EL-O-MATIC GmbH, Siemensring 112, 47877 Willich
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D2-Control

General description

EL-O-MATIC F-series actuator with D2-control
(sample picture for a selected type of control)

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1. Purpose and function:

We have designed the D2-control to equip pneumatic rotary actuators with

- **end position damping**,
- **start-up damping or**
- **full damping of the entire rotation angle with the greatest possible reduction in dead time*** (only for single-acting actuators).

****Dead time** is the period of time in which the rotary actuator is already being supplied with control air or vented, but the swivel movement has not yet started.*

With **end position damping**, the rotation of the actuator stem initially starts at an unrestricted speed until the damping angle is reached. The actuator stem then rotates through the damping angle at a reduced speed until the end position is reached.
The size of the damping angle and the speed at which it is swung through are adjustable.

A classic application for end position damping is to avoid Joukovsky shocks, also commonly known as water hammer. For this, the valve of a liquid-carrying pipe must close the last approx. 10-20° at a greatly reduced speed.

With **start-up damping**, the rotation of the actuator stem starts within the damping angle at a reduced speed - while minimizing the dead time as much as possible.
After leaving the damping angle, the actuator stem then rotates at an unrestricted speed until it reaches the end position.
The size of the damping angle and the speed at which it is swung through are adjustable. The dead time is minimized.

Start-up damping is used, for example, in pipes that are under very high pressure, where a valve that initially opens slowly ensures gentle pressure equalization.

With **full damping**, the speed of a single acting actuator is reduced over the entire rotation angle of the actuator stem. The speed is adjustable. The basic functionality of this application can also be achieved with a simple throttle, but the D2 control offers the advantage of minimizing the dead time. This becomes even more important the lower the swivel speed is to be and the larger the air volume of the actuator.

2. Features of the D2-control:

- Our D2-control works **pneumatically/mechanically** with a high degree of adjustment accuracy of the damping angle.
- The **damping angle** is infinitely adjustable across the entire rotation angle of the actuator.
- The **speed** at which the damping angle is swung through is also continuously adjustable.
- The **dead time** is minimized for all applications.

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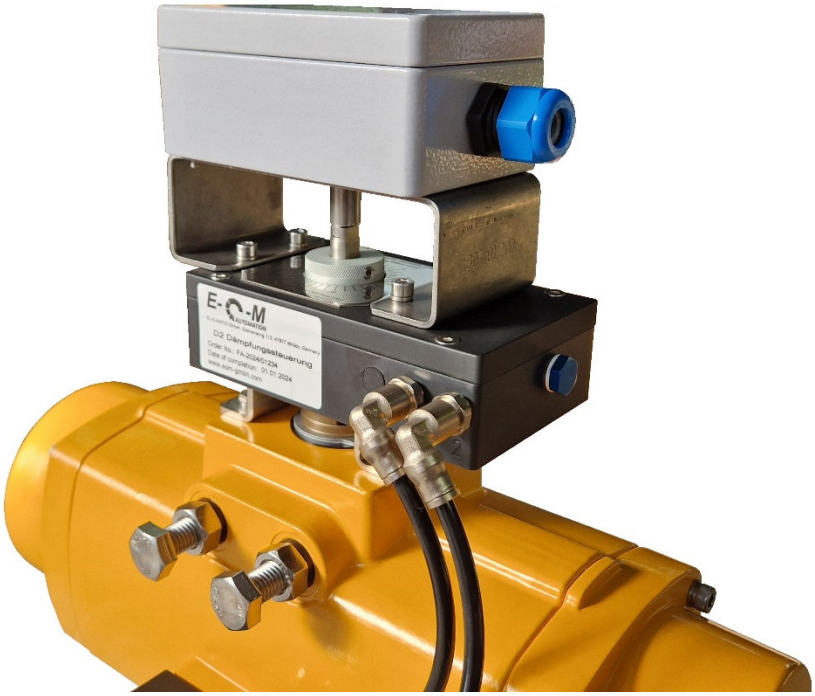
- The D2-control is designed with **spring chamber ventilation** (single-acting actuators) so that atmospheric air is kept away from the actuator and control.
- All 3/2-way NAMUR versions with spring chamber ventilation for single-acting actuators or all 5/2-way NAMUR versions for double-acting actuators can be used as **solenoid valves**.
- The D2-controll is equipped with a **VDI/VDE(3845)** interface for setting up, for example, a position feedback device.
- The 3 types of damping of the D2-control can be applied to **both rotation directions** (clockwise or counterclockwise).
- With single-acting actuators, a function **in or against the safety position** (end position of the rotation direction in the event of air failure) is possible.

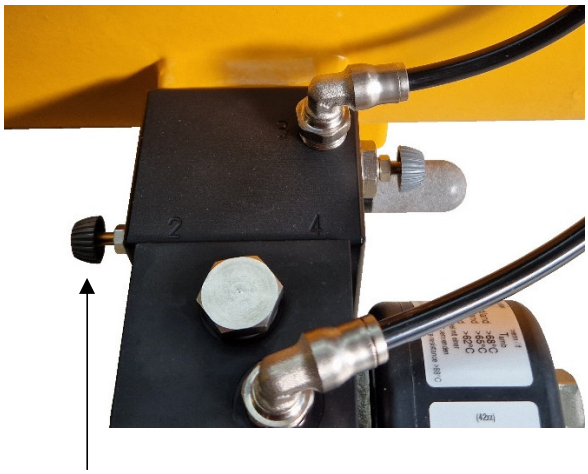


VDI/VDE(3845) interface with assembled position feedback device

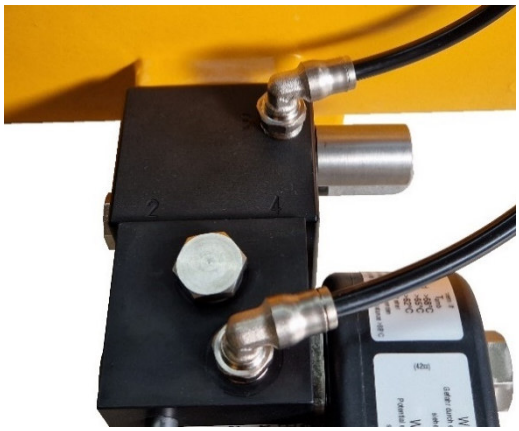
Suitable actuators:
Our D2-control can be used for double and single acting actuators up to a rotation angle of 180°. The actuators must have a NAMUR interface for the air connection and a VDI/VDE(3845) interface for accessory mounting on the upper stem end.

3. Options:

The specific characteristics of the D2-control acts in one rotation direction.
As an option, it is possible to reduce the speed of the opposite direction over the entire rotation angle with an additional throttle valve.
The throttle valves can be fitted with caps that prevent accidental adjustment.



Optional throttle valve for opposite rotation direction



Optional cap for the throttle valve

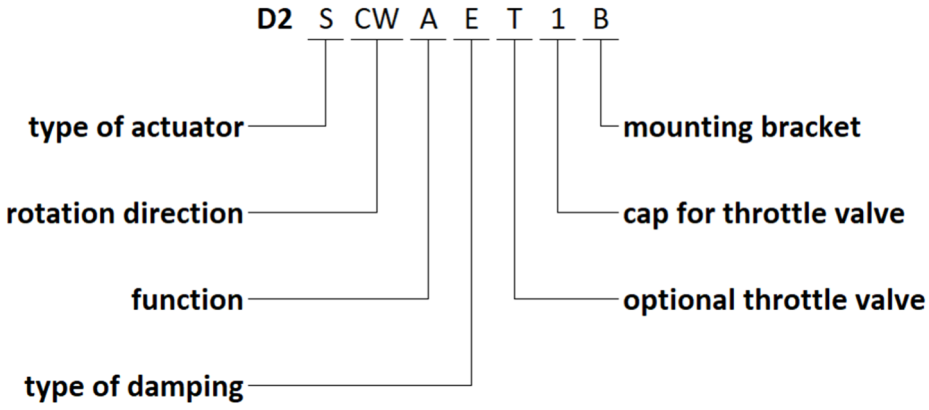
4. Technical Data:

- Ambient temperature: -10°C up to +60°C
- Air supply pressure: 2 up to 8 bar (g)
- flow: 350 l/min at 6 bar (g)
- pneumatic connection: according to the selected solenoid valve
- Control: 3/2-way solenoid valve according to NAMUR with spring chamber ventilation for single-acting actuators
  5/2-way solenoid valve according NAMUR for Double acting actuators
- Material (body): Aluminum alloy, black anodized
- Material (stem): stainless steel
- Material (mounting bracket): stainless steel
- Operating media: filtered, oil-free or oiled compressed air
- Installation orientation: any

5. Configuring the D2-control:

Since our D2control can be used for different actuators, applications and functionalities, we have created a product configuration code that helps to uniquely identify the control required by your process.

Product configuration code:



type of actuator:
S single acting
D double acting

rotation direction:
CW clock-wise / spring closing
CC counter-clock-wise / spring opening

function:
A into fail safe position (single acting actuator)
A venting chamber A (double acting actuator)
B against fail safe position (singel acting actuator)
B venting chamber B (double acting actuator)

type of damping:
E end position, full damping
S start-up damping

optional throttle valve:
0 without (standard)
T with

cap for throttle valve:
0 without (standard)
1 1 piece
2 2 pieces (when optional throttle vavle is selected)

mounting bracket:
B bracket 130x30x30mm (actuator size F600-F4000)
S bracket 80x30x20mm (actuator size F25-F350)
N without

We will be happy to send you data sheets with details on individual configurations upon request.

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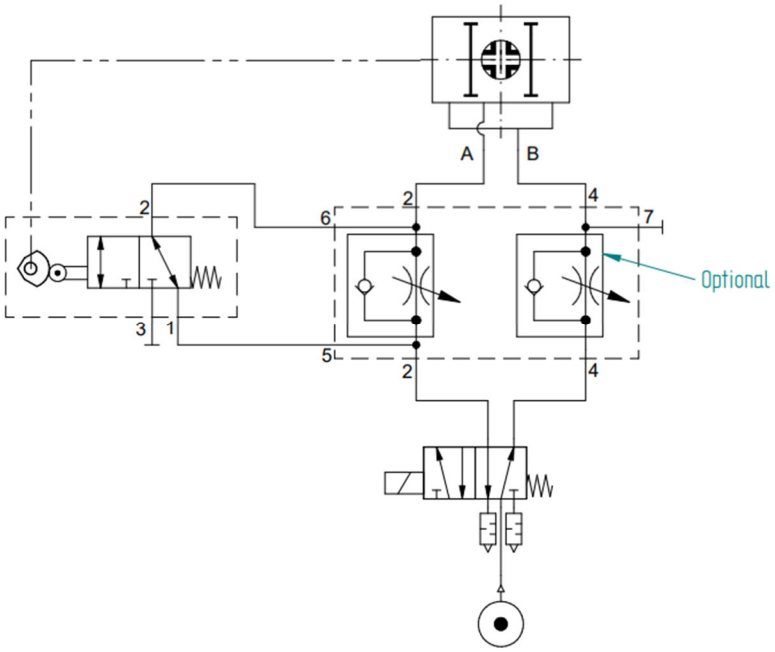
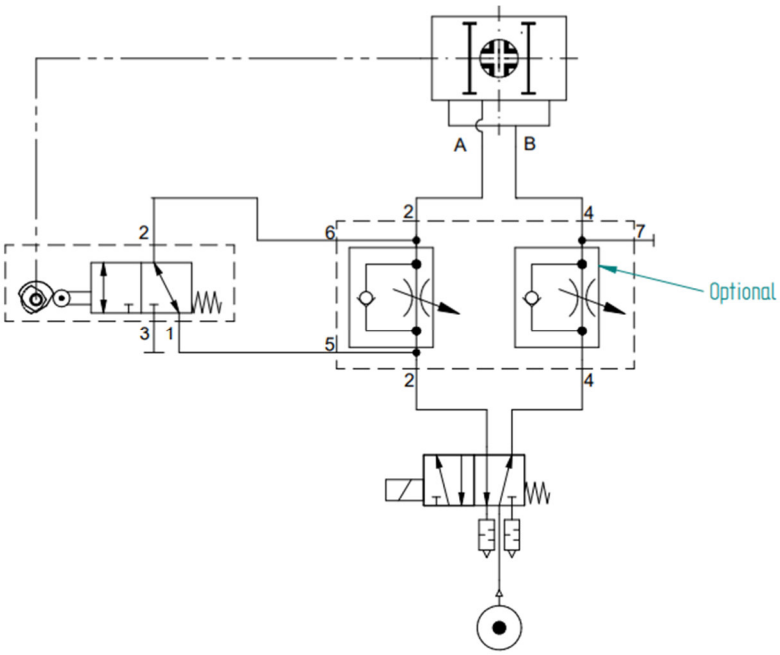
6. Pneumatic scheme of specific configurations :



End position damping for double acting actuators

D2DxxAET0Nxxxx

Function: when venting chamber „A“ of the actuator



Start-up damping, with limited dead-time for double acting actuators

D2DxxAST0Nxxxx

Function: when venting chamber „A“ of the actuator

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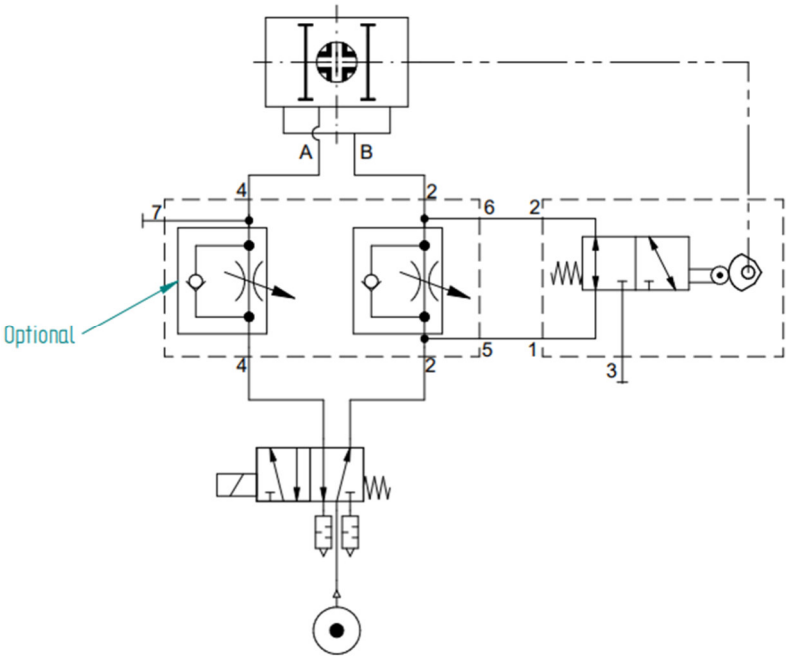
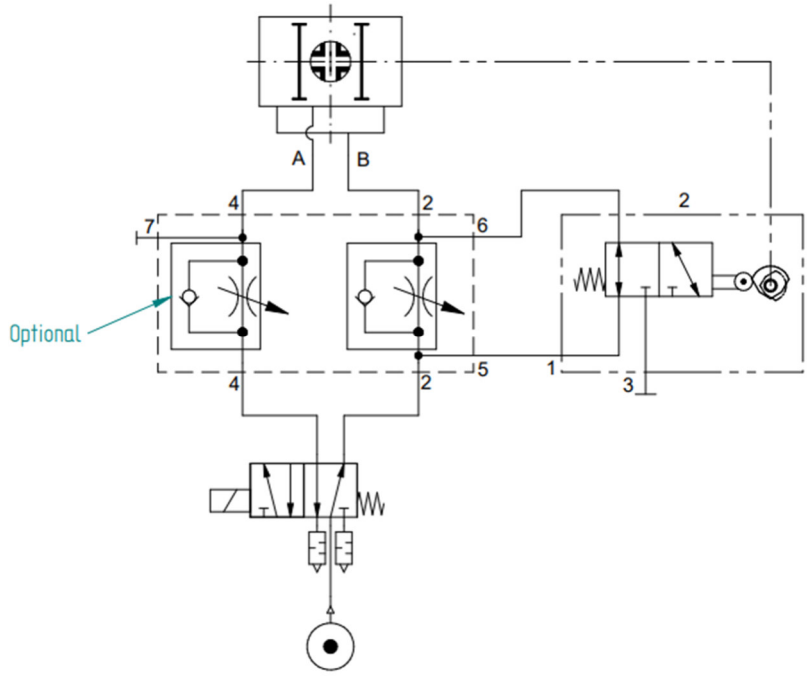


End position damping for double acting actuators

D2DxxBET0Nxxxx

Function: when venting chamber „B“ of the actuator

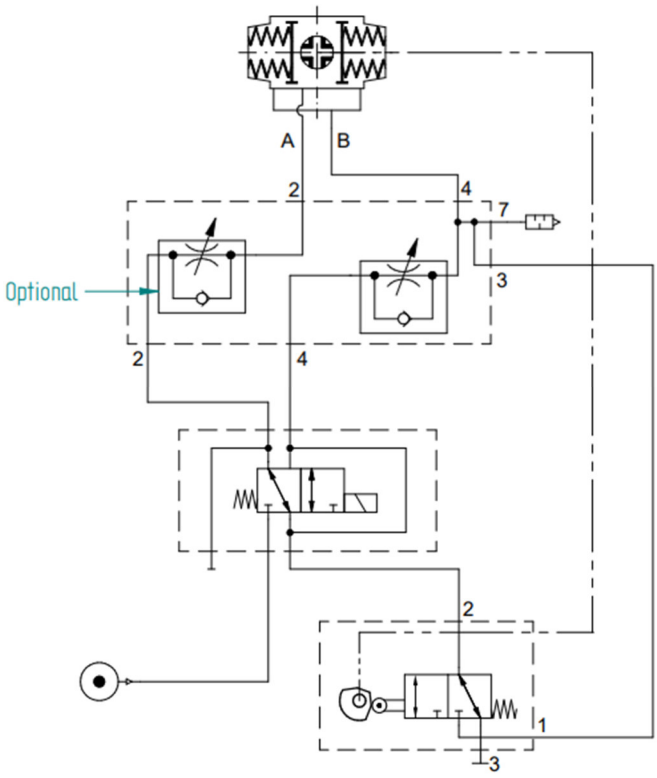


Start-up damping, with limited dead-time for double acting actuators

D2DxxBST0Nxxxx

Function: when venting chamber „B“ of the actuator

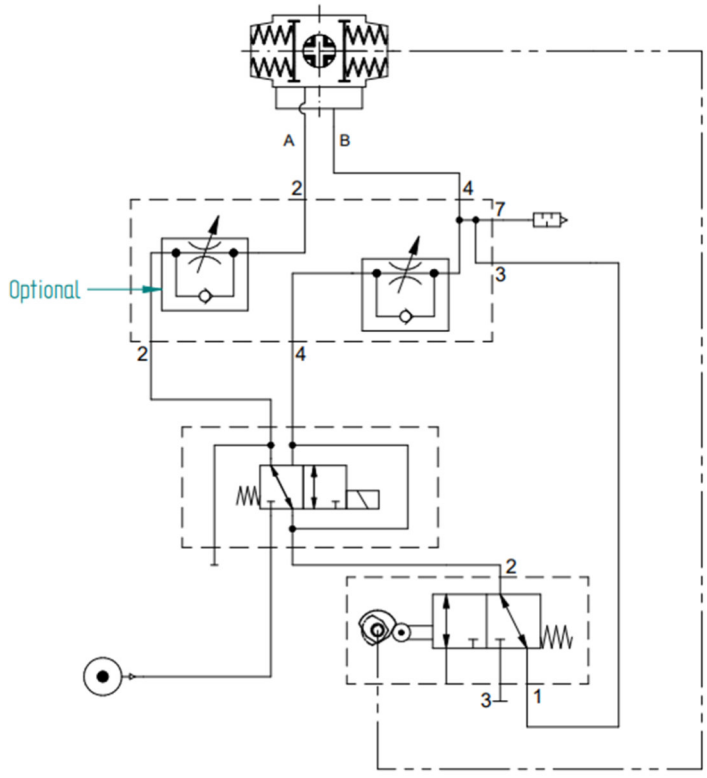
Product information / IOM D2-Control



End position damping for single acting actuators

D2SxxAET0Nxxxx

Function: in fail safe position

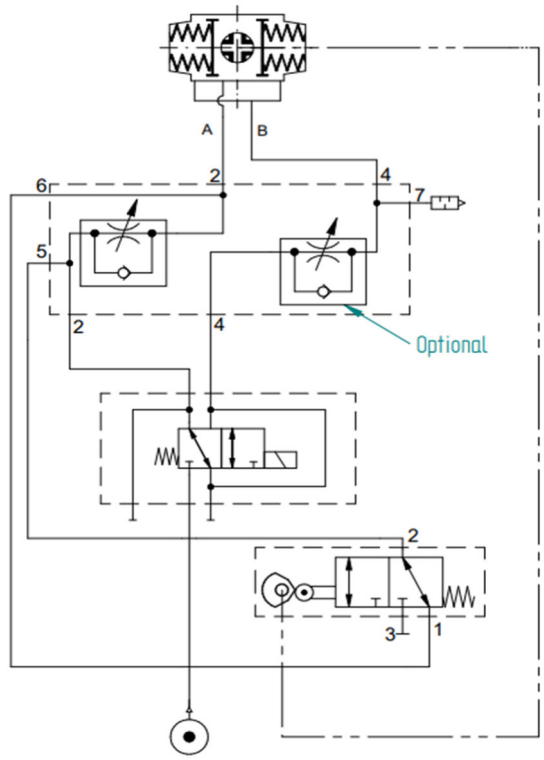


Start-up damping with limited dead-time for single acting actuators

D2SxxAST0Nxxxx

Function: in fail safe position

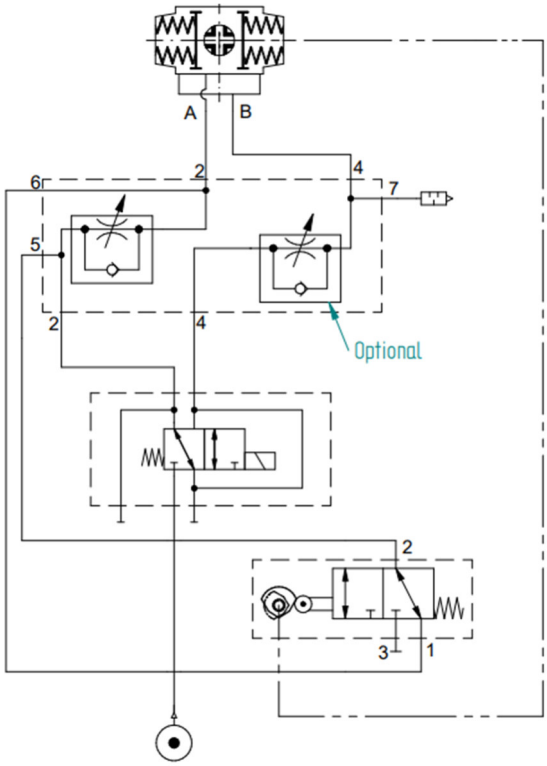
Product information / IOM D2-Control



End position damping for single acting actuators

D2SxxBET0Nxxxx

Function: against fail safe position



Start-up damping with limited dead-time for single acting actuators

D2SxxBST0Nxxxx

Function: against fail safe position

7. Tools for assembly and adjustment:

For assembly, commercially available tools in metric dimensions are required:

- Allen key 2,5mm, preferably with ball head, for the hexagon socket set screw on the adjustment ring
- Allen key 3mm, for the fastening screws of the bracket to the attached control head
- Allen key 4mm, for the fastening screws of a solenoid valve
- Open-end or ring spanner 8mm, for fastening the bracket to an actuator

8. Storage:

The D2-control unit should be stored in a dry place. All connections should be fitted with a protective plug or neatly packed in a bag to prevent dirt from entering.

9. Assembly to an actuator:

The D2-control consists of 2 main components: the D2 control head and the NAMUR connection block with the throttle valve (or optionally a second throttle valve).

The connection components (hoses / piping) and the solenoid valve can also be provided on request.

Step 1: Fastening the NAMUR connection block

Remove the NAMUR connection block from the packaging. The two O-rings supplied must be greased slightly and inserted into the recess provided on the connection block for connection positions 4 and 2 (NAMUR connection diagram).

Options

A) Single acting actuators:

Now attach the connection block to the actuator using the enclosed M5 screws and a 4mm Allen key so that connection 3 points upwards when viewed from above. Tightening of the screws with 2.8Nm.

B) Double acting actuators:

a. For versions with the function of venting double acting actuators via chamber A:
Now attach the connection block to the actuator using the enclosed M5 screws and a 4mm Allen key so that connection 5/6 points upwards when viewed from above. Tightening of the screws with 2.8Nm.

b. For versions with the function of venting double acting actuators via chamber B:
Now attach the connection block to the actuator using the enclosed M5 screws and a 4mm Allen key so that connection 5/6 points downwards when viewed from above. Tightening of the screws with 2.8Nm.

Now attach the solenoid valve to the connection block according to the manufacturers specificaions.

Step 2: Mounting the D2 control head on the actuator

Please make sure to select the correct size of the bracket for your actuator.

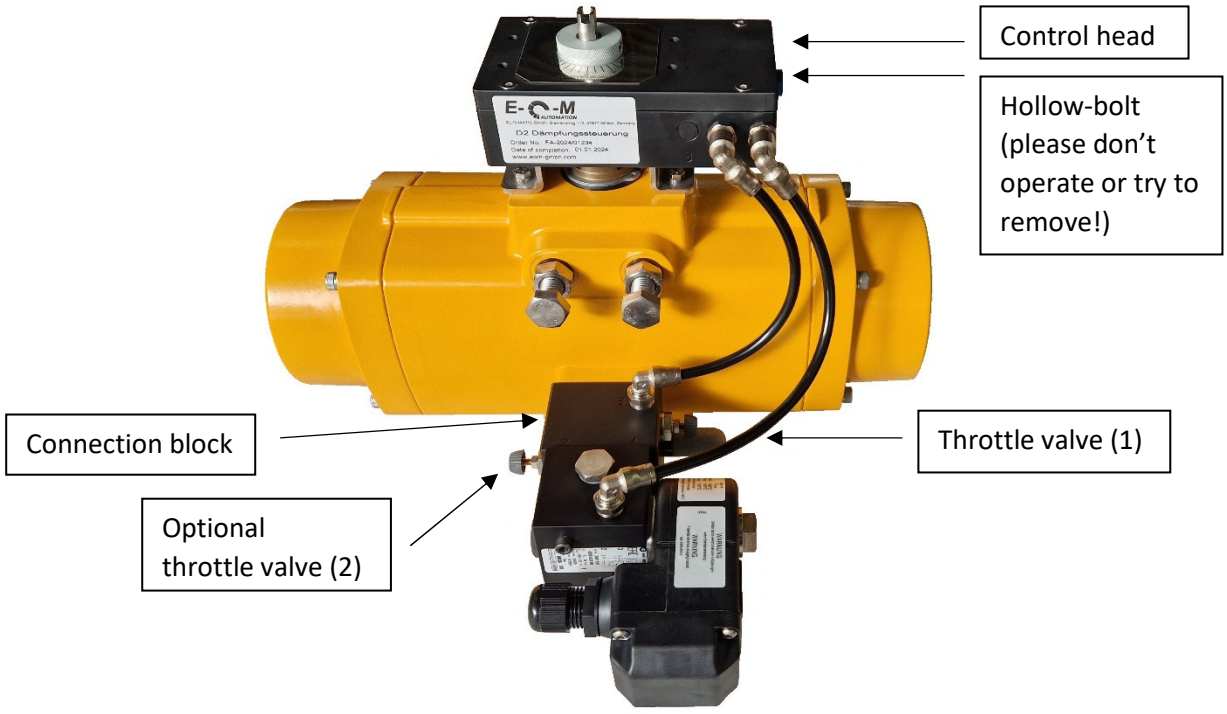
First, attach the bracket to the underside of the D2 control head using the 4 M5x8 flat head screws provided, with a 3mm Allen key (bracket and control head parallel). Tightening torque of the screws 2.8Nm.

Place the D2 control head on the actuator so that the dihedron of the adjustment ring shaft engages with the groove in the actuator shaft and the pneumatic connections of the D2 control head point in the direction of the D2 NAMUR connection block. Attach the bracket using the 4 M5x12 hexagon screws and spring washers provided. The tightening torque of the screws is 2.8 Nm.

Now connect the pneumatic connections of the D2 head to the connections of the connection block and solenoid valve in accordance with the relevant pneumatic plan. The assembly is now complete.

10. Commissioning:

Views after assembly (configuration of the assembly as an example according to the selected pneumatic plan). Examples of piping components.



(Position of socket set screw towards marking after assembly example)

10.1 Setting the damping angle:

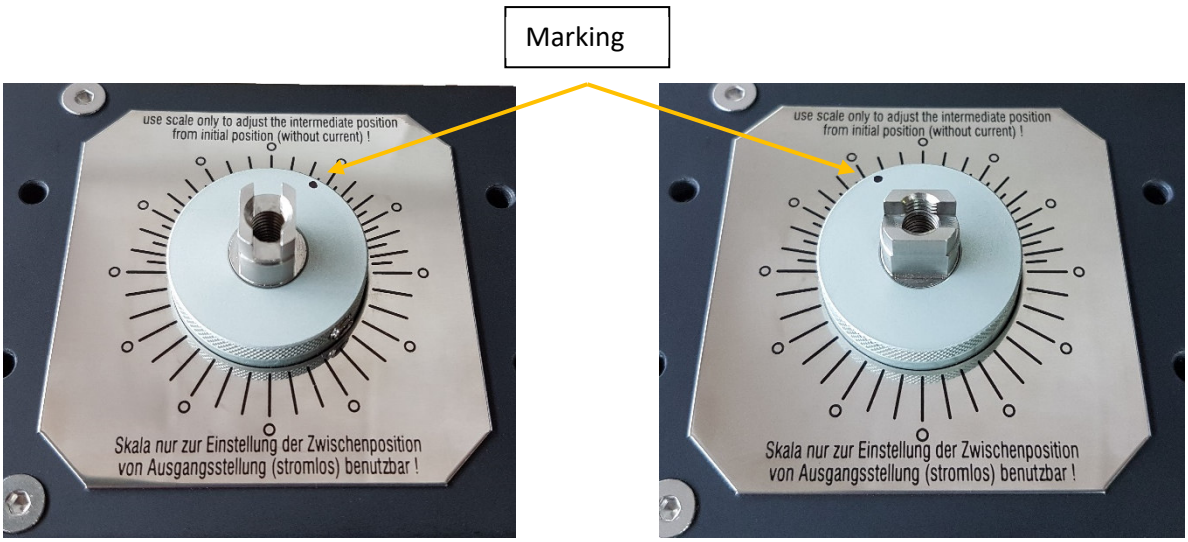
a. The actuator needs to be vented first. The easiest way to adjust the settings is when no accessories are installed via the VDI/VDE interface on the D2 control head.

b. The damping angle is adjusted by turning the adjustment ring:
- clockwise for code "**CW**"-actuators (spring closing)
- counter-clockwise for code "**CC**"-actuators (spring opening)

c. Loosen the hexagon socket screw on the adjustment ring:
- If the marking on the adjustment ring is in the 0° position (not shown in the drawing) (delivery condition approx. 45°, unless otherwise requested), no damping occurs
- If the marking on the adjustment ring is in the position of the maximum actuator rotation angle, e.g. 90°, the entire rotation angle of the actuator is damped (see point 10.3, exclusion of dead time)
- any intermediate position can be set
  Example: If the marking is set to 30°, the damping angle is 30° and the last 30° of the rotation angle is dampened, see **example graphics on the next page**

d. Tighten the hexagon socket screw on the adjustment ring in the desired position (approx. 3 Nm)

e. Check the result with the pressurized actuator in operation and correct according to steps a-d if necessary.



View for clockwise rotating actuator (CW) with unpressurized actuator

View for counter-clockwise actuator (CC) with unpressurized actuator

10.2 Adjusting the rotation speed within the damping angle:

The adjustment is made via the throttle valve (1)

- Turning clockwise reduces the rotation speed
- Turning counter-clockwise increases the rotation speed

10.3 full damping, minimized dead time:

If damping is required over the entire rotation angle (full damping angle) while simultaneously reducing the dead time as much as possible, the actuator must be adjusted in accordance with point 10.1 so that the marking is positioned at least 1 degree below the maximum actuator rotation angle; for an actuator with a 90° rotation angle, this should be at a maximum of 89°.

10.4 Optional: Adjusting the rotation speed against the fail-safe position:

The adjustment is made via the optional throttle valve (2)

- Turning clockwise reduces the rotation speed
- Turning counter-clockwise increases the rotation speed

11. Troubleshooting:

If any problems cannot be explained or solved by the below table, please contact us.

The actuator does not rotate anymore	Checking the solenoid valve function	The solenoid valve must operate and transmit air supply pressure to the D2-control.
	Checking the air pressure	The air supply pressure at the actuator must be high enough to operate the actuator including the valve according to the design parameters.
	Checking the throttle valves on the D2 connection block	The throttles may be clogged: open them slightly and check if the actuator rotates. Then reset them to the original setting.
	Checking the D2 control head	The engagement between actuator and control head must be positive. The adjustment ring is not supposed to be rotated freely.
	Checking actuator and valve according manufacturer specification	

12. Additional information / Declaration of incorporation:

Projekt: D2 Steuerung ohne MV
Produkt: D2 Steuerung
Hersteller: EL-O-MATIC GmbH

Verantw.: Sullery, Matthias

EL-O-MATIC GmbH
Siemensring 112
47877 Willich
Tel: +49 2154 499 66 0

Declaration of incorporation

The manufacturer

EL-O-MATIC GmbH

Herewith declares that the following product

Product name: D2-control
Year of construction: 2024
Description:
Control for start-up and end position damping for pneumatic actuators with continuous adjustment of damping angle and rotation speed with maximum reduction of dead time

complies with the following essential requirements of the Machinery Directive 2006/42/EC and all relevant provisions of the applicable legislation (hereinafter) - including any amendments thereto in force at the time of the declaration.
see appendix "List of requirements complied with according to Annex I of the EC Machinery Directive 2006/42/EC"

The following legislation was applied:
Machinery Directive 2006/42/EC

It is prohibited to put this product into operation until the machine or system into which this product is to be incorporated or of which it forms a component complies with the provisions of all relevant legislation.

The specific technical documentation for the product has been drawn up in accordance with Annex VII, Part B; upon reasoned request, this documentation can be sent by email to a national body.

Name and address of the person authorized to compile the technical documentation:
Sullery, Matthias

location: Willich
date: 23.04.2024

(signature)
General Manager

Dokument1 Seite 2 von 2 27.08.2024

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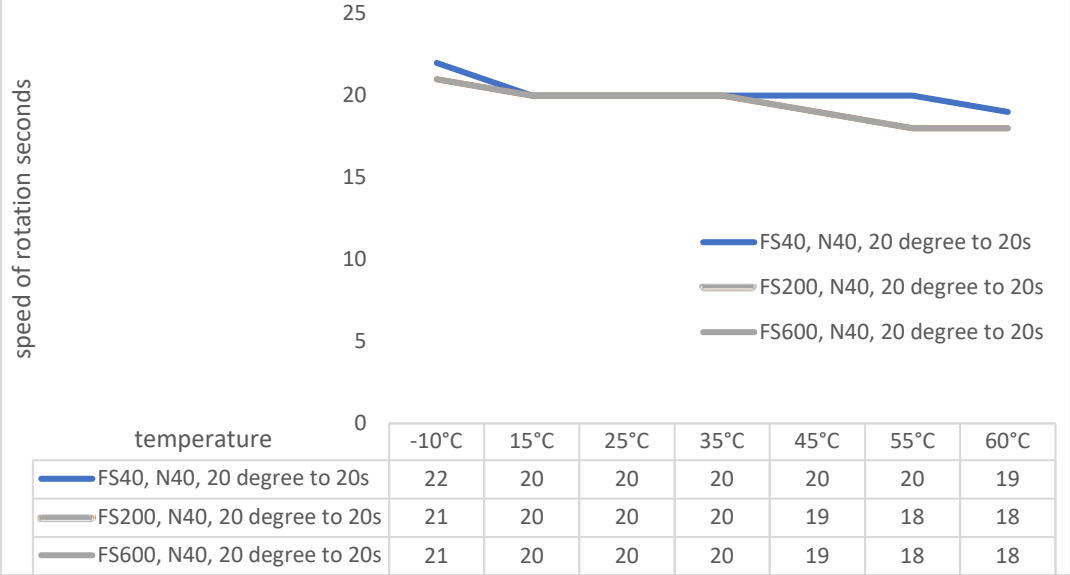
Notes on positioning time stability:

The D2 control is a mechanical-pneumatic unit which is influenced by the ambient temperature. In the range from 0°C to 45°C the deviation of the set times will exceed a tolerance of 5%.

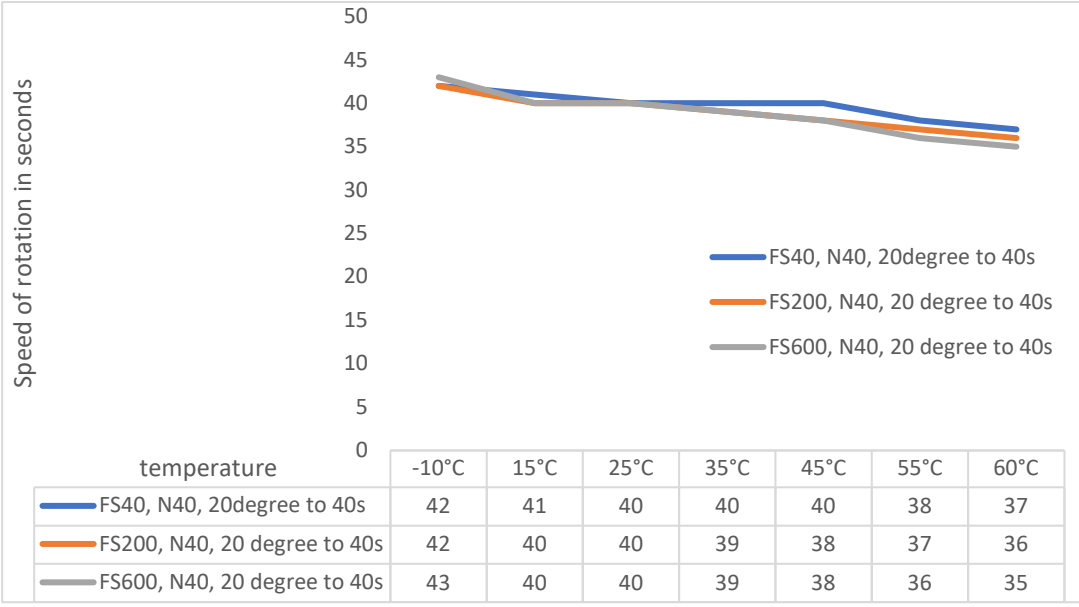
With larger temperature deviations, the deviations can become larger.

Selected examples of measurements at 4.5 bar (g) control pressure. Setting value at room temperature of 20°C and setting time 20 seconds:



temperature	-10°C	15°C	25°C	35°C	45°C	55°C	60°C
FS40, N40, 20 degree to 20s	22	20	20	20	20	20	19
FS200, N40, 20 degree to 20s	21	20	20	20	19	18	18
FS600, N40, 20 degree to 20s	21	20	20	20	19	18	18

Selected examples of measurements at 4.5 bar (g) control pressure. Setting value at room temperature of 20°C and setting time 40 seconds:



temperature	-10°C	15°C	25°C	35°C	45°C	55°C	60°C
FS40, N40, 20degree to 40s	42	41	40	40	40	38	37
FS200, N40, 20 degree to 40s	42	40	40	39	38	37	36
FS600, N40, 20 degree to 40s	43	40	40	39	38	36	35