PROFIBUS diagnostic bundle for SIMATIC S7

For the PROFIBUS-DP diagnosis a diagnostic package is available, which includes the following components:

- **S7 diagnostic block FB125** for the analysis and supply of the diagnostic information of a PROFIBUS-DP system.

- **ProTool diagnostic pictures** for the display of the diagnostic information on HMI devices or visualization system. The diagnostic pictures access the information of the S7 diagnostic block and bring them to the display.

1 Diagnostic block FB125

The FB125 is a interrupt-driven function for detection of failed and faulty DP slaves. In the case of faulty slaves, detailed diagnostics information concerning the cause of the fault is displayed (slot or module number, module status, channel number, channel fault). The diagnostics information of any DP slaves can be read and interpreted via individual diagnostics. Overview diagnostics give information on configured, existing, failed and faulty DP slaves. The FB125 diagnostic block also offers information of subordinate ASI bus systems, when a DP/ASI-Link is used as a DP slave. If there is an diagnostic repeater (MLFB: 6ES7 972-0ABxx-0XA0) in the plant, the FB125 decodes the diagnostic frame of the repeater and informs you about error location and error cause.

All interrupts are delayed during execution of the FB125.

1.1 Application area of FB125

FB125 can be used in the following integral and external DP interfaces:

- CPU 313C-2 DP
- CPU 314C-2 DP
- CPU 315-2 DP (from 6ES7 315-2AF02-0AB0)
• CPU 315-2 DP (only 6ES7 315-2AF01-0AB0):
  ➔ FB125 without detection of faulty slaves by Start/RESET
• CPU 316-2 DP
• CPU 318-2 DP
• C7-626 DP (from 6ES7 626-2AG01-0AE3)
• C7-633 DP and C7-634 DP
• SINUMERIK 840D with integrated CPU315-2 DP (6ES7 315-2AF01-0AB0):
  ➔ FB125 without detection of faulty slaves by Start/RESET
• SINUMERIK 840DI with integrated CPU315-2 DP (6ES7 315-2AF03-0AB0)
• CPU 41x-2/3/4 DP
• CP 443-5
• IM 467 and IM 467 FO
• WIN AC
• WIN LC
• **Not** for CP 342-5

1.2 Calling the FB125 in the S7 user program

The DP diagnostic block is called via the following statement in the user program:

```
CALL FB125, DBxy  (xy represents any instance data block number)
```

The parameter list then appears automatically with the formal operands which should not be parameterized. The controlling of the building block function is made by the ProTool diagnostic pictures.

```
OB1 / OB82 / OB86
```

**Picture 2: Call of FB125**

This call (including the same instance data block number and the same user actual operand) must be made in the three execution levels **OB1, OB82 and OB86**. A nested FB125 call in the three execution
levels is possible (e.g.: OB82 → FC120 → FB125). The order and the contents of the 20 bytes of temporary local data of the organization blocks OB1, OB82 and OB86 must not be changed but can be extended at any time.

The following SFCs are used internally in the FB125: SFC13 and SFC51 with SZL 0C91 (in the case of an internal DP interface to the master CPU) or SZL 4C91 (in the case of an external DP interface to the CP/IM). It is not permissible to call SFC13 and/or SFC51 with SZL 0C91/4C91 in OB1 in addition to the FB125 call.

Evaluation of the information at the block output parameters only makes sense in the cyclic program section (OB1).

The block FB125 will be processed orderly, if the BIE-Bit is set as “1”. And the BIE-Bit will be removed, if the processing of FB125 was error.

1.3 Technical specifications of FB125

Runtime without pending diagnostics message: depend on the DP master
e.g. CPU 315-2 DP as DP master: approx. 4ms

Runtime with pending diagnostics message: depend on the DP master and the slave diagnostics length
e.g. CPU 315-2 DP as DP master: approx. 11ms

Memory used in the CPU: 6,3 Kbytes
2 ProTool-Diagnostic pictures

PROFIBUS Diagnostic pictures are supplied for the existing SIEMENS HMI devices. The tags of the pictures are assigned to data of the FB125-Instance data block. Text lists and graphics are provided as well.

ProTool project engineering was created with ProTool/ProCS V5.2 + Service Pack 3

The diagnostic pictures available for the following HMI devices:

- OP 7
- OP 012 (Sinumerik)
- OP 17
- OP 27
- OP 37
- TP 27
- TP 37
- MP 270
- ProTool Runtime
- OP 170B
- TP 170B
- MP 370
- MP 370 Touch

2.1 Pictures

<table>
<thead>
<tr>
<th>Name</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DetailDiag</td>
<td>Detailed diagnostic</td>
</tr>
<tr>
<td>CableDiag</td>
<td>Cable diagnostic with Diagnostic Repeater</td>
</tr>
<tr>
<td>OverviewDiag</td>
<td>Diagnostic overview</td>
</tr>
</tbody>
</table>

2.1.1 Picture „OverviewDiag“

![Overview diagnostic diagram]

Picture 3: Overview Diagnostic
Specification of the DP Mastersystem, which should be diagnosed.

Specification of the DP Interface type, in the case of an external DP Master interface.

Overview message whether all Slaves operates trouble free.

Slave with diagnosis (failed or disturbed).

Number of Slaves with diagnosis.

Change to the detail diagnosis (picture "DetailDiag" displayed).

Indicated number of the DP Master systems and DP tape of interface is taken over. The DP analysis is afterwards initialized and again started. The entire DP Master system is again entered, i.e. all projected, available, failed and disturbed DP Slaves is determined automatically in an initialization routine.

Quit PROFIBUS-Diagnosis.
2.1.2 Picture „DetailDiag“

Change to the operating mode automatic.

Change to cable diagnostic (Picture “CableDiag” will be shown). This button will only be shown in the picture “DetailDiag” while the diagnostic repeater is implemented to the plant and some cable errors are detected.

Step up to the next failed/disturbed DP Slave.

Step up to the next error on the displayed DP Slave.

Change to the manual operating mode with “single diagnosis”.

Picture 4: Detail Diagnostic
Specification of the number of the Slaves for the single diagnosis.

Activation of the single diagnosis of the indicated Slaves.

Change to the overview diagnosis (picture "OverviewDiag" displayed).

### 2.1.3 Picture „CableDiag“

<table>
<thead>
<tr>
<th>Station A/B</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station X/Y</td>
<td>255</td>
<td>1</td>
</tr>
<tr>
<td>Distance to X/Y</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Picture 5: Cable Diagnostic

Station X/Y means the „number of the slave“
Distance to X/Y is indicated in „meter“

Station X/Y: 255 resp. FF (hex) means „no valid Station number“
Distance to X/Y: –1 resp. FFFF (hex) means „no valid cable length“

Step up to the next cable error.
Back to the picture “DetailDiag”.

Change to the overview diagnosis (picture "OverviewDiag" will be displayed).

### 2.2 Tags

<table>
<thead>
<tr>
<th>Name</th>
<th>Meaning</th>
<th>Control access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address_In</td>
<td>Slave address input</td>
<td>DB125.DBB3</td>
</tr>
<tr>
<td>Address_Out</td>
<td>Slave address output</td>
<td>DB125.DBB6</td>
</tr>
<tr>
<td>Asi0_7</td>
<td>ASI-Slaves</td>
<td>DB125.DBB18</td>
</tr>
<tr>
<td>Asi8_15</td>
<td></td>
<td>DB125.DBB9</td>
</tr>
<tr>
<td>Asi16_23</td>
<td></td>
<td>DB125.DBB20</td>
</tr>
<tr>
<td>Asi24_31</td>
<td></td>
<td>DB125.DBB21</td>
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<tr>
<td>Channel_No</td>
<td>Channel number</td>
<td>DB125.DBB14</td>
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<td>Channel_Typ1</td>
<td>Channel type, part 1</td>
<td>DB125.DBB15</td>
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<tr>
<td>Channel_Typ2</td>
<td>Channel type, part 2</td>
<td>DB125.DBB15</td>
</tr>
<tr>
<td>Count_Diag</td>
<td>Number of diagnosis per Slave</td>
<td>DB125.DBB26</td>
</tr>
<tr>
<td>Count_Slaves</td>
<td>Number of concerned Slaves</td>
<td>DB125.DBB5</td>
</tr>
<tr>
<td>Diag_Hex1</td>
<td>Diagnostic data in Hex format</td>
<td>DB125.DBB938</td>
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<tr>
<td>Diag_Hex2</td>
<td></td>
<td>DB125.DBB939</td>
</tr>
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<td>Diag_Hex3</td>
<td></td>
<td>DB125.DBB940</td>
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<tr>
<td>Diag_Hex4</td>
<td></td>
<td>DB125.DBB941</td>
</tr>
<tr>
<td>Diag_Hex5</td>
<td></td>
<td>DB125.DBB942</td>
</tr>
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<td>Diag_Hex6</td>
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<td>DB125.DBB943</td>
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<td>Diag_Hex7</td>
<td></td>
<td>DB125.DBB944</td>
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<td>Diag_Hex8</td>
<td></td>
<td>DB125.DBB945</td>
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<tr>
<td>Diag_Hex9</td>
<td></td>
<td>DB125.DBB946</td>
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<td>Diag_Hex10</td>
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<td>DB125.DBB947</td>
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<td>DB125.DBB948</td>
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<td>DB125.DBB949</td>
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<td>DB125.DBB950</td>
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<td>Diag_Hex14</td>
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<td>Diag_Hex15</td>
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<tr>
<td>Diag_Hex16</td>
<td></td>
<td>DB125.DBB953</td>
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<tr>
<td>Distance_DR</td>
<td>Cable diagnostic: Distance to Diagnostic-Repeater</td>
<td>DB125.DBW24</td>
</tr>
<tr>
<td>Distance_x</td>
<td>Cable diagnostic: Distance to Station x</td>
<td>DB125.DBW20</td>
</tr>
<tr>
<td>Distance_y</td>
<td>Cable diagnostic: Distance to Station y</td>
<td>DB125.DBW22</td>
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<tr>
<td>DP_Interface</td>
<td>DP-Interface type</td>
<td>DB125.DBX2.0</td>
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<td>DP_Master</td>
<td>DP-Master system</td>
<td>DB125.DBW0</td>
</tr>
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<td>Error_Code</td>
<td>Error code</td>
<td>DB125.DBW16</td>
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<tr>
<td>Error_No</td>
<td>Error number</td>
<td>DB125.DBB10</td>
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<tr>
<td>Error_Type</td>
<td>Error type</td>
<td>DB125.DBB11</td>
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<td>Global_Info</td>
<td>Collection display</td>
<td>DB125.DBX4.0</td>
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<td>Hand_Auto</td>
<td>Manual / automatic operation</td>
<td>DB125.DBX2.1</td>
</tr>
<tr>
<td>Module_No</td>
<td>Module number</td>
<td>DB125.DBB12</td>
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<td>Module_State</td>
<td>Module status</td>
<td>DB125.DBB13</td>
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<tr>
<td>Next_Error</td>
<td>Step up to the next error on the Slave</td>
<td>DB125.DBX2.3</td>
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<tr>
<td>Next_Slave</td>
<td>Step up to the next concerned Slave</td>
<td>DB125.DBX2.2</td>
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<tr>
<td>Reset</td>
<td>Reset analysis, take over inputs</td>
<td>DB125.DBX2.4</td>
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<tr>
<td>Single_Diag</td>
<td>Activate single diagnosis</td>
<td>DB125.DBX2.5</td>
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<tr>
<td>Slave1_16</td>
<td>DP-Slaves</td>
<td>DB125.DBW1240</td>
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<tr>
<td>Slave17_32</td>
<td></td>
<td>DB125.DBW1242</td>
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<td>Slave33_48</td>
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<td>DB125.DBW1244</td>
</tr>
<tr>
<td>Slave49_64</td>
<td></td>
<td>DB125.DBW1246</td>
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</table>
### 2.3 Text lists

<table>
<thead>
<tr>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable_Diag</td>
<td>Cable diagnostic with Diagnostic-Repeater</td>
</tr>
<tr>
<td>Channel_Type</td>
<td>Type of channel</td>
</tr>
<tr>
<td>DP_Interface</td>
<td>DP interface</td>
</tr>
<tr>
<td>Error_Text</td>
<td>Error text</td>
</tr>
<tr>
<td>Global_Info</td>
<td>Collection display</td>
</tr>
<tr>
<td>Hand_Auto</td>
<td>Manual / automatic operation</td>
</tr>
<tr>
<td>Module_State</td>
<td>Module Status</td>
</tr>
<tr>
<td>Name_Station</td>
<td>Station Name</td>
</tr>
<tr>
<td>Reset</td>
<td>Reset analysis, take over inputs</td>
</tr>
<tr>
<td>Single_Diag</td>
<td>Activate single diagnosis</td>
</tr>
<tr>
<td>Slave1</td>
<td>Slave 1</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Slave128</td>
<td>Slave 128</td>
</tr>
<tr>
<td>Slave_Ident1</td>
<td>Manufacturer identifier, part 1</td>
</tr>
<tr>
<td>Slave_Ident2</td>
<td>Manufacturer identifier, part 2</td>
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<tr>
<td>Slave_Ident3</td>
<td>Manufacturer identifier, part 3</td>
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<tr>
<td>Status1</td>
<td>Slave-Status , part 1</td>
</tr>
<tr>
<td>Status2</td>
<td>Slave-Status , part 2</td>
</tr>
</tbody>
</table>

Due to the different function range of the HMI devices, the number of variables will change. This table describes the variables for the MP270.

Due to the smaller volume of project data available in the OP7 and OP17 devices, a reduced number of error messages has been integrated into the ProTool-applications for these devices (Text list "Error_Text").

In the text list "Name_Station", a designation can be assigned to each Slave address (e.g. local flag). This designation appears in the detail view apart from the output field "DP address" (variable "Address_Out").

### 2.4 Graphics

<table>
<thead>
<tr>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slave 1</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>128</td>
<td>Slave 128</td>
</tr>
<tr>
<td>Array</td>
<td>Slave empty field</td>
</tr>
<tr>
<td>Auto</td>
<td>Automatic operation</td>
</tr>
<tr>
<td>Cable_Diag</td>
<td>Cable Diagnostic with Diagnostic-Repeater</td>
</tr>
<tr>
<td>Empty</td>
<td>Empty field</td>
</tr>
<tr>
<td>Hand</td>
<td>Manual operation</td>
</tr>
<tr>
<td>Next_Slave</td>
<td>Step up to the next concerned Slave</td>
</tr>
<tr>
<td>Overview</td>
<td>Change to the outline diagnosis</td>
</tr>
<tr>
<td>Reset</td>
<td>Reset analysis, take over inputs</td>
</tr>
<tr>
<td>Single_Diag</td>
<td>Activate single diagnosis</td>
</tr>
<tr>
<td>ZP_DETAIL</td>
<td>Change to the detail diagnosis</td>
</tr>
<tr>
<td>ZP_ESC</td>
<td>Quit PROFIBUS diagnosis</td>
</tr>
<tr>
<td>ZP_NEXT_ERR</td>
<td>Step up to the next error on the Slave</td>
</tr>
</tbody>
</table>

Due to the different function range of the HMI devices, the number of variables will change. This table describes the variables for the MP270.
3  Integration into the S7 user project

The function block FB125 and the ProTool Diagnostic pictures are offered in a archived STEP7-Project. With the STEP7-Function "Retrieve" the project can be opened and unpacked in the SIMATIC MANAGER. Prerequisite for the display of the HMI stations in the SIMATIC manager is the installation of ProTool/ProCS V5.2 + Service Pack 3 (or later).

![Picture 6: S7-Project after retrieve]

3.1  Integration of the S7 diagnostic block FB125

In the project all necessary S7-Blocks including the organizational components (OB1, OB82, OB86) are provided within call of the diagnostic block FB125.

The S7-Blocks from the STEP7-Projekt can be easily brought into the respective user project with simply "copy" and "paste". The call interfaces of the diagnostic block FB125 can be copied from the provided organizational components (OB1, OB82, OB86) and inserted into the user program.

3.2  Integration of the ProTool pictures

All pictures, including variables, controls, symbol lists and graphs are provided in the project.

The pictures, tags, text lists and graphics can be easily brought from the STEP7-Project into the respective user project by simply "copy" and "paste".

The "Steuerung_1" was adapted to the PLC of the user project (including OP and network parameters):

![Picture 7: Configuration of the PLC]
3.3 Controlling of the FB125 with operands and HMI device

If the FB125 needs to be controlled via operands (e.g. input / outputs) as well as via the HMI devices, then proceed as follows:

- Supply of the parameter line of the FB125 with actual operands in the S7-User program.
- An HMI can control the FB125 information directly from the PLC by access to an internal function border in the instance data block of the FB125 (byte 1400 ... 1403), which corresponds exactly to the FB parameter line. The variables of the PROFIBUS Diagnose pictures must be adapted accordingly.
- Over the data bit DB125.DBX1402.6 (CONTROL_INT) the internal controlling of the diagnostic block is activated and the analysis of the parameter line with formal operands is switched off.
  
  | CONTROL_INT =0: | External control actively (over FP parameter line with actual operands) |
  | CONTROL_INT =1: | Internal control actively (over internal function border in the instance data building block) |

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400.0</td>
<td>stat</td>
</tr>
<tr>
<td>1402.0</td>
<td>stat</td>
</tr>
<tr>
<td>1402.1</td>
<td>stat</td>
</tr>
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<td>1402.2</td>
<td>stat</td>
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<td>1402.3</td>
<td>stat</td>
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<td>1402.4</td>
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</tr>
<tr>
<td>1402.5</td>
<td>stat</td>
</tr>
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<tr>
<td>1403.0</td>
<td>stat</td>
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