BACnet Flow Controller for Fan Filter Units
BFC Series
# BACNET FLOW CONTROLLER

## TABLE OF CONTENTS

### Product Overview
- General Information ................................................................. 1

### Installation & Mounting Instructions
- Typical Wiring ........................................................................... 2
- Input/Output Description .......................................................... 2

### Display Navigation
- Initial Startup ........................................................................... 3
- Service Menu ........................................................................... 4
- Service Menu – Fan ................................................................. 5
- Service Menu – Filter ............................................................... 6
- Service Menu – I/O ................................................................. 7
- Service Menu – BACnet ............................................................ 8
- Service Menu – Diagnostics ....................................................... 8

### Networking & Setup
- Network Wire Specifications ..................................................... 9
- Network Layout ......................................................................... 10
- Package/Component Identification .......................................... 12
- Location ................................................................................... 13
- Mounting .................................................................................. 14
- BAS Input Signal ...................................................................... 15
- Analog RPM Feedback ............................................................ 16
- Wiring and Cables ..................................................................... 17

### Maintenance
- Troubleshooting ....................................................................... 18
- Specifications ............................................................................ 19
- BACnet points list for BFC firmware v2.0.0 ............................. 20
BACNET FLOW CONTROLLER

PRODUCT OVERVIEW

General Information

The BACnet Flow Controller (BFC) is a BTL listed DDC fan controller designed specifically for controlling flow through Fan Filter Units (FFU) with EC motor technology. The BFC controls an EC motor through a local setpoint which is adjustable using a push button interface on the BFC, by an analog BAS input voltage, or over BACnet.

In addition to fan control, the BFC can monitor filter pressure drop, filter loading, signal for filter changes, monitor the motor and filter lifetime in hours, as well as report airflow and air temperature over the filter. This information can be viewed from the LCD screen on the front of the BFC controller, or over BACnet on a building management system.

NOTE: This manual only covers the BFC controller. For troubleshooting an ECM motor, please visit http://www.priceindustries.com and download the ECM Motor Troubleshooting Manual.

FRONT OF BFC CONTROLLER

1. Service Port RJ12 Jack
2. BACnet Connection RJ45 Jacks
3. Up and Down arrow buttons for navigation
4. Menu button for info menu and entering Service menus

BACK OF BFC CONTROLLER

1. Service Port RJ12 Jack
2. BACnet Connection RJ45 Jacks
3. 24 VAC Power Connection
4. Pressure Transducer
5. 0-10 VDC Analog Outputs
6. 24 VAC Binary Outputs
7. Contact Closure
8. Analog Inputs
9. Thermistor Input
10. Motor #1 Jack
11. BACnet MS/TP Terminals
Typical Wiring

![Typical Wiring Diagram]

**NOTE 1:**
Use RJ45 jacks for BACnet connection, or 3 position terminal block for 3-wire connection (+, -, NetCom). NetCom must be wired.

**Input/Output Description**

<table>
<thead>
<tr>
<th><strong>Analog Outputs</strong></th>
<th>Configurable for Unit Pressure, CFM (Air Flow), RPM (Motor Speed), Filter Load and BAS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO1</td>
<td></td>
</tr>
<tr>
<td>AO2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>24 VAC Binary Outputs</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BO1</td>
<td>Red LED out</td>
</tr>
<tr>
<td>BO3</td>
<td>Green LED out</td>
</tr>
<tr>
<td>COM</td>
<td>COMMON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Analog Inputs</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AI1</td>
<td>Input voltage for remote fan speed control</td>
</tr>
<tr>
<td>AI2</td>
<td>Spare</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermistor Input</td>
<td>Analog input for monitoring air over filter temperature, 10k type J thermistor</td>
</tr>
<tr>
<td>Contact Closure</td>
<td>Binary input</td>
</tr>
</tbody>
</table>
# BACNET FLOW CONTROLLER

## DISPLAY NAVIGATION

### Initial Startup

When the BFC controller is powered up with 24VAC it will display the following information:

<table>
<thead>
<tr>
<th>PRICE ELECTRONICS</th>
<th>Start-up screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFC VERSION X.X.X</td>
<td>Displays firmware version</td>
</tr>
<tr>
<td>ECM SPEED X RPM</td>
<td>Displays RPM of motor 1</td>
</tr>
<tr>
<td>ECM SETPOINT X %</td>
<td>Displays ECM setpoint in % motor speed</td>
</tr>
<tr>
<td>UNIT STATUS XXX</td>
<td>Displays current unit status (Off, Normal, No RPM Signal, and Overspeed)</td>
</tr>
<tr>
<td>CURRENT MODE XXX</td>
<td>Displays current control over the unit (BACnet, BAS, Local)</td>
</tr>
</tbody>
</table>

*LCD display will cycle between ECM SPEED, ECM SETPOINT, UNIT STATUS, CONTROL MODE, BAS SIGNAL, and BAS SETPOINT during normal operation.

**Change ECM motor setpoint using ▲ and ▼ arrow keys**

| LOCAL SETPOINT 58% | Setpoint will save after being adjusted with arrow keys |

**NOTE:** Local setpoints are stored to EEPROM and will remain set after power failures.
Service Menu

Hold down Menu button for 5 seconds, display will show 'Passcode'. Use Up and Down arrow buttons to enter this sequence: Down, Up, Up, Down.

- **FAN**
  - Allows you to see or adjust:
    - Current CFM
    - CFM Offset
    - CFM Tweak
    - Fan Type
    - Unit Size ie. 2X2
    - Wheel Type
    - Voltage Type
    - Motor Runtime (in hours)
    - Reset Motor Runtime

- **FILTER**
  - Filter Load
  - Load Trip
  - Current Pressure
  - Filter Type
  - Filter Runtime (in hours)
  - Reset Filter

- **I/O**
  - BAS (Analog In 1)
  - Analog In 2 (AO1 Usage)
  - Analog Out 1
  - Analog Out 1 Present Value
  - Analog Out 2 (AO2 Usage)
  - Analog Out 2 Present Value

- **BACNET**
  - MAC Address
  - Device Instance
  - Baud Rate
  - RS-485 Termination

- **DIAGNOSTICS**
  - Restore Defaults
**BACNET FLOW CONTROLLER**

**DISPLAY NAVIGATION**

**Service Menu – Fan**
Press Menu button to enter this menu. Use Up and Down arrow buttons to navigate through.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CURRENT CFM XXXX CFM</strong></td>
<td>Read Only</td>
</tr>
<tr>
<td><strong>CFM OFFSET 0 CFM</strong></td>
<td>Adjust airflow reading +/- up to 500 CFM to coincide with balancer measured airflow</td>
</tr>
<tr>
<td></td>
<td>Example: flow hood reads 550 CFM</td>
</tr>
<tr>
<td></td>
<td>Airflow reading on BFC is 500 cfm</td>
</tr>
<tr>
<td></td>
<td>Adjust CFM offset to +50 CFM</td>
</tr>
<tr>
<td><strong>CFM TWEAK 100 %</strong></td>
<td>Adjust airflow reading between 50 to 200%</td>
</tr>
<tr>
<td></td>
<td>Example: flow hood reads 550 CFM</td>
</tr>
<tr>
<td></td>
<td>Airflow reading on BFC is 500 cfm</td>
</tr>
<tr>
<td></td>
<td>Adjust CFM tweak to +110%</td>
</tr>
<tr>
<td><strong>FAN TYPE XXX</strong></td>
<td>Adjust fan type from Constant Volume to Constant Torque. Airflow (CFM) will be hidden if fan type is constant torque</td>
</tr>
<tr>
<td><strong>UNIT SIZE 2X2</strong></td>
<td>Displays the ECM motor calibration for FFU nominal size (2x2)</td>
</tr>
<tr>
<td></td>
<td>Selectable sizes are: 2' x 2', 2' x 3', 2' x 4'</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> Must match actual configuration of FFU.</td>
</tr>
<tr>
<td><strong>WHEEL TYPE XXX</strong></td>
<td>Adjust unit wheel type from FC to BC. Read only varying on fan type and unit size</td>
</tr>
<tr>
<td></td>
<td>The wheel type is factory set, but it can be adjusted only under the Constant Torque setting. From there, you can set the wheel type to BC on 2’ x 3’ and 2’ x 4’ units only.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> BC wheel type is for Constant Torque only.</td>
</tr>
<tr>
<td><strong>VOLTAGE TYPE XXX</strong></td>
<td>Adjust unit voltage type from 115/240/277.</td>
</tr>
<tr>
<td><strong>MOTOR RUNTIME 0 HRS</strong></td>
<td>Read Only – Displays number of hours on motor since last reset</td>
</tr>
<tr>
<td><strong>RESET MOTOR RUNTIME</strong></td>
<td>Resets Motor Runtime</td>
</tr>
<tr>
<td><strong>PRESS MENU TO EXIT</strong></td>
<td></td>
</tr>
</tbody>
</table>
**BACNET FLOW CONTROLLER**

**DISPLAY NAVIGATION**

**Service Menu – Filter**

Press Menu button to enter this menu. Use Up and Down arrow buttons to navigate through.

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILTER LOAD XX %</td>
<td>Read Only - Displays % of filter loading based on new, clean filter pressure drop</td>
</tr>
<tr>
<td>LOAD TRIP 1.50</td>
<td>Adjust filter load trip point</td>
</tr>
<tr>
<td></td>
<td>Example: Filter loading trip point at 1.50 inH2O</td>
</tr>
<tr>
<td></td>
<td>Filter calibrated pressure: 0.16 inH2O</td>
</tr>
<tr>
<td></td>
<td>Filter load will trip at .24 inH2O</td>
</tr>
<tr>
<td>CURRPRESSURE 0 IN H2O</td>
<td>Read Only – Displays the current differential pressure measured across the filter</td>
</tr>
<tr>
<td>FILTER TYPE XXX</td>
<td>Adjust filter type, BTR, RSR.</td>
</tr>
<tr>
<td></td>
<td>BTR = Bench Top Removable  RSR = Room Side Removable</td>
</tr>
<tr>
<td>FILTER RUNTIME 0 HRS</td>
<td>Read Only – Displays number of hours on filter since last reset</td>
</tr>
<tr>
<td>RESET FILTER</td>
<td>Resets Filter Runtime</td>
</tr>
<tr>
<td>PRESS MENU TO EXIT</td>
<td></td>
</tr>
</tbody>
</table>
**BACNET FLOW CONTROLLER**

**DISPLAY NAVIGATION**

**Service Menu – I/O**

Press Menu button to enter this menu. Use Up and Down arrow buttons to navigate through.

- **BAS (A11)**
  - **0 VDC**
  - Read Only – Displays current input BAS voltage for motor speed control

- **AI2**
  - **0 VDC**
  - Read Only – Displays input voltage to Analog Input 2

- **AO1 USAGE**
  - **CFM**
  - Configure Analog Output 1 for:
    - Unit Press - Unit Pressure; Range (0*-2* of H2O)
    - CFM - Airflow; Range (0 - 5000 CFM)
    - RPM - Range (0 - 2500 RPM). See page 11 for RPM details.
    - Filter Life - Range (0 - 100%)
    - BAS - 0-10VDC signal to BAS
  - Disabled

- **AO1 PRESVAl**
  - **0 VDC**
  - Read Only - Present Value for Analog Output 1

- **AO2 USAGE**
  - **CFM**
  - Configure Analog Output 2 for:
    - Unit Press - Unit Pressure; Range (0*-2* of H2O)
    - CFM - Airflow; Range (0 - 5000 CFM)
    - RPM - Range (0 - 2500 RPM). See page 11 for RPM details.
    - Filter Life - Range (0 - 100%)
    - BAS - 0-10VDC signal to BAS
  - Disabled

- **AO2 PRESVAl**
  - **0 VDC**
  - Read Only - Present Value for Analog Output 2

**PRESS MENU TO EXIT**
Service Menu – BACnet

MAC ADDRESS

1

Sets unit’s MAC address

**NOTE:** the MAC address (range 1-99) is added to the device instance.

Example: MAC address = 1, device instance = 100, total address for this BFC would be 101

DEVICE INST

0,000,101

This is the ‘software’ BACnet address and must be unique to your building site.

Range: 1 – 4,194,303

BAUD RATE

76800

This sets the BACnet MS/TP baud rate

9600 baud (all BACnet devices must at least support this speed) – slowest

19200 baud

38400 baud

76800 baud (default baud rate for Price products) - fastest

RS-485 TERM, DISABLED

Enable and disable RS-485 termination on MS/TP segment.

PRESS MENU TO EXIT

Service Menu – Diagnostics

RESTORE DEFAULTS

This allows a full controller reset, and will revert all user changes back to Price defaults

PRESS MENU TO EXIT
**BACnet Wiring**

The Price BACnet Flow Controller (BFC) has the option of using a CAT 5 cable to run BACnet MS/TP, or cable hardwired into a pluggable terminal block *(see next page if using hardwired BACnet connections)*. The RJ-45 jacks for use with the supplied BACnet cables are directly tied to the pluggable terminal block, and so any combination of supplied cables and hardwired connections can be used on a single network segment.

BACnet networks must be run in a daisy chain configuration, meaning there is only one main cable and each network device is connected directly along its path, with no more than 30 devices per segment, and MS/TP segment lengths must not exceed 1050 feet.

**Termination**

BACnet MS/TP networks must be terminated to ensure proper operation. A network should be terminated twice, once at the beginning and once at the end. Termination helps reduce reflections and noise. The terminating can be done with a 100 ohm resistor across the + and - lines. Termination can also be done via software using the Price BACnet Flow Controller. For more information see the BACnet Service Menu section of this manual.

**Tech Tip:** The Price BACnet MS/TP to IP Router has built in termination and it is enabled by default (since the router is typically the beginning of the entire MS/TP network). Now you only have to go and find/terminate that last device.

**Electrical Noise**

Electrical noise can affect both analog signal and digital communications such as BACnet. Therefore do not route high voltage lines next to the BACnet network! Avoid noisy electrical sources such as:

- Variable Frequency Drives
- High current power lines (main panel feeds)
- Fluorescent light fixtures

If you must pass near noisy electrical lines cross at right angles. This will help reduce the amount of noise coupled to the network wires.
BACNET FLOW CONTROLLER

PRODUCT OVERVIEW

Use Price supplied CAT-5 cables for BACnet whenever possible. If not possible to use Price supplied cables, follow these wire specifications.

Network Wire Specifications

For the BACnet MS/TP network specific wire is required. Do not use standard power or “thermostat” wire. This wire does not have the necessary requirements for digital communications. While it’s possible it may work (temporarily) the network will be unreliable and not operating at optimal performance.

BACnet MS/TP Wire type recommendations

- Use 2 balanced twisted pairs, one for + and -, one for NET COM
- Low capacitance (17pF or less)
- Plenum rated (FT6, CMP ratings)
- 100-120 ohm, Balanced
- (CAT5, CAT5E, CAT6 network cable has excellent specifications and will work in almost any BACnet MS/TP application.)

- Price controllers use the Orange Compliment for (+), the Orange for (-), and the Brown and Brown Compliment together for the (NET COM) connections. These are paired in a standard CAT5E cable. Pre-terminated CAT5 cables are available from Price. Model code: NETC35 (35 ft plenum rated cable, terminated with RJ45 plugs, 568-B standard)

Use RJ45 jacks for BACnet connection, or 3 position terminal block for 3-wire connection (+, -, NET COM) NET COM must be wired.
PRODUCT OVERVIEW

BACnet Service Menu

Each controller’s MAC address, Device Instance, and Baud rate are set in the BACnet sub-menu of the service menu accessed through the LCD screen on the face of the BFC. For information on how to select a MAC address and Device instance for any controller on a network, see following pages.

To set the controller’s BACnet settings, enter the Service Menu and adjust settings as follows:

NOTE: When the screen displays a flashing value, that value is ready to be changed and can be adjusted by pressing the arrow keys. Pressing Menu will save the value.

Hold down the Menu button on the LCD Thermostat for 5 seconds until prompted for a passcode; use 
 and to enter the passcode; DOWN, UP, UP, DOWN.

The screen will now display “SERVICE MENU: FAN”

Scroll down to the BACnet sub-menu.

Press the Menu button to enter this menu.

Screen will now show “MAC ADDRESS = 1”. This is the default setting and can be programmed between 1 and 99 by pressing Menu and using the UP and DOWN arrows ( ).

Use to scroll to whatever MAC you are intending to set this controller to, once you arrive at the number, press Menu to save

NOTE: By default, the MAC address will appear as the last 2 digits of the device instance.

The device instance defaults to 100, but will be displayed with the last 2 digits as the MAC if the previous screen was set to enabled. Press Menu then use the arrow keys to change the device instance.

NOTE: Each Menu press will change allow changes in different tiers of the device instance (so that you don’t have to scroll for extended periods to get into the millions range – supposing that’s where you need to set your device instance)

The baud rate is the speed that the MS/TP network runs at. EVERY device on the network must run at the same speed.

Price controllers are defaulted to a baud rate of 76800, but can be changed to 38400, 19200, or 9600. For a network segment with all Price controllers, it’s recommended that the baud rate be left at 76800.

*Choose lower baud rates only when integrating with devices by other manufacturers whose maximum speed is lower than 76800 (eg. 38400).

Once all settings are made, scroll down and press Menu. The controller will then re-start, this is because all BACnet info is only read once at startup.
BACNET FLOW CONTROLLER

PRODUCT OVERVIEW

BACnet Networking and Setup

Setting the MAC Address:

MAC (media access control) must be UNIQUE on an MS/TP network segment within building. An installer setting up an MS/TP segment must ensure each device has a UNIQUE MAC Address (Range 1-99). The MAC Address is set through the LCD thermostat or LCD setup tool.

**NOTE:** Each device on a network segment must be set to run at the same speed or baud rate.

**NETWORK SEGMENT #1 ▼**

**NETWORK SEGMENT #2 ▼**

**TECH TIP ▼**

24 VAC power HOT and COMMON polarities are critical and must not be reversed on ANY devices! Reverse polarity will stop communication on that MS/TP segment. All 24 VAC transformers must be grounded on their secondary side for BACnet to work.

NET COM wire must be connected at each device and is critical for BACnet network reliability. Use one twisted pair for + and -, and another twisted pair for NET COM for optimal noise cancellation.
### BACNET FLOW CONTROLLER

#### PRODUCT OVERVIEW

**Setting the Device Instance (Coupled MAC and DI)**

**Device Instance:**

A Device Instance number identifies a device within an entire building, therefore giving it a unique number or Address, much like a telephone ext. number. A building can have one telephone number, but all the extensions have a unique number to identify them. A Device Instance number would work the same way and must be unique throughout the building.

Below is a table defining how a Device Instance number is obtained.

**NOTE:** Each device on a network segment must be set to run at the same speed or baud rate.

<table>
<thead>
<tr>
<th>Description</th>
<th>Default Value (Factory)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC Address</td>
<td>6</td>
<td>Value: limited to 1-99</td>
</tr>
<tr>
<td>Tier 1 (x100)</td>
<td>58</td>
<td>Value: limited to 0-99</td>
</tr>
<tr>
<td>Tier 2 (x10,000)</td>
<td>1</td>
<td>Value: limited to 0-99</td>
</tr>
<tr>
<td>Tier 3 (x1,000,000)</td>
<td>0</td>
<td>Value: limited to 0-4</td>
</tr>
</tbody>
</table>

**Example Device Instance setup with Default settings:**

- MAC Address = 6 (6 x 1 = 6) – Set through software
  
  + TIER 1 = 58 (58 x 100 = 5800) – Set through software
  
  + TIER 2 = 1 (1 x 10,000 = 10,000) – Set through software
  
  + TIER 3 = 0 (0 x 1,000,000 = 1,000,000) – Set through software

  \[
  \text{Final Device Instance} = 0,015,806 \]

  \[
  \begin{array}{cccc}
  \text{Tier3} & \text{Tier2} & \text{Tier1} & \text{MAC Address} \\
  0 & 01 & 58 & 06 \\
  \end{array}
  \]
BACNET FLOW CONTROLLER

PRODUCT OVERVIEW

Setting the Device Instance (De-coupled MAC and DI)

Device Instance:
A Device Instance number identifies a device within an entire building, therefore giving it a unique number or Address, much like a telephone ext. number. A building can have one telephone number, but all the extensions have a unique number to identify them. A Device Instance number would work the same way and must be unique throughout the building.

Below is a table defining how a Device Instance number is obtained.

**NOTE:** Each device on a network segment must be set to run at the same speed or baud rate.

<table>
<thead>
<tr>
<th>Description</th>
<th>Example Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 (x01)</td>
<td>4</td>
<td>Value: limited to 1-99</td>
</tr>
<tr>
<td>Tier 2 (x100)</td>
<td>58</td>
<td>Value: limited to 0-99</td>
</tr>
<tr>
<td>Tier 3 (x10,000)</td>
<td>1</td>
<td>Value: limited to 0-99</td>
</tr>
<tr>
<td>Tier 4 (x1,000,000)</td>
<td>0</td>
<td>Value: limited to 0-4</td>
</tr>
</tbody>
</table>

Example Device Instance setup with Default settings:

- TIER 1 = 4 (4 x 1 = 4) – Set through software
  + TIER 2 = 58 (58 x 100 = 5800) – Set through software
  + TIER 3 = 1 (1 x 10,000 = 10,000) – Set through software
  + TIER 4 = 0 (0 x 1,000,000 = 1,000,000) – Set through software

= Final Device Instance = 0,015,806
BACNET FLOW CONTROLLER

NETWORKING & SETUP

Network Layout
The BFC can be connected over BACnet MS/TP and added to an existing BAS front end system. Price also offers its own mini front-end system known as FFU-BFC-FE which acts as a graphics package. The Price WEB Server allows the user to view variables such as filter status, CFM, etc. for each FFU and modify setpoints as needed.

Devices
Webserver: Provides the graphical web interface, plugs into IP Router. 2000 node capacity.
IP Router: Acts as interface between Internet and internal system. 5 ports. 1 Port for Building WAN (Internet/Building Network – You cannot plug a BACnet Router or IP Switch into this port). 4 LAN Ports available (Used for BACnet Routers and IP Switches).
BACnet Router: Interfaces between BACnet MS/TP system and IP Router (internet). Supports 30 FFU.
IP Switch: Expands available connections for BACnet router, 5 ports.

| CONNECTION EXAMPLE (LESS THAN 30 UNITS) |

![Network Diagram](image-url)
## BACNET FLOW CONTROLLER

### NETWORKING & SETUP

#### CONNECTION EXAMPLE (GREATER THAN 30 UNITS)

<table>
<thead>
<tr>
<th>Max # of Units</th>
<th>QTY of BACnet Routers</th>
<th>QTY of IP Switches</th>
<th>QTY of IP Router</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>90</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>120</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>150</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>180</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>210</td>
<td>7</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>240</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>270</td>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>300</td>
<td>10</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>330</td>
<td>11</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Assumes two ports on IP router are filled with BACnet routers (i.e. 60 FFU’s total). More units are supported, contact Critical Environments applications team for more information.
BACNET FLOW CONTROLLER

INSTALLATION & MOUNTING INSTRUCTIONS

Package/Component Identification

Web Additional

The WEB-ADDITIONAL package is used to connect additional FFU systems to the WEB-MASTER system.

Components:

250000-931 - PRTU Bacnet Router

1. PRTU-BAC-RTR
2. NETC2 cable (to connect to PRTU-IP-RTR)
3. DIN Rail

PRTU IP Switch

The IP-SWITCH is required if there are more than 3 PRTU systems being connected to the Web Server. This component is used to expand the “LAN” port on the IP-RTR, allowing a further 3 PRTU systems to be connected. See the example layout section of this manual for further detail.

Examples:

- 1-3 PRTU Systems: No IP Switch required
- 4-6 PRTU Systems: Qty: 1 IP Switch required
- 7-9 PRTU Systems: Qty: 2 IP Switch required

Components:

250000-933 - PRTU IP Switch

1. PRTU-IP-SWITCH
2. NETC2 cable (to connect to PRTU-IP-RTR)
3. DIN Rail

Please ensure you have all components before proceeding. Inspect components for shipping damage. Do not install components that appear damaged. Contact your local PRICE Sales Rep for quick ship replacements.

As always, for the latest information and video please visit priceindustries.com.

priceindustries.com | BACNET FLOW CONTROLLER - Manual 17
BACNET FLOW CONTROLLER

INSTALLATION & MOUNTING INSTRUCTIONS

Location

The Front-End components should be mounted in an accessible location close to a network connection. Price suggests mounting these components in the network or server room.

The WEB-SERVER, PRTU-IP-RTR, PRTU-BAC-RTR, and PRTU-IP-SWITCH (if applicable) should all be mounted together.

MOUNTING DETAILS

PRTU-IP-RTR  PRTU-BAC-RTR  WEB-SERVER  PRTU-IP-SWITCH

MOUNT TOGETHER IN SERVER ROOM

LONG-DISTANCE MS/TP CONNECTION
(SEE WIRING SECTION)
BACNET FLOW CONTROLLER

INSTALLATION & MOUNTING INSTRUCTIONS

Mounting

Use the included DIN rail to securely mount the Front-End components.

1. Using 3 screws (by others) mount the DIN rail horizontally to a secure, accessible surface.
2. Hang the Price PRTU-WEB onto the DIN rail using the TOP white clips.
3. Using the Price Electronics screwdriver, gently pull down on the BLACK clip, while pushing gently on the WEB-SERVER towards the DIN rail. The Price Web Server should click securely into place.
4. Use the mounting clips on the rear of the BAC-RTR, IP-RTR, or IP-SWITCH to mount the components to the DIN rail. Slip the top clip behind the DIN rail flange, then use steady pressure to push the component down then back towards the DIN rail to secure.
5. The same section of DIN rail can be used to mount multiple components.
BACNET FLOW CONTROLLER

NETWORKING & SETUP

BAS Input Signal

The BAS input signal overrides the local setpoint using a remote 0 – 10VDC signal. If the BAS signal drops below 1VDC local control (via the push buttons) is restored.

<table>
<thead>
<tr>
<th>BAS Voltage</th>
<th>Response</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1 VDC</td>
<td>Local control mode using push buttons</td>
<td>Local setpoint can be adjusted from 0 – 100% using push buttons</td>
</tr>
<tr>
<td>1-2 VDC</td>
<td>Motor Off</td>
<td>Recommend sending a 1.5 VDC signal to command motor off</td>
</tr>
<tr>
<td>2-9 VDC</td>
<td>Modulating Control</td>
<td>2 – 9 VDC modulates motor from 0 – 100%</td>
</tr>
<tr>
<td>9-10 VDC</td>
<td>Maximum Speed</td>
<td>Motor is running at maximum speed (100%)</td>
</tr>
</tbody>
</table>

BAS equations exist in each fan powered terminal product service and installation manual to relate CFM to volts DC. The VDC in the equations however are for the 1-5 volt scale of voltage measured across the manual mode POT taps. The BAS input voltage is a 2-10 VDC scale, and therefore VDC calculated for a given CFM using the equation must be doubled to achieve that cfm using the BAS input. See standard speed controller BAS section for an example of calculating the voltage required for a specific CFM.

If the BFC will be connected to BACnet, the BACnet motor speed setpoint will override both the BAS analog input, and the local setpoint for motor speed control.

Motor speed setpoint priorities are:

1. BACnet
2. BAS analog signal
3. Local setpoint adjust
Analog RPM Feedback

A two wire connection supplies an analog (0-10 VDC) signal that is directly proportional to the MOTOR 1 RPM. The range is 0 – 2500 RPM and it will output a proportional 0 – 10 VDC signal. If a dual blower system is used, only the RPM of motor 1 can be read.

**NOTE:** The minimum speed of an ECM is approximately 250 RPM. Formula for outputs below (tolerance +/- 5%):

- VDC output = (RPM /250)
- Rpm = (VDC * 250)

Output signal: 0 – 10 VDC @ 20 k ohm minimum input impedance and is short circuit protected (output impedance is 511 ohm to protect against incorrect wiring).

- Black Wire – Analog RPM output com (-)
- White Wire – Analog RPM output signal (+)
Wiring and Cables

*For in depth ECM motor troubleshooting, please refer to ECM Troubleshooting Manual on Price Industries' website.

The ECM speed controller requires 24 VAC power from a transformer and outputs control signals to the ECM motor on dual MTA-100 jacks. Either jack or both jacks can be used (for dual fan systems).

The control cable (with RED connector) must be plugged into the circuit board correctly. (See Figure 2)

**NOTE:** Make sure that this cable is connected properly. It is keyed one way, and make sure all of the pins are covered.
## Troubleshooting

<table>
<thead>
<tr>
<th>Fault</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary Outputs not functioning</td>
<td>The Binary outputs send out 24VAC and are factory wired to the LED on the FFU. Make sure the BFC has 24VAC power, and then check voltage at binary outputs and COM terminals if the LED does not light up.</td>
</tr>
<tr>
<td>Analog Outputs not functioning</td>
<td>The Analog outputs send out 0-10VDC. Make sure the BFC has 24VAC power, and then check voltage at the suspect analog output with a multimeter. You should see a voltage range of 0-10VDC.</td>
</tr>
<tr>
<td><strong>BACnet Communication Errors</strong></td>
<td><strong>Option #1</strong></td>
</tr>
<tr>
<td></td>
<td>BACnet - MS/TP is based on a RS-485 network. It must be wired in a daisy chain configuration. A daisy chain means that there is only one main cable, and every network device is connected directly along its path.</td>
</tr>
<tr>
<td></td>
<td>DO NOT use Star, Bus, “T”, or any other type of network configuration. Any of these other network configurations will result in an unreliable network, and make troubleshooting almost impossible.</td>
</tr>
<tr>
<td></td>
<td>Correct polarity is imperative on MISTP wiring. Always ensure that the positive terminal on a device has the same color wire connected to it throughout the network, same for the negative terminal. Eg. 2 wire conductor with black and white wires – black to the positive terminal, and white to the negative terminal. Keep this consistency throughout the network.</td>
</tr>
<tr>
<td></td>
<td><strong>Option #2</strong></td>
</tr>
<tr>
<td></td>
<td>Price does not use EOL or termination on their devices. Terminating a device is almost never required at the low baud rate of MS/TP devices. In fact terminating can create more problems than it solves.</td>
</tr>
<tr>
<td></td>
<td>The network speed or baud rate must be the same throughout the network.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> The default speed for Price BACnet MS/TP controls is 76800. BACnet MS/TP currently supports 4 standard speeds which are: 9600, 19200, 38400 and 76800.</td>
</tr>
<tr>
<td></td>
<td><strong>Option #3</strong></td>
</tr>
<tr>
<td></td>
<td>Binary Address must be unique for each device on the network. No two devices can have the same Address. This includes if you are incorporating a Price product into an existing network. Determine the existing Addressing scheme for the existing network. The Address is set on the Addressable dip switches on the UMCB.</td>
</tr>
<tr>
<td></td>
<td><strong>Option #4</strong></td>
</tr>
<tr>
<td></td>
<td>Grounding and 24VAC polarity: Proper grounding is absolutely essential when wiring the MS/TP BACnet Network. Proper grounding will prevent many potential problems that can occur in a network of devices. Common symptoms of a poorly grounded network can include inconsistent BACnet MS/TP communications and damage from voltage spikes. The most practical method of grounding is to ground every 24VAC transformer common/neutral used to power the controls.</td>
</tr>
<tr>
<td></td>
<td>Connect the “common/neutral” wire of the SECONDARY side of the transformer to earth ground – such as the ground screw on in the electrical box.</td>
</tr>
<tr>
<td></td>
<td><strong>Option #5</strong></td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> Flipping 24VAC HOT and COMMON will cause the BACnet MS/TP Network to stop communicating!! Ensure HOT and COMMON are not reversed on ANY controllers.</td>
</tr>
<tr>
<td></td>
<td><strong>WARNING:</strong> Controllers will still power up and run even if HOT and COMMON are reversed. However output signals to other devices such as heaters, relays, etc will not work as intended!</td>
</tr>
</tbody>
</table>
## BACNET FLOW CONTROLLER

### MAINTENANCE

#### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power:</strong></td>
<td>Pluggable 24 VAC, 50/60 Hz, 50 VA Class 2</td>
</tr>
<tr>
<td><strong>Input Power:</strong></td>
<td>24 VAC, 50/60 Hz, 5 VA (plus external loads), Class 2</td>
</tr>
<tr>
<td><strong>Environmental (operating):</strong></td>
<td>10°C to 50°C (50°F to 122°F), 0% to 95% RH (non-condensing)</td>
</tr>
<tr>
<td><strong>Environmental (storage):</strong></td>
<td>-30°C to 50°C (50°F to 122°F), 0% to 95% RH (non-condensing)</td>
</tr>
<tr>
<td><strong>Inputs:</strong></td>
<td>1 Thermistor Input (10K Ohm, Type J)</td>
</tr>
<tr>
<td></td>
<td>2 Analog Inputs: 0-10 VDC</td>
</tr>
<tr>
<td></td>
<td>1 Contact Closure Input</td>
</tr>
<tr>
<td><strong>Outputs:</strong></td>
<td>3 Binary Outputs (24 VAC) for LEDs</td>
</tr>
<tr>
<td></td>
<td>2 Analog Outputs (10 mA maximum, 0-10 VDC)</td>
</tr>
<tr>
<td></td>
<td>2 ECM motor connections</td>
</tr>
<tr>
<td><strong>Networking:</strong></td>
<td>BACnet (MS/TP)</td>
</tr>
<tr>
<td><strong>Indicators:</strong></td>
<td>BACnet RX/TX and Fault lights</td>
</tr>
</tbody>
</table>
### BACnet Flow Controller

#### Maintenance

**BACnet points list for BFC firmware v2.0.0**

<table>
<thead>
<tr>
<th>Object</th>
<th>Name</th>
<th>Units</th>
<th>Default</th>
<th>Range</th>
<th>Description</th>
<th>R/W</th>
<th>RETAINED ON POWER FAILURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI1</td>
<td>Analog Input 1 (BAS)</td>
<td>Volts DC</td>
<td>Dynamic</td>
<td>Dynamic</td>
<td>Analog Output can be tied to several signals. See O&amp;M manual for detail. I/O Menu</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AI2</td>
<td>Analog Input 2</td>
<td>Volts DC</td>
<td>Dynamic</td>
<td>Dynamic</td>
<td>Analog Output can be tied to several signals. See O&amp;M manual for detail. I/O Menu</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AI3</td>
<td>Thermistor</td>
<td>°F/°C</td>
<td>Dynamic</td>
<td>(-59)-300</td>
<td>Current air temperature over filter</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AI4</td>
<td>ECM Speed</td>
<td>r/min</td>
<td>Dynamic</td>
<td>0-2500</td>
<td>Current RPM of motor</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AI5</td>
<td>Unit Pressure</td>
<td>inH2O</td>
<td>Dynamic</td>
<td>Dynamic</td>
<td>Current differential pressure measured across the filter</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>BI1</td>
<td>Contact Closure</td>
<td>Contacts Open/ Closed</td>
<td>Dynamic</td>
<td>Contacts Open/ Closed</td>
<td>Binary Input for monitoring only</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AO1</td>
<td>Analog Output 1 (RPM)</td>
<td>Volts DC</td>
<td>N/A</td>
<td>0-10 VDC</td>
<td>Configurable for Unit Pressure, CFM, RPM, Filter Load and BAS</td>
<td>R/W</td>
<td>Y</td>
</tr>
<tr>
<td>AO2</td>
<td>Analog Output 2 (Filter Load)</td>
<td>Volts DC</td>
<td>N/A</td>
<td>0-10 VDC</td>
<td>Configurable for Unit Pressure, CFM, RPM, Filter Load and BAS</td>
<td>R/W</td>
<td>Y</td>
</tr>
<tr>
<td>AO3</td>
<td>ECM Setpoint</td>
<td>%</td>
<td>50</td>
<td>0-100</td>
<td>Set ECM motor setpoint</td>
<td>R/W</td>
<td>Y</td>
</tr>
<tr>
<td>AV1</td>
<td>Filter Load</td>
<td>%</td>
<td>0</td>
<td>0-100%</td>
<td>Current percent of filter loading based on new, clean filter pressure drop</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AV2</td>
<td>Filter Runtime</td>
<td>Hours</td>
<td>N/A</td>
<td>0-99999</td>
<td>Current number of hours on filter since last reset. Enter value of zero after filter has been replaced and calibrated</td>
<td>R/W</td>
<td>Y</td>
</tr>
<tr>
<td>AV3</td>
<td>Motor Runtime</td>
<td>Hours</td>
<td>N/A</td>
<td>0-99999</td>
<td>Current number of hours on motor since last reset</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AV4</td>
<td>Airflow</td>
<td>Cfm</td>
<td>N/A</td>
<td>0-9999</td>
<td>Current airflow</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AV5</td>
<td>Filter Calibrated Pressure</td>
<td>inH2O</td>
<td>N/A</td>
<td>Dynamic</td>
<td>Unit pressure when filter was calibrated</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AV6</td>
<td>Filter Trip Pressure</td>
<td>inH2O</td>
<td>0</td>
<td>Dynamic</td>
<td>Filter trip pressure</td>
<td>R</td>
<td>N</td>
</tr>
<tr>
<td>AV7</td>
<td>Filter Loading Trip Point</td>
<td>Numeric</td>
<td>1.5</td>
<td>1-3</td>
<td>Set filter loading trip point</td>
<td>R/W</td>
<td>Y</td>
</tr>
</tbody>
</table>
# BACNET FLOW CONTROLLER

## MAINTENANCE

**BACnet points list for BFC firmware v2.0.0**

<table>
<thead>
<tr>
<th>Object</th>
<th>Name</th>
<th>Units</th>
<th>Default</th>
<th>Range</th>
<th>Description</th>
<th>R/W</th>
<th>RETAINED ON POWER FAILURE</th>
</tr>
</thead>
</table>
| MV1    | Unit Status           | Text  | Dynamic | 4 States | 1 Off  
          2 Normal  
          3 No RPM Signal  
          4 Overspeed      | R    | N           |
| MV2    | Control Mode          | Text  | Dynamic | 3 States | 1 BACnet  
          2 BAS  
          3 Local | R    | Y           |
| MV3    | Unit Fan Type         | Text  | Dynamic | 2 States | 1 Constant Torque  
          2 Constant Volume | R    | Y           |
| MV4    | Unit Size             | Text  | Dynamic | 3 States | 1 2x2  
          2 2x3  
          3 2x4 | R    | Y           |
| MV5    | Unit Filter Type      | Text  | Dynamic | 2 States | 1 BTR  
          2 RSR | R    | Y           |
| MV6    | Unit Wheel Type       | Text  | Dynamic | 2 States | 1 FC  
          2 BC | R    | Y           |
| MV7    | Unit Voltage Type     | Text  | Dynamic | 3 States | 1 115  
          2 240  
          3 277 | R    | Y           |