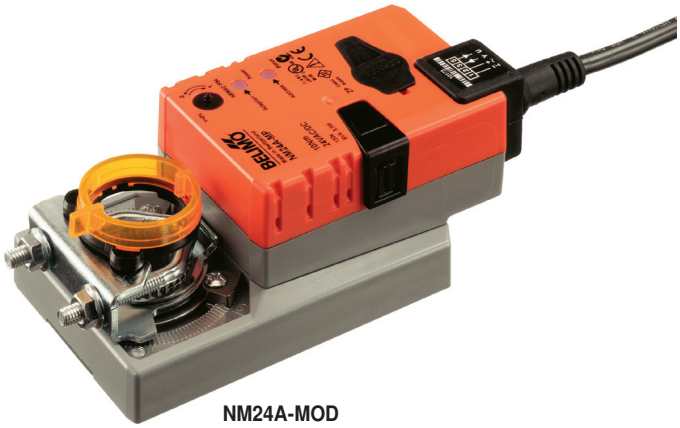
**Damper actuator for Modbus for adjusting air dampers in ventilation and air conditioning systems in buildings**

- **Torque 10 Nm**
- **Nominal voltage AC/DC 24V**
- **Communication via Modbus RTU (RS-485)**
- **Conversion of sensor signals**
- **NM24A-MOD with cable NM24A-MOD-J6 with socket**



**NM24A-MOD**

## Technical data

| **Electrical data** | | |
|---|---|---|
| Nominal voltage | AC 24V, 50/60 Hz / DC 24V | |
| Nominal voltage range | AC 19.2 ... 28.8V / DC 21.6 ... 28.8V | |
| Power consumption In operation | 3.5 W @ nominal torque | |
| At rest | 1.3 W | |
| For wire sizing | 6 VA | |
| Connection NM24A-MOD | Cable 1 m, 6 x 0.75 mm² | |
| NM24A-MOD-J6 | RJ12 socket | |

| **Data for Modbus** | | |
|---|---|---|
| Protocol | Modbus RTU (RS-485), not galvanically isolated | |
| Number of nodes | Max. 32 (without repeater) | |
| Transmission formats | 1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1<br>Default: 1-8-N-2 (start bits, data bits, parity, stop bits) | |
| Baud rates | 9 600, 19 200, 38 400, 76 800, 115 200 Bd<br>Default: 38 400 Bd | |
| Scheduling | 120 Ω, can be switched | |
| Parameterisation | With the service tool ZTH-GEN,<br>push-button-operated fast addressing 1 ... 16 possible | |

| **Functional data** | **Factory settings** | **Variable** | **Setting** |
|---|---|---|---|
| Torque (nominal torque) | Min. 10 Nm @ nominal voltage | 25%, 50%, 75% reduced | ..... |
| Position accuracy | ±5% | | |
| Direction of rotation | As an option with switch 0 / 1 | | |
| Direction of motion at Y = 0% | At switch position 0 ↶ or 1 ↷ | Electronically reversible | ..... |
| Manual override | Gearing latch disengaged with push-button, can be locked | | |
| Angle of rotation | Max. 95°∢, can be limited at both ends with adjustable mechanical end stops | | |
| Running time | 150 s / 90°∢ | 43 ... 173 s | ..... |
| Automatic adjustment of running time, control and feedback to match the mechanical angle of rotation | Manual triggering of the adaption by pressing the «Adaption» button or with the PC tool | Automatic adaption whenever the supply voltage is switched on, or manual triggering | ..... |
| Override controls, controllable via Modbus | MAX (maximum position) = 100%<br>MIN (minimum position) = 0% | MAX = (MIN + 30°∢) ... 100%<br>MIN = 0% ... (MAX – 30°∢) | ..... |
| Sound power level | max. 35 dB(A) | With a running time of 43 s = 45 dB(A)<br>173 s = 35 dB(A) | |
| Position indication | mechanical, pluggable | | |

| **Safety** | |
|---|---|
| Protection class | **III** Safety extra-low voltage |
| Degree of protection | IP54 in any mounting position<br>(for NM24A-MOD-J6 only with extra protective sleeve) |
| EMC | CE according to 2004/108/EC |

## Technical data *(continued)*

| | |
|---|---|
| Principle of operation | Type 1 (according to EN 60730-1) |
| Rated current voltage | 0.8 kV (according to EN 60730-1) |
| Control pollution degree | 3 (according to EN 60730-1) |
| Ambient temperature | –30 ... +50°C |
| Non-operating temperature | –40 ... +80°C |
| Ambient humidity | 95% r.h., non-condensing (according to EN 60730-1) |
| Maintenance | Maintenance-free |
| **Dimensions / Weight** | |
| Dimensions | See «Dimensions» on page 8 |
| Weight | Approx. 830 g |

## Safety notes

- **The actuator must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.**
- **It may only be installed by suitably trained personnel. Any legal regulations or regulations issued by authorities must be observed during installation.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The cable must not be removed from the device.**
- **When calculating the required torque, the specifications supplied by the damper manufacturers (cross-section, design, installation site), and the air flow conditions must be observed.**
- **The device contains electrical and electronic components and is not permitted to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

## Product features

**Principle of operation**
The actuator is fitted with an integrated interface for Modbus RTU, receives its digital positioning signal from the superordinate Modbus-Master and returns the current status.

**Converter for sensors**
Connection option for a sensor (passive or active sensor or switching contact). In this way, the analogue sensor signal can be easily digitised and transferred to Modbus.

**Parameterisable actuators**
The factory settings cover the most common applications. As desired, individual parameters can be adapted for specific systems or servicing with a service tool (e.g. ZTH-GEN).
The Modbus communication parameters (address, baud rate, …) are set with the ZTH-GEN.
Pressing push-button 3 while connecting the supply voltage resets the communication parameters to the factory setting.
Quick addressing: The Modbus address can alternatively be set using push-buttons from 1 to 16. The value selected is added to the «Basic address» parameter and results in the effective Modbus address. For example, with a basic address of 140, Modbus addresses between 141 and 156 can be parameterised using quick addressing.

**Simple direct mounting**
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

**Manual override**
Manual override with push-button possible (the gear is disengaged for as long as the button is pressed or remains locked).

**Adjustable angle of rotation**
Adjustable angle of rotation with mechanical end stops.

**High operational reliability**
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

**Home position**
When the supply voltage is switched on for the first time, i.e. at commissioning or after pressing the «gear disengagement» switch, the actuator travels to the home position.

| Pos. direction of rotation switch | Home position |
|---|---|
| 0 / 1: Y = 0 | ccw: Left stop |
| Y = 0 | cw: Right stop |

The actuator then moves into the position defined by Modbus-Master.

## Modbus overview

**Register**

| | No. | Adr | Register |
|---|---|---|---|
| In operation | 1 | 0 | **Setpoint [%]** |
| | 2 | 1 | **Override control** |
| | 3 | 2 | **Command** |
| | 4 | 3 | Actuator type |
| | 5 | 4 | Relative position [%] |
| | 6 | 5 | Absolute position [°] [mm] |
| | 7 | 6 | Relative volumetric flow [%]<br>(only for VAV/EPIV) |
| | 8 | 7 | Absolute volumetric flow (pressure) [$m^3/h$] [l/min] [Pa]<br>(only for VAV/EPIV) |
| | 9 | 8 | Sensor value [mv] [Ω] [–] |
| Service | 101 | 100 | Series number 1st part |
| | 102 | 101 | Series number 2nd part |
| | 103 | 102 | Series number 4th part |
| | 104 | 103 | Firmware version (Modbus module) |
| | 105 | 104 | Malfunction and service information |
| | 106 | 105 | **Min [%]** |
| | 107 | 106 | **Max [%]** |
| | 108 | 107 | **Sensor type** |
| | 109 | 108 | **Bus fail position** |

- Registers in Bold can be written
- Registers <100 (In operation) which can be written are volatile and should therefore be updated periodically
- Registers >100 which can be written are non-volatile

**Commands**

All data is arranged in a table and addressed by 1..n (register) or 0..n-1 (address). No distinction is made between data types (Discrete Inputs, Coils, Input Registers, Holding Registers). As a consequence, all data can be accessed with the two commands for Holding Register. The commands for Discrete Inputs and Input Registers can be used as an alternative.

Standard commands:
Read Holding Registers [3]
Write Single Register [6]

Optional commands:
Read Discrete Inputs [2]
Read Input Registers [4]
Write Multiple Registers [16]

**Note regarding Read Discrete Inputs**
The command reads one or more bits and can alternatively be used for register 105 (Malfunction and service information). The start address to be used is 1664.

## Modbus register description

**Register 1: Setpoint**

Setpoint for actuator setting or volumetric flow in hundredths of one percent,
i.e. 0…10 000 corresponds to 0…100%

**Register 2: Override control**

Overriding the setpoint with defined values

| Override control | |
|---|---|
| 0 | None |
| 1 | Open |
| 2 | Close |
| 3 | Min |
| 5 | Max |

**Register 3: Command**

Initiation of actuator functions for service and test; the register is reset automatically.

| Command | |
|---|---|
| 0 | None |
| 1 | Adaption |
| 2 | Test run |
| 3 | Synchronisation |
| 4 | Reset actuator malfunctions |

**Register 4: Actuator type**

Actuator type; the allocation may deviate from the basic category with some actuators.

| Actuator type | |
|---|---|
| 0 | Actuator not connected / not known |
| 1 | Air/water actuators with/without safety function |
| 2 | Volumetric flow controller VAV / EPIV |
| 3 | Fire damper actuator |

**Register 5: Relative position**

Relative position in hundredths of one percent,
i.e. 0 … 10 000 correspond to 0 … 100%

**Register 6: Absolute position**

Absolute position
0 … 10 000 (65535 if not supported by the actuator)
The unit depends on the device:
[°] for actuators with rotary movement
[mm] for actuators with linear movement

**Register 7: Relative volumetric flow**

Relative volumetric flow in hundredths of one percent of Vnom,
i.e. 0 … 10 000 correspond to 0 … 100%
This value is available only for VAV controllers and EPIV devices (actuator type: 2).
For all other types, 65535 will be entered.

**Register 8: Absolute volumetric flow**

Absolute volumetric flow
This value is available only for VAV controllers and EPIV devices (actuator type: 2).
For all other types, 65535 will be entered.
The unit depends on the device:
[$m^3/h$] for VAV controllers (or [Pa] for pressure applications)
[l/min] for EPIV devices

**Register 9: Sensor value**

Current sensor value; dependent on the setting in Register 108
The unit depends on the sensor type: [mv] [Ω] [-]

**Register 101, 103: Series number**

Each MP node has an unambiguous series number which is either impressed on or glued to the node. The series number consists of 4 segments, although only parts 1, 2 and 4 are displayed on Modbus.
Example: 00839-31324-064-008

| Register 9 | Register 10 | Register 11 |
|---|---|---|
| 1st part | 2nd part | 4th part |
| 00839 | 31234 | 008 |

**Register 104: Firmware Version**

Firmware version of Modbus module (VX.XX)
e.g. 101 V1.01

## Modbus register description *(continued)*

**Register 105: Malfunction and service information**

The status information is split into messages about the actuator (malfunctions) and other service information.

| | Bit | Description |
|---|---|---|
| **Malfunctions** (low byte) | 0 | Excessive utilisation |
| | 1 | Mechanical travel increased |
| | 2 | Mechanical overload |
| | 3 | – |
| | 4 | Safety-relevant faults (fire protection only) |
| | 5 | Damper test error (fire protection only) |
| | 6 | Duct temperature too high (fire protection only) |
| | 7 | Smoke detector tripped (fire protection only) |
| **Service** (high byte) | 8 | Internal activity (test run, adaption, …) |
| | 9 | Gear disengagement active |
| | 10 | Bus watchdog triggered |
| | 11 | – |
| | 12 | – |
| | 13 | – |
| | 14 | – |
| | 15 | – |

The malfunction bits can be reset with Register 3 (command 4) or with the Belimo PC-Tool. Malfunctions 0 and 4 cannot be reset.

**Register 106: Min / Vmin setting**

Minimum limit (position or volumetric flow) in hundredths of one percent, i.e. 0…10 000 correspond to 0…100%
Caution: Changing the setting may result in malfunctions.

**Register 107: Max / Vmax setting**

Maximum limit (position or volumetric flow) in hundredths of one percent, i.e. 2000…10 000 correspond to 20…100%
Caution: Changing the setting may result in malfunctions.

**Register 108: Sensor type**

Sensor type connected to the actuator; in the absence of sensor specification, the switching at the Y input will have the effect of a local compulsion.

| Sensor type | |
|---|---|
| 0 | None |
| 1 | Active sensor (mV) |
| 2 | Passive sensor 1 k (Ω) |
| 3 | Passive sensor 1 … 20 k (Ω) |
| 4 | Switching contact (0 / 1) |

**Note**
After changing the sensor type, the actuator must always be restarted in order for correct sensor values to be read out.

**Register 109: Bus fail position**

Modbus communication is not monitored as standard. In the event of a breakdown in communication, the actuator retains the current setpoint.
The bus monitoring controls the Modbus communication. If neither the setpoint (Register 1) nor the override control (Register 2) is renewed within 120 seconds, the actuator controls to the bus fail position (closed / open).
Triggered bus monitoring is indicated in Register 105.

| Bus fail position | |
|---|---|
| 0 | Last setpoint (no bus monitoring) |
| 1 | Fast close if time is exceeded |
| 2 | Fast open if time is exceeded |

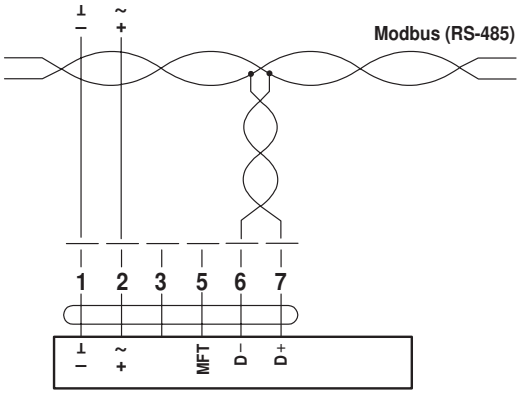
## Electrical installation

### Connection diagram for cable layout

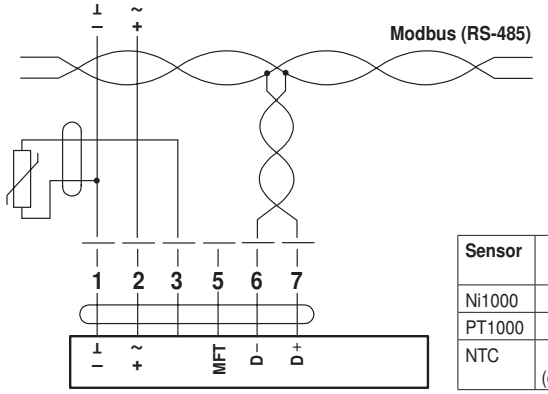
**Note**
Connection via safety isolating transformer.

**Note**
Modbus signal assignment:
$C_1$ = D– = A
$C_2$ = D+ = B
Power supply and communication are not galvanically isolated.
Interconnect ground signal of the devices.

### Connection without sensor

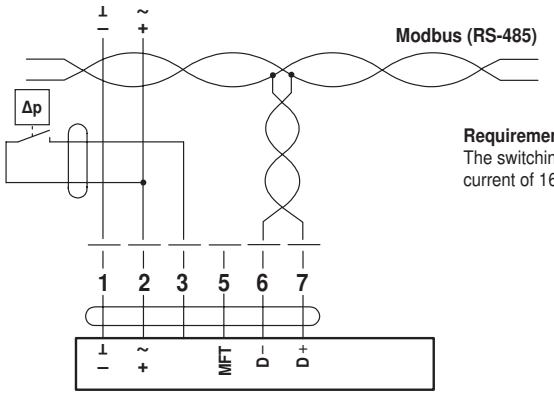



### Connection with passive sensor, e.g. Pt1000, Ni1000, NTC



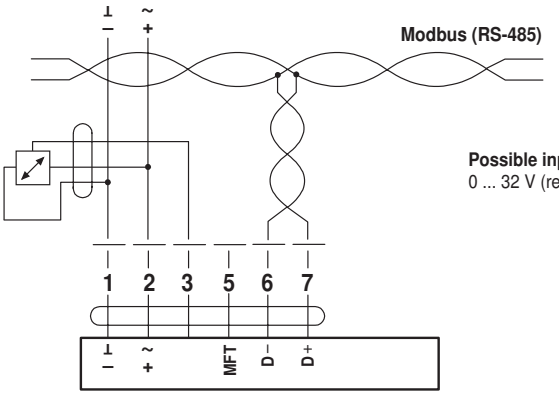

| Sensor | Temperature range | Resistance range | Resolution |
|---|---|---|---|
| Ni1000 | –28 ... +98°C | 850 ... 1600 Ω | 1 Ω |
| PT1000 | –35 ... +155°C | 850 ... 1600 Ω | 1 Ω |
| NTC | –10 ... +160°C (depending on type) | 200 ... 50 kΩ | 1 Ω |

### Connection with switching contact, e.g. Δp-monitor




**Requirements for switching contact:**
The switching contact must be able to accurately switch a current of 16 mA at 24 V.

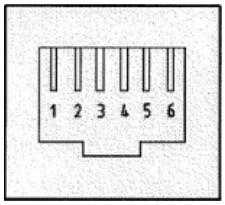
### Connection with active sensor, e.g. 0 ... 10 V @ 0 ... 50°C




**Possible input voltage range:**
0 ... 32 V (resolution 30 mV)

## Electrical installation *(continued)*

**RJ12 socket**



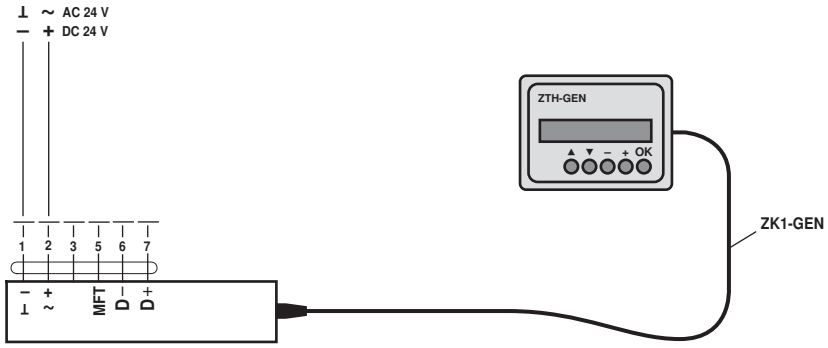

**Connection assignment:**
Pin 1: AC/DC 24V
Pin 2: GND
Pin 3: D– (A)
Pin 4: D+ (B)
Pin 5: AC/DC 24V
Pin 6: GND

**Modbus signal assignment:**
$C_1$ = D– = A
$C_2$ = D+ = B

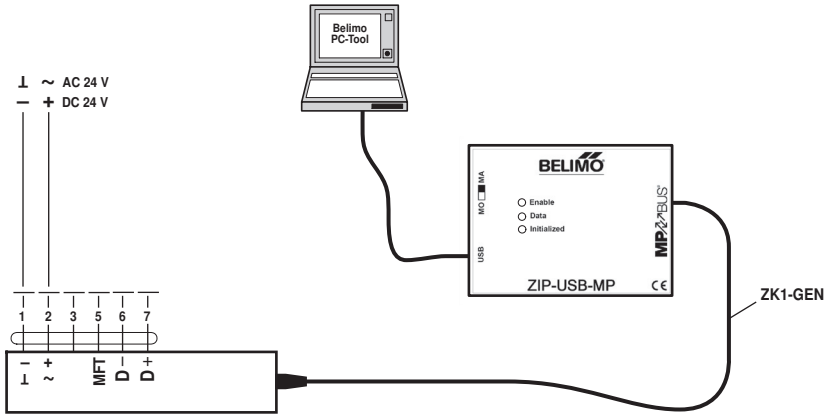
**Notes**
- Always fit feed pins in pairs!
- Only attach and remove connection cable when de-energised!

## Parameterisation

**ZTH-GEN**

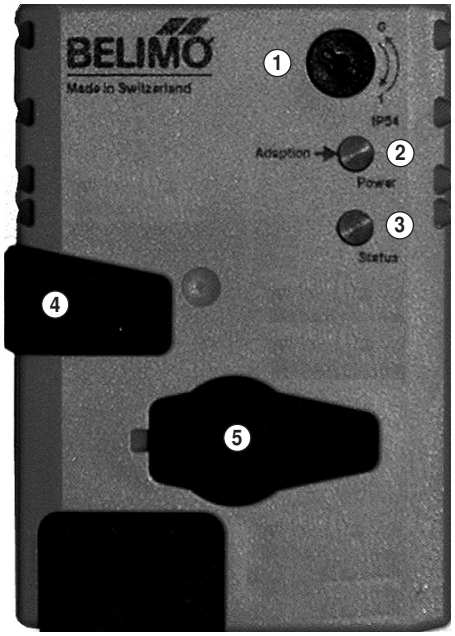



**PC tool**




**Note**
The actuator can be triggered with the PC tool under «PP».

## Operating controls and indicators




**① Direction of rotation switch**
Switching over: Direction of rotation changes

**② Push-button and LED display green**
Off: No power supply or fault
Illuminated: In operation
Flashing: Address mode: pulses according to set address (1 ... 16) when starting: reset to factory setting (communication)
Press button: in standard mode: switches on angle of rotation adaptation
in address mode: confirmation of set address (1 ... 16)

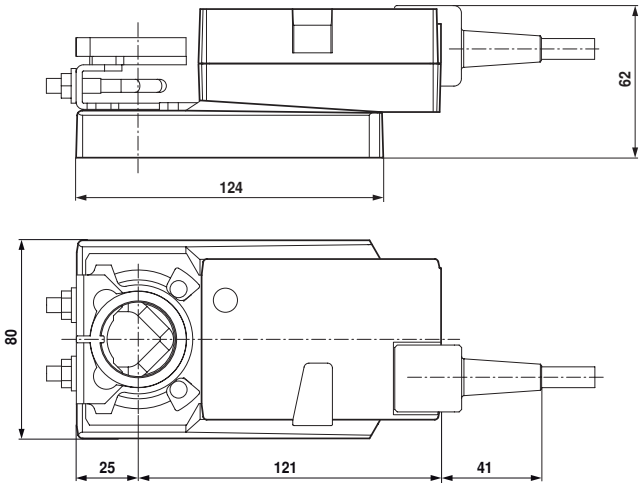
**③ Push-button and LED display yellow**
Off: The actuator is ready
Illuminated: Adaption or synchronising process active
or actuator in address mode (green LED indicator flashing)
Flickering: Modbus communication active
Press button: in operation (>3 s): switch address mode on and off
in address mode: address setting by pressing several times
when starting (>5 s): reset to factory setting (communication)

**④ Gear disengagement button**
Press button: Gear disengaged, motor stops, manual override possible
Release button: Gear engaged, synchronisation starts, followed by standard operation

**⑤ Service plug**
For connecting parameterising and service tools

## Dimensions [mm]

### Dimensional drawings




| Damper spindle | Length | ⌀ | □ | ◇ |
|---|---|---|---|---|
| | ≥40 | 8 ... 26.7 | ≥8 | ≤26.7 |
| * | ≥20 | 8 ... 20 | ≥8 | ≤20 |

* Option (Accessory K-NA)

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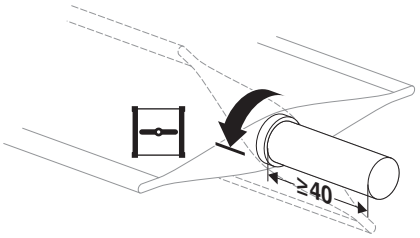
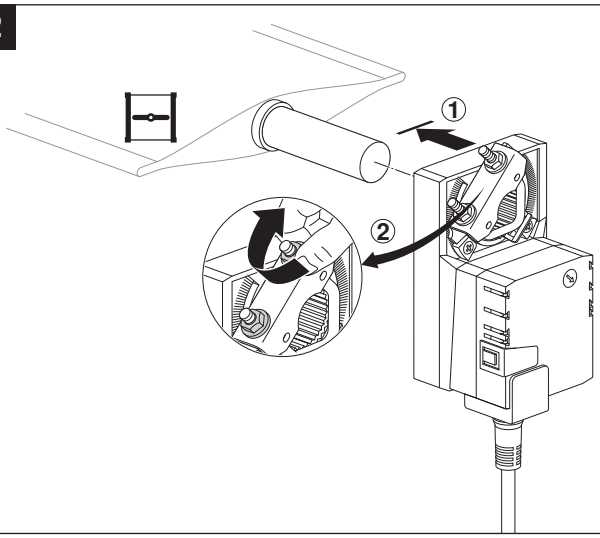
**1**

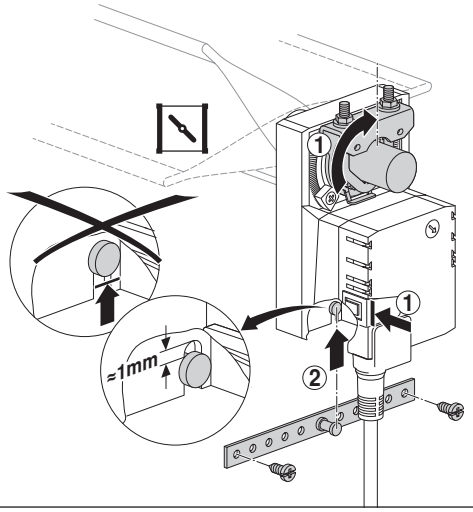



| | | |
|---|---|---|
| 8 ... 26.7 | ≥8 | ≤26.7 |

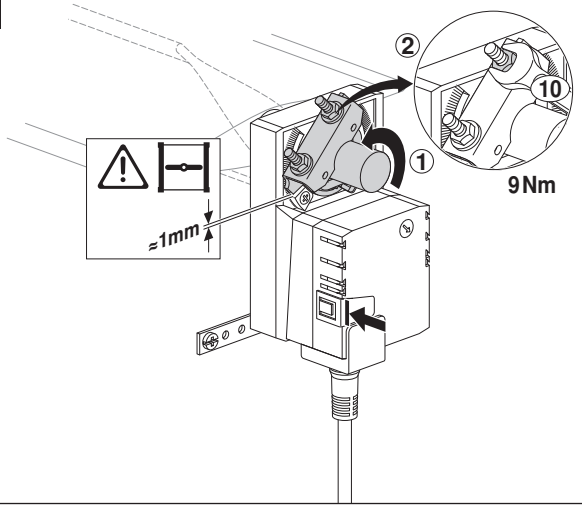
**2**



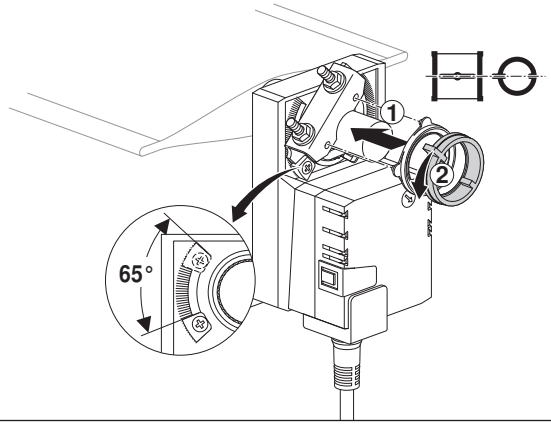

**3**

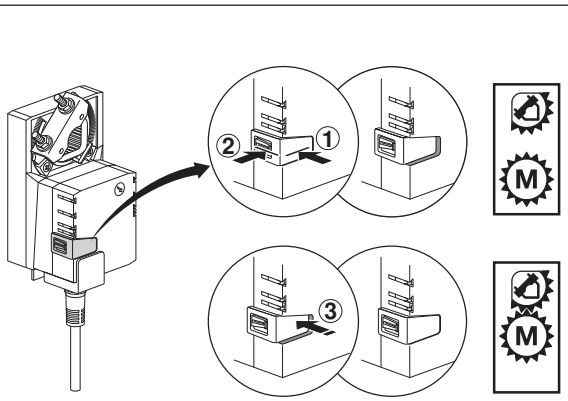



**4**

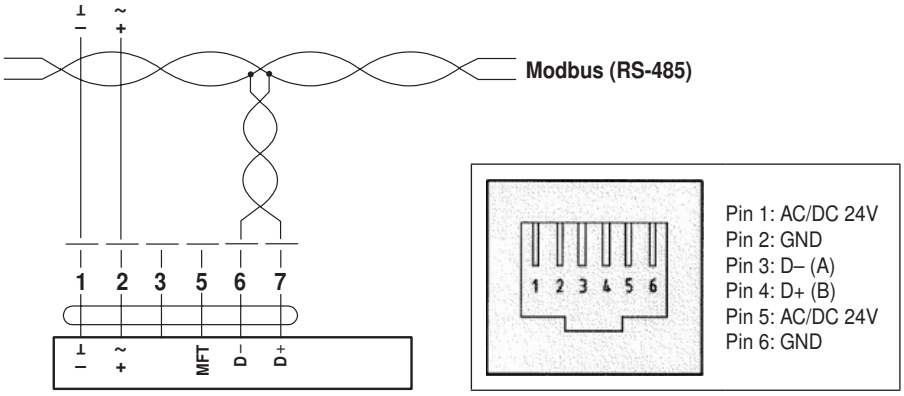



**5**

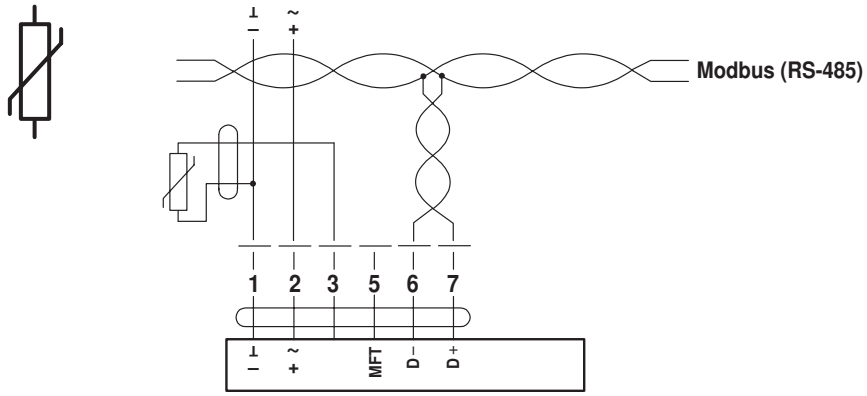


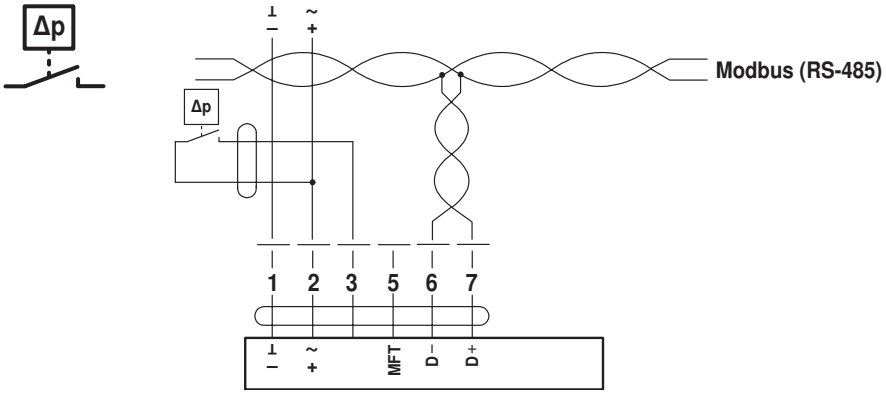
**AC 24 V / DC 24 V**




**AC 24 V / DC 24 V**




**AC 24 V / DC 24 V**




**AC 24 V / DC 24 V**