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Operating Instructions for SMARTCON Control Units - Firmware 1600

OM-ENGLISH-AB-FW1600-V1.00-2023.08.08

Contents

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Hazard Warnings

Hazard warnings in this manual indicate potential harm to the user or the product. For the person interacting with the product, the level of risk includes consequences ranging from slight, up to lethal injuries. As for the product, disobeying the warnings may cause damage to the equipment and/or void the warranty. Therefore, said warnings are made apparent to instruct and warn the user, which precautions have to be made prior to performing any actions described in this manual. The user must read and be familiar with the manual, before performing any tasks as described in this manual.

Hazard warnings in this manual are presented in these three forms:

WARNING: These warning notices refer to personal safety. Failure to obey these notices could result in personal injury or death.

CAUTION: General precautions must be made. Failure to obey these notices could result in personal injury and/or equipment damage.

NOTE: Directs the user's attention to essential information.

SEC-OM-ENGLISH-AB-FW1600-V1.00-2023.08.09

Operating Instructions for SMARTCON Control Units - Firmware 1600

1 Introduction

The controller is intended to monitor and control the actuator and provides the interface between the operator, the control system and the actuator.

1.1 Operating unit

Operation relies on two switches: the control switch and a padlock-protected selector switch.
Information visualization is provided by 4 integrated indicator lights, as well as the graphic display.
For better visibility, switch symbols (✓, ✗, +, −) are on the cover.

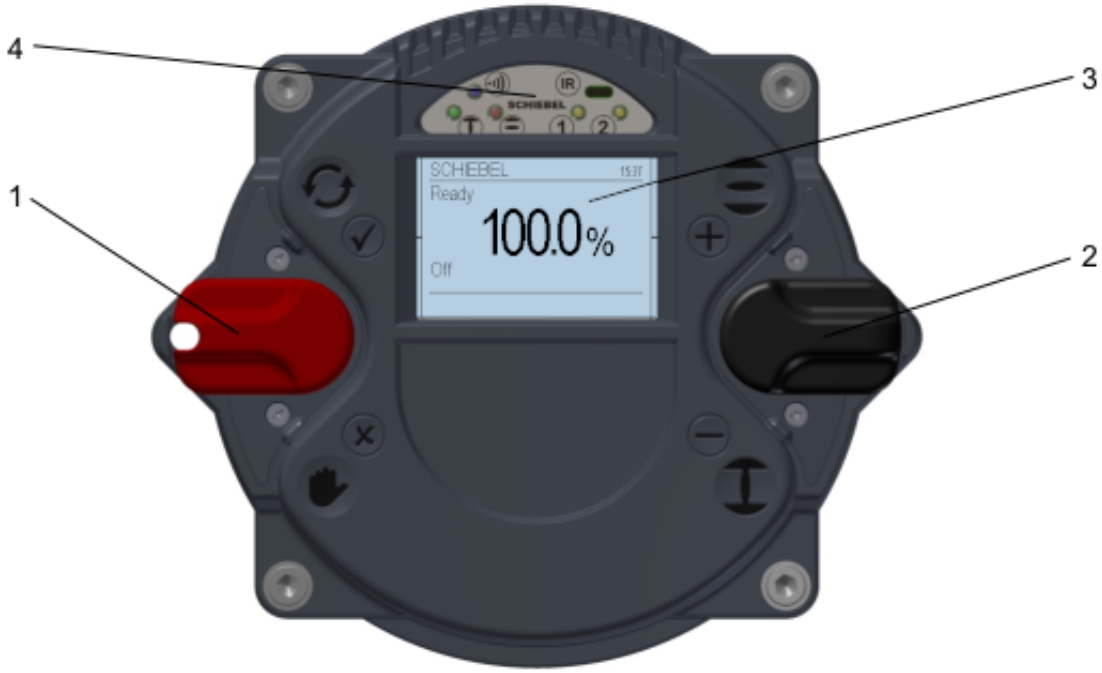

Figure 1: *1. . . Selector switch, 2. . . Control switch, 3. . . Graphic display, 4. . . LED display*

The controller switches serve on the one hand for electric-motor operation of the actuator and, on the other hand, to configure and view various menu items.

The controller cover may be wiped clean with a damp cloth.
The mounting position of the control unit can be turned in 90° steps (*see Operating Instructions for Actuators Type AB with Control Unit*).

1.2 Display elements

1.2.1 Graphic display

The graphic display used in the controller allows text display in different languages.

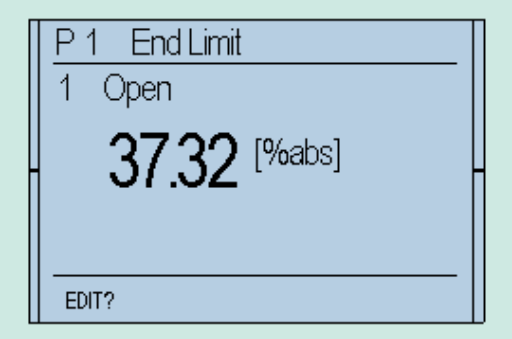

Figure 2

During operation, the displays shows the position of the actuator as a percentage, operation mode and status. When using the option "identification", a customer-specific label is shown at the bottom of the display (e.g., PPS Number).

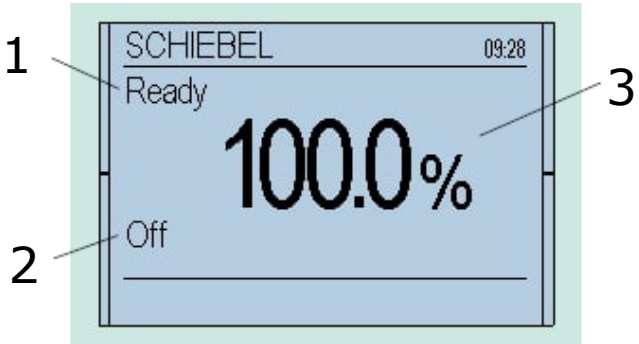

Figure 3: *1. . . Status, 2. . . Operation mode, 3. . . Position*

CAUTION: The display should not be exposed to direct sunlight over a long peroid - risk of a defect in combination with very high temperatures.

1.2.2 Status symbols according to NAMUR recommendation NE 107

NOTE: This feature is vailable from firmware version 1610 and upwards.

To standardize the signaling of status data at field level, standard symbols according to NAMUR recommendation NE 107 can be displayed on the graphic display (see figure 4). The purpose of these is to map the status of the actuator to a standardized format. This function can be activated with parameter P20.13 - NAMUR status. An overview of the status symbols is provided in the table 1.

Table 1: *Overview of the status symbols according to NAMUR recommendation 107*

			
Failure	**Out Of Specification**	**Maintenance Required**	**Check Function**
Example: Motor is not controlled	Example: Device operated outside specifications	Example: Maintenance required	Example: Configuration change, local control

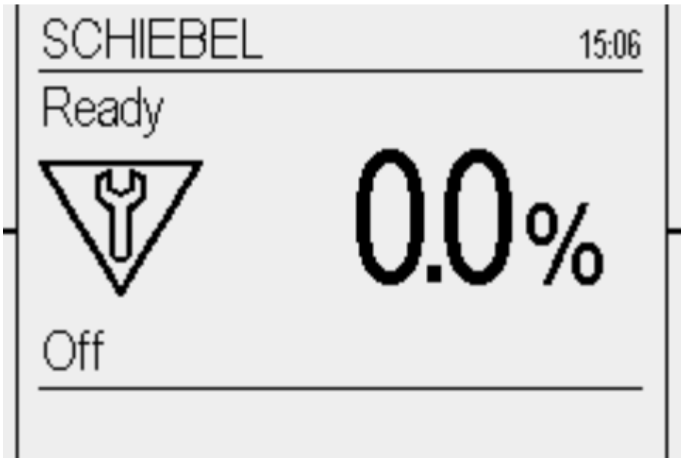

Figure 4: *Graphic display during operation with the position indicator and the* ***Check Function*** *symbol.*

For SCHIEBEL actuators, various status messages are assigned to the status symbols according to table 2. It is possible to change the assignment of the status messages of the actuator controls to any NAMUR symbols using the parameterization software **SCHIEBEL SmartTool2**.

Table 2: *Assignment of the status messages of the controller to the NAMUR status symbols*

State	**NAMUR Status**
Hand wheel	Check Function
Status: Not Activated	Failure
Status: Error	Failure
Status: Warning	Out Of Specification
Emergency	Check Function
Control mode: LOCAL	Check Function
Control mode: OFF	Check Function
PVST is active	Check Function
Wireless commmunication	Check Function

1.2.3 LED Display

In order to provide the user with a better status visualization, basic information is displayed with the help of 5 colored LEDs.
When the power supply is switched on, a self-test is carried out which causes all 5 LEDs to light up briefly.

Figure 5

Description	Colour	Lit up	Flashes quickly	Flashes slowly	Does not light up
L1	Yellow	No torque error	Torque fault	—	[1]
L2	Yellow	Ready (operational readiness)	Travel fault (no operational readiness!)	Warning	Error (no operational readiness) motor temperature, supply voltage absent, internal error [1]
L3	Green [2]	CLOSE [3]	Moving to CLOSE position	Applies upon torque-dependent closing: Occurs when the end position CLOSE is reached but the cut-out torque has not yet been reached	Actuator is not in the CLOSE position.
L4	Red [2]	OPEN [3]	Moving to OPEN position	Applies upon torque-dependent opening: Occurs when the end position OPEN is reached but the cut-out torque has not yet been reached	Actuator is not in the OPEN position.
L5	Blue	Bluetooth connected	Bluetooth data transmission	Bluetooth ON, not connected	Bluetooth/Infrared OFF
	Red	Infrared connected	Infrared data transmission	Infrared ON, not connected	

[1] LED L1 and L2 are turned off as long as an infrared connection is active.
[2] Colour of LED L3 and L4 can be changed by parameter P1.7 - see section 2.1, page 14.
[3] A travel fault is indicated by a lit L3 and L4.

1.3 Operation

The actuator is operated via the switches located on the controller (selection- and control switch). All actuator settings can be entered with these switches. Furthermore, configuration is also possible via the IR interface or the Bluetooth Interface (see section 4, page 59). Flip the switch up or down to regulate the parameter menu scrolling speed.

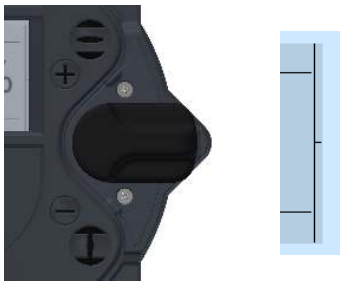

Figure 6: *Neutral position*

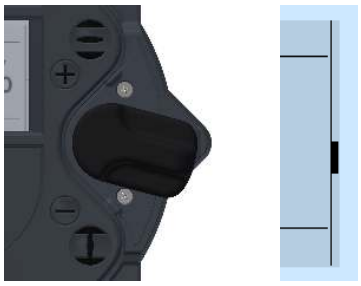

Figure 7: *Slight switch flip (it will move to the next parameter)*

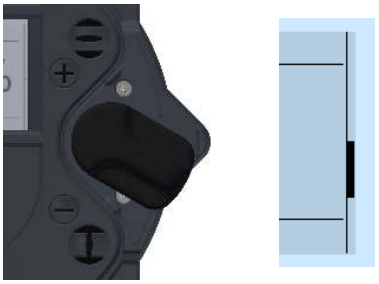

Figure 8: *halfway switch flip (it will jump to the next parameter category)*

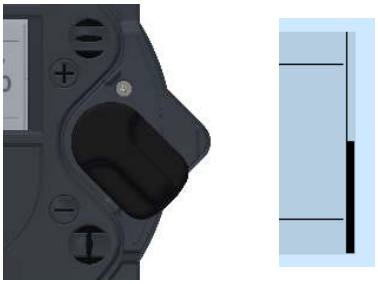

Figure 9: *Full switch flip (it will jump to the end of the menu)*

1.4 Welcome Menu

The welcome menu presents the user a welcome message, and guides the user through some basic settings. Some basic settings include the language and the timezone. Please follow the instructions shown on the display.

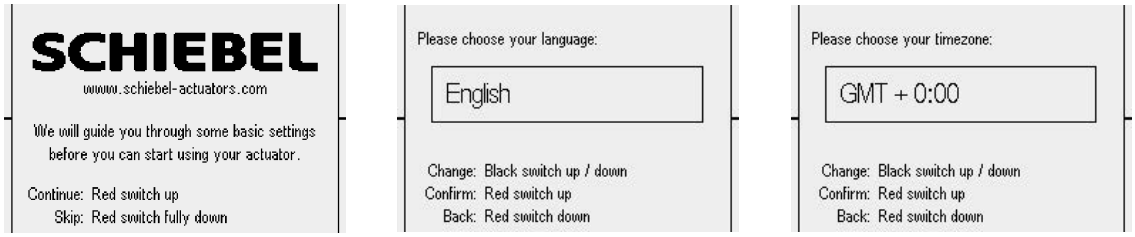

Figure 10: *Welcome menu (1/2)*

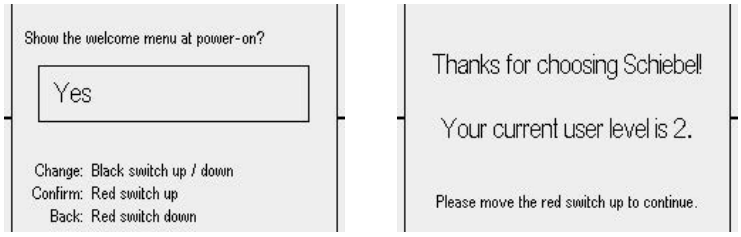

Figure 11: *Welcome menu (2/2)*

1.4.1 Operation mode

Use the selector switch (red) to determine the various operating states of the actuator. In each of these positions, it is possible to block the switch by means of a padlock and thus protect the actuator against unauthorized access.

The selector switch has the following positions:

OFF	The actuator can be neither operated via the remote control nor via the control switches of the controller.
Local	It is possible to operate the actuator by motor via the control switch. Control via the remote inputs may be possible with appropriate configuration (superimposed control commands, emergency commans)
Remote	The actuator is ready to process control commands via input signals. The control switch for the motor operation of the actuator is not enabled.

Besides defining the operational status, the selector switch is used in configuration mode to confirm or cancel parameter inputs.

Depending on the selector switch position, the control switch performs different functions:

Selector switch in the OFF position:	The control switch is used to scroll up or down the menu according to internal symbolism. From the neutral position towards ⊕ you reach the status and history data areas. Towards the ⊖ symbols you reach the parameter menu. Here, the selection switch either confirms ✓ or rejects ✗ the current input according to associated symbolism.
Selector switch in the REMOTE position:	The control switch gives you access to status, history data and parameter area.
Selector switch in the LOCAL position:	With the control switch, the actuator can be operated by motor. You may also operate the actuator in inching and self-hold mode. Switches are spring-loaded to snap back automatically into their neutral position. (To confirm a control command, the control switch must be pushed all the way into its mechanical locking position.)

1.4.2 Configuration

NOTE: Please make sure, that the set user level has permission to read/write the parameters.

In principle, all parameters are shown as numbers in the corresponding parameter point. From the actuator menu, use the control switch to access different menu points. The lower left corner of the display shows the "EDIT" option.

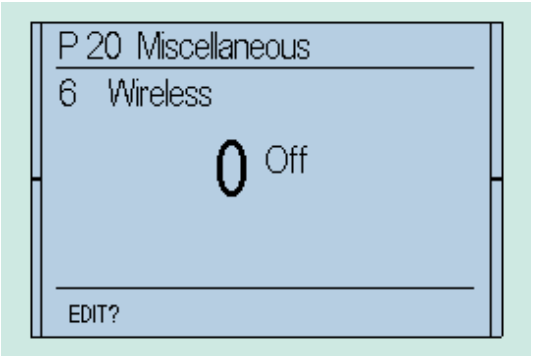

Figure 12

Confirm the selector switch (with a slight flip towards ✓, (see Figure 17, page 12 to Figure 19, page 12) to change the selected parameter. To confirm this input readiness, the display changes from "EDIT" to "SAVE".

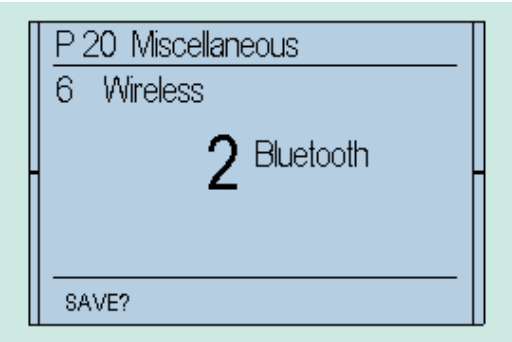

Figure 13

Use the control switch towards to the characters to change the parameter. ⊕ or ⊖ (see Figure 6 til Figure 9, page 9) After reaching the desired parameter value, confirm the value with the selector switch (again, flip it slightly towards ✓, (see Figure 17, page 12 til Figure 19, page 12).

1.4.3 Configuration example

By way of example, we will change parameter P20.6 (wireless) from 0 (wireless off) to 2 (Bluetooth communication on). Thus, the Bluetooth connection is activated for a short time and then deactivated again automatically: The operating and control switch must be in the neutral position

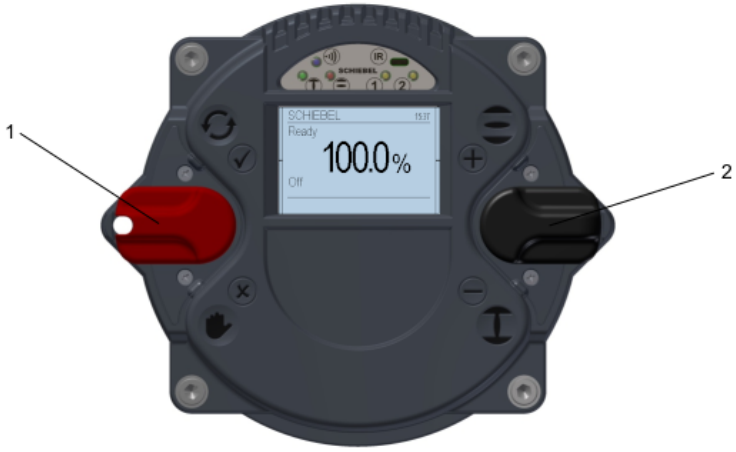

Figure 14: *1. . . Selector switch (red) , 2. . . Control switch (black)*

Now, move the control switch down (towards) until the menu item "P 20.6 Miscellaneous - Wireless" is displayed.

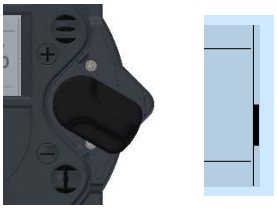

Figure 15

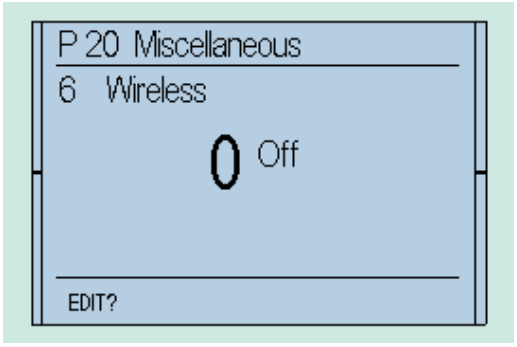

Figure 16

Afterwards, flip up slightly the selector switch (towards) and let it snap back to its neutral position

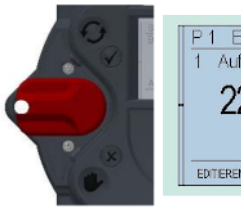

Figure 17

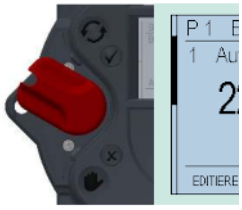

Figure 18

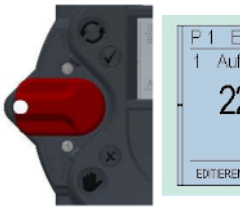

Figure 19

This changes the bottom line of the display from "EDIT?" to "SAVE?"

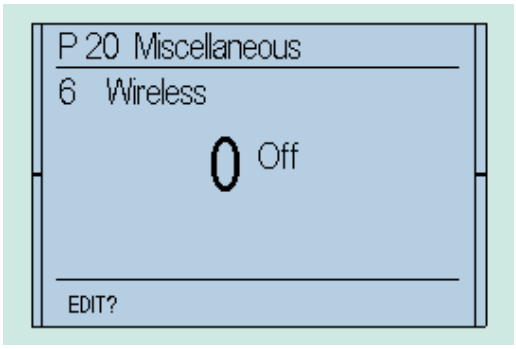

Figure 20

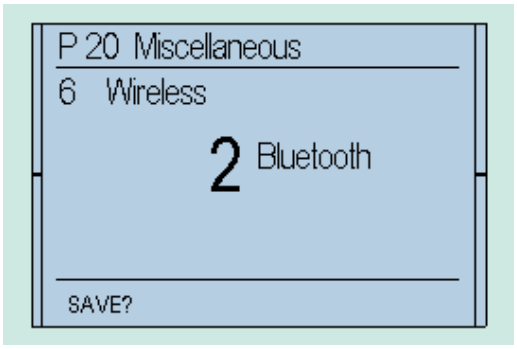

Figure 21

Thereafter, flip up the control switch (toward) to change the value from 0 (off) to 2 (Bluetooth)

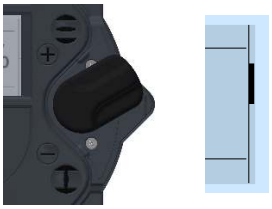

Figure 22

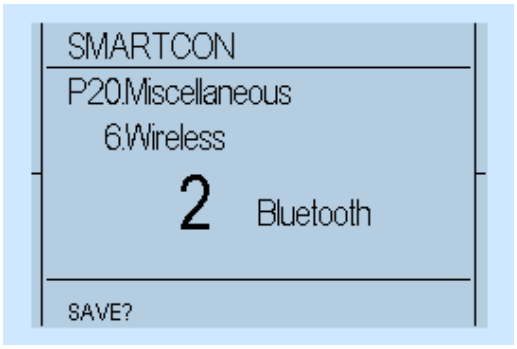

Figure 23

If the value changes to 1, confirm the selection by flipping halfway up the selector switch (towards) and letting it snap back to its neutral position (see Figure 17 til Figure 19).

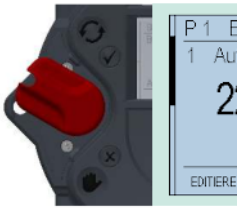

Figure 24

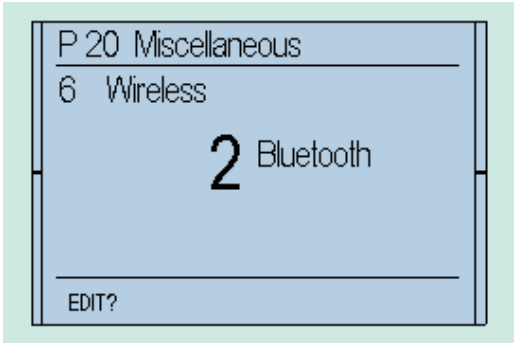

Figure 25

This changes the bottom line of the display from "SAVE?" to "EDIT?" and the parameter is stored.

Furthermore, certain parameters (end positions, intermediate positions).can be set using "TEACHIN". Thus, their configuration is greatly simplified.
After selecting the appropriate menu item (for example: End position) and chanching the the input type from "EDIT?" to "SAVE?", move the selector switch (red) to "manual mode" and lock it into place. As you do so, the display will show the message "TEACHIN" and the current position value will be applied continuously to the parameter value. In this mode, further to manual operation by hand wheel, the actuator can be motor-driven with the control switch to the desired position (see *Operating Instructions for Actuators Type AB with Control Unit*).

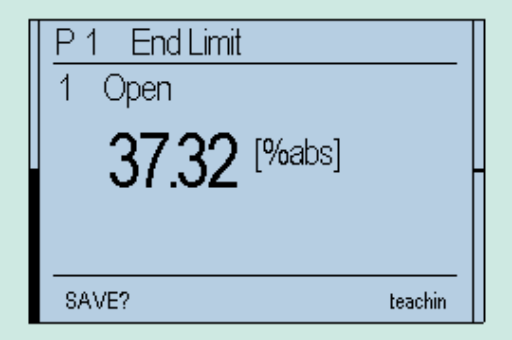

Figure 26

CAUTION: Please note that, during motor operation, only torque monitoring remains active, as travel adjustment will happen subsequently. Therefore, please check beforehand whether the maximum torque has been already set.

After reaching the desired, to-be-defined position, move the selector switch back to the neutral position. Finally, the parameter value must still be saved by flipping the selector switch halfway up and letting it snap back to the neutral position (see Figure 17 till Figure 19, page 12).

2 Parameter menu

For each parameter group, you can find a description, tabular overview of the menu items and possible configurations. The parameter list below also includes all possible options per menu item. Please note that some of the menu items listed and described may not be delivered with your configuration.

2.1 Parameter group: End limit

These parameters are used to configure the end position and switch off behavior of the actuator. In this regards, it is important to ensure that the basic mechanical configuration described in the *Operating Instructions for Actuators Type AB with Control Unit* has already been made.

CAUTION: Ensure, that these parameters are set during commissioning before operating the actuator. In addition, the settings in the "Torque" menu must be compared with the permissible values of the valve and corrected as appropriate. Failing to oblige may damage the driven equipment.

NOTE: In general, 100% stands for fully open and 0% for fully closed. Please note that these values cannot be changed. The end position range is reached as soon as 0% or 100% is shown on display.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P1.1	End limit	Open	TEACHIN; 0...100 %abs	The parameter value can be set using TEACHIN. With a known travel, the second end position can be entered after setting the first end position.
P1.2	End limit	Close	TEACHIN; 0...100 %abs	The parameter value can be set using TEACHIN. With a known travel, the second end position can be entered after setting the first end position.
P1.3	End limit	Switch off Open	0: By travel	The actuator uses end-position signals to switch off and report the end position. **Attention: For failsafe-actuators in failsafe-direction not applicable. End limit by travel in failsafe-position only possible by changing the mechanical connection to the valve.**
			1: By torque	The actuator signals the end position or stops the motor only after reaching the specified torque in the end position. If the torque is reached and end position signal not, the actuator reports an error. If the end position is reached and the control command drops off during the build-up of the torque, the motor stops and the required torque is not reached. **Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force**

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	Menu item	Sub-menu item	poss. setting	Notes / Comments
			2: By torque1	Like „torque“, but in the end position range, the actuator keeps moving against the end position, even when the control command drops off, whilst switch-off torque is not reached, until the required torque is reached, or a control command against the current direction is registered. **Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force**
			3: By torque2	Like „torque1“, but in the end position range automatically an additional control command is generated to reach and hold the torque. If the torque decrease and the actuator is in the end position it will be restored automatically. e.g.: Changes due to temperature differences, settlement. **Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force**
			4: By travel1	Like „travel“, however, the actuator still continues to drive the set Overrun time after reaching the end position, even when the positioning command is released. Only relevant if Overrun time (P1.10, P1.11) is greater than 0. **Attention: For failsafe-actuators in failsafe-direction not applicable.**
P1.4	End limit	Switch-off Close	1: travel	see P1.3
			1: By torque	see P1.3
			2: By torque1	see P1.3
			3: By torque2	see P1.3
			4: By travel1	see P1.3
P1.5	End limit	Closing direction	CW (0)	Actuator is designed for clockwise = closing.
			CCW (1)	Reverse direction of rotation! Counterclockwise = closing. The crossing of all signals and commands is performed by the controller.
P1.6	End limit	Rot. sense pos.	0	Rotation sense of the Potentiometer. No function in ACTUSMART CM series.
			1	
P1.7	End limit	LED function	Close = green (0)	Definition of the LED colour of the CLOSED or OPEN end postion signalization.
			Close = red (1)	
			Close = green, yellow inv. (2)	Definition of the LED colour of the CLOSED or OPEN end postion signalization. Yellow LEDs (1 and 2) are inverted.
			Close = red, yellow inv. (3)	
P1.8	End limit	End limit hyst.	0.1. . . 10.0%	Hysteresis range for end position signals: Example: End position hysteresis 1% means that the End position OFF is reached when closing 0%, and will be left when opening only at 1%, i.e., a re-closing can only take place after leaving this hysteresis.

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	Menu item	Sub-menu item	poss. setting	Notes / Comments
P1.9	End limit	Ramp	0.1...100%	When approaching the end position, the speed is reduced.
P1.11	End limit	Overrun Open	0...60 s	Switch-off delay after reaching the end position see travel1 (P1.3, P1.4)
P1.12	End limit	Overrun Close	0...60 s	Switch-off delay after reaching the end position travel1 (P1.3, P1.4)

CAUTION: When installing the actuator on a gear or a thrust unit, please take into account the limits and factors of the gear / thrust unit at parametrization.

NOTE: When using end-limit switch-off by torque, the end position limit must be set before reaching the torque limit. Accordingly, the actuator will only signal the final end position if the configured torque and the associated end position are reached. If the end position is not reached, a torque error is reported (see section 1.2.3, page 8).

2.2 Parameter group: Torque

If no torque was specified with the order, the actuator is supplied from the factory with the maximum configurable torque.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P2.1	Torque	Open	40...100%	Switch-off torque in OPEN direction **NOTE:** The range can be restricted via the menu item P2.3.
P2.2	Torque	Close	40...100%	As P2.1 but in CLOSED direction.
P2.3	Torque	Torque limit	40...100%	Torque to protect the valve, the transmission, or the thrust unit. This value limits the setting of parameters P2.1 and P2.2 to prevent an erroneous increase above the allowed value of these two parameters.
P2.4	Torque	Latching	{0: off}	For self locking actuators
			1: on	For non-self locking actuators If a torque switch-off occurs in a direction, the actuator is locked to further move in that direction, until a move command in the other direction is signalled, i.e., the actuator stays locked to move in that direction, even if the torque decreases after torque switch-off.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P2.5	Torque	Boost Open	0...120% {0%}	Increase the torque during motor start (approx. 0.5 sec) in direction OPEN. On large flywheel masses, an unwanted shut-off can be avoided. Furthermore, break free effect can thus be achieved. When setting values are less than the switch-off torque in OPEN direction (P2.1) there will be no torque increasing during motor start. **CAUTION:** The torque increase should occur only if the valve is designed for it!
P2.6	Torque	Boost Close	0...120% {0%}	As P2.5 but in CLOSED direction.
P2.7	Torque	Hysteresis	{0: 50%}	After a torque switch-off, the current torque must be reduced by at least the hysteresis, to enable the actuator to be driven in the switch-off direction.
			1: 25%	
			2: 12%	
			3: 6%	
			4: 3%	
P2.8	Torque	Warning Open	40...100% [4)]	User-defined setting for issuing a warning when the set torque is reached in the OPEN direction. For an output of this warning, the binary outputs can be parameterized accordingly (see chapter 2.10, page 29. Quit occurs as soon as the torque is below the set value. To deactivate the warning, this parameter value is set to 0.
P2.9	Torque	Warning Zu	0...100% [4)]	Like P2.8, in CLOSE direction.

CAUTION: When installing the actuator on an additional gear, please take into account the corresponding values of the gear / thrust unit as you enter the actuator parameters. To achieve an effective output torque (incl. gear) / output power (including thrust unit) ratio, the factor gear/thrust unit must be considered.

[4)] From Firmware Version 1610

2.3 Parameter group: Travel Time

NOTE: This parameter group is available from firmware version 1610 and upwards.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P3.1	Travel Time	Warning Open	0...3600 sec.	User-defined setting for issuing a warning when the set operating time is exceeded in the OPEN direction (reaching the OPEN end position). The set travel time is valid for the total travel, and is calculated proportionally depending on the current position. The warning is acknowledged as soon as the OPEN signal is no longer present. For an output of this warning, the binary outputs can be parameterized accordingly (see chapter 2.10, page 29. The warning is only issued in the REMOTE operating mode. To deactivate the warning, this parameter value is set to 0.
P3.2	Travel Time	Warning Close	0...3600 sec.	As P3.1, in CLOSE direction.
P3.3	Travel Time	Tolerance	0...3600 sec.	An additional tolerance may be added for both travel times set in P3.1 and P3.2. The set tolerance time is independent from the actual position of the actuator.

2.4 Parameter group: Speed

NOTE: The parameter group speed only applies to actuators type ABCSC.V1.2 FU.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P4.1	Speed	Local Open	5 – 100%	Output speed for local operation in direction OPEN
P4.2	Speed	Local Close	5 – 100%	As P4.1 but in direction CLOSE
P4.3	Speed	Remote Open	5 – 100%	Output speed for remote operation in direction OPEN
P4.4	Speed	Remote Close	5 – 100%	As P4.3 but in direction CLOSE
P4.5	Speed	Emergency Open	5 – 100%	Output speed for emergency operation in direction OPEN
P4.6	Speed	Emergency Close	5 – 100%	As P4.5 but in direction CLOSE
P4.7	Speed	Torque-dependent.	5 – 100%	seal-tight speed. Speed at which the actuator runs near the end position at torque-dependent switch off (see P1.3 u. P1.4)
P4.8	Speed	Minimum	5 – 100%	Minimum speed

NOTE: 50% means nominal output speed (50Hz) and 100% meens that the output speed is 2 times faster (100Hz).

2.5 Parameter group: Ramp (optional)

The start ramp can be set separately for each operation mode. Thus, a 100% start ramp means, that the motor attains its maximum speed in about a second. Higher speeds (see section 2.4) lead to shorter runtimes. If the ramp is set below 100%, the starting time increases in an inversely proportional fashion.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P5.1	Ramp	Local	1...100%	Start ramp for local operation
P5.2	Ramp	Remote	1...100%	Start ramp for remote operation
P5.3	Ramp	Emergency	1...100%	Start ramp for emergency operation

2.6 Parameter group: Control

	Menu item	Sub-menu item	poss. setting	Notes / comments
P6.1	Control	Phase sequence	0: off	Phase sequence detection is deactivated. A wrong phase sequence will not be shown on the display and also not corrected. In case of wrong phase sequence the actuator will drive in the wrong direction.
			1: on	Phase sequence detection is activated. A wrong phase sequence will be shown on the display but not corrected. In case of wrong phase sequence the actuator cannot be driven electrical.
			2: auto	The phase sequence will be corrected automatically. The actuator will always drive in the right direction.
P6.2	Control	Ready delay	0...10 sec	Drop-out delay for the ready signal (bin. outputs)
P6.5	Control	24 V output	0	24 V auxiliary output is deactivated (see chapter 7 on page 62 for technical data). The function of the auxiliary input is still activated.
			1	24 V auxiliary output is activated (see chapter 7 on page 62 for technical data).
P6.6	Control	Min. impuls	0.1...2.0 sec	Minimum switch-on time of the motor.
P6.17	Control	Remote Display	0: off	The remote display is deactivated.
			1: Menu	Access to parameter menu is possible on the remote display. Motor control is deactivated on the remote display, i.e., LOCAL and REMOTE operating modes are handled by the main display.
			2: Menu/Control	Access to parameter menu and motor control is possible on the remote display and the main display. In case of a communication loss with the remote display, the actuator will be in operating mode OFF.
			3: Menu/Control (Fallback)	Access to parameter menu and motor control is possible on the remote display and the main display. In case of communication loss with the remote display, the actuator will fall back to the set operating mode on the main display.

2.7 Parameter group: User Level

From the Display firmware version 1.600 and upward, the parameter group no. 7 allows to set the default user levels accessed locally or via bus.

The user levels allow access restrictions to certain parameters. Depending on the user level read/write setting per parameter, the menu items can only be seen or edited, if the current user level is equal or higher than the required user level.
Parameters are assigned default user levels. These may be changed with the SmartTool2, if the set user level in the SmartTool2 is equal or higher than the current user level-setting of the parameter (-group).

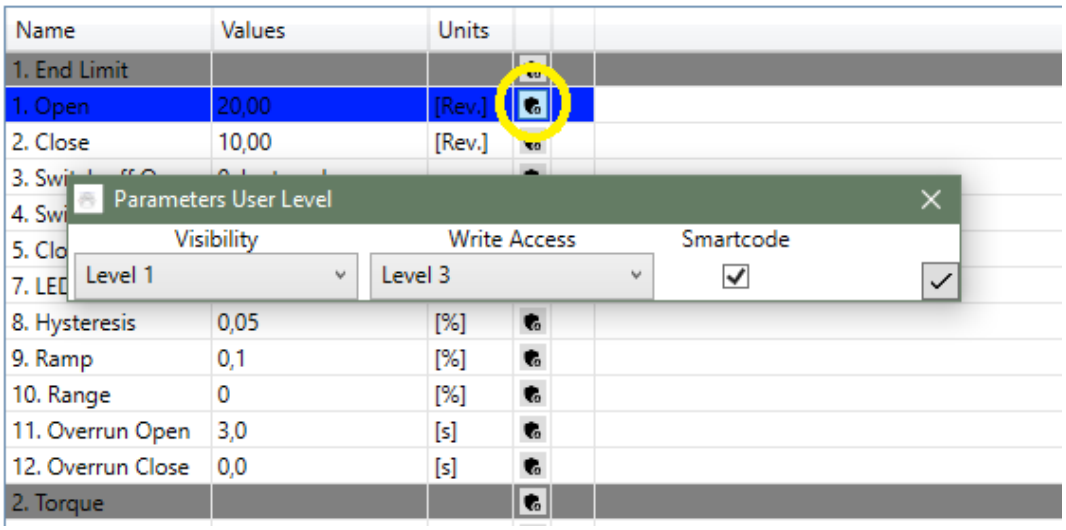

Figure 27: *Actuator parameters on the SmartTool2; Parameter user level can be set by clicking the button as marked above*

The following table shows the default passwords for the user levels:

User Level	Password Local	Password Wireless
1	LLVL1	WLVL1
2	LLVL2	WLVL2
3	LLVL3	WLVL3
4	LLVL4	WLVL4

The default passwords can be changed with the SmartTool2 (Adjust Wizard - Access tab, see figure 28) or directly on the actuator control unit ("P7.3 - Change Password").

NOTE: Editing the parameter "P7.4 - Change Password" will change the password for the current user level.

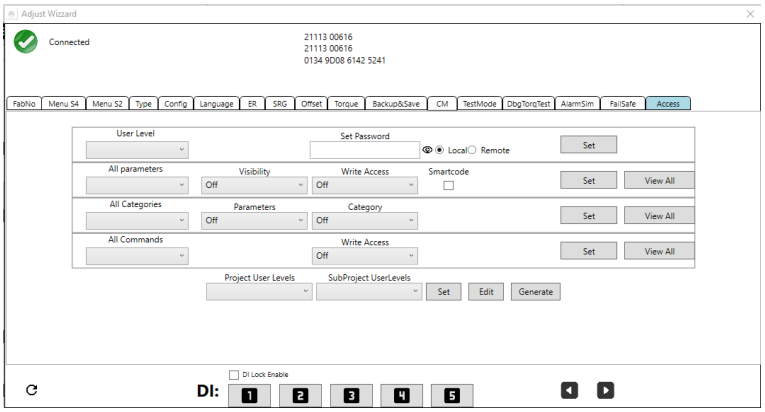

Figure 28: *SmartTool2 Adjust Wizard - Access Tab*

	Menu item	Sub-menu item	poss. setting	Notes / comments
P7.1	User Level	Local	0...6	Sets the default user level on the ACTUSMART control unit. The set user level will revert back to this user level, if the user level was changed with menu item "U - User level" after 3 minutes of inactivity or upon restarting the actuator. Password will be prompted, if the set user level is higher than the currently active user level.
P7.2	User Level	Bus	0...6	Sets the user level on access via Bus.
P7.3	User Level	Remote Display	0...6	Sets the user level on the remote display.
P7.4	User Level	Change Password	6-digit	Changes the password of the current active user level.
P7.5	User Level	Timeout	0. . . 60 min [5)]	This parameter sets the duration in minutes for which, in case of inactivity, the currently active user level is reset to the level set in parameter P7.1 after the set duration has elapsed.

NOTE: The parameters have preset user level settings. The table in section 2.21 on page 52 shows an overview of the default user level settings for all parameters.

[5)] From Firmware Version 1610

2.8 Parameter group: Position

In addition to OPEN and CLOSED end positions, you may define intermediate positions. These can be used as feedback signals for the binary outputs or as target value for fix position approach.

NOTE: If you change the end positions (see section 2.1, page 14), intermediate positions are retained percentage-wise, i.e., the absolute positions of the intermediate positions change.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P8.1	Position	Intermed.pos.1	TEACHIN 0...100%	Position value of intermediate position 1
P8.2	Position	Intermed.pos.2	TEACHIN 0...100%	see above
P8.3	Position	Intermed.pos.3	TEACHIN 0...100%	see above
P8.4	Position	Intermed.pos.4	TEACHIN 0...100%	see above
P8.5	Position	Emerg.position	TEACHIN 0...100%	Position value of the emergency position.
P8.6	Position	Hysteresis	0.1...10.0%	Hysteresis range of intermediate positions. Within this hysteresis, no repositioning occurs upon reaching the intermediate positions (option: fix position approach). Furthermore, the output functions for position = intermediate position are active within this range (see P10.1).
P8.7	Position	Intermed.pos.5	TEACHIN 0...100%	see above
P8.8	Position	Intermed.pos.6	TEACHIN 0...100%	see above
P8.9	Position	Intermed.pos.7	TEACHIN 0...100%	see above
P8.10	Position	Intermed.pos.8	TEACHIN 0...100%	see above
P8.11	Position	Dead Band	0...10%	Tolerance range for the position deviation (intermediate position - actual position), where no adjustment occurs. The deadband should not be set too low, to prevent actuator oscillation.
P8.12	Position	Gain	0...100%	The gain (gradient) affects the positioning to the target intermediate position. The smaller the gain selected (e.g. 20%), the earlier the actuator starts reducing its speed in case of speed variable actuators on approaching the target position. This leads to better positioning (smaller reachable deadband). A 100% setting disables this gradient.
P8.13	Position	Hysteresis	0...100%	This hysteresis value applies to the set value in "P8.11 - Dead Band".
P8.14	Position	Intermed.pos.9	TEACHIN 0...100%	see above
P8.15	Position	Intermed.pos.10	TEACHIN 0...100%	see above

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P8.16	Position	Intermed.pos.11	TEACHIN 0...100%	see above
P8.17	Position	Intermed.pos.12	TEACHIN 0...100%	see above
P8.18	Position	Intermed.pos.13	TEACHIN 0...100%	see above
P8.19	Position	Intermed.pos.14	TEACHIN 0...100%	see above
P8.20	Position	Intermed.pos.15	TEACHIN 0...100%	see above
P8.21	Position	Intermed.pos.16	TEACHIN 0...100%	see above

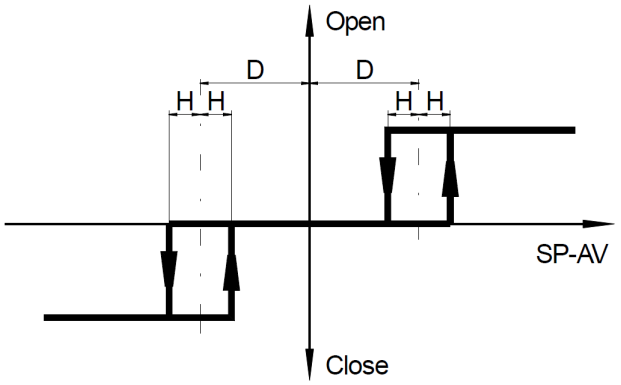

Figure 29: *Function principle of the dead band and hysteresis in conjunction with intermediate positions*

The figure above shows the working principle of the parameters "P8.11 - Dead Band" and "P8.13 - Hysteresis". The set dead band thresholds are added and subtracted from the intermediate positions. The hysteresis sets the threshold on the deadband thresholds. E.g. if the intermediate position is 50%, dead band is 1% and hysteresis is 50%, the dead band thresholds will be at 49% and 51%. On top of that, the hysteresis for the 49% threshold will be at 50% of the dead band value, which is ±0.5%; thus the hysteresis on the 49% dead band threshold is at 48.5% and 49.5%. The actuator will move toward 50%, if the actual position is below 48.5% and stop, if the actual position is between 49.5% and the "outer" hysteresis mirrored on the ordinate, which is 51.5% in this case.

NOTE: Please be aware, that a 100% setting for hysteresis will cause oscillation due to overlapping thresholds.

2.9 Parameter group: Binary inputs

The controller is equipped with up to 5 freely configurable binary inputs. Please find further information on technical data of the binary inputs in the *Operating Instructions for Actuators Type AB with Control Unit*. Binary inputs are also effective during actuator control via Profibus (option).

Default binary inputs are as follows:

Input 1: OPEN
Input 2: CLOSED
Input 3: STOP
Input 4: EMERGENCY OPEN
Input 5: EMERGENCY Closed

	Menu item	Sub-menu item	poss. setting	Notes / comments
P9.1	Bin. Input	Input 1	-1: Not activated	This input is not active, i.e., it is not shown in the status "S2 - Bin. Inputs.
			0: No Function	This input has no function.
			1: Open	OPEN command in REMOTE mode (selector switch in position REMOTE).
			2: Close	CLOSE command in REMOTE mode (selector switch in position REMOTE).
			3: Stop	STOP command in REMOTE mode (selector switch in position REMOTE).
			4: Open Lock	Self-hold for OPEN, i.e., a short pulse is sufficient and the actuator moves then into the end position. Use the STOP command to stop the actuator.
			5: Close Lock	Self-hold for CLOSE, see OPEN SELF-HOLD
			6: Emergency Open	Superimposed run command; run the actuator in direction OPEN regardless of whether the selection switch is set to REMOTE or LOCAL operation
			7: Emergency Close	Superimposed run command; run the actuator in direction CLOSE regardless of whether the selection switch is set to REMOTE or LOCAL
			8: Deblock	The actuator may be operated only with a switched signal. Both in local and remote operation
			9: Open/Close	The actuator moves towards OPEN if input is active and towards CLOSED otherwise
			10: Close/Open	The actuator moves towards CLOSED if input is active and towards OPEN otherwise
			11: Positioner On	Release of the postioner
			12: Open inv.	As OPEN but active low
			13: Close inv.	As CLOSE but active low
			14: Stop inv.	As STOP but active low
			15: Open Lock inv.	As Open Self-Hold but active low
			16: Close Lock inv.	As Closed Self-Hold. but active low
			17: Emergency-Open inv.	As Emergency-Open but active low
			18: Emergency-Close inv.	As Emergency-Close but active low
			19: Block	with activated (switched) signal, the actuator is locked for operation also in local mode

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			20: Positioner off	Positioner lock
			21: Deblock Local	The actuator may be operated only with a switched signal.
			22: Block Local	as Release Local but active low
			23: Emerg. Open Lock	Trigger lock OPEN (in LOCAL and REMOTE mode). Actuator moves with the highest priority to OPEN; command continues internally active after reaching the end position OPEN. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			24: Emerg. Close Lock	Trigger lock CLOSE (in LOCAL and REMOTE mode). Actuator moves with the highest priority to CLOSED; command continues internally active after reaching the end position CLOSED. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			25: Emerg. Unlock	Drop the lock
			26: Failsafe	Trigger the failsafe function in all operating modes (only functional in Failsafe actuators).
			27: Failsafe inv.	As Failsafe, but active low
			28: Emerg. Open Lock inv.	As Emerg. Open Lock, but active low
			29: Emerg. Close Lock inv.	As Emerg. Close Lock, but active low
			30: Emerg. Unlock inv.	As Emerg. Unlock, but active low
			31: Intermediate position1	Approach intermediate position 1 (P8.1) in REMOTE mode (fix position approach). There is no repositioning upon reaching the intermediate position within the hysteresis (see P8.6). Higher priority than intermediate position 2, 3 and 4
			32: Intermediate position2	As intermediate position 1, but with higher priority than intermediate positions 3 and 4
			33: Intermediate position3	As intermediate position 1, but with higher priority than intermediate position 4
			34: Intermediate position4	As intermediate position 1, but with lowest priority.
			35: Emergency position	Approach emergency position (P 8.5). As intermediate position 1, but with higher priority than intermediate positions 1, 2
			36: Intermediate position1 inv.	As Intermediate position 1, but active low
			37: Intermediate position2 inv.	As Intermediate position 2, but active low
			38: Intermediate position3 inv.	As Intermediate position 3, but active low
			39: Intermediate position4 inv.	As Intermediate position 4, but active low
			40: Emergency position inv.	As Emergency position, but active low

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			41: Travel Open	reserved for future use
			42: Travel Close	reserved for future use
			43: Travel Open inv.	reserved for future use
			44: Travel Close inv.	reserved for future use
			45: Failsafe lock	reserved for future use (only for Failsafe actuators)
			46: Failsafe lock inv.	reserved for future use (only for Failsafe actuators)
			47: Intermed.pos.Bit0	Intermed.pos.Bit0 to Intermed.pos.Bit3 allow to signal intermediate positions 1 to 16 through a bit pattern (binary to decimal; decimal value + 1 corresponds to the Int.pos.). Bit3 is the MSB. E.g. to move to Int.pos.1, all Bits should be 0; to move to Int.pos.3, Bit 1 should be 1.
			48: Intermed.pos.Bit1	see 47: Intermed.pos.Bit0
			49: Intermed.pos.Bit2	see 47: Intermed.pos.Bit0
			50: Intermed.pos.Bit0 inv.	As 47: Intermed.pos.Bit0 but active low
			51: Intermed.pos.Bit1 inv.	see 50: Intermed.pos.Bit0 inv.
			52: Intermed.pos.Bit2 inv.	see 50: Intermed.pos.Bit0 inv.
			53: PVST Start	Start PVST (optional, see PVST section)
			54: PVST Start inv.	As 53: PVST Start, but active low.
			55: Intermed.pos.Bit3	see 47: Intermed.pos.Bit0
			56: Intermed.pos.Bit3 inv.	see 50: Intermed.pos.Bit0 inv.
P9.2	Bin. Input	Input 2	see Input 1	
P9.3	Bin. Input	Input 3	see Input 1	
P9.4	Bin. Input	Input 4	see Input 1	
P9.5	Bin. Input	Input 5	see Input 1	
P9.9	Bin. Input	Input Channel 1	see Input 1	Function (see Input 1) for virtual input channel 1. See section 2.9.1 for more information about the virtual inputs.
P9.10	Bin. Input	Input Channel 2	see Input 1	See Input Channel 1.
P9.11	Bin. Input	AND Mask 1	-32768...+32767	See section 2.9.1 for the usage of virtual inputs.
P9.12	Bin. Input	AND Mask 2	-32768...+32767	
P9.13	Bin. Input	AND Mask 3	-32768...+32767	
P9.14	Bin. Input	AND Mask 4	-32768...+32767	

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P9.15	Bin. Input	AND Mask 5	-32768...+32767	
P9.16	Bin. Input	AND Mask 6	-32768...+32767	
P9.17	Bin. Input	AND Mask 7	-32768...+32767	
P9.18	Bin. Input	AND Mask 8	-32768...+32767	
P9.19	Bin. Input	OR Mask 1	-32768...+32767	
P9.20	Bin. Input	OR Mask 2	-32768...+32767	

NOTE: For optional functions such as a relay board please refer to the corresponding IOM.

2.9.1 Optional: Virtual Input

Upon order or by unlocking via Smartcode, the virtual input functionality may be activated, to extend and/or to define a logic switching through the input signal states. This behaviour is achieved by using logic AND and OR gates.

Each AND gate is connected with all binary inputs twice, once directly and once through an inverted input. The physical binary inputs are assigned a bit of a bit field, i.e., input 1 is assigned to bit 0, input 2 is assigned to bit 1, inverted input 1 is assigned to bit 8, inverted input 2 is assigned to bit 9 and so forth (see figure 30 for a visual representation). By entering the sum of all requested bits as a decimal value for an AND Mask, the AND gate will deliver a TRUE output value, if the input signals are correct.
An AND gate will deliver a TRUE output value, if all input values are TRUE (consider inverted inputs). If a binary input is not defined, it is deemed as don't care.

The OR gates are connected to all AND gate outputs. The same bit-wise assignation as for the binary inputs applies for the designation of the AND gate outputs, i.e., AND mask 1 is bit 0, AND mask 2 is bit 1 and so forth (see figure 30 for a visual representation). By entering the sum of all requested bits as a decimal value for an OR Mask, the OR gate will deliver a TRUE output value, if the input signals are correct.
An OR gate will deliver a TRUE output value, if at least one of the input values is true (consider inverted inputs). If an AND gate is not defined, it is deemed as don't care.

The following table shows the binary input assignations in binary and their decimal value.

NOTE: There are two separate bit fields; one for the binary inputs and the other one for the AND mask outputs.

Input source	Bit location	Decimal Value
Bin. Input 1	0000 0000 0000 0001	1
Bin. Input 2	0000 0000 0000 0010	2
Bin. Input 3	0000 0000 0000 0100	4
Bin. Input 4	0000 0000 0000 1000	8
Bin. Input 5	0000 0000 0001 0000	16
Inv. bin. Input 1	0000 0001 0000 0000	256
Inv. bin. Input 2	0000 0010 0000 0000	512
Inv. bin. Input 3	0000 0100 0000 0000	1024
Inv. bin. Input 4	0000 1000 0000 0000	2048
Inv. bin. Input 5	0001 0000 0000 0000	4096
AND Mask 1 out	0000 0001	1
AND Mask 2 out	0000 0010	2
AND Mask 3 out	0000 0100	4
AND Mask 4 out	0000 1000	8
AND Mask 5 out	0001 0000	16
AND Mask 6 out	0010 0000	32
AND Mask 7 out	0100 0000	64
AND Mask 8 out	1000 0000	128

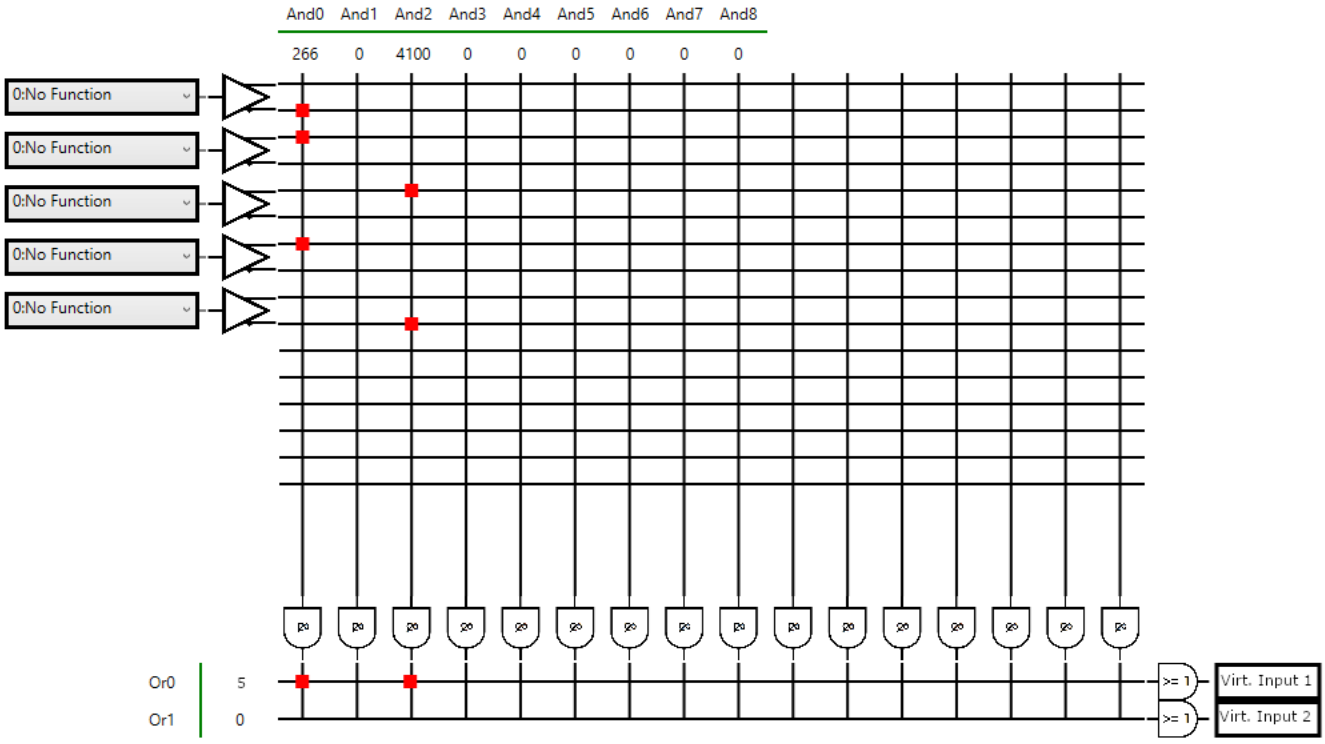

Figure 30: *An example of the configuration of the AND and OR masks on the SmartTool2 parameterization software.*

The example above shows, that the AND gate 0, which is AND mask 1, requires a FALSE signal on bin. input 1, a TRUE signal on bin. input 2 and a TRUE signal on bin. input 4. Summing up the decimal value of these nodes equals the value, which has to be set in P9.11 - AND Mask 1 (NOT(BinIn1) + BinIn2 + BinIn4 corresponds to 256 + 2 + 8 = 266). The AND gate will output TRUE, only if the BinIn1 signal is FALSE, BinIn2 is TRUE and BinIn4 is TRUE, otherwise it stays FALSE.
The same principle applies to the OR gate 0, which is OR Mask 1. The OR gate needs at least a TRUE signal from AND gate 0 or from AND gate 2. Summing up the decimal value of these nodes equals the value, which has to be set in P9.19 - OR Mask 1 (And0 + And2 corresponds to 1 + 4 = 5). The OR gate will output TRUE, if at least one of the two AND gates output a TRUE value.

2.10 Parameter group: Binary outputs

The controller is equipped with up to 8 freely configurable binary outputs. Please find further information on technical data of the binary outputs in the *Operating Instructions for Actuators Type AB with Control Unit*. Provided with external supply, binary outputs are optically isolated from the rest of the controller.

Default binary outputs are as follows:

Output 1: Ready	Output 2: End position OPEN
Output 3: End position CLOSED	Output 4: Run OPEN
Output 5: Run CLOSED	Output 6: Torque
Output 7: LOCAL	Output 8: REMOTE

	Menu item	Sub-menu item	poss. setting	Notes / comments
P10.1	Bin. Output	Output 1	0: No Function	The output has no function.
			1: Ready	Actuator is ready
			2: Fault	General fault; actuator is not ready
			3: Open	Actuator is in open position
			4: Closed	Actuator is in closed position
			5: Running Open	Actuators runs in direction Open
			6: Running Closed	Actuators runs in direction Closed
			7: Running	Actuator is running in either Open or Closed direction
			8: Torque Open	Switch-off torque was reached in Open direction, actuator has been switched off
			9: Torque Closed	Switch-off torque was reached in Closed direction, actuator has been switched off
			10: Torque	Switch-off torque was reached in either Closed or Open direction
			11: Travel Open	The Open end position has been reached
			12: Travel Closed	The Closed end position has been reached
			13: Pos. > Int.1	Position > Intermediate position 1
			14: Pos. < Int.1	Position < Intermediate position 1
			15: Pos. > Int.2	Position > Intermediate position 2
			16: Pos. < Int.2	Position < Intermediate position 2
			17: Pos. > Int.3	Position > Intermediate position 3
			18: Pos. < Int.3	Position < Intermediate position 3
			19: Pos. > Int.4	Position > Intermediate position 4
			20: Pos. < Int.4	Position < Intermediate position 4

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			21: Local	Local oerating mode (selector switch in position Local)
			22: Remote	Remote operating mode (selector switch in position Remote)
			23: Off	Off operating mode (selector switch in the Off position)
			24: Mot.temp.Warning	The motor temperature is above the warning threshold.
			25: Mot.temp.Switchoff	The motor temperature is above the motor switchoff threshold.
			26: Always	Signal is always on
			27: Never	Signal is always off
			28: Bin. Input 1	Forwarding of binary input to output
			29: Bin. Input 2	Forwarding of binary input to output
			30: Bin. Input 3	Forwarding of binary input to output
			31: Bin. Input 4	Forwarding of binary input to output
			32: Bin. Input 5	Forwarding of binary input to output
			33: Torque Open Masked	As Torque OPEN, but it will supress (mask) this signal in the end position upon torque-dependent switch-off.
			34: Torque Closed Masked	As Torque CLOSED, but it will supress (mask) this signal in the end position upon torque-dependent switch-off.
			35:Ready Remote	Ready and Remote operating mode
			36: Ready Local	Ready and Local operating mode
			37: Ready Local/remote	Ready and Local or Remote mode
			38: Emerg. Open Locked	Lock OPEN is enabled. OPEN command is internally queued with the highest priority and will not be dropped even in the end position.
			39: Emerg. Closed Locked	Lock CLOSED is enabled. CLOSED command is internally queued with the highest priority and will not be dropped even in the end position.
			40: Failsafe OK1	Failsafe OK (only for Failsafe actuators)
			41: Failsafe OK2	Failsafe OK and Ready (only for Failsafe actuators)
			42: Failsafe OK3	Failsafe OK,Ready and Remote (only for Failsafe actuators)
			43: Emerg. Locked	Lock Open or Lock Closed is enabled.
			44: Ready/TorqueOK	Actuator is ready and no torque switch-off
			45: Ready / Remote / TorqueOK	Actuator is ready for operation in REMOTE mode and no torque switch-off
			46: Pos.=Int1	Position = Intermediate position 1. The width of the interval is set with the parameter P8.6.
			47: Pos.=Int2	Position = Intermediate position 2. The width of the interval is set in parameter P8.6.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			48: Pos.=Int3	Position = Intermediate position 3. The width of the interval is set in parameter P8.6.
			49: Pos.=Int4	Position = Intermediate position 4. The width of the interval is set in parameter P8.6.
			50: Pos.=EmergPos	Position = emergency position. The width of the interval is set in parameter P8.6.
			51: Bus Bit 1	In existing bus interface (hardware option), the output is set according to the selected bit bus.
			52: Bus Bit 2	
			53: Bus Bit 3	
			54: Bus Bit 4	
			55: Bus Bit 5	
			56: Bus Bit 6	
			57: Bus Bit 7	
			58: Bus Bit 8	
			59: Virtual 1	Configurable output function
			60: Virtual 2	
			61: Virtual 3	
			62: Virtual 4	
			63: Control OK	The SMARTCON control is operational.
			64: Control voltage OK	The auxiliary voltage for the SMARTCON control is OK. This function is only available if the auxiliary voltage output is not switched on (P6.5 to 0).
			65: PVST OK	The PVST was successful.
			66: PVST Failure	The PVST was not successful(see PVST section).
			67: PVST Active	A PVST was triggered. The actuator is running a PVST.
			68: Emerg. OPEN	Emergency OPEN command is active. The signal remains active, as long as the emergency command is active, even if the end limit is reached.
			69: Emerg. CLOSE	Emergency CLOSE command is active. The signal remains active, as long as the emergency command is active, even if the end limit is reached.
			70: Analog In. 1 Fault	There is no or a faulty signal on the analog input 1.
			71: Analog In. 2 Fault	There is no or a faulty signal on the analog input 2.
			72: Phase Sequence Fault	Cause on basis: Active phase sequence detection on single phase actuators, loss of main power while connected to external 24VDC auxiliary voltage, or loss of phase 2.
			73: Power Supply Fault	No power supply to the power electronics (when the controller is powered from the auxiliary power input). Defect of power electronics.
			74: Inverter Fault	The inverter is defective or the wiring is faulty (Only for CM.V1.2 actuator series).
			75: Manual Override	Manual override is active (For FailSafe-Actuators); see the FailSafe-section for more information about the manual override.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			76: Travel Sensor Fault	The travel measurement is out of range or the wiring is defective for AB CSC.V1.2 actuators. The travel sensor is not calibrated for CM actuators.
			77: Torque Sensor Fault	Potentiometer fault on Basis, or cable is broken.
			78: Bus Fault	No communication with the optional bus.
			79: Bus Watchdog	Watchdog for bus communication has reacted.
			80: Undervoltage Warning	The input voltage is below the regular voltage range, but motor operation is still possible.
			81: Battery Low	Battery on display board is empty, loss of time/date or counter values possible.
			83: Undervoltage Fault	The input voltage is too low, The motor is switched off, until the input voltage is in the regular voltage range.
			84: Undervoltage Switchoff	The input voltage dropped below the lower threshold multiple times. The motor is turned off for 5 minutes. This error can be acknowledged by switching the selector switch to OFF or by turning the actuator off and on.
			85: Overvoltage Warning	The input voltage is over the regular voltage range, but motor operation is still possible.
			86: Internal Fault	Internal communication error between electrical components, i.e. Internal Comm.E error, or Internal Comm.L error or Internal Comm.D error.
			87: Torque Masked	Is set, if 33: Torque Open Mask or 34: Torque Close Mask is set.
			88: Torque Open Exceeded	The set torque value in parameter P2.8 is exceeded.
			89: Torque Close Exceeded	The set torque value in parameter P2.9 is exceeded.
			90: Torque Exceeded	The set torque value in parameter P2.8 or P2.9 is exceeded.
			91: Travel Time Open Exceeded	The set time in parameter P3.1 is exceeded
			92: Travel Time Close Exceeded	The set time in parameter P3.2 is exceeded
			93: Travel Time Exceeded	The set time in parameter P3.1 or P3.2 is exceeded
P10.2	Bin. Output	Output conf. 1	0: normal	Output 1 is set to normal, i.e. if the condition in point P10.1 is met, Output 1 is set to HIGH (active HIGH).
			1: inverted	If the condition in point P10.1 is met, Output 1 is set to LOW (active LOW).
			2: norm. flashing	If the condition in point P10.1 is met, Output 1 starts blinking (active HIGH).
			3: inv. flashing	If the condition in point P10.1 is not met, Output 1 starts blinking (otherwise it is set to HIGH).
P10.3	Bin. Output	Output 2	see Output 1	

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P10.4	Bin. Output	Output 2 Konf.	see Output 1 conf.	
P10.5	Bin. Output	Output 3	see Output 1	
P10.6	Bin. Output	Output 3 Konf.	see Output 1 conf.	
P10.7	Bin. Output	Output 4	see Output 1	
P10.8	Bin. Output	Output 4 Konf.	see Output 1 conf.	
P10.9	Bin. Output	Output 5	see Output 1	
P10.10	Bin. Output	Output 5 Konf.	see Output 1 conf.	
P10.11	Bin. Output	Output 6	see Output 1	
P10.12	Bin. Output	Output 6 Konf.	see Output 1 conf.	
P10.13	Bin. Output	Output 7	see Output 1	
P10.14	Bin. Output	Output 7 Konf.	see Output 1 conf.	
P10.15	Bin. Output	Output 8	see Output 1	
P10.16	Bin. Output	Output 8 Konf.	see Output 1 conf.	
P10.29	Bin. Output	Virtual 1	see Output 1	Function (see Output 1) for virtual output 1. See section 2.10.1 for more information about the virtual inputs.
P10.30	Bin. Output	Virtual 2	see Output 1	see Virtual 1
P10.31	Bin. Output	Virtual 3	see Output 1	see Virtual 1
P10.32	Bin. Output	Virtual 4	see Output 1	see Virtual 1
P10.33	Bin. Output	Virtual 5	see Output 1	see Virtual 1
P10.34	Bin. Output	Virtual 6	see Output 1	see Virtual 1
P10.35	Bin. Output	Virtual 7	see Output 1	see Virtual 1
P10.36	Bin. Output	Virtual 8	see Output 1	see Virtual 1
P10.37	Bin. Output	AND Mask 1	-32768...+32767	See section 2.10.1 for more information about the virtual inputs.
P10.38	Bin. Output	AND Mask 2	-32768...+32767	
P10.39	Bin. Output	AND Mask 3	-32768...+32767	
P10.40	Bin. Output	AND Mask 4	-32768...+32767	
P10.41	Bin. Output	AND Mask 5	-32768...+32767	
P10.42	Bin. Output	AND Mask 6	-32768...+32767	
P10.43	Bin. Output	AND Mask 7	-32768...+32767	
P10.44	Bin. Output	AND Mask 8	-32768...+32767	
P10.45	Bin. Output	AND Mask 9	-32768...+32767	
P10.46	Bin. Output	AND Mask 10	-32768...+32767	
P10.47	Bin. Output	AND Mask 11	-32768...+32767	
P10.48	Bin. Output	AND Mask 12	-32768...+32767	
P10.49	Bin. Output	AND Mask 13	-32768...+32767	
P10.50	Bin. Output	AND Mask 14	-32768...+32767	
P10.51	Bin. Output	AND Mask 15	-32768...+32767	
P10.52	Bin. Output	AND Mask 16	-32768...+32767	

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P10.53	Bin. Output	OR Mask 1	-32768...+32767	
P10.54	Bin. Output	OR Mask 2	-32768...+32767	
P10.55	Bin. Output	OR Mask 3	-32768...+32767	
P10.56	Bin. Output	OR Mask 4	-32768...+32767	

NOTE: When using the parameters torque-dependent OPEN or torque-dependent CLOSED (see section 2.1, page 14, items P1.3 and P1.4), the actuator will only be open or closed when the set torque and the associated end position is reached. If the end position is not reached, a torque error is reported (see section 1.2.3, page 8).

NOTE: For optional functions such as a relay board please refer to the corresponding IOM.

2.10.1 Optional: Virtual Output

Upon order or by unlocking via Smartcode, the virtual output functionality may be activated, to extend and/or to define a logic switching through the output signal states. This behaviour is achieved by using logic AND and OR gates.

Each AND gate is connected with all binary outputs twice, once directly and once through an inverted input. The physical binary outputs are assigned a bit of a bit field, i.e., output 1 is assigned to bit 0, input 2 is assigned to bit 1, inverted input 1 is assigned to bit 8, inverted input 2 is assigned to bit 9 and so forth (see figure 31 for a visual representation). By entering the sum of all requested bits as a decimal value for an AND Mask, the AND gate will deliver a TRUE output value, if the signals are correct.
An AND gate will deliver a TRUE output value, if all binary output values are TRUE (consider inverted inputs). If a binary output is not defined, it is deemed as don't care.

The OR gates are connected to all AND gate outputs. The same bit-wise assignation as for the binary outputs applies for the designation of the AND gate outputs, i.e., AND mask 1 is bit 0, AND mask 2 is bit 1 and so forth (see figure 31 for a visual representation). By entering the sum of all requested bits as a decimal value for an OR Mask, the OR gate will deliver a TRUE output value, if the input signals are correct.
An OR gate will deliver a TRUE output value, if at least one of the input values is true (consider inverted inputs). If an AND gate is not defined, it is deemed as don't care.

The following table shows the binary input assignations in binary and ther decimal value.

NOTE: There are two separate bit fields; one for the binary inputs and the other one for the AND mask outputs.

Input source	Bit location	Decimal Value
Bin. Output 1	0000 0000 0000 0001	1
Bin. Output 2	0000 0000 0000 0010	2
Bin. Output 3	0000 0000 0000 0100	4
Bin. Output 4	0000 0000 0000 1000	8
Bin. Output 5	0000 0000 0001 0000	16
Bin. Output 6	0000 0000 0010 0000	32
Bin. Output 7	0000 0000 0100 0000	64
Bin. Output 8	0000 0000 1000 0000	128
Inv. bin. Input 1	0000 0001 0000 0000	256
Inv. bin. Input 2	0000 0010 0000 0000	512
Inv. bin. Input 3	0000 0100 0000 0000	1024
Inv. bin. Input 4	0000 1000 0000 0000	2048
Inv. bin. Input 5	0001 0000 0000 0000	4096
Inv. bin. Input 6	0010 0000 0000 0000	8192
Inv. bin. Input 7	0100 0000 0000 0000	16384
Inv. bin. Input 8	1000 0000 0000 0000	32768
AND Mask 1 out	0000 0000 0000 0001	1
AND Mask 2 out	0000 0000 0000 0010	2
AND Mask 3 out	0000 0000 0000 0100	4
AND Mask 4 out	0000 0000 0000 1000	8
AND Mask 5 out	0000 0000 0001 0000	16
AND Mask 6 out	0000 0000 0010 0000	32
AND Mask 7 out	0000 0000 0100 0000	64
AND Mask 8 out	0000 0000 1000 0000	128
AND Mask 9 out	0000 0001 0000 0000	256
AND Mask 10 out	0000 0010 0000 0000	512
AND Mask 11 out	0000 0100 0000 0000	1024
AND Mask 12 out	0000 1000 0000 0000	2048
AND Mask 13 out	0001 0000 0000 0000	4096
AND Mask 14 out	0010 0000 0000 0000	8192
AND Mask 15 out	0100 0000 0000 0000	16384
AND Mask 16 out	1000 0000 0000 0000	32768

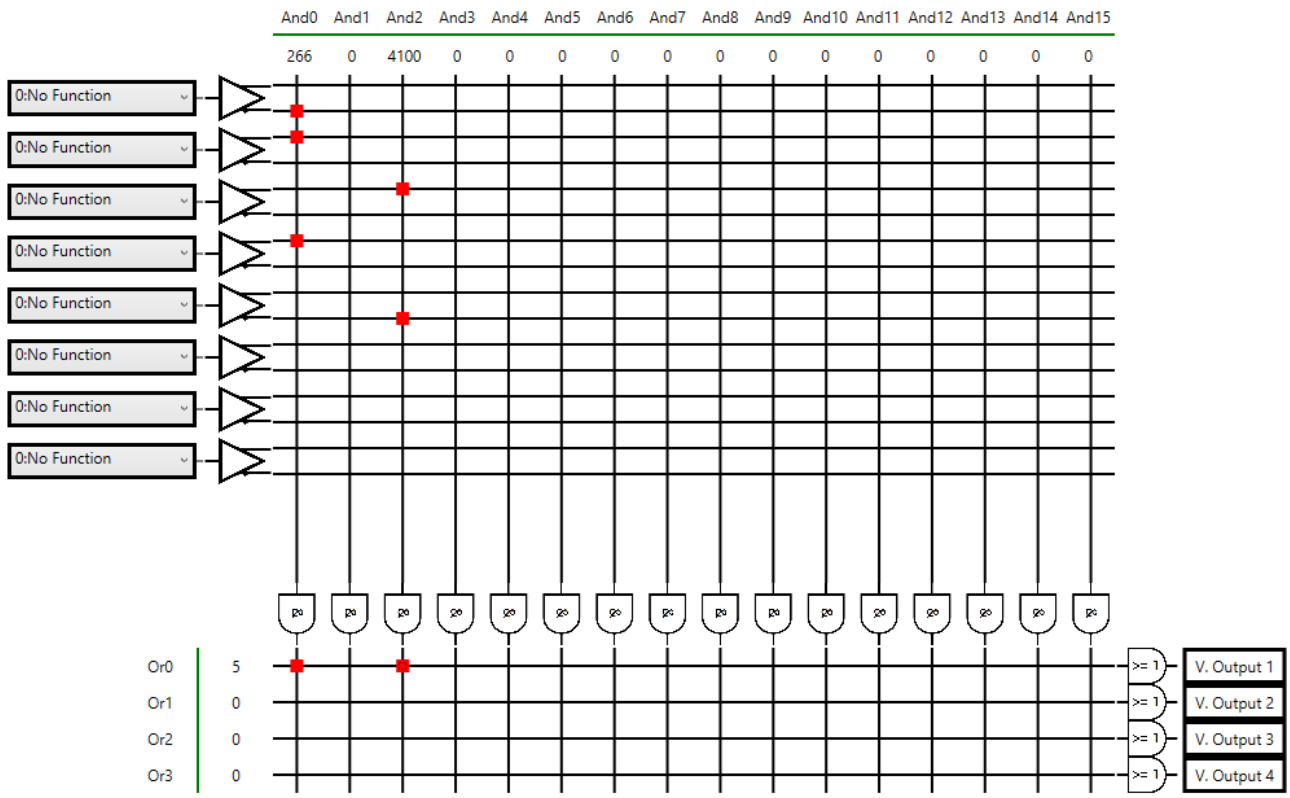

Figure 31: *An example of the configuration of the AND and OR masks on the SmartTool2 parameterization software.*

The example above shows, that the AND gate 0, which is AND mask 1, requires a FALSE signal on bin. output 1, a TRUE signal on bin. output 2 and a TRUE signal on bin. output 4. Summing up the decimal value of these nodes equals the value, which has to be set in P10.37 - AND Mask 1 (NOT(BinOut1) + BinOut2 + BinOut4 corresponds to 256 + 2 + 8 = 266). The AND gate will output TRUE, only if the BinOut1 signal is FALSE, BinOut2 is TRUE and BinOut4 is TRUE, otherwise it stays FALSE.
The same principle applies to the OR gate 0, whis is OR Mask 1. The OR gate need at least a TRUE signal from AND gate 0 or from AND gate 2. Summing up the decimal value of these nodes equals the value, which has to be set in P10.53 - OR Mask 1 (And0 + And2 corresponds to 1+4 = 5). The OR gate will output TRUE, if at least one of the two AND gates output a TRUE value.

2.11 Parameter group: Analog Signal (optional)

Analog signal (or position output) is used to indicate the current position of the actuator using 0/4. . . 20 mA; it can be retrofitted using a Smartcode.
If this option is not enabled, the menu point shows the message "inactive".
No adjustment to the end positions or the travel is required. Adjustment is automatically performed during the configuration of travel limit positions (see section 2.1, page 14).
No further settings are necessary for torque-dependent switch-off, because the controller exclusively uses travel limit positions for the calculation, regardless of whether this is defined by the torque or the travel limit positions.

The factory default setting is:
4 mA at 0% position 20 mA at 100% position

	Menu item	Sub-menu item	poss. setting	Notes / comments
P11.1	Position-Output	Function 1	0: off	mA output disabled
			1: Position	mA output corresponds to the actual position value.
			2: Pos. Valvechar.	mA output corresponds to the actual position value taking into account the valve characteristic.
			3: Torque 1	mA output corresponds to the actual torque value.
				torque = 100% Close: mA output = start
				torque = 0%: mA output = center
				torque = 100% Open: mA output = end
			4: Torque 2	mA output corresponds to the actual torque value.
				torque = 100% Close: mA output = end
				torque = 0%: mA output = start
				torque = 100% Open: mA output = end
			5: Torque 3	mA output corresponds to the actual torque value.
				torque = 150% Close: mA output = start
				torque = 0%: mA output = center
				torque = 150% Open: mA output = end
			6: Torque 4	mA output corresponds to the actual torque value.
				torque = 150% Close: mA output = end
				torque = 0%: mA output = start
				torque = 150% Open: mA output = end
			7: Ext. Setpoint 1	Passes on the mA input signal on ext. setpoint input.
			8: Ext. Setpoint 2	Passes on the raw mA input signal on ext. setpoint input.
P11.2	Analog Signal	Begin 1 (at 0%)	0. . . 20.5 mA {4 mA}	mA value for the Closed (0%) position
P11.3	Analog Signal	End 1 (at 100%)	0. . . 20.5 mA {20 mA}	mA value for the On (100%) position
P11.4	Analog Signal	Calib. 20 mA 1	-10%. . . +10%	Calibrating the output position during the setting of this parameter will output a 20 mA (100%) signal. Use this parameter to calibrate accurately the 20 mA output signal (e.g., if you measure 19.8 mA at the output, just add 1% (0.2 mA. . . 1% of 20 mA) to the displayed value).
P11.5	Analog Signal	Function 2	see Function 1	

P11.6	Analog Signal	Begin 2 (at 0%)	see Begin 1	
P11.7	Analog Signal	End 2 (at 100%)	see End 1	
P11.8	Analog Signal	Calib. 20 mA 2	see Calib. 20 mA 1	

2.12 Parameter group: Step Mode

Step mode operation can be used to extend the operating time in certain ranges or for the whole travel; it is available in local, remote and emergency mode. Step mode operation can be activated individually for the directions OPEN and CLOSED. Cycle start, cycle end, cycle duration and interval time can be set separately for both directions (see Figure 32, page 39).

	Menu item	Sub-menu item	poss. setting	Notes / comments
P12.1	Step Mode	Function	0: Not activated	Step mode operation is disabled
			1: Activated	Step mode operation is enabled in LOCAL, REMOTE and EMERGENCY operation
			2: Only Local	Step mode mode is only enabled in LOCAL mode
			3: Only Remote	Step mode mode is only enabled in REMOTE mode
			4: Only Local + Remote	Step mode mode is enabled in REMOTE and LOCAL mode
P12.2	Step Mode	Start Open	0...100%	In OPEN direction, position in % from which the step mode operation should start.
P12.3	Step Mode	End Open	0...100%	In OPEN direction, position in % of which the step mode operation should end.
P12.4	Step Mode	ON-Time Open	0.1...60	Runtime in OPEN direction
P12.5	Step Mode	OFF-Time Open	0.2...60	Pause time in OPEN direction
P12.6	Step Mode	Start Close	0...100%	In CLOSED direction, position in % from which the step mode operation should start.
P12.7	Step Mode	End Close	0...100%	In CLOSED direction, position in % of which the step mode operation should end.
P12.8	Step Mode	ON-Time Close	0.1...60	Runtime in Closed direction
P12.9	Step Mode	OFF-Time Close	0.2...60	Pause time in Closed direction
P12.10	Step Mode	Timebase	0: Seconds	Time basis for run and pause times
			1: Minutes	
P12.11	Step Mode	Speed adaption	0: Off	Speed adaption not activated. Normal Step Mode.
			1: On	Speed adaption is activated. The speed is reduced according to the runtime and pause time in the step mode range. (Example: Running time 1 sec and pause time 1 sec results in half the speed). If the minimum speed is undershot, the actuator clocks in the converted ratio with the minimum speed. The speed adjustment is only applicable to actuators of the type CM and AB CSC.

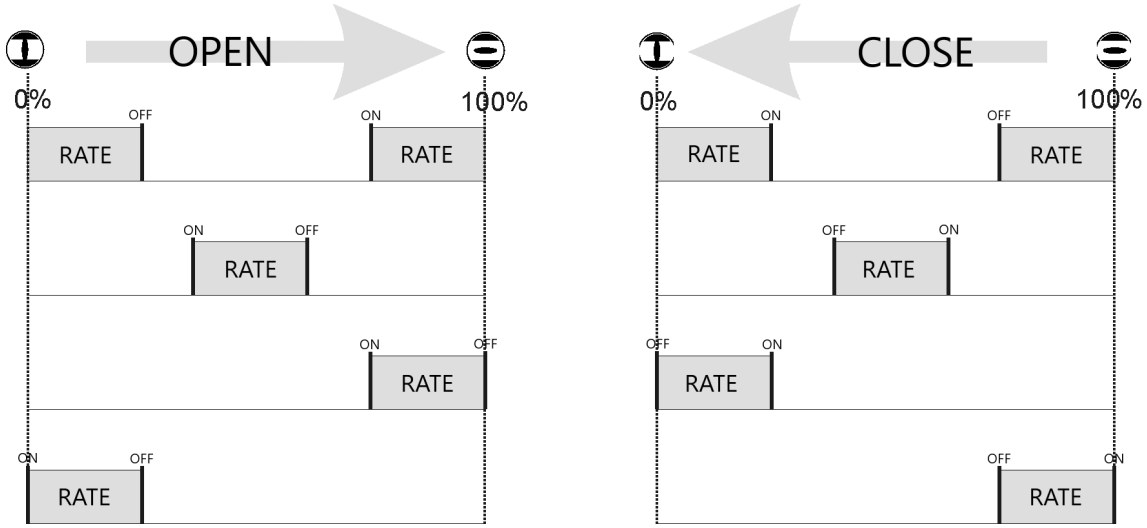

Figure 32

CAUTION: It is important to ensure that the mode of operation is not exceeded! The running info on the actuator (see section 1.2.3, page 8) only flashes while the drive is running, i.e. during the break, no flash!

2.13 Parameter group: Positioner (optional)

The positioner SR option is used to control the electric actuator by means of a set point input 0/4...20 mA signal. The SR helps control the position of the actuator, i.e. the positioner ensures that the actual value and thus the position of the actuator matches the desired set point.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P13.1	Positioner	Function	0: Off	Positioner disabled
			1: Position	mA input for the position setpoint
			2: Pos. valvechar.	mA input for the position setpoint, taking into account the valve characteristic
P13.2	Positioner	Begin (at 0%)	0...20.5 mA {4.0 mA}	mA value of the setpoint for the CLOSED (0%) position
P13.3	Positioner	End (at 100%)	0...20.5 mA {20.0 mA}	mA value of the setpoint for the OPEN (100%) position
P13.4	Positioner	Dead band	0.05...10.0% {1.0%}	Tolerance range for the control deviation (set point position – actual position) where no adjustment occurs. The deadband should not be set too low to prevent actuator oscillation.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P13.5	Positioner	Gain	1. . . 100% {100%}	The gain (gradient) affects the positioning close to the target position. The smaller the gain selected (e.g. 20%), the earlier the actuator starts reducing its speed in case of speed variable actuators on approaching the target position. In case of actuators with fixed speed (reversing starters), the speed reduction is done by pulsing (also see params P13.9 and P13.10). This leads to better positioning (smaller reachable deadband). A 100% setting disables this gradient.
P13.6	Positioner	Live zero detect.	0: Ignore	The setpoint monitoring (monitoring the setpoint to below approximately 2 mA = loss of signal) is disabled.
			1: Stop	Actuator stops on signal failure.
			2: Open	On signal failure, actuator moves the OPEN position.
			3: Close	Actuator moves on signal failure to the CLOSED position.
			4: Emerg.pos.	On signal failure, the actuator moves the defined emergency position (see parameter P13.7).
			5: Emerg. Open	Emergency open on signal failure.
			6: Emerg. Close	Emergency close on signal failure.
			7: Last valid value	Moves to the last valid value after signal failure; relevant for setpoints over bus. The actuator will move to the 4mA position, in case of an analog input signal failure.
			8: Failsafe	Failsafe-operation on signal failure.
P13.7	Positioner	Emergency pos.	0. . . 100% {50,0%}	Determination of the emergency position (Can also be set in the menu P8.5)
P13.8	Positioner	Calib.Setpoint 20mA	-10% . . . +10%	Calibration value for the 20mA setpoint. 1% = approx. 0.2mA. Calibration process: By applying 20mA on the setpoint input, this parameter is corrected until the readout matches 20mA.
P13.9	Positioner	Min. impulse	0.2. . . 2.0 s {0,2 s}	Variable speed actuators (Actusmart CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): Minimum activation time of the reversing contactors. For very small activation times (<0.3. . . 0.5 s), the motor will be switched off during start-up process, which significantly increases mechanical wear on reversing contactors. With frequent periods of very small activation times (restless loop, small dead zone, clocking near to the target value), we therefore recommend electronic reversing contactors.
P13.10	Positioner	Period	0.1. . . 2.0 s {2.0 s}	Variable speed actuators (Actusmart CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): This parameter is only relevant in Step mode when approaching the target position (parameter gain smaller than 100%) and determines the period of a run / pause cycle.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P13.11	Positioner	Begin pos. (a0)	0.0. . . 25.0% {2.0%}	Smallest controllable position other than the end position CLOSED. The range 0% . . . a0 will be just passed through. Use the parameter a0 to define the beginning of the allowable control range of the valve (e.g., blind spot for ball segment valves, etc.).
P13.12	Positioner	End pos. (e0)	75.0. . . 100.0% {98.0%}	Largest controllable position other than the end position OPEN. The area e0 . . . 100% is just passed through. Use the parameter e0 to define the end of the allowable control range of the valve.
P13.13	Positioner	Begin setp. (a1)	0.0. . . 25.0% {2.0%}	Below this value, the end position CLOSED is controlled. In the range 0% . . . a1 cannot be controlled (end position tolerance). The initial setpoint a1 is associated with a small hysteresis (1/4 of the deadband).
P13.14	Positioner	End setp. (e1)	75.0. . . 100.0% {98,0%}	Above this value, the end position OPEN is controlled. The range e1. . . 100% cannot be controlled (end position tolerance). The final setpoint e1 is associated with a small hysteresis (1/4 of the deadband).
P13.15	Positioner	Calib. Setpoint 0mA	-10% . . . +10%	Calibration of 0mA for the input setpoint. 1% = approx. 0.2mA. Calibration process: By applying 0mA on the setpoint input, this parameter is corrected until the readout matches 0mA.
P13.16	Positioner	Hysteresis	0. . . 100%	Hysteresis range for setpoint signal, with regard to the dead band. Setting 0 equals to a hysteresis of 25%.

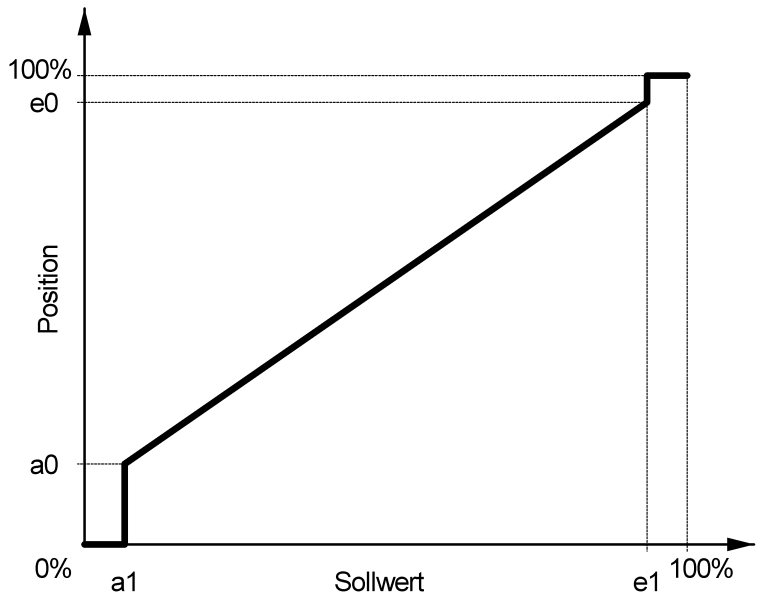

Figure 33: *Assigning the position to the setpoint*

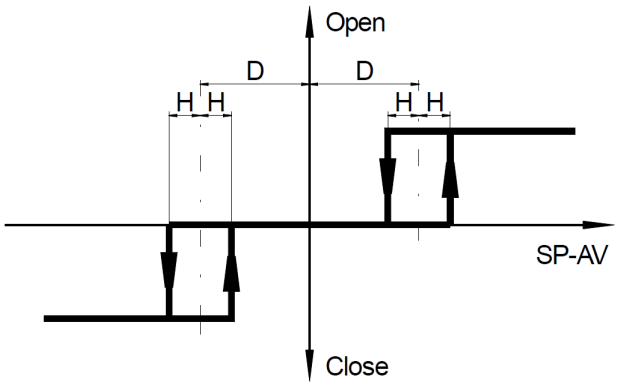

Figure 34: *Function principle of the dead band, and hysteresis in conjunction with the positioner*

The figure above shows the working principle of the parameters "P13.4 - Dead Band" and "P13.16 - Hysteresis". The set dead band thresholds are added and subtracted from the setpoint. The hysteresis sets the threshold on the deadband thresholds. E.g. if the setpoint is 50%, dead band is 1% and hysteresis is 50%, the dead band thresholds will be at 49% and 51%. On top of that, the hysteresis for the 49% threshold will be at 50% of the dead band value, which is ±0.5%; thus the hysteresis on the 49% dead band threshold is at 48.5% and 49.5%. The actuator will move toward 50%, if the actual position is below 48.5% and stop, if the actual position is between 49.5% and the "outer" hysteresis mirrored on the ordinate, which is 51.5% in this case.

NOTE: Please be aware, that a 100% setting for hysteresis will cause oscillation due to overlapping thresholds.

2.14 Parameter group: PID controller (optional)

The optional PID controller is used for controlling an external actual value (process variable) to a setpoint using 0/4-20 mA signal by readjusting the actuator.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P14.1	PID-controller	Function	0: disabled	PID controller disabled
			1: Position	The output of the PID controller corresponds to the position setpoint of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see 2.13).
			2: Speed	The output of the PID controller corresponds to the change of the position setpoint (speed) of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see 2.13).
			3: Position Change	The output of the PID controller corresponds to the change of the position setpoint (speed) of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see 2.13). Hence a control mode similar to the speed mode (see setting 2 above) is possible also for actuators with constant speed.
P14.2	PID-controller	External Setpoint	0: fixed	The PID controller uses an internal, fixed setpoint (see param P14.3).

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			1: external	The PID controller uses the external setpoint. The adjustment of this setpoint is done with the params P13.2 and P13.3 (see 2.13).
P14.3	PID-controller	Fixed setpoint	0. . . 100%	Specification of the internal fixed setpoint
P14.4	PID-controller	Start (at 0%)	0. . . 20.5 mA	mA value at 0% of the external actual value
P14.5	PID-controller	End (at 100%)	0. . . 20.5 mA	mA value at 100% of the external actual value
P14.6	PID-controller	Gain (P)	-50.0. . . +50.0	Gain (proportional value) of the PID-controller
P14.7	PID-controller	Reset time (I)	0. . . 100.0 s	The shorter the reset time (integral time, integral value), the stronger is the effect of the integral component of the PID-controller. Values below 1.0 will disable the integral component.
P14.8	PID-controller	Lead time (D)	0. . . 100.0 s	The larger the lead time (differential/derivative value), the stronger is the effect of the derivative component of the PID-controller. To reduce the influence of noise, a first-order lag element with 1sec time constant is added (DT_1) .
P14.9	PID-controller	Offset	-200. . . +200%	The offset value will be added to the output value of the PID controller.
P14.10	PID-controller	Inverse operation[6)]	0: Off	The output of the PID controller is not inverted.
			1: On	The output of the PID controller is inverted.
P14.12	PID-controller	Live zero detect.	0: Ignore	The monitoring of the external actual value is disabled
			1: Stop	Actuator stops on signal failure of external actual value
			2: Open	Actuator moves on signal failure of external actual values to the OPEN position.
			3: Close	Actuator moves on signal failure of external actual values to the CLOSED position.
			4: Emergency position	Actuator moves on signal failure of external actual values to the EMERGENCY position (see param P13.7)
P14.13	PID-controller	Calibration of ext. actual value	-10.0. . . +10.0%	Calibration process: By applying 20 mA to the external actual value input, this parameter is corrected until the readout matches to 20 mA.
P14.14	PID-controller	Process begin	-32768. . . +32767	Mantissa of the real process variable (begin of external actual value).
P14.15	PID-controller	Process end	-32768. . . +32767	Mantissa of the real process variable (end of external actual value).
P14.16	PID-controller	Process comma shift	-3. . . +3	Position of the comma for process begin/end (P14.14, P14.15), e.g.: mantissa = 200, comma shift) -2/2, process value = 2.00/20000
P14.17	PID-controller	Process unit	–	Unit of the real process variable

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P14.18	PID-controller	Dead Band	-0.1. . . 10.0%	Tolerance range for the control deviation (set point - external actual value) where no adjustment occurs.

2.15 Parameter group: Bus systems (optional)

The manuals for the Bus systems are available in the download area on our homepage **www.schiebel-actuators.com**.

2.16 Parameter group: Stroke test (optional)

2.16.1 Operating Manual Partial-Valve-Stroke-Test (PVST)

For a PVST (Partial Valve Stroke Test) the actuator performs in regular intervalls a defined movement. This also moves the connected valve.
With the PVST, only a part of the full valve stroke is passed through. If the full valve stroke is passed through, this is called FVST (Full Valve Stroke Test) or FST (Full Stroke Test).

Typically, a PVST is applied to valves that are in the open limit position for a long time (e.g., emergency shut-down valves). These valves are only used in the event of system malfunctions, maintenance or functional tests. Between these events, the plant operator has no information if the valve can still be closed if required.

Normally a short, small movement of the valve in the closing direction is not disturbing the system process. The PVST performs this movement regularly. As a result, on the one hand, a fixation of mechanical components is reduced and, on the other hand, errors are detected prematurely before any emergency shutdown is required.
This procedure increases the security system metrics.

The PVST can either be triggered by the control unit on the actuator itself (internally) or by the control system (externally).

Internal trigger:
Manual trigger of the PVST via the menu of the control unit: see parameter P16.11
Time based trigger of the PVST: see parameter P16.7, P16.9 und P16.10

External trigger:
The PVST can be triggered via the binary inputs or an optional fieldbus system.

Procedure of the PVST:

1. The actuator must be in the start position which is set in parameter P16.2. The set hysteresis in parameter P1.8 is taken into account.
2. The actuator must be in the REMOTE mode and READY state.
3. Release of the PVST (internal or external)
4. The status of PVST is set as **PVST-Active**.
5. The actuator moves from the start position to the test range which is defined in parameter P16.3.
6. After reaching the final test position the actuator remains in this position for a specific time, defined in parameter P16.4.

7. Then the actuator moves back to the start position.
8. If the PVST was successful the status will be set to **PVST-OK** otherwise to **PVST-Error**.

The status of the PVST can be monitored continuously via the binary outputs or via the optional fieldbus.

Result of the PVST:
For a successful PVST the following terms must be fulfilled:

1. The actuator must be in the tolerance range of the set hysteresis in the starting position.
2. The actuator must be in the REMOTE mode and READY state during the whole PVST (no error).
3. The PVST must not be interrupted by an other command (binary inputs, commands from optional fieldbus).
4. The switch-off torque must not be exceeded during the PVST.
5. The total time of the PVST must be lower than the maximum time, set in parameter P16.8.

If one or more of the above terms are violated the PVST is not successful.

Parameters: Stroke test

	Menu Item	Subitem	Options	Explanation/Comments
P16.1	Stroke test	Stroke test		This parameter activates the PVST. For standard actuators (without failsafe function) the PVST is only viable electrically by motor. For failsafe actuators the PVST can additionally be executed as failsafe operation in failsafe direction by spring.
			0	No stroke test is executed.
			1	Stroke test is executed electrically.
			2	Stroke test is executed in failsafe operation by spring.
			3	Two stroke tests. 1. Test: electrically 2. Test: in failsafe operation
			4	Two stroke tests. 1. Test: in failsafe operation 2. Test: electrically
P16.2	Stroke test	Start position	0,00...100,00%	Start position for the PVST. This value must be 0,00% or 100,00%. If the actuator is not in one of this positions in case of a PVST start the test is not executed and not successful concluded.
P16.3	Stroke test	Test range	0,00...100,00%	In this range the actuator is moved during the PVST. e.g. Start position: 100,00%, test range: 30,00% The PVST starts at 100,00% and moves the actuator to 70,00% (100,00%-30,00%). After that the actuator moves back to 100%.
P16.4	Stroke test	Resting time	0...10s	Amount of seconds how long the actuator remains in the end position of the PVST before moving back to the start position.
P16.5	Stroke test	Speed Open	0...100%	With this parameter it is possible to set the speed in the Open direction for the PVST as far as the actuator has this capability.

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	Menu Item	Subitem	Options	Explanation/Comments
P16.6	Stroke test	Speed Close	0...100%	With this parameter it is possible to set the speed in the Close direction for the PVST as far as the actuator has this capability.
P16.7	Stroke test	Time trigger		If this value is set greater than 0 the PVST will be repeated cyclic according the specific set value. The start command for the PVST is set for one minute and is reseted after the test till the next caclic start.
			0	Off
			1	Every hour
			2	Every 2 hours
			3	Every 3 hours
			4	Every 4 hours
			5	Every 6 hours
			6	Every 8 hours
			7	Every 12 hours
			8	Every day
			9	Every week
			10	Every 2 weeks
			11	Every month
			12	Every 2 months
			13	Every 3 months
			14	Every 4 months
			15	Every 6 months
			16	Every year
P16.8	Stroke test	Max. time	0...120s	Maximum timespan for the duration of the PVST. If the test takes longer than the adjusted time it is not successfull. The function is deactivated by setting the value to 0.
P16.9	Stroke test	Start date	yyyy-mm-dd	With this parameter the date for the first PVST is set. Parameter is only relevant if P16.7 Time trigger is greater 0.
P16.10	Stroke test	Start time	hh:mm:ss	With this parameter the time for the first PVST is set. The value for the seconds is not relevant. The start command is active for the whole minute independent from the adjusted seconds. Parameter is only relevant if P16.7 Time trigger is greater 0.
P16.11	Stroke test	Start test	0...1	With this parameter the PVST function can be started from the control menu to test the adjusted values. When the parameter is set to 1, the PVST starts once the actuator is in REMOTE-mode.

2.17 Parameter group: Characteristic curves (optional)

With this option, customers can enable travel-dependent torque, speed and valve characteristic curves.

2.17.1 Torque characteristic

With this characteristic curve, torque limits already set under menu item **P2-torque** (see section 2.2, page 16) can be further **reduced** depending on travel. Characteristics can be configured via the SMARTTOOL software (see Figure 35, page 47).

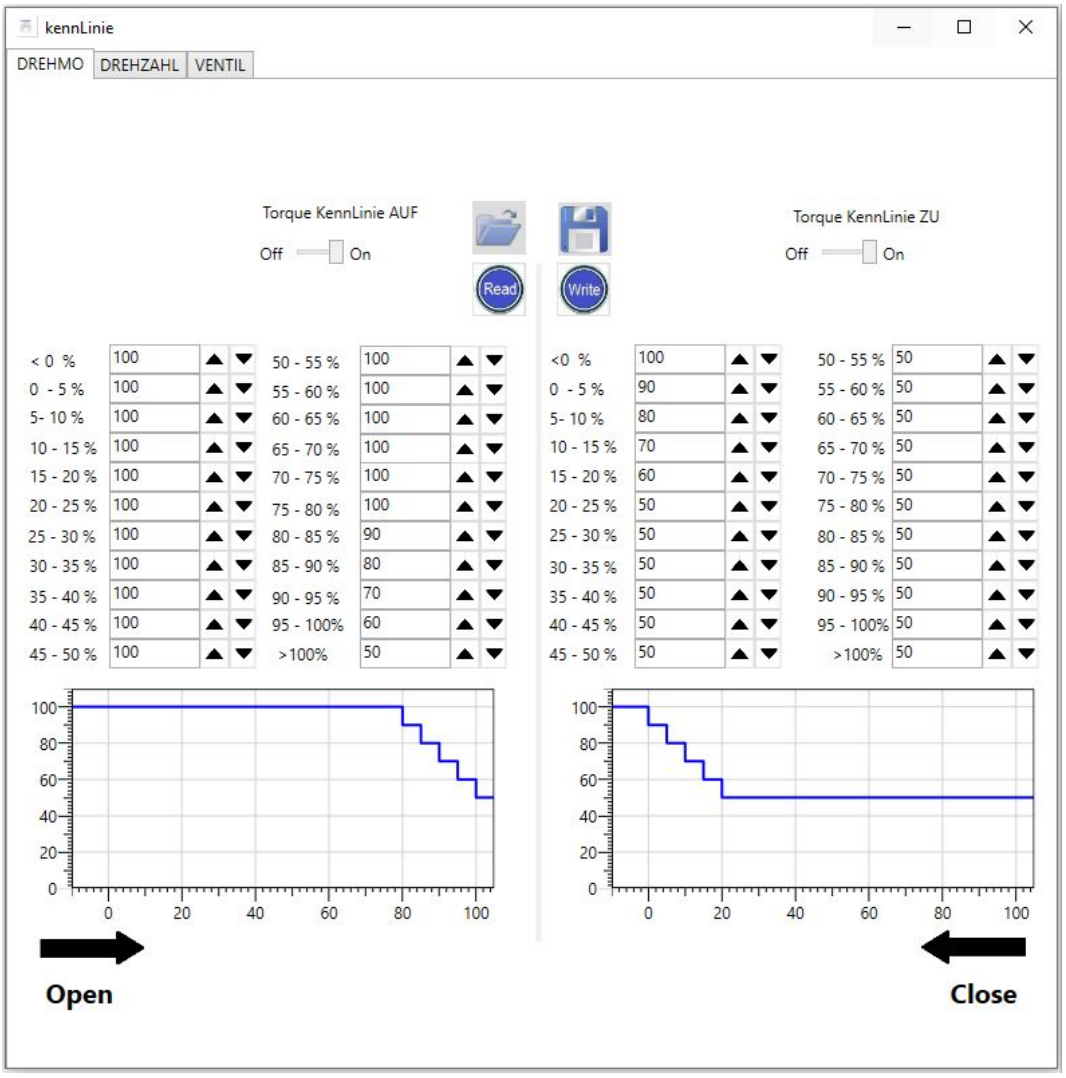

Figure 35: *Torque characteristic*

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.1	Characteristic	Torque Open	0: Off	The torque characteristic curve is disabled for the OPEN direction.
			1: On	The torque characteristic curve is enabled for the OPEN direction.
P17.2	Characteristic	Torque Closed	0: Off	The torque characteristic curve is disabled for the CLOSED direction.
			1: On	The torque characteristic curve is enabled for the CLOSED direction.

2.17.2 Speed characteristic

With this characteristic curve, speed limits already set under menu item **P4-speed** (see section 2.4, page 18) can be further **reduced** depending on travel. Characteristics can be configured via the SMARTTOOL software (see Figure 36, page 48).

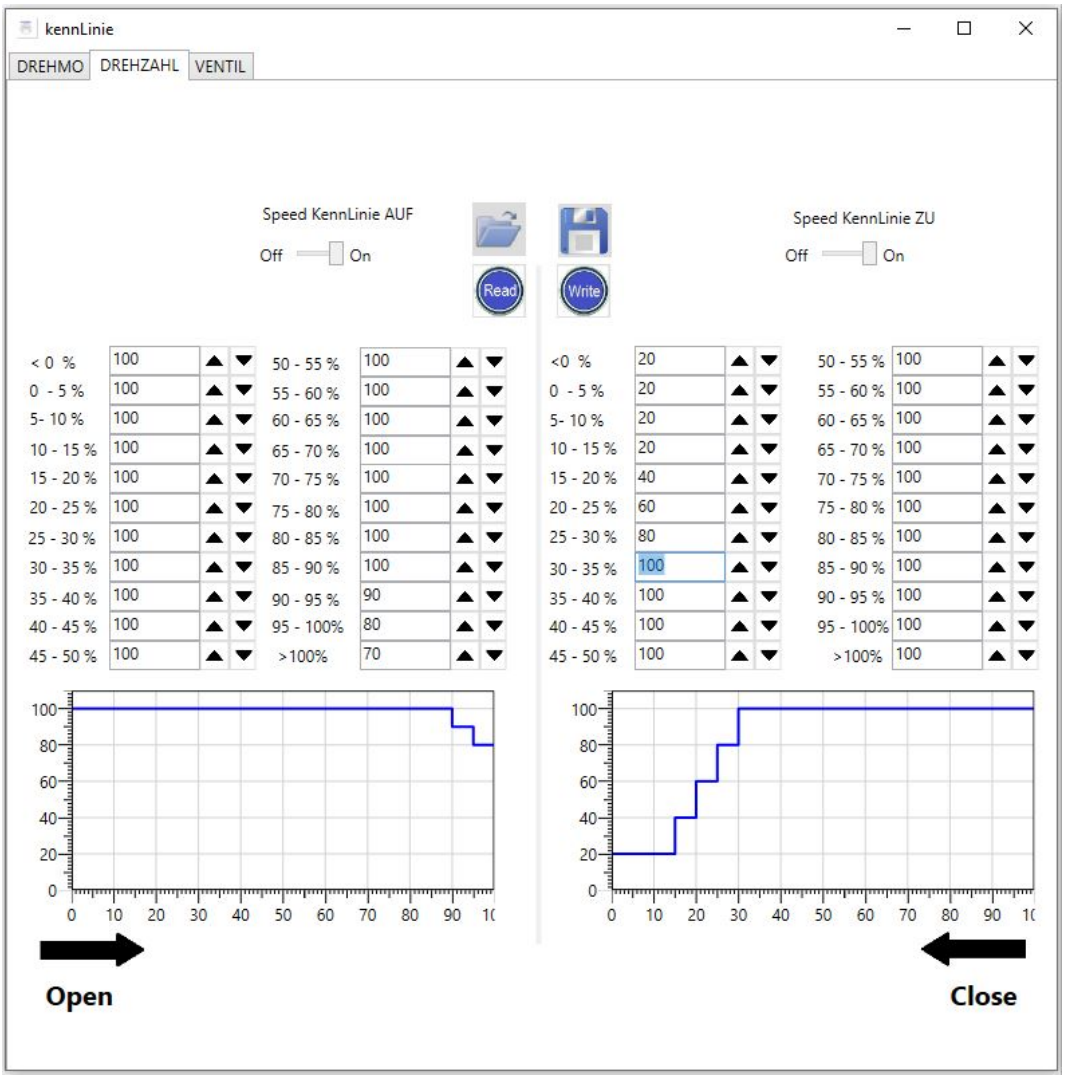

Figure 36: *Speed characteristic*

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.3	Characteristic	Speed Open	0: Off	The speed characteristic curve is disabled for the OPEN direction.
			1: On	The speed characteristic curve is enabled for the OPEN direction.
P17.4	Characteristic	Speed Closed	0: Off	The speed characteristic curve is disabled for the CLOSED direction.
			1: On	The speed characteristic curve is enabled for the CLOSED direction.

2.17.3 Valve characteristic

With this characteristic curve the mapping between the actuator position and the setpoint of the valve can be adjusted. Hence it is possible to compensate and linearize the gerneral nonlinear characteristic curves of valves. Characteristics can be configured via the SMARTTOOL software (see Figure 37, page 49).

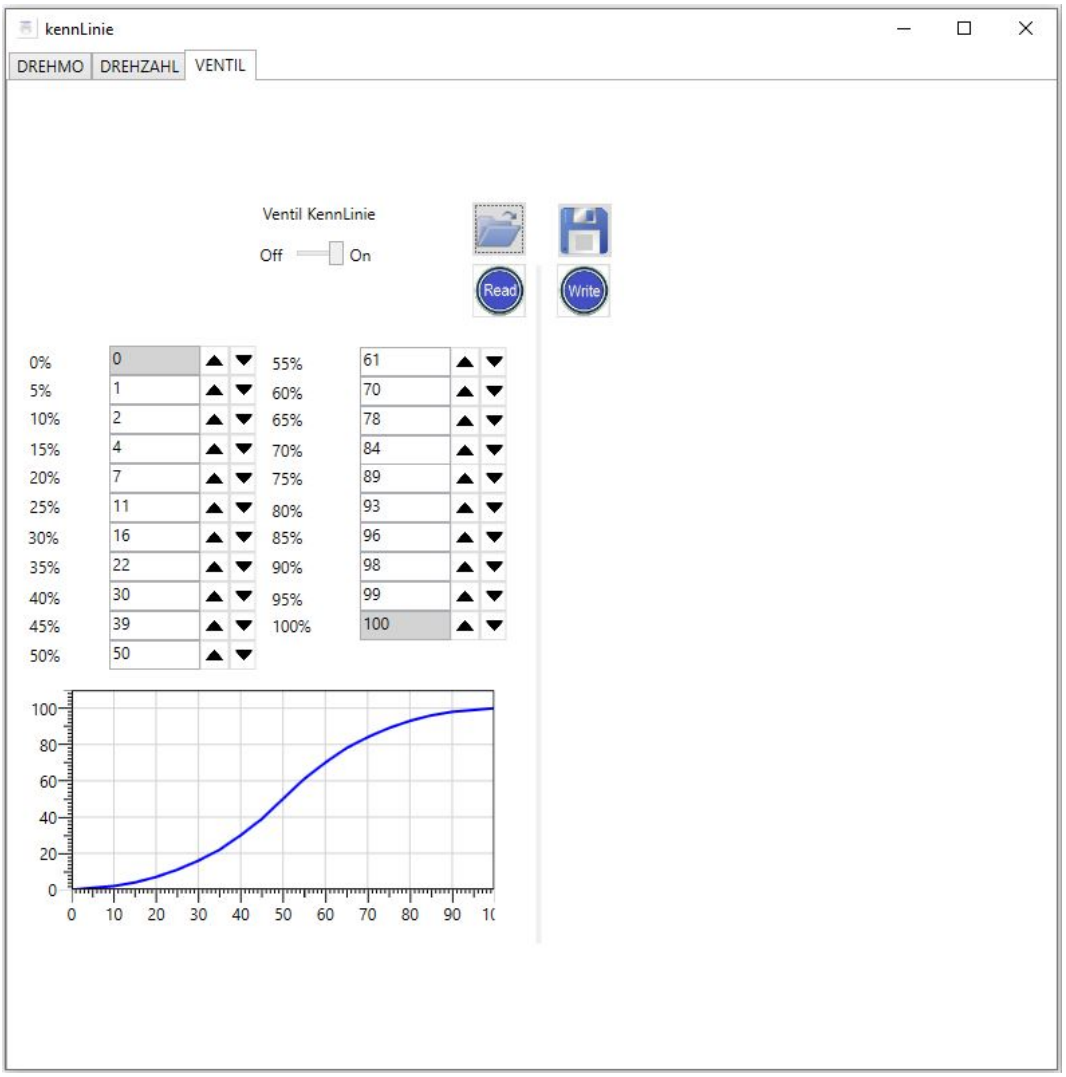

Figure 37: *Valve characteristic*

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.5	Characteristic	Valve	0: Off	The valve characteristic curve is disabled.
			1: user defined	The valve characteristic curve is enabled as configured in the SMARTTOOL.

2.18 Parameter group: Identification (optional)

This option allows entering further custom-identification parameters.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P18.1	Identification	PPS number	15 digits	Used to enter a PPS number. This is displayed in the bottom line. **NOTE:** Parameter P20.5 must be set to 0.

2.19 Parameter group: System Parameters

Used for actuator configuration. Most of these parameters are used to display crucial information about the actuator configuration for servicing, thus, only visible for user level service or higher.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P19.6	System Parameters	Calib.IST	-10. . . +10%	This value is used to offset the output signal of the ACTUSMART control unit's analog output. The mA-signal may be calibrated with a current measurement device.
P19.7	System Parameters	Calib.Setpoint 20mA	-10. . . +10%	This value is used to offset the input signal on analog input 1 measured by the ACTUSMART control unit. The measured mA-signal may be calibrated with an external setpoint generator.
P19.8	System Parameters	Calib.ext.act.val. 20mA	-10. . . +10%	This value is used to offset the input signal on the external analog input 2 measured by the ACTUSMART control unit. The measured mA-signal may be calibrated with an external setpoint generator.
P19.12	System Parameters	LCD Contrast	80. . . 150	The display contrast may be set with this parameter.
P19.15	System Parameters	Welcome Menu	0; 1	Starts the actuator with the welcome menu on startup, if set to 1.
P19.21	System Parameters	LED Function		See "P1.7 - LED function" in section 2.1 on page 14.
P19.56	System Parameters	LCD Inverse	0; 1	Inverts the display pixels.

2.20 Parameter group: Miscellaneous

	Menu item	Sub-menu item	poss. setting	Notes / comment
P20.1	Miscellaneous	Language	0: German	Defines the menu language
			1: English	
			2: Russian	
			3: Czech	
			4: Spanish	
			5: French	
			6: Italian	
			7: Danish	
			8: Hungarian	
			9: Turkish	
			10: Greek	
			11: Polish	
			12: Serbian	
			13: Croatian	
			14: Bulgarian	
			15: Dutch	

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			16: Romanian	
			17: Swedish	
P20.2	Miscellaneous	Smartcode		Enables additional features by entering a Smartcode
P20.3	Miscellaneous	Restore Backup	0:	no action
			1: Customer -	Restores all parameters to the customer backup parametrization, **without changing** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
			2: Customer +	Restores all parameters to the customer backup parametrization, **including** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
			3: Service -	Restores all parameters to the service backup parametrization, **without changing** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
			4: Service +	Restores all parameters to the service backup parametrization, **including** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
			5: Workshop -	Restores all parameters to the workshop backup parametrization, **without changing** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
			6: Workshop +	Restores all parameters to the workshop backup parametrization, **including** the end limits (P1.1 and P1.2) and the switch off torques and torque limit(P2.1, P2.2 and P2.3).
P20.4	Miscellaneous	Save Backup	0:	no action
			1: Customer	By saving this setting, the current parameters are adopted as customer parameters.
			2: Service	By saving this setting, the current parameters are adopted as service parameters.
			3: Workshop	By saving this setting, the current parameters are adopted as workshop parameters.
P20.5	Miscellaneous	Info line	0. . . 15	The bottom line of the display shows various diagnostic values.
P20.6	Miscellaneous	Wireless	0: Off	The infrared and bluetooth connection is disabled.
			1: Infrared	The infrared connection is active for about 3 minutes unless communication is detected.
			2: Bluetooth	The Bluetooth connection is active for about 3 minutes unless communication is detected.
			3: Infrared+	The infrared connection is activated.
			4: Bluetooth+	The Bluetooth connection is activated.
P20.7	Miscellaneous	Menu style	0. . . 2	different menu styles
P20.9	Miscellaneous	Time	YYYY-MMM-DD, HH:MM:SS	Sets the date and time on the actuator. Move the red selector switch to highlight the next value, and down to highlight the prior value.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P20.10	Miscellaneous	Timezone	-840. . . 840 min.	Sets the timezone; offsets the shown time in minutes.
P20.11	Miscellaneous	Daylight saving time	0: Off	Time without daylight saving
			1: On	Turns on daylight saving time
			2: Auto	With this setting, the daylight saving time is automatically detected.

NOTE: Backups are prioritized; the higher the number, the higher the priority. For example, if parameters are backed up as service, the customer parameters will be overwritten.

2.21 Default User Level Settings

The following table shows the default user level settings for all parameters on a brand-new actuator.

Parameter	Menu item	Sub-menu item	Default UL Read	Default UL Write
P1.1	End Limit	Open	1	3
P1.2	End Limit	Close	1	3
P1.3	End Limit	Switch Off Open	2	4
P1.4	End Limit	Switch Off Close	2	4
P1.5	End Limit	Closing direction	2	4
P1.7	End Limit	LED Function	1	3
P1.8	End Limit	Hysteresis	2	4
P1.9	End Limit	Ramp	2	4
P1.11	End Limit	Overrun Open	2	4
P1.12	End Limit	Overrun Close	2	4
P2.1	Torque	Open	2	4
P2.2	Torque	Close	2	4
P4.1	Speed	Local Open	2	4
P4.2	Speed	Local Close	2	4
P4.3	Speed	Remote Open	2	4
P4.4	Speed	Remote Close	2	4
P4.5	Speed	Emerg. Open	2	4
P4.6	Speed	Emerg. Close	2	4
P4.7	Speed	Torquedep. oper.	2	4
P4.8	Speed	Minimal	2	4
P5.1	Ramp	Local	2	4
P5.2	Ramp	Remote	2	4
P5.3	Ramp	Emergency	2	4
P6.2	Control	Ready delay	2	4
P6.5	Control	24V Output	2	4
P6.6	Control	Min. Impuls	2	4
P6.17	Control	Remote Display	2	4
P7.1	User Level	Local	2	4

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Parameter	Menu item	Sub-menu item	Default UL Read	Default UL Write
P7.2	User Level	Bus	2	4
P7.3	User Level	Remote Display	2	4
P7.4	User Level	Change Password	1	1
P8.1	Position	Intermed.pos.1	1	3
P8.2	Position	Intermed.pos.2	1	3
P8.3	Position	Intermed.pos.3	1	3
P8.4	Position	Intermed.pos.4	1	3
P8.5	Position	Emerg.position	1	3
P8.6	Position	Hysteresis	1	3
P8.7	Position	Intermed.pos.5	1	3
P8.8	Position	Intermed.pos.6	1	3
P8.9	Position	Intermed.pos.7	1	3
P8.10	Position	Intermed.pos.8	1	3
P8.11	Position	Dead Band	1	3
P8.12	Position	Gain	1	3
P8.13	Position	Hysteresis	1	3
P8.14	Position	Intermed.pos.9	1	3
P8.15	Position	Intermed.pos.10	1	3
P8.16	Position	Intermed.pos.11	1	3
P8.17	Position	Intermed.pos.12	1	3
P8.18	Position	Intermed.pos.13	1	3
P8.19	Position	Intermed.pos.14	1	3
P8.20	Position	Intermed.pos.15	1	3
P8.21	Position	Intermed.pos.16	1	3
P9.1	Bin. Input	Input 1	2	4
P9.2	Bin. Input	Input 2	2	4
P9.3	Bin. Input	Input 3	2	4
P9.4	Bin. Input	Input 4	2	4
P9.5	Bin. Input	Input 5	2	4
P10.1	Bin. Output	Output 1	2	4
P10.2	Bin. Output	Output conf. 1	2	4
P10.3	Bin. Output	Output 2	2	4
P10.4	Bin. Output	Output conf. 2	2	4
P10.5	Bin. Output	Output 3	2	4
P10.6	Bin. Output	Output conf. 3	2	4
P10.7	Bin. Output	Output 4	2	4
P10.8	Bin. Output	Output conf. 4	2	4
P10.9	Bin. Output	Output 5	2	4
P10.10	Bin. Output	Output conf. 5	2	4
P10.11	Bin. Output	Output 6	2	4
P10.12	Bin. Output	Output conf. 6	2	4
P10.13	Bin. Output	Output 7	2	4
P10.14	Bin. Output	Output conf. 7	2	4
P10.15	Bin. Output	Output 8	2	4

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Parameter	Menu item	Sub-menu item	Default UL Read	Default UL Write
P10.16	Bin. Output	Output conf. 8	2	4
P11.1	Analog Signal	Function 1	2	4
P11.2	Analog Signal	Begin 1 (at 0%)	2	4
P11.3	Analog Signal	End 1 (at 100%)	2	4
P11.4	Analog Signal	Calib.20mA 1	2	4
P11.5	Analog Signal	Function 2	2	4
P11.6	Analog Signal	Begin 2 (at 0%)	2	4
P11.7	Analog Signal	End 2 (at 100%)	2	4
P11.8	Analog Signal	Calib.20mA 2	2	4
P12.1	Step mode	Function	2	4
P12.2	Step mode	Start Open	2	4
P12.3	Step mode	End Open	2	4
P12.4	Step mode	ON time Open	2	4
P12.5	Step mode	OFF time Open	2	4
P12.6	Step mode	Start Close	2	4
P12.7	Step mode	End Close	2	4
P12.8	Step mode	ON time Close	2	4
P12.9	Step mode	OFF time Close	2	4
P12.10	Step mode	Time base	2	4
P12.11	Step mode	Speed adaption	2	4
P13.1	Positioner	Function	2	4
P13.2	Positioner	Begin (at 0%)	2	4
P13.3	Positioner	End (at 100%)	2	4
P13.4	Positioner	Dead band	2	4
P13.5	Positioner	Gain	2	4
P13.6	Positioner	Live zero detect.	2	4
P13.7	Positioner	Emergency pos.	1	3
P13.8	Positioner	Calib.setpoint	2	4
P13.9	Positioner	Min.Impuls	2	4
P13.10	Positioner	Period	2	4
P13.11	Positioner	Begin pos. (a0)	2	4
P13.12	Positioner	End pos. (e0)	2	4
P13.13	Positioner	Begin setp. (a1)	2	4
P13.14	Positioner	End setp. (e1)	2	4
P13.15	Positioner	Calib.setpoint offset	2	4
P13.16	Positioner	Hysteresis	2	4
P14.1	PID-controller	Function	2	4
P14.2	PID-controller	Ext.setpoint	2	4
P14.3	PID-controller	Setpoint value	2	4
P14.4	PID-controller	Begin (at 0%)	2	4
P14.5	PID-controller	End (at 100%)	2	4
P14.6	PID-controller	Proportional	2	4
P14.7	PID-controller	Integral	2	4
P14.8	PID-controller	Differential	2	4

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Parameter	Menu item	Sub-menu item	Default UL Read	Default UL Write
P14.9	PID-controller	Offset	2	4
P14.12	PID-controller	Live zero detect.	2	4
P14.13	PID-controller	Cal.ext.act.val	2	4
P14.14	PID-controller	Process begin	2	4
P14.15	PID-controller	Process end	2	4
P14.16	PID-controller	Process comma shift	2	4
P14.17	PID-controller	Process unit	2	4
P14.18	PID-controller	Dead band	2	4
P16.1	Stroketest	Stroketest	2	4
P16.2	Stroketest	Start position	2	4
P16.3	Stroketest	Test range	2	4
P16.4	Stroketest	Resting time	2	4
P16.5	Stroketest	Speed Open	2	4
P16.6	Stroketest	Speed Close	2	4
P16.7	Stroketest	Time trigger	2	4
P16.8	Stroketest	Max. time	2	4
P16.9	Stroketest	Start Time	2	4
P16.10	Stroketest	Start Test	2	4
P17.1	Characteristic	Torque Open	2	4
P17.2	Characteristic	Torque Close	2	4
P17.3	Characteristic	Speed Open	2	4
P17.4	Characteristic	Speed Close	2	4
P17.5	Characteristic	Valve	2	4
P18.1	Identification	KKS-Number	2	4
P19.6	System	Calib.IST	2	4
P19.7	System	Calib.SOLL	2	4
P19.8	System	Calib.EIST	2	4
P19.12	System	LCD Contrast	2	4
P19.15	System	Welcome Menu	4	4
P19.21	System	LED Function	1	3
P19.56	System	LCD Inverse	2	4
P20.1	Miscellaneous	Language	1	3
P20.2	Miscellaneous	Smartcode	1	1
P20.3	Miscellaneous	Restore	4	4
P20.4	Miscellaneous	Backup	4	4
P20.5	Miscellaneous	Info display	1	3
P20.6	Miscellaneous	Wireless	1	3
P20.7	Miscellaneous	Menu Style	1	3
P20.9	Miscellaneous	Time	1	3
P20.10	Miscellaneous	Timezone	1	3
P20.11	Miscellaneous	Daylight saving time	1	3

3 Status area

The status area presents current process and diagnostic data. In this area, data is read-only. To access the status area, move the control switch in the direction where the selector switch should be in the neutral position or in the remote position.

The status area is divided into 2 sub-areas:

- Status
- History

3.1 Status

3.1.1 Status – binary outputs

Display of binary outputs: The display shows output control as opposed to output status, i.e. the supply of the binary outputs is ignored. A switched output is represented by 1.

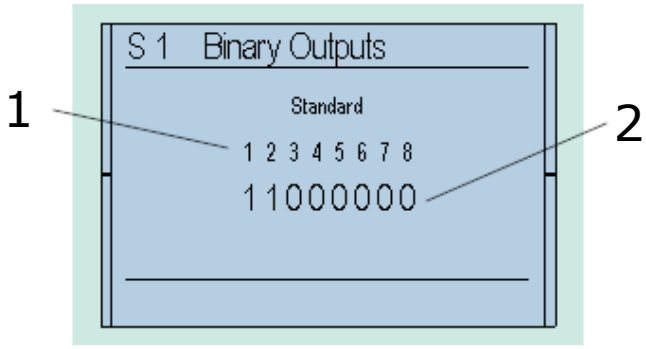


Figure 38: *1. . . Output Number, 2. . . Signal (0 = LOW; 1 = HIGH)*

3.1.2 Status – binary inputs

Display of binary inputs: A set input is represented by 1.

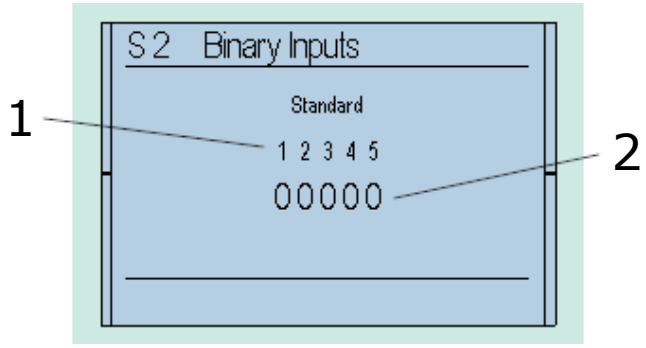


Figure 39: *1. . . Input number, 2. . . Signal (0 = LOW; 1 = HIGH)*

3.1.3 Status – analog values

Display of analogue values: Input 1 (In1) is used by the positioner as the setpoint; Input 2 (In2) serves as an external value for the optional PID controler. In the analogue output (out), only the control signal is shown, regardless of whether the output current actually flows or not (interruption of the current loop).

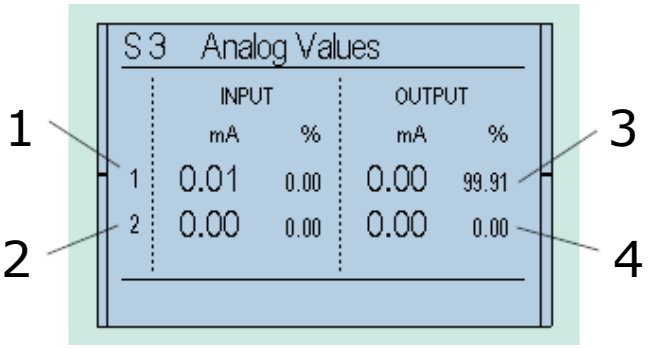


Figure 40: *1. . . Input 1, 2. . . Input 2, 3. . . Output, 4. . . All values in mA*

3.1.4 Status – absolute values

This status displays the absolut position of the actuator.

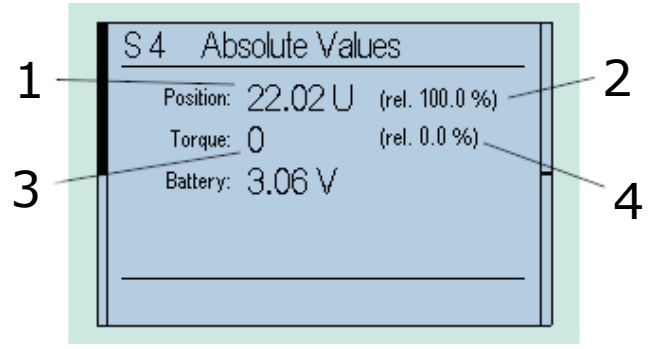


Figure 41: *1. . . Absolute value of the position unit, 2. . . Relative value of the position unit 3 and 4 . . . Absolute and elative value for the torque unit (calibrated in factory)*

3.1.5 Status – firmware

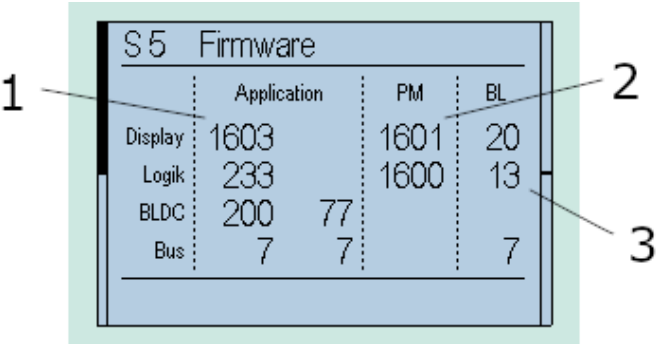


Figure 42: *1. . . Firmware version of the corresponding el. component, 2. . . Parameter set version, 3. . . Bootloader version*

3.1.6 Status – serial number

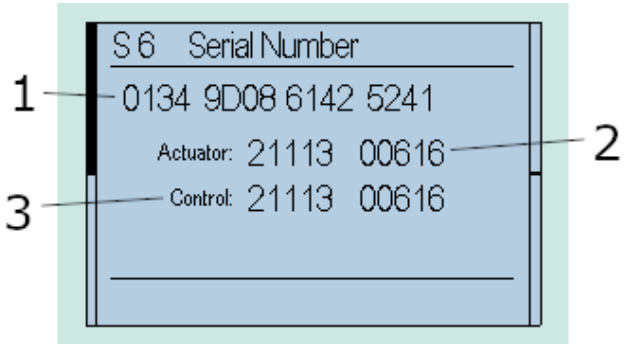


Figure 43: *1. . . Serial number of the electronics, 2. . . Serial number of the actuator, 3. . . Serial number of the control unit*

3.1.7 Status – meter readings

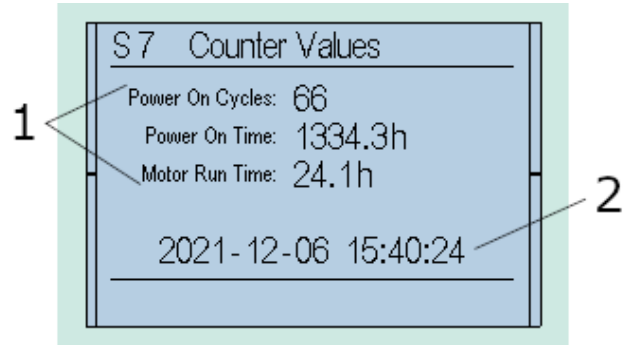


Figure 44: *1. . . Counters for power on cycles, power on time and motor run time, 2. . . Actual date and time*

3.2 History

History shows the last 20 history entries. In addition to the plain text entry, the time since the last history entry and, in case of an error, the error value is also provided.
Please note that the actuator can only calculate time if energized. For error analysis, please refer to section 6, page 59.

NOTE: Up to 500 history entries are saved, and may be viewed with the SmartTool2.

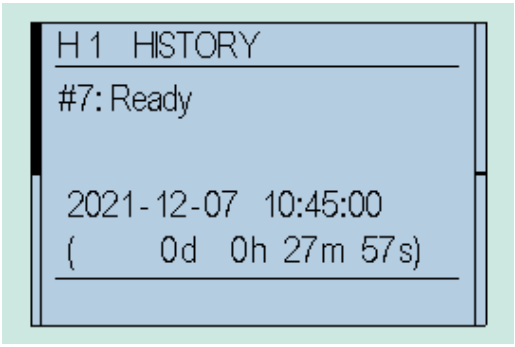


Figure 45: *Example for a history entry.*

4 Infrared connection

For easier communication and better visualization of the menu options, the unit provides an infrared port for connection to a PC.
The required hardware (connection cable to the PC's RS-232 or USB connectors) and the corresponding software are available as options.
The SMARTTOOL software, in addition to communication with the actuator, allows the management of multiple actuators to transfer the configuration to different actuators.
This approach can greatly simplify operation.
Please refer to the SMARTTOOL software operating instructions manual for further information.

During operation, it must be ensured that the IR interface surface is protected from strong disturbances which may otherwise compromise the communication.
Before mounting the infrared adapter, clean the surface of the infrared interface with a damp cloth.

When the infrared interface is enabled, it is indicated by LED L5 (see section 1.2.3, Figure 46, page 8). The infrared interface can be enabled in the menu item P20.6.

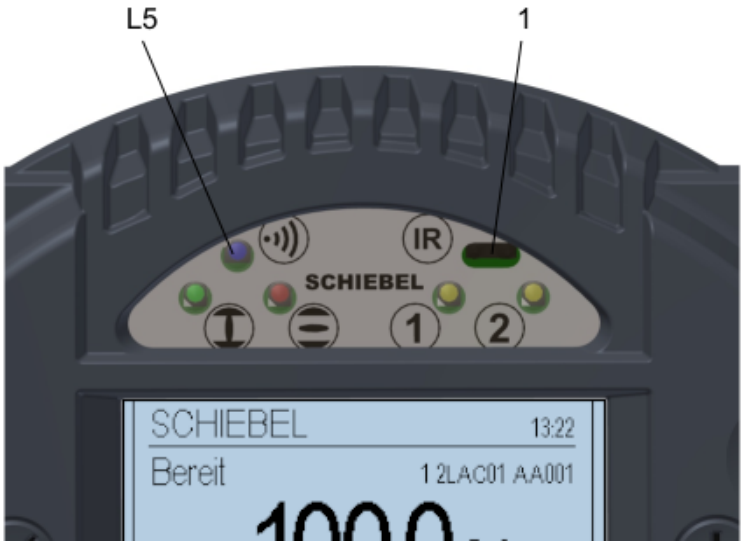


Figure 46: *1. . . Infrared connection*

5 Bluetooth connection

In addition to the infrared interface, it is also possible to configure the Control System using a Bluetooth interface.
Software required for Android equipment is available as an option.
In addition to communication with the actuator, the Android software also enables management of multiple actuators, allowing easy transfer of parameter sets to various actuators.
This approach can significantly simplify commissioning.

When the Bluetooth interface is enabled, this is indicated by LED L5 (see Figure 46 resp. section 1.2.3, page 8). The Bluetooth interface can be enabled in menu item P20.6.

6 Troubleshooting

Upon warning or error, the bottom line of the display will show the corresponding plain text description. This event will also be entered into the history (see section 3.2, page 58).

6.1 History Entries

Listed below are all possible history entries. In case of a warning, the alarm will be visualized on the left side of the main display. If an alarm occurs, the display background light will be red, and the main display will show, that the actuator is not ready.

NOTE: Each error has a unique error number. Each error also has its separate “OK” message in the history after the fault has gone.

History Entry	Type	Description
#3: Mot. temp. warn. #19: Mot. temp. warn. OK	n.a.	The motor temperature is in the critical range although the actuator remains fully functional.
#4: Mot. temp. switchoff #20: Mot. temp. switchoff OK	Alarm	Overtemp in motor, fault on Basis or BLDC, On Basis: loss of main power (3x400V) or cable break between CSC and motor; on BLDC: cable break between BLDC and motor.
#5: Phase sequ. fault #6: Phase sequ. OK	Alarm	Cause on Basis: Active phase sequence detection on single phase actuators, loss of main power while connected to external 24 VDC auxiliary voltage, or loss of phase L2.
#7: Ready	Information	Written to the history after all errors are gone.
#8: Power On	Information	Is written to the history after power on the actuator, even if there are some errors.
#9: Power supply Fault #21: Power supply OK	Alarm	No power supply to the power electronics (when the controller is powered from the auxiliary power input). Defect of power electronics – please contact the manufacturer.
#11: Failsafe Fault #12: Failsafe OK	Alarm	Communication error between Failsafe board and Logic, loss of external 24 V Failsafe Voltage, or overtemp. on Failsafe brake.
#13: Manual override #14: Manual override Off	Alarm	Manual override on Failsafe active (visible in status S4), cable/switch broken.
#17: Travel Sensor Fault #18: Travel Sensor OK	Alarm	The travel unit is outside the permitted range (potentiometer fault on Basis), cable broken, or multiturnsensor calibration lost on CM – please contact the manufacturer.
#22: Torque Sensor Fault #23: Torque Sensor OK	Alarm	Potentiometer fault on Basis, or cable broken.
#24: Bus Fault #25: Bus OK	Warning	No communication with the optional bus system.
#26: Bus Watchdog #27: Bus Watchdog OK	Warning	Watchdog for bus communication has reacted.
#28: Undervoltage> Warning #29: Voltage OK	Warning	The input voltage is below the regular voltage range, but motor operation is still possible.
#32: Internal Comm. Fault L>Error #33 Internal Comm. Fault L>OK	Alarm	Communication error between Logik and Basis/BLDC, cable broken between boards, or board defect.
#34: Internal Comm. Fault D>Error #35: Internal Comm. Fault D>OK	Alarm	Communication error between Display and Logik, cable broken between boards, boards defect, or firmware update on Logik not properly done.
#36: Failsafe not ready #37: Failsafe ready	Alarm	Failsafe voltage OK and Failsafe not initialized (LUS not tensioned).

continued on next page

continued from previous page

History Entry	Type	Description
#38: RTC Battery low #39: RTC Battery OK	Warning	Battery on Display board is empty, loss of time/date or counter values possible.
#44: Inverter Fault #45 Inverter OK	n.a.	BLDC parameter error or defective BLDC. Please contact the manufacturer.
#46: Analog Input 1 Signal Loss #47: Analog Input 1 OK	Warning	SRG active, Positioner live zero detection activated, no setpoint value recognized.
#48: Analog Input 2 Signal Loss #49: Analog Input 2 OK	Warning	Ext. setpoint active, Ext. setpoint live zero detection activated, no Ext. setpoint value recognized
#50: End Limits Are The Same #51: End Limits OK	Alarm	The End limits for OPEN and CLOSE are the same values.
#52: User Input Switches Error #53: User Input Switches OK	Alarm	The selector switches are not calibrated. Please use the the calibration function in the wizard in the SmartTool2.
#54: PVST Error #55: PVST OK	Information	The last PVST was not successful
#56: Internal Comm. Fault E>Error #57: Internal Comm. Fault E>OK	Warning	Communication error between remote display and main display. Cable to from remote display to EB2_2, EB2_2 to EB2_1, or EB2_1 to main display broken. Also, one of the boards may be faulty.
#58: Undervoltage Error	n.a.	The input voltage is below the minimum threshold voltage; motor operation is not given. May appear in the history, if the actuator was turned off, in which case no #29: Voltage OK entry will be registered.
#59: Undervoltage Switch.Off	n.a.	The input voltage line caused the actuator to turn off 6 times, indicating an unstable power supply.
#60: Overvoltage Warning	n.a.	The input voltage is over the regular supply voltage range. Motor operation is possible.
#61: PVST Start	Information	A PVST procedure was started
#62: Parameter Change	Information	Shows information about, which value was written on a parameter. The values for N, L and S are internal values and useful for diagnosing.
#63: Restore	Information	A restore procedure via P20.3 was undertaken.
#64: Password Change	Information	A password change has been undertaken.
#65: History Cleared	Information	The complete history entry memory was cleared by the manufacturer.
#68: Emergency operation #69: Emergency operation Off	Information	The actuator is in emergency operation.
#70: Permission Change	Information	The read/write permission of a parameter or a parameter group was changed.

7 Technical data

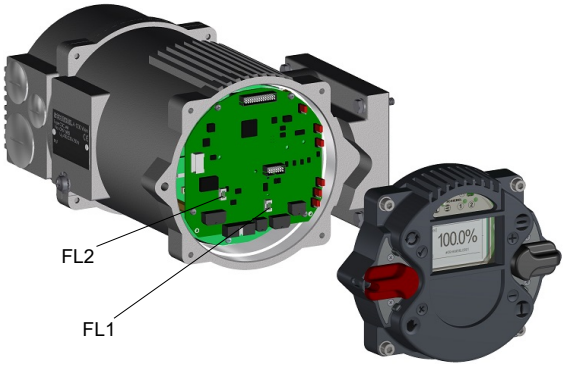


Figure 47: *Control unit*

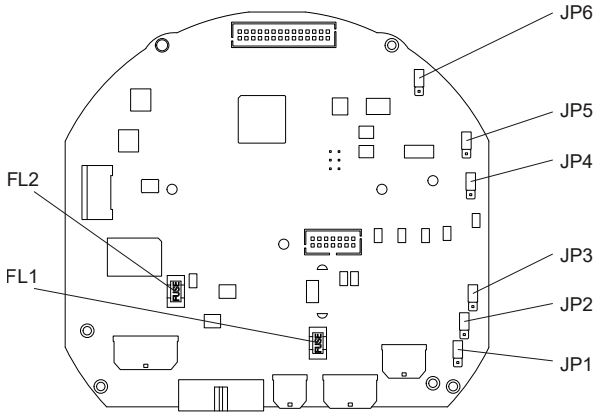


Figure 48: *Logic-board*

7.1 Binary outputs

Count: 8
Power supply: ..... 24 VDC nominal
range: 11...35 VDC
(either from internal or external)
Max voltage drop at set output: ..... 1 V
Output voltage at non-set output: ..... <1 V
Maximum current per output: ..... 500 mA (short circuit proof)
Maximum permissible total current for all outputs: ..... 4 A
Fuse (Fuse FL2, see Figure 48, page 62): ..... 4 A slow
(Littelfuse 454 NANO^2 Slo-Blo®)

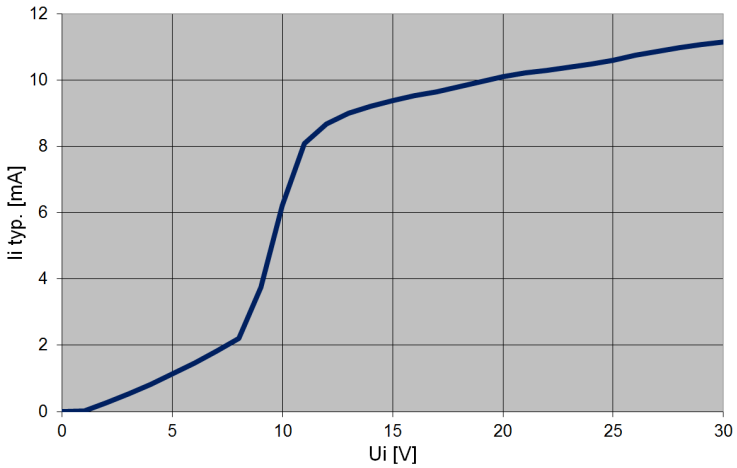
Binary outputs with external supply are separated from other controllers via optocouplers.

It is allowed to connect binary outputs in parallel. If the outputs have the same setting, the current of each output may be added together. If the settings of the outputs are different, a hardwired logical OR is realized.

7.2 Binary inputs

Count: 5
Nominal voltage: ..... 24 VDC
towards common ground
Voltage for input set: ..... >10 V (8.5 V typ.)
Voltage for input not set: ..... <7 V (8.5 V typ.)
Maximum voltage: ..... 30 VDC
Current consumtion at 24 VDC: ..... 10.5 mA typ.

Binary inputs are separated from other controllers via optocouplers.



Ui . . . Input voltage
Ii . . . Input current

Figure 49: *Binary inputs, input characteristic*

Jumpers JP1 . . . JP3 can be used to interconnect the binary inputs to groups with separate earths:

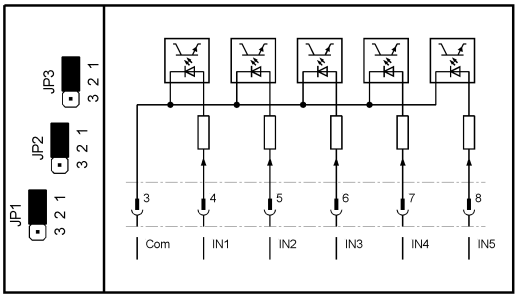


Figure 50: *5 inputs with same common*

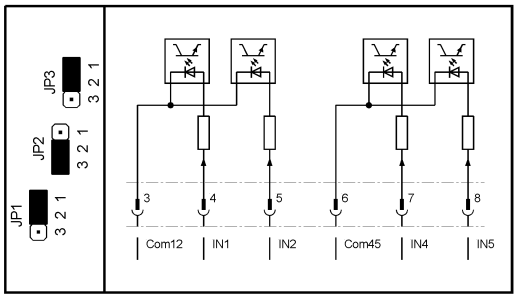


Figure 51: *2 separated groups of 2 inputs with same ground*
Input IN3 is disabled.

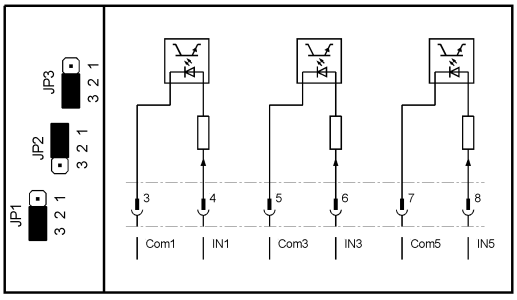


Figure 52: *3 separated inputs*
Inputs IN2 and IN4 are disabled.

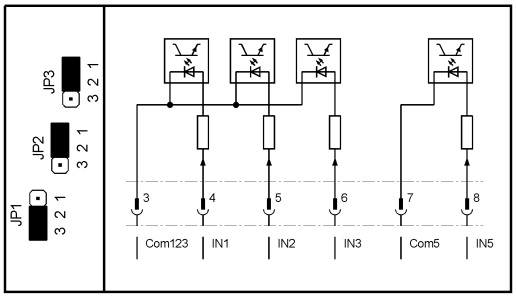


Figure 53: *3 inputs with same common and 1 separated input.*
Input IN4 is disabled.

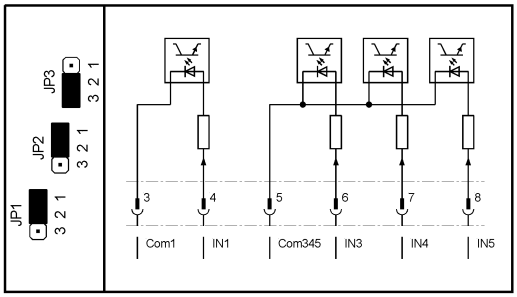


Figure 54: *1 separated input and 3 inputs with same common.*
Input IN2 is disabled.

Examples:

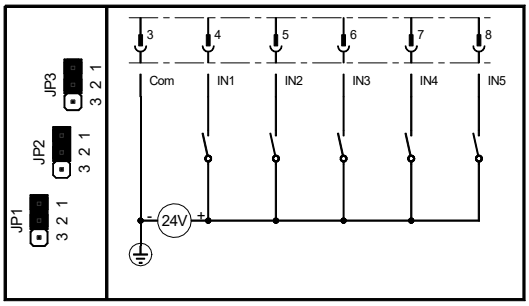


Figure 55: *5 inputs with common = "-" using external 24V*

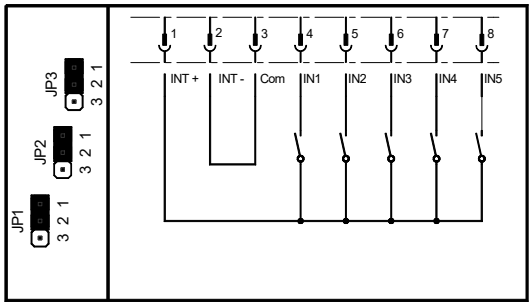


Figure 56: *5 inputs with common = "-" using internal 24V (e.g. for dry contacts)*

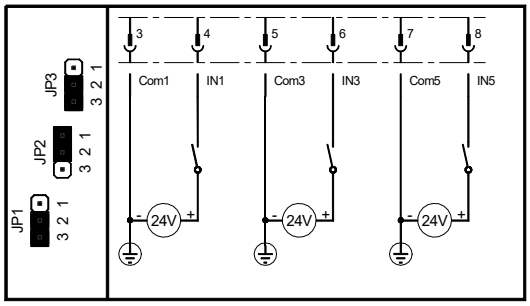


Figure 57: *3 separated inputs using 3 separated external 24V*

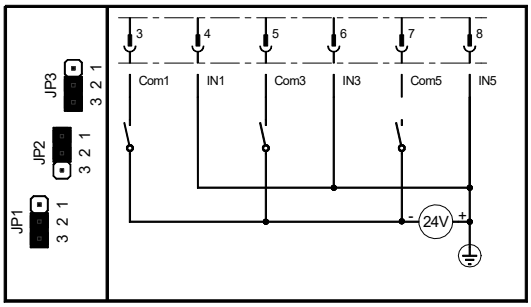


Figure 58: *3 separated inputs with common = "+" using external 24V*

7.3 Analog inputs

Input 1: setpoint value

Current range: ..... 0...25 mA
Resolution: ..... 14 bit
Accuracy: 0.5%
Input resistance: ..... 60 Ω

Analog input 1 is electrically isolated from the rest of the electronic system.

Input 2: External actual value (only in combination with PID controller)

Current range: ..... 0...20.8 mA
Resolution: ..... 12 bit
Accuracy: 0.5%
Input resistance: ..... 120 Ω

Jumper JP6 can be used to switch analog input 2 from a passive input (default) to an input with internal 24 V power supply (for 4...20 mA, two-wire transmitters).

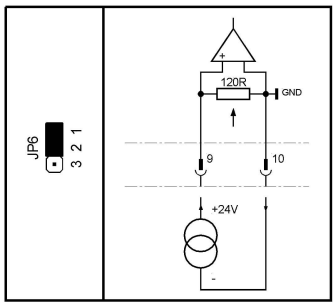


Figure 59: *Passive input (default)*

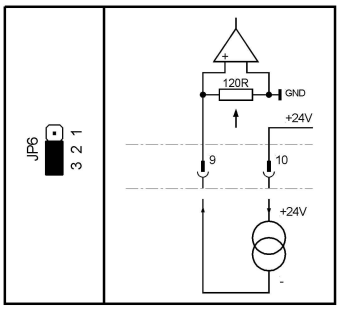


Figure 60: *Input with internal suppy (active input)*

NOTE: The analog input 2 is referenced to common of the electronic system and the auxiliary power supply (see section 7.5).

7.4 Analog output

Current range: ..... 0...20.8 mA
Resolution: ..... 12 bit
Accuracy: 0.5%
Max load: ..... 600 Ω

The analog output is galvanically isolated from the rest of the electronic system.
Jumper JP4 can be used to switch the analog output from an active power source (default) to a current sink, allowing the output to simulate a 4...20 mA, two-wire transmitter.

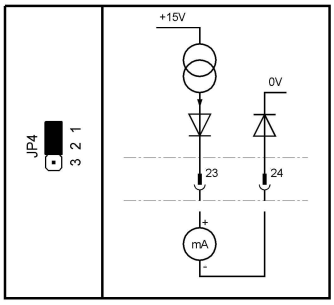


Figure 61: *Current source*

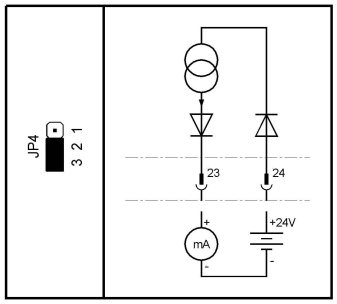


Figure 62: *Current sink*

Ground potential is the potential of the control unit and the auxiliary supply (see chapter 7.5).

7.5 Auxiliary voltage input and output

Input voltage range (auxiliary voltage input): . . . . . 20. . . 30 VDC
Maximum current consumption (auxiliary voltage input): . . . . . 500 mA
Maximum current consumption in power-save mode (auxiliary voltage input): . . . . . 120 mA
Output voltage (auxiliary voltage output): . . . . . typ. 23 V
Maximum output current (auxiliary voltage output): . . . . . 200 mA
Capacitance of common ground vs. earth: . . . . . typ. 100 nF
Maximum allowed voltage of common ground vs. earth: . . . . . max. 40 Vs
Fuse (Fuse FL1, see picture 48, page 62): . . . . . 1 A slow
(Littelfuse 454 NANO^2 Slo-Blo®)

Ground potential is the common ground of the controller and the analog inputs and outputs.
The auxiliary voltage output can be set in menu P6.5.

The power-save mode is defined as follows:

- No power supply (the controller is powered exclusively through the 24 V auxiliary voltage input).
- The backlight of the LCD display switches off automatically.
- No additional hardware options included (Profibus Interface, DeviceNet interface, relay board, etc. . .).
- Binary outputs and the mA output are not enabled; when activating, the respective currents must be added to the total current consumption.

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