ENGINEERING
TOMORROW

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.

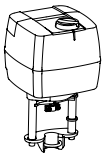
Features:
- Manual operation mechanical and/or electrical
- Position indication, LED signalization
- Selectable speed 2 or 6 s/mm
- Automatic adaptation of stroke to valve's end positions that reduces commissioning time (*self stroking*)
- Integrated auxilliary switch
- Characteristic optimization
- 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 - **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**

Technical data

Please check power supply and power consumption prior connection!

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) 21 (230 V)	19 (24 V) 28 (230 V)	19 (24 V) 28 (230 V)	19.2 (24 V) 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	°C	0 … + 55			
Storage and transport temperature	°C	−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 EMC Directive 2004/108/EEC			Low Voltage Direct. 2006/95/EEC EMC Directive 2004/108/EEC Safety function acc. to DIN EN 14597

Disposal

The actuator must be dismantled and the elements sorted into various material groups before disposal.

Before disassembly please contact Danfoss support for disassembly instructions.

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.

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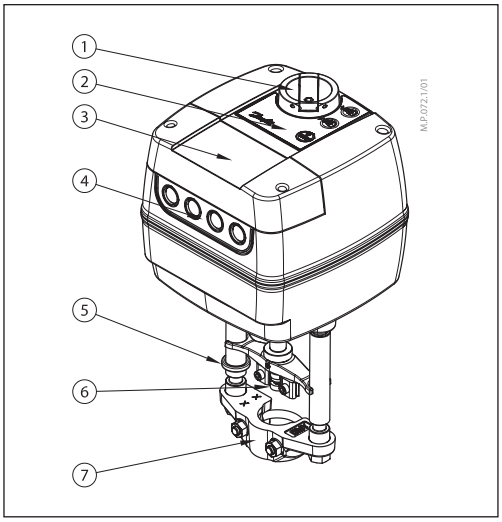
Design

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)

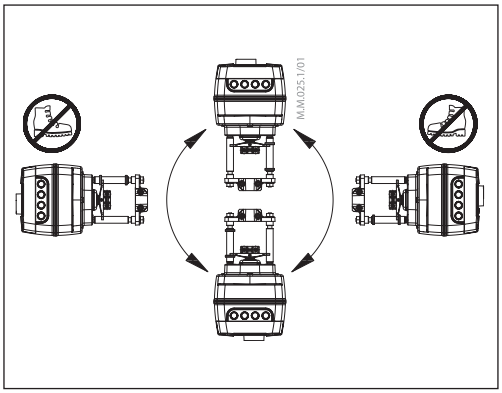
* *additional gland support with one M16 and one M20 gland added with AME 655GA and AME 659SD actuators only.*



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

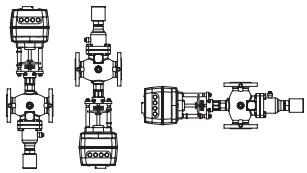
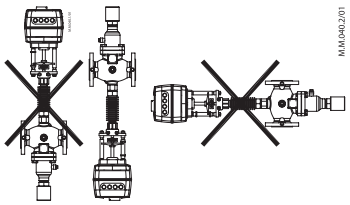
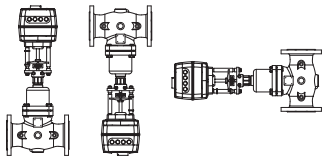
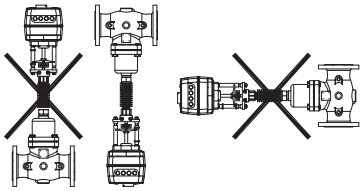
Electrical connections can be accessed by removing the service cover.

AME 655GA / 659SD

Four cable entries are supplied with actuator.

AME 655 / 658

Four cable entries are provided for M 16×1.5 or M 20×1.5 cable glands. Note that in order to maintain the enclosure's IP rating, appropriate cable glands must be used.

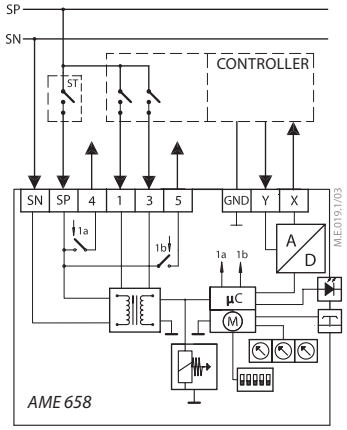
<150°C  *VFU 2 + adapter* **065B3527**	**150-200°C ZF4** **200-350°C ZF5**  *VFU 2 + adapter* **065B3527** *+ ZF4/5*
<150°C  *VFG/S + adapter* **065B3527**	**150-200°C ZF4** **200-350°C ZF5**  *VFG/S + adapter* **065B3527** *+ ZF4/5*

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.

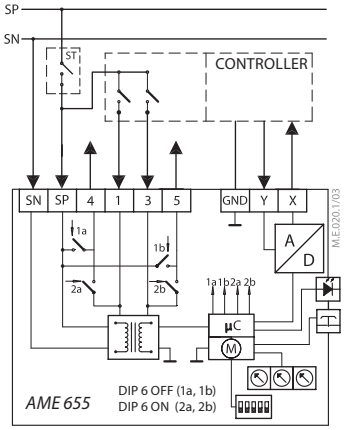
Recommended cross-sectional area of the wiring is 1.5 mm²

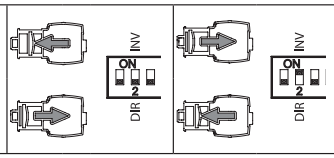
AME 658 *wiring for modulating mode*



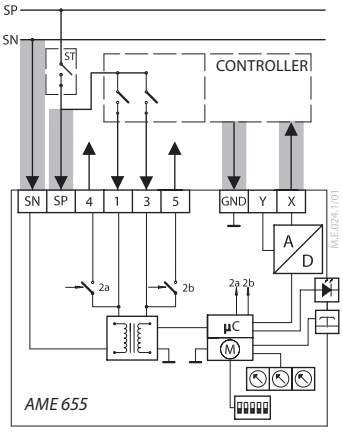
24V
230V

AME 655 *wiring for modulating mode*

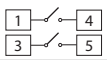
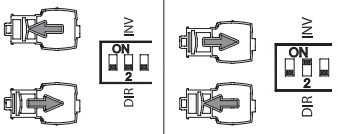


SN	0 V	Neutral
SP	24, 230 V ac/dc	Power supply
4, 5	SP(ac)	SP output -max 4A -min 3W
1 **3**	SP 	Input
GND	0 V	Neutral
Y	0(2)-10 V 0(4)-20 mA	Input
X	0(2)-10 V 0(4)-20 mA	Output

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



24V
230V

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

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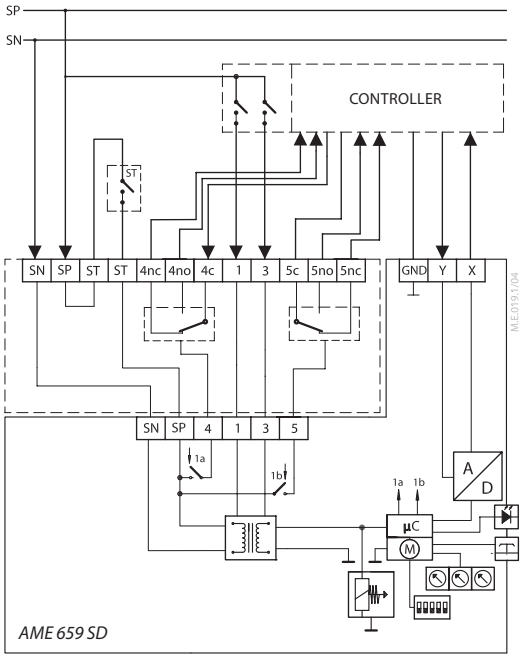
Wiring AME 659 SD
AME 655 GA

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 mm²

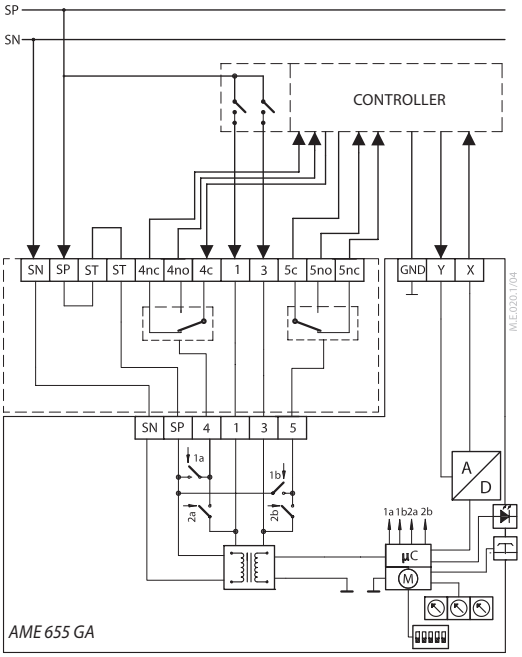
24V
230V

AME 659 SD *wiring for modulating mode*



24V
230V

AME 655 GA *wiring for modulating mode*



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.

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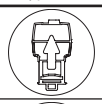
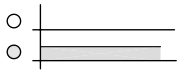
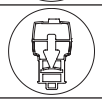
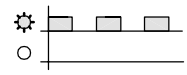
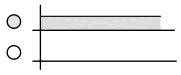
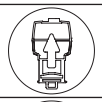
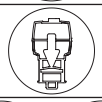
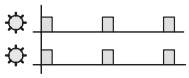
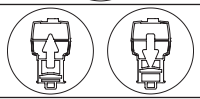
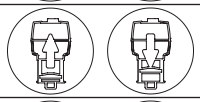
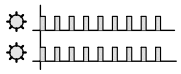
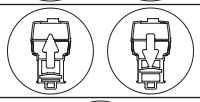
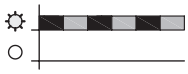
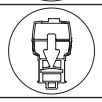
LED signalling

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 (1 s cycle)	Self stroking mode - Actuator is retracting the stem
			Flashing (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 (1 s cycle)	Set up stroke limitation (retracted stem)
			Flashing (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** (**M**otorised **C**ontrol **V**alve) 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 dependents from the controller to output terminals 4 and 5.

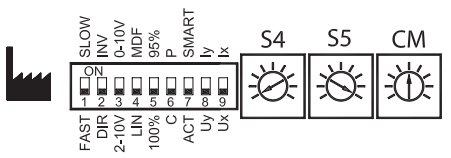


Fig. 1

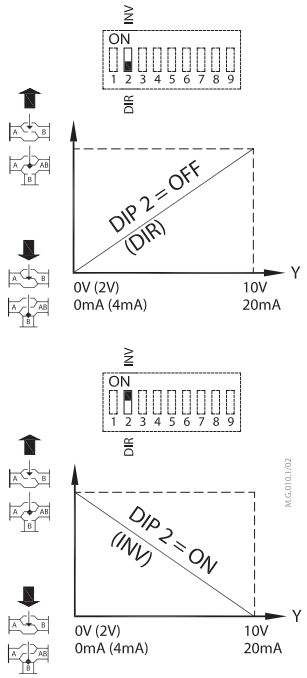


Fig. 2

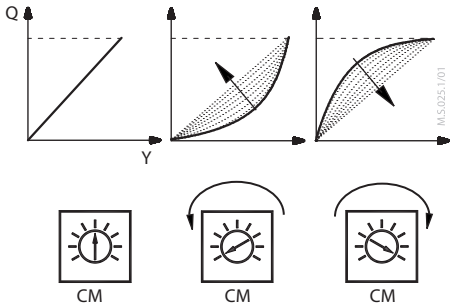


Fig. 3

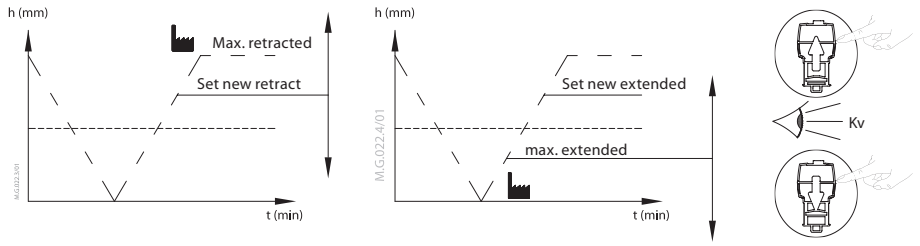


Fig. 4 (For more details see instructions document)

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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:
Y detection is disabled if DIP8 is set to ON positions and DIP3 is set to OFF position.

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)

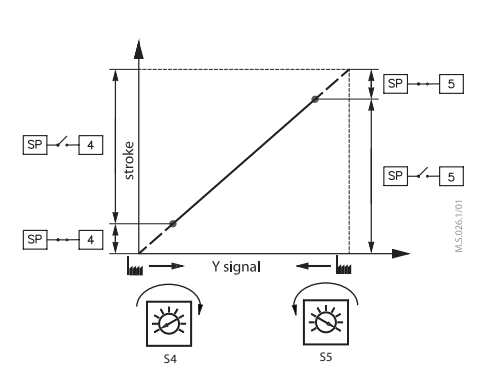


Fig. 5

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 ouput 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.

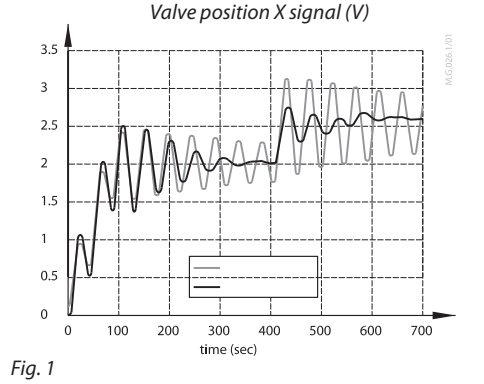
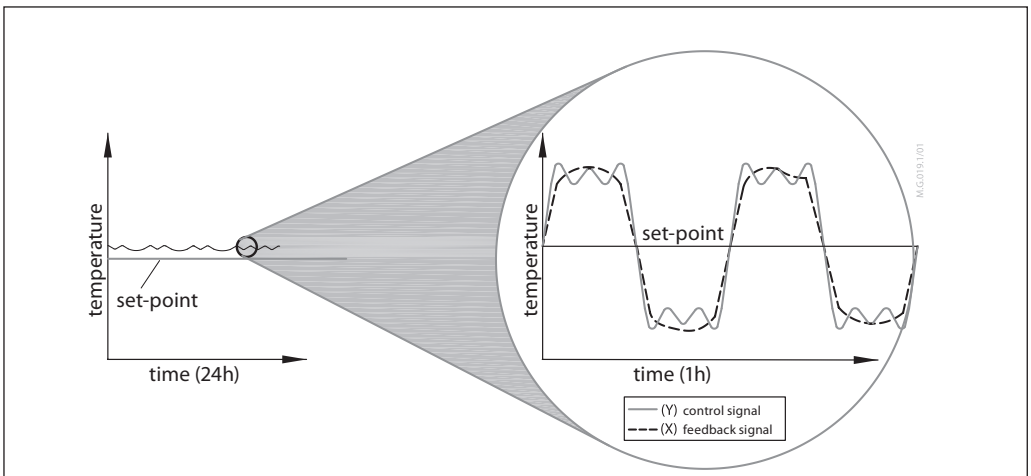


Fig. 1

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 2nd 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.



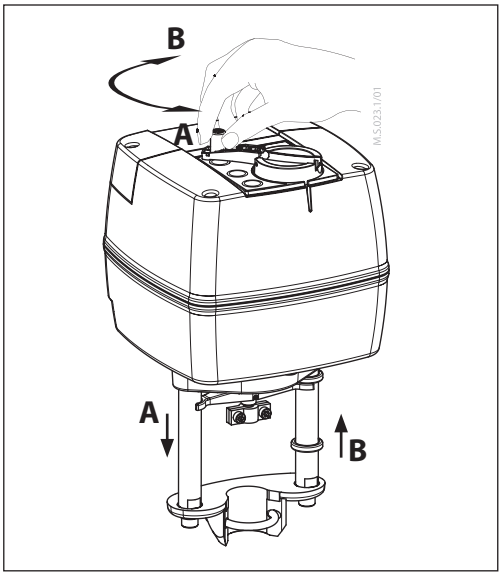
Manual operation

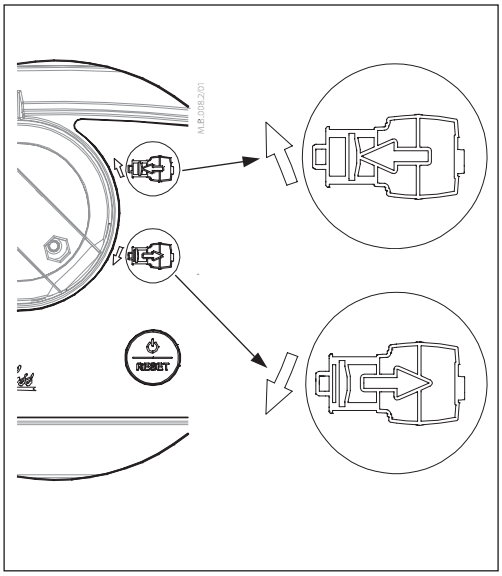
Mechanical and electrical operation are not allowed to be used at the same time!

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	×	✓

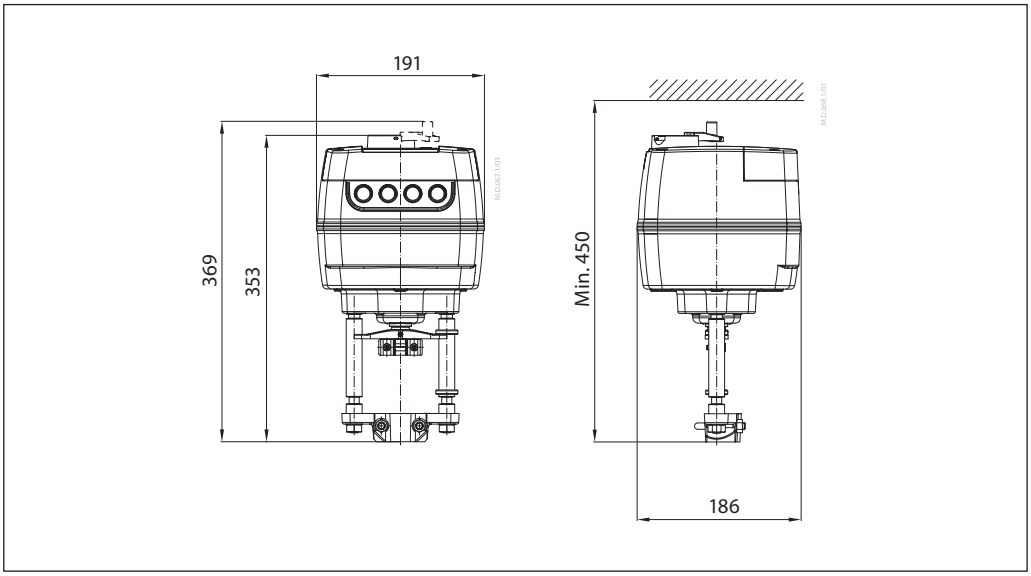




Mechanical manual operation
Actuators AME 655/658 have a knob & crank on the top of the housing which enables manual positioning of the actuator.
Use Mechanical manual operation only when the power is disconnected.

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



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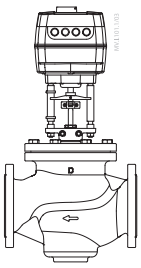
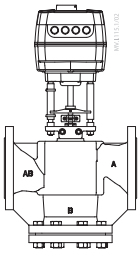
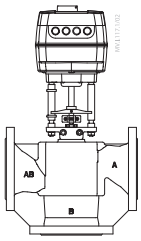
Actuator – valve combinations



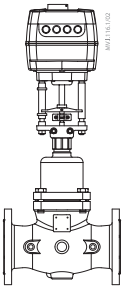
AME 65x +
VFM 2



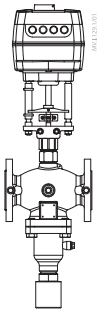
AME 65x +
VF 2 (DN 100-150)
VL 2 (DN 100)
VFS 2 (DN 65-100)



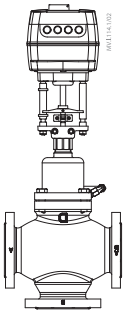
AME 65x +
VF 3 (DN 100-150)
VL 3 (DN 100)



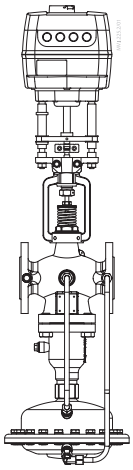
AME 65x +
VFG(S) 2 +
adapter:
065B3527 *(DN 15-250)*



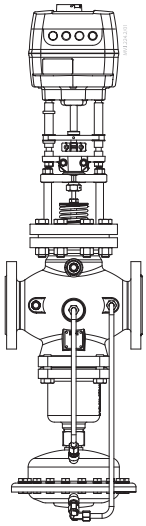
AME 65x +
VFU +
adapter:
065B3527 *(DN 15-125)*



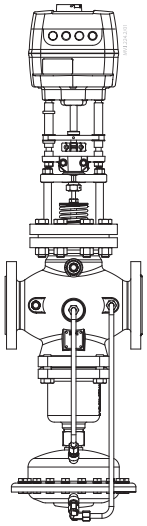
AME 65x +
VFG 3 +
adapter:
065B3527 *(DN 25-125)*



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.*

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