bürkert
FLUID CONTROL SYSTEMS

# Type 336x
# AE33

Software description for electromotive control valves

## Operating instructions - software

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Operating Instructions 2301/01_EN-GB_00810560 / Original EN

# Software description for electromotive control valves

**Note on table of contents.**

Menus that are sufficiently explained by the help text displayed, and which do not need any further description, are not listed in the table of contents.

You can find the complete menu structure, divided into configuration areas with a short description of all menus, in Chapter "Overview of the menus".

## Content



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# 1 ABOUT THESE INSTRUCTIONS

The instructions describe the software of the Types 3360, 3361, 3363, 3364 and 3365 electromotive control valves.

**Important safety information!**

You can find safety and usage information for the device in its own operating instructions.

▸ Read instructions carefully.

## 1.1 Symbols

**DANGER!**

**Warns of an immediate danger!**

▸ Failure to observe these instructions will result in death or serious injuries.

**WARNING!**

**Warns of a potentially hazardous situation!**

▸ Failure to observe these instructions may result in serious injuries or death.

**CAUTION!**

**Warns of a potential danger!**

▸ Failure to observe may result in moderate or minor injuries.

**NOTE!**

**Warns of damage to property!**

▸ Failure to observe the warning may result in damage to the device or the equipment.

**Indicates important additional information, tips and recommendations.**

**Refers to information in these operating instructions or in other documentation.**

▶ Highlights instructions to avoid a danger.

→ Designates a procedure which you must carry out.

Designates a result.

MENU Symbol for software interface texts.

## 1.2 Definition of the term “device”

- **Device:** The term “device” used in these instructions applies to the types described in these instructions: 3360, 3361, 3363, 3364, 3365, AE33
- **AG2**: Actuator size 2 with a nominal force of 1300 or 2500 N for seat size 3...50
  **AG3**: Actuator size 3 with a nominal force of 7700 or 10,000 N for seat size 40...100

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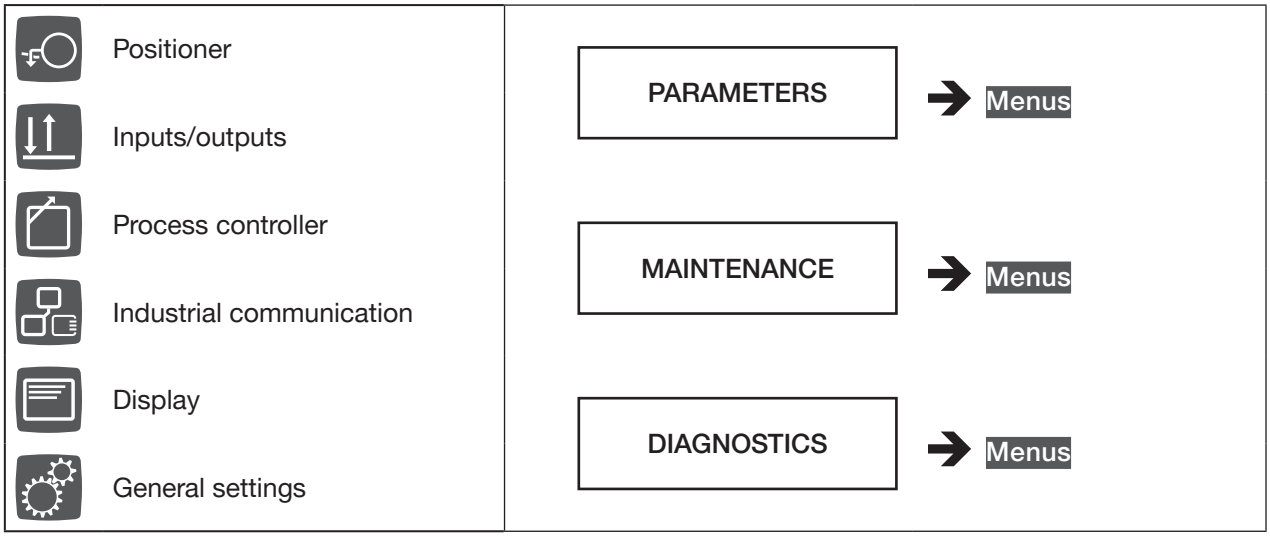
# 2 OVERVIEW OF THE MENUS

The software for the electromotive control valve is divided into the following areas, in accordance with the functions:

- **Configuration areas**
  The menus for each configuration area are assigned to the PARAMETER MAINTENANCE and DIAGNOSTICS registers.




- **Context menu**
  The context menu can be used to access the home screen, user-defined views and configuration areas. The type and number of the available submenus depends on the area from which the context menu is accessed.

## 2.1 Menus in positioner configuration area

| PARAMETERS for positioner | |
|---|---|
| **Levels 1 and 2** | **Description** |
| START-UP | Assistant for position control start-up.<br>Not available in devices with process control function. |
| X.CONTROL | For a description, see chapter<br>"3.1 X.CONTROL - parameterisation of position control". |
| DBND | Set insensitivity range (dead band). |
| ACCELERATION | Set acceleration. (only for AG2) |
| SAFEPOS | For a description, see chapter<br>"3.2 SAFEPOS - setting safety position and energy storage system". |
| FUNCTION | Select safety position. |
| Item | Set user-defined safety position. |
| ENERGY PACK | Energy storage system functions. See chapter "3.2.3 ENERGY-PACK - energy storage system functions" on page 35. |

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| PARAMETERS for positioner | |
|---|---|
| **Levels 1 and 2** | **Description** |
| DIAPHRAGM (AG2 only) | For a description, see chapter "3.3 DIAPHRAGM - diaphragm valve settings" on page 39. Only available for diaphragm control valves. |
| Cutoff force | Set sealing force. |
| Additional force | Set amplification of sealing force. |
| Maximum force | Set maximum sealing force. |
| M.Q.0.TUNE | Set M.Q0.TUNE function parameters. |
| M.CLEAN | Set cleaning function period time. |
| DIP.SWITCH | Indicates DIP switch configuration.<br>Only available in the Bürkert Communicator PC software and devices without a display module.<br>You can find the references to the detailed description of the submenus in the main menu of the same name, which are listed on level 1 below. |
| DIR.CMD | Indicates DIP switch position: effective direction between input signal and position set-point. |
| CHARACT | Indicates DIP switch position: correction characteristic enabled/disabled. |
| CUTOFF | Indicates DIP switch position: sealing function enabled/disabled. |
| MANUAL MODE | Indicates DIP switch position: HAND operating mode enabled/disabled. |
| ADD.FUNCTION | For a description, see chapter "3.4 ADD.FUNCTION - enabling and disabling auxiliary functions".<br>You can find the references to the detailed description of the submenus in the main menu of the same name, which are listed on level 1 below. |
| CHARACT | Enabling and disabling auxiliary function: correction characteristic. |
| CUTOFF | Enabling and disabling auxiliary function: sealing function. |
| DIR.CMD | Enabling and disabling auxiliary function: change effective direction. |
| SPLTRNG | Enabling and disabling auxiliary function: signal range division. |
| X.LIMIT | Enabling and disabling auxiliary function: limitation of mechanical stroke range. |
| X.TIME | Enabling and disabling auxiliary function: limitation of control speed. |
| CHARACT | For a description, see chapter "3.5 CHARACT - configure correction characteristic". |
| TYPE | Select correction characteristic: linear, equal percentage or user-defined. |
| TABLE DATA | Programme user-defined correction characteristic. |

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| PARAMETERS for positioner | |
|---|---|
| **Levels 1 and 2** | **Description** |
| CUTOFF | For a description, see chapter "3.6 CUTOFF - configuring the sealing function". |
| CUTOFF.type | Select source for input signal of sealing function. |
| Lower limit | Define the lower limit for the sealing function. |
| Upper limit | Define the upper limit for the sealing function. |
| DIR.DMD | For a description, see chapter "3.7 DIR.CMD - change the effective direction of the standard signal for the valve position". |
| SPLTRNG | For a description, see chapter "3.8 SPLTRNG - signal split range". |
| X.LIMIT | For a description, see chapter "3.9 X.LIMIT - mechanical stroke limit". |
| X.TIME | For a description, see chapter "3.10 X.TIME - actuating time limit". |

*Table1: Menus - PARAMETERS for positioner*

| MAINTENANCE for positioner | |
|---|---|
| **Levels 1 and 2** | **Description** |
| CALIBRATION | For a description, see chapter "3.11 MAINTENANCE - start-up and maintenance of positioner". |
| X.TUNE | Automatic adjustment of position control for seat valves. |
| M.Q.0.TUNE | Adjustment of position control for diaphragm valves. |
| M.CLEAN | Cleaning function for diaphragm valves. |
| M.SERVICE | Diaphragm armature start-up. |

*Table2: Menus - MAINTENANCE for positioner*

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| DIAGNOSTICS for positioner | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| SYSTEM.VALUES | Overview of specific system values. |
| Operation time | Indicates entire operating duration of the device. |
| Travel accumulator | Indicates entire path taken by the spindle. |
| Direction change | Indicates entire number of direction changes. |
| Device temperature | Indicates current device temperature. |
| Highest temperature | Indicates the highest temperature previously measured. |
| Lowest temperature | Indicates the lowest temperature previously measured. |
| HISTOGRAM.POS | Histogram of dwell time frequency over the entire runtime of the device. |
| HISTOGRAM.SPAN | Histogram of movement span over the entire runtime of the device. |
| HISTOGRAM.DTEMP | Histogram of device temperature over the entire runtime of the device. |
| ENERGY PACK | Energy storage system diagnostics. For a description, see chapter "3.2.3.2. Settings in DIAGNOSTICS – ENERGY-PACK".<br>The menu is only displayed when the energy storage system is enabled. |
| State of health | Indicates state of health (SOH) of the energy storage. |
| NAMUR state | **Select device status for the failure of the energy storage system.**<br>Only adjustable if immediate start is set for the behaviour of the actuator during a restart (setting in PARAMETER → SAFEPOS → ENERGY PACK → FUNCTION → Immediate control ). |
| Error | The status message "error" is issued in the event of an energy storage system failure.<br>The device moves to the safety position and can only then be operated if the energy storage system is replaced. |
| Out of specification | The status message "out of specification" is issued in the event of an energy storage system failure.<br>The device can still be operated despite the failure of the energy storage system. |
| USER.DIAGNOSIS | Configuration of user-specific diagnostic functions. |
| MSG.CONFIG | Configuration of messages for user-specific diagnostic functions. |
| Acknowledge | Set confirmation of diagnostic messages: desired or not desired. |
| Logbook | Select diagnostic functions for which messages are entered in the logbook. |

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| DIAGNOSTICS for positioner | | |
|---|---|---|
| **Levels 1, 2 and 3** | **Description** | |
| NAMUR type | Define NAMUR status for diagnostic functions.<br>The status signals, according to NAMUR NE 107, are set for the diagnostic function messages in this menu.<br>The status signals have different priorities.<br>If multiple diagnostic messages with different status signals are present, the signal for the message with the highest priority is displayed.<br>Priority of status signals: | |
| ADD.DIAGNOSE | Enabling and disabling diagnostic functions.<br>The following diagnostic functions can be enabled: | |
| | SERVCE.TIME | Maintenance interval: operating duration. |
| | TRAVEL.ACCU | Maintenance interval: spindle path taken. |
| | CYCLE.COUNTER | Maintenance interval: number of direction changes. |
| | POS.MONITOR | Monitoring positioner position at constant position set-point. |
| | PV.MONITOR | Monitoring process actual value at constant position set-point value. |
| | HISTOGRAM.POS | Histogram of dwell time frequency. |
| | HITSTOGRAM.SPAN | Histogram of movement span. |
| | The diagnostic function is included in the USER.DIAGNOSE menu as a menu option on activation, and can be set there. | |
| SERVICE.TIME | Diagnostics and maintenance interval of operating duration.<br>Physical size: time[1].<br>The operating duration is the time in which the device is switched on. If the operating duration reaches the time limit of the prescribed interval, a message is generated. | |
| Operation time | Indicates entire operating duration of the device. | |
| Interval | Set maintenance interval[2]. | |
| Next message | Indicates the remaining operating duration until the next message. | |

| Priority | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Signal colour | red | orange | yellow | blue |
| Icon |  |  |  |  |
| Meaning | Failure, error or fault | Function check | Out of specification | Maintenance required |

| DIAGNOSTICS for positioner | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| TRAVEL.ACCU | Diagnostics and maintenance interval of the spindle path taken.<br>Physical size: length[1].<br>The spindle path is the path that the actuator spindle takes.<br>The maintenance interval is related to the totalled path of the spindle. When the spindle has taken the prescribed path of the interval, a message is generated. |
| Travel accumulator | Indicates the entire path taken by the spindle of the device. |
| Interval | Set maintenance interval[2]. |
| Next message | Indicates the remaining spindle path until the next message. |
| CYCLE.COUNTER | Diagnostics and maintenance interval for the number of direction changes.<br>The direction change is related to the actuator.<br>When the number of direction changes for the prescribed interval has been reached, a message is generated. |
| Direction change | Indicates total number of direction changes of the device. |
| Interval | Set maintenance interval[2]. |
| Next message | Indicates the remaining direction change until the next message. |
| POS.MONITOR | Monitoring positioner position at constant position set-point.<br>For a description, see chapter “3.12.1 POS.MONITOR - positioner position monitoring” on page 52. |
| Tolerance band | Set tolerance band for permitted control deviation. Information in per cent. |
| Compensation time | Set maximum time[1] by which equilibrium must be reached, then the monitoring of the positioner position starts. |
| PV.MONITOR | **Only available in devices with process control function.**<br>**Menu for** monitoring process actual value at constant position set-point value.<br>Monitoring via PV.MONITOR revolves around the same principle as described in the POS.MONITOR menu<br>The difference to POS.MONITOR is that in this case, the actual value of the process control is monitored and not the actual position. |
| Tolerance band | Set tolerance band for permitted control deviation.<br>The physical size displayed[1] depends on the process size to be controlled, which is stated in the UNIT menu<br>(Configuration area Process controller → Parameter). |

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| DIAGNOSTICS for positioner | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| Compensation time | Set maximum time[1] by which equilibrium must be reached, then the monitoring of the process actual value starts. |
| HISTOGRAM | Configure menu for creating histograms. |
| Start \| Stop | Start and stop the recording of histograms. |
| Clear | Reset histograms. |
| HISTOGRAM.POS | Indicates the histogram of dwell time frequency. |
| Operation time | Indicates the run time[1] for the histogram for the dwell time frequency. |
| Travel accumulator | Indicates the path taken[1] for the histogram for the dwell time frequency. |
| HISTOGRAM.SPAN | Indicates the histogram for the movement span. |
| Operation time | Indicates the run time[1] for the histogram for the movement span. |
| Direction change | Indicates the number of direction changes for the histogram of the movement span. |

[1] The physical unit displayed can be changed in the Bürkert Communicator PC software:

To change the physical unit, click on the square symbol above the value displayed. Select the physical unit in the open dialogue box.

[2] When the interval has expired, the device status displayed will change and a message will be issued. The issuing of the message and the device status display can be configured in the MSG.CONFIG menu.

*Table3: Menus - diagnostics for positioner*

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## 2.2 Menus in inputs/outputs configuration area

| PARAMETERS for inputs/outputs | |
|---|---|
| **Levels 1 and 2** | **Description** |
| CMD | **Only available in devices with process control function.**<br>Parameterise position set-point value. |
| CMD.source | Select signal source for the set-point value setting default of the positioner. |
| ANALOG.type | Select standard signal for the set-point value setting default of the positioner: 0-5 V, 0-10 V, 4-20 mA, 0-20 mA.<br>The menu is only available when the Analogue signal source has been selected in the CMD.source menu. |
| Signal loss detection | Enable cable break detection for the set-point value of the positioner.<br>Define the status report during a cable break: out of specification or error.<br>The menu is only available for the following parameterisation:<br>in the CMD.source menu, select the Analogue signal source.<br>In the CMD.typemenu, select standard signal 4-20 mA. |
| CMD.manual | Manual position set-point value requirement.<br>The menu is only available when the Manual signal source has been selected in the CMD.source menu. |
| CMD/SP | **Only available in devices with process control function.**<br>Parameterise measured values. |
| SP.source | Select signal source for the set-point value setting default of the positioner. |
| CMD.source | Select signal source for the set-point value setting default of the positioner. |
| ANALOG.type | Select standard signal for the set-point value setting default: 0-5 V, 0-10 V, 4-20 mA, 0-20 mA.<br>The menu is only available when the Analogue signal source has been selected in the SP.source/CMD.source menu. |
| Signal loss detection | Enable cable break detection for the set-point value of the process controller.<br>Define the status report during a cable break: out of specification or error.<br>The menu is only available for the following parameterisation:<br>in the SP.source/CMD.source menu, select the Analogue signal source.<br>In the CMD.typemenu, select standard signal 4-20 mA. |
| SP.scale | Scale process set-point value.<br>During scaling, the values for the lower and upper process set-point value are assigned to the respective current or voltage value of the standard signal. |
| SP.manual | Manually specify process set-point value.<br>The menu is only available when the Manual signal source has been selected in the SP.source menu. |
| PV | **Only available in devices with process control function**.<br>See chapter “4.1 PV - parameterising process actual value” on page 53. |

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| PARAMETERS for inputs/outputs | |
|---|---|
| **Levels 1 and 2** | **Description** |
| PV.source | Select signal source for the set-point value setting default of the process controller: analogue, büS. |
| ANALOG.type | Select process actual value signal type: 4-20 mA, frequency, Pt 100.<br>The menu is only available when the Analogue signal source has been selected in the PV.source menu. |
| K-Factor | Set K factor.<br>The menu is only available for the following parameterisation:<br>Select Analogue signal source in the PV.source menu.<br>In the ANALOG.type menu, select the Frequency signal type. |
| PV.scale | Scale process actual value.<br>The menu is only available for the following parameterisation:<br>Select Analogue signal source in the PV.source menu.<br>Select signal type 4-20 mA in the ANALOG.type menu. |
| Signal loss detection | Enable cable break detection for the process actual value.<br>Define the status report during a cable break: out of specification or error.<br>The menu is only available for the following parameterisation:<br>in the PV.source menu, select the Analogue signal source.<br>In the ANALOG.typemenu, select standard signal 4-20 mA. |

*Table4: Menus - PARAMETERS for inputs/outputs, SP, CMD main menus*

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| PARAMETERS for inputs/outputs | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| ADDITIONAL IOs | Configuration of signal inputs and outputs. |
| DIGITAL IN | Digital input configuration. |
| X.CO/P.CO.source | Define signal source for position/process control switchover. |
| EXT-ERROR.source | Define signal source for external errors. |
| M.CLEAN.source | Define signal source for the M.CLEAN cleaning function for diaphragm valves. |
| EXT-ERROR.para | Define behaviour of control valve when an external error occurs:<br>SAFEPOS Actuator moves to the set safety position.<br>Stop Actuator remains in place. |
| DIGITAL.type | Select the digital signal type.<br>The normally open (NO) and normally closed (NC) switch functions can be selected for the signal.<br>The menu is only available when a digital signal source has been defined in the DIGITAL IN menu for one of the following listed functions:<br>- External error EXT-ERROR.source or<br>- Cleaning function M.CLEAN.source. |
| DIGITAL OUT 1 and DIGITAL OUT 2 | For a description, see “4.2 DIGITAL OUT - digital output configuration”. |
| SOURCE | Select signal source for the digital output: Internal or büS. |
| FUNCTION | Define function for the digital output. |
| DIGITAL.type | Define switching status for the digital output. |
| ANALOG OUT | **Only available in devices with analogue output option.**<br>Configuration of additional analogue output. |
| SIGNAL | Select input signal for analogue input:<br>- CMD position set-point value<br>- POS actual position<br>- SP process set-point value<br>- PV actual process (SP and PV only in devices with process controller function)<br>- büS input signal is specified by büS network. |
| ANALOG.type | Select standard signal for the additional analogue output: 0-5 V, 0-10 V, 4-20 mA, 0-20 mA. |
| SCALE | Scale input signal of additional analogue output. |

*Table5: Menus - PARAMETERS for inputs/outputs, ADDITIONAL IOs main menu*

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| MAINTENANCE for inputs/outputs | |
|---|---|
| **Levels 1 and 2** | **Description** |
| CALIBRATION | Menu for calibration of signal for set-point and actual values, optional additional analogue output, and for analogue inputs 1 and 2. |
| CMD | Calibration of position set-point value for devices with position control function.<br><br>The menu is only available when the analogue input has been selected as a source for the input signal.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → CMD.source → Analogue.<br><br>The type of signal that has been defined as the standard signal for the input signal is displayed for calibration.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → CMD → ANALOG.type. |
| SP I CMD | **Only available in devices with process control function.**<br><br>Calibration of process set-point value (SP) or position set-point value (CMD).<br><br>The menu is only available when the analogue input has been selected as a source for the input signal.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → SP.source or CMD.source → Analogue.<br><br>The type of signal that has been defined as the standard signal for the input signal is displayed for calibration.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → SP I CMD → ANALOG.type. |
| PV | **Only available in devices with process control function.**<br><br>Calibration of process actual value (PV).<br><br>The menu is only available when the analogue input has been selected as a source for the input signal.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → PV.source → Analogue.<br><br>The type of signal that has been defined as the standard signal for the input signal is displayed for calibration.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → PV → ANALOG.type. |
| ANALOG OUT | **Only available in devices with analogue output option.**<br><br>Calibration of analogue output.<br><br>The type of signal that has been defined as the standard signal for the analogue output is displayed for calibration.<br>This depends on the following setting:<br>Configuration area Inputs/Outputs → ANALOG OUT → ANALOG.type. |
| CALIBRATION RESET | Reset calibration values to factory setting. |

*Table6: Menus - MAINTENANCE for inputs/outputs*

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## 2.3 Menus in the process controller configuration area

The process controller configuration area is only available in devices with process control function.

| PARAMETERS for process controllers | |
|---|---|
| **Levels 1 and 2** | **Description** |
| START-UP | Assistant for process control start-up. |
| PID.PARAMETER | For a description, see chapter "5.1 PID PARAMETERS - parameterising the process controller" on page 57. |
| DBND | Set insensitivity range (dead band) of the process controller. |
| KP | Set proportional part (P part of PID controller). |
| TN | Set reset time (I part of PID controller). |
| TV | Set derivative time (D part of PID controller). |
| XO | Set operating point. |
| UNIT | Select physical size for the process sizes.<br>Which physical sizes are available depends on which signal type and source have been assigned to the process actual value.<br>The menus for parameterising the process actual value are located in the configuration area → Inputs/Outputs → PV. |
| P.CO Unit PLC | Select physical process control unit for the PLC. |
| SP.SLOPE | For a description, see chapter "5.2 SP.SLOPE - set slope rate per unit of time" on page 59. |
| SP.SLOPE on/off | Enable or disabled menu for setting slope rate. |
| Rise | Set slope rate for upward movement. |
| Fall | Set slope rate for downward movement. |
| SP.Filter | Select filter for process set-point value.<br>Levels 0-9 can be selected for filtering the process set-point value.<br>Level 0: lowest/no impact on filtering.<br>Level 9: greatest impact on filtering. |
| PV.Filter | Select filter for process actual value.<br>Levels 0-9 can be selected for filtering the process actual value.<br>Level 0: lowest/no impact on filtering.<br>Level 9: greatest impact on filtering. |

*Table7: Menus - PARAMETERS for process controllers*

| MAINTENANCE for process controllers | |
|---|---|
| **Levels 1 and 2** | **Description** |
| CALIBRATION | Menu for calibration of process control. |

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| MAINTENANCE for process controllers | |
|---|---|
| **Levels 1 and 2** | **Description** |
| P.TUNE | Automatic PID controller parameterisation.<br><br>The parameters for the P, I and D part of the PID controller are automatically determined and transferred to the corresponding menus (KP, TN, TV) when the function is executed.<br><br>The KP, TN, TV menus are located in the **Configuration area** Process controller → PARAMETERS → PID.PARAMETER and can be readjusted there if necessary.<br><br>**Explanation of PID controller:**<br>Control valves with process control function possess an integrated PID process controller. Any process variable, such as flow rate, temperature, pressure etc. can be controlled by connecting a corresponding sensor.<br><br>In order to obtain good control behaviour, the PID controller must be adapted to the characteristics of the process (control loop). This task requires regulation technology experience and measuring aids, and is time-consuming.<br>With the P.TUNE function, the PID controller integrated in the process controller can automatically be parametrised. |
| P.LIN | Automatic linearisation of the process characteristic.<br><br>The linearisation of the process characteristic is only necessary if process characteristic varies substantially from linearity. Linearisation using the function P.LIN can take a lot of time with slow processes.<br>**Note:** The characteristics are entered in the Charact table date. |

*Table8: Menus - MAINTENANCE for process controllers*

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## 2.4 Menus in industrial communication configuration section

The industrial communication configuration area is only available in devices with the gateway option.

| PARAMETERS for industrial communication | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Protocol | Select protocol for communication.<br>The following are available for selection: PROFINET, EtherNet/IP, Modbus TCP. |
| DNS compatible name | Set DNS compatible name.<br>The menu is only available in PROFINET. |
| MAC address | Indicates the MAC address. |
| Fixed IP address | Set IP address. |
| Network mask | Set network mask. |
| Standard gateway | Set standard gateway. |
| Temporary IP address | Set temporary IP address. |
| Unit conversion | Set physical units. |
| Advanced settings | Menu for advanced settings. |
| IP settings | Settings for EtherNet/IP.<br>The menu is only available in EtherNet/IP. |
| Internal cycle time | Set internal cycle time. |
| Communication timeout | Set:<br>- Time limitation (timespan before a procedure is interrupted due to an error).<br>- Timeout (timespan until a faulty procedure, the error itself is triggered). |
| Edit values to be hidden | Edit values to be hidden. |
| Reset hidden values | Reset hidden values. |
| Firmware update protocol | Indicates the protocol for firmware update. |
| Reset devices | Reset devices.<br>The following are available for selection:<br>Restart<br>Hardware reset of industrial communication<br>Restore XML data |

*Table9: Menus - PARAMETERS for industrial communication*

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| MAINTENANCE for industrial communication | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Version number | Indicates the communication stack.<br>The following are displayed: |
| | Stack name |
| | Stack version |
| | Stack build |
| | Stack revision |
| | Stack date |
| | ICom version |

*Table10: Menus - MAINTENANCE for industrial communication*

| DIAGNOSTICS for industrial communication | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Protocol | Indicates the protocol. |
| Established connections to PLC | Set connection to the PLC. |
| Communication status | Indicates the communication status. |
| Advanced | More displays. |
| Last status code | Indicates the last status code. |

*Table11: Menus - DIAGNOSTICS for industrial communication*

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## 2.5 Menus in the display configuration area

The display configuration area is only available in devices with display (option).

| PARAMETERS for display | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Brightness | Set brightness for the device display. |
| Contrast | Set contrasts for the device display. |
| Screen saver | Set screen saver for the device display. |
| Wait period | Set wait period between operation and enabling of the screen saver for the device display.<br>Factory setting: 1 minute. |
| Brightness | Set brightness of the screen saver for the device display. |

*Table12: Menus - PARAMETERS for display*

| MAINTENANCE for display | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Version numbers | Indicates the version numbers of the device display. |
| Software version | Indicates the software version of the device display. |
| Hardware version | Indicates the hardware version of the device display. |
| Identification number | Indicates the identification number for the device display. |
| Software identification number | Indicates the software identification number for the device display. |
| Serial number | Indicates the serial number for the device display. |

*Table13: Menus - MAINTENANCE for display*

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## 2.6 Menus in the general settings configuration area

| PARAMETERS for general settings | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| Status LED | For a description, see chapter “6.1 Status LED - setting LED for device status display” on page 60. |
| Mode | Set LED operation mode for displaying device states.<br>The following LED modes can be selected:<br>• NAMUR mode<br>• Valve mode<br>• Valve mode + warnings<br>• LED off. |
| Valve open | Select LED colour for “valve open” device status display. The colours yellow and green are available for selection.<br>The menu is only available when the valve mode or the valve mode + warnings have been selected. |
| Valve closed | Select LED colour for “valve open” device status display. The colours yellow and green are available for selection.<br>The menu is only available when the valve mode or the valve mode + warnings have been selected. |
| büS | Parameterisation of the device as a büS participant. |
| Displayed name | Issue name under which the device is displayed. |
| Location | Specify location to be shown for the device. |
| Description | The input window can be used to describe the device or for additional information on the device.<br>No entry required. |
| Advanced | Further settings for the device as participant of a network. |
| Unique device name | Assign communication ID for communication in the network.<br>If the communication ID is changed, the assigned partnership with another participant is lost. |
| Baud rate | Set transmission speed for the device as a büS participant or CANopen participant. |
| büS address | Assign address under which the device is operated as a büS participant or CANopen participant. |
| Bus mode | Select CANopen or büS communication protocol. |

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| PARAMETERS for general settings | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| CANopen status | Define the communication status for the device:<br>The participant can be communicated with via SDOs. PDO communication is not possible.<br>Operational: the participant can independently send and receive process data.<br>The menu is only available when selecting the CANopen communication protocol. |
| Deallocation delay | Time from the loss of a partner to deletion of its configuration. |
| Alarm limits | Indicates and sets the limits that, when exceeded or not reached, cause the device to trigger an error alert or warning.<br>The limits for issuing an error message can only be read, not set. |
| Supply voltage<br>Actuator supply voltage | Indicates and sets the limits for supply voltage. |
| Error above | Indicates the limit for supply voltage, the exceedance of which triggers an error alert from the device. Note hysteresis! |
| Error below | Indicates the limit for supply voltage, the failure to meet which triggers an error alert from the device. Note hysteresis! |
| Warning above | Set the limit for the supply voltage, the exceedance of which triggers a warning from the device. Note hysteresis! |
| Warning below | Indicates the limit for the supply voltage, the failure to meet which triggers an error alert from the device. Note hysteresis! |
| Hysteresis | Set the hysteresis for the limit values of the supply voltage.<br>The hysteresis is centrally assigned to the limit.<br>Example:<br>Warning above 26 V<br>Hysteresis 0.4 V<br>The warning is triggered at a supply voltage >26.2 V and cancelled again at a supply voltage <25.8 V. |
| Device temperature | Indicates and sets the limits for device temperature. |
| Error above | Indicates the limit for device temperature, the exceedance of which triggers an error alert from the device. Note hysteresis! |
| Error below | Indicates the limit for device temperature, the failure to meet which triggers a warning from the device. Note hysteresis! |
| Warning above | Set the limit for the device temperature, the exceedance of which triggers a warning from the device. Note hysteresis! |
| Warning below | Indicates the limit for the device temperature, the failure to meet which triggers a warning from the device. Note hysteresis! |

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| PARAMETERS for general settings | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| Hysteresis | Set the hysteresis for the device temperature limits.<br>The hysteresis is centrally assigned to the limit.<br>Example:<br>Warning above 80°C<br>Hysteresis 4°C<br>The warning is issued for a device temperature >82 °C and is cancelled with a device temperature <78 °C. |
| Quickstart | Menu for the initial start-up of the display, setting the language and unit system.<br>The menu is automatically retrieved during the initial start-up of the display. The settings made are labelled with a tick.<br>This menu is not available in the Bürkert Communicator PC software. |
| Display | Set displays for initial start-up.<br>Select language: English, German, French.<br>Select unit system: metric, imperial, Anglo-American (U.S.). |
| Diagnostics | Menu for enabling and deactivating the diagnostics function. |
| Active | Diagnostics function enabled:<br>• Device status and valve settings are displayed depending on the LED mode set on the LED illuminated ring.<br>• Error messages are entered in the logbook.<br>Setting LED mode: see chapter “6.1 Status LED - setting LED for device status display” on page 60 |
| Inactive | Diagnostics function disabled:<br>• No display of device status on LED illuminated ring and no entry of error messages in the logbook.<br>• The valve settlings are displayed on the LED illuminated ring, even when the diagnostics function is disabled, depending on the LED mode set. Setting LED mode: see chapter “6.1 Status LED - setting LED for device status display” on page 60.<br>• The safety position is approached by the actuator, even if the diagnostic function is disabled, depending on the menu setting, during an internal or external error, cable break or supply voltage failure. Set safety position, see chapter “3.2 SAFEPOS - setting safety position and energy storage system” on page 34. |
| Language | Set language for the menu texts.<br>English, German, French.<br>The setting with the Bürkert Communicator PC software is made in the menu bar Options → Language. |

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| PARAMETERS for general settings | |
|---|---|
| **Levels 1, 2 and 3** | **Description** |
| Passwords | For a description, see chapter "6.2 Passwords - enabling and disabling password protection" on page 63.<br>The setting with the Bürkert Communicator PC software is made in the menu bar Options → Password Manager. |
| Physic. units | Define the physical units used for displaying the physical size values.<br>The setting with the Bürkert Communicator PC software is made in the menu bar View → Unit system. |
| Configuration client | Backup of device configuration in an external device (only available if no SIM card is plugged in). |
| Mode | Defines whether the configuration will be managed by another device in the büS network. |
| Change operation mode | Change the current operation mode |

*Table14: Menus - PARAMETERS for general settings*

| DIAGNOSTICS for general settings | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Device status | Information on the device status. |
| Operating duration | Indicates the operating duration over the entire life cycle of the device. |
| Device temperature | Indicates the device temperature. |
| Supply voltage | Indicates the supply voltage. |
| Min./Max. values | Indicates the minimum and maximum measured values for device temperature and supply voltage. |
| Removable storage status | Indicates if SIM card available. |
| büS status | Information on the büS network. |
| Receive errors | Indicates present receive errors. |
| Receive errors max. | Indicates all past and current receive errors. |
| Transmit errors | Indicates present transmit errors. |
| Transmit errors max. | Indicates all past and current transmit errors. |
| CANopen status | Information on device's state of communication as büS network participant. Pre-operational or operational. |
| Logbook | Menu for displaying and managing logbook entries. |
| Configuration client | Backup of device configuration in an external device (only available if no SIM card is plugged in). |

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| DIAGNOSTICS for general settings | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Transferable memory status | Current status of the configuration client |
| Status | Detailed status of the configuration client Indicates when a SIM card is plugged in. |
| Reconfiguration counter | |

*Table15: Menus - DIAGNOSTICS for general settings*

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| MAINTENANCE for general settings | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Device information | Indicates device-specific data. |
| Displayed name | Indicates the name entered for the device.<br>The name is entered in the configuration area General settings → Parameters in the menu büS → Displayed name. |
| Identification number | Indicates the identification number of the device. |
| Serial number | Indicates the serial number of the device. |
| Software identification number | Indicates the identification number of the software used in the device. |
| Software version | Indicates the version of the software used in the device. |
| büS version | Indicates the büS version of the device. |
| Hardware version | Indicates the hardware version of the device. |
| Product type | Indicates the type designation of the device. |
| Manufacture date | Indicates the date on which the device was manufactured. |
| eds version | Indicates the eds version. |
| Device driver | Information on the driver of the device.<br>This menu is only available in the Bürkert Communicator PC software. |
| Reset device | Menu for resetting and restarting the device. |
| Restart | Restart the device.<br>A voltage reset is performed during the device reboot. The configuration and parameterisation settings for the device remain after the reboot. |
| Factory reset | Reset the device to factory setting.<br>When performing a factory reset, the corresponding settings defined for the device are overwritten by the default values. |
| Simulation | For a description, see chapter “6.3 Simulation - simulate device functions” on page 64. |
| SIGNAL GENERATOR | Menu for the simulation of the set-point value. |
| PROCESS SIMULATION | Menu for the simulation of the process and process valve. |
| AUTO/MANU | Toggle AUTOMATIC and MANUAL operating states. |
| Manual mode | Indicates the current valve position and measured values.<br>The menu is only available in devices with display module and if the Manual mode operating state is selected in the AUTO/MANU menu. |

*Table16: Menus - MAINTENANCE for general settings*

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## 2.7 Context menu for operation on display

The context menu is only available on the device display in the operating structure shown.

**Opening the context menu:** Hold down menu button

The type and scope of the context menu depend on whether it is opened in the views area or the configuration area.

In the Bürkert Communicator PC software, the partially identical menus are integrated differently into the operating structure.

**A detailed description of the Bürkert Communicator PC software can be found in the respective operating instructions.**

| **Context menu in views area** (only available during operation on device display) | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Message overview | Indicates existing messages.<br>To display all the text of a message, select the message with the arrow key and open with the menu button. |
| Add new view | Create new views. |
| Delete this view | Delete current view. |
| Change layout | Set or change layout for the views.<br>6 different layouts are available for selection. |
| 1 value | Layout for the display of 1 measured value. |
| 2 values | Layout for the display of 2 measured values. |
| 4 values | Layout for the display of 4 measured values. |
| Trend | Layout for displaying the process progression as a graphic curve. |
| Trend with 2 values | Layout for displaying 2 measured values and with the process progression as a graphic curve. |
| Process control | **Preset layout by the factory for the home screen.**<br>This layout shows the position of the valve as a value and graphically via an icon for the position indicator.<br>The icons for changing the operating state to AUTOMATIC and MANUAL, and for closing and opening the valve, are also displayed. |
| Change title | Change title of views.<br>The title of the view is displayed in the information bar above the view. |
| Change value | Set which measured values will be displayed in the views.<br>In the Process Control layout, the view of the measured values cannot be changed. |

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| Context menu in views area<br>(only available during operation on device display) | | |
|---|---|---|
| **Levels 1 and 2** | **Description** | |
| Change unit | Set the physical units to be used for displaying the measured values in the views.<br>In the Process Control layout, the physical unit in which the measured values are displayed cannot be changed. | |
| Change decimal places | Set decimal places for displaying the measured values.<br>This setting is only possible for the 1 value, 2 values and 4 values layouts. | |
| Change user level | Menu for changing the user level.<br>There are 3 user levels for assigning access rights, for which password protection is assigned.<br>The 3 user levels are: | |
| | Advanced user | Rights: reading values, limited right to change values.<br>Factory setting: password protection not enabled. |
| | Installer | Rights: reading values, expanded right to change values.<br>Factory setting: password protection not enabled. |
| | Bürkert | Only for Bürkert employees.<br>Factory setting: password protection enabled. |
| | See also chapter "6.2 Passwords - enabling and disabling password protection" on page 63. | |

*Table17: Menus - context menu in views area*

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| Context menu in configuration area<br>(only available during operation on device display) | |
|---|---|
| **Levels 1 and 2** | **Description** |
| Message overview | Indicates existing messages.<br>To display all the text of a message, select the message with the arrow key and open with the menu button. |
| Help | Indicates context-related help texts.<br>Help is only available for the configuration areas Positioner, Position Controller and Inputs/Outputs. |
| Set shortcut | Create shortcut to a menu.<br>If a shortcut is created for a menu, the menu can be opened directly in the context menu.<br>Create shortcut.<br>Enter a name with the arrow key and menu button on the displayed character table and confirm with OK.<br>For the shortcut, the menu is listed under the name that was entered as the last menu option in the context menu. |
| Where am I? | The path where the menu is located in the operating structure is displayed. |
| Change user level | Menu for changing the user level.<br>There are 3 user levels for assigning access rights, for which password protection is assigned.<br>The 3 user levels are:<br>**Advanced user**: Rights: reading values, limited right to change values. Factory setting: password protection not enabled.<br>**Installer**: Rights: reading values, expanded right to change values. Factory setting: password protection not enabled.<br>**Bürkert**: Only for Bürkert employees. Factory setting: password protection enabled.<br>See also chapter "6.2 Passwords - enabling and disabling password protection" on page 63 |

*Table18: Menus - context menu in configuration area*

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# 3 POSITIONER MENUS

Menus in the Positioner configuration area are described in this chapter.

## 3.1 X.CONTROL - parameterisation of position control

The parameters for position control can be readjusted in this menu. Only make readjustments if this is required for the task in question.

### 3.1.1 DBND - insensitivity range of the position control

**Configuration area:** Positioner → **Menu:** X.CONTROL

**Required access rights for settings in menu:** advanced user

**Factory setting:** 0.5%

**Functional dependencies:**

| Menu | Function |
|---|---|
| X.LIMIT | Limitation of mechanical stroke range |

The effect of this function is that the control valve only responds after a set control difference, protecting the valve body and the actuator.

The insensitivity range (dead band) is stated in % and is related to the scaled stroke range that can be limited in the X.LIMIT menu.
(see chapter “3.9 X.LIMIT - mechanical stroke limit” on page 48 ).

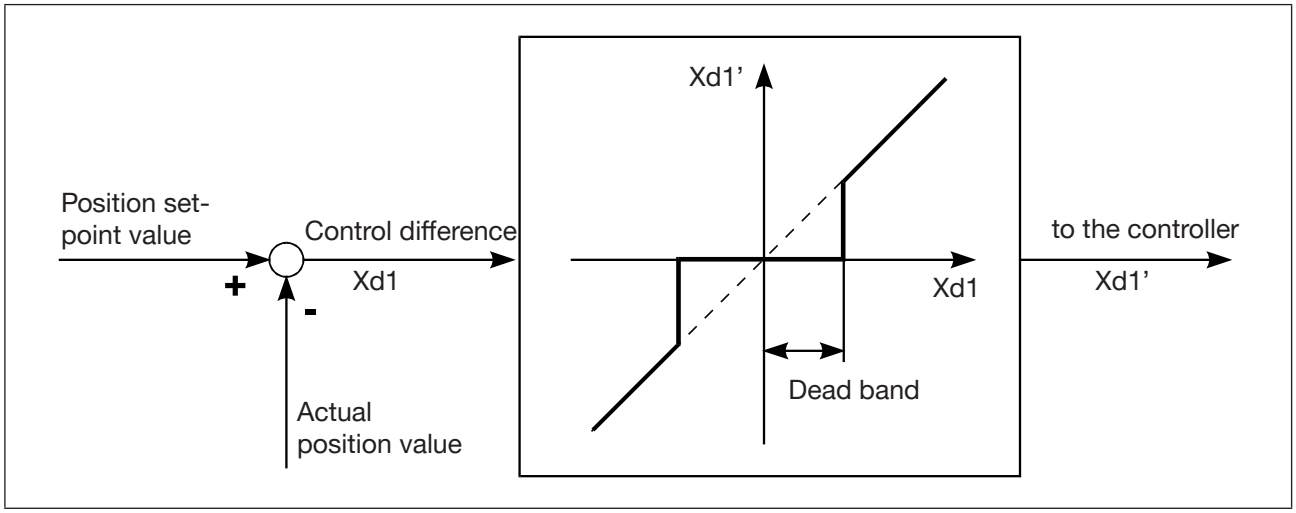


*Image 1: Diagram, insensitivity range*

### 3.1.2 ACCELERATION - control speed acceleration (for AG2 only)

**Configuration area:** Positioner → **Menu:** X.CONTROL

**Required access rights for settings in menu:** advanced user

**Factory setting:** medium

Three different levels can be selected for acceleration when starting and braking the actuator: Slow, Medium, Fast.

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A slow acceleration protects the actuator train, the result of this is a longer actuating time.

**Slow**: For gentle starting or braking, where the actuator train is mechanically and electrically protected.

**Medium**: Good compromise between actuating time and protective starting and braking.

**Fast**: Shortest actuating time.

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## 3.2 SAFEPOS - setting safety position and energy storage system

The safety position for the valve is set in this menu, and the energy storage system enabled or disabled.

### 3.2.1 FUNCTION - select safety position

**Configuration area:** Positioner → **Menu:** SAFEPOS

**Required access rights for settings in menu:** advanced user

**Factory setting:** Close

**Functional dependencies:**

| Menu | Function |
|---|---|
| SP/CMD/PV<br>Signal loss detection | Setting device behaviour in the event of a cable break |
| DIGITAL IN | Parameterisation of digital input |
| - | Option: SAFEPOS energy-pack energy storage system |

The safety position that the valve assumes during the following events is selected in this menu:

- Internal error
- Cable break if parameterised accordingly.
  Setting in Inputs/Outputs → SP/ CMD/PV → Signal loss detection
- External error (digital input) if parameterised accordingly.
  Setting in Inputs/Outputs → ADDITIONAL IOs → DIGITAL IN
- Supply voltage failure (optional). This function is only available for devices that have the optional SAFEPOS energy-pack energy storage system.

**The following safety positions are available for selection:**

| Selection | Impact on safety position |
|---|---|
| Close | Valve closed |
| Open | Valve open |
| User-defined | freely defined safety position input by a per cent value<br>(0% = closed, 100% = open). |
| Inactive | Valve remains in an undefined position in the event of a supply voltage failure. |

*Table19: Selecting the safety position*

**The safety position is only approached in the AUTOMATIC operating state.**

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### 3.2.2 Position - set user-specific safety position

**Configuration area: Positioner → Menu: SAFEPOS**

**Required access rights for settings in menu: advanced user**

**Functional dependencies:**

| Menu | Function |
|---|---|
| FUNCTION | Select User-Defined |

The user-specific safety position is set in per cent in this submenu (0% = closed, 100% = open).

The Position is only available if the safety position User-Defined is selected in the FUNCTION menu.

### 3.2.3 ENERGY-PACK - energy storage system functions

**Configuration area: Positioner**

**Required access rights for settings in menu: advanced user**

**Factory setting: function Immediate control, Self-diagnostics Error**

**Dependencies: only available in devices with the SAFEPOS energy-pack energy storage system option.**

The function of the energy storage system is set in this menu.

The energy storage system acts as an emergency voltage supply in order to move the valve to the selected safety position in the event of a power failure. The energy storage system must be dimensioned so that the actuator can move into the selected safety position from any position during the nominal load. Operation with the energy storage system is displayed on the display with an icon.

**Settings and information for energy storage system: configuration area: Positioner →**

| Function description | Path to menu | |
|---|---|---|
| | Tab → | Menu |
| Enabling and disabling the energy storage system. | PARAMETER → | SAFEPOS → ENERGY-PACK → Function On \| Off |
| Actuator behaviour during a restart.[3] | PARAMETER → | SAFEPOS → ENERGY-PACK → FUNCTION |
| Information on state of health (SOH) of the energy storage system.[3] | PARAMETER → | SAFEPOS → ENERGY-PACK → State of health |
| | DIAGNOSE → | ENERGY-PACK → State of health |
| If the immediate start is set for the actuator behaviour during a restart, select the device for the energy storage system failure (SOH 0%).[4] | DIAGNOSE → | ENERGY-PACK → NAMUR state |

[3] The menu is only displayed when the energy storage system is enabled.

[4] The menu is only displayed when the energy storage system is enabled, and if PARAMETER → SAFEPOS → ENERGY-PACK → FUNCTION → Immediate control has been selected.

*Table20: Settings and information for energy storage system*

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### 3.2.3.1. Settings in PARAMETER – SAFEPOS – ENERGY-PACK

**Function On | Off - enabling and disabling the energy storage system function**

The function of the energy storage system is enabled or disabled in this menu.

- On The function of the energy storage system is enabled depending on the status of the energy storage system and the device status, messages are issued (see “Table22: Status messages on the energy storage system” on page 38).
  The actuator moves to the safety position when the Error status message appears.
- Off The function of the energy storage system is disabled. No messages about the status of the energy storage system are issued. The actuator does not move to the safety position if the energy storage system fails (SOH 0%).

**WARNING!**

**Danger from an uncontrolled process when the energy storage system function is disabled.**

Moving to the safety position in the event of a power failure is not guaranteed if the energy storage system function is disabled.

▸ If the valve position is relevant for safety reasons, do not disable the energy storage system function.

**FUNCTION - set actuator behaviour during a restart.**

The behaviour during a restart is set in this menu for devices with energy storage systems.

- Immediate control: The device immediately starts in the AUTOMATIC operating state during a restart. Moving to the safety position is not guaranteed if the power supply is disrupted shortly afterwards.
- Control if ready: During a restart, the device only starts in the AUTOMATIC operating state if the energy storage system is ready to safely move the actuator to its safety position.

**State of health - information on the state of health (SOH) of the energy storage system**

The state of health (SOH) of the energy storage system is displayed in this menu.
The state of health describes the ageing condition of the cells. A criterion for this is which loading quantity the cells can still pick up. The ability to pick things up decreases as the service life increases, and depends on usage conditions.

SOH 100%: equivalent to new condition

SOH 0%: the loading quantity is too low to move the actuator to the safety position.

**The FUNCTION and State of health menu is only displayed when the energy storage system is enabled.**

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### 3.2.3.2. Settings in DIAGNOSTICS – ENERGY-PACK

**The menu is only displayed when the energy storage system is enabled.**

**State of health - information on the state of health (SOH) of the energy storage system.**

The state of health (SOH) of the energy storage system is displayed in this menu.

**NAMUR state - select device status for the failure of the energy storage system.**

The behaviour of the device during an energy storage system failure (SOH 0%) is set in this menu, depending on the status message.

**The following device statuses can be selected:**

| Status message | Impact on the behaviour of the device |
|---|---|
| Error | When the loading quantity of the energy storage system is too low (SOH 0%), the actuator moves to the safety position. The device can only then be operated if the energy storage system is replaced. |
| Out of specification | If the loading quantity of the energy storage system is too low (SOH 0%), the status “out of specification” is displayed. A message is triggered. The device can still be operated despite the failure of the energy storage system. |

*Table21: Select device status for self-diagnostics of energy storage system*

**If the self-diagnostics of the energy storage system has been converted, a device restart is required.**

**Possible status messages for the energy storage system when the diagnostic function is enabled:**

| Status messages according to NAMUR | Dependencies | |
|---|---|---|
| | Energy storage system status | Setting in the menu |
| Failure, error or fault | State of health: SOH 0 %<br>Loading quantity too low. The device moves to the safety position and can only then be operated if the energy storage system is replaced. | PARAMETER → SAFEPOS → ENERGY-PACK → FUNCTION → Control if ready |
| | | DIAGNOSE → ENERGY-PACK → NAMUR state → Error |
| Out of specification | State of health: SOH 0 %<br>Loading quantity too low. The device can still be operated despite the failure of the energy storage system. | PARAMETER → SAFEPOS → ENERGY-PACK → FUNCTION → Immediate control |
| | | DIAGNOSE → ENERGY-PACK → NAMUR state → Out of specification |
| Maintenance | State of health: SOH lower internal warning limit<br>The capacity is greatly reduced. The energy storage system needs to be replaced soon. | - |

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| Status messages according to NAMUR | Dependencies | |
|---|---|---|
| | Energy storage system status | Setting in the menu |
| Function check | This status is displayed after the device has restarted. The energy storage system is not ready yet.<br>The device starts operation when the emergency voltage supply is guaranteed by the energy storage system. | PARAMETER → SAFEPOS → ENERGY-PACK → FUNCTION → Control if ready |

*Table22: Status messages on the energy storage system*

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## 3.3 DIAPHRAGM - diaphragm valve settings

The sealing force of the diaphragm armature is set in this menu, as is the parameter for the M.Q0.TUNE function in devices with process control.

The sealing force is determined by automatically executing the M.Q0.TUNE function. Manual adjustment is only required when the valve does not close tightly.

### 3.3.1 Cutoff force - sealing force

**Configuration area: Positioner → Menu: DIAPHRAGM**

**Required access rights for settings in the menu: Installer**

**Dependencies: only available for diaphragm control valves**

The force that is required in the AUTOMATIC operating state, in order to close the valve tightly, is specified in this menu. The required force depends on operating conditions such as temperature, medium pressure etc.

The sealing force can automatically be determined with the M.Q0.TUNE function (see "3.3.4 M.Q0.TUNE - parameter of M.Q0.TUNE function").

### 3.3.2 Additional force - amplification of sealing force

**Configuration area: Positioner → Menu: DIAPHRAGM**

**Required access rights for settings in menu: Installer**

**Factory setting: 300 N**

**Dependencies: only available for diaphragm control valves**

If the valve does not close tightly enough, the set sealing force (cutoff force) can be amplified in the Additional force menu.

**NOTE!**

**Damage or premature wear of diaphragm if sealing force is too high.**

- The sealing force with amplification (cutoff force + additional force) cannot be greater than the maximum sealing force (maximum force).

### 3.3.3 Maximum force - maximum sealing force

**Configuration area: Positioner → Menu: DIAPHRAGM**

**Required access rights for settings in the menu: Installer**

**Dependencies: only available for diaphragm control valves**

The maximum force at which the closing of the valve can impact the diaphragm is set in this menu. The maximum sealing force is relevant when closing the valve in MANUAL operating state and when executing the M.Q0.TUNE function.

The maximum sealing force is determined by automatically executing the M.Q0.TUNE function.

Only set the maximum sealing force manually in the following cases:
- Cancellation of M.Q0.TUNE
- Valve no longer closes tightly, due to wear.

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### 3.3.4 M.Q0.TUNE - parameter of M.Q0.TUNE function

**Configuration area: Positioner → Menu: DIAPHRAGM**

**Required access rights for settings in the menu: Installer**

**Dependencies: only available in diaphragm control valves and devices with process control function.**

The parameters for executing the M.Q0.TUNE function can be changed in this menu. With the M.Q0.TUNE function, the position control is adjusted at the physical stroke of the actuator in use and the required sealing force is determined.

The basis for calculating the sealing force is the seal closure point, which is manually approached when executing M.Q0.TUNE. Alternatively, the seal closure point can be determined via the process actual value in devices with process control function (PV limit submenu). The optimum force for sealing is calculated with an algorithm.

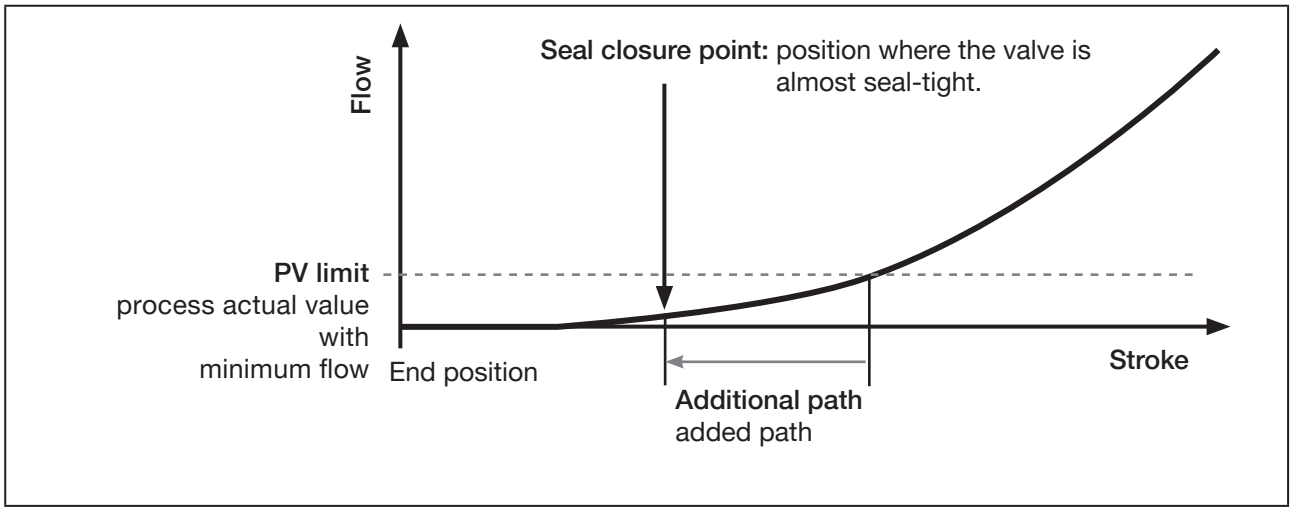


*Table23: Sealing function parameters*

**Additional path - to set the additional path seal closure point:**

**Factory setting: depends on diaphragm size/nominal diameter of the valve**

**PV limit - set process actual value with minimum flow:**

**Factory setting: 1%**

**PV time - set time constant for the process**

**Factory setting: 0.5 s**

### 3.3.5 M.CLEAN - set cleaning function period time

**Configuration area: Positioner → Menu: DIAPHRAGM**

**Required access rights for settings in menu: Bürkert service**

**Factory setting: 5 s**

**Dependencies: only available for diaphragm control valves**

The period time for the cleaning function is set in this menu. During the cleaning function, the valve continuously changes between the 80% and 100% open positions. This means that all parts in contact with media are accessible for cleaning during the flushing process.

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## 3.4 ADD.FUNCTION - enabling and disabling auxiliary functions

**Configuration area:** Positioner

**Required access rights for settings in menu: installer**

**Factory setting: no auxiliary function enabled**

The device has auxiliary functions for more demanding control tasks. The auxiliary functions can be enabled and disabled in the ADD.FUNCTION menu.

Auxiliary functions that are not enabled are hidden in the 1st level of the parameters configuration area. Enabled auxiliary functions are displayed in the 1st level of the parameters configuration area and can be configured there.

The auxiliary function becomes ineffective when disabled. The settings previously made under this auxiliary function remain in place even after disabling.

**Enabling auxiliary functions in**  **Positioner** configuration area:

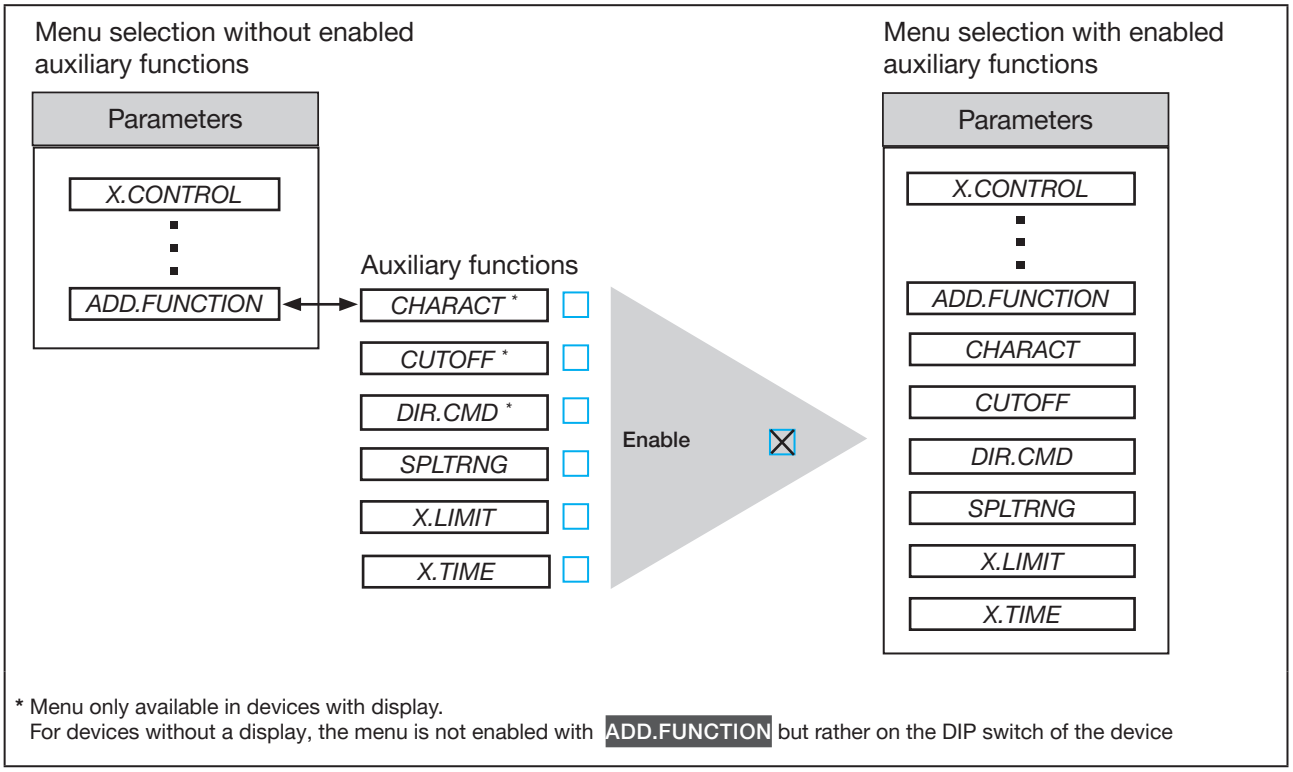


*Image 2: Enabling the auxiliary functions*

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## 3.5 CHARACT - configure correction characteristic

**Configuration area: Positioner**

**Factory setting: correction characteristic disabled.**

The correction characteristic with which the flow characteristic and operating characteristic are corrected, depending on the set-point position (CMD) and valve stroke (POS), is configured in this menu.

When the correction characteristic is enabled, the flow characteristic or operating characteristic is corrected depending on the set-point position (CMD) and valve stroke (POS).

**Flow characteristic:**
The flow characteristic $k_V = f(s)$ indicates the flow rate of a valve, expressed by the $k_V$ value, as a function of the stroke s of the actuator spindle. The flow characteristic is determined by the shape of the valve body, the valve plug and the diaphragm. Two types of flow characteristics are generally realised: the linear and the equal percentage.

With linear characteristics, equal stroke changes are apportioned the same $k_V$ value changes $dk_V$.

$$(dk_V = n_{lin} \cdot ds).$$

With equal percentage characteristics, a change in stroke ds corresponds to an equal percentage change in the $k_V$ value.

$$(dk_V/k_V = n_{equiper} \cdot ds).$$

**Operating characteristic:**
The operating characteristic Q = f(s) shows the relationship between the volume flow Q in the installed valve and the stroke s. The properties of the pipes, pumps and consumers are included in this characteristic. The operating characteristic therefore has a different shape than the flow characteristic.

For positioning applications of controllers, special requirements are often placed on the operating characteristic, e.g. linearity. For this reason, it is occasionally necessary to correct the operating characteristic in an appropriate manner. The control valve therefore has a transmission element that performs various characteristics. These characteristics are used to correct the operating characteristic.

Equal percentage characteristics 1:25, 1:33, 1:50, 25:1, 33:1 and 50:1 as well as a linear characteristic can be set. In addition, it is possible to programme a user-defined characteristic by entering supporting points.

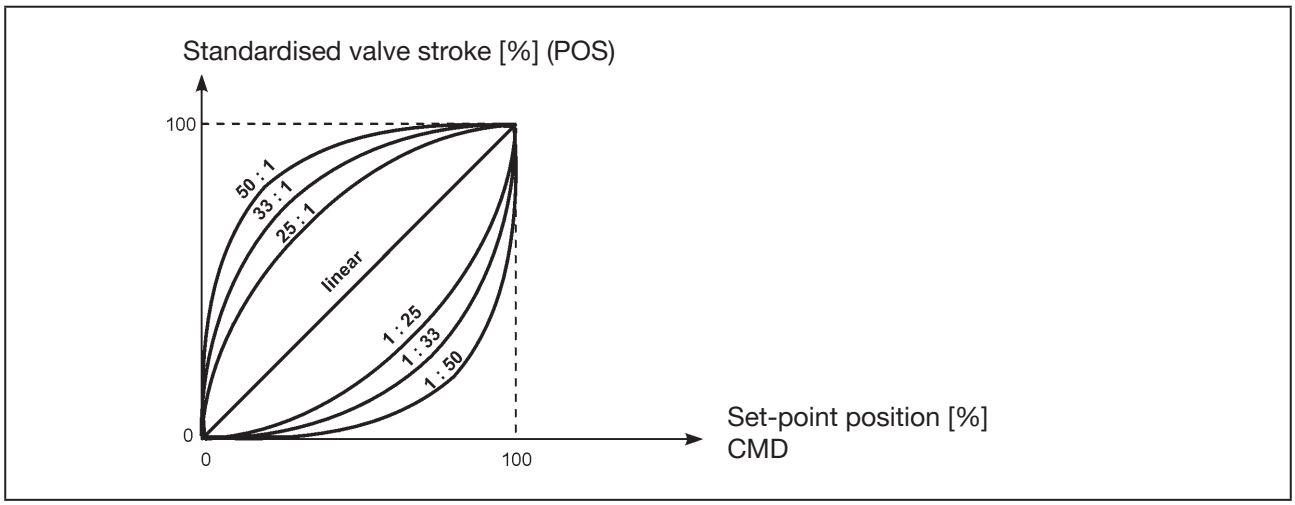


*Image 3: Characteristics*

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### 3.5.1 TYPE - correction characteristic selection

**Configuration area: Positioner → Menu: CHARACT**

**Required access rights for settings in menu: advanced user**

**Factory setting: linear**

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the CHARACT auxiliary function |
| | For devices without display: enabling the CHARACT auxiliary function on the DIP switch of the device. |

The correction characteristic with which the flow characteristic and operating characteristic are corrected, depending on the set-point position (CMD) and valve stroke (POS), is selected in this menu.

The correction characteristic is selected in the Bürkert Communication PC software for devices without a display.

**Correction characteristics available for selection:**

| Menu designation | Description of characteristic |
|---|---|
| Linear | Linear correction characteristic |
| GP 1:25 | Equal percentage correction characteristics |
| GP 1:33 | |
| GP 1:50 | |
| GP 25:1 | |
| GP 33:1 | |
| GP 50:1 | |
| User-defined | User-defined correction characteristic, freely programmable via supporting points |

*Table24: Correction characteristic selection*

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### 3.5.2 TABLE DATA - programme user-defined correction characteristic

**Configuration area:** Positioner → **Menu:** CHARACT

**Required access rights for settings in menu: advanced user**

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the CHARACT auxiliary function. |
| | For devices without display: enabling the CHARACT auxiliary function on the DIP switch of the device. |
| CHARACT | Select the User-Defined correction characteristic in the TYPE submenu. |

The correction characteristic with which the flow characteristic and operating characteristic are corrected, depending on the set-point position (CMD) and valve stroke (POS), is programmed specifically for the user in this menu.

The correction characteristic is corrected in the Bürkert Communicator PC software for devices without a display.

**Programming:** During programming, the supporting points that divide the stroke into 5 per cent steps are assigned a position set-point value via the standard signal (CMD). The programmed correction characteristic is displayed as a graph in the display or in the Bürkert Communicator PC software.

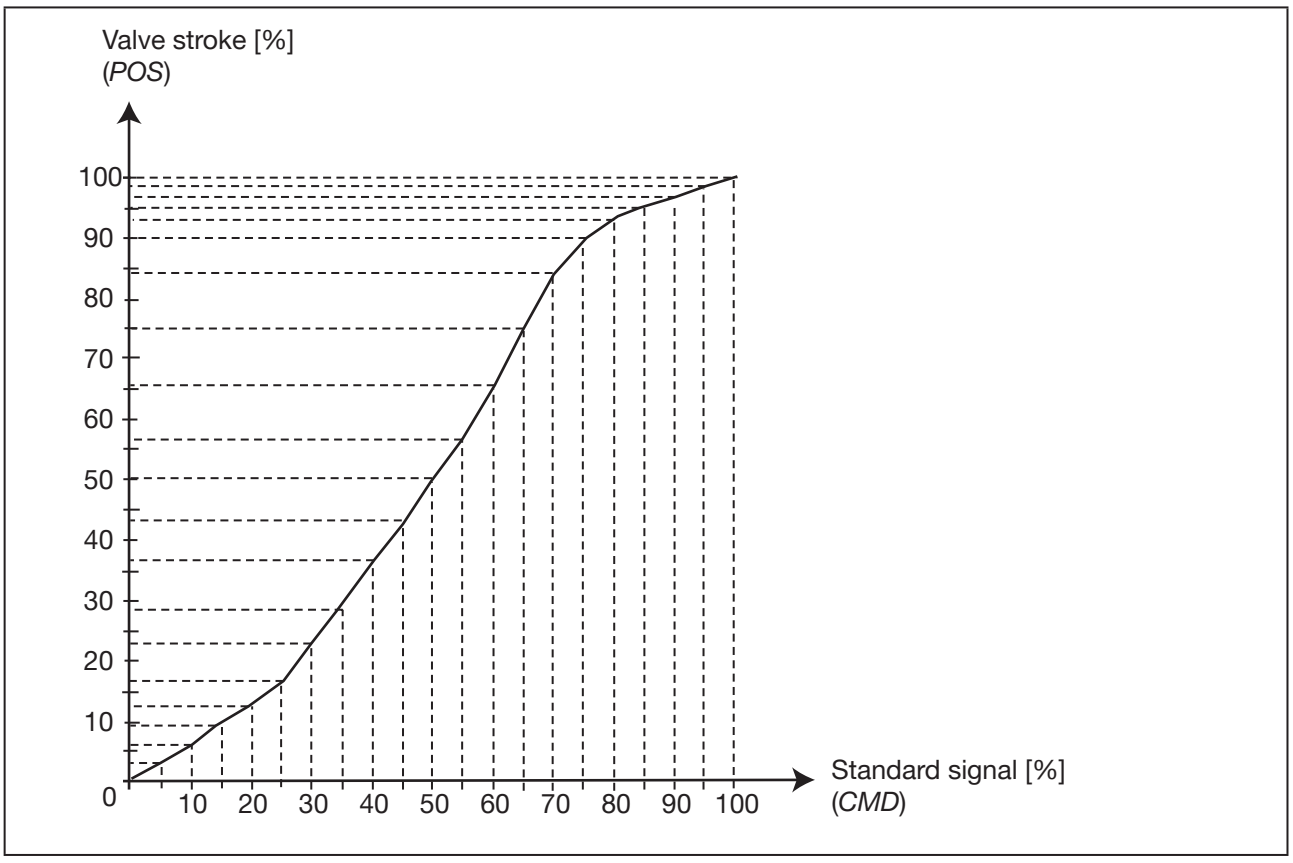


*Image 4: Example of a programmed correction characteristic*

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## 3.6 CUTOFF - configuring the sealing function

Configuration area: Positioner

Required access rights for settings in menu: advanced user

Factory setting: sealing function disabled.

Functional dependencies:

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the CUTOFF auxiliary function |
| | For devices without display: enabling the CUTOFF auxiliary function on the DIP switch of the device. |

The sealing function is configured in this menu. This function causes the valve to seal or open completely within the set range.

The parameters for the sealing or opening of the valve (CMD) is stated in per cent. The transfer from sealing or opening to closed-loop control mode occurs with a hysteresis of 1%.

For devices with process control function, there is an option for the sealing function to be related to the process set-point value or the position set-point value.

### 3.6.1 CUTOFF.type - select source for the sealing function input signal

Configuration area: Positioner → Menu: CUTOFF

Required access rights for settings in menu: advanced user

Factory setting: X.CO, position set-point value

Functional dependencies: only available in devices with process control function.

The source for the sealing function input signal is defined in this menu.

The sealing function limits for the scaling range of the process set-point value are given in per cent.

Lower limit - enter the lower limit for the sealing function

Factory setting: 1% (0...25%)

Upper limit - enter the upper limit for the sealing function

Factory setting: 100% (75...100%)

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## 3.7 DIR.CMD - change the effective direction of the standard signal for the valve position

**Configuration area:** Positioner

**Required access rights for settings in menu:** advanced user

**Factory setting:** Rise, positive effective direction

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the DIR.CMD auxiliary function |
| | For devices without display: enabling the DIR.CMD auxiliary function on the DIP switch of the device. |

The effective direction of the standard signal in relation to the valve position is changed in this menu.

**Meaning of the setting:**

Rise: The position 0% (valve closed) is actuated with the standard signal 0 V, 0 mA or 4 mA.

Fall: The position 0% (valve closed) is actuated with the standard signal 5 V, 10 V or 20 mA.

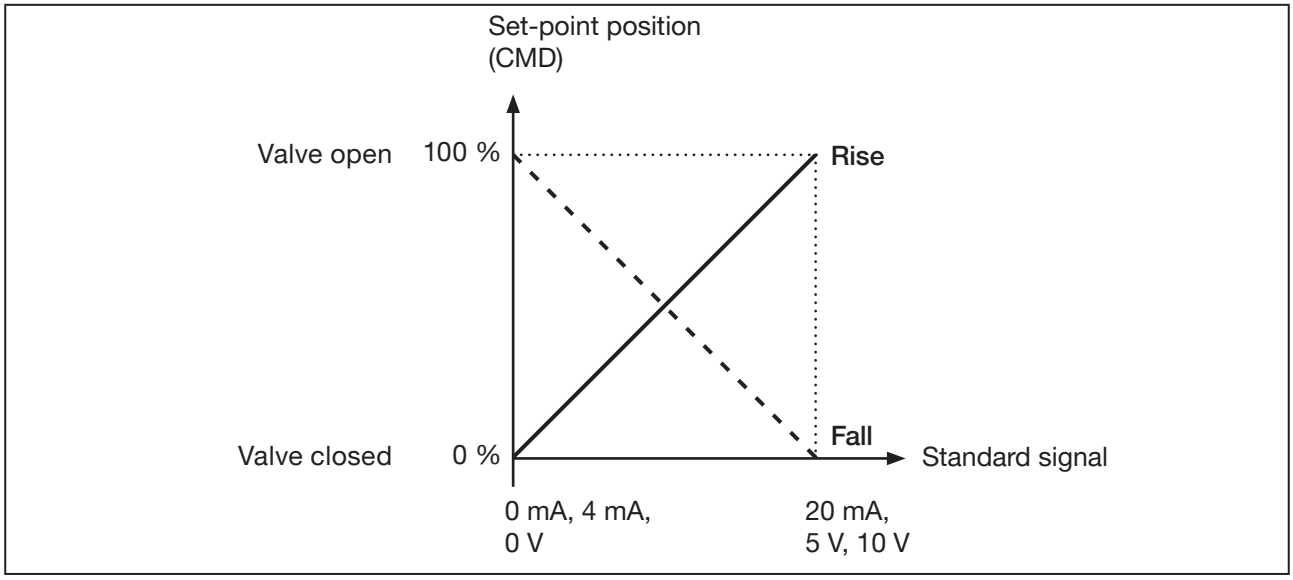


*Image 5: Effective direction diagram*

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## 3.8 SPLTRNG - signal split range

**Configuration area:** Positioner

**Required access rights for settings in menu: advanced user**

**Factory setting: minimum 0%, maximum 100% (no signal split range)**

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the SPLTRNG auxiliary function. |

It is possible to split the standard signal range between several devices in this menu. The standard signal for the position set-point value is limited here by a minimum and a maximum value.

The minimum and maximum value at which the standard signal range is limited are given in per cent.

The limited standard signal range covers the entire stroke range that runs through the valve.

The signal range can be split without or with overlapping for the standard signal ranges 0...20 mA, 4...20 mA, 0...5 V or 0...10 V.

With signal split range, several valves can be used alternately, or simultaneously for overlapping set-point value ranges, as proportional valves.

**Setting range for the minimum and maximum values:**

Minimum 0...90%

Maximum 10...100%

There must be a difference of at least 10% between minimum and maximum.

Example: splitting of one standard signal range into two set-point value ranges

**Example**

Standard signal range: 4...20 mA

Setting device 1 set-point value range:
Minimum 0%, maximum 37.5%

Setting device 2 set-point value range minimum: 37.5%, maximum 100%

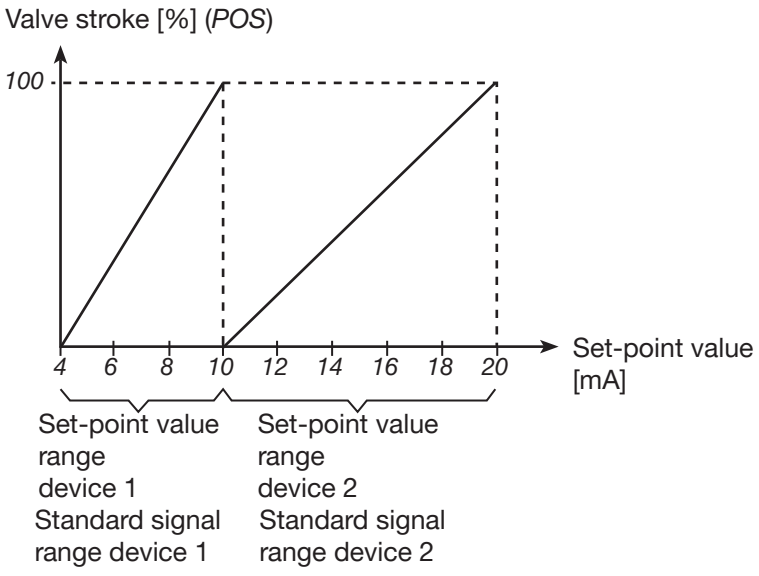


*Image 6: Diagram, signal split range*

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## 3.9 X.LIMIT - mechanical stroke limit

**Configuration area:** Positioner

**Required access rights for settings in menu: advanced user**

**Factory setting: minimum 0%, maximum 100% (no stroke limit)**

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the X.LIMIT auxiliary function. |

The physical stroke range of the valve that is prescribed by the mechanical end positions can be limited in this menu.

To limit the valve stroke, a percentage is entered for the start and end positions in relation to the physical stroke range. The stroke range of the limited stroke is thereby set to 100%.

**Setting range for the start and end positions:**

Minimum 0...90%

Maximum 10...100%

There must be at least 10% difference between the start and end positions. This means that the minimum valve stroke is 10% of the physical stroke range.

The stroke limit is not effective in MANUAL operating state. The valve can be manually moved into positions that lie outside the limited stroke range.

Valve positions that lie outside the limited stroke range are displayed as negative or positive values >100%.

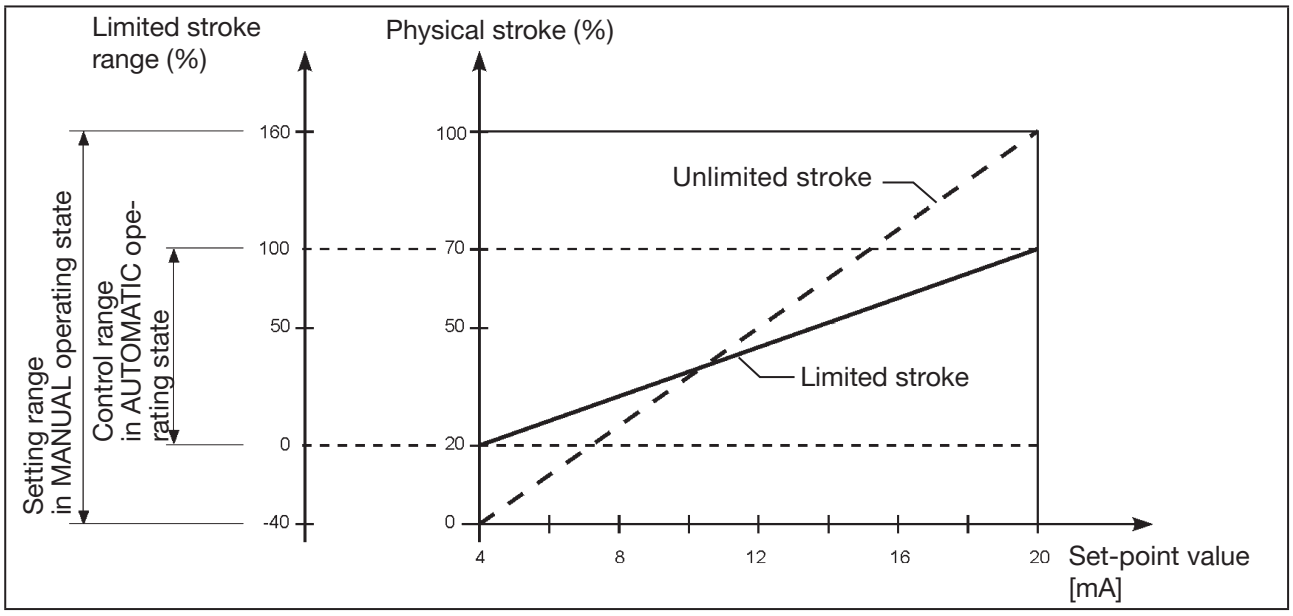


*Image 7: Diagram, mechanical stroke limit*

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## 3.10 X.TIME - actuating time limit

**Configuration area:** Positioner

**Required access rights for settings in menu: advanced user**

**Factory setting: maximum speed that has been determined by the X.TUNE function.**

**Functional dependencies:**

| Menu | Function |
|---|---|
| ADD.FUNCTION | Enabling the X.TIME auxiliary function. |

The opening and closing times of the valve for the entire stroke can be extended in this menu, which limits the control speeds.

During start-up, the minimum opening and closing time is automatically determined for the entire stroke with the X.TUNE function, and transferred over to the X.TIME menu. The valve is then opened and closed at maximum speed.

To limit the control speed, the time span in which the valve opens and closes in relation to the entire stroke range is entered.

**Setting range for the opening and closing times:**

Opening time 1*...60 s

Closing time 1*...60 s

* *Theoretical value. The lowest closing time is determined with the X.TUNE function, depending on the device.*

**Impact of limited opening speed on a spike in set-point value**

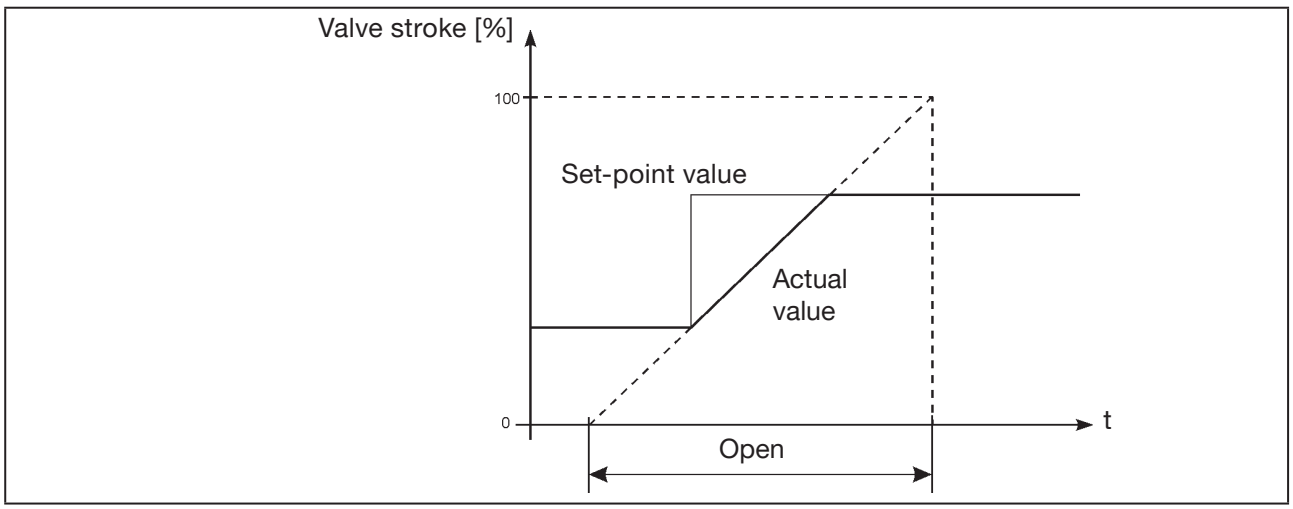


*Image 8: Diagram, limited opening speed*

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## 3.11 MAINTENANCE - start-up and maintenance of positioner

Configuration area: Positioner/MAINTENANCE

The functions for start-up of the position control and the diaphragm armature, and a function that supports the cleaning of the diaphragm control valves, are located in this menu.

### 3.11.1 X.TUNE - automatic adjustment of position control for seat valves

Configuration area: Positioner/MAINTENANCE

Required access rights for settings in menu: installer

Functional dependencies: not available in diaphragm control valves
The X.TUNE function is executed with the OPEN button and CLOSE button of the device for devices without a display.

The position control is adapted to the physical conditions of the device with the X.TUNE function. The sensor signal is then set to the (physical) stroke of the proportional valve used.

### 3.11.2 M.Q0.TUNE - adjustment of position control for diaphragm valves

Configuration area: Positioner/MAINTENANCE

Required access rights for settings in menu: installer

Functional dependencies: only available in diaphragm control valves
The M.Q0.TUNE function is executed with the OPEN button and CLOSE button of the device for devices without a display.

The position control is adapted to the physical conditions of the device with the M.Q0.TUNE function.

The following parameters are automatically determined and adapted when the M.Q0.TUNE is executed:

- Sensor signal adapted to the (physical) stroke of the proportional valve used.
- Optimum sealing force determined. The optimum sealing force takes into account the valve seal closure and the long service life of the diaphragm due to low wear.

**Menus for executing M.Q0.TUNE**

1 menu or 2 menus are available for adjusting the position control for diaphragm valves, depending on the device variant. The difference between the two menus lies in the determination of the seal closure point.

- M.Q0.TUNE-MANU is available in all diaphragm control valves.

  The seal closure point is determined by a manual approach.

- M.Q0.TUNE-AUTO is only available in diaphragm control valves with process controller function.

  The seal closure point is automatically determined via the process set-point value. The measured values and process control must be scaled before executing M.Q0.TUNE-AUTO.

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### 3.11.3 M.CLEAN - cleaning function for diaphragm control valve

**Configuration area:** Positioner/MAINTENANCE

**Required access rights for settings in menu: installer**

**Functional dependencies:**

| Menu | Function |
|---|---|
| - | Only available for diaphragm control valves. |
| M.CLEAN.source | Triggering the function via the digital input. |

The cleaning function for the diaphragm control valves is started and ended with the menu.

While the M.CLEAN is executed, the valve continuously changes between the 80% and 100% open positions. As a result, all parts in contact with media are accessible for cleaning during the flushing process, and the diaphragm armature can be cleaned without leaving residue.

**Triggering the cleaning function via the digital input:**

The cleaning function can be triggered via the digital input, as an alternative to triggering in the menu. To do this, the source Digital must be selected in the Inputs/Outputs configuration area.

Path: ADDITIONAL IOs → DIGITAL IN → M.CLEAN.source

### 3.11.4 M.SERVICE - diaphragm armature start-up

**Configuration area:** Positioner/MAINTENANCE

**Required access rights for settings in menu: installer**

**Functional dependencies:**

| Menu | Function |
|---|---|
| - | Only available for diaphragm control valves. |
| - | For devices without a display: trigger M.SERVICE with the OPEN button and CLOSE button. |

The start-up function for the diaphragm armature is triggered with the menu.

The M.SERVICE function is executed during assembly, before the diaphragm socket is screwed firmly to the valve body, and is an important help in the assembly of the diaphragm.

The M.SERVICE function prevents the diaphragm from being damaged or installed in a twisted position during assembly. When the diaphragm is installed in a twisted position, it has a shorter service life.

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## 3.12 DIAGNOSTICS - positioner diagnostics

**Configuration area:** Positioner/DIAGNOSTICS

The diagnostics function is configured in this menu, and the values of the different diagnostics are displayed.

### 3.12.1 POS.MONITOR - positioner position monitoring

**Configuration area:** Positioner/DIAGNOSTICS

**Required access rights for settings in menu: installer**

The current position of the actuator is monitored with the POS.MONITOR function.

The tolerance band for the position set-point value (in per cent) is specified in the Tolerance band submenu. The tolerance band states the permitted deviation between the actual position and the position set-point value in equilibrium state (after the balancing time has expired). A message is issued when the permitted deviation is exceeded.

A timespan for harmonising the actual position with the position set-point value is specified in the Compensation time submenu.
This timespan is designated as balancing time and starts as soon as the position set-point value is constant. Monitoring begins after the balancing time has expired.

If the control deviation of the actual position to the position set-point value is greater than the one specified in the tolerance band during monitoring, a message is issued.

Schematic representation

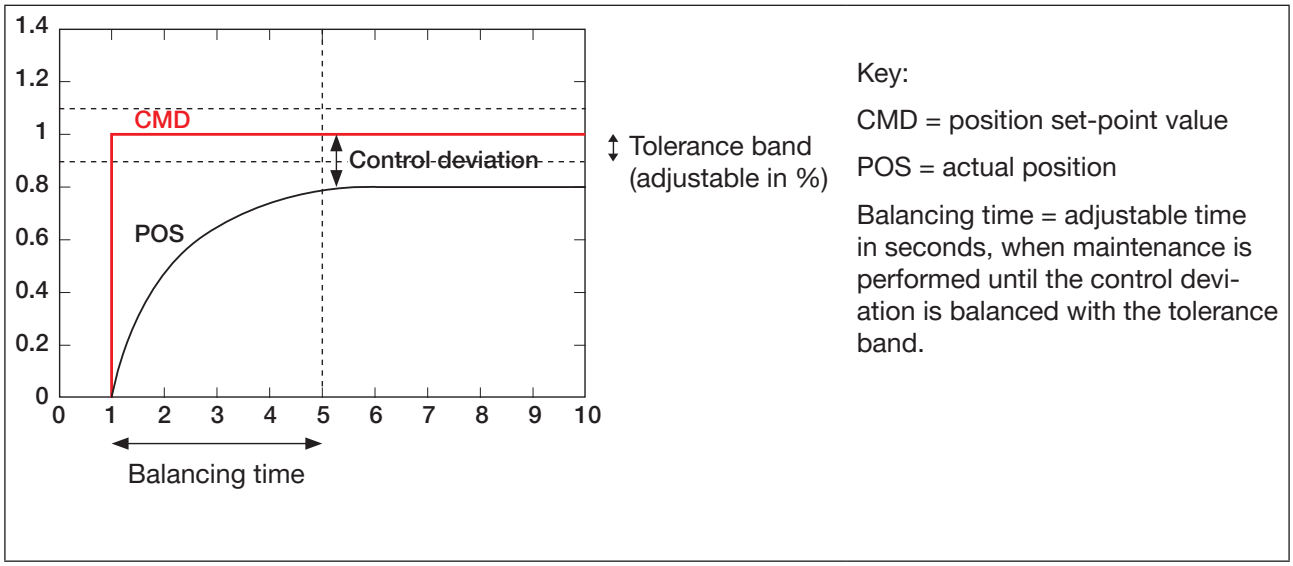


*Image 9: POS.MONITOR; schematic representation of position monitoring*

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# 4 INPUTS/OUTPUTS MENUS

## 4.1 PV - parameterising process actual value

**Configuration area: Inputs/Outputs**

**Required access rights for settings in menu: installer**

**Functional dependencies: only available in devices with process control function.**

In this menu, the signal source for the process actual value is selected and the analogue signal source parameterised, depending on the selection.

The signal sources büS and Analogue are available for selection in the PV.source submenu.

Analogue: for all analogue sensors (4-20 mA, Pt 100, frequency).

büS: sensor signals via büS. (büS-compatible sensors or analogue sensors that are coupled with the IO-module in the büS network.)

When the Analogue signal source has been selected, the following options are available for parameterising the process actual value:

- Select signal type for the process actual value in the menu ANALOG.type
  Available for selection: 4-20 mA, frequency, Pt 100.
  **Factory setting: 4-20 mA**

The physical unit is set in the process controller configuration area in the UNIT menu.

### 4.1.1 Settings when selecting 4-20 mA signal type

- Scaling process actual value in the PV.scale menu.
  **Factory setting: minimum 0%, maximum 100%**
- Enable cable break detection for the process actual value in the Signal loss detection menu.
  The device status for issuing the message is also defined with enabling.

  Out of specification and Error are available for selection.
  When Error has been selected, the actuator moves to the safety position during a cable break.

### 4.1.2 Settings when selecting frequency signal type

Setting the K factor to calibrate the flow sensor in the K-Factor menu.

**K factor description:**

The K factor (pulse/litre) is proportionality factor for conversion between the sensor signal (pulse/unit of time) and process actual value PV (quantity/unit of time).

**Calculation:**

$$\textit{Sensor pulse} \cdot \frac{1}{\textit{K factor}} = \textit{flow rate volume}$$

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**Example:**

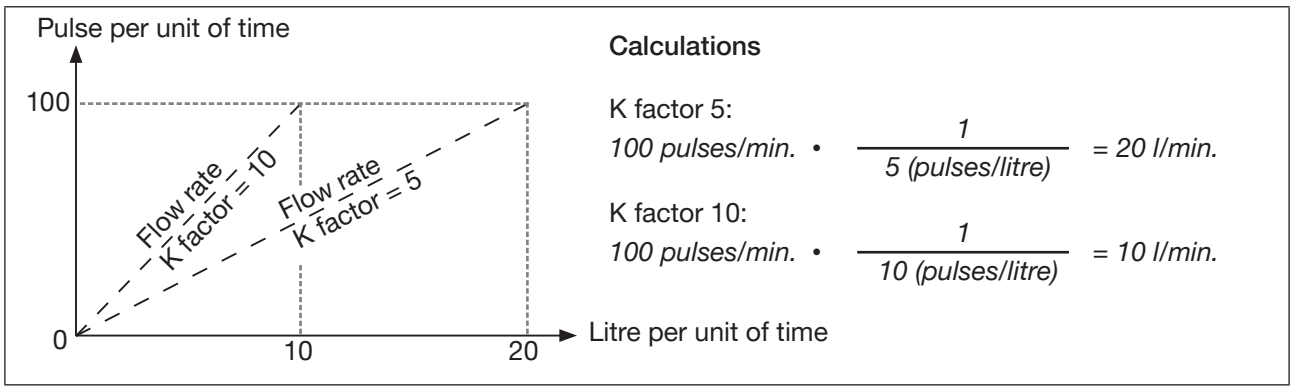


*Image 10: Example: K factor for sensor calibration with frequency signal type*

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## 4.2 DIGITAL OUT - digital output configuration

**Configuration area:** Inputs/Outputs → ADDITIONAL IOs

**Required access rights for settings in menu: installer**

**Functional dependencies: only available in devices with process control function.**

The description applies to the DIGITAL OUT 1 and DIGITAL OUT 2 menus. The menu for configuration is identical for both digital outputs.

The auxiliary digital output is configured in the DIGITAL OUT 1 menu.

### 4.2.1 Select signal source for the digital output

The signal sources Internal and büS are available for selection in the SOURCE submenu.

**Factory setting: Internal**

Internal is selected when the signal is to be used for an internal task/function.

büS is used when a büS signal is to be emitted via the digital output!

### 4.2.2 Define digital output function

The FUNCTION submenu is used to define the digital output event when the switching signal 0 or 1 should be emitted.

**Factory setting: Position limit**

| | |
|---|---|
| Position limit | Valve position monitoring. Set limit position exceeded or missed.<br>When selecting this function, the menu of the same name appears a level higher, in order to enter the percentage from which a control deviation should be displayed. |
| Device state | Messages about device status available, yes or no<br>When selecting this function, the menu of the same name appears a level higher, in order to define the device status for which the message should be issued.<br>**Factory setting: Error**<br>The following device statuses are available for selection:<br>Maintenance Maintenance required<br>Out of specification<br>Function check<br>Error Failure, error or fault |
| Manual mode | AUTOMATIC or MANUAL operating state |
| Control deviation | Permitted control deviation exceeded<br>When selecting this function, the menu of the same name appears a level higher, in order to enter the percentage from which a control deviation should be displayed. |
| Safepos | Actuator in safety position |

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**Output options and related switching signals for digital output 1 and 2:**

| Menu | Switching signal | Description |
|---|---|---|
| Position limit | 0 | Actual position is above limit position |
| | 1 | Actual position is below limit position |
| Device state | 0 | Message for selected device state available |
| | 1 | Message for selected device state not available |
| Manual mode | 0 | Device is in AUTOMATIC operating state |
| | 1 | Device is in MANUAL operating state |
| Control deviation | 0 | Control deviation is within the set limit |
| | 1 | Control deviation is outside the set limit |
| Safepos | 0 | Actuator is not in the safety position |
| | 1 | Actuator is in the safety position |

The output signal depends on the set switching status of NO or NC.

| Switching signal | Switching statuses | |
|---|---|---|
| | NO normally open | NC normally closed |
| 0 | 0 V | 24 V |
| 1 | 24 V | 0 V |

### 4.2.3 Define switching status for the digital output

The switching status for the digital output is defined in the DIGITAL.type submenu.

**Factory setting: Normally open**

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# 5 PROCESS CONTROLLER MENUS

## 5.1 PID PARAMETERS - parameterising the process controller

**Configuration area:** Process controller

**Required access rights for settings in menu: advanced user**

**Functional dependencies: only available in devices with process control function.**

The following control technology parameters of the process controller are manually set in this menu.

DBND Insensitivity range (dead band) of the process controller

KP Proportional part (P part of PID controller)

TN Reset time (I part of PID controller)

TV Derivative time (D part of PID controller)

XO Operating point

You can find the basics for setting the process controller in chapters "7 Properties of PID controllers" on page 68 and "8 Rules for adjusting PID controllers" on page 73.

### 5.1.1 DBND – set insensitivity range (dead band)

This function ensures that the process controller does not respond until a certain control difference is reached. This protects the electric actuator.

**Factory setting:** 1.0% related to the span of the scaled process actual value (setting in configuration area Inputs/Outputs → PV → PV.scale).

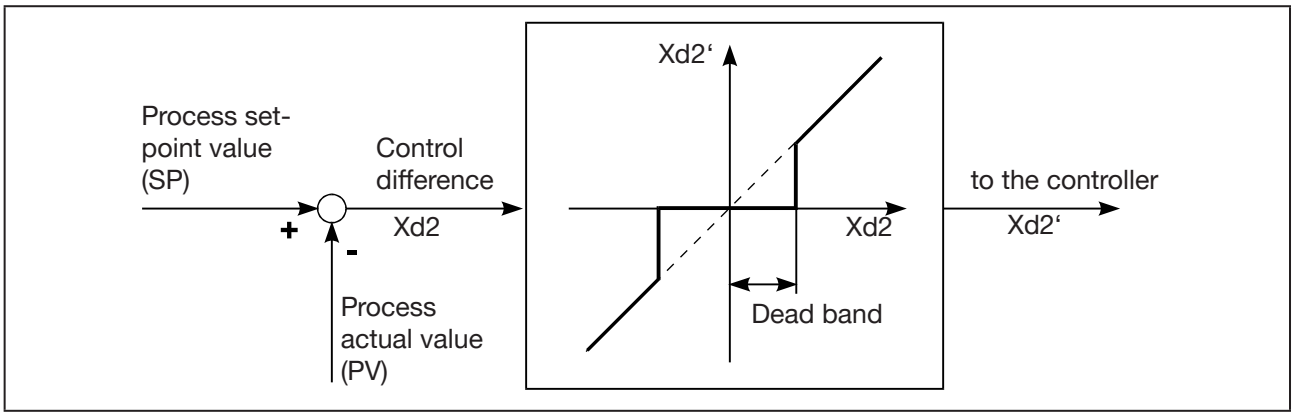


*Image 11: DBND diagram; insensitivity range for process control*

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### 5.1.2 Setting PID controller parameters

A PID controller is implemented for process control in devices with a process controller function, as well as the actual position control.

**The PID controller can be parameterised automatically with the aid of the P.TUNE function.**

**The menu for triggering the P.TUNE function is located in the configuration area → Process controller → MAINTENANCE → CALIBRATION.**

**The menu items for parameterising the PID controller:**

**KP** **Proportional part (amplification factor)**

The proportional part determines the P part of the PID controller.

**Factory setting: 1**

Setting proportional part in the submenu:

**Value** **Set the value.**

**Unit** **Set physical unit.**
The selection depends on the physical size that is set in the Process controller configuration area in the Parameter → UNIT menu.

**TN** **Reset time**

The reset time determines the I part of the PID controller. Disabled at 999 s.

**Factory setting: 999 s**

**TV** **Derivative time**

The derivative time determines the D part of the PID controller

**Factory setting: 0 s**

### 5.1.3 XO - set operating point

The operating point corresponds to an actuating variable in per cent, which is added to the PID actuating variable of the process controller as an offset, regardless of the control deviation. The PID actuating variable of the process controller depends on the control deviation.

The operating point is mainly used in process controllers with P structure. The effect of the operating point in this case is that the control difference of 0 can be reached at a certain working point in the process in stationary state.

**Factory setting: 0.0%**

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## 5.2 SP.SLOPE - set slope rate per unit of time

**Configuration area:** Process controller

**Required access rights for settings in menu: advanced user**

**Factory setting: 1.000**

The speed at which the process set-point value is changed can be limited in the SP.SLOPE menu.

The Rise and Fall parameters state how much the process set-point value can change in 1 second.

**Setting in the menu.**

A value for the physical unit in relation to 1 second is entered for the setting.

RISE Setting for upwards movement.

Fall Setting for downwards movement.

**Impact of limited speed on a spike in set-point value**

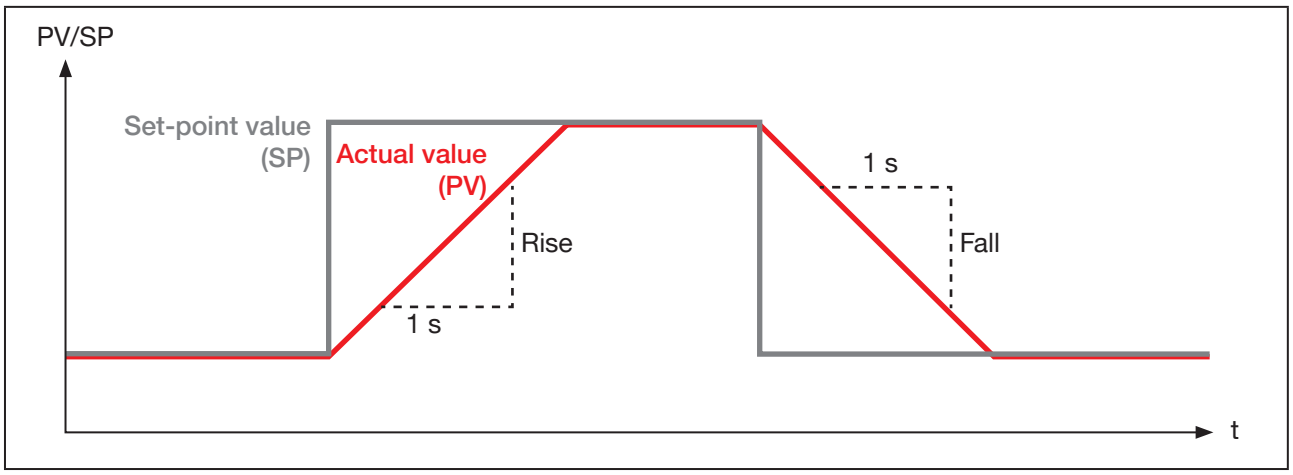


*Image 12: SP.SLOPE, Impact of limited speed on a spike in set-point value*

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# 6 GENERAL SETTINGS MENUS

## 6.1 Status LED - setting LED for device status display

**Configuration area:** General settings

**Required access rights for settings in menu:** installer

**Factory setting:** valve mode + warnings

The Status LED menu is used to set which device statuses are displayed on the LED illuminated ring.

The following LED modes can be selected:

- NAMUR mode
- Valve mode
- Valve mode + warnings
- LED off

**The colour for displaying the “Valve open” and “Valve closed” device statuses can be set for the Valve mode and Valve mode + warnings.**

### 6.1.1 Valve mode description

The valve position and device status “Failure” are displayed in the valve mode.

**Notifications on device statuses “Out of specification”, “Maintenance required” and “Function check” are not displayed in the valve mode.**

**Displays in valve mode:**

For device status “Normal”: Continuously lit in the colour of the valve position.
For device status “Failure”: Alternating flashing between red and the valve position colour.

| Valve position | Colour for valve position | Colour for device status “Failure” |
|---|---|---|
| open | yellow | red |
| in between | white | |
| closed | green | |

*Table25: Display of device status in valve mode*

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### 6.1.2 Valve mode + warnings description

In this operation mode, the valve position and device statuses “Failure”, “Out of specification”, “Maintenance required” and “Function check” are displayed.

If several device statuses exist simultaneously, the device status with the highest priority is displayed. The priority is based on the severity of the deviation from standard operation (red = failure = highest priority).

**Displays in valve mode + warnings:**
For device status “Normal”: Continuously lit in the colour of the valve position.
For device statuses that deviate from “Normal”: flashes alternately with the colours for the valve position and the device status.

| Valve position | Colour for valve setting (factory setting) | Colour for device status | | | |
|---|---|---|---|---|---|
| | | Failure, error or fault | Function check | Out of specification | Maintenance required |
| open | yellow | red | orange | yellow | blue |
| in between | white | | | | |
| closed | green | | | | |

*Table26: Display of device status in valve mode + warnings*

### 6.1.3 Setting the colours for indicating valve position

**Configuration area: General settings → Status LED**

**Required access rights for settings in menu: installer**

**Functional dependencies: setting only possible for Valve mode and Valve mode + warnings.**

**Factory setting: yellow for valve open, green for valve closed.**

The open and closed valve positions can be assigned to the colours yellow and green for the display on the LED illuminated ring.

If the Status LED → Operation mode menu has been used to select Valve mode or Valve mode + warnings, the following submenus are available for the settings:

- Valve open The colour of the LED illuminated ring is selected in this menu for displaying the “Valve open” device status. The colours yellow and green are available for selection.
- Valve closed The colour of the LED illuminated ring is selected in this menu for displaying the “Valve closed” device status. The colours yellow and green are available for selection.

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### 6.1.4 NAMUR operation mode description

In NAMUR mode the LED light ring lights up in the colour specified for the device status as per NAMUR NE 107.

If several device statuses exist simultaneously, the device status with the highest priority is displayed. The priority is based on the severity of the deviation from standard operation (red = failure = highest priority).

Indicators in NAMUR operation mode:

| Status indicator in line with NE 107, issue 2006-06-12 | | | |
|---|---|---|---|
| **Colour** | **Colour code** | **Description** | **Meaning** |
| red | 5 | Failure, error or fault | Due to a malfunction in the device or its peripherals, closed-loop control mode is not possible. |
| orange | 4 | Function check | Work is being carried out on the device, which means that closed-loop control mode is temporarily not possible. |
| yellow | 3 | Out of specification | The environment conditions or process conditions for the device are not within the specified range.<br>Internal device diagnostics indicate problems within the device or with the process properties. |
| blue | 2 | Maintenance required | The device is in closed-loop control mode, but function will soon be restricted.<br>→ Perform device maintenance. |
| green | 1 | Diagnostics active | Device is in error-free operation. Status changes are highlighted in colour.<br>Messages are sent via any fieldbus that may be connected. |
| white | 0 | Diagnostics inactive | Device is switched on.<br>Status changes are not displayed.<br>Messages are not transferred via a fieldbus that may be connected. |

*Table27: Indication of the device status in NAMUR operation mode*

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## 6.2 Passwords - enabling and disabling password protection

**Configuration area:** General settings → Passwords

**Required access rights for settings in menu: installer (with password protection set)**

**Factory setting: password protection not enabled**

Password protection is not enabled on delivery. Settings in the software can be made at any time and without entering a password.

A password is required for settings that only Bürkert employees are allowed to make.

After enabling password protection, settings in the software are now only possible with the required access rights and by entering a code.

There are 3 user levels for assigning access rights.

| User level | Icon | Description |
|---|---|---|
| Advanced user | | PIN required: factory-set code 5678<br>Rights: reading values, limited right to change values. |
| Installer | | PIN required. Factory-set code 1946<br>Rights: reading values, expanded right to change values. |
| Bürkert | | PIN required.<br>Only for Bürkert employees |

*Table28: User levels*

The factory-set code (password) can be changed for the advanced user and installer user levels.

**Note!** Document password and make it accessible to authorised personnel.

Once the screen saver is active, settings that require a certain user level are only possible with input of a password.

When password protection is enabled, the user level Installer is required to change the password protection.

User levels are changed in the context menu.

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## 6.3 Simulation - simulate device functions

The set-point value, process and process valve can be simulated independently of each other with this function.

**The simulation becomes inactive when the device is restarted.**
**The settings in the Simulation menu are reset to the factory setting.**

### 6.3.1 SIGNAL GENERATOR - set-point value simulation

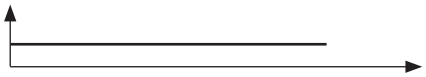
**Configuration area: General settings → MAINTENANCE → Simulation**

**Required access rights for settings in menu: installer**

**Factory setting: SIGNAL GENERATOR switched off (Off), signal form constant**

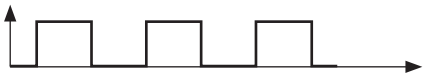
The settings for the set-point value simulation are made in this menu.
The signal form for the simulation of the set-point value is defined in the SIGNAL.form submenu.

**Constant** Constant signal



**Sine** Sine wave

**Square** Square wave



**Triangle** Triangle wave

**Mixed** Runs through a sequence of changing signals.

The following parameters can be set for the selected signal form:

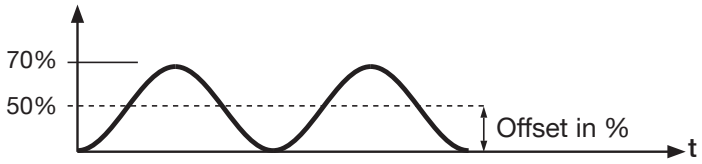
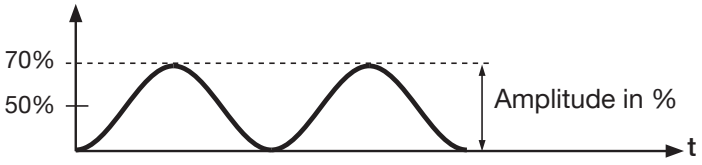
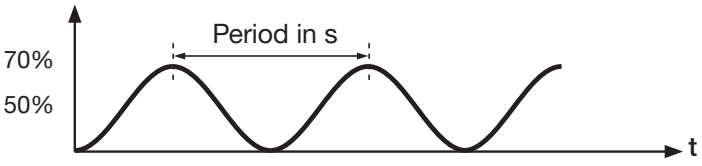
| Menu option | Parameter setting | Schematic representation of parameters with sine wave example |
|---|---|---|
| Offset | (zero point shift in %) |  |
| Amplitude | (amplitude in %) |  |
| Period | (Period duration in s) |  |

*Table29: Parameter settings of signal forms for the set-point value simulation*

## 6.3.2 PROCESS SIMULATION - simulation of process and process valve

**Configuration area:** General settings → MAINTENANCE → Simulation

**Required access rights for settings in menu: installer**

**Functional dependencies: only available in devices with process control function.**

**Factory setting: process simulation disabled**

A control loop that can be modelled from different transmission functions can be simulated with the process simulation. It is then possible to test the behaviour of the device under process conditions, and preset the process controller by executing the P.TUNE function.

**Description of the menu for simulating a process:**

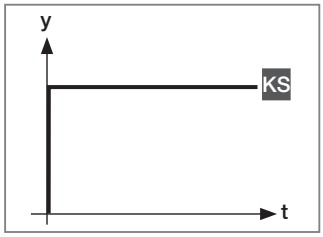
In the PROCESS.form menu, different transmission functions can be selected for modelling the control loop. These are switched in turn during simulation.

**Structure of process simulation model**

| Transmission functions | | | | | | |
|---|---|---|---|---|---|---|
| P-element | Dead time element | Non-linearity of characte-ristic curve | PT1 element no. 1 | PT1 element no. 2 | PT2 element | I-element |
| → KS → | → | → linear → | → | → | → | → |
| Always available.<br>Amplification factor.<br>Setting in the KS menu. | Setting in the Dead time menu. | Setting in the NON-LINEARITY menu.<br>For user-specific cha-racteristic, see chapter CHARACT | Select transmission elements in the Process.form menu.<br>Setting transmission elements in the menus:<br>1.PT1 2.PT1 PT2t, PT2d | | | |

*Table30: Process simulation structure*

**Description of transmission functions**

| Transmission function | Transmission behaviour presentation |
|---|---|
| P-element | Input variable u →  → Output variable y  |

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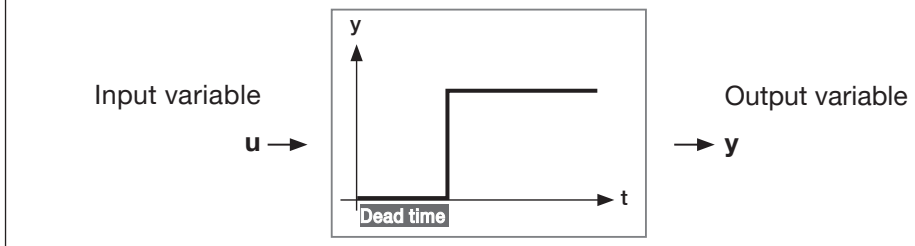
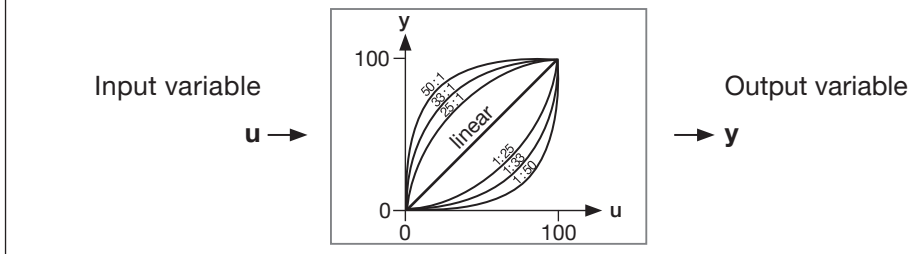
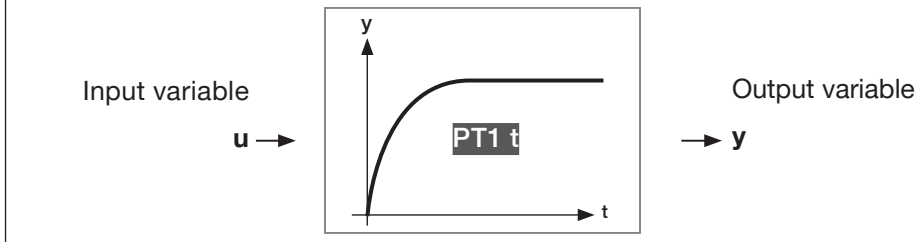
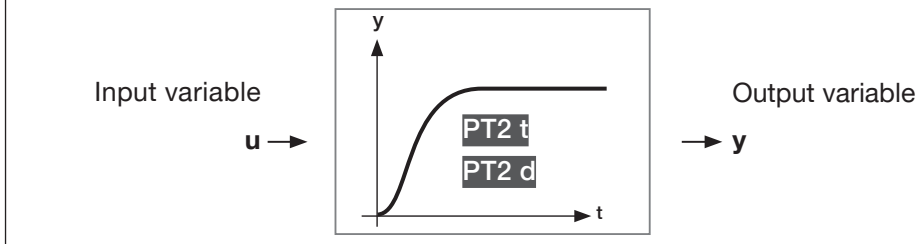
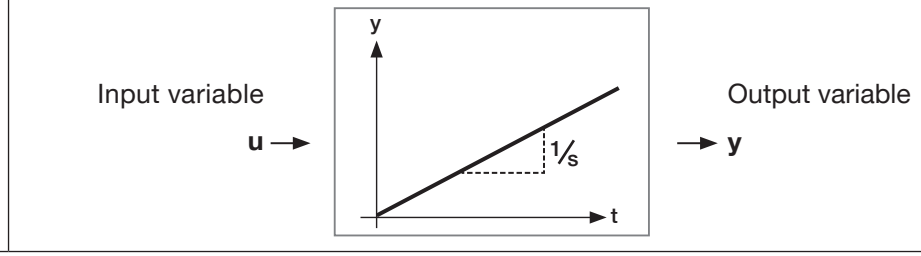
| Transmission function | Transmission behaviour presentation |
|---|---|
| Dead time element |  |
| Non-linearity |  |
| PT1 element |  |
| PT2 element |  |
| I-element |  |

*Table31: Description of transmission functions*

The amplification factor for the process control loop can be entered in the KS menu.

A dead time for the process control loop can be entered in the Dead time menu.

A linear or non-linear process can be selected in the NON-LINEARITY menu.

The time constant for each transmission element for the simulation of the process can be entered in the 1.PT1 t, 2.PT1 t and PT2 t menus.

The damping ratio for the PT2 transmission element for the simulation of the process can be entered in the PT2 d menu.

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### Example of a modelled process control loop $PT_1$ - $T_t$:

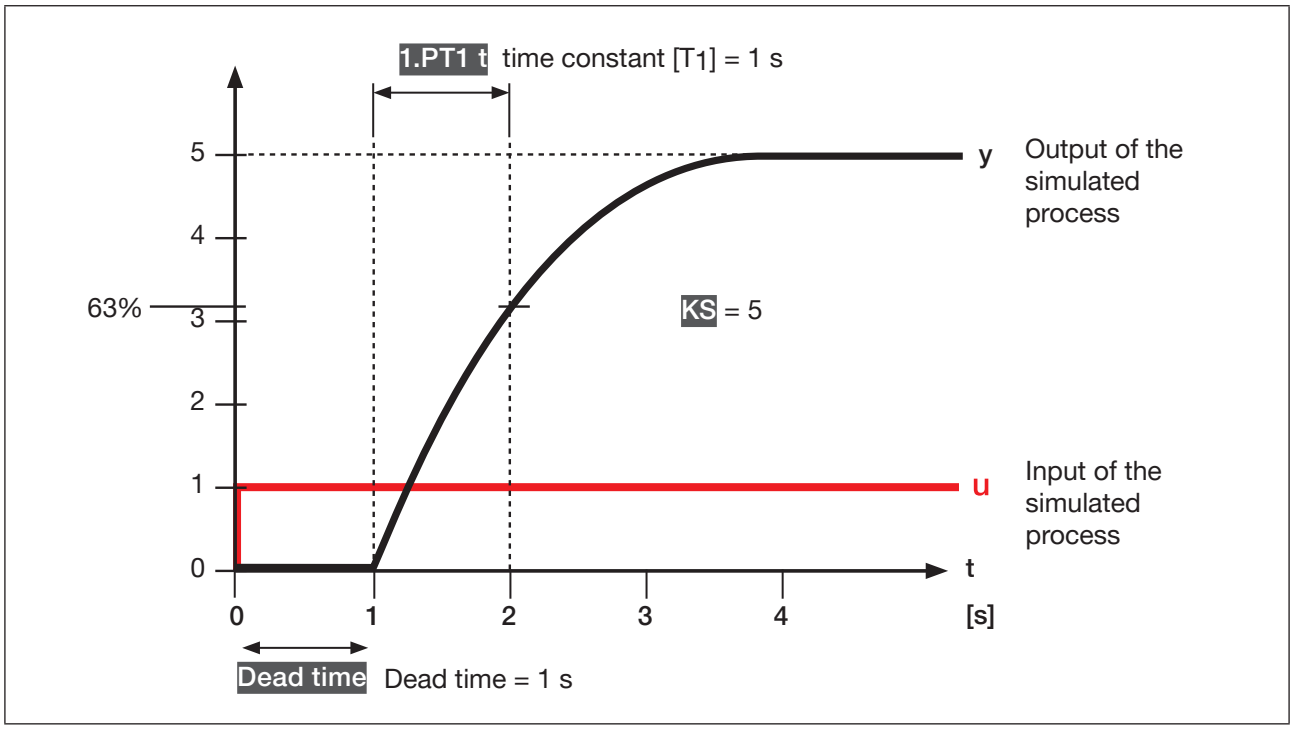


*Image 13: Example of a modelled process control loop $PT_1$ - $T_1$*

### Example of a modelled process control loop $PT_2$:

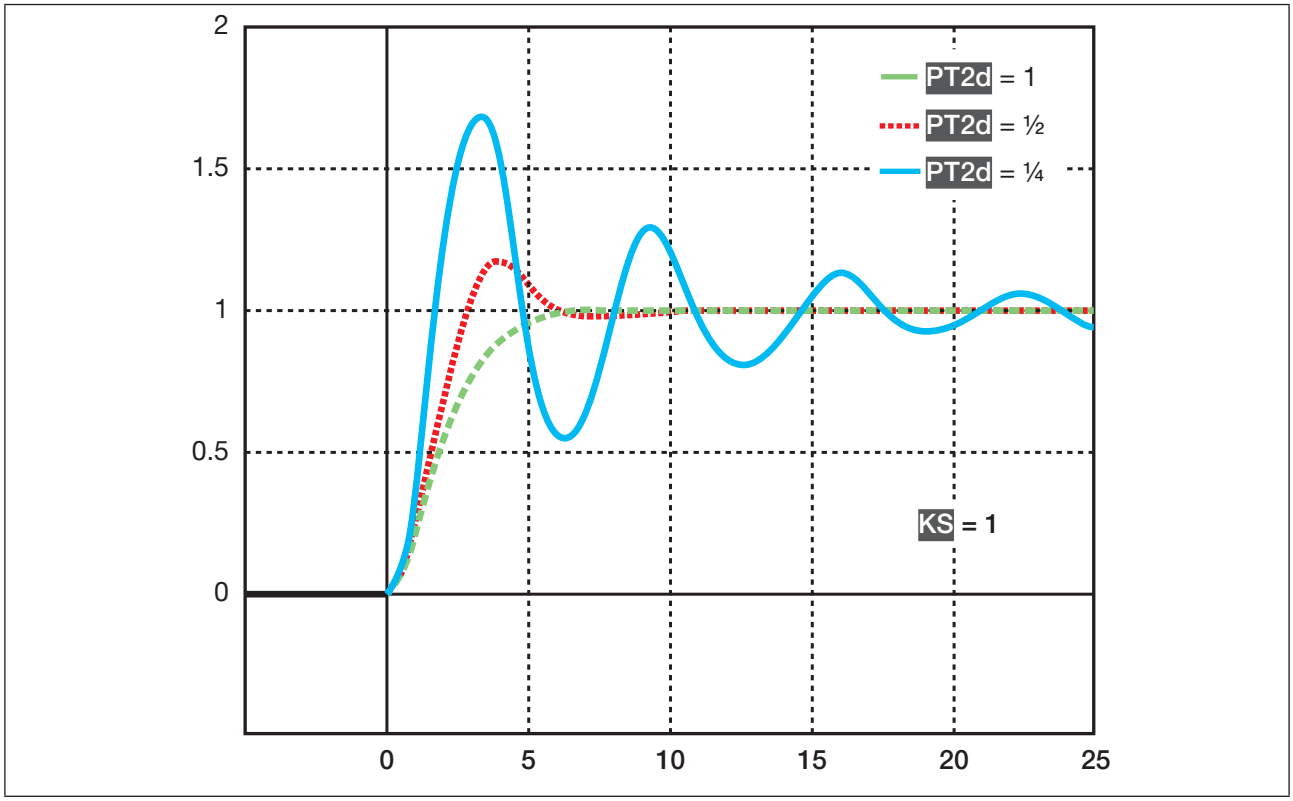


*Image 14: Example of different damping types with a modelled process control loop $PT_2$*



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# 7 PROPERTIES OF PID CONTROLLERS

A PID controller has a proportional, an integral and a differential part (P, I and D parts).

## 7.1 P part

Function:

$$Y = Kp \cdot Xd$$

Kp is the proportional action factor (amplification factor). It is given as a ratio of the setting range ΔY to the proportional range ΔXd.

**Characteristic and step response of the P part of a PID controller**

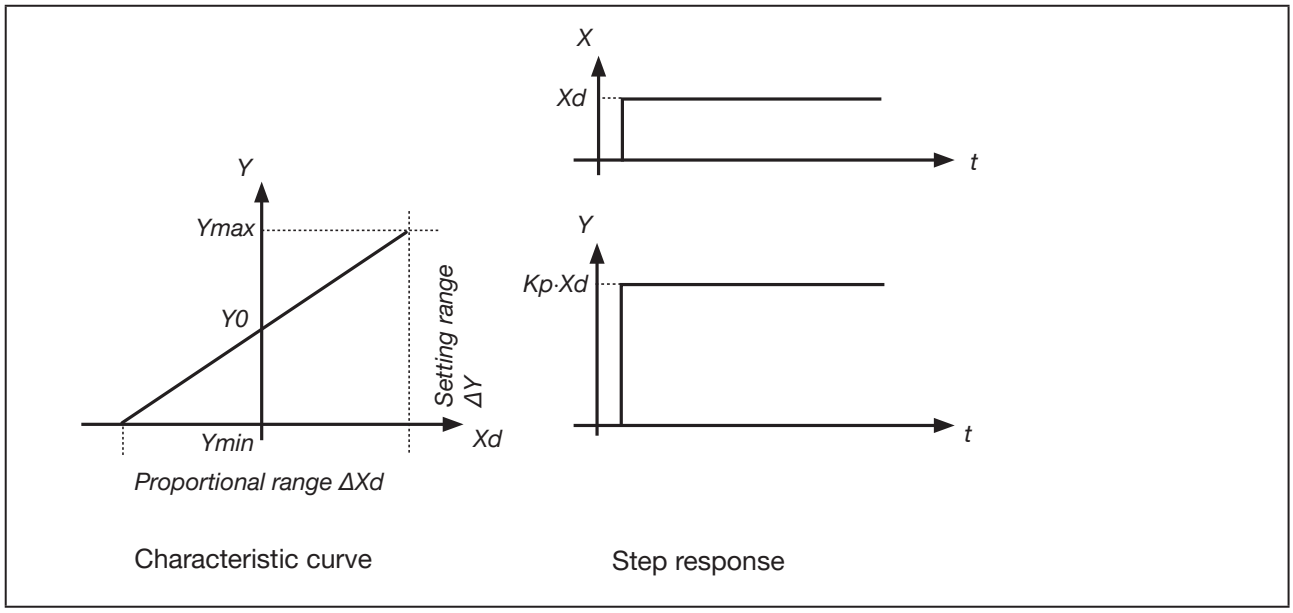


*Image 15: Characteristic and step response of the P part of a PID controller*

**Properties**

A pure P controller theoretically works without delays, i.e. it is fast and therefore dynamically favourable. It has a residual control difference, i.e. it does not completely eliminate the effects of disturbances and is therefore relatively unfavourable from a static viewpoint.

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## 7.2 I part

Function:

$$Y = \frac{1}{Ti} \int X \, d \, dt \qquad (5)$$

Ti is the integration or actuating time. It is the time that expires until the actuating variable has run through the entire setting range.

**Characteristic and step response of the I part of a PID controller**

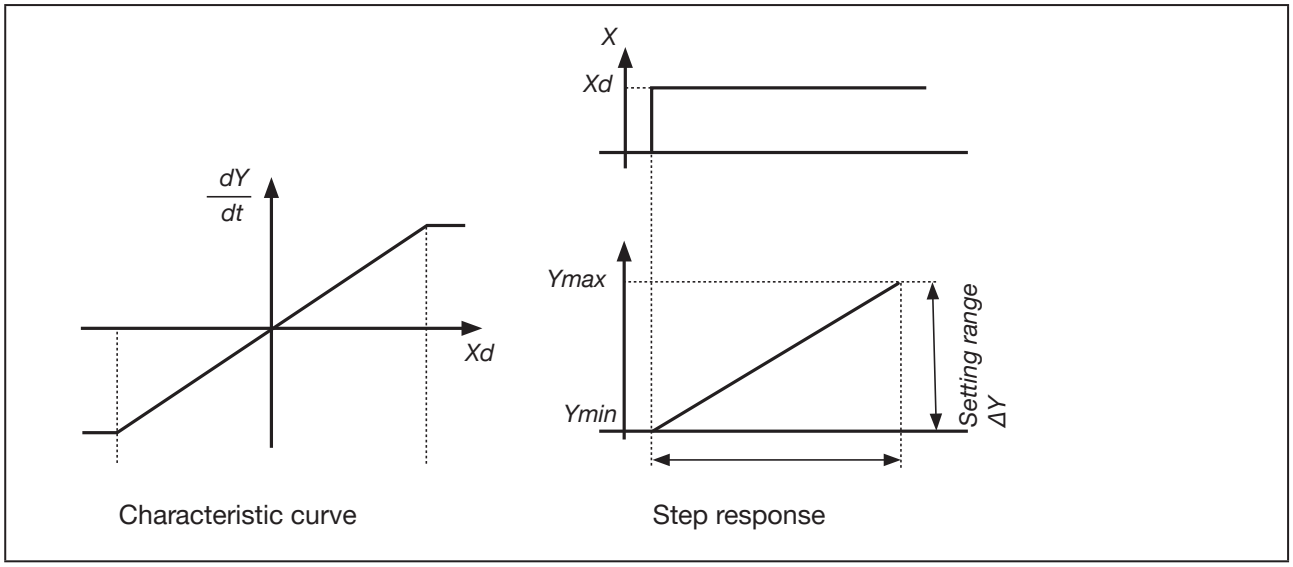


*Image 16: Characteristic and step response of the I part of a PID controller*

**Properties**

A pure I controller completely eliminates the effects of disturbances. It therefore has a favourable static behaviour. Due to its finite control speed, it operates more slowly than a P controller and tends towards oscillation. It is therefore dynamically relatively unfavourable.

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## 7.3 D part

Function:

$$Y = K_d \cdot \frac{dX_d}{dt} \qquad (6)$$

Kd is the differential action factor. The greater the Kd is, the stronger the D influence.

**Characteristic and step response of the D part of a PID controller**

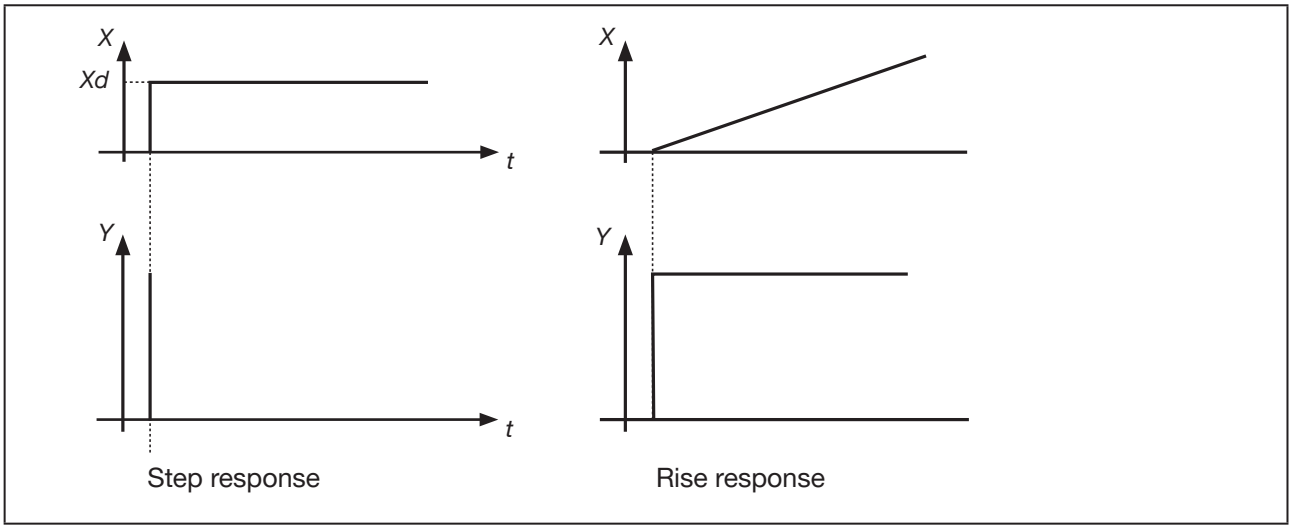


*Image 17: Characteristic and step response of the D part of a PID controller*

**Properties**

A controller with a D part reacts to changes in the control variable and can thus reduce any control differences that occur more quickly.

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## 7.4 Superimposing the P, I and D parts

Function:

$$Y = Kp \cdot Xd + \frac{1}{Ti}\int Xd\,dt + Kd\frac{dXd}{dt} \qquad (7)$$

With Kp · Ti = Tn and Kd/Kp = Tv, we obtain for the **function of the PID controller**:

$$Y = Kp \cdot \left(Xd + \frac{1}{Tn}\int Xd\,dt + Tv\frac{dXd}{dt}\right) \qquad (8)$$

| | |
|---|---|
| Kp | Proportional part/amplification factor |
| Tn | Reset time<br>(the time required to obtain the same change in the actuating variable through the I part as was caused by the P part) |
| Tv | Hold-back time<br>(the time by which a certain actuating variable is obtained earlier with the D part than with a pure P controller) |

**Step response and rise response of the PID controller**

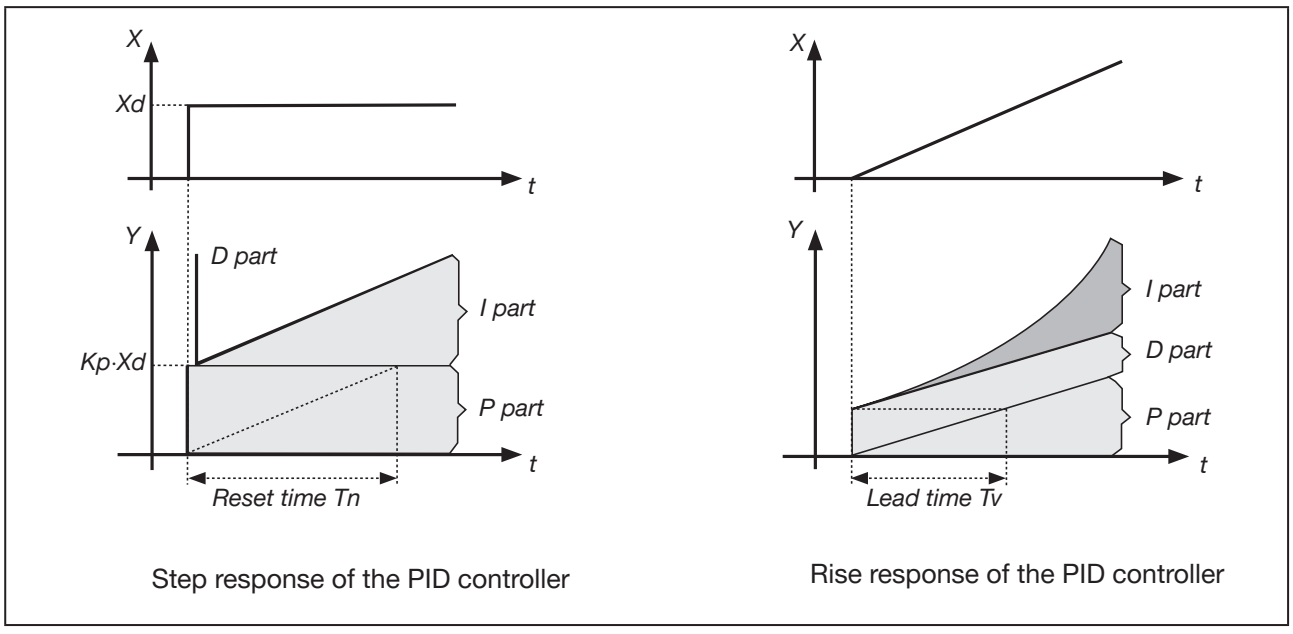


*Image 18: Characteristic, step response and rise response of the PID controller*

# 7.5 Implemented PID controller

## 7.5.1 D part with delay

In the Type 8693 process controller, the D part is implemented with a delay T.

Function:

$$T \cdot \frac{dY}{dt} + Y = Kd \cdot \frac{dXd}{dt} \qquad (9)$$

**Superimposing the P, I and DT parts**

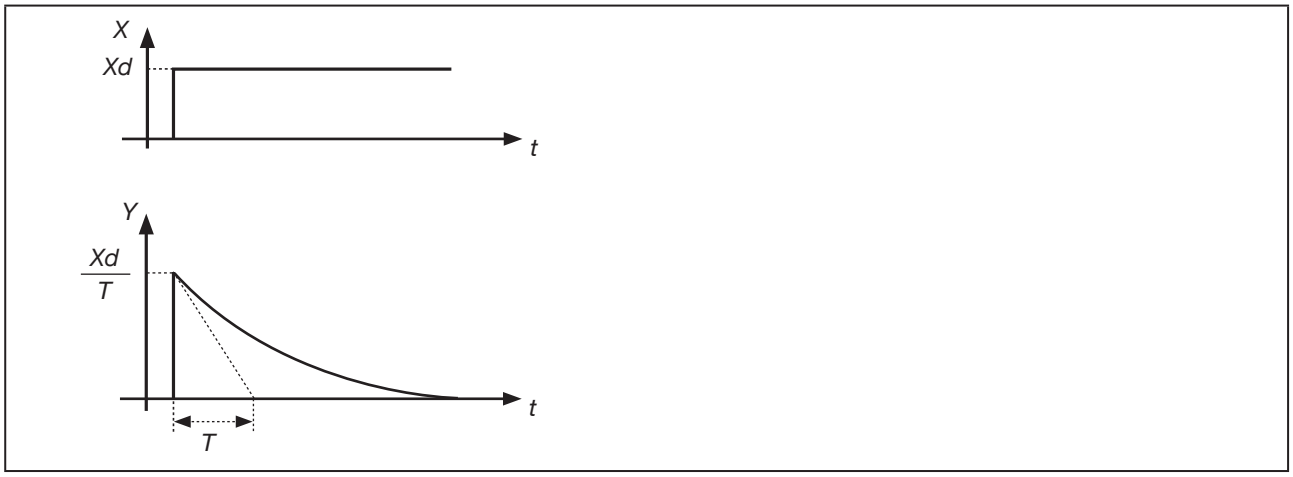


*Image 19: Superimposing the P, I and DT parts*

## 7.5.2 Function of the real PID controller

$$T \cdot \frac{dY}{dt} + Y = Kp\left(Xd + \frac{1}{Tn}\int Xd\,dt + Tv\,\frac{dXd}{dt}\right) \qquad (10)$$

**Superimposing the P, I and DT parts**

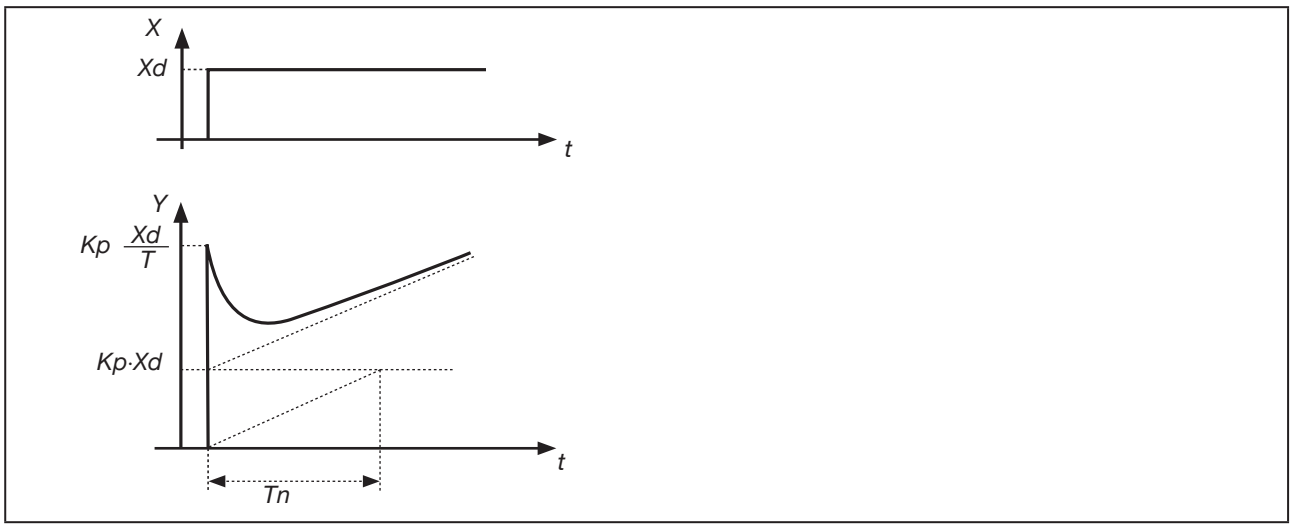


*Image 20: Characteristic, step response of the real PID controller*

# 8 RULES FOR ADJUSTING PID CONTROLLERS

The Type 8693 control system is equipped with a self-optimisation function for the structure and parameters of the integrated process controller. The determined PID parameters can be viewed via the operating menu and empirically optimised as required.

The literature on control technology contains a number of rules which can be used to experimentally determine a favourable setting of the controller parameters. In order to avoid incorrect settings, the conditions under which the rules were set up in each case must be kept in mind. Apart from the properties of the control loop and the controller itself, it makes a difference whether a change in disturbance or a command variable is to be compensated.

## 8.1 Adjustment rules of Ziegler and Nichols (oscillation method)

With this method, the controller parameters are set on the basis of the behaviour of the control loop at the limit of stability. The control parameters are initially set so that the control loop begins to oscillate. The resulting critical characteristic values enable a favourable setting of the controller parameters to be deduced. A prerequisite for using this method is naturally that the control loop is permitted to oscillate.

**Procedure**

→ Set the controller to P controller (i.e. Tn = 999, Tv = 0), initially select a small Kp

→ Set the desired set-point value

→ Increase Kp until the control variable executes continuous undamped oscillation.

The proportional action factor (amplification factor) set at the limit of stability is designated $K_{crit}$. The resulting oscillation period is designated $T_{crit}$.

**Course of controlled variable at the limit of stability**

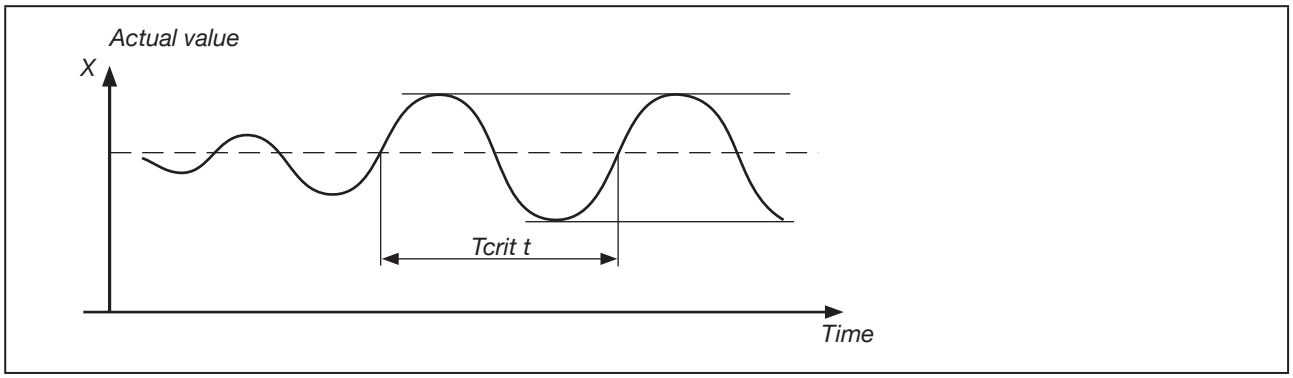


*Image 21: Course of the control variable PID*

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Controller parameters can then be calculated from $K_{crit}$ and $T_{crit}$, in accordance with the following table.

**Parameter setting according to Ziegler and Nichols**

| Controller type | Parameter setting | | |
|---|---|---|---|
| P controller | Kp = 0.5 $K_{crit}$ | - | - |
| PI controller | Kp = 0.45 $K_{crit}$ | Tn = 0.85 $T_{crit}$ | - |
| PID controller | Kp = 0.6 $K_{crit}$ | Tn = 0.5 $T_{crit}$ | Tv = 0.12 $T_{crit}$ |

*Table32: Parameter setting according to Ziegler and Nichols*

The adjustment rules of Ziegler and Nichols have been determined for P loops with first order time delay and dead time. However, they apply only to controllers with disturbance behaviour and not for those with command behaviour.

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## 8.2 Adjustment rules according to Chien, Hrones and Reswick (actuating variable step method)

With this method, the control parameters are set on the basis of the transient behaviour of the control loop. A step in the actuating variable of 100% is delivered. The times Tu and Tg are derived from the curve of the actual value of the control variable.

**Course of the control variable after a step in the actuating variable ΔY**

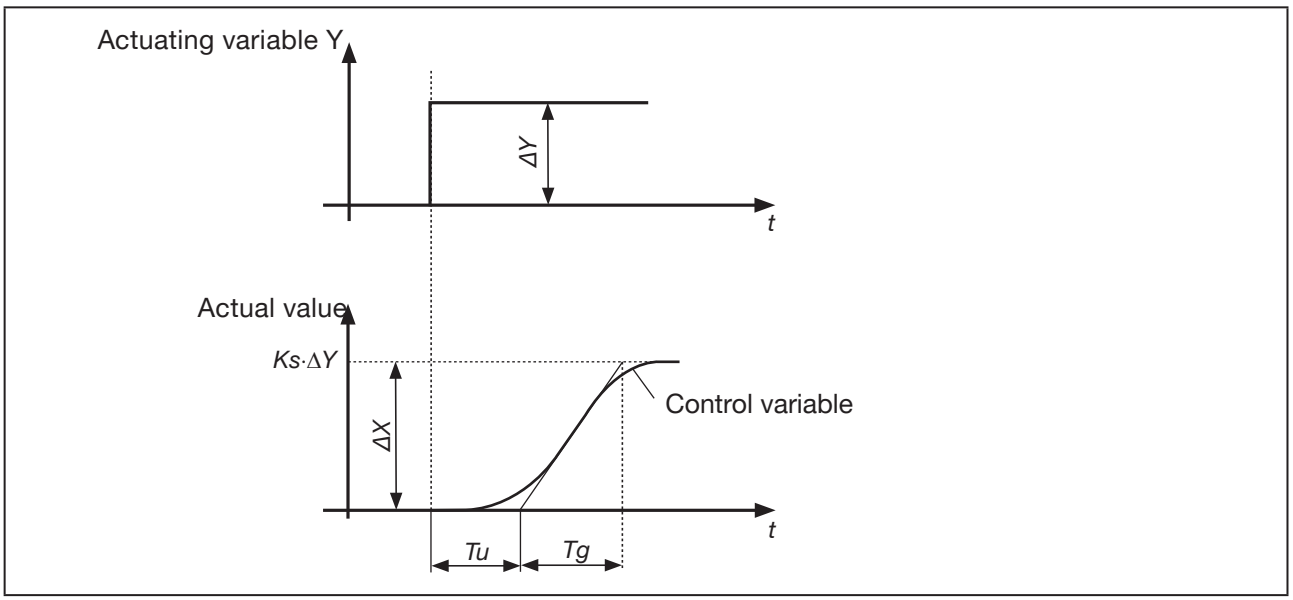


*Image 22: Course of the control variable after a step in the actuating variable*

**Procedure**

→ Switch controller to MANUAL (MANU) operating state

→ Deliver a step in the actuating variable and record the control variable with a chart recorder

→ If there are critical courses (e.g. if there is a risk of overheating), switch off in good time.

**It must be noted that with thermally sluggish systems, the actual value of the control variable may continue to rise after switching off.**

In the following "Table33", the setting values are given for the controller parameters as a function of Tu, Tg and Ks for command and disturbance behaviour, as well as for an aperiodic control event and a control event with 20% overshoot. They apply for loops with P behaviour, with dead time and with first order delay.

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### Parameter setting according to Chien, Hrones and Reswick

| Controller type | Parameter setting | | | |
|---|---|---|---|---|
| | with aperiodic control event (0% overshoot) | | with control event with 20% overshoot | |
| | Command | Fault | Command | Fault |
| P controller | $Kp = 0.3 \cdot \frac{Tg}{Tu \cdot Ks}$ | $Kp = 0.3 \cdot \frac{Tg}{Tu \cdot Ks}$ | $Kp = 0.7 \cdot \frac{Tg}{Tu \cdot Ks}$ | $Kp = 0.7 \cdot \frac{Tg}{Tu \cdot Ks}$ |
| PI controller | $Kp = 0.35 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 1.2 \cdot Tg$ | $Kp = 0.6 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 4 \cdot Tu$ | $Kp = 0.6 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = Tg$ | $Kp = 0.7 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 2.3 \cdot Tu$ |
| PID controller | $Kp = 0.6 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = Tg$<br>$Tv = 0.5 \cdot Tu$ | $Kp = 0,95 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 2.4 \cdot Tu$<br>$Tv = 0.42 \cdot Tu$ | $Kp = 0,95 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 1.35 \cdot Tg$<br>$Tv = 0.47 \cdot Tu$ | $Kp = 1.2 \cdot \frac{Tg}{Tu \cdot Ks}$<br>$Tn = 2 \cdot Tu$<br>$Tv = 0.42 \cdot Tu$ |

*Table33: Parameter setting according to Chien, Hrones and Reswick*

The amplification factor Ks of the control loop is obtained from:

$$K_s = \frac{\Delta X}{\Delta Y} \qquad (11)$$

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# 9 GLOSSARY

| | |
|---|---|
| Autotune | Adjustment of position sensor of position control at the physical stroke of the proportional valve.<br>Menu designation for executing Autotune below.<br>For globe and angle seat control valves: X.TUNE<br>For diaphragm control valves: M.Q.0.TUNE |
| Views area | Section of device software for displaying values.<br>The measured values are displayed in one or more views in the views area. |
| SAFEPOS energy-pack | Own name for the energy storage system that is used for Bürkert devices. |
| Configuration area | Section of device software in which the configuration and parameterisation of the device occur.<br>The software of the electromotive control valve is divided into the following configuration areas:<br>• Positioner<br>• Inputs/outputs<br>• Process controller (only available in devices with process control function)<br>• Industrial communication<br>• Display<br>• General settings |
| Context menu | Menu that is only available on the display of the device and can be retrieved in any position on the menu structure. As well as indicating context-sensitive information, the context menu is used for adjusting the display and changing access rights. |
| NAMUR | Abbreviation and proper name for the User Association for Automation in Process Industries e.V. |
| NAMUR NE 107 | Recommendation for the “self-monitoring and diagnostics of field devices”. |
| Tab | Section of device software. The device software is subdivided into configuration areas, with menus assigned to the PARAMETER, MAINTENANCE and DIAGNOSTICS tabs depending on function. |

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