

## Data sheet

# Actuators for modulating & 3-point control

**AME 655** – without safety function

**AME 655 GA** – without safety function (replacement for AMV(E) 4xx/6xx)

**AME 658 SU, AME 658 SD** – with safety function (spring up/down)

**AME 659 SD** – with safety function (spring down); **DIN EN 14597** certified

## Description



Actuators are primarily designed to regulate valve in the respond to the demand of a controller in District Heating/cooling, Heating, Ventilating and Air conditioning systems.

Actuators AME 655, 658 and 659 can be controlled by electronic controllers with modulating or 3-point control output.

Actuators can be used without any adapter in combination with:

- Valve types VFM, VFS (DN 65-100), VF (DN 100-150) and VL (DN 100)
- Self-acting flow controller AFQM 6 and AFQM\*.

\* With adapter **065B3527** for AFQM 6 or AFQM PN 25, if produced before March 2015.



Used with adapter **065B3527** in combination with:

- Valve types VFG(S) and VFU.

## Features:

- Manual operation mechanical and/or electrical
- Position indication, LED signalization
- Selectable speed 2 or 6 s/mm
- Automatic adaptation of stroke to valve's end positions that reduces commissioning time (*self stroking*)
- Integrated auxilliary switch
- Characteristic optimization
- Adjustable stroke limitation
- Anti-oscillation function
- Pulse or continuous output signal (4&5)
- Voltage or current output signal X
- External reset button
- Auto detection of Y signal
- 3-point or modulating control selection
- Galvanic insulation Y, X and output terminal 4&5
- Thermal and overload protection
- Precise control and fast response in 3-point mode (0.01 s)

## Special feature for AME 655GA and AME 659SD:

- Potential free terminal
- Able to connect wires as were connect by AMV(E) 41X or 61X)
- Equipped with cable glands

## Main data:

- Nominal voltage (ac or dc):
  - 24 V, 50 Hz/60 Hz
  - 230 V, 50 Hz/60 Hz
- Control input signal: modulating or 3-point
- Force: 2000 N
- Stroke: 50 mm
- Speed (selectable): 2 or 6 s/mm
- Max. medium temperature: depends on valve type. (from 150°C up till 300°C)

Ordering

Actuators

| Picture | Type       | Power supply (V) | Code No. |
|---------|------------|------------------|----------|
|         | AME 655    | 24               | 082G3442 |
|         |            | 230              | 082G3443 |
|         | AME 655 GA | 24               | 082G3439 |
|         |            | 230              | 082G3438 |
|         | AME 658 SU | 24               | 082G3450 |
|         |            | 230              | 082G3451 |
|         | AME 658 SD | 24               | 082G3448 |
|         |            | 230              | 082G3449 |
|         | AME 659 SD | 24               | 082G3454 |
|         |            | 230              | 082G3455 |

Accessories - Stem heater

| Type                      | DN     | Code No. |
|---------------------------|--------|----------|
| Stem heater for VFM valve | 65-250 | 065Z7022 |

Accessories - Adapter

| Type  | Code No. |
|---|----------|
| Adapter for VFG/S, VFU and AFQM 6 & AFQM PN 25 if produced before March 2015. | 065B3527 |

Accessories - Stem clutch

| Type                                      | Code No. |
|---|----------|
| Stem clutch for all AMV (E) 65x actuators | 003G6398 |

Accessories - Potential free terminal \*

| Type   | Code No. |
|--|----------|
| Potential free terminal for all AME 65x actuators 24V  | 003G6336 |
| Potential free terminal for all AME 65x actuators 230V | 003G6337 |

\* Included in AME 659 SD & AME 655 GA

Technical data



**Please check power supply and power consumption prior connection!**

**Note:**  
Do not use safety activations for ON/OFF regulation.

| Actuator type                                 |      | AME 655/655 GA   | AME 658 SD                       | AME 658 SU                        | AME 659 SD  |
|---|------|--|----------------------------------|-----------------------------------|---|
| Power supply                                  | V    | 24 or 230; +10 ... -15 %; ac or dc   |                                  |                                   |   |
| Power consumption                             | VA   | 12 (24 V)<br>21 (230 V)  | 19 (24 V)<br>28 (230 V)          | 19 (24 V)<br>28 (230 V)           | 19.2 (24 V)<br>35.7 (230 V)   |
| Frequency                                     | Hz   | 50/60  |                                  |                                   |   |
| Control input Y                               | V    | 0-10 (2-10) [Ri = 40 kΩ]   |                                  |                                   |   |
|   | mA   | 0-20 (4-20) [Ri = 500 Ω]   |                                  |                                   |   |
|   | -    | 3-point (wiring auto-detection)  |                                  |                                   |   |
| Control output X                              | V    | 0-10 (2-10) [Ri = 10 kΩ]   |                                  |                                   |   |
|   | mA   | 0-20 (4-20) [Ri = 510 Ω]   |                                  |                                   |   |
| Closing force                                 | N    | 2000   |                                  |                                   |   |
| Max. stroke                                   | mm   | 50   |                                  |                                   |   |
| Speed (selectable)                            | s/mm | 2 or 6   |                                  |                                   |   |
| Max. medium temperature                       | °C   | Depends on valve type. No limitations for 150°C, for higher temperature see page 3, INSTALLATION |                                  |                                   |   |
| Ambient temperature                           |      | 0 ... +55  |                                  |                                   |   |
| Storage and transport temperature             |      | -40 ... +70 (storing for 3 days)   |                                  |                                   |   |
| Humidity                                      |      | 5-95% (no condensing)  |                                  |                                   |   |
| Protection class                              |      | II   |                                  |                                   |   |
| Grade of enclosure                            |      | IP 54  |                                  |                                   |   |
| Weight  | kg   | 5.3  | 8.6                              | 8.6                               | 8.6   |
| Safety function                               |      | -  | Yes                              | Yes                               | Yes (DIN EN 14597)  |
| Safety function runtime/50 mm stroke          | s    | -  | 120                              | 120                               | 120   |
| Manual operation                              |      | Electrical and mechanical  | Electrical and mechanical        | Electrical and mechanical         | Electrical  |
| Power failure response                        |      | Stem remains in last position  | Safety function extends the stem | Safety function retracts the stem | Safety function extends the stem  |
| CE - marking in accordance with the standards |      | Low Voltage Directive 2006/95/EEC<br>EMC Directive 2004/108/EEC                                  |                                  |                                   | Low Voltage Direct. 2006/95/EEC<br>EMC Directive 2004/108/EEC<br>Safety function acc. to DIN EN 14597 |

Commissioning

Complete the mechanical and electrical installation (see instructions) and perform the necessary checks and tests:

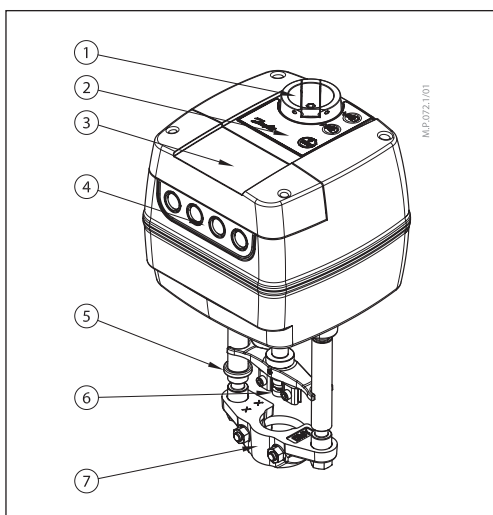
- Turn on the power
- Set the appropriate control signal and check that the valve stem direction is correct for the application.

The unit is now fully commissioned.

**Design**

1. Manual operation knob
2. Function buttons
3. Service cover
4. Removable gland support \*
5. End position indication ring
6. Stem connector
7. Valve connector (yoke)

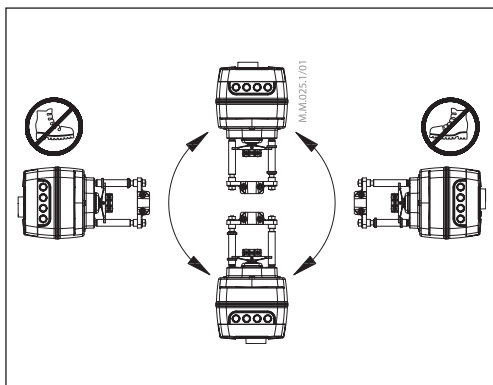
\* additional gland support with one M16 and one M20 gland added with AME 655GA and AME 659SD actuators only.



**Installation**

**Mechanical**

Please check the allowed installation positions for the valve and actuator. The actuator can be installed in all positions (see below).



Use a M8/SW13 key (not supplied) to fit the actuator to the valve body. Allow for necessary clearance for maintenance purposes. To link valve and actuator stems use a 4mm Allen key (not supplied). The actuator has position indication rings which should be pushed together before el. connection; after self-stroking they indicate end positions of the stroke.

**Electrical connection**

Electrical connections can be accessed by removing the service cover.

**AME 655GA / 659SD**

Four cable entries are supplied with actuator.

**AME 655 / 658**

Four cable entries are provided for M 16x1.5 or M 20x1.5 cable glands. Note that in order to maintain the enclosure's IP rating, appropriate cable glands must be used.

|      | Code No. |
|------|----------|
| ZF 4 | 003G1394 |
| ZF 5 | 003G1396 |

| <150°C                                 | 150-200°C ZF4<br>200-350°C ZF5   |
|--|--|
| <p>VFU 2 + adapter <b>065B3527</b></p> | <p>VFU 2 + adapter <b>065B3527</b> + ZF4/5</p>   |
| <p>VFG/S + adapter <b>065B3527</b></p> | <p>VFG/S + adapter <b>065B3527</b> + ZF4/5<br/>VFG/S + adapter <b>065B3527</b> + ZF5 (DN 15-125)</p> |

**Wiring AME 655  
AME 658 SU/SD**



Do not touch anything on the PCB!  
Do not remove the service cover  
before the power supply is fully  
switched off.

**Max. allowed current output on  
terminals 4 and 5 is 4A.  
Min. power is 3W.**

**Recommended cross-sectional  
area of the wiring is 1.5 mm<sup>2</sup>**

**AME 658 wiring for modulating mode**

AME 658

**AME 655 wiring for modulating mode**

AME 655  
DIP 6 OFF (1a, 1b)  
DIP 6 ON (2a, 2b)

**24V  
230V**

|             |                 |                                 |
|-------------|-----------------|---------------------------------|
| <b>SN</b>   | 0 V             | Neutral                         |
| <b>SP</b>   | 24, 230 V ac/dc | Power supply                    |
| <b>4, 5</b> | SP(ac)          | SP output<br>-max 4A<br>-min 3W |
| <b>1</b>    |                 | Input                           |
| <b>3</b>    |                 |                                 |
| <b>GND</b>  | 0 V             | Neutral                         |
| <b>Y</b>    | 0(2)-10 V       | Input                           |
|             | 0(4)-20 mA      |                                 |
| <b>X</b>    | 0(2)-10 V       | Output                          |
|             | 0(4)-20 mA      |                                 |

**Optional: AME 655 connected as 3-point version**

AME 655

**24V  
230V**

|             |                             |  |
|-------------|-----------------------------|--|
| <b>SN</b>   | 0 V                         | Neutral  |
| <b>1.3</b>  | 24, 230 V ac/dc             | Power supply   |
| <b>4, 5</b> | SP(ac)                      | SP output<br>-max 4A<br>-min 3W  |
| <b>1</b>    |                             | Input  |
| <b>3</b>    |                             |  |
| <b>X</b>    | Ix 0(4)-20mA<br>Ux 0(2)-10V | X output possible only<br>when power supply is<br>connected to the SN & SP.<br>GND must be as well<br>connected. |

**Wiring AME 659 SD  
AME 655 GA**



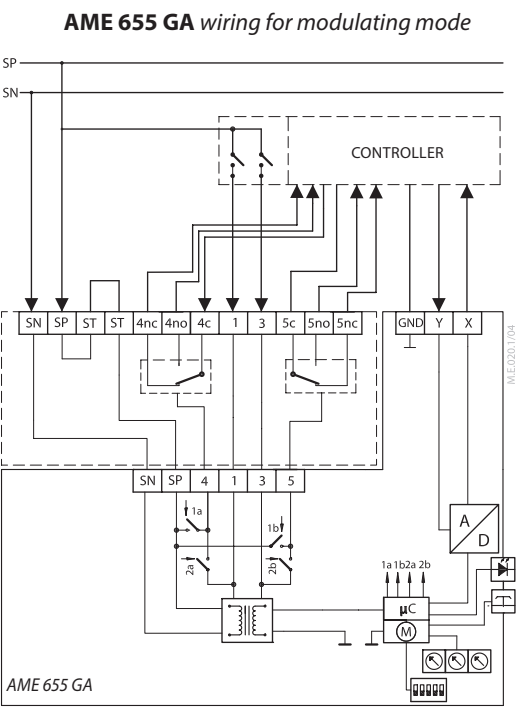
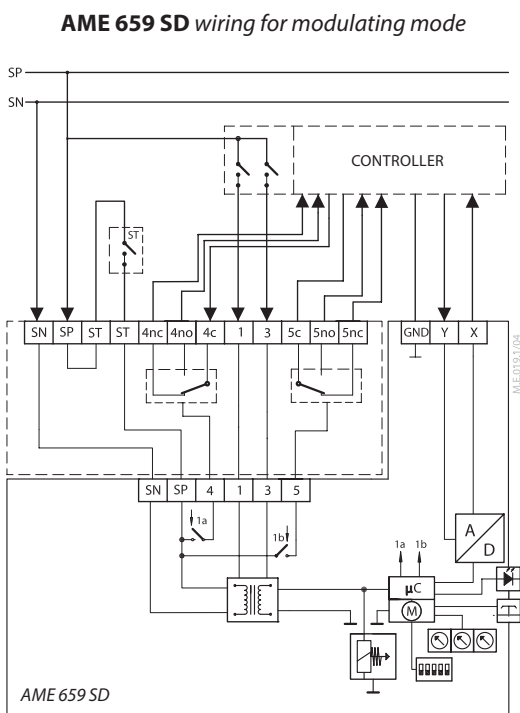
Do not touch anything on the PCB!  
Do not remove the service cover  
before the power supply is fully  
switched off.

**Max. allowed current output on  
terminals 4nc and 5nc is 4A.  
Min. power is 3W.**

**Recommended cross-sectional  
area of the wiring is 1.5 mm<sup>2</sup>**



**24V  
230V**



**Actuator operating modes****LED operating mode indicator**

The three-colour (green/yellow/red) LED function indicators are located on the actuator cover. They indicate different operating modes.

**RESET button**

Actuators AME 655/658/659 have external RESET button which is located on top cover of the actuator next to LED indicators. With this button you can enter or exit Stand-By mode (press once) or Self stroking mode (press and hold for 5 seconds). See next paragraph for mode details.

**Operating modes**

- **Self stroking mode**

Self stroking mode starts automatically the first time when power supply is applied to the actuator. To start self stroking procedure **press and hold RESET button for 5 seconds** until the green light starts flashing. End positions of the valve are automatically set and the actuator goes to stationary mode and starts responding to the control signal.

- **Stand-By mode**

**(versions AME 655/658/659)**

**Press the RESET button for 1 sec.** to enter Stand-By mode. The actuator stops in current position and stops responding to any control signal. Red light is constantly lit. You can manually operate the actuator with mechanical handle (versions AME 655/658) or control buttons (versions AME 655/658/659). This mode can be very useful during the commissioning of other equipment, or for service purposes. In this mode you can also set positions of the additional switches. To exit Stand-By mode press the RESET button again.

- **Positioning mode**

The actuator is operating automatically. The stem is extending or retracting according to the control signal. When positioning is finished the actuator goes to stationary mode. If for one or another reason 3-point signal (terminally 1 and 3) and Y signal would be present at the same time, 3-point signal would prevail.

- **Stationary mode**

The actuator is operating without errors.

- **Error mode**

Working temperature is too high - check the ambient temperature.

Stroke is too short - check the connection with valve and valve operation, or check if valve is blocked.

LED signalling

| LED             | Indication type |  |                         | Operating mode   |
|-----------------|-----------------|--|-------------------------|--|
| Green LED:      |                 |  | Constantly lit          | Positioning mode - Actuator is retracting the stem   |
|                 |                 |  | Constantly lit          | Positioning mode - Actuator is extending the stem  |
|                 |                 |  | Flashing<br>(1 s cycle) | Self stroking mode - Actuator is retracting the stem   |
|                 |                 |  | Flashing<br>(1 s cycle) | Self stroking mode - Actuator is extending the stem  |
| Yellow LED:     |                 |  | Constantly lit          | Stationary mode - Actuator has reached upper end position (retracted stem)                                 |
|                 |                 |  | Constantly lit          | Stationary mode - Actuator has reached bottom end position (extended stem)                                 |
|                 |                 |  | Flashing                | Stationary mode - Single blink when Y signal is presents and double blinks when Y signal is not connected) |
| Red LED:        |                 |  | Constantly lit          | Stand-By mode  |
|                 |                 |  | Flashing                | Error Mode   |
| Red/ Yellow LED |                 |  | Flashing<br>(1 s cycle) | Set up stroke limitation (retracted stem)  |
|                 |                 |  | Flashing<br>(1 s cycle) | Set up stroke limitation (extended stem)   |
| Dark            | No indication   |  |                         | No power supply  |

**DIP switch setting**

The actuator has a selection of DIP switches (Fig. 1) under the service cover.

**DIP1: FAST/SLOW – Speed selection**

- FAST; 2 s/mm
- SLOW; 6 s/mm

**DIP2: DIR/INV – Direct or inverse acting selector (Fig. 2):**

- DIR; the actuator is direct acting to input signal
- INV; the actuator is inverse (reverse) acting to control signal

**DIP3: 2-10 V/0-10 V – Input/output**

- 2-10 V; the input signal is in the range from 2-10 V (voltage input) or from 4-20 mA (current input)
  - 0-10 V the input signal is in the range from 0-10 V (voltage input) or from 0-20 mA (current input)
- Signal range selector sets Y and X signal.

**DIP4: LIN/MDF – Characteristic modification function (Fig. 3):**

- LIN ; Linear correlation between Y signal and stem position
- MDF (Modified) position; Enables modified correlation between Y signal and stem position. Degree of modification depends on setting of potentiometer CM.

The function enables to change **MCV (Motorised Control Valve)** characteristic (for example linear to logarithmic and logarithmic to linear) and works with all combinations of DIP switch settings.

**DIP5: 100%/95% – Stroke limitation (fig.4):**

- Set new maximum retracted position of the actuator
- Set new minimum extended position of the actuator.

**DIP6: C/P – Output signal mode selector (Fig. 5):**

- An output signal is present on terminal 4 when the position of the actuator is equal to or lower than the S4 set point. An output signal is present on terminal 5 when the position of the actuator is equal to or higher than the S5 set point.
- DIP6 position **C** provides a constant output signal on terminals 4 or 5, regardless of the input signal.
- DIP6 position **P** provides a pulse signal through parallel or cascade electrical wiring input 1 and 3 depends from the controller to output terminals 4 and 5.

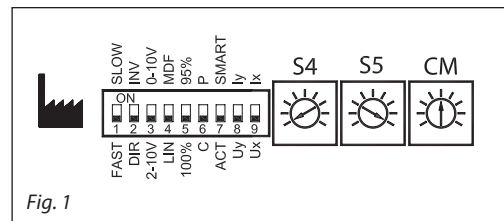


Fig. 1

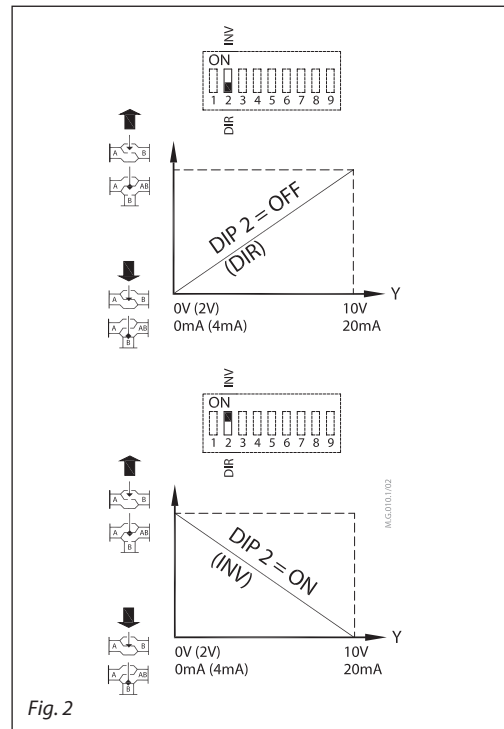


Fig. 2

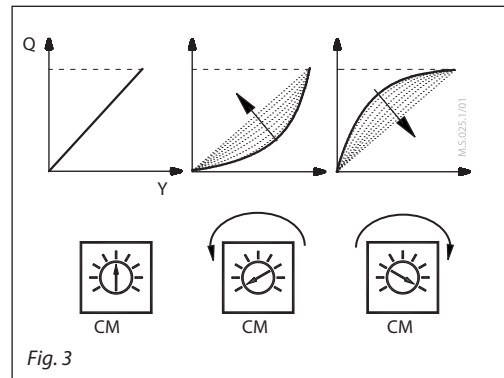


Fig. 3

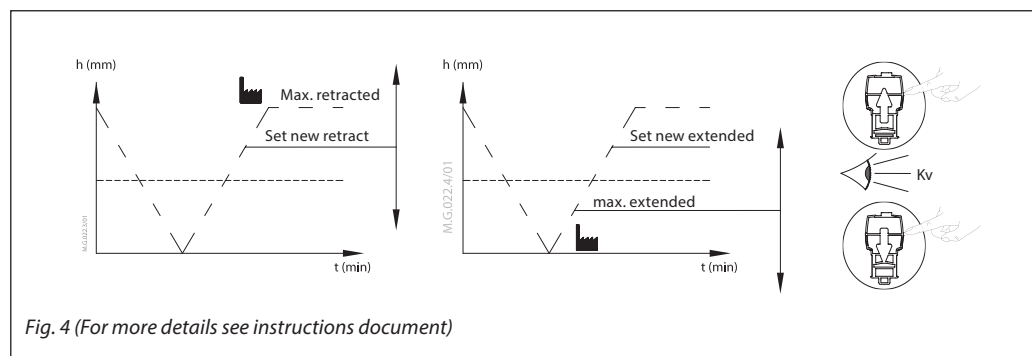


Fig. 4 (For more details see instructions document)



**DIP switch setting**  
(continuous)

**DIP7: Smart function selector:**

- OFF ; the actuator does not try to detect oscillations in the system
- ON ; actuator enables special anti-oscillation algorithm – see section on anti-oscillation algorithm

**DIP8: Uy/Iy –Input signal type selector:**

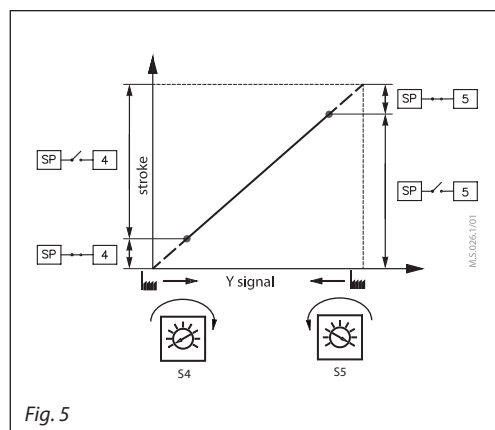
- Uy; input signal Y is set to voltage (V)
- Iy; input signal Y is set to current (mA)

**NOTE:**

If DIP3 and DIP8 are both set to ON position Y detection is disabled.

**DIP9: Ux/Ix –Output signal type selector:**

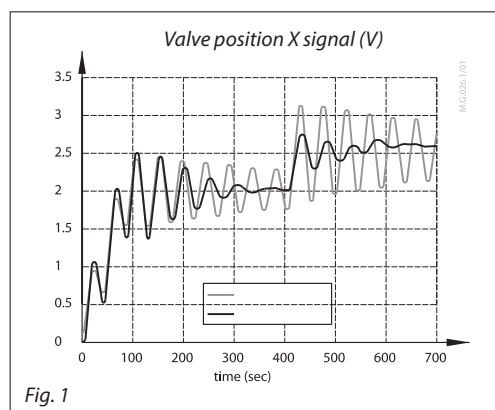
- Ux; output signal X is set to voltage (V)
- Ix; output signal X is set to current (mA)



**Anti oscillations algorithm**

(SW 7 in position ON)

The actuator has special anti oscillations algorithm. In case control signal Y on certain point oscillates (Fig. 1) - looking from time perspective, algorithm starts to lower the amplification of the output to the valve. Instead of having static characteristics actuator changes to dynamic characteristics. After the control signal does not oscillate anymore output to the valve slowly returns back to static characteristics.

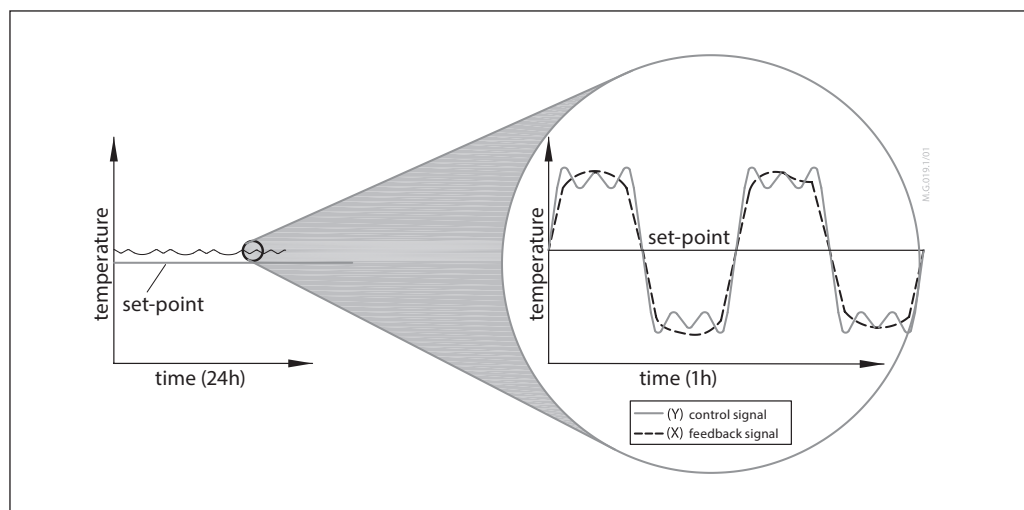


**Oscillation**

Harmonic oscillations are high frequency oscillations with low amplitude that vary around its own equilibrium value and not around set-point temperature. They can appear in up to 70 % of control time, even though the system is properly commissioned. Harmonic oscillations have negative influence on control stability, and lifetime of the valve and actuator.

**Smoothing function**

The smoothing function implemented in the new 2<sup>nd</sup> generation of anti-oscillation function reduces harmonic oscillations; the actual temperature is closer to the set-point (*desired temperature*). Smoother operation increases lifetime of the valve and actuator. This saves energy and reduces costs in general.



Manual operation

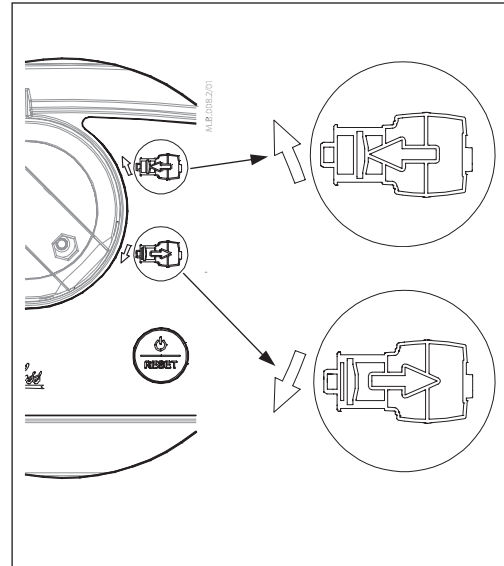
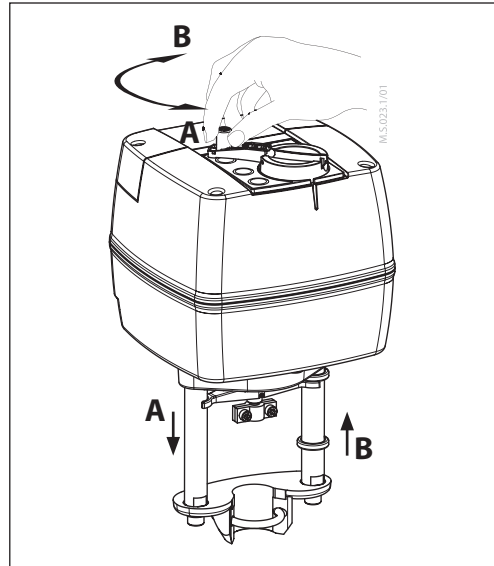


Mechanical and electrical operation are not allowed to be used at the same time!

Actuators AME 655/658 can be manually positioned when in Stand-By mode or when there is no power supply (mechanically).

The actuator AME 659 can be manually positioned only in Stand-By mode.

| Actuator type | Mechanical operation | Electrical operation |
|---------------|----------------------|----------------------|
| AME 655       | ✓                    | ✓                    |
| AME 658       | ✓                    | ✓                    |
| AME 659       | ✗                    | ✓                    |



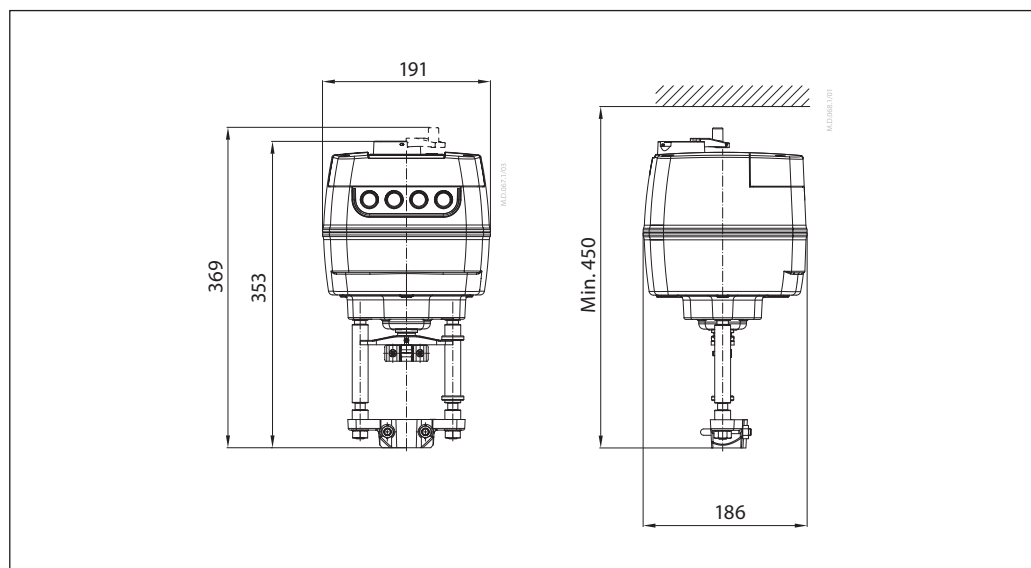
**Mechanical manual operation**

Actuators AME 655/658 have a knob & crank on the top of the housing which enables manual positioning of the actuator.  
**Use Mechanical manual operation only when the power is disconnected.**

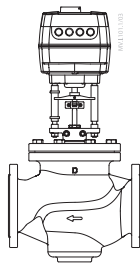
**Electrical manual operation**

Actuators AME 655, 658/659 have two buttons on the top of the housing that are used for electrical manual positioning (up or down) if the actuator is in Stand-By mode. First press the RESET button until the actuator goes to Stand-By mode (red LED is lit). By pressing the upper button the stem will be extended and by pressing the lower button the stem will be retracted.

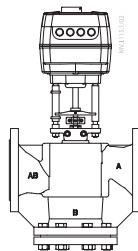
Dimensions



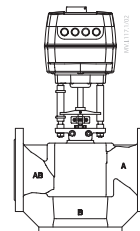
Actuator – valve combinations



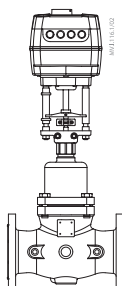
AME 65x +  
VFM 2



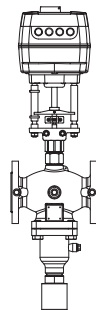
AME 65x +  
VF 2 (DN 100-150)  
VL 2 (DN 100)  
VFS 2 (DN 65-100)



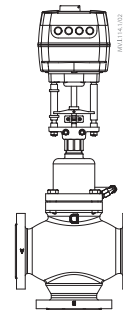
AME 65x +  
VF 3 (DN 100-150)  
VL 3 (DN 100)



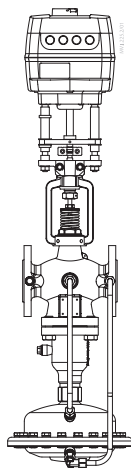
AME 65x +  
VFG + adapter **065B3527** + ZF 4/5  
VFGS + adapter **065B3527**  
+ ZF5 (DN 15-125)



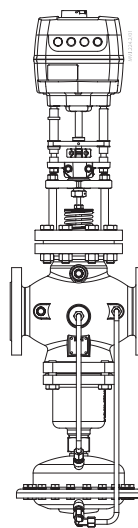
AME 65x +  
VFU +  
adapter:  
**065B3527** (DN 15-125)



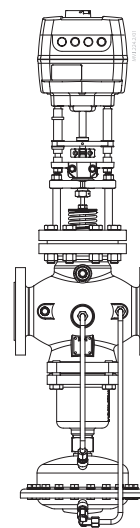
AME 65x +  
VFG 3 +  
adapter:  
**065B3527** (DN 25-125)



AME 65x +  
AFQM 6 \*



AME 65x +  
AFQM PN 16 (DN 65-125)



AME 65x +  
AFQM PN 25 \*

\* Please use adapter **065B3527** for combination with AFQM PN25 & AFQM 6 if produced before March 2015.



**Danfoss A/S**

Climate Solutions • danfoss.com • +45 7488 2222

Any information, including, but not limited to information on selection of product, its application or use, product design, weight, dimensions, capacity or any other technical data in product manuals, catalogues descriptions, advertisements, etc. and whether made available in writing, orally, electronically, online or via download, shall be considered informative, and is only binding if and to the extent, explicit reference is made in a quotation or order confirmation. Danfoss cannot accept any responsibility for possible errors in catalogues, brochures, videos and other material. Danfoss reserves the right to alter its products without notice. This also applies to products ordered but not delivered provided that such alterations can be made without changes to form, fit or function of the product.

All trademarks in this material are property of Danfoss A/S or Danfoss group companies. Danfoss and the Danfoss logo are trademarks of Danfoss A/S. All rights reserved.