User Instructions
MAN-02-04-60-0359-EN Rev. 4
August 2023

Operating Manual for Bettis RTS CM Series

Compact Multi-Turn Electric Actuator

BETTIS

EMERSON

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Section 1: Introduction

NOTE:
This User Instructions applies to Bettis RTS CM series actuators with a firmware version of 1600 or newer.

These operating instructions apply to Bettis RTS CM Series of Compact Multi-Turn Actuators.

The scope of application covers the operation of industrial valves, e.g., globe valves, gate valves, butterfly valves and ball valves. For other applications please consult with the factory.

The manufacturer shall not be liable for incorrect use and possible damage arising thereof. The risk shall be borne solely by the user.

Using the unit as intended also entails the observance of these operating instructions.

⚠ CAUTION

When operating electrical equipment, certain parts inevitably carry hazardous voltage levels. Work on the electrical system or equipment must be carried out only in accordance with electrical regulations by a qualified electrician himself or by specially instructed personnel under the control and supervision of a qualified electrician.

Maintenance instructions must be observed as otherwise the safe operation of the actuator cannot be guaranteed.

Failure to follow the warning information may result in serious bodily injury or property damage. Qualified personnel must be thoroughly familiar with all warnings contained in this operating manual.

Proper transport, storage, installation, assembly and careful commissioning are essential to proper and safe operation.

⚠ WARNING

When working in potentially explosive areas, observe the European Standards EN 60079-14 “Electrical Installations in Hazardous Areas” and EN 60079-17 “Inspection and Maintenance of Electrical Installations in Hazardous Areas”.

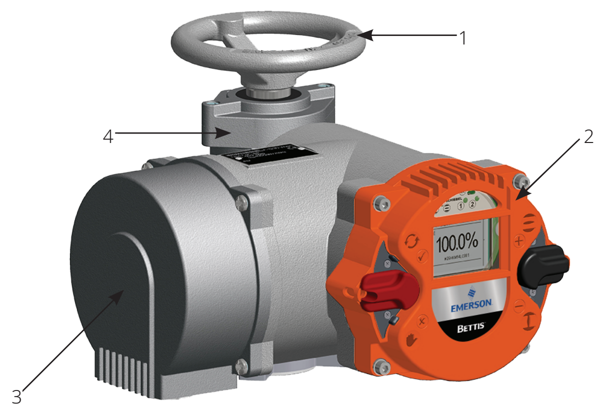
Maintenance work on open actuators may only be conducted if these are de-energized. Reconnection during maintenance is strictly prohibited.

Section 2: General

The Bettis RTS Series Compact Multi-Turn actuator is a rotary actuator with integrated controller for valve operation. The integral multi-turn sensor allows setting the travel limits without opening the housing.

2.1 Actuator Overview

Figure 1. The Bettis RTS Series Compact Multi-Turn Actuator



Parts Overview:

1. Handwheel
2. Control unit (Operating unit)
3. Connection compartment
4. Gear component

2.2 Serial Number and Type Label

Each actuator of the RTS Compact Multi-Turn CM series carries a serial number.
The serial number begins with the year and that can be read from the type label (see Figure 2) of the actuator (the type label is located next to the handwheel, see Figure 3).

Using this serial number, Emerson can uniquely identify the actuator (type, size, design, options, technical data and test report).

Figure 2. Bettis RTS Tag and Serial Number

Type: CM-32A-100HB
No.: 18113E04203
Close: 32Nm
Open: 32Nm
EMERSON.
CE
1026
2018
Tamb-40..+60°C
<100 - II 2 G Ex d e IICT 4 Gb
2,5-70 IP68 TÜV-A16ATEX0007X
I_N: 1,47A/230VAC LC16.13198-1S
110-240VAC 50/60Hz AEx de IIC T4 Gb
IECEx LC 17.0003X
S2-15min Ex de IIC T4 Gb
Class 1 Div 1 & 2 Group A
19200 Northwest Fwy, Houston, TX 77065 180830/1

Figure 3. Label 1 - Type Label

Actuators which are suitable for operation in explosive atmosphere (see EU Directive 94/9/EG and EN 60079-0 Standard) are separately designated by a special type label (EEx, TÜV Standard, see Figure 4).

Figure 4. Type Label of the Actuator for Operation in Explosive Atmosphere

Type: exCM06.V1.2
No.: 19114 01051
Close: 16,0-64Nm (16,0Nm)
Open: 16,0-64Nm (64Nm)
EMERSON.
CE
1026
2019
Tamb-40..+60°C
61revs. 61-1462sec II 2 G Ex db eb IIC T4 Gb
2,5-60rpm IP67 TÜV-A 13ATEX0006X
I_N: 0,84-0,67A
3x380-480V 50/60Hz
S2-15min
Josef Benc Gasse 4, 1230 Vienna, Austria 191190/1

2.3 Operating Mode

RTS Compact Multi-Turn CM actuators are suitable for open-loop control (S2 operating mode - on/off duty) and closed-loop control (S9 operating mode - modulating duty) according to EN 60034-1.

2.4 Protection Class

Bettis RTS Compact Multi-Turn CM actuators come by default with IP68 (EN 50629) protection.

CAUTION

The protection class specified on the type label is only effective when cable glands also provide the required protection class, the cover of the connection compartment is carefully secured and the mounting position (see Section 2.5) is observed.

We recommend metallic threaded cable glands with a metrical thread. Unused cable inlets must be closed with stopping plugs. On Explosion proof actuators, cable glands with protection class **EEx e according EN 60079-7** must be used. After removing covers for assembly purposes or adjustment work, take special care upon reassembly so that seals are not damaged and remain properly fastened. Improper assembly may lead to water ingress and to failures of the actuator.

NOTE:
The cover of the control unit - the Operating unit - (see Figure 1) must not be opened.

Allow a certain sag in the connector cables before reaching the screwed cable glands so that water can drip off from the connector cables without running to the screwed cable glands. As a result, forces acting on the screwed cable glands are also reduced (see Section 2.5).

2.5 Mounting Position

Generally, the installation position is irrelevant. However, based on practical experience, it is advisable to consider the following for outdoors use or in splash zones:

- Mount actuators with cable inlet facing downwards
- Ensure that sufficient cable slack is available

2.6 Direction of Rotation

Unless specifically ordered otherwise, the standard direction is (see Figures 5 and 6):

- **Right turning (clockwise) = CLOSING**
- **Left turning (counterclockwise) = OPENING**

Clockwise rotation of the actuator is given when the output shaft turns counterclockwise when looking at the output shaft.

Figure 5. Clockwise = Close

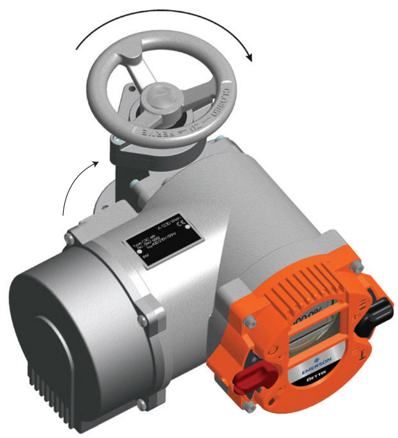
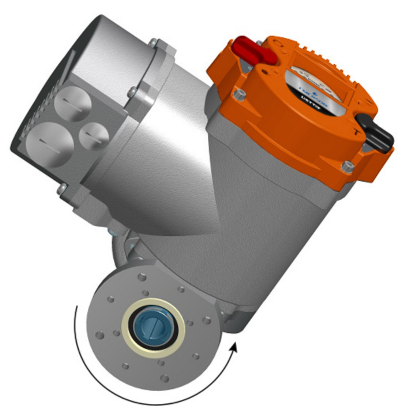


Figure 6. Counterclockwise = Close



⚠ CAUTION

All specifications in this operating manual refer to the standard direction of rotation.

2.7 Protection Devices

2.7.1 Torque

Bettis RTS Compact Multi-Turn actuators provide electronic torque monitoring. The switch-off torque can be modified in the menu of the controller for each direction separately. By default, switch-off torque is set to the ordered value. If no torque was specified with the order, the actuator is supplied from the factory with the maximum configurable torque. For more information, (see Section 7.2).

2.7.2 Motor Temperature

All Bettis RTS Compact Multi-Turn CM actuators are normally equipped with motor winding temperature sensors, which protect the motor against excessive winding temperature. The display will show the corresponding error upon exceeding the permissible motor temperature (see Section 12.1).

2.7.3 Input Fuse, Thermal Fuse

The frequency inverter is protected by an input fuse and the explosion proof version by a thermal fuse. If one of the fuses releases, a serious defect occurs and the frequency inverter must be replaced.

2.8 Ambient Temperature

Unless otherwise specified upon ordering, the following operating temperatures apply:

- On/off duty (open-loop control) -25 to +60 °C
- Modulating duty (closed-loop control) -25 to +60 °C
- Explosion proof version -20 to +40 °C (acc. EN 60079-0)
- Explosion proof version with extended temperature range -40 to +60 °C

CAUTION

The maximum operating temperature can also depend on further order-specific components. Please refer to the technical data sheets to confirm the as-delivered product specifications.

2.9 Delivery Condition of the Actuators

For each actuator, an inspection report is generated upon final inspection. In particular, this comprises a full visual inspection, calibration of the torque measurement in connection with an extensive run examination and a functional test of the microcontroller.

These inspections are conducted and documented according to the quality system and can be made available if necessary. The basic setting of the end position must be performed after assembly on the actuator.

⚠ CAUTION

Commissioning instructions (see Section 5) must be strictly observed. During assembly of the supplied valves at the factory, end positions are set and documented by attaching a label (see Figure 8). During commissioning at the plant, these settings must be verified.

Figure 7. Label

Einbaukomponenten sind voreingestell. Stellantrieb darf weder demontiert noch in seiner Stellung zur Armatur verändert werden, andernfalls ist eine Neueinstellung erforderlich. Bei anlagenseitiger Inbetriebnahme können Neujustagen erforderlich werden.	Built-in components are preset. The actuator must not be removed or changed in its position to the valve, otherwise a re-adjustment is required. Also at commissioning, re-adjustment may be required.

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2.10 Information Notice (Tag)

Each actuator is provided with a bilingual tag containing key information, which is attached to the handwheel after final inspection. This tag also shows the internal commission registration number (see Figure 8).

Figure 8. Tag

tag-cm-v1.00-2016.08.30 (Emr)

EMERSON
19200 Northwest Freeway, Houston, TX 77065 USA. Phone # (281) 477-4100

ATTENTION! Important documents are located near the actuator

The operating instructions must be observed for any and all operations on the actuator!

Short/long-term storage, installation, and maintenance shall be performed as stated in operational instructions.

HOISTING EQUIPMENT: Use soft straps only. Do not use hand wheel for hoisting purposes.

Prior to **START-UP** remove *silica gel* from the electrical enclosure.

All MAINTENANCE WORK must only be carried out when actuator is de-energized completely.

Take precautions to prevent accidentally switching on during maintenance.

Follow the wiring diagram instructions when performing electrical connections!

CONSIGNMENT No:
See back page

Section 3: Packaging, Transport and Storage

Depending on the order, actuators may be delivered packed or unpacked. Special packaging requirements must be specified when ordering. Please use extreme care when removing or repackaging equipment.

CAUTION

Use soft straps to hoist the equipment; do not attach straps to the handwheel. If the actuator is mounted on a valve, attach the straps to the valve and not to the actuator.

3.1 General

The connection compartment of Bettis RTS Compact Multi-Turn CM actuators contains 5 g of factory supplied silica gel.

CAUTION

Please remove the silica gel before commissioning the actuator (see Section 5).

3.2 Storage

CAUTION

- Store actuators in well-ventilated, dry premises
- Protect against floor dampness by storing actuators on wooden grating, pallets, mesh boxes or shelves
- Protect the actuators against dust and dirt with plastic wrap
- Actuators must be protected against mechanical damage
- The storage temperature must be between -20 to +40 °C

It is not necessary to open the controller of the actuator for servicing batteries or similar operations.

3.3 Long-Term Storage

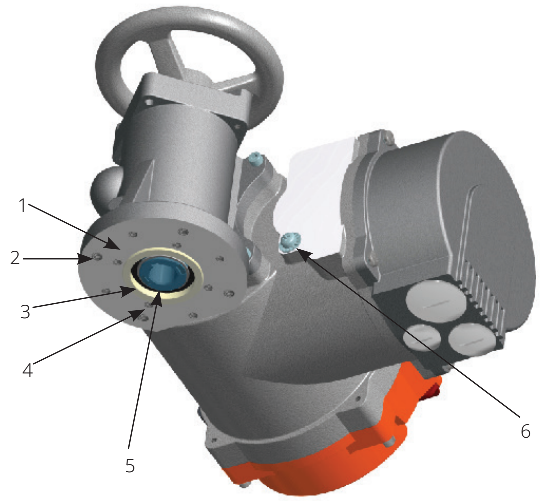
CAUTION

If you intend to store the actuator for over 6 months, also follow the instructions below:

- The silica gel in the connection compartment must be replaced after 6 months of storage (from date of delivery).
- After replacing the silica gel, brush the connection cover seal with glycerin. Then, carefully close the connection compartment again.
- Coat screw heads and bare spots with neutral grease or long-term corrosion protection.
- Repair damaged paint work arising from transport, improper storage, or mechanical influences.
- For explosion proof actuators, it is not allowed to extensively over paint the actuator According to the standard, in order to avoid electrostatic charge, the maximum thickness of the varnish paint is limited to 200 μm.
- Every 6 months, all measures and precautions for long-term storage must be checked for effectiveness and corrosion protection and silica gel renewed.
- Failure to follow the above instructions may lead to condensation which can damage to the actuator.

Section 4: Installation Instructions

Figure 9. Parts Overview



Parts Overview:

1. Mounting flange
2. Bolt pattern G0/F10
3. Centering ring
4. Bore pattern F07
5. Shaft connection
6. Ground connection

NOTE:
Installation work of any kind of actuator may only be performed by qualified personnel.

4.1 Mechanical Connection

See Figure 10.

Check whether the valve flange, actuator flange and valve shaft coincide with the shaft connector of the actuator. For output type “A” (threaded bushing with bore), check ensure the thread of the valve matches the thread of the actuator. In general, proceed as follows:

- Clean the bare parts of the actuator uncoated with corrosion protection.
- Thoroughly clean mounting flange of the valve.
- In the actuator, properly lubricate the output shaft and the valve of the driven shaft.
- In the “A” version, ensure that the valve bushing is properly lubricated.
- Attach the actuator to the valve or gearbox.
- Tighten fastening screws (torque according to Table 1).
- By means of the handwheel, check the ease of movement of the actuator-valve connection.

Table 1. Thread Table (1)

Thread	Tightening (Nm) for screws with strength class	
	8.8	A2-70/A4-70
M6	11	8
M8	25	18
M10	51	36
M12	87	61
M16	214	150
M20	431	294
M30	1489	564

NOTE:
For output type A/Am (unbored/bored threaded bushing), you must sufficiently lubricate both needle bearings in the output after processing and cleaning the spindle nut. For this purpose, use the optional Bettis RTS CM grease lubricant or a grease lubricant according to our recommendation (see Section 15.3).

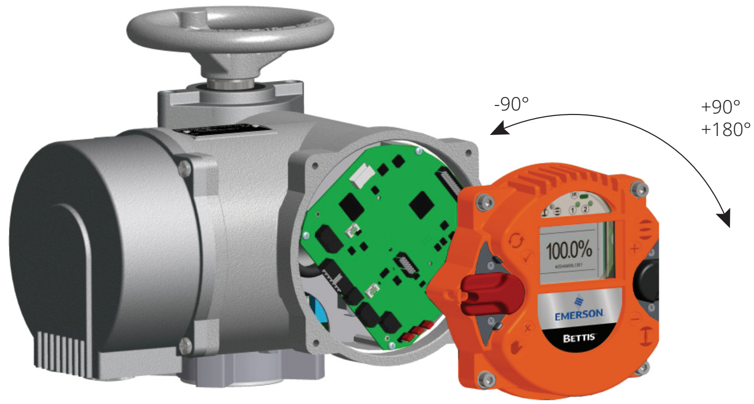
4.2 Mounting Position of the Operating Unit

The mounting position of the operating unit can be rotated in 90° steps.

CAUTION

During installation, the position of the control unit in relation to direct sunlight must be observed. It is recommended to protect the unit from direct sunlight (roof, installation position) to avoid possible malfunctions.

Figure 10. Control System Mounting



- Disconnect the actuator and control system from the power supply.
- To prevent damage to the electronic components, both the control system and the person have to be earthed.
- Unscrew the bolts for the interface surface and carefully remove the service cover.
- Turn service cover to new position and put back on.
  - Ensure correct position of the O-ring
  - Turn service cover by max. of 180°
  - Put service cover on carefully so that no cables get wedged in
- Tighten bolts evenly in a clockwise sequence.

NOTE:
Max torque 5 Nm.

4.3 Electrical Connection

⚠ CAUTION

Electrical connections may only be carried out by qualified personnel. Please observe all relevant national security requirements, guidelines, and regulations. The equipment should be de-energized before working on electrical connections. As a first step connect the ground screw and confirm the absence of electrostatic discharge during connection.

The line and short circuit protection must be done on the system side.

The ability to unlock the actuator is to be provided for maintenance purposes. For the dimensioning the rated current is to be used (see Technical Data).

Check whether the power supply (voltage, frequency) is consistent with the connection data (see Figure 2).

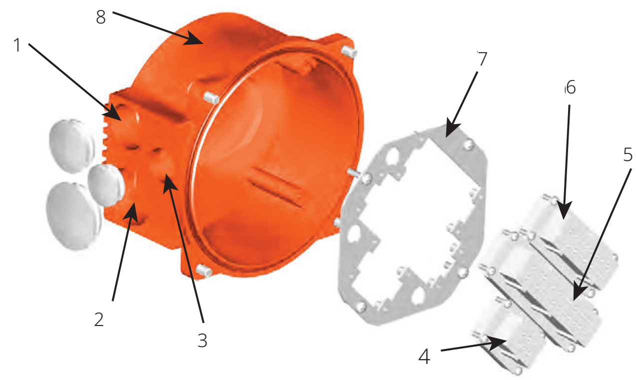
The connection of electrical wiring must follow the circuit diagram. This can be found in the appendix of the documentation. The circuit diagram can be ordered from Emerson by specifying the serial number.

When using options, such as a Profibus connection, the relevant guidelines must be followed.

4.3.1 Power Supply Connection

Bettis RTS Compact Multi-Turn CM actuators feature an integrated motor controller, i.e. only a connection to the power supply is required. In non-explosion proof actuators, the wiring uses a connector independent from control signals (see Figure 11).

Figure 11. Enclosure Parts

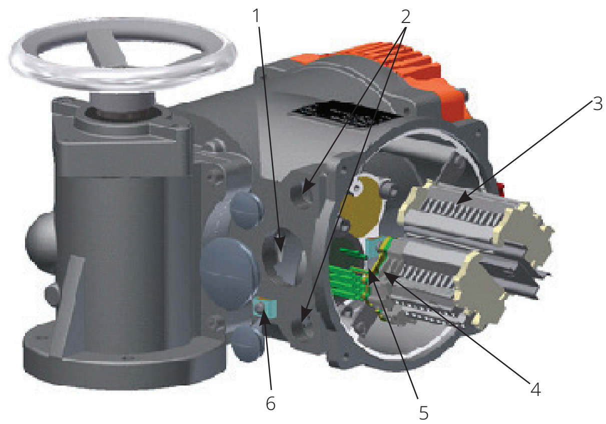


Parts Overview:

1. Metric screw M32x1.5
2. M40x1.5, 3 - M25x1.5
3. M25x1.5
4. Plug insert (for power supply)
5. Plug insert (for control cables)
6. Connector for options
7. Connector Plate
8. Connecting Housing

Explosion proof actuators or on special request the connection will be made via terminals (see Figure 12).

Figure 12. Bettis RTS Terminal Box



Terminal Box Overview:

1. Metric screw M40x1.5
2. 2 x M20x1.5
3. M25x1.5
4. Terminals for the power supply
5. Terminal for ground connection
6. Outside ground connection

CAUTION

If, during outdoor installation, commissioning is not carried out immediately after electrical connection, the power supply must be connected at a minimum to achieve a heating effect. In this case, the silica gel may remain in the connection compartment until commissioning (see Section 3.3).

Section 5: Commissioning

Before commissioning, please ensure the actuator is correctly assembled and electrically connected (see Section 4).

⚠ CAUTION

Remove silica gel from the connection compartment.

5.1 General

⚠ CAUTION

During commissioning and after every disassembly of the actuator, the positions (see Section 5.5) must be reset.

5.2 Manual Operation

The use of a differential gearbox in the handwheel assembly makes mechanical clutching unnecessary during manual operation.

⚠ CAUTION

Manual operation with mechanical or electromechanical equipment (such as: lever, drilling machine, etc.) is NOT ALLOWED, as this may damage the product.

5.3 Mechanical Default Settings and Preparation

The use of multi-turn sensors makes mechanical settings unnecessary.

⚠ CAUTION

Before the motorized operation of the valve, it is essential to check and adjust torque settings.

5.4 User Level and Permissions

In order to edit and/or show certain parameters, a user level with the necessary permissions has to be set as current user level. The current user level may be set temporarily in the "U User Level" menu item. It is also possible to set the default user level, which will be set as the current user level until set otherwise ("U User Level" or default user level). Please refer to Section 7.6 for more information about the user levels.

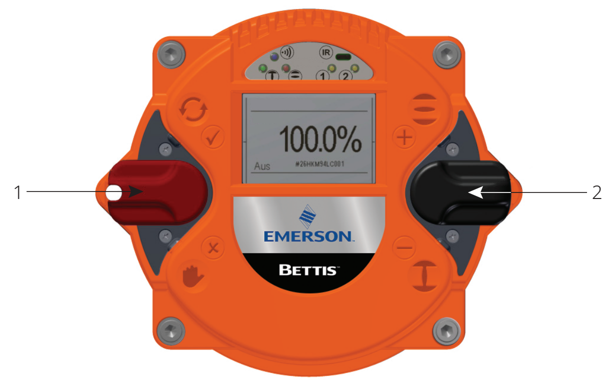
5.5 End Limit Setting

A detailed description of the operation of the Bettis RTS Compact Multi-Turn CM controller can be found in Section 6.3.

5.5.1 End limit OPEN

Step 1 - Set the selector switch and control switch to the center position.

Figure 13. Switches in Center Position



Terminal Box Overview:

1. Selector Switch (Red)
2. Control Switch (Black)

Step 2 - Scroll through the menu with the control switch. Move the control switch towards the first menu item "P 1.1 End limit - Open".

Figure 14. Control Switch End Limit Open

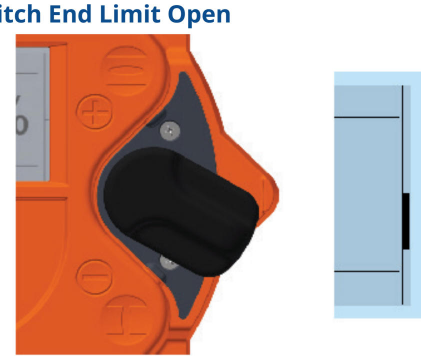
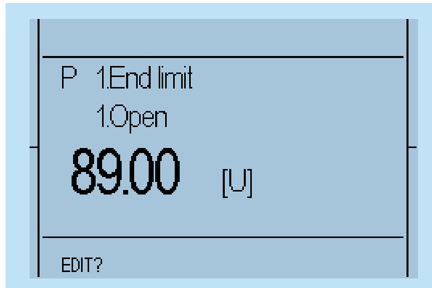


Figure 15. Control Switch End Limit Open



Step 3 - Afterwards, flip up the selector switch slightly and let it snap back to its neutral position.

Figure 16. Selector Switch Setting (1)

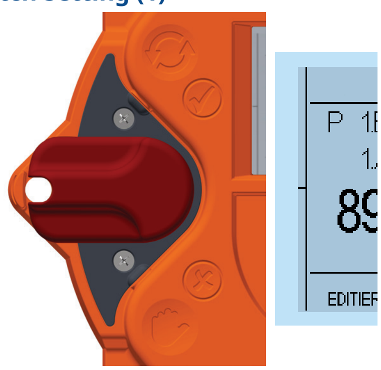


Figure 17. Selector Switch Setting (2)

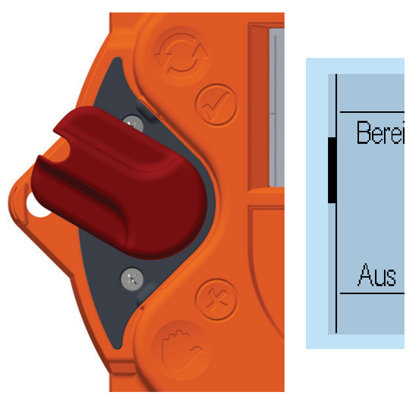
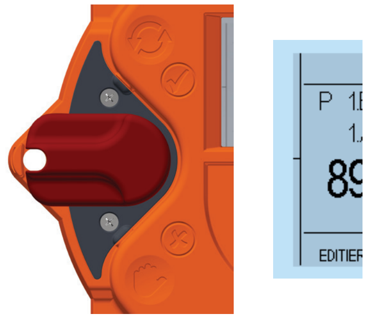


Figure 18. Selector Switch Setting (3)



Step 4 - This changes the bottom line of the display from “EDIT?” to “SAVE?”

Figure 19. Edit and Save

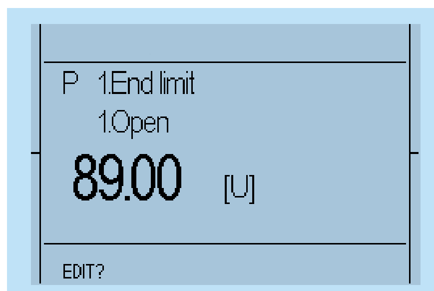
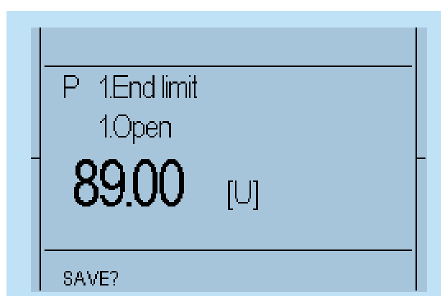


Figure 20. Save Settings



Step 5 - Then, push down the selector switch until it snaps into place. In doing so, the bottom right now on the display will show “TEACHIN” ⊗.

⚠ CAUTION

Once the display shows “TEACHIN”, use the control switch (black switch) to start the motorized operation of the actuator. In this mode, no travel-dependent switch-off occurs in the end position.

⚠ 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 parameterized.

Step 6 - Absolute and relative values on the display will change continuously along with position changes.

Figure 21. Position Change Selector Setting

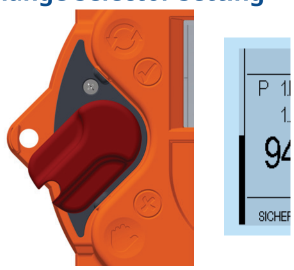
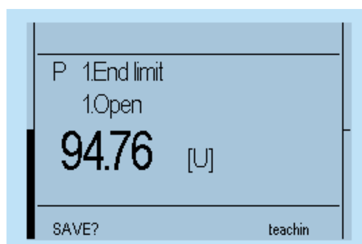


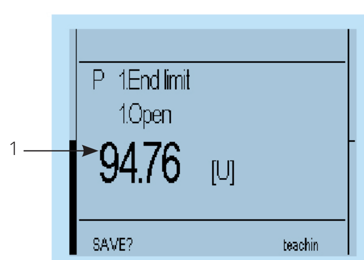
Figure 22. Position Change Display



Step 7 - Manually move the actuator with the handwheel (see Section 2.1 or 2.6) or by motor via the control switch (black button) to the end position OPEN of the valve.

- Absolute value: Absolute value of the position feedback
- Relative value: the value to the other end position

Figure 23. Absolute Value



Display Overview:

1. Absolute value

Step 8 - When the desired end position OPEN of the valve is reached, move the selector switch back to the middle position. Thus, the line "TEACHIN" disappears.

Figure 24. Selector for End Position (Save)

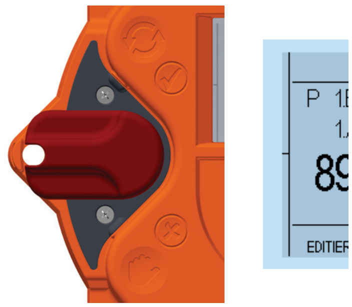
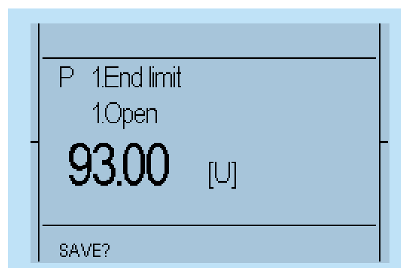


Figure 25. End Position Display



Step 9 - In order to confirm the end position (save), slightly flip up the selector switch towards ✓ and let it snap back to its neutral position.

Figure 26. Selector Setting Save (1)

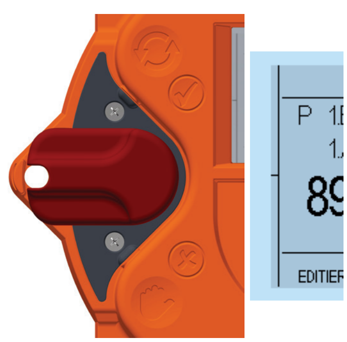


Figure 27. Selector Setting Save (2)

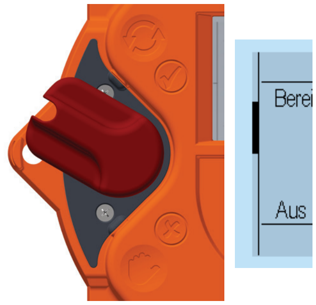
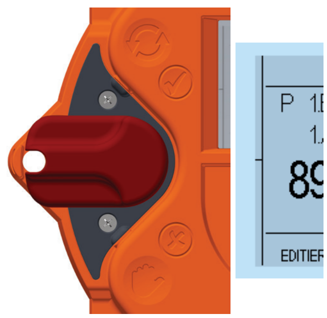


Figure 28. Selector Setting Save (3)



Step 10 - This changes the bottom line of the display for “SAVE?” to “EDIT?” and the end position is stored.

Figure 29. Selector Setting Display (1)

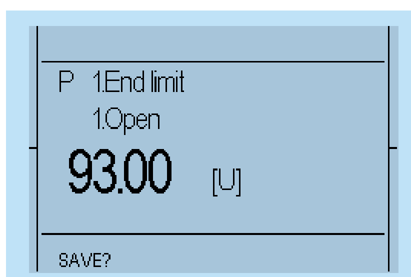
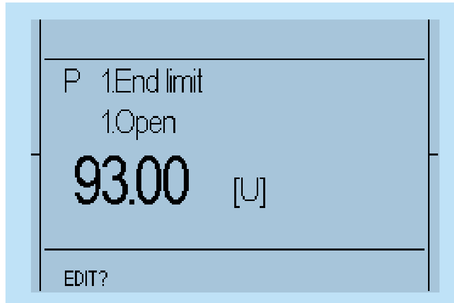


Figure 30. Selector Setting Display (2)



5.5.2 End limit CLOSE

Repeat 5.4.1 but select “P 1.2 End limit - End limit CLOSE”.

5.6 Final Step

Following commissioning, ensure covers a sealed and cable inlets are closed. Also, check the actuator for damaged paint (by transportation or installation) and take necessary steps to repair if needed.

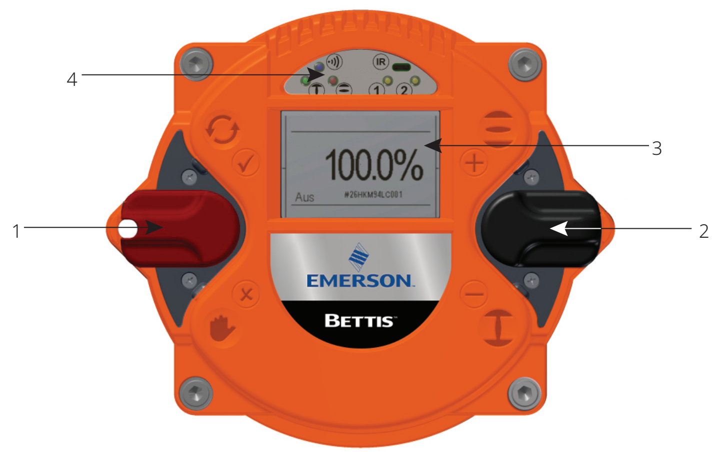
Section 6: Control Unit

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

6.1 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 31. Operating Unit Controls



Display Overview:

1. Selector Switch
2. Control Switch
3. Graphic Display
4. LED Display

The control switch has dual function.

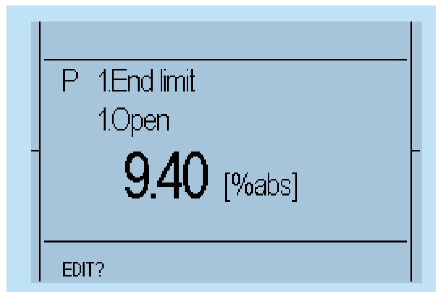
The controller cover may be wiped clean with a damp cloth.
The mounting position of the control unit can be turned in 90° steps (see Section 4.2).

6.2 Display Elements

6.2.1 Graphic Display

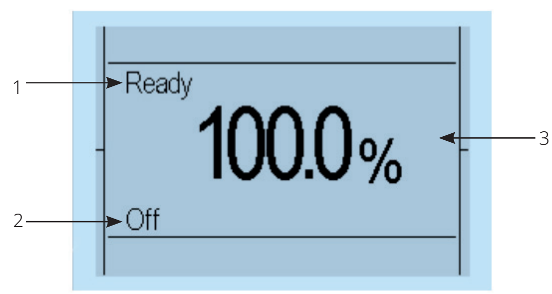
The graphic display used in the controller allows text display in different languages.

Figure 32. Display (1)



During operation, the display 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 33. Display (2)



Display Overview:

1. Status
2. Operation Mode
3. Position

⚠ CAUTION

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

6.2.2 LED Display

To provide users with better status information, basic status data is displayed using 4 color LEDs. As the device powers up, it undertakes a self-test whereby all 4 LEDs briefly lit up simultaneously.

Figure 34. LED Display

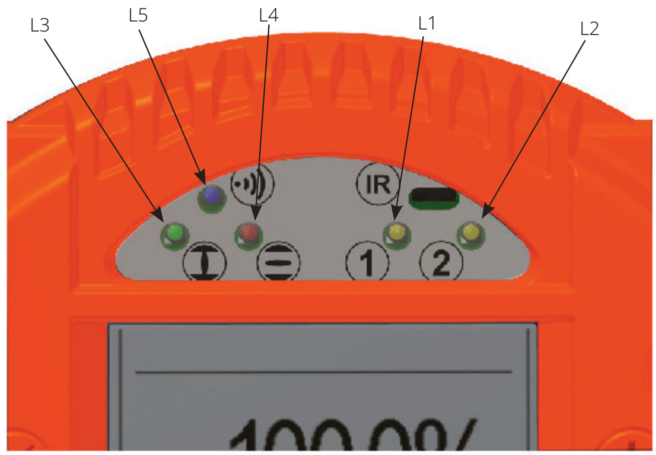


Table 2. LED Color Legend

Description	Color	Lits Up	Flashes Quickly	Flashes Slowly	Does Not Light Up
L1	Yellow	No torque error	Torque fault	-	-
L2	Yellow	Ready (operational readiness)	Path error (no operational readiness!)	-	Error (no operational readiness) motor temperature, supply voltage absent, internal error
L3(1)	Red	OPEN	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.
L4(1)	Green	Closed	Moving to CLOSED position	Applies upon torque-dependent closing: Occurs when the end position CLOSED is reached but the cut-out torque has not yet been reached	Actuator is not in the closed position.
L5	Blue	Bluetooth® enabled	Bluetooth data transmission	Bluetooth ON, no data transmission	Bluetooth/Infrared OFF
	Red	Infrared ON	Infrared data transmission	Infrared ON	

6.3 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 9). Flip the switch up or down to regulate the parameter menu scrolling speed.

Figure 35. Neutral Position

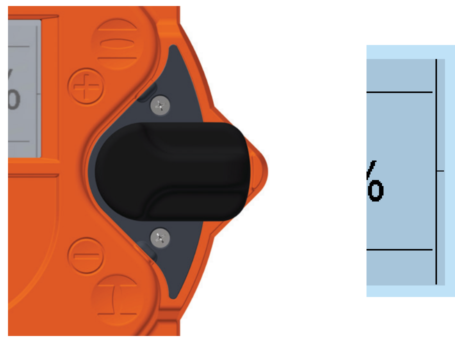


Figure 36. Slight Switch Flip (It Will Move to the Next Parameter)

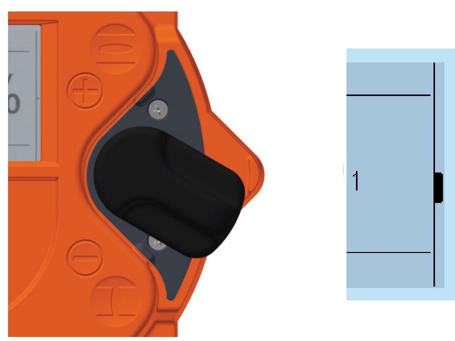


Figure 37. Halfway Switch Flip (Jump to the Next Parameter Category)

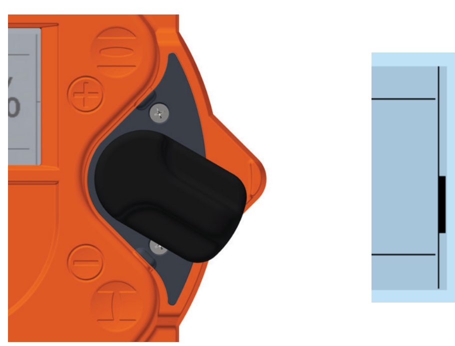
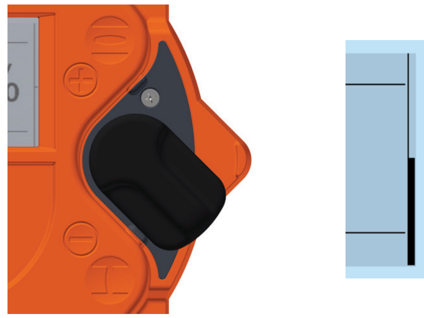


Figure 38. Full Switch Flip (Jump to the End of the Menu)

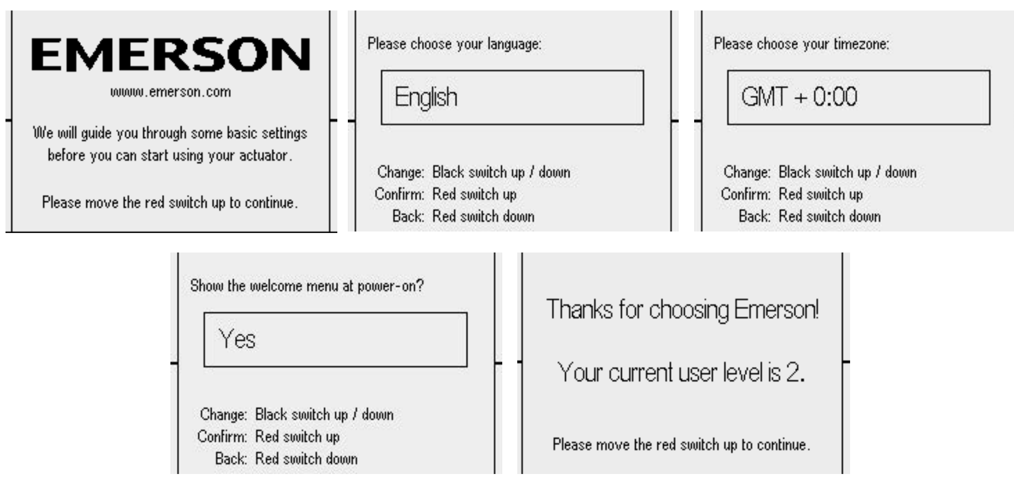


6.4 Welcome Menu

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 time zone. Please follow the instructions shown on the display.

1. LED L1 and L2 are turned off as long as an infrared connection is active.
2. Color of LED L3 and L4 can be changed by parameter P1.7 - see Section 7.1.
3. A travel fault is indicated by a lit L3 and L4.

Figure 39. Welcome Menu



6.4.1 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:

Table 3. Selector Positions

Position	Function
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 commands).
Remote	The actuator is ready to process control commands via input signals. The control switch for the motor operation of the actuator is disabled.

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:

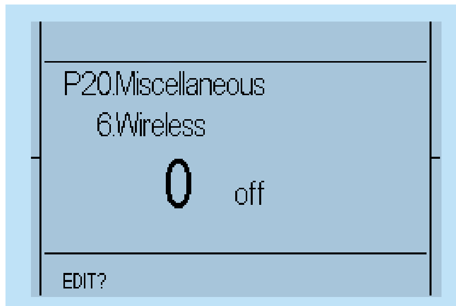
Table 4. Control Switch Positions

Position	Function
Selector switch in the OFF position	The control switch is used to scroll up or down through 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.)

6.4.2 Configuration

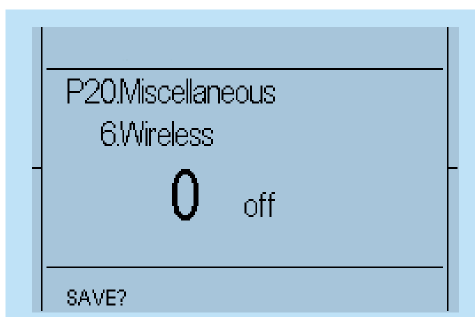
In principle, all parameters are shown as numbers in the corresponding parameter point. From the actuator menu, use the control switch to access different menu points. The lower left corner of the display shows the “EDIT” option.

Figure 40. Configuration Display (1)



Confirm the selector switch (with a slight flip upwards, towards ✓, (see Figures 26 to 28) to change the selected parameter. To confirm this input readiness, the display changes from “EDIT” to “SAVE”.

Figure 41. Configuration Display (2)



Move the control switch towards to the characters to change the parameter. ⊕ or ⊖ (see Figures 35 to 42). After reaching the desired parameter value, confirm the value with the selector switch (again, flip it slightly towards ✓, (Figures 26 to 28).

6.4.3 Configuration Example

As an 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:

Step 1 - The operating and control switch must be in the neutral position.

Figure 42. Selector Switch (1, Red) Control Switch (2, Black)

Step 2 - Now, move the control switch down (towards) until the menu item “P20.6 Miscellaneous - Wireless” is displayed.

Figure 43. Control Switch Flipped Down

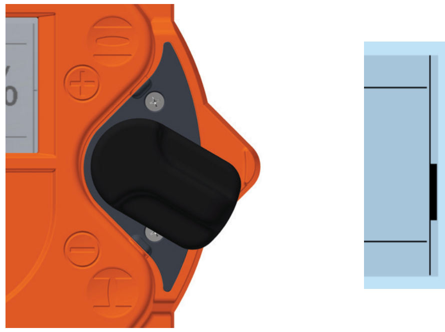
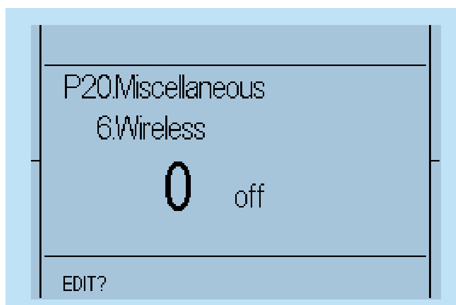


Figure 44. Display (1)



Step 3 - Afterwards, flip up slightly the selector switch (towards) and let it snap back to its neutral position.

Figure 45. Selector Switch in Neutral Position

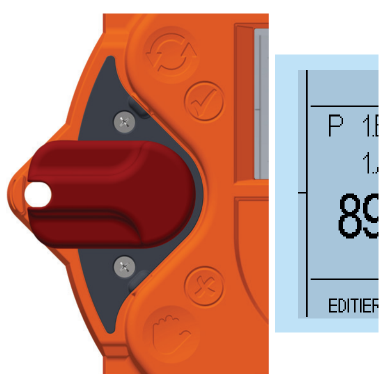


Figure 46. Selector Switch Flipped Up

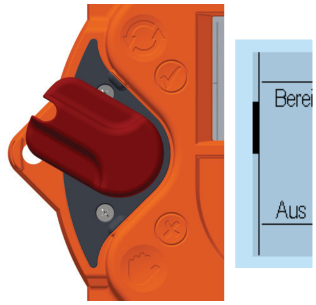
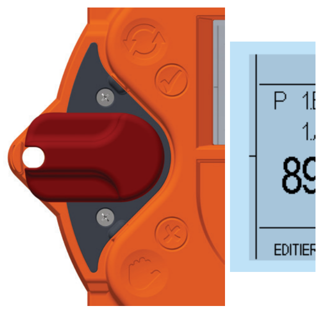


Figure 47. Selector Switch in Neutral Position



Step 4 - This changes the bottom line of the display from “EDIT?” to “SAVE?”.

Figure 48. Display (2)

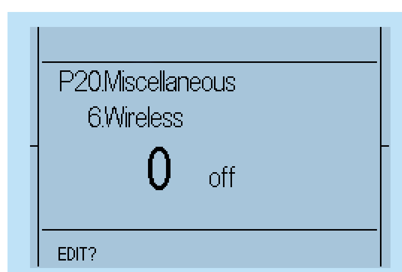
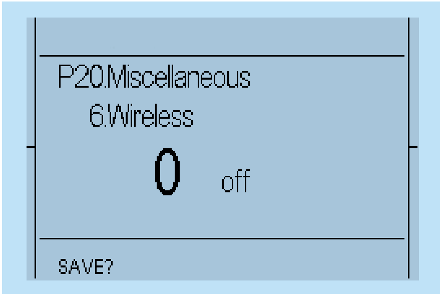


Figure 49. Display (3)



Step 5 - Flip up the control switch (towards) to change the value from 0 (off) to 2 (Bluetooth).

Figure 50. Control Switch Flipped Up

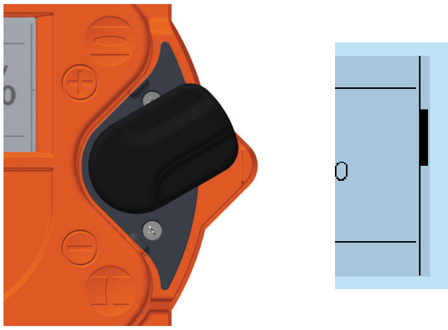
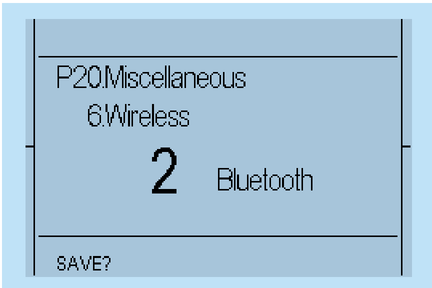


Figure 51. Switch to One



Step 6 - If the value changes to 1, confirm the selection by flipping the selector switch halfway up (towards) and letting it snap back to its neutral position (see Figures 45 to 47).

Figure 52. Selector Switch Flipped Halfway Up

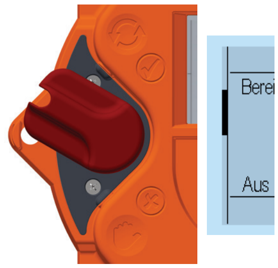
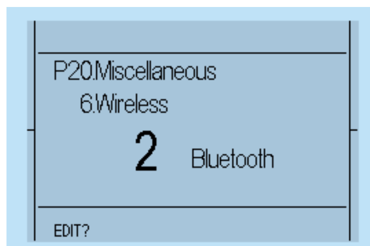


Figure 53. Display After Confirming Selection

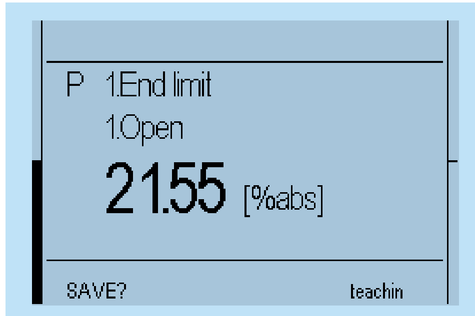


Step 7 - This changes the bottom line of the display from "SAVE?" to "EDIT?" and the parameter is stored.

6.4.4 "TEACHIN"

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 changing 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 handwheel, the actuator can be motor-driven with the control switch to the desired position (see Section 5.5.1).

Figure 54. **"Teachin" on Display**



⚠ 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, 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 Figures 45 to 47).

Section 7: Parameter Menu

For each parameter group, you can find a description tabular overview of the menu items and possible configurations. The parameter list, see Table 5, also includes all possible options per menu item. Please note that some of the menu items listed and described may not be available with your configuration.

7.1 Parameter Group: End Limit

These parameters are used to configure the end position and switch-off behavior of the actuator. It is important to ensure that the basic mechanical configuration described in Section 5.5 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 (see Section 7.2) must be compared with the permissible values of the valve and corrected as appropriate).

⚠ CAUTION

Generally, 100% stands for fully open and 0% for fully closed. Please note that these values cannot be changed.

Table 5. End Limit Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P1.1	End limit	Open	TEACHIN; 0 to 100U[1]	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 to 100U[1]	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	by travel (0)	The actuator uses end-position signals to switch-off and report the end position
			by torque (1)	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 signal is not reached, 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.
			by torque1 (2)	Like torque, but in the end position range, this is also extended when the positioning command is released, until the torque is reached
			by torque2 (3)	Like torque1, however, an actuating command is automatically generated additionally in the end position range so that the end position in the end position range is approached even without a positioning command
			by travel1 (4)	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
P1.4	End limit	Switch-off Close	by travel (0)	The actuator uses end-position signals to switch-off and report the end position
			by torque (1)	The actuator signals the end position or stops the motor only after reaching the specified torque with the proviso that it has reached the end position. If the end position signal is not reached, the actuator reports an error
			by torque1 (2)	See P1.3
			by torque2 (3)	See P1.3
			by travel1 (4)	See P1.3
P1.5	End limit	Closing direction	right (0)	Actuator is designed for clockwise = closing
			left (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 Bettis RTS CM series
			1	
P1.7	End limit	LED function	Close=green (0)	Definition of the LED color of the CLOSED or OPEN end position indication
			Close=red (1)	
			Close = green, yellow inv. (2)	Definition of the LED color of the CLOSED or OPEN end position signalization. Yellow LEDs (1 and 2) are inverted.
			Close = red, yellow inv. (3)	
P1.8	End limit	End limit hyst	0.1 to 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
P1.9	End limit	Ramp	0.1 to 100%	When approaching the end position, the speed is reduced
P1.11	End limit	Overrun Open	0 to 60 s	Switch-off delay after reaching the end position see travel1 (P1.3, P1.4)
P1.12	End limit	Overrun Open	0 to 60 s	Switch-off delay after reaching the end position travel1 (P1.3, P1.4)

NOTE:
[1] Representative for CM32; U - number of revolutions.

⚠ CAUTION

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

⚠ CAUTION

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 6.2.2).

7.2 Parameter Group: Torque

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

Table 6. Torque Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P2.1	Torque	Open	8 to 32 Nm[2]	Switch-off torque in OPEN direction CAUTION: The range can be restricted via the menu item P2.3
P2.2	Torque	Close	8 to 32 Nm[2]	As P2.1 but in CLOSED direction

NOTE:
[2] Representative for CM32.

⚠ 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 (including gear)/output power (including thrust unit) ratio, the ratio of gear/thrust unit must be considered.

7.3 Parameter Group: Speed

Table 7. Speed Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P4.1	Speed	Local Open	1.0 to 72.2 RPM	Output speed for local operation in direction OPEN
P4.2	Speed	Local Close	1.0 to 72.2 RPM	As P4.1 but in direction CLOSE
P4.3	Speed	Remote Open	1.0 to 72.2 RPM	Output speed for remote operation in direction OPEN
P4.4	Speed	Remote Close	1.0 to 72.2 RPM	As P4.3 but in direction CLOSE
P4.5	Speed	Emergency Open	1.0 to 72.2 RPM	Output speed for emergency operation in direction OPEN
P4.6	Speed	Emergency Close	1.0 to 72.2 RPM	As P4.5 but in direction CLOSE
P4.7	Speed	Torque-dependent	1.0 to 72.2 RPM	Seal-tight speed. Speed at which the actuator runs near the end position at torque-dependent switch-off (see P1.3 and P1.4)
P4.8	Speed	Minimum	1.0 to 72.2 RPM	Minimum speed

⚠ CAUTION

The max. speed for the 24 V DC actuator version is reduced to 20 RPM.

7.4 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 7.3) lead to shorter runtimes. If the ramp is set below 100%, the starting time increases in an inversely proportional fashion.

Table 8. Ramp Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P5.1	Ramp	Local	1 to 100%	Start ramp for local operation
P5.2	Ramp	Remote	1 to 100%	Start ramp for remote operation
P5.3	Ramp	Emergency	1 to 100%	Start ramp for emergency operation

7.5 Parameter Group: Control

Table 9. Control Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P6.2	Control	Ready delay	0 to 10 s	Drop-out delay for the ready signal (Binary outputs)
P6.5	Control	24 V output	0	24 V auxiliary output is deactivated (Section 17.5). The function of the auxiliary input is still activated.
			(1)	24 V auxiliary output is activated (Section 17.5).
P6.6	Control	Minimum impulse	0.1 to 2.0 s	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.
			2: 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.

7.6 Parameter Group: User Level

From the Display firmware version 1600 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 55. Actuator Parameters on the SmartTool2

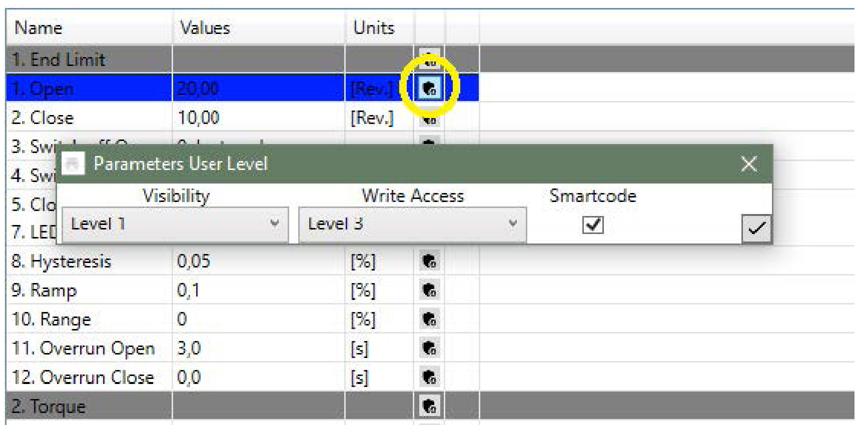


Table 10 shows the default passwords for the user levels.

Table 10. Position Parameter Group

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 56) or directly on the actuator control unit ("P7.4 - Change Password").

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

Figure 56. SmartTool2 Adjust Wizard - Access Tab

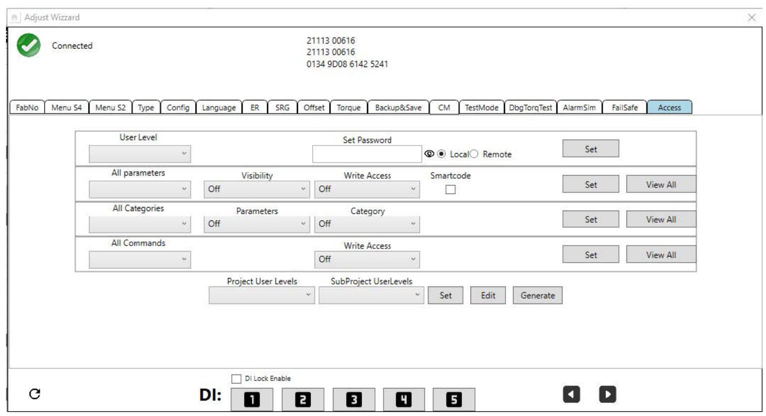


Table 11.

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P7.1	User Level	Local	0 to 6	Sets the default user level on the RTS CM 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 to 6	Sets the user level on access via Bus.
P7.3	User Level	Remote Display	0 to 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.

NOTE:
The parameters have preset user level settings. Tables 34 to 37 show an overview of the default user level settings for all parameters.

7.7 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.

⚠ CAUTION

If you change the end positions (see Section 7.1 intermediate positions are retained percentage-wise, i.e., the absolute positions of the intermediate positions change.

Table 12. Position Parameter Group (1)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P8.1	Position	Intermediate position 1	TEACHIN 0 to 100%	Position value of intermediate position 1
P8.2	Position	Intermediate position 2	TEACHIN 0 to 100%	See above
P8.3	Position	Intermediate position 3	TEACHIN 0 to 100%	See above
P8.4	Position	Intermediate position 4	TEACHIN 0 to 100%	See above
P8.5	Position	Emergency position	TEACHIN 0 to 100%	Position value of the emergency position
P8.6	Position	Hysteresis	0.1 to 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	Intermediate position 5	TEACHIN 0 to 100%	See above
P8.8	Position	Intermediate position 6	TEACHIN 0 to 100%	See above
P8.9	Position	Intermediate position 7	TEACHIN 0 to 100%	See above
P8.10	Position	Intermediate position 8	TEACHIN 0 to 100%	See above
P8.11	Position	Deadband	0 to 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 to 10%	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 to 10%	This hysteresis value applies to the set value in “P8.11 - Deadband”.
P8.14	Position	Intermediate position 9	TEACHIN 0 to 100%	See above

Table 13. Position Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P8.15	Position	Intermediate position 10	TEACHIN 0 to 100%	See above
P8.16	Position	Intermediate position 11	TEACHIN 0 to 100%	See above
P8.17	Position	Intermediate position 12	TEACHIN 0 to 100%	See above
P8.18	Position	Intermediate position 13	TEACHIN 0 to 100%	See above
P8.19	Position	Intermediate position 14	TEACHIN 0 to 100%	See above
P8.20	Position	Intermediate position 15	TEACHIN 0 to 100%	See above
P8.21	Position	Intermediate position 16	TEACHIN 0 to 100%	See above

Figure 57. Function Principle of the Deadband and Hysteresis in Conjunction with Intermediate Positions

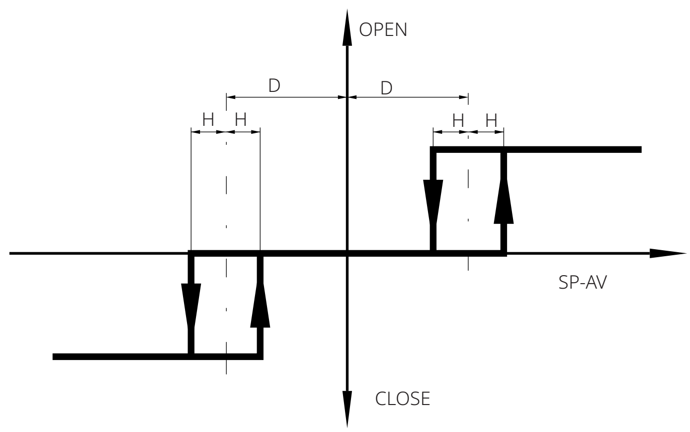


Figure 57 shows the working principle of the parameters "P8.11 - Deadband" and "P8.13 - Hysteresis". The set deadband thresholds are added and subtracted from the intermediate positions. The hysteresis sets the threshold on the deadband thresholds. E.g., if the intermediate position is 50%, deadband is 1% and hysteresis is 50%, the deadband thresholds will be at 49% and 51%. On top of that, the hysteresis for the 49% threshold will be at 50% of the deadband value, which is ±0.5%; thus the hysteresis on the 49% deadband 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.

7.8 Parameter Group: Binary Inputs

The controller is equipped with 5 freely configurable binary inputs. Please find further information on technical data of the binary inputs in Section 17.2. 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

Table 14. Binary Inputs Parameter Group (1)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P9.1	Binary Input	Input 1	-1: Not activated	This input is not active, i.e., it is not shown in the status S2 - Binary Inputs.
			0: no function	This input has no function
			1: Open	OPEN command in REMOTE mode (selector switch in position REMOTE).
			2: Closed	CLOSED command in REMOTE mode (selector switch in position REMOTE).
			3: Stop	STOP command in REMOTE mode (selector switch in position REMOTE).
			4: Open Self-hold	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: Closed Self hold	Self-hold for CLOSED, 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 Closed	Superimposed run command; run the actuator in direction CLOSED regardless of whether the selection switch is set to REMOTE or LOCAL
			8: Release	The actuator may be operated only with a switched signal. Both in local and remote operation
			9: Open/Closed	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	Release of the positioner
			12: Open inv.	As open but active low
			13: Close inv.	As CLOSED but active low
			14: Stop inv.	As STOP but active low
			15: Open Self-Hold inv.	As Open Self-Hold but active low
			16: Closed Self-Hold inv.	As Closed Self-Hold but active low
			17: Emergency-Open inv.	As Emergency-Open but active low
			18: Emergency-Closed inv.	As Emergency-Closed but active low
			19: Block	With activated (switched) signal, the actuator is locked for operation also in local mode
			20: Controller lock	Positioner lock
			21: Release Local	The actuator may be operated only with a switched signal
			22: Block Local	As Release Local but active low
			23: Lock Open	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.

Table 15. Binary Inputs Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P9.1	Binary Input	Input 1	24: Lock Closed	Trigger lock CLOSED (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: Lock Off	Drop the lock
			26: Fail-safe	Trigger the Fail-safe function in all operating modes (only functional in Fail-safe actuators)
			27: Fail-safe inv.	As Fail-safe but active low
			28: Lock Open inv.	As Lock Open but active low
			29: Lock Closed inv.	As Lock Closed but active low
			30: Lock Off inv.	As Lock Off but active low
			31: Intermediate position 1	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 position 2	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 (P8.5). As intermediate position 1 but with higher priority than intermediate positions 1, 2
			36: Intermediate position 1 inv.	As Intermediate position 1 but active low
			37: Intermediate position 2 inv.	As Intermediate position 2 but active low
			38: Intermediate position 3 inv.	As Intermediate position 3 but active low
			39: Intermediate position 4 inv.	As Intermediate position 4 but active low
			40: Emergency position inv.	As Emergency position but active low
			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: Fail-safe lock	Reserved for future use (only for fail-safe actuators)
			46: Fail-safe lock inv.	Reserved for future use (only for fail-safe actuators)

Table 16. Binary Inputs Parameter Group (3)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P9.1	Binary Input	Input 1	47: Intermediate position Bit0	Intermediate position Bit0 to Intermediate position 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: Intermediate position Bit1	See 47: Intermediate position Bit0
			49: Intermediate position Bit2	See 47: Intermediate position Bit0
			50: Intermediate position Bit0 inv.	As 47: Intermediate position Bit0 but active low
			51: Intermediate position Bit1 inv.	See 50: Intermediate position Bit0 inv.
			52: Intermediate position Bit2 inv.	See 50: Intermediate position Bit0 inv
			53: PVST Start	Start PVST (optional, see PVST section)
			54: PVST Start inv.	As 53: PVST Start but active low
			55: Intermediate position Bit3	See 47: Intermediate position Bit0
			56: Intermediate position Bit3 inv.	See 50: Intermediate position Bit0 inv
P9.2	Binary Input	Input 2	See Input 1	-
P9.3	Binary Input	Input 3	See Input 1	-
P9.4	Binary Input	Input 4	See Input 1	-
P9.5	Binary Input	Input 5	See Input 1	-

7.9 Parameter Group: Binary Outputs

The controller is equipped with 8 freely configurable binary outputs. Please find further information on technical data of the binary outputs in Section 17.1. 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

Table 17. Binary Outputs Parameter Group (1)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.1	Binary Output	Output 1	0: User defined	Optional
			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
			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: Position > Intermediate 1	Position > Intermediate position 1
			14: Position < Intermediate 1	Position < Intermediate position 1
			15: Position > Intermediate 2	Position > Intermediate position 2
			16: Position < Intermediate 2	Position < Intermediate position 2
			17: Position > Intermediate 3	Position > Intermediate position 3
			18: Position < Intermediate 3	Position < Intermediate position 3
			19: Position > Intermediate 4	Position > Intermediate position 4
			20: Position < Intermediate 4	Position < Intermediate position 4
			21: Local	Local operating mode (selector switch in position)

Table 18. Binary Outputs Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.1	Binary Output	Output 1	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. Switch off	The motor temperature is above the motor switch-off threshold
			26: Always	Signal is always on
			27: Never	Signal is always off
			28: Binary Input 1	Forwarding of binary input to output
			29: Binary Input 2	Forwarding of binary input to output
			30: Binary Input 3	Forwarding of binary input to output
			31: Binary Input 4	Forwarding of binary input to output
			32: Binary Input 5	Forwarding of binary input to output
			33: Torque Open ma.	As Torque OPEN although it will suppress (mask) this signal in the end position upon torque-dependent switch-off
			34: Torque Closed ma.	As Torque CLOSED although it will suppress (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: Lock Open	Lock OPEN is enabled. OPEN command is internally queued with the highest priority and will not be dropped even in the end position
			39: Lock Closed	Lock CLOSED is enabled. CLOSED command is internally queued with the highest priority and will not be dropped even in the end position
			40: Fail-safe OK1	Fail-safe OK (only for fail-safe actuators)
			41: Fail-safe OK2	Fail-safe OK and Ready (only for fail-safe actuators)
			42: Fail-safe OK3	Fail-safe OK, Ready and Remote (only for fail-safe actuators)
			43: Lock	Lock Open or Lock Closed is enabled
			44: Ready/TorqueOK	Actuator is ready and no torque switch-off
			45: Ready/Remote/ Torque OK	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

Table 19. Binary Outputs Parameter Group (3)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.1	Binary Output	Output 1	47: Position = Intermediate 2	Position = Intermediate position 2. The width of the interval is set with the parameter P8.6.
			48: Position = Intermediate 3	Position = Intermediate position 3. The width of the interval is set with the parameter P8.6.
			49: Position = Intermediate 4	Position = Intermediate position 4. The width of the interval is set with the parameter P8.6.
			50: Pos.=Emergency Position	Position = emergency position. The width of the interval is set with the 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: Line voltage OK	Supply voltage for the motor is OK
			64: Control voltage OK	The auxiliary voltage 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
			67: PVST Active	A PVST was triggered. The actuator is running a PVST
			68: Emergency 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: Emergency 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 24 V DC 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 fail-safe-Actuators); see the fail-safe-section for more information about the manual override

Table 20. Binary Outputs Parameter Group (4)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.1	Binary Output	Output 1	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: Under voltage 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: Under voltage Fault	The input voltage is too low, The motor is switched off, until the input voltage is in the regular voltage range.
			84: Under voltage Switch off	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: Over voltage 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.
4-5 P10.2	Binary 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	Binary Output	Output 2	See Output 1	-
P10.4	Binary Output	Output 2 Conf.	See Output 1 conf.	-
P10.5	Binary Output	Output 3	See Output 1	-
P10.6	Binary Output	Output 3 Conf.	See Output 1 conf.	-
P10.7	Binary Output	Output 4	See Output 1	-
P10.8	Binary Output	Output 4 Conf.	See Output 1 conf.	-
P10.9	Binary Output	Output 5	See Output 1	-
P10.10	Binary Output	Output 5 Conf.	See Output 1 conf.	-
P10.11	Binary Output	Output 6	See Output 1	-
P10.12	Binary Output	Output 6 Conf.	See Output 1 conf.	-
P10.13	Binary Output	Output 7	See Output 1	-
P10.14	Binary Output	Output 7 Conf.	See Output 1 conf.	-
P10.15	Binary Output	Output 8	See Output 1	-
P10.16	Binary Output	Output 8 Conf.	See Output 1 conf.	-

⚠ CAUTION

When using the point torque-dependent OPEN or torque-dependent CLOSED (see Section 7.1, Menu 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 6.2.2).

7.10 Parameter Group: Position Output (Optional)

Position output is used to indicate the current position of the actuator using 0/4 to 20 mA; it can retrofitted using software code.

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 7.1).

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 settings are:

- 4 mA at 0% position
- 20 mA at 100% position

Table 21. Position Output Parameter Group

	Menu Item	Sub Menu Item	Position 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: Position Valve characteristic	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	Position Output	Start (at 0%)	0 to 20.5 mA (4 mA)	mA value for the Closed (0%) position
P11.3	Position Output	End (at 100%)	0 to 20.5 mA (20 mA)	mA value for the On (100%) position
P11.4	Position Output	Calibration 20 mA	-10% to +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 Output	Function 2	See Function 1	-
P11.6	Analog Output	Start (at 0%)	See Start	-
P11.7	Analog Output	End (at 100%)	See End	-
P11.8	Analog Output	Calibration 20 mA 2	See Calibration 20 mA 1	-

7.11 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.

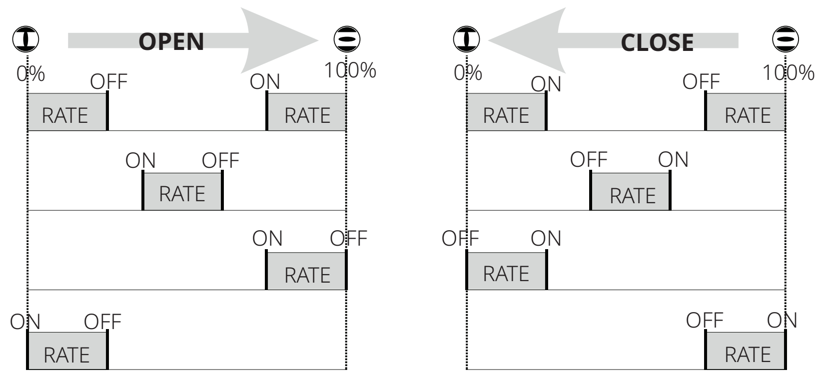
Step mode operation can be activated individually for the directions OPEN and CLOSED.

Cycle start, cycle end, cycle duration and interval time can be set separately for both directions (see Figure 58).

Table 22. Step Mode Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P12.1	Step mode function	Mode	disabled	Step mode operation is disabled
			enabled	Step mode operation is enabled in LOCAL, REMOTE and EMERGENCY operation
			Local only	Step mode is only enabled in LOCAL mode
			Remote only	Step mode is only enabled in REMOTE mode
			Local + Remote only	Step mode is enabled in REMOTE and LOCAL mode
P12.2	Step mode function	Start Open	0 to 100%	In OPEN direction, position in % from which the step mode operation should start
P12.3	Step mode function	End Open	0 to 100%	In OPEN direction, position in % of which the step mode operation should end
P12.4	Step mode function	Runtime Open	0.1 to 60	Runtime in OPEN direction
P12.5	Step mode function	Pause time Open	0.2 to 60	Pause time in OPEN direction
P12.6	Step mode function	Start Closed	0 to 100%	In CLOSED direction, position in % from which the step mode operation should start
P12.7	Step mode function	End Closed	0 to 100%	In CLOSED direction, position in % of which the step mode operation should end
P12.8	Step mode function	Run time Closed	0.1 to 60	Runtime in Closed direction
P12.9	Step mode function	Pause time	0.2 to 60	Pause time in Closed direction
P12.10	Step mode function	Time base	0: Seconds	Time basis for run and pause times
			1: Minutes	
P12.11	Step mode function	Speed adaptation	0:	Speed adaptation not activated. Normal step mode function
			1:	Speed adaptation is activated. The speed is reduced according to the runtime and pause time in the step mode range. (Example: Running time 1 second and pause time 1 second 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

Figure 58. Position Setting and Timing



NOTE:

It is important to ensure that the mode of operation is not exceeded. The running info on the actuator (see Section 6.2.2) only flashes while the drive is running, i.e. during the break, no flash.

7.12 Parameter Group: Positioner (Optional)

The positioner SR option is used to control the electric actuator by means of a set point input 0/4 to 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.

Table 23. Positioner Parameter Group (1)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P13.1	Positioner	Function	off	Positioner disabled
			1: Position	mA input for the position setpoint
			2: Position valve characteristic	mA input for the position setpoint, taking into account the valve characteristic
P13.2	Positioner	Begin (at 0%)	0 to 20.5 mA (4.0 mA)	mA value of the setpoint for the CLOSED (0%) position
P13.3	Positioner	End (at 100%)	0 to 20.5 mA (20.0 mA)	mA value of the setpoint for the OPEN (100%) position
P13.4	Positioner	Deadband	0.1 to 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
P13.5	Positioner	Gain	1 to 100% (100%)	The gain (gradient) affects the positioning close to the target position. The smaller the gain selected (for example, 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 parameters P13.9 and P13.10). This provides a 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	Actuator moves to OPEN position
			3: Close	Actuator moves to CLOSED position on signal failure
			4: Emergency position	On signal failure, the actuator moves to defined emergency position (see parameter P13.7)
			5: Emergency Open	Emergency open on signal failure
			6: Emergency 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 4 mA position, in case of an analog input signal failure
			8: Fail-safe	Fail-safe operation on signal failure
P13.7	Positioner	Emergency position	0 to 100% (50.0%)	Determination of the emergency position (Can also be set in the menu P8.5)
P13.8	Positioner	Calibration setpoint	-10% to +10%	Calibration value for the 20 mA setpoint. 1% = approximately 0.2 mA. Calibration process: By applying 20 mA on the setpoint input, this parameter is corrected until the readout matches 20 mA

Table 24. Positioner Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P13.9	Positioner	Min. impulse	(0.2 s)	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	(2.0 s)	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
P13.11	Positioner	Begin position (a0)	0.0 to 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 position (e0)	75.0 to 100.0% (98.0%)	Largest controllable position other than the end position OPEN. The area e 0 to 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 to 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 to 100% (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	Calibration setpoint offset	-10% to +10%	Calibration of zero for the input setpoint. 1% = 0.2 mA
P13.16	Positioner	Hysteresis	0 to 100%	Hysteresis range for setpoint signal, with regard to the deadband. Setting 0 equals to a hysteresis of 25%.

Figure 59. Assigning the Position to the Setpoint

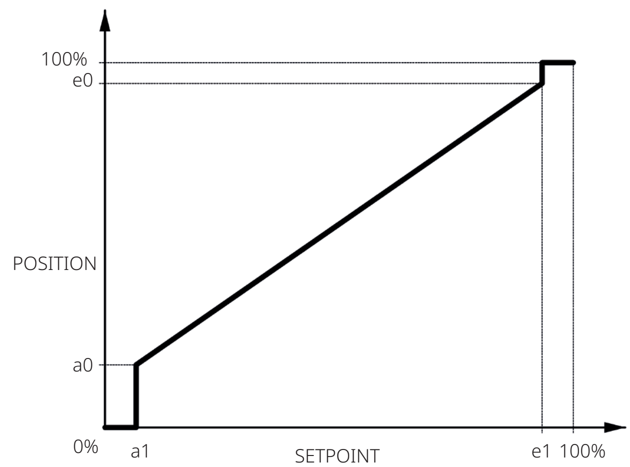


Figure 60. Function Principle of the Deadband And Hysteresis in Conjunction with the Positioner

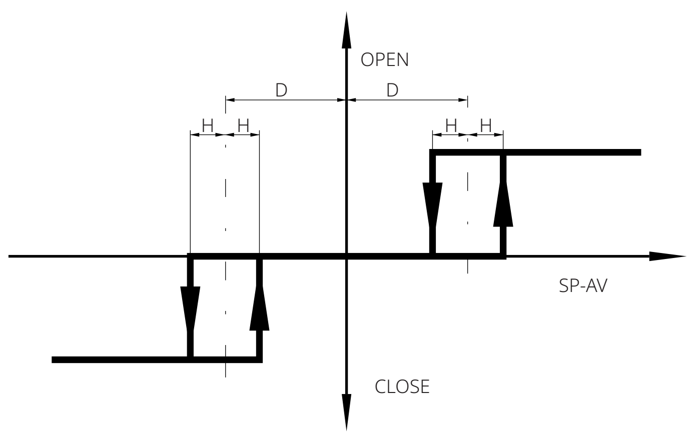


Figure 60 shows the working principle of the parameters “P13.4 - Deadband” and “P13.16 - Hysteresis”. The set deadband thresholds are added and subtracted from the setpoint. The hysteresis sets the threshold on the deadband thresholds. E.g., if the setpoint is 50%, deadband is 1% and hysteresis is 50%, the deadband thresholds will be at 49% and 51%. On top of that, the hysteresis for the 49% threshold will be at 50% of the deadband value, which is ±0.5%; thus the hysteresis on the 49% deadband 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.

7.13 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 to 20 mA signal by readjusting the actuator.

Table 25. PID-Controller Parameter Group (1)

	Menu Item	Sub Menu Item	Position 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 Section 7.12)
			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 Section 7.12)
			3: 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 Section 7.12). 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 parameter P14.3)
			1: external	The PID-controller uses the external setpoint. The adjustment of this setpoint is done with the parameters P13.2 and P13.3 (see Section 7.12)
P14.3	PID-controller	Fixed setpoint	0 to 100%	Specification of the internal fixed setpoint
P14.4	PID-controller	Start (at 0%)	0 to 20.5 mA	mA value at 0% of the external actual value
P14.5	PID-controller	End (at 100%)	0 to 20.5 mA	mA value at 100% of the external actual value
P14.6	PID-controller	Gain (P)	+50.0 to 50.0	Gain (proportional value) of the PID-controller. A negative value reverses the effective direction of the PID-controller, e.g.: Positive gain: The actuator opens when the desired value is greater than the external actual value. Negative gain: The actuator closes when the desired value is greater than the external actual value
P14.7	PID-controller	Reset time (I)	0 to 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

Table 26. PID-Controller Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P14.8	PID-controller	Lead time (D)	0 to 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 1 s time constant is added (DT_1)
P14.9	PID-controller	Offset	-200 to 200%	The offset value will be added to the output value of the PID-controller
P14.10[3]	PID-controller	Inverse operation	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	On signal failure of external actual values, actuator moves to the OPEN position
			3: Closed	On signal failure of external actual values, actuator moves to the CLOSED position
			4: Emergency position	On signal failure of external actual values, actuator moves to the EMERGENCY position (see parameter P13.7)
P14.13	PID-controller	Calibration of ext. actual value	-10 to +10%	Calibration process: By applying 20 mA to the external actual value input, this parameter is corrected until the readout matches 20 mA
P14.14	PID-controller	Process begin	-32768 to +32767	Mantissa of the real process variable (beginning of external actual value)
P14.15	PID-controller	Process end	-32768 to +32767	Mantissa of the real process variable (end of external actual value)
P14.16	PID-controller	Process comma shift	-3 to +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
P14.18	PID-controller	Deadband	0.1 to 10.0% (1.0%)	Tolerance range for the control deviation (set point external actual value) where no adjustment occurs

NOTES:
[3] Up to firmware 1.609.

7.14 Parameter Group: Bus Systems (Optional)

The manuals for Bus Systems are available at www.emerson.com, Bettis RTS Electric Actuator under Manuals and Guides tab.

7.15 Parameter Group: Characteristic Curves (Optional)

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

7.15.1 Torque Characteristic

With this characteristic curve, torque limits already set under menu item P2-torque (see Section 7.2), can be further reduced depending on travel. Characteristics can be configured with the SMARTTOOL software (see Figure 61).

Figure 61. Torque Characteristic Curve Display

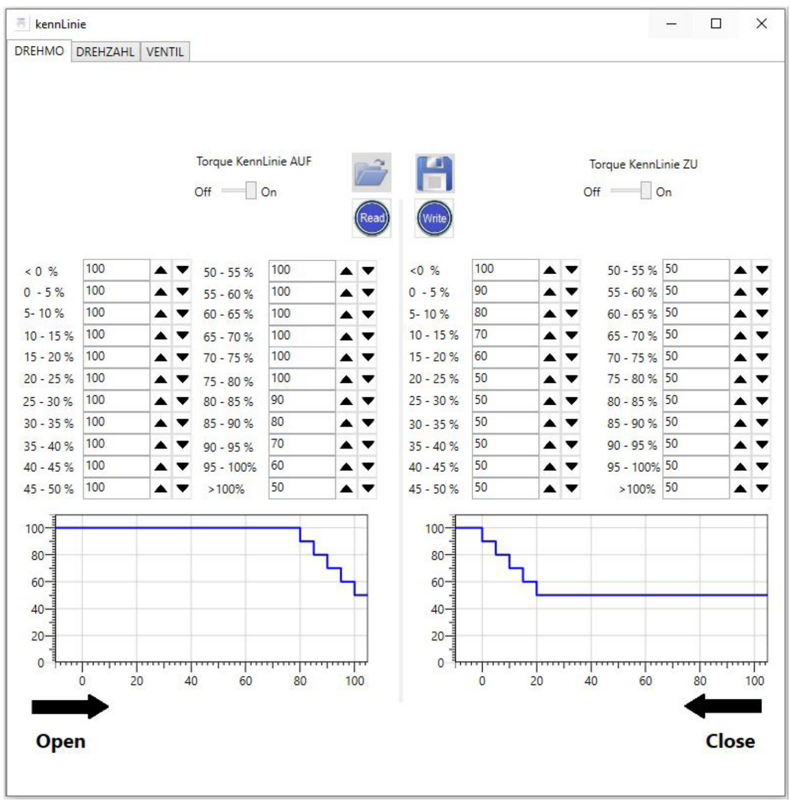


Table 27. Torque Characteristic Curve Parameter Group

	Menu Item	Sub Menu Item	Position 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

7.15.2 Speed Characteristic

With this characteristic curve, speed limits already set under menu item P4-speed (see Section 7.3) can be further reduced depending on travel. Characteristics can be configured via the SMARTTOOL software (see Figure 62).

Figure 62. Speed Characteristic Curve Display

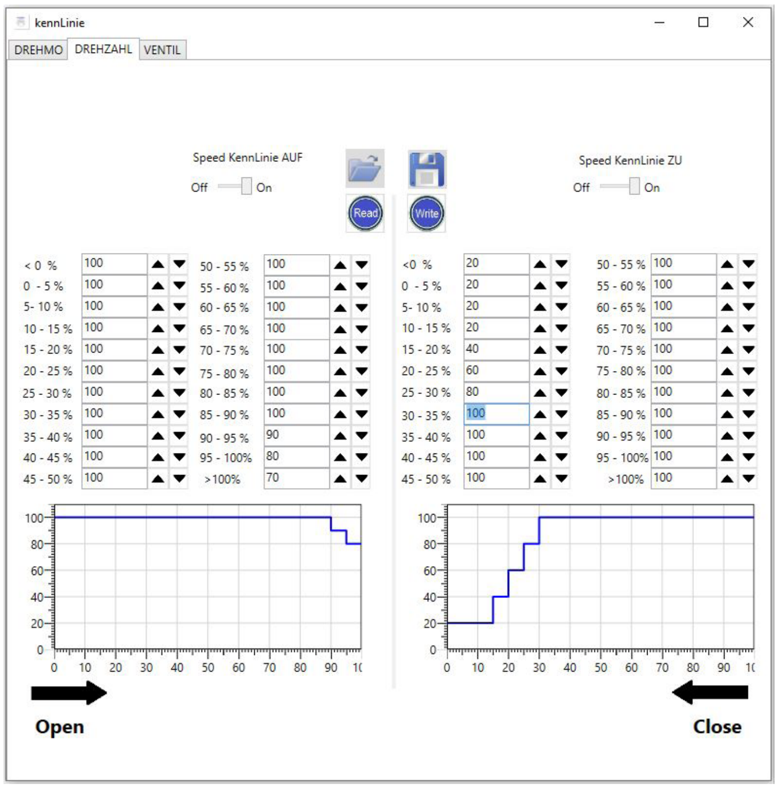


Table 28. Speed Characteristic Curve Parameter Group

	Menu Item	Sub Menu Item	Position 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.

7.15.3 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 general nonlinear characteristic curves of valves. Characteristics can be configured via the SMARTTOOL software (see Figure 63).

Figure 63. Valve Characteristic Curve Display

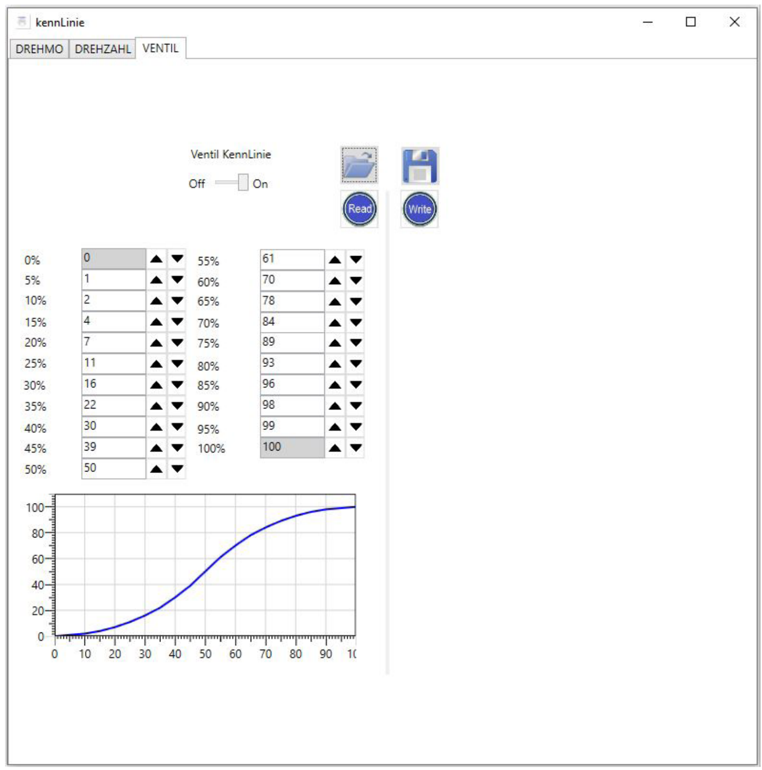


Table 29. Valve Characteristic Curve Parameter Group

	Menu Item	Sub Menu Item	Position 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.

7.16 Parameter Group: Identification (Optional)

This option allows entering further custom-identification parameters.

Table 30. Identification Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P18.1	Identification	PPS number	15-digit	Used to enter a PPS number. This is displayed in the bottom line. CAUTION: point P20.5 must be set to 0.

7.17 Parameter Group: System Parameters

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.

Table 31. System Parameter Group

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P19.6	System Parameters	Calibration IST	-10 to +10%	This value is used to offset the output signal of the Bettis RTS CM control unit's analog output. The mA signal may be calibrated with a current measurement device.
P19.7	System Parameters	Calibration Setpoint 20 mA	-10 to +10%	This value is used to offset the input signal on the external analog input 2 measured by the Bettis RTS CM control unit. The measured mA signal may be calibrated with an external setpoint generator.
P19.8	System Parameters	Calibration ext. act.val. 20 mA	-10 to +10%	This value is used to offset the input signal on the external analog input 2 measured by the Bettis RTS CM control unit. The measured mA signal may be calibrated with an external setpoint generator.
P19.12	System Parameters	LCD Contrast	80 to 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 7.1.
P19.33	System Parameters	MUSE-Detection	0: -	MUSE-Detection is not executed.
			1: Execute	MUSE-Detection is executed.
P19.56	System Parameters	LCD Inverse	0; 1	Inverts the display pixels.

7.18 Parameter Group: Miscellaneous

Table 32. Miscellaneous Parameter Group (1)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P20.1	Miscellaneous	Language	0: German 1: English 2: Russian 3: Chech 4: Spanish 5: French 6: Italian 7: Danish 8: Hungarian 9: Turkish 10: Greek 11: Polish 12: Serbian 13: Croatian 14: Bulgarian 15: Dutch 16: Romanian 17: Swedish	Defines the menu language
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).

Table 33. Miscellaneous Parameter Group (2)

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
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 to 15	The fourth line of the display shows various diagnostic values.
P20.6	Miscellaneous	Infrared	Off (0)	The infrared connection is disabled
			On (1)	The infrared connection is activated for about 3 minutes
			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 to 2	Different menu styles
P20.9	Miscellaneous	Time	-	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.
P20.10	Miscellaneous	Time zone	-840 to 840 minutes	Sets the time zone; 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.

7.19 Default User Level Settings

Table 34 shows the default user level settings for all parameters on a brand new actuator.

Table 34. Default User Level Settings (1)

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	Emergency Open	2	4
P4.6	Speed	Emergency 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	24 V Output	2	4
P6.6	Control	Min. Impulse	2	4
P6.17	Control	Remote Display	2	4
P7.1	User Level	Local	2	4
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	Intermediate position 1	1	3
P8.2	Position	Intermediate position 2	1	3
P8.3	Position	Intermediate position 3	1	3
P8.4	Position	Intermediate position 4	1	3
P8.5	Position	Emergencyposition	1	3
P8.6	Position	Hysteresis	1	3
P8.7	Position	Intermediate position 5	1	3
P8.8	Position	Intermediate position 6	1	3
P8.9	Position	Intermediate position 7	1	3
P8.10	Position	Intermediate position 8	1	3
P8.11	Position	Deadband	1	3
P8.12	Position	Gain	1	3
P8.13	Position	Hysteresis	1	3

Table 35. Default User Level Settings (2)

Parameter	Menu Item	Sub Menu Item	Default UL Read	Default UL Write
P8.14	Position	Intermediate position 9	1	3
P8.15	Position	Intermediate position 10	1	3
P8.16	Position	Intermediate position 11	1	3
P8.17	Position	Intermediate position 12	1	3
P8.18	Position	Intermediate position 13	1	3
P8.19	Position	Intermediate position 14	1	3
P8.20	Position	Intermediate position 15	1	3
P8.21	Position	Intermediate position 16	1	3
P9.1	Binary Input	Input 1	2	4
P9.2	Binary Input	Input 2	2	4
P9.3	Binary Input	Input 3	2	4
P9.4	Binary Input	Input 4	2	4
P9.5	Binary Input	Input 5	2	4
P10.1	Binary Output	Output 1	2	4
P10.2	Binary Output	Output conf. 1	2	4
P10.3	Binary Output	Output 2	2	4
P10.4	Binary Output	Output conf. 2	2	4
P10.5	Binary Output	Output 3	2	4
P10.6	Binary Output	Output conf. 3	2	4
P10.7	Binary Output	Output 4	2	4
P10.8	Binary Output	Output conf. 4	2	4
P10.9	Binary Output	Output 5	2	4
P10.10	Binary Output	Output conf. 5	2	4
P10.11	Binary Output	Output 6	2	4
P10.12	Binary Output	Output conf. 6	2	4
P10.13	Binary Output	Output 7	2	4
P10.14	Binary Output	Output conf. 7	2	4
P10.15	Binary Output	Output 8	2	4
P10.16	Binary 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	Calibration 20 mA 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	Calibration 20 mA 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

Table 36. Default User Level Settings (3)

Parameter	Menu Item	Sub Menu Item	Default UL Read	Default UL Write
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	Deadband	2	4
P13.5	Positioner	Gain	2	4
P13.6	Positioner	Live zero detect.	2	4
P13.7	Positioner	Emergency position	1	3
P13.8	Positioner	Calibration setpoint	2	4
P13.9	Positioner	Minimum Impulse	2	4
P13.10	Positioner	Period	2	4
P13.11	Positioner	Begin position (a0)	2	4
P13.12	Positioner	End position (e0)	2	4
P13.13	Positioner	Begin setp. (a1)	2	4
P13.14	Positioner	End setp. (e1)	2	4
P13.15	Positioner	Calibration 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
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	Deadband	2	4
P16.1	Stroke test	Stroke test	2	4
P16.2	Stroke test	Start position	2	4
P16.3	Stroke test	Test range	2	4
P16.4	Stroke test	Resting time	2	4
P16.5	Stroke test	Speed Open	2	4
P16.6	Stroke test	Speed Close	2	4
P16.7	Stroke test	Time trigger	2	4
P16.8	Stroke test	Maximum time	2	4
P16.9	Stroke test	Start Time	2	4
P16.10	Stroke test	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

Table 37. Default User Level Settings (4)

Parameter	Menu Item	Sub Menu Item	Default UL Read	Default UL Write
P18.1	Identification	KKS-Number	2	4
P19.6	System	Calibration IST	2	4
P19.7	System	Calibration SOLL	2	4
P19.8	System	Calibration 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	Time zone	1	3
P20.11	Miscellaneous	Daylight saving time	1	3

Section 8: Status Area

The status area presents current process and diagnostic data. Here 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:

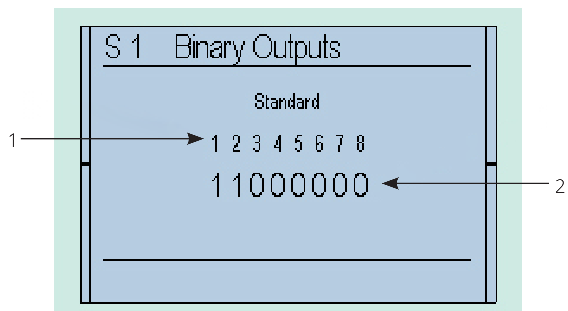
- Status
- History

8.1 Status

8.1.1 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 64. Binary Output Display



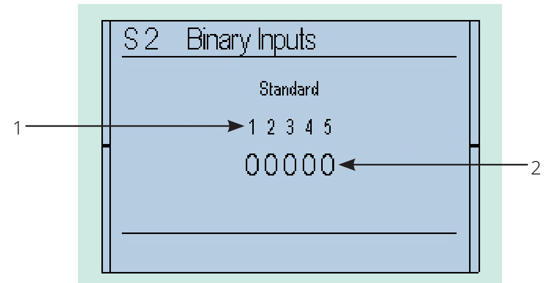
Display Overview:

1. Output Number
2. Signal (0 = Low; 1 = High)

8.1.2 Status - Binary Inputs

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

Figure 65. Binary Input Display



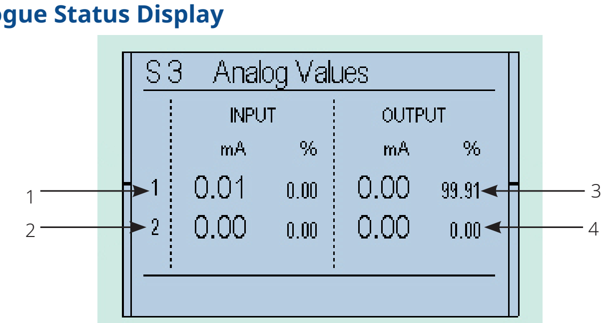
Display Overview:

1. Input Number
2. Signal (0 = Low; 1 = High)

8.1.3 Status - Analogue 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-controller. 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 66. Analogue Status Display



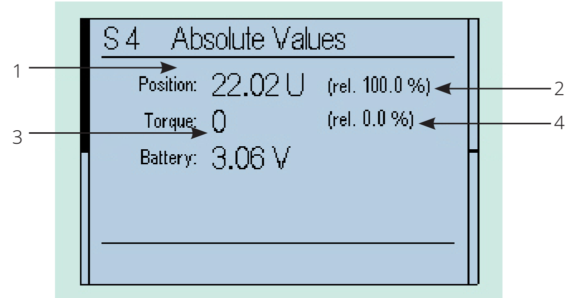
Display Overview:

1. Input 1
2. Input 2
3. Output
4. All values in mA

8.1.4 Status - Absolute Values

This status displays the absolute position of the actuator.

Figure 67. Absolute Value Display

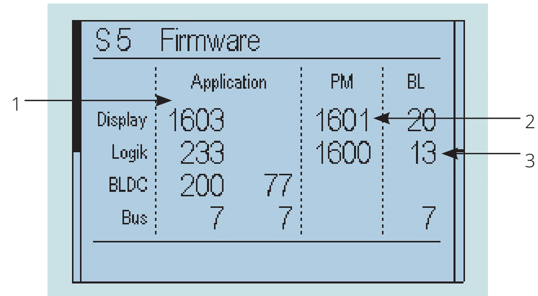


Display Overview:

1. Absolute value of the position unit
2. Relative value of the position unit
3. Absolute value of the torque unit
4. Relative value of the position unit (calibrated in factory)

8.1.5 Status - Firmware

Figure 68. Firmware Status Display

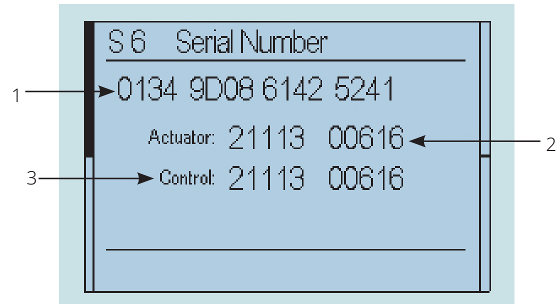


Display Overview:

1. Firmware
2. Firmware Date

8.1.6 Status - Serial Number

Figure 69. Serial Number Display

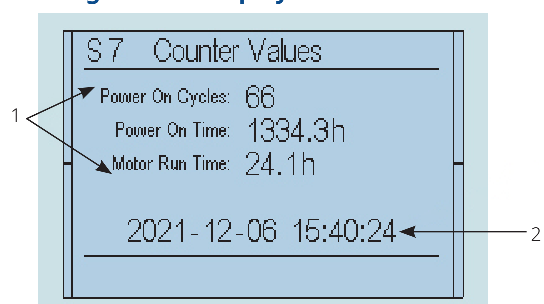


Display Overview:

1. Serial number of the control unit
2. Serial number of the actuator
3. Serial number of electronics

8.1.7 Status - Meter Readings

Figure 70. Meter Readings Status Display



Display Overview:

1. Power-on cycles
2. Operating hours
3. Engine duration

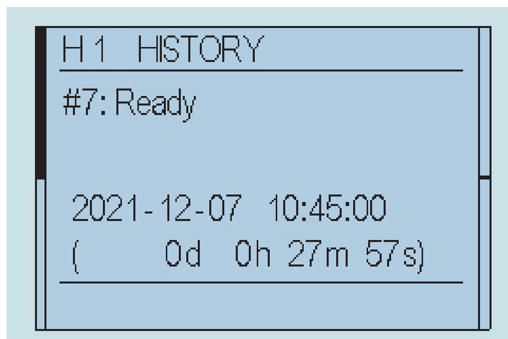
8.2 History

History shows the last 20 history entries. In addition to the plain text entry, the time since the last history entry is also provided.

Please note that the actuator can only calculate time if energized. For error analysis, please refer to Section 12.1.

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

Figure 71. Example for a History Entry

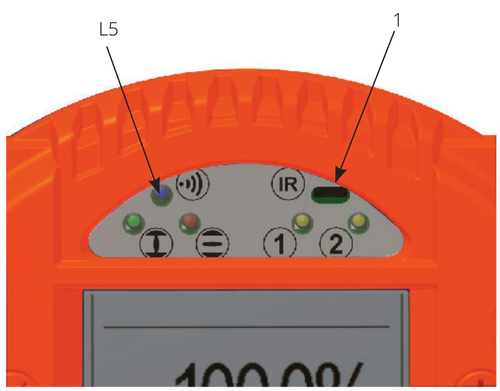


Section 9: Infrared Connection

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, ensure that the IR interface surface is protected from strong disturbances which may 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 Light-emitting (LED) (see Figure 72). The infrared interface can be enabled in the menu item P20.6.

Figure 72. LED IR Indicator



Display Overview:

1	Infrared connection
L5	Bluetooth connection

Section 10: Bluetooth Link

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 simplify commissioning significantly.

When the Bluetooth interface is enabled, this is indicated by the LED L5 (see Figure 72). The Bluetooth interface can be enabled in menu item P20.6.

Section 11: Maintenance

Maintenance work on open actuators may only be conducted if the actuators are de-energized. Reconnection during maintenance is strictly prohibited.

NOTE:
Work on the electrical system or equipment must be carried out only in accordance with electrical regulations by a qualified electrician or by specially instructed personnel under the control and supervision of a qualified electrician.

⚠ CAUTION

For explosion proof actuators, it is necessary before opening the cover to wait a certain time after switching off, see explosion protection sticker (Figure 73). Following times are specified for the actuators.

- CM32: 5 min
- CM64: 10 min

Figure 73. Explosion Protection Sticker

Display Overview:

1. Explosion protection sticker

Actuators are ready for use after installation. By default, the actuator is delivered filled with oil.

On-going monitoring:

- Beware of increased running noise. During long downtime periods, operate the actuator at least every 3 months.
- For actuators with output types A, B and C according to DIN 3210-A, B1, B2, and C according to DIN ISO 5210, relubricate at least every 6 months on existing grease fittings, see Section 15.

Actuators are designed for installation in any position (see Section 2.5). Therefore, the main body is not equipped with a level indication or a drain plug. The replacement of the lubricant from the main body must be performed via the handwheel.

Every approximately 10,000 to 20,000 hours (about 5 to 15 years), depending on the workload, you must:

- Change Oil
- Replace seals
- Check all roller bearings and the worm-wheel assembly and replace if necessary
- Check our lubricants table for recommended oils and greases (see Section 15).

⚠ CAUTION

Check the cable glands at regular intervals (annually) for tightness of the cables and retighten if necessary.

If the visual inspection (e.g. dust or water penetration) indicates that the effectiveness of the sealing elements of the cable entry has suffered damage or aging, such elements have to be replaced preferably by using the original spare parts from the manufacturer of the equipment or through cable entries of comparable quality as well as the same ex- or IP protection class. If screws need to be replaced, it is preferable to use original replacement parts. The tensile strength of the screws must be at least 400 N/mm^2 .

Section 12: 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 8.2).

12.1 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.

Table 38. History Entries and their Descriptions (1)

History Entry	Type	Description
#3: Mot. temp. warn. #19: Mot. temp. warn. OK	Warning	The motor temperature is in the critical range although the actuator remains fully functional.
#4: Mot. temp. switch off #20: Mot. temp. switch off OK	Alarm	Over temperature in motor, fault on Basis or BLDC, On Basis: loss of main power (3x400 V) or cable break between CSC and motor; on BLDC: cable break between BLDC and motor.
#5: Phase sequ. fault #6: Phase sequ. OK	N/A	Cause on Basis: Active phase sequence detection on single phase actuators, loss of main power while connected to external 24 V DC 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: Fail-safe Fault #12: Fail-safe OK	Alarm	Communication error between fail-safe board and logic, loss of external 24 V fail-safe voltage, or over temperature on fail-safe brake.
#13: Manual override #14: Manual override off	Alarm	Manual override on fail-safe activate (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 multi-turn sensor calibration lost on CM - please contact the manufacturer.
#22: Torque Sensor Fault #23: Torque Sensor OK	N/A	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: Under voltage> Warning #29: Voltage OK	Warning	The input voltage is below the regular voltage range, but motor operation is still possible.

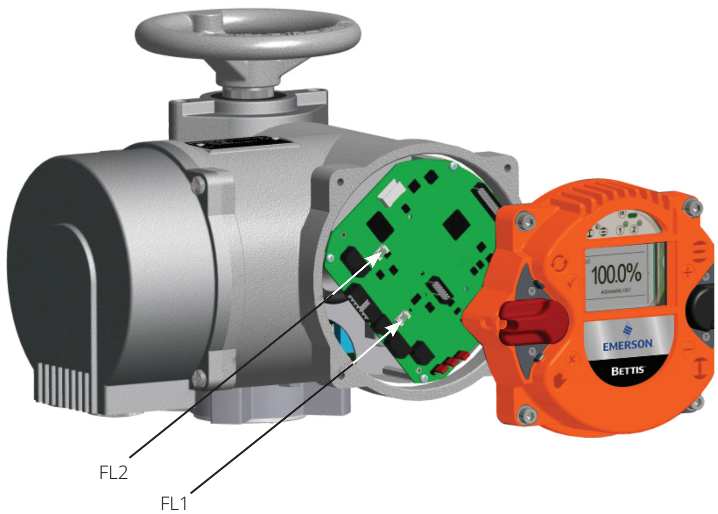
Table 39. History Entries and their Descriptions (2)

Error	LED indicators	Description
#32: Internal Comm. Fault L>Error #33 Internal Comm. Fault L>OK	Alarm	Communication error between Logic 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 Logic, cable broken between boards, boards defect, or firmware update on Logic not properly done.
#36: Fail-safe not ready #37: Fail-safe ready	N/A	Fail-safe voltage OK and fail-safe not initialized (LUS not tensioned).
#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	Alarm	BLDC parameter error 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 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: Under voltage Error	Alarm	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: Under voltage Switch.Off	Alarm	The input voltage line caused the actuator to turn off 6 times, indicating an unstable power supply.
#60: Overvoltage Warning	Warning	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 Write Access	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.

Section 13: Fuses

The logic board of the controller cover (see Figure 74) features two miniature fuses for the control lines.

Figure 74. Fuse Location



Display Overview:

1. Fuse FL1 for auxiliary supply
2. Fuse FL2 for the Binary Outputs

Table 40. Fuses on the Logic Board

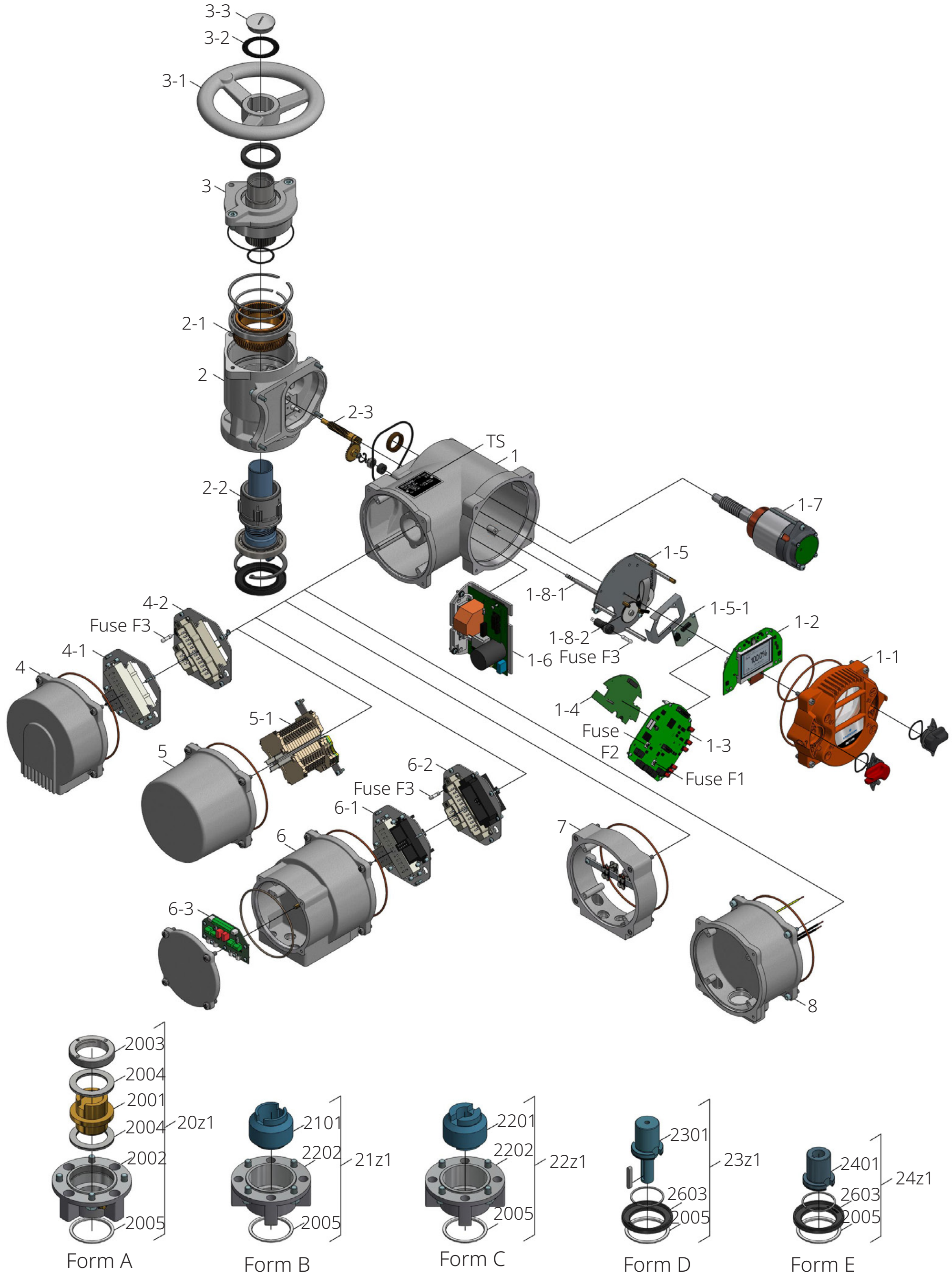
Fuse	Value	Manufacturer	List of Spare Parts
FL1	1AT	Littelfuse 454 NANO$^{2®}$ Slo-Blo® slow	FUSE-F1
FL2	4AT	Littelfuse 454 NANO^{2} Slo-Blo slow	FUSE-F2

NOTE:
The frequency inverter is protected by an input fuse and the explosion proof version also has a thermal fuse (see Section 2.7.3).

Section 14: Spare Parts

When ordering spare parts, please provide the serial number of the actuator.
Check the separate break-down image and separate list of spare parts.

Figure 75. Spare Parts - Bettis RTS CM (ex) CM32



⚠ CAUTION

When ordering spare parts, you must provide the serial number (look type shield or status menu S6). Use only original spare parts supplied by Emerson. Using other parts will render the warranty void. Illustrations may differ from actual spare parts.

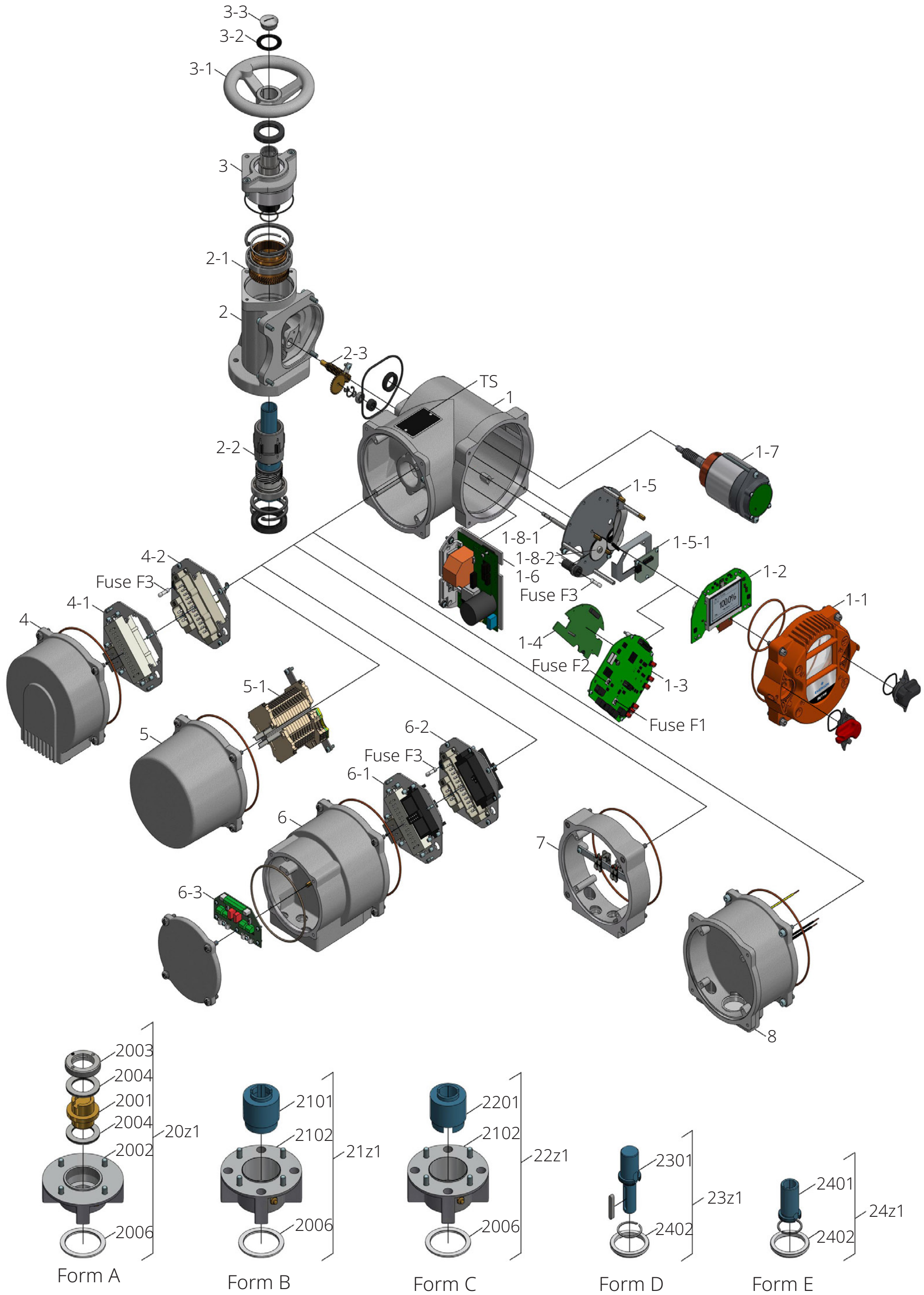
Table 41. Spare Parts Bettis RTS CM (ex) CM32 (1)

Asm.	No.	Description
1	-	**E-case**
	1-1	Control unit cover
	1-2	Display circuit board
	1-3	Logic circuit board
	Fuse-F1	Micro fuse 1 A
	Fuse-F2	Micro fuse 4 A
	1-4	Expansion board (bus, relay)
	1-5	Multi-turn sensor assembly
	1-5-1	Multi-turn sensor
	1-6	BLDC
	Fuse-F3	Fuse 5AT (16AT for 24 V actuators with BLDC version 200)
	1-7	Motor
	1-8-1	Sensor shaft
	1-8-2	Gear Z30
2	-	**Mechanical case**
	2-1	Worm gear
	2-2	Output shaft
	2-3	Helical cut pinion gear
3	-	**Handwheel assembly**
	3-1	Handwheel
	3-2	Screw plug
4	-	**Plug cover**
	4-1	Plug frame customer side (socket)
	4-2	Plug frame actuator side (pins)
5	-	**Terminal box cover**
	5-1	Terminal block
6	-	**Entire bus plug cover with plugs and circuit board**
	6-1	Bus plug frame customer side (socket)
	6-2	Bus plug frame actuator side (pins)
	6-3	Bus connection board
7	-	**Additional ring bus (Ex)**
8	-	**400 V module**
TS	-	**Type plate**
20z1	-	**Output form “A” assembly G0/F10**
	2001	Threaded spindle nut
	2002	Flange “A”
	2003	Ring nut
	2004	Bearing assembly

Table 42. Spare Parts Bettis RTS CM (ex) CM32 (2)

Asm.	No.	Description
21z1	-	**Output form “B” assembly G0/F10**
	2101	Std “B” socket
	2102	Std flange “B”
22z1	-	**Output form “C” assembly G0/F10**
	2201	Std claw coupling “C”
	2102	Std flange “B”
23z1	-	**Std output form “D” assembly G0/F10**
	2301	Output shaft D Ø20 mm
	2402	Centering ring
24z1	-	**Std output form “E” assembly G0/F10**
	2401	Output shaft E Ø20 mm
	2402	Centering ring

Figure 76. Spare Parts - Bettis RTS CM (ex) CM64



⚠ CAUTION

When ordering spare parts, you must provide the serial number (look type shield or status menu S6). Use only original spare parts supplied by Emerson. Using other parts will render the warranty void. Illustrations may differ from actual spare parts.

Table 43. Spare Parts Bettis RTS CM (ex) CM64 (1)

Asm.	No.	Description
1	-	**E-case**
	1-1	Control unit cover
	1-2	Display circuit board
	1-3	Logic circuit board
	Fuse-F1	Micro fuse 1 A
	Fuse-F2	Micro fuse 4 A
	1-4	Expansion board (bus, relay)
	1-5	Multi-turn sensor assembly
	1-5-1	Multi-turn sensor
	1-6	BLDC
	Fuse-F3	Fuse 5 A
	1-7	Motor
	1-8-1	Sensor shaft
	1-8-2	Gear
2	-	**Mechanical case**
	2-1	Worm gear
	2-2	Output shaft
	2-3	Helical cut pinion gear
3	-	**Handwheel assembly**
	3-1	Handwheel
	3-2	Screw plug
4	-	**Plug cover**
	4-1	Plug frame customer side (socket)
	4-2	Plug frame actuator side (pins)
5	-	**Terminal box cover**
	5-1	Terminal block
6	-	**Entire bus plug cover with plugs and circuit board**
	6-1	Bus plug frame customer side (socket)
	6-2	Bus plug frame actuator side (pins)
	6-3	Bus connection board
7	-	**Additional ring bus (Ex)**
8	-	**400 V module**
TS	-	**Type plate**
20z1	-	**Output form “A” assembly G0/F10**
	2001	Threaded spindle nut
	2002	Flange “A”
	2003	Ring nut
	2004	Bearing assembly

Table 44. Spare Parts Bettis RTS CM (ex) CM64 (2)

Asm.	No.	Description
21z1	-	**Output form “B” assembly G0/F10**
	2101	Std “B” socket
	2102	Std flange “B”
22z1	-	**Output form “C” assembly G0/F10**
	2201	Std claw coupling “C”
	2102	Std flange “B”
23z1	-	**Std output form “D” assembly G0/F10**
	2301	Output shaft D Ø20 mm
	2402	Centering ring
24z1	-	**Std output form “E” assembly G0/F10**
	2401	Output shaft E Ø20 mm
	2402	Centering ring

Section 15: Lubricant Recommendation and Requirements

15.1 Main Body: -40 to +60 °C

Operating oil: DIN 51 517-CLP-HC

i.e. fully synthetic high-performance gear oils based on poly-alpha-olefins (PAO):

Viscosity class:	68 ISO VG
Pour point:	< -54 °C (according DIN ISO 3016)
Lubricant requirement CM32:	200 to 250 ml
Lubricant requirement CM64:	300 to 350 ml

15.2 Output Type A and Spindle Drives (Linear Actuators) -40 to +60 °C

Grease DIN 51825-K(P) R -40

i.e. water repellent complex grease on Al-soap base with high resistance to acids and alkalis:

Penetration 0.1 mm:	310 to 340
Dropping point:	about 260 °C
NLGI No.:	1

Acid-free, little or not water-reactive

15.3 Basic Lubricant Service Interval

The service interval for the Bettis RTS actuators is ten years from the shipping date, Emerson. However, the functionality and service life of the lubricants depends on the operating conditions. Reduction factors must be taken into consideration if applicable.

Table 45. Reduction Factors

Operating Condition(s)	Definition	Reduction Factor (Multiplier)
Duty time DT	(Total engine running time)	-
Extremely high DT	Over 1250 hours/year	0.5
High DT	Over 500 hours/year	0.7
Extremely low DT	Less than 0.5 hours/year	0.8
Ambient temperature	(Permanent or long-term)	-
Extremely changeable	Between -10 and +50 °C	0.5
Extremely high	Above +50 °C	0.7
Extremely low	Below -25 °C	0.9
Output speed	(On actuator main shaft)	-
High speed	Over 80 U/min	0.8
Utilization	(Relative to rated power)	-
Very high	Over 90%	0.8
High	Between 80 and 90%	0.9

Application example:

Extremely low DT + extremely low ambient temperature + high speed + 87% utilization

=> 0.8 x 0.9 x 0.8 x 0.9 = 0.51 reduction factor

Lubrication maintenance interval => 10 years x 0.51 = 5.1 years (62 months).

CAUTION

This calculated maintenance interval does neither apply to the maintenance of output type A (treated bushing) units nor to the maintenance of linear and spindle drive units.
These units must be periodically lubricated (at least every 6 months) via the grease nipples (see Section 15.2).

During maintenance of our actuators, remove and replace old grease with new one.
Mixing of different lubricant types is NOT permitted.

Quantities needed for lubricant service are listed in Section 15.

Section 16: Technical Data and Certifications

16.1 Binary Outputs

Figure 77. Control Unit

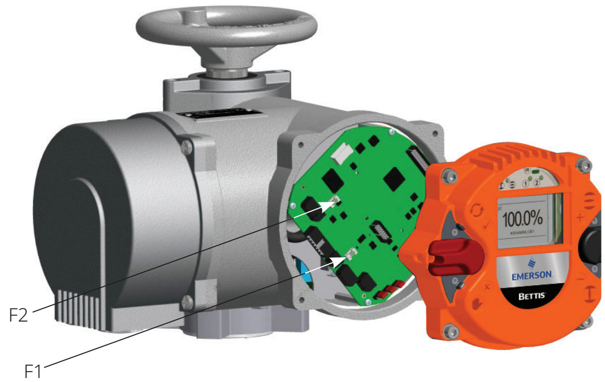


Figure 78. Logic Board

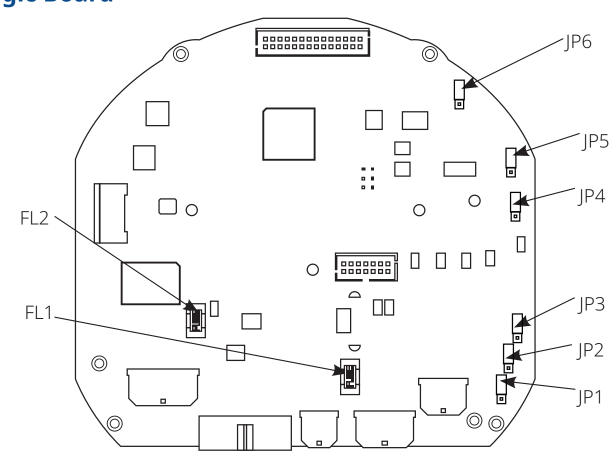


Table 46. Binary Outputs

Characteristic	Value
Count	8
Power supply	24 V DC nominal range: 11 to 35 V DC (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 F2, see Figure 77)	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 (see Section 7.9), the current of each output may be added together. If the settings of the outputs are different, a hard wired logical OR is realized.

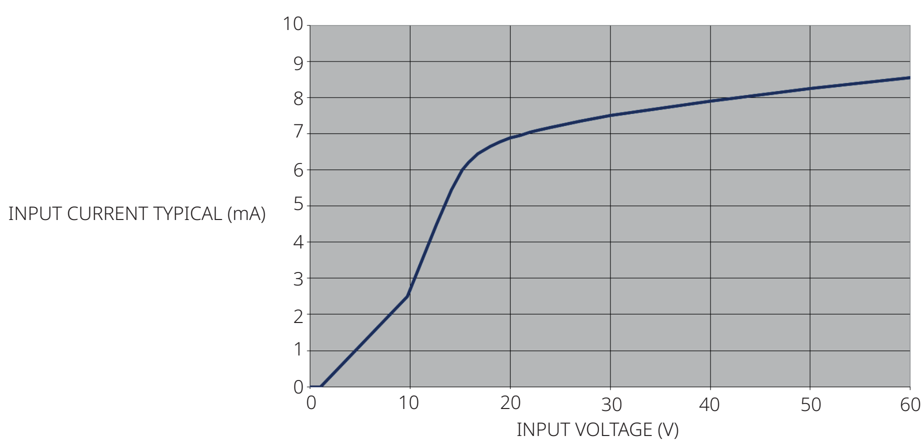
16.2 Binary Inputs

Table 47. Binary Inputs

Characteristic	Value
Count	5
Nominal voltage	24 V DC towards common ground
Threshold voltage for input set	>10 V max. (8.5 V Typical)
Threshold voltage for input not set	<10 V
Maximum voltage	30 V DC
Current consumption at 24 V DC	10.5 mA Typical

Binary inputs are separated from other controllers via optocouplers.

Figure 79. Current/Voltage Relation



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

Figure 80. 5 Inputs with Same Common

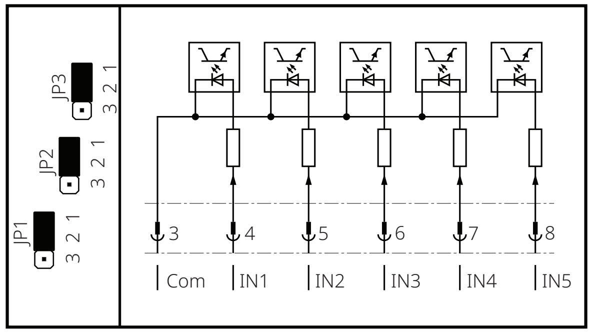


Figure 81. 2 Separated Groups of 2 Inputs with Same Ground Input IN3 is Disabled

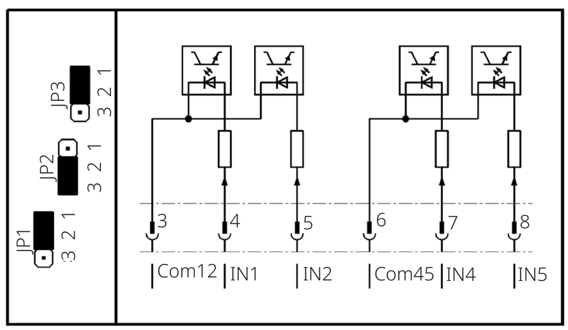


Figure 82. 3 Separated Inputs; Inputs IN2 and IN4 are Disabled

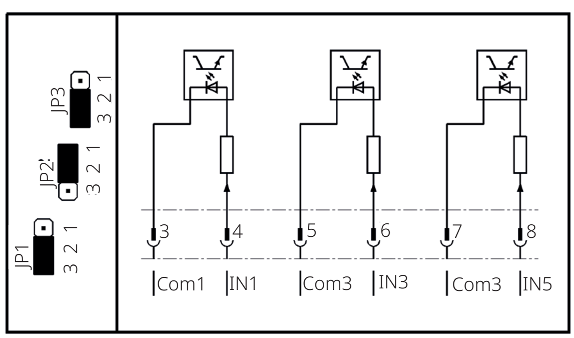


Figure 83. **3 Inputs with Same Common and 1 Separated Input IN4 is Disabled**

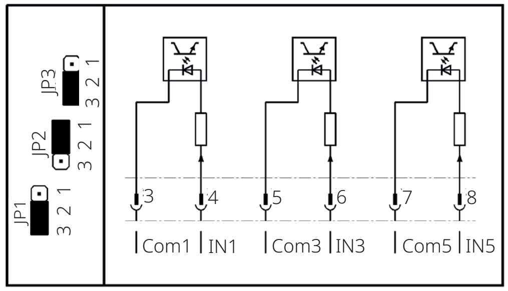


Figure 84. **1 Separated Input and 3 Inputs with Same Common Input IN2 is Disabled**

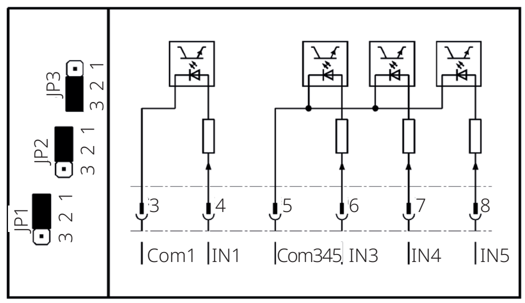


Figure 85. **5 inputs with Common = "-" Using External 24 V**

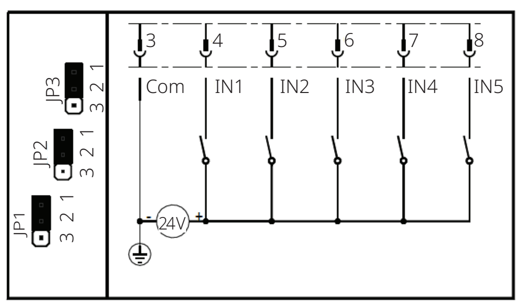


Figure 89. **5 Inputs with Common = "-" Using Internal 24 V (e.g. for dry contacts)**

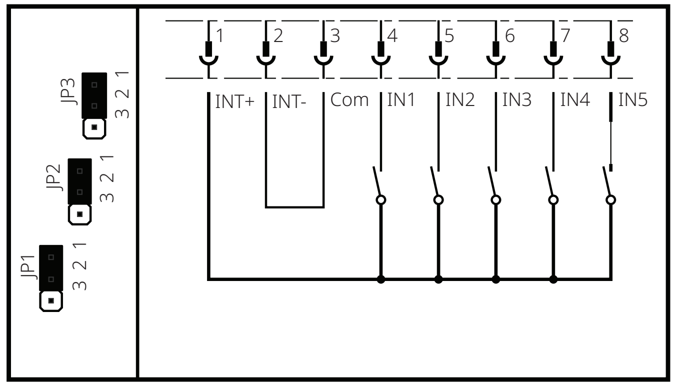


Figure 90. **3 Separated Inputs Using 3 Separated External 24 V**

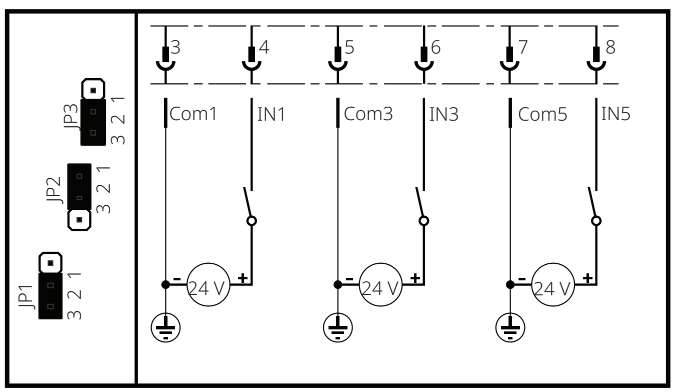
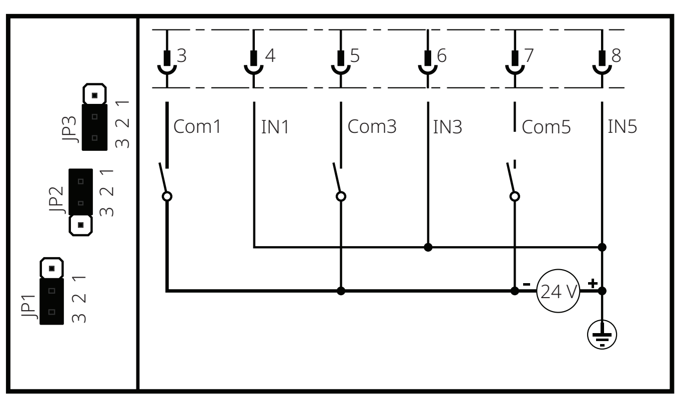


Figure 91. **3 Separated Inputs Using 3 Separated External 24 V**



16.3 Analog Inputs

Table 48. Input 1: Setpoint Value

Characteristic	Value
Current range	0 to 25 mA
Resolution	14 Bit
Accuracy	0.5%
Input resistance	60 Ohm

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

Table 49. Input 2: External Actual Value Only in Conjunction with the PID-Controller

Characteristic	Value
Current range	0 to 20.8 mA
Resolution	12 Bit
Accuracy	0.5%
Input resistance	120 Ohm

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 to 20 mA, two-wire transmitters).

NOTE:
The analog input 2 is referenced to common of the electronic system and the auxiliary power supply.

16.4 Analog Output

Table 50. Analog Output

Characteristic	Value
Current range	0 to 20.8 mA
Resolution	12 Bit
Accuracy	0.5%
Input resistance	600 Ohm

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 to 20 mA, two-wire transmitter.

Figure 92. Current Source

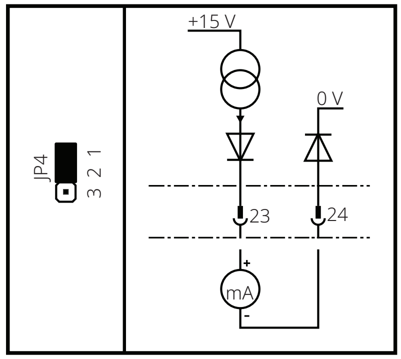
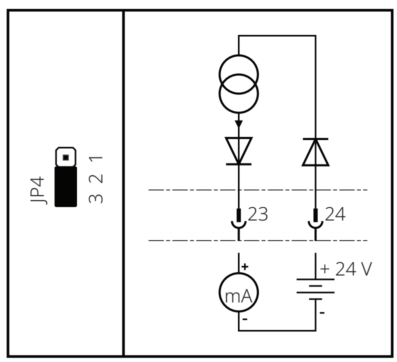


Figure 93. Current Sink



Ground potential is the potential of the control unit and the auxiliary supply.

16.5 Auxiliary Voltage Input and Output

Table 51. Auxiliary Voltage Input and Output

Characteristic	Value
Input voltage range (auxiliary voltage input)	20 to 30 V DC
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)	Typical 23 V
Maximum output current (auxiliary voltage output)	200 mA
Resistance of common ground vs earth	Typical 500 k Ohms
Resistance of common ground vs earth (floating version)	> 10 M Ohms
Capacitance of common ground vs earth	Typical 100 nF
Maximum allowed voltage of common ground vs earth	Max. 40 V
Fuse (Fuse F1, see Figure 78)	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 (see Section 7.5).

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.

16.6 Connections

16.6.1 Connections for Non-explosion Proof Version

Table 52. Non-Explosion Proof Connections

Connection	Value
Power/motor	Industrial plug with 6 pins Screw connection 16 A, max. 2.5 mm^2, AWG14
Control signals	Industrial plug with 24 pins Screw connection 16 A, max. 2.5 mm^2, AWG14

Optionally, contacts are available in crimp or cage clamp designs.

16.6.2 Connections for Explosion Proof Version

Table 53. Explosion Proof Connections

Connection	Value
Power/motor	Terminals with screw connection 16 A, 0.5 to 4 mm^2, AWG20 - AWG12
Control signals	Terminals with screw connection 4 A, 0.5 to 2.5 mm^2, AWG20 - AWG14

16.7 Miscellaneous

Table 54. Miscellaneous

Characteristic	Value
Ambient temperature	-
Non-explosion proof version	-25 to +60 °C
Explosion proof version	-20 to +40 °C (according EN 60079-0)
Ex version with extended temperature range	-40 to +60 °C
Protection according to EN 60529	IP67
Standard color	RAL7024

NOTE:
If the actuator is exposed to excessive UV light, color deviations of the painting might occur.

Section 17: Mode of Operation

17.1 CM32/64

Table 55. ON-OFF and Inching Operation

CM32	CM64
S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034
2.5 to 72 RPM	2.5 to 60 RPM
M_{max} = 32 Nm	M_{max} = 64 Nm
M_{avg} = 16 Nm	M_{avg} = 20 Nm

Table 56. Modulating Operation

CM32	CM64
S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 15 minutes according to IEC 60034
2.5 to 36 RPM	2.5 to 30 RPM
M_{max} = 32 Nm	M_{max} = 64 Nm
M_{avg} = 16 Nm	M_{avg} = 32 Nm

Table 57. Continuous Modulating Operation

CM32	CM64
S9 - 1.800 c/h according to IEC 60034	S9 - 1.800 c/h according to IEC 60034
2.5 to 20 RPM	2.5 to 20 RPM
M_{max} = 32 Nm	M_{max} = 64 Nm
M_{avg} = 10 Nm	M_{avg} = 20 Nm

17.2 CM32/64 + QT

Table 58. ON-OFF and Inching Operation

CM32 + QT12	CM32 + QT25	CM64 + QT50
S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034
2.5 to 10 RPM	2.5 to 20 RPM	2.5 to 20 RPM
M_{max} = 120 Nm	M_{max} = 250 Nm	M_{max} = 500 Nm
M_{avg} = 60 Nm	M_{avg} = 125 Nm	M_{avg} = 160 Nm

Table 59. Modulating Operation

CM32 + QT12	CM32 + QT25	CM64 + QT50
S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034
2.5 to 10 RPM	2.5 to 20 RPM	2.5 to 20 RPM
M_{max} = 120 Nm	M_{max} = 250 Nm	M_{max} = 500 Nm
M_{avg} = 60 Nm	M_{avg} = 125 Nm	M_{avg} = 250 Nm

Table 60. Continuous Modulating Operation

CM32 + QT12	CM32 + QT25	CM64 + QT50
S9 - 1.800 c/h according to IEC 60034	S9 - 1.800 c/h according to IEC 60034	S9 - 1.800 c/h according to IEC 60034
2.5 to 10 RPM	2.5 to 20 RPM	2.5 to 20 RPM
M_{max} = 120 Nm	M_{max} = 250 Nm	M_{max} = 500 Nm
M_{avg} = 40 Nm	M_{avg} = 80 Nm	M_{avg} = 160 Nm

17.3 CM32/64 + Linear

17.3.1 CM32/64 + L

Table 61. ON-OFF and Inching Operation

CM32 + L05	CM32 + L15	CM64 + L25
S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034
2.5 to 72 RPM	2.5 to 72 RPM	2.5 to 60 RPM
F_{max} = 15 kN	F_{max} = 15 kN	F_{max} = 25 kN
F_{avg} = 7.5 kN	F_{avg} = 7.5 kN	F_{avg} = 10 kN

Table 62. Modulating Operation

CM32 + L05	CM32 + L15	CM64 + L25
S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034
2.5 to 36 RPM	2.5 to 36 RPM	2.5 to 30 RPM
F_{max} = 15 kN	F_{max} = 15 kN	F_{max} = 25 kN
F_{avg} = 7.5 kN	F_{avg} = 7.5 kN	F_{avg} = 12.5 kN

Table 63. Continuous Modulating Operation

CM32 + L05	CM32 + L15	CM64 + L25
Not Available	Not Available	Not Available

17.3.2 CM32/CM64 + LB

Table 64. ON-OFF and Inching Operation

CM32 + LB05	CM32 + LB30	CM64 + LB64
S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034	S2 - 15 minutes according to IEC 60034
2.5 to 72 RPM	2.5 to 72 RPM	2.5 to 60 RPM
F_{max} = 15 kN	F_{max} = 30 kN	F_{max} = 60 kN
F_{avg} = 15 kN	F_{avg} = 15 kN	F_{avg} = 20 kN

Table 65. Modulating Operation

CM32 + LB05	CM32 + LB30	CM64 + LB64
S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034	S4 - 1.200 c/h - max. 50% DC according to IEC 60034
2.5 to 36 RPM	2.5 to 36 RPM	2.5 to 30 RPM
F_{max} = 15 kN	F_{max} = 30 kN	F_{max} = 60 kN
F_{avg} = 15 kN	F_{avg} = 15 kN	F_{avg} = 30 kN

Table 66. Continuous Modulating Operation

CM32 + LB05	CM32 + LB30	CM64 + LB64
S9 - 1.800 c/h according to IEC 60034	S9 - 1.800 c/h according to IEC 60034	S9 - 1.800 c/h according to IEC 60034
2.5 to 20 RPM	2.5 to 20 RPM	2.5 to 20 RPM
F_{max} = 15 kN	F_{max} = 30 kN	F_{max} = 60 kN
F_{avg} = 10 kN	F_{avg} = 10 kN	F_{avg} = 20 kN

Section 18: Characteristic Curves

18.1 Characteristic Curves - CM32

Figure 94. Current Draw of the Standard Version

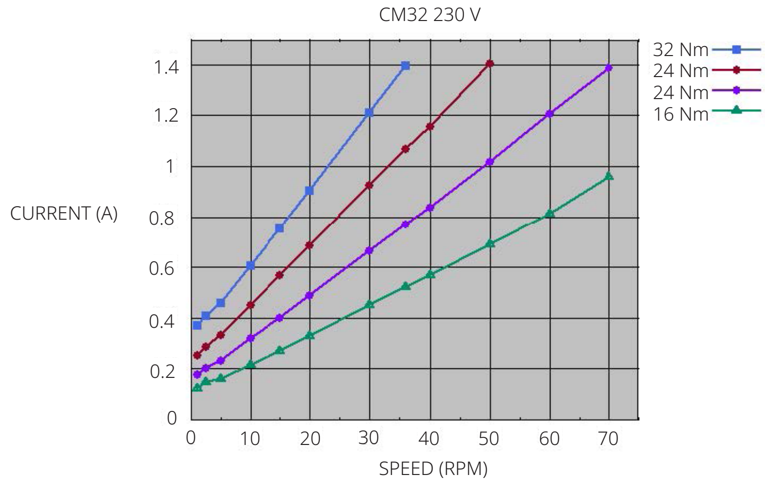


Figure 95. Current Draw of the 24 V DC Version

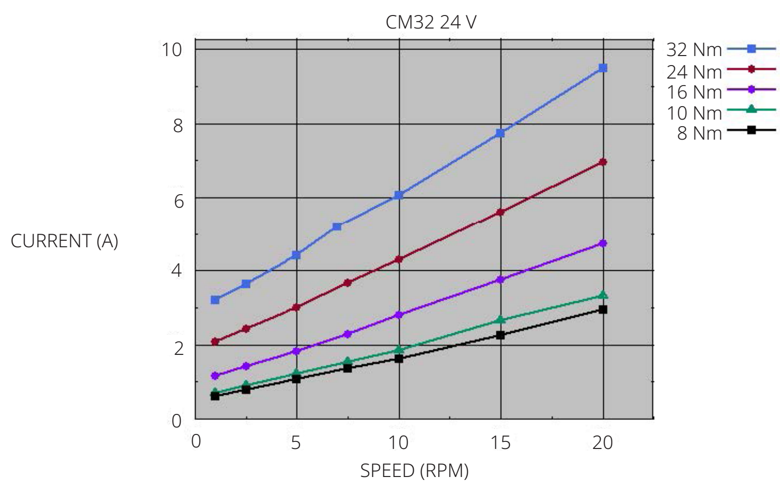
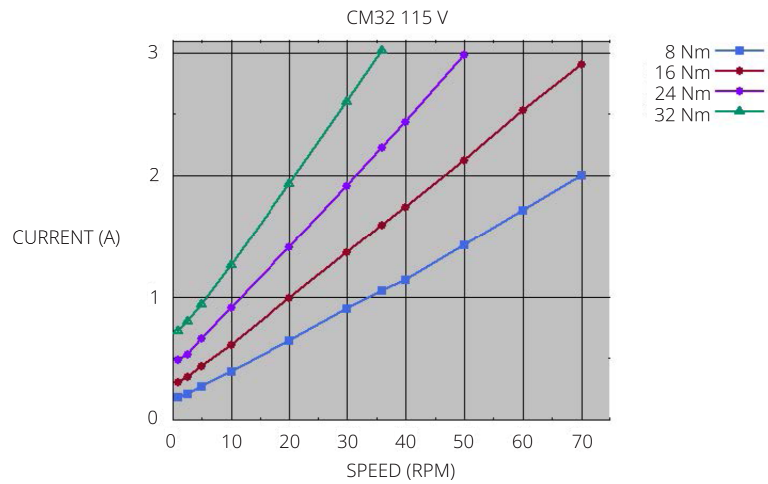


Figure 96. Current Draw of the Standard Version



18.2 Characteristic Curves - CM64

Figure 97. Current Draw of the Standard Version

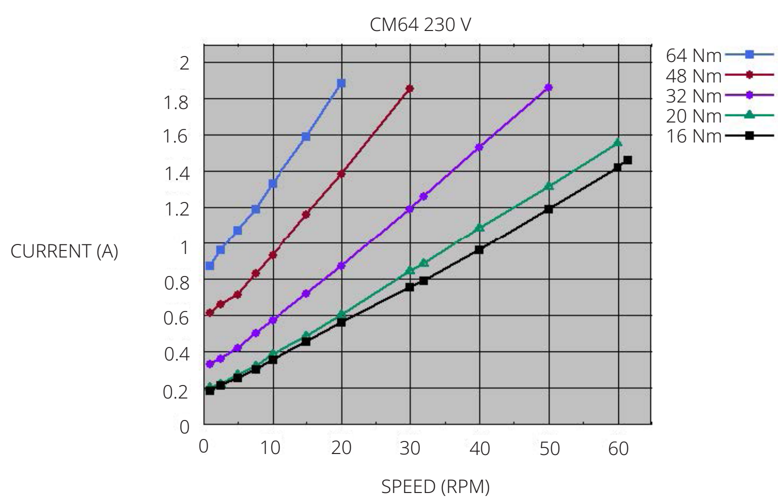
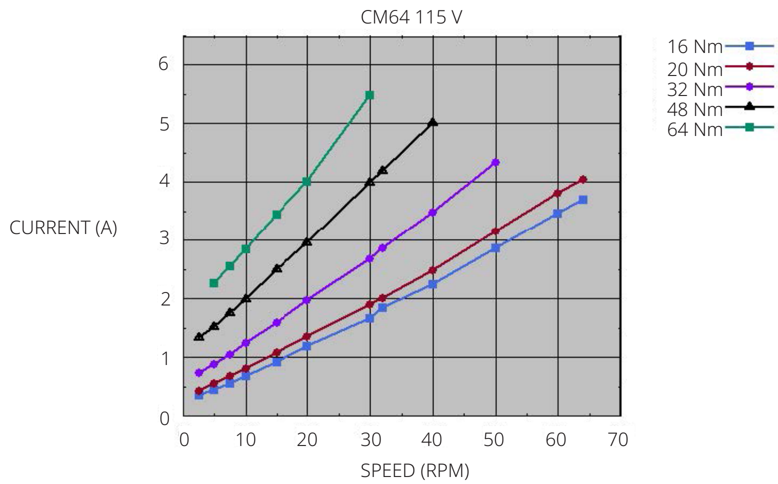


Figure 98. Current Draw of the Standard Version



Appendix A: Handwheel Force

Table 67. Required Handwheel Force at Nominal and Maximum Actuator Torque

Actuator	Nominal Actutor Torque (Nm)	Handwheel Torque (Nm)	Handwheel Rim Force (N)*	Max. Actuator Torque (Nm)	Handwheel Torque (Nm)*	Handwheel Rim Force (N)	Handwheel Diameter (mm)
CM32	9.6	4.8	34	32	16.0	114	140
CM64	21.3	10.7	53	64	32.0	160	200

NOTE:
The handwheel force calculated for two-hand operation.

Appendix B: Speed vs Torque Current Consumption

Table 68. RTS CM32 1PH 115 V AC

8 Nm		16 Nm		24 Nm		32 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
1.00	0.18	1.00	0.30	1.00	0.49	1.00	0.72
2.50	0.21	2.50	0.35	2.50	0.53	2.50	0.80
5.00	0.27	5.00	0.43	5.00	0.66	5.00	0.94
10.00	0.39	10.00	0.61	10.00	0.91	10.00	1.26
20.00	0.64	20.00	0.99	20.00	1.41	20.00	1.93
30.00	0.90	30.00	1.36	30.00	1.91	30.00	2.60
36.00	1.05	36.00	1.59	36.00	2.22	36.00	3.01
40.00	1.14	40.00	1.74	40.00	2.43	-	-
50.00	1.42	50.00	2.12	50.00	2.98	-	-
60.00	1.71	60.00	2.53	-	-	-	-
70.00	2.00	70.00	2.90	-	-	-	-

Table 69. RTS CM32 1PH 230 V AC

8 Nm		16 Nm		24 Nm		32 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
1.00	0.12	1.00	0.18	1.00	0.25	1.00	0.37
2.50	0.15	2.50	0.20	2.50	0.29	2.50	0.41
5.00	0.16	5.00	0.23	5.00	0.33	5.00	0.46
10.00	0.22	10.00	0.32	10.00	0.45	10.00	0.60
20.00	0.33	20.00	0.49	20.00	0.68	20.00	0.90
30.00	0.45	30.00	0.66	30.00	0.92	30.00	1.21
36.00	0.52	36.00	0.77	36.00	1.07	36.00	1.40
40.00	0.57	40.00	0.84	40.00	1.16	-	-
50.00	0.69	50.00	1.02	50.00	1.40	-	-
60.00	0.81	60.00	1.21	-	-	-	-
70.00	0.96	70.00	1.39	-	-	-	-

Table 70. RTS CM32 3PH 400 V AC

8 Nm		16 Nm		24 Nm		32 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
1.00	0.10	1.00	0.14	1.00	0.18	1.00	0.18
2.50	0.11	2.50	0.15	2.50	0.18	2.50	0.19
5.00	0.12	5.00	0.17	5.00	0.20	5.00	0.22
10.00	0.16	10.00	0.18	10.00	0.21	10.00	0.27
20.00	0.17	20.00	0.24	20.00	0.30	20.00	0.37
30.00	0.22	30.00	0.30	30.00	0.38	30.00	0.48
36.00	0.25	36.00	0.34	36.00	0.43	36.00	0.54
40.00	0.26	40.00	0.36	40.00	0.46	-	-
50.00	0.30	50.00	0.42	50.00	0.55	-	-
60.00	0.35	60.00	0.48	-	-	-	-
70.00	0.40	70.00	0.55	-	-	-	-

Table 71. RTS CM32 24 V DC

8 Nm		10 Nm		16 Nm		24 Nm		32 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
1.00	0.61	1.00	0.70	1.00	1.16	1.00	2.09	1.00	3.19
2.50	0.77	2.50	0.89	2.50	1.41	2.50	2.41	2.50	3.63
5.00	1.08	5.00	1.22	5.00	1.81	5.00	3.00	5.00	4.42
7.50	1.37	7.50	1.53	7.50	2.28	7.50	3.66	7.50	5.19*
10.00	1.62	10.00	1.86	10.00	2.80	10.00	4.30	10.00	6.05*
15.00	2.24	15.00	2.64	15.00	3.75	15.00	5.61*	15.00	7.72*
20.00	2.93	20.00	3.31	20.00	4.73*	20.00	6.95*	20.00	9.49*

NOTE:
* Design capable with BLDC v10.1, pending certification approval.

Table 72. RTS CM64 1PH 115 V AC

8 Nm		20 Nm		32 Nm		48 Nm		64 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
2.50	0.34	2.50	0.42	2.50	0.73	2.50	1.32	-	-
5.00	0.44	5.00	0.54	5.00	0.88	5.00	1.51	5.00	2.26
7.50	0.55	7.50	0.67	7.50	1.04	7.50	1.74	7.50	2.54
10.00	0.68	10.00	0.81	10.00	1.23	10.00	1.99	10.00	2.84
15.00	0.91	15.00	1.08	15.00	1.58	15.00	2.49	15.00	3.44
20.00	1.18	20.00	1.35	20.00	1.96	20.00	2.95	20.00	4.01
30.00	1.66	30.00	1.89	30.00	2.68	30.00	3.99	-	-
32.00	1.83	32.00	2.00	32.00	2.85	-	-	-	-
40.00	2.24	40.00	2.48	40.00	3.47	-	-	-	-
50.00	2.86	50.00	3.15	50.00	4.33	-	-	-	-
60.00	3.47	60.00	3.80	-	-	-	-	-	-

Table 73. RTS CM64 1PH 230 V AC

8 Nm		20 Nm		32 Nm		48 Nm		64 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
2.50	0.21	2.50	0.22	2.50	0.36	2.50	0.66	2.50	0.96
5.00	0.25	5.00	0.27	5.00	0.42	5.00	0.71	5.00	1.07
7.50	0.30	7.50	0.32	7.50	0.50	7.50	0.83	7.50	1.19
10.00	0.35	10.00	0.37	10.00	0.57	10.00	0.93	10.00	1.33
20.00	0.56	20.00	0.59	20.00	0.87	20.00	1.38	15.00	1.59
30.00	0.75	30.00	0.82	30.00	1.19	30.00	1.85	20.00	1.88
32.00	0.79	32.00	0.86	32.00	1.26	-	-	-	-
40.00	0.96	40.00	1.05	40.00	1.53	-	-	-	-
50.00	1.19	50.00	1.29	50.00	1.86	-	-	-	-
60.00	1.42	60.00	1.53	-	-	-	-	-	-

Table 74. RTS CM64 3PH 400 V AC

8 Nm		20 Nm		32 Nm		48 Nm		64 Nm	
Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)	Speed (RPM)	Current (A)
1.00	0.13	1.00	0.17	1.00	0.29	1.00	0.38	1.00	0.39
2.50	0.16	2.50	0.19	2.50	0.29	2.50	0.40	2.50	0.40
5.00	0.20	5.00	0.23	5.00	0.34	5.00	0.34	5.00	0.43
10.00	0.28	10.00	0.31	10.00	0.36	10.00	0.37	10.00	0.52
15.00	0.33	15.00	0.35	15.00	0.36	15.00	0.45	15.00	0.61
20.00	0.37	20.00	0.34	20.00	0.39	20.00	0.53	20.00	0.67
30.00	0.36	30.00	0.37	30.00	0.50	30.00	0.66	-	-
40.00	0.40	40.00	0.46	40.00	0.62	40.00	-	-	-
50.00	0.48	50.00	0.55	50.00	0.71	50.00	-	-	-
60.00	0.55	60.00	0.63	-	-	-	-	-	-

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