SIEMENS

# SIPART

# Electropneumatic positioners SIPART PS2 with 4 to 20 mA/HART

Diagnostics Manual



6DR50..
6DR51..
6DR52..
6DR53..
6DR59..


**05/2024**
A5E53054898-AA

## Legal information

### Warning notice system

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 only to property damage have no safety alert symbol. These 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**

indicates that minor personal injury can result if proper precautions are not taken.

**NOTICE**

indicates that property damage can result if proper precautions are not taken.

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.

### Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

**⚠ WARNING**

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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# Table of contents

# Introduction

# 1

## 1.1 Purpose of this documentation

This Diagnostics Manual contains information for performing diagnostics on the positioner and the valve.

The Diagnostics Manual is intended for service technicians authorized by Siemens and for personnel responsible for diagnostics.

Referenced document:

- Operating Instructions Electropneumatic Positioner SIPART PS2 with 4 to 20 mA/HART

  The operating instructions contain information on the safe commissioning, use and maintenance of the positioner.

## 1.2 User documentation

The user documentation for this product consists of the following documents:

| Document | Availability |
|---|---|
| Operating Instructions | • Available for download on the Internet. |
| Compact Operating Instructions, Explosion Protection | |
| Diagnostics Manual | |
| Getting Started (leaflet) | • Enclosed with the product.<br>• Available for download on the Internet. |

### See also

SIPART PS2 product information (http://www.siemens.com/sipartps2)

Manuals (http://www.siemens.com/processinstrumentation/documentation)

## 1.3 Document history

| Edition | Note |
|---|---|
| 05/2024 | New diagnostic manual created. |

## 1.4 Product compatibility

The table describes the compatibility between manual edition, firmware, device revision, Electronic Device Description (EDD) and SIEMENS Device Manager Software.

The diagnostic functions available in the positioner depend on the firmware version.

| Manual edition, note | Firmware (FW) | Device revision | Electronic Device Description (EDD) | Device Manager software, compatible version |
|---|---|---|---|---|
| 05/2024: 1st Edition | 5.05.00 | 8 | 25.00.00 | • SIEMENS SIMATIC PDM Version 9.0 or higher<br>• SIEMENS SITRANS DTM Version 4.x<br>• SIEMENS SITRANS Mobile IQ as of version 4.02 (Bluetooth) |
| | 5.04.00 | 8 | 25.00.00 | • SIEMENS SIMATIC PDM Version 9.0 or higher<br>• SIEMENS SITRANS DTM Version 4.x |
| | 5.03.00 | 8 | 25.00.00 | |
| | 5.02.00<br>5.02.01 | 7 | 24.00.00 | |
| | 5.01.00 | 6 | 23.00.00 | |
| | 5.00.00 | 5 | 22.00.00 | |

# Safety notes

# 2

## 2.1 Warning symbols on the device

| Symbol | Explanation |
|---|---|
|  | Consult operating instructions |

## 2.2 Unexpected movements when executing diagnostic functions

**WARNING**

**Unexpected movements of the positioner and the valve**

Danger of injury. Danger of crushing.

When diagnostic functions are started, the positioner can move the actuator of the valve independently.

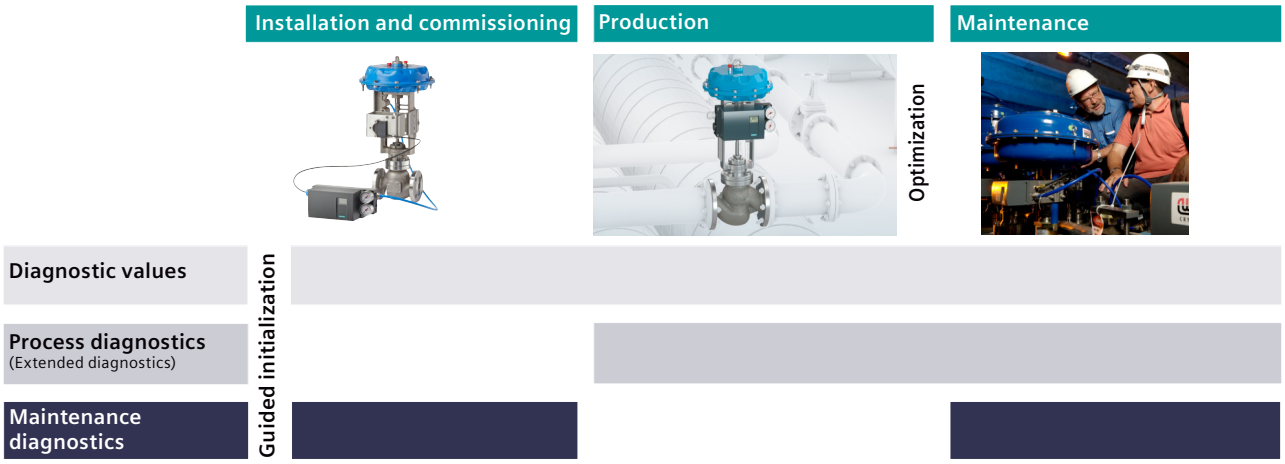
- Ensure that no body parts or objects are within the movement range of the positioner and the valve while the diagnostic function is running.
- Observe the separate operating instructions and all safety-relevant information when performing diagnostics on the positioner.
- Note that operation of the positioner is interrupted during certain diagnostic functions.

# Diagnostics options

# 3

## 3.1 Overview of diagnostic functions

Different diagnostic functions are available for the various operating phases of the positioner.




| | Product operating phases | | |
|---|---|---|---|
| | **Installation and commissioning** | **Production** | **Maintenance** |
| | Check the positioner after commissioning and before production. | The positioner is in the process and actively controls the flow rate at a process valve via an actuator.<br>Passive monitoring and diagnostics of the valve, optimization of the control behavior. | The positioner is not in the running process: No active control of a flow rate.<br>Active testing and diagnostics of the valve. |
| **Diagnostic function** | **Application examples** | | |
| Diagnostic values (Page 17) | • Actuator travel<br>• Travel time | • Device temperatures<br>• Current values of the process diagnostics | • Stroke counter<br>• "Drag pointer" for maximum value |
| Process diagnostics (Page 93) | - | • Partial Stroke Test<br>• Alarms when upper limits are violated | • Long-term trends in process diagnostics<br>• Adapt maintenance intervals |
| Maintenance diagnostics (Page 505) | • Installation check<br>• Function test | - | • Determine the status of the process valve<br>• Compare with installation status |

# Diagnostic values

# 4

## 4.1 Definition of diagnostic values

The diagnostic values of the positioner are counters, maintenance information or values for process diagnostics with the following functions and properties:

- The diagnostic values monitor the valve.
- The diagnostic values can be read out in all operating states of the positioner.
- The positioner saves the diagnostic results every 15 minutes, so that the diagnostic values of the last 15 minutes are lost at most in the event of a power failure.
- Some diagnostic values can be reset.

| Saving diagnostic values | Description | Additional information |
|---|---|---|
| **Counter** | Display for cumulative values, e.g.<br>• Total strokes<br>• Operating hours<br>• Alarms | Counter (Page 33) |
| **Maintenance information** | Shows current measured values, e.g.<br>• Setpoint current<br>• Current temperature | Maintenance information (Page 50) |
| **Values for process diagnostics** | Shows the current status and the values for process diagnostics, e.g.<br>• PST status<br>• Pneumatic leakage<br>• Stiction<br>• End position offset | Values for process diagnostics (Page 64) |

## 4.2 With local operation: Displaying diagnostic values

### Open Diagnostics mode

- Press the 3 buttons on the display simultaneously for at least 2 seconds.
  ⇒ "Diagnostics" mode is active.
  Diagnostic value shown in the display:


  – The top line shows the value, e.g. "107".
  For values greater than 99 999, the display switches to exponential format. Example: The value "1 234 567" is shown as "1.23E6".
  – The bottom line shows the number of the diagnostic value, e.g. "1", and the short name of the diagnostic value, e.g. "STRKS".

### Displaying diagnostic values

The diagnostic values are shown on the display in ascending or descending order.

- In ascending order: Press the button.
  ⇒ The next highest diagnostic value is displayed.
- Descending order: Hold down the button and press the button at the same time.
  ⇒ The next lower diagnostic value is displayed.

### Set diagnostic value to zero

**Requirement**

The diagnostic value can be reset.

**Procedure**

1. Select the desired diagnostic value.
2. Press the button for at least 5 seconds.
   ⇒ The "rESEt" display changes to "0". The value is set to zero.

### Exit Diagnostics mode

- Press the button for at least 2 seconds.

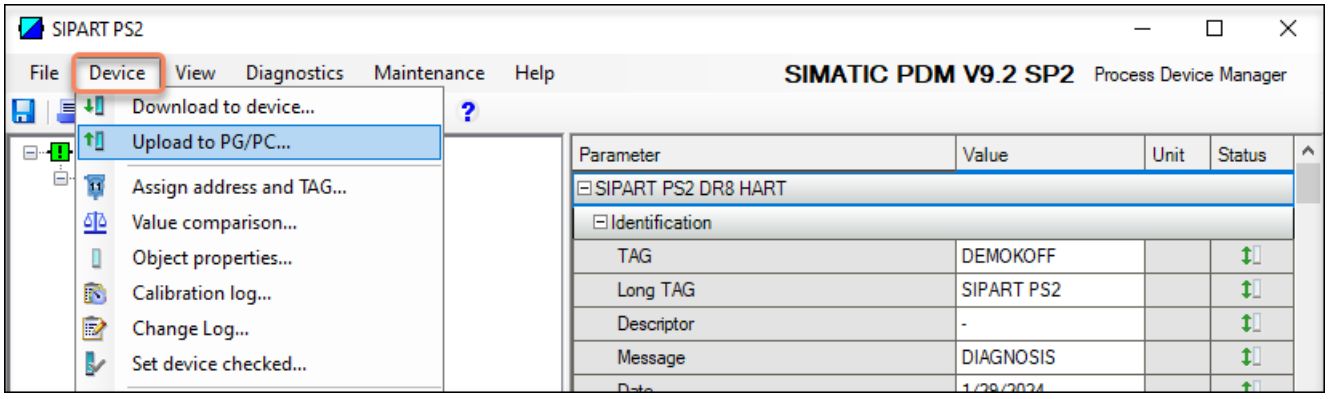
## 4.3 With SIMATIC PDM: Displaying diagnostic values

### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

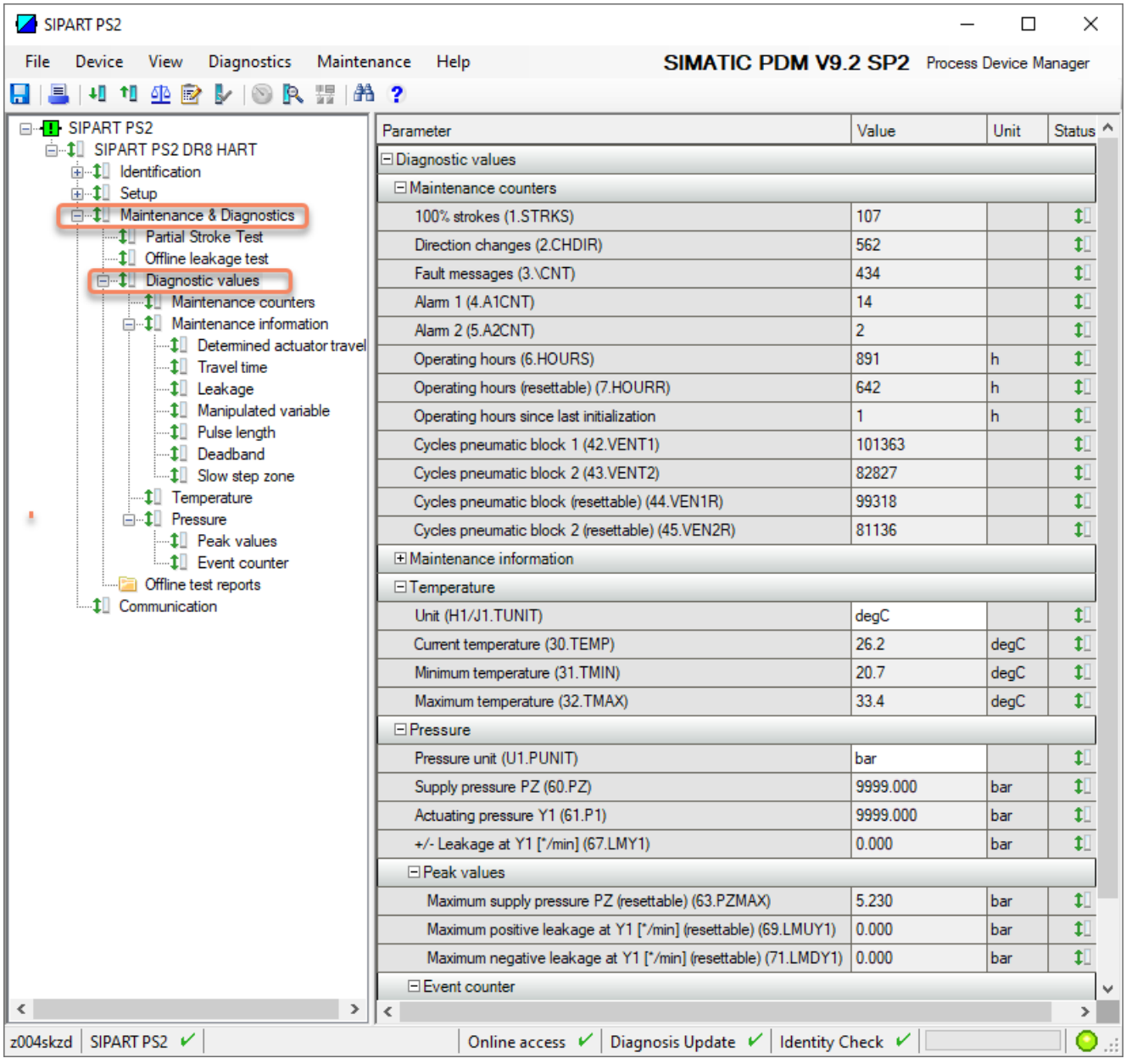
### Displaying diagnostic values

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. Select the directory "Maintenance & Diagnostics > Diagnostic values".
   ⇒ The counters for the diagnostic values are displayed.



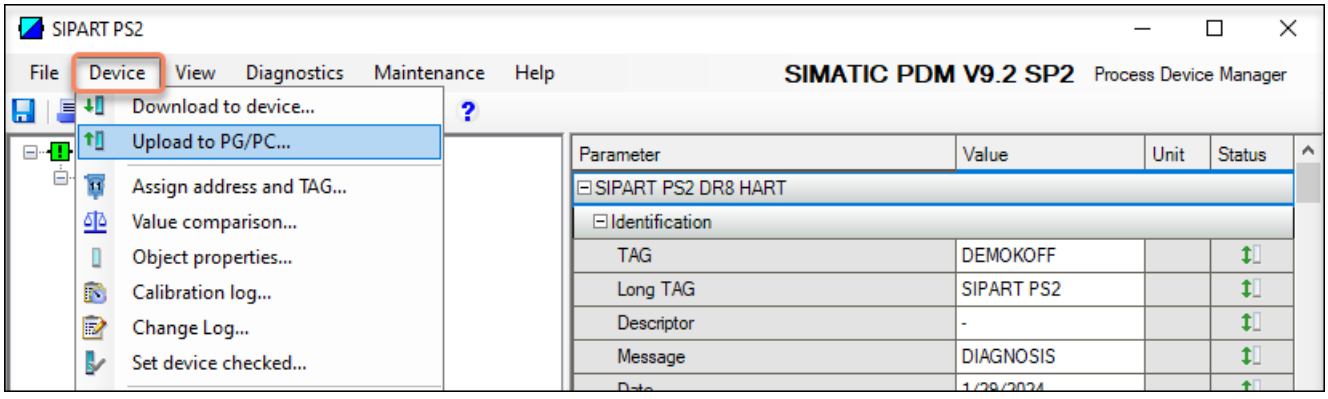
## 4.4 With SIMATIC PDM: Display and reset resettable diagnostic values

### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

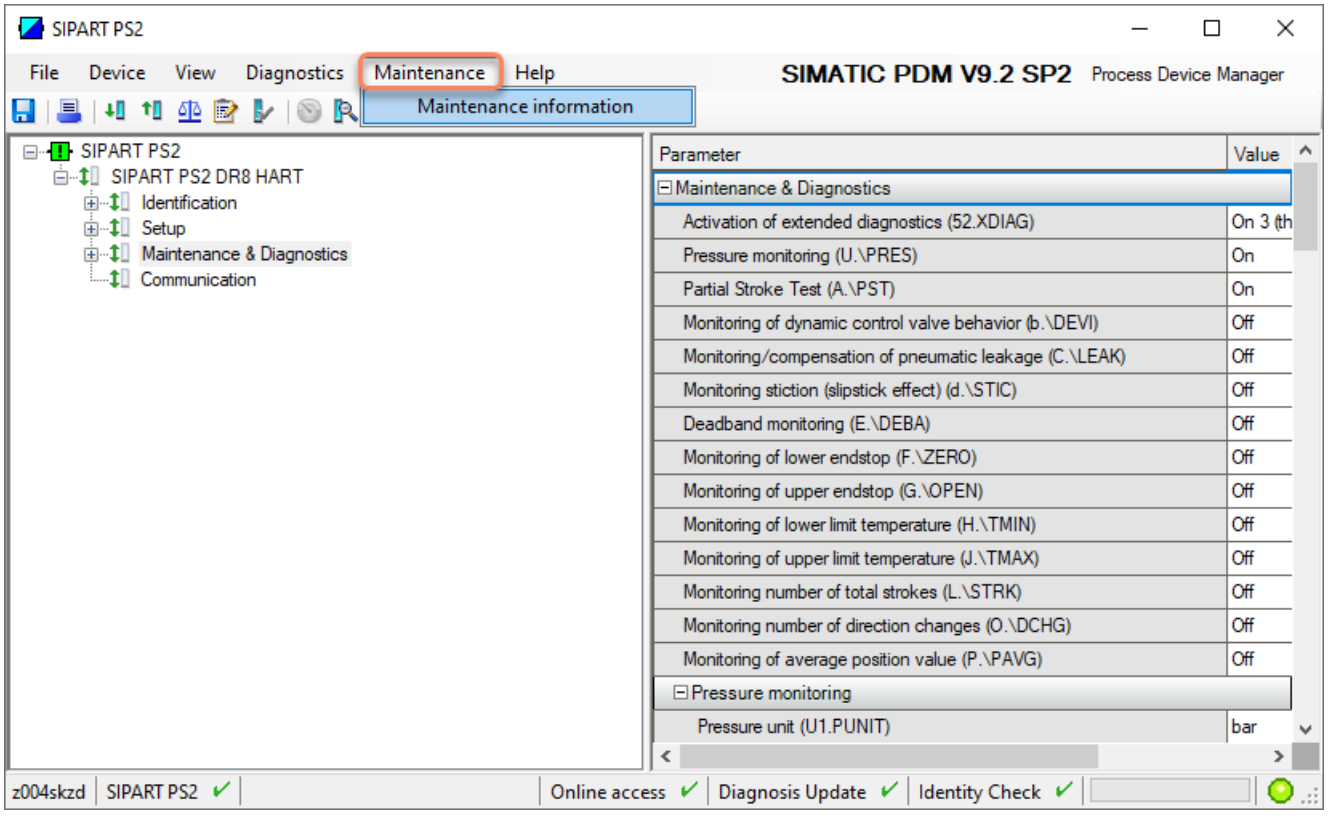
### Open the menu in SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Maintenance" dialog, select the command "Maintenance information".

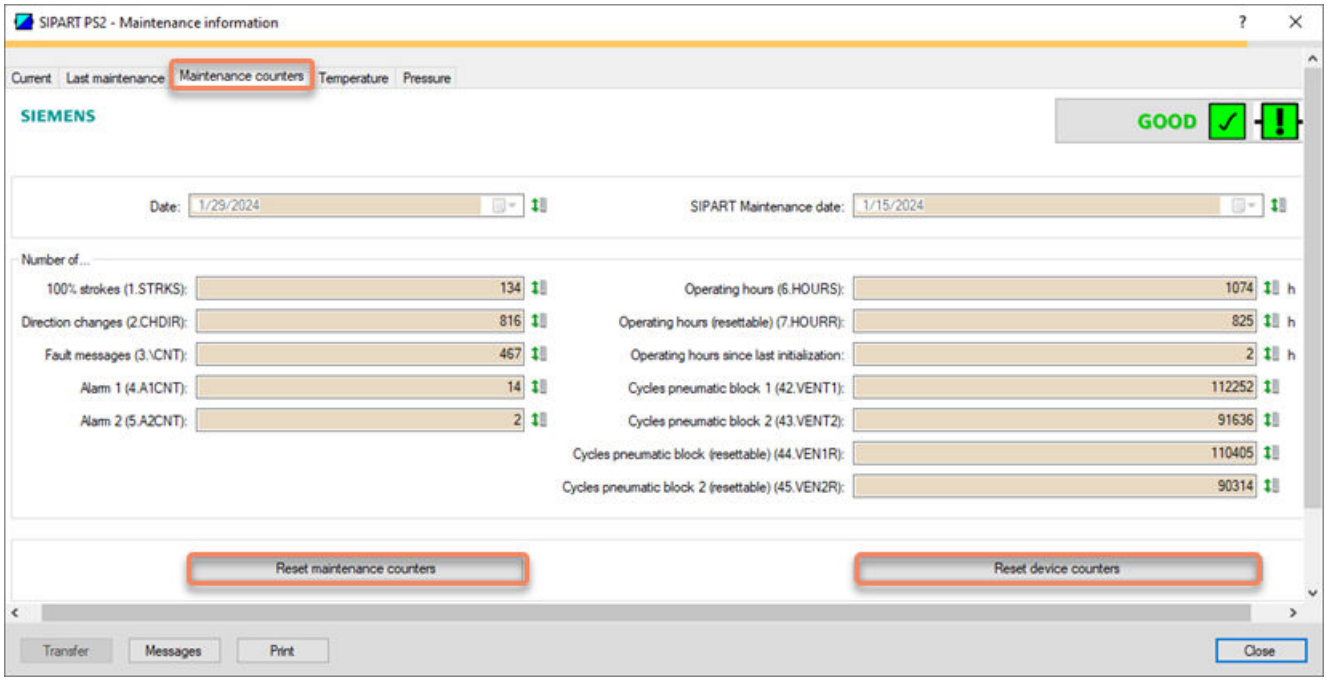



⇒ The "Maintenance information" dialog opens.

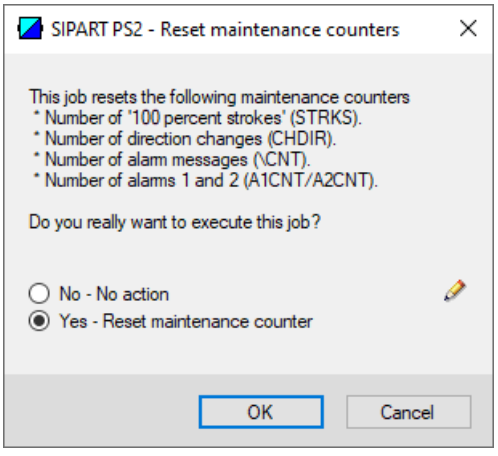
## Reset maintenance counter and device counter

### Reset maintenance counter

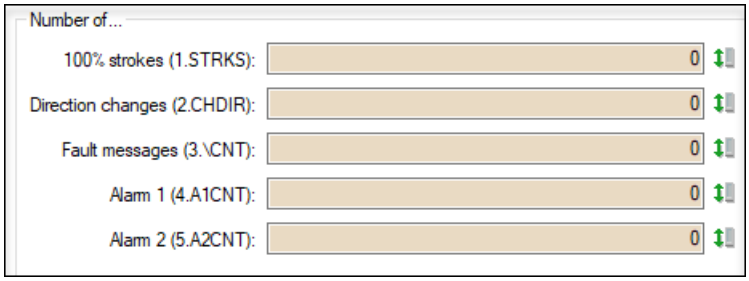
1. Open the "Maintenance counters" tab.
2. Click the "Reset maintenance counters" button.




⇒ The "Reset maintenance counters" dialog opens.

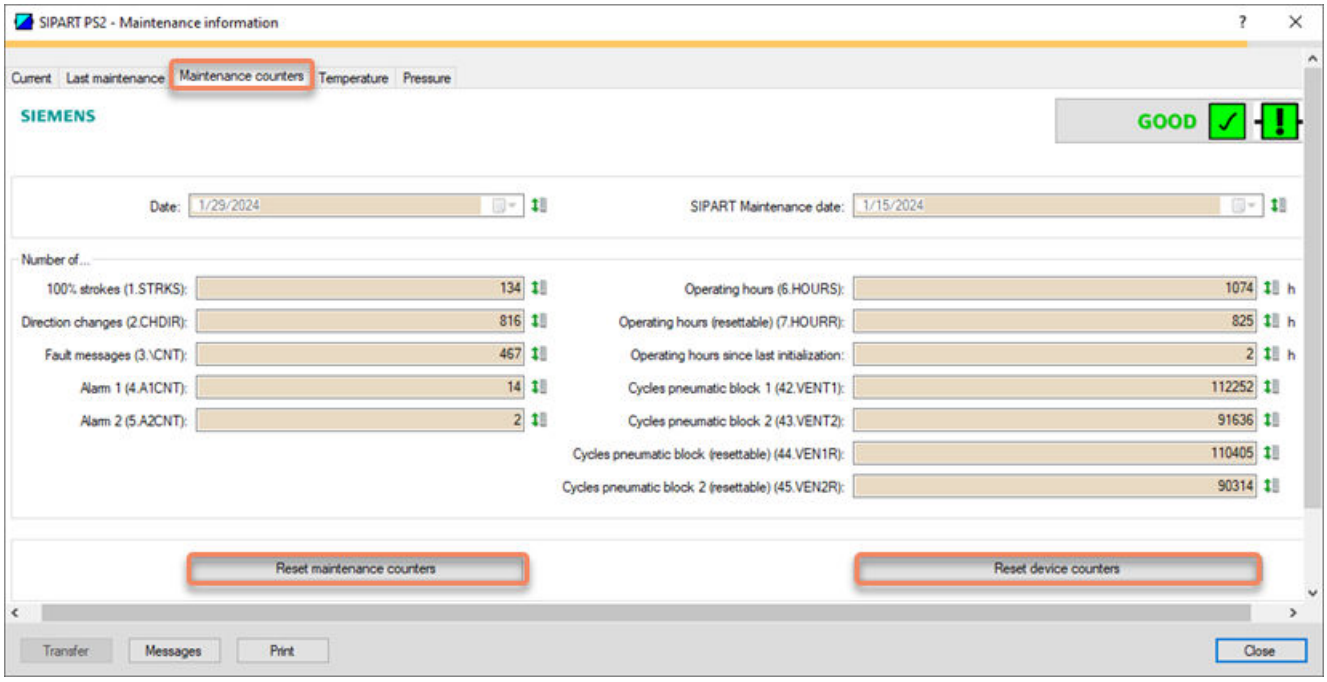


3. Select the option button "Yes - Reset maintenance counter".
4. Click the "OK" button.
   ⇒ The maintenance counters are set to zero.

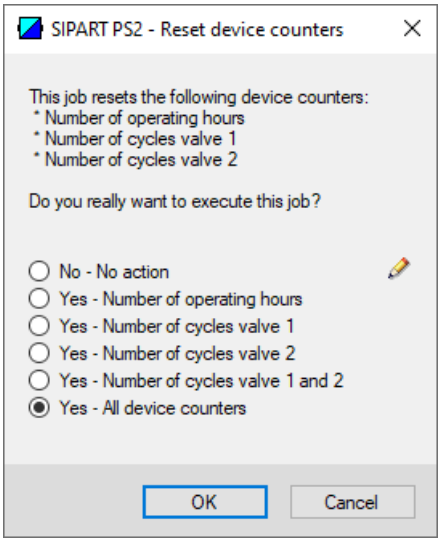


**Reset device counter**

1. Click the "Reset device counters" button.

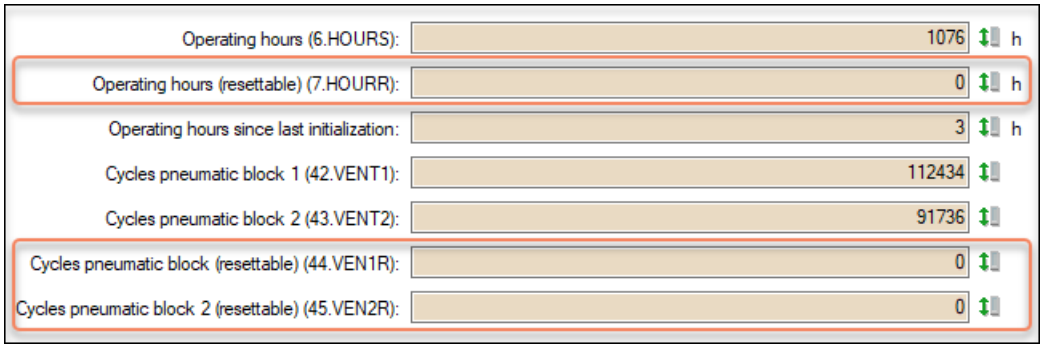



⇒ The "Reset device counters" dialog opens.




2. Select the required option button, e.g. "Yes - All device counters".

3. Click "OK".
   ⇒ The selected, resettable device counters are set to zero.

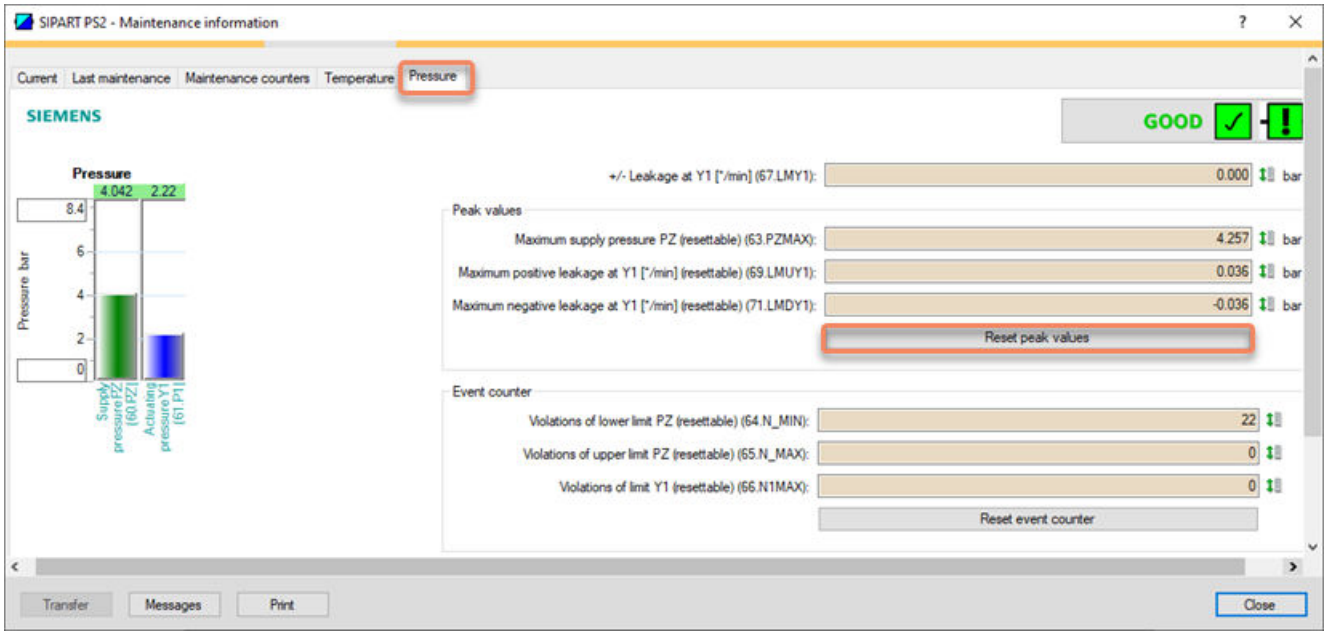



4. Close the "Maintenance information " dialog.

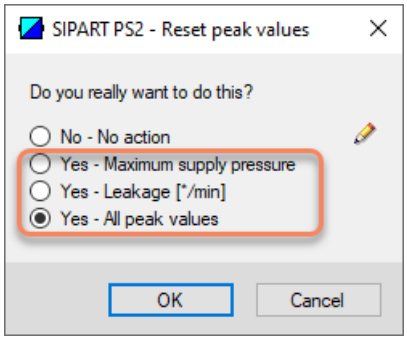
## Reset maximum pressure values and pressure event counter

### Reset maximum pressure values

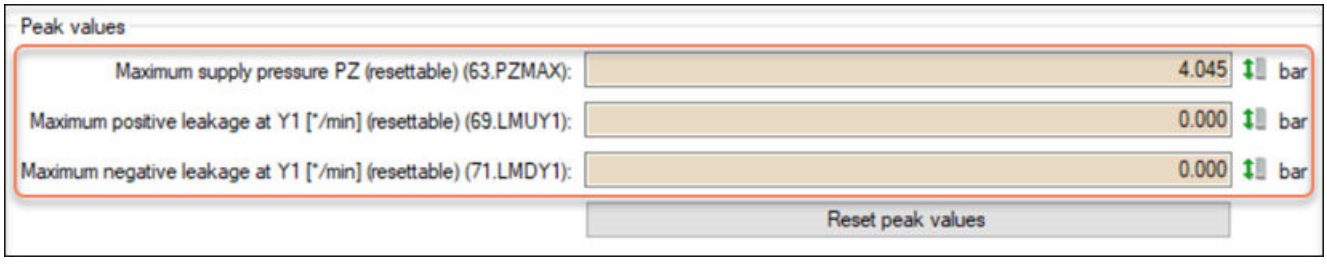
1. In the "Maintenance" dialog, select the command "Maintenance information".
   ⇒ The "Maintenance information" dialog opens.
2. Open the "Pressure" tab.



3. Click the "Reset peak values" button.
   ⇒ The "Reset peak values" dialog opens.

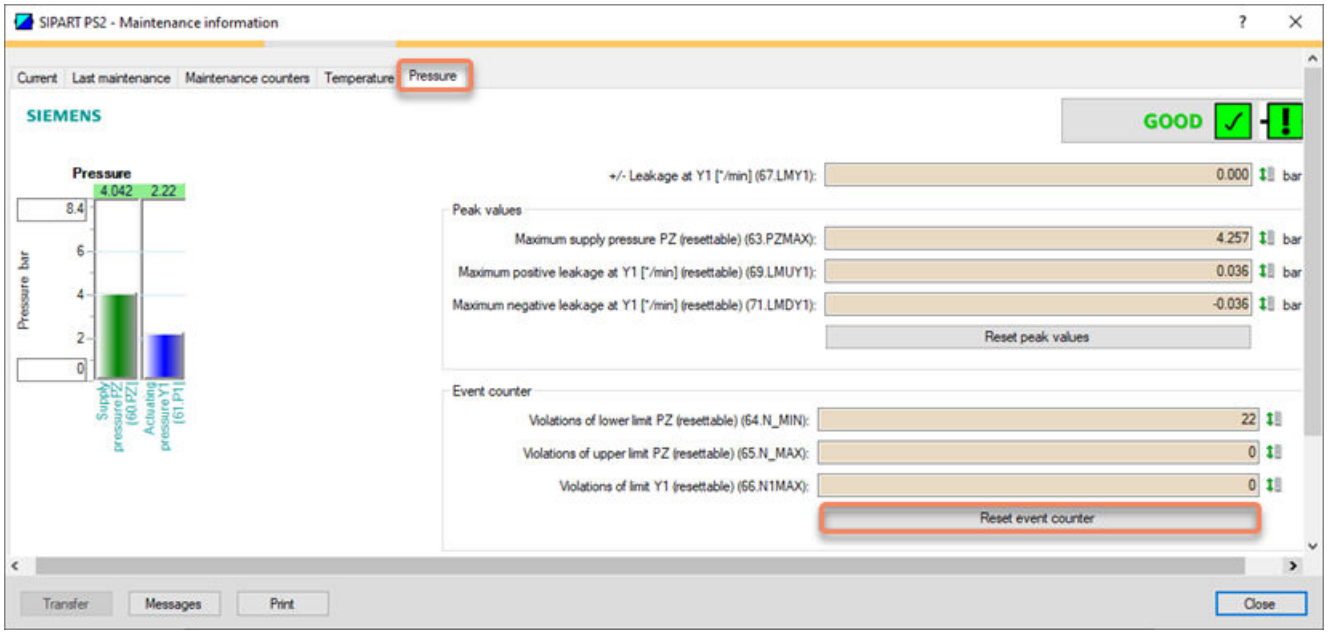



4. Select the required option button, e.g. "Yes - All peak values".
5. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
6. Wait until the status "... successfully reset" is displayed.
7. Click the "Close" button.
   ⇒ The selected maximum pressure values are set to zero.

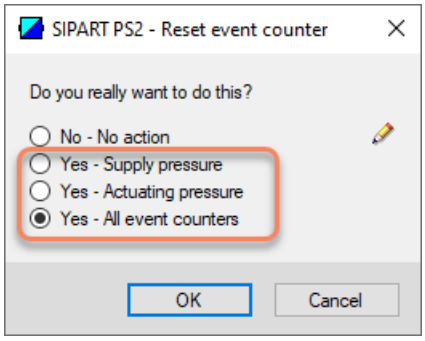


**Reset pressure event counter**

1. Click the "Reset event counter" button.

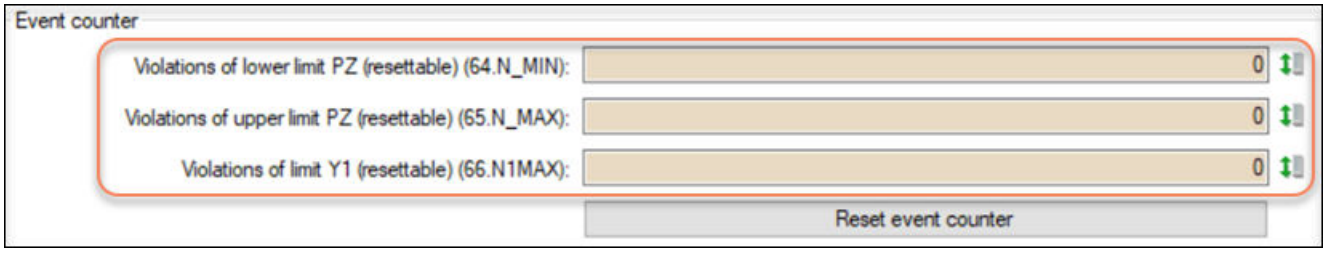



⇒ The "Reset event counter" dialog opens.




2. Select the required option button, e.g. "Yes - All event counters".
3. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
4. Wait until the status "... successfully reset".

5. Click the "Close" button.
   ⇒ The selected event counters are set to zero.




6. Close the dialog.

## 4.5 Save maintenance data

| **Diagnostic value** | **Save maintenance information**<br>**Short designation: 46.STORE** |
|---|---|
| Function | This function saves the relevant diagnostic values as maintenance data. |
| Note | Comparing the stored diagnostic values with the current diagnostic values allows conclusions to be drawn about the mechanical wear of the valve.<br>The values of the following 12 diagnostic values are saved:<br>• Determined actuator travel (8.WAY)<br>• Travel time UP (9.TUP)<br>• Travel time DOWN (10.TDOWN)<br>• Leakage test (11.LEAK)<br>• Endstop 0% position (21.P0)<br>• Endstop 100% position (22.P100)<br>• Pulse length UP (23.IMPUP) - For additional information, see the operating instructions<br>• Pulse length DOWN (24.IMPDN) - For additional information, see the operating instructions<br>• Deadband UP (26.DBUP)<br>• Deadband DOWN (27.DBDN)<br>• Slow speed zone UP (28.SSUP) - For additional information, see operating instructions<br>• Slow speed zone DOWN (29.SSDN) - For additional information, see operating instructions |

### Save current diagnostic values as maintenance data

The 12 diagnostic values mentioned above can be saved using the following 2 options.

### Local operation

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display  simultaneously for at least 2 seconds.
2. Select the diagnostic value "46.STORE". The number of maintenance data stores is displayed, e.g. "0".
3. Press the  button for at least 5 seconds and the display will show "Strt" appears on the display.
   ⇒ After 5 seconds, the number of maintenance data memories is shown on the display, e.g. "1". The current diagnostic values were saved as maintenance data.

The saved maintenance data can be displayed with SIMATIC PDM can be displayed.

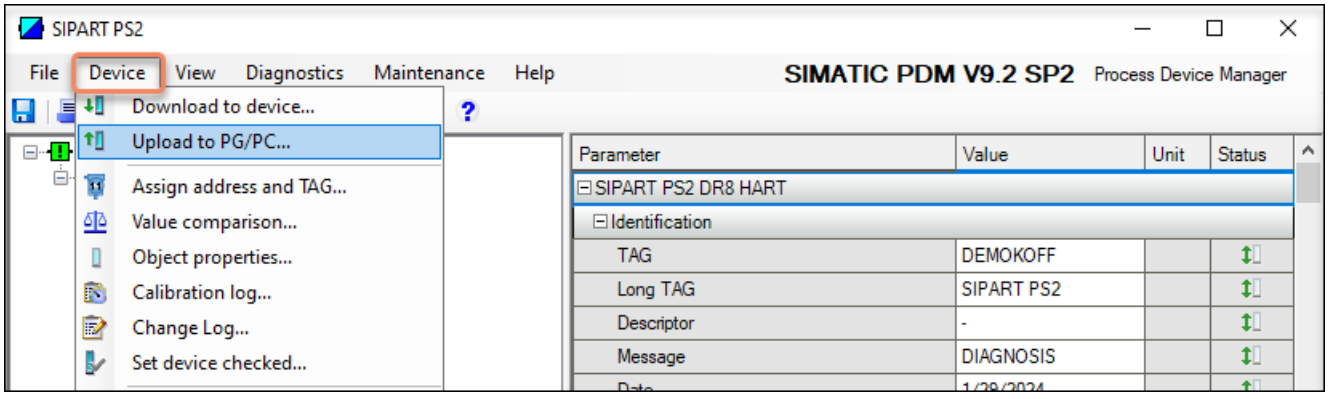
### Remote operation with SIMATIC PDM

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

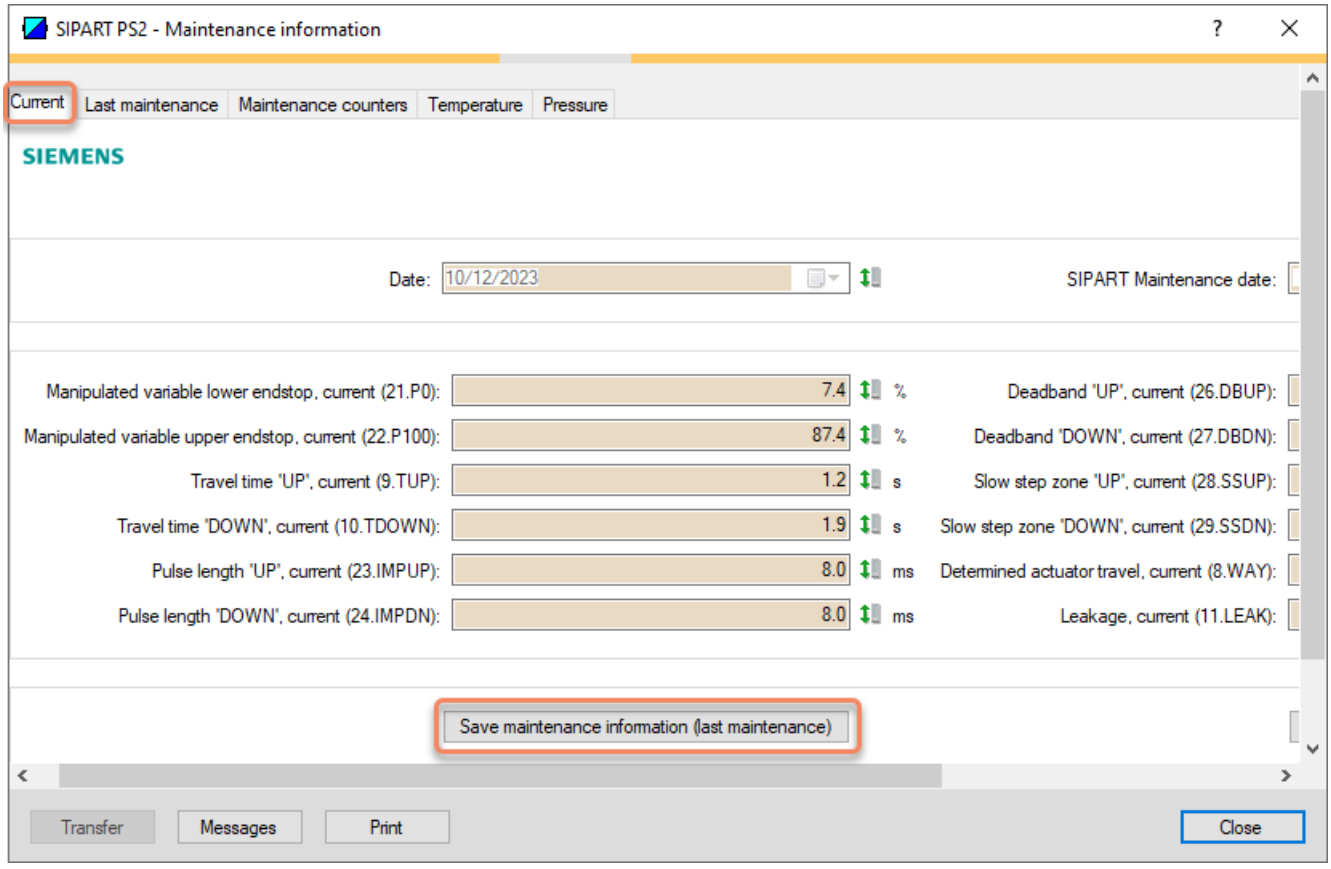
**Procedure**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC....." command.



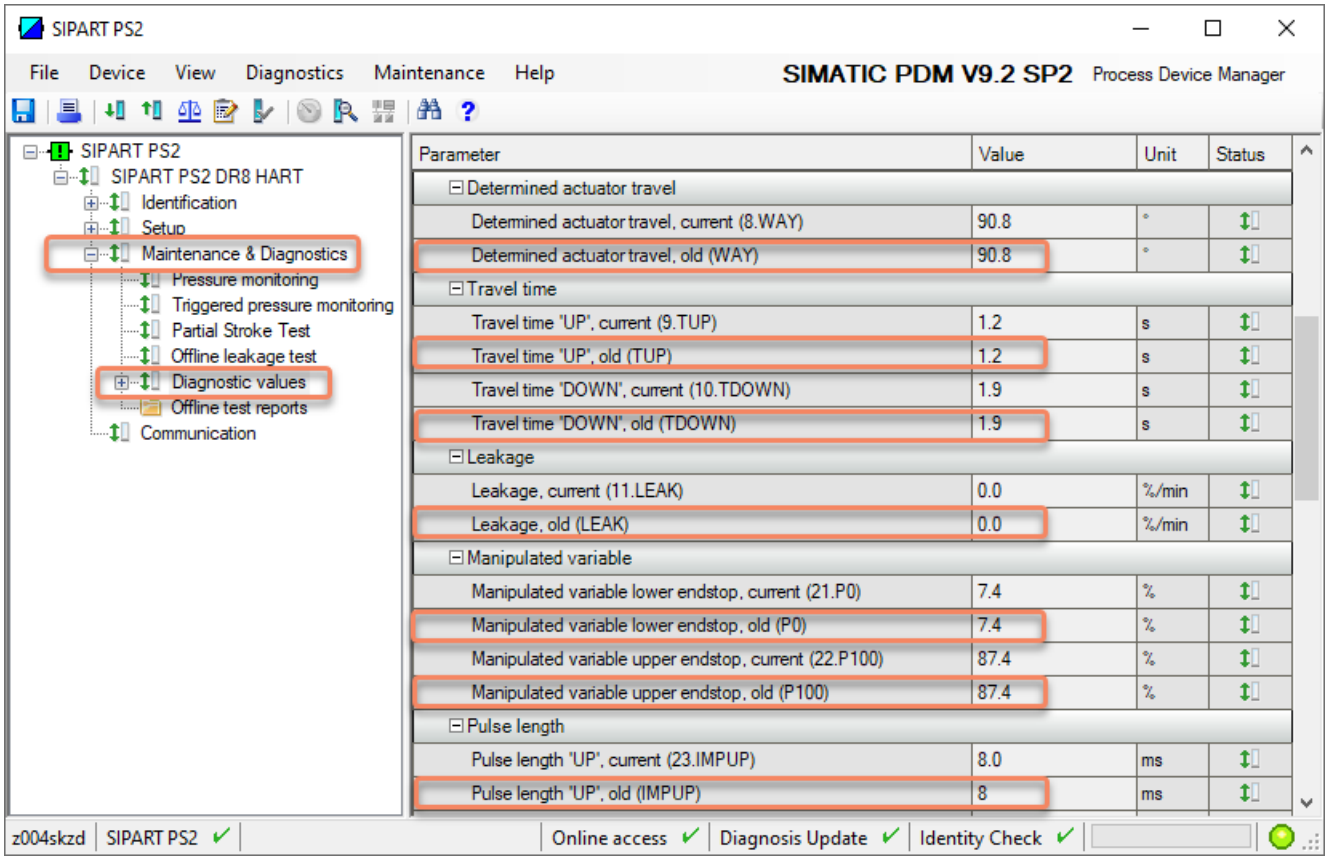

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. In the "Maintenance" dialog, select the command "Maintenance information".

7. In the "Current" tab, press the "Save maintenance information (last maintenance)" button.




⇒ The diagnostic values are saved as maintenance data with the extension "old".

8. To compare the saved maintenance data: In the "Maintenance & Diagnostics" directory >>, select "Diagnostic values".




The current diagnostic value have the extension "current".

## 4.6 Counter

### 4.6.1 Counter overview

| Diagnostic value counter | Short designation | Additional information |
|---|---|---|
| 100% stroke | 1.STRKS | 100%- stroke (1.STRKS) (Page 35) |
| Direction reversal | 2.CHDIR | Change of direction (2.CHDIR) (Page 35) |
| Fault messages | 3.↳CNT | Fault messages (3.\CNT) (Page 36) |
| Alarm 1 | 4.A1CNT | Alarm 1 (4.A1CNT) (Page 36) |
| Alarm 2 | 5.A2CNT | Alarm 2 (5.A2CNT) (Page 37) |
| Operating hours | 6.HOURS | Operating hours (6.HOURS) (Page 38) |
| Operating hours, resettable | 7.HOURR | Operating hours, resettable (7.HOURR) (Page 38) |
| Operating hours in temperature range 1 ... 9 | 33.T1 ... 41.T9 | Operating hours in the temperature range 1 to 9 (33.T1 ... 41.T9) (Page 39) |

| Diagnostic value counter | Short designation | Additional information |
|---|---|---|
| Switching cycles of pneumatic block, valve 1 | 42.VENT1 | Switching cycles pneumatic block (42.VENT1 / 43.VENT2) (Page 43) |
| Switching cycles of pneumatic block, valve 2 | 43.VENT2 | |
| Number of switching cycles of pneumatic block, valve 1, resettable | 44.VEN1R | Switching cycles pneumatic block, resettable (44.VEN1R / 45.VEN2R) (Page 44) |
| Number of switching cycles of pneumatic block, valve 2, resettable | 45.VEN2R | |
| Operating hours in the travel range WT00 ... WT95 | 49.WT00 ... 56.WT95 | Operating hours in the travel range WT00 to WT95 (49.WT00 ... 56.WT95) (Page 45) |
| Violations of lower limit PZ, (resettable) | 64.N_MIN | Violations of lower limit PZ, resettable (64.N_MIN) (Page 49) |
| Violations of upper limit PZ, resettable | 65.N_MAX | Violation of upper limit PZ, resettable (65.N_MAX) (Page 49) |
| Exceeded limit Y1, resettable | 66.N1_MAX | Violation of limit Y1, resettable (66.N1MAX) (Page 50) |

### 4.6.2 100%- stroke (1.STRKS)

| **Diagnostic value** | **100% strokes**<br>**Short designation: 1.STRKS** | |
|---|---|---|
| Function | The counter adds up the movements of the actuator and shows the number of total strokes.<br>A total stroke is defined as the distance between the position 0% to 100% and back from 100% to 0%.<br>Partial strokes are totaled in the counter. The total 200% movement is counted as 1 stroke in the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_lift_int |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 16 ... 19<br>Format: Unsigned-32 |

### 4.6.3 Change of direction (2.CHDIR)

| **Diagnostic value** | **Direction changes**<br>**Short designation: 2.CHDIR** | |
|---|---|---|
| Function | During operation, the counter records and totals every change of direction with a movement greater than 0.25%. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_number_dirchange |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 12 ... 15<br>Format: Unsigned-32 |

### 4.6.4 Fault messages (3.\CNT)

| **Diagnostic value** | **Fault messages**<br>**Short designation: 3.↳CNT** | |
|---|---|---|
| Function | The counter records and totals all error messages that occur in the positioner. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_errors |
| | DisplayValue | ≙ Value |
| HART-communicationread | Command | #169 |
| | Response Data | Bytes: 50 ... 51<br>Format: Unsigned-16 |

### 4.6.5 Alarm 1 (4.A1CNT)

| **Diagnostic value** | **Alarm 1**<br>**Short designation: 4.A1CNT** | |
|---|---|---|
| Function | The counter records and totals all Alarm 1 error messages that have occurred in the positioner. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The application parameter "44.AFCT - Alarmfunktion" is activated. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_a1cnt |
| | DisplayValue | ≙ Value |
| HART-communicationread | Command | #169 |
| | Response Data | Bytes: 52 ... 55<br>Format: Unsigned-32 |

### 4.6.6 Alarm 2 (5.A2CNT)

| **Diagnostic value** | **Alarm 2**<br>**Short designation: 5.A2CNT** | |
|---|---|---|
| Function | The counter records and totals all Alarm 2 error messages that have occurred in the positioner. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The application parameter "44.AFCT - Alarmfunktion" is activated. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_a2cnt |
| | DisplayValue | ≙ Value |
| HART-communicationread | Command | #169 |
| | Response Data | Bytes: ... 59<br>Format: Unsigned-32 |

### 4.6.7 Operating hours (6.HOURS)

| **Diagnostic value** | **Operating hours**<br>**Short designation: 6.HOURS** | |
|---|---|---|
| Function | If the positioner is supplied with electrical auxiliary energy, the counter adds up the operating hours. | |
| Note | The diagnostic value cannot be reset. | |
| Display range | 0 ... 4.29E9 | |
| Unit | h (hours) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_hours |
| | DisplayValue | ≙ Value |
| HART-communicationread | Command | #169 |
| | Response Data | Bytes: 32 ... 36<br>Format: Unsigned-32 |

### 4.6.8 Operating hours, resettable (7.HOURR)

| **Diagnostic value** | **Operating hours, resettable**<br>**Short designation: 7.HOURR** | |
|---|---|---|
| Function | If the positioner is supplied with electrical auxiliary energy, the counter adds up the operating hours since the last reset of the 7.HOURR diagnostic value. | |
| Note | The diagnostic value can be reset.<br>Example application: Start a new counter after replacing the pneumatic block. | |
| Display range | 0 ... 4.29E9 | |
| Unit | h (hours) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_hours_resettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #193 |
| | Response Data | Bytes: 0 ... 3<br>Format: Unsigned-32 |

## 4.6.9 Operating hours in the temperature range 1 to 9 (33.T1 ... 41.T9)

| **Diagnostic values** | **Operating hours in temperature range 1 ... 9**<br>**Short designation: 33.T1 ... 41.T9** | | | | |
|---|---|---|---|---|---|
| Function | The diagnostic values show how long the positioner has been operated in specific temperature ranges. | | | | |
| Note | During operation, the measured temperature is averaged over one hour and assigned to the diagnostic value of the corresponding temperature range. This allows conclusions to be drawn about the operating conditions of the positioner and the valve. | | | | |
| Display range | 0 ... 4.29E9 | | | | |
| Unit | h (hours) | | | | |
| **Communication** | | | | | |
| SIMATIC PDM Export | Diagnostic values | Name | Label | DisplayValue | Unit |
| | 33.T1 | ps2_histogr_temp_0 | • -40 °C ... -30 °C<br>• -49 °F ... -22 °F | ≙ Value | h |
| | ... | ... | ... | ... | |
| | 41.T9 | ps2_histogr_temp_8 | • 75 °C ... 90 °C<br>• 167 °F ... 194 °F | ≙ Value | |
| | | | | | |
| | Temperature unit | Name | Label | DisplayValue | |
| | | ps2_histogr_temp_unit | Unit | • °C<br>• °F | |
| HART communication (read) | Command | #176 | | | |
| | Response Data | Bytes: 1 ... 27<br>Format: Unsigned-24 | Histogram Value 1 ... 9 (3 bytes each) in units of hours | | |
| | | Byte: 0<br>Format: Enum | Histogram Value Unit Code<br>• 32: °C<br>• 33: °F | | |

The diagnostic values 33.T1 to 41.T9 are assigned to the following temperature ranges:

| **Diagnostic value "Operating hours in temperature range Tx"** | | **Assigned temperature range** | |
|---|---|---|---|
| | | **[°C]** | **[°F]** |
| 33.T1 | Temperature range 1 | < -30 | < -22 |
| 34.T2 | Temperature range 2 | -30 ... -15.1 | -2 ... 5 |
| 35.T3 | Temperature range 3 | -15 ... -0.1 | 5 ... 32 |
| 36.T4 | Temperature range 4 | 0 ... 14.9 | 32 ... 59 |
| 37.T5 | Temperature range 5 | 15 ... 29.9 | 59 ... 86 |
| 38.T6 | Temperature range 6 | 30 ... 44.9 | 86 ... 113 |
| 39.T7 | Temperature range 7 | 45 ... 59.9 | 113 ... 140 |
| 40.T8 | Temperature range 8 | 60 ... 75 | 140 ... 167 |
| 41.T9 | Temperature range 9 | > 75 | > 167 |

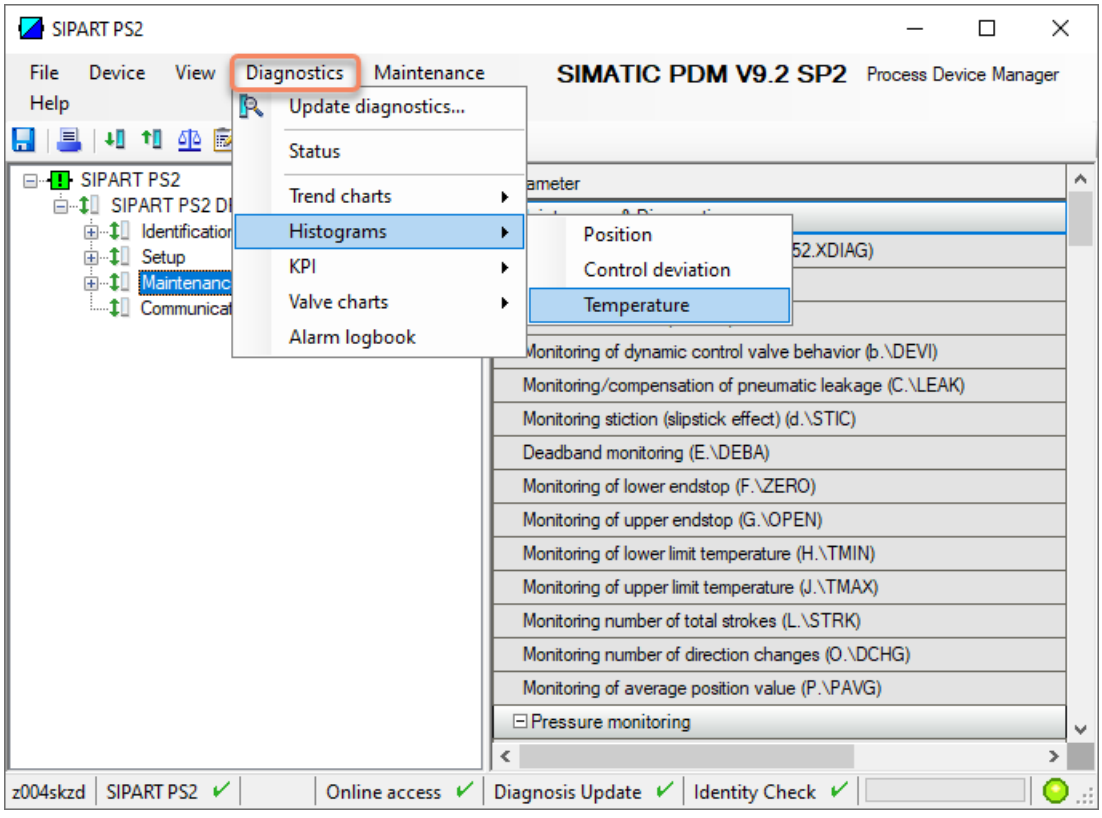
### Remote operation with SIMATIC PDM: Show histogram

**Requirement**

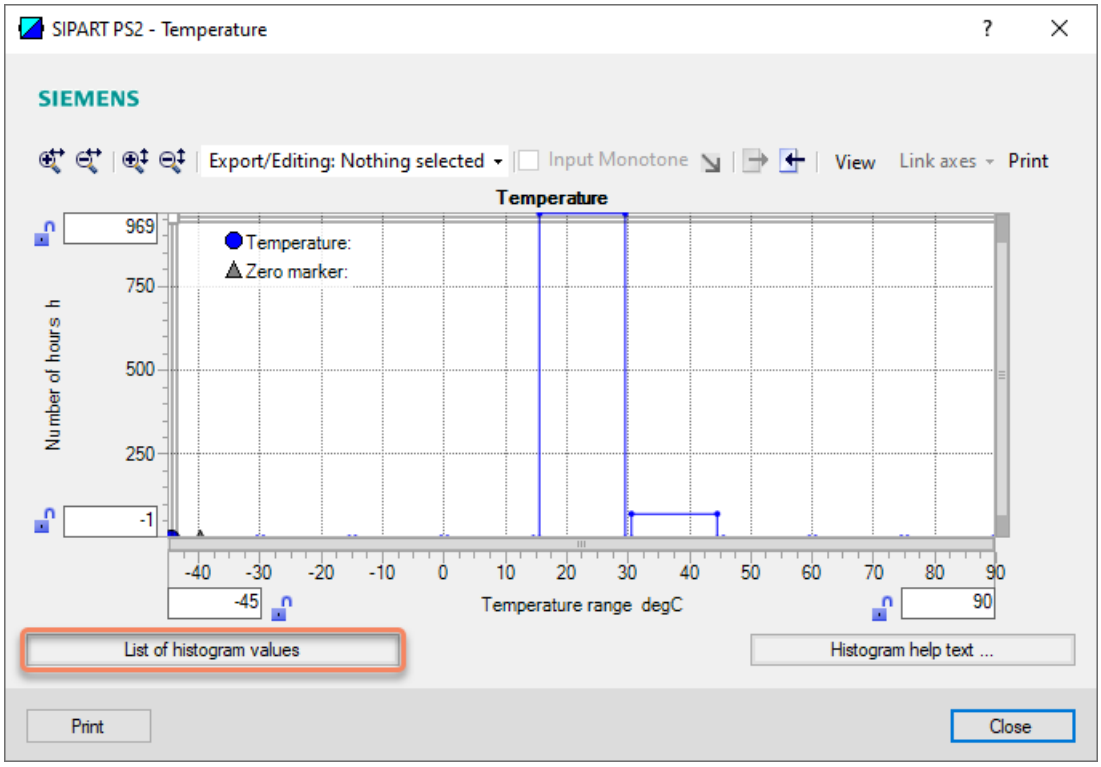
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

**Procedure**

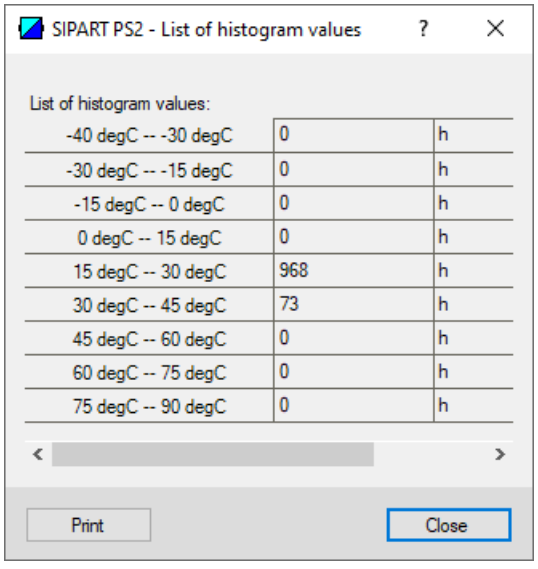
1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Diagnostics" menu, select the "Histograms > Temperature".




⇒ The current data is loaded from the positioner. "Load in PG/PC..." is not required.
⇒ The "Temperature" dialog shows the operating hours in the temperature range, divided into 9 temperature ranges.




3. To display the number of operating hours in the temperature range numerically:
   Click the "List of histogram values" button.




4. Close the dialog.

### 4.6.10 Switching cycles pneumatic block (42.VENT1 / 43.VENT2)

| **Diagnostic values** | **Cycles pneumatic block 1**<br>**Short designation: 42.VENT1** | |
|---|---|---|
| | **Cycles pneumatic block 2**<br>**Short designation: 43.VENT2** | |
| Function | The counters add up the number of actuation processes and show the switching frequency of the pneumatic block.<br>The pneumatic block of the positioner pressurizes and depressurizes the actuator.<br>• Single-acting actuators:<br>– The diagnostic value "42.VENT1" sums the pressurizing processes.<br>– The diagnostic value "43.VENT2" sums the depressurizing processes.<br>• Double-acting actuators:<br>– The diagnostic value "42.VENT1" sums the pressurizing (Y2) with depressurizing (Y1).<br>– The diagnostic value "43.VENT2" sums the pressurizing (Y1) with depressurizing (Y2). | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| **Cycles pneumatic block 1 (42.VENT1)** | | |
| SIMATIC PDM Export | Name | ps2_pill1 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 20 ... 23<br>Format: Unsigned-32 |
| **Cycles pneumatic block 2 (43.VENT2)** | | |
| SIMATIC PDM Export | Name | ps2_pill2 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 24 ... 27<br>Format: Unsigned-32 |

## 4.6.11 Switching cycles pneumatic block, resettable (44.VEN1R / 45.VEN2R)

| | | |
|---|---|---|
| **Diagnostic values** | **Cycles pneumatic block 1, resettable**<br>**Short designation: 44.VEN1R** | |
| | **Cycles pneumatic block 2, resettable**<br>**Short designation: 45.VEN2R** | |
| Function | The counters total the number of actuation processes and show the switching frequency of the pneumatic block since the last reset of the diagnostic values 44.VEN1R and 45.VEN2R.<br>The pneumatic block of the positioner pressurizes and depressurizes the actuator.<br>• Single-acting actuators:<br>– The diagnostic value "44.VEN1R" sums the pressurizing processes.<br>– The diagnostic value "45.VEN2R" sums the depressurizing processes.<br>• Double-acting actuators:<br>– The diagnostic value "44.VEN1R" sums the pressurizing (Y2) with depressurizing (Y1).<br>– The diagnostic value "45.VEN2R" sums the pressurizing (Y1) with depressurizing (Y2). | |
| Note | The diagnostic values can be reset.<br>Example application: Start a new counter after replacing the pneumatic block. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| **Cycles pneumatic block 1, resettable (44.VEN1R)** | | |
| SIMATIC PDM Export | Name | var_pill1_resettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #193 |
| | Response Data | Bytes: 4 ... 7<br>Format: Unsigned-32 |
| **Cycles pneumatic block 2, resettable (45.VEN2R)** | | |
| SIMATIC PDM Export | Name | var_pill2_resettable |
| | DisplayValue | ≙ Value |
| HART-communicationread | Command | #193 |
| | Response Data | Bytes: 8 ... 11<br>Format: Unsigned-32 |

## 4.6.12 Operating hours in the travel range WT00 to WT95 (49.WT00 ... 56.WT95)

| **Diagnostic values** | **Operating hours in position WT00 ... WT95**<br>**Short designation: 49.WT00 ... 56.WT95** | | | | |
|---|---|---|---|---|---|
| Function | The diagnostic values show how long a process valve was operated in which travel range by the positioner in "Automatic" mode.<br>The positioner continuously registers the current position and updates the operating hours counter for the corresponding travel range every hour. This allows conclusions to be drawn about the operating conditions and an assessment of the control characteristics of the control circuit and the entire valve. | | | | |
| Note | The total travel range from 0 to 100% is divided into 8 or 20 travel ranges.<br>• With local operation and indication on the display: The diagnostic values "49.WT00" to "56.WT95" show the operating hours in the assigned 8 travel ranges.<br>• With Device Manager Software, e.g. SIMATIC PDM: The operating hours are displayed in 20 travel ranges. | | | | |
| Display range | 0 ... 4.29E9 | | | | |
| Unit | h (hours) | | | | |
| **Communication** | | | | | |
| SIMATIC PDM Export | Control range in % | Name | Label | DisplayValue | Unit |
| | 0 ... 5 | ps2_histogr_readback_0 | 0 ... 5 % | ≙ Value | h |
| | ... | ... | ... | ... | |
| | 95 ... 100 | ps2_histogr_readback_19 | 95 ... 100 % | ≙ Value | |
| HART communication (read) | Command | #174 | | | |
| | Response Data | Bytes: 0 ... 59<br>Format: Unsigned-24 | Histogram Value 1 ... 20 (3 bytes each) in units of hours | | |

### With local operation

The display shows the diagnostic values "49.WT00" to "56.WT95" show the operating hours in the assigned 8 travel ranges.

| **Diagnostic value "Operating hours in the travel range WTxx"** | | **Assigned travel range [%]** |
|---|---|---|
| 49.WT00 | Travel range WT00 | < 5 |
| 50.WT05 | Travel range WT05 | 5 ... 9.9 |
| 51.WT10 | Travel range WT10 | 10 ... 29.9 |
| 52.WT30 | Travel range WT30 | 30 ... 49.9 |
| 53.WT50 | Travel range WT50 | 50 ... 69.9 |
| 54.WT70 | Travel range WT70 | 70 ... 89.9 |
| 55.WT90 | Travel range WT90 | 90 ... 94.9 |
| 56.WT95 | Travel range WT95 | ≥ 95 |

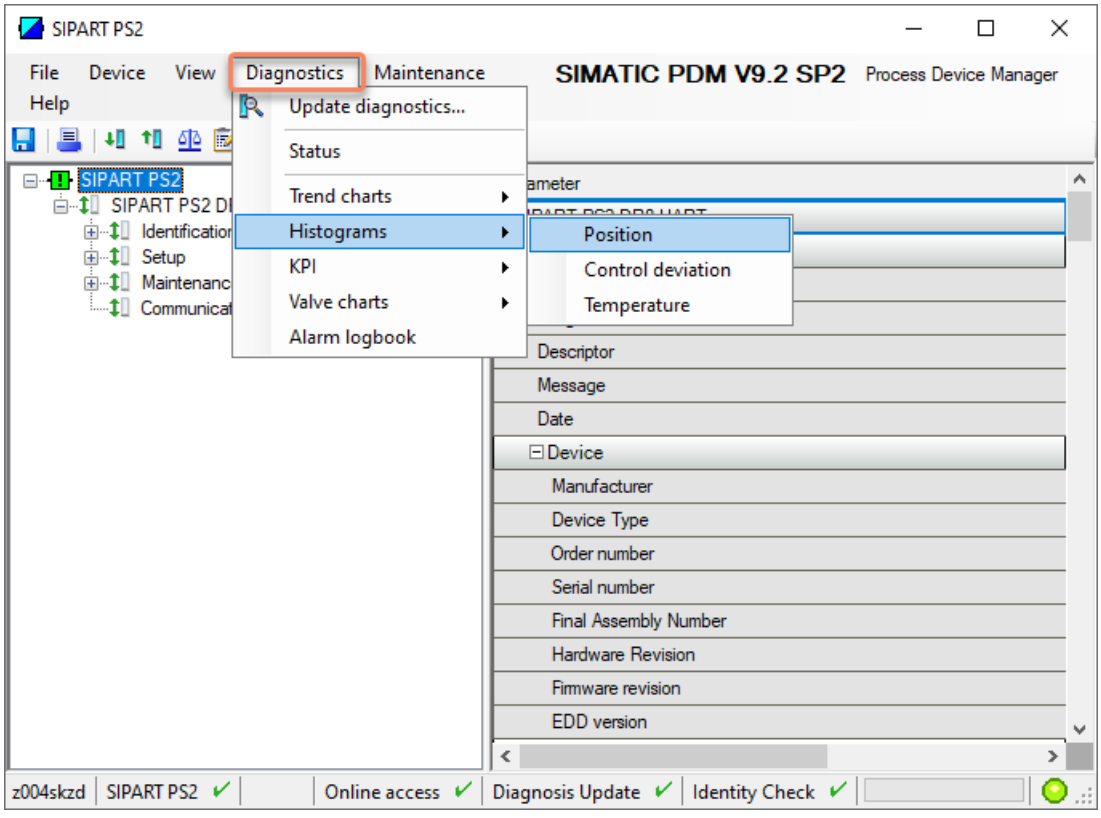
### With SIMATIC PDM: Display histogram and set "Operating hours in the travel range" to zero

**Requirement**

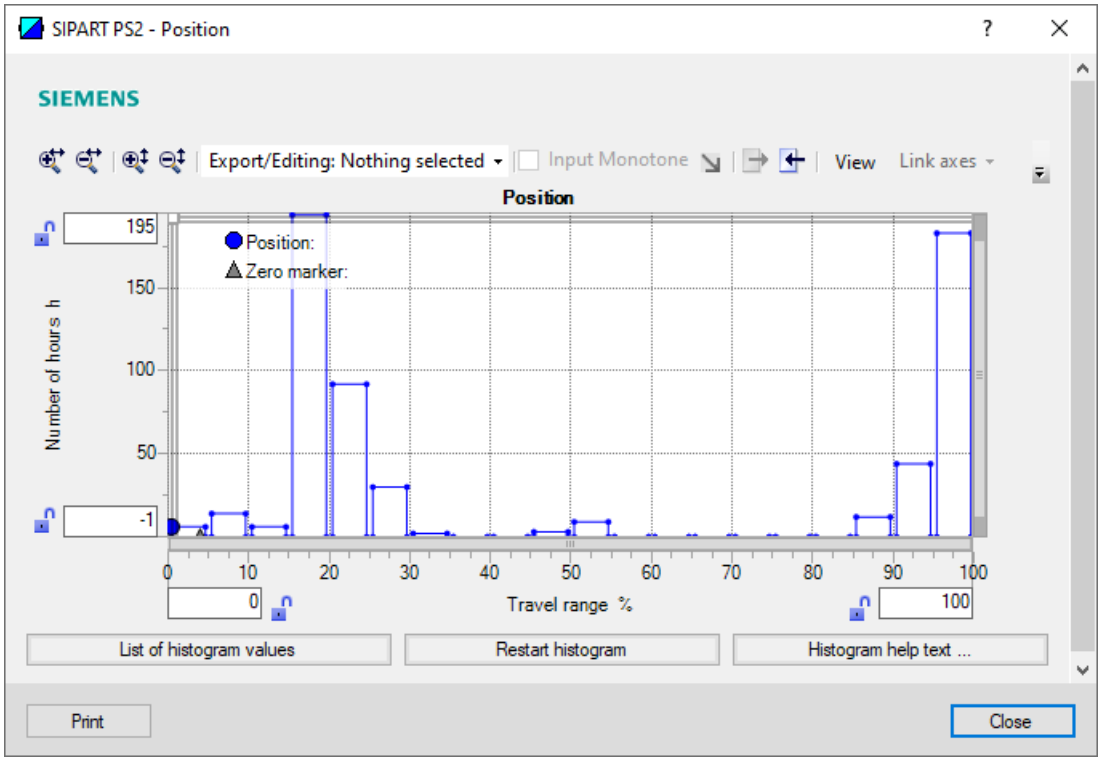
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

**Procedure**

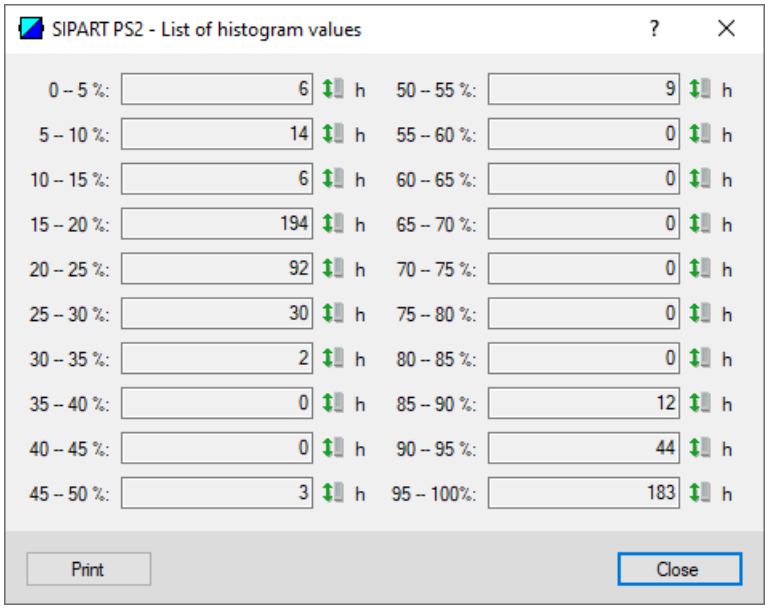
1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Diagnostics" menu, select the "Histograms > Position".




⇒ The current data is loaded from the positioner. "Load in PG/PC..." is not required.
⇒ The "Position" dialog shows the operating hours in the travel range divided into 20 travel ranges.




3. To display the number of operating hours in the travel range numerically:
   Click the "List of histogram values" button.




4. If necessary, set the operating hours counter to zero:
   In the "Position" dialog, click the "Restart histogram" button.
   ⇒ The operating hours counters for the control ranges in the positioner and in SIMATIC PDM are set to zero.

5. Close the dialog.

### 4.6.13 Violations of lower limit PZ, resettable (64.N_MIN)

| **Diagnostic value** | **Violations of lower limit PZ, resettable**<br>**Short designation: 64.N_MIN** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U5.PZMLL of the "Pressure monitoring" process diagnostics (U.\PRES) parameter, the event counter of the diagnostic value "64.N_MIN" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "65.N_MAX" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitUnderrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 18 ... 19<br>Format: Unsigned-16 |

### 4.6.14 Violation of upper limit PZ, resettable (65.N_MAX)

| **Diagnostic value** | **Violations of upper limit PZ, resettable**<br>**Short designation: 65.N_MAX** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U6.PZMUL parameter of the "Pressure monitoring" process diagnostics (U.\PRES), the event counter of the diagnostic value "65.N_MAX" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "64.N_MIN" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitOverrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 20 ... 21<br>Format: Unsigned-16 |

### 4.6.15 Violation of limit Y1, resettable (66.N1MAX)

| **Diagnostic value** | **Violations of limit Y1, resettable**<br>**Short designation: 66.N1MAX** | |
|---|---|---|
| Function | If the actuating pressure Y1 exceeds the limit in the "U7.PCL" parameter of the "Pressure monitoring" (U.\PRES) process diagnostics, the event counter of the diagnostic value "66.N1MAX" is incremented. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has firmware version 5.03 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_P1_NoLimitReachedResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 22 ... 23<br>Format: Unsigned-16 |

## 4.7 Maintenance information

### 4.7.1 Overview of maintenance information

| **Diagnostic value maintenance information** | **Short designation** | **Additional information** |
|---|---|---|
| Determined actuator travel | 8.WAY | Determined actuator travel (8.WAY) (Page 51) |
| Travel time UP (direction 100% position) | 9.TUP | Travel time UP (9.TUP) (Page 52) |
| Travel time DOWN (direction 0% position) | 10.TDOWN | Travel time DOWN (10.TDOWN) (Page 52) |
| Leakage test | 11.LEAK | Leakage test (11.LEAK) (Page 53) |
| Deadband UP (direction 100% position) | 26.DBUP | Deadband UP (26.DBUP) / Deadband DOWN (27.DBDN) (Page 54) |
| Deadband DOWN (direction 0% position) | 27.DBDN | |
| Current temperature | 30.TEMP | Current temperature (30.TEMP) (Page 55) |
| Minimum temperature (min/max pointer) | 31.TMIN | Minimum temperature (31.TMIN) / Maximum temperature (32.TMAX) (Page 56) |
| Maximum temperature (min/max pointer) | 32.TMAX | |
| Setpoint current | 59.mA | Setpoint current (59.mA) (Page 57) |
| Supply pressure PZ | 60.PZ | Supply pressure PZ (60.PZ) (Page 58) |
| Actuating pressure Y1 | 61.P1 | Actuating pressure Y1 (61.P1) (Page 60) |
| Actuating pressure Y2 | 62.P2 | Actuating pressure Y2 (62.P2) (Page 62) |
| Maximum supply pressure PZ, resettable | 63.PZMAX | Maximum supply pressure PZ, resettable (63.PZMAX) (Page 64) |

## 4.7.2 Determined actuator travel (8.WAY)

| **Diagnostic value** | **Determined actuator travel**<br>**Short designation: 8.WAY** | |
|---|---|---|
| Function | The diagnostic value shows one of the following two values:<br>• For rotary actuators, the angle of rotation of the positioner axis that was determined during initialization.<br>• For linear actuator, the stroke in mm.<br>Requirements:<br>– Use of the SIEMENS Standard mounting kit "35 mm lever arm" or "130 mm lever arm".<br>– The setting in the "3.YWAY" application parameter corresponds to the mounting position of the actuator pin on the lever arm. | |
| Display range | 0 ... 130 | |
| Factory setting | 0 | |
| Unit | • Angle in °<br>• Stroke in mm | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_span_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #128 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |

### 4.7.3 Travel time UP (9.TUP)

| **Diagnostic value** | **Travel time UP**<br>**Short designation: 9.TUP** | |
|---|---|---|
| Function | The diagnostic value shows the travel time of the actuator in the direction of 100% position determined during initialization. | |
| Note | During initialization, the time between 17% and 83% travel is measured.<br>The result extrapolated for 0% to 100% travel is accepted as the diagnostic value "Travel time OPEN". | |
| Display range | 0 ... 1 000 | |
| Unit | s (seconds) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_tup_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #128 |
| | Response Data | Bytes: 4 ... 7<br>Format: Float |

### 4.7.4 Travel time DOWN (10.TDOWN)

| **Diagnostic value** | **Travel time DOWN**<br>**Short designation: 10.TDOWN** | |
|---|---|---|
| Function | The diagnostic value shows the travel time of the actuator in the direction of the 0% position determined during initialization. | |
| Note | During initialization, the time between 83% and 17% travel is measured.<br>The result extrapolated for 100% to 0% travel is accepted as the diagnostic value "Travel time DOWN". | |
| Display range | 0 ... 1 000 | |
| Unit | s (seconds) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_tdown_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #128 |
| | Response Data | Bytes: 8 ... 11<br>Format: Float |

### 4.7.5 Leakage test (11.LEAK)

| **Diagnosewert** | **Leakage test**<br>**Short designation: 11.LEAK** | | |
|---|---|---|---|
| Function | The diagnostic value shows the result of the last leakage test or starts the leakage test.<br>The leakage test detects pneumatic leaks in the actuator or in the piping. | | |
| Note | This diagnostic value can be used to start the leakage test as a maintenance diagnostic<br>→ Manual leakage test (Page 508). | | |
| Display options | - | The display has one of the following causes:<br>• No leakage test has been performed to date.<br>• The positioner is not initialized.<br>• The factory setting was restored with the application parameter "50.PRST" was. | |
| | 0.0 ... 100.0 | An existing test result means one of the following possibilities:<br>• The leakage test was performed manually.<br>• The leakage test was performed during initialization. | |
| Unit | %/minute<br>Note: The value shows the change in actuator position in % during the duration of the 1-minute leakage test. | | |
| **Communication** | | | |
| SIMATIC PDM Export | Name | ps2_leakage_act | |
| | DisplayValue | ≙ Value | |
| HART communication (read) | Command | #169 | |
| | Response Data | Byte: 32<br>Format: Enum | Leak Test state |
| | | Bytes: 29 ... 31<br>Format: Float | Leak Test value |

## 4.7.6 Deadband UP (26.DBUP) / Deadband DOWN (27.DBDN)

| **Diagnostic value** | **Deadband UP**<br>**Short designation: 26.DBUP** | |
|---|---|---|
| | **Deadband DOWN**<br>**Short designation: 27.DBDN** | |
| Function | The diagnostic values show the deadband of the positioner as a percentage:<br>• "Deadband UP " (26.DBUP) in direction 100% position<br>• "Deadband DOWN" (27.DBDN) in direction 0% position | |
| Note | The values either correspond to the manually set value of the application parameter "34.DEBA" or, if "34.DEBA" is set to "Auto", the value automatically adapted by the positioner. | |
| Display range | 0.1 ... 10.0 | |
| Unit | % | |
| **Communication** | | |
| **Deadband UP (26.DBUP)** | | |
| SIMATIC PDM Export | Name | ps2_dead_up_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 0 ... 3<br>Format: Float |
| **Deadband DOWN (27.DBDN)** | | |
| SIMATIC PDM Export | Name | ps2_dead_down_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 4 ... 7<br>Format: Float |

### 4.7.7 Current temperature (30.TEMP)

| **Diagnostic value** | **Current temperature**<br>**Short designation: 30.TEMP** | |
|---|---|---|
| Function | The diagnostic value shows the current temperature in the positioner enclosure. | |
| Note | • The temperature sensor is located in the enclosure on the electronics board.<br>• In order to switch over the temperature display between °C and °F: Press the ⚠ button on the display. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Current temperature (30.TEMP)** | | |
| SIMATIC PDM Export | Name | ps2_temp |
| | DisplayValue | ≙ Value |
| | Unit | ≙ Unit |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

## 4.7.8 Minimum temperature (31.TMIN) / Maximum temperature (32.TMAX)

| **Diagnostic value** | **Minimum temperature**<br>**Short designation: 31.TMIN** | |
|---|---|---|
| | **Maximum temperature**<br>**Short designation: 32.TMAX** | |
| Function | The minimum temperature and the maximum temperature inside the enclosure are continuously determined and stored in the manner of a drag indicator. | |
| Note | • To change the temperature display between °C and °F to switch: Press the ⚠ button on the display.<br>• The determined values can only be reset in the factory. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Minimum temperature (31.TMIN)** | | |
| SIMATIC PDM Export | Name | ps2_tmin |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 42 ... 45<br>Format: Float |
| **Maximum temperature (32.TMAX)** | | |
| SIMATIC PDM Export | Name | ps2_tmax |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 46 ... 49<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

### 4.7.9 Setpoint current (59.mA)

| **Diagnostic value** | **Setpoint current**<br>**Short designation: 59.mA** |
|---|---|
| Function | The diagnostic value shows the current setpoint current measured at the analog input in mA. |
| Display range | 0.0 ... 22.0 |
| Unit | mA |
| **Communication** | |
| The value is only shown on the display and cannot be exported. | |

## 4.7.10 Supply pressure PZ (60.PZ)

| **Diagnostic value** | **Supply pressure PZ**<br>**Short designation: 60.PZ** | |
|---|---|---|
| Function | The diagnostic value shows the current supply pressure PZ. | |
| Note | The differential pressure between the ambient pressure and the input PZ is measured.<br>If there is no supply pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P01 or P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Supply pressure PZ (60.PZ)** | | |
| SIMATIC PDM Export | Name | var_PZ_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 2 ... 5<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "60.PZ".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" the calibration was not successful due to excessive pressure deviation.

## 4.7.11 Actuating pressure Y1 (61.P1)

| **Diagnostic value** | **Actuating pressure Y1**<br>**Short designation: 61.P1** | |
|---|---|---|
| Function | Shows the current actuating pressure Y1. | |
| Note | The differential pressure between the ambient pressure and the output Y1 is measured.<br>If there is no actuating pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Actuating pressure Y1 (61.P1)** | | |
| SIMATIC PDM Export | Name | var_P1_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 6 ... 9<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "61.P1".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" was displayed, the calibration was not successful due to excessive pressure deviation.

## 4.7.12 Actuating pressure Y2 (62.P2)

| **Diagnostic value** | **Actuating pressure Y2**<br>**Short designation: 62.P2** | |
|---|---|---|
| Function | The diagnostic value shows the current actuating pressure Y2 value. | |
| Note | The differential pressure between the ambient pressure and the output Y2 is measured.<br>If there is no actuating pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Actuating pressure Y2 (62.P2)** | | |
| SIMATIC PDM Export | Name | var_P2_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 10 ... 13<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0,500 ... 0,500 bar
  - -0,050 ... 0,050 MPa
  - -72,51 ... 72,51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "62.P2".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" was displayed, the calibration was not successful due to excessive pressure deviation.

### 4.7.13 Maximum supply pressure PZ, resettable (63.PZMAX)

| **Diagnostic value** | **Maximum supply pressure PZ, resettable**<br>**Short designation: 63.PZMAX** | |
|---|---|---|
| Function | The supply pressure PZ is continuously monitored.<br>The highest measured value is displayed as the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Condition | The positioner has pressure sensors (-Z P01 or P02 option). | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum supply pressure PZ, resettable (63.PZMAX)** | | |
| SIMATIC PDM Export | Name | var_PZ_MaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 14 ... 17<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8 Values for process diagnostics

### 4.8.1 Overview of values for process diagnostics

These diagnostic values show the status and the current measured values of the process diagnostics.

Additional information on the process diagnostics → Process diagnostics (Page 93).

| Process diagnostics for monitoring | Diagnostic value | Short designation | Additional information |
|---|---|---|---|
| Partial Stroke Test<br>for SIPART PS2<br>• without pressure sensors<br>• with Z P01 option | PST status / Measured time | 12.PST | PST status / Measured time (12.PST) (Page 68) |
| | Time since last Partial Stroke Test | 13.PRPST | Time since last partial stroke test (13.PRPST) (Page 70) |
| | Time until next Partial Stroke Test | 14.NXPST | Time until next Partial Stroke Test (14.NXPST) (Page 70) |
| Partial Stroke Test (pressure sensor-supported)<br>for SIPART PS2 with option -Z P02 | PST status | 12.PST | PST status (12.PST) (Page 69) |
| | Time since last Partial Stroke Test | 13.PRPST | Time since last partial stroke test (13.PRPST) (Page 70) |
| | Time until next Partial Stroke Test | 14.NXPST | Time until next Partial Stroke Test (14.NXPST) (Page 70) |
| Dynamic response | Dynamic control valve behavior | 15.DEVI | Dynamic control valve behavior (15.DEVI) (Page 71) |
| Leakage and compensation (without pressure sensors) | Pneumatic leakage | 16.ONLK | Pneumatic leakage (16.ONLK) (Page 71) |
| | Length of the leakage compensation pulses | 57.LCPUL | Length of the leakage compensation pulses (57.LCPUL) (Page 78) |
| | Period of the leakage compensation pulses | 58.LCPER | Length of the leakage compensation pulses (58.LCPER) (Page 78) |
| Leakage (pressure sensor-supported)<br>for SIPART PS2with option -Z P02) | +/- Leakage at Y1 | 67.LMY1 | +/- leakage at Y1 (67.LMY1) (Page 86) |
| | +/- Leakage at Y2 | 68.LMY2 | +/- leakage at Y2 (68.LMY2) (Page 87) |
| | Maximum positive leakage at Y1 | 69.LMUY1 | Maximum positive leakage at Y1 (69.LMUY1) (Page 88) |
| | Maximum positive leakage at Y2 | 70.LMUY2 | Maximum positive leakage at Y2 (70.LMUY2) (Page 89) |
| | Maximum negative leakage at Y1 | 71.LMDY1 | Maximum negative leakage at Y1 (71.LMDY1) (Page 90) |
| | Maximum negative leakage at Y2 | 72.LMDY2 | Maximum negative leakage at Y2 (72.LMDY2) (Page 91) |
| Stiction | Stiction (slipstick effect) | 17.STIC | Stiction (slipstick effect) (17.STIC) (Page 72) |
| Deadband | Deadband UP | 26.DBUP | Deadband UP (26.DBUP) / Deadband DOWN (27.DBDN) (Page 75) |
| | Deadband DOWN | 27.DBDN | |
| 0% endstop | Lower endstop (0% position) | 18.ZERO | Endstop 0% position (18.ZERO) (Page 72) |
| 100% endstop | Upper endstop (100% position) | 19.OPEN | Endstop 100% position (19.OPEN) (Page 73) |
| Temperature | Current temperature | 30.TEMP | Current temperature (30.TEMP) (Page 76) |
| | Minimum temperature | 31.TMIN | Minimum temperature (31.TMIN) / Maximum temperature (32.TMAX) (Page 77) |
| | Maximum temperature | 32.TMAX | |
| Total strokes | 100% stroke | 1.STRKS | 100%- stroke (1.STRKS) (Page 66) |
| Direction reversal | Direction reversal | 2.CHDIR | Change of direction (2.CHDIR) (Page 66) |
| Average value of position | Average value of position | 20.PAVG | Average position value (20.PAVG) (Page 74) |

| Process diagnostics for monitoring | Diagnostic value | Short designation | Additional information |
|---|---|---|---|
| Supply pressure PZ<br>for SIPART PS2with option -Z P01/P02) | Supply pressure PZ | 60.PZ | Supply pressure PZ (60.PZ) (Page 79) |
| | Maximum supply pressure PZ, resettable | 63.PZMAX | Maximum supply pressure PZ, resettable (63.PZMAX) (Page 83) |
| | Violations of lower limit PZ, resettable | 64.N_MIN | Violations of lower limit PZ, resettable (64.N_MIN) (Page 84) |
| | Violation of upper limit PZ, resettable | 65.N_MAX | Violation of upper limit PZ, resettable (65.N_MAX) (Page 84) |
| Actuating pressure Y1<br>for SIPART PS2with option -Z P02) | Actuating pressure Y1 | 61.P1 | Actuating pressure Y1 (61.P1) (Page 81) |
| | Exceeded limit Y1, resettable | 66.N1MAX | Violation of limit Y1, resettable (66.N1MAX) (Page 85) |

## 4.8.2 100%- stroke (1.STRKS)

| **Diagnostic value** | **100% strokes**<br>**Short designation: 1.STRKS** | |
|---|---|---|
| Function | The counter adds up the movements of the actuator and shows the number of total strokes.<br>A total stroke is defined as the distance between the position 0% to 100% and back from 100% to 0%.<br>Partial strokes are totaled in the counter. The total 200% movement is counted as 1 stroke in the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_lift_int |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 16 ... 19<br>Format: Unsigned-32 |

## 4.8.3 Change of direction (2.CHDIR)

| **Diagnostic value** | **Direction changes**<br>**Short designation: 2.CHDIR** | |
|---|---|---|
| Function | During operation, the counter records and totals every change of direction with a movement greater than 0.25%. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_number_dirchange |
| | DisplayValue | ≙ Value |

| **Diagnostic value** | **Direction changes**<br>**Short designation: 2.CHDIR** | |
|---|---|---|
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 12 ... 15<br>Format: Unsigned-32 |

## 4.8.4 PST status / Measured time (12.PST)

| **Diagnostic value** | **Status PST / Measured time**<br>**Short designation: 12.PST** | |
|---|---|---|
| Function | The diagnostic value shows one of the following values:<br>• Status of the last Partial Stroke Tests (PST)<br>• If PST is successful: The measured time | |
| Note | The PST can be started manually with this diagnostic value → With local operation: Run PST (Page 130).<br>Requirement for PST:<br>Successful PST reference run → With local operation: Configure PST and execute reference run (Page 125) | |
| Status messages at the start of the PST | notoL | No Tolerance: The actuator is outside the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL). The PST does not start. |
| | Strt | Start: After 5 seconds, manual PST is started. |
| | WAIt | Wait: The PST is being executed. |
| Status/display options | OFF | The PST function is deactivated. |
| | C-ERR | Configuration error:<br>• PST cannot be started.<br>• The settings in the parameters "Start position" (A1.STPOS), "Stroke height" (A3.STRKH) and "Stroke direction" (A4.STRKD) are not plausible. |
| | FdIni | Failed PST Initialization: The PST reference run has failed. |
| | norEF | The PST reference run has not yet been performed. |
| | notSt | No Test: The PST has not yet been performed |
| | ###.# | Measured travel time (stroke time) of the PST in seconds.<br>The last PST was successfully executed. |
| | SdtSt | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed. |
| Factory setting | OFF | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_current_val |
| | Label | Measured stroke time (12.PST) |
| | DisplayValue | ≙ Value, e.g. "0.69" |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 0 ... 11<br>Format and meaning: → Via HART communication: Read out diagnostic results (Page 135) |

### 4.8.5 PST status (12.PST)

| **Diagnostic value** | **Status PST**<br>**Short designation: 12.PST** | |
|---|---|---|
| Function | The diagnostic value shows the status of the last Partial Stroke Test (PST). | |
| Note | The PST can be started manually with this diagnostic value → With local operation: Run PST (Page 190).<br>Requirement for PST:<br>Successful PST reference run → With local operation: Configure PST and execute reference run (Page 186) | |
| Requirement | The positioner has pressure sensors ( -Z P02 option). | |
| Status messages at the start of the PST | notoL | No Tolerance: The actuator is outside the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL). The PST does not start. |
| | Strt | Start: After 5 seconds, manual PST is started. |
| | WAIt | Wait: The PST is being executed. |
| Status/display options | Off | The PST is deactivated. |
| | C-ERR | Configuration error:<br>• PST cannot be started.<br>• Settings in the "Start position" (A1.STPOS) and "End position" (Ad.EN-POS) parameters are not plausible. |
| | FdIni | Failed PST Initialization: The PST reference run has failed. |
| | norEF | The PST reference run has not yet been performed. |
| | notSt | No Test: The PST has not yet been performed |
| | oCAY | The last PST was successfully executed. |
| | SdtSt | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed. |
| Factory setting | Off | |
| **Communication** | | |
| HART communication (read) | Command | #211 |
| | Response Data | Format and meaning: → Via HART communication: Read out diagnostic results (Page 196) |

### 4.8.6 Time since last partial stroke test (13.PRPST)

| **Diagnostic value** | **Time since last Partial Stroke Test**<br>**Short designation: 13.PRPST** | |
|---|---|---|
| Function | The diagnostic value shows the time since the last Partial Stroke Test (PST) in days or the status. | |
| Display options | ### | Days since the last PST |
| | notSt | No Test: The PST has not yet been performed |
| | norEF | The PST reference run has not yet been performed. |
| | Sdtst | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_prev_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 12 ... 15<br>Format: Float |

### 4.8.7 Time until next Partial Stroke Test (14.NXPST)

| **Diagnostic value** | **Time to next Partial Stroke Test**<br>**Short designation: 14.NXPST** | |
|---|---|---|
| Function | The diagnostic value shows the time until the next Partial Stroke Test (PST) in days. | |
| Requirement | • The PST is activated in "Configuration" mode.<br>• A test interval is set in the "A8.INTRV" parameter. | |
| Display options | Off | Factory setting or unfulfilled requirement |
| | ### | Days until next PST |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_next_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 17 ... 20<br>Format: Float |

### 4.8.8 Dynamic control valve behavior (15.DEVI)

| **Diagnostic value** | **Dynamic control valve behavior**<br>**Short designation: 15.DEVI** | |
|---|---|---|
| Function | The diagnostic value shows the deviation between the currently determined control behavior and the expected control behavior. | |
| Requirement | • For firmware version 5.00 to 5.02: The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".<br>• The positioner is initialized.<br>• The process diagnostics "Monitoring of dynamic control valve behavior" (b.\DEVI) is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_devi_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 30 ... 33<br>Format: Float |

### 4.8.9 Pneumatic leakage (16.ONLK)

| **Diagnostic value** | **Pneumatic leakage**<br>**Short designation: 16.ONLK** | |
|---|---|---|
| Function | The diagnostic value shows the current additional compressed air consumption caused by leakage. | |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. | |
| Display range | 0 ... 100 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_leak_online_val |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 34 ... 37<br>Format: Float |

## 4.8.10 Stiction (slipstick effect) (17.STIC)

| **Diagnostic value** | **Stiction (slipstick)**<br>**Short designation: 17.STIC** | |
|---|---|---|
| Function | The diagnostic value shows jerky changes in the process valve position, known as slip jumps, as a percentage of the travel distance. | |
| Note | Jerky changes in the process valve position indicate excessive stiction. | |
| Requirement | The process diagnostics "Monitoring of stiction (slipstick effect)" (d.\STIC) is activated. | |
| Display range | 0 ... 100 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_slip_stick_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |

## 4.8.11 Endstop 0% position (18.ZERO)

| **Diagnostic value** | **Endstop 0-%-Position**<br>**Short designation: 18.ZERO** | |
|---|---|---|
| Function | The diagnostic value shows the percentage by which the mechanical endstop at the 0% position has changed compared to the value at initialization. | |
| Requirement | • The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".<br>• The "Monitoring 0% stop" (F.\ZERO) process diagnostics is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_zero_value |
| | DisplayValue | ≙<br>Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 42 ... 45<br>Format: Float |

### 4.8.12 Endstop 100% position (19.OPEN)

| **Diagnostic value** | **Endstop 100-%-Position**<br>**Short designation: 19.OPEN** | |
|---|---|---|
| Function | The diagnostic value shows the percentage by which the mechanical endstop at the 100% position has changed compared to the value at initialization. | |
| Requirement | • The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".<br>• The "100% endstop monitoring" process diagnostics (G.\OPEN) is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_open_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 46 ... 49<br>Format: Float |

## 4.8.13 Average position value (20.PAVG)

| **Diagnostic value** | **Average position value**<br>**Short designation: 20.PAVG** | |
|---|---|---|
| Function | The diagnostic value shows the status of the process diagnostics "Monitoring of average position value" (P.\PAVG) or the last calculated average position value of the valve position during the time base set in the process diagnostics. | |
| Display options | OFF | The process diagnostics "Monitoring of average position value" (P.\PAVG) is deactivated. |
| | IdLE | The process diagnostics "Monitoring of average position value" (P.\PAVG) is activated but not yet started. |
| | rEF | Process diagnostics "Monitoring of average position value" (P.\PAVG) has been started and the reference average value "P2.STATE" is currently being calculated. |
| | COMP | The current average position value of the valve is currently being calculated. |
| | 0.0 ... 100.0 | Calculated average position value |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pos_avg_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 26 ... 29<br>Format: Float |

### See also

Monitoring the position average value (P.\PAVG) (Page 435)

## 4.8.14 Deadband UP (26.DBUP) / Deadband DOWN (27.DBDN)

| **Diagnostic value** | **Deadband UP**<br>**Short designation: 26.DBUP** | |
|---|---|---|
| | **Deadband DOWN**<br>**Short designation: 27.DBDN** | |
| Function | The diagnostic values show the deadband of the positioner as a percentage:<br>• "Deadband UP " (26.DBUP) in direction 100% position<br>• "Deadband DOWN" (27.DBDN) in direction 0% position | |
| Note | The values either correspond to the manually set value of the application parameter "34.DEBA" or, if "34.DEBA" is set to "Auto", the value automatically adapted by the positioner. | |
| Display range | 0.1 ... 10.0 | |
| Unit | % | |
| **Communication** | | |
| **Deadband UP (26.DBUP)** | | |
| SIMATIC PDM Export | Name | ps2_dead_up_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 0 ... 3<br>Format: Float |
| **Deadband DOWN (27.DBDN)** | | |
| SIMATIC PDM Export | Name | ps2_dead_down_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 4 ... 7<br>Format: Float |

## 4.8.15 Current temperature (30.TEMP)

| **Diagnostic value** | **Current temperature**<br>**Short designation: 30.TEMP** | |
|---|---|---|
| Function | The diagnostic value shows the current temperature in the positioner enclosure. | |
| Note | • The temperature sensor is located in the enclosure on the electronics board.<br>• In order to switch over the temperature display between °C and °F: Press the ⚠ button on the display. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Current temperature (30.TEMP)** | | |
| SIMATIC PDM Export | Name | ps2_temp |
| | DisplayValue | ≙ Value |
| | Unit | ≙ Unit |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

## 4.8.16 Minimum temperature (31.TMIN) / Maximum temperature (32.TMAX)

| | | |
|---|---|---|
| **Diagnostic value** | **Minimum temperature**<br>**Short designation: 31.TMIN** | |
| | **Maximum temperature**<br>**Short designation: 32.TMAX** | |
| Function | The minimum temperature and the maximum temperature inside the enclosure are continuously determined and stored in the manner of a drag indicator. | |
| Note | • To change the temperature display between °C and °F to switch: Press the ⚠ button on the display.<br>• The determined values can only be reset in the factory. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Minimum temperature (31.TMIN)** | | |
| SIMATIC PDM Export | Name | ps2_tmin |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 42 ... 45<br>Format: Float |
| **Maximum temperature (32.TMAX)** | | |
| SIMATIC PDM Export | Name | ps2_tmax |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 46 ... 49<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

## 4.8.17 Length of the leakage compensation pulses (57.LCPUL)

| **Diagnostic value** | **Length of the leakage compensation pulse**<br>**Short designation: 57.LCPUL** | |
|---|---|---|
| Function | The diagnostic value shows the length of the compensation pulses in milliseconds.<br>The sign indicates the control direction of the pulse. | |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. | |
| Display range | -256 ... 254 | |
| Factory setting | 0 | |
| Unit | ms (millisecond) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_LeakagePulsLength |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Byte 60<br>Format: Signed-8 |

## 4.8.18 Length of the leakage compensation pulses (58.LCPER)

| **Diagnostic value** | **Period of the leakage compensation pulse**<br>**Short designation: 58.LCPER** | |
|---|---|---|
| Function | The diagnostic value shows the cycle duration of the leakage compensation pulses. | |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. | |
| Display range | 0.00 ... 600.00 | |
| Factory setting | 0.00 | |
| Unit | s (second) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_LeakagePeriod |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes 60 ... 64<br>Format: Float |

### 4.8.19 Supply pressure PZ (60.PZ)

| **Diagnostic value** | **Supply pressure PZ**<br>**Short designation: 60.PZ** | |
|---|---|---|
| Function | The diagnostic value shows the current supply pressure PZ. | |
| Note | The differential pressure between the ambient pressure and the input PZ is measured.<br>If there is no supply pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P01 or P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Supply pressure PZ (60.PZ)** | | |
| SIMATIC PDM Export | Name | var_PZ_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 2 ... 5<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "60.PZ".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" the calibration was not successful due to excessive pressure deviation.

## 4.8.20 Actuating pressure Y1 (61.P1)

| **Diagnostic value** | **Actuating pressure Y1**<br>**Short designation: 61.P1** | |
|---|---|---|
| Function | Shows the current actuating pressure Y1. | |
| Note | The differential pressure between the ambient pressure and the output Y1 is measured.<br>If there is no actuating pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Actuating pressure Y1 (61.P1)** | | |
| SIMATIC PDM Export | Name | var_P1_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 6 ... 9<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "61.P1".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" was displayed, the calibration was not successful due to excessive pressure deviation.

## 4.8.21 Maximum supply pressure PZ, resettable (63.PZMAX)

| **Diagnostic value** | **Maximum supply pressure PZ, resettable**<br>**Short designation: 63.PZMAX** | |
|---|---|---|
| Function | The supply pressure PZ is continuously monitored.<br>The highest measured value is displayed as the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Condition | The positioner has pressure sensors (-Z P01 or P02 option). | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum supply pressure PZ, resettable (63.PZMAX)** | | |
| SIMATIC PDM Export | Name | var_PZ_MaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 14 ... 17<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.22 Violations of lower limit PZ, resettable (64.N_MIN)

| **Diagnostic value** | **Violations of lower limit PZ, resettable**<br>**Short designation: 64.N_MIN** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U5.PZMLL of the "Pressure monitoring" process diagnostics (U.\PRES) parameter, the event counter of the diagnostic value "64.N_MIN" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "65.N_MAX" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitUnderrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 18 ... 19<br>Format: Unsigned-16 |

## 4.8.23 Violation of upper limit PZ, resettable (65.N_MAX)

| **Diagnostic value** | **Violations of upper limit PZ, resettable**<br>**Short designation: 65.N_MAX** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U6.PZMUL parameter of the "Pressure monitoring" process diagnostics (U.\PRES), the event counter of the diagnostic value "65.N_MAX" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "64.N_MIN" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitOverrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 20 ... 21<br>Format: Unsigned-16 |

## 4.8.24 Violation of limit Y1, resettable (66.N1MAX)

| **Diagnostic value** | **Violations of limit Y1, resettable**<br>**Short designation: 66.N1MAX** | |
|---|---|---|
| Function | If the actuating pressure Y1 exceeds the limit in the "U7.PCL" parameter of the "Pressure monitoring" (U.\PRES) process diagnostics, the event counter of the diagnostic value "66.N1MAX" is incremented. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has firmware version 5.03 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_P1_NoLimitReachedResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 22 ... 23<br>Format: Unsigned-16 |

## 4.8.25 +/- leakage at Y1 (67.LMY1)

| **Diagnostic value** | **+/- Leakage at Y1**<br>**Short designation: 67.LMY1** | |
|---|---|---|
| Function | The diagnostic value shows the pressure increase or decrease (leakage) per minute for the actuating pressure Y1. | |
| Note | • The diagnostic value is determined in the controlled state.<br>• Positive values indicate an increase in pressure, e.g. in the event of pneumatic leakage between supply pressure PZ and actuating pressure Y1.<br>• Negative values indicate a decrease in pressure, e.g. if the pneumatic system is leaking. | |
| Requirement | The positioner has pressure sensors (Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **+/- Leakage at Y1 (67.LMY1)** | | |
| SIMATIC PDM Export | Name | var_LM_LeakageRateChamber1 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 24 ... 27<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.26 +/- leakage at Y2 (68.LMY2)

| **Diagnostic value** | **+/- Leakage at Y2**<br>**Short designation: 68.LMY2** | |
|---|---|---|
| Function | The diagnostic value shows the pressure increase or decrease (leakage) per minute for the actuating pressure Y2. | |
| Note | • The diagnostic value is determined in the controlled state.<br>• Positive values indicate an increase in pressure, e.g. in the event of pneumatic leakage between supply pressure PZ and actuating pressure Y2.<br>• Negative values indicate a decrease in pressure, e.g. if the pneumatic system is leaking. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **+/- Leakage at Y2 (68.LMY2)** | | |
| SIMATIC PDM Export | Name | var_LM_LeakageRateChamber2 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 28 ... 31<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.27 Maximum positive leakage at Y1 (69.LMUY1)

| **Diagnostic value** | **Maximum positive leakage at Y1**<br>**Short designation: 69.LMUY1** | |
|---|---|---|
| Function | The pressure change at Y1 is continuously monitored in the controlled state.<br>The maximum pressure increase is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum positive leakage at Y1 (69.LMUY1)** | | |
| SIMATIC PDM Export | Name | var_LM_P1DeltaPresMaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 32 ... 35<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.28 Maximum positive leakage at Y2 (70.LMUY2)

| **Diagnostic value** | **Maximum positive leakage at Y2**<br>**Short designation: 70.LMUY2** | |
|---|---|---|
| Function | The pressure change at Y2 is continuously monitored in the controlled state.<br>The maximum pressure increase is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum positive leakage at Y2 (70.LMUY2)** | | |
| SIMATIC PDM Export | Name | var_LM_P2DeltaPresMaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 36 ... 39<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.29 Maximum negative leakage at Y1 (71.LMDY1)

| **Diagnostic value** | **Maximum negative leakage at Y1**<br>**Short designation: 71.LMDY1** | |
|---|---|---|
| Function | The pressure change at Y1 is continuously monitored in the controlled state.<br>The maximum pressure drop is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum negative leakage at Y1 (71.LMDY1)** | | |
| SIMATIC PDM Export | Name | var_LM_P1DeltaPresMinPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 40 ... 43<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 4.8.30 Maximum negative leakage at Y2 (72.LMDY2)

| **Diagnostic value** | **Maximum negative leakage at Y2**<br>**Short designation: 72.LMDY2** | |
|---|---|---|
| Function | The pressure change at Y2 is continuously monitored in the controlled state.<br>The maximum pressure drop is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum negative leakage at Y2 (72.LMDY2)** | | |
| SIMATIC PDM Export | Name | var_LM_P2DeltaPresMinPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 44 ... 47<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

# Process diagnostics

# 5

## 5.1 Definition of process diagnostics

Process diagnostics monitor the valve, consisting of positioner, actuator and valve, during active operation.

Up to 3 thresholds for messages can be set for monitoring.

The results allow conclusions to be drawn about the condition and operating behavior of the valve.

Required maintenance work can be identified before the valve fails and maintenance cycles can be adapted to the condition of the valve.

The data and results of the process diagnostics are stored in the positioner for up to 30 months and can be read out via HART communication.

With Device Manager Software, e.g. SIMATIC PDM, the data can be displayed graphically and exported.

---

**Note**

**Display of the process diagnostics**

The display of the process diagnostics is deactivated in the factory setting: The application parameter "52.XDIAG" is set to "Off".

The process diagnostics are displayed if the setting "On1", "On2" or "On3" is activated in application parameter "52.XDIAG".

---

## 5.2 Activate extended diagnostics (52.XDIAG) and set the number of messages

### Function of the application parameter "Extended diagnostics" (52.XDIAG)

The SIPART PS2 positioner has several process diagnostics. With the factory setting of the positioner, the "Extended diagnostics" (52.XDIAG) parameter is deactivated and the process diagnostics are not visible on the display.

After changing the parameter "52.XDIAG" from "Off" to "On1", "On2" or "On3", the process diagnostics are visible and can be activated individually. The setting applies to all process diagnostics.

After setting "52.XDIAG" to "On1", "On2" or "On3", up to 3 thresholds for messages can be set for the process diagnostics.

**Note**

**When using the Digital I/O Module (DIO) for the alarm function "44.AFCT"**

- With setting "52.XDIAG" = "On3": The "A1" and "A2" alarms are not output via the Digital I/-O Module (DIO) output.
- With setting "52.XDIAG" = "On2": Only the "A1" alarm is output the digital output "DO1".
- With setting "52.XDIAG" = "On1": The "A1" alarm is output at the digital output "DO1". The "A2" alarm is output at the digital output "DO2".

Regardless of the use of the Digital I/O Module (DIO), the alarms "A1" and "A2" are output via the communication interface.

**Note**

**When using HART communication**

If one of the thresholds is exceeded and the setting is changed from "52.XDIAG" to "On1", "On2" or "On3":

- A readable entry with a timestamp is created in the alarm logbook of the positioner.
- The "more status available" bit is set.
- Request the specific message for process diagnostics with the HART command "#48".

Table 5-1 Application parameter "52.XDIAG"

| Setting | Description |
|---|---|
| Off | • The display of the process diagnostics is deactivated.<br>• The messages are deactivated. |
| On1 | • The process diagnostics are displayed.<br>• 1-stage message for all process diagnostics: The **threshold 3 messages** are activated.<br>• If threshold 3 is exceeded:<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The "Fault signal output" is activated. |

| Setting | Description |
|---|---|
| On2 | • The process diagnostics are displayed.<br>• 2-stage message for all process diagnostics: **Threshold 2 messages** and **threshold 3 messages** are activated.<br>• If threshold 2 is exceeded:<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The digital output "DO2" is activated.<br>• If threshold 3 is exceeded:<br>– The threshold 2 message is **not** issued.<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The "Fault signal output" is activated. The digital output "DO2" is deactivated. |
| On3 | • The process diagnostics are displayed.<br>• 3-stage message for all process diagnostics: **Threshold 1 messages, threshold 2 messages** and **threshold 3 messages** are activated.<br>• If threshold 1 is exceeded:<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The digital output "DO1" is activated.<br>• If threshold 2 is exceeded:<br>– The threshold 1 message is **not** issued.<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The digital output "DO2" is activated. The digital output "DO1" is deactivated.<br>• If threshold 3 is exceeded:<br>– The threshold 1 message and the threshold 2 message are **not** issued.<br>– A specific process diagnostics message is shown on the display.<br>– With the optional Digital I/O Module (DIO): The "Fault signal output" is activated. The digital outputs "DO1" and "DO2" are deactivated. |

## Activate the application parameter "Extended diagnostics" (52.XDIAG)

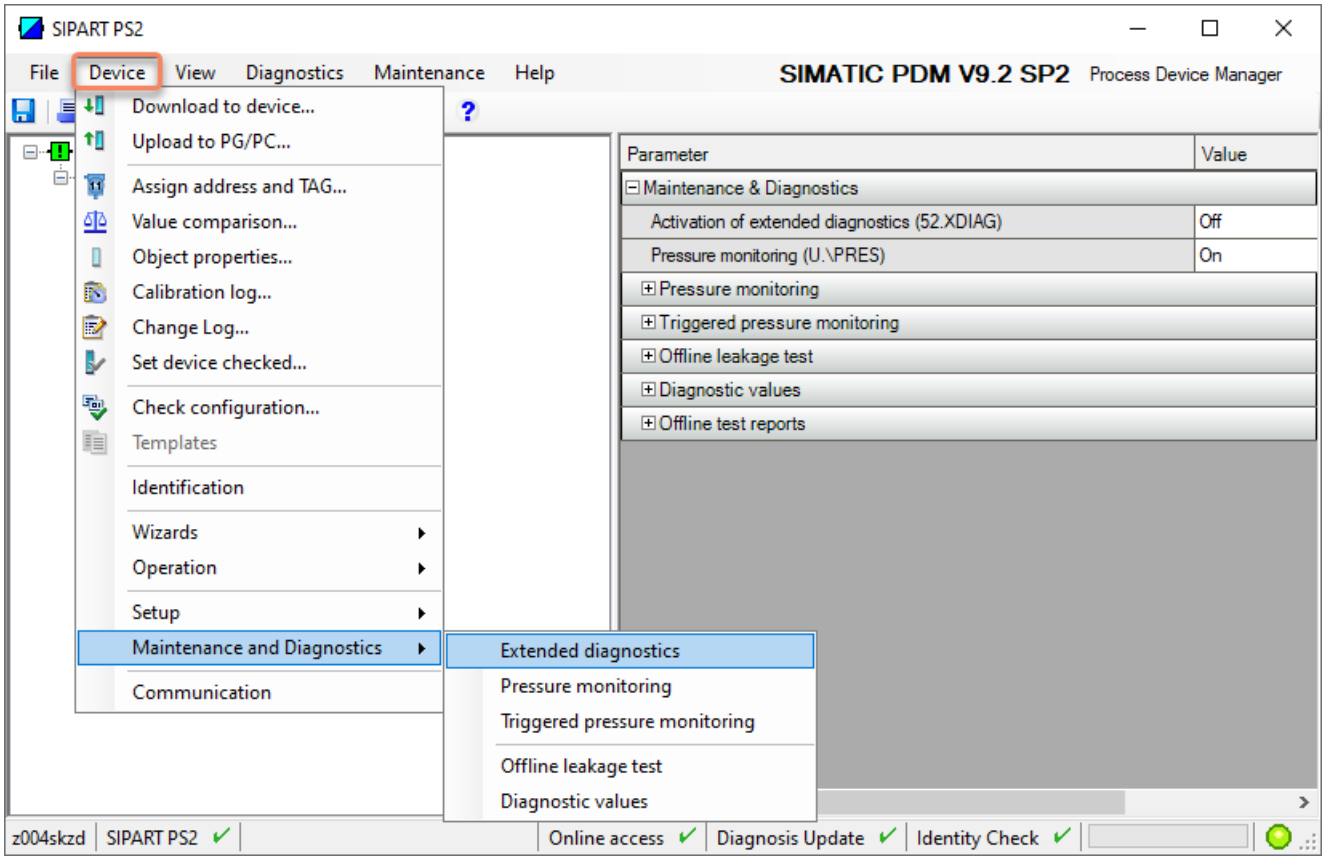
The parameter can be activated with the following 2 options.

**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the application parameter "52.XDIAG".
3. For "52.XDIAG", set the value to "On1", "On2" or "On3".
   ⇒ The process diagnostics "A.\PST" to "U.\PRES" appear on the display.

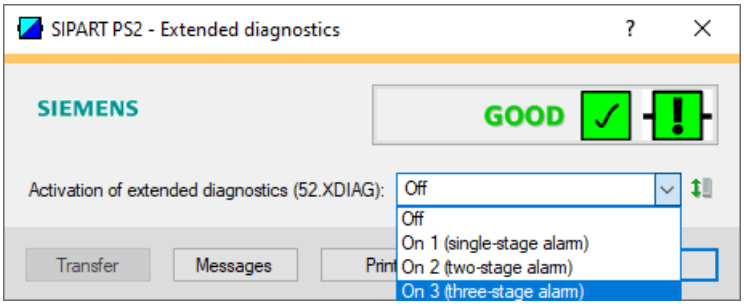
**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. Select the directory "Device > Maintenance and Diagnostics > Extended diagnostics".

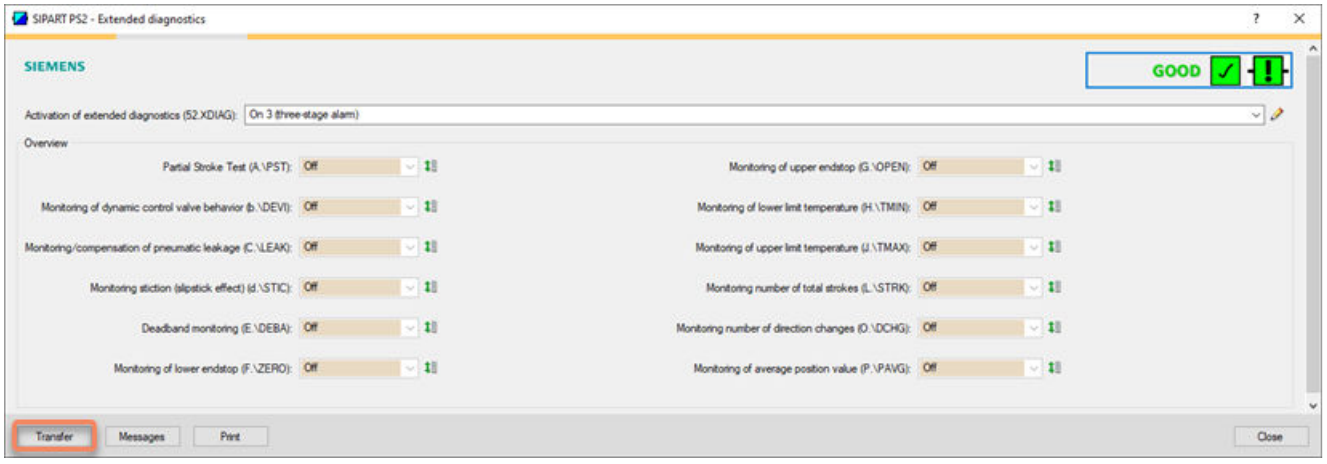



⇒ The "Extended diagnostics" dialog is displayed.

3. For "Activation of extended diagnostics" (52.XDIAG), set the value to "On1", "On2" or "On3".




⇒ The messages are activated and the status of the process diagnostics "A.\PST" to "P.\PAVG" is displayed.




4. Save the change with the "Transfer" button.
5. Close the dialog.

## 5.3 Overview of process diagnostics

The process diagnostics available in the positioner depend on the following general conditions:

- Firmware version of the positioner
- Features of the positioner: Without pressure sensor or with pressure sensors (-Z P01/P02 options)

| **Process diagnostics for monitoring** | **Short designation** | **Diagnostics applicable for Positioner SIPART PS2 ...** | | | **Additional information** |
|---|---|---|---|---|---|
| | | **Without pressure sensor** | **With pressure sensor (Z P01 option)** | **With pressure sensors (Z P02 option)** | |
| Partial Stroke Test (without pressure sensors) | A.\PST | **X** | **X** | Only with U.\PRES = Off | Partial Stroke Test (without pressure sensors) (Page 99) |
| Partial Stroke Test (pressure sensor-supported) | A.\PST | - | - | **X** | Partial Stroke Test (pressure sensor-supported) (Page 149) |
| Dynamic response | b.\DEVI | **X** | **X** | **X** | Monitoring of dynamic control valve behavior (b.\DEVI) (Page 212) |
| Leakage and compensation | C.\LEAK | **X** | **X** | **X** | Monitoring/compensation of pneumatic leakage (C.\LEAK) (Page 237) |
| Leakage (pressure sensor-supported) | U.\PRES | - | - | **X** | Monitoring of pneumatic leakage (pressure sensor-supported) (Page 261) |
| Stiction | d.\STIC | **X** | **X** | **X** | Monitoring of stiction (slipstick) (d.\STIC) (Page 293) |
| Deadband | E.\DEBA | **X** | **X** | **X** | Monitoring of deadband "E.\DEBA" (Page 314) |
| 0% endstop | F.\ZERO | **X** | **X** | **X** | Monitoring 0% stop (F.\ZERO) (Page 335) |
| 100% endstop | G.\OPEN | **X** | **X** | **X** | Monitoring 100% endstop (G.\OPEN) (Page 357) |
| Temperature | H.\TMIN, J.\TMAX | **X** | **X** | **X** | Monitoring of lower limit temperature (H.\TMIN) and upper limit temperature (J.\TMAX) (Page 379) |
| Total strokes | L.\STRK | **X** | **X** | **X** | Monitoring the number of total strokes (L.\STRK) (Page 405) |
| Direction reversal | O.\DCHG | **X** | **X** | **X** | Monitoring the number of changes in direction (O.\DCHG) (Page 421) |
| Average value of position | P.\PAVG | **X** | **X** | **X** | Monitoring the position average value (P.\PAVG) (Page 435) |
| Supply pressure PZ (pressure sensor-supported) | U.\PRES | - | **X** | **X** | Monitoring of supply pressure PZ (pressure sensor-supported) (Page 451) |
| Actuating pressure Y1 (pressure sensor-supported) | U.\PRES | - | - | **X** | Monitoring actuating pressure Y1 (pressure sensor-supported) (Page 481) |

# 5.4 Partial Stroke Test (without pressure sensors)

## 5.4.1 Functional description

The Partial Stroke Test (PST) is used on valves with single-acting actuators on valves, e.g. on safety valves.

During a PST reference run, the time required for a defined reference distance is measured and a distance-time diagram is recorded.

In the following PSTs, the measured time is compared with the time of the reference run.

The determined time difference can be monitored with adjustable thresholds.

If these thresholds are exceeded, messages are output via the display and optionally via the digital contacts or HART communication.

The distance-time diagram of the last executed PST is saved in the positioner and can be read out.

If the PST is repeated regularly, characteristic curves can be compared with each other and changes over time can be determined.

Regular movement of the process valve can prevent the valve from getting stuck.

The PST is configured and executed with Device Manager Software, e.g. SIMATIC PDM. The software can be used to read PST data from the positioner and display it as charts.

Local configuration via the display and buttons is also possible.

Diagnostic values for PST:

- PST status / Measured time (12.PST)
- Time since last partial stroke test (13.PRPST)
- Time until next Partial Stroke Test (14.NXPST)

The PST can be started via:

- Local operation
- Remote operation with a Device Manager Software e.g. SIMATIC PDM
- Digital input "DI1" or "DI2"
- Remote operation via HART communication
- Cyclic test interval

## 5.4.2 Activate PST

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### "Partial Stroke Test (A.\PST)" parameter

| | | |
|---|---|---|
| Function | The parameter activates or deactivates the Partial Stroke Test (PST). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

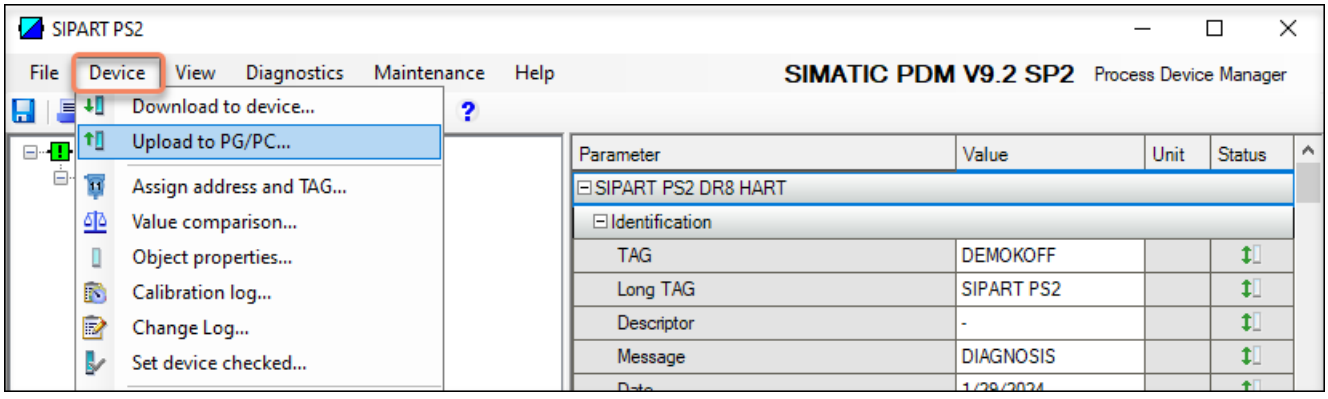
### Remote operation with SIMATIC PDM

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

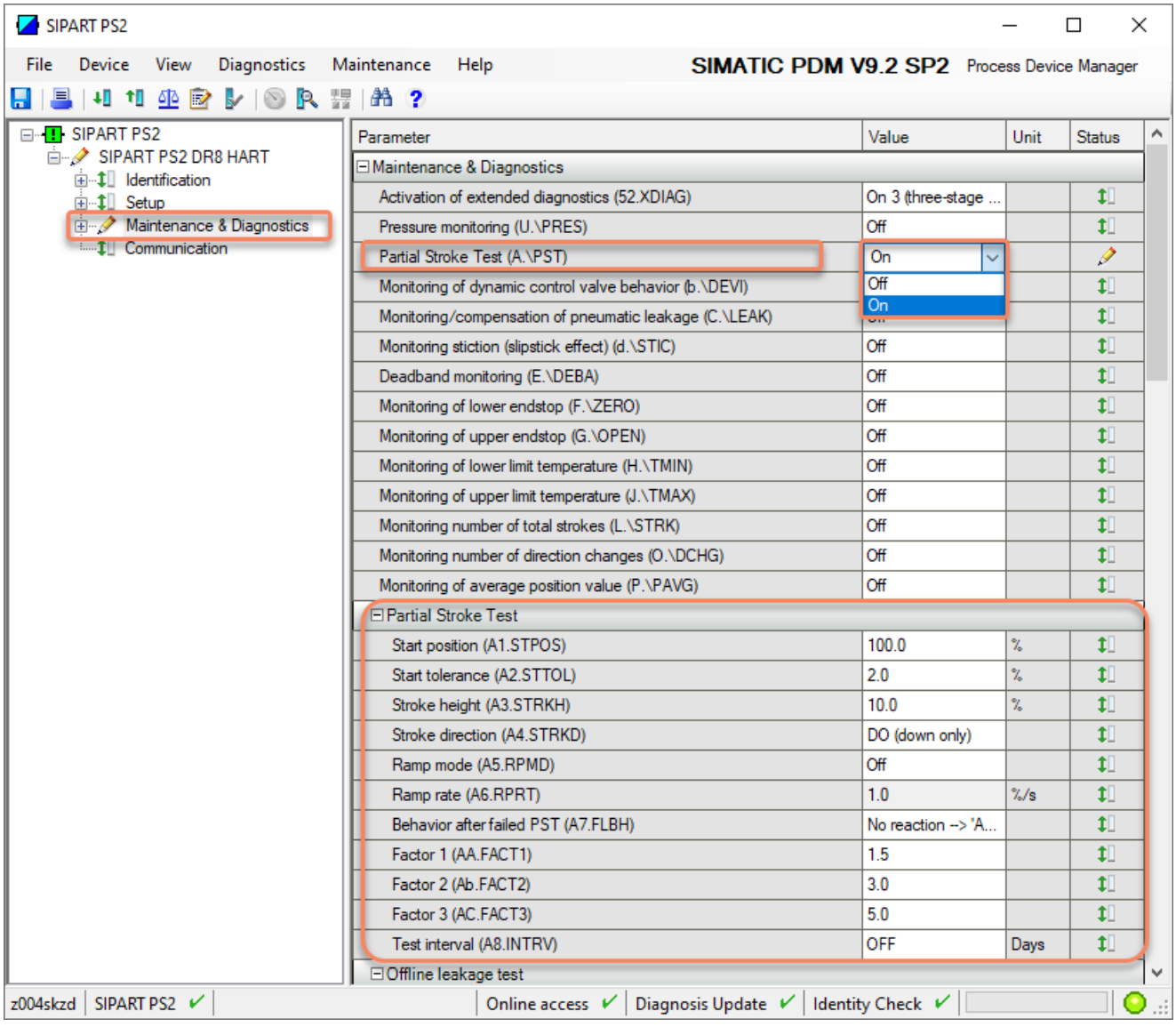
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Partial Stroke Test (A.\PST)", set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. In the "Device" menu, select the command "Download to device...".
9. Select the check box "Load changed parameters only".
10. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
11. Wait until the status "Load to Device: Action finished" is displayed.
12. Close the dialog.

### With local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "A.\PST" parameter of the "Partial Stroke Test" process diagnostics.
3. Set the "" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. Switch the positioner to "Manual (MAN)" mode by pressing the button on the display simultaneously for at least 5 seconds.

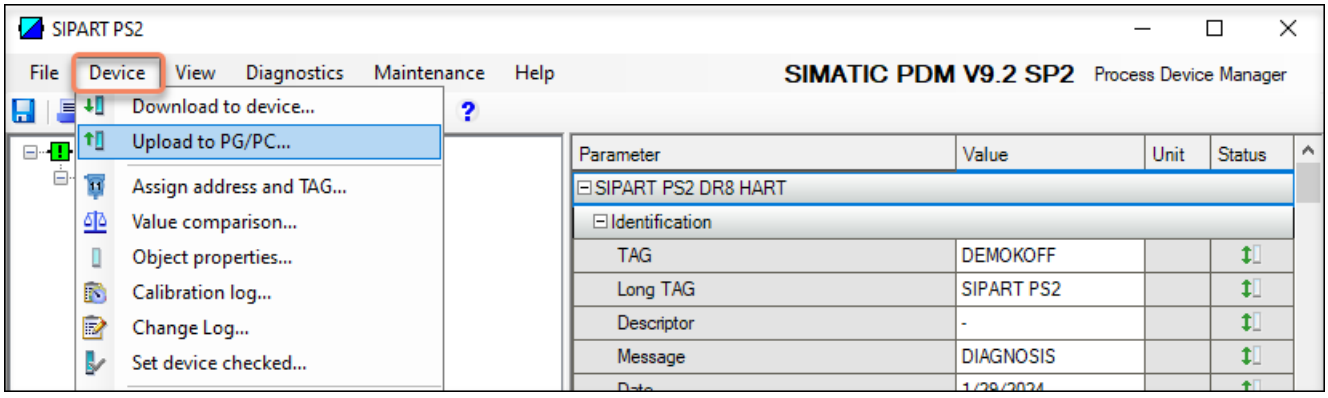
### 5.4.3 With SIMATIC PDM: Configure PST with wizard and execute reference run

#### Requirement

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The positioner is in "Automatic (AUT)" mode.

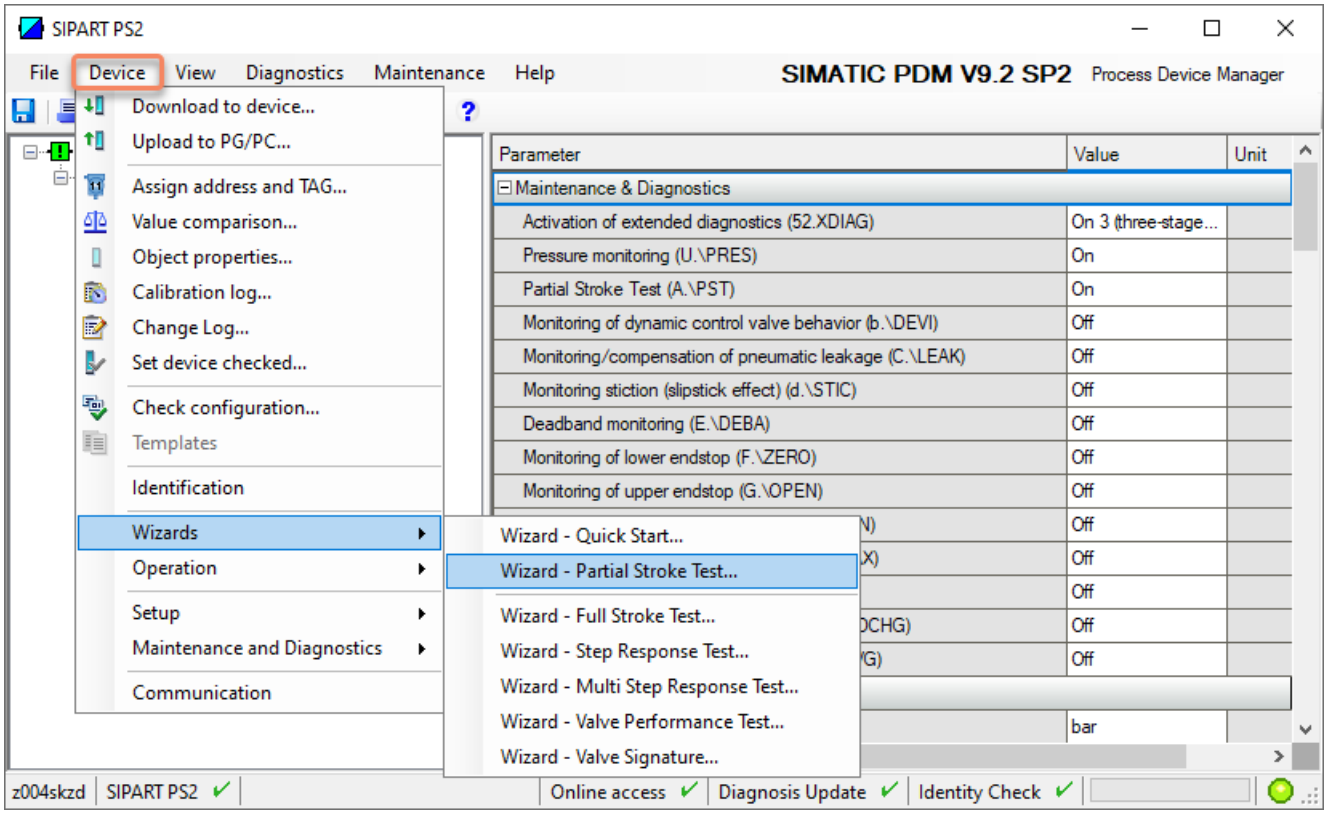
#### Open Wizards menu

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC...".




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

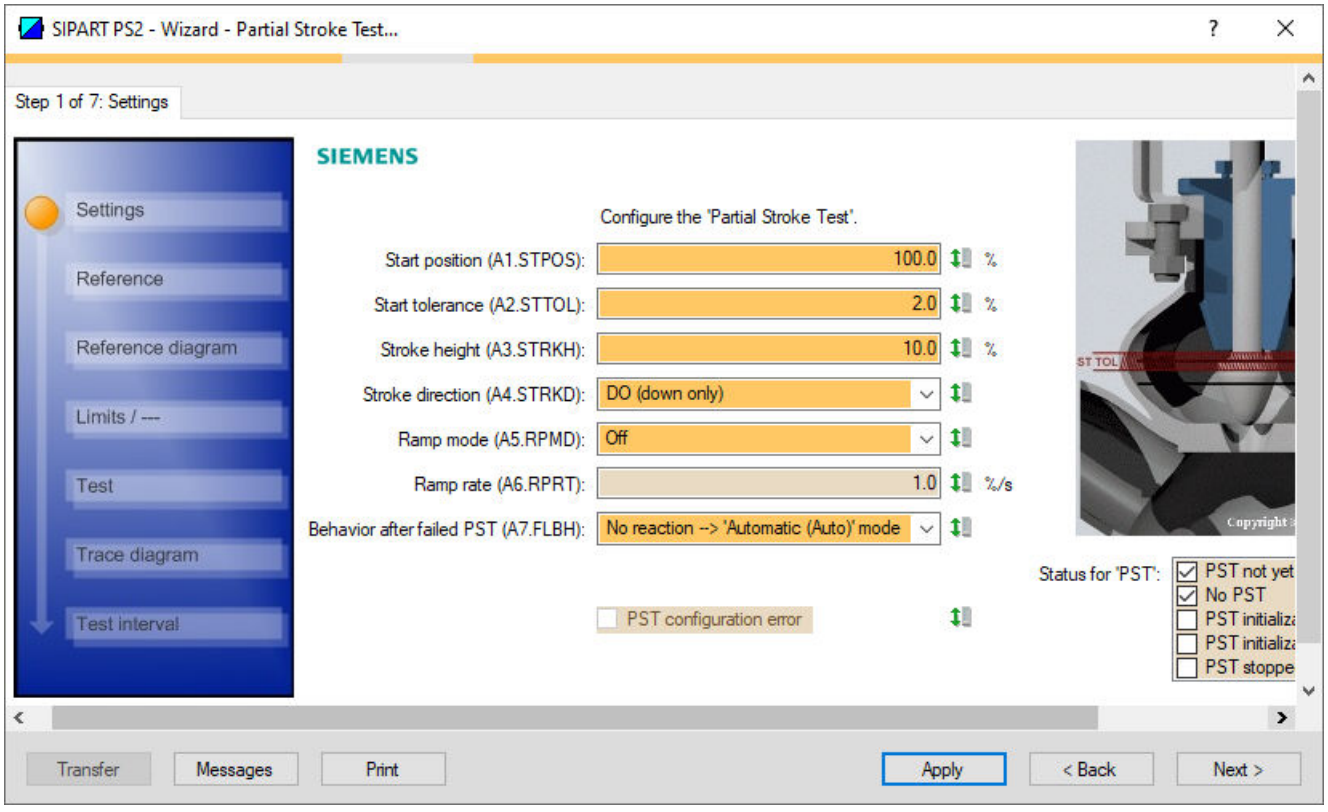
5. Close the dialog.
6. In the "Device" menu, select the command "Wizards > Wizard - Partial Stroke Test...".




⇒ The "Step 1 of 7: Settings" dialog opens.

### Step 1: Settings

In this step, the parameters for the traversing range and the duration of the PST are configured.




The "Status for PST" dialog box shows the current status of the PST.

If the PST reference run has already been successfully executed, the "PST initialization OK" message is highlighted.

Table 5-2 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| Apply | Saves the changed values of the dialog |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Enter the "Start position".

| **A1.STPOS** | **Start position** |
|---|---|
| Function | The parameter defines the start position of the PST. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

2. Enter the "Start tolerance".

| **A2.STTOL** | **Start tolerance** |
|---|---|
| Function | The parameter defines the start tolerance of the PST. |
| Note | Example: Start position "100.0", start tolerance "2.0".<br>• During the PST reference run, the actuator moves from the current position to the start position. When the position 98% is exceeded, the start position is considered reached.<br>• The PST only starts when the actuator is between the positions 98% and 102%. |
| Setting range | 0.1 ... 10.0 |
| Factory setting | 2.0 |
| Unit | % |

3. Enter the "Stroke height".

| **A3.STRKH** | **Stroke height** |
|---|---|
| Function | The parameter defines the control range of the PST. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 10.0 |
| Unit | % |

4. Enter the "Stroke direction".

| **A4.STRKD** | **Stroke direction** | |
|---|---|---|
| Function | The parameter defines the actuating direction of the PST. | |
| Setting options | uP | The actuator only moves towards the 100% position:<br>• The positioner moves the actuator from the start position to the upper target position and measures the time.<br>• After reaching the upper target position, the actuator moves back to the start position.<br>Upper target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) + Stroke height (A3.STRKH) |
| | do | The actuator only moves towards the 0% position:<br>• The positioner moves the actuator from the start position to the lower target position and measures the time.<br>• After reaching the lower target position, the actuator moves back to the start position.<br>Low target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) - Stroke height (A3.STRKH) |
| | uP do | The actuator moves in both directions:<br>• The positioner moves the actuator from the start position to the upper target position and measures the time.<br>• After reaching the upper target position, the positioner moves the actuator to the lower target position and measures the time.<br>• After reaching the lower target position, the actuator moves back to the start position.<br>Setpoint position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) ± Stroke height (A3.STRKH) |
| Factory setting | do | |

5. If needed, activate the "Ramp mode".

| **A5.RPMD** | **Ramp mode** | |
|---|---|---|
| Function | The parameter activates ramp mode.<br>The ramp mode can be used to influence the actuating speed and thus the duration of the PST. This can reduce the impact on the process. | |
| Setting options | Off | Ramp mode is deactivated.<br>The PST is without control. |
| | On | Ramp mode is activated.<br>The PST is executed with the ramp rate according to "A6.RPRT" parameter. |
| Factory setting | Off | |

6. If Ramp mode is activated, enter the "Ramp rate".

| **A6.RPRT** | **Ramp rate** |
|---|---|
| Function | The ramp rate defines the duration of the PST:<br>• Smaller values extend the duration.<br>• Larger values shorten the duration. |
| Note | The ramp rate refers to the total stroke of the valve.<br>Example: The setting "10.0" means that the PST is executed with a travel of 10% per second. |
| Requirement | The "Ramp mode" (A5.RPMD) parameter is activated. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.0 |
| Unit | %/s |

7. Configure the "Behavior after failed PST".

| **A7.FLBH** | **Behavior after failed PST** | |
|---|---|---|
| Function | The parameter defines the behavior of the positioner after a failed PST.. | |
| Note | Example of failed PST: The threshold assigned with "Factor 3" (AC.FACT3) has been exceeded. | |
| Setting options | Auto | Switch to "Automatic (AUT)" mode. "AUT" is shown in the display. |
| | HoLd | Hold current position. |
| | AirIn | Aerate actuator with supply pressure PZ. |
| | AirOu | Vent actuator. |
| Factory setting | Auto | |

8. Click the "Apply" button.
9. Click the "Next >" button.
   ⇒ The "Step 2 of 7: Reference" dialog opens.

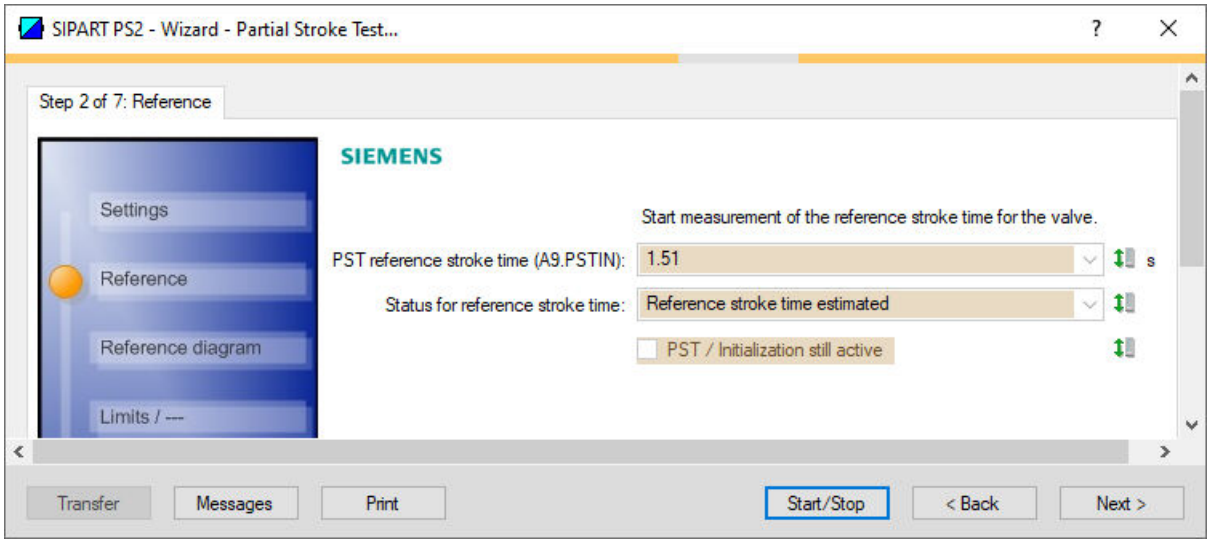
### Step 2: Perform PST reference run

In this step, the PST reference run is performed and the measured value is determined and displayed.

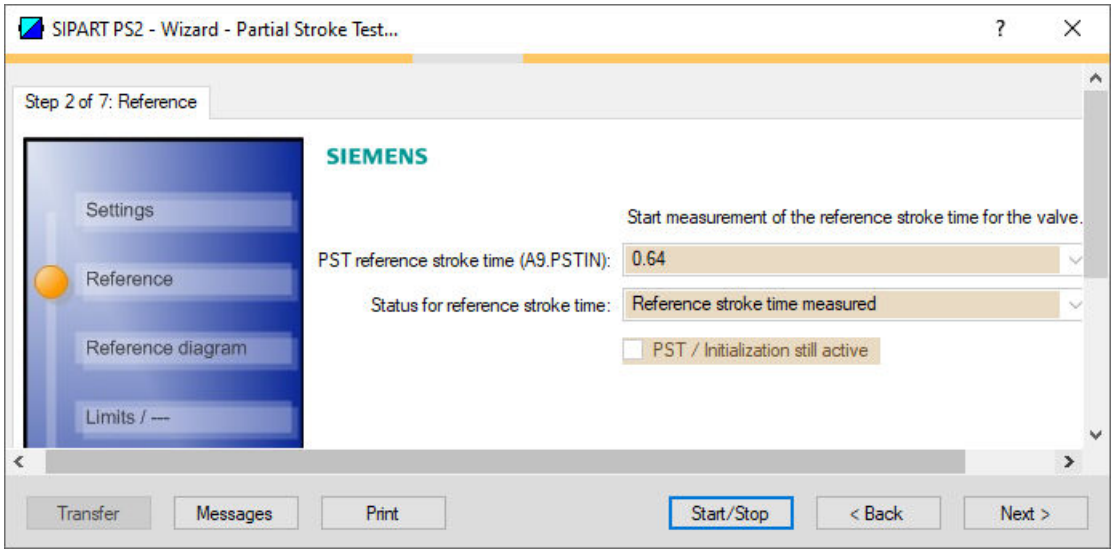
Perform the PST reference run in the following cases:

- After re-initializing the positioner
- After the commissioning the valve
- If there is a fundamental change in the operating conditions
- When changing the PST parameters
- Before the first PST

If a PST reference run has not yet been performed or the PST parameters have been changed, the expected reference stroke time is displayed, e.g. "1.51 s".

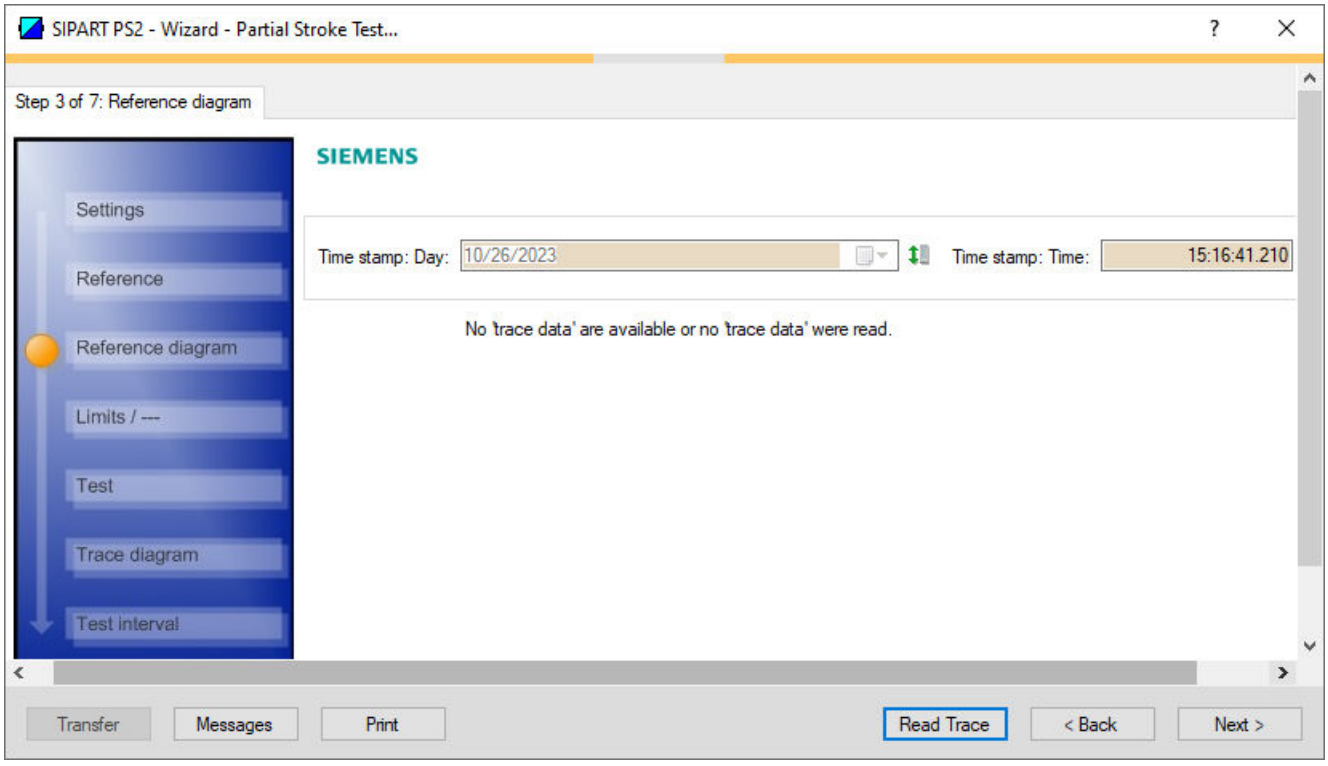



1. Click the "Start/Stop" button.
2. Confirm the start in the following dialog with "OK".
   ⇒ The PST reference run is in progress.
   ⇒ "INPST" is shown in the display.
   ⇒ The dialog shows: "PST / Initialization still active".
   After successful completion, the following information is displayed in the dialog:
   - PST reference stroke time (A9.PSTIN), e.g. "0.64 s"
   - Status ...: "Reference stroke time measured"



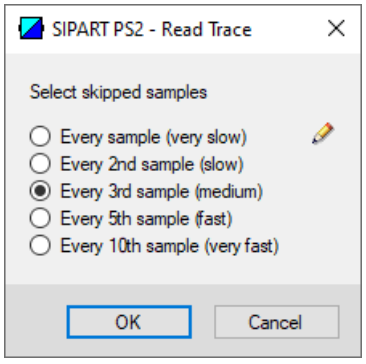

3. Click the "Next >" button.
   ⇒ The "Step 3 of 7: Reference diagram" dialog opens.

### Step 3: Reference diagram



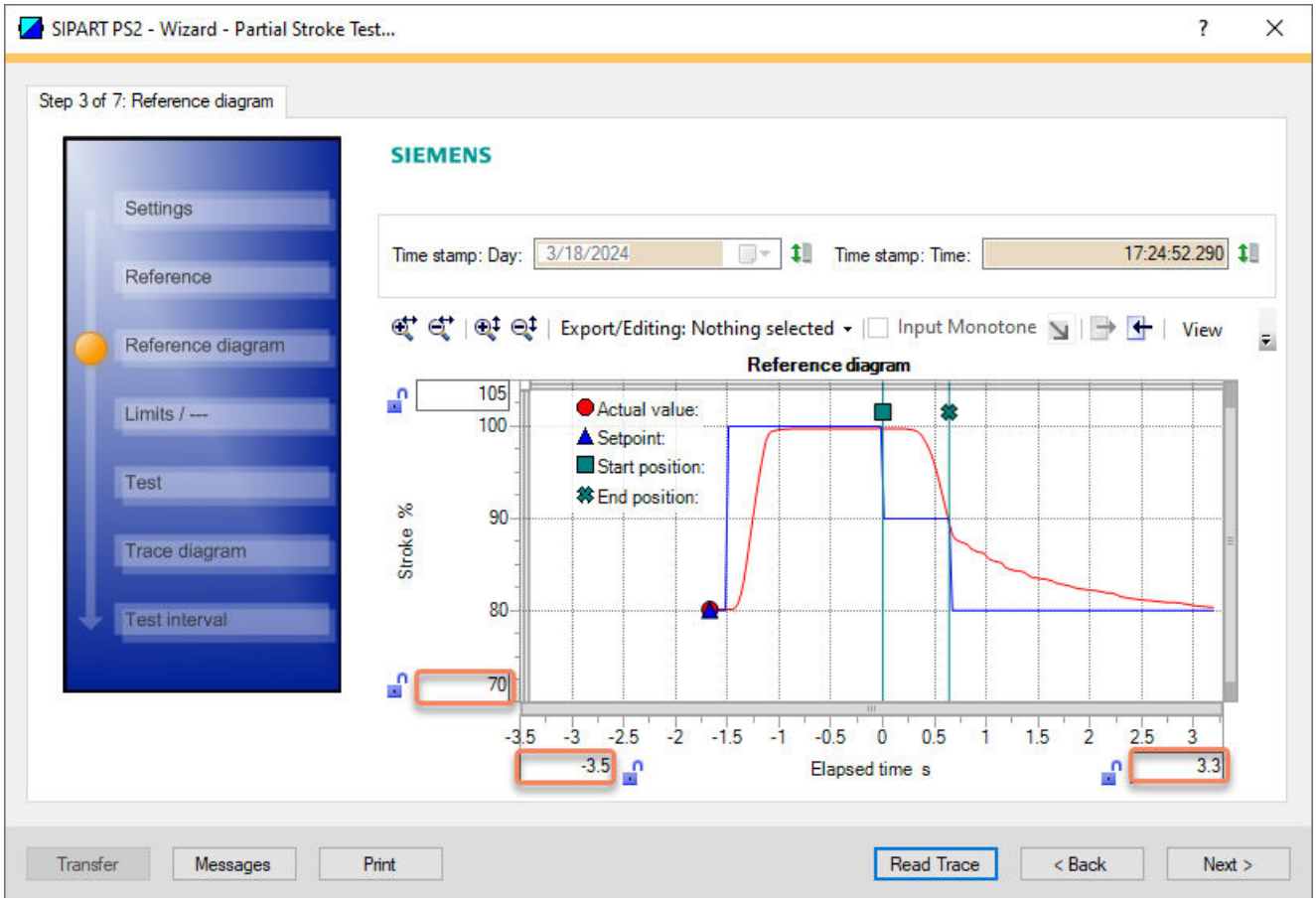

If a PST reference run was performed immediately beforehand, the diagram of the previous PST reference run is displayed.

1. Read out and display the diagram of the current PST reference run: Click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




As the HART communication may be slow, it is possible to load the chart data from the positioner in different resolutions.

4. Select the option button for the required sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog by clicking "OK".
   ⇒ The "Message Log" dialog opens.
6. Wait until the status "Finished" is displayed.
7. Close the "Message Log" dialog.
   ⇒ The chart of the current PST reference run is created and displayed.




Note on the example shown:

– The diagram display was scaled by changing the input fields of the axes, e.g. "70".

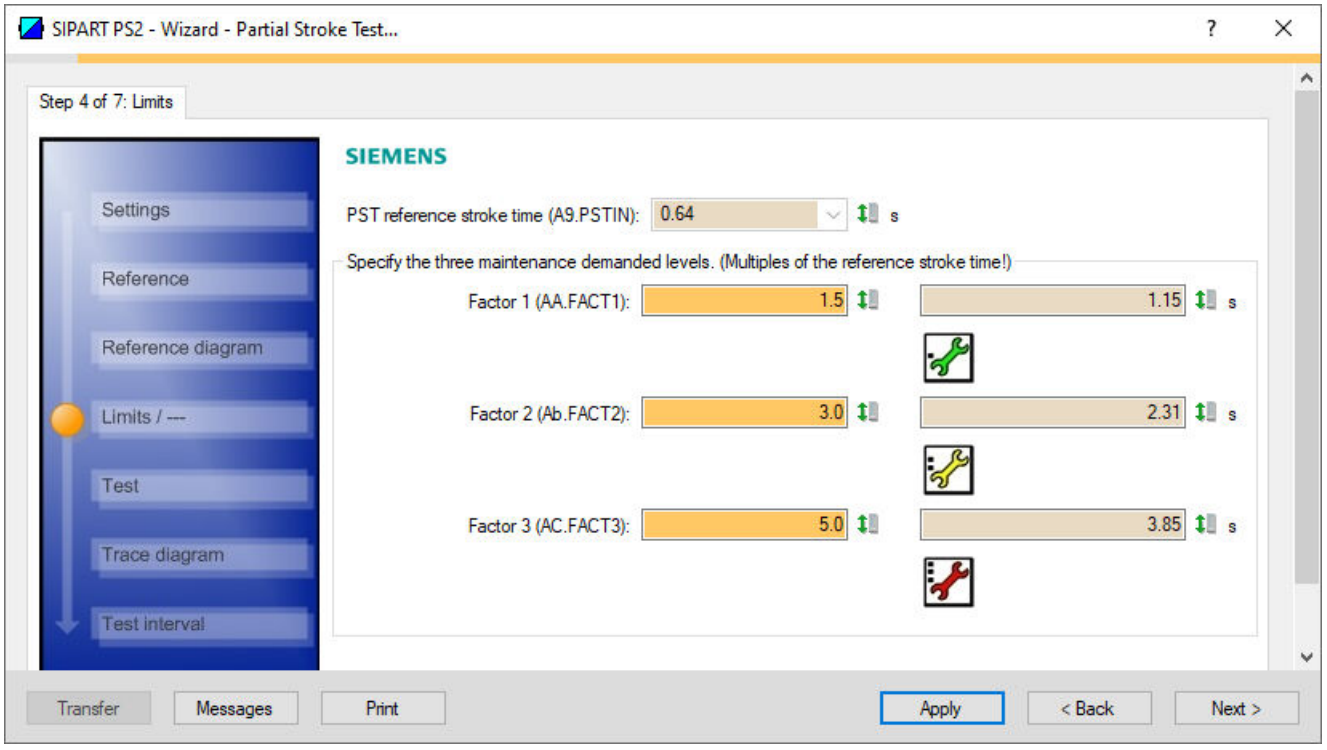
8. Click the "Next >" button.
   ⇒ The "Step 4 of 7: Limits" dialog opens.

## Step 4: Limits

The dialog shows the reference stroke time "A9.PSTIN", the factors 1, 2, 3 and the resulting thresholds for messages when exceeded:

- Threshold 1, e.g. "1.15" s
- Threshold 2, e.g. "2.31" s
- Threshold 3, e.g. "3.85" s

The messages can be output via the digital output, the display or via HART communication.




1. To adjust the thresholds: Change the values of factors 1, 2 and 3.

| **AA.FACT1** | **Factor 1** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in threshold 1 of the process diagnostics. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.5 |

| **Ab.FACT2** | **Factor 2** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in threshold 2 of the process diagnostics. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 3.0 |

| **AC.FACT3** | **Factor 3** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in threshold 3 of the process diagnostics. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 5.0 |

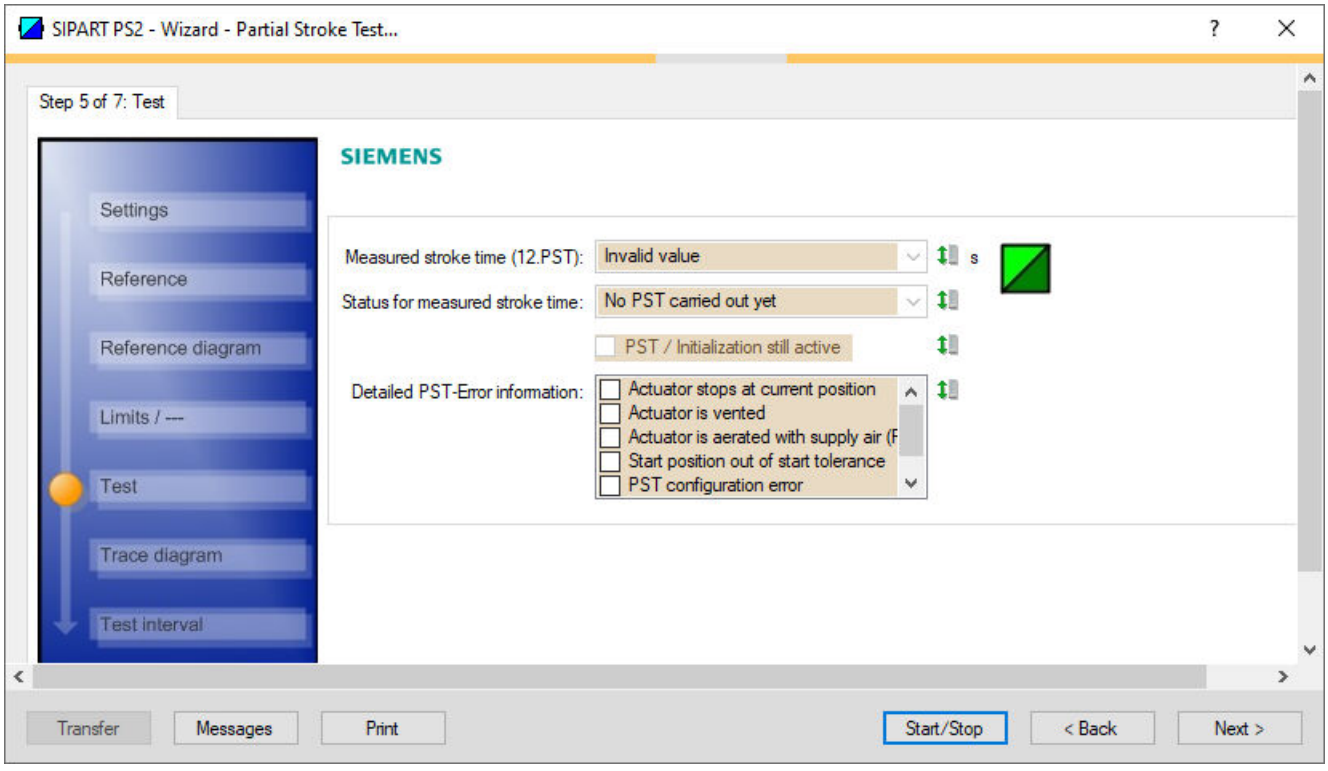
2. Save the changes with the "Transfer" button.
3. Click the "Next >" button.
   ⇒ The "Step 5 of 7: Test" dialog opens.

## Step 5: Test

### Requirement

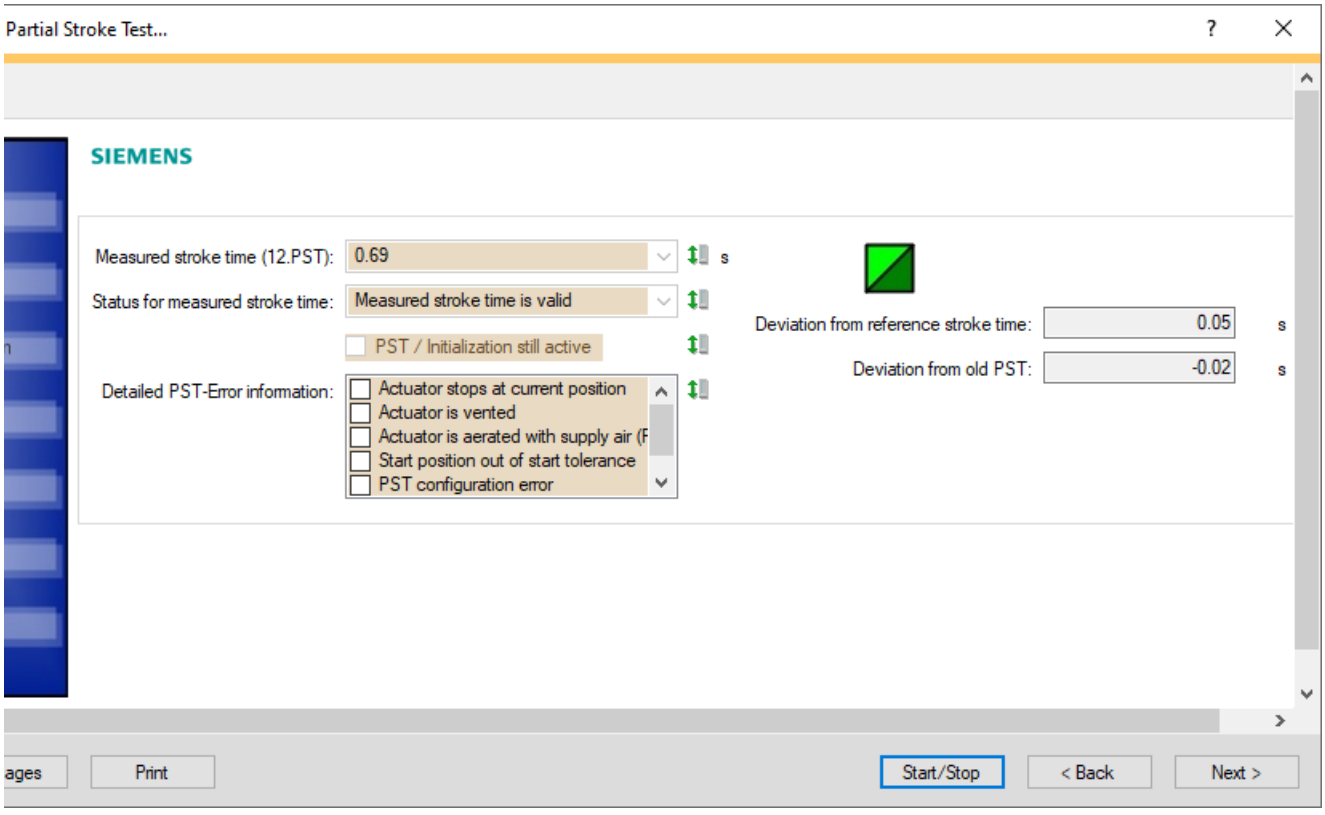
- The PST reference run was performed successfully.
- The actuator of the positioner is at the defined start position "A1.STPOS" ± Start tolerance "A1.STTOL".

### Procedure



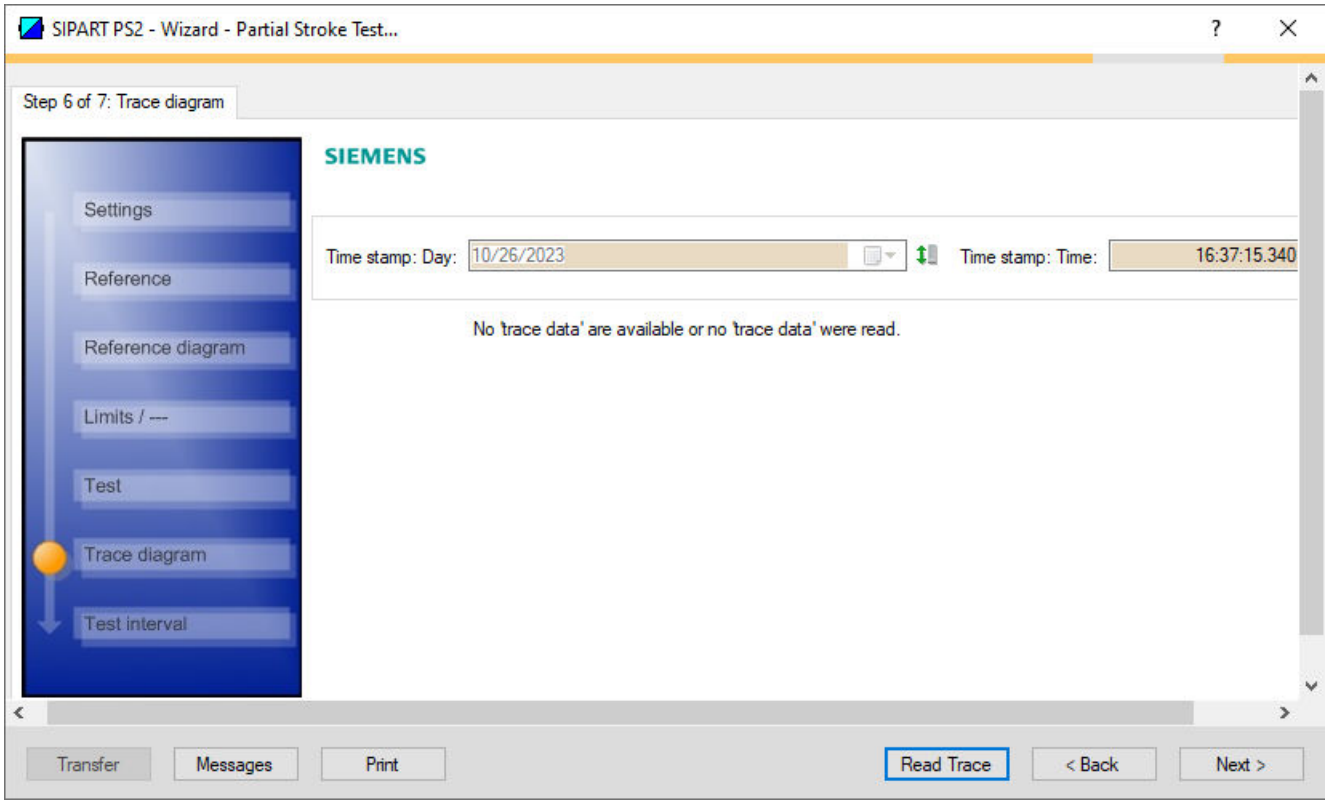
1. Click the "Start/Stop" button.
2. Confirm the start in the following dialog with "OK".
   ⇒ The PST is running.
   ⇒ The status "PST / Initialization still active" is highlighted.
   ⇒ "EXPST" is shown in the display.
   After a successful PST, the following is displayed:
   - Diagnostic value "Measured stroke time" (12.PST), e.g. "0.69 s"
   - Status "Measured stroke time is valid"
   - "Deviation from from reference stroke time" in seconds, e.g. "0.05 s"
   - With an additional PST: "Deviation from old PST" in seconds, e.g. "-0.02 s"

   If the PST fails, the reason is highlighted in the "Detailed PST-Error information" dialog box.



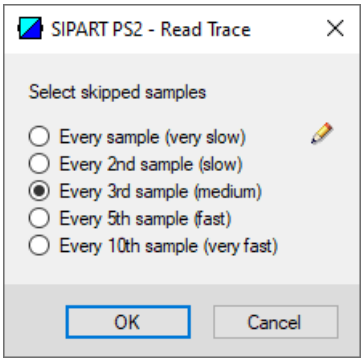

3. Click the "Next >" button.
   ⇒ The "Step 6 of 7: Trace diagram" dialog opens.

### Step 6: Trace chart



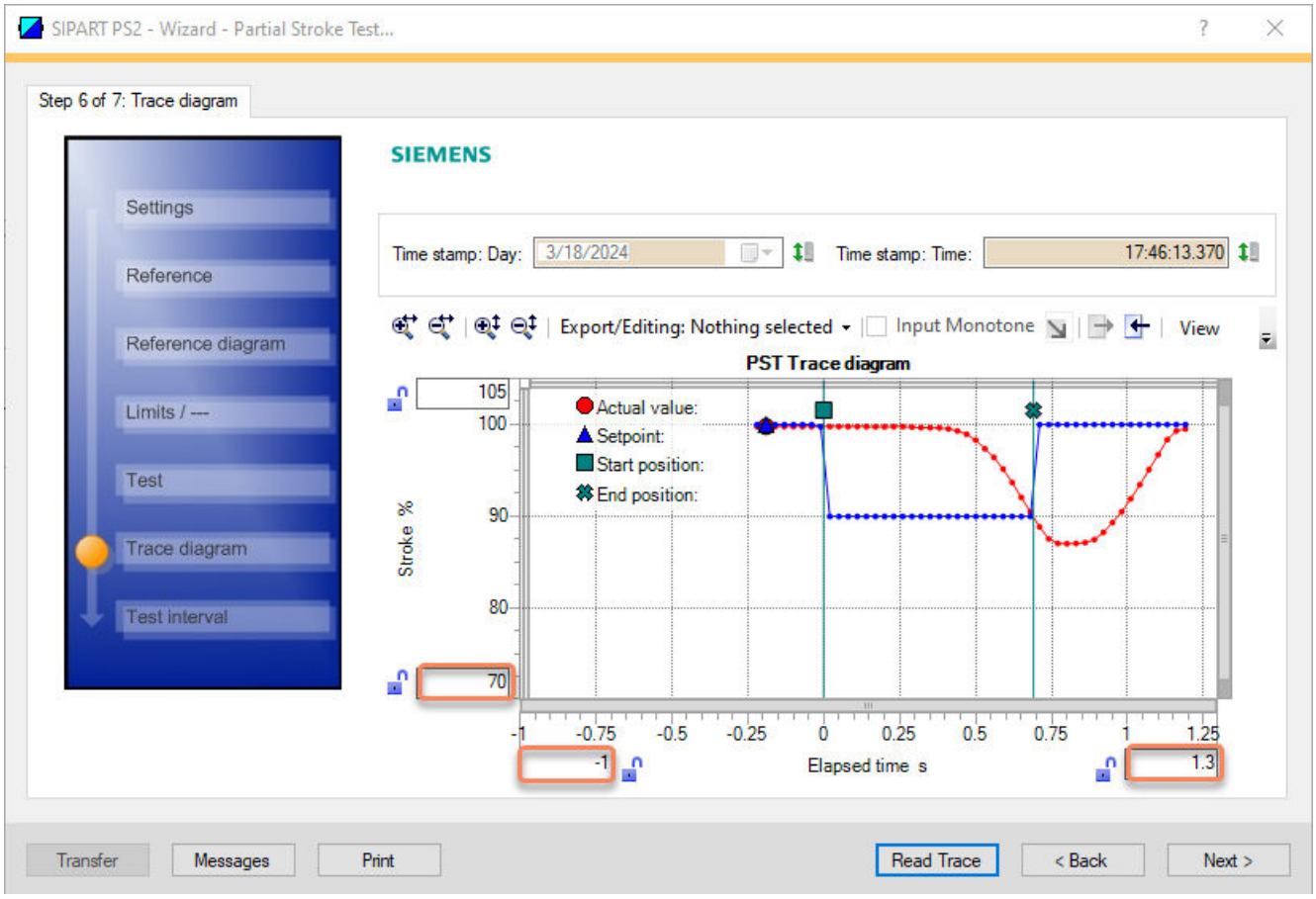

If an immediately preceding PST was executed, the diagram of the previous PST is displayed.

1. Click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




4. Select the option button for the sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.

6. Wait until the status "Finished" is displayed.
7. Close the "Message Log" dialog.
   ⇒ The chart for the current PST is created and displayed.

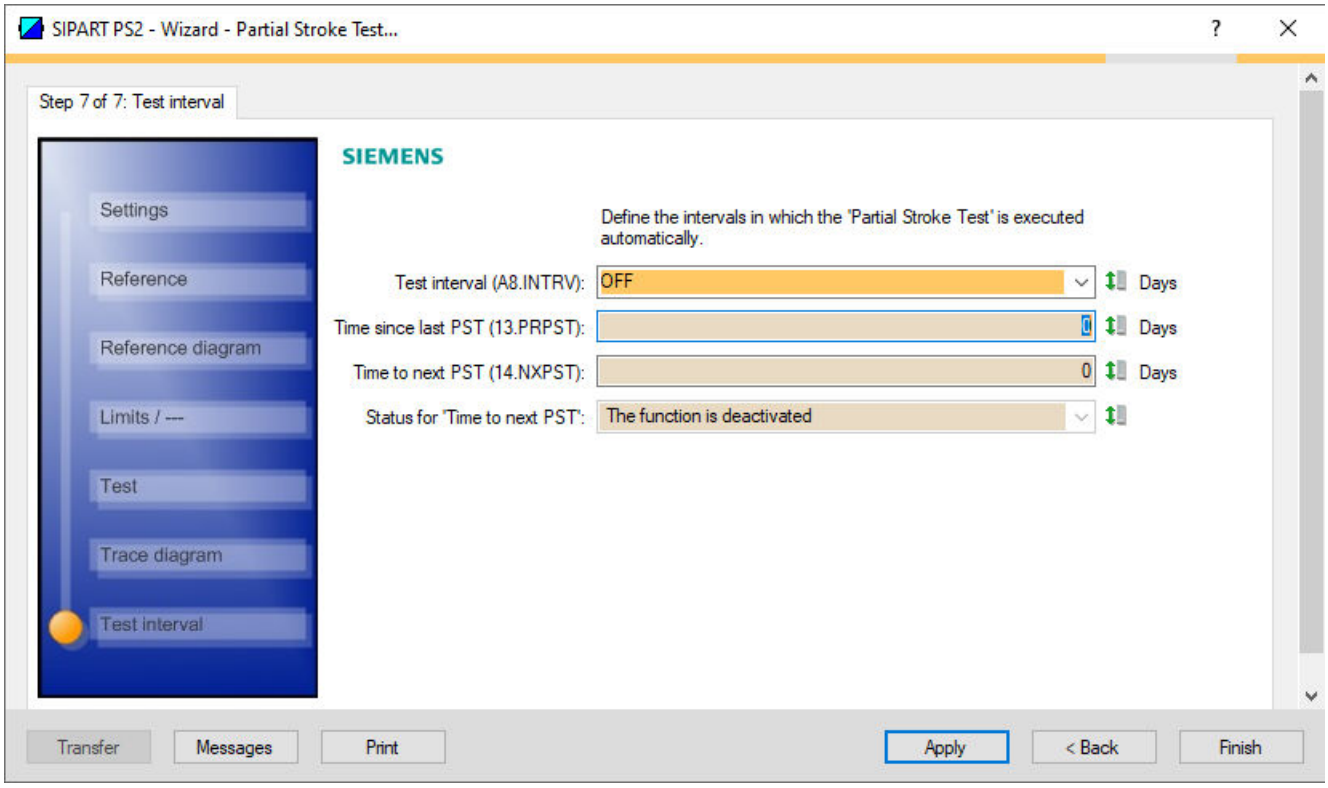



8. Click the "Next >" button.
   ⇒ The "Step 7 of 7: Test intervall" dialog opens.

## Step 7: Test interval

The PST can be started by various actions.

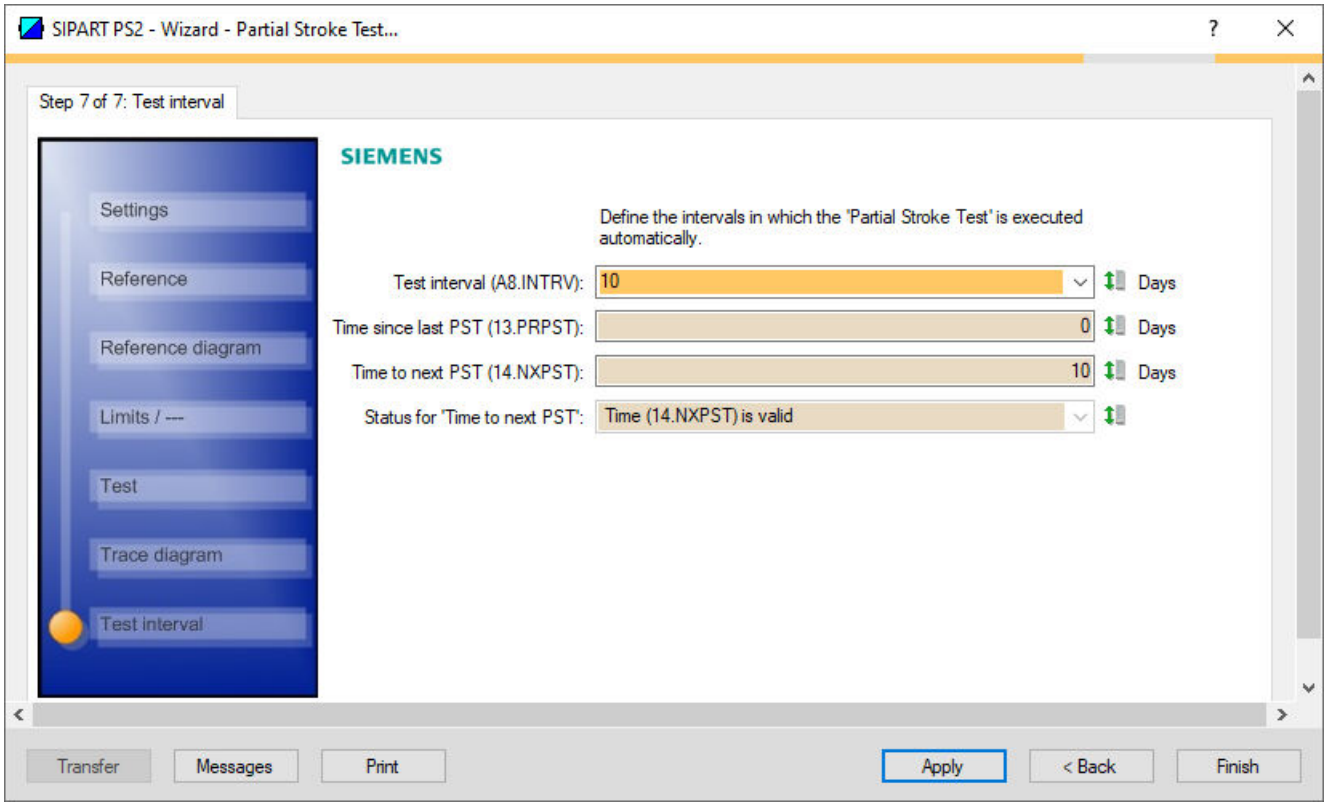
This step describes the internal scheduler that automatically starts the PST.


SIPART PS2 - Wizard - Partial Stroke Test...
Step 7 of 7: Test interval
SIEMENS
Settings
Reference
Reference diagram
Limits / ---
Test
Trace diagram
Test interval
Define the intervals in which the 'Partial Stroke Test' is executed automatically.
Test interval (A8.INTRV): OFF Days
Time since last PST (13.PRPST): 0 Days
Time to next PST (14.NXPST): 0 Days
Status for 'Time to next PST': The function is deactivated
Transfer
Messages
Print
Apply
< Back
Finish

1. Activate the test interval for the regular PST.
   – For the "Test interval" (A8.INTRV), select "<-120 ... 365>".
   – Enter the interval time in days, e.g. "10".

| **A8.INTRV** | **Test interval** | |
|---|---|---|
| Function | The parameter defines the interval time for the cyclic PST. | |
| Setting options | Off | The test interval is deactivated. |
| | 1 ... 365 | The test interval is activated and the interval time is defined in days. |
| Factory setting | Off | |

2. Click the "Apply" button.
   ⇒ The test interval is activated and is executed automatically if the requirements are met.
   Additional displays in the dialog:
   – Diagnostic value "Time since last PST" (13.PRPST), e.g. "0 Days".
   – Diagnostic value "Time to next PST" (14.NXPST), e.g. "10 days".




3. Close the dialog with the "Finish" button.
   ⇒ The diagnostics results and the chart are saved.

### 5.4.4 With SIMATIC PDM: Run PST

#### Requirement

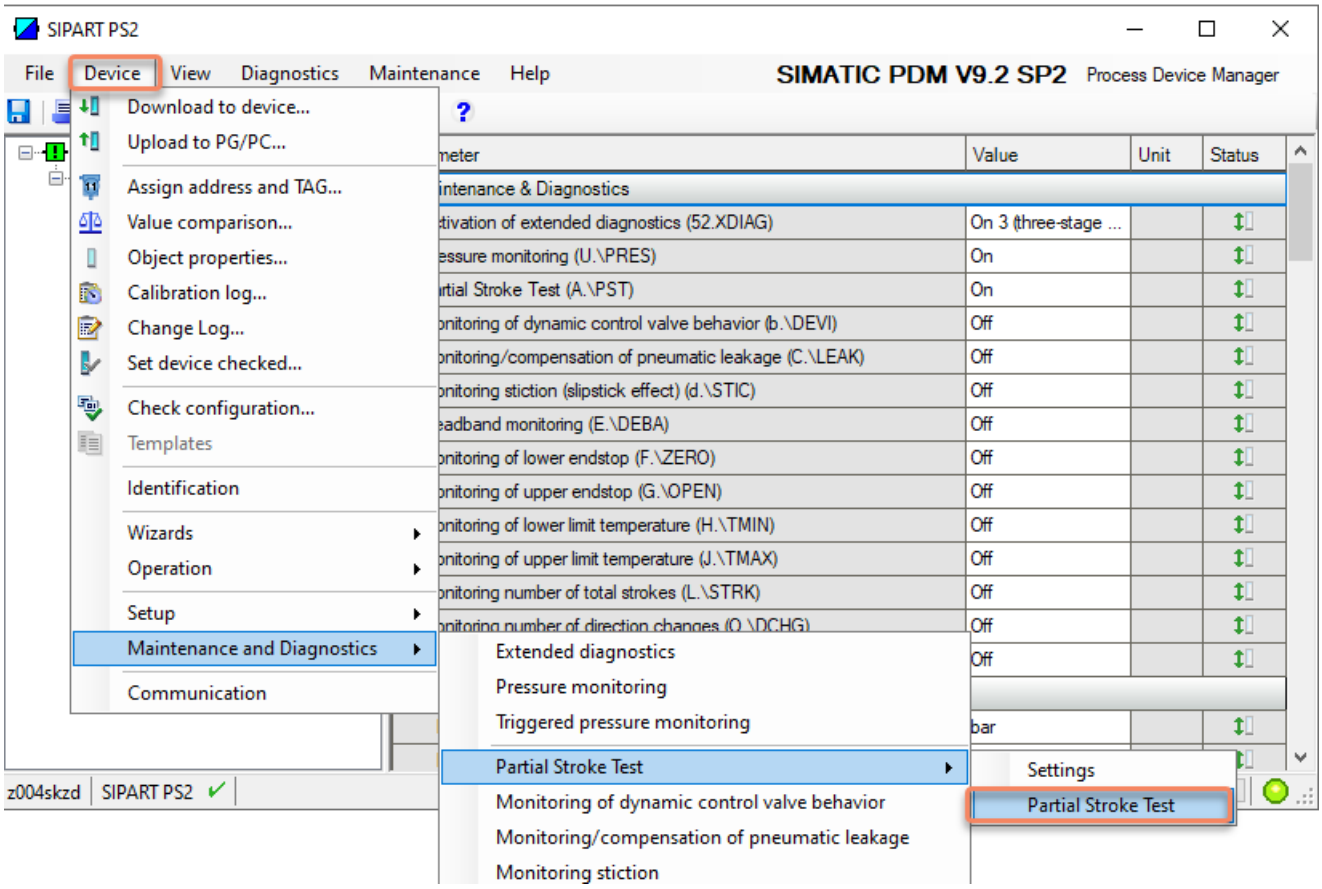
The PST reference run was performed successfully → With SIMATIC PDM: Configure PST with wizard and execute reference run (Page 103)

#### Start SIMATIC PDM

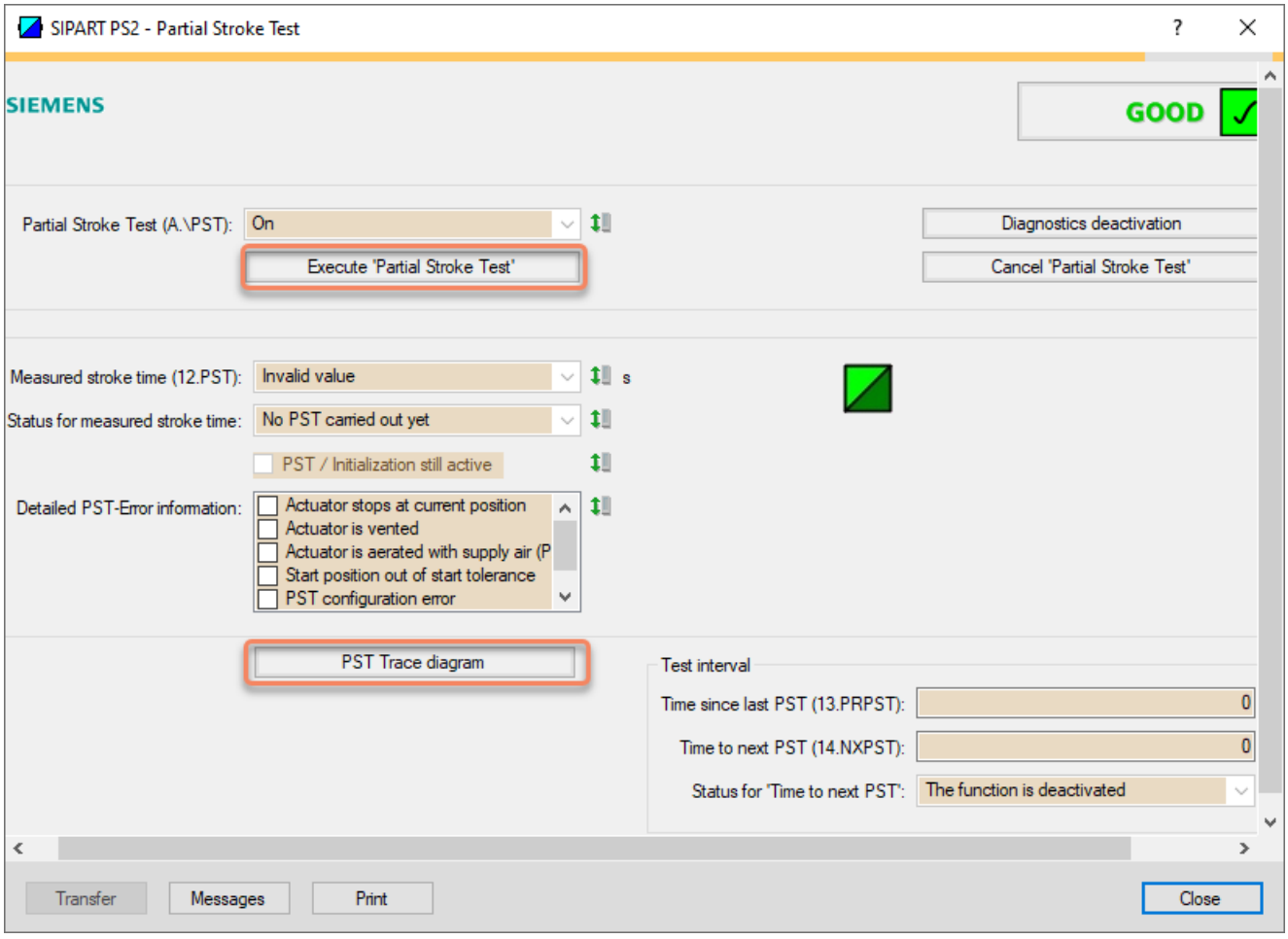
1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".

## Run PST

1. In the "Device" menu, select the command "Maintenance and Diagnostics > Partial Stroke Test > Partial Stroke Test".



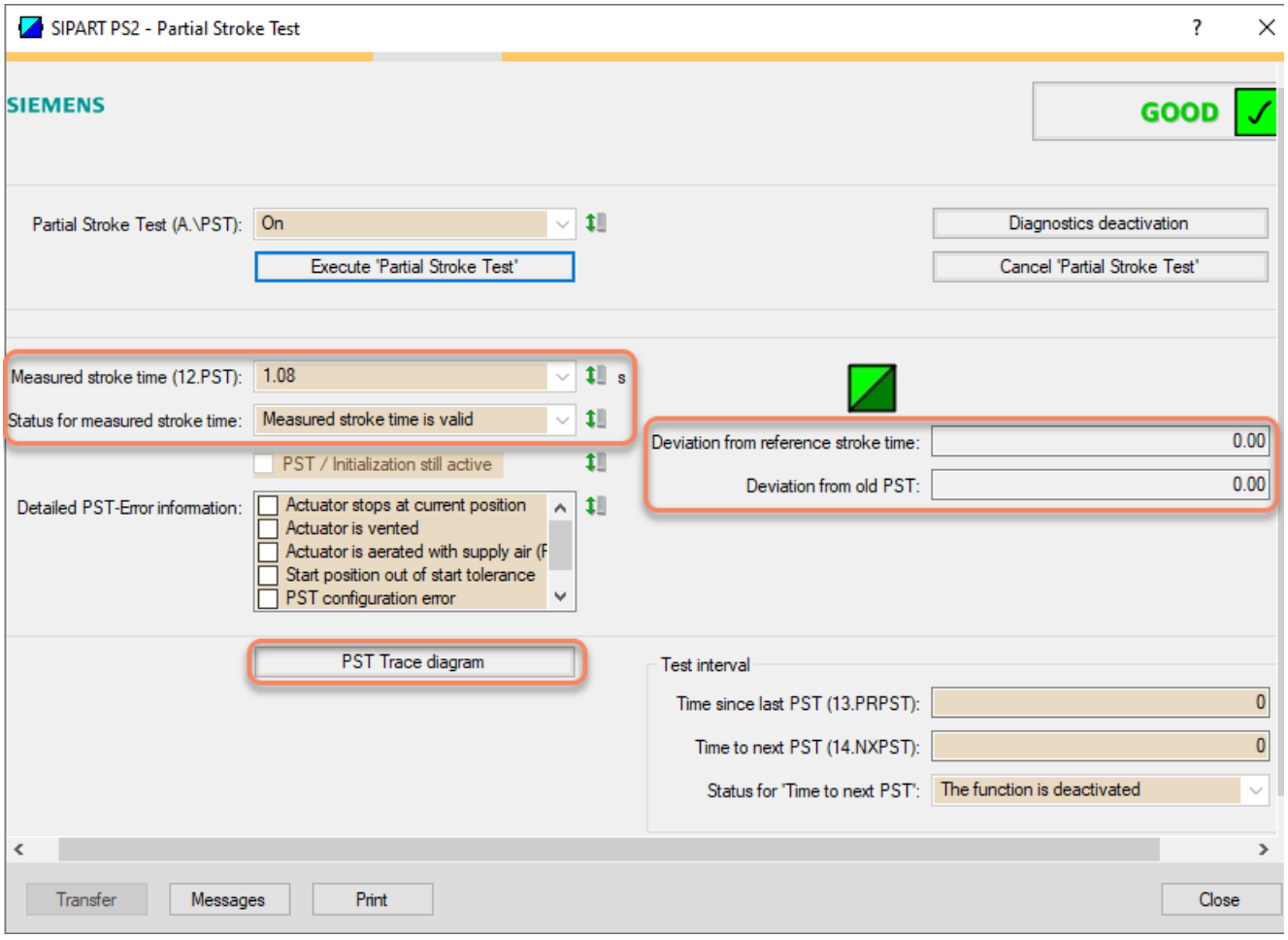

⇒ The "Partial Stroke Test" dialog opens.



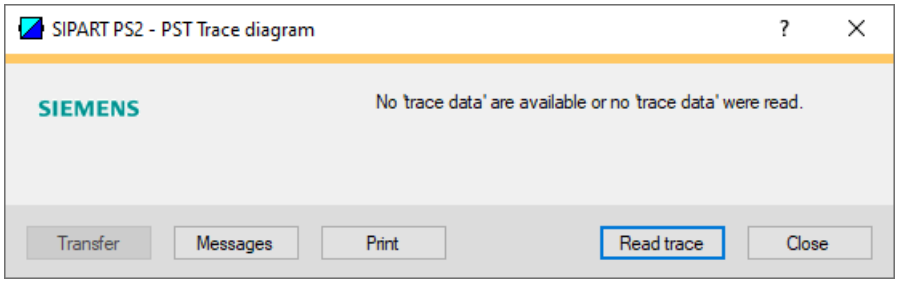

2. Ensure that the actuator is in the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL).

3. Start the PST with the "Execute Partial Stroke Test" button.
   ⇒ The PST starts.
   ⇒ "EXPST" is shown in the display.
   After a successful PST is displayed:
   - Diagnostic value "Measured stroke time" (12.PST), e.g. "1.08 s"
   - Status "Measured stroke time is valid"
   - "Deviation from from reference stroke time", e.g. "0.00 s"
   - With an additional PST: "Deviation from old PST" in seconds, e.g. "0.00 s"

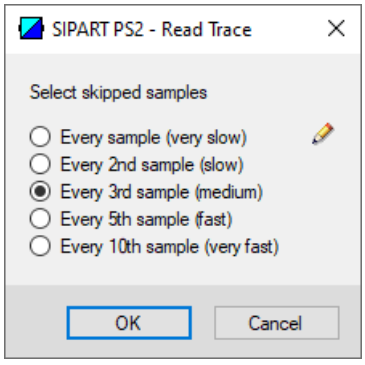
   If the PST fails, the reason is highlighted in the "Detailed PST-Error information" dialog box. If error message "Start position out of start tolerance" occurs: Move the actuator to the defined start position and start the PST again.



4. Click the "PST Trace diagram" button.
   ⇒ The "PST Trace diagram" dialog is displayed.

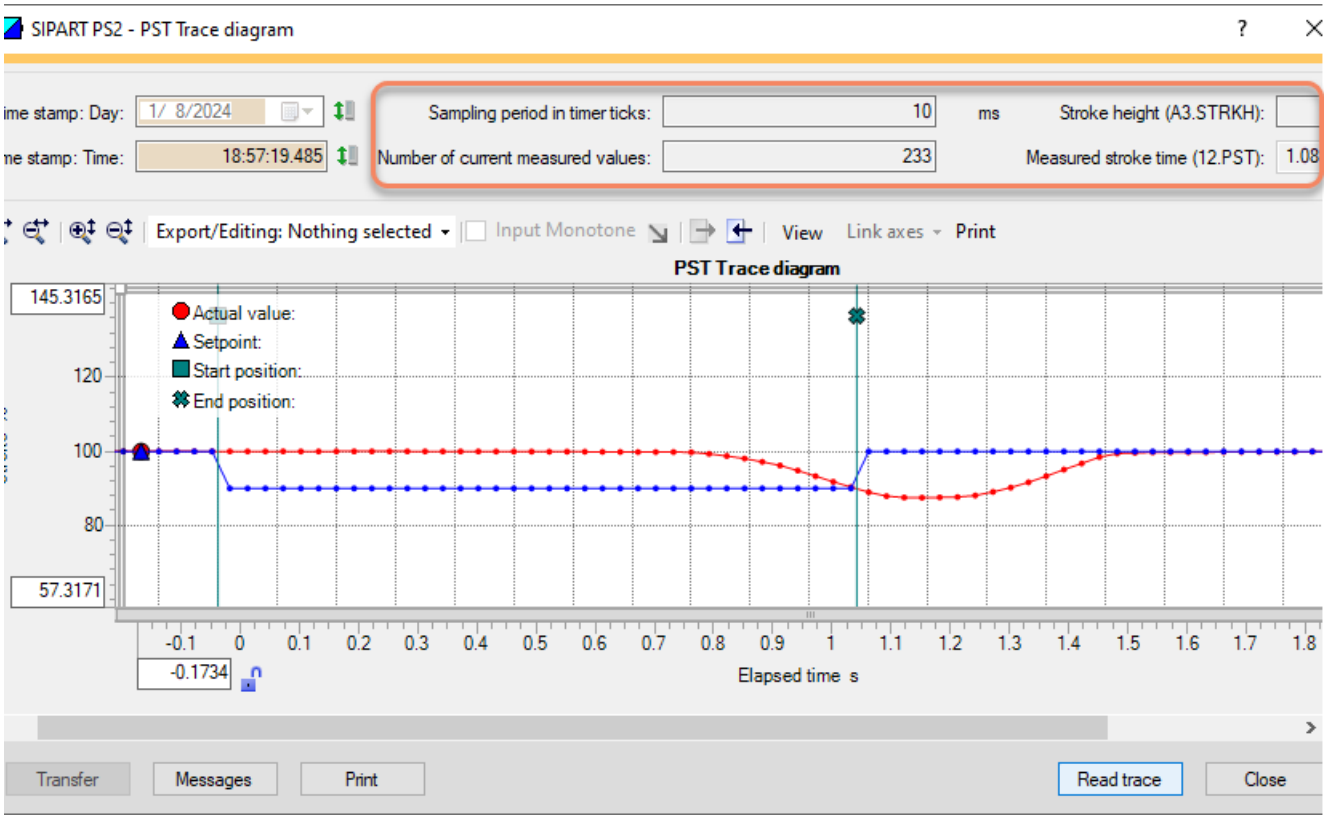



5. To display the PST trace chart, click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
6. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
7. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




   As the HART communication may be slow, it is possible to load the chart data from the positioner in different resolutions.
8. Select the option button for the required sample rate, e.g. "Every 3rd sample (medium)".
9. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
10. Wait until the status "Finished" is displayed.

11. Click the "Close" button.
    ⇒ The trace chart for the current PST is created and displayed.




12. Close the dialog with the "Close" button.
    ⇒ The diagnostics results and the chart are saved.

### 5.4.5 With local operation: Configure PST and execute reference run

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.

## Configuring parameters

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Configure the PST parameters.

| **A1.STPOS** | **Start position** |
|---|---|
| Function | The parameter defines the start position of the PST. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

| **A2.STTOL** | **Start tolerance** |
|---|---|
| Function | The parameter defines the start tolerance of the PST. |
| Note | Example: Start position "100.0", start tolerance "2.0".<br>• During the PST reference run, the actuator moves from the current position to the start position. When the position 98% is exceeded, the start position is considered reached.<br>• The PST only starts when the actuator is between the positions 98% and 102%. |
| Setting range | 0.1 ... 10.0 |
| Factory setting | 2.0 |
| Unit | % |

| **A3.STRKH** | **Stroke height** |
|---|---|
| Function | The parameter defines the control range of the PST. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 10.0 |
| Unit | % |

| **A4.STRKD** | **Stroke direction** | |
|---|---|---|
| Function | The parameter defines the actuating direction of the PST. | |
| Setting options | uP | The actuator only moves towards the 100% position:<br>• The positioner moves the actuator from the start position to the upper target position and measures the time.<br>• After reaching the upper target position, the actuator moves back to the start position.<br>Upper target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) + Stroke height (A3.STRKH) |
| | do | The actuator only moves towards the 0% position:<br>• The positioner moves the actuator from the start position to the lower target position and measures the time.<br>• After reaching the lower target position, the actuator moves back to the start position.<br>Low target position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) - Stroke height (A3.STRKH) |
| | uP do | The actuator moves in both directions:<br>• The positioner moves the actuator from the start position to the upper target position and measures the time.<br>• After reaching the upper target position, the positioner moves the actuator to the lower target position and measures the time.<br>• After reaching the lower target position, the actuator moves back to the start position.<br>Setpoint position = Start position (A1.STPOS) ± Start tolerance (A2.STTOL) ± Stroke height (A3.STRKH) |
| Factory setting | do | |

| **A5.RPMD** | **Ramp mode** | |
|---|---|---|
| Function | The parameter activates ramp mode.<br>The ramp mode can be used to influence the actuating speed and thus the duration of the PST. This can reduce the impact on the process. | |
| Setting options | OFF | Ramp mode is deactivated.<br>The PST is without control. |
| | On | Ramp mode is activated.<br>The PST is executed with the ramp rate according to "A6.RPRT" parameter. |
| Factory setting | OFF | |

| **A6.RPRT** | **Ramp rate** |
|---|---|
| Function | The ramp rate defines the duration of the PST:<br>• Smaller values extend the duration.<br>• Larger values shorten the duration. |
| Note | The ramp rate refers to the total stroke of the valve.<br>Example: The setting "10.0" means that the PST is executed with a travel of 10% per second. |

| **A6.RPRT** | **Ramp rate** |
|---|---|
| Requirement | The "Ramp mode" (A5.RPMD) parameter is activated. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.0 |
| Unit | %/s |

| **A7.FLBH** | **Behavior after failed PST** | |
|---|---|---|
| Function | The parameter defines the behavior of the positioner for a failed PST. | |
| Note | Example of failed PST: The threshold assigned with "Factor 3" (AC.FACT3) has been exceeded. | |
| Setting options | Auto | Switch to "Automatic (AUT)" mode. "AUT" is shown in the display. |
| | HoLd | Hold current position. |
| | AirIn | Aerate actuator with supply pressure PZ. |
| | AirOu | Vent actuator. |
| Factory setting | Auto | |

| **A8.INTRV** | **Test interval** | |
|---|---|---|
| Function | The parameter defines the interval time for the cyclic PST. | |
| Setting options | OFF | The test interval is deactivated. |
| | 1 ... 365 | The test interval is activated and the interval time is defined in days. |
| Factory setting | OFF | |

| **AA.FACT1** | **Factor 1** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in threshold 1 of the PST. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.5 |

| **Ab.FACT2** | **Factor 2** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in the threshold 2 of the PST. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 3.0 |

| **AC.FACT3** | **Factor 3** |
|---|---|
| Function | This factor multiplied by the reference stroke time "A9.PSTIN" results in the threshold 3 of the PST. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 5.0 |

3. Switch the positioner to "Manual mode (MAN)" by pressing the button for at least 5 seconds.

### Perform PST reference run

1. Select the "A9.PSTIN" parameter.
   When the following status is displayed in the top line of the display, the PST reference run can be started:

   – "C #,##", e.g. "C 0.7".

   If the status display is different, the PST reference run cannot be started.

| **A9.PSTIN** | **Start reference PST** | |
|---|---|---|
| Function | The parameter shows the status of the PST reference run and the calculated or measured reference stroke time for the travel from the PST start position (A1.STPOS) to the PST setpoint position. | |
| Status displays | noIni | Positioner has not yet been initialized. |
| | C ##.# | • Calculated: If the positioner has already been initialized, the calculated average travel time of the control valve is displayed, e.g. "0.7".<br>• The PST reference run has not yet been performed or the PST parameters have been changed. |
| | rEAL | The PST reference run is activated. |
| | INPST | The PST reference run is in progress. |
| | ###.# | Reference stroke time in seconds: The PST reference run was completed successfully. |
| | C-Err | Configuration error |
| | FdIni | Failed PST initialization. |
| | SdrEF | The PST reference run was canceled. |
| Factory setting | noIni | |

2. Press the ⚠ button for at least 5 seconds and the display will show "rEAL".
   ⇒ The PST reference run starts.
   ⇒ "INPST" is shown in the display.
3. Wait until the reference run is completed.
   ⇒ If the display shows a numerical value, e.g. "0.9", the PST reference run has been successfully completed.

### 5.4.6 With local operation: Run PST

**Requirement**

- The PST reference run was performed successfully → With local operation: Configure PST and execute reference run (Page 125).
- The positioner is in "Automatic (AUT)" mode.
- The actuator of the positioner is at the defined start position "A1.STPOS" ± Start tolerance "A2.STTOL".

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "12.PST".
3. Press the button for at least 5 seconds and the display will show "Strt".
   ⇒ The PST starts. "WAIt" is shown in the display.
   ⇒ During PST execution, the display shows "EXPST".
   The PST can be interrupted by pressing the button again.
4. Wait until PST is finished
   ⇒ After the successful PST, the display shows the measured time in seconds.

## 5.4.7 Via digital contacts: Start PST

### Requirement

The digital input DI2 is only available for positioners with Digital I/O Module (DIO).

### Activate and start digital input PST

The PST can be started via the digital input DI1 or DI2.

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Select the application parameter "42.DI1 - Digital input 1 function" or "43.DI2 - Digital input 2 function".
3. Set the parameter to one of the following values according to the actuation:
   - When actuated with a NO contact ("Normally Open"): "PST"
   - When actuated with a NC contact ("Normally Closed"): "-PST"

   ⇒ The digital input is activated for the PST activated.
4. Switch the positioner to "Manual (MAN)" mode by pressing the button on the display simultaneously for at least 5 seconds.
5. Switch the positioner to "Automatic (AUT)" mode by pressing the button.
   ⇒ Activating the connected NC contact or NO contact starts the PST.

### 5.4.8 Via HART communication: Start PST

**Requirement**

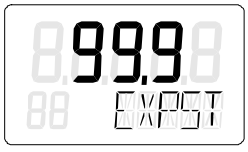
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52..

**Start PST**

Send to the positioner via HART communication:

- "#172" command
- Byte 0, Bit 5 and Byte 1, Bit 0

⇒ The PST starts and the display shows "EXPST".




**Cancel PST**

Send to the positioner via HART communication:

- "#172" command
- Byte 0, Bit 5 and Byte 1, Bit 1

## 5.4.9 Diagnostic value "PST status / Measured time" (12.PST)

| **Diagnostic value** | **Status PST / Measured time**<br>**Short designation: 12.PST** | |
|---|---|---|
| Function | The diagnostic value shows one of the following values:<br>• Status of the last Partial Stroke Tests (PST)<br>• If PST is successful: The measured time | |
| Note | The PST can be started manually with this diagnostic value → With local operation: Run PST (Page 130).<br>Requirement for PST:<br>Successful PST reference run → With local operation: Configure PST and execute reference run (Page 125) | |
| Status messages at the start of the PST | notoL | No Tolerance: The actuator is outside the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL). The PST does not start. |
| | Strt | Start: After 5 seconds, manual PST is started. |
| | WAIt | Wait: The PST is being executed. |
| Status/display options | OFF | The PST function is deactivated. |
| | C-ERR | Configuration error:<br>• PST cannot be started.<br>• The settings in the parameters "Start position" (A1.STPOS), "Stroke height" (A3.STRKH) and "Stroke direction" (A4.STRKD) are not plausible. |
| | FdIni | Failed PST Initialization: The PST reference run has failed. |
| | norEF | The PST reference run has not yet been performed. |
| | notSt | No Test: The PST has not yet been performed |
| | ###.# | Measured travel time (stroke time) of the PST in seconds.<br>The last PST was successfully executed. |
| | SdtSt | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed. |
| Factory setting | OFF | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_current_val |
| | Label | Measured stroke time (12.PST) |
| | DisplayValue | ≙ Value, e.g. "0.69" |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 0 ... 11<br>Format and meaning: → Via HART communication: Read out diagnostic results (Page 135) |

### 5.4.10 Diagnostic value " - Time since last Partial Stroke Test" (13.PRPST)

| **Diagnostic value** | **Time since last Partial Stroke Test**<br>**Short designation: 13.PRPST** | |
|---|---|---|
| Function | The diagnostic value shows the time since the last Partial Stroke Test (PST) in days or the status. | |
| Display options | ### | Days since the last PST |
| | notSt | No Test: The PST has not yet been performed |
| | norEF | The PST reference run has not yet been performed. |
| | Sdtst | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_prev_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 12 ... 15<br>Format: Float |

### 5.4.11 Diagnostic value "Time until next Partial Stroke Test" (14.NXPST)

| **Diagnostic value** | **Time to next Partial Stroke Test**<br>**Short designation: 14.NXPST** | |
|---|---|---|
| Function | The diagnostic value shows the time until the next Partial Stroke Test (PST) in days. | |
| Requirement | • The PST is activated in "Configuration" mode.<br>• A test interval is set in the "A8.INTRV" parameter. | |
| Display options | Off | Factory setting or unfulfilled requirement |
| | ### | Days until next PST |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_next_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 17 ... 20<br>Format: Float |

## 5.4.12 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52..
- The PST was executed.

### Procedure

Send to the positioner via HART communication:

- "#171" command

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-3 Response Data Bytes

| Byte | Format | Description | |
|---|---|---|---|
| 0 | Bits | PST State | |
| | | 0x01 | PST not yet initialized |
| | | 0x02 | PST initialization failed |
| | | 0x04 | PST initialization OK |
| | | 0x08 | No PST |
| | | 0x10 | PST stopped |
| | | 0x20 | PST fault |
| | | 0x40 | PST valid |
| | | 0x80 | PST / Initialization still active |
| 1 | Unsigned-8 | PST Error Byte | |
| | | Bit 0 | Actuator is held on actual position |
| | | Bit 1 | Actuator is deaerated |
| | | Bit 2 | Actuator is vented with full system pressure (PZ) |
| | | Bit 3 | Start position out of tolerance |
| | | Bit 4 | Configuration error |
| 2 ... 5 | Float | PST Reference Step Time | |
| 6 | Bits | PST Reference Step Time State | |
| | | 0x00 | Measurement of Reference stroke time failed |
| | | 0x01 | Device not initialized / Reference stroke time estimated |
| | | 0x02 | Reference stroke time measured |
| 7 ... 10 | Float | Partial Stroke Test Time | |

| Byte | Format | Description | |
|---|---|---|---|
| 11 | Bits | Partial Stroke Test Time State | |
| | | 0x00 | No PST carried out yet |
| | | 0x01 | PST interrupted |
| | | 0x01 | PST failed |
| | | 0x03 | Measured stroke time is valid |
| 12 ... 15 | Float | Time since the last Partial Stroke Test | |
| 16 | Bits | State of Time since the last Partial Stroke Test | |
| | | 0x00 | Function is deactivated |
| | | 0x01 | Time is valid |
| 17 ... 20 | Float | Time until the next Partial Stroke Test | |

Table 5-4 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |

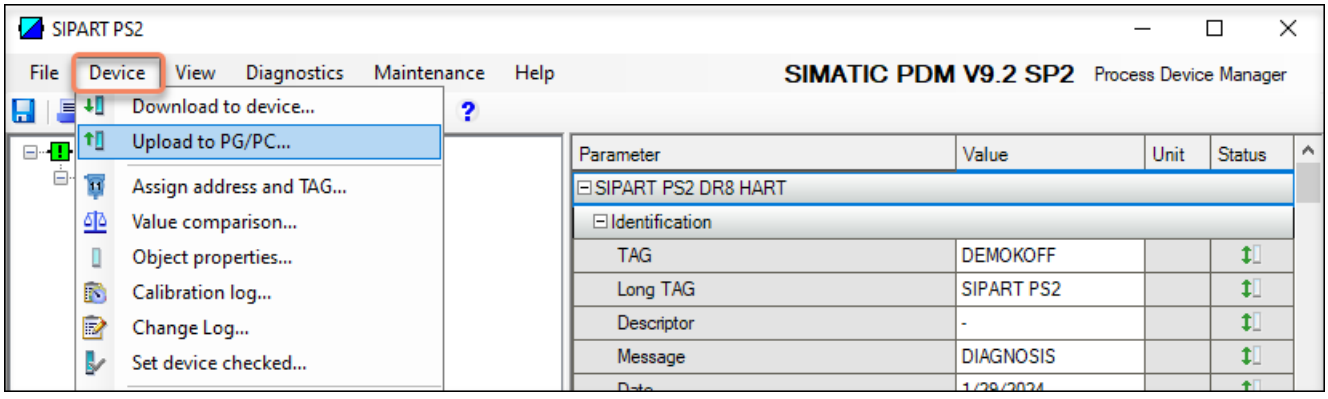
## 5.4.13 With SIMATIC PDM: Export diagnostics results

### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The PST was executed and the trace charts were displayed → With SIMATIC PDM: Run PST (Page 119).

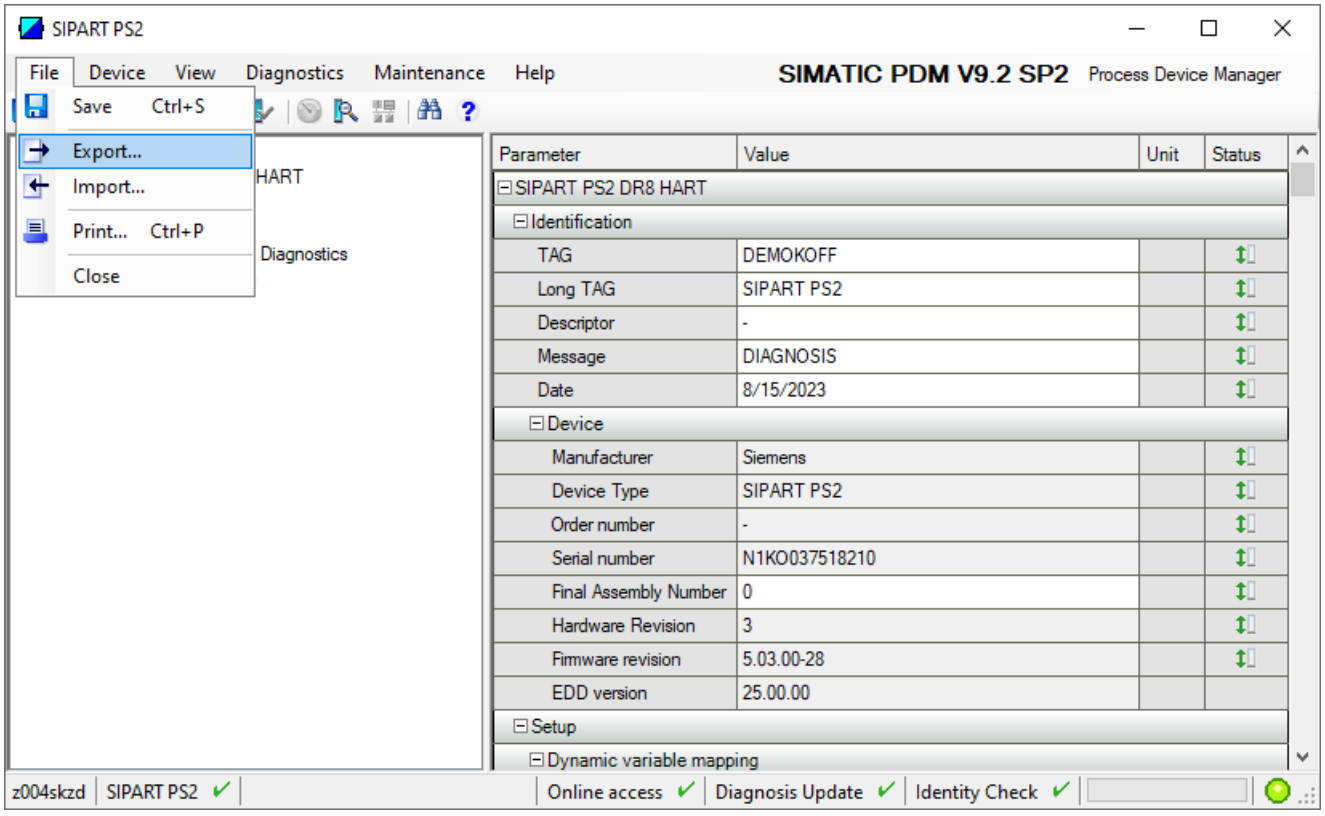
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



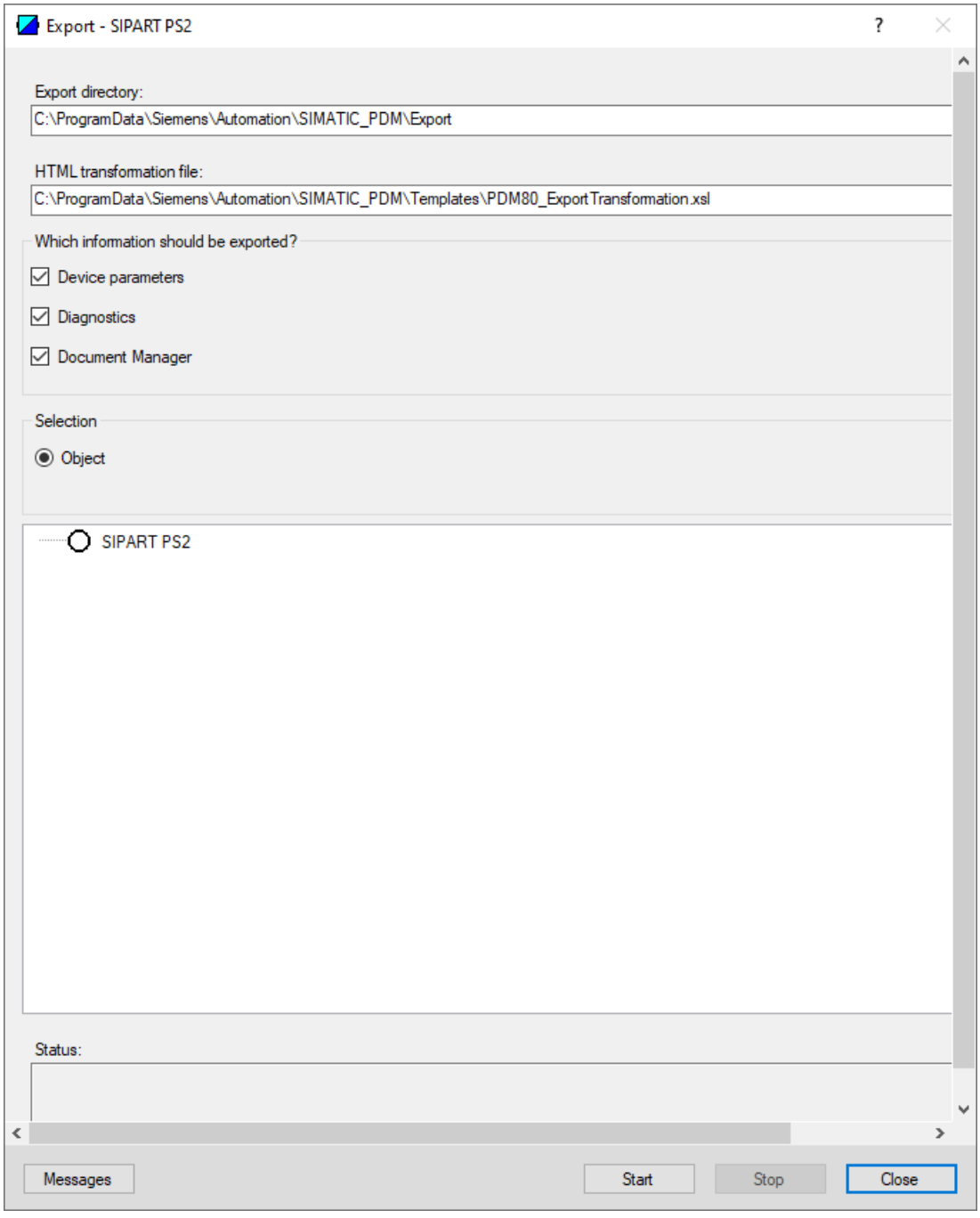

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "File" menu, select the "Export..." command.



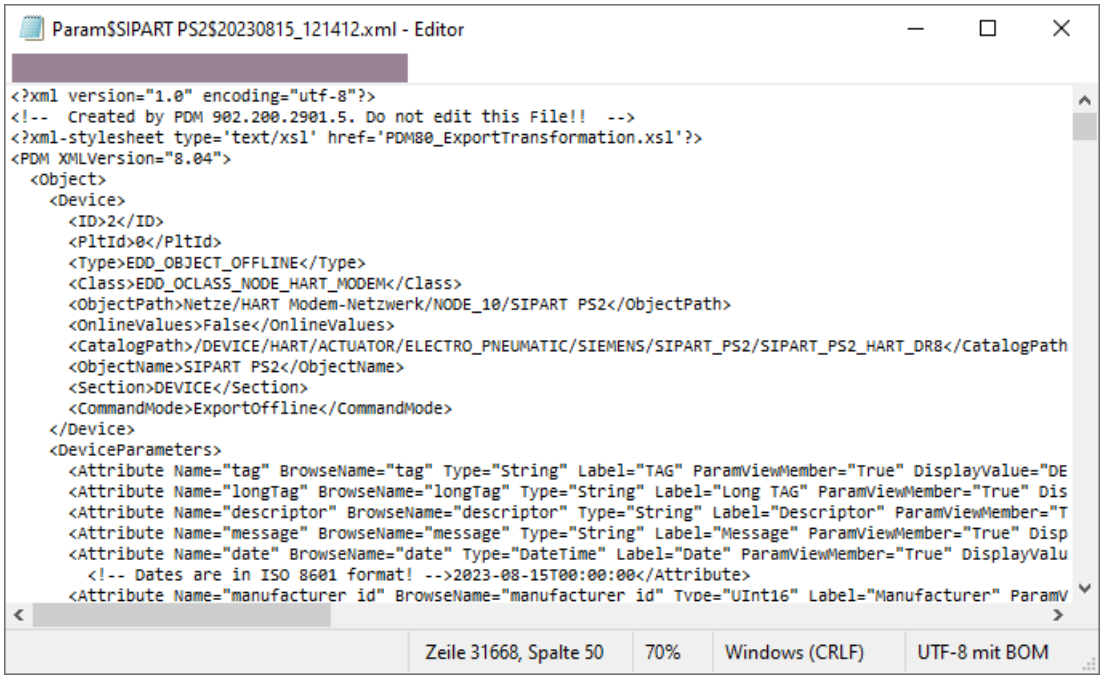

⇒ The "Export - ..." dialog opens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.

9. Wait until the status "Export: Action finished" is displayed.
   The following 2 files are stored in the export path:
   - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
   - XSL stylesheet "PDM80_ExportTransformation.xsl"
10. Close the dialog.
11. Open the XML file with suitable software, e.g. editor.




The XML file contains the following diagnostic data for the PST.

Table 5-5 Parameter

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| A1.STPOS | ps2_pst_start_pos | Start position (A1.STPOS) | 100.0 | % |
| A2.STTOL | ps2_pst_start_tol | Start tolerance (A2.STTOL) | 2.0 | % |
| A3.STRKH | ps2_pst_step_val | Stroke height (A3.STRKH) | 10.0 | % |
| A4.STRKD | ps2_pst_step_dir | Stroke direction (A4.STRKD) | DO (down only) | - |
| A5.RPMD | var_pst_ramp_mode | Ramp mode (A5.RPMD) | Off | - |
| A6.RPRT | var_pst_ramp_rate | Ramp rate (A6.RPRT) | 1.0 | %/s |
| A7.FLBH | var_pst_failure_behavior | Behavior after failed PST (A7.FLBH) | No reaction --> 'Automatic (Auto)' mode | - |
| AA.FACT1 | ps2_pst_factor_1 | Factor 1 (AA.FACT1) | 1.5 | - |
| Ab.FACT2 | ps2_pst_factor_2 | Factor 2 (Ab.FACT2) | 3.0 | - |
| AC.FACT3 | ps2_pst_factor_3 | Factor 3 (AC.FACT3) | 5.0 | - |

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | Name | Label | DisplayValue e.g. | Unit |
| A8.INTRV | ps2_pst_inter_val | Test interval (A8.INTRV) | OFF | • OFF<br>• Days |
| A9.PSTIN | ps2_pst_step_time | PST reference stroke time (A9.PSTIN) | 0.64 | s |

Table 5-6 Diagnostics results

| Diagnostic value/ <Parameter> | Data description in the XML file | | | |
|---|---|---|---|---|
| | Name | Label | DisplayValue e.g. | Unit |
| 12.PST<br><Last PST> | ps2_pst_current_val | Measured stroke time (12.PST) | 0.69 | s |
| 13.PRPST | ps2_pst_prev_time | Time since last PST (13.PRPST) | 0 | Days |
| 14.NXPST | ps2_pst_next_time | Time to next PST (14.NXPST) | 0 | Days |
| <PST reference run> | var_PST_REF_TimeStamp_Date | Time stamp: Day | 1/31/2024<br><mm/dd/yyyy> | - |
| | var_PST_REF_TimeStamp_Time | Time stamp: Time | 14:55:12.000 | - |
| | ps2_pst_step_time_status | Status for reference stroke time | Reference stroke time measured | - |
| <Last PST> | var_PST_TimeStamp_Date | Time stamp: Day | 1/31/2024<br><mm/dd/yyyy> | |
| | var_PST_TimeStamp_Time | Time stamp: Time | 15:10:02.000 | - |
| | ps2_pst_current_status | Status for measured stroke time | Measured stroke time is valid | - |
| <Deviation between "Measured stroke time (12.PST)" and "PST reference stroke time (A9.PSTIN)"> | par_delta_pst_and_rfz_new | Deviation from reference stroke time | 0.05 | s |

## 5.4.14 Messages

### 5.4.14.1 General information

**Requirement**

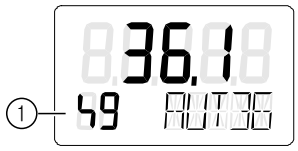
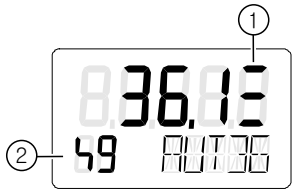
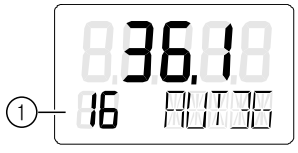
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.

**Notes**

If the limits are exceeded:

- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.4.14.2 Messages in the display

| Display | | Possible cause |
|---|---|---|
|  | ① Error code 9 | The actuator is outside the defined start position "A1.STPOS" ± start tolerance "A1.STPOS".<br>The PST does not start. |
|  | ① 1 bar<br>② Error code 9 | The PST measured stroke time exceeds the set threshold 1. |
|  | ① 2 bars<br>② Error code 9 | The PST stroke time exceeds the set threshold 2. |
|  | ① 3 bars<br>② Error code 9 | The PST measured stroke time exceeds the set threshold 3. |
|  | ① Error code 16 | The combination of the parameter values "A1.STPOS", "A3.STRKH" and "A4.STRKD" is not plausible.<br>The PST does not start. |

If the set thresholds are exceeded, error code "9" is output.

If several messages are present at the same time, the display switches between the different error codes.

### 5.4.14.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

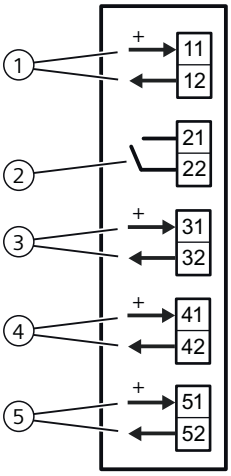
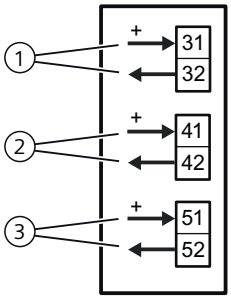
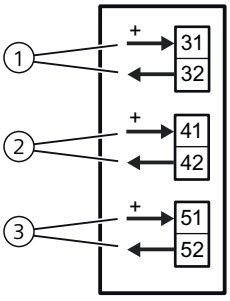
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

## I/Os

| **Digital I/O Module (DIO)<br>6DR4004-6A / -8A** | **Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS)<br>6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

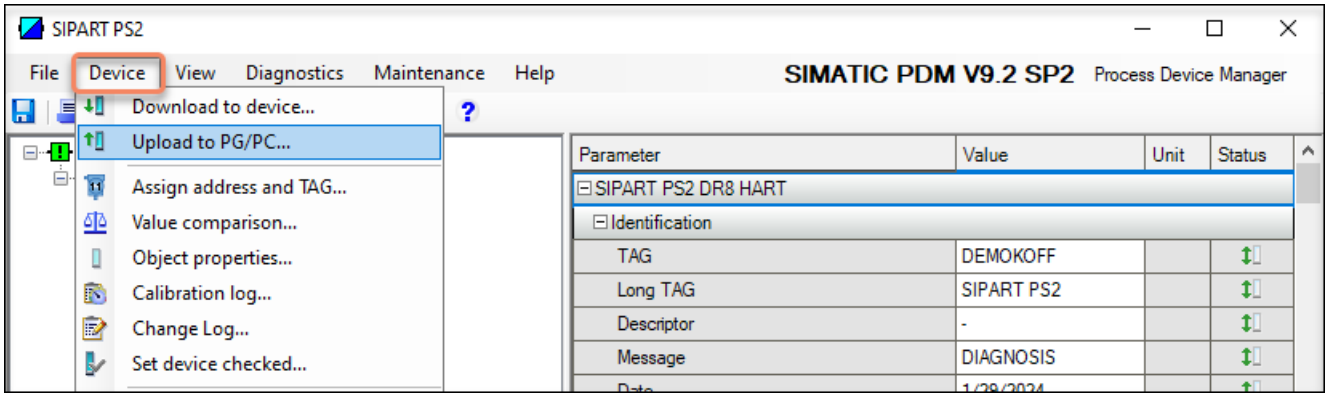
### 5.4.14.4 With SIMATIC PDM: Display PST status

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

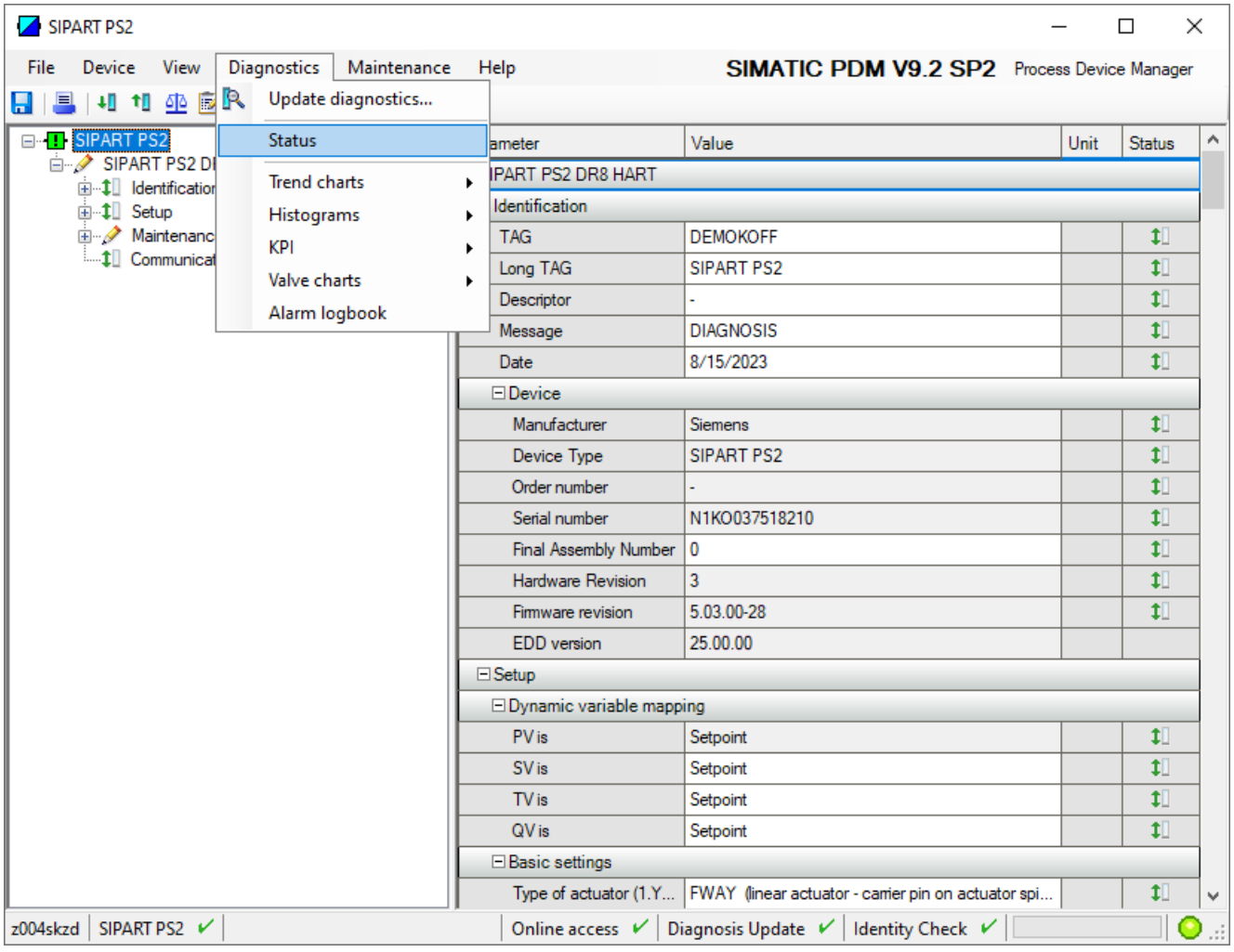
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

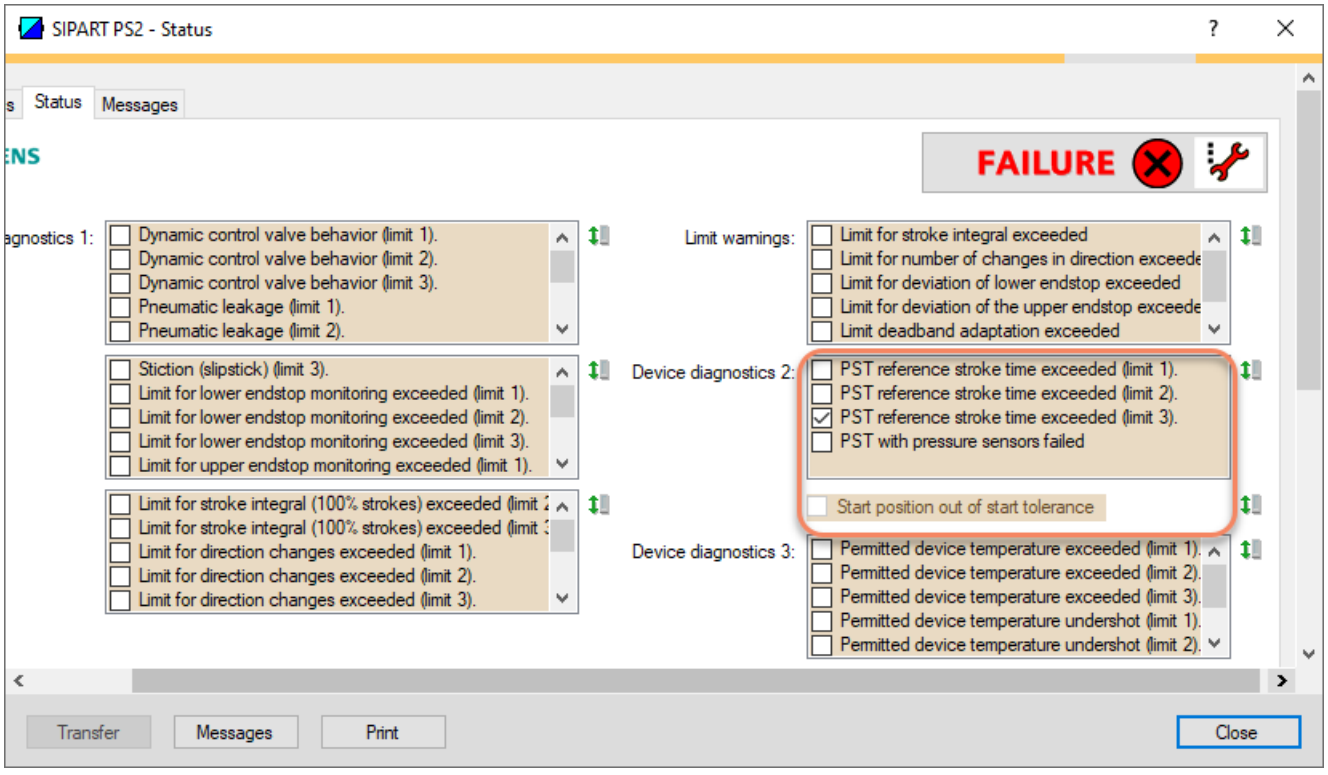



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the command "Status".



7. Select the "Status" tab.
   If a threshold is exceeded, the corresponding message is highlighted:
   - PST reference stroke time exceeded (limit x)
   - Start position out of tolerance




8. Close the dialog.

#### 5.4.14.5 Via HART communication: Get messages

**Requirement**

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52..

**Call up message for process diagnostics**

If a process diagnostics threshold is violated, the "more status available" bit is set.

Send the "#48" command to the positioner via HART communication.

⇒ The 20 Bytes of are returned

When the thresholds for the "A.\PST" process diagnostics are exceeded, the messages are contained in the following bytes:

- Byte 17, Bit 7 corresponds to threshold 1 exceeded.
- Byte 17, Bit 6 corresponds to threshold 2 exceeded.
- Byte 17, Bit 5 corresponds to threshold 3 exceeded.

#### 5.4.14.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.5 Partial Stroke Test (pressure sensor-supported)

### 5.5.1 Functional description

The Partial Stroke Test (PST) is used on valves with single-acting actuators, e.g. on safety valves.

During a PST reference run, pressure position data is recorded and the abort criteria for the subsequently executed PSTs are determined.

Abort criteria:

- The determined pressure value for the valve breakaway from the PST start position.
- The PST pressure value determined for the end position, which the PST should not fall below.

When using Device Manager Software e.g. SIMATIC PDM, an expert mode is available with which these termination criteria can be changed manually.

At the PST, the following additional Key Performance Indicators (KPI) are determined:

- Standstill time before PST start
- Measured start position
- Pressure in chamber 1 at start position
- Breakout pressure in chamber 1
- Measured end position
- Pressure in chamber 1 at end position
- Breakout pressure in chamber 1 (return)
- Electronics temperature
- Operating hours

If the PST falls below the pressure limit, the PST stops.

A message is issued via the display, the digital contacts and the communication.

The KPIs and the pressure-position data of the last 10 PSTs are stored in the positioner and can be read out.

The PST data can also be used to determine friction coefficients, spring characteristics and hysteresis.

Regular movement of the process valve can prevent the valve from getting stuck.

The PST is configured and executed with Device Manager Software, e.g. SIMATIC PDM. The software can be used to read PST data from the positioner and display it as charts.

Local configuration via the display and buttons is possible to a limited extent.

Diagnostic values for PST:

- PST status (12.PST)
- Time since last partial stroke test (13.PRPST)
- Time until next Partial Stroke Test (14.NXPST)

The PST can be started via:

- Local operation
- Remote operation with Device Manager Software e.g. SIMATIC PDM
- Digital input
- Remote operation via HART communication
- Cyclic test interval

## 5.5.2 Activate PST

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.

### "Partial Stroke Test" (A.\PST) parameter

| | | |
|---|---|---|
| Function | The parameter activates or deactivates the Partial Stroke Test (PST). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

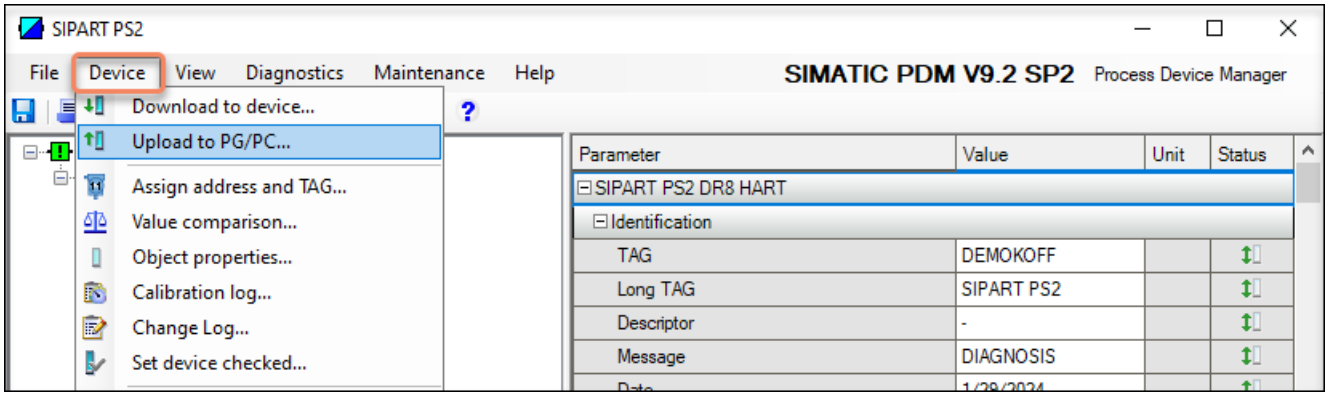
### Remote operation with SIMATIC PDM

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

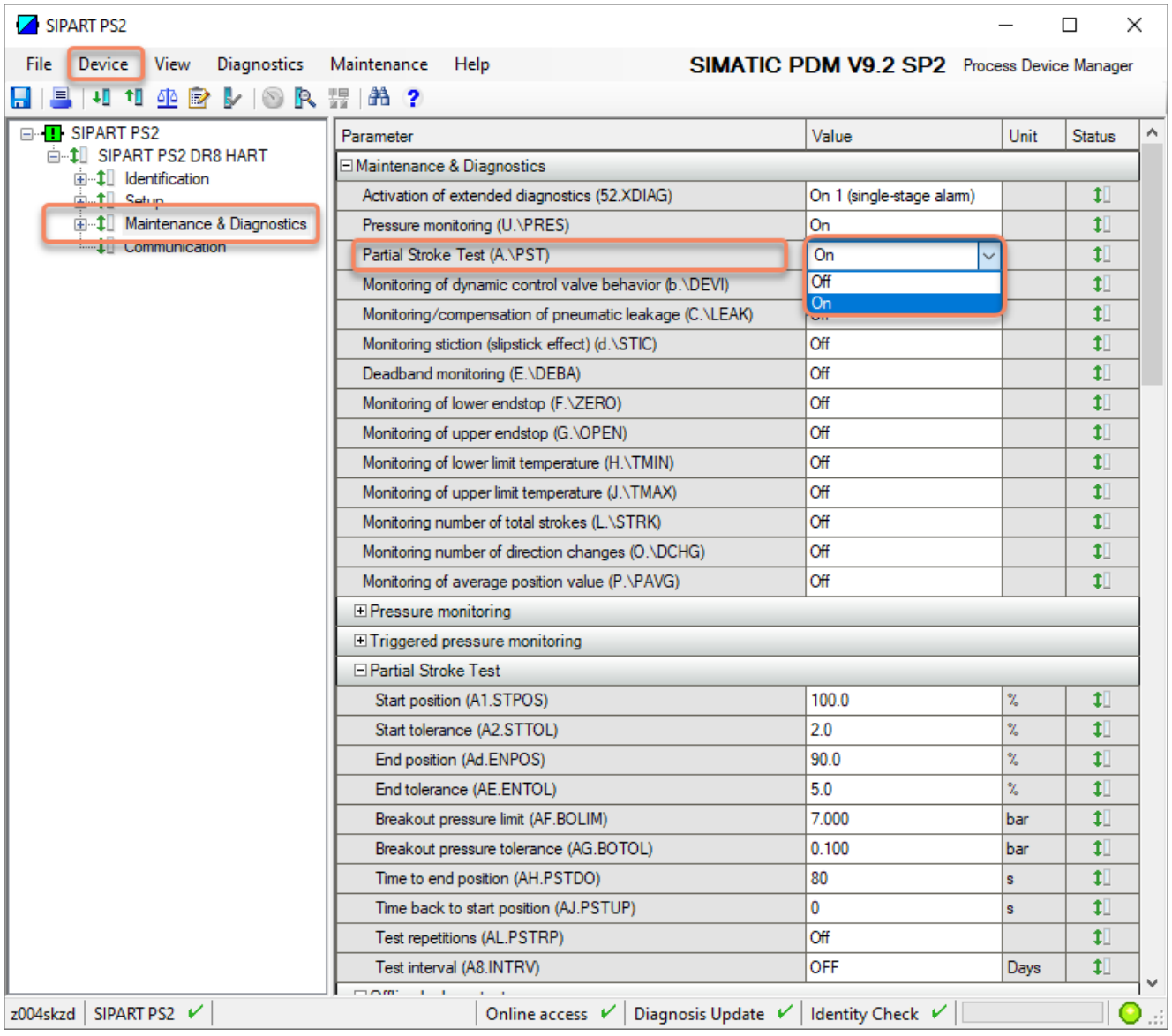
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Partial Stroke Test (A.\PST)", set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. In the "Device" menu, select the command "Download to device...".
9. Select the check box "Load changed parameters only".
10. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
11. Wait until the status "Load to Device: Action finished" is displayed.
12. Close the dialog.

### With local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "A.\PST" parameter of the "Partial Stroke Test" process diagnostics.
3. Set the "" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. Switch the positioner to "Manual (MAN)" mode by pressing the button on the display simultaneously for at least 5 seconds.

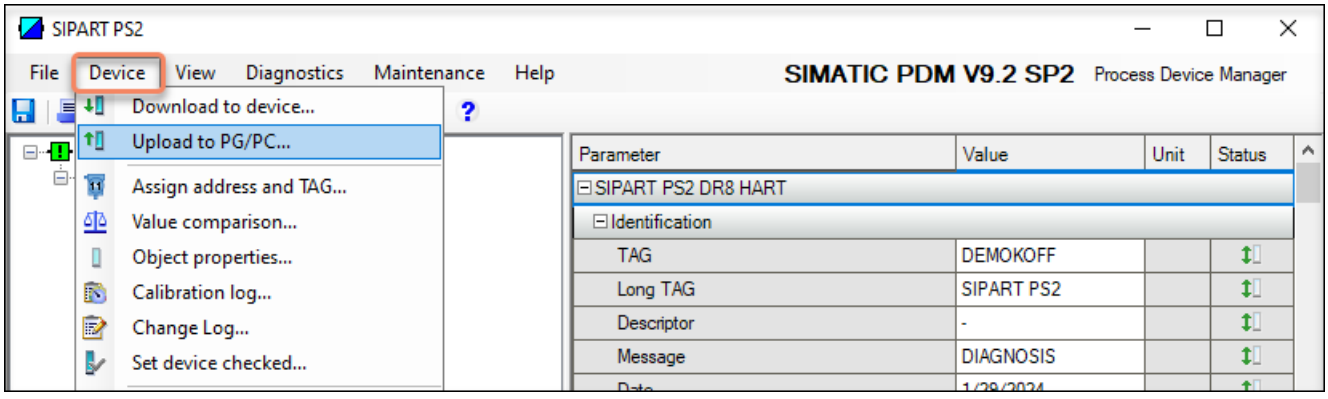
## 5.5.3 With SIMATIC PDM: Configure PST with wizard and execute reference run

### Requirement

- The positioner has pressure sensors (Z P02 option)
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The positioner is in "Automatic (AUT)" mode.

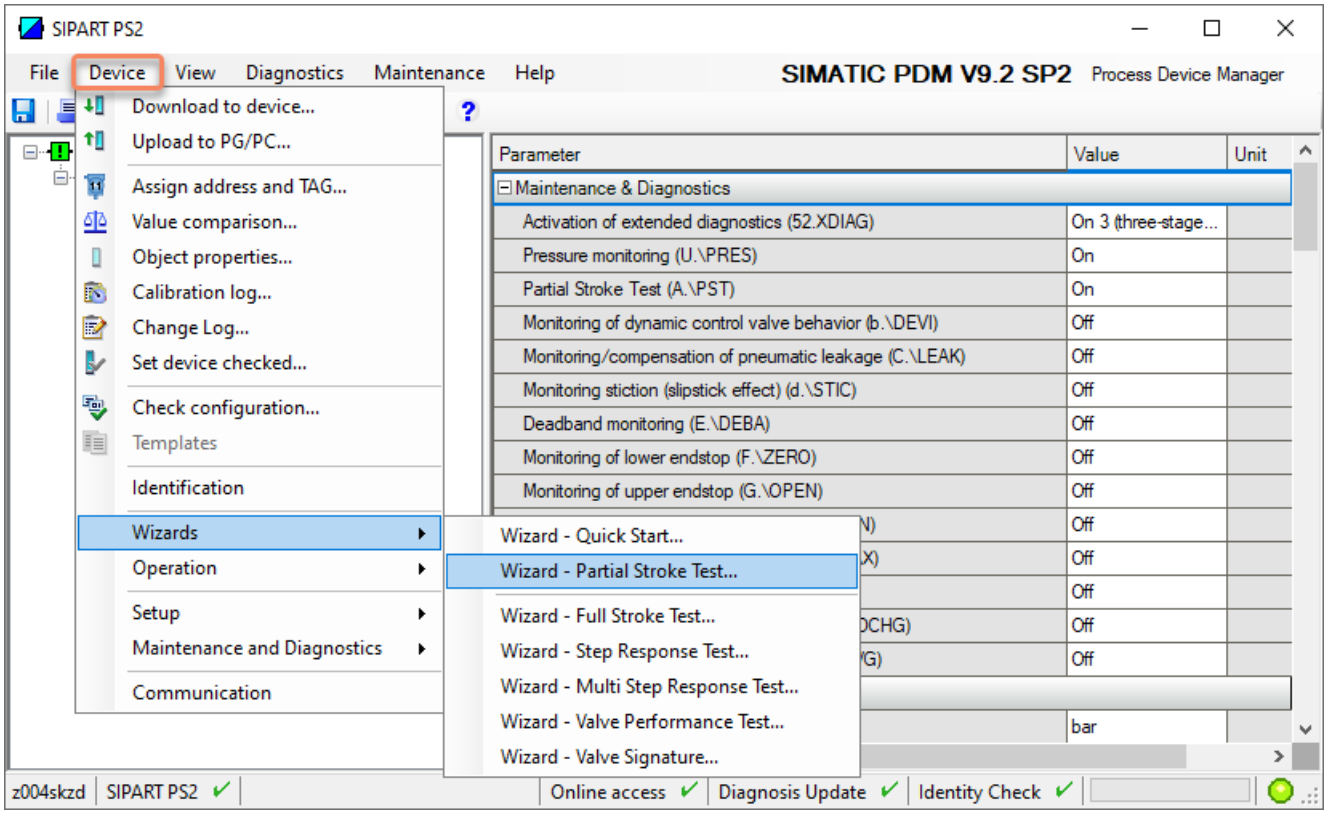
### Open Wizards menu

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC...".




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

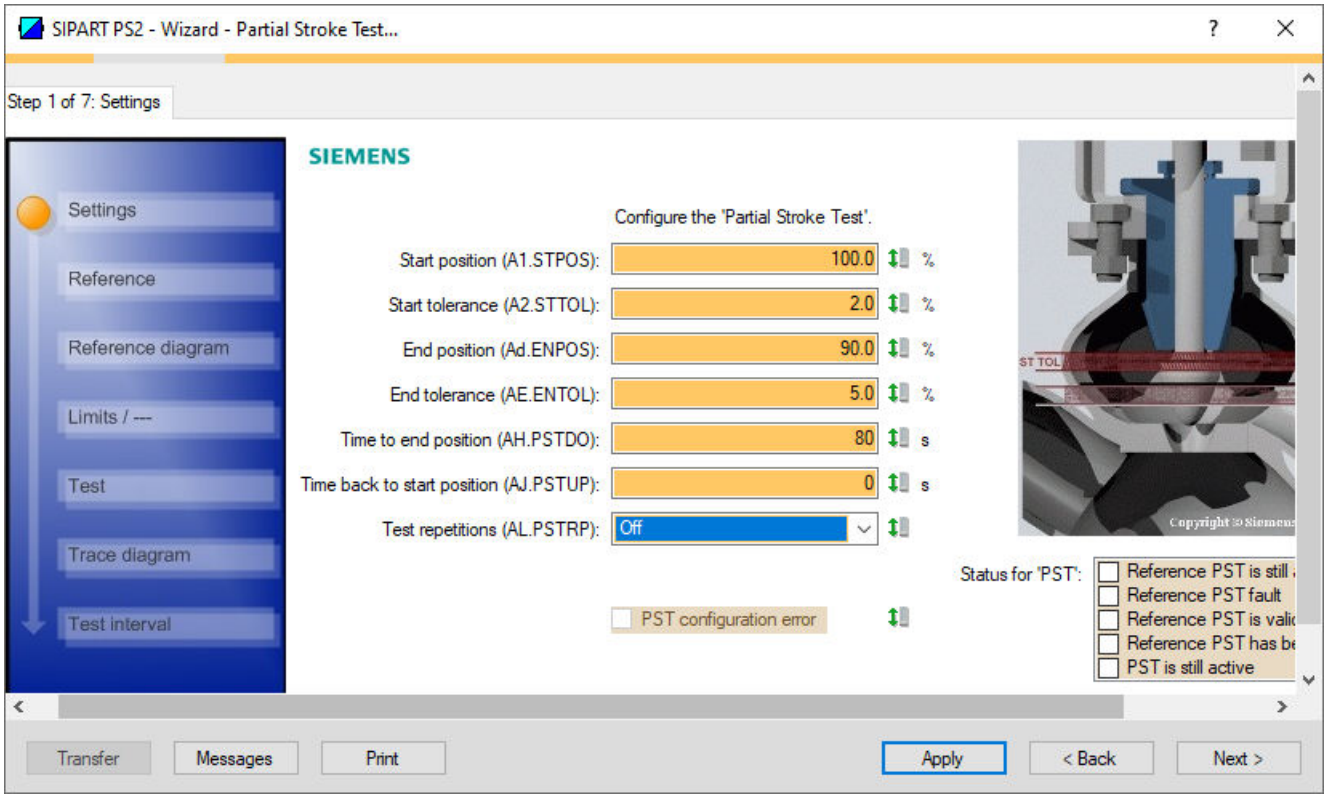
5. Close the dialog.
6. In the "Device" menu, select the command "Wizards > Wizard - Partial Stroke Test...".




⇒ The "Step 1 of 7: Settings" dialog opens.

### Step 1: Settings

In this step, the parameters for the traversing range and the duration of the PST are configured.




The "Status for PST" dialog box shows the current status of the PST.

If the PST reference run has already been successfully executed, the "Reference PST is valid" message is highlighted.

Table 5-7 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| Apply | Saves the changed values of the dialog |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Enter the "Start position".

| **A1.STPOS** | **Start position** |
|---|---|
| Function | The parameter defines the start position of the PST. |
| Note | The start position of the PST should correspond to the fully pressurized position of the actuator.<br>This means that the start position should not correspond to the safety position of the process valve. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

2. Enter the "Start tolerance".

| **A2.STTOL** | **Start tolerance** |
|---|---|
| Function | The parameter defines the start tolerance of the PST. |
| Note | Example: Start position "100.0", start tolerance "2.0".<br>• During the PST reference run, the actuator travels from the current position to the start position. When the position 98% is exceeded, the start position is considered reached.<br>• The PST only starts when the actuator is between the positions 98% and 102%. |
| Setting range | 0.1 ... 10.0 |
| Factory setting | 2.0 |
| Unit | % |

3. Enter the "End position".

| **Ad.ENPOS** | **End position** |
|---|---|
| Function | The parameter defines the end position of the PST.<br>• During the PST reference run to determine the abort pressure, the actuator moves from the start position to the end position, taking into account the end tolerance (AE.ENTOL).<br>• The actuator moves from the start position to the end position during the PST. As the end position is approached based on pressure, it can be slightly undercut. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 90.0 |
| Unit | % |

4. Enter the "End tolerance".

| **AE.ENTOL** | **End tolerance** |
|---|---|
| Function | The parameter defines the end tolerance of the PST relative to the end position. |
| Note | Example: End position "90.0", end tolerance "5.0".<br>• During the PST reference run to determine the abort pressure, the actuator moves to position "85.0".<br>• With PST, the actuator moves to the end position "90.0".<br>As the end position is approached based on pressure, it can be slightly undercut. |
| Setting range | 1.0 ... 20.0 |
| Factory setting | 5.0 |
| Unit | % |

5. Enter the "Time to end position".

| **AH.PSTDO** | **Time to end position** |
|---|---|
| Function | The parameter defines the minimum duration that the PST uses for depressurizing to travel from the start position to the end position. |
| Note | Example: Value "1".<br>Depending on the process actuator, the PST needs a minimum time to cover the distance. The actuator moves directly to the end position. |
| Setting range | 1 ... 300 |
| Factory setting | 80 |
| Unit | s (second) |

6. Enter the "Time back to start position".

| **AJ.PSTUP** | **Time back to start position** | |
|---|---|---|
| Function | The parameter defines the minimum duration that the PST uses for pressurizing to move from the end position back to the start position. | |
| Note | Example 1: You have left the value at the factory setting "0".<br>• The PST travels from the end position uncontrolled directly back to the start position.<br>Example 2: Value "1".<br>• Depending on the process actuator, the PST needs a minimum time to cover the distance. The actuator gradually returns to the start position. | |
| Setting range | 0 ... 300 | • If "0": No data recording when returning to the start position.<br>• With ≥ "1": Recording of data when returning to the start position. |
| Factory setting | 0 | |
| Unit | s (second) | |

7. If needed, activate "Test repetitions" and enter the number.

| **AL.PSTRP** | **Test repetitions** | |
|---|---|---|
| Function | Test repetitions in the event of a failed PST | |
| Setting options | Off | The test repetition function is deactivated. |
| | 1 ... 3 | The test repetition function is activated and the number defined. |
| Factory setting | 0ff | |

8. Click the "Apply" button.
9. Click the "Next >" button.
   ⇒ The "Step 2 of 7: Reference" dialog opens.

## Step 2: Perform PST reference run

In this step, the PST reference run is performed and various measured values are determined and displayed.

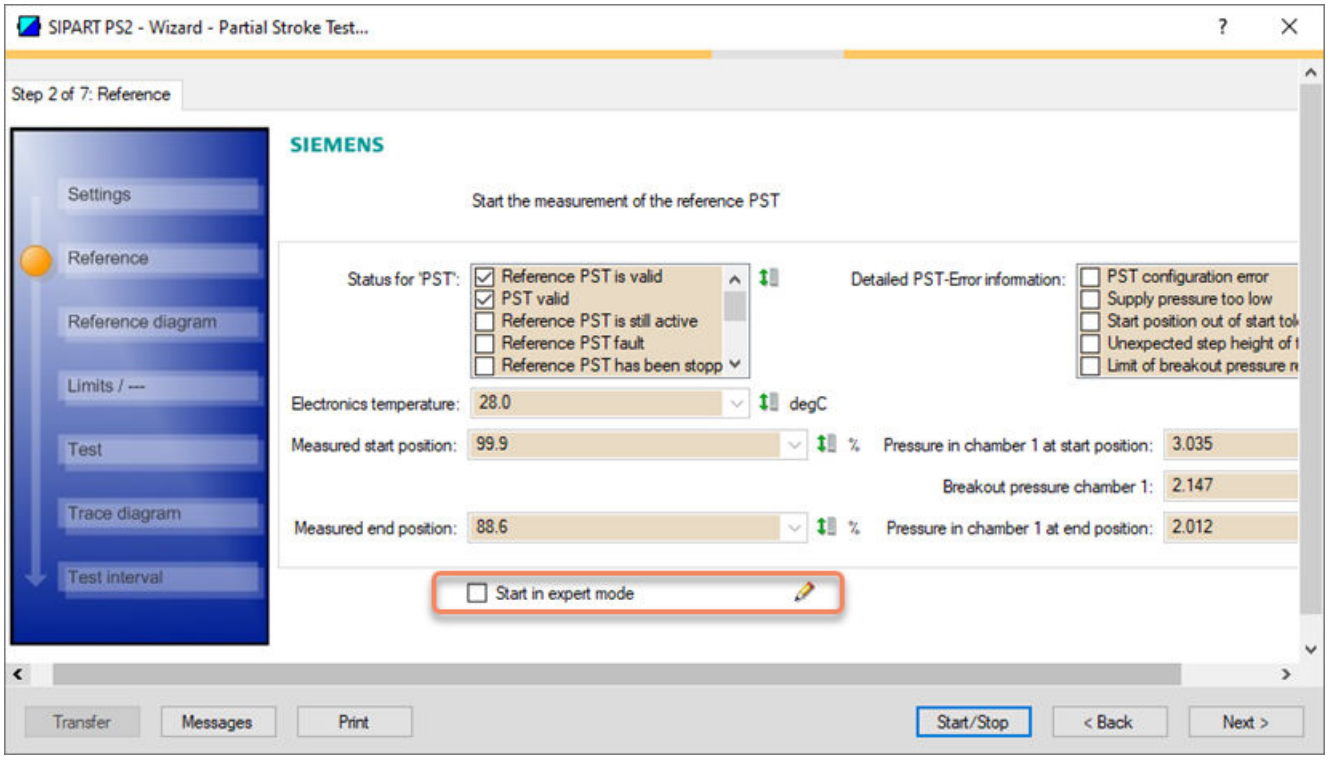
Perform the PST reference run in the following cases:

- After re-initializing the positioner
- After the commissioning the valve
- If there is a fundamental change in the operating conditions
- When changing the PST parameters
- Before the first PST

### Displays in the dialog

The dialog contains the following information:

- The "Status for PST" shows the current PST status.
- The "Detailed PST-Error information" dialog box show the current error.
- If a PST reference run has already been performed, the results of the previous PST reference run are displayed.




**Perform PST reference run**

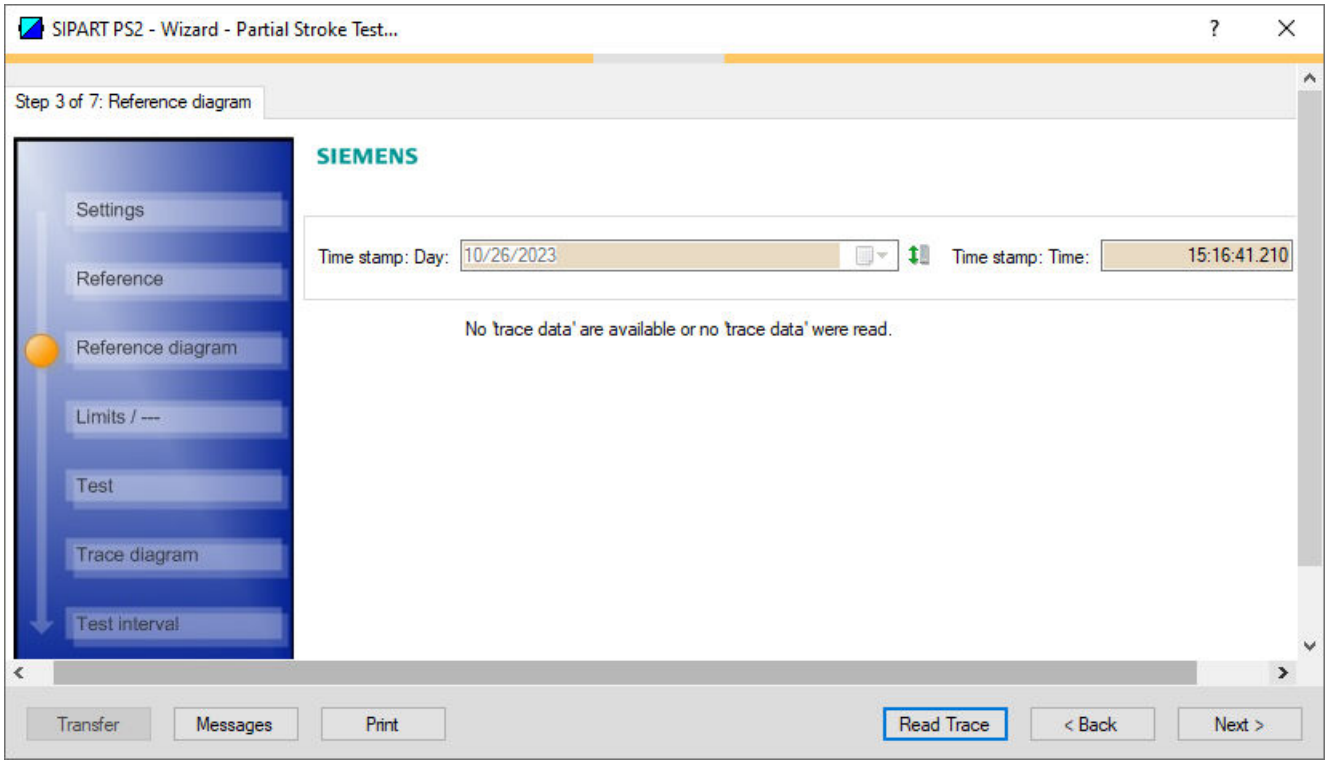
1. Click the "Start/Stop" button.
2. Confirm the start in the following dialog with "OK".
   ⇒ The PST reference run is in progress.
   ⇒ In the "Status for PST" dialog box, "Reference PST is still active" is displayed.
   ⇒ "INPST" is shown in the display.
   After successful completion, the results and the status are displayed in the "Reference PST is valid" dialog.
3. Click the "Next >" button.
   ⇒ The "Step 3 of 7: Reference diagram" dialog opens.

**Perform PST reference run with expert mode**

If the PST reference run fails, the abort criteria can be set manually.

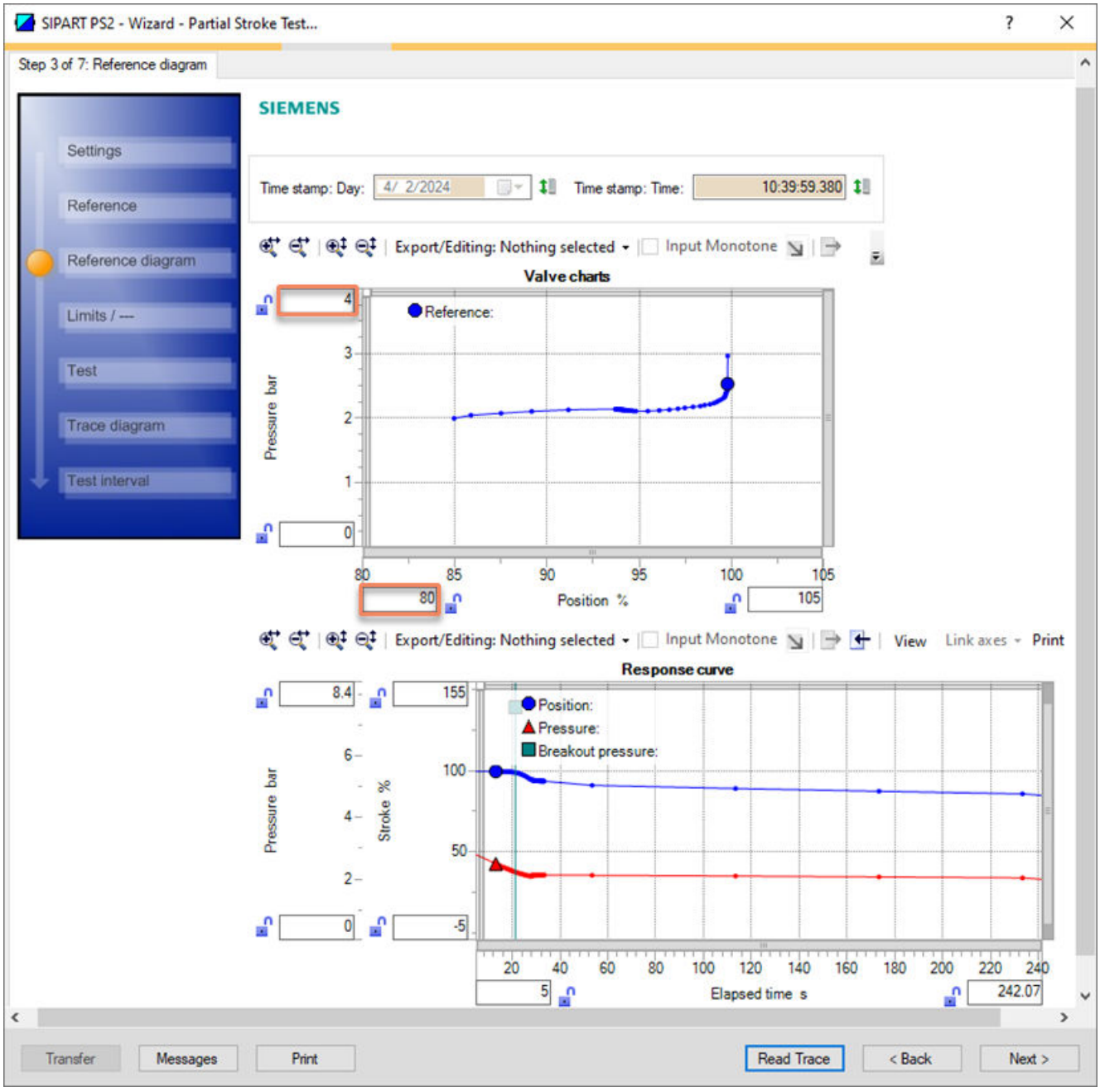
1. Select the "Start in expert mode" check box.
2. Click the "Start/Stop" button.
   ⇒ The "Expert mode" dialog opens → With SIMATIC PDM: Run PST in expert mode (Page 173).

### Step 3: Reference diagram



If a PST reference run was performed immediately beforehand, the diagram of the previous PST reference run is displayed.

1. Click the "Read Trace" button.
   ⇒ The chart for the current PST reference run is created and displayed.



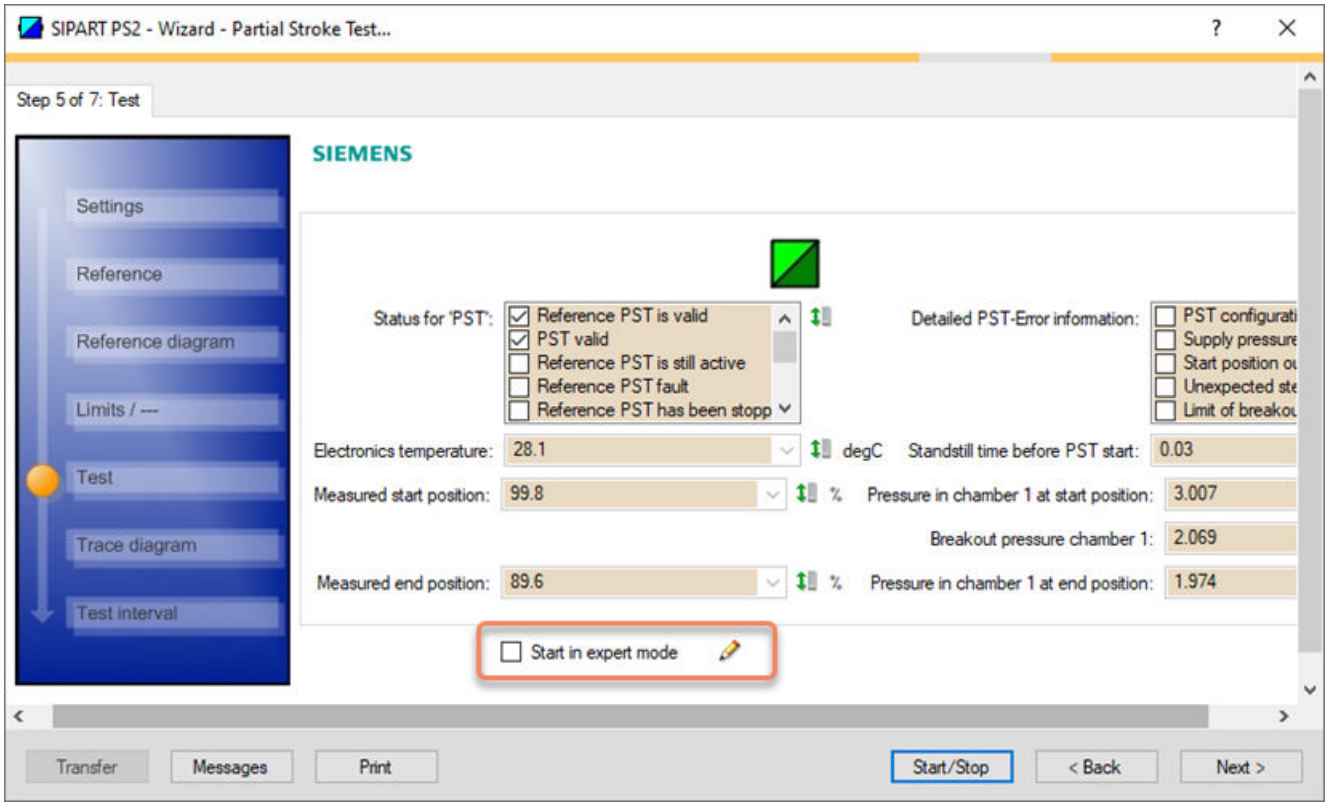

Notes on the example shown:
The diagram display is scaled by changing the input fields of the axes, e.g. "4".

2. Click the "Next >" button.
   ⇒ The "Step 5 of 7: Test" dialog opens.

## Step 5: Test

**Requirement**

- The PST reference run was performed successfully.
- The actuator is at the defined start position "A1.STPOS" ± Start tolerance "A1.STTOL".




**Run PST**

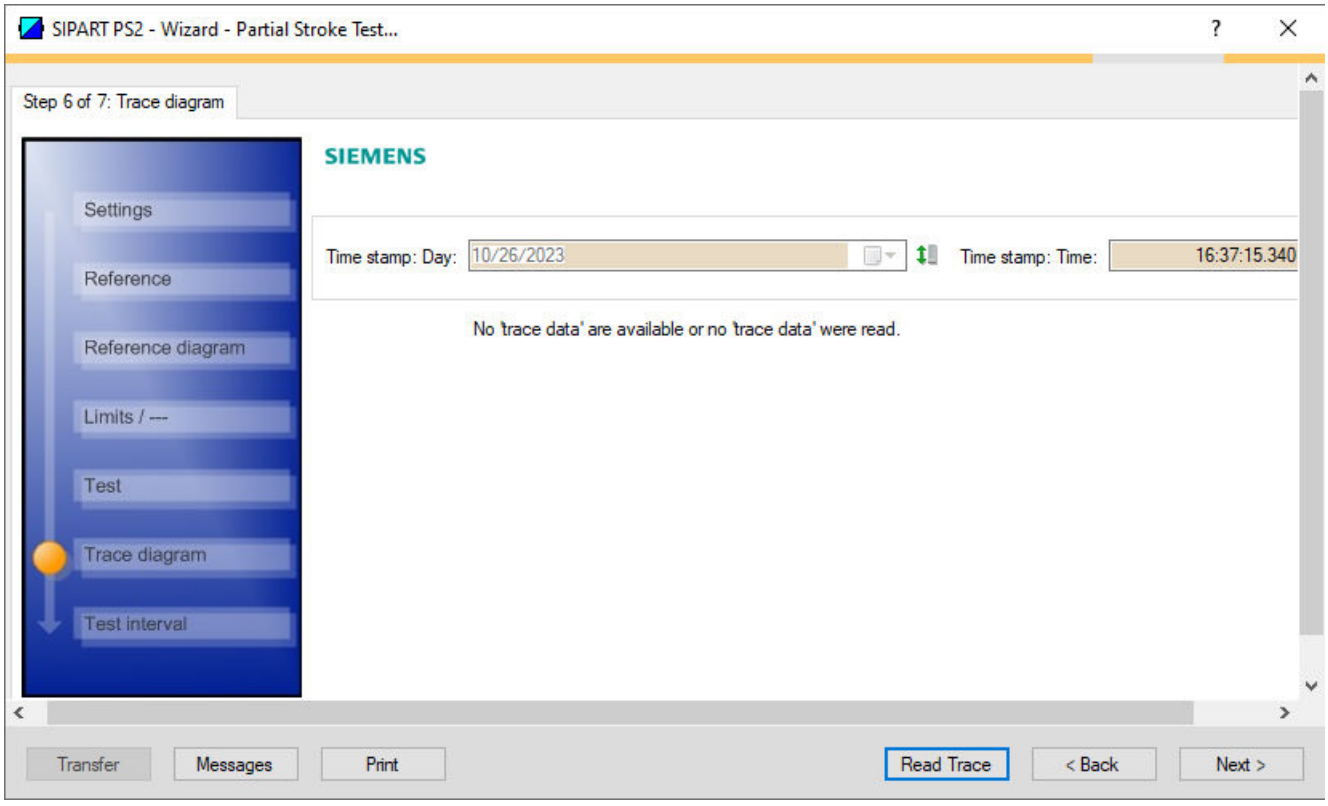
1. Click the "Start/Stop" button.
2. Confirm the start in the following dialog with "OK".
   ⇒ The PST is running.
   ⇒ In the "Status for PST" dialog box, " PST is still active" is highlighted.
   ⇒ "EXPST" is shown in the display.
   After a successful PST, the results and the following states are displayed:
   – "Reference PST is valid".
   – "PST valid".
   If the PST fails, the reason is highlighted in the "Status for PST" dialog box.
3. Click the "Next >" button.
   ⇒ The "Step 6 of 7: Trace diagram" dialog opens.

**Run PST with expert mode**

In the event of a failed PST, the abort criteria of the PST can be set manually.

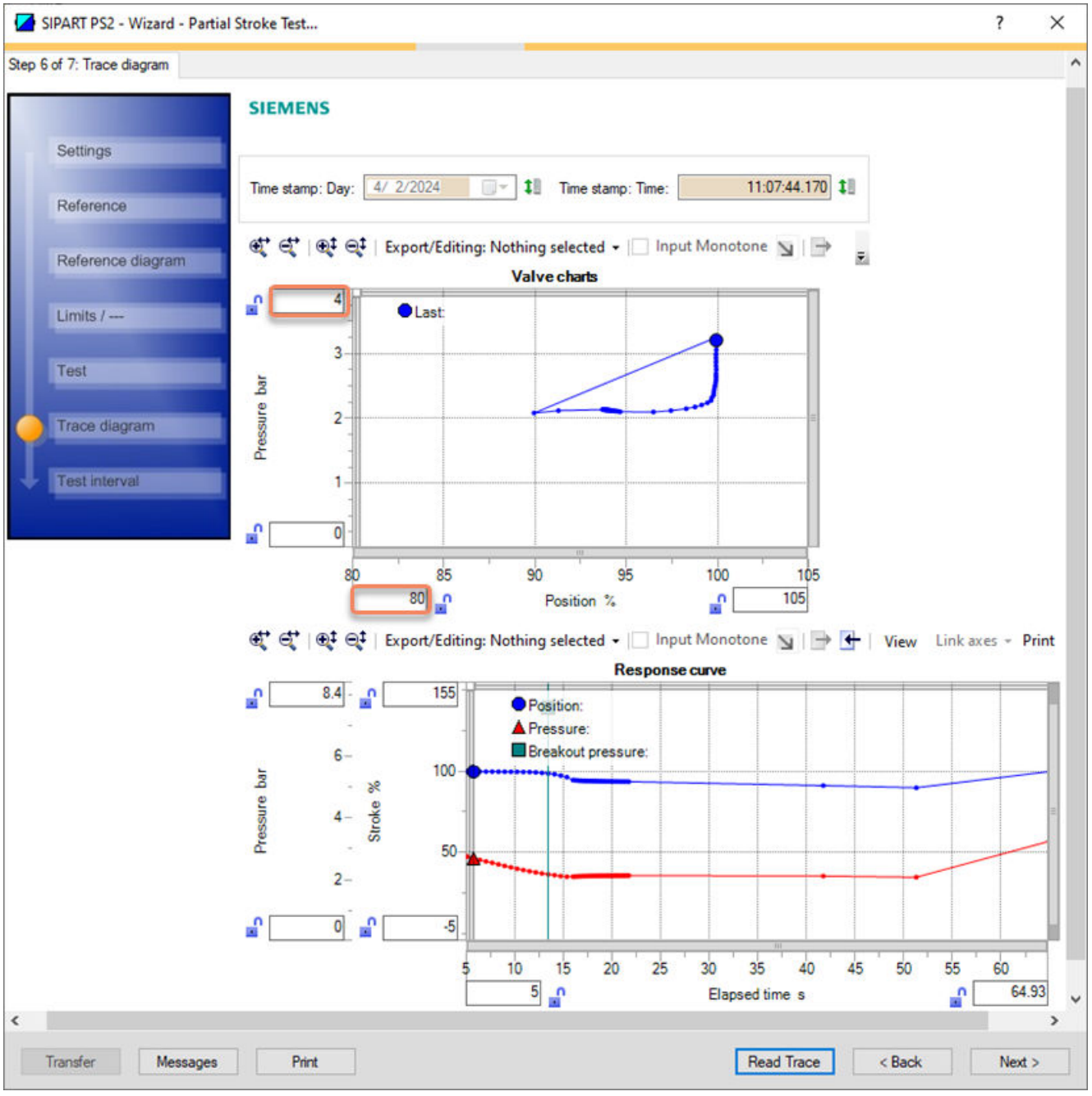
1. Select the "Start in expert mode" check box.
2. Click the "Start/Stop" button.
   ⇒ The "Expert mode" dialog opens → With SIMATIC PDM: Run PST in expert mode (Page 173).

### Step 6: Trace chart



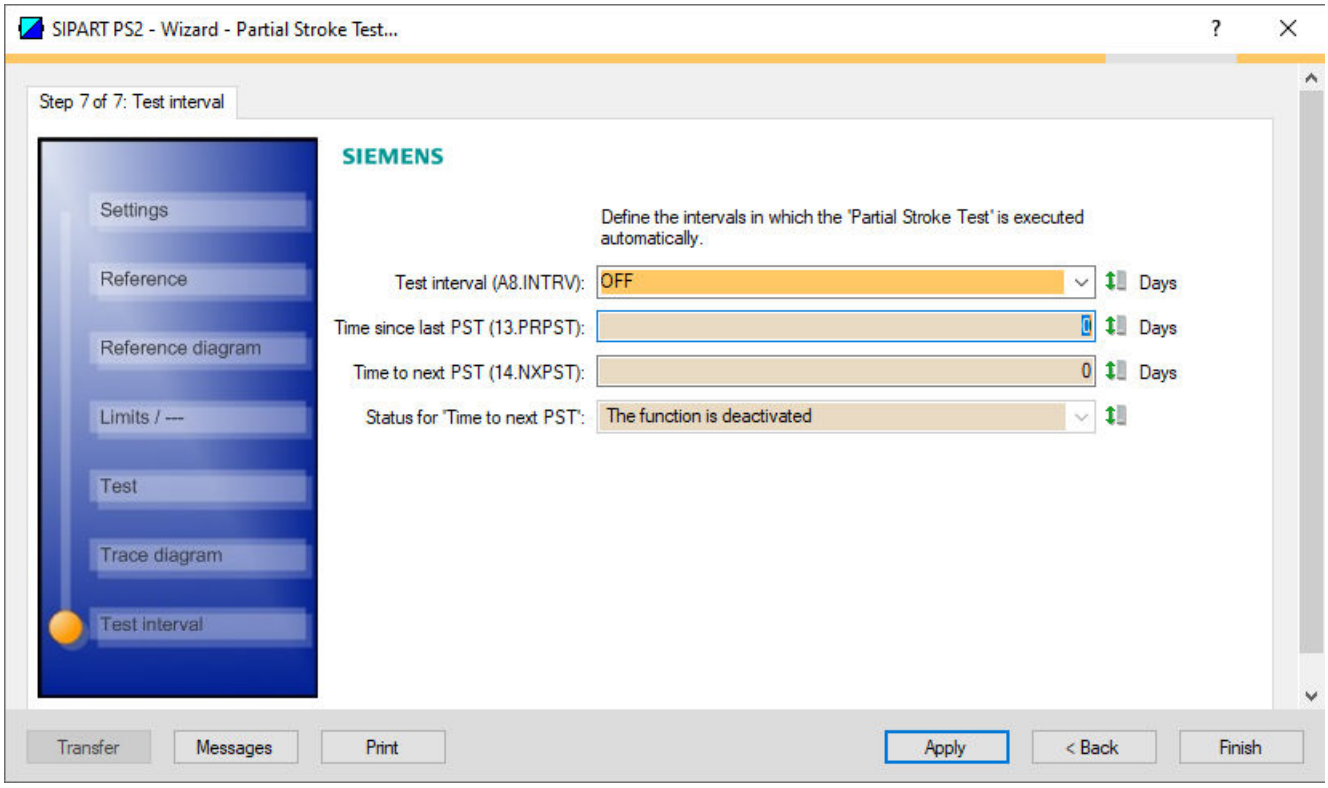
If an immediately preceding PST was executed, the diagram of the previous PST is displayed.

1. Click the "Read Trace" button.
   ⇒ The chart for the current PST is created and displayed.




2. Click the "Next >" button.
   ⇒ The "Step 6 of 7: Test intervall" dialog opens.

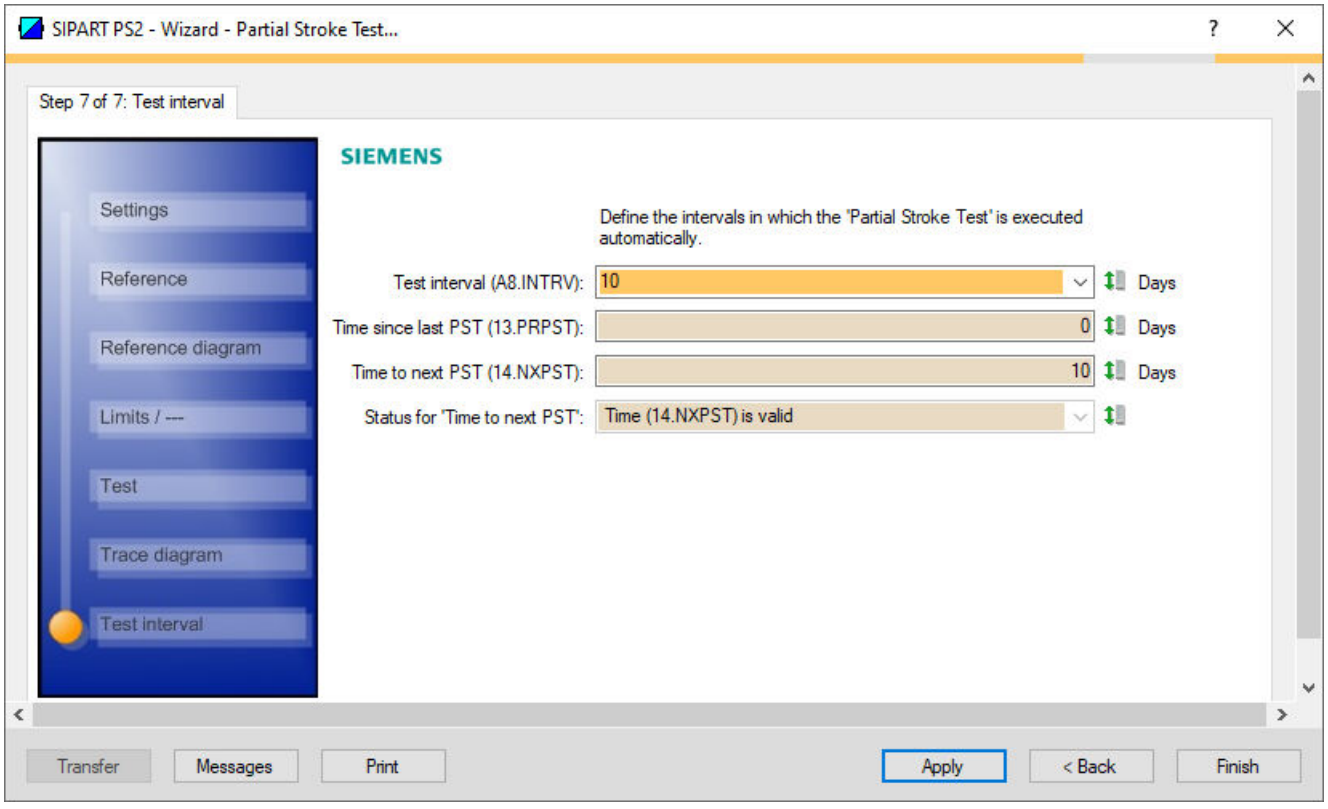
### Step 7: Test interval



1. If needed, activate the "Test interval".

| **A8.INTRV** | **Test interval** | |
|---|---|---|
| Function | The parameter activates and defines the interval time for the cyclical PST. | |
| Setting options | Off | The test interval is deactivated. |
| | 1 ... 365 | The test interval is activated and the interval time is defined in days. |
| Factory setting | Off | |

2. Click the "Apply" button.
   ⇒ The test interval is activated and is executed automatically if the requirements are met.
   Further displays:
   - Diagnostic value "Time since last PST" (13.PRPST) in days, e.g. "0".
   - Diagnostic value "Time to next PST" (14.NXPST) in days, e.g. "10".




3. Close the dialog with the "Finish" button.
   ⇒ The test results and the chart are saved.

### 5.5.4 With SIMATIC PDM: Run PST

#### Requirement

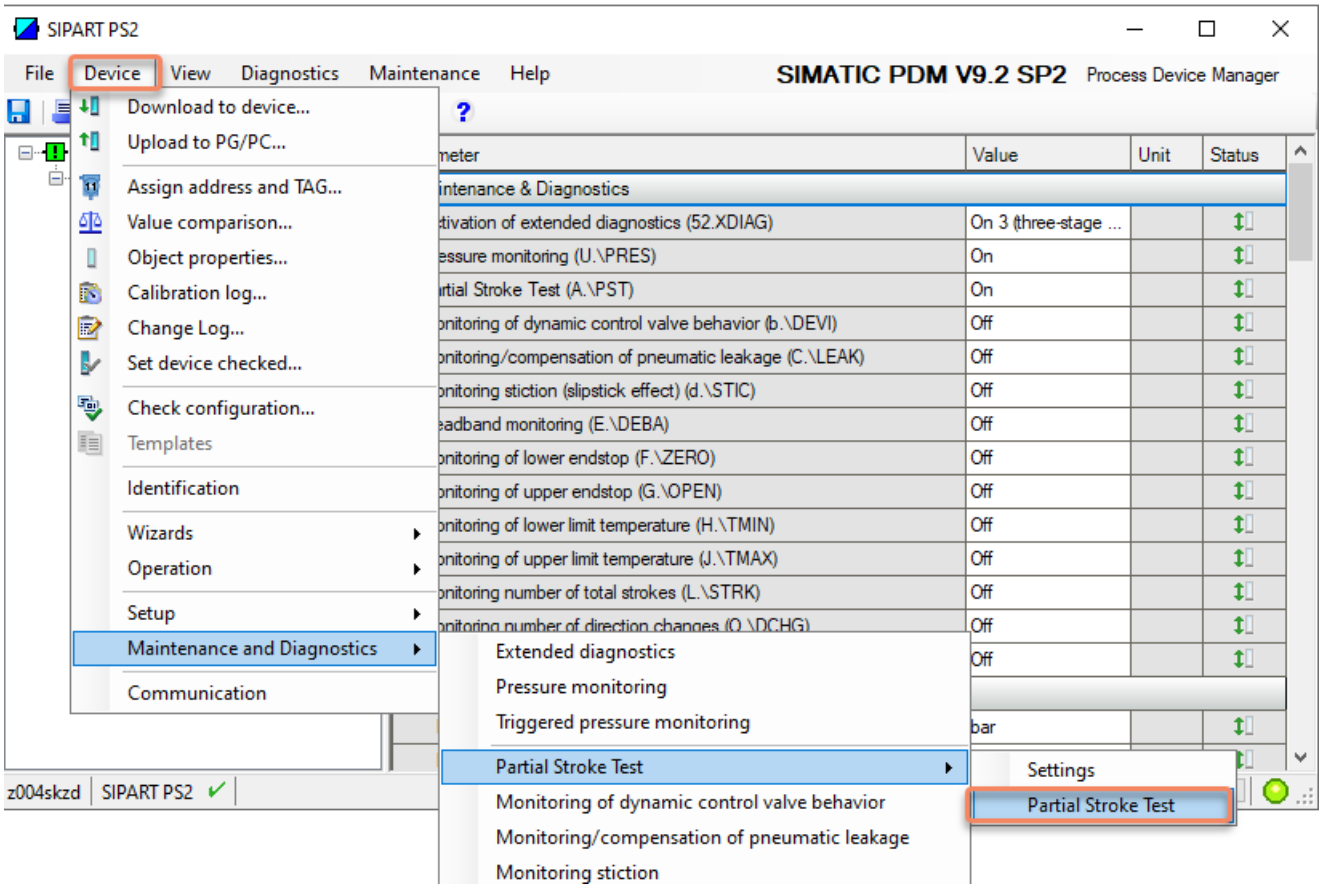
The PS reference run was performed successfully → With SIMATIC PDM: Configure PST with wizard and execute reference run (Page 153).

#### Start SIMATIC PDM

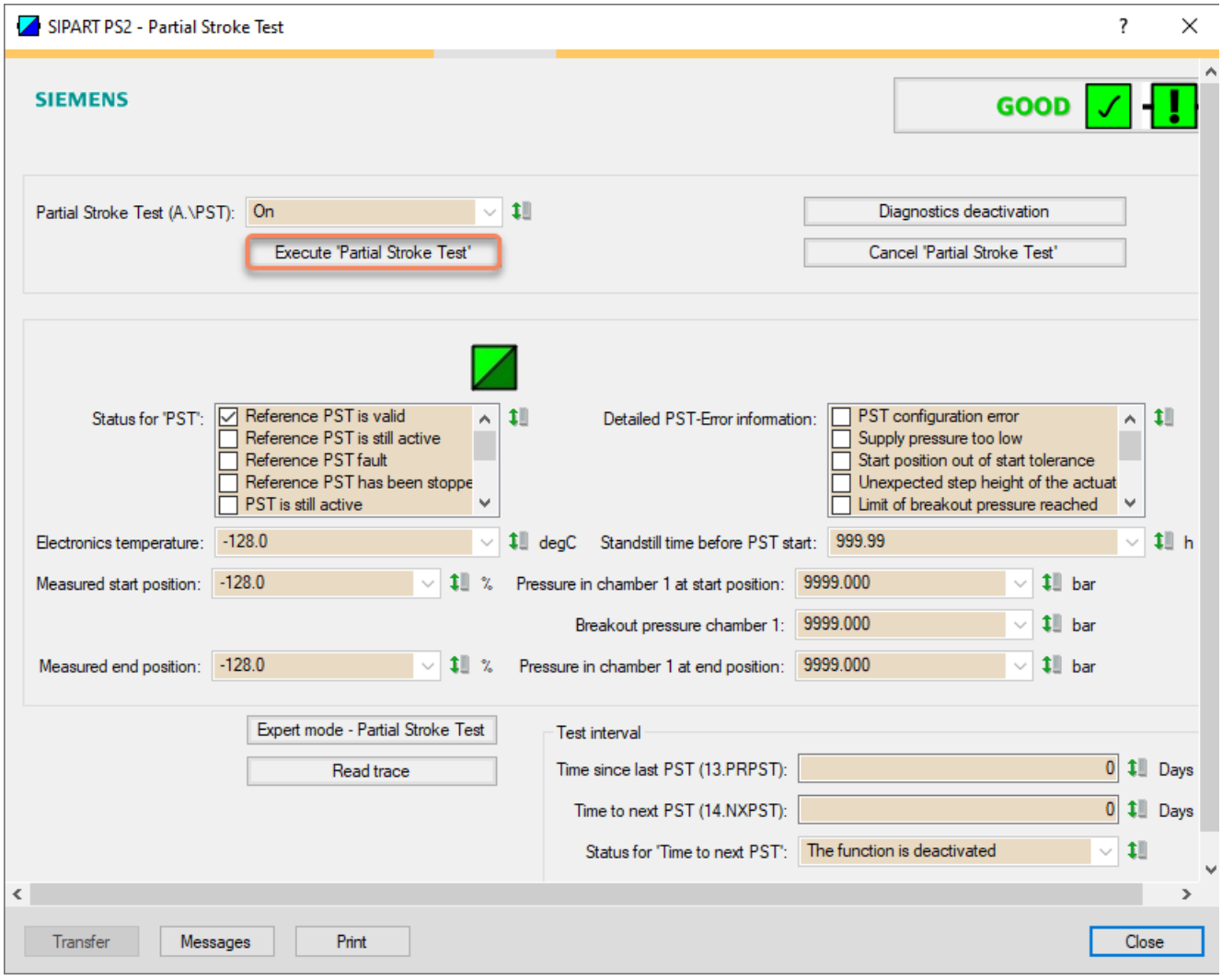
1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".

## Run PST

1. In the "Device" menu, select the command "Maintenance and Diagnostics > Partial Stroke Test > Partial Stroke Test".



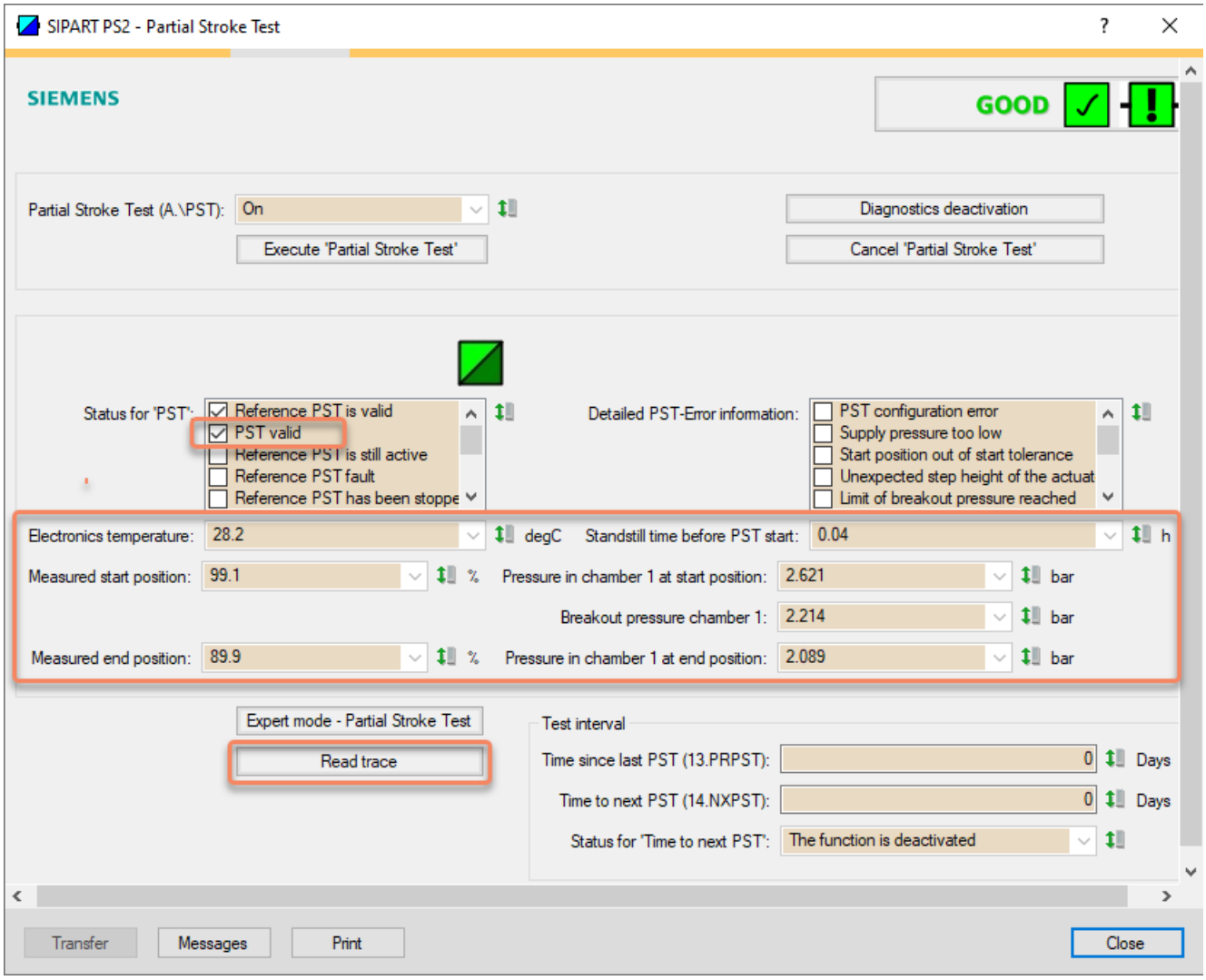

⇒ The "Partial Stroke Test" dialog opens.




2. Ensure that the actuator is in the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL)

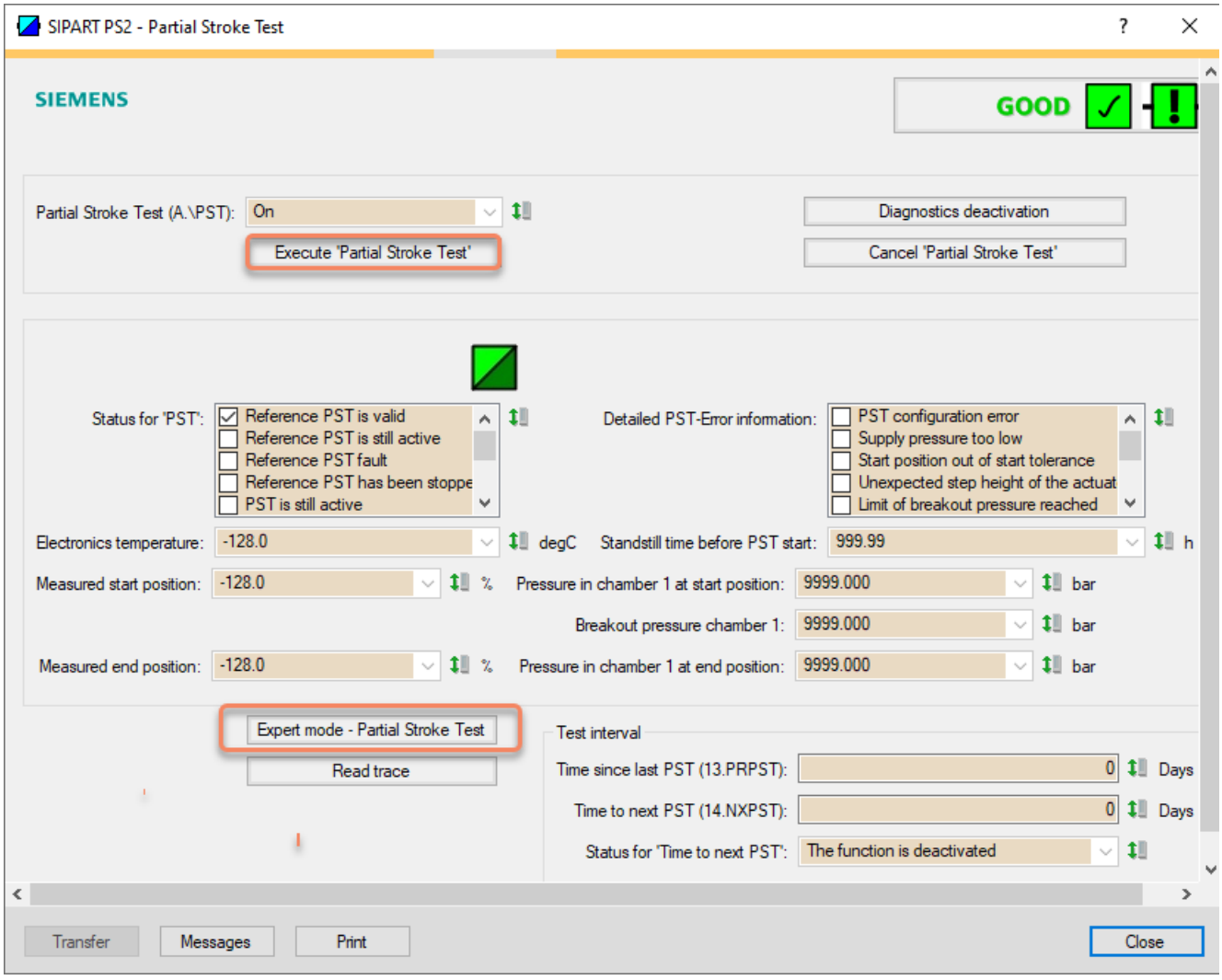
### Run PST

1. Start the PST with the "Execute Partial Stroke Test" button.
   After the successful PST, the results are displayed and the status "PST valid" is highlighted.
   If error message "Start position out of start tolerance" occurs: Move the actuator to the defined start position and start the PST again.




### Run PST in expert mode

If the PST fails, the PST termination criteria can be set manually.

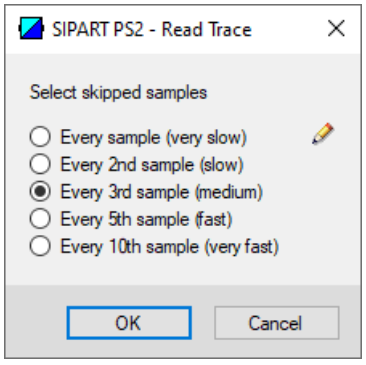



1. Start the PST with the "Expert mode - Partial Stroke Test" button.
   ⇒ The "Expert mode" dialog opens → With SIMATIC PDM: Run PST in expert mode (Page 173).

### Determine PST results

1. To display the PST trace chart, click the "Read trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.

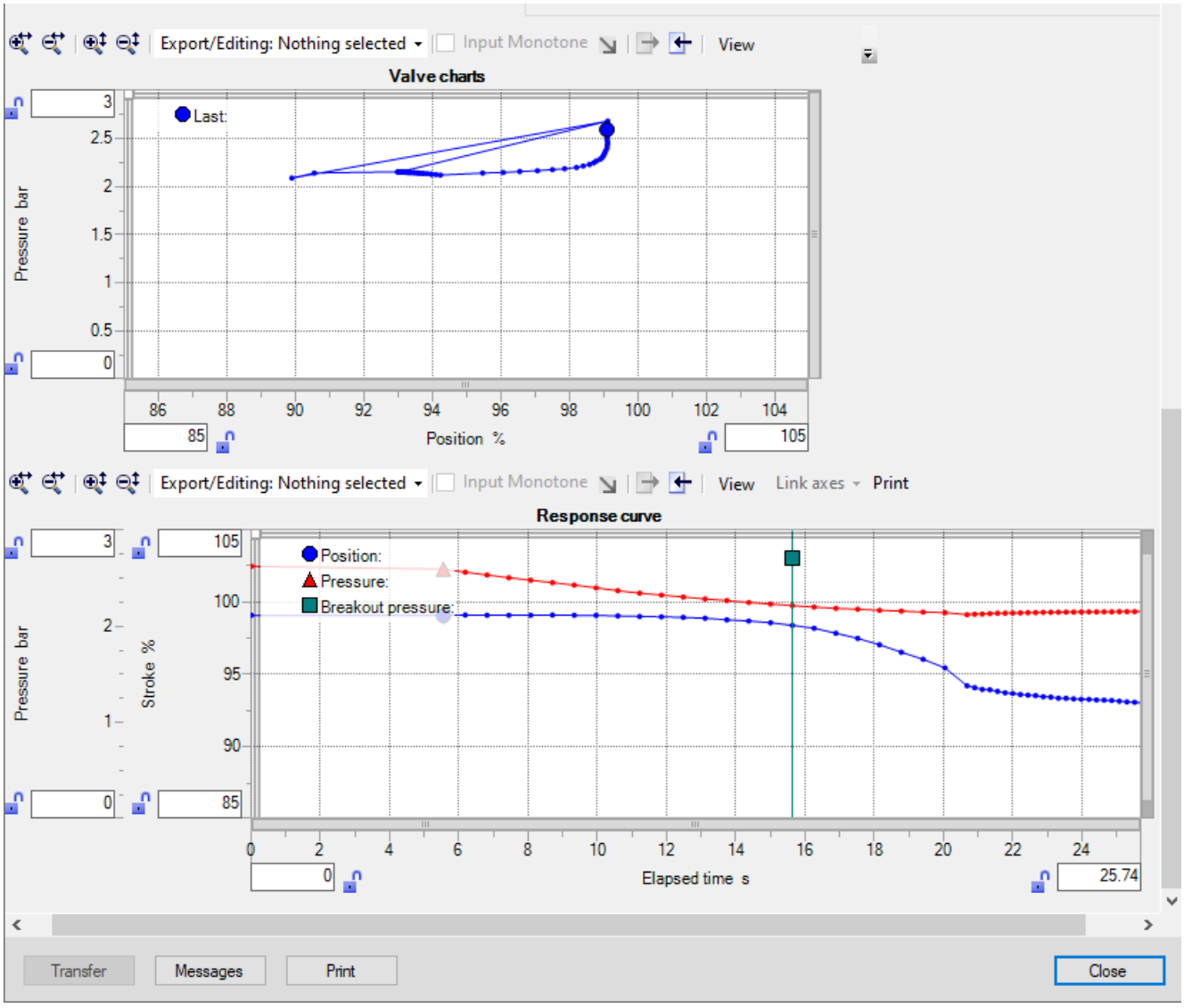
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




   As HART communication can be slow, the diagram data can be loaded from the positioner in different resolutions.

4. Select the option button for the required sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
6. Wait until the status "Finished" is displayed.

7. Click the "Close" button.
   ⇒ The trace chart for the current PST is created and displayed.




8. Close the dialog with the "Close" button.
   ⇒ The test results and the chart are saved.

## 5.5.5 With SIMATIC PDM: Run PST in expert mode

### Requirement

The PST is configured with the SIMATIC PDM wizard → With SIMATIC PDM: Configure PST with wizard and execute reference run (Page 153)

or with SIMATIC PDM executed → With SIMATIC PDM: Run PST (Page 167).

## Function of the PST expert mode

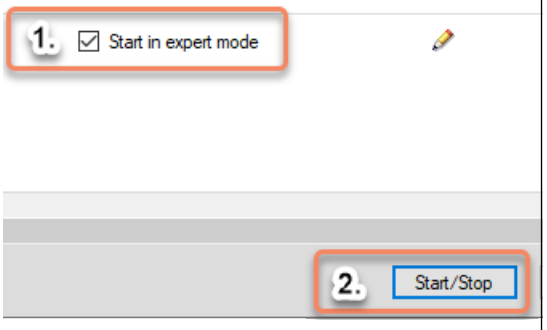
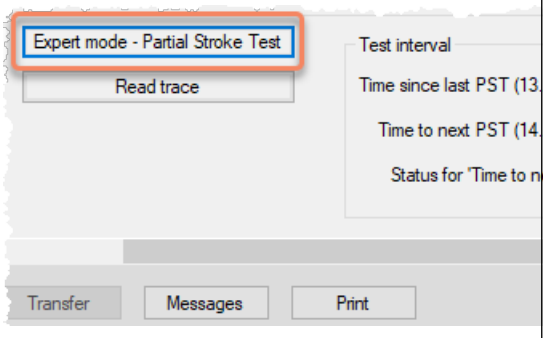
With the optional expert mode, the abort criteria of the PST reference run or the PST can be changed manually.

The limit of the breakout pressure and the abort pressure can be reduced temporarily or permanently.

Because more compressed air is released than is required to reach the PST end position, it can be easier for the process valve to break away.

| **NOTICE** |
| --- |
| **Partial Stroke Test (PST) with modified abort criteria**<br>By reducing the breakout or abort pressure, the process valve can move below the defined PST end position (Ad.ENPOS) . |

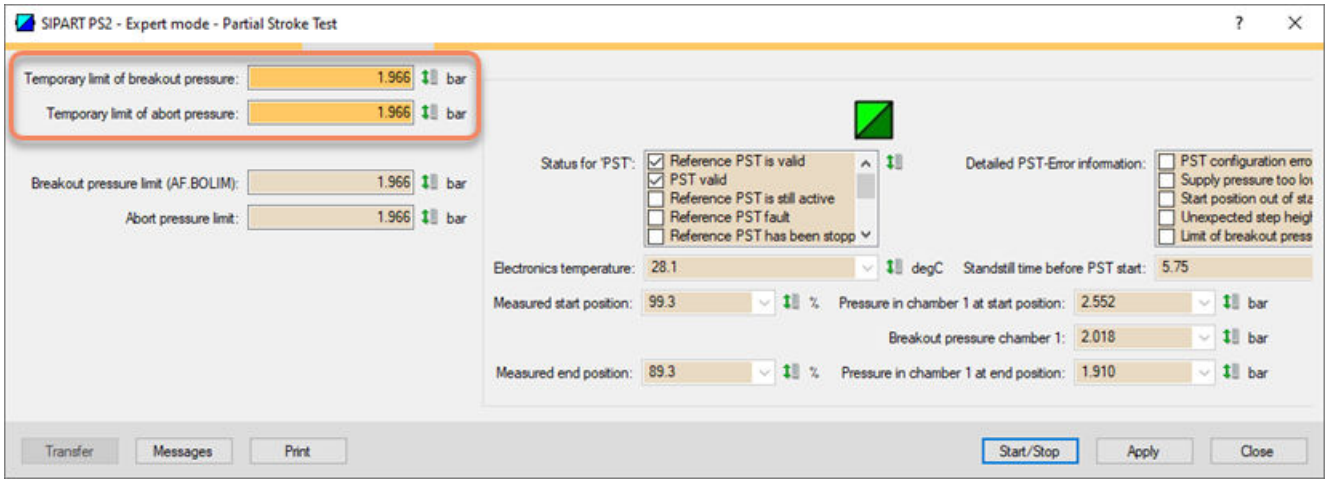
## Start expert mode

| **Start expert mode from "Wizard - Partial Stroke Test"** | **Start expert mode from "Maintenance and diagnostics > Partial Stroke Test"** |
| --- | --- |
|  |  |
| 1. Select the "Start in expert mode" check box.<br>2. Click the "Start/Stop" button. | 1. Click the "Expert mode - Partial Stroke Test" button. |
| ⇒ The "Expert mode" dialog opens. | ⇒ The "Expert mode" dialog also opens. |

## Expert mode

In the "Expert mode" dialog, the status and error messages are displayed in the following dialog boxes:

- Status for PST
- Detailed PST-Error information




**Note**

**Partial Stroke Test (PST) in expert mode**

The PST uses the pressure values of the following parameters as abort criteria**:**

- Temporary limit of breakout pressure
- Temporary limit of abort pressure

## Definitions

## Breakout pressure limit

The pressure at which the process valve must have moved after the PST start, otherwise the PST aborts with the "Limit of Breakout pressure reached" message.

- The pressure value is determined in the PST reference run.
  Or
- The pressure value was defined via "Temporary Breakout pressure limit".

### Temporary Breakout pressure limit

The pressure at which the process valve must have moved in **expert mode** after PST start, the process valve must have moved, otherwise the PST aborts with the message "Limit of Breakout pressure reached".

- You can use the "Start/Stop" button to execute the PST with "Temporary Breakout pressure limit".
- You can use the "Apply" button to set the temporary pressure value as a permanent pressure value in "Breakout pressure limit".

### Abort pressure limit

The pressure at which the PST end position (Ad.ENPOS) must be reached, otherwise the PST aborts with the message "Abort pressure limit reached".

- The pressure value results from the PST reference run determined at the PST end position (Ad.ENPOS) and the PST end tolerance (AE.ENTOL).
  or
- The pressure value was defined via "Temporary Abort pressure limit".

### Temporary Abort pressure limit

The pressure at which the PST end position (Ad.ENPOS) must be reached in **Expert mode**, otherwise the PST aborts with the message "Abort pressure limit reached".

- You can use the "Start/Stop" button to execute the PST with "Temporary Abort pressure limit".
- You can use the "Apply" button to set the temporary pressure value as a permanent pressure value in "Abort pressure limit".

### Run PST in expert mode

| **NOTICE** |
| --- |
| **Partial Stroke Test (PST) with modified abort criteria**<br>By reducing the breakout or abort pressure, the process valve can move below the defined PST end position (Ad.ENPOS) . |

1. Change the values of the temporary PST termination criteria:
   – Temporary limit of breakout pressure
   – Temporary limit of abort pressure
2. To start the PST reference run or the PST: Click the "Start/Stop" button.
3. Confirm the start in the following dialog with "OK".
   ⇒ The PST reference run or the PST is started.

4. Wait until the PST is completed.
   After successful completion, the results and the following status are displayed:
   - Reference PST is valid
     or
   - PST is valid

   If the following error messages appear, adjust the temporary pressure values again if necessary and repeat the PST reference run or the PST:
   - Reference PST fault
   - PST fault
   - Limit of Breakout pressure reached
   - Abort pressure limit reached
5. Determine the termination criteria by which to decide how to run the following PSTs outside expert mode:

   **Note**

   **Partial Stroke Test (PST) outside expert mode**

   The PST uses the pressure values of the following parameters as abort criteria**:**
   - Breakout pressure limit
   - Abort pressure limit

   - If the temporary pressure values are **not** to apply:
     Click the "Close" button.
     ⇒ The "Expert mode" dialog closes.
     or
   - If the temporary pressure values are to apply:
     Click the "Apply" button.
     ⇒ The temporary pressure values are **permanently** applied in the "Breakout pressure limit" and "Abort pressure limit" parameters.
     Click the "Close" button.
     ⇒ The "Expert mode" dialog closes.
6. Complete the configuration or execution of the PST.
   - Wizard - Partial Stroke Test → With SIMATIC PDM: Configure PST with wizard and execute reference run (Page 153)
   - Maintenance and diagnostics > Partial Stroke Test → With SIMATIC PDM: Run PST (Page 167)

   **Note**

   Shorten the PST test interval (A8.INTRV) to maintain the smooth running of the process valve.

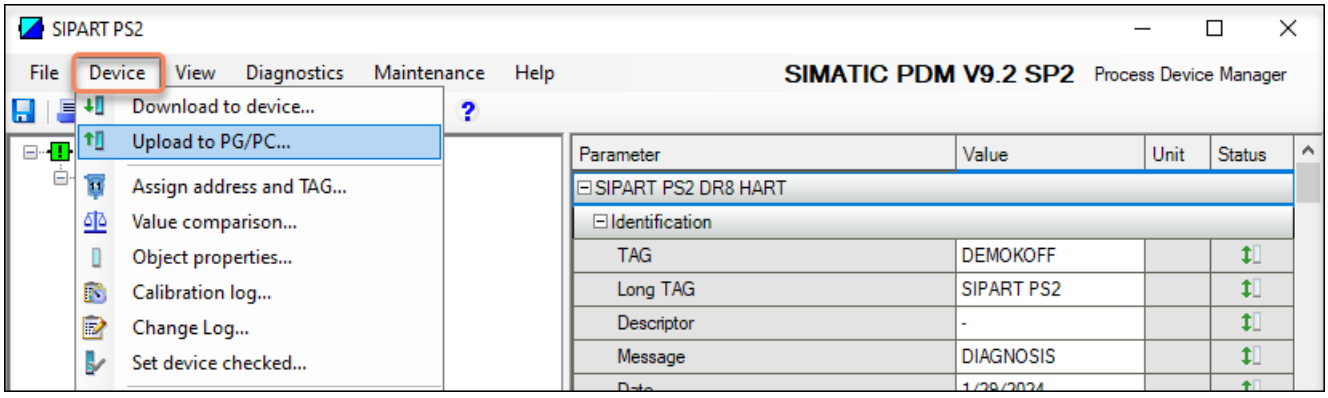
## 5.5.6 With SIMATIC PDM: Display PST results, KPIs and diagrams

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The PST was executed.

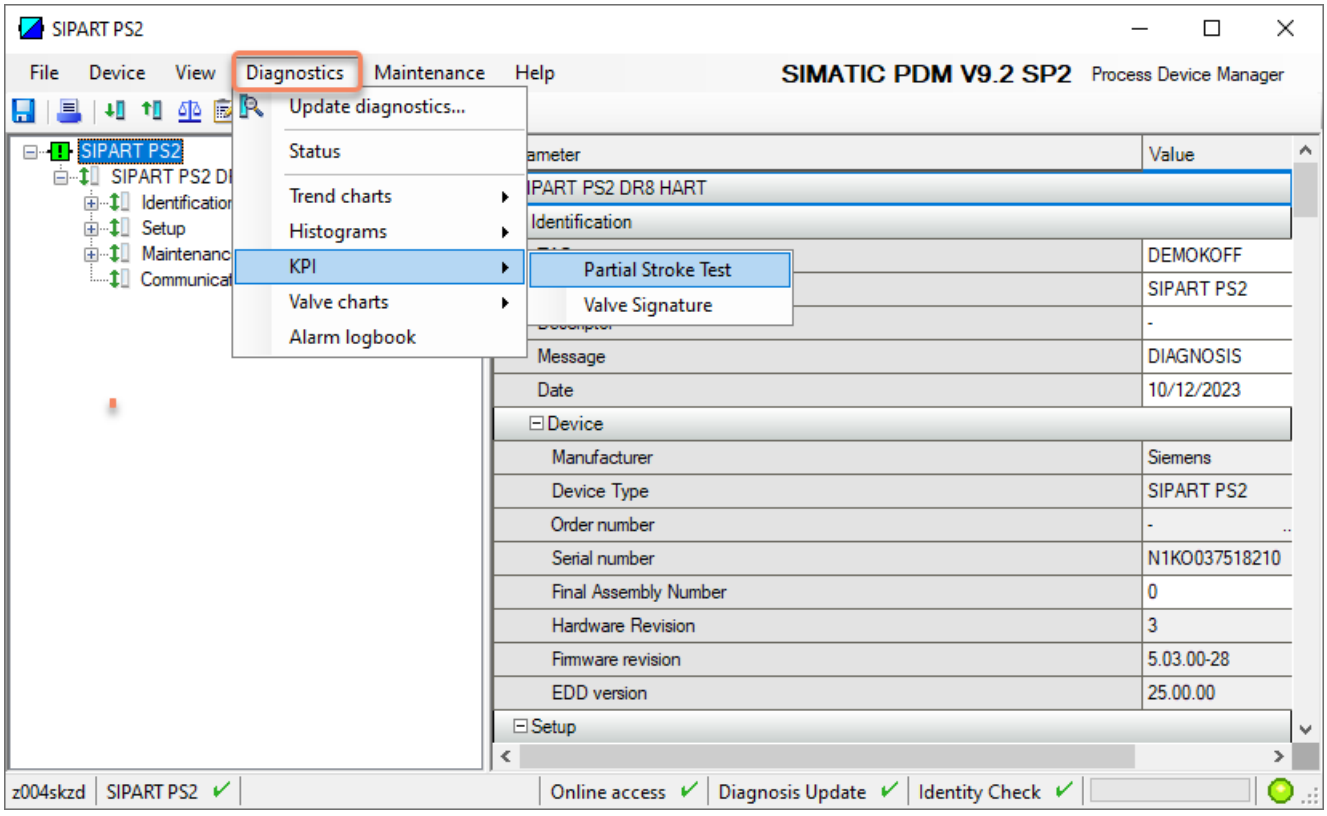
### Display PST results and KPI

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

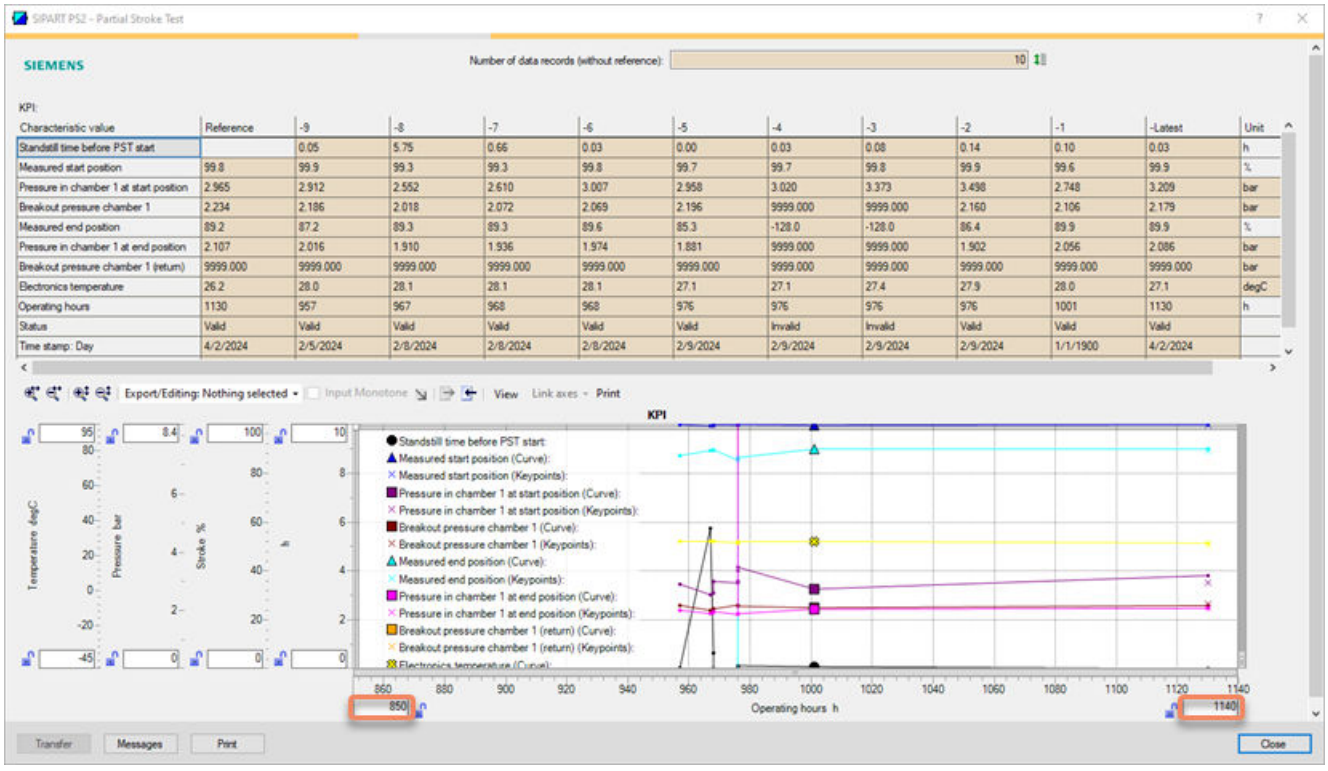



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the command "KPI > Partial Stroke Test".



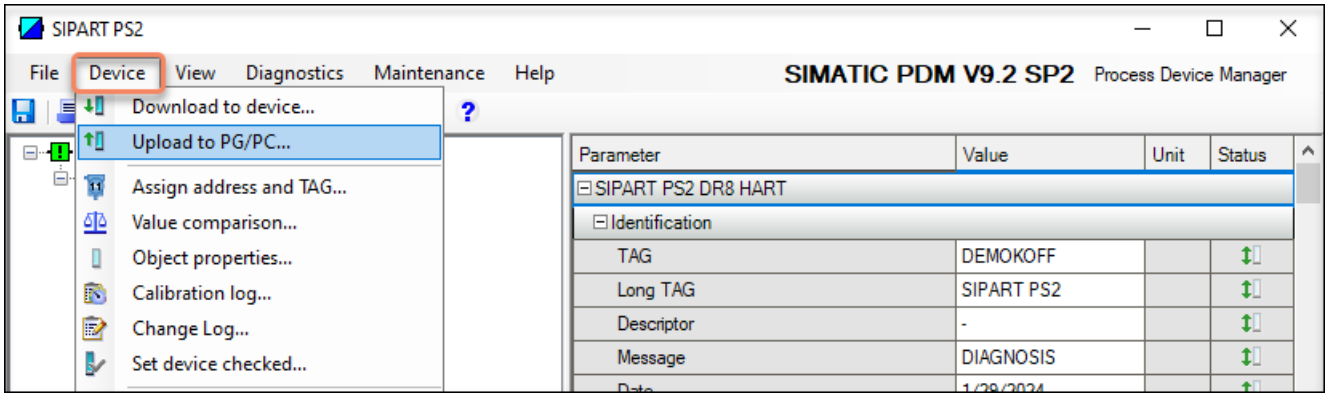

⇒ The "Partial Stroke Test" dialog opens.
The results of the last 10 Partial Stroke Tests are displayed in the dialog.




7. Close the dialog.

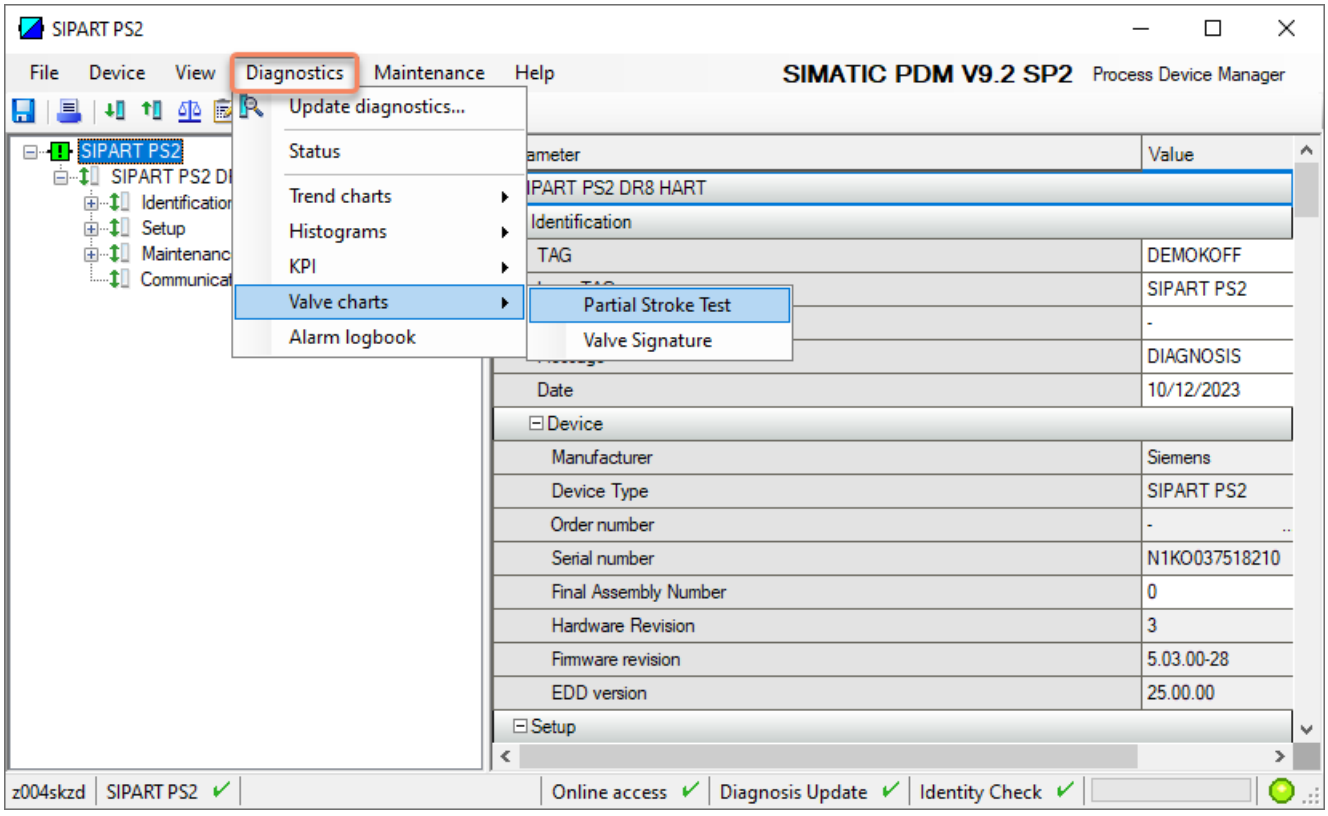
## Display PST diagrams

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



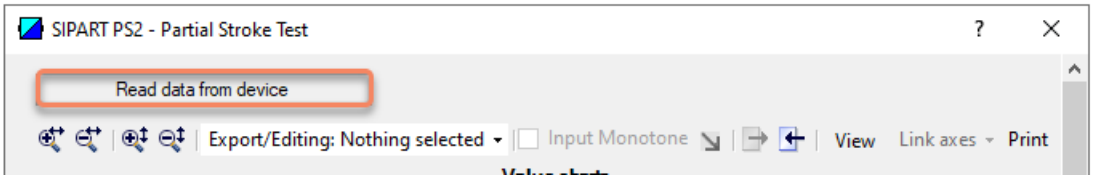

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Valve charts > Partial Stroke Test" command.



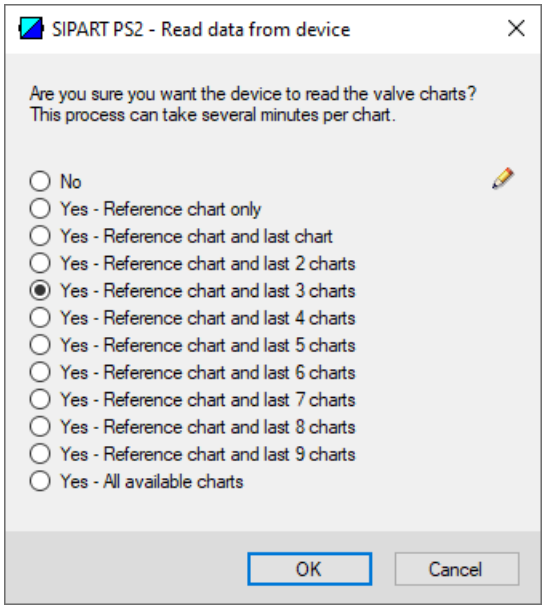

⇒ The "Partial Stroke Test" dialog opens.

7. Click the "Read data from device" button.



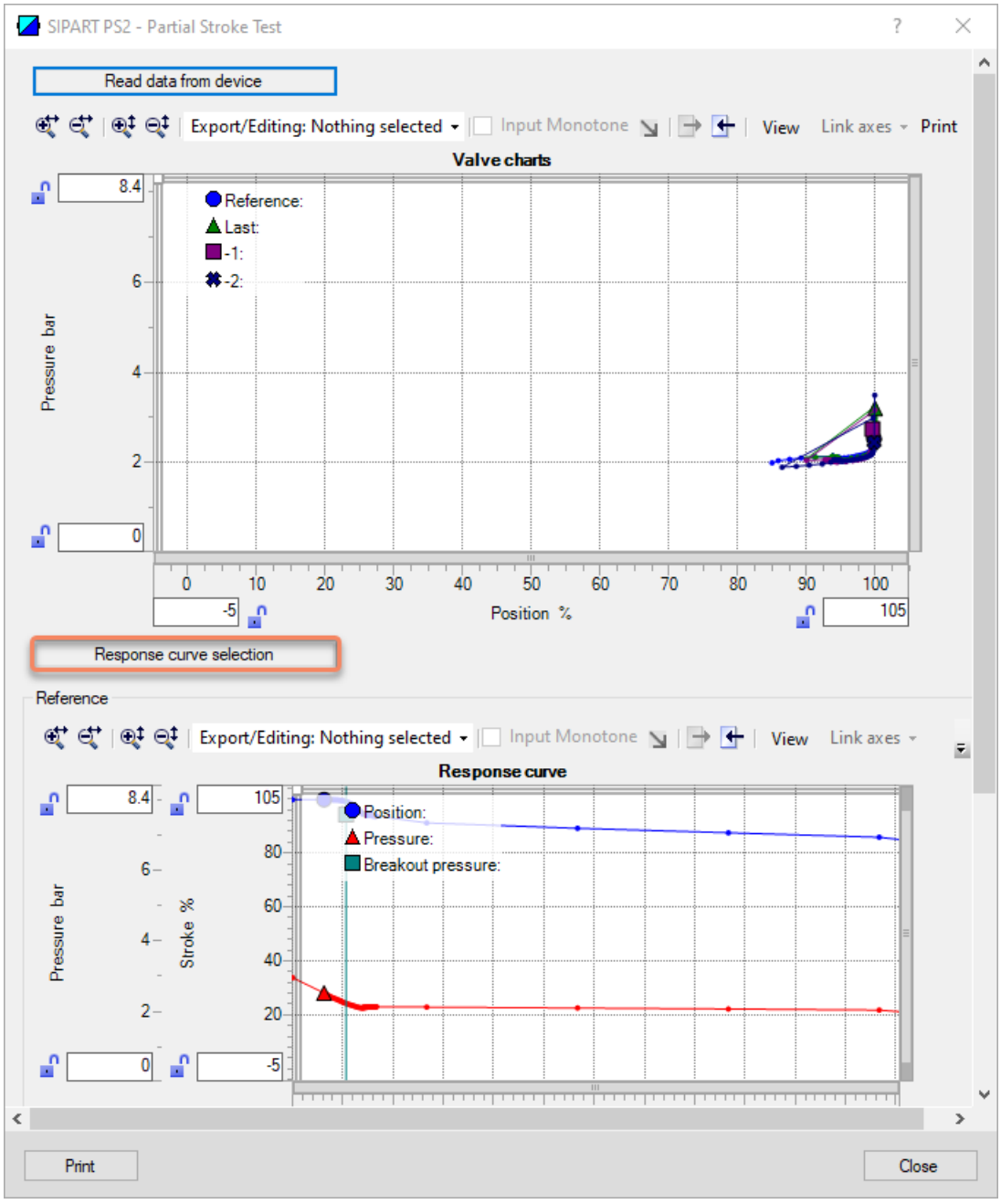

⇒ The "Read data from device" dialog opens.

8. Activate the desired selection and amount of data.

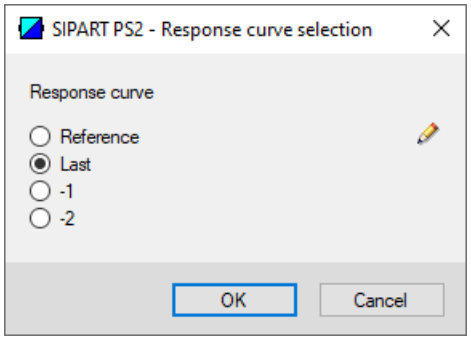



9. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
10. Wait until the status "Finished" is displayed.
11. Close the "Message Log" dialog.

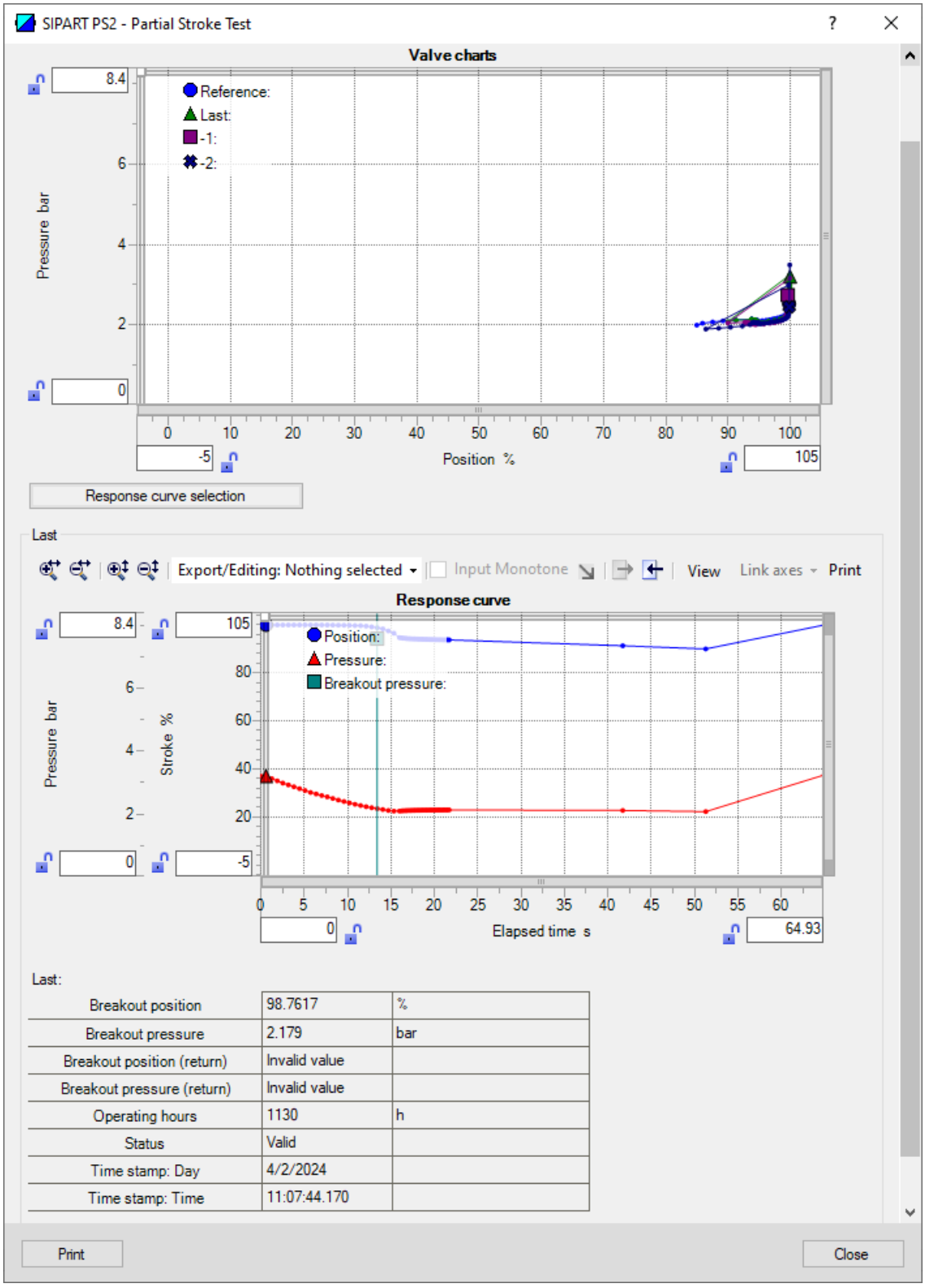
12. In the "Partial Stroke Test" dialog, click the "Response curve selection" button.



13. In the "Response curve selection" dialog, activate the required selection and confirm with "OK".




⇒ The dialog with the charts of the selected data is displayed.




14. Close the dialog.

### 5.5.7 With local operation: Configure PST and execute reference run

**Requirement**

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.

## Configuring parameters

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Configure the PST parameters.

| **A1.STPOS** | **Start position** |
|---|---|
| Function | The parameter defines the start position of the PST. |
| Note | The start position of the PST should correspond to the fully pressurized position of the actuator.<br>This means that the start position should not correspond to the safety position of the process valve. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

| **A2.STTOL** | **Start tolerance** |
|---|---|
| Function | The parameter defines the start tolerance of the PST. |
| Note | Example: Start position "100.0", start tolerance "2.0".<br>• During the PST reference run, the actuator moves from the current position to the start position. When the position 98% is exceeded, the start position is considered reached.<br>• The PST only starts when the actuator is between the positions 98% and 102%. |
| Setting range | 0.1 ... 10.0 |
| Factory setting | 2.0 |
| Unit | % |

| **A8.INTRV** | **Test interval** | |
|---|---|---|
| Function | The parameter defines the interval time for the cyclic PST. | |
| Setting options | OFF | The test interval is deactivated. |
| | 1 ... 365 | The test interval is activated and the interval time is defined in days. |
| Factory setting | OFF | |

| **Ad.ENPOS** | **End position** |
|---|---|
| Function | The parameter defines the end position of the PST.<br>• During the PST reference run to determine the abort pressure, the actuator moves from the start position to the end position, taking into account the end tolerance (AE.ENTOL).<br>• The actuator moves from the start position to the end position during the PST. As the end position is approached based on pressure, it can be slightly undercut. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 90.0 |
| Unit | % |

| **AE.ENTOL** | **End tolerance** |
|---|---|
| Function | The parameter defines the end tolerance of the PST relative to the end position. |
| Note | Example: End position "90.0", end tolerance "5.0".<br>• During the PST reference run to determine the abort pressure, the actuator moves to position "85.0".<br>• With PST, the actuator moves to the end position "90.0".<br>As the end position is approached based on pressure, it can be slightly undercut. |
| Setting range | 1.0 ... 20.0 |
| Factory setting | 5.0 |
| Unit | % |

| **AH.PSTDO** | **Time to end position** |
|---|---|
| Function | The parameter defines the minimum duration that the PST uses for depressurizing to travel from the start position to the end position. |
| Note | Example: Value "1".<br>Depending on the process actuator, the PST needs a minimum time to cover the distance. The actuator moves directly to the end position. |
| Setting range | 1 ... 300 |
| Factory setting | 80 |
| Unit | s (second) |

| **AJ.PSTUP** | **Time back to start position** | |
|---|---|---|
| Function | The parameter defines the minimum duration that the PST uses for pressurizing to move from the end position back to the start position. | |
| Note | Example 1: You have left the value at the factory setting "0".<br>• The PST travels from the end position uncontrolled directly back to the start position.<br>Example 2: Value "1".<br>• Depending on the process actuator, the PST needs a minimum time to cover the distance. The actuator moves gradually to the start position. | |
| Setting range | 0 ... 300 | • If "0": No data recording when returning to the start position.<br>• With ≥ "1": Recording of data when returning to the start position. |
| Factory setting | 0 | |
| Unit | s (second) | |

| **AL.PSTRP** | **Test repetitions** | |
|---|---|---|
| Function | Test repetitions in the event of a failed PST | |
| Setting options | OFF | The test repetition function is deactivated. |
| | 1 ... 3 | The test repetition function is activated and the number defined. |
| Factory setting | 0FF | |

### Perform PST reference run

1. Select the "AY.PSTRF" parameter.
   The PST reference run can be started with one of the following status displays in the top line of the display:
   - "Empty"
   - "oCAY"

   If the status display is different, the PST reference run cannot be started.

| **AY.PSTRF** | **Start reference PST** | |
|---|---|---|
| Function | The parameter shows the status of the PST reference run. | |
| Status displays | noIni | Positioner has not yet been initialized. |
| | "Empty" | The PST reference run has not yet been performed or the PST parameters have been changed. |
| | rEAL | The PST reference run is activated. |
| | INPST | The PST reference run is in progress. |
| | oCAY | The PST reference run was completed successfully. |
| | C-Err | Configuration error |
| | FdIni | Failed PST initialization: The PST reference run failed. |
| | SdrEF | The PST reference run was canceled. |
| Factory setting | noIni | |

2. Press the ⚠ button for at least 5 seconds and the display will show "rEAL".
   ⇒ The PST reference run starts.
   ⇒ "INPST" is shown in the display.
3. Wait until the PST reference run is completed.
   ⇒ If the display shows "oCAY", the PST reference run has been successfully completed.

### 5.5.8 With local operation: Run PST

#### Requirement

- The PST reference run was performed successfully → With local operation: Configure PST and execute reference run (Page 186).
- The positioner is in "Automatic (AUT)" mode.
- The actuator is at the defined PST start position (A1.STPOS) ± PST start tolerance (A2.STTOL).

#### Procedure

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "12.PST".
   The PST can be started when one of the following status displays appears in the top line of the display:
   – "notSt": No Test - The PST has not yet been performed.
   – "oCAY": The last PST was successfully executed.

   With other status displays, the PST cannot be started → Diagnostic value "PST status" (12.PST) (Page 194).
3. Start PST Press the ⚠ button for at least 5 seconds and the display will show "Strt".
   ⇒ The PST starts. Indication on the display "WAIt".
   ⇒ Indication in the display during PST execution: "EXPST".
   The PST can be interrupted by pressing the ⚠ button again.
4. Wait until PST is finished
   ⇒ After the successful PST, the display shows "oCAY".

## 5.5.9 Run PST in local expert mode

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.
- The parameters of the PST process diagnostics are configured → With local operation: Configure PST and execute reference run (Page 186).

### Note on the PST in local expert mode

The limit of the breakout pressure can be changed with the following 2 parameters, e.g. to enable breakout in the case of a stuck process valve.

| AF.BOLIM | Breakout pressure limit |
|---|---|
| Function | The parameter defines the pressure at which the process valve must have moved after the PST start, otherwise the PST aborts.<br>The pressure value is determined in the PST reference run or defined via the "Temporary Breakout pressure limit" parameter. |
| Note | Example: Limit for breakout pressure "1.5", tolerance for breakout pressure "0.2".<br>The breakout must be detected before the pressure has reached 1.3 bar.<br>For double-acting actuators, the value relates to the pressure difference P2 minus P1. |
| Setting range | 0.1 ... 7 |
| Factory setting | 7<br>Automatic adjustment is made after the PST reference run. |
| Unit | bar |

| AG.BOTOL | Breakout pressure tolerance |
|---|---|
| Function | The parameter defines the tolerance for the breakout pressure of the PST. |
| Note | Example: Limit for breakout pressure "1.5", tolerance for breakout pressure "0.2".<br>The breakout must be detected before the pressure has reached 1.3 bar.<br>For double-acting actuators, the value relates to the pressure difference P2 minus P1. |
| Setting range | 0.1 ... 6 |
| Factory setting | 0.1 |
| Unit | bar |

The abort pressure cannot be changed locally, but only with SIMATIC PDM in expert mode.

### Configure parameters and run PST

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Configure the PST parameters AF.BOLIM and AG.BOTOL.
3. Start the PST → With local operation: Run PST (Page 190).
   The PST can alternatively be used with SIMATIC PDM via digital contacts or via HART communication.

## 5.5.10 Via digital contacts: Start PST

### Requirement

The digital input DI2 is only available for positioners with Digital I/O Module (DIO).

### Activate and start digital input PST

The PST can be started via the digital input DI1 or DI2.

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Select the application parameter "42.DI1 - Digital input 1 function" or "43.DI2 - Digital input 2 function".
3. Set the parameter to one of the following values according to the actuation:
   – When actuated with a NO contact ("Normally Open"): "PST"
   – When actuated with a NC contact ("Normally Closed"): "-PST"

   ⇒ The digital input is activated for the PST activated.
4. Switch the positioner to "Manual (MAN)" mode by pressing the button on the display simultaneously for at least 5 seconds.
5. Switch the positioner to "Automatic (AUT)" mode by pressing the button.
   ⇒ Activating the connected NC contact or NO contact starts the PST.

### 5.5.11 Via HART communication: Start PST

#### Requirement

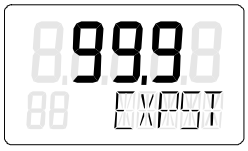
- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.

#### Start PST

Send to the positioner via HART communication:

- Command "#172"
- Byte 0, Bit 5 and Byte 1, Bit 0

⇒ The PST starts and the display shows "EXPST".



#### Cancel PST

Send to the positioner via HART communication:

- Command "#172"
- Byte 0, Bit 5 and Byte 1, Bit 1

## 5.5.12 Diagnostic value "PST status" (12.PST)

| **Diagnostic value** | **Status PST**<br>**Short designation: 12.PST** | |
|---|---|---|
| Function | The diagnostic value shows the status of the last Partial Stroke Test (PST). | |
| Note | The PST can be started manually with this diagnostic value → With local operation: Run PST (Page 190).<br>Requirement for PST:<br>Successful PST reference run → With local operation: Configure PST and execute reference run (Page 186) | |
| Requirement | The positioner has pressure sensors ( -Z P02 option). | |
| Status messages at the start of the PST | notoL | No Tolerance: The actuator is outside the defined "Start position" (A1.STPOS) ± "Start tolerance" (A2.STTOL). The PST does not start. |
| | Strt | Start: After 5 seconds, manual PST is started. |
| | WAIt | Wait: The PST is being executed. |
| Status/display options | Off | The PST is deactivated. |
| | C-ERR | Configuration error:<br>• PST cannot be started.<br>• Settings in the "Start position" (A1.STPOS) and "End position" (Ad.EN-POS) parameters are not plausible. |
| | FdIni | Failed PST Initialization: The PST reference run has failed. |
| | norEF | The PST reference run has not yet been performed. |
| | notSt | No Test: The PST has not yet been performed |
| | oCAY | The last PST was successfully executed. |
| | SdtSt | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed. |
| Factory setting | Off | |
| **Communication** | | |
| HART communication (read) | Command | #211 |
| | Response Data | Format and meaning: → Via HART communication: Read out diagnostic results (Page 196) |

### 5.5.13 Diagnostic value " - Time since last Partial Stroke Test" (13.PRPST)

| **Diagnostic value** | **Time since last Partial Stroke Test**<br>**Short designation: 13.PRPST** | |
|---|---|---|
| Function | The diagnostic value shows the time since the last Partial Stroke Test (PST) in days or the status. | |
| Display options | ### | Days since the last PST |
| | notSt | No Test: The PST has not yet been performed |
| | norEF | The PST reference run has not yet been performed. |
| | Sdtst | Stopped Test: The last PST was interrupted. |
| | FdtSt | Failed Test: The last PST failed |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_prev_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 12 ... 15<br>Format: Float |

### 5.5.14 Diagnostic value "Time until next Partial Stroke Test" (14.NXPST)

| **Diagnostic value** | **Time to next Partial Stroke Test**<br>**Short designation: 14.NXPST** | |
|---|---|---|
| Function | The diagnostic value shows the time until the next Partial Stroke Test (PST) in days. | |
| Requirement | • The PST is activated in "Configuration" mode.<br>• A test interval is set in the "A8.INTRV" parameter. | |
| Display options | Off | Factory setting or unfulfilled requirement |
| | ### | Days until next PST |
| Unit | Days | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pst_next_time |
| | DisplayValue | ≙ Value |
| HART communication | Command | #171 |
| | Response Data | Bytes: 17 ... 20<br>Format: Float |

## 5.5.15 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The PST was executed.

### Display the diagnostics status

Send to the positioner via HART communication:

- Command "#209"
- Byte 0

The answer consists of the following data:

Table 5-8 Status byte for PST_ADV resp. PST_REFADV

| Bit | Status |
|---|---|
| 0 | PST_ADVREF running |
| 1 | PST_ADVREF failed |
| 2 | PST_ADVREF valid |
| 3 | PST_ADVREF stopped |
| 4 | PST_ADV running |
| 5 | PST_ADV failed |
| 6 | PST_ADV valid |
| 7 | PST_ADV stopped |

### Read out PST results

#### Request

Send to the positioner via HART communication:

- Command "#211"
- Byte 0 with the index the PST: "0" or "1" to"9".

| Byte | Format | Description | |
|---|---|---|---|
| 0 | Unsigned-8 | Index of the data record to be read | |
| | | 0 | Current or latest data record |
| | | 1 ... 9 | Previous data record |

#### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-9 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Unsigned-8 | Data record index of the read data |
| 1 | Unsigned-8 | Advanced PST State |
| 2 ... 3 | Unsigned-16 | Advanced PST Error |
| 4 ... 7 | Float | Advanced PST Idleness time |
| 8 ... 11 | Float | Advanced PST: Start Position |
| 12 ... 15 | Float | Advanced PST: End Position |
| 16 | Enum | Pressure Unit |
| 17 ... 20 | Float | Advanced PST: Pressure P1 at Start Position |
| 21 ... 24 | Float | Advanced PST: Pressure P2 at Start Position |
| 25 ... 28 | Float | Advanced PST: Pressure P1 at Breakout Position Down |
| 29 ... 32 | Float | Advanced PST: Pressure P2 at Breakout Position Down |
| 33 ... 36 | Float | Advanced PST: Pressure P1 at End Position |
| 37 ... 40 | Float | Advanced PST: Pressure P2 at End Position |
| 41 | Enum | Temperature Unit |
| 42 ... 45 | Float | Advanced PST Electronic Temperature |
| 46 ... 48 | Date | Advanced PST Timestamp: Date |
| 49 ... 52 | Time | Advanced PST Timestamp: Time |
| 53 ... 56 | Float | Advanced PST: Pressure P1 at Breakout Position Return |
| 57 ... 60 | Float | Advanced PST: Pressure P2 at Breakout Position Return |
| 61 ... 64 | Unsigned-32 | Advanced PST Operating Hours Counter |

Table 5-10 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 6 | Error | Device-Specific Command Error |

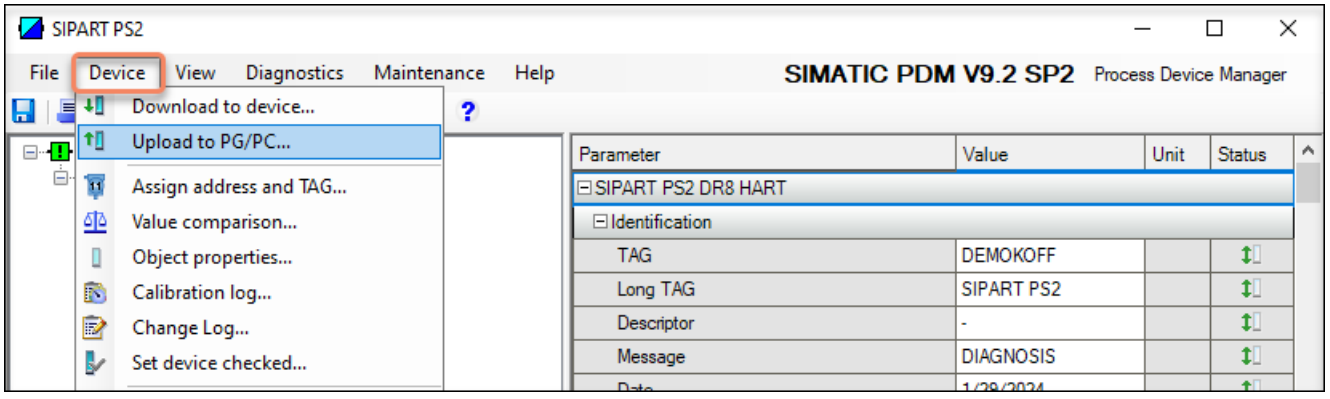
## 5.5.16 With SIMATIC PDM: Export diagnostics results

### Requirement

- The positioner has pressure sensors ( -Z P02 option).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The PST was executed and the trace charts were displayed → With SIMATIC PDM: Configure PST with wizard and execute reference run (Page 153).

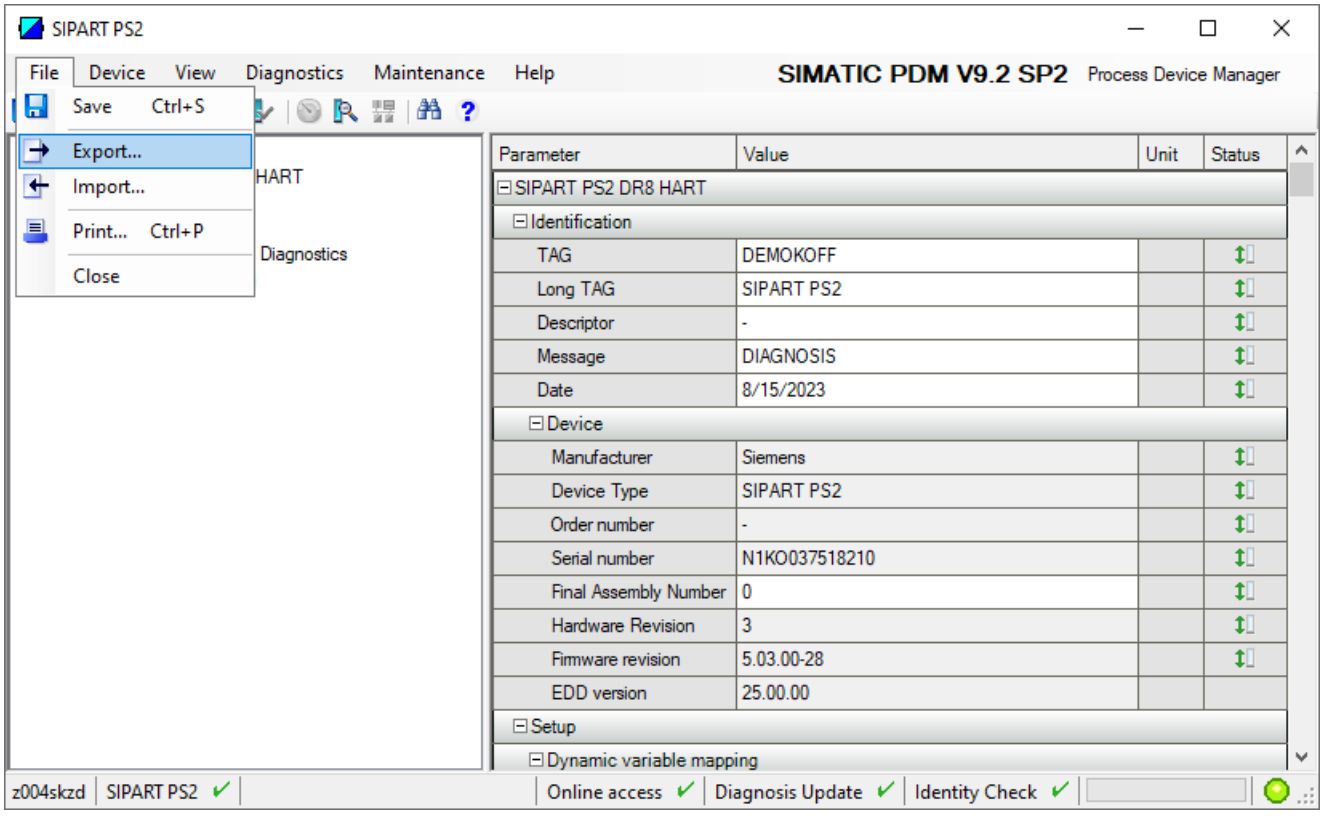
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



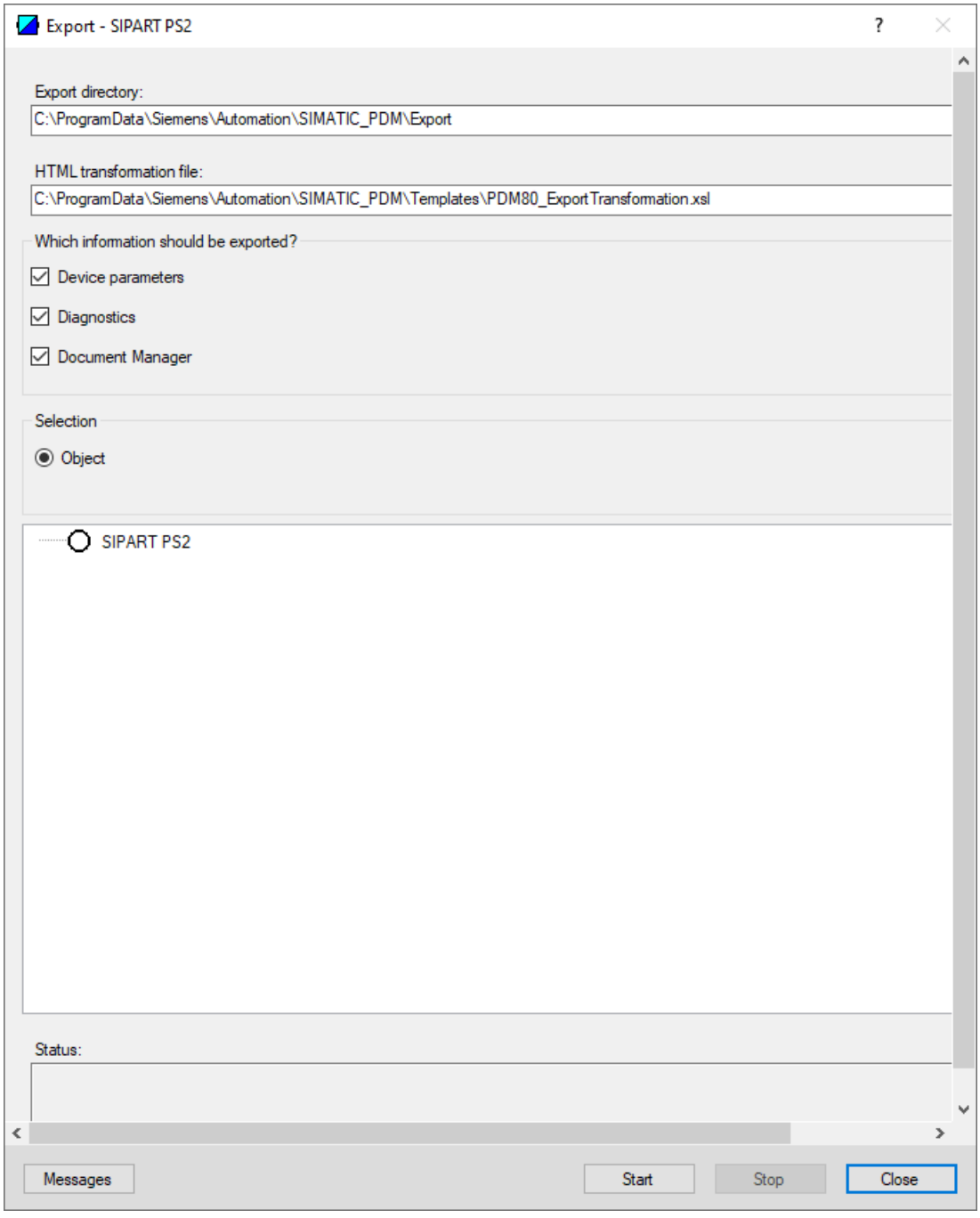

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "File" menu, select the "Export..." command.



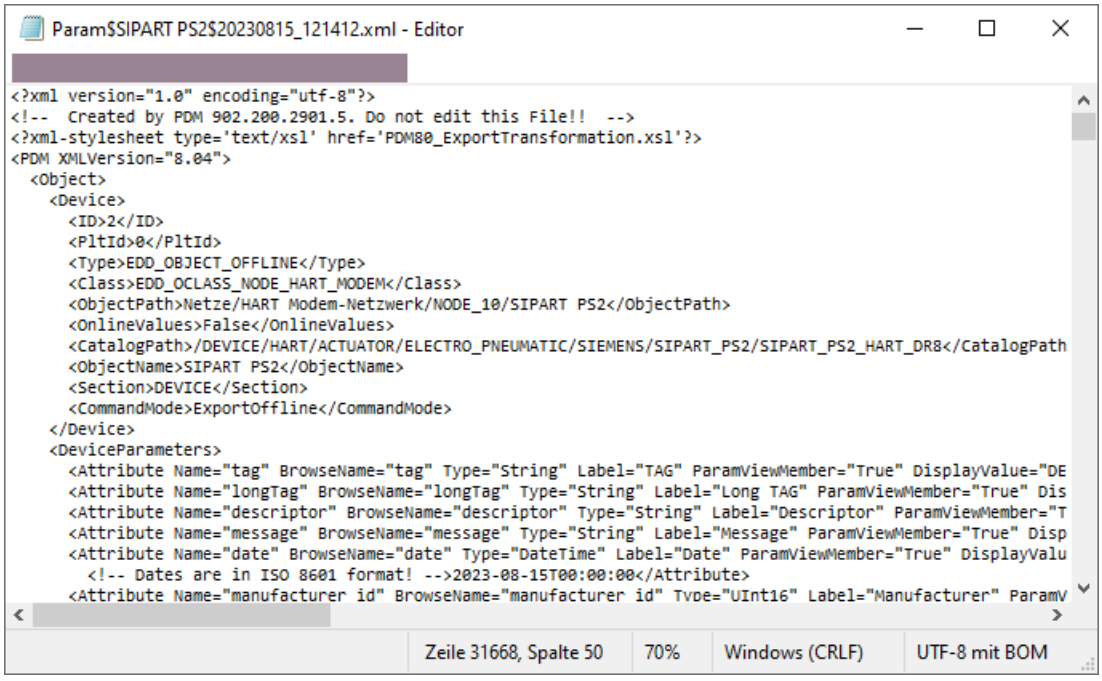

⇒ The "Export - ..." dialogopens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.

9. Wait until the status "Export: Action finished" is displayed.
   The following 2 files are stored in the export path:
   - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
   - XSL stylesheet "PDM80_ExportTransformation.xsl"
10. Close the dialog.
11. Open the XML file with suitable software, e.g. an editor.




The XML file contains the following data for process diagnostics.

Table 5-11 Parameter

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| A1.STPOS | ps2_pst_start_pos | Start position (A1.STPOS) | 100.0 | % |
| A2.STTOL | ps2_pst_start_tol | Start tolerance (A2.STTOL) | 2.0 | % |
| Ad.ENPOS | var_PST_Adv_EndPos | End position (Ad.ENPOS) | 90.0 | % |
| AE.ENTOL | var_PST_Adv_EndTol | End tolerance (AE.ENTOL) | 5.0 | % |
| AF.BOLIM | var_PST_Adv_BreakoutPresLimit | Breakout pressure limit (AF.BOLIM) | 2.022 | • bar<br>• MPa<br>• psi |
| AG.BOTOL | var_PST_Adv_BreakoutPresTol | Breakout pressure tolerance (AG.BOTOL) | 0.100 | |
| AH.PSTDO | var_PST_Adv_TimeDown | Time to end position (AH.PSTDO) | 80 | s |
| AJ.PSTUP | var_PST_Adv_TimeReturn | Time back to start position (AJ.PSTUP) | 0 | s |

| **Parameter** | **Data description in the XML file** | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| AL.PSTRP | var_PST_Adv_Repeat | Test repetitions (AL.PSTRP) | OFF | - |
| A8.INTRV | ps2_pst_inter_val | Test interval (A8.INTRV) | OFF | • OFF<br>• Days |

Table 5-12 Diagnostics results

| **Diagnostic value/ Parameter** | **Data description in the XML file** | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| 13.PRPST | ps2_pst_prev_time | Time since last PST (13.PRPST) | 0 | Days |
| 14.NXPST | ps2_pst_next_time | Time to next PST (14.NXPST) | 0 | Days |
| Abort pressure limit | var_PST_Adv_AbortPresLimit | Abort pressure limit | 0.333 | • bar<br>• MPa<br>• psi |

| Diagnostic value/ Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| <PST reference run> | var_KPI_PST_AdvRef_State_2_F8 | Status for 'PST' | 0 | - |
| | var_KPI_PST_AdvRef_State_2_Valid | Status for 'PST' | Valid | - |
| | var_KPI_PST_AdvRef_State_2_03 | Status for 'PST' | 0 | - |
| | var_KPI_PST_AdvRef_Error_2 | Detailed PST-Error information | 0 | - |
| | var_KPI_PST_AdvRef_TimeStamp_Date | Time stamp: Day | 1/31/2024 <mm/dd/yyyy> | - |
| | var_KPI_PST_AdvRef_TimeStamp_Time | Time stamp: Time | 14:35:42.165 | - |
| | var_KPI_PST_AdvRef_OperatingHours | Operating hours | 946 | h |
| | var_KPI_PST_AdvRef_ElectronicsTemp | Electronics temperature | 27.1 | • °C<br>• °F |
| | var_KPI_PST_AdvRef_StartPos_ActValue | Measured start position | 99.8 | % |
| | var_KPI_PST_AdvRef_EndPos_ActValue | Measured end position | 89.4 | % |
| | var_KPI_PST_AdvRef_BreakoutTime_P1 | Breakout pressure chamber 1 | 2.286 | • bar<br>• MPa<br>• psi |
| | var_KPI_PST_AdvRef_StartPos_P1 | Pressure in chamber 1 at start position | 3.143 | |
| | var_KPI_PST_AdvRef_BreakoutTime_P1 | Breakout pressure chamber 1 | 2.286 | |
| | var_KPI_PST_AdvRef_EndPos_P1 | Pressure in chamber 1 at end position | 2.128 | |
| | var_KPI_PST_AdvRef_BreakoutTime_P1_Return | Breakout pressure chamber 1 (return) | 9999.000 | |
| | var_KPI_PST_AdvRef_BreakoutTime_P2 | Breakout pressure chamber 2 | 9999.000 | |
| | var_KPI_PST_AdvRef_StartPos_P2 | Pressure in chamber 2 at start position | 9999.000 | |
| | var_KPI_PST_AdvRef_EndPos_P2 | Pressure in chamber 2 at end position | 9999.000 | |
| | var_KPI_PST_AdvRef_BreakoutTime_P2_Return | Breakout pressure chamber 2 (return) | 9999.000 | |

| **Diagnostic value/ Parameter** | **Data description in the XML file** | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| <Last PST> | var_KPI_PST_AdvLatest_State_2_80 | Status for 'PST' | 0 | - |
| | var_KPI_PST_AdvLatest_State_2_Valid | Status for 'PST' | Valid | - |
| | var_KPI_PST_AdvLatest_State_2_3F | Status for 'PST' | Reference PST is valid | - |
| | var_KPI_PST_AdvLatest_IdlenessTime | Standstill time before PST start | 0.00 | h |
| | var_KPI_PST_AdvLatest_Error_2 | Detailed PST-Error information | 0 | - |
| | var_KPI_PST_AdvLatest_TimeStamp_Date | Time stamp: Day | 1/31/2024 <mm/dd/yyyy> | - |
| | var_KPI_PST_AdvLatest_TimeStamp_Time | Time stamp: Time | 14:40:58.715 | - |
| | var_KPI_PST_AdvLatest_OperatingHours | Operating hours | 947 | h |
| | var_KPI_PST_AdvLatest_ElectronicsTemp | Electronics temperature | 27.1 | • °C<br>• °F |
| | var_KPI_PST_AdvLatest_StartPos_ActValue | Measured start position | 99.8 | % |
| | var_KPI_PST_AdvLatest_EndPos_ActValue | Measured end position | 89.9 | % |
| | var_KPI_PST_AdvLatest_StartPos_P1 | Pressure in chamber 1 at start position | 2.956 | • bar<br>• MPa<br>• psi |
| | var_KPI_PST_AdvLatest_BreakoutTime_P1 | Breakout pressure chamber 1 | 2.271 | |
| | var_KPI_PST_AdvLatest_EndPos_P1 | Pressure in chamber 1 at end position | 2.080 | |
| | var_KPI_PST_AdvLatest_BreakoutTime_P1_Return | Breakout pressure chamber 1 (return) | 9999.000 | |
| | var_KPI_PST_AdvLatest_StartPos_P2 | Pressure in chamber 2 at start position | 9999.000 | |
| | var_KPI_PST_AdvLatest_BreakoutTime_P2 | Breakout pressure chamber 2 | 9999.000 | |
| | var_KPI_PST_AdvLatest_EndPos_P2 | Pressure in chamber 2 at end position | 9999.000 | |
| | var_KPI_PST_AdvLatest_BreakoutTime_P2_Return | Breakout pressure chamber 2 (return) | 9999.000 | |
| | var_KPI_PST_Adv_NumberOfDatasets | Number of data records (without reference) | 10 | - |

Table 5-13 KPIs of the maximum of 9 predecessor PSTs

| **Data description in the XML file** | | | |
|---|---|---|---|
| **Name** | **Label** | **DisplayValue** | **Unit** |
| var_KPI_PST_AdvM**1**_State_2_80<br>...<br>var_KPI_PST_AdvM**9**_State_2_80 | Status for 'PST' | ... | - |
| var_KPI_PST_AdvM**1**_State_2_Valid<br>...<br>var_KPI_PST_AdvM**9**_State_2_Valid | Status for 'PST' | ... | - |
| var_KPI_PST_AdvM**1**_State_2_3F<br>...<br>var_KPI_PST_AdvM**9**_State_2_3F | Status for 'PST' | ... | - |
| var_KPI_PST_AdvM**1**_IdlenessTime<br>...<br>var_KPI_PST_AdvM**9**_IdlenessTime | Standstill time before PST start | ... | h |
| var_KPI_PST_AdvM**1**_Error_2<br>...<br>var_KPI_PST_AdvM**9**_Error_2 | Detailed PST-Error information | ... | - |
| var_KPI_PST_AdvM**1**_TimeStamp_Date<br>...<br>var_KPI_PST_AdvM**9**_TimeStamp_Date | Time stamp: Day | ... | - |
| var_KPI_PST_AdvM**1**_TimeStamp_Time<br>...<br>var_KPI_PST_AdvM**9**_TimeStamp_Time | Time stamp: Time | ... | - |
| var_KPI_PST_AdvM**1**_OperatingHours<br>...<br>var_KPI_PST_AdvM**9**_OperatingHours | Operating hours | ... | h |
| var_KPI_PST_AdvM**1**_ElectronicsTemp<br>...<br>var_KPI_PST_AdvM**9**_ElectronicsTemp | Electronics temperature | ... | • °C<br>• °F |
| var_KPI_PST_AdvM**1**_StartPos_ActValue<br>...<br>var_KPI_PST_AdvM**9**_StartPos_ActValue | Measured start position | ... | % |
| var_KPI_PST_AdvM**1**_EndPos_ActValue<br>.....<br>var_KPI_PST_AdvM**9**_EndPos_ActValue | Measured end position | ... | % |

| **Data description in the XML file** | | | |
|---|---|---|---|
| **Name** | **Label** | **DisplayValue** | **Unit** |
| var_KPI_PST_AdvM**1**_StartPos_P1<br>...<br>var_KPI_PST_AdvM**9**_StartPos_P1 | Pressure in chamber 1 at start position | ... | • bar<br>• MPa<br>• psi |
| var_KPI_PST_AdvM**1**_BreakoutTime_P1<br>.....<br>var_KPI_PST_AdvM**9**_BreakoutTime_P1 | Breakout pressure chamber 1 | ... | |
| var_KPI_PST_AdvM**1**_EndPos_P1<br>...<br>var_KPI_PST_AdvM**9**_EndPos_P1 | Pressure in chamber 1 at end position | ... | |
| var_KPI_PST_AdvM**1**_BreakoutTime_P1_Return<br>...<br>var_KPI_PST_AdvM**9**_BreakoutTime_P1_Return | Breakout pressure chamber 1 (return) | ... | |
| var_KPI_PST_AdvM**1**_StartPos_P2<br>...<br>var_KPI_PST_AdvM**9**_StartPos_P2 | Pressure in chamber 2 at start position | ... | |
| var_KPI_PST_AdvM**1**_BreakoutTime_P2<br>...<br>var_KPI_PST_AdvM**9**_BreakoutTime_P2 | Breakout pressure chamber 2 | ... | |
| var_KPI_PST_AdvM**1**_EndPos_P2<br>...<br>var_KPI_PST_AdvM**9**_EndPos_P2 | Pressure in chamber 2 at end position | ... | |
| var_KPI_PST_AdvM**1**_BreakoutTime_P2_Return<br>...<br>var_KPI_PST_AdvM**9**_BreakoutTime_P2_Return | Breakout pressure chamber 2 (return) | ... | |

## 5.5.17 Messages

### 5.5.17.1 General information

**Requirement**

- The positioner has pressure sensors (-Z P02 option).
- The application parameter "52.XDIAG" is set to "On1", "On2" or "On3".
- Process diagnostics "Partial Stroke Test" (A.\PST) is activated.

**Notes**

- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - With the "#48" command, you can query the specific message for process diagnostics.

### 5.5.17.2 Messages in the display

#### Indication on the display

| Display | Possible cause | Remedy |
|---|---|---|
|  <br>① Error code 16 | The parameter values of the PST are not configured correctly.<br>If, on start of the PST, the plausibility check of the PST parameters fails, this fault message is displayed, but not reported via the fault message output. | • Execute stroke direction from high pressure level to low pressure level.<br>For double-acting actuators, the pressure difference P2 minus P1 is relevant.<br>• Configure the parameters "A1.STPOS", "A2.STTOL", "Ad.ENPOS" so that the appropriate one of the following two conditions is fulfilled:<br>– At higher pressure levels at the 100% position:<br>A1.STPOS - A2.STTOL > Ad.ENPOS + 5 %<br>– At higher pressure levels at the 0% position:<br>A1.STPOS + A2.STTOL < Ad.ENPOS - 5 % |

### 5.5.17.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

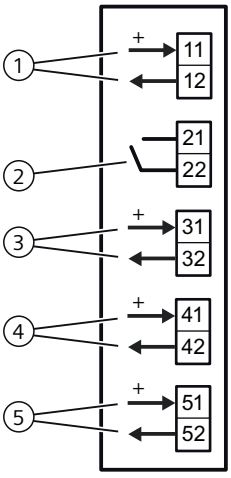
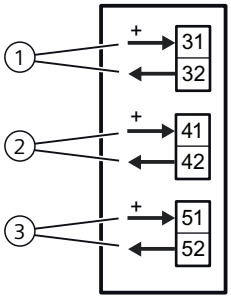
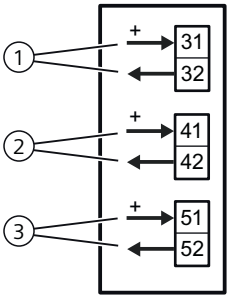
- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Message for the Partial Stroke Test

The fault message output is activated in the following situations:

- PST with pressure sensors failed
- Start position out of tolerance

#### I/Os

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR40046K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

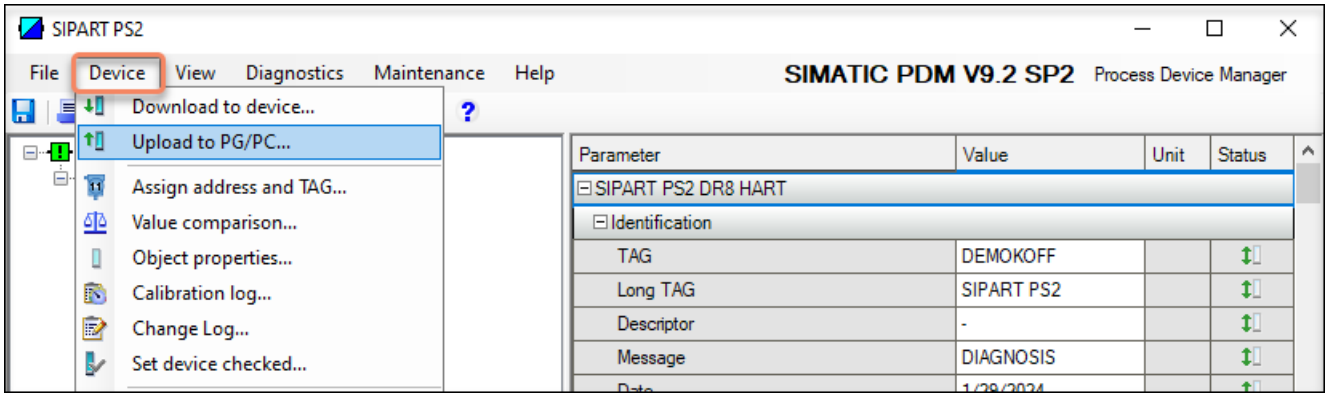
### 5.5.17.4 With SIMATIC PDM: Display PST status

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

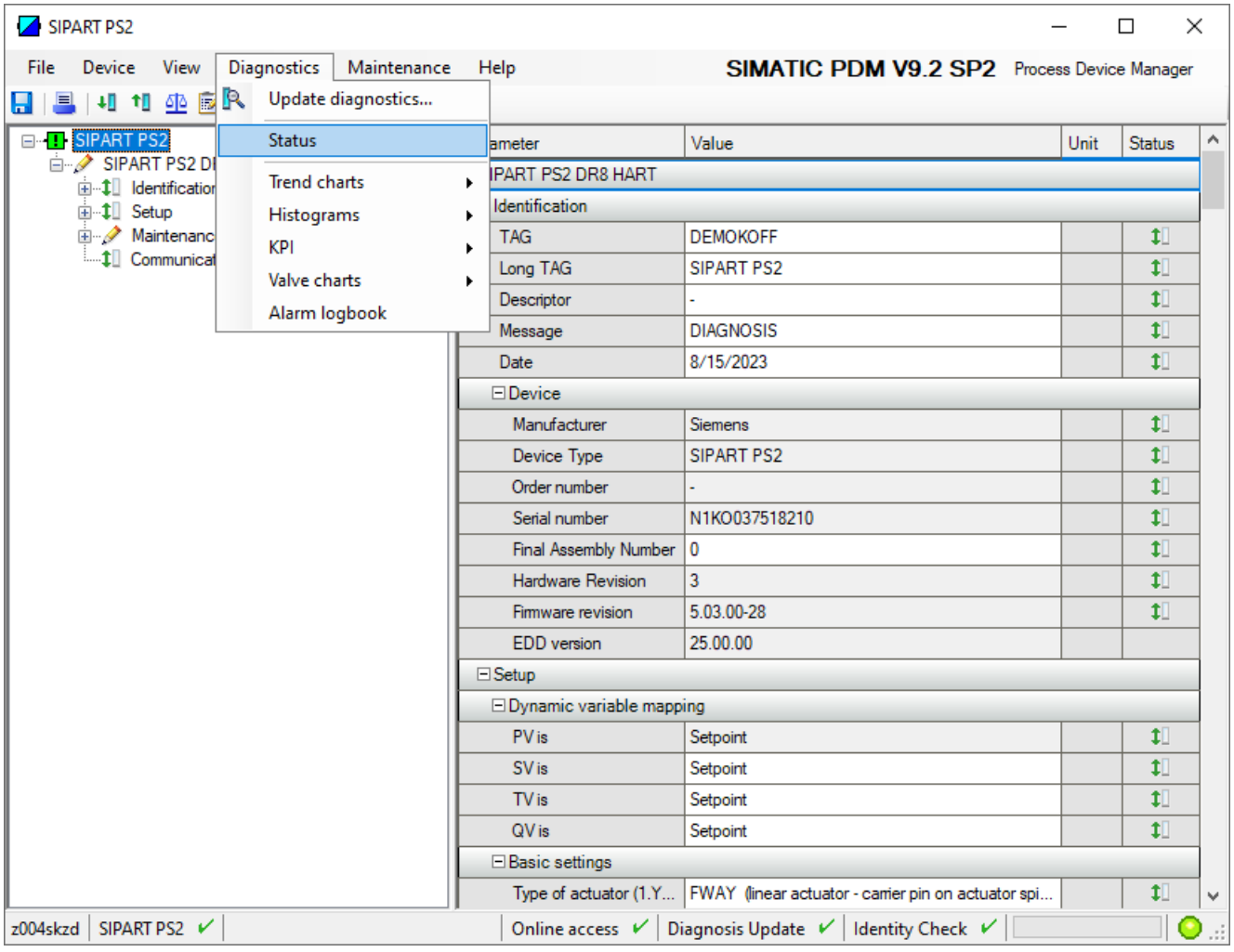
#### Procedure

1. In SIMATIC PDM , open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.




7. Select the "Status" tab.
   In the event of an error, the corresponding message is highlighted:
   - PST with pressure sensors failed
   - Start position out of tolerance
8. Close the dialog.

### 5.5.17.5 Via HART communication: Get messages

#### Requirement

- The positioner has pressure sensors ( -Z P02 option).
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52..

### Call up message for process diagnostics

Send the "#48" command to the positioner via HART communication.

⇒ 20 bytes are returned as data.

The message for the "A.\PST" process diagnostics is contained in the following Byte:

- Byte 17, Bit 4 corresponds to PST failed.

### 5.5.17.6 Reset messages

Messages are saved in the alarm logbook of the positioner.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.6 Monitoring of dynamic control valve behavior (b.\DEVI)

### 5.6.1 Functional description

Process diagnostics monitors the dynamic control valve behavior.

During diagnostics, the currently determined control behavior is compared with the expected control behavior and displayed as a percentage deviation.

When the positioner is in operation, the current value of the deviation is displayed in the diagnostic value "Dynamic control valve behavior" (15.DEVI).

#### Ring memory

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, e.g. SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

The process diagnostics are monitored with adjustable thresholds. If the limits are exceeded, messages are output via the display and optionally via the digital contacts or HART communication.

## 5.6.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics of "Monitoring of dynamic control valve behavior" (b.\DEVI)

| | | |
|---|---|---|
| Function | Process diagnostics monitors the dynamic control valve behavior. | |
| Note | The current value of the deviation is shown in the display or in SIMATIC PDM in the "Dynamic control valve behavior" diagnostic value (15.DEVI) . | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **b1.TIM** | **Time constant** | |
|---|---|---|
| Function | The parameter defines the damping effect.<br>The time constant is found during initialization from the determined travel times "uP" and "doWn" . | |
| Setting option/setting range | Auto | The time constant determined during initialization is effective. |
| | 1 ... 400 | If the determined time constant is not sufficient: Alternatively, enter a value between "1" and "400".<br>Examples:<br>• The value "1" results in very weak damping.<br>• The value "400" causes strong damping. |
| Factory setting | Auto | |
| Unit | Seconds | |

| **b2.LIMIT** | **Limit** |
|---|---|
| Function | The parameter defines the limit in percent for the permissible deviation from the expected position progression.<br>The limit is a factor in the formation of thresholds. |
| Note | Recommendation: During operation of the positioner, observe the diagnostic value "Dynamic control valve behavior" (15.DEVI). Enter the resulting maximum value as the minimum limit "b2.LIMIT". |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.0 |
| Unit | % |

| **b3.FACT1** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "b2.LIMIT" results in threshold 1 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: **b3.FACT1** < b4.FACT2 < b5.FACT3 |
| Factory setting | 5.0 | |

| **b4.FACT2** | **Factor 2** | |
|---|---|---|
| Function | This factor multiplied by the value of "b2.LIMIT" results in threshold 2 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: b3.FACT1 < **b4.FACT2** < b5.FACT3 |
| Factory setting | 10.0 | |

| **b5.FACT3** | **Factor 3** | |
|---|---|---|
| Function | This factor multiplied by the value of "b2.LIMIT" results in threshold 3 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: b3.FACT1 < b4.FACT2 < **b5.FACT3** |
| Factory setting | 15.0 | |

## Activate and configure "Monitoring of dynamic control valve behavior"

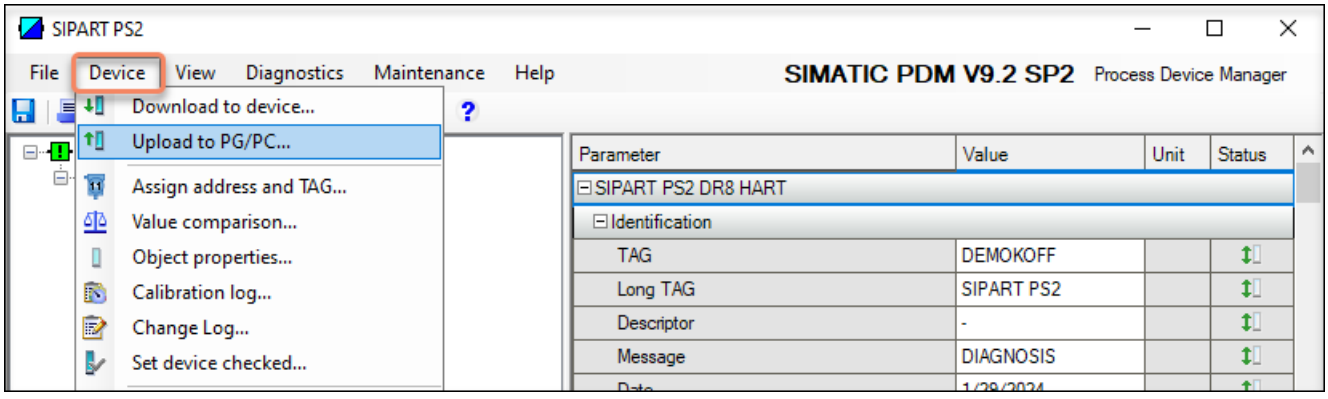
Process diagnostics can be activated and configured using the following 2 options.

**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "b.\DEVI" of the process diagnostics "Monitoring of dynamic control valve behavior".
3. Set the "b.\DEVI" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - b1.TIM
   - b2.LIMIT
   - b3.FACT1
   - b4.FACT2
   - b5.FACT3

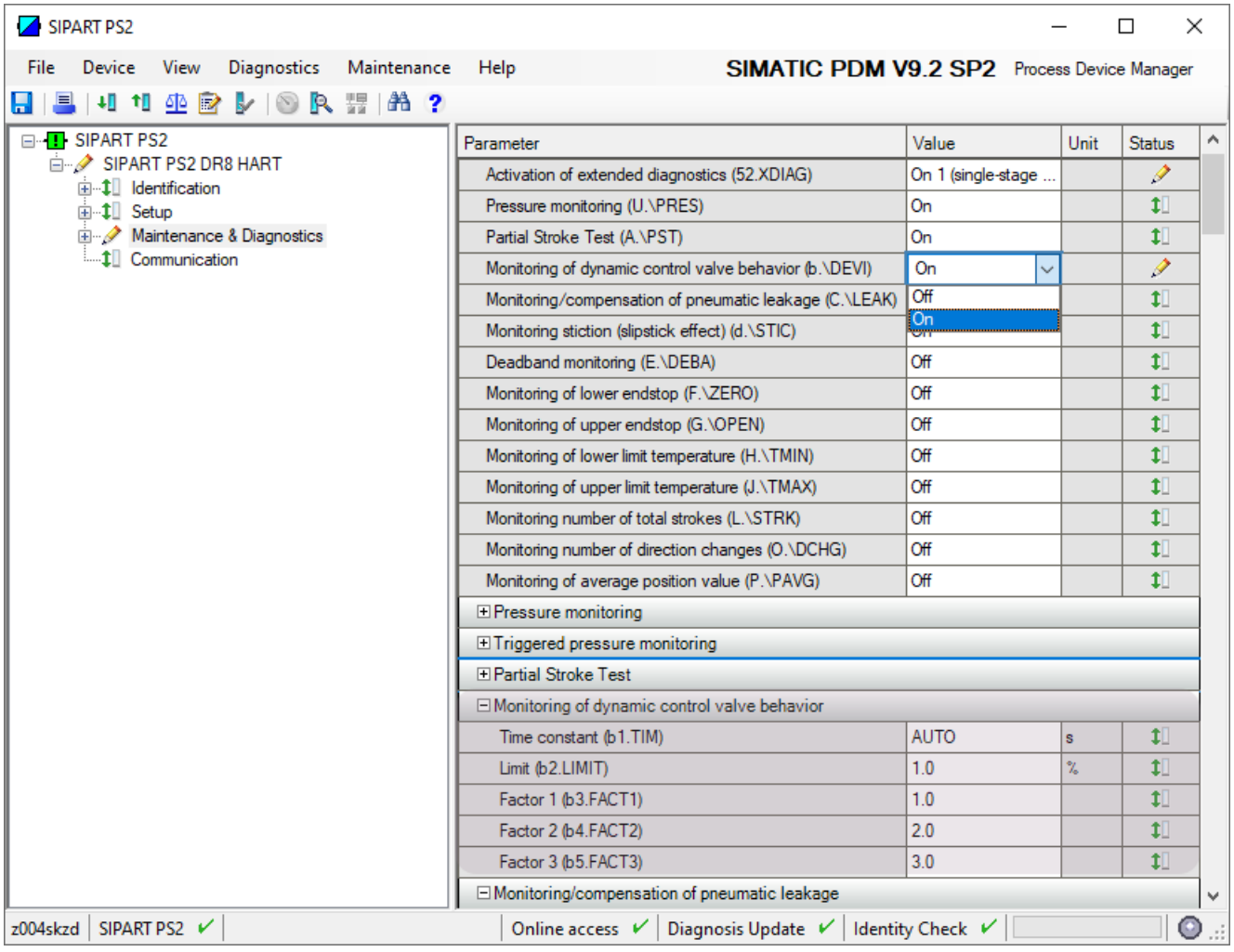
**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of dynamic control valve behavior" (b.\DEVI), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - b1.TIM
   - b2.LIMIT
   - b3.FACT1
   - b4.FACT2
   - b5.FACT3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.

12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

### 5.6.3 With SIMATIC PDM: Show diagnostic results

#### Requirement

- The positioner has firmware version 5.02 or higher.

  **Note**

  For positioners with firmware version 5.00 or 5.01, no data for process diagnostics "b.\DEVI" are stored in the positioner.

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "b.\DEVI" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "b.\DEVI".

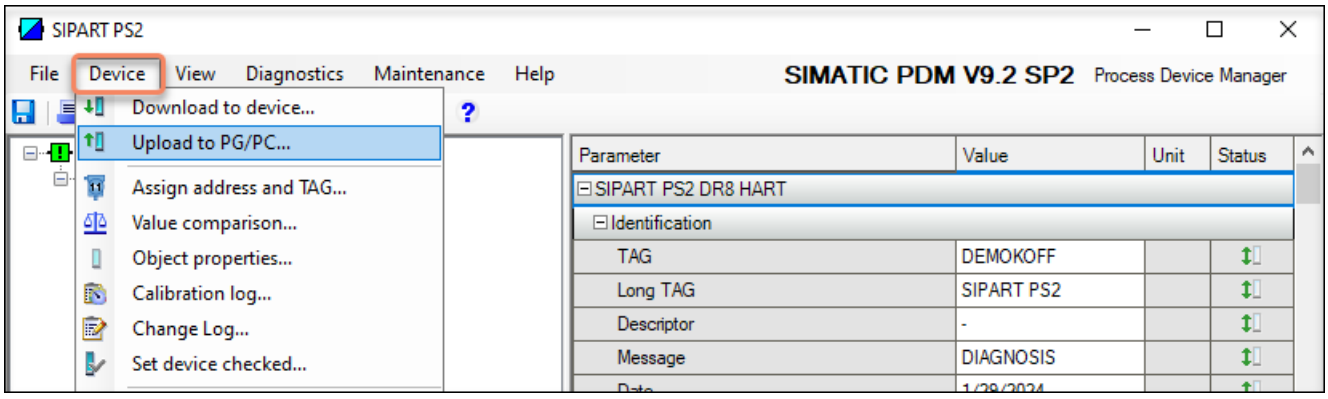
  **Note**

  If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "b2.LIMIT".

- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

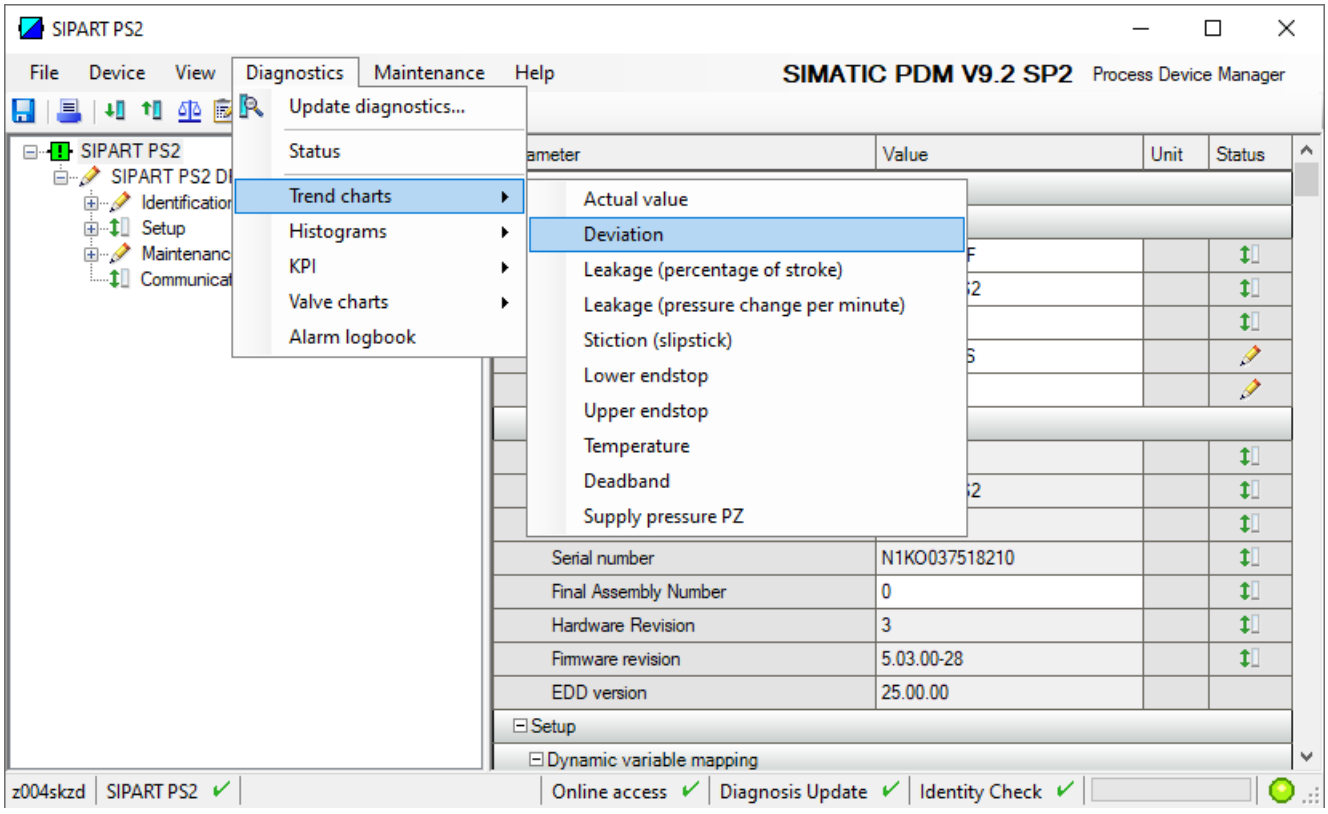



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Trend charts > Deviation" command.

**Note**

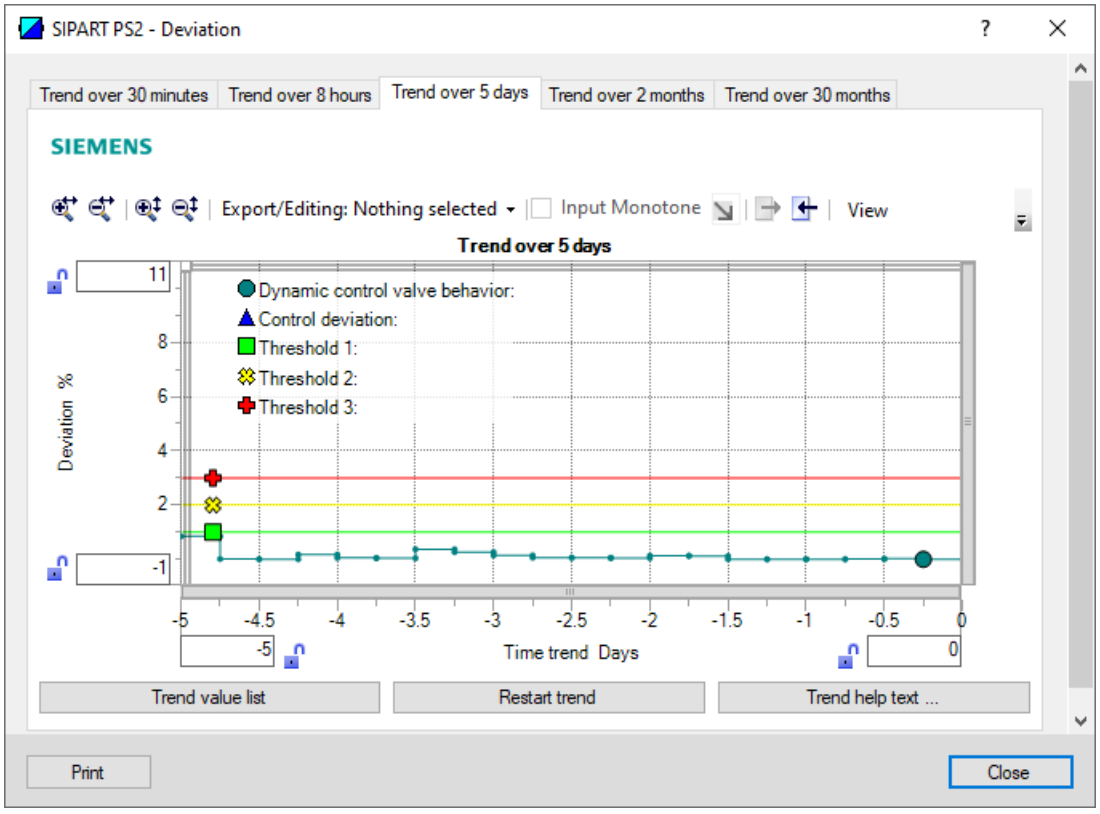
The "b.\DEVI" process diagnostics does not have an independent trend display. The process diagnostics are displayed in the "Deviation" trend display.




⇒ The "Deviation" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days - shown as an example
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of "Threshold 1, 2 and 3" are also shown.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

## 5.6.4 Diagnostic value "Dynamic control valve behavior" (15.DEVI)

| **Diagnostic value** | **Dynamic control valve behavior**<br>**Short designation: 15.DEVI** | |
|---|---|---|
| Function | The diagnostic value shows the deviation between the currently determined control behavior and the expected control behavior. | |
| Requirement | • For firmware version 5.00 to 5.02: The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".<br>• The positioner is initialized.<br>• The process diagnostics "Monitoring of dynamic control valve behavior" (b.\DEVI) is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_devi_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 30 ... 33<br>Format: Float |

## 5.6.5 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has firmware version 5.02 or higher.

  **Note**

  For positioners with firmware version 5.00 or 5.01, no data for process diagnostics "b.\DEVI" are stored in the positioner.

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "b.\DEVI" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "b.\DEVI".
- The positioner has a HART interface: SIPART PS2 6DR51...6DR52...

### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "40".
  Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 40 | Last 30 minutes |
| 41 | Last 8 hours |
| 42 | Last 5 days |
| 43 | Last 2 months |
| 44 | Last 30 months |

### Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-14 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |

| Byte | Format | Description |
|---|---|---|
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1.<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | Value of threshold 1 (b2.LIMIT × b3.FACT1) |
| 47 ... 50 | Float | Value of threshold 2 (b2.LIMIT × b4.FACT2) |
| 51 ... 54 | Float | Value of threshold 3 (b2.LIMIT × b5.FACT3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-15 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## 5.6.6 With SIMATIC PDM: Export diagnostics results

### Requirement

- The positioner has firmware version 5.02 or higher.

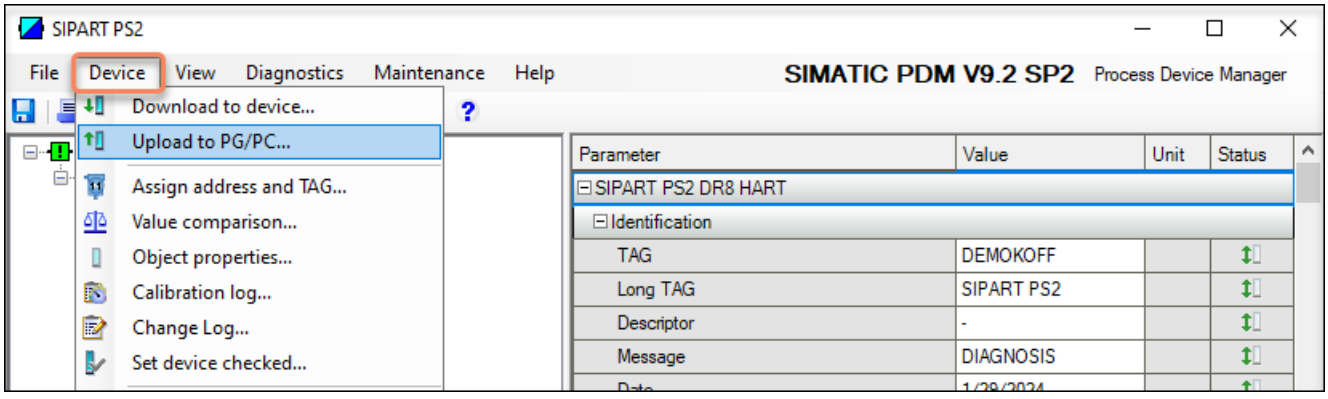
  **Note**

  For positioners with firmware version 5.00 or 5.01, no data for process diagnostics "b.\DEVI" are stored in the positioner.

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "b.\DEVI" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "b.\DEVI".
- The positioner has a HART communicator: SIPART PS2 6DR51...\6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

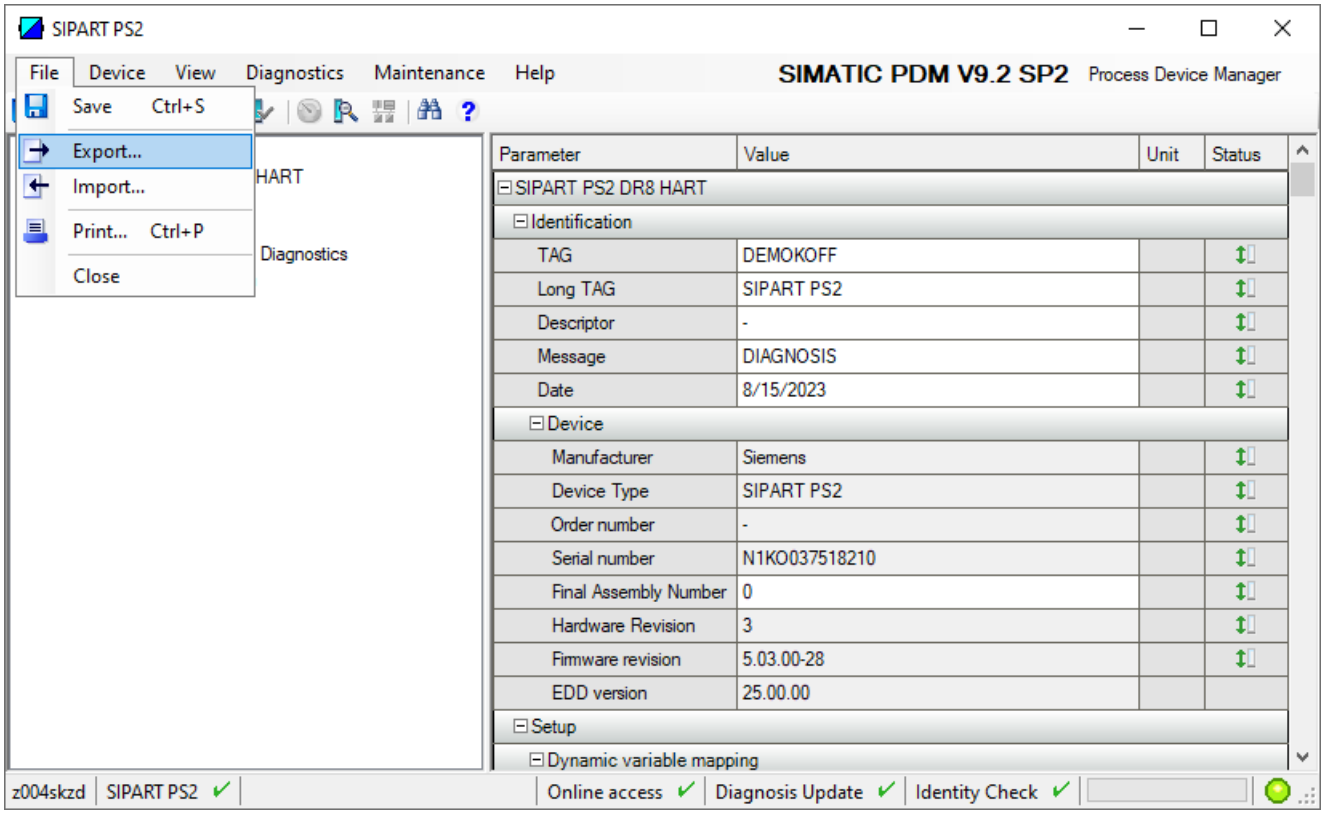
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



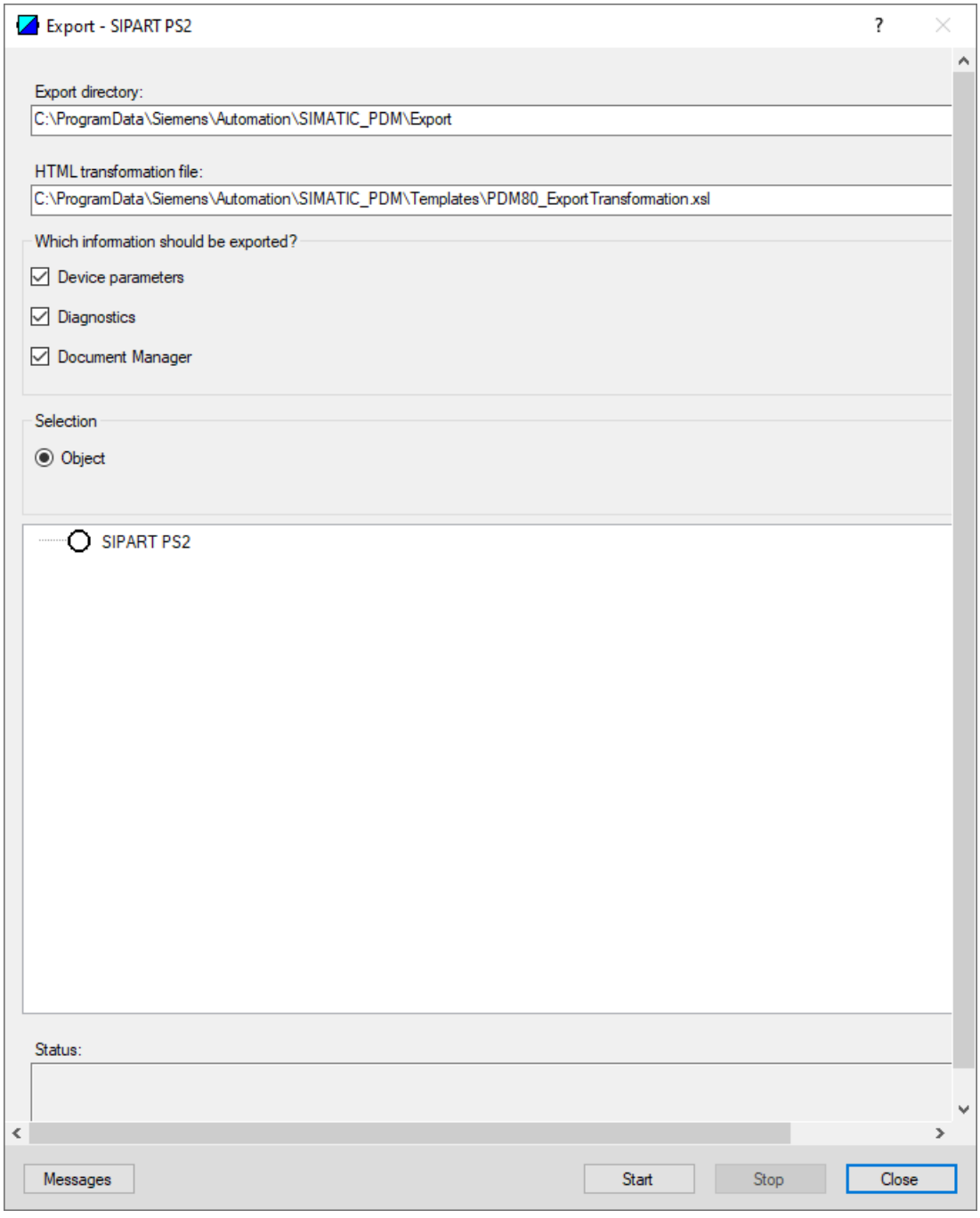

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Deviation" → With SIMATIC PDM: Show diagnostic results (Page 218).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu, select the "Export..." command.



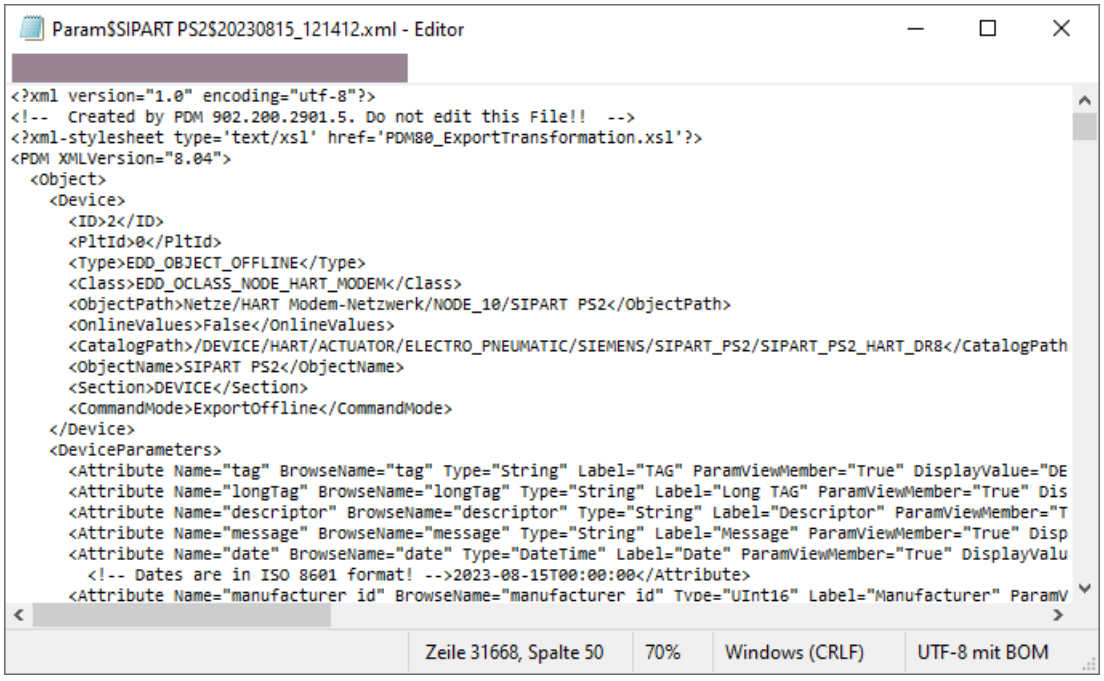

⇒ The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file contains 100 lines with the exported process diagnostics data.
There are 20 lines for each of the five 5 ring memories.
The data for process diagnostics is labeled with Name= "var_trend_dynamic_devi...".
The 1st data line reads, for example:
<Attribute **Name="var_trend_dynamic_devi_30min_0**"
BrowseName="var_trend_dynamic_devi_30min_0"
Type="Int16" **Label="0.0 up to -1.5 minutes"**
ParamViewMember="False" **DisplayValue="0.6"** Import="True" State="16" **Unit="%"**>143</
Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.6", is the deviation that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "b.\DEVI" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | **Name** | **Label (Time span of data determination)** | **DisplayValue e.g.** | **Unit** |
| Last 30 minutes | 20 | var_trend_dynamic_devi_30min_0 | 0.0 up to -1.5 minutes | 0.6 | % |
| | | ... | ... | ... | |
| | | var_trend_dynamic_devi_30min_19 | -28.5 up to -30.0 minutes | 0.6 | |
| Last 8 hours | 20 | var_trend_dynamic_devi_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_dynamic_devi_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_dynamic_devi_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_dynamic_devi_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_dynamic_devi_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_dynamic_devi_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_dynamic_devi_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_dynamic_devi_30m_19 | -855 up to -900 days | ... | |

## 5.6.7 Messages

### 5.6.7.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

**Notes**

If the limits are exceeded:

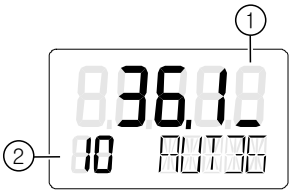
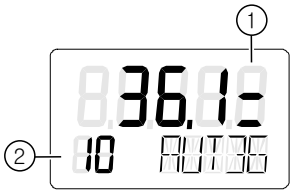
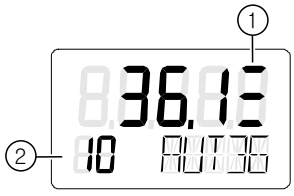
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.6.7.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "10" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 10 | ① 2 bars<br>② Error code 10 | ① 3 bars<br>② Error code 10 |

### 5.6.7.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

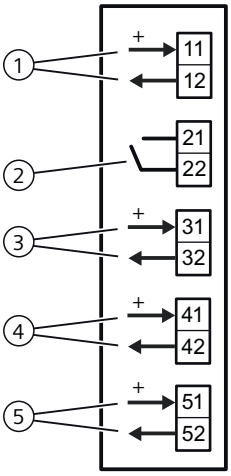
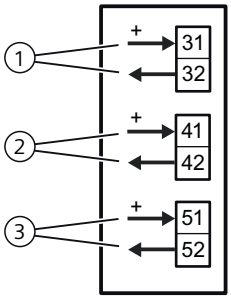
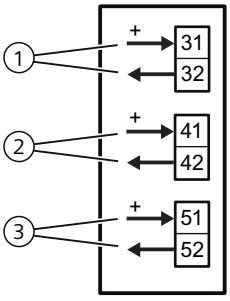
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

## I/Os

| **Digital I/O Module (DIO)<br>6DR4004-6A / -8A** | **Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS)<br>6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

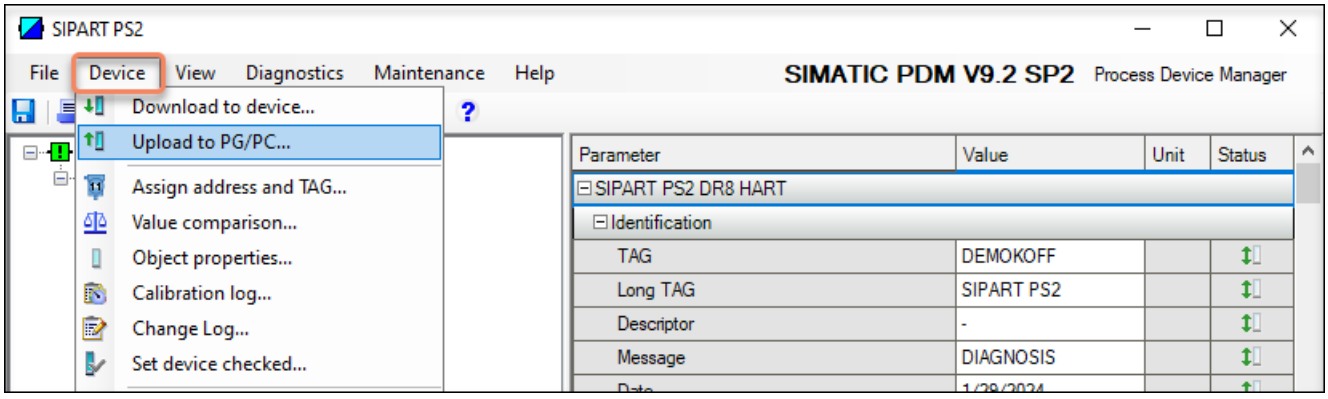
### 5.6.7.4 With SIMATIC PDM: Display diagnostics status

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

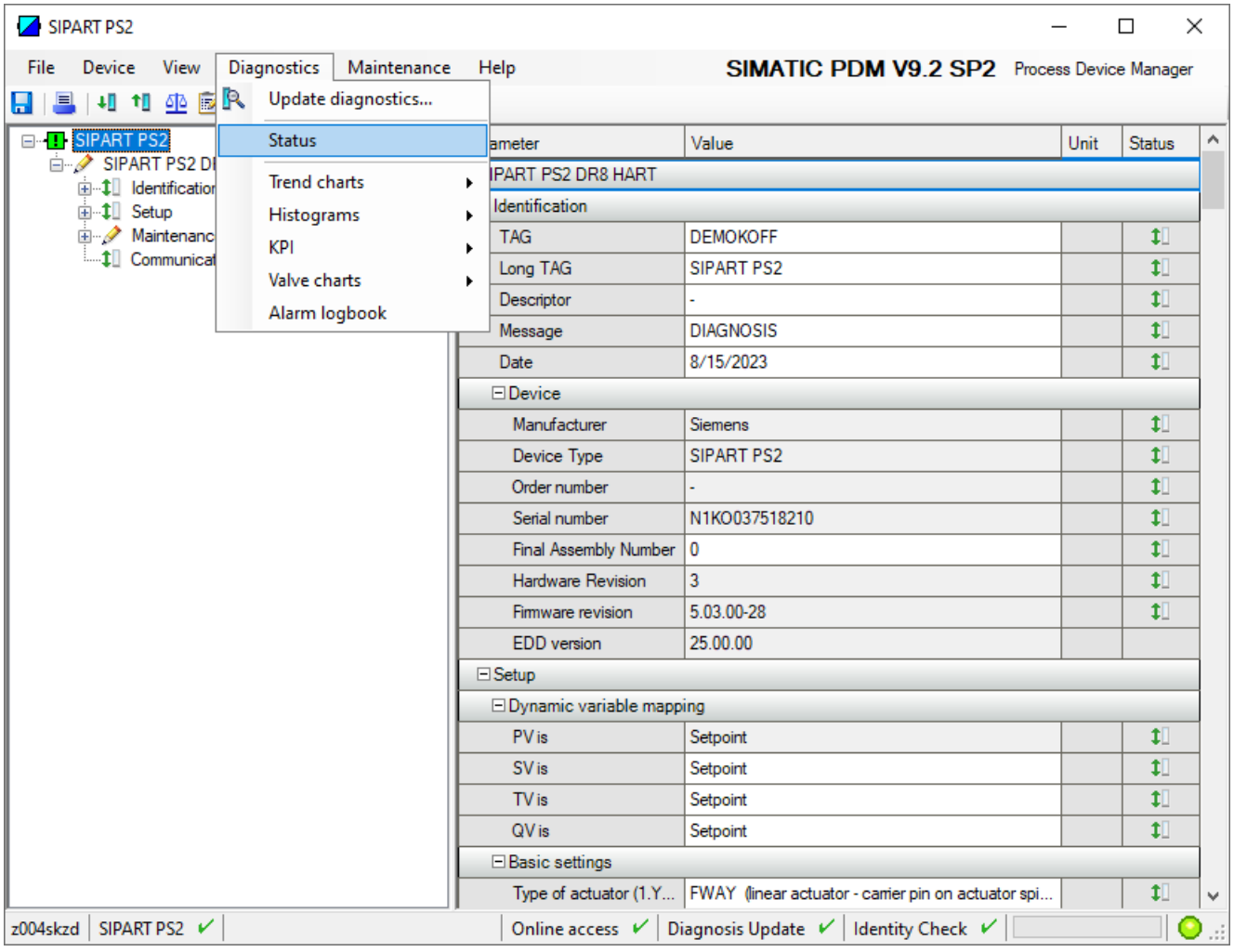
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

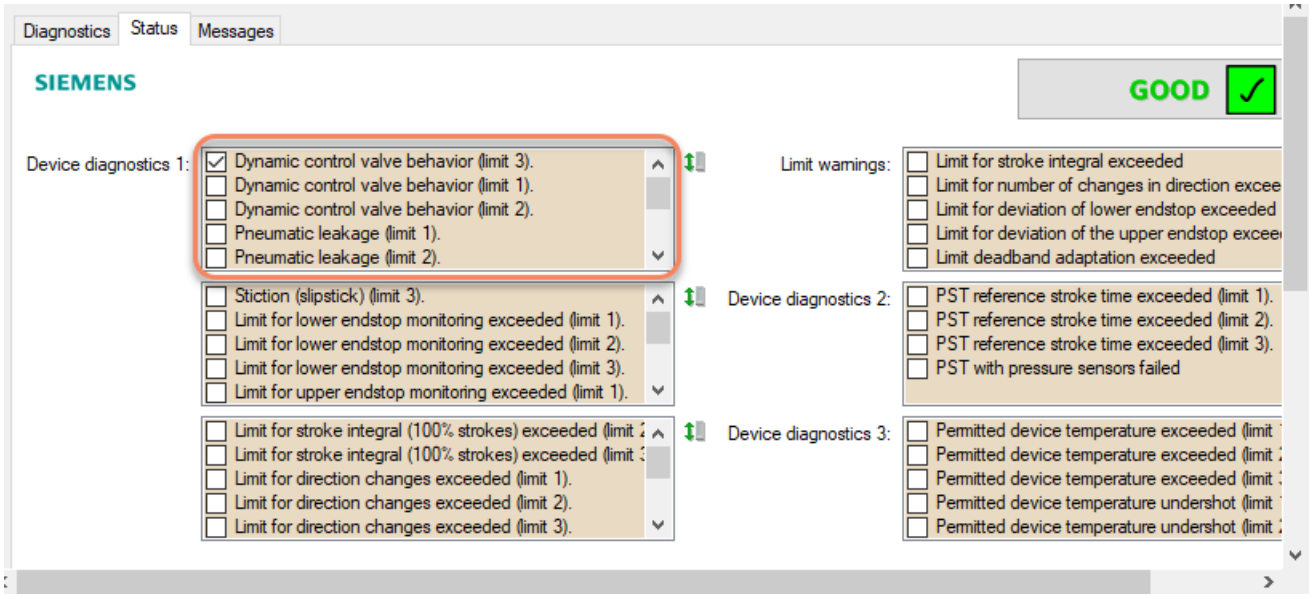



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the corresponding message "Dynamic control valve behavior (limit x)" is highlighted.




8. Close the dialog.

### 5.6.7.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52..

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "b.\DEVI" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 14, bit 7 corresponds to threshold 1 exceeded.
  - Byte 14, bit 6 corresponds to threshold 2 exceeded.
  - Byte 14, bit 5 corresponds to threshold 3 exceeded.

### 5.6.7.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.7 Monitoring/compensation of pneumatic leakage (C.\LEAK)

### 5.7.1 Functional description

Process diagnostics activates leakage monitoring and leakage compensation.

The pneumatic leakages mainly occur in the actuator or in the pipe installation.

**Leakage monitoring**

- Leakage monitoring determines the current additional compressed air consumption of the valve caused by leakage while the actuator is moving.
- The diagnostics compare the expected air consumption with the actual air consumption when the actuator is moving.
- The current deviation is displayed as a percentage value in the diagnostic value "Pneumatic leakage" (16.ONLK) and stored in the ring memory.

**Note**

**Accuracy of results**

Note that this monitoring only provides results with single-acting, spring-loaded actuators and a setpoint from 5 to 95%.

**Leakage compensation**

- The leakage compensation compensates the leakage in control phases with constant setpoint.
- Leakage compensation increases the quality of control by reducing or preventing the typical periodic oscillation of leaky valves.
- The leakage compensation compensates leakages up to 2% of the positioner's air performance.
- The following diagnostic values show the length and period of the current leakage compensation pulses:
  - Length of the leakage compensation pulses (57.LCPUL)
  - Period of the leakage compensation pulses (58.LCPER)

  The leakage compensation values are not saved in the ring memories.

**Ring memory**

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, e.g. SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.7.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics of "Monitoring/compensation of pneumatic leakage" (C.\LEAK)

| | | |
|---|---|---|
| **Leakage monitoring** | | |
| Function | Leakage monitoring determines the current additional compressed air consumption of the valve caused by leakage while the actuator is moving. | |
| Note | The current deviation is displayed as a percentage value in the diagnostic value "Pneumatic leakage" (16.ONLK) . | |
| **Leakage compensation** | | |
| Function | The leakage compensation compensates the leakage in control phases with constant setpoint. | |
| Note | The following diagnostic values show the length and period of the current leakage compensation pulses:<br>• Length of the leakage compensation pulses (57.LCPUL)<br>• Period of the leakage compensation pulses (58.LCPER) | |
| **Leakage monitoring and leakage compensation** | | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **C1.LIMIT** | **Limit** |
|---|---|
| Function | The parameter defines the limit of the increased compressed air in percent.<br>The limit is a factor in the formation of thresholds. |
| Note | 1. During operation of the positioner, observe the "Pneumatic leakage" diagnostic value (16.ONLK) with regard to the maximum value occurring.<br>– If no leakage exists, monitoring of the increased compressed air consumption is automatically calibrated in such a way during the initialization that the diagnostic value 16.ONLK remains below the value "30".<br>– A value above "30" indicates a leak as the cause of the additional compressed air consumption.<br>2. In the "C1.LIMIT" parameter, enter the maximum value that occurred in the diagnostic value as the limit. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.0 |
| Unit | % |

| **C2.FACT1** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "C1.LIMIT" results in threshold 1 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: **C2.FACT1** < C3.FACT2 < C4.FACT3 |
| Factory setting | 5.0 | |

| **C3.FACT2** | **Factor 2** | |
|---|---|---|
| Function | This factor multiplied by the value of "C1.LIMIT" results in threshold 2 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: C2.FACT1 < **C3.FACT2** < C4.FACT3 |
| Factory setting | 10.0 | |

| **C4.FACT3** | **Factor 3** | |
|---|---|---|
| Function | This factor multiplied by the value of "C1.LIMIT" results in threshold 3 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: C2.FACT1 < C3.FACT2 < **C4.FACT3** |
| Factory setting | 15.0 | |

## Activate and configure "Monitoring/compensation of pneumatic leakage"

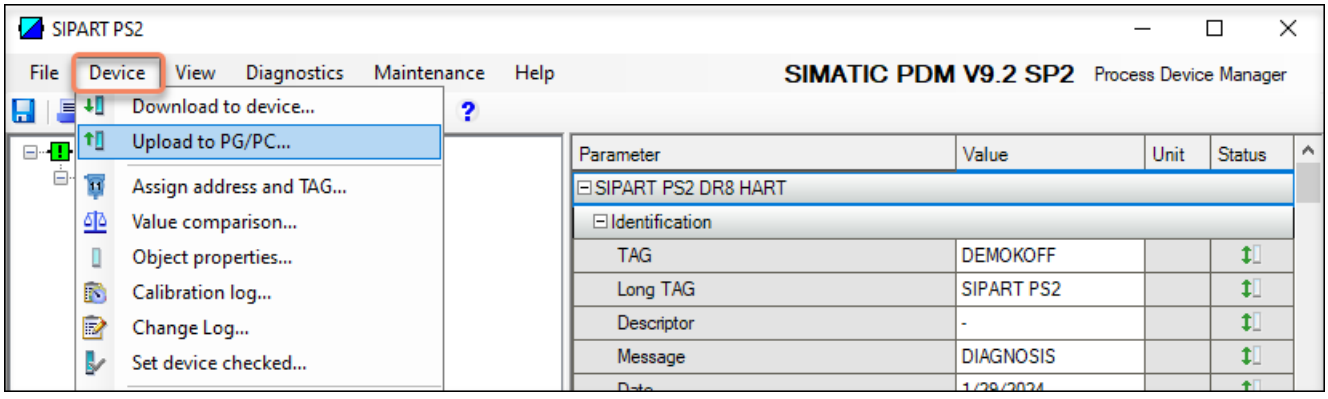
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

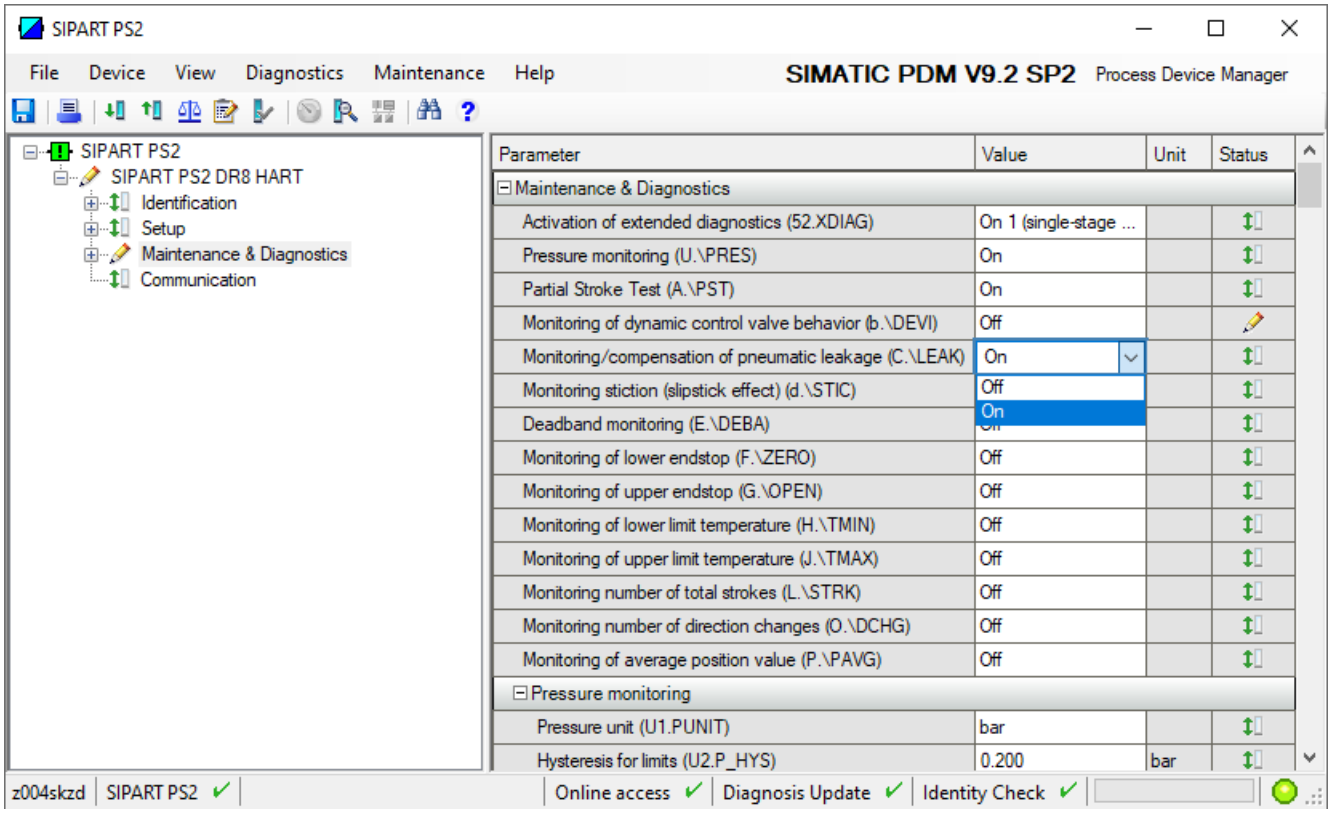
1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the parameter "C.\LEAK" of the process diagnostics "Monitoring/compensation of pneumatic leakage".
3. Set the "C.\LEAK" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - C1.LIMIT
   - C2.FACT1
   - C3.FACT2
   - C4.FACT3

**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring/compensation of pneumatic leckage" (C.\LEAK), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed

8. To adapt the thresholds to the valve, change the parameter values:
   - C1.LIMIT
   - C2.FACT1
   - C3.FACT2
   - C4.FACT3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

### 5.7.3 With SIMATIC PDM: Display diagnostic results of the leakage monitoring

**Requirement**

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "C.\LEAK" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "C.\LEAK".

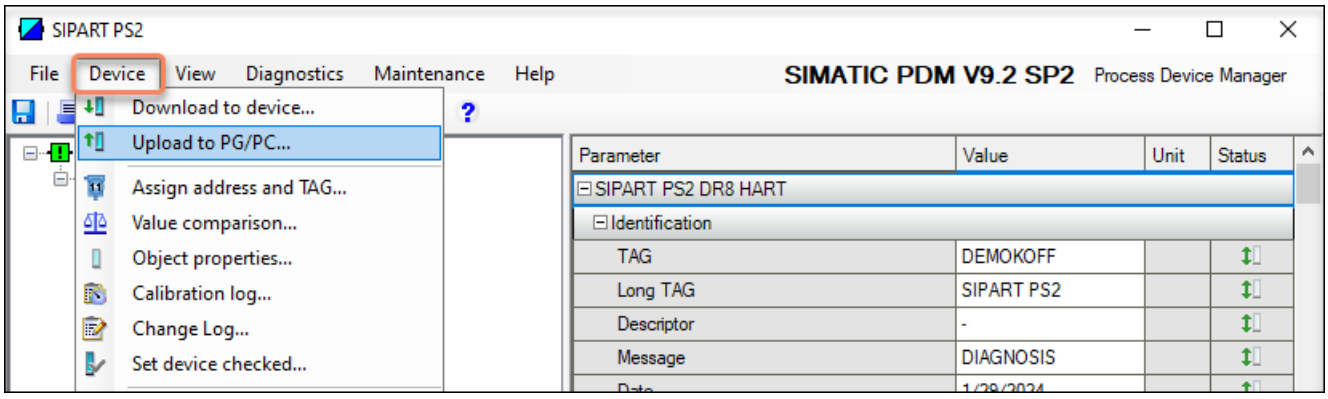
  **Note**

  If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "C1.LIMIT".

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

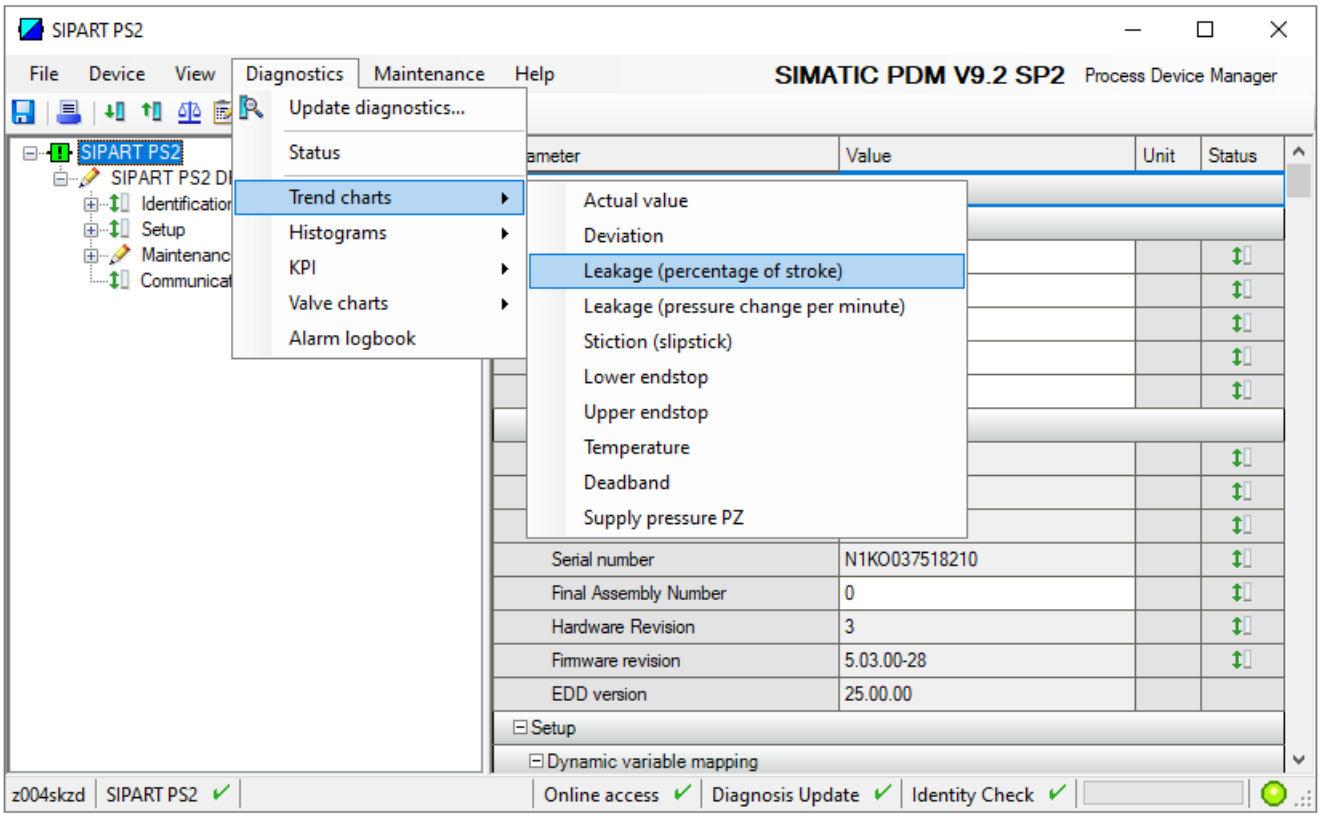
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

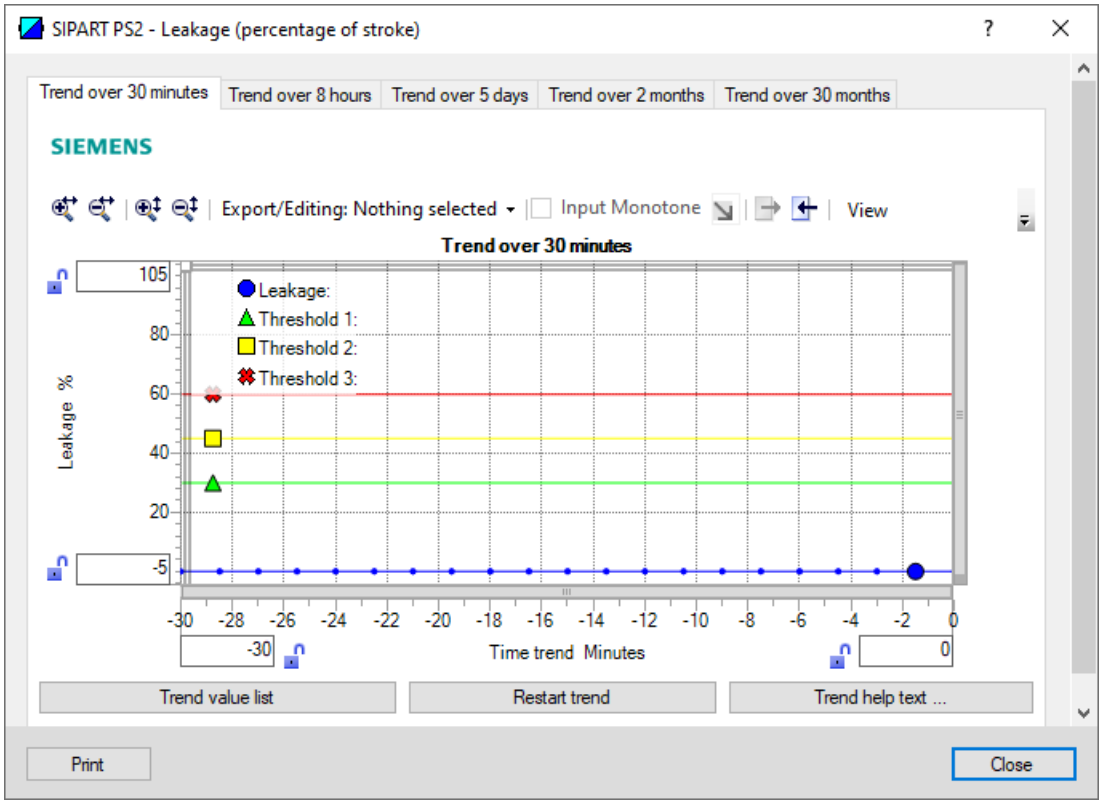
6. In the "Diagnostics" menu, select the "Trend charts > Leakage (percentage of stroke)" command.




The "Leakage (percentage of stroke)" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of thresholds 1, 2 and 3 are also shown.




| Button | Notes |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.7.4 Diagnostic value "Pneumatic leakage" (16.ONLK)

| **Diagnostic value** | **Pneumatic leakage**<br>**Short designation: 16.ONLK** | |
|---|---|---|
| Function | The diagnostic value shows the current additional compressed air consumption caused by leakage. | |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. | |
| Display range | 0 ... 100 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_leak_online_val |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 34 ... 37<br>Format: Float |

### 5.7.5 Diagnostic value "Length of the leakage compensation pulse" (57.LCPUL)

| **Diagnostic value** | **Length of the leakage compensation pulse**<br>**Short designation: 57.LCPUL** | |
|---|---|---|
| Function | The diagnostic value shows the length of the compensation pulses in milliseconds.<br>The sign indicates the control direction of the pulse. | |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. | |
| Display range | -256 ... 254 | |
| Factory setting | 0 | |
| Unit | ms (millisecond) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_LeakagePulsLength |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Byte 60<br>Format: Signed-8 |

### 5.7.6 Diagnostic value "Period of the leakage compensation pulse" (58.LCPER)

| **Diagnostic value** | **Period of the leakage compensation pulse**<br>**Short designation: 58.LCPER** |
|---|---|
| Function | The diagnostic value shows the cycle duration of the leakage compensation pulses. |
| Requirement | The process diagnostics "Monitoring of pneumatic leakage" (C.\LEAK) is activated. |
| Display range | 0.00 ... 600.00 |

| **Diagnostic value** | **Period of the leakage compensation pulse**<br>**Short designation: 58.LCPER** | |
|---|---|---|
| Factory setting | 0.00 | |
| Unit | s (second) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_LeakagePeriod |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes 60 ... 64<br>Format: Float |

## 5.7.7 Via HART communication: Read out diagnostic results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "C.\LEAK" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "C.\LEAK".

  **Note**

  If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "C1.LIMIT".

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "10".

Send the request for each of the 5 ring memories separately.

| **Ring memory index** | **Ring memory for time span** |
|---|---|
| 10 | Last 30 minutes |
| 11 | Last 8 hours |
| 12 | Last 5 days |
| 13 | Last 2 months |
| 14 | Last 30 months |

## Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-16 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | Value of threshold 1 (C1.LIMIT × C2.FACT1) |
| 47 ... 50 | Float | Value of threshold 2 (C1.LIMIT × C3.FACT2) |
| 51 ... 54 | Float | Value of threshold 3 (C1.LIMIT × C4.FACT3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-17 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## 5.7.8 With SIMATIC PDM: Export diagnostics results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "C.\LEAK" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is activated regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "C.\LEAK".

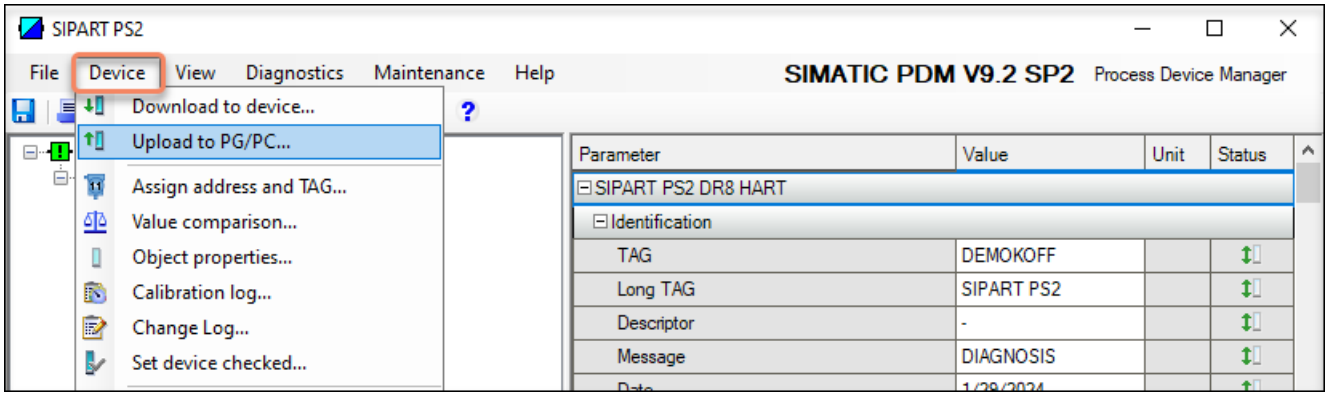
**Note**

If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "C1.LIMIT".

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

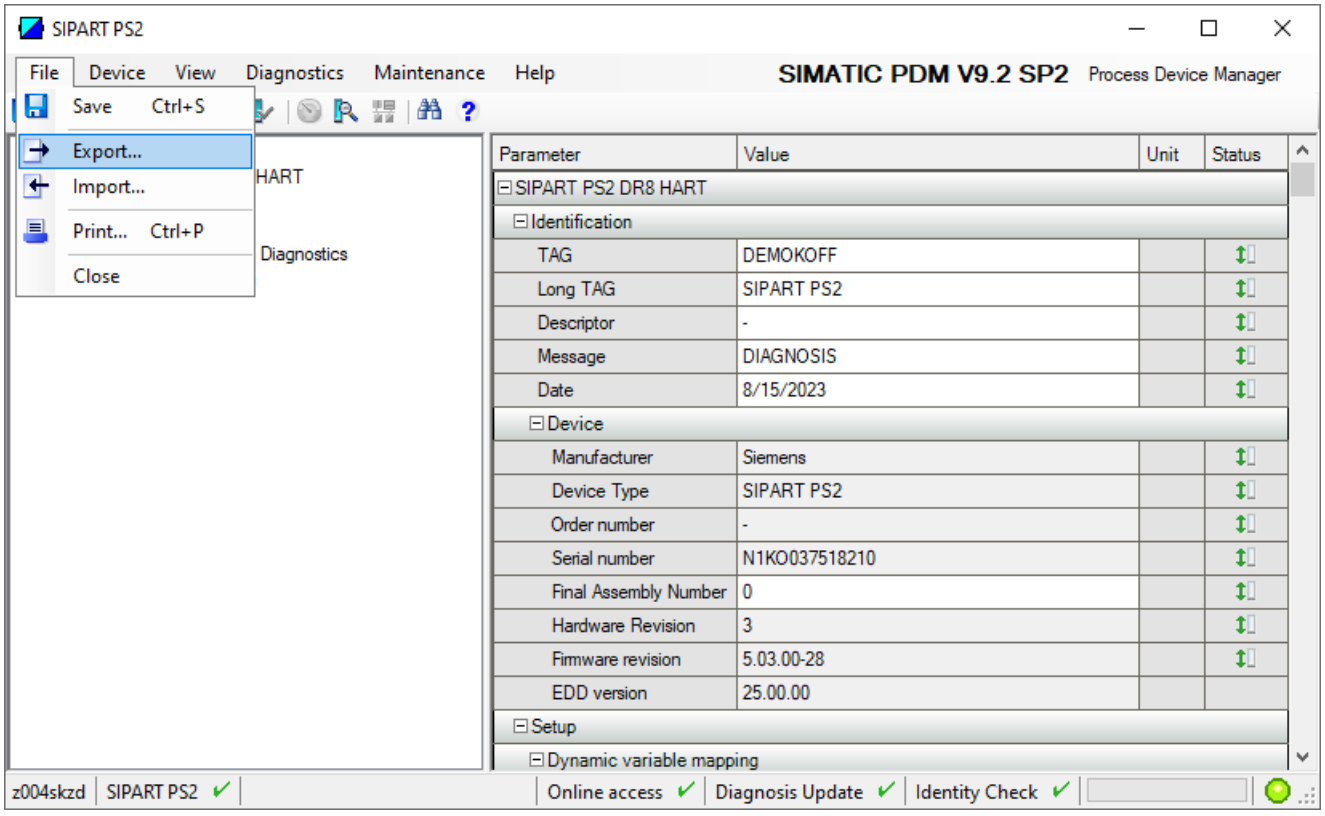
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



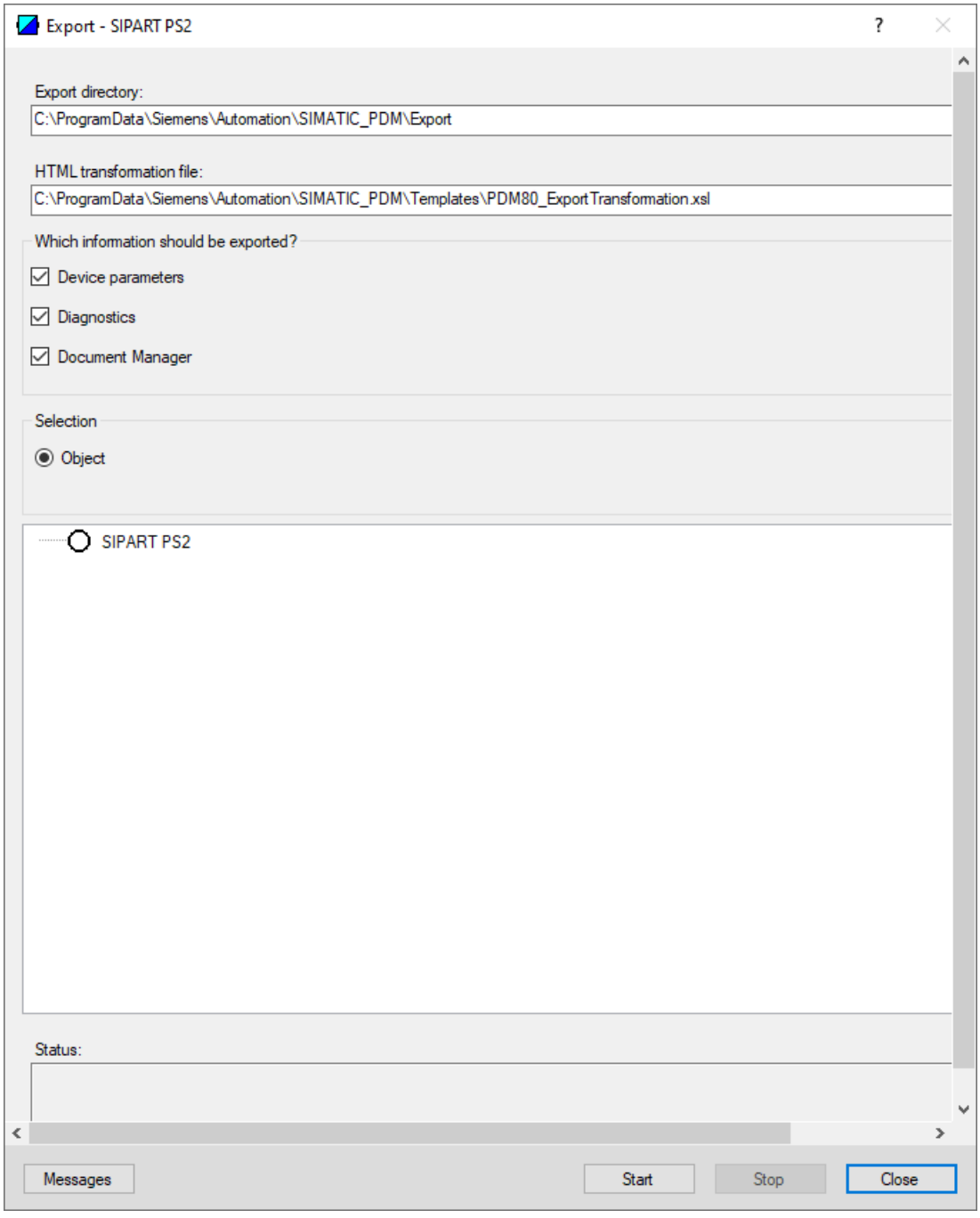

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Leckage (percentage of stroke)" → With SIMATIC PDM: Display diagnostic results of the leakage monitoring (Page 242).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.
7. In the "File" menu, select the "Export..." command.



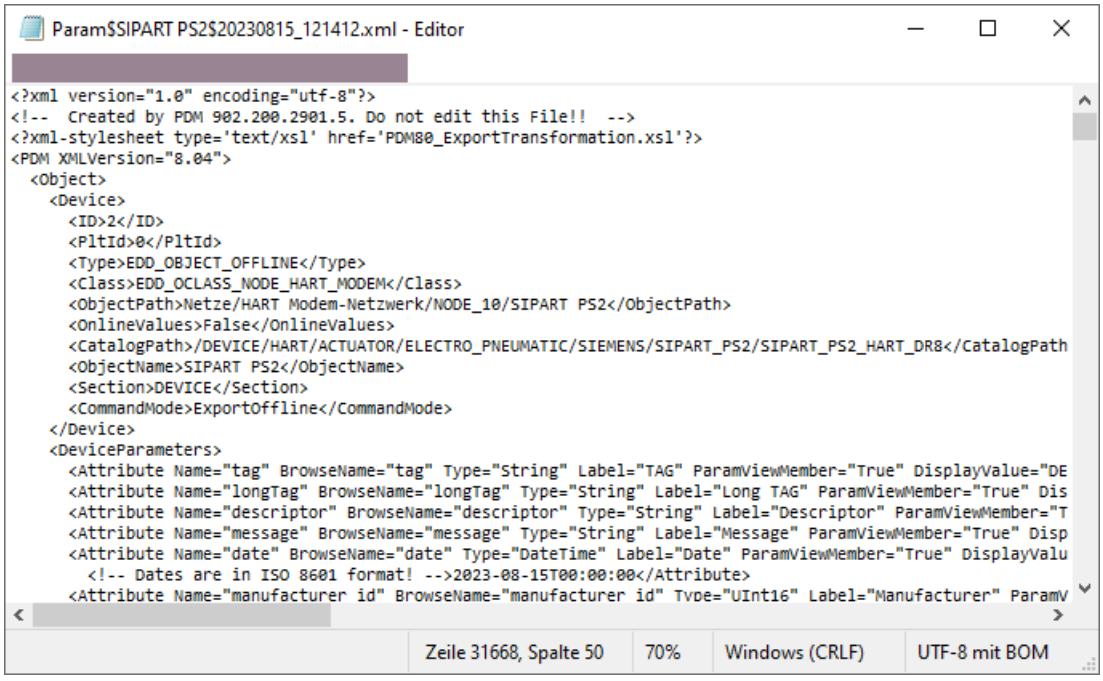

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file"Param$xxx$yyyymmdd_hhmmss.xml", z. B. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. editor.




The XML file contains 100 lines with the exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name= "var_trend_leakage...".
The 1st data line reads, for example:
<Attribute **Name="var_trend_leakage_30min_0"**
BrowseName="var_trend_leakage_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"**
ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="%"**>0</
Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the deviation that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "C.\LEAK" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (≙ Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_leakage_30min_0 | 0.0 up to -1.5 minutes | 0.0 | % |
| | | ... | ... | ... | |
| | | var_trend_leakage_30min_19 | -28.5 up to -30.0 minutes | 0.0 | |
| Last 8 hours | 20 | var_trend_leakage_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_leakage_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_leakage_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_leakage_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_leakage_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_leakage_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_leakage_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_leakage_30m_19 | -855 up to -900 days | ... | |

## 5.7.9 Messages

### 5.7.9.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

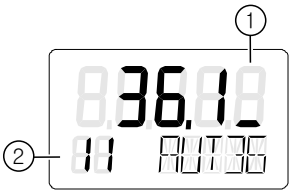
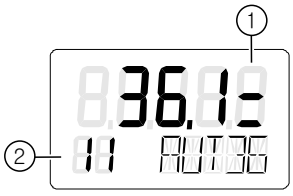
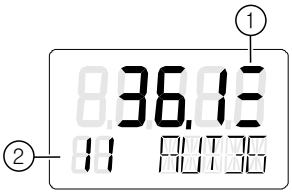
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.7.9.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "11" is output.

If several messages are present at the same time, the display switches between the different error codes.

| **Leakage monitoring** | | |
|---|---|---|
| **1 bar means: Threshold 1 exceeded.** | **2 bars means: Threshold 2 exceeded.** | **3 bars means: Threshold 3 exceeded.** |
|  |  |  |
| ① 1 bar<br>② Error code 11 | ① 2 bars<br>② Error code 11 | ① 3 bars<br>② Error code 11 |

| **Leakage compensation** | | |
|---|---|---|
| **1 bar means: Small leakage detected.** | **2 bars means: Medium leakage detected.** | **3 bars means: Large leakage detected.** |
|  |  |  |
| ① 1 bar<br>② Error code 11 | ① 2 bars<br>② Error code 11 | ① 3 bars<br>② Error code 11 |
| Result:<br>• The leakage compensation compensates for the leakage.<br>• The quality of the control is maintained by the leakage compensation. | Result:<br>• The leakage compensation limit has been reached.<br>• The quality of the control can be influenced by the leakage. | Result:<br>• The leakage compensation cannot completely compensate for the leakage.<br>• The quality of the control is influenced by the leakage. |

### 5.7.9.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

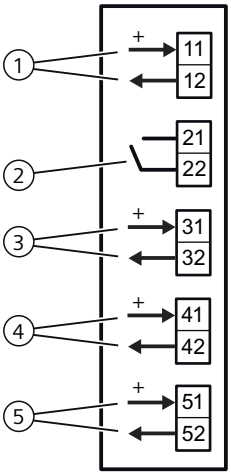
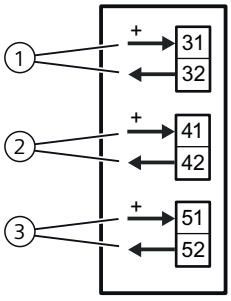
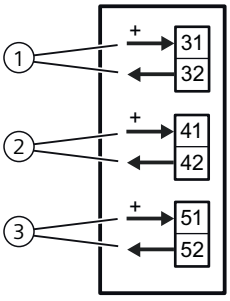
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

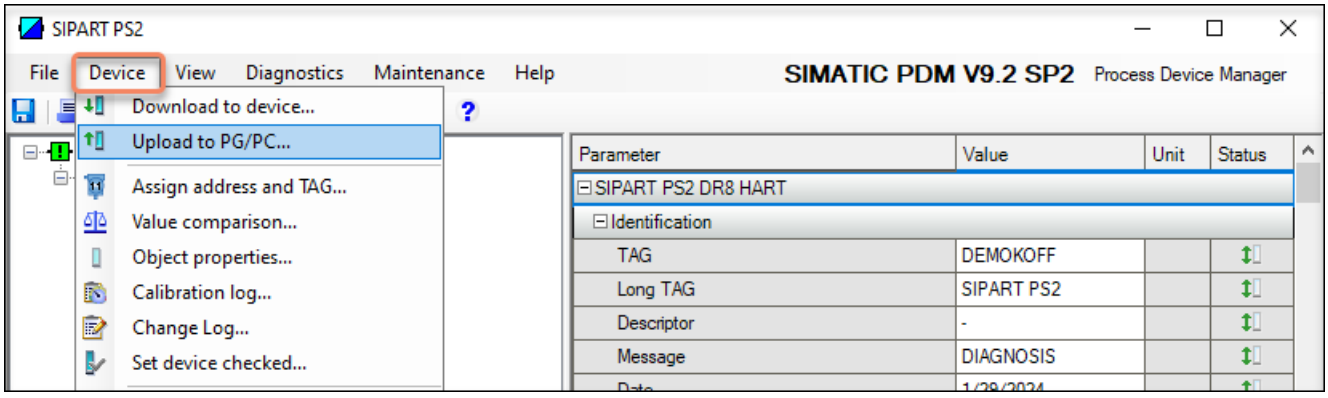
### 5.7.9.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

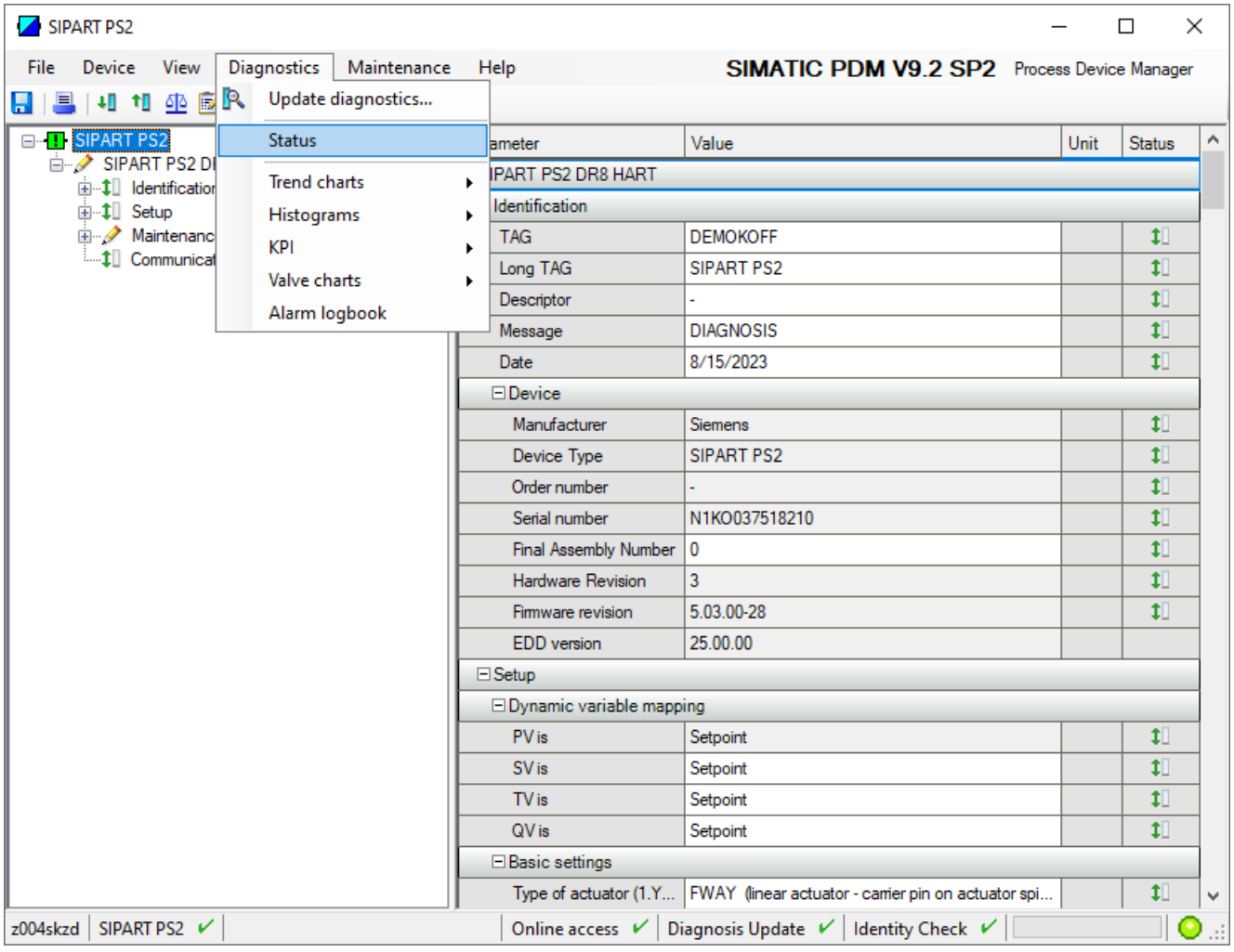
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

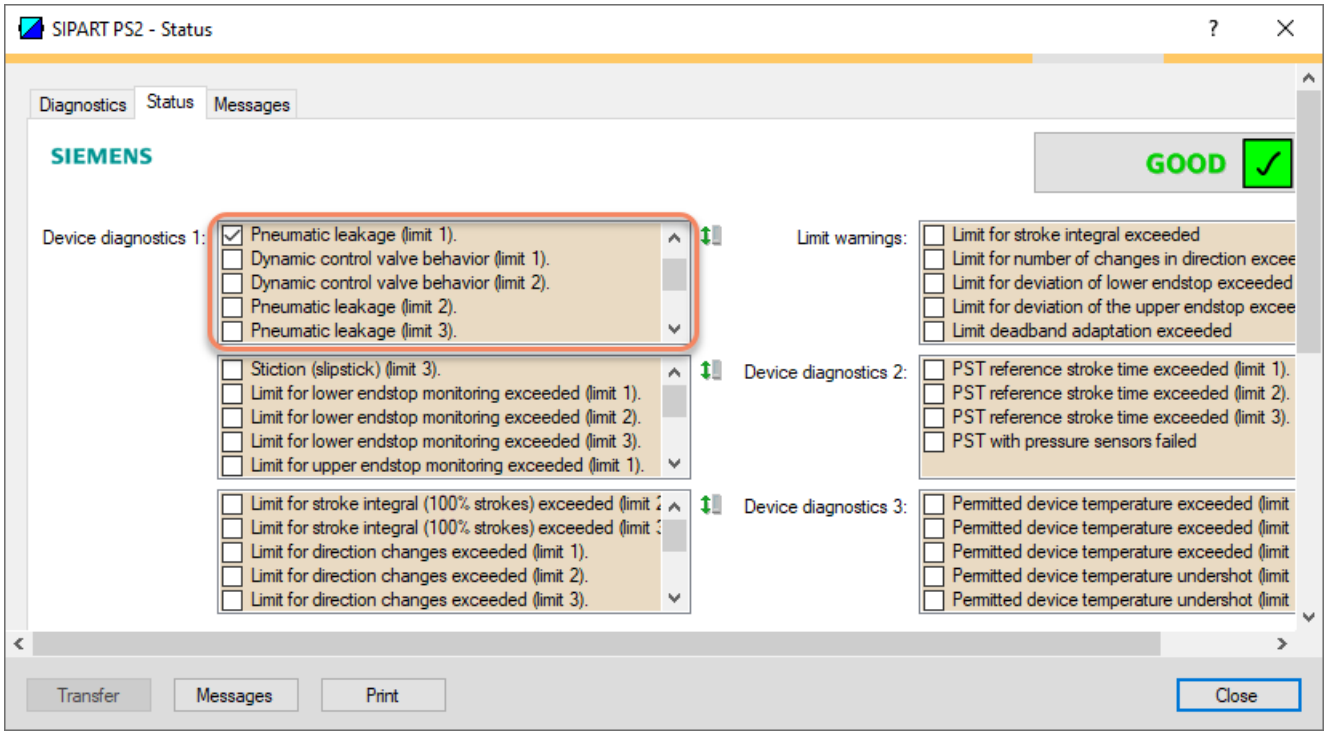



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message"Pneumatic leckage (limit x)" is highlighted.




8. Close the dialog.

### 5.7.9.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "C.\LEAK" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 14, bit 4 corresponds to threshold 1 exceeded.
  - Byte 14, bit 3 corresponds to threshold 2 exceeded.
  - Byte 14, bit 2 corresponds to threshold 3 exceeded.

### 5.7.9.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.8 Monitoring of pneumatic leakage (pressure sensor-supported)

### 5.8.1 Functional description

Process diagnostics monitors the signal pressures Y1 and Y2.

The monitoring of the actuating pressure Y2 is only available for the double-acting positioner.

The result shows the pressure loss or the pressure increase as a pressure unit per minute.

If the falling or rising pressure values exceed the limit in the regulated state, a message is issued.

Process diagnostics parameters:

- Limit ±leakage (U8.LRL)

Process diagnostics parameters:

- +/- Leakage at Y1 (67.LMY1)
- +/- Leakage at Y2 (68.LMY2)
- Maximum positive leakage at Y1 (69.LMUY1)
- Maximum positive leakage at Y2 (70.LMUY2)
- Maximum negative leakage at Y1 (71.LMDY1)
- Maximum negative leakage at Y2 (72.LMDY2)

**Ring memory**

For the signal pressures Y1 and Y2, 20 data each are stored in 5 ring memories for different time periods using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes (90 seconds) |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, e.g. SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.8.2 Activate and configure diagnostics

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.

### General parameters

| **U1.PUNIT** | **Pressure unit** |
|---|---|
| Function | The parameter defines the pressure unit for all pressure sensor-supported diagnostics. |
| Setting options | • bar<br>• MPa<br>• psi |

### Process diagnostics parameters

| **U8.LRL** | **Limit +/- leakage** | |
|---|---|---|
| Function | The parameter defines the limit for pressure changes per minute in the regulated state.<br>Process diagnostics can be used to detect leaks. | |
| Note | • If the factory setting is "0.000", process diagnostics are deactivated.<br>• Recommendation: When process diagnostics is activated, the set value should be at least "0.100 bar/min".<br>If the measured value exceeds the limit, the "Automatic (AUT)" and "Manual mode (MAN)" operating modes, error code "22" appears on the display.<br>A message is entered in the alarm logbook. To reset the error code: Eliminate leakage.<br>If the leak cannot be eliminated: Increase the limit or set the value to "0". | |
| Setting range | 0.000 ... 7.000 | bar/min |
| | 0.000 ... 0.700 | MPa/min |
| | 0.00 ... 101.53 | psi/min |
| Factory setting | 0.000 | |

### Activate and configure "Monitoring of pneumatic leakage (pressure sensor-supported)"

Process diagnostics can be activated and configured using the following 2 options.

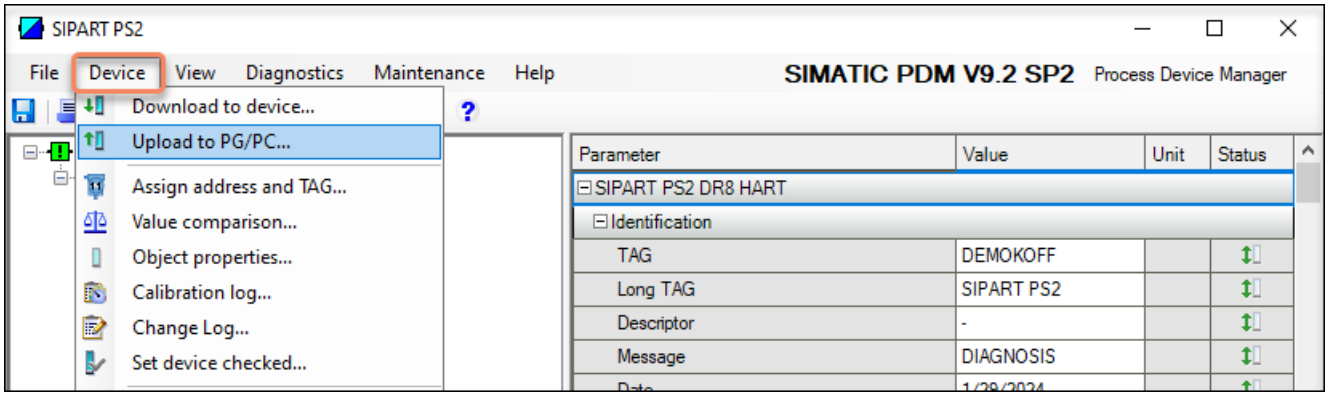
**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "U.\PRES" parameter of the "Pressure monitoring".

3. Set the "" parameter to "On".
   ⇒ The associated parameters are displayed.
4. Change the "U8.LRL" parameter to a value not equal to "0.000".
   ⇒ Process diagnostics is activated.

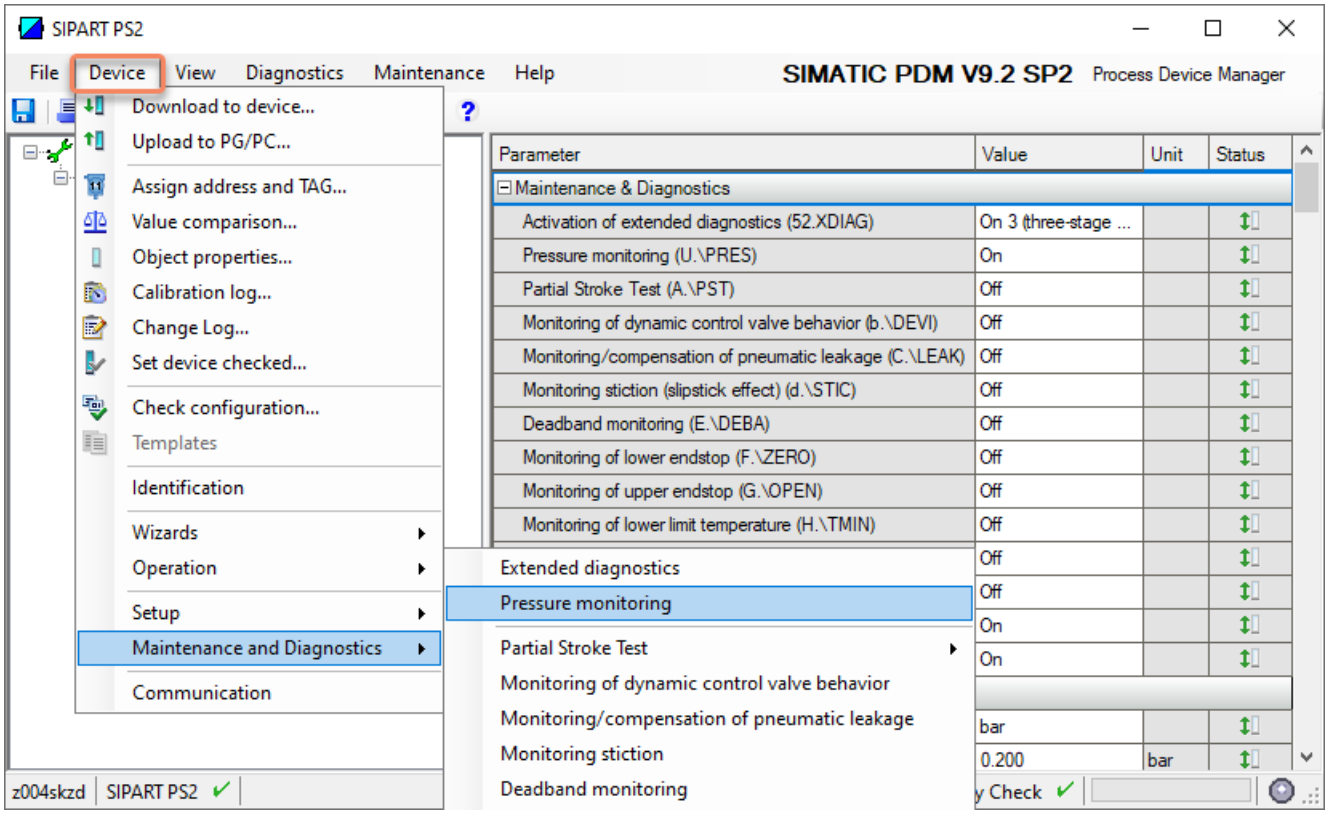
**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



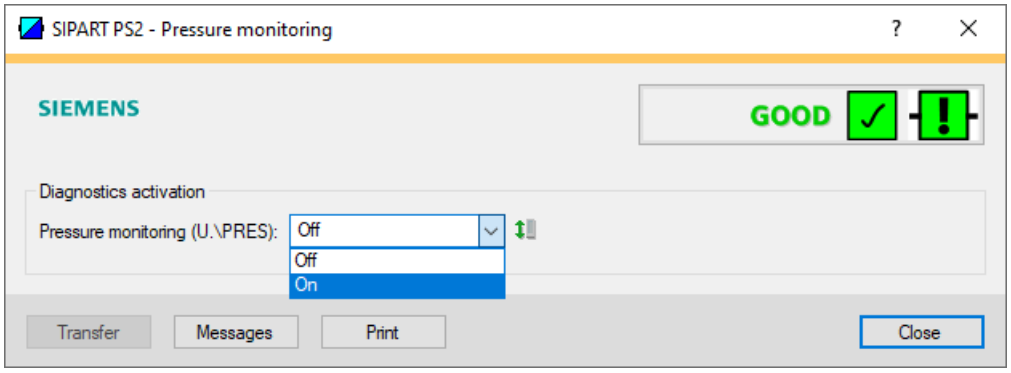

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".

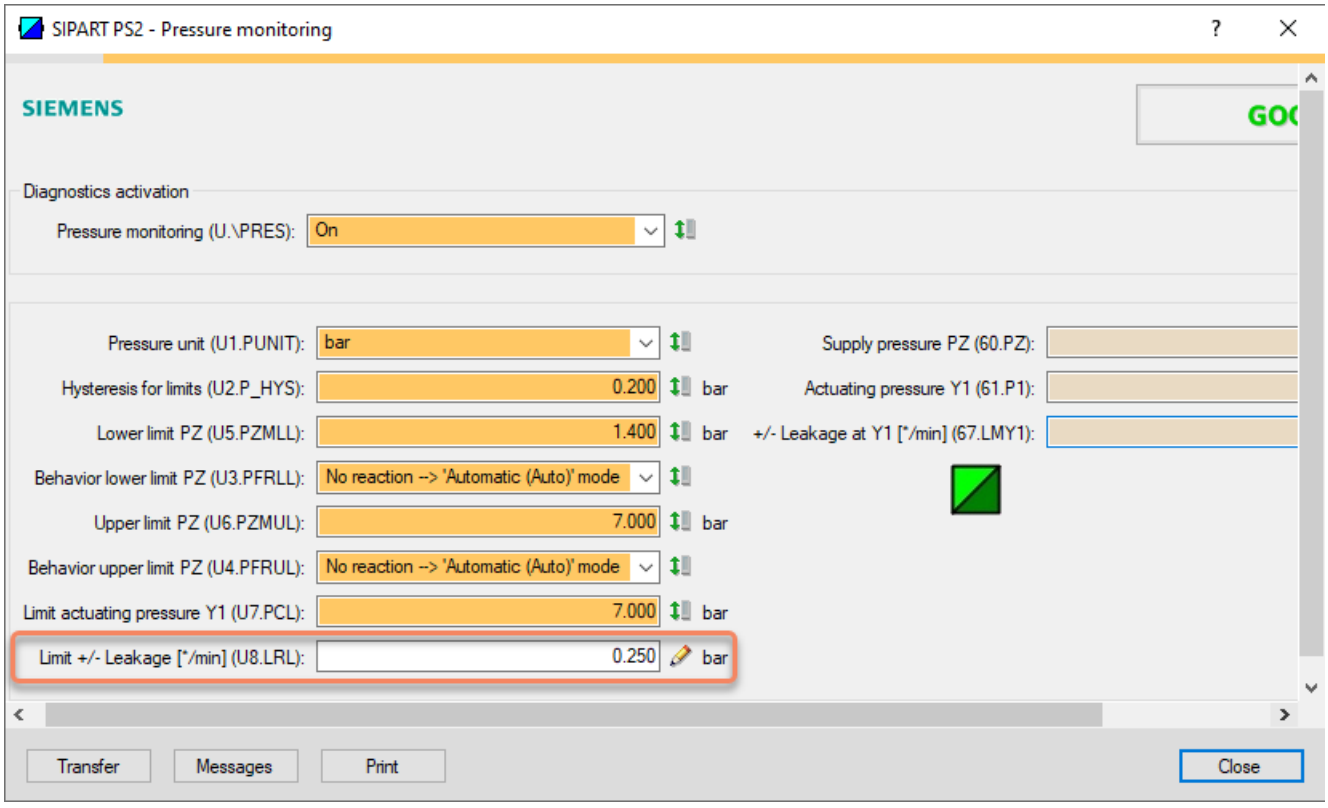



⇒ The "Pressure monitoring" dialog is displayed.

7. Activate "Pressure monitoring" (U.\PRES) with the value "On".




⇒ The dialog with the current parameters is displayed.




8. Change the "U8.LRL" parameter to a value not equal to "0.000", e.g. "0.250".
9. Transfer these changes to the positioner with the "Transfer" button.
10. Close the dialog.
11. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
12. In the "Upload to PG/PC..." dialog, click the "Start" button.
    ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".

## 5.8.3 With SIMATIC PDM: Show diagnostic results

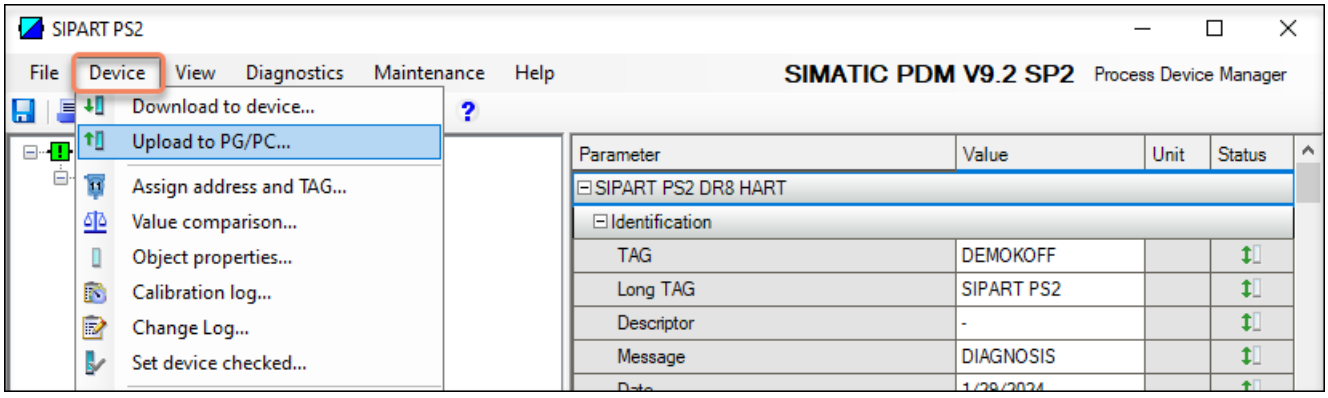
### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- Monitoring of pressure sensor-based leakage is activated → Activate and configure diagnostics (Page 263).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

### Procedure

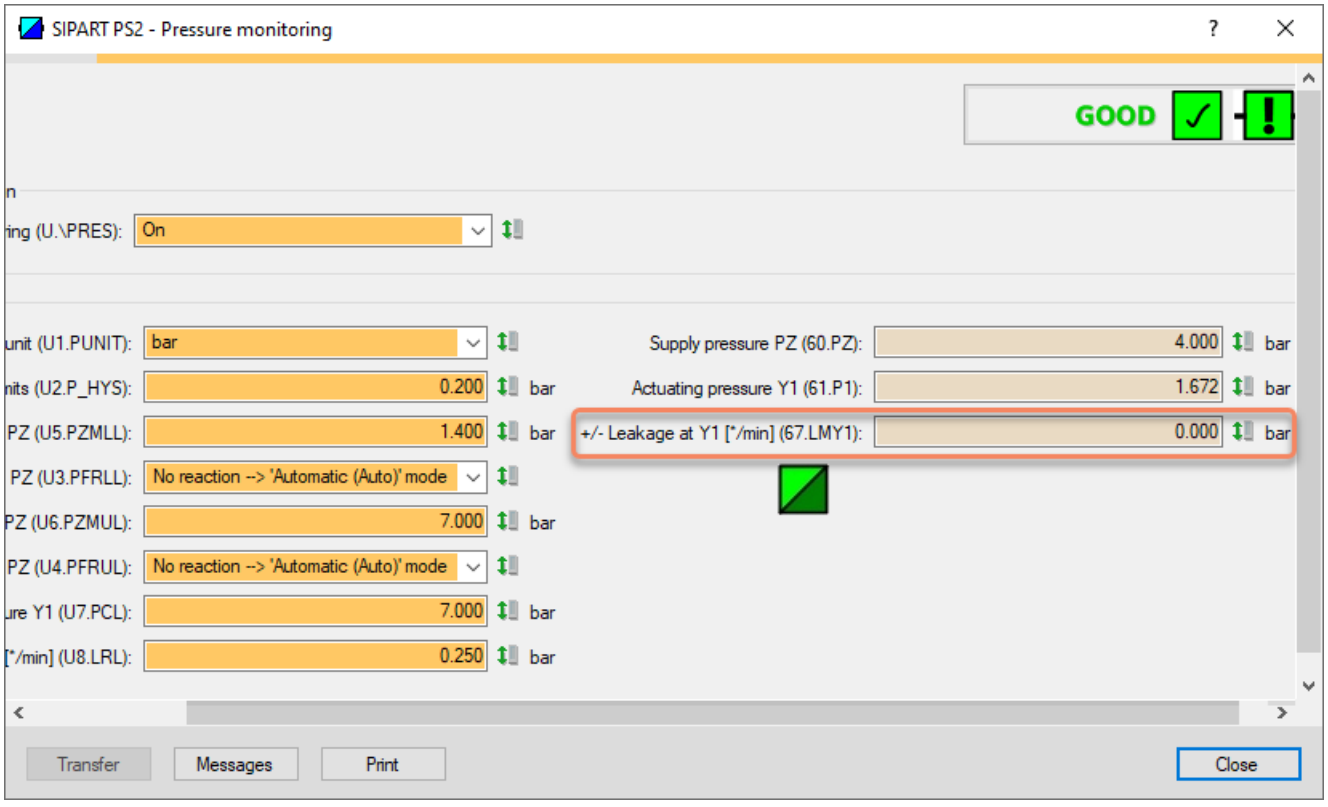
**Display parameters and diagnostic results**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

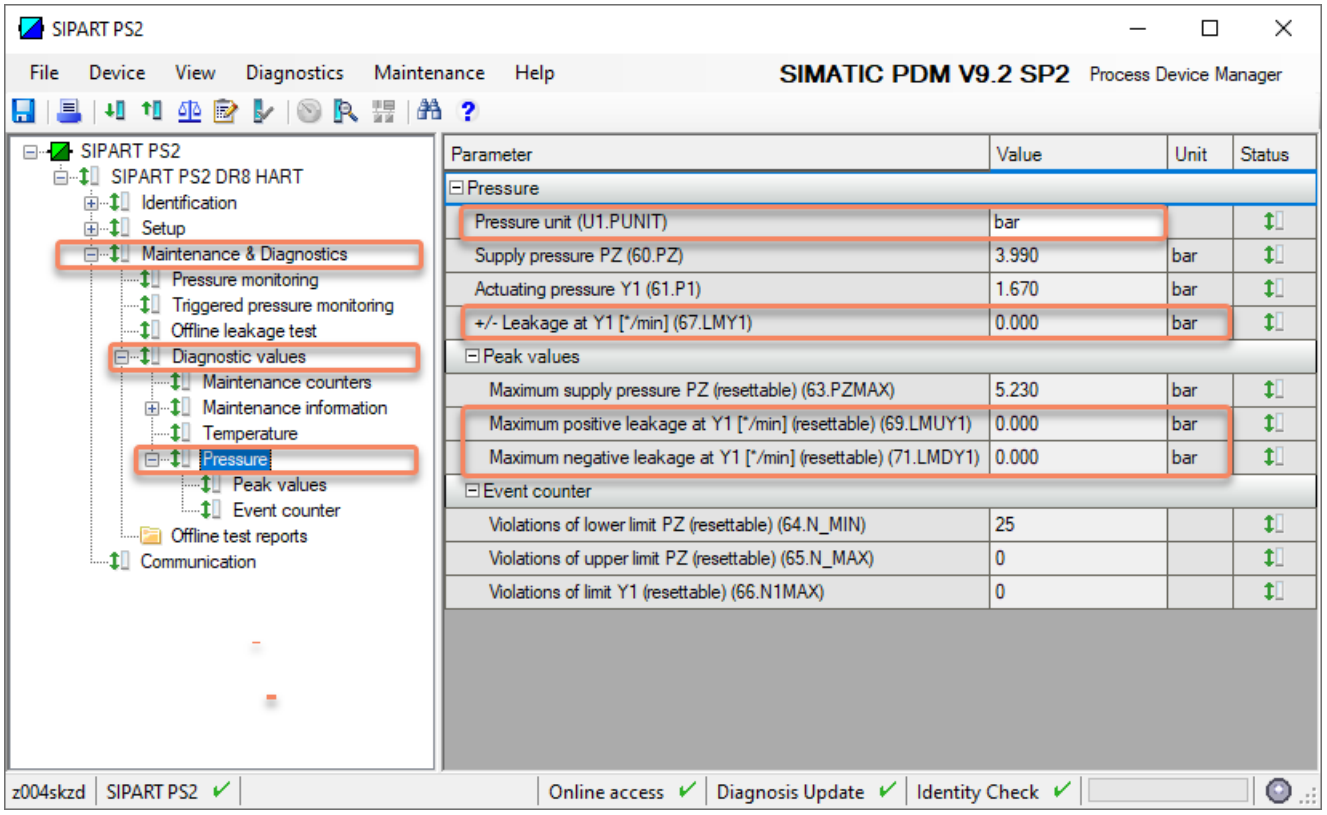



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".
   ⇒ The "Pressure monitoring" dialog shows the parameters and current leakage at Y1, with double-acting positioners also at Y2.

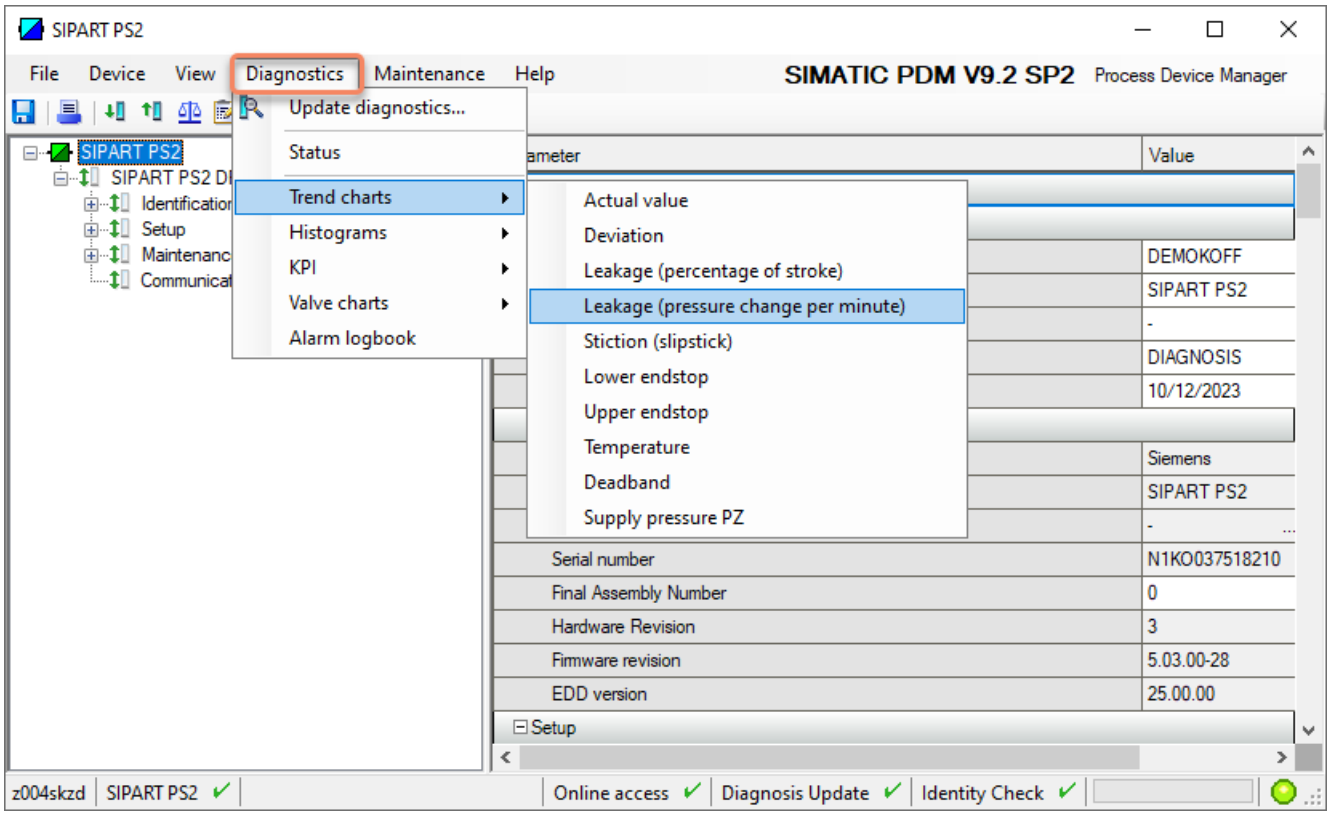


7. Close the dialog.
8. Select the directory "Maintenance & Diagnostics > Diagnostic values > Pressure".
   ⇒ The diagnostic results are displayed:
   - Pressure unit (U1.PUNIT)
   - +/- Leakage at Y1 (67.LMY1)
   - +/- Leakage at Y2 (68.LMY2)
   - Maximum positive leakage at Y1 (69.LMUY1)
   - Maximum positive leakage at Y2 (70.LMUY2) - only with double-acting positioner
   - Maximum negative leakage at Y1 (71.LMDY1)
   - Maximum negative leakage at Y2 (72.LMDY2) - only with double-acting positioner



### Display trend data

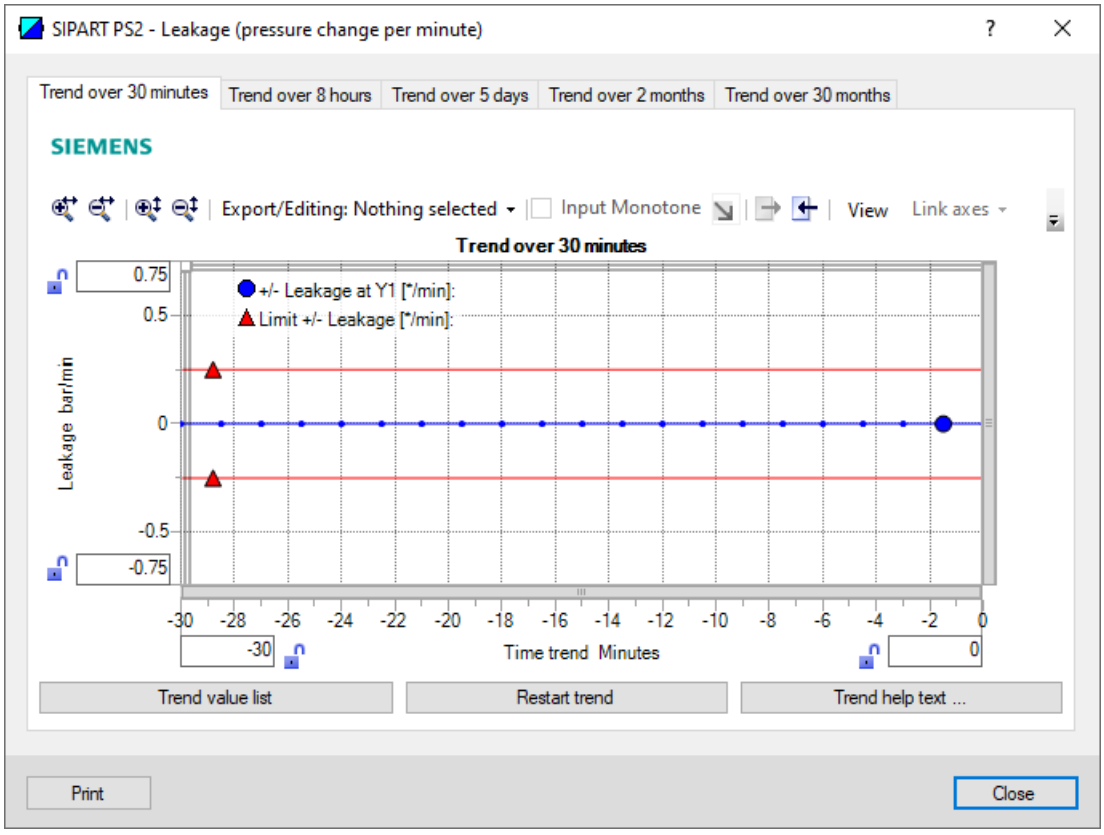
1. In the "Diagnostics" menu, select the "Trend charts > Leakage (pressure change per minute)" command.




The "Leakage (pressure change per minute)" dialog is displayed.
The dialog contains the tabs, each with a trend chart for the determined pressure values:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum 2 × 20 data of the corresponding 2 ring memories for the positive and negative leakage.
The 2 lines for the limit "+/- leakage" (U8.LRL) are displayed.




| Button | Notes |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

2. Close the dialog.

## 5.8.4 Diagnostic value " +/-Leakage at Y1" (67.LMY1)

| **Diagnostic value** | **+/- Leakage at Y1**<br>**Short designation: 67.LMY1** | |
|---|---|---|
| Function | The diagnostic value shows the pressure increase or decrease (leakage) per minute for the actuating pressure Y1. | |
| Note | • The diagnostic value is determined in the controlled state.<br>• Positive values indicate an increase in pressure, e.g. in the event of pneumatic leakage between supply pressure PZ and actuating pressure Y1.<br>• Negative values indicate a decrease in pressure, e.g. if the pneumatic system is leaking. | |
| Requirement | The positioner has pressure sensors (Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **+/- Leakage at Y1 (67.LMY1)** | | |
| SIMATIC PDM Export | Name | var_LM_LeakageRateChamber1 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 24 ... 27<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.5 Diagnostic value " +/-Leakage at Y2" (68.LMY2)

| **Diagnostic value** | **+/- Leakage at Y2**<br>**Short designation: 68.LMY2** | |
|---|---|---|
| Function | The diagnostic value shows the pressure increase or decrease (leakage) per minute for the actuating pressure Y2. | |
| Note | • The diagnostic value is determined in the controlled state.<br>• Positive values indicate an increase in pressure, e.g. in the event of pneumatic leakage between supply pressure PZ and actuating pressure Y2.<br>• Negative values indicate a decrease in pressure, e.g. if the pneumatic system is leaking. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **+/- Leakage at Y2 (68.LMY2)** | | |
| SIMATIC PDM Export | Name | var_LM_LeakageRateChamber2 |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 28 ... 31<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.6 Diagnostic value "Maximum positive leakage at Y1" (69.LMUY1)

| **Diagnostic value** | **Maximum positive leakage at Y1**<br>**Short designation: 69.LMUY1** | |
|---|---|---|
| Function | The pressure change at Y1 is continuously monitored in the controlled state.<br>The maximum pressure increase is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum positive leakage at Y1 (69.LMUY1)** | | |
| SIMATIC PDM Export | Name | var_LM_P1DeltaPresMaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 32 ... 35<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.7 Diagnostic value "Maximum positive leakage at Y2" (70.LMUY2)

| **Diagnostic value** | **Maximum positive leakage at Y2**<br>**Short designation: 70.LMUY2** | |
|---|---|---|
| Function | The pressure change at Y2 is continuously monitored in the controlled state.<br>The maximum pressure increase is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum positive leakage at Y2 (70.LMUY2)** | | |
| SIMATIC PDM Export | Name | var_LM_P2DeltaPresMaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 36 ... 39<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.8 Diagnostic value " Maximum negative leakage at Y1" (71.LMDY1)

| **Diagnostic value** | **Maximum negative leakage at Y1**<br>**Short designation: 71.LMDY1** | |
|---|---|---|
| Function | The pressure change at Y1 is continuously monitored in the controlled state.<br>The maximum pressure drop is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum negative leakage at Y1 (71.LMDY1)** | | |
| SIMATIC PDM Export | Name | var_LM_P1DeltaPresMinPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 40 ... 43<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.9 Diagnostic value " Maximum negative leakage at Y2" (72.LMDY2)

| **Diagnostic value** | **Maximum negative leakage at Y2**<br>**Short designation: 72.LMDY2** | |
|---|---|---|
| Function | The pressure change at Y2 is continuously monitored in the controlled state.<br>The maximum pressure drop is determined and stored in the manner of a drag pointer. | |
| Note | The diagnostic value can be reset. | |
| Requirement | • The positioner is double-acting.<br>• The positioner has pressure sensors (-Z P02 option). | |
| Display range | ±0.000 ... 9.999 | bar/min |
| | ±0.000 ... 0.999 | MPa/min |
| | ±0.00 ... 99.99 | psi/min |
| Unit | • bar/min<br>• MPa/min<br>• psi/min | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum negative leakage at Y2 (72.LMDY2)** | | |
| SIMATIC PDM Export | Name | var_LM_P2DeltaPresMinPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 44 ... 47<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

## 5.8.10 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- Monitoring of pressure sensor-based leakage is activated → Activate and configure diagnostics (Page 263).

### Read out trend data

#### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "50".
  Send the request separately for each of the 5 ring memories for the Y1 actuating pressure and for double-acting positioners for the actuating pressure Y2.

| Ring memory index for Y1 | Ring memory for time span |
|---|---|
| 50 | Last 30 minutes |
| 51 | Last 8 hours |
| 52 | Last 5 days |
| 53 | Last 2 months |
| 54 | Last 30 months |

| Ring memory index for Y2 | Ring memory for time span |
|---|---|
| 55 | Last 30 minutes |
| 56 | Last 8 hours |
| 57 | Last 5 days |
| 58 | Last 2 months |
| 59 | Last 30 months |

#### Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-18 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |

| Byte | Format | Description |
|---|---|---|
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each) |
| 43 ... 46 | Float | Limit positive leakage (U8.LRL) |
| 47 ... 50 | Float | Limit negative leakage (U8.LRL) |
| 51 ... 54 | Float | - |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-19 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## Process diagnostics data

### Request

Send to the positioner via HART communication:

- Command "#198"

### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-20 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Pressure monitoring (U.\PRES) |
| **1** | **Enum** | **Pressure unit (U1.PUNIT)** |
| 2 ... 5 | Float | Lower limit PZ (U5.PZMLL) |
| 6 ... 9 | Float | Hysteresis for limits (U2.P_HYS) |
| 10 | Enum | Behavior lower limit PZ (U3.PFRLL) |
| 11 | Enum | Behavior upper limit PZ (U4.PFRUL) |
| 12 ... 15 | Float | Upper limit PZ (U6.PZMUL) |
| 16 ... 19 | Float | Limit actuating pressure Y1 (U7.PCL) |
| **20 ... 23** | **Float** | **Limit leakage (U8.LRL)** |
| 24 ... 25 | Unsigned-16 | Time pressure measurement Y1 (U9.TPMT) |

Table 5-21 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |

## Diagnostic values

### Data request

Send to the positioner via HART communication:

- Command "#200"

### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-22 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Unsigned-8 | Number of available Pressure Sensors |
| **1** | **Enum** | **Pressure Unit (U1.PUNIT)** |
| 2 ... 5 | Float | Supply Pressure Value (60.PZ) |
| 6 ... 9 | Float | Chamber 1 Pressure Value (61.P1) |
| 10 ... 13 | Float | Chamber 2 Pressure Value (62.P2) |
| 14 ... 17 | Float | Supply Pressure Maximum Pointer resettable (63.PZMAX) |
| 18 ... 19 | Unsigned-16 | Number of Supply Pressure Limit Underruns resettable (64.N_MIN) |
| 20 ... 21 | Unsigned-16 | Number of Supply Pressure Upper Limit Overruns resettable (65.N_MAX) |
| 22 ... 23 | Unsigned-16 | Number of Chamber Pressure 1 Limit reached resettable (66.N1MAX) |
| **24 ... 27** | **Float** | **Delta Pressure Chamber 1 (67.LMY1)** |
| **28 ... 31** | **Float** | **Delta Pressure Chamber 2 (68.LMY2)** |
| **32 ... 35** | **Float** | **Chamber 1 positive Delta Pressure Maximum Pointer resettable (69.LMUY1)** |
| **36 ... 39** | **Float** | **Chamber 2 positive Delta Pressure Maximum Pointer resettable (70.LMUY2)** |
| **40 ... 43** | **Float** | **Chamber 1 negative Delta Pressure Maximum Pointer resettable (71.LMDY1)** |
| **44 ... 47** | **Float** | **Chamber 2 negative Delta Pressure Maximum Pointer resettable (72.LMDY2)** |

Table 5-23 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |

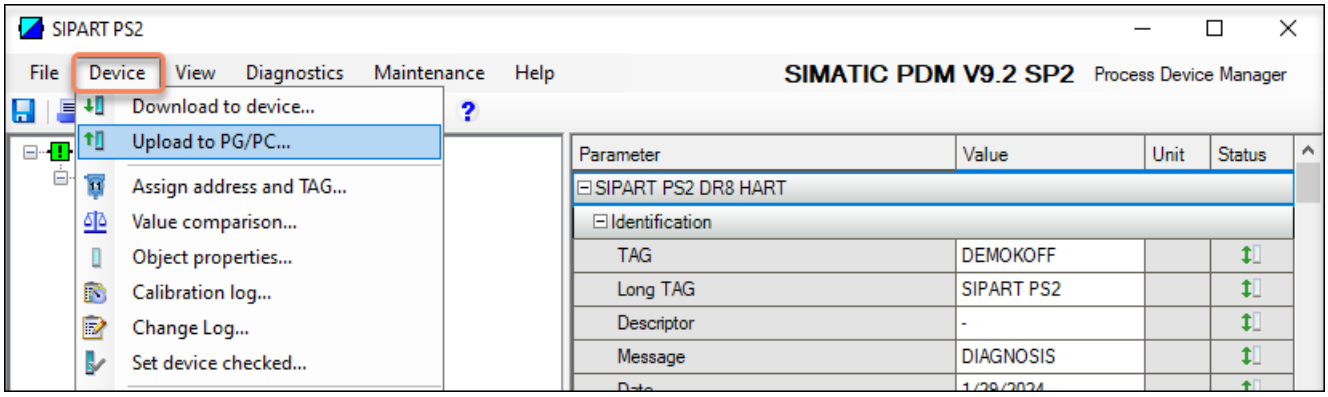
## 5.8.11 With SIMATIC PDM: Export diagnostics results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

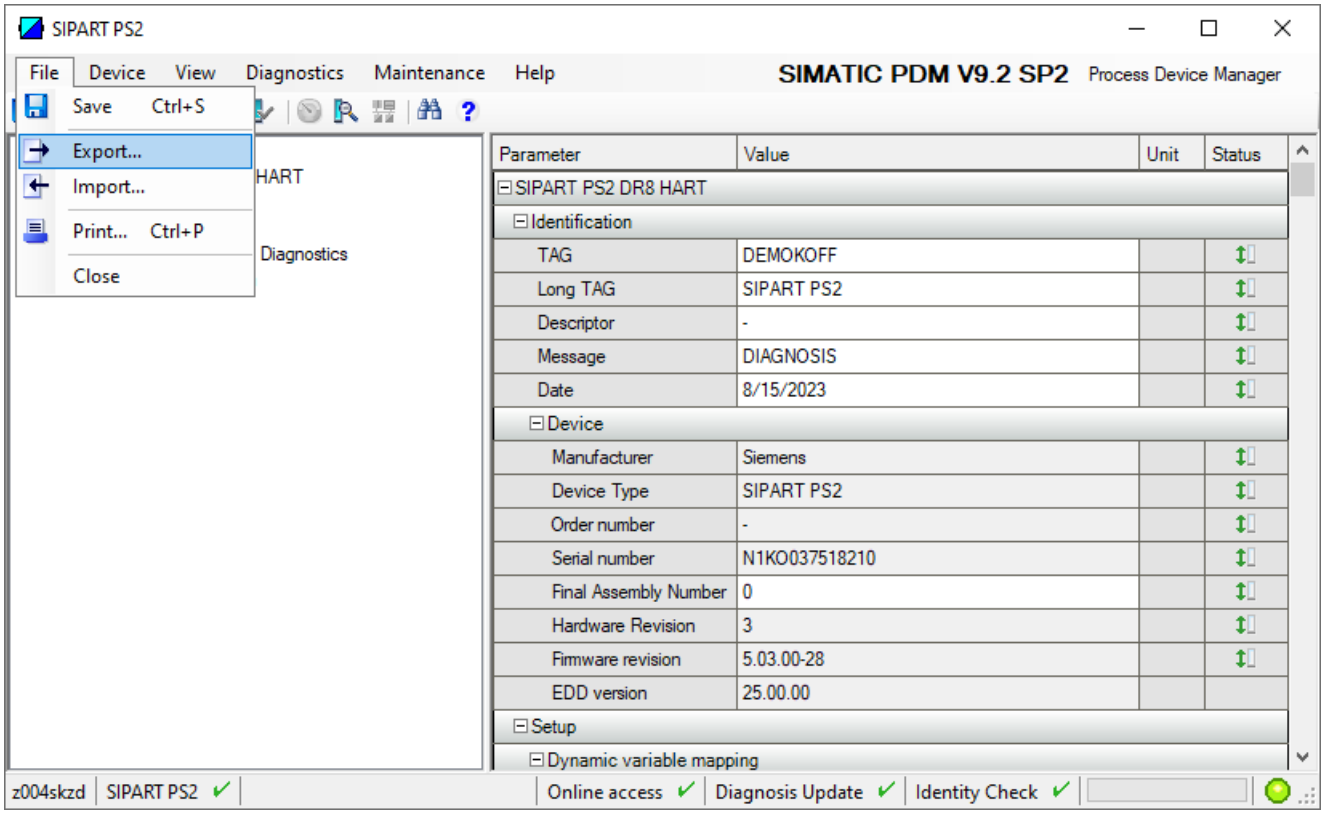
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



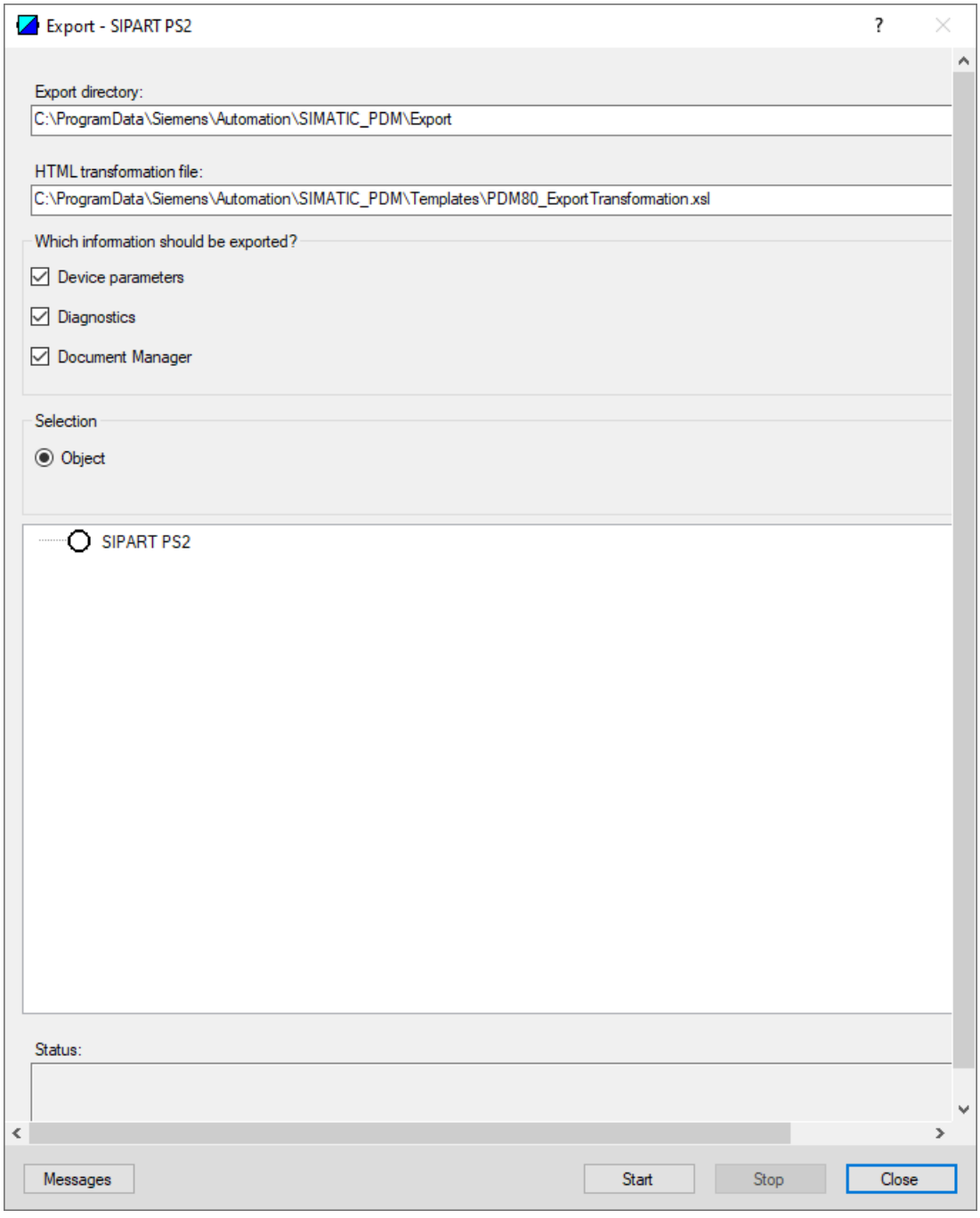

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Leakage (pressure change per minute)" Trend Charts > → With SIMATIC PDM: Show diagnostic results (Page 267).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu of SIMATIC PDM , select the command "Export..."..



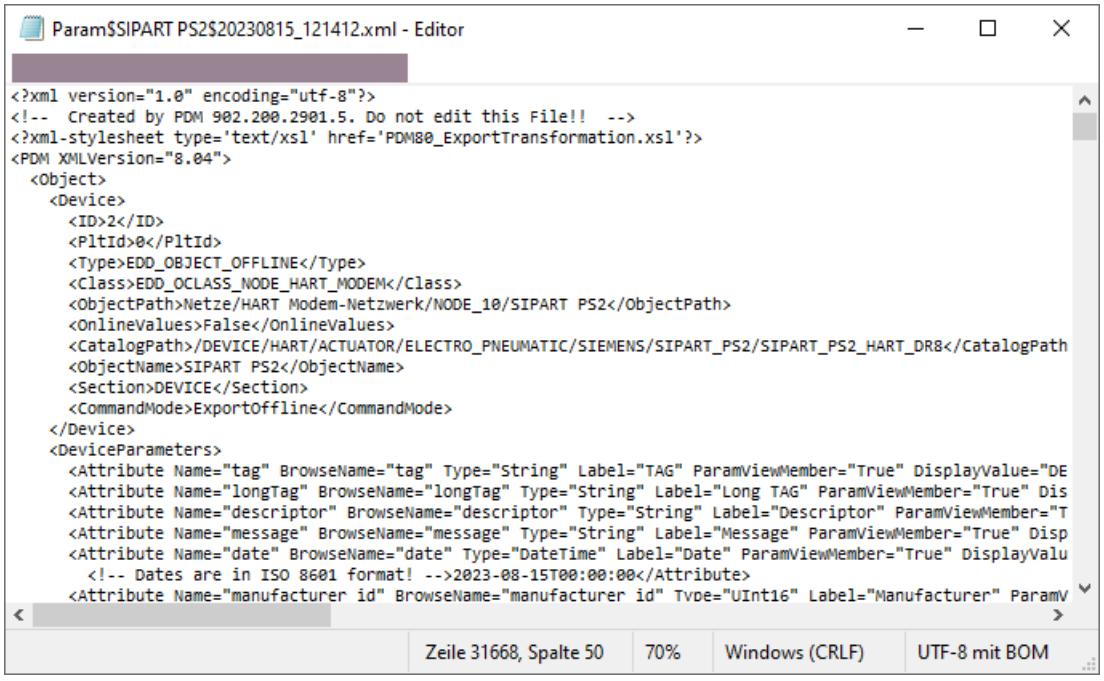

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file lists 100 lines for Y1 and Y2 with the exported trend data of the process diagnostics.
Each of the 2 × 5 ring memories contains 20 data.
The data for **Y1** are labeled with Name = "var_trend_leakage_rate_**P1**_...".
The data for **Y2** are labeled with Name = "var_trend_leakage_rate_**P2**_...".
The 1st data line reads, for example:
**<Attribute Name="var_trend_leakage_rate_P1_30min_0" BrowseName="var_trend_leakage_rate_P1_30min_0" Type="Int16" Label="0,0 bis -1,5 Minuten" ParamViewMember="False" DisplayValue="0,000"** Import="True" State="16" **Unit="bar/min"**>0</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.000", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes for the specified unit.
- The table shows a summary of the 100 data exported with the XML file for Y1 and Y2.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | • var_trend_leakage_rate_P1_30min_0<br>• var_trend_leakage_rate_P2_30min_0 | 0.0 up to -1.5 minutes | 0.000 | • bar/min<br>• MPa/min<br>• psi/min |
| | | ... | ... | ... | |
| | | • var_trend_leakage_rate_P1_30min_19<br>• var_trend_leakage_rate_P2_30min_19 | -28.5 up to -30.0 minutes | ... | |
| Last 8 hours | 20 | • var_trend_leakage_rate_P1_8h_0<br>• var_trend_leakage_rate_P2_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | • var_trend_leakage_rate_P1_8h_19<br>• var_trend_leakage_rate_P2_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | • var_trend_leakage_rate_P1_5d_0<br>• var_trend_leakage_rate_P2_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | • var_trend_leakage_rate_P1_5d_19<br>• var_trend_leakage_rate_P2_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | • var_trend_leakage_rate_P1_2m_0<br>• var_trend_leakage_rate_P2_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | • var_trend_leakage_rate_P1_2m_19<br>• var_trend_leakage_rate_P2_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | • var_trend_leakage_rate_P1_30m_0<br>• var_trend_leakage_rate_P2_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | • var_trend_leakage_rate_P1_30m_19<br>• var_trend_leakage_rate_P2_30m_19 | -855 up to -900 days | ... | |

The XML file contains the following additional data for process diagnostics.

Table 5-24 Parameter

| **Parameter** | **Data description in the XML file** | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| U1.PUNIT | var_pressureUnit | Druckeinheit (U1.PUNIT) | bar | • bar<br>• MPa<br>• psi |
| U8.LRL | var_LM_LeakageRateLimit | Grenzwert +/- Leckage [*/min] (U8.LRL) | 0.250 | • bar/min<br>• MPa/min<br>• psi/min |

Table 5-25 Diagnostic values

| **Diagnostic value** | **Data description in the XML file** | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| 67.LMY1 | var_LM_LeakageRateChamber1 | +/- Leakage at Y1 [*/min] (67.LMY1) | 0.000 | • bar/min<br>• MPa/min<br>• psi/min |
| 68.LMY2 | var_LM_LeakageRateChamber2 | +/- Leakage at Y2 [*/min] (68.LMY2) | 0.000 | |
| 69.LMUY1 | var_LM_P1DeltaPresMaxPointerResettable | Maximum positive leakage at Y1 [*/min] (resettable) (69.LMUY1) | 0.000 | |
| 70.LMUY2 | var_LM_P2DeltaPresMaxPointerResettable | Maximum positive leakage at Y2 [*/min] (resettable) (70.LMUY2) | 0.000 | |
| 71.LMDY1 | var_LM_P1DeltaPresMinPointerResettable | Maximum negative leakage at Y1 [*/min] (resettable) (71.LMDY1) | 0.000 | |
| 72.LMDY2 | var_LM_P2DeltaPresMinPointerResettable | Maximum negative leakage at Y2 [*/min] (resettable) (72.LMDY2) | 0.000 | |

## 5.8.12 Messages

### 5.8.12.1 General information

#### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.

#### Notes

If the limits are exceeded:

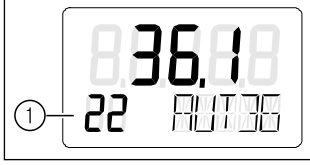
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.8.12.2 Messages in the display

#### Indication on the display

If the set limit is exceeded, error code "22" is output.

If several messages are present at the same time, the display switches between the different error codes.

| Display | | Possible cause |
|---|---|---|
|  | ① Error code 22 | The increase or decrease in pressure (leakage) exceeds the limit "+/- leakage" (U8.LRL). |

### 5.8.12.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

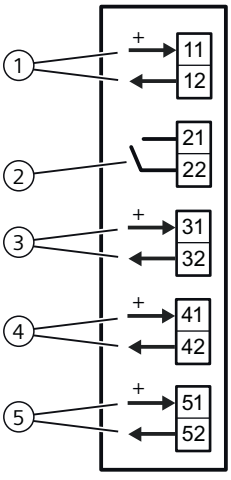
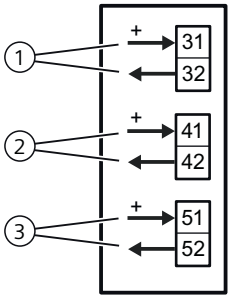
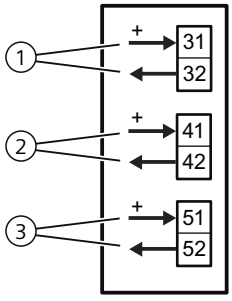
- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Message via the digital output

If one of the following values exceeds the limit (U8.LRL), the fault signal output is activated:

- Maximum pressure change / positive leakage at Y1 (69.LMUY1)
- Maximum pressure change / negative leakage at Y1 (71.LMDY1)
- Maximum pressure change / positive leakage at Y2 (70.LMUY2)
- Maximum pressure change / negative leakage at Y2 (72.LMDY2)

#### I/Os

| **Digital I/O Module (DIO)<br>6DR4004-6A / -8A** | **Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS)<br>6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault signal output, in conjunction with 6DR4004-3ES without function<br>② Digital output 1<br>③ Digital output 2 | ① Fault signal output, in conjunction with 6DR4004-4ES without function<br>② Digital output 1<br>③ Digital output 2 |

### 5.8.12.4 With SIMATIC PDM: Read diagnostics status

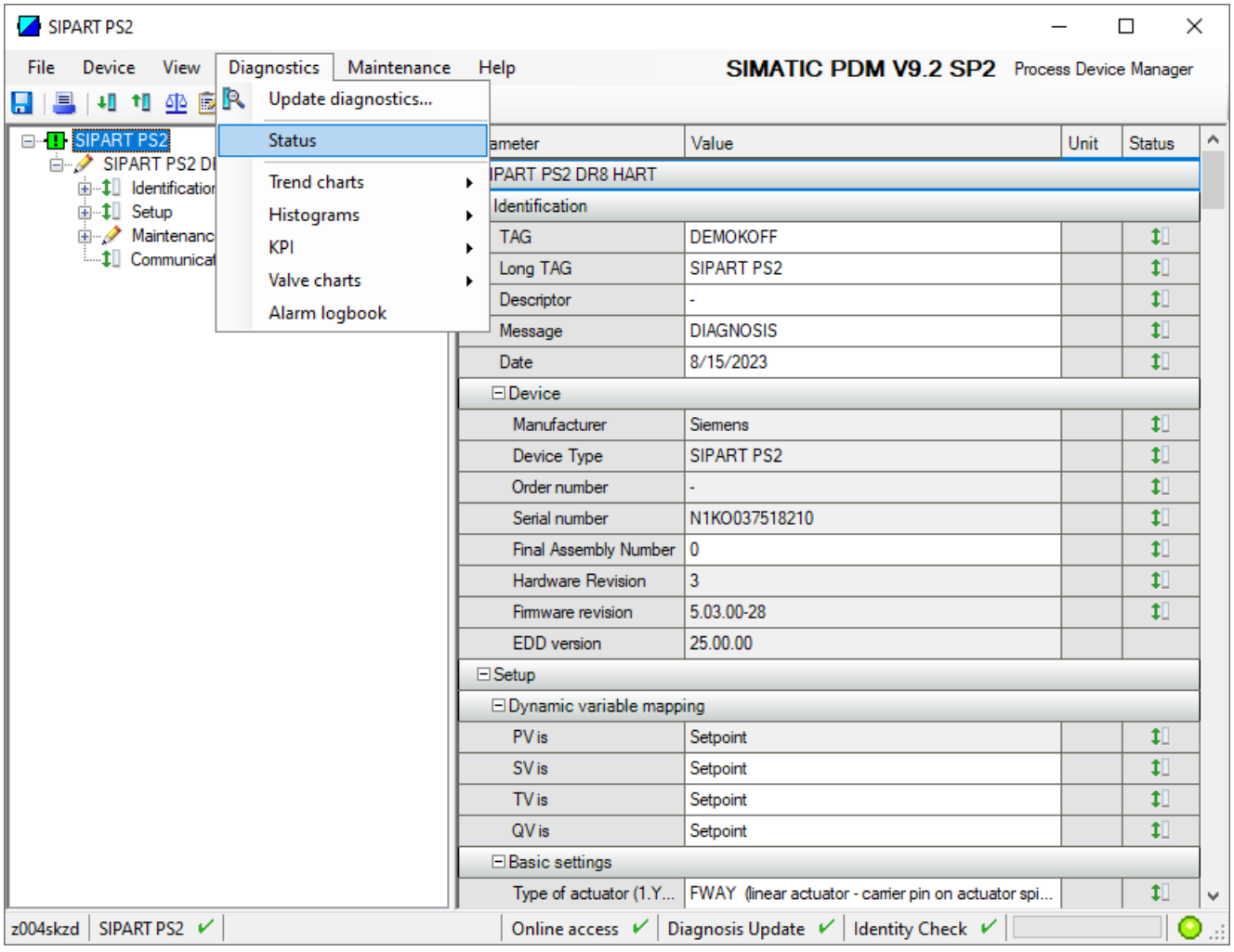
#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created for the positioner.

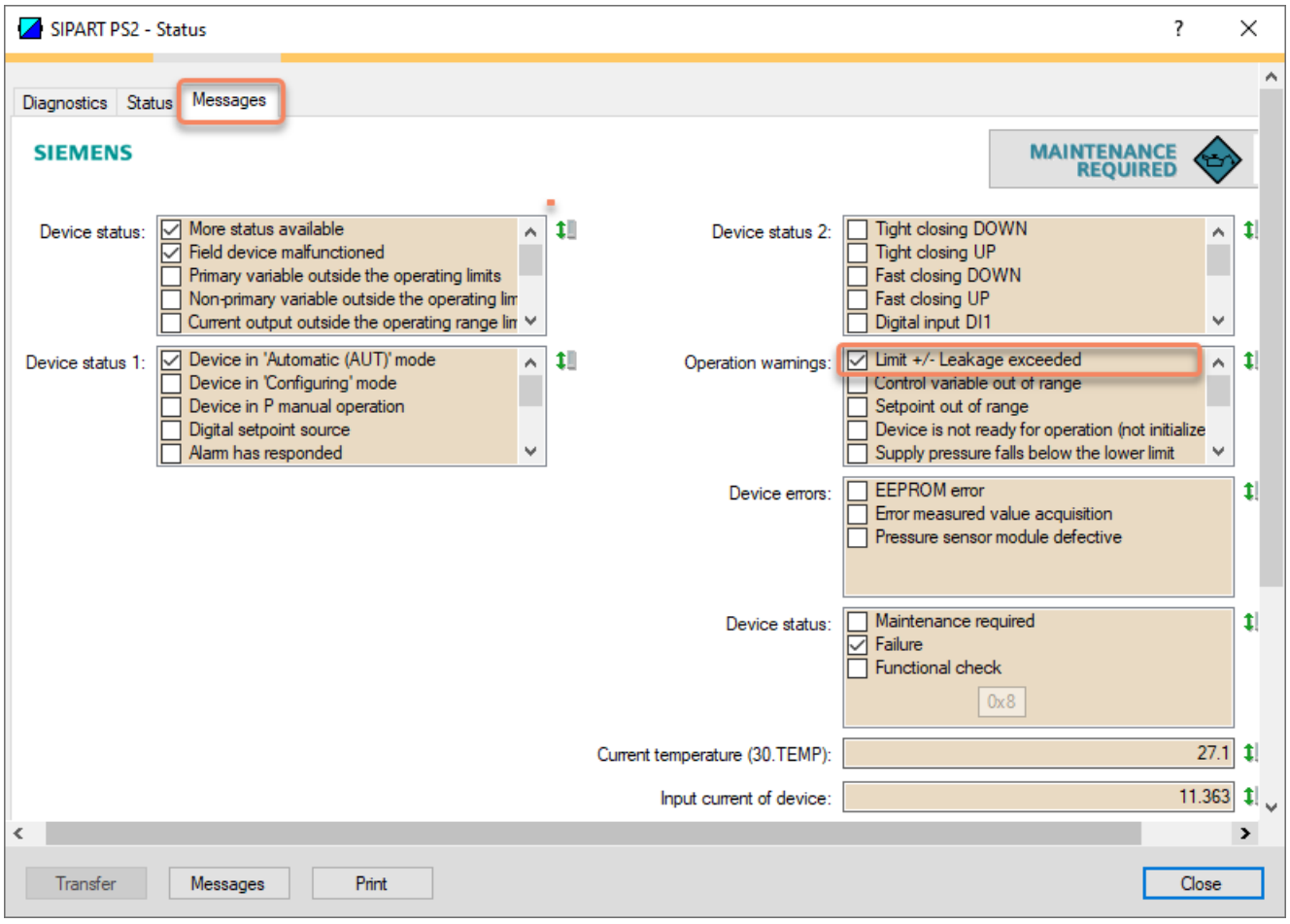
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Messages" tab.
   If the limit is exceeded, the message is highlighted:
   – "Limit +/- Leakage exceeded"




8. Close the dialog.

### 5.8.12.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If the set limit for leakage monitoring is exceeded, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 Bytes is returned.
  The message for the process diagnostics is contained in the following Byte:
  – Byte 3, Bit 7 corresponds to leakage limit exceeded.

#### 5.8.12.6 Reset messages

The error messages are saved in the alarm logbook of the positioner.

The error messages can be reset using the corrective measures.

| Error message | Possible cause | Remedy |
|---|---|---|
| Error code "22" | The increase or decrease in pressure (leakage) exceeds or falls below the "limit +/- leakage" (U8.LRL). | • Find and rectify the cause of the pressure increase or decrease (leakage).<br>• Reset the diagnostic values via display, SIMATIC PDM or HART communication:<br>– Maximum positive leakage at Y1 (69.LMUY1)<br>– Maximum negative leakage at Y1 (71.LMDY1)<br>– Maximum positive leakage at Y2 (70.LMUY2)<br>– Maximum negative leakage at Y2 (72.LMDY2)<br>• Reset the limit "U8.LRL" to "0.000".<br>⇒ Monitoring is activated. |

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.9 Monitoring of stiction (slipstick) (d.\STIC)

### 5.9.1 Functional description

Process diagnostics continuously monitor the stiction of the valve.

In the event of setpoint changes, jerky changes in the process valve position, so-called slip jumps, indicate excessive stiction.

The size of the slip jumps is determined as a percentage of the travel distance and displayed as the diagnostic value "stiction" (17.STIC).

**Ring memory**

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.9.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring of stiction (slipstick effect)" (d.\STIC)

| | | |
|---|---|---|
| Function | Process diagnostics continuously monitor the stiction of the valve. | |
| Note | The size of the slip jumps is determined as a percentage of the travel distance and displayed as the diagnostic value "stiction" (17.STIC). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

**Note**

**Incorrect interpretation in case of travel times below one second**

If the travel times are less than one second, the positioner does not accurately differentiate between a normal movement of the actuator and a sudden change.

- If necessary, increase the travel time by adjusting the pneumatic restrictor(s)

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **d1.LIMIT** | **Limit** |
|---|---|
| Function | The parameter defines the basic limit for slipstick detection as a percentage.<br>The limit is a factor in the formation of thresholds. |
| Note | Recommendation:<br>• During operation of the positioner, observe the "stiction" (17.STIC) diagnostic value.<br>• Enter the resulting maximum value as the limit. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 1.0 |
| Unit | % |

| **d2.FACT1** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "d1.LIMIT" results in threshold 1 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: **d2.FACT1** < d3.FACT2 < d4.FACT3 |
| Factory setting | 5.0 | |

| **d3.FACT2** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "d1.LIMIT" results in threshold 2 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: d2.FACT1 < **d3.FACT2** < d4.FACT3 |
| Factory setting | 10.0 | |

| **d4.FACT3** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "d1.LIMIT" results in threshold 3 of the process diagnostics. | |
| Setting range | 0.1 ... 100.0 | Condition: d2.FACT1 < d3.FACT2 < **d4.FACT3** |
| Factory setting | 15.0 | |

## Activate and configure "Monitoring of stiction"

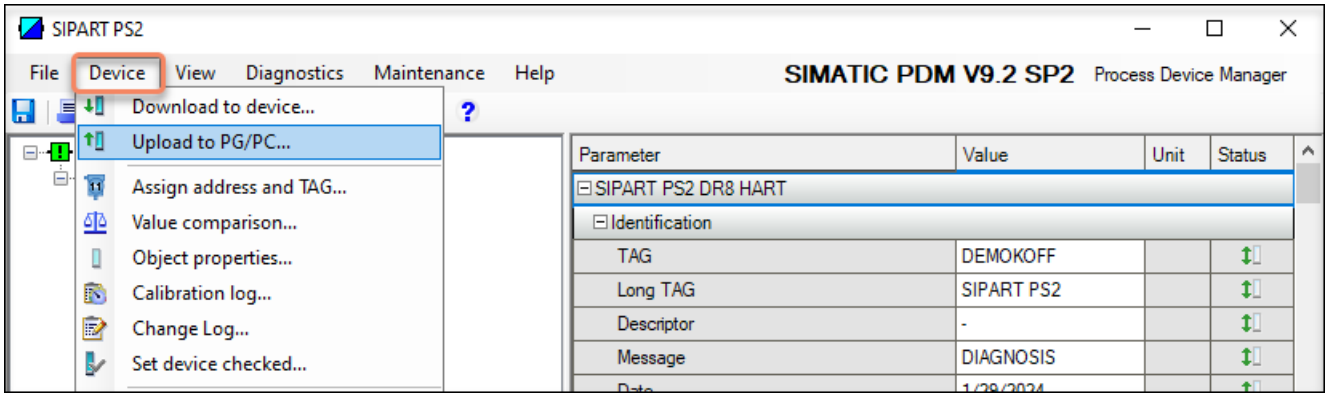
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

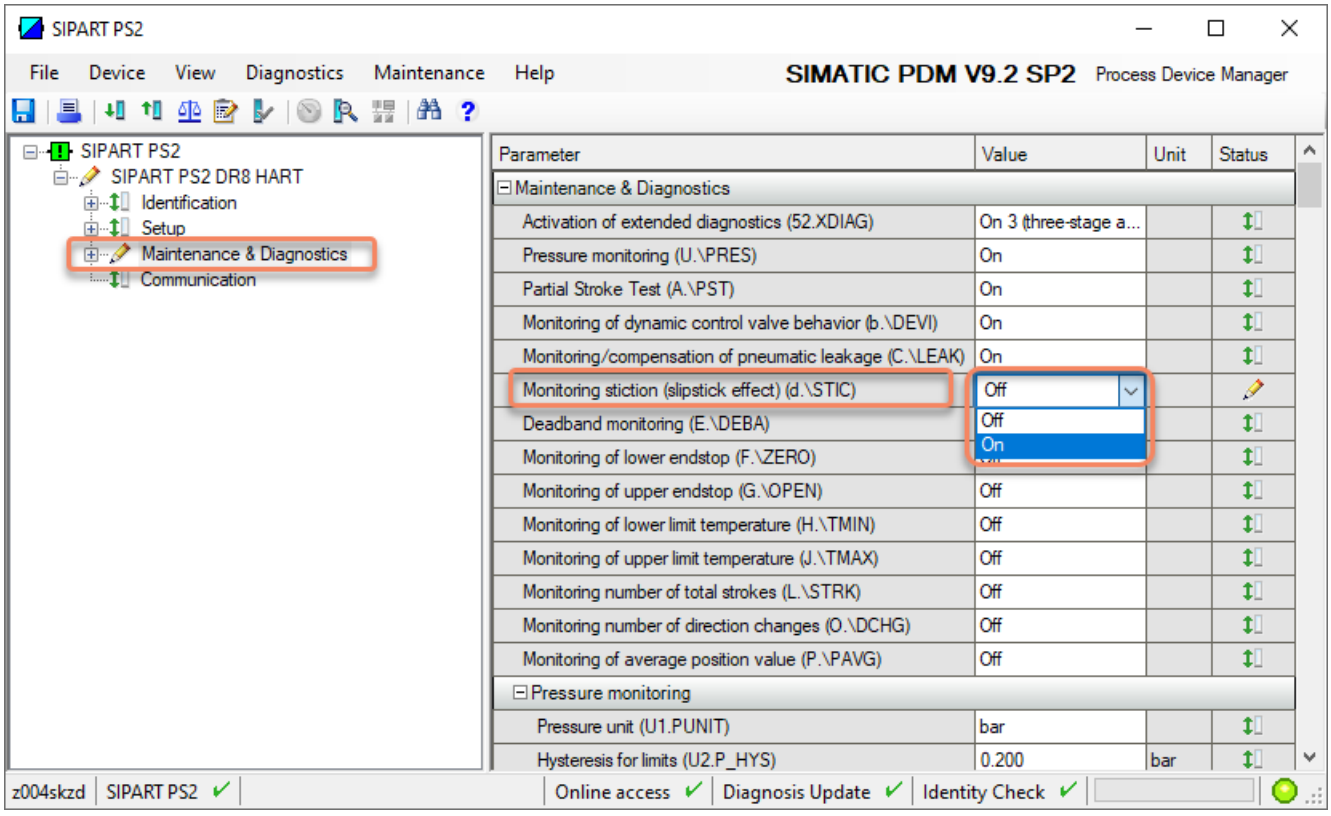
1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "d.\STIC" of the "Stiction monitoring" process diagnostics.
3. Set the "d.\STIC" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - d1.LIMIT
   - d2.FACT1
   - d3.FACT2
   - d4.FACT3

### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring stiction (slipstick effect)" (d.\STIC), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - d1.LIMIT
   - d2.FACT1
   - d3.FACT2
   - d4.FACT3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

## 5.9.3 With SIMATIC PDM: Show diagnostic results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "d.\STIC" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "d.\STIC".

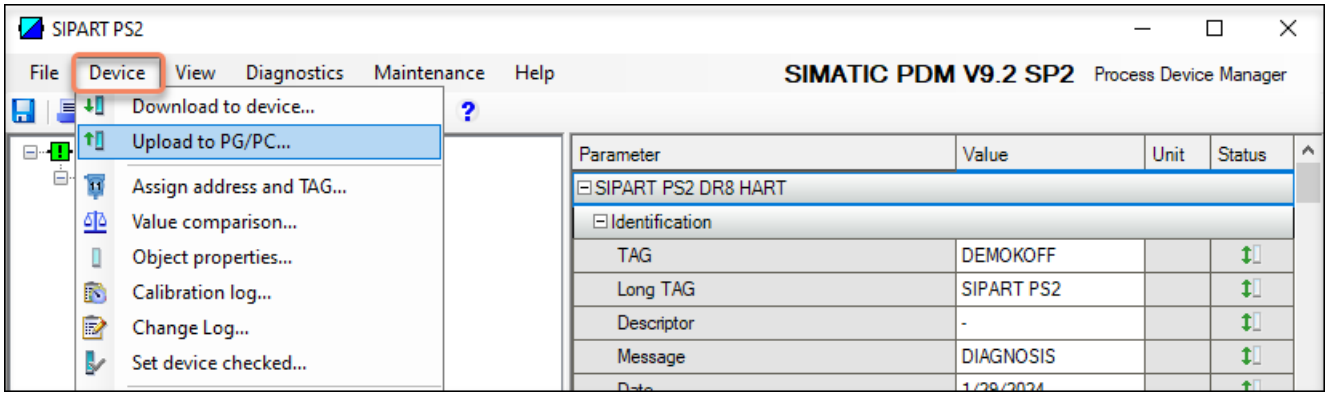
**Note**

If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "d1.LIMIT".

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

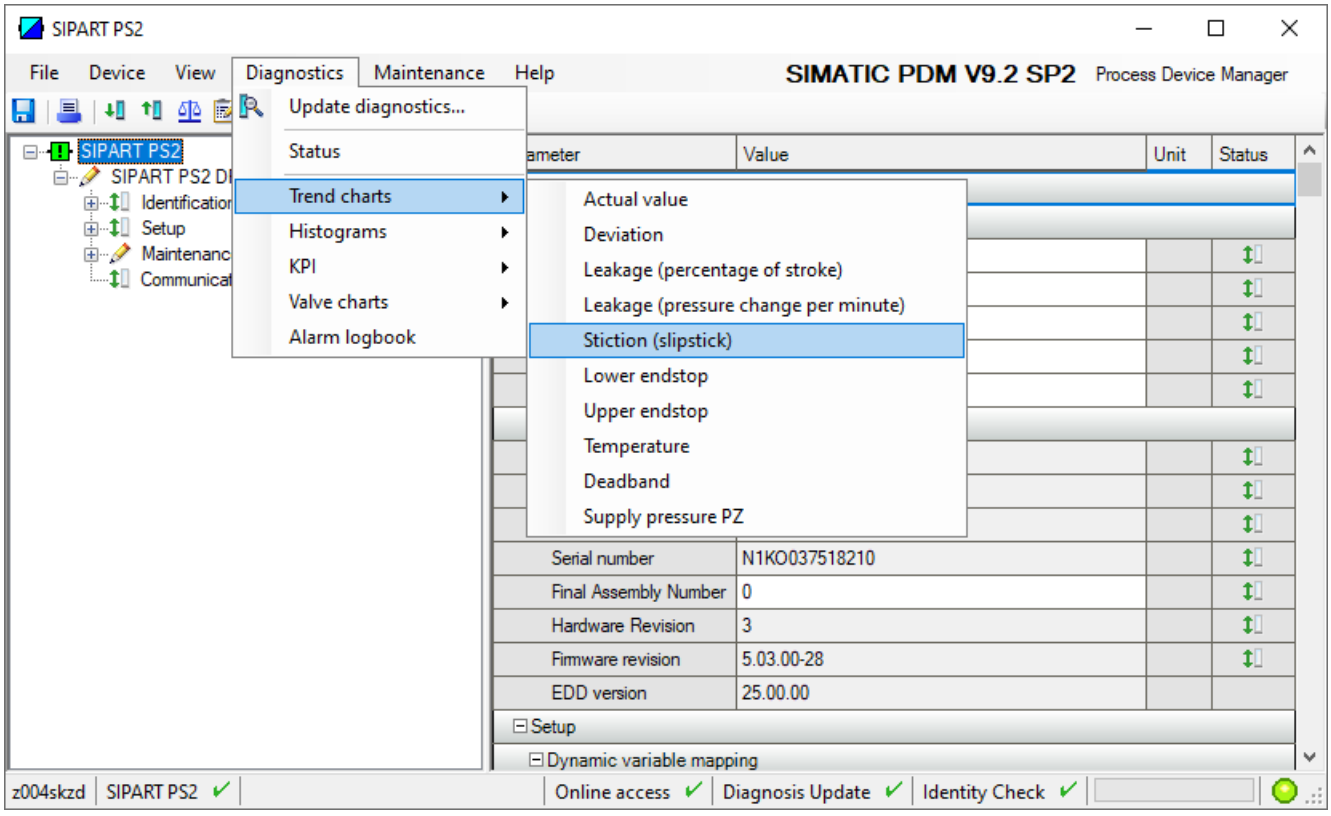
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

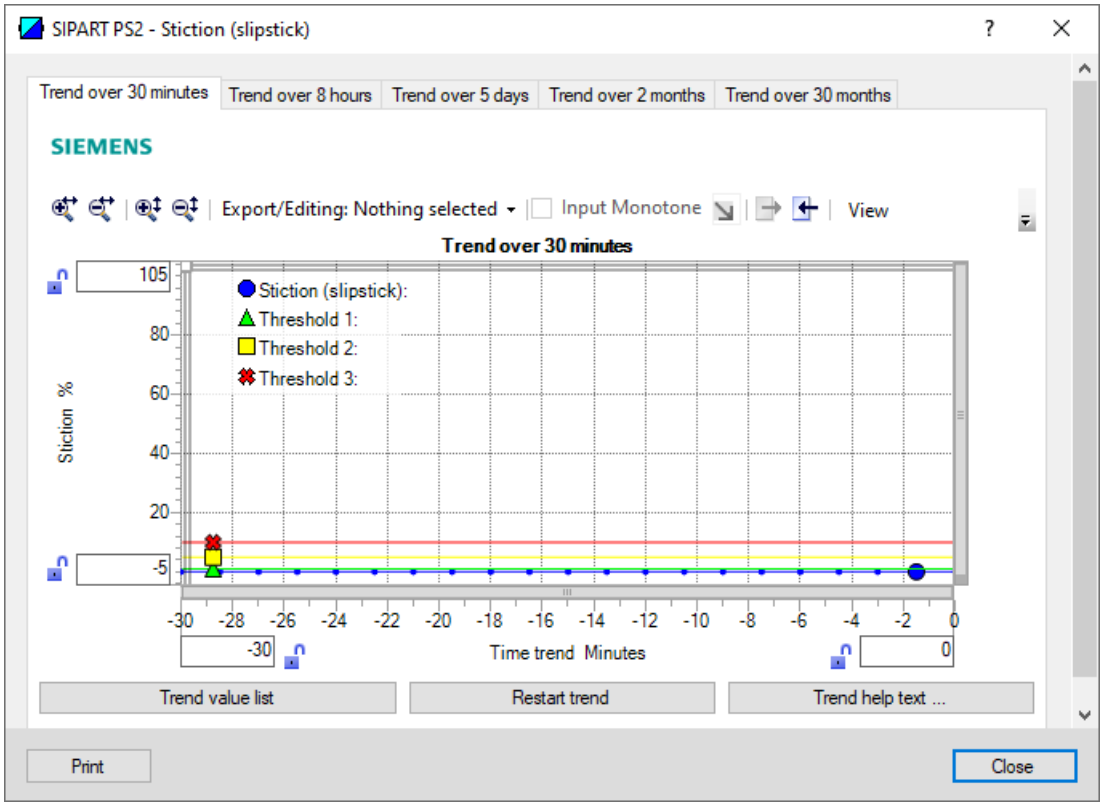
6. In the "Diagnostics" menu, select the "Trend charts > Stiction (slipstick)" command.




⇒ The "Stiction (slipstick)" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of thresholds 1, 2 and 3 are also shown.




| Button | Notes |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.9.4 Diagnostic value "Stiction (slipstick)" (17.STIC)

| **Diagnostic value** | **Stiction (slipstick)**<br>**Short designation: 17.STIC** | |
|---|---|---|
| Function | The diagnostic value shows jerky changes in the process valve position, known as slip jumps, as a percentage of the travel distance. | |
| Note | Jerky changes in the process valve position indicate excessive stiction. | |
| Requirement | The process diagnostics "Monitoring of stiction (slipstick effect)" (d.\STIC) is activated. | |
| Display range | 0 ... 100 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_slip_stick_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |

### 5.9.5 Via HART communication: Read out diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "d.\STIC" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "d.\STIC".

  **Note**

  If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "d1.LIMIT".

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "15".

Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 15 | Last 30 minutes |
| 16 | Last 8 hours |
| 17 | Last 5 days |
| 18 | Last 2 months |
| 19 | Last 30 months |

## Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-26 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | Value of threshold 1 (d1.LIMIT × d2.FACT1) |
| 47 ... 50 | Float | Value of threshold 2 (d1.LIMIT × d3.FACT2) |
| 51 ... 54 | Float | Value of threshold 3 (d1.LIMIT × d4.FACT3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-27 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## 5.9.6 With SIMATIC PDM: Export diagnostics results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "d.\STIC" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "d.\STIC".

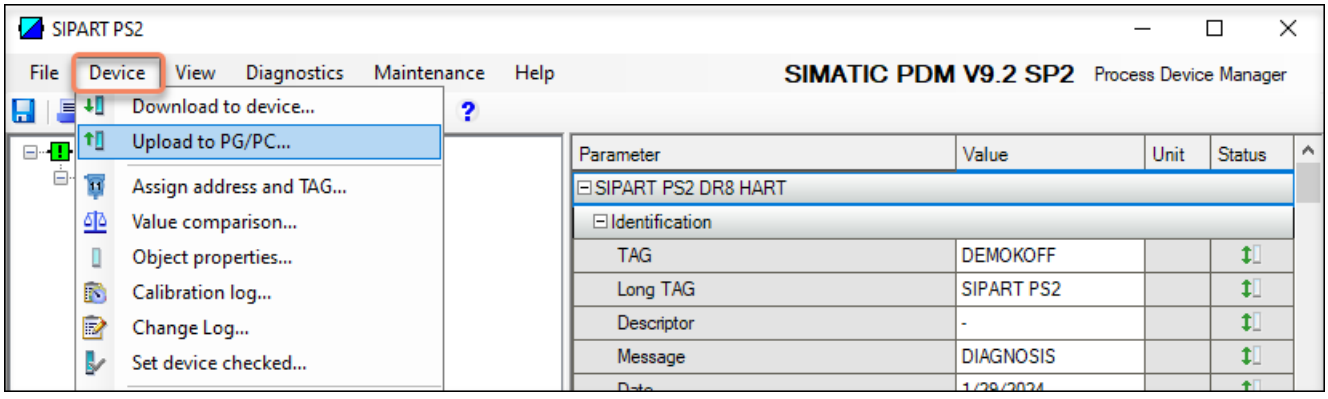
**Note**

If unwanted diagnostic messages appear on the display or via communication, increase the value of the diagnostic parameter "d1.LIMIT".

- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

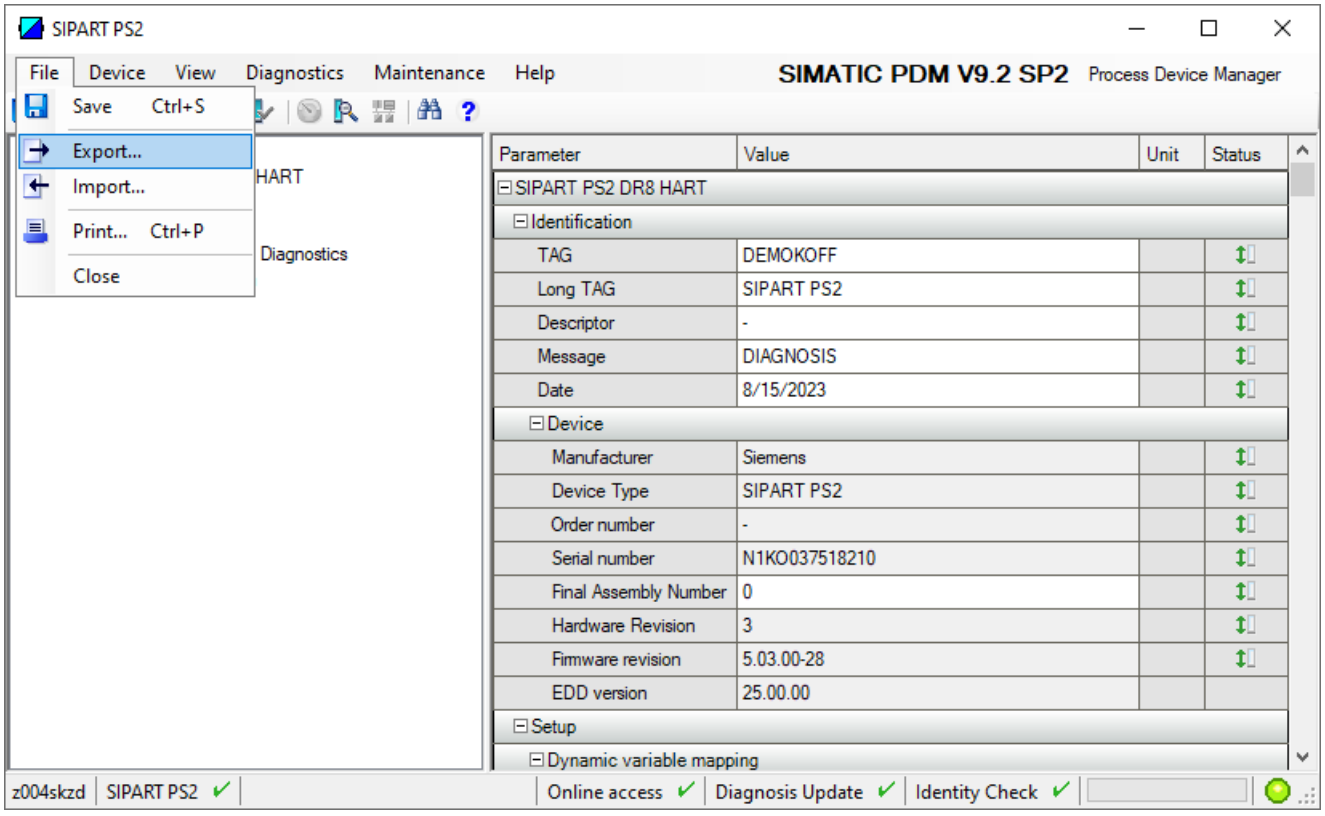
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



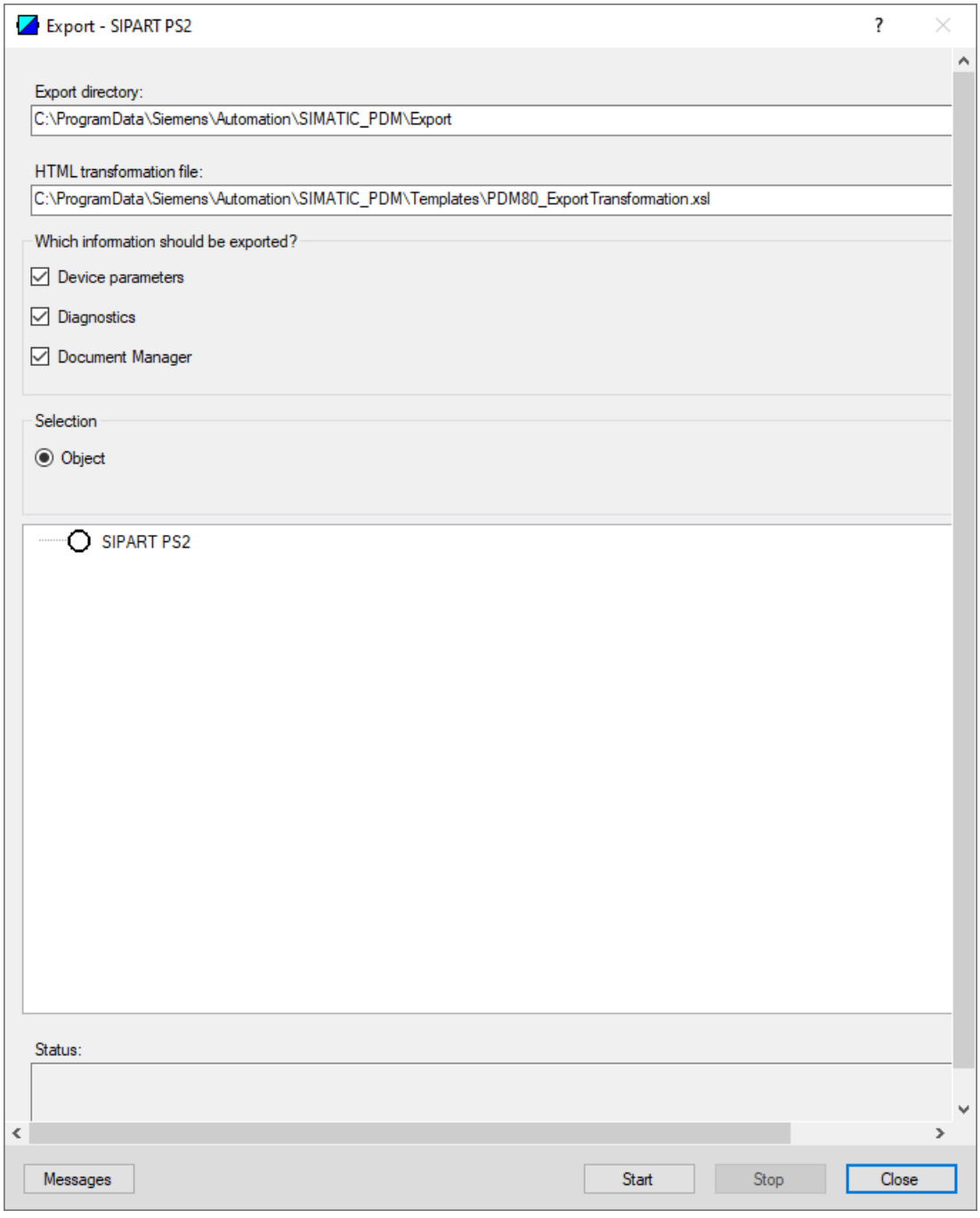

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Stiction (slipstick)" → With SIMATIC PDM: Show diagnostic results (Page 298).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu, select the "Export..." command.



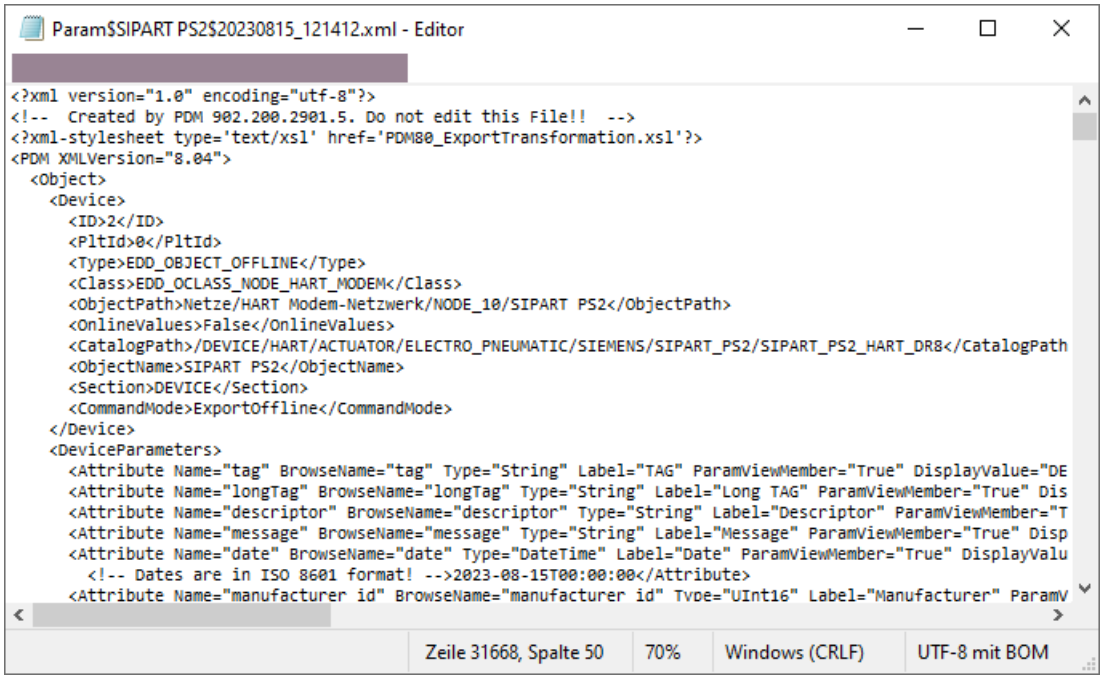

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. editor.




The XML file contains 100 lines with the 100 exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name = "var_trend_slipstick...".
Exemplary data line:
<Attribute **Name="var_trend_slipstick_30min_0"**
BrowseName="var_trend_slipstick_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"**
ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="%"**>0</
Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "d.\STIC" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_slipstick_30min_0 | 0.0 up to -1.5 minutes | 0.0 | % |
| | | ... | ... | ... | |
| | | var_trend_slipstick_30min_19 | -28.5 up to -30.0 minutes | 0.0 | |
| Last 8 hours | 20 | var_trend_slipstick_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_slipstick_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_slipstick_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_slipstick_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_slipstick_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_slipstick_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_slipstick_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_slipstick_30m_19 | -855 up to -900 days | ... | |

## 5.9.7 Messages

### 5.9.7.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

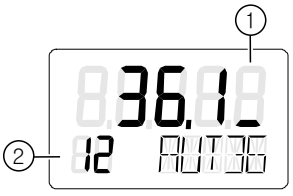
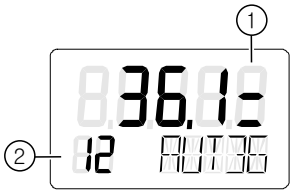
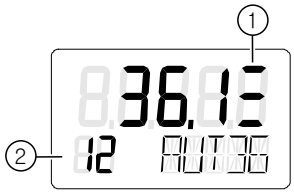
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.9.7.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "12" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 12 | ① 2 bars<br>② Error code 12 | ① 3 bars<br>② Error code 12 |

### 5.9.7.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

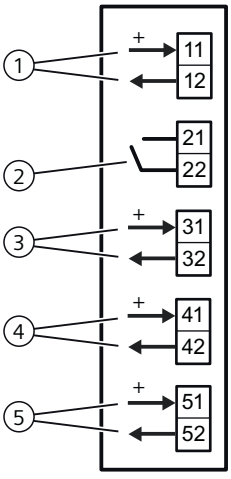
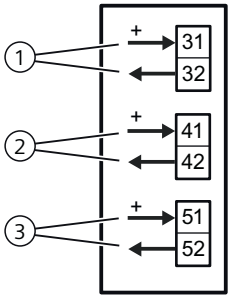
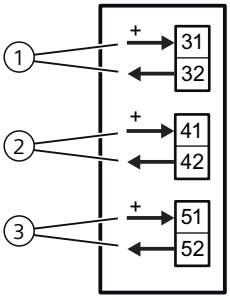
### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

### I/Os

| **Digital I/O Module (DIO) 6DR4004-6A / -8A** | **Inductive Limit Switches (ILS) 6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS) 6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

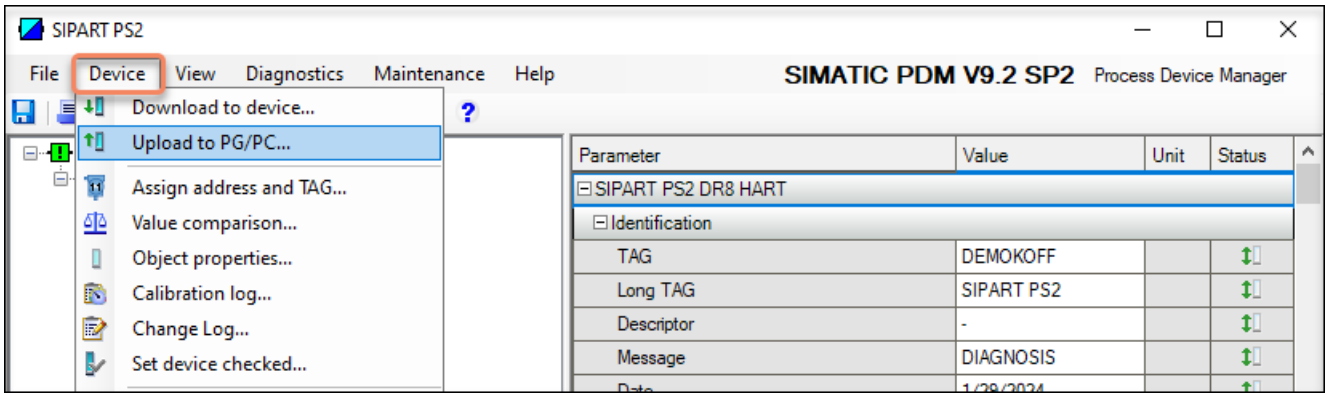
## 5.9.7.4 With SIMATIC PDM: Display diagnostics status

### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

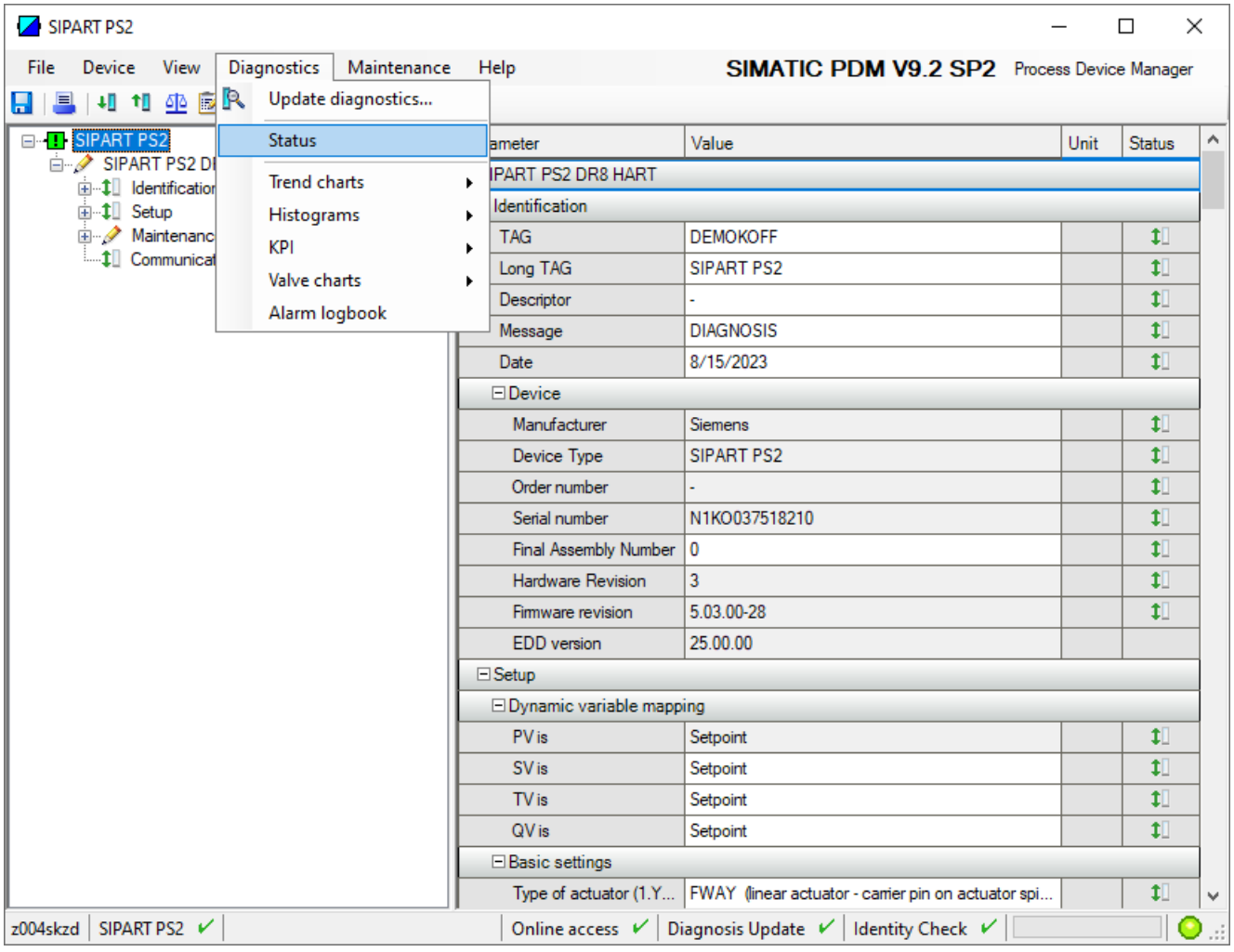
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

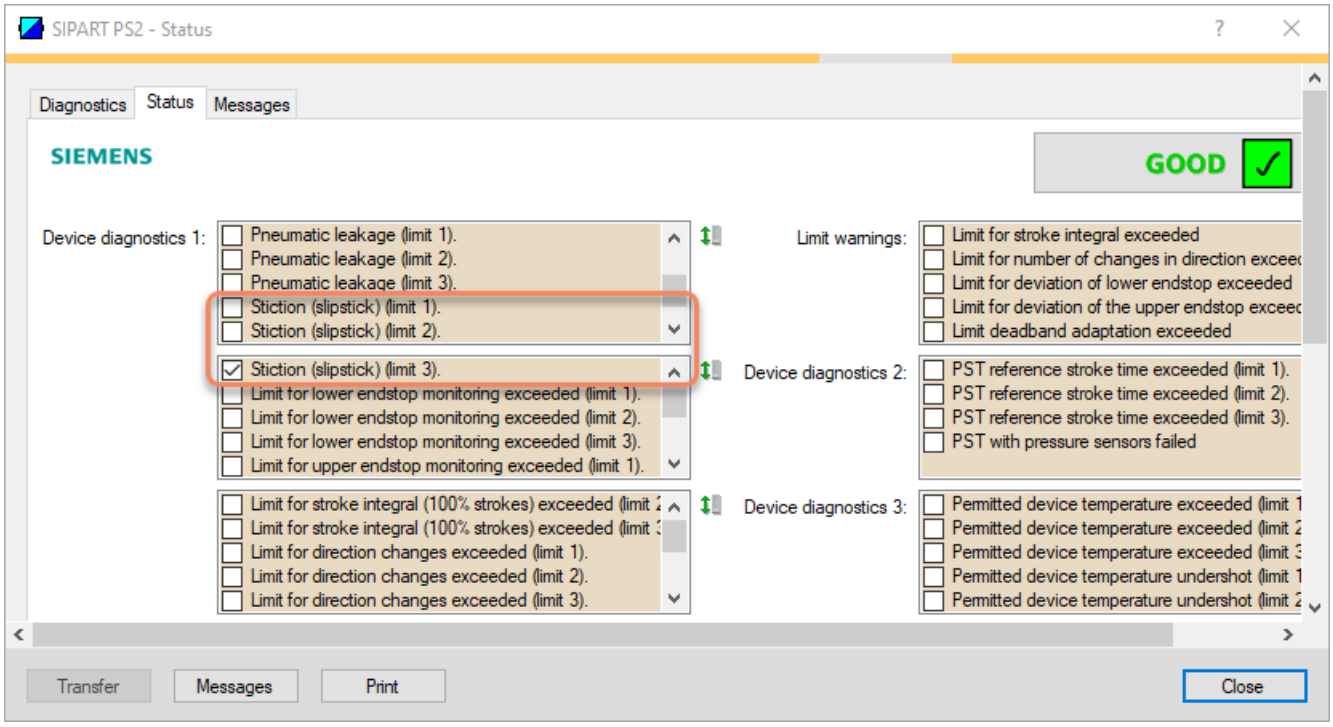



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Stiction (slipstick) (limit x)" is highlighted.




8. Close the dialog.

### 5.9.7.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "d.\STIC" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 14, bit 1 corresponds to threshold 1 exceeded.
  - Byte 14, bit 0 corresponds to threshold 2 exceeded.
  - Byte 15, bit 7 corresponds to threshold 3 exceeded.

### 5.9.7.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.10 Monitoring of deadband "E.\DEBA"

### 5.10.1 Functional description

Process diagnostics continuously monitor the automatic adjustment of the deadband.

If the application parameter "34.DEBA - Deadband of closed-loop controller" is set to "Auto", the size of the deadband is adapted as follows in automatic mode:

- When control oscillations are detected: The deadband is gradually increased.
- In the absence of control oscillations: The deadband is gradually reduced.

The current value of the deadband is displayed in these diagnostic values:

- Deadband UP (26.DBUP)
- Deadband DOWN (27.DBDN)

**Ring memory**

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with an adjustable threshold. If this threshold is exceeded, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.10.2 Activate and configure diagnostics

### Requirement

- The application parameter "34.DEBA" is set to "Auto".
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring the deadband" (E.\DEBA)

| | | |
|---|---|---|
| Function | Process diagnostics continuously monitor the automatic adjustment of the deadband.<br>If the application parameter "34.DEBA" is set to "Auto", the size of the deadband is adapted in automatic mode.<br>• When control oscillations are detected: The deadband is gradually increased.<br>• In the absence of control oscillations: The deadband is gradually reduced. | |
| Note | If the deadband increases disproportionately during automatic adjustment of the deadband during operation, this indicates a fault in the system, e.g. greatly increased friction.<br>The current value of the deadband is displayed in these diagnostic values:<br>• Deadband UP (26.DBUP)<br>• Deadband DOWN (27.DBDN) | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

**Note**

**Fault message display**

The 3-stage fault message display has not been implemented for monitoring the deadband.

The positioner only triggers threshold 3 messages.

### Process diagnostics parameters

If process diagnostics is activated with "On", the following parameter is visible.

| **E1.LEVL3** | **Threshold** | |
|---|---|---|
| Function | The parameter defines a limit in percent for the automatic adjustment of the deadband. | |
| Setting range | 0.1 ... 10.0 | • With setting "0.1" to "2.9":<br>– The limit is monitored.<br>– If exceeded in automatic mode: The threshold 3 message is activated.<br>• With setting "3.0" to "10.0"':<br>– The limit is not monitored.<br>– No message if exceeded. |
| Factory setting | 1.0 | |
| Unit | % | |

## Activate and configure "Monitoring of deadband"

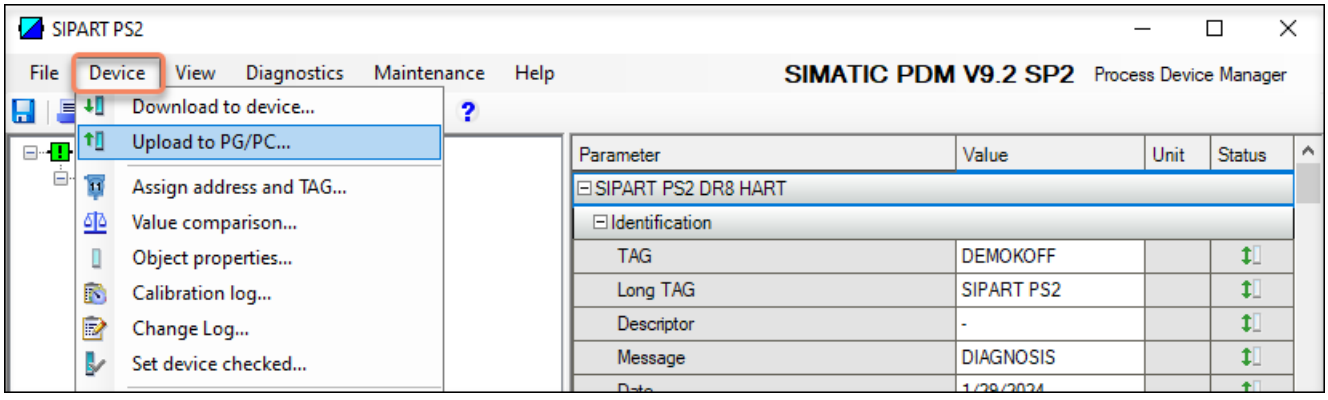
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "E.\DEBA" of the "Monitoring of deadband" process diagnostics.
3. Set the "E.\DEBA" parameter to "On".
   ⇒ Process diagnostics are activated and the associated parameter is displayed.
4. To adapt the threshold to the valve, change the limit in the "E1.LEVL3" parameter.

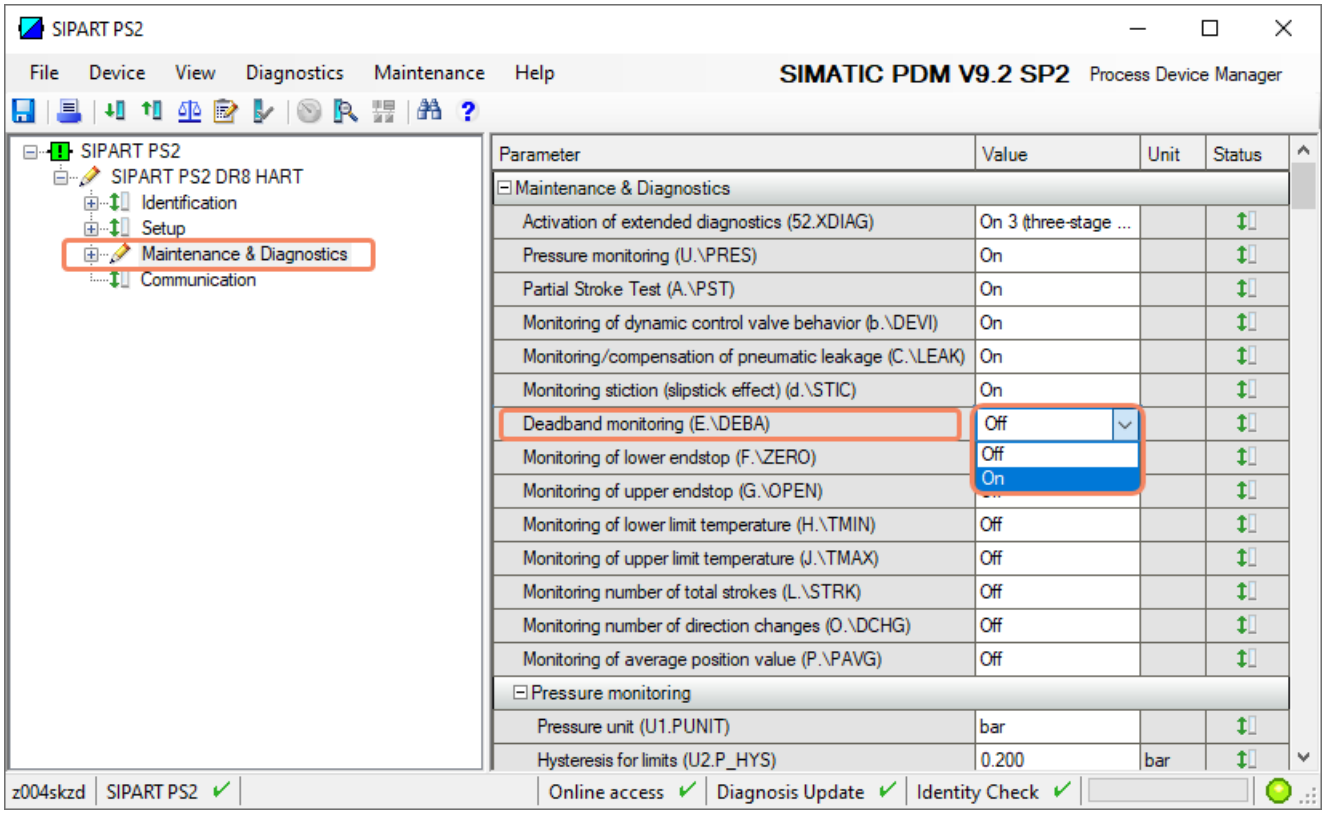
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Deadband monitoring (E.\DEBA)",E.\DEBA set the value to "On".
   ⇒ Process diagnostics are activated and the associated parameter is displayed.
8. To adapt the threshold to the valve: Change the limit in the "E1.LEVL3" parameter, change the limit.
9. In the "Device" menu, select the command "Download to device..."...
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

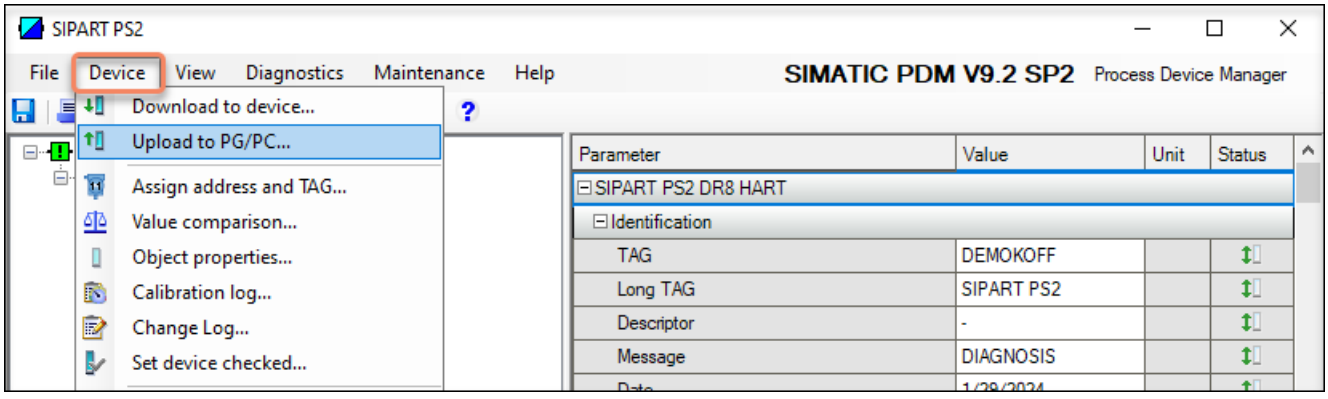
## 5.10.3 With SIMATIC PDM: Show diagnostic results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "E.\DEBA" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "E.\DEBA".
- The application parameter "34.DEBA" is set to "Auto".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

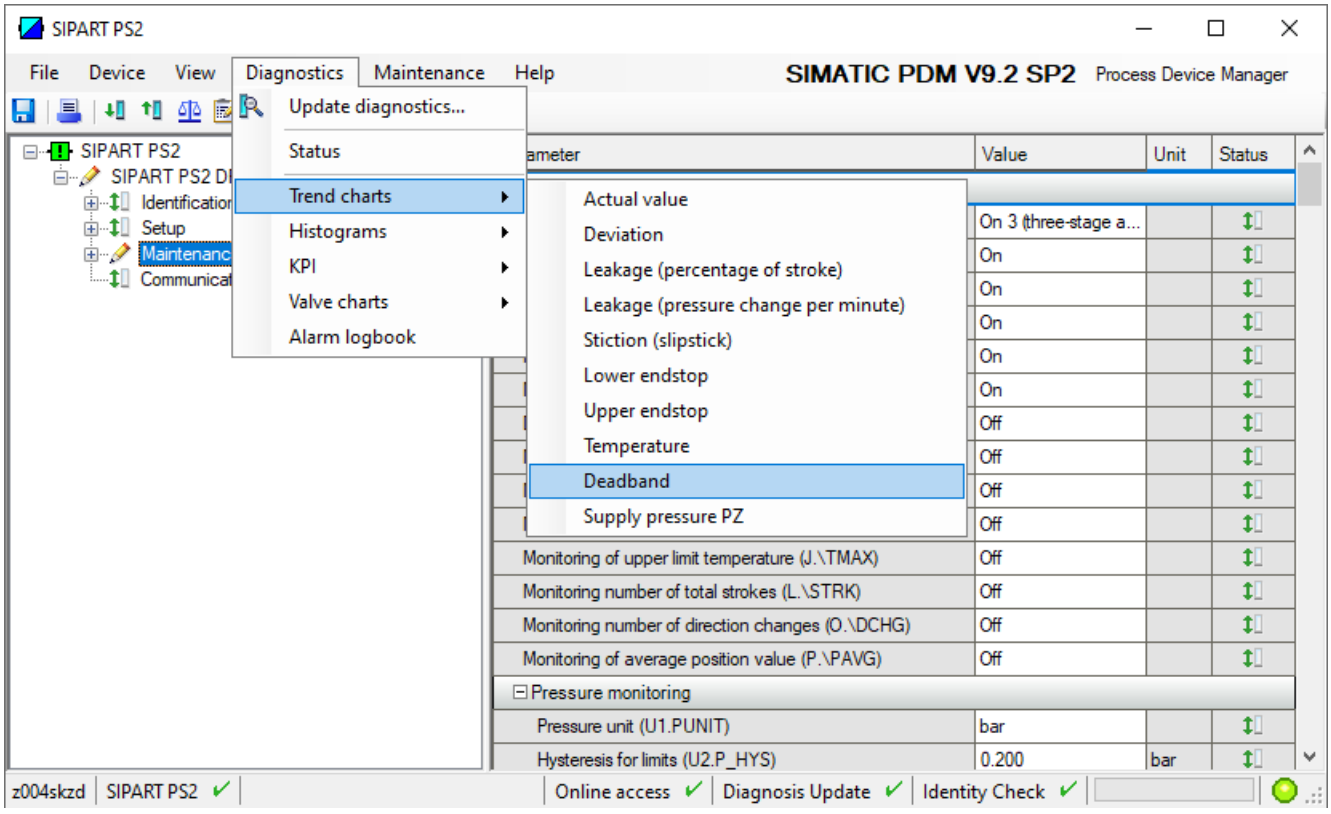
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

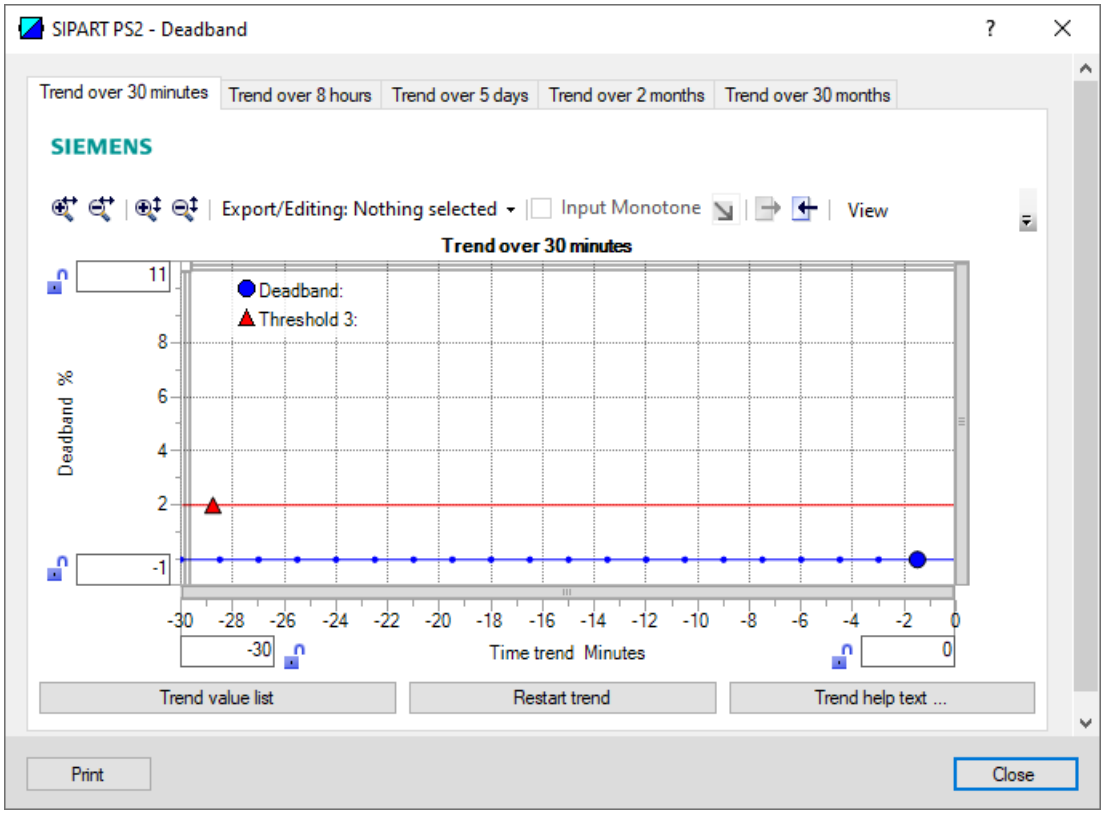
6. In the "Diagnostics" menu, select the "Trend charts > Deadband" command.




⇒ The "Deadband" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The line for "Threshold 3" is also displayed.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.10.4 Diagnostic values "Deadband UP" (26.DBUP) / "Deadband DOWN" (27.DBDN)

| **Diagnostic value** | **Deadband UP**<br>**Short designation: 26.DBUP** | |
|---|---|---|
| | **Deadband DOWN**<br>**Short designation: 27.DBDN** | |
| Function | The diagnostic values show the deadband of the positioner as a percentage:<br>• "Deadband UP " (26.DBUP) in direction 100% position<br>• "Deadband DOWN" (27.DBDN) in direction 0% position | |
| Note | The values either correspond to the manually set value of the application parameter "34.DEBA" or, if "34.DEBA" is set to "Auto", the value automatically adapted by the positioner. | |
| Display range | 0.1 ... 10.0 | |
| Unit | % | |
| **Communication** | | |
| **Deadband UP (26.DBUP)** | | |
| SIMATIC PDM Export | Name | ps2_dead_up_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 0 ... 3<br>Format: Float |
| **Deadband DOWN (27.DBDN)** | | |
| SIMATIC PDM Export | Name | ps2_dead_down_act |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 4 ... 7<br>Format: Float |

### 5.10.5 Via HART communication: Read out diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "E.\DEBA" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "E.\DEBA".
- The application parameter "34.DEBA" is set to "Auto".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "35".

Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 35 | Last 30 minutes |
| 36 | Last 8 hours |
| 37 | Last 5 days |
| 38 | Last 2 months |
| 39 | Last 30 months |

### Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-28 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | - |
| 47 ... 50 | Float | - |
| 51 ... 54 | Float | Value of threshold 3 (E1.LEVL3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-29 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |

| Code | Class | Description |
|---|---|---|
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

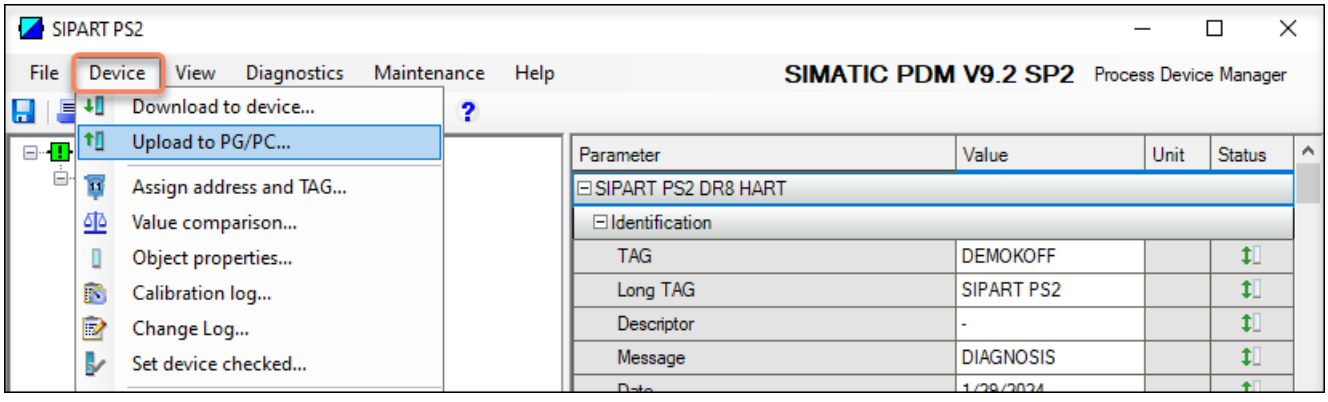
## 5.10.6 With SIMATIC PDM: Export diagnostics results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "E.\DEBA" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "E.\DEBA".
- The application parameter "34.DEBA" is set to "Auto".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

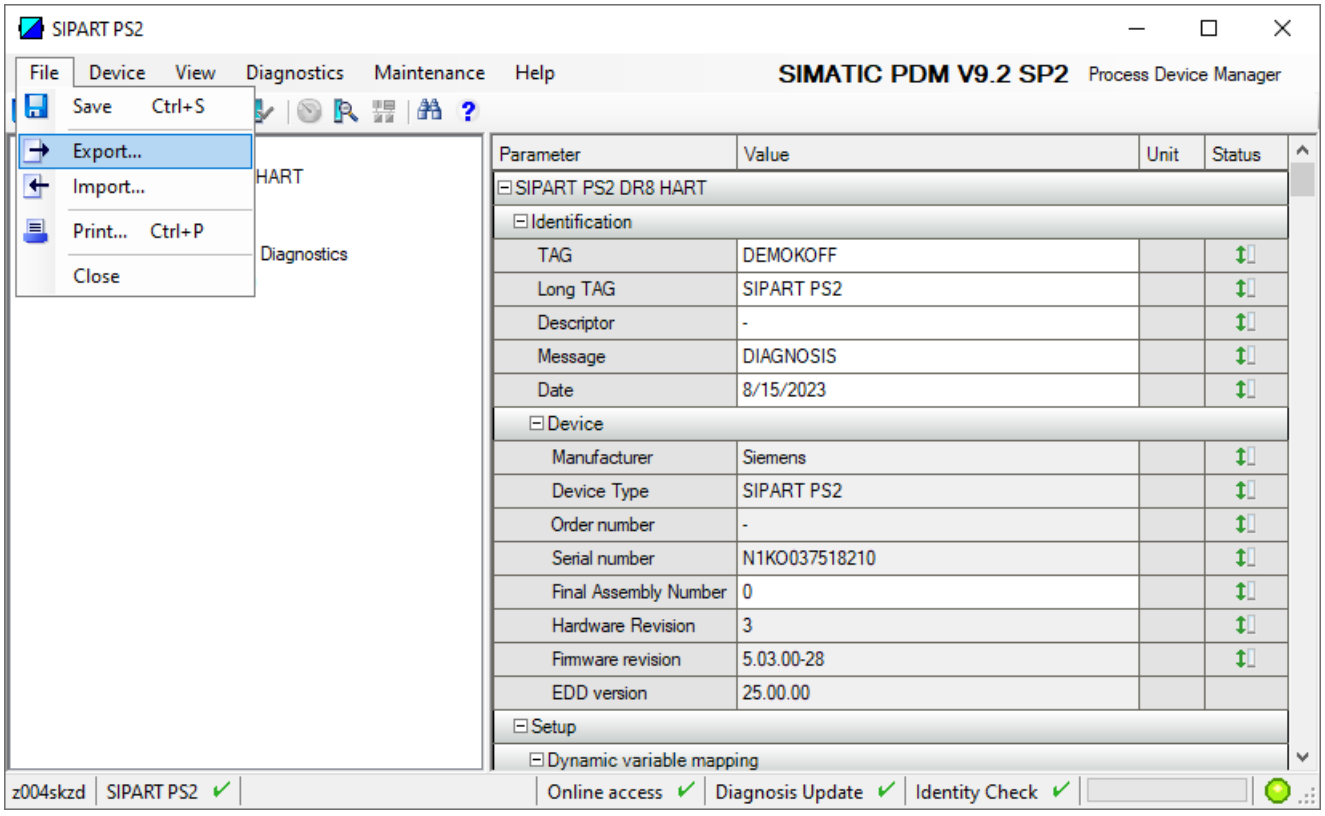
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



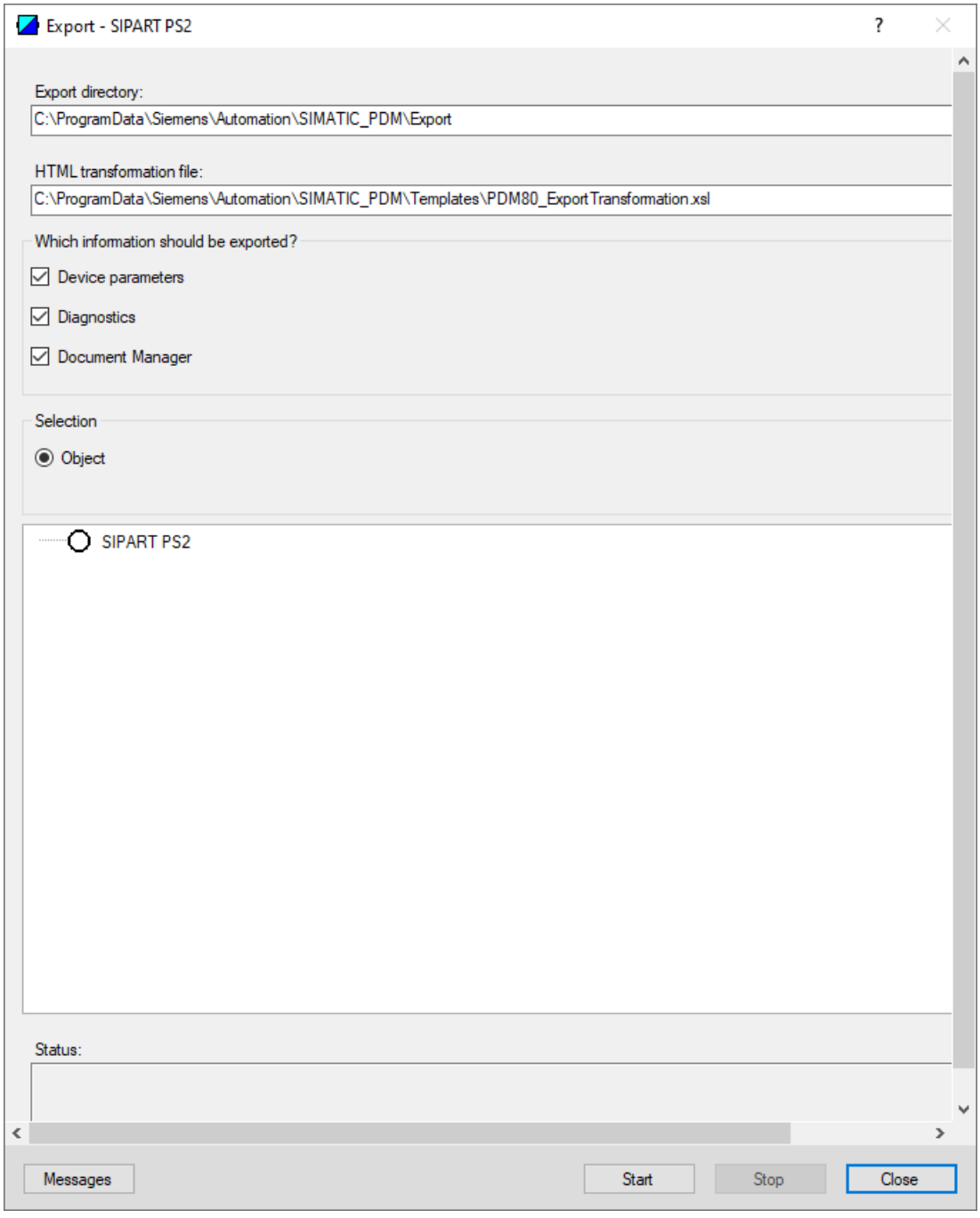

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Deadband" → With SIMATIC PDM: Show diagnostic results (Page 318).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.
7. In the "File" menu, select the "Export..." command.



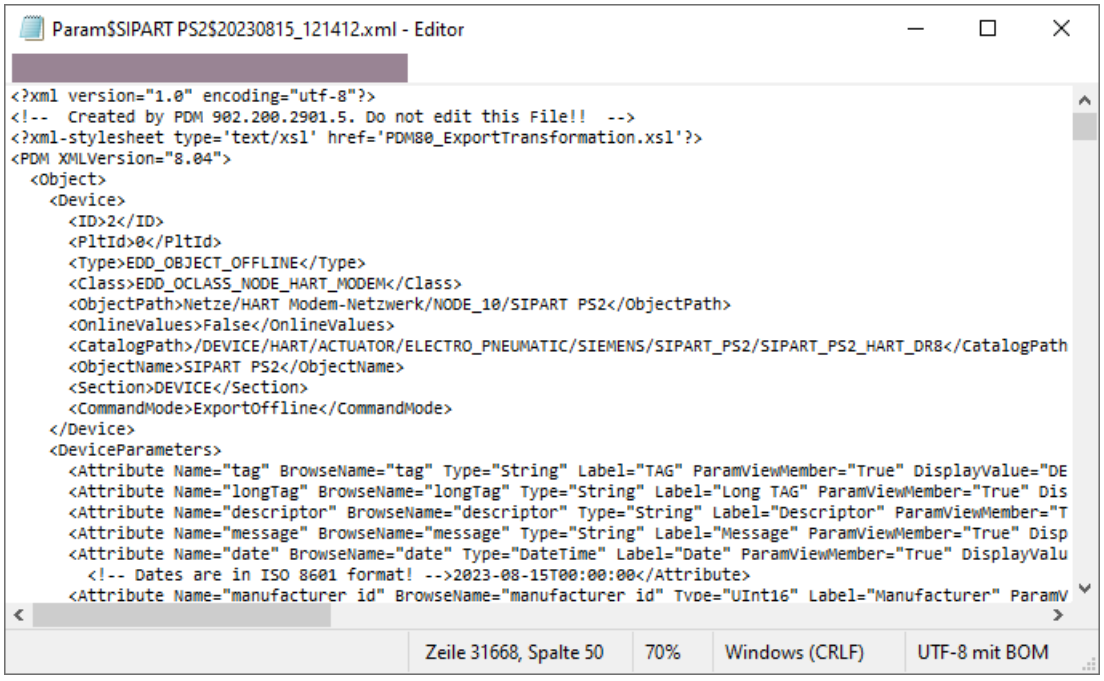

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. editor.




The XML file contains 100 lines with the 100 exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name = "var_trend_deba...".
Exemplary data line:
<Attribute **Name="var_trend_deba_30min_0**" BrowseName="var_trend_deba_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"** ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="%"**>0</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "E.\DEBA" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_deba_30min_0 | 0.0 up to -1.5 minutes | 0.0 | % |
| | | ... | ... | ... | |
| | | var_trend_deba_30min_19 | -28.5 up to -30.0 minutes | 0.0 | |
| Last 8 hours | 20 | var_trend_deba_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_deba_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_deba_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_deba_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_deba_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_deba_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_deba_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_deba_30m_19 | -855 up to -900 days | ... | |

## 5.10.7 Messages

### 5.10.7.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.10.7.2 Messages in the display

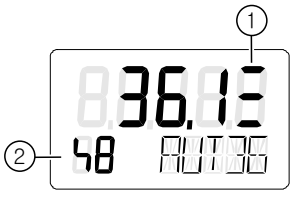
#### Requirement

The application parameter "34.DEBA" is set to "Auto".

#### Indication on the display

If the set threshold is exceeded, error code "8" is output.

If several messages are present at the same time, the display switches between the different error codes.




① 3 bars

② Error code 8

### 5.10.7.3 Messages via digital signals

#### Requirement

- The positioner has a fault signal output, which is located on one of the following modules:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- The application parameter "34.DEBA" is set to "Auto".

#### Message for deadband monitoring

**Note**
**Fault message display**

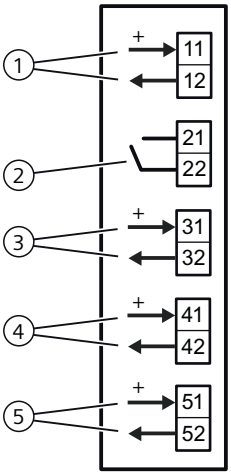
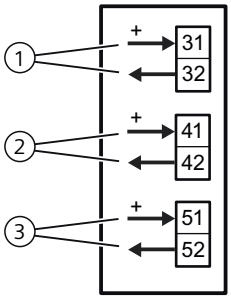
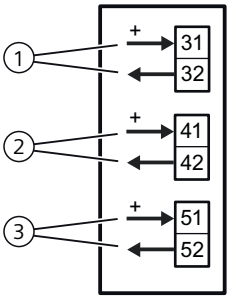
The 3-stage fault message display has not been implemented for monitoring the deadband.

The positioner only triggers threshold 3 messages.

Monitoring is activated when the threshold "E1.LEVL3" is set to a limit between "0.1" and "2.9".

If the limit is exceeded in automatic mode, the fault signal output is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

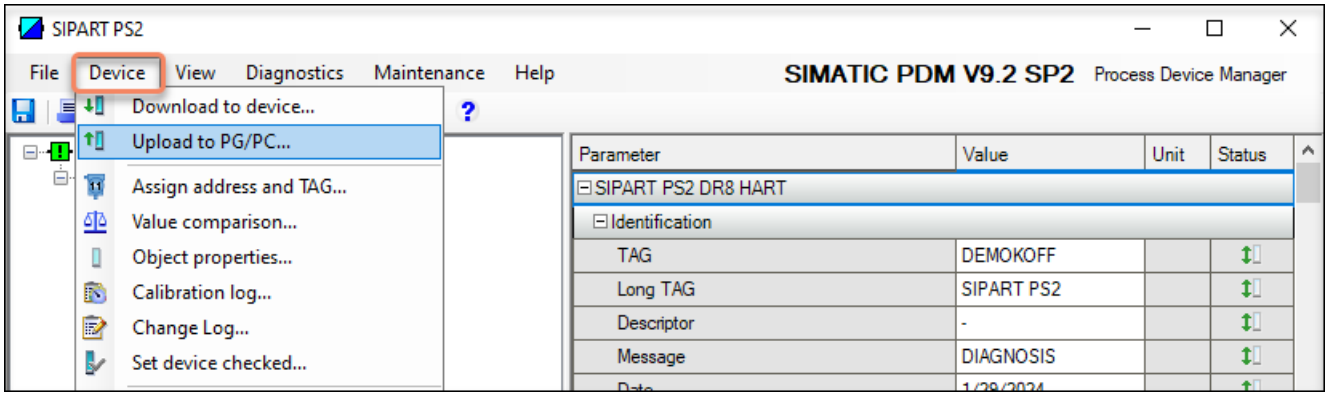
### 5.10.7.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The application parameter "34.DEBA" is set to "Auto".
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

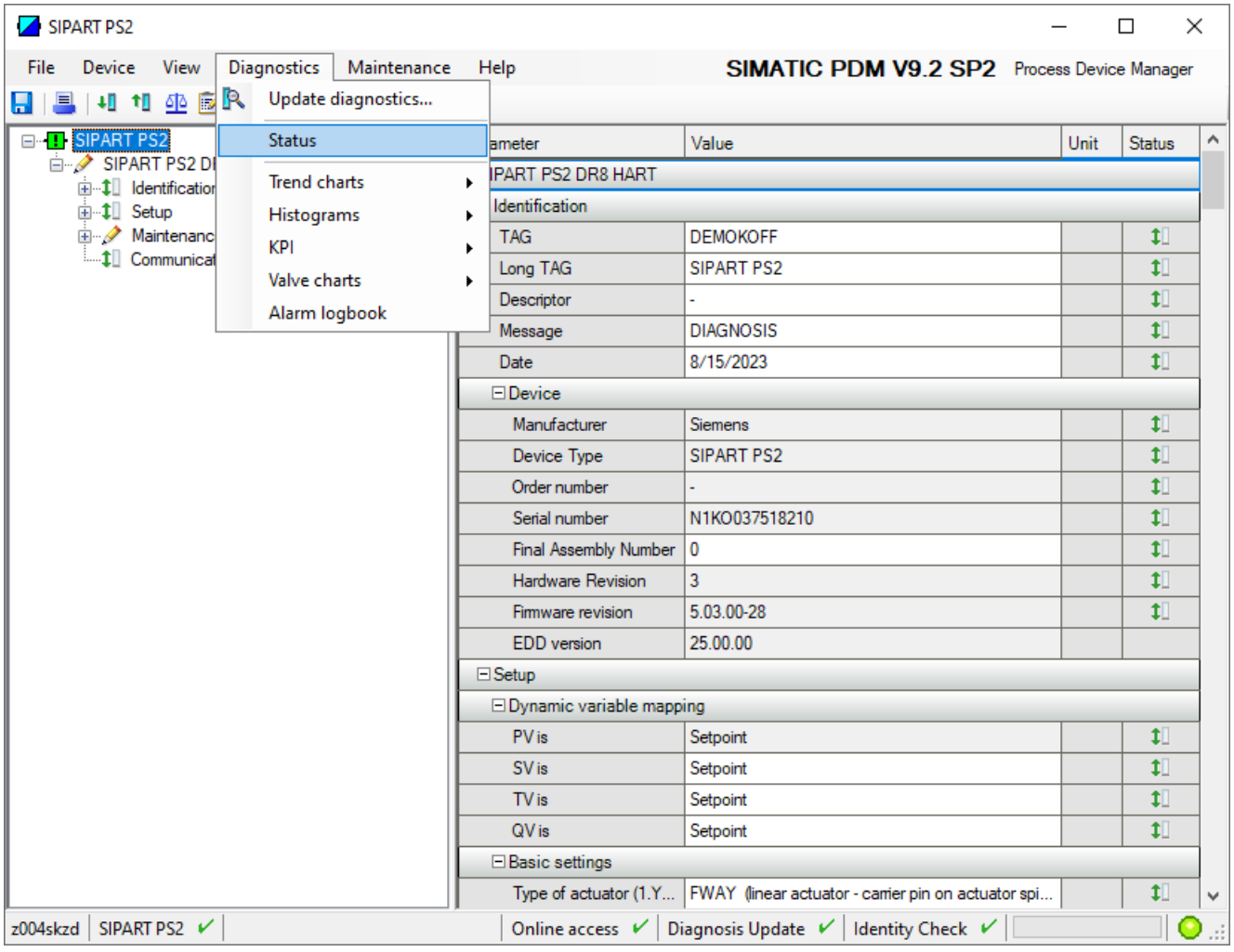
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

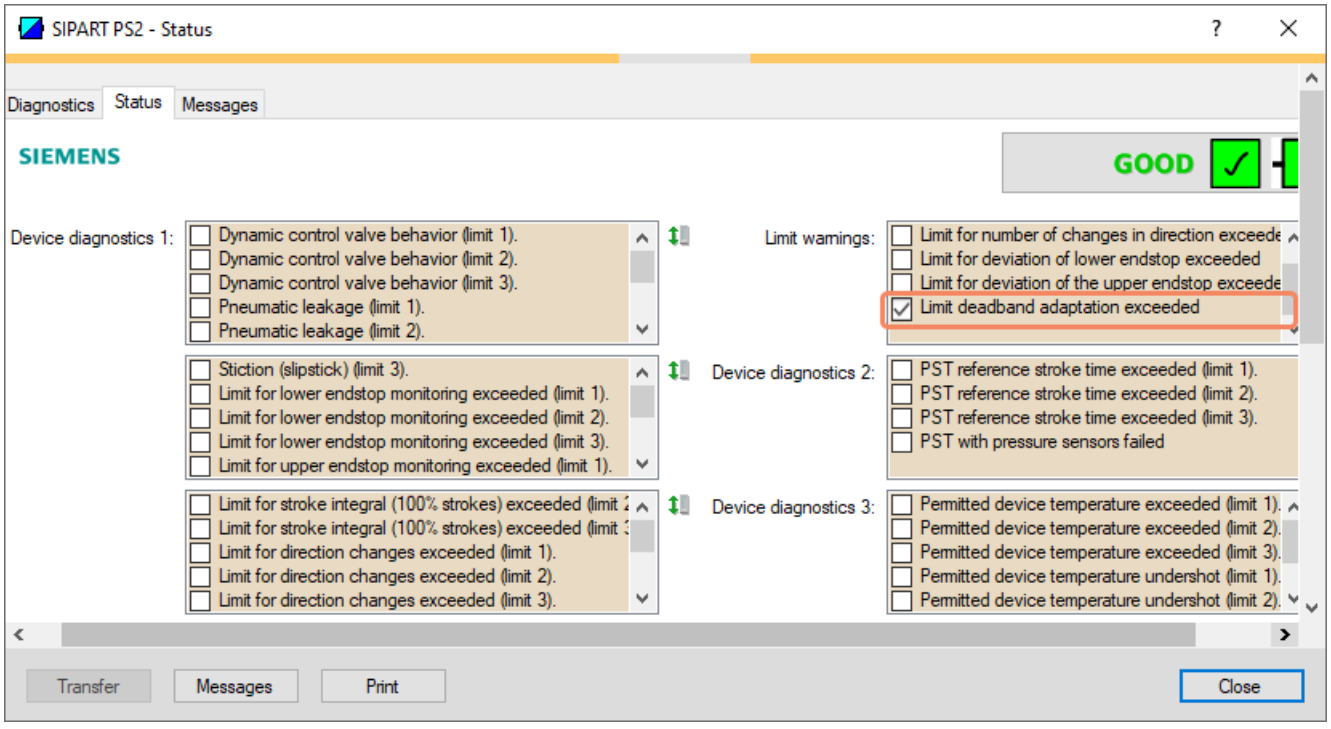



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When the threshold is exceeded, the message "Limit deadband adaptation exceeded" is highlighted.




8. Close the dialog.

### 5.10.7.5 Via HART communication: Get messages

#### Requirement

- The application parameter "34.DEBA" is set to "Auto".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If the process diagnostics threshold is exceeded, the "more status available" is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  The message when the threshold for the "E.\DEBA" process diagnostics is contained in the following byte:
  - Byte 2, bit 4 corresponds to threshold 3 exceeded.

### 5.10.7.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.11 Monitoring 0% stop (F.\ZERO)

### 5.11.1 Functional description

The process diagnostics continuously monitor the deviation of the endstop at the 0% position.

It checks whether the upper endstop has changed compared to its value during initialization.

The amount of deviation is determined as a percentage of the travel distance and displayed as the diagnostic value "Endstop 0% position" (18.ZERO).

**Note**

**Fault detection**

Monitoring of the endstop not only responds to faults in the valve.

A mechanical change in the position feedback can also result in violating a threshold.

**Ring memory**

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.11.2 Activate and configure diagnostics

### Requirement

- The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring 0% endstop" (F.\ZERO)

| | | |
|---|---|---|
| Function | The process diagnostics continuously monitor the deviation of the endstop at the 0% position. | |
| Note | The amount of deviation is determined as a percentage of the travel distance and displayed as the diagnostic value "Endstop 0% position" (18.ZERO). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

**Note**

**Fault detection**

Monitoring of the endstop not only responds to faults in the valve.

A mechanical change in the position feedback can also result in violating a threshold.

### Process diagnostics parameters

If the process diagnostics are activated with "On", the associated parameters are visible.

| **F1.LEVL1** | **Threshold 1** | |
|---|---|---|
| Function | The parameter defines threshold 1 for the permissible deviation of the lower stop (position 0%) as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: **F1.LEVL1** < F2.LEVL2 < F3.LEVL3 |
| Factory setting | 1.0 | |
| Unit | % | |

| **F2.LEVL2** | **Threshold 2** | |
|---|---|---|
| Function | The parameter defines threshold 2 for the permissible deviation of the lower stop (position 0%) as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: F1.LEVL1 < **F2.LEVL2** < F3.LEVL3 |
| Factory setting | 2.0 | |
| Unit | % | |

| **F3.LEVL3** | **Threshold 3** | |
|---|---|---|
| Function | The parameter defines threshold 3 for the permissible deviation of the lower stop (position 0%) as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: F1.LEVL1 < F2.LEVL2 < **F3.LEVL3** |
| Factory setting | 4.0 | |
| Unit | % | |

## Activate and configure "Monitoring 0% endstop"

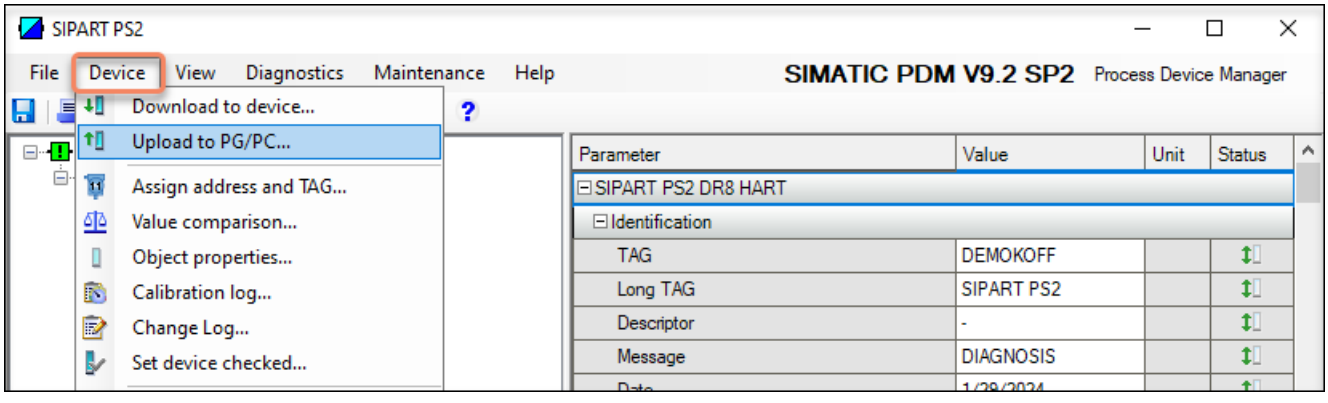
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "F.\ZERO" of the "Monitoring 0% stop" process diagnostics.
3. Set the "F.\ZERO" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - F1.LEVL1
   - F2.LEVL2
   - F3.LEVL3

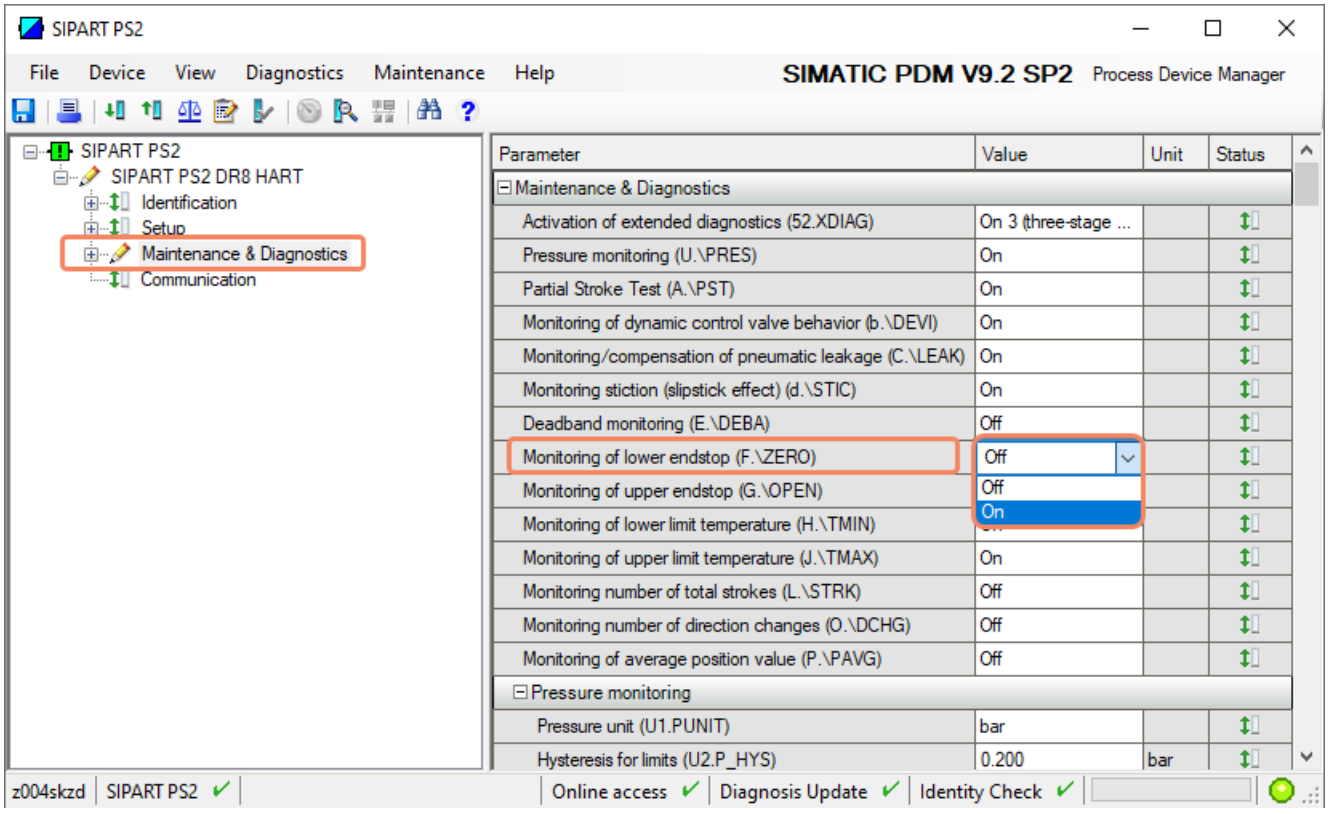
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of lower endstop" (F.\ZERO), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - F1.LEVL1
   - F2.LEVL2
   - F3.LEVL3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start".
    ⇒ If the check box is activated, only the changed parameters are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

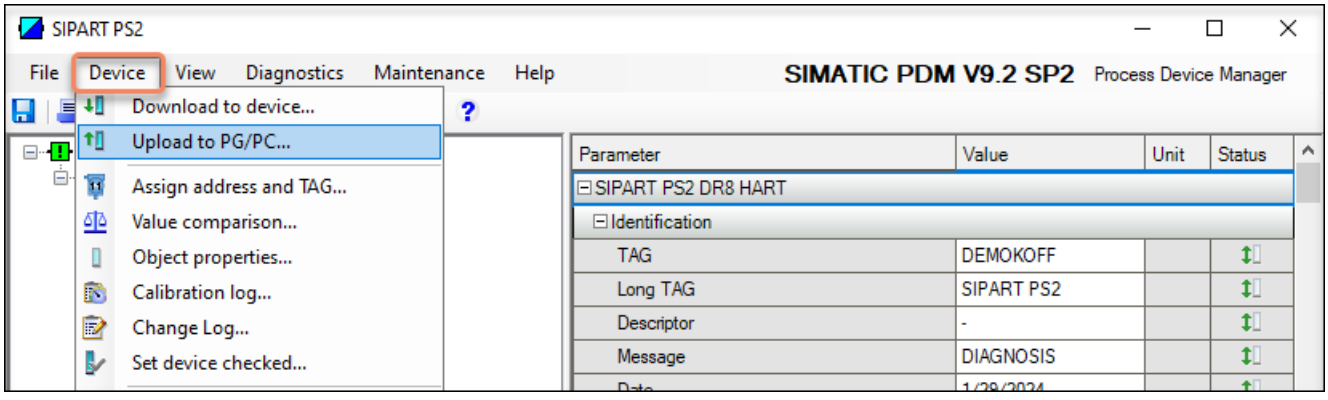
## 5.11.3 With SIMATIC PDM: Show diagnostic results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "F.\ZERO" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "F.\ZERO".
- The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

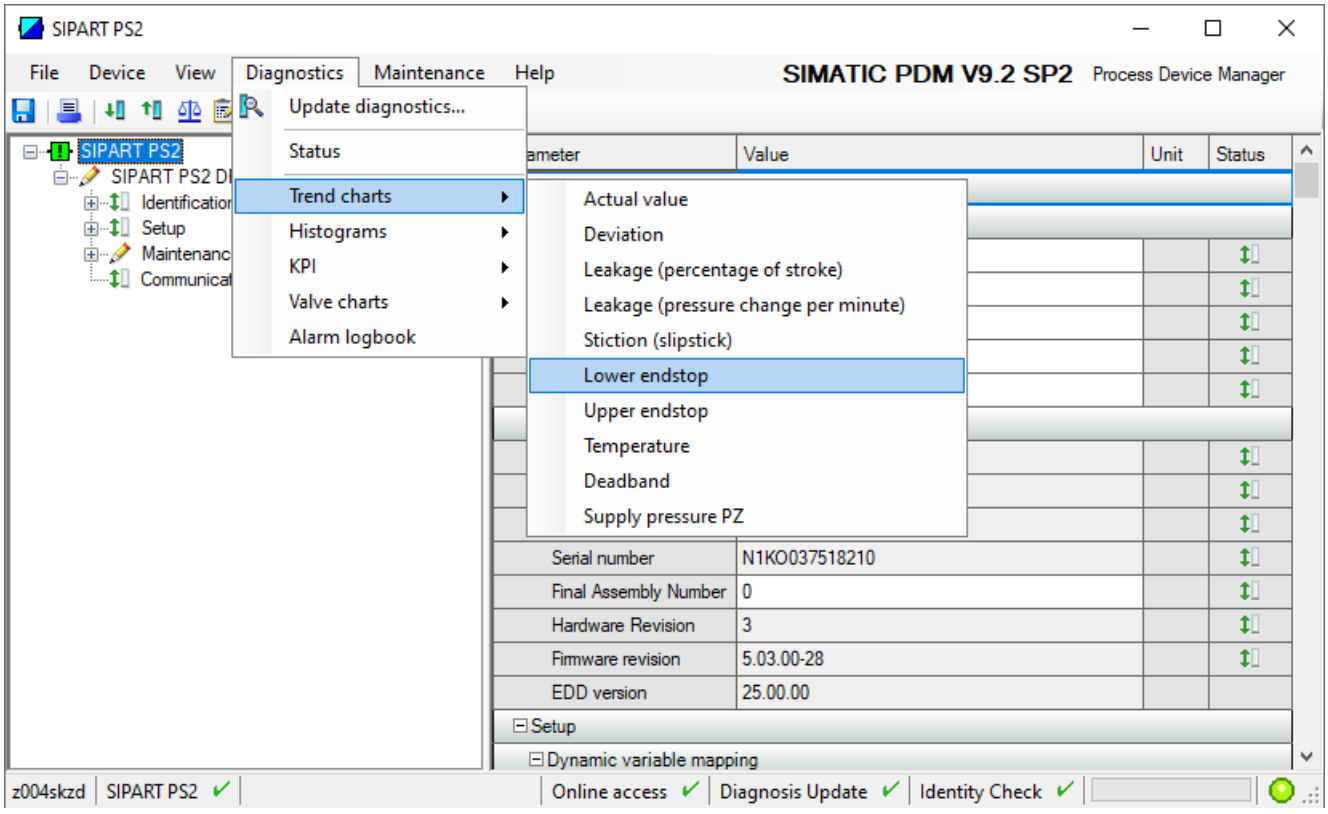
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

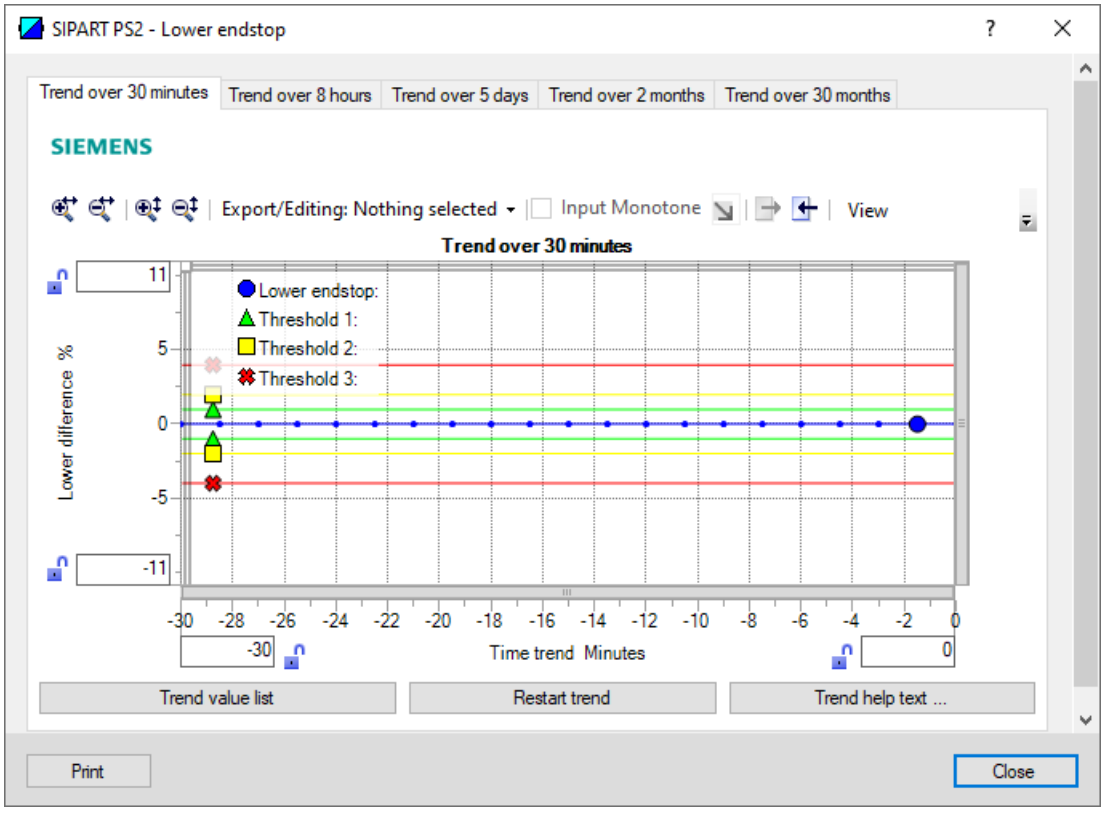
6. In the "Diagnostics" menu, select the "Trend charts > Lower endstop" command.




⇒ The "Lower endstop" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of "Threshold 1, 2 and 3" are also shown.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.11.4 Diagnostic value "Endstop 0% position" (18.ZERO)

| **Diagnostic value** | **Endstop 0-%-Position**<br>**Short designation: 18.ZERO** | |
|---|---|---|
| Function | The diagnostic value shows the percentage by which the mechanical endstop at the 0% position has changed compared to the value at initialization. | |
| Requirement | • The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".<br>• The "Monitoring 0% stop" (F.\ZERO) process diagnostics is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_zero_value |
| | DisplayValue | ≙<br>Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 42 ... 45<br>Format: Float |

### 5.11.5 Via HART communication: Read out diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "F.\ZERO" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "F.\ZERO".
- The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "20".

Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 20 | Last 30 minutes |
| 21 | Last 8 hours |
| 22 | Last 5 days |
| 23 | Last 2 months |
| 24 | Last 30 months |

## Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-30 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | Value of threshold 1 (F1.LEVL1) |
| 47 ... 50 | Float | Value of threshold 2 (F2.LEVL2) |
| 51 ... 54 | Float | Value of threshold 3 (F3.LEVL3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-31 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

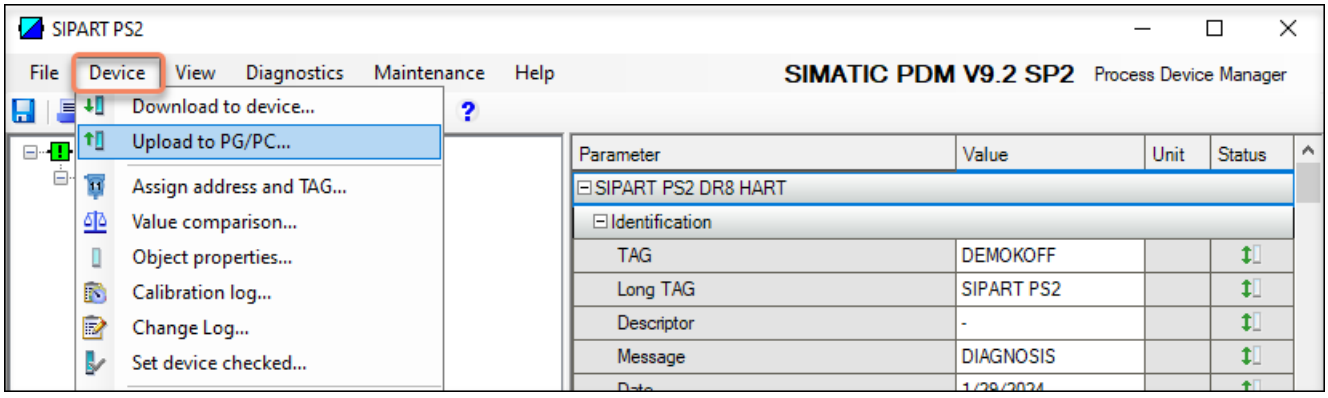
### 5.11.6 With SIMATIC PDM: Export diagnostics results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "F.\ZERO" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "F.\ZERO".
- The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

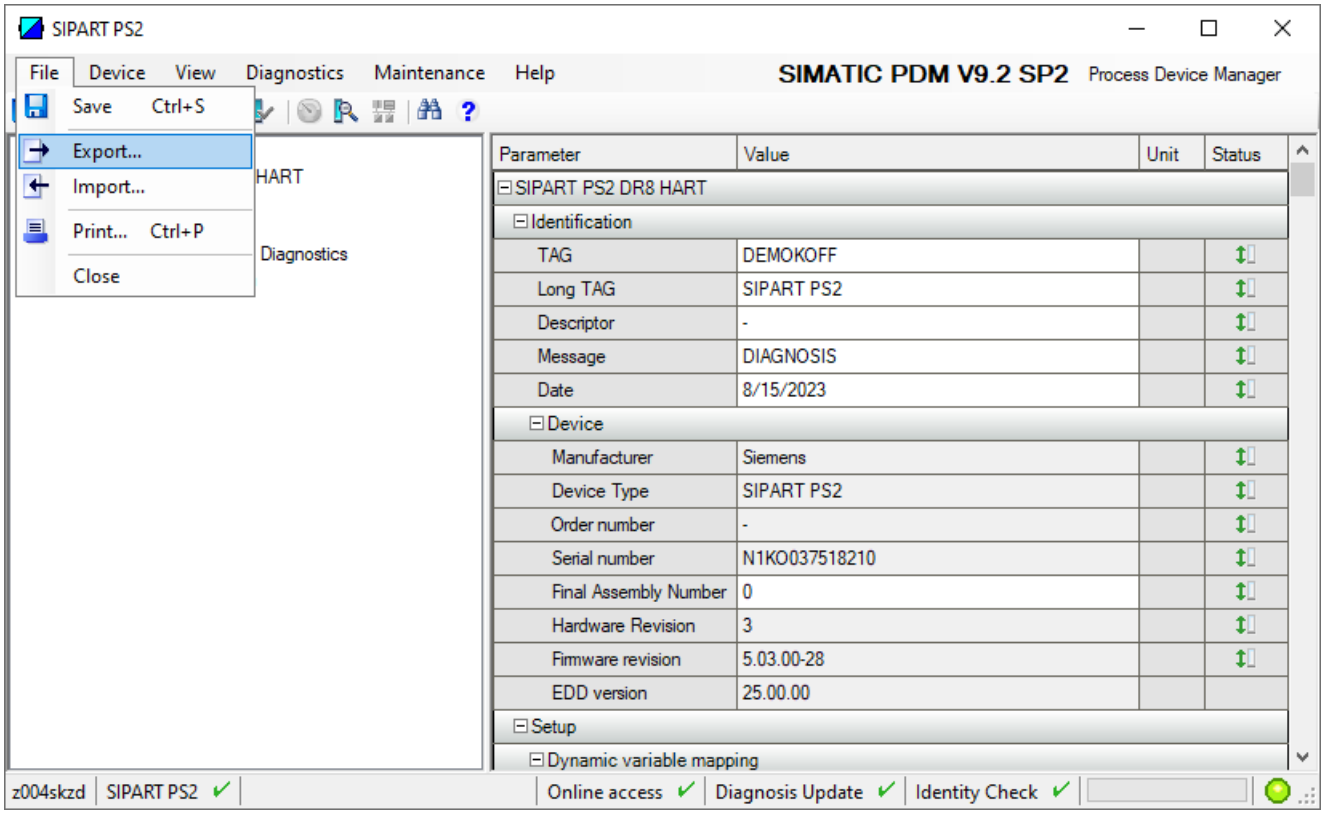
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



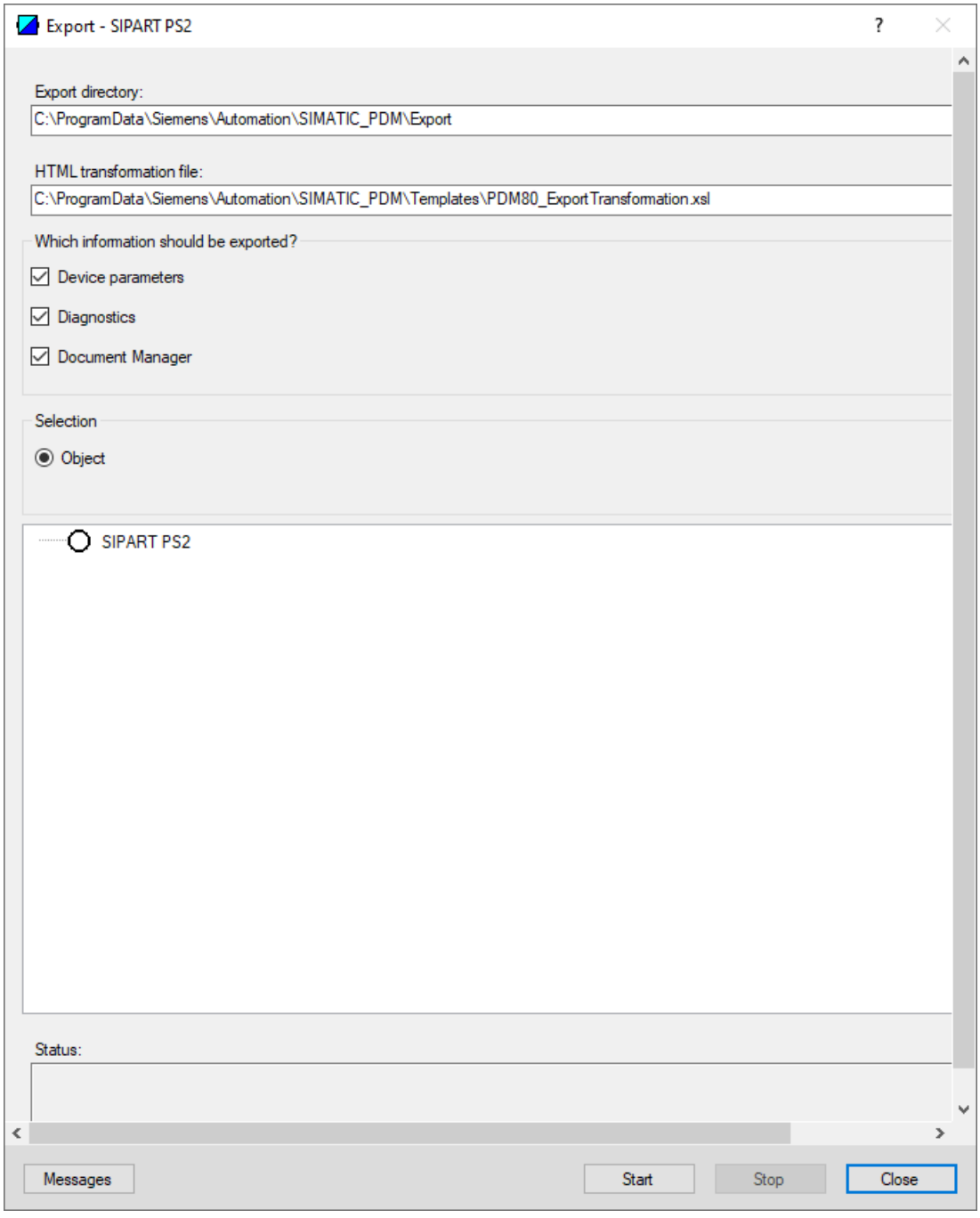

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Lower endstop" → With SIMATIC PDM: Show diagnostic results (Page 340).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu, select the "Export..." command.



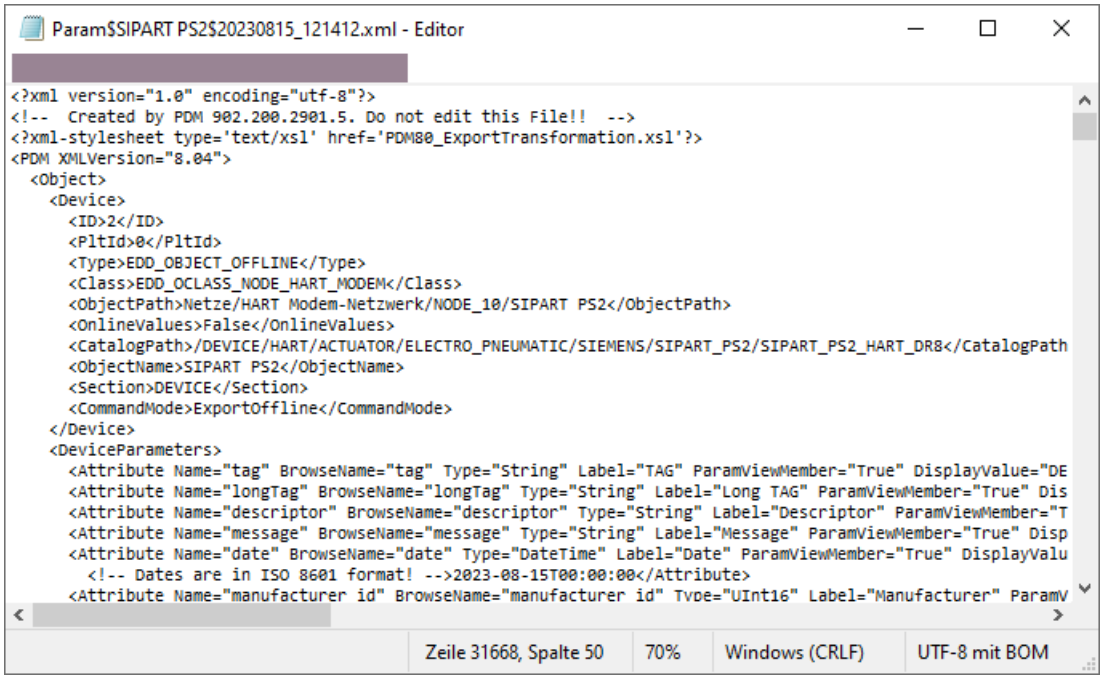

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file contains 100 lines with the 100 exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name = "var_trend_zero...".
Exemplary data line:
<Attribute **Name="var_trend_zero_30min_0**" BrowseName="var_trend_zero_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"** ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="%"**>0</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "F.\ZERO" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | **Name** | **Label (Time span of data determination)** | **DisplayValue e.g.** | **Unit** |
| Last 30 minutes | 20 | var_trend_zero_30min_0 | 0.0 up to -1.5 minutes | 0.0 | % |
| | | ... | ... | ... | |
| | | var_trend_zero_30min_19 | -28.5 up to -30.0 minutes | 0.0 | |
| Last 8 hours | 20 | var_trend_zero_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_zero_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_zero_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_zero_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_zero_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_zero_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_zero_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_zero_30m_19 | -855 up to -900 days | ... | |

## 5.11.7 Messages

### 5.11.7.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.11.7.2 Messages in the display

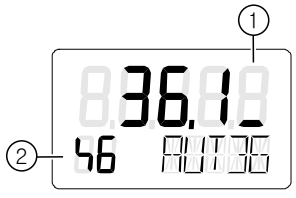
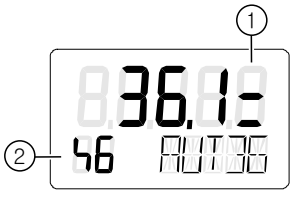
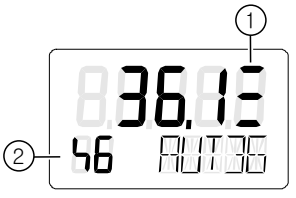
#### Requirement

The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".

#### Indication on the display

If the set thresholds are exceeded, error code "6" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 6 | ① 2 bars<br>② Error code 6 | ① 3 bars<br>② Error code 6 |

### 5.11.7.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

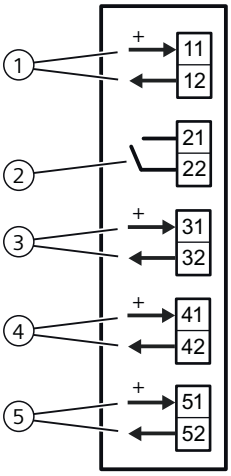
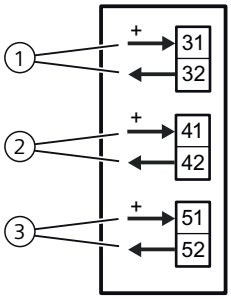
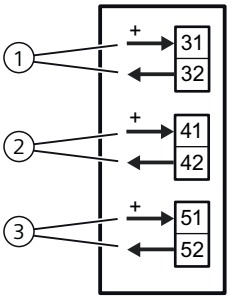
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

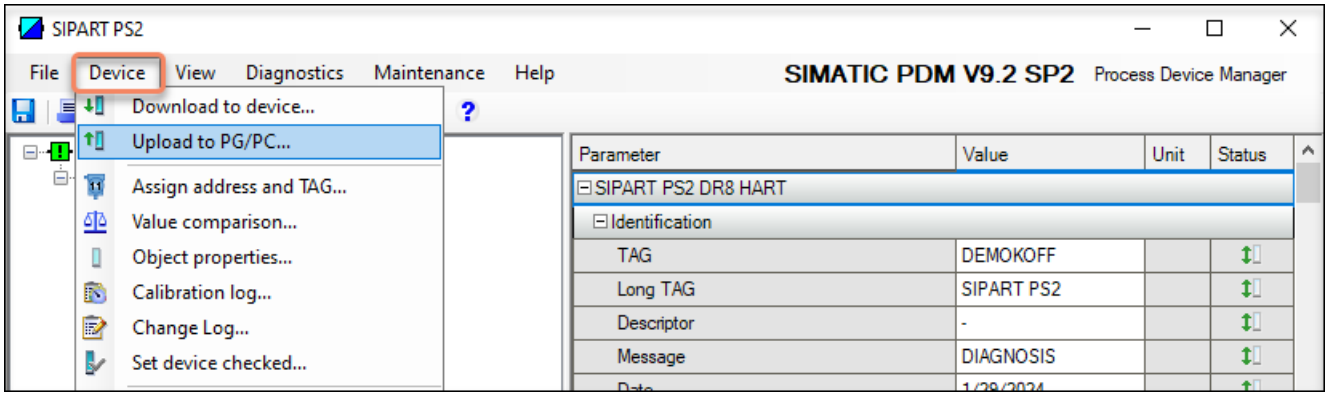
### 5.11.7.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

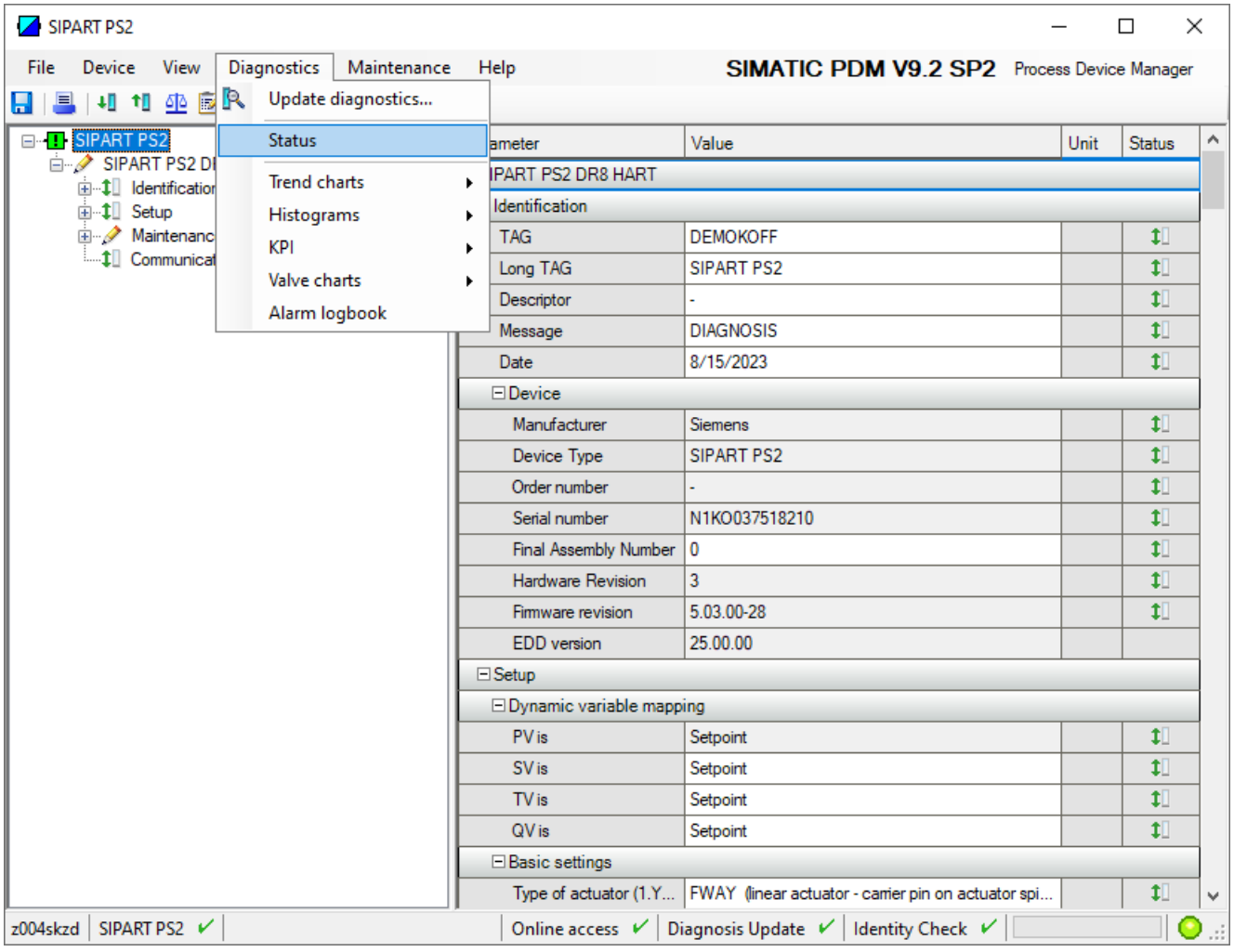
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

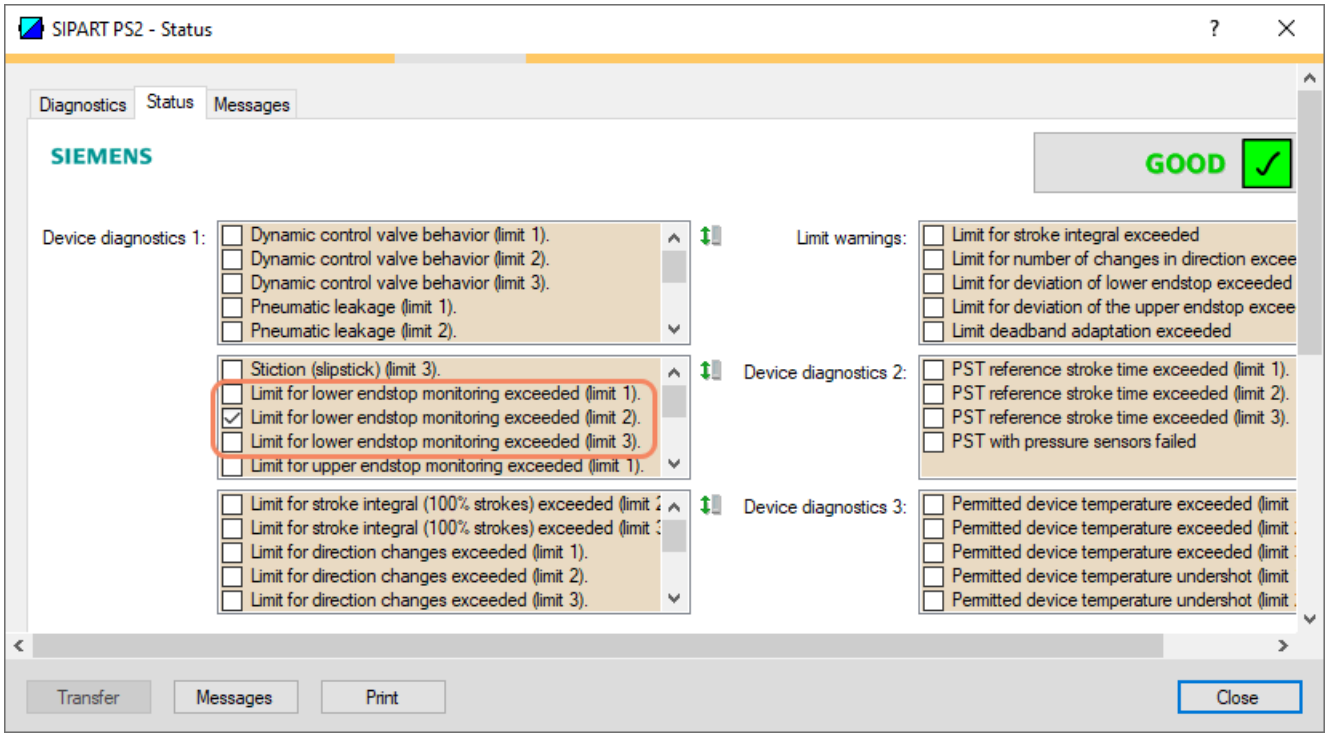



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Limit for lower endstop monitoring exceeded (limit x)" is highlighted.




8. Close the dialog.

### 5.11.7.5 Via HART communication: Get messages

#### Requirement

- The application parameter "39.YCLS" is set to one of the following values: "do", "uP do", "Fd", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART interface: SIPART PS2 6DR51...\6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "F.\ZERO" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 15, bit 6 corresponds to threshold 1 exceeded.
  - Byte 15, bit 5 corresponds to threshold 2 exceeded.
  - Byte 15, bit 4 corresponds to threshold 3 exceeded.

#### 5.11.7.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.12 Monitoring 100% endstop (G.\OPEN)

### 5.12.1 Functional description

Process diagnostics continuously monitor the deviation of the endstop at the 100% position.

It checks whether the upper endstop has changed compared to its value during initialization.

The size of the deviation is determined as a percentage of the travel distance and displayed as the diagnostic value "Endstop 100% position" (19.OPEN).

**Note**

**Fault detection**

Monitoring of the endstop not only responds to faults in the valve.

A mechanical change in the position feedback can also result in violating a threshold.

**Ring memory**

If data storage is activated in the positioner, the deviation data determined is stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.12.2 Activate and configure diagnostics

### Requirement

- The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring 100% endstop" (G.\OPEN)

| | | |
|---|---|---|
| Function | Process diagnostics continuously monitor the deviation of the endstop at the 100% position. | |
| Note | The size of the deviation is determined as a percentage of the travel distance and displayed as the diagnostic value "Endstop 100% position" (19.OPEN). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

**Note**

**Fault detection**

Monitoring of upper endstop not only responds to faults in the valve.

A mechanical change in the position feedback can also result in violating a threshold.

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **G1.LEVL1** | **Threshold 1** | |
|---|---|---|
| Function | The parameter defines threshold 1 for the permissible deviation of the endstop at the 100% position as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: **G1.LEVL1** < G2.LEVL2 < G3.LEVL3 |
| Factory setting | 1.0 | |
| Unit | % | |

| **G2.LEVL2** | **Threshold 2** | |
|---|---|---|
| Function | The parameter defines threshold 2 for the permissible deviation of the endstop at the 100% position as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: G1.LEVL1 < **G2.LEVL2** < G3.LEVL3 |
| Factory setting | 2.0 | |
| Unit | % | |

| **G3.LEVL3** | **Threshold 3** | |
|---|---|---|
| Function | The parameter defines threshold 3 for the permissible deviation of the endstop at the 100% position as a percentage of the travel distance. | |
| Setting range | 0.1 ... 10.0 | Condition: G1.LEVL1 < G2.LEVL2 < **G3.LEVL3** |
| Factory setting | 4.0 | |
| Unit | % | |

## Activate and configure "Monitoring 100% endstop"

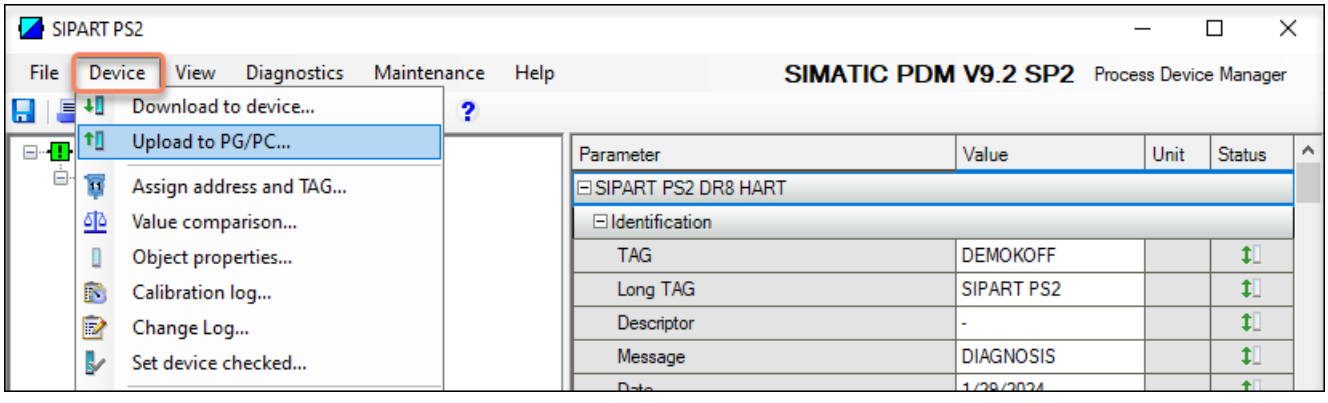
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "G.\OPEN" of the process diagnostics "Monitoring 100% endstop".
3. Set the "G.\OPEN" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - G1.LEVL1
   - G2.LEVL2
   - G3.LEVL3

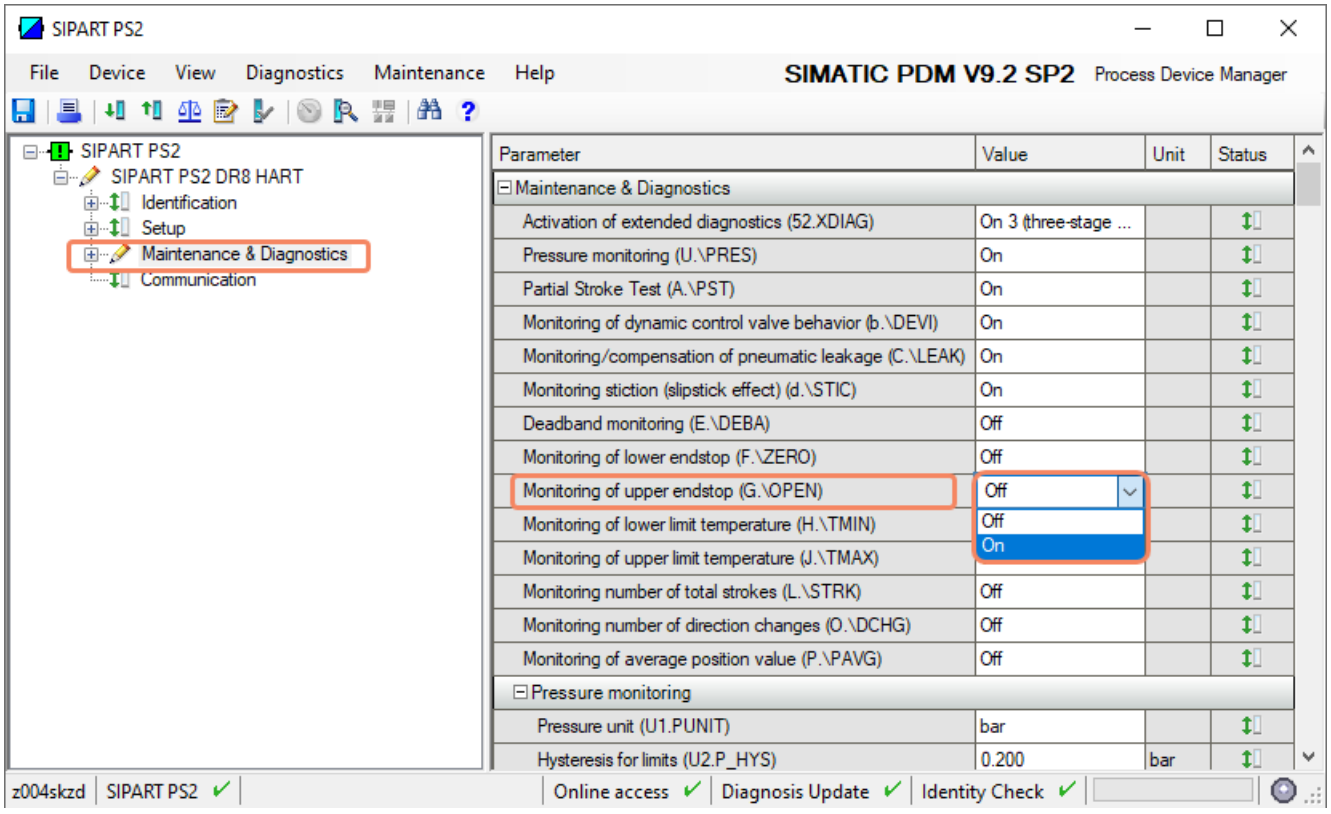
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of upper endstop" (G.\OPEN), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - G1.LEVL1
   - G2.LEVL2
   - G3.LEVL3
9. In the "Device" menu, select the command "Download to device..."...
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

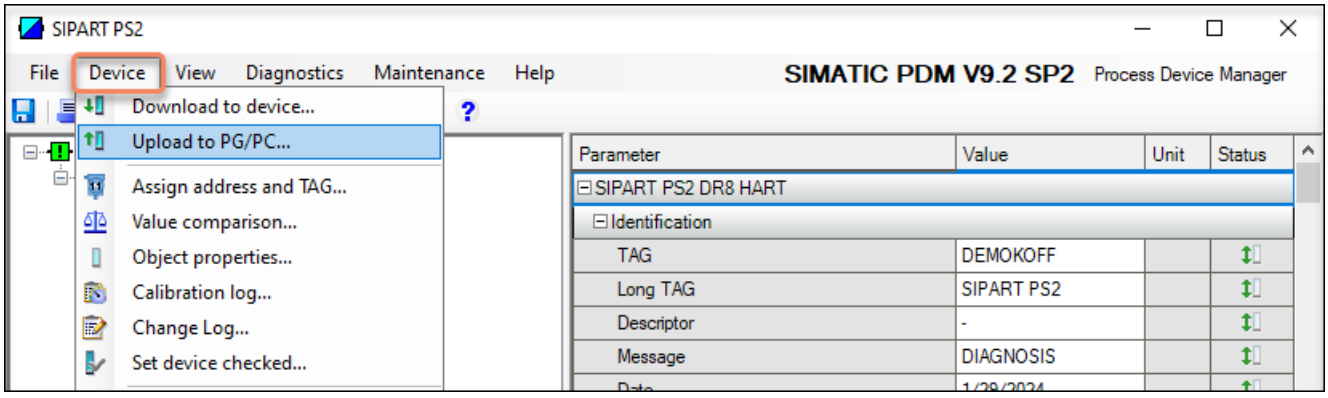
### 5.12.3 With SIMATIC PDM: Show diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "G.\OPEN" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "G.\OPEN".
- The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

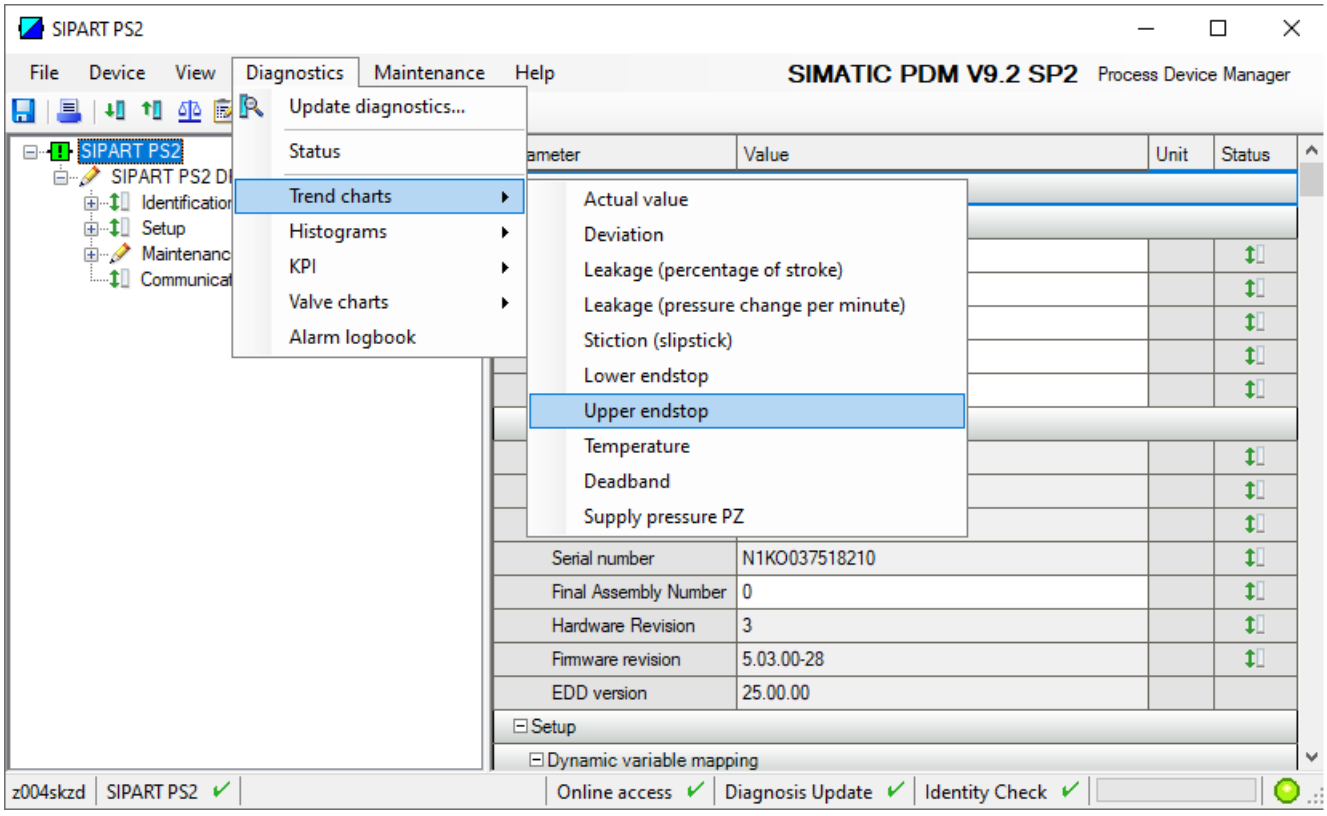
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

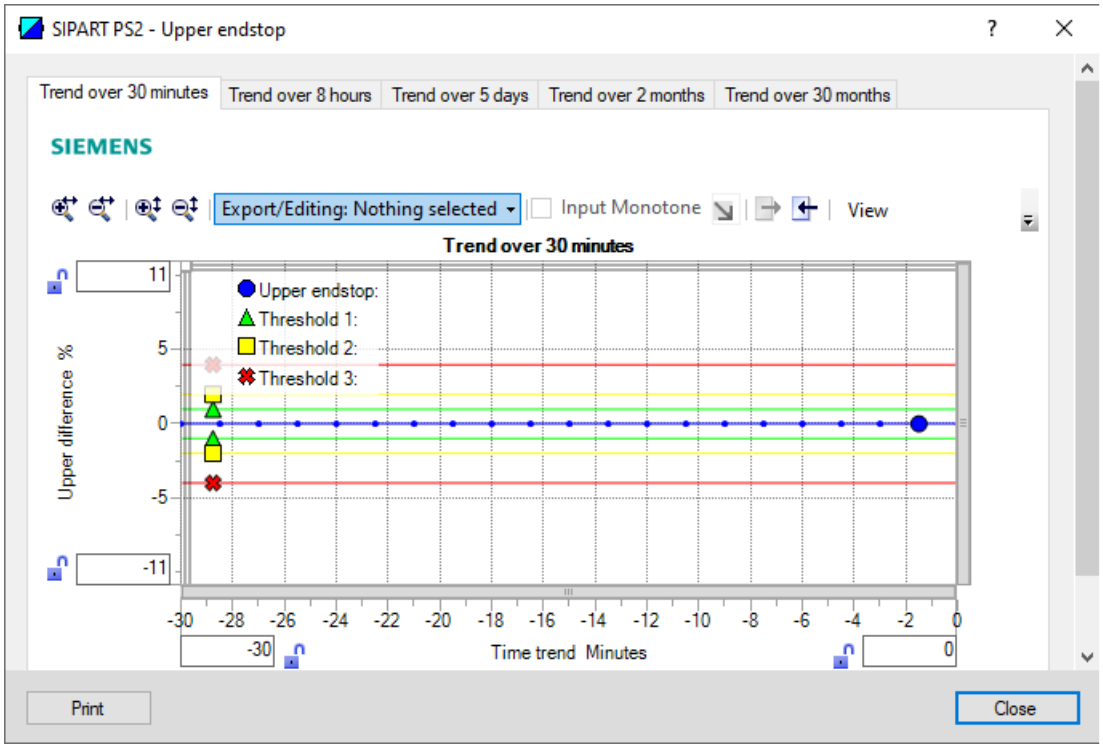
6. In the "Diagnostics" menu, select the "Trend charts > Upper endstop" command.




⇒ The "Upper endstop" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of "Threshold 1, 2 and 3" are also shown.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.12.4 Diagnostic value "Endstop 100% position" (19.OPEN)

| **Diagnostic value** | **Endstop 100-%-Position**<br>**Short designation: 19.OPEN** | |
|---|---|---|
| Function | The diagnostic value shows the percentage by which the mechanical endstop at the 100% position has changed compared to the value at initialization. | |
| Requirement | • The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".<br>• The "100% endstop monitoring" process diagnostics (G.\OPEN) is activated. | |
| Display range | 0.0 ... 100.0 | |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_open_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 46 ... 49<br>Format: Float |

### 5.12.5 Via HART communication: Read out diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "G.\OPEN" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "G.\OPEN".
- The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "25".

Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 25 | Last 30 minutes |
| 26 | Last 8 hours |
| 27 | Last 5 days |
| 28 | Last 2 months |
| 29 | Last 30 months |

## Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-32 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256/1<br>Examples:<br>• 256 ≙ 1%<br>• 25 600 ≙ 100% |
| 43 ... 46 | Float | Value of threshold 1 (G1.LEVL1) |
| 47 ... 50 | Float | Value of threshold 2 (G2.LEVL2) |
| 51 ... 54 | Float | Value of threshold 3 (G3.LEVL3) |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-33 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

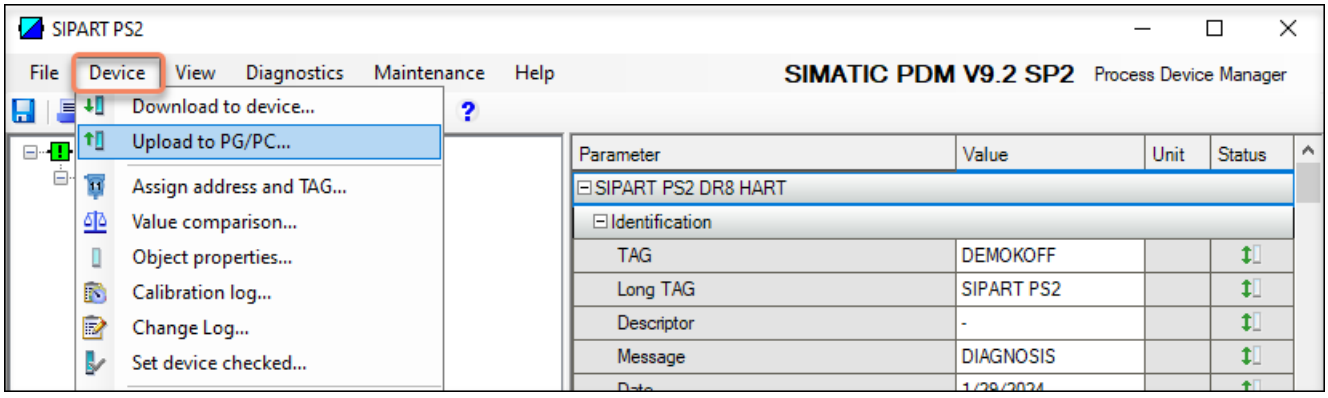
### 5.12.6 With SIMATIC PDM: Export diagnostics results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "G.\OPEN" is set to "On".
  - For positioners with firmware version as of 5.03, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "G.\OPEN".
- The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

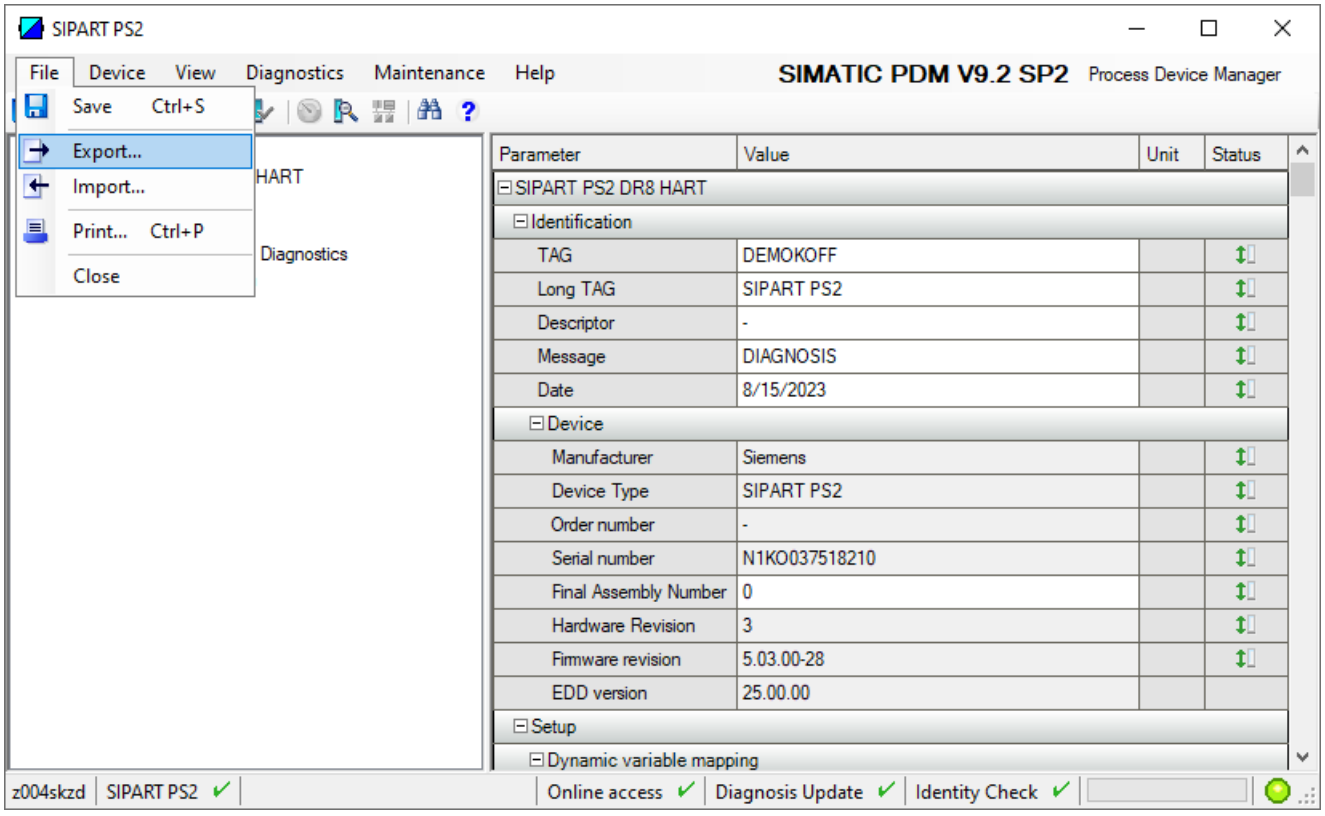
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



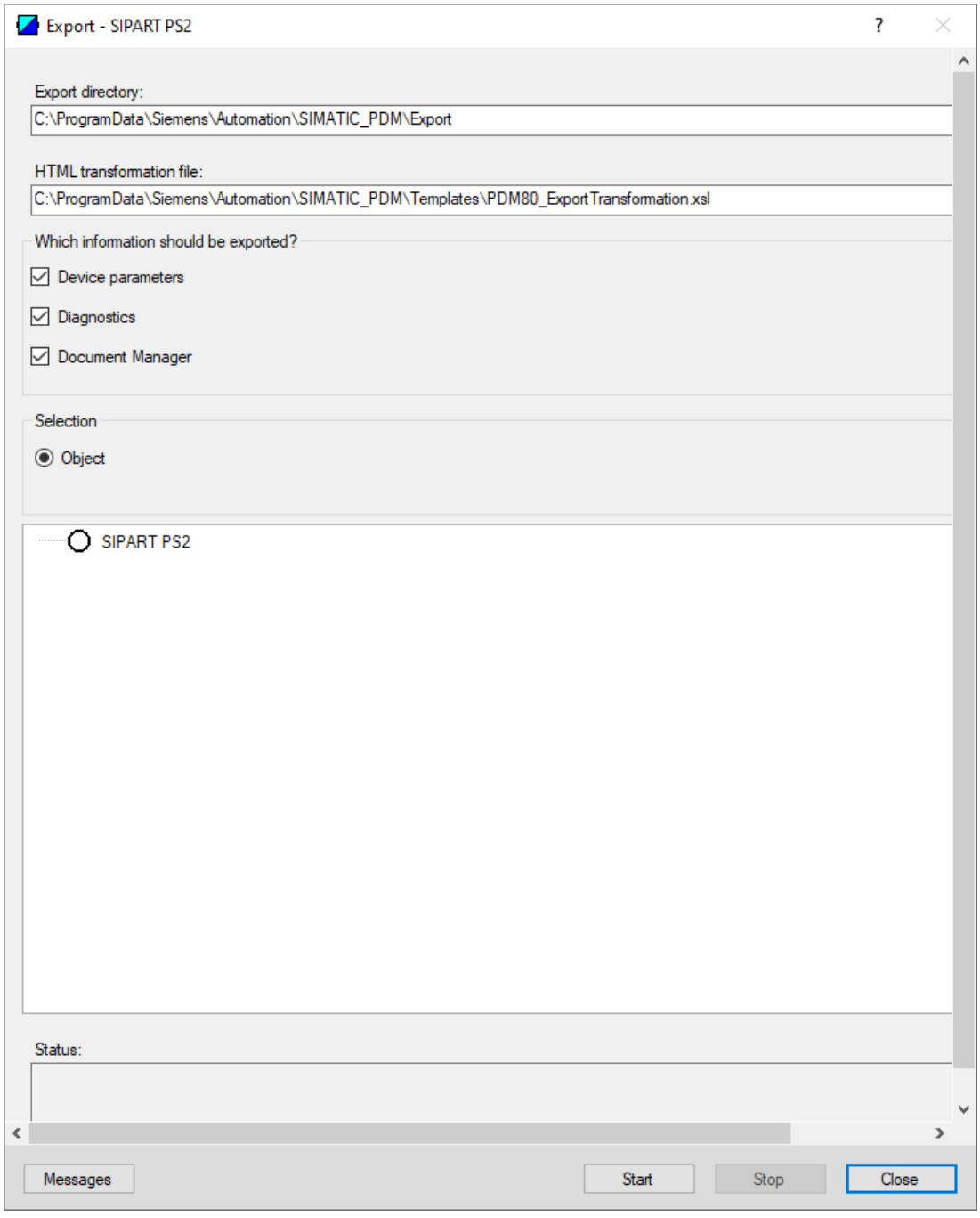

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Upper endstop" → With SIMATIC PDM: Show diagnostic results (Page 362).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu, select the "Export..." command.



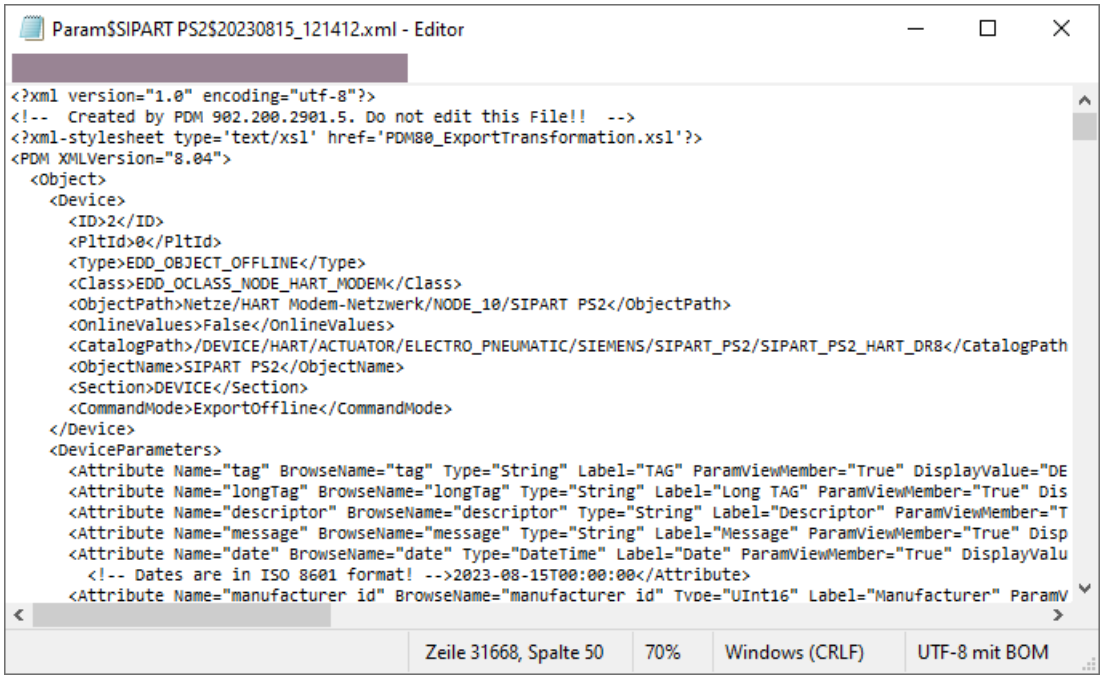

⇒ The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file contains 100 lines with the 100 exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name = "var_trend_open...".
Exemplary data line:
<Attribute **Name="var_trend_open_30min_0**" BrowseName="var_trend_open_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"** ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="%"**>0</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the "G.\OPEN" process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_open_30min_0 | 0.0 up to -1.5 minutes | 0.0 | % |
| | | ... | ... | ... | |
| | | var_trend_open_30min_19 | -28.5 up to -30.0 minutes | 0.0 | |
| Last 8 hours | 20 | var_trend_open_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_open_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_open_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_open_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_open_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_open_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_open_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_open_30m_19 | -855 up to -900 days | ... | |

## 5.12.7 Messages

### 5.12.7.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.12.7.2 Messages in the display

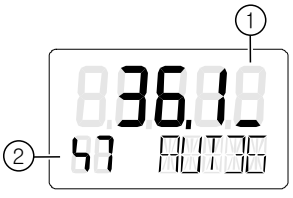
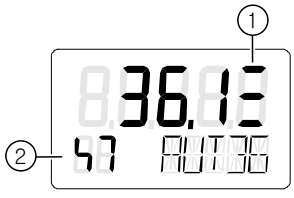
#### Requirement

The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do".

#### Indication on the display

If the set thresholds are exceeded, error code "7" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 7 | ① 2 bars<br>② Error code 7 | ① 3 bars<br>② Error code 7 |

### 5.12.7.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

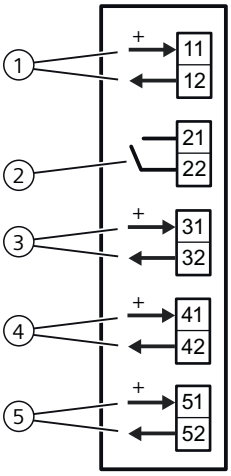
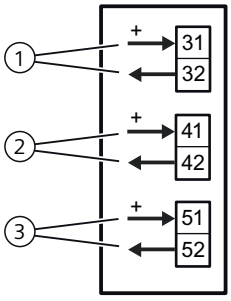
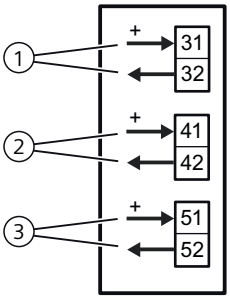
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

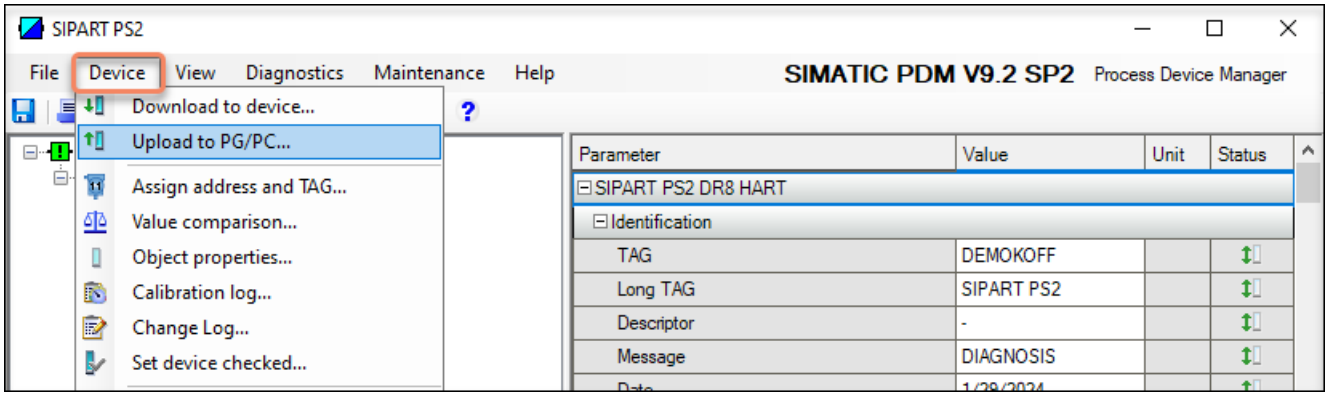
### 5.12.7.4 With SIMATIC PDM: Read status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

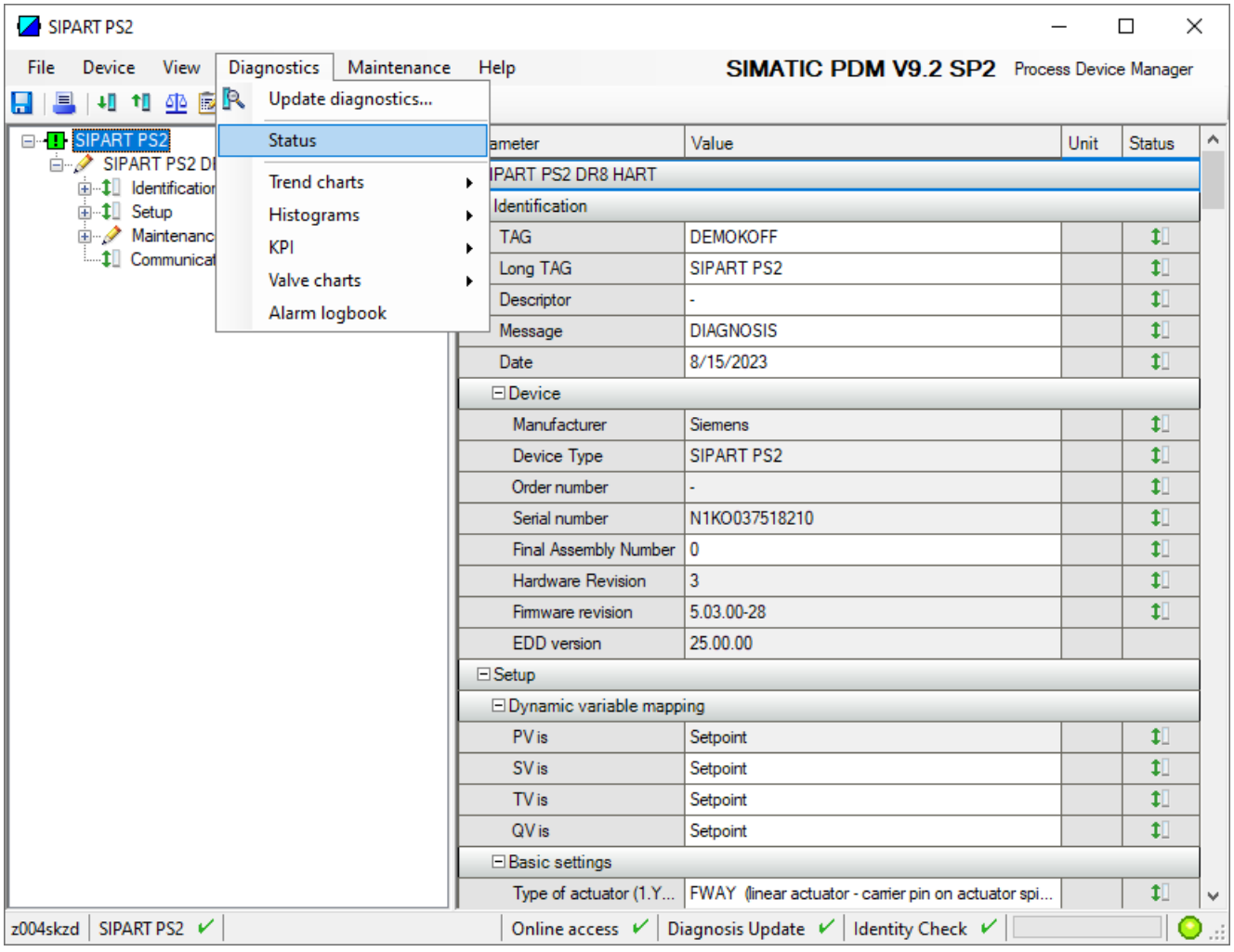
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

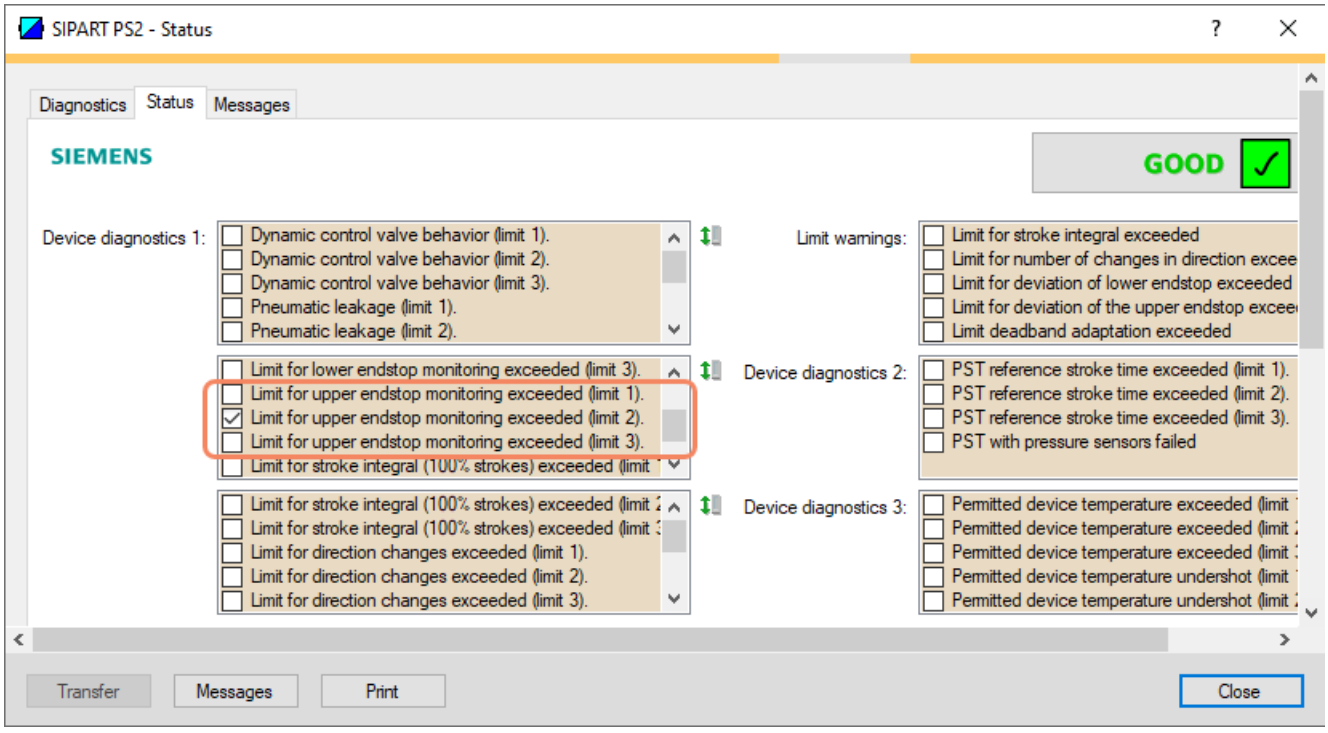



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Limit for upper endstop monitoring exceeded (limit x)" is highlighted.




8. Close the dialog.

### 5.12.7.5 Via HART communication: Get messages

#### Requirement

- The application parameter "39.YCLS" is set to one of the following values: "uP", "uP do", "Fu", "Fu Fd", "uP Fd", "Fu do"
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "G.\OPEN" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 15, bit 3 corresponds to threshold 1 exceeded.
  - Byte 15, bit 2 corresponds to threshold 2 exceeded.
  - Byte 15, bit 1 corresponds to threshold 3 exceeded.

#### 5.12.7.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.13 Monitoring of lower limit temperature (H.\TMIN) and upper limit temperature (J.\TMAX)

### 5.13.1 Functional description

Process diagnostics continuously monitor the temperature of the positioner.

The temperature sensor is located in the enclosure on the electronics board.

The current temperature is displayed in the "Current temperature" (30.TMP) diagnostic value in "°C" or in "°F".

**Ring memory**

If data storage is activated in the positioner, the measured temperatures are stored in the positioner's ring memories.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.13.2 Activate and configure diagnostics (H.\TMIN)

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### "Monitoring of lower limit temperature" process diagnostics (H.\TMIN)

| | | |
|---|---|---|
| Function | Process diagnostics continuously monitor the lower limit temperature of the positioner. | |
| Note | The current temperature is displayed in the "Current temperature" (30.TMP) diagnostic value in "°C" or in "°F".<br>The minimum occurring temperature is displayed in the diagnostic value "Minimum temperature" (31.TMIN). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the associated parameters are visible.

| **H1.TUNIT** | **Unit** |
|---|---|
| Function | The parameter defines the unit of the displayed temperature.<br>The unit also applies to all other temperature-related parameters. |
| Setting options | • °C<br>• °F |
| Factory setting | °C |

| **H2.LEVL1** | **Threshold 1** | | |
|---|---|---|---|
| Function | The parameter defines threshold 1 for the lower limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: **H2.LEVL1** < H3.LEVL2 < H4.LEVL3 |
| | -40.0 ... 194.0 | °F | |
| Factory setting | -25.0 °C | | |

| **H3.LEVL2** | **Threshold 2** | | |
|---|---|---|---|
| Function | The parameter defines threshold 2 for the lower limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: H2.LEVL1 < **H3.LEVL2** < H4.LEVL3 |
| | -40.0 ... 194.0 | °F | |
| Factory setting | -30.0 °C | | |

| H4.LEVL3 | Threshold 3 | | |
|---|---|---|---|
| Function | The parameter defines threshold 3 for the lower limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: H2.LEVL1 < H3.LEVL2 < **H4.LEVL3** |
| | -40.0 ... 194.0 | °F | |
| Factory setting | -40.0 °C | | |

## Activate and configure "Monitoring of lower limit temperature"

Process diagnostics can be activated and configured using the following 2 options.

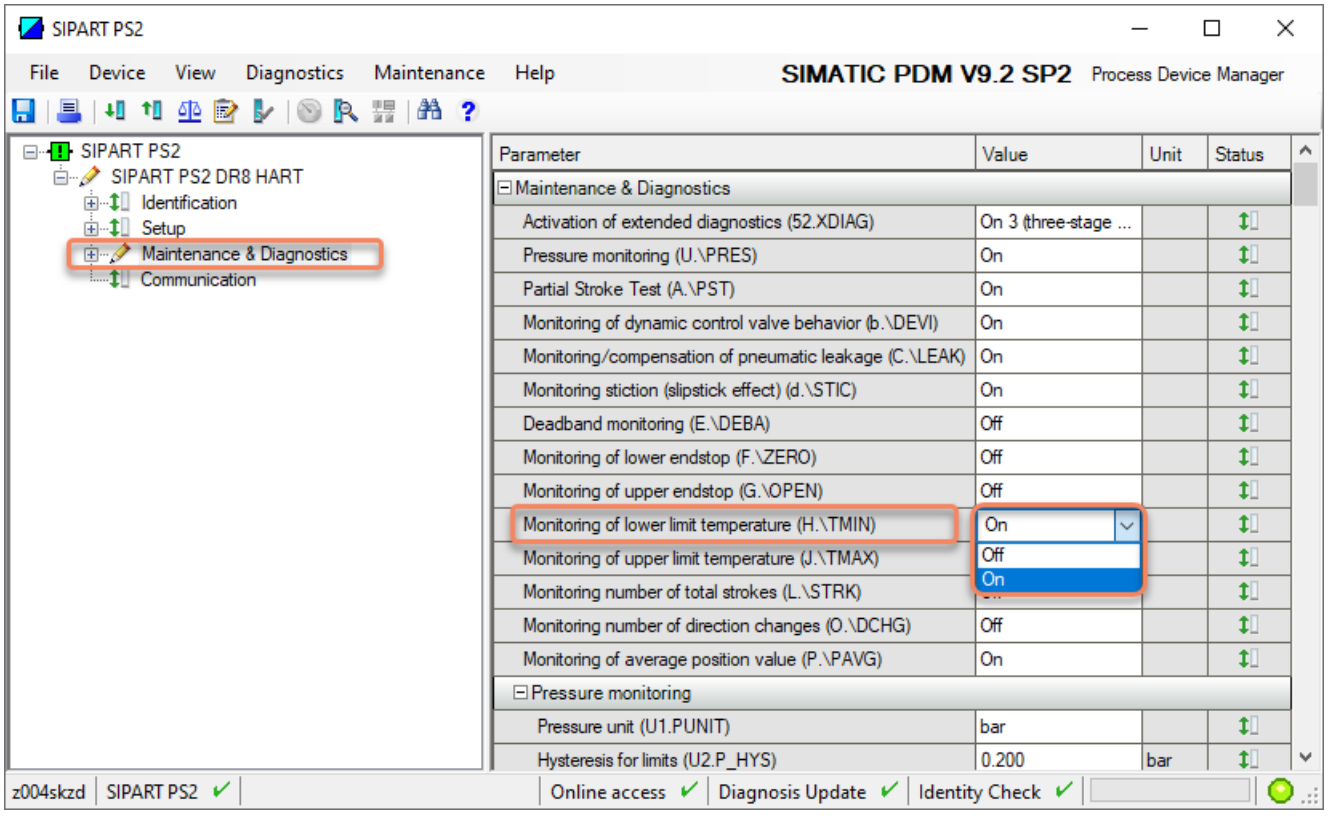
**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "H.\TMIN" parameter of the "Monitoring of lower limit temperature" process diagnostics.
3. Set the "H.\TMIN" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - H1.TUNIT
   - H2.LEVL1
   - H3.LEVL2
   - H4.LEVL3

**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager" .
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of lower limit temperature" (H.\TMIN), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - H1.TUNIT
   - H2.LEVL1
   - H3.LEVL2
   - H4.LEVL3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

## 5.13.3 Activate and configure diagnostics (J.\TMAX)

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring of upper limit temperature" (J.\TMAX)

| | | |
|---|---|---|
| Function | The process diagnostics continuously monitor the upper limit temperature of the positioner. | |
| Note | The current temperature is displayed in the "Current temperature" (30.TMP) diagnostic value in "°C" or in "°F".<br>The maximum occurring temperature is displayed in the diagnostic value "Maximum temperature" (32.TMAX). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the associated parameters are visible.

| **J1.TUNIT** | **Unit** |
|---|---|
| Function | The parameter defines the unit of the displayed temperature.<br>The unit also applies to all other temperature-related parameters. |
| Setting options | • °C<br>• °F |
| Factory setting | °C |

| **J2.LEVL1** | **Threshold 1** | | |
|---|---|---|---|
| Function | The parameter defines threshold 1 for the upper limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: **J2.LEVL1** < J3.LEVL2 < J4.LEVL3 |
| | -40.0 ... 194.0 | °F | |
| Factory setting | 75.0 °C | | |

| **J3.LEVL2** | **Threshold 2** | | |
|---|---|---|---|
| Function | The parameter defines threshold 2 for the upper limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: J2.LEVL1 < **J3.LEVL2** < J4.LEVL3 |
| | -40.0 ... 194.0 | °F | |
| Factory setting | 80.0 °C | | |

| **J4.LEVL3** | **Threshold 3** | | |
|---|---|---|---|
| Function | The parameter defines threshold 3 for the upper limit temperature. | | |
| Setting range | -40.0 ... 90.0 | °C | Condition: J2.LEVL1 < J3.LEVL2 < **J4.LEVL3** |
| | -40.0 ... 194.0 | °F | |
| Factory setting | 90.0 °C | | |

## Activate and configure "Monitoring of upper limit temperature"

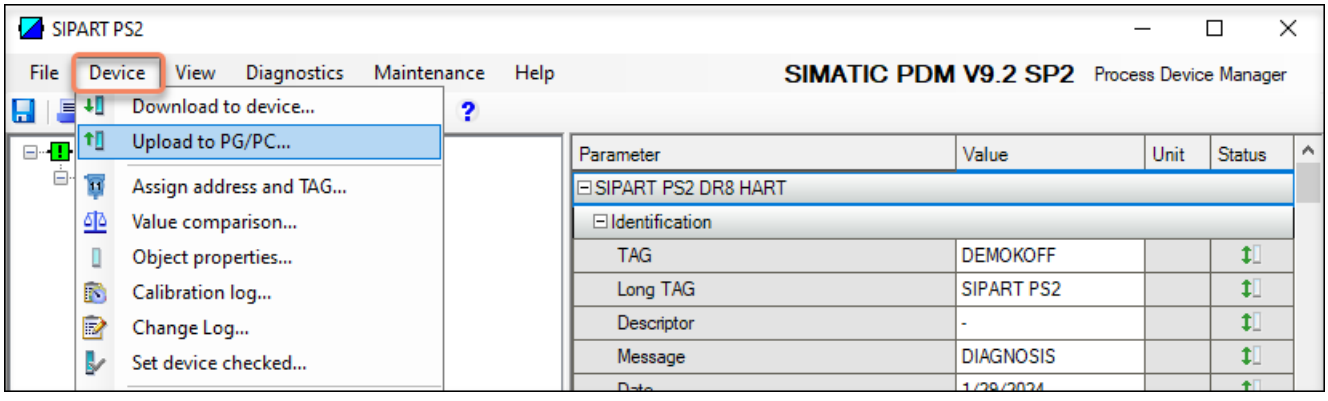
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "J.\TMAX" parameter of the process diagnostics "Monitoring of upper limit temperature".
3. Set the "J.\TMAX" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - J1.TUNIT
   - J2.LEVL1
   - J3.LEVL2
   - J4.LEVL3

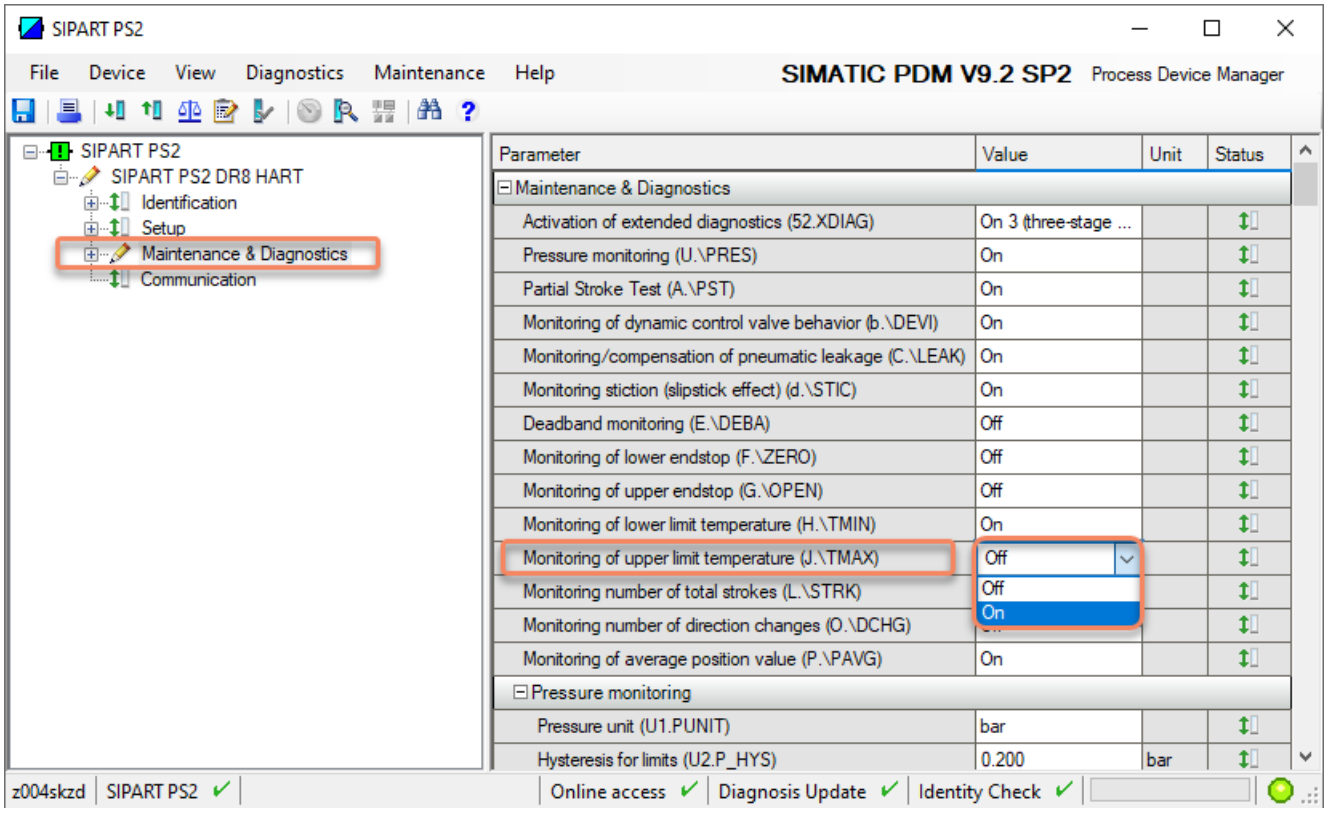
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of upper limit temperature" (J.\TMAX), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. Change the values of the parameters to adapt the thresholds to the valve:
   - J1.TUNIT
   - J2.LEVL1
   - J3.LEVL2
   - J4.LEVL3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

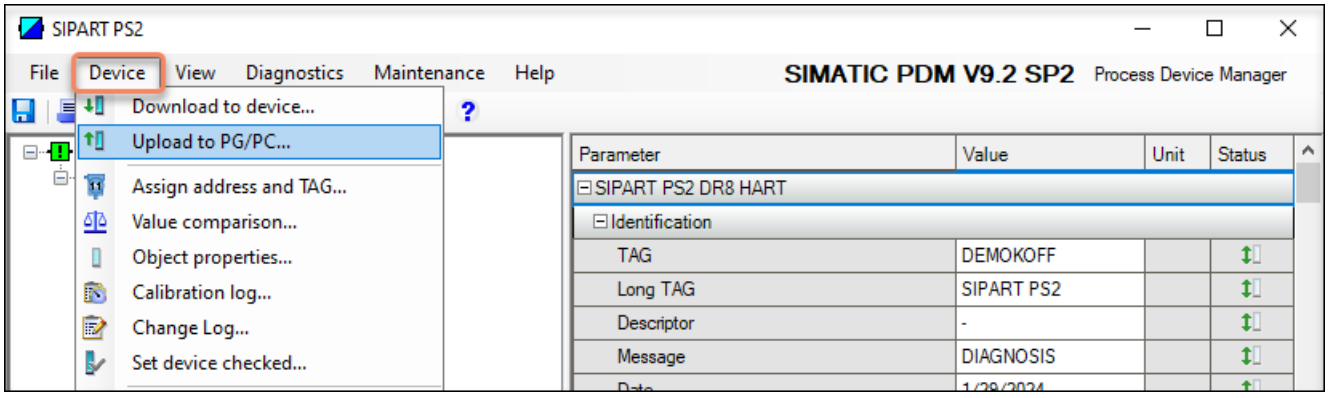
## 5.13.4 With SIMATIC PDM: Show diagnostic results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX" is set to "On".
  - For positioners with firmware version 5.03 or higher, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

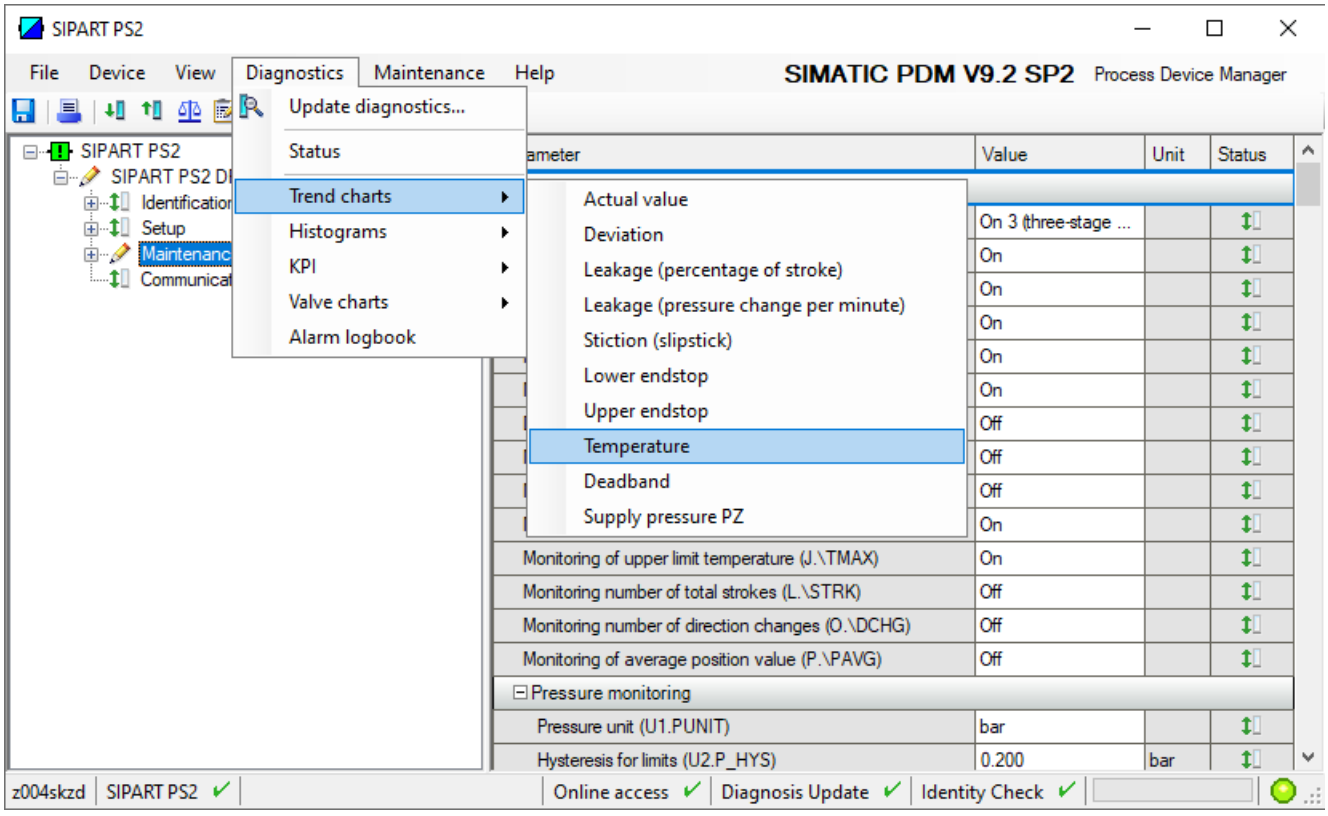
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

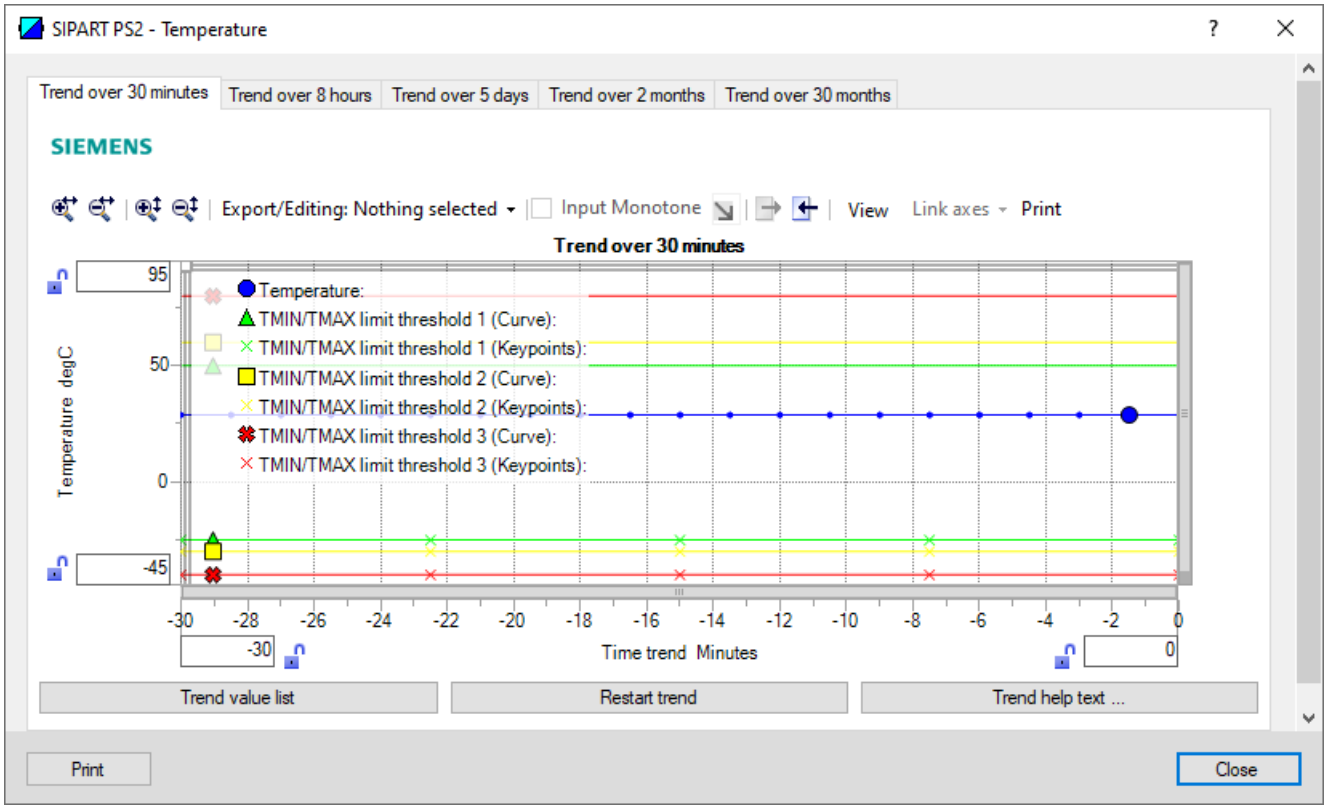
6. In the "Diagnostics" menu, select the "Trend charts > Temperature" command.




⇒ The "Temperature" dialog is displayed.
The dialog contains tabs, each with a trend chart for the deviations determined:

- Trend over 30 minutes
- Trend over 8 hours
- Trend over 5 days
- Trend over 2 months
- Trend over 30 months

The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
The lines of "Threshold 1, 2 and 3" are also shown for the both the upper and lower limits.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

7. Close the dialog.

### 5.13.5 Diagnostic value "Current temperature" (30.TEMP)

| **Diagnostic value** | **Current temperature**<br>**Short designation: 30.TEMP** | |
|---|---|---|
| Function | The diagnostic value shows the current temperature in the positioner enclosure. | |
| Note | • The temperature sensor is located in the enclosure on the electronics board.<br>• In order to switch over the temperature display between °C and °F: Press the ⚠ button on the display. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Current temperature (30.TEMP)** | | |
| SIMATIC PDM Export | Name | ps2_temp |
| | DisplayValue | ≙ Value |
| | Unit | ≙ Unit |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 38 ... 41<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

## 5.13.6 Diagnostic values "Minimum temperature" (31.TMIN) / "Maximum temperature" (32.TMAX)

| **Diagnostic value** | **Minimum temperature**<br>**Short designation: 31.TMIN** | |
|---|---|---|
| | **Maximum temperature**<br>**Short designation: 32.TMAX** | |
| Function | The minimum temperature and the maximum temperature inside the enclosure are continuously determined and stored in the manner of a drag indicator. | |
| Note | • To change the temperature display between °C and °F to switch: Press the ⚠ button on the display.<br>• The determined values can only be reset in the factory. | |
| Display range | -50 ... 100 | °C |
| | -58 ... 212 | °F |
| Unit | • °C<br>• °F | |
| **Communication** | | |
| **Minimum temperature (31.TMIN)** | | |
| SIMATIC PDM Export | Name | ps2_tmin |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 42 ... 45<br>Format: Float |
| **Maximum temperature (32.TMAX)** | | |
| SIMATIC PDM Export | Name | ps2_tmax |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 46 ... 49<br>Format: Float |
| **Temperature unit (H1/J1.TUNIT)** | | |
| SIMATIC PDM Export | Name | ps2_unit_temp_code |
| | DisplayValue | • °C<br>• °F |
| HART communication (read) | Command | #169 |
| | Response Data | Byte: 37<br>Format: Enum |

### 5.13.7 Via HART communication: Read out diagnostic results

#### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX" is set to "On".
  - For positioners with firmware version 5.03 or higher, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Request

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "30".

Send the request for each of the 5 ring memories separately.

| Ring memory index | Ring memory for time span |
|---|---|
| 30 | Last 30 minutes |
| 31 | Last 8 hours |
| 32 | Last 5 days |
| 33 | Last 2 months |
| 34 | Last 30 months |

#### Answer

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-34 Response Data Bytes

| Byte | Format | Description | |
|---|---|---|---|
| 0 | Enum | Ring memory index | |
| 1 | Unsigned-8 | Number of valid values in the ring memory | |
| 2 | Enum | Unit of the ring memory values in °C | |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each)<br>Scaling: 256 per °C in two's complement format | |
| 43 ... 46 | Float | Value of threshold 1 (H2.LEVL1) | For the lower limit temperature |
| 47 ... 50 | Float | Value of threshold 2 (H3.LEVL2) | |
| 51 ... 54 | Float | Value of threshold 3 (H4.LEVL3) | |

| Byte | Format | Description | |
|---|---|---|---|
| 55 ... 58 | Float | Value of threshold 1 (J2.LEVL1) | For the upper limit temperature |
| 59 ... 62 | Float | Value of threshold 2 (J3.LEVL2) | |
| 63 ... 66 | Float | Value of threshold 1 (J4.LEVL3) | |

Table 5-35 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

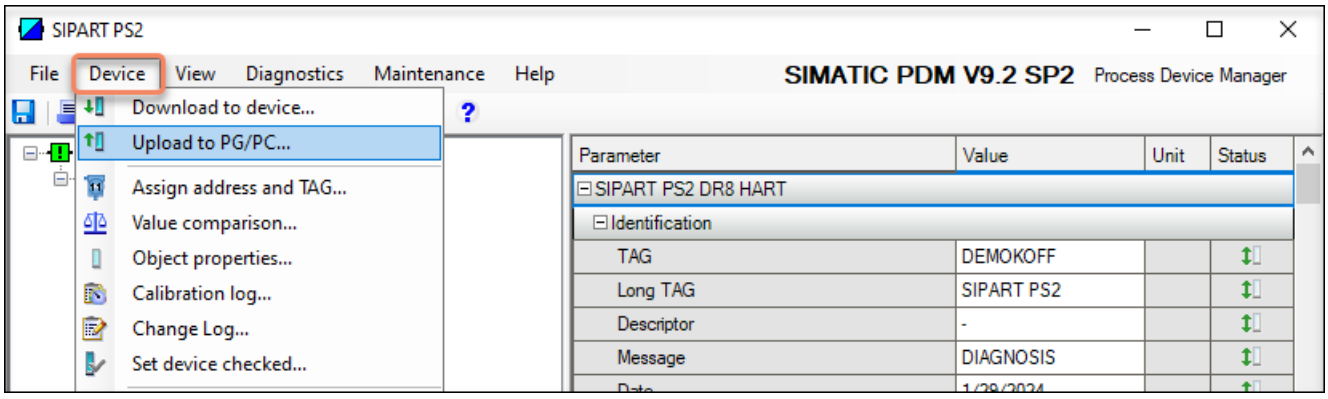
## 5.13.8 With SIMATIC PDM: Export diagnostics results

### Requirement

- Data backup is activated. The data is saved in the positioner from the time of activation.
  - For positioners with firmware version 5.00, 5.01 or 5.02: The application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX" is set to "On".
  - For positioners with firmware version 5.03 or higher, data storage is always activated, regardless of the setting of the application parameter "52.XDIAG" and the process diagnostics parameter "H.\TMIN" or "J.\TMAX".
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

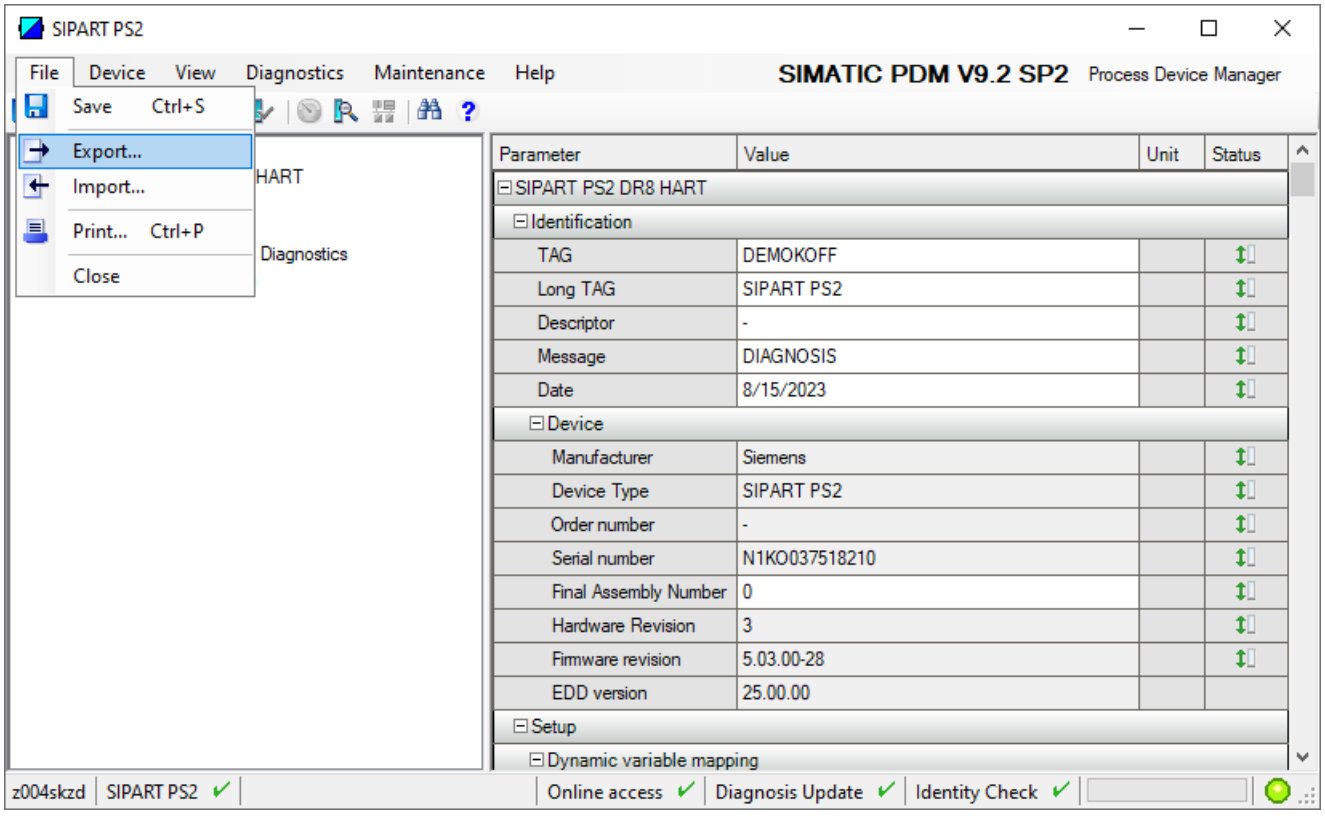
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



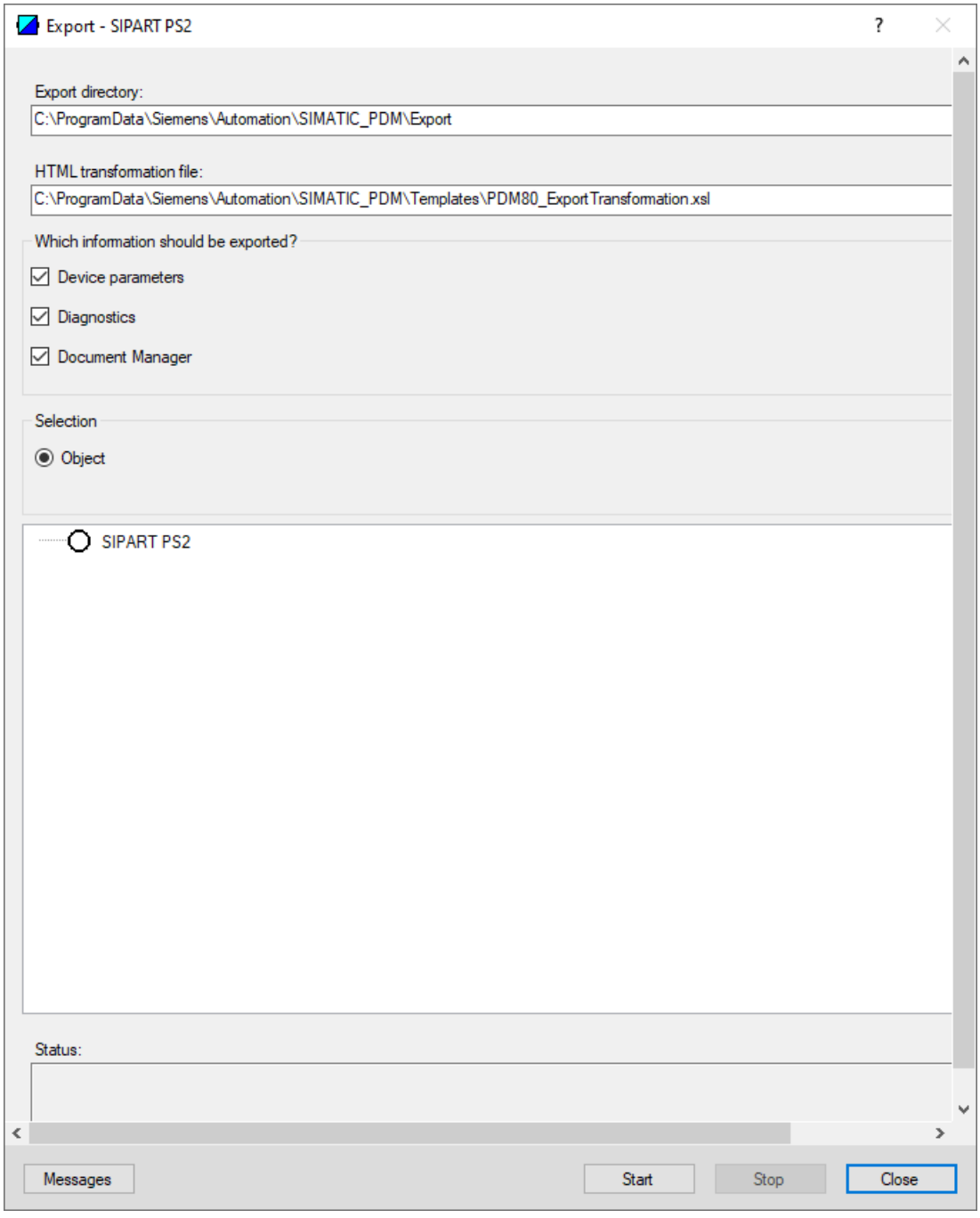

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Temperature" → With SIMATIC PDM: Show diagnostic results (Page 386)
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu, select the "Export..." command.



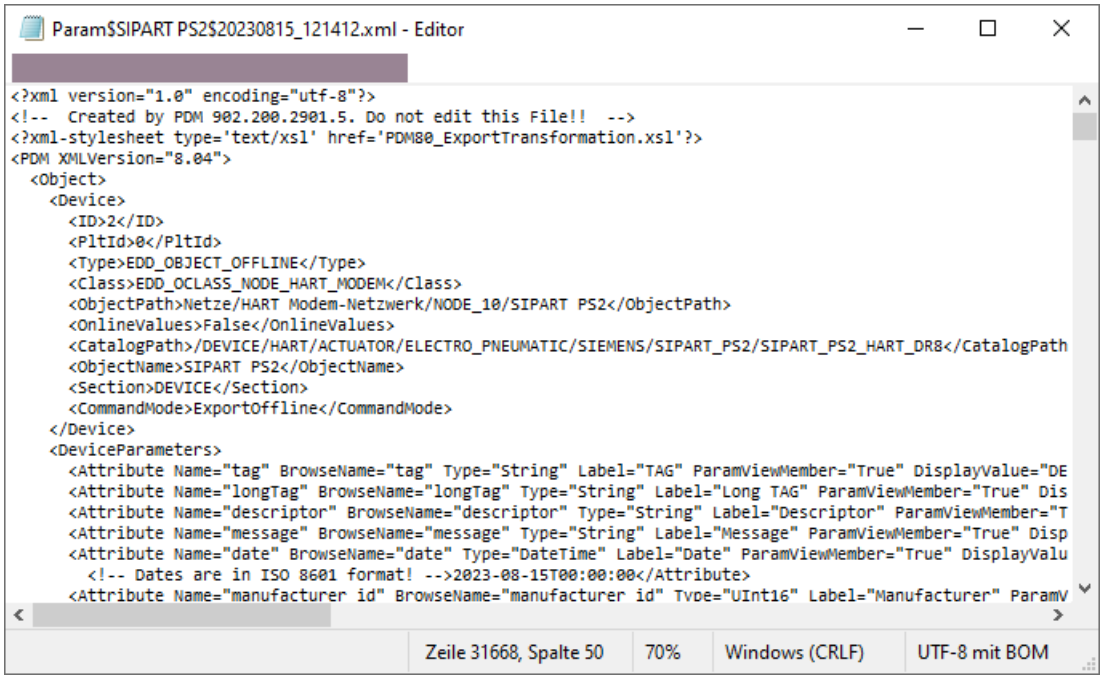

⇒ The "Export..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. editor.




The XML file contains 100 lines with the 100 exported process diagnostics data.
Each of the 5 ring memories contains 20 data entries.
The data for process diagnostics is labeled with Name = "var_trend_temp...".
The 1st data line reads, for example:
<Attribute **Name="var_trend_temp_30min_0**" BrowseName="var_trend_temp_30min_0" Type="Int16" **Label="0.0 up to -1.5 minutes"** ParamViewMember="False" **DisplayValue="0.0"** Import="True" State="32" **Unit="degC"**>0</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "0.0", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes.
- The table shows a summary of the 100 data of the process diagnostics exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_temp_30min_0 | 0.0 up to -1.5 minutes | 0.0 | • °C<br>• °F |
| | | ... | ... | ... | |
| | | var_trend_temp_30min_19 | -28.5 up to -30.0 minutes | ... | |
| Last 8 hours | 20 | var_trend_temp_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_temp_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_temp_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_temp_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_temp_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_temp_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_temp_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_temp_30m_19 | -855 up to -900 days | ... | |

## 5.13.9 Messages

### 5.13.9.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.13.9.2 Messages in the display

#### Monitoring of lower limit temperature (H.\TMIN)

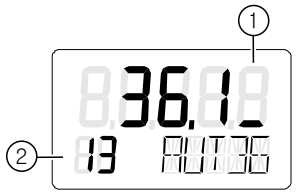
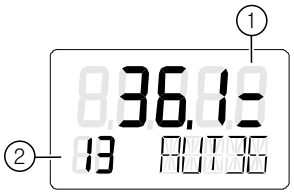
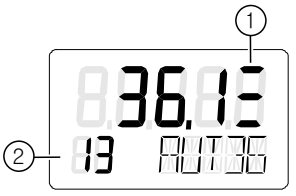
**Requirement**

Process diagnostics "Monitoring lower limit temperature" (H.\TMIN) is activated.

**Indication on the display**

Error code "13" is output if the value falls below the set thresholds.

If several messages are present at the same time, the display switches between the different error codes.

| If the value falls below threshold 1 | If the value falls below threshold 2 | If the value falls below threshold 3 |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 13 | ① 2 bars<br>② Error code 13 | ① 3 bars<br>② Error code 13 |

#### Monitoring of upper limit temperature (J.\TMAX)

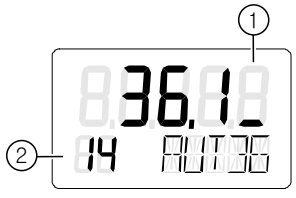
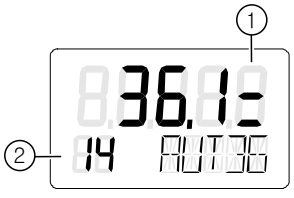
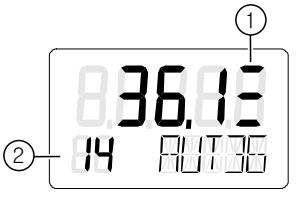
**Requirement**

The process diagnostics "Monitoring of upper limit temperature" (J.\TMAX) is activated.

**Indication on the display**

If the set thresholds are exceeded, error code "14" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 14 | ① 2 bars<br>② Error code 14 | ① 3 bars<br>② Error code 14 |

### 5.13.9.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

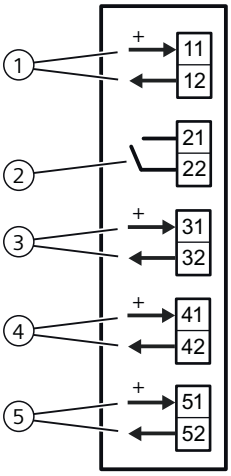
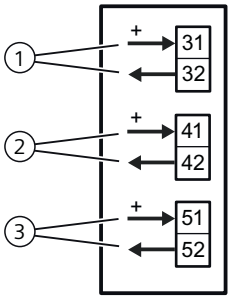
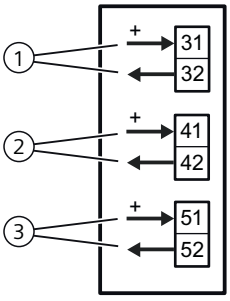
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

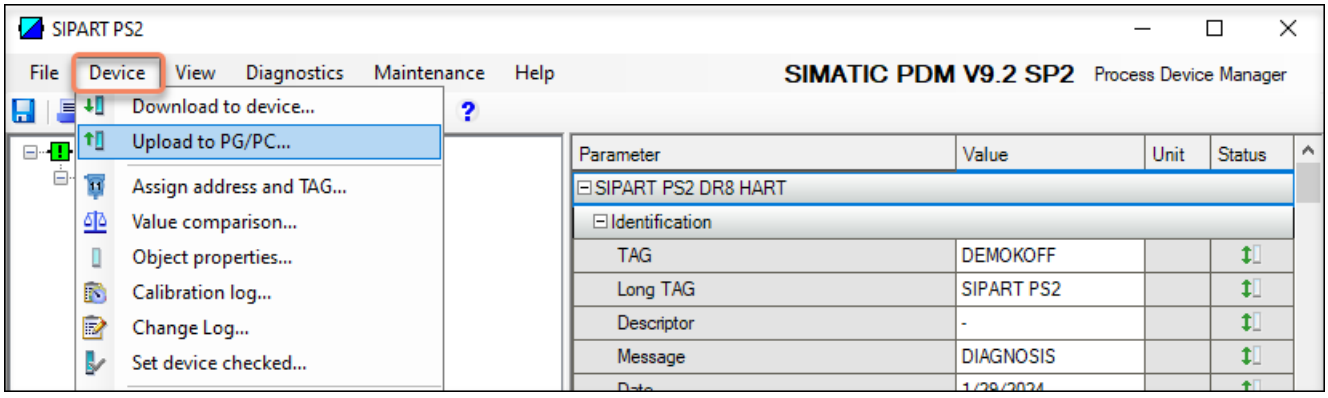
### 5.13.9.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

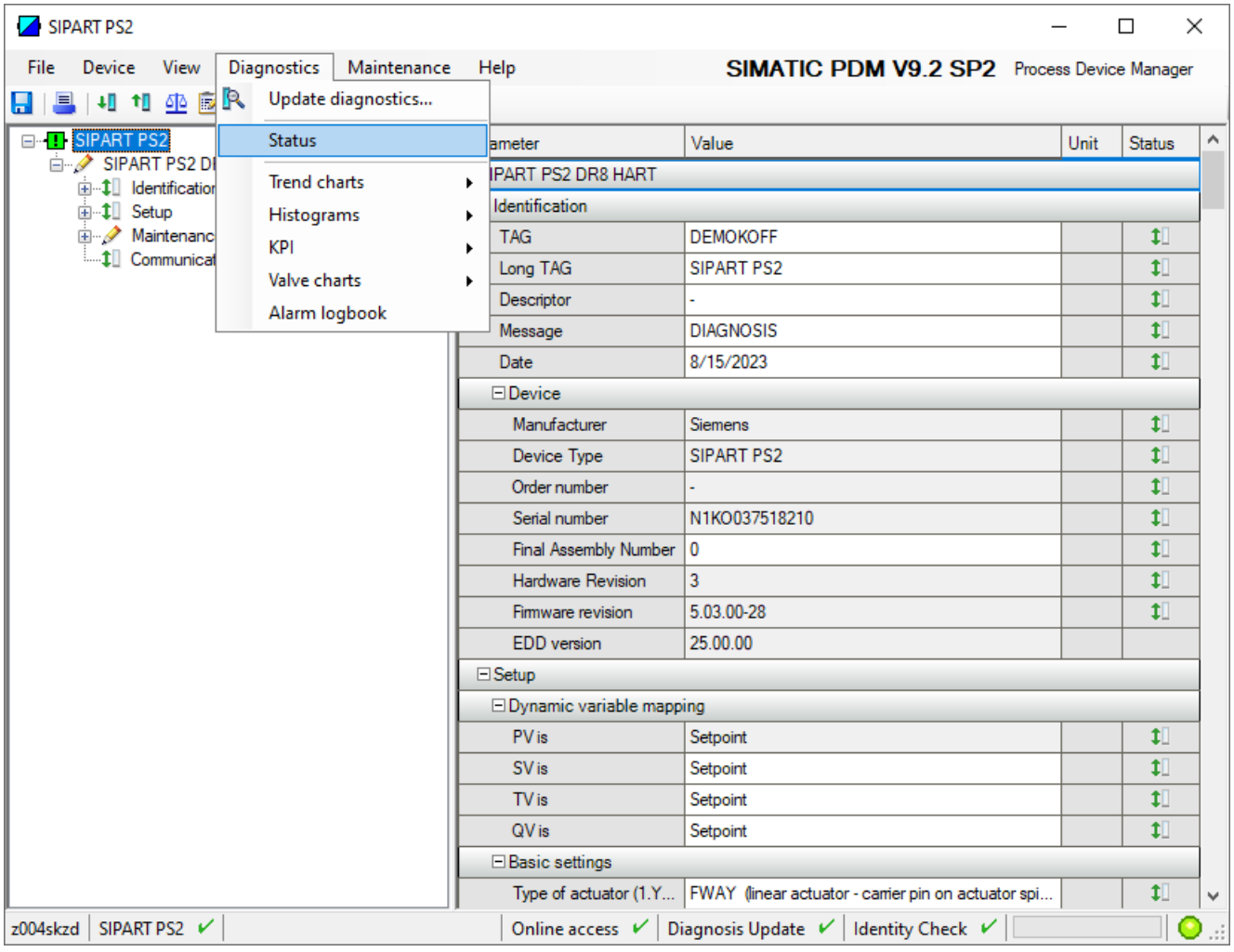
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

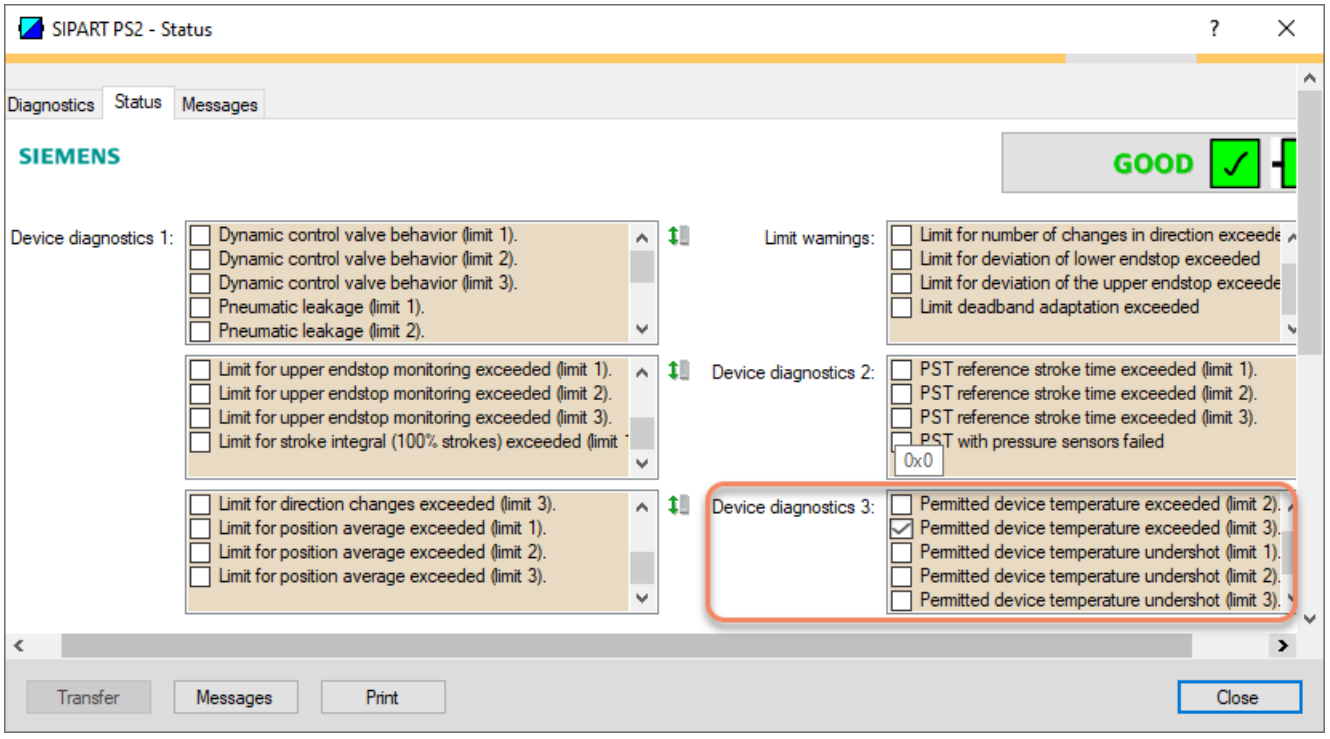



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   - When a threshold is exceeded, the message "Permitted device temperature exceeded (limit x)" is highlighted.
   - If the value falls below the threshold, the message "Permitted device temperature undershot (limit x)" is highlighted.




8. Close the dialog.

### 5.13.9.5 Via HART communication: Get messages

#### Requirement

- When monitoring the lower limit temperature (H.\TMIN): The process diagnostics is activated with "On".
- With monitoring the upper limit temperature (J.\TMAX): The process diagnostics is activated with "On".
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...

#### Get message

If the value is above or below the threshold of the process diagnostics, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.

**Lower temperature limit monitoring (H.\TMIN)**

The messages for falling below the thresholds are contained in the following bytes:

- Byte 18, bit 4 corresponds to violation of lower threshold 1.
- Byte 18, bit 3 corresponds to violation of lower threshold 2.
- Byte 18, bit 2 corresponds to violation of lower threshold 3.

**Monitoring the upper limit temperature (J.\TMAX)**

The messages when the thresholds are exceeded are contained in the following bytes:

- Byte 18, bit 7 corresponds to threshold 1 exceeded.
- Byte 18, bit 6 corresponds to threshold 2 exceeded.
- Byte 18, bit 5 corresponds to threshold 3 exceeded.

#### 5.13.9.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the upper of lower thresholds are no longer violated during process diagnostics, the message on the display disappears, e.g. after successful maintenance or when the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.14 Monitoring the number of total strokes (L.\STRK)

### 5.14.1 Functional description

The process diagnostics continuously monitor the total number of strokes performed by the valve.

A total stroke is defined as the distance between the position 0% to 100% and back from 100% to 0%.

Partial strokes are totaled in the counter. The total 200% movement is counted as 1 stroke in the diagnostic value.

The current value is displayed in the diagnostic value "100% strokes" (1.STRKS).

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.14.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring of number of total strokes" (L.\STRK)

| | | |
|---|---|---|
| Function | The process diagnostics continuously monitor the total number of strokes performed by the valve. | |
| Note | The current value is displayed in the diagnostic value "100% strokes" (1.STRKS). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **L1.LIMIT** | **Limit for number of strokes** |
|---|---|
| Function | The parameter defines the basic limit for the number of total strokes. |
| Setting range | 1 ... 1.00E8 |
| Factory setting | 1.00E6 |

| **L2.FACT1** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "L1.LIMIT" results in threshold 1 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: **L2.FACT1** < L3.FACT2 < L4.FACT3 |
| Factory setting | 1.0 | |

| **L3.FACT2** | **Factor 2** | |
|---|---|---|
| Function | This factor multiplied by the value of "L1.LIMIT" results in threshold 2 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: L2.FACT1 < **L3.FACT2** < L4.FACT3 |
| Factory setting | 2.0 | |

| **L4.FACT3** | **Factor 3** | |
|---|---|---|
| Function | This factor multiplied by the value of "L1.LIMIT" results in threshold 3 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: L2.FACT1 < L3.FACT2 < **L4.FACT3** |
| Factory setting | 5.0 | |

### Activate and configure "Monitoring of number of total strokes"

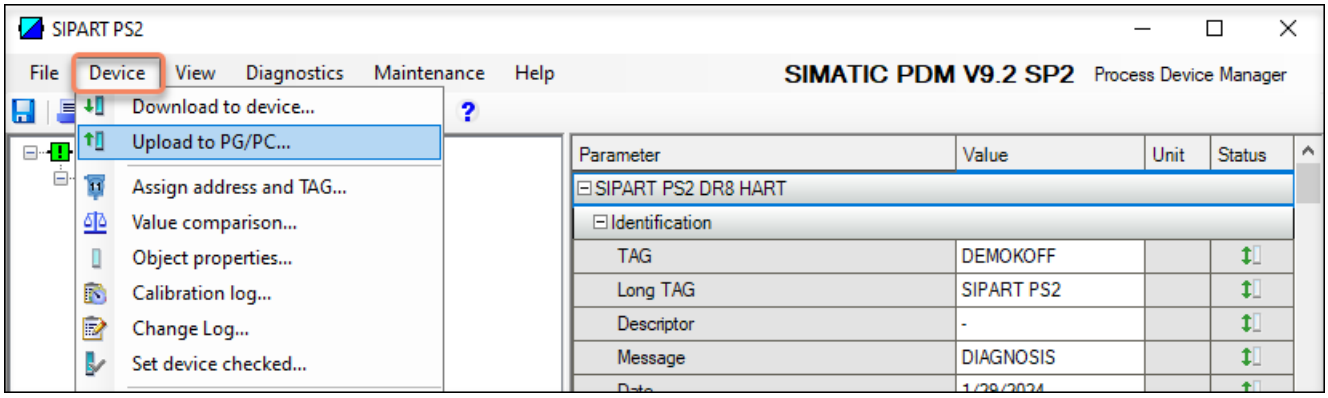
Process diagnostics can be activated and configured using the following 2 options.

**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "L.\STRK" of the process diagnostics "Monitoring of number of total strokes".
3. Set the "L.\STRK" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - L1.LIMIT
   - L2.FACT1
   - L3.FACT2
   - L4.FACT3

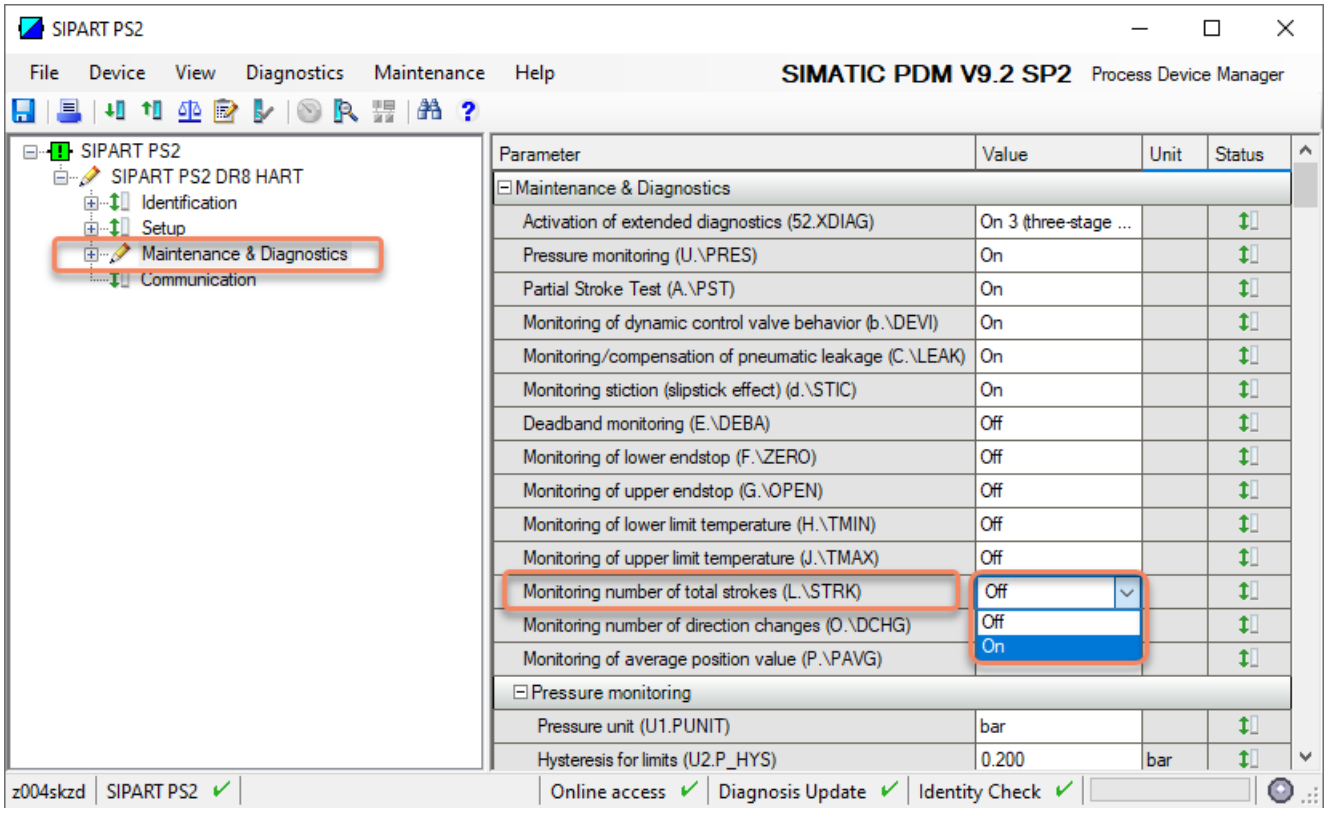
**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring number of total strokes" (L.\STRK), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - L1.LIMIT
   - L2.FACT1
   - L3.FACT2
   - L4.FACT3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

### 5.14.3 Diagnostic value "100% stroke" (1.STRKS)

| **Diagnostic value** | **100% strokes**<br>**Short designation: 1.STRKS** | |
|---|---|---|
| Function | The counter adds up the movements of the actuator and shows the number of total strokes.<br>A total stroke is defined as the distance between the position 0% to 100% and back from 100% to 0%.<br>Partial strokes are totaled in the counter. The total 200% movement is counted as 1 stroke in the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_lift_int |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 16 ... 19<br>Format: Unsigned-32 |

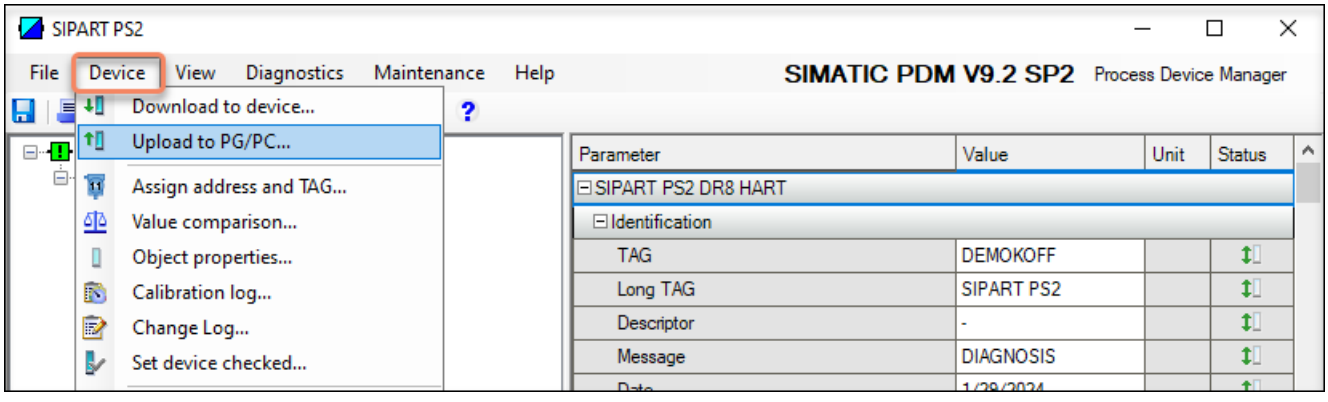
### 5.14.4 With SIMATIC PDM: Export diagnostics results

#### Requirement

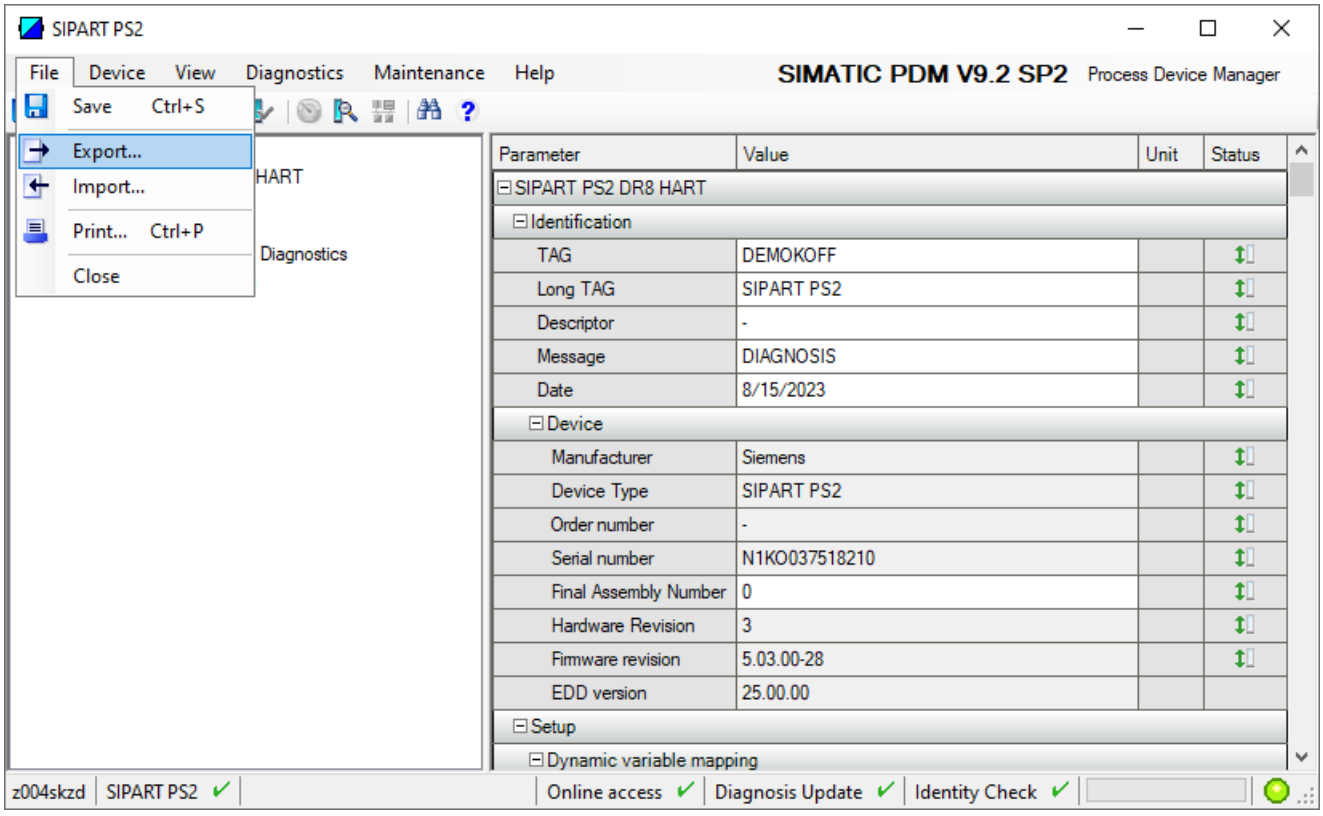
- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

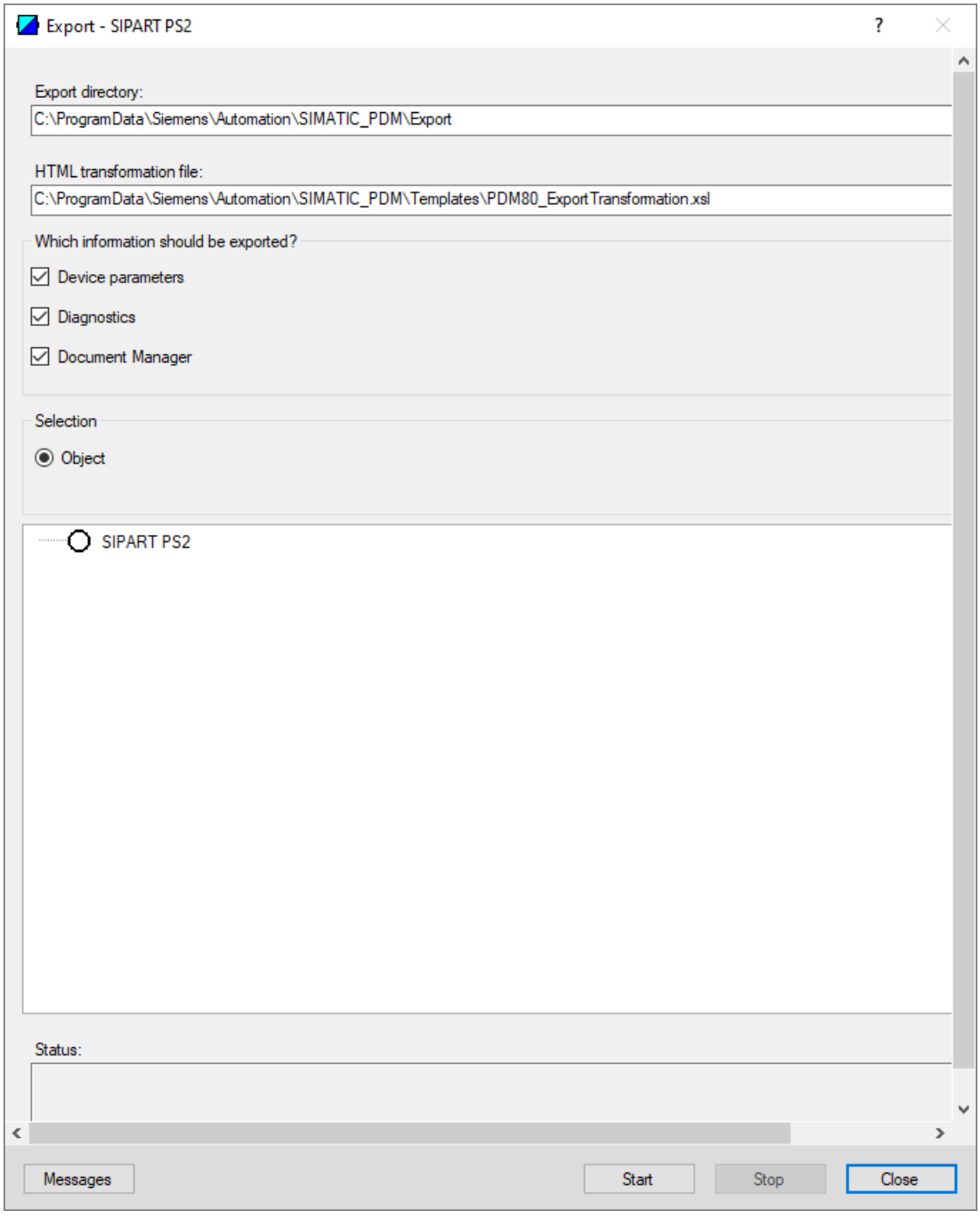


3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. In the "File" menu, select the "Export..." command.



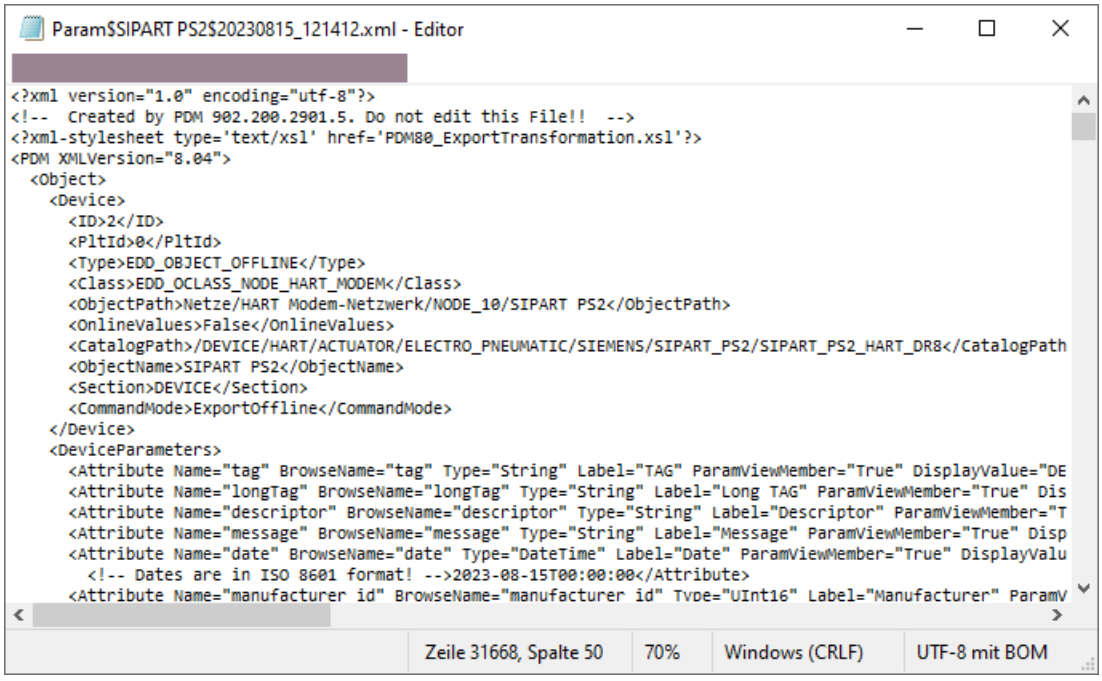

⇒ The "Export - ..." dialog opens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.

9. Wait until the status "Export: Action finished" is displayed.
   The following 2 files are stored in the export path:
   - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
   - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
10. Close the dialog.
11. Open the XML file with suitable software, e.g. an editor.




The data for process diagnostics is labeled with Name = "ps2_lift_int".
Exemplary data line:
<Attribute Name="**ps2_lift_int**" BrowseName="ps2_lift_int" Type="UInt32"
Label="100% strokes (1.STRKS)" ParamViewMember="True" **DisplayValue="78"**
Import="True" State="16" Unit="">78</Attribute>
⇒ The numerical value at "DisplayValue", e.g. "78", is the number of total strokes completed.

## 5.14.5 Messages

### 5.14.5.1 General information

#### Requirement

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

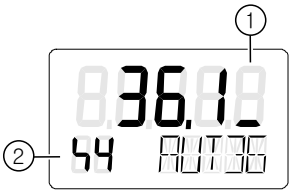
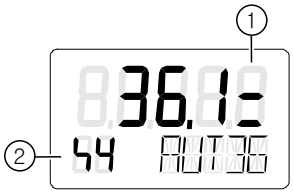
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.14.5.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "4" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 4 | ① 2 bars<br>② Error code 4 | ① 3 bars<br>② Error code 4 |

### 5.14.5.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

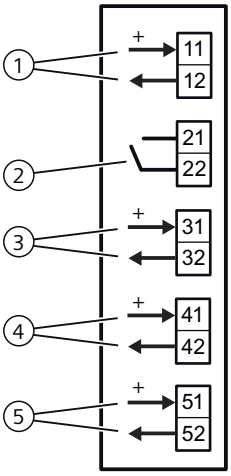
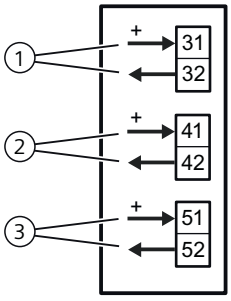
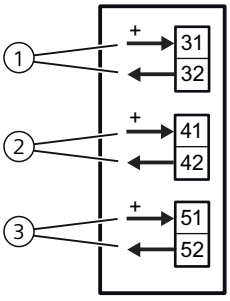
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

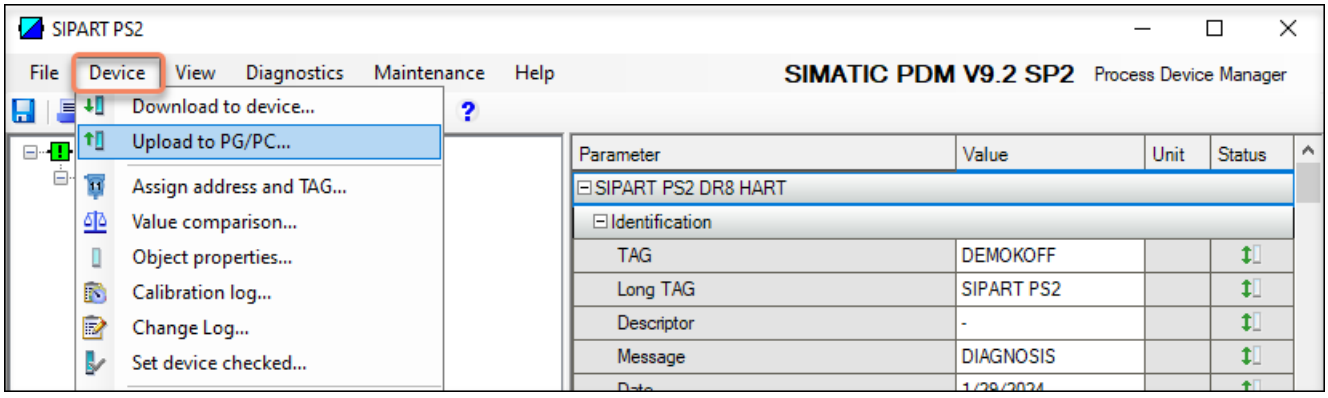
### 5.14.5.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

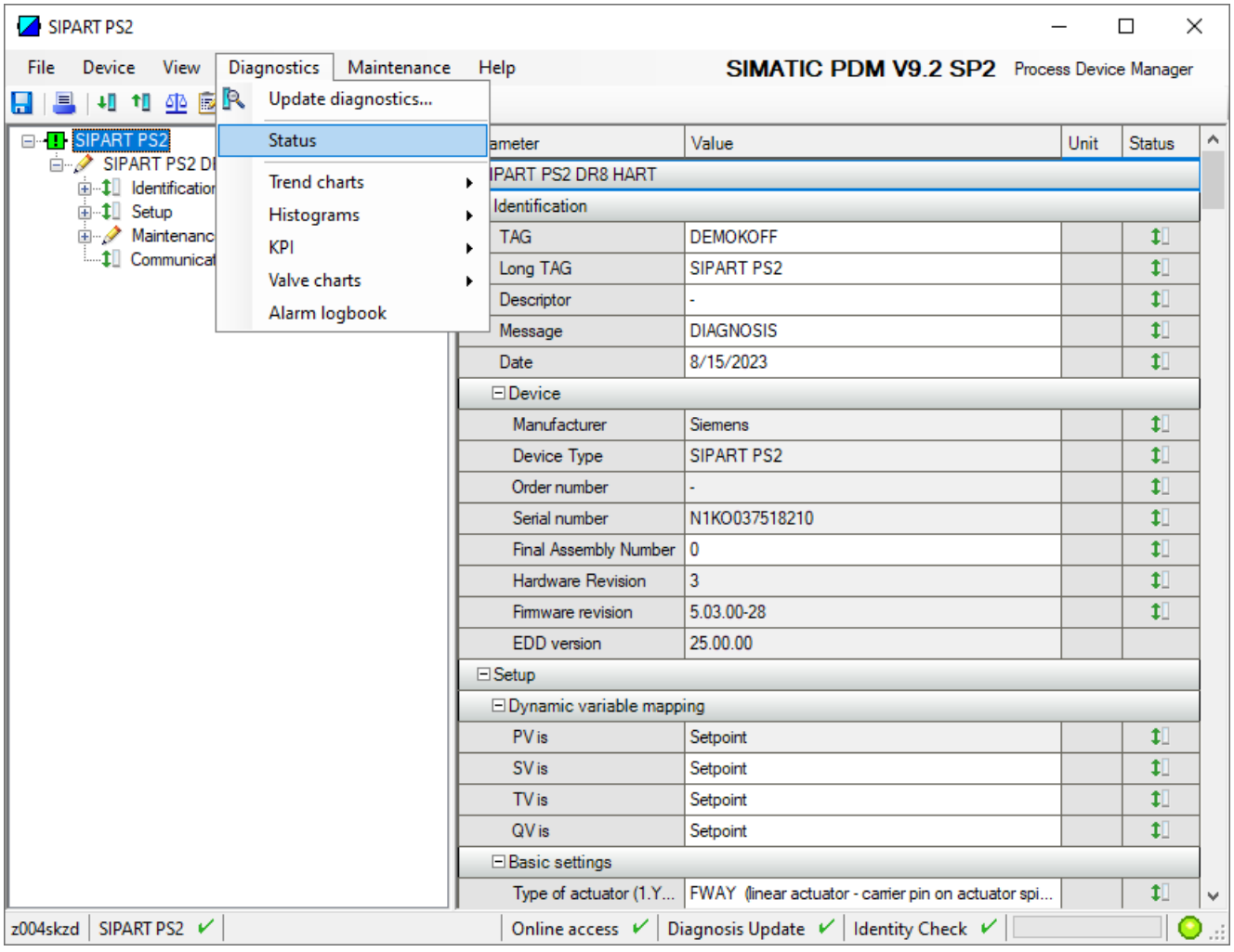
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

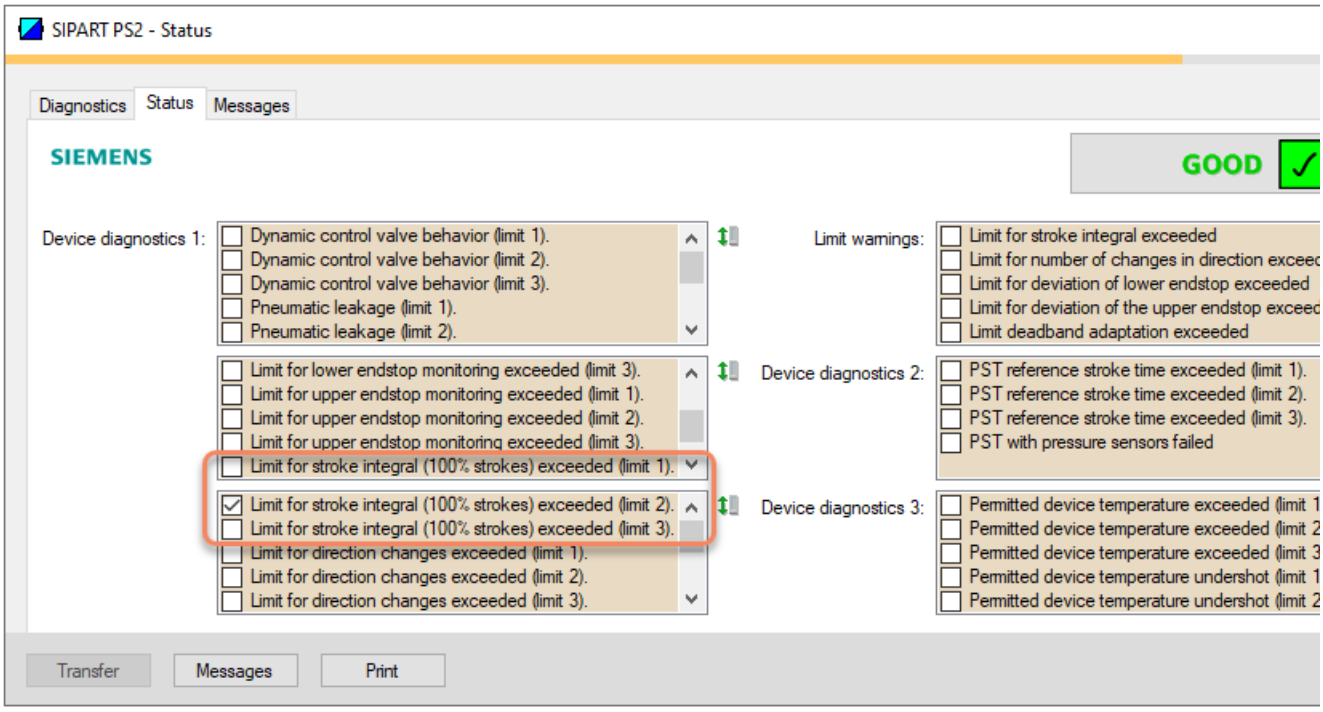



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Limit for stroke integral (100% strokes) exceeded (limit x)" is highlighted.




8. Close the dialog.

### 5.14.5.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "L.\STRK" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 15, bit 0 corresponds to threshold 1 exceeded.
  - Byte 16, bit 7 corresponds to threshold 2 exceeded.
  - Byte 16, bit 6 corresponds to threshold 3 exceeded.

#### 5.14.5.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.15 Monitoring the number of changes in direction (O.\DCHG)

### 5.15.1 Functional description

The process diagnostics continuously monitor the number of changes in direction with a movement greater than 0.25%.

The current value is displayed in the diagnostic value "Number of changes in direction" (2.CHDIR).

The data can be read and processed using HART commands.

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.15.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics of "Monitoring of number of changes in direction" (O.\DCHG)

| | | |
|---|---|---|
| Function | The process diagnostics continuously monitor the number of changes in direction with a movement greater than 0.25%. | |
| Note | The current value is displayed in the diagnostic value "Number of changes in direction" (2.CHDIR). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If the process diagnostics are activated with "On", the following parameters can be seen.

| **O1.LIMIT** | **Limit of direction change** |
|---|---|
| Function | The parameter defines the basic limit for the number of changes in direction. |
| Setting range | 1 ... 1.00E8 |
| Factory setting | 1.00E6 |

| **O2.FACT1** | **Factor 1** | |
|---|---|---|
| Function | This factor multiplied by the value of "O1.LIMIT" results in threshold 1 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: **O2.FACT1** < O3.FACT2 < O4.FACT3 |
| Factory setting | 1.0 | |

| **O3.FACT2** | **Factor 2** | |
|---|---|---|
| Function | This factor multiplied by the value of "O1.LIMIT" results in threshold 2 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: O2.FACT1 < **O3.FACT2** < O4.FACT3 |
| Factory setting | 2.0 | |

| **O4.FACT3** | **Factor 3** | |
|---|---|---|
| Function | This factor multiplied by the value of "O1.LIMIT" results in threshold 3 of the process diagnostics. | |
| Setting range | 0.1 ... 40.0 | Condition: O2.FACT1 < O3.FACT2 < **O4.FACT3** |
| Factory setting | 5.0 | |

## Activate and configure "Monitoring of number of changes in direction"

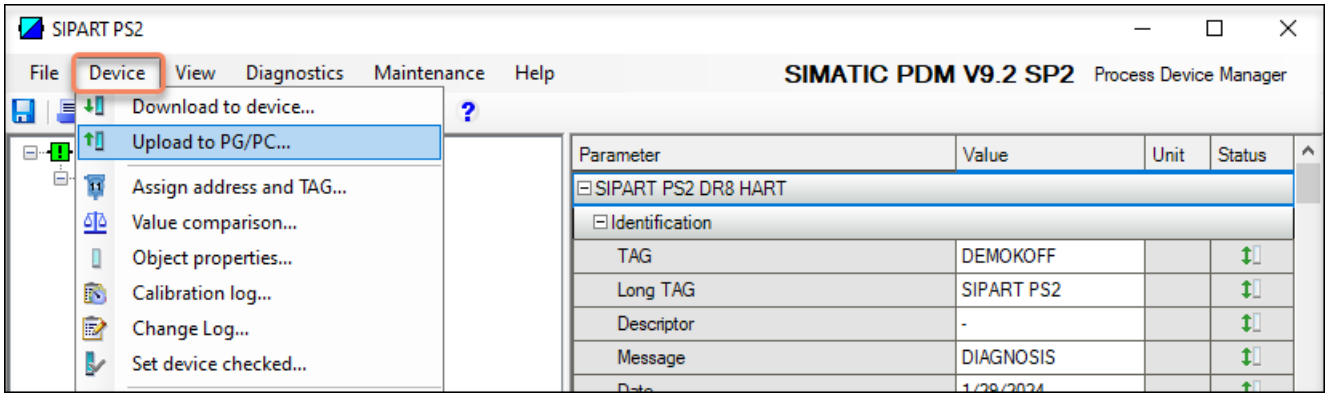
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "O.\DCHG" of the "Monitoring number of changes in direction" process diagnostics.
3. Set the "O.\DCHG" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the thresholds to the valve, change the parameter values:
   - O1.LIMIT
   - O2.FACT1
   - O3.FACT2
   - O4.FACT3

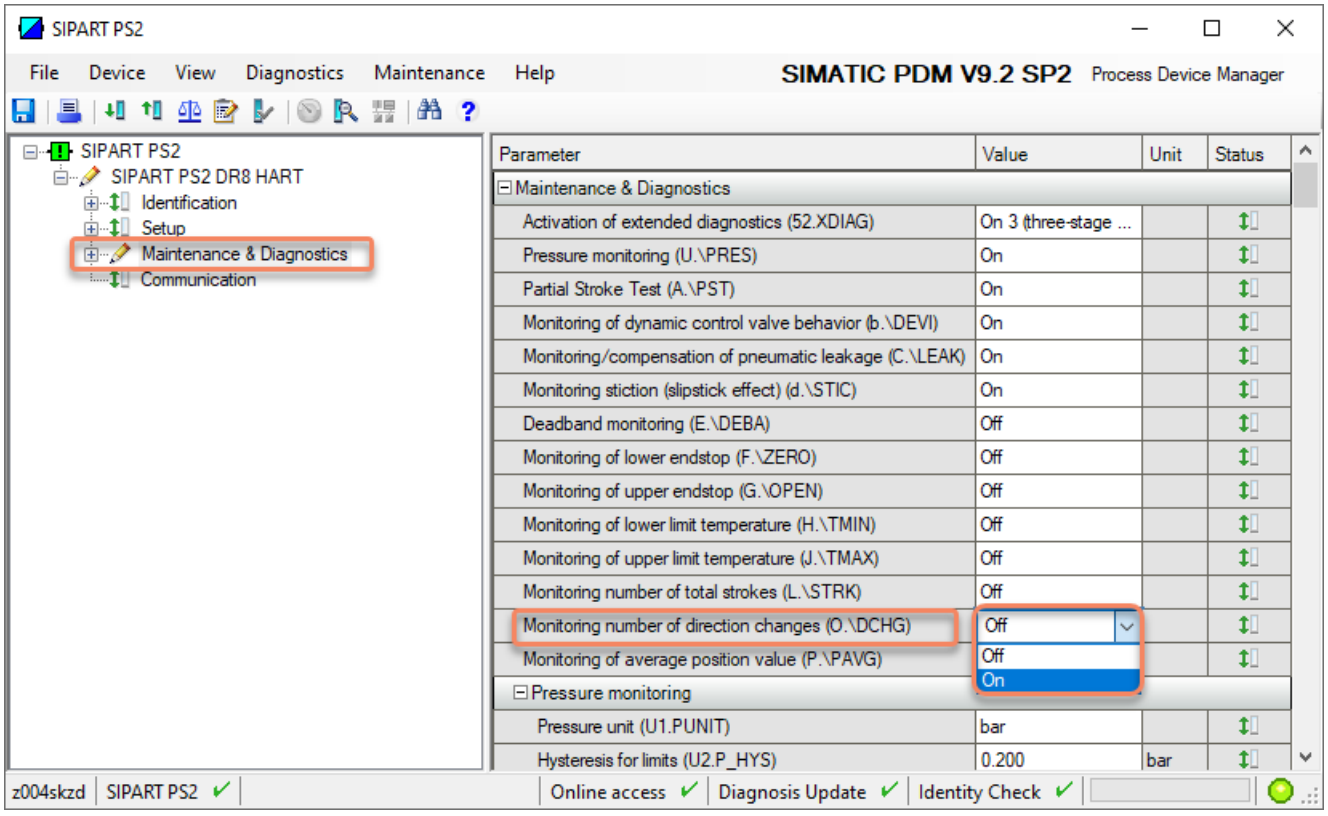
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring number of direction changes" (O.\DCHG), set the value to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - O1.LIMIT
   - O2.FACT1
   - O3.FACT2
   - O4.FACT3
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

### 5.15.3 Diagnostic value "Direction change" (2.CHDIR)

| **Diagnostic value** | **Direction changes**<br>**Short designation: 2.CHDIR** | |
|---|---|---|
| Function | During operation, the counter records and totals every change of direction with a movement greater than 0.25%. | |
| Note | The diagnostic value can be reset. | |
| Display range | 0 ... 4.29E9 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_number_dirchange |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #169 |
| | Response Data | Bytes: 12 ... 15<br>Format: Unsigned-32 |

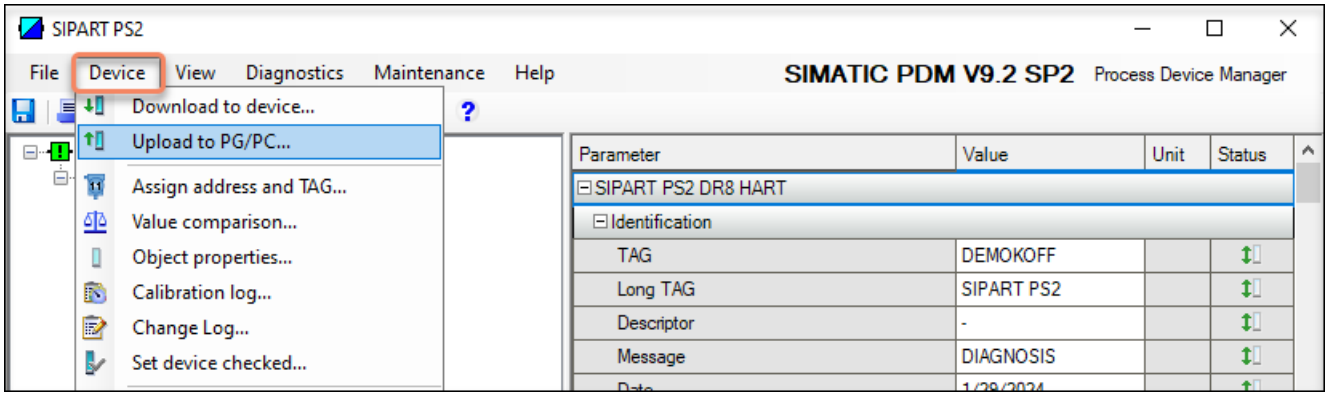
### 5.15.4 With SIMATIC PDM: Export diagnostics results

#### Requirement

- The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

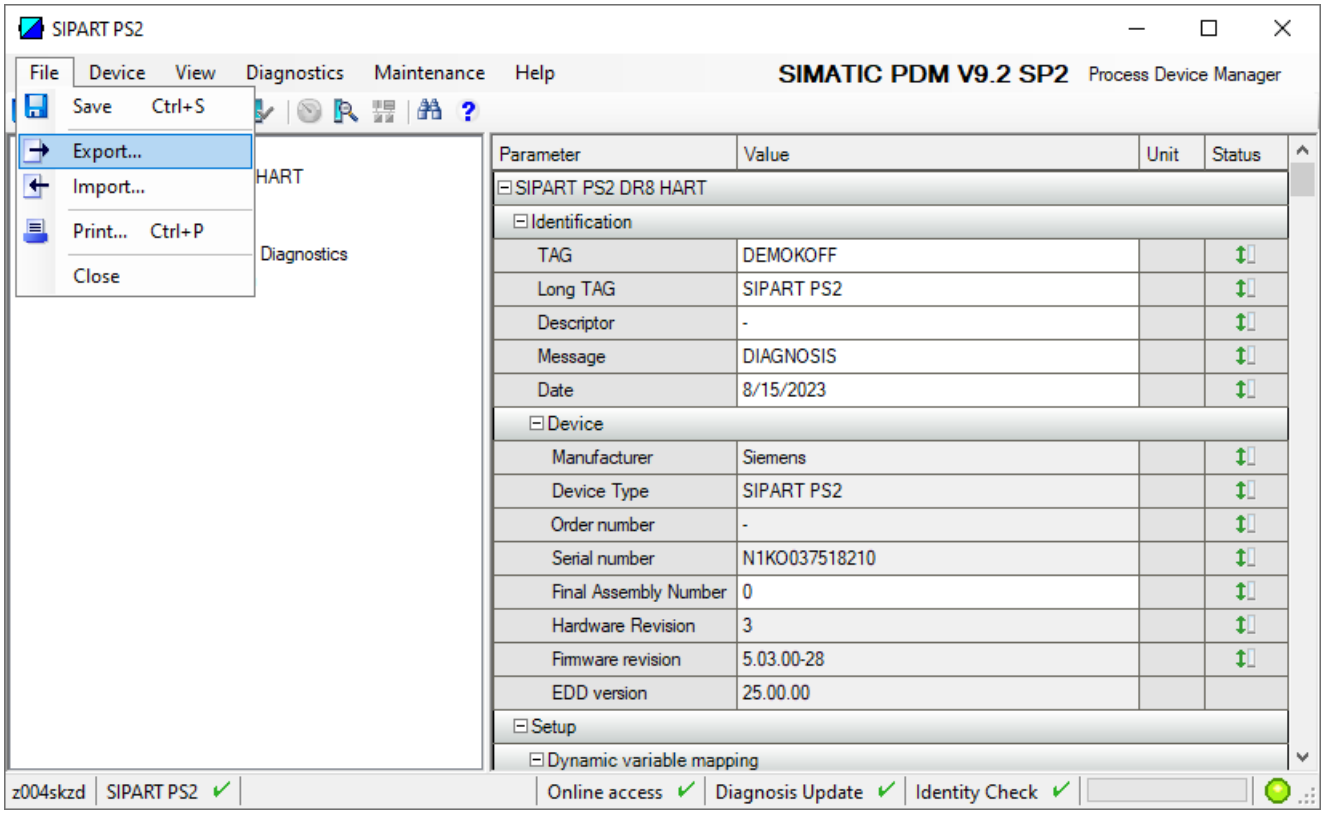
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



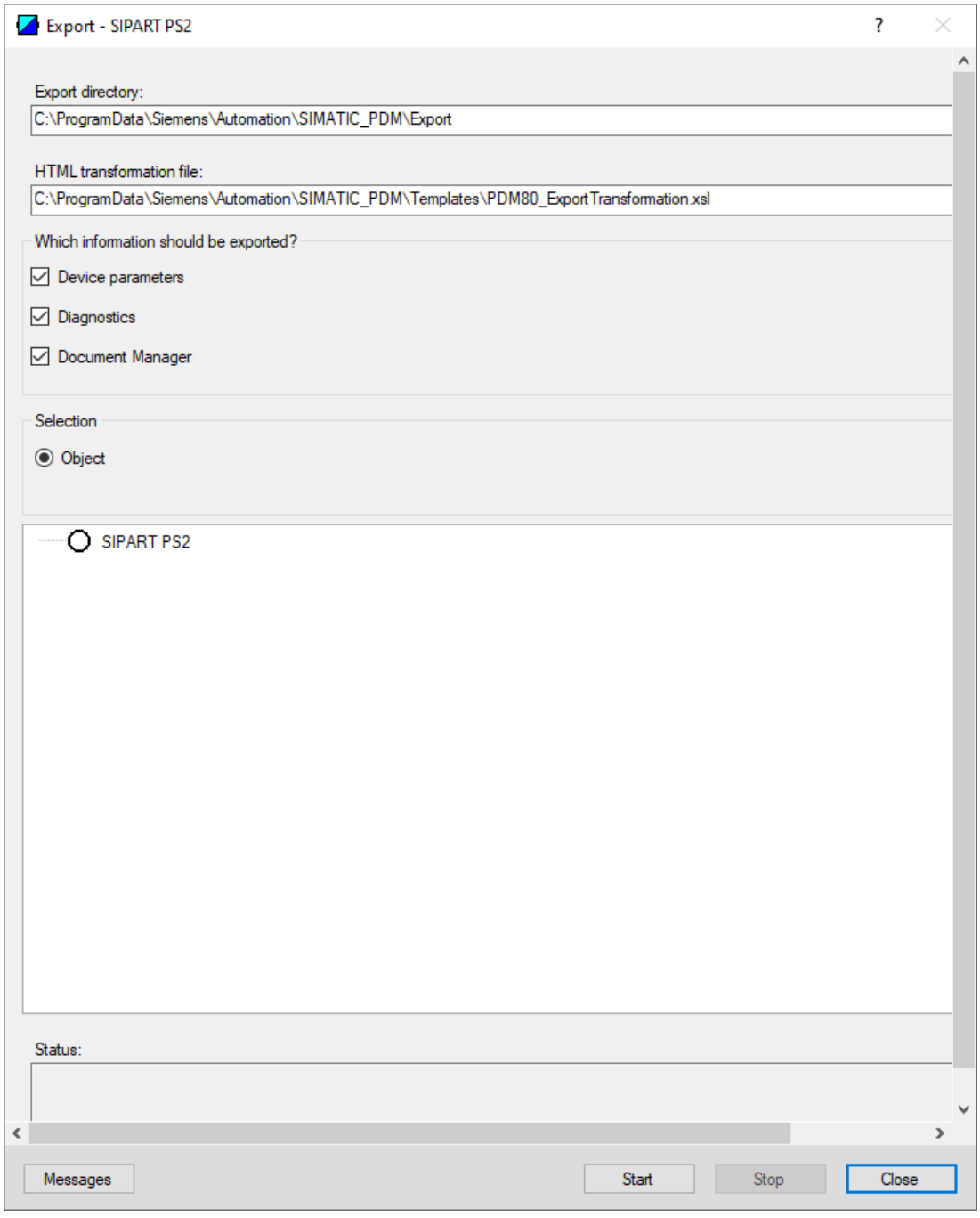

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "File" menu, select the "Export..." command.



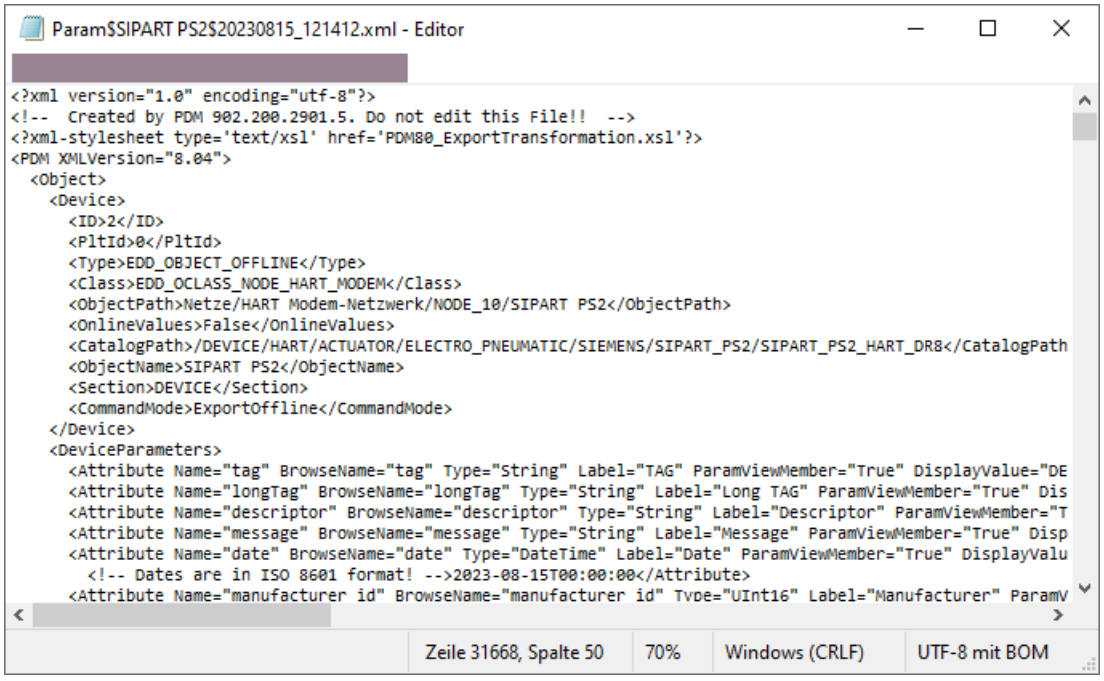

⇒ The "Export - ..." dialog opens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.

9. Wait until the status "Export: Action finished" is displayed.
   The following 2 files are stored in the export path:
   - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
   - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
10. Close the dialog.
11. Open the XML file with suitable software, e.g. an editor.




The data for process diagnostics is labeled with Name = "ps2_number_dirchange".
Exemplary data line:
<Attribute Name="**ps2_number_dirchange**" BrowseName="ps2_number_dirchange" Type="UInt32" Label="Direction changes (2.CHDIR)" ParamViewMember="True" **DisplayValue="337"** Import="True" State="16" Unit="">337</Attribute>
⇒ The numerical value at "DisplayValue", e.g. "337", is the number of changes in direction with a movement greater than 0.25%.

## 5.15.5 Messages

### 5.15.5.1 General information

#### Requirement

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

#### Notes

If the limits are exceeded:

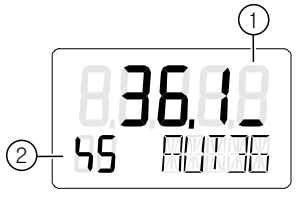
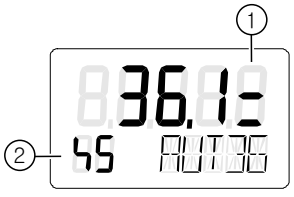
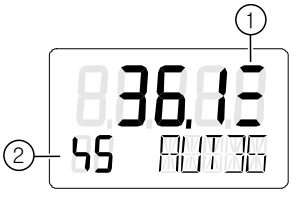
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.15.5.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "5" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 5 | ① 2 bars<br>② Error code 5 | ① 3 bars<br>② Error code 5 |

### 5.15.5.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

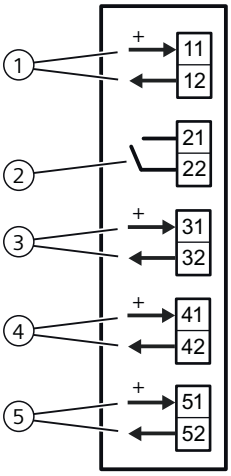
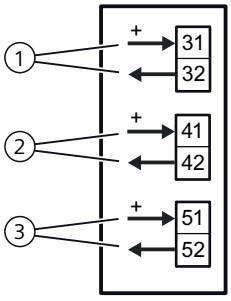
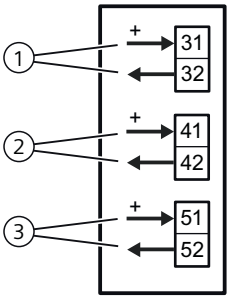
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| **Digital I/O Module (DIO) 6DR4004-6A / -8A** | **Inductive Limit Switches (ILS) 6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS) 6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

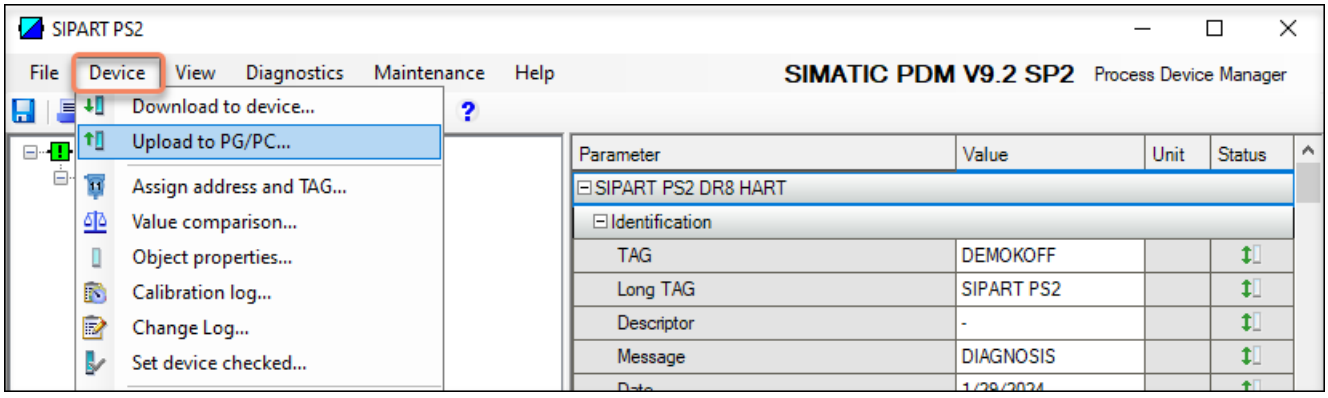
### 5.15.5.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

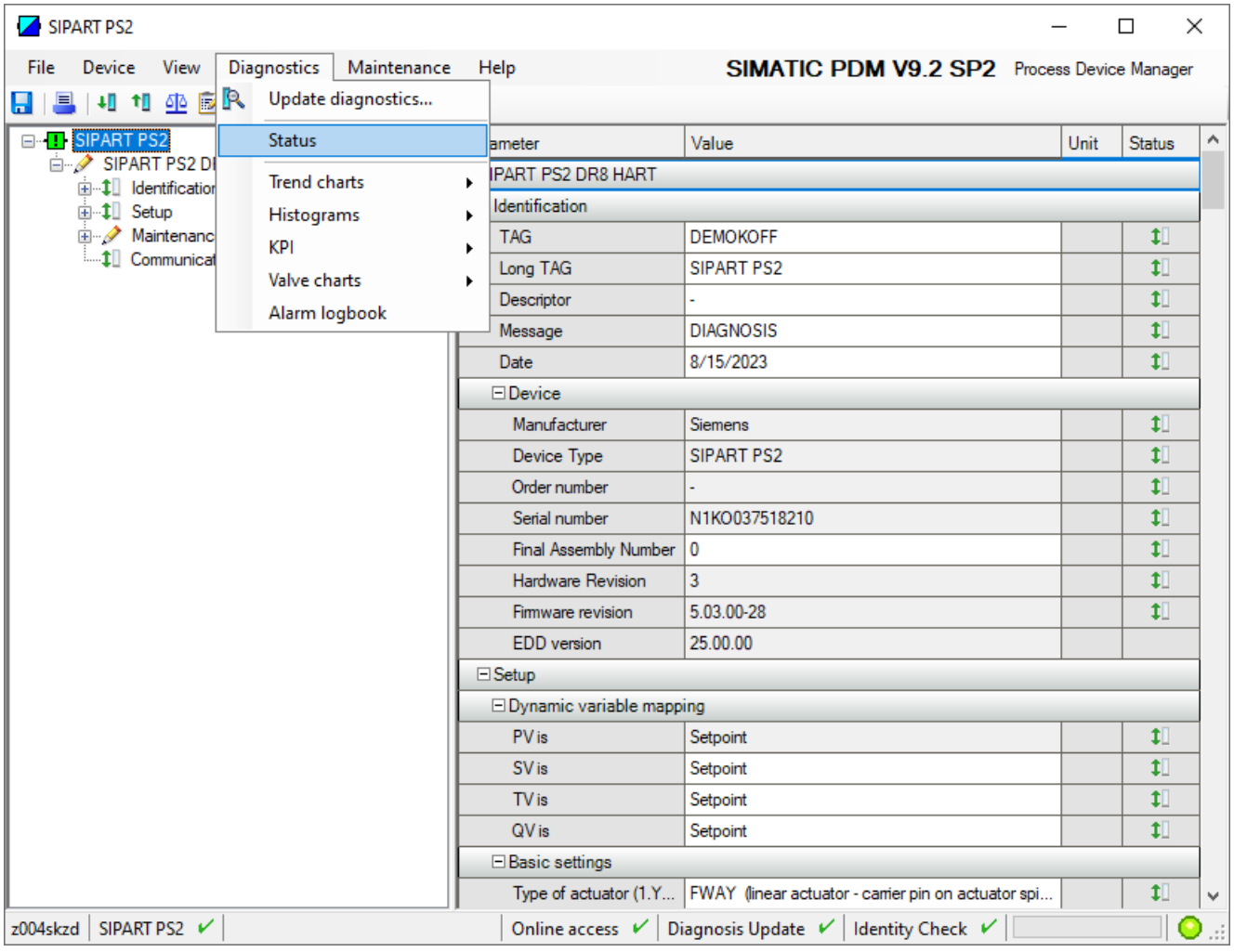
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Device" menu of SIMATIC PDM, select the command "Upload to PG/PC...".

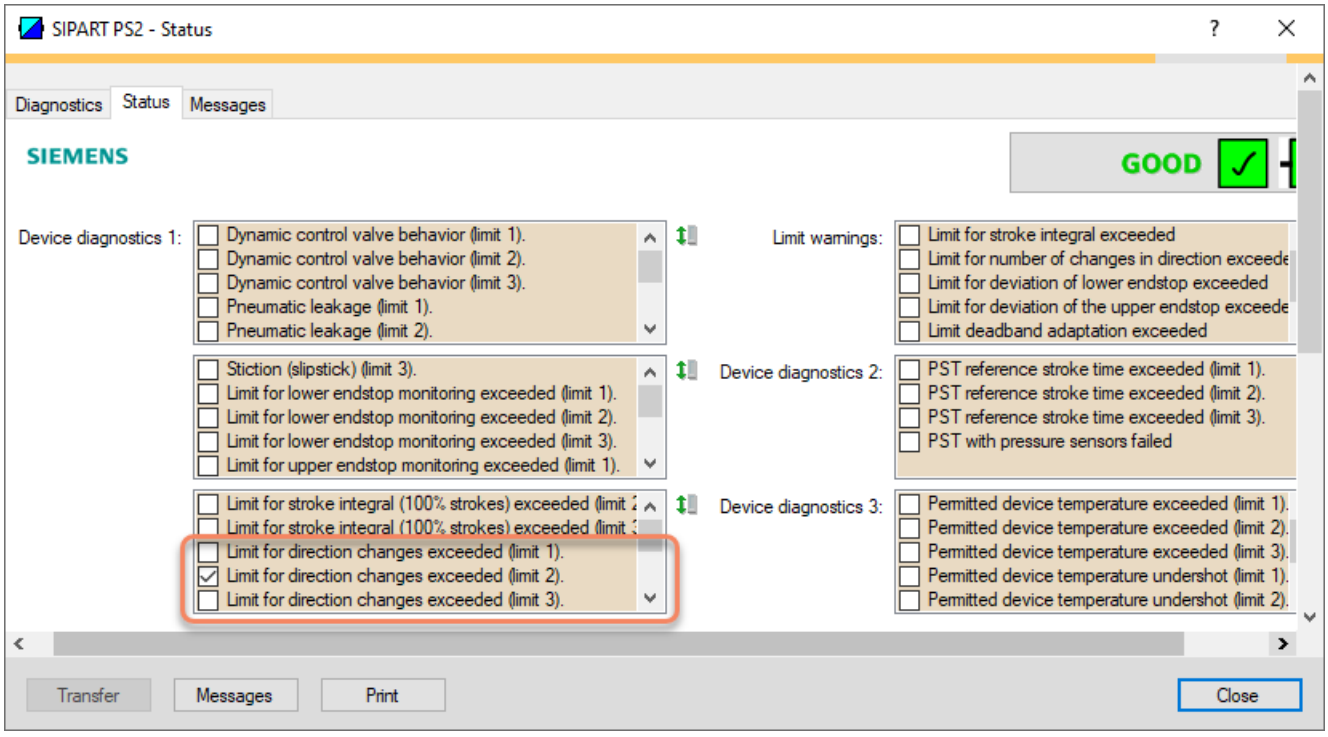



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Limit for direction changes exceeded (limit x)" is highlighted.




8. Close the dialog.

### 5.15.5.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "O.\DCHG" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 16, bit 5 corresponds to threshold 1 exceeded.
  - Byte 16, bit 4 corresponds to threshold 2 exceeded.
  - Byte 16, bit 3 corresponds to threshold 3 exceeded.

#### 5.15.5.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.16 Monitoring the position average value (P.\PAVG)

### 5.16.1 Functional description

Process diagnostics monitors the pipes for blockages or leaks during a continuous process.

For this, the positioner forms a reference average value for the valve position over an adjustable period of time.

During diagnostics, the current average position value of the valve is compared with the reference average value.

The current average position value is displayed in the "Average position value" diagnostic value (20.PAVG).

Process diagnostics can be monitored with adjustable thresholds. If these thresholds are violated, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.16.2 Activate and configure diagnostics

### Requirement

The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### Process diagnostics "Monitoring of average position value" (P.\PAVG)

| | | |
|---|---|---|
| Function | Process diagnostics monitors the pipes for blockages or leaks during a continuous process. | |
| Note | The current average position value is displayed in the "Average position value" diagnostic value (20.PAVG). | |
| Setting options | Off | Process diagnostics are deactivated. |
| | On | Process diagnostics is activated. |
| Factory setting | Off | |

### Process diagnostics parameters

If process diagnostics is activated with "On", the following process diagnostics parameters are visible.

| **P1.TBASE** | **Time basis for average value generation** | |
|---|---|---|
| Function | The parameter defines the time base for the time intervals for calculating the reference average value and the current average position value of the process valve. | |
| Note | The reference average value is calculated in the 1st time base.<br>In the following time intervals, the current average position value is calculated and compared with the reference average value. | |
| Setting options | 0,5 h | 30 minutes |
| | 8 h | 8 hours |
| | 5 d | 5 days |
| | 60 d | 60 days |
| | 2,5 y | 2.5 years |
| Factory setting | 0,5 h | |

| **P2.STATE** | **Reference average value** | |
|---|---|---|
| Function | The parameter shows the status or the value of the determined reference average value. | |
| Note | With local operation, this parameter can be used to start the determination of the reference average value and the position average value. | |
| Display options | IdLE | The reference average value has not yet been established. |
| | Strt | The creation of the reference average value was started. |
| | rEF | The reference average value is currently being established. |
| | ###,# | Calculated reference average value in percent |
| Factory setting | IdLE | |

**Note**

**Current average position value**

The current average position value is displayed in the "Average position value" diagnostic value (20.PAVG).

If an average position value has not yet been determined, the value "COMP" is displayed.

| **P3.LEVL1** | **Threshold 1** | |
|---|---|---|
| Function | The parameter defines threshold 1 for the maximum percentage deviation of the current position average value from the reference average value. | |
| Setting range | 0.1 ... 100.0 | Condition: **P3.LEVL1** < P4.LEVL2 < P5.LEVL3 |
| Factory setting | 2.0 | |
| Unit | % | |

| **P4.LEVL2** | **Threshold 2** | |
|---|---|---|
| Function | The parameter defines threshold 2 for the maximum percentage deviation of the current position average value from the reference average value. | |
| Setting range | 0.1 ... 100.0 | Condition: P3.LEVL1 < **P4.LEVL2** < P5.LEVL3 |
| Factory setting | 5.0 | |
| Unit | % | |

| **P5.LEVL3** | **Threshold 3** | |
|---|---|---|
| Function | The parameter defines threshold 3 for the maximum percentage deviation of the current position average value from the reference average value. | |
| Setting range | 0.1 ... 100.0 | Condition: P3.LEVL1 < P4.LEVL2 < **P5.LEVL3** |
| Factory setting | 10.0 | |
| Unit | % | |

## Activate and configure "Monitoring of average value of position"

Process diagnostics can be activated and configured using the following 2 options.

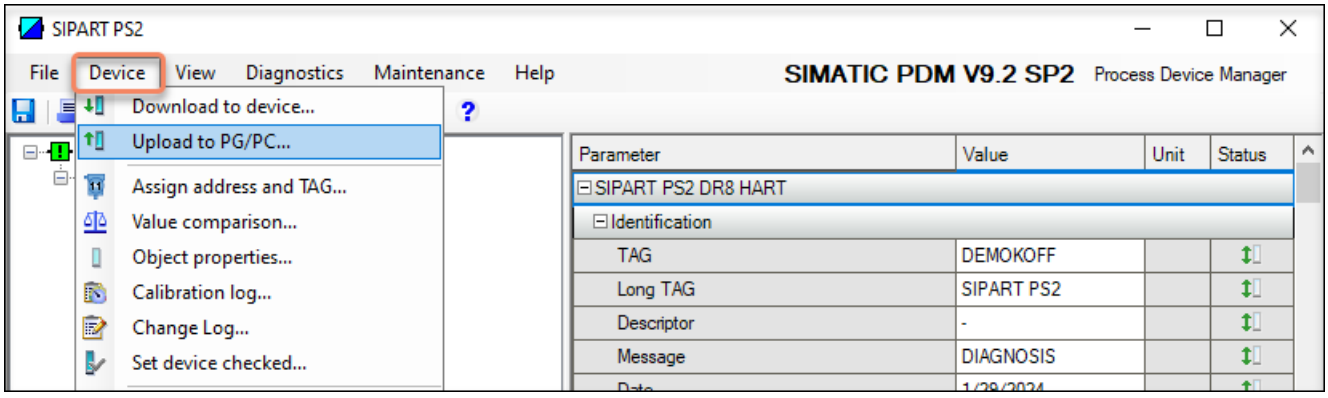
**Local operation**

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "P.\PAVG" of the process diagnostics "Monitoring of average position value".
3. Set the "" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.

4. To adapt the thresholds to the valve, change the parameter values:
   - P1.TBASE
   - P3.LEVL1
   - P4.LEVL2
   - P5.LEVL3
5. Select the "P2.STATE" parameter.
   This parameter starts the calculation of the average position value.
   If an average reference value has never been determined, the parameter is set to "IdLE".
6. Press the ⚠ button for at least 5 seconds.
   ⇒ The indicator in the display changes from "IDLE" to "rEF".
   ⇒ The reference average value is determined in the time base set in the "P1.TBASE" parameter.
   ⇒ When the 1st time interval has elapsed, e.g. "0.5h", the determined reference average value is shown on the display, e.g. "50.2".
   ⇒ Once the 2nd time interval has elapsed, the current average position value is shown in the diagnostic value "Average position value" (20.PAVG).

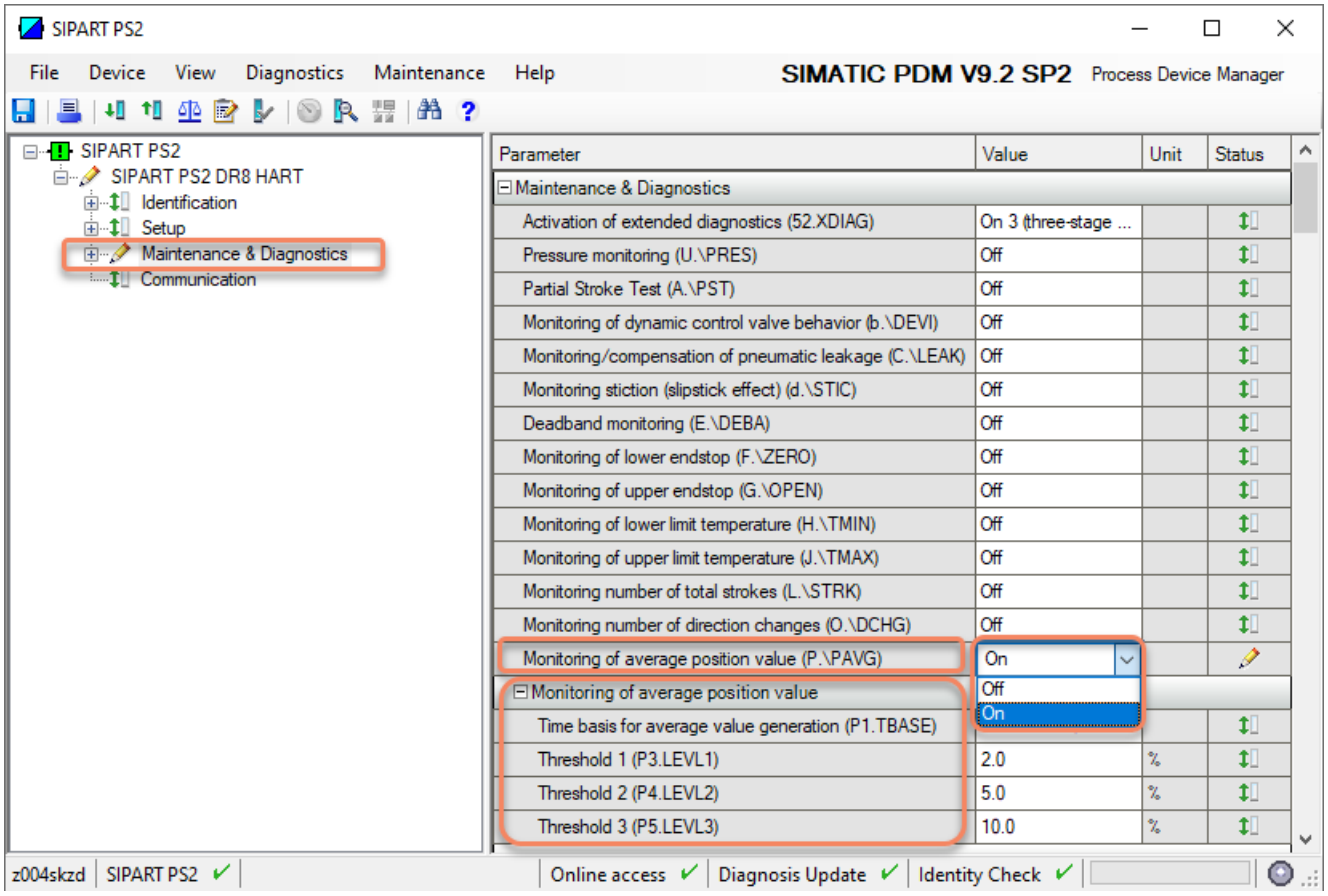
**Remote operation with SIMATIC PDM**

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



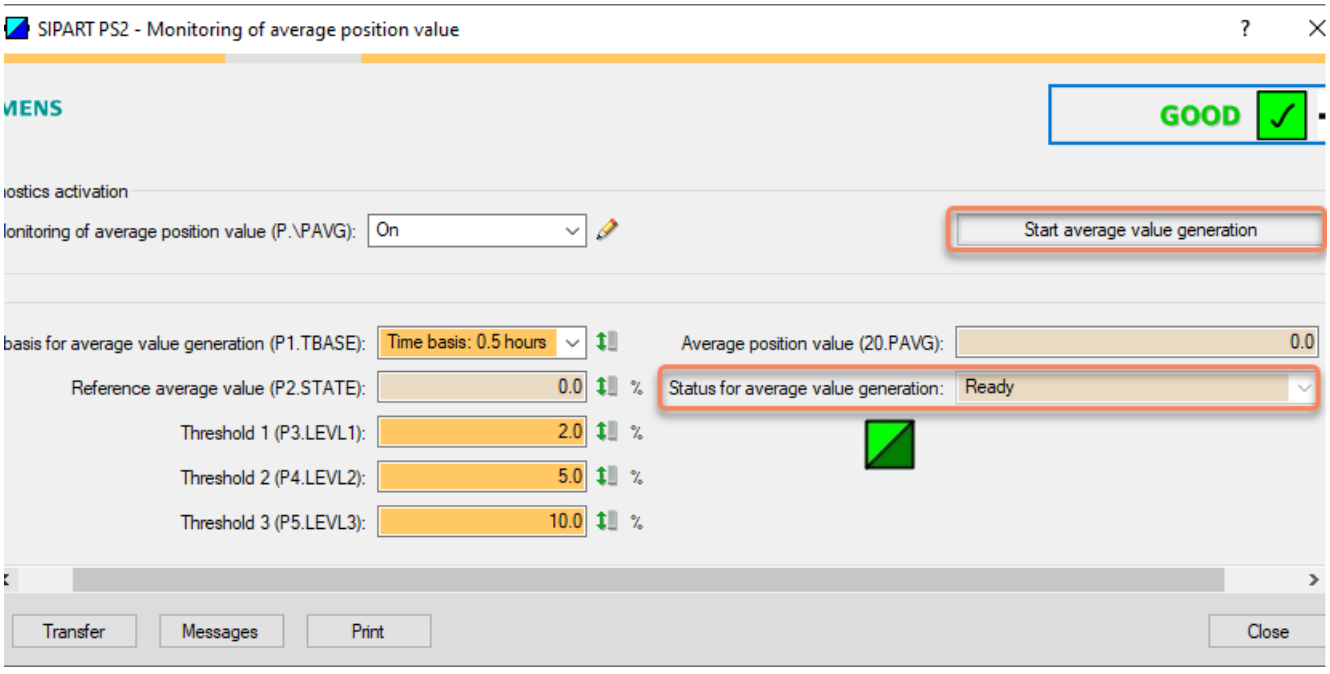

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. Select the "Maintenance & Diagnostics" directory.




7. For "Monitoring of average position value" (P.\PAVG), set the value "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
8. To adapt the thresholds to the valve, change the parameter values:
   - P1.TBASE
   - P3.LEVL1
   - P4.LEVL2
   - P5.LEVL3
9. In the "Device" menu of SIMATIC PDM, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to PG/PC: Action finished" is displayed.
13. Close the dialog.

14. In the "Device" menu, select the command "Maintenance and Diagnostics > Monitoring of average position value".
    ⇒ The "Monitoring of average position value " dialog opens.



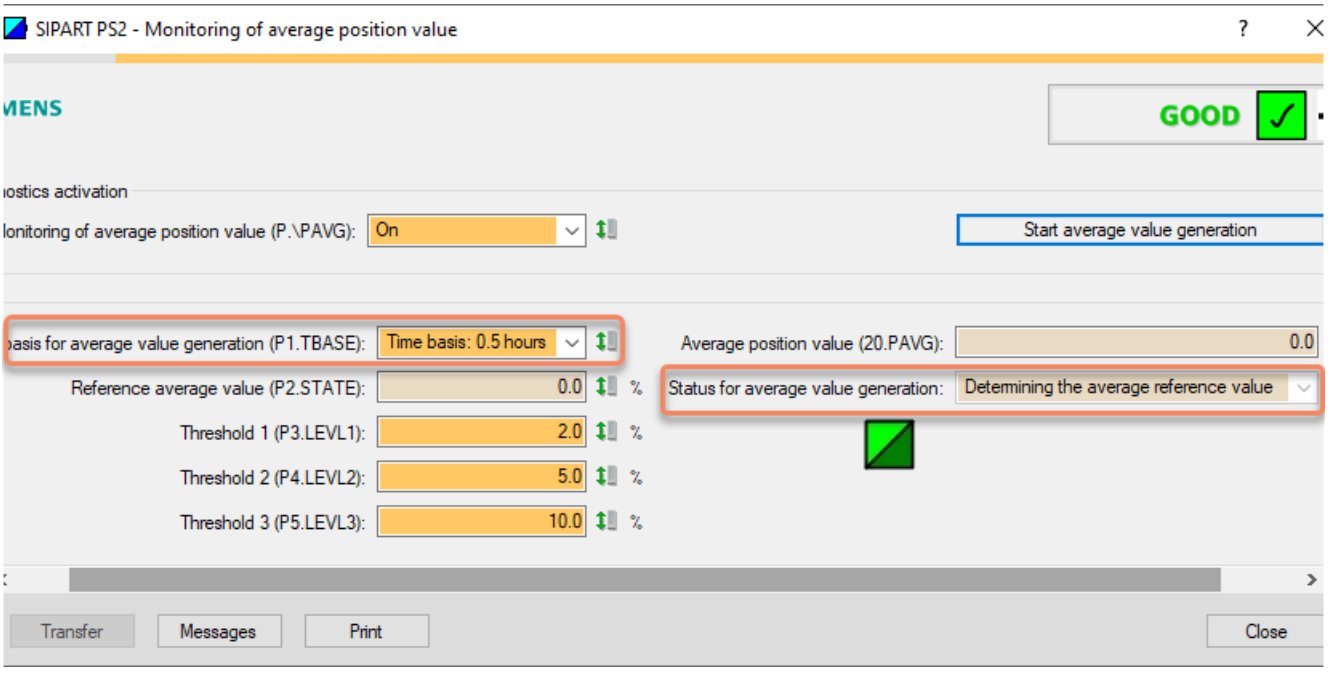

15. Note the status in the "Status for average value generation" dialog box.
    No diagnostics can be started with the "Ready" status.
    The following states are possible:

| Status | Description |
|---|---|
| Off | The diagnostics is deactivated. |
| Ready | The diagnostics can be started. |
| Determining the average reference value | - |
| Determining the average value of position | - |
| Value is valid | - |

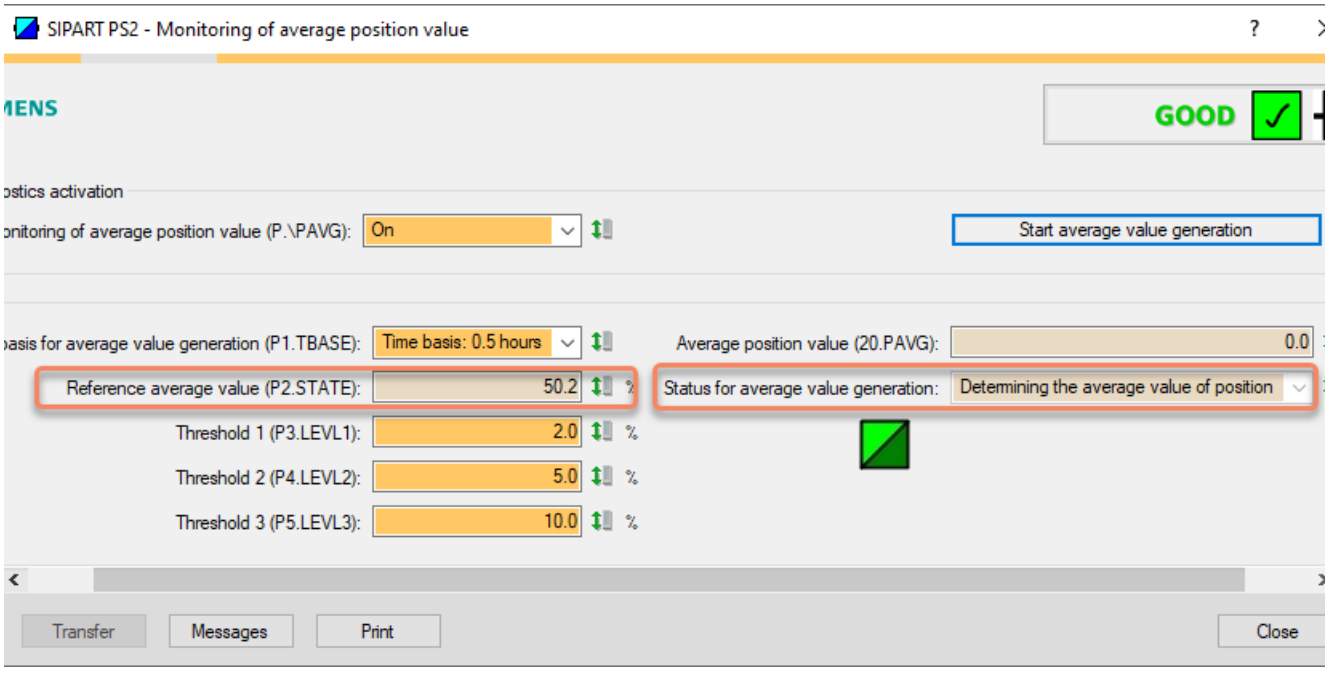
16. Click the "Start average value generation" button.
    ⇒ The "Start average value generation" dialog opens.

17. Confirm the diagnostics and close the dialog.
    ⇒ An additional dialog opens.

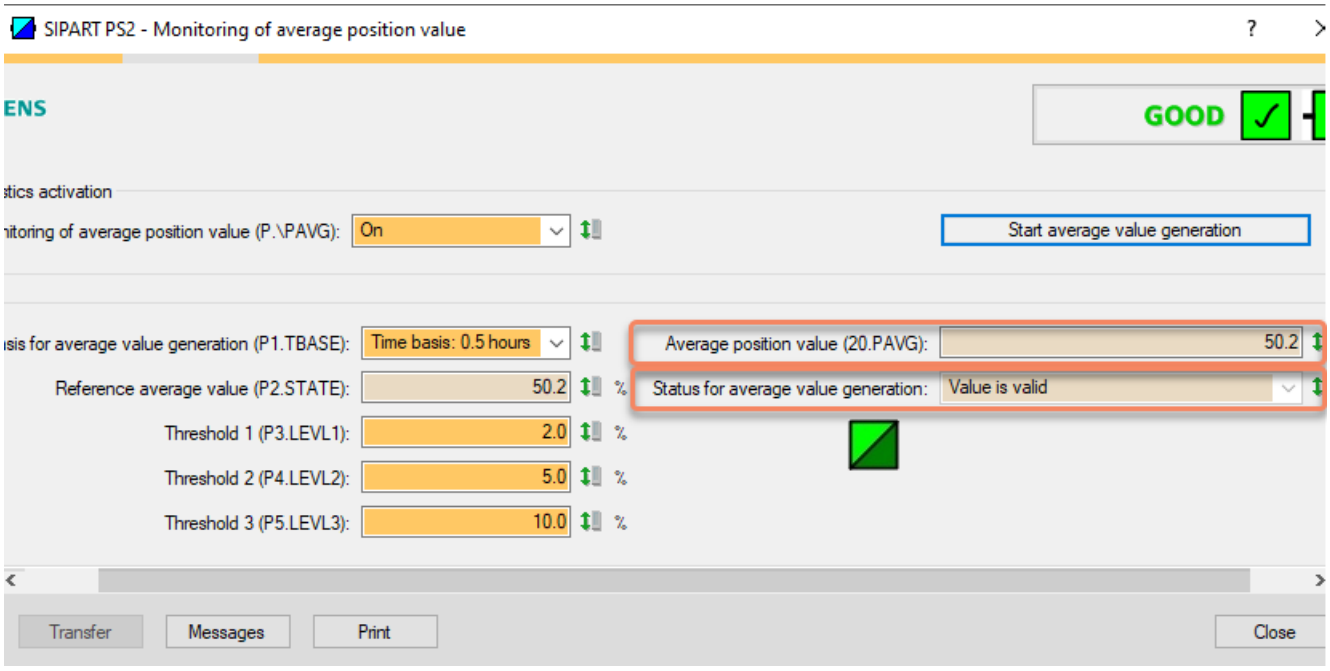
18. Confirm the start to determine the reference average value.
⇒ The reference average value is determined in the time base (time interval) set in the "P1.TBASE" parameter.
⇒ In the "Status for average value generation" dialog box, the status changes to "Determining the average reference value" .




After the set 1st time interval has elapsed:
⇒ In the "Reference average value" (P2.STATE) dialog box, the determine value is displayed, e.g. "50.2".
⇒ The status changes to "Determining the average value of position".



After the 2nd time interval has elapsed:
⇒ The determined current diagnostic value "Average position value" 20.PAVG is displayed, e.g. "50.2".
⇒ The status changes to "Value is valid".




19. Close the dialog with the "Close" button.

### 5.16.3 Diagnostic value "Average value of position" (20.PAVG)

| **Diagnostic value** | **Average position value**<br>**Short designation: 20.PAVG** | |
|---|---|---|
| Function | The diagnostic value shows the status of the process diagnostics "Monitoring of average position value" (P.\PAVG) or the last calculated average position value of the valve position during the time base set in the process diagnostics. | |
| Display options | OFF | The process diagnostics "Monitoring of average position value" (P.\PAVG) is deactivated. |
| | IdLE | The process diagnostics "Monitoring of average position value" (P.\PAVG) is activated but not yet started. |
| | rEF | Process diagnostics "Monitoring of average position value" (P.\PAVG) has been started and the reference average value "P2.STATE" is currently being calculated. |
| | COMP | The current average position value of the valve is currently being calculated. |
| | 0.0 ... 100.0 | Calculated average position value |
| Unit | % | |
| **Communication** | | |
| SIMATIC PDM Export | Name | ps2_pos_avg_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #171 |
| | Response Data | Bytes: 26 ... 29<br>Format: Float |

### 5.16.4 Messages

#### 5.16.4.1 General information

**Requirement**

- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- Process diagnostics is activated.

### Notes

If the limits are exceeded:

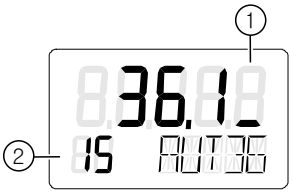
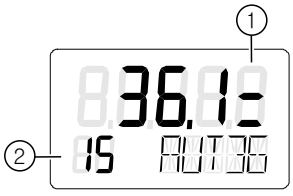
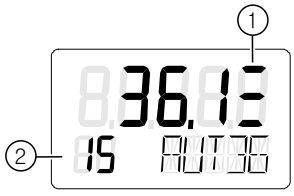
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.16.4.2 Messages in the display

#### Indication on the display

If the set thresholds are exceeded, error code "15" is output.

If several messages are present at the same time, the display switches between the different error codes.

| If threshold 1 is exceeded | If threshold 2 is exceeded | If threshold 3 is exceeded: |
|---|---|---|
|  |  |  |
| ① 1 bar<br>② Error code 15 | ① 2 bars<br>② Error code 15 | ① 3 bars<br>② Error code 15 |

### 5.16.4.3 Messages via digital signals

#### Requirement

The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Digital I/O Module (DIO)

**If the application parameter "52.XDIAG" is set to "On3" and threshold 1 is exceeded**

- The digital output "DO1" is activated.

**If the application parameter "52.XDIAG" is set to "On2" or "On3" and threshold 2 is exceeded**

- The digital output "DO2" is activated.
- The digital output "DO1" is deactivated (with "52.XDIAG" = "On3").

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.
- The digital output "DO2" is deactivated (with "52.XDIAG" = "On2").
- The digital outputs "DO1" and "DO2" are deactivated (for "52.XDIAG" = "On3").

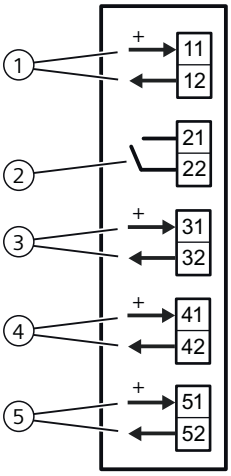
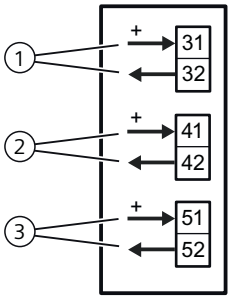
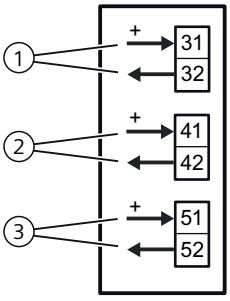
#### Inductive Limit Switches (ILS) or Mechanic Limit Switches (MLS)

On the ILS and MLS modules, only the "Fault message output" is available as a digital output. Only exceeding threshold 3 is output.

**If the application parameter "52.XDIAG" is set to "On1", "On2" or "On3" and threshold 3 is exceeded**

- The digital output "Fault signal output" is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault message output, has no function in combination with 6DR4004-3ES<br>② Digital output 1<br>③ Digital output 2 | ① Fault message output, has no function in combination with 6DR4004-4ES<br>② Digital output 1<br>③ Digital output 2 |

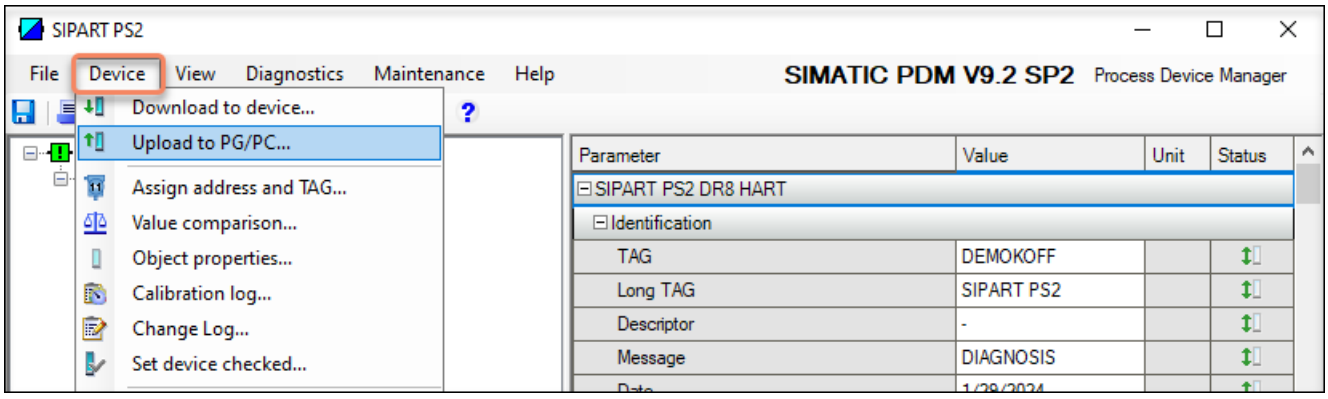
### 5.16.4.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

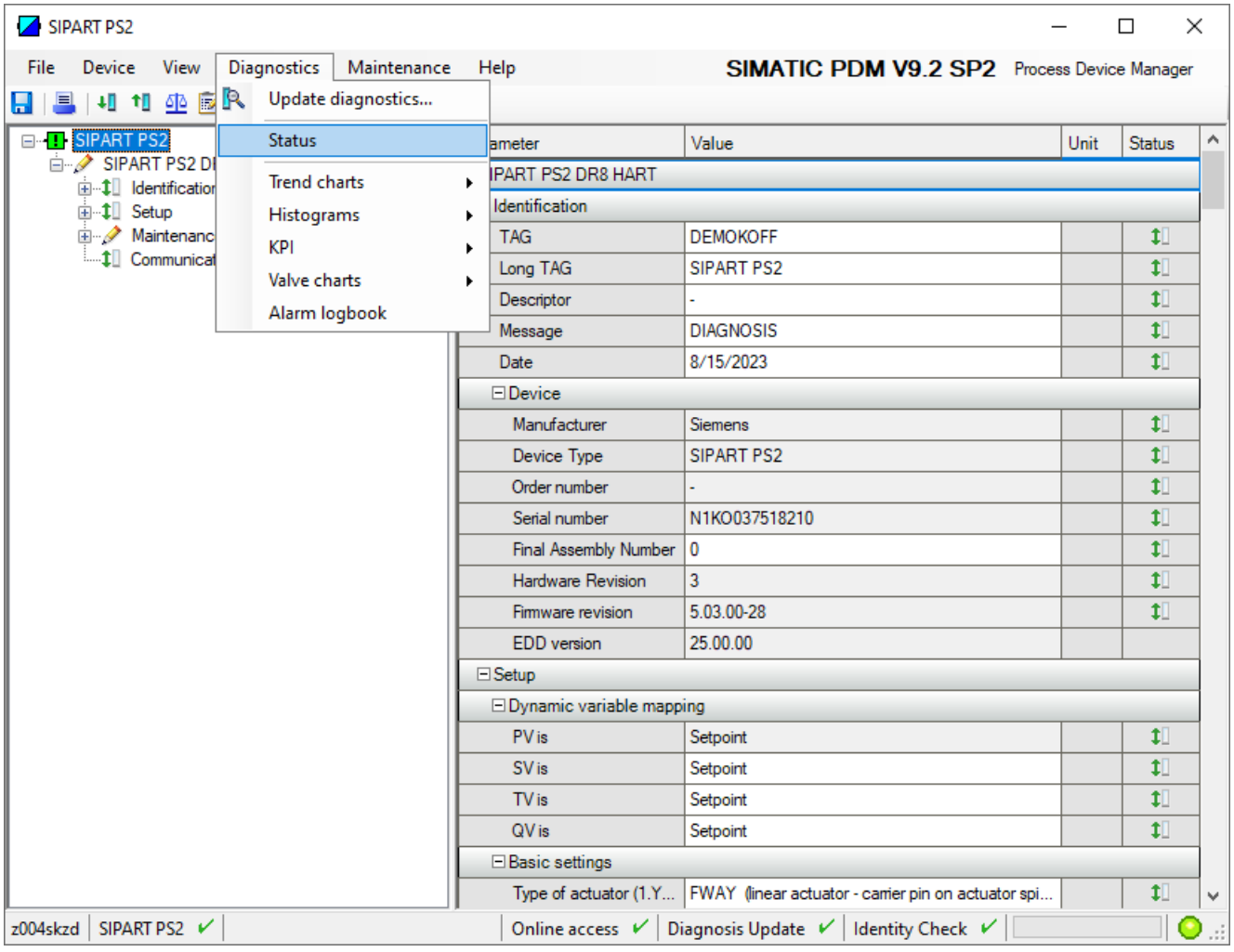
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

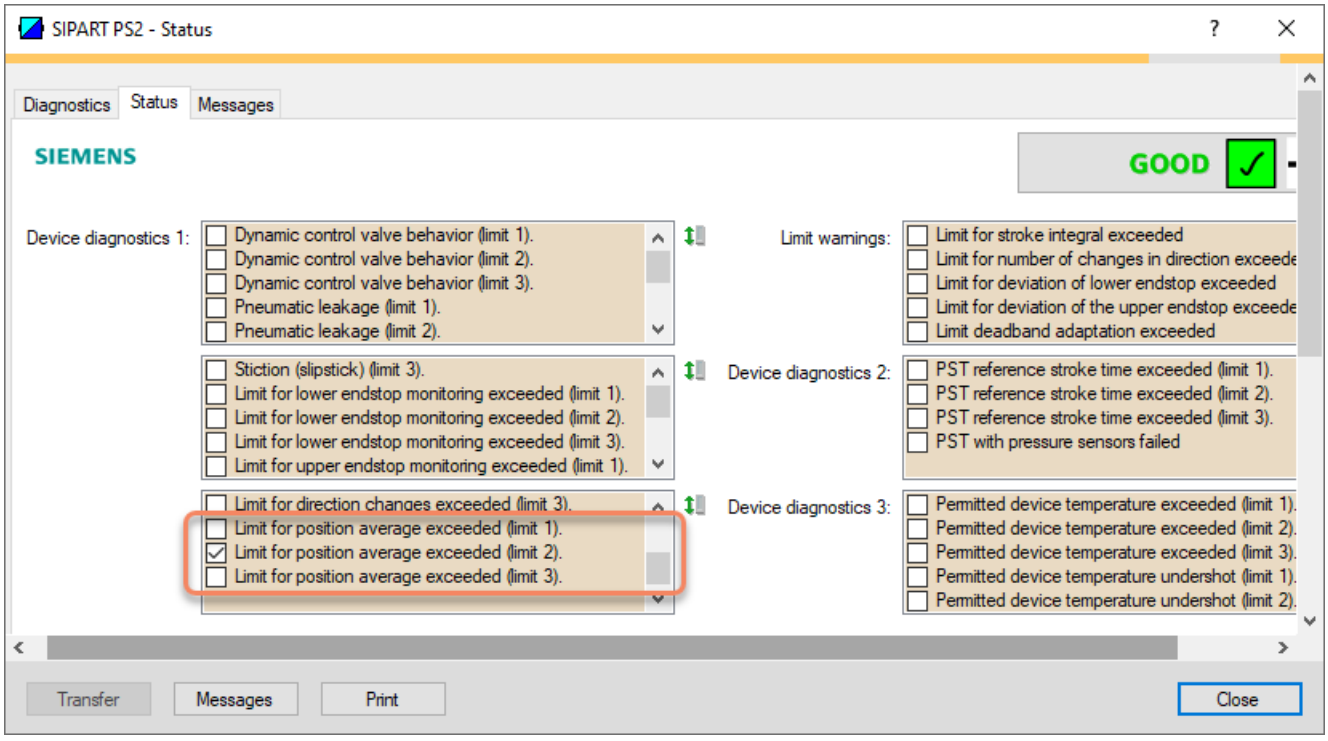



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Status" tab.
   When a threshold is exceeded, the message "Limit for position average exceeded (limit x)" is highlighted.




8. Close the dialog.

### 5.16.4.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

#### Get message

If a process diagnostics threshold is violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  When the thresholds for the "P.\PAVG" process diagnostics are exceeded, the messages are contained in the following bytes:
  - Byte 16, bit 2 corresponds to threshold 1 exceeded.
  - Byte 16, bit 1 corresponds to threshold 2 exceeded.
  - Byte 16, bit 0 corresponds to threshold 3 exceeded.

#### 5.16.4.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

If the threshold is no longer exceeded during process diagnostics, the message on the display disappears, e.g. after successful maintenance or if the process conditions change.

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

## 5.17 Monitoring of supply pressure PZ (pressure sensor-supported)

### 5.17.1 Functional description

The process diagnostics monitors the supply pressure PZ.

Process diagnostics parameters:

- Hysteresis for limits (U2.P_HYS)
- Lower limit PZ (U5.PZMLL)
- Upper limit PZ (U6.PZMUL)
- Behavior of the positioner when the value violates the lower limit PZ (U3.PFRL)
- Behavior of the positioner when the upper limit PZ (U4.PFRUL) is violated

Process diagnostics parameters:

- Current supply pressure PZ (60.PZ)
- Maximum supply pressure PZ (63.PZMAX)
- Event counter violations of lower limit PZ (64.N_MIN)
- Event counter violations of upper limit PZ (65.N_MAX)

**Ring memory**

The process diagnostics data obtained is stored in the ring memory of the positioner.

In each case, 20 data entries are stored in 5 ring memories for different lengths of time using the FIFO method (First In - First Out) .

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 30 minutes | 20 | 1.5 minutes (90 seconds) |
| Last 8 hours | 20 | 24 minutes |
| Last 5 days | 20 | 6 hours |

| Ring memory for time span | Amount of data | Time interval between the data |
|---|---|---|
| Last 2 months | 20 | 3 days |
| Last 30 months | 20 | 45 days |

The data can be stored in Device Manager Software, such as SIMATIC PDM, as a trend and exported for further processing.

The data can be read and further processed using HART commands.

The process diagnostics are monitored with adjustable thresholds. If the upper or lower limits are violated, messages are output via the display and optionally via the digital contacts or HART communication.

## 5.17.2 Activate and configure diagnostics

### Requirement

- The positioner has pressure sensors (Z P01 or -Z P02 option)
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### General parameters for pressure sensor-based diagnostics

| **U1.PUNIT** | **Pressure unit** |
|---|---|
| Function | The parameter defines the pressure unit. |
| Setting options | • bar<br>• MPa<br>• psi |
| Factory setting | bar |

| **U2.P_HYS** | **Hysteresis for limits** | |
|---|---|---|
| Function | The parameter defines the hysteresis for the following parameters:<br>• Lower limit of the supply pressure (U5.PZMLL)<br>• Upper limit of supply pressure (U6.PZMUL)<br>• Limit of the actuating pressure at the Y1 connection (U7.PCL) | |
| Setting range | 0.200 ... 1.000 | bar |
| | 0.020 ... 0.100 | MPa |
| | 2.900 ... 14.50 | psi |
| Factory setting | 0.200 | bar |
| | 0.020 | MPa |
| | 2.900 | psi |

### Process diagnostics parameters

| **U3.PFRLL** | **Behavior lower limit PZ** | |
|---|---|---|
| Function | The parameter defines the behavior of the positioner as soon as the lower limit of the supply pressure PZ is violated. | |
| Note | If the supply pressure fails or if the supply pressure is less than 1.4 bar:<br>• Observe the note in the section "Behavior in the event of failure of the electrical auxiliary energy and/or the supply pressure PZ" in the operating instructions. | |
| Setting options | Cont<br>≙ No reaction -> Automatic (Auto) mode> | The positioner continues to follow the setpoint. |
| | HoLd<br>≙ Hold current position (HOLd) | The current position is held.<br>The positioner follows the setpoint again only when the supply pressure PZ has exceeded the lower limit again. |
| Factory setting | Cont | |

| **U4.PFRUL** | **Behavior upper limit PZ** | |
|---|---|---|
| Function | The parameter defines the behavior of the positioner as soon as the upper limit of the supply pressure PZ is violated. | |
| Setting options | Cont<br>≙ No reaction -> Automatic (Auto) mode> | The positioner continues to follow the setpoint. |
| | HoLd<br>≙ Hold current position (HOLd) | The current position is held.<br>The positioner follows the setpoint again, only when the supply pressure PZ has fallen below the upper limit again. |
| Factory setting | Cont | |

| **U5.PZMLL** | **Lower limit PZ** | |
|---|---|---|
| Function | The parameter defines the minimum required supply pressure PZ. | |
| Note | If the supply pressure fails or if the supply pressure is less than 1.4 bar:<br>• Observe the note in the section "Behavior in the event of failure of the electrical auxiliary energy and/or the supply pressure PZ" in the operating instructions.<br>Diagnostic values:<br>• Current supply pressure PZ (60.PZ)<br>• Event counter violations of lower limit PZ (64.N_MIN) | |
| Setting range | 1.400 ... 7.000 | bar |
| | 0.140 ... 0.700 | MPa |
| | 20.31 ... 101.53 | psi |
| Factory setting | 1.400 | bar |
| | 0.140 | MPa |
| | 20.31 | psi |

| **U6.PZMUL** | **Upper limit PZ** | |
|---|---|---|
| Function | The parameter defines the maximum allowable supply pressure PZ. | |
| Note | • If the value is exceeded: In the "Automatic (AUT)" mode and "Manual (MAN)" mode, the display shows error code "20".<br>• If the supply pressure PZ after exceeding the limit "U6.PZMUL" has fallen below the limit minus the hysteresis"U2.P_HYS", the error code is no longer displayed.<br>If the parameter "U4.PFRUL" is set to "HoLd", the control is active again.<br>Diagnostic values:<br>• Current supply pressure PZ (60.PZ)<br>• Maximum supply pressure PZ (63.PZMAX)<br>• Event counter violations of upper limit PZ (65.N_MAX) | |
| Setting range | 1.400 ... 7.000 | bar |
| | 0.140 ... 0.700 | MPa |
| | 20.31 ... 101.53 | psi |

| U6.PZMUL | Upper limit PZ | |
|---|---|---|
| Factory setting | 7.000 | bar |
| | 0.700 | MPa |
| | 101.53 | psi |

## Activate and configure "Monitoring of supply pressure PZ"

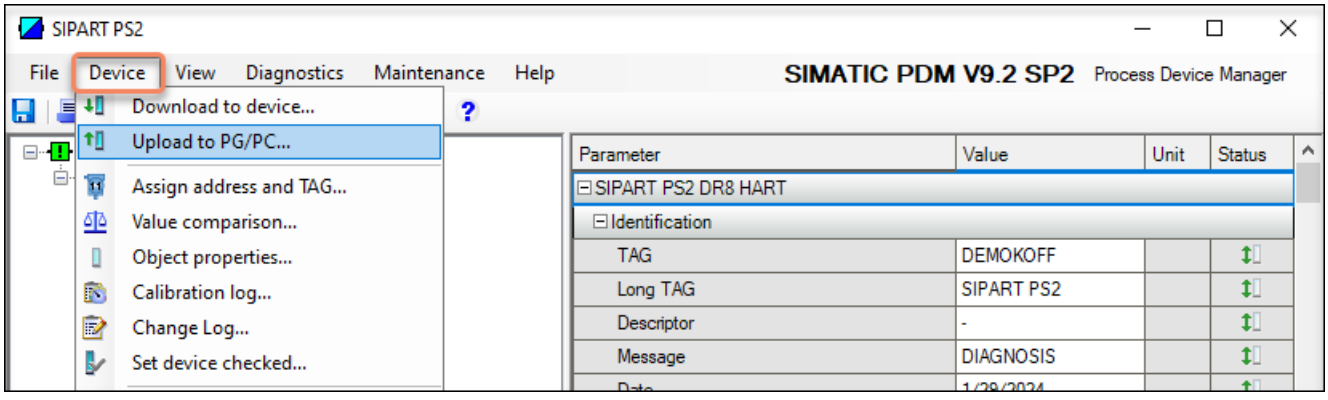
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "U.\PRES" parameter of the "Pressure monitoring".
3. Set the "U.\PRES" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the limits at the valve, change the parameters:
   - U1.PUNIT
   - U2.P_HYS
   - U3.PFRLL
   - U4.PFRUL
   - U5.PZMLL
   - U6.PZMUL

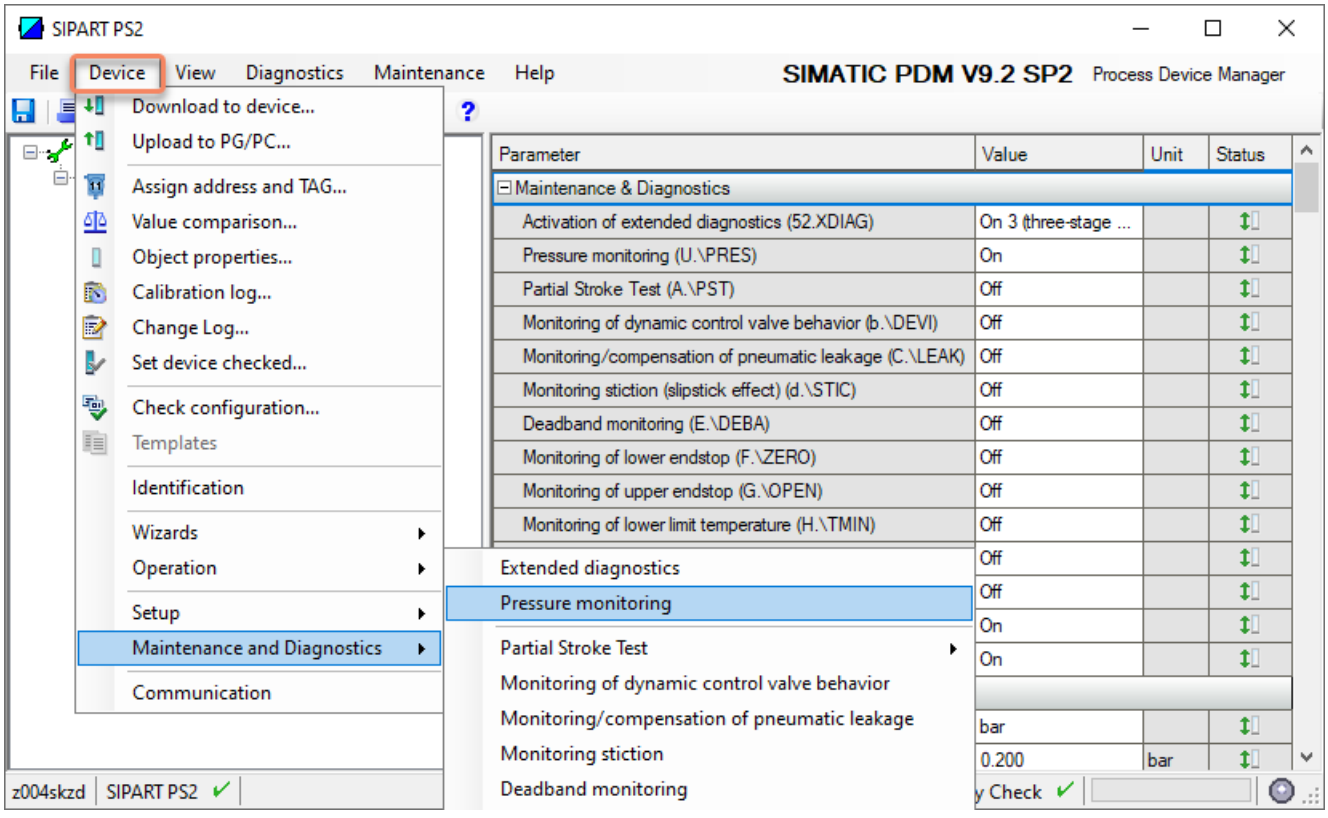
### Remote operation with SIMATC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



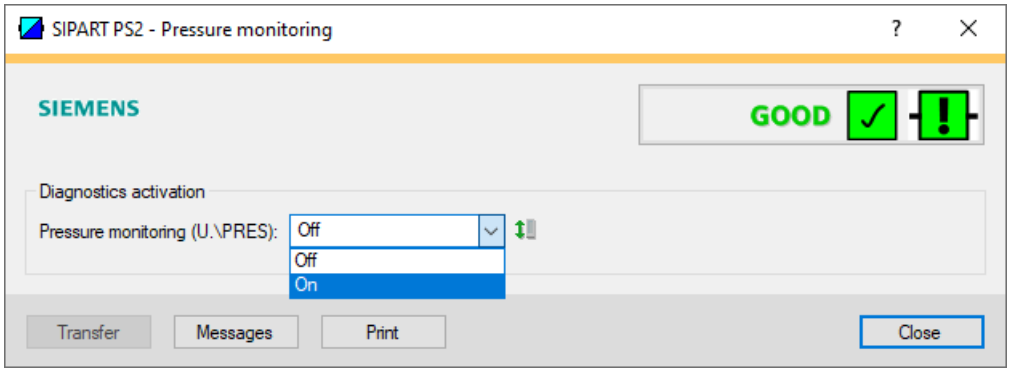

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".

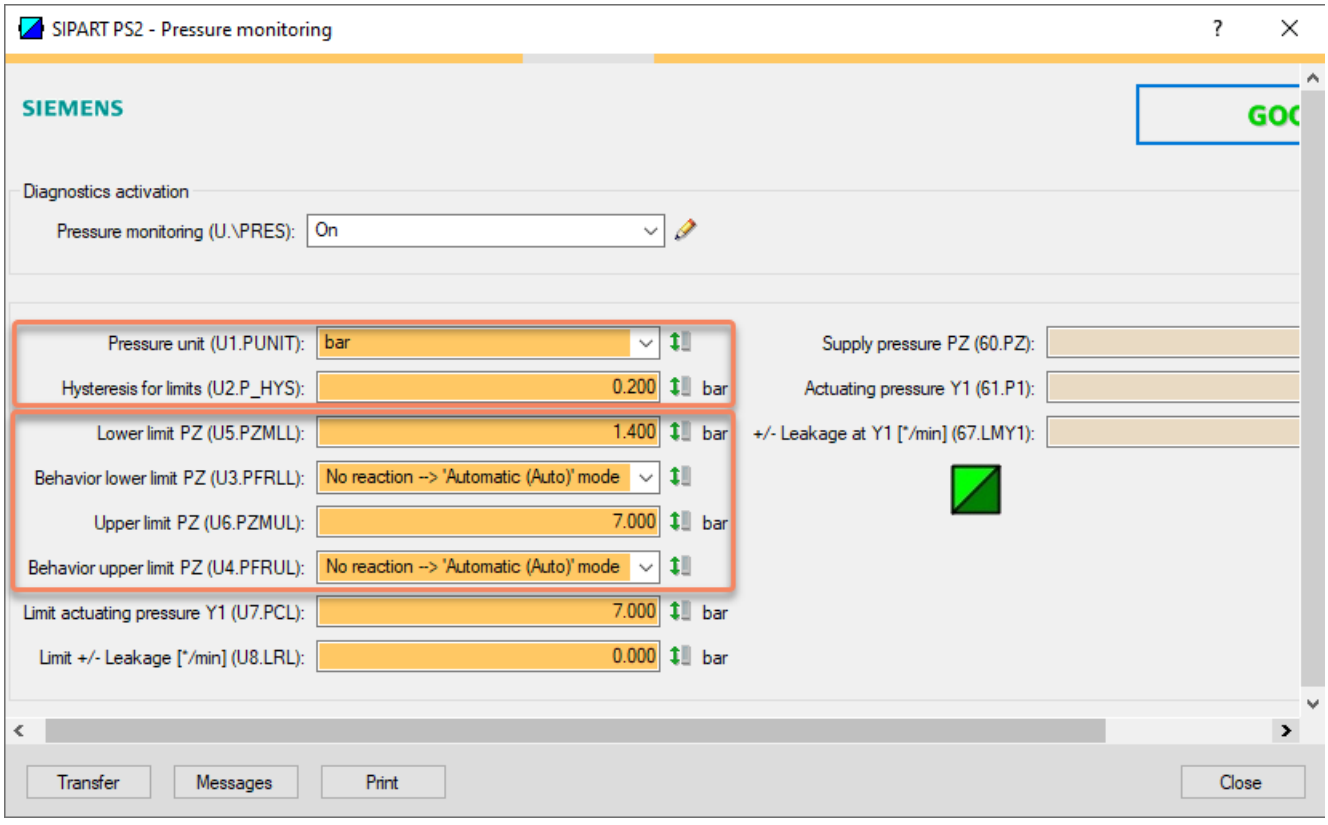



⇒ The "Pressure monitoring" dialog is displayed.

7. Select the "Pressure monitoring" (U.\PRES) with the value "On".




⇒ The dialog is displayed with the current parameters.




8. To adapt the limits at the valve, change the parameters:
   - U1.PUNIT
   - U2.P_HYS
   - U3.PFRLL
   - U4.PFRUL
   - U5.PZMLL
   - U6.PZMUL

9. Transfer these changes to the positioner with the "Transfer" button.
10. Close the dialog.
11. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
12. In the "Upload to PG/PC..." dialog, click the "Start" button.
    ⇒ The current parameters are loaded and displayed in the "Process Device Manager".

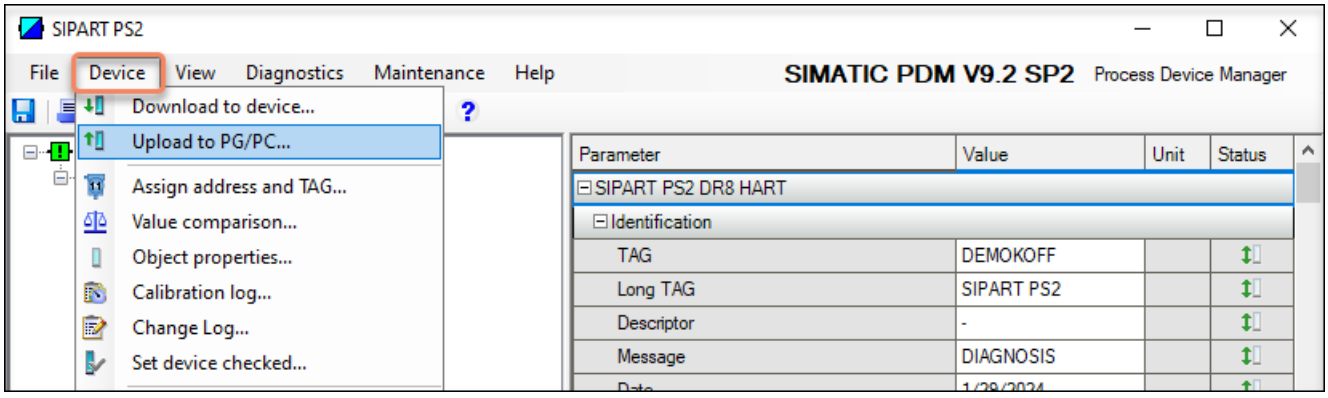
## 5.17.3 With SIMATIC PDM: Show diagnostic results

### Requirement

- The positioner has pressure sensors (Z P01 or -Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

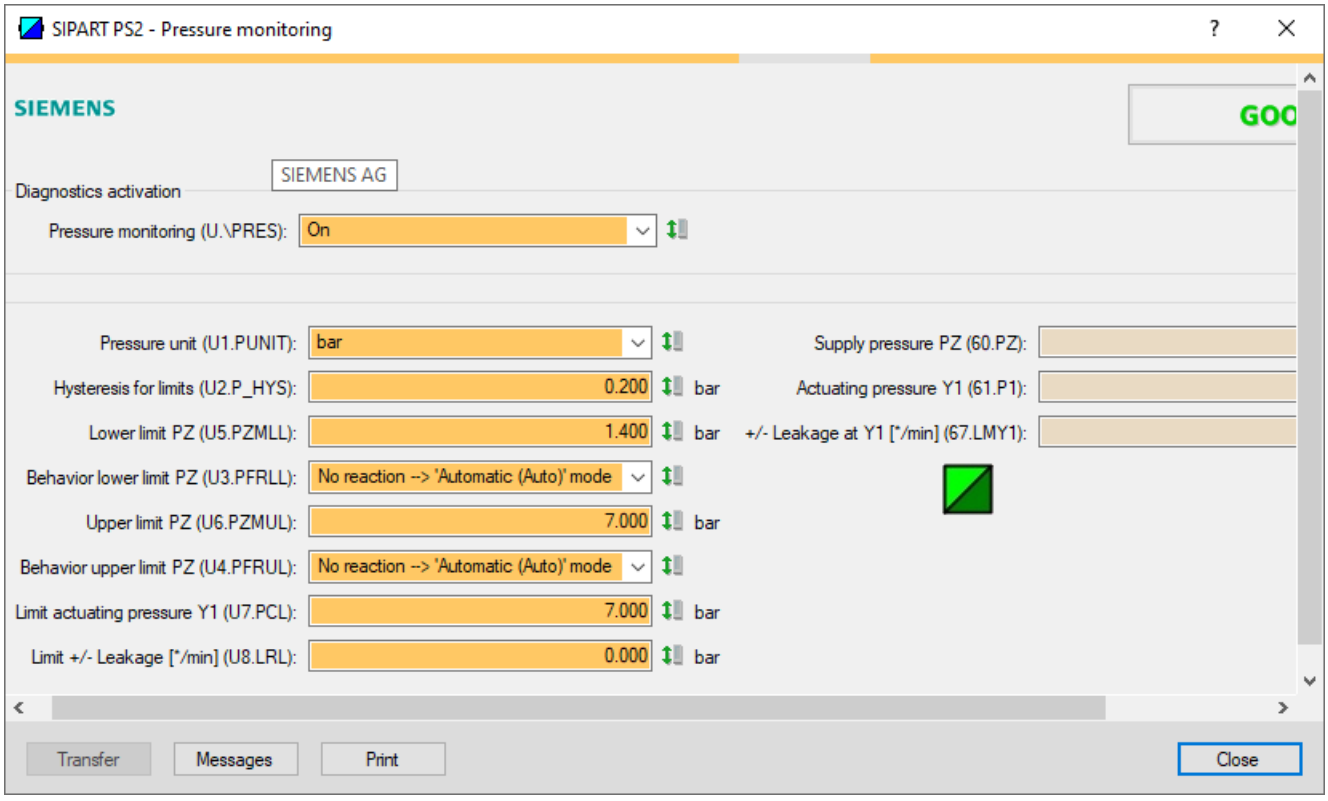
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

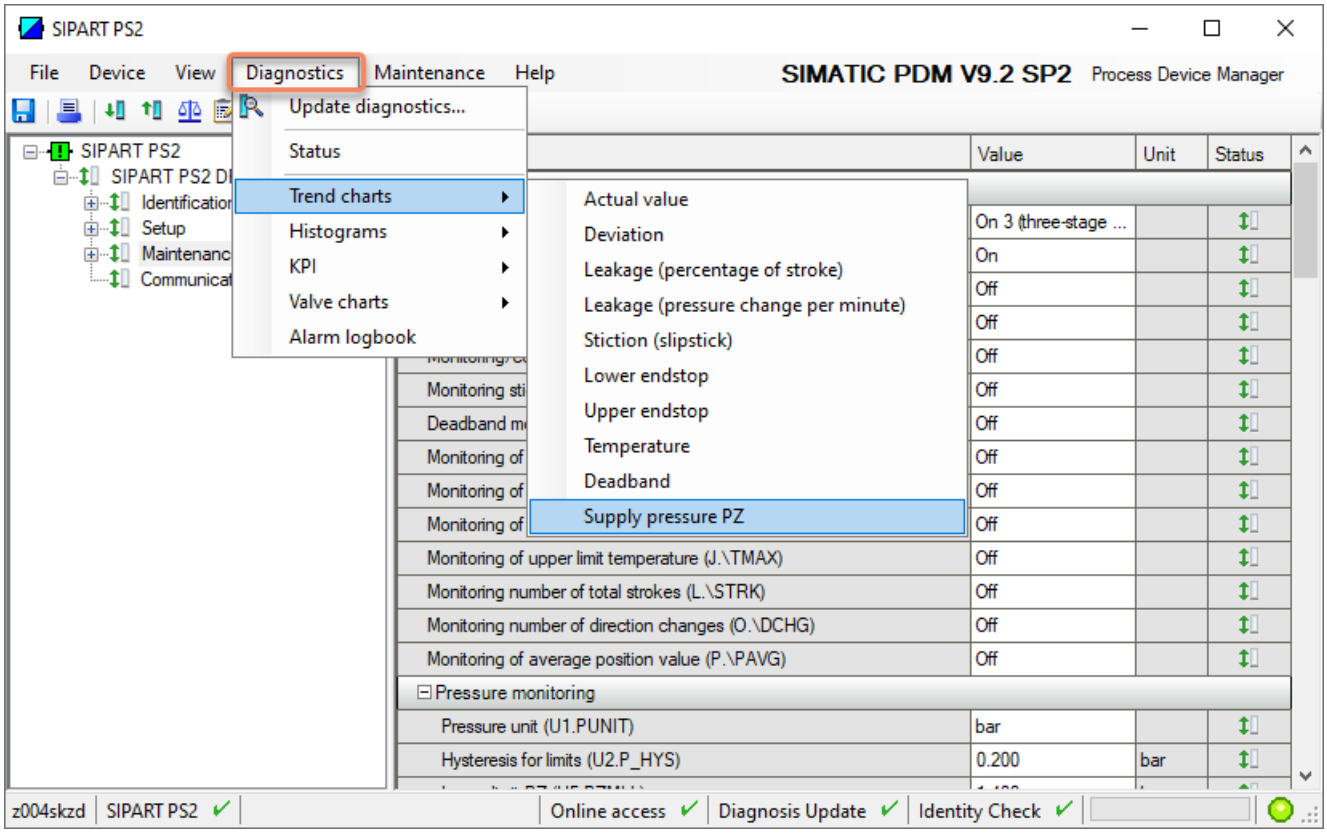



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".
   ⇒ The "Pressure monitoring" dialog shows the current settings.

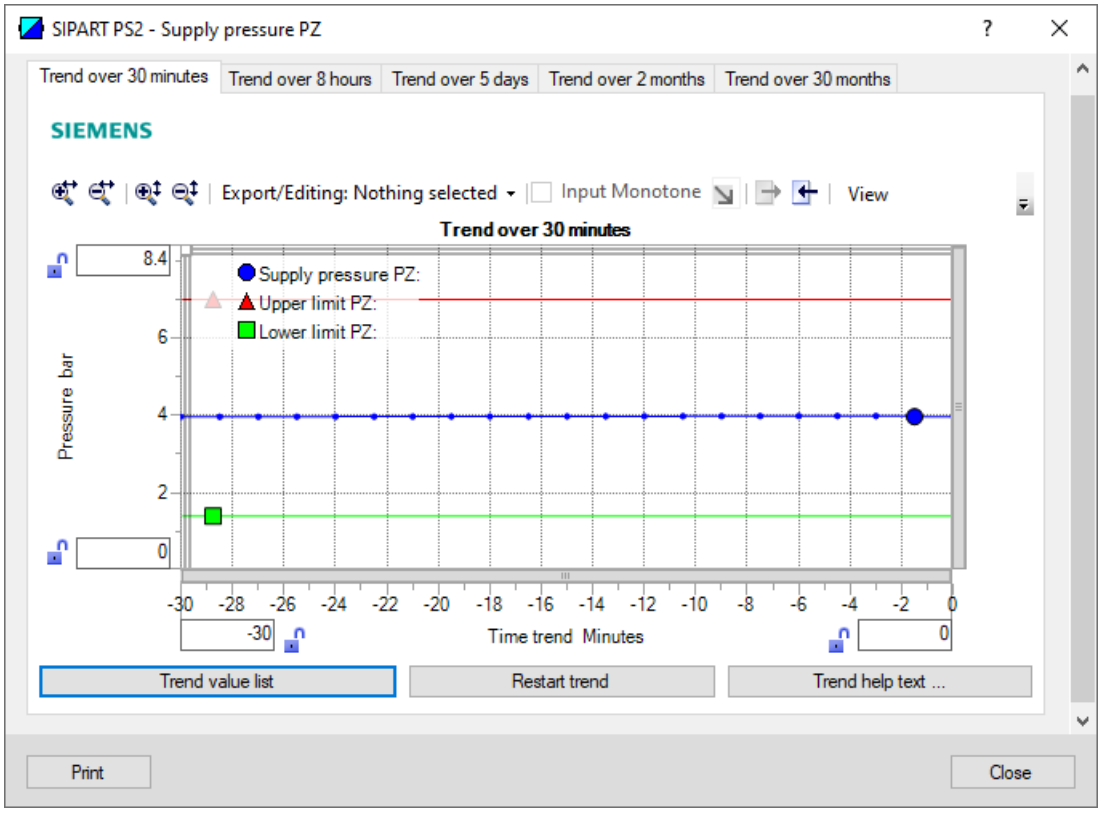


7. In the "Diagnostics" menu, select the "Trend charts > Supply pressure PZ" command.



8. The "Supply pressure PZ" dialog is displayed.
   The dialog contains the tabs, each with a trend chart for the determined pressure values:
   - Trend over 30 minutes
   - Trend over 8 hours
   - Trend over 5 days
   - Trend over 2 months
   - Trend over 30 months

   The respective trend chart is based on the maximum of 20 data from the corresponding ring memory.
   The lines for "Upper limit PZ" and "Lower limit PZ" are also shown.




| Button | Description |
|---|---|
| Trend value list | Shows the 20 data for the displayed trend chart. |
| Restart trend | Caution: This function deletes the data stored in the positioner in all 5 ring memories. |
| Trend help text ... | Explains how process diagnostics works. |

9. Close the dialog.

## 5.17.4 Diagnostic value " Supply pressure PZ" (60.PZ)

| **Diagnostic value** | **Supply pressure PZ**<br>**Short designation: 60.PZ** | |
|---|---|---|
| Function | The diagnostic value shows the current supply pressure PZ. | |
| Note | The differential pressure between the ambient pressure and the input PZ is measured.<br>If there is no supply pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P01 or P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Supply pressure PZ (60.PZ)** | | |
| SIMATIC PDM Export | Name | var_PZ_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 2 ... 5<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "60.PZ".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" the calibration was not successful due to excessive pressure deviation.

## 5.17.5 Diagnostic value "Maximum supply pressure PZ" (63.PZMAX)

| **Diagnostic value** | **Maximum supply pressure PZ, resettable**<br>**Short designation: 63.PZMAX** | |
|---|---|---|
| Function | The supply pressure PZ is continuously monitored.<br>The highest measured value is displayed as the diagnostic value. | |
| Note | The diagnostic value can be reset. | |
| Condition | The positioner has pressure sensors (-Z P01 or P02 option). | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Maximum supply pressure PZ, resettable (63.PZMAX)** | | |
| SIMATIC PDM Export | Name | var_PZ_MaxPointerResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 14 ... 17<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### 5.17.6 Diagnostic value "Violations of lower limit PZ, resettable" (64.N_MIN)

| **Diagnostic value** | **Violations of lower limit PZ, resettable**<br>**Short designation: 64.N_MIN** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U5.PZMLL of the "Pressure monitoring" process diagnostics (U.\PRES) parameter, the event counter of the diagnostic value "64.N_MIN" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "65.N_MAX" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitUnderrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 18 ... 19<br>Format: Unsigned-16 |

## 5.17.7 Diagnostic value "Violation of upper limit PZ, resettable" (65.N_MAX)

| **Diagnostic value** | **Violations of upper limit PZ, resettable**<br>**Short designation: 65.N_MAX** | |
|---|---|---|
| Function | If the supply pressure PZ exceeds the limit in the U6.PZMUL parameter of the "Pressure monitoring" process diagnostics (U.\PRES), the event counter of the diagnostic value "65.N_MAX" is incremented. | |
| Note | The diagnostic value can be reset at the same time as the "64.N_MIN" diagnostic value. | |
| Requirement | The positioner has firmware version 5.02 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_PZ_NoLimitOverrunResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 20 ... 21<br>Format: Unsigned-16 |

## 5.17.8 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P01 or -Z P02 option)
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

### Ring memory of the "Monitoring of supply pressure PZ"

**Request**

Send to the positioner via HART communication:

- Command "#173"
- Ring memory index of the process diagnostics, e.g. "45".
  Send the request for each of the 5 ring memories separately.

| **Ring memory index** | **Ring memory for time span** |
|---|---|
| 45 | Last 30 minutes |
| 46 | Last 8 hours |
| 47 | Last 5 days |
| 48 | Last 2 months |
| 49 | Last 30 months |

**Answer**

The response consists of the following data on the requested ring memory:

- Response Data Bytes
- Command-Specific Response Code

Table 5-36 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Ring memory index |
| 1 | Unsigned-8 | Number of valid values in the ring memory |
| 2 | Enum | Unit of the ring memory values |
| 3 ... 42 | Signed-16 | Values 1 ... 20 of the ring memory (2 bytes each) in "mbar".<br>Example:<br>• 1 ≙ 0.001 bar<br>• 1000 ≙ 1 bar |
| 43 ... 46 | Float | Lower limit PZ (U5.PZMLL) |
| 47 ... 50 | Float | Upper limit PZ (U6.PZMUL) |
| 51 ... 54 | Float | - |
| 55 ... 58 | Float | - |
| 59 ... 62 | Float | - |
| 63 ... 66 | Float | - |

Table 5-37 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## Additional pressure sensor-based data

**Request**

Send to the positioner via HART communication:

- Command "#198"

**Answer**

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-38 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | Pressure monitoring (U.\PRES) |
| **1** | **Enum** | **Pressure unit (U1.PUNIT)** |
| **2 ... 5** | **Float** | **Lower limit PZ (U5.PZMLL)** |
| **6 ... 9** | **Float** | **Hysteresis for limits (U2.P_HYS)** |
| **10** | **Enum** | **Behavior lower limit PZ (U3.PFRLL)** |
| **11** | **Enum** | **Behavior upper limit PZ (U4.PFRUL)** |
| **12 ... 15** | **Float** | **Upper limit PZ (U6.PZMUL)** |
| 16 ... 19 | Float | Limit actuating pressure Y1 (U7.PCL) |
| 20 ... 23 | Float | Limit leakage (U8.LRL) |
| 24 ... 25 | Unsigned-16 | Time pressure measurement Y1 (U9.TPMT) |

Table 5-39 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

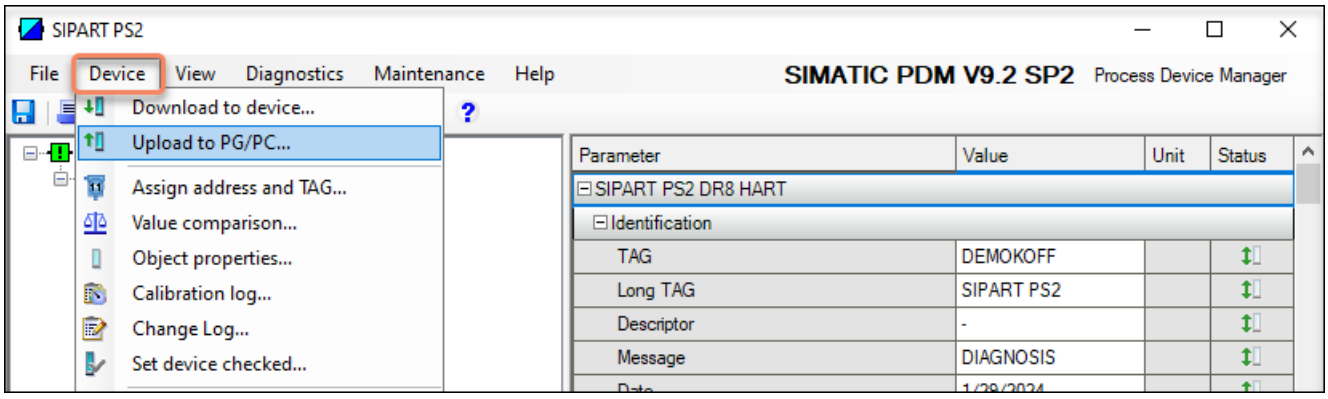
## 5.17.9 With SIMATIC PDM: Export diagnostics results

### Requirement

- The positioner has pressure sensors (-Z P01 or -Z P02 option)
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

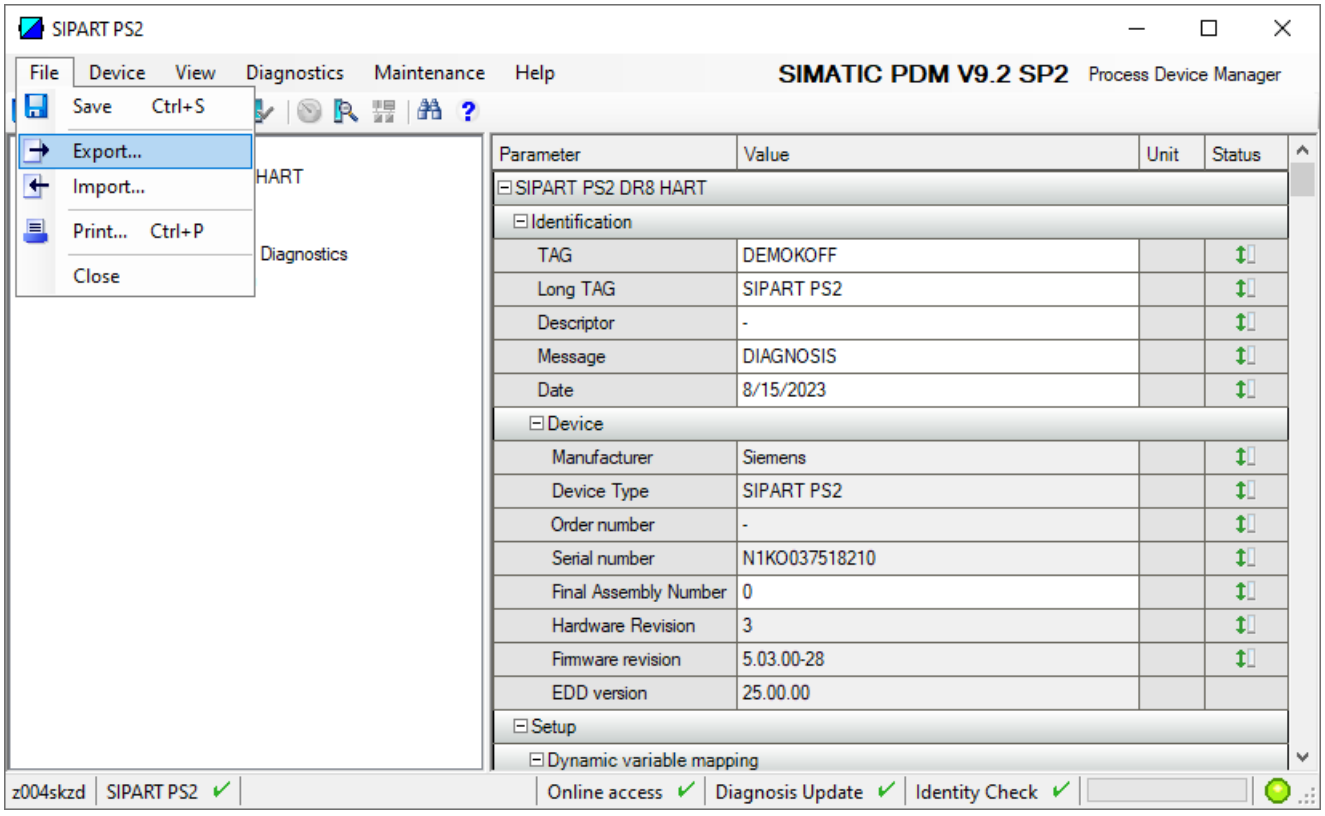
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



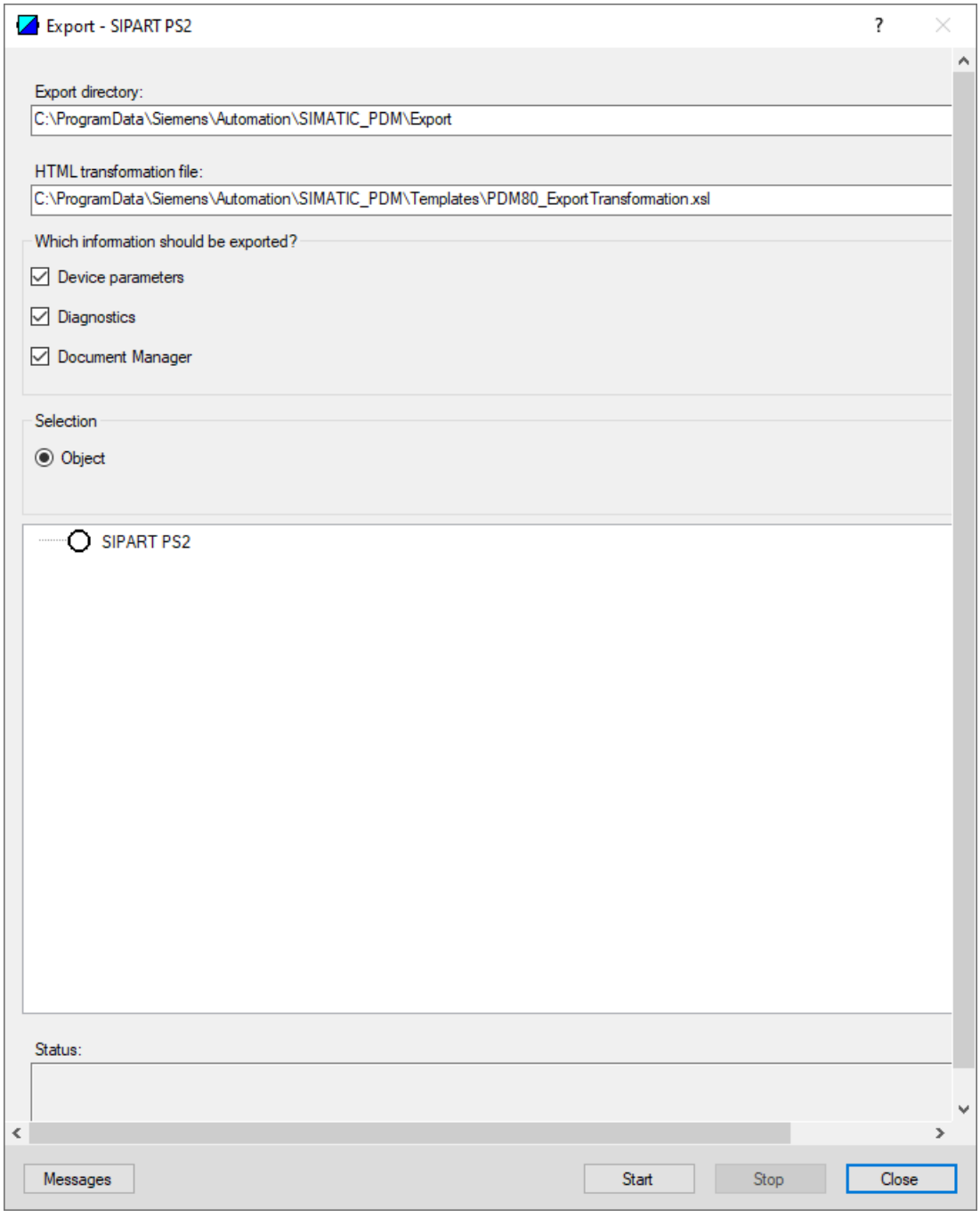

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. Open the trend chart in the "Diagnostics" menu with the command "Trend charts > Supply pressure PZ" → With SIMATIC PDM: Show diagnostic results (Page 458).
   When the trend chart opens, the current data of this process diagnostics in the positioner are read out by SIMATIC PDM.

7. In the "File" menu of SIMATIC PDM , select the command "Export..."..



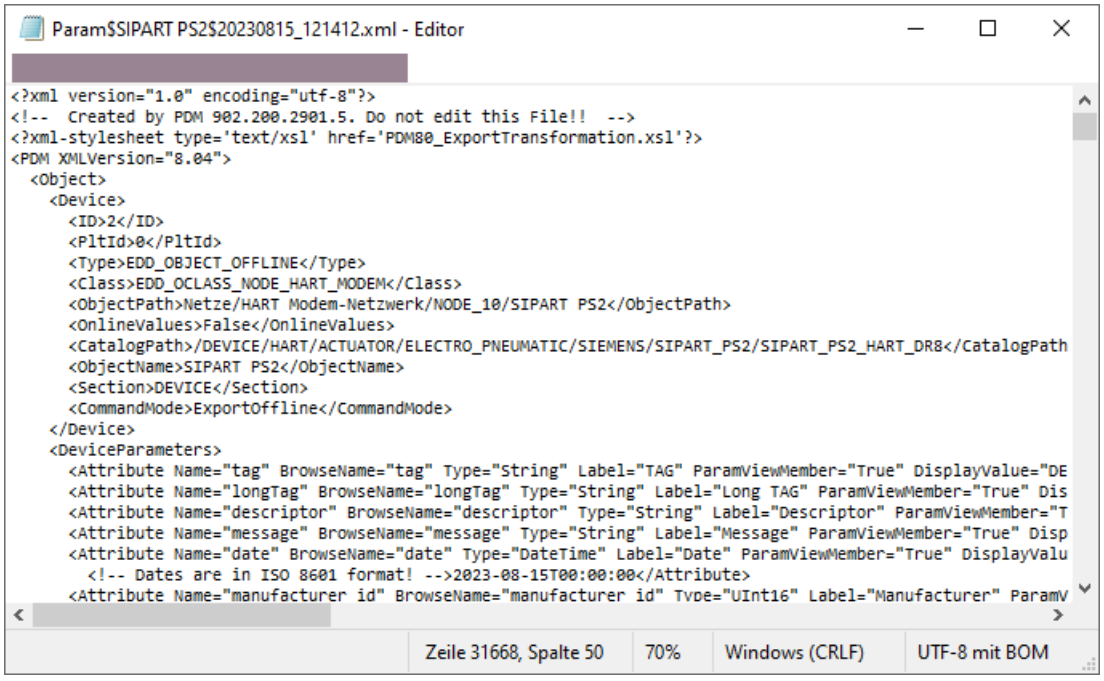

The "Export - ..." dialog opens.

8. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




9. Start the export with the "Start" button.

10. Wait until the status "Export: Action finished" is displayed.
    The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file contains 100 lines with the exported process diagnostics data.

Each of the 5 ring memories contains 20 data entries.

The data for process diagnostics is labeled with Name = "var_trend_PZ...".

Exemplary data line:

<Attribute **Name="var_trend_PZ_30min_0" BrowseName="var_trend_PZ_30min_0"** Type="Int16" **Label="0,0 bis -1,5 Minuten"** ParamViewMember="False" **DisplayValue="4,001"** Import="True" State="16" **Unit="bar"**>4001</Attribute>

- The texts marked in bold are included and explained in the following table.
- The numerical value at "DisplayValue", e.g. "4.001", is the value that was determined with the process diagnostics in the period 0 to -1.5 minutes for the specified unit.
- The table shows a summary of the 100 data for the supply pressure PZ exported with the XML file.

| Ring memory for time span | Amount of data | Data description in the XML file | | | |
|---|---|---|---|---|---|
| | | Name | Label (≙ Time span of data determination) | DisplayValue e.g. | Unit |
| Last 30 minutes | 20 | var_trend_PZ_30min_0 | 0.0 up to -1.5 minutes | 4.001 | • bar<br>• MPa<br>• psi |
| | | ... | ... | ... | |
| | | var_trend_PZ_30min_19 | -28.5 up to -30.0 minutes | ... | |
| Last 8 hours | 20 | var_trend_PZ_8h_0 | 0 up to -24 minutes | ... | |
| | | ... | ... | ... | |
| | | var_trend_PZ_8h_19 | -456 up to -480 minutes | ... | |
| Last 5 days | 20 | var_trend_PZ_5d_0 | 0 up to -6 hours | ... | |
| | | ... | ... | ... | |
| | | var_trend_PZ_5d_19 | -114 up to -120 hours | ... | |
| Last 2 months | 20 | var_trend_PZ_2m_0 | 0 up to -3 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_PZ_2m_19 | -57 up to -60 days | ... | |
| Last 30 months | 20 | var_trend_PZ_30m_0 | 0 up to -45 days | ... | |
| | | ... | ... | ... | |
| | | var_trend_PZ_30m_19 | -855 up to -900 days | ... | |

The XML file contains the following additional data for process diagnostics.

Table 5-40 Parameter

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | Name | Label | DisplayValue e.g. | Unit |
| U1.PUNIT | var_pressureUnit | Pressure unit (U1.PUNIT) | bar | • bar<br>• MPa<br>• psi |
| U2.P_HYS | var_PZ_Hysteresis | Hysteresis for limits (U2.P_HYS) | 0.200 | |
| U3.PFRLL | var_PZ_FailureReaction | Behavior lower limit PZ (U3.PFRLL) | No reaction - Automatic operating mode (Auto) | - |
| U4.PFRUL | var_PZ_FailureReactionUL | Behavior upper limit PZ (U4.PFRUL) | No reaction - Automatic operating mode (Auto) | - |
| U5.PZMLL | var_PZ_LowerLimit | Lower limit PZ (U5.PZMLL) | 1.400 | • bar<br>• MPa<br>• psi |
| U6.PZMUL | var_PZ_UpperLimit | Upper limit PZ (U6.PZMUL) | 7.000 | |

Table 5-41 Diagnostic values

| Diagnostic value | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| 60.PZ | var_PZ_value | Supply pressure PZ (60.PZ) | 3.981 | • bar<br>• MPa<br>• psi |
| 63.PZMAX | var_PZ_MaxPointerResettable | Maximum supply pressure PZ (resettable) (63.PZMAX) | 5.230 | |
| 64.N_MIN | var_PZ_NoLimitUnderrunResettable | Violations of lower limit PZ (resettable) (64.N_MIN) | 9 | - |
| 65.N_MAX | var_PZ_NoLimitOverrunResettable | Violations of upper limit PZ (resettable) (65.N_MAX) | 0 | - |

## 5.17.10 Messages

### 5.17.10.1 General information

#### Requirement

- The positioner has pressure sensors ( -Z P01 or -Z P02 option)
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.

#### Notes

If the upper or lower limits are violated:

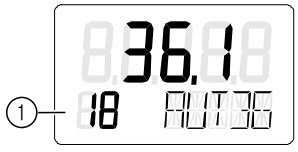
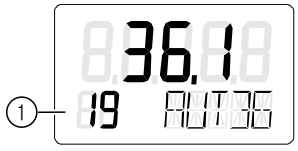
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.17.10.2 Messages in the display

#### Indication on the display

If the upper or lower limits are violated, the respective error code is displayed.

If several messages are present at the same time, the display switches between the different error codes.

| Display | | Possible cause |
|---|---|---|
|  | ① Error code 18 | The supply pressure PZ violates the lower limit (U5.PZMLL). |
|  | ① Error code 19 | The supply pressure PZ is outside the specification. |
|  | ① Error code 20 | The supply pressure PZ violates the upper limit "U6.PZMUL". |
| Error code 18, 19 or 20 with error message HoLd | | See error code 18, 19 or 20.<br>The positioner is set to "Hold position" if the "U3.PFRLL" or "U4.PFRUL" parameter is set to "HoLd" is set. |

### 5.17.10.3 Messages via digital signals

#### Requirement

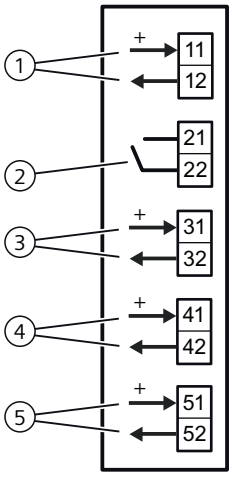
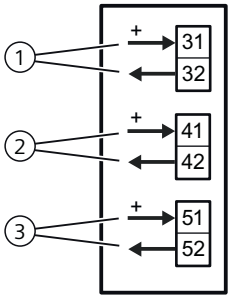
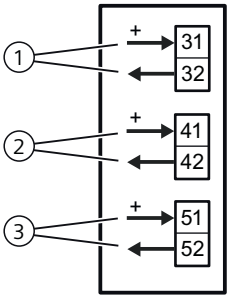
- The positioner has a fault signal output, which is located on one of the following modules:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)

#### Message via the digital output

If at least one of the following states is present, the fault signal output is activated:

- Supply pressure PZ lower than 1.4 bar (device specification)
- Supply pressure PZ higher than 7.0 bar (device specification)
- Supply pressure PZ less than "Lower limit PZ" (U5.PZMLL)
- Supply pressure PZ higher than "Upper limit PZ" (U6.PZMUL)

#### I/Os

| **Digital I/O Module (DIO)<br>6DR4004-6A / -8A** | **Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G** | **Mechanic Limit Switches (MLS)<br>6DR4004-6K** |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault signal output, in conjunction with 6DR4004-3ES without function<br>② Digital output 1<br>③ Digital output 2 | ① Fault signal output, in conjunction with 6DR4004-4ES without function<br>② Digital output 1<br>③ Digital output 2 |

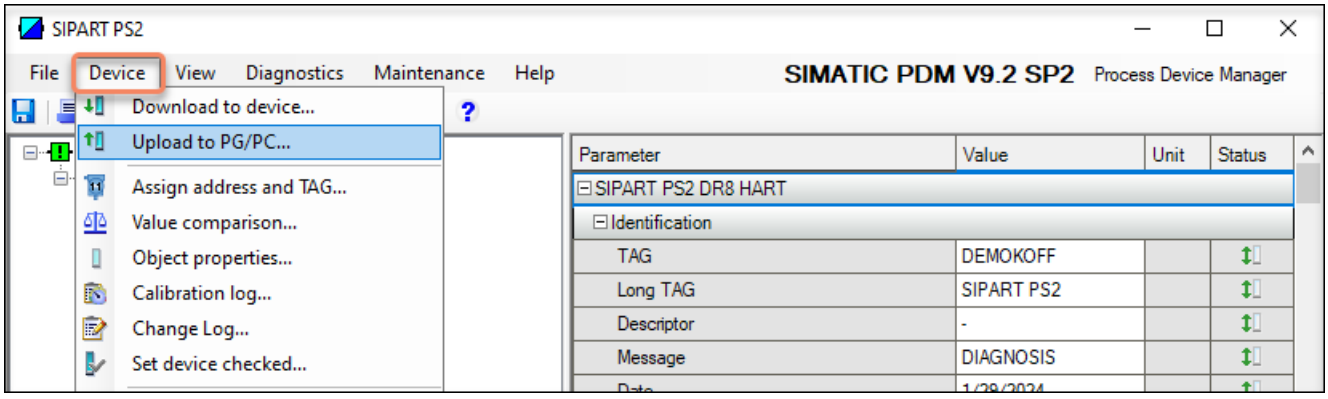
### 5.17.10.4 With SIMATIC PDM: Display diagnostics status

#### Requirement

- The installation of SIMATIC PDM as of version 9.0 is available.
- In SIMATIC PDM, an object is created with the firmware version of the positioner.

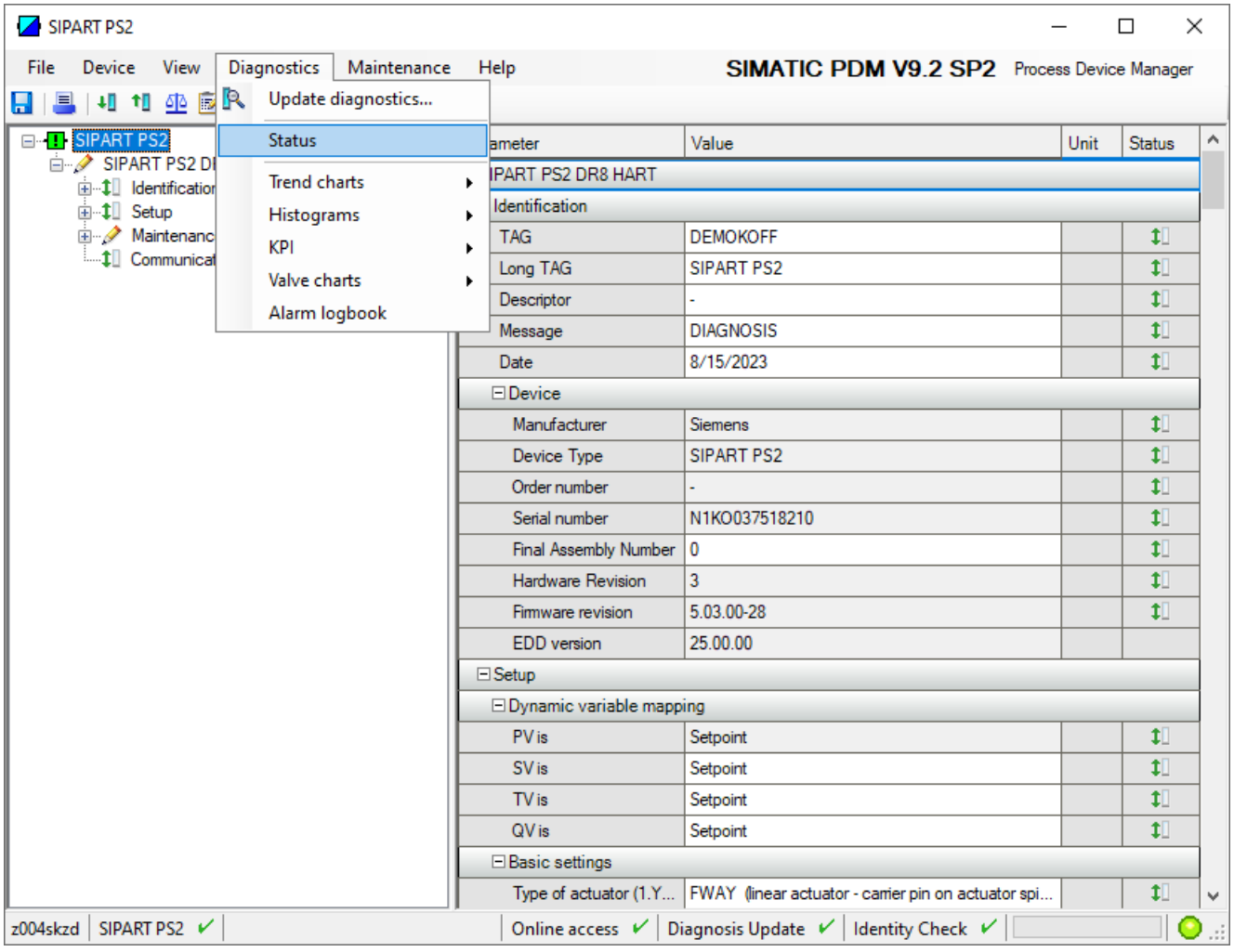
#### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

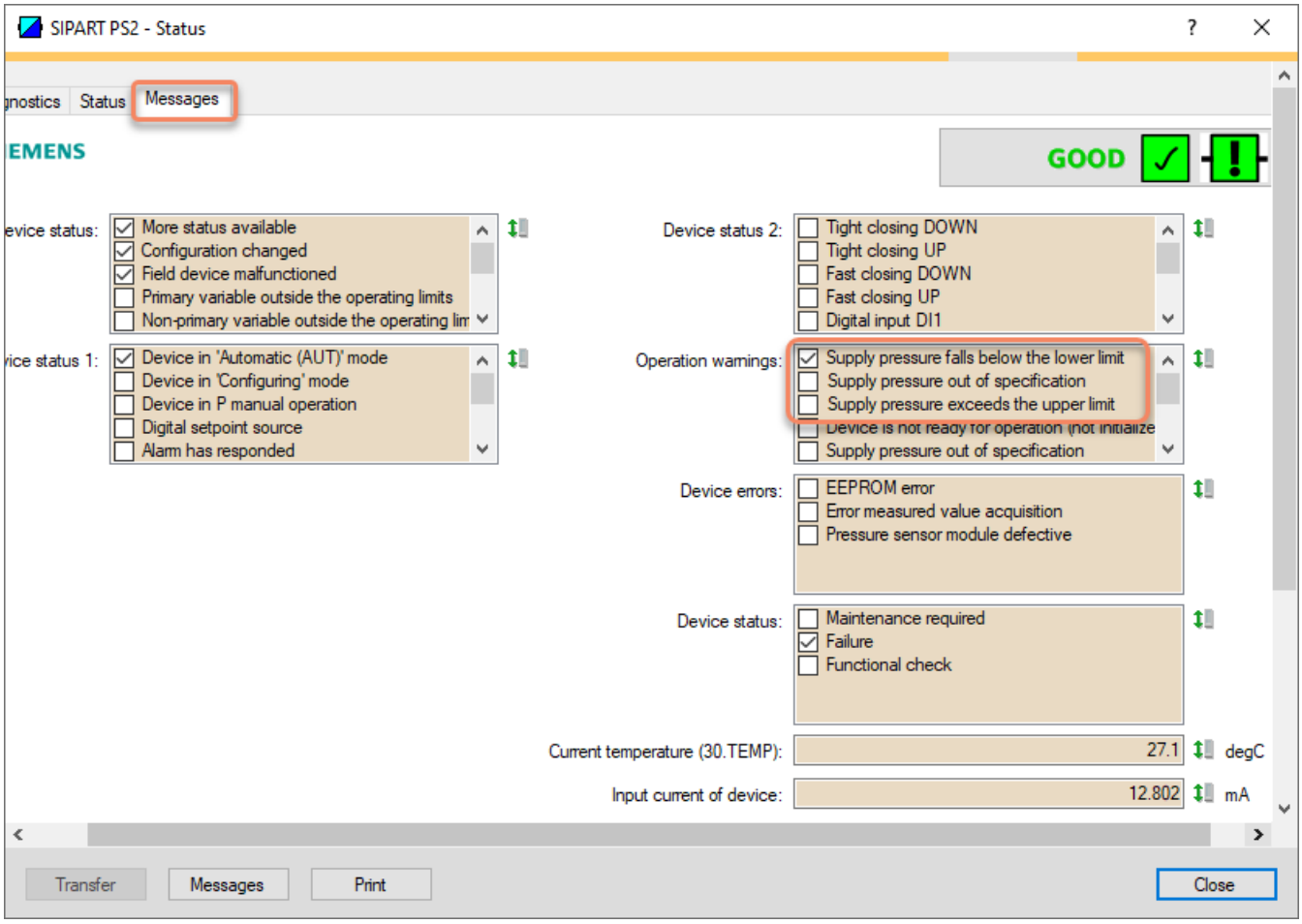



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Messages" tab.
   If a upper or lower limit is violated, the corresponding message is highlighted:
   - Supply pressure falls below the lower limit
   - Supply pressure out of specification
   - Supply pressure exceeds the upper limit




8. Close the dialog.

### 5.17.10.5 Via HART communication: Get messages

#### Requirement

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52...

### Get message

If the set upper or lower limits for "Monitoring of supply pressure PZ" are violated, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  The messages for the "Monitoring of supply pressure" process diagnostics are contained in the following bytes:
  - Byte 3, Bit 3: Supply pressure PZ falls below the "Lower limit" (U5.PZMLL).
  - Byte 3, Bit 4: The supply pressure PZ is off-specification.
  - Byte 3, Bit 5: The supply pressure PZ violates the "Upper limit" (U6.PZMUL).

## 5.17.10.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

The error messages can be reset using the corrective measures.

| Error code/error message | Possible cause | Remedy |
|---|---|---|
| 18 | Supply pressure PZ falls below the lower limit "U5.PZMLL". | • Increase supply pressure PZ until the upper limit (U5.PZMLL) plus hysteresis "U2.P_HYS" is violated.<br>• Limit "U5.PZMLL" is set lower than the current supply pressure PZ. |
| 19 | The supply pressure PZ is off-specification. | • Adjust supply pressure PZ until the device-specific limits of 1.4 to 7 bar ± hysteresis "U2.P_HYS" are adhered to. |
| 20 | The supply pressure PZ violates the upper limit "U6.PZMUL". | • Reduce supply pressure PZ until the limit (U6.PZMUL) minus hysteresis (U2.P_HYS) is fallen below.<br>• Limit "U6.PZMUL" is set higher than the current supply pressure PZ. |
| 18, 19 or 20<br>HoLd | The positioner is set to "Hold position" if the "U3.PFRLL" or "U4.PFRUL" parameter is set to "HoLd" is set. | • Adjust the supply pressure PZ according to the help for error codes "18", "19" or "20". |

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

# 5.18 Monitoring actuating pressure Y1 (pressure sensor-supported)

## 5.18.1 Functional description

Process diagnostics monitors actuating pressure Y1.

- If the value is exceeded: In the "Automatic (AUT)" mode and "Manual (MAN)" mode, error code "21" is shown on the display. The positioner holds the position. The positioner holds the position.
- If, after exceeding the limit "U7.PCL", the actuating pressure Y1 falls below the limit minus the hysteresis "U2.P_HYS", the error code is no longer displayed. Control is active once again.

Process diagnostics parameters:

- Hysteresis for limits (U2.P_HYS)
- Limit actuating pressure Y1 (U7.PCL)

Process diagnostics parameters:

- Current actuating pressure Y1 (61.P1)
- Event counter violations of upper limit for actuating pressure Y1 (66.N1MAX)

The data can be displayed in SIMATIC PDM and exported for further processing.

The data can be read and processed using HART commands.

The process diagnostics are monitored with adjustable thresholds. If the limit is exceeded, messages are output via the display and optionally via the digital contacts or the HART communication.

## 5.18.2 Activate and configure diagnostics

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".

### General parameters for pressure sensor-based diagnostics

| **U1.PUNIT** | **Pressure unit** |
|---|---|
| Function | The parameter defines the pressure unit. |
| Setting options | • bar<br>• MPa<br>• psi |
| Factory setting | bar |

| **U2.P_HYS** | **Hysteresis for limits** | |
|---|---|---|
| Function | The parameter defines the hysteresis for the following parameters:<br>• Lower limit of the supply pressure (U5.PZMLL)<br>• Upper limit of supply pressure (U6.PZMUL)<br>• Limit of the actuating pressure at the Y1 connection (U7.PCL) | |
| Setting range | 0.200 ... 1.000 | bar |
| | 0.020 ... 0.100 | MPa |
| | 2.900 ... 14.50 | psi |
| Factory setting | 0.200 | bar |
| | 0.020 | MPa |
| | 2.900 | psi |

### Process diagnostics parameters

| **U7.PCL** | **Limit actuating pressure Y1** |
|---|---|
| Function | The parameter defines the maximum allowable actuating pressure Y1. |
| Note | • If the value is exceeded: In the "Automatic (AUT)" mode and "Manual (MAN)" mode, error code "21" is shown on the display. The positioner holds the position.<br>• If, after exceeding the limit "U7.PCL", the actuating pressure Y1 falls below the limit minus the hysteresis "U2.P_HYS", the error code is no longer displayed. Control is active once again.<br>Diagnostic values:<br>• Current actuating pressure Y1 (61.P1)<br>• Event counter violations of upper limit for actuating pressure Y1 (66.N1MAX) |

| U7.PCL | Limit actuating pressure Y1 | |
|---|---|---|
| Setting range | 1.400 ... 7.000 | bar |
| | 0.140 ... 0.700 | MPa |
| | 20.31 ... 101.53 | psi |
| Factory setting | 7.000 | bar |
| | 0.700 | MPa |
| | 101.53 | psi |

## Activate and configure "Monitoring of actuating pressure Y1"

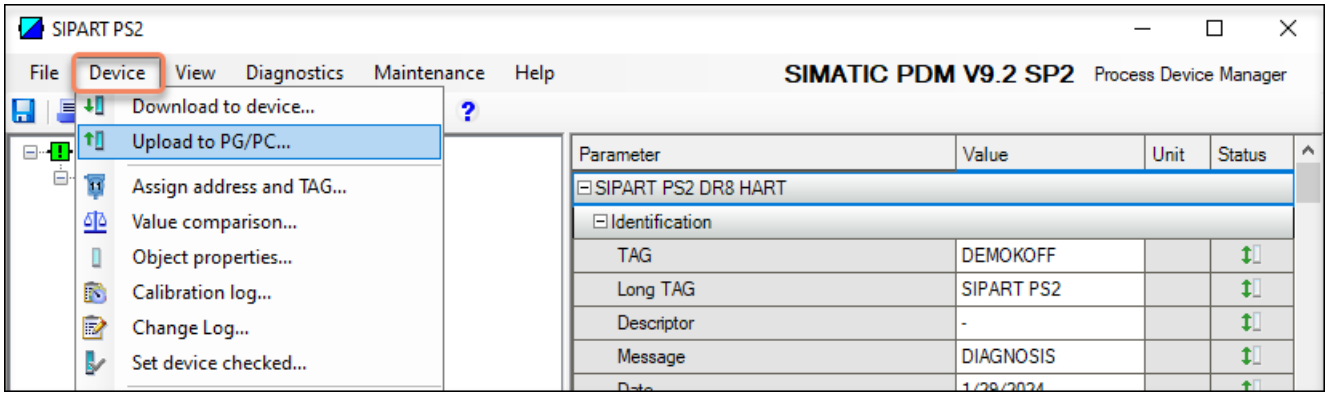
Process diagnostics can be activated and configured using the following 2 options.

### Local operation

1. Switch the positioner to "Configure" mode by pressing the button on the display for at least 5 seconds.
2. Use the buttons on the display to select the "U.\PRES" parameter of the "Pressure monitoring".
3. Set the "U.\PRES" parameter to "On".
   ⇒ Process diagnostics is activated and the associated parameters are displayed.
4. To adapt the limits at the valve, change the parameters:
   - U1.PUNIT
   - U2.P_HYS
   - U7.PCL

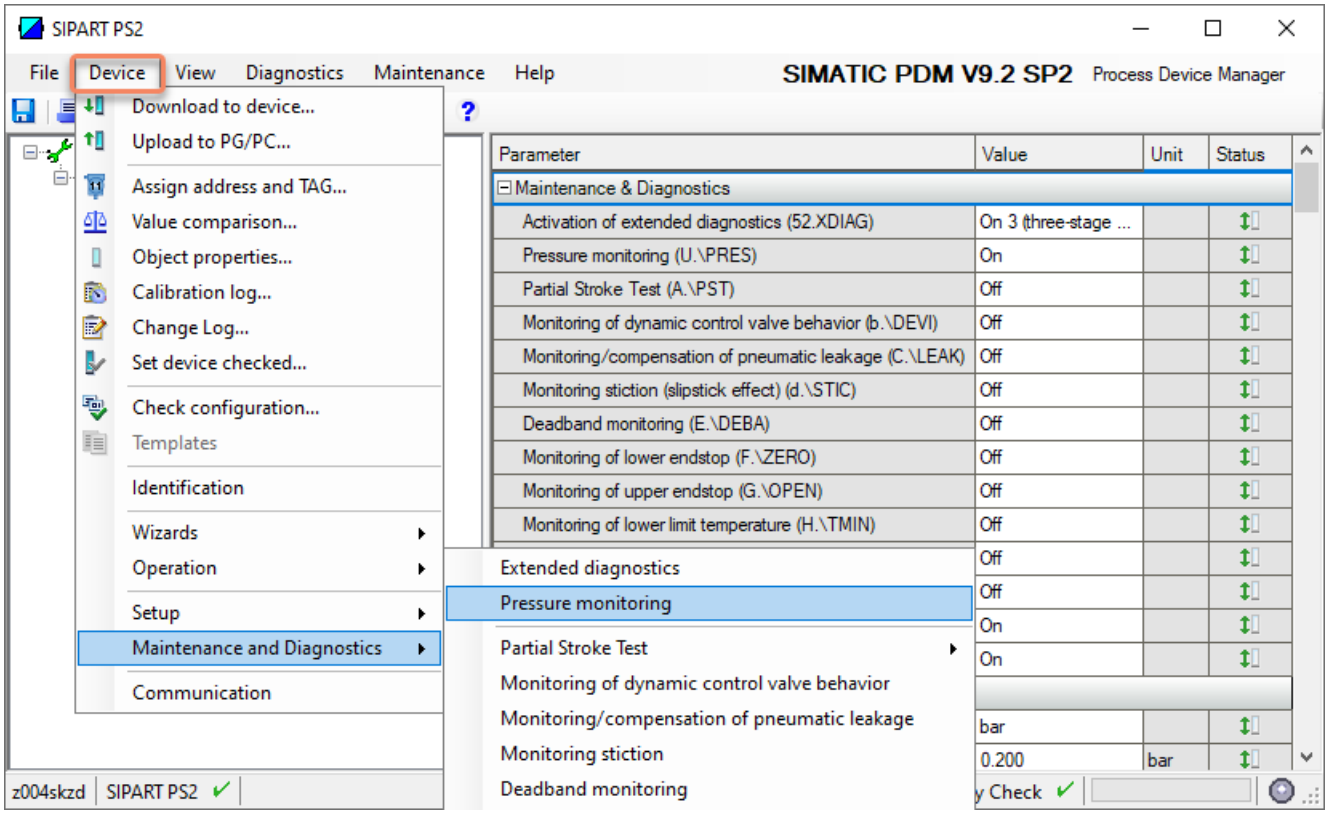
### Remote operation with SIMATIC PDM

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



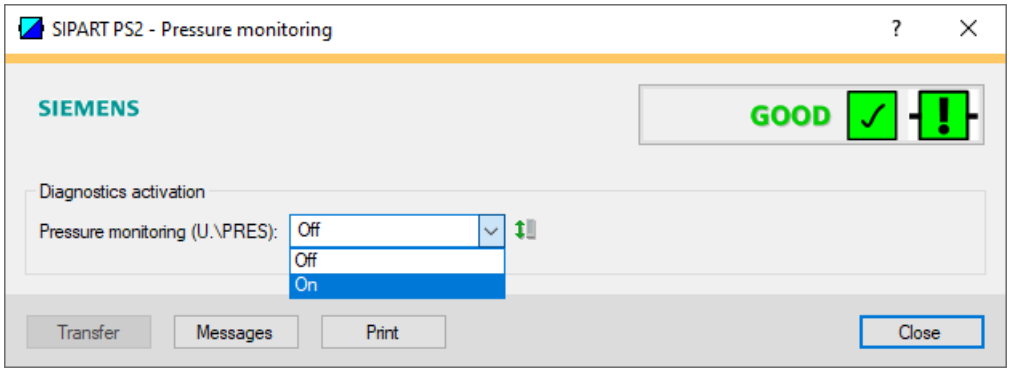

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".

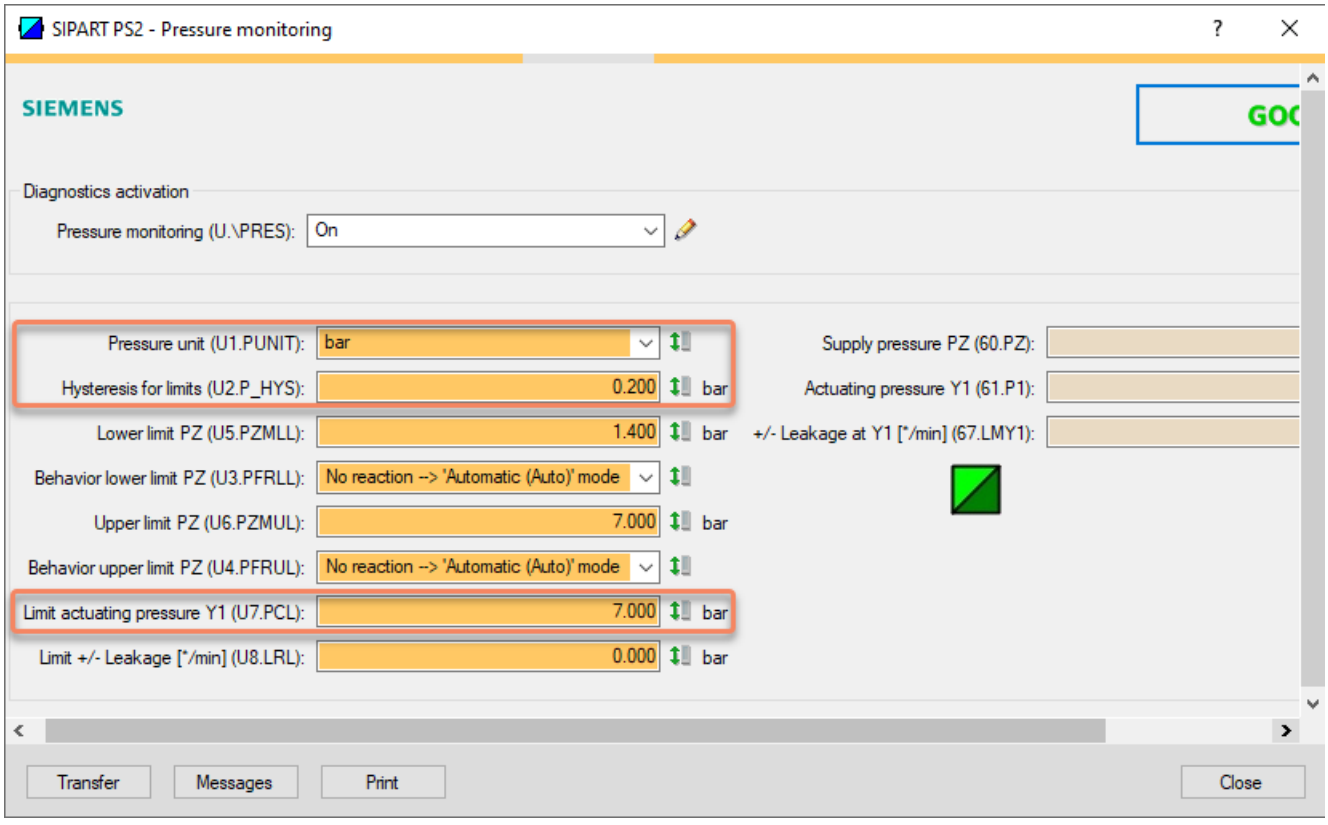



⇒ The "Pressure monitoring" dialog is displayed.

7. Activate "Pressure monitoring" (U.\PRES) with the value "On".




⇒ The dialog is displayed with the current parameters.




8. To adapt the limits at the valve, change the parameters:
   - U1.PUNIT
   - U2.P_HYS
   - U7.PCL
9. Transfer these changes to the positioner with the "Transfer" button.
10. Close the dialog.

11. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.
12. In the "Upload to PG/PC..." dialog, click the "Start" button.
    ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".

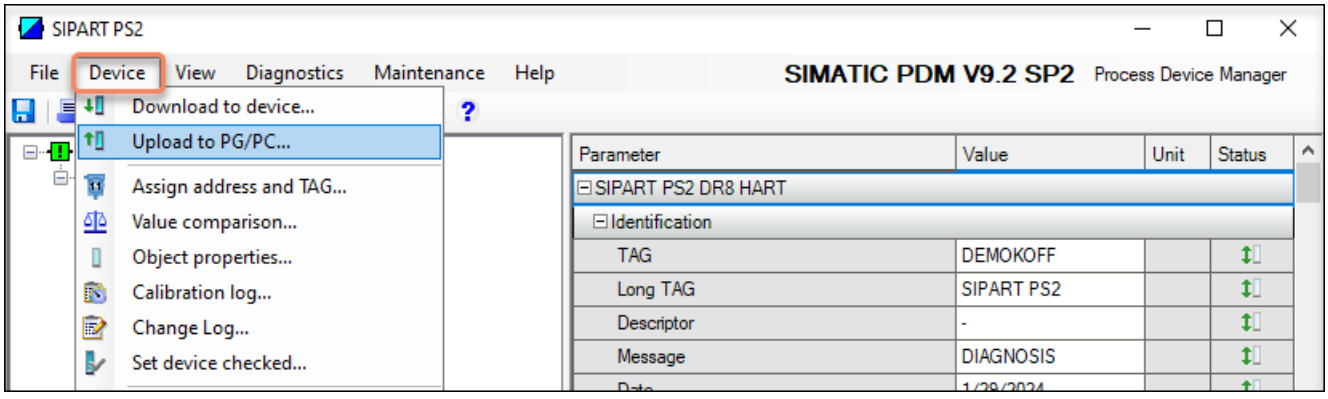
## 5.18.3 With SIMATIC PDM: Show diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

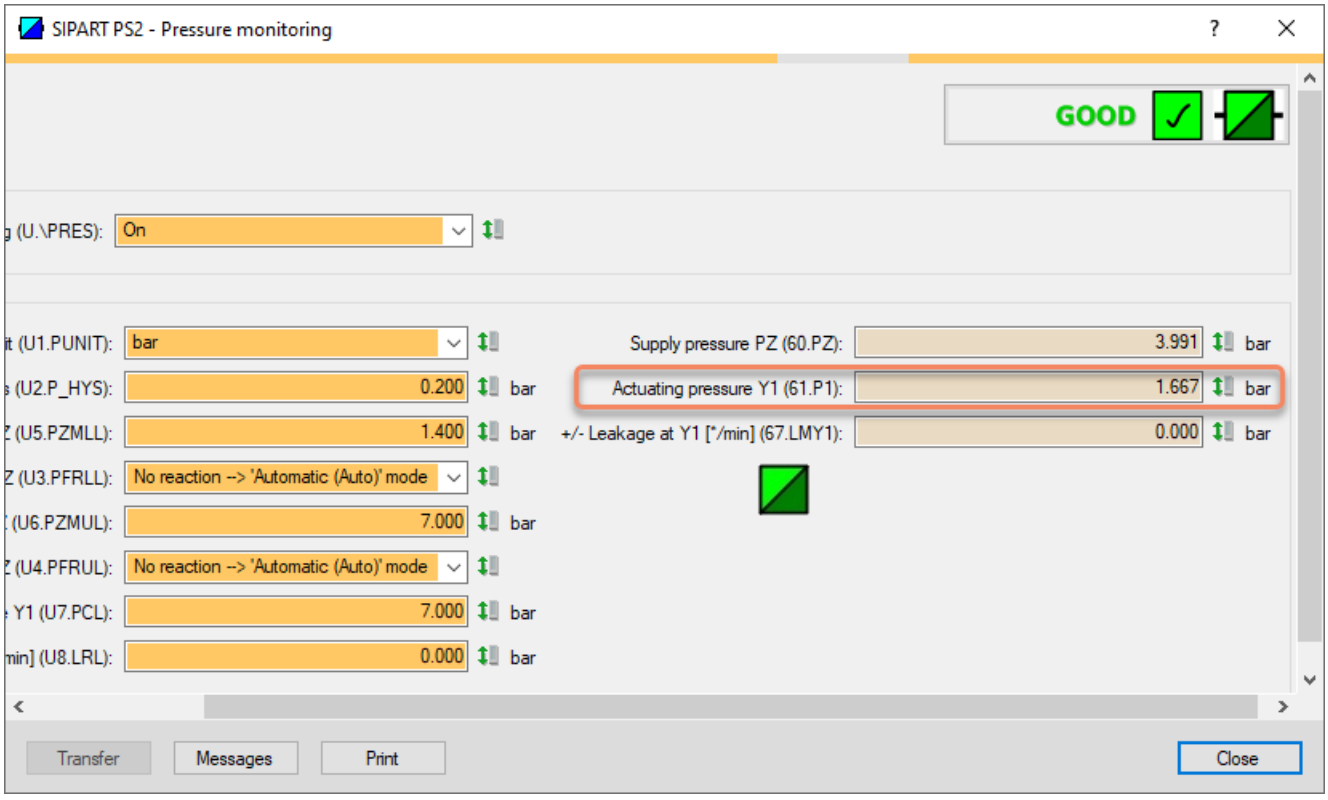
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure Monitoring".

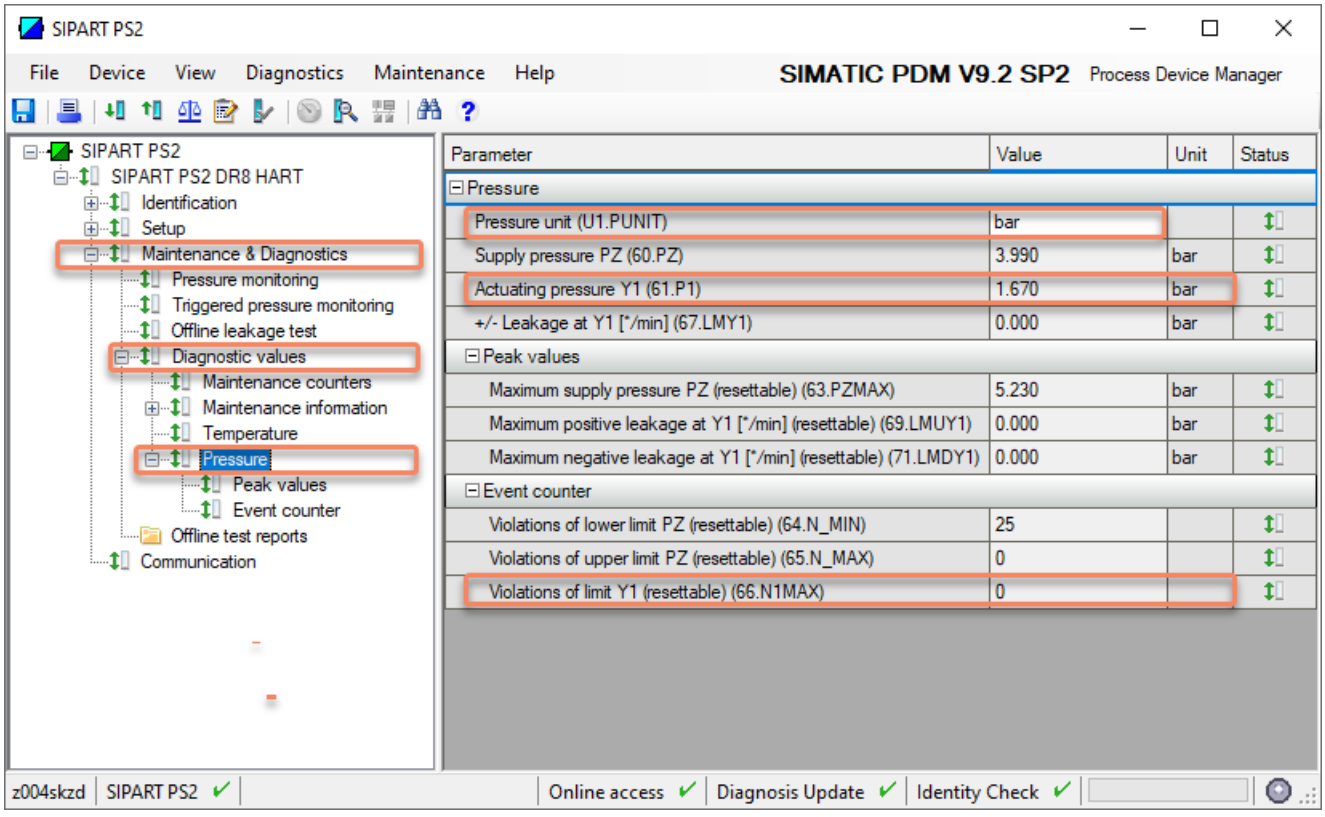



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Device" menu, select the command "Maintenance and Diagnostics > Pressure monitoring".
   ⇒ The "Pressure monitoring" dialog shows the parameters and current "Actuating pressure Y1" (61.P1).



7. Close the dialog.
8. Select the directory "Maintenance & Diagnostics > Diagnostic values > Pressure".
   ⇒ The following diagnostic results are displayed:
   - Pressure unit (U1.PUNIT)
   - Actuating pressure Y1 (61.P1)
   - Violations of limit Y1, resettable (66.N1MAX)



## 5.18.4 Diagnostic value "Actuating pressure Y1" (61.P1)

| **Diagnostic value** | **Actuating pressure Y1**<br>**Short designation: 61.P1** | |
|---|---|---|
| Function | Shows the current actuating pressure Y1. | |
| Note | The differential pressure between the ambient pressure and the output Y1 is measured.<br>If there is no actuating pressure, the displayed value should be approximately "0".<br>Depending on the positioner's operating altitude above sea level, the zero point of the pressure sensors may deviate and must be calibrated. | |
| Requirement | • The positioner has pressure sensors (-Z P02 option).<br>• "Pressure monitoring" (U.\PRES) is activated. | |
| Display range | 0 ... 9.999 | bar |
| | 0 ... 0.999 | MPa |
| | 0 ... 145.00 | psi |
| Unit | • bar<br>• MPa<br>• psi | The unit is defined in the "U1.PUNIT" parameter of "Pressure monitoring" (U.\PRES). |
| **Communication** | | |
| **Actuating pressure Y1 (61.P1)** | | |
| SIMATIC PDM Export | Name | var_P1_value |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes 6 ... 9<br>Format: Float |
| **Pressure unit (U1.PUNIT)** | | |
| SIMATIC PDM Export | Name | var_pressureUnit |
| | DisplayValue | • bar<br>• MPa<br>• psi |
| HART communication (read) | Command | #200 |
| | Response Data | Byte: 1<br>Format: Enum |

### Calibrate zero point

**Requirement**

- The positioner is depressurized.
- The displayed pressure deviation is in the following range:
  - -0.500 ... 0.500 bar
  - -0.050 ... 0.050 MPa
  - -72.51 ... 72.51 psi

**Procedure**

1. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
2. Select the diagnostic value "61.P1".
3. Press the button for at least 5 seconds and the display will show "rESEt".
   ⇒ If "0" is displayed, the calibration was successful.
   ⇒ If "notoL" was displayed, the calibration was not successful due to excessive pressure deviation.

## 5.18.5 Diagnostic value "Violation of limit Y1, resettable" (66.N1MAX)

| **Diagnostic value** | **Violations of limit Y1, resettable**<br>**Short designation: 66.N1MAX** | |
|---|---|---|
| Function | If the actuating pressure Y1 exceeds the limit in the "U7.PCL" parameter of the "Pressure monitoring" (U.\PRES) process diagnostics, the event counter of the diagnostic value "66.N1MAX" is incremented. | |
| Note | The diagnostic value can be reset. | |
| Requirement | The positioner has firmware version 5.03 or higher. | |
| Display range | 0 ... 99 999 | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_P1_NoLimitReachedResettable |
| | DisplayValue | ≙ Value |
| HART communication (read) | Command | #200 |
| | Response Data | Bytes: 22 ... 23<br>Format: Unsigned-16 |

## 5.18.6 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

### Read out process diagnostics parameters

**Request**

Send to the positioner via HART communication:

- Command "#198"

**Answer**

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-42 Response Data Bytes

| **Byte** | **Format** | **Description** |
|---|---|---|
| 0 | Enum | Pressure monitoring (U.\PRES) |
| **1** | **Enum** | **Pressure unit (U1.PUNIT)** |
| 2 ... 5 | Float | Lower limit PZ (U5.PZMLL) |

| Byte | Format | Description |
|---|---|---|
| **6 ... 9** | **Float** | **Hysteresis for limits (U2.P_HYS)** |
| 10 | Enum | Behavior lower limit PZ (U3.PFRLL) |
| 11 | Enum | Behavior upper limit PZ (U4.PFRUL) |
| 12 ... 15 | Float | Upper limit PZ (U6.PZMUL) |
| **16 ... 19** | **Float** | **Limit actuating pressure Y1 (U7.PCL)** |
| 20 ... 23 | Float | Limit leakage (U8.LRL) |
| 24 ... 25 | Unsigned-16 | Time pressure measurement Y1 (U9.TPMT) |

Table 5-43 **Command-Specific Response Codes**

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

## Read out the results of the process diagnostics

### Request

Send to the positioner via HART communication:

- Command "#200"

### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 5-44 Response data bytes

| Byte | Format | Description (parameter) |
|---|---|---|
| 0 | Unsigned-8 | Number of available Pressure Sensors |
| **1** | **Enum** | **Pressure Unit (U1.PUNIT)** |
| 2 ... 5 | Float | Supply Pressure Value (60.PZ) |
| **6 ... 9** | **Float** | **Chamber 1 Pressure Value (61.P1)** |
| 10 ... 13 | Float | Chamber 2 Pressure Value (62.P2) |
| 14 ... 17 | Float | Supply Pressure Maximum Pointer resettable (63.PZMAX) |
| 18 ... 19 | Unsigned-16 | Number of Supply Pressure Limit Underruns resettable (64.N_MIN) |
| 20 ... 21 | Unsigned-16 | Number of Supply Pressure Upper Limit Overruns resettable (65.N_MAX) |
| **22 ... 23** | **Unsigned-16** | **Number of Chamber Pressure 1 Limit reached resettable (66.N1MAX)** |
| 24 ... 27 | Float | Delta Pressure Chamber 1 (67.LMY1) |

| Byte | Format | Description (parameter) |
|---|---|---|
| 28 ... 31 | Float | Delta Pressure Chamber 2 (68.LMY2) |
| 32 ... 35 | Float | Chamber 1 positive Delta Pressure Maximum Pointer resettable (69.LMUY1) |
| 36 ... 39 | Float | Chamber 2 positive Delta Pressure Maximum Pointer resettable (70.LMUY2) |
| 40 ... 43 | Float | Chamber 1 negative Delta Pressure Maximum Pointer resettable (71.LMDY1) |
| 44 ... 47 | Float | Chamber 2 negative Delta Pressure Maximum Pointer resettable (71.LMDY2) |

Table 5-45 **Command-Specific Response Codes**

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 5 | Error | Too Few Data Bytes Received |
| 6 | Error | Device Specific Command Error |
| 16 | Error | Access Restricted |

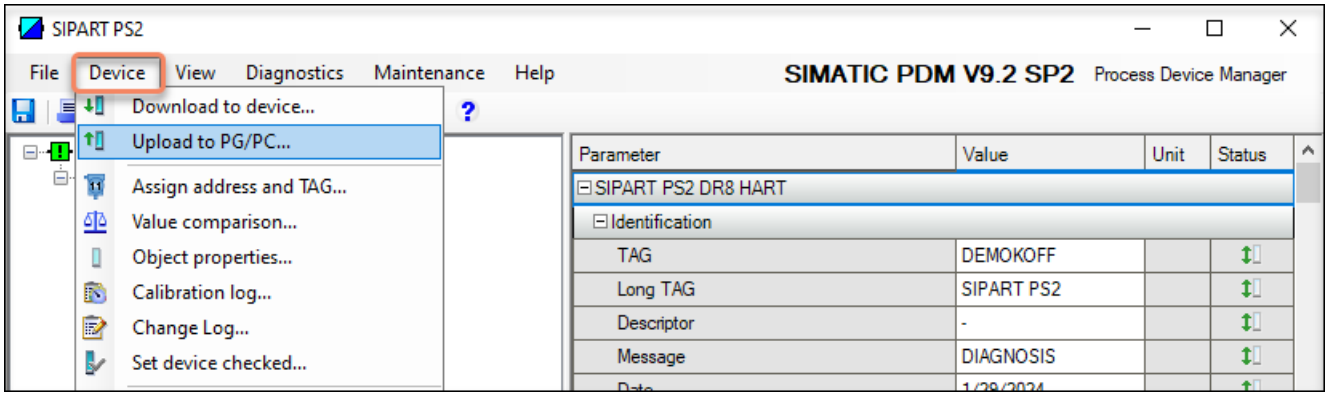
## 5.18.7 With SIMATIC PDM: Export diagnostics results

### Requirement

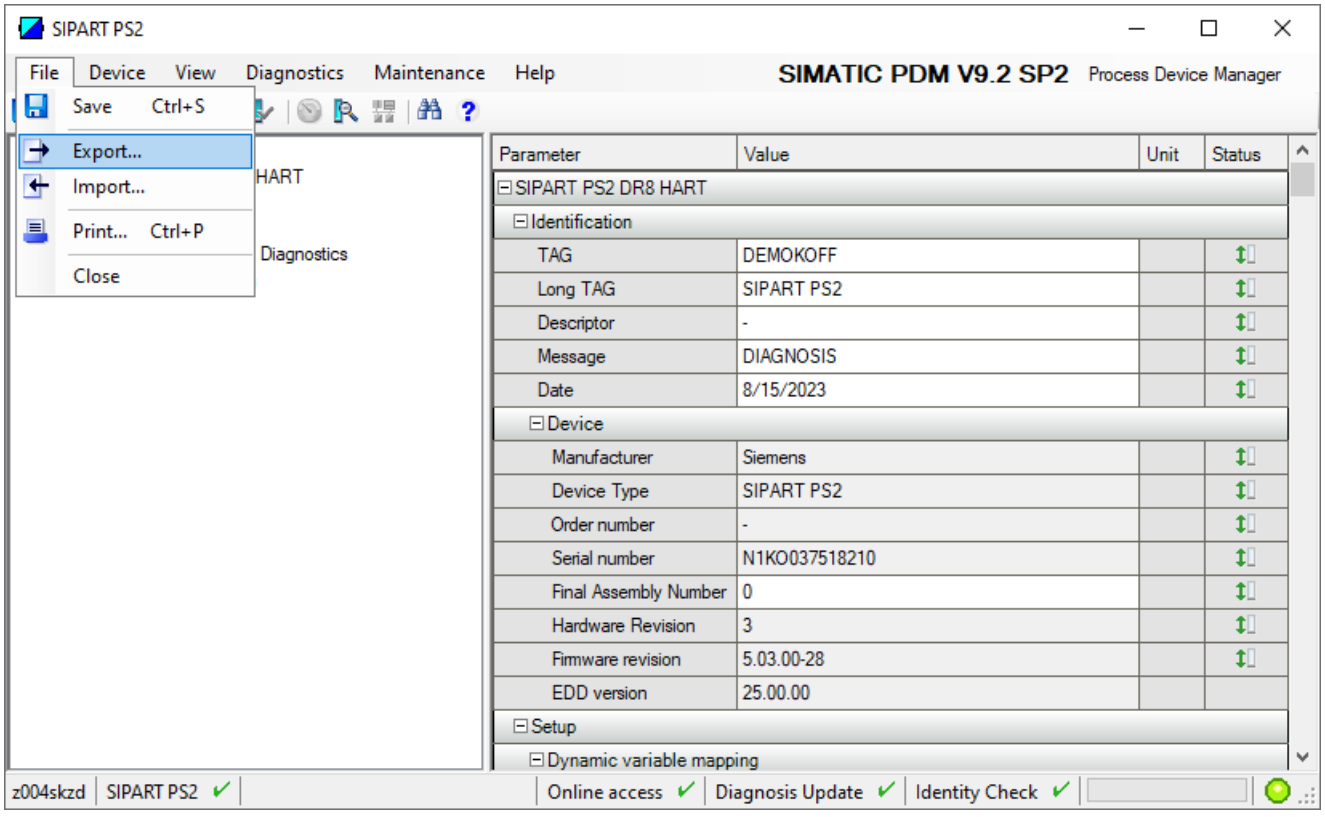
- The positioner has pressure sensors (-Z P02 option).
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

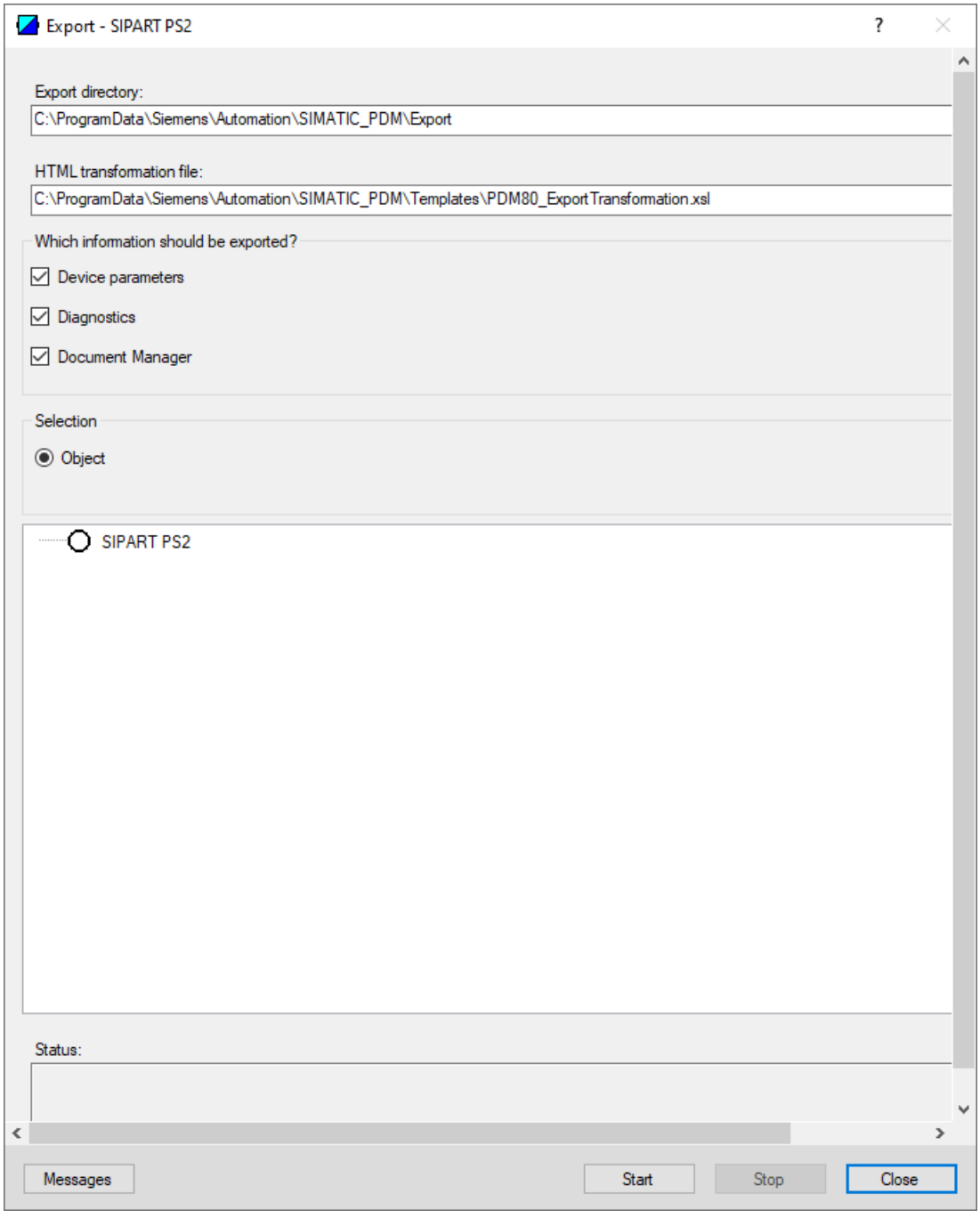



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.
6. In the "File" menu of SIMATIC PDM , select the command "Export...".



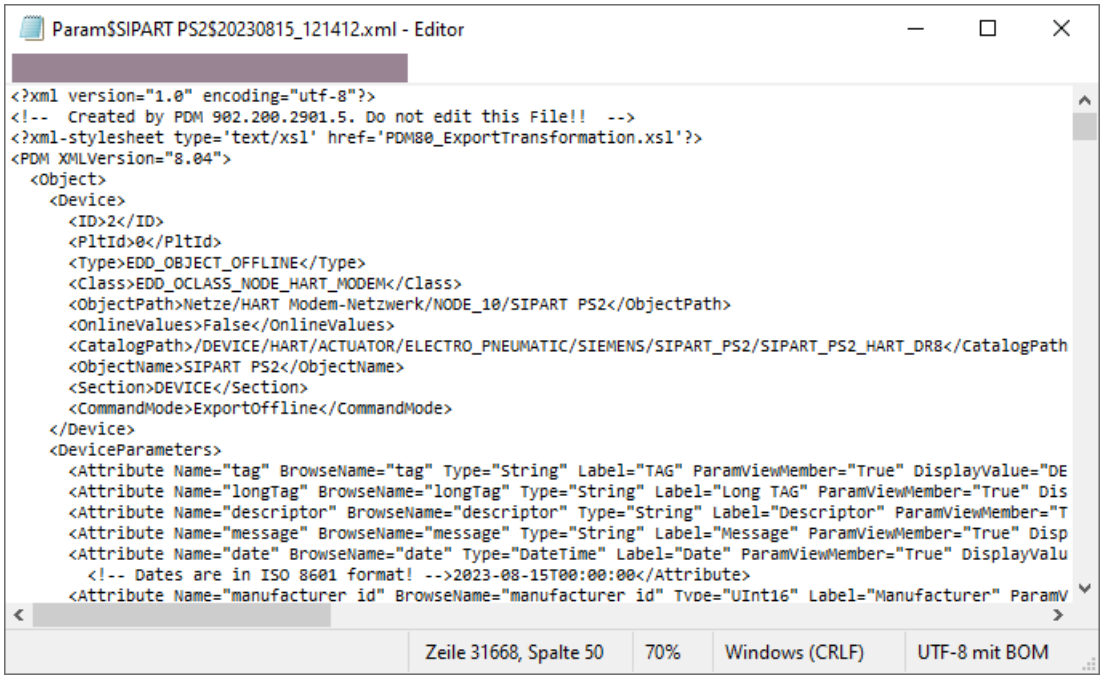

The "Export - ..." dialog opens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.

9. Wait until the status "Export: Action finished" is displayed.
   The following 2 files are stored in the export path:
   - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
   - XSL-Stylesheet "PDM80_ExportTransformation.xsl"
10. Close the dialog.
11. Open the XML file with suitable software, e.g. an editor.




The XML file contains the following data for process diagnostics.

Table 5-46 Parameter

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| U1.PUNIT | var_pressureUnit | Druckeinheit (U1.PUNIT) | bar | • bar<br>• MPa<br>• psi |
| U2.P_HYS | var_PZ_Hysteresis | Hysterese für Grenzwerte (U2.P_HYS) | 0.200 | |
| U7.PCL | var_pressureChamberLimit | Grenzwert Stelldruck Y1 (U7.PCL) | 7.000 | |

Table 5-47 Diagnostic values

| Diagnostic value | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| 61.Y1 | var_P1_value | Stelldruck Y1 (61.P1) | 1.670 | • bar<br>• MPa<br>• psi |
| 66.N1MAX | var_P1_NoLimitReachedResettable | Überschreitungen Grenzwert Y1 (rücksetzbar) (66.N1MAX) | 0 | (Quantity) |

### See also

Activate and configure diagnostics (Page 482)

## 5.18.8 Messages

### 5.18.8.1 General information

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- "Pressure monitoring" (U.\PRES) is activated.

### Notes

If the limits are exceeded:

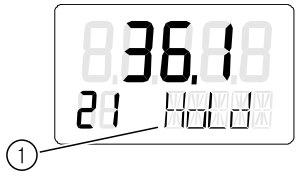
- A message appears on the display.
- The fault message output is activated when one of the following modules is used:
  - Digital I/O Module (DIO)
  - Inductive Limit Switches (ILS)
  - Mechanic Limit Switches (MLS)
- When using HART communication:
  - The "more status available" bit is set.
  - You can use the "#48" command to query the specific message for process diagnostics.

### 5.18.8.2 Messages in the display

#### Indication on the display

If the set limit is exceeded, the respective error code is output.

If several messages are present at the same time, the display switches between the different error codes.

| Display | | Possible cause |
|---|---|---|
|  | ① Error code 21 | The actuating pressure at Y1 exceeds the limit "U7.PCL" |
|  | ① Error code 21 with error message HoLd | The actuating pressure at Y1 exceeds the limit "U7.PCL"<br>The positioner is set to "Hold position" if the "U3.PFRLL" or "U4.PFRUL" parameter is set to "HoLd" is set. |

### 5.18.8.3 Messages via digital signals

#### Requirement

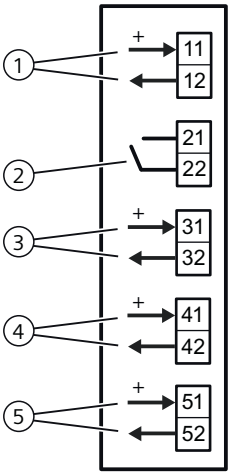
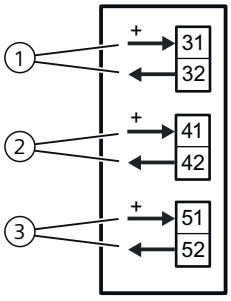
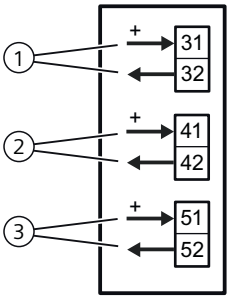
The positioner has a fault signal output, which is located on one of the following modules:

- Digital I/O Module (DIO)
- Inductive Limit Switches (ILS)
- Mechanic Limit Switches (MLS)

#### Message via the digital output

If the actuating pressure Y1 is higher than the limit "U7.PCL", the fault message output is activated.

**I/Os**

| Digital I/O Module (DIO)<br>6DR4004-6A / -8A | Inductive Limit Switches (ILS)<br>6DR4004-6G / -8G | Mechanic Limit Switches (MLS)<br>6DR4004-6K |
|---|---|---|
|  |  |  |
| ① Digital input DI2, galvanically isolated<br>② Digital input DI2, dry contact<br>③ Fault message output<br>④ Digital output DO1<br>⑤ Digital output DO2 | ① Fault signal output, in conjunction with 6DR4004-3ES without function<br>② Digital output 1<br>③ Digital output 2 | ① Fault signal output, in conjunction with 6DR4004-4ES without function<br>② Digital output 1<br>③ Digital output 2 |

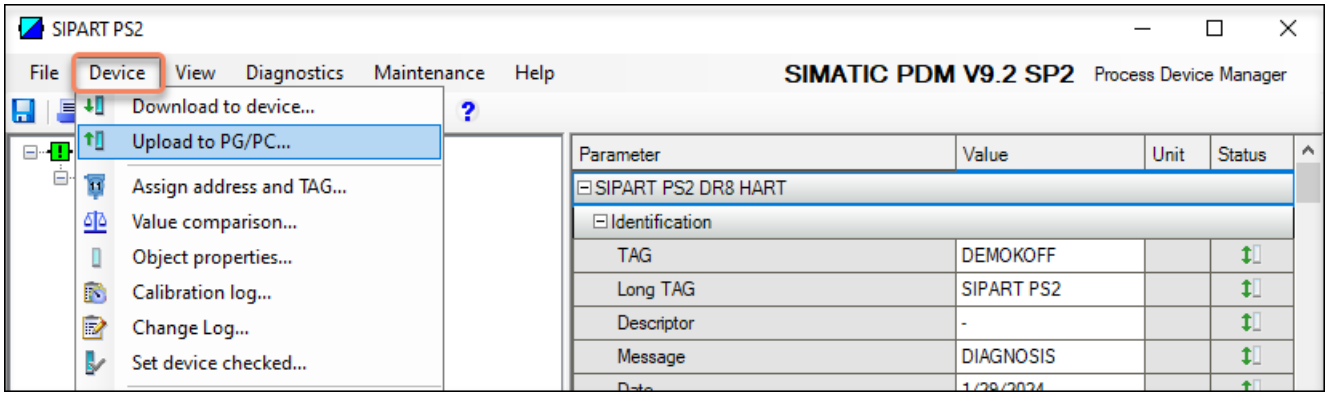
### 5.18.8.4 With SIMATIC PDM: Display diagnostics status

**Requirement**

- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created for the positioner.

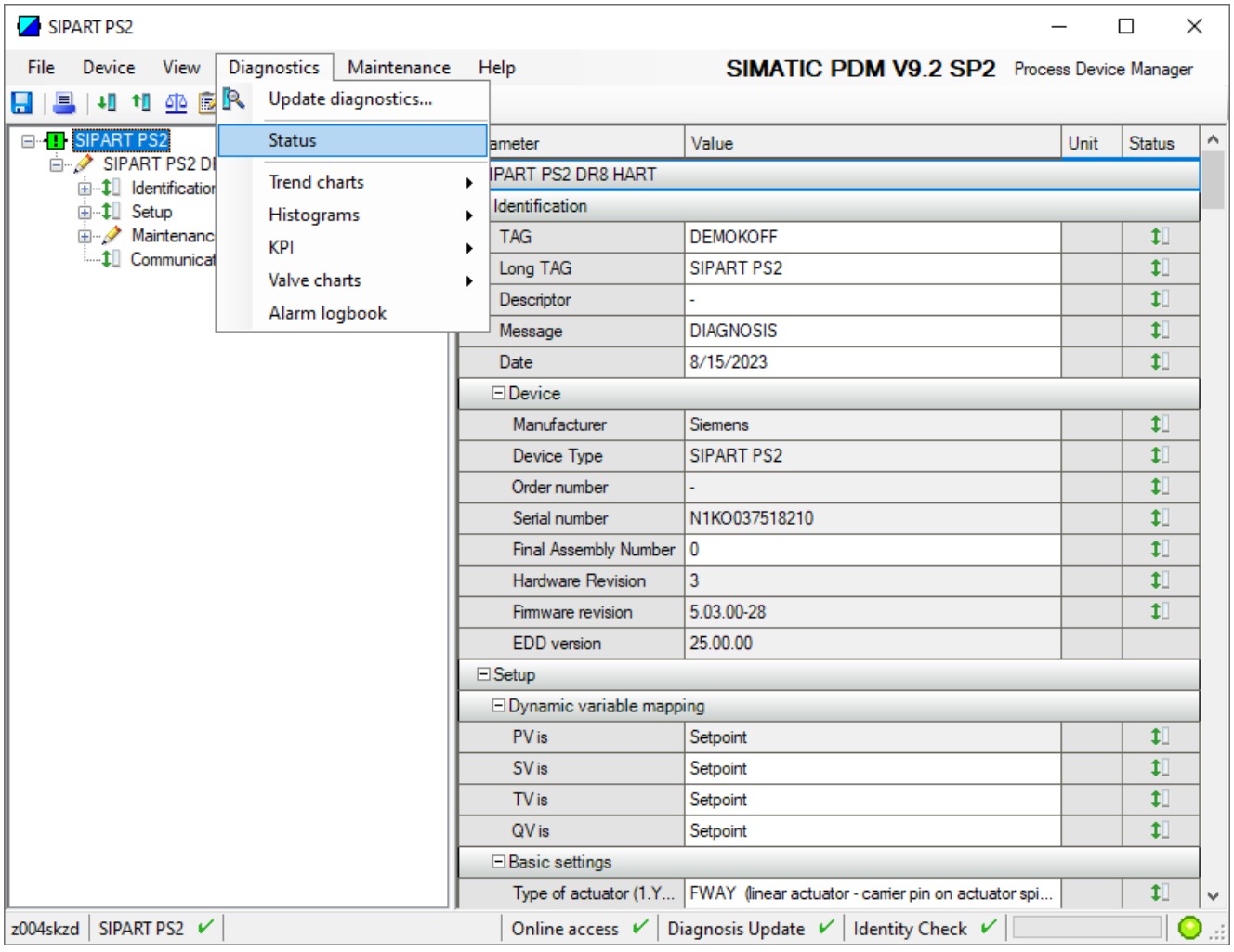
## Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

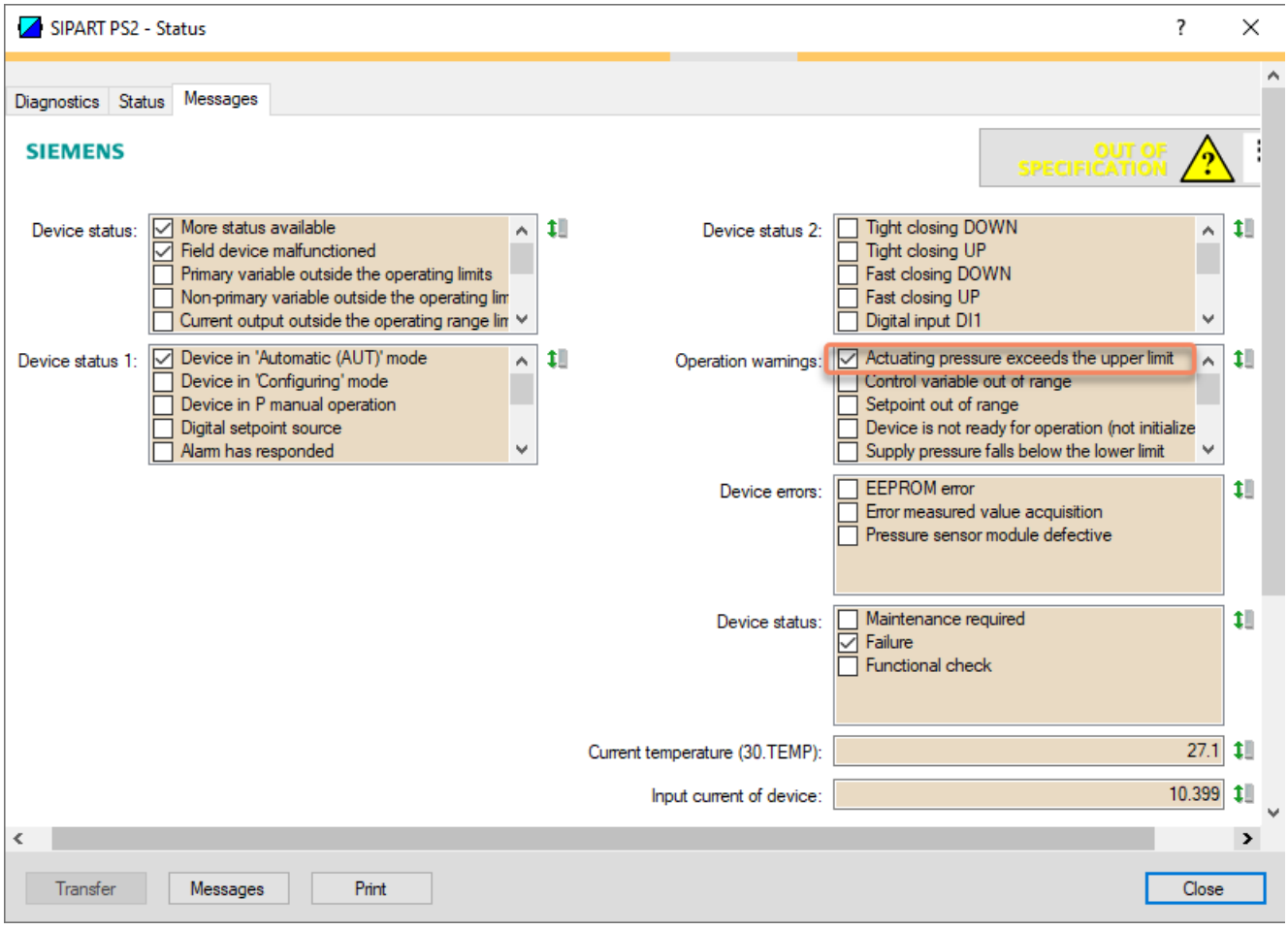



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Status" command.



7. Select the "Messages tab.
   If "Limit actuating pressure Y1" (U7.PCL) is exceeded, the message is highlighted:
   – Actuating pressure exceeds the upper limit




8. Close the dialog.

### 5.18.8.5 Via HART communication: Get messages

#### Condition

The positioner has a HART communicator: SIPART PS2 6DR51.../6DR52..

### Get message

If the limit for actuating pressure Y1 is exceeded, the "more status available" bit is set.

- Use the "#48" command to call up the specific message for process diagnostics.
  The command returns 20 bytes of data.
  The message for the process diagnostics "Monitoring of actuating pressure Y1" is contained in the following Byte:
  - Byte 3, Bit 6: The actuating pressure at Y1 exceeds the limit "U7.PCL".

## 5.18.8.6 Reset messages

The messages are saved in the alarm logbook of the positioner.

The error messages can be reset using the corrective measures.

| Error code/error message | Possible cause | Remedy |
|---|---|---|
| 21 | The actuating pressure Y1 exceeds the limit "U7.PCL". | • Check to determine why the actuating pressure was exceeded.<br>• Reduce the actuating pressure Y1 by moving the positioner in the opposite direction.<br>• Limit "U7.PCL" is set higher than the current actuating pressure Y1. |
| 21<br>HoLd | The positioner is set to "Hold position" if the "U3.PFRLL" or "U4.PFRUL" parameter is set to "HoLd" is set. | |

The message on the display disappears immediately if one of the following measures is taken:

- After another process diagnostics are successfully executed.
- Set application parameter "52.XDIAG" to "Off".
  ⇒ Process diagnostics are deactivated.
- Set the process diagnostics parameter to "Off".
  ⇒ Process diagnostics are deactivated.

# Maintenance diagnostics

# 6

## 6.1 Definition of maintenance diagnostics

During a maintenance phase, e.g. while the flow rate is not being actively controlled, active tests and diagnostics can be performed using the maintenance diagnostics on the valve.

This determines the condition of the valve.

The current diagnostic results can be compared and evaluated with previous results.

## 6.2 Overview of maintenance diagnostics

The maintenance diagnostics available in the positioner depend on the firmware version.

| **Maintenance diagnostic** | **Function** | **Diagnostics applicable for SIPART PS2 ... positioner** | | | **Additional information** |
|---|---|---|---|---|---|
| | | **Without pressure sensor** | **With pressure sensor (-Z P01 option)** | **With pressure sensors (-Z P02 option)** | |
| Leakage test | The test uses position measurement to detect pneumatic leaks in the actuator or in the piping. | **X** | **X** | **X** | Leakage test (Page 507) |
| Full Stroke Test | The test analyzes the valve based on a complete stroke in both directions. | **X** | **X** | **X** | Full Stroke Test (FST) (Page 509) |
| Step Response Test | The test analyzes the valve based on a partial stroke in one direction. | **X** | **X** | **X** | Step Response Test (SRT) (Page 519) |
| Multi Step Response Test | The test analyzes the valve based on several partial strokes. | **X** | **X** | **X** | Multi Step Response Test (Page 528) |
| Valve Performance Test | The test determines the following valve characteristics:<br>• Hysteresis<br>• Non-linearity<br>• Non-repeatability<br>• Measurement deviation<br>• Average measurement deviation of all cycles<br>• Maximum measurement deviation<br>• Total mean measurement deviation<br>• Uncertainty | - | - | **X** | Valve Performance Test (VPT) (Page 540) |
| Valve Signature (drucksensorgestützt) | The diagnostics create the characteristics of the valve using the pressure sensors integrated in the positioner.<br>The dependency between pressure and position of the valve is shown. | - | - | **X** | Valve Signature (VS) (Page 548) |
| Triggered pressure monitoring (drucksensorgestützt) | The diagnostics determine the pressure difference between 2 measurements and thus test the function of external attachments, e.g. the solenoid valve. | - | - | **X** | Triggered pressure monitoring (TPM) (Page 574) |

# 6.3 Leakage test

## 6.3.1 Functional description

The leakage test detects pneumatic leaks in the actuator or in the piping.

The test blocks the pneumatic outputs Y1 and Y2 for 1 minute.

The position of the valve is monitored: In the event of a pneumatic leak, the position of the valve changes.

As a result, the change in position per minute is shown on the display and saved in the diagnostic value "Leakage test" (11.LEAK) .

The leakage test can be started during initialization or as a manual test at a later time.

- During initialization: The positioner automatically moves the valve to a center position and performs the test.
  Additional information → Operating instructions
- Manual test in the "Manual mode (MAN)" → Manual leakage test (Page 508)

**Note**

During the 1-minute test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.

### 6.3.2 Manual leakage test

#### Requirement

- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Manual (MAN)" mode.

#### Procedure

1. Set the actuator to the desired start position.
   The position of the actuator must not be at one of the two end positions, "Endstop 0% position" or "Endstop 100% position".
   - Recommended for actuators with spring: Set a position with high chamber pressure, e.g. 90 to 95%.
   - Recommendation for drives without spring: Set a medium position, e.g. 40 to 60%.
2. Switch the positioner to "Diagnostics" mode by pressing the 3 buttons on the display simultaneously for at least 2 seconds.
3. Select the diagnostic value "Leakage test" (11.LEAK).
4. Press the button for at least 5 seconds.
   => "Strt" is shown in the display.
   => The leakage test starts after 5 seconds.
   => The display alternates between "tESt" and the current position of the actuator for 1 minute.

After 1 minute, the display shows the difference between the actuator position before and after the test.

### 6.3.3 Diagnostic value "Leakage test" (11.LEAK)

| **Diagnosewert** | **Leakage test**<br>**Short designation: 11.LEAK** | | |
|---|---|---|---|
| Function | The diagnostic value shows the result of the last leakage test or starts the leakage test.<br>The leakage test detects pneumatic leaks in the actuator or in the piping. | | |
| Note | This diagnostic value can be used to start the leakage test as a maintenance diagnostic → Leakage test (Page 507). | | |
| Display options | - | The display has one of the following causes:<br>• No leakage test has been performed to date.<br>• The positioner is not initialized.<br>• The factory setting was restored with the application parameter "50.PRST" was. | |
| | 0.0 ... 100.0 | An existing test result means one of the following possibilities:<br>• The leakage test was performed manually.<br>• The leakage test was performed during initialization. | |
| Unit | %/minute<br>Note: The value shows the change in actuator position in % during the duration of the 1-minute leakage test. | | |
| **Communication** | | | |
| SIMATIC PDM Export | Name | ps2_leakage_act | |
| | DisplayValue | ≙ Value | |
| HART communication (read) | Command | #169 | |
| | Response Data | Byte: 32<br>Format: Enum | Leak Test state |
| | | Bytes: 29 ... 31<br>Format: Float | Leak Test value |

## 6.4 Full Stroke Test (FST)

### 6.4.1 Functional description

The Full Stroke Test (FST) analyzes the valve based on a complete stroke in both directions.

The test moves the actuator of the valve from the start position (0%) to the end position (100%) and back to the start position.

The actual value curve is analyzed in accordance with the IEC 61514-2 standard.

The FST can be configured and executed during a maintenance phase of the valve with a Device Manager Software, e.g. SIMATIC PDM.

Local operation via the display and buttons is not possible.

The result of the test is saved in the positioner and can be compared with previous recordings to detect changes in the valve.

With SIMATIC PDM, the diagnostics results can be read from the positioner and displayed as charts.

**Note**

During the test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.
- The positioner moves the valve.

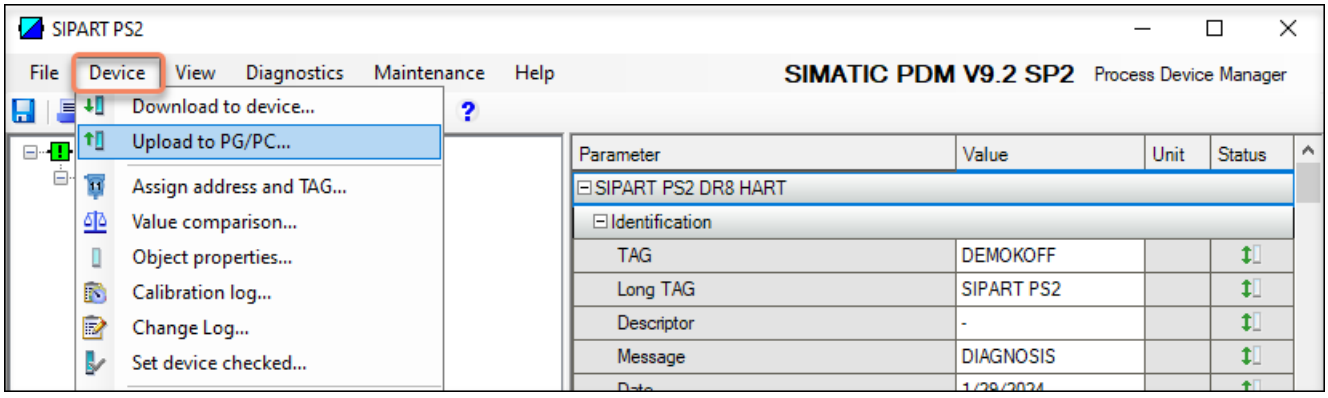
## 6.4.2 Start full stroke test.

### Requirement

- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Automatic (AUT)" mode.
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

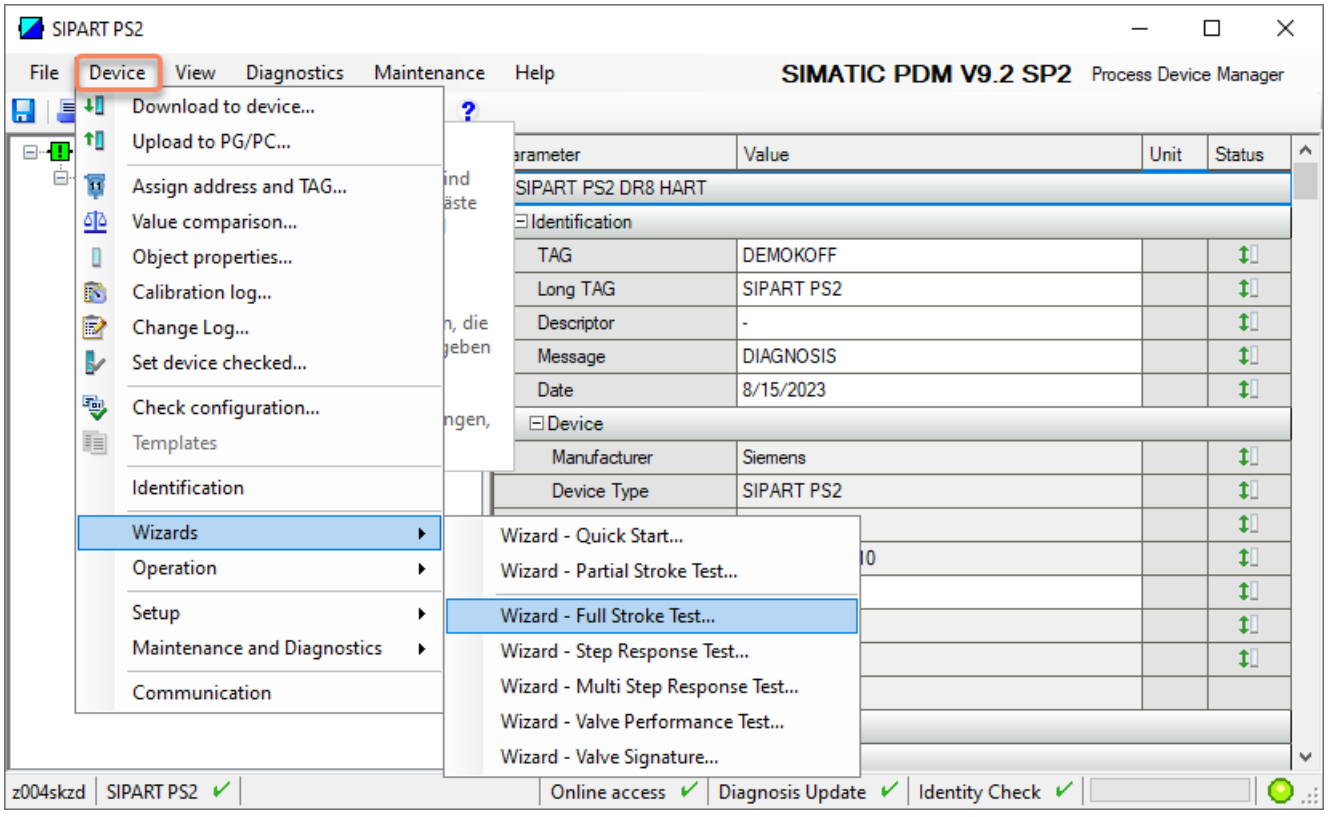
### Start FST

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Device > Wizards"menu, select the command "Wizard - Full Stroke Test...".




⇒ The dialog with "Step 1 of 3: Settings" opens.

## Step 1: Settings

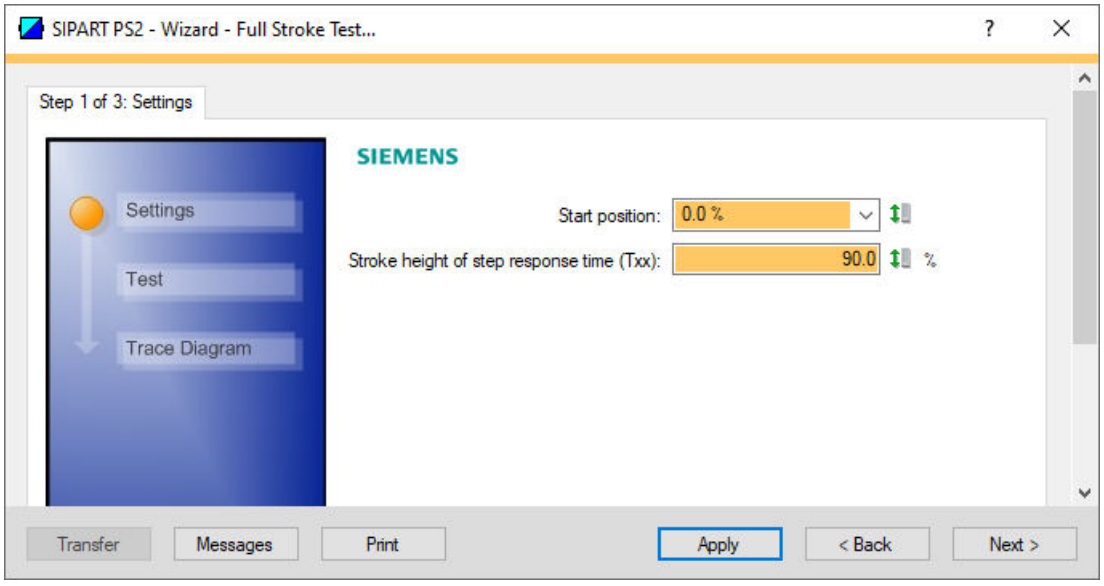


Table 6-1 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| Apply | Saves the changed values of the dialog |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Select the "Start position".

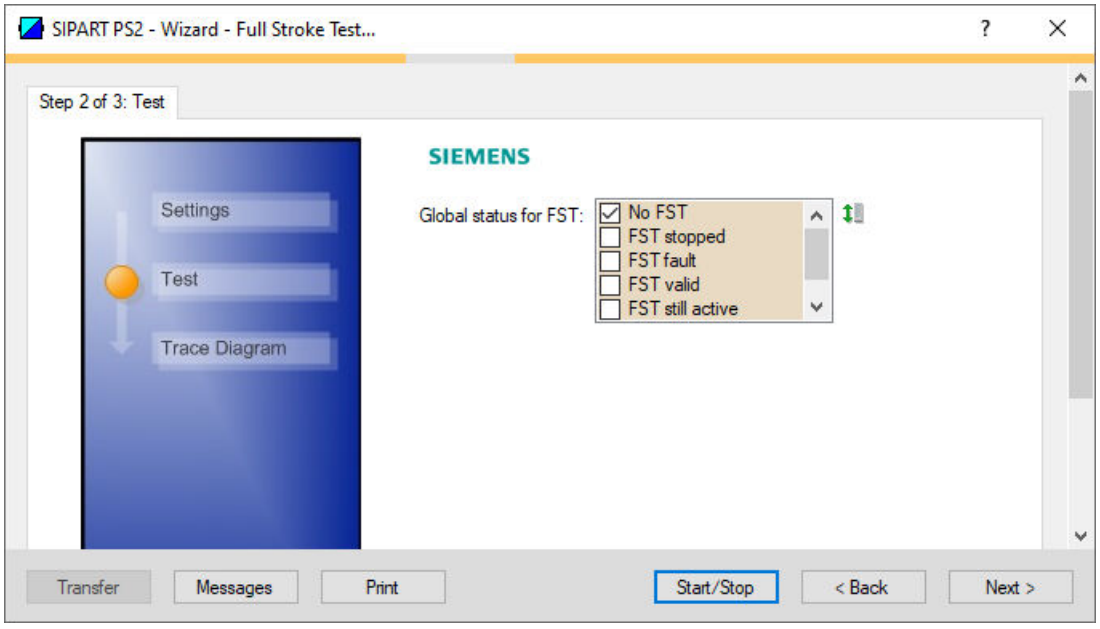
| **Start position** | |
|---|---|
| Function | The parameter defines the start position of the FST in percent. |
| Setting options | • 0.0<br>• 100.0 |
| Factory setting | 0.0 |
| Unit | % |

2. Enter the "Stroke height of step response time (Txx)".

| **Stroke height of step response time (Txx)** | |
|---|---|
| Function | The parameter defines the stroke height in percent for determining the step response times Txx. |
| Setting range | 5.0 ... 95.0 |
| Factory setting | 90.0 |
| Unit | % |

3. Click the "Apply" button.
4. Click the "Next >" button.
   ⇒ The "Step 2 of 3: Test" dialog opens.

### Step 2: Test




If an immediately preceding FST was executed, the diagram of the previous FST is displayed.

In the "Global status for FST" dialog box, the current status for the FST is displayed.

The following states are possible:

- No FST
- FST stopped
- FST fault
- FST valid
- FST still active

**Procedure**

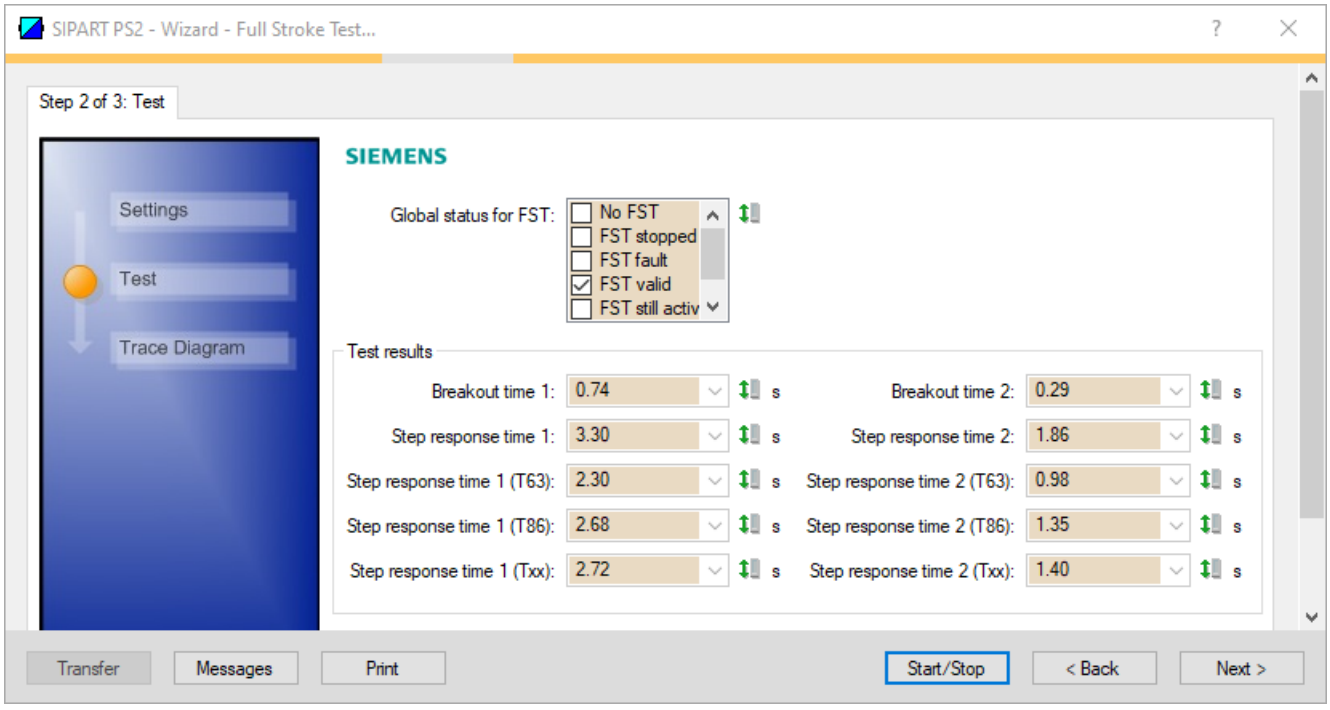
1. Click the "Start/Stop" button.
   ⇒ A dialog opens.
2. Confirm the start with "OK".
   ⇒ A dialog opens with a note on possible damage.
3. Follow the instructions in the dialog.
4. To start the test, select the "Yes" option button and click "OK".
   ⇒ The "FST" starts.
   ⇒ "FST" is shown in the display.
   ⇒ A dialog opens.

5. Close the dialog with "OK".
   The positioner moves the actuator as follows:
   - From the start position to the start position.
   - From the start position to the center position.
   - From the center position to the end position ≙ start position.
   - From the start position back to the start position.

   Faults or errors are displayed in the "Detailed information" dialog box:
   - Start position not reached
   - Mid position not reached
   - End position not reached

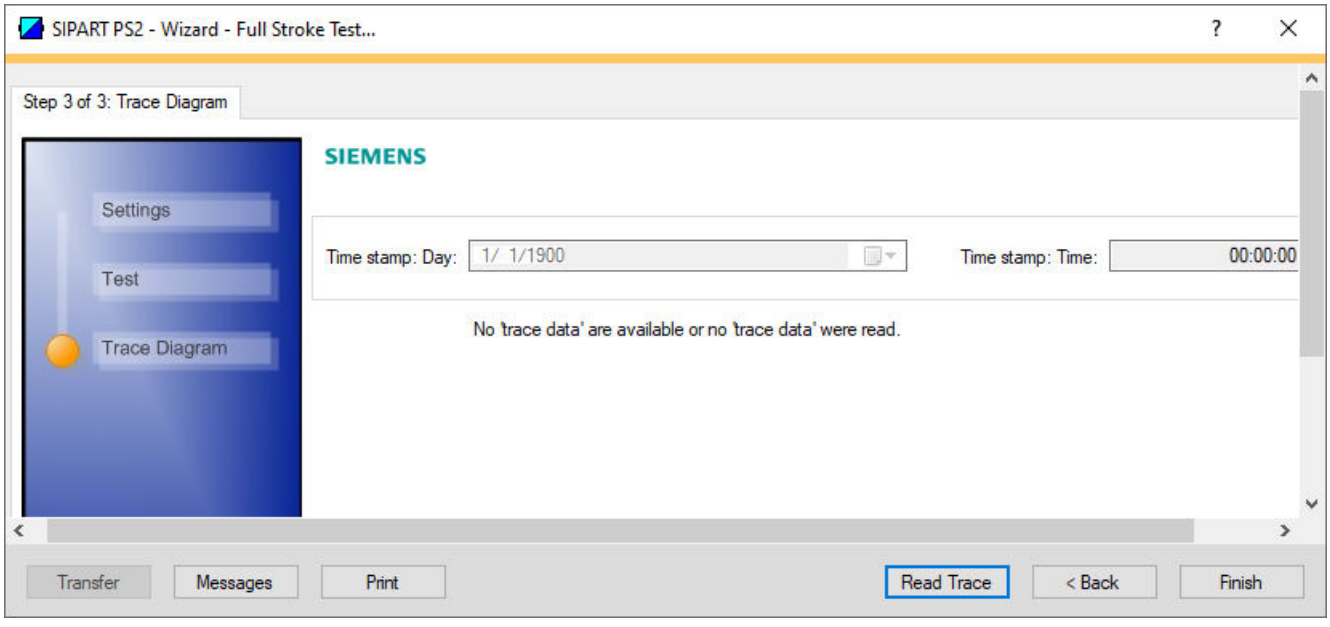
   The "FST valid" status is highlighted after successful diagnostics.
   The results are presented in "Test results" dialog box:

| Characteristic value | Description |
|---|---|
| Breakout time 1 | Time between activation of the positioner and the beginning of the movement of the valve from the start position to the center position. |
| Breakout time 2 | Time between activation of the positioner and the beginning of the movement of the valve from the center position to the start position. |
| Step response time 1 | Time between activation of the positioner in the start position and reaching center position. |
| Step response time 2 | Time between activation of the positioner in the center position and reaching the start position. |
| Step response time 1 (T63) | Time between activation of the positioner in the start position and reaching 63.2% of the distance to the center position. |
| Step response time 2 (T63) | Time between activation of the positioner in the center position and reaching 63.2% of the distance to the start position. |
| Step response time 1 (T86) | Time between activation of the positioner in the start position and reaching 86.5% of the distance to the center position. |
| Step response time 2 (T86) | Time between activation of the positioner in the center position and reaching 86.5% distance to the start position. |
| Step response time 1 (Txx) | Time between activation of the positioner in the start position and reaching Txx% of the distance to the center position.<br>Txx corresponds to the "Stroke height of the step response time" set in step 1. |
| Step response time 2 (Txx) | Time between activation of the positioner in the center position and reaching Txx% distance to the start position.<br>Txx corresponds to the "Stroke height of the step response time" set in step 1. |



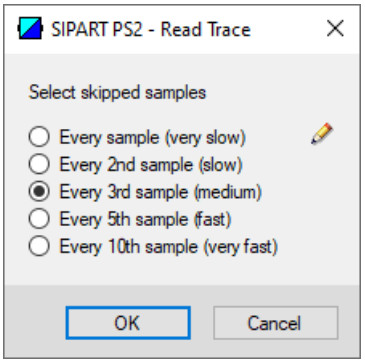

6. Click the "Next >" button.
   ⇒ The "Step 3 of 3: Trace Diagram" dialog opens.

### Step 4: Create trace chart



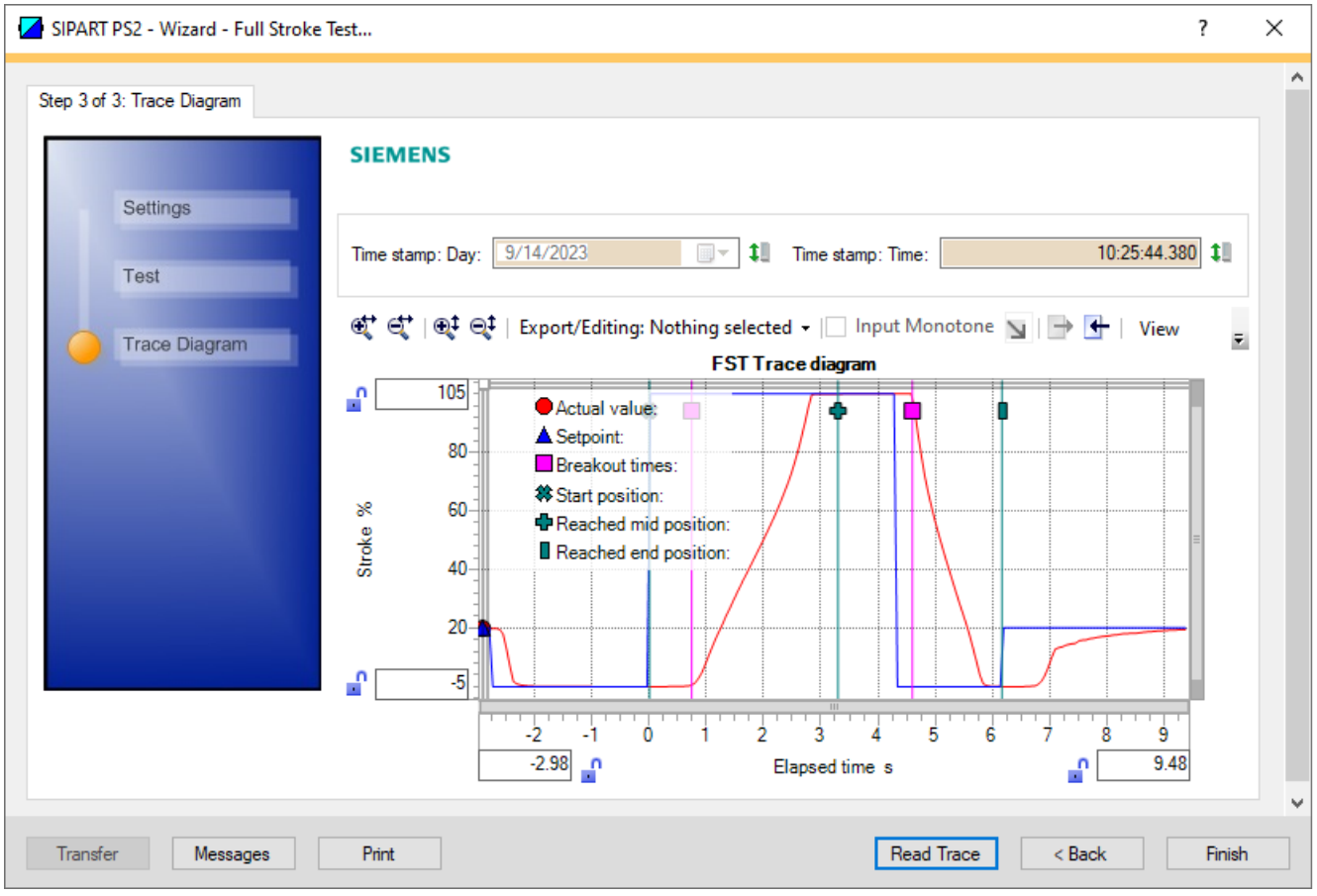
If an immediately preceding FST was executed, the diagram of the previous FST is displayed.

1. Click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




   As the HART communication may be slow, it is possible to load the chart data from the positioner in different resolutions.
4. Select the option button for the required sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog by clicking "OK".
   ⇒ The "Message Log" dialog opens.
6. Wait until the status "Finished" is displayed.

7. Click the "Close" button.
   ⇒ The trace chart of the current FST is displayed.




The diagram below shows an example of the setpoint values and the actual values.

8. Close the dialog with the "Finish" button.
   ⇒ The test results and the chart are saved.

## Displaying test results

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. Select the "Maintenance & Diagnostics" directory.
3. Select "Offline test reports" .
4. Click the "Show offline test reports" button.
5. Select "Full Stroke Test".
   ⇒ The test results are displayed.

# 6.5 Step Response Test (SRT)

## 6.5.1 Functional description

The Step Response Test (SRT) analyzes the valve based on a partial stroke in one direction.

The test moves the actuator of the valve from a freely configurable start position to a freely configurable end position.

The actual value curve is analyzed in accordance with the IEC 61514-2 standard.

The SRT can be configured and executed during a maintenance phase of the valve with a Device Manager Software, e.g. SIMATIC PDM.

Local operation via the display and buttons is not possible.

The result of the test is saved in the positioner and can be compared with previous recordings to detect changes in the valve.

With SIMATIC PDM, the diagnostics results can be read from the positioner and displayed as charts.

**Note**

During the test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.
- The positioner moves the valve.

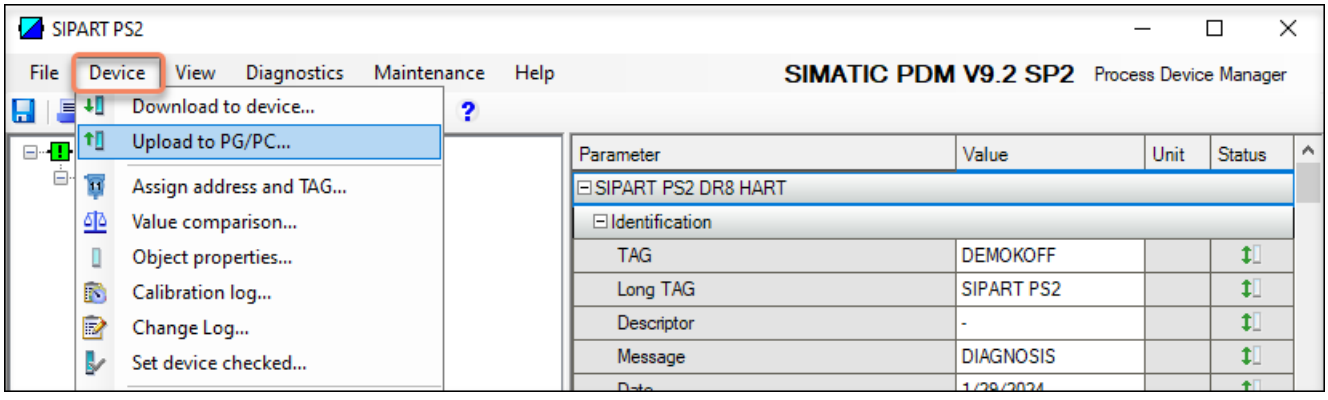
## 6.5.2 Start Step Response Test

### Requirement

- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

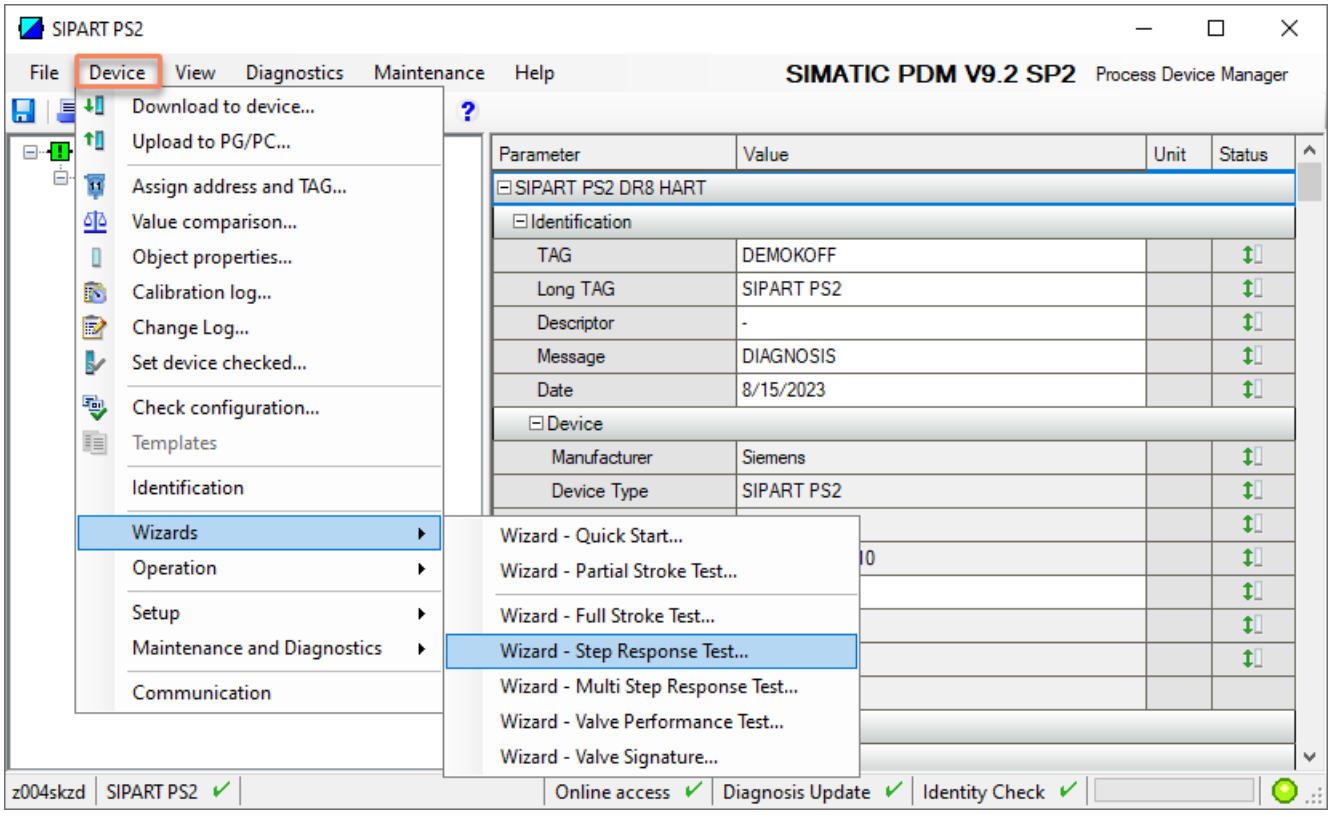
### Start SRT

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Device > Wizards" menu, select the command "Wizard - Step Response Test...".




⇒ The dialog with "Step 1 of 3: Settings" opens.

## Step 1: Set the parameters

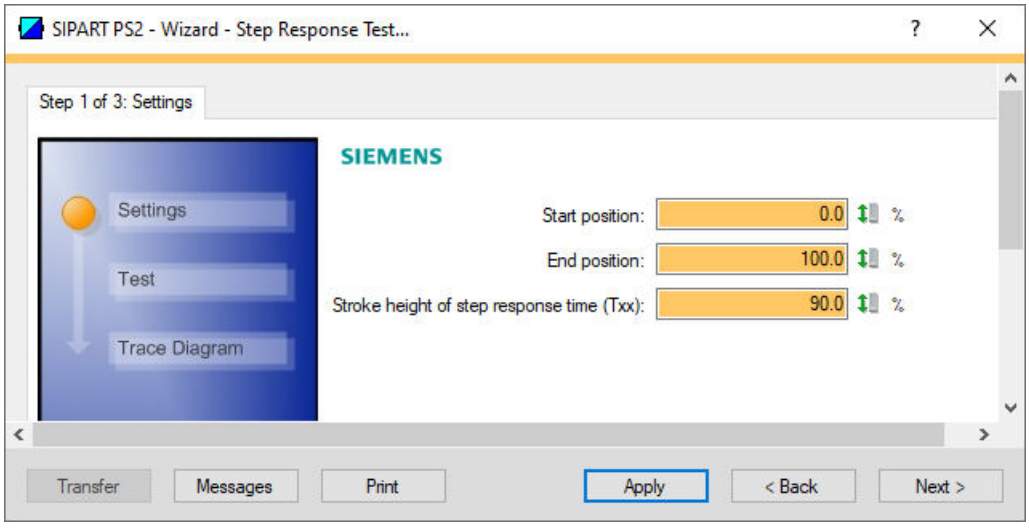


Table 6-2 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| Apply | Saves the changed values of the dialog |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Enter the "Start position".

| **Start position** | |
|---|---|
| Function | The parameter defines the start position of the SRT in percent. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 0.0 |
| Unit | % |
| **Communication** | |

2. Enter the "End position".

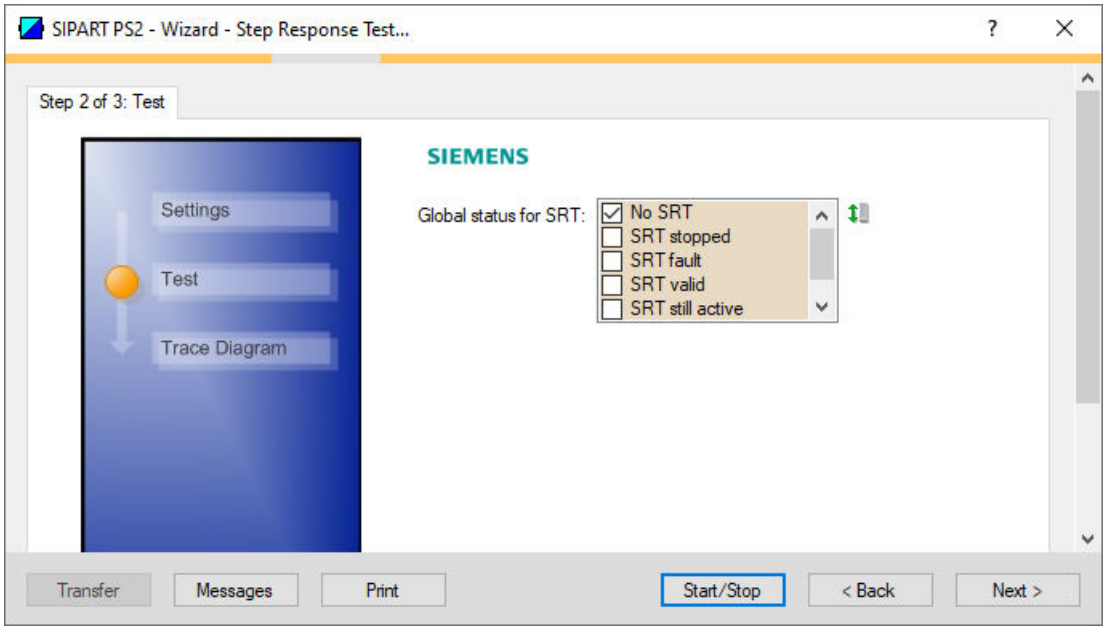
| **End position** | |
|---|---|
| Function | The parameter defines the end position of the SRT in percent. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

3. Enter the "Stroke height of step response time (Txx)".

| **Stroke height of step response time (Txx)** | |
|---|---|
| Function | The parameter defines the stroke height in percent for determining the step response times Txx. |
| Setting range | 5.0 ... 95.0 |
| Factory setting | 90.0 |
| Unit | % |

4. Click the "Apply" button.
5. Click the "Next >" button.
   ⇒ The "Step 2 of 3: Test" dialog opens.

### Step 2: Test




If an immediately preceding SRT was executed, the diagram of the previous SRT is displayed.

In the "Global status for SRT" dialog box, the current status for the SRT is displayed

The following states are possible:

- No SRT
- SRT stopped
- SRT fault
- SRT valid
- SRT still active

#### Procedure

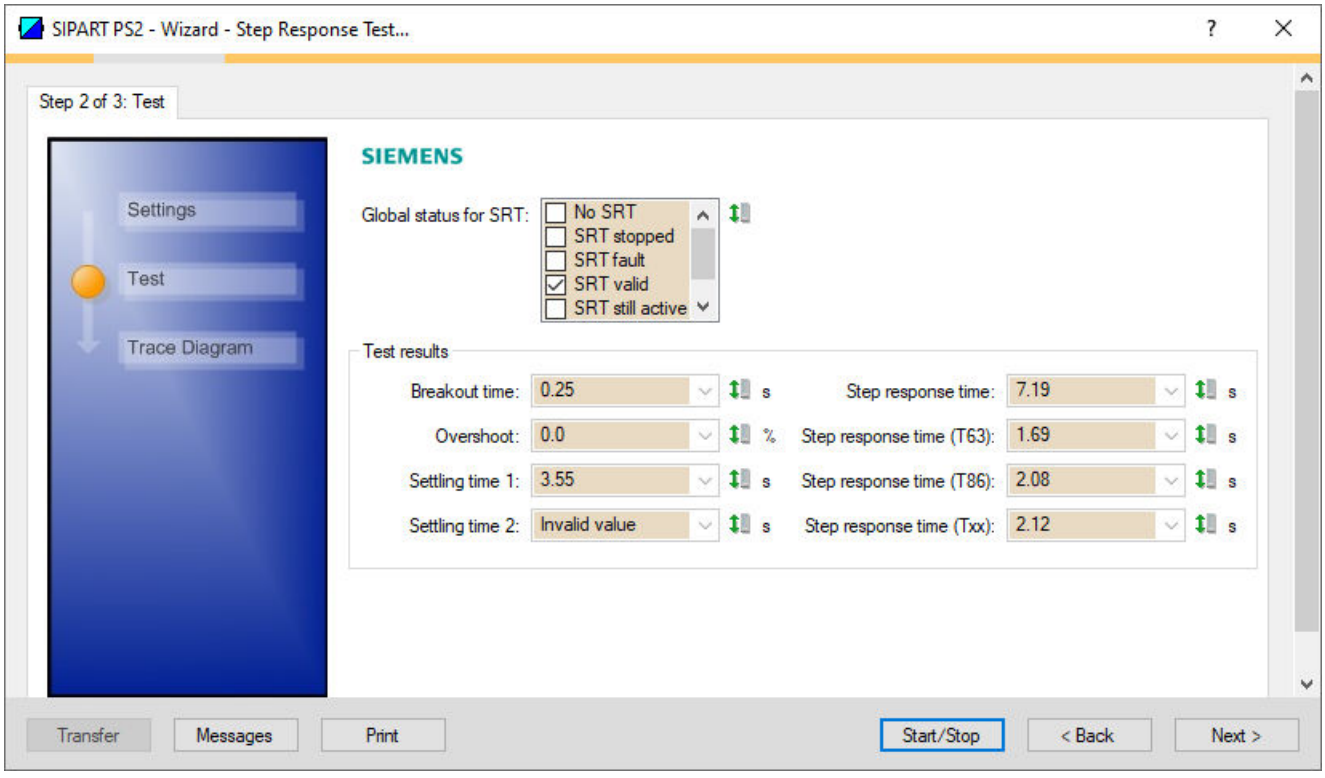
1. Click the "Start/Stop" button.
   ⇒ A dialog opens.
2. Confirm the start with "OK".
   ⇒ A dialog opens with a note on possible damage.
3. Follow the instructions in the dialog. To start the test, select the "Yes" option button and click "OK".
   ⇒ The "SRT" starts.
   ⇒ "SRT" is shown in the display.
   ⇒ A dialog opens.

4. Close the dialog with "OK".
   The positioner moves the actuator as follows:
   - From the start position to the start position.
   - From the start position to the end position.
   - From the start position back to the start position.

   Faults or errors are displayed in the "Detailed information" dialog box:
   - Start position not reached
   - Mid position not reached
   - End position not reached

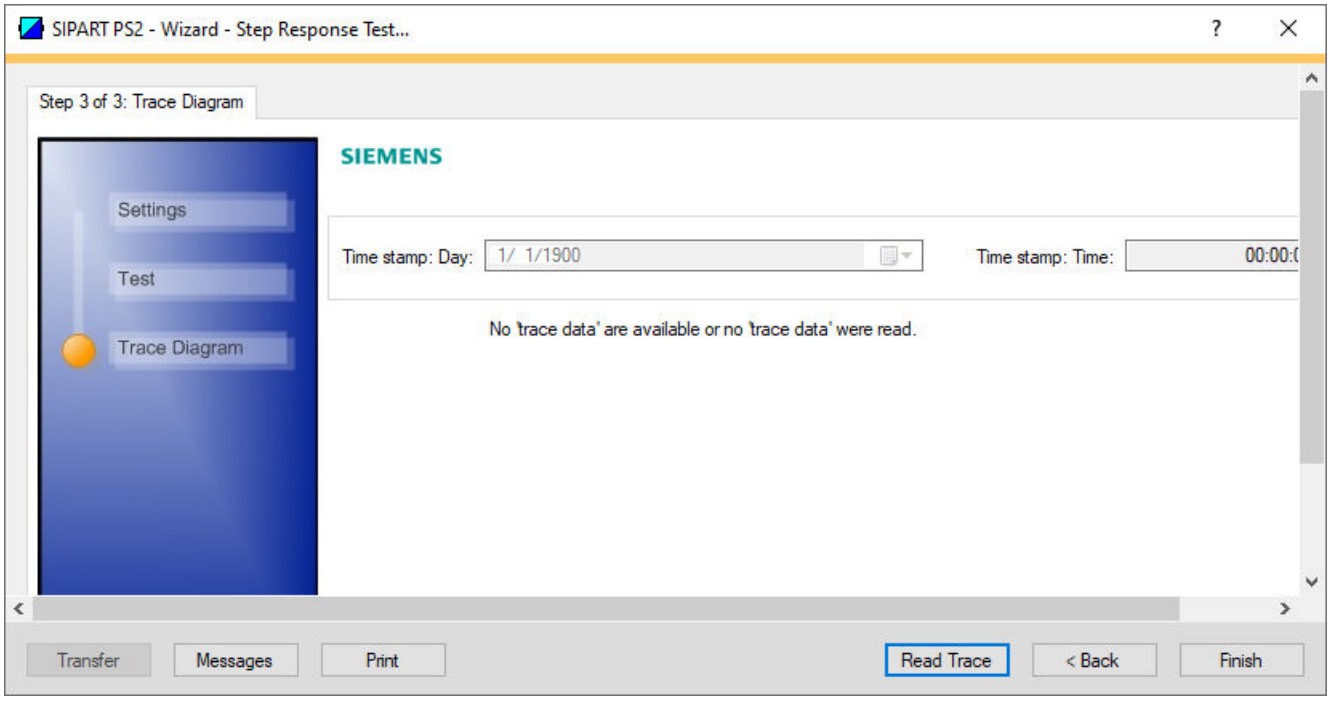
   The following status is highlighted after successful diagnostics: "SRT valid".
   The results are presented in "Test results" dialog box:
   - Breakout time
   - Overshoot
   - Settling time 1
   - Settling time 2
   - Step response time
   - Step response time (T63)
   - Step response time (T86)

– Step response time(Txx)
  Corresponds to the set "Stroke height of step response time T" from step 1.



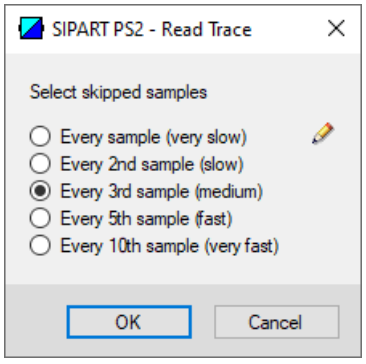

5. Click the "Next >" button.
   ⇒ The "Step 3 of 3: Trace Diagram" dialog opens.

### Step 3: Trace chart




If an immediately preceding SRT was executed, the diagram of the previous SRT is displayed.

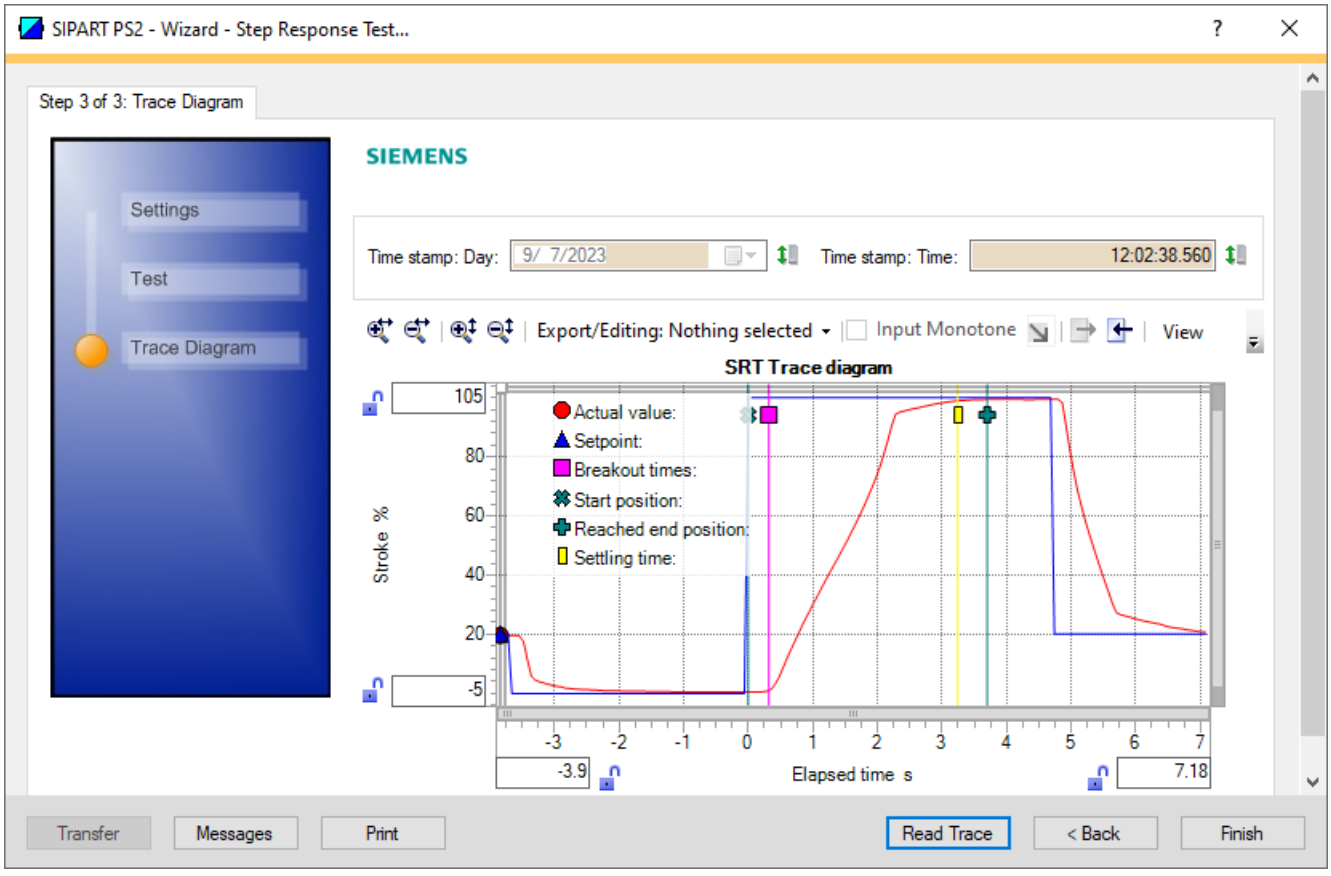
1. Click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




As the HART communication may be slow, it is possible to load the chart data from the positioner in different resolutions.

4. Select the corresponding option button for the required sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog by clicking "OK".
   ⇒ The "Message Log" dialog opens.

6. Wait until the status "Finished" is displayed.
7. Click the "Close" button.
   ⇒ The trace chart of the current SRT is displayed.




The diagram below shows an example of the result of the SRT with the following settings:

- Start position "0.0"
- End position "100.0"

8. Close the dialog with the "Finish" button.
   ⇒ The test results and the chart are saved.

## Displaying test results

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. Select the "Maintenance & Diagnostics" directory.
3. Select "Offline test reports" .
4. Click the "Show offline test reports" button.
5. Select "Step Response Test"
   ⇒ The test results are displayed.

# 6.6 Multi Step Response Test

## 6.6.1 Functional description

The Multi Step Response Test (MSRT) analyzes the valve based on several partial strokes.

The test moves the actuator of the valve to up to 20 freely configurable start and end positions.

The actual value curve is analyzed in accordance with the IEC 61514-2 standard.

The MSRT can be configured and executed during a maintenance phase of the valve with a Device Manager Software, e.g. SIMATIC PDM.

Local operation via the display and buttons is not possible.

The result of the test is saved in the positioner and can be compared with previous recordings to detect changes in the valve.

With SIMATIC PDM, the diagnostics results can be read from the positioner and displayed as charts.

**Note**

During the test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.
- The positioner moves the valve.

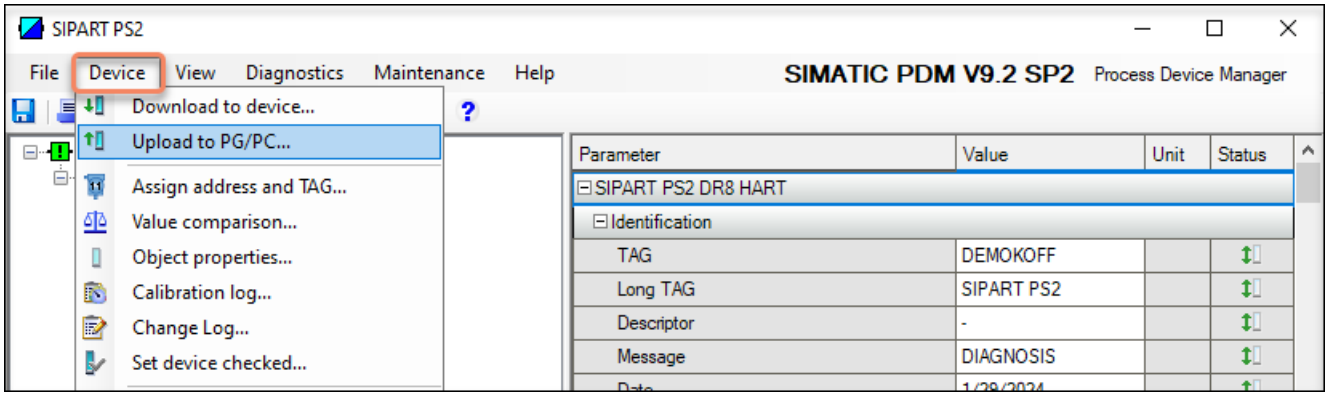
## 6.6.2 Start Multi Step Response Test

### Requirement

- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Automatic (AUT)" mode.
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

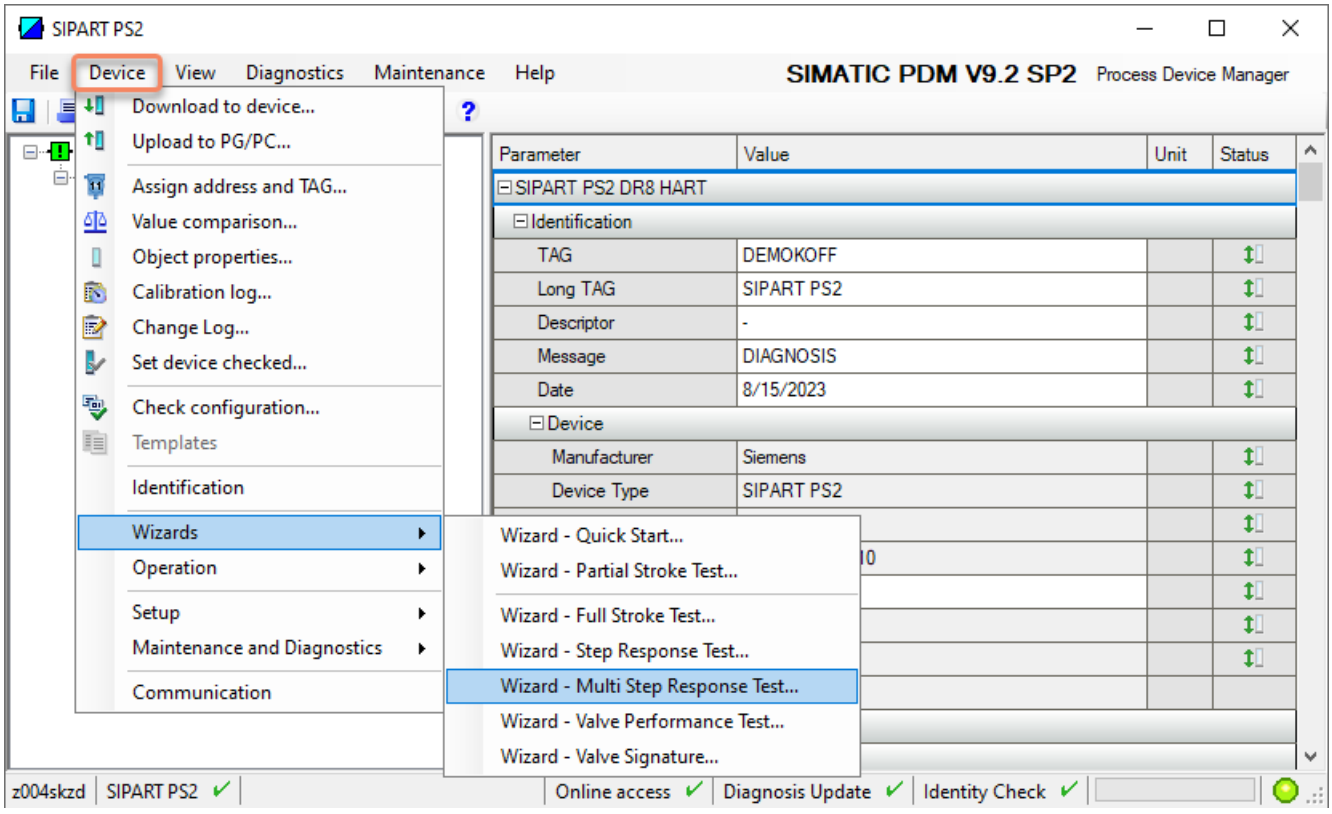
### Start MSRT

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Device > Wizards" menu, select the command "Wizard - Multi Step Response Test...".




⇒ The dialog with "Step 1 of 4: Settings" opens.

### Step 1: Set the parameters

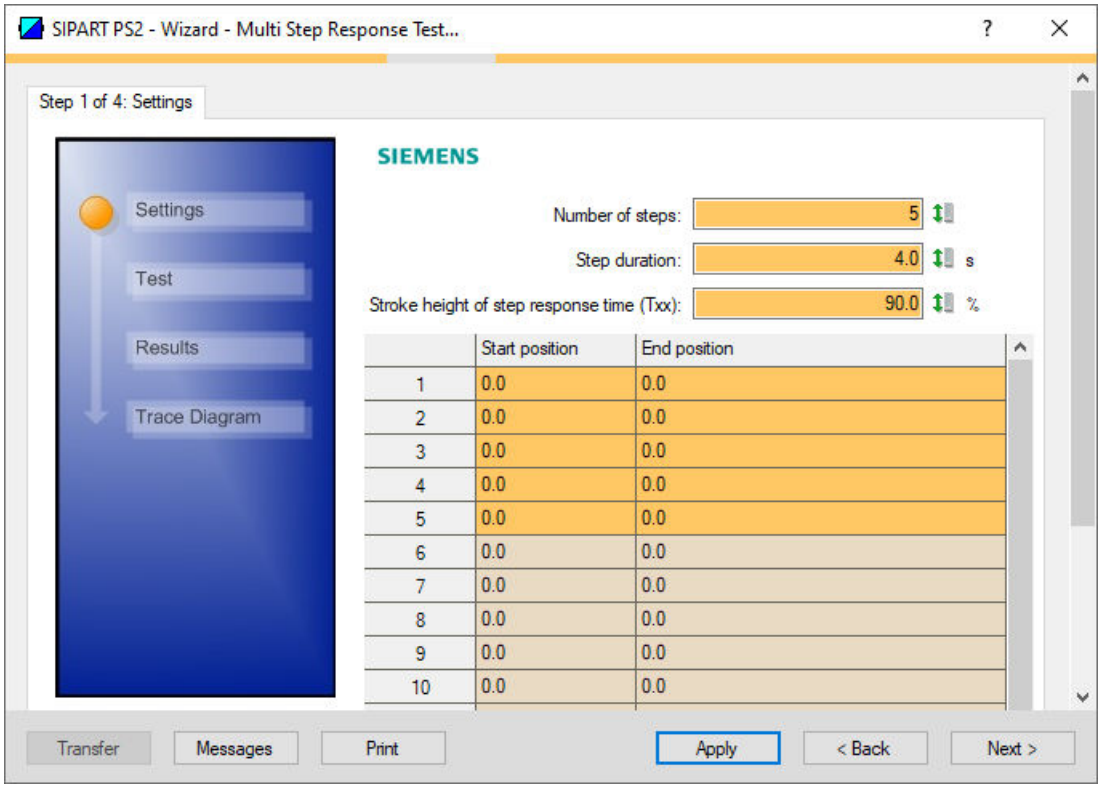



Table 6-3 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| Apply | Saves the changed values of the dialog |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Enter the "Number of steps".

| **Number of steps** | |
|---|---|
| Function | The parameter defines the number of individual jumps in the MSRT. |
| Setting range | 2 ... 20 |
| Factory setting | 5 |

2. Enter the "Step duration".

| **Step duration** | |
|---|---|
| Function | The parameter defines the duration of each individual jump. |
| Setting range | 0.1 ... 100.0 |
| Factory setting | 4.0 |
| Unit | s (second) |

3. Enter the "Stroke height of step response time (Txx)".

| **Stroke height of step response time (Txx)** | |
|---|---|
| Function | The parameter defines the stroke height in percent for determining the step response times Txx. |
| Setting range | 5.0 ... 95.0 |
| Factory setting | 90.0 |
| Unit | % |

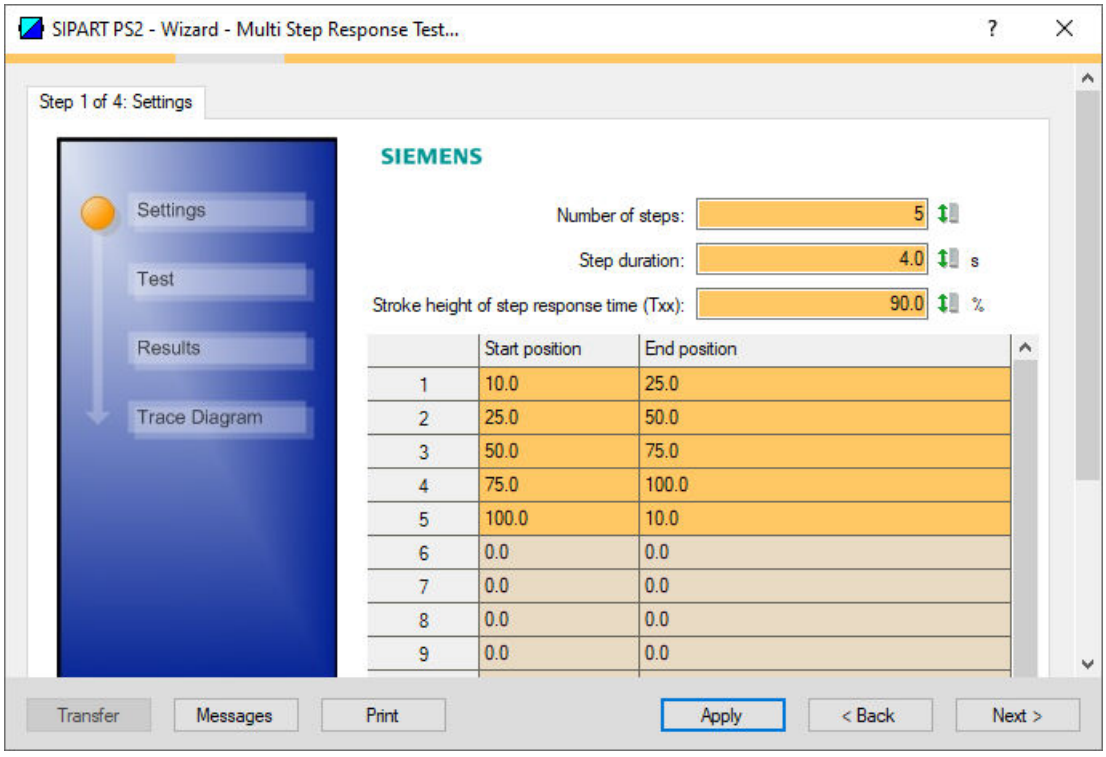
4. Enter a value for "Start position" in the colored lines.
   The number of lines highlighted in color corresponds to the value entered for "Number of steps".

| **Start position** | |
|---|---|
| Function | The parameters define the start position of the respective test step as a percentage. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 0.0 |
| Unit | % |

5. Enter a value for "End position" in the colored lines.
   The number of lines highlighted in color corresponds to the value entered for "Number of steps".

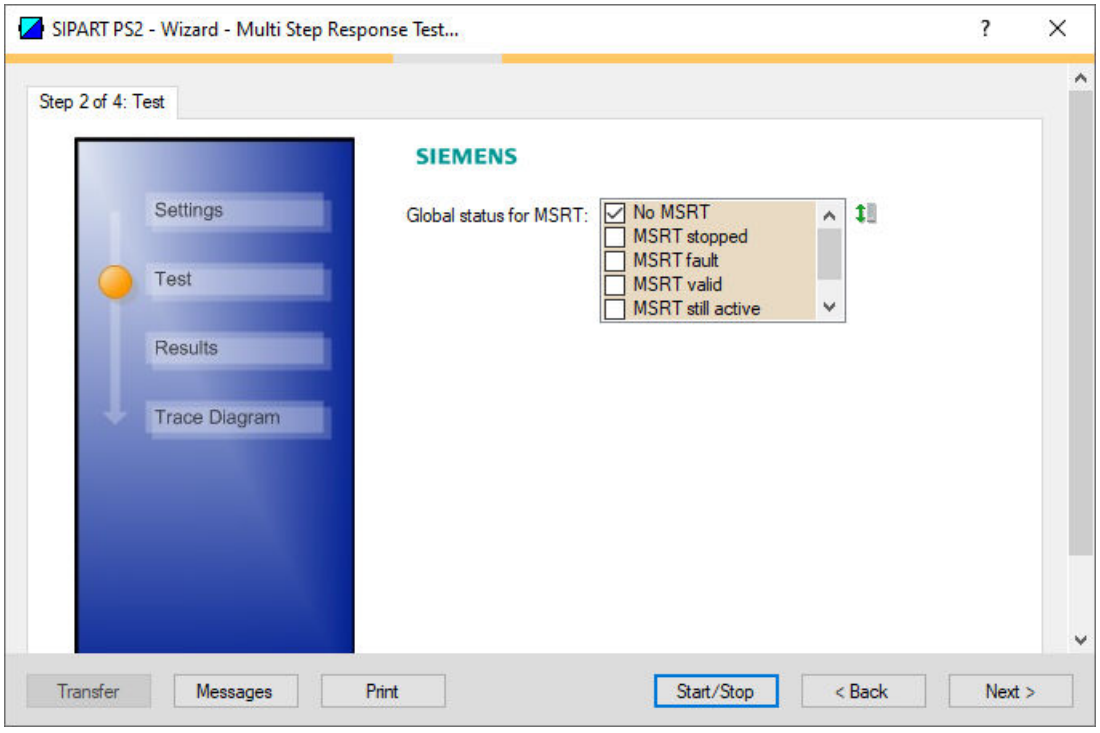
| **End position** | |
|---|---|
| Function | The parameters define the end position of the respective test step as a percentage. |
| Setting range | 0.0 ... 100.0 |
| Factory setting | 100.0 |
| Unit | % |

Exemplary parameter values




6. Click the "Apply" button.
7. Click the "Next >" button.
   ⇒ The "Step 2 of 4: Test" dialog opens.

### Step 2: Test




In the "Global status for MSRT" dialog box, the current status for the MSRT is displayed.

The following states are possible:

- No MSRT
- MSRT stopped
- MSRT fault
- MSRT valid
- MSRT still active

**Procedure**

1. Click the "Start/Stop" button.
   ⇒ A dialog opens.
2. Confirm the start with "OK".
   ⇒ A dialog opens with a note on possible damage.
3. Follow the instructions in the dialog.
4. To start the test, select the "Yes" option button and click "OK".
   ⇒ The "MSRT" starts.
   ⇒ "MSRT" is shown in the display.
   ⇒ A dialog opens.

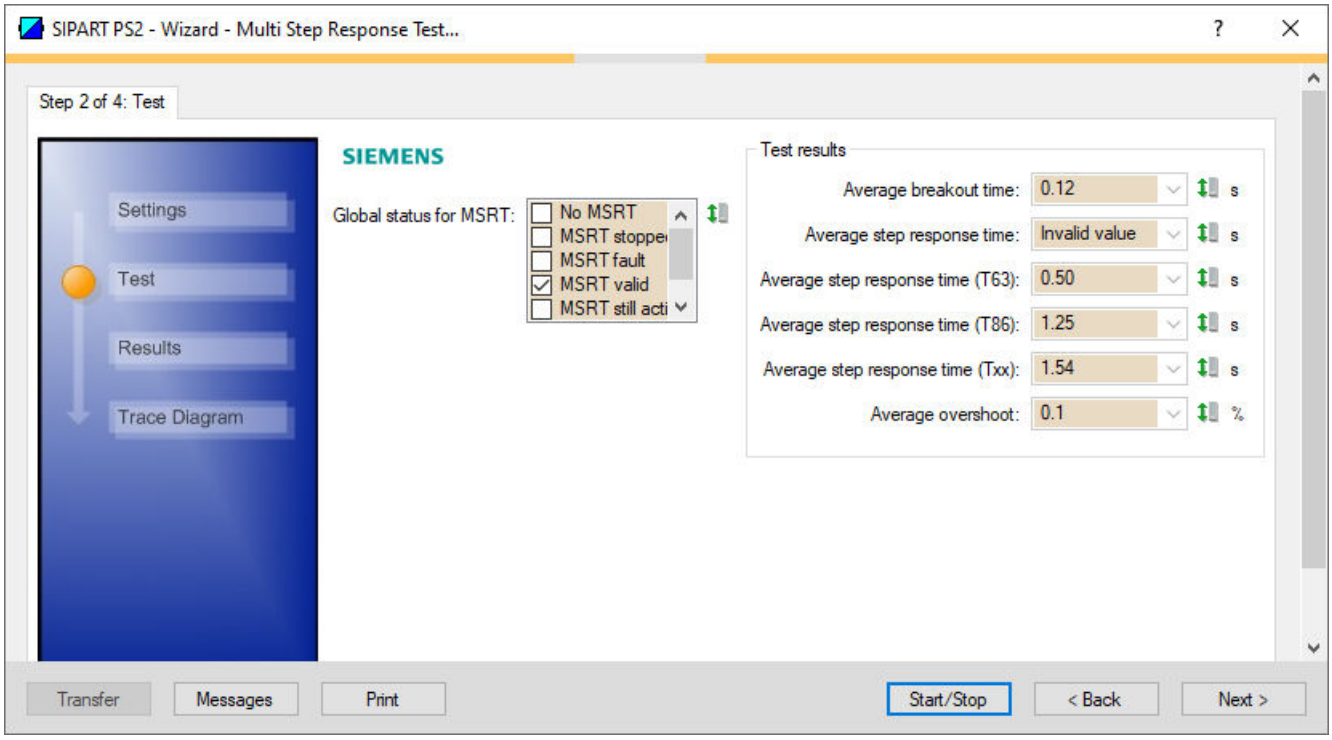
5. Close the dialog with "OK".
   The positioner moves the actuator as follows:
   - From the current starting position to the 1st starting position.
   - From the 1st start position to the set positions one after the other.
   - After reaching the last end position, return to the start position.

   During the test, the number of jumps performed is displayed in the "Running status (Step)" dialog box.
   Faults or errors are displayed in the "Detailed information" dialog box:
   - Start position of first step not reached
   - End position of last step not reached

   Remedy:
   - In step 1, set a longer duration or another end positions in the "Step duration" parameter.
   - Start the test again in step 2.

   Once the diagnostics has been successfully completed, the results are displayed in the dialog as average values:
   - Average breakout time
   - Average step response time
   - Average step response time (T63)
   - Average step response time (T86)
   - Average step response time (Txx)
     Txx corresponds to the "Stroke height of the step response time" set in step 1.

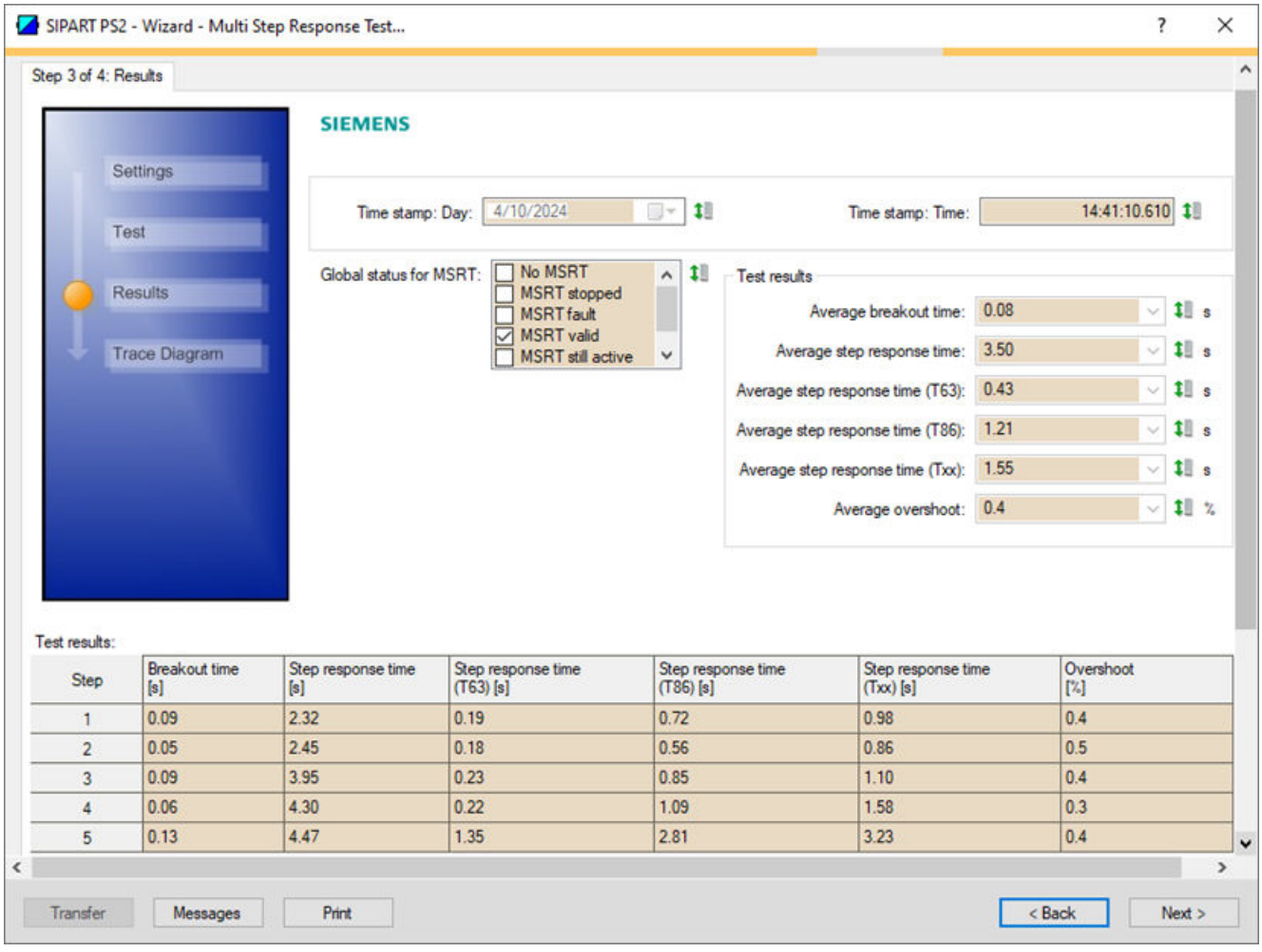
– Average overshoot




6. Click the "Next >" button.
   ⇒ The "Step 3 of 4: Results" dialog opens.

### Step 3: Results

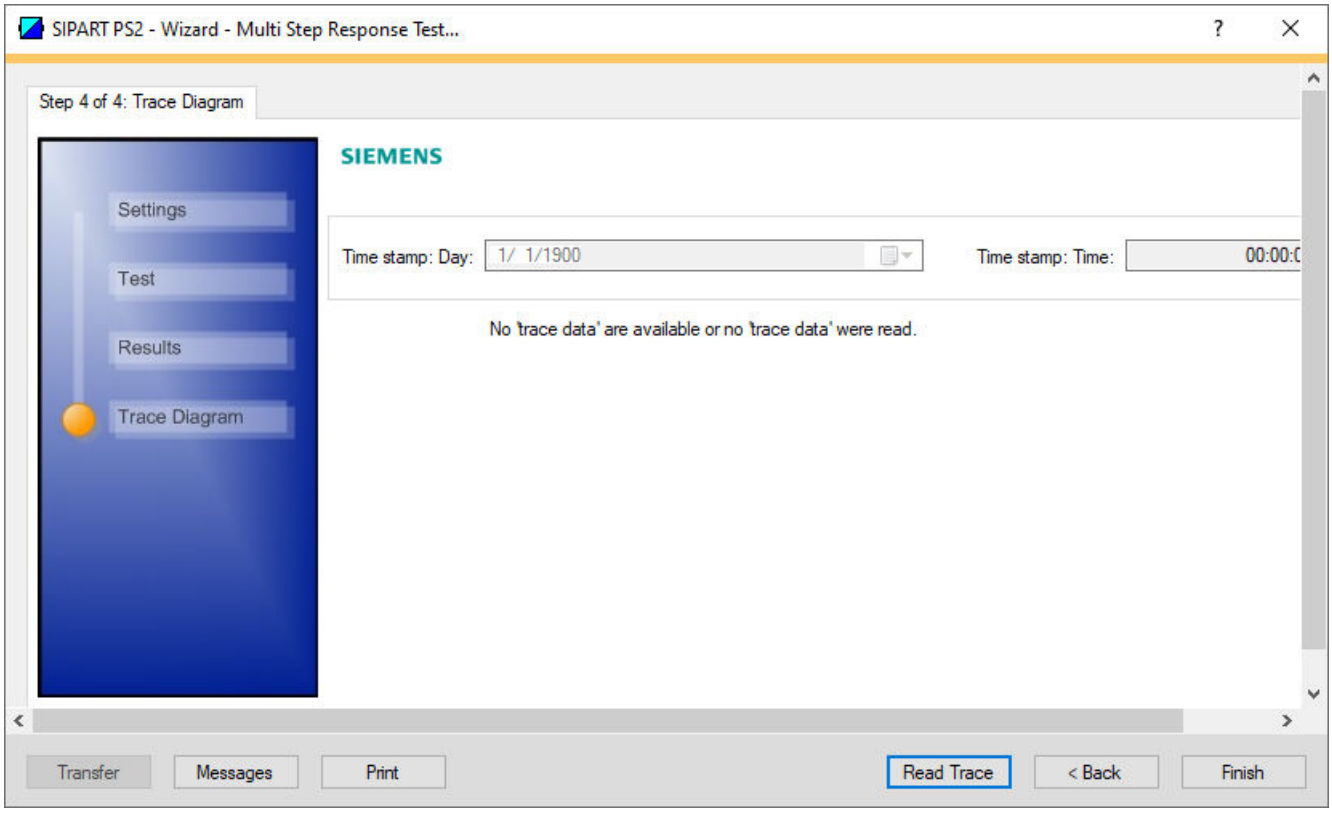
The test results for each step of the MSRT are displayed.




| Step | Breakout time [s] | Step response time [s] | Step response time (T63) [s] | Step response time (T86) [s] | Step response time (Txx) [s] | Overshoot [%] |
|---|---|---|---|---|---|---|
| 1 | 0.09 | 2.32 | 0.19 | 0.72 | 0.98 | 0.4 |
| 2 | 0.05 | 2.45 | 0.18 | 0.56 | 0.86 | 0.5 |
| 3 | 0.09 | 3.95 | 0.23 | 0.85 | 1.10 | 0.4 |
| 4 | 0.06 | 4.30 | 0.22 | 1.09 | 1.58 | 0.3 |
| 5 | 0.13 | 4.47 | 1.35 | 2.81 | 3.23 | 0.4 |

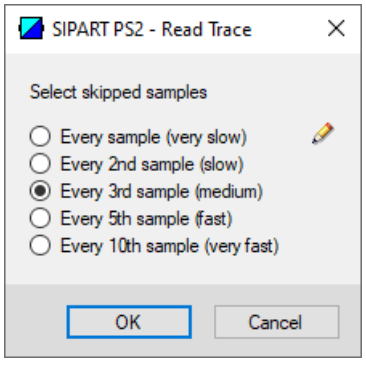
1. Click the "Next >" button.
   ⇒ The "Step 4 of 4: Trace Diagram" dialog opens.

### Step 4: Create trace chart



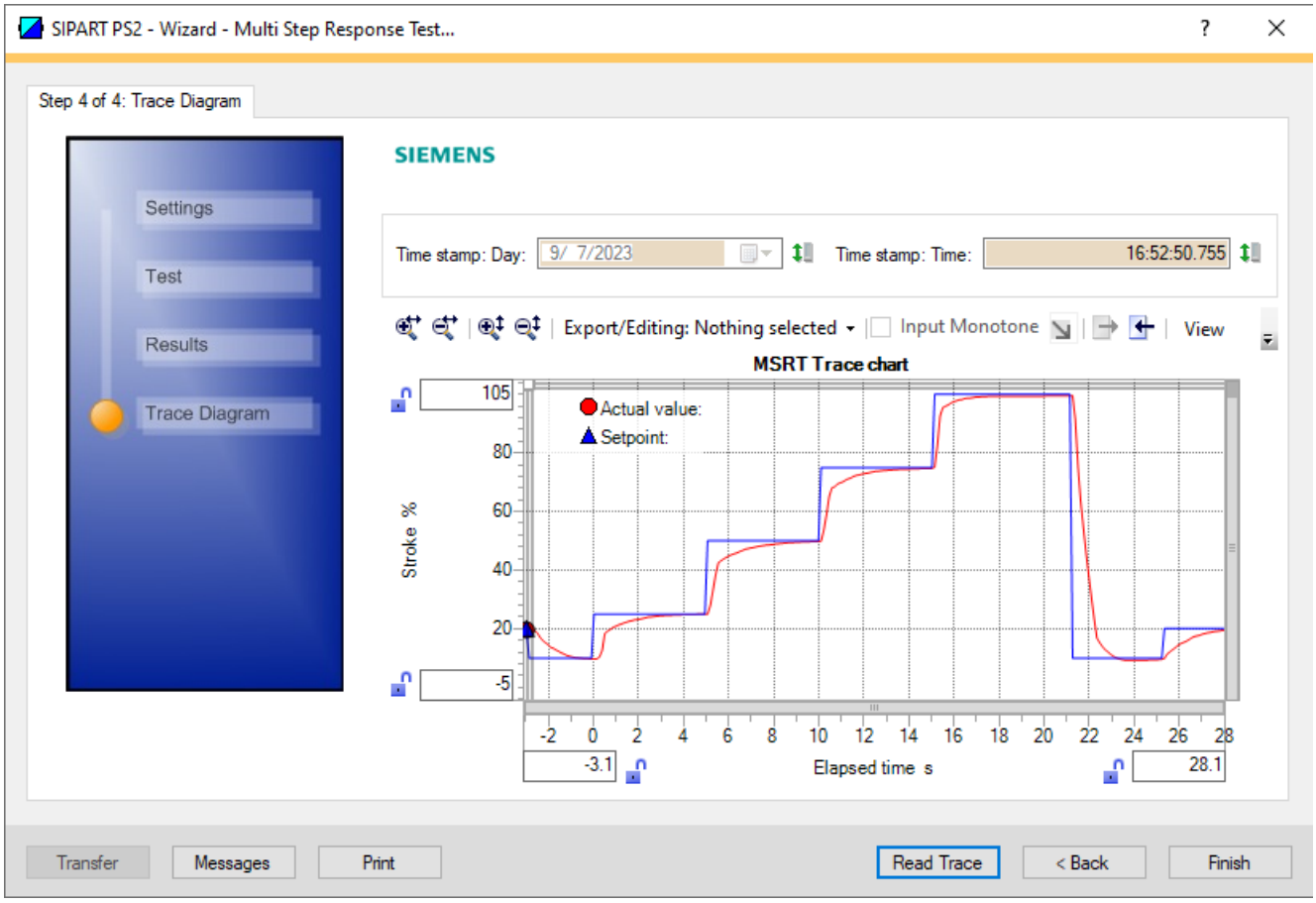

If an immediately preceding MRST was executed, the diagram of the previous MRST is displayed.

1. Click the "Read Trace" button.
   ⇒ The "Read Trace - Sample type" dialog opens.
2. Select the option button "Read in actual value only" or "Read in actual value and setpoint" dialog.
3. Click "OK".
   ⇒ The "Read Trace - Select skipped samples" dialog opens.




As the HART communication may be slow, it is possible to load the chart data from the positioner in different resolutions.

4. Select the option button for the required sample rate, e.g. "Every 3rd sample (medium)".
5. Close the dialog by clicking "OK".
   ⇒ The "Message Log" dialog opens.
6. Wait until the status "Finished" is displayed.
7. Close the dialog.
   ⇒ The chart of the current MSRT is displayed.




The diagram below shows an example of the setpoint values and the actual values, each with 5 start and end positions.

8. Close the dialog with the "Finish" button.
   ⇒ The test results and the chart are saved.

## Displaying test results

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. Select the "Maintenance & Diagnostics" directory.
3. Select "Offline test reports" .

4. Click the "Show offline test reports" button.
5. Select "Multi Step Response Test".
   ⇒ The test results are displayed.

# 6.7 Valve Performance Test (VPT)

## 6.7.1 Functional description

The Valve Performance Test (VPT) determines the following valve characteristics in accordance with IEC 61298-2:

- Hysteresis
- Non-linearity
- Non-repeatability
- Measurement deviation
- Average measurement deviation of all cycles
- Maximum measurement deviation
- Total mean measurement deviation
- Uncertainty

During the test, 3 cycles are run through.

1 cycle corresponds to one full stroke: From the start position "0.0%" to the center position "100.0%" and to the end position "0.0%".

1 cycle contains 20 measuring steps:

- 10 measuring steps between "0.0%" and "100.0%"
- 10 measuring steps between "100.0%" and "0.0%"

The VPT can be configured and executed during a maintenance phase of the valve with a Device Manager Software, e.g. SIMATIC PDM.

Local operation via the display and buttons is not possible.

The result of the test is saved in the positioner and can be compared with previous recordings to detect changes in the valve.

With SIMATIC PDM, the diagnostics results can be read from the positioner and displayed as charts.

**Note**

During the test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.
- The positioner moves the valve.

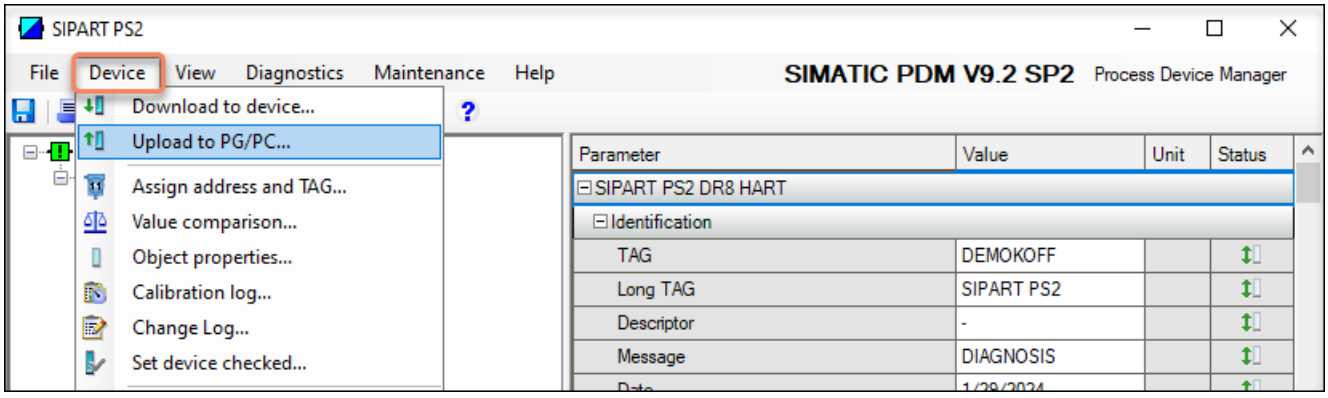
## 6.7.2 Start Valve Performance Test

### Requirement

- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Automatic (AUT)" mode.
- The positioner has a HART interface: SIPART PS2 6DR51...\6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

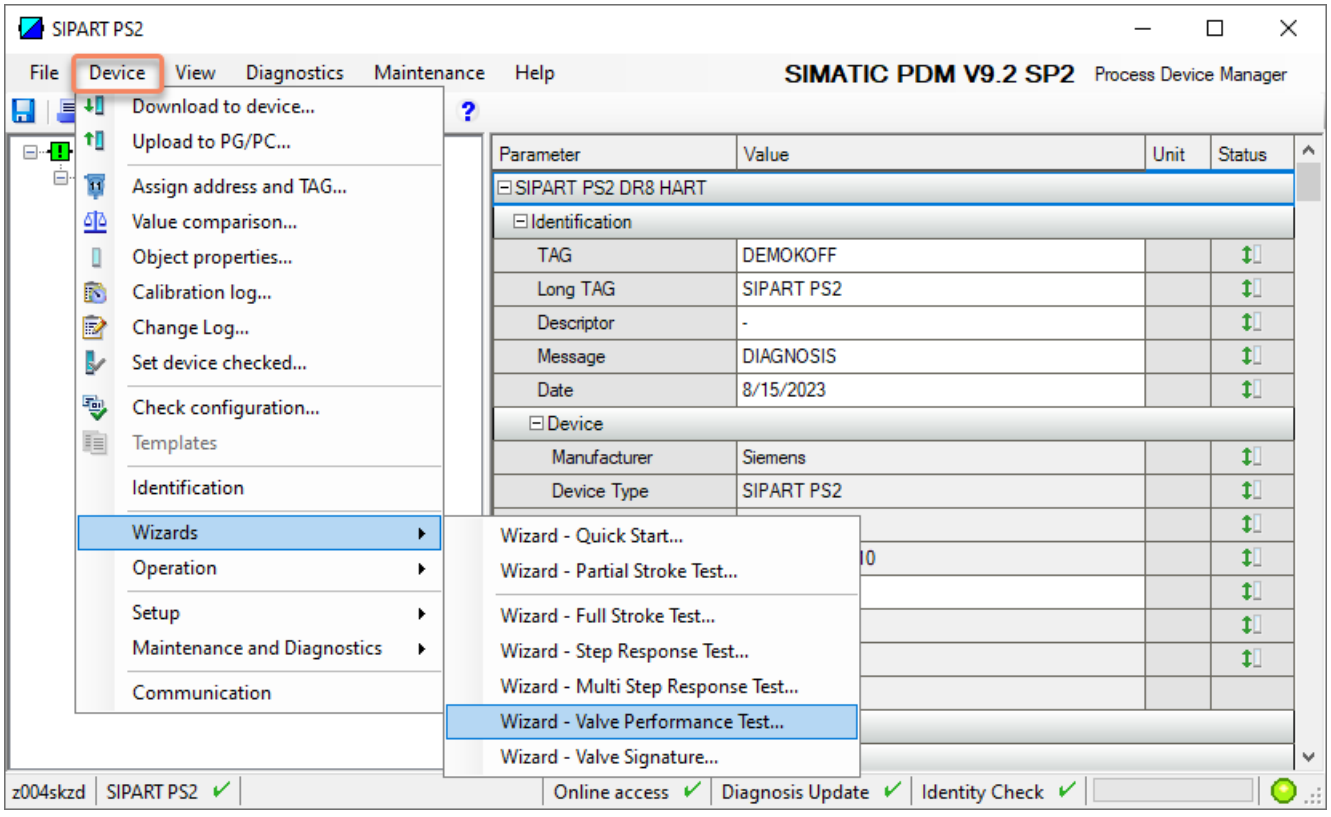
### Start VPT

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Device > Wizards" menu, select the command "Wizard - Valve Performance Test...".




⇒ The dialog with "Step 1 of 3: Settings" opens.

### Step 1: Description

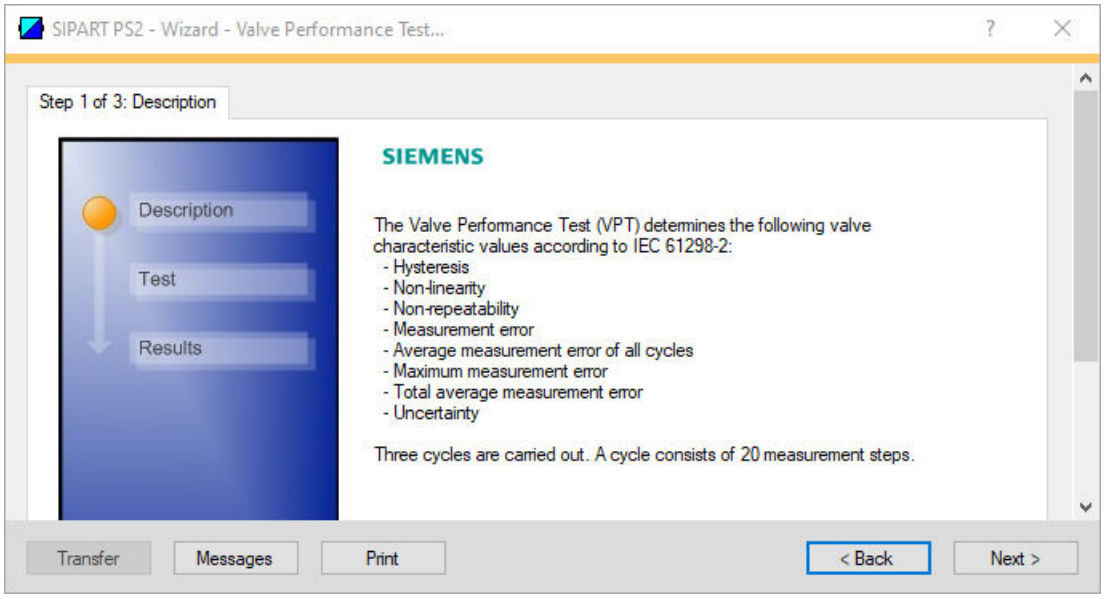


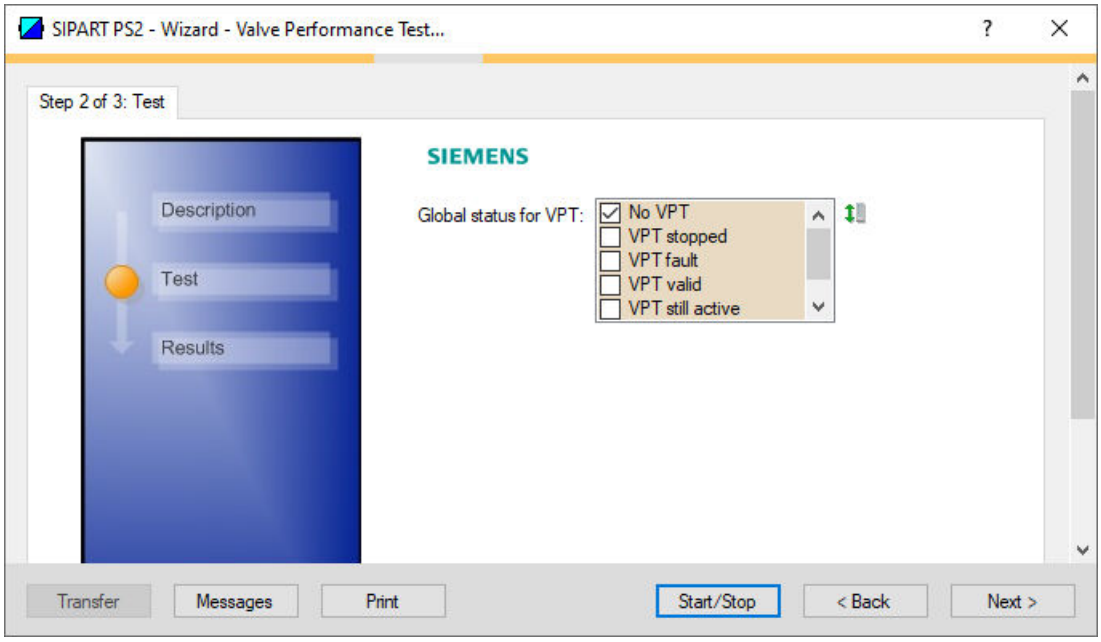

Table 6-4 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Click the "Next >" button.
   ⇒ The "Step 2 of 3: Test" dialog opens.

### Step 2: Test

If a successful VPT has already been performed, the results of the previous VPT are displayed.




If an immediately preceding VPT was executed, the diagram of the previous VPT is displayed.

In the "Global status for VPT" dialog box, the current status for the VPT is displayed

The following states are possible:

- No VPT
- VPT stopped
- VPT fault
- VPT valid
- VPT still active

**Procedure**

1. Click the "Start/Stop" button.
   ⇒ A dialog opens.
2. Confirm the start with "OK".
   ⇒ A dialog opens with a note on possible damage.
3. Follow the instructions in the dialog.
4. To start the test, select the "Yes" option button and click "OK".
   ⇒ The "VPT" starts.
   ⇒ "VPT" is shown in the display.
   ⇒ A dialog opens.

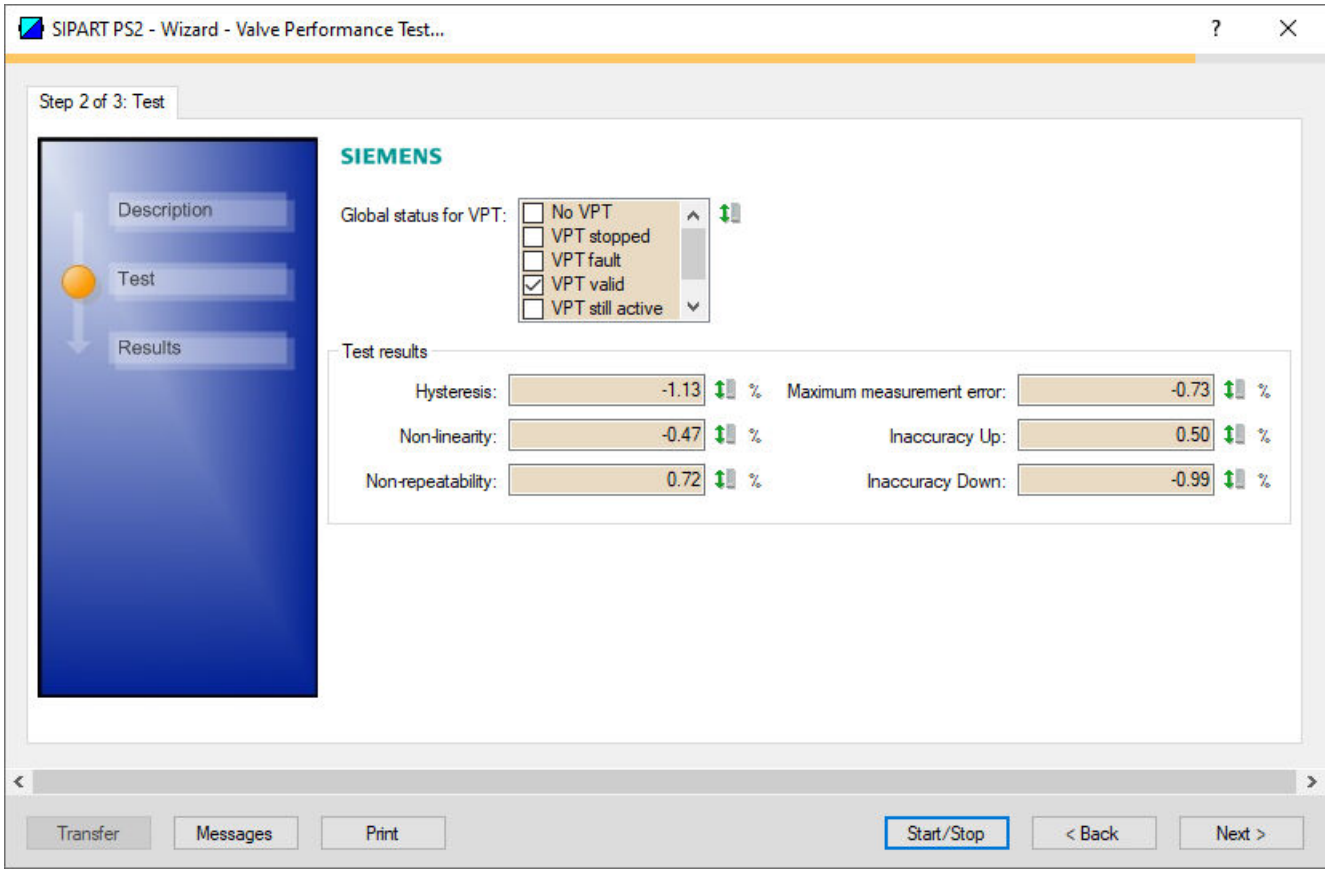
5. Close the dialog with "OK".
   The positioner moves the actuator from the current starting position to the start position "0.0%" and runs through 3 cycles:
   - From the start position "0.0%" with 10% increments to the center position "100.0%". The measured values are determined for each of the 10 measuring steps.
   - From the center position "100.0%" with 10% steps to the end position "0.0%" (≙ start position).
     The measured values are determined for each of the 10 measuring steps.

   After completion of the 3rd cycle, the positioner moves the actuator back to the start position. The following information is displayed in the dialog during the test:
   - Running status (cycle): Shows the number of the currently executed cycle.
   - Running status (step): Shows the number of the step executed in this cycle.

   Faults or errors are displayed in the "Detailed information" dialog box:
   - Start position not reached
   - End position not reached

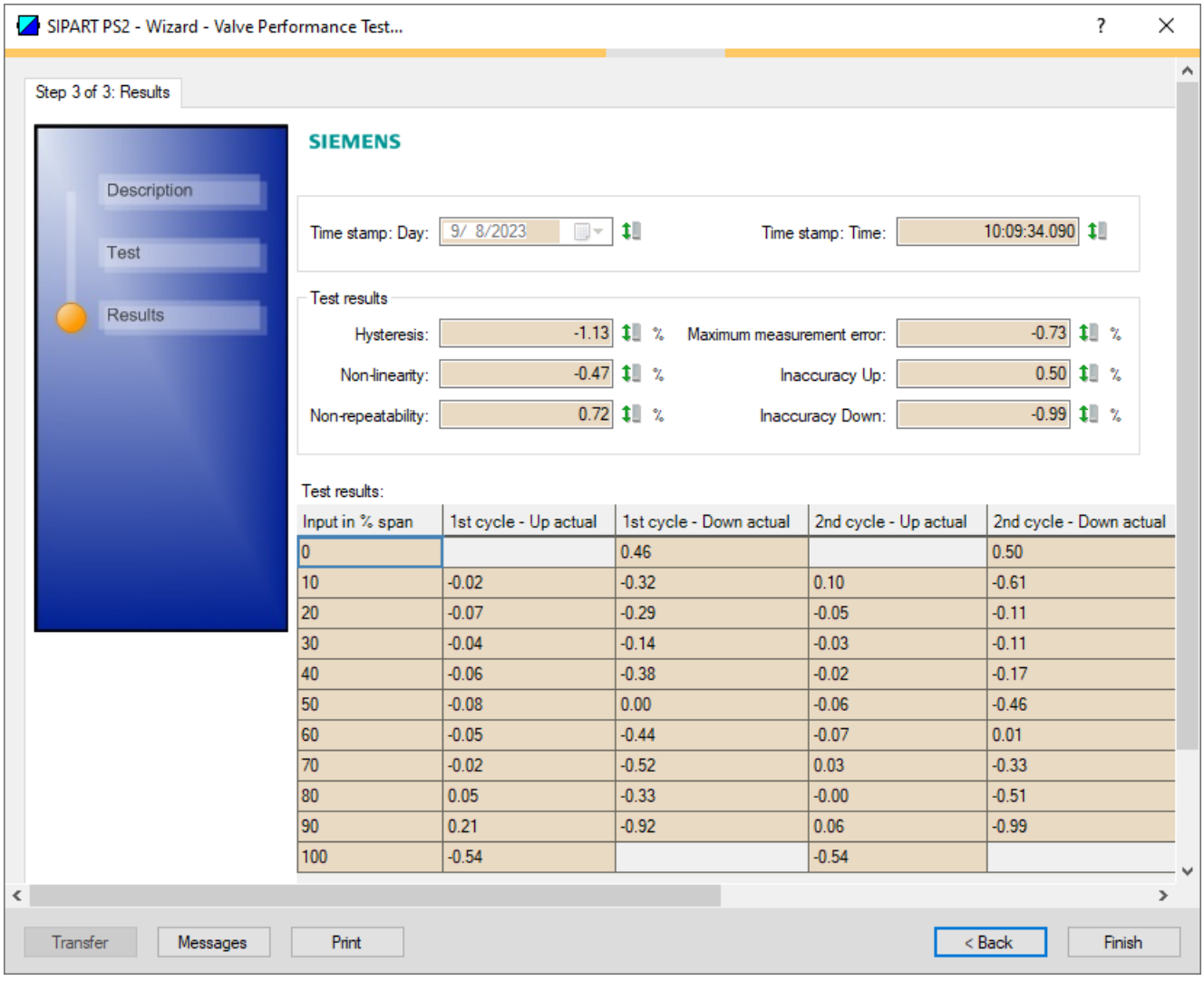
   The following status is highlighted after successful completion of the diagnostics: "VPT valid". The results are presented in "Test results" dialog box:

| Characteristic value | Description |
|---|---|
| Hysteresis | The difference between consecutive output values at measured and unmeasured measuring points for each individual test cycle at the same test point in percent [%].<br>Measured up and measured down means: Each measuring point is approached from 2 sides.<br>The largest value from all test cycles is recorded as "hysteresis" and expressed as a percentage [%]. |
| Non-linearity | The largest positive or negative deviation in percent [%] between the curve of the average values and the selected straight line.<br>The non-linearity is independent of the deadband and hysteresis. |
| Non-repeatability | The difference between the measured or calibrated measured values at the same input value as a percentage [%] of the span (setpoint).<br>The largest difference between all measured values recorded or measured at the same input value as a percentage [%] of the span (setpoint) is recorded as "Non-repeatability". |
| Maximum measurement error | The largest positive or negative measured value from the average values of all cycles. |
| Inaccuracy Up | The largest positive deviation of all measured values up or down from the ideal input value as a percentage [%] of the span (setpoint). |
| Inaccuracy Down | The largest negative deviation of all measured values up or down from the ideal input value as a percentage [%] of the span (setpoint). |




6. Click the "Next >" button.
   ⇒ The "Step 3 of 3: Results" dialog opens.

### Step 3: Results




The following test results are displayed in the dialog:

- The 6 valve characteristic values are the average values of all measurement steps of the 3 cycles as a percentage.
- The measured values of all measuring steps of the 3 cycles are each displayed as a percentage deviation of the actual position from the setpoint position.

1. Close the dialog with the "Finish" button.
   ⇒ The test results are saved.

### Displaying test results

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. Select the "Maintenance & Diagnostics" directory.
3. Select "Offline test reports" .

4. Click the "Show offline test reports" button.
5. Select "Valve Performance Test"
   ⇒ The test results are displayed.

## 6.8 Valve Signature (VS)

### 6.8.1 Functional description

The Valve Signature (VS) determines the characteristics of the valve over the entire operating range.

With the Valve Signature, the pressure position data are recorded and the following Key Performance Indicators (KPI) determined:

- Breakout pressure
- Breakout position
- Breakout pressure (return)
- Breakout position(return)
- Operating hours

For single-acting actuators, the actuating pressure is displayed above the position.

For double-acting actuators with spring return, the difference between the actuating pressures is shown above the position.

**VS-reference**

During initialization of the positioner, a Valve Signature is performed in RUN 6 and the KPIs are saved as a reference.

The previous reference is replaced with each subsequent initialization.

**Additional properties**

- The KPIs of the last 10 Valve Signatures are stored in a ring memory in the positioner. With more Valve Signatures, the KPIs are replaced in the ring memory using the FIFO method (First In - First Out).
- The Valve Signature is configured and executed with Device Manager Software, e.g. SIMATIC PDM.
- The KPIs can be read, displayed and compared with SIMATIC PDM.
- The data can also be used to determine friction coefficients, spring characteristics and hysteresis.

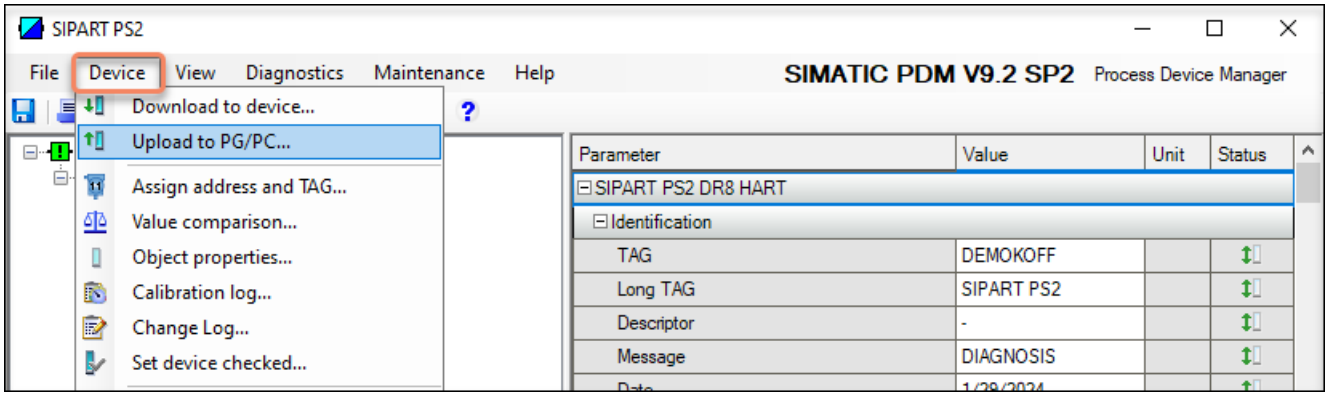
## 6.8.2 With SIMATIC PDM: Start valve signature

### Requirement

- The positioner has pressure sensors (Z P02 option).
- Process diagnostics "Pressure monitoring" (U.\PRES) is activated.
- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Automatic (AUT)" mode.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

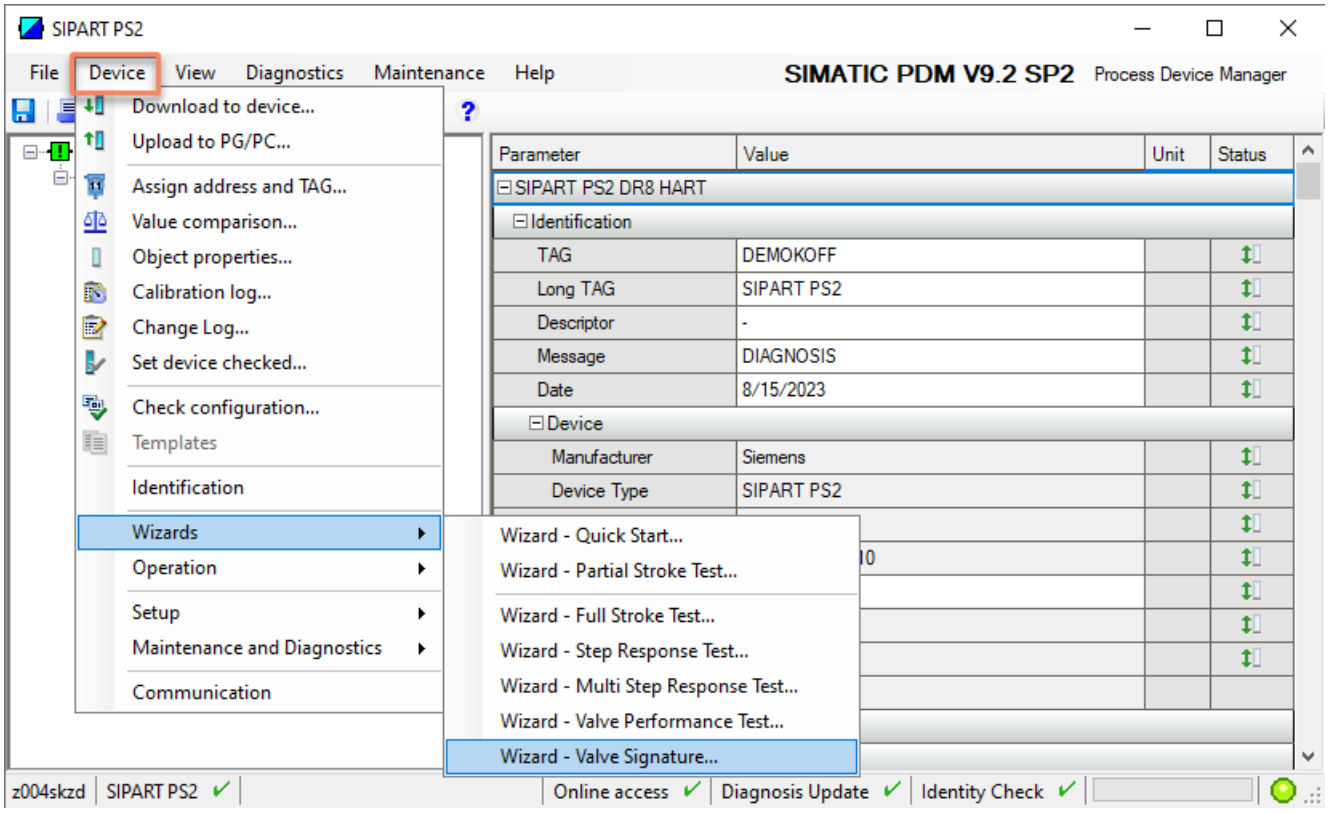
### Start VS

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.




3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. Close the dialog.
6. In the "Device > Wizards" menu, select the command "Wizard - Valve Signature...".




⇒ The "Step 1 of 3: Description" dialog opens.

## Step 1: Description

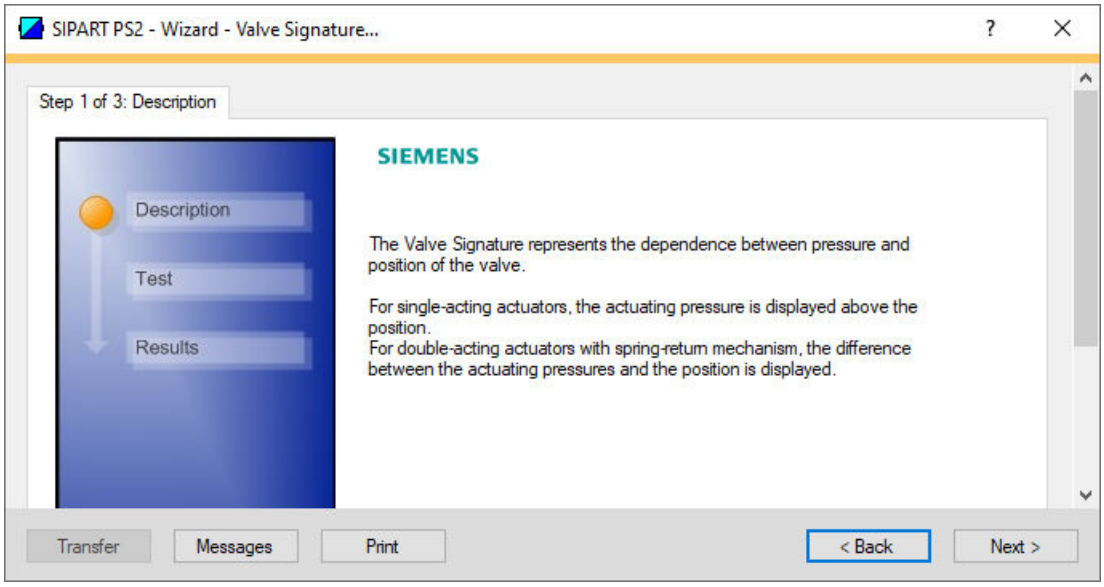


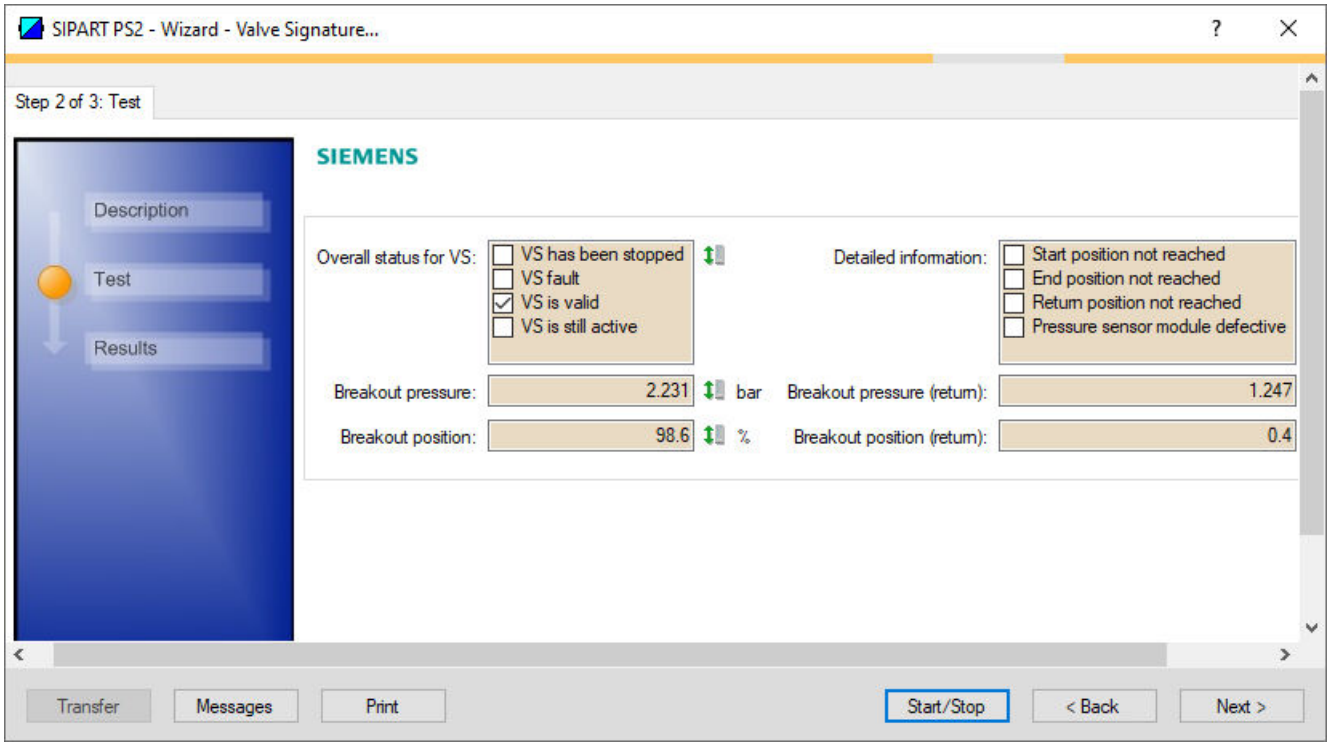
Table 6-5 Explanation of the buttons

| | |
|---|---|
| Transfer | Transfers data to the positioner |
| Messages | Opens the message log |
| Print | Creates a PDF file |
| < Back | Opens the dialog of the previous step |
| Next > | Opens the dialog for the next step |

1. Click the "Next >" button.
   ⇒ The "Step 2 of 3: Test" dialog opens.

## Step 2: Test

If a successful Valve Signature has already been performed, the results of the previous Valve Signature are displayed.




In the "Overall status for VS" dialog box, the current status for the Valve Signature is displayed.

The following states are possible:

- VS stopped
- VS fault
- VS valid
- VS still active

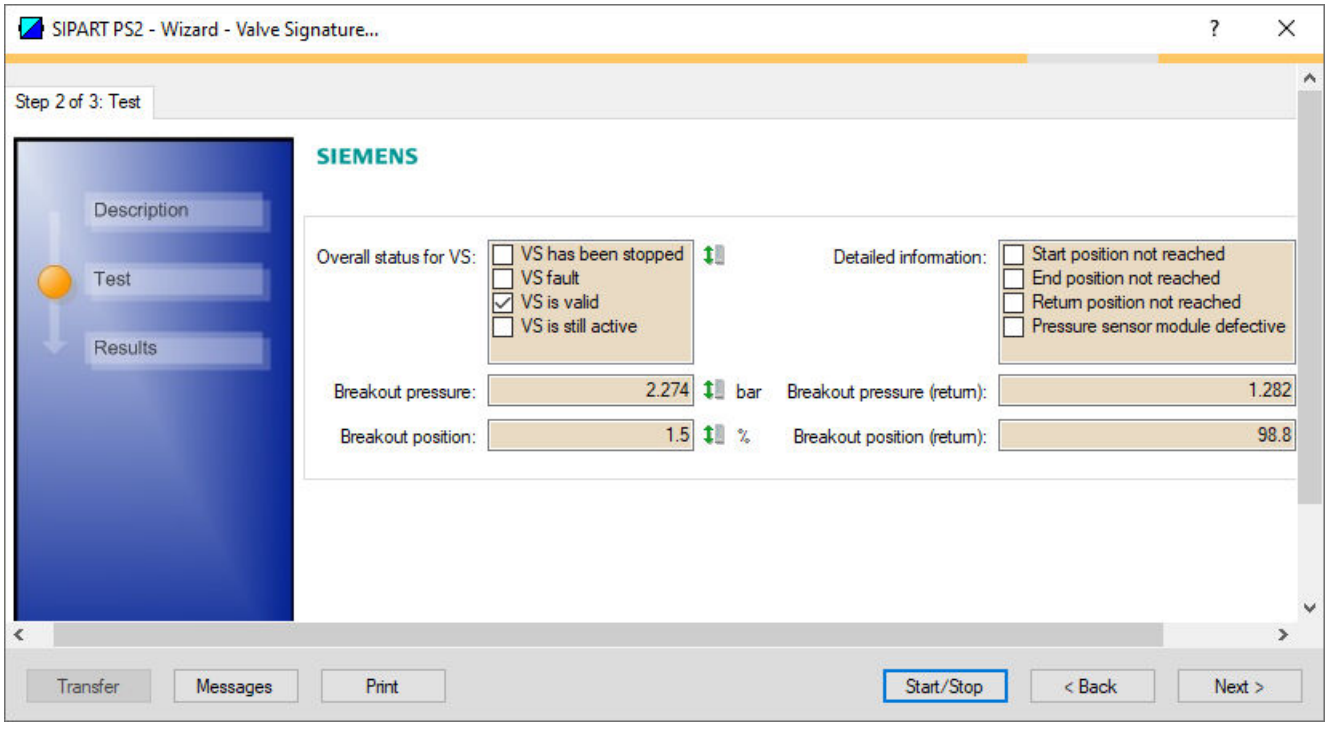
**Procedure**

1. Click the "Start/Stop" button.
   ⇒ A dialog opens.
2. Confirm the start with "OK".
   ⇒ A dialog opens with a note on possible damage.
3. Follow the instructions in the dialog.
4. To start the test, select the "Yes" option button and click "OK".
   ⇒ The maintenance diagnostics Valve Signature starts.
   ⇒ "VS" is shown in the display.
   ⇒ A dialog opens.
5. Close the dialog with "OK".
   The positioner moves the actuator as follows:
   - From the current starting position to the starting position "100.0%".
   - From the start position step by step to the "0.0%" position.
   - From the position "0.0%" gradually to the position "100.0%".
   - From the "100.0%" position back to the starting position.

   Faults or errors are displayed in the "Detailed information" dialog box:
   - Start position not reached
   - End position not reached
   - Return position not reached
   - Pressure sensor module defective

6. Wait until the diagnostics is completed.
   – One of the following states is selected in the dialog: VS stopped, VS fault or VS valid.
   – "AUT" is shown in the display.

   The following status is highlighted after successful diagnostics: "VS valid".
   The following KPIs are displayed as results in the dialog:
   – Breakout pressure in bar
   – Breakout position in %
   – Breakout pressure (return) in bar
   – Breakout position (return) in %

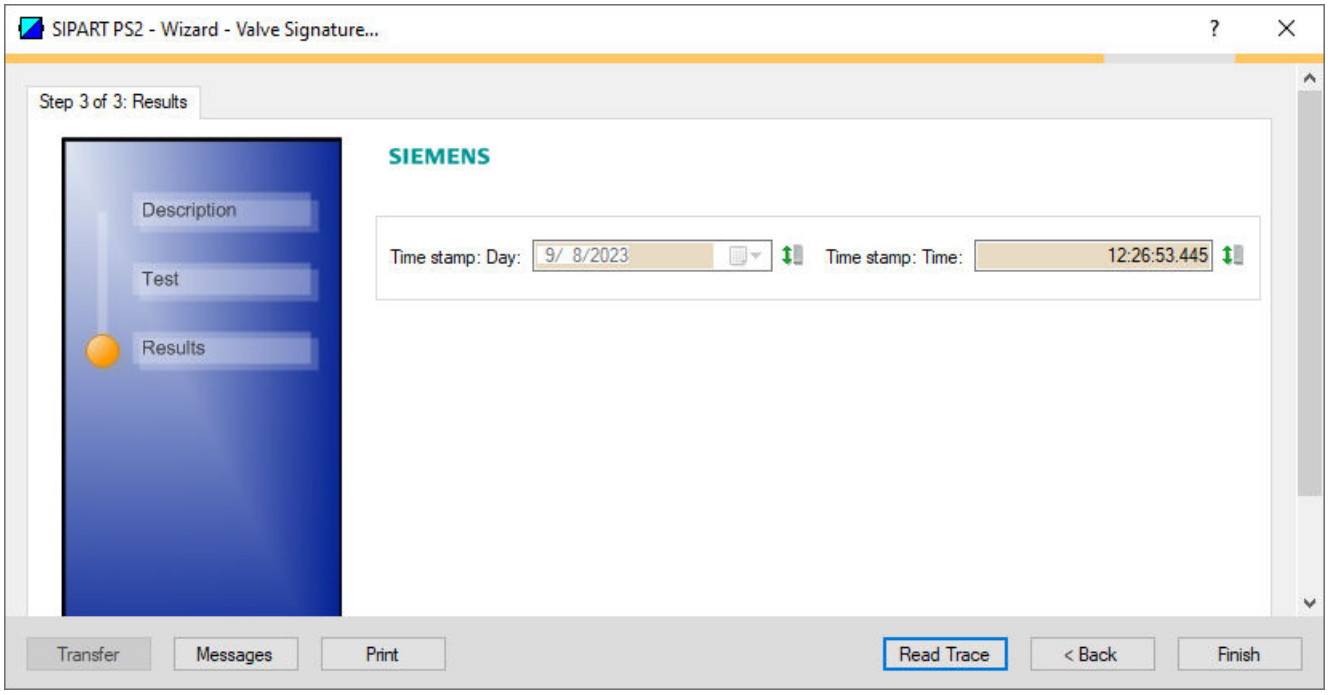



7. Click the "Next >" button.
   ⇒ The "Step 3 of 3: Results" dialog opens.

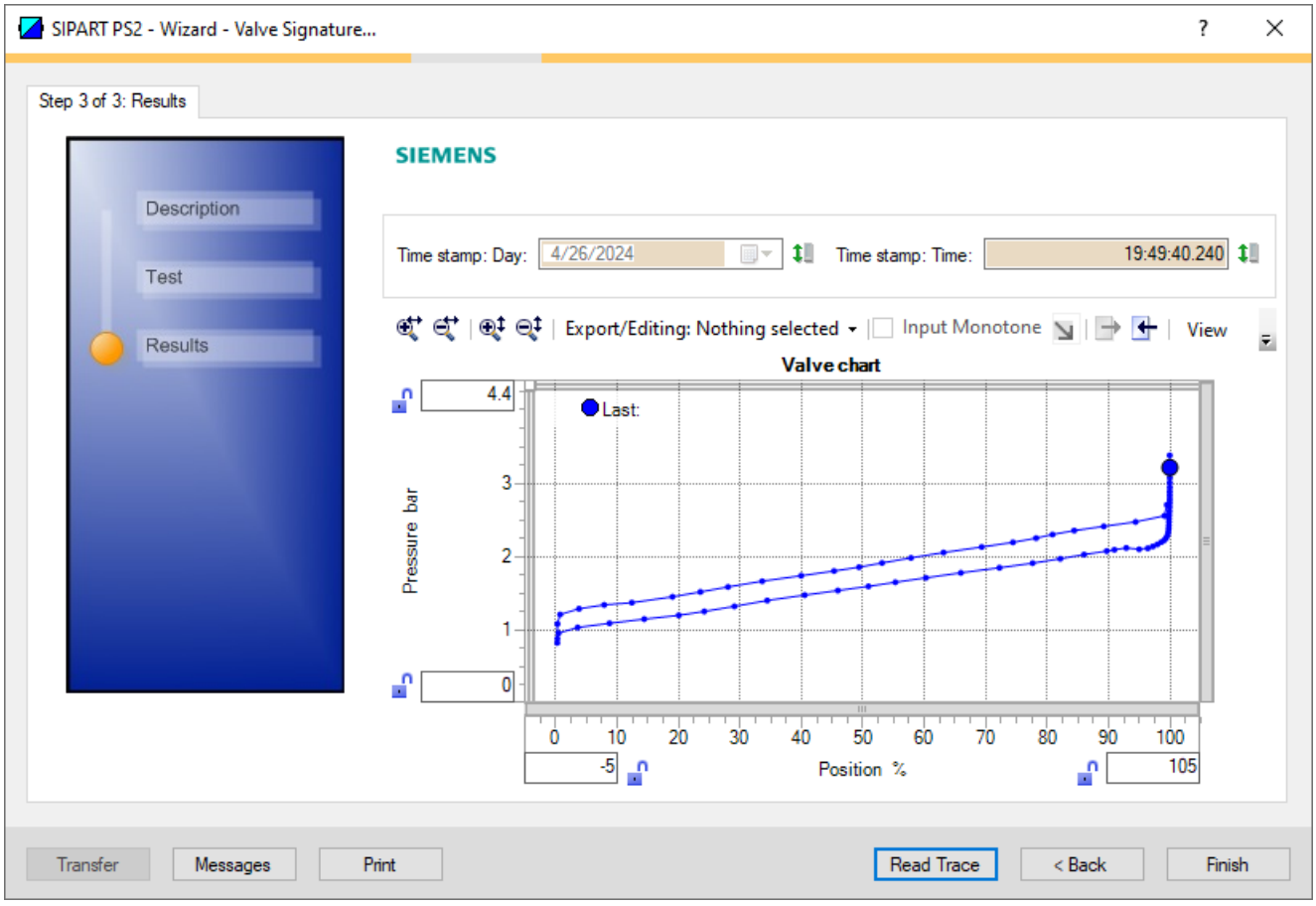
## Step 3: Results

In this step, the diagram of the Valve Signature can be displayed.

The result of the current and the previous Valve Signatures can be displayed with the following menu: "Diagnostics > KPI > Valve Signature" Valve Signature] → With SIMATIC PDM: Display VS results, KPIs and diagrams (Page 556).


SIPART PS2 - Wizard - Valve Signature...
Step 3 of 3: Results
Description
Test
Results
SIEMENS
Time stamp: Day:
9/ 8/2023
Time stamp: Time:
12:26:53.445
Transfer
Messages
Print
Read Trace
< Back
Finish

1. Click the "Read Trace" button.
2. Wait until the diagram is displayed in the dialog.




3. Close the dialog with the "Finish" button.
   ⇒ The test results and the chart are saved.

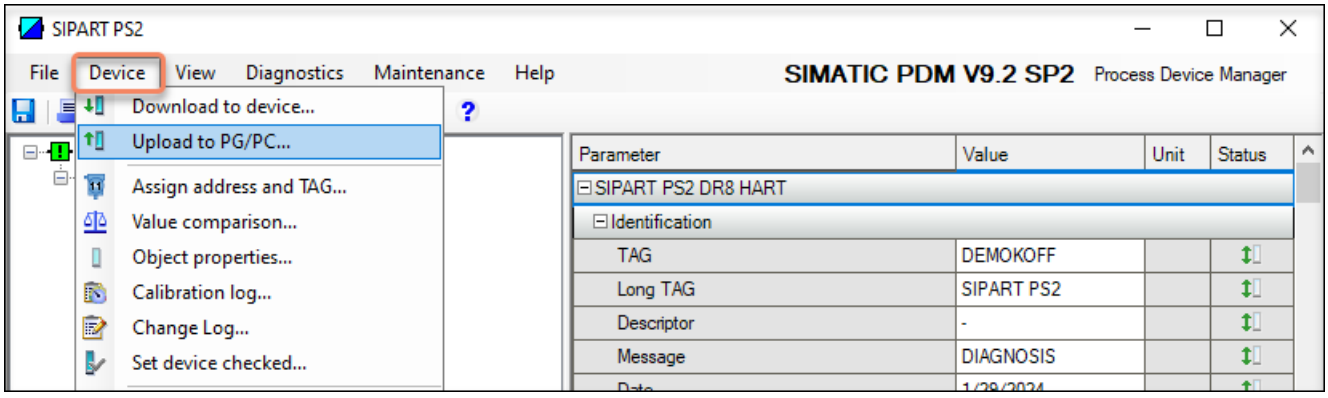
## 6.8.3 With SIMATIC PDM: Display VS results, KPIs and diagrams

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The Valve Signature was executed → With SIMATIC PDM: Start valve signature (Page 549).

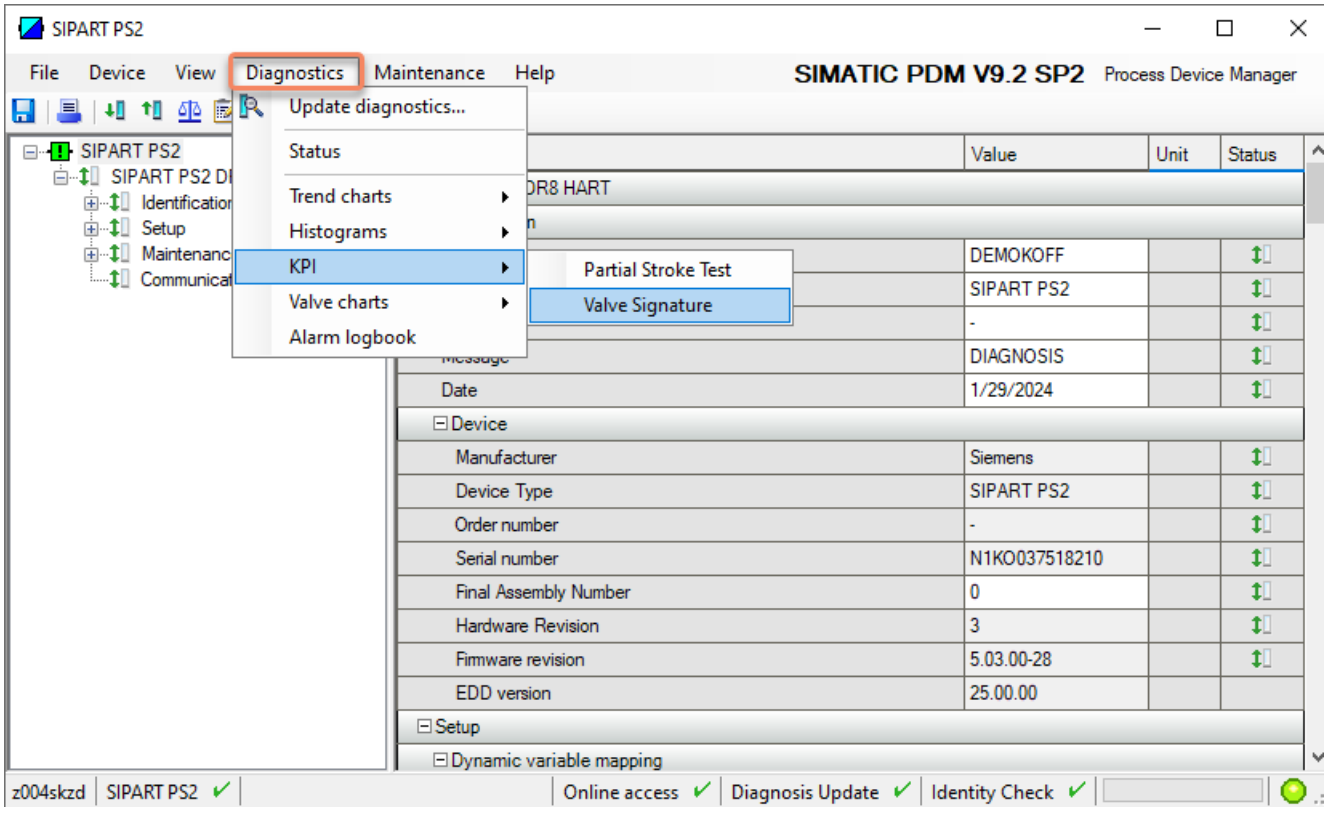
### Display VS results and KPI

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

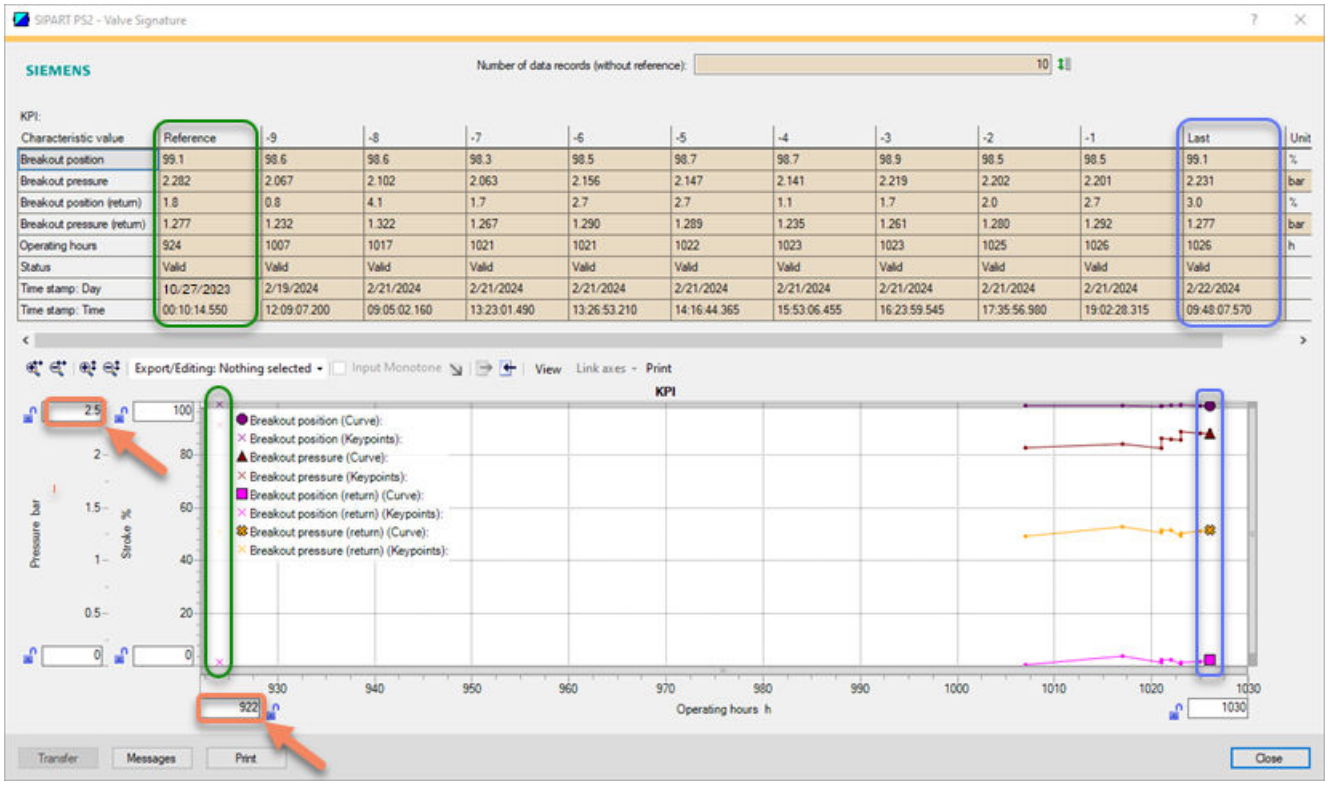



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics"menu, select the command"KPI > Valve Signature".




⇒ The "Valve Signature" dialog opens.
In the dialog, the results of the last 10 Valve Signature are displayed as values and diagrams.



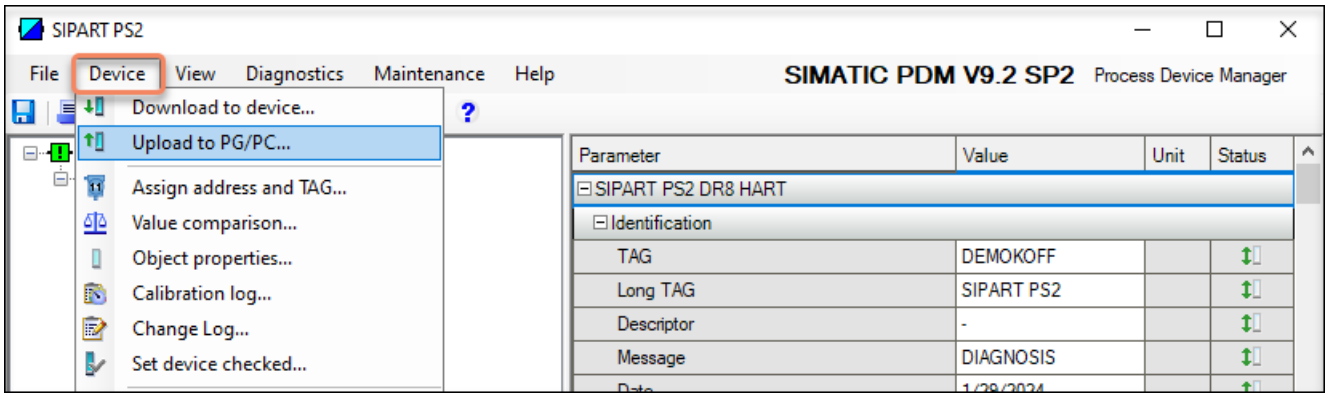

Notes on the example shown:

- The diagram display was scaled by changing the input fields of the axes, e.g. with "922" as the start value for the "Operating hours (h)".
- The reference data of the Valve Signature from the last initialization are marked in green.
- The data of the last executed Valve Signature are marked in blue.

7. Close the dialog with the "Close" button.

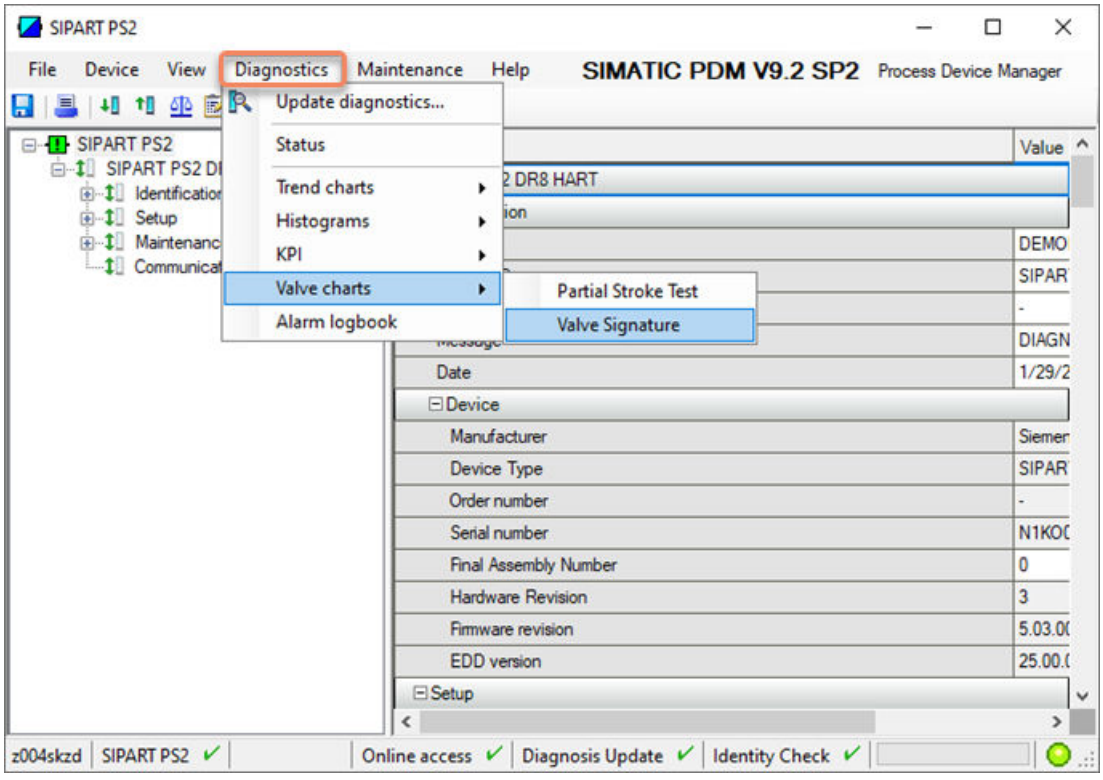
### Show VS diagrams

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



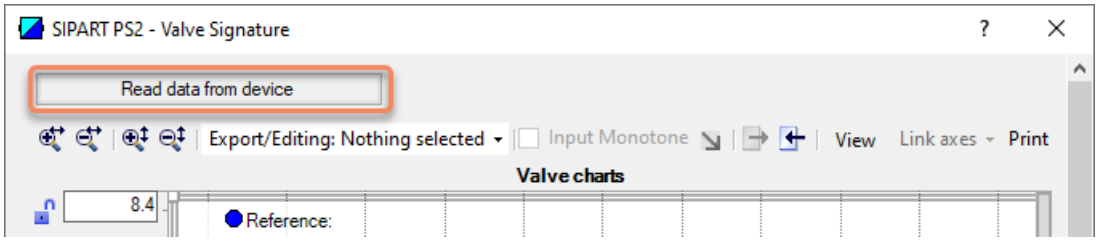

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "Diagnostics" menu, select the "Valve Charts > Valve Signature" > Valve Signature command.



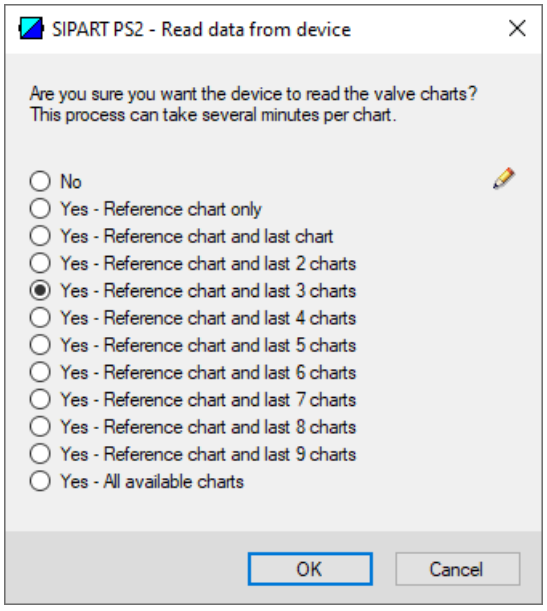

⇒ The "Valve Signature" dialog opens.
If a Valve Signature has already been performed and displayed, the diagram of the previous Valve Signature is displayed.

7. Click the "Read data from device" button.



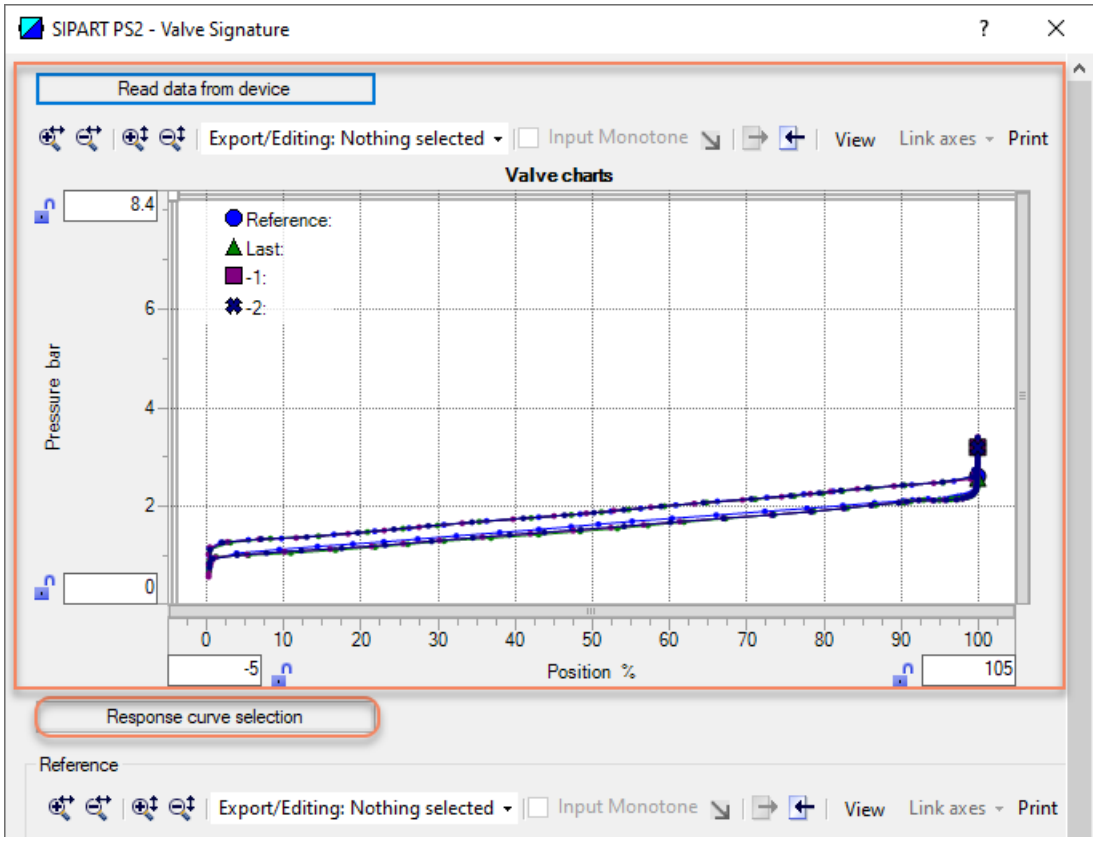

⇒ The "Read data from device" dialog opens.

8. Select the option button for the desired data.

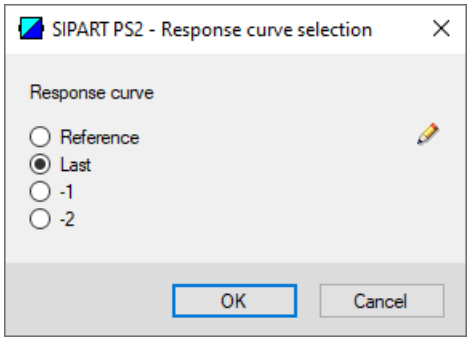



9. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
10. Wait until the status "Finished" is displayed.

11. Click the "Close" button.
    ⇒ In the upper area of the "Valve Signature" dialog, the diagram is updated with the selected data.

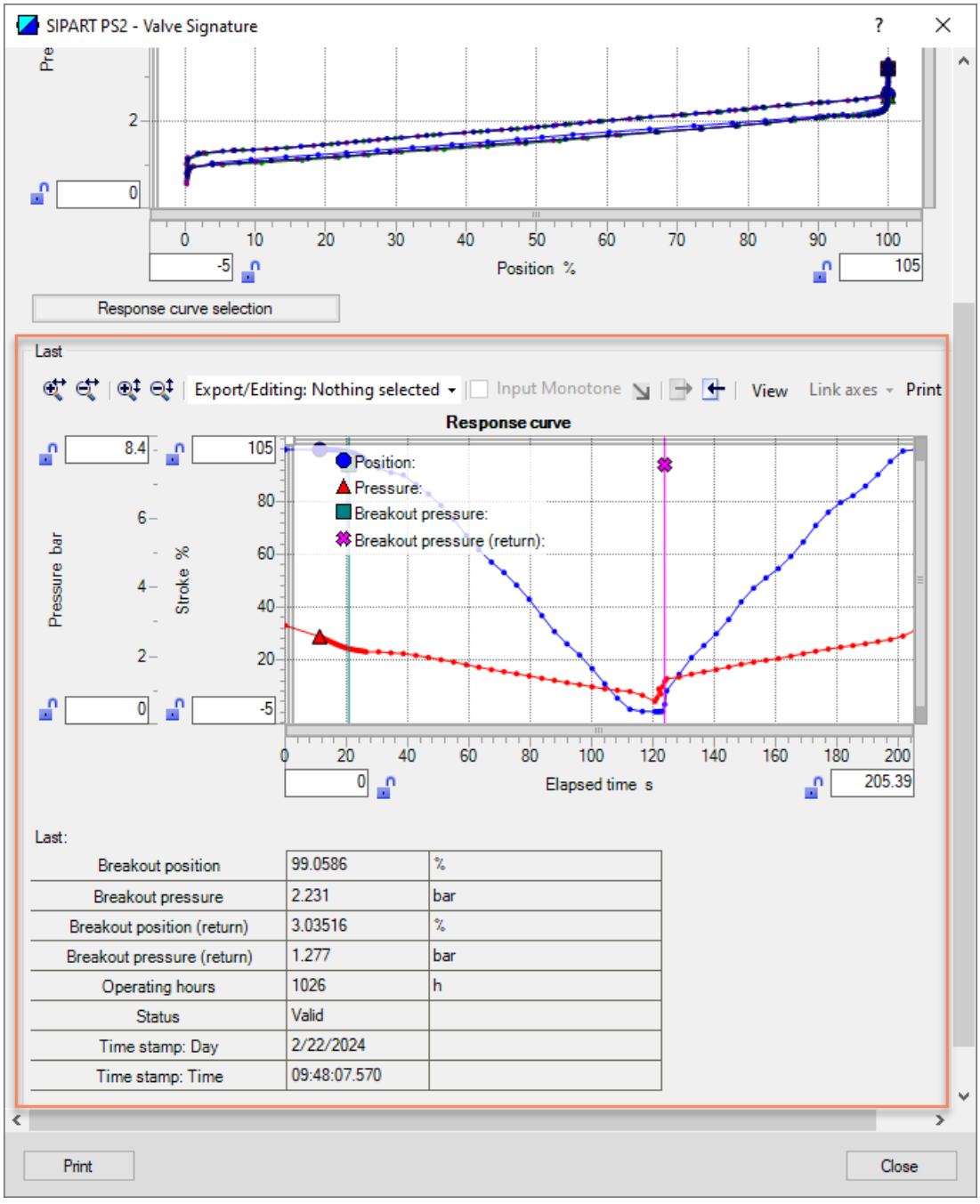



12. To display the data and diagram of a specific Valve Signature: Click the "Response curve selection" button.
    ⇒ "Response curve selection".




13. Select the option button for the required data, e.g. "Last".

14. Close the dialog with "OK".
    ⇒ In the lower section of the "Valve Signature" dialog, the diagram and the data for the selected Valve Signature are displayed, e.g. "Last".




15. Close the dialog.

## 6.8.4 Via HART communication: Start valve signature

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The positioner is in "Automatic (AUT)" mode.

### Start VS

Send to the positioner via HART communication:

- "#172" command
- Byte 0 = 7 and Byte 1 = 5

⇒ Diagnostics starts and the "VS" is shown on the display.

### Cancel VS

Send to the positioner via HART communication:

- "#172" command
- Byte 0 = 7 and Byte 1 = 255

## 6.8.5 Via HART communication: Read out diagnostic results

### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The "Valve Signature" (VS) has been executed.

### Display diagnostics status

**Request**

Send to the positioner via HART communication:

- Command "#210"
- Byte 1

**Answer**

The answer consists of the following data.

Table 6-6 Global status for VS

| Bit | Status |
|---|---|
| 4 | VS stopped |
| 5 | VS fault |
| 6 | VS valid |
| 7 | VS still active |

### Read out diagnostic results

**Request**

Send to the positioner via HART communication:

- "#210" command
- Byte 0 with the index of the VS "0" or "1" to "9"

| Byte | Format | Description | |
|---|---|---|---|
| 0 | Unsigned-8 | Index of the data record to be read | |
| | | 0 | Current or latest data record |
| | | 1 ... 9 | Previous data record |

**Answer**

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 6-7 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Unsigned-8 | Data record index of the read data |
| 1 | Unsigned-8 | Valve Signature State |
| 2 | Unsigned-8 | Valve Signature Error |
| 3 | Enum | Pressure Unit |
| 4 ... 7 | Float | Valve Signature Breakout Pressure Up |
| 8 ... 11 | Float | Valve Signature Breakout Position Up |
| 12 ... 15 | Float | Valve Signature Breakout Pressure Return |
| 16 ... 19 | Float | Valve Signature Breakout Position Return |
| 20 ... 22 | Date | Valve Signature Timestamp: Date |
| 23 ... 26 | Time | Valve Signature Timestamp: Time |
| 27 ... 30 | Unsigned-32 | Valve Signature Operating Hours Counter |

Table 6-8 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 6 | Error | Device Specific Command Error |

## Results of the VS reference

### Request

Send to the positioner via HART communication:

- Command "#215"

### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 6-9 Response Data Bytes

| Byte | Format | Description | |
|---|---|---|---|
| 0 | Unsigned-8 | Valve Signature State | |
| 1 | Unsigned-8 | Valve Signature Error | |
| 2 | Enum | Pressure Unit | |
| 3 ... 6 | Float | Valve Signature Upper Pressure Value | |
| 7 ... 10 | Float | Valve Signature Lower Pressure Value | |
| 11 | Enum | Valve Signature Spring Detection | |
| | | 0 | Valve without spring |
| | | 1 | Valve with spring |
| 12 ... 15 | Float | Valve Reference Signature Breakout Pressure Up | |

| Byte | Format | Description |
|---|---|---|
| 16 ... 19 | Float | Valve Reference Signature Breakout Position Up |
| 20 ... 23 | Float | Valve Reference Signature Breakout Pressure Return |
| 24 ... 27 | Float | Valve Reference Signature Breakout Position Return |
| 28 ... 30 | Date | Valve Reference Signature Timestamp: Date |
| 31 ... 34 | Time | Valve Reference Signature Timestamp: Time |
| 35 ... 38 | Unsigned-32 | Valve Reference Signature Operating Hours Counter ###± |

Table 6-10 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 6 | Error | Device Specific Command Error |

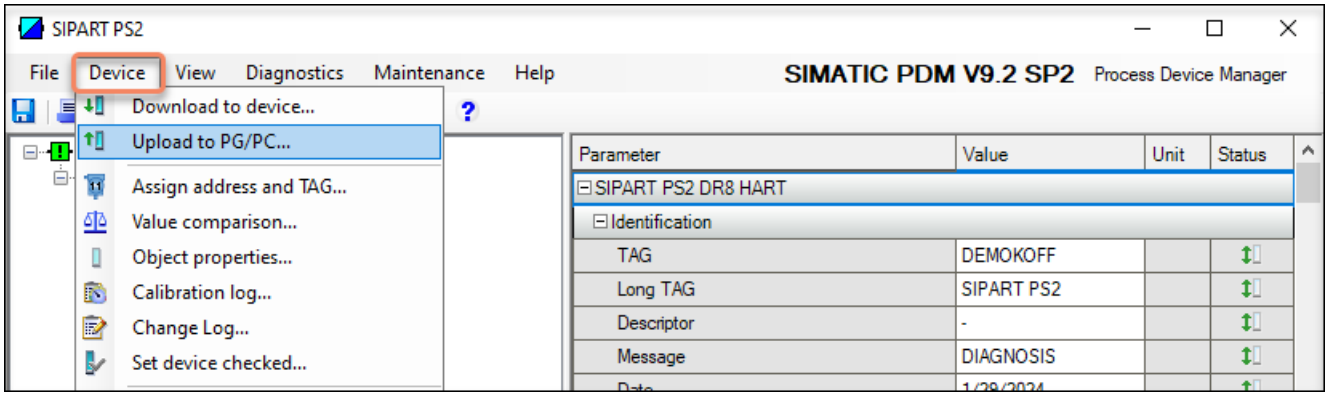
## 6.8.6 With SIMATIC PDM: Export diagnostics results

### Requirement

- The positioner has pressure sensors ( -Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.
- The "Valve Signature" (VS) was executed and the diagrams were displayed → With SIMATIC PDM: Start valve signature (Page 549).

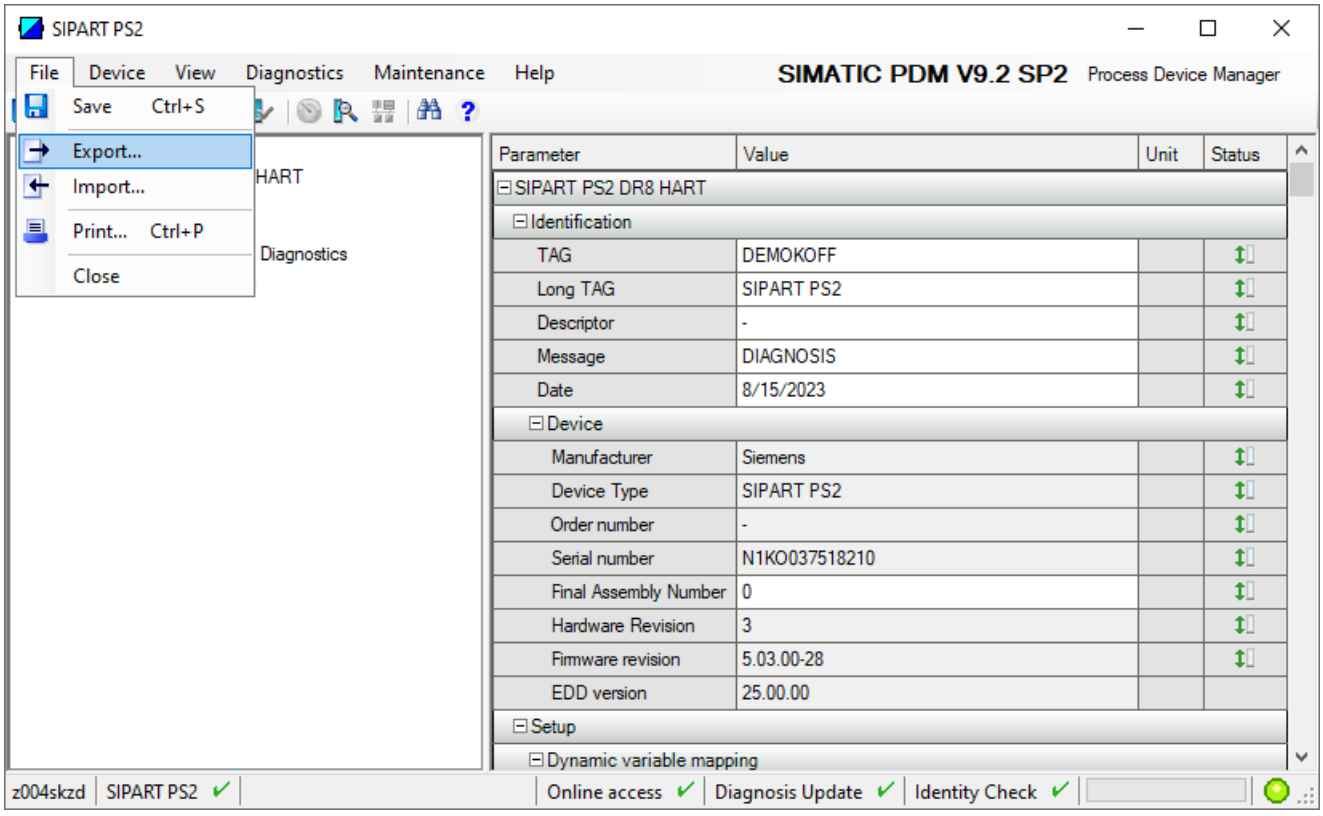
### Procedure

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.



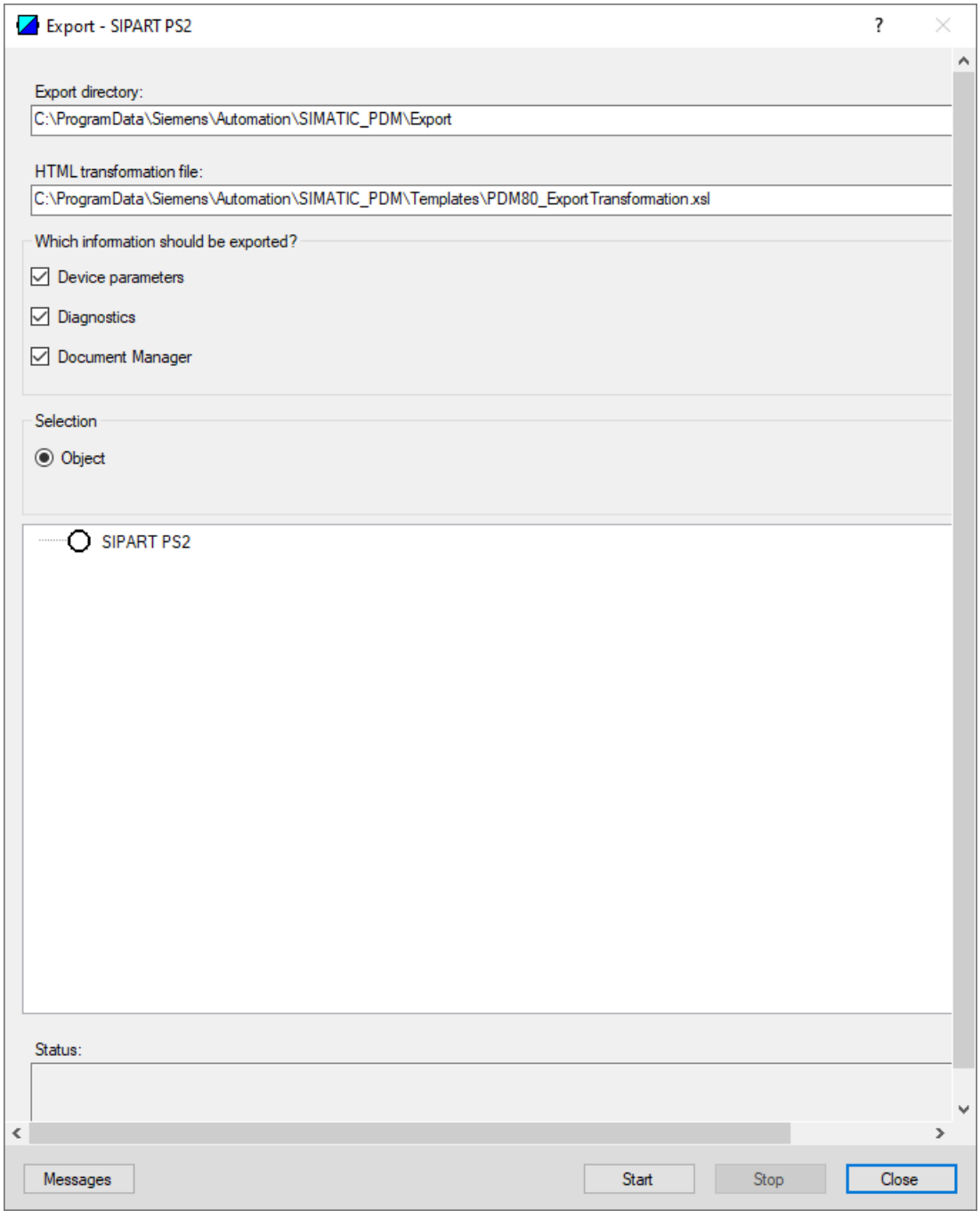

3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.
5. Close the dialog.

6. In the "File" menu, select the "Export..." command.



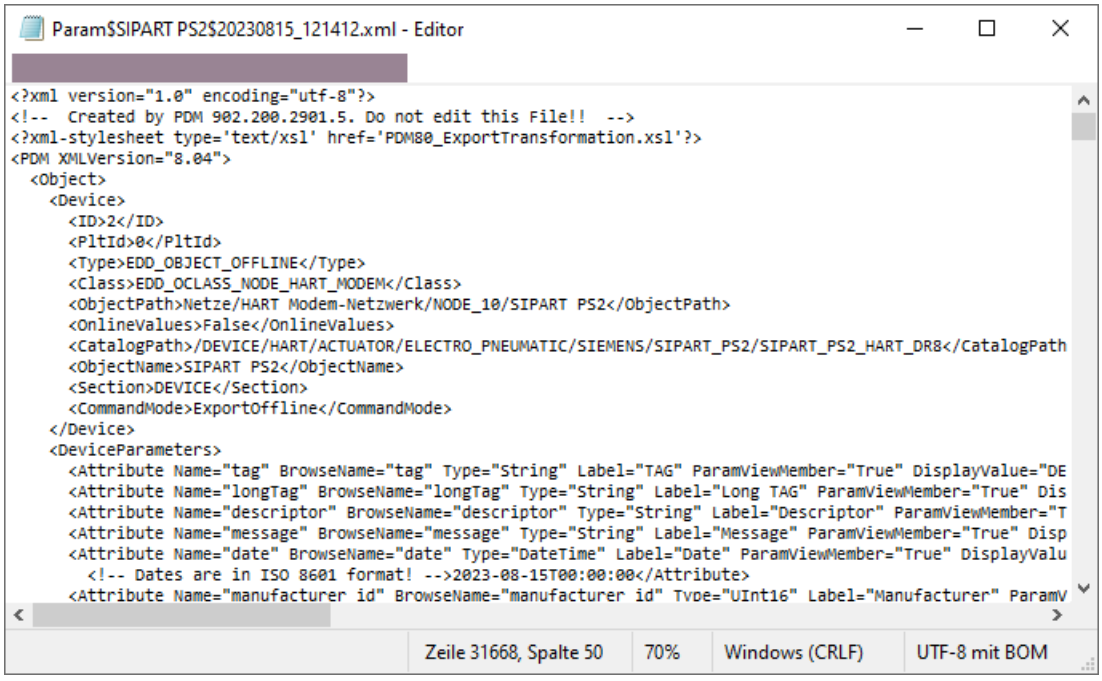

The "Export - ..." dialog opens.

7. Select the check boxes:
   - Device parameters - required
   - Diagnostics - required
   - Document Manager - optional




8. Start the export with the "Start" button.
9. Wait until the status "Export: Action finished" is displayed.

10. The following 2 files are stored in the export path:
    - XML file "Param$xxx$yyyymmdd_hhmmss.xml", e.g. "Param$SIPART PS2$20230815_121412.xml"
    - XSL stylesheet "PDM80_ExportTransformation.xsl"
11. Close the dialog.
12. Open the XML file with suitable software, e.g. an editor.




The XML file contains the following diagnostic results for the VS.

Table 6-11 Parameter

| Parameter | Data description in the XML file | | | |
|---|---|---|---|---|
| | **Name** | **Label** | **DisplayValue e.g.** | **Unit** |
| VS Reference | var_KPI_VS_Ref_CurState_80 | Overall status for VS | 0 | - |
| | var_KPI_VS_Ref_CurState_Valid | Overall status for VS | Valid | - |
| | var_KPI_VS_Ref_CurState_3F | Overall status for VS | 0 | - |
| | var_KPI_VS_Ref_ErrorByte | Detailed information | 0 | - |
| | var_KPI_VS_Ref_BreakoutPressure-Up | Breakout pressure | 2.282 | • bar<br>• MPa<br>• psi |
| | var_KPI_VS_Ref_BreakoutPositionUp | Breakout position | 99.1 | % |
| | var_KPI_VS_Ref_BreakoutPressure-Down | Breakout pressure (return) | 1.277 | • bar<br>• MPa<br>• psi |
| | var_KPI_VS_Ref_BreakoutPosition-Down | Breakout position (return) | 1.8 | % |
| | var_KPI_VS_Ref_TimeStamp_Date | Time stamp: Day | 8/21/2023 <mm/dd/yyyy> | - |
| | var_KPI_VS_Ref_TimeStamp_Time | Time stamp: Time | 14:35:56.980 | - |
| | var_KPI_VS_Ref_OperatingHours | Operating hours | 924 | h |
| Latest VS | var_KPI_VS_Latest_CurState_80 | Overall status for VS | 0 | - |
| | var_KPI_VS_Latest_CurState_Valid | Overall status for VS | Valid | - |
| | var_KPI_VS_Latest_CurState_3F | Overall status for VS | 0 | - |
| | var_KPI_VS_Latest_ErrorByte | Detailed information | 0 | - |
| | var_KPI_VS_Latest_BreakoutPres-sureUp | Breakout pressure | 2.202 | • bar<br>• MPa<br>• psi |
| | var_KPI_VS_Latest_BreakoutPosi-tionUp | Breakout position | 98.5 | % |
| | var_KPI_VS_Latest_BreakoutPres-sureDown | Breakout pressure (return) | 1.280 | • bar<br>• MPa<br>• psi |
| | var_KPI_VS_Latest_BreakoutPosi-tionDown | Breakout position (return) | 2.0 | % |
| | var_KPI_VS_Latest_Time-Stamp_Date | Time stamp: Day | 2/21/2024 <mm/dd/yyyy> | - |
| | var_KPI_VS_Latest_Time-Stamp_Time | Time stamp: Time | 17:35:56.980 | - |
| | var_KPI_VS_Latest_OperatingHours | Operating hours | 1025 | - |
| Number of VS Data-sets | var_KPI_VS_NumberOfDatasets | Number of data records (with-out reference) | 10 | - |

Table 6-12 KPIs of the maximum of 9 predecessor VS

| **Data description in the XML file** | | | |
|---|---|---|---|
| **Name** | **Label** | **DisplayValue** | **Unit** |
| var_KPI_VS_M1_CurState_80<br>...<br>var_KPI_VS_M9_CurState_80 | Overall status for VS | ... | - |
| var_KPI_VS_M1_CurState_Valid<br>...<br>var_KPI_VS_M9_CurState_Valid | Overall status for VS | ... | - |
| var_KPI_VS_M1_CurState_3F<br>...<br>var_KPI_VS_M9_CurState_3F | Overall status for VS | ... | - |
| var_KPI_VS_M1_ErrorByte<br>...<br>var_KPI_VS_M9_ErrorByte | Detailed information | ... | - |
| var_KPI_VS_M1_BreakoutPressureUp<br>...<br>var_KPI_VS_M9_BreakoutPressureUp | Breakout pressure | ... | • bar<br>• MPa<br>• psi |
| var_KPI_VS_M1_BreakoutPositionUp<br>...<br>var_KPI_VS_M9_BreakoutPositionUp | Breakout position | ... | % |
| var_KPI_VS_M1_BreakoutPressureDown<br>...<br>var_KPI_VS_M9_BreakoutPressureDown | Breakout pressure (return) | ... | • bar<br>• MPa<br>• psi |
| var_KPI_VS_M1_BreakoutPositionDown<br>...<br>var_KPI_VS_M9_BreakoutPositionDown | Breakout position (return) | ... | % |
| var_KPI_VS_M1_TimeStamp_Date<br>...<br>var_KPI_VS_M9_TimeStamp_Date | Time stamp: Day | ... | - |
| var_KPI_VS_M1_TimeStamp_Time<br>...<br>var_KPI_VS_M9_TimeStamp_Time | Time stamp: Time | ... | - |
| var_KPI_VS_M1_OperatingHours<br>...<br>var_KPI_VS_M9_OperatingHours | Operating hours | ... | - |

# 6.9 Triggered pressure monitoring (TPM)

## 6.9.1 Functional description

At the Triggered pressure monitoring (TPM), 2 time-shifted pressure measurements are performed at the Y1 connection:

- 1. Measurement at the start of diagnostics
- 2. Measurement at the end of the set duration (≙ Parameter "Time pressure measurement Y1" (U9.TPMT))

Once the test has been completed, the pressure difference between the 2 measurements is determined and displayed.

This test can be used to check the function of external attachments between the 2 measurements, e.g. a temporary air release.

Parameters of the TPM diagnostics:

- Time pressure measurement Y1 (U9.TPMT)

The diagnostics is made with Device Manager Software or, for example SIMATIC PDM of via HART communication, executed and read out.

Local operation is not possible.

**Note**

During the test, the positioner is not in "Automatic (AUT)" mode and has the following behavior:

- Any system deviations that occur are not corrected.
- The positioner does not follow the setpoint.
- The positioner moves the valve.

## 6.9.2 With SIMATIC PDM: Configuring and starting TPM

### Requirement

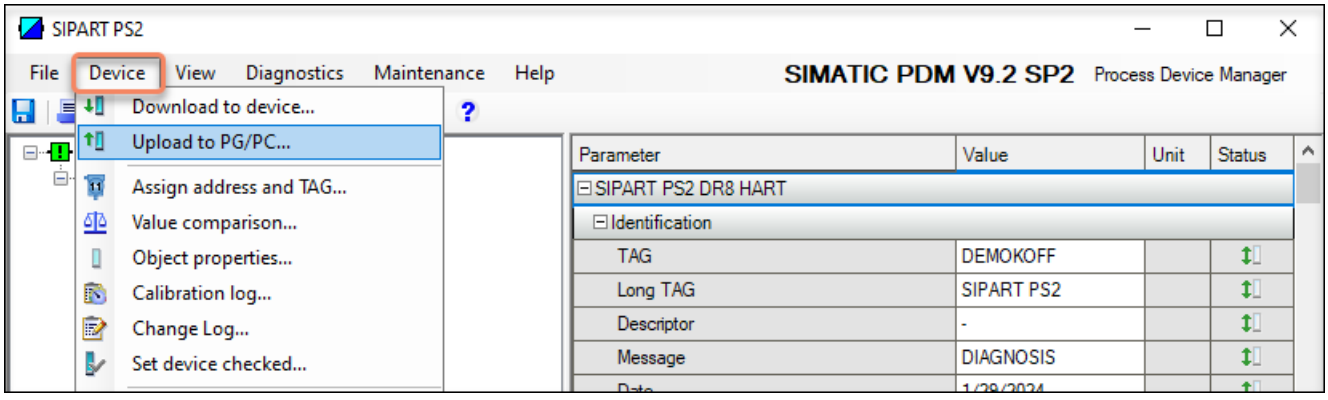
- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.
- The positioner is in a maintenance phase, e.g. while the flow rate is not being actively controlled.
- The positioner is attached to the valve and connected to the power supply and the compressed air supply.
- The "52.XDIAG" application parameter is set to "On1", "On2" or "On3".
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

### Diagnostics parameters

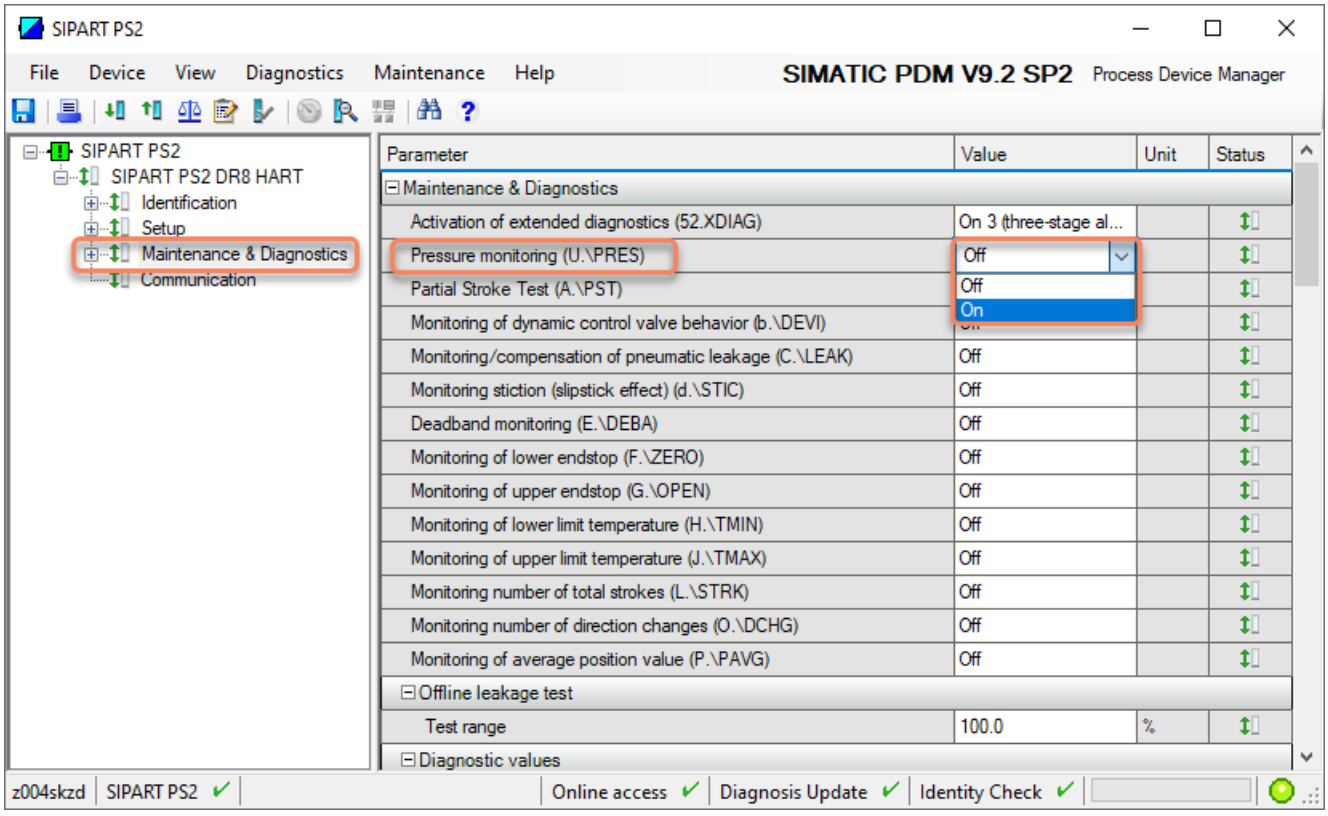
| **U9.TPMT** | **Time pressure measurement Y1** | |
|---|---|---|
| Function | The parameter defines the time interval between the 1st pressure measurement and the 2nd pressure measurement at the Y1 connection. | |
| Setting range | 1 ... 1000 | |
| Factory setting | 1 | |
| Unit | s (second) | |
| **Communication** | | |
| SIMATIC PDM Export | Name | var_TPM_Time |
| | DisplayValue | ≙ Value |

### Configuring and starting diagnostics

1. Switch the positioner to "Automatic (AUT)" mode.
2. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
3. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

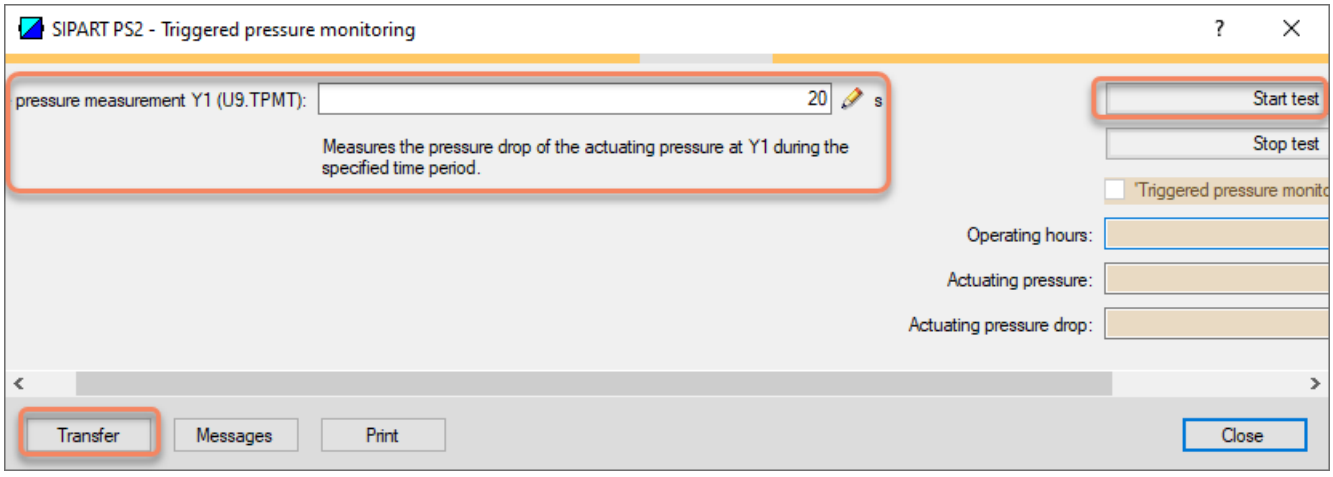


4. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
5. Wait until the status "Load to PG/PC: Action finished" is displayed.
6. Close the dialog.
7. Select the "Maintenance & Diagnostics" directory.




8. For "Pressure monitoring" (U.\PRES), set the value to "On".
9. In the "Device" menu, select the command "Download to device...".
10. Recommendation: Select the check box "Load changed parameters only".
11. In the dialog, click the "Start" button.
    ⇒ If the check box is selected, only the changed parameter values are loaded into the positioner.
12. Wait until the status "Load to Device: Action finished" is displayed.
13. Close the dialog.

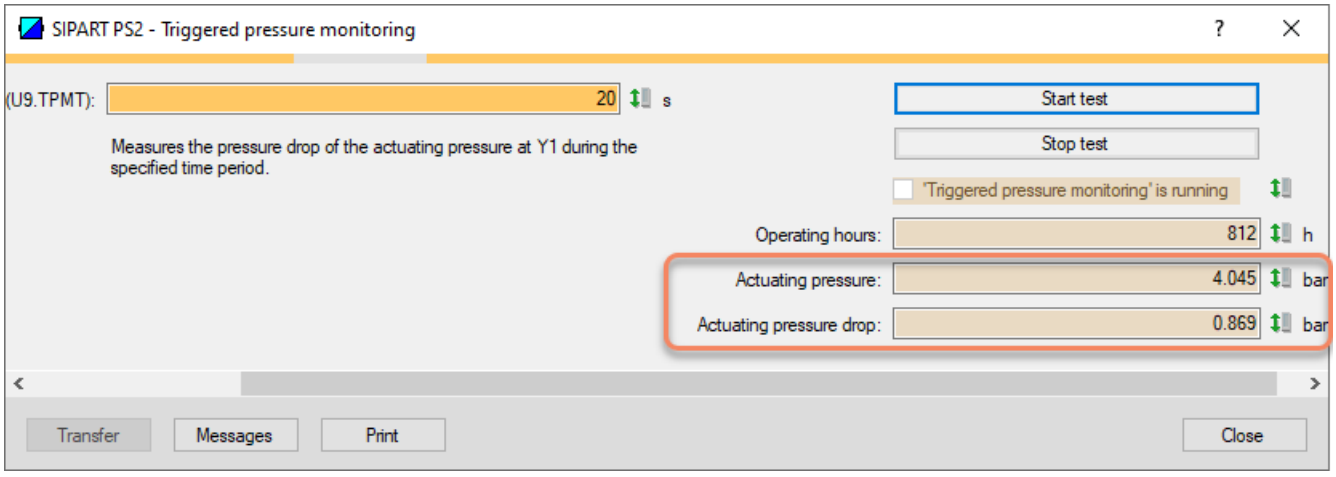
14. In the "Device" menu, select the command "Maintenance and Diagnostics > Triggered pressure monitoring".
    ⇒ The "Triggered pressure monitoring dialog is displayed.




15. Set the "U9.TPMT" parameter to a sufficient value, e.g. "20" seconds.
    During the set duration of the test, the positioner behaves as follows
    - The positioner is not in "Automatic (AUT)" mode.
    - Any system deviations that occur are not corrected.
    - The positioner does not follow the setpoint.
16. Transfer the change to the positioner with the "Transfer" button.
17. Start with the "Start test" button.
18. Note the information in the following dialog.
19. To start the diagnostics, select the "Yes" option button and click "OK".
    ⇒ Diagnostics starts with the 1st pressure measurement at the Y1 connection.
    ⇒ The "Triggered Pressure monitoring is running" status is highlighted in the dialog.
    ⇒ "TPM" is shown in the display.


20. Confirm the start in the following dialog with "OK".
    ⇒ The function of external attachments can be tested, e.g. a temporary air release.

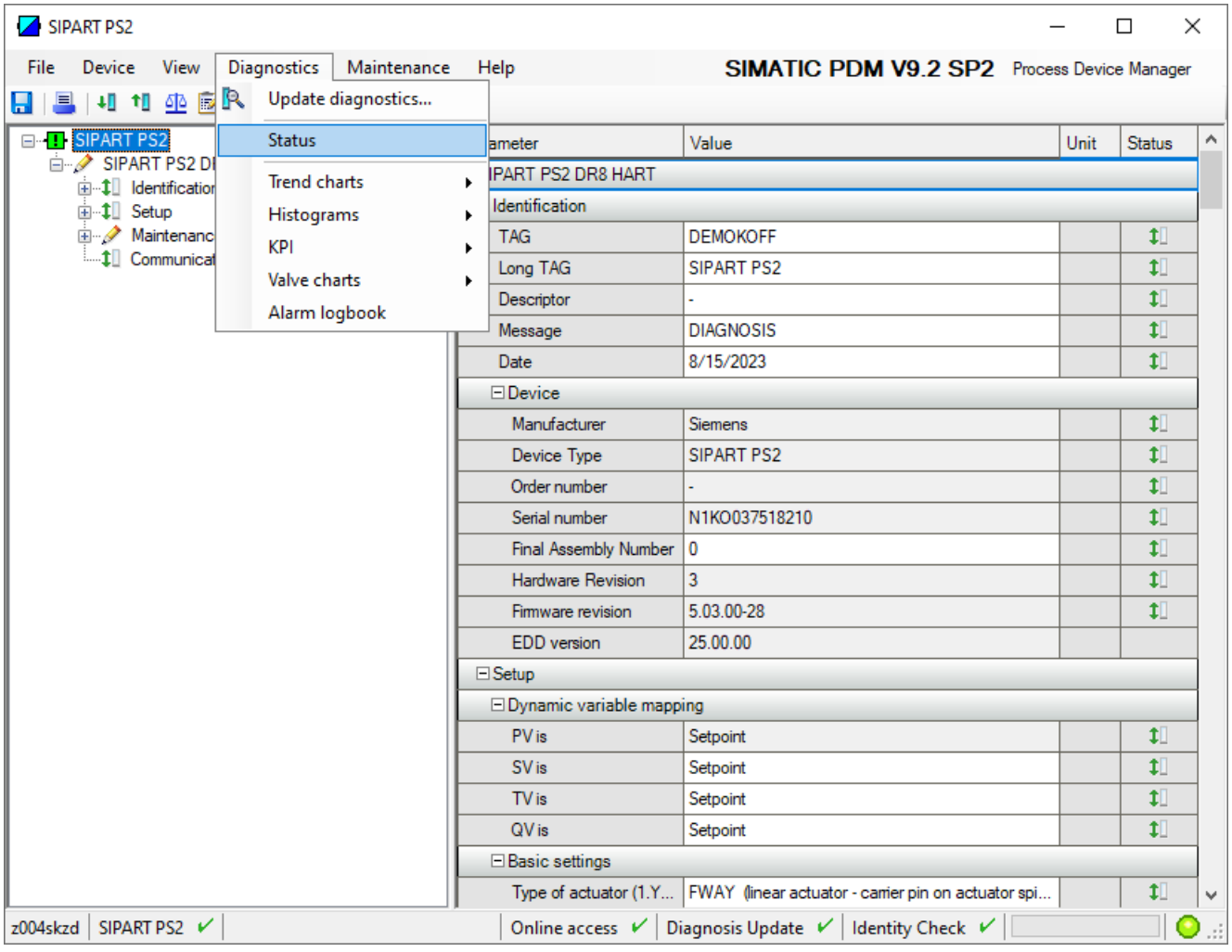
21. Wait for the end of the set duration and the 2nd pressure measurement at the Y1 connection. The diagnostic results are displayed in the dialog:
    - Operating hours
    - Actuating pressure : Shows the result of the 1st measurement.
    - Actuating pressure drop: Shows the pressure drop of the signal pressure during the set duration "U9.TPMT".



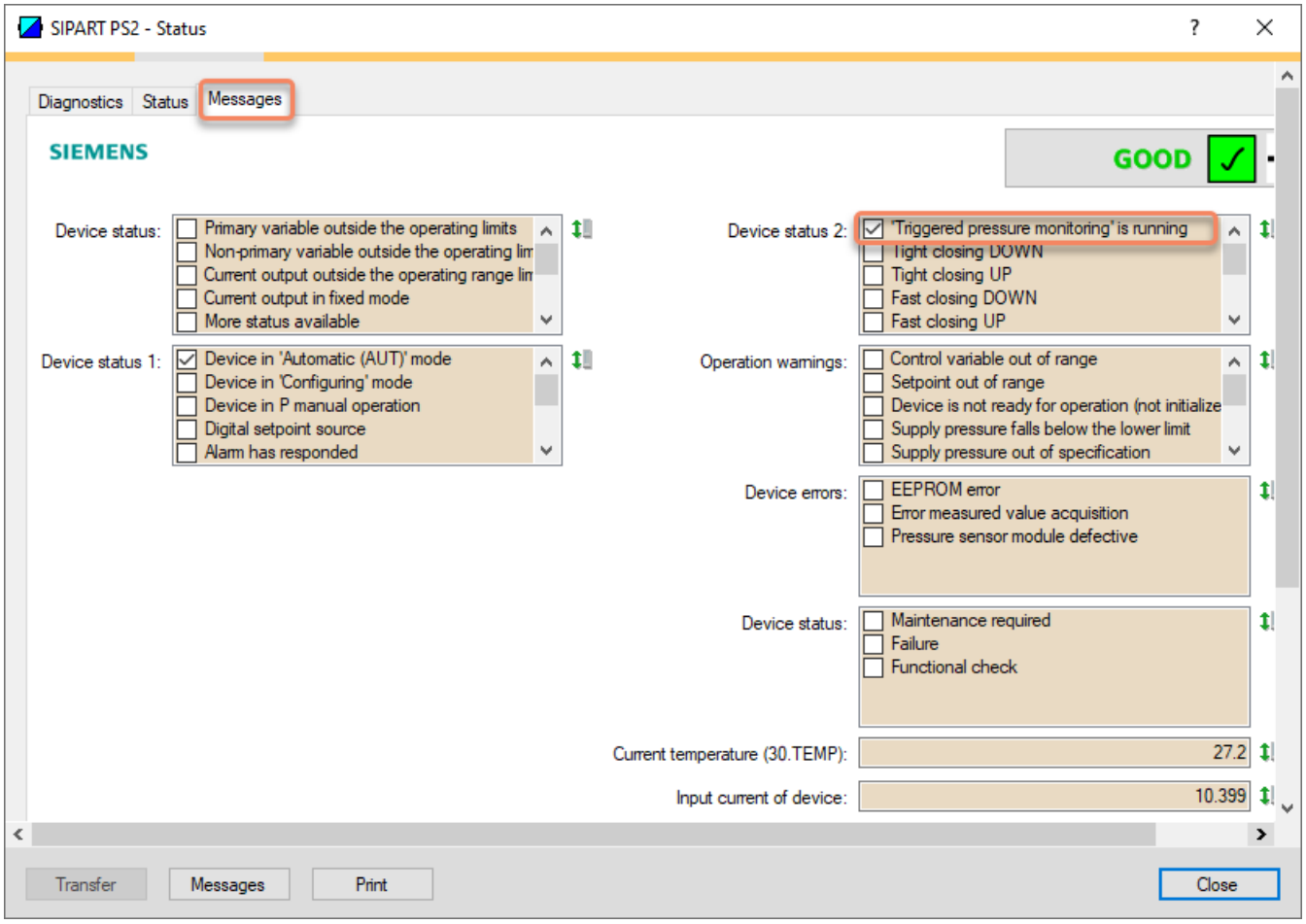

22. Close the dialog with the "Close" button.

## Read diagnostics status

1. In the "Diagnostics" menu, select the "Status" command.




2. Select the "Messages" tab.
   The following message is highlighted while the test is running:
   – Triggered pressure monitoring is running




3. Close the dialog.

### 6.9.3 Via HART communication: Configuring and starting TPM

#### Requirement

- The positioner has pressure sensors (-Z P02 option).
- "Pressure monitoring" (U.\PRES) is activated.

#### Diagnostics parameters

| **U9.TPMT** | **Time pressure measurement Y1** | |
|---|---|---|
| Function | The parameter defines the time interval between the 1st pressure measurement and the 2nd pressure measurement at the Y1 connection. | |
| Setting range | 1 ... 1000 | |
| Factory setting | 1 | |
| Unit | s (second) | |
| **Communication** | | |
| HART communication (read) | Command | #198 |
| | Response Data | Bytes: 24 ... 25<br>Format: Unsigned-16 |
| HART communication (write) | Command | #199 |
| | Request Data | Bytes: 24 ... 25<br>Format: Unsigned-16 |

#### Request diagnostic parameters

**Request**

Send to the positioner via HART communication:

- "#198" command

**Answer**

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 6-13 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 1 | Enum | Pressure unit (U1.PUNIT) |
| 24 ... 25 | Unsigned-16 | Time pressure measurement Y1 (U9.TPMT) |

Table 6-14 **Command-Specific Response Codes**

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |

## Change diagnostic parameters (optional)

### Request

Send to the positioner via HART communication:

- "#199" command
- Bytes 24 ... 25 for the set value of the parameter "U9.TPMT"

### Answer

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 6-15 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 1 | Enum | Pressure unit (U1.PUNIT) |
| 24 ... 25 | Unsigned-16 | Time pressure measurement Y1 (U9.TPMT) |

Table 6-16 Command-Specific Response Codes

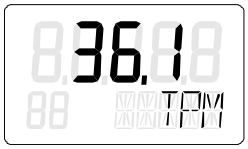
| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 2 | Error | Invalid Selection |
| 3 | | Passed Parameter Too Large |
| 4 | | Passed Parameter Too Small |
| 5 | | Too Few Data Bytes Received |
| 6 | | Device-Specific Command Error |
| 7 | | In Write Protect Mode |
| 16 | | Access Restricted |
| 32 | | Busy |

## Start diagnostics

Send to the positioner via HART communication:

- "#172" command
- Byte 0, Bit 5 and Byte 1, Bit 6

⇒ "TPM" is shown in the display.




**Cancel diagnostics**

- "#172" command
- Byte 0, Bit 5 and Byte 1, Bit 7

**Display the diagnostics status**

- "#48" command
- Byte 1, Bit 7

## Read out diagnostic results

**Request**

Send to the positioner via HART communication:

- "#212" command

**Answer**

The answer consists of the following data:

- Response Data Bytes
- Command-Specific Response Code

Table 6-17 Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 1 | Enum | Pressure Unit (U1.PUNIT) |
| 1 ... 4 | Unsigned-32 | Triggered Pressure Monitoring: Operating Hours Counter |
| 5 ... 8 | Float | Triggered Pressure Monitoring: Chamber Pressure |
| 9 ... 12 | Float | Triggered Pressure Monitoring: Chamber Pressure Drop |

Table 6-18 Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 6 | Error | Device Specific Command Error |

# Alarm logbook

# 7

## 7.1 Functionality and capacity

The positioner has an alarm logbook that is designed as a ring memory.

The alarm logbook saves all messages and alarms that occur during operation, e.g. when a threshold is exceeded, using the FIFO method (First In - First Out)

If the capacity is exceeded, previous messages are replaced by current messages.

**Capacity of the alarm logbook**

| Firmware (FW) of the positioner | | Capacity |
|---|---|---|
| 5.00 | | 30 entries |
| 5.01 | | |
| 5.02 | | |
| 5.03 | Note: For SIPART PS2 with pressure sensors -Z P01/P02 | 400 entries |
| 5.04 | | 30 entries |
| 5.05 | | |

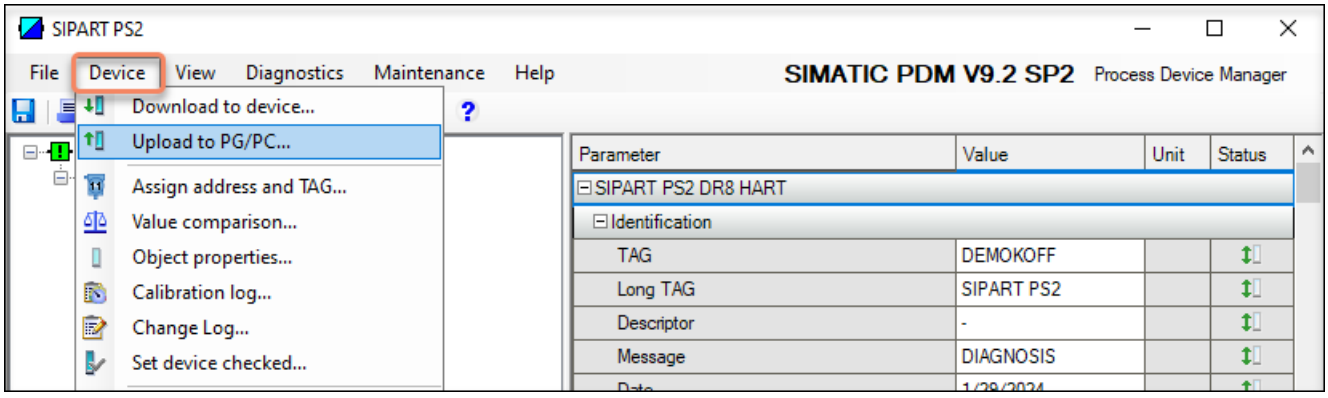
## 7.2 Open alarm logbook

### Requirement

- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

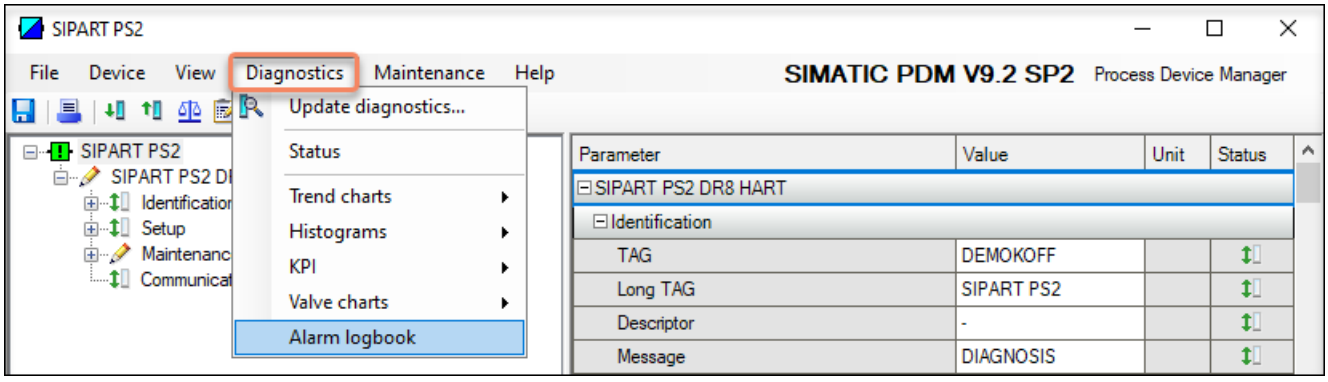
### Display and update messages in the alarm logbook

1. In SIMATIC PDM, open the object of the positioner, e.g. "SIPART PS2".
2. In the "Process Device Manager" editor in the "Device" menu, select the "Upload to PG/PC..." command.

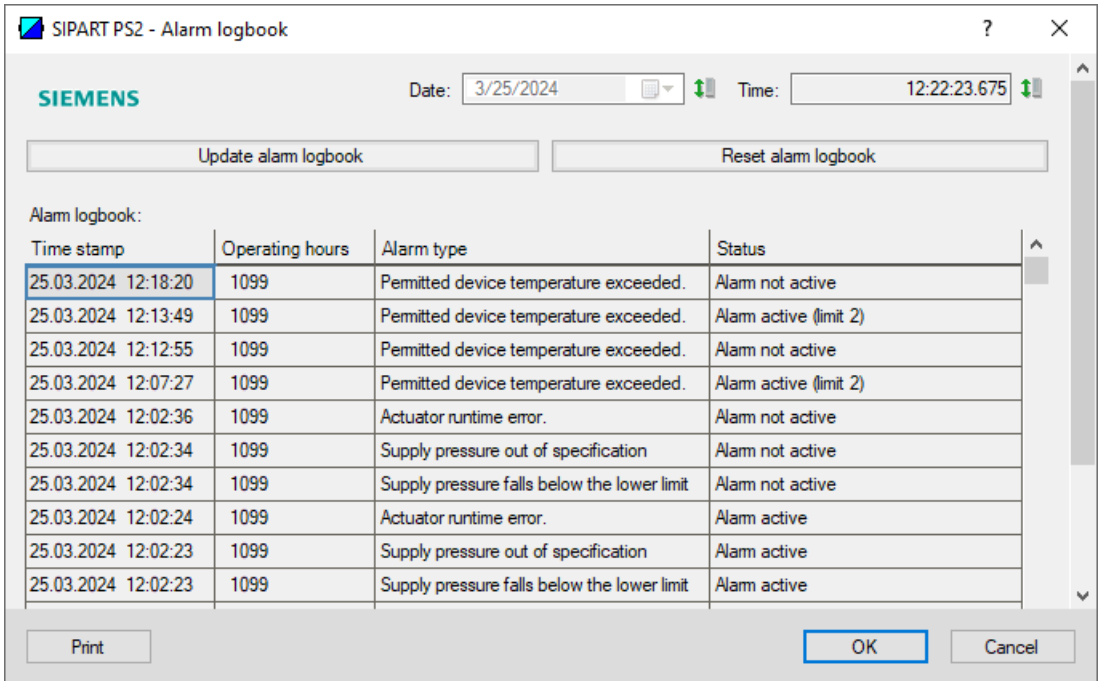



3. In the "Upload to PG/PC..." dialog, click the "Start" button.
   ⇒ The current parameters of the positioner are loaded into the "Process Device Manager".
4. Wait until the status "Load to PG/PC: Action finished" is displayed.

5. In the "Diagnostics" menu, select the "Alarm logbook" command.

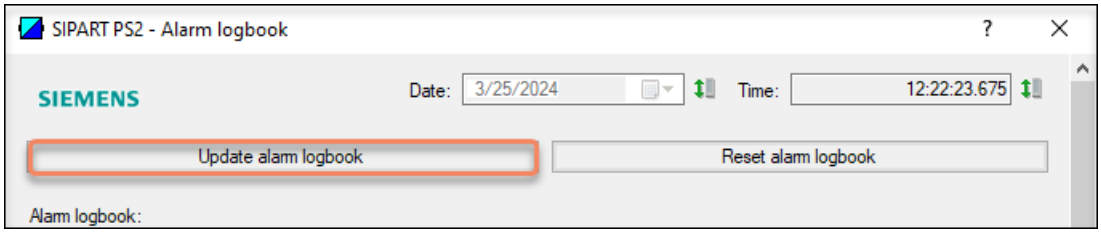



⇒ The "Alarm logbook" dialog opens.
The procedure is shown as an example with FW 5.03.
For FW 5.00 to 5.02, the "Update" and "Reset" buttons are located at the bottom of the dialog.

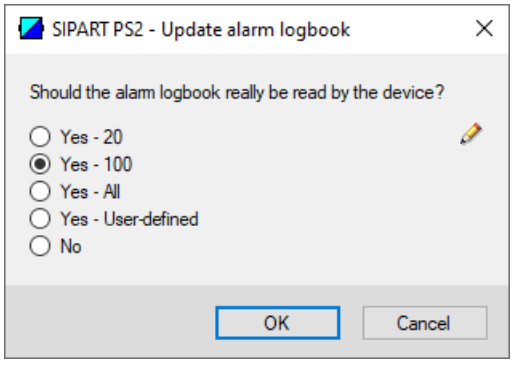



The dialog shows the messages since the alarm log was last updated.

6. Click the "Update alarm logbook" button.




⇒ The "Update Alarm logbook" dialog opens.




7. Select the required option button, e.g. "Yes - 100" dialog.
8. Close the dialog with "OK".
   ⇒ The "Message Log" dialog opens.
9. Wait until the status "Finished" is displayed.
10. Click the "Close" button.
    ⇒ When present, they are displayed in the "Alarm logbook" dialog.
11. Close the dialog with "OK".

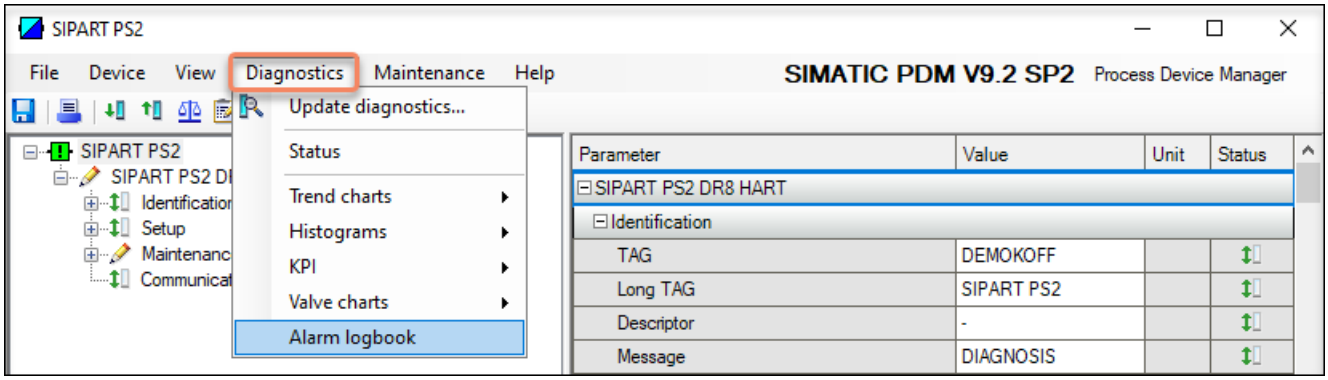
## 7.3 Reset messages in the alarm logbook

### Requirement

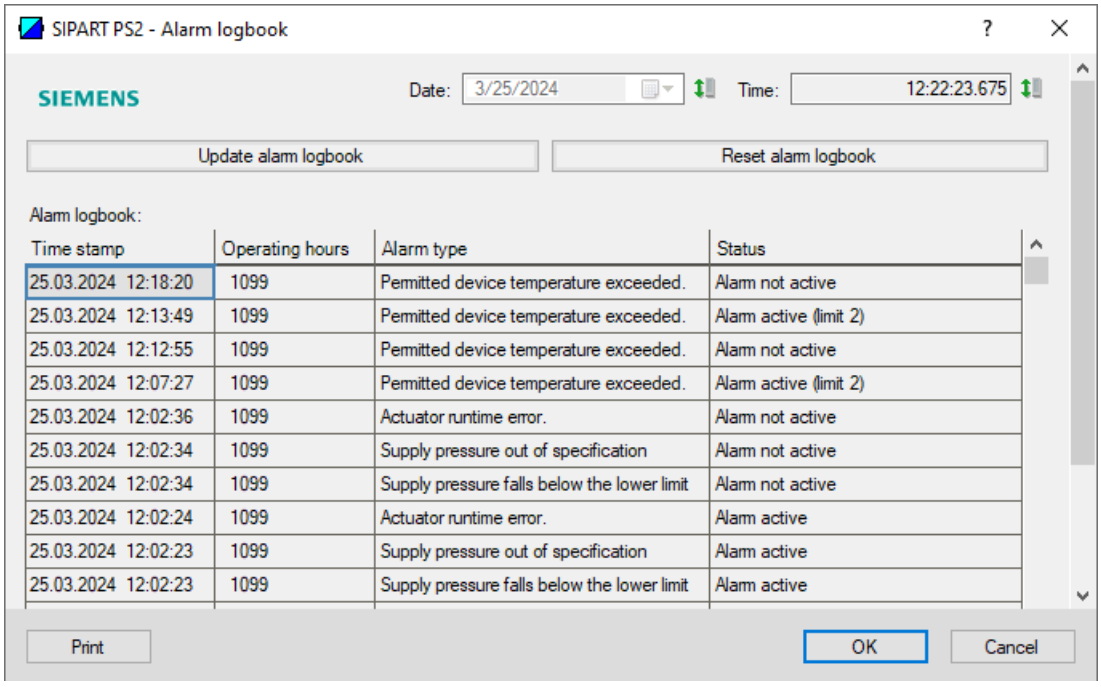
- The positioner has a HART interface: SIPART PS2 6DR51.../6DR52...
- The installation of SIMATIC PDM as of version 9.0 is available.
- An object with the firmware version of the positioner is created in SIMATIC PDM.

## Reset messages in the alarm logbook

1. In the "Diagnostics" menu, select the "Alarm logbook" command.

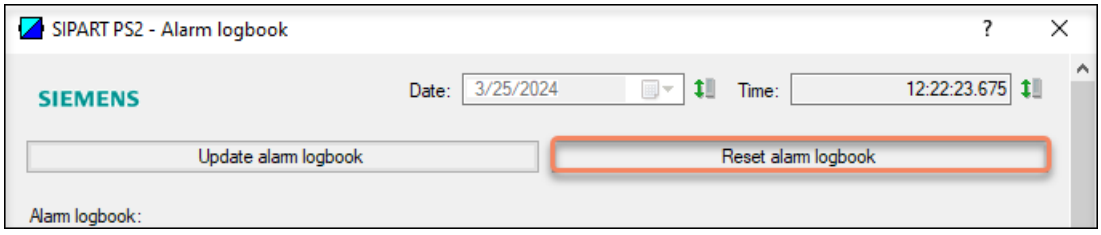



⇒ The "Alarm logbook" dialog opens.
The procedure is shown as an example with FW 5.03.
For FW 5.00 to 5.02, the "Update" and "Reset" buttons are located at the bottom of the dialog.

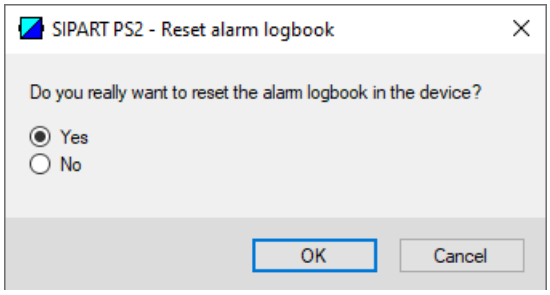



The dialog shows the messages since the alarm log was last updated.

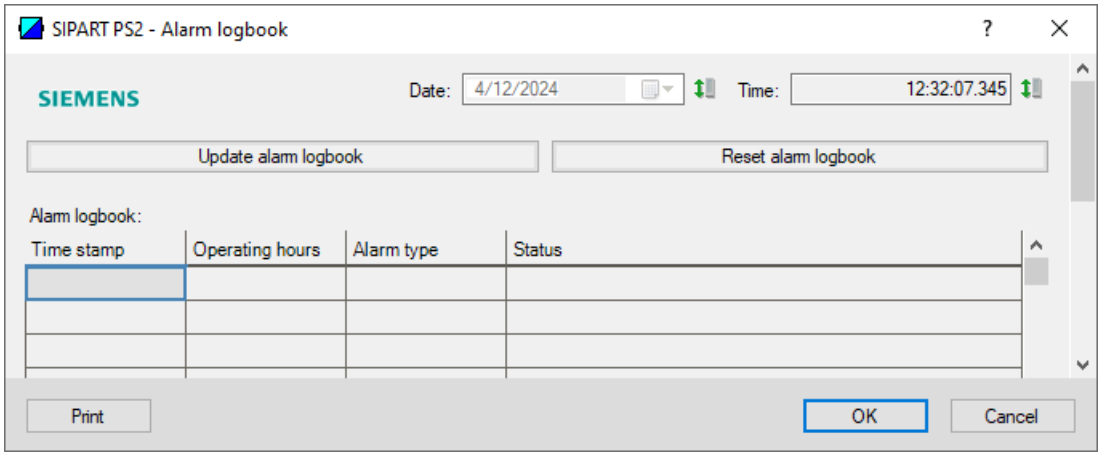
2. Click the "Reset alarm logbook" button.



⇒ The "Reset Alarm logbook" dialog opens.




3. Select the option button "Yes" dialog.
4. Close the dialog with "OK".
   ⇒ The messages in the alarm logbook of the positioner are deleted.
5. Click the "Update alarm logbook" button.
   ⇒ The dialog is updated: The messages have been removed.




6. Close the dialog with "OK".

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