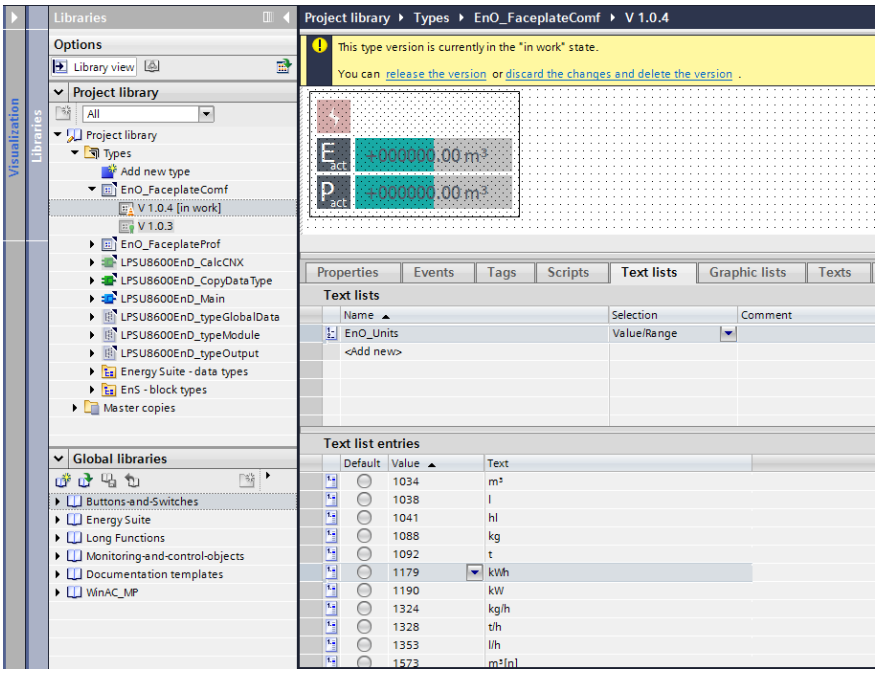
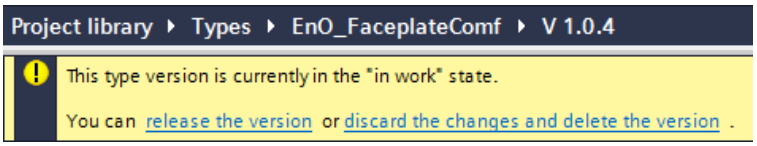
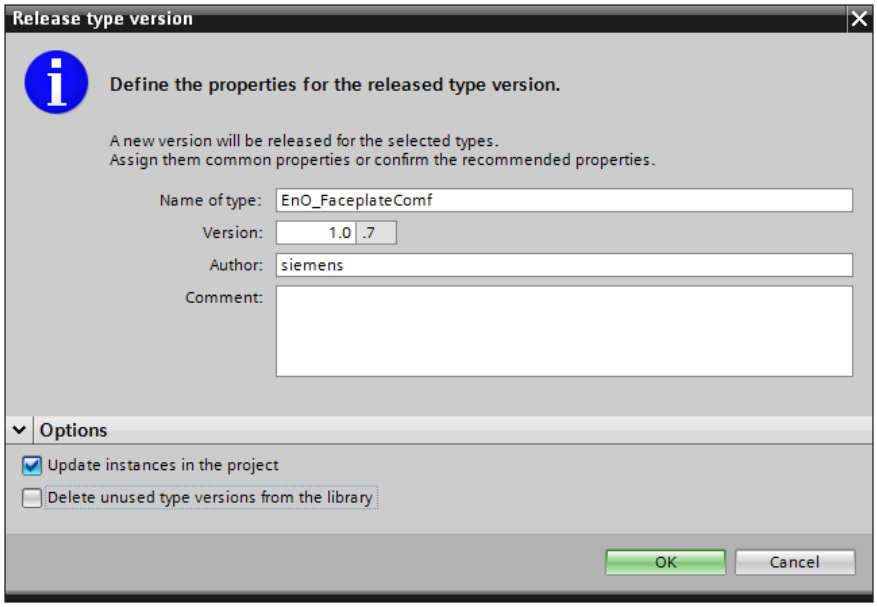
No.	Action
1.	Download the global library "LPSU8600_EnergyData", unzip it in a folder of your choice and then open it. Download in entry ID 109738082. Skip this step if the library from chapter 2.2 is still open.
2.	Go to the "Master Copies > HMI > Comfort/Advanced > EnergySuiteVisu" folder. 

No.	Action
3.	Drag the “Templates” into the “Screen management > Templates” folder of the operator panel, using drag-and-drop.  **Note:** The "Paste" dialog is opened. Select the "Replace existing objects and move to this location" option and confirm the dialog with "OK". The new template is integrated in the folder of the existing templates. 
4.	Open the screen "LPSU8600EnD_HeadPower" in "Screens > LPSU8600EnD > Head" in the project tree.
5.	Go to the properties of the screen via "Properties > General".
6.	Change the template of the screen from "LPSU8600EnD_Power" to "LPSU8600EnD_PowerEnS".
7.	Delete the I/O boxes for outputs 1 to 4.
8.	Repeat the steps no. 4 to 7 for each CNX expansion module for which you want to visualize the energy data via "SIMATIC Energy Suite".

No.	Action
9.	Download the global library "109739775_EnS_Visu_LIB_V14.zip" and the appropriate documentation for the Energy Suite visualization: https://support.industry.siemens.com/cs/ww/en/view/109739775 Unzip the library into a folder of your choice and then open it in the TIA Portal.
10.	Integrate the visualization elements according to chapter 3.2 of the documentation that you have downloaded in no. 9.
11.	Go the text lists in “Text and graphic lists” in the project tree and select the "EnO_Units" text list in the "Text list" tab. 

No.	Action
12.	Select the entries with the text "kWh" and "kW" in the "text list entries" window.  Open the setting for the entries via the "Properties > Texts" tab. 
13.	Change the text from "kWh" to "Wh" and from "kW" to "W".  **Note:** Through the normalization factor 1000 the power value is calculated in "W" and the energy values in "Wh". This is why the unit has to be adjusted in the "EnO_Units" text list.

No.	Action
14.	Open the “Types” folder in the “project library”. 
15.	Open the faceplate "EnO_FaceplateComf" to edit it via the appropriate "Edit faceplate" context menu. 

No.	Action
16.	Go to the "Text list" tab. 
17.	Change the texts "kWh" and "kW" as described in step no. 12 and 13.
18.	Release the new version of the faceplate via "release the version". 
19.	Update all faceplate instances used of faceplate "EnO_FaceplateComf". Confirm the dialog with “OK”. 

4 Appendix

4.1 Service and Support

Industry Online Support

Do you have any questions or need support?

Siemens Industry Online Support offers access to our entire service and support know-how as well as to our services.

Siemens Industry Online Support is the central address for information on our products, solutions and services.

Product information, manuals, downloads, FAQs and application examples – all information is accessible with just a few mouse clicks at https://support.industry.siemens.com/.

Technical Support

Siemens Industry's Technical Support offers quick and competent support regarding all technical queries with numerous tailor-made offers – from basic support to individual support contracts.

Please address your requests to the Technical Support via the web form: www.siemens.en/industry/supportrequest

Service offer

Our service offer comprises, among other things, the following services:

- Product Training
- Plant Data Services
- Spare Parts Services
- Repair Services
- On Site and Maintenance Services
- Retrofit & Modernization Services
- Service Programs and Agreements

Detailed information on our service offer is available in the Service Catalog: https://support.industry.siemens.com/cs/sc

Industry Online Support app

Thanks to the "Siemens Industry Online Support" app, you will get optimum support even when you are on the move. The app is available for Apple iOS, Android and Windows Phone.
https://support.industry.siemens.com/cs/ww/en/sc/2067

4.2 Links and literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com.
\2\	Link to this entry https://support.industry.siemens.com/cs/ww/en/view/109738082
\3\	Link to this entry “SITOP PSU8600: Faceplates and Communication Blocks (TIA Portal, STEP 7 and WinCC)” https://support.industry.siemens.com/cs/ww/en/view/102379345.
\4\	Link to application example "SIMATIC Energy Suite – Visualization Examples" https://support.industry.siemens.com/cs/ww/en/view/109739775.
\5\	Link to application example "SIMATIC Energy Suite – Getting Started" https://support.industry.siemens.com/cs/ww/en/view/109739102.
\6\	Link to application example "Shutdown of IPCs with Software Controller in SITOP PSU8600 Buffer Mode" https://support.industry.siemens.com/cs/ww/en/view/109737962.

4.3 Change documentation

Table 4-2

Version	Date	Modifications
V1.0	01/2017	First version