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 technology, 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 \( (V_{\text{min}} \text{ and } V_{\text{max}}) \) can be set either locally with PC-Tool or ZTH-.. or by using the LNS plug-in available from Belimo.

**Operating and service devices**
Belimo PC-Tool or ZTH-VAV / 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-D2LON</td>
<td>5 Nm</td>
<td>2.5 W</td>
<td>5 VA (max. 5 A @ 5 ms)</td>
<td>Approx. 500 g</td>
</tr>
<tr>
<td>NMV-D2LON</td>
<td>10 Nm</td>
<td>3 W</td>
<td>6 VA (max. 5 A @ 5 ms)</td>
<td>Approx. 700 g</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 assembly.
- 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
- 2 ... ~300 Pa (OEM-specific)

### Operating pressure
- Max. 1000 Pa

### Characterisation
- OEM-specific differential pressure sensor linearisation

### Installation position
- Any, no reset necessary

### Operating medium (see «Used materials»)
- Supply and exhaust air in the comfort zone and in applications with sensor-compatible media

### Used materials
- PC + ABS in accordance with UL94-V0; stainless steel, DIN 1.4301 X10CrNiS1810; PP Santoprene

### 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
- \( V_{nom} \) OEM-specific nominal volumetric flow setting, suitable for the VAV unit
- \( V_{max} \) 100% of \( V_{nom} \)
- \( V_{min} \) 0 ... 100% of \( V_{nom} \) (see VAV-Compact documentation, page 17 Lower control limit)
- \( V_{mid} \) 0 ... 100% of \( V_{min} ... V_{max} \)

### Control
- Actual value signal \( U_5 \)  
  (Connection 5)  
  – adjustable: 2 ... 10V or 0 ... 10V  
  – adjustable: Volumetric flow or damper position

### 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: Adaptation / Addressing / Service function
- LED display
  - 24V supply
  - Status / Service / Bus function

### Actuator
- Brushless, non-blocking actuator with current reduction
- Torque (nominal torque)
  - See «Overview of types» on page 1
- Direction of rotation
  - ccw / cw
- Angle of rotation
  - 95°<3, adjustable mechanical or electronic limiting
- Adaptation
  - 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, terminals

### Safety
- Protection class
  - III Safety extra-low voltage
- Degree of protection
  - IP64
- 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
VAV-Compact LON

VAV controller for LonWorks®

Functional Profile as per LonMark®

The LON-capable VAV controller is certified by LonMark®. The functions of the VAV controller are provided with LonWorks® network as standardised network variables in accordance with LonMark®. The Node Object #0, the Damper Actuator Object #8110, the Open Loop Sensor Object #1 and the Thermostat Object #8060 are implemented in the actuator.

**Node Object #0**

The node object contains the object status and object request functions.

- **nviRequest** (SNVT_obj_request)
  Input variable for requesting the status of a particular object in the node.

- **nvoStatus** (SNVT_obj_status)
  Output variable that outputs the current status of a particular object in the node.

- **nvoFileDirectory** (SNVT_address)
  Output variable that shows information in the address range of the Neuron chip.

**Configuration Properties**

- **SCPTdevMajVer** (165)
- **SCPTdevMinVer** (166)
- **SCPTobjMajVer** (167)
- **SCPTobjMinVer** (168)

**Damper Actuator Object #8110**

- **nviRelStpt** (SNVT_lev_percent)
  Via this input variable, the set volume is specified for the VAV controller in % of the VAV unit. This variable is normally linked to the output variable of an HVAC controller.

- **nviActuatState** (SNVT_switch)
  Via this input variable, a preset volume is specified for the VAV controller (in % of the VAV unit). Note on priority: The variable which was most recently active, either nviActuatorState or nviRelStpt, has priority.

- **nviManOvrd** (SNVT_hvac_overid)
  Via this input variable, the actuator can be manually overridden to be set at a particular position or to a particular volume.

- **nvoActualValue** (SNVT_lev_percent)
  This output variable shows the current volume (in % of the VAV unit) and can be used for control circuit feedback or for displaying positions.

- **nvoAbsAngle** (SNVT_angle_deg)
  This output variable shows the current damper angle of the corresponding VAV unit and can be used for control and display purposes.

- **nvoAbsAirFlow** (SNVT_flow)
  This output variable shows the current volumetric flow through the corresponding VAV unit and can be used for control and display purposes.

**Open Loop Sensor Object #1**

- **nvoSensorValue** (SNVT_xxx)
  This output variable shows the current sensor value. Depending on the connected sensor, the output variable can be configured via the sensor plug-in and specifically adapted to the system.

**Configuration Properties**

- **SCPTobjMajVer** (167)
- **SCPTobjMinVer** (168)
- **SCPTminSendTime** (52)
- **SCPTmaxSendTime** (49)
- **SCPTminRcvTime** (48)
- **SCPTminDeltaAngl** (43)
- **SCPTminDeltaFlow** (47)
- **SCPTserialNumber** (179)
- **SCPTactuatorType** (41)
- **SCPToemType** (61)
- **SCPTlocation** (17)
- **SCPTnomAngle** (58)
- **SCPTnomAirFlow** (57)
- **SCPTminSetpoint** (50)
- **SCPTmaxSetpoint** (50)
- **SCPTdriveTime** (45)
- **SCPTdirection** (44)

Note

More detailed information on the functional profiles can be found on the website of LonMark® (www.lonmark.org).

The SNVT... can be configured as:

- **SNVT_temp_p**
- **SNVT_lev_percent**
- **SNVT_lux**
- **SNVT_temp**
- **SNVT_abs_humid**
- **SNVT_press_p**
- **SNVT_switch**
- **SNVT_enthalpy**
- **SNVT_smo_obscur**
- **SNVT_flow**
- **SNVT_ppm**
- **SNVT_power**
- **SNVT_flow_p**
- **SNVT_rpm**
- **SNVT_elec_kwh**
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 nvoCoolOutlet or the nvoHeatOutput, respectively.
  - Cooling = 33 … 0%
  - Valve closed 33 … 66%
  - Heating = 66 … 100%

- **nvoEffectSetpt** `SNVT_temp_p`
  - Shows the actual setpoint of the controller.

**Configuration Properties**

- SCPObjMajorVer (167)
- SCPObjMinorVer (168)
- SCTMaxRecTime (48)
- SCTMaxSendTime (49)
- SCTIpPassTime (34)
- SCPTipProtos (60)
- SCPTipConfig (5)
- SCPTipSensitivity (4)

**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.
### Functional Profile as per LONMARK®

**Functions Inlets Occupancy**

<table>
<thead>
<tr>
<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>OC_OCCUPIED</td>
<td>OC_OCCUPIED</td>
<td>Comfort</td>
<td></td>
</tr>
<tr>
<td>OC_UNOCCUPIED</td>
<td>OC_UNOCCUPIED</td>
<td>Comfort</td>
<td></td>
</tr>
<tr>
<td>OC_NUL (default)</td>
<td>OC_NUL (default)</td>
<td>Comfort</td>
<td></td>
</tr>
</tbody>
</table>

**Functions Occupancy**

<table>
<thead>
<tr>
<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>OC_OCCUPIED</td>
<td>OC_OCCUPIED</td>
<td>Bypass</td>
<td>Occupied time is modified by the amount of the bypass time (can be adjusted in the plug-in)</td>
</tr>
<tr>
<td>OC_UNOCCUPIED</td>
<td>OC_UNOCCUPIED</td>
<td>Pre-comfort</td>
<td></td>
</tr>
<tr>
<td>OC_NUL (default)</td>
<td>OC_NUL (default)</td>
<td>Pre-comfort</td>
<td></td>
</tr>
</tbody>
</table>

**Function nvoHeatCoolOut**

<table>
<thead>
<tr>
<th>nvoHeatCoolOut</th>
<th>SNVT_lev_percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>Frost</td>
</tr>
<tr>
<td>33%</td>
<td>Heating</td>
</tr>
<tr>
<td>66%</td>
<td>Neutral zone</td>
</tr>
<tr>
<td>100%</td>
<td>(dew point not reached)</td>
</tr>
</tbody>
</table>

### 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.
### 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)</td>
<td>The value 0xFFFF represents invalid data</td>
</tr>
<tr>
<td>HVO_FLOW_PERCENT</td>
<td>percent</td>
<td>0% ... +100.00% (0.005%)</td>
<td>The value 0x7FFF represents invalid data</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>

### 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>

---

**Note**

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

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**Products no longer available**
Electrical installation

Wiring diagrams

VAV controllers

AC 24V
DC 24V

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. \( \Delta p \)-monitor

AC 24V
DC 24V

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

AC 24V
DC 24V

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)

AC 24V

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.
Parameterisation

The actuator can be parameterised as follows:
– $V_{\text{min}}$ und $V_{\text{max}}$ settings
– Torque reduction
– Direction of rotation
– Function test or adaption can be triggered
– Volumetric flow or damper position

Parameterisation of the connected actuator

Notes
• The actuator can be triggered with the PC-Tool under «PP».
• The USB cable is included in the ZIP-USB-MP scope of delivery.
• The connection cable ZK1-GEN has to be ordered separately.

Parameterisation of the actuator, Standalone, without AC/DC 24V supply

Notes
• The actuator can be triggered with the PC-Tool under «PP».
• The RS-232 cable is included in the ZIP232 scope of delivery.
• The power supply unit ZN230-24 has to be ordered separately.
VAV-Compact LON

VAV controller for LonWorks®

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
   - For connecting MFT parameterisation and service tools (see page 5)
   - For a more detailed description, see the S4-VAV-Compact product information.

Dimensions [mm]

Dimensional drawings LMV-D2LON

Dimensional drawings NMV-D2LON

Products no longer available
Products no longer available