User Instructions
MAN-02-04-60-0351-EN Rev. 4
September 2019

Operating Manual for Bettis RTS FQ Series

Fail-Safe Quarter-Turn Electric Actuator

BETTIS™

EMERSON™

Table of Contents

Section 8: Parameter Menu

Section 9: Status Area

Section 10: Infrared Connection

Section 11: Bluetooth Connection

Section 12: Maintenance

Section 13: Troubleshooting

Section 14: Fuses

Section 15: Lubricant Recommendation and Requirements

Section 16: Training

Section 17: Technical Data and Certifications

Section 1: Introduction

NOTE:
Also refer to the operating manual for Bettis RTS CM Compact Multi-Turn Series.

Bettis RTS FQ Fail-Safe Quarter-Turn electric actuators are designed to operate appropriate fittings when a fail-safe functionality is required.

Appropriate fittings are all kinds of fittings that require a 90° movement to operate (butterfly valves, ball valves, taps in general, etc.).

In the event of a power failure or if the fail-safe function is triggered deliberately, the actuator shifts the fitting to the fail-safe position, using the built-in energy storage device to do so.

Figure 1 Bettis RTS FQ Fail-Safe Quarter-Turn Actuator

Section 2: Functional Description of the RTS FQ Fail-Safe Quarter-Turn Actuator

In normal operation, the actuator is operated by a PM motor (1) via a worm gear stage (2) and a planetary gear train (3). The motor drives the spindle nut of a ball screw (4). The sun gear shaft of the planetary gear train is fixed in place by an operating current brake (5).

The ball screw converts the rotational movement of the gear unit into linear motion, which, on the other hand, charges the spring assembly (7), which acts as an energy storage device. On the other hand, a rack and pinion gear (6) converts the linear motion into the 90° output motion to move the fitting shaft (9).

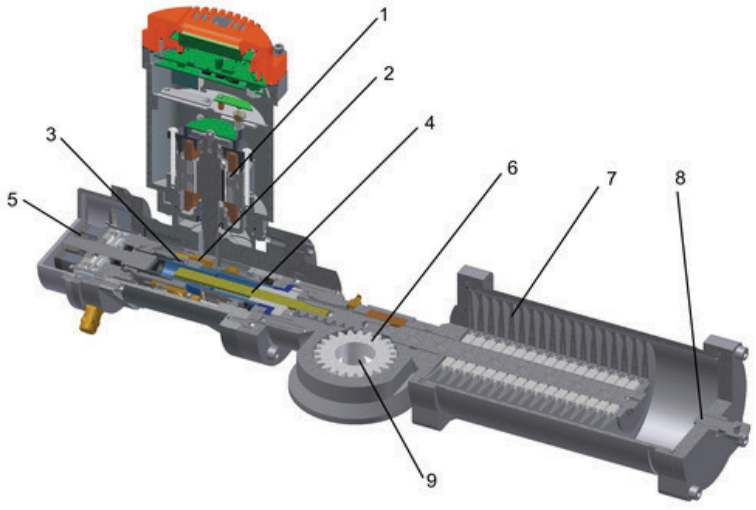
There are no engaging or disengaging elements between the motor. The energy storage device and the fitting shaft in the actuator. All the gear unit components are permanently engaged.

While moving against the fail-safe direction, the electric motor has to move both the fitting and the energy storage device (disk spring assembly) for the fail-safe stroke.

If the supply for the operating current brake is interrupted by a power failure, or intentionally triggers a fail-safe stroke, the actuator will no longer hold position, and the energy stored in the disk spring assembly will be converted into kinetic energy so as to move the actuator and thus the fitting to the fail-safe position. In this situation, the entire gear chain for the actuator with the exception of the worm gear stage will be moved until the adjustable mechanical end stop (8) is reached or, if applicable, be stopped for the fitting.

Owing to this operating principle, neither an initializing stroke nor resetting of the drive is required after a fail-safe stroke. As soon as the power supply is restored, the actuator is immediately ready for operation.

Figure 2 Cut-out of the RTS FQ Fail-Safe Quarter-Turn Actuator



Parts Overview:

1. PM Motor
2. Worm Gear Stage
3. Planetary Gear Train
4. Ball Screw
5. Operating Current Brake
6. Rack and Pinion Gear
7. Spring Assembly
8. End Stop
9. Fitting Shaft

This compact fail-safe actuator can be built as a version for “fail-safe open” (counter clockwise direction of rotation when looking at the fitting shaft) or “fail-safe close” (clockwise direction of rotation). It is even possible to subsequently change the fail-safe direction (separate manual available). Some assembly work is required. Having this conversion performed at our factory is recommended, however.

Figure 3 Fail-Safe Open Version

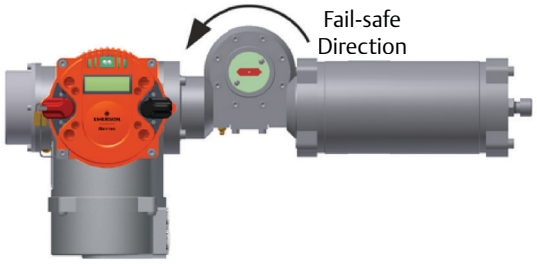
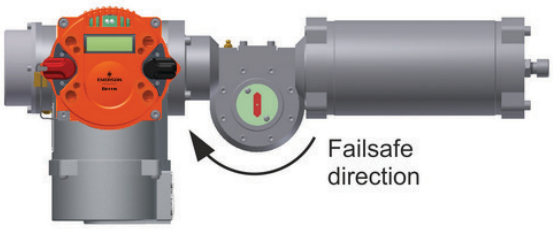


Figure 4 Fail-Safe Close Version



Section 3: General

3.1 Safety Instructions

⚠ CAUTION: FOLLOW SAFETY INSTRUCTIONS

When operating electrical devices, certain parts are inevitably under dangerous voltage. Work on the electrical systems or components may only be carried out by electricians or by individuals who have been instructed how to do so, working under the guidance and supervision of an electrician in accordance with electrotechnical regulations.

⚠ WARNING: ALWAYS REFER TO STANDARDS

When working in potentially explosive areas, refer to European Standards EN 60079-14 “Installing Electrical Systems in Explosion Endangered Areas” and EN 60079-17 “Inspection and Maintenance of Electrical Installations in Explosion Endangered Areas”.
Working in potentially explosive areas is subject to special regulations (European Standard EN 60079-17), which must be complied with. Any additional national regulations must be heeded.

⚠ CAUTION: ALWAYS BE AWARE OF DANGER TO EXPLOSION

Work on the open actuator under voltage may only be done if it is certain that there is no danger of explosion for the duration of the work.

3.2 Serial Number

Each actuator of the Bettis RTS FQ Series carries a serial number. The serial number is a 10-digit number that begins with the year and that can be read from the type label (see Figure 3) the type label is located next to the handwheel).

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

3.3 Protection Class

Bettis RTS FQ Fail-Safe Quarter-Turn actuators come by default with IP 68 (EN 50629) protection.

⚠ CAUTION:

The protection class specified on the type label is only effective when the cable glands also provide the required protection class, the cover of the connection compartment is carefully secured closed, and the mounting position (see Section 3.4) 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 EN60079-7** 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 3.4)

3.4 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.

3.5 Direction of Rotation

⚠ CAUTION: OBSERVE DIRECTION OF ROTATION

The standard direction of rotation for the actuator is:

- Clockwise = The actuator runs counter to the fail-safe direction
- Counterclockwise = The actuator runs in the fail-safe direction

Which direction, opening or closing of the fitting causes, depends on:

- The fail-safe direction of the actuator
- The closing direction of the fitting

All the information in this Operating Manual refers to the standard direction of rotation.

3.6 Protective Devices

3.6.1 Torque

Bettis RTS FQ Fail-Safe Quarter-Turn actuators provide electronic torque monitoring. The switch-off torque can be modified in the controller menu 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 8.1.

3.6.2 Motor Temperature

All ACTUSMART 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 13.1.

3.6.3 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.

3.7 Ambient Temperature

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

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

3.8 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 microcontrollers.

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.

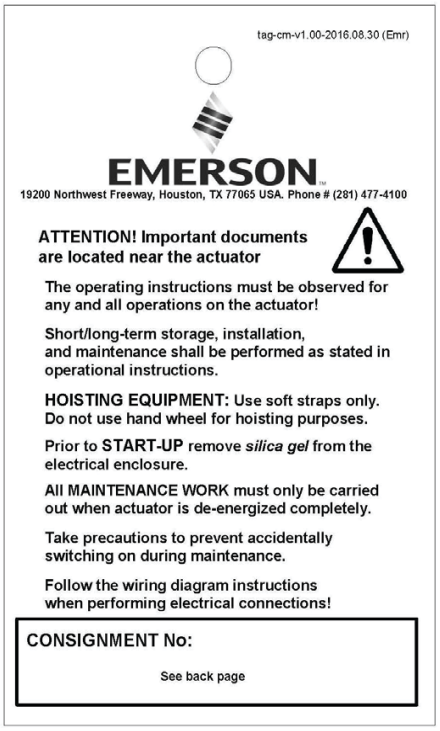
⚠ CAUTION

Commissioning instructions (see Section 5, page 25) must be strictly observed! During assembly of the supplied valves at the factory, end postions are set and documented by attaching a label (see Figure 5). During commissioning at the plant, these settings must be verified.

3.9 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 5).

Figure 5 Tag



Section 4: 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 APPROPRIATE LIFTING EQUIPMENT

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.

4.1 General

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

⚠ CAUTION: REMOVE SILICA GEL

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

4.2 Storage

⚠ CAUTION: OBSERVE PROPER STORAGE

- 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°C - +40°C

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

4.3 Long-term Storage

⚠ CAUTION: 6 MONTHS OF STORAGE

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 glycerine. Then, carefully close the connection compartment again
- Coat screw heads and bare spots with neutral grease or long-term corrosionprotection
- Repair damaged paintwork arising from transport, improper storage, or mechanical influences
- For explosion-proof actuators, it is not allowed to extensively overpaint 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 5: Installation Instructions

Installation work of any kind for the actuator may only be performed by qualified personnel.

5.1 Mechanical Connection

Check:

- Whether the fitting flange and actuator flange match-up.
- Whether the drilled hole matches up with the shaft.
- Whether there is sufficient engagement of the fitting shaft in the actuator hole.

Make sure the fitting is in the same position as the actuator:

- For a “fail-safe opener” actuator, the fitting has to be completely open.
- For a “fail-safe closer” actuator, the fitting has to be completely closed.

In general, heed the following instructions:

- Clean the bare parts on the actuator coated with rust protectant.
- Clean the mounting surface for the fitting thoroughly.
- Lightly grease the fitting shaft.
- Set the actuator in place.
- Make sure of centered positioning and that the contact surface of the flange is full.
- Fasten the actuator with suitable bolts:
  - Minimum strength grade: 8.8 or A2-70
  - Ensure sufficient thread engagement (min. 1xd)

⚠ CAUTION: USE SUITABLE BOLTS

Screws that are too long may go against the thread root, creating the risk of the actuator moving radially in relation to the fitting. This may lead to the bolts shearing off.

Unsuitable bolts may result in the actuator falling off.

- Tighten bolts to the correct torque, alternating between bolts on opposite sides.

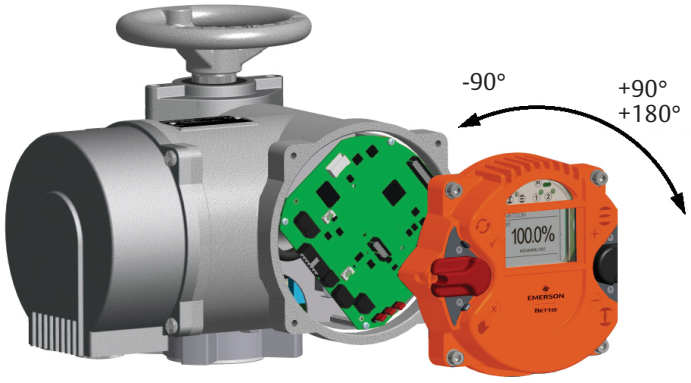
Table 1. Torque Thread Table (1)

Thread	Tightening Torque [Nm] for Bolts with Strength Grade	
	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

5.2 Mounting Position of the Control Unit

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

Figure 6



- 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 grounded.
- Undo 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 maximum of 180°.
  - Put service cover on carefully so that no cables get wedged in.
- Tighten bolts evenly in a crosswise sequence.

5.3 Electrical Connection

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

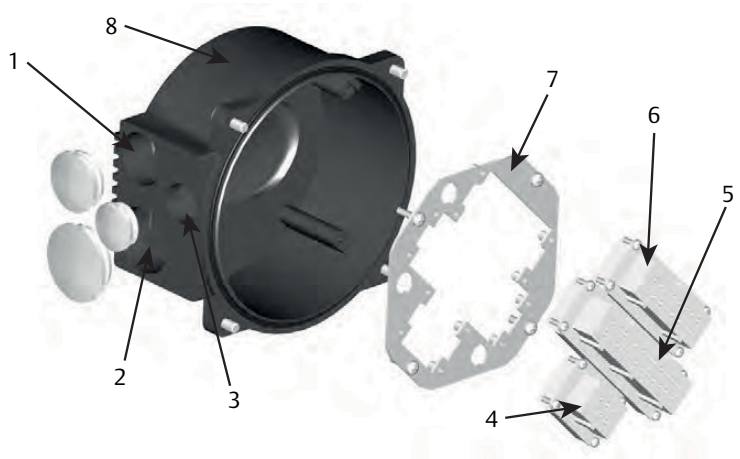
The line and short circuit protection must be done on the system side. The ability to unlock the actuator is to be provided for maintenance purposes. For the dimensioning, the rated current is to be used (see Technical Data).

Check whether the power supply (voltage, frequency) is consistent with the connection data (see nameplate - Figure 5). 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.

5.3.1 Power Supply Connection

RTS CM Compact Series actuators feature an integrated motor controller, i.e., it only requires a connection to the power supply. By non-explosionproof actuators the wiring uses a connector independent from control signals (see Figure 7).

Figure 7 Power Supply Connections

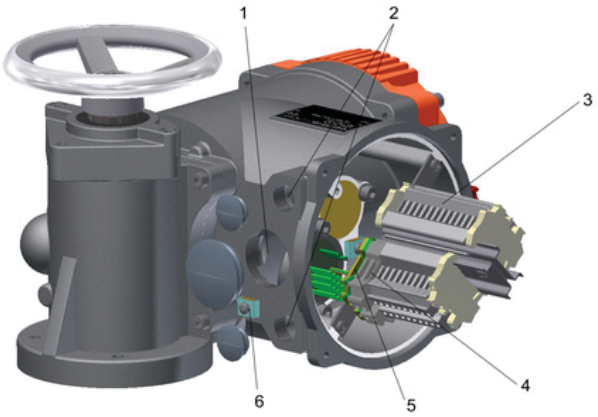


Parts Overview:

1. Metric Screw M32x1.5
2. M40x1.5
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

Explosionproof actuators or on special request the connection will be made via terminals (see Figure 6).

Figure 8 Terminal Box



Parts Overview:

1. Metric Screw M40x1.5
2. 2xM20x1.5
3. Terminals for the Control Signals
4. Terminals for the Power Supply
5. Terminal for Ground Connection
6. Outside Ground Connection

⚠ CAUTION: OBSERVE CORRECT PROCEDURE

See Section 14.3.

Section 6: Commissioning

It is assumed that the actuator has been installed and electrically connected correctly. (See Section 5).

NOTE:
Remove silica gel from the alarm cover.

6.1 General Information

NOTE:
When commissioning and each time after dismounting the actuator, the positions have to be reset (see Section 6.4).

6.2 Manual Operation

There is no way to operate this actuator design manually.

6.3 Mechanical Default Settings, Preparation

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

⚠ CAUTION: OBSERVE CORRECT PROCEDURE

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

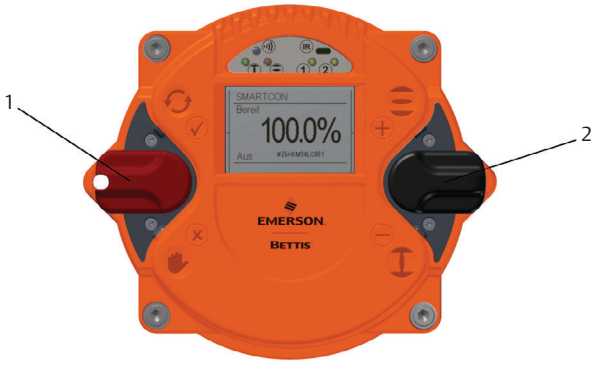
6.4 End Limit Setting

A detailed description of the operation of the RTS CM Compact Series controller can be found in Section 7.3.

6.4.1 End Limit OPEN

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

Figure 9 Selector/Control Switch



Parts 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 "P1.1 End limit – Open".

Figure 10 Control Switch (First Menu Item)

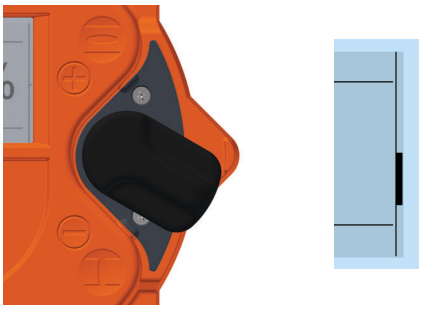
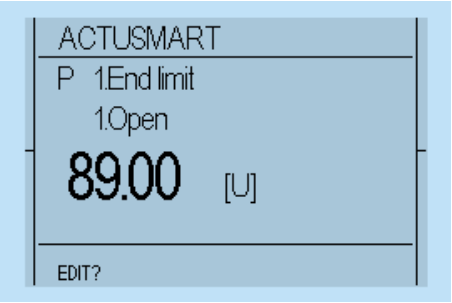


Figure 11 Display (1)



Step 4 - Afterwards, flip up the selector switch slightly and let it snap back to its neutral position.

Figure 12 Selector Switch in Neutral Position (1)

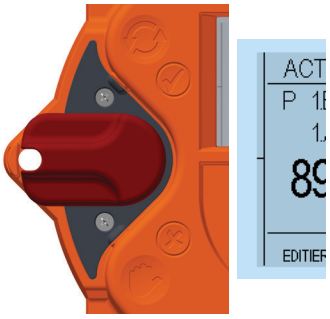


Figure 13 Selector Switch Flipped Up (1)

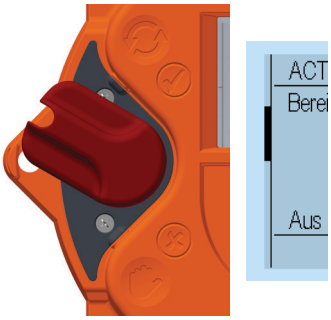
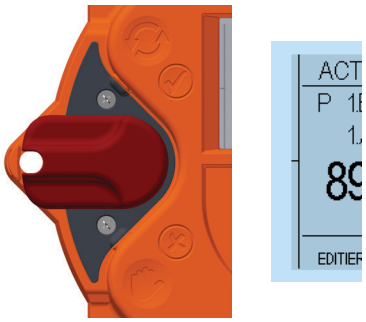


Figure 14 Selector Switch in Neutral Position (2)



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

Figure 15 Display (2)

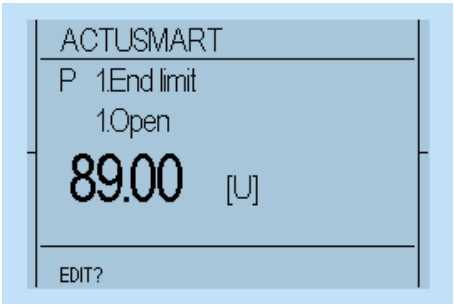
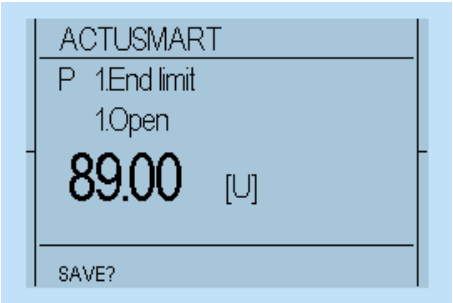


Figure 16 Display (3)



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" X.

⚠ CAUTION: USE APPROPRIATE SWITCH

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: MAX. TORQUE MUST BE PARAMETERISED

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 parameterised.

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

Figure 17 Selector Switch Flipped Down

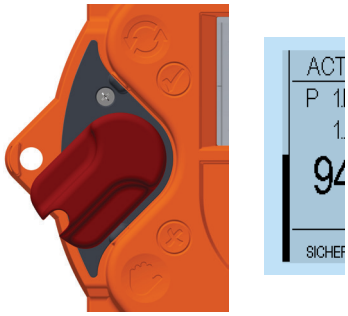
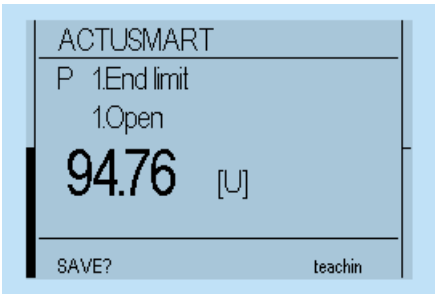


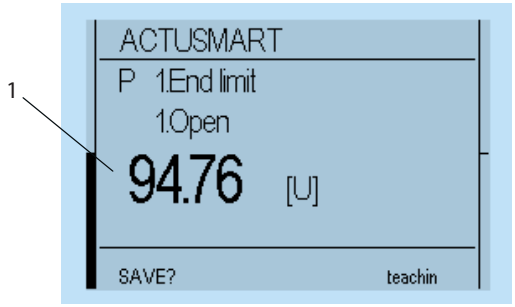
Figure 18 Display (4)



Step 7 - Manually move the actuator with the handwheel (see Section 3.1 or Section 3.5) 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 19 Display (5)



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 20 Selector Switch in Neutral Position (4)

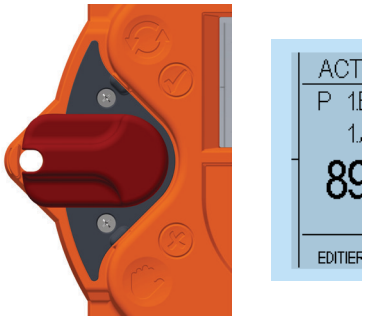
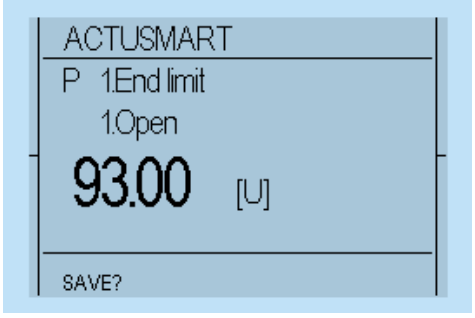


Figure 21 Display (6)



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

Figure 22 Selector Switch in Neutral Position (5)

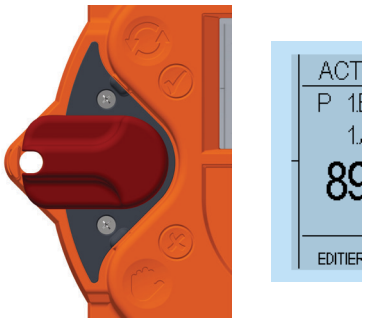


Figure 23 Selector Switch Flipped Up (2)

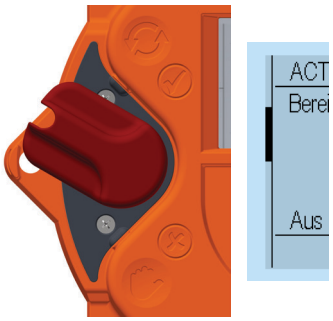
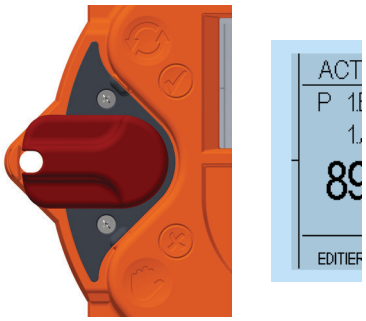


Figure 24 Selector Switch in Neutral Position (6)



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

Figure 25 Display (7)

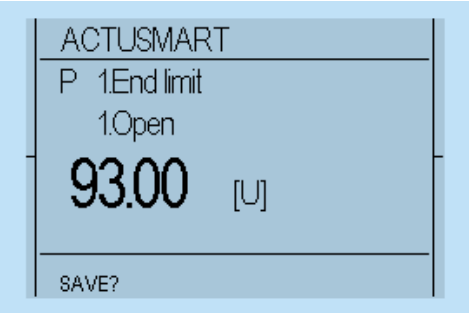
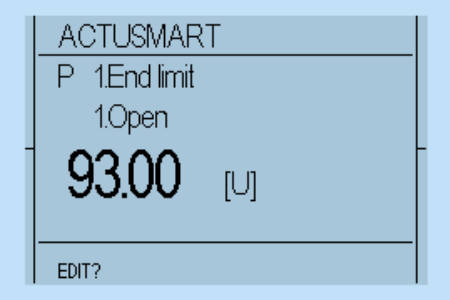


Figure 26 Display (8)



6.4.2 End Limit CLOSE

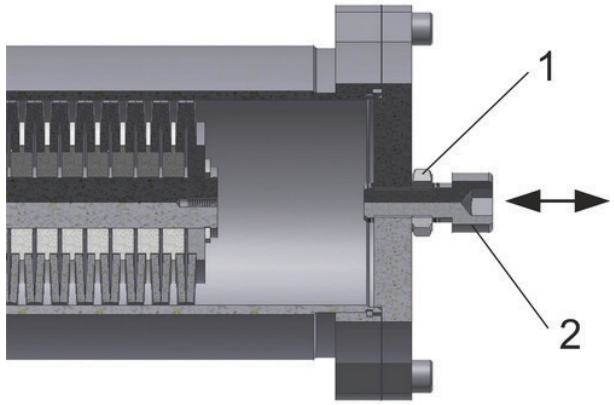
Repeat 6.4.1 but select "P1.2 End limit - End limit CLOSE".

6.5 Setting the Mechanical End Stop

The RTS FQ Fail-Safe Quarter-Turn actuator only has one limited mechanical end stop that limits the travel at the fail-safe end position. The end stop is at the end of the spring cup.

Depending on the size of the actuator, the end stop can be combined with a hydraulic damper.

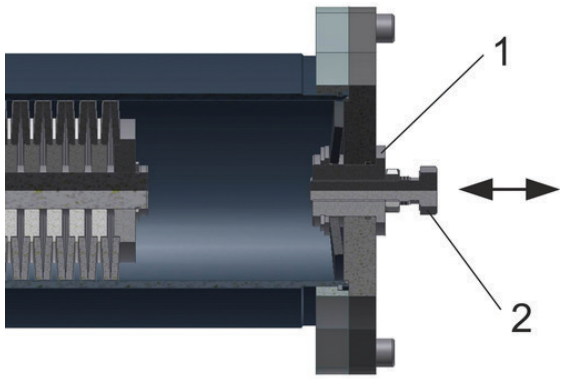
Figure 27 Mechanical End Stop (1)



Parts Overview:

1. Lock Nut
2. End Stop

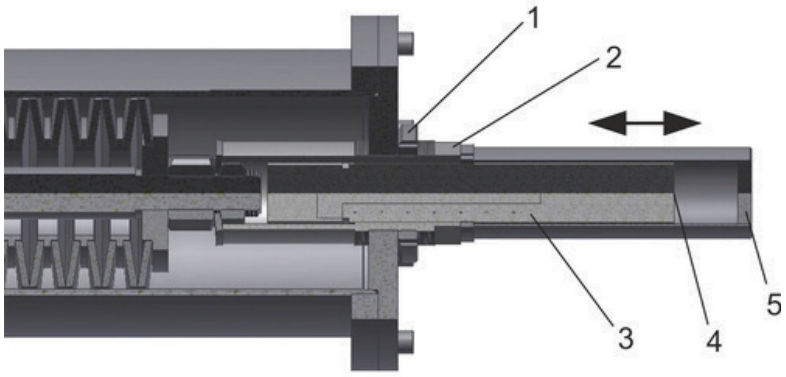
Figure 28 Mechanical End Stop (2)



Parts Overview:

1. Lock Nut
2. End Stop

Figure 29 Mechanical End Stop (3)



Parts Overview:

1. Lock Nut
2. End Stop (hex SW70mm)
3. Hydraulic Damper
4. Damper Adjusting Screw
5. Cover

To adjust the end stop, first undo the locknuts. To lengthen the stroke by means of the end stop, unscrew the end stop out of the cover flange.

NOTE:
Upon delivery, the end stop is set to the maximum possible stroke. Further unscrewing causes no further extension of stroke; the end stop becomes ineffective.

Check:

- In fail-safe operation, let the actuator run against the stop.
- Despite the locknut being undone, it must not be possible to screw the end stop further into the cover flange.

NOTE:
If the stroke is to be shortened by means of the end stop, the actuator must not be in the fail-safe position. Before adjusting, it is necessary to move the actuator electrically at least 10% away from the end position.

After undoing the locknut, screw the end stop into the cover flange, and check the adjustment of the end stop by triggering a fail-safe stroke.

In electrical operation, it is not permissible for the mechanical end stop to be run into. After adjusting the mechanical end stop, check the setting of the travel end position and correct it if necessary. After completing the adjustment work, fix the locknuts back in place.

6.6 Adjusting of Fail-Safe Speed

Emerson Bettis RTS FQ Fail-Safe Quarter-Turn actuators are equipped with an adjustable passive eddy current brake, by which it is possible to change the failsafe speed.
When delivered the failsafe speed is set to minimum.

After mounting the actuator to valve and test run, fail-safe speed can be increased if necessary.

NOTE:

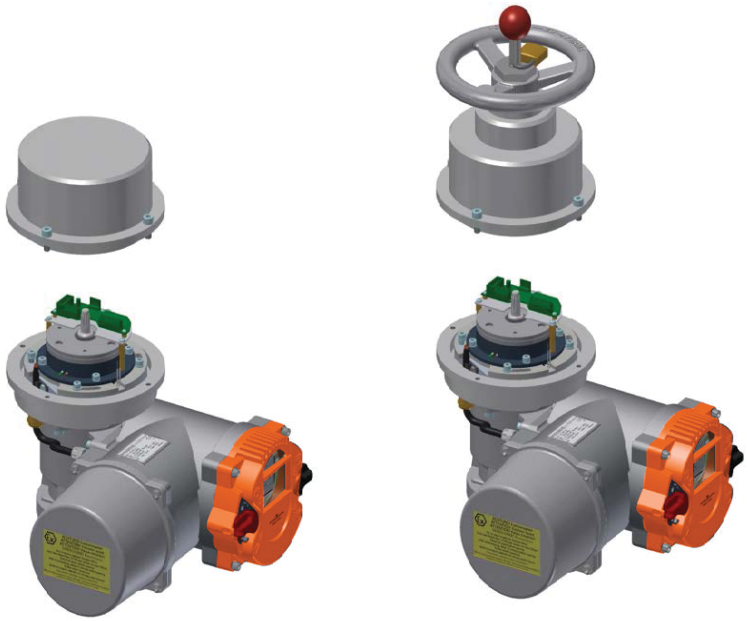
Valve or piping may be damaged due to high actuating speed.

Setting Procedure:

All adjustment work may only be performed with the actuator disconnected from the power supply. Due to this requirement, the actuator has to be in the fail-safe position! Any powering up must be ruled out during maintenance!

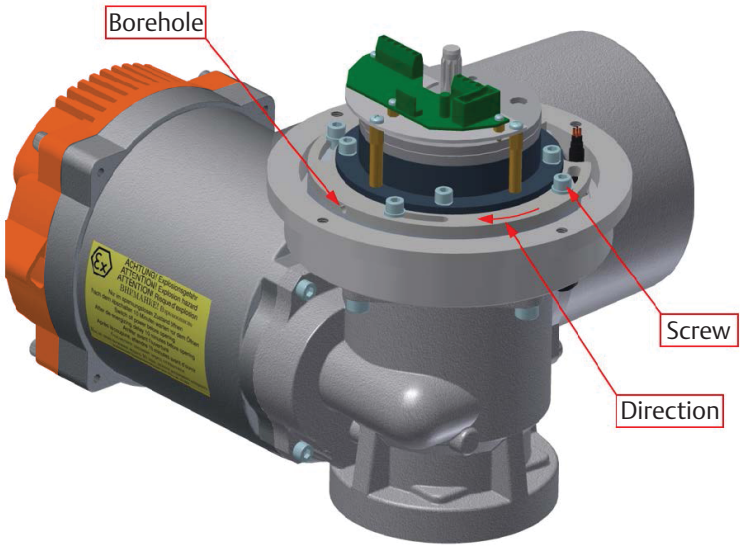
When working in potentially explosive areas, heed European Standards EN 60079-14 “Installing Electrical Systems in Explosion Endangered Areas” and EN 60079-17 “Inspection and Maintenance of Electrical Installations in Explosion Endangered Areas”

Figure 30 Removing the Cover



1. Remove cover according Figure 30.
   Attention: In the version with handwheel there is a cable connection which has to be unplugged.
2. Loosen but do not remove 4pcs of screws according Figure 31.
3. Insert 3mm allen key into radial borehole of flange.
4. Turn flange by use of allen key in direction according Figure 31.
   Half of possible rotating angle will approximately double failsafe speed of actuator.
   While holding flange with key in desired position retighten screws.
5. In the version with handwheel reconnect the cable to the cover.
6. Remount the cover while be aware of correct position of O-ring sealing.
7. Retest actuator to check for correct failsafespeed.

Figure 31 Adjusting Speed



6.7 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.

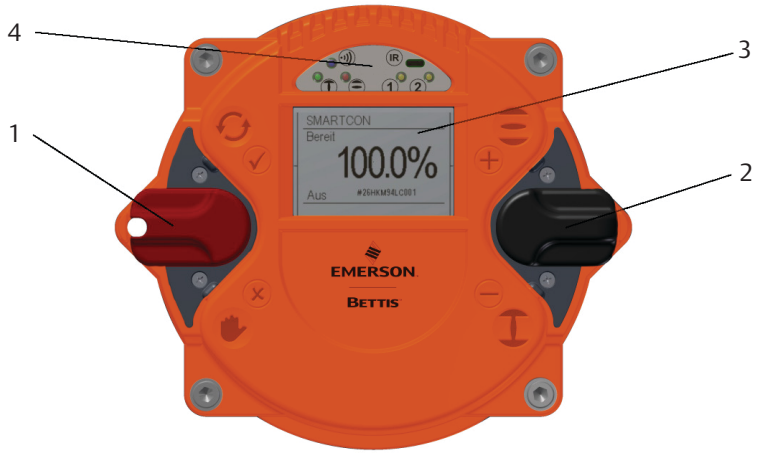
Section 7: Control Unit

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

7.1 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 32 Selctor/Control Switch Operating Unit



Parts Overview:

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

The control switch has dual function.

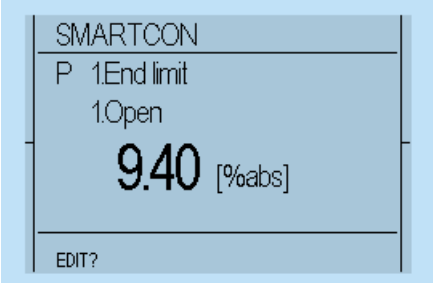
The controller cover may be wiped clean with a damp cloth. The mounting position of the control unit can be turned in 90° steps (see Section 5.2).

7.2 Display Elements

7.2.1 Graphic Display

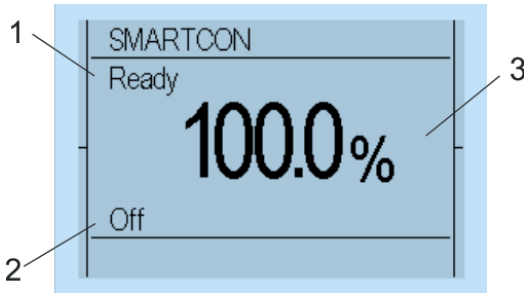
The graphic display used in the controller allows text display in different languages.

Figure 33 Display (9)



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

Figure 34 Display (10)



Display Overview:

1. Status
2. Operation Mode
3. Position

7.2.2 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 light up simultaneously.

Figure 35 LED Display

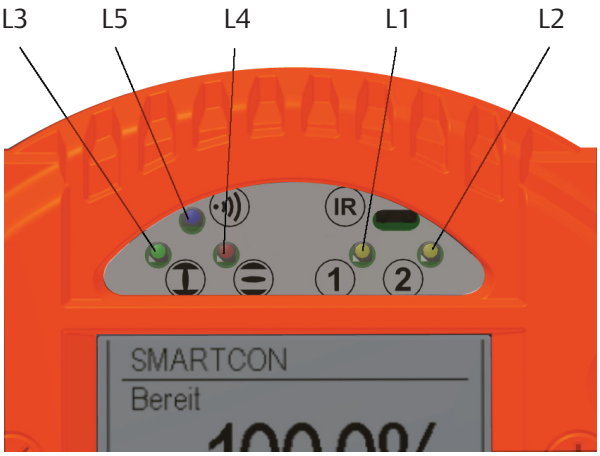


Table 2. LED Function Table

Description	Colour	Lights 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	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	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	

7.3 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 11). Flip the switch up or down to regulate the parameter menu scrolling speed.

Figure 36 Neutral Position

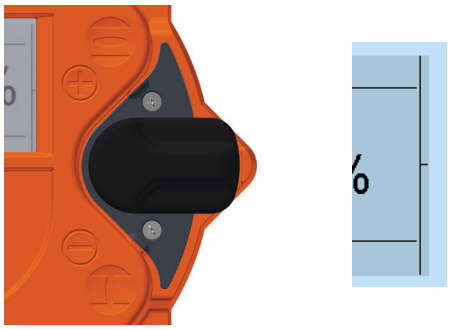
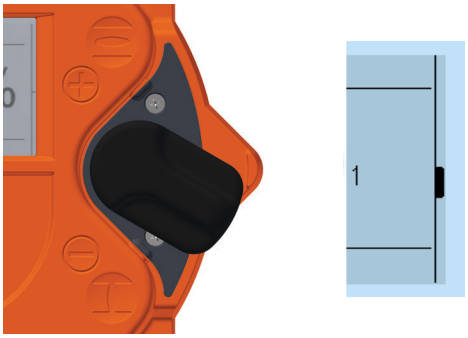


Figure 37 Slight Switch Flip (it will move to the next parameter)



LED L1 and L2 can be changed by parameter P1.7 - see Section 18.1.

Figure 38 Halfway Switch Flip (it will jump to the next parameter category)

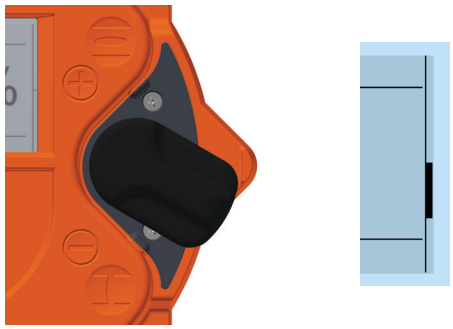
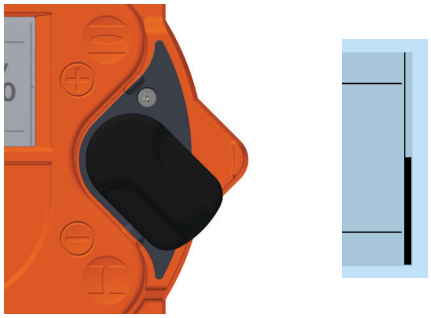


Figure 39 Full Switch Flip (it will jump to the end of the menu)



7.3.1 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. Operating Mode Table

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 not enabled.

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

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

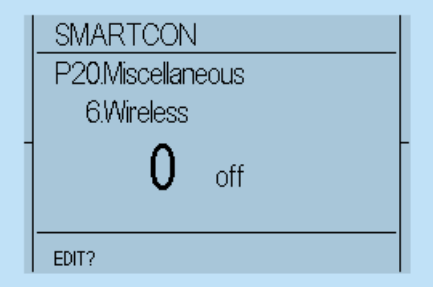
Table 4. Selector Switch Position Table

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

7.3.2 Configuration

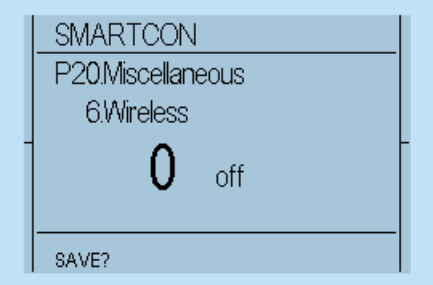
In principle, all parameters are shown as numbers in the corresponding parameter point. From the actuator menu, use the control switch to access different menu points. The lower left corner of the display shows the "EDIT?" option.

Figure 40 Display (11)



Confirm the selector switch with a slight flip towards ✓, (see Figure 24 to Figure 28) to change the selected parameter. To confirm this input readiness, the display changes from "EDIT?" to "SAVE?".

Figure 41 Display (12)



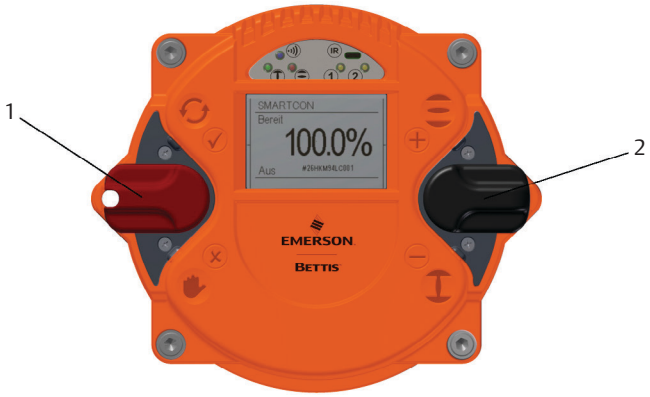
Use the control switch towards to the characters to change the parameter ⊕ or ⊖ (see Figure 33 to Figure 36). After reaching the desired parameter value, confirm the value with the selector switch again, flip it slightly towards ✓, (see Figure 24 to Figure 28).

7.3.3 Configuration Example

By way of example, we will change parameter P20.6 (wireless) from 0 (wireless off) to 2 (Bluetooth communication on). Thus, the Bluetooth connection is activated for a short time and then deactivated again automatically.

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

Figure 42 Selector/Control Switch (2)



Parts Overview:

1. Selector Switch (red)
2. Control Switch (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

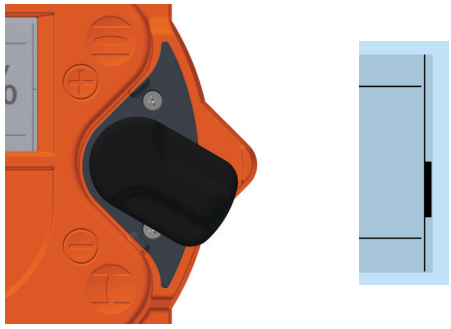
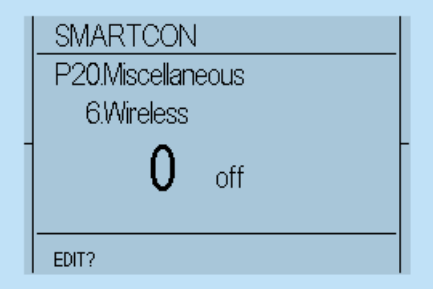


Figure 44 Display (13)



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 (7)

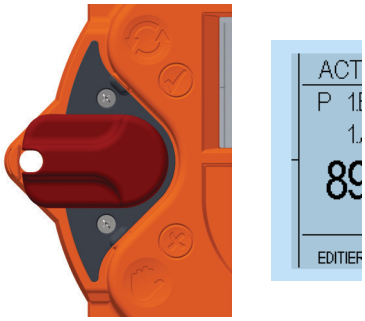


Figure 46 Selector Switch Flipped Up (3)

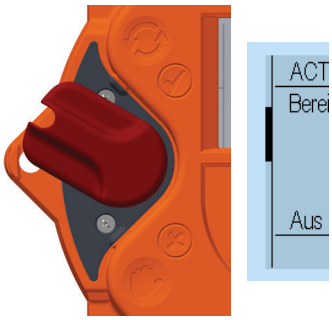
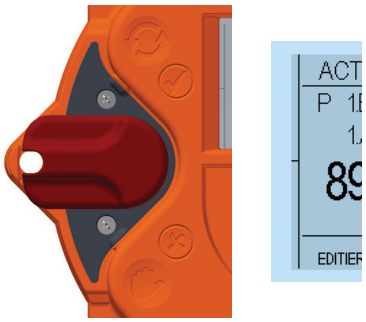


Figure 47 Selector Switch in Neutral Position (8)



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

Figure 48 Display (14)

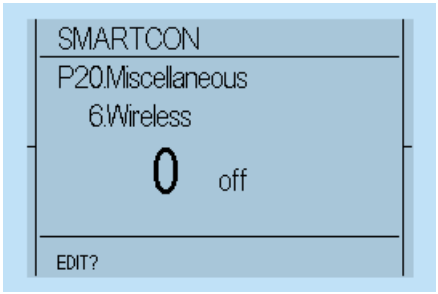
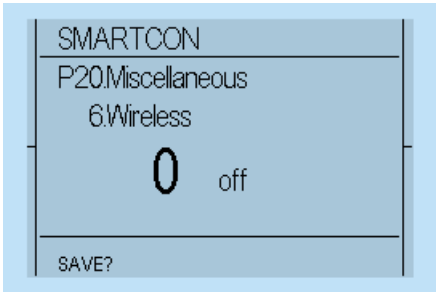


Figure 49 Display (15)



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

Figure 50 Control Switch Flipped Up

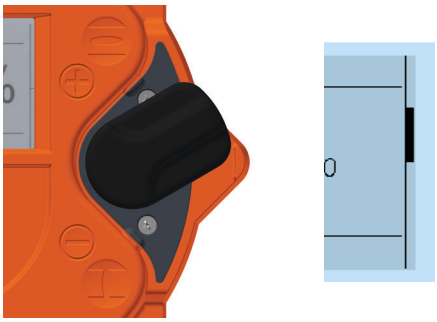
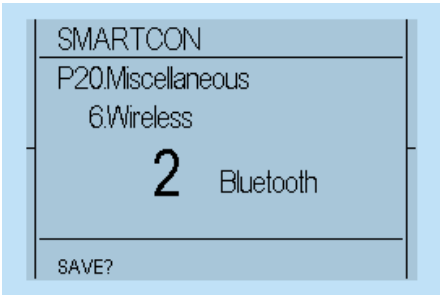


Figure 51 Display (16)



Step 6 - If the value changes to 1, confirm the selection by flipping halfway up the selector switch towards and letting it snap back to its neutral position (see Figure 51 to Figure 53).

Figure 52 Selector Switch Flipped Halfway Up

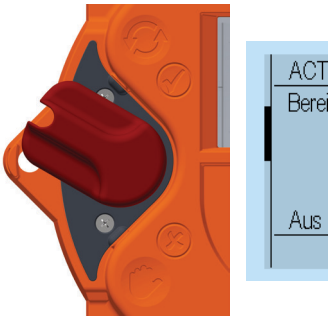
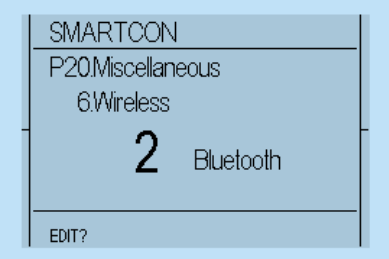


Figure 53 Display (17)



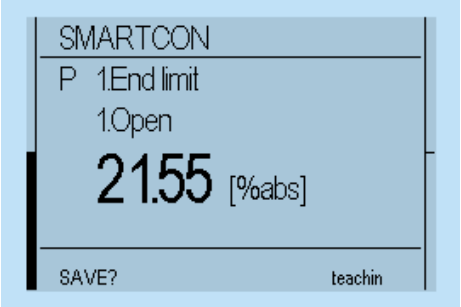
This changes the bottom line of the display from "SAVE?" to "EDIT?" and the parameter is stored.

7.3.4 "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 changhing the input type from "EDIT?" to "SAVE?", move the selector switch (red) to manual mode and lock it into place. As you do so, the display will show the message "TEACHIN" and the current position value will be applied continuously to the parameter value. In this mode, further to manual operation by hand wheel, the actuator can be motor-driven with the control switch to the desired position (see Section 6.4).

Figure 54 Display (18)



⚠ CAUTION: MAX. TORQUE MUST BE ALREADY SET

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

After reaching the desired, to-be-defined position, move the selector switch back to the neutral position. Finally, the parameter value must still be saved by flipping the selector switch halfway up and letting it snap back to the neutral position (see Figure 42 to Figure 46).

Section 8: Parameter Menu

For each parameter group, you can find a description, tabular overview of the menu items and possible configurations.

The parameter list below also includes all possible options per menu item. Please note that some of the menu items listed and described may not be delivered with your configuration.

8.1 Parameter Group: End Limit

These parameters are used to configure the end position and switch off behavior of the actuator. In this regards, it is important to ensure that the basic mechanical configuration described in Section 6.4, page 15 has already been made.

⚠ CAUTION: SET CORRECT PARAMETERS

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: NOTE OPEN/CLOSE VALUES

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	Poss. Setting	Notes / Comments
P1.1	End limit	Open	TEACHIN; 0 - 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 - 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 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)	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 (1)	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 colour of the CLOSED or OPEN end postion signalization.
			Close=red (1)	
P1.8	End limit	End limit hyst	0,1 - 10,0%	Hysteresis range for end position signals: Example: End position hysteresis 1% means, that the End position OFF is reached when closing 0%, and will leave it 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 - 100%	When approaching the end position, the speed is reduced.
P1.10	End limit	Range	0 - 100%	End position range for torque (P1.3, P1.4). Permissible range in which the torque is to be achieved. If the actuator comes to the end of the end position range, the motor shuts off even if the torque has not been reached.
P1.11	End limit	Overrun Open	0 - 60 s	Switch-off delay after reaching the end position see travel1 (P1.3, P1.4)
P1.12	End limit	Overrun Close	0 - 60 s	Switch-off delay after reaching the end position travel1 (P1.3, P1.4)

[1)] representative for CM03

⚠ CAUTION: NOTE TRAVEL LIMITS

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

⚠ CAUTION: SET LIMITS CORRECTLY

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)

8.2 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	Poss. Setting	Notes / Comments
P2.1	Torque	Open	8 - 32Nm[2)]	Switch-off torque in OPEN direction CAUTION: The range can be restricted via menu item P2.3.
P2.2	Torque	Close	8 - 32Nm[2)]	As P2.1, but in CLOSED direction.
P2.3	Torque	Torque limit	8 - 32Nm[2)]	Torque to protect the valve, the transmission, or the thrust unit. This value limits the setting of parameters P2.1 and P2.2 to prevent an erroneous increase above the allowed value of these two parameters.
P2.4	Torque	Latching	Off (0)	Unassigned in RTS Compact Multi-Turn CM series

[2)] representative for CM03

⚠ CAUTION: NOTE GEAR AND THRUST UNITS

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

8.3 Parameter Group: Speed

Table 7. Speed Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting[2)]	Notes / Comments
P4.1	Speed	Local Open	2.5 - 72.2 rpm	Output speed for local operation in direction OPEN
P4.2	Speed	Local Close	2.5 - 72.2 rpm	As P4.1, but in direction CLOSE
P4.3	Speed	Remote Open	2.5 - 72.2 rpm	Output speed for remote operation in direction OPEN
P4.4	Speed	Remote Close	2.5 - 72.2 rpm	As P4.3, but in direction CLOSE
P4.5	Speed	Emergency Open	2.5 - 72.2 rpm	Output speed for emergency operation in direction OPEN
P4.6	Speed	Emergency Close	2.5 - 72.2 rpm	As P4.5, but in direction CLOSE
P4.7	Speed	Torque-dependent.	2.5 - 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	2.5 - 72.2 rpm	Minimum speed

⚠ CAUTION: NOTE MAXIMUM SPEED LIMITS

The max. speed for the 24VDC actuator version is reduced to 20 rpm.

8.4 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	Poss. Setting	Notes / Comments
P5.1	Ramp	Local	5 - 100%	Start ramp for local operation
P5.2	Ramp	Remote	5 - 100%	Start ramp for remote operation
P5.3	Ramp	Emergency	5 - 100%	Start ramp for emergency operation

8.5 Parameter Group: Control

Table 9. Control Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P6.2	Control	Ready delay	0 - 10 sec.	Drop-out delay for the ready signal (Binary outputs)
P6.5[3)]	Control	24V output	0	24V auxiliary output is deactivated (chapter 22.5). The function of the auxiliary input is still activated.
			[1]	24V auxiliary output is activated (chapter 22.5).
P6.6	Control	Min. impuls	0.1 - 2.0 sec	Minimum switch-on time of the motor.

[3)] since firmware 1.303

8.6 Parameter Group: Password

The actuator control can be password-protected to prevent access at different levels. It is possible to prevent entry by unauthorized personnel or to entirely lock motor operation. Default password is set to "000änd thus deactivated. You can use both numbers and capital letters in your password. After entering a password, password protection is activated. To remove password protection, enter an empty password (000).

When accessing a password-protected parameter, the user is automatically prompted for its introduction. Only after correctly entering the password, it is possible to change the corresponding parameters.

Table 10. Password Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P7.1	Password	Reading PWD	3-digit	Status display and history data are still viewable; access to the parameter menu is locked until this password is introduced. Parameter menu scrolling is only enabled after entering the password. Electric motor operation is unlocked.
P7.2	Password	Writing PWD	3-digit	Status display, history data and parameter menu can be viewed. However, parameters become read-only.
P7.3	Password	Bluetooth PWD	15-digit	Password for the Bluetooth connection, empty password deactivates the password request.

8.7 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: CHANGING END POSITIONS

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 11. Position Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P8.1	Position	Intermed. pos.1	TEACHIN 0 - 100%	Position value of intermediate position 1
P8.2	Position	Intermed. pos.2	TEACHIN 0 - 100%	see above
P8.3	Position	Intermed. pos.3	TEACHIN 0 - 100%	see above
P8.4	Position	Intermed. pos.4	TEACHIN 0 - 100%	see above
P8.5	Position	Emerg. position	TEACHIN 0 - 100%	Position value of the emergency position.
P8.6	Position	Hysteresis	0,1 - 10,0%	Hysteresis range of intermediate positions. Within this hysteresis, no repositioning occurs upon reaching the intermediate positions (option: fix position approach). Furthermore, the output functions for position = intermediate position are active within this range (see P10.1 . . .).

8.8 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 12. Binary Inputs Parameter Group (1)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P9.1	Binary Input	Input 1	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 postioner
			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: Contoller 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.
			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: Failsafe	Trigger the failsafe function in all operating modes (only functional in Failsafe actuators).
			27: Failsafe inv.	As Failsafe, 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

Table 13. Binary Inputs Parameter Group (2)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P9.1	Binary Input	Input 1	31: Intermediate position1	Approach intermediate position 1 (P8.1) in REMOTE mode (fix position approach). There is no repositioning upon reaching the intermediate position within the hysteresis (see P8.6). Higher priority than intermediate position 2, 3 and 4
			32: Intermediate position2	As intermediate position 1, but with higher priority than intermediate positions 3 and 4
			33: Intermediate position3	As intermediate position 1, but with higher priority than intermediate position 4
			34: Intermediate position4	As intermediate position 1, but with lowest priority
			35: Emergency position	Approach emergency position (P 8.5). As intermediate position 1, but with higher priority than intermediate positions 1, 2
			36: Intermediate position1 inv.	As Intermediate position 1, but active low
			37: Intermediate position2 inv.	As Intermediate position 2, but active low
			38: Intermediate position3 inv.	As Intermediate position 3, but active low
			39: Intermediate position4 inv.	As Intermediate position 4, but active low
			40: Emergency position inv.	As Emergency position, but active low
			41: Travel Open	reserved for future use
			42: Travel Close	reserved for future use
			43: Travel Open inv.	reserved for future use
			44: Travel Close inv.	reserved for future use
			45: Failsafe lock	reserved for future use (only for Failsafe actuators)
			46: Failsafe lock inv.	reserved for future use (only for Failsafe actuators)
P9.2	Bin. Input	Input 2	see Input 1	
P9.3	Bin. Input	Input 3	see Input 1	
P9.4	Bin. Input	Input 4	see Input 1	
P9.5	Bin. Input	Input 5	see Input 1	

8.9 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 14. Binary Outputs Parameter Group (1)

	Menu Item	Sub Menu Item	Poss. 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: Runing	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 postion has been reached
			12: Travel Closed	The Closed end postiion has been reached
			13: Pos. > Int.1	Position > Intermediate position 1
			14: Pos. < Int.1	Position < Intermediate position 1
			15: Pos. > Int.2	Position > Intermediate position 2
			16: Pos. < Int.2	Position < Intermediate position 2
			17: Pos. > Int.3	Position > Intermediate position 3
			18: Pos. < Int.3	Position < Intermediate position 3
			19: Pos. > Int.4	Position > Intermediate position 4
			20: Pos. < Int.4	Position < Intermediate position 4
			21: Local	Local operating mode (selector switch in position)

Table 15. Binary Outputs Parameter Group (2)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P10.1	Binary Output	Output 1	22: Remote	Remote operating mode (selctor switch in position Remote)
			23: Off	Off operating mode (selector switch in the Off position)
			24: no function	no function
			25: Motor error	The motor temperature sensor has reported an error
			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 supress (mask) this signal in the end position upon torque-dependent switch off.
			34: Torque Closed ma.	As Torque CLOSED although it will supress (mask) this signal in the end position upon torque-dependent switch off.
			35: Ready Remote	Ready and Remote operating mode
			36: Ready Local	Ready and Local operating mode
			37: Ready Local/remote	Ready and Local or Remote mode
			38: 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: Failsafe OK1	Failsafe OK (only for failsafe actuators)
			41: Failsafe OK2	Failsafe OK and Ready (only for failsafe actuators)
			42: Failsafe OK3	Failsafe OK,Ready and Remote (only for failsafe actuators)
			43: Lock	Lock Open or Lock Closed is enabled.
			44: Ready/TorqueOK	Actuator is ready and no torque switch off
			45: Ready/Remote/ TorqueOK	Actuator is ready for operation in REMOTE mode and no torque switch off
			46: Pos.=Int1	Position = Intermediate position 1. The width of the interval is set with the parameter P8.6.

Table 16. Binary Outputs Parameter Group (3)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P10.1	Binary Output	Output 1	47: Pos.=Int2	Position = Intermediate position 2. The width of the interval is set with the parameter P8.6.
			48: Pos.=Int3	Position = Intermediate position 3. The width of the interval is set with the parameter P8.6.
			49: Pos.=Int4	Position = Intermediate position 4.The width of the interval is set with the parameter P8.6.
			50: Pos.=EmergPos	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. [4]
			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 for the SMARTCON control is OK. This function is only available if the auxiliary voltage output is not switched on (P6.5 to 0).
			65: Oil pressure OK	The oil pressure is higher than the minimum pressure (P6.10).
			66: Oil level OK	The oil level is OK.
			67: Pump OK	The temperature sensor in the pump motor and the external motor protection have not tripped.
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	Bin. Output	Output 2	see Output 1	
P10.4	Bin. Output	Output 2 conf.	see Output 1 conf.	
P10.5	Bin. Output	Output 3	see Output 1	
P10.6	Bin. Output	Output 2 conf.	see Output 1 conf.	
P10.7	Bin. Output	Output 4	see Output 1	

Table 17. Binary Outputs Parameter Group (4)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
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.	

[4] from Firmware 1.323

⚠ CAUTION: NOTE SET TORQUE AND POSITION

When using the point torque-dependent OPEN or torque-dependent CLOSED (see Section 7.1, Menu P1.3 u. 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)

8.10 Parameter Group: Position Output (optional)

Position output is used to indicate the current position of the actuator using 0/4-20 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 posi- tions for the calculation. Regardless of whether this is defined by the torque or the travel limit positions.

The factory default setting is:

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

Table 18. Position Output Parameter Group

	Menu item	Sub Menu Item	Poss. Setting	Notes / Comments
P11.1	Position Output	Function 1	0: off	mA output disabled
			1: Position	mA output corresponds to the actual position value.
			2: Pos. Valvencahr.	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: mAoutput = start
				torque = 0%: mAoutput = center
				torque = 100% Open: mAoutput = end
			4: Torque 2	mAoutput corresponds to the actual torque value.
				torque = 100% Close: mAoutput = end
				torque = 0%: mAoutput = start
				torque = 100% Open: mAoutput = end
			5: Torque 3	mAoutput corresponds to the actual torque value.
				torque = 150% Close: mAoutput = start
				torque = 0%: mAoutput = center
				torque = 150% Open: mAoutput = end
			6: Torque 4	mAoutput corresponds to the actual torque value.
				torque = 150% Close: mAoutput = end
				torque = 0%: mAoutput = start
				torque = 150% Open: mAoutput = end
P11.2	Position Output	Start 1 (at 0%)	0 - 20,5 mA {4mA}	mA value for the Closed (0%) position
P11.3	Position Output	End 1 (at 100%)	0 - 20,5 mA {20mA}	mA-value for the On (100%) position
P11.4	Position Output	Calib. 20mA	-10% - +10% see Output 1	Calibrating the output position during the setting of this parameter will output a 20mA (100%) signal. Use this parameter to calibrate accurately the 20mA output signal. (e.g., if you measure 19.8 mA at the output, just add 1% (0.2 mA. . . 1% of 20mA) to the displayed value)
P11.5	Analog Output	Function 2	see Function 1	
P11.6	Analog Output	Begin 2 (at 0%)	see Begin 1	
P11.7	Analog Output	End 2 (at 100%)	see End 1	
P11.8	Analog Output	Calib. 20 mA 2	see Calib. 20 mA 1	

8.11 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.

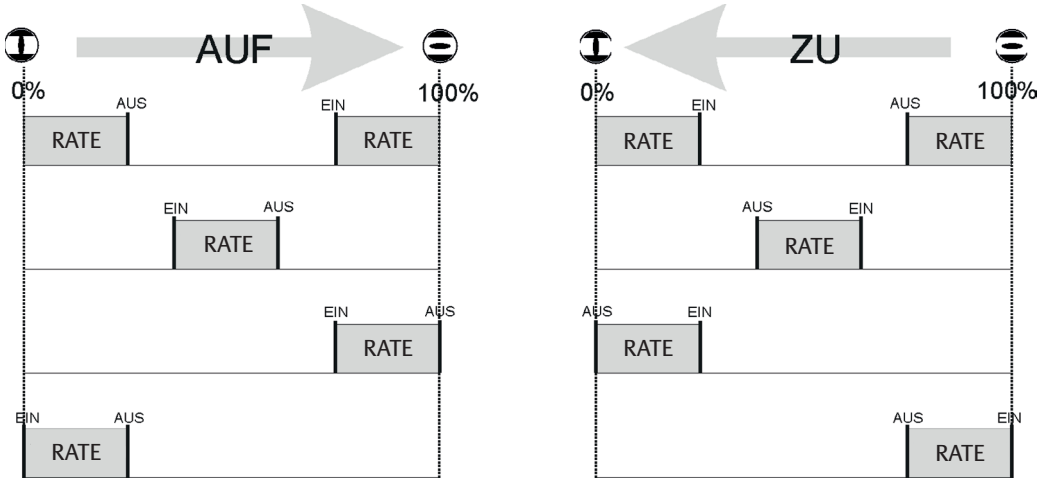
Step mode operation can be activated individually for the directions OPEN and CLOSED.

Cycle start, cycle end, cycle duration and interval time can be set separately for both directions. (see Figure 55)

Table 19. Step Mode Parameter Group

	Menu Item	Sub Menu Item	Poss. 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 mode is only enabled in LOCAL mode
			Remote only	Step mode mode is only enabled in REMOTE mode
			Local + Remote only	Step mode mode is enabled in REMOTE and LOCAL mode
P12.2	Step mode function	Start Open	0 - 100%	In OPEN direction, position in % from which the step mode operation should start.
P12.3	Step mode function	End Open	0 - 100%	In OPEN direction, position in % of which the step mode operation should end.
P12.4	Step mode function	Runtime Open	0,1 - 60	Runtime in OPEN direction
P12.5	Step mode function	Pause time Open	0,2 - 60	Pause time in OPEN direction
P12.6	Step mode function	Start Closed	0 - 100%	In CLOSED direction, position in % from which the step mode operation should start.
P12.7	Step mode function	End Closed	0 - 100%	In CLOSED direction, position in % of which the step mode operation should end.
P12.8	Step mode function	Run time Closed	0,1 - 60	Runtime in Closed direction
P12.9	Step mode function	Pause time	0,2 - 60	Pause time in Closed direction
P12.10	Step mode function	Timebase	0: Seconds	Time basis for run and pause times
			1: Minutes	
P12.11	Step mode function	Speed adaptation	0:	Speed adaption not activated. Normal step mode function.
			1:	Speed adaption is activated. The speed is reduced according to the runtime and pause time in the step mode range. (Example: Running time 1 sec and pause time 1 sec results in half the speed). If the minimum speed is undershot, the actuator clocks in the converted ratio with the minimum speed. The speed adjustment is only applicable to actuators of the type CM and AB CSC.

Figure 55 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 6.2.2) only flashes while the drive is running, i.e. during the break, no flash.

8.12 Parameter Group: Positioner (optional)

The positioner SR option is used to control the electric actuator by means of a set point input 0/4-20 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.

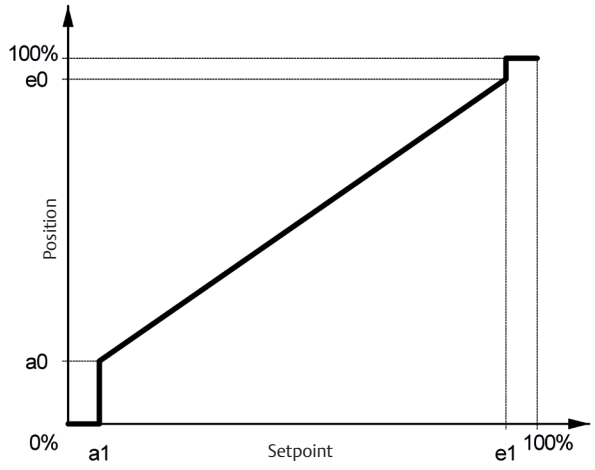
Table 20. Positioner Parameter Group (1)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P13.1	Positioner	Function	off	Positioner disabled
			1: Position	mAinput for the position setpoint
			2: Pos valvechar.	mAinput for the position setpoint, taking into account the valve characteristic
P13.2	Positioner	Begin (at 0%)	0 – 20,5 mA {4,0 mA}	mA value of the setpoint for the CLOSED (0%) position
P13.3	Positioner	End (at 100%)	0 – 20,5 mA {20,0 mA}	mA value of the setpoint for the OPEN (100%) position
P13.4	Positioner	Dead band	0,1 – 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 – 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 params P13.9 and P13.10). This provided a better positioning (smaller reachable deadband). A 100% setting disables this gradient.
P13.6	Positioner	Live zero detect.	Ignore	The setpoint monitoring (monitoring the setpoint to below approximately 2mA = loss of signal) is disabled.
			Stop	Actuator stops on signal failure.
			Open	On signal failure, actuator moves the OPEN position.
			Close	Actuator moves on signal failure to the CLOSED position.
			Emerg. pos.	On signal failure, the actuator moves the defined emergency position (see parameter P13.7).

Table 21. Positioner Parameter Group (2)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P13.7	Positioner	Emergency pos.	0 – 100% {50,0%}	Determination of the emergency position. (it can also be set in the menu P8.5)
P13.8	Positioner	Calib. setpoint	-10% - +10%	Calibration value for the mA setpoint. Calibration process: By applying 20 mA on the setpoint input, this parameter is corrected until the readout matches 20 mA.
P13.9	Positioner	Min. Impuls	{0,2 s}	Variable speed actuators (RTS Compact Multi-Turn CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): Minimum activation time of the reversing contactors. For very small activation times (<0.3 ... 0.5 s), the motorwill be switched off during start-up process, which increases significantly reversing contactors mechanical wear. With frequent periods of very small activation times (restless loop, small dead zone, clocking near to the target value), we therefore recommend electronic reversing contactor.
P13.10	Positioner	Period	{2,0 s}	Variable speed actuators (RTS Compact Multi-Turn CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): This parameter is only relevant when Step mode is enabled and when approaching the target position (parameter gain smaller than 100 %) and determines the period of a run / pause cycle.
P13.11	Positioner	Begin pos. (a0)	0,0 – 25,0% {2,0%}	Smallest controllable position other than the end position CLOSED. The range 0% . . . a0 will be just passed through. Use the parameter a0 to define the beginning of the allowable control range of the valve (e.g., blind spot for ball segment valves, etc.).
P13.12	Positioner	End pos. (e0)	75,0 – 100,0% {98,0%}	Largest controllable position other than the end position OPEN. The area e0 . . . 100% is just passed through. Use the parameter e0 to define the end of the allowable control range of the valve.
P13.13	Positioner	Begin setp. (a1)	0,0 – 25,0% {2,0%}	Below this value, the end position CLOSED is controlled. In the range 0% . . . a1 cannot be controlled (end position tolerance). The initial setpoint a1 is associated with a small hysteresis (1/4 of the deadband).
P13.14	Positioner	End setp. (e1)	75,0 – 100,0% {98,0%}	Above this value, the end position OPEN is controlled. The range e1 . . . 100% cannot be controlled (end position tolerance). The final setpoint e1 is associated with a small hysteresis (1/4 of the deadband).
P13.15	Positioner	Calib.setpoint offset	-10% - +10%	Calibration of zero for the input setpoint. 1% = 0.2mA

Figure 56 Assigning the position to the setpoint



8.13 Parameter Group: PID Controller (optional)

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

Table 22. PID Controller Parameter Group (1)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P14.1	PID-controller	Function	0: disabled	PID controller disabled
			1: Position	The output of the PID controller corresponds to the position setpoint of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see 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 7.12).[5)]
			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.[6)]
P14.2	PID-controller	External Setpoint	0: fixed	The PID controller uses an internal, fixed setpoint (see param P14.3).
			1: external	The PID controller uses the external setpoint. The adjustment of this setpoint is done with the params P13.2 and P13.3 (see 7.12).
P14.3	PID-contoller	Fixed setpoint	0 – 100%	Specification of the internal fixed setpoint
P14.4	PID-contoller	Start (at 0%)	0 - 20,5 mA	mA value at 0% of the external actual value
P14.5	PID-controller	End (at 100%)	0 - 20,5 mA	mA value at 100% of the external actual value
P14.6	PID-contoller	Gain (P)	+50,0 - 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-contoller	Reset time (I)	0 – 100,0 s	The shorter the reset time (integral time, integral value), the stronger is the effect of the integral component of the PID-controller. Values below 1,0 will disable the integral component.
P14.8	PID-controller	Lead time (D)	0 – 100,0 s	The larger the lead time (differential/derivative value), the stronger is the effect of the dervative component of the PID-controller. To reduce the influence of noise a first-order lag element with 1sec time constant is added (DT1) .

Table 23. PID Controller Parameter Group (2)

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P14.9	PID-contoller	Offset	-200 – 200%	The offset value will be added to the output value of the PID controller.
P14.12	PID-contoller	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 param P13.7).
			5: Emergency PID	Reserved for future use
P14.13	PID-contoller	Calibration of ext. actual value	-10.0 - +10.0%	Calibration process: By applying 20mA to the external actual value input, this parameter is corrected until the readout matches 20 mA.
P14.14	PID-contoller	Process begin	32768 - +32767	Mantissa of the real process variable (begin of external actual value)
P14.15	PID-contoller	Process end	32768 - +32767	Mantissa of the real process variable (end of external actual value)
P14.16	PID-contoller	Process comma shift	-3 - +3	Position of the comma for process begin/end (P14.14, P14.15), e.g.: mantissa = 200, comma shift = -2/2, process value = 2.00/20000
P14.17	PID-contoller	Process unit	-	Unit of the real process variable
P14.18	PID-contoller	Dead band	0.1 - 10.0% {1.0%}	Tolerance range for the control deviation (set point – external actual value) where no adjustment occurs. [7]

[5] from firmware 1.338

[6] from firmware 1.340

[7] up to firmware 1.337

[8] up to firmware 1.337

8.14 Parameter Group: Bus Systems (optional)

The manuals for the Bus systems are available in the download area on our homepage www.emerson.com under the tab Quality & Service.

8.15 Parameter Group: Characteristic Curves (optional)

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

With these characteristic curves, torque limits already set under menu item P2 (torque) can be further reduced depending on travel. Characteristics can be configured via the infrared interface with the SMARTTOOL software (see Figure 57).

Figure 57 Characteristic Curves Display

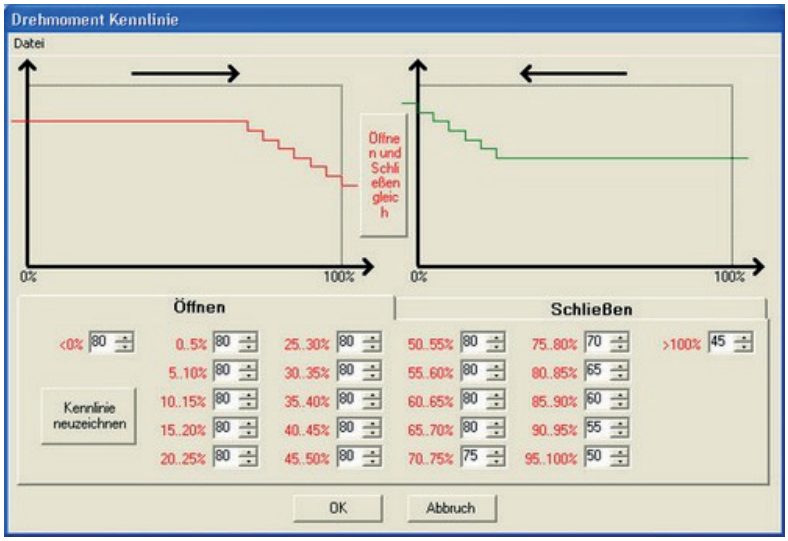


Table 24. Characteristic Curves Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P17.1	Characteristic	Torque Open	0: Off	The torque characteristic curve is disabled for the OPEN direction.
			1: On	The torque characteristic curve is enabled for the OPEN direction.
			2: Local + Remote only	The torque characteristic curve is enabled for the OPEN direction only in LOCAL and REMOTE mode (while disabled in the EMERGENCY mode).
P17.2	Characteristic	Torque Closed	0: Off	The torque characteristic curve is disabled for the CLOSED direction.
			1: On	The torque characteristic curve is enabled for the CLOSED direction.
			2: Local + Remote only	The torque characteristic curve is enabled for the CLOSED direction only in LOCAL and REMOTE mode (while disabled in the EMERGENCY mode).

8.16 Parameter Group: Identification (optional)

This option allows entering further custom-identification parameters.

Table 25. Characteristic Curves Parameter Group

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

8.17 Parameter Group: System Parameters (locked)

Used for actuator configuration and not available for customers.

8.18 Parameter Group: Miscellaneous

Table 26. Miscellaneous Parameter Group

	Menu Item	Sub Menu Item	Poss. Setting	Notes / Comments
P20.1	Miscellaneous	Language	0: German	Defines the menu language
			1: English	
			2: Russian	
			3: Czech	
			4: Spanish	
			5: French	
			6: Italian	
			7: Danish	
			8: Hungarian	
			9: Turkish	
			10: Greek	
			11: Polish	
			12: Serbian	
			13: Croatian	
P20.2	Miscellaneous	Smartcode		Enables additional features by entering a Smartcode.
P20.3	Miscellaneous	Restore Parameters	Customer conf. -	By saving this setting, all parameters except the end positions are reset to the customer parameters.
			Customer conf. +	By saving this setting, all parameters are reset to the customer parameters.
			Backup parameters. -	By saving this setting, all parameters except the end positions are reset to the factory settings.
			Backup parameters. +	By saving this setting, all parameters are reset to the factory settings.
P20.4	Miscellaneous	Backup Parameters	Customer conf.	By saving this setting, the currently set parameters are adopted as customer parameters.
P20.5	Miscellaneous	Info line	{0} - 31	The fourth line of the display shows various diagnostic values.
P20.6	Miscellaneous	Infrared	0: Off	The infrared connection is disabled
			1: Infrarot	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: Infrarot+	The infrared connection is activated.
			4: Bluetooth+	The Bluetooth connection is activated.
P20.7	Miscellaneous	Menu style	0 -2	Different menu styles.
P20.11	Miscellaneous	Daylight saving time	0: Off	Normal time is activated.
			1: On	Daylight saving time is activated.
			2: Auto	The actuator switches automatically between Daylight saving time and Normal time.

Section 9: Status Area

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

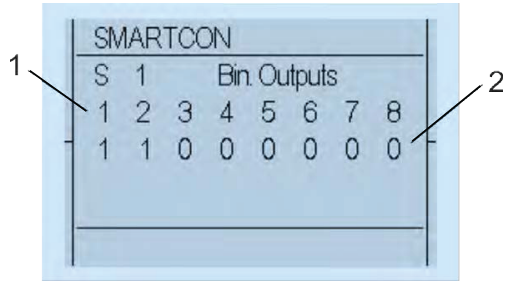
- Status
- History

9.1 Status

9.1.1 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 58 Binary Output Display



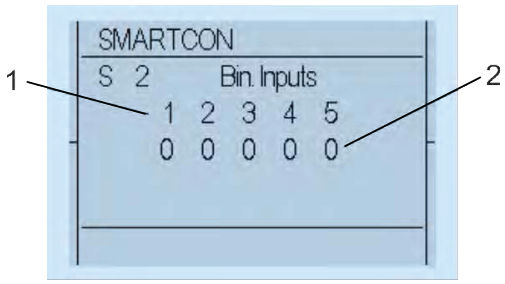
Display Overview:

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

9.1.2 Status – Binary Inputs

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

Figure 59 Binary Input Display



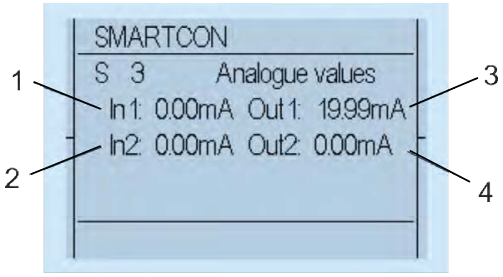
Display Overview:

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

9.1.3 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 controler. In the analogue output (out), only the control signal is shown, regardless of whether the output current actually flows or not (interruption of the current loop).

Figure 60 Analogue Status Display



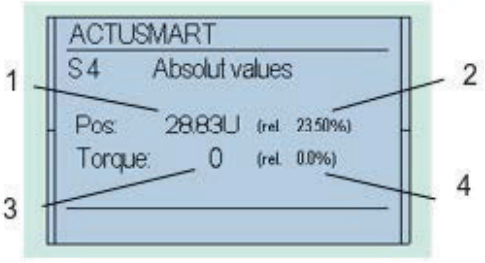
Display Overview:

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

9.1.4 Status – Absolute values

This status displays the absolute position of the actuator.

Figure 61 Absolute Value Display

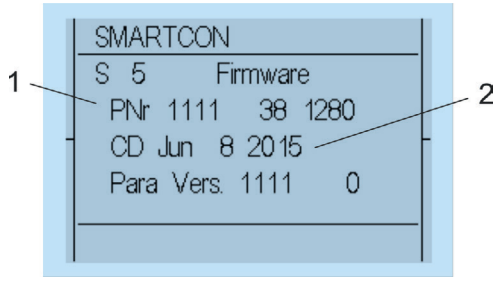


Display Overview:

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)

9.1.5 Status – Firmware

Figure 62 Firmware Status Display

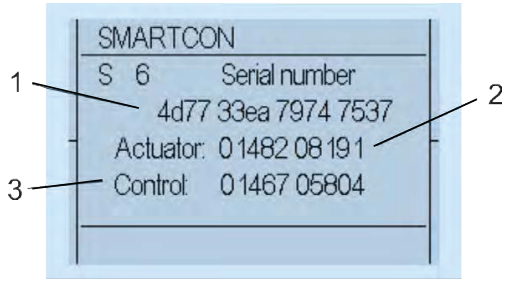


Display Overview:

1. Firmware
2. Firmware date

9.1.6 Status – Serial number

Figure 63 Serial Number Display

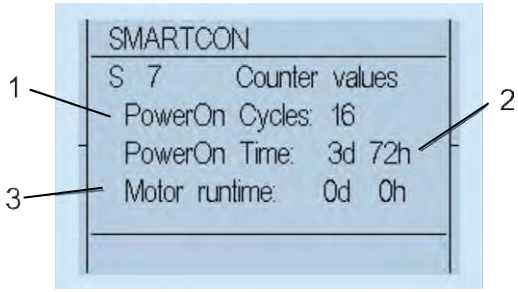


Display Overview:

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

9.1.7 Status - meter readings

Figure 64 Meter Readings Status Display



Display Overview:

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

9.2 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 energised. For error analysis, please refer to Section 12.1.

Section 10: Infrared Connection

For easier communication and better visualization of the menu options, the unit provides an infrared port for connection to a PC.

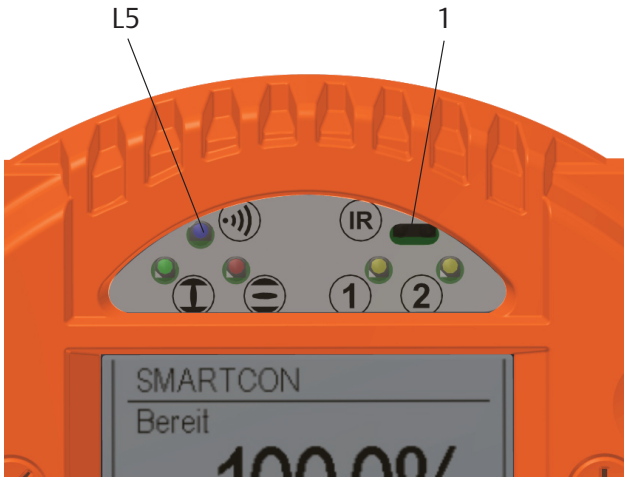
The required hardware (connection cable to the PC's RS-232 or USB connectors) and the corresponding software are available as options.

During operation, it must be ensured that the IR interface surface is protected from strong disturbances -which may other- wise 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 Diode L5 (see Figure 65).The infrared interface can be enabled in the menu item P20.6.

Figure 65 LED IR Indicator



Display Overview:

1. Infrared connection

Section 11: Bluetooth Connection

In addition to the infrared interface, it is also possible to configure the Control System using a Bluetooth interface.

Software required for Android equipment is available as an option. In addition to communication with the actuator, the Android software also enables management of multiple actuators, allowing easy transfer of parameter sets to various actuators. This approach can significantly simplify commissioning.

When the Bluetooth interface is enabled, this is indicated by LED L5 (see Figure 65). The Bluetooth interface can be enabled in menu item P20.6.

Section 12: Maintenance

All maintenance work may only be performed with the actuator disconnected from the power supply.

Due to this requirement, the actuator has to be in the fail-safe position!
If this is not the case, it may be because of a fault in the fitting (stuck fitting shaft).

⚠ CAUTION

The actuator has a pre-stressed disk spring assembly! When undoing the flange mounting bolts, the spring force against the fitting can cause the actuator to turn abruptly or come loose from the fitting. Adequate safety measures must be taken.

Any powering up must be ruled out during maintenance!
Work on the electrical systems or components may only be carried out by electricians or by individuals who have been instructed how to do so, working under the guidance and supervision of an electrician in accordance with electro technical regulations.
After completing their commissioning, the actuators are ready for use.
The actuator is filled with oil as standard when shipped.

Routine Checks:

- Be mindful of increased running noises. In cases of long down times, operate the actuator at least every three months.
- Check the fail-safe function (check the operating time and smoothness of running in fail-safe operation). Lengthening in the running time may also be caused by an increased torque requirement for the fitting after long down times.

⚠ CAUTION

The actuator has a pre-stressed disk spring assembly. Improper dismounting may lead to both damage to the actuator as well as serious injuries! If maintenance work is needed requiring the actuator to be dismounted, contact Emerson regarding detailed instructions and/or any special-purpose tools for relaxing the spring assembly! Maintenance work on open actuators may only be conducted if these are deenergized. Reconnection during maintenance is strictly prohibited. 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.

For explosion-proof actuators, it is necessary before opening the cover to wait a certain time after switching off, see explosion protection sticker (Figure 66). Following times are specified for the actuators.

- CM03: 5 min
- CM06: 10 min

The actuators are designed for any mounting position (See Section 3.3), which is why there is neither a filling level indicator nor a drain plug on the main casing.
Depending on the stressing subjected to, do the following approx. every 10,000 to 20,000 hours (about 5 years; see Section 15):

- Oil change
- Replace seals
- Check all the roller bearings and the worm gear assembly and replace if necessary.

Take the types of oils and greases to be used from our Lubricant Table. (See Section 15).
Check the cable glands at regular intervals (annually) for tightness of the cables and retighten if necessary.

If the visual inspection (eg. 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.

Figure 66 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, re-lubricate at least every 6 months on existing grease fittings (see Section 15.3).

Actuators are designed for installation in any position (see Section 3.4). 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 approx. 10,000 to 20,000 hours (about 5 years, see Section 15), depending on the workload, you must:

- Change oil, and
- 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).

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

If the visual inspection (eg. 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 13: 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)

13.1 Error List

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

Table 27. Errors and Indication (1)

Error	LED indicators	Description
#3: Mot. temp. warn. #19: Mot. temp. warn. OK	L4 flashes slowly	The motor temperature is in the critical range although the actuator remains fully functional.
#4: Mot. temp. trip. #20: Mot. temp. OK	L4 is off	Overtemp in motor, fault on Basis or BLDC, On Basis: loss of main power (3x400V) or cable break between CSC and motor; on BLDC: cable break between BLDC and motor.
#5: Phase sequ. error #6: Phase sequ. OK	L4 is off	Cause on Basis: Active phase sequence detection on single phase actuators, loss of main power while connected to external 24VDC auxiliary voltage, or loss of phase L2.
#7: Ready	L4 is off	Written to the history after all errors are gone.
#8: Power On	L4 is off	Is written to the history after power on the actuator, even if there are some errors.
#9: Power supply error #21: Power supply OK	L4 is off	No power supply to the power electronics (when the controller is powered from the auxiliary power input). Defect of power electronics – please contact the manufacturer.
#11: Failsafe error #12: Failsafe OK	L4 is off	Communication error between Failsafe board and Logic, loss of external 24 V Failsafe Voltage, or overtemp. on Failsafe brake.
#13: Manual override #14: Manual override off	L4 is off	Manual override on Failsafe activate (visible in status S4), cable/switch broken.
#17: Travel error #18: Travel OK	L1 and L2 lit up L4 flashes fast	The travel unit is outside the permitted range (potentiometer fault on Basis), cable broken, or multiturnsensor calibration lost on CM – please contact the manufacturer.
#22: Torque error #23: Torque OK	L3 flashes fast L4 is off	Potentiometer fault on Basis, or cable broken.
#24: Bus error #25: Bus OK	L4 flashes slowly	No communication with the optional bus system.
#26: Bus Watchdog #27: Bus Watchdog OK	L4 flashes slowly	Watchdog for bus communication has reacted.
#28: Undervoltage #29: Voltage OK	L4 is off	reserved for future use

Table 28. Errors and Indication (2)

Error	LED indicators	Description
#32: Internal Comm. L> error #33 Internal Comm. L> OK	L4 is off	Communication error between Logik and Basis/BLDC, cable broken between boards, or board defect.
#34: Internal Comm. D> error #35: Internal Comm. D> OK	L4 is off	Communication error between Display and Logik, cable broken between boards, boards defect, or firmware update on Logik not properly done.
#36: Failsafe not ready #37: Failsafe ready	L4 flahes slowly	Failsafe voltage OK and Failsafe not initialized (LUS not tensioned).
#38: Battery low #39: Battery OK	L4 is off	Battery on Display board is empty, loss of time/date or counter values possible.
#44: Inverter error Para #45 Inverter OK Para	L4 is off	BLDC parameter error.
#46: Analog Input 1 Failure #47: Analog Input 1 OK	L4 flashes slowly	SRG active, Positioner live zero detection activated, no setpoint value recognized.
#48: Analog Input 2 Failure #49: Analog Input 2 OK	L4 flashes slowly	Ext. setpoint active, Ext. setpoint live zero detection activated, no Ext. setpoint value recognized

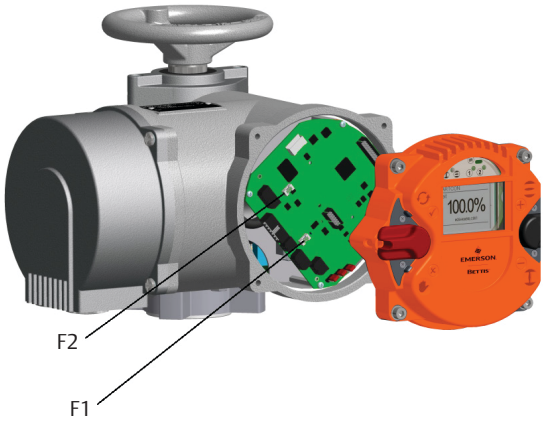
Table 29. Errors in case of special types

Error	LED indicator	Description
#30: Oil level low #31: Oil level OK	–	Binary input on Basis board or switch faulty.
#40: Oil pressure low #41: Oil pressure OK	–	Analog input (4. . . 20 mA) on Basis board faulty.
#42: Motor protection #43 Motor protection OK	–	Binary input on Basis board or switch faulty.

Section 14: Fuses

The logic board of the controller cover (see Figure 67) features two miniature fuses for the control lines.

Figure 67 Fuse Location



Display Overview:

1. Fuse FL1 fuse for auxiliary supply
2. Fuse FL2 fuse for the binary outputs

Table 30. Fuses on the Logic Board

Fuse	Value	Manufacturer	List of spare parts
FL1	1AT	Littelfuse 454 NANO2 Slo-BloQR träge	C302c
FL2	4AT	Littelfuse 454 NANO2 Slo-BloQR träge	C302d

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 15: Lubricant Recommendation and Requirements

15.1 Main Body: -25 to +60C

Operating oil: DIN 51 517-CLP-HC

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

Viscosity class:	320 ISO VG
Pourpoint:	< -39C (according DIN ISO 3016)
Lubricant requirement CM03:	200. . . 250 ml
Lubricant requirement CM06:	400. . . 450 ml

15.2 Main Body: -40 to +60C

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
Pourpoint:	< -54C (according DIN ISO 3016)
Lubricant requirement CM03:	200. . . 250 ml
Lubricant requirement CM06:	400. . . 450 ml

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

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:	to 265
Dropping point:	about 260C
NLGI No.:	1

acid-free, little or not water-reactive

15.4 Basic Lubricant Service Interval

⚠ CAUTION: CONSIDER REDUCTION FACTORS

The service interval for RTS CM Compact Series 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 have to be taken into consideration if applicable.

Table 31. Lubrication Utilization (1)

Operating Condition(s)	Definition	Reduction Factor (Multiplier)
Duty Time (DT)	(Total engine running time)	
Extremely high DT	Over 1,250 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 longterm)	
Extremely changeable	Between -10°C and +50°C	0.5
Extremely high	Over +50°C	0.7
Extremely low	Below -25°C	0.9
Output speed	(on main shaft of actuator)	
High speed	Over 80 rpm	0.8
Utilisation	(relative to rated power)	
Very high	Over 90%	0.8
High	Between 80 to 90%	0.9

Application example:
Extremely low DT + extremely low ambient temperature + high speed + 87% utilization
> 0.8 * 0.9 * 0.8 * 0.9 = 0.51 reduction factor
Lubrication maintenance interval) 10 years * 0.51 = 5.1 years (62 months).

⚠ CAUTION

This calculated maintenance interval does neither apply to the maintenance of output type A (threated 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).

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: Training

⚠ CAUTION

If you experience problems during installation or upon adjustments on site, please contact Emerson, Texas at +1 281 477 4100 or to prevent any operational errors or damage to the actuators. Emerson recommends engaging only qualified personnel for installation of RTS CM Comapct Series actuators. Upon special request of the client, Emerson can conduct training on the activities listed in this operating manual at the factory of Emerson.

Section 17: Technical Data and Certifications

17.1 Binary Outputs

Figure 68 Control Unit

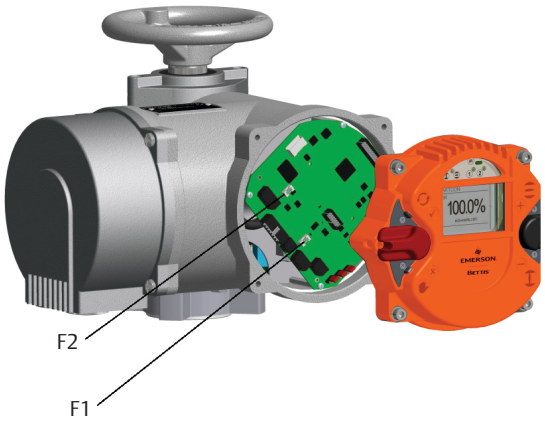


Figure 69 Logic Board

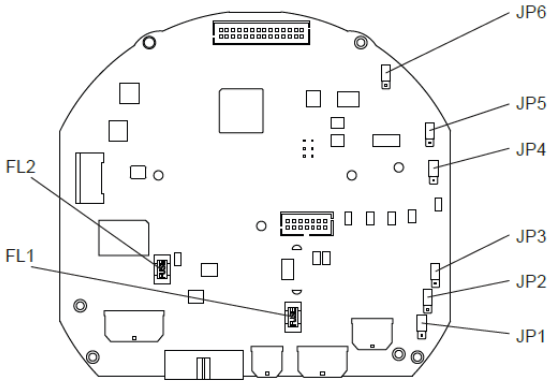


Table 32. Binary Outputs

Characteristic	Value
Count	8
Power supply	24VDC nominal range: 11. . . 35VDC (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:	500mA (short circuit proof)
Maximum permissible total current for all outputs:	4A
Fuse (Fuse FL2, see Figure 69)	4 A slow (Littelfuse 454 NANO2 Slo-Blo®)

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

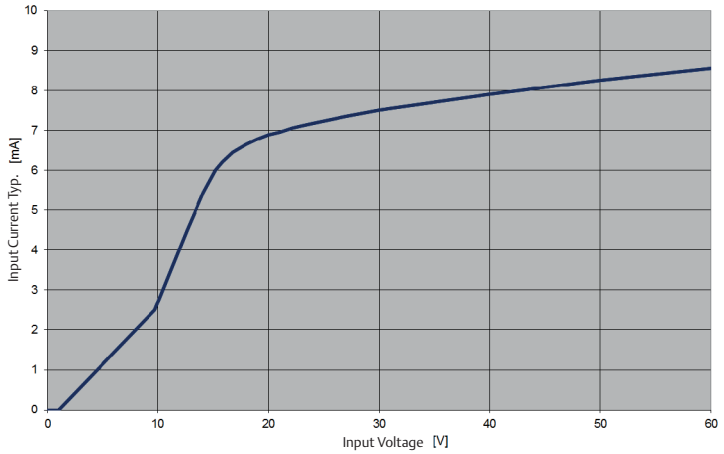
17.2 Binary Inputs

Table 33. Binary Inputs

Characteristic	Value
Count	5
Nominal voltage	24VDC towards common ground
Thresholf voltage for input set	>10 V max. (8.5V typ.)
Treshold voltage for input not set	<17 V (8.5V typ.)
Maximum voltage:	30VDC
Current consumtion at 24VDC	10.5mA typ.

Binary inputs are separated from other controllers via optocouplers.

Figure 70 Current/Voltage Relation



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

Figure 71 5 Inputs with Same Common

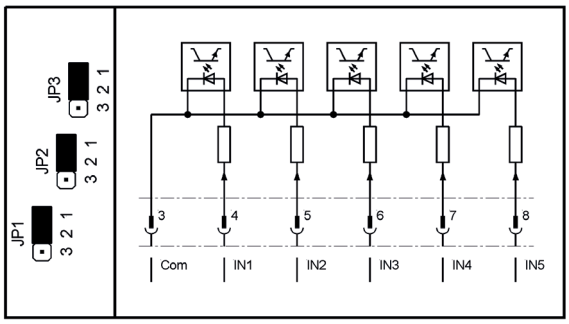


Figure 72 2 Separated Groups of 2 Inputs with Same Ground Input IN3 is Disabled.

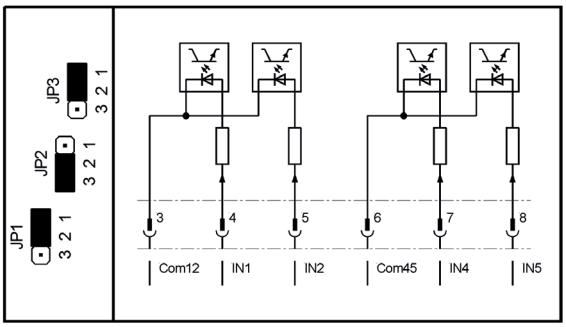


Figure 73 3 Separated Inputs; Inputs IN2 and IN4 are Disabled.

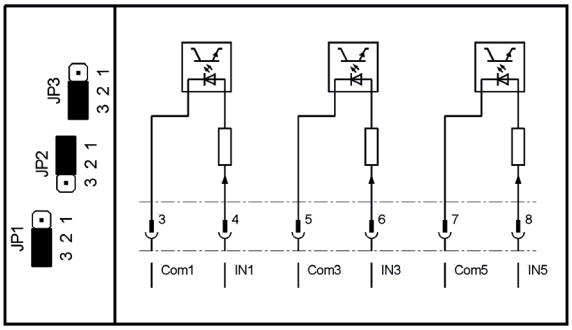


Figure 74 **3 Inputs with Same Common and 1 Separated Input. Input IN4 is Disabled.**

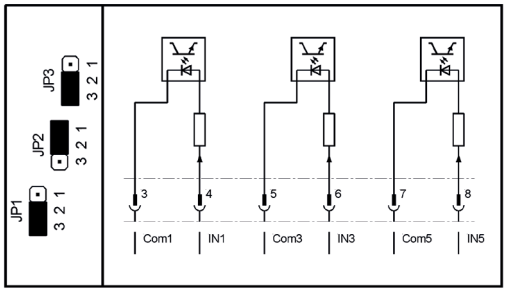


Figure 75 **1 Separated Input and 3 Inputs with Same Common. Input IN2 is Disabled.**

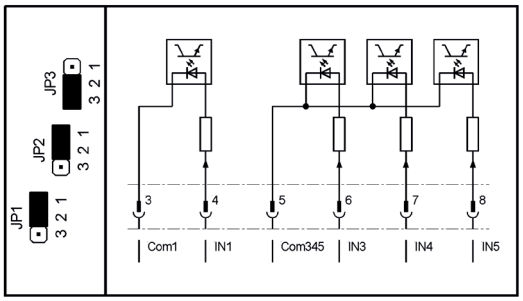


Figure 76 **5 inputs with common = "-" using external 24V**

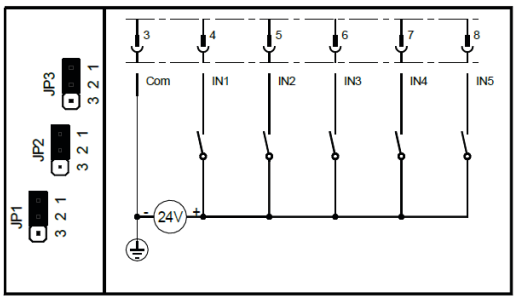


Figure 77 5 inputs with common = "-" using internal 24V (e.g. for dry contacts)

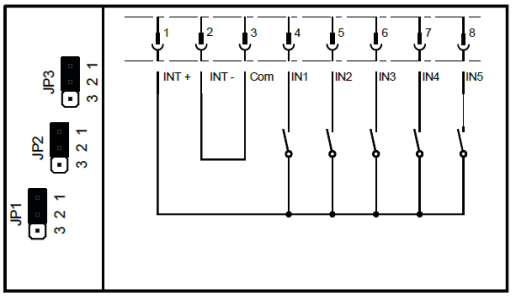


Figure 78 3 separated inputs using 3 separated external 24V

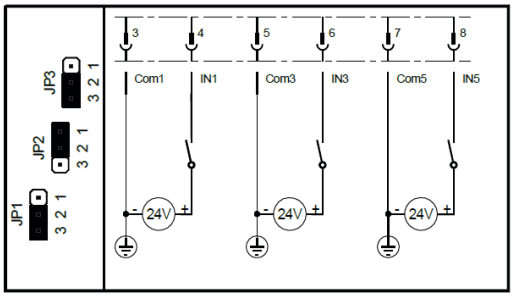
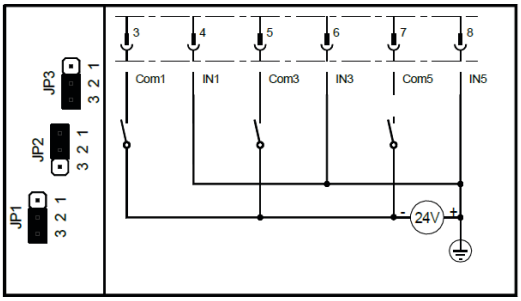


Figure 79 3 separated inputs using 3 separated external 24V



17.3 Analog Inputs

Table 34. Input 1: Setpoint Value

Characteristic	Value
Current range:	0-25mA
Resolution:	14Bit
Accuracy:	0,5%
Input resistance:	60 Ω

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

Table 35. Input 2: External Actual Value Only in Conjunction with the PID Controller

Characteristic	Value
Current range:	0-20,8mA
Resolution:	12Bit
Accuracy:	0,5%
Input resistance:	120 Ω

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

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

17.4 Analog Output

Table 36. Analog Output

Characteristic	Value
Current range:	0-20,8mA
Resolution:	12Bit
Accuracy:	0,5%
Input resistance:	600 Ω

The analog output is galvanically isolated from the rest of the electronic system.

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

Figure 80 Current Source

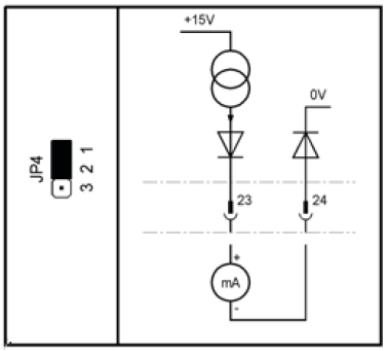
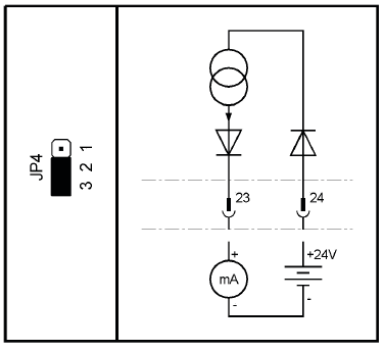


Figure 81 Current Sink



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

17.5 Auxiliary Voltage Input and Output

Table 37. Auxiliary voltage input and output

Characteristic	Value
Input voltage range (auxiliary voltage input)	20. . . 30VDC
Maximum current consumption (auxiliary voltage input)	500mA
Maximum current consumption in power-save mode (auxiliary voltage input)	120mA
Output voltage (auxiliary voltage output)	typ. 23 V
Maximum output current (auxiliary voltage output)	200mA
Resistance of common ground vs. earth	typ. 500k Ω
Resistance of common ground vs. earth (floating version)	> 10M Ω
Capacitance of common ground vs. earth	typ. 100 nF
Maximum allowed voltage of common ground vs. earth	max. 40 Vs
Fuse (Fuse F1, see Figure 67)	1 A slow (Littelfuse 454 NANO2 Slo-Blo R)

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 24V 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.

17.6 Connections

17.6.1 Connections for non explosion-proof version

Table 38. Non-explosion-proof Connections

Connection	Value
Power/motor:	Industrial plug with 6 pins Screw connection 16A, max. 2,5mm² , AWG14
Control signals	Industrial plug with 24 pins Screw connection 16A, max. 2,5mm² , AWG14

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

17.6.2 Connections for explosion-proof version

Table 39. Explosion-proof Connections

Connection	Value
Power/motor:	terminals with screw connection 16A, 0,5. . . 4mm² , AWG20. . . AWG12
Control signals	terminals with screw connection 4A, 0,5. . . 2,5mm² , AWG20. . . AWG14

17.7 Miscellaneous

Table 40. Miscellaneous

Characteristic	Value
Ambient temperature	
non explosion-proof version	-25 . . . +60°C
explosion-proof version	-20 . . . +40°C (according EN 60079-0)
ex version with extended temperature range	-40 . . . +60°C
Protection according to EN 60529:	IP67
Standard colour:	RAL7024

TYPE		FQ-03	FQ-06	FQ-10	FQ-20	FQ-30	FQ-50
Max Electric Torque	max. lbs. ft (Nm)	220 (300)	440 (600)	738 (1000)	1475 (2000)	2210 (3000)	3687 (5000)
End of Spring Remaining Fail-Safe Torque	max. lbs. ft (Nm)	110 (150)	220 (300)	369 (500)	730 (1000)	1100 (1500)	1800 (2500)
Modulating Torque Rating	max. lbs. ft (Nm)	110 (150)	220 (300)	369 (500)	730 (1000)	1100 (1500)	1800 (2500)
Fail-Safe Spring Return Direction		Selectable (CW or CCW) spring return					
Fail-Safe Trigger		Loss of 24 V DC fail-safe command signal or main power supply (selectable)					
Electric Stroke Time Range (Field Adjustable)	sec	14 - 420	14 - 420	20 - 500	30 - 850	38 - 1050	60 - 1600
Fail-Safe Spring Rate / Field Adjustable	sec	1 - 5	1 - 5	1 - 5	3 - 10	3 - 10	6 - 15
Available Travel		90 +/– 5° with mechanical end-stop					
Operation Mode	On/Off Duty	S2					
	Modulating Duty	S9					
Manual Override		Optional					
VALVE-MOUNTING							
Mounting Base	ISO 5210	F07/F10	F10/F12	F12/F14	F14/F16	F14/F16	F16/F25
Max Stem Diameter	inch (mm)	1 (25.4)	1.57 (40)	1.92 (49)	2.36 (60)	2.36 (60)	2.95 (75)
Max Square (Flats)	inch (mm)	0.86 (22)	1.25 (32)	1.61 (41)	1.88 (48)	1.88 (48)	(55)
OPERATING CONDITIONS							
Ingress Protection		IP66 (NEMA 4x) , IP67 (NEMA 6), IP68					
Ambient Temperature		- 40° C (-40°F) to +60°C (140°F)					
HOUSING							
Material		Aluminum					
Enclosure		Weather-proof / Explosion-proof (optional)					
Certification		1ph, 24VD – CSA NEC 500 / NEC505, ATEX, IECEx, LVD 3ph - ATEX		1ph, 24VD – CSA NEC 505, ATEX			
Coating		High quality two component polyurethane paint system-C3 ISO12944-5					
Weight Approx.	lb. (kg)	77 (35)	117 (53)	229 (104)	311 (141)	450 (204)	754 (342)
MOTOR - BRUSHLESS TECHNOLOGY							
Isolation Class		Insulation class F, max. 155° C (311°F) permanent temperature					
Power Supply	V	24 - 230 VDC / 115 - 230 VAC Single Phase / 380 - 480 VAC Three Phase 24 VDC (option not available with FQ-10, FQ-30, FQ-50)					
Current Consumption	A	2.5					
Power Comsumption idle with fail-safe brake energized	W	40					
ACTUATOR CONTROL							
Technology	Integrated processor control unit with frequency technology for variable speed control						
Control Unit							
Control Elements	· Pad-lockable selector switch LOCAL - OFF- REMOTE contact less sensor technology · Control switch OPEN - STOP - CLOSE contact less sensor technology · Language independent symbols						
Control Functions	· Full stroke test · Partial stroke test						
Local Display	Backlit LCD display, can be rotated in 90 degree increments						
LEDs	4 programmable red, green, blue LEDs for operation - readiness - warning - and error messages						
Communication	Infrared communication interface and Bluetooth technology including Android App for simple configuration						
Control							
Inputs	5 configurable binary (discrete) control inputs OPEN - STOP - CLOSE - EMERGENCY OPEN - EMERGENCY CLOSE · Nominal voltage 24VDC						
Status							
Outputs	· 8 configurable binary (relay) outputs: READY - OPEN - CLOSE - RUNNING OPEN - RUNNING CLOSE - TORQUE - LOCAL - REMOTE · Power supply 24 VDC +/– 6V (selectable internal or external)						
Voltage Input and Output							
Power Supply - External	· Input power range: 20-30VDC max current consumption 320mA or 100mA in current save mode · Status indication also in case of a main power supply failure						
Power Supply - By Actuator	· Output voltage: typical 22V max output current 150mA · Reference ground is the common ground of the control unit and of the analog inputs and outputs						
FUNCTIONS							
Standard	· Switch-off mode adjustable, travel or torque dependent · Torque adjustable: 25-100% of max torque · Adjustable speed for process optimization and emergency speeds. · Password protection (reading and/or writing) · Multilingual display · Status indication for binary inputs/outputs and analog signals on LCD display · Data logging for analysis and service · Motor protection by positive temperature coefficient sensors						
ELECTRICAL CONNECTION							
Cable Entry	3 metric threaded boreholes for cable grands: Weather-proof 1xM40, 1xM32, 1xM25 / Explosion-proof 1xM40 + 2xM20						
OPTIONS							
Digital Communication	Modbus RTU, ProfiBus, ProfiNet, Foundation FieldBus HART Platforms						
Relay Board	250 VAC, 2A with 4 outputs						
Analog Position Transmitter	0/4-20mA (2-wire)						
Coating	4 layer with Epoxy under coat for increased corrosion protection – C5-I, C5-M ISO12944-5						

World Area Configuration Centers (WACC) offer sales support, service, inventory and commissioning to our global customers.
Choose the WACC or sales office nearest you:

NORTH & SOUTH AMERICA

19200 Northwest Freeway
Houston TX 77065
USA
T +1 281 477 4100

Av. Hollingsworth
325 Iporanga Sorocaba
SP 18087-105
Brazil
T +55 15 3413 8888

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6777 8211

No. 1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P. R. China
T +86 22 8212 3300

MIDDLE EAST & AFRICA

P. O. Box 17033
Jebel Ali Free Zone
Dubai
T +971 4 811 8100

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650

24 Angus Crescent
Longmeadow Business Estate East
P.O. Box 6908 Greenstone
1616 Modderfontein Extension 5
South Africa
T +27 11 451 3700

EUROPE

Holland Fasor 6
Székesfehérvár 8000
Hungary
T +36 22 53 09 50

Strada Biffi 165
29017 Fiorenzuola d'Arda (PC)
Italy
T +39 0523 944 411

For complete list of sales and manufacturing sites, please visit www.emerson.com/actuationtechnologieslocations or contact us at info.actuationtechnologies@emerson.com

www.emerson.com/bettis

BETTIS™

EMERSON™