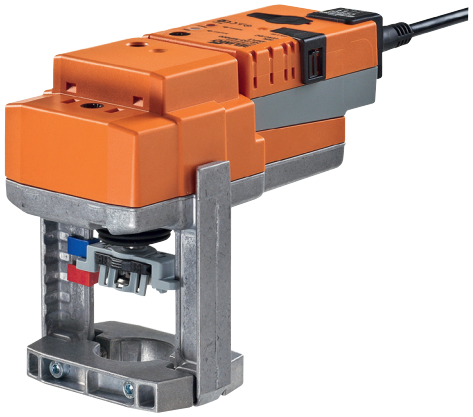
BELIMO

# Technical data sheet NV24A-MOD

**Communication-capable globe valve actuator for 2-way and 3-way globe valves**

- **Actuating force 1000 N**
- **Nominal voltage AC/DC 24 V**
- **Nominal stroke 20 mm**
- **Communication via Modbus RTU (RS-485)**
- **Conversion of sensor signals**



Modbus

## Technical data

| | | |
|---|---|---|
| **Electrical data** | Nominal voltage | AC/DC 24 V |
| | Nominal voltage frequency | 50/60 Hz |
| | Nominal voltage range | AC 19.2...28.8 V / DC 21.6...28.8 V |
| | Power consumption in operation | 1.5 W |
| | Power consumption at rest | 0.5 W |
| | Power consumption for wire sizing | 3 VA |
| | Connection supply / control | Cable 1 m, 6 x 0.75 mm² |
| **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 rate | 9600, 19 200, 38 400, 76 800, 115 200 Bd<br>Default: 38 400 Bd |
| | Terminating resister | 120 Ohm, can be switched |
| | Parameterisation | with service tool ZTH EU<br>Push-button-operated fast addressing 1 ... 16 possible |
| **Functional data** | Actuating force | 1000 N |
| | Position accuracy | 5% absolute |
| | Manual override | Gear disengagement with push-button, can be locked |
| | Nominal stroke | 20 mm |
| | Actuating time | 150 s / 20 mm |
| | Variable actuating time | 90...150 s / 20 mm |
| | Override control | MAX (maximum position) = 100%<br>MIN (minimum position) = 0% |
| | Sound power level motor max. | 45 dB(A) |
| | Sound power level motor note | 55 dB (A) @ 90 s running time |
| | Position indication | Mechanical 5 … 20 mm stroke |
| **Safety** | Protection class IEC/EN | III Safety extra-low voltage |
| | Degree of protection IEC/EN | IP54 |
| | EMC | CE according to 2004/108/EC |
| | Certification IEC/EN | Certified according to IEC/EN 60730-1 and IEC/EN 60730-2-14 |
| | Mode of operation | Type 1 |
| | Rated impulse voltage supply / control | 0.8 kV |
| | Control pollution degree | 3 |
| | Ambient temperature | 0...50°C |
| | Non-operating temperature | -40...80°C |
| | Ambient humidity | 95% r.h., non-condensing |
| | Maintenance | Maintenance-free |
| **Weight** | Weight approx. | 1400 kg |

## Safety notes

- This actuator has been designed for application in stationary heating, ventilation and air-conditioning systems and is not allowed to be used outside the specified field of application, especially not in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied with during installation.
- The switch for changing the direction of motion/the closing point may be adjusted only by authorised personnel. The direction of stroke is critical, particularly in connection with frost protection circuits.
- 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.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.

## Product features

**Mode 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 passed along to Modbus.

**Adjustable-parameter actuators**
The factory settings cover the most common applications. Individual parameters can be altered with the BELIMO service tool MFT-P or with the service tool ZTH EU.
The Modbus communication parameters (address, baud rate, …) are set with the ZTH EU. Pressing push-button 3 while connecting the supply voltage resets the communication parameters to the factory setting.
Fast addressing: Alternatively, the Modbus address can be set with the buttons in area 1 to 16. The value selected is added to the "Basic address" parameter and produces the effective Modbus address. With a basic address of 140, for example, the parameters for Modbus addresses between 141 and 156 can be set using fast addressing.

**Direct mounting**
Simple direct mounting on the globe valve by means of form-fit hollow clamping jaws. The actuator can be rotated by 360° on the valve neck.

**Manual override**
Manual override with push-button possible - temporary, permanently. The gear is disengaged and the actuator decoupled for as long as the button is pressed / latched. The stroke can be adjusted by using a hexagon socket screw key (4 mm), which is inserted into the top of the actuator. The stroke spindle extends when the key is rotated clockwise.

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

**Combination valve/actuator**
Refer to the valve documentation for suitable valves, their permitted medium temperatures and closing pressures.

**Position indication**
The stroke is indicated mechanically on the bracket with tabs. The stroke range adjusts itself automatically during operation.

**Home position**
Setting ex-works: Actuator spindle is retracted.
When valve-actuator combinations are shipped, the direction of motion is set in accordance with the closing point of the valve.

**Direction of stroke switch**
When actuated, the direction of stroke switch changes the running direction in normal operation.

**Adaptation of stroke range**
The first time the supply voltage is switched on, i.e. at the time of commissioning, the actuator carries out a stroke adaptation, which is when the operating range and position feedback adjust themselves to the mechanical stroke.
Manual triggering of the adaptation can be carried out by pressing the "Adaptation" button or with the PC-Tool.

## Modbus overview

**Register**

| | No. | Adr | Register |
|---|---|---|---|
| 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) [m³/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 non-permanent and should therefore be updated periodically
- Registers >100 which can be written are not non-permanent

**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 compulsions

| 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 | Adaptation |
| 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 device has an unambiguous series number which is either impressed on or glued to the housing. 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

**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 | Utilisation too high |
| | 1 | Actuation path increased |
| | 2 | Mechanical overload |
| | 3 | – |
| | 4 | Safety-relevant malfunction (fire protection only) |
| | 5 | Damper mobility fault (fire protection only) |
| | 6 | Channel temperature too high (fire protection only) |
| | 7 | Smoke detector tripped (fire protection only) |
| **Service** (high byte) | 8 | Internal activity (test run, adaptation, …) |
| | 9 | Gear disengagement active |
| | 10 | Bus monitoring 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**

Minimum 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 | Rapid close if time is exceeded |
| 2 | Rapid open if time is exceeded |

## Accessories

| | Description | Type |
|---|---|---|
| Service tools | Service tool, for MF/MP/Modbus/LonWorks actuators and VAV controllers | ZTH EU |
| | Belimo PC-Tool, software for adjustments and diagnostics | MFT-P |

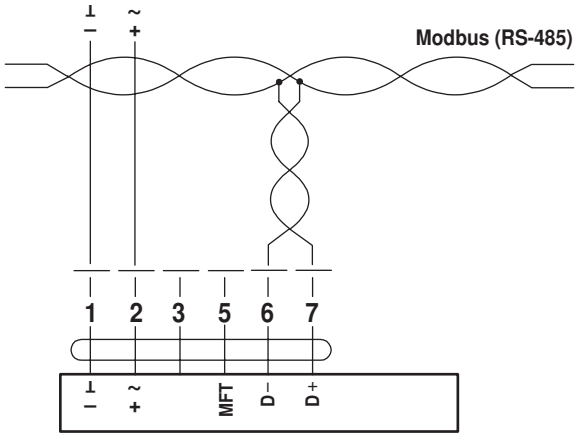
## Electrical installation

**Notes**

- Connection via safety isolating transformer.
- Direction of stroke switch factory setting: Actuator spindle retracted.

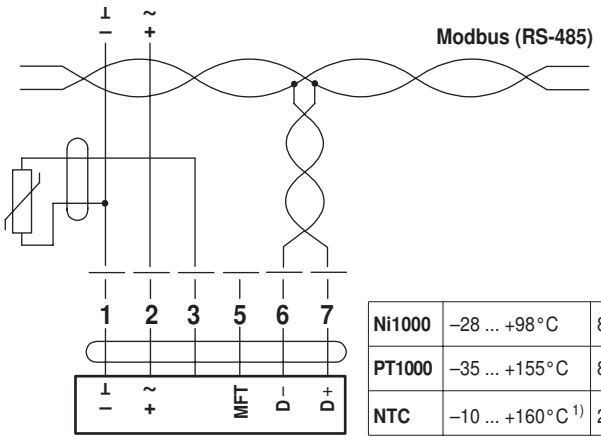
### Wiring diagrams

#### Connection without sensor




**Note**
Modbus signal assignment:
$C_1$ = D- = A
$C_2$ = D+= B
Communication and supply are not galvanically isolated.
Connect earth signal for devices with one another.

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

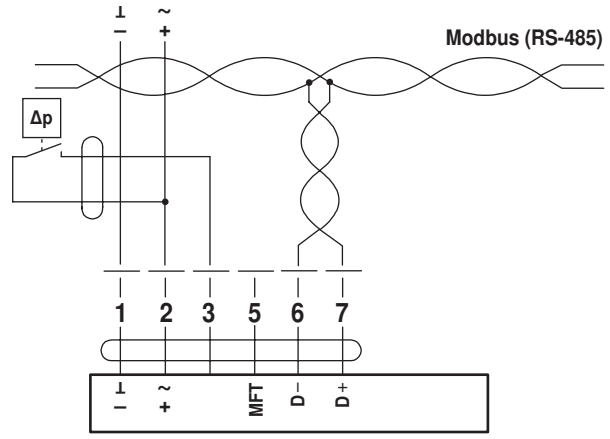



| | | |
|---|---|---|
| Ni1000 | –28 ... +98°C | 850 ... 1600 Ω 2) |
| PT1000 | –35 ... +155°C | 850 ... 1600 Ω 2) |
| NTC | –10 ... +160°C 1) | 200 Ω ... 50 kΩ 2) |

1) Depe nding on type
2) Resolution 1 Ohm

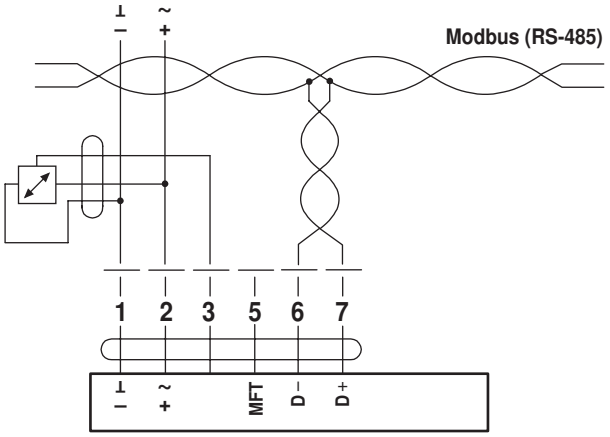
## Electrical installation

### Connection with switching contact, e.g. pressure control device



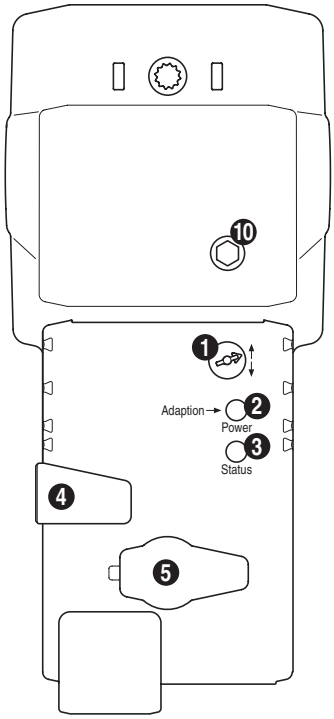

Switching contact requirements:
The switching contact must be able to switch a current of 16 mA at 24V accurately.

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




Possible vol tage range:
0 ... 32 V (resolution 30 mV)

## Operating controls and indicators




**① Direction of stroke switch**

| | |
|---|---|
| Switching: | Direction of stroke changes |

**② Push-button and LED display green**

| | |
|---|---|
| Off: | No power supply or malfunction |
| Illuminated: | In operation |
| Flashing: | Address mode: Pulse according to set address (1…16) |
| | When starting: Reset to factory setting (communication) |
| Press button: | In standard mode: Triggers stroke adaption |
| | In address mode: Confirmation of set address (1…16) |

**③ Push-button and LED display yellow**

| | |
|---|---|
| Off: | Standard mode |
| Illuminated: | Adaptation procedure active |
| | Or: Actuator in address mode (LED display green flashing) |
| Flickering: | Modbus communication active |
| Press button: | In operation (>3s): Activate and deactivate address mode |
| | In address mode: Address setting by pressing several times |
| | When starting (>5s): Reset to factory setting (communication) |

**④ Gear disengagement button**

| | |
|---|---|
| Press button: | Gear disengages, motor stops, manual override possible |
| Release button: | Gear engages, standard mode |

**⑤ Service plug**

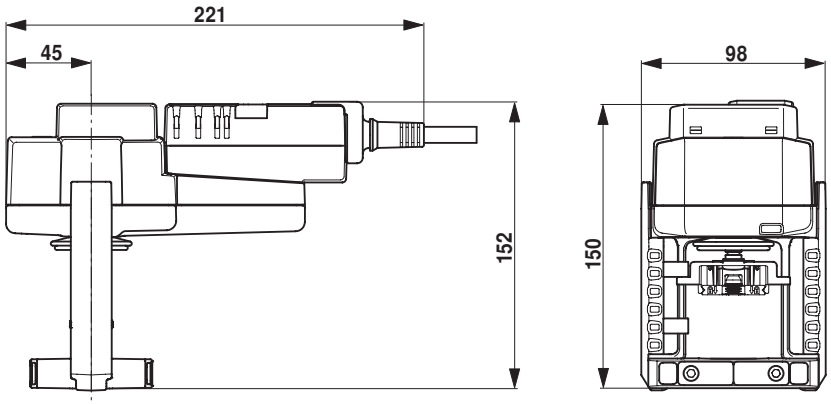
For connecting the parameterisation and service tools

**⑩ Manual override**

| | |
|---|---|
| Clockwise: | Actuator spindle extends |
| Counterclockwise: | Actuator spindle retracts |

## Dimensions [mm]

### Dimensional diagrams




## Further documentation

- Data sheets for globe valves
- Installation instructions for actuators and/or globe valves, respectively
- Notes for project planning for 2- and 3-way globe valves (hydraulic characteristic curves and circuits, installation instructions, commissioning, maintenance, etc.)
- Overview "Valve-actuator combinations"