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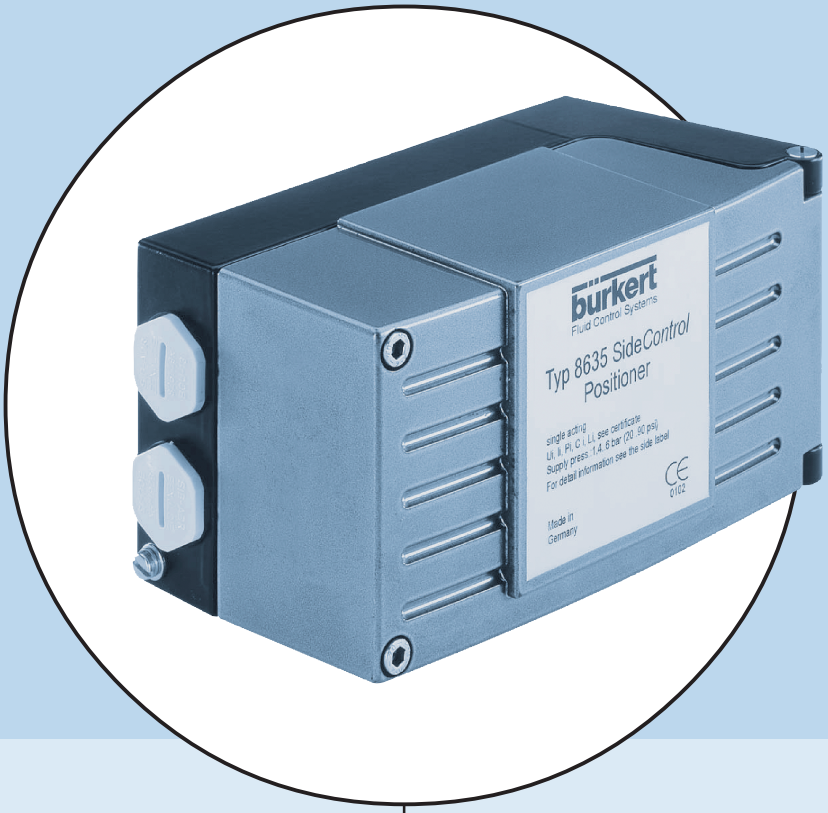
Fine Controls (UK) LTD, Bassendale Road, Croft Business Park,
Bromborough, Wirral, CH62 3QL UK
Tel: 0151 343 9966
Email: sales@finecontrols.com

# Operating Instructions

## Bedienungsanleitung
## Instructions de Service




# Type 8635

## SIDE Control Positioner

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

bürkert
Fluid Control Systems

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Operating Instructions 1009/05_EU-EN_00804608

# Operating Instructions for SIDE Control Positioner Type 8635 *(S/HART, PROFIBUS PA, HART-Hand Terminal)*

## GENERAL NOTES



## SYSTEM DESCRIPTION *(S/HART)*



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## SYSTEM DESCRIPTION *(PROFIBUS PA)*



## INSTALLATION



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## INDUCTIVE PROXIMITY SWITCHES *(S/HART, PROFIBUS PA, OPTION)*



## OPERATING AND CONTROLLER FUNCTIONS



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## OPERATING THE PROCESS CONTROLLER *(S/HART)*



## CONFIGURATION FOR BUS COMMUNICATION *(PROFIBUS PA)*



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## OPERATING VIA THE HART HAND TERMINAL *(HART)*



## MAINTENANCE AND ERROR ELIMINATION ON THE POSITIONER



## MAINTENANCE AND ERROR ELIMINATION ON THE PROCESS CONTROLLER *(S/HART)*



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# Appendix

## GENERAL RULES



## OPERATING STRUCTURE



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## APPROVALS *(S/HART)*



## APPROVALS *(PROFIBUS PA)*



## APPROVALS *(S/HART, PROFIBUS PA)*



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# GENERAL NOTES



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# Symbols

The following symbols are used in these operating instructions:

→ marks a work step that you must carry out.

**ATTENTION!** marks notes on whose non-observance your health or the functioning of the device will be endangered.

**NOTE** marks important additional information, tips and recommendations.

*(S/HART)*
*(PROFIBUS PA)*
*(HART)*

indicate chapters or sections of the text which are valid only for certain versions of the SIDE Control.

# General safety notes

Please observe the notes in these operating instructions together with the conditions of use and permitted data that are specified in the data sheets of the electropneumatic positioner, in order that the device will function perfectly and remain operable for a long time:

- This device left the manufacturer's factory in a faultless condition with regard to technical safety and was tested. Proper transport, storage and installation are the prerequisites for continued correct functioning.
- Keep to standard engineering rules in planning the use of and operating the device!
- Installation and intervention for maintenance work are only allowed by qualified personnel using suitable tools!
- Observe the current regulations on accident prevention and safety for electrical devices during operation and maintenance of the device!
- Take suitable precautions to prevent inadvertent operation or damage by unauthorized action!
- On non-observance of these notes and unauthorized interference with the device, we will refuse all liability and the warranty on device and accessories will become void!

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## Protection from damage by electrostatic charging

ATTENTION
EXERCISE CAUTION ON HANDLING!
ELECTROSTATICALLY SENSITIVE
COMPONENTS / MODULES

This device contains electronic components that are sensitive to electrostatic discharge (ESD). Contact to electrostatically charged persons or objects will endanger these components. In the worst case, they will be immediately destroyed or will fail after commissioning.

Observe the requirements of EN 100015-1 (IEC 61340-5-1) in order to minimize the possibility of, or avoid, damage from instantaneous electrostatic discharge. Also take care not to touch components that are under supply voltage.

## Device-related notes

- For installation and operation in potentially hazardous (explosive) locations, observe the regulations. These are to be found in EN 60079-14 (IEC 60079-14).
- On electrical connection of the inherently safe circuits, observe the data in the relevant certificate of conformity.
- Take suitable precautions to prevent electrostatic charging of plastic parts of the housing (see EN 100015-1 / IEC 61340-5-1).
- No components shall be connected to the inputs and outputs of the boards whose electrical data lie outside the limits determined for inherently safe operation and stated on the data sheet for the positioner.
- In potentially explosive locations, only inherently safe devices (of EN 50020 / IEC 60079-11) shall be connected to the serial interface.
- The plastic covering shall be removed only by the manufacturer!
- Interventions in the device with the housing open shall not be carried out in very humid or aggressive atmospheres. Take precautions to prevent inadvertent mechanical damage to the boards or their components. Limit the duration of opening of the housing to that which is absolutely necessary.

## Scope of delivery

Immediately after receipt of a shipment, make sure that the contents are undamaged and match the scope of delivery stated on the packing slip. In general this consists of:

- SIDE Control
- Operating Instructions for the SIDE Control

Add-on kits for linear and part-turn actuators may be obtained as accessories.

If there are discrepancies, please contact immediately our customer service:

Bürkert Fluid Control Systems / Service Department
Chr.-Bürkert-Str. 13-17
D-76453 Ingelfingen
Tel.: (+49 7940) 10-111 Fax: (+49 7940) 10-448
E-Mail: info@de.buerkert.com

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## Warranty conditions

This document contains no promise of guarantee . Please refer to our general terms of sales and delivery. The warranty is only valid if the device is used as authorized in accordance with the specified application conditions.

**ATTENTION!**

The warranty covers only faultless condition of the SIDE Control. No liability will be accepted for consequential damage of any kind that may arise from failure or malfunctioning of the device.

## Master code *(S/HART)*

Operation of the SIDE Control *(S/HART)* can be blocked with a freely selectable user code. Independent of this, there exists an unchangeable master code with which you can execute all operative actions on the device. This 4-digit master code is to be found in the Appendix of these operating instructions in the Chapter *Master code (S/HART)*.

If required, cut out this code and keep it separate from these operating instructions.

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# SYSTEM DESCRIPTION *(S/HART)*



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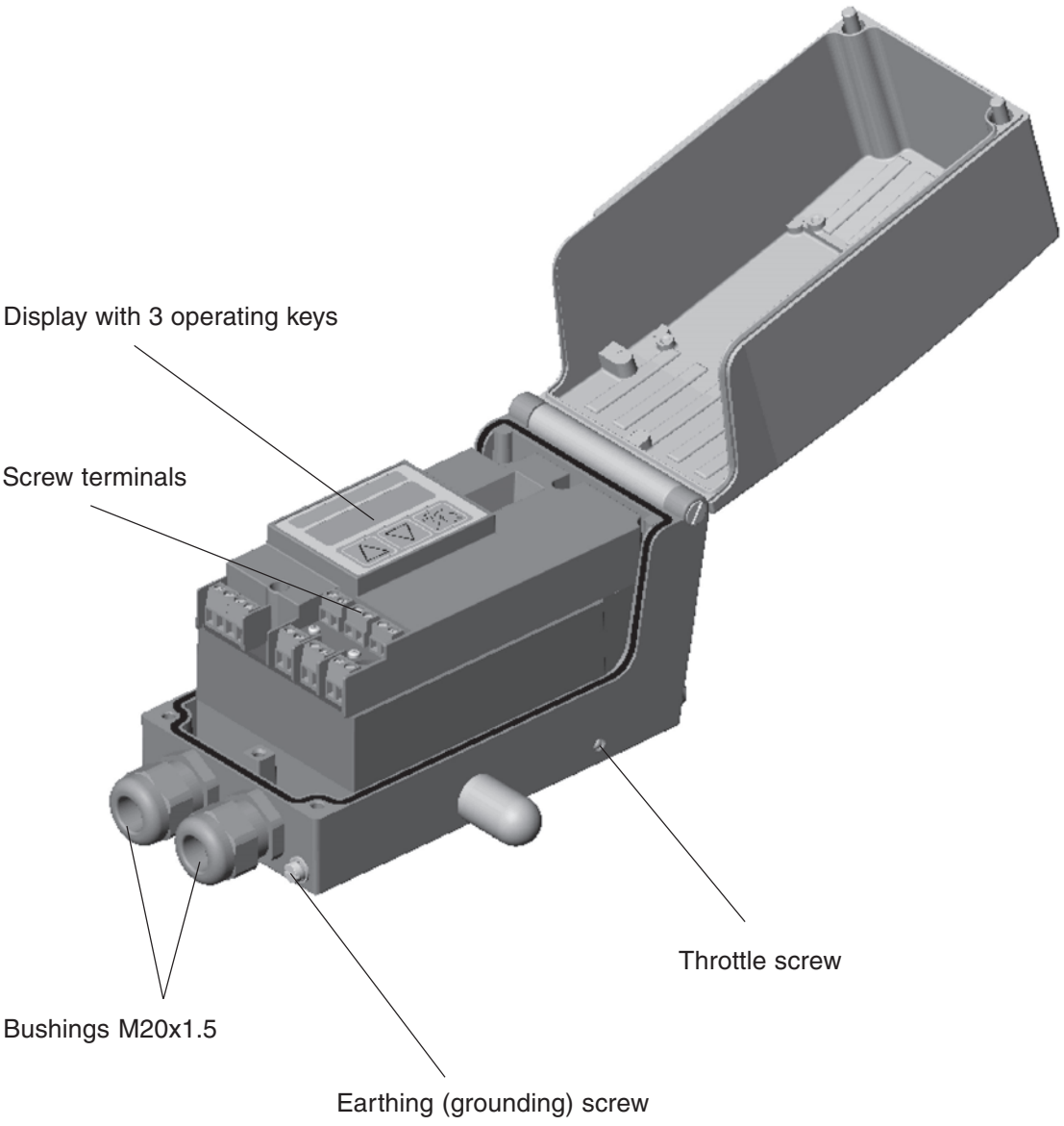
# Construction of SIDE Control *(S/HART)*

The SIDE Control *(S/HART)* is a digital positioner for pneumatically operated continuous valves with single-acting linear or part-turn actuators.

The SIDE Control *(S/HART)* can be operated via a keypad with display. An optional extra is communication to the HART protocol.

## Illustration

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## Features

- **Position sensor**
  Very high resolution conductive plastic potentiometer
- **Microprocessor controlled electronics**
  for signal processing, control and driving the piezoelectric positioning system; setpoint entry and power supply are via a 4 ... 20 mA standard signal.
- **Operating elements**
  The device can be set (configuration and parametrization) locally via three inside keys. An inside, 8-digit, 16-segment LC display is provided, which can also show the setpoint or actual value.
- **Positioning system**
  A piezoelectric positioning system serves to drive the valve actuator.
- **Position repeater** *(option)*
  via 2 inductive proximity switches (initiators)
- **Electrical interfaces**
  Cable bushing (M20x1.5) with screw terminals
- **Pneumatic interfaces**
  G1/4” interior thread
- **Housing**
  Aluminium housing (hard anodized and plastic-coated) with swing-up cover and captive screws.
- **Attachment**
  to linear actuators to NAMUR recommendation (DIN IEC 534 T6) or to part-turn actuators to VDI/VDE 3845.
  Option: integral attachment to Bürkert continuous valves

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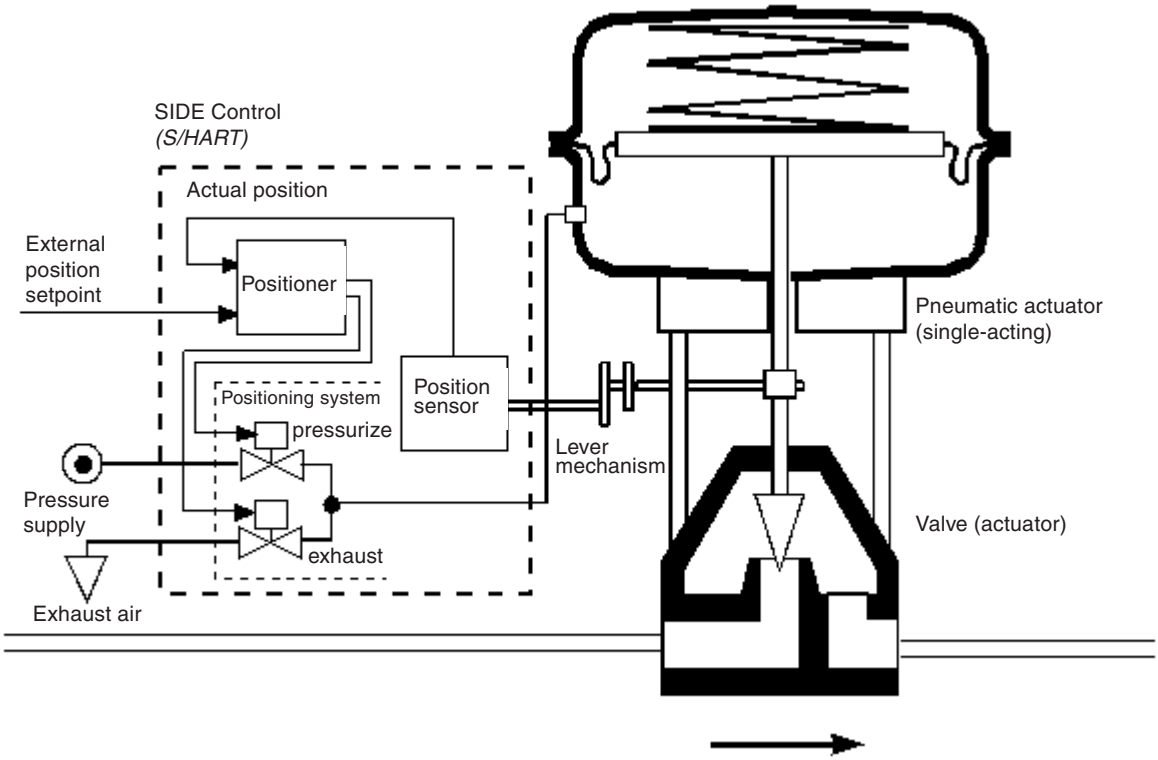
## Functional diagram of the SIDE Control *(S/HART)* connected to a control valve with single-acting diaphragm actuator




**NOTE**

In the case of integral attachment of the SIDE Control *(S/HART)* to a Bürkert continuous valve, the position sensor is situated outside the SIDE Control *(S/HART)* on the actuator and is connected to the latter with a cable.

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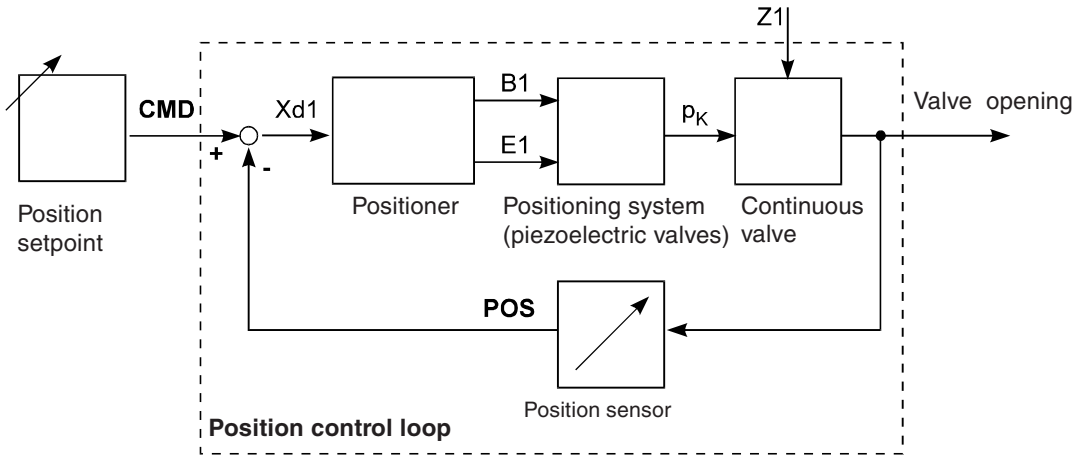
# Operation as a positioner *(S/HART)*

The SIDE Control *(S/HART* controls the position of the pneumatic actuator, whereby the position sensor measures the actual position (POS) of the actuator. The controller compares this actual value of the position with the setpoint (CMD), which is presented as a standard signal. If a control difference (Xd1) exists, a pulse-width modulated voltage signal is sent to the positioning system as the correcting variable. If the difference is positive, the pressurizing piezoelectric valve is driven via output B1; if it is negative, the exhausting piezoelectric valve is driven via output E1. In this way, the position of the actuator is altered until the control difference is 0. Z1 represents a disturbance.

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## Characteristics of the positioner software

| Supplementary function | Effect |
|---|---|
| **Positioner with supplementary functions** | |
| *AUTOTUNE* | Automatic adaptation of positioner to the control valve in use. |
| Tight-closing function | Valve closes tight outside the control range. A value is specified (in %) from which the actuator is completely exhausted (at 0%) or pressurized (at 100%). |
| Stroke limitation | Mech. valve piston movement only within a defined stroke range. |
| Limitation of correcting speed | Actuator takes a preset time to move from OPEN to CLOSED or from CLOSED to OPEN. |
| Signal range splitting | Splitting of the standard signal range over 2 or more SIDE Controls. |
| Correction charakteristic for adaptation to the operating curve | Linearization of the process curve can be carried out. |
| Insensitivity range | The positioner responds only above a control difference to be specified. |
| Direction of action of the controller setpoint | Reserve of direction of action of the setpoint. |
| Direction of action of the actuator | Reserve of direction of action of the actuator. |
| Safety position | Valve moves to a defined safety position |
| Code protection | Blocking of the keypad or menu |
| Factory reset | Reset to factory settings |
| **Repeater (option)** | |
| Analog feedback of position | Feedback of the values POS and CMD |
| Binary outputs | Feedback of various controller conditions (e.g. sensor breakage or controller in safety position). |

| **Hierarchic operating concept for simple operation with the following levels** | |
|---|---|
| Process operation | In this level, you switch between Automatic and Manual operation. |
| Configuration | In this level, you specify on commissioning certain basic functions and configure supplementary functions as required. |

| **Communication via HART protocol (option)** | |
|---|---|
| HART Hand Terminal | Operation of the SIDE Control via a HART Hand Terminal |

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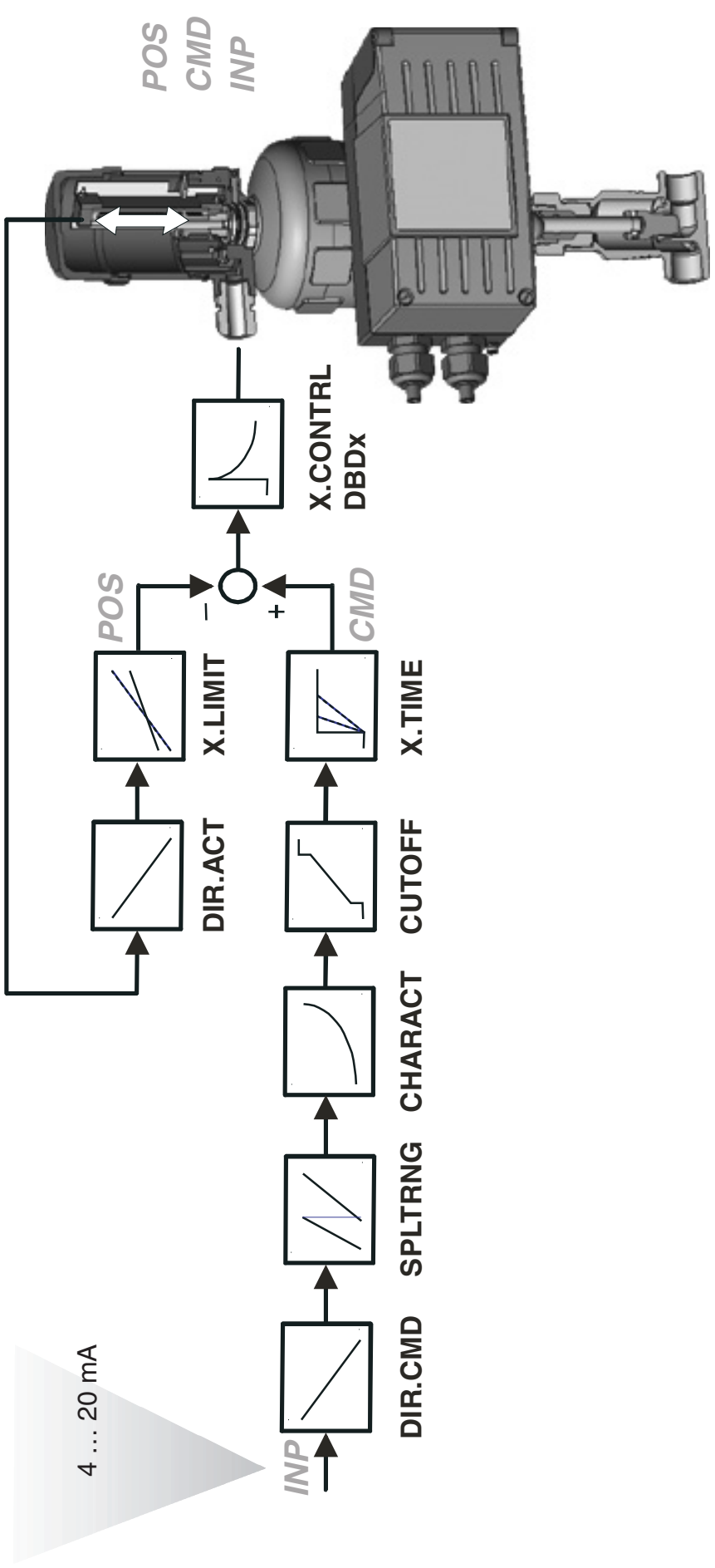
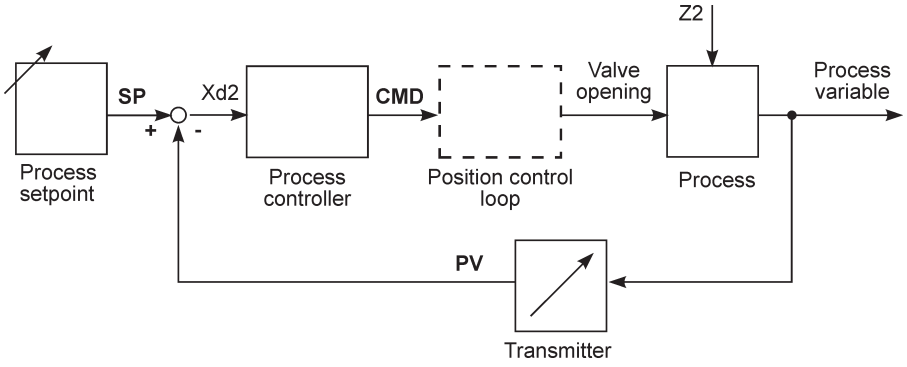
**Schematic illustration of position control**



# Operation as a process controller *(S/HART, option)*

If the SIDE Control *(S/HART)* is operated as a process controller, the abovementioned position control becomes a lower-ranking auxiliary control loop. The overall result is a cascade control system.

The process controller (as a main control loop) is implemented in the SIDE Control *(S/HART* as a PID controller. In this case the process setpoint (SP) is preset and compared with the actual value (PV) of the process variable to be controlled, which is supplied by a sensor. Formation of the correcting variable is done according to the description of the positioner. Z2 represents a disturbance acting on the process.




## Characteristic of the process controller software *(option)*

| **Supplementary function** | **Effect** |
|---|---|
| **Positioner with supplementary functions** | |
| *AUTOTUNE* | Automatic adaptation of positioner to the control valve in use. |
| Tight-closing function | Valve closes tight outside the control range. A value is specified (in %) from which the actuator is completely exhausted (at 0 %) or pressurized (at 100 %) . |
| Stroke limitation | Mech. valve piston movement only within a defined stroke range. |
| Limitation of correction speed | Actuator takes a preset time to move from OPEN to CLOSED or from CLOSED to OPEN. |
| Correction characteristic for adaptation to the operating curve | Linearization of the process curve can be carried out. |
| Insensitivity range | The positioner responds only above a control difference to be specified. |
| Direction of action of the controller setpoint | Reverse of direction of action of the setpoint. |
| Direction of action of the actuator | Reverse of direction of action of the actuator. |
| Safety position | Valve moves to a defined safety position |
| Code protection | Blocking of the keypad or menu |
| Factory reset | Reset to factory settings |

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| Supplementary function | Effect |
|---|---|
| **Connectable process controller with the following characteristics (option)** | |
| Control structure | PID |
| Parameters which can be set | Proportional action factor, reset time, rate time and operating point |
| Scalable inputs | Position of decimal points, lower and upper scale values of process value and setpoint |
| Selection of setpoint specification | Setpoint specified either via standard signal input or via keys |

| **Hierarchic operating concept for simple operation with the following levels** | |
|---|---|
| Process operation | In this level, you switch between Automatic and Manual operation. |
| Configuration | In this level, you specify on commissioning certain basic functions and configure supplementary functions as required. |

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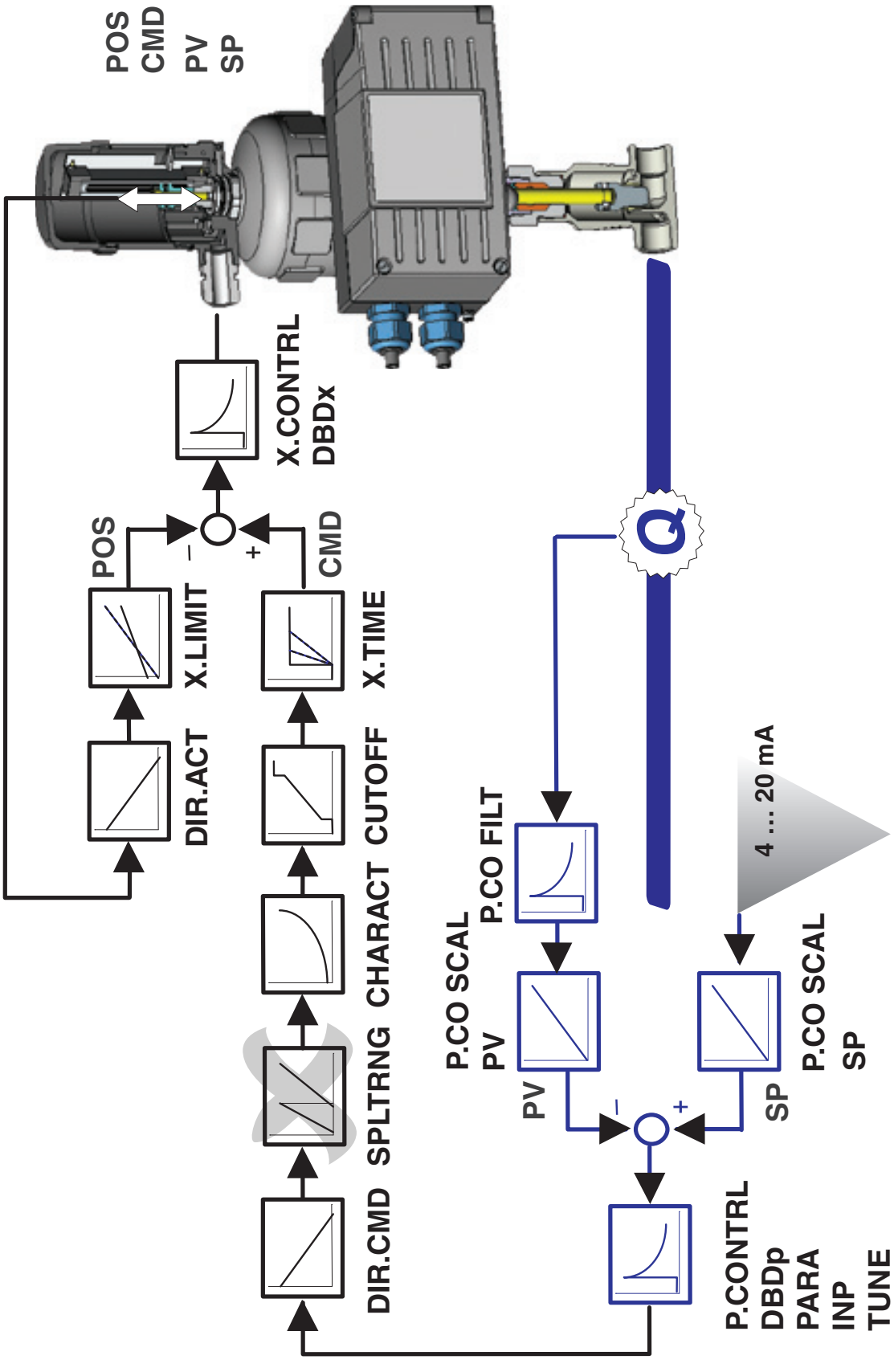
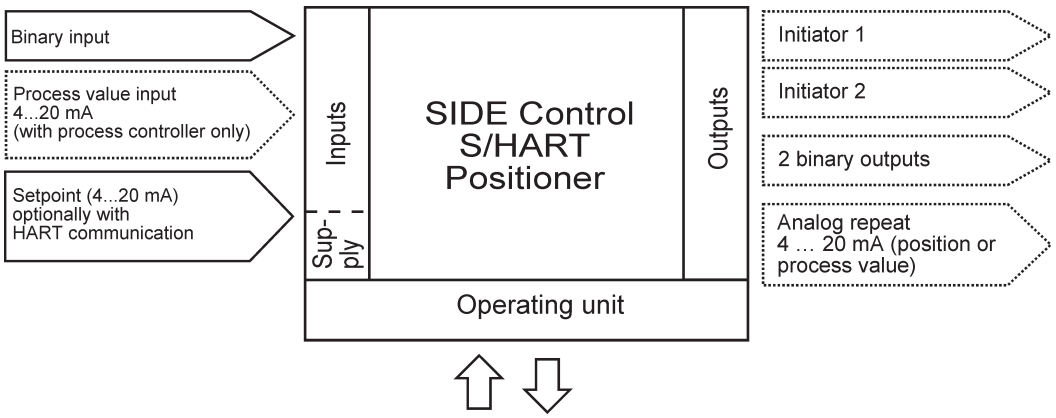
Schematic illustration of process control



# Interfaces *(S/HART)*




Note: Optional inputs and outputs are enclosed by dotted lines.

**NOTE** The SIDE Control *(S/HART)* is a 2-conductor device, i.e. the voltage supply is provided via the 4 ... 20 mA signal.

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# Technical data of the SIDE Control *(S/HART)*

## Technical data *(S/HART)*

**OPERATING CONDITIONS**

| | |
|---|---|
| Permissible ambient temperature | -25 ... +65 °C (with non-Ex devices or T4/T5) |
| | -25 ... +60 °C (with T6) |
| System of protection | IP 65 to EN 60529 |
| | (only with correctly connected cable) |

**CONFORMITY TO THE FOLLOWING STANDARDS**

| | |
|---|---|
| CE Symbol | Conformity wrt. EMC Guideline 89/336/EEC |
| Low Voltage Guidline | 73/23/EEC |
| Explosion protection (optional) | EEX ia IIC T4/T5/T6 |

**MECHANICAL DATA**

| | |
|---|---|
| Housing dimensions, outside (WxHxD) | 174 x 88 x 93 mm |
| Housing material | Aluminium |
| | hard anodized and plastic-coated |
| Seal material | NBR / Neoprene |
| Other exterior parts | stainless steel (V4A) |
| Mass | approx. 1.5 kg |

**ELECTRICAL DATA**

| | |
|---|---|
| Connections | 2 M20x1.5 bushings |
| | with screw terminals 0.14 ... 1.5 $mm^2$ |
| Power supply | via setpoint input 4-20 mA |
| Burden voltage | < 12 V DC |
| Burden resistance | 590 Ω at 20 mA and 11.8 V DC |
| Process value input (option) | 4-20 mA |
| Burden voltage | 200 mV at 20 mA |
| Burden resistance | 10 Ω |
| Binary input | mechanical make/break contact |
| Inductive proximity switch (optional) | to DIN EN 60947-5-6 (NAMUR) |
| Structural shape | SJ3.5-G-N |
| Manufacturer | Pepperl+Fuchs |
| Output signal for switching amplifier | to DIN EN 50227 (NAMUR) |
| Rated voltage $U_0$ | 8 V |
| Current (sensor uncoated) | ≥ 2.1 mA |
| Current (sensor coated) | ≤ 1.2 mA |

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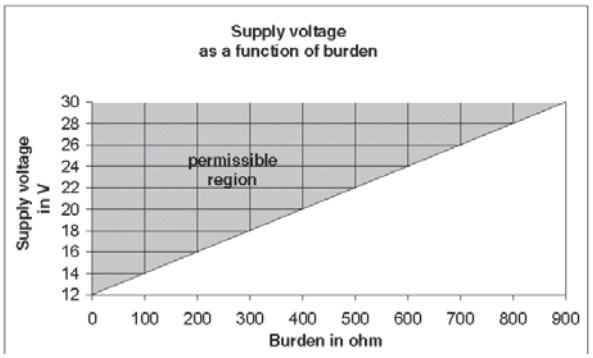
| | |
|---|---|
| Analog repeat (optional) | 4 ... 20 mA (electrically isolated) |
| Supply voltage | $U_{supply}$ = 12 ... 30 V DC |
| Burden | $U_{supply} \geq 12\ V + RB \bullet 20\ mA$ |




| | |
|---|---|
| Binary outputs (optional) | to EN 50 227 (electrically isolated) |
| Supply voltage | 5 ... 11 V DC |
| Current in switching status OPEN | < 1.2 mA |
| Current in switch. status CLOSE | > 2.1 mA |
| Sense of action | NO (normally open) or NC (normally closed) (may be parametrized) |
| max. permissible values | see Declaration of Conformity |

**PNEUMATIC DATA**

| | |
|---|---|
| Control medium | Quality classes to DIN ISO 8573-1 |
| Dust content | Class 5: max. 40 µm particle size, max. 10 mg/m³ particle density |
| Water content | Class 3: max. pressure dew point - 20 °C or at least 10 degrees below lowest operating temperature |
| Oil content | Class 3: max. 1 mg/m³ |
| Temperatur range of compressed air | - 25 ... + 65 °C (with non-Ex devices or T4/T5)<br>- 25 ... + 60 °C (with T6) |
| Pressure range | 1.4 ... 6.0 bar |
| Supply pressure variation | max. ± 10 % during operation |
| Air flow capacity of control valve | |
| at 1.4 bar pressure drop over valve | ca. 55 $L_N$/min STP for pressurizing and exhausting |
| at 6 bar pressure drop over valve | ca. 170 $L_N$/min STP for pressurizing and exhausting |
| Self-consumption of air in balanced state | 0.0 $L_N$/min STP |
| Throttle screw | adjustment ratio ca.10:1 |
| Connections | G1/4" internal thread |

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## Factory settings *(S/HART)*

| Function | Factory setting |
|---|---|
| *CHARACT* | *CHA LIN* |
| *CUTOFF* | *CUT* ⊥ = 0 %; *CUT* ⊤ = 100 % |
| *DIR.CMD* | *DIR.CRISE* |
| *DIR.ACT* | *DIR.ARISE* |
| *SPLTRNG* | *SR* ⊥ = 0 (%); *SR* ⊤ = 100 (%) |
| *X.LIMIT* | *LIM* ⊥ = 0 %, *LIM* ⊤ = 100 % |
| *X.TIME* | |
| *T.OPN* | Values determined by *AUTOTUNE* |
| *T.CLS* | Values determined by *AUTOTUNE* |
| After execution of *SETFACT*: 1 s | |
| *OUTPUT* | |
| *OUT ANL:* | |
| *OUT POS* | *OUT 4'20 A* |
| *OUT BIN:* | |
| *OUT DEV* | *DEV 5.0 NORM OPN* |
| *SAFEPOS* | 0 |
| *BIN-IN* | *B.IN SPOS / NORM OPN* |

| Function | Factory setting |
|---|---|
| *X.CONTRL* | |
| *X.CO DBND* | 1 % |
| *X.CO PARA* | |
| *KX* ⊤ | Values determined by *AUTOTUNE* |
| *KX* ⊥ | Values determined by *AUTOTUNE* |
| After execution of *SETFACT*: 1 | |
| *P.CONTRL* | |
| *P.CO DBND* | 1 % |
| *P.CO PARA* | |
| *KP* | 1.00 |
| *TN* | 999.9 |
| *TV* | 0.0 |
| *X0* | 0 |
| *P.CO SETP* | *SETP INT* |
| *P.CO FILT* | 0 |
| *P.CO SCAL* | *PV*⊥000.0, *PV*⊤100.0 |
| *P.CO TUNE* | *D'ACT* |
| *CODE* | *CODE 0000* |

**NOTE** The functions and factory settings shown in grey are optionally valid with analog repeat *(OUTPUT)* or with process controller *(P.CONTRL)*.

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# SYSTEM DESCRIPTION *(PROFIBUS PA)*



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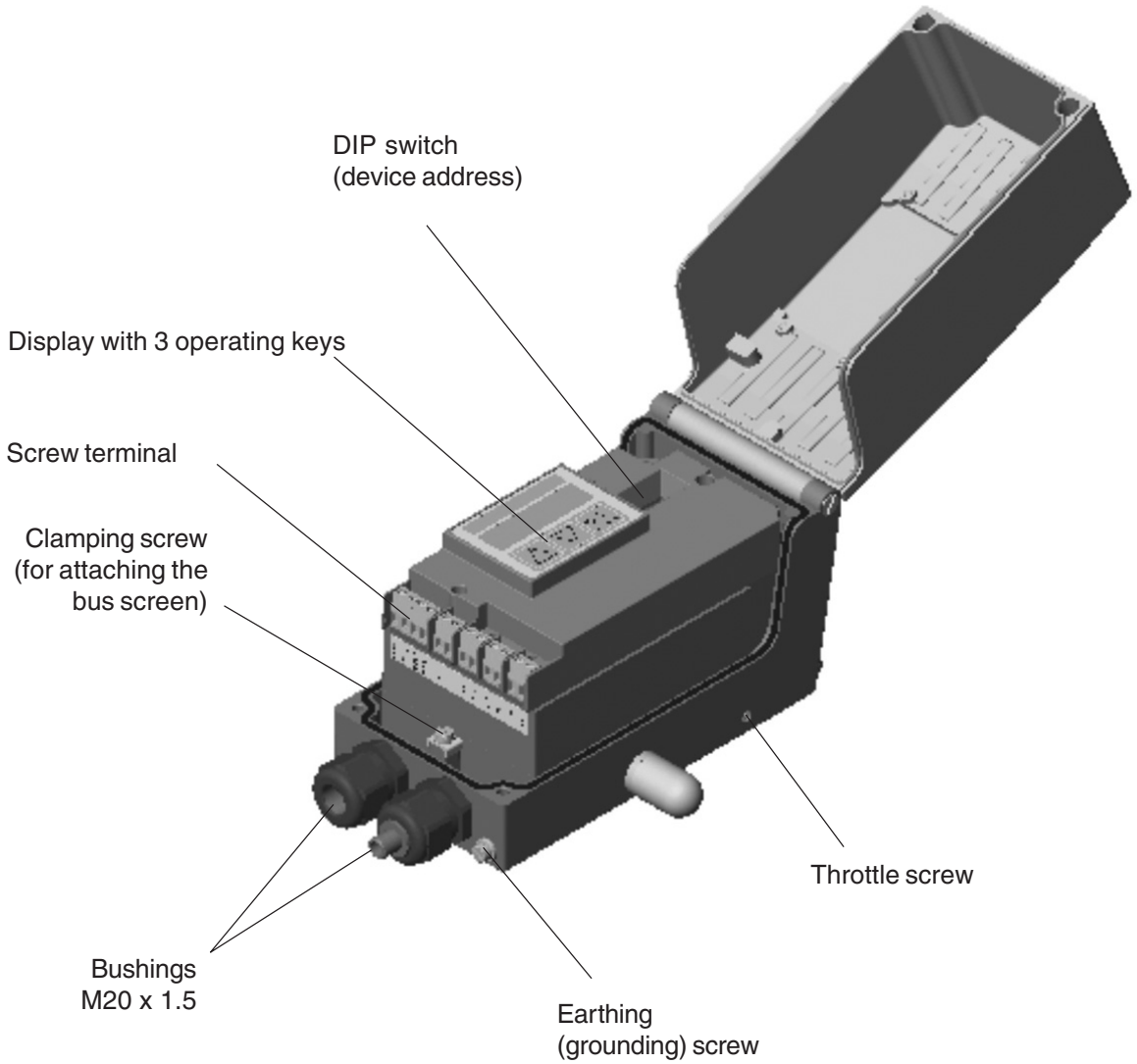
# Construction of SIDE Control *(PROFIBUS PA)*

The SIDE Control *(PROFIBUS PA)* is a digital positioner for pneumatically operated continuous valves with single-acting linear or part-turn actuators.
The SIDE Control *(PROFIBUS PA)* can be controlled via PROFIBUS PA from a central automation system (e.g. process control system). The momentary valve position is reported via the bus.

For detailled information on commissioning a PROFIBUS PA branch, we recommend the *PROFIBUS Commissioning Guidelines* by the PROFIBUS Users Organization (PUO).

## Illustration

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## Features

- **Position sensor**
  Very high resolution conductive plastic potentiometer
- **Microprocessor controlled electronics**
  for signal processing, control and driving the piezoelectric positioning system
- **Operating elements**
  The device can be set (configuration and parametrization) locally via three inside keys. An inside, 8-digit, 16-segment LC display is provided, which can also show the set point or actual value.
- **Positioning system**
  A piezoelectric positioning system serves to drive the valve actuator.
- **Electrical interfaces**
  M20 bushings with screw terminals
- **Pneumatic interfaces**
  G1/4" interior thread
- **Housing**
  Aluminium housing (hard anodized and plastic-coated) with swing-up cover and captive screws.
- **Attachment**
  to linear actuators to NAMUR recommendation (DIN 534 T6) or to part-turn actuators to VDI/VDE 3845)

## Options

- Position feedback via 2 inductive proximity switches (initiators).
- Integral attachment to Bürkert continuous valves.

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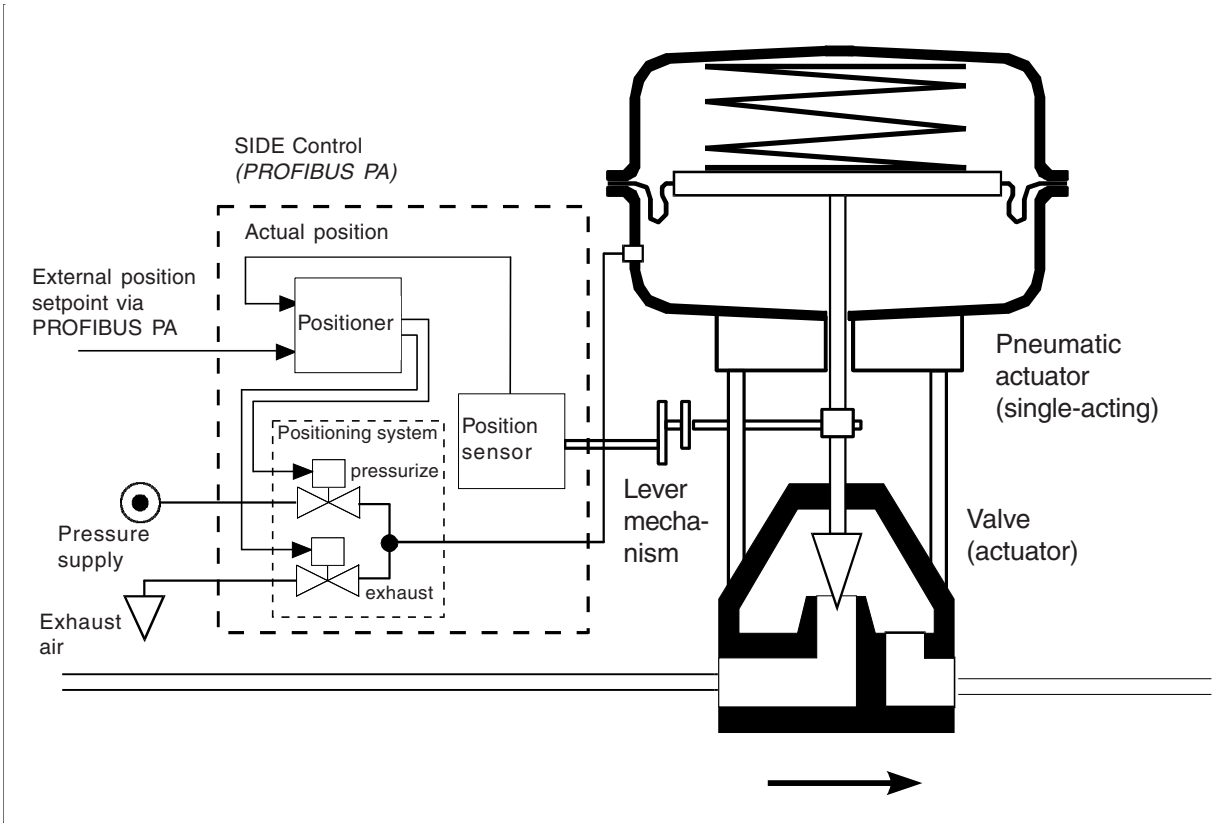
## Functional diagram of the SIDE Control *(PROFIBUS PA)* connected to a control valve with single-acting diaphragm actuator




**NOTE**

In the case of Integral attachment of the SIDE Control *(PROFIBUS PA)* to a Bürkert continuous valve, the position sensor is situated outside the SIDE Control *(PROFIBUS PA)* on the actuator and is connected to the latter with a cable.

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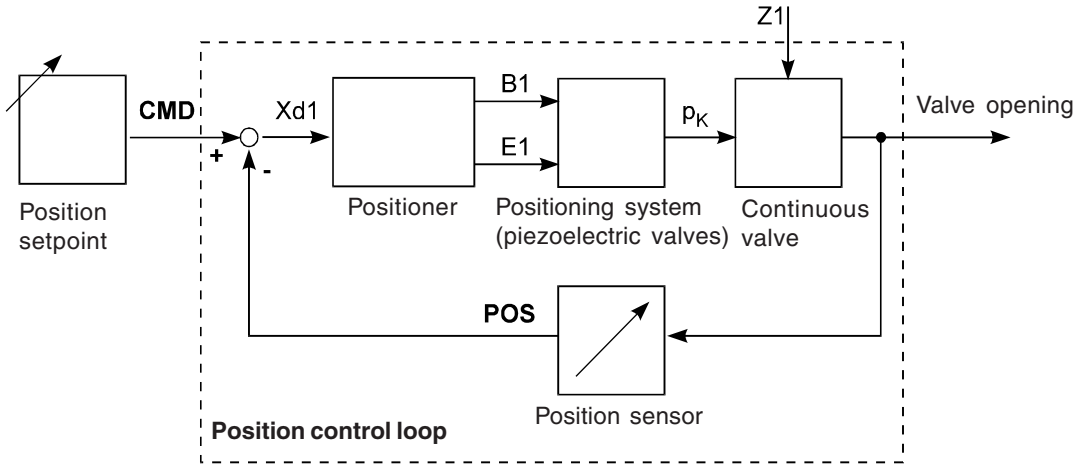
# Operation as a positioner *(PROFIBUS PA)*

The SIDE Control *(PROFIBUS PA)* controls the position of the pneumatic actuator, whereby the position sensor measures the actual position (POS) of the actuator. The controller compares this actual value of the position with the setpoint (CMD), which may be set via the PROFIBUS PA. If a control difference (Xd1) exists, a pulse-width modulated voltage signal is sent to the positioning system as the correcting variable. If the difference is positive, the pressurizing piezoelectric valve is driven via output B1; if it is negative, the exhausting piezoelectric valve is driven via output E1. In this way, the position of the actuator is altered until the control difference is 0. Z1 represents a disturbance.

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## Characteristics of the positioner software

| Supplementary function | Effect |
|---|---|
| **Positioner with supplementary functions** | |
| *AUTOTUNE* | Automatic adaptation of positioner to the control valve in use. |
| Tight-closing function | Valve closes tight outside the control range. A value is specified (in %) from which the actuator is clompletely exhausted (at 0 %) or pressurized (at 100 %). |
| Stroke limitation | Mech. valve piston movement only within a defined stroke range. |
| Limitation of correction speed | Actuator takes a preset time to move from OPEN to CLOSED or from CLOSED to OPEN. |
| Correction characteristic for adaptation to the operating curve (via PROFIBUS PA) | Linearization of the process curve can be carried out. |
| Insensitivity range | The positioner responds only above a control difference to be specified. |
| Direction of action of the controller setpoint | Reverse of direction of action of the setpoint |
| Direction of action of the actuator | Reverse of direction of action of the actuator |
| Safety position | Valve moves to a defined safety position |
| Factory reset | Reset to factory settings |

| Communication via PROFIBUS PA protocol |
|---|

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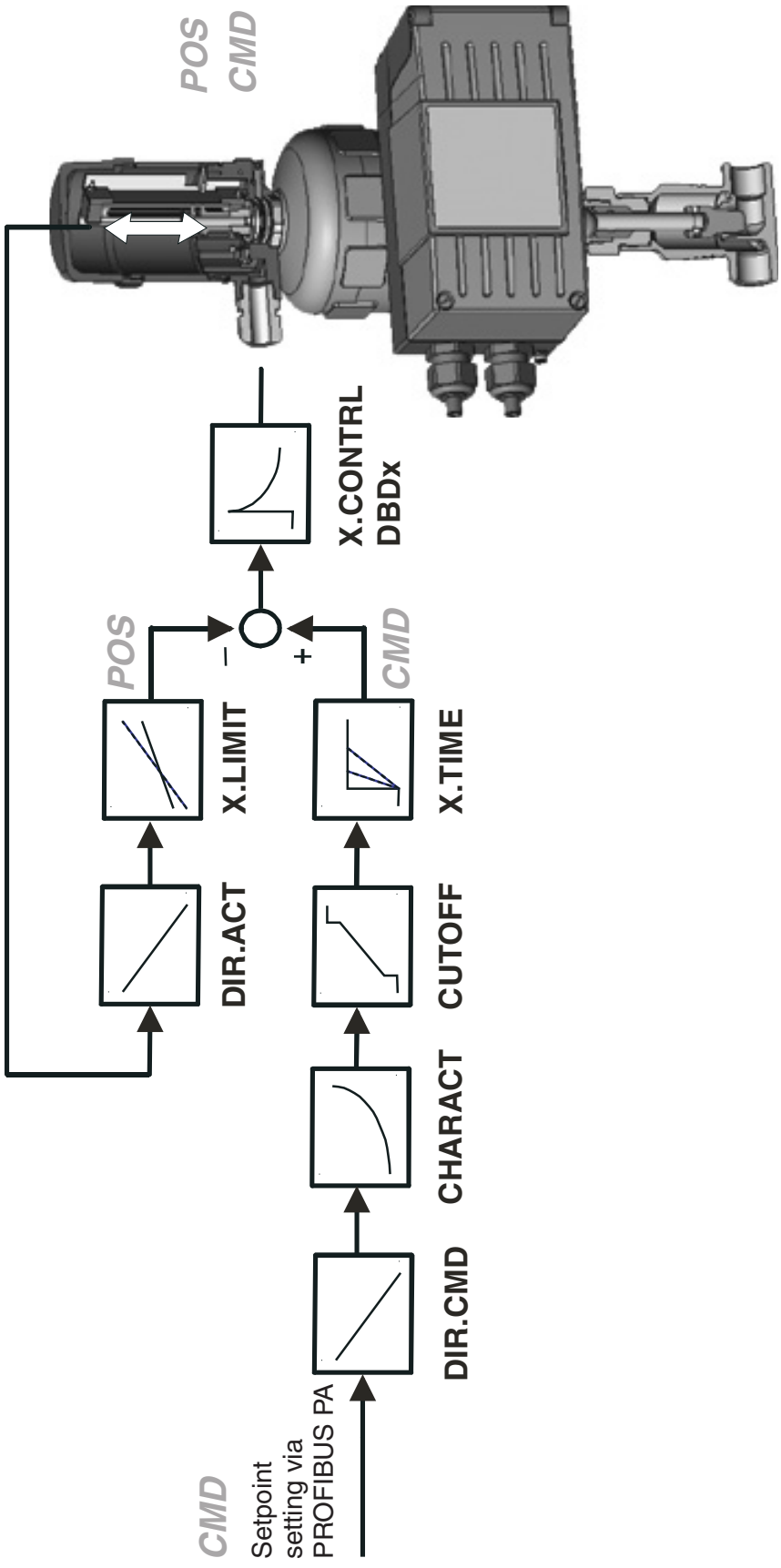
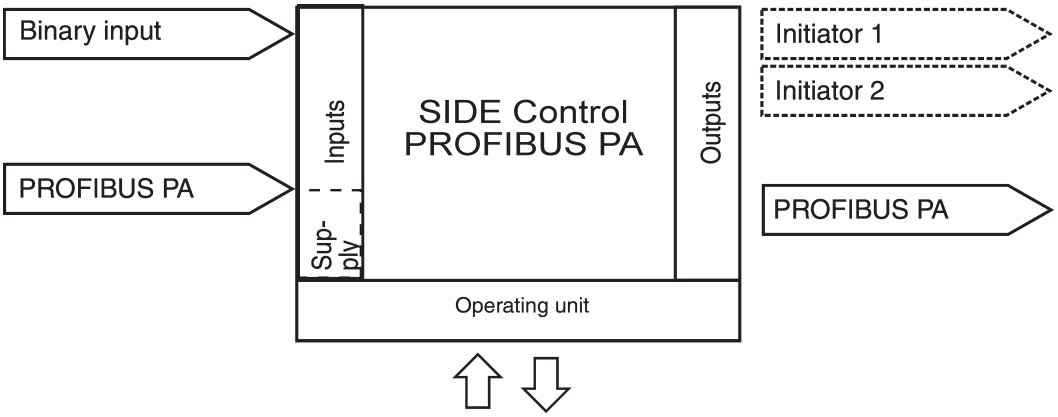
## Schematic illustration of position control



# Interfaces *(PROFIBUS PA)*




Note: Optional inputs and outputs are enclosed by dotted lines

**NOTE** The SIDE Control *(PROFIBUS PA)* is a 2-conductor device, i.e. the voltage supply is provided via the PROFIBUS PA signal.

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# Technical data of the SIDE Control *(PROFIBUS PA)*

## Technical data *(PROFIBUS PA)*

**OPERATING CONDITIONS**

| | |
|---|---|
| Permissible ambient | - 25 ... + 65 °C (with non-Ex devices or T4/T5) |
| temperature | - 25 ... + 60 °C (with T6) |
| System of protection | IP 65 to EN 60529 |
| | (only with correctly connected cable) |

**CONFORMITY TO THE FOLLOWING STANDARDS**

| | |
|---|---|
| CE symbol | Conformity wrt. EMC Guideline 89/336/EEC |
| Low Voltage Guidline | 73/23/EEC |
| Explosion protection (optional) | EEX ia IIC T4/T5/T6 |

**MECHANICAL DATA**

| | |
|---|---|
| Housing dimensions, outside (W x H x D) | 174 x 88 x 93 mm |
| Housing material | Aluminium |
| | hard anodized and plastic-coated |
| Seal material | NBR / Neoprene |
| Other exterior parts | stainless steel (V4A) |
| Mass | approx. 1.5 kg |

**ELECTRICAL DATA**

| | |
|---|---|
| Connections | 2 M20 x 1.5 |
| | bushings with screw terminals 0.14 ... 1.5 $mm^2$ |
| Power supply | via PROFIBUS PA signal |
| to Ex segment coupler | 9 ... 15 V DC (Ex) |
| to segment coupler | 9 ... 24 V DC (NonEx) |
| Operating current from bus | 12 mA ± 7 % without FDE |
| Fault current protection | 5 mA ± 10 % FDE |
| Binary input | mechanical make/break contact |
| Inductive proximity switch (optional) | to DIN EN 60947-5-6 (NAMUR) |
| Structural shape | SJ3,5-G-N |
| Manufacturer | Pepperl+Fuchs |
| Output signal for switching amplifier | to DIN EN 50227 (NAMUR) |
| Rated voltage $U_0$ | 8 V |
| Current (sensor uncoated) | ≥ 2.1 mA |
| Current (sensor coated) | ≤ 1.2 mA |

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**PNEUMATIC DATA**

| | |
|---|---|
| Control medium | Quality classes to DIN ISO 8573-1 |
| Dust content | Class 5:<br>max. 40 µm particle size<br>max. 10 mg/m³ particle density |
| Water content | Class 3:<br>max. pressure dew point<br>- 20 °C or at least 10 degrees below lowest operating temperature |
| Oil content | Class 3: max. 1 mg/m³ |
| Temperature range of compressed air | - 25 ... + 65 °C (with non-Ex devices or T4/T5)<br>- 25 ... + 60 °C (with T6) |
| Pressure range | 1.4 ... 6.0 bar |
| Supply pressure variation | ± 10 % during operation |
| Air flow capacity of control valve | |
| at 1.4 bar pressure drop over valve | ca. 55 $l_N$/min STP for pressurizing and exhausting |
| at 6 bar pressure drop over valve | ca. 170 $l_N$/min STP for pressurizing and exhausting |
| Self-consumption of air in balanced state | 0.0 $l_N$/min |
| Throttle screw | adjustment ratio ca. 10:1 |
| Connections | G1/4" internal thread |

## Factory settings *(PROFIBUS PA)*

| Function | Factory setting | Function | Factory setting |
|---|---|---|---|
| *CUTOFF* | *CUT* $_{\perp}$ = 0 %; *CUT* $^{\top}$ = 100 % | *SAFEPOS* | 0 |
| *DIR.CMD* | *DIR.CRISE* | *BIN-IN* | *B.IN SPOS / NORM OPN* |
| *DIR.ACT* | *DIR.ARISE* | *X.CONTRL* | |
| *X.LIMIT* | *LIM* $_{\perp}$ = 0 %, *LIM* $^{\top}$ = 100 % | *X.CO DBND* | 1 % |
| *X.TIME* | | *X.CO PARA* | |
| *T.OPN* | Values determined by *AUTOTUNE* | *KX* $^{\top}$ | Values determined by *AUTOTUNE* |
| *T.CLS* | Values determined by *AUTOTUNE* | *KX* $_{\perp}$ | Values determined by *AUTOTUNE* |
| After execution of *SETFACT*: 1 s | | After execution of *SETFACT*: 1 | |

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# INSTALLATION



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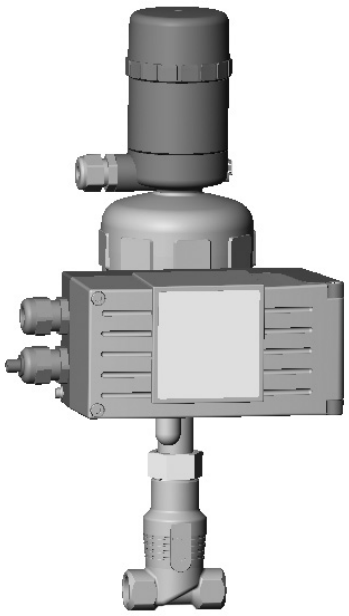
# Attachment and assembly

The SIDE Control may be attached to different continuous valves. The valves which may be used are continuous valves with a linear activator to NAMUR recommendation (DIN IEC 534 T6) and such with a part-turn actuator to VDI/VDE 3845. Furthermore, the SIDE Control is available completely preassembled on a Bürkert continuous valve from series 27xx.

## Complete system with Bürkert continuous valve from series 27xx

The SIDE Control is available in combination with Bürkert continuous valves from the series 27xx as a completely preassembled and tested system.



**ATTENTION!**

The connecting line from the SIDE Control to the external positioning sensor shall not be lengthened. Only the positioning sensor supplied shall be connected to the SIDE Control.
If manipulations are carried out, the EX approval will become void!

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## Attachment to a continuous valve with linear actuator acc. to NAMUR

Transmission of the valve position to the position sensor built into the SIDE Control is via a lever (to NAMUR).

### Add-on kit to linear activator (Id no. 787 215)

(obtainable from Bürkert as an accessory)

| Serial no. | Quantity | Designation |
|---|---|---|
| 1 | 1 | NAMUR attachment bracket IEC 534 |
| 2 | 1 | U-piece |
| 3 | 2 | Clamping piece |
| 4 | 1 | Driving pin |
| 5 | 1 | Conical roller |
| 6a | 1 | NAMUR lever for stroke range 3 - 35 mm |
| 6b | 1 | NAMUR lever for stroke range 35 - 130 mm |
| 7 | 2 | U-bolt |
| 8 | 4 | Hex screw DIN 933 M8 x 20 |
| 9 | 2 | Hex screw DIN 933 M8 x 16 |
| 10 | 6 | Lock washer DIN 127 A8 |
| 11 | 6 | Washer DIN 125 B 8.4 |
| 12 | 2 | Washer DIN 125 B 6.4 |
| 13 | 1 | Spring VD-115E 0.70 x 11.3 x 32.7 x 3.5 |
| 14 | 1 | Spring washer DIN 137 A6 |
| 15 | 1 | Retaining washer DIN 6799 - 3,2 |
| 16 | 3 | Lock washer DIN 127 A6 |
| 17 | 3 | Hex screw DIN 933 M6 x 25 |
| 18 | 1 | Hex nut DIN 934 M6 |
| 19 | 1 | Square nut DIN 557 M6 |
| 21 | 4 | Hex nut DIN 934 M8 |
| 22 | 1 | Guide bushing 6.2 x 9.9 x 15 x 3.5 |

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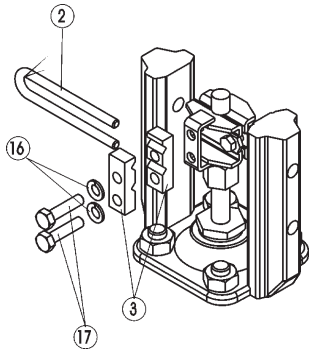
## Assembly

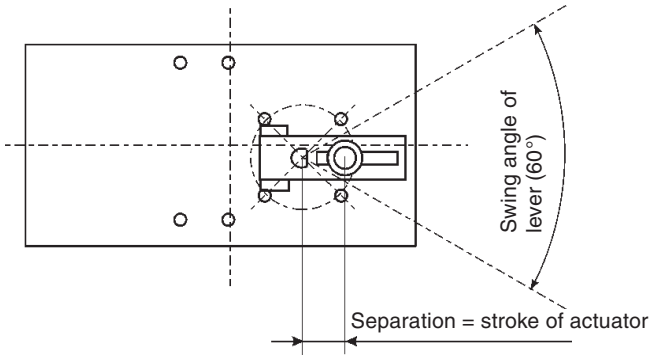
→ Mount U-piece (2) using clamping pieces (3), hex screws (17) and lock washers (16) on actuator spindle.

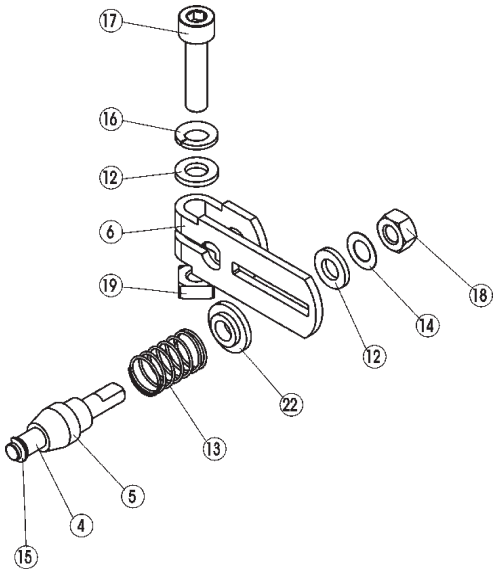
→ Select the short lever (Table *Add-on kit to linear actuator,* Serial no. 6a) or long lever (Table *Add-on kit to linear actuator,* Serial no. 6b), depending on the actuator stroke.




→ Assemble the lever (if not preassembled).

The distance of the driving pin from the axle should be equal to the actuator stroke. This results in a swing angle of the lever of 60°. This assures that the position sensor works with good resolution. The scale printed on the lever is irrelevant.



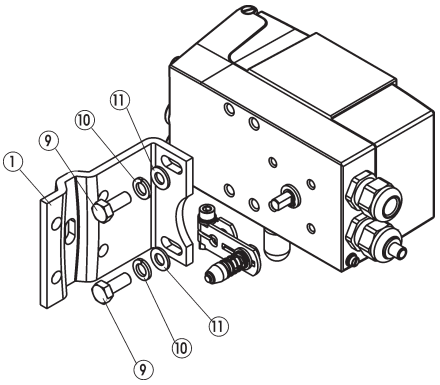

→ Push the lever onto the axle of the SIDE Control and screw it tight.

→ Fix attachment bracket (1) with hex screws (9), lock washers (10) and washers (11) to the rear side of the SIDE Control.

**NOTE**

Which M8 thread on the SIDE Control is chosen depends on the size of the actuator

→ To determine the correct position, hold the SIDE Control with bracket against the actuator. The conical roller (5) on the lever of the position sensor must be able to move freely in U-piece (2) on the actuator over the entire stroke. At 50% stroke, the lever position should be roughly horizontal (see under *Alignment of the lever mechanism*).

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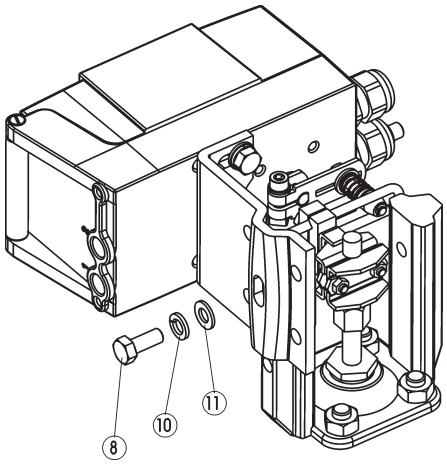
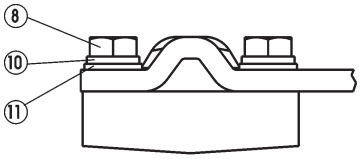
## Actuator with cast frame

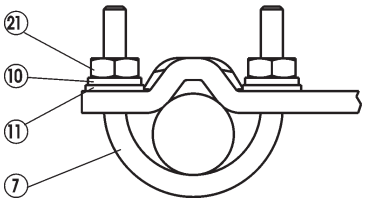
→ Fix the SIDE Control with bracket by means of one or more hex screws (8), washers (11) and lock washers (10) to the cast frame.




## Actuator with post yoke

→ Fix the SIDE Control with bracket with U-bolts (7),
washers (11), lock washers (10) and hex nuts (21) to the post yoke.




## Alignment of the lever mechanism

The lever mechanism can only be aligned properly when the device has been connected electrically and pneumatically.

→ In the manual mode, move the actuator to half stroke (corresponding to scale on actuator).

→ Move the device vertically until the lever is horizontal.

→ Fix the device finally to the actuator.

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## Attachment to a continuous valve with part-turn actuator

The axle of the position sensor built into the SIDE Control is coupled directly to the axle of the part-turn actuator.

### Add-on kit to part-turn activator (Id no. 651 741)

| Serial no. | Quantity | Designation |
|---|---|---|
| 1 | 1 | Adapter |
| 2 | 2 | Setscrew DIN 913 M4 x 4 |
| 3 | 4 | Cap screw DIN 933 M6 x 12 |
| 4 | 4 | Lock washer B6 |

(obtainable from Bürkert as an accessory)

### Other accessories required

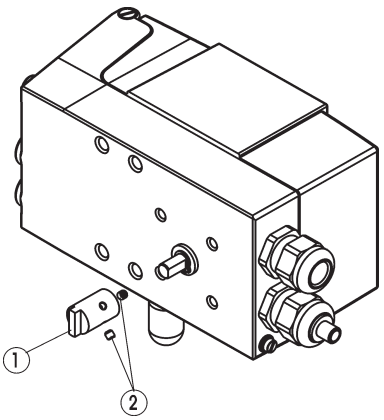
Attachment bracket with fixing screws (acc. to VDI/VDE 3845) - available from the manufacturer of the part-turn actuator.

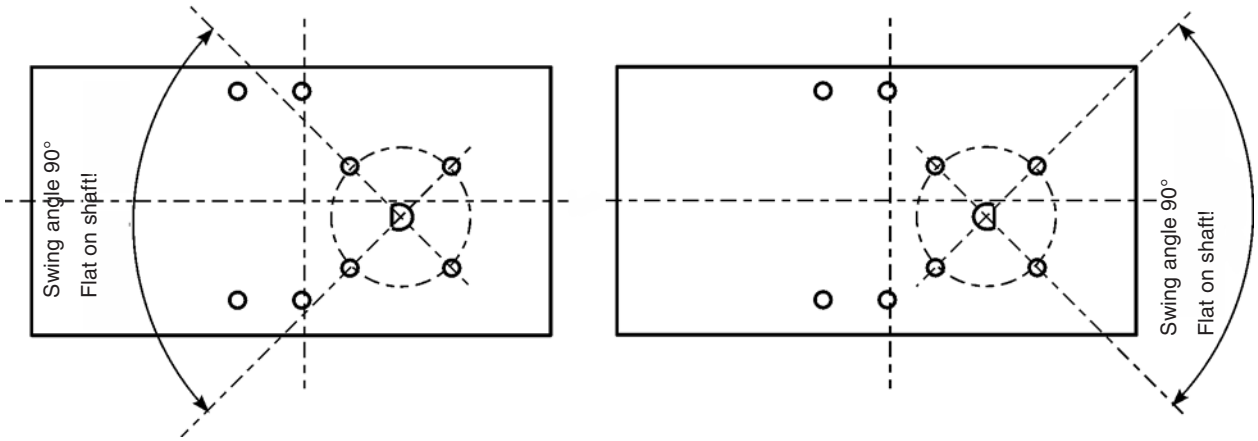
### Assembly

→ Determine the orientation of attachment of the SIDE Control (parallel to the actuator or rotated by 90°).

→ Determine the basic position and direction of rotation of the actuator.

→ Push adapter (1) onto the axle of the SIDE Control and fix it with 2 setscrews (2). One of the setscrews should press onto the flat on the axle (**to prevent slip!**). It must be assured that the axle of the SIDE Control can move only in one of the ranges shown below in the drawings **observe the flat on the axle!**.

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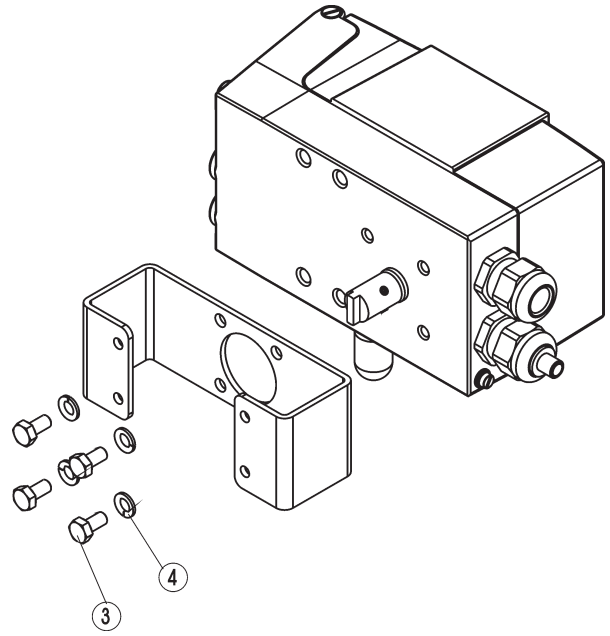
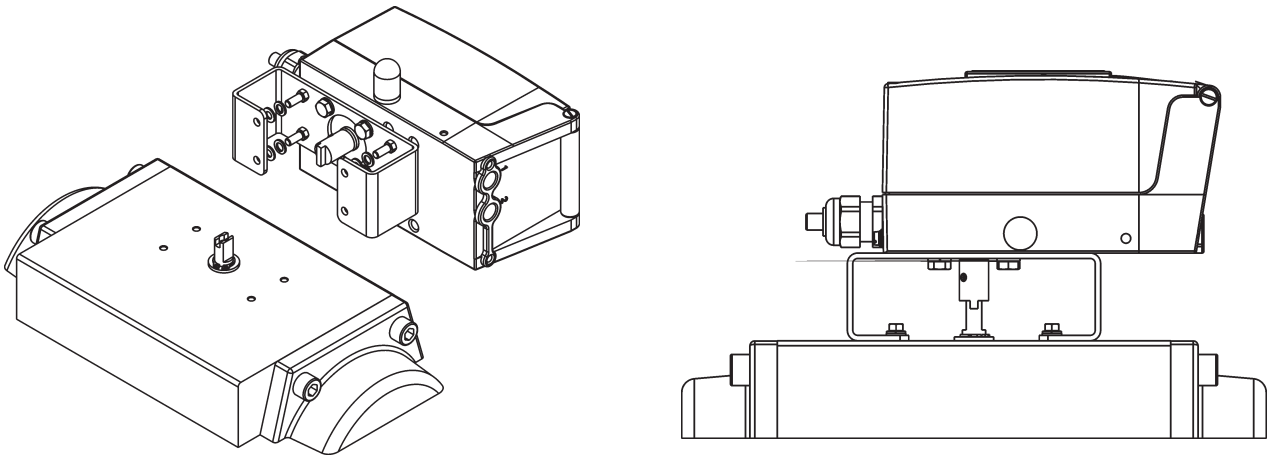
→ Place the SIDE Control on the bracket and fix it with 4 cap screws (3) and lock washers (4).




→ Place the SIDE Control with the bracket on the part-turn actuator and fix it.



**NOTE**

If after starting the function *X.TUNE* the message *X.ERR 5* appears in the LC display, the alignment of the axle of the SIDE Control to the axle of the actuator is incorrect.

→ In this case, check the alignment as described above.

→ Then repeat the function *X.TUNE.*

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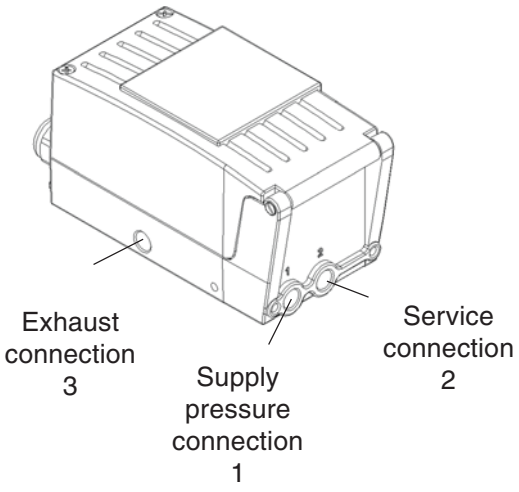
# Fluidic connection

The locations of the fluidic connections are shown in the following drawing:




→ Connect supply pressure to connection 1.

→ Connect the service connection 2 to the chamber of the single-acting actuator.

→ If possible, connect a silencer or the like to connection 3. If the connection is left open, there is a risk of water splashes entering the SIDE Control.

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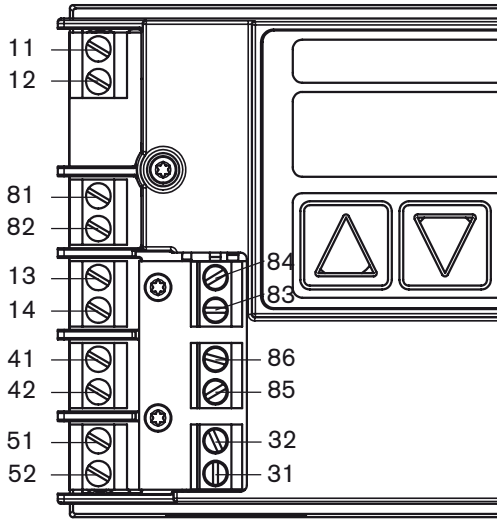
# Electrical connection *(S/HART)*

→ To make electrical connections, open the cover of the SIDE Control *(S/HART)* by unscrewing the 2 screws.




| Terminal designation | Allocation | External connection |
|---|---|---|
| 11 + | Setpoint + | 4 ... 20 mA signal |
| 12 - | Setpoint - | GND |
| 13 + | Process value + (option) | 4 ... 20 mA signal |
| 14 - | Process value - (option) | GND |
| 31 | Actual value output + (option) | 31 + RB 12 … 30 V |
| 32 | Actual value output - (option) | 32 - 1) |
| 41 + | Initiator 1+ (option) | 41 + Switching amplifier |
| 42 - | Initiator 1- (option) | 42 - to EN 50227 |
| 51+ | Initiator 2+ (option) | 51 + Switching amplifier |
| 52 - | Initiator 2- (option) | 52 - to EN 50227 |
| 81 | Binary input + | 81 or Switch (make contact |
| 82 | Binary input - | 82 or break contact) |
| 83 | Binary output 1+ (option) | 83 + 5 … 11 V |
| 84 | Binary output 1- (option) | 84 A - |
| 85 | Binary output 2+ (option) | 85 + 5 … 11 V |
| 86 | Binary output 2- (option) | 86 A - |

1) Burden resistance RB: see Chapter *Technical Data*

**ATTENTION!**

During the electrical connection of the inherently safe circuits, always observe the data in the attached Certificate of Conformity!

**HINWEIS**

Connection of a potential equalization conductor (PE) to the electronics is unnecessary.

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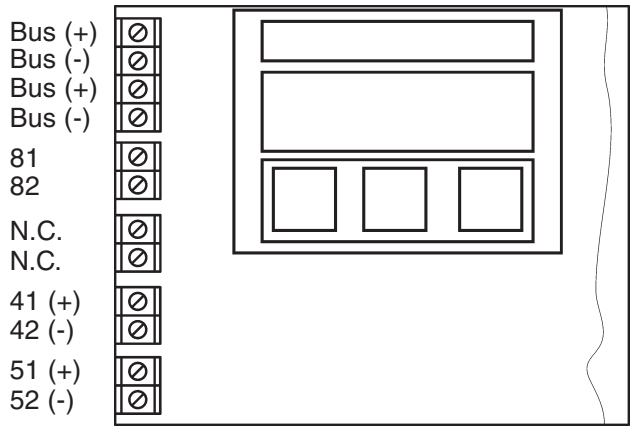
# Electrical connection *(PROFIBUS PA)*

→ To make electrical connections, open the cover of the SIDE Control *(PROFIBUS PA)* by unscrewing the 2 screws.

## Configuration of the terminals




| Terminal designation | Allocation | External connection |
|---|---|---|
| BUS (+) | PROFIBUS-PA (IN) | to IEC 1158-2 (either polarity between input terminals) |
| BUS (-) | PROFIBUS-PA (IN) | |
| BUS (+) | PROFIBUS-PA (OUT) | to IEC 1158-2 (either polarity between output terminals) |
| BUS (-) | PROFIBUS-PA (OUT) | |
| 81 | Binary input | connected via switch (make contact) to terminal 82 |
| 82 | Binary input | 81 / 82 / or |
| N.C. | not connected | |
| N.C. | not connected | |
| 41 + | Initiator 1 + (option) | 41 (+) / 42 (-) / Switching amplifier to EN 50227 |
| 42 - | Initiator 1 - (option) | |
| 51 + | Initiator 2 + (option) | 51 (+) / 52 (-) / Switching amplifier to EN 50227 |
| 52 - | Initiator 2 - (option) | |

Use screened cable for connecting the bus and the binary input in order to assure reliability and EC conformity. The cable screens can be attached using the clamping screw (on the post between the M20 bushings). The cable screens must be attached at both ends. On the outside of the housing there is a further screw for further connection to a suitable earthing (grounding) point.

**ATTENTION!**

During the electrical connection of the inherently safe circuits, always observe the data in the attached Certificate of Conformity!

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# INDUCTIVE PROXIMITY SWITCHES *(S/HART, PROFIBUS PA, OPTION)*



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# Description of the inductive proximity switches

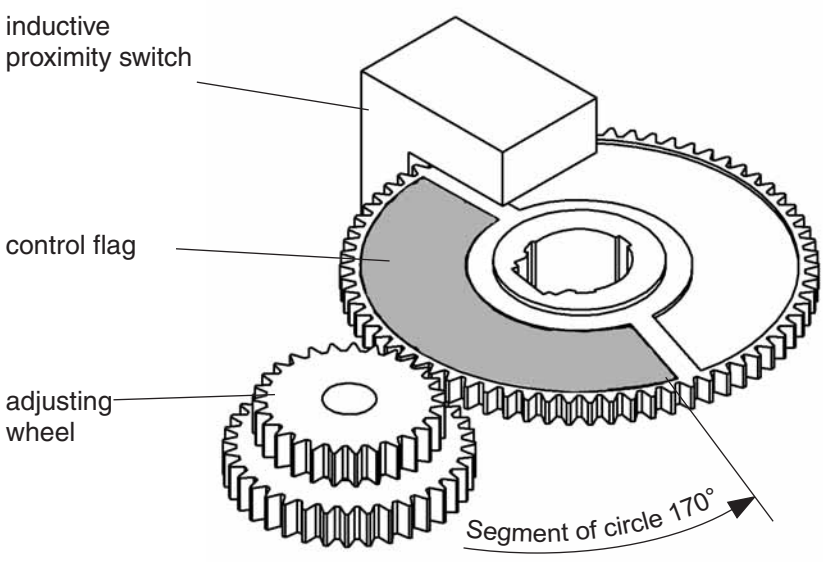
Any actuator position can be registered with an inductive proximity switch. Depending on the version of the device, one or two inductive proximity switches are installed. The output signals can be processed with switching amplifiers to „NAMUR“ to EN 50227 or VDE 0660 T 212.

As soon as the control flags installed in the SIDE Control enter the fork-shaped inductive proximity switch, the current changes.

Proximity switch operated: current ≤1.2 mA

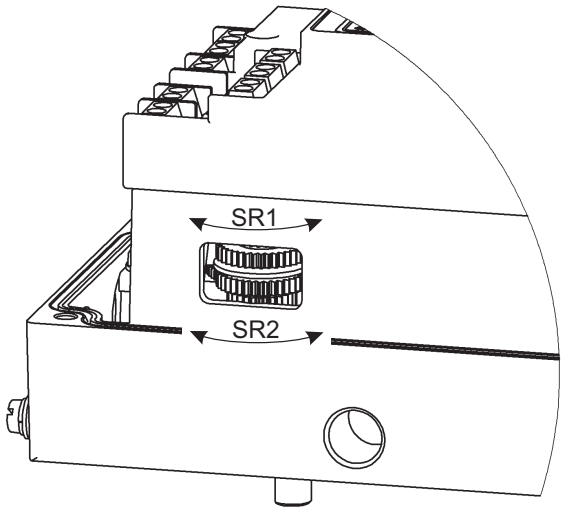
Proximity switch not operated: current ≥ 2.1 mA

The control flags are designed such that the signal is then maintained until the end position is reached.




# Configuration of the adjusting wheels *(option)*

**NOTE** Even when the device is equipped with only one proximity switch, both adjusting wheels are installed. In this case only SR1 is active.

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# Settings

**NOTE**

First put the device into operation, as described in the chapter *Operation and Control Functions*. The function *AUTOTUNE* must have been executed, so that the actuator stroke is displayed correctly.

## Setting with one inductive proximity switch

### The upper end position is to be set (Position 1 with part-turn actuators)

→ Move the actuator in the manual mode to the position in which initiation is to take place. Turn adjusting wheel SR1 ***to the right*** until the current jumps from ≥ 2.1 mA to ≤ 1.2 mA.

### The lower end position is to be set (Position 2 with part-turn actuators)

→ Move the actuator in the manual mode to the position in which initiation is to take place. Turn adjusting wheel SR1 ***to the left*** until the current jumps from ≥ 2.1 mA to ≤ 1.2 mA.

## Setting with two inductive proximity switches

### The upper end position is to be set (Position 1 with part-turn actuators)

→ Move the actuator in the manual mode to the position in which initiation is to take place. Turn adjusting wheel SR2 ***to the right*** until the current jumps from ≥ 2.1 mA to ≤ 1.2 mA.

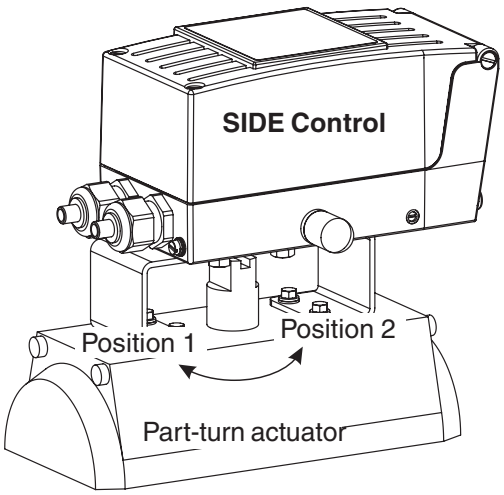
On turning the adjusting wheel, take care that the other adjusting wheel is not turned.

### The lower end position is to be set (Position 2 with part-turn actuators)

→ Move the actuator in the manual mode to the position in which initiation is to take place. Turn adjusting wheel SR2 ***to the left*** until the current jumps from ≥ 2.1 mA to ≤ 1.2 mA.

On turning the adjusting wheel, take care that the other adjusting wheel is not turned.

# Definition of the end positions with part-turn actuators

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# OPERATING AND CONTROLLER FUNCTION



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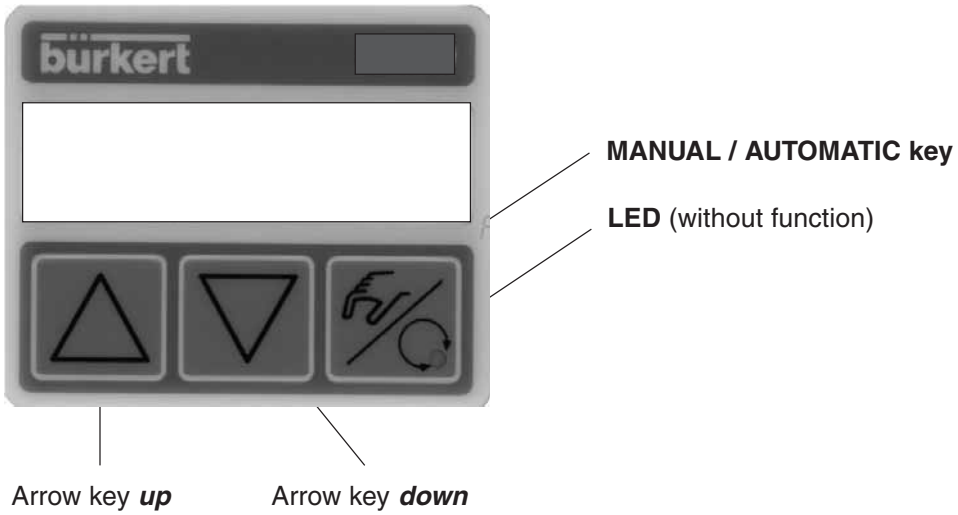
# Operating and display elements

The SIDE Control is equipped with a 3-key operating and display element with an LC display. The functions of the keys are described in the following sections.




# Operating levels

Operation of the SIDE Control is done via two operating levels:

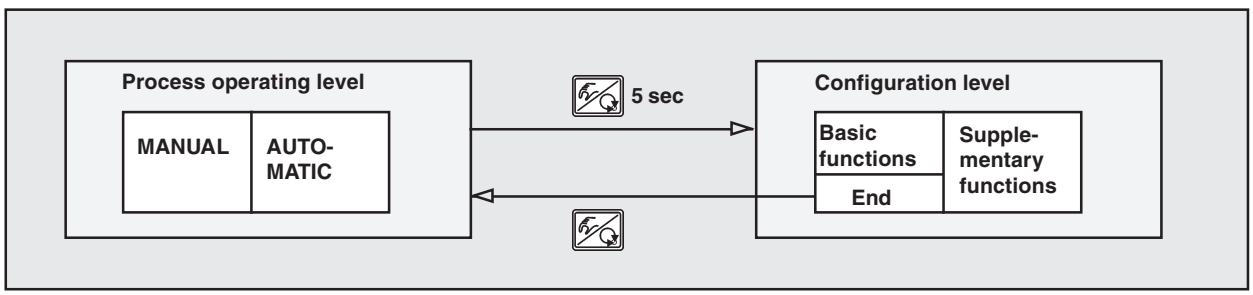
- ***Process operating level***

  After the device is switched on, the process operating level is active. In this level, you can switch between the operating modes *AUTOMATIC* and *MANUAL*.

  In the *AUTOMATIC* mode, position or process control run (process control only with the option *process controller*). In the *MANUAL* mode, the valve can be manually opened and closed.

- ***Configuration level***

  In the configuration level, you can specify the first commissioning of the basic functions and configure supplementary functions if needed.

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# Commissioning and set-up as a positioner

➔ Before commissioning, execute the fluidic and electrical installations.

## Procedure for specifying the basic settings

➔ On first commissioning of the SIDE Control, make the following basic settings:

- Enter the control function of the actuator used.
- Start the automatic adaptation of the controller to the current operating conditions (*AUTOTUNE*).

### Configuration of the keys

| | | |
|---|---|---|
|  | MANUAL/AUTOMATIC key | Switch between main and sub-menu items, e.g. *ADDFUNCT - CHARACT* |
|  | Arrow keys | Switch between equal-ranking menu items, e.g. *ADDFUNCT - X.TUNE* |

### Factory settings of the controller *(S/HART)*

| Function | Factory setting | Function | Factory setting |
|---|---|---|---|
| *CHARACT* | *CHA LIN* | *X.CONTRL* | |
| *CUTOFF* | *CUT* ⊥ = 0 %; *CUT* ⊤ = 100 % | *X.CO DBND* | *1 %* |
| *DIR.CMD* | *DIR.CRISE* | *X.CO PARA* | |
| *DIR.ACT* | *DIR.ARISE* | *KX* ⊤ | Values determined by *AUTOTUNE* |
| *SPLTRNG* | *SR* ⊥ = 0 (%); *SR* ⊤ = 100 (%) | *KX* ⊥ | Values determined by *AUTOTUNE* |
| *X.LIMIT* | *LIM* ⊥ = 0 %, *LIM* ⊤ = 100 % | After execution of *SETFACT*: 1 | |
| *X.TIME* | | *P.CONTRL* | |
| *T.OPN* | Values determined by *AUTOTUNE* | *P.CO DBND* | *1 %* |
| *T.CLS* | Values determined by *AUTOTUNE* | *P.CO PARA* | |
| After execution of *SETFACT*: 1 | | *KP* | *1.00* |
| *OUTPUT* | | *TN* | *999.9* |
| *OUT ANL:* | | *TV* | *0.0* |
| *OUT POS* | *OUT 4'20 A* | *X0* | *0* |
| *OUT BIN* | *:* | *P.CO SETP* | *SETP INT* |
| *OUT DEV* | *DEV 5.0 NORM OPN* | *P.CO FILT* | *0* |
| *SAFEPOS* | *0* | *P.CO SCAL* | *PV* ⊥ *000.0, PV* ⊤ *100.0* |
| *BIN-IN* | *B.IN SPOS / NORM OPN* | *P.CO TUNE* | *D'ACT* |
| | | *CODE* | *CODE 0000* |

**NOTE** The functions and factory settings shown in grey are optionally valid with analog repeat *(OUTPUT)* or with process controller *(P.CONTRL).*

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## Factory settings of the controller *(PROFIBUS PA)*

| Function | Factory setting | Function | Factory setting |
|---|---|---|---|
| *CUTOFF* | *CUT* $_{\perp}$ = 0 %; *CUT* $^{\top}$ = 100 % | *SAFEPOS* | *0* |
| *DIR.CMD* | *DIR.CRISE* | *BIN-IN* | *B.IN SPOS / NORM OPN* |
| *DIR.ACT* | *DIR.ARISE* | *X.CONTRL* | |
| *X.LIMIT* | *LIM* $_{\perp}$ = 0 %, *LIM* $^{\top}$ = 100 % | *X.CO DBND* | *1 %* |
| *X.TIME* | | *X.CO PARA* | |
| *T.OPN* | Values determined by *AUTOTUNE* | *KX* $^{\top}$ | Values determined by *AUTOTUNE* |
| *T.CLS* | Values determined by *AUTOTUNE* | *KX* $_{\perp}$ | Values determined by *AUTOTUNE* |
| After execution of *SETFACT*: 1 s | | After execution of *SETFACT*: 1 | |

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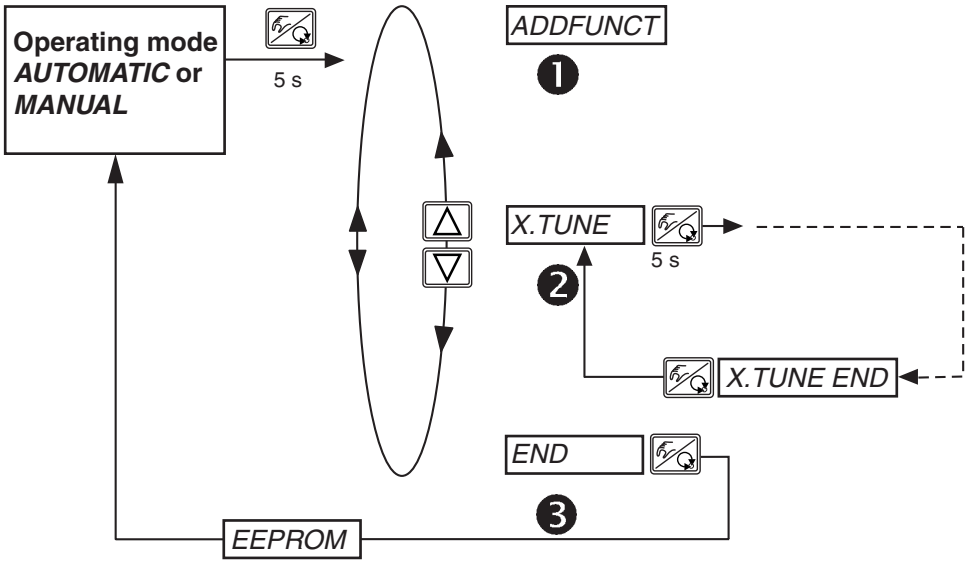
## Main menu for settings on commissioning




## Description of procedure

### 1 *ADDFUNCT*

see section *Configuring the supplementary functions.*

➔ Jump over this menu item on first commissioning.

### 2 *X.TUNE - AUTOTUNE* for positioners

#### Start the automatic adaptation of the positioner to the current operating conditions *(X.TUNE)*

The following functions are initiated automatically:

- Adaptation of the sensor signal to the (physical) stroke of the valve used.
- Determination of parameters for driving the integral piezoelectric positioning system
- Setting of the controller parameters of the positioner.
  Optimization is done according to the criteria: as short a correcting time as possible and freedom from overshoot.

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Proceed as follows:

➔ Switch on the voltage supply.

➔ Depress the MANUAL/AUTOMATIC key for 5 seconds - switch to configuration level.

➔ Press the ARROW key - scroll to menu item *X.TUNE.*

➔ Depress the MANUAL/AUTOMATIC key for 5 seconds - start of *X.TUNE.*

➔ After completion of *AUTOTUNE,* press briefly the MANUAL/AUTOMATIC key - store operating conditions.

➔ Press the ARROW key - scroll to menu item *END*

➔Press briefly the MANUAL/AUTOMATIC key - jump to mode *AUTOMATIC* or *MANUAL*

| Display message | Description |
|---|---|
| *TUNE 5*<br>*TUNE 4*<br>:<br>*TUNE 0* | Countdown from 5 to 0 to start<br>*AUTOTUNE* |
| ¦ *X.T INIT*<br>¦ *X.T A1-P*<br>¦ *X.T TOPN*<br>¦ *X.T TCLS*<br>: | Display of the *AUTOTUNE* phase in progress at the moment (progress is indicated by a rotating bar to the left of the display) |
| *X.TUNE END* | Flashing display → end of *AUTOTUNE* |
| *X.ERR* X | Message on occurrence of an error<br>(to right of display: error number, see chapter *Maintenance and Error Elimination on the Controller*) |

**NOTE**

On commissioning the SIDE Control, execution of *X.TUNE* is **absolutely** necessary. The positioner determines the optimum settings for the valve used and the current operating conditions (supply pressure).

If the supplementary function *X.CONTRL* is present in the main menu during execution of *X.TUNE*, automatic determination of the positioner dead band *X.CO.DBND* occurs additionally as a function of the frictional behaviour of the actuator (see section *X.CONTRL).*

The function *X.TUNE* should be executed with the valve unpressurized or shut off, since otherwise pressure variations in the valve may cause faulty adaptation of the controller. The supply pressure (pneumatic auxiliary energy) should be set to the value that will exist in later operation!

**ATTENTION!**

During execution of the *AUTOTUNE* function, the valve moves autonomously from its momentary position. For this reason, never execute *AUTOTUNE* when a process is running!

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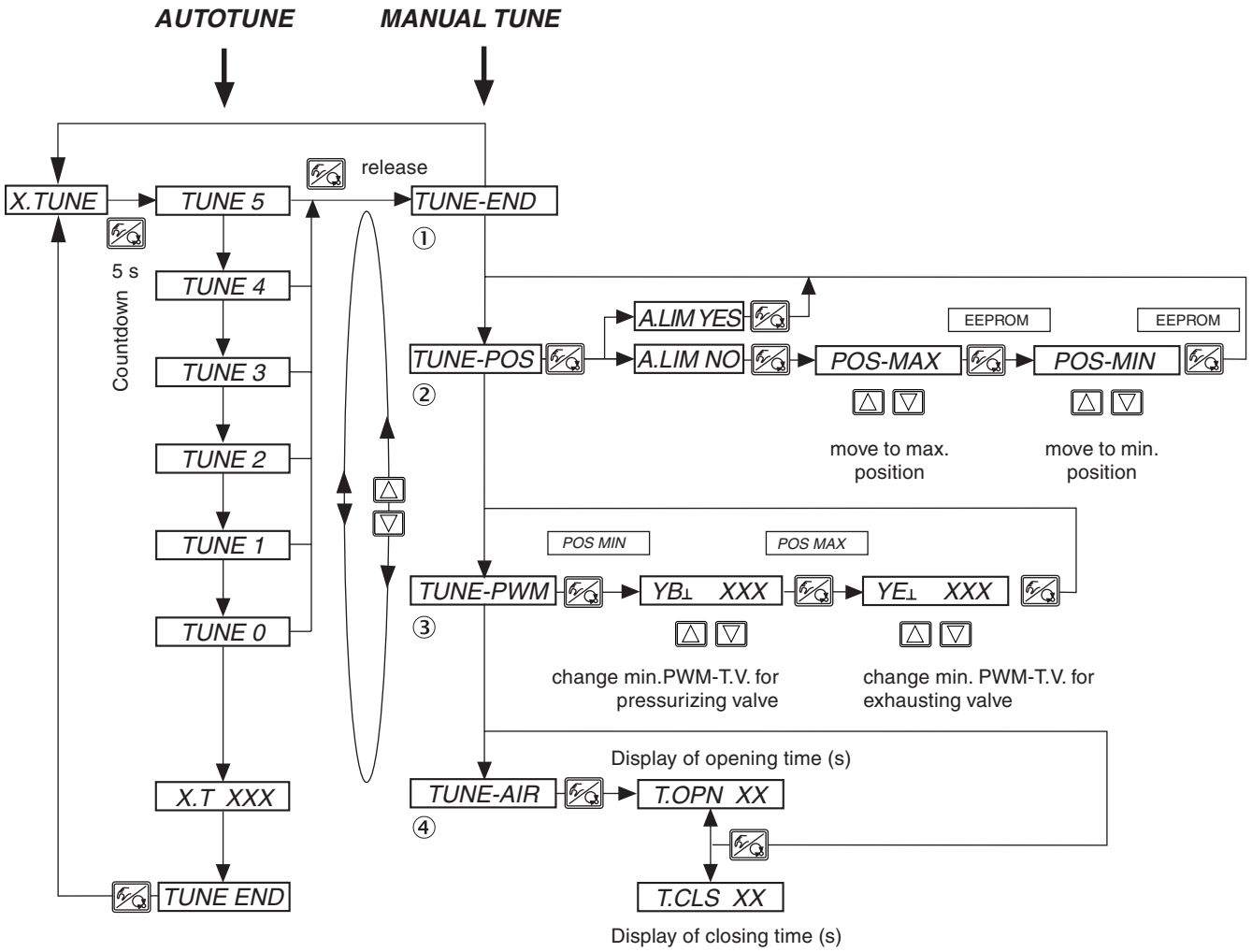
### MANUAL *TUNE* FUNCTIONS

Access to the manual *TUNE* functions can be obtained by the selecting of *X.TUNE* in the main menu and briefly pressing the MANUAL/AUTOMATIC key or aborting the countdown by releasing the MANUAL/AUTOMATIC key.




The following parameters, which are determined automatically during *X.TUNE* , may be preset or changed afterwards manually.

**① *TUNE-END* - Return to main menu**

**② *TUNE-POS* - Preset end positions**

The *AUTOTUNE* function determines the end positions of the control armature automatically on the basis of the physical stops. Certain armatures (e.g. continuously turning butterfly valves) possess no physical end stop, so that the end positions must be manually preset by means of *TUNE-POS*. An immediately following *AUTOTUNE* takes over the manual end position settings and continues with setting the positioning system and optimization of the positioner.

**NOTE** | If a manual preset of the end positions with *TUNE-POS* is necessary, it must be done **before** execution of *AUTOTUNE*.

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③ ***TUNE-PWM* - Readjustment of minimum PWM pulse-duty factor for driving the piezoelectric valves integrated in the SIDE Control**

The *AUTOTUNE* function determines automatically the required PWM-PDF for driving the piezoelectric valves integrated in the SIDE Control. These values may deviate from the optimum because of unfavourable frictional behaviour of the actuator. With *TUNE-PWM*, you can reajust it such that the lowest possible speed results for both directions of movement.

**NOTE** The function *TUNE-PWM* must be executed **after** *AUTOTUNE*!

④ ***TUNE-AIR* - Adaptation of the opening and closing times of the process valve**

The required maximum air flow capacity of the internal positioning system depends on the volume of the actuator. Ideal control behaviour of the positioner is obtained with an air flow capacity that leads to an opening or closing time of the armature of 1 ... 2 s. For this reason, the SIDE Control is equipped with a throttle screw to vary the maximum air flow capacity of the internal positioning system. The position of the throttle screw is to be seen in the chapter *System Description / Structure of the SIDE Control*. The adjustment of this throttle screw is made by means of *TUNE-AIR* , whereby the corresponding times are determined by cyclic opening and closing of the valve and displayed.

**NOTE** The function *TUNE-AIR* must be executed **after** *AUTOTUNE*!

**ATTENTION!**

To avoid cause faulty adaptation of the controller, ***be sure to*** execute ***X.TUNE*** at the supply pressure (= pneumatic auxiliary energy) that will exist in later operation.

The function *X.TUNE* should be executed preferably without operating medium pressure to exclude disturbances from forces resulting from flow.

## ❸ *END* - Quitting the main menu

➔ To quit the main menu, select the menu item *END* with the arrow keys △ ▽ .

On the right of the display, the software version is shown (END XX). After pressing the MANUAL/ AUTOMATIC key, the message EEPROM appears on the display for ca. 3 ... 5 s while the changes are being stored. Afterwards, the device is back in the mode in which it was before switching over to the main menu (MANUAL or AUTOMATIC).

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# Configuring the supplementary functions

**NOTE**

The operating concept for the SIDE Control is based on a strict separation between the basic and supplementary functions. In the delivered state, only the basic functions *ADDFUNCT, X.TUNE and END* are activated. These suffice for normal operation.

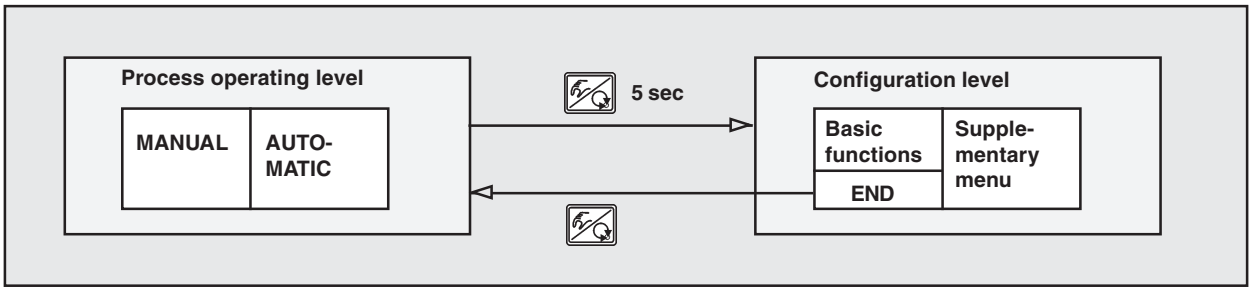
For more demanding control applications, you can select and specify supplementary functions in the configuration level.

## Keys in the configuration level

| Press key | in menu | in a selected and confirmed menu item |
|---|---|---|
| ▲ | Scroll up (select) | Increment (increase) numeric value |
| ▼ | Scroll down (select) | Decrement (decrease) numeric value |
| **Press key** | **in menu** | **in menu *ADDFUNCT*** |
| ↵ | Confirm selected menu item | Confirm selected menu item of supplementary menu to add it to the main menu. The menu item is marked with an asterisk (*) in the supplementary menu. |
| | Confirm values set | The menu item appears in the main menu and can be selected and edited there. Confirm the menu item selected and marked with an asterisk in the supplementary menu for deletion from the main menu. |

## Configuration menu

### Switching between the process operating level and the configuration level

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➔  **5 s** To activate the configuration menu, press (in the process operating level) the MANUAL / AUTOMATIC key for 5 seconds.

The configuration menu consists of a main and a supplementary menu. The main menu contains initially the basic functions which are absolutely necessary for first commissioning. The supplementary menu comprises supplementary functions which may be selected. It may be reached via the menu item *ADDFUNCT* of the main menu. Specification of device functions and parameters is possible within the main menu. If needed, the main menu may be extended by functions from the supplementary menu, which can then also be specified.

## Addition of supplementary functions to the main menu

➔ Select in the main menu the item *ADDFUNCT*.

➔ By pressing the MANUAL / AUTOMATIC key, you enter the supplementary menu.

➔ With the arrow keys, select the desired supplementary function.

➔ By pressing the MANUAL / AUTOMATIC key, you confirm addition of the supplementary function to the main menu. The function is automatically marked with an asterisk (*).

➔ All marked functions are added to the main menu after confirmation of *ENDFUNCT*.

➔ In the main menu, enter the parameters for the supplementary functions.

## Deletion of supplementary functions from the main menu

 **NOTE** | By deletion of a function from the main menu, the settings previously made under this function will become invalid.

➔ Select in the main menu the item *ADDFUNCT*.

➔ By pressing the MANUAL / AUTOMATIC key, you enter the supplementary menu.

➔ With the arrow keys, select a supplementary function marked with (*).

➔ By pressing the MANUAL / AUTOMATIC key, you confirm deletion of the supplementary function (the asterisk (*) marking is deleted).

➔ After confirmation of *ENDFUNCT*, the supplementary function is deactivated and deleted from the main menu.

## Setting of numeric values

Numeric values are set in the menu items provided by pressing the keys △ (increment value) or ▽ (decrement value) one or more times. In the case of 4-digit numbers, only the flashing digit can be set with the arrow keys. By pressing the MANUAL / AUTOMATIC key, you can switch to the next digit.

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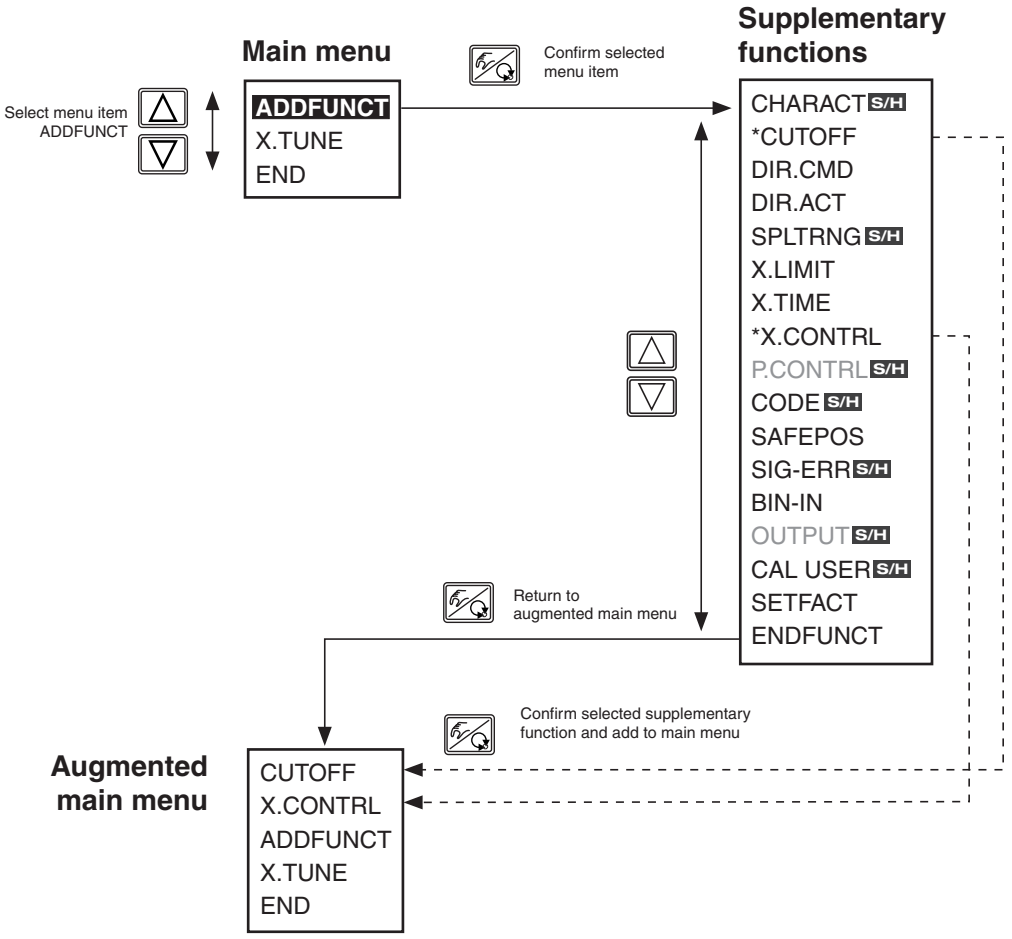
## Principle of adding supplementary functions to the main menu

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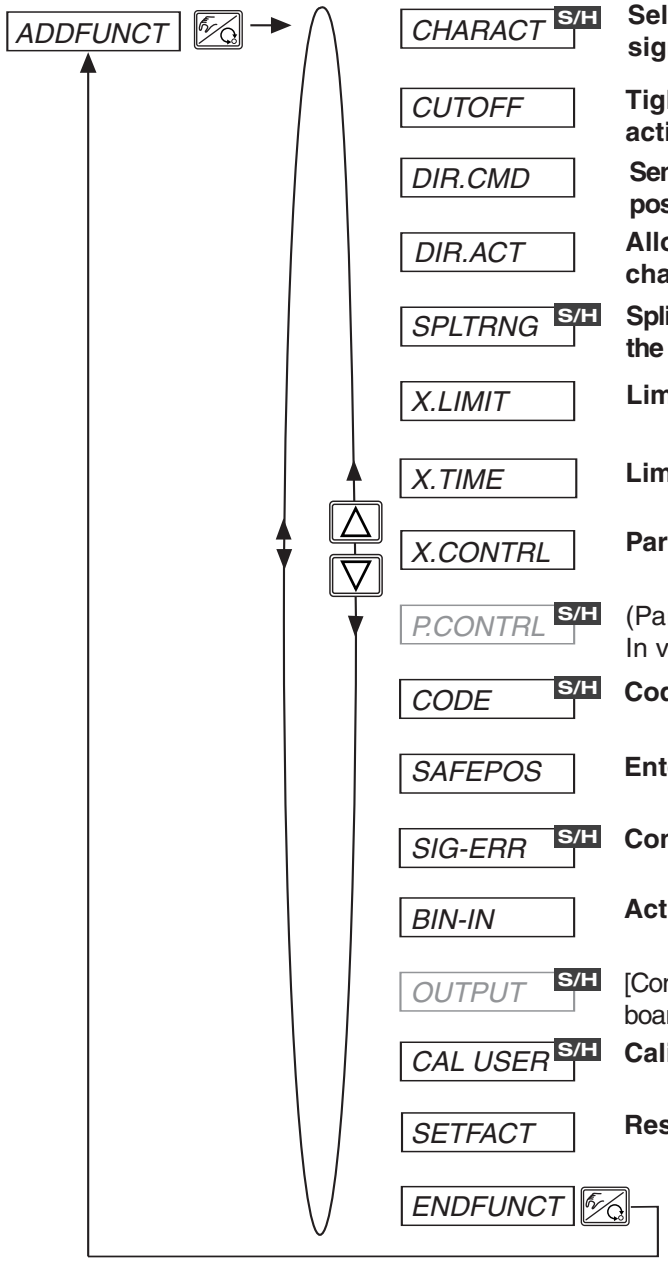
## Supplementary functions




**Select the transfer characteristic between input signal and stroke (correction characteristic)**

**Tight-closing function for positioner or for active process controller (*S/HART only*)**

**Sense of action between input signal and setpoint position**

**Allocation of state of pressurization of actuator chamber (Port $2_1$) to actual position**

**Splitting of signal range; input signal in % for which the valve runs through the entire stroke range.**

**Limitation of mechanical stroke range**

**Limitation of correcting speed**

**Parametrization of positioner**

(Parametrization of PID process controller)
In version as positioner: no function!

**Code protection for settings**

**Enter safe position**

**Configure error recognition, signal level**

**Activation of binary input**

[Configuration of the outputs (only with supplementary board for analog repeat or binary outputs)]

**Calibration**

**Reset for factory settings**

**NOTE** The supplementary functions marked with S/H are available only in the S/HART version of the SIDE Control.

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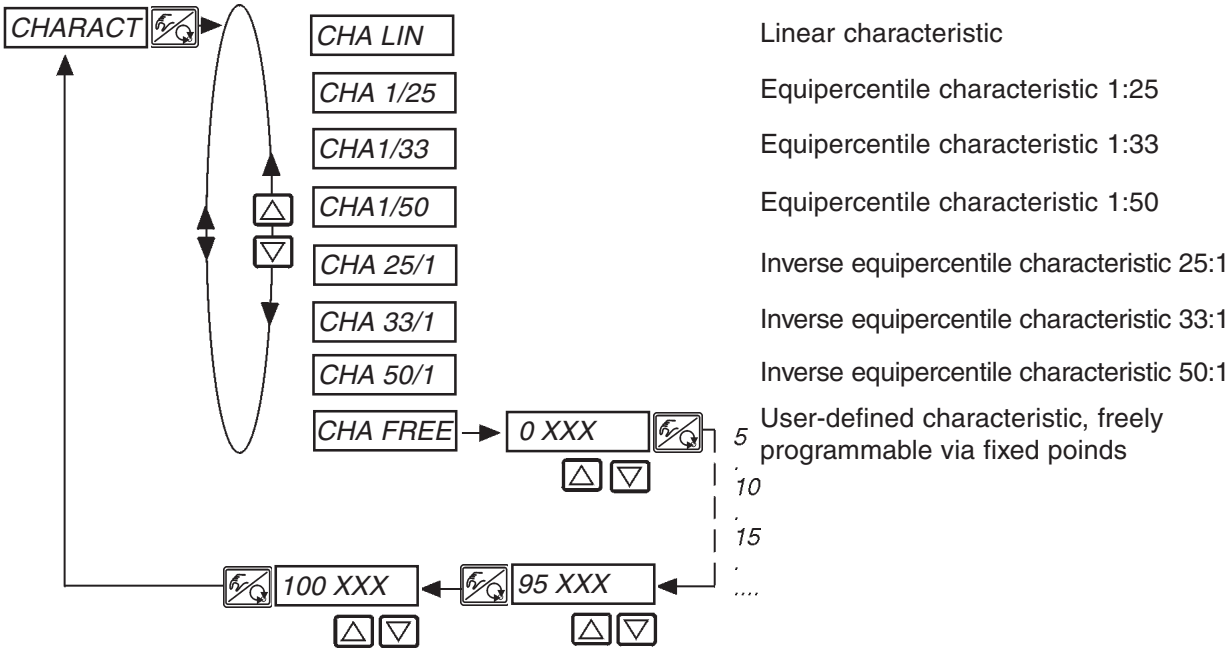
## CHARACT

### Selection of the transfer characteristic between input signal (position setpoint) and stroke (correction curve) *(S/HART)*

Customized characteristic (Characteristic)

Factory setting: *CHA LIN*

With this supplementary function, you can select a transfer characteristic with respect to setpoint (position setpoint CMD) and valve stroke (POS) to correct the flow or operating characteristic.




The flow characteristic $k_v = f(s)$ describes the flow through a valve, expressed by the $k_v$ value, as a function of the stroke s of the actuator spindle. It is determined by the shape of the valve seat and the seat seal. In general, two types of flow characteristic are realized: the linear and the equipercentile.

With linear characteristics, equal changes in stroke ds are allocated to equal changes in $k_v$ value $dk_v$

$$(dk_V = n_{lin} * ds).$$

With an equipercentile characteristic, a change in stroke ds corresponds to an equipercentile change in $k_v$ value

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

The operating characteristic Q = f(s) represents the relationship between the volumetric flow Q passing through a valve installed in a system and the stroke s. This characteristic contains the properties of the piping, pumps and consumers. It hence has a different shape from the flow characteristic.

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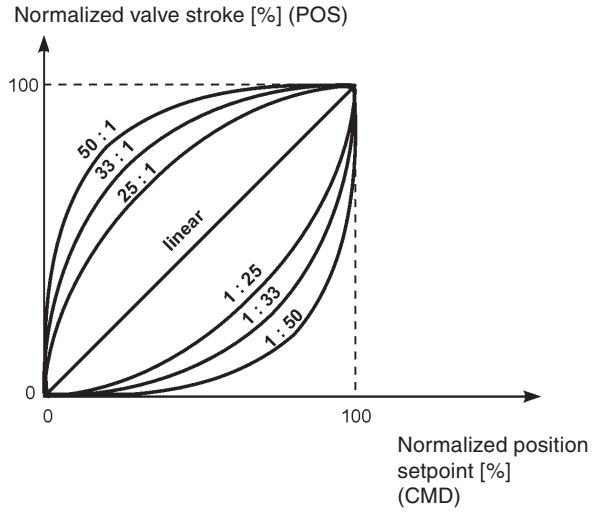


For positioning applications of controllers, special requirements are usually made on the shape of the characteristic, e.g. linearity. For this reason it is sometimes necessary to correct its shape in a suitable manner. For this purpose, a transfer member is provided in the SIDE Control S/HART which realizes different characteristics. These are used to correct the operation characteristic.

The equipercentile characteristics 1:25, 1:33, 25:1, 33:1 and 50:1 and a linear characteristic may be set. Furthermore, it is possible to freely program a characteristic via fixed points or have it calibrated automatically.

**Entering the freely programmable characteristic**

The characteristic is defined via 21 fixed points distributed evenly over the 0...100 % range of the position setpoint. They are separated by 5 %. Each fixed point may be allocated to a freely selectable stroke (setting range 0...100 %). The difference between two adjacent values of stroke may not exceed 20 %.

To enter the point on the characteristic (values of the function), first select the menu item ***CHA FREE***.

After pressing the MANUAL/AUTOMATIC key, the first fixed point is displayed (0 %). Next to it is the value of the function (initially 0 %).

With the arrow keys, set a value of the function between 0 and 100 %. After confirmation by pressing the MANUAL/AUTOMATIC key, the next fixed point is displayed, etc. Finally, press the MANUAL/AUTOMATIC key to confirm the value of the function belonging to the last fixed point (100 %). The display returns to the menu item CHARACT.

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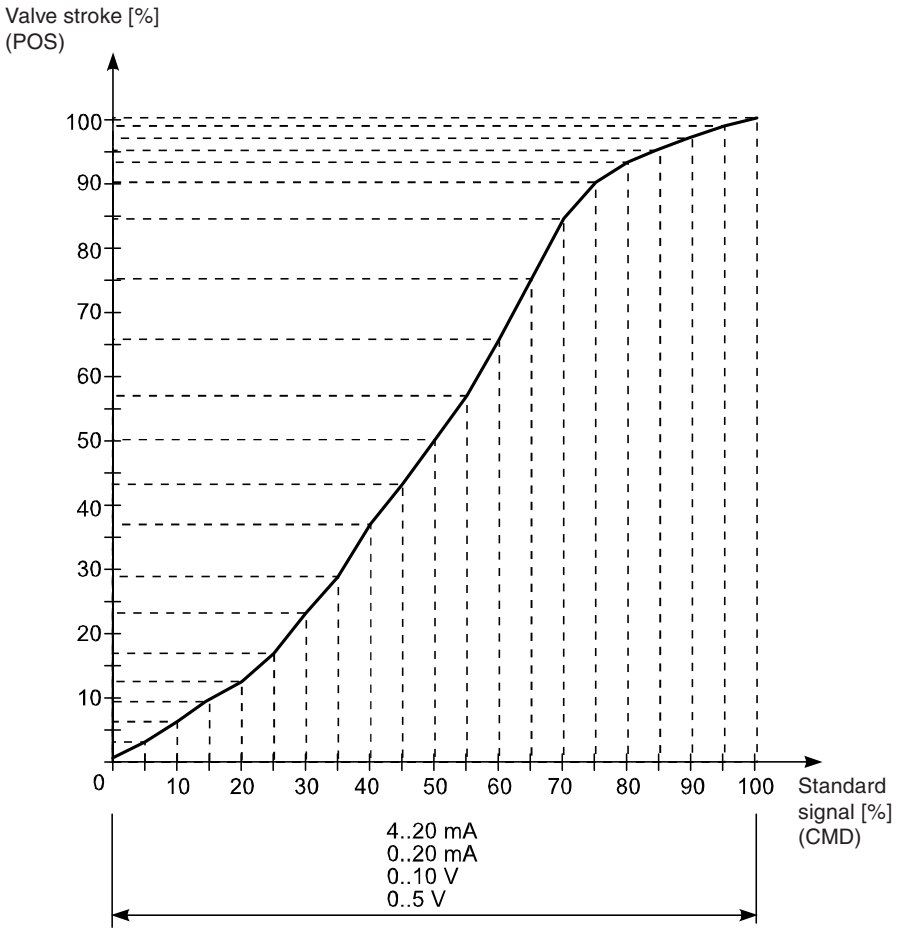
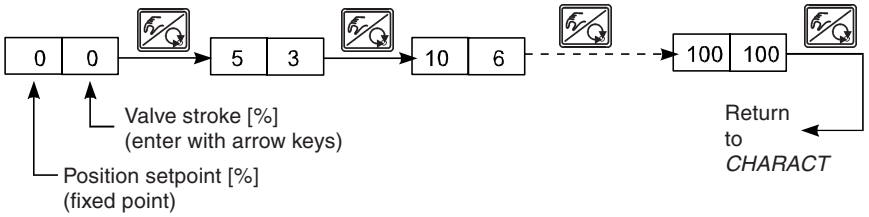
**Example of a programmed characteristic**




Entering the fixed points:




**NOTE** The fixed points that were entered should be noted in the table in the Appendix.

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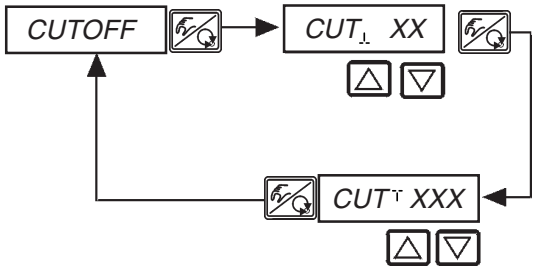
## CUTOFF

### Tight-closing function for positioners

Factory setting: $CUT_{\perp}$ = 0 %; $CUT^{\top}$ = 100 %

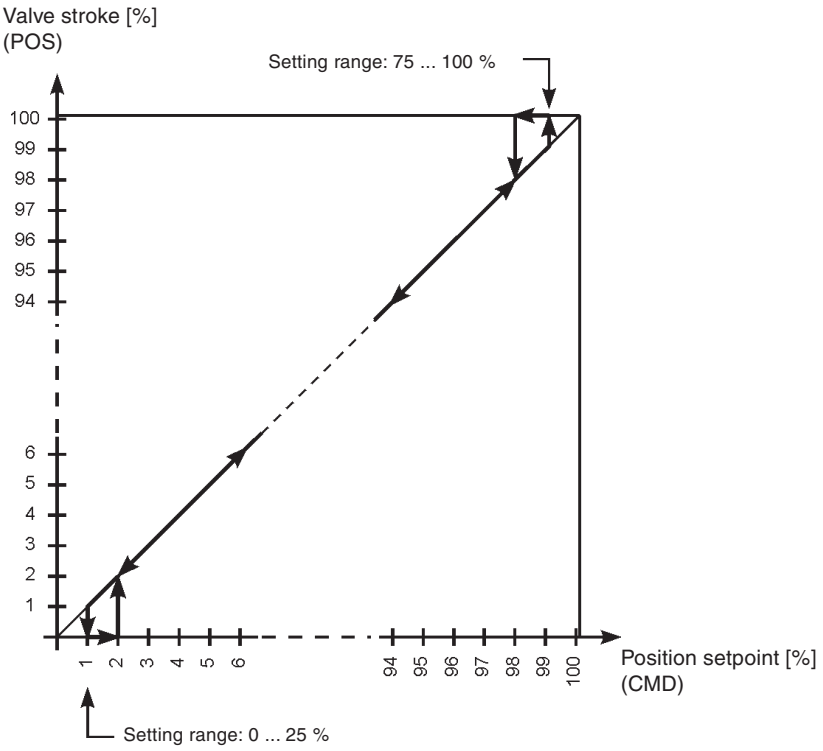
This function causes the valve to close tight outside the control range. Enter here the limits in % for the position setpoint (CMD) or for the process setpoint (SP) with activated PID controller (*S/HART only*), outside which the actuator is to be completely pressurized or exhausted, respectively. Opening or resumption of control occurs with a hysteresis of 1 %.

When the process valve is in the tight-closing region, a flashing MIN or MAX symbol appears on the display.




Tight-closing threshold exhaust (0 = inactive);
setting range: 0 ... 25 %

Tight-closing threshold pressurize (100 = inactive);
setting range: 75 ... 100 %

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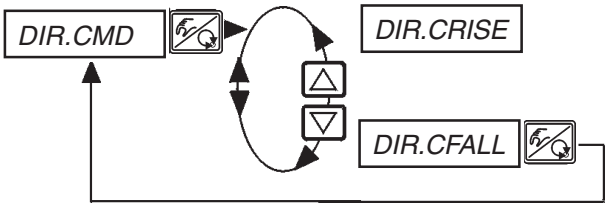
## *DIR.CMD*

### Sense of action (direction) of the positioner setpoint

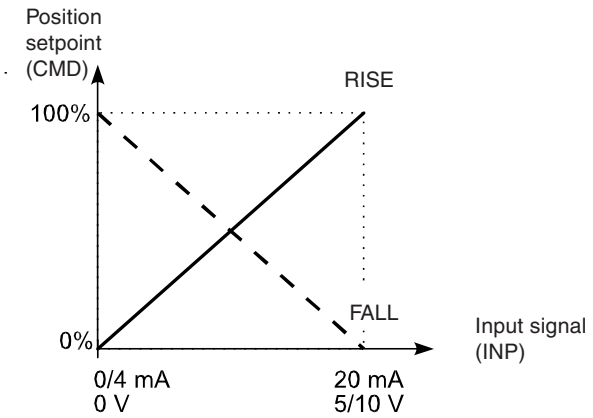
Factory setting: *DIR.CRISE*

With this supplementary function, you can set the sense of action between the input signal (INP) and the position setpoint (CMD) of the actuator.




Direct sense of action
(e.g. 4 mA or 0 V ➔ 0 %,
20 mA or 5/10 V ➔ 100%)

Inverse sense of action
(e.g. 4 mA or 0 V ➔ 100%,
20 mA or 5/10 V ➔ 0%)

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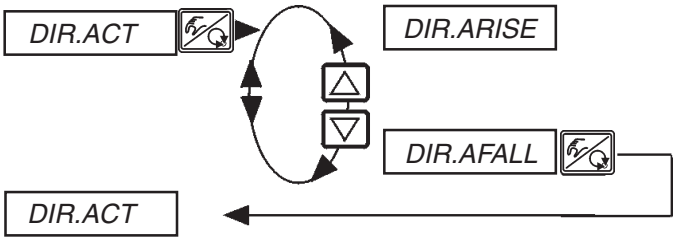
## *DIR.ACT*

### Sense of action (direction) of the actuator

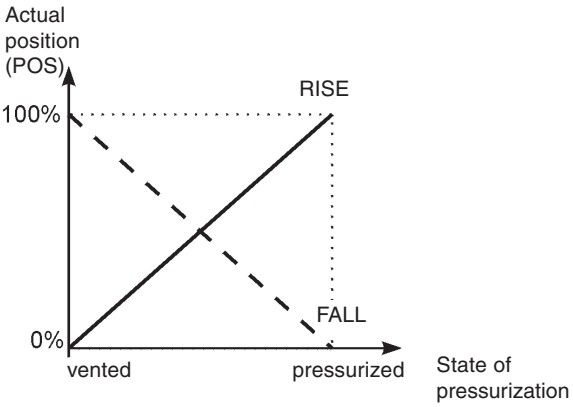
Factory setting: *DIR.ARISE*

With this supplementary function, you can set the sense of action between the state of pressurization of the actuator and the actual position (POS).




Direct sense of action
(vented ➔ 0 %; pressurized ➔ 100 %)

Inverse sense of action
(vented ➔ 100 %; pressurized ➔ 0 %)

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## *SPLTRNG*

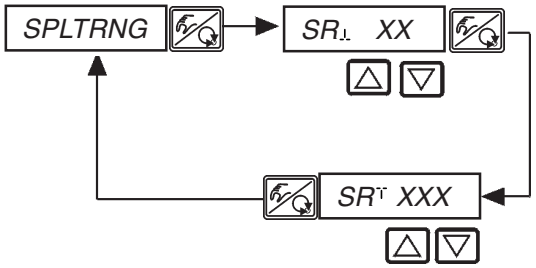
## Splitting of signal range (Split range) *(S/HART)*

Max. and min. values of the input signal in % for which the valve runs through the entire stroke range.

Factory setting: $SR_{\perp}$ = 0 (%); $SR^{\top}$ = 100 (%)

**NOTE** This function is active only in operation as a positioner

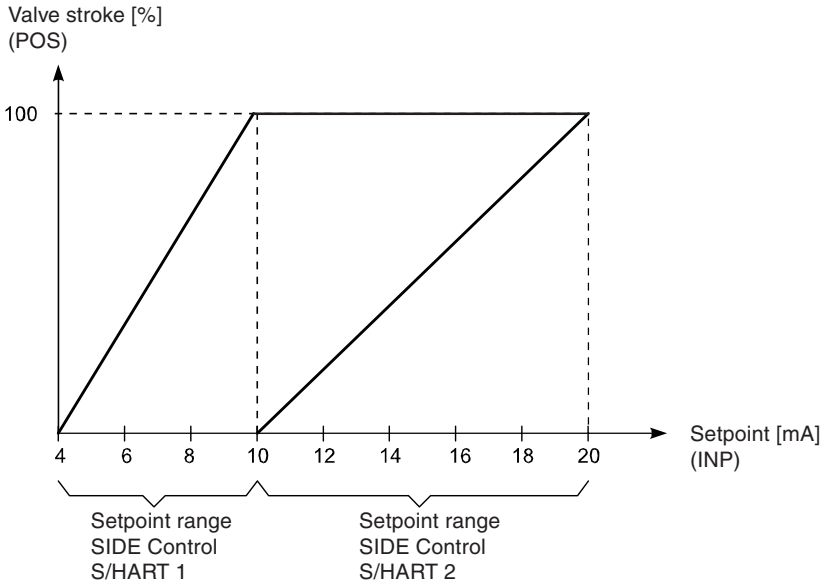
With this supplementary function you can limit the position setpoint range of the SIDE Control *(S/HART)* by specifying a minimum and a maximum value. In this way it is possible to split the standard signal range (4..20 mA) over several SIDE Control S/HARTs (with or without overlap). In this way, several valves may be used **alternately** or, with overlapping setpoint ranges, **simultaneously** as servo components.




Entering the minimum value of the input signal in % (0 ... 75 (%) of the standard signal range)

Entering the maximum value of the input signal in % (25 ... 100 (%) of the standard signal range)

**Splitting a standard signal range into two setpoint ranges**

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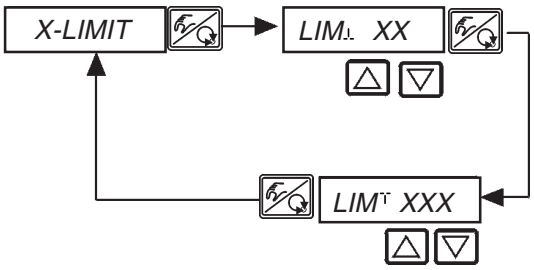
## X.LIMIT

### Limitation of the mechanical stroke range

Factory setting: $LIM_{\perp}$ = 0%, $LIM^{\top}$ = 100%

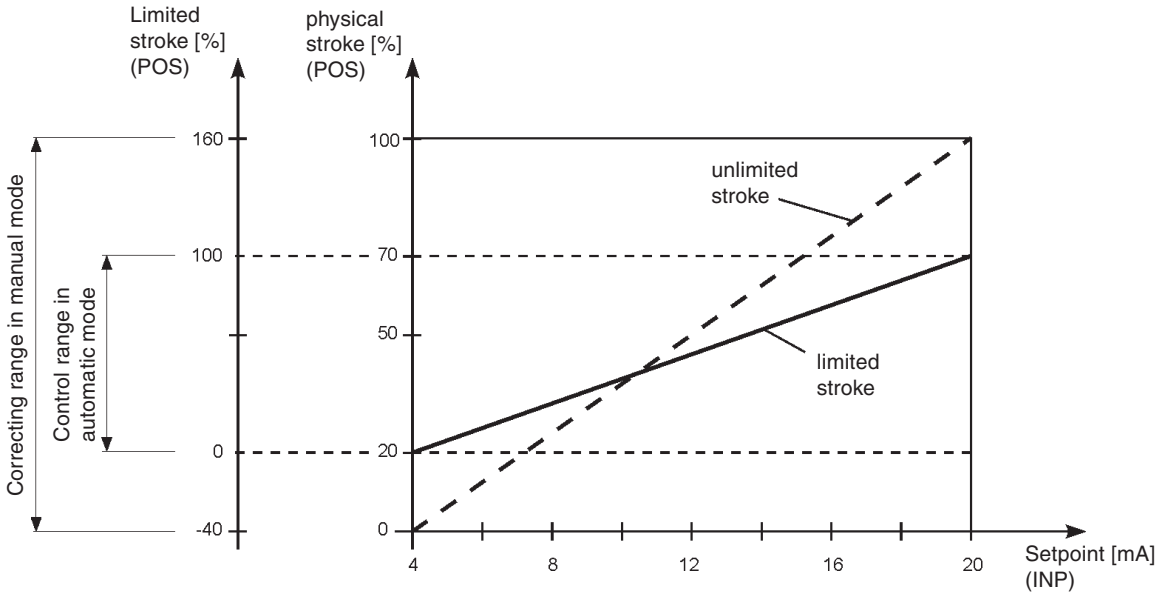
This supplementary function limits the (physical) stroke to preset % values (minimum and maximum). The range of the limited stroke is thereby set to 100 %. If the limited stroke range is left during operation, negative or positive POS values or POS values greater than 100 % are displayed.




Entering the start value of the stroke range in %, 0..50% of the overall stroke

Entering the end value of the stroke range in %, 50..100% of the overall stroke

The minimum separation between $LIM_{\perp}$ and $LIM^{\top}$ is 50 %.

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### *X.TIME*

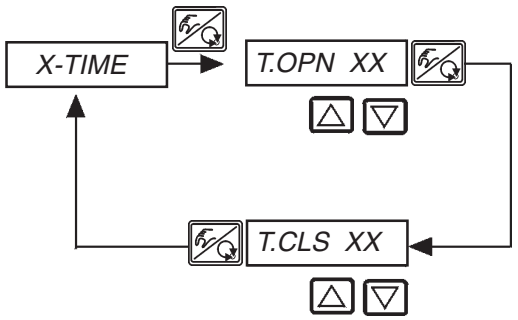
## Limitation of the correcting speed

Factory setting: 1 s

**NOTE**

On execution of the function *X.TUNE*, the minimum opening and closing times are entered automatically for *T.OPN* and *T.CLS* for the entire stroke. In this way, the maximum speed can be run.

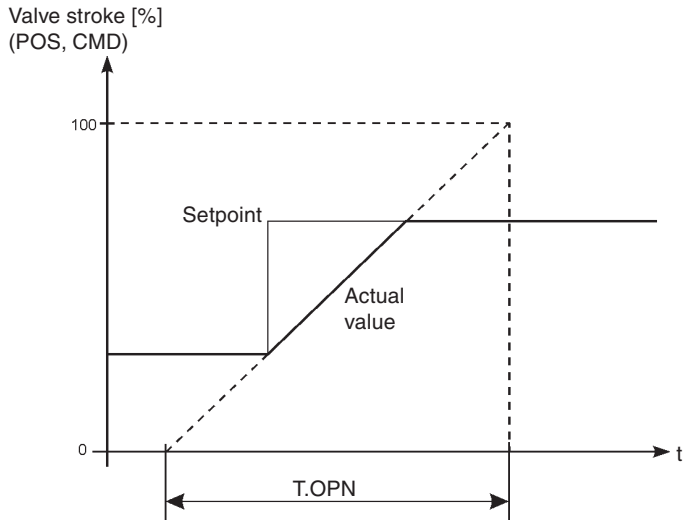
If the correcting speed is to be limited, values can be entered for *T.OPN* and *T.CLS* that lie between the minimum values determined by *X.TUNE* and 60 s.




Opening time for the entire stroke (in seconds)

Closing time for the entire stroke (in seconds)

**Effect of limitation of the opening speed after a step in the setpoint**




**NOTE**

If *AUTOTUNE* determines correction times < 1s, *X.TIME* will be copied automatically into the main menu and the corresponding value set to 1 s.

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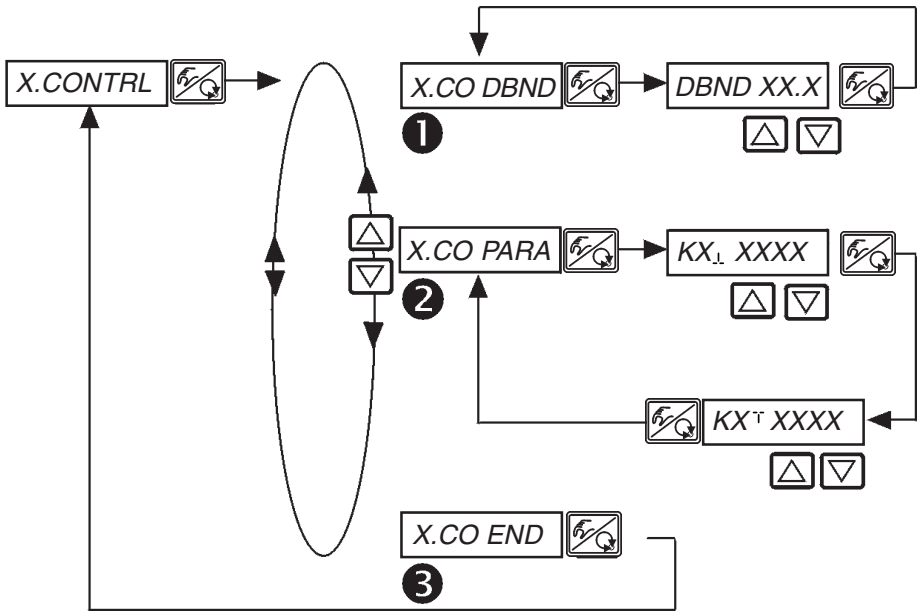
## X.CONTRL

### Parametrization of the positioner

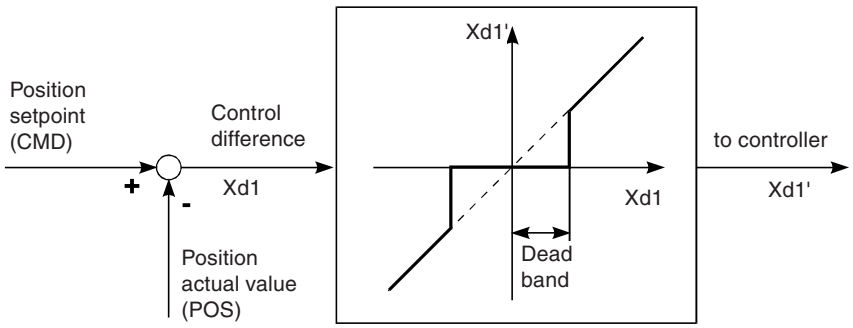



**1** **Insensitivity range (dead band) of the positioner**

Entry of the dead band in %, referred to the scaled stroke range; i.e. *LIM⊤* minus *LIM⊥* (see function *X.LIMIT*). This function assures that the positioner cuts in only above a certain control difference. The function reduces wear on the piezoelectric valves in the SIDE Control and the pneumatic actuator.

**NOTE**

If the supplementary function *X.CONTRL* is present in the main menu during execution of *X.TUNE (AUTOTUNE* of the positioner), automatic determination of the positioner dead band *X.CO.DBND* occurs additionally as a function of the frictional behaviour of the actuator. The value determined in this way is a standard value and can be reajusted manually.




**2** **Parameters of the positioner**

| | |
|---|---|
| *KX⊥ XXXX* | Amplification factor of positioner (to close the valve) |
| *KX⊤ XXXX* | Amplification factor of positioner (to open the valve) |

**3** **End** of parametrization of positioner. Jump back to *X.CONTRL*

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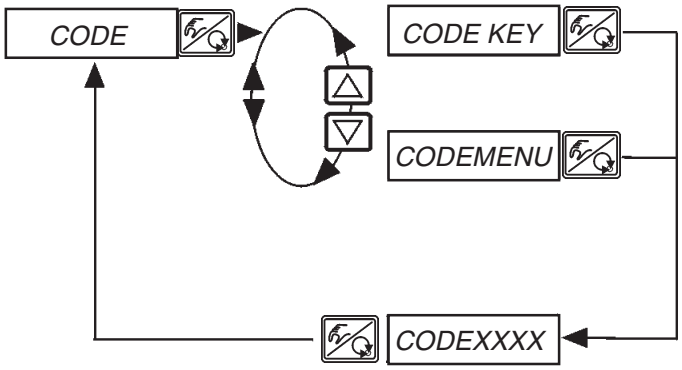
## *CODE*

### Code protection for the settings *(S/HART)*

Factory setting: *CODE 0000*




Locking of all manipulations that would change the operating mode of the device. (The messages on the display can be switched over.)

Locking of entry into the configuration level.

Entry of the 4-digit code.

*CODEXXXX* If the code protection is activated, entry of the code will be demanded on every protected operative manipulation:

Changing the flashing digit

Confirming the digit and switch to next digit

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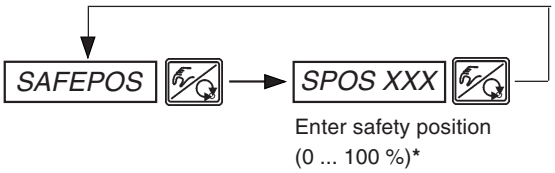
## *SAFEPOS*

### Entering the safety positioning

Factory setting: 0 %




* When the safety position is 0 % or 100 %, the actuator will be **fully** vented or pressurized as soon as the safety position is activated in the supplementary function *SIG-ERR* or *BIN-IN*.

**NOTE**

The safety position set is only moved to when a corresponding signal is present at the binary input (for configuration see *BIN-IN*), or on occurrence of a signal error (for configuration see *SIG-ERR*).

This function is executed only in the AUTOMATIC mode.

With the fast pressurize / fast vent variant, two valves are driven in each case to obtain faster pressurizing and venting.

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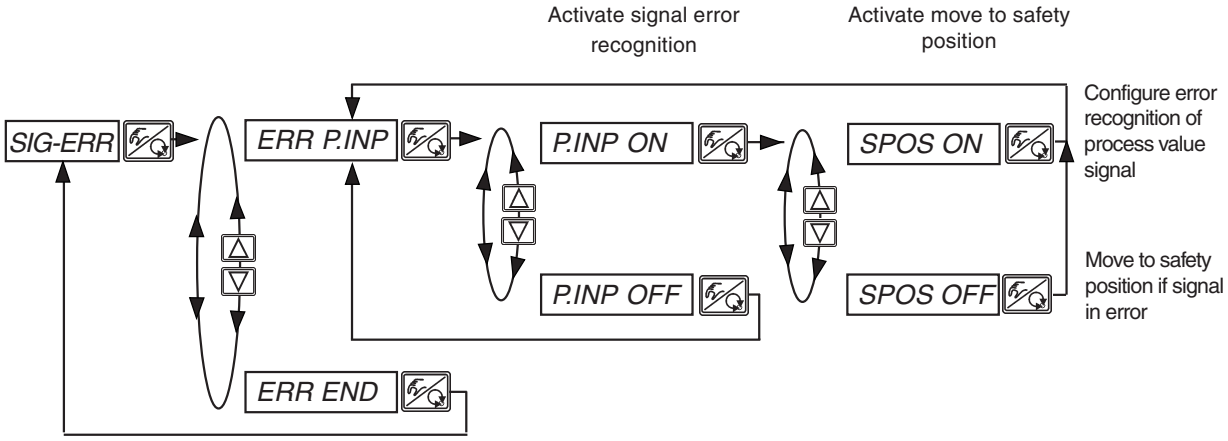
### *SIG-ERR*

## Configuration of error recognition signal level *(S/HART)*




**NOTE**

**Error recognition**
Error recognition can be selected only with 4 ... 20 mA signal of the process value.
Error is recognized with an input signal ≤ 3.5 mA (±0.5 % of end value, hysteresis 0.5 % of end value).
With signal error recognition activated: PV FAULT ≙ signal error of process controller value.
With the process controller deactivated, *NOT.AVAIL* appears in the selection menu.

**Safety position *SPOS ON***

If *SPOS ON* is set, the following configurations may occur:

Activated menu item *SAFEPOS*
On error recognition the actuator moves to the position set under *SAFEPOS.*

Deactivated menu item *SAFEPOS*
On error recognition the actuator moves to the end position which it would assume in the zero-voltage state.

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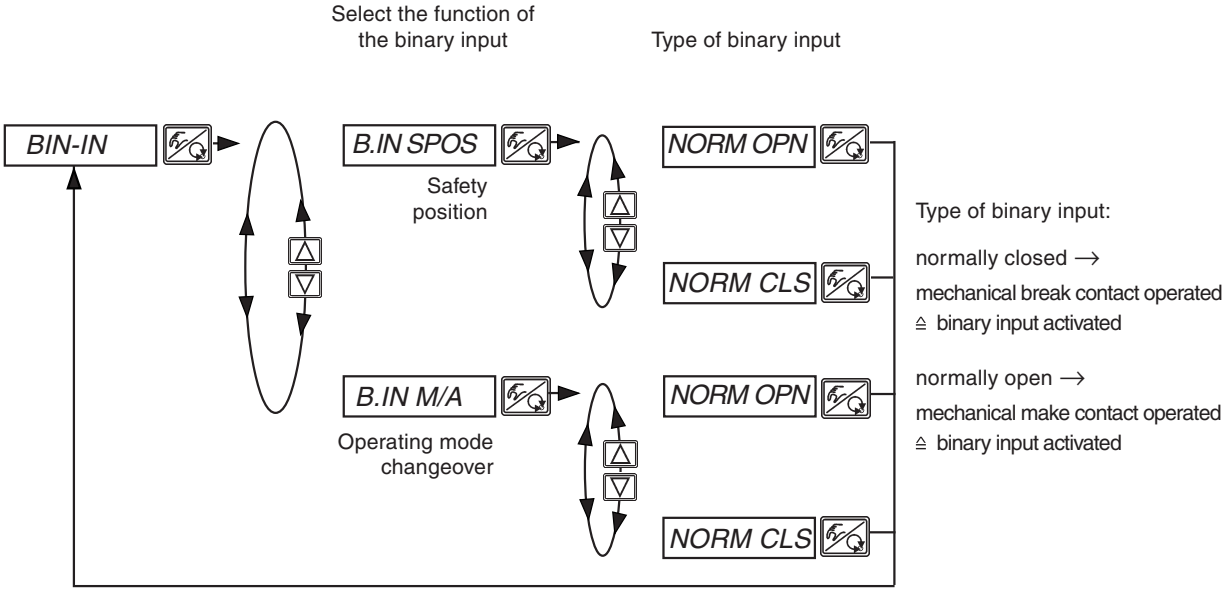
## *BIN-IN*

## Activating the binary input




**Safety position *B.IN SPOS***

Moving to a safety position.

Activated menu item *SAFEPOS*
The actuator moves to the position set under *SAFEPOS*.

Deactivated menu item *SAFEPOS*
The actuator moves to the end position which it would assume in the zero-voltage state.

**Operating mode changeover *B.IN M/A***

Changeover of operating mode between MANUAL and AUTOMATIC.

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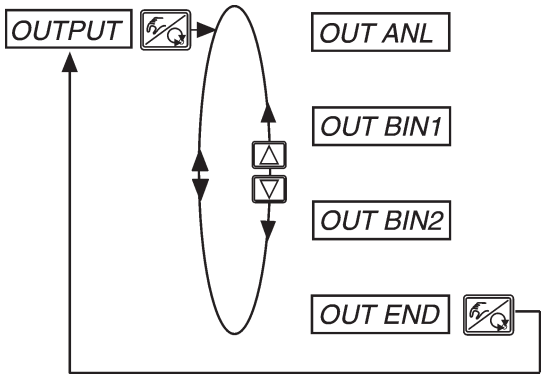
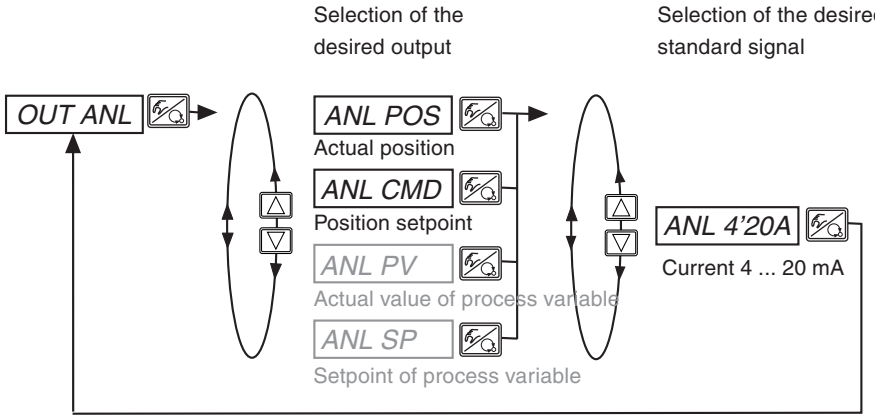
## *OUTPUT (Option)*

### Configuratin of the outputs *(S/HART)*




1. Configure the analog output
2. Configure binary output 1
3. Configure binary output 2
4. End of configuration of the outputs

### 1 *OUT ANL* - Standard signal for the analog position output




**NOTE** The signal types shown in grey can be selected only if the process controller is activated.

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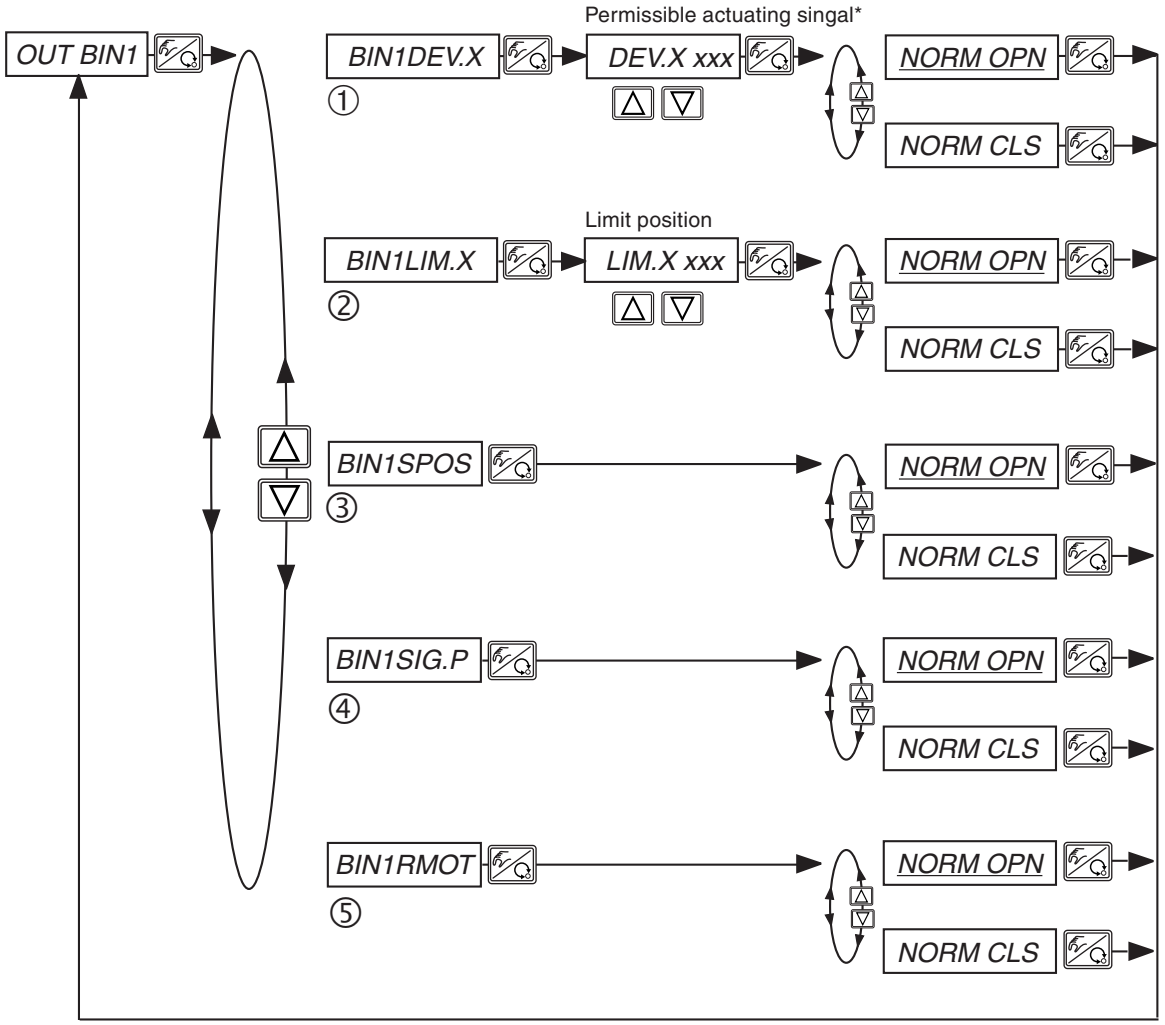
## ❷ *OUT BIN1* - Configuration of binary output 1

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**NOTE**

*NORM CLS (NC)* "Normally Closed"-
output, in switched state *low* (<1.2 mA)

*NORM OPN (NO)* "Normally Open"-
output, in switched state *high* (>2.1 mA)

**① *BIN1 DEV.X***

Selection: alarm output for too great an actuating signal from the positioner

***** The permissible actuating signal *DEV.X XXX* shall not be smaller than dead band.

**② *BIN1 LIM.X***

Selection: binary position output
*LIM.X XXX* - limit position

| *OUT BIN1* | *NORM OPN* | *NORM CLS* |
|---|---|---|
| *POS > LIM* | <1.2 mA   | >2.1 mA   |
| *POS < LIM* | >2.1 mA  | <1.2 mA  |

**③ *BIN1 SPOS***

Selection: actuator in safety position

**④ *BIN1 SIG.P***

Selection: error message in process value signal

**⑤ *BIN1 RMOT***

Selection: operating mode *Automatic* and *External Setpoint* activated

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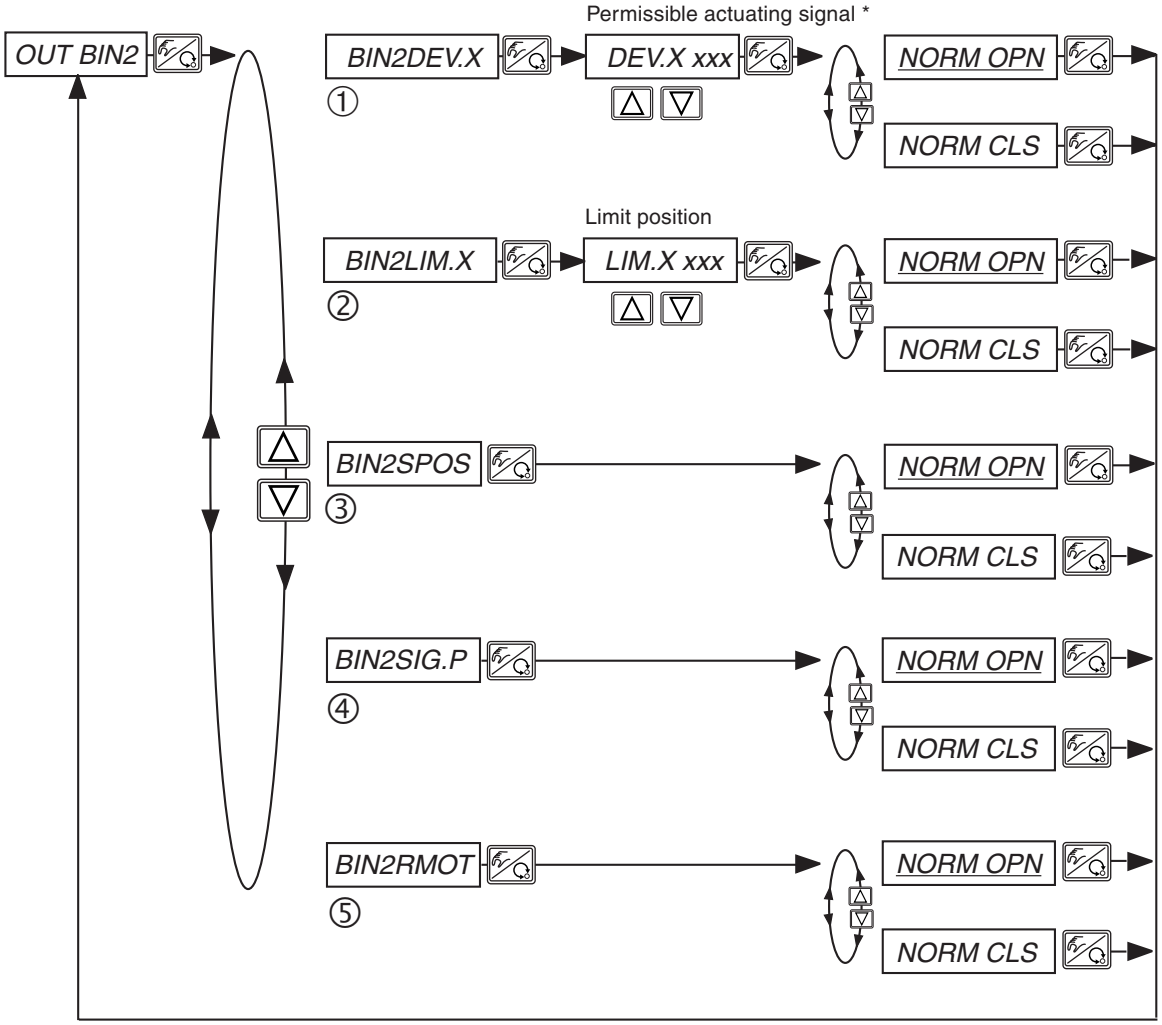
### ❸ *OUT BIN2* - Configuring binary output 2

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**NOTE**

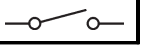
*NORM CLS (NC)* "Normally Closed"-
output, in switched state *low* (<1.2 mA)

*NORM OPN (NO)* "Normally Open"-
output, in switched state *high* (>2.1 mA)

**① *BIN2 DEV.X***
Selection: alarm output for too great an actuating signal from the positioner

***** The permissible actuating signal *DEV.X XXX* shall not be smaller than dead band.

**② *BIN2 LIM.X***
Selection: binary position output
*LIM.X XXX* - limit position

| *OUT BIN2* | *NORM OPN* | *NORM CLS* |
|---|---|---|
| *POS > LIM* | <1.2 mA  | >2.1 mA  |
| *POS < LIM* | >2.1 mA  | <1.2 mA  |

**③ *BIN2 SPOS***
Selection: actuator in safety position

**④ *BIN2 SIG.P***
Selection: error message in process value signal

**⑤ *BIN2 RMOT***

Selection: operating mode *Automatic* and *External Setpoint* activated

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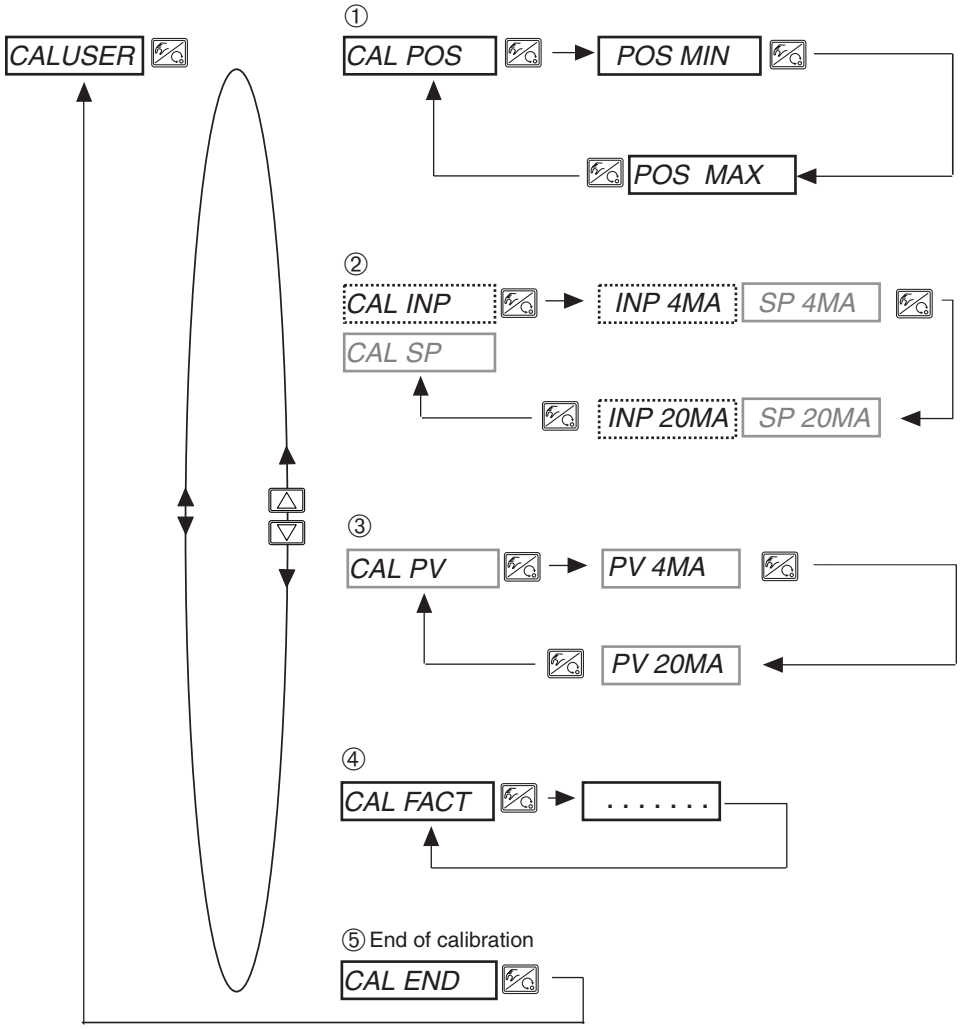
### CAL.USER

**Calibration of the actual value display and the inputs for the position setpoint, process setpoint and process value** *(S/HART)*




**NOTE**

The signal types shown in grey can only be selected if the process controller is activated.

The signal enclosed by a dotted line can only be selected if the process controller is deactivated.

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①

***CAL.POS***

**Calibration of the position display (0 - 100 %)**

Storage of the minimum position:

Move to minimum position of the valve via arrow keys and confirm by pressing the MANUAL / AUTOMATIC key.

Storage of the maximum position:

Move to the maximum position of the valve via arrow keys and confirm this value by pressing the MANUAL / AUTOMATIC key.

②

***CAL INP***

**Calibration of the position setpoint (4 ... 20 mA)**

***CAL SP***

**Calibration of the process setpoint (4 ... 20 mA)**

This menu item does not appear with internal setpoint!

Storage of the minimum input signal (4 mA):
Apply the minimum value of the standard signal to the input and confirm it by pressing the MANUAL / AUTOMATIC key.

Storage of the maximum input signal (20 mA):
Apply the maximum value of the standard signal to the input and confirm it by pressing the MANUAL / AUTOMATIC key.

③

***CAL PV***

**Calibration of the process setpoint (4 ... 20 mA)**

This menu item does not appear on selection of frequency setpoint!

Storage of the minimum input signal (4 mA):
Apply the minimum value of the process value signal to the input and confirm the value by pressing the MANUAL/AUTOMATIC key.

Storage of the maximum input signal (20 mA):
Apply the maximum value of the process value signal to the input and confirm the value by pressing the MANUAL/AUTOMATIC key.

Select Pt-100:
Alter the value displayed using the arrow keys until the display on the SIDE Control S/HART agrees with that on the reference measuring instrument. Then confirm the value by pressing the MANUAL/ AUTOMATIC key.

④

***CAL FACT***

**Reset of the settings under *CAL.USER* to the factory settings:**

Hold down the MANUAL / AUTOMATIC key until the countdown has finished.

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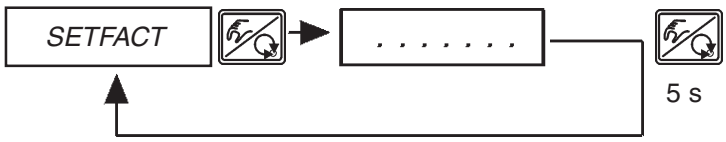
## SETFACT

### Resetting to the factory settings

With this function, all the settings made by the user can be reset to the status on delivery.

All EEPROM parameters with the exception of the calibration values are reset to the default values. Then a hardware reset is executed.




To initiate the function, hold down the MANUAL/AUTOMATIC key for ca. 5 s until the countdown has finished.

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# Operating the process

Each time after switching on the voltage supply, the SIDE Control is automatically in the process operating level. To change to the process operating level from the configuration level, confirm the menu item *END* by pressing the MANUAL/AUTOMATIC key.

In the process operating level, the normal controlled operation is executed and monitored (in the *AUTOMATIC* mode), and the valve opened or closed by hand (*MANUAL* mode).

## Changing between the operating modes:

Operate the MANUAL/AUTOMATIC key to switch between the *MANUAL* and *AUTOMATIC* modes.

5 sec

Both in the *MANUAL* and the *AUTOMATIC* modes, you can change to the configuration level by pressing the MANUAL/AUTOMATIC key for longer than 5 seconds.On switching back to the process operating level, the operating mode is resumed that was set before switching over.

| Operating mode | Display |
|---|---|
| *AUTOMATIC* | An apostrophe (') runs continuously from left to right. |
| *HAND* | - |

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# Operating mode AUTOMATIC *(S/HART)*

In the *AUTOMATIC* mode, the normal controlled operation is executed and monitored.

## Meaning of the keys in the operating mode AUTOMATIC

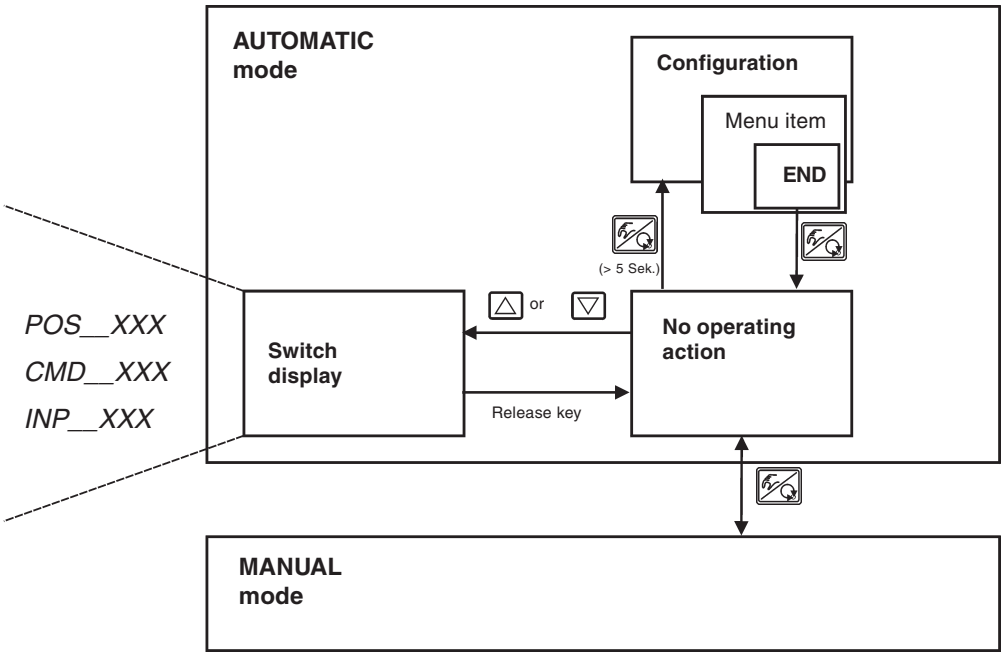
| | |
|---|---|
| ▲ or ▼ | switch over the display |
| ▲ or ▼ > 3 s | change the setpoint value:<br>with supplementary function *P.CONTRL / P.CO SETP / SETP INT* configured and display *SP* set |

## Displays in the operating mode AUTOMATIC

With reference to the controller, the following displays are possible:

- Actual position of valve actuator — *POS__XXX* (0 ... 100 %)
- Position setpoint of valve actuator (perhaps rescaled by an activated split-range function or correction characteristic) — *CMD__XXX* (0 ... 100 %)
- Input signal for position setpoint — *INP__XXX* (4 ... 20 mA)

By pressing the arrow keys, you can switch between these 3 display options.




**NOTE**

If the device is in the safety position (for the relevant configuration, see menu item *BIN-IN*), the message *SAFE XXX* appears on the display.
If the menu item *CUTOFF* is activated and the process valve is in the tight-closing range, a flashing *MIN* or *MAX* symbol appears on the display.

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# Operating mode AUTOMATIC *(PROFIBUS PA)*

In the ***AUTOMATIC*** mode, the normal controlled operation is executed and monitored. The setpoint is specified via the PROFIBUS PA signal.

## Meaning of the keys in the operating mode AUTOMATIC

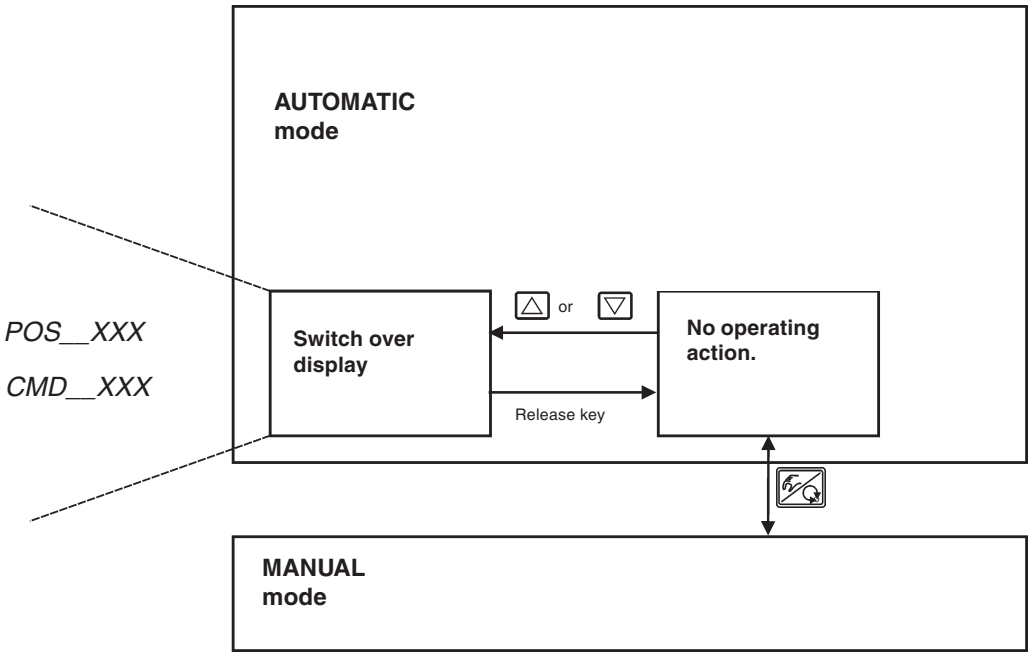
 or  Switch over the display

## Displays in the operating mode AUTOMATIC

With respect to the controller, the following displays are possible:

- Actual position of valve actuator — *POS__XXX* (0 ... 100 %)
- Setpoint position of valve actuator after or correction characteristic: — *CMD__XXX* (0 ... 100 %)

By pressing the arrow keys, you can switch between these 2 display options.




**NOTE** | If the device in the safety position (for the relevant configuration, see menu item *BIN-IN*), the message *SAFE XXX* appears on the display.

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# Operating mode MANUAL

In the *MANUAL* mode, the valve can be opened and closed by hand.

## Meaning of the keys in the operating mode MANUAL

Press the △ key in the MANUAL mode:
actuator pressurized (SFA*: valve opens, SFB*: valve closes)

Press the ▽ key in the MANUAL mode:
actuator vented (SFA*: valve closes, SFB*: valve opens)

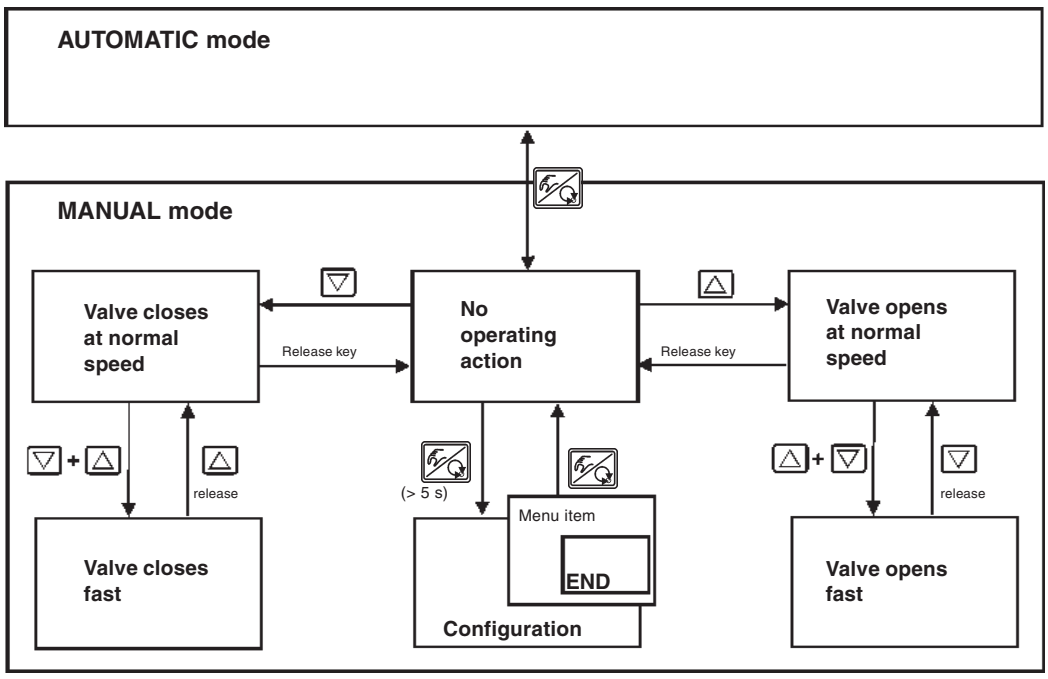
△ + ▽ Hold down the △ key and simultaneously press the ▽ key:
fast pressurization of actuator (SFA*: valve opens, SFB*: valve closes)

▽ + △ Hold down the ▽ key and simultaneously press the △ key:
fast venting of actuator (SFA*: valve closes, SFB*: valve opens)

*SFA: actuator closes by spring force
*SFB: actuator opens by spring force

## Displays in the operating mode MANUAL

The last display set in the AUTOMATIC mode is shown.
By selecting *POS_XXX*, the actual value of the valve actuator can be checked.

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# OPERATING THE PROCESS CONTROLLER (S/HART)



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# Factory settings of the process controller

| Function | Factory setting |
|---|---|
| *P.CONTRL* | |
| *P.CO DBND* | *1 %* |
| *P.CO PARA* | |
| *KP* | *1.00* |
| *TN* | *999.9* |
| *TV* | *0.0* |
| *X0* | *0* |
| *P.CO SETP* | *SETP INT* |
| *P.CO FILT* | *0* |
| *P.CO SCAL* | *PV⊥ 000.0, PV⊤ 100.0* |
| *P.CO TUNE* | *D'ACT* |

# Setting up a process control system

In order to be able to operate the SIDE Control *(S/HART)* as a process controller, you must execute the following steps:

A ➔ In all cases, first execute the self-parametrization for positioners *(X.TUNE)*.

B ➔ Add the supplementary function *P.CONTRL* to the main menu via the configuration menu.

The function *P.Q'LIN* is also added to the main menu with the function *P.CONTRL*.

C ➔ Call up the basic settings for the process controller under *P.CONTRL*.

D Linearization of the process characteristic:

If you are dealing with a flow control system, the process characteristic can be linearized automatically:

➔ Initiate the function *P.Q'LIN*.

E Self-optimization of the process controller

➔ Activate the function *P.CO TUNE* and initiate the self-optimization of the PID parameters of the process controller.

**ATTENTION!** In all cases, keep to the following sequence: ***X.TUNE ➔ P.Q'LIN ➔ P.CO TUNE***

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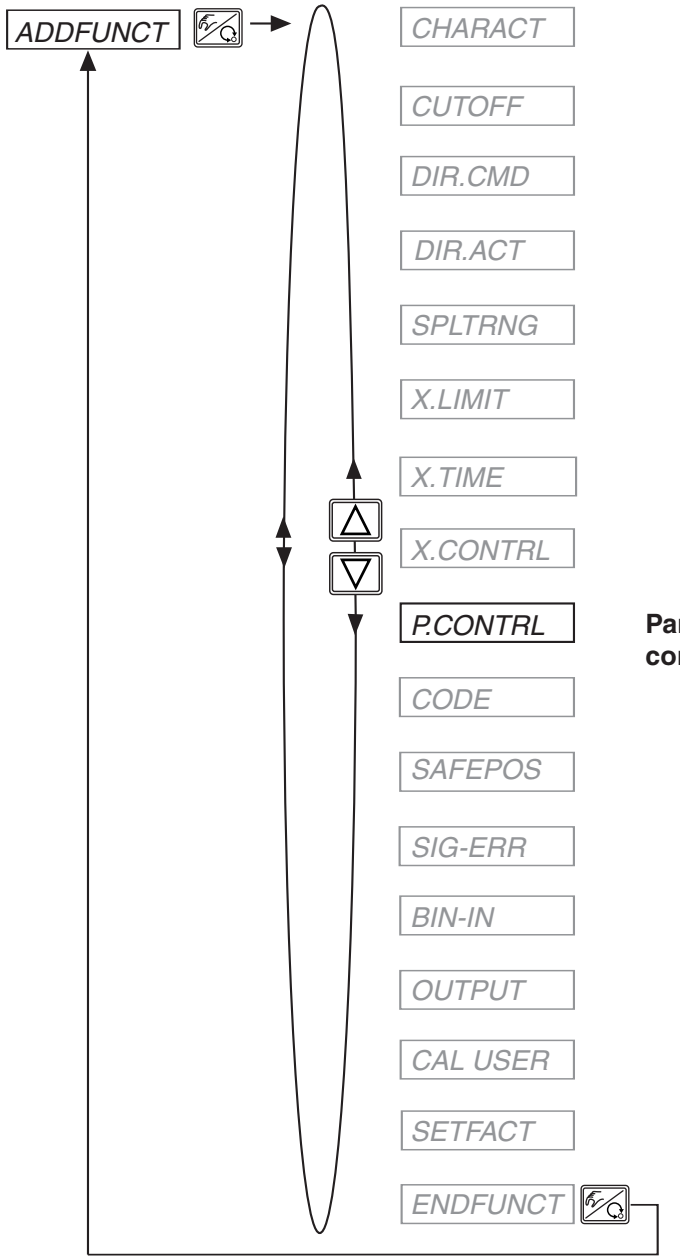
# Self-parametrization for positioners - *X.TUNE*

Ⓐ

The description of self-parametrization for positioners is to be found in the chapter *Operating and Controller Functions / Commissioning and set-up as a positioner / Main menu for settings on commissioning /* ❷ *X.TUNE.*

# Supplementary function *P.CONTRL*

Ⓑ (see also the section *Operating and Controller Functions - Configuring the Supplementary Functions*)




**Parametrization of the PID process controller**

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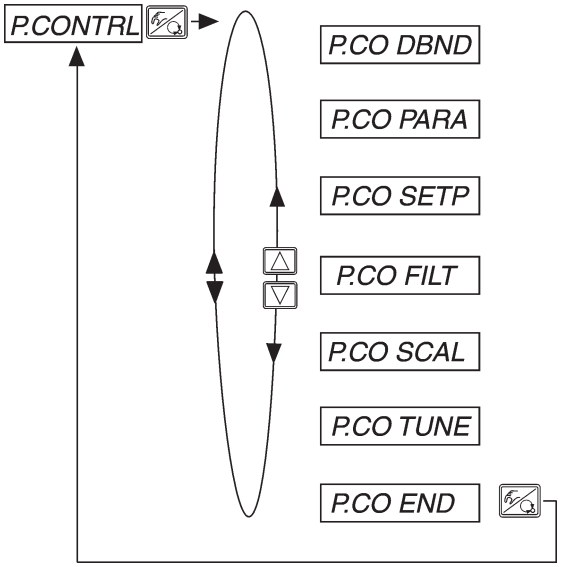
## Basic settings of the function *P.CONTRL*

Ⓒ

### Parametrization of the process controller




Insensitivity range (dead band) of the PID process controller

Parameters of the PID process controller

Type of setpoint setting

Filtering of the process value input

Scaling of the process controller

Process tune of the process controller

Storage of the new parameters
End of the parametrization of the process controller

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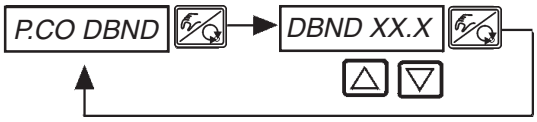
## *P.CO - DBND*
## Insensitivity range (dead band) of the process controller

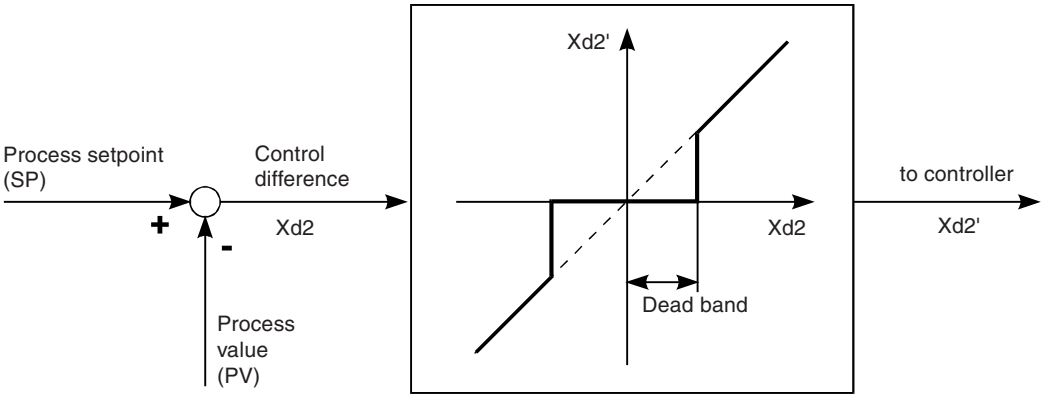
Factory setting: 1% (relative to the range width of the process value scaled by *SCAL PV*$_{\perp}$ und *PV*$^{\top}$ )

This function assures that the process controller cuts in only above a certain control difference. The function reduces wear on the piezoelectric valves in the SIDE Control *(S/HART)* and the pneumatic actuator.




Entering the dead band in %

**Insensitivity range with process control**

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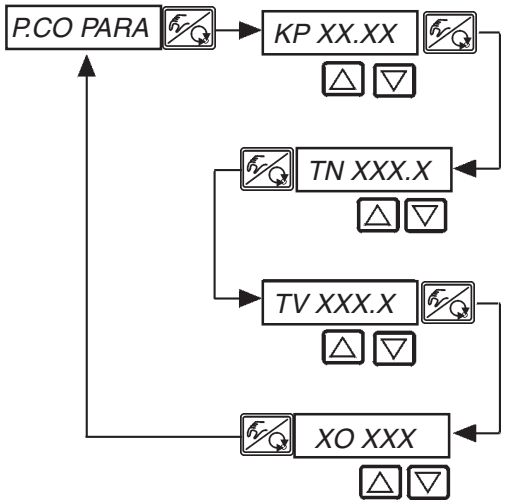
### *P.CO - PARA*
### Parameters of the PID process controller




Amplification factor of the process controller
0 ... 99.99 (factory setting 1.00)

Reset time
0.5 s ... 999.9 s (factory setting 999.9 s)

Rate time
0 s ... 999.9 s (factory setting 0 s)

Operating point
0.0 ... 100 % (factory setting 0 %)

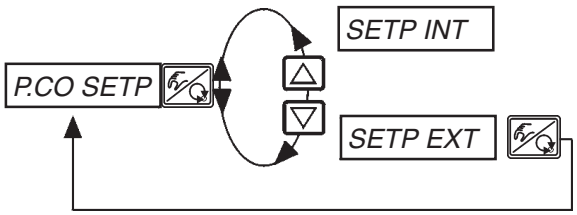
**NOTE**

The parameters that were entered should be noted in the table in Appendix *Tables for process controller.*

For definition of the parameters of a PID controller, see Appendix *General Rules.*

For self-parametrization of the PID parameters, see step Ⓔ.

### *P.CO - SETP*
### Type of setpoint setting (internal / external)




Setpoint setting internally via the keys on the SIDE Control *(S/HART).*

Setpoint setting externally via the standard signal input.

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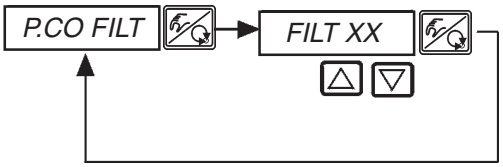
## *P.CO - FILT*
## Filtering of the process value input

Factory setting: 0

Filter has low-pass behaviour (PT1).

Range: 0 ... 9




*FILT XX*
Setting in 10 steps: 0 ... 9

**Setting in 10 steps**

| Setting | Corresponds to limiting frequency (Hz) | Effect |
|---|---|---|
| 0 | 10 | minimum filter effect |
| 1 | 5 | |
| 2 | 2 | |
| 3 | 1 | |
| 4 | 0.5 | |
| 5 | 0.2 | |
| 6 | 0.1 | |
| 7 | 0.07 | |
| 8 | 0.05 | |
| 9 | 0.03 | maximum filter effect |

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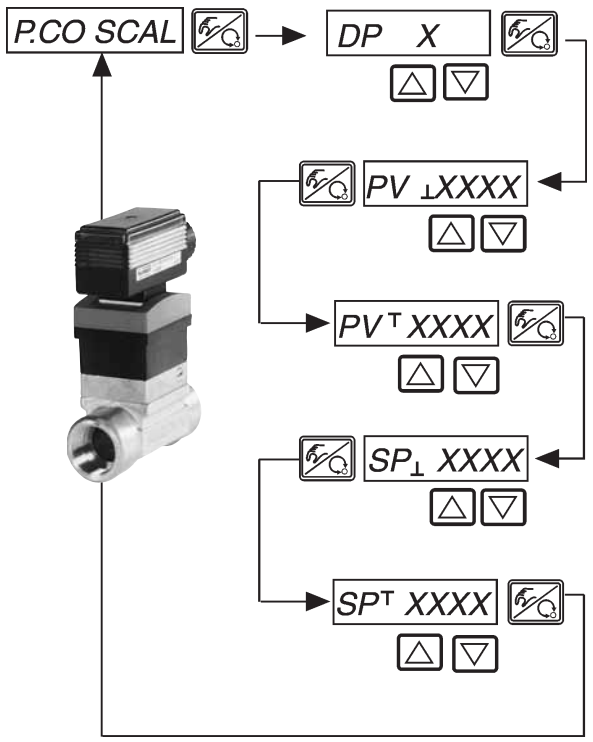
## *P.CO SCAL*
## Scaling the process controller




Position of the decimal point for process value and setpoint (setting range: 0 ... 3)

Lower scaling value for process value; the value is assigned to 4 mA. **(*)**

Upper scaling value for process value; the value is assigned to 20 mA.**(*)**

Lower scaling value for process setpoint; the value is assigned to 4 mA. **(**)**

Upper scaling value for process setpoint; the value is assigned to 20 mA. **(**)**

**(*)** This setting specifies the reference range for the deadband of the process controller and for the analog repeat of the process value (option).

**(**)** This setting is active only when *P.CO SETP / SETP EXT* has been selected.

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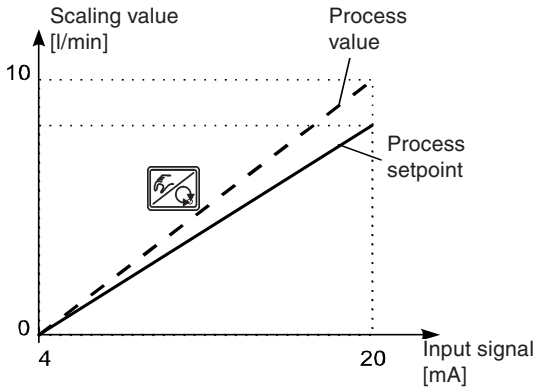
**Example of scaling for the 4 ... 20 mA input**

Process value from transmitter: 4 ... 20 mA corresponds to 0 ... 10 l/min

Process setpoint of SPS: 4 ... 20 mA corresponds to 0 ... 8 l/min




Example for entering scaling values

| | Variant 1 | Variant 2 | Variant 3 |
|---|---|---|---|
| PV ⊥ | 0 | 0 | 0 |
| PV ⊤ | 1.0 | 10.0 | 100.0 |
| SP ⊥ | 0 | 0 | 0 |
| SP ⊤ | 0.8 | 8.0 | 80.0 |

**NOTE**

On entering small scaling values, decimal places are automatically added to increase the precision of display, such that the maximum possible digit range is given between the lower and upper scaling values in each case. The amplification factor *KP* of the process controller refers to the scaling values set.

With *P.CO SETP / SETP INT* (setpoint entry via the arrow keys), scaling of the setpoint via *SP⊥* und *SP⊤* is not possible. The setpoint may be entered directly corresponding to the scaled process variable *(PV⊥, PV⊤)*.

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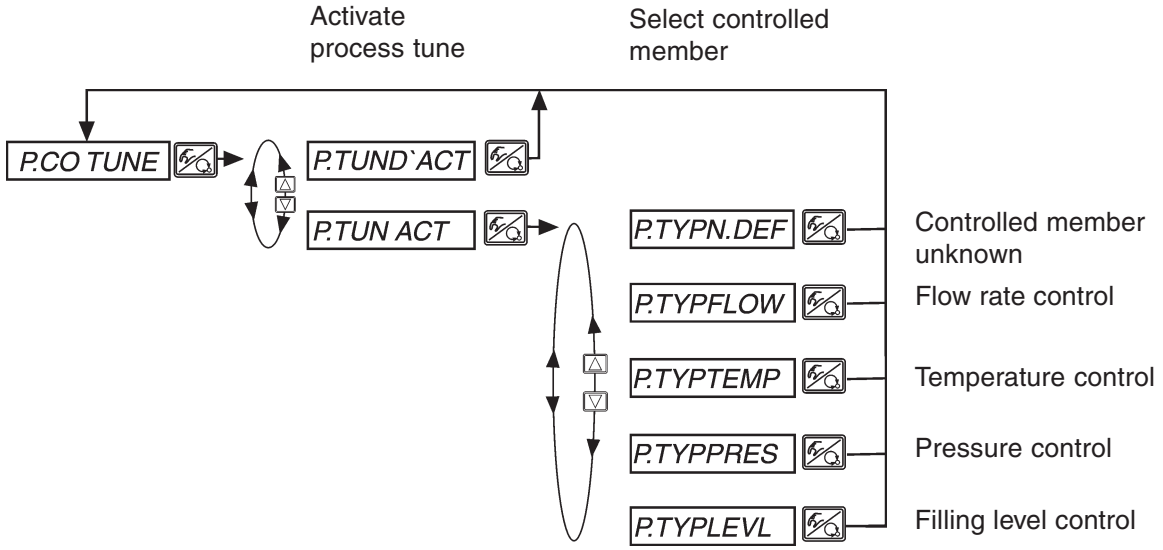
### *P.CO TUNE*
### Activating self-optimization of the process controller (process tune)




**NOTE** Process tune is started in the operating mode *AUTOMATIC*.

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# P.Q'LIN

## Starting the routine for linearization of the process characteristic

Ⓓ

This function makes sense only when flow control is to be carried out.

➔ You start the routine for linearization of the process characteristic by calling up the menu item *P.Q'LIN* in the main menu and pressing the MANUAL/AUTOMATIC key for 5 seconds.

With the activation of the function *P.CONTRL*, the function *P.Q'LIN*, which is required for process control, is copied into the main menu.
Via this function, the program is started for autonomous determination of the fixed points for a correction characteristic.

The program increases in 20 steps the valve stroke from 0 to 100 % and measures the associated process variable. The pairs of values of the correction characteristic are stored as a freely programmable characteristic under the menu item *CHARACT/CHAFREE* and may be viewed under this menu item.

If the menu item *CHARACT* was not transfered under the menu item *ADDFUNC* to the main menu, this is done automatically on execution of the function *P.Q'LIN*. At the same time, the menu item *CHARACT/CHAFREE* is activated.

## Displays during calling up and execution of the routine

| Display | Description |
|---|---|
| *P.Q'LIN 5*<br>*P.Q'LIN 4*<br>*:*<br>*P.Q'LIN 0* | Countdown from 5 to 0 for starting the routine |
| *¦ P.Q'LIN 0*<br>*¦ P.Q'LIN 1*<br>*¦ P.Q'LIN 2*<br>*¦ P.Q'LIN 3*<br>*:* | Display of the fixed point that is being approached at the moment (progress is indicated by rotating bars to the left of the display) |
| *P.Q'LIN.END* | (flashing) End of routine |
| *Q.ERR X.X* | Message on occurrence of an error (to right of display: error number - see section *Maintenance of the process controller)* |

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# *P.CO TUNE*

## Self-optimization of the process controller (process tune)

Ⓔ

The control system SIDE Control is equipped with a positioner which if required can be supplemented by a superimposed process controller (see chapter *Operation as a Process Controller*).

The positioner controls the position of the process valve to the desired setpoint and is automatically parametrized and optimized by the *X.TUNE* function.

The superimposed process controller, which together with a sensor forms a process control loop, controls any process variable. It has a PID structure whose components may be combined in various ways (P, PI, PD, PID), and freely parametrized (KP, TN, TV).

In order to obtain good control behaviour, the structure of the controller must be adapted to the characteristics of the process (controlled member). The parameters must be chosen to obtain a short setting time, a small overshoot width and good damping.

Parametrization demands experience in control technique, measuring equipment and is time consuming. For this reason, SIDE Control has a self-optimization function *P.TUNE*. This function provides an unique, direct determination of the parameters. The results may be read out as needed and modified in any way desired.

### METHOD OF OPERATION

During commissioning of the control system, the process is excited by a step in the setpoint in a closed control loop. This step is carried out within the future working range of the process control system and serves to determine characteristic variables of the process. Calculation of the PID controller parameters is carried out on the basis of these characteristic variables by use of a modified Ziegler-Nichols procedure.

### SETPOINT MODULATOR

In addition to optimization of the PID parameters, a setpoint modulator (filter) is calculated for the reduction of unwanted non-linear effects. Such effects may arise because of physical limitation of the correcting variables and the floating time of the control valve.

The setpoint modulator further improves the control behaviour. It is activated as long as the *P.TUNE* function is activated in the operating menu of the SIDE Control (***P.TUN ACT***). When the function *P.TUNE* is deactivated in the operating menu (***P.TUN D'ACT***) after completion of self-optimization, the process is controlled with the optimized PID parameters and the setpoint modulator is deactivated.

**ATTENTION!**

Be sure to comply with the sequence Ⓐ ... Ⓔ on setting up the process control system!

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## Operation

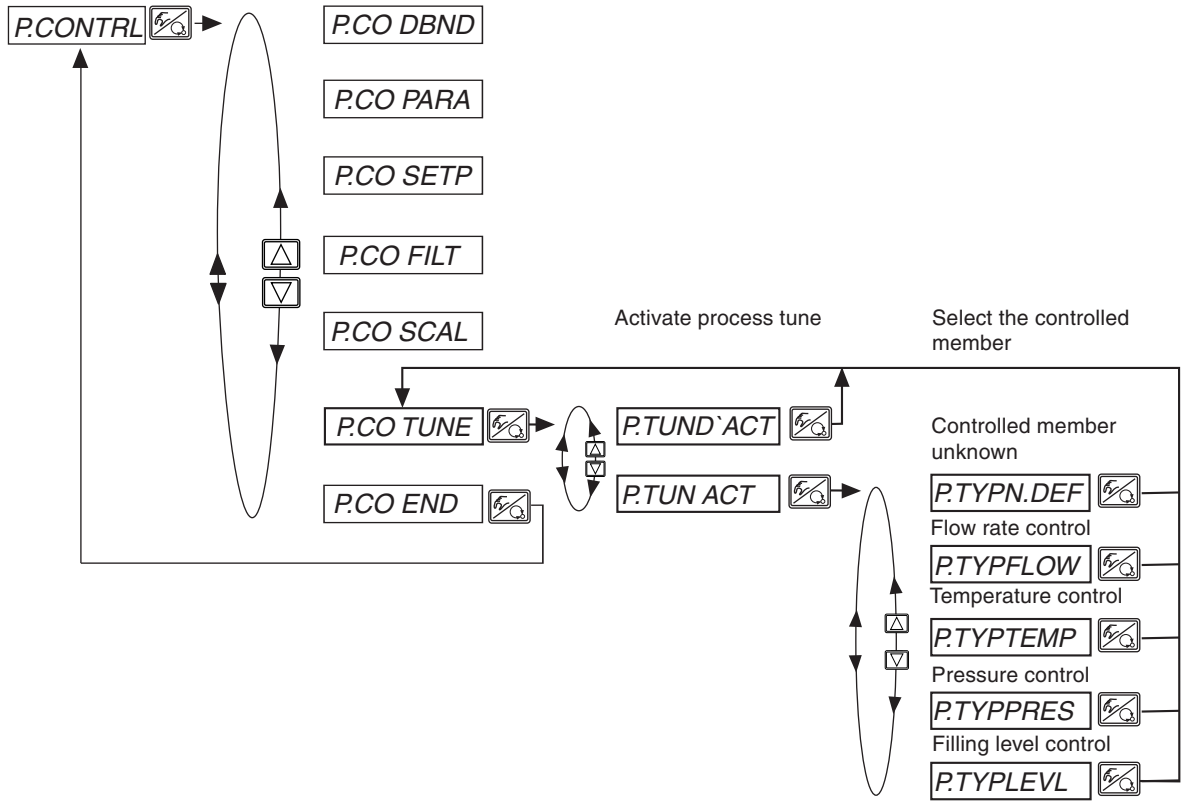
To carry out self-optimization (process tune) on the process controller, proceed as follows with the **steps ❶ ... ❹** described.

**NOTE** All operating steps for the execution of process tune are performed on the spot using the operating elements (keypad and display) of the SIDE Control.

**Step ❶ - Activate process tune**

You are in the menu item *P.CONTROL* in the **configuration level** of SIDE Control. Activate process tune on the process controller *P.TUN ACT* and select the process type corresponding to your control job.

If the process is unknown, enter *P.TYP N.DEF* (not defined).




Change to the ***process operating level*** by quitting the configuration level via the menu item *END X.XX* and switching the device to the operating mode *AUTOMATIC*.

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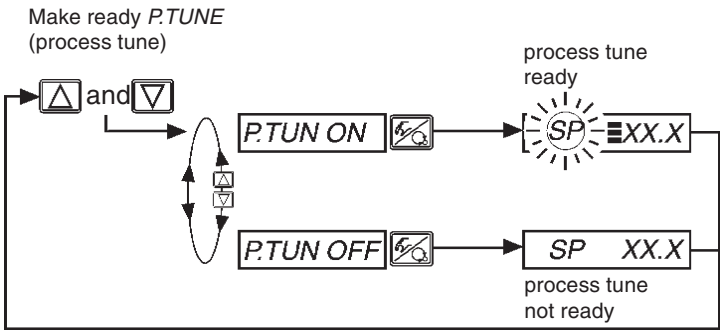
**Step ❷ - Process tune ready to start**

You are in the **process operating level** in the *AUTOMATIC* mode.

Make ready process tune by the following operating procedure:




The next setpoint step entered via the keypad (see Step ❹ ) is now used for parameter optimization. The setpoint *SP* is set equal to the actual sensor value *PV* and is the starting value for the optimization step.

Adaptation / modification of this starting value is described in Step ❸ .

Readiness of process tune is symbolized in the display by three horizontal bars behind the flashing setpoint symbol *SP* .

**Step ❸ - Adaptation of the starting value for the optimization step (optional)**

If required you can carry out an adaptation of the starting value for the optimization step. Switch the device to the *MANUAL* mode. By pressing the arrow keys, open or close the process valve, which causes a corresponding change in the process value *PV*. As soon as the desired starting value is set, switch the device back to the *AUTOMATIC* mode.

**Step ❹ - Initiate process tune**

You are in the ***process operating level*** in the *AUTOMATIC* mode.

Process tune is now initiated by entering via the keypad a setpoint step. This step should take place in the future working range of the process control system.

The procedure is as follows:

or > 3 s

With the display *SP* (setpoint) set, press one of the arrow keys for longer than 3 seconds to activate the mode for changing the process setpoint. After release of the key, the first digit of the process setpoint flashes.

or

Set the value of the flashing digit of the process setpoint *SP*.

Confirm the value set and move to the next digit. After confirmation of the fourth digit, the process setpoint set is stored as the end value of the process setpoint step.

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**NOTE**

The setpoint step for parameter optimization must always be entered via the operating keypad. This also applies when, on configuration, the function *P.CONTRL / P.CO SETP / SETP EXT* (setpoint setting via analog input) was specified. In this case, the external setpoint setting is reactivated only after completion of process tune.

Self-optimization of the process controller now runs automatically. The display shows a rotating bar and the message *P.TUNE*. After completion of process tune, the device is in the *AUTOMATIC* mode. The process controller works from this point on with the optimized PID parameters and controls to the current, internal or external setpoint *SP*.
To execute a new optimization cycle, repeat **Steps ❷ ... ❹** .

**NOTE**

Process tune in the operating menu of the SIDE Control remains activated, so that process control is carried out with the setpoint modulator (filter) in order to reduce unwanted, non-linear effects. If control is to be carried out without the setpoint modulator, process tune in the operating menu must be deactivated: *P.CONTRL / P.CO TUNE / P.TUN* ***D'ACT***.

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# Operating the process

Each time after switching on the voltage supply, the SIDE Control *(S/HART)* is automatically in the process operating level. To change to the process operating level from the configuration level, confirm the menu item *END* by pressing the MANUAL/AUTOMATIC key.

In the process operating level, normal controlled operation is executed and monitored (in the *AUTOMATIC* mode), and the valve opened or closed by hand (*MANUAL* mode).

## Changing between the operating modes

Operate the MANUAL/AUTOMATIC key to switch between the *MANUAL* and *AUTOMATIC* modes.

5 sec

Both in the *MANUAL* and the *AUTOMATIC* modes, you can change to the configuration level by pressing the MANUAL/AUTOMATIC key for longer than 5 seconds. On switching back to the process operating level, the operating mode is resumed that was set before switching over

| Operating mode | Display |
|---|---|
| *AUTOMATIC* | An apostrophe (') runs continuously from left to right. |
| *MANUAL* | - |

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# Operating mode AUTOMATIC

In the *AUTOMATIC* mode, normal controlled operation is executed and monitored.

## Meaning of the keys in the AUTOMATIC mode

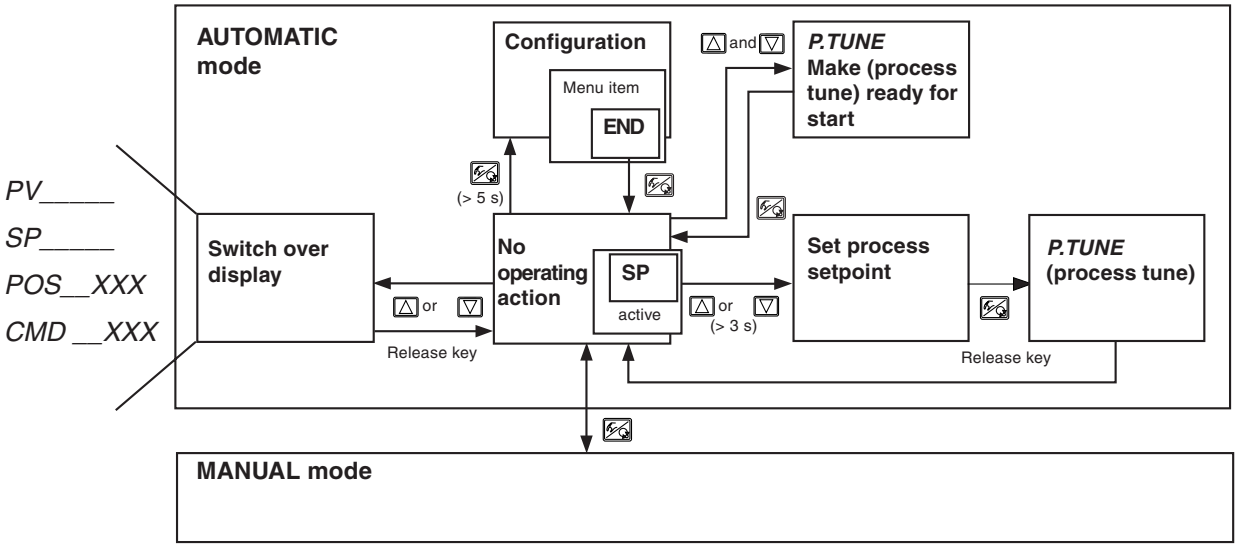
| | |
|---|---|
| △ or ▽ | Switch over the display |
| △ or ▽ > 3 s | Change the process setpoint:<br>With configured supplementary functions *P.CONTRL / P.CO SETP / SETP INT* and *SP* display set. |
| △ and ▽ | Make *P.TUNE* (process tune) ready for start:<br>With PID self-optimization activated, *P.CONTRL* / *P.CO TUNE* / *P.TUN ACT* |

## Displays in operating mode AUTOMATIC

With the process controller activated, the following parameters can be displayed:

- Actual value of process variable (process value) — *PV_____* (- 999 ... 9999)
- Setpoint of process variable (process setpoint) — *SP_____* (- 999 ... 9999)
- Actual position of valve actuator — *POS __XXX* (0 ... 100 %)
- Setpoint position of valve actuator after rescaling or correction curve — *CMD __XXX* (0 ... 100 %)

By pressing the arrow keys, you can switch between these display options.




**NOTE**

If the device is in the safety position (for the relevant configuration, see menu item *SIG-ERR or BIN-IN*), the message *SAFE XXX* appears on the display.
If the menu item *CUTOFF* is activated and the process valve is in the tight-closing range, a flashing *MIN* or *MAX* symbol appears on the display.
If the process value (PV) is outside the range of measurement (above or below), a flashing bar appears on the display.

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# Manual changing of the process setpoint


or
> 3 s


If the supplementary *function P.CONTRL / P.CO SETP / SETP INT* (setting of the setpoint via keys) was specified on configuration, then with the display *SP* set (setpoint) and on pressing one of the arrow keys for longer than 3 seconds, the mode for changing the process setpoint can be activated. After release of the key, the first digit of the process setpoint flashes.


or


The first digit of the process setpoint can be set.

After confirmation with the MANUAL / AUTOMATIC key, the set value is stored.

In the same manner, the other digits are set. After confirmation of the fourth digit, the display returns to the previous mode.

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# Operating mode MANUAL

In the MANUAL mode, the valve can be opened and closed by hand.

## Meaning of the keys in operating mode MANUAL

Press the △ key in the MANUAL mode:
actuator pressurized (SFA*: valve opens, SFB*: valve closes)

Press the ▽ key in the MANUAL mode:
actuator vented (SFA*: valve closes, SFB*: valve opens)

△ + ▽ Hold down the △ key and simultaneously press the ▽ key:
fast pressurization of actuator (SFA*: valve opens, SFB*: valve closes)

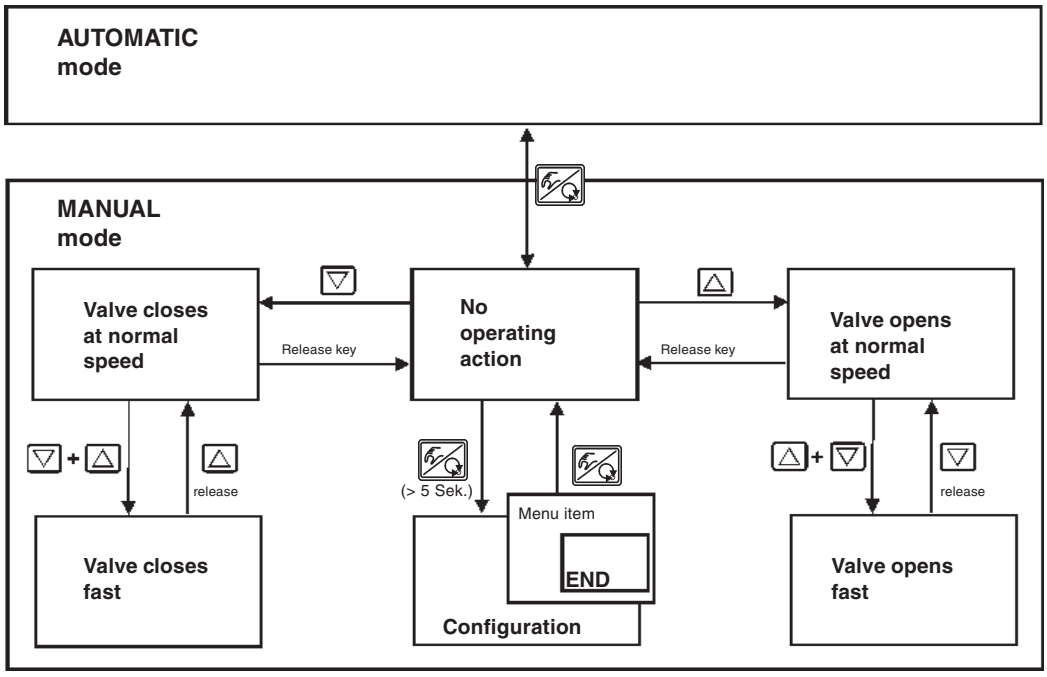
▽ + △ Hold down the ▽ key and simultaneously press the △ key:
fast venting of actuator (SFA*: valve closes, SFB*: valve opens)

*SFA: actuator closes by spring force
*SFB: actuator opens by spring force

## Displays in operating mode MANUAL

The last display set in the AUTOMATIC mode is shown.
By selecting *POS_XXX*, the actual position of the valve actuator can be checked.

To dislay the actual position of the valve actuator during MANUAL operation, first change to the display *POS_XXX* in the AUTOMATIC mode.

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# CONFIGURATION FOR BUS COMMUNICATION *(PROFIBUS PA)*



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# GSD file

```
;************************  COMPANY INFORMATION  ************************
;*                                                                     *
;*  Bürkert                                                            *
;*                                                                     *
;*                                                                     *
;*********************  DEVICE and FILE INFORMATION  *********************
;*                                                                     *
;*              FILE NAME: Buer9710.gsd Profil GSD                     *
;*             DEVICE TYPE: PROFIBUS_PA                                *
;*      DEVICE INFORMATION: 8635 Sidecontrol                           *
;*    PROFILE COMPATIBILITY: PROFILE 3.0                               *
;*      DPV1 IMPLEMENTATION: yes                                       *
;*                                                                     *
;************************  GSD REVISION INFORMATION  ************************
;* $Revision::   1.0                                                $ *
;* $Date::   5 April 2000 15:00                                     $ *
;*                                                                     *
;*   DATE | NAME | VERSION | COMMENT                                    *
;*  ---------------------------------------------------------------    *
;* 18.02.2000 | Ht   |   1.0   | Release 3.0                           *
;* 04.03.2000 ht 1.1 Bitmaps inserted                                  *
;* 5.04.2000 ht 1.2 bug fix, typ, text, len, Semikolon                 *
;* 5.04.2000 ht 1.3 name bitmaps                                       *
;* 11.03.02 ht user param data len = 3                                 *
;* 08.10.02 ht 1.5extend max diag len to 20 according to diagnostics   *
;*********************************************************************
;*                                                                     *
;*****************************  General DP Keywords  ***********************
#Profibus_DP
GSD_Revision        = 2
Vendor_Name         = "Buerkert"
Model_Name          = "8635"
Revision            = "Profile 3.0"
Ident_Number        = 0x0569
Protocol_Ident      = 0
Station_Type        = 0
FMS_supp            = 0
Hardware_Release    = "all"
Software_Release    = "3.00"

31.25_supp          = 1
45.45_supp          = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
12M_supp            = 1
MaxTsdr_31.25       = 100
MaxTsdr_45.45       = 250
MaxTsdr_93.75       = 1000
MaxTsdr_187.5       = 60
MaxTsdr_500         = 100
MaxTsdr_1.5M        = 150
MaxTsdr_3M          = 250
MaxTsdr_6M          = 450
MaxTsdr_12M         = 800
```

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```
Implementation_Type = "SPC4/ITEC"
Bitmap_Device       = "bue0569n"
Bitmap_Diag         = "bue0569d"
;Bitmap_SF          = ""

;********* Additional Keywords For Different Phsical Interfaces  ***************
;****************** DP Master (Class 1) Related Keywords  ***********************
;********* Additional Master Related Keywords For DP Extensions  **********

;********************* Basic DP_Slave Related Keywords  ************************
Freeze_Mode_supp    = 0
Sync_Mode_supp      = 0
Auto_Baud_supp      = 0
Set_Slave_Add_supp  = 1
Min_Slave_Intervall = 250
Modular_Station     = 1
Max_Module          = 1
Max_Input_Len       = 15
Max_Output_Len      = 10
Max_Data_Len        = 25
Max_Diag_Data_Len   = 20
Max_user_Prm_Data_Len = 3
Ext_User_Prm_Data_Const(0) = 0x00, 0x00, 0x00

Unit_Diag_Bit(16)  = "Error appears"
Unit_Diag_Bit(17)  = "Error disappears"
Unit_Diag_Bit(24)  = "Hardware failure electronics"
Unit_Diag_Bit(25)  = "Hardware failure mechanics"
Unit_Diag_Bit(26)  = "Motor temperature too high"
Unit_Diag_Bit(27)  = "Electronic temperature too high"
Unit_Diag_Bit(28)  = "Memory error"
Unit_Diag_Bit(29)  = "Measurement failure"
Unit_Diag_Bit(30)  = "Device not initialized"
Unit_Diag_Bit(31)  = "Device initialization failed"
Unit_Diag_Bit(32)  = "Zero point error"
Unit_Diag_Bit(33)  = "Power supply failed"
Unit_Diag_Bit(34)  = "Configuration invalid"
Unit_Diag_Bit(35)  = "Restart"
Unit_Diag_Bit(36)  = "Coldstart"
Unit_Diag_Bit(37)  = "Maintenance required"
Unit_Diag_Bit(38)  = "Characteristics invalid"
Unit_Diag_Bit(39)  = "Ident_Number violation"
Unit_Diag_Bit(55)  = "Extension Available"


;                       Modules for Analog Output
; RB = READBACK, CB = CHECKBACK, RC_OUT = RCAS_OUT, RC_IN = RCAS_IN
;
```

(1.)
```
Module      = "Setpoint SP_D"   0x82,0x84,0x08,0x05
EndModule
```

(2.)
```
Module      = "SP+READBACK+POS_D"  0xC6,0x84,0x86,0x08,0x05,0x08,0x05,0x05,0x05
EndModule
```

(3.)
```
Module      = "SP+CHECKBACK"   0xC3,0x84,0x82,0x08,0x05,0x0A
EndModule
```

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*(4.) Module = "SP+READBACK+POS_D+CHECKBACK"*
*0xC7,0x84,0x89,0x08,0x05,0x08,0x05,0x05,0x05,0x0A*
*EndModule*

*(5.) Module = "RCAS_IN+RCAS_OUT" 0xC4,0x84,0x84,0x08,0x05,0x08,0x05*
*EndModule*

*(6.) Module = "RCAS_IN+RCAS_OUT+CHECKBACK" 0xC5,0x84,0x87,0x08,0x05,0x08,0x05,0x0A*
*EndModule*

*(7.) Module = "SP+RB+RIN+ROUT+POS_D+CB"*
*0xCB,0x89,0x8E,0x08,0x05,0x08,0x05,0x08,0x05,0x08,0x05,0x05,0x05,0x0A*
*EndModule*

*Slave_Family = 12*

*;********** Additional Keywords For Modul Assignment **********
;********** Slave Related Keywords For DP Extensions **********
;********** Slave Related Keywords For ProfiSafe Profile ***********

*END OF GSD FILE*

One option is to be selected from the options for cyclic data exchange.
Under (1.) is to be found the simplest possibility, which corresponds only to the setpoint.
If one wishes to work with this manufacturer-specific file, the ident number selector must be set to „Manufacturer-Specific“ (1).

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# Setting the device address

Configuration and parametrization of the SIDE Control *(PROFIBUS PA)* are done locally via menu functions or via the bus. The valve can also be opened and closed locally by hand. The setpoint can be specified via the bus.

With **DIP switch 8**, one sets whether the device address is to be set on the device or via the bus

| DIP switch 8 | Setting |
|---|---|
| OFF | Enter the device address with the DIP switch |
| ON | Enter the device address via the bus |

With DIP switch 8 in the OFF position, the device address can be set via **DIP switches 1 to 7**. The permissible range for the address is 3 to 124.

| DIP-1 | DIP-2 | DIP-3 | DIP-4 | DIP-5 | DIP-6 | DIP-7 | Address | |
|---|---|---|---|---|---|---|---|---|
| $2^0$ | $2^1$ | $2^2$ | $2^3$ | $2^4$ | $2^5$ | $2^6$ | | |
| ON | ON | OFF | OFF | OFF | OFF | OFF | 3 | "Permissible range for address" |
| | | | | | | | : | |
| OFF | OFF | ON | ON | ON | ON | ON | 124 | |
| ON | OFF | ON | ON | ON | ON | ON | 125 | 125 |
| OFF | ON | ON | ON | ON | ON | ON | 126 | 126 |

**NOTE** The DIP switch settings are read in only on switching on the device.

## Cyclic parameters

### *SP* Setpoint of valve position

These parameters are of type DS-33 (value and status - floating point structure).The structure of this type of parameter is shown in the following table:

| Element no. | Name of element | Type | Length |
|---|---|---|---|
| 1 | Value | Float - (8) | 4 byte |
| 2 | Status | Unsigned 8 - (5) | 1 byte |

The „good“ status is 0 x 80. The configuration *SP* is supported.

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## Configuration parameters

| Parameter | Slot index | Index abso-lute | Read | Write | Type | Size byte | Memory class |
|---|---|---|---|---|---|---|---|
| **Device management** | | | | | | | |
| Directory_object_header | 1 | 0 | X | | OSTRING | 12 | C |
| Composite_directory_entrie | 1 | 1 | X | | OSTRING | 24 | C |
| | | | | | | | |
| **Physical Block** | | | | | | | |
| Block object | 0 | 16 | X | | DS-32 | 20 | C |
| ST_REV | 0 | 17 | X | | UNSIGNED16 | 2 | N |
| TAG_DESC | 0 | 18 | X | X | OSTRING | 32 | S |
| STRATEGY | 0 | 19 | X | X | UNSIGNÈD16 | 2 | S |
| ALERT_KEY | 0 | 20 | X | X | UNSIGNED8 | 1 | S |
| TARGET_MODE | 0 | 21 | X | X | UNSIGNED8 | 1 | S |
| MODE_BLK | 0 | 22 | X | | DS-37 | 3 | D |
| ALARM_SUM | 0 | 23 | X | | DS-42 | 8 | D |
| SOFTWARE_REVISION | 0 | 24 | X | | OSTRING | 16 | C |
| HARDWARE_REVISION | 0 | 25 | X | | OSTRING | 16 | C |
| DEVICE_MAN_ID | 0 | 26 | X | | UNSIGNED16 | 2 | C |
| DEVICE_ID | 0 | 27 | X | | OSTRING | 16 | C |
| SERIALNUMBER | 0 | 28 | X | | OSTRING | 16 | C |
| DIAGNOSIS | 0 | 29 | X | | OSTRING | 4 | D |
| DIAGNOSIS_EXTENSION | 0 | 30 | X | | OSTRING | 6 | D |
| DIAGNOSIS_MASK | 0 | 31 | X | | OSTRING | 4 | C |
| DIAGNOSIS_MASK_EXTENSION | 0 | 32 | X | | OSTRING | 6 | C |
| FACTORY_RESET | 0 | 35 | X | X | UNSIGNED16 | 2 | S |
| DESCRIPTOR | 0 | 36 | X | X | OSTRING | 32 | S |
| DEVICE_MESSAGE | 0 | 37 | X | X | OSTRING | 32 | S |
| DEVICE_INSTAL_DATE | 0 | 38 | X | X | OSTRING | 16 | S |
| LOCAL_OP_ENA | 0 | 39 | X | X | UNSIGNED8 | 1 | N |
| IDENT_NUMBER | 0 | 40 | X | X | UNSIGNED8 | 1 | S |
| View_1 (diagnosis) | 0 | 52 | X | | OSTRING | 17 | D |

N: Non-volatile parameter
S: Static revision counter parameter
D: Dynamic parameter
C: Constant parameter

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| Parameter | Slot index | Index abso-lute | Read | Write | Type | Size byte | Memory class |
|---|---|---|---|---|---|---|---|
| **Function Block (Analog Output)** | | | | | | | |
| Block object | 1 | 16 | X | | DS-32 | 20 | C |
| ST_REV | 1 | 17 | X | | UNSIGNED16 | 2 | N |
| **TAG_DESC** | 1 | 18 | X | X | OSTRING | 32 | S |
| STRATEGY | 1 | 19 | X | X | UNSIGNED16 | 2 | S |
| ALERT_KEY | 1 | 20 | X | X | UNSIGNED8 | 1 | S |
| TARGET_MODE | 1 | 21 | X | X | UNSIGNED8 | 1 | S |
| MODE_BLK | 1 | 22 | X | | DS-37 | 3 | D |
| ALARM_SUM | 1 | 23 | X | | DS-42 | 8 | D |
| BATCH | 1 | 24 | X | X | OSTRING | 10 | S |
| SP | 1 | 25 | X | X | DS-33 | 5 | D |
| PV_SCALE | 1 | 27 | X | X | DS-36 | 11 | S |
| READBACK | 1 | 28 | X | | DS-33 | 5 | D |
| RCAS_IN | 1 | 30 | X | X | DS-33 | 5 | D |
| IN_CHANNEL | 1 | 37 | X | X | UNSIGNED16 | 2 | S |
| OUT_CHANNEL | 1 | 38 | X | X | UNSIGNED16 | 2 | S |
| FSAVE_TIME | 1 | 39 | X | X | FLOAT | 4 | S |
| FSAVE_TYPE | 1 | 40 | X | X | UNSIGNED8 | 1 | S |
| FSAVE_VALUE | 1 | 41 | X | X | FLOAT | 4 | S |
| RCAS_OUT | 1 | 43 | X | X | DS-33 | 5 | D |
| POS_D | 1 | 47 | X | | DS-34 | 2 | D |
| SETP_DEVIATION | 1 | 48 | X | | FLOAT | 4 | D |
| CHECK_BACK | 1 | 49 | X | | OSTRING | 3 | D |
| CHECK_BACK_MASK | 1 | 50 | X | | OSTRING | 3 | C |
| SIMULATE | 1 | 51 | X | X | DS-50 | 6 | S |
| INCREASE_CLOSE | 1 | 52 | X | X | UNSIGNED8 | 1 | S |
| OUT | 1 | 53 | X | X | DS-33 | 5 | D |
| OUT_SCALE | 1 | 54 | X | X | DS-36 | 11 | S |

N: Non-volatile parameter
S: Static revision counter parameter
D: Dynamic parameter
C: Constant parameter

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| Parameter | Slot index | Index absolute | Read | Write | Type | Size byte | Memory class |
|---|---|---|---|---|---|---|---|
| **Transducer Block (Analog Output)** | | | | | | | |
| Block object | 1 | 100 | X | | DS-32 | 20 | C |
| ST_REV | 1 | 101 | X | | UNSIGNED16 | 2 | N |
| **TAG_DESC** | 1 | 102 | X | X | OSTRING | 32 | S |
| STRATEGY | 1 | 103 | X | X | UNSIGNED16 | 2 | S |
| ALERT_KEY | 1 | 104 | X | X | UNSIGNED8 | 1 | S |
| TARGET_MODE | 1 | 105 | X | X | UNSIGNED8 | 1 | S |
| MODE_BLK | 1 | 106 | X | | DS-37 | 3 | D |
| ALARM_SUM | 1 | 107 | X | | DS-42 | 8 | D |
| ACT_STROKE_TIME_DEC | 1 | 109 | X | | FLOAT | 4 | S |
| ACT_STROKE_TIME_INC | 1 | 110 | X | | FLOAT | 4 | S |
| TAB_ENTRY | 1 | 117 | X | X | UNSIGNED8 | 1 | D |
| TAB_X_Y_VALUE | 1 | 118 | X | X | FLOAT | 8 | D |
| TAB_MIN_NUMBER | 1 | 119 | X | | UNSIGNED8 | 1 | N |
| TAB_MAX_NUMBER | 1 | 120 | X | | UNSIGNED8 | 1 | N |
| TAB_ACTUAL_NUMBER | 1 | 121 | X | | UNSIGNED8 | 1 | N |
| DEADBAND | 1 | 122 | X | X | FLOAT | 4 | S |
| DEVICE_CALIB_DATE | 1 | 123 | X | X | OSTRING | 16 | S |
| DEVICE_CONFIG_DATE | 1 | 124 | X | X | OSTRING | 16 | S |
| LIN_TYPE | 1 | 125 | X | X | UNSIGNED8 | 1 | S |
| RATED_TRAVEL | 1 | 132 | X | X | FLOAT | 4 | S |
| SELF_CALIB_CMD | 1 | 133 | X | X | UNSIGNED8 | 1 | N |
| SELF_CALIB_STATUS | 1 | 134 | X | | UNSIGNED8 | 1 | N |
| SERVO_GAIN_1 | 1 | 135 | X | X | FLOAT | 4 | S |
| SETP_CUTOFF_DEC | 1 | 138 | X | X | FLOAT | 4 | S |
| SETP_CUTOFF_INC | 1 | 139 | X | X | FLOAT | 4 | S |
| TOTAL_VALVE_TRAVEL | 1 | 145 | X | | FLOAT | 4 | D |
| TOT_VALVE_TRAV_LIM | 1 | 146 | X | X | FLOAT | 4 | S |
| TRAVEL_LIM_LOW | 1 | 147 | X | X | FLOAT | 4 | S |
| TRAVEL_LIM_UP | 1 | 148 | X | X | FLOAT | 4 | S |
| TRAVEL_RATE_DEC | 1 | 149 | X | X | FLOAT | 4 | S |
| TRAVEL_RATE_INC | 1 | 150 | X | X | FLOAT | 4 | S |

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| Parameter | Slot index | Index abso-lute | Read | Write | Type | Size byte | Memory class |
|---|---|---|---|---|---|---|---|
| **Transducer Block (Analog Output)** | | | | | | | |
| VALVE_MAINT_DATE | 1 | 151 | X | X | OSTRING | 16 | S |
| SERVO_GAIN_2 | 1 | 152 | X | X | FLOAT | 4 | S |
| TAB_OP_CODE | 1 | 155 | X | X | UNSIGNED8 | 1 | D |
| TAB_STATUS | 1 | 156 | X | | UNSIGNED8 | 1 | D |
| POSITIONING_VALUE | 1 | 157 | X | | DS-33 | 5 | D |
| FEEDBACK_VALUE | 1 | 158 | X | | DS-33 | 5 | D |
| VALVE_MAN | 1 | 159 | X | X | OSTRING | 16 | S |
| ACTUATOR_MAN | 1 | 160 | X | X | OSTRING | 16 | S |
| VALVE_TYP | 1 | 161 | X | X | OSTRING | 1 | S |
| ACTUATOR_TYPE | 1 | 162 | X | | UNSIGNED8 | 1 | C |
| ACTUATOR_ACTION | 1 | 163 | X | X | UNSIGNED8 | 1 | S |
| VALVE_SER_NUM | 1 | 164 | X | X | OSTRING | 16 | S |
| ACTUATOR_SER_NUM | 1 | 165 | X | X | OSTRING | 16 | S |
| ADD_GEAR_SER_NUM | 1 | 166 | X | X | OSTRING | 16 | S |
| ADD_GEAR_MAN | 1 | 167 | X | X | OSTRING | 16 | S |
| ADD_GEAR_ID | 1 | 168 | X | X | OSTRING | 16 | S |
| ADD_GEAR_INST_DATE | 1 | 169 | X | X | OSTRING | 16 | S |
| *SETP_DEVIATION_LIMIT | 1 | 180 | X | X | FLOAT | 4 | S |
| *TIME_OUT_MONITOR_VALUE | 1 | 181 | X | X | UNSIGNED16 | 2 | D |
| *TIME_OUT_MONITOR_LIMIT | 1 | 182 | X | X | UNSIGNED16 | 2 | S |
| View | 1 | 200 | X | | OSTRING | 13 | D |

* not available via PDM or Commuwin
N: Non-volatile parameter
S: Static revision counter parameter
D: Dynamic parameter
C: Constant parameter

SETP_DEVIATION_LIMIT
0: function switched off,
otherwise limit value (7) of setpoint. On exceeding, 0 x 02 is outputted in the 1st byte of the diagnosis extension and a diagnosis message generated.

TIME_OUT_MONITOR
A time (100 ms basis) is started when the setpoint leaves the dead band. If this time exceeds the limit, 0 x 01 is outputted in the 1st byte of the diagnosis extension and a diagnosis message generated.

The bit remains in place for 10 s.

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# OPERATING VIA THE HART HAND TERMINAL *(HART)*



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# General

The SIDE Control Type 8635 may be configured, in the version with HART interface, by means of a HART-compatible hand terminal.

Program the hand terminal with the device description belonging to the SIDE Control Type 8635 (Device Description = DD).

These DDs are administrated and released by the HART Communication Foundation (HCF: www.hartcomm.org). The DDs may be programmed by companies (*programming sites*) authorized by the HCF and who are provided with all DDs. A complete list of all authorized companies may be obtained from www.hartcomm.org.

A hand terminal may contain several DDs. On purchase of a hand terminal or on updating of the DDs, the HART user must choose which DDs the hand terminal should contain.

The following operating instructions refer to the HART Communicator Rosemount Model 275 for the DD revision 2 (HCF DD library listing: 78/EF/02/02).

You can see a listing of all DDs presently available in the HART Communicator in the sub-menu Utility → Simulation. This can be reached with the ← key via the online menu.

General information on the SIDE Control Type 8635, e.g. on the Autotune function, a description of all available functions, factory settings etc. are to be found in the chapters *Operating and Controller Functions or Operating the Process Controller*. The chapter *Operating via the HART Hand Terminal* is merely a supplement.

Data is transferred with the HART protocol in the form of a superimposed frequency: a digital signal (2200 Hz ≡ 0, 1200 Hz ≡ 1) is modulated onto the setpoint standard signal 4 ... 20 mA by the FSK procedure (Frequency Shift Keying).
The SIDE Control Type 8635 works with the HART Protocoll-Revision 5.7.

**NOTE**

The handling of the HART-compatible hand terminal (HART Communicator) should be taken from the operating instructions enclosed with the device.

**ATTENTION!**

Note that operation of the SIDE Control by the hand terminal may lead to malfunctions in the running process, e.g. in the Autotune function or on changing some parameters (on scaling of process value / external setpoint or on changing the decimal point, since an update in the SIDE Control takes place only after quitting the function).
**Only if these malfunctions cannot cause damage to the installation, may the controller be configured in the *running process* via the HART hand terminal !**

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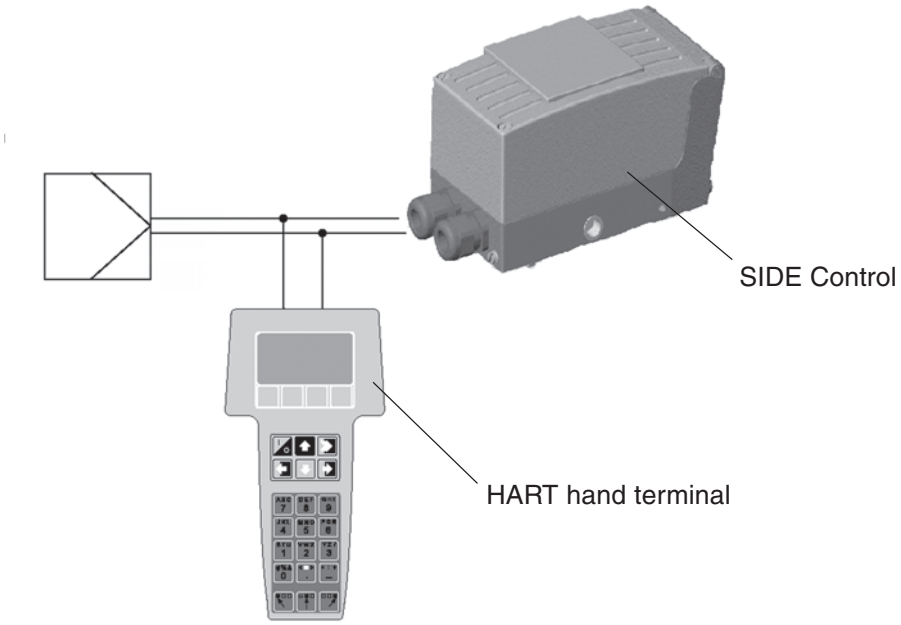
# System description

## Illustration of the system




## Menu description and key assignment

A maximum of five menus are displayed in numbered display lines. Further menu items may be reached by pressing the operating key ⊡ .

An inversely displayed menu item with an ➔ behind the line number may be selected with the operating key ⊡. You either arrive at data entry or are branched to a sub-menu. It is also possible to directly select a menu item with an ➔ behind the line number by entering the line number [**1**] to [**9**] on the alphanumeric keypad.
Since only single-digit line numbers are available, menu items over 9 are shown without line numbers: they may only be accessed via the operating key ⊡ .

In the first line or the first two lines, the menu selected at the moment is shown. If an ← is shown to the right of the menu name, you can reach the higher-ranking menu with the ⊡ - key.

In the display fields shown inversely directly above the function keys *F1* to *F4*, the software commands valid for the current menu, such as *HELP, NEXT or HOME*, appear. The selected command can be confirmed with the underlying function key *F1* to *F4.*

In this way, for example, a help text may be called up in all menu levels in which the *HELP* button appears, using the function key *F1*.

Lengthy text which cannot be shown in the display is made legible by confirming the commands *PGUP* or *PGDN*.

The help text is quitted with *EXIT*.

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## Data entry

Fields for data entry are shown inverse and the respective digit flashes.

Using the keys ➔ and ➔, you can select the fields and delete with the command *DEL* via the correspondig function key.

Data is entered via the alphanumeric keys 1 ... 9**.**

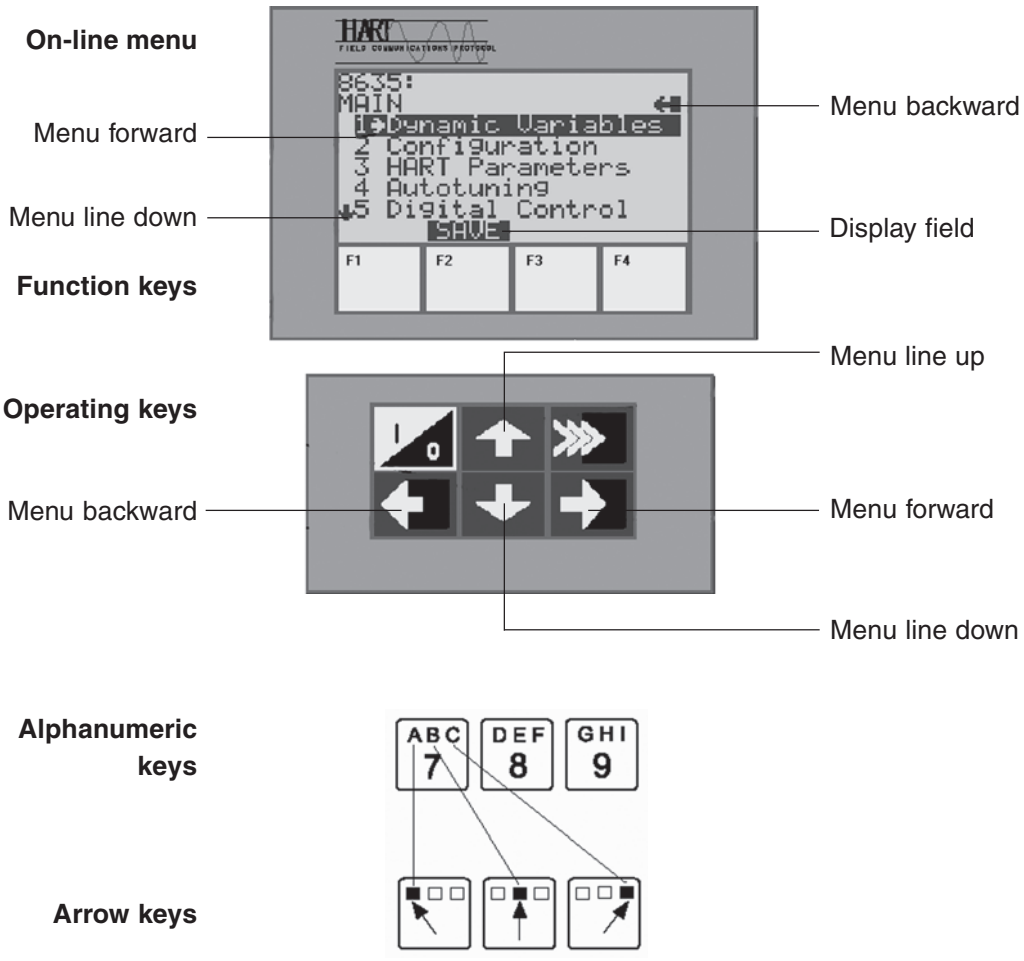
With the function key for *ESC* you quit the entry field. The data just entered are not stored.

With *ENTER* you store the entry, quit the entry field and send the changed value to SIDE Control.

With *EXIT* you quit the current entry or display field and with ➔ you return to the last selected menu.

By pressing the function key for *HOME* you reach the on-line menu.

All important keys and display elements are shown in the following illustrations.







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# Commissioning

## Preparation

→ Before commissioning, execute the fluidic and electrical installations.

→ Connect the HART hand terminal via the 2-pole communication line to the SIDE Control. Attach the communication lines parallel to the setpoint standard signal. Correct polarity must not be observed.

→ Supply the SIDE Control with pneumatic auxiliary energy (inlet air) and apply a setpoint ≥ 4 mA.

→ Switch on the hand terminal with the *I/O* key: the display shows for a few seconds a self-test message. If the hand terminal was connected for the first time to the field device, a warm start is executed which is completed with the function key *F3 - NEXT*. In the display appears the basic menu for the SIDE Control Type 8635 in the on-line mode.

→ On first commissioning, execution of the *Autotune* function is absolutely necessary. SIDE Control automatically determines the optimum settings for the current operating conditions (see also the chapter *Operating and Controller Functions).*

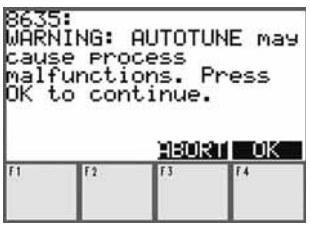
→ The menu item *AUTOTUNE* is to be found in the Main menu under item 2.

## *AUTOTUNE* procedure (required on first commissioning)

→ Select the menu item *AUTOTUNE* in the *Main* menu via the operating keys ↑ or ↓ and then start the function via the operating key →. The following message appears.


Message after start of
the *AUTOTUNE* function.

→ With *F3 - ABORT* you can quit the *AUTOTUNE* function without starting.
With *F4 - OK* you confirm the start.
After pressing the *F4* key, a warning message appears that the *AUTOTUNE* function may cause malfunctions in the running process.




Warning before start of
*AUTOTUNE* function.

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During run-off of *AUTOTUNE*, messages appear with display of the currently running *AUTOTUNE* phase:

*Running AUTOTUNE: 1*

*Running AUTOTUNE: 2*

*Running AUTOTUNE: 3*

.....

Running of the *AUTOTUNE* function is completed with an *OK* message.


*OK* message after completion
of the *AUTOTUNE* function

If the message *AUTOTUNE error X* appears on the display, an error is shown.
X stands for the error number. In the chapter M*aintenance and Error Elimination on the Controller*, you will find an explanation of this error number.

➔ On pressing *F4 - OK*, you return to the main menu.

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# Operating the positioner via the HART hand terminal

## Configuration

A prerequisite for configuration of the HART hand terminal is that the *AUTOTUNE* function has been executed before first commissioning.

→ First define the device-specific parameters such as instrument code, description, date, message or factory number in the *Main* menu under *HART parameters* - ⊡ *device setup*.

→ To configure the supplementary functions, enter the *Main* menu / submenu *Configuration* (Item 1).

As to be seen in the chapter *Operating and Controller Functions*, all supplementary functions which you want to use must be released.

→ For this purpose, enter the submenu *Configuration* / *Add Function* (Item 2). With the operating key ⊡ select the corresponding function.

→ With the function key *F2 - ON*, release the function if is was locked. You can equally lock a released function again with the function key *F2 - OFF*.

→ From item 3 of the submenu *Configuration* on, you can alter the released supplementary functions.

**ATTENTION!**

All parameters not altered by *AUTOTUNE* are only stored in the RAM memory of the SIDE Control and hence will no longer be present after a cold start. If you want to permanently store the altered parameters, they must be saved via the menu item *EEPROM Control* in the *Main* menu or in the menu *Configuration* - ⊡ *Save to EEPROM*.

## Display of the process variables

A display of the following process variables may be obtained via the menu *Main / Dynamic variables.*

| Variable | Description | Unit |
|---|---|---|
| POS | Actual position | % |
| POScurrent | Actual position | mA |
| INPcurrent | Input signal for setpoing position | mA |
| PV | Process value (irrelevant for positioner) | |
| SP | Process setpoint (irrelevant for positioner) | |

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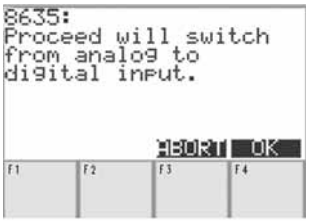
## Changing the process variables

Via the menu item *Digital control* in the *Main* menu, you can specify the 4 ... 20 mA input signal *INP* digitally via the HART interface (0% = 4 mA; 100% = 20 mA).

### Procedure

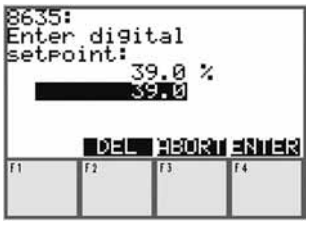
→ Select the menu item *Digital control* in the *Main* menu via the operating key ↑ or ↓ .

→ Start the function via the operating key → . The following message appears.




Message after starting *Digital control*

→ Confirm with *F4 - OK*. The entry mask shown appears.



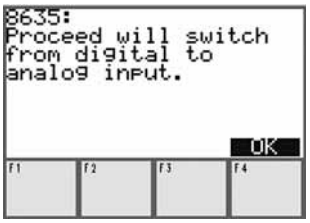

Entry mask for the digital input value.

→ Specify a digital input value between 0 % and 100 %.

→ Using *F4 - ENTER*, transmit the value entered to the SIDE Control.

→ Using *F3 - ABORT*, quit the entry mask. A message appears as shown below.

→ By conforming with *F4 - OK* you return to the *Main* menu.




Message after quitting *Digital control*

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# Operating the process controller via the HART hand terminal

This chapter serves as a supplement to the chapter *Operating the positioner via the HART hand terminal* and contains only the information required for the process controller.

General information on the process controller, e.g. setting up a process control system or factory settings, are to be found in the chapter *Operating the process controller*.

## Configuration

For process control you need the supplementary function *P-CONTROL*.

→ Release the function by switching the function *P-CONTROL* to *ON* with the function key *F2* in the submenu *Configuration* under Item 1 - *Add Function.*

→ Configure *P-CONTROL* after release in the submenu *Configuration* - ⊡ *P-CONTROL*.

**ATTENTION!**

All altered parameters are only stored in the RAM memory of the SIDE Control and hence will no longer be present after a cold start. If you want to permanently store the altered parameters, they must be saved via the menu item *EEPROM Control* in the *Main* menu or in the menu *Configuration* - ⊡ *Save to EEPROM*.

As soon as *P-CONTROL* has been activated via *Add Function*, two additional functions may be selected: *P.Q'LIN and PTUNE*.

### P.Q'LIN

*P.Q'LIN* serves to linearize the process characteristic and may be started under *Configuration* or under *Main* - ⊡ *PQLIN*.

#### Procedure

→ Select *PQLIN* via the operating key ⊡ or ⊡ and then start the function via the operating key ⊡. The following message appears:


Start of function *PQLIN*

→ You can either the function *P.Q'LIN* with *F3 - ABORT* or start the function *P.Q'LIN* via the key *F4 - OK*. As long as *P.Q'LIN* is running, the following message appears:

*Running PQLIN*

Running of the function *P.Q'LIN* is ended by an *OK* message.

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*OK* message after completion of the function *PQLIN*

If the message *P.Q'LIN error X* appears on the display, this indicates an error.
X stands for the error number. In the chapter *Maintenance and Error Elimination on the Process Controller*, you will find an explanation of this error number.

→ On pressing *F4 - OK*, you return to the main menu.

## *PTUNE*

*PTUNE* serves to determine the optimal control parameters *KP*, *TN*, *TV* and may be started under *Main* - ⊡ *PTUNE,* provided that the menu item *P.CO TUNE* has been previously set to *active* in the menu *Configuration* under *P-CONTROL.*

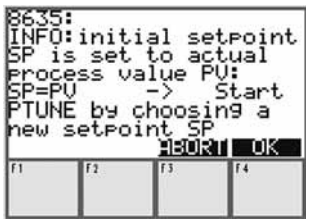
**Procedure**

**NOTE** The function *PTUNE* can be aborted at any time with the function key *F3 – ABORT*.

→ Select *PTUNE* via the operating key ⊡ or ⊡ and then start the function via the operating key ⊡.
The following message appears:

*SET PTUNE ON*

→ Confirm with the key *F4 - OK*.
*PTUNE* is ready to start. The following message appears:




Message after the start of the *PTUNE* function.

This message serves to explain the method of functioning of *PTUNE* :
The current process value *PV* is used as a starting value for the optimization step. It is important here that the actual value has reached equilibrium. By specification of a setpoint step, parameter optimization can be started.

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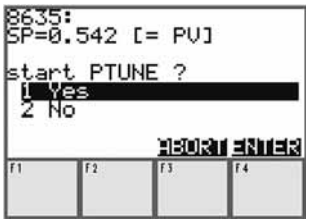
**NOTE**

Contrary to the execution of *PTUNE* via the SIDE Control, the process value *PV,* and hence the starting value for the optimization step, cannot be changed by switching over to the MANUAL mode and opening and closing the valve.

→ After confirmation with *F4 - OK*, the process value *PV* is read in for 10 s. You thus have the possibility of checking whether the actual value is constant and you can decide whether the *PTUNE* function should be initiated (enter *Yes*) or whether the process value *PV* should be read in again for a further 10 s (enter *No*).

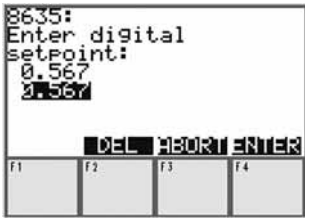



User query

→ After entry of *Yes*, you now have the possibility of initiating control parameter optimization by specifying a setpoint step.

*Start PTUNE by choosing a new setpoint SP*

→ Confirm the message with *F4 - OK*.
On the HART hand terminal, the entry mask for the setpoint appears.




Entry mask for specifying a setpoint step.

→ Enter the new value and confirm with *F4 - ENTER*.
Self-optimization of the process controller runs autonomously. On the HART hand terminal, the following message appears:

*Running PTUNE*

Running of the function *PTUNE* is ended by an *OK* message.


*OK* message after completion of the function *PTUNE*.

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If the message *PTUNE error X* appears on the display, an error is shown.
X stands for the error number. In the chapter M*aintenance and Error Elimination on the Controller*, you will find an explanation of this error number.

➔ On pressing *F4 - OK*, you return to the main menu.

## Display of the process variables

A display of the following process variables is obtained via the *Main* menu */ Dynamic variables*.

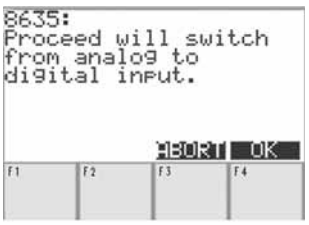
| Variable | Description | Unit |
|---|---|---|
| POS | Actual position | % |
| POScurrent | Actual position | mA |
| INPcurrent | Input signal for setpoint position (irrelevant for process controller) | mA |
| PV | Process value | |
| SP | Process setpoint | |

## Changing the process variables

Via the menu item *Digital control* in the *Main* menu*,* you can specify process setpoint *SP* via the HART interface.

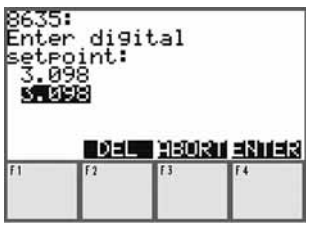
➔ Select the menu item *Digital control* in the *Main* menu via the operating key ↑ or ↓.

➔ Start the function via the operating key → . The following message appears.




Message after starting *Digital control*

➔ Confirm with *F4 - OK.* The entry mask shown appears.




Entry mask for the process setpoint.

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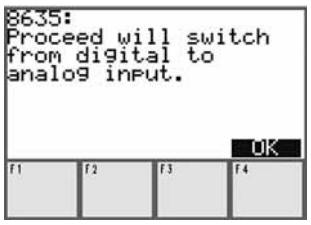
➔ Specify a process setpoint between *PVmin* (scaled minimum process value) and *PVmax* (scaled maximum process value).
While the setpoint is being specified via the HART interface, SIDE Control is switched to internal setpoint setting.

➔ Using *F4 - ENTER,* transmit the value entered to the SIDE Control.

➔ Using *F3- ABORT*, quit the entry mask. A message appears as shown below.




Message after quitting *Digital control*

➔ By confirming with *F4 - OK* you return to the *Main* menu.
If the setpoint was specified externally before starting *Digital control*, this mode is restored after confirmation with *F4 - OK.*

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# Memory organization

SIDE Control has a volatile RAM memory and a non-volatile EEPROM memory.

All parameters altered via the HART hand terminal are only written in the RAM memory of the SIDE Control (excepting with the *AUTOTUNE* function) and hence will no longer be present after a cold start. If you want to permanently store the altered parameters, they must be saved via the menu item *EEPROM Control* in the *Main* menu or in the menu *Configuration* - ➔ *Save to EEPROM*.

If the parameters altered via the HART hand terminal are to be removed from the RAM, the original status of the EEPROM can be restored via the menu item *EEPROM Control* in the *Main* menu or in the menu *Configuration* - ➔ *Load from EEPROM*.

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# MAINTENANCE AND ERROR ELIMINATION ON THE POSITIONER



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# Maintenance

When operated according to these Operating Instructions**, the SIDE Control** is **maintenance free.**

# Error messages and malfunctions

## Error messages on the LC display

### General error messages

| Display | Causes of error | Remedy |
|---|---|---|
| *INT.ERROR* | Internal error | None, device faulty |

### Error messages on execution of the function *X.TUNE*

| Display | Causes of error | Remedy |
|---|---|---|
| *X.ERR 1* | No compressed air connected | Connect compressed air |
| *X.ERR 2* | Air pressure failure during *AUTOTUNE* | Check compressed air supply |
| *X.ERR 3* | Actuator system or actuator system leaky on exhaust side | None, device faulty |
| *X.ERR 4* | Actuator system leaky on pressurized side | None, device faulty |
| *X.ERR 5* | The dead band of the internal position sensor system is exceeded | Check alignment of the axle of the SIDE Control and correct (see chapter *Installation*) |
| *X.ERR 6* | The end positions for *POS-MIN* and *POS-MAX* are too near together. | Check whether the allocation of the end positions to *POS-MIN* and *POS-MAX* via the function *TUNE-POS* is correct.<br>If incorrect:<br>execute *TUNE-POS* again.<br>If correct:<br>*TUNE-POS* with this arrangement of the end positions is not possible since they are too close together. |
| *X.ERR 7* | False allocation of *POS-MIN* and *POS-MAX* | To determine *POS-MIN* and *POS-MAX,* move the actuator in each case in the direction shown on the display. |

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## Other malfunctions

| Problem | Possible causes | Remedy |
|---|---|---|
| POS = 0 (with CMD > 0 %) or<br>POS = 100 %, (with CMD < 100 %) | Tight-closing function *(CUTOFF)* has been inadvertently activated. | Deactivate tight-closing function |

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# MAINTENANCE AND ERROR ELIMINATION ON THE PROCESS CONTROLLER *(S/HART)*



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# Maintenance

When operated according to these Operating Instructions**, the SIDE Control *(S/HART)*** is **maintenance free.**

# Error messages and malfunctions

## Error messages on the LC display

### General error messages

| Display | Causes of error | Remedy |
|---|---|---|
| *INT.ERROR* | Internal error | None, device faulty |
| *PV FAULT* | Signal error, actual value, process controller | Check signal |

### Error messages on execution of the function *X.TUNE*

| Display | Causes of error | Remedy |
|---|---|---|
| *X.ERR 1* | No compressed air connected | Connect compressed air |
| *X.ERR 2* | Air pressure failure during *AUTOTUNE* | Check compressed air supply |
| *X.ERR 3* | Actuator or actuator system leaky on exhaust side | None, device faulty |
| *X.ERR 4* | Actuator system leaky on pressurized side | None, device faulty |
| *X.ERR 5* | The dead band of the internal position sensor system is exceeded | Check alignment of the axle of the SIDE Control *(S/HART*) and correct (see chapter *Installation*) |
| *X.ERR 6* | The end positions for *POS-MIN* and *POS-MAX* are too near together. | Check whether the allocation of the end positions to *POS-MIN* and *POS-MAX* via the function *TUNE-POS* is correct.<br>If incorrect:<br>execute *TUNE-POS* again.<br>If correct:<br>*TUNE-POS* with this arrangement of the end positions is not possible since they are too close together. |
| *X.ERR 7* | False allocation of *POS-MIN* and *POS-MAX* | To determine *POS-MIN* and *POS-MAX*, move the actuator in each case in the direction shown on the display. |

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### Error messages on execution of the function *P.Q'LIN*

| Display | Causes of error | Remedy |
|---|---|---|
| *Q.ERR 1* | No compressed air connected<br><br>No change of process variable | Connect compressed air<br><br>Check process; if necessary, switch on pump or open shut-off valve |
| *Q.ERR 2* | Current fixed point of the valve stroke was not reached since<br>• air supply failure during *P.Q'LIN*<br>• no *AUTOTUNE* has been executed | <br><br>• Check compressed air supply<br>• Execute *AUTOTUNE* |

## Other malfunctions

| Problem | Possible causes | Remedy |
|---|---|---|
| *POS* = 0 (with CMD > 0 %) or<br>*POS* = 100 %, (with CMD < 100%)<br>*PV* = 0 (with *SP* > 0 ) or<br>*PV* = $PV_{\downarrow}$ (with *SP* > $SP_{\downarrow}$) | Tight-closing function *(CUTOFF)* has been inadvertently activated | Deactivate tight-closing function |
| *Only with device with process controller:*<br>Device does not work as a positioner despite correctly executed settings. | Menu item *P.CONTRL* stands in main menu. The device thus works as a process controller and expects a process value at the corresponding input. | Remove the menu item *P.CONTRL* from the main menu. |

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# GENERAL RULES
# (APPENDIX)



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# Selection criteria for continuous valves

The following criteria are of decisive importance for optimal control behaviour and attainment of the maximum flow rate through the valve:

- Correct choice of flow coefficient, which is defined essential by the size of the valve;
- Good matching of the valve size to the pressure conditions, taking into consideration the other flow resistances in the system.

Dimensioning guidelines can be given on the basis of the flow coefficient ($k_V$).
The $k_V$ value refers to the standardized conditions with respect to pressure, temperature and media properties.

The $k_v$ value is defined as the flow rate in m³/h of water through a component at a pressure difference $\Delta p$ of 1 bar and a temperature of 20 °C.

With continuous valves the "$k_{VS}$ value" is additionally used. This specifies the $k_V$ value when the continuous vlve is fully open.

Depending on the specified data, the following cases must be distinguished on selection of a valve:

a) The pressures before and after the valve $p_1$ and $p_2$ are known at which the desired maximum flow rate $Q_{max}$ is to be attained:

The required $k_{VS}$ value is obtained from:

$$k_{VS} = Q_{\max} \cdot \sqrt{\frac{\Delta p_0}{\Delta p}} \cdot \sqrt{\frac{\rho}{\rho_0}} \qquad (1)$$

where:

| | |
|---|---|
| $k_{VS}$ | is the flow coefficient of the continuous valve when fully open [m³/h] |
| $Q_{max}$ | is the maximum volumetric flow rate [m³/h] |
| $\Delta p_0$ | is 1 bar; the pressure drop over the valve as in the definition of $k_V$ |
| $r_0$ | is 1000 kg/m³; the density of water as in the definition of $k_V$ |
| $\Delta p$ | is the pressure drop over the valve [bar] and |
| r | is the density of the medium [kg/m³] |

b) The pressures at the inlet and outlet of the overall system ($p_1$ and $p_2$) are known at which the desired maximum flow rate $Q_{max}$ is to be attained:

| | |
|---|---|
| Step 1: | Calculate the flow coefficient of the overall system $k_{Vges}$ from equation (1). |
| Step 2: | Measure the flow rate through the system without the continuous valve (e.g. by short-circuiting the piping where the valve is installed). |
| Step 3: | Calculate the flow coefficient of the system without the continuous valve ($k_{Vs}$) from equation (1). |
| Step 4: | Calculate the required $k_{VS}$ value of the continuous valve ($k_{vs}$) from equation (2): |

$$k_{VS} = \sqrt{\frac{1}{\frac{1}{k_{Vges}^{\,2}} - \frac{1}{k_{Va}^{\,2}}}} \qquad (2)$$

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**NOTE**

The $k_{VS}$ of the continuous valve should have at least the value calculated from the equation (1 or 2) relevant to the application, but under no circumstances be very much greater.

The rule of thumb often used with switching valves, "somewhat larger never hurts", can be strongly detrimental to the control behaviour of continuous valves!

Determination in practice of the upper limit to the $k_{VS}$ value of the continuous valve is possible by means of the so-called "valve authority" $\Psi$:

$$\Psi = \frac{(\Delta p)_{V0}}{(\Delta p)_0} = \frac{{k_{Va}}^2}{{k_{Va}}^2 + {k_{VS}}^2} \qquad (3)$$

$(\Delta p)_{V0}$ is the pressure drop over the fully opened valve and

$(\Delta p)_0$ is the pressure drop over the entire system

**NOTE**

**With a valve authority $\Psi$ < 0.3 the continuous valve is overdimensioned.**

With the valve fully open, in this case the flow resistance is significantly smaller than that of the other fluidic components in the system. This means that only in the lower opening range is the valve position dominant in the operating characteristic. For this reason, the operating characteristic is strongly deformed.

By selection of a progressive (equiprocentile) characteristic between position setpoint and valve stroke, this can be partially compensated and the operating characteristic linearized within certain limits. **However, the valve authority $\Psi$ should be > 0.1, even when using a corrected characteristic.**

The control behaviour (control performance, settling time) when using a corrected characteristic is strongly dependent on the operating point.

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# Characteristics of PID controllers

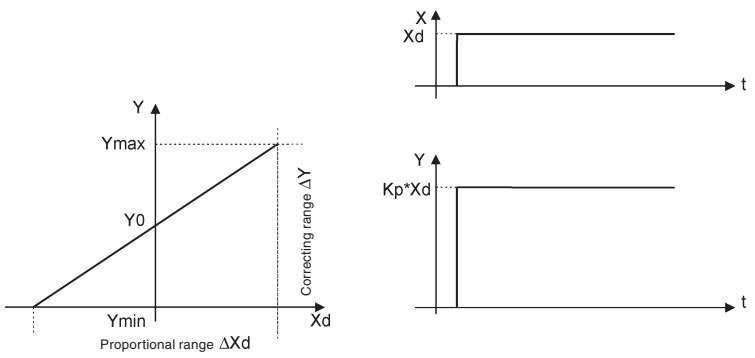
A PID controller has a proportional, an integral and a differential component (P, I and D components).

## P component

Function: $Y = Kp \cdot Xd$

Where Kp is the proportional action factor (amplification factor). It is given by the ratio of the correcting range ΔY to the proportional range ΔXd.

### Characteristic and step response of the P component of a PID controller




***Characteristic*** ***Step response***

## Characteristics

A pure P controller works theoretically undamped, i.e. it is fast and dynamically favourable. It has a residual control difference, i.e. it does not completely eliminate the effects of disturbances and is thus relatively unfavourable from a static viewpoint.

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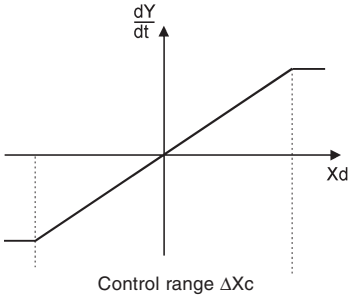
## I component

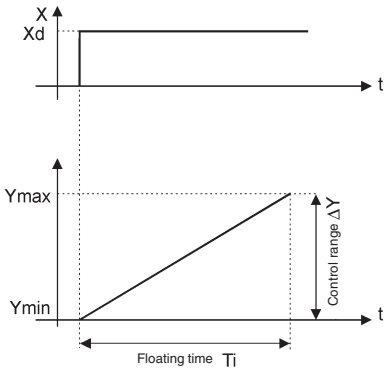
Function: $Y = \frac{1}{Ti}\int Xd\ dt$

Ti is the integration or floating time. It is the time that expires until the controller output has run through the entire correcting range.

### Characteristic and step resonse of the I component of a PID controller




***Characteristic***




***Step response***

### Characteristics:

A purely I controller completely eliminates the effects of disturbances. It thus has a favourable static behaviour. Because of its finite correcting speed, it works more slowly than a P controller and tends to oscillation. It is hence dynamically relatively unfavourable.

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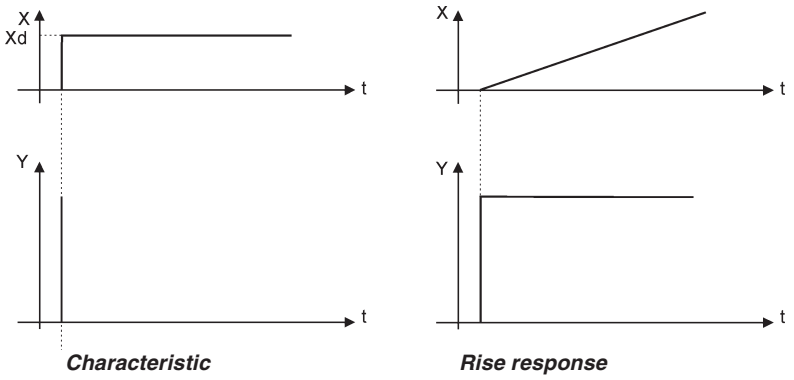
## D component

Function: **Y = Kd d Xd/dt**

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

### Characteristic and step response of the D component of a PID controller




*Characteristic* *Rise response*

### Characteristic

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

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## Superimposing the P, I and D components

Function: $\mathbf{Y = Kp\ Xd + \frac{1}{Ti}\int Xd\ dt + d\ Xd/dt}$

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

$$\mathbf{Y = Kp\ (Xd + \frac{1}{Tn}\int Xd\ dt + Tv\ \ dXd/dt)}$$

Kp is the proportional action factor / amplification factor

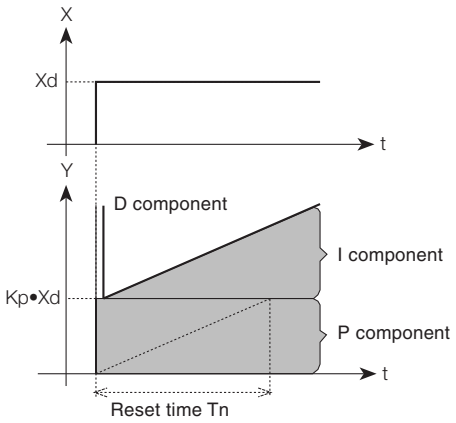
Tn Reset time

(the time required to obtain the same change in correcting variable by the I component as was caused by the P component)

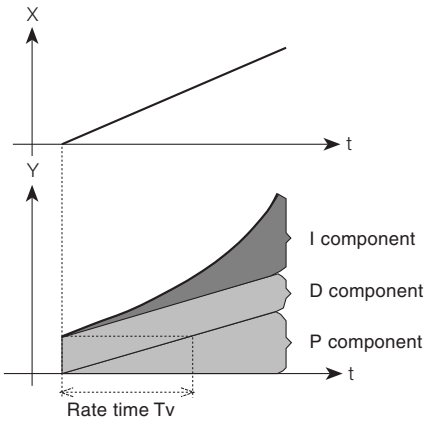
Tv is the rate time

(the time by which a certain change in correcting variable is obtained earlier with the D component than if would have been with a pure P controller)

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




***Step response of the PID controller***




***Rise response of the PID controller***

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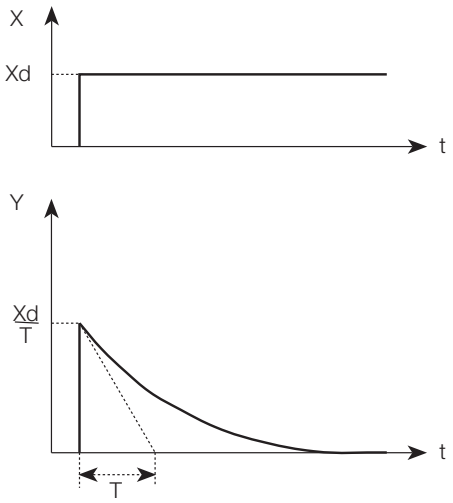
# Actual PID controller

## D component with delay

In the process controller of the positioner, the D component is realized with a delay T.

Function: $T \frac{dY}{dt} + Y = Kd \frac{dXd}{dt}$

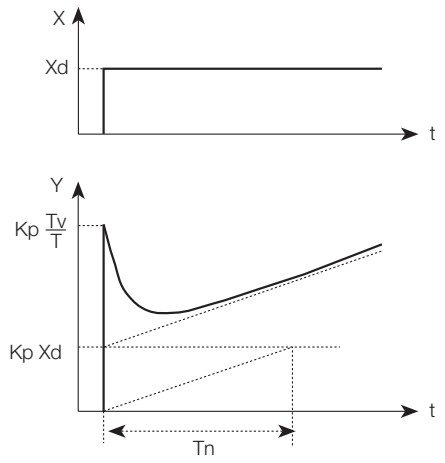
### Superimposing the P, I and DT components




## Function of the real PID controller

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

### Step response of the real PID controller

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# Rules for adjusting PID controllers

The literature on control technology contains a number of rules by which a favourable setting of the controller parameters can be determined experimentally. 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 characteristics of the controlled member and the controller itself, it makes a difference whether a change in disturbance or a command variable is to be compensated.

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

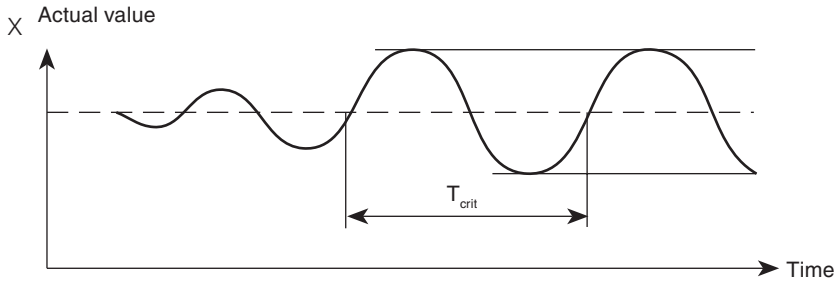
With this method, the controller parameters are set on the basis of the behaviour of the control loop at the limit of stability. These parameters are initially set such that the control loop begins to oscillate. Critical characteristic values occurring allow one to deduce a favourable setting of the control parameters. A prerequisite for using this method is naturally that the control loop is permitted to oscillate.

### Procedure:

- Set the controller to P control (i.e. Tn = 999, Tv = 0), Kp initially small.
- Set the desired set point.
- Increase Kp until the controlled 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 $T_{crit}$.

### Curve of controller output at the limit of stability




From $K_{crit}$ and $T_{crit}$, the controller parameters can then be calculated using the following table.

### Parameter setting according to Ziegler and Nichols:

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

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

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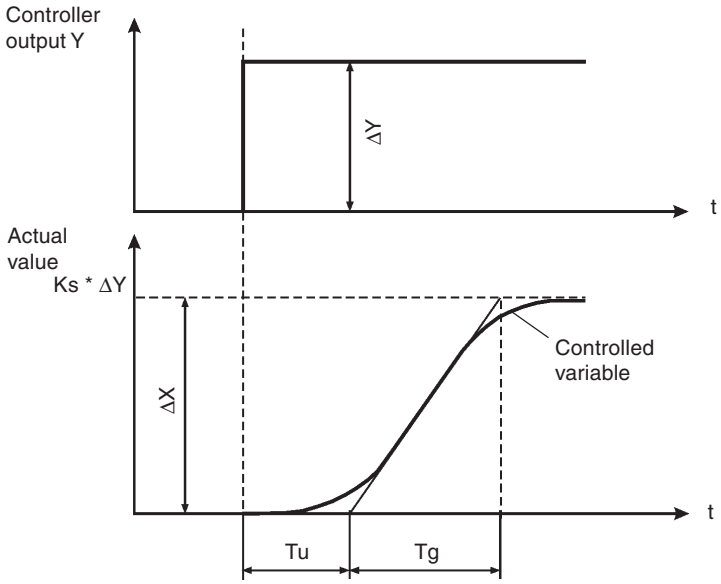
# Adjustment rules of Chien, Hrones and Reswick (controller output step method)

With this method the controller parameters are set on the basis of the transient behaviour of the controlled member. A step in the controller output of 100 % is delivered. The times Tu and Tg are derived from the curve of the actual value of the controlled variable.

## Curve of the controlled variable after a step in controller output ΔY




## Procedure

- Switch controller to MANUAL
- Deliver a step in controller output and register the controlled variable with a chart recorder
- With critical runs (e.g. on risk of overheating), switch off in good time.

**NOTE** It should be observed that with thermally sluggish systems, the actual value of the controlled variable may continue to rise after switching off.

In the following table, 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% overswing. They apply for members 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 % overswing) | | with control event with 20 % overswing | |
| | Command | Disturbance | Command | Disturbance |
| P | $Kp = 0.3 \frac{Tg}{Tu*Ks}$ | $Kp = 0.3 \frac{Tg}{Tu*Ks}$ | $Kp = 0.7 \frac{Tg}{Tu*Ks}$ | $Kp = 0.7 \frac{Tg}{Tu*Ks}$ |
| PI | $Kp = 0.35 \frac{Tg}{Tu*Ks}$<br>$Tn = 1.2\ Tg$ | $Kp = 0.6 \frac{Tg}{Tu*Ks}$<br>$Tn = 4 \cdot Tu$ | $Kp = 0.6 \frac{Tg}{Tu*Ks}$<br>$Tn = Tg$ | $Kp = 0.7 \frac{Tg}{Tu*Ks}$<br>$Tn = 2.3 \cdot Tu$ |
| PID | $Kp = 0.6 \frac{Tg}{Tu*Ks}$<br>$Tn = Tg$<br>$Tv = 0.5 \cdot Tu$ | $Kp = 0.95 \frac{Tg}{Tu*Ks}$<br>$Tn = 2.4 \cdot Tu$<br>$Tv = 0.42 \cdot Tu$ | $Kp = 0.95 \frac{Tg}{Tu*Ks}$<br>$Tn = 1.35 \cdot Tg$<br>$Tv = 0.47 \cdot Tu$ | $Kp = 1.2 \frac{Tg}{Tu*Ks}$<br>$Tn = 2 \cdot Tu$<br>$Tv = 0.42 \cdot Tu$ |

The proportional action factor Ks of the controlled member is obtained from:

$$Ks = \frac{\Delta X}{\Delta Y}$$

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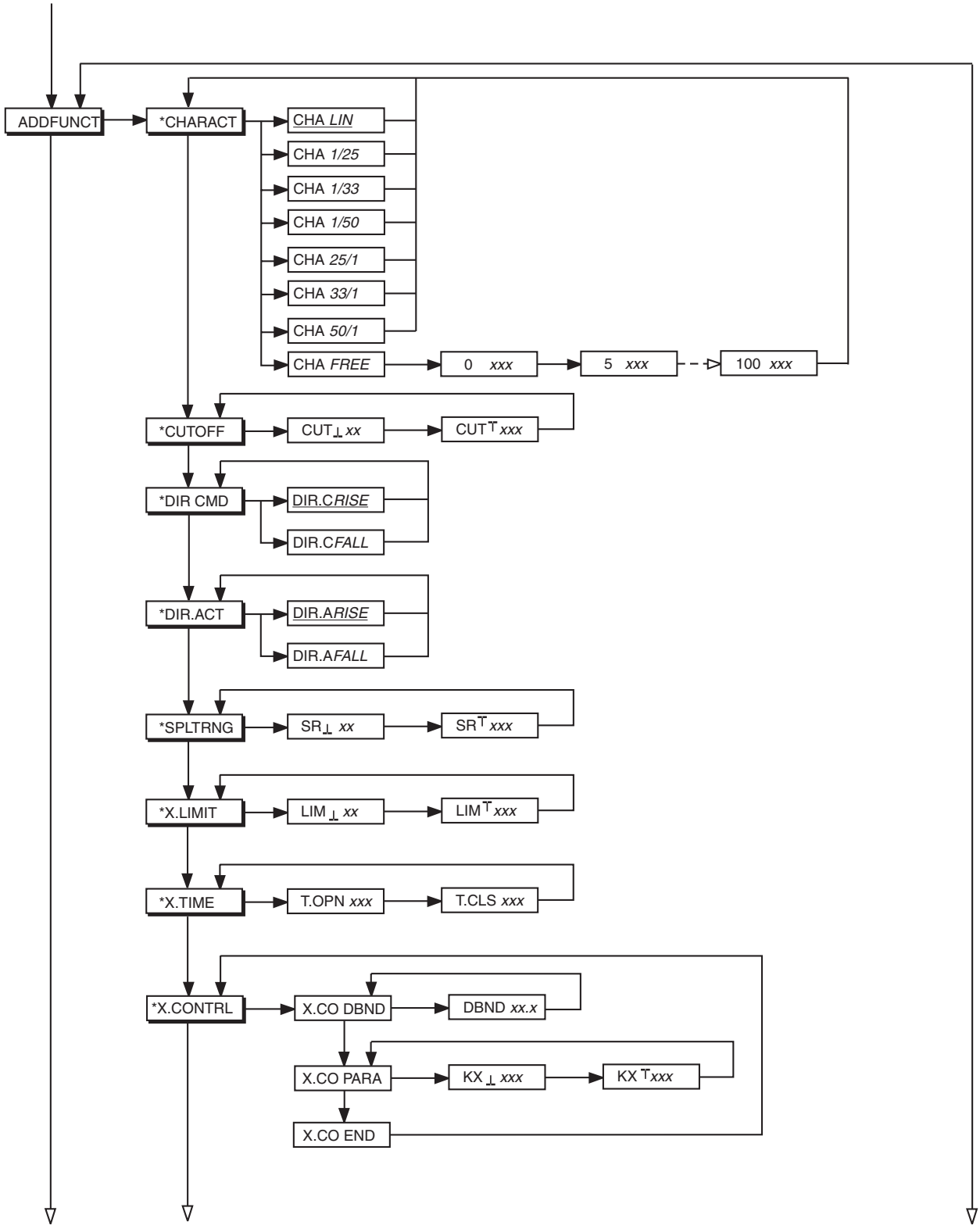
# OPERATING STRUCTURE
# (APPENDIX)



MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

# Operating structure of the SIDE Control *(S/HART)*

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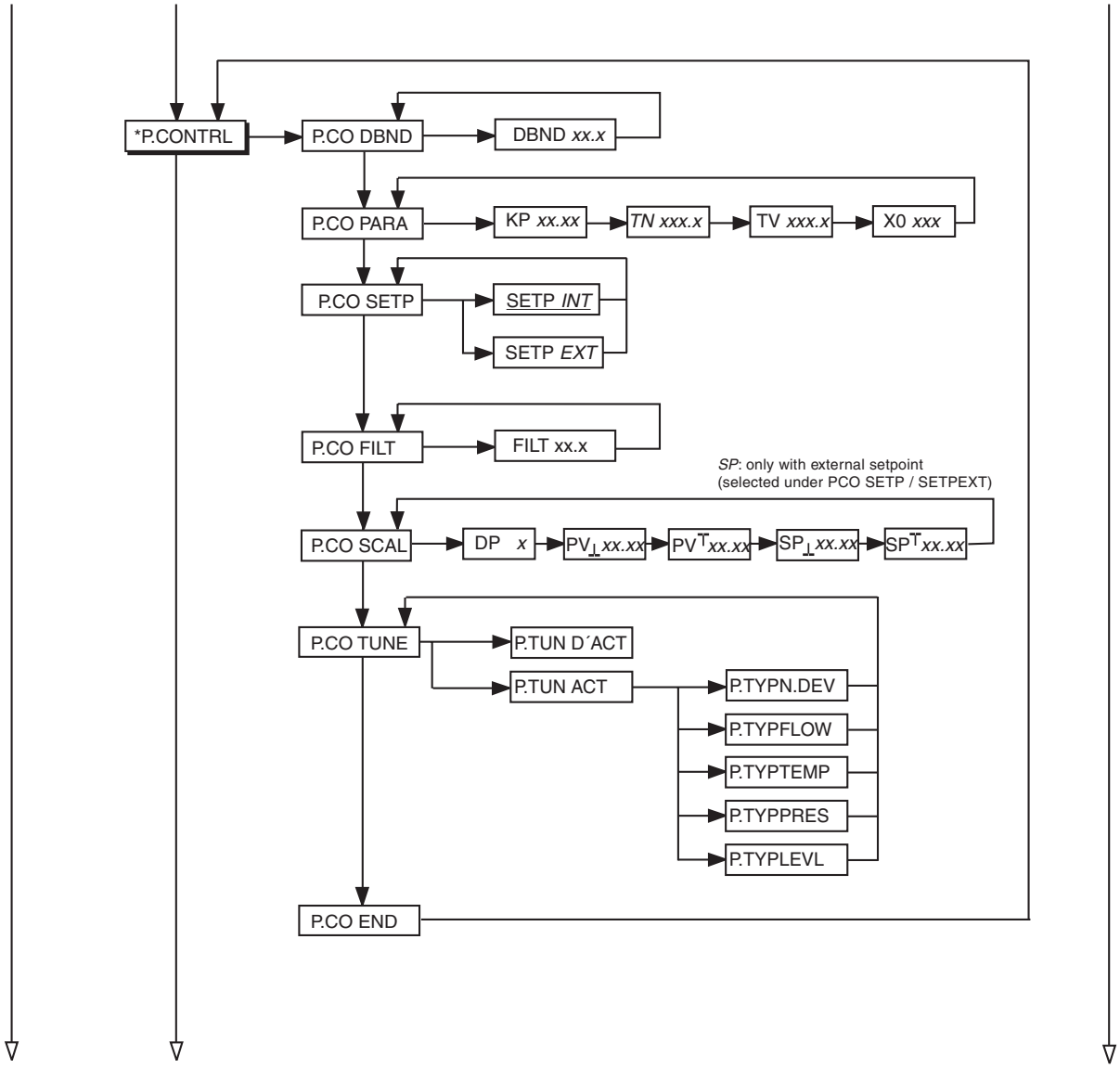
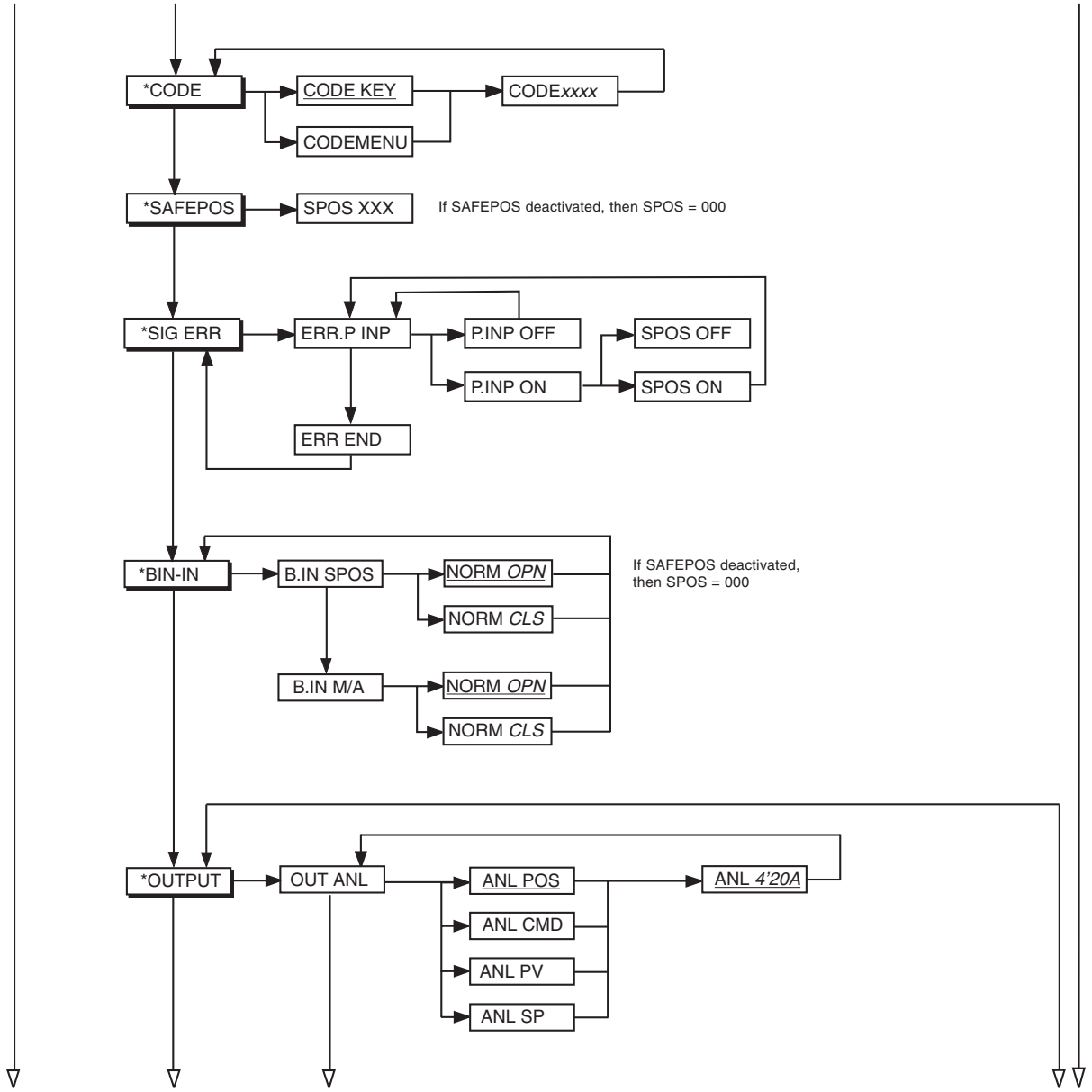
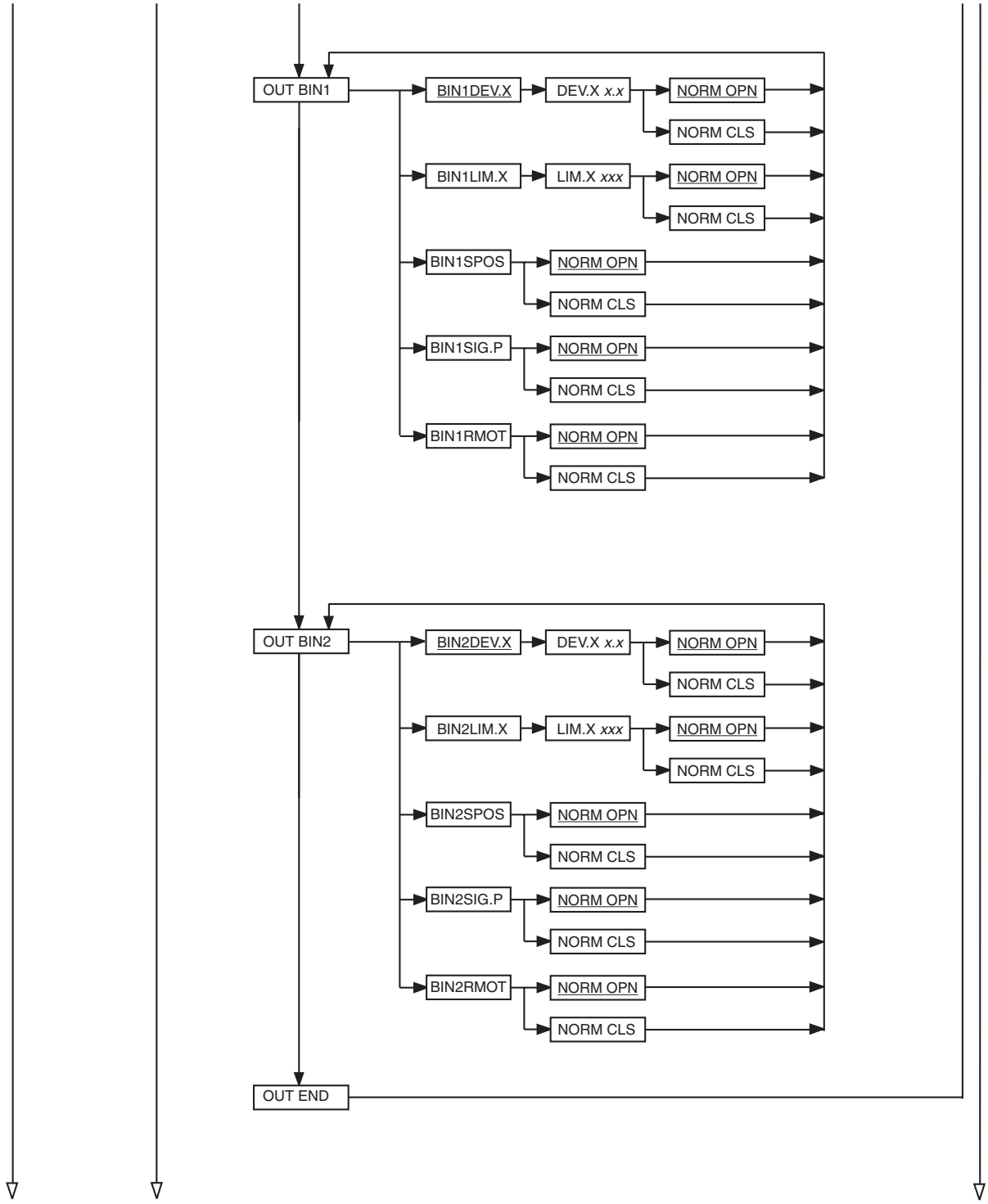


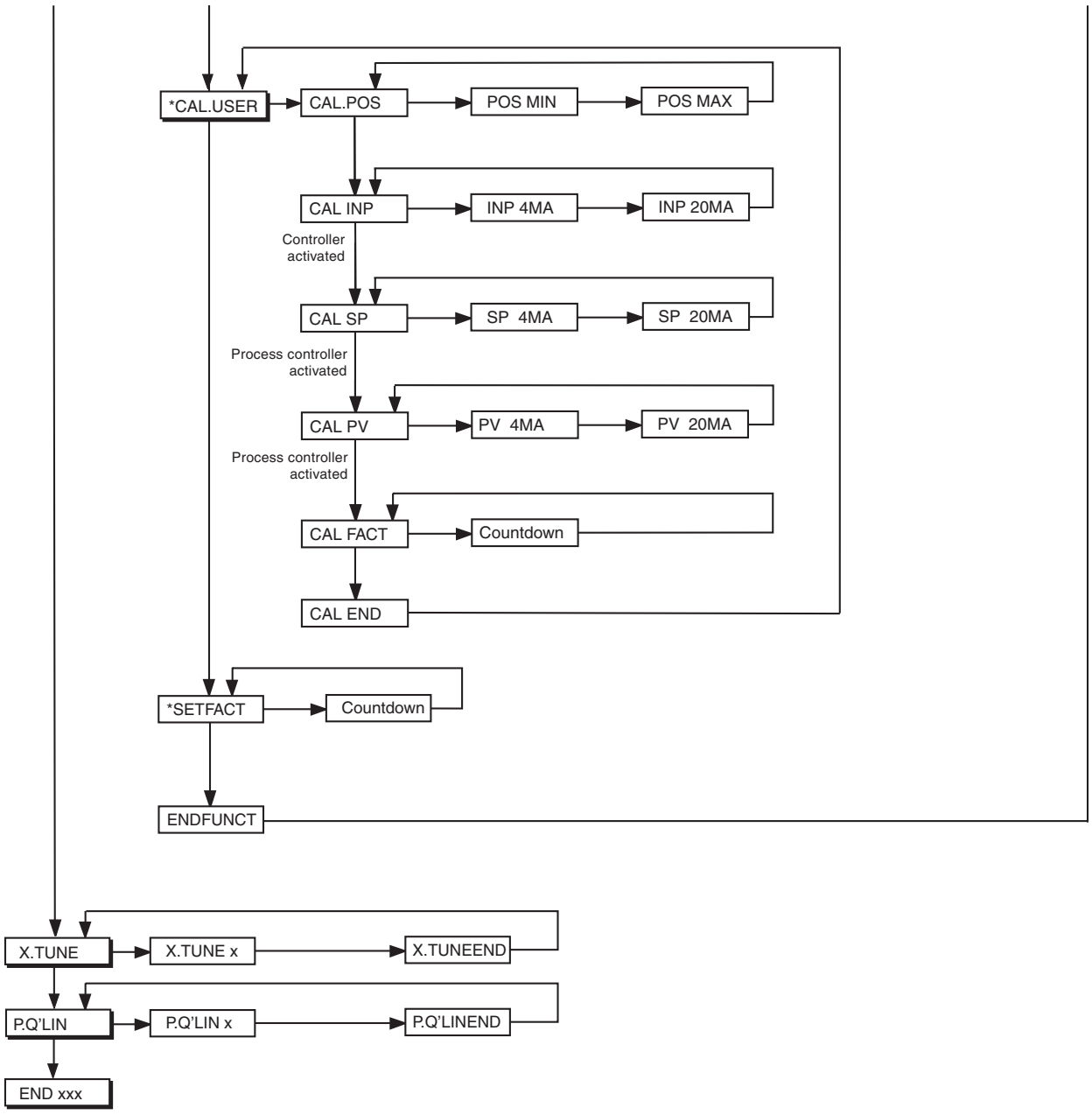

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)




MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)




MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

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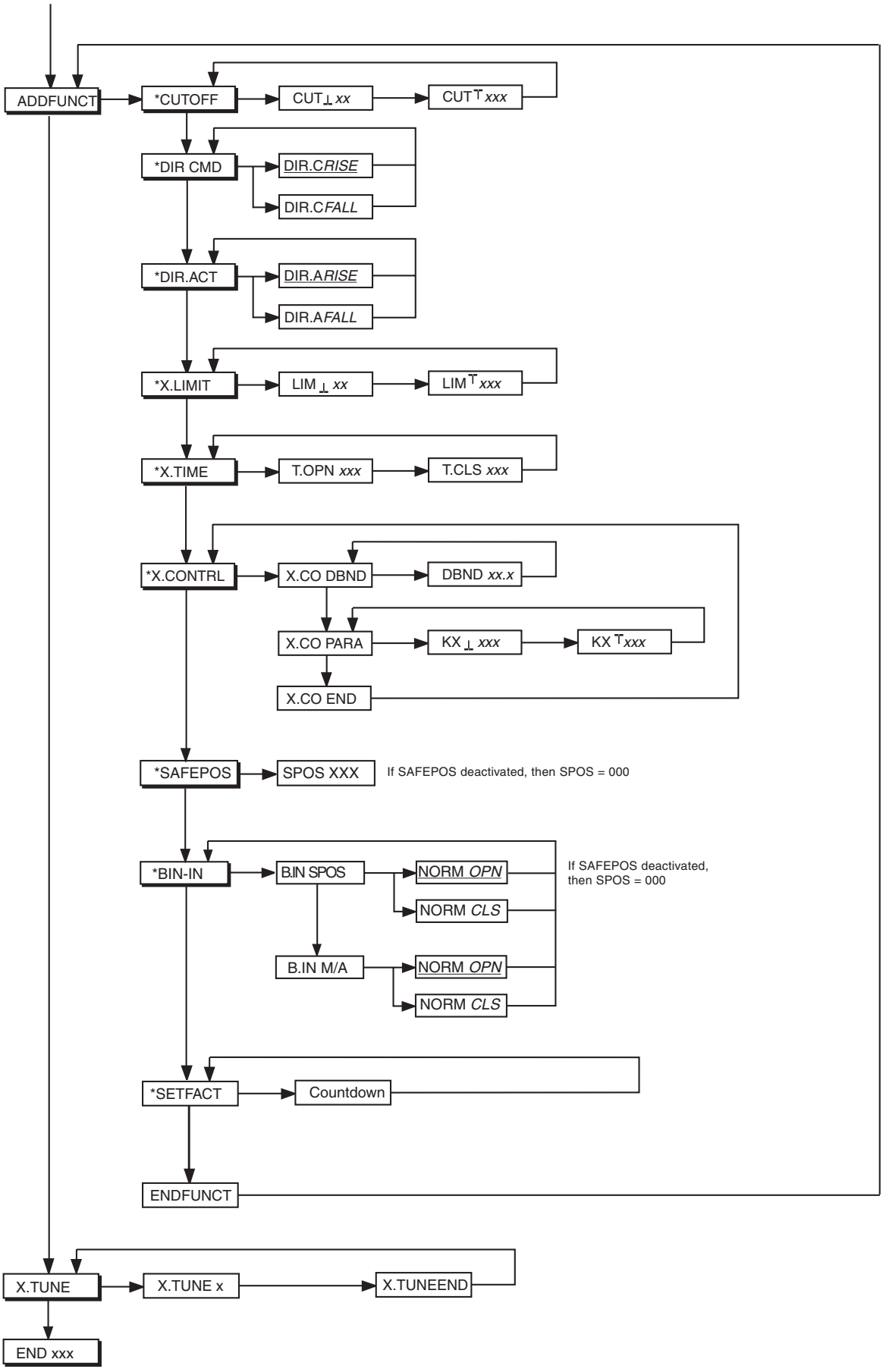
# Operating structure of the SIDE Control *(PROFIBUS PA)*



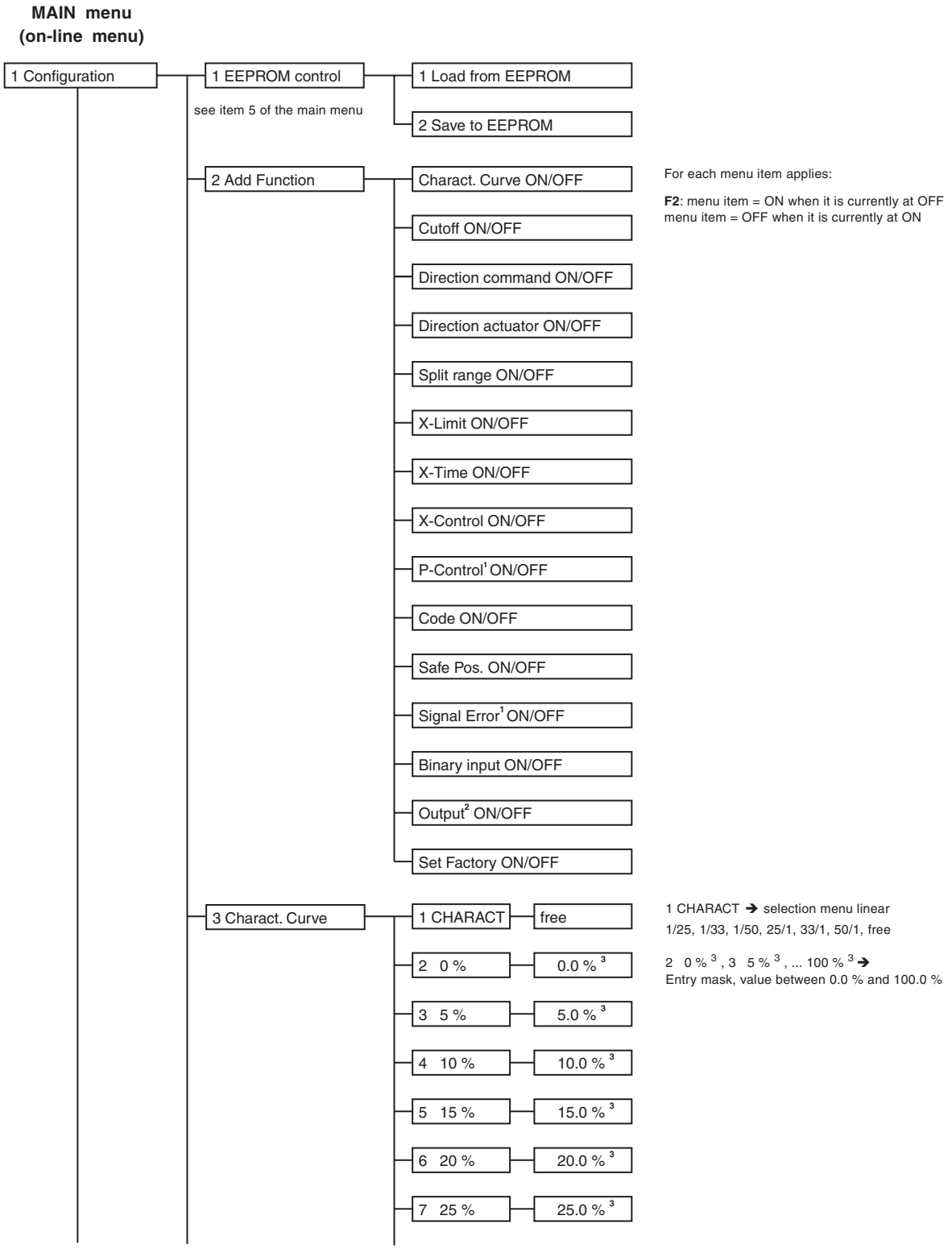

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released I freigegeben)

# Operating structure of the HART hand terminal *(HART)*

**Input / selection options:**

**F3** – [**ESC**] Quit the entry mask or selection menu without storing the changes

**F4** – [**ENTER**] Quit the entry mask or selection menu with storage of the changes

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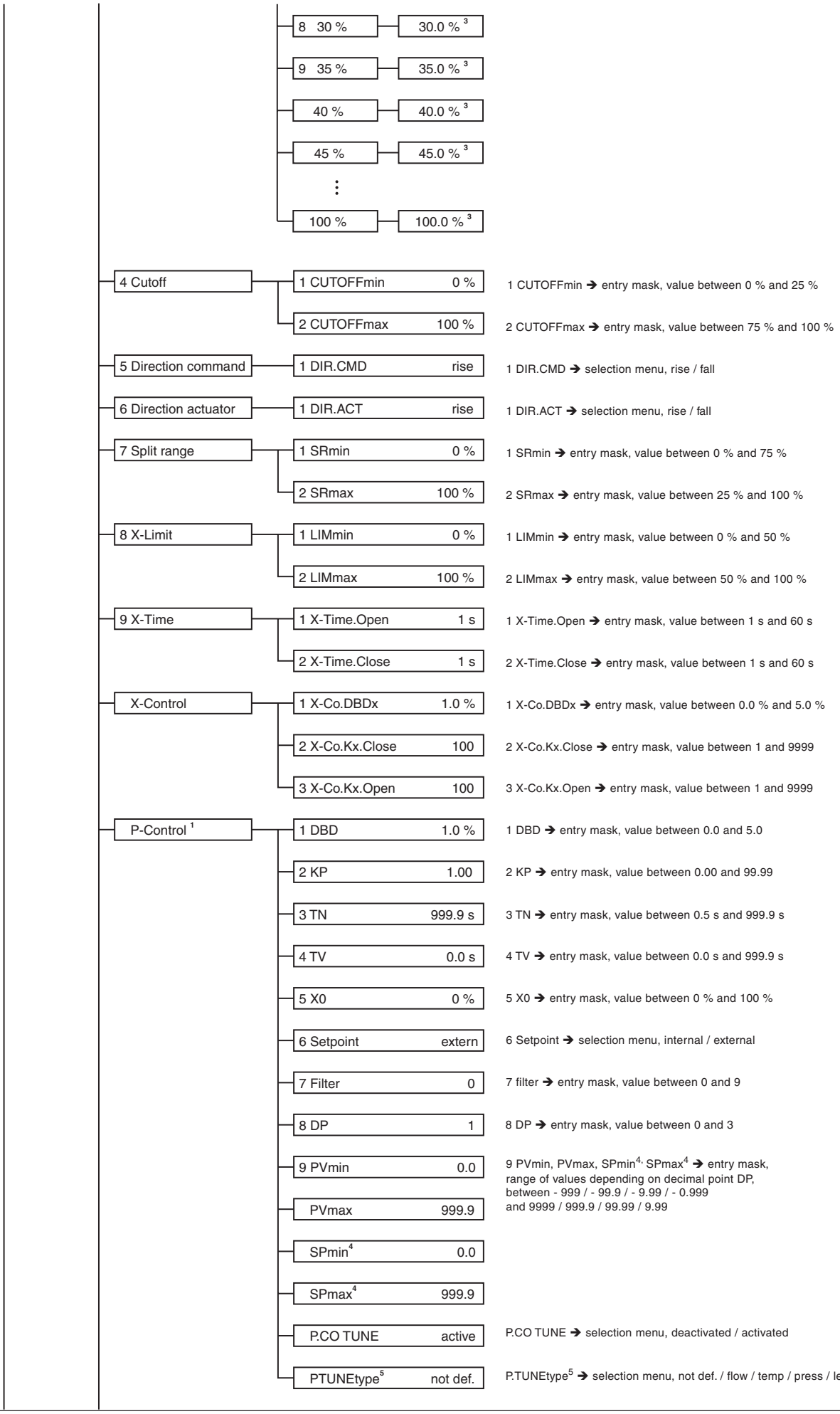
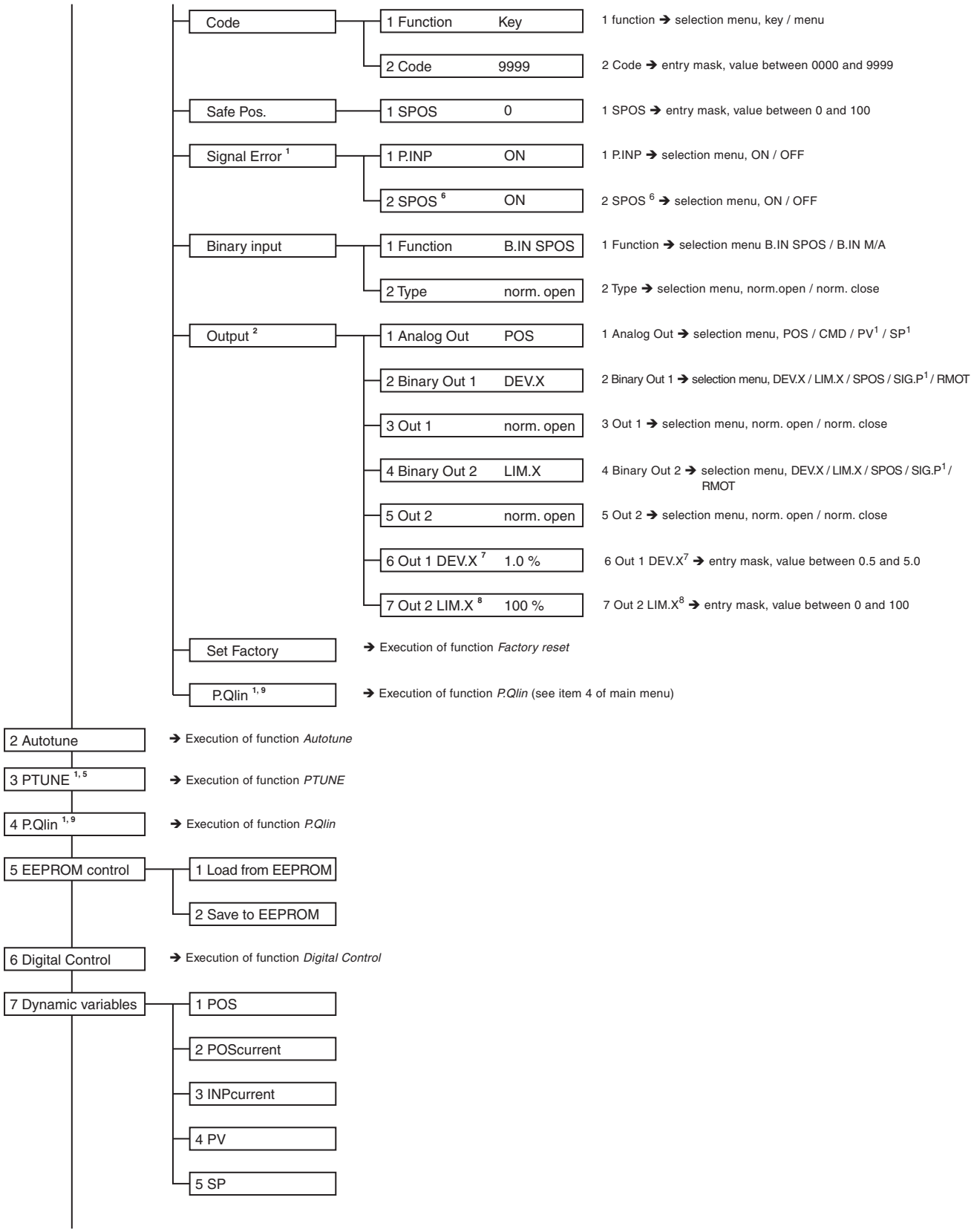
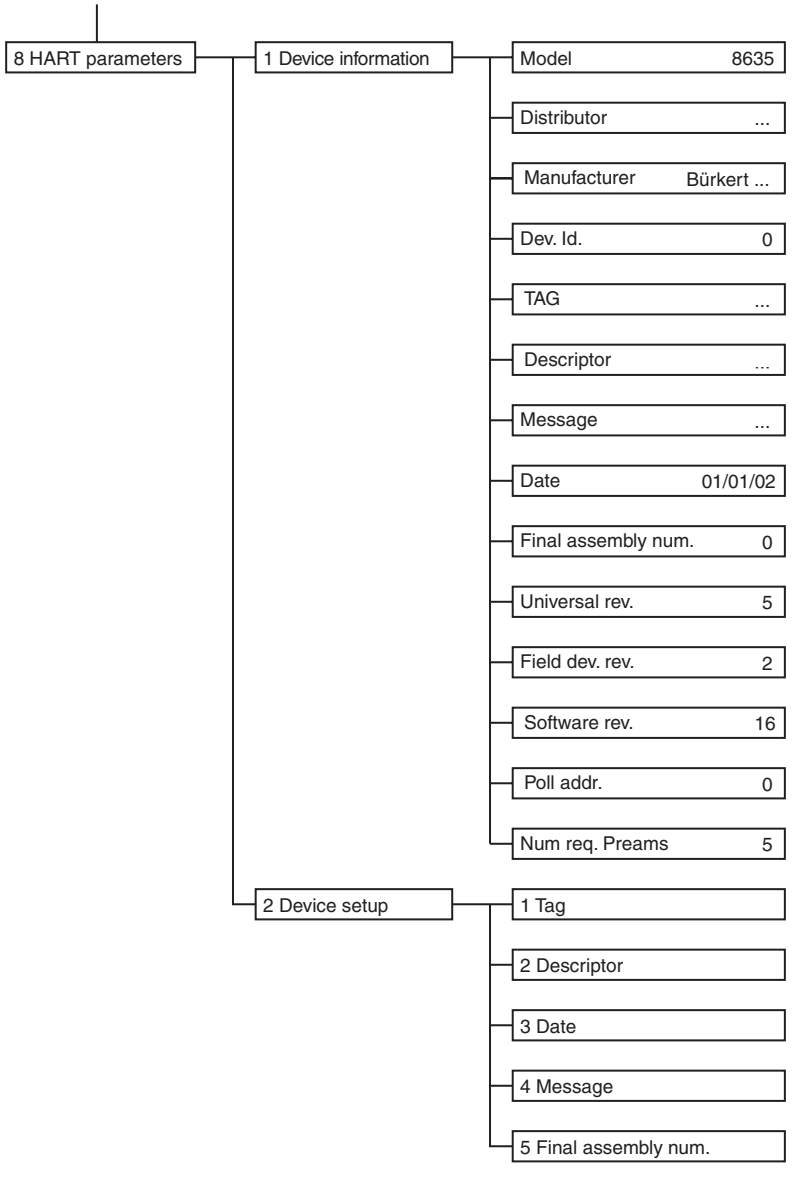



MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)




MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

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[1] Only with version with process controller.

[2] Only with version with APR (Analog Position Repeat)

[3] Only with *CHARACT* = free

[4] Menu item only present when *SETPOINT* = external has been set in menu item *P-CONTROL*.

[5] Menu item only present when *P.CO TUNE* = activated has been set in menu item *P-CONTROL*.

[6] Menu item only present when *P.INP* = ON has been set in menu item *SIGNAL ERROR*.

[7] Menu item only present when Binary Out 1 = *DEV.X* or = *LIM.X* has been set in menu item *OUTPUT*.

[8] Menu item only present when Binary Out 2 = *DEV.X* or = *LIM.X* has been set in menu item *OUTPUT*.

[9] Menu item only present when *P-CONTRL* = ON has been set in menu item *ADD FUNCTION*.

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# TABLE FOR POSITIONER

# (APPENDIX)

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# Table for your settings on the positioner

## Settings of the freely programmable characteristic

| **Fixed point** (position set point in %) | **Valve stroke [%]** | | |
|---|---|---|---|
| | **Date:** | **Date:** | **Date:** |
| **0** | | | |
| **5** | | | |
| **10** | | | |
| **15** | | | |
| **20** | | | |
| **25** | | | |
| **30** | | | |
| **35** | | | |
| **40** | | | |
| **45** | | | |
| **50** | | | |
| **55** | | | |
| **60** | | | |
| **65** | | | |
| **70** | | | |
| **75** | | | |
| **80** | | | |
| **85** | | | |
| **90** | | | |
| **95** | | | |
| **100** | | | |

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# TABLES FOR PROCESS CONTROLLER S/HART

## (APPENDIX)

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# Tables for your settings on the process controller

## Settings of the freely programmable characteristic

| Fixed point (position set point in %) | Valve stroke [%] | | |
|---|---|---|---|
| | Date: | Date: | Date: |
| 0 | | | |
| 5 | | | |
| 10 | | | |
| 15 | | | |
| 20 | | | |
| 25 | | | |
| 30 | | | |
| 35 | | | |
| 40 | | | |
| 45 | | | |
| 50 | | | |
| 55 | | | |
| 60 | | | |
| 65 | | | |
| 70 | | | |
| 75 | | | |
| 80 | | | |
| 85 | | | |
| 90 | | | |
| 95 | | | |
| 100 | | | |

## Parameters set on the process controller

| | Date: | Date: | Date: | Date: |
|---|---|---|---|---|
| KP | | | | |
| TN | | | | |
| TV | | | | |
| X0 | | | | |
| DBND | | | | |
| DP | | | | |
| PV ⊥ | | | | |
| PV ⊤ | | | | |
| SP ⊥ | | | | |
| SP ⊤ | | | | |
| UNIT | | | | |
| KFAC | | | | |
| FILT | | | | |
| INP | | | | |
| | | | | |

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# MASTER CODE S/HART

# (APPENDIX)

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**MASTER CODE**

**7175**

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

# APPROVALS S/HART (APPENDIX)



MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released I freigegeben)

# EC Declaration of Conformity

Bürkert Werke GmbH & Co. KG hereby declares as the manufacturer that these products comply with the requirements listed in the Guidelines of the Council for Harmonization of the Regulations of the Member States

- **in respect of electrical equipment with rated voltages of 50-1000 V/AC or 75-1500 V/DC (Low Voltage Guideline 73/23/EEC),**
- **in respect of electromagnetic compatibility (89/336/EEC)**
- **and are stipulated for devices and protective systems for use in potentially explosive zones (ATEX, 94/9EC),**

For the assessment of the products in respect of compliance with the Low Voltage Guideline, the following standards were applied:

| | |
|---|---|
| EN 50178: 04/98 | Equipment of heavy current installations with electronic equipment |
| EN 60730-1: 01/96 | Automatic electrical control devices |
| DIN VDE 0110-1: 04/97 | Insulation co-ordinates for electrical equipment in low voltage installations |
| EN 60529: 11/92 | Types of protection provided by the housing (IP code) |
| DIN VDE 60204-1: 06/93 | Safety of machines |
| VDE 0580: 10/94 | Electromagnetic devices, general regulations |

For the assessment of the products in respect of electromagnetic compatibility, the following standards were applied:

| | |
|---|---|
| EN 61000-6-4: 08/02 | Basic engineering standard for interference emission; Part 2: Industrial domain |
| EN 61000-6-2: 03/00 | Basic engineering standard for interference resistance; Part 2: Industrial domain |

For the assessment of the products in respect of ATEX, the following standards were applied:

| | |
|---|---|
| EN 50014: 02/00 | Electrical equipment for potentially explosive zones, general regulations |
| EN 50020: 1994 | Electrical equipment for potentially explosive zones, inherently safe „i“ |

The production was audited (CE0102) by the

Physikalischen Technischen Bundesanstalt
Bundesallee 100
D-38116 Braunschweig.

Ingelfingen, 27.09.2004
place and date

Otto Walch
Certifications Manager

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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

# (1) EC-TYPE-EXAMINATION CERTIFICATE

**(Translation)**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

**PTB 04 ATEX 2027**

(4) Equipment: Positioner, type 8635 SideControl S/HART

(5) Manufacturer: Bürkert Werke GmbH & Co.

(6) Address: Christian-Bürkert-Str. 13-17, 74653 Ingelfingen, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 04-23524.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN 50014:1997 + A1 + A2** **EN 50020:2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

**Ex II (1) 2 G EEx ia IIC T6**

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Gerlach

Braunschweig, March 29, 2004

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 56







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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

(13) # SCHEDULE

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 04 ATEX 2027

(15) Description of equipment

The positioner, type 8635 SideControl S/HART is intended for mounting onto several drives.

The positioner is installed in the hazardous area.

For relationship between the temperature class and the permissible range of the ambient temperature reference is made to the following table.

| temperature class | permissible range of the ambient temperature |
|---|---|
| T6 | -25 °C ... 60 °C |
| T5 | -25 °C ... 65 °C |
| T4 | -25 °C ... 65 °C |

Electrical data

Current input (terminals 11, 12) ..... type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i$ = 30 V
$I_i$ = 100 mA
$P_i$ = 1 W

$C_i$ negligibly low
$L_i$ negligibly low

Process control input (terminals 13, 14) ..... type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i$ = 30 V
$I_i$ = 100 mA
$P_i$ = 1 W

$C_i$ = 11 nF
$L_i$ negligibly low







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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 04 ATEX 2027**

| | |
|---|---|
| Binary input (terminals 81, 82) | type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit<br>Maximum values:<br>$U_o$ = 8.8 V<br>$I_o$ = 0.2 mA<br>$C_o$ = 5.5 µF<br>$L_o$ = 1000 mH |
| Interface RS 232 (terminals X4 1...3) | type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit<br>Maximum values:<br>$U_i$ = 8.8 V<br>$I_i$ = 100 mA<br>$P_i$ = 880 mW<br>$C_i$ negligibly low<br>$L_i$ negligibly low |
| or | zum Anschluss an ein Programmiergerät außerhalb des explosionsgefährdeten Bereiches<br>$U_m$ = 250 V |

**Options**

| | |
|---|---|
| Actual-value output (terminals 31, 32) | type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit<br>Maximum values:<br>$U_i$ = 30 V<br>$I_i$ = 100 mA<br>$P_i$ = 1 W<br>$C_i$ negligibly low<br>$L_i$ negligibly low |
| Initiators (terminals 41, 42 and 51, 52) | type of protection Intrinsic Safety EEx ia IIC only for connection to a certified intrinsically safe circuit |





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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 04 ATEX 2027**

Maximum values:

$U_i$ = 15.5 V
$I_i$ = 52 mA
$P_i$ = 150 mW

$C_i$ = 200 nF
$L_i$ = 0.2 mH

Binary outputs..... type of protection Intrinsic Safety EEx ia IIC
(terminals 83, 84 and 85, 86) only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i$ = 30 V
$I_i$ = 100 mA
$P_i$ = 1 W

$C_i$ negligibly low
$L_i$ negligibly low

The connections for piezo valves, position measuring system, HART-, indicating- and pressure sensor-board are internal intrinsically safe circuits.

(16) Test report PTB Ex 04-23524

(17) Special conditions for safe use

none

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Gerlach

Braunschweig, March 29, 2004







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# APPROVALS PROFIBUS PA (APPENDIX)



MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

# EC Declaration of Conformity

Bürkert Werke GmbH & Co. KG hereby declares as the manufacturer that these products comply with the requirements listed in the Guidelines of the Council for Harmonization of the Regulations of the Member States.

- **in respect of electrical equipment with rated voltages of 50-1000 V/AC or 75-1500 V/DC (Low Voltage Guideline 73/23/EEC),**
- **in respect of electromagnetic compatibility (89/336/EEC)**
- **and are stipulated for devices and protective systems for use in potentially explosive zones (ATEX, 94/9EC),**

For the assessment of the products in respect of compliance with the Low Voltage Guideline, the following standards were applied:

| | |
|---|---|
| EN 50178: 04/98 | Equipment of heavy current installations with electronic equipment |
| EN 60730-1: 01/96 | Automatic electrical control devices |
| DIN VDE 0110-1: 04/97 | Insulation co-ordinates for electrical equipment in low voltage installations |
| EN 60529: 11/92 | Types of protection provided by the housing (IP code) |
| DIN VDE 60204-1: 06/93 | Safety of machines |
| VDE 0580: 10/94 | Electromagnetic devices, general regulations |

For the assessment of the products in respect of electromagnetic compatibility, the following standards were applied:

| | |
|---|---|
| EN 61000-6-4: 08/02 | Basic engineering standard for interference emission; Part 2: Industrial domain |
| EN 61000-6-2: 03/00 | Basic engineering standard for interference resistance; Part 2: Industrial domain |

For the assessment of the products in respect of ATEX, the following standards were applied:

| | |
|---|---|
| EN 50014: 02/00 | Electrical equipment for potentially explosive zones, general regulations |
| EN 50020: 1994 | Electrical equipment for potentially explosive zones, inherently safe „i“ |

The production was audited (CE0102) by the

Physikalischen Technischen Bundesanstalt
Bundesallee 100
D-38116 Braunschweig.

Otto Walch

Ingelfingen, 27.09.2004
place and date

Otto Walch
Certifications Manager

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

(1) # EC-TYPE-EXAMINATION CERTIFICATE

**(Translation)**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

**PTB 03 ATEX 2038**

(4) Equipment: Positioner, type 8635 SideControl PA

(5) Manufacturer: Bürkert Werke GmbH & Co. KG

(6) Address: Christian-Bürkert-Str. 13-17, 74653 Ingelfingen, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-23109 .

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN 50014:1997 + A1 + A2** **EN 50020:2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

**II (1) 2 G EEx ia IIC T6**

Zertifizierungsstelle Explosionsschutz Braunschweig, September 02, 2003
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor







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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

(13) # S C H E D U L E

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2038

(15) Description of equipment

The positioner, type 8635 SideControl PA is intended for mounting onto various drives.

The positioner is installed inside hazardous areas.

For relationship of the temperature class and the permissible range of the ambient temperature reference is made to the table below:

| temperature class | permissible range of the ambient temperature |
|---|---|
| T6 | -25 °C ... 60 °C |
| T5 | -25 °C ... 65 °C |
| T4 | -25 °C ... 65 °C |

Electrical data

Field bus terminal ..... type of protection Intrinsic Safety EEx ia IIC
(BUS (+), BUS (-) only for connection to a certified intrinsically
available in duplicate) safe circuit in accordance with the FISCO-model

Maximum values:

$U_i$ = 15 V
$I_i$ = 215 mA
$P_i$ = 1.95 W

$C_i$ negligibly low
$L_i$ negligibly low

Process control input ..... type of protection Intrinsic Safety EEx ia IIC
(terminals 11, 12) only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i$ = 30 V
$I_i$ = 100 mA
$P_i$ = 1 W

$C_i$ = 22 nF
$L_i$ negligibly low





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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2038**

| | |
|---|---|
| Initiators (terminals 41, 42 and 51, 52) | type of protection Intrinsic Safety EEx ia IIC or EEx ib IIC<br>only for connection to a certified intrinsically safe circuit in accordance with the FISCO-model<br>Maximum values:<br>$U_i$ = 15.5 V<br>$I_i$ = 52 mA<br>$P_i$ = 150 mW<br>$C_i$ = 200 nF<br>$L_i$ = 0.2 mH |
| Binary input (terminals 81, 82) | type of protection Intrinsic Safety EEx ia IIC<br>only for connection to a mechanical switch<br>Maximum values:<br>$U_o$ = 6 V<br>$I_o$ = 0.14 mA<br>$C_o$ = 40 µF<br>$L_o$ = 1000 mH |
| Programming interface (X80) | for connection to the adaptor Flasher/M16C outside of the hazardous area |
| Interface RS 232 (X180) | for connection to a RS 232-interface<br>$U_m$ = 250 V |

(16) Test report PTB Ex 03-23109

(17) Special conditions for safe use

none

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, September 02, 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24







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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

## 1. SUPPLEMENT

**according to Directive 94/9/EC Annex III.6**

## to EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2038

## (Translation)

Equipment: Positioner, type 8635 SideControl PA

Marking: ⟨Ex⟩ **II (1) 2 G EEx ia IIC T6**

Manufacturer: Bürkert Werke GmbH & Co.

Address: Christian-Bürkert-Str. 13-17
74653 Ingelfingen, Germany

Description of supplements and modifications

In future the positioner, type 8635 SideControl PA may also be manufactured according to the test documents listed in the test report.

The electrical data of field bus terminal change as follows:

Electrical data

Field bus terminal ..... type of protection Intrinsic Safety EEx ia IIC
BUS (+), BUS (-) only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i$ = 17.5 V
$I_i$ = 360 mA
$P_i$ = 2.52 W

$C_i$ negligibly low
$L_i$ negligibly low

All further specifications are valid without changes for this 1. supplement too.

Test report: PTB Ex 04-23526

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, May 17, 2004

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# APPROVALS S/HART, PROFIBUS PA (APPENDIX)



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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

## (1) EG-Baumusterprüfbescheinigung

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - **Richtlinie 94/9/EG**

(3) EG-Baumusterprüfbescheinigungsnummer

**PTB 99 ATEX 2219 X**

(4) Gerät: Schlitzinitiatoren Typen SJ... und SC...

(5) Hersteller: Pepperl + Fuchs GmbH

(6) Anschrift: D-68307 Mannheim

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Physikalisch-Technische Bundesanstalt bescheinigt als benannte Stelle Nr. 0102 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht PTB Ex 99-29175 festgelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

**EN 50014:1997** **EN 50020:1994**

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Bau des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes.

(12) Die Kennzeichnung des Gerätes muß die folgenden Angaben enthalten:

**Ex II 2 G EEx ia IIC T6**

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Braunschweig, 22. Dezember 1999

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24





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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

(13) **Anlage**

(14) **EG-Baumusterprüfbescheinigung PTB 99 ATEX 2219 X**

(15) Beschreibung des Gerätes

Die Schlitzinitiatoren Typen SJ... und SC... dienen zur Umformung von Wegänderungen in elektrische Signale.

Die Schlitzinitiatoren dürfen mit eigensicheren Stromkreisen, die für die Kategorien und Explosionsgruppen [EEx ia] IIC oder IIB bzw. [EEx ib] IIC oder IIB bescheinigt sind, betrieben werden. Die Kategorie sowie die Explosionsgruppe der eigensicheren Schlitzinitiatoren richtet sich nach dem angeschlossenen, speisenden eigensicheren Stromkreis.

Elektrische Daten

Auswerte- und Versorgungsstromkreis ..... in Zündschutzart Eigensicherheit EEx ia IIC/IIB
bzw. EEx ib IIC/IIB
nur zum Anschluß an bescheinigte eigensichere Stromkreise
Höchstwerte:

| Typ 1 | Typ 2 | Typ 3 | Typ 4 |
|---|---|---|---|
| $U_i$ = 16 V | $U_i$ = 16 V | $U_i$ = 16 V | $U_i$ = 16 V |
| $I_i$ = 25 mA | $I_i$ = 25 mA | $I_i$ = 52 mA | $I_i$ = 76 mA |
| $P_i$ = 34 mW | $P_i$ = 64 mW | $P_i$ = 169 mW | $P_i$ = 242 mW |

Der Zusammenhang zwischen dem Typ des angeschlossenen Stromkreises, der höchstzulässigen Umgebungstemperatur und der Temperaturklasse sowie den wirksamen inneren Reaktanzen für die einzelnen Typen der Schlitzinitiatoren ist der Tabelle zu entnehmen:

# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**Anlage zur EG-Baumusterprüfbescheinigung PTB 99 ATEX 2219 X**

| Typen | $C_i$ | $L_i$ | Typ 1 | | | Typ 2 | | | Typ 3 | | | Typ 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Höchstzulässige Umgebungstemperatur in °C bei Einsatz in Temperaturklasse | | | | | | | | | | | |
| | [nF] | [µH] | T6 | T5 | T4-T1 | T6 | T5 | T4-T1 | T6 | T5 | T4-T1 | T6 | T5 | T4-T1 |
| SC2-N0... | 150 | 150 | 72 | 87 | 100 | 65 | 80 | 100 | 40 | 55 | 75 | 23 | 38 | 54 |
| SC3,5-N0-Y... | 150 | 150 | 72 | 87 | 100 | 65 | 80 | 100 | 40 | 55 | 75 | 23 | 38 | 54 |
| SC3,5...-N0... | 150 | 150 | 73 | 88 | 100 | 66 | 81 | 100 | 45 | 60 | 89 | 30 | 45 | 74 |
| SJ1,8-N-Y... | 30 | 100 | 73 | 88 | 100 | 67 | 82 | 100 | 45 | 60 | 78 | 30 | 45 | 57 |
| SJ2,2-N... | 30 | 100 | 73 | 88 | 100 | 67 | 82 | 100 | 45 | 60 | 78 | 30 | 45 | 57 |
| SJ2-N... | 30 | 100 | 73 | 88 | 100 | 67 | 82 | 100 | 45 | 60 | 78 | 30 | 45 | 57 |
| SJ3,5-...-N... | 50 | 250 | 73 | 88 | 100 | 66 | 81 | 100 | 45 | 60 | 89 | 30 | 45 | 74 |
| SJ3,5-H... | 50 | 250 | 73 | 88 | 100 | 66 | 81 | 100 | 45 | 60 | 89 | 30 | 45 | 74 |
| SJ5-...-N... | 50 | 250 | 73 | 88 | 100 | 66 | 81 | 100 | 45 | 60 | 89 | 30 | 45 | 74 |
| SJ5-K... | 50 | 550 | 72 | 87 | 100 | 66 | 81 | 100 | 42 | 57 | 82 | 26 | 41 | 63 |
| SJ10-N... | 50 | 1000 | 72 | 87 | 100 | 66 | 81 | 100 | 42 | 57 | 82 | 26 | 41 | 63 |
| SJ15-N... | 150 | 1200 | 72 | 87 | 100 | 66 | 81 | 100 | 42 | 57 | 82 | 26 | 41 | 63 |
| SJ30-N... | 150 | 1250 | 72 | 87 | 100 | 66 | 81 | 100 | 42 | 57 | 82 | 26 | 41 | 63 |

(16) Prüfbericht PTB Ex 99-29175

(17) Besondere Bedingungen

1. Beim Einsatz der Schlitzinitiatoren Typen SJ... und SC... im Temperaturbereich von -60°C bis -20 °C sind diese durch Einbau in ein zusätzliches Gehäuse vor Schlageinwirkung zu schützen.
2. Die Anschlußteile der Schlitzinitiatoren Typen SJ... und SC... sind so zu errichten, daß mindestens der Schutzgrad IP20 gemäß IEC-Publikation 60529:1989 erreicht wird.
3. Der Zusammenhang zwischen dem Typ des angeschlossenen Stromkreises, der höchstzulässigen Umgebungstemperatur und der Temperaturklasse sowie den wirksamen inneren Reaktanzen für die einzelnen Typen der Schlitzinitiatoren ist der Tabelle unter Punkt (15) dieser EG-Baumusterprüfbescheinigung zu entnehmen.
4. Es ist die Vermeidung von unzulässiger elektrostatischer Aufladung des Kunststoffgehäuses der Schlitzinitiatoren Typ SJ30-N... zu beachten (Warnhinweis auf dem Gerät).

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen

Durch vorgenannte Normen abgedeckt.

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, 22. Dezember 1999

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24

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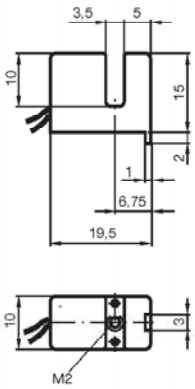
## Inductive proximity switches — SJ3,5-G-N

**Comfort series**

**3.5 mm slot width**




CE

| | |
|---|---|
| Switching element function | NAMUR NC |
| Slot width | 3.5 mm |
| Depth of immersion (lateral) | 5 ... 7 typ. 6 mm |
| Installation | |
| Nominal voltage $U_o$ | 8 V |
| Operating voltage $U_B$ | 5 ... 25 V |
| Switching frequency f | 0 ... 3000 Hz |
| Current consumption | |
| Measuring plate not detected | ≥ 3 mA |
| Measuring plate detected | ≤ 1 mA |
| Ambient temperature | -25 ... 100 °C (248 ... 373 K) 1) |
| EMC in accordance with | EN 60947-5-2 |
| Standard conformity | DIN EN 60947-5-6 (NAMUR) |
| Connection type | 0,5 m, leads LIY |
| Core cross-section | 0,14 mm² |
| Housing material | PBT |
| Protection degree | IP67 |
| Data for Ex areas<\b> | |
| Standard conformity | EN 50014:1997<br>EN 50020:1994 |
| EG Declaration of conformity | PTB 99 ATEX 2219 X |
| Appropriate type | SJ3,5-...-N... |
| Marking | Ex II 2 G EEx ia IIC T6 |
| Effective internal inductivity $C_i$ | ≤ 50 nF 2) |
| Effective internal inductance $L_i$ | ≤ 250 µH 2) |

**Operating instructions for use in hazardous areas**

1) **Warning**: when using in hazardous areas, reduced values must be heeded!

2) For one sensor circle; a cable with a length of 10 m is allowed for.

The temperature ranges, depending on the temperature class, are to be taken from the type test certificate

Additional information can be found in the type test certificate

**Installation, startup**

This product was developed and approved for use in hazardous areas in the protection category intrinsic safety according to EN 50014 and EN 50020.

The intrinsic safety is only guaranteed in interconnection with an appropriate operating resource and in accordance with the verification of intrinsic safety

The type test certificate and the applicable laws/guidelines for the use or planned purpose must be heeded.

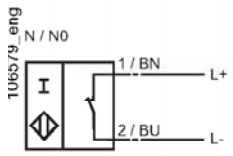
Device must be protected from strong electromagnetic fields and mechanical damage.

**Maintenance, repair**

No changes may be made to operating resources which are operating in hazardous areas.

Repairs to these operating resources are not possible

**Connection**

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MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

MAN 1000011213 EN Version: H printed: 22.09.2010 Status: RL (released | freigegeben)

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