A pressure sensor, digital VAV controller and damper actuator all in one, providing a VAV-Compact solution with a communications capability for pressure-independent VAV systems in the comfort zone

- Control function: VAV
- Control: LonWORKS®
- Integrated temperature controller
- Integration in LonWORKS® systems
- Conversion of sensor signals
- Service button and LEDs for servicing and commissioning
- Diagnostic socket for operating devices

### Brief description

| **Application** | The digital VAV-Compact has PI control characteristics and is used for pressure-independent control of VAV units in the comfort zone. |
| **Mode of operation** | The actuator is equipped with an integrated interface for LonWORKS®. The actuator can be connected and controlled directly with LonWORKS® via transceiver FTT-10A. |
| **Converter for sensors** | Connection option for a sensor (passive or active sensor or switching contact). In this way, the analogue sensor signal can be easily digitised and passed along to LonWORKS®. |
| **Integrated temperature controller** | The actuator has an integrated temperature controller (Thermostat Object LonMARK® #8060). This makes it easy to implement individual room control solutions. The controller can be set using the LNS plug-in available from Belimo. |
| **Pressure measurement** | Maintenance-free, dynamic, differential pressure sensor, proven in a wide range of applications, suitable for use in offices, hospital wards, alpine hotels or cruise liners. |
| **Actuator** | Two versions are available, depending on the size of the VAV unit: 5 or 10 Nm. |
| **VAV – variable volumetric flow** | The VAV-Compact is supplied with its modulating setpoint by a room temperature controller via LonWORKS®. This facilitates demand-related, power-saving ventilation in individual rooms or zones of air conditioning systems. The operating range (V_{min} and V_{max}) can be set either locally with PC-Tool or ZTH-GEN or by using the LNS plug-in available from Belimo. |
| **Operating and service devices** | Belimo PC-Tool or Service-Tool ZTH-GEN, pluggable on the VAV-Compact. |
| **Assembly and connection** | The VAV-Compact device, which is assembled on the unit by the OEM, is connected using the prefabricated connecting cable. |
| **OEM factory settings** | The VAV-Compact is mounted on the VAV unit by the unit manufacturer, who adjusts and tests it according to the application. The VAV-Compact is sold exclusively via the OEM channel for this reason. |

### Type listing

<table>
<thead>
<tr>
<th>Type</th>
<th>Torque</th>
<th>Power consumption</th>
<th>For wire sizing</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMV-D3LON</td>
<td>5 Nm</td>
<td>2.5 W</td>
<td>4.5 VA (max. 5 A @ 5 ms) Approx. 500 g</td>
<td></td>
</tr>
<tr>
<td>NMV-D3LON</td>
<td>10 Nm</td>
<td>3 W</td>
<td>5.5 VA (max. 5 A @ 5 ms) Approx. 700 g</td>
<td></td>
</tr>
</tbody>
</table>

### Safety notes

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

#### Supply
- **Nominal voltage**
  - AC 24V, 50/60 Hz
  - DC 24V
- **Power supply range**
  - AC 19.2 ... 28.8V
  - DC 21.6 ... 28.8V
- **Differential pressure sensor**
  - 0 ... 600 Pa
- **Overload Capability**
  - ±3000 Pa
- **Installation position**
  - Any, no reset necessary
- **Operating medium**
  - Supply and exhaust air in the comfort zone and in applications with sensor-compatible media
- **Materials in contact with medium**
  - Glass, Epoxy resin, PA, TPE
- **Measuring air conditions**
  - 0 ... +50°C / 5 ... 95% rH, non-condensating
- **Application**
  - SUPPLY AIR/EXHAUST AIR VAV units, integrated in LonWorks® System

#### Operating volumetric flow
- **$V_{\text{nom}}$**
  - OEM-specific nominal volumetric flow setting, suitable for the VAV unit
- **$V_{\text{max}}$**
  - 20 ... 100% of $V_{\text{nom}}$
- **$V_{\text{min}}$**
  - 0 ... 100% of $V_{\text{nom}}$

#### Control
- **Actual value signal $U_5$ (Connection 5)**
  - adjustable: 2 ... 10V or 0 ... 10V
  - adjustable: Volumetric flow, damper position or differential pressure
- **Max. 0.5 mA**

#### Bus function LonWorks®
- **Certified**
  - in accordance with LonMark® 3.3
- **Processor**
  - Neuron 3150
- **Transceiver**
  - FTT-10A, compatible with LPT-10
- **Functional Profile as per LonMark®**
  - Damper Actuator Object #8110 / Open Loop Sensor Object #1 / Thermostat Object #8060
- **LNS plug-in for actuator / sensor / controller**
  - Can be run with any LNS-based integration tool (min. for LNS 3.x)
- **Service key and status LED**
  - in accordance with LonMark® guidelines
- **Conductors, cables**
  - Conductor lengths, cable specifications and topology of the LonWorks® network in accordance with the ECHELON® guidelines

#### Operation and servicing
- **Pluggable / PC-Tool (V3.1 or higher)**
- **Communication**
  - LonWorks®
- **Push-button**
  - Adaption / Addressing
- **LED display**
  - 24V supply
  - Status / Bus function

#### Actuator
- **Brushless, non-blocking actuator with current reduction**
- **Direction of rotation**
  - ccw / cw
- **Angle of rotation**
  - 95°±3, adjustable mechanical or electronic limiting
- **Adaption**
  - Adjustment range coverage and resolution to control range
- **Manual disengagement**
  - Push-button self-resetting without functional impairment
- **Position indication**
  - Mechanical with pointer
- **Sound intensity**
  - Max. 35 dB (A)
- **Damper rotation**
  - Clamp, axis round 10 ... 20 mm / axis square 8 ... 16 mm
  - Positive fit in various versions, e.g. 8 x 8 mm

#### Connection
- **Cable, 6 x 0.75 mm²**

#### Safety
- **Protection class**
  - III Safety extra-low voltage
- **Degree of protection**
  - IP54
- **EMC**
  - CE acc. to 89/336/EEC
- **Mode of operation**
  - Type 1 (as per EN 60730-1)
- **Rated impulse voltage**
  - 0.5 kV (as per EN 60730-1)
- **Control pollution degree**
  - 2 (as per EN 60730-1)
- **Ambient temperature**
  - 0 ... +50°C
- **Non-operating temperature**
  - -20 ... +80°C
- **Ambient humidity range**
  - 5 ... 95% rH, non-condensating (in accordance with EN 60730-1)
- **Maintenance**
  - Maintenance-free
The SNVT_... can be configured as:

<table>
<thead>
<tr>
<th>SNVT_...</th>
<th>SNVT_lev_percent</th>
<th>SNVT_temp_p</th>
<th>SNVT_press_p</th>
<th>SNVT_switch</th>
<th>SNVT_enthalpy</th>
<th>SNVT_smo_obscur</th>
<th>SNVT_flow</th>
<th>SNVT_flow_p</th>
</tr>
</thead>
<tbody>
<tr>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
<td>lux</td>
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<tr>
<td>humid</td>
<td>humid</td>
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<td>humid</td>
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<tr>
<td>ppm</td>
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<td>power</td>
</tr>
<tr>
<td>elect_kwh</td>
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<td>elect_kwh</td>
<td>elect_kwh</td>
<td>elect_kwh</td>
<td>elect_kwh</td>
</tr>
</tbody>
</table>
Individual room control solutions can be implemented with the thermostat object LONMARK® #8060. An LNS plug-in is available for configuring the regulation parameters.

**Thermostat Object #8060**

- **nviSetPoint** (SNVT_temp_p)
  - Setpoint specification for the controller from the higher-level system or the room control unit. If this variable is not linked, then the local setpoints of the controller object apply (can be adjusted via plug-in).
  - The setpoint specification from the higher-level system influences the setting on the controller as follows:
    - Example: Comfort setpoint for heating = 21 °C and Comfort setpoint for cooling = 23 °C. The median point between heating and cooling is thus 22 °C. Now, if the external setpoint (nviSetPoint) is 23 °C, then the heating setpoint will shift to 22 °C and the cooling setpoint to 24 °C. The setpoints for Pre-Comfort heating and cooling will also be shifted accordingly.

- **nviSpaceTemp** (SNVT_temp_p)
  - Room temperature from external room sensor. It is imperative that this variable be linked; typically, it is linked with the variable of the sensor object.

- **nviOccCmd** (SNVT_occupancy)
  - Occupancy specification from the command centre (for the function, see the table entitled «Functions Inputs Occupancy» page 5).

- **nviEnergyHoldOff** (SNVT_switch)
  - In the case of active EnergyHoldOff, the controller will be set to the Building Protection setpoints.

- **nviSetptOffset** (SNVT_temp_p)
  - Shifting of the room control unit. If the nviSetPoint is linked, then this input has an influence on the variable value of nviSetPoint, i.e. it corrects it. Otherwise, the Comfort and Pre-Comfort setpoints for heating and cooling will be adjusted directly by the amount of the shift (compare example with nviSetPoint).

- **nviDewpointAlarm** (SNVT_switch)
  - In the case of active DewpointAlarm, the controller will be set to the building protection setpoints. The cooling sequence is deactivated.

- **nviSenOccCmd** (SNVT_occupancy)
  - Occupancy specification from the local occupancy switch (for the function, see the table entitled «Functions Inputs Occupancy» page 5).

- **nvoHeatOutput** (SNVT_leq_percent)
  - Control signal for heating.

- **nvoCoolOutput** (SNVT_leq_percent)
  - Control signal for cooling.

- **nvoSpaceTemp** (SNVT_temp_p)
  - Displays the room temperature of the nviSpaceTemp. If nviSpaceTemp is not linked, then the variable will display the value 0x7FFF.

- **nvoUnitStatus** (SNVT_HVAC_Status)
  - Displays the operating mode of the controller (in accordance with Functional Profile #8060).

- **nvoHeatCoolOut** (SNVT_leq_percent)
  - Depicts the heating and cooling sequence for controlling the 6-way characterised control valves (see illustration, page 5).
  - This outlet runs parallel to the nvoCoolOutput or the nvoHeatOutput, respectively.

- **nvoEffectSetpt** (SNVT_temp_p)
  - Shows the actual setpoint of the controller.

**Note**

A restart is necessary after accessing network variables for the purpose of rewriting them or after deleting links in order to initialise the variables.
VAV-Compact LON

VAV controller for LonWORKS®

Functional Profile as per LONMARK®

Continued

<table>
<thead>
<tr>
<th>Functions Inlets Occupancy</th>
<th>Occupancy specification from nviOccCmd command centre</th>
<th>Occupancy switch nviSenOccCmd</th>
<th>Room operating status</th>
<th>Comfort extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note</td>
<td>The function nviOccCmd has a higher priority than the function nviSenOccCmd.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                          | OC_OCCUPIED                                           | OC_OCCUPIED                 | Comfort               |
|                          | OC_UNOCCUPIED                                         | OC_UNOCCUPIED              | Comfort               |
|                          | OC_NUL (default)                                      | OC_NUL (default)           | Comfort               |

|                          | OC_STANDBY                                            | OC_OCCUPIED                | Bypass                |
|                          | OC_UNOCCUPIED                                         | OC_UNOCCUPIED              | Pre-comfort           |
|                          | OC_NUL (default)                                      | OC_NUL (default)           | Pre-comfort           |

|                          | OC_UNOCCUPIED                                         | OC_OCCUPIED                | Building protection   |
|                          | OC_UNOCCUPIED                                         | OC_UNOCCUPIED              | Building protection   |
|                          | OC_NUL (default)                                      | OC_NUL (default)           | Building protection   |

|                          | OC_NUL (default)                                      | OC_OCCUPIED                | Comfort               |
|                          | OC_UNOCCUPIED                                         | OC_UNOCCUPIED              | Pre-comfort           |
|                          | OC_NUL (default)                                      | OC_NUL (default)           | Comfort               |

**Function nvoHeatCoolOut**

Typical application
Heating / cooling with Belimo
6-way characterised control valve.

Note chilled ceiling application
The nvoHeatCoolOutput is set into the neutral zone (50%) in the event that the temperature does not reach the dew point.

**Notes**
More detailed information on the Functional Profiles can be found on the website of LONMARK® (www.lonmark.org).

www.belimo.com
Override control with the SNVT nviManOvrd

<table>
<thead>
<tr>
<th>Functions</th>
<th>state</th>
<th>variable used</th>
<th>air flow controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVO_OFF</td>
<td>--</td>
<td>no reaction</td>
<td></td>
</tr>
<tr>
<td>HVO_POSITION</td>
<td>percent</td>
<td>no reaction</td>
<td></td>
</tr>
<tr>
<td>HVO_FLOW_VALUE</td>
<td>flow</td>
<td>0 ... nciNomAirFlow (liter/sec). The value 0xFFFF represents invalid data.</td>
<td></td>
</tr>
<tr>
<td>HVO_FLOW_PERCENT</td>
<td>percent</td>
<td>0% ... +100.00% (0.005%). The value 0x7FFF represents invalid data.</td>
<td></td>
</tr>
<tr>
<td>HVO_OPEN</td>
<td>--</td>
<td>full open</td>
<td></td>
</tr>
<tr>
<td>HVO_CLOSE</td>
<td>--</td>
<td>full closed</td>
<td></td>
</tr>
<tr>
<td>HVO_MINIMUM</td>
<td>--</td>
<td>configured flow</td>
<td></td>
</tr>
<tr>
<td>HVO_MAXIMUM</td>
<td>--</td>
<td>configured flow</td>
<td></td>
</tr>
<tr>
<td>all others</td>
<td>--</td>
<td>not supported</td>
<td></td>
</tr>
</tbody>
</table>

Note
The basic setting is «HVO_OFF». This value is loaded when the power supply is switched on.

Example

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVO_OFF</td>
<td>Temperature controller setpoints are active</td>
</tr>
<tr>
<td>HVO_OPEN</td>
<td>All VAV units are fully open (e.g. flushing operation or night cooling)</td>
</tr>
<tr>
<td>HVO_CLOSE</td>
<td>All VAV units are completely closed (dampers close when system is switched off)</td>
</tr>
</tbody>
</table>
VAV-Compact LON

VAV controller for LonWorks®

Electrical installation

Wiring diagrams

**VAV controllers**

<table>
<thead>
<tr>
<th>AC 24V</th>
<th>DC 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

Connect via safety isolation transformer.

**Note**

The current volumetric flow (0/2 ... 10V corresponds to 0 ... 100% \( V'_{\text{nom}} \)) can be measured with a voltmeter at connection 5 (U).

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

<table>
<thead>
<tr>
<th>AC 24V</th>
<th>DC 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>AC 24V</th>
<th>DC 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

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

Sensor scaling:
The sensors can be scaled with the sensor plug-in (sensor table).

**VAV controller with local override control (analogue override)**

<table>
<thead>
<tr>
<th>AC 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Note**

If no sensor is integrated, then connection 3 (Y) is available for the protective circuit of a local override control.
Options: CLOSED, \( V'_{\text{max}} \), OPEN

**Note**

Functions only with nominal voltage AC 24V.

---

**Warning**

Connect via safety isolation transformer.
Tool connection

Setting and diagnostics

Setting and the diagnostics of the connected VAV-Compact controller can be checked and set quickly and easily with the Belimo PC-Tool or the Service-Tool ZTH-GEN.

On-board service connection

The service connection integrated in the VAV-Compact allows the console used to be connected quickly.

Belimo VAV operating and service devices

- Belimo PC-Tool, with level converter ZIP-232-KA
- Service-Tool ZTH-GEN

MP connection (5)

The VAV-Compact can also communicate (connection wire 5) with the Service-Tools via the MP connection. The connection can be established during operation on site, i.e. in the connection socket, at the tool socket of the Belimo room temperature controller CR24 or on the floor or control cabinet terminals.
Operating controls and indicators

1. **Push-button and green LED display**
   - Off: No voltage supply or fault
   - Green, on: Operation
   - Press key: Switches on angle of rotation adaption followed by standard operation

2. **Service button for commissioning with LonWorks® and LED display yellow for LON status**
   - Off: The damper actuator is integrated ready-for-operation in the LonWorks® network.
   - Yellow, on: No application software is loaded in the actuator.
   - Yellow, flashing: The actuator is ready-for-operation, but not integrated in the LonWorks® network.
     - (flashing interval 2 s) (unconfigured)
   - Other flashing codes: A fault is present in the actuator.
   - Press key: Service Pin Message will be sent to the LonWorks® network.

3. **Gear disengagement key**
   - Press key: Gear disengaged, motor stops, manual override possible
   - Release key: Gear engaged, synchronisation starts, followed by standard operation

4. **Service plug**
   - Connecting Belimo PC-Tool and Service-Tool, respectively (see page 8)
   - For a more detailed description, see the S4-VAV-Compact product information.

Dimensions [mm]

- **Dimensional drawings LMV-D3LON**
  - See diagrams with dimensions

- **Dimensional drawings NMV-D3LON**
  - See diagrams with dimensions