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Diagnostics for enabled Configuration Control with S7-1500 and ET200SP

TIA Portal, S7-1500, ET 200SP



<https://support.industry.siemens.com/cs/ww/en/view/29430270>

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1 Task

1.1 Overview

Introduction

The previous application “Application example for ET 200SP (PROFINET) and S7-1500 by using the library” (<https://support.industry.siemens.com/cs/ww/en/view/29430270>) describes the configuration control (option handling) for the central configuration (central processing unit) and for the distributed configuration (distributed IO device) on the example of a “muffin production”. With each new configuration the module slots also change, i.e. the real slot of the modules is no longer that of the configured slot. The changed configuration also has an effect on the diagnostics of the devices and their modules.

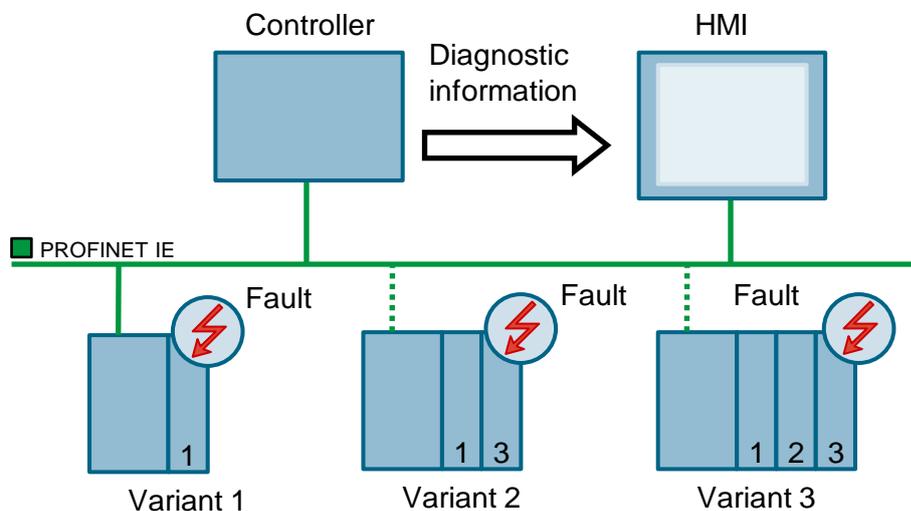
The “Diagnostics in User Program with S7-1500” application (<https://support.industry.siemens.com/cs/en/en/view/98210758>) shows how you can determine the configured slot of a disturbed module with the user program. However, in the event of a changed configuration, the real slot of the disturbed module is of interest.

This example is based on these two applications and shows the diagnostics in the user program with the enabled configuration control.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



Description of the automation task

The production plant is controlled via a central controller and a distributed IO device. Depending on the muffin version, a different configuration of the distributed IO device is necessary.

The automation task consists of monitoring the plant in their different variants and to determine the fault on the actual slot. The user program takes on the system diagnostics of the plant. The determined diagnostic information is displayed on an operator panel.

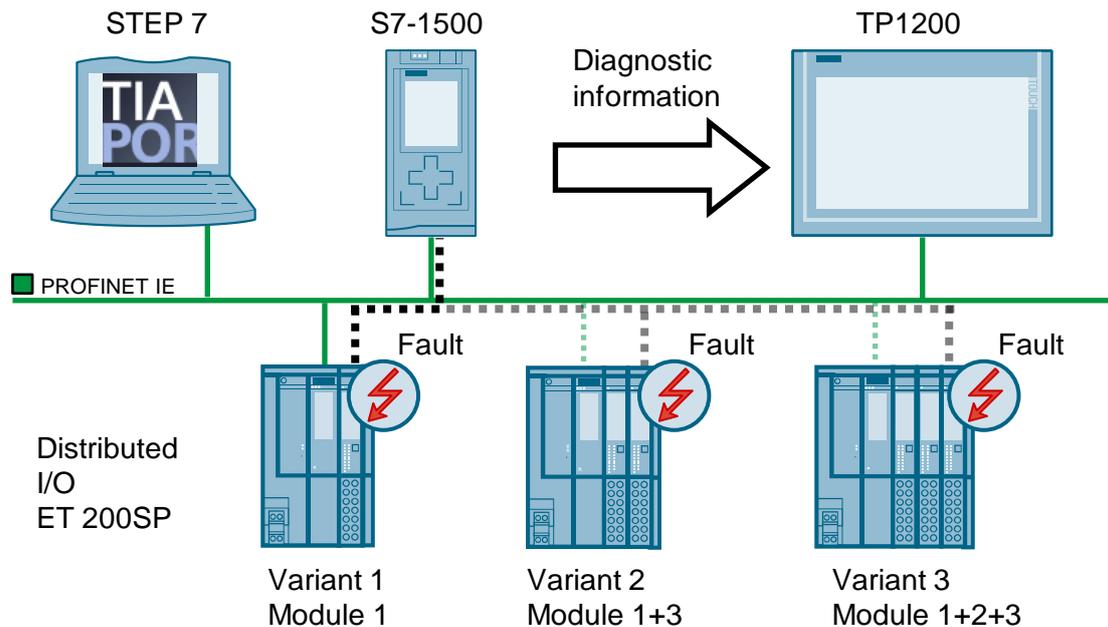
2 Solution

2.1 Overview

Schematic layout

The figure below shows a schematic overview of the most important components of the solution:

Figure 2-1



Setup

The distributed I/O devices ET 200SP is connected via PROFINET IO with a S7-1500 controller. Depending on the production, the ET 200SP is used in variant 1, variant 2 or variant 3. The ET 200SP detect faults on its modules and sends the diagnostic data to the assigned controller. The controller evaluates this diagnostic information in the user program and detects the real slot of the faulty module.

The operator panel displays the evaluated information graphically for each IO system or in a device view.

Topics not covered in this application

- This application does not include a description of the integrated system diagnostics.
- This application does not contain a complete discussion of all diagnostic options provided by the user program. The extension of the present code by the user is therefore possible and necessary.
- This application does not include a detailed description of the diagnostic instructions.

Note

For a detailed description of the diagnostic instructions, please refer to the TIA Portal online help or the "STEP 7 Professional V14 system manual"
<https://support.industry.siemens.com/cs/ww/en/view/109742272>

- This application does not include a description of the diagnostic instructions of S7-1200 controllers.

Basic knowledge of these topics is assumed.

Assumed knowledge

Basic knowledge for the following issues is assumed:

- STEP 7 (TIA Portal)
- WinCC (TIA Portal)
- STEP 7 block architecture and programming
- PROFINET IO
- Configuration control (option handling)

2.2 Hardware and software components

2.2.1 Validity

The application was tested with

- STEP 7 V14
- S7-1500 V2.0
- ET 200SP V3.1.0

2.2.2 Components used

The application was created with the following components:

It is recommended to use the TIA Selection Tool for configuring the hardware:

<http://www.siemens.en/tia-selection-tool>

Note

A list of the hardware and software products used can also be found in the “29430270_OH_S71500_WITH_DIAG_PRODUCTS_v10.zip” file in the archive. Use the TIA Selection Tool for this.

Hardware components

Table 2-1

Component	Qty	Article number	Note
CPU 1516-3 PN/DP	1	6ES7516-3AN00-0AB0	Alternatively, any other CPU S7-1500 can also be used.
Memory Card, 12 Mbytes	1	6ES7954-8LE02-0AA0	
Digital input, DI 16x24VDC BA,	2	6ES7521-1BH10-0AA0	The digital input modules are not required, since they are deselected with the configuration controller.
IM 155-6 PN ST incl. server module, incl. bus adapter 2xRJ45	1	6ES7155-6AA00-0BN0	ET 200SP V3.1.0
DI 8x24VDC ST	1	6ES7131-6BF00-0BA0	Diagnostics can be configured
DQ 4x24VDC/2A ST	1	6ES7132-6BD20-0BA0	Diagnostics can be configured
DQ 8x24VDC/0.5A ST	1	6ES7132-6BF00-0BA0	Diagnostics can be configured

2 Solution

2.2 Hardware and software components

Component	Qty	Article number	Note
BU-type A0, 16 push-in, 2 feed terminals separated (digital/analog, max. 24VDC/10A)	1	6ES7193-6BP00-0DA0	
BU-type A0, 16 push-in, 2 feed terminals bridged (digital/analog, 24VDC/10A)	2	6ES7193-6BP00-0BA0	
TP1200 Comfort	1	6AV2124-0MC01-0AX0	

Software components

Table 2-2

Component	Qty	Article number	Note
STEP 7 Professional V14	1	6ES7822-1AA04-0YA5	
WinCC Professional V14	1	6AV210.-....4-0	

Sample files and projects

The following list includes all files and projects that are used in this example.

Table 2-3

Component	Note
29430270_OH_S71500_WITH_DIAG_DOKU_v20_en.pdf	This document.
29430270_OH_S71500_WITH_DIAG_CODE_v20.zip	This zip file contains the STEP 7 project.
29430270_OH_S71500_WITH_DIAG_PRODUCTS_v10.zip	The zip file contains: TIA Selection Tool file with hardware and software products.

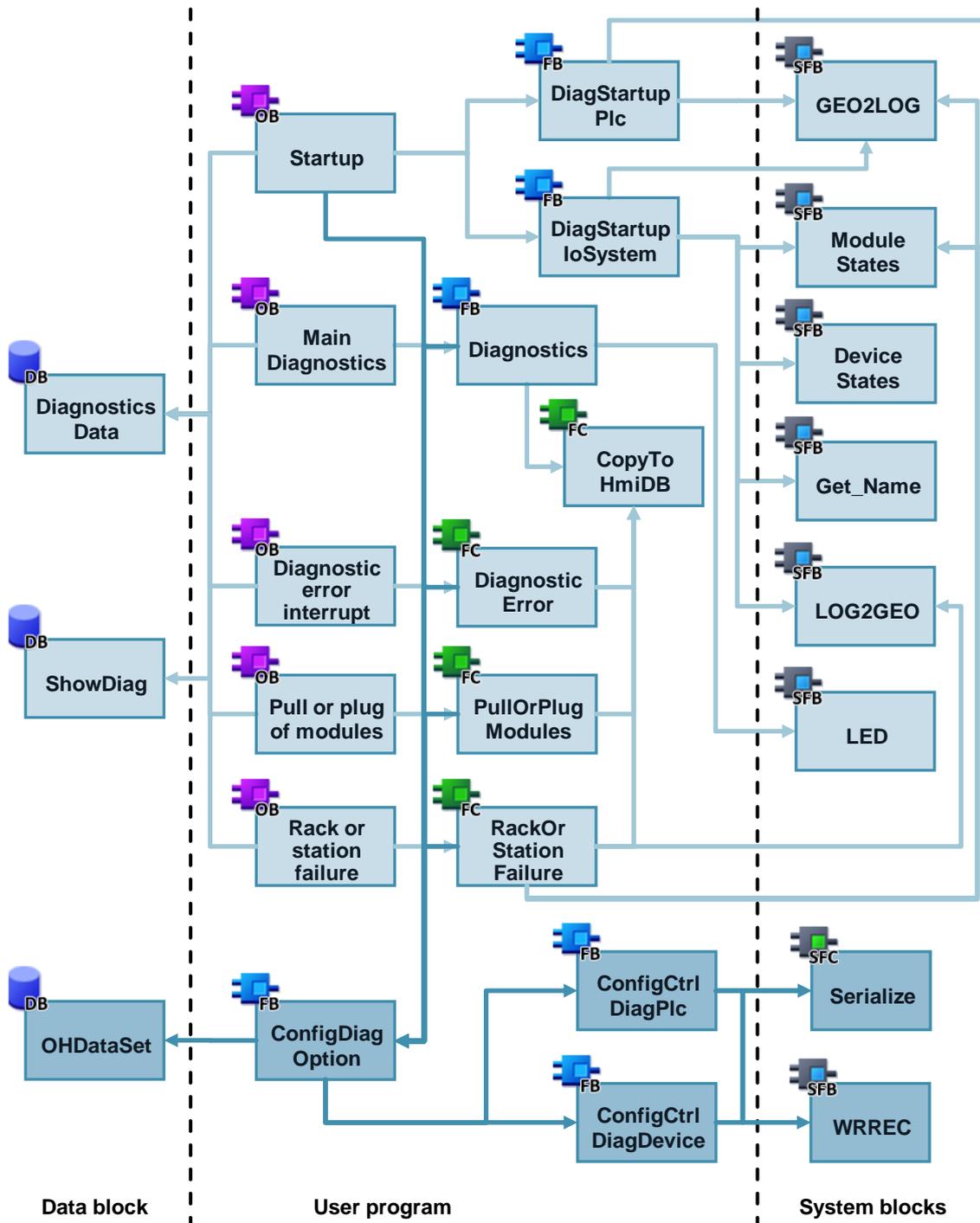
3 Mode of Operation

3.1 General overview

Program overview

The graphic below shows the program structure of the entire STEP 7 project.

Figure 3-1



3 Mode of Operation

3.1 General overview

Note

The description of the blocks in light blue can be found in the application “Diagnostics in User Program with S7-1500”
<https://support.industry.siemens.com/cs/en/en/view/98210758>.

The following table only describes the blocks of the user program that are additionally required for the evaluation of the diagnostic information when the configuration control is active.

Table 3-1

Symbolic name	Description
OHDataSet DB2100	The global data block includes the control data records (variants) for the configuration control.
Startup [OB100]	The startup OB calls the “ConfigDiagOption” function block.
ConfigDiagOption [FB2110]	The block calls the function blocks “ConfigCtrlDiagPlc” and “ConfigCtrlDiagDevice”.
ConfigCtrlDiagPlc [FB2112]	The function block takes on the configuration control and the diagnostics evaluation of the controller.
ConfigCtrlDiagDevice [FB2111]	The function block takes on the configuration control and the diagnostics evaluation of the devices (here ET 200SP).

3.2 Global data block "OHDataset" [DB2100]

Overview

The "OHDataset" data block includes all control data records for the configuration control.

The figure below shows the structure of the "OHDataset" global data block.

Figure 3-2

OHDataset		
	Name	Data type
1	Static	
2	OHET200SP	Array[0..2] of *typeRecord196ET200SP*
3	OHS71500	*typeRecord196S71500central*
4	OHET200SPStatus	DWord
5	OHS71500Status	DWord
6	doConfigET200SP	Bool
7	variantsET200SP	Int
8	doConfigS71500	Bool
9	variantsS71500	Int

Table 3-2

Tag name	Data type	Meaning
OHET200SP	Array[0..2] of "typeRecord196ET200SP"	The control data record for variant 1 to 3 of ET 200SP.
OHS71500	"typeRecord196S71500central"	Control data record of the S7-1500 controller
OHET200SPStatus	DWord	Write status of data record for ET 200SP
OHS71500Status	DWord	Write status of data record for S7-1500 controller
doConfigET200SP	Bool	Enable configuration control for ET 200SP
variantsET200SP	Int	Selection of the variant for ET 200SP
doConfigS71500	Bool	Enable configuration control for S7-1500 controller
variantsS71500	Int	Selection of the variant for S7-1500 controller

Note

The structure of the control data records for the S7-1500 controller and the ET 200SP are described in the documentation for "Library for S7-1200/1500 (central) and ET 200 PN (decentral)" <https://support.industry.siemens.com/cs/ww/en/view/29430270>.

3.3 Function block "ConfigDiagOption" [FB2110]

The block serves as central block for the configuration control with diagnostics of the controller and the devices of the individual IO systems.

Interfaces

Figure 3-3 Call in "Startup [OB100]" for controller and IO system 1

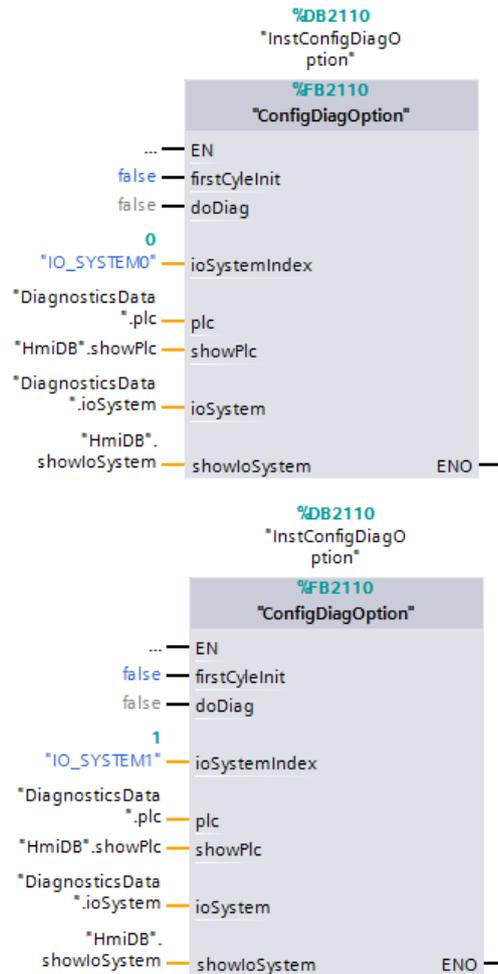


Figure 3-4 Call in the diagnostics functions

```
"InstConfigDiagOption" (firstCycleInit := FALSE,
                        doDiag := TRUE,
                        ioSystemIndex := #tempIoSystemIndex,
                        plc := #plc,
                        showPlc := #showPlc,
                        ioSystem := #ioSystem,
                        showIoSystem := #showIoSystem);
```

Table 3-3

Type	Parameter	Data type	Description
Input	firstCycleInit	Bool	TRUE in the first cycle
	doDiag	Bool	Enabling diagnostics
	ioSystemIndex	Int	Index of the IO system (0 for local)
InOut	plc	“typePlc”	Diagnostic data of the controller and respective local modules
	showPlc	“typeShowPlc”	Diagnostic data of the controller and its local modules for visualization
	ioSystem	Array[1..“MAX_SYSTEM”] of “typeIoSystem”	Diagnostic data of the IO system
	showIoSystem	Array[1..“MAX_SYSTEM”] of “typeShowIoSystem”	Diagnostic data of the IO system for visualization

Note You can find the description of the diagnostic data in the “Diagnostics in User Program with S7-1500” application <https://support.industry.siemens.com/cs/en/en/view/98210758>.

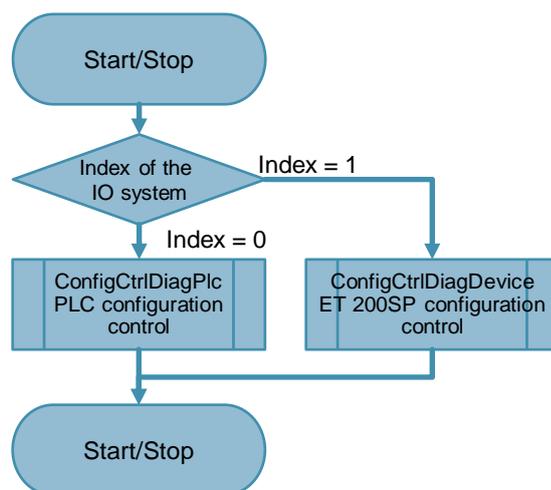
Function description

The block includes all calls that are required for the configuration control of the controller and the devices in a project. The devices to be configured are divided between the individual IO systems. Each IO system has its own index. The controller is looked at separately and has the index 0. When calling the block an index has to be transferred. This is why the block has to be called for the controller and for each IO system with the respective index.

The block calls the function blocks “ConfigCtrlDiagPlc” and “ConfigCtrlDiagDevice” for the configuration and diagnostics of the controller or the ET 200SP.

The following figure shows the principle program sequence of the function block.

Figure 3-5



3.4 Function block "ConfigCtrlDiagPlc" [FB2112]

The function block takes on the configuration and the diagnostics evaluation of the controller.

Interfaces

Figure 3-6 Call in "ConfigDiagOption [FB2110]"

```
#instConfigCtrlDiagPlc(firstCycleInit := #firstCycleInit,
                      doDiag := #doDiag,
                      doConfig := "OHDataset".doConfigS71500,
                      deviceHeadLaddr := 33,
                      status => "OHDataset".OHS71500Status,
                      optionRecord := "OHDataset".OHS71500,
                      plc := #plc,
                      showPLC := #showPlc);
```

Table 3-4

Type	Parameter	Data type	Description
Input	firstCycleInit	Bool	TRUE in the first cycle
	doDiag	Bool	Enabling diagnostics
	deviceHeadLaddr	Int	HW ID [Head] of the controller (Default: 33)
InOut	doConfig	Bool	Enabling configuration
	optionRecord	VARIANT	Active control data record
	plc	"typePlc"	Diagnostic data of the controller and respective local modules
	showPlc	"typeShowPlc"	Diagnostic data of the controller and its local modules for visualization
Output	status	DWord	Write data record status

Function description

The "ConfigCtrlDiagPlc" block writes the control data record required for the configuration control into the controller.

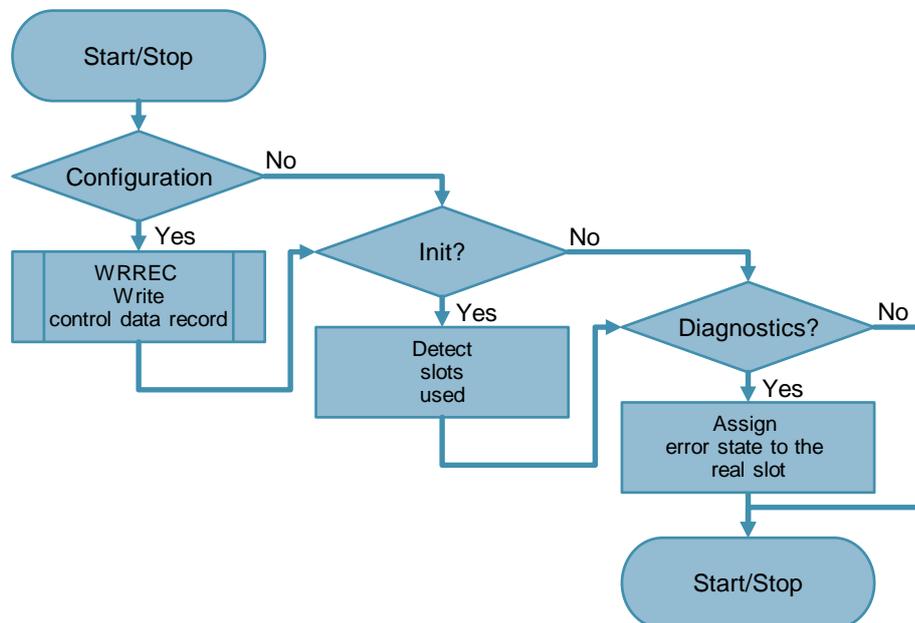
For more information, please refer to the documentation
 "Library for S7-1200/1500 (central) and ET 200 PN (decentral)"
<https://support.industry.siemens.com/cs/ww/en/view/29430270>.

After the configuration the block determines the slots used, based on the active control data record.

When the diagnostics is enabled, the block assigns the fault status of the modules to the actual slot.

The following figure shows the principle program sequence of the function block.

Figure 3-7



3.5 Function block "ConfigCtrlDiagDevice" [FB2111]

The function block takes on the configuration and the diagnostics evaluation of the ET 200SP.

Interfaces

Figure 3-8 Call in "ConfigDiagOption [FB2110]" for a ET 200SP

```
#instConfigCtrlDiagET200SP(firstCycleInit := #firstCycleInit,
                           doDiag := #doDiag,
                           doConfig := "OHDataset".doConfigET200SP,
                           deviceHeadLaddr := "ET_200SP-Head",
                           status => "OHDataset".OHET200SPStatus,
                           optionRecord := "OHDataset".OHET200SP["OHDataset".variantsET200SP],
                           ioSystem := #ioSystem[#ioSystemIndex],
                           showIoSystem := #showIoSystem[#ioSystemIndex]);
```

Table 3-5

Type	Parameter	Data type	Description
Input	firstCycleInit	Bool	TRUE in the first cycle
	doDiag	Bool	Enabling diagnostics
	deviceHeadLaddr	Int	HW ID [Head] of the device to be configured
InOut	doConfig	Bool	Enabling configuration
	optionRecord	VARIANT	Active control data record
	ioSystem	"typeIoSystem"	Diagnostic data of the IO system
	showIoSystem	"typeShowIoSystem"	Diagnostic data of the IO system for visualization
Output	status	DWord	Write data record status

Function description

The "ConfigCtrlDiagDevice" block writes the data record of the ET 200SP, required for the configuration control into the controller.

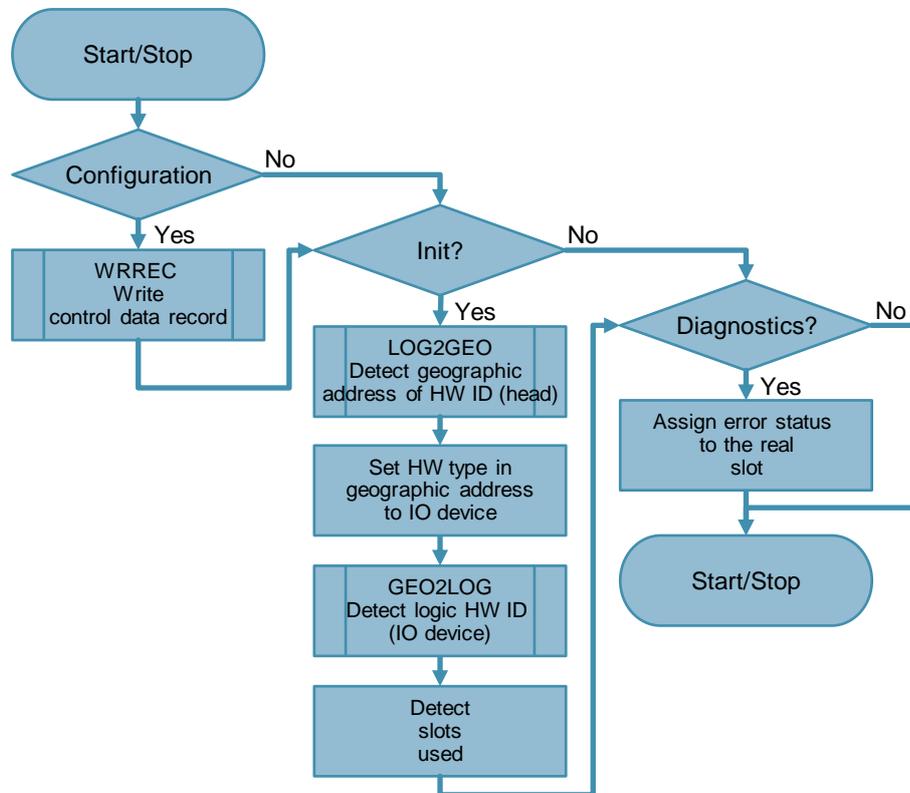
For more information, please refer to the documentation "Library for S7-1200/1500 (central) and ET 200 PN (decentral)" <https://support.industry.siemens.com/cs/ww/en/view/29430270>

After the configuration the block determines the slots used, based on the active control data record. For the diagnostics the hardware ID (IO device) has to be previously determined with "LOG2GEO" and "GEO2LOG".

When the diagnostics is enabled, the block assigns the fault status of the modules to the actual slot.

The following figure shows the principle program sequence of the function block.

Figure 3-9

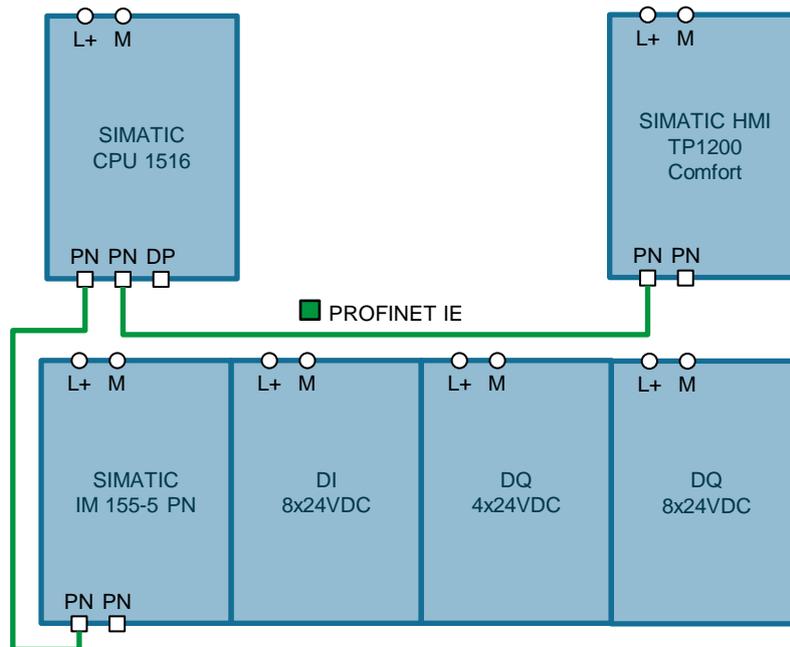


4 Installation and Commissioning

4.1 Installing the hardware

The figure below shows the hardware configuration of the application with maximal fitting (variant 3).

Figure 4-1



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Note The setup guidelines of the devices must generally be followed.

4.2 IP addresses and device names

In the example, the following device numbers, IP addresses and device names are used:

Table 4-1

Component	Device number	IP Address	Device name
SIMATIC CPU 1516	0	192.168.0.1	PLC_1
SIMATIC IM 155-6 PN	1	192.168.0.2	ET200SP
SIMATIC HMI TP1200	-	192.168.0.4	TP1200

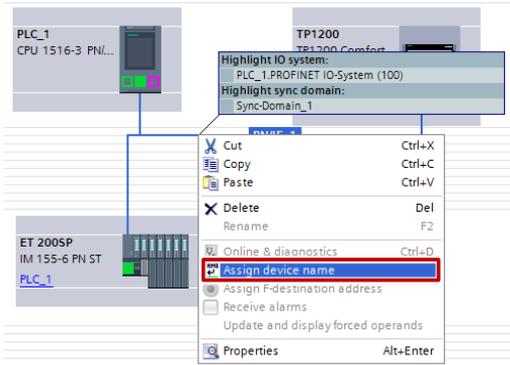
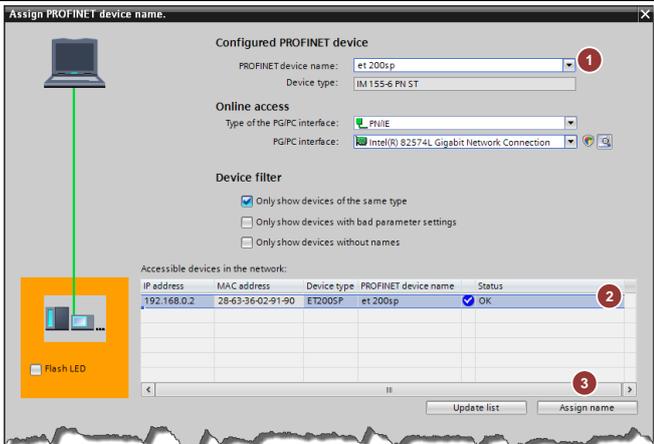
4.3 Installing the software (download)

Note At this point, it is assumed that the necessary software has been installed on your computer and that you are familiar with the software.

4.4 Assigning a PROFINET device name

In order for all PROFINET devices to be able to communicate with each other, a PROFINET device name must be assigned. The configured IP addresses of the devices are automatically transferred when downloading the project.

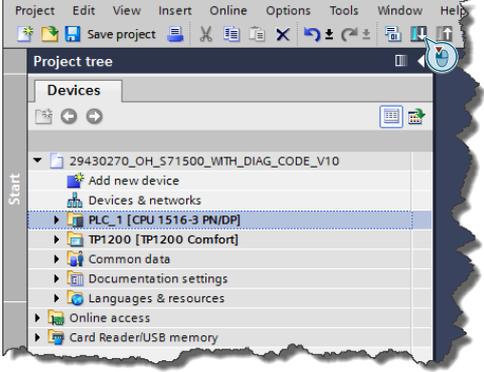
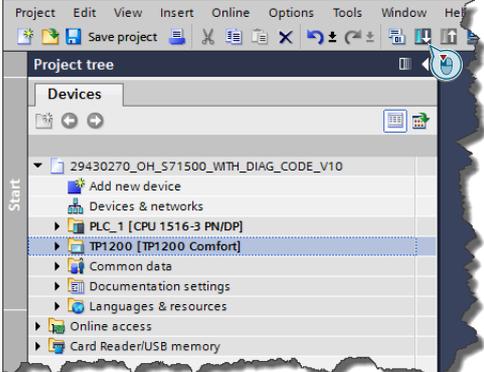
Table 4-2: Instruction – PROFINET in TIA Portal

No.	Action	Notes
1.	Start the TIA Portal and open the example project.	-
2.	Open “Devices & Network” and activate the “Network view”. Right-click the PROFINET connection and select “Assign device name”.	
3.	In this window, assign the PROFINET device names to all of the devices. <ol style="list-style-type: none"> 1. Select the “PROFINET device name”. 2. In the list, select the device you wish to assign the PROFINET device name to. 3. Click on “Assign name” 	
4.	If required, repeat step 3 until all devices have a PROFINET device name.	

4.5 Load project

The software example is available on the HTML page from which you downloaded this document.

Table 4-3

No.	Action	Notes
1.	Unzip the zipped code folder 29430270_OH_S71500_WITH_DIAG_CODE_V10.zip into a directory of your choice.	
2.	Open the "29430270_OH_S71500_WITH_DIAG_CODE_V10.ap13" project with the TIA Portal.	
3.	Select the "PLC_1" folder of the controller in the project tree and click the "Download to device" button in the toolbar.	 <p>The screenshot shows the TIA Portal interface with the 'Project tree' pane on the left. The project is '29430270_OH_S71500_WITH_DIAG_CODE_V10'. Under the 'Devices' section, the 'PLC_1 [CPU 1516-3 PN/DP]' folder is selected and highlighted in blue. The toolbar at the top right contains various icons, including a 'Download to device' icon (a computer with a downward arrow).</p>
4.	Select the "TP1200" folder of the operator panel in the project tree and click the "Download to device" button in the toolbar.	 <p>The screenshot shows the TIA Portal interface with the 'Project tree' pane on the left. The project is '29430270_OH_S71500_WITH_DIAG_CODE_V10'. Under the 'Devices' section, the 'TP1200 [TP1200 Comfort]' folder is selected and highlighted in blue. The toolbar at the top right contains various icons, including a 'Download to device' icon (a computer with a downward arrow).</p>

4.6 Integrating the application into an existing project

The application described here can be fully integrated into your project. The necessary steps are described below.

4.6.1 Configuring the diagnostic settings

For each module of your project you can enable the module-specific diagnostic settings separately.

The following diagnostic settings are possible, for example:

- No supply voltage L+
- Wire break
- Short circuit to ground
- etc.

Note

Information, on how to configure the diagnostic settings is available in “System Diagnostics with S7-1500 and TIA Portal”
<http://support.automation.siemens.com/WW/view/en/68011497> in chapter 5.

4.6.2 Integrating the PLC objects

Table 4-4

No.	Action
1.	Copy the “Diagnostics” folder to your project in “PLC_1 > PLC tags”.
2.	Copy the “Diagnostics” and “ConfigurationControl” folder to your project in “PLC_1 > PLC data types”.
3.	Copy the “Diagnostics” and “ConfigurationControl” folder to your project in “PLC_1 > Program blocks”.
4.	If your project already contains error OBs, copy the networks of the error OBs of the application into your respective error OBs Please ensure that the position of the inserted code may have an effect the program sequence. Then you delete the error OBs OB82, OB83 and OB86 of the application.

4 Installation and Commissioning

4.6 Integrating the application into an existing project

No.	Action																																																																																					
5.	<p>Adjusting constants to your project</p> <p>To do this, open the user constants tab in “PLC tags > Diagnostics > ConstDiagnostics”</p> <p>Adjust the diagnostics application to your project with the user constants. To do so, change the following constants:</p> <ol style="list-style-type: none"> Optional: if you wish to save storage space, adjust the MAX_DEVICES_SYSTEM constant to the highest device number in your project. In der visualization, a maximum of 256 devices are displayed. Adjust the MAX_SYSTEM constant to the number of IO systems in your project. Create new constants for further IO systems. For example, “IO_SYSTEM2 Int 2” etc. These constants are used in the next step as index for the IO system. 																																																																																					
	<table border="1"> <thead> <tr> <th colspan="5">ConstDiagnostics</th> </tr> <tr> <th></th> <th>Name</th> <th>Data type</th> <th>Value</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>DEV_STATE_OK</td> <td>USInt</td> <td>1</td> <td>device state ok</td> </tr> <tr> <td>2</td> <td>DEV_STATE_FAULT</td> <td>USInt</td> <td>2</td> <td>device state fault</td> </tr> <tr> <td>3</td> <td>DEV_STATE_LOST_CON</td> <td>USInt</td> <td>3</td> <td>device state lost connection</td> </tr> <tr> <td>4</td> <td>DEV_STATE_DISABLED</td> <td>USInt</td> <td>4</td> <td>device state device disabled</td> </tr> <tr> <td>5</td> <td>DEV_STATE_WAS_FAULT</td> <td>USInt</td> <td>12</td> <td>device state was fault</td> </tr> <tr> <td>6</td> <td>DEV_STATE_WAS_LOST</td> <td>USInt</td> <td>13</td> <td>device state connection was lost</td> </tr> <tr> <td>7</td> <td>DEV_STATE_WAS_DISABLED</td> <td>USInt</td> <td>14</td> <td>device state device was disabled</td> </tr> <tr> <td>8</td> <td>MAX_DEVICES_SYSTEM</td> <td>Int</td> <td>256</td> <td>max number of devices per IO system 1</td> </tr> <tr> <td>9</td> <td>MAX_MODULES_DEVICE</td> <td>Int</td> <td>81</td> <td>max number of modules per device</td> </tr> <tr> <td>10</td> <td>MAX_MODULES_LOCAL</td> <td>Int</td> <td>31</td> <td>max number of local modules</td> </tr> <tr> <td>11</td> <td>LAST_DEVICE</td> <td>Int</td> <td>-1</td> <td>no next device</td> </tr> <tr> <td>12</td> <td>MAX_SYSTEM</td> <td>Int</td> <td>1</td> <td>max number of devices per IO system 2</td> </tr> <tr> <td>13</td> <td>IO_SYSTEM1</td> <td>Int</td> <td>1</td> <td>index for IO system 1</td> </tr> <tr> <td>14</td> <td>IO_SYSTEM2</td> <td>Int</td> <td>2</td> <td>index for IO system 2 3</td> </tr> <tr> <td>15</td> <td>IO_SYSTEM0</td> <td>Int</td> <td>0</td> <td>index for local PLC</td> </tr> </tbody> </table>	ConstDiagnostics						Name	Data type	Value	Comment	1	DEV_STATE_OK	USInt	1	device state ok	2	DEV_STATE_FAULT	USInt	2	device state fault	3	DEV_STATE_LOST_CON	USInt	3	device state lost connection	4	DEV_STATE_DISABLED	USInt	4	device state device disabled	5	DEV_STATE_WAS_FAULT	USInt	12	device state was fault	6	DEV_STATE_WAS_LOST	USInt	13	device state connection was lost	7	DEV_STATE_WAS_DISABLED	USInt	14	device state device was disabled	8	MAX_DEVICES_SYSTEM	Int	256	max number of devices per IO system 1	9	MAX_MODULES_DEVICE	Int	81	max number of modules per device	10	MAX_MODULES_LOCAL	Int	31	max number of local modules	11	LAST_DEVICE	Int	-1	no next device	12	MAX_SYSTEM	Int	1	max number of devices per IO system 2	13	IO_SYSTEM1	Int	1	index for IO system 1	14	IO_SYSTEM2	Int	2	index for IO system 2 3	15	IO_SYSTEM0	Int	0	index for local PLC
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15	IO_SYSTEM0	Int	0	index for local PLC																																																																																		

4 Installation and Commissioning

4.6 Integrating the application into an existing project

No.	Action
6.	<p>Adjusting IO-system in “Startup [OB100]”</p> <ol style="list-style-type: none"> 1. Open the “Startup [OB100]” startup OB 2. Open die system constants in “PLC tags > Default tag table” 3. Divide the editing section vertically 4. Assign the hardware identifier of the respective IO system (data type: Hw_IoSystem) from the system constants to the “ioSystemHwId” input of the “DiagStartupIoSystem” function block. 5. Assign the diagnostic structure of an IO system of the “DiagnosticsData” data block to the “ioSystem” parameter. Please note that each IO system receives its own index 6. If necessary, add further instances of the “DiagStartupIoSystem” function block into startup OB “Startup [OB100]” and repeat steps 4 and 5. For each IO system, an instance of function block “DiagStartupIoSystem” must be available.

The screenshot shows the SIMATIC Manager interface. On the left, the 'Default tag table' is displayed with the following data:

Name	Data type	Value
Local-Display	Hw_SubModule	54
Local-Exec	Hw_SubModule	52
Local	Hw_SubModule	49
Local-DP_interface_1	Hw_Interface	60
Local-PROFINET_interface_1	Hw_Interface	64
Local-PROFINET_interface_1-Port_1	Hw_Interface	65
Local-PROFINET_interface_1-Port_2	Hw_Interface	66
Local-PROFINET_interface_2	Hw_Interface	72
Local-PROFINET_interface_2-Port_1	Hw_Interface	73
OB_Main	OB_PCYCLE	1
Local-DI_16x24VDC_BA_1	Hw_SubModule	269
Local-DI_16x24VDC_BA_2	Hw_SubModule	270
Local-PROFINET-IO-System	Hw_IoSystem	257
ET_200SP-Proxy	Hw_SubModule	264
ET_200SP-IODevice	Hw_Device	262
ET_200SP-PROFINET_interface	Hw_Interface	265
CU_BusAdapter-Port_2	Hw_Interface	260
CU_BusAdapter-Port_1	Hw_Interface	266

The 'DiagStartupIoSystem' function block is shown in the network editor. It is connected to the 'ioSystemHwId' parameter (value 257) and the 'ioSystem' parameter (value 'ioSystem[IO_SYSTEM1]').

4.6.3 Integrating devices with configuration control into the project

This chapter shows you what you have to do if you add devices to your project with enable configuration control.

Note

The template (PLC data type) included in the project for the control data record of an ET 200MP is valid for firmware V3.0.

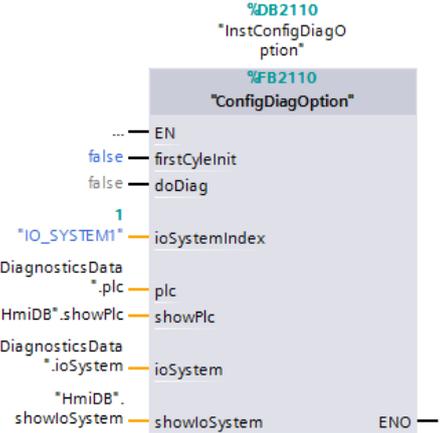
Table 4-5

No.	Action
1.	Add device and enable configuration control. (see “Application example for ET 200SP (PROFINET) and S7-1500 by using the library” https://support.industry.siemens.com/cs/ww/en/view/29430270)
2.	Open the “OHDataset” data block in the “PLC_1 > Program blocks > ConfigurationControl” folder. <ol style="list-style-type: none"> Create a tag with control data record variants. The structure of the different control data records is described in the documentation for “Library for S7-1200/1500 (central) and ET 200 PN (decentral)” https://support.industry.siemens.com/cs/ww/en/view/29430270. Create a tag for the status. Create a tag for enabling the configuration control. Repeat steps 1 to 3 for each other device.

OHDataset		
	Name	Data type
1	Static	
2	1 OHET200SP	Array[0..2] of *typeRecord196ET200SP*
3	OH571500	*typeRecord196S71500central*
4	2 OHET200SPStatus	DWord
5	OH571500Status	DWord
6	3 doConfigET200SP	Bool
7	variantsET200SP	Int
8	doConfigS71500	Bool
9	variantsS71500	Int

4 Installation and Commissioning

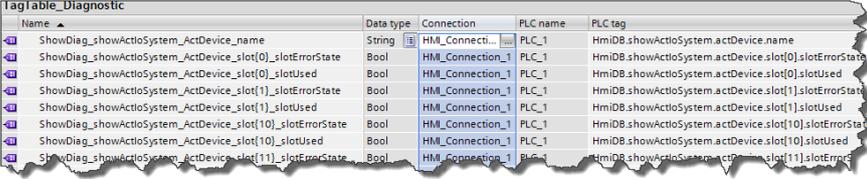
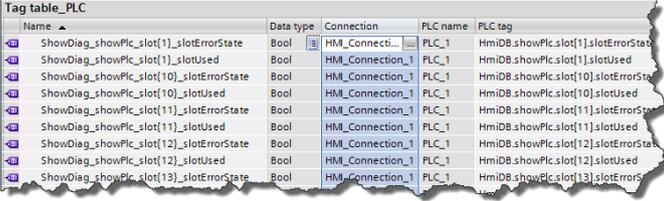
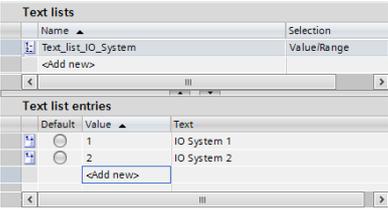
4.6 Integrating the application into an existing project

No.	Action
3.	<p>Open the “ConfigDiagOption” data block in the “PLC_1 > Program blocks > ConfigurationControl” folder.</p> <ol style="list-style-type: none"> 1. Add the “ConfigCtrlDiagDevice” block as multi-instance in the respective CASE branch of the IO-system. 2. Assign the parameters the according tags from the “OHDataset” data block (see figure). 3. Assign the “deviceHeadLaddr” parameter the hardware ID (head) of the device from the system constant in “PLC tags > Default tag table”. 4. Repeat steps 1 to 3 for each other device. <p>Please note the assignment of the devices to the respective IO systems.</p> <pre> "IO_SYSTEM1": //===== // call configuration control for IO system 1 //===== 1 // configuration control of ET 200SP #instConfigCtrlDiagET200SP(firstCyleInit := #firstCyleInit, doDiag := #doDiag, doConfig := "OHDataset".doConfigET200SP, deviceHeadLaddr := "ET 200SP-Head", status => "OHDataset".OHET200SPStatus, optionRecord := "OHDataset".OHET200SP["OHDataset".variantsET200SP], ioSystem := #ioSystem[#ioSystemIndex], showIoSystem := #showIoSystem[#ioSystemIndex]); </pre>
4.	<p>Open the “Startup [OB100]” startup OB in the “PLC_1 > Program blocks > Diagnostics” folder.</p> <ol style="list-style-type: none"> 1. Set the tag to enable the configuration control.  <ol style="list-style-type: none"> 2. Add an instance of the “ConfigDiagOption” block for each IO system. 

4.6.4 Integrating the HMI elements

This chapter describes how to integrate the entire HMI application.

Table 4-6

No.	Action
1.	Copy the folders “Diagnostic” and “ConfigurationControl” into your HMI project in “TP1200 > HMI tags”.
2.	Open the “TagTable_Diagnostic” HMI tags and set the HMI connection of your HMI in the “Connection” column. 
3.	Open the HMI tag table “Tag table_PLC” and set the HMI connection of your HMI in the “Connection” column. 
4.	In “TP1200 > Scripts > VB scripts” copy the “Diagnostic” folder into your HMI project.
5.	In “TP1200 > Screen management > Pop-up screens” copy the “Pop-up_OverviewModules” screen into your HMI project.
6.	Copy the screens “Topic_001.0_PLC”, “Topic_002.0_IO_System”, “Topic_003.0_Messages” and “Topic_004.0_OptionHandling” into your HMI project in “TP1200 > Screens > 001_Application”.
7.	Select your template or no template in the properties of the screens.
8.	Link the screens to your already existing screens.
9.	Open the “Text and graphic lists” in “TP1200”. Adjust the “Text_list_IO_System” text list to the number of your IO systems. The text list is used for selecting the IO system in the “Topic_002.0_IO_System” screen. 

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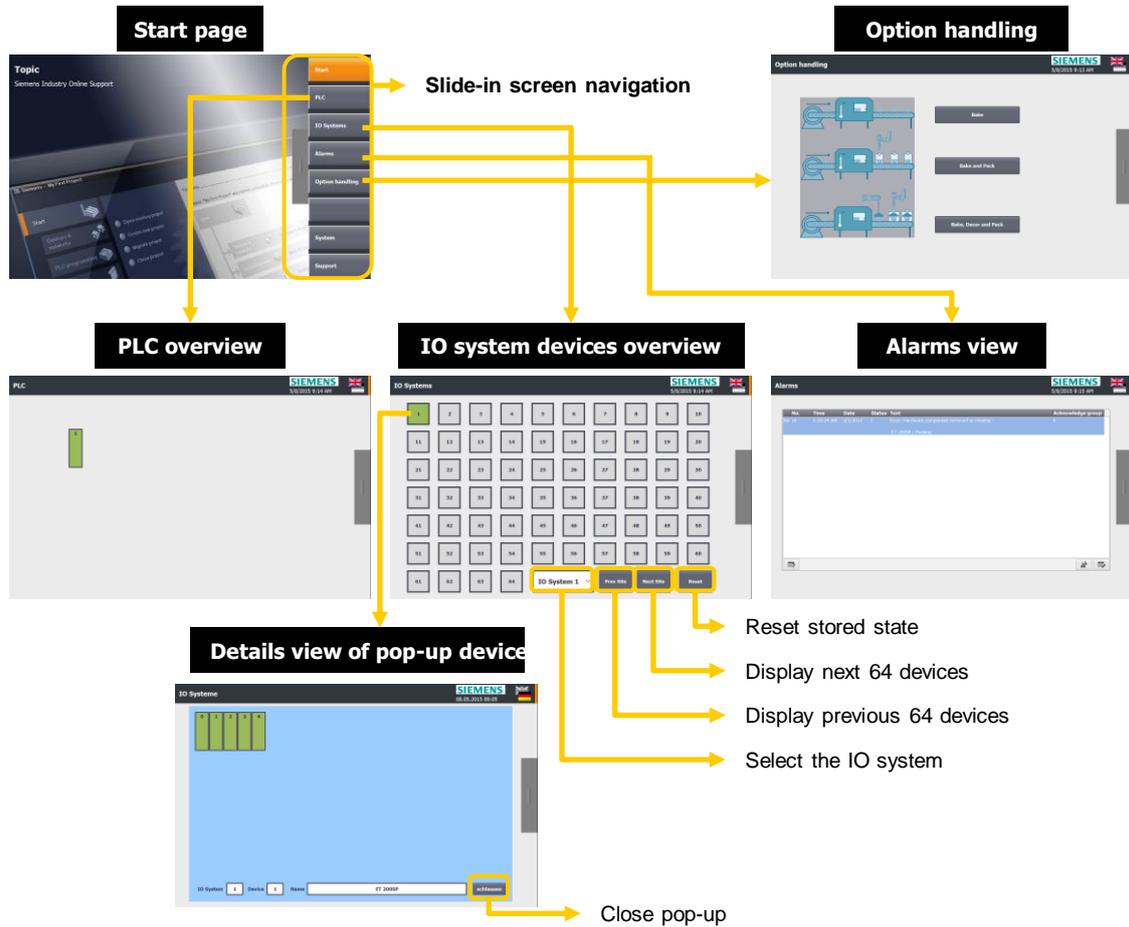
Note You can also copy the entire HMI from the example and integrate the HMI application into it.

5 Operating the Application

5.1 Overview

The figure below shows the user interface of the operator panel.

Figure 5-1



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The “Topic” screen shows the start screen of the application.

The slide-in screen is used for screen navigation.

The “PLC” screen shows the diagnostic information of the controller and its modules.

The “IO-Systems” screen shows the configured PROFINET IO devices of the selected IO system. The IO system can be selected via a symbolic input field. Click on “Next Site” to display the next 64 devices, click on “Prev Site” to display the previous 64 devices. In the visualization, the devices with device number 1 to 256 can be displayed. Clicking on “Reset” deletes the saved state of the devices.

Clicking on a device opens the pop-up screen with the details view of the device. The view shows the diagnostic information of the modules of a device, the index of the IO system, the device number, and the device name. Click on the “close” button to close the pop-up screen again.

The “Alarms” screen shows the alarms window with the messages.

Select the variant for the configuration control in the “Option handling” screen.

5.2 Displaying the status of the devices

The devices can have a different status. The table below shows the status display and its meaning.

Table 5-1

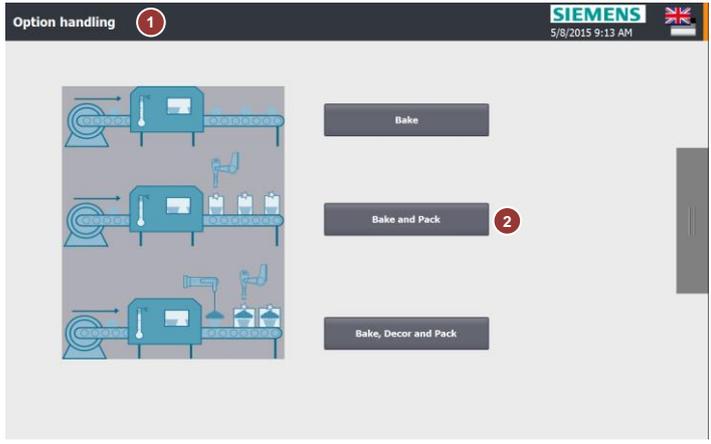
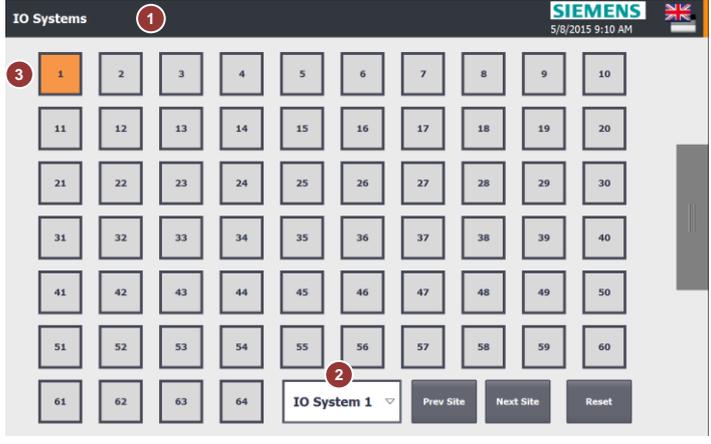
Status	Display	Meaning
1		Device OK
2		Device faulty
3		Device lost connection
12		Device was faulty
13		Device had lost connection

5.3 Diagnostics at the operator panel

“Missing module to ET 200SP” diagnostic

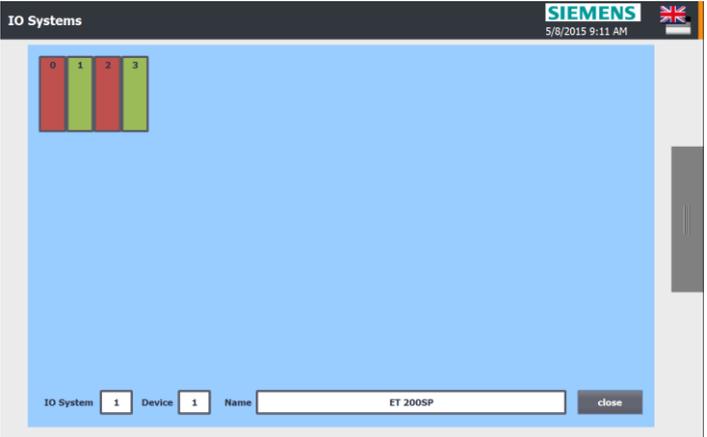
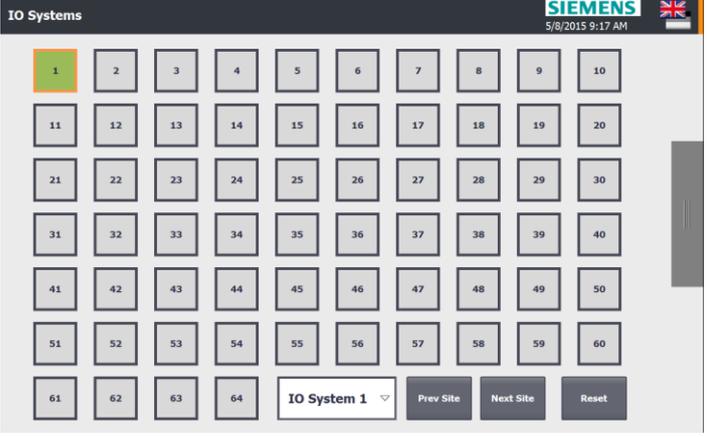
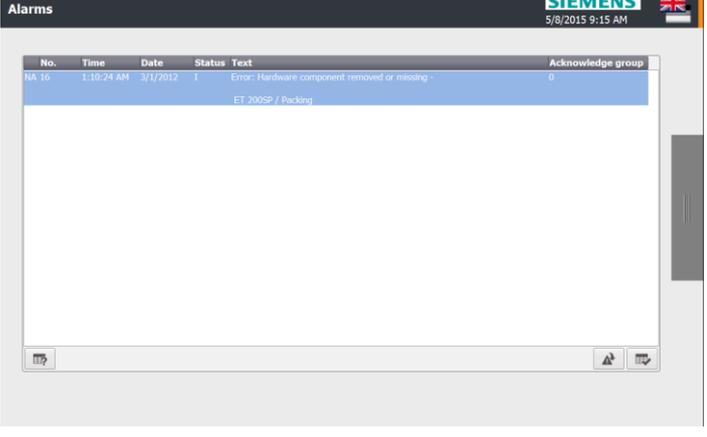
For diagnosing the failure, please proceed as follows.

Table 5-2

No.	Action	Notes
1.	<ol style="list-style-type: none"> Open the “Option handling” screen on the operator panel. Select the variant 2 “Bake and Pack”. <p>Adjust the hardware to variant 2. The DQ8 module is configured on slot 3 and is reconfigured to slot 2.</p>	
2.	<p>Pull out the DQ8 module on slot 2 of ET200SP.</p>	
3.	<ol style="list-style-type: none"> Open the “IO Systems” screen at the operator panel. Select “IO System 1”. The screen indicates the fault on the device with device number 1. For detailed information on the fault, please click on the button of device 1. 	

5 Operating the Application

5.3 Diagnostics at the operator panel

No.	Action	Notes
4.	<p>The pop-up screen with the details view of device 1 opens. The view shows an error on slot 2, the index of the IO system, the device number, and the device name.</p> <p>The detail view only shows the assigned slots.</p> <p>Clicking on “close” closes the pop-up screen.</p>	
5.	<p>Reinsert the module into slot 2.</p> <p>The icon of device 1 turns green with an orange frame. This means that the device had failed and the fault has been removed.</p> <p>Clicking on “Reset” deletes the saved state and the frame turns black again.</p>	
6.	<p>Open the “Alarms” screen to have the alarm for the failure displayed.</p>	

5.4 Evaluating the diagnostic information

Using an example, this chapter illustrates where the diagnostic information can be found in the event of an error. Polling this information in your program now enables you to program specific responses to certain failures in your plant.

Evaluating the “missing module at ET200SP” diagnostic information

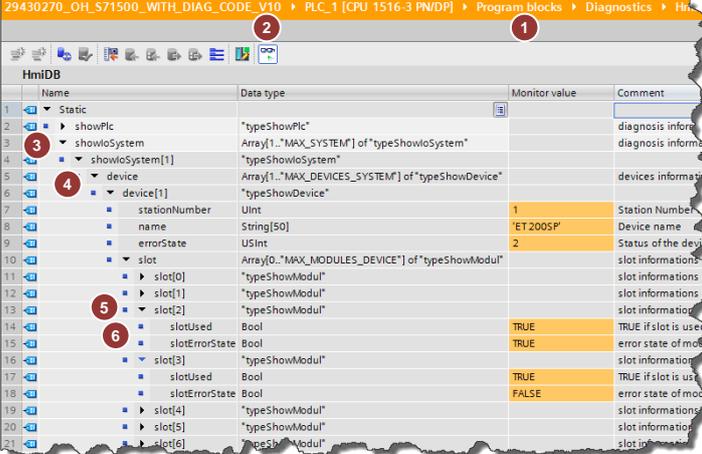
The diagnostic information of the failure is available in the following locations.

Table 5-3

No.	Action	Notes
1.	Variants 2 is active and the DQ8 module on slot 2 of ET 200SP is still pulled out (see 5.3 Diagnostics at the operator panel).	
2.	<p>The fault is stored in the “DiagnosticsData” global data block on the configured slot. The data block can be interpreted in the following way:</p> <ol style="list-style-type: none"> Open the “DiagnosticsData” global data block in the TIA Portal. Click on the “Watch all” button. Open the “ioSystem > ioSystem[1]” folder. The error state of the IO system is displayed here. Open the “device > device[1]” folder. Error state and device names are displayed here. Open the “slot > slot[3]” folder. An error on slot 3 is displayed here. 	<p>The screenshot shows the 'DiagnosticsData' table in the TIA Portal. The table has columns for Name, Data type, Monitor value, and Comment. The 'device' folder is expanded to show 'device[1]', which is further expanded to show 'slot' and 'slot[3]'. The 'slotErrorState' for 'slot[3]' is highlighted in orange and set to 'TRUE'. Red circles with numbers 1 through 6 are overlaid on the screenshot to indicate the steps described in the action column.</p>

5 Operating the Application

5.4 Evaluating the diagnostic information

No.	Action	Notes																																																																																								
3.	<p>The fault is stored in the “HmiDB” global data block on real slot. The data block can be interpreted in the following way:</p> <ol style="list-style-type: none"> 1. Open the “HmiDB” global data block in the TIA Portal. 2. Click on the “Watch all” button. 3. Open the “showIoSystem > showIoSystem[1]” folder. The error state of the IO system is displayed here. 4. Open the “device > device[1]” folder. Error state and device names are displayed here. 5. Open the “slot > slot[2]” folder. An error on slot 2 is displayed here. 	 <table border="1" data-bbox="660 389 1362 763"> <thead> <tr> <th>Name</th> <th>Data type</th> <th>Monitor value</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>Static</td> <td></td> <td></td> <td></td> </tr> <tr> <td>showPfc</td> <td>"typeShowPfc"</td> <td></td> <td>diagnosis inform</td> </tr> <tr> <td>showIoSystem</td> <td>Array[1.."MAX_SYSTEM"] of "typeShowIoSystem"</td> <td></td> <td>diagnosis inform</td> </tr> <tr> <td>showIoSystem[1]</td> <td>"typeShowIoSystem"</td> <td></td> <td></td> </tr> <tr> <td>device</td> <td>Array[1.."MAX_DEVICES_SYSTEM"] of "typeShowDevice"</td> <td></td> <td>devices informat</td> </tr> <tr> <td>device[1]</td> <td>"typeShowDevice"</td> <td></td> <td></td> </tr> <tr> <td>stationNumber</td> <td>UInt</td> <td>1</td> <td>Station Number</td> </tr> <tr> <td>name</td> <td>String[50]</td> <td>'ET 2005P'</td> <td>Device name</td> </tr> <tr> <td>errorState</td> <td>USInt</td> <td>2</td> <td>Status of the devi</td> </tr> <tr> <td>slot</td> <td>Array[0.."MAX_MODULES_DEVICE"] of "typeShowModul"</td> <td></td> <td></td> </tr> <tr> <td>slot[0]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slot[1]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slot[2]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slotUsed</td> <td>Bool</td> <td>TRUE</td> <td>TRUE if slot is used</td> </tr> <tr> <td>slotErrorState</td> <td>Bool</td> <td>TRUE</td> <td>error state of mod</td> </tr> <tr> <td>slot[3]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slotUsed</td> <td>Bool</td> <td>TRUE</td> <td>TRUE if slot is use</td> </tr> <tr> <td>slotErrorState</td> <td>Bool</td> <td>FALSE</td> <td>error state of mod</td> </tr> <tr> <td>slot[4]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slot[5]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> <tr> <td>slot[6]</td> <td>"typeShowModul"</td> <td></td> <td>slot information</td> </tr> </tbody> </table>	Name	Data type	Monitor value	Comment	Static				showPfc	"typeShowPfc"		diagnosis inform	showIoSystem	Array[1.."MAX_SYSTEM"] of "typeShowIoSystem"		diagnosis inform	showIoSystem[1]	"typeShowIoSystem"			device	Array[1.."MAX_DEVICES_SYSTEM"] of "typeShowDevice"		devices informat	device[1]	"typeShowDevice"			stationNumber	UInt	1	Station Number	name	String[50]	'ET 2005P'	Device name	errorState	USInt	2	Status of the devi	slot	Array[0.."MAX_MODULES_DEVICE"] of "typeShowModul"			slot[0]	"typeShowModul"		slot information	slot[1]	"typeShowModul"		slot information	slot[2]	"typeShowModul"		slot information	slotUsed	Bool	TRUE	TRUE if slot is used	slotErrorState	Bool	TRUE	error state of mod	slot[3]	"typeShowModul"		slot information	slotUsed	Bool	TRUE	TRUE if slot is use	slotErrorState	Bool	FALSE	error state of mod	slot[4]	"typeShowModul"		slot information	slot[5]	"typeShowModul"		slot information	slot[6]	"typeShowModul"		slot information
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Note

For further failures, you can also proceed as described above.

6 Links & Literature

Table 6-1

	Topic	Title
\1\	Siemens Industry Online Support	http://support.industry.siemens.com
\2\	Download page of the entry	https://support.industry.siemens.com/cs/ww/en/view/29430270
\3\	Diagnostics in the User Program with S7-1500	https://support.industry.siemens.com/cs/ww/en/view/29430270 https://support.industry.siemens.com/cs/en/en/view/98210758
\4\	System Diagnostics with S7-1500 and TIA Portal	https://support.industry.siemens.com/cs/ww/en/view/68011497
\5\	STEP 7 Professional V14 System Manual	https://support.industry.siemens.com/cs/ww/en/view/109742272
\6\	S7-1500 System Manual	https://support.industry.siemens.com/cs/ww/en/view/59191792

7 History

Table 7-1

Version	Date	Modifications
V1.0	05/2015	First version
V2.0	03/2017	Update to STEP 7 V14