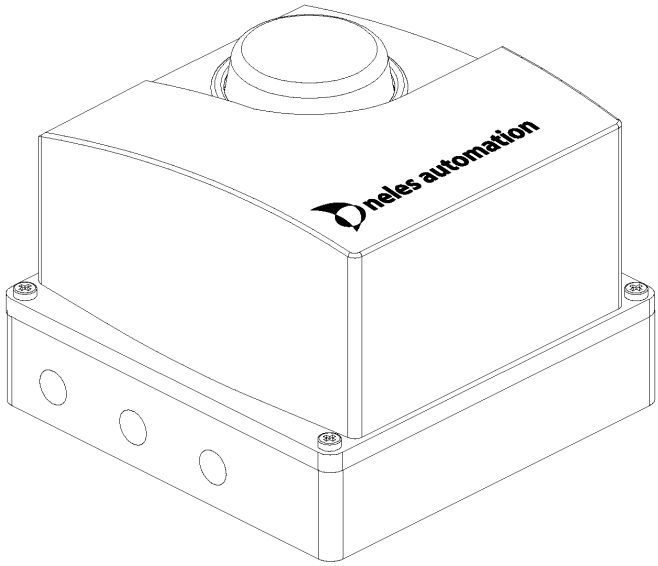

PROFIBUS PA VALVE POSITIONER

Series ND800PA rev1.0

USER'S GUIDE

Table of Contents

1 Introduction

ND800PA is a PROFIBUS PA compatible valve positioner made by Metso Automation.

Simatic PDM is a field device configurator software that supports PROFIBUS DP/PA and HART devices.

The ND800PA documentation is provided in two manuals:

- ND800PA Installation, Maintenance and Operation instructions /1/. This document describes the physical installation instructions and configuration using the Local User Interface.
- ND800PA User's Guide. This document describes the functionality of the device in the Simatic PDM point of view.

This device is designed according to the PROFIBUS-PA Profile for Process Control Devices Version 3.0 /2/.

1.1 Abbreviations

OLE Object Linking and Embedding (Microsoft technology)
OPC OLE for Process Control (Microsoft technology)
DDE Dynamic Data Exchange (Microsoft technology)
LUI Local User Interface
PDM Process Device Manager

1.2 Referenced Documents

/1/ ND800PA Installation, Maintenance and Operation instructions.

/2/ PROFIBUS Nutzerorganisation, PROFIBUS-PA Profile for Process Control Devices Version 3.0, October 1999.

2 Quick start instructions

1. Install the PDM driver and the GSD file. See page 6.
2. Add the ND800PA to the Simatic PDM project. See Appendix B.

2.1 ND800PA basic setup

1. Set the **Assembly related configuration**. See page 17.
2. Set the **Profibus Communication Fail Safe Action**. See page 17.
3. Run the **Automatic travel calibration**. See page 33.
4. Set the Bus address from LUI or PDM.
5. Configure the GSD module. See page 11.

2.2 Fine tuning

Some applications may require some of the following adjustments;

- Direction
- Travel Time limiting
- Cutoff
- Limits
- Dead angle compensation
- Flow characterization

Diagnostic warning and alarm limits also may need adjustment as well as the supply pressure estimate.

3 Installation

The ND800PA is shipped with one CD-ROM disc. The CD-ROM disc contents;

- GSD file
- Simatic PDM driver
- Installation, Maintenance and Operation instructions (IMO)
- Users Guide

3.1 GSD file

GSD file is needed for the PROFIBUS master (class 1) to be able to configure the cyclic DP communication between the master and the slave. The Profibus master could be a DCS or PLC from any vendor. All of these systems have their own, separate configuration tools. All of these tools understand the ND800PA GSD file.

The following example (figures 1-5) describes how to add the NEL_052D.GSD file to the Siemens Step 7 Hardware catalog as well as to the hardware project.

Figure 1. Select “Install New *.GSE Files”.

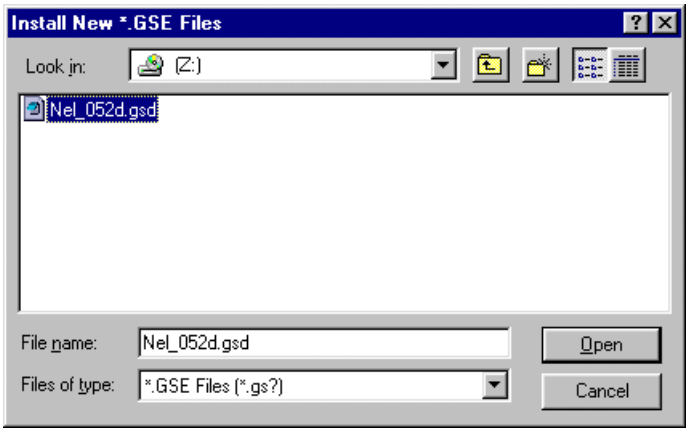

Figure 2. Browse to CD-ROM drive and select NEL_052D.GSD.

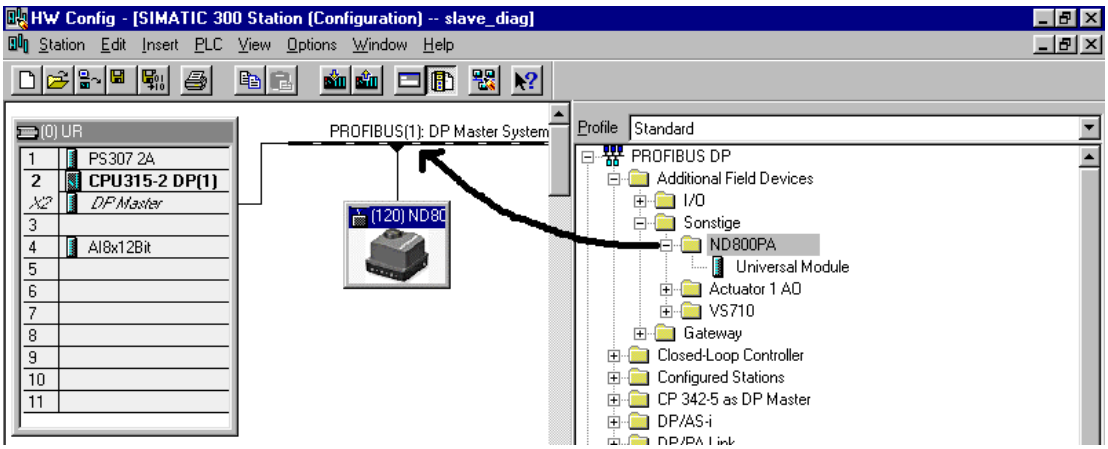

Figure 3. Now the ND800PA appears on the hardware catalog. Drag and drop the ND800PA object to the hardware project.

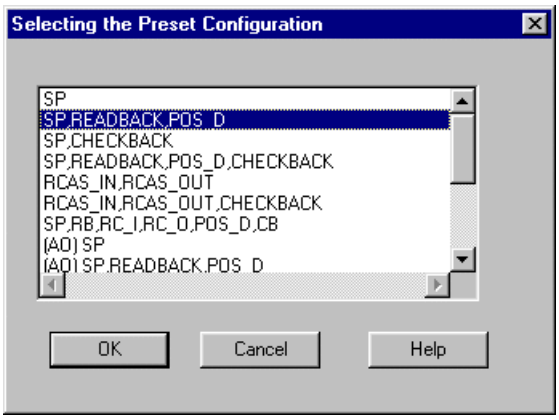

Figure 4. Select the module for the cyclic communication. In this case the module contains signals SP, READBACK and POS_D.

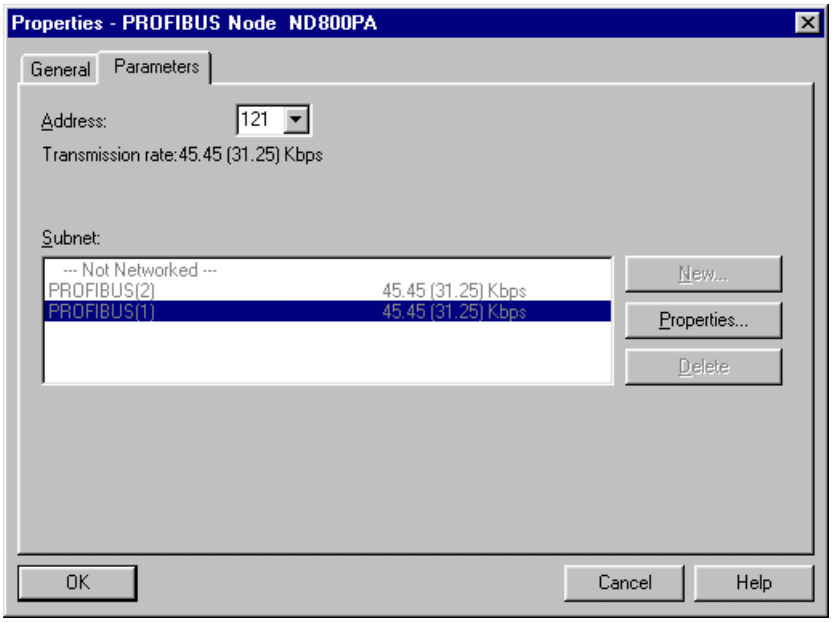

Figure 5. Select the device slave address. This does not change the slave address but only tells to the S7 project that what the current address is.

3.2 Simatic PDM driver

Simatic PDM driver adds the ND800PA device support to the Simatic PDM. This driver is tested with following PDM versions:

- PDM v. 5.0.1
- PDM v. 5.0.1 SP3
- PDM v. 5.0.2 SP1

The driver installation is described in figures 6-11.

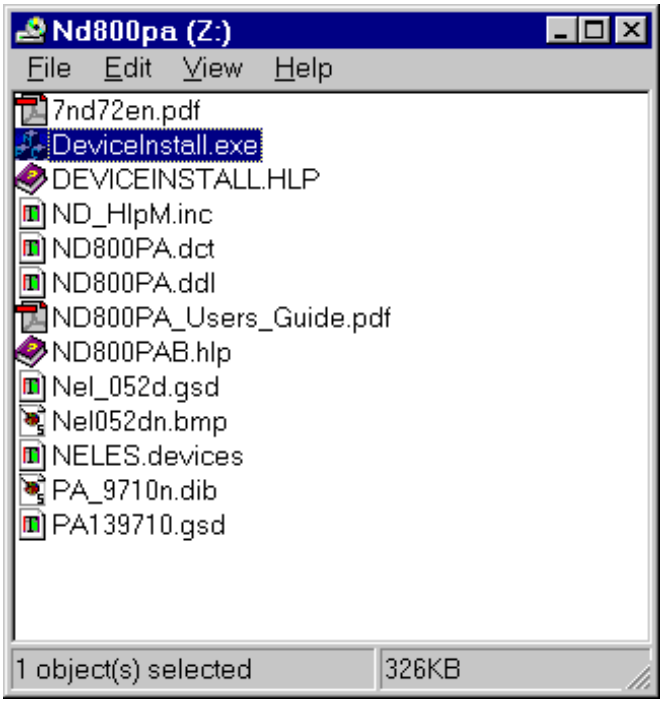

Figure 6. Browse to CD-ROM drive and start (double click) DeviceInstall.

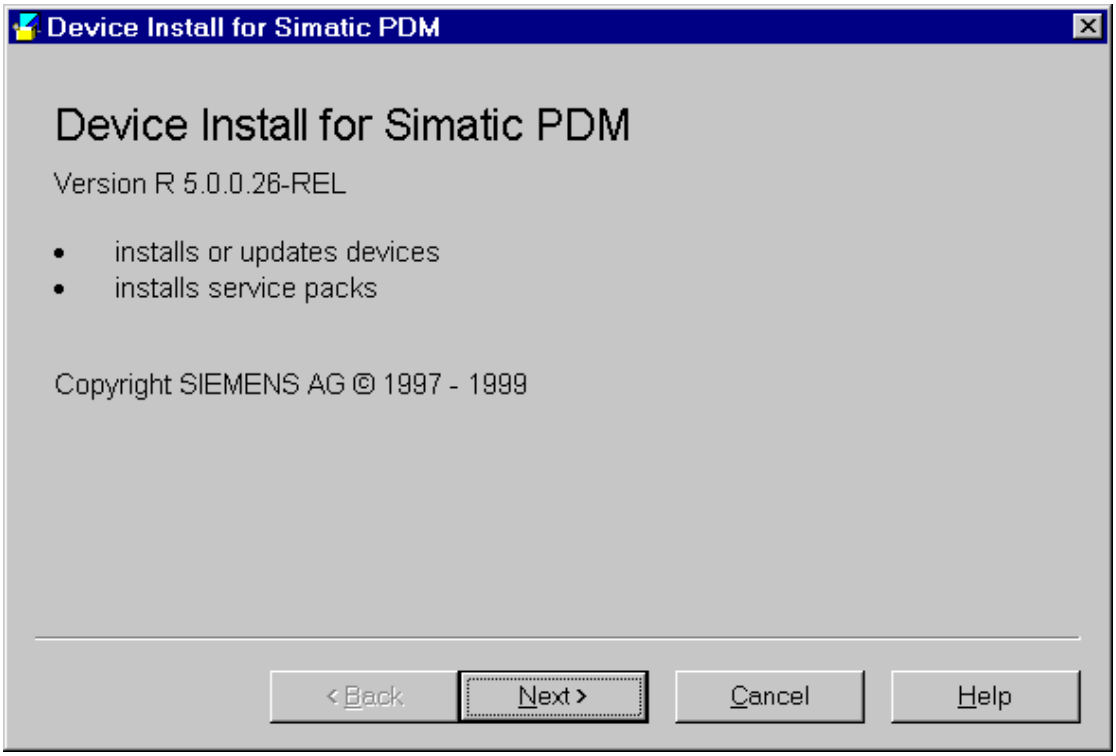

Figure 7. Click Next.

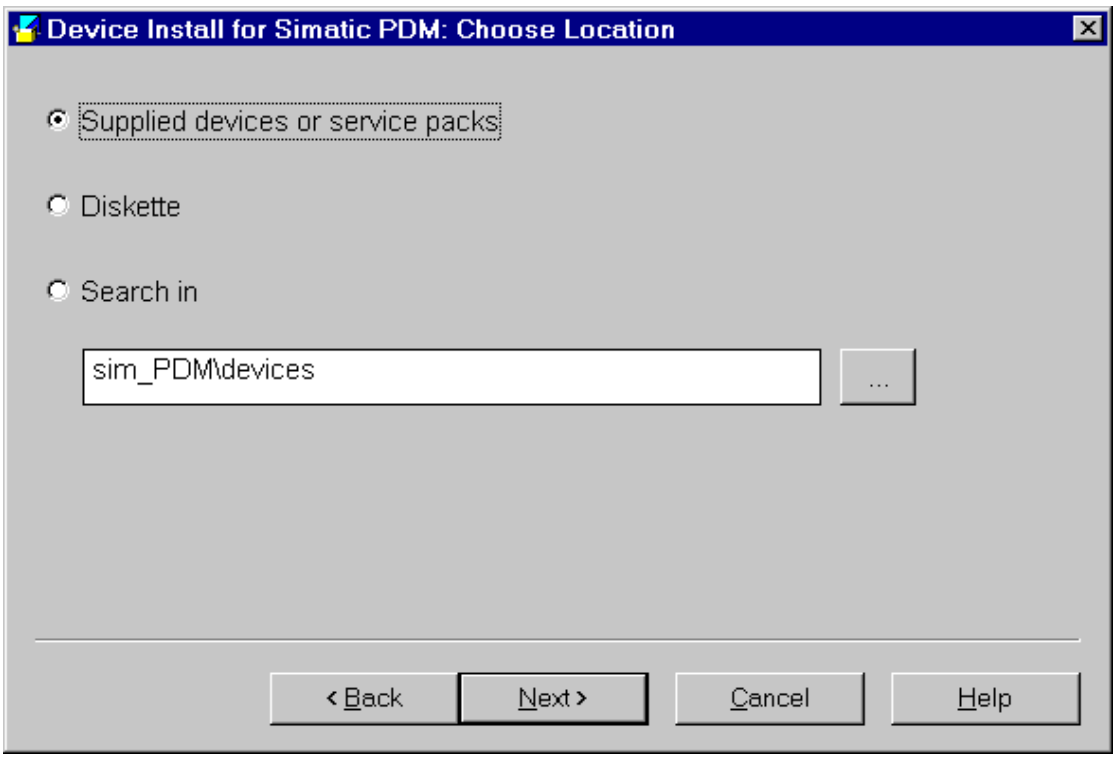

Figure 8. Select “Supplied devices or service packs” and click Next.

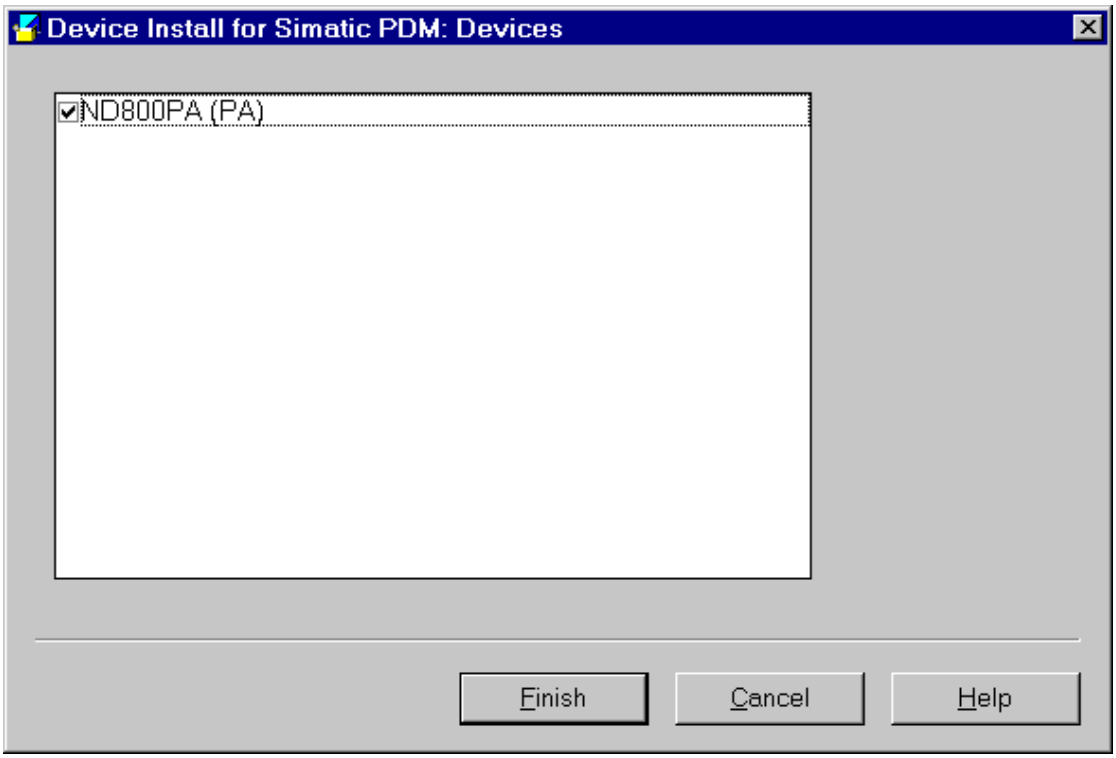

Figure 9. Click Finish.

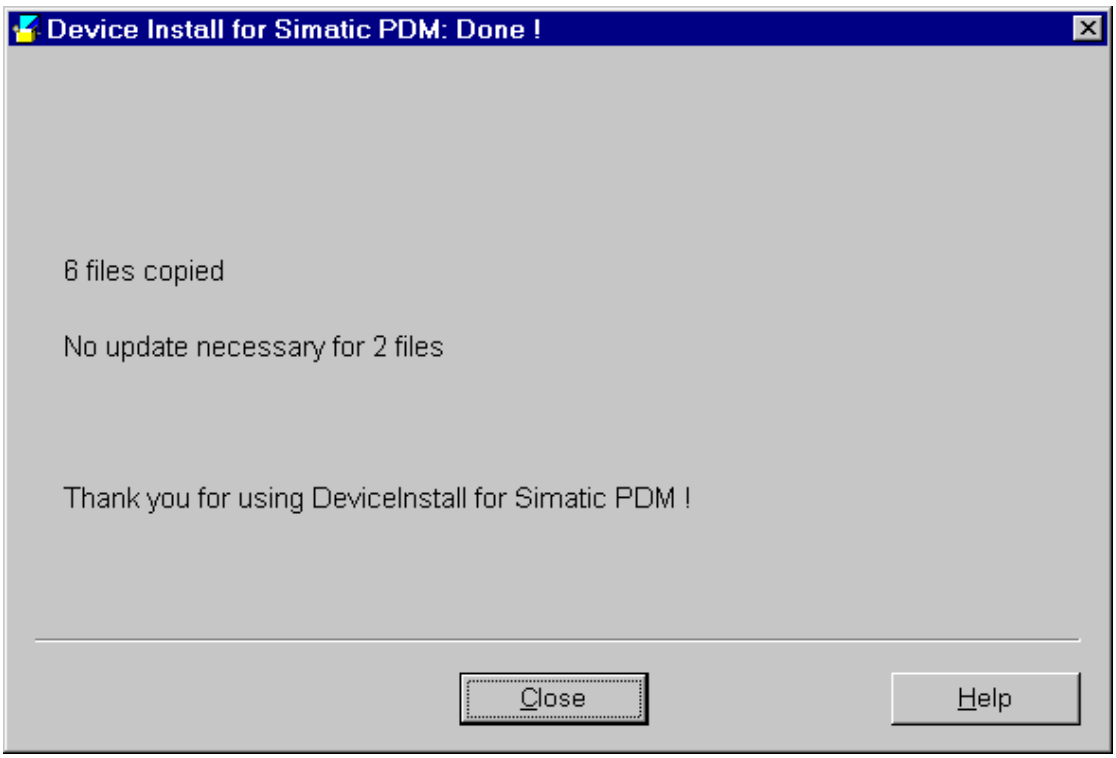

Figure 10. Result of successful installation.

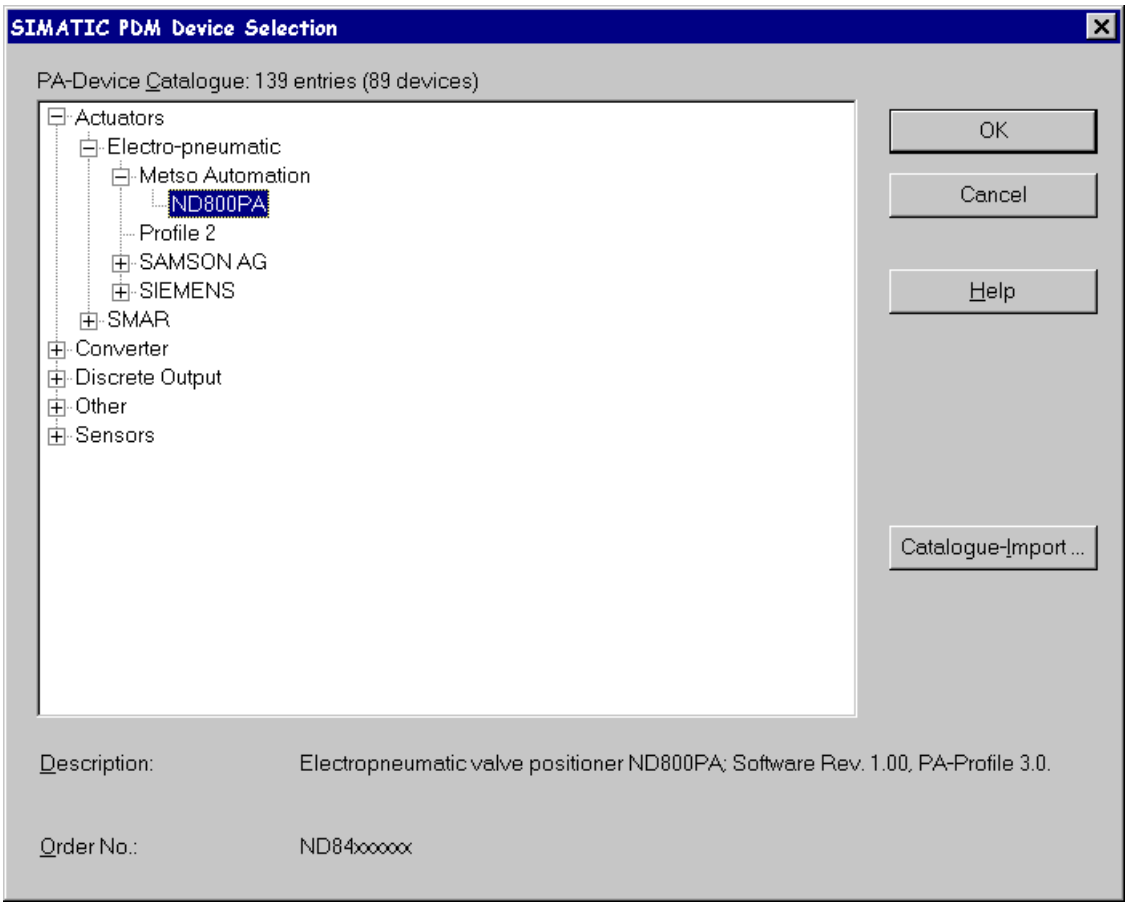

Figure 11. Now the ND800PA device should appear in the PA-Device Catalogue window. This window can be found by selecting the menu *Insert / PDM / PFOFIBUS PA device* in the Simatic Manager Process Device Network view.

4 ND800PA GSD modules

The control communication is basically as follows; PLC/DCS writes the valve position setpoint to the ND800PA and reads the position measurement from the ND800PA. This communication is configured by the GSD modules.

GSD module is a set of data, which the ND800PA and DCS/PLC exchanges cyclically until the end of the world. The GSD modules are listed in the GSD file. The ND800PA GSD file name is **Nel_052d.gsd.** During the DCS/PLC configuration, the configuration software, such as Siemens Simatic Step 7, reads the **Nel_052d.gsd** file and asks user, which GSD module should be used.

The ND800PA has following GSD modules;
- SP
- SP,READBACK,POS_D
- SP,CHECKBACK
- SP,READBACK,POS_D,CHECKBACK
- RCAS_IN,RCAS_OUT
- RCAS_IN,RCAS_OUT,CHECKBACK
- SP,RB,RC_I,RC_O,POS_D,CB

Abbreviations; RB=READBACK, RC_I=RCAS_IN, RC_O=RCAS_OUT, CB=CHECKBACK

For compatibility reasons the modules are represented in both *Identifier Byte* format and in *Extended Identifier Format.*

SP is the valve position setpoint in the AUTO mode. The ND800PA *Analog Output Block* default target mode is AUTO. The range is 0-100%.

READBACK is the valve position measurement. The range is 0-100%.

POS_D contains the limit switch information. The values are:
1 = closed
2 = opened
3 = intermediate

If the limit switches are not installed, the POS_D value is determined from the position measurement sensor as follows:
1 = closed, Position <= 2%
2 = opened, Position >=98%
3 = intermediate, 2 < Position < 98

RCAS_IN is the valve position setpoint in the Remote Cascade mode. Before this setpoint is used, the Analog Output Block (AO) **actual** mode has to be the RCAS mode. This requires as follows;
- AO block **target** mode must be RCAS.
- The DCS/PLC has to go through the *remote cascade initialization* sequence with the ND800PA. This is done by using the STATUS bytes of the RCAS_IN and RCAS_OUT signals.

RCAS_OUT feeds back the SP or RCAS_IN, depending on the mode.

CHECKBACK is a diagnostic signal. All control systems has their ways to convert this standard bit-information to human readable alert messages. See table 1.

Table 1. CHECKBACK signal bit-enumeration.

Byte	Bit	Description	Indication Class
0	0	Field device in Fail safe active	R
	1	Request for local Operation	R
	2	Field device under local control, LOCKED OUT switch is in gear	R
	3	Emergency override active	R
	4	Actual position feedback different from expected position	R
	5	Indicates that the torque limit in OPEN direction is exceeded	R
	6	Indicates that the torque limit in CLOSE direction is exceeded	R
	7	Indicates status of travel monitoring equipment, if YES, travel time for actuator has exceeded.	A
1	0	Actuator is moving towards open direction	R
	1	Actuator is moving towards close direction	R
	2	The alert generated by any change to the static data (Function and Transducer Block).	A
	3	Simulation of process values is enabled	R
	4	-	-
	5	Internal control loop disturbed	R
	6	Positioner inactive (OUT status = BAD)	R
	7	Device under selftest	R
2	0	Indicates that total valve travel limit is exceeded	R
	1	Indicates that an additional input (i.e. for diagnostics) is activated	R
	2...7	-	

R Indication, remains active as long as the reason for the message exists.
A Indication, will be automatically reset after 10s.

In addition to the actual value (IEEE-754 float), all GSD module signals (except CHECKBACK) have a **status** information (See table 2). The status tells the quality of the value. Example; READBACK status is **bad, device failure**, if the position measurement sensor is broken.

Table 2. Status byte mapping.

Status byte in case that the limit bits are zeros	Quality Bits		Additional information Bits				Limit Bits		Meaning
	7	6	5	4	3	2	1	0	
0x00	0	0	0	0	0	0	x	x	bad
0x04	0	0	0	0	0	1	x	x	bad, configuration error
0x08	0	0	0	0	1	0	x	x	bad, not connected
0x0C	0	0	0	0	1	1	x	x	bad, device failure
0x10	0	0	0	1	0	0	x	x	bad, sensor failure
0x14	0	0	0	1	0	1	x	x	bad, no communication (last usable value)
0x18	0	0	0	1	1	0	x	x	bad, no communication (no usable value)
0x1C	0	0	0	1	1	1	x	x	bad, out of service
0x40	0	1	0	0	0	0	x	x	uncertain
0x44	0	1	0	0	0	1	x	x	uncertain, last usable value
0x48	0	1	0	0	1	0	x	x	uncertain, substituted value
0x4C	0	1	0	0	1	1	x	x	uncertain, initial value
0x80	1	0	0	0	0	0	x	x	good
0x84	1	0	0	0	0	1	x	x	good, Update event (change of parameters)
0xA0	1	0	1	0	0	0	x	x	good, go into failsafe position (command)
0xA4	1	0	1	0	0	1	x	x	good, maintenance required
0xC0	1	1	0	0	0	0	x	x	good (cascade)
0xC4	1	1	0	0	0	1	x	x	good (cascade), initialization confirmed
0xC8	1	1	0	0	1	0	x	x	good (cascade), initialization requested
0xCC	1	1	0	0	1	1	x	x	good (cascade), rcas mode not requested
0xD8	1	1	0	1	1	0	x	x	good (cascade), local operation has priority
0xE0	1	1	1	0	0	0	x	x	good (cascade), go into failsafe position (command)
	x	x	x	x	x	x	0	0	value is not limited
	x	x	x	x	x	x	0	1	value is low limited
	x	x	x	x	x	x	1	0	value is high limited
	x	x	x	x	x	x	1	1	value is constant

x = could be any (0 or 1)

In addition to the CHECKBACK, the ND800PA has two more diagnostic signals. These signals are not included in the GSD modules.

DIAGNOSIS contains standard diagnostic information (See table 3). This parameter is available to DCS/PLC if it supports a DP service called **ddlm_slave_diag**. The idea here is that this parameter is not polled cyclically, but whenever new information is available, the ND800PA rises a diagnostic flag (in cyclic communication). When DCS/PLC sees that flag, it reads the DIAGNOSIS parameter by using the ddlm_slave_diag service.

DIAGNOSIS EXTENSION is manufacturer specific extension to the DIAGNOSIS (See table 4). This parameter is included in the ddlm_slave_diag service only if the **PROFIBUS Ident Number** is selected to be Manufacturer specific.

Table 3. Diagnosis parameter bit-enumeration.

Byte	Bit	Description	Indication Class
1	0	Hardware failure of the electronic	R
	1	Hardware failure mechanics	R
	2	Motor- temperature too high	R
	3	Electronic temperature too high	R
	4	Memory error	R
	5	Failure in measurement	R
	6	Device not initialised (No selfcalibration)	R
	7	Selfcalibration failed	R
2	0	Zero point error (limit position)	R
	1	Power supply failed (electrical, pneumatic)	R
	2	Configuration not valid	R
	3	New-start-up (warmstart up) carried out.	A
	4	Re-start-up (coldstart up) carried out.	A
	5	Maintenance required	R
	6	Characterisation invalid	R
	7	Set to 1 (one), if the Ident_Number of the running cyclic data transfer and the value of Physical Block IDENT_NUMBER_SELECTOR parameter are different.	R
3	0 ... 7	Reserved for use within the PNO	
4	0 ... 6	Reserved for use within the PNO	
4	7	More diagnosis information is available	

R Indication, remains active as long as the reason for the message exists.
A Indication, will be automatically reset after 10s.

Table 4. Diagnosis Extension parameter bit-enumeration.

Byte	Bit	Description	Indication Class
1	0	Pneumatic prestage valve 1 control failure	R
	1	Pneumatic prestage valve 2 control failure	R
	2	Position feedback ADC low limit failure	R
	3	Position feedback ADC high limit failure	R
	4	Pressure sensor failure	R
	5-7	-	
2	0	EEPROM error	R
	1	RAM error	R
	2	ROM error	R
	3	Processor failure	R
	4	Board to board communication timeout	R
	5	Write was not successful	R
	6-7	-	
3	0	Valve full strokes warning limit exceeded	R
	1	Valve reversals warning limit exceeded	R
	2	Actuator full strokes warning limit exceeded	R
	3	Actuator reversals warning limit exceeded	R
	4	Deviation warning limit exceeded	R
	5	Load factor warning limit exceeded	R
	6	Deviation alarm limit exceeded	R
	7	Load factor alarm limit exceeded	R
4	0	Pneumatics problem	R
	1	Friction problem	R
	2	Travel deviation alert	R
	3	Load factor alert	R
	4-7	-	
5	0-7	-	
6	0-7	-	

R Indication, remains active as long as the reason for the message exists.
A Indication, will be automatically reset after 10s.

5 Operation

The ND800PA Simatic PDM user interface is divided in three main categories.

- Parameter groups. The static configuration parameters are grouped in logical groups. The parameters in the groups are presented in the parameter table. The parameter table can be saved to the Hard Disk. The saved parameter table can be compared with the parameters in the device.
- Device menu. Device menu contains high-level device functions like Calibration.
- View menu. Unlike the Device menu, the View menu contains only passive elements such as measured value displays.

In the following paragraphs the ND800PA functionality is described in means of Parameter groups, Device menu and View menu.

The Parameter groups are presented in figure 12.

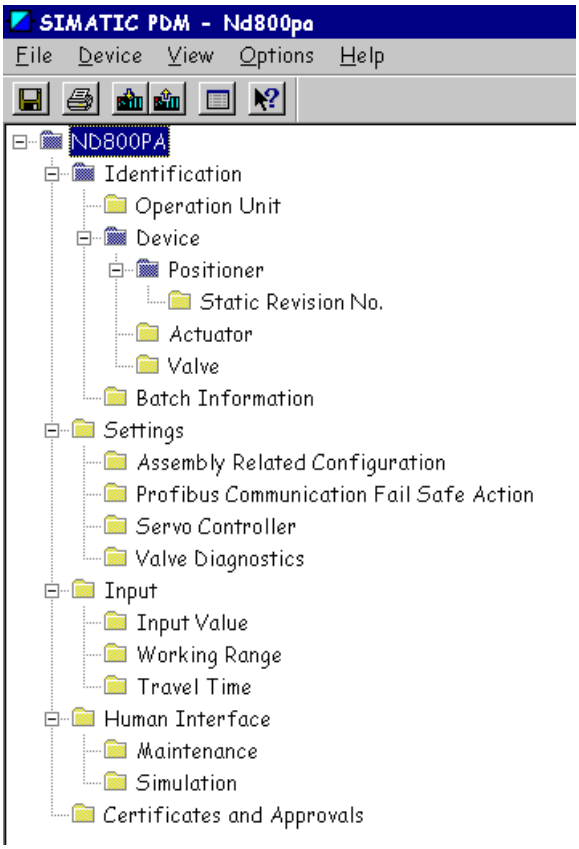

Figure 12. ND800PA Parameter Groups in Simatic PDM.

5.1 Identification Group

5.1.1 Operation Unit

TAG
Text; can be used in any way. A recommended use is as a unique label for a field device in the plant.

Descriptor
Text that is associated with the Field Device. This text can be used by the user in any way. There is no specific recommended use.

Message
Text that is associated with the Field Device. This text can be used by the user in any way. There is no recommended use.

5.1.2 Device

5.1.2.1 Positioner

Manufacturer
References a specific manufacturer, which is usually a company name, that is responsible for the manufacture of this Field Device.

Device ID
Uniquely identifies the Field Device when combined with the Manufacturer Identification and Device Type. Therefore, this variable cannot be modified by the Host user.

Software Revision
Device software revision number.

Hardware Revision
Device hardware (electronics) revision number.

Serial Number
Uniquely identifies the Field Device. Therefore, this variable cannot be modified by the Host.

Device PCB Serial Number
Device Printed Circuit Board serial number.

Installation Date
The Installation date of the device.

Profile Revision
Revision number of the profile relating to the block.

PROFIBUS Ident Number
Each PROFIBUS-DP device shall have an Ident Number provided by the PNO. There are profile specific Ident Numbers. A device may have a profile specific one and the manufacturer specific one. The user is able to choose one of both using this parameter. Selections are

- Profile specific (0x9710)
- Manufacturer specific (0x052D)

NOTE
The Ident Number can be changed only when the cyclic communication is not active.

5.1.2.1.1 Static Revision No

Physical Block, Transducer Block, Function Block
The revision level of the static data associated with the block. The Static Revision No. is changed by the device each time a static parameter is changed in value.

5.1.2.2 Actuator

Manufacturer
References a specific manufacturer, which is usually a company name, that is responsible for the manufacture of this Field Device.

Actuator Class
Actuator class is electro-pneumatic.

Actuator Type
Actuator type indication. Options are
- Undefined
- Single acting actuator
- Double acting actuator

Actuator Fail Action
Actuator fail safe position during LOSS OF SUPPLY PRESSURE. This parameter is informational only.
- Not initialised
- Opening (100%)
- Closing (0%)
- None (Double acting actuator)

Serial Number
Actuator serial number can be written here.

5.1.2.3 Valve

Manufacturer
References a specific manufacturer, which is usually a company name, that is responsible for the manufacture of this Field Device.

Valve Type
Valve type indication. Options are
- Linear moving valve, sliding valve
- Rotary moving valve, part-turn

Serial Number
Valve serial number can be written here.

5.1.3 Batch Information

Batch ID
Identifies a certain batch to allow assignment of equipment-related information (e.g. faults, alarms ...) to the batch.

Batch Unit
Identifies the active Control Recipe Unit Procedure or the related Unit (e.g. reactor, centrifuge, drier).

Batch Operation
Identifies the active Control Recipe Operation.

Batch Phase
Identifies the active Control Recipe Phase.

5.2 Settings Group

5.2.1 Assembly Related Configuration

NOTE
These parameters are valve assembly related; you should thus check that the control valve assembly conforms to the setting of these parameters !

Position Sensor Rotation
Defines relationship between the position sensor rotation and the valve action. If the position sensor rotates clockwise when the valve closes, set Standard: clockwise to close. With inverse rotation set Nonstandard: counter-clockwise to close. See /1/ for more information of operation directions and air connections. Options are
- Standard : Clockwise to close
- Non-standard : Counter clockwise to close

Actuator type
Actuator type selection. Options are
- Undefined
- Single acting actuator
- Double acting actuator

Valve Type
Valve type selection. Options are
- Linear moving valve, sliding valve
- Rotary moving valve, part-turn

Positioner Fail Action
Configuration of the action taken during the LOSS OF SUPPLY POWER (supply pressure is available). This action takes place ALSO when the positioner software notices a fatal device failure. In these both cases the spool valve feeds C1 (pneumatic connector) and releases C2 pressure. See /1/ how to set this parameter. Options are
- Close
- Open

Actuator Fail Action
Actuator fail safe position during LOSS OF SUPPLY PRESSURE. This parameter is informational only.
- Not initialised
- Opening (100%)
- Closing (0%)
- None (Double acting actuator)

Dead Angle Compensation
This adjustment is used to change the valve travel from fully closed to a desired travel with a small change in input signal near the 0% value of the input signal range. This can be used to compensate dead angle in a ball or segment valve such that it is equal to the a_0 adjustment in conventional Neles positioners. The a_0 adjustment is used especially with small ball valves which require a turn of several degrees from the closed position before any flow through the valve is perceptible. Suitable a_0 values for Neles segment and ball valves can be found in /1/. See figure 13.

Limit switches
This parameter defines either the limit switches are installed or not. Options are;
- Not installed (default)
- Installed

5.2.2 Profibus Communication Fail Safe Action

Fail Safe Mode
Defines reaction of device if communication fault is still detected after fail safe time. Options

are
- Fail Safe Value is used as control regulator input
- Storing last valid setpoint
- Positioner does Positioner Fail Action

Fail Safe Time
Time in seconds from detection of failure in output block up to the output action of the block output if the condition still exists.

Fail Safe Default Value
Default Value for the setpoint input if communication fault is detected.

5.2.3 Servo Controller

Servo controller gain
The servo controller gain value. This parameter is adjusted automatically during the Automatic Travel Calibration. After travel calibration the value is 1.0. For enhanced control use value 1.2.

Servo controller parameter D
Servo controller tuning parameter D.
- 0.0 for double acting actuators (factory set)
- 1.0 for single acting actuators (factory set)

Servo controller parameter B
Servo controller tuning parameter B. This parameter is adjusted automatically during the Automatic Travel Calibration. After travel calibration the value is 1.0.

5.2.4 Valve Diagnostics

These settings are used to set limits for different diagnostics information to warn the user when the limits are exceeded. The limits should first be set to high values such that no unnecessary warnings are given. After gaining experience, the user can tune the limits to more accurate levels.

When a particular limit is exceeded, it is reported in corresponding **Diagnosis** and **Diagnosis extension** status messages.

Supply Pressure
Set this parameter to the average value of the positioner supply pressure. Supply pressure is used to calculate the load factor.

Travel Deviation Warning Limit
Warning limit for the deviation between the setpoint and actual travel.

Travel Deviation Alarm Limit
Travel deviation alarm limit.

Load Factor Warning Limit
Load factor warning limit. In the case of a single acting actuator, the load factor shows the actuator load with respect to the present spring force, i.e., a load factor of 100% indicates that the actual load may exceed the spring force. For double acting actuators, the load factor shows the actuator load with respect to the user-given supply pressure level, i.e., a load factor of 100% indicates that the actual load may exceed maximum attainable pressure difference being equal to the supply pressure. A high load factor indicates the presence of high friction or an undersized actuator if the given supply pressure is equal to actual supply pressure level.

Load Factor Alarm Limit
Load factor alarm limit.

Valve Full Strokes Warning Limit
Warning limit for the distance the valve has traveled in full strokes. One full stroke means

valve movement from 0 to 100%. E.g. if valve moves from 40% to 50% full strokes increases by 0.1.

Valve Reversals Warning Limit
Warning limit for the number of changes in valve movement direction.

Actuator Full Strokes Warning Limit
Warning limit for the distance the actuator has traveled in full strokes.

Actuator Reversals Warning Limit
Warning limit for the number of changes in actuator movement direction.

5.3 Input Group

The input signal modifications accomplished using Dead Angle Compensation, Cut-Off and Limit functions are presented in figure 13.

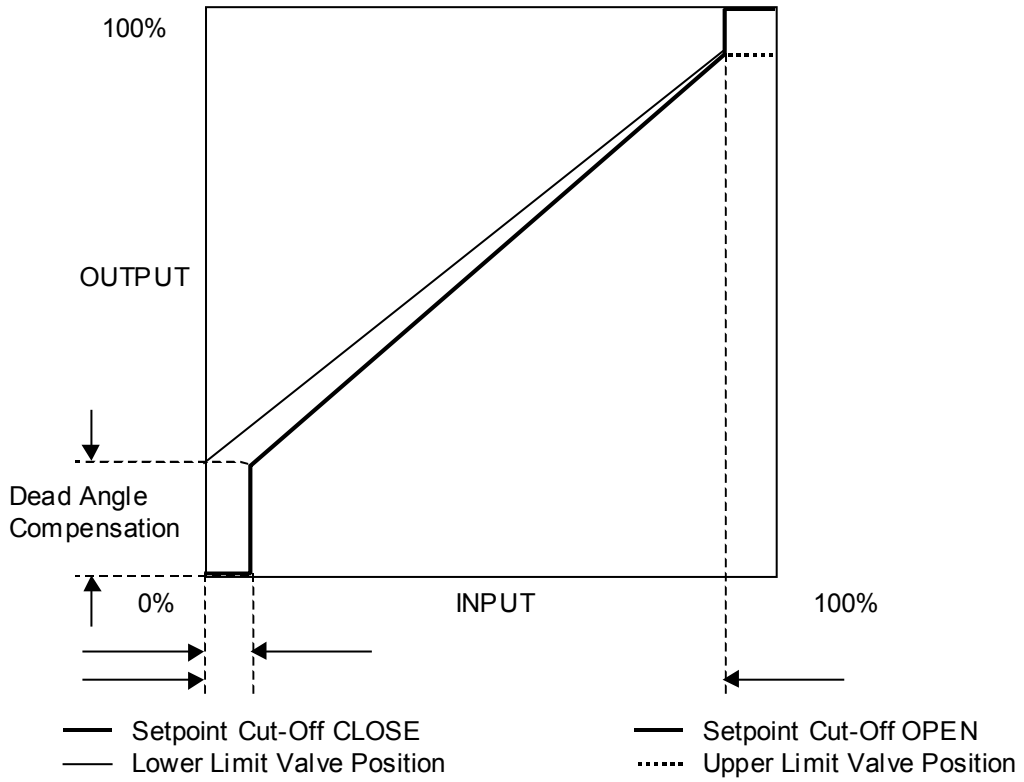

Figure 13. The input signal modifications accomplished using Dead Angle Compensation, Cut-Off and Limit functions.

Note:
Setpoint Cut-Off function overrides the Limit function. If Setpoint Cut-Off CLOSE is greater than 0%, the Lower Limit Valve Position is not applied (has value of 0%). Correspondingly, if Setpoint Cut-Off OPEN is smaller than 100%, the Upper Limit Valve Position is not applied (has value of 100%).

5.3.1 Input value

Direction
Direction of positioner. Options are
- Rising (increasing of setpoint input results in opening of the valve)
- Falling (increasing of setpoint input results in closing of the valve)

Lower Value
Defines the operational lower range value of the input value (0%) in engineering units.

Upper Value
Defines the operational upper range value of the input value (100%) in engineering units.

Unit (Input)
The engineering unit of the input value.

Setpoint Cut-Off CLOSE
When the servo setpoint goes below the defined percent of span, the valve is driven to the CLOSED position. See figure 13.

Setpoint Cut-Off OPEN
When the servo setpoint goes above the defined percent of span, the valve is driven to the OPEN position. See figure 13.

5.3.2 Working Range

Lower Value
Lower Value (Output Signal Range): Lower range value of the process variable (0%) in engineering units.

Upper Value
Upper Value (Output Signal Range): Upper range value of the process variable (100%) in engineering units.

Unit (Output)
The engineering unit that the output value is reported in.

Lower Limit Valve Position
Lower limit of the valve position in percent of travel span. Travel span corresponds to the Output Signal Range (Upper Value and Lower Value). See figure 13

Upper Limit Valve Position
Upper limit of the valve position in percent of travel span. Travel span corresponds to the Output Signal Range (Upper Value and Lower Value). See figure 13.

5.3.3 Travel Time

Travel Time CLOSE
Setpoint for the time in seconds between the change of the state from OPEN to CLOSED.

Travel Time OPEN
Setpoint for the time in seconds between the change of the state from CLOSED to OPEN.

5.4 Human Interface Group

5.4.1 Maintenance

Calibration Date
Date of last calibration of the device.

Configuration Date
Date of last configuration of the device.

Maintenance Date
Date of last valve maintenance.

5.4.2 Simulation

Simulation
Enable or disable the simulation function.

Simulation Value
For commissioning and maintenance reasons, it is possible to simulate the Readback by defining the value and the status. This means that the Transducer Block and the Function Block will be disconnected.

Quality
Signal quality information. See table 2.

Limit
Signal limit information. See table 2.

5.5 Certificates and Approvals Group

Device Certification
Certification of the device.

5.6 Device menu

The items in the device menu are presented in figure 14.

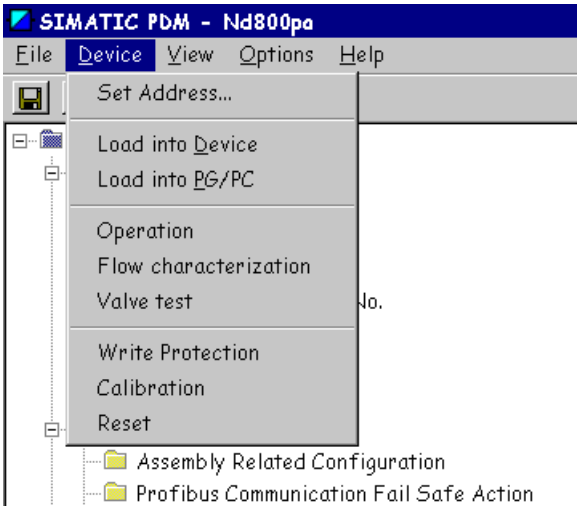

Figure 14. Device menu items.

5.6.1 Operation

5.6.1.1 Page AUTO

The page AUTO in the operation window is presented in figure 15. From this window it is possible to change the operating mode of the device and change the value of the auto-mode valve position setpoint (SP).

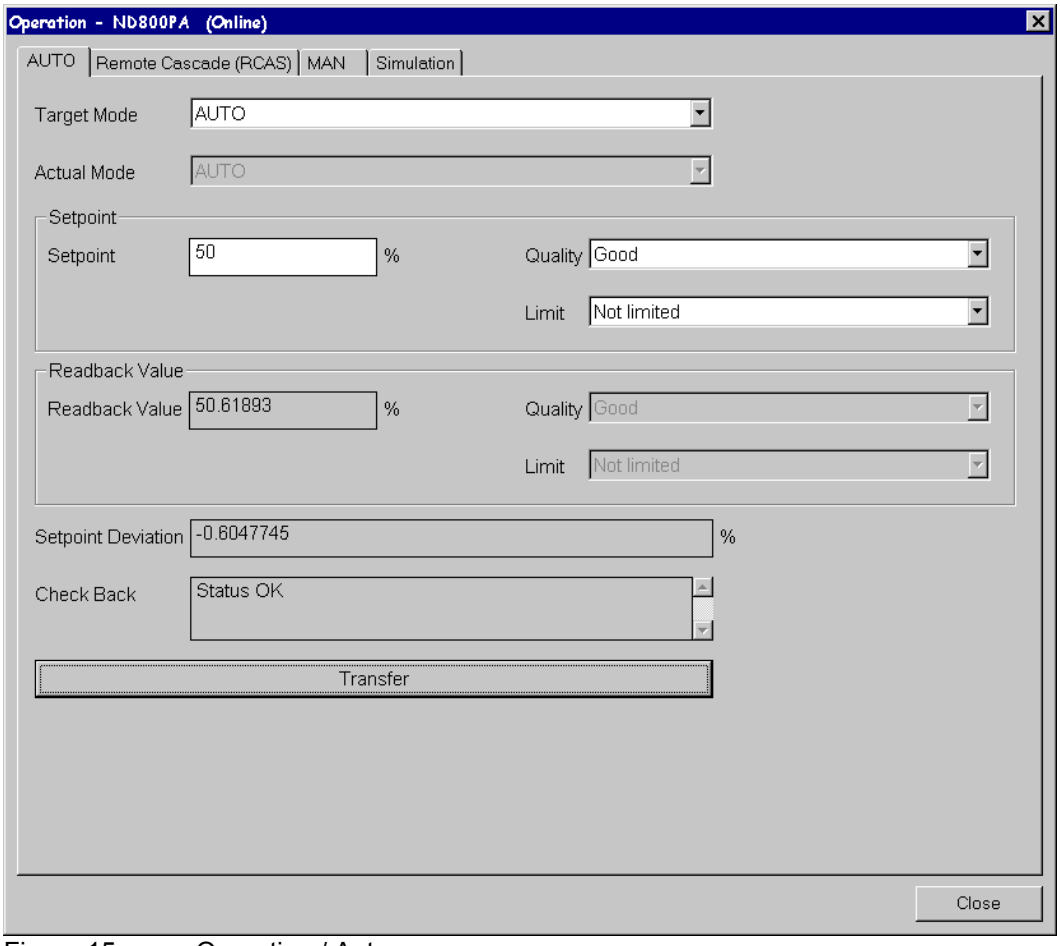

Figure 15. Operation / Auto.

5.6.1.2 Page Remote Cascade

The page Remote Cascade in the operation window is presented in figure 16. From this window it is possible to change the operating mode of the device and change the value of the RCAS-mode valve position setpoint (RCAS_IN).

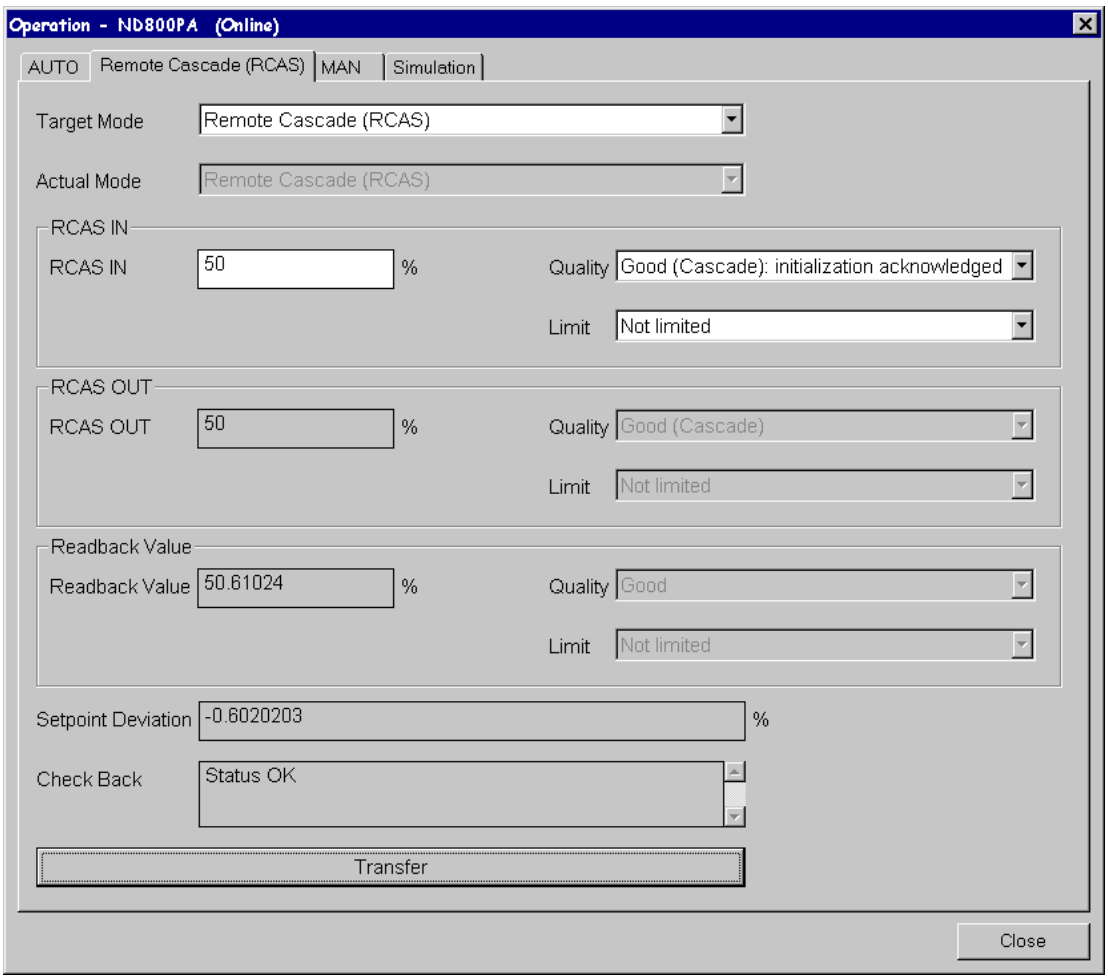

Figure 16. Operation / RCAS.

5.6.1.3 Page MAN

The page MAN in the operation window is presented in figure 17. From this window it is possible to change the operating mode of the device and change the value of the manual-mode valve position setpoint (OUT).

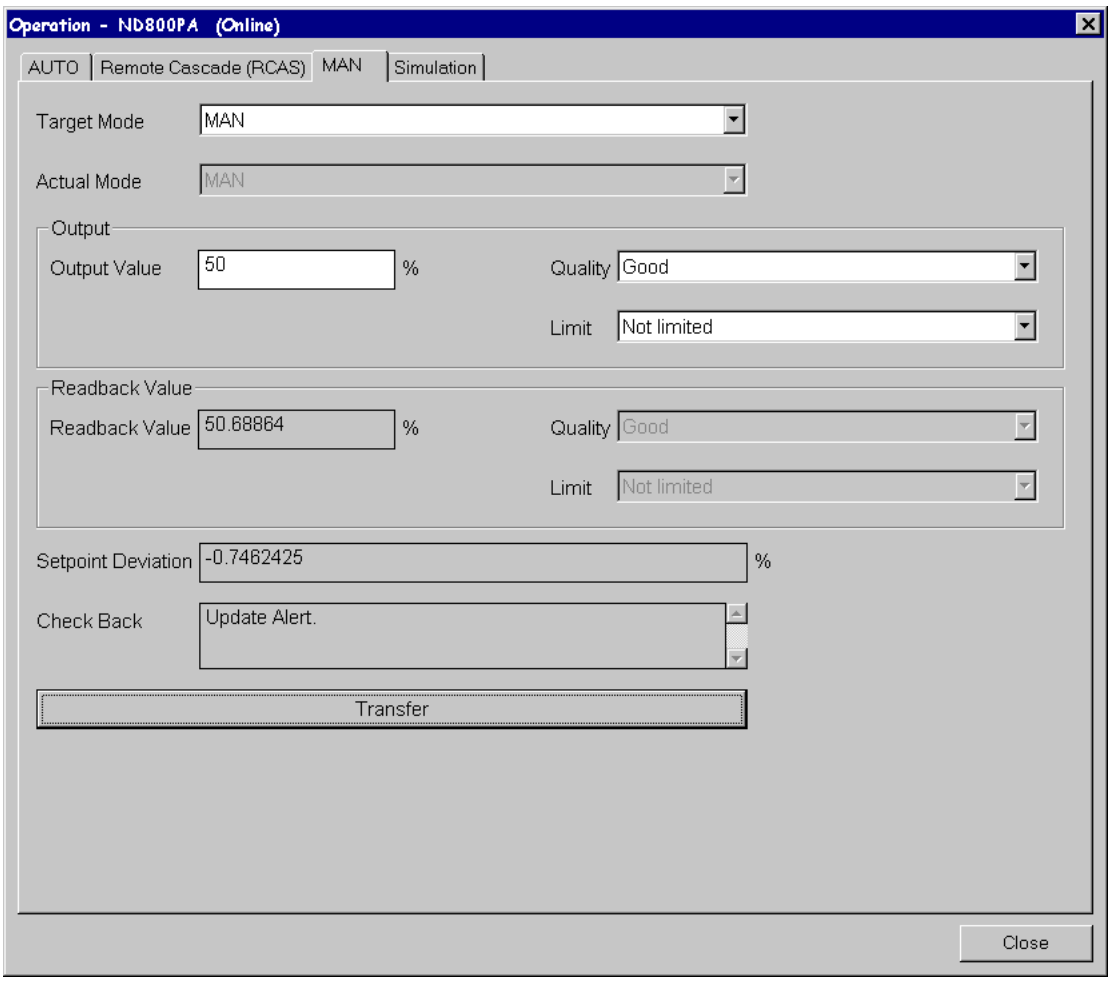

Figure 17. Operation / MAN.

5.6.1.4 Page Simulation

The page Simulation in the operation window is presented in figure 18. From this window it is possible to enable/disable the simulation function and simulate the Readback value and status.

When simulation is enabled, the Analog Output Block and the Tansducer Block are disconnected. The simulation value and status are copied to the AO Block Readback signal. Simulation is useful during the device commissioning and maintenance.

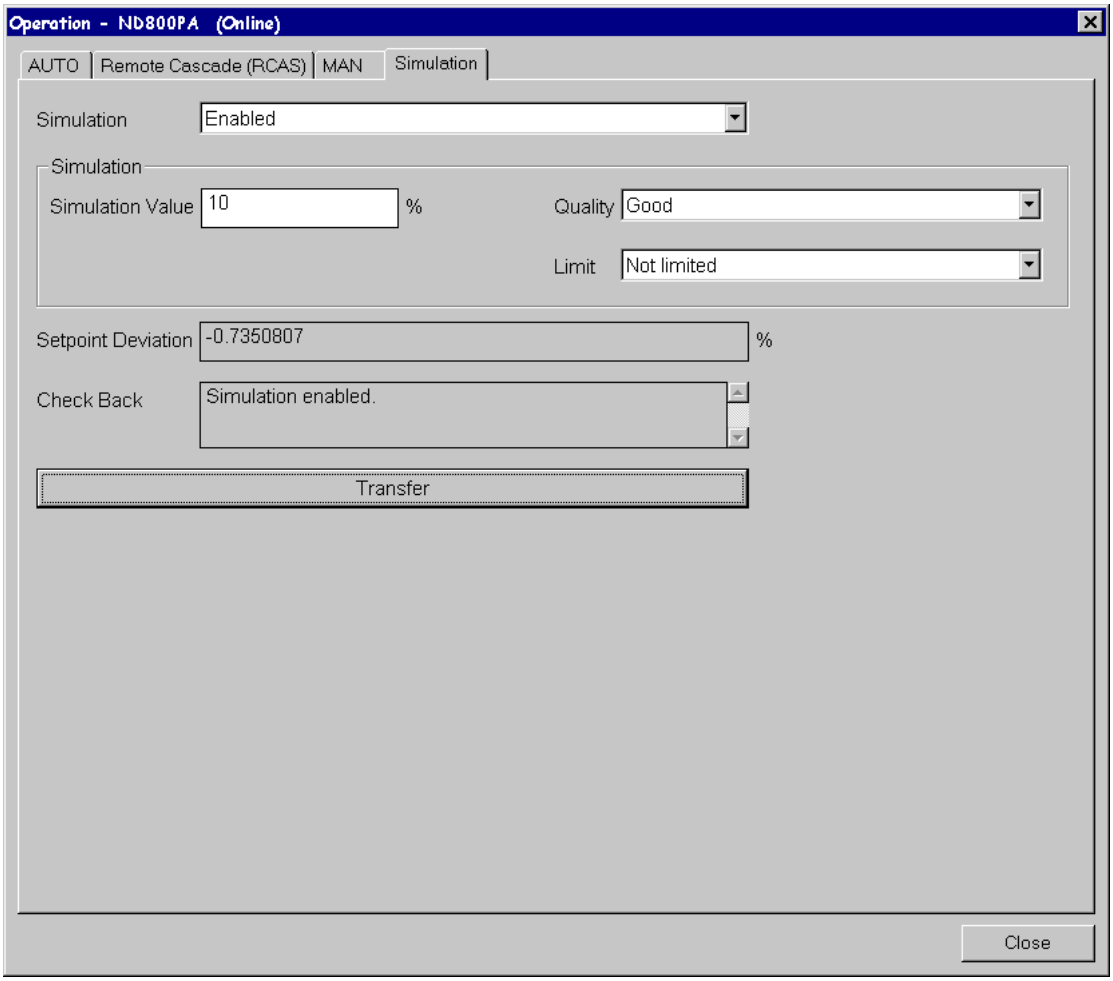

Figure 18. Operation / Simulation.

5.6.2 Flow characterization

When optimizing process control loop performance a linear relationship between the flow and valve position setpoint signal should be established. This can be achieved by using this flow characterization design tool.

Valve *inherent* flow characteristics curve tells the (normalized) valve capacity (effective flow cross-section) versus the valve position. This curve is specific to the physical valve design.

Valve *installed* flow characteristics curve tells the (normalized) flow versus the valve position. This curve is the result of the inherent flow characteristics curve and the process pressure behavior.

The flow characterization design tool changes the valve inherent flow characteristics curve to any desired curve. **Current inherent characteristics table** tells the flow characteristics without any signal modifications. **Desired inherent characteristics table** tells the desired characteristics. Based on this information, the tool calculates the required signal modification, **Signal modification table**, which is as well user editable.

Current inherent characteristics table (Figure 19)
This table tells the inherent flow characteristics without any signal modifications (flow characterization is off). The table values are the relative flow coefficients at corresponding valve openings.

Desired inherent characteristics table (Figure 20)
This table tells the desired inherent flow characteristics. The table values are the relative flow coefficients at corresponding valve openings.

Fill table (Figures 19 & 20)
- User defined - When this option is selected, the table can be entered by user.
- Linear - Fills the table with linear characteristic values.
- Equal percentage 1:25 - Fills the table with Equal percentage characteristic values.
- Equal percentage 1:33 - Fills the table with Equal percentage characteristic values.
- Equal percentage 1:50
- Quick opening (Equal percentage inverse 1:25)
- Quick opening (Equal percentage inverse 1:33)
- Quick opening (Equal percentage inverse 1:50)
- Neles L1-series butterfly valve - Fills the table with Neles specific characteristic values.
- Neles R-series segment valve - Fills the table with Neles specific characteristic values.
- Neles M-series ball valve - Fills the table with Neles specific characteristic values.
- Clear - Clears the table.

Signal modification table (Figure 21)
Signal modification table. The table values are inputs at corresponding outputs.

Characterization (Figure 21)
This parameter controls the characterization. Options are:
- Off - Shows the active state or turns the characterization off.
- On - Shows the active state or turns the characterization on.
- Calculate new Signal mod table from CURRENT and DESIRED tables
- Clear Signal mod table
- Enable new Signal mod table using all table values
- Enable new Signal mod table using every second table value. This option fills the missing points using linear interpolation.

NOTE:
If the installed flow characteristics curve is known, this tool can ALTERNATIVELY be used to modify the installed characteristics. In this case all the words INHERENT in the tool must be understood as INSTALLED. The installed curve can be found by a simple process test or it can be calculated by the Nelprof software.

NOTE:
The dead angle compensation is done before the characterization.

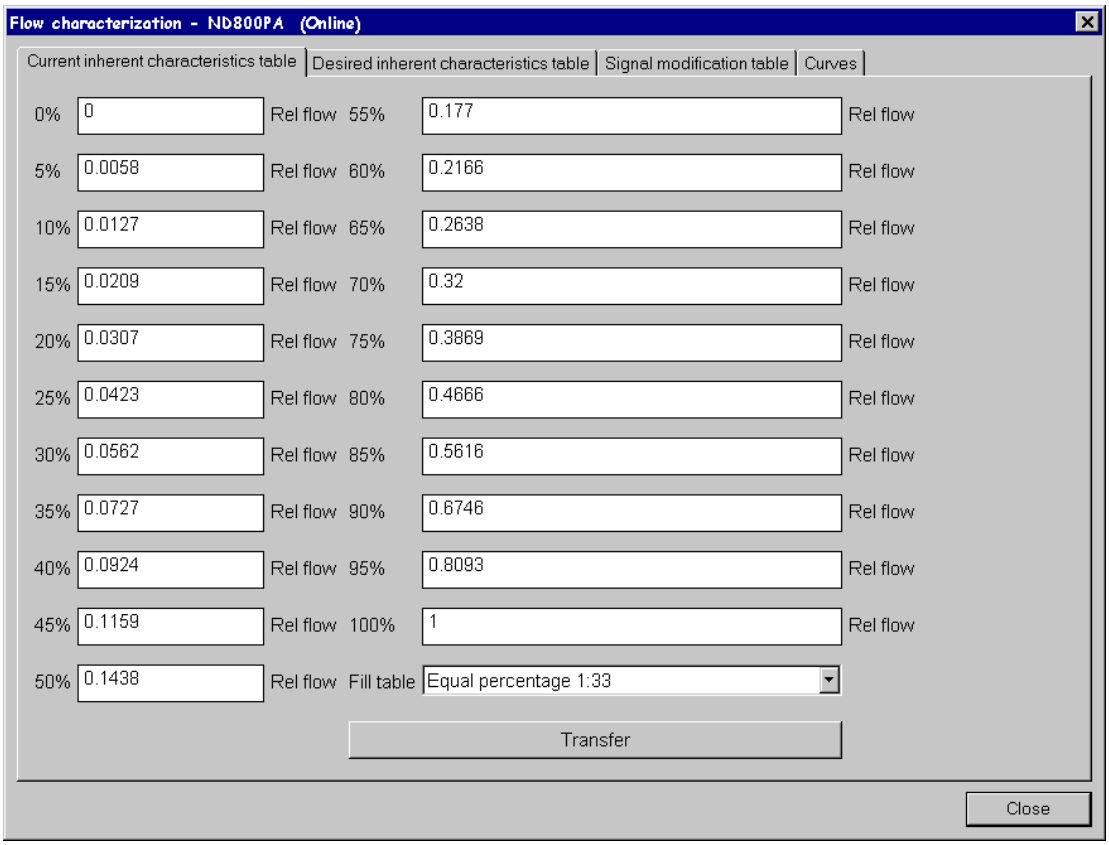

Figure 19. Current inherent characteristics table.

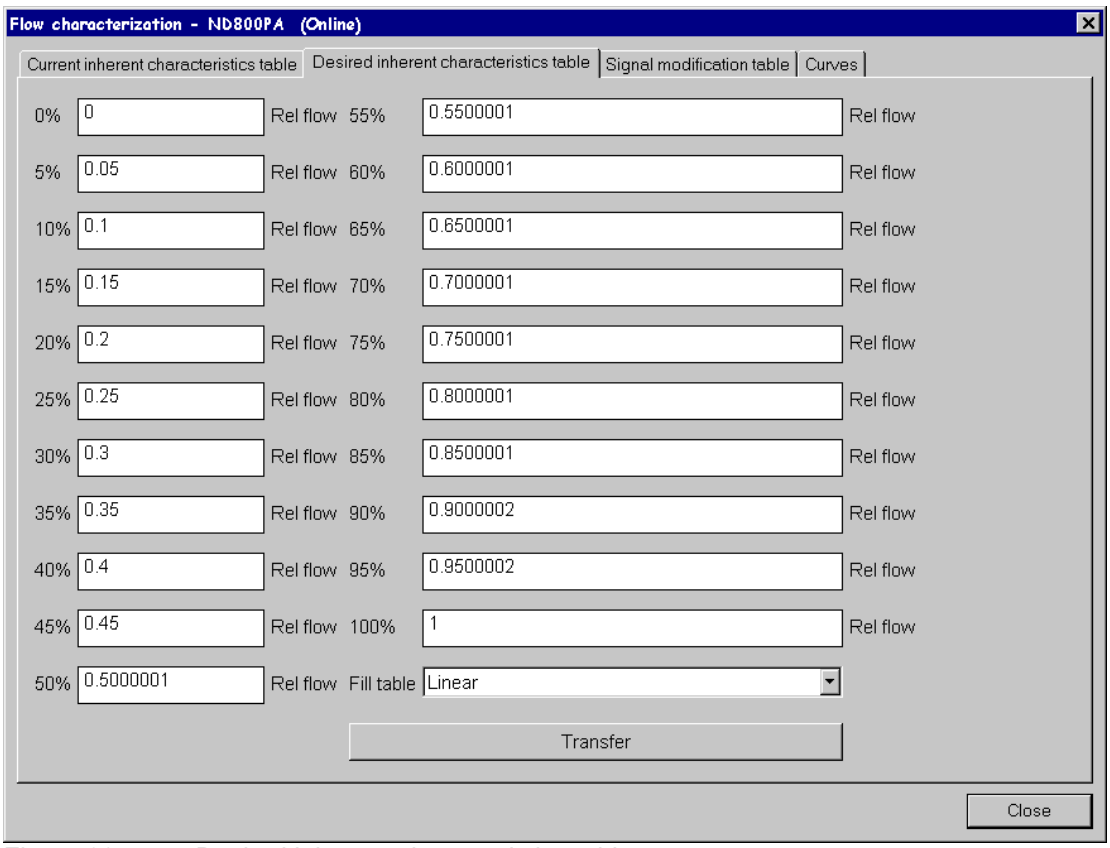

Figure 20. Desired inherent characteristics table.

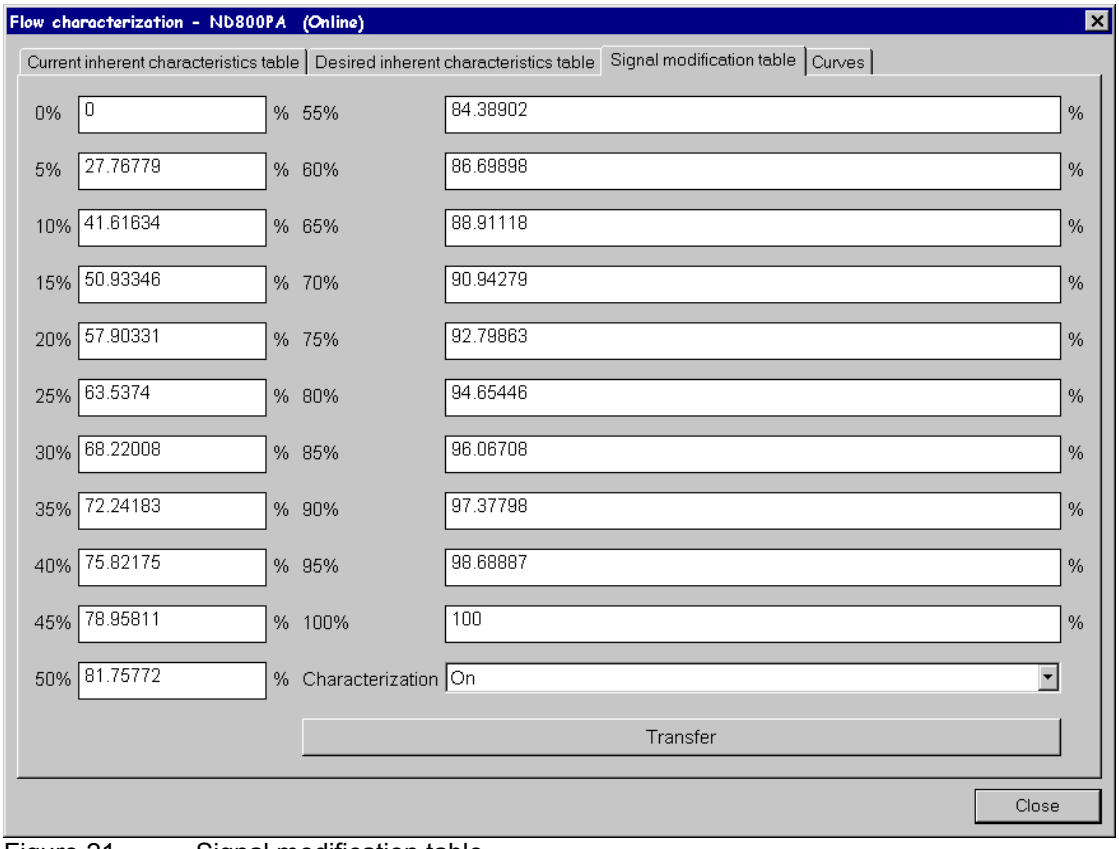

Figure 21. Signal modification table.

The page “Curves” shows the Current, Desired and the signal modification tables in graphical format.

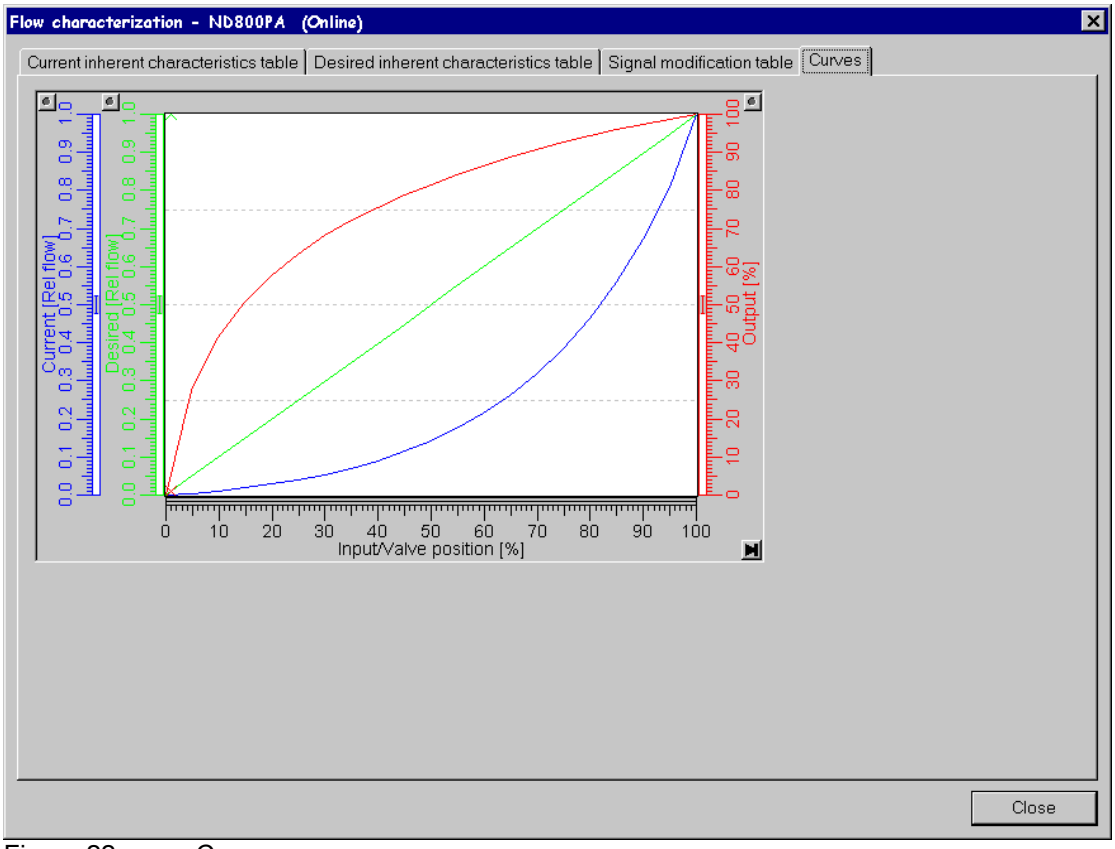

Figure 22. Curves.

5.6.3 Valve test

To ensure that the control valves are working properly they can be tested with the Testing function. Two control valve performance tests, the Hysteresis loop and Step response, can be run with the device. The Step response test tells how rapidly the valve reacts to the input signal, while the Hysteresis loop test tells how large is the dynamic hysteresis + dead band, which indicates friction quantity. The control valve test results can be used to diagnose the condition of the control valve, thus showing the need for possible future maintenance work. Running control valve tests is, therefore, very important predictive maintenance work and ensures optimal performance of the control valve in every situation. Note that control valve testing affects process control by driving the control valve independently of the input signal from the control system !

The valve test control page is presented in figure 23. Before starting the test, adjust the test settings. Test can be started by pressing the button “Start test”. Test can also be cancelled any time by pressing the button “Cancel test”. The dialog “Test state” shows the current sate of the test procedure.

The graphic window shows the on-line measurements; Positioning value and Feedback value. The window axis can be adjusted by double clicking the window. The purpose of this window is just for monitoring the test execution. This window is **not intented to be used to examine the test results**, since the sampling time is too long and not constant.

After successfull test, the test results can be found from the pages Step response test results (fig 24) and Hysteresis test results (fig 25). The data for these graphs is collected by the device itself. The data size is 50 measurement points.

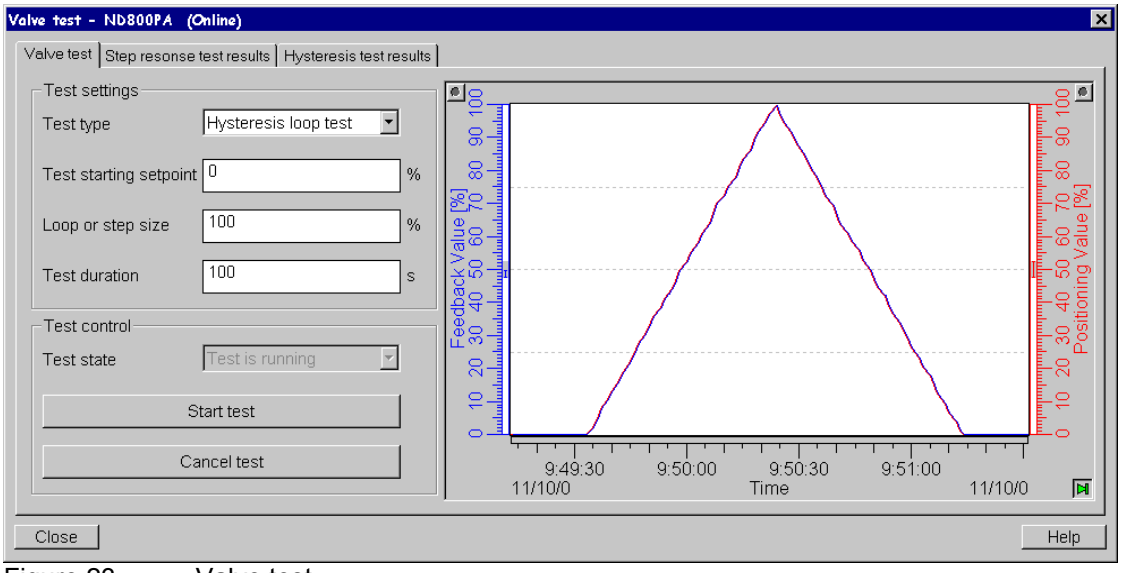

Figure 23. Valve test.

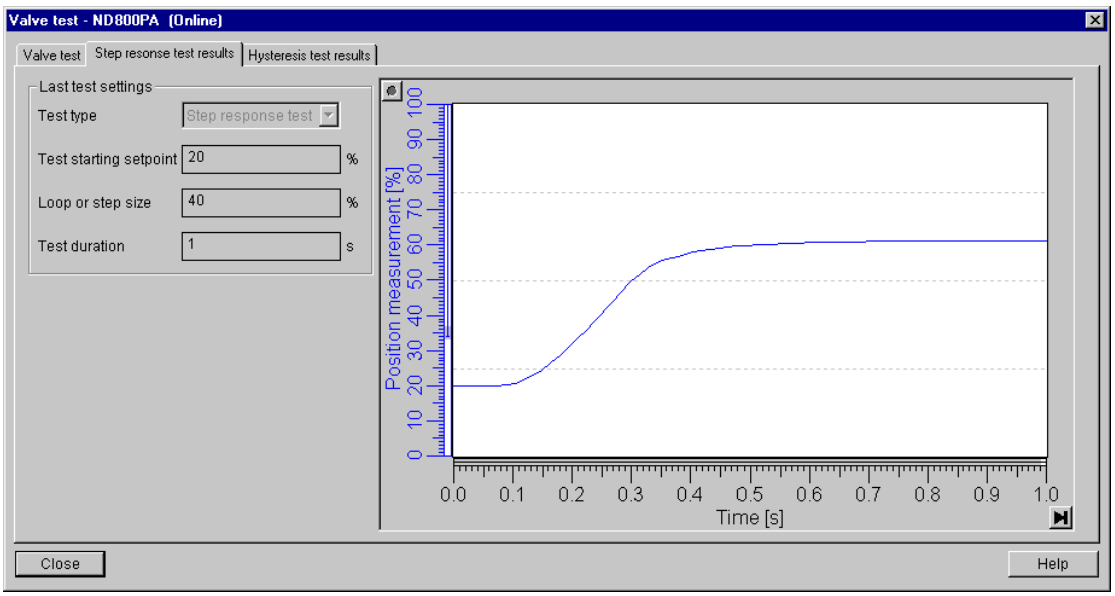

Figure 24. Page Step response test results.

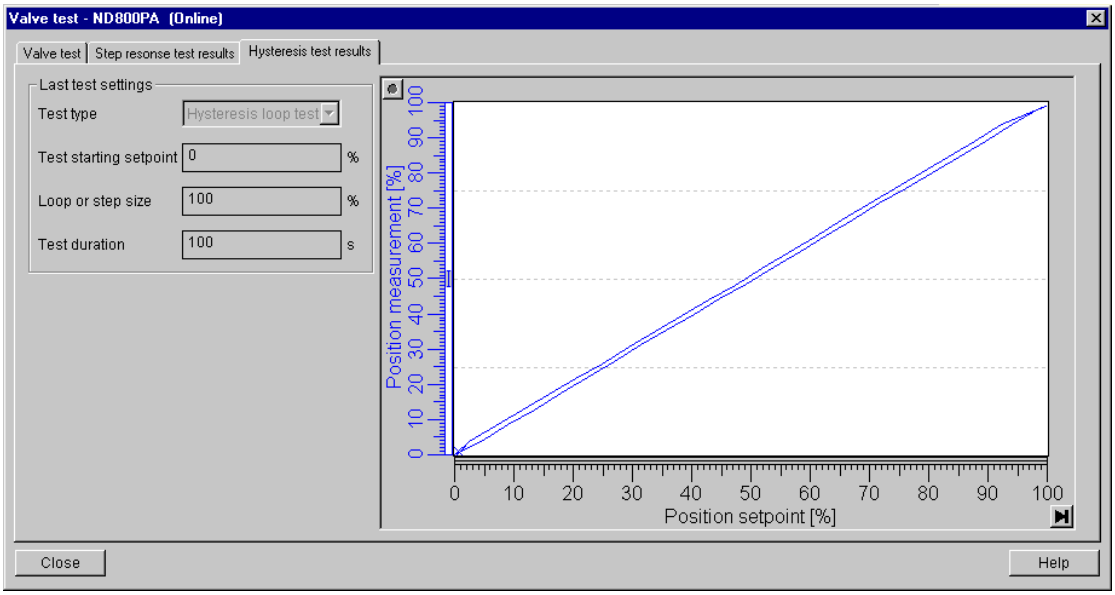

Figure 25. Page Hysteresis test results.

5.6.4 Write Protection

The window Write Protection is presented in figure 26. From this window it is possible to configure three different write protection options

- HW Write Protection. Indicates the position of a hardware jumper which protects all acyclic write access to all writeable parameters of a device.
- SW Write Locking. Protects all acyclic write access to all writeable parameters of a device except this SW Write Locking one. Selections are On and Off.
- Local Operation. Enables/Disables the local operation of the device. The operation of the host has higher priority then the local terminal one. If communication fails for a time greater 30 sec, local operation will be enabled automatically. Communication failure is defined here as absence of cyclic and acyclic communication for the specified time period. If Local Operation parameter is disabled and the communication is working again, then the device switch back to remote operation.

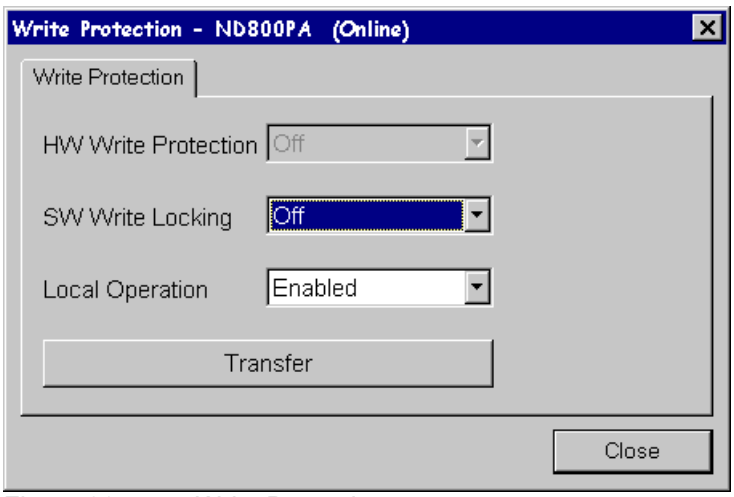

Figure 26. Write Protection.

5.6.5 Calibration

5.6.5.1 Page Calibration

The page Calibration in the Calibration window is presented in figure 27. From this window it is possible to run following calibration routines

- Automatic Travel Calibration. This calibration calibrates the position sensor range and tunes the servo control tuning parameters. This calibration must be done during the device commissioning.
- Position Sensor Calibration. This calibration is needed only when the position sensor module is replaced. Position sensor is factory calibrated.
- Pressure Sensor Calibration. This calibration is needed only when the pressure sensor module is replaced. Pressure sensor is factory calibrated.
- Temperature Measurement Calibration. This calibration calibrates the on-board temperature measurement. Temperature measurement is factory calibrated.

Each calibration routine prompts and advises the user via dialog boxes.

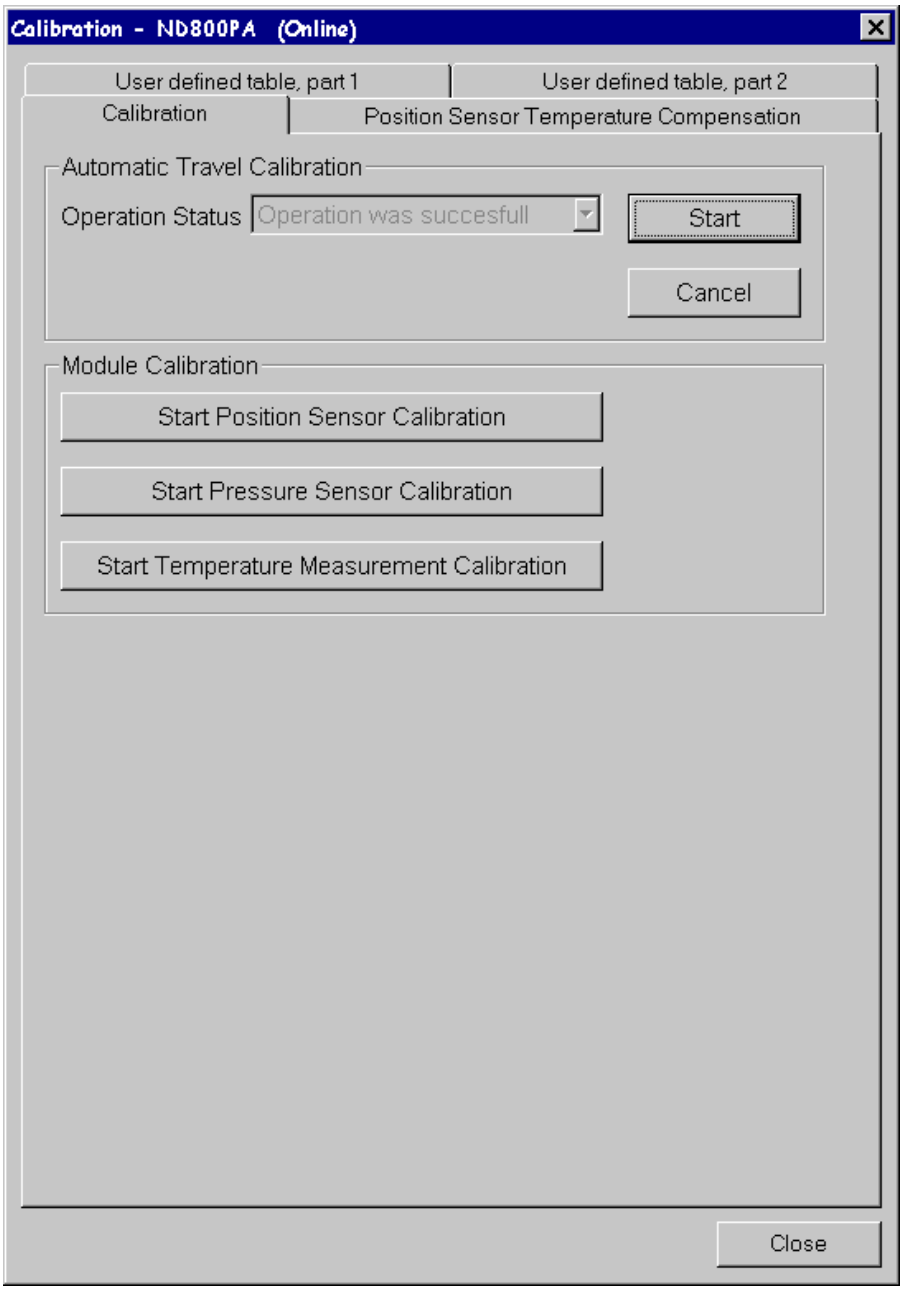

Figure 27. Calibration.

5.6.5.2 Page Position Sensor Temperature Compensation

The page Position Sensor Temperature Compensation in the Calibration window is presented in figure 28. From this window it is possible to configure the position sensor temperature compensation. Options are

- Compensation off. This selection turns the compensation off.
- Compensation on, User defined table. This selection turns the compensation on and uses the User defined table. User defined table (part 1 of 2) is presented in figure 29.
- Compensation on, Default table. This selection turns the compensation on and uses the default compensation table stored in the device memory (permanently).

The position sensor temperature compensation is factory configured. The configuration is needed only when the position sensor module is replaced.

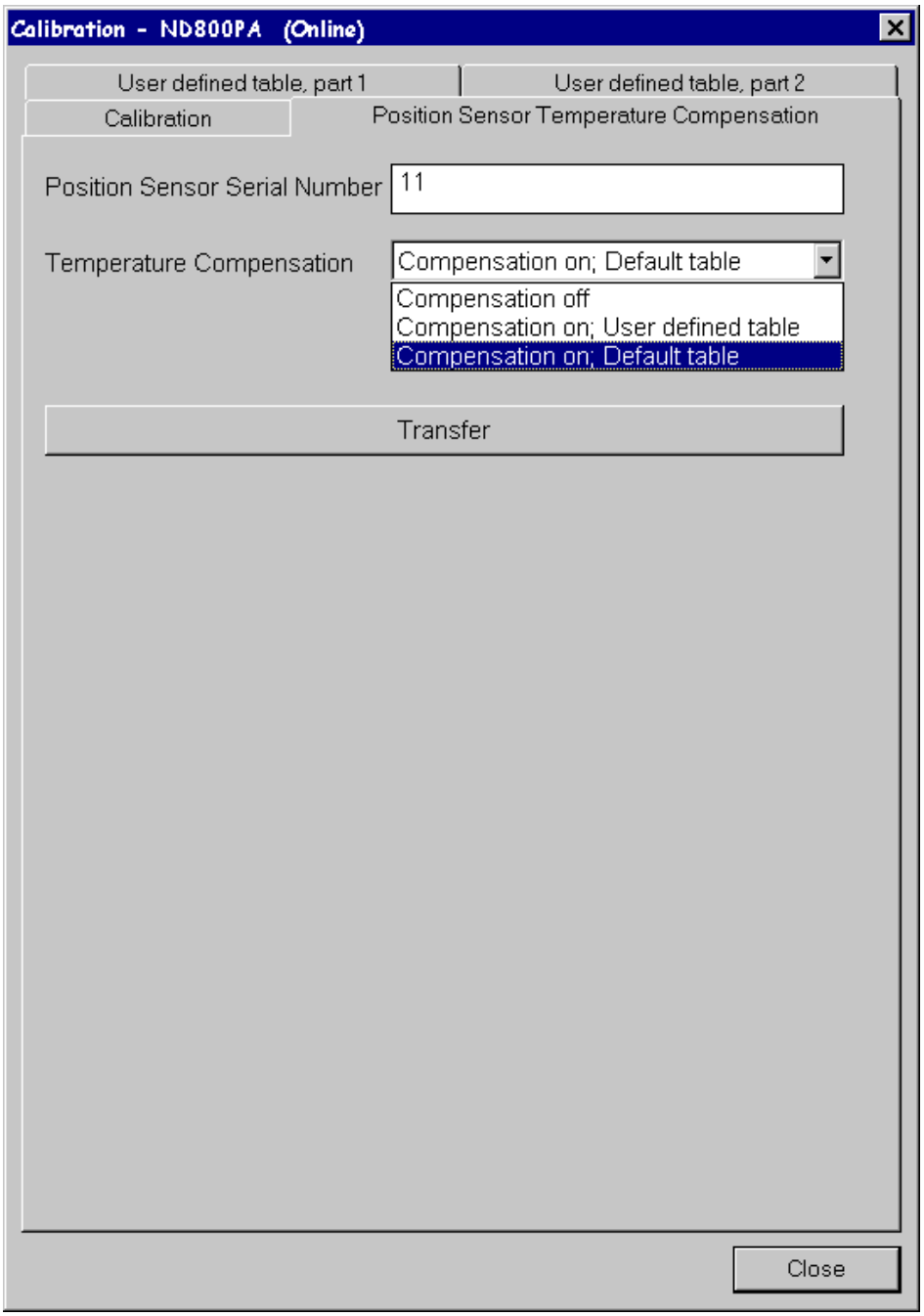

Figure 28. Position Sensor Temperature Compensation.

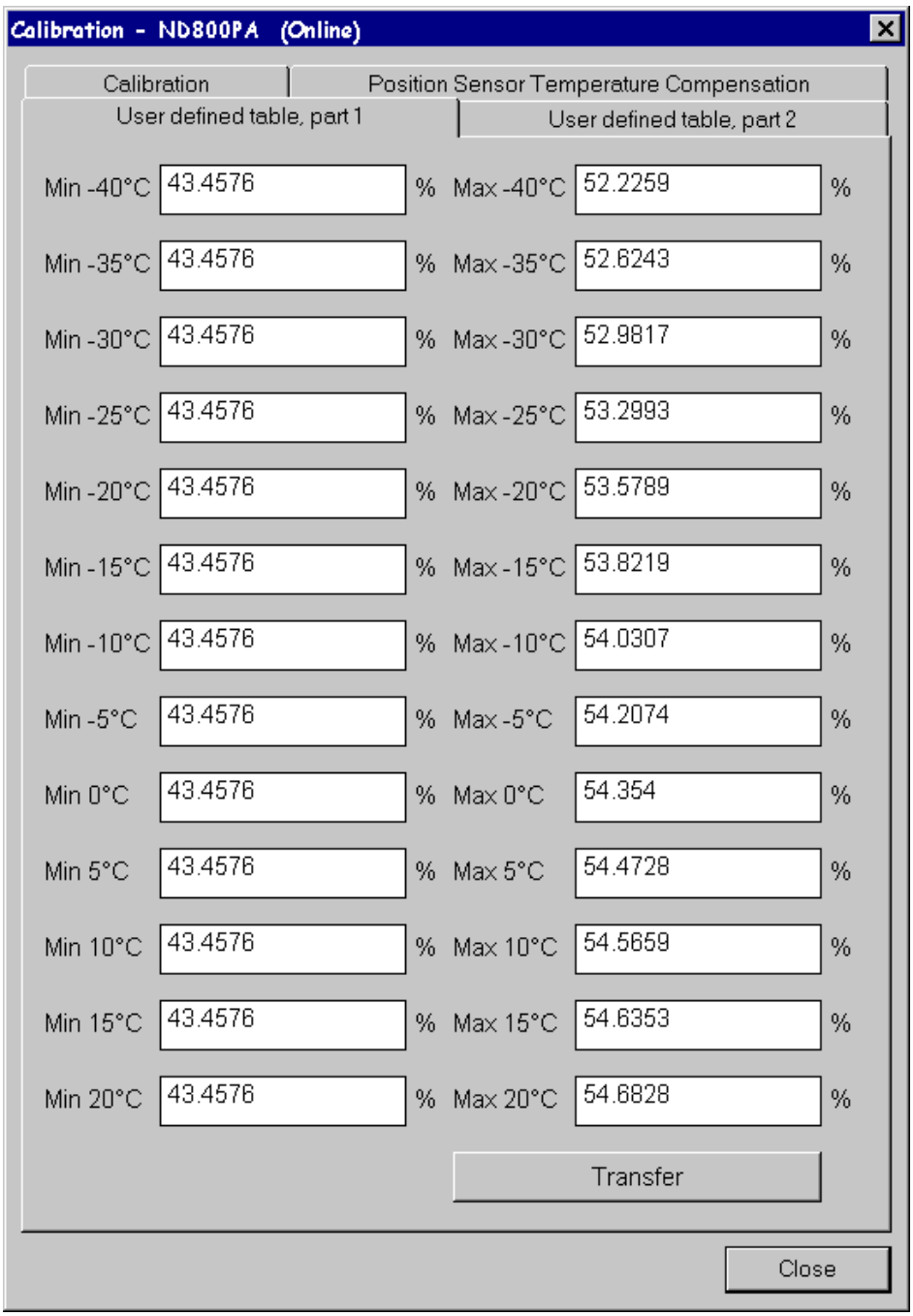

Figure 29. User defined temperature compensation table, part 1.

5.6.6 Reset

5.6.6.1 Page Factory Reset

The page Factory Reset in the Reset window is presented in figure 30. From this window it is possible to carry out three different reset functions

- Factory Reset resets device parameters to default values. The bus address remains the same.
- Warmstart of the device. All parametrisation remains unchanged.
- Reset the bus address to value 126.

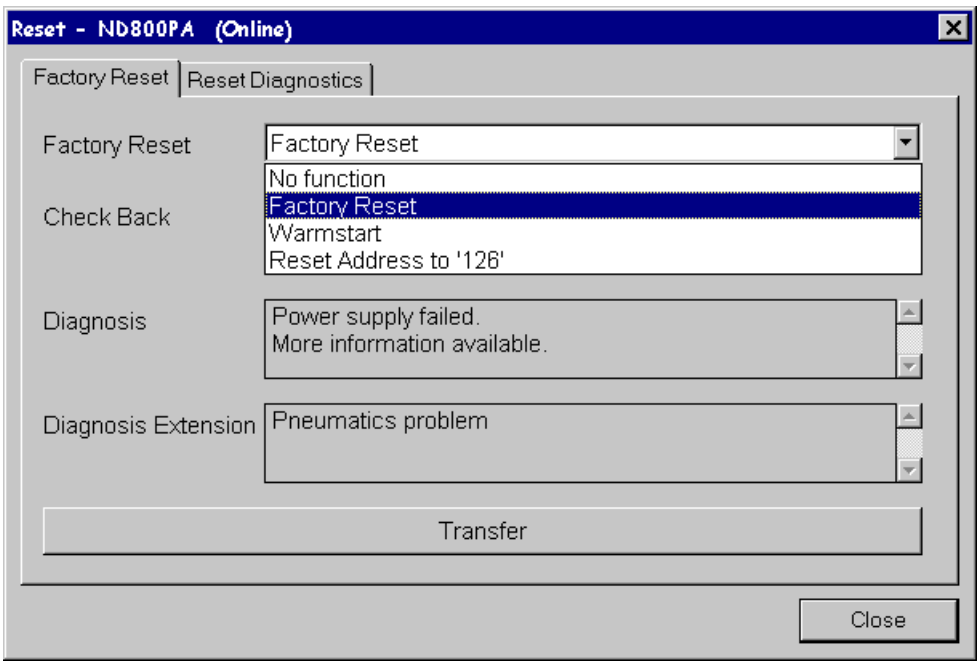

Figure 30. Factory Reset.

5.6.6.2 Page Reset Diagnostics

The page Reset Diagnostics in the Reset window is presented in figure 31. From this window it is possible reset following diagnostic trends

- Event history
- Travel Deviation trend
- Valve travel vs. time trend
- Load Factor trend
- Valve travel counters
- Actuator travel counters

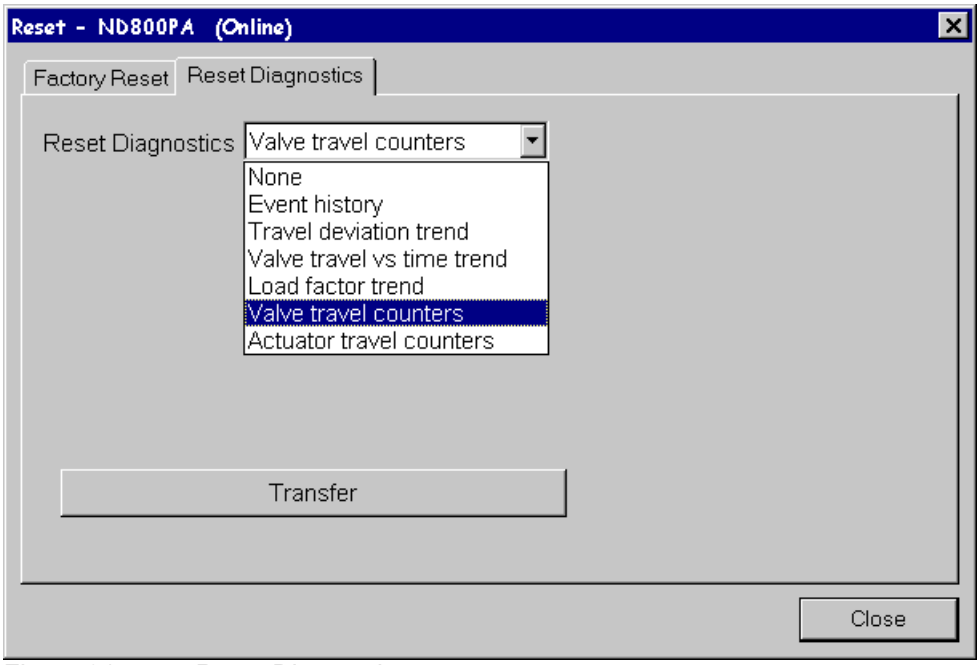

Figure 31. Reset Diagnostics.

5.7 View menu

The items in the view menu are presented in the figure 32.

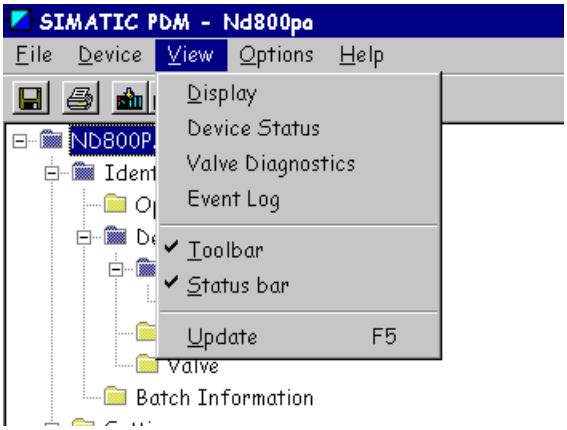

Figure 32. View menu.

5.7.1 Display

5.7.1.1 Page Measured Value

The page Measured Value of the window Display is presented in the figure 33. This window monitors the Setpoint, Readback value and related information.

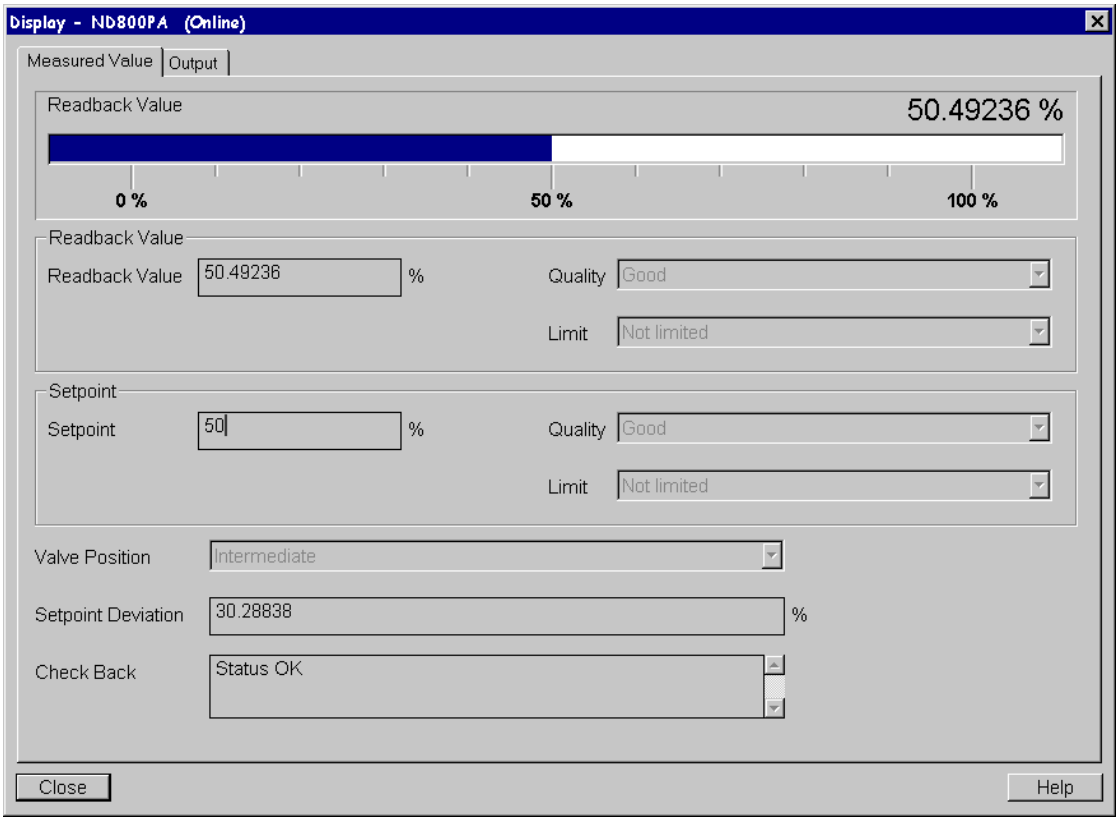

Figure 33. Display \ Measured Value.

5.7.1.2 Page Output

The page Output of the window Display is presented in the figure 33. This window monitors the AO Block Output and Positioning value. The signal modifications presented in figure 13 and characterization impact between these two signals. Positioning value is the final servo control setpoint after all signal modifications.

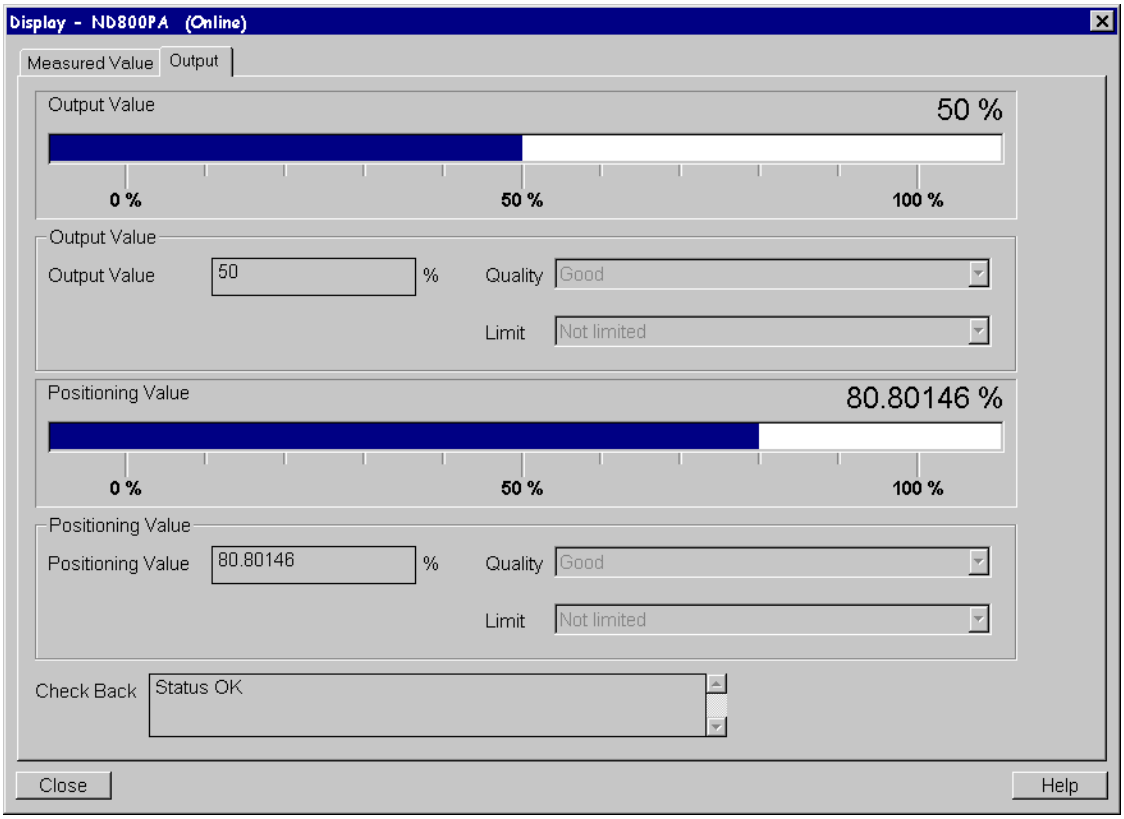

Figure 34. Display \ Output.

5.7.2 Device Status

5.7.2.1 Page General

The page General of the window Device Status is presented in the figure 35. This window has first some identification parameters and the last three ones are diagnostic parameters.

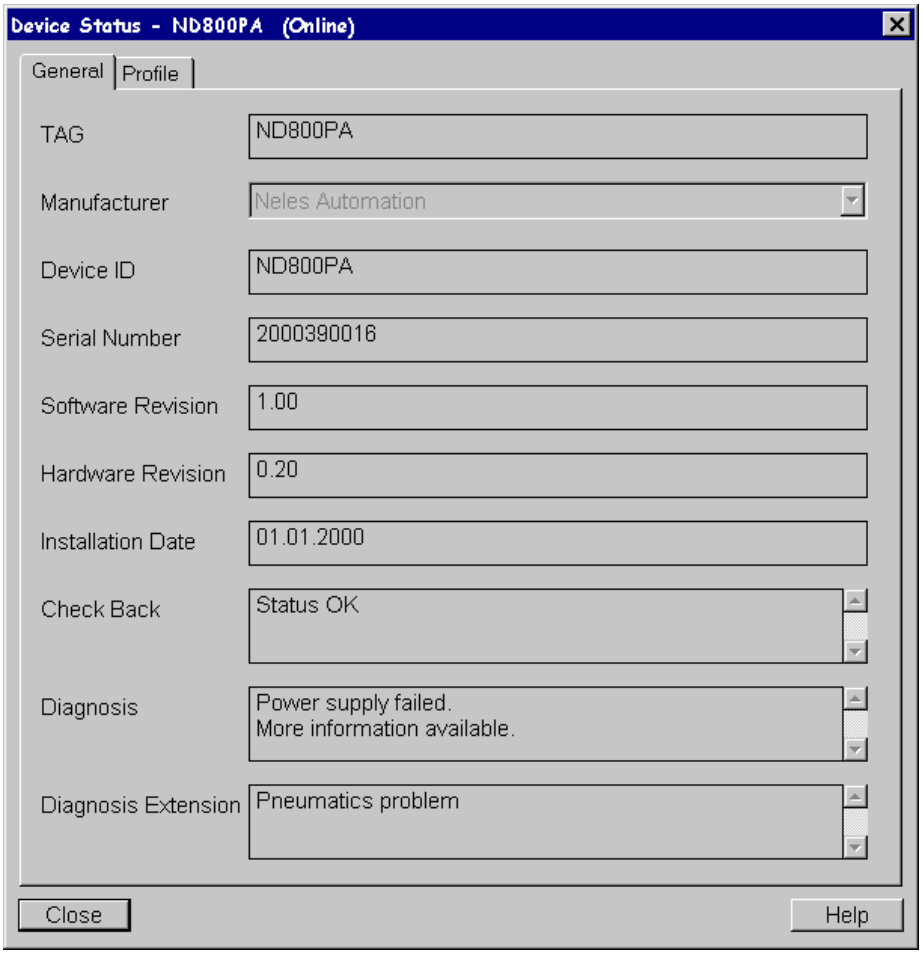

Figure 35. Device Status \ General.

Parameters Checkback, Diagnosis and Diagnosis Extension report the device diagnostic status messages. These parameters are explained in tables 1, 3 and 4, correspondingly.

5.7.2.2 Page Profile

The page Profile of the window Device Status is presented in the figure 36. This window monitors the revision level of the static data associated with the three blocks. The Static Revision No. is changed by the device each time a static parameter has changed in value.

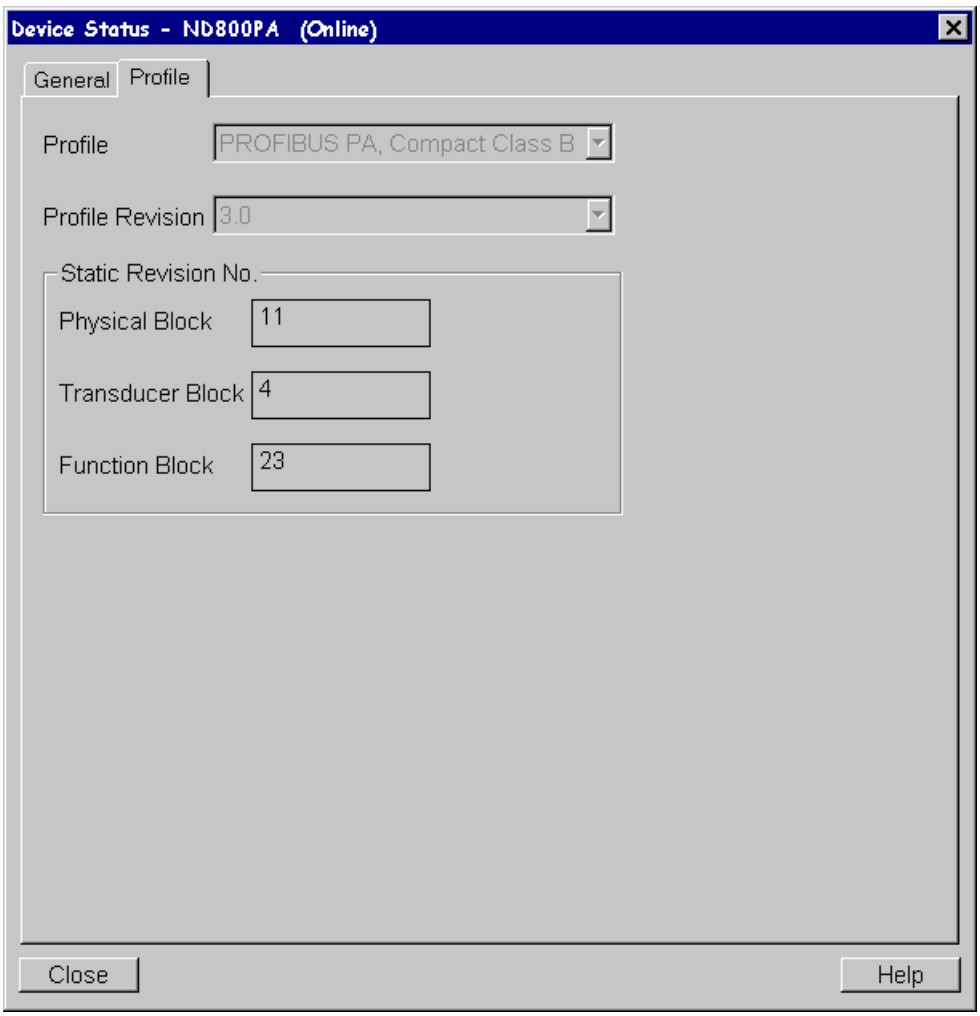

Figure 36. Device Status \ Profile.

5.7.3 Valve Diagnostics

The ND800PA valve controller continuously monitors control valve behavior. It records valve travel trends, histograms and possible alerts. Trends and histograms show how the valve has operated over a long time period. Alerts tell about the latest problems in control valve operation including control behavior and ND800PA valve controller faults. Valve and actuator travel distances and reversals are also counted to inform the user of the need for maintenance.

All the diagnostics information is very important for the process control and maintenance needs. Diagnostics information is on-line data which allows the process automation people to check the condition of the control valves anytime needed. This checking is done in real-time and it does not disturb the process. With these trends, histograms, travel distance and reversal counters and alert reports user can schedule the maintenance needs for the control valves. This is highly important predictive maintenance and it allows control valves and therefore the whole process to work more accurate and more reliably.

5.7.3.1 Page Measurements Trend

The page Measurements Trend of the window Valve Diagnostics is presented in the figure 37. This window trends following measurements

- The Actuator Pressure Difference graph can be used to check that the control valve is working properly. With the aid of pressure information, possible friction and actuator leakages can be discovered by comparing prevailing and previous pressure curves. Actuator pressure is the pressure difference in double-acting actuators and the pressure opposed to the spring in single-acting actuators.
- The Device Temperature graph shows the temperature inside the ND800PA valve controller on the PCB (Printed Circuit Board). The temperature information can be used for checking that the environmental temperature is within specified ambient temperature limits. This ensures reliability of the ND800PA valve controller.
- Device operation time. This comprises the total time during which the valve controller has been operating, and is displayed in hours. Resetting the diagnostics does not affect the total time.

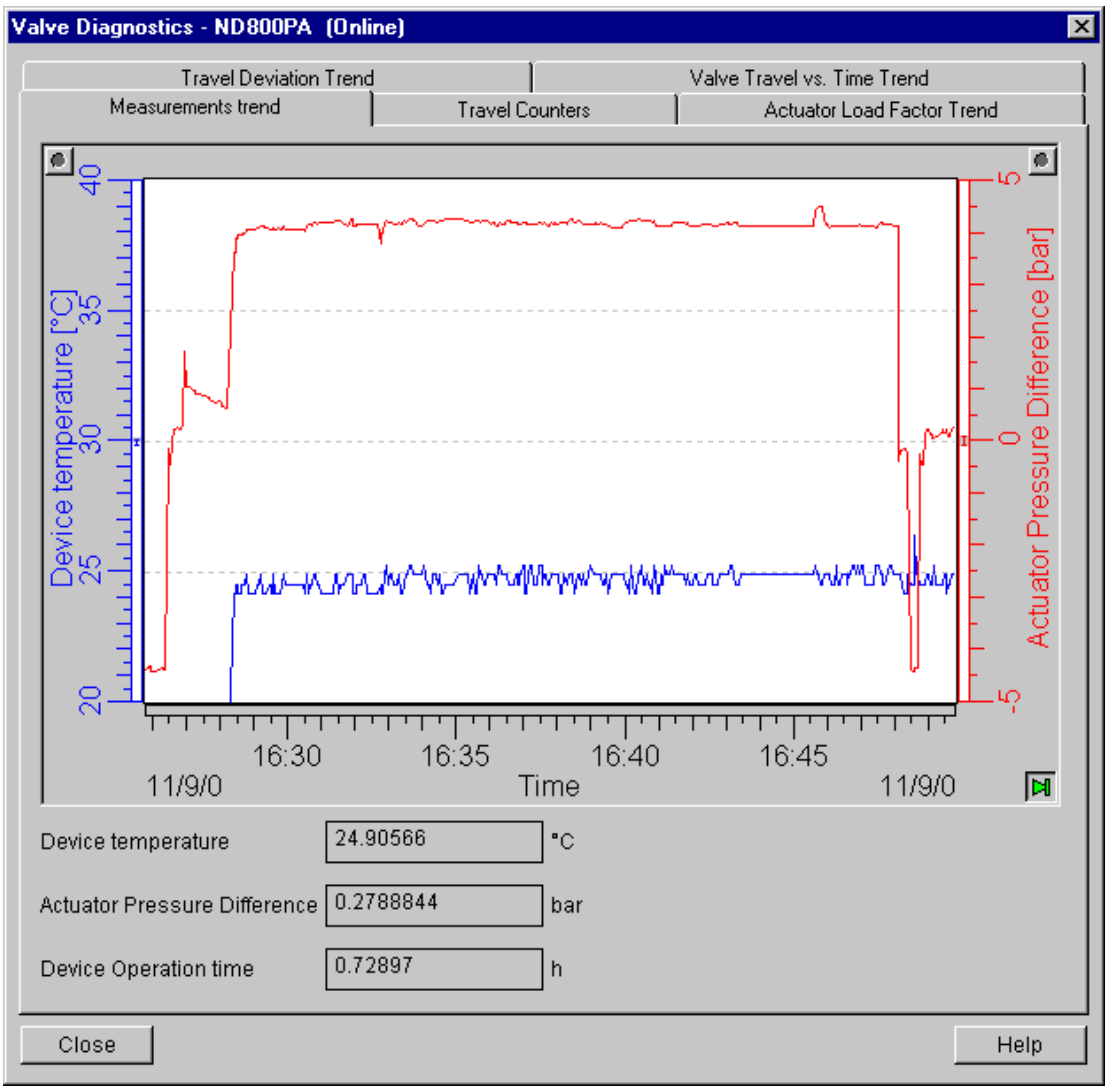

Figure 37. Valve Diagnostics \ Measurements Trend.

5.7.3.2 Page Travel Counters

The page Travel Counters of the window Valve Diagnostics is presented in the figure 38. This window monitors following parameters

- Valve number of full strokes. The distance the valve has traveled in full strokes. One full stroke means valve movement from 0 to 100%. E.g. if valve moves from 40% to 50% full strokes increases by 0.1.
- Valve number of reversals**.** The number of changes in valve movement direction.
- Actuator number of full strokes. The distance the actuator has traveled in full strokes.
- Actuator number of reversals**.** The number of changes in actuator movement direction.

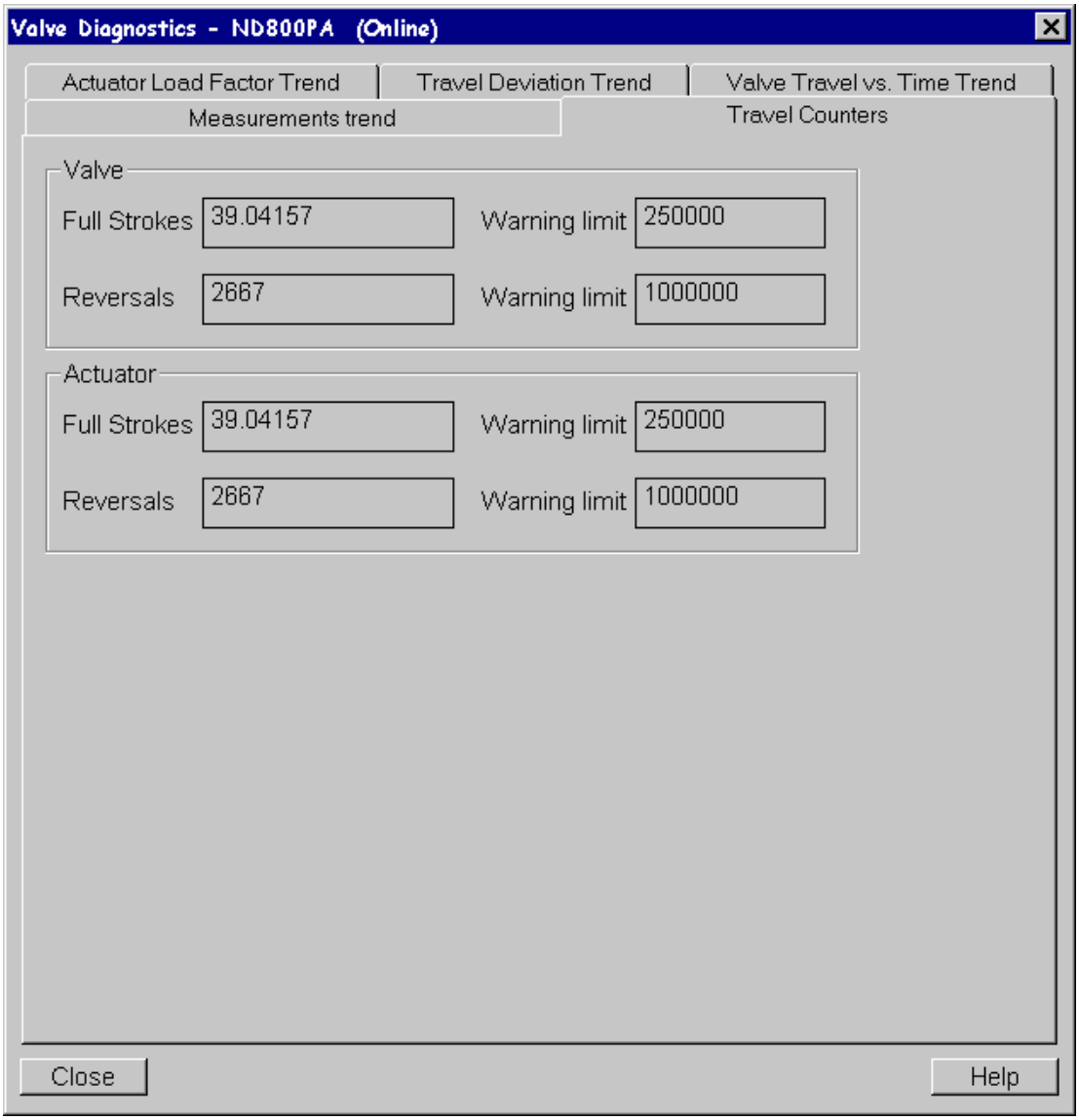

Figure 38. Valve Diagnostics \ Travel Counters.

5.7.3.3 Page Travel Deviation Trend

This trend shows the deviation between the setpoint and actual travel during total valve operation time. The travel deviation trend can be used to analyse present and predict future behaviour of the control valve. The travel deviation is not updated when the valve is appropriately fully open or closed.

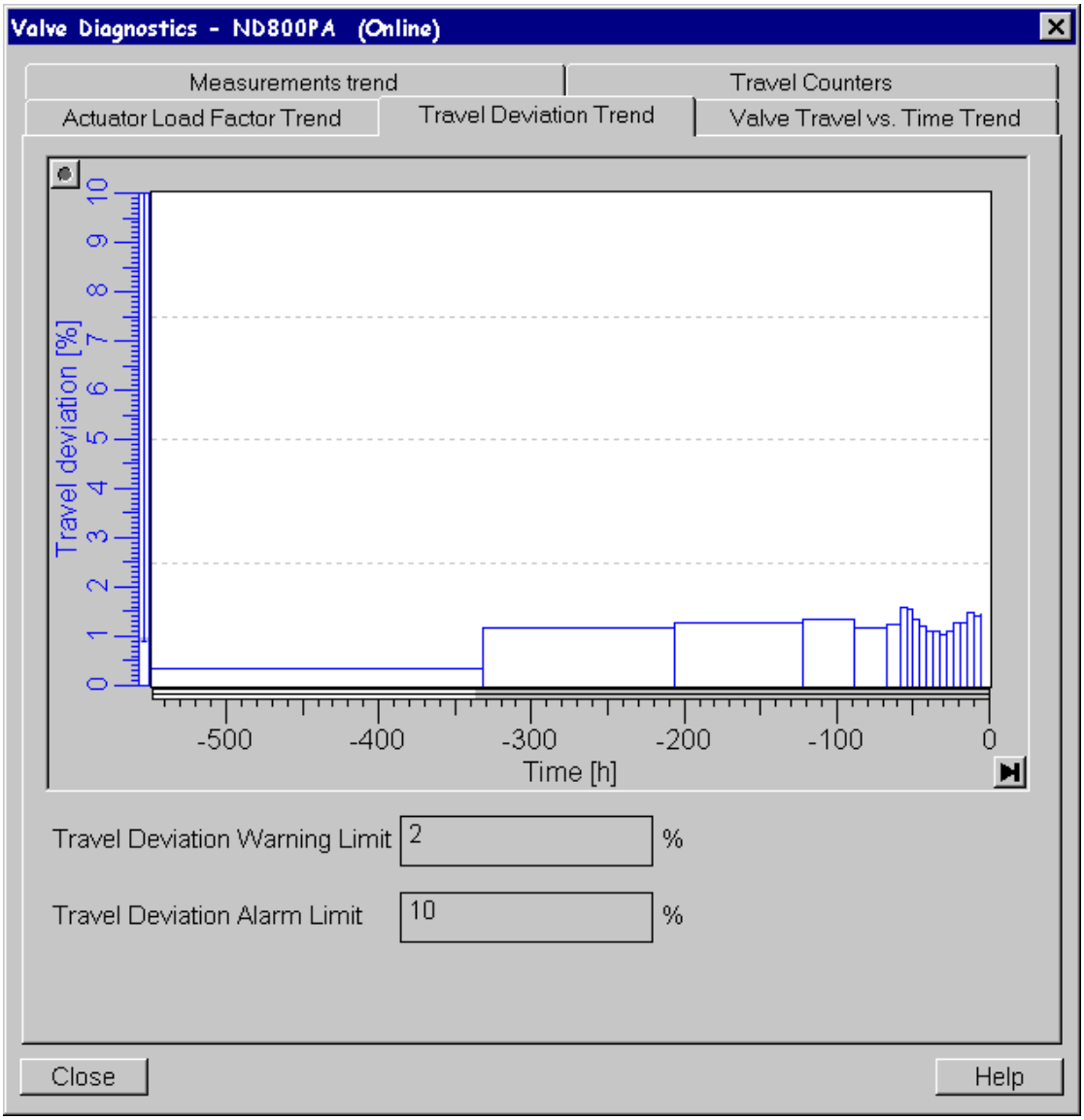

Figure 39. Valve Diagnostics \ Travel Deviation Trend

5.7.3.4 Page Actuator Load Factor Trend

This trend shows the load factor of the actuator as a percentage. In the case of a single acting actuator, the load factor shows the actuator load with respect to the present spring force, i.e., a load factor of 100% indicates that the actual load may exceed the spring force. For double acting actuators, the load factor shows the actuator load with respect to the user-given supply pressure level, i.e., a load factor of 100% indicates that the actual load may exceed maximum attainable pressure difference being equal to the supply pressure. The trend can be used for analysing the condition of the control valve. A high load factor indicates the presence of high friction or an undersized actuator if the given supply pressure is equal to actual supply pressure level. The load factor is not updated when the valve is appropriately fully open or closed.

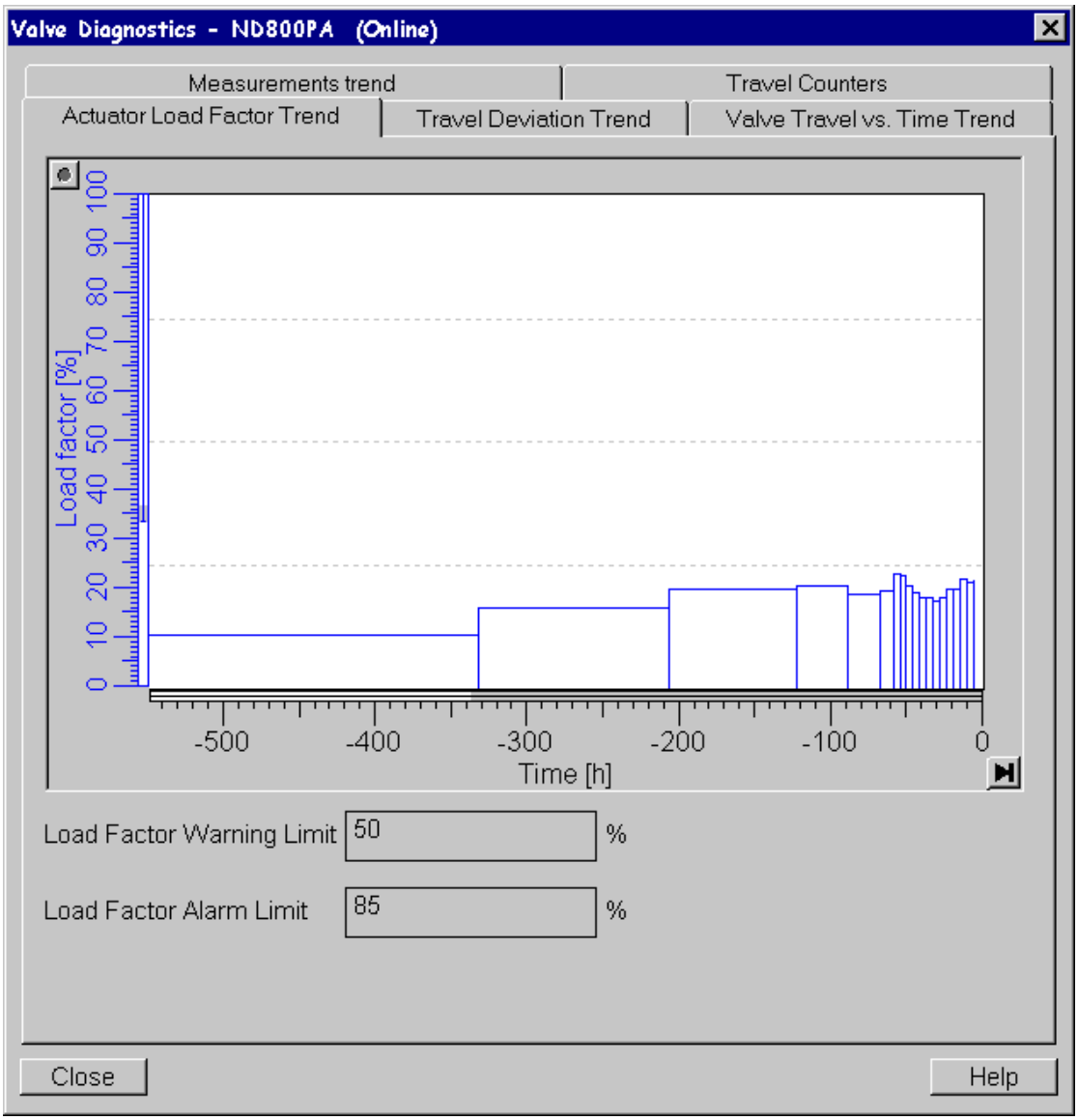

Figure 40. Valve Diagnostics \ Actuator Load Factor Trend

5.7.3.5 Page Valve Travel vs. Time Trend

The histogram illustrates the valve's opening history as percentages of total valve operation time. Valve opening is on the horizontal axis and percentages of operation time on the vertical axis. This histogram can be used to check valve sizing. If the valve operates mostly in small openings, this indicates that the valve is oversized for the application.

Elapsed trend time reports the time during which the data for the statistics displayed have been collected, and is displayed in hours.

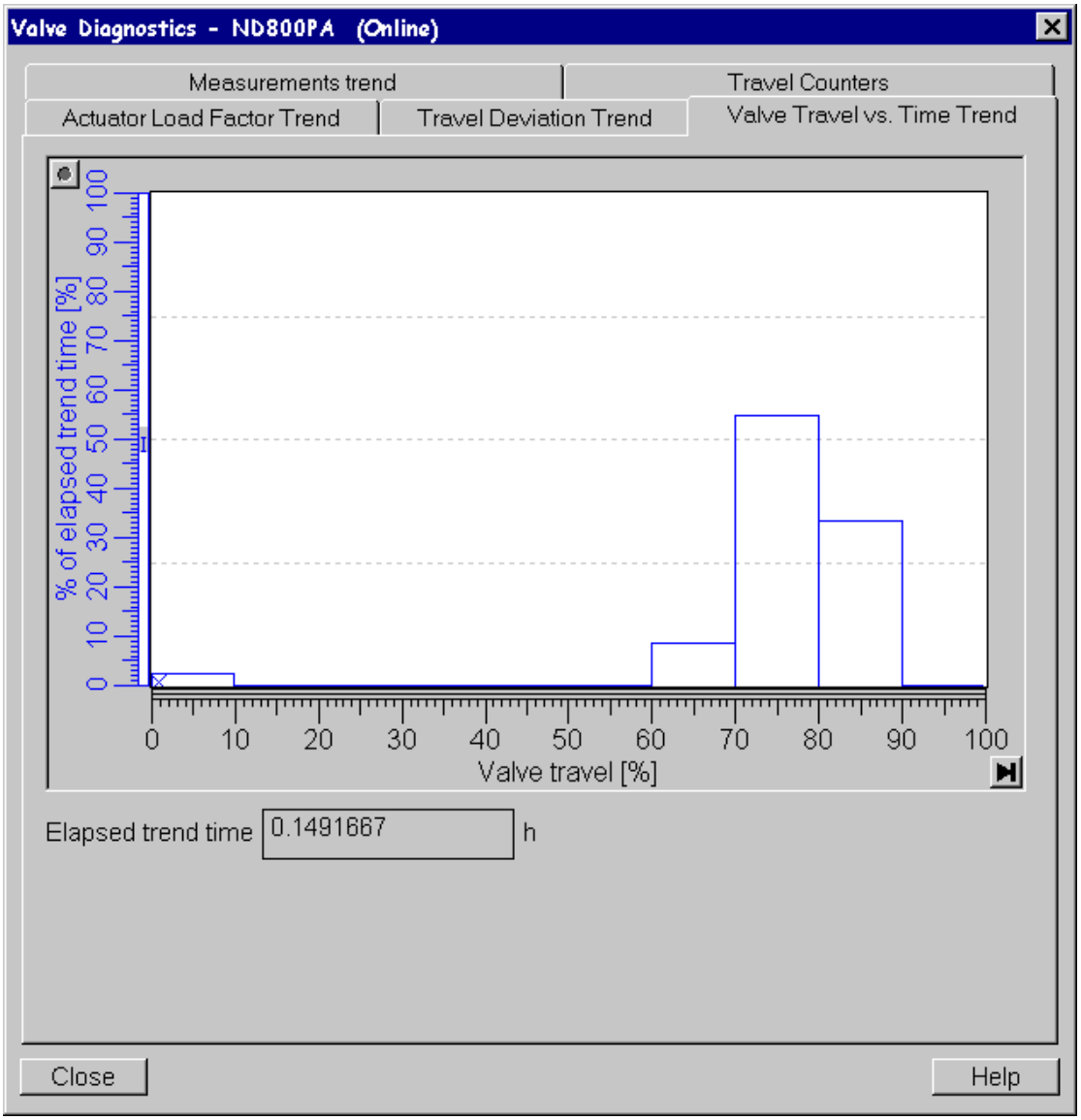

Figure 41. Valve Diagnostics \ Valve Travel vs. Time Trend

5.7.4 Event log

Event log holds 20 latest events and failures stored in the ND800PA memory.

- Event - Event description.
- Count - Number of consecutively occurred events.
- Time stamp - Event time stamps represented in device operating hours. If there are consecutively occurred events, the time stamp reports the last event occurrence time.

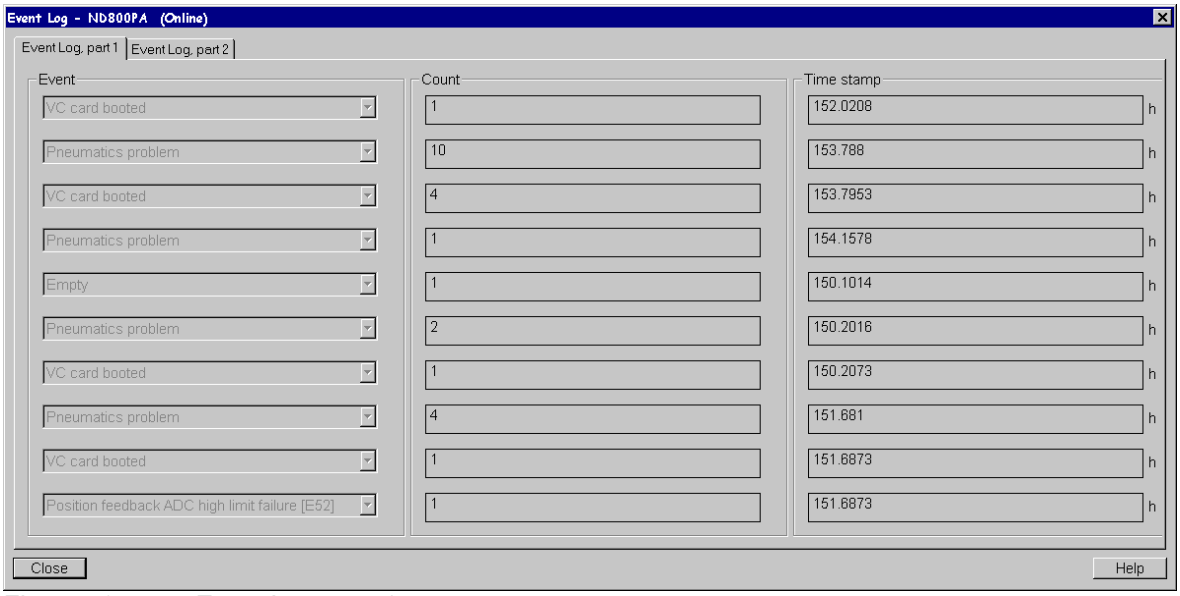

Figure 42. Event Log, part 1.

6 Appendix A. Parameter table.

The ND800PA parameters can be accessed by using an OPC or DDE server from any vendor. The parameters are listed in the following table.

Table 5. ND800PA Parameter table.

Slot	Index	Ele-ment	Default Value	Object	Parameter Description	Data Type	# of ele-ments	Cyclic	read write
				Device Management					
1	0			HEADER		unsigned16	6		r
		1	0x0000	Dir_ID	Directory ID (reserved)				
		2	0x0001	Num_Dir_Rev	Directory Revision Number				
		3	0x0001	Num_Dir_Obj	Number of Directory Objects (Directories)				
		4	0x0006	Num_Dir_Entries	Total Number of Directory Entries				
		5	0x0001	First_Comp_Dir_Entry	Entry number of first Composite List Dir Entry				
		6	0x0003	Num_Comp_Dir_Entry	Number of Composite List Directory Entries				
1	1			COMPOSITE_LIST_DIRECTORY_ENTRY		unsigned16	12		r
		1	0x0104	Start_PB_Ref	Directory Index Physical Block (Resource Block)				
			0x0001	Num_PB	Number of Physical Blocks (1)				
		2	0x0105	Start_First_TB_Ref	Directory Index for first Transducer Block				
			0x0001	Num_TB	Number of Transducer Blocks				
		3	0x0106	Start_First_FB_Ref	Directory Index for first Function Block				
			0x0001	Num_FB	Number of Function Blocks				
		4	0x010E	Slot_Index_PB	Communication related address index to PB				
			0x0022	Num_PB_Param	(Incl. reserved cells)				
		5	0x0200	Slot_Index_TB	(Absolute index)				
			0x00C9	Num_TB_Param	(Incl. reserved cells)				
		6	0x0300	Slot_Index_FB	(Absolute index)				
			0x0032	Num_FB_Param	(Incl. reserved cells)				
				Physical Block					
1	14			BLOCK_OBJECT	Block characteristic	ds32	1		r
		1	0	reserved					
		2	0x01	Block Object	Block type (physical)				
		3	0x02	Parent Class					
		4	0	Class					
		5	0x00000000	DD–Reference (reserved)					
		6	0x0000	DD–Revision (reserved)					
		7	0x4002	Profile	PA profile number assigned by PNO for PROFIBUS – PA = 64, Compact Class B				
		8	0x0300	Profile Revision					
		9	0x00	Execution Time	for future use				
		10	0x0022	Number of Parameters					
		11	0x0040	Index of VIEW 1					
		12	0x01	Number of View Lists					
1	15		0	ST_REV	Counter that is incremented on every change of configuration parameters	unsigned16	1		r
1	16			TAG_DESC	Unique tag in the system that the user can specify	visible_string	32		r, w
1	17		0	STRATEGY	Strategy Value can be written to by user for alarm processing	unsigned16	1		r, w
1	18		0	ALERT_KEY		unsigned8	1		r, w
1	19		0x08	TARGET_MODE	Target mode of the PB = Auto	unsigned8	1		r, w
1	20			MODE_BLK	Block mode	ds37	1		r
		1	0x08	Actual	Auto				
		2	0x08	Permitted	Auto				
		3	0x08	Normal	Auto				
1	21			ALARM_SUM	Alarm status	ds42	1		r
		1	0x0000	Current_Alarm					
		2	0x0000	Unacknowledged					
		3	0x0000	Unreported					
		4	0x0000	Disabled					
1	22		1.0	SOFTWARE_REVISION	Software Revision	octet_string	16		r
1	23		0.2	HARDWARE_REVISION	Hardware Revision	octet_string	16		r
1	24		Metso Automation	DEVICE_MAN_ID	Manufacturer identification	unsigned16	1		r
1	25		ND800PA	DEVICE_ID		visible_string	16		r
1	26			DEVICE_SER_NUM	Device serial number	visible_string	16		r
1	27			DIAGNOSIS	Diagnostic information (bit–coded)	octet_string	4		r
1	28			DIAGNOSIS_EXTENSION	Manufacturer specific extension to DIAGNOSIS	octet_string	6		r
1	29		0xFFFF0080	DIAGNOSIS_MASK	Bits supported by DIAGNOSIS	octet_string	4		r
1	30		0x3F3FFF0F0000	DIAGNOSIS_MASK_EXTENSION	Bits supported by DIAGNOSIS_EXTENSION	octet_string	6		r
1	31		-/-	DEVICE_CERTIFICATION		octet_string	32		r
1	32		2457	WRITE_LOCKING	Write protection selection	unsigned16	1		r, w
1	33		0	FACTORY_RESET	Reset device to default values	unsigned16	1		w
1	34		-/-	DESCRIPTOR		octet_string	32		r, w
1	35		-/-	DEVICE_MESSAGE		octet_string	32		r, w
1	36		1.1.2000	DEVICE_INSTAL_DATE	Date of device installation	octet_string	16		r, w
1	37		1	LOCAL_OP_ENA	Enable / disable local operation	unsigned8	1		r, w
1	38		1	IDENT_NUMBER_SELECTOR	Switch: Profile ID / Manufacturer ID	unsigned8	1		r, w
1	39		0	HW_WRITE_PROTECTION	Indicates the state of the write protection DIP switch				r, w
1	47		0	DEVICE_PCB_SN					r
1	78			**VIEW_1**		struct	4		r
		1		1	ST_REV				
		2		6	MODE_BLK				
		3		7	ALARM_SUM				
		4		13	DIAGNOSIS				
				Transducer Block					

Slot	Index	Ele-ment	Default Value	Object	Parameter Description	Data Type	# of ele-ments	Cyclic	read write
2	0			BLOCK_OBJECT	Block characteristic	ds32	1		r
		1	0x0	reserved					
		2	0x03	Block Object	Block type (transducer)				
		3	0x05	Parent Class					
		4	0x02	Class					
		5	0x00000000	DD–Reference (reserved)					
		6	0x0000	DD–Revision (reserved)					
		7	0x4002	Profile	PA profile number assigned by PNO for PROFIBUS – PA = 64, Compact Class B				
		8	0x0300	Profile Revision					
		9	0x00	Execution Time	for future use				
		10	0x00C9	Number of Parameters					
		11	0x00D2	Index of VIEW 1					
		12	0x01	Number of View Lists					
2	1		0	ST_REV	Counter that is incremented on every change of configuration parameters	unsigned16	1		r
2	2			TAG_DESC	Unique tag in the system that the user can specify	visible_string	32		r, w
2	3		0	STRATEGY	Strategy Value can be written to by user for alarm processing	unsigned16	1		r, w
2	4		0	ALERT_KEY		unsigned8	1		r, w
2	5		0x08	TARGET_MODE	Target mode of the TRANSDUCER = Auto	unsigned8	1		r, w
2	6			MODE_BLK	Block mode	ds37	1		r
		1	0x08	Actual	Auto				
		2	0x08	Permitted	Auto				
		3	0x08	Normal	Auto				
2	7			ALARM_SUM	Alarm status	ds42	1		r
		1	0x0000	Current_Alarm					
		2	0x0000	Unacknowledged					
		3	0x0000	Unreported					
		4	0x0000	Disabled					
2	23		1.1.2000	DEVICE_CALIB_DATE	Calibration date of the device	OctetString			r, w
2	24		1.1.2000	DEVICE_CONFIG_DATE	Configuration date of the device	OctetString			r, w
2	25		0	LIN_TYPE	Linearization type	Unsigned8			r, w
2	32		100	RATED_TRAVEL	Rated travel of the valve	Float			r, w
2	33		0	SELF_CALIB_CMD	Calibration start	Unsigned8			r, w
2	34		0	SELF_CALIB_STATUS	Status of calibration	Unsigned8			r
2	35		1.0	SERVO_GAIN_1	Servo controller gain	Float			r, w
2	38		2	SETP_CUTOFF_DEC	Setpoint cutoff	Float			r, w
2	39		100	SETP_CUTOFF_INC	Setpoint cutoff	Float			r, w
2	47		0	TRAVEL_LIMIT_LOW	Valve position limitation	Float			r, w
2	48		100	TRAVEL_LIMIT_UP	Valve position limitation	Float			r, w
2	49		0	TRAVEL_RATE_DEC	Travel rate limitation	Float			r, w
2	50		0	TRAVEL_RATE_INC	Travel rate limitation	Float			r, w
2	51		1.1.2000	VALVE_MAINT_DATE	Date of valve maintenance	OctetString			r, w
2	57		-	POSITIONING_VALUE	Valve position setpoint after all signal modifications	DS_33			r
		1	0	Value		IEEE-754 float	4		
		2		Status		unsigned8	1		
2	58		-	FEEDBACK_VALUE	Measured valve position	DS_33			r
		1	0	Value		IEEE-754 float	4		
		2		Status		unsigned8	1		
2	59		Metso Automation	VALVE_MAN	Valve manufacturer	OctetString			r, w
2	60		Metso Automation	ACTUATOR_MAN	Actuator manufacturer	OctetString			r, w
2	61		1	VALVE_TYPE	Valve type	Unsigned8			r, w
2	62		0	ACTUATOR_CLASS	Actuator class (always electropneumatic)	Unsigned8			r
2	63		0	ACTUATOR_FAIL_ACTION	Actuator fail safe position during LOSS OF SUPPLY PRESSURE. This parameter is informational only.	Unsigned8			r, w
2	64		-/-	VALVE_SER_NUM	Valve serial number	OctetString			r, w
2	65		-/-	ACTUATOR_SER_NUM	Actuator serial number	OctetString			r, w
2	66		-/-	ADD_GEAR_SER_NUM	Serial No. of the gearing	OctetString			r, w
2	67		-/-	ADD_GEAR_MAN	Gearing manufacturer	OctetString			r, w
2	68		-/-	ADD_GEAR_ID	Gearing identification	OctetString			r, w
2	69		1.1.2000	ADD_GEAR_INST_DATE	Date of installation of gearing	OctetString			r, w
2	100		0.0	SERVO_PARAM_D	Servo controller tuning parameter D	float			r, w
2	102		1.0	SERVO_PARAM_B	Servo controller tuning parameter B	float			r, w
2	104		0	ACT_TYPE	Actuator type	Unsigned8			r, w
2	105		0	LIMIT_SWITCHES	Limit switch presence selection	Unsigned8			r, w
2	106		5	SUPPLY_PRESSURE	Supply pressure estimate	float			r, w
2	108		0	POSITIONER_FAIL_ACTION	Configuration of the action taken during the LOSS OF SUPPLY POWER (supply pressure is available). This action takes place ALSO when the positioner software notices a fatal device failure.	Unsigned8			r, w
2	110		1	POS_SENSOR_ROT	Position sensor rotation	Unsigned8			r, w
2	112		0	DEAD_ANGLE_COMP	Dead ngle compensation	float			r, w
2	114		0	SOURCE_CHARACTERISTICS_TABLE	Source characteristics table	struct			r, w
		1 to 21		table_value	Relative flow coefficients	float			r, w
		22	none	FILL_TABLE	Fill table	Unsigned 8			r, w
2	116		0	TARGET_CHARACTERISTICS_TABLE	Target characteristics table	struct			r, w
		1 to 21		table_value	Relative flow coefficients	float			r, w
		22	none	FILL_TABLE	Fill table	Unsigned 8			r, w
2	118		0	SIGNAL_MOD_TABLE		struct			r, w
		1 to 21		table_value	Output values	float			r, w

Slot	Index	Ele-ment	Default Value	Object	Parameter Description	Data Type	# of ele-ments	Cyclic	read write
2			off	CHARACTERIZATION	Characterization control	Unsigned 8			r, w
2	120			ACT_PRESSURE	Actuataor pressure difference measurement	float			r
2	122			DEV_TEMPERATURE	Device temperature measurement	float			r
2	124			OPERATION_TIME	Device operation time	float			r
2	126			EVENT_LOG_EVENT_TABLE	Event log	struct			r
		1 to 20		table_value		Unsigned16			
2	128			EVENT_LOG_COUNT_TABLE	Event log	struct			r
		1 to 20		table_value		Unsigned16			
2	130			EVENT_LOG_TIME_TABLE	Event log	struct			r
		1 to 20		table_value		float			
2	132			TRAVEL_DEVIATION_TREND_TIME_TABLE	Travel deviation trend	struct			r
		1 to 20		table_value		float			
2	134			TRAVEL_DEVIATION_TREND_ERROR_TABLE	Travel deviation trend	struct			r
		1 to 20		table_value		float			
2	135		2	TRAVEL_DEVIATION_WARNING_LIMIT	Travel deviation trend	float			r, w
2	136		10	TRAVEL_DEVIATION_ALARM_LIMIT		float			r, w
2	138			VALVE_TRAVEL_VS_TIME_TREND		struct			r
		1 to 10		table_value		float			
2		11		ELAPSED_TREND_TIME		float			r
2	140			LOAD_FACTOR_TREND_TIME_TABLE		struct			r
		1 to 20		table_value		float			
2	142			LOAD_FACTOR_TREND_FACTOR_TABLE		struct			r
		1 to 20		table_value		float			
2	143		50	LOAD_FACTOR_WARNING_LIMIT		float			r, w
2	144		85	LOAD_FACTOR_ALARM_LIMIT		float			r, w
2	146			VALVE_TRAVEL_COUNTERS		struct			r
2		1		FULL_STROKES		float			r
2		2	250 000	FULL_STROKES_WARNING_LIMIT		Unsigned32			r, w
2		3		REVERSALS		Unsigned32			r
2		4	1 000 000	REVERSALS_WARNING_LIMIT		Unsigned32			r, w
2	148			ACT_TRAVEL_COUNTERS		struct			r
2		1		FULL_STROKES		float			r
2		2	250 000	FULL_STROKES_WARNING_LIMIT		Unsigned32			r, w
2		3		REVERSALS		Unsigned32			r
2		4	1 000 000	REVERSALS_WARNING_LIMIT		Unsigned32			r, w
2	150		0	RESET_DIAGNOSTICS		Unsigned8			r, w
2	152			VALVE_TEST		struct			r, w
2		1	Step	TEST_TYPE		Unsigned16			r, w
2		2	20	TEST_STARTING_SETPOINT		float			r, w
2		3	20	TEST_LOOP_OR_STEP_SIZE		float			r, w
2		4	10	TEST_DURATION		float			r, w
2		5	idle	TEST_START		Unsigned8			r, w
2	154			LAST_VALVE_TEST_SETTINGS		struct			r
2		1		TEST_TYPE		Unsigned16			r
2		2		TEST_STARTING_SETPOINT		float			r
2		3		TEST_LOOP_OR_STEP_SIZE		float			r
2		4		TEST_DURATION		float			r
2	156			LAST_VALVE_TEST_SP_OR_TIME_TABLE_1		struct			r
		1 to 25		table_value		float			
2	158			LAST_VALVE_TEST_SP_OR_TIME_TABLE_2		struct			r
		1 to 25		table_value		float			
2	160			LAST_VALVE_TEST_POSITION_TABLE_1		struct			r
		1 to 25		table_value		float			
2	162			LAST_VALVE_TEST_POSITION_TABLE_2		struct			r
		1 to 25		table_value		float			
2	164		0	POS_SENSOR_SN	Position sensor serial number	Unsigned32			r, w
2	168			POS_SENSOR_TEMP_COMP	Position sensor temeperature compensation	Unsigned8			r, w
2	170			POS_SENSOR_TEMP_COMP_MIN_TABLE	Position sensor temeperature compensation table	struct			r, w
		1 to 26		table_value		float			
2	172			POS_SENSOR_TEMP_COMP_MAX_TABLE	Position sensor temeperature compensation table	struct			r, w
		1 to 26		table_value		float			
2	210			**VIEW_1**		struct	3		
				1 6 7	ST_REV MODE_BLK ALARM_SUM				
				Analog Output Block					
3	0			BLOCK_OBJECT	Block characteristic	ds32	1		r

Slot	Index	Ele-ment	Default Value	Object	Parameter Description	Data Type	# of ele-ments	Cyclic	read write
		1	0	reserved					
		2	0x02	Block Object	Block type (function)				
		3	0x02	Parent Class	Output				
		4	0x01	Class	Analog output				
		5	0x00000000	DD–Reference (reserved)					
		6	0x0000	DD–Revision (reserved)					
		7	0x4002	Profile	PA profile number assigned by PNO for PROFIBUS – PA = 64, Compact Class B				
		8	0x0300	Profile Revision					
		9	0x00	Execution Time	for future use				
		10	0x0032	Number of Parameters					
		11	0x0040	Index of VIEW 1					
		12	0x01	Number of View Lists					
3	1		0	ST_REV	Counter that is incremented on every change of configuration parameters	unsigned16	1		r
3	2			TAG_DESC	Unique tag in the system that the user can specify	visible_string	32		r, w
3	3		0	STRATEGY	Strategy Value can be written to by user for alarm processing	unsigned16	1		r, w
3	4		0	ALERT_KEY		unsigned8	1		r, w
3	5		0x08	TARGET_MODE	Target mode of the AO = Auto	unsigned8	1		r, w
3	6			MODE_BLK	Block mode	ds37	1		r
		1	0x08	Actual	Auto				
		2	0x08	Permitted	Auto				
		3	0x08	Normal	Auto				
3	7			ALARM_SUM	Alarm status	ds42	1		r
		1	0x0000	Current_Alarm					
		2	0x0000	Unacknowledged					
		3	0x0000	Unreported					
		4	0x0000	Disabled					
	8			BATCH_INFORMATION	Stored information for batch processes	record	4		r, w
		1	0	Batch_ID		unsigned32			
		2	0	Equipment		unsigned16			
		3	0	Operation		unsigned16			
		4	0	Phase		unsigned16			
3	9			SP	Setpoint in per cent, with ref. to PV_SCALE	ds33	1	x	r, w
		1	0	Value		IEEE-754 float	4		
		2	0x18	Status		unsigned8	1		
3	11			PV_SCALE	Scaling of the setpoint	ds36	1		r, w
		1	100	EU at 100%					
		2	0	EU at 0%					
		3	1342	Units Index					
		4	2	Decimal Point					
3	12			READBACK	Readback in per cent, with ref. to PV_SCALE	ds33	1	x	r
		1	0	Value		IEEE-754 float	4		
		2		Status		unsigned8	1		
3	14			RCAS_IN	Setpoint in Remote Cascade mode	ds33	1	x	r, w
		1	0	Value		IEEE-754 float	4		
		2	0x18	Status		unsigned8	1		
3	21		1	IN_CHANNEL	Assignment to the transducer block (feedback)	unsigned16	1		r, w
3	22		1	OUT_CHANNEL	Assignment to the transducer block (positioning)	unsigned16	1		r, w
3	23		30	FSAFE_TIME	Response time after communication failure	float	1		r, w
3	24		2	FSAFE_TYPE	Type of response to communication failure	unsigned8	1		r, w
3	25		0	FSAFE_VALUE	Setpoint on communication failure	float	1		r, w
3	27			RCAS_OUT	Readback in Remote Cascade mode	ds33	1	x	r
		1	0	Value		IEEE-754 float	4		
		2		Status		unsigned8	1		
3	31			POS_D	Discrete position	ds34		x	r
		1		Value		unsigned8	1		
		2		Status		unsigned8	1		
3	32			SETP_DEVIATION	Difference between position setpoint and measurement	float	1		r
3	33			CHECK_BACK	Device information	octet_string	3	x	r
3	34		0x9F7603	CHECK_BACK_MASK	Mask for device information	octet_string	3		r
3	35			SIMULATE	Simulation of the readback	ds50	1		r, w
				Simulate_Status					
				Simulate_Value					
			0	Simulate_En / Disable					
3	36		0	INCREASE_CLOSE	Positioning direction	unsigned8	1		r, w
3	37			OUT	Setpoint in per cent, with ref. to OUT_SCALE	ds33	1		r
		1	0	Value		IEEE-754 float	4		
		2		Status		unsigned8	1		
3	38			OUT_SCALE	Scaling of the output value	ds36	1		r, w
		1	100	EU at 100%					
		2	0	EU at 0%					
		3	1342	Units Index					
		4	2	Decimal Point					
3	64			**VIEW_1**		struct	6		
				1	ST_REV				
				6	MODE_BLK				
				7	ALARM_SUM				
				12	READBACK				
				31	POS_D				
				33	CHECK_BACK				

7 Appendix B. Adding the ND800PA to the PDM project.

The following table is a copy from Siemens document “Using SIMATIC PDM to connect a PROFIBUS PA device to a PROFIBUS interface (Standalone-Version)” (simaticpdm_pa_e.pdf).

Table 6. Adding the ND800PA to the Simatic PDM project.

Action	Mouse action	Input	Remark
Start SIMATIC PDM	➢ Double click on the „SIMATIC-Manager“		This starts the SIMATIC-Manager. The SIMATIC-Manager is used to set up the communication ways; which are used by SIMATIC PDM.
Select the **Process Device Network View** as default view	➢ Options -> Customize -> View -> „Process Device Network View“		
Set the PC/PG-Interface	➢ Options -> „Set PG/PC-Interface“ ➢ Click on e.g. CP5511(Profibus) ➢ Click on „Properties“ ➢ Make following settings: - Profile: DP - Transmission Rate: 45,45kbps - Deselect „Not the Only Master Active“		If you are installing a PCMCIA adapter, make sure the SIMATIC Net adapter is connected to the PCMCIA card.
Create a new project	➢ File -> New	Enter the project name + Click on „OK“	
Insert a PROFIBUS DP network	➢ Double click on „networks“ in the right window ➢ Click on „networks“ in the left window ➢ Right mouse button -> Insert new object -> PROFIBUS DP network		
Insert a PC	➢ Click on „Networks“ in the left window ➢ Right mouse button -> Insert new object -> PC		
Define the new PC to the active PC	➢ Click on „PC“ in the left window ➢ Right mouse button -> Options -> Define current PC		By selecting "Define current PC", the PC object you just inserted into the project is marked to indicate that it is used as the active PC.
Insert a interface in the active PC	➢ Click on „(x)PC“ in the right window ➢ Right mouse button -> Insert new object -> PROFIBUS DP interface		
Select the correct network for the PROFIBUS DP interface	➢ Double click on „(x)PC“ in the right window ➢ Click on „PROFIBUS DP interface“ in the right window ➢ Right mouse button -> Object properties ➢ Select Page „Network“ ➢ Select PROFIBUS DP network about the arrow ➢ Click on „OK“		
Insert a PA device	➢ Click in the left window on „PROFIBUS DP network“ ➢ Right mouse button -> Insert new object -> PROFIBUS PA device	Enter the device name ->Click on „OK“	
Set the device address	➢ Click on the new PA device in the right window ➢ Right mouse button -> Object properties ➢ Select Page „Connection“	Enter the PA address ->Click on „OK“	The address must correspond to the PA address of the connected device. Default address: 126
The parametering of the device is within SIMATIC PDM	➢ Double click on the new PA device in the right window ➢ Select the right device about the menu tree (This menu comes only by the first selection.)		
	➢ The parametering of the device is within SIMATIC PDM		