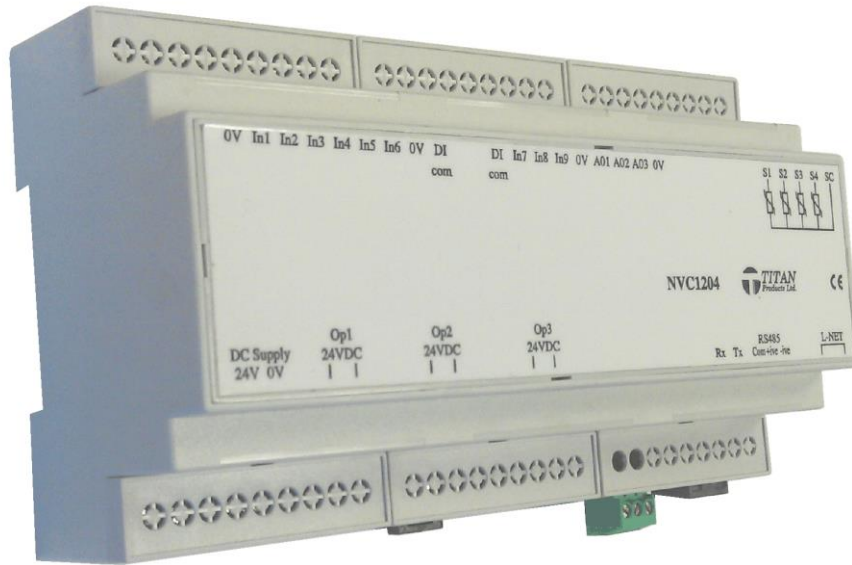# Natural Ventilation Controller with 24vDC drive NVC-1204

BACnet Enabled

FEATURES

> 24V DC supply
> Native BACnet communications
> Master/Slave grouping (shared information)
> 3 x 0-10V outputs
> 3 x 24V DC relay outputs
> 9 x 0-10V Analogue inputs or use as Digital Inputs
> 4 x 10K3 temperature sensor inputs
> Remote setpoint display option
> In built calendar time clock
> Din Rail Mounting

SPECIFICATION

Supply	24VDC (+/- 15%)
	must be rated for the total output load.
Power consumption	3 VA (no RDU) plus outputs
(controller only)	8 VA with RDU display
0-10V outputs	5mA max
Temperature Sensors	10K3A1
Analogue Inputs	0-10V
Digital Inputs	Voltfree
Relay outputs	24VDCrated at 10 amp max.
	(Combined Max should not exceed 15A Max).
Communications	Native BACnet
Network	MS/TP -RS485
Indication	Tx/Rx comm.'s
	Relay operation
Enclosure	Din Mounting (IP20)
	L94-VO
Size	160 mm wide

Description

The Natural Ventilation Controller NV1204 provides 3 zones of control and can operate as a stand-alone controller or integrated into a BMS with the inbuilt BACnet communications over MSTP.

The controlled outputs are 24V DC reverse action relays provide proportional positioning control and incorporate an option for a remote manual selection of the ventilation positions.

Each output is individually fused with PCB mounted resettable fuses and the three outputs are fed from the high current 24V DC controller supply.
The output drive status is indicated by a tri-state LED showing:-

Off   No drive
Green Window opening
Red   Window closing

Each of the three zones can operate independently for individual control settings based on the corresponding temperature and CO2 levels

Signals for Zone Occupancy, External Temperature, Wind, Rain, Heat and Fire can come from a central BMS over the BACnet communications or from a Master NV1204 controller and these signals will determine the operational status of the controller.

In addition to the DC relay outputs there are 3 x 0-10V outputs that can be used for signals to the respective zone ACO/4S room user interface units. These signals with enable and disable the manual ACO operation as well as provide a signal level indicating the auto position of the controlled outputs.

The controller settings are done using a RDU unit or an FPT601 connected to the controller via the RJ11 socket.

The control action is Time Proportional Control (TPC) outputs from the measurement of the respective C02 and temperature values taking the greater of the 2 measured values against a Setpoint and proportional band setting for both temperature and CO2. The Proportional Positioning is based on the total run time of the ventilation actuator which will control in defined percentage steps the position of the window/vents

On power up the controller will synchronise the outputs to a closed condition for the duration of the set actuator drive time plus a percentage of overrun time. The overrun time is to ensure a datum point can be established on power up since the position of the vents is not known at this time. The overrun time setting is added to the close signal each time a call is made for the vent actuators to be fully closed.

A signal to open the vents during the synchronisation period will be ignored until the synchronised process is complete.

Whilst the controller can be set to operate 3 independent zones the controller can be configured to alternative zone combinations for example to control outputs 1 with 2 and or 3 from one set of control parameters.

Manual selection of the vent position can be achieved with the ACO/4S user interface (see ACO4S operation)

Temperature sensors.

The temperature sensors can be either 0-10V input (ranged 0-50'C) or 10K3A1 Thermister and each zone is set to operate the controller outputs on a rise in temperature for comfort ventilation control. The 4th temperature sensor input is allocated to the measurement of the external temperature. The external temperature and respective internal temperature values are also used for determining summer/winter seasonal conditions as well as the night Free Cooling (Purge) cycle.

Control Settings

The settings listed describe a range of standard options and operational features that are available from the applications library that is resident in the Natural Ventilation Controller software. The RDU user interface provides the ability to adjust zone temperature Setpoints and to select timed occupancy extension as and when required.
All other setting are access code restricted and can be modified using the RDU or FPT601 unit or via the BMS using the inbuilt BACnet communications.

Controller Settings & Options	Description
Network	Native BACnet (RS485 MS/TP) or Stand-alone
Unit address	Sets the controller unit MAC address on MS/TP bus. **Range 1 to 127**
Baud Rate	Communication baud rate **Range Options: - 9,600 19,200 38,400 or 76,800**
Dev Object ID	Allows the setting of the device object ID. **Range 0 to 4194302**
Group Control	Allows individual controllers to be set-up as a **Group Master** or **Group Slave**. This sets groups of controllers to take control information and instructions such as temperatures, Global Setpoint, occupancy, Heat, Rain and Fire inputs from a common Master (125 Slaves max). Any number of Groups can be set within the limit of 126 controllers on the MS/TP network

Temperature Setpoint

The controller Temperature Setpoint (GSP) is common to all zones and can be derived from :-
1) A temperature **Compensated Setpoint** varying with the prevailing external temperature conditions.
2) A **Fixed Setpoint** which is a permanent fixed value that is applied to the controller at setup.

The Global Setpoint (GSP) is allocated to the three controlled zones and the individual Zone temperature setpoints can be adjusted via the RDU user display within a predefined limited range or from the BMS. Any +/- Reset Setpoint (RSP) setting from the GSP value will become the zone default value when the controller is switched On/Off.

Inputs

External 10K3A1 Thermister
The external temperature sensor/value is used for a number of control options.

a)   Used for a low limit to reset the temperature control to minimum fresh air should the external temp fall below a preset level (See External Low Limit). CO2 control of the ventilation can be set to take priority in low limit temperature conditions.

b)   Used to monitor the external temperature in un-occupied modes to activate or inhibit free cooling (see Free Cooling).

c)   Used to adjust the Global Temperature Setpoint in compensated control mode.

If the External temperature value is supplied from the BMS then the controller physical input must be taken out of service (OOS).

Whilst the NV1204 can be used for stand alone and or Group Master/Slave operation when it is connected to a BMS objects are available for centrally transmitted signals such as: -

Adverse Weather (close all vent)
Fire (close all vents)
Occupancy. Auto Controlled
Unoccupied Close all vents
Night Purge (open selected vent)

Zone Inputs

Zone Temperature The control sensor can be from a 0-10V temperature signal in the combined C02 sensor (range 0-50'C) or option configured to use one of the 10K3 Thermister inputs.

CO2 0-10V Input A CO2 sensor is provided per zone for priority control of the ventilation. The CO2 sensor provides a linear 0-10V signal across a range of 0-2000ppm.

Manual Control (ACO/4S) Each zone operates with a TITAN ACO/4S unit 0-10V signal which will allow Manual selection of the vent positions

Output from Nat Vent Controller to the ACO input (all values are +/- 0.5V)
ACO disabled   = <1V (Override is indicated static LED)
Auto/Active   = 2V closed (all LED's off)
 1st stage %   = 4V (1st left LED On static in Auto)
 X%   = 6V (2nd left LED On static in Auto
 X%   = 8V (3rd left LED on static in Auto)
 Max %   = 10V (4th left LED on static in Auto)

The 0-10v input signal on the ACO/4S unit is used for enabling and disabling the ACO manual functions as well as providing indication of the auto control position of the vents.

Output from ACO/4S to Controller when enabled with the input level at 2V or above and when the Manual selection is made using the ACO buttons
Auto/Active   = 2V closed (LED's dictated by Auto)
1st stage %   = 4V (1st left LED On slow pulse)
2nd stage   = 6V (2nd from left LED on slow pulse)
3rd stage   = 8V (3rd from left LED on slow pulse)
4th stage   = 10V (4th from left LED on slow pulse)

When the controller signal is 2V or above the ACO/4S is enabled and manual operation can take place. Manual selection can only move up from the auto position and when this is done then the manual selected position is indicated with a pulsed LED. The operator can not move below the auto control position

If after a manual selection has been set the Auto control input matches or exceeds the manual value then the Auto control takes priority and cancels any previous manual selection.

Control Overrides

In addition to the BMS override functions there are a number of control override signals within the Natural Ventilation control configuration and these are:

External Low Limit If the external temperature falls below a set threshold, the normal temperature control is inhibited and the vents are reset to minimum position (option selectable). The CO2 level is still allowed to control the ventilation under low external temperature conditions.

Internal Low Limit	If the internal temperature falls below a set threshold, the CO2 control and/or Manual Open signals can be inhibited (if required).
Manual Control	Use a TITAN ACO/4S room interface unit. (see details above)
Free cooling	During the unoccupied periods the ventilation should normally be fully closed. Free cooling is dictated by the Controller or BMS and this will allow the vents to be pre-positioned to any of the 4 vent positions for night cooling. The Free Cooling will be inhibited if the external temperature is below the low limit threshold.

Time Control

The occupancy times can be transmitted to the controllers by the BMS or if required the NV1204 can be programmed via its own internal calendar time scheduler. In a Group Master/Slave setup the group occupancy can be transmitted from the designated NV1204 Master.

Setup (Engineer's settings)

The NV1204 controller provides a group of global control options and a number of zone control settings. All the settings are done through the RDU or FPT601 Field Programming Tool. Or via the BMS network and the settings are as follows:-

Output Control

This setting determines the number of individual controlled zones and the number of outputs that can be attached to a single zone. Number of zones 1-2-3 (if 3 is selected then the following options are not allowed)

DC Outputs for Zone 1 – (op1 or + op2 or + op3 or all)
DC Outputs for Zone 2 – (op2 or op2 + op3)

Global Temperature Setpoint

GSP Type:-	The Global Temperature Setpoint (GSP) is determined by the external temperature compensation or Fixed. The GSP is used for the base temperature setting of the zone control point.
(Fixed/Ext Temp)	If a Fixed setpoint is selected then this is determined at the Setup or by the BMS over the network and this value become the controller fixed default value.
If **Ext Temp**	Compensated then a continuous temperature compensated adjustment of the GSP is exerted within the controller using the internal Winter and Summer SP with the Winter and Summer Ext SP. (see fig below). The value of the external temperature can be derived from a controller sensor or the BMS.
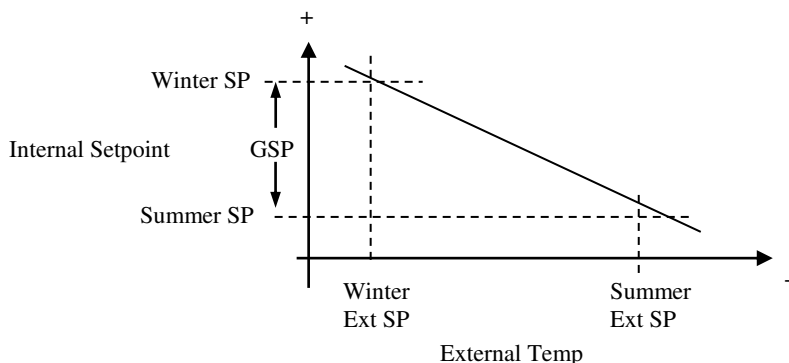
The following settings need to be entered if External Temperature adjustment is used for the GSP.

Winter SP:- 0 – 30'C   The maximum internal temperature setpoint to be used during winter conditions.

Summer SP:- 0 – 30'C   The minimum temperature setpoint to be used during summer conditions.

Win Ext SP:- 0 – 30'C   The external temperature that corresponds to the maximum winter control setpoint when using external temperature compensation to define the global setpoint.

Sum Ext SP:- 0 – 30'C   The external temperature that corresponds to the minimum summer control setpoint when using external temperature compensation to define global setpoint.

If GSP is set for temperature compensation then each zone setpoint can be adjusted plus or minus providing an adjustment to the calculated setpoint that is derived from the compensated schedule.

Global Settings and Control Strategies

Rain Vent Position :-   If rain is detected by the controller then automatic control is inhibited and the ventilation dampers are driven to the minimum % setting (ZN Min % if set) until the rain detection is cleared.

CO2 Setpoint :- 0-2000ppm   The CO2 sensor gives 0-10V output for a range of 0 to 2000ppm. This setting defines the point at which the CO2 value begins to open the ventilation using its own Proportional control function and this setting is common to the 3 controlled zones.

Ext LL Position :- Min%/Closed/Disabled

       This defines whether the vents should be fully closed or set to Min% when the external temperature falls below the low limit setting. If disabled then the natural ventilation temperature control is not inhibited or reset by low external temperature conditions.

Ext LL Thres :- 0 – 30'C   This defines the external low limit threshold below which the ventilation dampers will be closed.

Int LL CO2 :- Enabled/Disabled

       This defines whether an internal low limit temperature will inhibit CO2 ventilation control.

Int LL Man :- Enabled/Disabled

       This defines whether an internal low limit temperature will inhibit CO2 control or manual open override from the ACO room unit

Int LL Thres :- 0 – 30'C   This is the internal low limit temperature value that will inhibit the activation of the CO2 control and manual override from the ACO. The use of the inhibit action on both conditions can be individually selected.

Heat Position :-   The ventilation position will automatically go to the closed or minimum % setting if Heat On is detected.

CO2 :- No Ctrl/Ctrl   This defines whether CO2 control is required. If Crtl is selected then the output control is based on the greater of the temperature or C02 values also if selected the CO2 values are displayed on the RDU

Free Cool :- Position   This selects the position of the vents for Free Cooling. There are 4 positions plus closed as described in the control section. Free cooling will also be dictated by the BMS as and when required.

Free Cool Int :- 0– 30'C   This is the internal temperature limit above which the action of Free Cooling in the un- occupied period will be allowed by the controller.

Occ Override Time :- 0 – 8 hours

This allows occupancy extension outside normal hours of operation. The controller will automatically time out and reset to the desired operation after the elapse of override time setting.

Zone Settings and Control Strategies (available for each zone)

Relay Drive time   **Range 5 – 300 seconds**
This setting is the time taken by the ventilation drive motors to run from fully closed to fully open and is used to provide the positional adjustment of the vent to match the control voltage signal input. There will be a setting for each output and the ability to select a common time base for all 3 outputs

Relay Drive overrun timer   **Range 0 to 300% of drive time**
This setting is used to add additional drive time to the close signal to ensure the vents are fully closed each time a 0V input is seen or on start up or when the controller is switched Off or on actual power up.

Zn RSP Range :- 0 – 5'C   This is the + and - adjustment of offset of the zone GSP allowed by the BMS or RDU/FPT

Zn Temp Pb :- 1 – 5'C   This defines the proportional band for the temperature control.

Zn CO2 PB :- 100 – 1000ppm   This defines the proportional band for the CO_2 control.

Controller Display & Options

Temp Units :-   All temperature values are shown in degrees C

Disp CO2 :-   The CO_2 value can be displayed or inhibited.

Maintenance. Passcode   The 4 digit Passcode when using a RDU/FPT as is required to enter the controller at the low level maintenance menu.

Set Up Passcode   The Passcode required to enter the high level Set Up menu.
(customer entry)
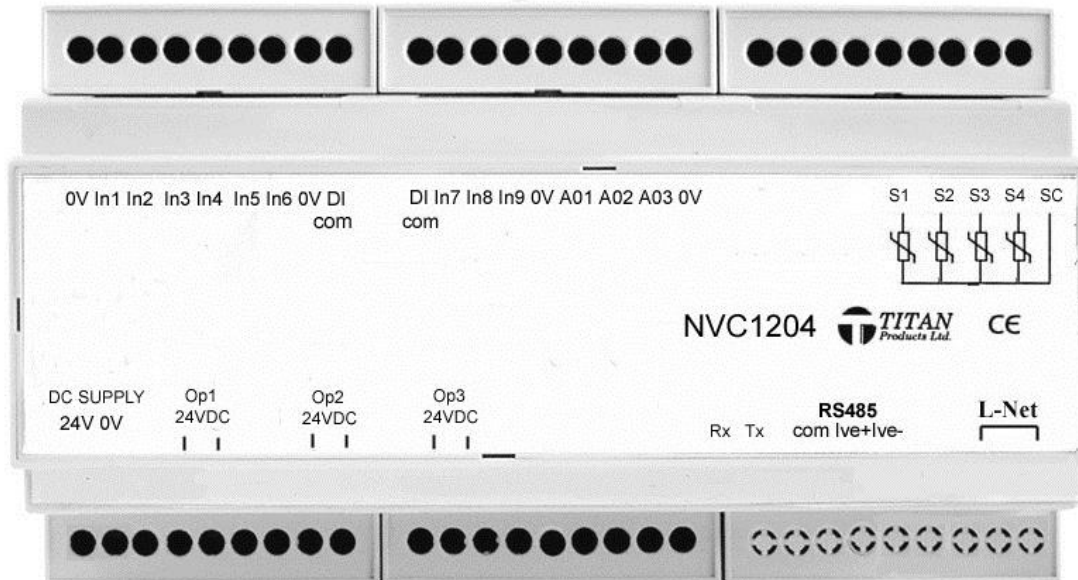
Physical IO

9 x Analogue Inputs   Used for the CO_2 sensors, temp sensors and ACO manual override units..

4 x Temperature Sensors   Used for measurement of the controlled zones and the external temperature.

3 x 0-10V Analogue Outputs   Outputs are configured to provide the following control options: -
Zone 1 - ACO
Zone 2 - ACO
Zone 3 - ACO

3 x 24VDC Outputs   24V DC outputs for each of the three zones or can be used for one common zone.

NVC1024 Terminal layout