SIEMENS

SIMATIC

S7-PDIAG for S7-300 and S7-400
Configuring Process Diagnostics

Getting Started Edition 07/2005

First Steps with S7-PDIAG and ProAgent

The Getting Started for This product is not a stand-alonedescription.
It is a part of the manual and can be called via "First Steps".



Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. The notices shown below are graded according to the degree of danger.



Danger
indicates that death or severe personal injury **will** result if proper precautions are not taken.



Warning
indicates that death or severe personal injury **may** result if proper precautions are not taken.



Caution
with a safety alert symbol indicates that minor personal injury can result if proper precautions are not taken.

Caution
without a safety alert symbol indicates that property damage can result if proper precautions are not taken.

Attention
indicates that an unintended result or situation can occur if the corresponding notice is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel.** Within the context of the safety notices in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:



Warning
This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.
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Welcome to the S7-PDIAG and ProAgent Sample Program for First-time Users

Getting Started with S7-PDIAG

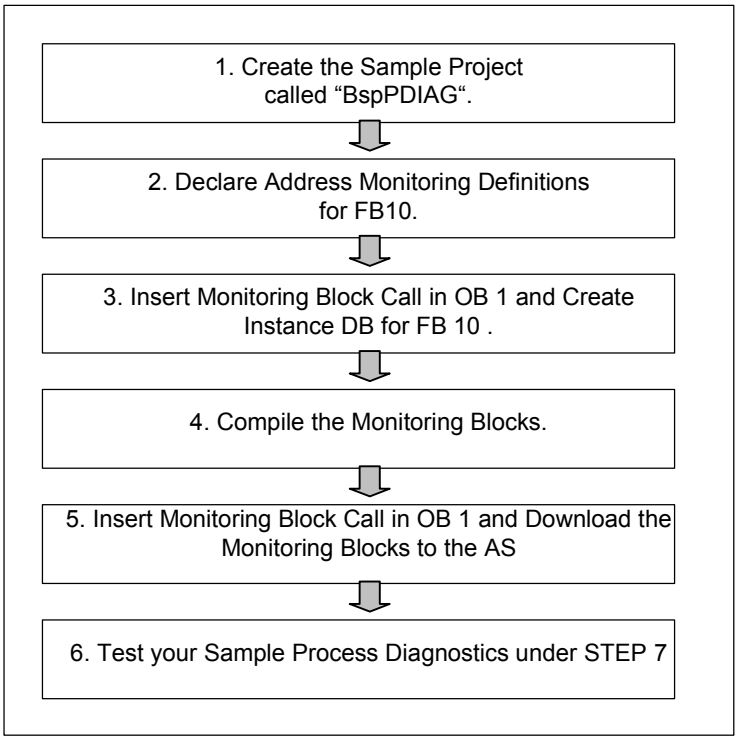
The example of address monitoring definition used in this chapter guides you step-by-step through an entire project configuration under S7-PDIAG.

We shall also show you all steps required under ProTool and ProAgent for programming a fully functional process diagnostics control and OP (HMI).

Overview of the Procedure

The diagram below provides and overview of procedures required for programming address monitoring definitions under S7-PDIAG.

Proceed as follows:



Create the Sample Project / Program

How to Create the Sample Project

In the first step, open the STEP 7 wizard in SIMATIC Manager and create a new project under the name "BspPDIAG". Add an S7 program to your corresponding HW Config.

How to Generate the S7 Sample Program

In SIMATIC Manager, select the block container for your "BspPDIAG" project below the S7 program and the hardware configuration. Call menu command **Insert > S7 Block > Function Block** and select the following function block:

- FB10

You can now use the blocks mentioned above to create an address monitoring definition.

Executability

In order to enable runtime for this sample program on the PLC, input byte "0" and output byte "1" must be interconnected to digital modules. If your system is only equipped with a CPU but not with digital modules, insert OB122 (I/Q access error) and monitor your parameters via "Status/Control variable".

Programming FB10

Open FB10 in SIMATIC Manager with double-click. Edit the statement list under "LAD/STL/FBD" as follows:

1. In the first network, enter:
   Network name: Logic operation Q1.0 in FB 10

   Program:
   ```
   A I 0.0
   A I 0.1
   A I 0.2
   A I 0.3
   = Q 1.0
   ```
2. Save the block via the file menu command **File > Save**.

Declaring Address Monitoring Definitions for FB10

Introduction

After you have programmed the block for your sample program, you can proceed to create an address monitoring definition for this block.

Procedure

1. If not already open, double-click on FB10 to open it in SIMATIC Manager. The "LAD/STL/FBD" Editor opens.
2. Output Q1.0 of the example is to be monitored. Address monitoring is therefore to be added for this output. Position the cursor on the instruction line "= Q 1.0" and call **Edit > Special Object Properties > Monitoring** to open the "Process Monitoring Definitions" dialog box.
3. In the "Templates" box, select "S7-PDIAG: Address Monitoring" and the click on "New".
   Result: The "S7-PDIAG: Address Monitoring" dialog box displays the "Definitions" tab. The initial diagnostics address displayed is taken from the statement list, i.e."Q1.0".
4. In order to assign this error message the corresponding message text, enter "Q 1.0 = Level 1 in FB10" in the "Message" group box .
5. Exit the tab with "OK". You have now configured an address monitoring definition for Q1.0 at level 1. This configuration is now displayed in the "Existing Monitoring Definitions" box of the "Process Monitoring Definitions" dialog box also.
6. Click on "Close" to exit the "Process Monitoring Definitions" dialog box.
7. Save the block via the menu command **File > Save,** for the newly created error definition to be saved in the block and then exit the LAD/STL/FBD Editor.
8. Insert the following call for FB 10 at the end of OB 1 in the "BspPDIAG" project:
   - CALL FB 10, DB 10
9. Click "Yes" In the subsequent dialog box to create the instance DB which does not yet exist (in this case: DB 10).
   Result: The DB 10 was created with the S7-PDIAG-relevant data and has also retained the attribute "S7_pdiag = true".
10. Save the block and its new error definition via menu command **File > Save** and exit the LAD/STL/FBD Editor.

Insert Monitoring Block Call in OB 1 and Download the Monitoring Blocks to the AS

Introduction

In order to enable the monitoring blocks you generated, you must download them to your PLC and add a call for these blocks in OB1, or at the appropriate point in your user program.

Requirement

You have generated the monitoring blocks for your entire user program.

Adding a Call to OB1

1. Open OB1 in the SIMATIC Manager by double-clicking it.
2. Add the following lines:
   CALL FB 44, DB 44
   PDIAGZyklus: = OB1_SCAN_1
3. Save the block and exit the "LAD/STL/FBD" Editor.

Note

FB 44 contains the error detection. If an error is detected in FB44 it will automatically call FB45, which is responsible for the acquisition of initial values and of the status.

Downloading the Sample Program

In SIMATIC Manager you can download the program example "BspPDIAG" to your PLC. Proceed as follows:

1. Select the block container in SIMATIC Manager.
2. Download the sample program to your CPU via menu command **PLC > Download > To Module.**

Generate the Monitoring Blocks

Introduction

The steps below show you how to generate monitoring blocks from your error definitions.

Procedure

1. In SIMATIC Manager, select the "Blocks" container and open S7-PDIAG via the menu command **Options > Configure Process Monitoring.**
   Result: The unit overview of S7-PDIAG displays the PDIAG-relevant units; in this case FB10 and DB10.
2. In S7-PDIAG, call menu command **Process Diagnostics > Compile**. If you are initially compiling these data, you will be prompted to check the compilation settings. Confirm this message with "OK".
3. In the "Defaults" tab of the next "Settings" dialog box that you can also call via menu command **Options > Settings**, set the error ID "44" for the error detection blocks to be compiled, and the ID "45" for initial value/status acquisition blocks.
4. Exit the dialog box with "OK". A progress bar is displayed and the monitoring blocks are generated. If an error occurs during compilation, a message will appear on the screen.
   Result: SIMATIC Manager displays the generated monitoring blocks and the corresponding SFCs required.

How To Test your Sample Process Diagnostics In STEP 7

Now that you have gone through the entire configuration process with S7-PDIAG using the example project, you can simulate a process error and display the configured messages via the STEP 7 function "CPU Message".

Requirements

In order to view the messages without using an OP, call the "CPU Message" function included in the standard software package. Proceed as follows:

1. Switch to online mode in SIMATIC Manager.
   Result: The online project window pops up.
2. Select the program example "BspPDIAG".
3. Call the "CPU Message" function via the menu command **PLC > CPU Messages ...**.
4. In the next dialog box "Customize", enable the check box below "A" in order to enable you to view the Alarm_S messages. Close the dialog box.

Now that you have customized your error message display under "CPU message", you can go ahead and trigger a process error.

How to Trigger the Error Message in FB10

Trigger a error message configured in FB10 as follows:

1. Set inputs I0.0, I0.1, I0.2 and I0.3, all at the same time. If not in possession of digital modules, you can use the STEP 7 function "Status/Control Variable".
   Result: You set output Q1.0 at FB10 to "1". S7-PDIAG recognizes this as error due to your error definition. An error message will appear with the message text you entered. The "CPU Message" window now displays this error message.

What Comes Next?

In the previous chapters you have learned step-by-step how to use S7-PDIAG to create a STEP 7 program with diagnostic functions.

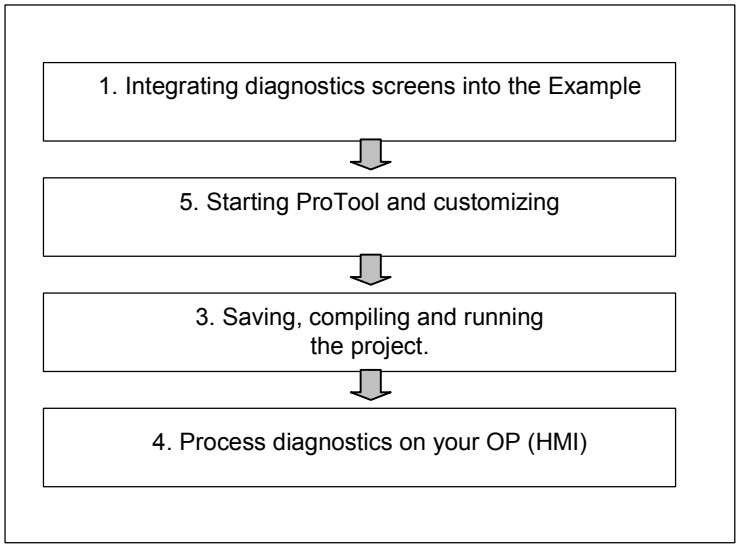
You will now learn how to create a configuration for diagnosing processes on an OP (hereafter referred to as operator panel) using the ProTool configuration software and the corresponding optional package ProAgent (from the SIMATIC HMI product family).

This section will then show you how to diagnose a process on the operator panel. This will also familiarize you with the different diagnostic screens.

Getting Started with ProAgent

In the next chapters will shall show you how to use ProTool to create a configuration with diagnostic functions for the sample project above, and how to download it to the OP and perform process diagnostics.

Proceed as follows:



Requirement

In order to configure process diagnostics under ProTool, you must have successfully generated the monitoring blocks for your user program, as described at the start of this chapter.

Operator Panel

The following description shows the OP25 as an example of a display device in all the figures. The procedure is identical for all display devices.

Integrating Diagnostics Screens into the Example

Introduction

Before you can program process diagnostics for the OP (HMI), you first need to implement the corresponding images into your S7-PDIAG project.

IN our example we only need the diagnostics screens, and you can therefore import the default configuration and diagnostics screen files supplied with the software package to your sample project. Otherwise you will have to copy and paste the diagnostic screens, as described in the manual.

Procedure

Integrate the diagnostic screens as follows:

1. If you have not already done so, start SIMATIC Manager and call menu command **File > Open**.
2. In the "Open" dialog box, select the "Projects" option. Select the "BspPDIAG" project from the list.
3. Similarly, open the "ProAgent" project.
   if this project does not appear in your table, click on "Find" and open the "ProAgent" project via the ProTool directory "Default\ProAgent".
   The "ProAgent" project contains default projects for various types of operator panels.
4. For our example we only need the diagnostics screens. You can therefore import the default configuration and diagnostics screen files directly to your sample project.
5. Drag and drop the "ProAgentPCmedium" configuration file to the "BspPDIAG" project or save via **File > Save as** to the "BspPDIAG" project.

Starting ProTool and Customizing

Introduction

The next step is to start ProTool and customize your settings. Of particular importance is that you select the network parameters, the CPU and the units.

How to Select Network Parameters and the CPU

Proceed as follows:

1. Start the ProTool CS configuration software by doubleclicking on the symbol for ProAgentPCmedium.
2. In the configuration overview, select the "PLC" item.
3. Double-click on "PLC_1" on the right side and then click on "Parameters" in the control dialog.
4. Select your network parameters and the networked CPU.
5. Confirm your entries with "OK".

How to Select Units

Now select these units for which you want to enable process diagnostics. Proceed as follows:

1. Call the menu command **PLC > ProAgent**.
2. Highlight "PLC_1" and click on "Select Unit". The entry will be included in the list of selected units.
3. Exit the "ProAgent" dialog box with "**OK**".
   Result: You have now enabled diagnostics functions for all units of PLC_1.

Saving, Compiling and Starting the User Program

Introduction

After you have completed the configuration, all that is left to do is to save, compile and start the user program. You can initiate these steps all at once by starting ProTool RT.

Note

If you do not want to use the same PC that you used for the configuration as the operator panel in this example, you must download the compiled program to the operator panel and then start it there.

Procedure

Proceed as follows:

1. Click on the symbol
2. Answer the compiler prompt with **Yes**.
3. **Result:** ProTool synchronizes its data to the STEP 7 database. This routine copies the diagnostic data and ALARM_S message texts from the database to the ProTool configuration.
   The save, compile and download sequence is now running. The status window meanwhile displays various messages on its "Compile" tab, e.g. ProTool messages during compilation.
4. ProTool RT starts up and you can now begin process diagnostics.

Process Diagnostics on your OP (HMI)

Introduction

Now that you created a configuration for the OP and downloaded it to your operator panel as described in the previous chapters, you can go on to perform a process diagnostics run.

Requirements

Before you can perform process diagnostics on the OP, you must have completed all the steps described in the previous sections:

- the control program must have been downloaded to the CPU and
- the configuration data must be in the operating unit.

Diagnostics Startup Screen

After you have started ProTool RT, the operator panel opens the diagnostics startup screen. One of your options here is to change either to the overview screen or to the message screen. Change for the time being to the message screen by clicking the corresponding button.

Message Screen

The message screen is blank at first because there have not been any errors so far.

1. Now simulate an error in FB10 as you have done previously.
   An error message is output on the message screen of the OP:
2. Click on *ACK* to hide the message window.
   Of course, although you have now acknowledged the message, you still have to react to the error itself. Until you clear the error, the small window containing the error character will keep flashing.

Explanations Relating to the Message Screen

The asterisk to the left of the message indicates that this message is diagnosable. Since this is the only message displayed so far, it is already selected. You recognize the selection by the inverted message line (light letters on a dark background).

When several messages are displayed, you first have to use the cursor keys or the mouse to select the message for which you want to perform process diagnostics. Then press the corresponding button to call the overview screen.

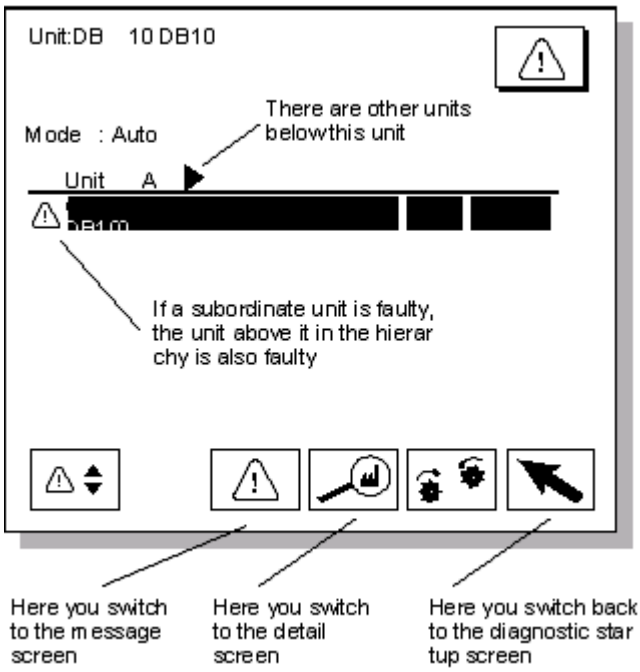
"Faulty Unit" Overview Screen

A warning triangle identifies the faulty unit. The warning triangle is flashing, since this is the first error to occur. If the error had involved consequential errors, warning symbols would likewise appear for the affected units, but they would not flash.

You recognize where the error first occurred from the location of the warning triangle. In many cases, this is where you will find the cause of the error and its consequential errors. The faulty unit has already been selected. Above the unit table you can see an arrowhead pointing to the left. This arrow indicates that the selected unit (Unit_11 in this case) is part of a unit at a higher hierarchy level.

"Higher-level Unit" Overview Screen

The following overview screen shows you the higher-level unit, in this case DB10.



Explanations relating to "Higher-level Units"

A warning triangle identifies the faulty unit. The warning triangle is flashing, as this is the first error to occur. If the error had involved consequential errors, warning symbols would likewise appear for the affected units, but they would not flash.

You recognize where the error first occurred from the location of the warning triangle. In many cases, this is where you will find the cause of the error and its consequential errors. The faulty unit has already been selected.

Now press the corresponding button to call the detail screen.

Detail Screen

The detail screen specifies the error triggering signals.

The signals that triggered the alarm message are identified by a lightning symbol. The address monitoring function we have defined in the *Getting Started with S7-PDIAG* chapter monitors output Q1.0. The error message will be triggered if Q1.0 = 1. This is the case in the current situation.

You can see the cause in the central area of the detail screen:

The status of all inputs I 0.0, I0.1, I0.2 and I0.3 is "1". According to the assignment, the status at output Q1.0 was therefore also set to "1". In order to eliminate this error, at least one of the inputs must be reset to "0".

Display as Signal List

In order to display the program code in the central area of the detail screen, you can toggle between STL, signal list and LAD by clicking on the corresponding button.

The display will appear as a symbol list in the central area of the detail screen.

LAD Display

Click again on the corresponding button. This will move you cyclically to the next display:

The display will appear as a ladder diagram in the central area of the detail screen.

Conclusion

You have now learned how to simulate an error, monitor its error message on the PC and locate the cause of error.