



**BERNARD®  
CONTROLS**

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## AQ SWITCH RANGE



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*Start Up Guide*

SUG\_17003 EN - Ind. E  
Art: 5100466



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Our actuator has been designed, manufactured and tested rigorously to give you maximum satisfaction.

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In accordance with its policy of continuous improvement, Bernard Controls reserves the right to modify the specifications of all products described herein without prior notice.

All measures are expressed in metric units. Converted values to other systems (notably US and UK) are given for reference only.

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## **1 DOCUMENTS**

Please keep this manual and all the documents that accompany it nearby so that you can consult them if necessary.

We decline all responsibility for damages caused by not observing the instructions of this manual.

## 2 INTENDED USE OF THE ACTUATOR

Bernard Controls actuators are manufactured in accordance with the latest technical evolutions and safety regulations.

The AQ SWITCH and AQ SWITCH POSITIONER are intended to operate a valve or a damper in moderate environmental and operational constraints.

All other uses are considered inadequate.

In no case will the manufacturer be held responsible for damages or harm caused by using the actuator for any purpose other than that for which it is designed. The user takes responsibility for all risks.

The notion of intended use also includes compliance with the instructions in this manual and all accompanying documents, as well as compliance with the installation and maintenance conditions.

## 3 SAFETY

This device complies with current applicable safety standards.

The installation, use and maintenance of this unit require a skilled and trained staff.

Please carefully read this entire document before mounting and starting-up the actuator.



Warnings and cautions in this manual cannot cover all the risks associated with the use of the actuator. In addition to the instructions given, it is important to exercise good judgment and apply basic principles of safety.



As a standard, AQ actuators are configured to close clockwise. If your actuator closes counterclockwise, please see §0.

## 4 PACKAGING, STORAGE AND MAINTENANCE

### 4.1 Packaging

AQ actuators are delivered in a cardboard box of a size equivalent to the actuator and sit in a cardboard wedge.

### 4.2 Storage

Actuators should be stored under a shelter, in a clean and dry place, and protected from wide temperature variations.



- Avoid placing the actuator directly on the floor.
- Check that the plugs on cable entries are correctly tightened.
- Check that the cover screws are correctly tightened to ensure weatherproof sealing of the cover.



The heating element must be connected to the power supply, especially if the storage place is wet (standard 230 VAC, except otherwise specified).

AQ actuators include electrical components and lubricated gears.

Even with a weatherproof enclosure, oxidation, seizing and other alterations may occur if actuators are not correctly stored.

#### What to check after storage

1. Visually check the electrical equipment.
2. Manually operate the micro-switches, buttons, selectors, etc., to ensure their proper mechanical functioning.
3. Manually operate the actuator.

### 4.3 Maintenance

This actuator features lifetime lubrication. If the device is correctly mounted and sealed, no specific maintenance is required.

Test the motor operation once a year and make sure that the electrical compartment is free from condensation.

This actuator includes an anticondensation heater to avoid condensation build-up when operating in a wet atmosphere.

## 5 HANDWHEEL OPERATION

AQ actuators feature a handwheel for safety operation.

To avoid potentially harmful rotating protruding parts during electrical operation, AQ handwheels feature a foldable handle: you can fold it during electrical operation and unfold it if you need to operate the actuator manually.

## 6 ASSEMBLY ON THE VALVE OR DAMPER

The actuator should be directly attached to the valve using proper bolts or via a proper interface.

If the valve is in the closed position, then the actuator should also be installed in the closed position. If the valve is open, so should be the actuator.



If you cannot reach the correct position because you are blocked by a mechanical stop, loosen the mechanical stop so that you have enough space to go to the correct position.

After assembly on the valve or on the damper, the actuator can operate in any position.



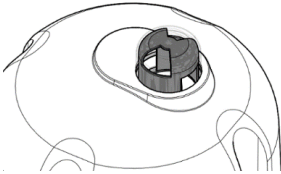
However:

- do not lift the actuator by the handwheel to avoid damage on internal gearing.
- cable glands must not be oriented upwards (loss of water tightness).

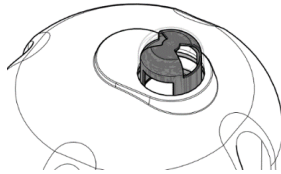


## 6.1 Changing closing direction visual indication

As a standard, AQ actuators are configured to close clockwise. If the actuator must close counterclockwise, you can change the orientation of the position indicator cap.



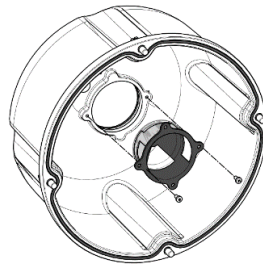
**Standard indicator orientation**  
for clockwise closing



**Reverse indicator orientation**  
for counterclockwise closing

### How to change cap orientation

1. Disassemble the cover then the cap.
2. Turn the cap 90°.
3. Reassemble the cap then the cover.

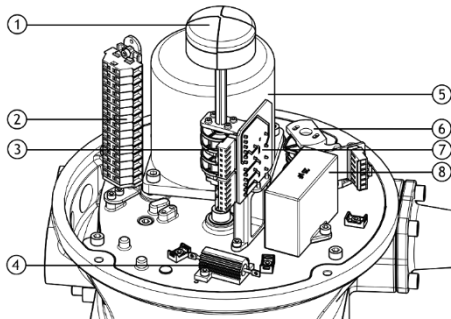




## 7 ELECTRICAL COMMISSIONING

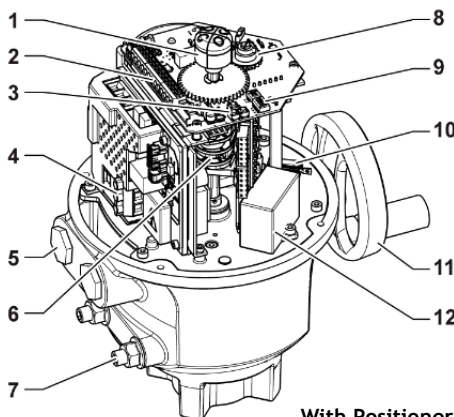
### 7.1 Electrical configurations

During the commissioning, the actuator will correspond to one of the two following configurations:



Without Positioner

- 8 - Capacitor
- 7 - Switches board
- 6 - Torque limiter (except on AQ5/10/15)
- 5 - Motor
- 4 - Heating resistance
- 3 - Cams
- 2 - Terminal block
- 1 - Position indicator



With Positioner

- 12 - Capacitor (Except 24 VDC option)
- 11 - Handwheel
- 10 - Heating resistance
- 9 - Micro-switches
- 8 - Potentiometer
- 7 - Mechanical stop
- 6 - Cams
- 5 - Plug (cable gland)
- 4 - Power terminal block
- 3 - Push buttons
- 2 - Command and signaling terminal block
- 1 - Position indicator

The actuator and its components are wired to internal terminal blocks.

## 7.2 Before wiring



- The electrical connection of the actuator must be carried out by a qualified professional. All interventions inside the actuator must be carried out by a qualified professional.
- In case of incorrect installation, there is a risk of electric shock and damage to the device.

Before the electrical commissioning, you need to:

- **open the cover**
- **install cable glands**
- **wire the actuator**

### How to open the cover

1. With a 10 mm angled socket wrench, unscrew the 4 cover screws. Do not remove them from the cover.
2. Remove the cover by pulling it out along its axis.

### How to install cable glands



- Cable gland size depends on what you ordered (M20 or ¾" NPT cable entries).
- Unused entries must be kept closed by their plug.

*For each cable entry used:*

1. Remove the plugs.
2. Separate the sealing nut from its cable gland.
3. Thread the sealing nut on the cable and pass the cable through the cable gland.
4. Screw and tighten the cable gland in the cable entry.

## 7.3 Wiring

### 7.3.1 Wiring without positioner option

#### How to wire actuator

The wiring must be done according to the wiring diagram that matches the characteristics of your actuator.



Both thermal protector and torque limit switches must be integrated into your control system to prevent potential damage to the actuator or valve.

1. Using a 3×0.5 mm flat blade screwdriver, connect the power supply on the terminals as indicated in the wiring diagram.
2. Crimp a ring cable lug on the ground cable.
3. Remove the screw using a 4 mm hex key.
4. Install a washer between the head of the screw and the ring cable lug.
5. Tighten the screw.
6. Tighten the sealing nut on the cable gland when you have completed the wiring.

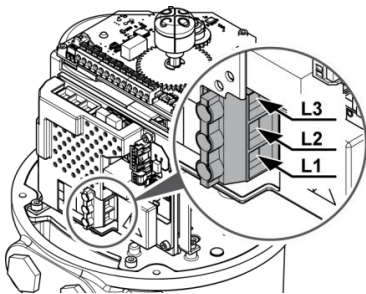


### 7.3.2 Wiring with positioner option

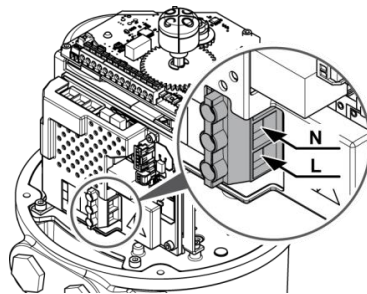
#### Power terminal block

The power terminal block is located on a side of the electronic assembly and consists of a screw-type terminal.

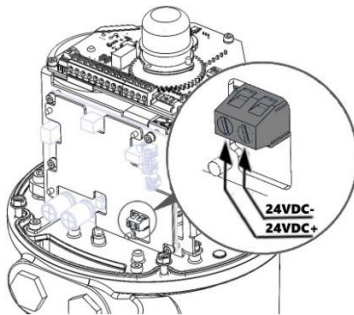
For three-phase supply, the positioner provides automatic phase correction, thus phase sequence is not important. If one of the phases is missing, the actuator does not start and sends an alarm (Fault relay).



3Ph: L1, L2, L3



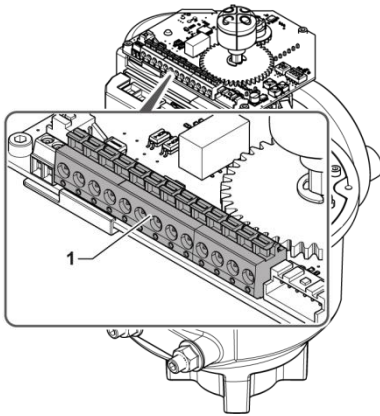
1Ph: L (Live), N (Neutral)



Direct Current 24VDC

Tighten the sealing nut on the cable gland when you have completed wiring.

## Control and signaling terminal block



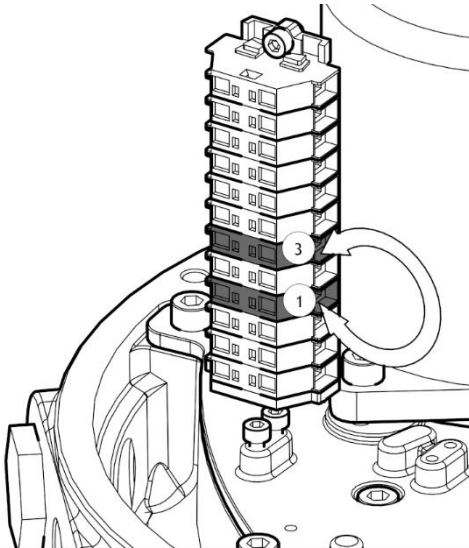
The control and signaling terminal block (1) is located on the top of the electronic assembly.

1. Connect the control and signaling wires (marked 1 to 13) on the upper terminals.
2. Tighten the sealing nut on the cable gland when you have completed wiring.



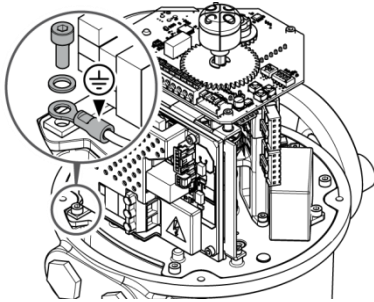
### 7.3.3 Wiring for pre wired actuators

1. Using a 3×0.5 mm flat blade screwdriver, connect the customer power supply on the terminals as indicated in the wiring diagram.
2. If the actuator closes counterclockwise, swap on the actuator side of the terminal block the cables 1 and 3.





### 7.3.4 Internal ground terminal



The ground terminal is a metal tab with a threaded hole located under the terminal board at its bottom.

### How to wire actuator with Positioner

The wiring must be done according to the wiring diagram of your actuator.

1. Using a 3×0.5 mm flat blade screwdriver, connect the power supply on terminals marked L1, L2 & L3 (3Ph) or L, N (1Ph) or 24VDC+, 24VVDC- (DC) according to your supply type.
2. Crimp a ring cable lug on the ground cable.
3. Remove the screw using a 4 mm hex key.
4. Install a washer between the head of the screw and the ring cable lug.
5. Tighten the screw.
6. Tighten the sealing nut on the cable gland when you have completed wiring.
7. To close actuator counterclockwise, set the switch **D** on position **ON**.



## 7.4 After wiring

### What to check after wiring

Once the wiring of the actuator is completed, please check the following:

1. Make sure that the power supply voltage matches the information on the sticker located on the side of the actuator.
2. Check that all connectors or cable glands are correctly tightened.
3. If positioning board is present, check that the switch **D** is positioned on:
  - **ON** for counterclockwise closing,
  - **OFF** for clockwise closing.
4. Manually drive the valve to a mid-travel position.
5. Electrically operate in the closing direction (usually clockwise) rotation and check that the motor rotates in the right direction.
6. Using a screwdriver, press the lever on the closed limit switch and make sure that the motor stops.
7. Repeat steps 4 and 5 for the opening direction (usually counterclockwise).



If any fault is detected at this stage, please check that your wiring is correct.

## 7.5 Heating element

Each actuator includes a heating resistor.

As soon as the actuator is installed in the field, it is recommended to power the resistor to prevent condensation.



Immediately put the cover back in place after start-up while ensuring its seal is clean. Never leave the actuator electrical components without their protection cover.

In case of water intrusion:

- Dry electrical components before putting the cover back on.
- Check the electrical insulation.



## 8 TRAVEL LIMITS SETTINGS

The actuator is factory-set for a 90° travel.

It features 2 devices to limit the travel:

- Cams trigger switches to switch off power at an end position or to signal a position. They are factory pre-set, but you can re-adjust them during commissioning if necessary.
- Mechanical stops mechanically limit rotation to protect the valve in case of over-travel.

### 8.1 Cams settings corresponding to end position switches

The actuator stops on the open and closed positions when the corresponding end position switch is tripped.



The 2 blue labels, **ACL** and **CL**, and the 2 white labels, **AOL** and **OL**, are valid and accurate for standard clockwise closing only.



You must never electrically stop the actuator on mechanical stops.

1. Turn the setting screw of the blue cam corresponding to the clockwise travel limit switch (1 in **Figure 1**) with a screwdriver (see **Figure 2**).

The cam disk is then turning.

2. Set the cam disk until you hear a click from the switch. It indicates that the switch has been triggered.



Make sure that the cam operates the lever in the right direction (as shown by the arrow in **Figure 2**), otherwise the switch could be damaged.

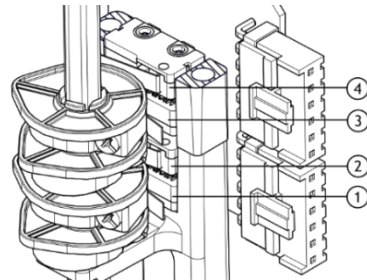


Figure 1 Switches

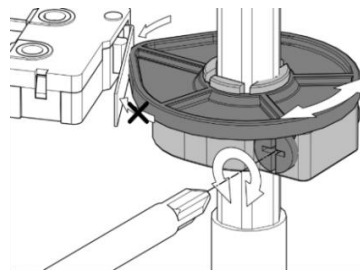


Figure 2 Setting a cam



3. Perform a short electrical counterclockwise operation, then go clockwise and stop on the switch.
4. Check that the valve position is correct. If it is not, return to step 1.



If you cannot reach the correct closed position because you are blocked by the mechanical stop, loosen the mechanical stop so that you have enough space to go to the correct closed position, then return to step 1.

5. Turn the setting screw of the gray cam corresponding to the counterclockwise travel limit switch (**2 in Figure 1**) with a screwdriver.  
The cam disk is then turning.
6. Set the cam disk until you hear a click from the switch. It indicates that the switch has been triggered.

Perform complete electrical valve opening and closing operations to check that everything is correct. If it is not the case, return to step 1.

It is mandatory that the motor stops on the travel limit switch and not on the mechanical stop (check available extra travel to the stop with the handwheel).



## 8.2 Mechanical stops settings

### 8.2.1 for clockwise closing

1. Loosen the nut corresponding to the clockwise mechanical stop (2 in **Figure 3**).
2. Turn back the mechanical stop 1.5 turns.
3. Drive the actuator to the clockwise travel limit position.
4. Get the mechanical stop in contact with the output sleeve then move it back 1.5 turns.
5. Tighten the nut to keep the mechanical stop in position.
6. Loosen the nut corresponding to the counterclockwise mechanical stop (1 in **Figure 3**).
7. Perform steps 2 to 5 for the counterclockwise direction.

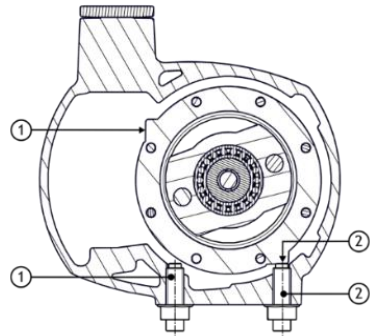


Figure 3 Mechanical stops

### 8.2.2 for counterclockwise closing

1. Loosen the nut corresponding to the counterclockwise mechanical stop (2 in **Figure 3**).
2. Turn back the mechanical stop 1.5 turns.
3. Drive the actuator to the counterclockwise travel limit position.
4. Get the mechanical stop in contact with the output sleeve then move it back 1.5 turns.
5. Tighten the nut to keep the mechanical stop in position.
6. Loosen the nut corresponding to the clockwise mechanical stop (1 in **Figure 3**).
7. Perform steps 2 to 5 for the clockwise direction.



### 8.3 Cams settings corresponding to signaling switches (if wired)

1. Slightly drive the output in the clockwise direction using the manual override.
2. Set the blue cam corresponding to the clockwise signaling switch (3 in **Figure 1**).
3. Slightly drive the output in the counterclockwise direction using the manual override.
4. Set the Gray cam corresponding to the counterclockwise signaling switch (4 in **Figure 1**).

### 8.4 Positioner settings (OPTION)

1. With a voltmeter, check that the voltage at test points 2-3 of the potentiometer is equal to 0.6 V



The voltage must never go below 0.6 V. If it does, adjust the potentiometer by turning its shaft using a flat blade screwdriver so that the voltage reaches 0.6 V.

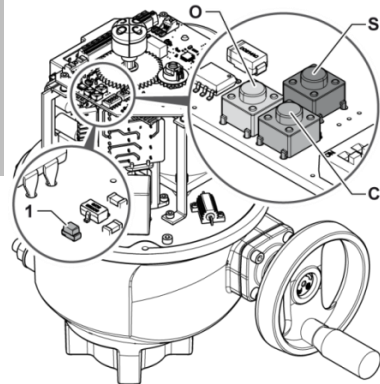


Figure 4 Local commands

2. Press the **S** local setup command (see **Figure 4**) for 5 seconds to enter the stroke calibration mode.  
The LED (1) starts blinking.
3. Press the **O** local open command until the required open position is reached.
4. Once the opening switch is tripped, press the **S** local setup command to validate the position.
5. Press on the **C** local close command until the device closes completely.
6. Once the closing switch is tripped, press the **S** local setup command to validate the position.

The device performs an AUTOSET to self-calibrate the deadband.

The device is now set. The LED stops blinking and stays ON.

If the LED continues to blink after the AUTOSET process, it is indicating one or several of the following errors:

|                        | 2                                                                                                                | 3                                                                                                                                                        | 4                                                                                                                                                                       | 5                                                                 |
|------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Times blinking (blips) | <ul style="list-style-type: none"> <li>Memory error <i>and/or</i></li> <li>Potentiometer out of range</li> </ul> | <ul style="list-style-type: none"> <li>Loss of input signal (not valid for 0-10V) <i>and/or</i></li> <li>Loss of phase (for 3Ph power supply)</li> </ul> | <ul style="list-style-type: none"> <li>Blocking/jamming detected <i>and/or</i></li> <li>Incoherence between potentiometer measure and end-of-travel position</li> </ul> | Other (position out of range, pumping error, thermal fault, etc.) |

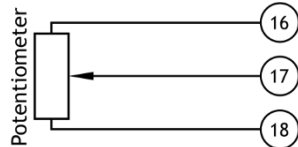
## 9 SETTINGS OF POSITION OPTIONS

### 9.1 Position feedback potentiometer (OPTION)

The potentiometer used for the actuator position feedback is driven by the travel cam block system.

For clockwise closing:

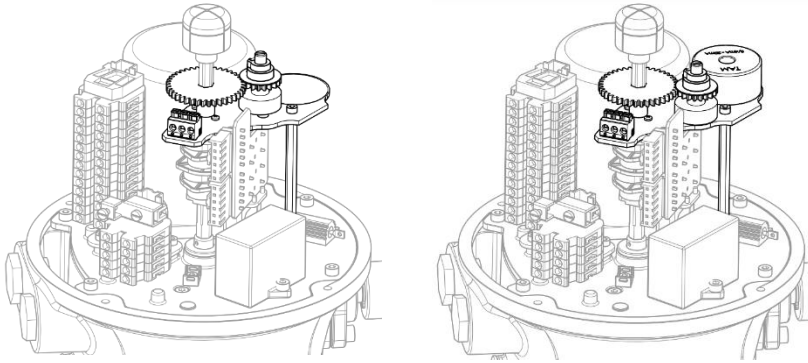
- 0% position indicates a closed valve.
- 100% position indicates an open valve.



The resistance value is measured between terminals 16 and 17.

#### How to set the potentiometer circuit board

1. Drive the actuator to the **CLOSED** position.
2. Loosen the positioner pinion blocking screw with a hex key.
3. Adjust the potentiometer by turning its shaft using a flat blade screwdriver so that the resistance value exceeds 0 Ohm and regularly increases, then turn backwards to reach the closest value to 0 Ohm.
4. Tighten back the positioner pinion blocking screw.
5. Drive the actuator to the **OPEN** position (usually counterclockwise).
6. Write down the resistance value corresponding to the 100% position.
7. Come back to the **CLOSED** position (usually clockwise).
8. Check that the resistance shows a repeatable near zero value for the 0% position.



*Position feedback potentiometer (Left) & TAM position transmitter (Right)*

### Signal inversion

To change the signal variation direction, invert the potentiometer wires on the terminal block (e.g. for a connection on 16/17/18, invert 16 and 18).

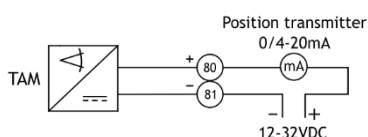


## 9.2 TAM position transmitter (OPTION)

The TAM transmitter delivers a 4 to 20 mA signal that is linearly proportional to the angular position of the valve.

### Electrical connections

A filtered or stabilized power supply should be provided within the 12 to 32 VDC range. Maximum admissible resistance values are given in the following table:



| DC supply (volts) | Max. admissible resistance (ohms) |
|-------------------|-----------------------------------|
| 12                | 150                               |
| 24                | 750                               |
| 32                | 1050                              |

### Signal direction inversion

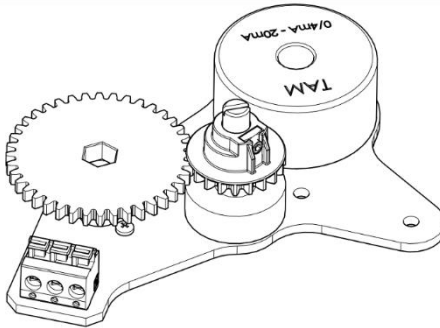
The TAM transmitter, when supplied with a clockwise closing actuator, provides a signal that rises from closed position to open position.

If an opposite signal variation is required, simply move 2 jumpers on the board near the potentiometer:

- direct signal: jumpers on 1-3 and 2-4
- reversed signal: jumpers on 1-2 and 3-4

### How to set TAM

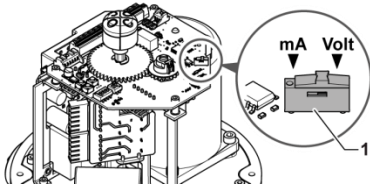
1. Connect a milli-amp meter on the terminal block and bring power (24 VDC).
2. Always start by adjusting the 4 mA.
3. Drive the actuator to the position corresponding to 4 mA (CLOSED position).
4. Loosen the potentiometer pinion blocking screw with a hex key.



5. Adjust the potentiometer by turning its shaft with a flat blade screwdriver so that the output current reaches a minimum value.
6. Turn backwards until the current value regularly increases, then turn backwards again and stop as soon as the minimum value determined above is reached.
7. Tighten back the potentiometer pinion blocking screw.  
The potentiometer is then positioned at the very beginning of its track.
8. Use the TAM adjustment screw marked **0/4 mA** to adjust the current to a value as close to 4 mA as possible.
9. Drive the actuator to the position corresponding to 20 mA (open position).
10. Turn the screw marked **20 mA** so that it reads exactly 20 mA on the milli-amp meter.
11. Come back to the closed position.
12. Check that, for the 0% position, the signal current shows a repeatable value that is close to 4 mA.

## 9.3 Positioner board setting (OPTION)

### 9.3.1 Input signal

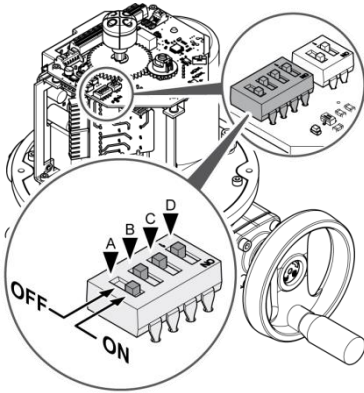


The valve can be controlled in 2 different ways:

- 0-10V/0-20mA signal
- 4-20 mA signal

Depending on the type of signal chosen, set the selector (1) to the Volt (0-10V signal) or mA (4-20mA signal) position.

### 9.3.2 Dip switches position



There are 4 dip switches to set the following:

- Closing type (AQ25/30/50 only)
- Fail position and input signal
- Direction of rotation

➔ Set the dip switches according to your installation.

#### Closing type

| Switch A | Actions           |
|----------|-------------------|
| ON       | Close on torque   |
| OFF      | Close on position |

## Fail position and input signal

| Switch B | Switch C | Signal type      | Fail position |
|----------|----------|------------------|---------------|
| ON       | ON       | 0-20 mA / 0-10 V | Fail last     |
| ON       | OFF      | 4-20 mA          | Fail open     |
| OFF      | ON       | 4-20 mA          | Fail closed   |
| OFF      | OFF      | 4- 20 mA         | Fail last     |

## Direction of rotation

| Switch D | Actions                        |
|----------|--------------------------------|
| ON       | Closing counterclockwise (CCW) |
| OFF      | Closing clockwise (CW)         |



You must power off and power on the actuator for the changes to take effect.

### 9.3.3 Position feedback

The actuator includes a positioning feedback function.

When the selector is set on mA the actuator transmits the position feedback with 4-20mA signal.

When the selector is set on Volt, the actuator transmits the position feedback with 0-20mA signal. It is required to add a 500 Ohms resistor to get a 0-10V signal.



## 10 TORQUE LIMITING DEVICE (EXCEPT ON AQ5/10/15)



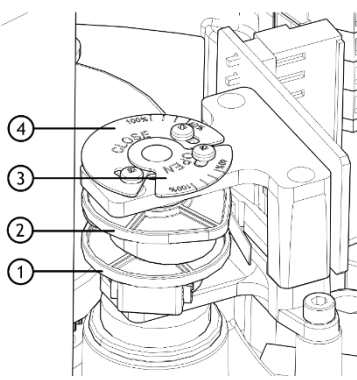
If the actuator stops on a position which is not the one required, please check that the actuator did not reach a mechanical stop or that the valve has no stiff point.

Actuators are set and tested in our factory according to the torque stated on the order. If no torque is specified, the actuator is supplied with the limiter set to the maximum output torque (100%).

In both cases, you can adjust the torque limiter if necessary.

### 10.1 Torque limiter operation

The actuator is protected by a torque limiting device in case of over-torque.



- 4 - Closing direction torque scale
- 3 - Opening direction torque scale
- 2 - Counterclockwise direction cam
- 1 - Clockwise direction cam

The torque limiter is triggered when cams (1) or (2) trigger their corresponding switches when rotating.

The torque limiter is fitted with 2 scale disks (3) and (4) to adjust the torque limit for both directions. They have torque graduations from 40 to 100% of the maximum torque deliverable by the actuator.



The torque limiter provides a maintained contact.

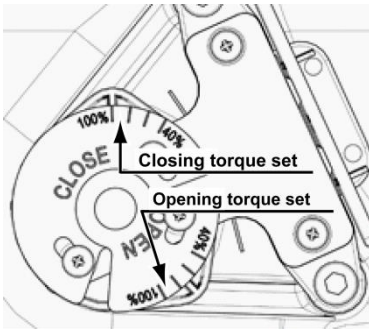


## 10.2 Torque limiter adjustment



The torque scale disk is factory-set and is a reference for cams setting. Do not modify its position or you will not be able to set the torque limiter accurately.

- ➔ To adjust torque limits, set the tips of the cams to match the required percentage of maximum torque.



1. For the closing torque limit, set the tip of cam (1) on the required percentage on the CLOSE scale.
2. For the opening torque limit, set the tip of cam (2) on the required percentage on the OPEN scale.



On the above figure, the closing torque limit is 100% and the opening torque limit is 70%.



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