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# **LONMARK<sup>®</sup>**

# **Functional Profile:**

# **Damper Actuators**

- general purpose**
- fire and smoke**
- airflow control**

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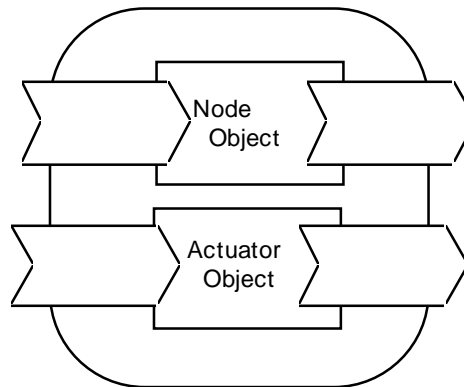
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## Overview

This document describes the profile of a HVAC damper actuator object. The HVAC damper actuator object makes use of the Node Object. Three sub types of HVAC actuators can be handled by this object:

- general purpose actuators
- fire and smoke actuators
- airflow control actuators

In addition more than one actuator can be controlled by a single HVAC damper actuator object.



**Figure 1.1** Functional Profile

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## Example Usage

The Damper actuator object interacts with one or more of the following nodes:

- Thermostat
- HVAC Controller
- Multistate switches / Positioner
- Building Management System (BMS)
- Commissioning / Installation node
- Monitoring node (PC, Displays, ..)

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## Use of the Node Object

The Node Object is fully described in the LONMARK Application Layer interoperability Guidelines.

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## Mandatory Network Variables

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### SNVT\_obj\_request

```
network input SNVT_obj_request nviRequest;
```

#### *Valid Range*

RQ\_NORMAL, RQ\_UPDATE\_STATUS, RQ\_REPORT\_MASK are supported as described in the LONMARK Application Layer interoperability Guidelines.

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### SNVT\_obj\_status

```
network output SNVT_obj_status nvoStatus;
```

This output network variable reports the status of any object on the node.

The semantic meaning of `nvoStatus` in relation to a damper actuator is described below.

#### *Valid Range*

The valid range is any value within the defined limits of `SNVT_obj_status`. The following states are supported:

<b>invalid_id:</b>	the object addressed in <code>nviRequest</code> does not exist.
<b>invalid_request:</b>	the requested code is not supported by the addressed object.
<b>disabled:</b>	the addressed object is currently disabled. Any updated input NV's are not executed by the actuator and no output will be updated.
<b>out_of_service:</b>	actuator not functional, or physically not present
<b>mechanical_fault:</b>	expected end stop lost or unexpected end stop occurred
<b>over_range:</b>	expected end stop lost
<b>under_range:</b>	unexpected end stop
<b>electrical_fault:</b>	the power supply voltage is out of its nominal range
<b>self_test_in_progress:</b>	adaptation (angle of rotation) or sync in progress
<b>manual_control:</b>	the gear release or the manual winding is currently activated.
<b>in_alarm:</b>	the addressed object is currently in alarm condition, the actuator doesn't work properly.
<b>in_warning/in_servicecall:</b>	the selected actuator has detected a service call condition but is still functional ( <b>proposed new state</b> ).
<b>in_override:</b>	indicates that <code>nviManOverride</code> is not "normal"

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## Optional Network Variables

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### File Request

```
network input SNVT_file_req nviFileReq;
```

File Request is used to access the configuration parameters

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### File Status

```
network output SNVT_file_status nvoFileStat;
```

File Status is used to access the configuration parameters

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## Configuration Properties

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### Max Send Time

```
network input config SNVT_time_sec nciMaxSendTime;
```

Indicates the maximum period of time that expires before the node object automatically updates all it's nvo's (e.g. nvoStatus).

#### *Valid Range*

see SNVT\_time\_sec

#### *Default Value*

0 (no automatic update)

#### *SCPT Reference*

SCPTmaxSendTime(49)

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### Min Send Time

```
network input config SNVT_time_sec nciMinSendTime;
```

Indicates the minimum period of time that expires before the node object automatically updates all it's nvo's (e.g. nvoStatus).

#### *Valid Range*

see SNVT\_time\_sec

#### *Default Value*

30 s

#### *SCPT Reference*

SCPTminSendTime(52)

## Max Receive Time

network input config SNVT\_time\_sec nciRcvTime;

Indicates the max receive time for the network input variables (nviActuatorState or nviRelStpt) before changing to default values.

### *Valid Range*

see SNVT\_time\_sec

### *Default Value*

0 (time-out not enabled)

### *SCPT Reference*

SCPTmaxRcvTime(54)

## Damper Actuator Object Details

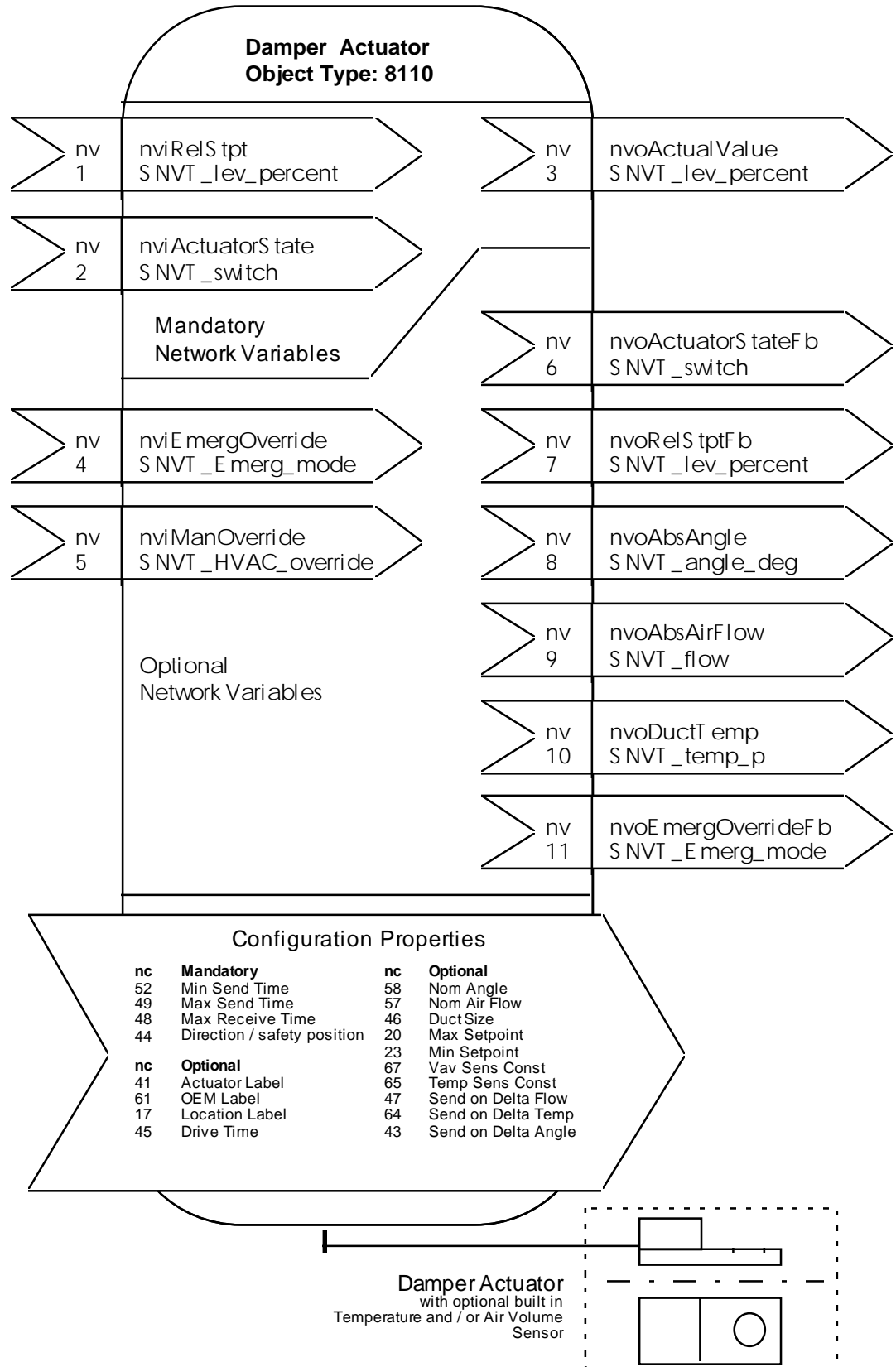


Figure 1.1 Damper Actuator Object Details

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## Mandatory Network Variables

### Actuator Setpoint Input

network input SNVT\_lev\_percent nviRelStpt;

This input network variable controls the relative actuator setpoint. It would normally be used for comfort control and therefore be connected to a HVAC controller / Thermostat.

0% equals min setting and 100% equals max setting. Depending on the type of actuator either the damper angle or the air volume is controlled.

#### Application

<b>general purpose</b>	<b>fire / smoke</b>	<b>airflow controller</b>
damper angle	damper angle	air volume

#### Valid Range

The valid Range is 0-100%

#### Default Value

Default Value is 0%

#### Remark

The valid actuator setpoint is given by the latest update on either nviActuatorState or nviRelStpt.

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### Actuator State Input

network input SNVT\_switch nviActuatorState;

This input network variable controls the actuator state. It is used for comfort control where the actuator is connected to a switch that forces the actuator to a pre defined set of positions or air volumes. The following table shows the relation between the value field of SNVT\_switch and the associated function.

state	val %	<b>general purpose</b>	<b>fire / smoke</b>	<b>air flow controller</b>
0	x	close (1)	safety position (1)	close (1)
1	0-19.5	close (1)	safety position (1)	close (1)
1	20-39.5	min position	min position	min air volume
1	40-59.5	inter. position	inter. position	inter. position
1	60-79.5	max position	max position	max air volume
1	80-100	open (1)	operating position (1)	open (1)

1) for definition see configuration property "direction / safety position" (nc 7)



### *Valid Range*

The valid Range is 0 to 100%.

### *Default Value*

Default Value is 20 (min)

### *Remark*

The valid actuator setpoint is given by the latest update on either `nviActuatorState` or `nviRelStpt`.

---

## Actual Position Output

network output SNVT\_lev\_percent nvoActualValue;

This output reflects the current position of the actuator and can be used as part of a control loop and for monitoring purposes.

### *Valid Range*

0% - 100%

### *When Transmitted*

The variable is transmitted immediately when it's value has changed by a predetermined amount. Depending on the actuator type this is defined by either `nciSendOnDeltaAngle` or `nciSendOnDeltaFlow`.

### *Update Rate*

Defined by `nciMinSendTime` and `nciMaxSendTime`

### *Default Service Type*

The default service type is unacknowledged

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## Optional Network Variables

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### Emergency Override Input

network input SNVT\_Emerg\_mode nviEmergOverride;

This input is used in fire and smoke applications to open and close an actuator with maximum speed. This input has highest priority, therefore if activated all other inputs and the input heartbeat timer (`nciRcvTime`) are disabled.

	<b>Actuator Action</b>
NORMAL	<code>nviActuatorState</code> , <code>nviRelSetpt</code> , <code>nviManOverride</code> are valid
PRESSURIZE	not valid
DEPRESSURIZE	not valid
PURGE	operating position (1)
FIRE	safety position (1)

1) for definition see configuration property "direction / safety position" (nc 7)

### *Valid Range*

see table

### *Default*

Default value is NORMAL.

In the case of communication loss or power fail a safety damper automatically runs to it's predefined safety position.

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## Manual Override Input

network input SNVT\_HVAC\_override nviManOverride;

This input is used to command the actuator into a manual mode (mainly used during balancing).

### *Valid Range*

state	no_manual; manual_flow; manual_flow_percent; open; close; minimum; maximum; manual_nul
ManPosition	0% to 100%
ManFlow	0 to 65535 liters per second

### *Default*

Default value is "no\_manual". This value will be adopted at power-up.

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## Actuator Setpoint Feedback Output

network output SNVT\_lev\_percent nvoRelStptFb;

This output network variable mirrors the actual value of nviRelStpt. This can be used for multiple Sensor applications.

### *Valid Range*

same as nviRelStpt

### *When Transmitted*

The variable is transmitted immediately when a change is made to nviRelSetpt.

### *Update Rate*

There is no maximum update rate.

### *Default Service Type*

The default service type is unacknowledged

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## Actuator State Feedback Output

network output SNVT\_switch nvoActuatorStateFb;

This output network variable mirrors the actual value of `nviActuatorState`. This can be used for multiple Sensor applications.

### *Valid Range*

same as `nviActuatorState`

### *When Transmitted*

The variable is transmitted immediately when a change is made to `nviActuatorState`.

### *Update Rate*

There is no maximum update rate.

### *Default Service Type*

The default service type is unacknowledged

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## Emergency Override Feedback Output

network output SNVT\_emerg\_mode nvoEmergOverrideFb;

This output network variable mirrors the value of `nviEmergOverride`. This can be used to read back the high priority `nviEmergOverride` input.

### *Valid Range*

same as `nviEmergOverride`

### *When Transmitted*

The variable is transmitted immediately when a change is made to `nviEmergOverride`.

### *Update Rate*

There is no maximum update rate.

### *Default Service Type*

The default service type is unacknowledged

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## Damper Angle Output

network output SNVT\_angle\_deg nvoAbsAngle;

This output network variable reflects the current position of the actuators shaft / damper blade and can be used for monitoring and service purposes.

### *Valid Range*

The valid range is limited to the mechanical working range of the associated actuator (-5..95 or -5..185). A value of 0x7FFF indicates “data not available” (e.g. during startup)

### *When Transmitted*

The variable is transmitted immediately when it's value has changed by a predefined amount which is specified in nciSendOnDeltaAngle.

### *Update Rate*

Defined by nciMinSendTime and nciMaxSendTime

### *Default Service Type*

The default service type is unacknowledged

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## Air Flow Output

network output SNVT\_flow nvoAbsAirFlow;

This output network variable reflects the current air flow through the associated VAV box and can be used as part of a control loop and for monitoring purposes.

### *Valid Range*

The valid range is 0 ... 65'535 (l/s). A value of 0x7FFF indicates that no VAV sensor is present.

### *When Transmitted*

The variable is transmitted immediately when it's value has changed by a predefined amount which is specified in nciSendOnDeltaFlow.

### *Update Rate*

Defined by nciMinSendTime and nciMaxSendTime

### *Default Service Type*

The default service type is unacknowledged

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## Inside Duct Temperature Output

network output SNVT\_temp\_p nvoDuctTemp;

This output network variable reflects the current temperature inside the duct and can be used for monitoring purposes.

### *Valid Range*

The valid range is -50 .. 150 degree C. A value of 0x7FFF indicates that no duct temperature sensor is present.

### *When Transmitted*

The variable is transmitted immediately when it's value has changed by a predefined amount which is specified in nciSendOnDeltaTemp.

### *Update Rate*

Defined by nciMinSendTime and nciMaxSendTime

### *Default Service Type*

The default service type is unacknowledged

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## Configuration Properties

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### Min Send Time

network input config SNVT\_time\_sec nciMinSendTime;

Indicates the minimum period between output network variable transitions.

### *Valid Range*

see SNVT\_time\_sec

### *Default Value*

tbd

### *SCPT Reference*

SCPTminSendTime(52)

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### Max Send Time

network input config SNVT\_time\_sec nciMaxSendTime;

Indicates the maximum period of time that expires before the actuator object automatically updates all its output variables.

### *Valid Range*

see SNVT\_time\_sec

### *Default Value*

0 (no automatic update)

### *SCPT Reference*

SCPTmaxSendTime(49)

---

## **Max Receive Time**

```
network input config SNVT_time_sec nciRcvTime;
```

Indicates the max receive time for the network input variables (nviActuatorState or nviRelStpt or nviManOverride) before changing to default value.

### *Valid Range*

see SNVT\_time\_sec

### *Default Value*

0 (time-out not enabled)

### *SCPT Reference*

SCPTmaxRcvTime(48)

---

## **Direction / Safety position**

```
network input config SNVT_state nciDirection;
```

nciDirection is used to set the actuators sense of rotation.

bit0=0 : actuator runs CW (top view) if e.g. nviRelSetpt is 100%

bit0=1 : actuator runs CCW (top view) if nviRelSetpt is 100%

bit1=0 : safety position = damper closed

bit1=1 : safety position = damper open

Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer.

### *Default Value*

bit0=0, bit1=0

### *SCPT Reference*

SCPTdirection(44)

---

## **Flow Send on Delta**

```
network input config SNVT_flow nciSendOnDeltaFlow;
```

Indicates the minimum delta on the air flow to send a new value on nvoAbsFlow.

### *Valid Range*

same as SNVT\_flow

### *Default Value*

10 l/s

### *SCPT Reference*

SCPTminDeltaFlow(47)

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## **Duct Temperature Send on Delta**

```
network input config SNVT_temp_p nciSendOnDeltaTemp;
```

Indicates the minimum delta on the duct temperature to send a new value on nvoDuctTemp.

### *Valid Range*

same as SNVT\_temp\_p

### *Default Value*

1 degree C

### *SCPT Reference*

SCPTminDeltaTemp(64)

---

## **Damper Angle Send on Delta**

```
network input config SNVT_ang_deg nciSendOnDeltaAngl;
```

Indicates the minimum delta on the damper angle to send a new value on nvoDamperAngle.

### *Valid Range*

same as SNVT\_angle\_deg

### *Default Value*

5 degrees

### *SCPT Reference*

SCPTminDeltaAngl(43)

---

## **Actuator Label**

```
network output config SNVT_str_asc nciActuatorType;
```

This configuration property can be used to identify the exact actuator type or label. This information is read only.

### *Default Value*

Actuator Label

### *SCPT Reference*

SCPTactuatorType(41)

---

## **OEM Label**

```
network input config SNVT_str_asc nciOemType;
```

This configuration property can be programmed by the OEM and can be used to identify the unit name (e.g. VAV-Box type). Write access can be disabled by the manufacturer.

### *Default Value*

OEM Label (16 lower bytes used only)

### *SCPT Reference*

SCPToemType(61)

---

## **Location Label**

```
network input config SNVT_str_asc nciLocation;
```

This configuration property can be used to provide physical location of the actuator object. Write access can be disabled by the manufacturer.

### *Valid Range*

Location Label (16 lower bytes used only)

### *Default Value*

None specified.

### *SCPT Reference*

SCPT\_location (17)

---

## **Drive Time**

```
network input config SNVT_time_sec nciDriveTime;
```

This configuration property sets the transition time for a full stroke (100%).

Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer. `nciDriveTime` does not affect airflow control actuators.

### *Default Value*

150 seconds

### *Valid Range*

depending on actuator type (e.g. 50s .. 600s)



## *SCPT Reference*

SCPTdriveTime(45)

---

### **NomAngle**

```
network input config SNVT_Angle_deg nciNomAngle;
```

Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer. Write access may also cause an automatic self test to get the mechanical working range of the actuator.

#### *Default Value*

90

#### *Valid Range*

0-95

## *SCPT Reference*

SCPTnomAngle(58)

---

### **NomAirFlow**

```
network input config SNVT_flow nciNomAirFlow;
```

nciNomAirFlow is used to calculate the airflow and therefore is relevant only for airflow control actuators. Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer.

#### *Default Value*

Programmed by the box manufacturer or balancer

#### *Valid Range*

same as SNVT\_flow

## *SCPT Reference*

SCPTnomAirFlow(57)

---

### **Duct Size**

```
network input config SNVT_area nciDuctSize;
```

nciDuctSize is used to calculate the Air Flow and therefore is relevant only for VAV actuators / controllers. Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer.

#### *Default Value*

0xFFFF (indicates that the box isn't set up correct)

### *Valid Range*

same as SNVT\_area

### *SCPT Reference*

SCPTductArea(46)

---

## **Max Setpoint**

```
network input config SNVT_lev_percent nciMaxSetpoint;
```

Depending on the actuator category this configuration property sets either the max angle of rotation or the maximum air flow (see either NomAngle or NomAirVolume).

### *Valid Range*

0% .. 163% of the nominal value. nciMaxSetpt has to be equal or more than nciMinSetpt.

### *Default Value*

100%

### *SCPT Reference*

SCPT\_max\_rnge (20)

---

## **Min Setpoint**

```
network input config SNVT_lev_percent nciMinSetpoint;
```

Depending on the actuator category this configuration property set's either the min angle of rotation or the minimum air flow (see either NomAngle or NomAirVolume)..

### *Valid Range*

0% .. 163% of the nominal value nciMinSetpt has to be equal or less than nciMaxSetpt.

### *Default Value*

0%

### *SCPT Reference*

SCPT\_min\_rnge (23)

---

## **VAV Sensor Constant**

```
network input config SNVT_multiplier nciVavSensConst;
```

nciVavSensConst is used to calculate the Air Flow and therefore relevant only for airflow control actuators. Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer.

*Default Value*

Programmed by the VAV Box manufacturer or balancer

*SCPT Reference*

SCPTsensConstVAV(67)

---

## Temperature Sensor Constant

```
network input config SNVT_multiplier nciTempSensConst;
```

nciTempSensConst is used to calibrate the optional duct temperature sensor. Since improper usage may cause a nonfunctional device, write access can be disabled by the manufacturer.

*Default Value*

1

*SCPT Reference*

SCPTsensConstTemp(65)

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## Power-up State

All input variables are set to their default values.