

Data sheet

NovoCon® S, M, L and XL Digital actuators



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Description

NovoCon® S

NovoCon® S is a high accuracy multi-functional field bus actuator, specifically designed for use in combination with the Pressure Independent Control Valve type AB-QM in sizes from DN 10-32.

The flow is modulated by the AB-QM pressure independent control valve to avoid overflow and reduced boiler and/or chiller efficiency.

The actuator with AB-QM is used to control water supply to fan coil units, chilled beams, induction units, small re-heaters, re-coolers, AHU's and other terminal units for zone control, in which heating/chilled water is the controlled medium. Due to its accuracy, remote functionality and flow indication features, this product facilitates an accelerated commissioning process, allows easy maintenance, improves indoor comfort, increases energy savings and allows for fair cost allocation of heat/cool energy.

The high position accuracy of the actuator, together with the pressure independent and linear characteristic of the AB-QM valve, allow NovoCon® S to be used as a flow indicator. Setup of the actuator and valve parameters are made via fieldbus. Control is achieved via field bus or via analog inputs to NovoCon® S.

Typical applications are:

- Radiant ceiling panels, supplied by 4 pipes (Heating supply and return and cooling supply and return).
- Fan coil units, with single coils supplied by 4 pipes (Heating supply and return and cooling supply and return).

General features:

- Remote commissioning/Pre-set/Flush features
- Flow, power emission and energy indication
- High position resolution and accuracy
- Energy management algorithms
- 4/2-pipe changeover applications
- I/O applications
- LED bar displaying status and alarms
- No tools required for mounting
- Maintenance-free lifetime
- Self-positioning process
- Low-noise operation
- Plug-in halogen free cables
- Auto MAC addressing for BACnet
- Auto baud rate detection
- Intrinsic alarm reporting for BACnet
- Valve blockage alarm
- Broken wire detection on analog control (NovoCon S) and ground signal (NovoCon M-XL)
- Choice of BACnet MS/TP or Modbus RTU in the same product
- Mis-wiring protection on any wire up to 30 V

Combined with the Actuator NovoCon® ChangeOver®, NovoCon® S offers a unique solution in controlling both the AB-QM valve and a 6-port motorised ball valve that performs a diverting function between two water circuits in 4-pipe changeover systems.

This diverting function, primarily used for radiant panels, also allows the cooling and heating capacity of a fan coil unit to be increased for the same compact size compared to a double coil model where the heating and cooling water circuits each have their own coil.

The 6-port diverting valve and actuator work in combination with an AB-QM PIBCV valve and NovoCon® S bus actuator. The AB-QM balances the flow and the NovoCon® S bus actuator controls the flow. NovoCon® S also controls the 6-port diverting valve actuator which switches between heating and cooling. This unique functionality is characterized by the following:

- There is only one single field bus and power supply connection cable to the NovoCon® S actuator. This powers both the NovoCon® S and controls the 6-port actuator. Furthermore, there is feedback from the 6-port actuator to NovoCon® S.
- The NovoCon® S actuator automatically fault-detects, by means of comparing 0-10V control & feedback signals, if the 6-port actuator is in manual operation mode, removed from the valve or if the 6-port valve is blocked.
- The NovoCon® S actuator has two Design Flow Rate pre-settings: one for heating and another for cooling.
- The NovoCon® S actuator indicates power emission and logs energy consumption for heating and cooling energy based on flow, supply and return pipe temperature measurement.
- While in maintenance mode, the 6-port actuator is able to fully close the valve and prevent any leakage, thereby saving on stop valves.
- Logic contained within the NovoCon® S actuator, ensures that only one actuator in each pair (NovoCon® S and 6-port valve actuator) drives. This ensures that 2 actuators in the pair never drive at the same time. This reduces voltage booster demands in daisy chains.
- The NovoCon® S actuator detects if the 6-port actuator cable is disconnected. If this is the case an alarm is initiated.

Features CO6:

- NovoCon® S + ChangeOver® actuator represents only ONE device on the fieldbus network needing no physical I/O
- No cross-flow between heating and cooling
- Simple connection and control
- Feedback for position status and alarms
- Quiet and reliable operation
- Maintenance free
- Teflon seal and polished chrome valve ball to prevent valve sticking
- Blocked valve alarm
- Manual override



Description (continued)

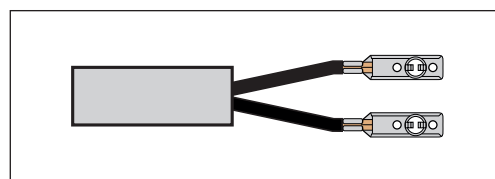
NovoCon® S (continued)

Features Energy:

- Supply and return temperature measurement
- Power emission indication reading
- Energy management functionality for both heating and cooling e.g. minimum delta T management
- Energy logging of both heating and cooling

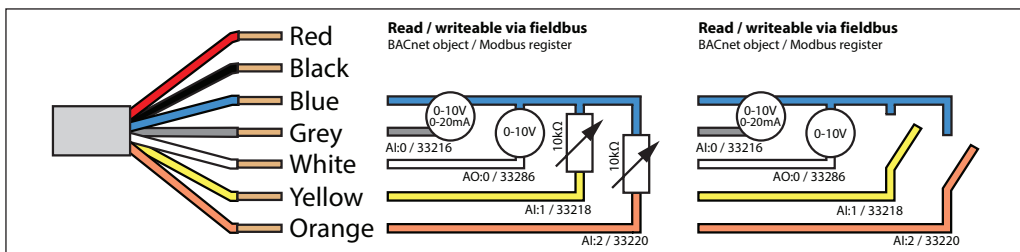
Features I/O:

- Connect to other devices and present them on the field bus, e.g. room thermostat, window contact, CO2 sensor, humidity sensors, fan control, 0-10V actuator etc.
- Select temperature units, Ohms or use as



potential free contacts. Closed circuit <math><900\Omega</math>, open circuit 100k $\Omega</math>.$

- Available connections: 1 x analog output (V), 1 x analog input (V/mA) and 2 x resistance based inputs ($^{\circ}\text{C}/^{\circ}\text{F}/\text{Ohms}$)



NovoCon® M

NovoCon® M is a high accuracy multi-functional fieldbus actuator, specifically designed for use in combination with the Pressure Independent Control Valve type AB-QM NovoCon® in sizes from DN 40-100 used in air handling units AHU, chillers and distribution station applications. The high position accuracy of the actuator, together with the pressure independent and linear characteristic of the AB-QM valve, allow NovoCon® M to be used as a flow indicator. Setup of the actuator and valve parameters are made via fieldbus. Control is achieved via fieldbus or via analog inputs to NovoCon® M.

General features:

- Remote commissioning/Pre-set/Flush features
- Flow, power emission and energy indication
- High position resolution and accuracy
- Energy management algorithms
- Inputs/Outputs
 - 3x Resistance Inputs (Pt1000, PT500, PT100, NTC 10k Type 2 & 3)
 - 1x Analog Input (0-10V or 0/4-20mA),
 - 1x Analog Output (0-10V)
- LED displaying status and alarms
- No tools required for mounting on valve
- Maintenance-free lifetime
- Low-noise operation
- Auto MAC addressing for BACnet
- Auto baud rate detection
- Intrinsic alarm reporting for BACnet
- Valve blockage alarm
- Choice of BACnet MS/TP or Modbus RTU in the same product
- Mis-wiring protection on any wire up to 30 V

NovoCon® L, XL

NovoCon® L/XL is a high accuracy multi-functional fieldbus actuator, specifically designed for use in combination with the Pressure Independent Control Valve type AB-QM in sizes from DN 125-250 used in air handling units AHU, chillers and distribution station applications. The high position accuracy of the actuator, together with the pressure independent and linear characteristic of the AB-QM valve, allow NovoCon® L/XL to be used as a flow indicator. Setup of the actuator and valve parameters are made via fieldbus. Control is achieved via fieldbus or via analog inputs to NovoCon® L/XL.

General features:

- Remote commissioning/Pre-set/Flush features
- Flow, power emission and energy indication
- High position resolution and accuracy
- Energy management algorithms
- Inputs/Outputs
 - 3x Resistance Inputs (Pt1000, PT500, PT100, NTC 10k Type 2 & 3)
 - 1x Analog Input (0-10V or 0/4-20mA),
 - 1x Analog Output (0-10V)
- LED displaying status and alarms
- Maintenance-free lifetime
- Low-noise operation
- Auto MAC addressing for BACnet
- Auto baud rate detection
- Intrinsic alarm reporting for BACnet
- Valve blockage alarm
- Choice of BACnet MS/TP or Modbus RTU in the same product
- Mis-wiring protection on any wire up to 30 V

Ordering

NovoCon® S



| Type | Code No. |
|------------|----------|
| NovoCon® S | 003Z8504 |

Accessories



| Type | Length | Connections | Cable material | Code No. |
|-------------------------------------|--------|-----------------------|----------------|----------|
| Cable NovoCon® Digital | 1.5 m | bus / power | Halogen free | 003Z8600 |
| Cable NovoCon® Digital | 5 m | bus / power | Halogen free | 003Z8601 |
| Cable NovoCon® Digital | 10 m | bus / power | Halogen free | 003Z8602 |
| Cable NovoCon® Digital, daisy chain | 0.5 m | actuator / actuator | Halogen free | 003Z8609 |
| Cable NovoCon® Digital, daisy chain | 1.5 m | actuator / actuator | Halogen free | 003Z8603 |
| Cable NovoCon® Digital, daisy chain | 5 m | actuator / actuator | Halogen free | 003Z8604 |
| Cable NovoCon® Digital, daisy chain | 10 m | actuator / actuator | Halogen free | 003Z8605 |
| Cable NovoCon® I/O | 1.5 m | actuator / free wires | Halogen free | 003Z8612 |

Note! Cables are not included with actuator and must be ordered separately.



| | | | | |
|--------------------------------|-------------------------|--|-----|----------|
| Cable NovoCon® Energy | 1.5 m | Plug-in cable with Pt1000 surface temperature sensors | PVC | 003Z8610 |
| Cable NovoCon® Energy | 1.5 m | Plug-in cable with Pt1000 Immersed /universal temperature sensors (Ø 5,8mm) | PVC | 003Z8611 |
| Cable NovoCon® Temperature I/O | 1 m / Temp. sensor 1.5m | Plug-in cable with Pt1000 surface temperature sensors and free wires for input, output and power | PVC | 003Z8613 |

Note! If separate Pt1000 temperature sensors are needed, Danfoss has an array of Pt1000 sensors that can be used with NovoCon® S. See Danfoss Pt1000 sensors ESMT, ESM-10, ESM-11, ESMB-12, ESMC, ESMU and code no. 187F3418.

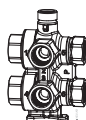


ChangeOver6 actuators

| | | | | |
|---|---------------------------|--|--------------|----------|
| Actuator NovoCon ChangeOver ⁶ | 1 m | Plug-in | Halogen free | 003Z8520 |
| Actuator NovoCon ChangeOver ⁶ Energy | 1 m Temp. sensor 1.5 m | Plug-in incl. Pt1000 surface temperature sensors | PVC | 003Z8521 |
| Actuator NovoCon ChangeOver ⁶ Flexible | 1.5 m | Actuator / open wires | Halogen free | 003Z8522 |

| Type | DN | Fire load class ¹⁾ | Code No. |
|------------------------------------|----|-------------------------------|----------|
| ChangeOver ⁶ insulation | 15 | B2 | 003Z3159 |

¹⁾ According to D/N 4102



| Type | DN | k _{vs} (m ³ /h) | Connection | Code No. |
|-------------------------------|----|-------------------------------------|------------|----------|
| ChangeOver ⁶ valve | 15 | 2.4 | Rp ½ | 003Z3150 |
| | 20 | 4.0 | Rp ¾ | 003Z3151 |

Service kit - combination with old AB-QM

| Type | Code No. |
|---|----------|
| NovoCon® adapter for AB-QM, DN 10-32 (5 pcs.) | 003Z0239 |

Accessories (Cable NovoCon® Energy)

| Type | Designation | Code No. |
|--|--|----------|
| Pockets for Cable NovoCon® Energy (003Z8611) | Immersion brass pockets, 40 mm, Ø 6.0 pair. For pipes DN25/32. | 087G6061 |

NovoCon® Configuration Tool

| Type | Length | Connections | Cable material | Code No. |
|-----------------------------------|--------|----------------|----------------------------------|----------|
| NovoCon® Configuration Tool cable | 5 m | USB / actuator | Halogen free. USB Converter, PVC | 003Z8620 |

Software available on www.novocon.com

Temperature sensors

| Type | Code No. |
|--|----------|
| Immersed Pt 1000 / f 5.2 mm / 1.5 m cable, pair, MID | 187F3418 |

Accessories

| Designation | Code No. |
|---|----------|
| Immersion brass-pockets, for 187F3418 35 mm, Ø 5.2 pair, MID. For pipes DN15-32 | 087G6053 |

Ordering (continued)

NovoCon® M

Actuator

| Type | Supply voltage | Code No. |
|------------|----------------|-----------------|
| NovoCon® M | 24V ac/dc | 003Z8540 |

Temperature sensors

| Type | Code No. |
|--|-----------------|
| Immersed Pt 1000 / Ø 5.2 mm / 1.5 m cable, pair, MID | 187F3418 |
| Immersed Pt 1000 / Ø 5.2 mm / 3.0 m cable, pair, MID | 187F3419 |

Accessories

| Designation | Code No. |
|---|-----------------|
| Immersion brass-pockets, 52 mm, Ø 5.2 pair, MID. For pipes DN40-65 | 087G6054 |
| Immersion brass-pockets, 85 mm, Ø 5.2 pair, MID. For pipes DN80-125 | 087G6055 |

Valves

| Type | Code No. |
|--------------------------------------|-----------------|
| AB-QM NovoCon DN40 PN16 3TP | 003Z1770 |
| AB-QM NovoCon DN50 PN16 3TP | 003Z1771 |
| AB-QM NovoCon DN50 PN16 - Flange 3TP | 003Z1772 |
| AB-QM NovoCon DN65 PN16 3TP | 003Z1773 |
| AB-QM NovoCon DN65 PN16 3TP HF | 003Z1793 |
| AB-QM NovoCon DN80 PN16 3TP | 003Z1774 |
| AB-QM NovoCon DN80 PN16 3TP HF | 003Z1794 |
| AB-QM NovoCon DN100 PN16 3TP | 003Z1775 |
| AB-QM NovoCon DN100 PN16 3TP HF | 003Z1795 |

Note: The above AB-QM NovoCon valves must be used with NovoCon® M.

NovoCon® Configuration Tool

| Type | Length | Connections | Cable material | Code No. |
|-----------------------------------|--------|----------------|----------------------------------|-----------------|
| NovoCon® Configuration Tool cable | 5 m | USB / actuator | Halogen free. USB Converter, PVC | 003Z8620 |

Software available on www.novocon.com

NovoCon® L, XL

Actuators

| Picture | Type | Valve type | Code No. |
|---------|---------------|-----------------|-----------------|
| | NovoCon® L | AB-QM DN125-150 | 003Z8560 |
| | NovoCon® L SU | AB-QM DN125-150 | 003Z8561 |
| | NovoCon® L SD | AB-QM DN125-150 | 003Z8562 |
| | NovoCon® XL | AB-QM DN200-250 | 003Z8563 |

Accessories

| Designation | Code No. |
|--|-----------------|
| Immersion brass-pockets, 85 mm, Ø 5.2 pair, MID. For pipes DN80-125 | 087G6055 |
| Immersion brass-pockets, 120 mm, Ø 5.2 pair, MID. For pipes DN150-200 | 087G6056 |
| Immersion stainless steel-pockets, 155mm, Ø 5.2 pair, MID. For pipes DN250 | 087G6059 |

Temperature sensors

| Type | Code No. |
|--|-----------------|
| Immersed Pt 1000 / Ø 5.2 mm / 3.0 m cable, pair, MID | 187F3419 |

NovoCon® Configuration Tool

| Type | Length | Connections | Cable material | Code No. |
|-----------------------------------|--------|----------------|----------------------------------|-----------------|
| NovoCon® Configuration Tool cable | 5 m | USB / actuator | Halogen free. USB Converter, PVC | 003Z8620 |

Software available on www.novocon.com

Cross reference table AB-QM – Flow sensor - NovoCon®:

| Valve code | Valve name | Valve connection | Actuator code | Actuator name | Flow sensor code | Flow sensor name | Flow sensor connection | NovoCon S cable | Temperature sensor code (Pt1000) | Immersion pockets code |
|------------|----------------------------------|------------------|---------------|---------------|------------------|----------------------------------|------------------------|-----------------|----------------------------------|------------------------|
| 003Z8220 | AB-QM 4.0 DN15 LF 0.2 m³/h | thread | 003Z8504 | NovoCon S | 3132976 | Sharky FS 473 DN15 Qp 0.6 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8221 | AB-QM 4.0 DN15 0.65 m³/h | thread | 003Z8504 | NovoCon S | 3132976 | Sharky FS 473 DN15 Qp 0.6 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8222 | AB-QM 4.0 DN15 HF 1.2 m³/h | thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8223 | AB-QM 4.0 DN20 1.1 m³/h | thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8224 | AB-QM 4.0 DN20 HF 1.9 m³/h | thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8320 | AB-QM 4.0 DN15 LF 0.2 m³/h | int. thread | 003Z8504 | NovoCon S | 3132976 | Sharky FS 473 DN15 Qp 0.6 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8321 | AB-QM 4.0 DN15 0.65 m³/h | int. thread | 003Z8504 | NovoCon S | 3132976 | Sharky FS 473 DN15 Qp 0.6 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8322 | AB-QM 4.0 DN15 HF 1.2 m³/h | int. thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8323 | AB-QM 4.0 DN20 1.1 m³/h | int. thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8324 | AB-QM 4.0 DN20 HF 1.9 m³/h | int. thread | 003Z8504 | NovoCon S | 3132977 | Sharky FS 473 DN15 Qp 1.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8205 | AB-QM 4.0 DN25 2.2 m³/h | thread | 003Z8504 | NovoCon S | 3132978 | Sharky FS 473 DN20 Qp 2.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8206 | AB-QM 4.0 DN25 HF 3.8 m³/h | thread | 003Z8504 | NovoCon S | 3133198 | Sharky FS 473 DN25 Qp 3.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8207 | AB-QM 4.0 DN32 3.6 m³/h | thread | 003Z8504 | NovoCon S | 3133198 | Sharky FS 473 DN25 Qp 3.5 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z8208 | AB-QM 4.0 DN32 HF 5.0 m³/h | thread | 003Z8504 | NovoCon S | 3133012 | Sharky FS 473 DN25 Qp 6.0 m³/h | thread | 003Z8613* | / | / |
| | | | | | | | | 003Z8612 | 187F3418 | 087G6053 |
| 003Z1770 | AB-QM NovoCon DN40 7.5 m³/h | thread | 003Z8540 | NovoCon M | 3132979 | Sharky FS 473 DN40 Qp 10.0 m³/h | thread | / | 187F3418 | 087G6054 |
| 003Z1771 | AB-QM NovoCon DN50 12.5 m³/h | thread | 003Z8540 | NovoCon M | 3132979 | Sharky FS 473 DN40 Qp 10.0 m³/h | thread | / | 187F3418 | 087G6054 |
| 003Z1773 | AB-QM NovoCon DN65 20.0 m³/h | flange | 003Z8540 | NovoCon M | 3132980 | Sharky FS 473 DN50 Qp 15.0 m³/h | flange | / | 187F3419 | 087G6054 |
| 003Z1793 | AB-QM NovoCon DN65 HF 25.0 m³/h | flange | 003Z8540 | NovoCon M | 3132981 | Sharky FS 473 DN65 Qp 25.0 m³/h | flange | / | 187F3419 | 087G6054 |
| 003Z1774 | AB-QM NovoCon DN80 28.0 m³/h | flange | 003Z8540 | NovoCon M | 3132981 | Sharky FS 473 DN65 Qp 25.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z1794 | AB-QM NovoCon DN80 HF 40.0 m³/h | flange | 003Z8540 | NovoCon M | 3132982 | Sharky FS 473 DN80 Qp 40.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z1775 | AB-QM NovoCon DN100 38.0 m³/h | flange | 003Z8540 | NovoCon M | 3132982 | Sharky FS 473 DN80 Qp 40.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z1795 | AB-QM NovoCon DN100 HF 59.0 m³/h | flange | 003Z8540 | NovoCon M | 3132983 | Sharky FS 473 DN100 Qp 60.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z0705 | AB-QM DN125 90.0 m³/h | flange | 003Z8560 | NovoCon L | 187F3530 | SONO 3500 CT DN100 Qp 60.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z0715 | AB-QM DN125 HF 110.0 m³/h | flange | 003Z8560 | NovoCon L | 187F3530 | SONO 3500 CT DN100 Qp 60.0 m³/h | flange | / | 187F3419 | 087G6055 |
| 003Z0706 | AB-QM DN150 150.0 m³/h | flange | 003Z8560 | NovoCon L | 187F3531 | SONO 3500 CT DN125 Qp 100.0 m³/h | flange | / | 187F3419 | 087G6056 |
| 003Z0716 | AB-QM DN150 HF 190.0 m³/h | flange | 003Z8560 | NovoCon L | 187F3531 | SONO 3500 CT DN125 Qp 100.0 m³/h | flange | / | 187F3419 | 087G6056 |
| 003Z0707 | AB-QM DN200 220.0 m³/h | flange | 003Z8563 | NovoCon XL | 187F3531 | SONO 3500 CT DN125 Qp 100.0 m³/h | flange | / | 187F3419 | 087G6056 |
| 003Z0717 | AB-QM DN200 HF 285.0 m³/h | flange | 003Z8563 | NovoCon XL | 187F3532 | SONO 3500 CT DN150 Qp 150.0 m³/h | flange | / | 187F3419 | 087G6056 |
| 003Z0708 | AB-QM DN250 300.0 m³/h | flange | 003Z8563 | NovoCon XL | 187F3532 | SONO 3500 CT DN150 Qp 150.0 m³/h | flange | / | 187F3419 | 087G6059 |
| 003Z0718 | AB-QM DN250 HF 370.0 m³/h | flange | 003Z8563 | NovoCon XL | 187F3532 | SONO 3500 CT DN150 Qp 150.0 m³/h | flange | / | 187F3419 | 087G6059 |

* IO cable with surface sensor (Pt1000)

Technical data

NovoCon® S

| | |
|--|--|
| Power supply range | 24 V AC/DC, 50 / 60 Hz * |
| Power consumption | Operating: 2.7 VA@24VAC / 1.2 W@24VDC Standby: 1.8 VA@24VAC / 0.7 W@24VDC |
| Protection class | III safety extra-low voltage |
| Control signal NovoCon® S | BACnet MS/TP, Modbus RTU 0-10 VDC, 0-5 VDC, 2-10 VDC, 5-10 VDC, 2-6 VDC, 6-10 VDC, 0-20 mA, 4-20 mA |
| Impedance | R _{in} AI:0 >100 kΩ (V); 500 Ω (mA) |
| | R _{out} AO: 1500 Ω |
| Actuator speed selections (<i>open to close</i>) | 3 sec/mm, 6 sec/mm, 12 sec/mm, 24 sec/mm, Constant Time |
| Stroke | 7 mm |
| Force | 90 N |
| Position accuracy | ± 0.05 mm |
| Ambient temp. range | -10° C to 50° C |
| Ambient humidity | 98% r.h., non-condensing (<i>according to EN 60730-1</i>) |
| Max. medium temp. | 120° C |
| Storage temp. range | -40 to 70 °C |
| Grade of enclosure | IP 54 (IP 40 upside down) |
| Weight | 0.4 kg |

* NovoCon® S is designed to operate at power deviations up to ±25%.

BACnet data

| Type | Description |
|-----------------------------|--|
| BACnet device profile | BACnet Application Specific Controller (B-ASC) |
| BACnet protocol | BACnet Master Slave / Token Passing (MS/TP) |
| BACnet baud rates supported | Auto baud rate detection* / 9600 bps / 19200 bps / 38400 bps / 56700 bps / 76800 bps / 115200bps |

Modbus RTU data

| | |
|------------------------------|---|
| Supported baud rates | Auto baud rate detection* / 9600 bps / 19200 bps / 38400 bps / 56700 bps / 76800 bps / 115200bps |
| Supported transmission modes | Parity: None (1-8-N-2) / Odd (1-8-O-1) / Even (1-8-E-1) / None (1-8-N-1) / Auto parity* Data format: Parity (Start bit - Data bits - Parity - Stop bits) |

* Default

NovoCon® M

| | | | |
|--|---------|---|-------------------------|
| Power supply | V | 24 ±25% ac/dc | |
| Power consumption | running | VA | <3.5@24Vac / <2.0@24Vdc |
| | standby | W | 2.0 ac / 0.9 dc |
| Frequency | Hz | 50/60±10% | |
| Control signal | VDC | BACnet MS/TP, Modbus RTU, 0-10, 0-5, 2-10, 5-10, 2-6, 6-10 | |
| | mA | 0-20, 4-20 | |
| Impedance | | R _{in} 90kΩ (V). 500 Ω (mA) | |
| | | R _{out} 250Ω | |
| Closing force | N | 550 | |
| Max. stroke | mm | 20 | |
| Position accuracy | mm | ± 0.2 | |
| Actuator speed selections (<i>open to close</i>) | s/mm | 3, 6, 12, 24, Constant Time | |
| Max. medium temperature | | 120 | |
| Ambient temperature | °C | -10 ... 50 | |
| Storage and transport temperature | | -40 ... 70 | |
| Ambient humidity | | 5-95% r.h., non-condensing (<i>according to EN 60730-1</i>) | |
| Protection class | | III | |
| Grade of enclosure | | IP 54 | |
| Weight | kg | 0.5 | |

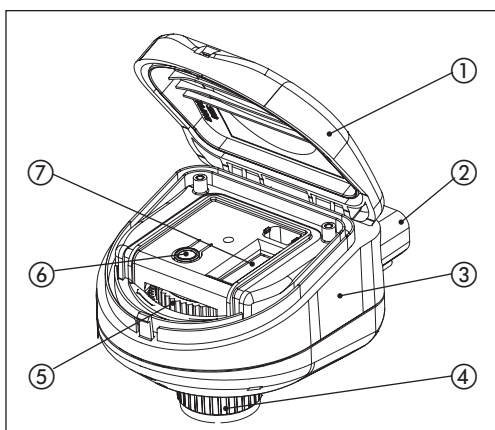
Technical data (continued)

NovoCon® L, XL

| Actuator type | | NovoCon® L | NovoCon® L SD | NovoCon® L SU | NovoCon® XL |
|---|-----------|--|--|-------------------------------------|-------------------------------|
| Power supply | V | 24; +10 ... -15 %; AC/DC | | | |
| Power consumption | Operating | 9.6VA@24VAC / 7.2W@24VDC | 14.4VA@24VAC / 12W@24VDC | 14.4VA@24VAC / 12W@24VDC | 13.9VA@24VAC / 10.8W@24VDC |
| | Standby | 1.7VA@24VAC / 0.7W@24VDC | | | |
| Frequency | Hz | 50/60 | | | |
| Control signal | Vdc | BACnet MS/TP, Modbus RTU, 0-10, 0-5, 2-10, 5-10, 2-6, 6-10 | | | |
| | mA | 0-20, 4-20 | | | |
| Impedance | | Rin 90kΩ (V). 500 Ω (mA) | | | |
| | | Rout 250Ω | | | |
| Position accuracy | mm | ± 1 | | | ± 1.8 |
| Actuator speed selections (open to close) | s / mm | 3, 6, 12, 24, Constant Time | | | |
| Max. medium temperature | °C | 120 | | | |
| Ambient temperature | | -10 ... 50 | | | |
| Storage and transport temperature | | -40 ... 70 (above 50°C, less than 3 days) | | | |
| Ambient humidity | | 5-95% r.h., non-condensing (according to EN 60730-1) | | | |
| Closing force | N | 2000 | | | 4000 |
| Max. stroke | mm | 50 | | | 80 |
| Protection class | | III | | | |
| Grade of enclosure | | IP 54 | | | |
| Weight | kg | 5.4 | 9.6 | 8.9 | 6.3 |
| Safety function | | - | Yes | | - |
| Safety function runtime / 32 mm stroke | s | - | 120 | | - |
| Manual operation | | Electrical and mechanical | Electrical and mechanical | Electrical and mechanical | Electrical and mechanical |
| Power failure response | | Stem remains in last position | Safety function Down, pushes stem down | Safety function Open, pulls stem up | Stem remains in last position |

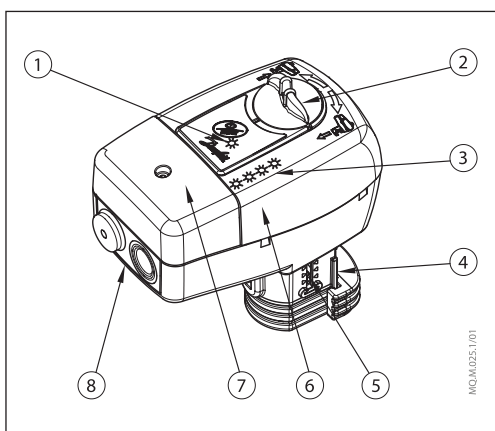
Design

NovoCon® S



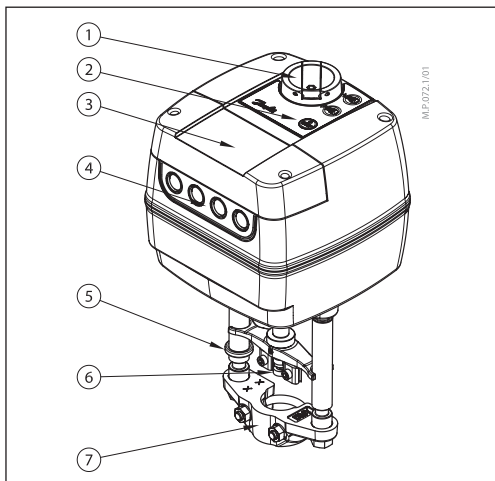
- 1. Removable lid
- 2. Bus and power connections
- 3. Status LED
- 4. Locking ring
- 5. Manual override
- 6. Reset button
- 7. DIP switches

NovoCon® M



- 1. Communication LED
- 2. Manual operation knob
- 3. Buttons and status LED
- 4. Valve connector
- 5. Position indicator
- 6. DIP switches (under cover)
- 7. Service cover
- 8. Removable gland support

NovoCon® L, XL



- 1. Manual operation knob
- 2. Buttons and status LED
- 3. Service cover
- 4. Removable gland support
- 5. End position indication ring
- 6. Stem connector
- 7. Valve connector

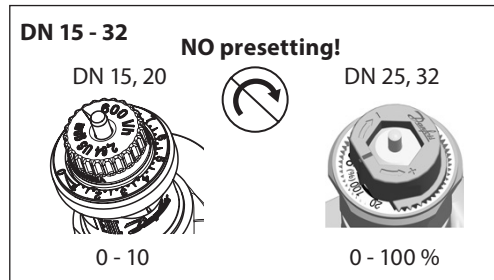
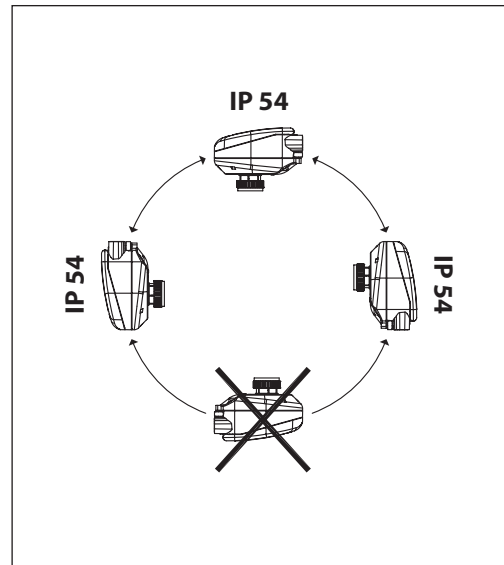
Installation and orientation

NovoCon® S

NovoCon® S can be mounted in any position. However, mounting orientation affects the IP classification. Using NovoCon® S upside down in cooling applications is not recommend due to non-resistance against liquid intrusion (only IP40 could be achieved). See illustration.

Note!

IP classification is only valid when cable or plugs are present in all connections.



No presetting should be done on AB-QM valves. Valve must be set to full open (10 = AB-QM 4.0, 100% = AB-QM)

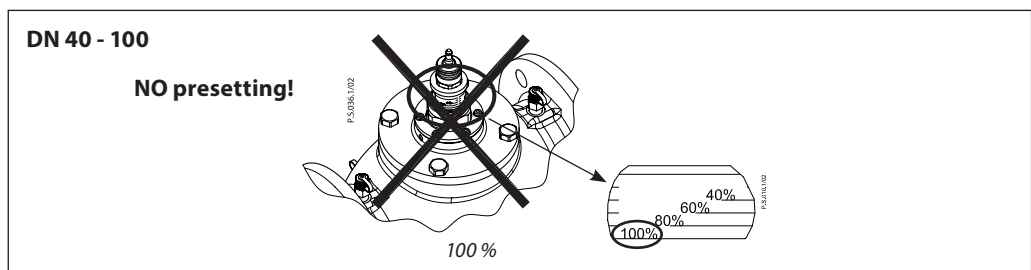
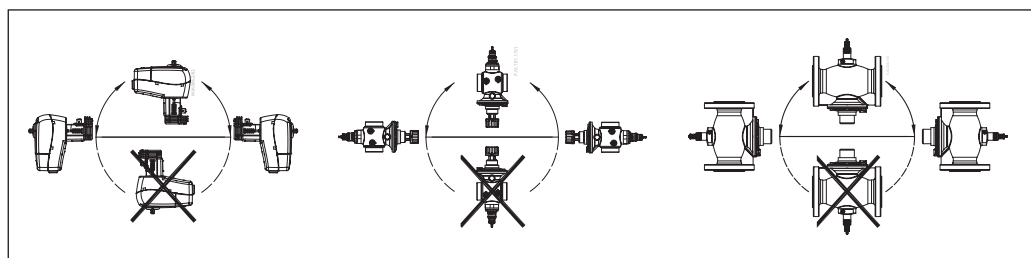
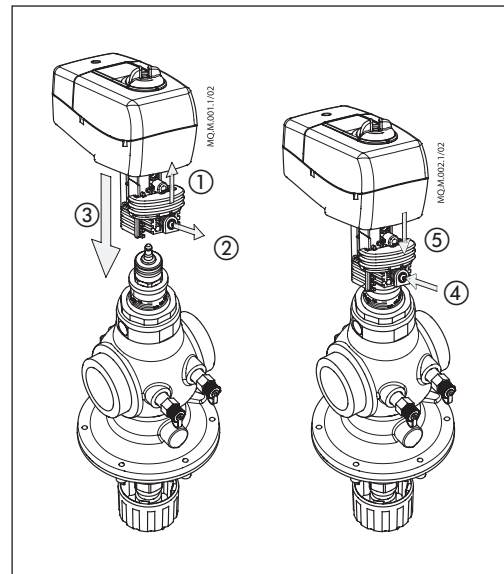
NovoCon® M

No tool is required to mount the actuator on the valve. Installation of the valve with the actuator is allowed in the horizontal position or upwards. Installation downwards is not allowed. The actuator must not be installed in an explosive atmosphere, at ambient temperature lower than 0 °C or at ambient temperature higher than 50 °C. It must not be subject to steam jets, water jets or dripping liquid.

Note: The actuator may be rotated up to 360° with respect to the valve stem by loosening the retaining fixture. Once the actuator is in place, retighten the retaining fixture.

Note: The cable and cable gland/grommet used, must not compromise the actuator's IP rating. There must be no strain on the connectors. The rubber cable grommet delivered from factory do not compromise the IP rating but do not provide full strain relief according to the LVD directive.

Please observe local rules and regulations.



Installation (continued)

NovoCon® L, XL

Mechanical

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

Installation of the actuator assembly is certified for placement within the plenum airspace. 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 calibration cycle they indicate end positions of the stroke.

Electrical connection

Electrical connections can be accessed by removing the service cover.

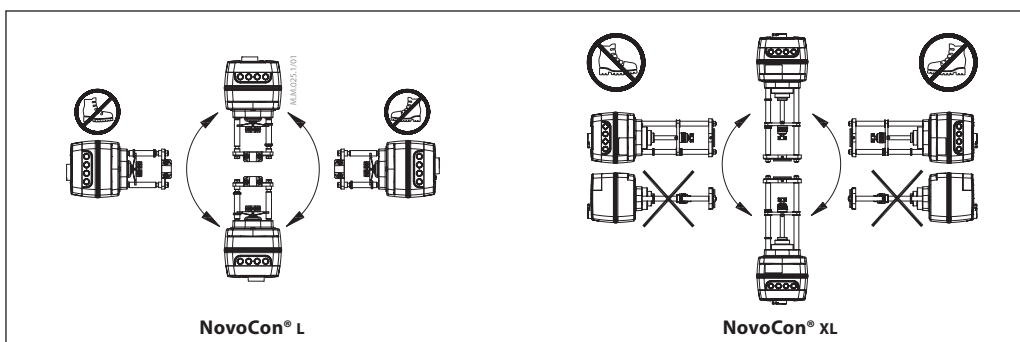
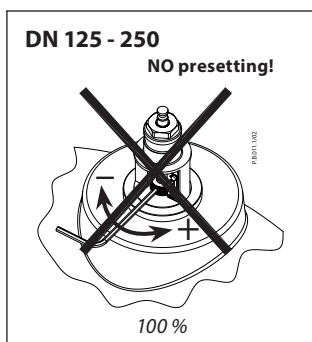
NovoCon® L/XL

Four cable entries are provided

- (1) M16x1.5
- (2) M20x1.5
- (1) 1/2"

Note in order to maintain the enclosure's rating appropriate electrical conduit connectors must be installed.

Please observe local rules and regulations.



Dip switches

The DIP switches located under the housing cover are for manual addressing. The jumper next to the connectors is used for terminal resistor setting.

DIP Switch Settings

NovoCon® S, L, XL

BACnet: Auto MAC addressing is default. For manual MAC addressing, use DIP Switches.
 Modbus: Manual MAC addressing is default. Automatic addressing is not available for Modbus.
 However, if an address has been assigned in BACnet before switching to Modbus, the address will also be used in Modbus if the DIP switches are left in the default positions.

| DIP Switch | Configuration name | OFF state (default) | ON state | | | | | | | | | | | | | | | | | | | | |
|--|--------------------|---------------------|----------|---|---|---|---|---|----|----|---|---|---|---|---|---|---|---|---|---|---------------------------------------|----------------------------|--|
| 1. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | ■ | | | | | | | | | | BACnet address / Modbus unit ID bit 0 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 2. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | ■ | | | | | | | | | BACnet address / Modbus unit ID bit 1 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | ■ | | | | | | | | | | | | | | | | | | | | | | |
| 3. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | ■ | | | | | | | | BACnet address / Modbus unit ID bit 2 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | ■ | | | | | | | | | | | | | | | | | | | | | |
| 4. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | ■ | | | | | | | BACnet address / Modbus unit ID bit 3 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 5. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | ■ | | | | | | BACnet address / Modbus unit ID bit 4 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | ■ | | | | | | | | | | | | | | | | | | | |
| 6. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | ■ | | | | | BACnet address / Modbus unit ID bit 5 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | | ■ | | | | | | | | | | | | | | | | | | |
| 7. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | ■ | | | | BACnet address / Modbus unit ID bit 6 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 8. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | ■ | | | Termination resistor (120Ω) | No termination | Termination resistor enabled ¹⁾ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | | | | ■ | | | | | | | | | | | | | | | | |
| 9. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | ■ | | | Not used | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | | | | | ■ | | | | | | | | | | | | | | | |
| 10. <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td></tr></table> ON OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | ■ | - | BACnet MS/TP ²⁾ | Modbus RTU ²⁾ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | | | | | | | | | |
| | | | | | | | | | ■ | | | | | | | | | | | | | | |

¹⁾ The actuator possesses a resistor, DIP switch no. 8, that can be activated in the last actuator on the bus for correct termination of the bus.
²⁾ When the protocol is changed on DIP switch no. 10, a power cycle is required to make the actuator adopt the newly selected protocol.

DIP Switch Settings

(continued)

NovoCon® M

BACnet: Auto MAC addressing is default. For manual MAC addressing, use DIP switches

Modbus: Manual MAC addressing is default. Automatic addressing is not available for Modbus.

However, if an address has been assigned in BACnet before switching to Modbus, the address will also be used in Modbus if the DIP switches are left in the default positions.

| DIP Switch | | Configuration name | OFF state (default) | ON state | | | | | | | | | | | | | | | | |
|------------|--|--------------------|---------------------|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---------------------------------------|----------------------------|--|
| 1. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | ■ | | | | | | | | BACnet address / Modbus unit ID bit 0 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| ■ | | | | | | | | | | | | | | | | | | | | |
| 2. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | ■ | | | | | | | BACnet address / Modbus unit ID bit 1 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | ■ | | | | | | | | | | | | | | | | | | | |
| 3. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | ■ | | | | | | BACnet address / Modbus unit ID bit 2 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | ■ | | | | | | | | | | | | | | | | | | |
| 4. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | ■ | | | | | BACnet address / Modbus unit ID bit 3 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | ■ | | | | | | | | | | | | | | | | | |
| 5. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | ■ | | | | BACnet address / Modbus unit ID bit 4 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | | ■ | | | | | | | | | | | | | | | | |
| 6. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | ■ | | | BACnet address / Modbus unit ID bit 5 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | | | ■ | | | | | | | | | | | | | | | |
| 7. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td><td></td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | ■ | | BACnet address / Modbus unit ID bit 6 | Logic '0' | Logic '1' |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | | | | ■ | | | | | | | | | | | | | | |
| 8. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td></tr> </table> R <input type="checkbox"/> ON <input type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | ■ | - | BACnet MS/TP ²⁾ | Modbus RTU ²⁾ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | | | | | ■ | | | | | | | | | | | | | |
| R. | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>■</td></tr> </table> R <input type="checkbox"/> ON <input checked="" type="checkbox"/> OFF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | ■ | Termination resistor (120Ω) | No termination | Termination resistor enabled ¹⁾ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | |
| | | | | | | | ■ | | | | | | | | | | | | | |

¹⁾ The actuator possesses a resistor, located between the connectors, DIP switch no. 9 R on/off, that can be activated in the last actuator on the bus for correct termination of the bus.

²⁾ When the protocol is changed on DIP switch no. 8, a power cycle is required to make the actuator adopt the newly selected protocol.

DIP Switch Settings - Manual Addressing

BACnet MAC address/Modbus Slave ID is set by DIP switch 1 to 7.

0 = OFF, 1 = ON

| DIP switch 1, 2, 3, 4 | | | | | | | | | | | | | | | DIP switch 5, 6, 7 | |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|------|
| 0000 | 1000 | 0100 | 1100 | 0010 | 1010 | 0110 | 1110 | 0001 | 1001 | 0101 | 1101 | 0011 | 1011 | 0111 | | 1111 |
| 0* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 000 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 100 |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 010 |
| 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 110 |
| 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 001 |
| 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 101 |
| 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 011 |
| 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127* | 111 |

* Addresses no. 0 and 127 must not be used.

Example

Setting MAC address to 37:

| DIP 1 | DIP 2 | DIP 3 | DIP 4 | DIP 5 | DIP 6 | DIP 7 |
|-------|-------|-------|-------|-------|-------|-------|
| ON | OFF | ON | OFF | OFF | ON | OFF |

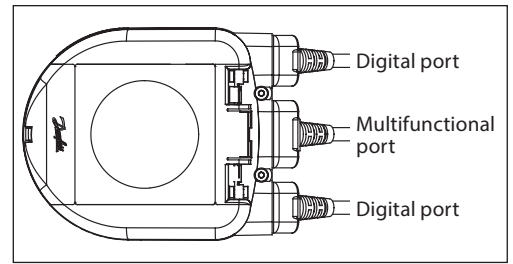
Wiring



NovoCon® S

The wiring of BACnet MS/TP or Modbus RTU (RS485) must be carried out in accordance with applicable standard ANSI/TIA/EIA-485-A-1998. **Galvanic separation shall be provided for segments crossing buildings. Common ground shall be used for all devices on the same network inclusive router, gateways etc.**

All bus connections in the cables are made with twisted wires.



The cable type used for NovoCon® analog, digital and I/O cables is AWG22/0.32mm². If other cables are used to extend the length, always use twisted pair wire for bus signal and include ground for the bus signal. The recommended cable type is AWG22/0.32 mm². If used for longer distances please use a AWG20/0.5mm² or AWG18/0.75mm² cable. The cable's impedance characteristic shall be between 100-130Ω. The capacitance between conductors shall be less than 100 pf per meter. The length of the cables influence on the communication speed. Longer cable lengths should result in lower baud rates. The total maximum cable length allowed per network is 1200m. Use a minimum 20 cm distance between 110V/230V/400V power line cables and bus cables. NovoCon® S has mis-wiring protection on up to 30 V AC/DC on all wires, but be aware that if 30V AC are connected to the Analog input, the external power supply will see this as a short circuit and blow the fuse in the external power supply.

NovoCon® digital daisy chain cable

Black O-ring

Black O-ring

The digital daisy chain cable is used to connect power and BACnet/Modbus between two NovoCon® S devices.

NovoCon® digital cable

White O-ring

- Red: Power
- Black: Common ground for power and bus signal wire
- Green: '+ ' non-inverting signal wire
- Green/White: '- ' inverting signal wire

The digital cable is used to connect NovoCon® to other BACnet/Modbus devices. It is also used to connect NovoCon to a longer length of power/communication cable other than standard sales codes.

Cable NovoCon® Energy with Pt1000 surface sensor

Green O-ring

NovoCon® Energy cable - Pt1000 surface sensors

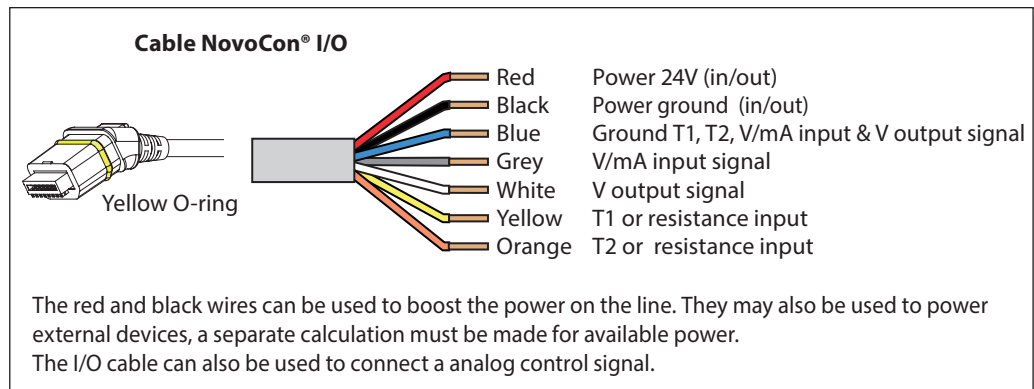
Cable NovoCon® Energy with universal Pt1000 temperature sensor

Green O-ring

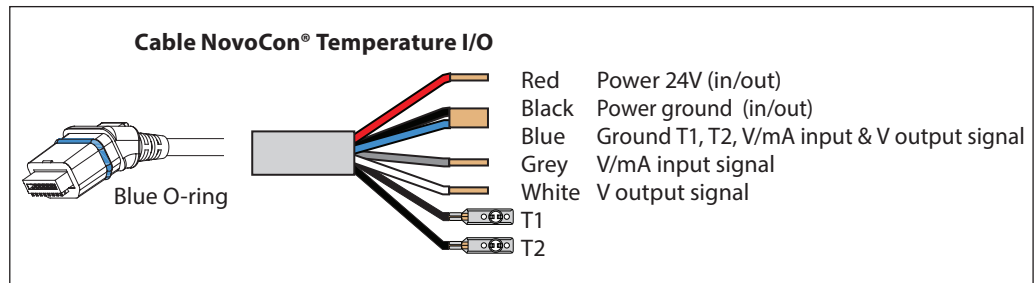
NovoCon® Energy cable - Pt1000 immersed sensors

Wiring (continued)

NovoCon® S (continued)



To avoid electrical short-circuiting, ensure that loose cable-ends have been **connected or isolated** before inserting the plug-in connector to the NovoCon® S actuator.



Wiring considerations

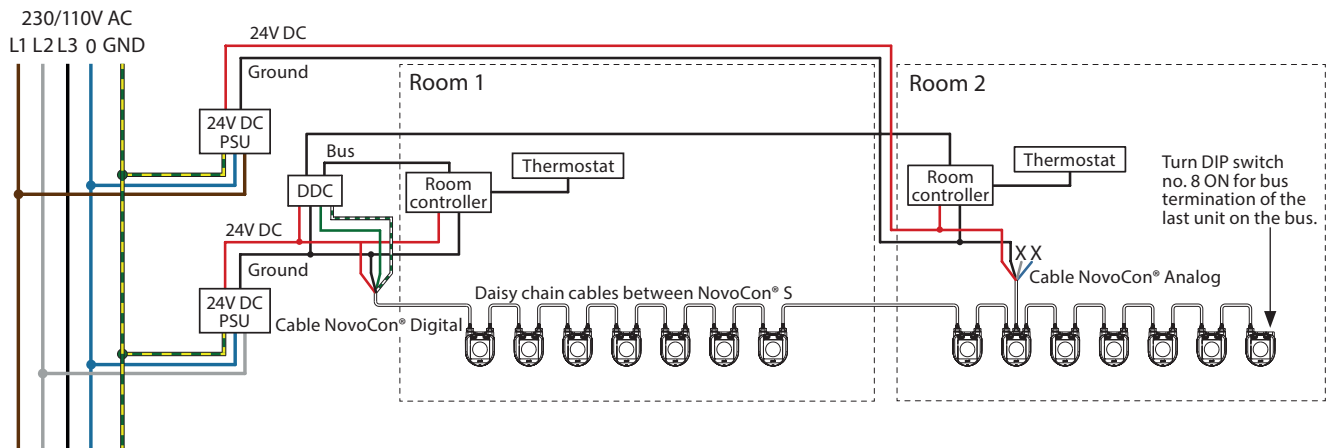
NovoCon® S

The important factors here are:

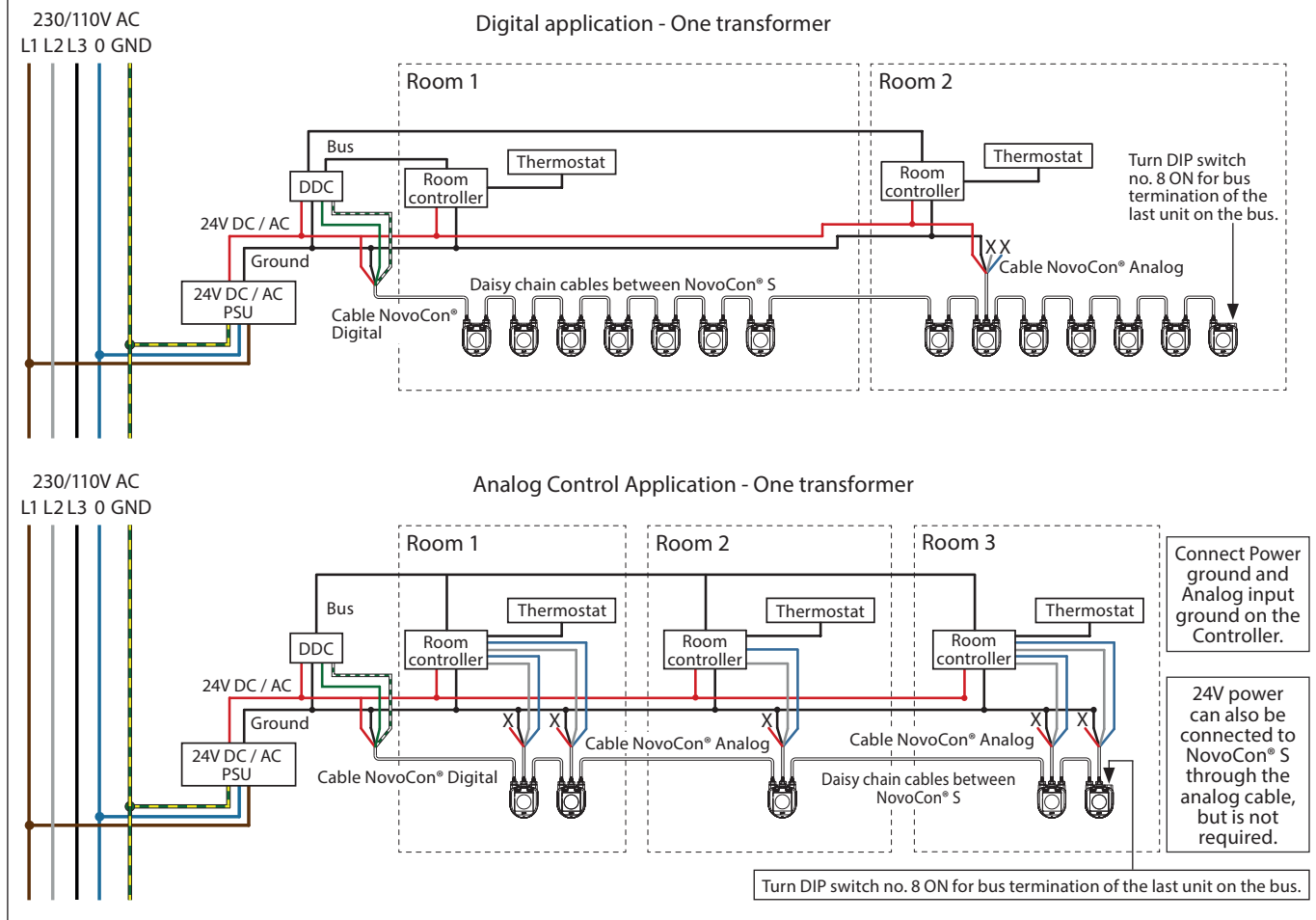
- Common ground
- 24VDC power supply is recommended
- In case more 24VAC power supplies are used always separate the 24VAC power supplies if different types of power supplies are used and / or different phases are used.

Wiring with DC power supply: (recommended solution)

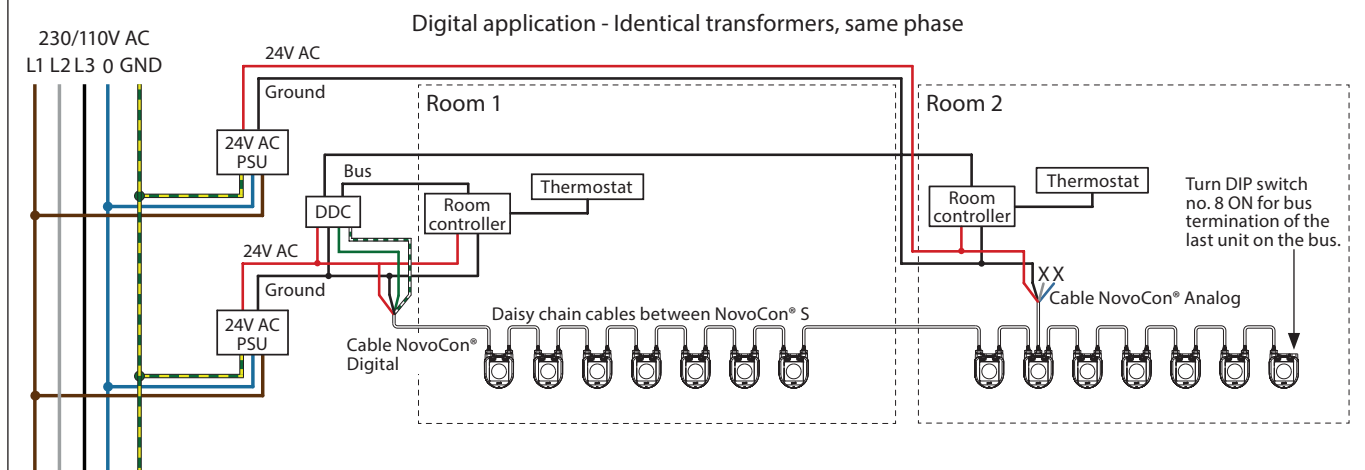
Digital application – 24V DC – PSU with power sharing capability, both on the same or different phases.



Wiring with DC or AC power supply:



Wiring with AC power supplies:

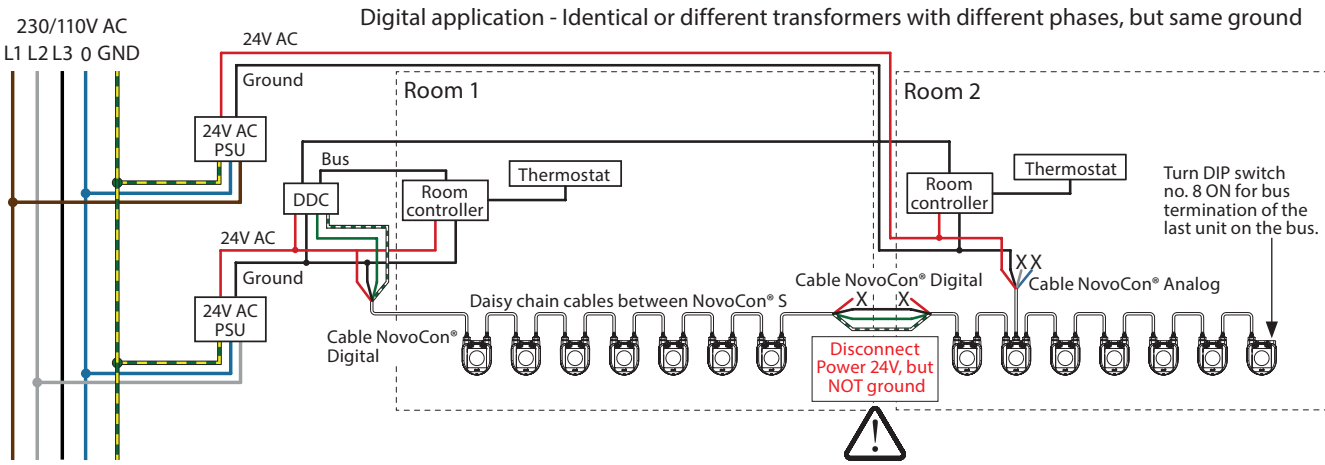


If the NovoCon® S network is supplied with two or more AC power boosters, caution must be observed when disconnecting one of the transformers from the high voltage power line. As the NovoCons are connected in a daisy chain, there may be high voltage on the primary side of the disconnected power supply. Disconnect always both the primary and secondary side of the transformer.

The power boosters must be protected against overload, otherwise the power booster may be damage if one of the other power boosters in the network is disconnected.

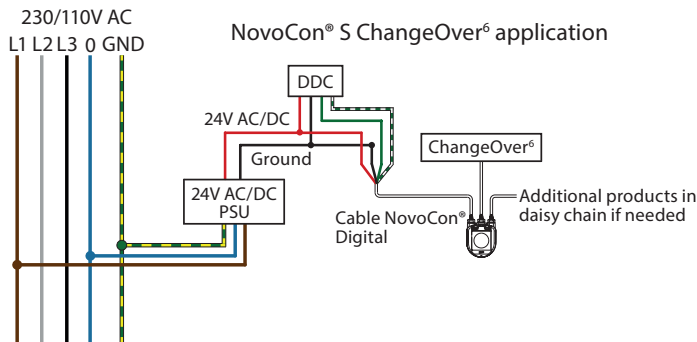
Wires that ends in an "X" must be properly terminated.

Wiring with AC power supply: (continued)

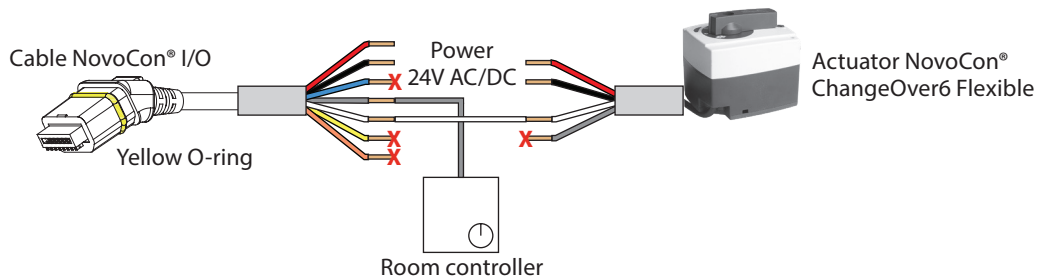


Wires that ends in an "X" must be properly terminated.

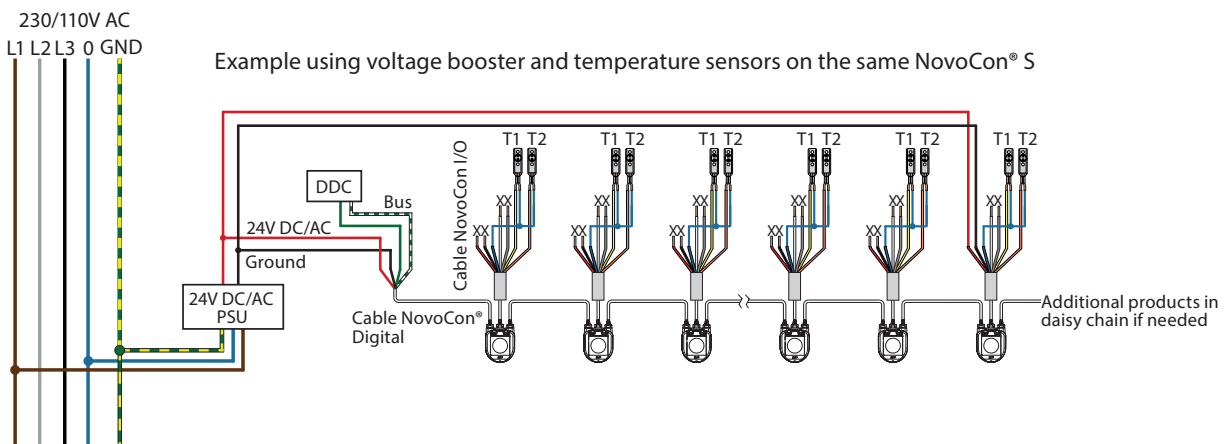
NovoCon® S ChangeOver⁶ application



Wiring Analog CO6 mode



Wiring I/O application



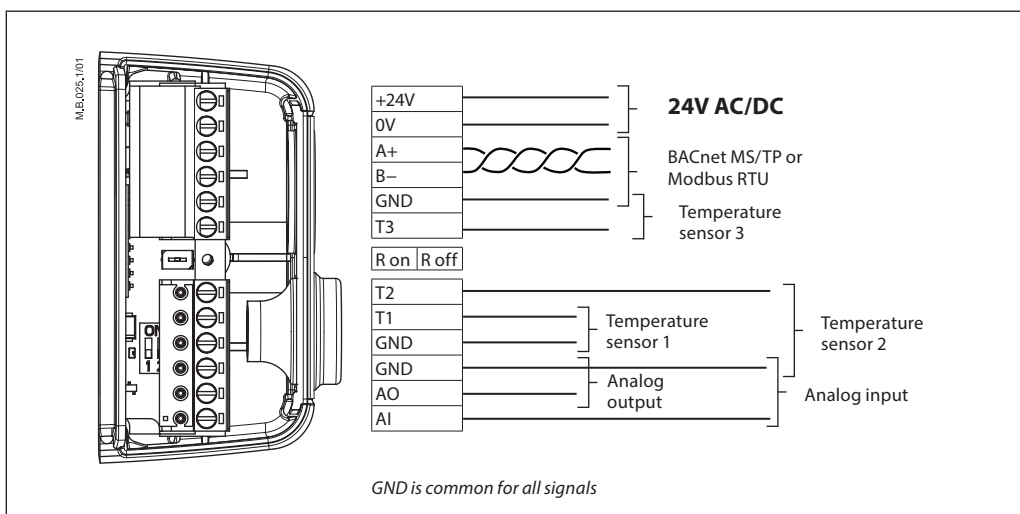
Wiring (continued)

NovoCon® M

The wiring of BACnet MS/TP or Modbus RTU (RS485) must be carried out in accordance with applicable standard ANSI/TIA/EIA-485-A-1998. Galvanic separation shall be provided for segments crossing buildings. The bus connection 'A+' is the non-inverting signal and 'B-' is the inverting signal wire.

Common ground shall be used for all devices on the same network including routers gateways etc. The recommended cable type is AWG22/0.32 mm² twisted pair. If used for longer distances, please use a AWG20/0.5mm² or AWG18/0.75 mm² cable. The cable's impedance characteristic shall be between 100-130 Ω. The capacitance between conductors shall be less than 100 pf per meter. The length of the cables influence the communication speed. Longer cable lengths should result in lower baud rates. The total maximum cable length allowed per network is 1200 m.

Use a minimum 20 cm separation distance between 110V/230V/400V power line cables and bus cables. NovoCon® M has mis-wiring protection up to 30V AC/DC on all wires but be aware that if 30V AC are connected to the Analog input, the external power supply will see this as a short circuit and blow the fuse in the external power supply.



Danfoss recommends that NovoCon® M should be used on its own sub-network for optimal performance.

General requirements and recommendations:

- Use the termination resistor (between the 2 connectors) at the end of each daisy chain.
- Generally, one power supply is preferred.
- If two power supplies are used, they must have the same polarity and the same common ground.
- A common ground must be used for all devices on the same sub-network, including routers and gateways.
- Galvanic separation shall be provided for segments crossing buildings.
- Total maximum sub-network cable length is 1200m.

NovoCon® L, XL

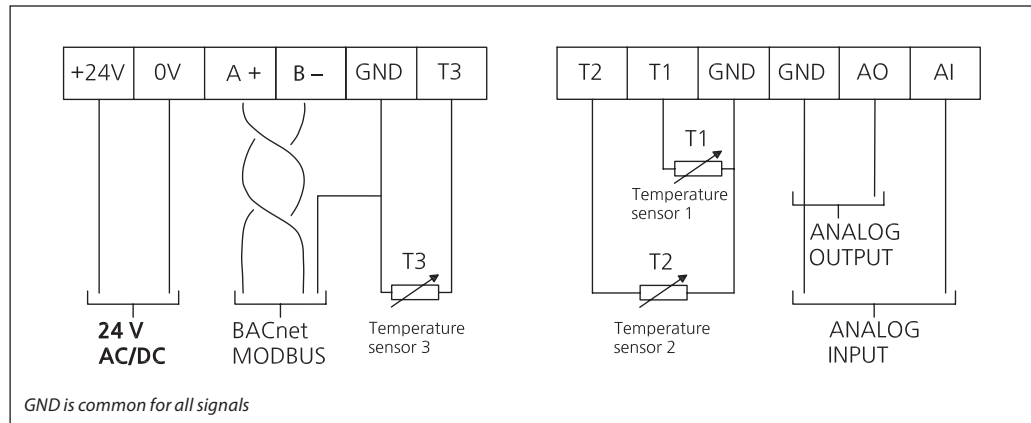
The wiring of BACnet MS/TP or Modbus RTU (RS485) must be carried out in accordance with applicable standard ANSI/TIA/EIA-485-A-1998. The bus connection 'A+' is the non-inverting signal and 'B-' is the inverting signal wire.

NovoCon® L/XL has a galvanic separated power supply, but common ground is recommended to use for all devices on the same network including routers gateways etc. The cable's impedance characteristic for communication shall be between 100-130 Ω. The capacitance between conductors shall be less than 100 pf per meter. The length of the cables influence the communication speed. Longer cable lengths should result in lower baud rates. The total maximum cable length allowed per network is 1200 m.

Use a minimum 20 cm separation distance between 110V/230V/400V power line cables and bus cables. NovoCon® L/XL has mis-wiring protection up to 30V ac/dc on all wires but be aware that if 30V ac are connected to the Analog input, the external power supply will see this as a short circuit and blow the fuse in the external power supply.

Wiring (continued)

NovoCon® L, XL (continued)



Danfoss recommends that NovoCon® L/XL should be used on its own sub-network for optimal performance.

General requirements and recommendations:

- Use the termination resistor (DIP switch 8) at the end of each daisy chain.
- Total maximum sub-network cable length is 1200m.

Daisy chain & Power booster

T-junctions

T-junction connections (stub lines) are not recommended.

In the event of T-Junction connections being used the following limitations must be adhered to:

- max T-junction cable length 1.5m (shortest standard digital cable)
 - total length of Network max 640m (+ 100m stub length)
 - max baud rate 76 kb/s ¹⁾
 - max number of devices on network 64 ¹⁾
 - main cable should be standard RS485 bus, twisted pair, min thickness AWG22 / 0.32mm².
- ¹⁾ When using less than 32 devices you may attempt to raise the speed to 115 kb/s.

Star topology

Star topology is not according to the RS485 standard and should not be used with NovoCon® S, M and L/XL.

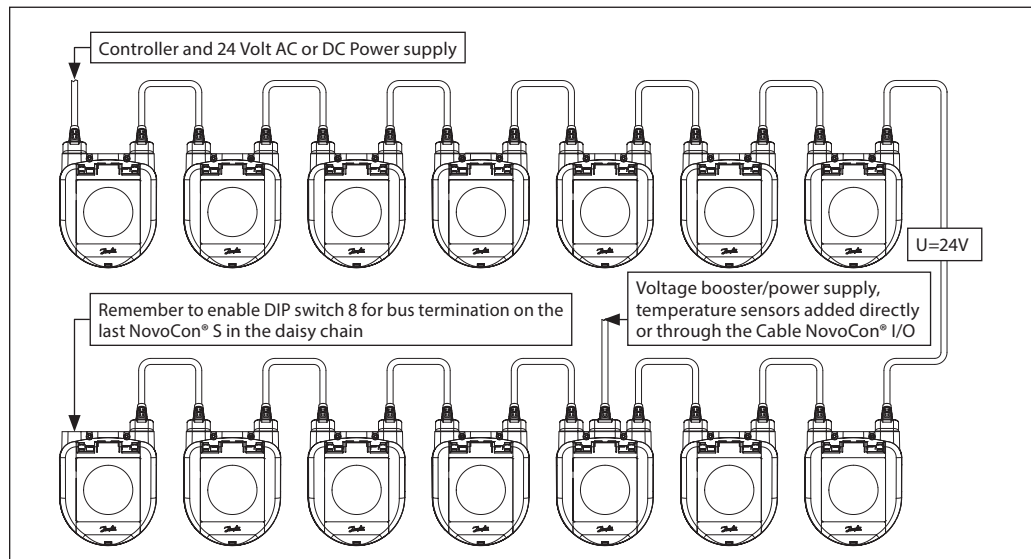
NovoCon® S

DC Power supply (recommended)

When daisy chaining with 10m NovoCon® cables and using a 24V DC power supply, additional voltage boosters/power supply is needed when 12 NovoCons in series is exceeded. See table below.

AC Power supply

When daisy chaining with 10m NovoCon® cables and using a 24V AC power supply, additional voltage boosters/power supply is needed when 7 NovoCons in series is exceeded. See table below. Important: The power supply used must be able to deliver 60% more power than the nominal rating of NovoCon® S.



Daisy chain & Power booster
(continued)

NovoCon® M

DC Power supply (recommended)

When daisy chaining with 10m AWG20/0,5 mm² twisted pair cable and using a 24V DC power supply, additional voltage boosters/power supply is needed when 12 NovoCons in series is exceeded.

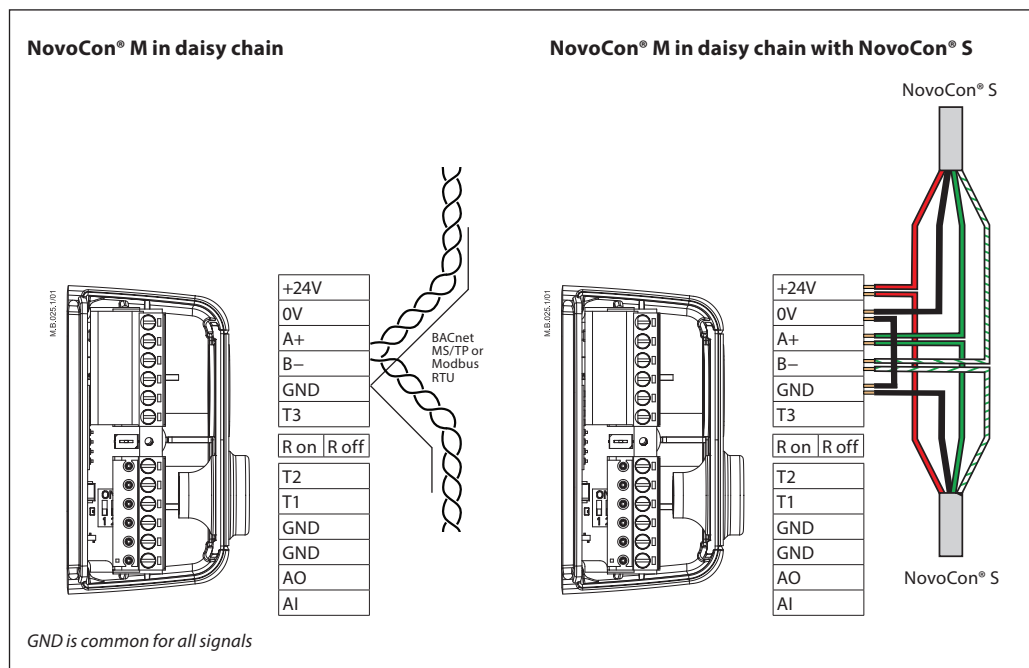
AC Power supply

When daisy chaining with AWG20/0,5 mm² twisted pair cable and using a 24V AC power supply, additional voltage boosters/power supply is needed when 7 NovoCons in series is exceeded.

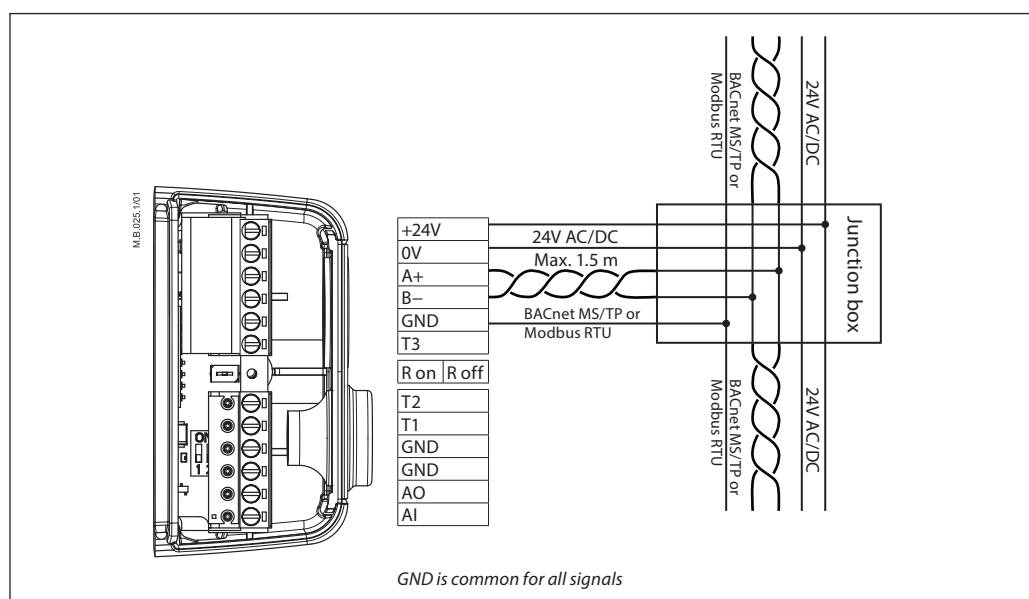
Important: The power supply used must be able to deliver 60% more power than the nominal rating of NovoCon® M.

Please secure:

- Common ground
- 24VDC power supply is recommended
- In case more 24VAC power supplies are used always separate the 24VAC power supplies if different types of power supplies are used and / or different phases are used.



! *If the NovoCon® M network is supplied with two or more AC power boosters, caution must be observed when disconnecting one of the transformers from the high voltage power line. As the NovoCons are connected in a daisy chain, there may be high voltage on the primary side of the disconnected power supply. Disconnect always both the primary and secondary side of the transformer. The power boosters must be protected against overload, otherwise the power booster may be damage if one of the other power boosters in the network is disconnected.*



Daisy chain & Power booster
(continued)

NovoCon® L, XL

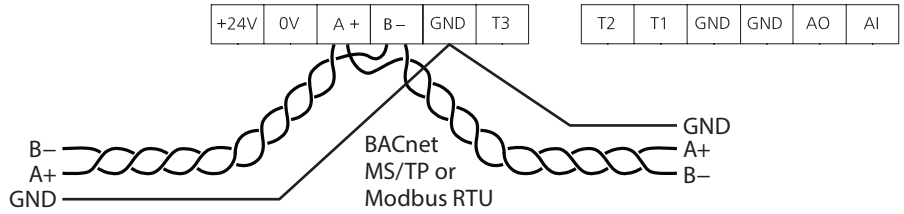
AC Power supply

Important: The power supply used must be able to deliver 60% more power than the nominal rating of NovoCon® L/XL.

Please secure:

- In case more 24V ac power supplies are used always separate the 24V ac power supplies if different types of power supplies are used and / or different phases are used.

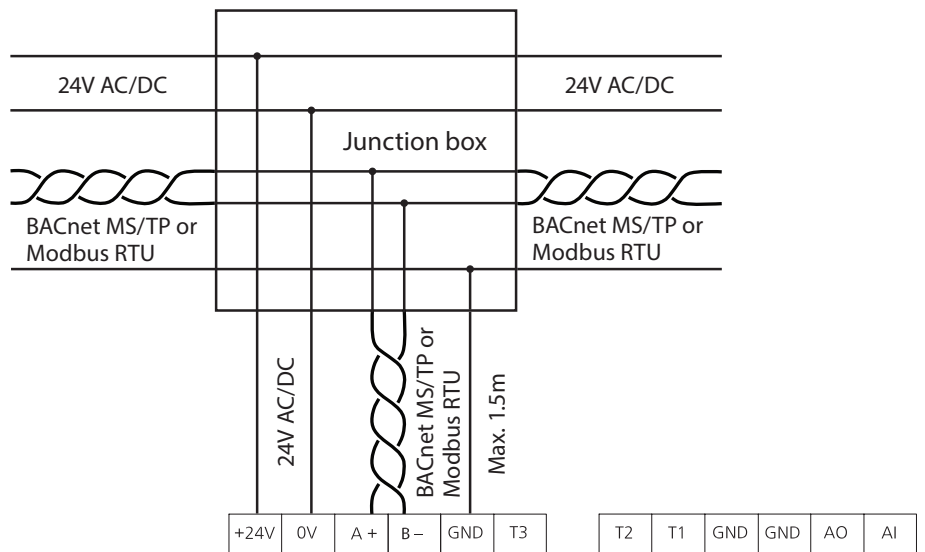
NovoCon® L/XL in daisy chain



GND is common for all signals



If the NovoCon® L/XL network is supplied with two or more AC power boosters, caution must be observed when disconnecting one of the transformers from the high voltage power line. As the NovoCons are connected in a daisy chain, there may be high voltage on the primary side of the disconnected power supply. Disconnect always both the primary and secondary side of the transformer. The power boosters must be protected against overload, otherwise the power booster may be damage if one of the other power boosters in the network is disconnected.

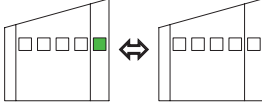


GND is common for all signals

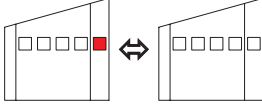
LED Display

NovoCon® S

BACnet/Modbus (RS485) activity

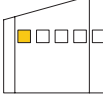


BACnet/Modbus (RS485) activity
 No light from LED: Actuator sees no activity on the network.
 LED turn on and off quickly, 10x/second:
 Normal operation on the network communication is OK.
 LED turn on and off slowly with green light, 3x/second: Normal operation on the network - communication over longer time directly with this actuator.

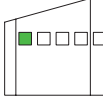


BACnet/Modbus (RS485) activity with ERRORS
 LED turns on and off slowly, 1x/second, with RED color: Actuator sees activity, but with errors.
 LED turn on and off quickly, 10x/second, with RED color: Bus conflict, another device may be using the same MAC address.

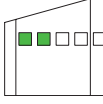
Position of valve/actuator



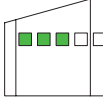
AB-QM valve is **fully closed**.



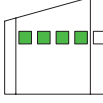
AB-QM is open 1-24% of Design Flow.



AB-QM is open 25-49% of Design Flow.



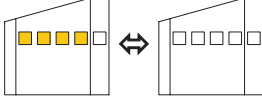
AB-QM is open 50-74% of Design Flow.



AB-QM is open 75-99% of Design Flow.



AB-QM valve is open 100% of Design Flow.



Flush is active
 All LEDs turns on/off with specific period.

LED Display (continued)

NovoCon® S (continued)

Movement of valve/actuator

NovoCon® S is closing the valve
All green LEDs are turned ON, then turned OFF one at the time (repeatedly).

NovoCon® S is opening the valve
All green LEDs are turned OFF, then turned ON one at the time (repeatedly).

NovoCon® S is calibrating
Green light moves forward and backwards, one by one.

De-air is active
Yellow LEDs are turned ON one by one, then turned OFF one by one (repeatedly).

Information from actuator

Blinking function, all green LEDs turns on/off. Used to physically identify individual actuator on the bus.

Error during closing
Debris might be trapped under the AB-QM valve cone. Flushing may solve the problem.

Temperature inside NovoCon® S is out of the recommended range
LEDs change between showing the alarms and showing normal operation. Ambient temperature has likely exceeded 60°C.

Internal NovoCon® S error
LEDs change between showing the alarms and showing normal between operation. Try:
A: Re-calibrate.
B: Turn power off and on.
C: If the error does not disappear actuator replacement can be necessary.

Error during NovoCon® S calibration
LEDs change between showing the alarms and showing normal operation. Verify if the NovoCon® S is correctly attached to the valve and recalibrate.

Power supply is outside limits
LEDs change between showing the alarms and showing normal operation. Use analog cables as voltage booster.

No Control Signal
In analog control the broken control wire is detected.
In CO6 mode or Inverted CO6 mode the ChangeOver⁶ actuator is not connected or damaged.

ChangeOver⁶ actuator
The ChangeOver⁶ actuator is in manual override or unable to reach position.

LEDs change between showing the alarms and showing normal operation.

LED Display (continued)

NovoCon® S (continued)

Pressing the mode button during normal operation

Calibration/Reset/Flush
 Press reset button. All LED's are turned off.
 Keep pressing the reset button for
 1 second: 1 LED ON
 2 seconds: 2 LEDs ON = Start calibration (Reset).
 3 seconds: 3 LEDs ON
 4 seconds: 4 LEDs ON = Start flushing.
 5 seconds or more = Return to normal operation.

Factory reset - reset to default settings
 Press and hold the reset button and then power up the actuator, all LED's are initially turned off.
 Keep pressing the reset button until 4 LED's are turned on = Reset to default settings.

When factory reset is performed it is shown by:
 1 short flash with all yellow position LED's.
 Note that after factory reset a calibration will be automatically be performed and all settings are reverted to factory settings.

NovoCon® M

BACnet/Modbus (RS485) activity

BACnet/Modbus (RS485) activity
 No light from LED: Actuator sees no activity on the network.
 LED turn on and off quickly, 10x/second:
 Normal operation on the network communication is OK.
 LED turn on and off slowly with green light, 3x/second: Normal operation on the network - communication over longer time directly with this actuator.

BACnet/Modbus (RS485) activity with ERRORS
 LED turns on and off slowly, 1x/second, with RED color: Actuator sees activity, but with errors.
 LED turn on and off quickly, 10x/second, with RED color: Bus conflict, another device may be using the same MAC address.

Position of valve/actuator

| | |
|--|---|
| | AB-QM valve is fully closed . |
| | AB-QM is open 1-24% of Design Flow. |
| | AB-QM is open 25-49% of Design Flow. |
| | AB-QM is open 50-74% of Design Flow. |
| | AB-QM is open 75-99% of Design Flow. |
| | AB-QM valve is open 100% of Design Flow . |
| | Flush is active All LEDs turns on/off with specific period. |

Movement of valve/actuator

| | |
|--|---|
| | NovoCon® is closing the valve All green LEDs are turned ON, then turned OFF one at the time (repeatedly). |
| | NovoCon® is opening the valve All green LEDs are turned OFF, then turned ON one at the time (repeatedly). |
| | NovoCon® is calibrating Green light moves forward and backwards, one by one. |
| | De-air is active Yellow LEDs are turned ON one by one, then turned OFF one by one (repeatedly). |

LED Display (continued)

NovoCon® M (continued)

Information from actuator

| | |
|--|--|
| | <p>Blinking function, all green LEDs turns on/off. Used to physically identify individual actuator on the bus.</p> |
| | <p>Error during closing Debris might be trapped under the AB-QM valve cone. Flushing may solve the problem.</p> |
| | <p>Temperature inside NovoCon® is out of the recommended range LEDs change between showing the alarms and showing normal operation. Ambient temperature has likely exceeded 60°C.</p> |
| | <p>Internal NovoCon® error LEDs change between showing the alarms and showing normal between operation. Try: A: Re-calibrate. B: Turn power off and on. C: If the error does not disappear actuator replacement can be necessary.</p> |
| | <p>Error during NovoCon® calibration LEDs change between showing the alarms and showing normal operation. Verify if the NovoCon® M is correctly attached to the valve and recalibrate.</p> |
| | <p>Power supply is outside limits LEDs change between showing the alarms and showing normal operation.</p> |
| | <p>No Control Signal In analog control mode a broken control wire is detected.</p> |

LEDs change between showing the alarms and showing normal operation.

Pressing the mode button during normal operation

| | |
|--|---|
| | <p>Calibration/Reset/Flush Press reset button. All LED's are turned off. Keep pressing the reset button for 1 second: 1 LED ON 2 seconds: 2 LEDs ON = Start calibration (Reset). 3 seconds: 3 LEDs ON 4 seconds: 4 LEDs ON = Start flushing. 5 seconds or more = Return to normal operation.</p> |
| | <p>Factory reset - reset to default settings Press and hold the reset button and then power up the actuator, all LED's are initially turned off. Keep pressing the reset button until 4 LED's are turned on = Reset to default settings.</p> <p>When factory reset is performed it is shown by: 1 short flash with all yellow position LED's. Note that after factory reset a calibration will be automatically be performed and all settings are reverted to factory settings.</p> |

LED Display (continued)

NovoCon® L, XL

BACnet/Modbus (RS485) activity

| | |
|--|---|
| | <p>BACnet/Modbus (RS485) activity No light from LED: Actuator sees no activity on the network. LED turn on and off quickly, 10x/second: Normal operation on the network communication is OK. LED turn on and off slowly with green light, 3x/second: Normal operation on the network - communication over longer time directly with this actuator.</p> |
|--|---|

| | |
|--|--|
| | <p>BACnet/Modbus (RS485) activity with ERRORS LED turns on and off slowly, 1x/second, with RED color: Actuator sees activity, but with errors. LED turn on and off quickly, 10x/second, with RED color: Bus conflict, another device may be using the same MAC address.</p> |
|--|--|

Position of valve/actuator

| | |
|--|--|
| | <p>AB-QM valve is fully closed.</p> |
|--|--|

| | |
|--|--|
| | <p>AB-QM is open 1-49% of Design Flow.</p> |
|--|--|

| | |
|--|---|
| | <p>AB-QM is open 50-99% of Design Flow.</p> |
|--|---|

| | |
|--|--|
| | <p>AB-QM valve is open 100% of Design Flow.</p> |
|--|--|

| | |
|--|--|
| | <p>Flush is active All LEDs turns on/off with specific period.</p> |
|--|--|

Movement of valve/actuator

| | |
|--|--|
| | <p>NovoCon® is closing the valve All green LEDs are turned ON, then turned OFF one at the time (repeatedly).</p> |
|--|--|

| | |
|--|--|
| | <p>NovoCon® is opening the valve All green LEDs are turned OFF, then turned ON one at the time (repeatedly).</p> |
|--|--|

| | |
|--|---|
| | <p>NovoCon® is calibrating Green light blink alternately.</p> |
|--|---|

| | |
|--|--|
| | <p>De-air is active Yellow LEDs blink alternately.</p> |
|--|--|

| | |
|--|-----------------------------|
| | <p>Stand-by mode</p> |
|--|-----------------------------|

Information from actuator

| | |
|--|---|
| | <p>Blinking function, all green LEDs turns on/off. Used to physically identify individual actuator on the bus.</p> |
|--|---|

LED Display (continued)

NovoCon® L, XL (continued)

Information from actuator (continued)

| | |
|--|---|
| | <p>Error during closing Debris might be trapped under the AB-QM valve cone. Flushing may solve the problem.</p> <p>Error during NovoCon® calibration LEDs change between showing the alarms and showing normal operation. Verify if the NovoCon® L/ XL is correctly attached to the valve and recalibrate.</p> |
| | <p>Temperature inside NovoCon® is out of the recommended range LEDs change between showing the alarms and showing normal operation. Ambient temperature has likely exceeded 60°C.</p> <p>Internal NovoCon® error LEDs change between showing the alarms and showing normal between operation. Try: A: Re-calibrate. B: Turn power off and on. C: If the error does not disappear actuator replacement can be necessary.</p> <p>Power supply is outside limits LEDs change between showing the alarms and showing normal operation.</p> |
| | <p>No Control Signal In analog control mode a broken control wire is detected.</p> |

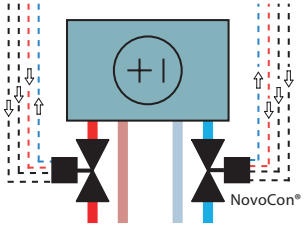
LEDs change between showing the alarms and showing normal operation.

Pressing the mode button during normal operation

| | |
|--|--|
| | <p>Calibration/Reset/Flush Press MODE button. All LED's are turned off. Keep pressing the reset button for</p> <p>1 second: 1 LED ON = Standby mode</p> <p>2 seconds: 2 LEDs ON = Start calibration (Reset).</p> <p>3 seconds: 1 LEDs ON</p> <p>4 seconds: Start flushing. If flushing should be stopped before the default timeout on 1 hour, press again for 1 sec.</p> |
| | <p>Factory reset - reset to default settings Press and hold the MODE button and then power up the actuator, all LED's are initially turned off. Keep pressing the MODE button for 4 seconds = Reset to default settings.</p> |
| | <p>When factory reset is performed it is shown by: 1 short flash with all yellow position LED's. Note that after factory reset a calibration will be automatically be performed and all settings are reverted to factory settings.</p> |

**Application principle
NovoCon® S I/O**

When combining the NovoCon® S and the Cable NovoCon® I/O, many options are possible



Resistance inputs can also be used as galvanic insulated digital inputs for detection of window contact, condensation switch etc. Connected: <900 Ohm. Disconnected 100 kOhm.

Operation example (DDC command)

| Object / Register | Write value | Description |
|-------------------|-------------|---|
| AV:1 / 33280 | 85 | DDC writes % opening value of the AB-QM valve |
| AO:0 / 33286 | 5.5 | DDC writes level of voltage on NovoCon® S analog output, which is sent to the connected remote device |

Read on the BMS example

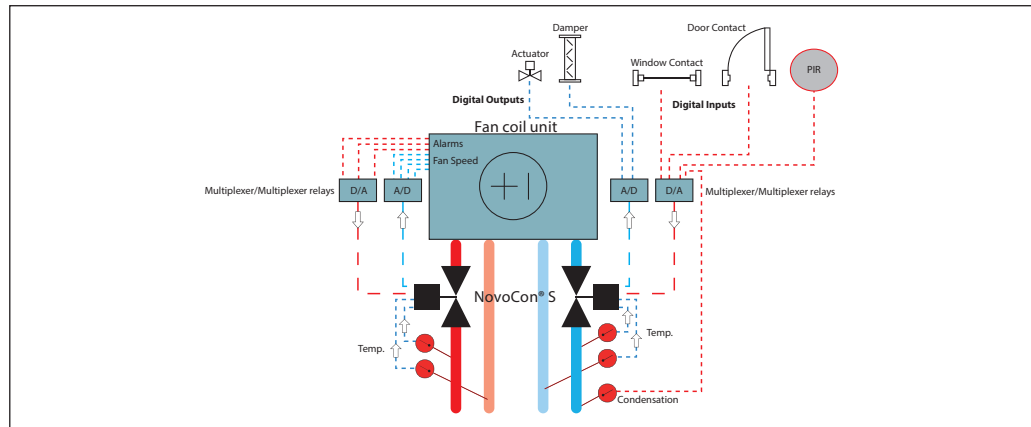
| Object / Register | Read value | Description |
|-------------------|------------|---|
| AO:0 / 33286 | 5.5 | Voltage output from NovoCon® S to remote device |
| AI:0 / 33216 | 6.5 | Voltage level on the analog control input measured by the actuator (may also be mA) |
| AI:1 / 33218 | 1160 | Resistance value (Ohm) received from remote device 1 |
| AI:2 / 33220 | 1263 | Resistance value (Ohm) received from remote device 2 |

**Application principle
NovoCon® I/O and
Multiplexers/Relays**

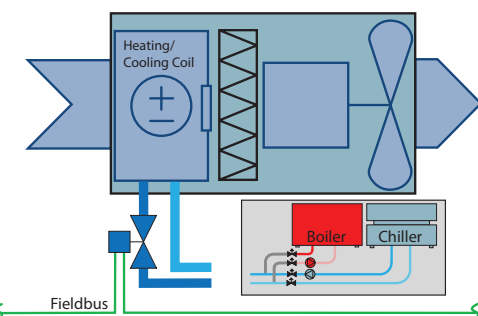
Multiplexers and relays (analog-digital-analog convertors) in combination with NovoCon® S, may be used to gather information on, or control on/off devices.

Using NovoCon's 0-10V output signal (AO:0 / 33286), multiplexer relays convert this signal in order to switch devices on or off e.g. 7V signal from NovoCon® S is converted inside the multiplexer so device1=on, device 2=on, device3=off. E.g. 4V signal from NovoCon® S is converted inside the multiplexer so the device1=on, device 2=off, device3=off.

Using NovoCon's 0-10V input signal (AI:0 / 33216) received from the multiplexers, the DDC can decipher the meaning of the voltage signal e.g. 7V signal to NovoCon® S from the multiplexer is deciphered by the DDC as meaning device1=on, device 2=on, device3=off. 4V signal to NovoCon® S from the multiplexer is deciphered by the DDC as meaning device1=on, device 2=off, device3=off.



**Application principle:
Central Plant Changeover –
2 pipe system**



| Object / Register | Write / read value | Description |
|-------------------|---------------------|--|
| MSV:9 / 32810 | Digital / Analog | The Heating and Cooling Design flow values below may be used. |
| MSV:3 / 32802 | Selected Valve Type | ISO valve selected = l/h, °C, kW and kg/m³. ANSI valve selected = GPM, °F, kBtu and lb/ft³ |
| AV:30 / 32796 | 250 | Design flow setting of Heating e.g. 250 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |
| MSV:10 / 32811 | Cooling | When the system is changed from central Heating to central Cooling the affected NovoCons may be written to so the correct Design flow will be adopted. |

**Application principle
ChangeOver⁶ - 4 pipe system**

Separate maximum flow pre-setting for heating and for cooling

Setup

| Object / Register | Write/ read value | Description |
|-------------------|---------------------|---|
| MSV:9 / 32810 | CO6 mode | While in CO6 mode, the V/mA input and output signals are used purely for controlling the 6-port valve actuator |
| MSV:3 / 32802 | Selected Valve Type | ISO valve selected = l/h, °C, kW and kg/m ³ . ANSI valve selected = g/min, °F, kBTU and lb/ft ³ |
| AV:30 / 32796 | 250 | Design flow setting of Heating e.g. 250 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |

**Application principle
ChangeOver⁶ Energy**

Setup

| Object / Register | Write/read value | Description |
|-------------------|------------------------|---|
| MSV:9 / 32810 | CO6 mode | While in CO6 mode, the V/mA input and output signals are used purely for controlling the 6-port valve actuator |
| AV:32 / 33288 | Power emission | Calculates energy based on values from flow feedback (AV:2) and temperature (AI:1 and AI:2) |
| AV:33 / 33290 | Heating Energy Counter | Accumulate Energy counter for heating |
| AV:34 / 33292 | Cooling Energy Counter | Accumulate Energy counter for cooling |
| MSV:3 / 32802 | Selected Valve Type | ISO valve selected = l/h, °C, kW and kg/m ³ . ANSI valve selected = g/min, °F, kBTU and lb/ft ³ |
| AI:1 / 33218 | Temperature | Select between temperature units or ohms |
| AI:2 / 33220 | Temperature | Select between temperature units or ohms |
| AV:30 / 32796 | 250 | Design flow setting of Heating e.g. 250 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |

**Application principle
Analog CO6 mode**

With the Object MSV:9 / register 32810 state 7 or 8 both NovoCon® S and the NovoCon® ChangeOver⁶ can be controlled by a single voltage output from a room controller. NovoCon® S can be customized to match the voltage values outputted by any room controller to both changeover and control the flow. This is done by configuring the objects AV:50-53 / register 32848-32854.

Setup

| Object / Register | Write/read value | Description |
|-------------------|------------------|---|
| MSV:9 / 32810 | Analog CO6 mode | The flow and changeover signal is controlled by a single analog input. |
| MSV:3 / 32802 | Valve type | ISO valve selected = l/h, °C, kW and kg/m ³ . ANSI valve selected = g/min, °F, kBTU and lb/ft ³ |
| AV:30 / 32796 | 200 | Design flow setting of Heating e.g. 200 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |
| BV:2 / 32786 | Direct | Used to switch the heating and cooling control signal from the Room controller. Must be set before AV:50-53 / register 32848-32854. |
| AV:50 / 32848 | 0 | The control signal (V) for heating 100% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:51 / 32850 | 3.3 | The control signal (V) for heating 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:52 / 32852 | 6.7 | The control signal (V) for cooling 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:53 / 32854 | 10 | The control signal (V) for cooling 100% open when MSV:9 / register 32810 = State 7 or 8. |

Application principle
Analog CO6 mode (continued)

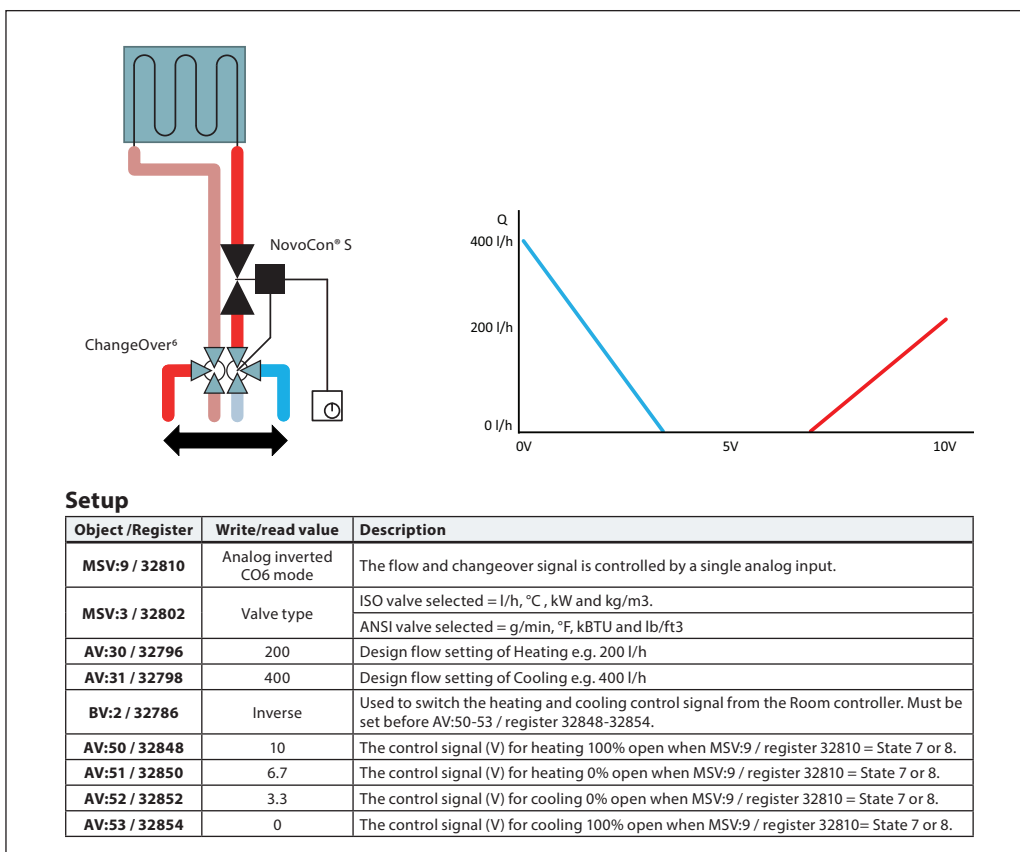
Setup

| Object / Register | Write/read value | Description |
|-------------------|------------------|---|
| MSV:9 / 32810 | Analog CO6 mode | The flow and changeover signal is controlled by a single analog input. |
| MSV:3 / 32802 | Valve type | ISO valve selected = l/h, °C, kW and kg/m3. ANSI valve selected = g/min, °F, kBTU and lb/ft3 |
| AV:30 / 32796 | 200 | Design flow setting of Heating e.g. 200 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |
| BV:2 / 32786 | Inverse | Used to switch the heating and cooling control signal from the Room controller. Must be set before AV:50-53 / register 32848-32854. |
| AV:50 / 32848 | 10 | The control signal (V) for heating 100% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:51 / 32850 | 6.7 | The control signal (V) for heating 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:52 / 32852 | 3.3 | The control signal (V) for cooling 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:53 / 32854 | 0 | The control signal (V) for cooling 100% open when MSV:9 / register 32810 = State 7 or 8. |

Setup

| Object / Register | Write/read value | Description |
|-------------------|--------------------------|---|
| MSV:9 / 32810 | Analog inverted CO6 mode | The flow and changeover signal is controlled by a single analog input. |
| MSV:3 / 32802 | Valve type | ISO valve selected = l/h, °C, kW and kg/m3. ANSI valve selected = g/min, °F, kBTU and lb/ft3 |
| AV:30 / 32796 | 200 | Design flow setting of Heating e.g. 200 l/h |
| AV:31 / 32798 | 400 | Design flow setting of Cooling e.g. 400 l/h |
| BV:2 / 32786 | Direct | Used to switch the heating and cooling control signal from the Room controller. Must be set before AV:50-53 / register 32848-32854. |
| AV:50 / 32848 | 0 | The control signal (V) for heating 100% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:51 / 32850 | 3.3 | The control signal (V) for heating 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:52 / 32852 | 6.7 | The control signal (V) for cooling 0% open when MSV:9 / register 32810 = State 7 or 8. |
| AV:53 / 32854 | 10 | The control signal (V) for cooling 100% open when MSV:9 / register 32810 = State 7 or 8. |

Application principle
Analog CO6 mode (continued)

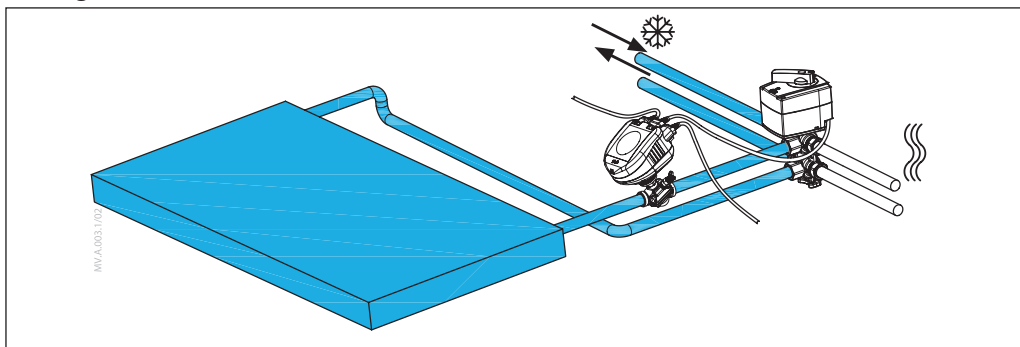


Application principle
ChangeOver⁶

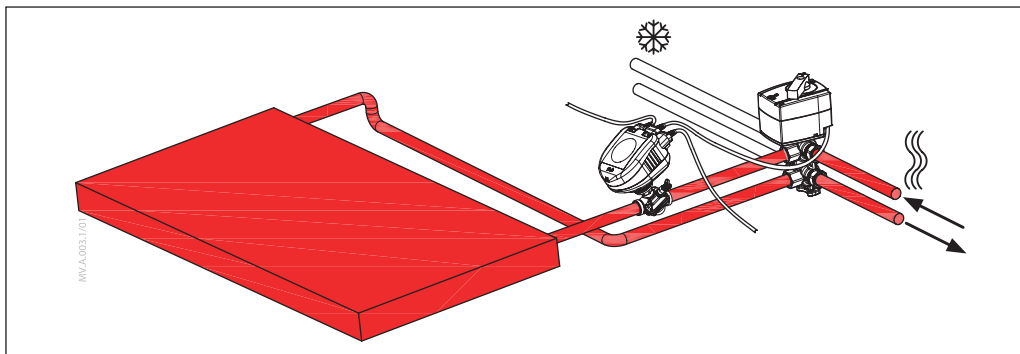
The ChangeOver⁶ is a 6-port valve with a rotary actuator that switches the flow between heating and cooling. An AB-QM pressure independent balancing and control valve with an actuator is used to balance the system and modulate the flow. When using the NovoCon® S for flow control, both NovoCon® S and the Actuator NovoCon® ChangeOver⁶ are represented on the fieldbus network and need no physical I/O for control.

Anti-sticking requirements:
To reduce the risk of the ball valve sticking due to water quality, the valve must be partially rotated at least every 7 days. This is a factory default setting and is handled by the object MSV:11 / register 32812.

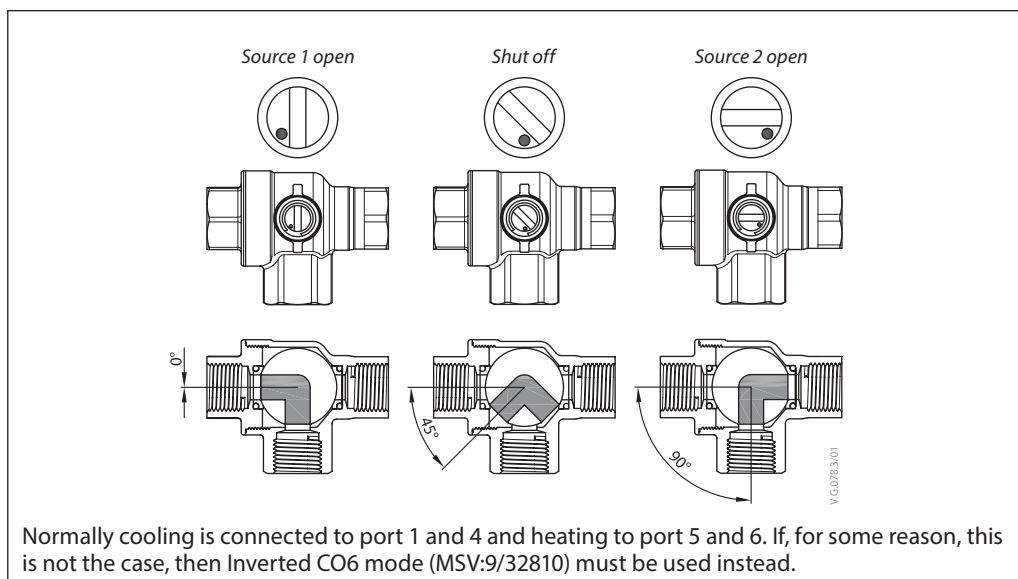
Cooling:



Heating:



No mixing and shut off



CO6, contrary to other ball valves, includes a shut off function. This function should only be used during maintenance and not during operation. This replaces the need for four ball valves. The Shut off command can only be performed when the Flow Rate Setpoint (AV:1/33280) is 0.

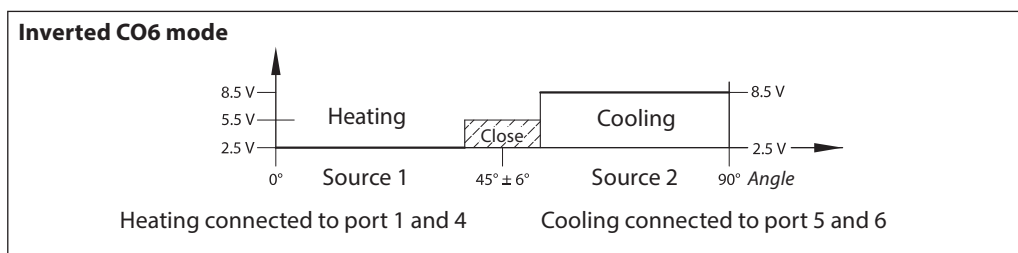
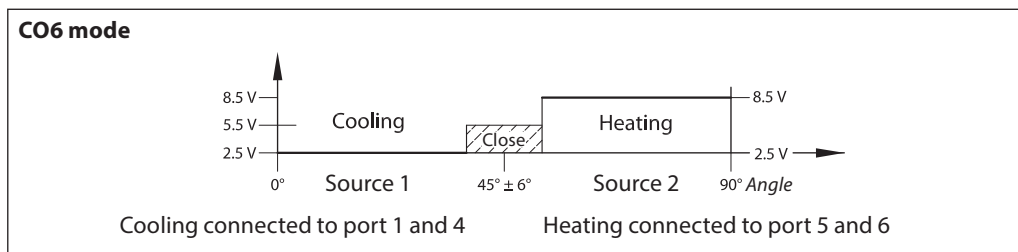
Application mode

State 3: CO6 Mode

Normally cooling is connected to ports 1 and 4 and heating to ports 5 and 6.

If that is not possible, then this may be switched and state **4: Inverted CO6 Mode** must be selected.

NovoCon® S and the ChangeOver⁶ actuator communicate with voltage control and feedback signal. Whole functionality is available by using simple bus commands. For easier technical understanding, please see below detailed explanation of the communication between NovoCon® S and the ChangeOver⁶ actuator.



Signal from NovoCon® S to the Actuator NovoCon® ChangeOver⁶

| | Stop the motor | Cooling | Shut-off | Heating |
|-------------------|----------------|---------|----------|---------|
| CO6 mode | 1.0 V | 2.5 V | 5.5 V | 8.5 V |
| Inverted CO6 mode | 1.0 V | 8.5 V | 5.5 V | 2.5 V |

Feedback signal from the Actuator NovoCon® ChangeOver⁶

| Unable to move | Cooling | Moving direction: Cooling to Heating | Shut-off | Moving direction: Heating to Cooling | Heating |
|----------------|---------|--------------------------------------|----------|--------------------------------------|---------|
| 1.0 V | 2.5 V | 4.0 | 5.5 V | 7.0 V | 8.5 V |

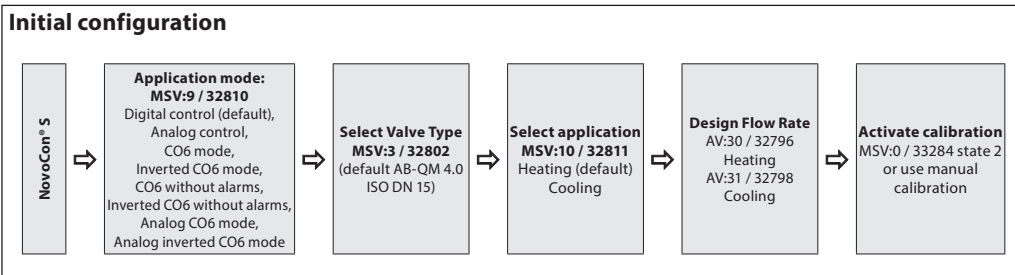
BACnet objects and Modbus registers usage

- Design flow rate setting

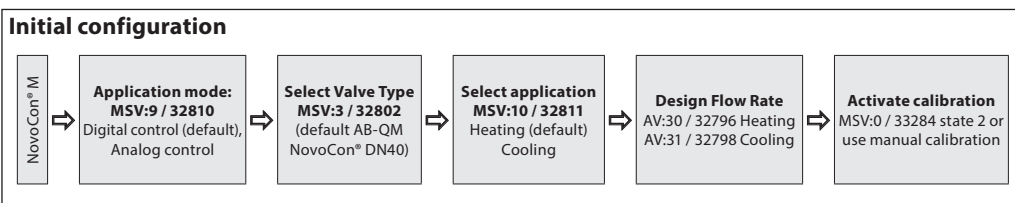
NovoCon® S

General

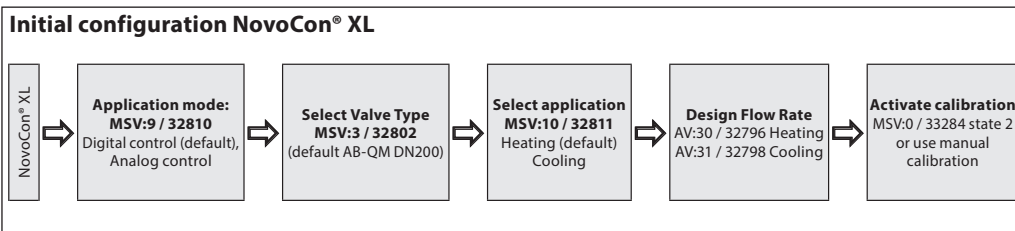
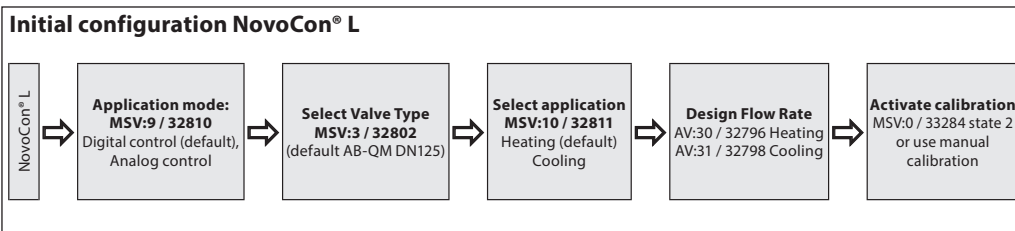
There are simple BACnet and Modbus settings that are essential to the basic setup configuration of NovoCon® in order to communicate and control. These are contained in the BACnet objects or in decimal format Modbus registers.



NovoCon® M



NovoCon® L, XL



BACnet objects and Modbus registers usage *(continued)*
- Advanced configuration and features

If the default setup of the actuator isn't suitable, special attention has to be paid to the following objects:

| | |
|----------------|---|
| MSV:9 / 32810 | Application mode |
| MSV:3 / 32802 | Selected Valve Type |
| MSV:10 / 32811 | Application command & status |
| AV:30 / 32796 | Design Flow Rate Heating |
| AV:31 / 32798 | Design Flow Rate Cooling |
| MSV:0 / 33284 | Actuator Mode and special features |
| Al:1 / 33218 | T1 value, temperature or resistance input |
| Al:2 / 33220 | T2 value, temperature or resistance input |
| Al:3 / 33222 | T3 value, temperature or resistance input |
| AV:32 / 33288 | Power emission |
| MSV:13 / 32815 | Energy management |

Application mode:

The default Application mode is Digital Control. In this mode the NovoCon® M is controlled via fieldbus and the voltage inputs and outputs are available to connect other devices. Alternatively, in Analog Control mode the NovoCon is expecting an analog control signal.

Selection of AB-QM valve type:

After selecting Application mode (see above), it is then necessary to select the AB-QM valve type that the actuator is mounted on. This is done with the object MSV:3 / 32802 Selected Valve Type. The present value of MSV:3 / 32802 may be set to values between 1 and 9. Each number represents a specific AB-QM valve type, which can be found in the table: Valve type selection. The default value for MSV:3 / 32802 is 1 i.e. AB-QM ISO DN40 valve.

Selection and setting of engineering units:

If there is a need to change the default engineering units, this is done in BACnet via the object's engineering units property or in separate objects, and in Modbus via separate registers. See the BACnet and Modbus tables for more details.

Setting the Design Flow Rate:

The designed maximum flow rate of the controlled system should be set if the nominal flow of the valve does not correspond to the designed maximum flow rate. The Design Flow Rate is set by changing the present value of:

- AV:30 / 32796 Design Flow Rate for Heating applications
- AV:31 / 32798 Design Flow Rate for Cooling applications

Temperature measurements:

Al:1 / 33218 Temperature T1 or resistance input, Al:2 / 33220 Temperature T2 or resistance input and Al:3 / 33222 Temperature T3 or resistance input are used to measure the temperature with temperature sensors. The resistance value may also be shown directly if selected, allowing these inputs to be used for other purposes than measuring temperature e.g. window contacts or other potential free contacts. Closed circuit <900Ω, open circuit 100kΩ.

Power emission:

AV:32 / 33288 Power emission is used to show the present hydronic power emission of the terminal unit, based on calculations from water flow rate and the temperature difference between supply and return pipes.

Energy Counter:

Either the Cooling or Heating thermal energy used is counted and logged under AV:33 / 33290 or AV:34 / 33292. This function is enabled and disabled with MSV:12 / 32814.

Flushing a system:

Actuator Mode and Special Features MSV:0 / 33284 has an option which allows the user to flush the system via the fieldbus. To start flushing the system, set MSV:0 / 33284 to 3, Flush. The actuator will then open up the AB-QM valve completely. Flush will end when:

- MSV:0 / 33284 is set back to 1 = Normal operation
- Or the power is cycled.
- Or the flush function times-out after 1 hour.

When flushing ends, the actuator returns to normal operation.

De-Airing of a system:

With MSV:0 / 33284, it is also possible to start the De-Air function in the actuator. This function will open and close the AB-QM valve a number of times, helping getting rid of trapped air in the hydronic system. Start De-Air by setting MSV:0 / 33284 to 4. De-air will run undisturbed until it ends. The state of the actuator will then go back to normal operation i.e. MSV:0 / 33284 = 1, Normal.

Controlling the actuator:

Under normal operation (Digital Control) of the actuator, where the flow through the AB-QM valve is to be controlled, the object Flow Rate Setpoint AV:1 / 33280 is used. The default setting for the Flow Rate Setpoint engineering unit is %.

This is the most suitable setting as the controller does not need to know anything about the Design Flow Rate setting of the actuator. The output signal from the controller needs only to be set up so it regulates from 0 to 100% of the Heating Design Flow Rate AV:30 / 32796 or Cooling Design Flow Rate AV:31 / 32798. Alternative Design Flow Rate AV:0 / 32768 can be used.

To change the flow rate through the valve, the present value of AV:1 / 33280 is written-to, in the range 0 – 100%.

If the engineering unit selected for AV:1 / 33280 must be l/h, the Flow Rate Setpoint through the valve must be written-to in integers representing l/h. An example of this could be a controller writing values to the actuator in the range 0 to 7500 l/h for a DN40 valve.

Alarms and warnings:

System issues can be detected by using BACnet object values BV:10 to BV:24 or Modbus register 33536, see BACnet and Modbus tables for more details.

Optimize BACnet network speed

Reducing Unnecessary PollforMaster Traffic

The MAX_MASTER setting in NovoCon® S can be set above the number of the highest used MAC address in the MS/TP sub network. The MAX_MASTER property is found in the Device object and has a default value of 127. If used, it should be noted that the MAX_MASTER property value should be adjusted accordingly at a later stage prior to adding more devices to the network when the highest MAC address exceeds the MAX_MASTER property value.

Important: Before MAX_MASTER can be set, ensure **ALL** network device MAC addresses are below the intended MAX_MASTER property value. Failure to do this may result in network communication problems.

Allocating Correct INFO_FRAMES

Setting for Controller:

Network Routers and Controller devices that transport traffic in the MS/TP network require a higher number of INFO_FRAMES than NovoCon® S. Therefore, these devices should have a higher value than NovoCon® S. A general rule of thumb for the sub network router's MAX_INFO_FRAMES property value is equal to the amount of MS/TP devices in the router's sub network. The MAX_INFO_FRAMES property is found in the Device object of MS/TP devices. NovoCon's default MAX_INFO_FRAMES value is 1.

Energy management MSV:13 / 32815

General Information - Energy Limitation States:

For all 'limitation' states within MSV:13/32815, a warning will be activated and made visible on the bus to inform the user that NovoCon® has taken control of the flow rate through the AB-QM valve. Whilst under NovoCon® control, the valve will not be closed at any time i.e. closing % constraints are contained within its algorithms, although an external device's control signal will always be able to close the valve. If the energy limitation settings are unobtainable without NovoCon® closing itself, a warning will be activated to inform the user that the set-point value is 'out of range'. Please note that NovoCon® will not automatically relinquish control of the flow rate as soon as the set-point is achieved if the external device e.g. DDC differs greatly with that of NovoCon's® calculated flow rate/opening %. TIP: This information may be used by the user to improve the external control device's PID.

General Information - Energy Control States:

For all 'control' states, except Power control, within MSV:13/32815, NovoCon® takes full control over the flow rate through the AB-QM valve and will not accept a control signal from an external device. Whilst under NovoCon® control, the valve will not be fully closed at any time i.e. closing % constraints are contained within its algorithms. If the energy control settings are unobtainable without NovoCon® closing or opening itself fully, a warning will be activated to inform the user that the set-point value is 'out of range'.

If MSV:13 (energy application) is switched from "not used" to:

- power limitation/control or delta temp. lim./control: T1 function and T2 function are locked to Supply/return temperature – these cannot be changed until app is disabled.
- return temp. limitation/control: The terminal corresponding to "return temperature function" is locked and cannot be changed until energy app is disabled.

Power Manager

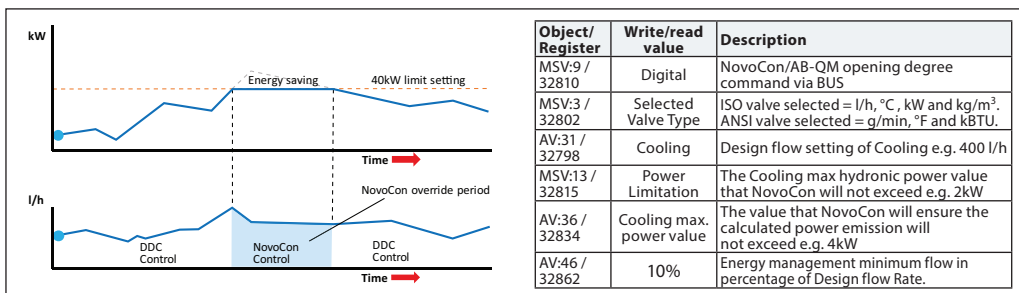
State 1: Not active

Energy management applications are disabled.

State 2: Power limitation (chilled water example)

NovoCon® calculates the instantaneous thermal power used and will then, when required, override the DDC control signal and limit the thermal power according to the user defined values in object / register AV:35 or 36 / 32832 or 32834. The thermal power is limited by closing the valve until the kW value measured, once again, falls below the defined limit. There are user defined limits for both Cooling Power and Heating Power. When this limitation is active, the warning object BV:23 / bit 23 in register 33536 will be set to 'on'.

Application example: When the "Power" is limited in this way we are able to prevent over consumption (during peak load) and balance design power distribution.



State 3: Power control

The thermal power is controlled directly in kW, kBtu or % and not l/hr / GPM. The thermal power through the valve is controlled by the object Flow Rate setpoint AV:1 in kW or kBtu/h (selected in MSV:21 / 32788) and is based on the flowrate and temperature sensors which are used to calculate the power consumption. Application example: Tempering a space (e.g. in storage hall) where we can set and keep the thermal power constant.

Energy management
MSV:13 / 32815 (continued)

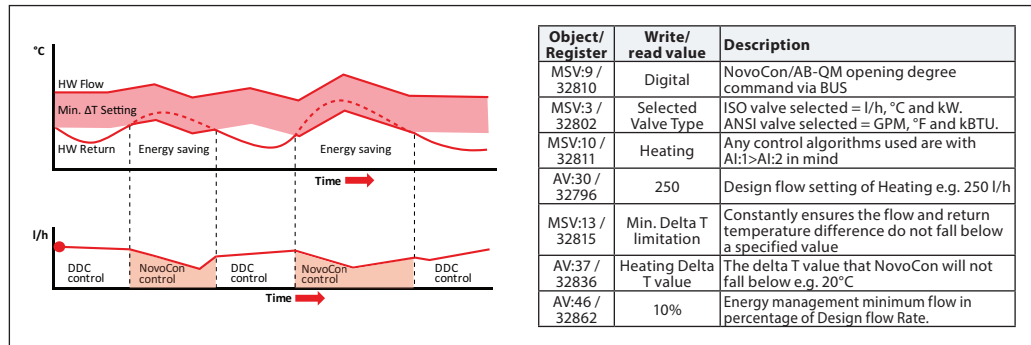
Delta T Manager

State 4: Min. Delta T limitation (heating water example)

NovoCon®, when required, overrides the DDC control signal and maintains a minimum temperature difference between the flow and return temperatures by starting to close the valve when the user defined minimum delta T is not achieved. This always ensures a minimum power transfer to the FCU irrespective of the flow temperature. This state may also be used in CO6 mode and will apply the appropriate value whilst in cooling/heating mode.

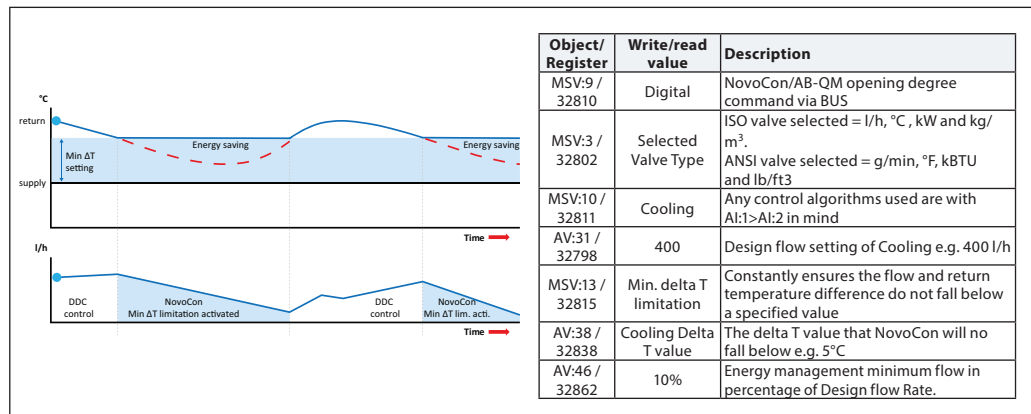
For heating, the delta T value is set in object / register AV:37 / 32836. When conditions allow for this limitation to be activated, the warning object BV:23 / bit 23 in register 33536 will be set to 'on'.

Application example: When we would like to improve the efficiency of boiler/chiller we can define the Minimum Delta T in the system.



State 4: Min. Delta T limitation (chilled water example)

Application example: When we would like to improve the efficiency in the system we can define the Minimum Delta T in the system.

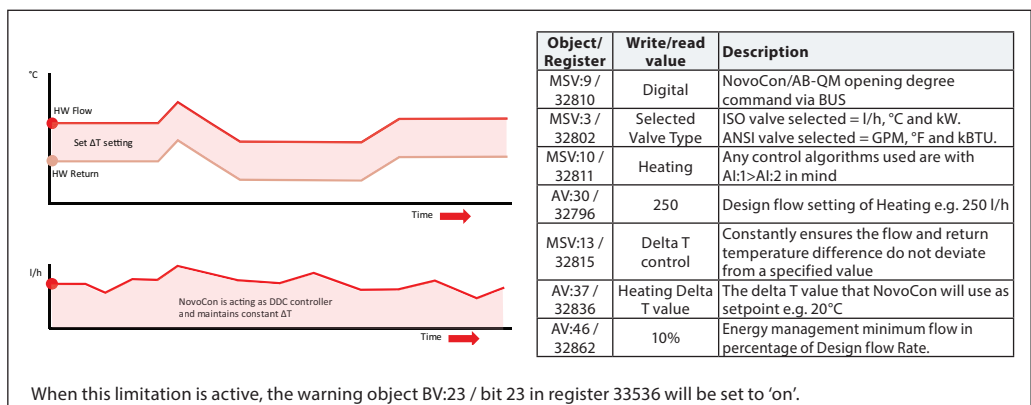


State 5: Delta T control (heating water example)

NovoCon® maintains a constant temperature difference between the flow and return temperatures by opening and closing the valve. When the flow temperature increases/decreases, so will the calculated delta T set-point for the return temperature. This always ensures a constant delta T across the FCU irrespective of the flow temperature. This state may also be used in CO6 mode and will apply the appropriate value whilst in cooling/heating mode.

The constant delta T for heating is set in object / register AV:37 / 32836 and for cooling AV:38 / 32838.

Application example: Tempering a space (e.g. in storage hall) where we can set and keep a constant Delta T.



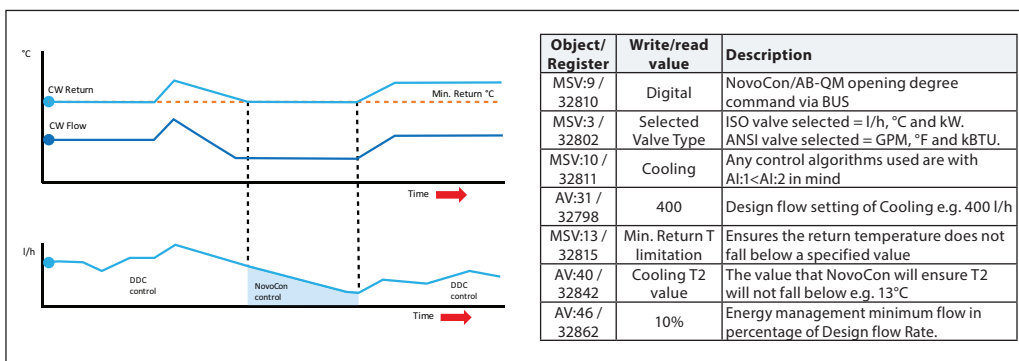
Energy management
MSV:13 / 32815 (continued)

State 6: Return T limitation (chilled water example)

NovoCon® ensures the minimum return temp. which is set in register / object AV:40 / 32842. This function will mainly be used for a Cooling application where the return temperature is higher than the flow temperature. NovoCon® overrides the DDC control signal when activated and maintains a minimum return temperature by starting to close the valve when the user defined minimum return temperature is not achieved. When conditions allow for this limitation to be active, the warning object BV:23 / bit 23 in register 33536 will be set to 'on'.

Application example:

To improve chiller efficiency and ensure proper flow temperature for cooling systems, we can prescribe minimum return temperature to avoid COP reduction as well as low Delta T syndrome.

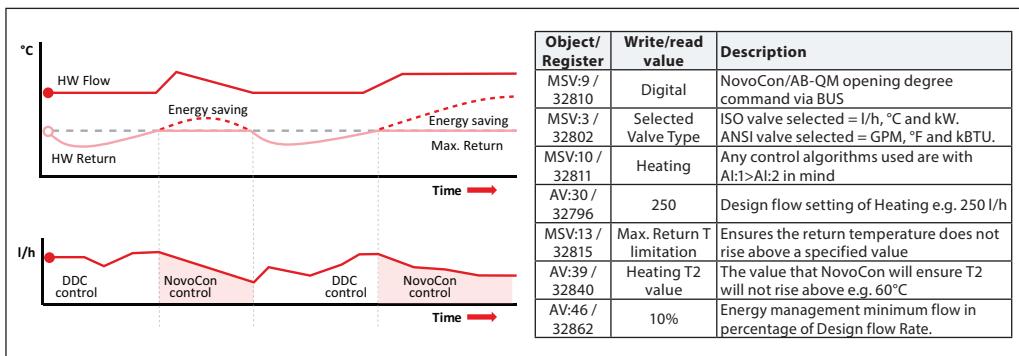


State 6: Return T limitation (heating water example)

NovoCon® ensures the maximum return temp. set in register / object AV:39 / 32840.

This function will mainly be used for a Heating application where the return temperature is lower than the flow temperature. NovoCon® overrides the DDC control signal when activated and maintains a maximum return temperature by starting to close the valve when the user defined maximum return temperature is not achieved. When conditions allow for this limitation to be active, the warning object BV:23 / bit 23 in register 33536 will be set to 'on'.

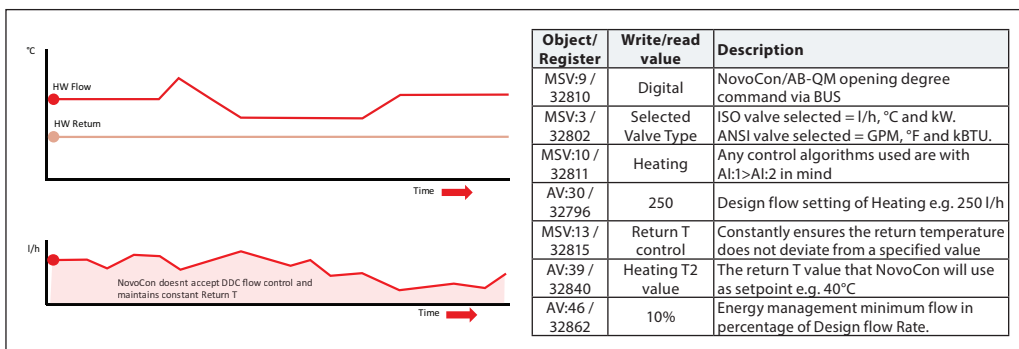
Application example: Heating systems that require a maximum return temperature for efficient heat source generation e.g. condensing boilers and heat pumps.



State 7: Return T control (heating water example)

A constant return temperature T2 value is set in object / register AV:39 / 32840 (Heating) or AV:40 / 32842 (Cooling). NovoCon® maintains a constant return temperature by modulating the valve based on an internal PID loop in NovoCon®. When the flow temperature increases/decreases, the Return T set-point remains the same. This will ensure a constant return temperature back to the energy source.

Application example: When we intend to use the return water for secondary usage e.g. pre-heat on a AHU or a standalone terminal unit in which the T2 value is used as the temperature set-point to be maintained.



Energy management
MSV:13 / 32815 (continued)

State 8: T3 temperature control

NovoCon offers stand-alone temperature control with room sensor (T3). In this function, NovoCon act as stand alone device and uses T3 for measuring temperature.

NovoCon S:

You can connect sensor to analog input connection on NovoCon S. It needs to be active sensor with voltage (0-10V) or current (0-20, 4-20mA) signal. On MSV:1/32800 you need to select type of signal from sensor (0-10V, 0-5V, 0-20mA, 4-20mA,...).

NovoCon M, L and XL:

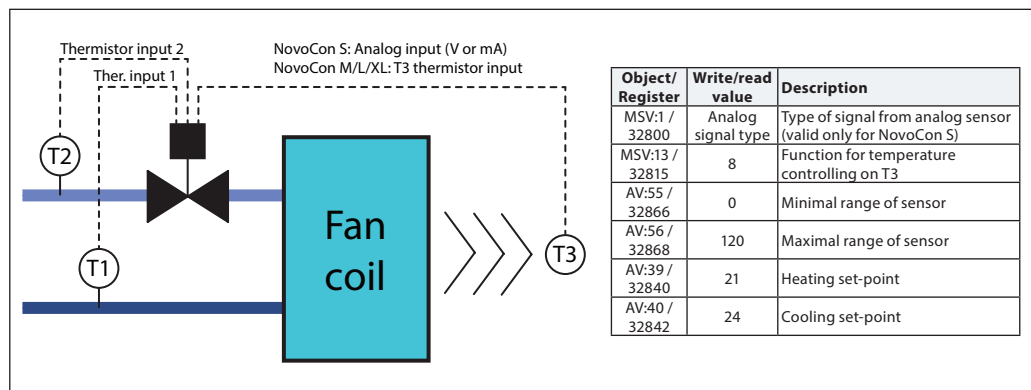
Sensor for controlling room temperature needs to be on T3 input.

Common settings:

Under Application command & status, state 8 needs to be selected. State 8 (value of MSV:13 /32815), means that NovoCon will control temperature on T3 sensor.

Range of measured temperature sensor needs to be set on AV:55/3 2866 and AV:56/32868 (low point and high point).

Set points of desired temperatures are in objects AV:39/32840 (heating) and AV:40/reg:32842 (cooling). Don't forget to choose right application(MSV:10/32811): Heating or cooling, since this is important for regulation process.

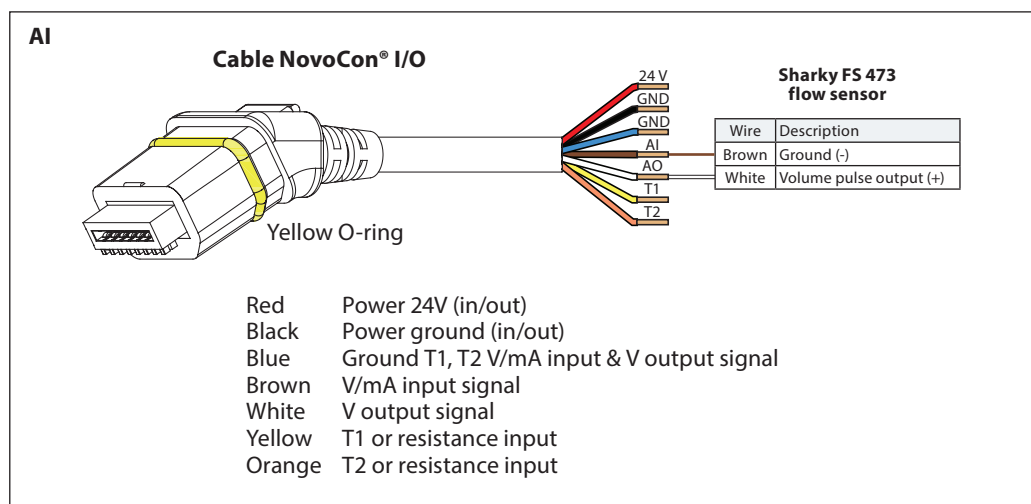


Commissioning/connection of flow sensor to:

NovoCon® S

NovoCon® S supports connection of flow sensor directly to NovoCon® IO cable. Flow sensor must be connected to AI and AO terminal. NovoCon must be set to digital mode (MSV:9/32810 = 2), output functionality set to Inactive (BV:3/32817 = 0) and value of output (AO:0/33286 = 10) on 10 V. You also need to select AI (MSV: 41/32821) input for connecting flow sensor.

To get right flow sensor value it is very important to set right value of liters per pulse on NovoCon® (AV: 43/32864). Usually this is written on flow sensor specification sheet. If we would like to use flow sensor for calculating energy we must also set register MSV:12/32814.



Commissioning/connection of flow sensor to: (continued)

NovoCon® S (continued)

| Object/Register | Write/read value | Description |
|-----------------|-----------------------------------|----------------------------|
| MSV:9 / 32810 | 2: Digital mode | Application mode |
| BV:3 / 32817 | 0: Inactive | Output feedback |
| AO:0 / 33286 | 10 | Value on output |
| MSV:41 / 32821 | 3: Flow sensor | AI input |
| AV:43 / 32864 | 0.625 (depends on flow sensor) | Pulse volume (liter/pulse) |
| MSV:12 / 32814 | 3: ON, flow sensor on return pipe | Energy counting method* |

*Energy counting method

MSV: 12 / 32814

State 1: Off

NovoCon® S is not calculating energy.

State 2: On, indicated flow

NovoCon® S is calculating energy based on temperature difference between T1 and T2 and using indicated flow.

State 3: On, flow sensor on return pipe

NovoCon® S is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on return pipe.

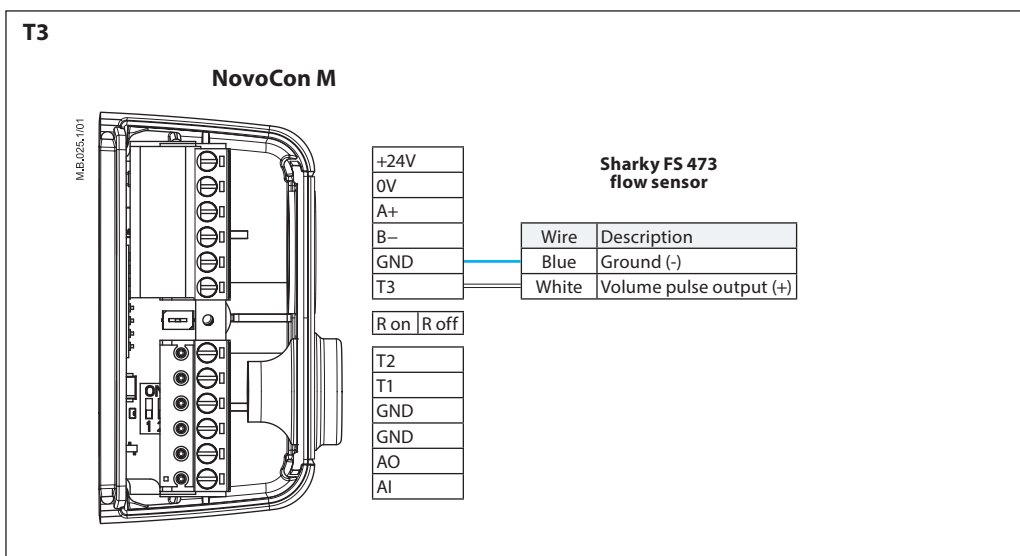
State 4: On, flow sensor on supply pipe

NovoCon® S is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on supply pipe.

NovoCon® M

NovoCon® M supports connection of flow sensor directly to NovoCon® inputs. Flow sensor must be connected to T3 and GND terminal. Therefore MSV:44/32824, needs to be changed to value 3. In this case T3 input senses pulses instead of temperature.

To get right flow sensor value it is very important to set right value of liters per pulse on NovoCon® (AV: 43/32864). Usually this is written on flow sensor specification sheet. If we would like to use flow sensor for calculating energy we must also set register MSV:12/32814.



| Object/Register | Write/read value | Description |
|-----------------|-----------------------------------|----------------------------|
| MSV:41 / 32824 | 3: Flow sensor | T3 input |
| AV:43 / 32864 | 0.15 (depends on flow sensor) | Pulse volume (liter/pulse) |
| MSV:12 / 32814 | 3: ON, flow sensor on return pipe | Energy counting method* |

*Energy counting method

MSV: 12 / 32814

State 1: Off

NovoCon® M is not calculating energy.

State 2: On, indicated flow

NovoCon® M is calculating energy based on temperature difference between T1 and T2 and using indicated flow.

State 3: On, flow sensor on return pipe

NovoCon® M is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on return pipe.

State 4: On, flow sensor on supply pipe

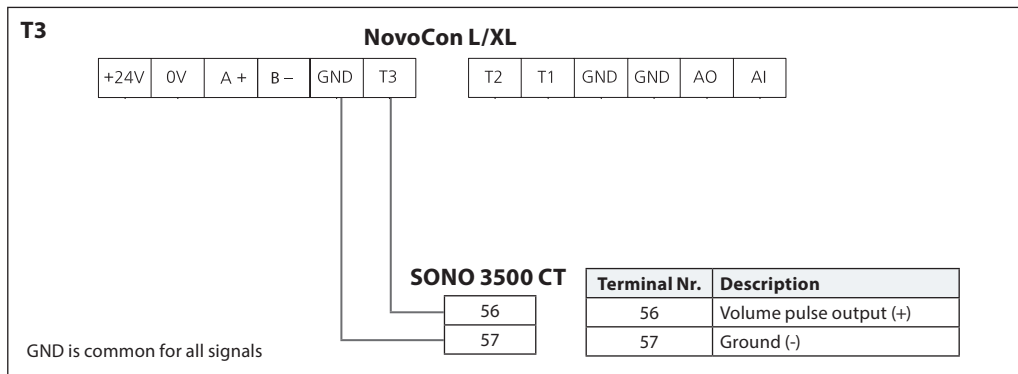
NovoCon® M is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on supply pipe.

Commissioning/connection of flow sensor to: (continued)

NovoCon® L, XL

NovoCon® L/XL supports connection of flow sensor directly to NovoCon® inputs. Flow sensor must be connected to T3 and GND terminal. Therefore MSV:44/32824, needs to be changed to value 3. In this case T3 input senses pulses instead of temperature.

To get right flow sensor value it is very important to set right value of liters per pulse on NovoCon® (AV: 43/32864). Usually this is written on flow sensor specification sheet. If we would like to use flow sensor for calculating energy we must also change register MSV:12/32814.



| Object/Register | Write/read value | Description |
|-----------------|-----------------------------------|----------------------------|
| MSV:41 / 32824 | 3: Flow sensor | T3 input |
| AV:43 / 32864 | 2.5 (depends on flow sensor) | Pulse volume (liter/pulse) |
| MSV:12 / 32814 | 3: ON, flow sensor on return pipe | Energy counting method* |

***Energy counting method**

MSV: 12 / 32814

State 1: Off

NovoCon® L/XL is not calculating energy.

State 2: On, indicated flow

NovoCon® L/XL is calculating energy based on temperature difference between T1 and T2 and using indicated flow.

State 3: On, flow sensor on return pipe

NovoCon® L/XL is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on return pipe.

State 4: On, flow sensor on supply pipe

NovoCon® L/XL is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on supply pipe.

Settings connected to flow sensor (NovoCon S/M/L/XL):

If either T1 or T2 ohmic input terminal is used for flow sensor or disabled:

energy app can't be switched to power lim./control or delta temp. lim./control, but might be switched to return temp. lim./control.

The former depends whether if the return temperature function is selected on the other terminal, which is not used for flow sensor connection.

If analog input terminal function is used for flow sensor or disabled, the following application modes in MSV:9 are not available:

- 1: Analog control - AI used for control signal
- 3: CO6 mode - AI used for CO6 status
- 4: Inverted CO6 mode - AI used for CO6 status
- 7: Analog CO6 mode - AI used for control signal
- 8: Inverted analog CO6 mode - AI used for control signal

In other words, the MSV:9 can't be switched to "Analog control" or to the CO6 modes except mode 5&6 (CO6 without alarms).

If MSV:9 application mode is used in "Analog control" or in combination with CO6 except states 5 and 6 (CO6 without alarms):

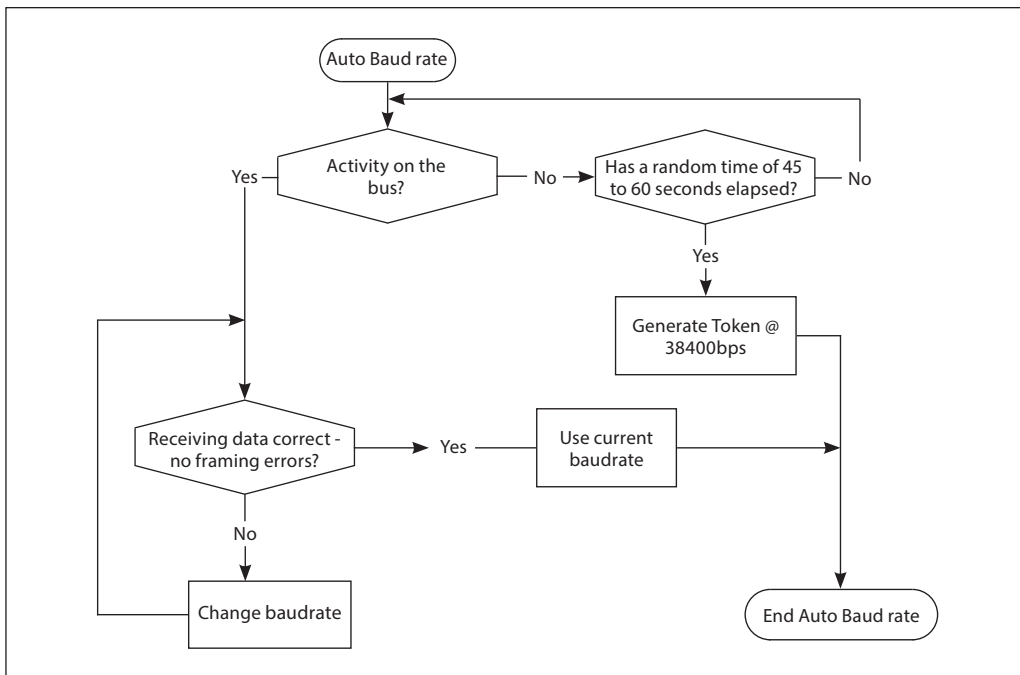
The AI terminal function is locked to state 2 "Analog input (voltage or current)" and can't be changed.

Auto baud rate

NovoCon® should be connected after, or at the same time as, other devices. NovoCon® will then adapt to its network's baud rate automatically.

Baud rate MSV:6 / 32804 must be set to 1 (default).

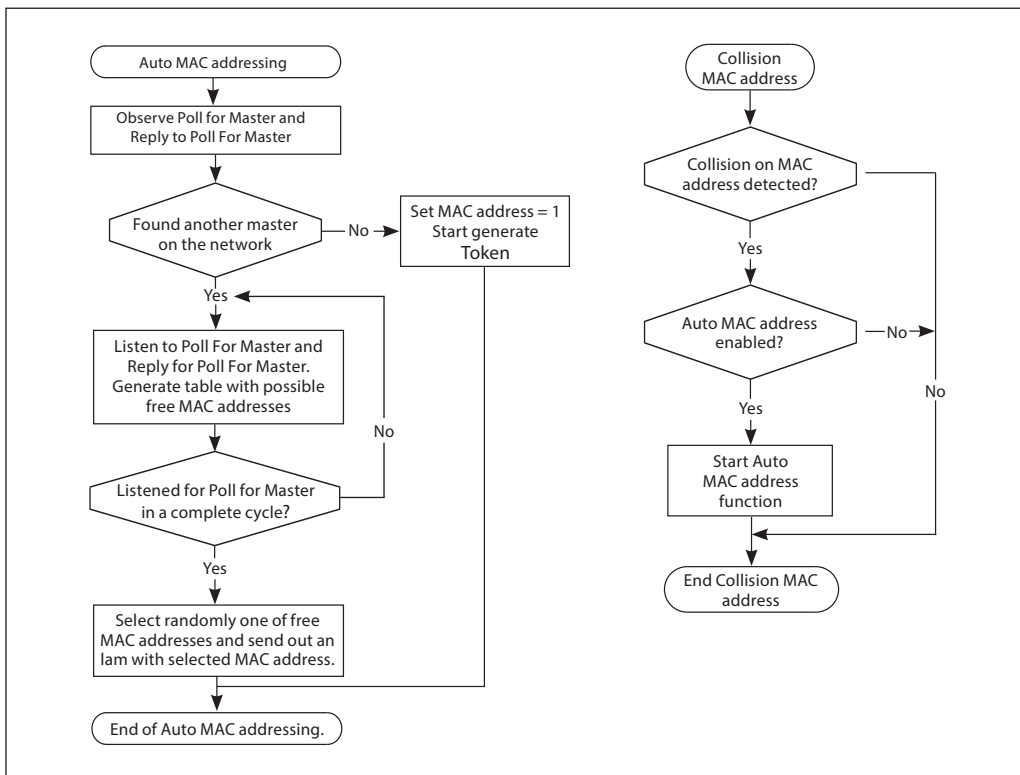
If the NovoCon® observes activity on the bus within 45 seconds after powering up, then it adopts the baud rate presently used on the network by other BACnet devices. If the actuator does not see activity on the network within this time, it generates a token and sends the token out at the default baud rate of 38400bps.



Auto MAC Addressing - BACnet only

MAC address assignment method MSV:5 must be set to 1 (default).

The NovoCon® actuator observes for occupied MAC addresses on the sub-network and then automatically assigns an available MAC address to the actuator only on first Power up. Assuming the address has not already been manually selected by DIP Switches. If a MAC address collision arises an Auto MAC addressing is enabled. This function will start the search for an available MAC address again. When an available MAC address is found, an "I-Am" notification will be sent out via BACnet. Please note that consecutive MAC addresses may not always be assigned.



BACnet Objects - Analog Value

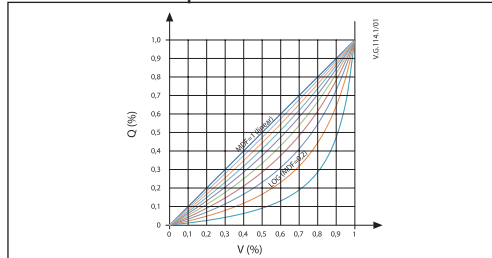
| Ident | Object / Parameter name | Unit | Read/Write | Min | Max | Default State | Resolution | Description | Persistent Yes/No |
|-------|---|--|------------|---|--|--|------------|--|-------------------|
| AV:0 | Design Flow Rate | 98: % 136: L/h 89: GPM | R/W | AB-QM 4.0 DN15-DN32: 10% of nominal flow AB-QM DN10-DN32: 20% of nominal flow AB-QM DN40-DN250: 40% of nominal flow | Setting Range Maximum from Valve table | Nominal value from the Valve table in L/h | 0.1 | Recommended to use AV:30 for Heating and/or AV:31 for cooling. Pre-set value for the Design Flow Rate when control signal is at 100%, if the Application mode is Analog or Digital control otherwise not used. Units can be changed via the object's engineering units property and/or MSV:20. The units L/h (ISO valves) or GPM (ANSI valves) comes from the object MSV:3 Selected Valve type. | Yes |
| AV:1 | Flow Rate Setpoint | 98: % 136: L/h 89: GPM 48: kW 157: kBTU/h | R/W | 0 | 100% or Design Flow value | 100% | 0.01 | The Flow Rate Setpoint (max. flow rate) through the AB-QM valve. Units can be changed via the object's engineering units property and/or MSV: 21. In case the Energy management functions are active the Flow Rate Setpoint will follow the actual setting controlled by the Energy Management function. NOTE: For kW or kBTU/h to become active, MSV:13 Power Controller (state:3) must be chosen. | Yes |
| AV:2 | Flow Rate feedback | % L/h, GPM | R | 0 | If L/h (GPM) is selected then the valve flow rate is set to the selected valve's (MSV:3) maximum value. Otherwise 100% | L/h or GPM depending on the selected valve | 0.001 | Flow rate indication based on the position of the Actuator stem. Units can be changed via the object's engineering units property and/or MSV:22. This object is supported by COV. | No |
| AV:3 | Control Fallback Time | 72: Minutes | R/W | 0 | 60 | 10 | 1 | Time before actuator reacts to a missing analog control signal. i.e. when MSV:9=1 Analog control and not receiving an analog control signal. | Yes |
| AV:4 | Alpha Value | 95: No units | R/W | 0.05 | 1.0 | 1.0 | 0.01 | Value used for shaping the curve in Manual Defined Function (MDF) mode to fit the characteristic curve of a heat exchanger. Linear setting: MDF=1. See curve below table. If AV:1 is in L/h in Digital mode, the alpha setting is ignored. See Alpha value diagram. | Yes |
| AV:5 | Valve closing or opening time | 73: Seconds | R/W | 18 | 700 | na | 1 | The time the actuator needs to move from 0% to 100% of Design Flow Rate. Use with MSV:4. | Yes |
| AV:6 | Voltage of internal power supply | Volts | R | 12 | 50 | na | 0.01 | Rectified voltage which powers the actuator. Too low voltage: 16.1-17.5V. Too high voltage: 38.3-43.4V. Used to check power booster numbers in the layout. | No |
| AV:7 | MAC Address | 95: No units | R/W | 1 | 126 | na | 1 | MAC Address used for BACnet communication. | Yes |
| AV:8 | Temperature in the Actuator | °C, °F | R | -20 | 100 | °C | 0.5 | Temperature measured inside the actuator. Units can be changed via the object's engineering units property. | No |
| AV:9 | Total Operating Hours | Hours | R | 0 | MAX | na | 1 | Total Operating Hours of the actuator. | Yes |
| AV:10 | Minutes since last power-up | Minutes | R | 0 | MAX | na | 1 | Minutes since the last power-up of the actuator. | No |
| AV:11 | Minutes since last calibration | Minutes | R | 0 | MAX | na | 1 | Minutes since the last time the actuator was calibrated to an AB-QM valve. | Yes |
| AV:12 | Minutes since fully closed | Minutes | R | 0 | MAX | na | 1 | Minutes since the last time the AB-QM valve was fully closed. | Yes |
| AV:13 | Minutes Since fully Opened | Minutes | R | 0 | MAX | na | 1 | Minutes since the last time the AB-QM valve was fully opened. | Yes |
| AV:14 | Lifetime estimate | na | R | 0 | MAX | na | 0.01 | Calculated percentage of expended lifetime. At 100% the valve and actuator have reached the estimated minimum lifetime. Replacement of valve and actuator is recommended. | Yes |
| AV:15 | Server Message Count | na | R | 0 | MAX | na | 1 | Server Message Count | No |
| AV:16 | Server Message Received | na | R | 0 | MAX | na | 1 | Server Message Received | No |
| AV:17 | Server Error Count | na | R | 0 | MAX | na | 1 | Server Error Count | No |
| AV:18 | Server Message sent | na | R | 0 | MAX | na | 1 | Server Message sent | No |
| AV:19 | Server Timeout Error | na | R | 0 | MAX | na | 1 | Server Timeout Error | No |
| AV:20 | Serial Number of the actuator | na | R | na | na | na | 1 | Description of this object holds the serial number of the actuator - programmed at the time of production. | na |
| AV:21 | The name of the Selected valve is shown here | L/h or GPM, Unit type comes from MSV:3 Selected Valve Type | R | na | na | na | 1 | Nominal flow of the selected AB-QM valve is shown in the present value. | na |
| AV:22 | Valve position at nominal flow | Millimetre | R | na | na | na | 1 | Position in mm for nominal flow of the selected AB-QM valve. | na |
| AV:23 | Maximum value for the Design Flow Rate | % | R | na | Setting Range Maximum from Valve table | % | 1 | Maximum level the Design Flow Rate can be increased to for the selected AB-QM valve. | na |
| AV:24 | The name of the User Defined Valve is shown here | 136: L/h or 89: GPM. Unit type written here is copied to the Valve Table. Default: L/h | R/W | 1 | NovoCon S: 5000 NovoCon M: 90000 NovoCon L/XL: | 600 | 0.1 | Name and Nominal Flow for the User Defined Valve. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | Yes |
| AV:25 | Valve position at nominal flow for User Defined Valve | 30: Millimetre | R/W | 1.5 | 5.8 | 4 | 0.01 | Position in mm for nominal flow of the User Defined Valve. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | Yes |
| AV:26 | Maximum value for the Design Flow in the User Defined Valve | 98: % | R/W | 100 | 150 | 100 | 1 | Maximum level the Design Flow can be increased to for the User Defined Valve. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | Yes |
| AV:27 | Alarm summary count | No units | R | na | na | 0 | na | Numerical overview about pending errors detected. Coding for AV:27 Alarm summary count is: If BV:10 is active then AV:27 is 1.0. If BV:11 is active then AV:27 is 2.0. If BV:12 is active then AV:27 is 4.0. If BV:13 is active then AV:27 is 8.0. If BV:14 is active then AV:27 is 16.0. If BV:15 is active then AV:27 is 32.0. If BV:16 is active then AV:27 is 64.0. If BV:17 is active then AV:27 is 128.0. If BV:18 is active then AV:27 is 256.0. If BV:19 is active then AV:27 is 512.0. If BV:20 is active then AV:27 is 1024.0. If BV:21 is active then AV:27 is 2048.0. If BV:22 is active then AV:27 is 4096.0. If BV:23 is active then AV:27 is 8192.0. If BV:24 is active then AV:27 is 16384.0. If BV:25 is active then AV:27 is 32768.0. If BV:26 is active then AV:27 is 65536.0. e.g. if both BV:11 & BV:12 are active then AV:27 is 6.0. This object is supported by COV | No |
| AV:30 | Heating Design Flow Rate | 98: % 136: L/h 89: GPM | R/W | AB-QM 4.0 DN15-DN32: 10% of nominal flow AB-QM DN10-DN32: 20% of nominal flow AB-QM DN40-DN250: 40% of nominal flow | Setting Range Maximum from Valve table | Nominal value from the Valve table in L/h | 0.1 | Pre-set value for the Design Flow Rate in heating mode, when the control signal is at 100%. MSV:10 must be set to Heating. The units L/h (ISO valves) or GPM (ANSI valves) comes from the object MSV:3 Selected Valve type | Yes |
| AV:31 | Cooling Design Flow Rate | 98: % 136: L/h 89: GPM | R/W | AB-QM 4.0 DN15-DN32: 10% of nominal flow AB-QM DN10-DN32: 20% of nominal flow AB-QM DN40-DN250: 40% of nominal flow | Setting Range Maximum from Valve table | Nominal value from the Valve table in L/h | 0.1 | Pre-set value for the Design Flow Rate in cooling mode, when the control signal is at 100%. MSV:10 must be set to Cooling. The units L/h (ISO valves) or GPM (ANSI valves) comes from the object MSV:3 Selected Valve type. | Yes |
| AV:32 | Power emission | 48: kW 157: kBTU/h | R | 0 | na | na | 0.01 | The hydronic power emission of the terminal unit, based on calculations from water flow rate and the temperature difference between supply (AI:1) and return (AI:2) pipes. If AV:41 Glycol correction is used, Power emission will be adjusted accordingly. Units can be changed via the object's engineering units property. | No |

BACnet Objects - Analog Value (continued)

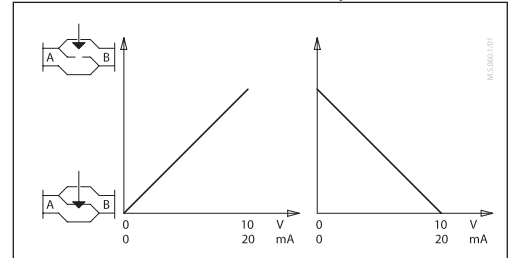
| Ident | Object / Parameter name | Unit | Read/Write | Min | Max | Default State | Description | Information | Persistent Yes/No |
|--------|-------------------------------|---------------------------------|------------|-----|-------|---------------|--|--|-------------------|
| AV:33 | Heating Energy counter | 19: kWh 126: MJ 147: kBtu | R | 0 | na | na | Accumulative Energy counter for heating. | Activated/Deactivated via MSV:12. Units set via MSV:27. If AV:41 Glycol correction is used, Heating Energy counter will be adjusted accordingly. | Yes |
| AV:34 | Cooling Energy counter | 19: kWh 126: MJ 147: kBtu | R | 0 | na | na | Accumulative Energy counter for cooling. | Activated/Deactivated via MSV:12. Units set via MSV:27. If AV:41 Glycol correction is used, Cooling Energy counter will be adjusted accordingly. | Yes |
| AV:35 | Heating max. Power | 48: kW 157: kBtu/h | R/W | 0 | na | 0 | Pre-set value for the design flow rate, in heating mode. | When using MSV:13 state Power limiter this is the maximum allowed hydronic energy output. This value is intended to limit the heating power through the terminal unit. | Yes |
| AV:36 | Cooling max. power | 48: kW 157: kBtu/h | R/W | 0 | na | 0 | Pre-set value for the design flow rate, in cooling mode. | When using MSV:13 state Power limiter this is the maximum allowed hydronic energy output. This value is intended to limit the cooling power through the terminal unit. | Yes |
| AV:37 | Heating Delta T | 62: °C 64: °F | R/W | na | na | 15 | Set-point value for the temperature difference between the flow and return pipes | If Energy management (MSV:13) functions are enabled (Min. delta T limitation (4) or Delta T control (5), this value is reference point (set point) for heating regulation. | Yes |
| AV:38 | Cooling Delta T | 62: °C 64: °F | R/W | na | na | 5 | Set-point value for the temperature difference between the flow and return pipes | If Energy management (MSV:13) functions are enabled (Min. delta T limitation (4) or Delta T control (5), this value is reference point (set point) for cooling regulation. | Yes |
| AV:39 | Heating T2 | 62: °C 64: °F | R/W | na | na | 35 | Set-point value for Heating T2 | If Energy management (MSV:13) functions are enabled (Max. Return T limitation (6), Return T control (7) or T3 temperature control (8), this value is reference point (set point) for heating regulation. | Yes |
| AV:40 | Cooling T2 | 62: °C 64: °F | R/W | na | na | 13 | Set-point value for Cooling T2 | For MSV:13 state Min. Return T management and Set return T control, this is the value the control is based on for cooling. | Yes |
| AV:41 | Glycol Factor | 95: No units | R/W | 0.5 | 2 | 1 | Glycol correction factor | Select appropriate factor from 0.5-2 if a glycol mixture is used. | Yes |
| AV:42 | Position feedback | 98: % | R | 0 | 100 | na | Flow rate indication in percentage | Flow rate indication in percentage based on the position of the Actuator stem. | No |
| AV:43 | Pulse volume | Litre/pulse (l/p) | R/W | 0 | na | 0 | Pulse volume of connected flow sensor | Adapts automatically to the selected AB-QM valve, but can be overwritten manually. If set to 0 NovoCon only count pulses and do not perform flow measurements based on received pulses. This can be used to connect e.g. water meter or energy meter. | Yes |
| AV:44 | Volume counter | m3 | R | 0 | na | 0 | Total accumulated water volume | Total accumulated water volume passed through the valve, combined from both heating and cooling | Yes |
| AV:45 | Pulse counter | pulse | R | 0 | na | 0 | Total accumulated number of pulses | Total accumulated number of pulses received from flow sensor | Yes |
| AV:46 | Energy management min flow | 98: % | R/W | 0 | 100 | 10 | Energy management minimum flow in percentage of AV:30 or AV:31 Design flow rate. | Minimum allowed flow while the Energy management function MSV:13 is active. Exceptions, the object has no effect if: The energy limitation is inactive or the Power control energy mgmt. function is selected. In this case, the min. flow limit is set to 2% of the Design flow rate. | Yes |
| AV:47 | Control-Gain P | 95: No units | R/W | na | na | 7 | Set proportional part for control | Sets the proportional part for control of the object MSV:13 Energy management functions. | Yes |
| AV:48 | Control-Gain I | 95: No units | R/W | na | na | 0.35 | Set integral part for control | Sets the integral part for control of the object MSV:13 Energy management functions. I parameter in sec. = (Pgain / Igain) * 2 sec. Default: 7/0.35 * 2sec. = 40 sec. | Yes |
| AV:50* | Analog CO6 Heating point 100% | 95: No units | R/W | 0 | 10 | 0 | Signal point for Analog CO6 mode | The control signal for heating 100% open when MSV:9 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| AV:51* | Analog CO6 Heating point 0% | 95: No units | R/W | 0 | 10 | 3.3 | Signal point for Analog CO6 mode | The control signal for heating 0% open when MSV:9 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| AV:52* | Analog CO6 Cooling point 0% | 95: No units | R/W | 0 | 10 | 6.7 | Signal point for Analog CO6 mode | The control signal for cooling 0% open when MSV:9 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| AV:53* | Analog CO6 Cooling point 100% | 95: No units | R/W | 0 | 10 | 10 | Signal point for Analog CO6 mode | The control signal for cooling 100% open when MSV:9 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| AV:55 | AI T3 sensor range Low | 62: °C / 64: °F | R/W | na | na | 0 | AI temperature sensor: Low point | Lowest temp. point of sensor measuring range | Yes |
| AV:56 | AI T3 sensor range High | 62: °C / 64: °F | R/W | na | na | 0 | AI temperature sensor: High point | Highest temp. point of sensor measuring range | Yes |
| AV:57 | Flushing time | 72: Minutes | R/W | 1 | 99999 | 60 | Flushing time in minutes | Flushing time in minutes | Yes |

* Only for NovoCon S

AV:4 / 32772 Alpha Value Curve



BV:2 / 32786 Direct or Inverse operation mode



BACnet Objects - Multi State Value

| Ident | Object / Parameter name | Read/Write | State Text | Default State | Description | Persistent Yes/No |
|-------|--|------------|---|---|---|----------------------------|
| MSV:0 | Actuator Mode and special features | R/W | 1: Normal 2: Calibration 3: Flush ¹⁾ 4: De-Air ²⁾ 5: Alarm | 1: Normal | Shows present mode of actuator. Calibration, flushing and de-air may be started from here. | Yes, except state 3, 4 & 5 |
| MSV:1 | Analog Control signal type and range | R/W | 1: 0-5 VDC 2: 0-10 VDC 3: 2-10 VDC 4: 5-10 VDC | 2: 0-10 VDC | Used to select the analog signal input type and range. | Yes |
| MSV:2 | Missing analog signal or action on power reset | R/W | 1: No action 2: CLOSE 3: OPEN 4: 50% of Design Flow | 1: No action | Position after missing analog signal or position after power reset in digital mode. | Yes |
| MSV:3 | Selected Valve Type | R/W | See table "Valve Type Selection" | Related to NovoCon type | This is the AB-QM valve type that the actuator is set-up to control. | Yes |
| MSV:4 | Actuator Speed | R/W | 1: 3 sec/mm 2: 6 sec/mm 3: 12 sec/mm | 4: 24 sec/mm 5: Constant Time | The amount of time the actuator takes to move 1mm or alternatively, a specified constant time function (see AV:5). The Constant Time value range is 18-700 seconds. | Yes |
| MSV:5 | MAC Address assignment method | R/W | 1: DIP Switch Settings or Auto Addressing 2: User configuration over BACnet or Auto Addressing | 1: DIP Switch Settings or Auto Addressing | Method used to set the BACnet MAC address. If the MAC address is not set by DIP Switch, the actuator will automatically assign itself an available MAC address. | Yes |
| MSV:6 | Baud Rate | R/W | 1: Auto Baud Rate Detection 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: 57600 bps 6: 76800 bps 7: 115200 bps | 1: Auto Baud Rate Detection | Baud Rate used for BACnet communication. | Yes |
| MSV:7 | LED Control | R/W | 1: Normal LED mode 2: Show alarms only 3: All LED's OFF 4: Blink | 1: Normal LED mode | Used to select the LED display required. | Yes |

¹⁾ Opens the valve fully for the time set in the object AV: 57 or until a new state is selected

²⁾ Opens and closes the valve 5 times at maximum speed

BACnet Objects - Multi State Value (continued)

| Ident | Object / Parameter name | Read/Write | State Text | Default State | Description | Persistent Yes/No |
|----------|--------------------------------|----------------------|---|----------------------------|--|-------------------|
| MSV:8 | Select field bus protocol | R/W | 1: DIP switch 2: BACnet 3: Modbus | 1: DIP switch | Selection of field bus protocol. See also the DIP Switch Settings section of the data sheet. When the protocol is changed, a power cycle is required to make the actuator adopt the newly selected protocol. | Yes |
| MSV:9 | Application mode | R/W | 1: Analog control 2: Digital control 3: CO6 mode* 4: Inverted CO6 mode* 5: CO6 without alarms* 6: Inverted CO6 without alarms* 7: Analog CO6 mode* 8: Analog inverted CO6 mode* | 2: Digital control | Select the actuator application mode. State 1: Analog Control. Flow is controlled with an analog signal e.g. 0-10V. Design Flow Rate set via AV:30 Heating and/or AV:31 Cooling. Alternative AV:0 can be used. State 2: Digital Control. AV:1 is used to control the flow. Design Flow Rate set via AV:30 Heating and/or AV:31 Cooling. Alternative AV:0 can be used. State 3: CO6 mode. AV:1 is used to control the flow. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. Heating is connected to the CO6 valve to ports 5 & 6 and cooling to ports 1 & 4. State 4: Inverted CO6 mode. AV:1 is used to control the flow. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. Ports are inverted in relation to State 3. State 5: CO6 without alarms. AV:1 is used to control the flow. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. This state may be used if the Analog Input is required to be used other than CO6 feedback. Be aware that in this state the status for the CO6 valve is not shown. State 6: Inverted CO6 without alarms. AV:1 is used to control the flow. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. Ports are inverted in relation to State 3. This state may be used if the Analog Input is required to be used other than CO6 feedback. Be aware that in this state the status for the CO6 valve is not shown. State 7: Analog CO6 mode. The flow is controlled from the Room controller via the analog input signal. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. BV:2 is in this case used to switch the control signal. Be aware that in this state the status for the CO6 valve is not shown. State 8: Analog inverted CO6 mode. The flow is controlled from the Room controller via the analog input signal. Heating Design Flow Rate set via AV:30 and AV:31 for Cooling Design Flow Rate. In this state the Cooling and heating is connected opposite of state 7. When changing to this state the values in AV:50-53 are reversed. BV:2 is in this case used to switch the control signal. Be aware that in this state the status for the CO6 valve is not shown. | Yes |
| MSV:10 | Application command & status | R/W (1-4) R (5-8) | 1: Heating 2: Cooling 3: CO6 Shut Off** 4: CO6 Start exercise 5: CO6 Moving towards Cooling* 6: CO6 Moving towards Heating* 7: CO6 Alarm* 8: CO6 Exercising* | 1: Heating | States 1 to 4 are commands for the Actuator NovoCon® ChangeOver® and impact Energy management Application MSV:13. States 5 to 8 are feedback from the Actuator NovoCon® ChangeOver®. State 3, shut-off mode may only be used for maintenance and is only possible when the Flow Rate Setpoint is 0%. In Central ChangeOver applications, state 1 and 2 are used to command heating or cooling. | Yes |
| MSV:11* | CO6 auto exercise | R/W | 1: ON 2: OFF | 1: ON | ON: The ChangeOver® valve will be moved from current position to shut off and back again once per week to maintain free movement, if CO6 mode is selected. OFF: Exercising the valve should be handled by BMS. | Yes |
| MSV:12 | Energy counting method | R/W | 1: Off 2: On, indicated flow 3: On, flow sensor on return pipe 4: On, flow sensor on supply pipe | 1: Off | State 1: Off NovoCon® is not calculating energy. State 2: On, indicated flow NovoCon® is calculating energy based on temperature difference between T1 and T2 and using indicated flow. State 3: On, flow sensor on return pipe NovoCon® is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on return pipe. State 4: On, flow sensor on supply pipe NovoCon® is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on supply pipe. | Yes |
| MSV:13 | Energy management | R/W | 1: Not active Power Manager: 2: Power limitation 3: Power control Temperature Manager: 4: Min. Delta T limitation 5: Delta T control 6: Return T limitation 7: Return T control 8: Temperature control | 1: Not used | Activate functions to optimize system performance. The calculated flow from the activated energy functions is limited to AV:46 Energy management min flow, except the function Power control that has a limitation at min. 2% of the Design Flow Rate. If needed the PI values can be fine tuned in objects AV:47 and AV:48. State 1: Not active State 2: If power is above the set value in AV:35/36, NovoCon will regulate to the specified limit AV:35 and/or AV:36. When this limitation is active, the warning BV:23 will be set to 'on'. State 3: The flowrate through the valve is controlled by AV:1 in %, kW or kBTU/h (selected in MSV:26) and is based on the flowrate and temperature inputs. State 4: If delta T value in AV:37 and/or AV:38 is exceeded, NovoCon will begin to close the valve until the AV:37 and/or AV:38 values are reached. When this limitation is active, the warning BV:23 will be set to 'on'. State 5: The constant delta T is set in AV:37 and/or AV:38 and NovoCon will regulate within these limits. When this control is active, the warning BV:23 will be set to 'on'. State 6: NovoCon ensures the min. or max. return temp. T2 set in AV:39 & AV:40. In MSV:10 Heating/cooling application must be selected. When this limitation is active, the warning BV:23 will be set to 'on'. State 7: A constant T2 value is set in AV:39 and/or AV:40. NovoCon will regulate to maintain these values constant. State 8: Temperature control (PI control loop), based on T3 sensor input. Set point for heating application is on AV:39 and for cooling on AV:40. | Yes |
| MSV:14 | T1, T2 temperature sensor type | R/W | Select temperature sensor type: 1: NTC10k Type 2 2: NTC10k Type 3 3: PT1000 4: PT500** 5: PT100** | 3: Pt1000 | Select the type of Temperature sensor connected to T1 and T2. | Yes |
| MSV:15** | T3 temperature sensor type | R/W | Select temperature sensor type: 1: NTC10k Type 2 2: NTC10k Type 3 3: PT1000 4: PT500 5: PT100 | 3: Pt1000 | Select the type of Temperature sensor connected to T3 | Yes |
| MSV:16 | Analog Output Type | R/W | 1: Follows MSV: 1 2: 0 - 10V | 1: Follows MSV:1 | 1: Follows Analog Input Type, MSV: 1 If 0-10V/0-20mA input, output 0-10V. If 2-10V/4-20mA, output 2-10V. If 5-10V input, output 5-10V. 2: Always 0 - 10V Type (follows Flow Rate feedback AV:2) | Yes |
| MSV:20 | Units of Design Flow Rate | R/W | 1: L/h 2: % 3: GPM | 1: L/h | Engineering Units used for the Design Flow AV:0, AV:30 and AV:31 | Yes |
| MSV:21 | Units of Flow Rate Setpoint | R/W | 1: L/h 2: % 3: GPM | 2: % 4: kW 5: kBTU/h | Engineering Units used for the desired Flow AV:1. NOTE: If kW or kBTU/h chosen then MSV:13 Power Controller (state:3) also becomes active | Yes |
| MSV:22 | Units of Actual Flow feedback | R/W | 1: L/h 2: % 3: GPM | 1: L/h | Engineering Units used for AV:2 | Yes |
| MSV:23 | Units of Temperature | R/W | 1: °C 2: °F | 1: °C | Engineering Units used for AV:8, AV:37-40 | Yes |
| MSV:24 | Units of T1 | R/W | 1: °C 2: °F | 3: Ohm 1: °C | Engineering Units used for AI:1 | Yes |
| MSV:25 | Units of T2 | R/W | 1: °C 2: °F | 3: Ohm 1: °C | Engineering Units used for AI:2 | Yes |
| MSV:26 | Units of Power | R/W | 1: kW 2: kBTU/h | 1: kW | Engineering Units used for AV:32 | Yes |
| MSV:27 | Units of Energy counter | R/W | 1: kWh 2: MJ | 3: kBTU 1: kWh | Engineering Units used for AV:33 and AV:34 | Yes |
| MSV:28 | Units of T3 | R/W | 1: °C 2: °F | 3: Ohm** 1: °C | Engineering Units used for AI:3 | Yes |
| MSV:41 | AI input | R/W | 1: Disabled 2: Analog input (voltage/current) 3: Flow sensor*** | 2: Analog input | Different options for analog input terminal | Yes |
| MSV:42 | T1 input | R/W | 1: Disabled 2: Supply temperature 3: Return temperature 4: Flow sensor | 2: Supply temp. | Different options for T1 terminal If MSV:24 is on value 3, then value is for resistance, not temperature. | Yes |
| MSV:43 | T2 input | R/W | 1: Disabled 2: Supply temperature 3: Return temperature 4: Flow sensor | 3: Return temp. | Different options for T2 terminal If MSV:25 is on value 3, then value is for resistance, not temperature. | Yes |
| MSV:44** | T3 input | R/W | 1: Disabled 2: Control temperature 3: Flow sensor | 2: Control temp. | Different options for T3 terminal If MSV:27 is on value 3, then value is for resistance, not temperature. | Yes |

* Only for NovoCon S

** Only for NovoCon M, L/XL

*** Not suitable for NovoCon M, L/XL

1) A zero Flow Rate Setpoint command (AV:1) closes the AB-QM, so that there is neither heating nor cooling. Do not use the CO6 maintenance shut-off function for this purpose.

The CO6 valve shut-off function should only be used for maintenance and only when the water temperature in terminal unit is equal to ambient temperature or the terminal unit is not mounted. A water temperature change inside of a closed coil could result in rising pressure and possible damage of to the terminal unit.

BACnet Objects - Binary Value

| Ident | Object / Parameter name | Read/Write | Active Text (1) | Inactive Text (0) | Default State | Description | Persistent Yes/No |
|--------|--|------------|-----------------|-------------------|---------------|--|-------------------|
| BV:2 | Direct or Inverse operation Mode | R/W | Inverse | Direct | Direct | Selection between Direct and Inverse operation mode. See Direct/Inverse diagram. For the states Analog CO6 mode and Inverted Analog CO6 mode this object is used to switch the control signal. | Yes |
| BV:3 | Analog feedback signal | R/W | Active | Inactive | Inactive | By activating this feature, the analog output signal (AO:0) and the position of the valve opening become linked. The voltage output type and range is linked to the MSV:1 present value. This feature may be used for FCU fan control for example and is only made available when MSV:9 Application Mode are in State 1: Analog control or State 2: Digital control. If BV:3 is active and the analog output signal (AO:0) is written to manually it must be relinquished i.e. write "NULL" to return to the original setting of BV:3. In case of Analog control 0-10V/0-20mA, the AO:0 feedback signal will be 0-10V. In case of Analog control 2-10V/4-20mA, the AO:0 feedback signal will be 2-10V. | Yes |
| BV:10 | Warning: Temperature of the actuator is out of recommended range | R | ON | OFF | na | The Temperature inside the Actuator is out of the recommended range. | No |
| BV:11 | Alarm: No Control Signal | R | ON | OFF | na | The actuator has detected that it has no analog control signal. | No |
| BV:12 | Alarm: Error during Closing | R | ON | OFF | na | The actuator is unable to reach it's intended closing position. Check for valve blockages. | No |
| BV:13 | Warning: Pre-set Conflict | R | ON | OFF | na | Conflict between the Mechanical AB-QM valve setting and the NovoCon®. The mechanical valve setting must be 100% or above. The warning will also be activated if the Selected Valve Type has different stroke than the actually valve used validated during calibration. | No |
| BV:14 | Warning: Voltage of power supply is too high | R | ON | OFF | na | Voltage of power supply is measured to be too high. When the measured voltage exceeds 43.4V the alarm will be turned ON for too high voltage. When the measured voltage is once more below 38.3V, the alarm will be turned OFF. | No |
| BV:15 | Warning: Voltage of power supply is too low | R | ON | OFF | na | Voltage of power supply is measured to be too low. If voltage drops below 14.5V (NovoCon S) or 19.0 (NovoCon M/L/XL), alarm is activated. If voltage drops below 14.0V (NovoCon S) or 13.0 (NovoCon M/L/XL), alarm is activated and motor disabled. If voltage goes above 15.5V (NovoCon S) or 18.2V (NovoCon M/L/XL), alarm deactivates and motor is enabled. | No |
| BV:16 | Alarm: Error during Calibration | R | ON | OFF | na | There was an error during calibration of the actuator. E.g. the NovoCon® actuator is not mounted on the valve or the valve is stuck. | No |
| BV:17 | Warning: BACnet MAC-address Conflict was Detected | R | ON | OFF | na | Two or more devices on the same BACnet sub-network have the same MAC-address. | No |
| BV:18 | Warning: Faults on the BACnet was detected | R | ON | OFF | na | Problems with communication on the network are detected. | No |
| BV:19 | Alarm: An internal Error has been detected | R | ON | OFF | na | Re-calibrate or power cycle actuator to reset - actuator replacement may be necessary | No |
| BV:20* | Alarm: CO6 in manual override or CO6 unable to move | R | ON | OFF | na | ChangeOver® actuator is in manual override or is unable to reach position. When the reason for the alarm is removed it may take up to 2 minutes before the alarm is cleared. | No |
| BV:21* | Alarm: CO6 actuator not connected or damaged | R | ON | OFF | na | The ChangeOver® actuator is not connected or is damaged. | No |
| BV:22 | Warning: Temp. sensors are missing or interchanged | R | ON | OFF | na | Temp. sensors are missing or interchanged | No |
| BV:23 | Warning: Energy limitation is active | R | ON | OFF | na | Limitation is active. E.g. Power limitation, min. delta T or min/max return T management limitation. | No |
| BV:24 | Warning: Energy management controller out of range | R | ON | OFF | na | Power, delta T or return T setpoint out of range or the setpoint can't be achieved. Action: Check that setpoint is achievable with the given flow rates and temperatures. | No |
| BV: 25 | Warning: Flow out of expectations | R | ON | OFF | na | Warning for lower or higher flow than expected | No |
| BV: 26 | Warning: No flow detected | R | ON | OFF | na | No flow detected with flow sensor | No |

* Only for NovoCon S

BACnet Objects - Device Object

List with some selected important Device Object properties.

| Property | Value | Read/Write | Description | Persistent Yes/No |
|-------------------------|---|------------|--|-------------------|
| Object ID | Instance Range: 0 to 4194302 | R/W | This property is normally called Device Instance number or Unique ID. | Yes |
| Object-Name | Combination of "NovoCon" + Type and Object ID | R/W | Product name. Max. 25 characters. | Yes |
| Firmware revision | Current firmware version | R | BACnet software revision. | Yes |
| Application S/W version | Current Application SW version | R | Actuator Application Software version. | Yes |
| Location | This string is empty when actuator is new. | R/W | Free text can be used to describe location etc. Max. 50 characters. | Yes |
| Description | Danfoss NovoCon actuator with BACnet MS/TP | R/W | Product description. Max. 50 characters. | Yes |
| Segmentation-supported | SEGMENTATION | R | Able to transmit and receive segmented messages. | Yes |
| Max-master | Default: 127 Range: 0-127 | R/W | The MAX_master setting in NovoCon® can be set above the highest used MAC address in the MS/TP sub network. | Yes |
| Max ADPU length | 480 | R | Maximum allowed ADPU length. | Yes |
| Max segments accepted | 5 | R | Max segments accepted | Yes |

**BACnet Objects
- Analog Input**

| Ident | Object / Parameter name | Unit | Read / Write | Min | Max | Default units | Description | Persistent Yes/No |
|-------|------------------------------------|-------------------------------|--------------|-----------------------|------------------------|---------------|---|-------------------|
| AI:0 | Voltage or Current on analog input | 5: Volts 2: mA | R | 0 | 10V 20mA | Volts | Voltage(V) or Current(mA) level on the analog control input, measured by the actuator. Units comes from MSV:1 Analog Control signal type and range. This object is supported by COV. In CO6 modes mA cannot be selected. | No |
| AI:1 | T1 value | 62: °C 64: °F, 4: Ohm** | R | -10°C 10°F 900Ω | 120°C 250°F 10kΩ | °C | Temperature/resistance measured from connected sensors. For Power emission AV:32, AI:1 is temperature on the flow pipe and AI:2 is temperature on the return pipe. When used as potential free contacts: Closed circuit <900Ω, open circuit 100kΩ. Recommended max. cable length 3m. Units can be changed via the object's engineering units property or via objects MSV:24 and MSV:25. The upper temperature limit for NTC 10k Type 2 sensors is 90°C/194°F. The upper temperature limit for NTC sensor 10k Type 3 is 95°C/203°F. This object is supported by COV. NovoCon S uses active voltage analog sensor (on analog input) for sensing temperature, range depends on sensor model. | No |
| AI:2 | T2 value | | | | | | | |
| AI:3 | T3 value | | | | | | | |

** Only for NovoCon M, L/XL

**BACnet Objects
- Analog Output**

| Ident | Object / Parameter name | Unit | Read / Write | Min | Max | Default units | Description | Persistent Yes/No |
|-------|--------------------------|-------|--------------|-----|-----|---------------|---|-------------------|
| AO:0 | Voltage on analog output | Volts | R/W | 0 | 10 | Volt | Output Voltage value. Type selectable in MSV:16. Note: In CO6 modes the present value is not writeable. | No |

**BACnet Objects
- Notification class**

| Ident | Object / Parameter name | Description |
|-------|---|--|
| NC:0 | Alarm Notifier, Subscribe here for alarms | Subscribe devices for receiving alarms |

NC:0 is an object where other BACnet devices can subscribe to be informed directly from this device if an alarm or warning is activated or cleared. A maximum of 4 devices can subscribe to this service. Subscribers of this object will be informed if any of the Warning or Alarms BV:10 to BV:24 is activated or cleared.

When the notification class NC:0 is going to be used to notify about changes with status of Warnings and Alarms (BV:10 – BV24), it is necessary to subscribe for notifications for the entire day and week: From 00:00:00:00 to 23:59:59:99 and all 7 days of the week. This is because the actuator does not have a clock built in and will therefore not be able to handle notifications with respect to time.

**BACnet Objects
- Averaging**

| Ident | Object / Parameter name | Min. Value | Average value | Max. Value | Window Interval | Window Sample | Description | Persistent Yes/No |
|-------|----------------------------------|--|---------------|------------|-----------------|---------------|--|-------------------|
| AVO:0 | Voltage of internal power supply | Updated according to actual measurements | | | 1 Day | 24 | Average of the rectified voltage that powers the actuator. | No |

BACnet BIBBs services

| Service | BIBBs | Init/Exe |
|----------------------------------|-----------|----------|
| ReadProperty | DS-RP-B | exe |
| WriteProperty | DS-WP-B | exe |
| Who-Is | DM-DDB-A | init |
| Who-Is | DM-DDB-B | exe |
| I-Am | DM-DDB-B | init |
| I-Am | DM-DDB-A | exe |
| Who-Has | DM-DOB-B | exe |
| I-Have | DM-DOB-B | init |
| DeviceCommunicationControl | DM-DCC-B | exe |
| ReinitializeDevice ¹⁾ | DM-RD-B | exe |
| ConfirmedEventNotification | AE-N-I-B | init |
| UnconfirmedEventNotification | AE-N-I-B | init |
| AcknowledgeAlarm | AE-ACK-B | exe |
| GetEventInformation | AE-INFO-B | exe |

| Service | BIBBs | Init/Exe |
|----------------------------|-----------|----------|
| GetAlarmSummary | AE-ASUM-B | exe |
| GetEnrollmentSummary | AE-ESUM-B | exe |
| AddListElement | DM-LM-B | exe |
| RemoveListElement | DM-LM-B | exe |
| ReadPropertyMultiple | DS-RPM-B | exe |
| WritePropertyMultiple | DS-WPM-B | exe |
| SubscribeCOV ²⁾ | DS-COV-B | exe |
| Restart | DM-R-B | exe |
| AtomicWriteFile | na | exe |

¹⁾ NovoCon® supports BACnet warm reset (power cycle) and Cold reset (factory reset). Note that after Cold/factory reset a calibration will be automatically performed and all settings will be reverted to factory settings.

²⁾ COV is implemented for the following: Analog Inputs AI:0, AI:1 and AI:2, and for the following Analog Values AV:2 and AV:27.

Modbus registers - Configuration

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Unit | Description of usage | Persistent Yes/No |
|-----------------|------------|-----------------|------------------|---|--|---|--|---|-------------------|
| 0x8000 32768 | R/W | 3,4 & 16 | FLOAT | Design Flow Rate | Recommended to use 32796 for Heating and/or 32798 for cooling. Pre-set value for the Design Flow Rate when control signal is at 100%. Unit follows 32787 | Nominal value from the Valve table in L/h | %, L/h, GPM | AB-QM 4.0 DN15-DN32: 10% of nominal flow AB-QM DN10-DN32: 20% of nominal flow AB-QM DN40-DN250: 40% of nominal flow | Yes |
| 0x8002 32770 | R/W | 3,4 & 6 | WORD | Control Fallback Time | Time before actuator reacts to a missing analog control signal | 10 | Minutes | Control Fallback Time in minutes, i.e.. 0 ... 60 correspond to 0 ... 60 minutes | Yes |
| 0x8004 32772 | R/W | 3,4 & 16 | FLOAT | Alpha Value | Value used for shaping the curve in Manual Defined Function (MDF) mode to fit the characteristics curve of a heat exchanger. If 33280 is in L/h in Digital mode, the alpha setting is ignored. | 1.0 | na | Alpha Value curve, i.e. 0.05 ... 1.00 correspond to 0.05 ... 1.00. Alpha = 1.00 is linear. Alpha = 0.2 is equal to the LOG function. See Alpha value diagram. | Yes |
| 0x8006 32774 | R/W | 3,4 & 16 | WORD | Valve closing or opening time | The time the actuator needs to move from 0% to 100% of Design Flow Rate. Use with 32803. | na | Seconds | Valve closing or opening time in seconds i.e.. 18 ... 700 correspond to 18 ... 700 seconds | Yes |
| 0x8008 32776 | R | 3,4 & 6 | FLOAT | Nominal Flow of the user defined valve | The Nominal flow of the user defined valve is shown here. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | na | L/h or GPM, Unit type comes from Valve Table | Nominal flow e.g. in Liters per hour i.e. 0 ..600 correspond to 0 ...600 L/h | Yes |
| 0x800A 32778 | R | 3 & 4 | FLOAT | Valve position at nominal flow for User Defined Valve | Position in mm for nominal flow of the User Defined Valve. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | 4 | Millimetre | Valve position for nominal flow in millimetre, i.e. 0.5 ... 5.8 correspond to 0.5 ... 5.8 millimetre | Yes |
| 0x800C 32780 | R/W | 3,4 & 6 | FLOAT | Maximum value for the Design Flow in the User Defined Valve | Maximum level the Design Flow Rate can be increased to for the User Defined Valve. This Object is used only if NovoCon® is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible. | 100 | Unit type follows 32787 selection: % or (L/h or GPM) | i.e. 100 ..150 correspond to 100 ...150 % | Yes |
| 0x8012 32786 | R/W | 3,4 & 6 | WORD | Direct or Inverse operation Mode | Selection between Direct and Inverse operation mode. See Direct/Inverse diagram. | 0: Direct | 0: Direct 1: Inverse | Selection between Direct and Inverse operation mode. See Direct/Inverse diagram. | Yes |
| 0x8013 32787 | R/W | 3,4 & 6 | WORD | Units of and display the Design Flow Rate | Units used to set and display the Design Flow Rate. Units for L/h & GPM comes from Selected Valve Type. | 0: L/h | 0: L/h 1: % 2: GPM | Engineering Units used for the Design Flow Rate. | Yes |
| 0x8014 32788 | R/W | 3,4 & 6 | WORD | Units of and display Flow Rate Setpoint | Units used to set and display Flow Rate Setpoint | 1: % | 0: L/h 1: % 2: GPM 3: kW 4: kBTU/h | Engineering Units used for the desired Flow 33280. Note: If kW or kBTU/h chosen then 32815 Power Controller (state 3) also becomes active. | Yes |
| 0x8015 32789 | R/W | 3,4 & 6 | WORD | Units of and display the Flow Rate feedback | Units used to set and display the Flow Rate feedback | 0: L/h | 0: L/h 1: % 2: GPM | Engineering Units used for 33282. | Yes |
| 0x8016 32790 | R/W | 3,4 & 6 | WORD | Units of temperature | Select between °C or °F to set and display temperature | 0: °C | 0: °C 1: °F | Engineering Units for 33796, 32836, 32838, 32840 & 32842. | Yes |
| 0x8017 32791 | R/W | 3,4 & 6 | WORD | Units of T1 | Units used to read the temperature or resistance value. | 0: °C | 0: °C 1: °F 2: Ohm** | Engineering Units used for 33218. | Yes |
| 0x8018 32792 | R/W | 3,4 & 6 | WORD | Units of T2 | | | | Engineering Units used for 33220. | |
| 0x8032 32818 | R/W | 3,4 & 6 | WORD | Units of T3 | | | | Engineering Units used for 33222. | |
| 0x8019 32793 | R/W | 3,4 & 6 | WORD | Units of Power | Units used to read the power usage. | 0: kW | 0: kW, 1: kBTU/h | Engineering Units for 33288. | Yes |
| 0x801A 32794 | R/W | 3,4 & 6 | WORD | Endian type | Word ordering for LONG and FLOAT types | 0: Big | 0: Big 1: Little | Used endian type for float and long registers | Yes |
| 0x801C 32796 | R/W | 3,4 & 16 | FLOAT | Heating Design Flow Rate | Pre-set value for the Design Flow Rate when the control signal is at 100%. | Nominal value from the Valve table in L/h | % , L/h, GPM | AB-QM 4.0 DN15-DN32: 10% of nominal flow AB-QM DN10-DN32: 20% of nominal flow AB-QM DN40-DN250: 40% of nominal flow | Yes |
| 0x801E 32798 | R/W | 3,4 & 16 | FLOAT | Cooling Design Flow Rate | 32811 must be set to Heating or Cooling. Unit follows 32787 | | | | |

** Only for NovoCon M, L/XL

Modbus registers - Configuration (continued)

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Description of usage | Persistent Yes/No |
|-----------------|------------|-----------------|------------------|--|---|------------------------|--|-------------------|
| 0x802A 32810 | R/W | 3,4 & 6 | WORD | Application mode | 1: Analog control 2: Digital control 3: CO6 mode* 4: Inverted CO6 mode* 5: CO6 without alarms* 6: Inverted CO6 without alarms* 7: Analog CO6 mode* 8: Analog inverted CO6 mode* | 2: Digital | Select the actuator application mode. State 1: Analog Control. Flow is controlled with an analog signal e.g. 0-10V. Design Flow Rate set via register 32796 Heating and/or 32798 Cooling. Alternative 32738 can be used. State 2: Digital Control. Register 33280 is used to control the flow. Design Flow Rate set via register 32796 Heating and/or 32798 Cooling. Alternative 32738 can be used. State 3*: CO6 mode. Register 33280 is used to control the flow. Heating Design Flow Rate set via register 32796 and register 32798 for Cooling Design Flow Rate. Heating is connected to the CO6 valve to ports 5 & 6 and cooling to ports 1 & 4. State 4*: Inverted CO6 mode. Register 33280 is used to control the flow. Heating Design Flow Rate set via register 32796 and 32798 for Cooling Design Flow Rate. Ports are inverted in relation to State 3.* State 5*: CO6 without alarms. Register 33280 is used to control the flow. Heating Design Flow Rate set via register 32796 and 32798 for Cooling Design Flow Rate. This state may be used if the Analog Input is required to be used other than CO6 feedback. Be aware that in this state the status for the CO6 valve is not shown.* State 6*: Inverted CO6 without alarms. register 33280 is used to control the flow. Heating Design Flow Rate set via register 32796 and 32798 for Cooling Design Flow Rate. Ports are inverted in relation to State 3. This state may be used if the Analog Input is required to be used other than CO6 feedback. Be aware that in this state the status for the CO6 valve is not shown.* State 7*: Analog CO6 mode. The flow is controlled from the Room controller via the analog input signal. Heating Design Flow Rate set via register 32796 and 32798 for Cooling Design Flow Rate. Register 32786 is in this case used to switch the control signal. Be aware that in this state the status for the CO6 valve is not shown.* State 8*: Analog inverted CO6 mode. The flow is controlled from the Room controller via the analog input signal. Heating Design Flow Rate set via register 32796 and 32798 for Cooling Design Flow Rate. In this state the Cooling and heating is connected opposite of state 7. When changing to this state the values in register 32848-32854 are reversed. Register 32786 is in this case used to switch the control signal. Be aware that in this state the status for the CO6 valve is not shown.* | Yes |
| 0x802B 32811 | R/W | 3,4 & 6 | WORD | Application command & status | 1: Heating 2: Cooling 3: CO6 Shut Off 4: CO6 Start exercise* 5: CO6 Moving towards Heating* 6: CO6 Moving towards Cooling* 7: CO6 Alarm* 8: CO6 Exercising* | 1: Heating | States 1 to 4 are commands for the Actuator NovoCon® ChangeOver6 and impact Energy management Application register 32815. States 5 to 8 are feedback from the Actuator NovoCon® ChangeOver6. State 3, shut-off mode may only be used for maintenance and is only possible when the Flow Rate Setpoint is 0%. In Central ChangeOver applications, state 1 and 2 are used to command heating or cooling. | Yes |
| 0x802C 32812* | R/W | 3,4 & 6 | WORD | CO6 auto exercise | 1: ON 2: OFF | 1: ON | 1: ON: The ChangeOver6 valve will be moved from current position to shut off and back again once per week to maintain free movement, if CO6 mode is selected. 2: OFF: Exercising the valve should be handled by BMS. | Yes |
| 0x802E 32814 | R/W | 3,4 & 6 | WORD | Energy counting method | 1: Off 2: On, indicated flow 3: On, flow sensor on return pipe 4: On, flow sensor on supply pipe | 1: Off | State 1: Off NovoCon® is not calculating energy. State 2: On, indicated flow NovoCon® is calculating energy based on temperature difference between T1 and T2 and using indicated flow. State 3: On, flow sensor on return pipe NovoCon® is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on return pipe. State 4: On, flow sensor on supply pipe NovoCon® is calculating energy based on temperature difference between T1 and T2 and using flow from flow sensor installed on supply pipe. | Yes |
| 0x802F 32815 | R/W | 3,4 & 6 | WORD | Energy management | 1: Not active Power Manager: 2: Power limitation 3: Power control Temperature Manager: 4: Min. Delta T limitation 5: Delta T control 6: Return T limitation 7: Return T control 8: Temperature control | 1: Not used | Activate functions to optimize system performance. The calculated flow from the activated energy functions is limited to register 32862 Energy management min flow, except the function Power control that has a limitation at min. 2% of the Design Flow Rate. If needed the PI values can be fine tuned in register 32856 and 32858. State 1: Not active. State 2: If power is above the set value in register 32832 or register 32834, NovoCon will regulate to the specified limit register 32832 and/or 32834. When this limitation is active, the warning bit 23 in register 33536 will be set to 'on'. State 3: The flowrate through the valve is controlled by register 33280 in %, kW or kBTU/h (selected in 32793) and is based on the flowrate and temperature inputs. State 4: If delta T value in register 32836 and/or 32838 is exceeded, NovoCon will begin to close the valve until the register 32836 and/or 32838 values are reached. When this limitation is active, the warning bit 23 in register 33536 will be set to 'on'. State 5: The constant delta T is set in register 32836 and/or 32838 and NovoCon will regulate within these limits. When this control is active, the warning bit 23 in register 33536 will be set to 'on'. State 6: NovoCon ensures the min. or max. return temp. T2 set in 32840 & 32842. In register 32811 Heating/cooling application must be selected. When this limitation is active, the warning bit 23 in register 33536 will be set to 'on'. State 7: A constant T2 value is set in 32840 and/or 32842. NovoCon will regulate to maintain these values constant. State 8: Temperature control (PI control loop), based T3 sensor input. Set point for heating application is on 32840 and for cooling on 32842. | Yes |
| 0x8020 32800 | R/W | 3,4 & 6 | WORD | Analog Control signal type and range | Used to select the analog control signal input type and range | 2: 0-10 VDC | Select 1, 2 or... based on the table below: 4: 5-10 VDC 1: 0-5 VDC 2: 0-10 VDC 3: 2-10 VDC 5: 2-6 VDC 6: 6-10 VDC 7: 0-20 mA 8: 4-20 mA | Yes |
| 0x8021 32801 | R/W | 3,4 & 6 | WORD | Missing analog signal or action on power reset | Position after missing analog signal or position after power reset in digital mode. | 1: No action | Select 1, 2 or... based on the table below: 1: No action 2: CLOSE 3: OPEN 4: Go to 50% of Design Flow Rate | Yes |
| 0x8022 32802 | R/W | 3,4 & 6 | WORD | Selected Valve Type | This is the AB-QM valve type that the actuator is set-up to control | 2: AB-QM 4.0 ISO DN 15 | See table Valve Type Selection | Yes |

* Only for NovoCon S

¹⁾ A zero Flow Rate Setpoint command (33280) closes the AB-QM, so that there is neither heating nor cooling, do not use the CO6 maintenance shut-off function for this purpose.

The CO6 valve shut-off function should only be used for maintenance and only when the water temperature in terminal unit is equal to ambient temperature or the terminal unit is not mounted. A water temperature change inside of a closed coil could result in rising pressure and possible damage of to the terminal unit.

Modbus registers - Configuration (continued)

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Unit | Description of usage | Persistent Yes/No |
|-------------------|------------|-----------------|------------------|--------------------------------|---|-----------------------------|-------------|---|-------------------|
| 0x8023 32803 | R/W | 3, 4 & 6 | WORD | Actuator Speed | The amount of time the actuator takes to move 1mm or alternatively, a specified constant time function (see 32774). The Constant Time value range is 18-700 seconds. | 4: 24 sec/mm | na | Select 1, 2 or... based on the table below: 1: 3 sec/mm 2: 6 sec/mm 3: 12 sec/mm 4: 24 sec/mm 5: Constant Time (set by register 0x8006) | Yes |
| 0x8024 32804 | R/W | 3, 4 & 6 | WORD | Baud Rate | Baud Rate used for bus communication | 1: Auto Baud Rate Detection | na | Select 1, 2 or... based on the table below: 1: Auto Baud Rate Detection 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: 57600 bps 6: 76800 bps 7: 115200 bps | Yes |
| 0x8025 32805 | R/W | 3, 4 & 6 | WORD | Select UART mode | Supported transmission modes | 5: Auto parity | na | Select 1, 2, 3 or 4 based on the table below: 1: 1-8-N-2 2: 1-8-O-1 3: 1-8-E-1 4: 1-8-N-1 5: Auto parity Data format: (Start bit-Data bits-Parity-Stop bits) | Yes |
| 0x8026 32806 | R/W | 3, 4 & 6 | WORD | Slave ID | Slave ID used for communication. | na | na | Slave ID used for communication | Yes |
| 0x8027 32807 | R/W | 3, 4 & 6 | WORD | Slave ID assignment method | The Slave ID address selection method. | 1: DIP Switch Settings | na | 1: DIP Switch Settings 2: User configuration over Modbus If DIP Switches are in an invalid position the actuator will automatically check if a Slave ID is present in the User Configuration. | Yes |
| 0x8028 32808 | R/W | 3, 4 & 6 | WORD | BUS protocol | Select field bus protocol to be used. See also the DIP Switch Settings section of the data sheet. When the protocol is changed, a power cycle is required to make the actuator adopt the newly selected protocol. | 1: DIP switch | na | Select 1, 2 or 3 based on the table below: 1: DIP switch 2: BACnet 3: Modbus | Yes |
| 0x8029 32809 | R/W | 3, 4 & 6 | WORD | LED Control | Used to select the LED display required. | 1: Normal LED mode | na | Select 1, 2 or... based on the table below: 1: Normal LED mode 2: Show alarms only 3: All LED's OFF 4: Blink (can be used to locate the actuator) | Yes |
| 0x8030 32816 | R/W | 3, 4 & 6 | WORD | Units of set Energy counter | Units used to set energy counter | 0: kWh 1: MJ 2: kBTU | na | Engineering Units used for 33290 & 33292. | Yes |
| 0x8031 32817 | R/W | 3, 4 & 6 | WORD | Analog feedback signal | Set analog output according to valve position | 0: Inactive | na | 0: Inactive 1: Active By activating this feature, the analog output signal (33286) and the position of the valve opening become linked. The voltage output type and range is linked to the 32800 present value. This feature may be used for FCU fan control for example and is only made available when 32810 Application Mode are in State 1: Analog control or State 2: Digital control. If 32817 is active and the analog output signal (33286) must be written to manually, it is necessary to change the setting of 32817 to inactive. In case of Analog control 0-10V/0-20mA, the register 33286 feedback signal will be 0-10V. In case of Analog control 2-10V/4-20mA, the register 33286 feedback signal will be 2-10V. | Yes |
| 0x8033 32819 | R/W | 3, 4 & 6 | WORD | T1, T2 temperature sensor type | Select the type of Temperature sensor connected to T1 and T2. | 3: Pt1000 | na | Select temperature sensor type: 1: NTC10k Type 2 2: NTC10k Type 3 3: Pt1000 4: PT500 5: PT100 | Yes |
| 0x8034 32820** | R/W | 3, 4 & 6 | WORD | T3 temperature sensor type | Select the type of Temperature sensor connected to T3. | 3: Pt1000 | na | Select temperature sensor type: 1: NTC10k Type 2 2: NTC10k Type 3 3: Pt1000 4: PT500 5: PT100 | Yes |
| 0x8035 32821 | R/W | 3, 4 & 6 | WORD | AI input | Different options for analog input terminal | 2: Analog input | na | 1: Disabled 2: Analog input (voltage/current) 3: Flow sensor*** | Yes |
| 0x8036 32822 | R/W | 3, 4 & 6 | WORD | T1 input | Different options for T1 terminal | 2: Supply temp. | na | 1: Disabled 2: Supply temperature 3: Return temperature 4: Flow sensor | Yes |
| 0x8037 32823 | R/W | 3, 4 & 6 | WORD | T2 input | Different options for T2 terminal | 3: Return temp. | na | 1: Disabled 2: Supply temperature 3: Return temperature 4: Flow sensor | Yes |
| 0x8038 32824** | R/W | 3, 4 & 6 | WORD | T3 input | Different options for T3 terminal | 2: Control temp. | na | 1: Disabled 2: Control temperature sensor 3: Flow sensor | Yes |
| 0x8039 32825 | R/W | 3, 4 & 6 | WORD | Analog Output Type | Analog output feedback signal type | 1 | na | 1: Follows Analog Input Type, register 32800. If 0-10V/0-20mA input, output 0-10V. If 2-10V/4-20mA, output 2-10V. If 5-10V input, output 5-10V. 2: Always 0 - 10V (follows Flow Rate feedback 33282) | Yes |
| 0x804C 32844 | R/W | 3, 4 & 16 | FLOAT | Glycol Factor | Glycol correction factor | 1 | na | Select appropriate factor from 0.5-2 if a glycol mixture is used. | Yes |
| 0x8050 32848* | R/W | 3, 4 & 16 | FLOAT | Analog CO6 Heating point 100% | Signal point for Analog CO6 mode* | 0 | na | The control signal for heating 100% open when register 32810 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| 0x8052 32850* | R/W | 3, 4 & 16 | FLOAT | Analog CO6 Heating point 0% | Signal point for Analog CO6 mode* | 3.3 | na | The control signal for heating 0% open when register 32810 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| 0x8054 32852* | R/W | 3, 4 & 16 | FLOAT | Analog CO6 Cooling point 0% | Signal point for Analog CO6 mode* | 6.7 | na | The control signal for cooling 0% open when register 32810 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| 0x8056 32854* | R/W | 3, 4 & 16 | FLOAT | Analog CO6 Cooling point 100% | Signal point for Analog CO6 mode* | 10 | na | The control signal for cooling 100% open when register 32810 = State 7 or 8. Overlapping heating and cooling control curves are not accepted. | Yes |
| 0x8058 32856 | R/W | 3, 4 & 16 | FLOAT | Control-Gain P | Set proportional part for control | 7 | na | Sets the proportional part for control of register 32815 Energy management functions. | Yes |
| 0x805A 32858 | R/W | 3, 4 & 16 | FLOAT | Control-Gain I | Set integral part for control | 0.35 | na | Sets the integral part for control of register 32815 Energy management functions. I parameter in sec. = (Pgain / Igain) * 2 sec. Default: 7/0.35 * 2sec. = 40 sec. | Yes |
| 0x805E 32862 | R/W | 3, 4 & 16 | FLOAT | Energy management min flow | Energy management minimum flow in percentage of register 32796 or 32798 Design flow Rate. | 10 | % | Minimum allowed flow while the Energy management function register 32815 is active. Exceptions, the object has no effect if: The energy limitation is inactive or the Power control energy mgmt. function is selected. In this case, the min. flow limit is set to 2% of the Design flow rate. 0...100 correspond to 0... 100%. | Yes |
| 0x8060 32864 | R/W | 3, 4 & 16 | FLOAT | Pulse volume | Pulse volume of connected flow sensor | 0 | Litre/pulse | Adapts automatically to the selected AB-QM valve, but can be overwritten manually. If set to 0 NovoCon only count pulses and do not perform flow measurements based on received pulses. This can be used to connect e.g. water meter or energy meter. | Yes |
| 0x8500 34048 | W | 6 | WORD | Reset | Warm reset = Power cycle. Cold reset = Factory reset. Note that after factory reset a calibration will be automatically be performed and all settings will be reverted to factory settings. | na | na | 0x5741 / 22337: Warm reset 0x434F / 17231: Cold reset. | na |
| 0x8062 32866 | R/W | 3, 4 & 16 | FLOAT | AI low temp | AI T sensor range Low | 0 | °C/°F | Lowest temp. point of sensor measuring range | Yes |
| 0x8064 32868 | R/W | 3, 4 & 16 | FLOAT | AI high temp | AI T sensor range High | 0 | °C/°F | Highest temp. point of sensor measuring range | Yes |
| 0x8066 32870 | R/W | 3, 4 & 6 | LONG | Flushing time | Flushing time in minutes | 60 | Minutes | Flushing time in minutes | Yes |

* Only for NovoCon S, ** Only for NovoCon M, L/XL, *** Not suitable for NovoCon M, L/XL

Modbus registers - Operating

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Unit | Description of usage | Persistent Yes/No |
|-----------------|------------|-----------------|------------------|------------------------------------|--|---------------|------------------------|--|---------------------------|
| 0x8200 33280 | R/W | 3,4 & 16 | FLOAT | Flow Rate Setpoint | The Flow Rate Setpoint through the AB-QM valve. Unit follows 32788. In case the Energy management functions are active the Flow Rate Setpoint will follow the actual setting controlled by the Energy Management function. | 100% | % L/h, GPM, kW, kBTU/h | Flow Rate Setpoint in percent, i.e.0 ... 100 correspond to 0 ... 100% | Yes |
| 0x8202 33282 | R | 3 & 4 | FLOAT | Flow Rate feedback | Flow Rate Indication based on the position of the Actuator stem. Unit follows 32789 | na | % L/h, GPM | Flow Rate feedback in percent, i.e. 0 ... 100 correspond to 0 ... 100%. If L/h (GPM) is selected in 32787 then the valve flow rate is set to the selected valve's 32776 maximum value. Otherwise 100% | No |
| 0x8204 33284 | R/W | 3,4 & 6 | WORD | Actuator Mode and special features | Shows present mode of actuator. Calibration, Flush and de-air may be started from here | 1:Normal | na | Select 1, 2 or ... based on the table below: 1: Normal 2: Calibration 3: Flush. Time set in register 32870 4: De-Air 5: Alarm | Yes, except state 3,4 & 5 |
| 0x8206 33286 | R/W | 3,4 & 16 | FLOAT | Voltage on analog output | Output Voltage value in Digital and Analog mode 32810. Type selectable in 32825. Note: In CO6 and Inversed CO6 mode the present value is not writeable | na | Volts | Voltage level i.e. 0.00 ... 10.00 correspond to 0.00 ... 10.00 V | No |
| 0x8208 33288 | R | 3,4 & 16 | FLOAT | Power emission | The hydronic power emission of the terminal unit, based on calculations from water flow rate and the temperature difference between supply (33218) and return (33220) pipes. Positive values reflect heating power emission. Negative values reflect cooling power emission. Units can be changed via the object's engineering units property. | na | kW, kBTU/h | Power in kW or kBTU/h. If register 32844 Glycol correction is used, Power emission will be adjusted accordingly. i.e. -1000.00 ... 1000.00 correspond to -1000.00 ... 1000.00 kW or in kBTU/h, i.e. -1000.00 ... 1000.00 correspond to -1000.00 ... 1000.00 kBTU/h | No |
| 0x820A 33290 | R | 3,4 & 16 | FLOAT | Heating Energy counter | Energy counter for heating | na | kWh, MJ, kBTU | Accumulative Energy counter for heating. i.e. 0.00 ... 1000.00 correspond to 0.00 ... 1000.00 kWh. If register 32844 Glycol correction is used, Heating Energy Counter emission will be adjusted accordingly. Activated/Deactivated via register 32814. | Yes |
| 0x820C 33292 | R | 3,4 & 16 | FLOAT | Cooling Energy counter | Energy counter for cooling | na | kWh, MJ, kBTU | Accumulative Energy counter for cooling. i.e. 0.00 ... 1000.00 correspond to 0.00 ... 1000.00 kWh. If register 32844 Glycol correction is used, Cooling Energy Counter emission will be adjusted accordingly. Activated/Deactivated via register 32814. | Yes |
| 0x820E 33294 | R | 3 & 4 | FLOAT | Position feedback | Flow rate indication in percentage | na | % | Flow rate indication in percentage based on the position of the Actuator stem. | No |
| 0x8210 33296 | R | 3, 4 | FLOAT | Volume counter | Total accumulated water volume | 0 | L | Total accumulated water volume passed through the valve, combined from both heating and cooling | Yes |
| 0x8212 33298 | R | 3, 4 | FLOAT | Pulse counter | Total accumulated number of pulses | 0 | pulse | Total accumulated number of pulses received from flow sensor | Yes |
| 0x8040 32832 | R/W | 3,4 & 16 | FLOAT | Heating max. Power | Pre-set value for the design power, in heating mode, when control signal is at 100% | 0 | kW, kBTU/h | When using register 32815 state Power limiter this is the maximum allowed hydronic energy output. This value is intended to limit the heating power through the terminal unit. i.e. 0.00 ... 10.00 correspond to 0.00 ... 10.00 kW | Yes |
| 0x8042 32834 | R/W | 3,4 & 16 | FLOAT | Cooling max. power | Pre-set value for the design power, in cooling mode, when control signal is at 100% | 0 | kW, kBTU/h | When using register 32815 state Power limiter this is the maximum allowed hydronic energy output. This value is intended to limit the cooling power through the terminal unit. i.e. 0.00 ... 10.00 correspond to 0.00 ... 10.00 kW | Yes |
| 0x8044 32836 | R/W | 3,4 & 16 | FLOAT | Heating Delta T | Set-point value for the temperature difference between the flow and return pipes | 15 | °C or °F | If Energy management (32815) functions are enabled (Min. delta T limitation (4) or Delta T control (5), this value is reference point (set point) for heating regulation. | Yes |
| 0x8046 32838 | R/W | 3,4 & 16 | FLOAT | Cooling Delta T | Set-point value for the temperature difference between the flow and return pipes | 5 | °C or °F | If Energy management (32815) functions are enabled (Min. delta T limitation (4) or Delta T control (5), this value is reference point (set point) for cooling regulation. | Yes |
| 0x8048 32840 | R/W | 3,4 & 16 | FLOAT | Heating T2 | Set-point value for Heating T2 | 35 | °C or °F | If Energy management (32815) functions are enabled (Max. Return T limitation (6), Return T control (7) or T3 temperature control (8), this value is reference point (set point) for heating regulation. | Yes |
| 0x804A 32842 | R/W | 3,4 & 16 | FLOAT | Cooling T2 | Set-point value for Cooling T2 | 13 | °C or °F | If Energy management (32815) functions are enabled (Max. Return T limitation (6), Return T control (7) or T3 temperature control (8), this value is reference point (set point) for cooling regulation. | Yes |

Modbus registers - Information

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Unit | Description of usage | Persistent Yes/No |
|-------------------|------------|-----------------|------------------|---|--|--|--|--|-------------------|
| 0x8100 33024 | R | 3 & 4 | FLOAT | Nominal flow of the selected valve type | Nominal flow of the selected valve type | 450 | L/h or GPM, Unit type comes from Valve Table | Nominal flow e.g. in Litres per hour i.e. 0 ...450 correspond to 0 ...450 L/h. | na |
| 0x8102 33026 | R | 3 & 4 | FLOAT | Valve position at nominal flow | Position in mm for nominal flow of the selected valve | na | Millimetre | Valve position for nominal flow in millimetre, i.e., 0.5 ... 5.8 correspond to 0.5 ... 5.8 millimetre. | na |
| 0x8104 33028 | R | 3 & 4 | FLOAT | Maximum value of the Design Flow Rate | Maximum level the Design Flow Rate can be increased to for the selected valve | Setting Range Maximum from Valve table | % | Maximum level of the Design Flow Rate in percent, i.e. 20 ... 100 correspond to 20 ... 100%. | na |
| 0x8120 33056 | R/W | 3 & 4 | STRING | Device name | Product name | NovoCon S | na | ASCII coded STRING | Yes |
| 0x8140 33088 | R | 3 & 4 | STRING | Model name | Type of the actuator | CO6 | na | ASCII coded STRING | Yes |
| 0x8160 33120 | R | 3 & 4 | STRING | Vendor name | Name of the Manufacture | Danfoss A/S | na | ASCII coded STRING | Yes |
| 0x8180 33152 | R/W | 3, 4 & 16 | STRING | Location description | Free text can be used to describe location etc. E.g. Room 1 | na | na | ASCII coded STRING. Max. 50 characters. | Yes |
| 0x81A0 33184 | R | 3, 4 | STRING | Serial number | Serial number of the actuator | na | 1 | Description of this object holds the serial number of the actuator, programmed at the production time. | Yes |
| 0x8108 33032 | R | 3, 4 | LONG | Product ID | Serial number of the actuator | na | 1 | Unique Product id. The last part of the serial number. | Yes |
| 0x810A 33034 | R | 3 & 4 | WORD | SW version | Software version of the actuator | na | na | ASCII coded WORD | Yes |
| 0x810B 33035 | R | 3 & 4 | WORD | HW version | Hardware version of the actuator | na | na | ASCII coded WORD | Yes |
| 0x81C0 33216 | R | 3 & 4 | FLOAT | Voltage or Current on analog input | Voltage(V) or Current(mA) level on the analog control input, measured by the actuator. In CO6 modes mA cannot be selected. | na | Volts / mA | Voltage level measured i.e. 0.00 ... 10.00 correspond to 10.00 ... 10.00 V or in mA, i.e. 0.00 ... 20.00 correspond to 0.00 ... 20.00 mA | No |
| 0x81C2 33218 | R | 3 & 4 | FLOAT | T1 value | Temperature/resistance measured from connected PT1000 sensors. For Power emission 33288, register 33218 is temperature on the flow pipe and 33220 is temperature on the return pipe. | °C | °C, °F, Ohm | Temperature measured in °C i.e. -10°C ... 120°C or resistance measured i.e. 900Ω ... 10kΩ. The upper temperature limit for NTC 10k Type 2 sensors is 90°C/194°F. The upper temperature limit for NTC sensor 10k Type 3 is 95°C/203°F. When used as potential free contacts: Closed circuit <900Ω, open circuit 100kΩ. The upper temperature limit for NTC 10k Type 2 sensors is 90°C/194°F. The upper temperature limit for NTC sensor 10k Type 3 is 95°C/203°F. Recommended max. cable length 3m. | No |
| 0x81C4 33220 | R | 3 & 4 | FLOAT | T2 value | | | | | |
| 0x81C6 33222 | R | 3 & 4 | FLOAT | T3 value | | | | | |
| 0x8402 33794** | R | 3 & 4 | FLOAT | Voltage of internal power supply | Measured rectified voltage which powers the actuator | na | Volts | Rectified voltage which powers the actuator. Too low voltage: 16.1-17.5V Too high voltage: 38.3-43.4V | No |
| 0x8404 33796 | R | 3 & 4 | FLOAT | Temperature in the actuator | Temperature measured inside the Actuator | na | na | Temperature measured inside the actuator. Unit is decided by 32790. | No |
| 0x8406 33798 | R | 3 & 4 | LONG | Total Operating Hours | Total Operating Hours of the actuator | Hours | Hours | Total Operating Hours of the actuator | Yes |
| 0x8408 33800 | R | 3 & 4 | LONG | Lifetime estimate | Calculated percentage of expended lifetime | % | na | At 100% the valve and actuator have reached the estimated minimum lifetime. Replacement of valve and actuator is recommended. | Yes |
| 0x8410 33808 | R | 3 & 4 | LONG | Minutes since last power-up | Minutes since the last power-up of the actuator | Minutes | Minutes | Minutes since the last power-up of the actuator | No |
| 0x8412 33810 | R | 3 & 4 | LONG | Minutes since last calibration | Minutes since the last time the actuator was calibrated to an AB-QM valve | Minutes | Minutes | Minutes since the last time the actuator was calibrated to a valve | Yes |
| 0x8414 33812 | R | 3 & 4 | LONG | Minutes since fully closed | Minutes since the last time the AB-QM valve was fully closed | Minutes | Minutes | Minutes since the last time the valve was fully closed | Yes |
| 0x8416 33814 | R | 3 & 4 | LONG | Minutes Since Fully Opened | Minutes since the last time the AB-QM valve was fully opened | Minutes | Minutes | Minutes since the last time the valve was fully opened | Yes |

* Only for NovoCon S
 ** Only for NovoCon M, L/XL

Alarms & warning

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Description of usage | Persistent Yes/No |
|-----------------------------------|--|-----------------|----------------------|--|--|---------------|----------------------|-------------------|
| 0x8300 33536 | R | 3&4 | LONG | Alarm: No Control Signal | The actuator has detected that it has no analog control signal | 0: OFF | Bit 0: 0:OFF; 1:ON | No |
| | | | | Alarm: Error during Closing | The actuator is unable to reach it's intended closing position. Check for valve blockages. | 0: OFF | Bit 1: 0:OFF; 1:ON | No |
| | | | | Alarm: Error during Calibration | There was an error during calibration of the actuator. E.g. the NovoCon® actuator is not mounted on the valve or the valve is stuck | 0: OFF | Bit 2: 0:OFF; 1:ON | No |
| | | | | Alarm: An internal Error has been detected | Re-calibrate or power cycle actuator to reset - actuator replacement may be necessary | 0: OFF | Bit 3: 0:OFF; 1:ON | No |
| | | | | Alarm: CO6 in manual override or CO6 unable to move* | ChangeOver® actuator is in manual override or is unable to reach position. When the reason for the alarm is removed it may take up to 2 minutes before the alarm is cleared. | 0: OFF | Bit 4: 0:OFF; 1:ON | No |
| | | | | Alarm: CO6 actuator not connected or damaged* | The ChangeOver® actuator is not connected or is damaged. | 0: OFF | Bit 5: 0:OFF; 1:ON | No |
| | | | | Alarm: Temp. sensors are missing or interchanged | Temp. sensors are missing or interchanged | 0: OFF | Bit 6: 0: OFF; 1:ON | No |
| | | | | Warning: Temperature of the actuator is out of recommended range | The Temperature inside the Actuator is out of the recommended range | 0: OFF | Bit 16: 0:OFF; 1:ON | No |
| | | | | Warning: Pre-set Conflict | Warning: Conflict between the Mechanical AB-QM valve setting and the NovoCon®. The mechanical valve setting must be 100% or above. The warning will also be activated if the Selected Valve Type has different stroke than the actually valve used validated during calibration. | 0: OFF | Bit 17: 0: OFF; 1:ON | No |
| | | | | Warning: Voltage of power supply is too high | Voltage of power supply is measured to be too high. When the measured voltage exceeds 43.4V the alarm will be turned ON for too high voltage. When the measured voltage is below 38.3V the alarm will be turned OFF | 0: OFF | Bit 18: 0:OFF; 1:ON | No |
| | | | | Warning: Voltage of power supply is too low | Voltage of power supply is measured to be too low. If voltage drops below 14.5V (NovoCon S) or 19.0 (NovoCon M/L/XL), alarm is activated. If voltage drops below 14.0V (NovoCon S) or 13.0 (NovoCon M/L/XL), alarm is activated and motor disabled. If voltage goes above 15.5V (NovoCon S) or 18.2V (NovoCon M/L/XL), alarm deactivates and motor is enabled. | 0: OFF | Bit 19: 0:OFF; 1:ON | No |
| | | | | Warning: Faults on communication was detected | Problems with Communication on the network are detected | 0: OFF | Bit 21: 0:OFF; 1:ON | No |
| | | | | Warning: Invalid Slave ID setting | Slave ID assignment was done incorrectly to either 0 or 127 | 0: OFF | Bit 22: 0:OFF; 1:ON | No |
| | | | | Warning: Energy limitation is active | Limitation is active. E.g. Power limitation, min. delta T or min/max return T management limitation. | 0: OFF | Bit 23: 0: OFF; 1:ON | No |
| | | | | Warning: Energy management controller out of range | Power, delta T or return T setpoint is out of range or the setpoint cannot be achieved. Action: Check that setpoint is achievable with the given flow rates and temperatures. | 0: OFF | Bit 24: 0: OFF; 1:ON | No |
| Warning: Flow out of expectations | Warning for lower or higher flow than expected | 0: OFF | Bit 25: 0: OFF; 1:ON | No | | | | |
| Warning: No flow detected | Flow sensor does not recognize any flow, through flow sensor | 0: OFF | Bit 26: 0: OFF; 1:ON | No | | | | |

* Only for NovoCon S

Firmware update

Manual update

Using BACnet MS/TP

| Ident | Object / Parameter name | Read/Write | State Text | Default State | Description |
|--------|-------------------------|------------|---|---------------|---|
| MSV:19 | Firmware update | R/W | 1: Normal 2: Prepare 3: Ready 4: Error 5: Received 6: Update | 1: Normal | Commands & status for firmware update. Method used to update the firmware: • Send 'Prepare' command to MSV:19. NovoCon® will prepare for the firmware update and change status to 'Ready'. • Send file to FIL:0. If successful, status should be 'Received'. • Send 'Update' command. NovoCon® will reboot and update the firmware. The status should be 'Normal' after a successful firmware update. |
| Ident | Object / Parameter name | Read/Write | State Text | Default State | Description |
| FIL:0 | File | W | File used to update the firmware | na | Used to transfer the new firmware to NovoCon®. |

Using Modbus RTU

| Modbus register | Read/Write | Modbus function | Modbus Data Type | Object / Parameter name | Description | Default State | Description of usage |
|-----------------|------------|-----------------|------------------|-------------------------|---|---------------|---|
| 0x8501 34049 | R/W | 3, 4 & 6 | WORD | Firmware update | 1: Normal 2: Prepare 3: Ready 4: Error 5: Received 6: Update | 1: Normal | Commands & status for Firmware update. Method used to update the Firmware: • Send 'Prepare' command to 34049. NovoCon® will prepare for the firmware update and change status to 'Ready'. • Send file using Modbus function 21. If successful, status should be 'Received'. • Send 'Update' command. NovoCon® will reboot and update the software. The status should be 'Normal' after a successful software update |

When using modbus function 21 (0x15) to update the firmware in NovoCon® it is nessecasy to perform the upload in smaller sections due to modbus limitations in file size, please see the modbus standard for more details.

Broadcast, update multiple NovoCon® by sending the firmware to Slave Id 0, is supported in modbus. However each NovoCon® must be Prepared before the firmware upload is performed.

Danfoss NovoCon® Configuration tool

Easy configuration, commissioning and firmware updates can be performed with the Danfoss configuration tool. Please see separate operating manual.



Valve Type Selection



Values for flow are valid for water applications. For glycol mixtures, please use correction factor.

NovoCon® S

| Index | Name | Nominal Flow | Units | Valve position for nominal flow [mm] | Setting Range Maximum [%] |
|------------------|-----------------------|--------------|-------|--------------------------------------|---------------------------|
| 1 | AB-QM 4.0 ISO DN 15LF | 200 | L/h | 4 | 100 |
| 2 ¹⁾ | AB-QM 4.0 ISO DN 15 | 650 | L/h | 4 | 100 |
| 3 | AB-QM 4.0 ISO DN 15HF | 1200 | L/h | 4 | 100 |
| 4 | AB-QM 4.0 ISO DN 20 | 1100 | L/h | 4 | 100 |
| 5 | AB-QM 4.0 ISO DN 20HF | 1900 | L/h | 4 | 100 |
| 6 | AB-QM 4.0 ISO DN 25 | 2200 | L/h | 4 | 100 |
| 7 | AB-QM 4.0 ISO DN 25HF | 3800 | L/h | 4 | 100 |
| 8 | AB-QM 4.0 ISO DN 32 | 3600 | L/h | 4 | 100 |
| 9 | AB-QM 4.0 ISO DN 32HF | 5000 | L/h | 4 | 100 |
| 10 | AB-QM ISO DN 10LF | 150 | L/h | 2.25 | 120 |
| 11 | AB-QM ISO DN 10 | 275 | L/h | 2.25 | 120 |
| 12 | AB-QM ISO DN 15LF | 275 | L/h | 2.25 | 120 |
| 13 | AB-QM ISO DN 15 | 450 | L/h | 2.25 | 120 |
| 14 | AB-QM ISO DN 15HF | 1135 | L/h | 4 | 110 |
| 15 | AB-QM ISO DN 20 | 900 | L/h | 2.25 | 120 |
| 16 | AB-QM ISO DN 20HF | 1700 | L/h | 4 | 110 |
| 17 | AB-QM ISO DN 25 | 1700 | L/h | 4.5 | 110 |
| 18 | AB-QM ISO DN 25HF | 2700 | L/h | 4.5 | 110 |
| 19 | AB-QM ISO DN 32 | 3200 | L/h | 4.5 | 110 |
| 20 | AB-QM ISO DN 32HF | 4000 | L/h | 4.5 | 110 |
| 21 | AB-QM ANSI ½" LF | 1.2 | GPM | 2.25 | 100 |
| 22 | AB-QM ANSI ½" | 2 | GPM | 2.25 | 100 |
| 23 | AB-QM ANSI ½" HF | 5 | GPM | 4 | 100 |
| 24 | AB-QM ANSI ¾" | 4 | GPM | 2.25 | 100 |
| 25 | AB-QM ANSI ¾" HF | 7.5 | GPM | 4 | 100 |
| 26 | AB-QM ANSI 1" | 7.5 | GPM | 4.5 | 100 |
| 27 | AB-QM ANSI 1" HF | 12 | GPM | 4.5 | 100 |
| 28 | AB-QM ANSI 1¼" | 14.1 | GPM | 4.5 | 100 |
| 29 | AB-QM ANSI 1¼" HF | 17.5 | GPM | 4.5 | 100 |
| 30 ²⁾ | User Defined Valve | NF | UF | VPNF | SRM |

¹⁾ Default

²⁾ The "User Defined Valve" is used only if NovoCon® S is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible.

When an ANSI valve is selected the units for flow and temperature are default changed from l/h to GPM and Celsius to Fahrenheit, and vice versa when an ISO valve is selected.

NovoCon® M

| Index | Name | Nominal Flow | Units | Valve position for nominal flow [mm] | Setting Range Maximum [%] |
|-----------------|---------------------------------|--------------|-------|--------------------------------------|---------------------------|
| 1 ¹⁾ | AB-QM NovoCon DN40 PN16 3TP | 7,500 | L/h | 10 | 100 |
| 2 | AB-QM NovoCon DN50 PN16 3TP | 12,500 | L/h | 10 | 100 |
| 3 | AB-QM NovoCon DN65 PN16 3TP | 20,000 | L/h | 15 | 100 |
| 4 | AB-QM NovoCon DN65 PN16 3TP HF | 25,000 | L/h | 15 | 100 |
| 5 | AB-QM NovoCon DN80 PN16 3TP | 28,000 | L/h | 15 | 100 |
| 6 | AB-QM NovoCon DN80 PN16 3TP HF | 40,000 | L/h | 15 | 100 |
| 7 | AB-QM NovoCon DN100 PN16 3TP | 38,000 | L/h | 15 | 100 |
| 8 | AB-QM NovoCon DN100 PN16 3TP HF | 59,000 | L/h | 15 | 100 |
| 9 ²⁾ | User Defined Valve | NF | UF | VPNF | SRMax |

¹⁾ Default

²⁾ The "User Defined Valve" is used only if NovoCon® M is not used with an AB-QM NovoCon® valve. Please contact your Danfoss representative to verify if the desired connection is possible.

NovoCon® L, XL

| Index | Name | Nominal Flow | Units | Valve position for nominal flow (mm) | Setting Range Maximum (%) |
|------------------|-------------------------|--------------|-------|--------------------------------------|---------------------------|
| 1 ¹⁾ | AB-QM DN125 PN16 3TP | 90,000 | L/h | 30 | 110 |
| 2 | AB-QM DN125 PN16 3TP HF | 110,000 | L/h | 30 | 110 |
| 3 | AB-QM DN150 PN16 3TP | 145,000 | L/h | 30 | 110 |
| 4 | AB-QM DN150 PN16 3TP HF | 190,000 | L/h | 30 | 110 |
| 5 ²⁾ | AB-QM DN200 PN16 3TP | 200,000 | L/h | 30 | 110 |
| 6 | AB-QM DN200 PN16 3TP HF | 270,000 | L/h | 30 | 110 |
| 7 | AB-QM DN250 PN16 3TP | 300,000 | L/h | 30 | 110 |
| 8 | AB-QM DN250 PN16 3TP HF | 370,000 | L/h | 30 | 110 |
| 9 | AFQM DN65 | 28,000 | L/h | 12 | 150 |
| 10 ³⁾ | User Defined Valve | NF | UF | VPNF | SRMax |

¹⁾ Default valve for NovoCon® L (valves index no. 5-8 cannot be selected).

²⁾ Default valve for NovoCon® XL (valves index no. 1-4 cannot be selected).

³⁾ The "User Defined Valve" is used only if NovoCon® L/XL is not used with an AB-QM valve. Please contact your Danfoss representative to verify if the desired connection is possible.

Temperature sensors

NovoCon® S

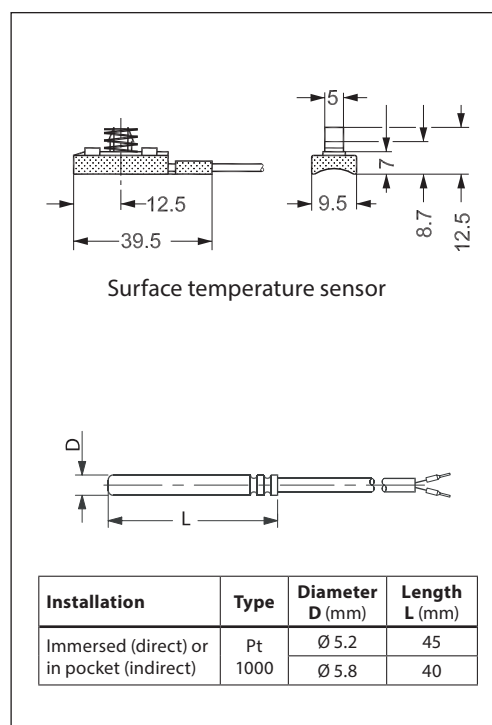
Functional description

The sensor unit consists of a platinum element, the resistance value of which changes proportionally with the temperature.

Pt 1000 ohm sensor (1000 ohm at 0°C). The sensor is adjusted and meets the tolerance requirements of EN 60751 Class B. The accuracy of temperature measurement is approximately 0.5° in typical operating range. It is unlikely, that during calculation of ΔT, deviation of both sensors would be summed up. Therefore, it is estimated that ΔT measurement accuracy is 0.5° when the sensors are mounted correctly.

It is not recommended to use longer wires on temperature sensors than 3m due to risk of electromagnetic interference. If long or thin wires are used it may be necessary to make an offset of the temperature reading in the BMS system.

| R (Typ.) Ohm | Temp. °C | Temp. °F | Tolerance. °C |
|--------------|----------|----------|---------------|
| 1117 | 30 | 86 | 0.45 |
| 1078 | 20 | 68 | 0.40 |
| 1039 | 10 | 50 | 0.35 |
| 1000 | 0 | 32 | 0.30 |
| 961 | -10 | 14 | 0.35 |
| 922 | -20 | -4 | 0.40 |
| 882 | -30 | -22 | 0.45 |



Tender text

NovoCon® S

Modulating, high accuracy, geared actuator with field bus (BACnet MS/TP and Modbus RTU) connectivity used to control pressure independent balancing and control valves type AB-QM DN10-250.

Control signal digital: BACnet MS/TP, Modbus RTU. Control signal analog: 0-10V/2-10V, 0-20mA/4-20mA

Direct connection to 6-port ball valve actuator with position feedback signal ¹⁾

Direct connection to 2x Pt1000 surface/immersed sensors and power emission indication ²⁾

Direct connection I/O: 2x resistance, AO and AI ³⁾

Actuator functionality is remotely accessible via the field bus:

- Design flow pre-setting
- Flushing the valve and terminal unit
- Error during closing intrinsic alarm reporting
- Alarm if CO6 6-port ball valve actuator is blocked, in manual override or disconnected ¹⁾
- Supply and return temperature readings, power emission indication ²⁾
- Energy counter (kWh, MJ, kBTU) ²⁾
- Alarm high/low deltaT and temperature sensors disconnected ²⁾
- Alpha characteristics setting
- Speed selection 3/6/12/24 s/mm
- Opening/closing time selection from 18s to 700s
- Auto MAC addressing (BACnet only)
- Auto Baud rate detection
- Flow indication based on measured stroke in l/h

Eu.bac interchangeability approved in combination with PIBCV valve

Supply Voltage: 24V DC/AC 50/60Hz

Spindle position accuracy: ±0.05mm

Cables: Halogen free plug-in available in 1.5m, 5m and 10m length

Temperature sensors: plug-in 2x Pt1000 surface or immersed 1.5m length

64 actuators can be connected to the same network

Supports BACnet service Change of Value (COV)

Supports remote Firmware updates

IP Class: 54

Stroke: 7mm

BACnet Testing Laboratories (BTL) listed BACnet MS/TP fieldbus device

Manual override function

Configuration tool available easy configuration, commissioning and firmware updates

Commissioning tool available for addressing, parametrization and hydronic continuous commission

¹⁾ CO6 application

²⁾ Energy application

³⁾ Remote I/O application

Tender text (continued)**NovoCon® M**

Modulating, high accuracy, geared actuator with bus connectivity used to control pressure independent control valves type AB-QM NovoCon® DN 40-100.
Control signal digital: BACnet MS/TP, Modbus RTU. Control signal analog: 0-10V/2-10V, 0-20mA/4-20mA
Actuator functionality is remotely accessible via the fieldbus:

- design flow pre-setting
- flushing the valve and terminal unit
- error during closing/opening/calibration alarm
- LIN/LOG/a-setting characteristics setting
- selectable speed
- opening/closing time selection
- auto MAC addressing (BACnet)
- auto Parity detection (Modbus)
- auto Baud rate detection
- Flow and energy indication

Supply Voltage 24V ac/dc

64 actuators can be connected to the same network

IP Class: 54

Stroke: 20mm

Manual override function

Click on mounting

LED status indication

BACnet Testing Laboratories (BTL) listed BACnet MS/TP fieldbus device

NovoCon® L, XL

Modulating, high accuracy, geared actuator with bus connectivity used to control pressure independent control valves type AB-QM DN125-250.
Control signal digital: BACnet MS/TP, Modbus RTU. Control signal analog: 0-10V/2-10V, 0-20mA/4-20mA
Actuator functionality is remotely accessible via the fieldbus:

- design flow pre-setting
- flushing the valve and terminal unit
- error during closing/opening/calibration alarm
- LIN/LOG/a-setting characteristics setting
- selectable speed
- opening/closing time selection
- auto MAC addressing (BACnet)
- auto Parity detection (Modbus)
- auto Baud rate detection
- Flow and energy indication
- Safety function in NovoCon® L SU/SD. Spring up or spring down for AB-QM DN125-150 valves.

Supply Voltage 24V ac/dc

64 actuators can be connected to the same network

IP Class: 54

Stroke: 50 mm

Manual override function

LED status indication

Trouble shooting

BACnet Fieldbus check:

It is possible to check the fieldbus state by examining error messaging related to the actuator in order to verify communication and detect early potential fieldbus related problems. This is done by the object values AV:15 to AV:19.

Quality of the BACnet network:

An important thing for good operation of the actuator is a well functioning network. Some values that tell you about the quality of the network can be found in the objects AV:15 to AV:19. The most important values are AV:17 Server Error Count and AV:19 Server Timeout Error. These two values should be much lower than AV:15, AV:16 and AV:18. As a general rule, it is important that AV:17 and AV:19 are not constantly increasing their count.

Quality of power supply:

The object / register AV:6 / 33794 may be used to check if the power supply and cabling, used to supply the actuator with power, is according to specification requirements. The present value of AV:6 / 33794 represents the current voltage measured inside the actuator. This is the voltage that the actuator monitors at all times and subsequently reacts on if outside the recommended range. See in the table below how the actuator reacts at different voltage levels.

| Voltage (Present value of AV:6 / 33794 | Reaction |
|---|---|
| Voltage below 14.5V (NovoCon S) or 19.0 (NovoCon M/L/XL) | Start alarm indication with LED. Initiate and alarm BV: 15 / 33536 Bit 19 and that the supply voltage is too low. |
| Voltage below 14.0V (NovoCon S) or 13.0 (NovoCon M/L/XL) | Motor is stopped. The LEDs indicating alarm and actuator still initiating alarm BV:15 / 33535 Bit 19 if the voltage hasn't dropped too low. |
| When voltage rises above 15.5V(NovoCon S) or 18.2V (NovoCon M/L/XL) again | Motor can run again. LED alarm indication stops and returns to normal operation. Alarm BV:15 / 33536 Bit 19 returns to normal operation. |
| When voltage rises above 43.4V | Start alarm indication with LED. Initiate an alarm BV:14 / 33536 Bit 18. |
| When voltage drops below 38.3V again | LED alarm indication stops and returns to normal operation. Alarm BV:14 / 33536 Bit 18 returns to normal operation. |

NB: the voltage level will be constantly changing depending on the operational activity of the entire group of actuators and other devices connected. The supply voltage will go up and down in value if:

- Power supply is not strong and stable
- If long cables are used in a daisy chain setup

A higher number of actuators running at the same time will reduce the supply voltage (for the last devices on a daisy chain cable, in particular).

The actuator's voltages are considered to be OK when all values of AV:6 / 33794 are above 18V, when all actuators are moving the motor/running. To ensure voltage in each device is OK under worst case operational conditions, the following is recommended:

- Run all the actuators on the daisy chain cable at the same time. While all are running, check each value of AV:6 / 32794. These values should still be above 18V and no previously mentioned voltage level alarms should be initiated or indicated. If LEDs indicate an alarm state or a BACnet/Modbus alarm is initiated, or a value less than 18V is observed, then cabling should be reviewed.
- Check the values of AVO:0. This BACnet object holds 3 values: Average measured voltage, Maximum measured voltage and Minimum measured voltage. The most important value here is the Minimum measured voltage. It can tell you the lowest voltage that has been measured during operation of the actuator.

Firmware update

Get the most out of your NovoCon® digital actuators and keep the firmware up to date with the most recent firmware version, which can be downloaded at www.novocon.com by selecting the tab: Support files.

Warning: Calibration must be done after successful upgrade of firmware.

BACnet data

| Type | Description |
|-----------------------------|--|
| BACnet device profile | BACnet Application Specific Controller (B-ASC) |
| BACnet protocol | BACnet Master Slave / Token Passing (MS/TP) |
| BACnet baud rates supported | Auto baud rate detection* / 9600 bps / 19200 bps / 38400 bps / 56700 bps / 76800 bps / 115200bps |

Modbus RTU data

| Type | Description |
|------------------------------|---|
| Supported baud rates | Auto baud rate detection* / 9600 bps / 19200 bps / 38400 bps / 56700 bps / 76800 bps / 115200bps |
| Supported transmission modes | Parity: None (1-8-N-2) / Odd (1-8-O-1) / Even (1-8-E-1) / None (1-8-N-1) / Auto parity* Data format: Parity (Start bit - Data bits - Parity - Stop bits) |

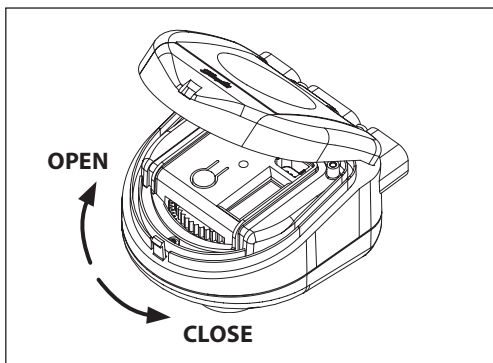
* Default

Manual operation

The actuators can be manually positioned when in Stand-By mode or when there is no power supply (mechanically).



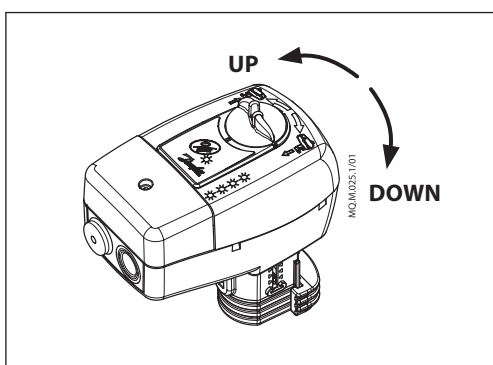
Mechanical and electrical operation are not allowed to be used at the same time!



NovoCon® S

Mechanical manual operation

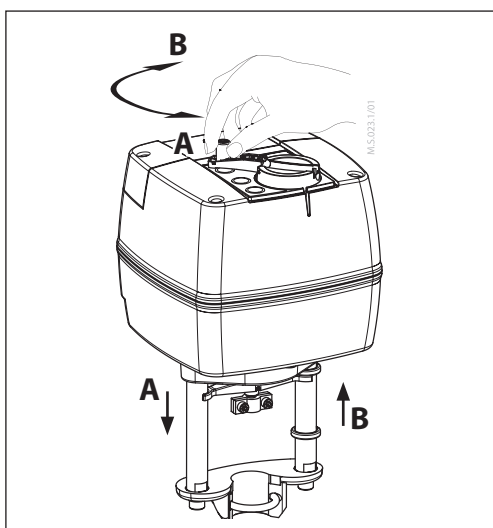
Manual operation is possible when NovoCon is not powered. Cover of NovoCon needs to be lifted to reach manual gear. Rotating gear to left will OPEN mounted valve and turning on right will closes it.



NovoCon® M

Mechanical manual operation

Manual operation is possible when NovoCon is not powered. Rotating knob to left will lift steam of valve UP and turning on right will push steam DOWN.

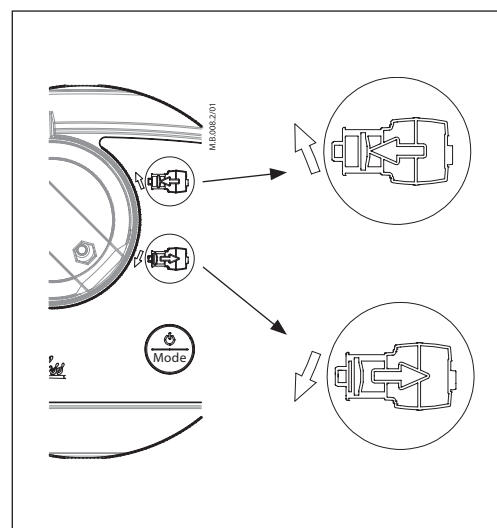


NovoCon® L, XL



Mechanical manual operation

The actuators 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.

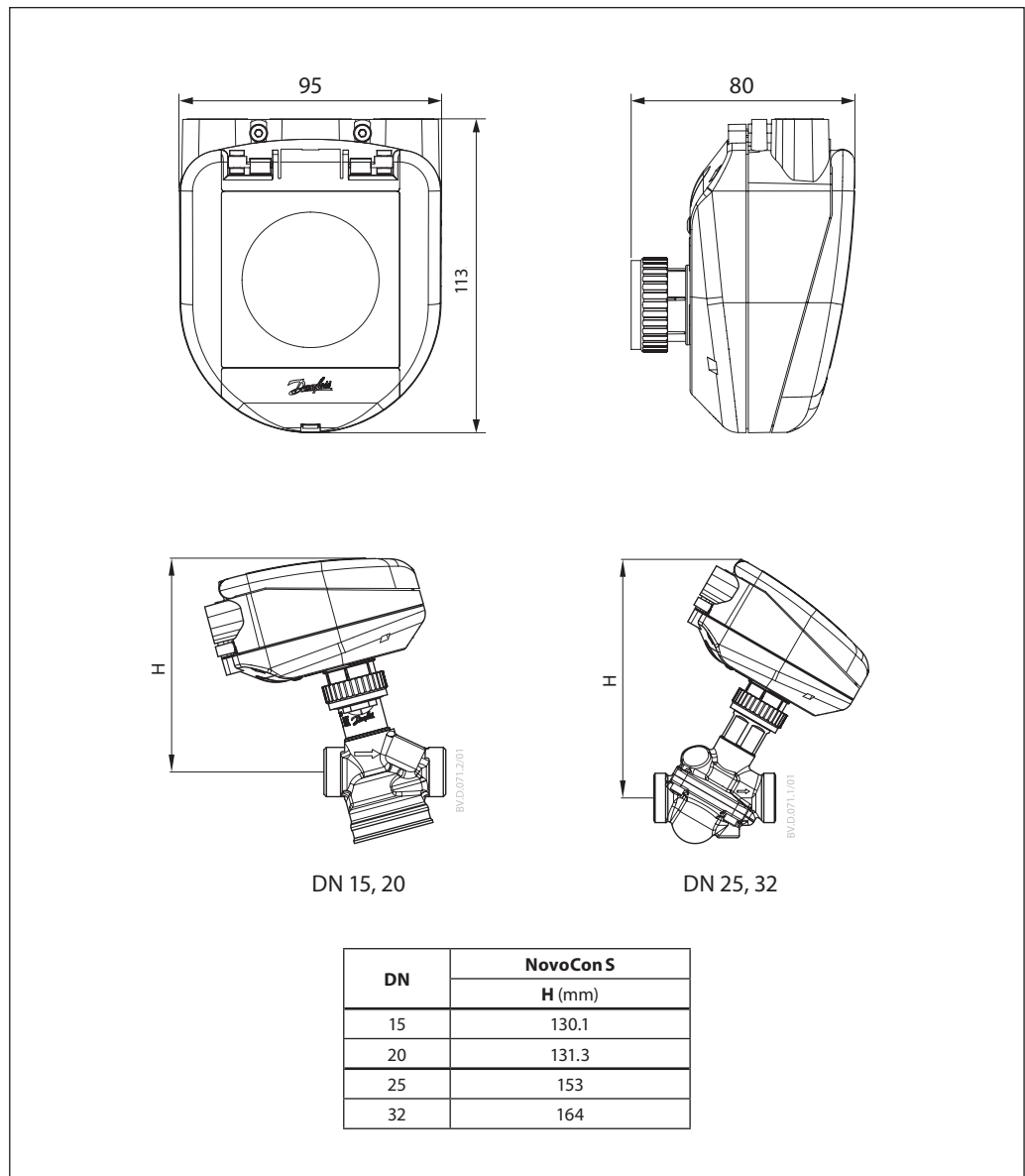


Electrical manual operation

The actuators 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 MODE 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.

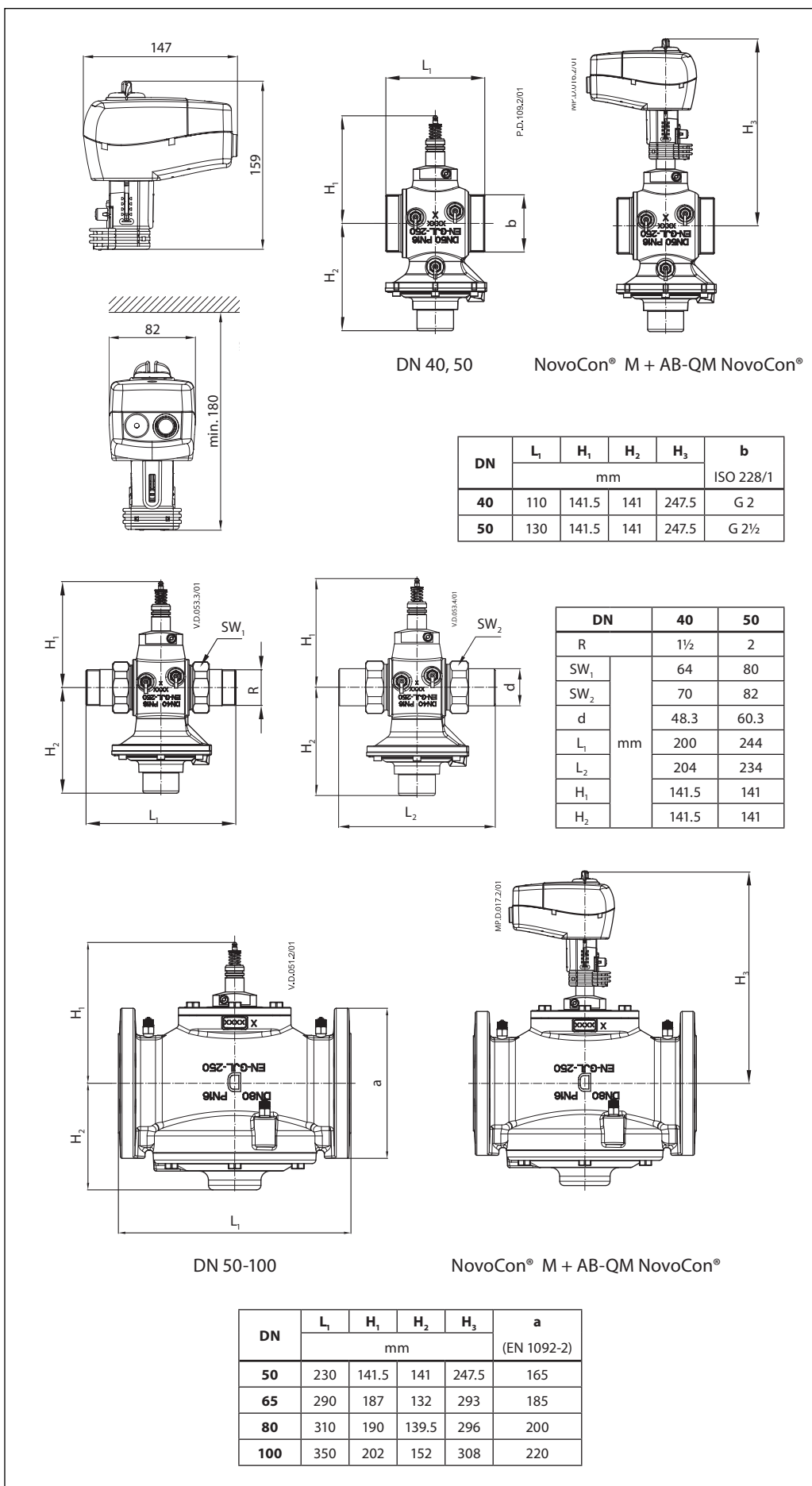
Dimensions

NovoCon® S



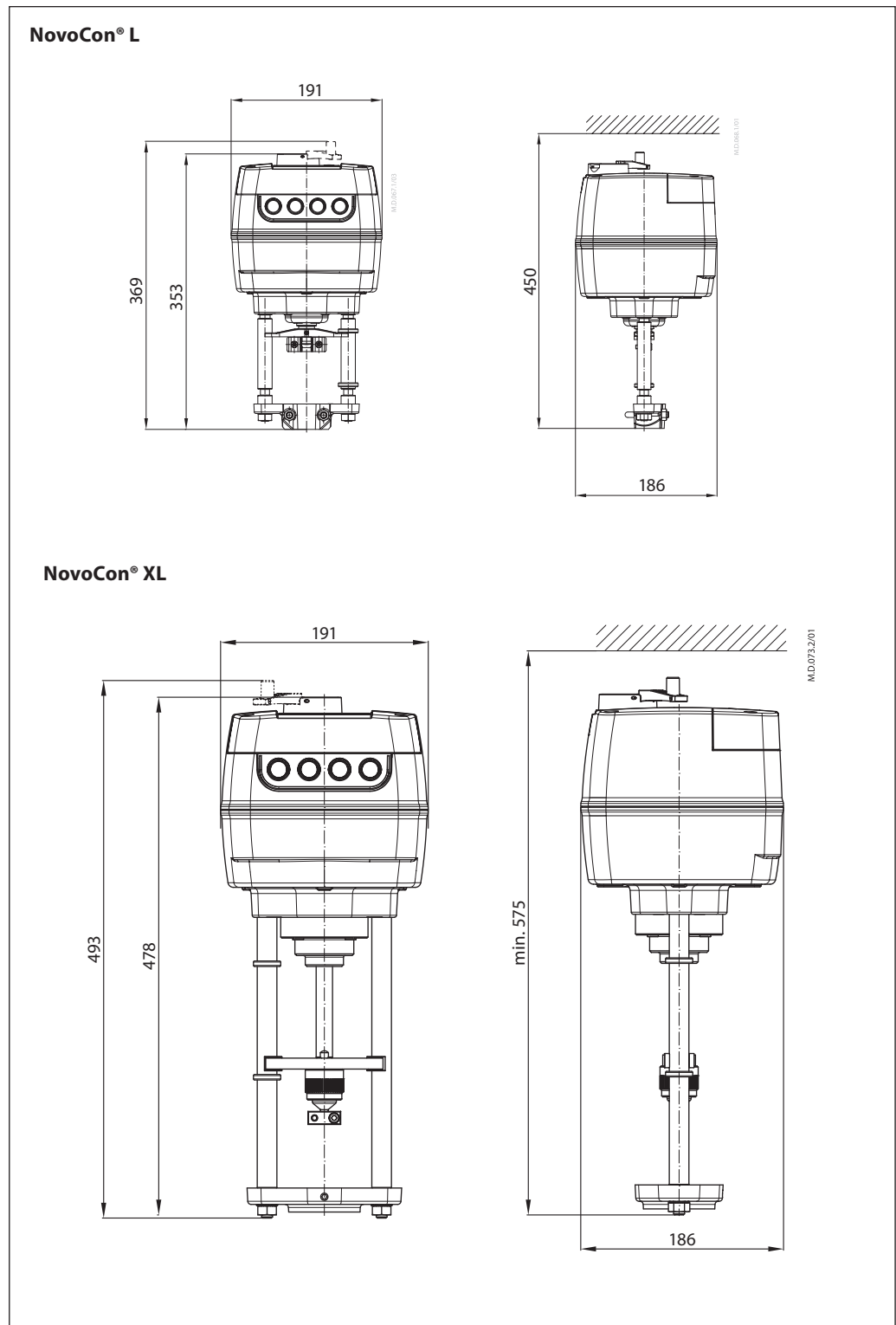
Dimensions (continued)

NovoCon® M



Dimensions (continued)

NovoCon® L, XL





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