Operating an S811+ Soft Starter with a Siemens PLC via Profibus DP

Introduction

The purpose of this application note is to demonstrate how to operate and monitor an S811+ soft starter via a Profibus DP network and a Siemens Simatic PLC with a Profibus master module. The C441SS or C441QS Profibus modules are used to interface the S811+ to the Profibus network.

A GSD file is available for the C441SS/C441QS modules and it may be downloaded from the Eaton web-site. The Profibus address is configured using the dip switches on the C441 Profibus modules. The data rate is auto detected from the master.

While this application example uses a Siemens Simatic S7-1200 controller with a Profibus DP master module to control and monitor the S811+, any Profibus master may be used for this purpose. Siemens Simatic Step 7 Basic, V13 programming software was used for this application example. The Simatic S7 PLC will be configured to poll the C441 Profibus module to operate and monitor the S811+ soft starter.

The C441 Profibus modules support Profibus DPV0 functionality. This document will demonstrate how to configure the Profibus master to monitor motor and status parameters from the S811+ as well using the S811+ to control and protect a motor.

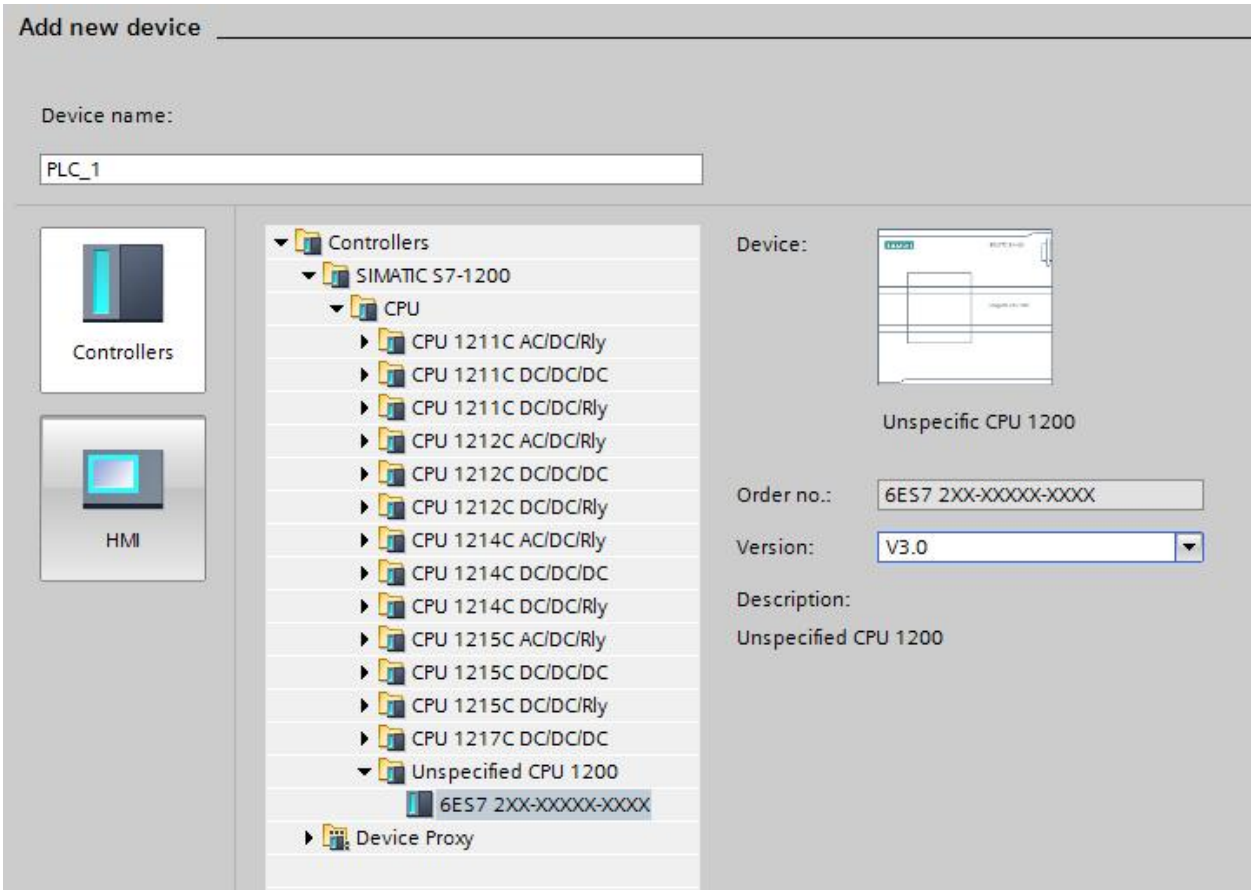
System Overview

The S811+ is controlled directly over Profibus via the C441 Profibus modules. The Siemens PLC controls the S811+ over Profibus. The S811+ protects the motor by tripping and stopping the motor when a fault condition occurs. Additional information on the S811+ soft starter can be found in the S811+ user manual, publication MN03900001E.

Creating a Project in Siemens Simatic Software

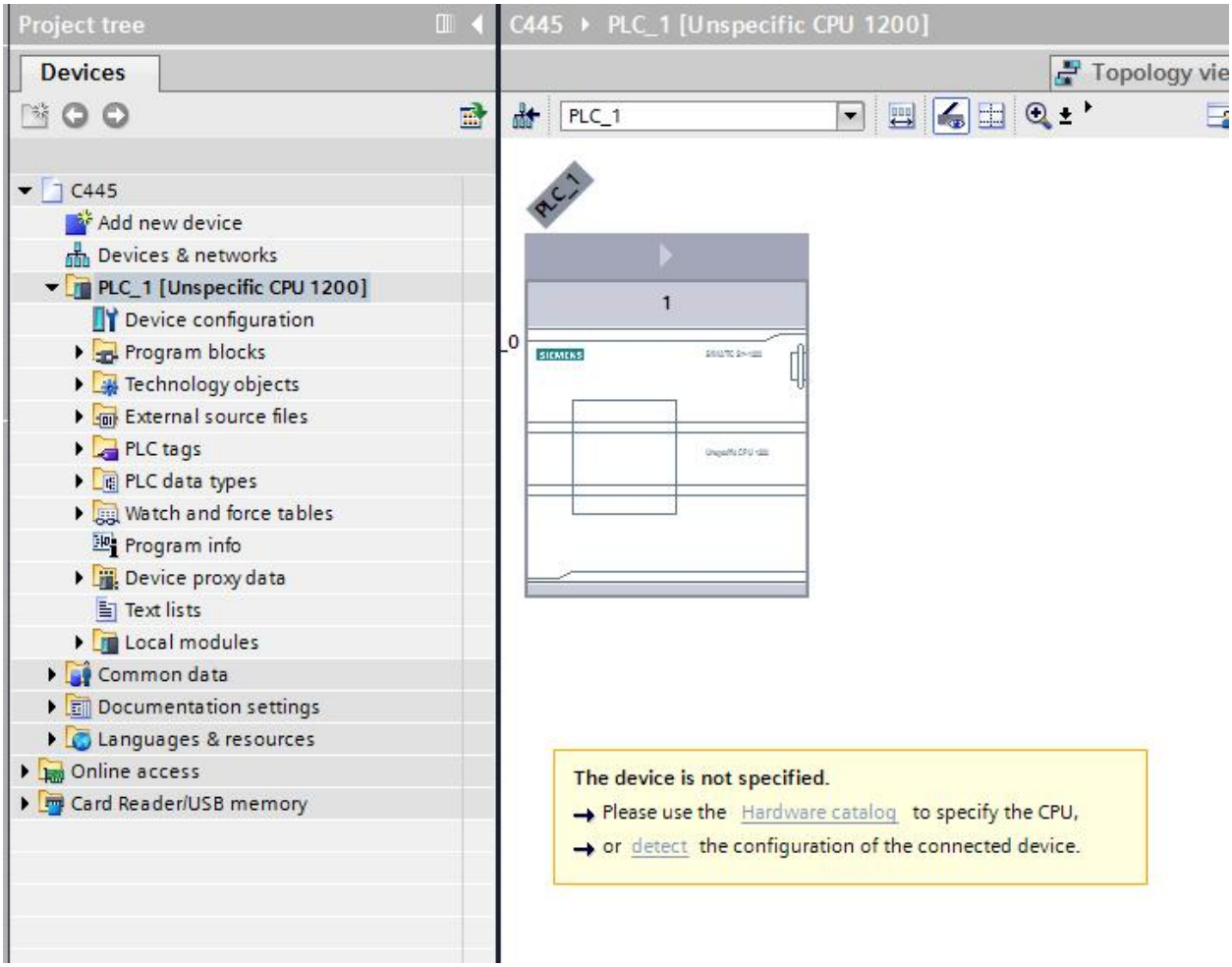
Create a project in Simatic software by starting the software and selecting Create New Project.

Enter a Project name and Path where the project will be stored, then select the Create button. Then, select “Configure a Device”, followed by “Add new Device”. The following screen will open. As shown below, select the “Unspecified CPU 1200” and the correct version, in this case version 3.



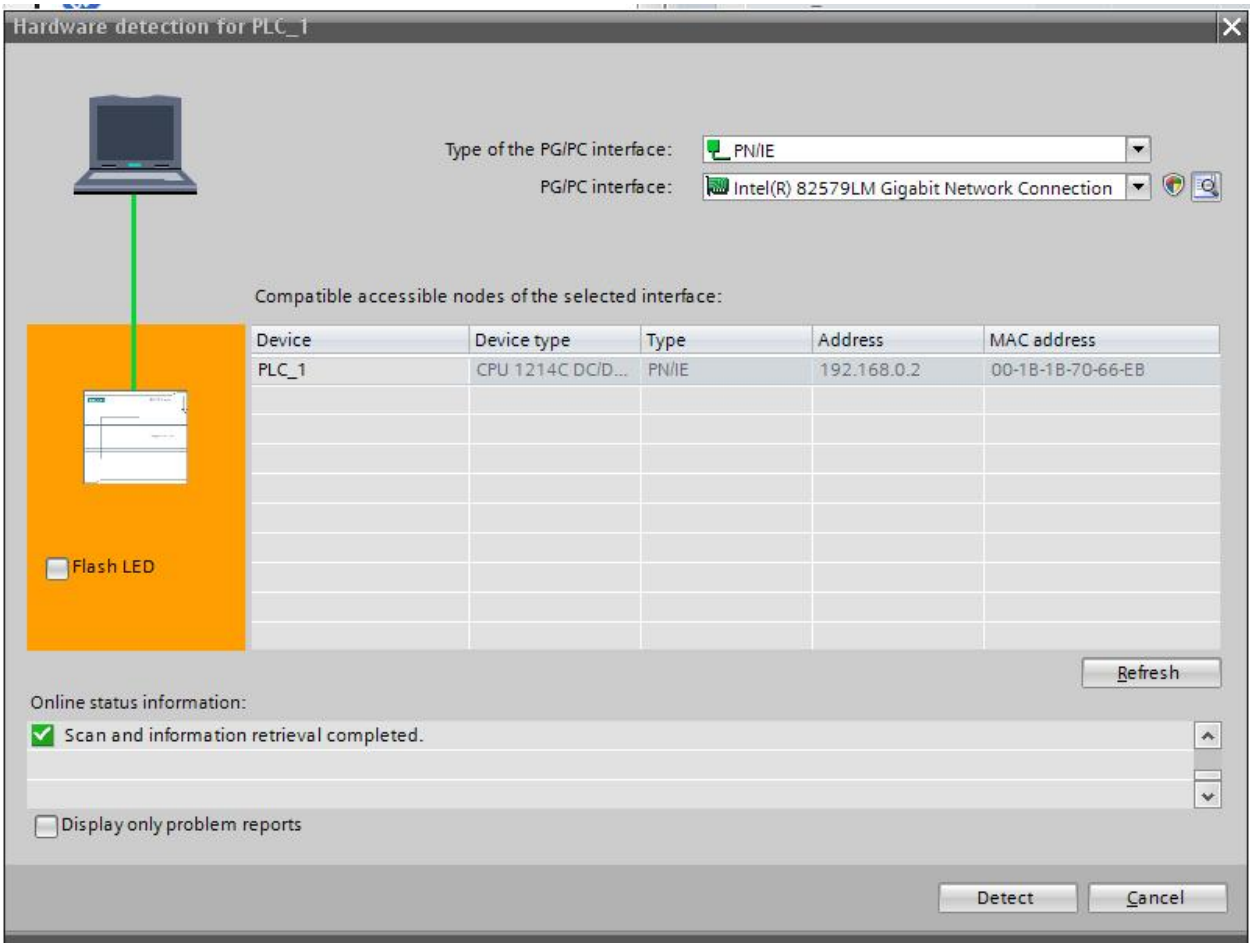
The Unspecified CPU 1200 was selected so the exact controller will not need to be selected from a long list of controllers. This selection will allow the software to auto detect the controller, as demonstrated below.

Select Project view from the lower left corner of the screen and the following will open.

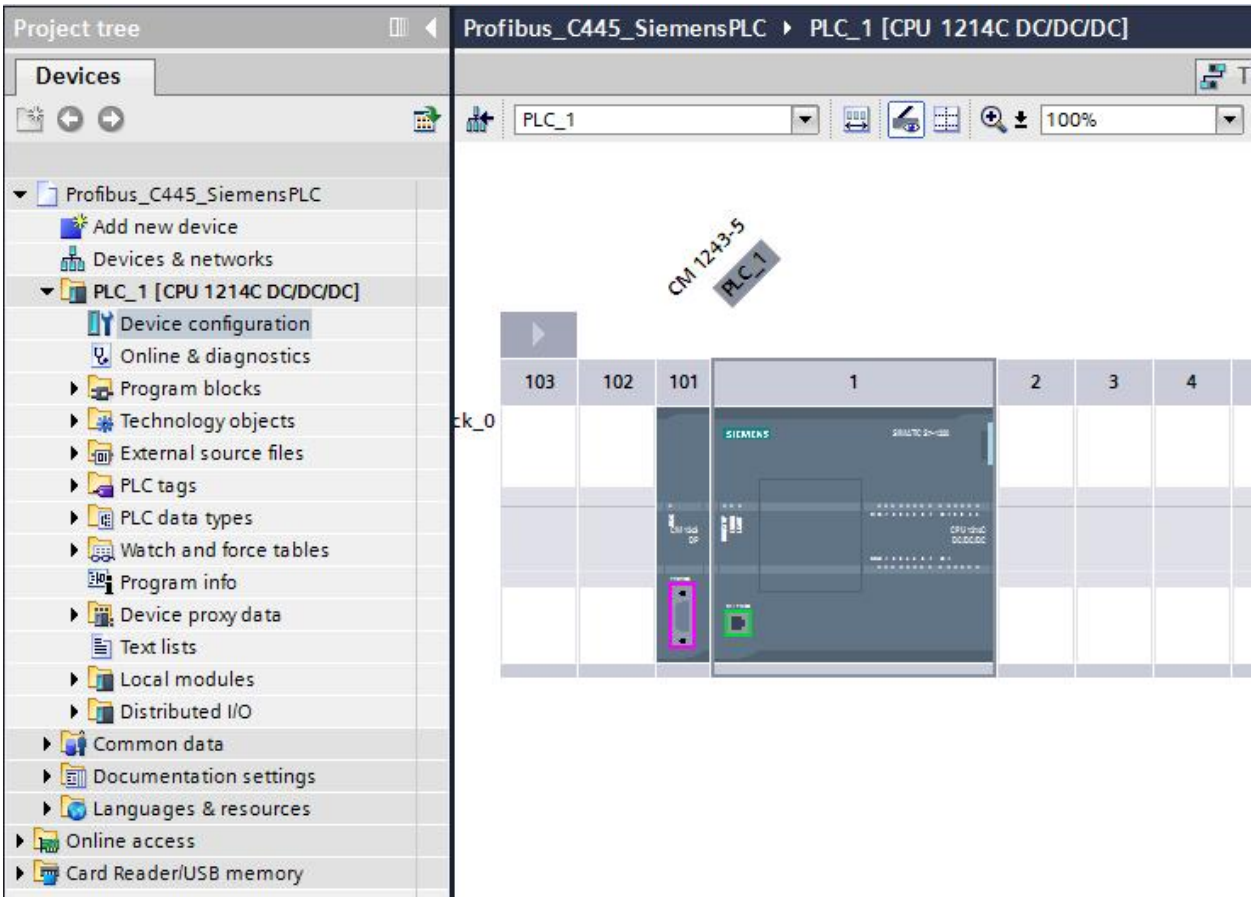


You must first establish communications with the CPU. Since this controller has an Ethernet port, that is the port used in this example to communicate with the CPU.

Select the CPU box to select it, then select “detect” in the yellow area below it. The Hardware Detection screen will be displayed as follows:



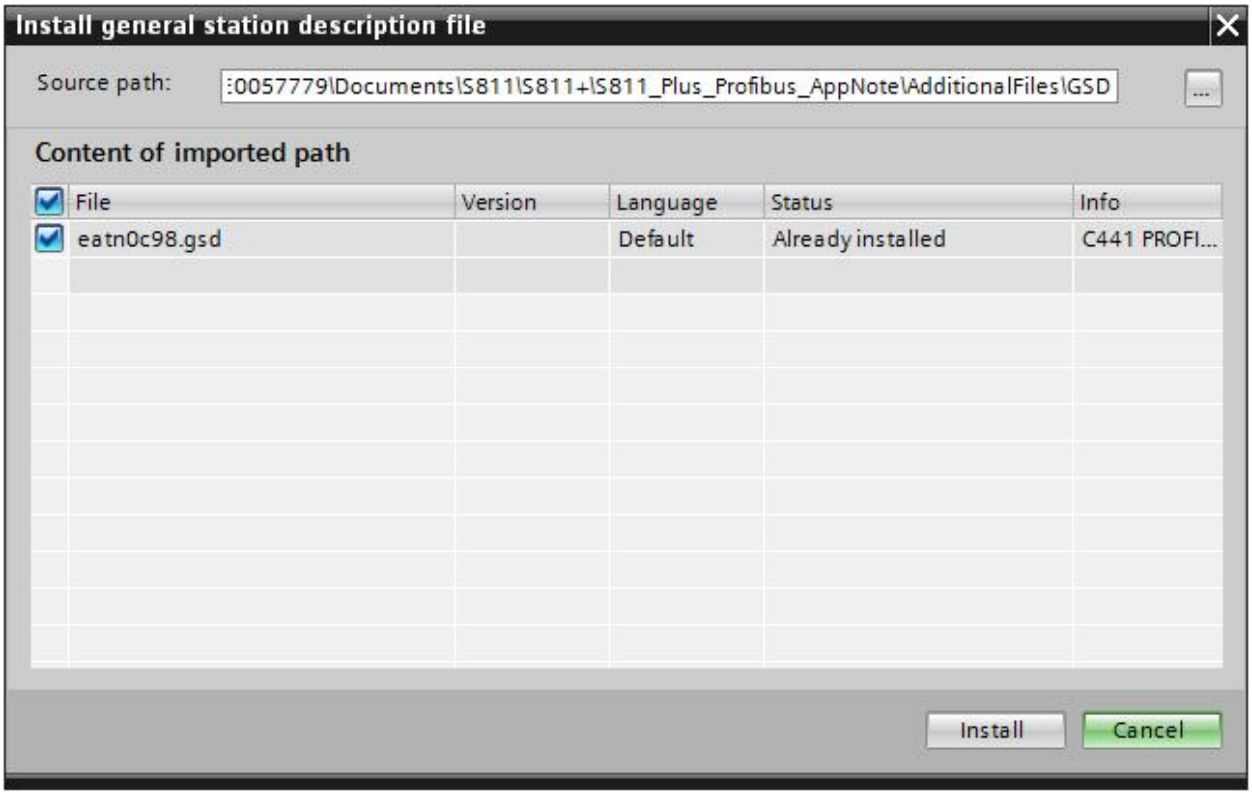
For this example, the Ethernet port on the PLC is being used to communicate with the PLC. It will also be used to upload/download the project later. Set up your computer and software to communicate with your PLC. Once communications is properly set up, select the Detect button and the software will detect the actual controller type and the Profibus master module connected to it as follows:



Connect a standard Profibus cable between the PROFIBUS master and the C441QS or C441SS module. Use the standard Profibus connectors and turn on the termination on one or both ends. Refer to the C441 Profibus User Manual (publication MN042002EN) for details on the C441 PROFIBUS communication module when used with the S811+ soft starter.

Installing GSD Files

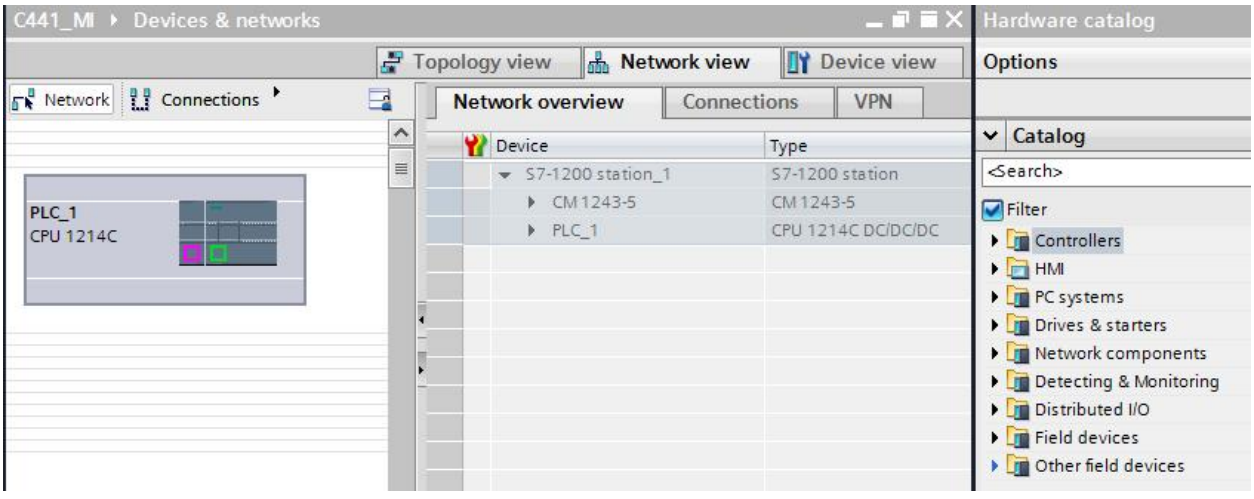
In the Simatic software, select the Options drop down menu and choose: “Install general station description file (gsd)”. Download the GSD file from the Eaton website for the C441QS and C441SS modules, then search for it on your hard drive by selecting the ellipses in the upper right hand corner of the following screen:



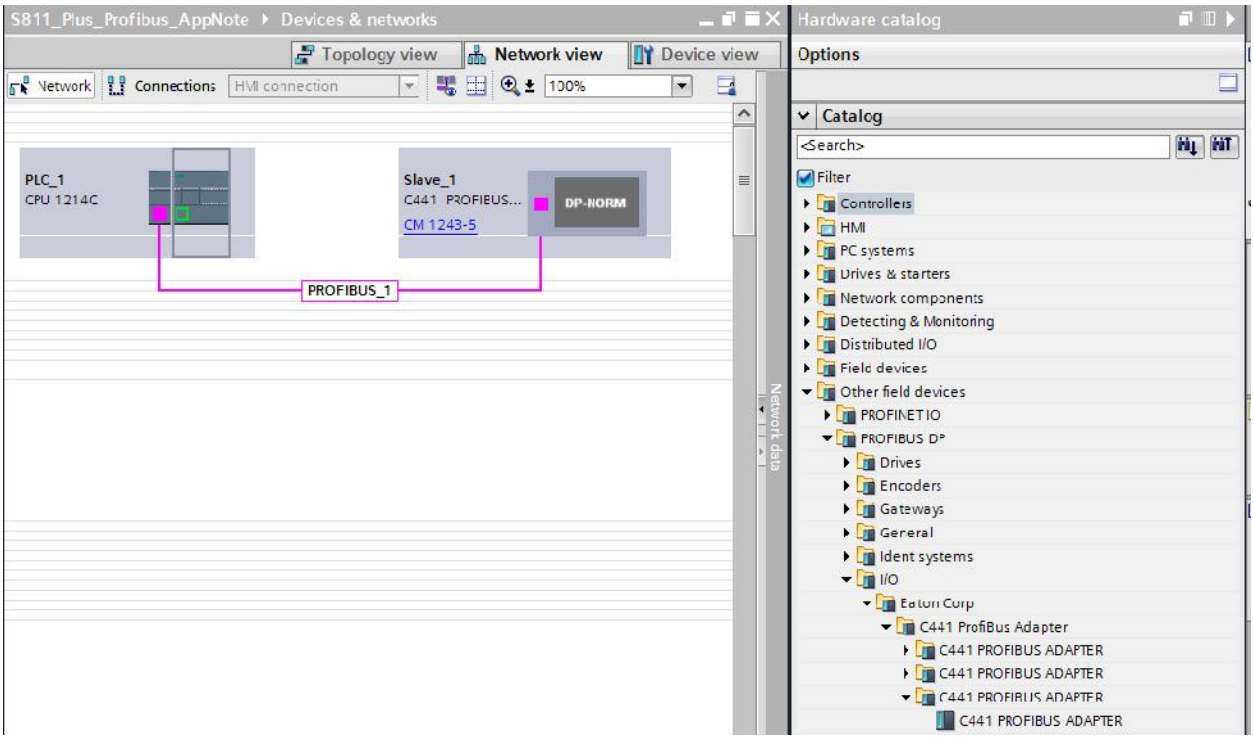
Select the 2 boxes by selecting the box next to File and next to the S811+ GSD file, then select Install and follow the directions to install the GSD file for the S811+ Soft Starter.

Adding the S811+ to the Profibus network in Siemen's Software

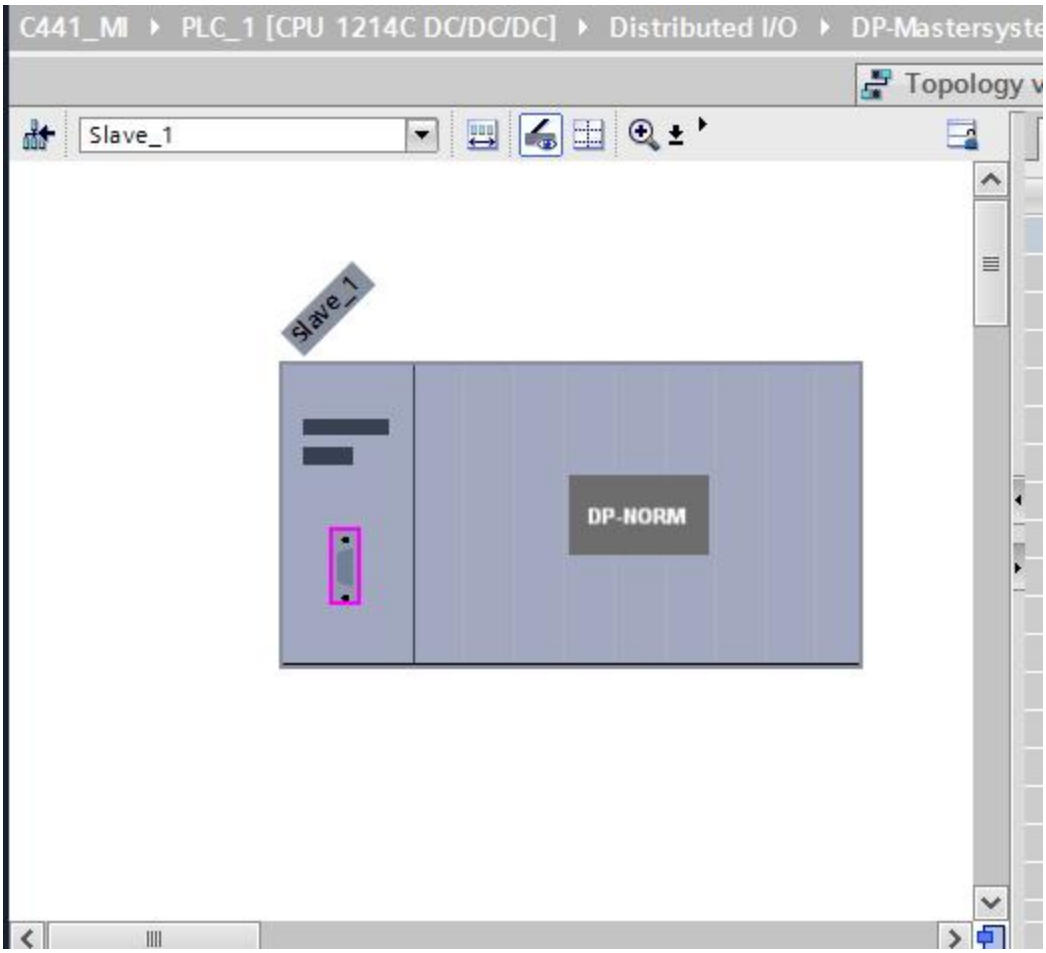
Per the following, select the Network View tab.



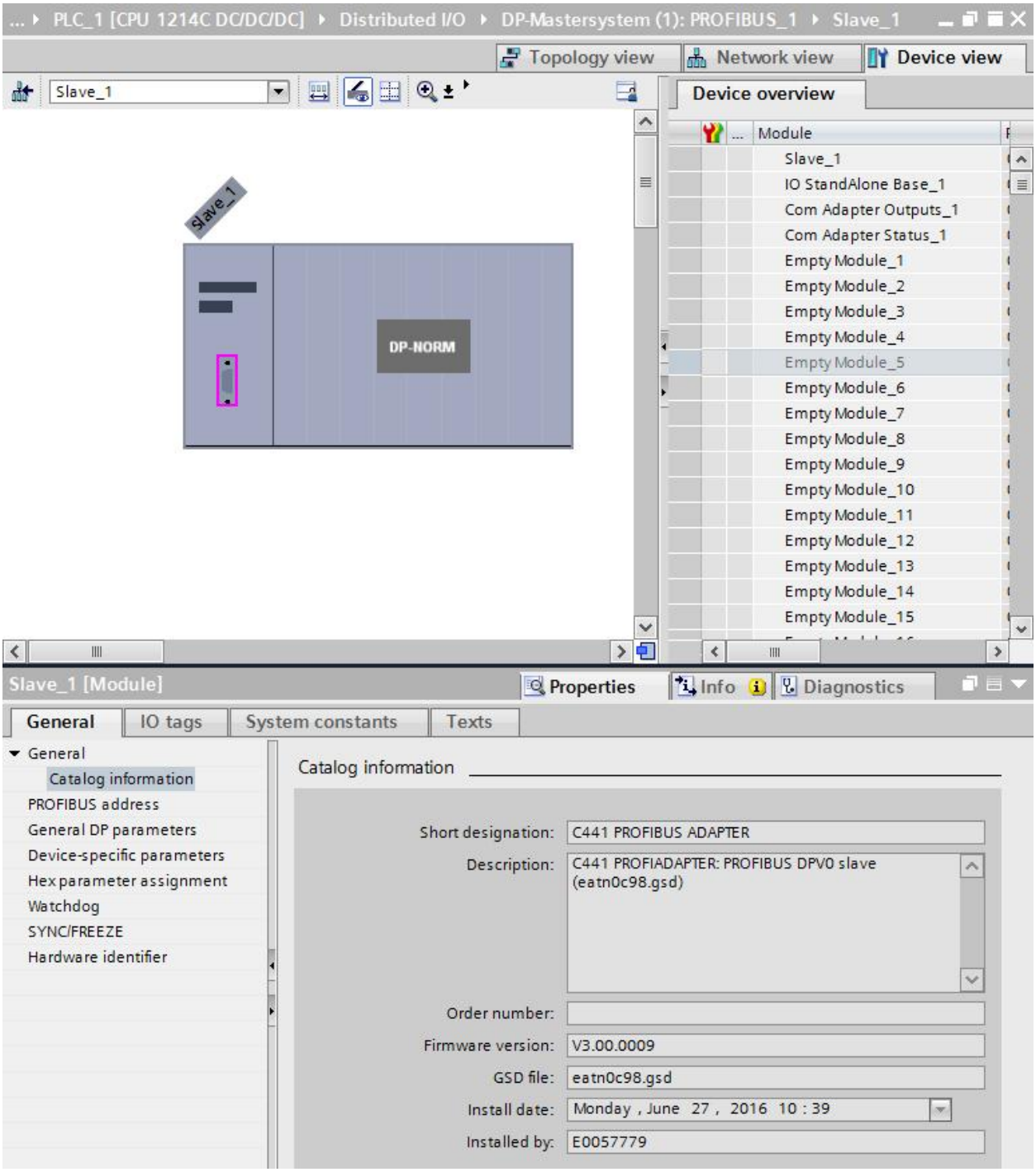
The PLC will be displayed. In the Catalog at the far right, select the arrow next to "Other field devices", then next to Profibus DP / I/O / Eaton Corp / C441 PROFIBUS Adapter / C441 Profibus Adapter. Drag and drop the device called C441 Profibus Adapter below the controller/PROFIBUS master on the Network View screen. Then select the purple square on the PROFIBUS master and drag it to the purple square on the C441 module and release the mouse button. The following should now be displayed:



The Profibus network has been created in the offline project. Double click the Slave_1 C441 Profibus module and the following will be displayed:



Double click the Slave_1 box and its Properties will open below it as follows:



Change the Profibus address to match the address selected on the C441SS or C441QS. For this example, the Profibus address being used is 3. The Transmission speed will default to 1.5 Mbps, which is fine. Any speed will work here because the C441QS and C441SS modules auto detect the data rate from the master. The data rate is dependent on the overall network cable length.

Next the I/O data to be used to control and monitor the S811+ and the C441 Profibus module is all listed in the Hardware Catalog for these devices. This information comes from the GSD file installed earlier.

Since the C441 Profibus modules are used as stand-alone I/O or to interface various Eaton motor control products to Profibus, the first thing that must be done is to remove the “IO StandAlone Base” and replace it with the “S811+ Softstarter Base”. Select the IO StandAlone Base row, then press the Delete key on the keyboard. Then drag and drop the S811+ Softstarter Base to the row left empty following the removal of the IO StandAlone Base.

The Com Adapter Outputs shown below the newly added S811+ base, should also be removed at this time. The S811+ Motor Control byte contains two bits to control the outputs, so this Com Adapter Outputs must be removed to avoid conflict. Remove it by selecting the row, then press the delete key and confirm.

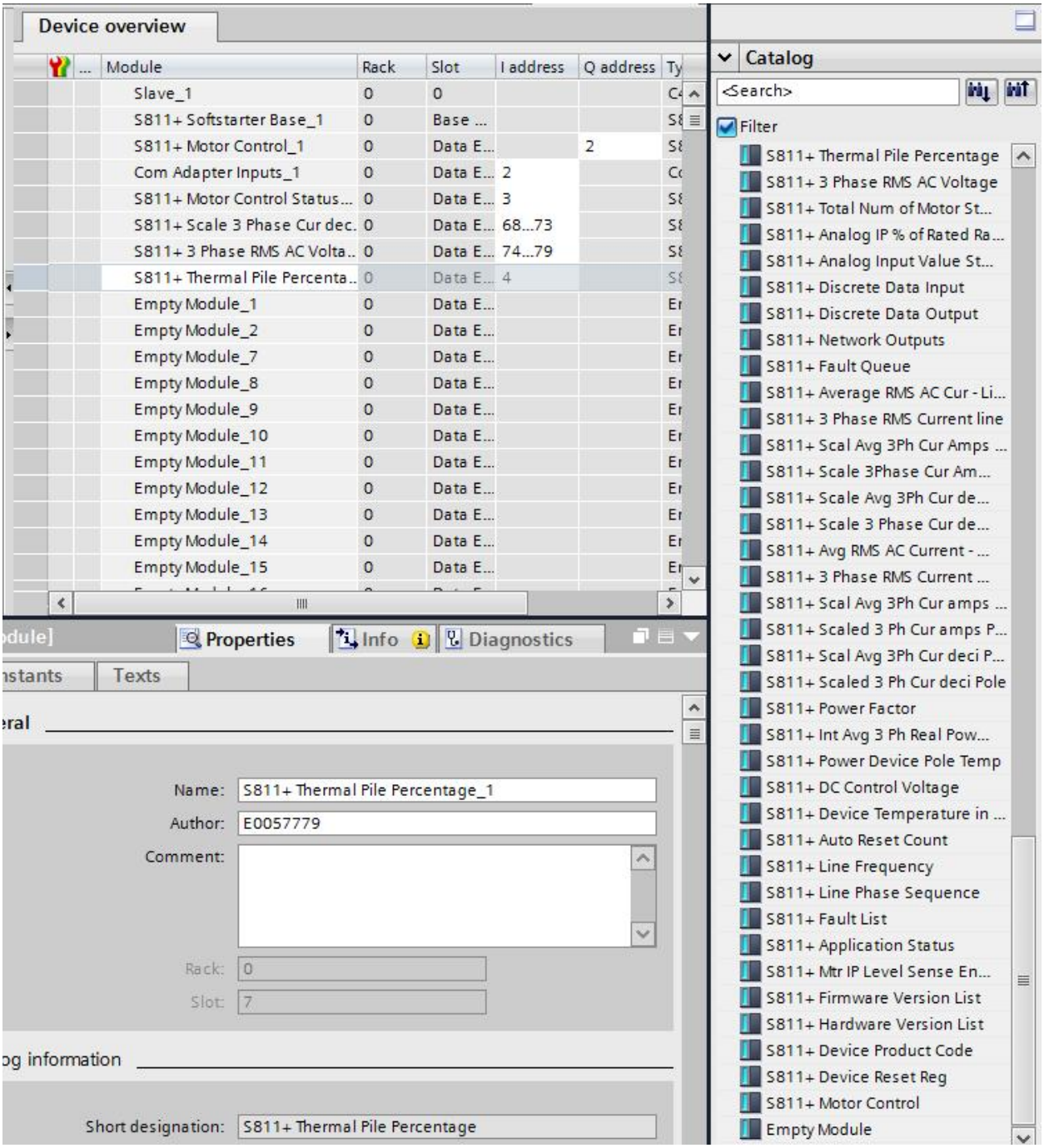
Add the S811+ Motor Control selection where the Com Adapter Outputs selection was just removed. The Com Adapter Inputs may be left if the inputs on the C441QS or C441SS modules are used. The status of these inputs are contained in bits 0-3 of this byte.

Next, add any S811+ parameters from the list that are to be monitored for the application by first deleting a row, then dragging and dropping the parameter in the empty row. Add as many parameters to be monitored as necessary. Be sure each parameter added is for the S811+ only.

For this application the following parameters are being used for control or are being monitored from the S811+ via Profibus:

Control: S811+ Motor Control byte	%QB2
Monitor:	
Com Adapter Inputs	%IB2
S811+ Motor Control Status	%IB3
3-Phase Currents (deciamps)	%IW68, %IW70, %IW72
3-Phase Voltages	%IW74, %IW76, %IW78
Thermal Pile %	%IB4

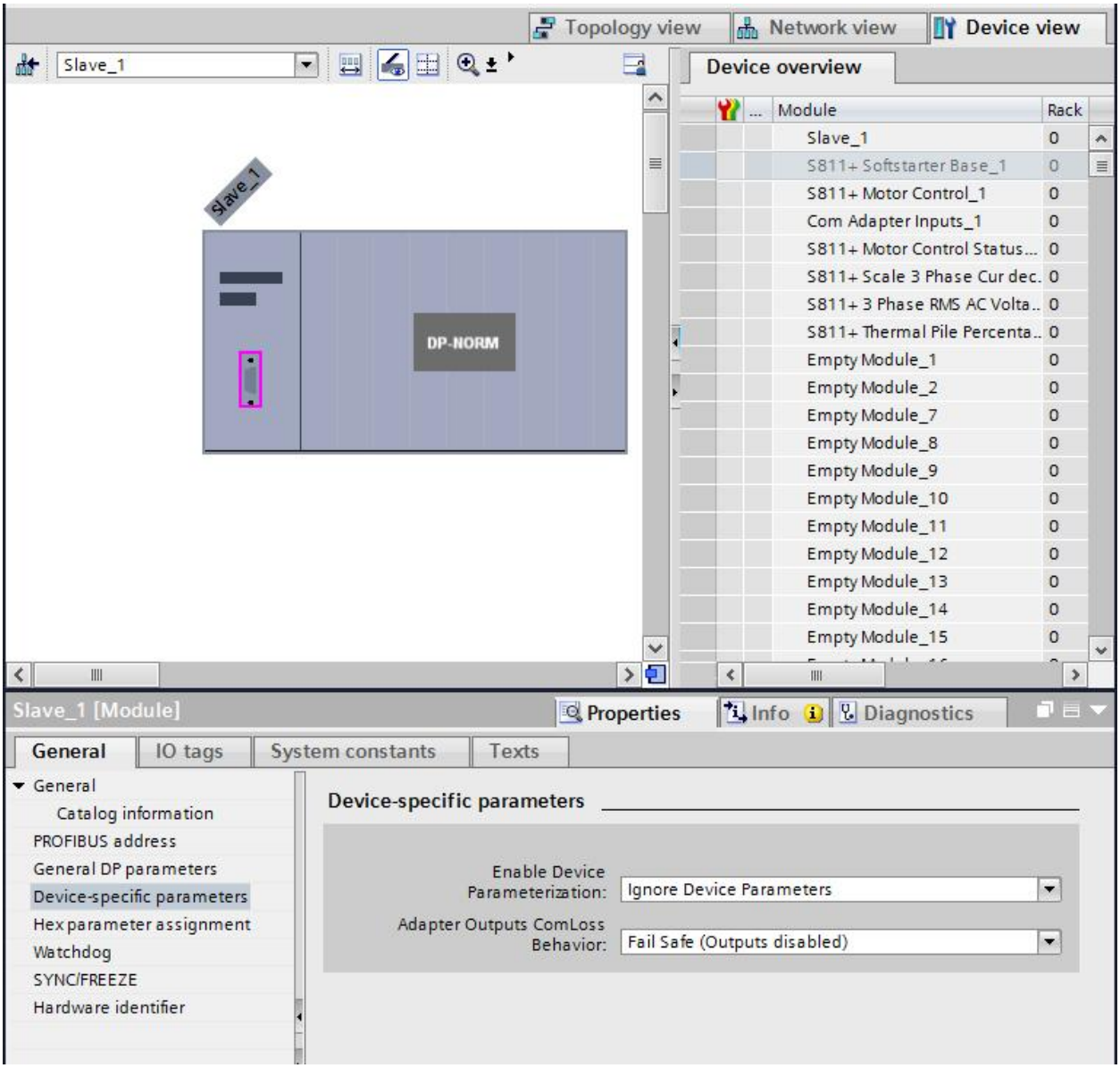
This is also shown below as entered into the software:



The tags for each S811+ must then be added to the Tag database so they may be used in the user program. This will be covered later in this document.

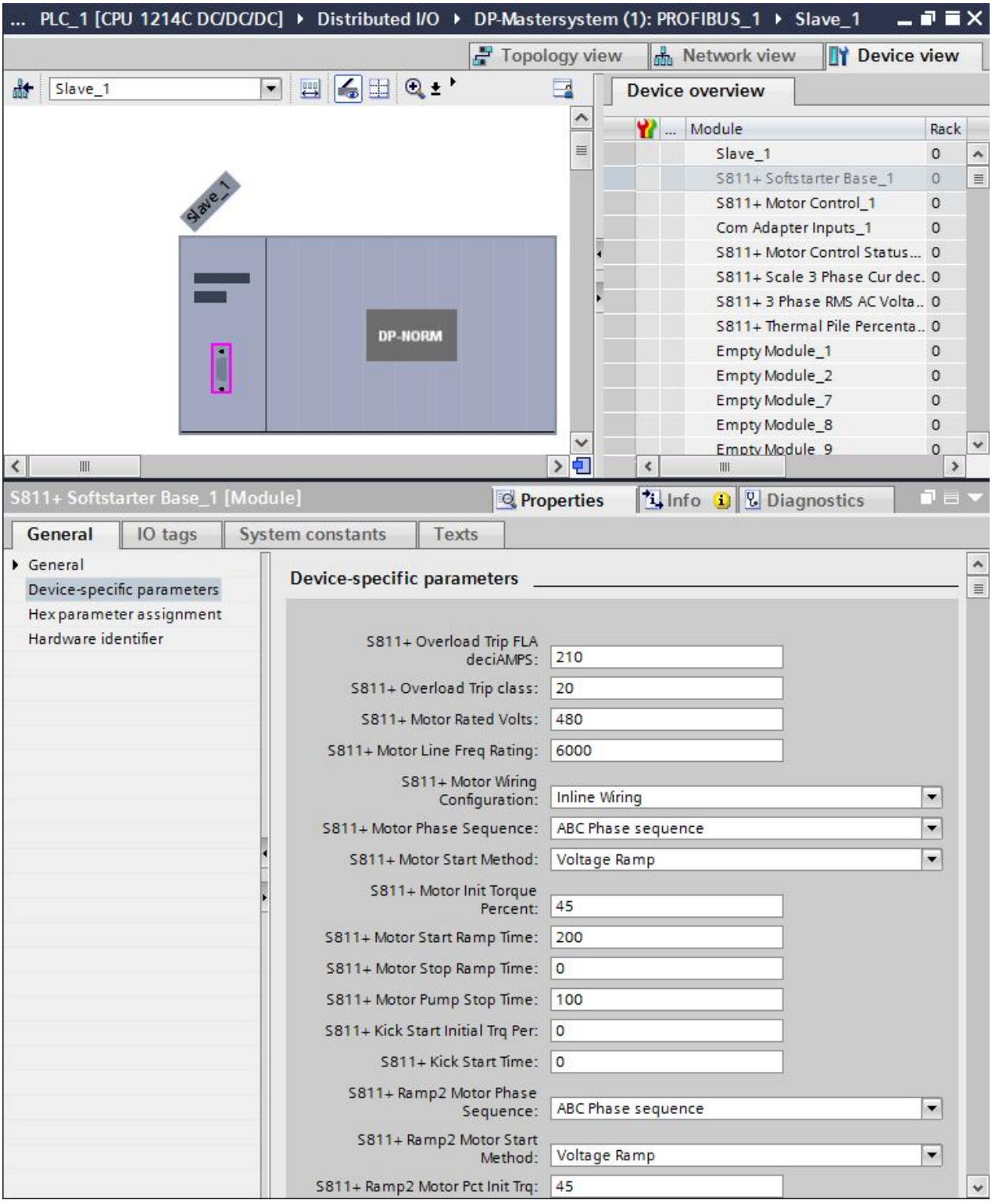
Device-specific Parameters

Another important option is the Device-specific Parameter file. This is a file containing configuration parameters for the S811+ in this case. This configuration file will be downloaded to the S811+ each time the Profibus master makes a connection with it. To enable this file to be downloaded, double click the Slave_1 S811+ in the Device View to reveal its properties below. Per the following, select Device-specific parameters:



By default, the Configuration file is not downloaded to the S811+. If this feature is to be used, change the Enable Device Parameterization selection above to Download Device Parameters.

If the configuration file is being used, the parameters for the configuration file can be found by double clicking the S811+ Softstarter Base under Device overview. Select Device-specific parameters as follows:



Modify each parameter as appropriate. When this project is downloaded to the PLC, the configuration files for each device will also be downloaded. These files, if enabled to do so, will then be downloaded to each slave device each time the master establishes a connection with them.

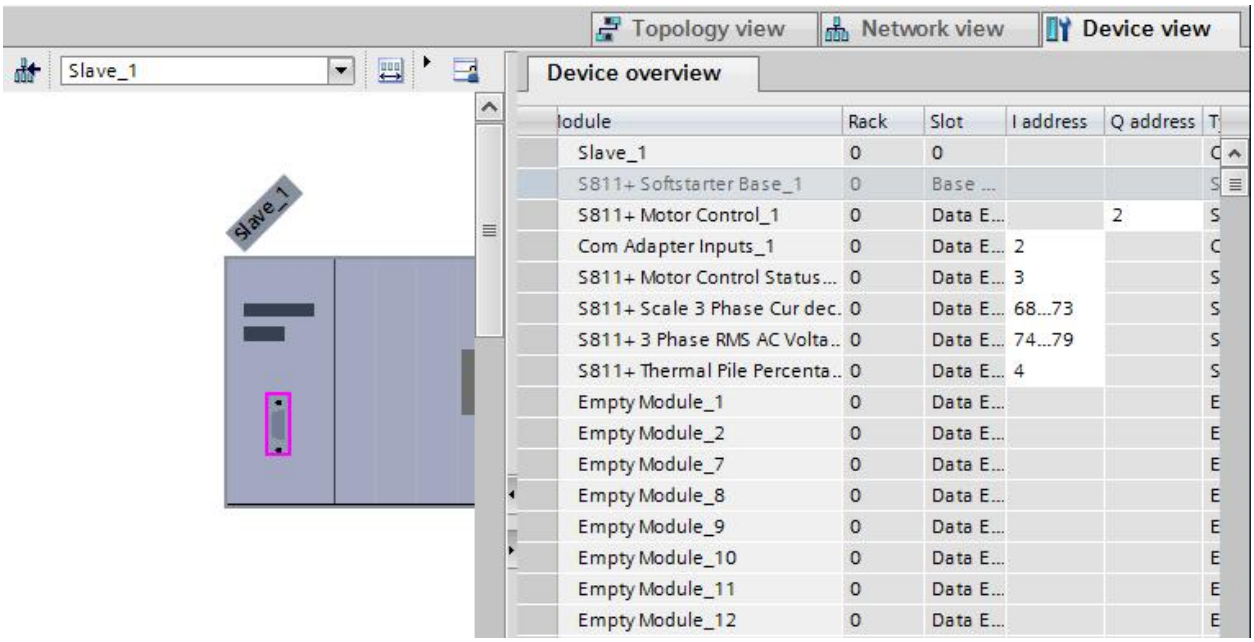
This feature also allows a new S811+ to be automatically configured if it needs to be replaced, minimizing downtime.

When utilizing the Profibus parameterization file with the C441/S811+, care must be taken for the following situations:

1. If the S811+ user interface is used to modify any configuration parameters in a S811+, these same changes must be made for the same parameters in the PROFIBUS parameterization file.
2. Be sure all the motor parameters and all other parameters for the C441/S811+ in the Profibus parameterization file are correct before enabling this file for download.

Map the I/O Tags for the C441/S811+ in the Siemens Programming Software

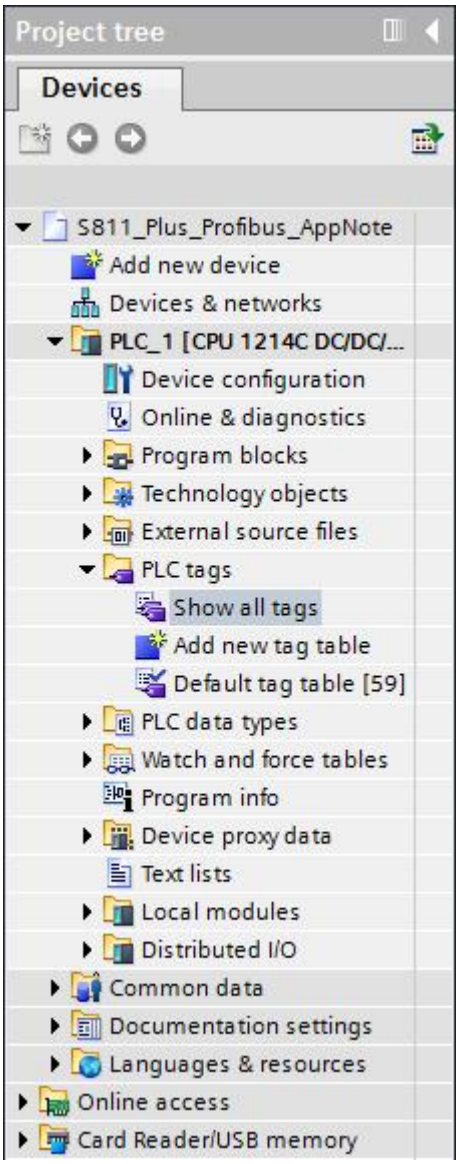
Under the device view for the C441/S811+ (Slave), the Device Overview shows the generic I/O addresses assigned to the I/O data.



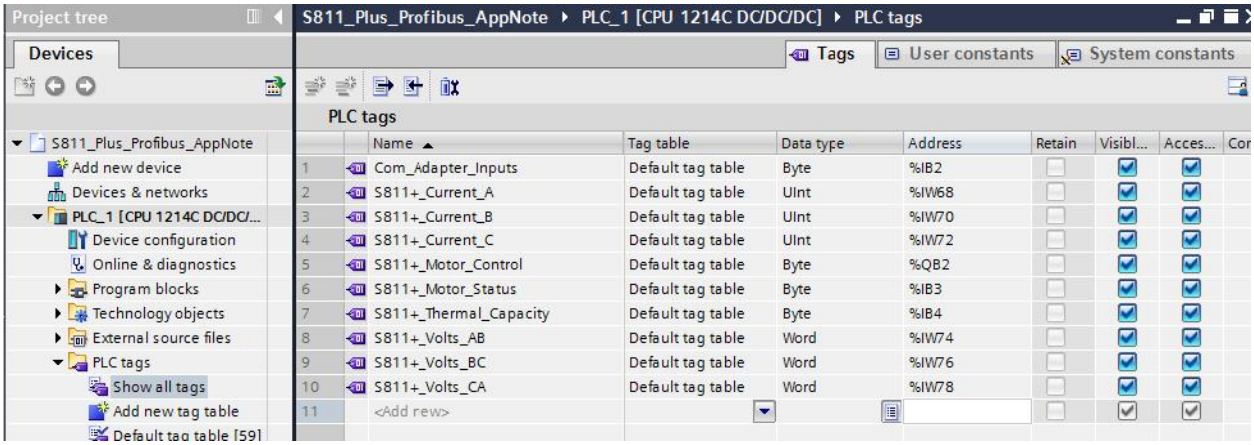
Module	Rack	Slot	I address	Q address	T
Slave_1	0	0			C
S811+ Softstarter Base_1	0	Base ...			S
S811+ Motor Control_1	0	Data E...		2	S
Com Adapter Inputs_1	0	Data E...	2		C
S811+ Motor Control Status...	0	Data E...	3		S
S811+ Scale 3 Phase Cur dec.	0	Data E...	68...73		S
S811+ 3 Phase RMS AC Volta..	0	Data E...	74...79		S
S811+ Thermal Pile Percenta..	0	Data E...	4		S
Empty Module_1	0	Data E...			E
Empty Module_2	0	Data E...			E
Empty Module_7	0	Data E...			E
Empty Module_8	0	Data E...			E
Empty Module_9	0	Data E...			E
Empty Module_10	0	Data E...			E
Empty Module_11	0	Data E...			E
Empty Module_12	0	Data E...			E

This is showing the I/O addresses that will be used when creating the PLC tags as described below.

To map the I/O tags so they may be used in the user program to control and monitor the S811+, select PLC tags in the project tree on the left and then choose Show all tags as shown below.

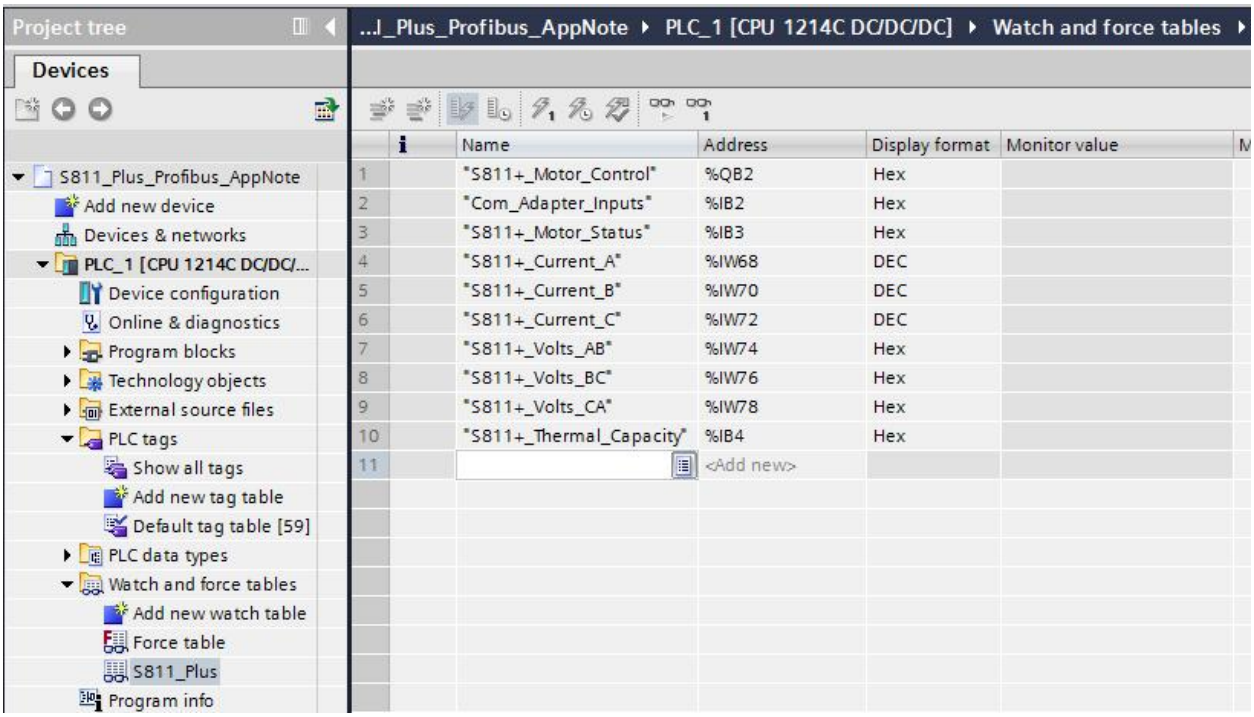


When double clicking Show all tags, the PLC tags screen will be displayed. Add tags to this screen as shown below. Names are entered for each tag and these tag names can then be used in the user program.



For the purposes of this application example, these tags will be added to a Watch and Force table rather than a program to test controlling/monitoring the S811+ via the Siemens PLC and the Profibus network.

Create a Watch and force table then add the S811+ I/O tags by double clicking in the name column, then selecting tags from the list of tags just created in the PLC Tags area. Note that the names for these addresses that you entered into the PLC Tags area are automatically populated.

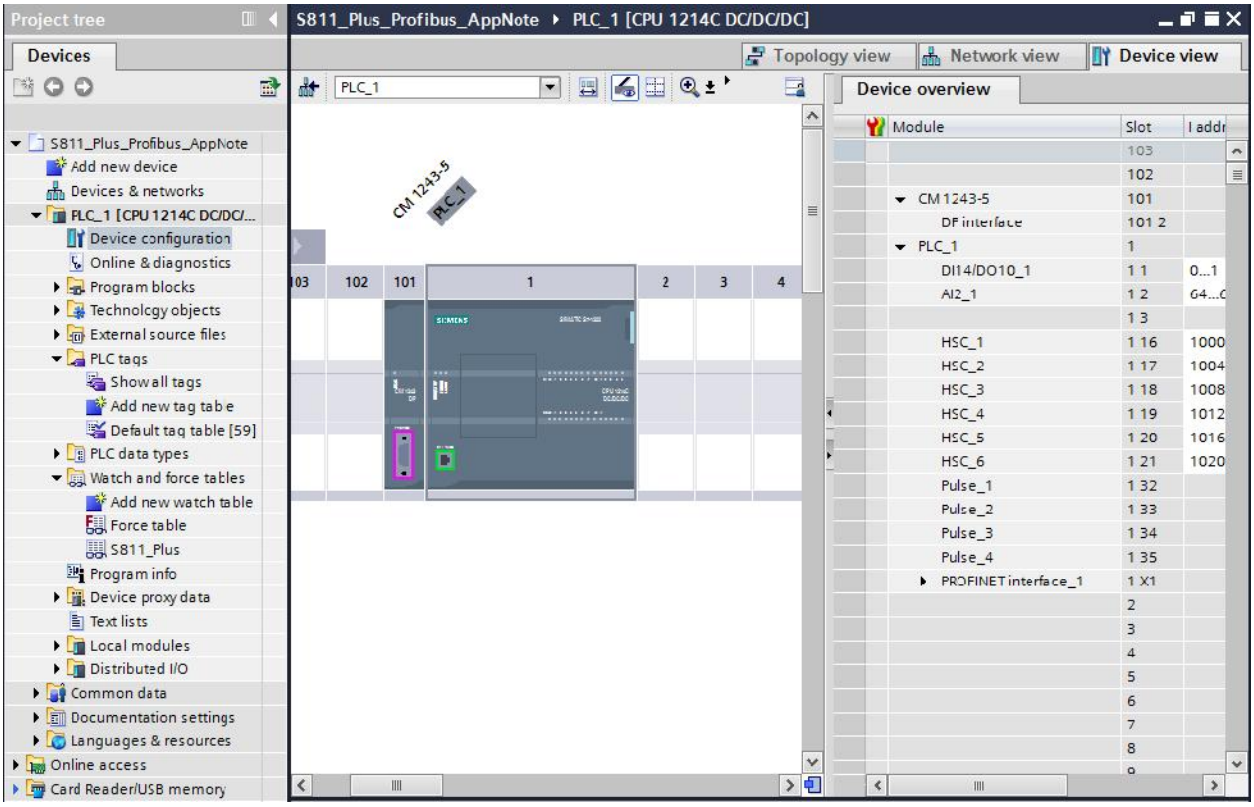


Controlling and Monitoring the C441/S811+ with the Siemens PLC using the Watch and Force Table

In place of a user program, this example will use the I/O tags for the C441/S811+ in the Watch List and control the S811+ by modifying the value for the Output tag and monitor the C441/S811+ by reading the input tags.

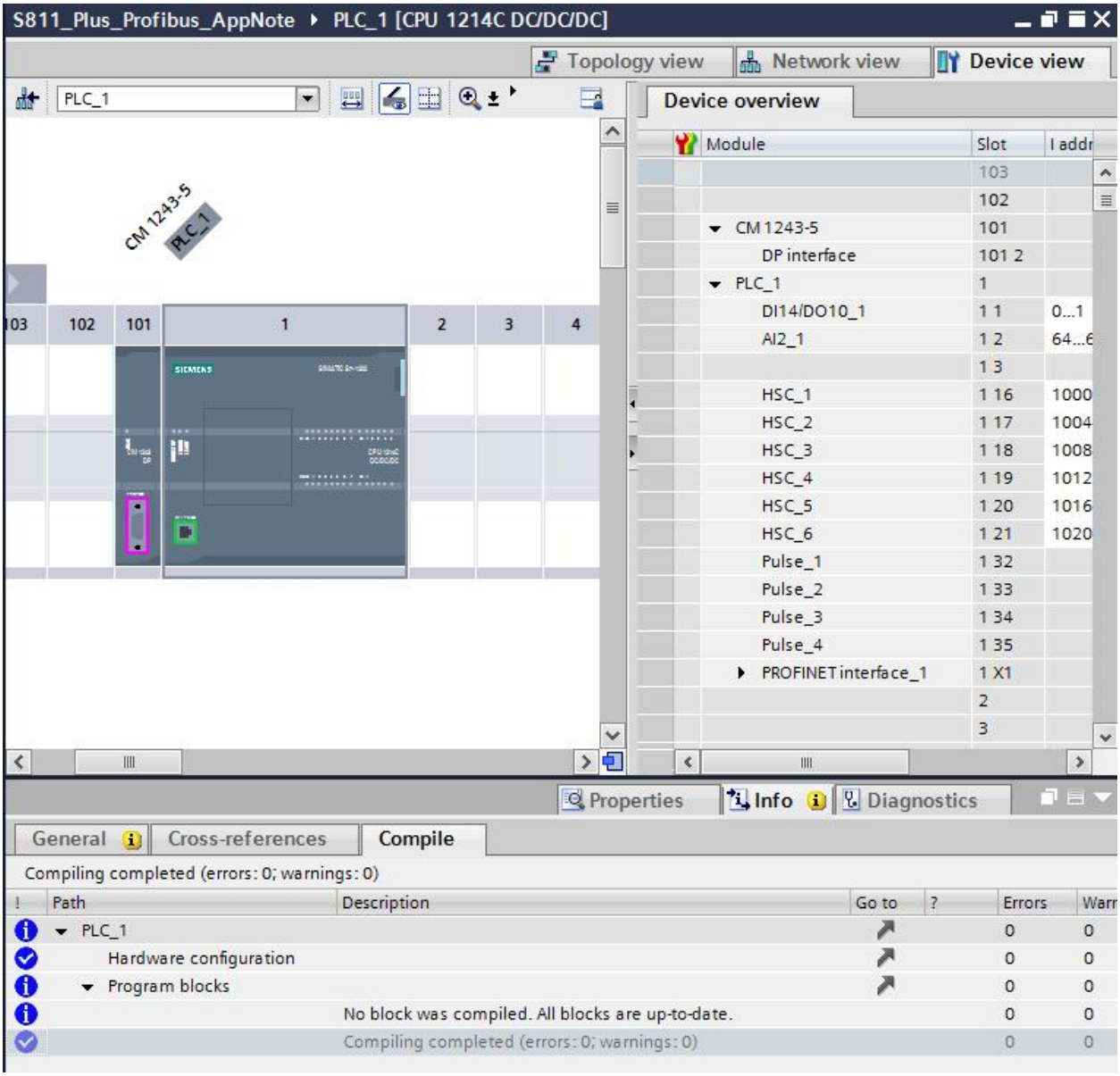
Downloading the program to the Siemens S7 PLC

The project must first be compiled with no errors before it is downloaded to the PLC. In the Project Tree under PLC_1 [CPU….], double click “Device configuration” as follows to display the Device View containing the PLC.

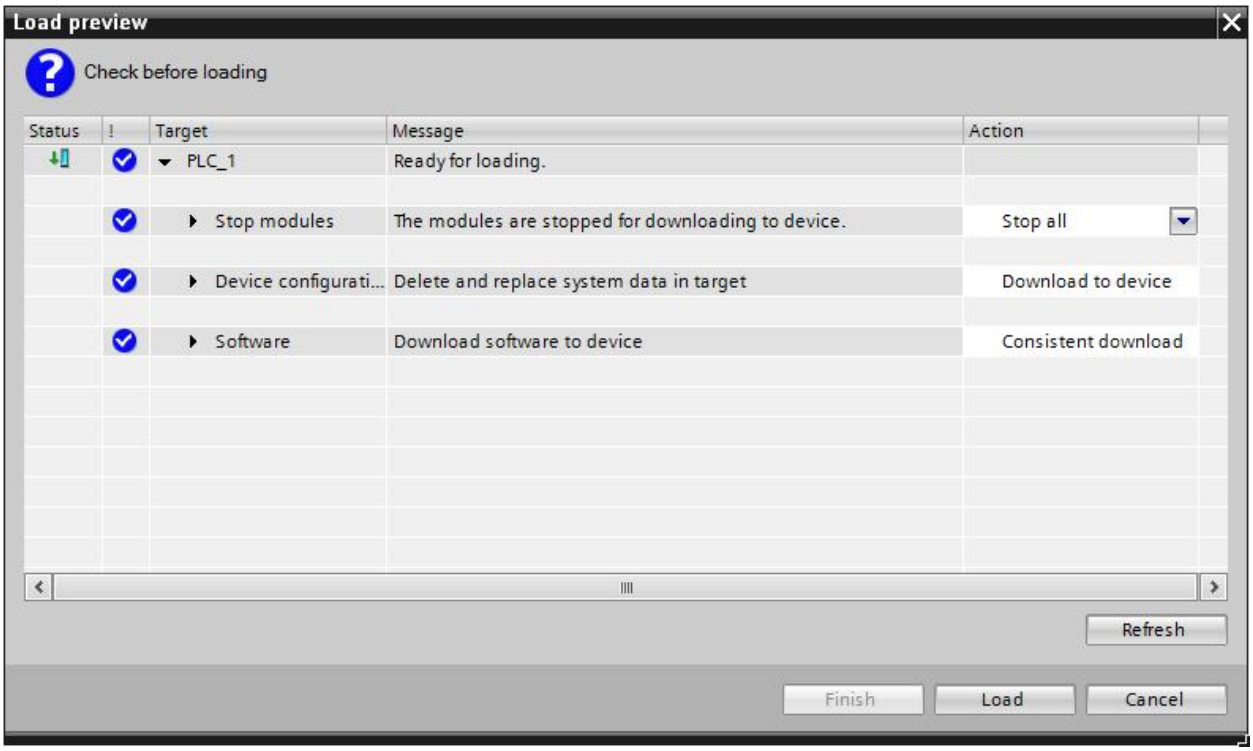


Select the PLC then click the Compile button. The compile button is just to the left of the Download button on the tool bar. Shown below are, from left to right: Compile button, download button and the upload button. As you hover over each of these buttons in the software, it will display its function.

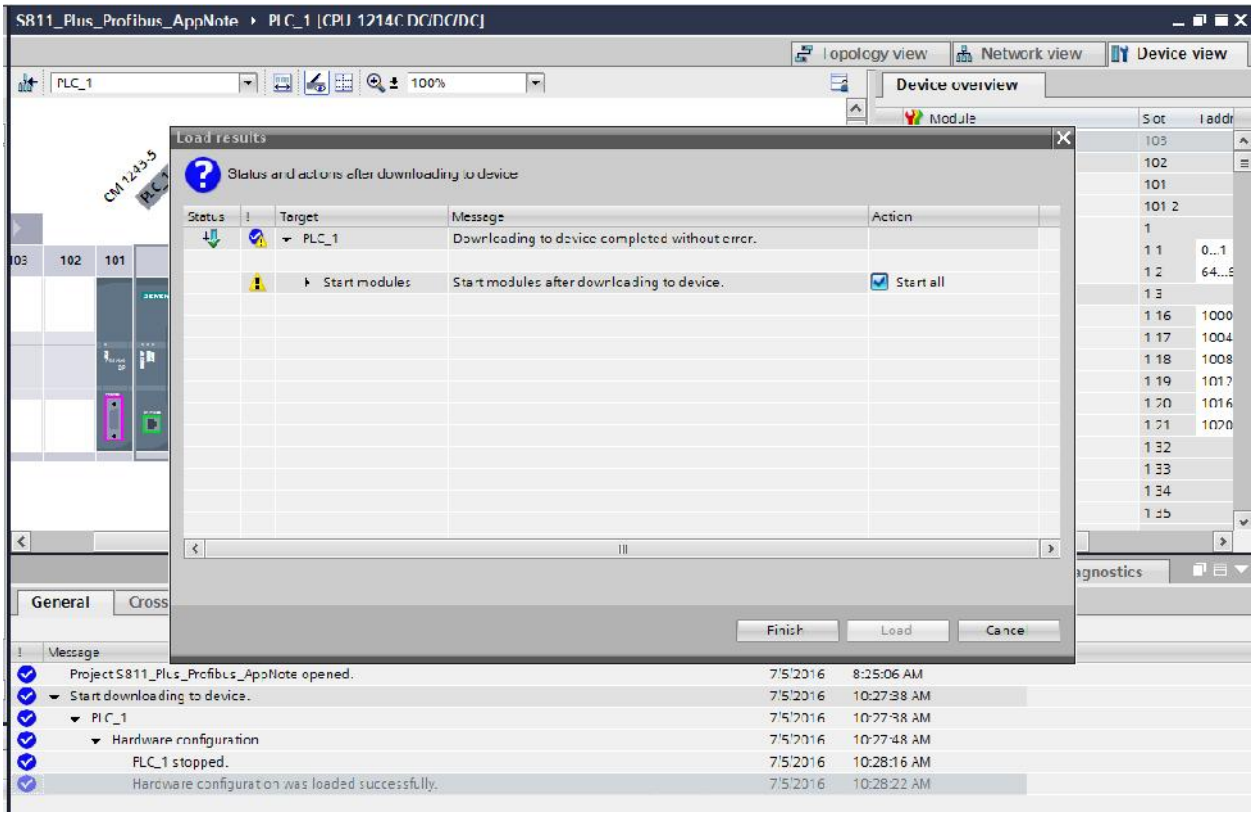
The results of the compile process will be displayed in the area below the PLC as follows:



Next, select the download button to download the project to the PLC. The following window will be displayed. If the controller was in the Run mode, it must be stopped for the download. Select “Stop all” per the following, then select the Load button.

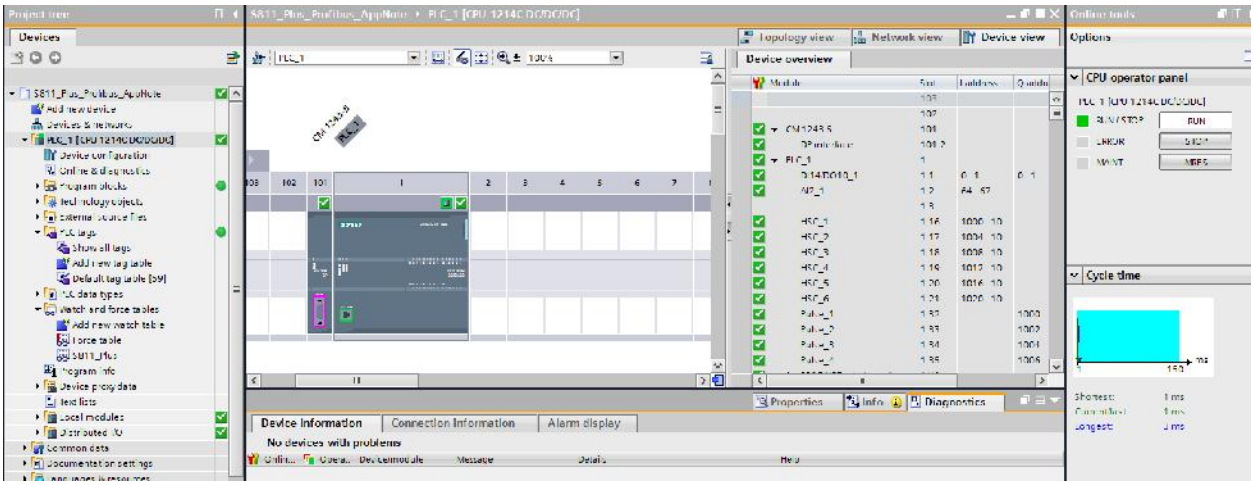


The results of the Load will be displayed in the lower portion of the project screen as shown below.

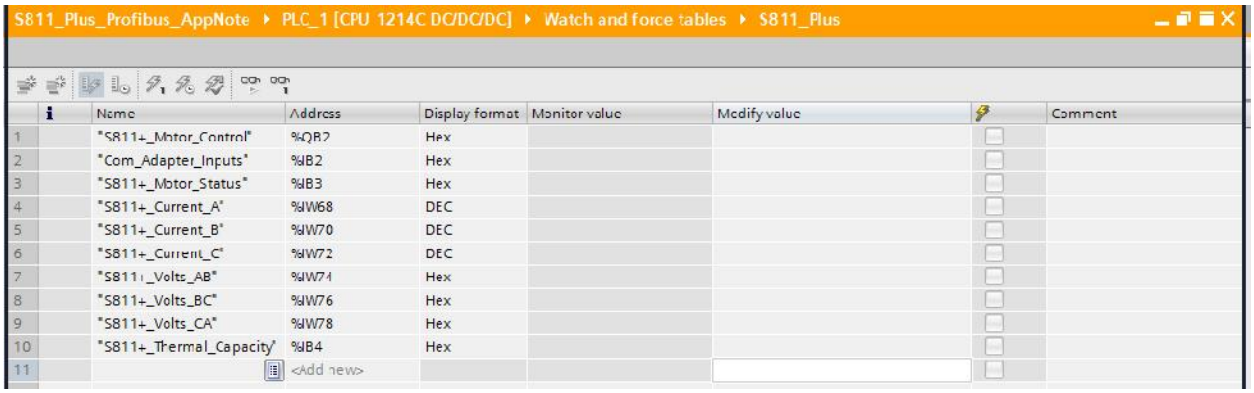


Select Finish to complete the download. This will complete the download and place the PLC into the Run mode.

With the PLC selected, select “Go online” from the Tool Bar to go online with the project running in the PLC. When online, the Simatic software should look like the following:



In the Project Tree on the left, double click “S811+” under “Watch and force tables” to display the following:



	Name	Address	Display format	Monitor value	Modify value	Comment
1	"S811+_Motor_Control"	%QB2	Hex			
2	"Com_Adapter_Inputs"	%IB2	Hex			
3	"S811+_Motor_Status"	%IB3	Hex			
4	"S811+_Current_A"	%IW68	DEC			
5	"S811+_Current_B"	%IW70	DEC			
6	"S811+_Current_C"	%IW72	DEC			
7	"S811+_Volts_AB"	%IW74	Hex			
8	"S811+_Volts_BC"	%IW76	Hex			
9	"S811+_Volts_CA"	%IW78	Hex			
10	"S811+_Thermal_Capacity"	%IB4	Hex			
11		<Add new>				

Below is the Tool Bar located above the Watch List.

If the second icon from the right is selected, the Watch List will begin monitoring and displaying the I/O data as follows:

S811_Plus_Profibus_AppNote ▸ PLC_1 [CPU 1214C DC/DC/DC] ▸ Watch and force tables ▸ S811_Plus

	Name	Address	Display format	Monitor value	Modify value
1	"S811+_Motor_Control"	%QB2	Hex	16#00	
2	"Com_Adapter_Inputs"	%IB2	Hex	16#01	
3	"S811+_Motor_Status"	%IB3	Hex	16#00	
4	"S811+_Current_A"	%IW68	DEC	0	
5	"S811+_Current_B"	%IW70	DEC	0	
6	"S811+_Current_C"	%IW72	DEC	0	
7	"S811+_Volts_AB"	%IW74	Hex	16#00EF	
8	"S811+_Volts_BC"	%IW76	Hex	16#00EE	
9	"S811+_Volts_CA"	%IW78	Hex	16#00F1	
10	"S811+_Thermal_Capacity"	%IB4	Hex	16#00	
11	<Add new>				

The S811+ can be configured for either 2-wire or 3-wire control, with 3-wire control as the default. The C441 Profibus modules sense the mode the S811+ is configured for and writes control information to the appropriate control register in the S811+. It's important to note the difference between the 2-wire and 3-wire control bytes.

3-wire control byte:

Bit 0 = Run1
Bit 1 = Run2
Bit 2 = Permissive
Bit 3 = Fault Reset
Bit 4 = Output 1 (control for C441 Profibus module output 1)
Bit 5 = Output 2 (control for C441 Profibus module output 2)
Bit 6 = Reserved
Bit 7 = Ramp2 enable

2-wire control byte:

Bit 0 = Run1
Bit 1 = Run2
Bit 2 = Reserved
Bit 3 = Fault Reset
Bit 4 = Output 1 (control for C441 Profibus module output 1)
Bit 5 = Output 2 (control for C441 Profibus module output 2)
Bit 6 = Reserved
Bit 7 = Ramp2 enable

In the "Modify value" column for QB2 enter a 1 to energize the S811+ if 2-wire control is used, or enter a value of 5 (set bits 0 and 2) if 3-wire control is being used.

The data can be entered/viewed in different formats by changing the Display Format for any value.

Each time values are entered or modified in the "Modify Value" column for the Output tags, the lightning bolt with a 1 under it shown below must be selected to instruct the software and the PLC to write the value to the C441/S811+.

Refer to the Profibus Chapter in the C441 Profibus User Manual (publication MN042002EN) for additional information on the configuration, control and monitoring parameters, Fault Codes, Diagnostic Telegrams and more.

References

S811+ User Manual, Publication MN03900001E

C441 Profibus User Manual, Publication MN042002EN