Technical data sheet: Room Pressure Control Series with High-Speed Actuator and Intelligent Controller for Supply and Exhaust Airflow Measurement and Control (RPC-C2)

NA-NB Models with High-Speed Actuator and Intelligent Controller for Room Pressure Control and Supply and Exhaust Airflow Measurement and Control.

NK-NL Models with High-speed Actuator and Intelligent Controller for Room Pressure Control and Supply and Exhaust Airflow Measurement and Control.

Description

Barcol-Air Room Pressure Control VAV series with integral High-Speed Actuator, Intelligent Controller and Room Pressure Transducers supplied fully factory assembled and calibrated, ready for plug and play installation. Designed for Room Pressure and Supply and Exhaust Air Control particularly for Hospitals, Clean Rooms, and Laboratories.

Barcol-Air NA and NB model terminals have round bodies, and the NK and NL series are rectangular. The NA and NK series have single skin bodies, and the NB and NL series have double skin with enclosed insulation for improved acoustic and thermal performance. All units are factory tested and calibrated ready to provide accurate room pressure and supply and exhaust airflow control on the supply air side or the exhaust air side of the room.

VAV Terminal Features

- Galvanized steel bodies with optional polyester powder paint finish or stainless-steel body for enhanced corrosion resistance
- NA and NB round series have sandwich construction galvanized steel oval damper blade for linearised performance with neoprene blade seal for low leakage
- NK and NL rectangular series have aluminum extruded parallel damper blades with edge seals and blade synchronizing gear wheels. NKS low leakage versions also have low leakage seals at the ends of the damper blades
- Low casing air leakage
  - NA & NB series are Class C according to Standard EN1751.
  - NK & NL series standard versions are Class A according to Standard EN1751 and NKS low leakage versions are Class C.
- Low closed blade air leakage
  - NA & NB series - Class 4 according to Standard EN1751 except size 100 and 125 which are Class 3.
  - NK & NL series standard versions are Class 1 according to standard EN1751 and NKS low leakage versions are Class 4, except models with 100mm and 200mm heights which are Class 3.

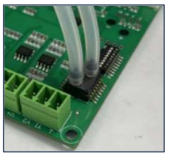
Control Features

- Damper Fast Speed Actuator

Speed	High Speed
Model	BA104Q24SR
Operating time	2.5 seconds
Nominal torque	4 NM
Power Requirement	24VDC /24VAC 50/60Hz
Power Input	13W

  Other models available upon request.
- Modbus RTU Room Pressure Controller

Model	RPC-C2
Power Requirement	24VDC /24VAC 50/60Hz
Power Input	3W
- Optional built-in power converters and transformers available for 230VAC to 24VDC or 230VAC to 24VAC power supply
- Zero button to keep airflow measurement accurate by manual correction of zero-point drift.
- Optional Auto Zero device to keep airflow measurement accurate by auto correction of zero-point drift.
- Communication protocol via Modbus RTU.
  BACnet IP or BACnet MS/TP also available via accessory Transfer Modules:
  - BAC1001 Modbus RTU to BACnet IP (256 points) or
  - BAC2004 Modbus RTU to BACnet IP or BACnet MSTP (1024 points)
- Controller inputs and outputs
  - Inputs: 4 x DI, 4 x UI
  - Outputs: 4 x Passive DO, 3 x AO
- Room pressure set point settings via:
  - Laptop with Modbus Connector
  - Building Management System (BMS)
  - HMI touch screen
- Controller build-in air pressure transducer (static membrane type) set for airflow sensor pressure measurement.

Pressure Range	±1000 Pa
Precision	±1.0%
Operation temperature	-40~85℃
- External room air pressure transducer (static membrane type) for room pressure measurement and control.

Model	RPC-PSP2
Pressure	Range ±100 Pa
Offset (FSS)	1.0%
Accuracy (1 to 70 Degrees C)	1.0%
Stability over one year (FSS)	1.0%
Pressure Sensing Element	Ceramic
Power Supply	24VDC/VAC

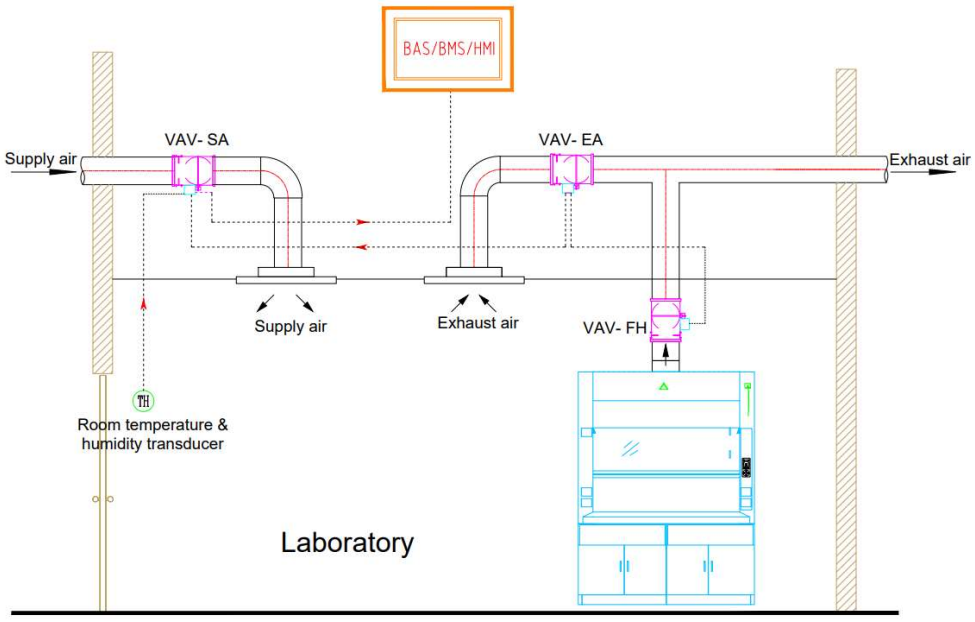
RPC-C2 Control Principles

Room Supply & Exhaust Air Intelligent Control is achieved using a Master-Slave control arrangement between the controllers of the Supply, Exhaust and Fume Hood VAV units. The Master controller on the Supply Air VAV-SA collects the measured airflow data from the Slave controllers installed on the Exhaust Air VAV-EA and Fume Hood VAV-FH units via Modbus RTU communication, and calculates the supply airflow required from the Supply Air VAV-SA unit to balance the Exhaust and Fume Hood airflows. This is Room Airflow Balance Control and it provides safe, fast response and stable control with energy savings.

In addition to the balance airflow the Supply Air VAV-SA is controlled to provide an additional Air Flow Difference to control the room pressure.

There are two variations of this system:

1. Room Airflow Balance Control with Constant Airflow Difference.



With this first variation of Air Balance Control the supply air VAV-SA maintains a Constant Airflow Difference at a setpoint level determined to maintain either the required positive or negative room pressure.

Exhaust Air and Hume Hood Control

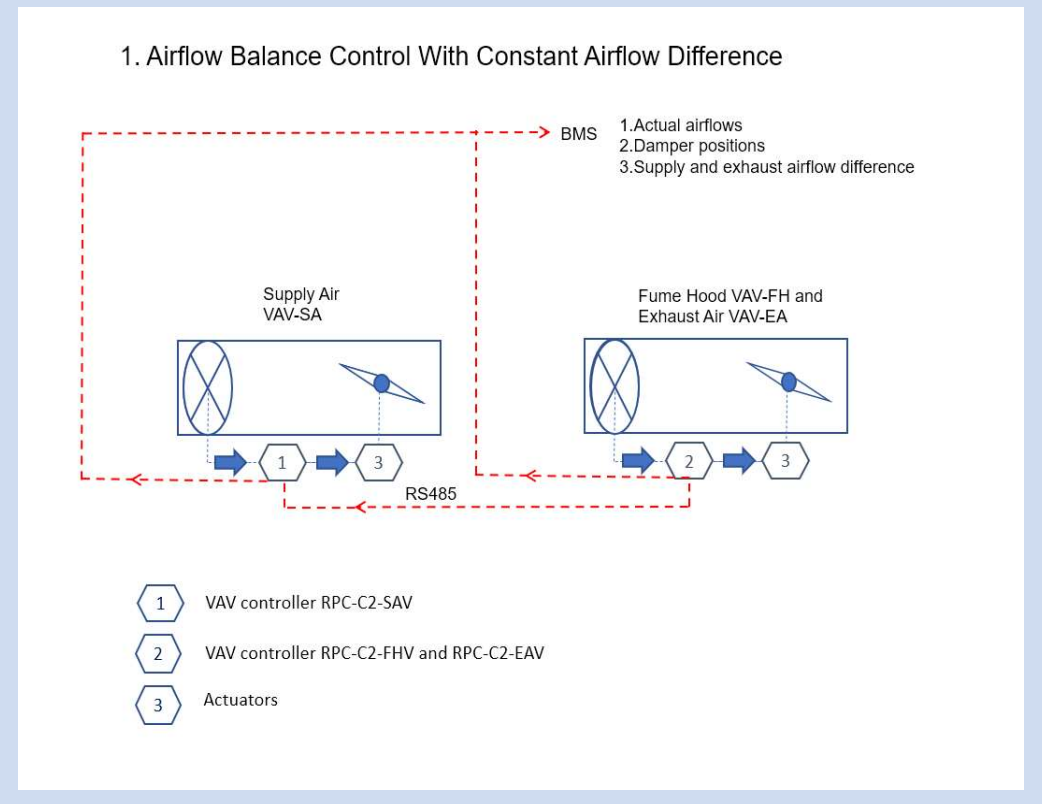
The Exhaust Air VAV-EA and Fume Hood VAV-FH units are controlled independently according to their specific purpose. The Exhaust Air VAV-EA unit is controlled to maintain the Room Minimum Required Ventilation Exhaust Airflow Rate, This, is calibrated in the master controller of the Supply Air VAV-SA to achieve the required minimum room ventilation air changes. The Fume Hood VAV-FH units are controlled by their respective Sash Window distance sensors to ensure a safe air velocity across the Sash Window of the Fume Hood to prevent room contamination.

The Exhaust Air VAV-EA and Supply Air VAV-SA use RPC-C2 controllers and the Fume Hood VAV-FH units use FHC-C3 controllers. Details of the RPC-C3 controller are available in the RPC-C3 product catalogue.

When the Fume Hood VAV-FH is not in operation, the Exhaust Air VAV-EA is controlled to operate at the Room Minimum Required Ventilation Exhaust Airflow Rate. When the Fume Hood VAV-FH is reactivated the Exhaust Air VAV-EA is controlled to reduce the exhaust airflow automatically to offset the Fume Hood airflow increase. The required Exhaust air VAV-EA flow rate is equal to the Room Minimum Ventilation Total Exhaust Airflow rate minus the sum of the Fume Hood VAV-FH exhaust airflow rates.

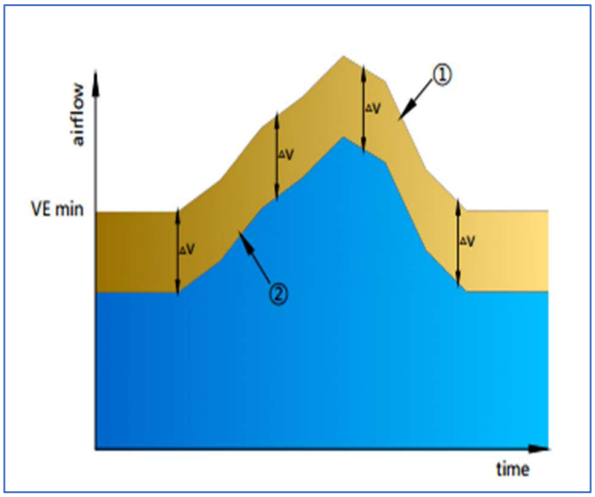
When the Fume Hood exhaust airflow is more than the Room Minimum Required Ventilation Total Exhaust Airflow rate, the Exhaust Air VAV-EA damper is closed. Then the Fume Hoods VAV-FH will alone provide the Minimum Ventilation Airflow Total Exhaust Airflow Rate for the room.

Control Schematic



Operational Diagram

1. Airflow Balance Control with Constant Airflow Difference



① Total Exhaust Airflow

② Total Supply Airflow

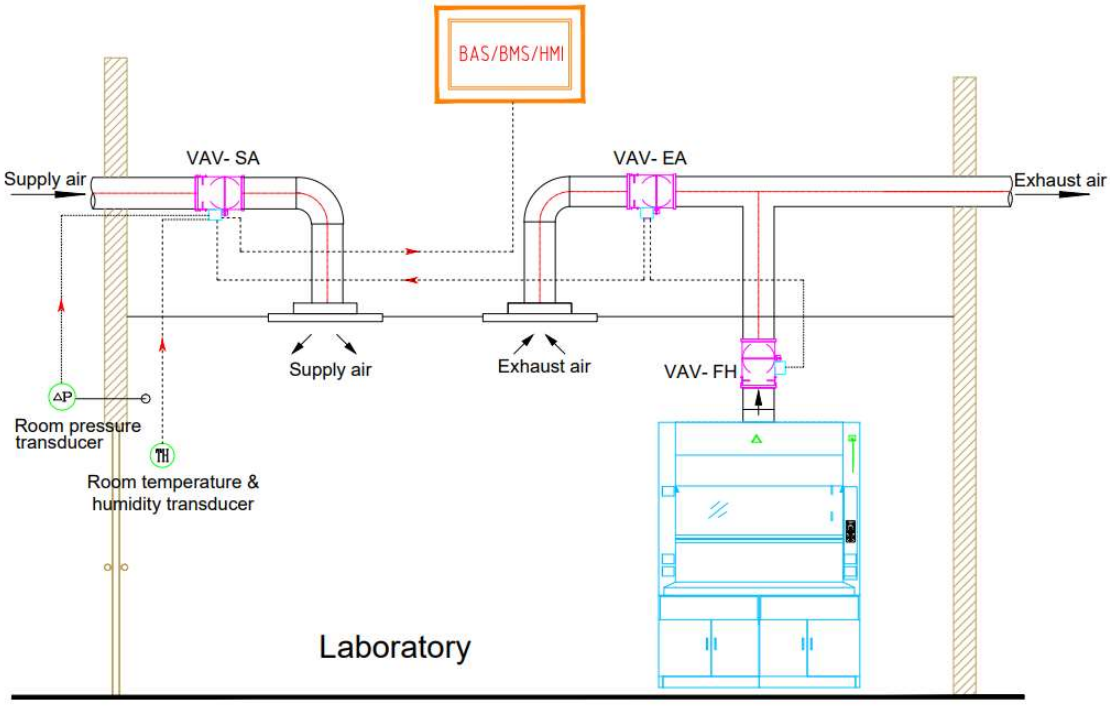
ΔV Constant Airflow Difference

VE min Room Minimum Required Ventilation Exhaust Airflow

Control Features

- Airflow Balance Control - Supply air controller follows Exhaust airflow changes
- Airflow Balance has fast response.
- Minimum Ventilation Control to maintain required ventilation air changes.
- Can monitor and display room temperature and humidity if required with added sensors.
- One remote button on HMI or BMS can control system on and off
- Can integrate 3 channels of communication interface, supported by Modbus RTU communication
- One master controller can communicate with 16 slave controllers

2. Room Pressure Cascade Control with Variable Airflow Difference.



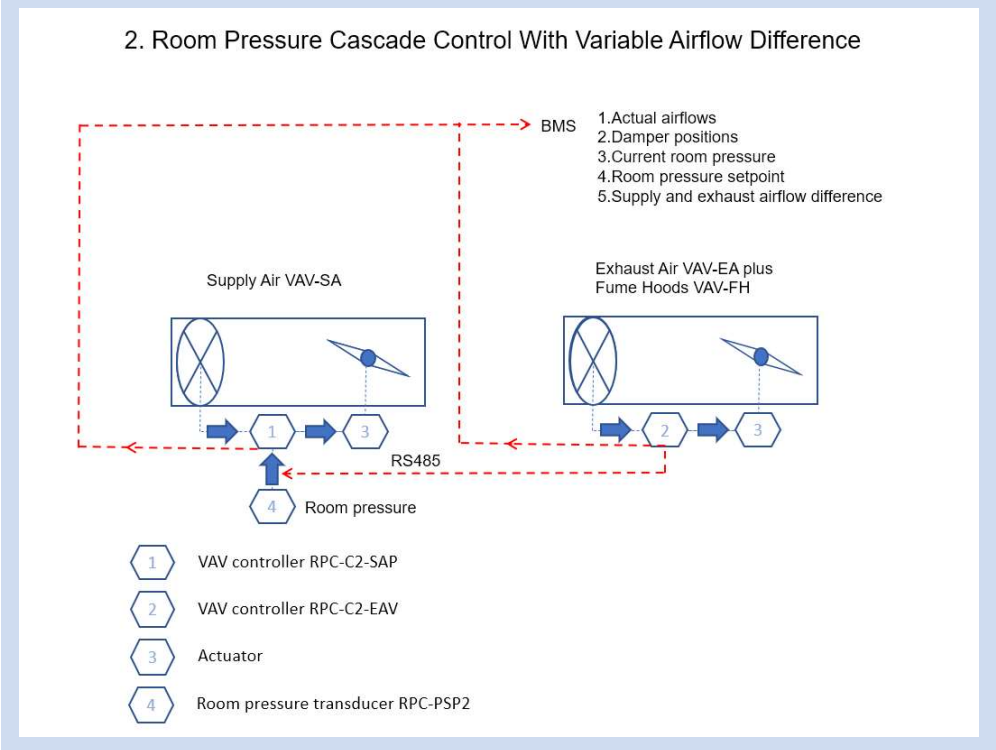
This system also operates with Room Airflow Balance Control with the supply air VAV-SA operating as master controller and collecting the measured exhaust airflows from the Exhaust Air VAV-EA and Fume Hood VAV-FH, and then calculating the required total Supply Air VAV-SA to balance the Exhaust Air VAV-EA and Fume Hood VAV-FH airflows. The Supply Air VAV-SA is also controlled to supply an additional Airflow Difference to control the room pressure.

However, this alternative has an important difference. The Supply Air VAV-SA Intelligent Controller, VARIES the Airflow Difference using an added Room Pressure transducer to provide feedback of the measured Room Pressure and Room Pressure CASCADE CONTROL principles to provide faster control response and increased accuracy.

Exhaust Air and Hume Hood Control

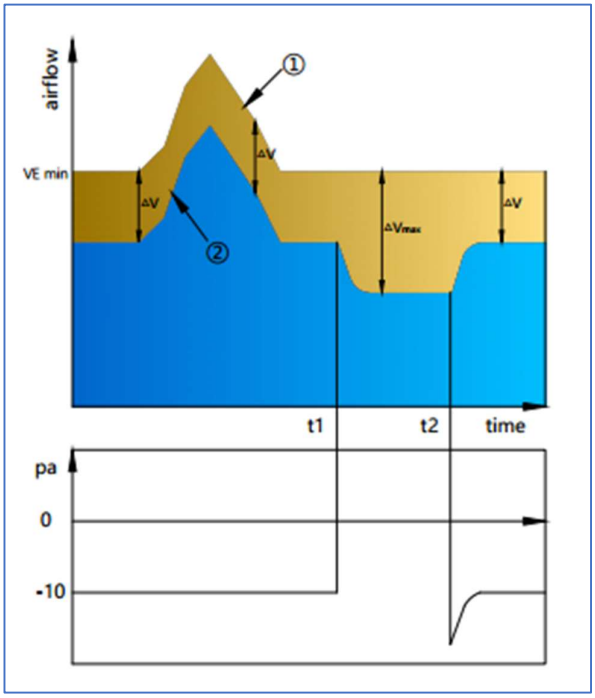
The control of the exhaust air VAV-EA and VAV-FH is the same as the Airflow Balance Control with Constant Airflow Difference, alternative 1 above.

Control Schematic



Operational Diagram

2. Room Pressure Cascade Control with Variable Airflow Difference



① Total Exhaust Airflow

② Total Supply Airflow

Δ V Constant Airflow Difference

T1 Door open

T2 Door close

VE min Room Minimum Required Ventilation Exhaust Airflow

Δ Vmax Max airflow difference between Exhaust airflow

Control Features

- Room pressure Cascade Control and Room Pressure Transducer feedback provides Variable Airflow Difference control with fast and accurate response.
- Minimum ventilation control to maintain required ventilation air changes.
- Controller can set air flow limits on the maximum difference between the Exhaust and Supply Airflows to facilitate quicker room pressure stablisation after door closing.
- Can monitor and display room temperature and humidity.
- One remote button on HMI or BMS can control system on and off
- Integrates 3 channels communication interface, supported by Modbus RTU communication
- One master controller can communicate with 16 slave controllers

RPC-C2 Control types

Room Airflow Balance Control using Constant Air Flow Difference Setting (RPC-C2-SAV)

Room Airflow Balance Control is achieved by the Supply Air VAV-SA collecting the measured airflow data from the Exhaust Air VAV-EA and Fume Hood VAV-FH controllers and controlling the Supply Air VAV-SA airflow to balance the Exhaust and Fume Hood Exhaust airflows. This provides safe, fast response and stable control with energy savings.
In addition to the balance airflow the Supply Air VAV-SA provides a CONSTANT additional Air Flow Difference to control the room pressure.

Room pressure with CASCADE control. (RPC-C2-SAP)

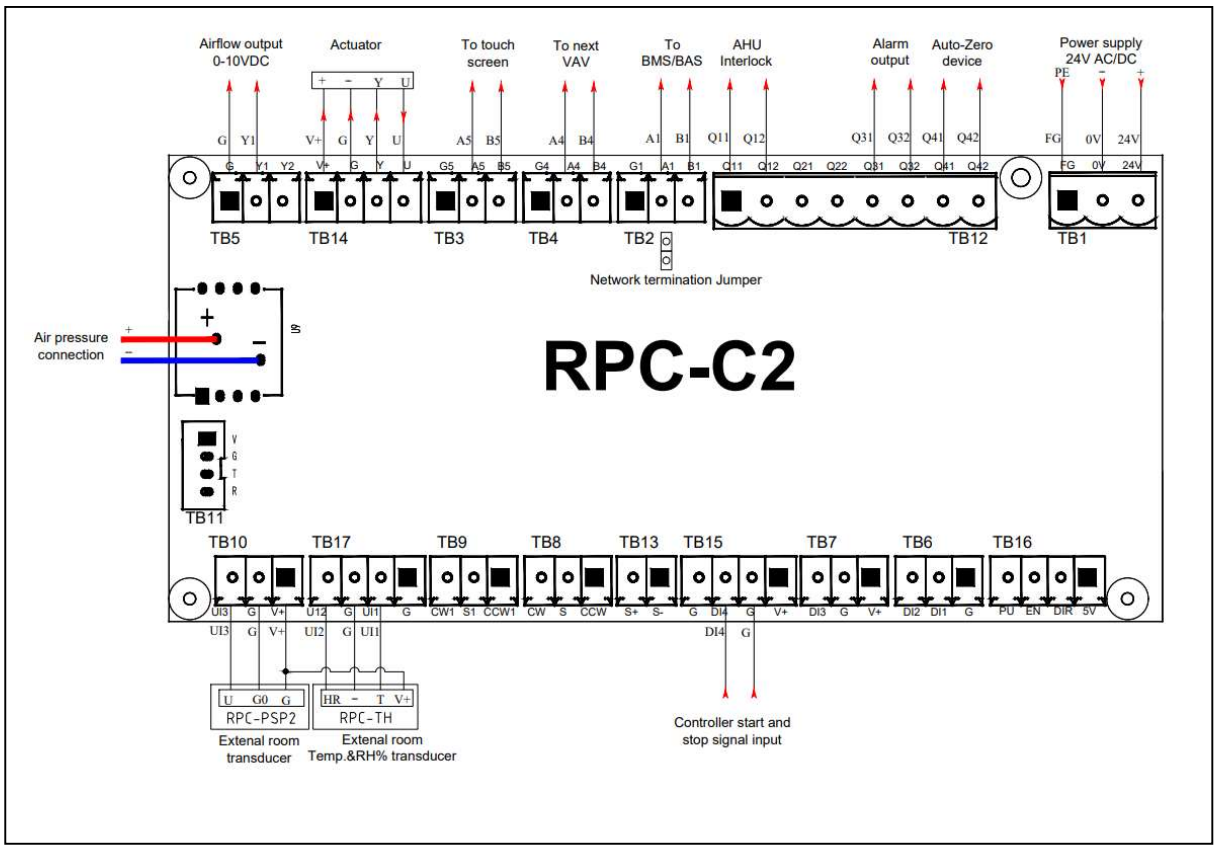
This control also uses Room Airflow Balance Control achieved by the Supply Air VAV-SA collecting the measured airflow data from the Exhaust Air VAV-EA and Fume Hood VAV-FH controllers and controlling the Supply Air VAV-SA airflow to balance the Exhaust and Fume Hood airflows.

In this case, in addition to the balanced airflow the Supply Air VAV-SA provides a VARIABLE additional Air Flow Difference to control the room pressure. The Variable additional Airflow Difference is determined using CASCADE control principles and feedback from an added Room Pressure Transducer. This provides faster control response with increased accuracy.

Room Exhaust Air Control exhaust air volume control for a Supply Air led system (RPC-C2-EA)

The Exhaust Air VAV-EA unit is controlled to maintain the Room Minimum Required Ventilation Exhaust Airflow Rate, which is calibrated in the master controller of the Supply Air VAV-SA. This assures the Room Ventilation Air Changes.
The Fume Hood VAV-FH units are controlled by their Sash Window distance sensors to ensure a safe air velocity across the Sash Window for the Fume Hood exhaust air.

Controller Configuration and Wiring Guidelines



1. The standard RPC-C2 product is supplied for use with a customer supplied 24VDC or 24VAC power supply which should be field connected to the 24VAC/DC terminals on the controller. If a 24VDC power supply is used it is essential to follow the indicated positive and negative polarity of these connections to avoid damage to the controls.
2. If the customer orders an optional factory installed and wired 230VAC to 24VDC or 24VAC power converter/transformer, then the external 230VAC power supply should be site connected to the 230VAC terminals on the power converter/transformer, including the earth terminal.
3. Master and Slave controllers should be connected together by Modbus RTU to facilitate their communication.
4. The controller's integrated airflow pressure transducer is used for measuring the actual air flow through the VAV unit flow sensor.
5. When units are ordered with Variable Airflow Difference and Room Pressure Cascade control the controller is factory connected to an additional external room pressure transducer to measure the room pressure and to facilitate the cascade control operation. The pneumatic connection tubes from the pressure transducer to the room pressure sensing points should be less than 5M long to avoid excessive pressure drop and the connector marked "+" is for connection to the measuring room, and the "-" is for

connection to the reference space of the measuring room.

6. The controller has three sets of built-in standard RS485 connector for Modbus RTU protocol communication:

   - TB2 is connected to the BMS system.

   - TB3 is usually connected to HMI screen or the Fume Hood monitor screen.

   - TB4 is for the communication between the master and slave controllers.

   The communication cable should be a shielded twisted pair with the shielded layer connected to ground.

7. The controller has four universal inputs (UI-1, UI-2, UI-3, U).

   - U connector in TB14 is factory connected to the actuator.

   - UI-1 and UI-2 in TB17 are available to connect the room temperature and humidity transducers when required.

   - UI-3 in TB10 is for factory connection of the external room pressure transducer when used for cascade control.

8. The controller also has four digital inputs (DI-1, DI-2, DI-3, DI-4).
   DI-3 in TB7 and DI-4 in TB15 are available for site connection to the door switch and external start and stop inputs when required.
   DI-2 in TB6 and DI-4 in TB15 is normally used for Fume Hood control applications.
   DI-1 in TB6 is not used.

9. The controller has 4 passive digital outputs (Q-11 & Q-12, Q-21 & Q-22, Q-31 & Q-32, Q41 & Q42) in TB12.
   Q11 & Q12 are available when required for site connection to interlock with air supply or exhaust fans.
   Q21 & Q22 are used for Fume Hood applications.
   Q31 & Q32 are for high and low-pressure alarms when used for room pressure cascade control applications.
   Q41 & Q42 are factory connected when the optional auto zero option is selected.

10. The controller has three analog outputs (Y1, Y2, Y).
    Y in TB14 is factory connected to the actuator.
    Y1 in TB5 is the output signal for airflow feedback 0-10VDC.
    Y2 is available for future use.

11. When the controller is at the end of the communication network, the control board internet jumper terminals should be capped to end the communication circuit.

Options and Accessories

• Communication Transfer Modules:

- BAC1001 Modbus RTU to BACnet IP (256 points) or
- BAC2004 Modbus RTU to BACnet IP or BACnet MSTP (1024 points).

• Optional built-in power converters/transformers: - 230VAC to 24VDC or - 230VAC to 24VAC

• Optional Auto Zero Device BAC-ZE for the control board built in pressure transducer connected to the air flow sensor.

Order Codes

NA -250 / RPC-C2-SAP / FA / TD /******

Group 1 2 3 4 5 6

Group 1: VAV product series

NA/NB/NK/NL, for details, please refer to the relevant VAV product catalogue

Group 2: VAV size

For details, please refer to the relevant VAV product catalogue

Group 3: Controller model

RPC-C2-SAV: Room supply air volume control with constant airflow difference

RPC-C2-SAP: Room pressure cascade control with variable airflow difference

RPC-C2-EA: Room exhaust air volume control

Group 4: Actuator type

FA: Fast speed actuator

LA: Standard speed actuator

Group 5: Power converter/transformer type

T0: Exclude power converters/transformer, site power supply to be used

TD: Include 24VDC power converter

TA: Include 24VAC transformer

Group 6: Other options

None: No options ordered.

BAC1001: 256 points Communication Transfer Modules

BAC2004: 1024 points Transfer Modules

BAC-ZE: Pressure Transducer Auto Zero Device

Order Model Example:

Model: NAROB/S/250/RPC-C2-SAP/FA/TD/BAC-ZE

Represents:

VAV model NA250 with Stainless Steel Body, Room Pressure with Cascade Control RPC-C2-SAP, with Barcol-Air Fast Actuator, and 24VDC power converter, and Auto Zero Device.