NV Embedded®
Installation, commissioning, configuration, operation, integration
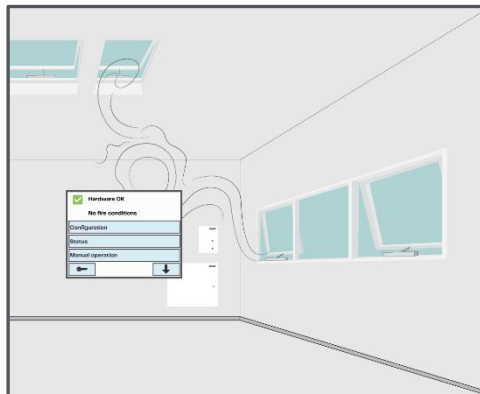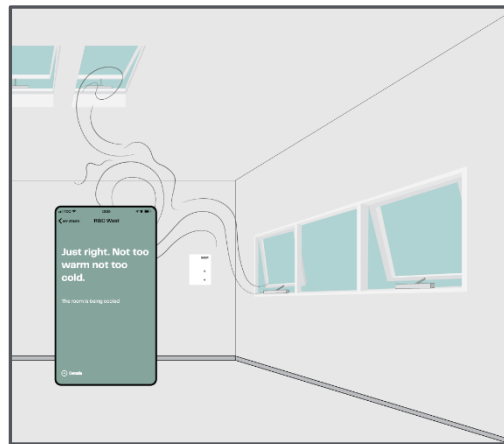
Contents

1. Application

The NV Embedded® system is exclusively designed for automatic indoor climate control. Among other things the system opens and closes windows, flaps, doors or heating valves and running solar shade curtains, awnings or blinds up and down.

Always check that your system meets the valid national regulations.

Pay attention to windows, flaps or doors opening time and opening speed.

1.1 Disclaimer and privacy policy

WindowMaster shall not be liable for consequential damage that may arise in connection with the Customer's, the Administrator's, registered users', or anybody else's configuration changes in NV Embedded®.

When using WindowMaster's app or dashboard to control the indoor climate in connection with an NV Embedded® solution, you register as a user with name, email address and password. Before you register as a user, you must accept our Terms of Use and General Terms for NV Embedded®, which is stated before downloading the app or start using the Dashboard.

Your contact information is not stored in our CRM system, but only in a secured WindowMaster Cloud and only in connection with the building to which you have been granted access.

2. General

NV Embedded® (NVE) is an indoor climate control solution, utilizing natural ventilation to deliver optimized indoor climate in buildings. The NVE climate control is based on temperature, CO_2 level and relative humidity as well as outdoor temperature, wind, and precipitation. The solution includes hardware and software components and is in this document referred to as the system.

This document describes the installation, commissioning, configuring, and operating the NVE solution. An example of a solution; including a 4-zone building and 2 Motor controllers (WCC 3x0 P), is used all through this document to make it easier to utilize. The structure, installation, configuration etc. is the same for WSC 3x0 P CompactSmoke™ and WSC 5x0 FlexiSmoke™ panels

This document assumes that the reader is familiar with WindowMaster actuators and WindowMaster Motor controllers, and in particular, the WCC 3xx Motor controller Plus series, the WSC 3x0 CompactSmoke™ Plus series and the WSC 5xx, from now on referred to as panel"". Please see the WCC 3x0 P, WSC 3x0 P and WSC 5xx Installation Instructions respectively, available from WindowMaster.com, for detailed information about these Motor controllers and Smoke panels.

This document also assumes that the reader has a general understanding of the structure of IP based networks, of building automation and Building Management Systems (BMS).

In the following the document describes the physical structure of the system including its hardware components, the process of installing and commissioning it, the configuration required to run it and how to operate it.

Integration levels

NVE can run as a standalone system or it can be integrated with BMS. The required level of integration determines how the NVE is to be configured. Integration can be achieved through either the BACnet, the Modbus or the KNX fieldbus technologies. When running as a standalone system NVE is not dependent on any fieldbus technology.

NVECloud

A Cloud solution, called NVECloud, is an optional part of the system. NVECloud is used for data logging and remote access, providing a User interface to the system, for facility managers. The Cloud solution also includes a mobile device app, giving occupants of a building overview on indoor climate in the building and the possibility to override the automatic control of windows.

NV Embedded® controllers connect to DNS name: windowmaster.azure-devices.net, using MQTT on TCP Port 8883.

3. Installation
3.1 Hardware components

The system described here includes the Natural Ventilation (NV) control module of the NVE. Other modules of the system like Heating control, Mechanical ventilation or sun shading control are discussed but their hardware components are not described in details.

Figure 1

The above figure shows the components and the connecting cables, which are required to implement a NVE system in a building with 4 zones and 5 windows. Note that the WOT 100 can be connected either to a panel (WCC or WSC) or to a WWS.

The **product list of this system includes:**
- Motor controller: 1 x WCC 310 P 0202 and 1 x WCC 320 P 1012
- Actuator: 5 x WMX 804-1
- Indoor room sensor: 4 x WWS 100
- Comfort keypad: 2 x WSK 120
- Weather station: 1 x WOT 100 and 1 x WLA 340 | or WOW 600

Cable list:

Function	Recommended cable type	Max cable length	Max no. of devices connected
Motor line cable	3 x 1.50mm^2 to 4mm^2	50 m (164 ft)	4 actuators
Comfort push button cable	2 x 2 x 0.5mm^2	200 m (656 ft)	n/a
WSK-Link™ cable	2 x 2 x 0.5mm^2	200 m (656 ft)	15 sensors
IP network cable	CAT5 Ethernet cable	100 m (328 ft)	2
Outdoor temperature cable	2 x 0.75mm^2 UV resistant	100 m (328 ft)	1
Weather station cable **WLA 340** **WOW 600**	6 x 0.5mm^2 UV resistant 8 x 0.5mm^2 UV resistant	80 m (262 ft)	1

Please see the installation manuals of the different products for detailed information about termination.

3.2   Software structure

3.2.1   License key

The software implementing the Indoor Climate Control of the NVE system is embedded in and running on the panel, hence the name NV Embedded®. To activate the NVE software on the panel the NVE Dongle license key must be inserted in the USB port on the panel.

Figure 3

NVE Dongle – A USB key including a license key for the NV Embedded® software and information for Cloud connecting, as well as a Cloud ID.

One dongle is required per WCC 3xx P MotorController

Figure 2

WCC 3xx P xxxx – Motor controller, used for running window actuators, heating valves and sun shading actuators, as well as running the NV Embedded® software to control the indoors climate in a building.

One dongle is required per WSC 3xx P CompactSmoke™ panel

Figure 4

WSC 3xx P xxxx – CompactSmoke™ panel, used for running window actuators, heating valves and sun shading actuators, as well as running the NV Embedded® software to control the indoors climate in a building.
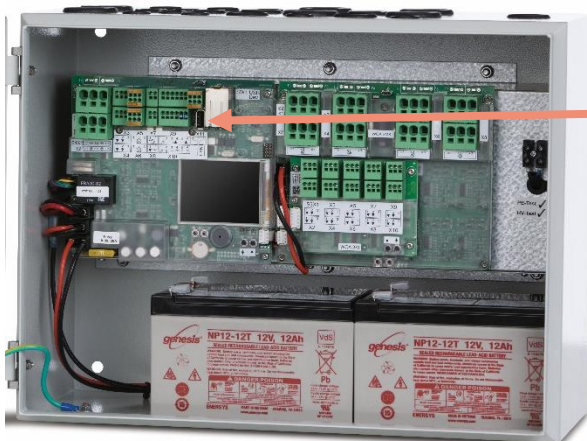
One dongle is required per 20A section in a WSC 5xx FlexiSmoke™ panel. Shown here is a WSC 540 panel which requires two dongles.

Figure 5

WSC 5xx – FlexiSmoke™ panel, used for running window actuators, heating valves and sun shading actuators, as well as running the NV Embedded® software to control the indoors climate in a building.
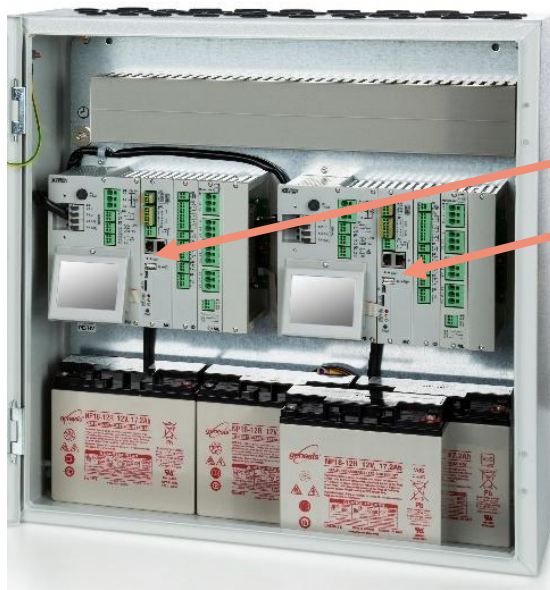
3.3 Panel structure

The indoor climate control embedded in the panel is implemented with the following software modules referred to as:

- **NV Controller**
  Controls the Natural Ventilation (NV) in a zone by opening/closing openings in the facade and/or the roof of the building. Must be active for a Heating or a Mech. Vent. Controller to be able to run.

- **Heating Controller**
  Controls the temperature in a zone using the available heating source like radiators, floor heating, air handling units and the like. The Heating controller is dependent on the NV Controller for temperature setpoints and actual sensor values. Heating Controller #1 is dependent on NV Controller #1 and so on.

- **Cooling Controller**
  Controls the temperature in a zone using the available cooling source like air handling units and the like. The Cooling controller is dependent on the NV Controller for temperature setpoints and actual sensor values. Cooling Controller #1 is dependent on NV Controller #1 and so on.

- **Mech. Vent. Controller**
  Controls mechanical ventilation equipment like VAV, AHU, exhaust ventilators and the like. The Mech. Vent. controller is dependent on the NV Controller for temperature setpoints and actual sensor values. Mech. Vent. Controller #1 is depending on NV Controller #1 and so on.

- **Sun shading Controller**
  Controls sun shading equipment.

- **Pulse schedule**
  Defines time schedules for pulse ventilation in addition to or instead for the demand driven pulse ventilation. Pulse ventilation is utilised when the system is in the Winter (heating) mode.

- **Building schedule**
  Defines a schedule for activating different building control scenarios. 3 basic control scenarios including building: "Occupied", "Secured" and "Unoccupied" can be defined. A "Night" state can be selected with each of the basic scenarios.

The below figure illustrates the structure of WCC 3xx P Motor controller and the relationship between its hardware and software components.
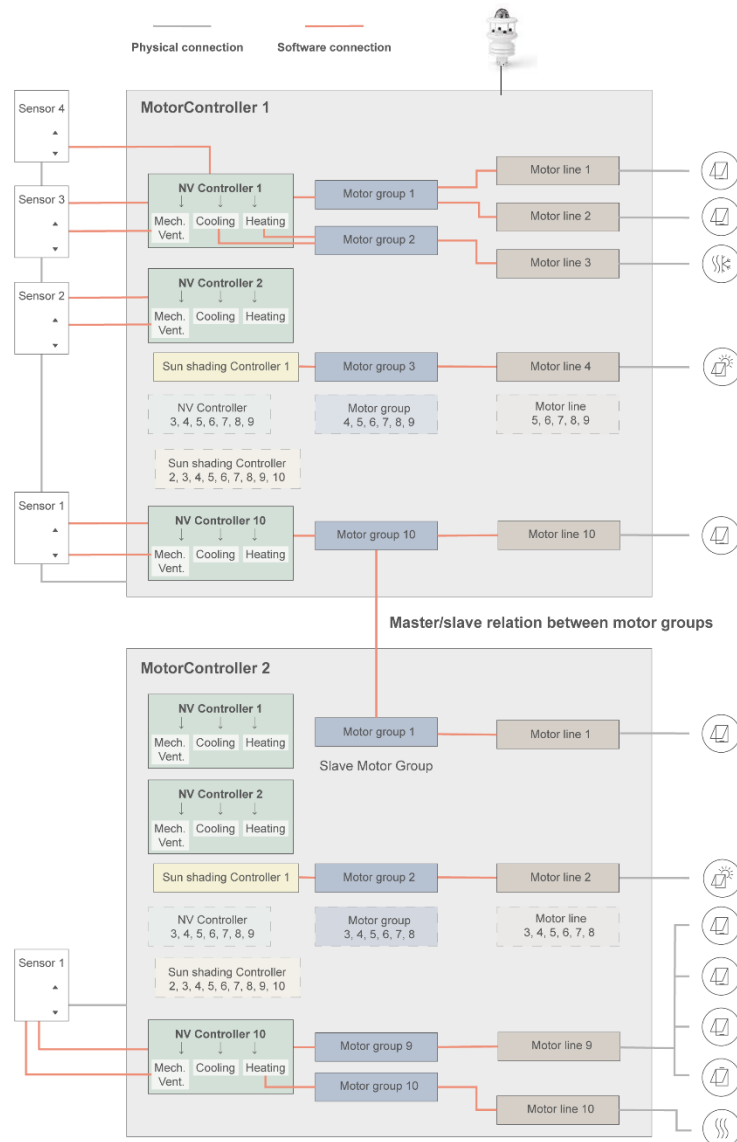

Figure 6

- Actuators, mounted on windows, are physically connected to the motor lines of the panel.
- Motor lines are associated with motor groups.
- Motor groups are associated with NV Controllers.
- WWS 100 sensors are physically connected to panels through WSK-Link™ cables. The sensors are then associated with NV Controllers.
- Motor groups on 2 different panels can be related in a 'Master/Slave' relation so the Slave Motor group always follow the position of the Master motor group.

Max number of components on a WxC 3x0 panel
- Max 10 motor lines per panel
- Max 15 motor groups per panel
- Max 10 NV controllers per panel
- Max 15 WWS 100 sensors connected per panel

Max number of components on a WSC 5xx panel
- Max 13 motor lines per 20A section
- Max 15 motor groups per 20A section
- Max 10 NV controllers per 20A section
- Max 10 WWS 100 sensors connected per 20A section

3.4   Assigning NV Controllers to building zones

A building is divided into zones. Most often a room is equal to a zone, but in some cases larger areas in a building, like a large open office area or a sports hall, can be divided into several logical zones. NVE controls the indoor climate in each zone independently from all other zones.

The indoor climate in a zone is controlled by a NV Controller, sometimes together with other Controllers. When NVE only controls the heating in a zone, the corresponding NV Controller must still be active to supply the Heating controller with setpoints and current sensor values.

Not all software controllers have to be active/present in a zone but when they are, they are working together to deliver the optimal indoor climate in the zone.

To select the panel, which will run the NV Controller for a specific zone, you have to look for the WWS 100 sensor that is installed in that specific zone. The panel, this sensor is connected to, is the panel that must run the NV Controller that will control the zone. Figure 5 illustrates assigning NV Controllers to the 4 zones in our example project.
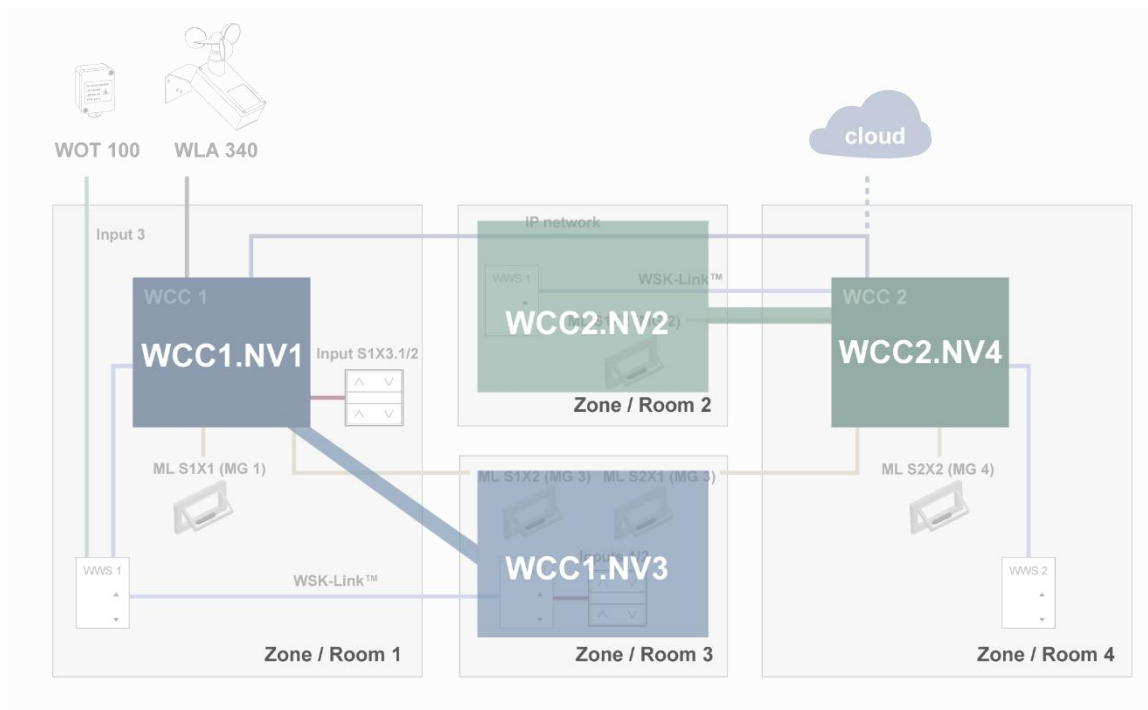

Figure 7

In the example project, we will assign WCC1.NV Controller1 (WCC1.NV1) to control Zone 1 since sensor WCC1.WWS1 and window WCC1.S1X1 are physically connected on WCC1.

We will assign WCC1.NV Controller3 (WCC1.NV3) to control Zone 3 since sensor WCC1.WWS2 and window WCC1.S1X2 are physically connected on WCC1.
Note that Zone3 has another window connected on WCC2. To control this window from WCC1.NV3, a Master/Slave relation between WCC1.MG3 and WCC2.MG3 must be defined.

We will assign WCC2.NV2 to control Zone 2 since sensor WCC2.WWS1 and window WCC2.S1X2 are physically connected on WCC2.

We will assign WCC2.NV4 to control Zone 4 since sensor WCC2.WWS2 and window WCC2.S2X2 are physically connected on WCC2

Assigning NV controllers to building zones should be considered during the detail projecting of the system, when deciding which sensors and windows are to be connected to what panel.

4. Commissioning and configuration

Commissioning a NVE system entails off-site detailed projecting, installation, hardware commissioning and testing as well as configuring each panel and each NV controller. Hardware commissioning and basic configuration must be done physically on site in front of the panels while observing the operation of actuators. When basic configuration is done the rest of the configuration can be done remotely through the IP network.

Hardware installation and commissioning are not in the scope of this document. Please refer to the product Installation Instructions of the products included in the NVE system.

4.1 Configuration tools

There are 3 different configuration tools available, each with their own benefits.

4.1.1 The Touchscreen

The entire configuration of a NVE system can be achieved from the touchscreen of the panel.

Note – Basic configuration parameters are visible in the 'Configuration' menu point while more advanced parameters are only available in the 'View all details' menu point. Scroll down in the Main menu to find the 'View all details' menu point.
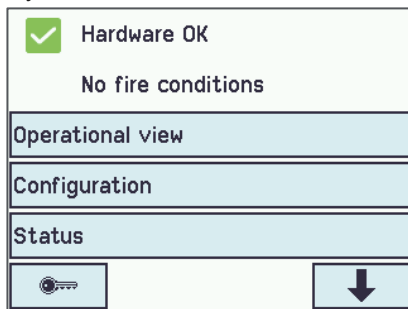
+ Available at all times. A computer is not needed.

+ Access to all parameters, depending on PIN code.

- Requires physical access to the panel.

- Access to only one panel at a time, lacking system overview.

4.1.2 WMaFlexiSmokeRemote

Once basic settings are done, configuration can be achieved through the WMaFlexiSmokeRemote tool. This tool is available from the WindowMaster website.
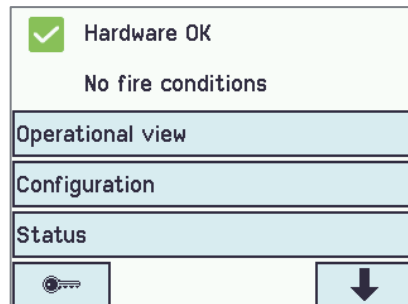
+ Remote access via network.
- Requires pre-knowledge of IP addresses.
- Access to only one panel at a time. Limited system overview.
- 'Enable remote control' must be "Yes".

4.1.3 WMaMotorParamTool

Once basic settings are done; configuration can be achieved through the WMaMotorParamTool tool. Contact WindowMaster for access to the tool.
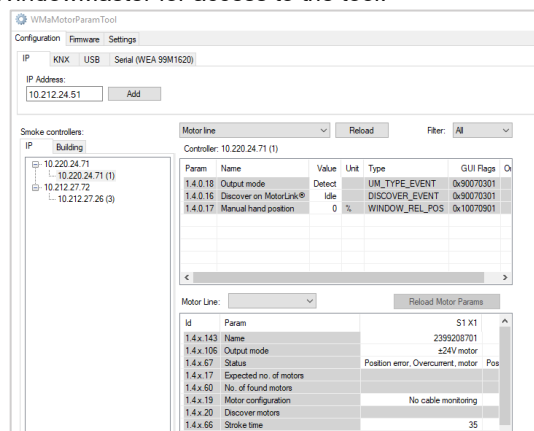
+ Remote access via network.
+ System overview of panels and building zones.
+ Automatic discovery of panels connected on LAN.
+ Possibility to manipulate more than one parameter at a time.
- Panels must be preconfigured with IP addresses.
- 'Enable parameter set form network' must be "Yes".

Note – The WMaMotorParamTool communicates with the panels by using the polling method. That means that the values and visible parameters you see on screen are from the last time the panel was polled, they are not automatically updated when values are changing on the panel. To ensure you are looking at the current values and current visible parameters on the panel, for the menu point you work with, **you must press the 'Reload' button**.

Note – Some parameters only become visible when the functions they support become available, for example the parameters of a NV Controller become visible once you "Enable" this NV Controller. To see newly visible parameters, **you must press the 'Reload' button**.

4.2 The Configuration process

4.2.1 Off-site preparation

Off-site preparations include detailed projecting, assigning NV controllers to building zones and preparing the data required for the configuration of all the panels and NV controllers in the system. See appendix B, for a set of tables including the information for the example project, used in this document. A template (.xlsx file) is available on www.windowmaster.com under "NV Embedded".

4.2.2 Commission and test each motor line

Commission and test each motor line on each panel. Assign the motor lines to their motor groups. Consider '*Figure 1*' where:

- WCC1.S1X1 is associated with Motor Group 1
- WCC1.S1X2 is associated with Motor Group 3
- WCC2.S1X2 is associated with Motor Group 2
- WCC2.S2X1 is associated with Motor Group 3
- WCC2.S2X2 is associated with Motor Group 4

4.2.3 Commission and test push buttons

Commission and test Manual override push buttons if they are connected to panels Local Inputs. Consider 'Figure 1' where:

Input WCC1.S1X3.1/2 configured with the Open/Close functions and is associated with Motor Group 1.

4.2.4 NVE Dongle

Plug the NVE Dongles onto the panels to license and activate the NVE software.
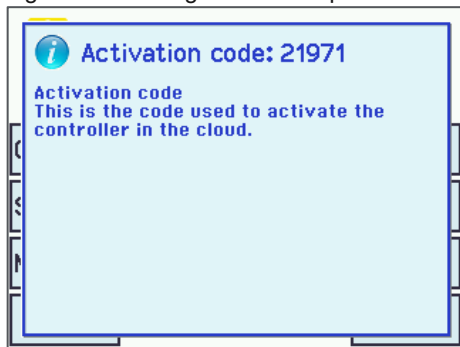
- Activation code is read from the panel's display just after the NVE Dongle is plugged in.
  The Activation code is not visible from the network.

- Make a note of the Cloud ID's from the NVE Dongle's label and the activation code from the display for later use, if you intend to create a NVECloud project for the NVE system you are commissioning.

4.2.5 WWS 100

Configure all WWS 100 sensors and verify that they work.
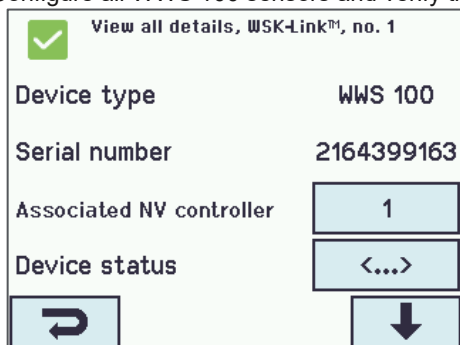
Select WSK-Link™ menu -

1 Select the actual room sensor, or sensors if more than one, and associate with the corresponding NV controller. You can identify a sensor by either letting the LED flash or if you activate the touch buttons for manual control on the sensor, the sensor will be identified in the panel's display.

In the example sensor 1 (WWS1 connected on WCC1) is associated with NV controller 1. Sensor 2 (WWS2 connected on WCC1) is associated with NV controller 3.

View all details, WSK-Link™, no. 1 ✅

Temperature	22.6 °C
CO2	600 ppm
Relative humidity	46%
Keypad 1 status	Idle

2   Check sensor values. Note that values are only shown when the **NV controller**, the sensor is associated with, is **activated.**

View all details, WSK-Link™, no. 1 ✅

Keypad 2 status	Idle
Sensor 1 input config	Degree Celsius (°C)
Sensor 2 input config	Move / Step
Sensor input 3 config	Move / Step

3   Configure external sensors if in used.
In the example the 'Sensor 1 input config' of sensor 1 is configure with "Degree Celsius" and the 'Outdoor temperature' of sensor 1 = "1".
This configuration means that the value of 'Sensor 1 input config' is to be understood as Degree Celsius coming from an outdoor temperature sensor.
The outdoor temperature is to be used by all the 10 NV controllers of this panel. In the example project, only NV Controllers 1 and 3 are activated.

View all details, WSK-Link™, no. 1 ✅

Outdoor temperature	1
Outdoor temperature	6.4 °C
Outdoor temperature used in zones	1 2 3 4 5 6 7 8 9 10
Send outdoor temp. to AO net	1 2 3 4 5 6 7 8 9 10 11 12 13

4.2.6   Weather station

Configure and test the weather station's wind and rain sensors on the panel the sensors are connected to. This example is using the WLA 340 weather station. The WOW 600 weather station, that also includes a wind direction and outdoor temperature sensors, is configured similarly.

View all details, Weather ✅

Sensor type	WLA 340
WSK Link™ Master present	Master not present
Status	<...>
Wind speed	0.0 m/s

• Set the Sensor type, "WLA 340" in the project example.

• 'WSK-Link™ Master present' is not applicable. WSK-Link™ is not used for weather data distribution.

• 'Data unchanged timeout' configures time elapsed from last value change before indicating an error. 0 disables the function.

• 'Send data to AOnet' specifies to which panels, on the AOnet subnet, the weather data will be sent. Section 5.2.10 covers AOnet.

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View all details, Weather	
Use RMS in filter	No
Retransmit time	300 s
Data unchanged timeout	48 hours
Send data to AO net	2

- Observe that wind speed values are shown. Note that the 'Filtered wind speed' value is changing much slower than the 'Wind speed'.

The rain sensor signal is, as default, connected on Local Input S1X10.5 and the Input is configured with the "Rain" function. (Safety must be replaced with Rain in this section).

View all details, Local input, S1X10.5 Safety	
Input type	Binary
Enable input	Yes
Control motor groups	1 2 3 4 5 6 7 8 9 10
Active function on controlled motors	Rain

- All Motor groups are associated with the Rain Input as a default.

- The default 'Rain' position of all Motor groups is 0%. Test the rain sensor and check that all Motor groups are closing.

4.2.7 IP network

Configure the IP network.

View all details, Network	
Link	Yes
DHCP	Yes
IP address	xxx.xxx.xxx.xxx
Subnet mask	255.255.255.0

For each panel:

- IP addresses must be coordinated and preferably issued by the IT organization of the building. WindowMaster recommends employing fixed IP addresses that are reserved in the DHCP server of the building.

- Check that the 'Link' status is "Yes" indicating that the physical network connection is OK.

4.2.8 Allow setting parameters from network.

Configuration, System	
The interval between service	0 days
LCD rotate view	No
Enable parameter set from network	Yes
Enable remote control	Yes

In the 'system menu' of each panel:

- Set the 'Enable parameter set from network' to "Yes" to allow remote configuration using the WMaMotorParamTool tool.

- Set 'Enable remote control' to "Yes" to allow remote configuration using the WMaFlexiSmokeRemote tool.

You are now ready to complete the configuration and commissioning of the system from a LAN network connection.

4.2.9 The 'system' menu
Set the parameters in the 'System' menu

Id	Parameter name	Value	Unit
1.0.0.22	Language	English	
1.0.0.78	Time zone	CET, Central European (UTC + 1)	
1.0.0.28	Date	2019-01-16	
1.0.0.27	Time	11:02:11	
1.0.0.74	Weekday	Wednesday	
1.0.0.79	Daylight saving	False	
1.0.0.82	Time zone offset	60	minutes
1.0.0.84	Time received from fieldbus	-	
1.0.0.80	Temperature unit	Celsius	
1.0.0.81	Name	WCC1	
1.0.0.35	Backup time stamp	-	
1.0.0.34	Unsaved changes	True	
1.0.0.23	Configuration command	No command	
1.0.0.86	Time for service	False	
1.0.0.85	Time for motor service	False	
1.0.0.26	LCD rotate view	False	
1.0.0.46	Enable parameter set from network	True	
1.0.0.61	Enable remote control	True	
1.0.0.62	Remote control TCP port	55555	
1.0.0.30	Show disabled instances	False	
1.0.0.32	Number of watchdog reboots	0	
1.0.0.36	Program build CRC	0xECD34C4E	

Controller: 10.212.27.25 (1), GPT_WCC-0.25, te [Remote control] [Log file]
System [Reload] [ ] Auto

- Language
- Time zone
- Date and Time

- Temperature unit - (Celsius)
- Name – (WCC1)

Ensure that
- Enable parameter set from network = **True** (default)
- Enable remote control = **True**

4.2.10 AOnet
Enable AOnet and set the AOnet ID
AOnet (Addressable Objects Network) is the NVE mechanism for distributing data among all panels in the system. The data distributed include weather data, safety signals, common building signals, time synchronizing and motor group Master/Slave communication. NVE uses the IP network as the medium for transmitting this data.

In a system the AOnet can be divided into **AOnet subnet**s. Each AOnet subnet can include up to 23 panels and or 20A sections (WSC 5xx panel). There is no limit to the number of AOnet subnets in one system.

Each WCC 3xx / WSC 3xx panel within the AOnet subnet must receive a unique AOnet ID between 1 and 23.
Each 20A section in a WSC 5xx panel within the AOnet subnet must receive a unique AOnet ID between 1 and 23.

ID 0 = Disabled AOnet.

ID 1 = Master panel. An AOnet subnet must have a 'Master' but there are no special requirements for a panel to be the Master in the AOnet subnet. Any panel within the AOnet subnet can be designated 'Master'.

ID 2 to 23 = members of the AOnet subnet.

Id	Parameter name	Value	Unit
1.22.0.16	Enable AOnet	True	
1.22.0.17	AOnet ID	1	
1.22.0.18	Master IP address	10.212.27.25	
1.22.0.19	This controller is master	True	
1.22.0.20	AOnet UDP port number	55557	
1.22.0.22	Clear table	False	
1.22.0.23	Sync. time with this controller	False	
1.22.0.24	Last sync. Time (UTC)	-	
1.22.0.25	IP address of foreign AOnet	0.0.0.0	

Id	Parameter name	1 (M)	2
1.22.x.16	IP address	10.212.27.25	10.212.27.26
1.22.x.17	Status	0	0
1.22.x.18	TX counter	1175799	574737
1.22.x.19	RX counter	328123	160358
1.22.x.20	TX error counter	0	0
1.22.x.21	TX timeout counter	0	131
1.22.x.22	Last alive (UTC)		2019-01-16 11:01:01
1.22.x.23	TX buffer full error counter	0	

- Enable AOnet

- To define a Master, insert panel's own IP address in the 'Master IP address' field. The panel will automatically receive AOnet ID 1.

- In all other panels insert unique AOnet ID's and the Master's IP address.

- The foreign IP address is the address of the Master of the next AOnet subnet. Insert the IP of the Master of AOnet subnet 2 in the Master of AOnet subnet 1 to send data from subnet 1 to subnet 2.

- The table shows all the panels belonging to the AOnet subnet.

In the project example we choose WCC1 to be the Master because the weather station is physically connected to it. WCC2 is configured with AOnet ID 2. We only have one AOnet subnet so the 'IP address of foreign AOnet' stays "o.o.o.o" meaning not used.

4.2.11 Name Motor Lines

In the Motor line menu insert a 'Name' and 'Max opening area' for each relevant motor line. Adjust any parameter that needs a value different from the default value.

Select motor line for motor parameters:			Reload Motor Params				Update Motor Params

Id	Parameter name	S1 X1	S1 X2	S2 X1	S2 X2	S2 X3	
1.4.x.143	Name	Sun blind	Staircase window	Upper left	Upper midt	Upper right	
1.4.x.106	Output mode	±24V motor	±24V motor	MotorLink®	MotorLink®	MotorLink®	M
1.4.x.67	Status	Closed, Locked			Closed, Locked	Closed, Locked	
1.4.x.17	Expected no. of motors			1	1	1	
1.4.x.60	No. of found motors			1	1	1	
1.4.x.19	Motor configuration	Blinds, WSA380	No cable monitoring				
1.4.x.20	Discover motors			Idle	Idle	Idle	
1.4.x.66	Stroke time	48	12				
1.4.x.144	Extended full stroke	100	100				
1.4.x.131	Louvre time	1800					
1.4.x.134	Louvre position after manual	35					
1.4.x.21	Motor group	1	2	3	4	5	

Id	Parameter name	S1 X1	S1 X2	S2 X1	S2 X2	S2 X3	
1.4.x.33	Comfort min. position	0	0	0	0	0	
1.4.x.34	Comfort max. position	100	100	100	100	100	
1.4.x.36	Smoke / heat speed			100	100	100	
1.4.x.37	Manual speed			75	75	75	
1.4.x.38	Auto. speed			30	30	30	
1.4.x.40	Manual command - auto. off period	30	30	30	30	30	
1.4.x.42	Man. operation after auto. comm.	30	30	30	30	30	
1.4.x.76	Open threshold	95	95	95	95	95	
1.4.x.77	Open status	False	False	False	False	False	
1.4.x.71	Max. unexpected overcurent			255	255	255	
1.4.x.90	Max. unexpected overcurrent (motor)			2	2	2	
1.4.x.140	Max. opening area	1,0	1,0	0,1	0,1	0,1	
1.4.x.68	Error	False	False	False	False	False	

4.2.12 Configure Motor Groups

Id	Parameter name	[1]	[2]	[3]
1.3.x.81	Name	MG1_OnWCC1		MG3_onWCC1
1.3.x.47	Controlling NV controller	1	None	3
1.3.x.86	Sunscreen controller		None	
1.3.x.59	Controlling heating zone		None	
1.3.x.119	Controlling cooling zone		None	
1.3.x.18	Manual absolute position	Not received	Not received	Not received
1.3.x.19	Manual relative position	Stop	Stop	Stop
1.3.x.20	Automatic opening	0	Not received	0
1.3.x.104	Slat position	Not received	Not received	Not received
1.3.x.48	NV max. comfort pos.	100		100
1.3.x.21	Field bus max. comfort pos. motor gr.	Not received	Not received	Not received
1.3.x.39	BACnet max. comfort pos. motor gr.	Not received	Not received	Not received
1.3.x.46	Modbus TCP max. comfort pos. motor gr.	Not received	Not received	Not received
1.3.x.22	Actual status	Not closed	Not closed	Closed
1.3.x.23	Actual maximum position	100	100	100
1.3.x.28	Comfort maximum position	100	100	100
1.3.x.107	Comfort maximum position, summer	100		100
1.3.x.108	Comfort maximum position, winter	100		100
1.3.x.29	Comfort safety maximum position	0	0	0
1.3.x.30	Comfort wind maximum position	0	0	0
1.3.x.56	Window maximum position rain	0	0	0
1.3.x.57	Window maximum position rain and wind	0	0	0
1.3.x.50	Maximum position, unoccupied	0	0	0
1.3.x.51	Maximum position, occupied	100	100	100
1.3.x.52	Maximum position, secure	50	50	50
1.3.x.109	Auto. maximum position, general	100		100
1.3.x.110	Auto. maximum position, temp. regulated	100		100
1.3.x.111	Auto. maximum position, temp. Regulated, night	100		100
1.3.x.112	Auto. maximum position, pulse ventilation	100		100
1.3.x.113	Auto. maximum position, pulse ventilation, night	100		100
1.3.x.114	Auto. maximum position, ventilation	100		100
1.3.x.115	Auto. maximum position, ventilation, night	100		100
1.3.x.85	Auto. maximum position, Trickle Ventilation	20		20
1.3.x.116	Auto. maximum position, Trickle Vent., night	20		20

Id	Parameter name	[1]	[2]	[3]
1.3.x.60	Cp values 1 and 2	0,02, 0,01		0,01, 0,0
1.3.x.61	Cp values 3 and 4	0,14, 0,15		0,01, 0,0
1.3.x.62	Cp values 5 and 6	-0,11, -0,12		0,01, 0,0
1.3.x.63	Cp values 7 and 8	-0,22, -0,01		0,01, 0,0
1.3.x.70	Local max. opening area	0,500	0,000	0,500
1.3.x.83	Slave max. opening area			1,000
1.3.x.84	Total max. opening area	0,500	0,000	1,500
1.3.x.130	Average window height, local	1,00	0,00	1,00
1.3.x.131	Average window height, slave	0,00	0,00	0,50
1.3.x.132	Average window height, total	1,00	0,00	0,67
1.3.x.128	Orientation	North		North
1.3.x.129	Height above ground	2,00		1,00
1.3.x.71	Actual Cp	0,04		0,01
1.3.x.72	Actual Qv	0,00		0,00
1.3.x.73	Actual AER	0,03		0,00
1.3.x.74	Actual auto. pos. max.	0		0
1.3.x.64	Link from master address	none	none	none
1.3.x.65	Link to slave address	none	none	ID: 2, MG: 3

1. Name relevant motor groups and associate them with NV Controllers and/or Heating or Sunscreen Controllers.

2. Adjust safety and other relevant parameters values if required.

3. Insert CP Values if applicable. CP values are used in conjunction with wind direction to control air exchange through the windows. Contact WindowMaster for calculating CP values for a specific project.

4. Set the orientation of the Motor group – North/East/South/West – and the hight of the bottom of the windows above the floor. These parameters determine the ventilation algorithm used and ultimately how much the windows will be opened in different situations. Note that the **Orientation must be set** for the NV control to work.

5. Link Master groups to Slave groups on different panels. When the link is created the Slave Motor group will follow any movement of the Master Motor group.

In the example project WCC1 (AOnet ID 1) MG3 is the master Motor group of WCC2 (AOnet ID 2) MG3 because WCC1.NV Controller 3 is controlling Zone 3 and must therefore control WCC2.MG3. See Figure 1.

4.2.13   Weather and Safety data distribution over AOnet

Weather and Safety data must be distributed from the panel, on which the sensors are physically connected to, to all other panels in the system.

Note: Setting up the sending of data is always done from the menu of the source of the data.

For example, sending outdoor temperature is done either from the menu of the WWS 100, the outdoor temperature sensor is connected on, the local Input the sensor is connected on or from the Weather menu, if WOW 600 is used.

Wind data –

1   The setting in the Master panel is either the actual type of the Sensor or "xxx from foreign AOnet", if the data is coming from another AOnet subnet. See also section 0. The weather station 'Sensor type', in AOnet member panels, is automatically set to "xxx from AOnet" type of the Weather station of the Master.

2   Check that wind speed values are showing.

In the project example WCC1 – the Master – is configured with 'Sensor type' "WLA 340" while WCC2 is automatically configured with "WLA 340 from AOnet".

WCC1 is also configured to send the weather data to WCC 2 (AOnet ID 2) with parameter 'Send data to AO net' = "2".

Rain (Safety) signal –

AOnet subnet Master:

1. Insert all the AOnet subnet member ID's in the 'Send local rain to AOnet' of the Master panel. The Master receives the signal locally, from its S1X10.5 input. See also section 0.

AOnet subnet member:

2. In the Local Input>All menu, insert all the local Motor groups that you want to react to the Rain signal in 'Control motor groups'.

3. Activate the Rain signal in the Master and observe that the value of the 'Usage of Rain from AO net' changes from "Not present" to "Present".

In the example project the WCC1 'Send local Rain to AO' includes AOnet ID "2" and WCC2 'Control motor groups' includes all the local motor groups.

Outdoor temperature –

Id	Parameter name	Value	Unit
1.5.0.17	Bus topology is ring	False	
1.5.0.18	Ring bus status	Open	
1.5.0.19	SHE bus 1 is OK	True	
1.5.0.20	SHE bus 2 is OK	True	
1.5.0.21	Bus error	False	
1.5.0.23	Feature is licensed	True	
1.5.0.24	Foreign outdoor temperature	0,0	℃
1.5.0.25	Foreign outdoor temperature used in zones		
1.5.0.26	Send foreign outdoor temp. to foreign AO net	False	

WSK-Link™   Reload   Auto
Controller: 10.212.27.224 (1), WCC-2.24   Remote control   Log file

Id	Parameter name	1	Unit
1.5.x.35	Device type	WWS 100	
1.5.x.16	Serial number	2164399163	
1.5.x.37	Associated NV controller	1	
1.5.x.21	Device status		
1.5.x.22	Connection	True	
1.5.x.23	Comfort motor group		
1.5.x.38	Temperature	23,0	℃
1.5.x.39	CO2	940	ppm
1.5.x.40	Relative humidity	28	%
1.5.x.41	Keys 1 status	Idle	
1.5.x.42	Keys 2 status	Idle	
1.5.x.43	Touch key status	Idle	
1.5.x.51	External sensor 1 config	Degree Celsius (℃)	
1.5.x.52	External sensor 2 config	On / Off	
1.5.x.53	External sensor 3 config	Move / Step	
1.5.x.54	External sensor 4 config	Move / Step	
1.5.x.49	Outdoor temperature	1	
1.5.x.61	Outdoor temperature	3,1	℃
1.5.x.50	Outdoor temperature used in zones	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	
1.5.x.62	Send outdoor temp. to AO net	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	
1.5.x.76	Send outdoor temp. to foreign AO net	True	

Id	Parameter name	[S3 X10.2]
1.6.x.16	Input type	Binary
1.6.x.56	Sensor type	WOT 100
1.6.x.42	Enable input	True
1.6.x.46	Control motor lines	
1.6.x.28	Control motor groups	
1.6.x.29	Active function on controlled motors	
1.6.x.38	Inactive function on controlled motors	
1.6.x.51	Use input in NV controller 'all'	
1.6.x.43	Control NV controllers	
1.6.x.57	Sensor value	
1.6.x.58	Control sun controllers	
1.6.x.59	Sensor temperature value	23,6
1.6.x.60	Sensor temperature offset	0,0
1.6.x.61	Sensor temperature to zone	23,6
1.6.x.62	Control NV controllers	1
1.6.x.63	Send outdoor temp. to AOnet	2, 3
1.6.x.64	Send outdoor temp. to foreign AOnet	False

AOnet subnet Master panel with outdoor temperature sensor connected on one of its WWS 100.

1 In the menu of the WSK-link™ menu, under the menu point that represents the WWS 100 that has an outdoor temperature sensor connected, insert in the 'Outdoor temperature used in zones' the local NV Controller numbers to receive the temperature. Insert in the 'Send outdoor temp. to AOnet' field the AOnet ID's of the panels, in the AOnet subnet, to receive the outdoor temperature values.

2 Set 'Send outdoor temp. to foreign AOnet' to True if there are more than one AOnet subnets in the system.

The outdoor temperature sensor can also be connected to any local Input on the panel.

3. Set the 'Sensor type to WOT 100, select the zones to use the Outdoor temperature and the AOnet ID's to receive it.

Id	Parameter name	Value	Unit
	NV controller		
	Controller: 10.212.27.213 (2), WCC 2.13		
1.19.0.17	Retransmit time	10	minutes
1.19.0.18	Data OK timeout	15	minutes
1.19.0.19	Fast wind speed	1,4	m/s
1.19.0.20	Slow wind speed	2,2	m/s
1.19.0.21	Raining	False	
1.19.0.22	Building mode, in	Occupied	
1.19.0.23	Building secure, in	False	
1.19.0.24	Building mode, out	Occupied	
1.19.0.25	Building error	False	
1.19.0.26	Building mech vent	False	
1.19.0.27	Building heating demand	False	
1.19.0.28	Feature is licensed	True	
1.19.0.29	Temperature received from AOnet	3,1	°C
1.19.0.30	Use AOnet outdoor temp. in zones	2, 4	

AOnet subnet member panels

3   In the NV Controller menu, in the All section, insert in the 'Use AOnet outdoor temp. in zones' field, the NV controllers to use the outdoor temperature value coming from AOnet.

In the example project WCC1 is the Master and the outdoor temperature sensor is connected on its WWS1. Insert ID 2 in the 'Send outdoor temp. to AOnet' field of WCC1.WWS1. WCC2 is an AOnet subnet member. Insert NV controllers 2 and 4 in the 'Use AOnet outdoor temp. in zones' field of WWC2, NV-Controller>All menu.

4.2.14   Configure NV Controllers

The NV Controllers are the software objects controlling the indoor climate in the building zones. NV Controllers present a large number of parameters to enable adapting the controlling of the indoor climate in the zones to the specific needs of their occupants. In many cases the default values of a NV controller parameters can be used and only few parameters may need altering. The following are the parameters you should consider during commissioning.

Id	Parameter name	1	2	3
1.19.x.161	Name	Zone 1		Zone 3
1.19.x.157	Building	1		1
1.19.x.158	Part	1		1
1.19.x.159	Zone	1		3
1.19.x.164	Building, part, zone cloud status	Changed locally		Changed locally
1.19.x.16	Wind speed, fast	0,0		
1.19.x.17	Wind speed, slow	0,0		0,0
1.19.x.18	Outdoor temperature	0,0		0,0
1.19.x.19	Raining	False		
1.19.x.46	Room active	True	False	True
1.19.x.47	Window control	True		True
1.19.x.48	Light	False		False
1.19.x.55	Temperature sensor	True		True

Id	Parameter name	1	2	3
1.19.x.131	Room volume	250		250
1.19.x.198	AER Calculation	Automatic		Automatic
1.19.x.199	AER Calculation, actual	Single sided ventilation		Single sided ventilation
1.19.x.67	Comfort temperature set point	21,0		21,0
1.19.x.81	Ventilation temp. setpoint offset, standby	-1,0		-1,0
1.19.x.82	Ventilation temp. setpoint offset, night	-1,0		-1,0
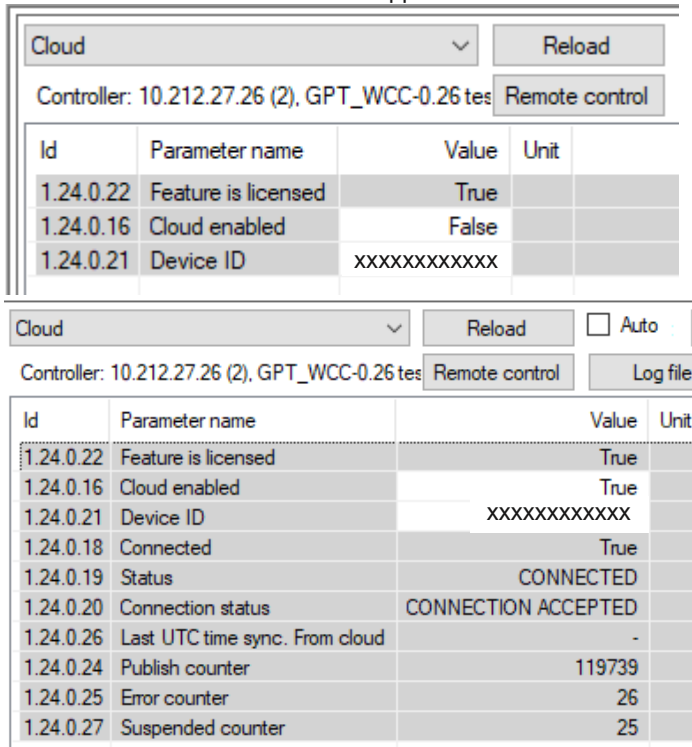
Id	Parameter name	1	2	3
1.19.x.116	WWS 100 LED output	Mains OK, Yellow LED		Mains OK, Yellow L...
1.19.x.117	Use local wind speed	True		True
1.19.x.118	Use local outdoor temperature	True		True
1.19.x.119	Use local safety	True		True
1.19.x.120	Zone hand position	0		0
1.19.x.121	Zone hand relative position	Stop		Stop
1.19.x.122	Zone windows status	Closed		
1.19.x.123	Zone average window position	0		Not received
1.19.x.162	Air quality	0		0

1. Activate the NV controllers (rooms) you would like to use, and press 'reload'.

2. Name NV controllers.

3. Specify Building, part and zone numbers. The combination of Building/Part/Zone must be unique across all panels in the project.

4. Enable control(s) e.g. window control and sensors (temp, CO_2, Rh%, PIR)

5. Insert room specific values like room volume, setpoints etc. If you have configured the Motor groups' 'Orientation' parameter correctly, the 'AER calculation' will be "Automatic" and the actual calculation mode will be correct. Check if the standard parameters need correcting according to the actual room and room function.

6. 'Use Local ....' means that local or AOnet data is used. If FALSE, then data from fieldbus will be used instead.
    In standalone systems these values must always be TRUE.

In the example project the names of the NV Controllers is 'Zone 1', 'Zone 3' but we recommend naming the NV controllers depending on the zones they control, for example 'Finance' or 'Auditorium'. The Building, Part and Zone numbers will be used in setting up the control of the building from NVECloud. See the 'NVECloud User Guide' for further details.

4.2.15　Enable Cloud

When panels have Internet access you can incorporate them in NVECloud and benefit from project administration from the Cloud and the use of the mobile app.

- Featured is licensed – indicates that the USB license key is plugged in, and it includes the license to incorporate it in NVECloud.

- Enabled 'Cloud' to activate the function.

- The 'Device ID' is the ID of the panel in NVECloud.

- When 'Cloud' is enabled the panel automatically begins to communicate with NVECloud. Observe the status of the connection and eventual errors.

Note that in order to incorporate your panels in your project administration in NVECloud you need the panel's device ID, seen here, and the Activation code which can only be seen on the panel's Display.

4.2.16　Time synchronization

Some of the functions of the NVE system, like the building schedule or the Pulse schedule, depend on the time of day or day of the week. The panel's built-in clock is not very accurate and over time it can be off by hours and even days.
To keep the built-in clock of a panel adjusted to the 'real' time and synchronized with all other panels in the system, time synchronization must be considered and if required implemented during project commissioning.
To keep the built-in time adjusted, an extern time signal must be used. NVE can receive extern time signals from 3 different sources:

- A signal from NVECloud.
- A signal from a fieldbus.
- A signal from the GPS sensor of the WOW 600 weather station.

NVECloud is automatically sending a time signal once a day, to all the panels that are connected to it. If your system is using NVECloud you don't have to do anything. The panel's time will be automatically synchronized by NVECloud.

If the NVE system will be integrated with a BMS system through a fieldbus, you must ask the BMS to send the time signal to the panels. The BMS can either send the time signal to each panel in the system, or it can send the signal to one panel that will then distribute the signal to the other panels through AOnet.

When WOW 600 is used, the panel, the weather station is connected to, must be configured to use the weather station's time signal and to distribute this signal to the other panels through AOnet.

In the Weather menu, set the '1.8.0.45 Adjust clock' parameter to "TRUE", to adjust the panel time to the Weather station signal.

In the AOnet menu, set the '1.22.0.23 Sync. time with this controller' parameter to "TRUE", to synchronize the time of all the panels on the AOnet with this panel.

4.3 Summery

When following the steps described above you have configured and setup a functioning standalone NV Embedded® system.

The next steps are optional and can include setting up the project administration in NVECloud. Consult the 'NVECloud - Quick Guide' for further information.

It is also important to optimize the performance of the system, adjusting it to specific requirements of the building, to achieve the best indoor climate the system can deliver. Chapter 5 discusses the operation and optimization of the NVE system.

5. Operation

To successfully operate the NVE system and be able to optimize its performance, one must understand how the system is functioning, and which parameters are governing it. In this chapter, the working of the main modules of the system are explained and their parameters are reviewed.

5.1 The NV controller

The NV Embedded® logic for controlling the indoor climate of a zone in a building is implemented in the NV controller software module. The NV controller employs and shares data with other software modules, like the Heating controller or the Pulse schedule modules, to achieve the optimal indoor climate in the zone.

The NV controller utilizes two basic ventilation strategies to control the indoor climate in a zone, depending on the temperature condition in the zone. When a zone needs cooling the zone is said to be in a "Summer mode" and the NV controller will employ the 'Temperature control' ventilation mode, trying to lower the temperature in the zone to the desired temperature setpoint. When a zone needs heating, the zone is said to be in "Winter mode" and the NV controller will employ the 'Pulse and Trickle ventilation' modes to try to keep a good air quality in the zone while minimizing heating energy loss and uncomfortable track due to opening windows and getting colder air into the zone.

5.1.1 The 'Building' concept

NV Embedded® can control the indoor climate individually in each room in a building. We call an individually controlled room or area in a building, for a zone. A zone is a physical volume in a building. To control the indoor climate in a zone we assign it a NV controller. This is done by associating the physically mounted window actuators and sensors in a zone with a specific NV controller.

A WCC 3xx / WSC 3xx panel can run up to 10 NV controllers so we can use one WCC 3xx / WSC 3xx panel to control the indoor climate in up to 10 zones in the physical building. A WSC 5xx panel can run up to 10 NV controllers per 20A section, so we can use one panel to control the indoor climate in up to 30 zones in the physical building.

In parallel with the physical building a 'Building' software module enables sharing data among NV controllers running on one and the same panel. In the case of a physical building, divided into up to 10 zones, the physical building and the 'Building' software module can correspond.

This figure illustrates these 2 Building concepts.

Building – Sharing data among all NV controllers in a panel. A NV controller controls a zone in the physical building.

Building – Physical building, logically divided into zones for indoor climate control

The 'Building' concept
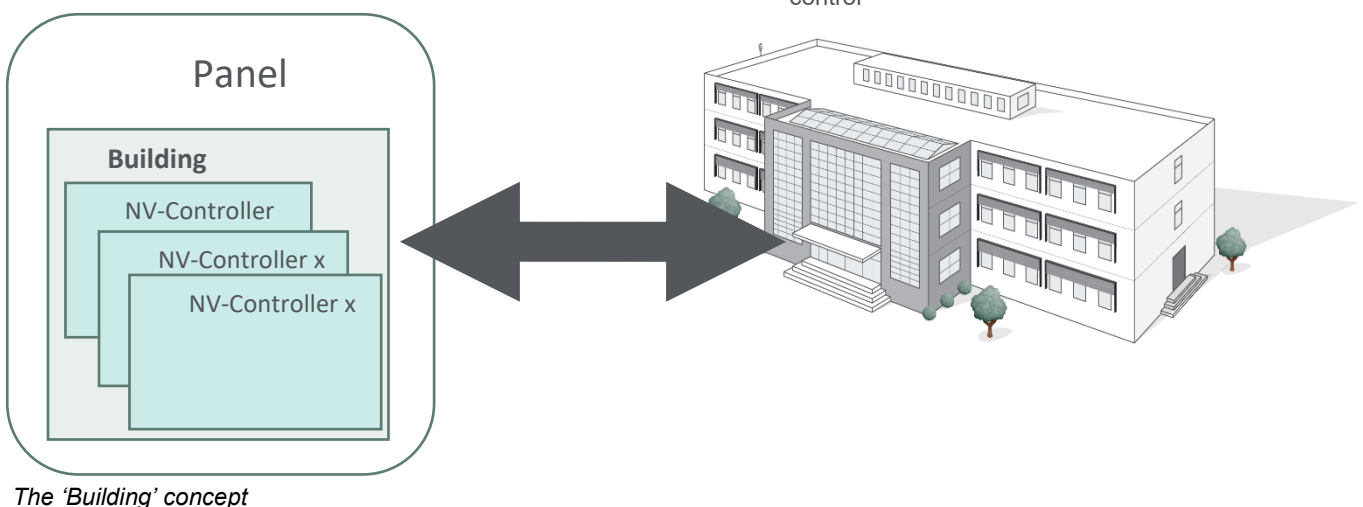
5.1.2   Building states

A building can be put in 3 different security modes:

- Occupied
- Unoccupied
- Secured

A set of Motor group window Max opening parameters are associated with the security states.

A building can be put in 3 different indoor climate states:

- Comfort
- Standby
- Night

A set of temperature setpoint offsets are associated with the different indoor climate states.

It is possible to assign different states to different NV controllers but in most cases the same states apply to the entire building and changing states is done in the Building level, not in the NV controller level. State changes in the Building level are then visible to the NV controllers.

Building states can be assigned to NV controllers from 'Local Inputs', the 'Building' states or from fieldbus. Changes of Building states during the day can be triggered by the 'Building schedule'. To learn how to use the 'Building schedule see capital 6.2.


You can decide, for each NV controller, which sources for states it must use.

Note that to prevent a NV controller from using states from 'Local Inputs' you must remove the NV controller association in the 'Local Input' menu.

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5.1.3 NV controller functionality

To control the indoor climate in a zone, the NV controller must receive input data from the physical world, and it can output information on its status and the status of the sensors and actuators associated with it. The control of a zone can be adjusted to meet the requirements of the users of the zone, by manipulating a long list of parameters. This figure illustrates the construction of the NV controller.
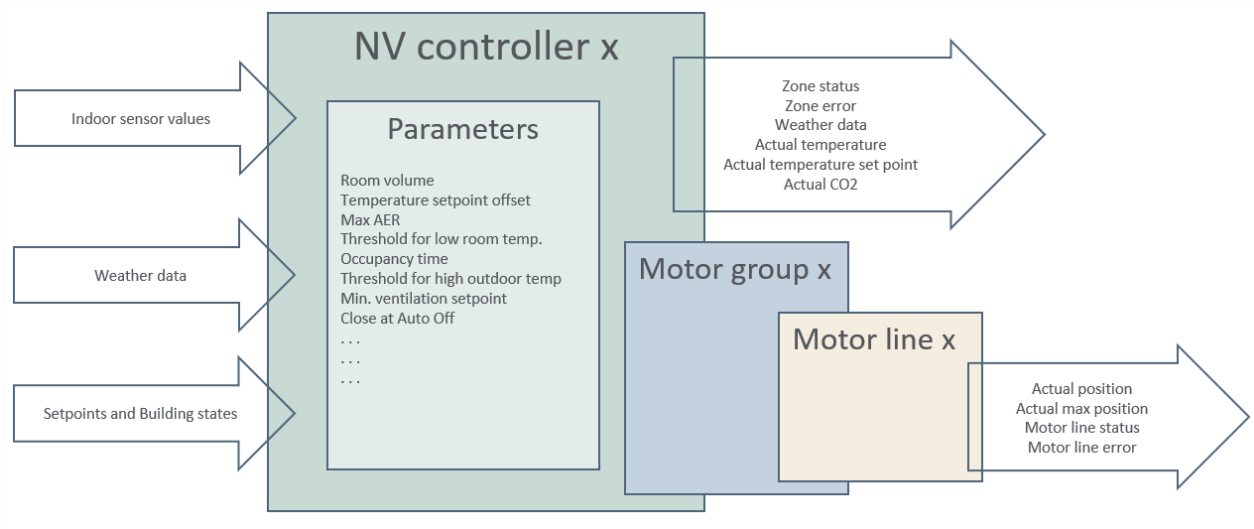
The NV controller

5.1.4 Summer/Winter mode

The Winter and Summer modes roughly correspond to the actual seasons but not always. When in Summer mode, also called Ventilation mode, the main function of the NV controller is to cool its zone down to the defined temperature setpoint. When in Winter mode, also called Heating mode, the main function of the NV controller is to maintain good air quality in the zone while minimizing heating loss from the zone due to opening windows and letting cold air in. If NV Embedded® is also responsible for heating in the zone, a Heating controller, in collaboration with the NV controller, is having the task of bringing the temperature in the zone up to the defined setpoint.

The NV controller decides on its Winter/Summer mode according to the diagrams in this figure:
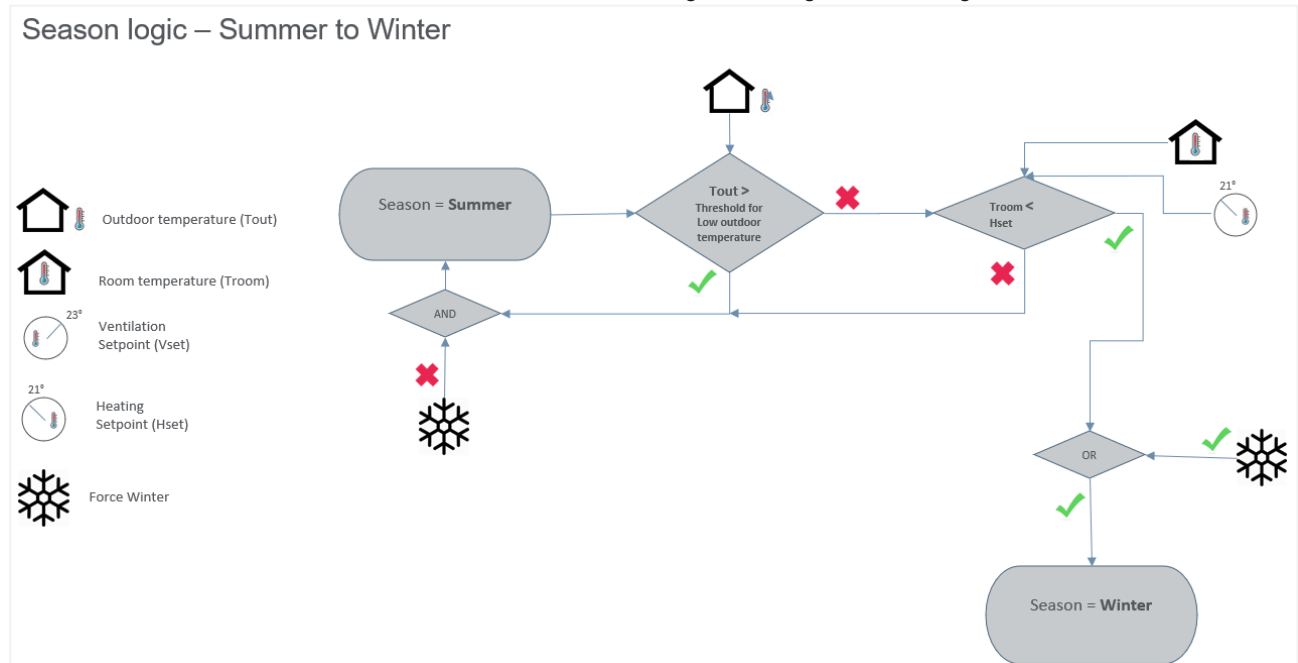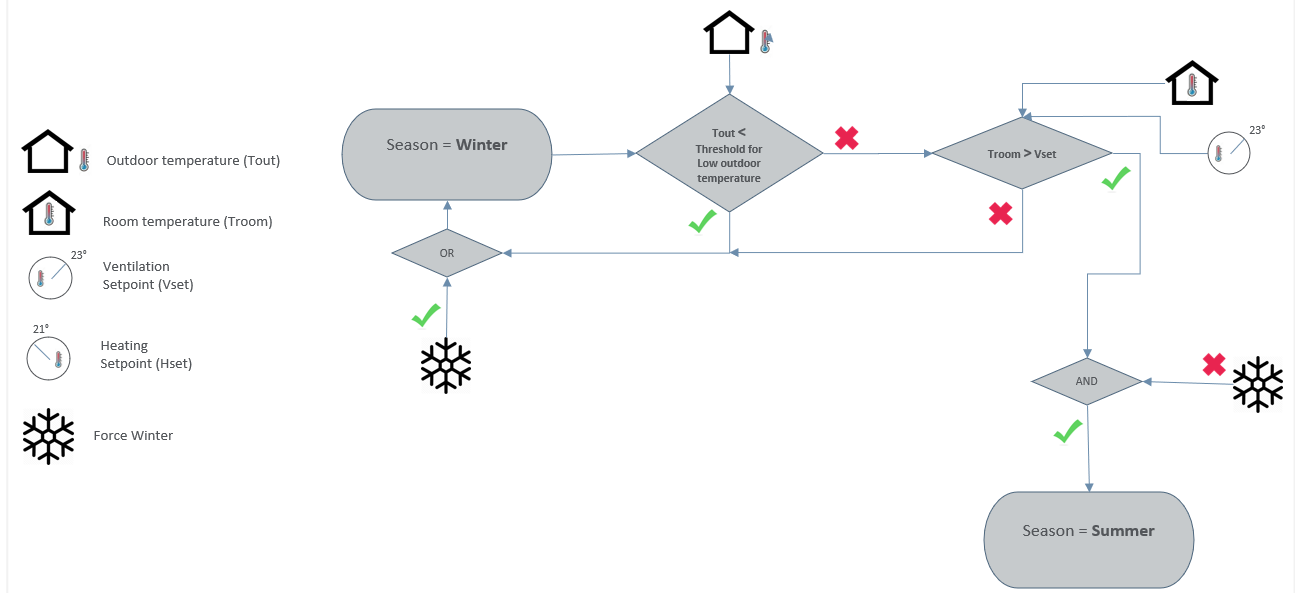
Summer/Winter change

When the zone temperature is below the Winter (heating) setpoint, and the outdoor temperature is below the threshold for low outdoor temperature the NV controller will switch to/be in Winter mode.
When the zone temperature is above Summer (Ventilation) setpoint and the outdoor temperature is above the threshold for low outdoor temperature the NV controller will switch to/be in Summer mode.
In the deadband (interval) between the Winter and the Summer setpoints the NV controller will stay in the mode it had, before entering the deadband area.
If 'Forced Winter' is "TRUE" the NV controller will be in Winter mode.

5.1.5   The Temperature setpoint scheme

The NV controller has one baseline **Ventilation setpoint**, a deadband between the Ventilation and Heating setpoints and offsets to the Standby and Night setpoints.

Heating setpoint = Ventilation setpoint - deadband

When the NV controller is switching to the Summer mode, the Ventilation setpoint becomes the actual setpoint. When the NV controller is switching to the Winter mode, the Heating setpoint becomes the actual setpoint.

The deadband and Ventilation offsets are calculated from the Ventilation setpoint. The Heating offsets are calculated from the Heating setpoint.

If you want to change the Ventilation setpoint you must change the base Ventilation setpoint. The Ventilation setpoint and the Heating setpoints will be changed respectively. If you only want to change the Heating setpoint you can change the Deadband between the Ventilation and the Heating setpoints. This figure illustrates this scheme.
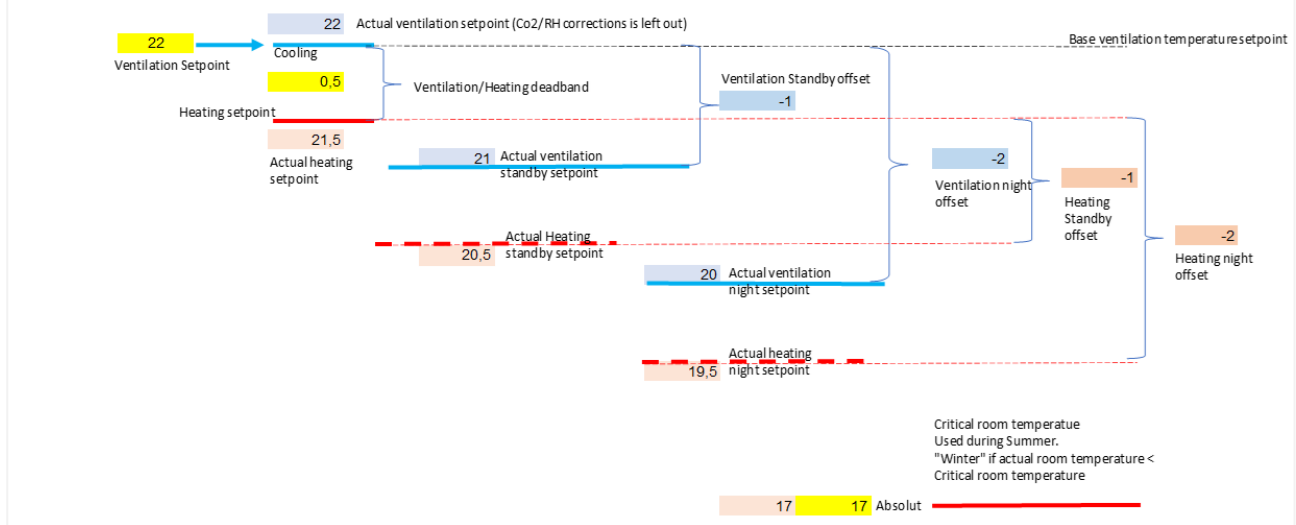
Temperature setpoint scheme

The Critical room temperature is used to ensure that windows are closed, and Heating is on if the actual temperature in a zone falls below the critical temperature.

When changing the temperature setpoint from fieldbus or from NVECloud the NV controller is calculating the difference between the newly arrived value and the current actual setpoint and then adds this difference to parameter 'Ventilation temperature setpoint input x.19.x.150'. When this input parameter change, the current Ventilation setpoint changes and in turn the current Heating setpoint changes as well.

5.1.5.1 Actual temperature setpoint

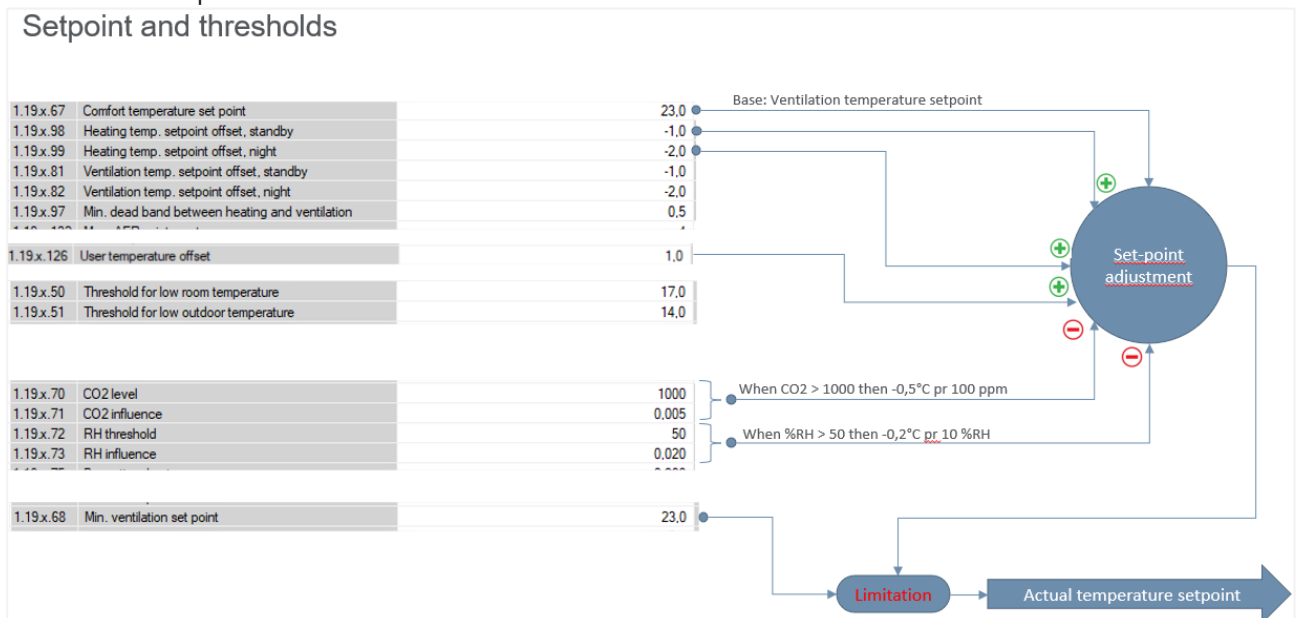The actual temperature setpoint, that is used in all relevant calculations, depends on offset parameters, User offset from the mobile app, thresholds for low temperatures and the influence of CO_2 and humidity levels. The next figure illustrates how the actual setpoint is calculated.

Actual temperature setpoint calculation

5.1.6 Temperature control ventilation

When in Summer mode the NV controller applies the Temperature control ventilation mode. In this mode the NV controller opens windows to lower the actual temperature in the zone to the actual temperature setpoint. Windows are opened in steps when the actual temperature is above the actual temperature setpoint. The frequency of the steps and the size of each step are demand driven so larger difference between actual temperature and setpoint will result in more frequent and larger steps than when the difference is smaller.

High CO2 and humidity levels contribute to lowering the actual temperature setpoint and by that increase the opening of windows and the air exchange in the zone. That, in turn, reduces the CO2 and humidity levels in the zone. As illustrated in the figure above, 2 parameters govern the influence of CO2 and humidity levels on the actual temperature setpoint. 'CO2 level' and 'RH threshold' - set the levels above which the NV controller will start reducing the temperature setpoint by the influence of the CO2 and RH.

'CO2 influence' and 'RH influence' – define the amount of setpoint reduction in relation to the difference between the 'CO2 level', 'RH threshold' and the actual measured levels of CO2 and humidity. When 'CO2 level' = 1000 ppm and 'CO2 influence' = 0.005 then 100 ppm difference above 1000 ppm, will result in a 0.5° Celsius reduction of the actual temperature setpoint.
Note that the 'Min. ventilation setpoint' parameter limits the actual temperature setpoint reduction to ensure that the temperature in the zone is never uncomfortably low.

To limit uncomfortable track from cold air coming through opened windows, the NV controller calculates the AER (Air Exchange Rate) in the zone. AER expresses the number of times per hour, the air in the zone is being changed. Higher AER means higher air flow through the windows. The volume of the zone and the geometric area of the windows in the zone, together with wind direction and wind velocity, determine the actual AER for a given windows opening position. A smaller zone volume with a larger opening area will result in less opening of window to reach the required AER in the zone. The max. AER parameters limit in this way the current allowed opening position of the windows.

The NV controller can apply 4 different calculation algorithms for the calculations of the current AER, depending on the location of the windows in the zone.
- Single side ventilation – for zones with windows located on only one side of the zone.
- Cross ventilation – for zones with windows located in different sides of the zone
- Stack ventilation – for zones with windows located in different heights above ground.
- Cross / Stack ventilation for zones with windows located on different sides and different heights.

The NV controller automatically selects the appropriate algorithm, depending on the 'Orientation' and the 'Height above ground' parameter values of its Motor groups, but the algorithm can also be set manually if required.

The 'Orientation' parameter of the Motor groups must therefore be set during commissioning.

Parameters defining the maximum allowed AER and the maximum allowed opening of windows may limit the opening of windows to less than the calculated open position, that depends on the actual temperature setpoint alone.
Some of the Motor group parameters defining window max. opening limitations.

Motor group	⌄	Reload	☐
Controller: 10.212.27.25 (ID 1), GPT_WCC-0.25	Remote control		

1.3.x.28	Comfort maximum position	100
1.3.x.29	Comfort safety maximum position	0
1.3.x.30	Comfort wind maximum position	0
1.3.x.31	Comfort open position	15
1.3.x.43	Comfort open close time	0
1.3.x.32	Comfort maximum wind speed	0,0
1.3.x.50	Maximum position, unoccupied	0
1.3.x.51	Maximum position, occupied	100
1.3.x.52	Maximum position, secure	50

NV controller parameters defining the behavior of the NV controller.

0.19.x.131	Room volume	140
0.19.x.198	AER Calculation	Single sided ventilation
0.19.x.199	AER Calculation, actual	Single sided ventilation
0.19.x.67	Base ventilation temperature setpoint	22,0
0.19.x.98	Heating temp. setpoint offset, standby	0,0
0.19.x.99	Heating temp. setpoint offset, night	0,0
0.19.x.81	Ventilation temp. setpoint offset, standby	-1,0
0.19.x.82	Ventilation temp. setpoint offset, night	-1,0
0.19.x.97	Deadband between ventilation and heating	1,0
0.19.x.132	Max. AER, winter extra	4
0.19.x.133	Max. AER, winter	5
0.19.x.134	Max. AER, winter eco.	6
0.19.x.135	Max. AER, summer extra	7
0.19.x.136	Max. AER, summer	5
0.19.x.137	Max. AER, summer economy	9
0.19.x.187	Max. AER, summer night extra	9
0.19.x.188	Max. AER, summer night	10
0.19.x.189	Max. AER, summer night economy	11
0.19.x.138	AER Temperature reduction reference, winter	16,0
0.19.x.139	AER Temperature reduction, winter	0,05
0.19.x.140	Min. AER, winter	0,1
0.19.x.141	AER Temperature increase reference, winter	18,0
0.19.x.142	AER Temperature increase, winter	0,10
0.19.x.143	AER Temperature reduction reference, summer	18,0
0.19.x.144	AER Temperature reduction, summer	0,10
0.19.x.145	Min. AER, summer	0,2
0.19.x.146	AER Temperature increase reference, summer	23,0
0.19.x.147	AER Temperature increase, summer	0,20
0.19.x.190	AER Temperature reduction reference, summer night	16,0
0.19.x.191	AER Temperature increase reference, summer night	21,0
0.19.x.192	AER max. base actual	5,00
0.19.x.193	AER max. actual	5,00
0.19.x.50	Threshold for low room temperature	17,0
0.19.x.200	High room temperature threshold, offset	1,0
0.19.x.201	High room temperature, hysterese	2,0
0.19.x.51	Threshold for low outdoor temperature	17,0
0.19.x.52	Close hand controlled windows at low room temp.	True
0.19.x.53	Occupancy time	10
0.19.x.59	Condition for warm outdoor conditions	High outdoor temp.
0.19.x.60	Mode during 'Warm outdoor conditions'	Pulse ventilation
0.19.x.61	Threshold for high outdoor temp.	28,0
0.19.x.62	Threshold for high apparent outdoor temp.	30,0
0.19.x.63	Hysteresis	1,0

1.19.x.64	Temperature difference	2,0
1.19.x.65	Close manual controlled windows at mode change	False
1.19.x.194	Warm outdoor conditions	False
1.19.x.66	Enable temperature controlled ventilation	True
1.19.x.195	Enable low outdoor temp. threshold for ventilation	False
1.19.x.68	Min. ventilation set point, day	21,0
1.19.x.203	Min. ventilation set point, night	18,0
1.19.x.69	Max. allowed temperature drop	0,3
1.19.x.58	Clear 'auto. off' when room unoccupied	False
1.19.x.160	Close at Auto Off	True
1.19.x.70	CO2 level	1000
1.19.x.71	CO2 influence	0,005
1.19.x.72	RH threshold	60
1.19.x.73	RH influence	0,020
1.19.x.74	Ventilation, RH Kd	0,000
1.19.x.75	Proportional gain	0,2000
1.19.x.76	Differential gain	0,0500
1.19.x.77	Wind reduction set point	2,0
1.19.x.78	Closing gain	10,0
1.19.x.79	Ventilation, Temperature Prik Filter tau	0,3
1.19.x.80	Ventilation, RH Prik Filter tau	1,0

5.1.7   Pulse and Trickle ventilation

When in Winter mode, the NV controller can be configured to combine Pulse and Trickle ventilation or to only utilize one of these ventilation modes.

5.1.7.1   Pulse ventilation

In Pulse ventilation mode the NV controller opens the windows occasionally, for a short period of time, to bring fresh air into the zone and reduce the CO_2 level in it. The frequency of executing pulses is by default demand driven but can also be combined with or replaced by a Pulse schedule.

Demand driven pulse ventilation

Control strategy
When Pulse ventilation is enabled

- If the actual CO_2 level in the zone exceeds the 'Pulse vent. CO_2 threshold' a pulse will be performed.
- The duration of the pulse and the interval between pulses depend on the difference between the threshold and actual CO_2, RH and temperature values.
- The maximum and minimum duration of pulse and interval between pulses are limited by the max. and min. duration and interval parameters.

NV controller			⌄	Reload	☐ Auto

Controller: 10.212.27.26 (ID 3), GPT_WCC-0.26 | Remote control | | Log file |

Id	Parameter name	Value	Unit	

Id	Parameter name	1
1.19.x.85	Pulse ventilation, enable	True
1.19.x.83	Pulse vent./ventilate, CO2 threshold	1200
1.19.x.84	Pulse vent./ventilate, RH threshold	70
1.19.x.86	Pulse ventilation, min. duration	30
1.19.x.87	Pulse ventilation, max. duration	180
1.19.x.88	Pulse ventilation, min. Interval between	30
1.19.x.89	Max. interval between two pulses	60
1.19.x.90	Pulse ventilation, temperature influence	0,2
1.19.x.183	Pulse vent., threshold for low room temperature	22,0
1.19.x.179	Trickle ventilation enabled	False

- Pulses will not be performed if the actual temperature in the zone is below the threshold for low room temperature.
- The maximum opening of the windows during a pulse is limited by the current max. opening of the Motor group the windows belong to.
- The actual interval between pulses, duration of a pulse and the window opening position during a pulse are determined by factors including the difference between the actual CO_2 level and the CO_2 threshold, the actual temperature in the zone, the actual relative humidity in the zone, the actual outdoor temperature, the actual wind speed and direction and the max. allowed AER.

Pulse schedule

Use the Pulse schedule menu to enforce pulse execution at determined times.

You can define an individual schedule for each zone by using the schedule's instance number – 1 to 10 – corresponding to the instance number of the NV controller, controlling the specific zone. Schedule instance 1 corresponds to NV controller 1 and so on.

For each of the 12 pulse definitions available for each zone, you can either specify one specific daily time, like 13:17, or you can specify that the pulse will be executed every hour, at a specific minute, starting and ending at specific hours in the day, like from 7:00 to 17:00 at the 15th minute of the hour..

You have the following options when scheduling a pulse at a specific time of the day:

- Time of day to execute the pulse

- Whether the pulse will be executed every day, only weekdays, only on weekend days or not at all (No).

- Whether the pulse is executed in Summer mode, Winter mode or in both modes.

- Whether the pulse is always executed, only executed if the CO2 level is above the defined threshold (Automatic) or not executed at all (None).

- The duration of the pulse in minutes.

To schedule an hourly pulse, first select the 'every hour' symbol at the end of the 24 hours drop down menu,

then specify:

Hour of the day to start, hour of the day to end, hourly minute to execute the pulse.

5.1.7.2   Trickle ventilation

In Trickle ventilation mode the NV controller keeps the windows slightly opened if the CO_2 level in a zone is higher than the defined CO_2 threshold level and the actual temperature in the zone is above the defined critical low level.

Control strategy
• If demand driven pulse is enabled - pulses are performed as usual.
    • Pulse opening command position = MAX value of ('Pulse ventilation' or 'Trickle ventilation').
    • Pulse closing command position = trickle ventilation position if position > 0 %.

• If Trickle is enabled - Trickle ventilation starts when the 'Trickle ventilation, number of pulses before' have been executed, but CO_2 level was not reduced to below the 'Pulse vent. / ventilate, CO_2 threshold' AND 'actual CO_2 level' is over the threshold for 'Trickle vent., CO_2 for min.' ventilation.

• If 'Demand driven pulse ventilation' is disabled OR the 'Numbers of pulses before trickle' = 0 then trickle starts if CO_2 level is over the threshold for 'Trickle vent., CO_2 for min.'.

• Trickle ventilation will not start if the indoor temperature is below the 'Trickle vent. Threshold for low room temperature'.

• When Trickle ventilation is active the windows opening is between 0% and the 'Max. opening during Trickle ventilation' position of the Motor group the windows belong to. The actual opening corresponds to the percentage of the actual CO2 level as calculated between the 'Trickle vent., CO2 level for min.' and the 'Trickle vent. CO2 level for max.'.

Note that different Motor groups can have different 'Max. opening during Trickle ventilation' positions and may result in windows in the same zone opening to different positions during Trickle ventilation.

5.2   The Building schedule

The Building schedule of the NV Embedded® (NVE) is used to set the NV controllers of a panel, in different states called 'Building states'. The set of parameters, associated with these different states, decide the way the NV Controllers control the indoor climate of the zones. For example, utilizing a lower temperature setpoint during night-time can be achieved by setting the building to the "Unoccupied" state in the evening. The building can be set back to "Occupied" state in the morning, raising the temperature setpoint and preparing the building to day-time activities.

Note that a Building schedule is running on a panel and can be used by the NV controllers running on it. In a small system the one panel may control the entire physical building but, in most cases, the physical building includes more than one panel, each with its own Building schedule. To run the same schedule through the entire physical building you can either set equal Building schedules on each panel in the system or set a schedule on one panel and distribute its Building state to the other panels through the AOnet mechanism.

Building states are event driven meaning that a Building stays in a specific state until an event changes it into another state. Changing state event can originate from different sources, the Schedule is only one of them. Other sources are Local Inputs and fieldbus objects. The current Building state depends on safety and comfort priorities as well as the possibility of a NV controller not to use the Building state at all.

5.2.1   Setting up a schedule

In the 'Building schedule' menu you can define 8 events for each day of the week. You must define an event at 00:00 for a day you would like to define Schedule events for.

Select the time for the event.

Select the state to be triggered. 3 security level states – 'Occupied', 'Unoccupied', 'Secure' are available and 3 combinations of a security level combined with the 'Night' temperature offset. The combination of 'UnoccupiedNight' for example allows you to implement an effective night cooling during the summer period.

5.2.2   Using a schedule event

In the NV controller>All menu set the 'Building mode out calculation' to select the priority of the source of events. The result of the priority calculation will show in the 'Building mode, out' parameter.

For each NV controller decide if it must, or not, use the 'Building states' and 'Building night' parameters.

Id	Parameter name	1	2
1.19x.152	Heating standby offset input		-1,0
1.19x.153	Heating night offset input		-2,0
1.19x.154	Cooling standby offset input		-1,0
1.19x.155	Cooling night offset input		-2,0
1.19x.151	Heating / cooling deadband input		1,0
1.19x.35	Presence detection		False
1.19x.36	Disable automatic, BACnet		False
1.19x.166	Disable automatic, Fieldbus		False
1.19x.167	Disable automatic, Modbus TCP		False
1.19x.37	Force winter, BACnet		False
1.19x.168	Force winter, fieldbus		False
1.19x.169	Force winter, Modbus TCP		False
1.19x.38	Ventilate		False
1.19x.39	Comfort level		Plus
1.19x.163	Local inputs		
1.19x.176	Use building 'Function inputs sum'		True
1.19x.177	Use building states		True
1.19x.185	Use Building night		True

5.3   The SUN controller

The NV Embedded® logic for controlling solar shading in a building is implemented in the SUN controller software module.

The Sun shading controller can be used for comfort control of sun shading. The controller will drive the shading equipment (curtains, owing, blinds) down when the actual illumination is higher than a threshold value and it will drive the shading equipment up when the actual illumination is lower than a threshold value.

Lux threshold values can be assigned to individual Motor groups allowing flexibility in controlling different facades or different parts of a façade.

The controller can be configured to react in different modes depending on Building states.

Safety positions for low outdoor temperature and high wind speed can be defined.

5.3.1 Controller construction

To control shading, the SUN controller must receive input data from the physical world, and it can output information on its status and the status of the actuators associated with it. The control of shading can be adjusted to fit requirements of the users of the building, by manipulating a list of parameters. This figure illustrates the construction of the SUN controller.
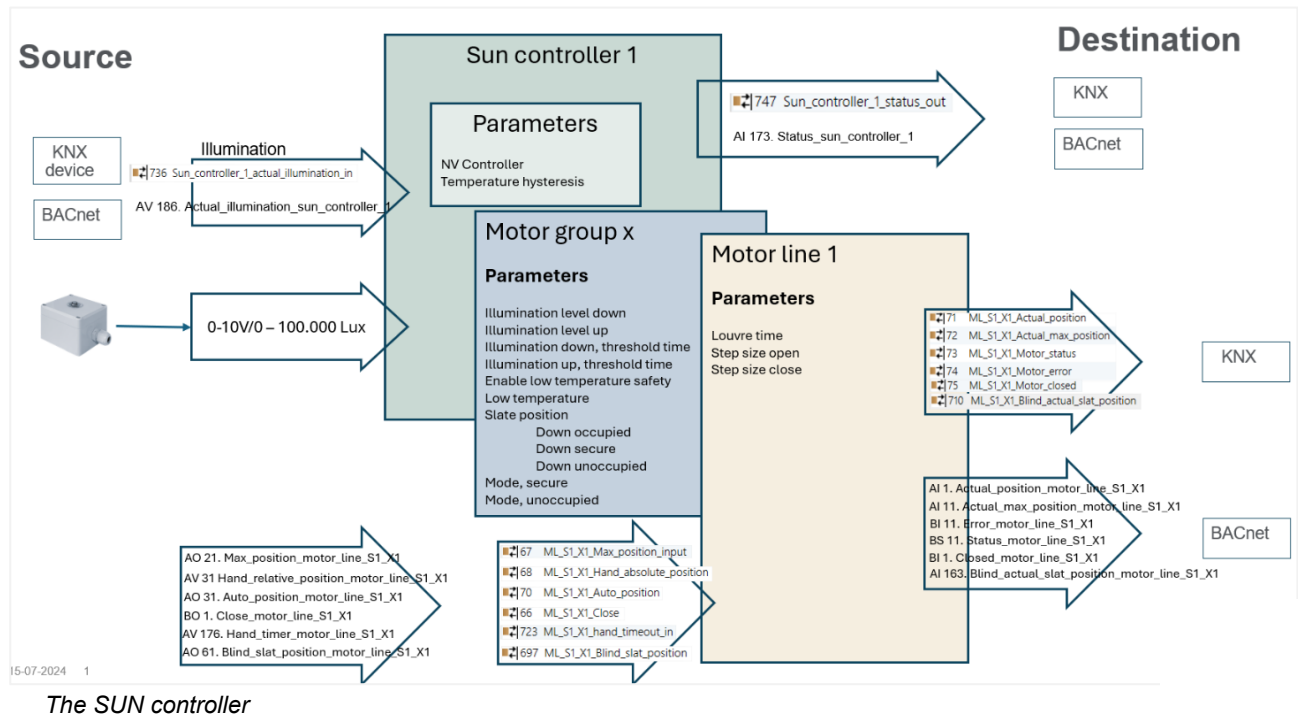
The SUN controller

5.3.2 Inputs and Outputs

The SUN controller must receive the current illumination level to control shading. The data can be received from fieldbus or from a 0-10V / 0 – 100000 Lux sensor. The sensor must be connected to the S1X3 or S1X4 Input terminals of the WxC 3xx P panel.

When configuring the S1X3.1 Input to receive the Lux signal, Input S1X3.2 is automatically configured to receive a Lux signal, and vice versa. You can use S1X3.2 to receive a signal from another Lux sensor but you can't use the Input to other types of signals. This is also true for terminal S1X4. The Input terminals on S3 can't receive the Lux signal.

We have tested the Input with the Thies Clima Brightness Transmitter type 7.1414.10.061 and recommend using this sensor in NVE blinds control.

Configure the 'Sensor type' to "0-10V 100kLx" and associate the Input with the Sun controller(s) that expects the Lux value.

The controller outputs its position control commands to the Motor Groups associated with it and it outputs its status to fieldbus objects. The Motor Groups apply limiting parameters to the commands and send them on to the Motor lines

associated with them, and to fieldbus objects to be used in case fieldbus sun shading actuators are used, instead of the panel's own Motor lines.

5.3.3   Parameters

Most of the parameters governing the behavior of the SUN shading, are implemented in the Motor Group object, to allow for flexibility of control withing one SUN controller. Other parameters like Up/Down running times and Louvre Step size are implemented in the Motor Line objects.

SUN controller parameters

Sun			

Controller: 10.212.27.219 (ID AOnet 20 CAN 1),

Id	Parameter name	Value	Unit
1.25.0.16	Debug	True	
1.25.0.17	Licensed features	3	Unknov

The 'NV Controller' associates the SUN controller to a NV controller to share its weather and Building states.

Id	Parameter name	1	
1.25.x.17	Enabled	True	Fals
1.25.x.16	Illumination	3.287	
1.25.x.18	NV Controller	1	
1.25.x.19	Auto. Off	False	
1.25.x.20	Use zone occupancy	False	
1.25.x.21	Temp. hysteresis	1,0	
1.25.x.22	Reposition time	20	

Motor group parameters

The maximum wind speed is defined in the Motor Group 'Comfort maximum wind speed' parameter and the shades will run to the 'Comfort safety maximum position' of the Motor Group when the wind speed exceeds the defined maximum wind speed.

Motor group		Reload	Auto

Controller: 10.212.27.219 (ID AOnet 20 CAN 1), Remote control   Log file

Id	Parameter name	1
1.3.x.87	Sunscreen control status	Auto
1.3.x.88	Sunscreen status	Up
1.3.x.102	Suncreen, illumination level, down	28.000
1.3.x.103	Suncreen, illumination level, up	20.000
1.3.x.99	Sunscreen, level, night, on	100
1.3.x.100	Sunscreen, level, night, off	150
1.3.x.101	Sunscreen, illumination up, threshold time	900
1.3.x.105	Sunscreen, illumination down, threshold time	180
1.3.x.91	Sunscreen, shade for privacy	False
1.3.x.92	Suncreen, slat pos., down, occupied	35
1.3.x.93	Suncreen, slat pos., down, secure	25
1.3.x.94	Suncreen, slat pos., down, unoccupied	0
1.3.x.96	Sunscreen mode, occupied	Auto
1.3.x.97	Sunscreen mode, secure	Down then hand
1.3.x.98	Sunscreen mode, unoccupied	Down then hand
1.3.x.90	Sunscreen, enable low. temp. safety	False
1.3.x.106	Send position when entering Auto	True

Motor line parameters

The '*Motor configuration'* must be either "Blinds, WSA380" or "Blinds" for the Motor line to be controlled as a blinds actuator and not a window actuator.

'…*startup time'* is the time it takes the blinds actuator to start moving the blinds. It is particularly important when you implement louvre control as louvre step durations are, in most cases, very short.

When '*Step size ..'* = 0, the "Step" command will be interpreted as "Stop". This setting should be used when controlling Screens, for example.

Id	Parameter name	S1 X1
1.4.x.17	Expected no. of motors	
1.4.x.60	No. of found motors	
1.4.x.19	Motor configuration	Blinds, WSA380
1.4.x.20	Discover motors	
1.4.x.66	Stroke time	50
1.4.x.159	Startup time	0
1.4.x.144	Extended full stroke, close	0
1.4.x.158	Extended full stroke, open	0
1.4.x.131	Louvre time	1800
1.4.x.160	Louvre, startup time	5
1.4.x.134	Louvre position after manual operation	15
1.4.x.157	Reverse louvre position	True
1.4.x.161	Always adjust louvre after 'over open'	False
1.4.x.162	Do not rerun louvre down	True
1.4.x.21	Motor group	1
1.4.x.147	Step size open	15
1.4.x.148	Step size close	15
1.4.x.150	Hand louvre position	50
1.4.x.133	Actual louvre position	0

5.4 The Heating controller

The NV Embedded® logic for controlling heating in a zone in a building is implemented in the Heating controller software module.

The Heating controller can control heating sources in the zone through actuators connected locally on the panel or through fieldbus objects. The controller receives temperature sensor data and temperature setpoints from the NV controller with the same instance number.

Heating controller parameters

The 'Heating off threshold' defines the average windows opening position in the zone, over which the heating in the zone will be closed, to save energy.

The 'PWM time base' specifies Pulse width Modulation time base for the fieldbus binary heating output objects. When this parameter = 0, the Heating valve value will be either 100% or 0% and the outputs become simple On/Off outputs.

There are no Motor group or motor line parameters specific to the heating controller. But the Max opening limiting parameters of Motor groups associated with a Heating controller must be considered carefully. In general, you do not want to limit the opening of a radiator valve when it rains or when the wind speed exceeds, say, 8 m/s.

Id	Parameter name	1
1.21.x.19	Heating controller	True
1.21.x.16	Heating override, BACnet	False
1.21.x.24	Heating override, Fieldbus	False
1.21.x.25	Heating override, Modbus TCP	False
1.21.x.17	Heating valve value	0
1.21.x.18	Heating valve	False
1.21.x.26	Heating off threshold	100
1.21.x.20	Proportional gain (Kp)	0,5000
1.21.x.21	Integration gain (Ki)	0,0100
1.21.x.22	PWM time base	0
1.21.x.23	Heating transmit threshold	1

5.5 The Cooling controller

The NV Embedded® logic for controlling mechanical cooling in a zone in a building is implemented in the Cooling controller software module.

The Cooling controller can control cooling sources in the zone through actuators connected locally on the Motor lines of the panel, or through fieldbus objects. The controller receives temperature sensor data and the ventilation (cooling) temperature setpoints from the NV controller with the same instance number.

Cooling controller parameters
The 'Cooling off threshold' defines the average windows opening position in the zone, in which the cooling in the zone will be closed, to save energy.

The 'PWM time base' specifies Pulse width Modulation time base for future implementation of binary cooling outputs. When this parameter = 0, the cooling valve value will be either 100% or 0% and the binary output will become a simple On/Off output. If you want to modulate the control of the cooling valve you must set the 'PWM time base' parameter larger than 0. If you need a PWM regulation of Motor lines you must configure the 'PWM' parameter of the Motor lines with the required time base.

The 'Cooling transmit threshold' defines the required change of value, before the controller is sending new command to the cooling actuator.

There are no Motor group or motor line parameters specific to the cooling controller. However, the Max opening limiting parameters of Motor groups associated with a Cooling controller must be considered carefully. In general, you do not want to limit the opening of a cooling valve when it rains or when the wind speed exceeds, say, 8 m/s.

The fieldbus objects of the Motor group and Motor line, associated with the Cooling Controllers, are used to send the open/close commands to fieldbus cooling actuators.

Cooling controller		Reload

Controller: 10.212.27.29 (AOnet 3), GPT_WSC3 [Remote control]

Id	Parameter name	[1]
1.29.x.19	Cooling control	True
1.29.x.17	Cooling valve value	0
1.29.x.18	Cooling valve	False
1.29.x.26	Cooling off threshold	100
1.29.x.20	Proportional gain (Kp)	0.5000
1.29.x.21	Integration gain (Ki)	0.0100
1.29.x.27	Max. integrator value	0.5
1.29.x.22	PWM time base	0
1.29.x.23	Cooling transmit threshold	1
1.29.x.30	Only cooling during varm outdoor conditions	False
1.29.x.31	Only cooling during night cooling	False
1.29.x.28	Safety output value	50
1.29.x.29	Value motion hour of the day	12

5.6 The Mech. Vent. controller

The Mechanical Ventilation (MV) controller is designed to control mechanical ventilation sources to assist the Natural Ventilation (NV) system, when the NV capacity is not sufficient to achieve the required indoor climate quality.
The MV controller is associated with a NV controller by sharing the same instance number. MV controller receives sensor data and basic setpoints from the NV controller.

The MV controller outputs a 0-100% signal and an On/Off signal. The signals are sent to an analogue 0-10V physical Output and a physical potential free digital output on the WWS 100 sensor of the controlled zone. These Outputs can, for example, be used to control a VAV damper or an exhaust ventilator located in the zone. The signals are also sent to fieldbus objects of the Motor group associated with the MV controller to be used with fieldbus controlled mechanical ventilation actuators.

Mech. Vent. controller parameters

Mech. vent. controller		Reload

Controller: 10.212.27.219 (ID AOnet 20 CAN 1), [Remote control]

Id	Parameter name	Value	Unit

Id	Parameter name	1
1.20.x.21	Mech. vent. control	True
1.20.x.47	Mech. vent. type	Assisting fan
1.20.x.72	Mech. vent. override status	False

The *'Temperature offset for start'* is used to start the Mech. Vent. later than the NV. A larger offset will result in the MV starting later, giving the NV more time to, alone, reach the required air quality.

The *'CO2 and RH level for start'* and *'level for full output'* define how much, in %, of the MV to use, in relation to the start and full output levels. These parameters are, in most cases, actually controlling the MV when windows are forced closed, for example in Winter mode where windows only open for pulse ventilation once in a while.

1.20.x.18	Mech. vent. value	100
1.20.x.19	Mech. vent.	True
1.20.x.22	Temperature offset for start	0,0
1.20.x.23	Temperature gain	0,0
1.20.x.24	CO2 level for start	1000
1.20.x.25	CO2 level for full output	1000
1.20.x.26	RH level start	100
1.20.x.27	RH level full output	100

6. Integration with BMS

In buildings that already have a BMS system, NVE can be integrated with it, to achieve overall optimal indoor climate. NVE can be integrated with a BMS system through the fieldbus protocols NVE supports. As of now NVE supports the KNX, BACnet IP, BACnet MSTP, Modbus TCP and Modbus RTU protocols.

Different levels of integration are possible, depending on the hardware and data the BMS system maintains. To take full advantage of the NVE system we recommend that the BMS supply NVE with setpoints and schedules of Building modes and Comfort/Standby/Night but leave the actual control of windows to the NVE´s highly specialized algorithms.

6.1 Hardware example

The following figure illustrates the hardware of an integrated system where room sensors and the weather station belong to the BMS system while the heating, windows and solar shading actuators belong to and controlled by NVE. The BMS delivers the data from their hardware to NVE through the BACnet field bus system.
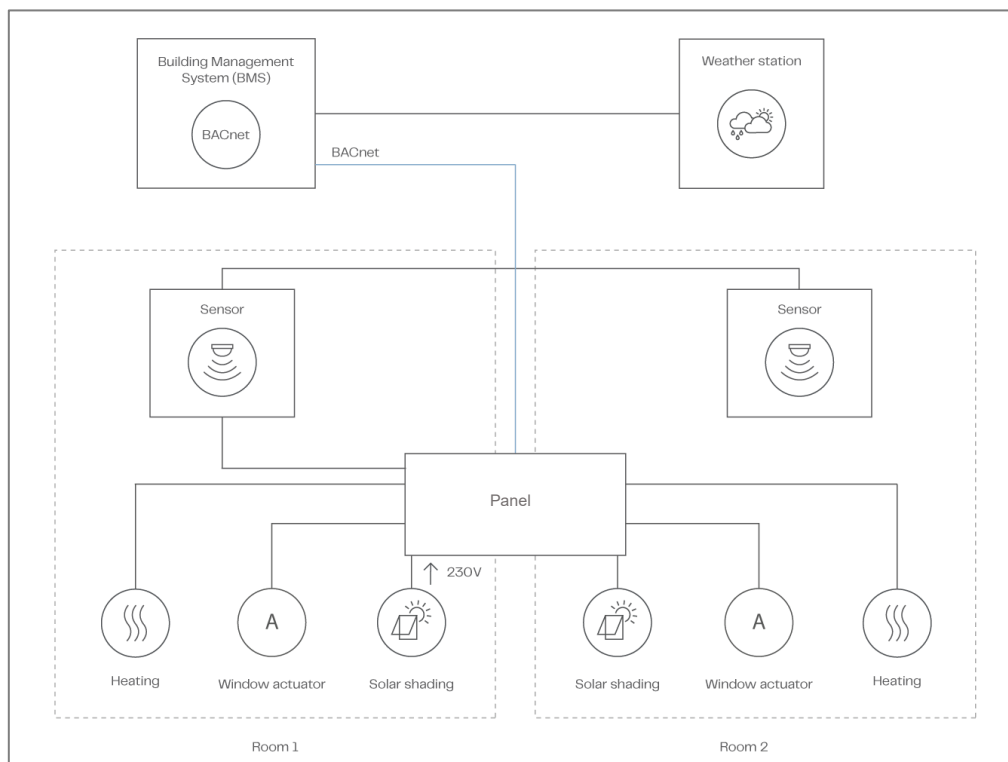
Integration with BMS – Hardware

Note that other levels of integration, with, for example, the room sensors belonging to the NVE systems or both room sensors and weather station belonging to the NVE system, are possible.

The NV controller, that implements the NV logic, has parameters to regulate its operation but it needs input signals from the surroundings and it outputs information on its status and modes of operation.

6.2   Integration through KNX

The following figure show the KNX group objects to use for the input signals and output status. The figure shows the objects for NV controller instance 1 and Motor line instance 1.
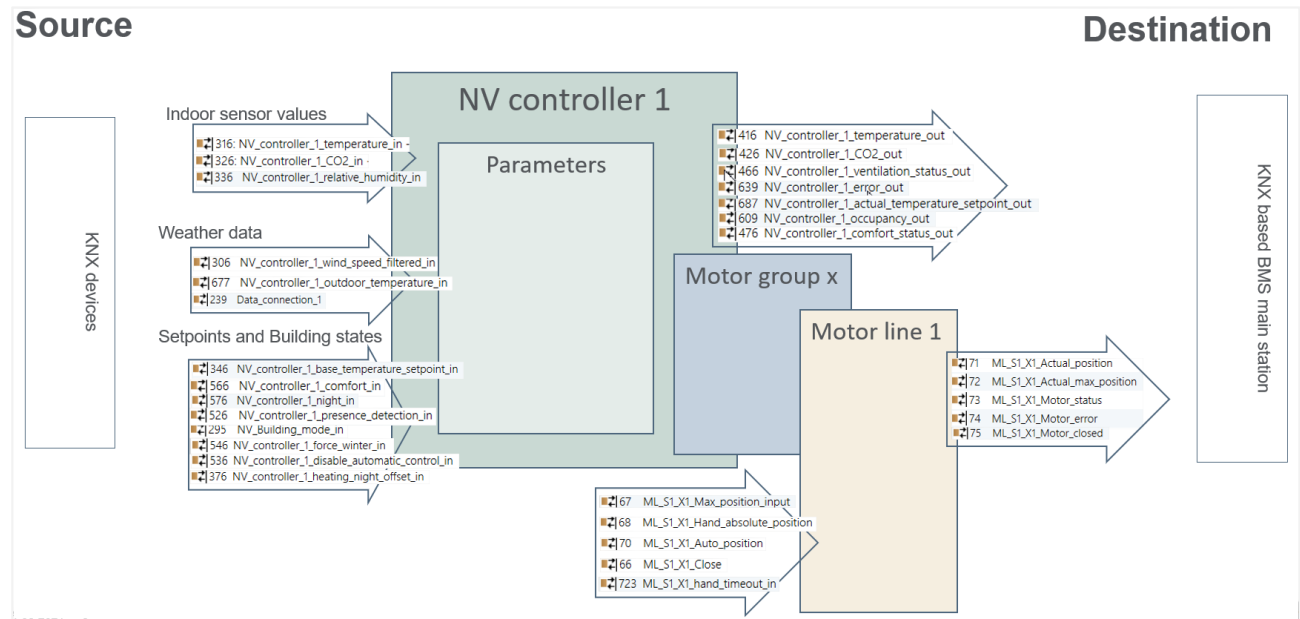
6.3   Integration through BACnet

The following figure shows the BACnet objects to use for the input signals and output status. The figure shows the objects for NV controller instance 1 and Motor line instance 1. Note in BACnet, data types are named from the bus point of view while this text, in general uses the panel point of view. Thus the 'Ventilation status' that the controller **outputs,** can be read from the BACnet **Analog Input** NV_Ventilation_status_x object.
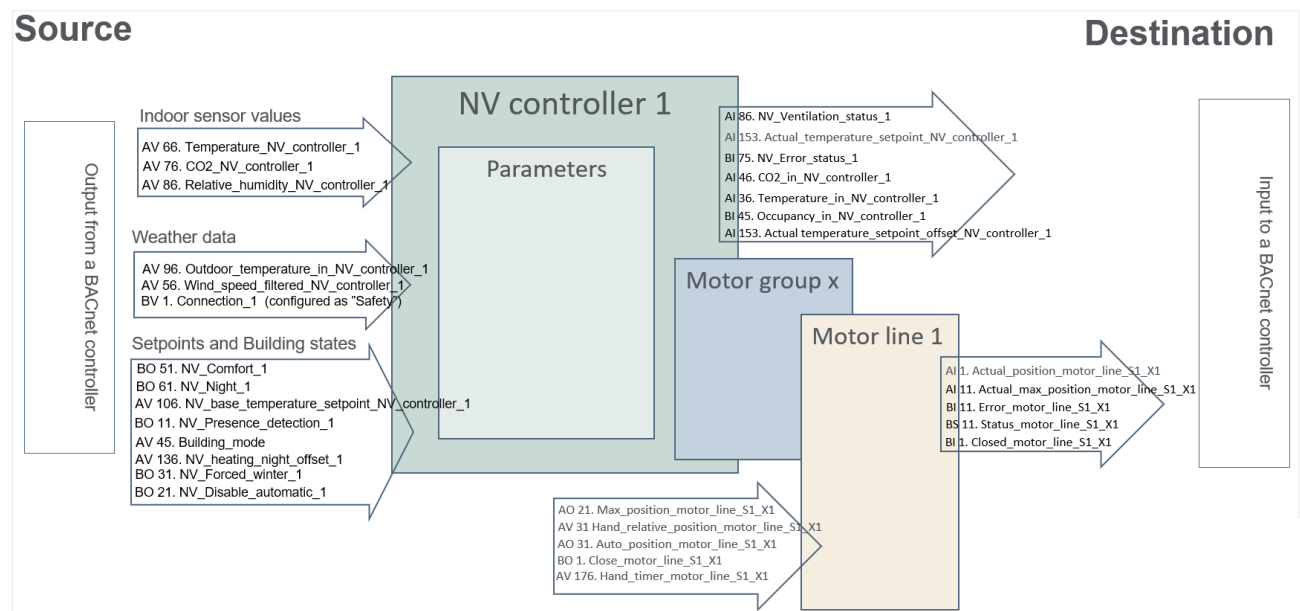
6.4   Source of input to the NV controller

You must configure the NV controller to tell it what source of the input signals to use.

- Indoor sensor input –
    - You must indicate that a sensor is present for the NV Controller to use the input form the WWS 100, which is physically connected on the panel and associated with the NV controller. Otherwise, the NV controller will use input from the fieldbus, if available.

- Weather data –
    - Selecting "Local" means that the NV controller will use the physical signals on its panel (the panel, the NV controller is running on) but signals coming from other panels through **AOnet** are also considered as "**Local**" signals. Signals coming from the fieldbus are used when "Local" is not selected.

- Local Inputs –
    - You associate 'Local Inputs' with NV controllers in the 'Local input' menu.
    - You can select to use 'Building function inputs sum', ´Building' night and 'Building states' in the NV controller. The 'Building' signals are originated from the 'Local inputs', the 'Building schedular' and AOnet.
    - Building functions and states are used, when they are present.

| NV controller | ⌄ | Reload | [|

Controller: 10.212.27.36 (ID 👆 NVEPanel2_WC | Remote control |

Id	Parameter name	1
1.19x.17	Wind speed, slow	0.0
1.19x.18	Outdoor temperature	-31.9
1.19x.19	Raining	False
1.19x.46	Room active	True
1.19x.47	Window control	True
1.19x.48	Light	False
1.19x.55	Temperature sensor	True
1.19.x.175	Fieldbus outdoor temperature	0.0

1.19x.117	Use local wind speed	True
1.19x.118	Use local outdoor temperature	True
1.19x.119	Use local safety	True

1.19x.176	Use building 'Function inputs sum'	True
1.19x.177	Use building states	True
1.19x.185	Use Building night	True

7. APENDIX A
7.1   Definitions of terms

CompactSmoke™ panel	A physical device, to which the window actuators, weather station and WWS 100 sensors are connected. The NVE software is also running on this device.
Cooling controller	A software object for controlling cooling actuators
Heating Controller	A software object for controlling heating actuators.
Mech. vent. Controller	A software object for controlling mechanical ventilation.
Motor controller	A physical device, to which the window actuators, weather station and WWS 100 sensors are connected. Either a Motor controller type WCC 3x0 P, a CompactSmoke™ panel type WSC 3x0 P or a FlexiSmoke™ panel type WSC 5xx. The NVE software is also running on this device.
Motor group	A group of one or more MotorLines that you intend to control together. For example, you may want to control façade and skylight windows in a zone in two separate Motor Groups
Motor line	An output to physically run window actuators. You can connect more than one actuator to a single MotorLine and can therefor run more than one window from one MotorLine but if a single window requires more than one actuator to run, we strongly recommend that you use one MotorLine to run a single window.
NVECloud	A Cloud solution provided by WindowMaster enabling system administration from the Cloud and the use of a mobile app.
NV Controller	A software object to control the indoors climate in a zone. The NV Controller receives sensor information and controls windows, heating, and mechanical ventilation to maintain the desired indoor climate in the zone.
NVE Dongle	A USB stick, which includes the license key for the NV Embedded® software, as well as the cloud ID to be used by the Motor controller, when connecting to NVECloud.
Panel	A physical device, to which the window actuators, weather station and WWS 100 sensors are connected. Either a Motor controller type WCC 3x0 P, a CompactSmoke™ panel type WSC 3x0 P or a FlexiSmoke™ panel type WSC 5xx. The NVE software is also running on this device.
Sun shading controller	A software object for controlling sun shading actuators.
Zone	An area in a building that a NV Controller controls. A zone in most cases corresponds to a room – an office, a classroom – in the building. In some cases, one large space in a building, such as an atrium or an open plan office, can be divided into 2 zones.

8. Appendix B

The file 'Project xxxx, NVE - Technical System Description xxxxxx.xlsm' available from www.windowmaster.com under "NV Embedded", is a tool designed to assist the Project Manager with preparing and documenting relevant information regarding installation and commissioning of a NV Embedded system. Most of the relevant data can and should be inserted off-site while doing the detailed projecting of the system. A small part of the data will only be available during the commissioning of the system.

The following extract from the file demonstrate its use to describe the example project used in this document.

8.1 Building view spreadsheet –

The Building view indicates the division of the building into zones and registers the different controllers employed in each of them

Building	Part	Zone no.	Name of zone	NV	Heating	Mech. ventilation	Sun shading	Heat& Smoke	Indoor sensor values source	Special functions	Room width	Room depth	Room height	Volume
1	1	1	Zone 1	1					WWS 100		2	2	3	12
1	1	2	Zone 2	1					WWS 100		3	4	3	36
1	1	3	Zone 3	1					WWS 100		4	6	3	72
1	1	4	Zone 4	1					WWS 100		5	8	3	120

8.2 Motor controllers / CompactSmoke™ / FlexiSmoke™ panels spreadsheet –

The Motor controllers/CompactSmoke™ panels spreadsheet includes a list of all Motor controllers, CompactSmoke™ and FlexiSmoke panels in the system. The list is being used to automatically create an individual sheet for each Motor controller, CompactSmoke™ and FlexiSmoke™ panels to include detailed configuration information.

Create WxC						

MotorController name	IP	AONet ID	Sends to forgein AONet IP	BACnet Instance	Weather station	Outdoor temp. connected
WxC1	10.0.0.1	1		1001	**WLA 340**	v
WxC2	10.0.0.2	2		1002		
WxC3	10.0.0.3	3		1003		
WxC4	10.0.0.4	4		1004		

The spreadsheet also gives the possibility to create a default list of BACnet objects that in most integrated system will be used by the BMS, in case the BMS is using BACnet.

Create Default BACnet objects list

☐ Include ML objects	Creates objects for each used Motor line.
☐ Include MG objects	Creates objects for each used Motor group.
☑ Include NV objects	Creates objects for each used NV controller.
☐ Include indoor sensor objects from the controller	Creates sensor objects for each zone as info to BMS.
☐ Include indoor sensor objects to the controller	Creates sensor objects for each zone to receive from BMS.
☑ Include zone weather objects	Creates weather sensor objects for each zone to recieive from or to send to BMS.
☐ Include only WOW600 weather objects	Creates weather sensor objects from WOW 600 to send to BMS.
☐ Include Building objects	Creates 'Building' objects for each Motor controller to and from BMS.

Note
* Fill in the Motor controllers table before cteating the WxC sheets and the BACnet objects list.
* The Motor controllers names and the BACnet Instance numbers must be filled before creating the BACnet objects list.
* Select the BACnet objects you need, depending on the integration requirements, as agreed with the BMS company.

8.3 Individual Motor controller / CompactSmoke™ / FlexiSmoke panel sheet

The sheet includes configuration data about Motor Lines, Motor Groups, Sensors and NV-controllers.

WxC1				MotorLines Name 1.4.x.143	ML usgae 1.4.x.106	No. of motors 1.4.x.17	Chain length (mm)	Window hight (cm)	Window bredth (cm)	No. of windows	Opening area 1.4.x.140	Windows location	Tag in layout
		card	ML										
Cloud-ID 1.24.0.21		S1	1		Not used								
MAC-adr 1.12.0.19/20			2		Not used								
AONet 1.22.0.17	1		1		Not used								
IP 1.12.0.24	10.0.0.1		2		Not used								
BACnet Instance 1.16.0.17	1001		3		Not used								
Weather station 1.8.0.16	WLA 340	S2	4		Not used								
			5		Not used								
			6		Not used								
			7		Not used								
			8		Not used								

Motor Groups					WWS 100			
MG	Name 1.3.x.81	Master of AO : MG 1.3.x.65	Slave of AO : MG 1.3.x.64	CP values 1.3.x.60 - 63	WSK add.	WWS serial no. 1.5.x.16	Out door temp. 1.5.x.49	
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				
		:	:	Go to CP				

NV Controllers							
NV Controller 1.19.x	Buil. .157	Part .158	Zone .159	Name .161	Heating controller	Mech.Vent controller	Volume