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®**
- **Integration into LONWORKS® systems**
- **Conversion of sensor signals**
- **Service button and LEDs for servicing and commissioning**
- **Diagnostic socket for operating devices**

LMV-D2LON

NMV-D2LON

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 directly connected and controlled with LONWORKS® via a FTT-10A transceiver.
Converter for sensors	Connection option for a sensor (active sensor or switching contact). In this way, the analog sensor signal can be easily digitised and transferred to LONWORKS®.
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	Three versions available, depending on the size of the VAV unit: 5 / 10 / 20 Nm. – Rotary actuator, depending on size – Linear actuator 150 N with 100, 200 or 300 mm linear motions
VAV – variable air volume	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 ($\dot{V}_{min}$ und $\dot{V}_{max}$) can be set either locally with PC-Tool or using the LNS plug-in available from Belimo.
Test function / test display	The VAV-Compact features an LED with a ready display for commissioning and functional checking as well as a service mode with air shortage, excess air and setpoint = actual value display with LEDs.
Operating and service devices	Belimo PC-Tool, remote control or ZEV, plugged into the VAV-Compact.
Assembly and connection	The VAV-Compact, which is assembled on the unit by the OEM, is connected using the pre-fabricated 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.

Overview of types

Type	Torque	Power consumption	For wire sizing	Weight
LMV-D2LON	5 Nm	3 W	5 VA (max. 5 A @ 5 ms)	approx. 500 g
NMV-D2LON	10 Nm	3.5 W	5.5 VA (max. 5 A @ 5 ms)	approx. 700 g

Safety notes

⚠

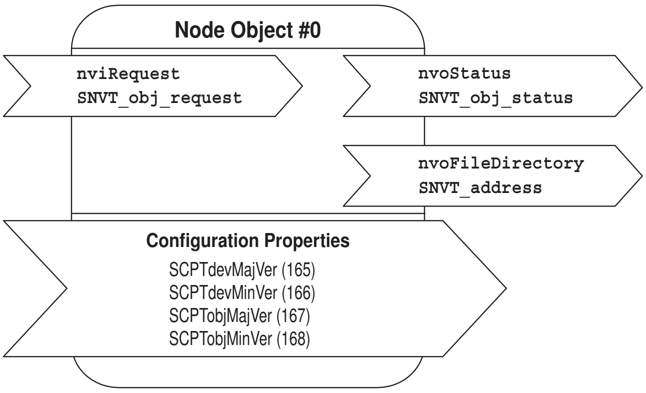
- **The device is not allowed to be used outside the specified field of application, especially in aircraft or any other form of air transport.**
- **Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.**
- **The 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 24 V, 50/60 Hz DC 24 V
Power supply range	AC 19.2 ... 28.8 V DC 21.6 ... 28.8 V
Differential pressure sensor	2 ... ~300 Pa (OEM-specific)
Operating pressure	max. 1000 Pa
Characterising	OEM-specific differential pressure sensor, linearisation
Installation position	Any, no reset necessary
Operating medium (see «Materials»)	Supply and exhaust air in the comfort zone and in applications with sensor-compatible media
Materials	PC + ABS to UL94-V0; stainless steel, DIN 1.4301 X10CrNiS1810; PP Santoprene
Measuring air conditions	0 ... +50 °C / 5 ... 95% r.h., non-condensing
Application	Supply/exhaust air units, integrated into LONWorks® systems
Operating volumetric flow	
$\dot{V}_{nom}$	OEM-specific nominal volumetric flow setting, matches VAV box
$\dot{V}_{max}$	30 ... 100% of $\dot{V}_{nom}$
$\dot{V}_{min}$	0 ... 100% of $\dot{V}_{nom}$ (see VAV-Compact documentation, page 17 «Minimum setting limit»)
$\dot{V}_{mid}$	0 ... 100% of ($\dot{V}_{min}$ ... $\dot{V}_{max}$)
Control	
Measured value signal U_5 (connection 5)	– Adjustable: 2 ... 10 V or 0 ... 10 V – Adjustable: Air volume or damper position } max. 0.5 mA
Bus function LONWORKS®	
Certified	According to LONMARK® 3.3
Processor	Neuron 3120
Transceiver	FTT-10A, compatible with LPT-10
Functional profile	According to LONMARK® / Damper actuator object #8110 / Open loop sensor object #1
LNS plug-in for actuator / sensor	Can be run with any LNS-based integration tool (min. for LNS 3.x)
Service button and status LED	According to LONMARK® guidelines
Conductors, cables	Conductor lengths, cable specifications and topology of the LONWorks® network according to the ECHELON® directives
Bedienung und Service	Pluggable / PC-Tool (V3.1 or higher)
Communication	LONWORKS®
Button	Adaptation / addressing / service function
LED indicator	– 24 V feed – Status / service / bus function
Actuator	Brushless, non-blocking actuator with current reduction
Torque (nominal torque)	see «Overview of typest» on page 1
Direction of rotation	left / right
Angle of rotation	95°∢, with adjustable mechanical or electronic limitin
Adaptation	Setting range recording and resolution to control range
Manual disengagement	Pushbutton, self-resetting without affecting functions
Position indication	Mechanical with pointer
Sound power level	max. 35 dB (A)
Spindle driver	– Clamp, for round spindles 10 ... 20 mm / square spindles 8 ... 16 mm – Positive fit, wide range of versions, e.g. 8 x 8 mm
Anschluss	Cable, 6 x 0.75 mm^2, terminals
Safety	
Protection class	III Safety extra-low voltage
Degree of protection	IP54
EMC	CE according to 89/336/EEC
Mode of operation	Type 1 (to EN 60730-1)
Rated impulse voltage	0.5 kV (to EN 60730-1)
Control pollution degree	2 (to EN 60730-1)
Ambient conditions	0 ... +50 °C
Non-operating temperature	–20 ... +80 °C
Ambient humidity range	5 ... 95% rH, non-condensating (to EN 60730-1)
Maintenance	Maintenance-free

Functional profile according to LonMark®

The LON-capable air volume controller is certified by LonMARK®. The controller functions are supplied with the LonWorks® network as standardised network variables according to LonMARK®. The node object #0, the damper actuator object #8110 and the open loop sensor object #1 are implemented in the actuator.



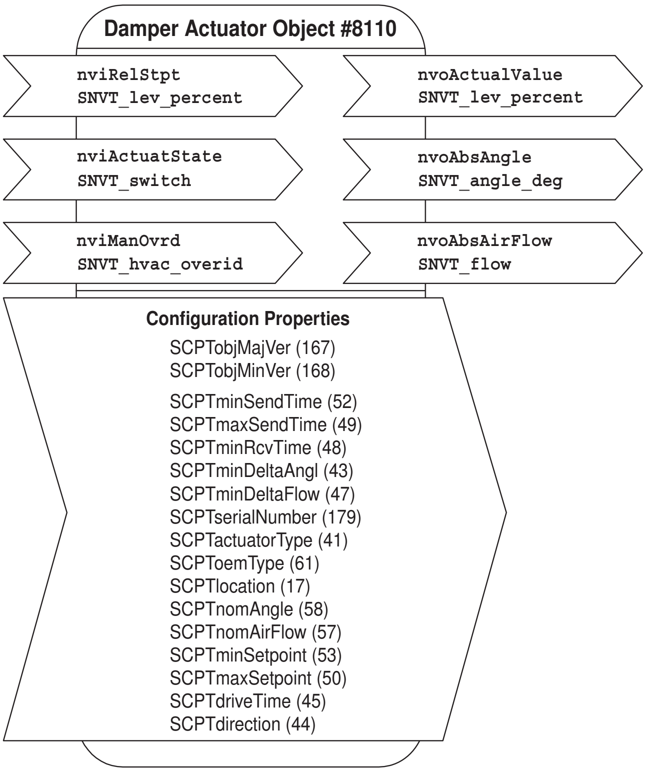
Node object #0

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.



Damper actuator object #8110

The actuator object is used to transmit the functions of the actuator to the LonWorks® network.

nviRelStpt **SNVT_lev_percent**
Via this input variable, the set volume is specified for the VAV controller in % $\dot{V}_{Nom}$ of the VAV unit.
This variable is normally linked to the output variable of an HVAC controller.

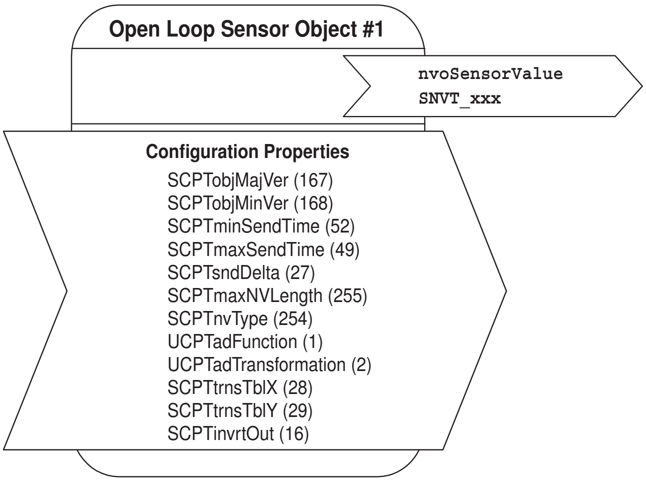
nviActuateState **SNVT_switch**
Via this input variable, a preset volume is specified for the VAV controller (in % $\dot{V}_{Nom}$ of the VAV unit).
Note on priority: The last variable that was active, either nviActuatorState or nviRelStpt, has priority.

nviManOvrd **SNVT_hvac_overid**
Via this input variable, the actuator can be manually overridden to set a particular position or particular volume (in % $\dot{V}_{Nom}$).

nvoActualValue **SNVT_lev_percent**
This output variable shows the current volume (in % $\dot{V}_{Nom}$ of the VAV box) and can be used for control circuit feedback or for displaying positions.

nvoAbsAngle **SNVT_angle_deg**
This output variable shows the current angle of rotation of the actuator or the damper blade and can be used to display the position or for service 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

A sensor can be connected to the air volume controller. An active sensor (output 0 ... 32 V) or a switch (on/off) can be connected.
In the case of the open loop sensor object, the measured sensor values are transferred to the LonWorks® network.

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.

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

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

Override control with the SNVT nviManOvrd

Functions

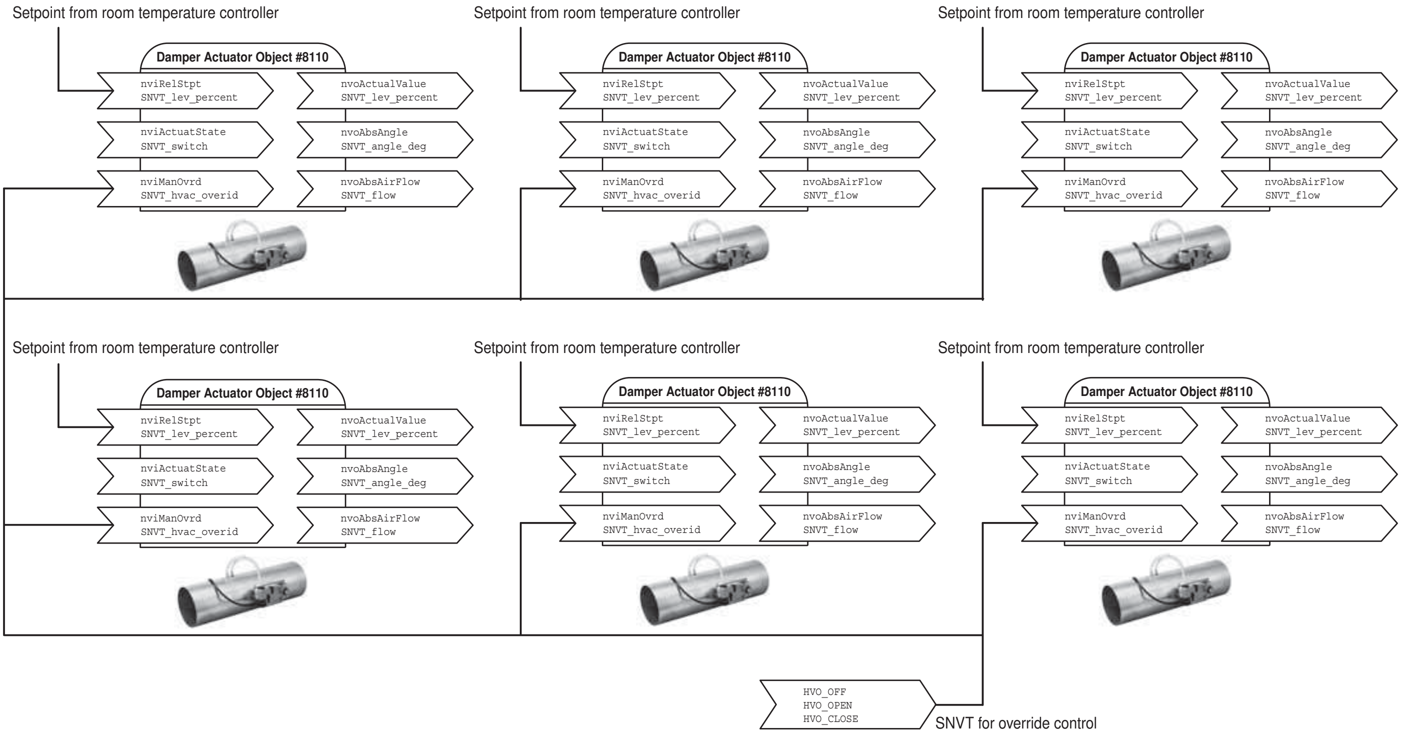
state	variable used	air flow controller
HVO_OFF	--	no reaction
HVO_POSITION	percent	no reaction
HVO_FLOW_VALUE	flow	0 ... nciNomAirFlow (liter/sec). The value 0xFFFF represents invalid data.
HVO_FLOW_PERCENT	percent	0% ... +100.00% (0.005%). The value 0x7FFF represents invalid data.
HVO_OPEN	--	full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

Note

The basic setting is “HVO_OFF”. This value is loaded when the power supply is switched on.

Example

Function	Description
HVO_OFF	Temperature controller setpoints are active
HVO_OPEN	All VAV units are fully open (e.g. flushing operation or night cooling)
HVO_CLOSE	All VAV units are fully closed (system closed when the plant is switched off)



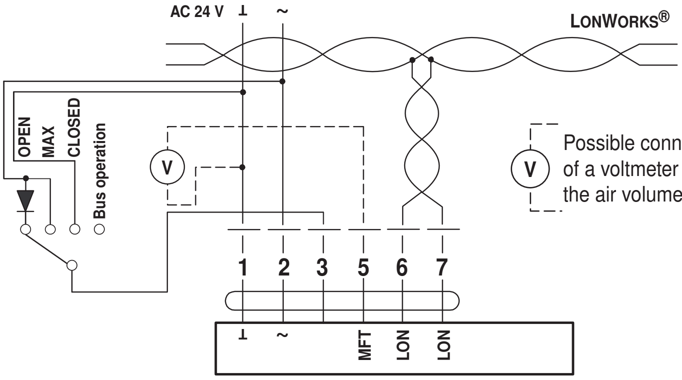
Electrical installation

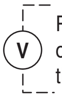
Wiring diagrams

Note
Connect via safety isolation transformer.

Note
If no sensor is connected, the analogue override control function can be used.
Please note: This only works if the actuator is supplied with AC 24 V.

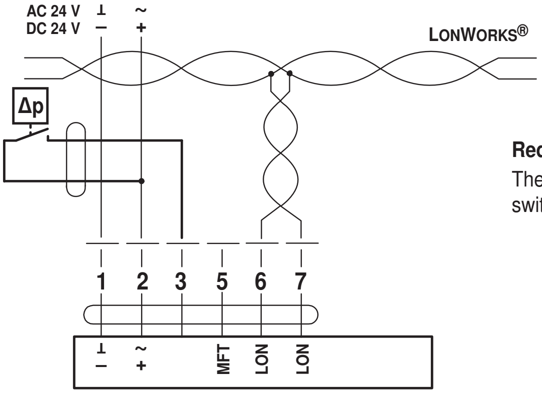
Connection without sensor





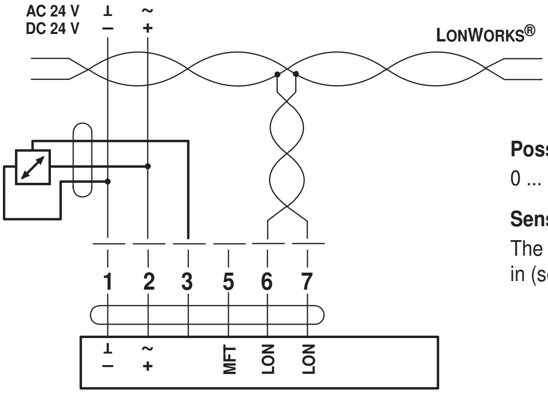
Possible connection of a voltmeter for checking the air volume or the position feedback U.

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



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

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



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

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

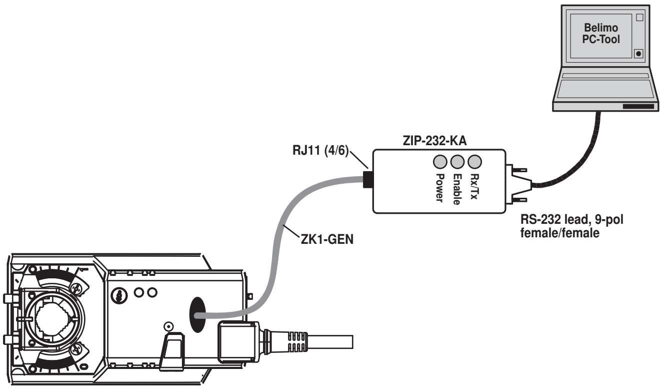
Parameterisation

Connection of the MFT parameterisation devices, e.g. Belimo PC-Tool MFT-P

The actuator can be parameterised as follows:
- $\dot{V}_{min}$ and $\dot{V}_{max}$ settings
- Torque reduction
- Direction of rotation
- Function test or adaption can be triggered
- Air volume or damper position

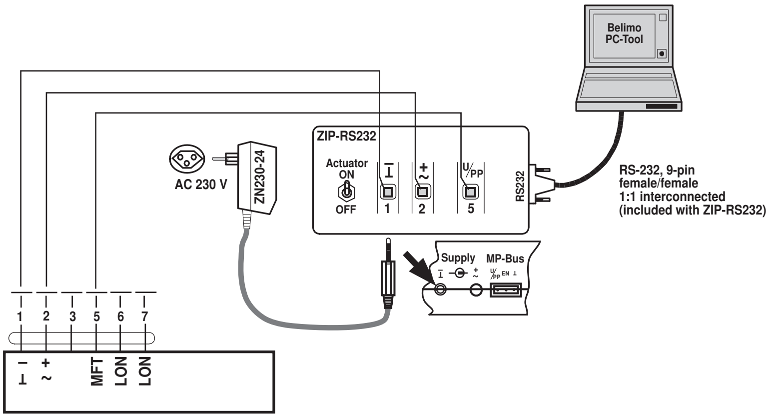
Parameterisation of the actuator

Parameterisation of the actuator when it has already been integrated in the complete system and is supplied with AC 24 V



Notes
- The actuator can be triggered with the PC-Tool under „PP“.
- The scope of delivery of ZIP-232-KA includes the RS232 cable.
- The connection cable ZK1-GEN has to be ordered separately.

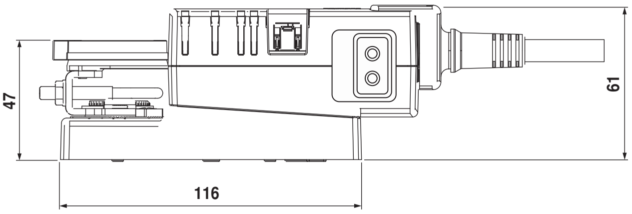
Parameterisation of the actuator before it is integrated in the complete system

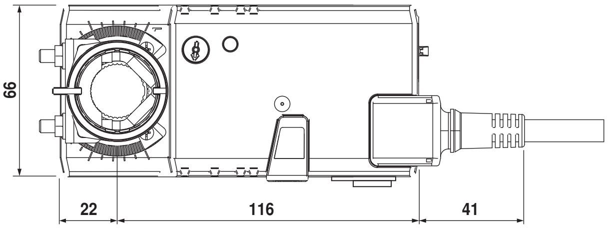


Notes
- The actuator can be triggered with the PC-Tool under „PP“.
- The scope of delivery of ZIP-232-KA includes the RS232 cable.
- The power supply unit ZN230-24 has to be ordered separately.

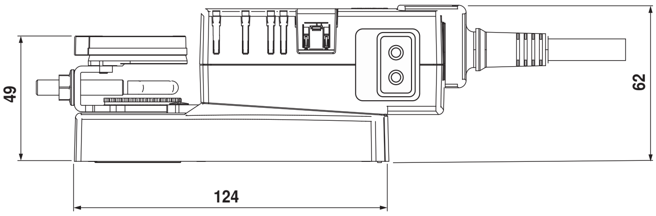
Dimensions [mm]

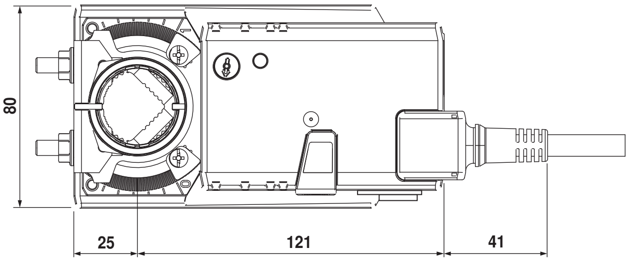
Dimensional drawings LMV-D2LON





Dimensional drawings NMV-D2LON





Operating controls and indicators

① **Pushbutton and green LED display**

Off:	No voltage supply or fault
Green, on:	Operation
Press button:	Switches on angle of rotation adaption followed by standard operation

② **Service button for commissioning for LONWORKS® and yellow LED display for the LON status**

Off:	The damper actuator is ready for operation in the LONWORKS® network.
Yellow, on:	No application software is loaded in the actuator.
Yellow, flashing: (flashing interval 2 s)	The actuator is ready for operation but not integrated in the LONWORKS® network (unconfigured).
Other flashing codes:	A fault is present in the actuator.
Press button:	Service pin message is sent to theLONWORKS® network.

③ **Gear disengagement switch**

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

④ **Service plug**

For connecting MFT parameterising and service tools (see page 5)

Detailed description see Product information S4-VAV-Compact.