RUSKIN

Air Quality Solutions

Technical Bulletin

Temp: 72.8°F
Velo: 5632 ACFM

RUSKIN

| MENU | ESC | UP | DOWN | ENTER |

Model: TDP05K

Advanced Thermal Dispersion Airflow & Temperature Measuring System

TDP05K Advanced Thermal Dispersion Airflow & Temperature Measuring System

Technical Bulletin
TDP05K

TDP05K Advanced Thermal Dispersion Probe Airflow Measuring System

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Document Introduction

This document describes the TDP05K Advanced Thermal Dispersion Probe Airflow Measuring System's features and functions. It also provides guidelines and instructions for setting up and troubleshooting these devices used in plenum and duct applications.

Navigating the Start-Up Menu

After installing the TDP05K Airflow Measuring System, power on the unit. Menu options appear on the front panel LCD display of the primary controller and are replicated on the remote user interface (see Figure 1). The LCD display has a 16 character per line, 2-line display.

Figure 1: Front Panel LCD Display of Primary TDP05K Controller & Remote User Interface

The display boot screen indicates the firmware version.
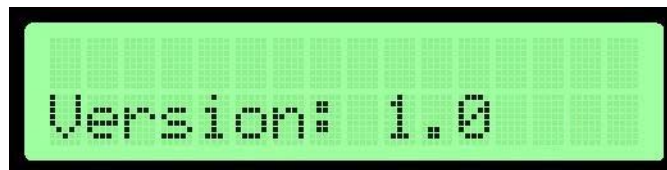
After 5 seconds, the display indicates the number of active probes and sensors. This example indicates one active probe and four total sensors.

After another 5 seconds, the display indicates that the unit is warming up.
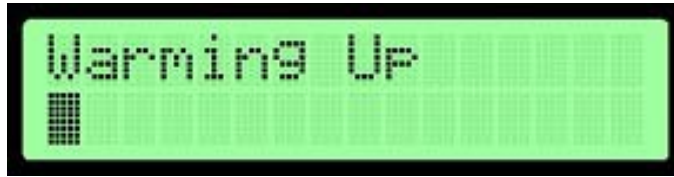
Normal Operation

The normal operation screens display the average temperature and average velocity or volume in the units selected.

When the display is configured for the International System of Units (SI), the display shows the temperature in Celsius and the average velocity in meters per second or the volume as liters per minute. See Table 3 for the available units.

When the display is configured for Imperial, the display shows the temperature in Fahrenheit and the average velocity in Actual Cubic Feet per Minute. See Table 3 for the available units.
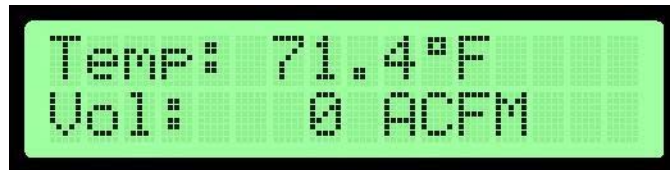
Note: An asterisk (*) appears on the top left corner of the display if the number of sensors has changed during normal operation mode.

Configuration

The onboard microprocessor in the TDP05K primary probe allows for system configuration, operating parameter selection, analog output configuration, and display filtering. The primary probe is the automation interface and also acts as a primary across a wired network to other ancillary probes (up to 15) and the remote display when that option is selected.

Note: Each primary and ancillary probe automatically reports temperature and flow based on the number of installed sensors (1 through 8) per probe.

Verify configuration and change certain parameters, within defined ranges, in the configuration mode.

Membrane Push Buttons

You can use the five membrane push buttons (MENU, ESC, UP, DOWN, and ENTER) on the front panel display cover to interface with the TDP05K primary controller.

You can use these push buttons during system configuration setup and while performing certain functions in the normal operation mode.

Navigating the Menu Options

The left arrow (→) symbol appears on the left side of the currently selected menu, submenu, or option. Press ENTER to access the selected option.

```
→Out1 mA Offset
 Out1 mA High
```
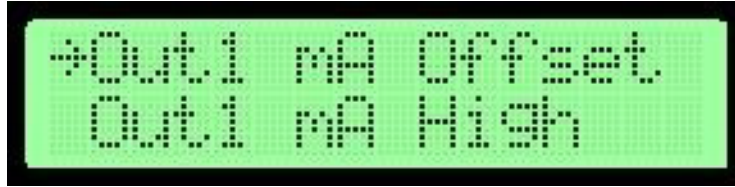
The up and down arrow (↕) symbol on line two of the display indicates that the selected digit or character can increment and decrement one character or digit at a time. The character or digit blinks when selected.

```
Num Data Points
1    ↕
```

Press the UP or DOWN buttons to scroll through the available menu and submenu options.

Press ESC to return to the previous menu without making updates to the currently selected option. Press ESC from the Operator or Supervisor Menu to return to normal operation mode.

Press MENU at any time to return to the normal operation mode.

To enter numerical values into a submenu selection option, enter the digits one at a time beginning with the leftmost digit. Press UP or DOWN to scroll through the numbers 0 through 9. When the correct value is displayed, press ENTER. The cursor automatically moves to the next position. If an error is made after pressing ENTER, press ESC to return to the previous digit.

Navigating the Operator Menu

The Operator Menu allows you to view, set, or change system parameters. System configuration setup in the Operator Menu may be required when connected to a building automation system.

1. During normal operation when the LCD screen displays the average temperature and average velocity or volume, press **MENU** and **UP or DOWN** until the arrow is next to Operator Menu.

```
→Operator Menu
 Supervisor Menu
```
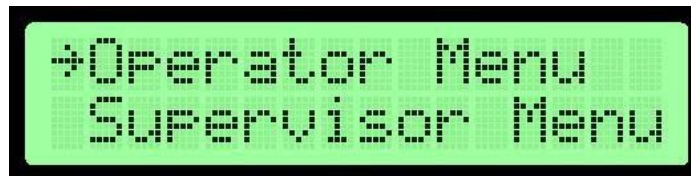
2. Press **ENTER** to enter the Operator Menu submenu options.

    a. If the Operator PIN is enabled, the LCD screen displays the following message:

```
Enter OPER PIN
0000
```

(1) Enter the 4-digit PIN to access the Operator Menu. PIN entry is made one digit at a time beginning with the leftmost digit. Press **UP or DOWN** to scroll through the numbers 0 through 9.

(2) When the correct number is displayed, press **ENTER** to select the digit. The cursor automatically moves to the next position. If an error is made after you press ENTER, press ESC to go back and change the digit.

Note: If the PIN is not correctly entered, the display returns to normal operation.

b.   If the Operator PIN is not enabled, the Operator Menu selections display.

Note: See *Enable, Disable, and Change the Operator PIN* for more information about enabling the PIN.

3. Press **UP or DOWN** to scroll through the available menu selections. See Table 1 for a list of Operator Menu submenus and their descriptions.

Note: Each Operator Menu submenu has submenu selections to access the configurable options.

Table 1:   Operator Menu Submenus

Operator Menu Submenus (Actual Display Name)	Submenu Description
Enable Operator PIN (Enable Oper PIN)	Allows user to select a PIN to access the Operator Menu and prevents unauthorized access of the Operator Menu
Change Operator PIN (Change Oper PIN)	Allows user to change the Operator Menu PIN.
Flow Configuration (Flow Config)	Configures system variables including duct size and shape, elevation, process type, and process maximum/units.
Display Configuration (Display Config)	Selects LCD display parameters.
Analog Output 1 Parameters (Output 1 Param)	Selects Analog Output 1 parameters including temperature, flow, or none.
Analog Output 2 Parameters (Output 2 Param)	Selects Analog Output 2 parameters including temperature, flow, or none.
Temperature Low Pass Filter (Temp LPF)	Selects the amount of filtering applied to the analog output for temperature.
Flow Low Pass Filter (Flow LPF)	Selects the amount of filtering applied to the analog output for flow.
Analog Output Calibration (Output Cal Menu)	Adjusts the span for the analog outputs to match the input expected values.
Temperature Balance Menu (Temp Bal Config)	Selects an offset to apply to the reported average temperature including front panel display, BACnet®, and Analog Outputs 1 and 2.
K-Factor Configuration (KFactor Config)	Turns the K-Factor on and off and allows for the calculation or selection of gain and offset values.
Menu Inactivity Timeout (Menu Timeout)	Selects a time period after which the backlight on the front panel display turns off when no menu activity is detected and automatically returns to normal operation.
BACnet Configuration (Network Cfg)	Configures BACnet settings and turn BACnet on and off.
BACnet Flow Alarm Configuration (Flow Alarm Cfg)	Configures high and low setpoints, deadband, and alarm delay settings and turns the BACnet flow high and low alarms on and off.

Table 1:   Operator Menu Submenus

Operator Menu Submenus (Actual Display Name)	Submenu Description
BACnet Temperature Alarm Configuration (Temp Alarm Cfg)	Configures high and low setpoints, deadband, and alarm delay settings and turns the BACnet temperature high and low alarms on and off.
Exit Operator Menu (Exit Oper Menu)	Returns the display to normal operation.

Enable, Disable, and Change the Operator PIN

The Enable Operator PIN and Change Operator PIN menu options enable or disable the Operator Menu PIN and change the current PIN.

Note: The PIN is not set or enabled on a device with factory-default settings.

Selected Submenu

Submenu Selection Display
*Default values shown
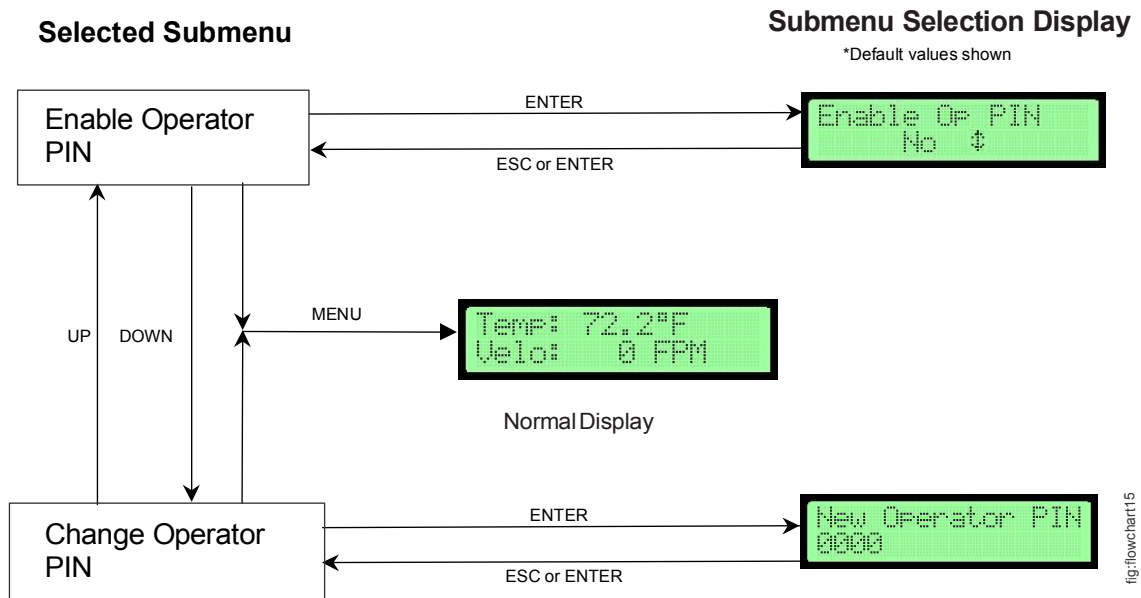
Figure 2: Operator PIN Flowchart

Note: If the Enable Operator PIN option is selected, the Operator Menu can only be accessed with a PIN.

To enable or disable the PIN:

1. Enter the **Enable Operator PIN** submenu.
2. Press **UP or DOWN** to choose Yes to enable the PIN or No to disable the PIN.
3. Press **ENTER** to confirm your selection.

To update the PIN:

1. Enter the **Change Operator PIN** submenu.
2. Press **UP or DOWN** to scroll through the numbers 0 through 9.
3. When the correct number is displayed, press **ENTER** to select the digit. The cursor automatically moves to the next position. If an error is made after pressing ENTER, press ESC to return to the previous digit.
4. Enter the **last digit** and press **ENTER** to store the PIN number. The display returns to the Operator Menu submenu display. Alternatively, press ESC to return to the Operator Menu without updating the PIN.

Note: If the PIN settings are enabled, the PIN number must be entered each time the Operator Menu is entered.

Flow Configuration

The Flow Configuration submenu stores the application-specific data for unique applications. The typical data includes units of measure, duct type and size, flow units, site elevation, system ranges, and output lockdown.

Selected Submenu	Submenu Selections	Submenu Selection Display

Default values shown

```
Flow Configuration   --ENTER-->   Duct Shape   --ENTER-->   Duct Shape
                     <--ESC---                  <--ESC or ENTER--   Rect ↕

                                UP ↑ ↓ DOWN

                                  Duct Height  --ENTER-->   Duct Height
                                               <--ESC or ENTER--   000.0 in

                                UP ↑ ↓ DOWN

                                  Duct Width   --ENTER-->   Duct Width
                                               <--ESC or ENTER--   000.0 in

                                UP ↑ ↓ DOWN

                                  Duct Diameter  --ENTER-->  Duct Diameter
                                                 <--ESC or ENTER--  000.0 in

                                UP ↑ ↓ DOWN

                                  Duct Area¹    --ENTER-->   Duct Area
                                                <--ESC or ENTER--  000.0 sq ft

                                UP ↑ ↓ DOWN

                                  Site Elevation  --ENTER-->  Elevation
                                                  <--ESC or ENTER--  00000 ft

                                UP ↑ ↓ DOWN

                                  Relative Humidity  --ENTER-->  Rel Humidity
                                                     <--ESC or ENTER--  50 % ↕

                                UP ↑ ↓ DOWN

                                  Flow Units   --ENTER-->   Flow Units Type
                                               <--ESC or ENTER--   actual/sec ↕

                                UP ↑ ↓ DOWN

                                  Max Full Range  --ENTER-->  Max Full Range
                                                  <--ESC or ENTER--  0000.00 ft/min

                                UP ↑ ↓ DOWN

                                  Output Lockout  --ENTER-->  Output Lockout
                                                  <--ESC or ENTER--  050.00 ft/min

                                UP ↑ ↓ DOWN

                                  Exit this Menu  -------->   Returns to
                                                  --ENTER-->  Operator Menu
```

fig:f:flowchart2

1. Duct Area controls area input when the Other duct shape is selected.

Figure 3: Flow Configuration Flowchart

Table 2: Flow Configuration Submenu Selections and Configurable Options

Flow Configuration Submenu Selections	Configurable Options
Duct Shape	Select between rectangle, round, oval, or other duct shapes.
Duct Width	Select between 0 to 120 in. or 0 to 304.8 cm.
Duct Height	Select between 0 to 120 in. or 0 to 304.8 cm.
Duct Diameter	Select between 0 to 120 in. or 0 to 304.8 cm.
Duct Area	Scroll between 0 to 100 square feet or 0 to 9.3 square meters. A value not stored or out of range error displays of the entry exceeds the design range. The units are previously determined.
Site Elevation	Select between 0 to 15,000 feet or 0 to 4,572 meters. The units are previously determined.
Relative Humidity	Select between 0 and 99% relative humidity 1% at a time. Holding the button increases the speed at which the value changes.
Flow Units	Select between the units listed in Table 3.
Output Lockout	Enter three digits with two decimal places. Units are in ft/min or m/sec.

1. In the Operator Menu, press **UP or DOWN** to scroll to the Flow Configuration submenu.

2. Press **ENTER**.

3. Scroll through the submenu options and make any necessary updates. See Table 2 for a description of the Flow Configuration submenu selection options and their configurable options.

See Table 3 and Table 4 for the available selections for units appropriate for the flow type.

Table 3: Volumetric Units of Measurement from Flow Unit Selection and Display Units

Actual Flow Units[1]	SI Units	Imperial Units		Standard Flow Units	SI Units	Imperial Units
Actual/Sec	ALPS	ACFS		Standard/Sec	SLPS	SCFS
Actual/Min	ALPM	ACFM		Standard/Min	SLPM	SCFM
Actual/Hour	ACMH	ACFH		Standard/Hour	SCMH	SCFH

1. Actual Flow Units is the default setting.

Table 4: Volumetric Units of Measurement (Part 1 of 2)

Volumetric Units of Measurement	Display
Actual Cubic Feet Per Second	ACFS
Actual Cubic Feet Per Minute	ACFM
Actual Cubic Feet Per Hour	ACFH
Actual Liters Per Second	ALPS
Actual Liters Per Minute	ALPM
Actual Cubic Meters Per Hour	ACMH
Standard Cubic Feet Per Second	ACFS
Standard Cubic Feet Per Minute[1]	SCFM
Standard Cubic Feet Per Hour	SCFH

Table 4: Volumetric Units of Measurement (Part 2 of 2)

Volumetric Units of Measurement	Display
Standard Liters Per Second	SLPS
Standard Liters Per Minute	SLPM
Standard Cubic Meters Per Hour	SCMH

1.   The standard conditions for Standard Cubic Feet Per Minute airflow measurements are as follows: 14.696 pounds per square inch (psia) equals 101.325 kPa at sea level. 70 degrees Fahrenheit equals 15.6 degrees Celsius. 50% relative humidity (RH).

Display Configuration

The Display Configuration submenu is used to configure display units, parameters, and line 2 customization. The level of display filtering from 0 to 4 (0 is off, 4 is 80%) is also configurable.
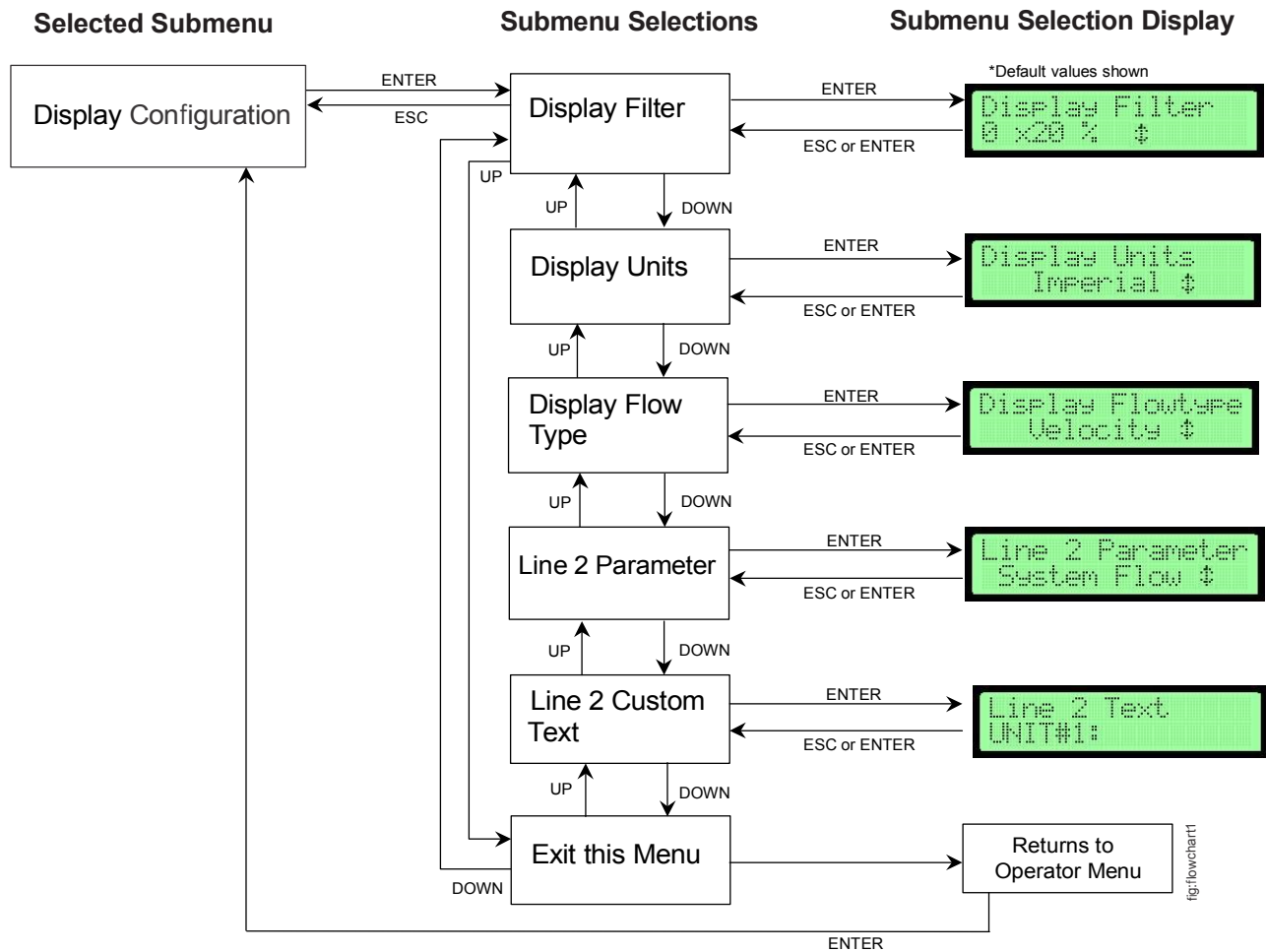
Selected Submenu **Submenu Selections** **Submenu Selection Display**

Figure 4: Display Configuration Flowchart

Table 5: Display Configuration Submenu Selections and Configurable Options

Display Configuration Submenu Selections	Configurable Options
Display Filter	Select between 0 and 4 where 0 is off. Filtering is equal to the value times 20%. A value of 2 is equal to 40% filtering.
Display Units	Select between SI and Imperial
Display Flow Type	Select between velocity and volume
Line 2 Parameters	Select between System Flow and Custom Text for text appearing in line 2 of the display
Line 2 Custom	Select up to seven ASCII characters to display in line 2 of the display. See *Selecting Custom Text* for more information.

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1. In the Operator Menu, press **UP or DOWN** to scroll to the Display Configuration submenu.

2. Press **ENTER**.
3. Scroll through the submenu options and make any necessary updates. See Table 5 for a description of the Display Configuration submenu selection options and their configurable options.

Selecting Custom Text

1. Scroll to the **Line 2 Custom** submenu and press **ENTER**.

2. Press **UP or DOWN** to scroll through the available character set. See Figure 5 for a list of available characters.


Figure 5: Custom Text Character Chart

3. Press **ENTER** to choose a character when it is displayed. The character is stored and the cursor advances one position to the right. Press ESC to return to the previous character.

4. Fill the line with characters for the remaining positions. After the seventh character is entered, the custom text is stored in memory and the display returns to the Display Configuration submenu.

Analog Output 1 Parameters

The Analog Output 1 Parameters submenu is used to select the process variables that Output 1 represents. Available process variables include flow, temperature, and none. If flow is selected, the output represents the defined flow design range.

Note: The factory-default setting for Analog Output 1 is airflow velocity. However, Output 1 or Output 2 can be configured for either airflow or temperature.

Selected Submenu   **Submenu Selection Display**

*Default values shown
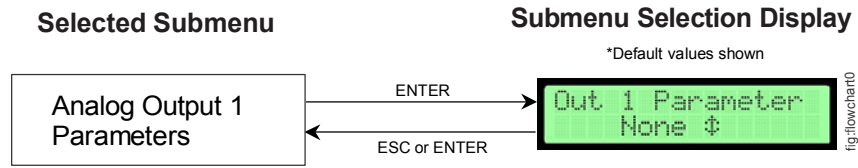
Figure 6: Analog Output 1 Parameters Flowchart

Table 6:   Analog Output 1 Submenu Selection and Configurable Option

Analog Output 1 Submenu Selection	Configurable Option
Output 1 Parameters	Select between none, flow, and temperature.

1. In the Operator Menu, press **UP or DOWN** to scroll to the Analog Output 1 submenu.

2. Press **ENTER**.
3. Make any necessary updates to the submenu selection. See Table 6 for a description of the Analog Output 1 submenu selection option and its configurable option.

Analog Output 2 Parameters

The Analog Output 2 Parameters menu allows you to select the process variables that Output 2 represents. Available process variables include flow, temperature, and none. If flow is selected, the output represents the defined flow design range. If temperature is selected, the output span is your temperature design range.

The temperature default is -25.6 to 120.2°F (-32°C to 49°C)

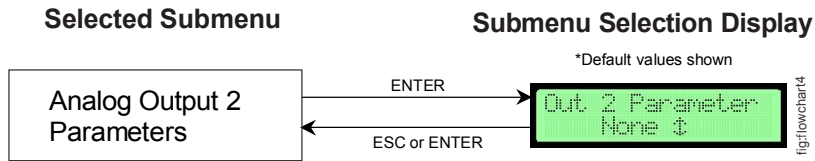**Note:** The factory-default setting for Analog Output 2 is temperature.

Figure 7: Analog Output 2 Parameters Flowchart

Table 7: Analog Output 2 Submenu and Configurable Options

Analog Output 2 Submenu	Configurable Option
Output 2 Parameters	Select between none, flow, and temperature.

1. In the Operator Menu, press **UP or DOWN** to scroll to the Analog Output 2 submenu.
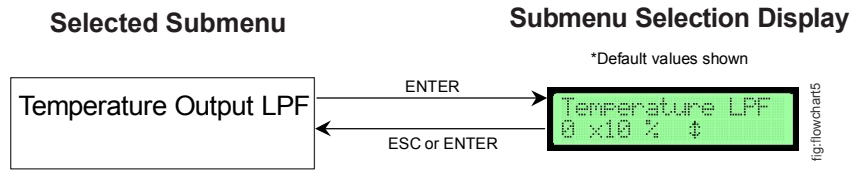

2. Press **ENTER**.

3. Make any necessary updates to the submenu selection. See Table 7 for a description of the Analog Output 2 submenu selection option and its configurable option.

Temperature Output LPF (Low Pass Filter)

The Temperature Output LPF (Low Pass Filter) submenu is used to select the level of process filtering applied to the temperature outputs. The levels are 0 to 9, with 0 indicating the filter is off and 9 indicating maximum filtering. The filtering affects the reported temperature values and analog channels configured for temperature. Display Filter is an additional filter selection applied only to the display.

Note: Each unit of filtering is equal to 10% filtering. For example, 2 is equal to 20%.

Figure 8: Temperature Output LPF Flowchart

Table 8:   Temperature Output LPF Submenu Selection and Configurable Option

Temperature Output LPF Submenu Selection	Configurable Option
Temperature Output LPF	Select between 0 to 9 (9 equals 90% filtering).

1. In the Operator Menu, press **UP or DOWN** to scroll to the Temperature Output LPF submenu.
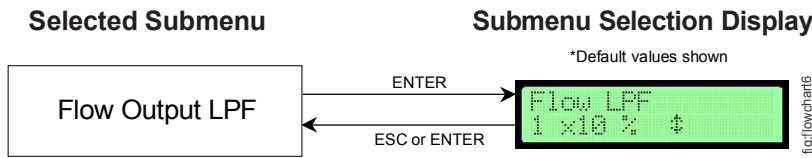

2. Press **ENTER**.
3. Make any necessary updates to the submenu selection. See Table 8 for a description of the Temperature Output LPF submenu selection option and its configurable option.

Flow Output LPF

The Flow Output LPF submenu allows you to select the level of process filtering applied to the flow outputs. The levels are 0 to 9, with 0 indicating the filter is off and 9 indicating maximum filtering. The filtering affects the reported flow values and analog channels configured for flow. Display Filter is an additional filter selection applied only to the display.

Note: Each unit of filtering is equal to 10% filtering. For example, 2 is equal to 20%.

Figure 9: Flow Output LPF Flowchart

Table 9: Flow Output LFP Submenu Selection and Configurable Option

Flow Output LPF Submenu Selection	Configurable Option
Flow LPF Selection	Select between 0 to 9 (9 equals 90% filtering)

1. In the Operator Menu, press **UP or DOWN** to scroll to the Flow Output LPF submenu.

2. Press **ENTER**.
3. Make any necessary updates to the submenu selection option. See Table 9 for a description of the Flow Output LPF submenu selection option and its configurable option.

Analog Output Calibration

The Analog Output Calibration submenu is used to calibrate adjustments to Analog Outputs 1 and 2. Span is used to obtain the greatest resolution over the expected or design operating range.
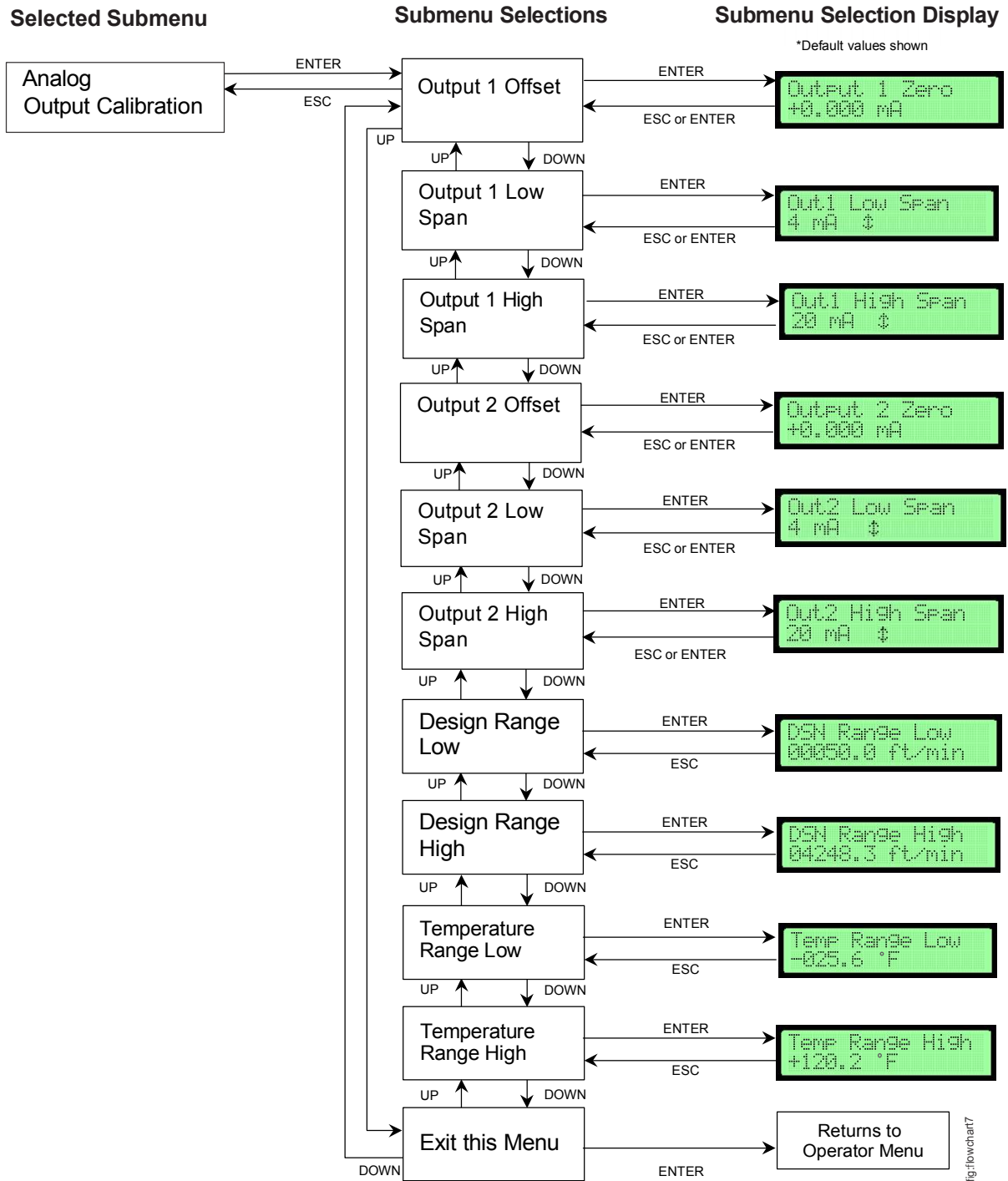
Selected Submenu	Submenu Selections	Submenu Selection Display

*Default values shown

Selected Submenu: Analog Output Calibration

ENTER → Output 1 Offset → ENTER → `Output 1 Zero +0.000 mA`
ESC ← (ESC or ENTER)

UP / DOWN → Output 1 Low Span → ENTER → `Out1 Low Span 4 mA ↕`
(ESC or ENTER)

UP / DOWN → Output 1 High Span → ENTER → `Out1 High Span 20 mA ↕`
(ESC or ENTER)

UP / DOWN → Output 2 Offset → ENTER → `Output 2 Zero +0.000 mA`
(ESC or ENTER)

UP / DOWN → Output 2 Low Span → ENTER → `Out2 Low Span 4 mA ↕`
(ESC or ENTER)

UP / DOWN → Output 2 High Span → ENTER → `Out2 High Span 20 mA ↕`
(ESC or ENTER)

UP / DOWN → Design Range Low → ENTER → `DSN Range Low 00050.0 ft/min`
ESC

UP / DOWN → Design Range High → ENTER → `DSN Range High 04248.3 ft/min`
ESC

UP / DOWN → Temperature Range Low → ENTER → `Temp Range Low -025.6 °F`
ESC

UP / DOWN → Temperature Range High → ENTER → `Temp Range High +120.2 °F`
ESC

UP / DOWN → Exit this Menu → ENTER → Returns to Operator Menu

fig:flowchart7

Figure 10: Analog Output Calibration Flowchart

Table 10: Analog Output Calibration Submenu Selections and Configurable Options

Analog Output Calibration Submenu Selections	Configurable Options
Output 1 mA Offset	Select between ±0 to 2 mA adjustment range
Output 1 mA Low Span	Select between 1 to 4 mA
Output 1 mA High Span	Select between 1 to 20 mA. This value must be higher than the low span value of Output 1.
Output 2 mA Offset	Select between ±0 to 2 mA adjustment range
Output 2 mA Low Span	Select between 1 to 4 mA
Output 2 mA High Span	Select between 1 to 20 mA. This value must be higher than the low span value of Output 2.
Design Range Low	Selects the low range of output flow spanning
Design Range High	Selects the maximum range of output flow spanning
Temperature Range Low	Select between -34.6 to 129.2°F (-37 to 54°C) for low range of output temperature spanning
Temperature Range High	Select between -34.6 to 129.2°F (-37 to 54°C) for maximum range of output temperature spanning

Note: By default, the TDP05K Airflow Measuring System is factory calibrated.

Calibrating the Analog Output

To calibrate the analog output with the primary probe mounted in its operating location or in a calibration lab:

1. Set the Analog Output 1 parameter to **None** to keep the output from changing with flow or temperature. See *Analog Output 1 Parameters* for instructions.

2. In the Operator Menu, press **UP or DOWN** to scroll to the Output Calibration submenu.

3. Press **ENTER**. Scroll to the **Output 1 mA Offset** submenu selection and press **ENTER**.

4. The display indicates the current Analog Output 1 offset.

5. Connect a digital multi-meter set to scale Analog Output 1 across terminals 1 and 2 on the TDP05K Airflow Measuring System. See Figure 11 for terminal locations.
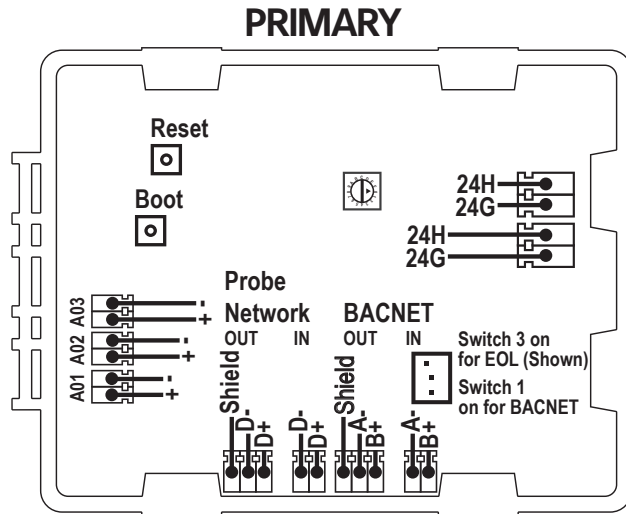
PRIMARY

Figure 11: TDP05K Airflow Measuring System—Terminals 1 and 2

Note: The output value should be between 1 and 20 mA. To align the load resistance with the digital multi-meter, connect the actual process load or a resistor of similar value to the actual process load (250 ohm/minute). The digital multi-meter should read a minimum value of 4.00 ± 0.01 mA as determined in Output 1 Span.

6. If the digital multi-meter reads out of tolerance, press **UP or DOWN** to adjust the output for an acceptable reading. Once the last digit is entered, the digital multi-meter reflects the adjusted Output 1 offset value.

7. Press **UP or DOWN** in the Output Calibration submenu to scroll to the Output 1 mA Low Span submenu selection.

8. Press **ENTER**. The display indicates the current Output 1 low span value.
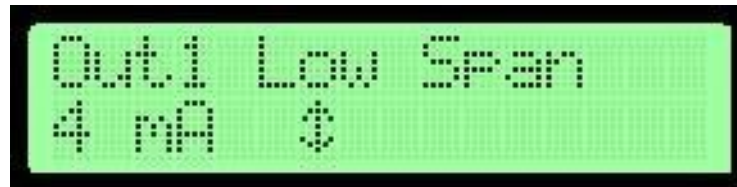
9. Press **UP and DOWN** to scroll between 1 and 4 mA to set the low span value.

Note: The low span value must be set lower than the high span value.

---

10. Once the low span is set, press **ENTER**. In the Output Calibration submenu, scroll to the **Output 1 mA High Span** submenu selection and press ENTER.

```
→Out1 mA High
 Out1 mA Low
```

11. The display indicates the current Analog Output 1 high span value. Press **UP or DOWN** to set the high span by scrolling between 1 and 20 mA. The high span value must be higher than the low span value.

```
Out1 High Span
20 mA    ↕
```

12. Once the high span is set, press **ENTER** to confirm the setting.

13. Set the parameter for Analog Output 1 to its previous value before the calibration process. See *Analog Output 1 Parameters* for instructions.

14. Repeat Steps 1 through 13 for Analog Output 2. In Step 5, connect the digital multi-meter across terminals 3 and 4.

15. After both outputs are configured and calibrated, if necessary, configure the Design Range Low, Design Range High, Temperature Range Low, and Temperature Range High submenu selections.

16. In the Operator Menu, press **UP and DOWN** to scroll to the **Analog Output Calibration** submenu. Press **ENTER**.

```
 Flow LPF
→Output Cal Menu
```

17. Scroll through the submenu options and make any necessary updates. See Table 10 for a description of the Analog Output Calibration submenu selection options and their configurable options.

Temperature Balance Configuration

The Temperature Balance Configuration submenu applies a temperature offset to the displayed and reported temperature and the temperature used for analog outputs.
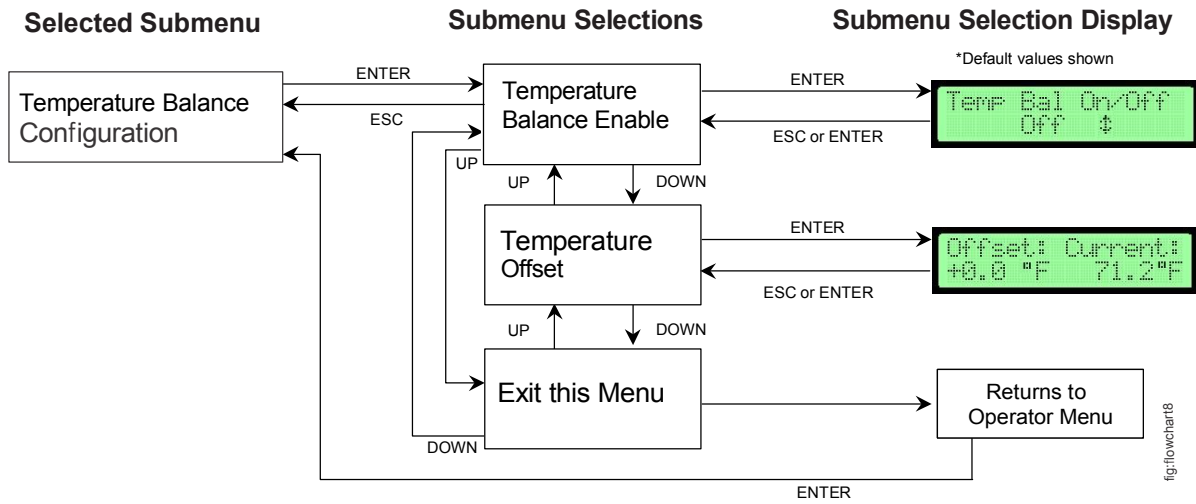

Figure 12: Temperature Balance Flowchart

Table 11: Temperature Balance Configuration Submenu Selections and Configurable Options

Temperature Balance Configuration Submenu Selections	Configurable Options
Temperature Balance Enable	Select On or Off.
Temperature Offset Selection	Enter the currently selected value. The temperature displayed on the left side of line 2 is the offset and the value on the right side of line 2 is a live view of the current temperature with the last confirmed offset value.The offset range is ±5.4°F (±3°C).

1. In the Operator Menu, press **UP or DOWN** to scroll to the Temperature Balance Configuration submenu.
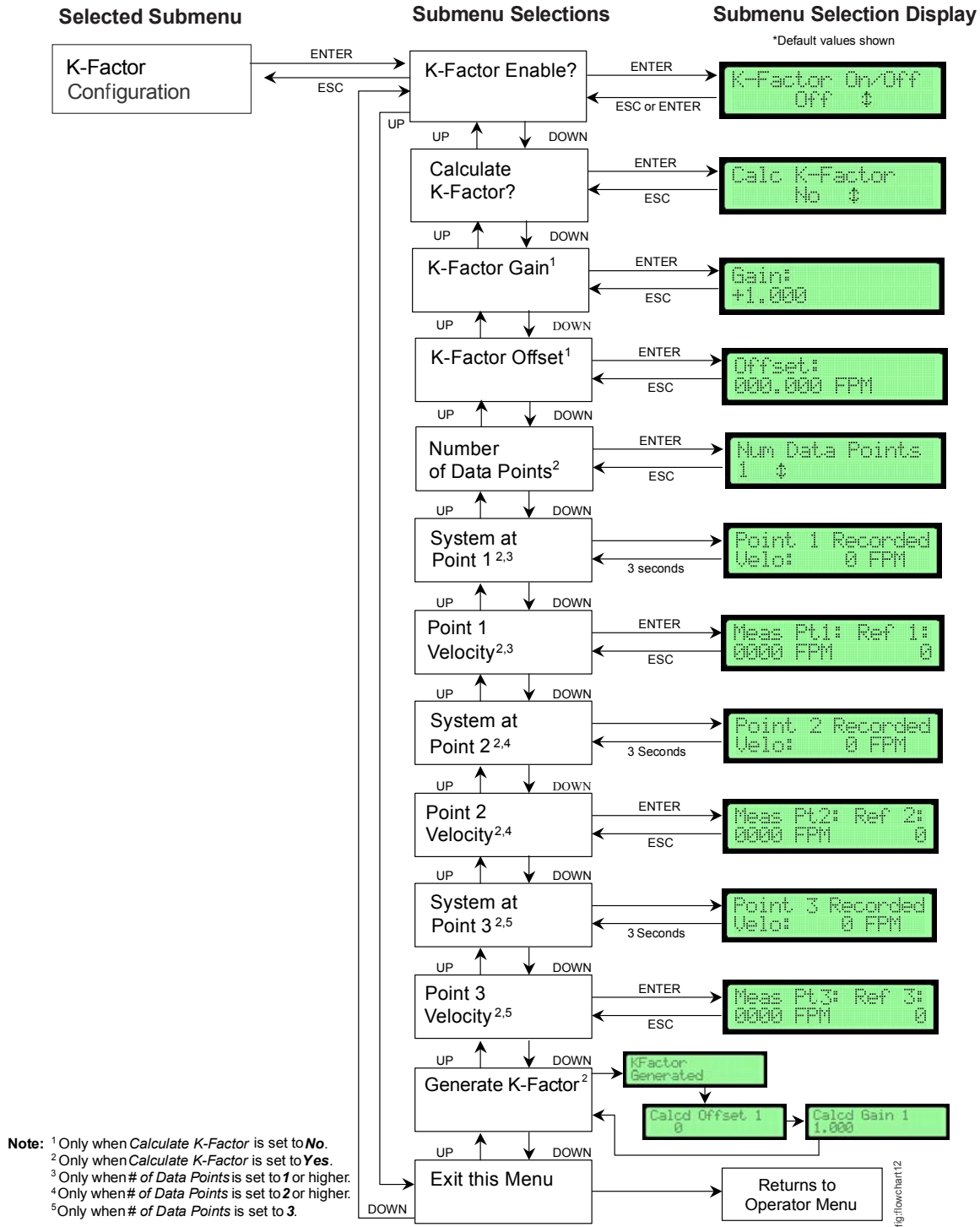

2. Press **ENTER**.

3. Scroll through the submenu options and make any necessary updates. See Table 11 for a description of the Temperature Balance Configuration submenu selection options and their configurable options.

K-Factor Configuration

The K-Factor Configuration submenu turns K-Factor on and calculates a K-Factor gain and offset from measured and reference data. The K-Factor gain and offset values can also be manually configured

Note: The auto K-Factor feature only works in FPM at this time..

Selected Submenu	Submenu Selections	Submenu Selection Display

Note: [1] Only when *Calculate K-Factor* is set to *No*.
[2] Only when *Calculate K-Factor* is set to *Yes*.
[3] Only when *# of Data Points* is set to *1* or higher.
[4] Only when *# of Data Points* is set to *2* or higher.
[5] Only when *# of Data Points* is set to *3*.

Figure 13: K-Factor Configuration Flowchart

Table 12: K-Factor Configuration Submenu Selections and Configurable Options

K-Factor Configuration Submenu Selections	Configurable Options
K-Factor Enable?	Select On or Off.
Calculate K-Factor	Select between Yes or No.
Manual Gain[1]	Update the currently selected value.
Manual Offset[1]	Update the currently selected value.
Number of Data Points[2]	Select between one to three points for calculating the K-Factor.
System at Point 1[2]	Record the current velocity over the sensors as reference point 1.
Point 1 Velocity[2]	Update the currently selected value. Reference point 1 is displayed on the right side and the measured value is entered on the left.
System at Point 2[2]	Record the current velocity over the sensors as reference point 2.
Point 2 Velocity[2]	Update the currently selected value. Reference point 2 is displayed on the right side and the measured value is entered on the left.
System at Point 3[2]	Record the current velocity over the sensors as reference point 3.
Point 3 Velocity[2]	Update the currently selected value. Reference point 3 is displayed on the right side and the measured value is entered on the left.
Generate K-Factor[2]	Calculate and update the K-Factor values used then display the calculated values.

1. This submenu selection only appears when Calculate K-Factor is set to No.
2. This submenu selection only appears when Calculate K-Factor is set to Yes.

Configuring the K-Factor

1. In the Operator Menu, press **UP or DOWN** to scroll to the **K-Factor Configuration** submenu.

2. Press **ENTER** to view the K-Factor Configuration submenu. Scroll to the **K-Factor Enable?** submenu selection.

3. Press **ENTER**. The display indicates the current K-Factor setting (Off or On).

4. Press **UP or DOWN** to change the setting and **ENTER** to confirm the setting. The new setting is stored in memory and the display returns to the K-Factor Configuration submenu.

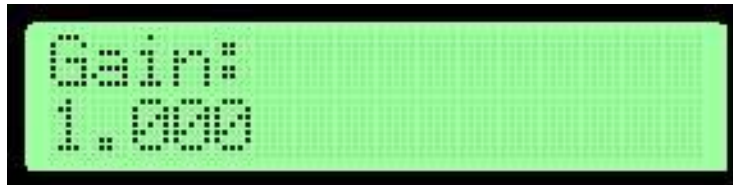5. Press **UP or DOWN** to scroll to the **Calculate K-Factor** submenu selection and press **ENTER**.

```
KFactor Enable?
→Calc KFactor?
```

6. Press **UP and DOWN** to scroll between Yes or No. Press **ENTER** to make a selection. If No is selected, see _Automatic Calculation of K-Factor Not Enabled_. If Yes is selected, see _Automatic Calculation of K-Factor Enabled_.

Automatic Calculation of K-Factor Not Enabled

1. When K-Factor is not enabled, the K-Factor Configuration submenu formats itself for manual K-Factor entry mode. Scroll to the **K-Factor Gain** submenu selection and press **ENTER**.

```
→KFactor Gain
 KFactor Offset
```

2. Press **ENTER** to adjust the manual K-Factor gain. Press **UP or DOWN** to modify the currently selected value.

```
Gain:
1.000
```

3. Press **ENTER** to confirm the value and return to the K-Factor Configuration submenu.

4. Scroll to the **K-Factor Offset** submenu selection.

```
 KFactor Gain
→KFactor Offset
```

5. Press **ENTER** to adjust the manual K-Factor gain. Press **UP or DOWN** to modify the currently selected value.

```
Offset:
+000 FPM
```

6. Press **ENTER** to confirm the value and return to the K-Factor Configuration submenu.

Automatic Calculation of K-Factor Enabled

Automatic K-Factor calculations can be adjusted to use up to three data points in the calculation. One data point calculates and uses one offset. Two data points calculate and use one offset and one gain in one equation. Three data points calculate and use two offsets and two gains in two equations that meet at the middle point.

1. In the K-Factor Configuration submenu, scroll to the **Number of Data Points** submenu selection.

```
Calc KFactor?
➜Num of Data Pts
```

2. Press **ENTER**. Press **UP or DOWN** to select the number of points to use in the K-Factor calculation.

```
Num Data Points
1    ↕
```

3. Press **ENTER** to confirm the value and return to the K-Factor Configuration submenu.
4. Scroll to the **System at Point 1** submenu selection.

```
Num of Data Pts
➜System @ Pt 1?
```

5. Press **ENTER**. Run the air handling system unit to the first K-Factor setpoint. Once the appropriate velocity is displayed on the external device, press **ENTER** to store the sensor data and measured velocity in FPM as the reference value for calculating the K-Factor equation. The display indicates the value is stored and displays the value for 3 seconds.

```
Point 1 Recorded
Velo:     0 FPM
```

Note: Allow the system at least 60 seconds after a velocity state change to balance the displayed readings.

6. The display returns to the K-Factor Configuration submenu. Scroll to the **Point 1 Velocity** submenu selection.

```
System @ Pt 1?
➜Pt 1 Velocity
```

7. Press **ENTER** to enter the first measured K-Factor setpoint that is acquired from an external device. Press UP or DOWN to modify the currently selected digit.
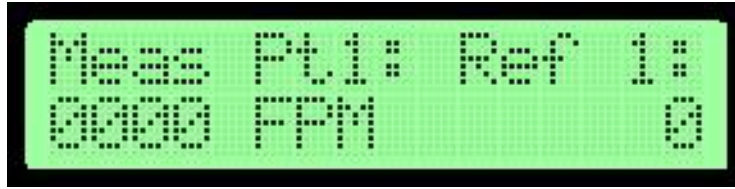
Note: The left side of the display indicates the measured value and the right side shows the corresponding reference value that was recorded for that point.
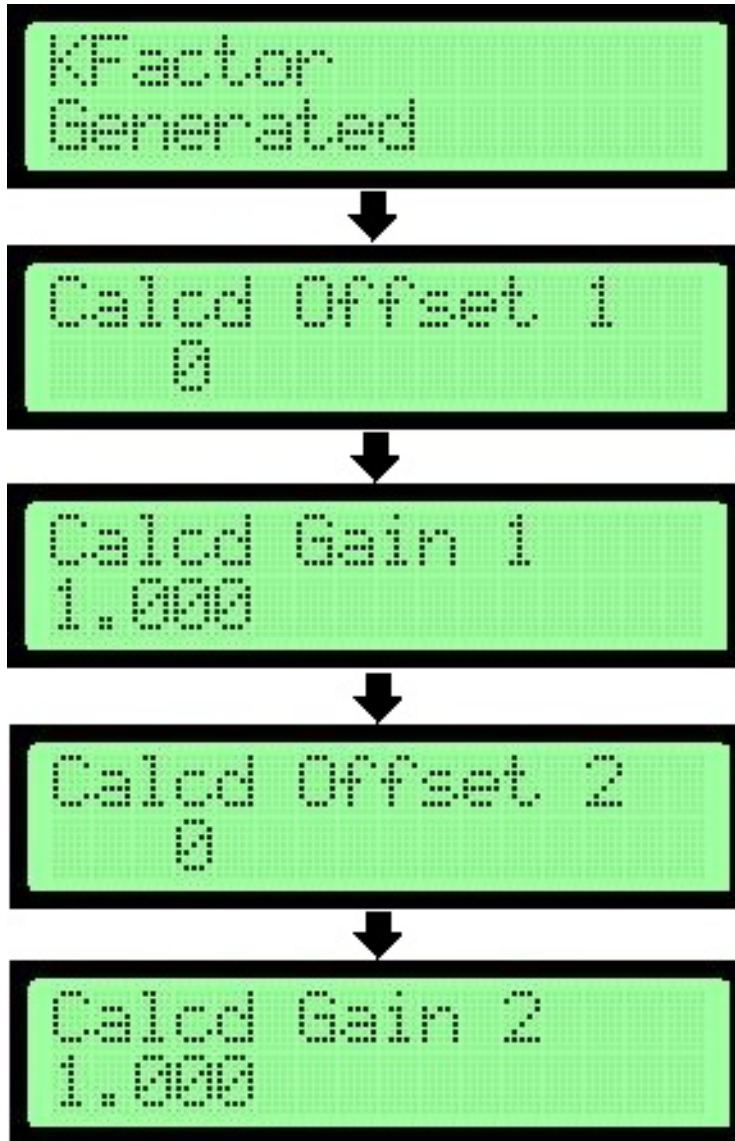
8. Press **ENTER** on the last digit to confirm the value and return to the K-Factor Configuration submenu.

9. If the number of data points from Step 2 was set for more than one, repeat Steps 4 through 8 for each point. Point 2 must be higher than point 1 and point 3 must be higher than point 2. When all points are recorded, continue to Step 10.

10. Press **UP or DOWN** to scroll to the Generate K-Factor submenu selection.

Note: The line above Generate K-Factor may display a different number depending on the number of data points selected.

11. Press **ENTER** to generate the K-Factor equation values.

Note: When one data point is selected, the display indicates the K-Factor Generated and Calculated Offset 1 screens. When two data points are selected, the display indicates the K-Factor Generated, Calculated Offset 1, and Calculated Gain 1 screens. When three data points are selected, all five screens display.

.

```
KFactor
Generated
```

⬇

```
Calcd Offset 1
        0
```

⬇

```
Calcd Gain 1
1.000
```

⬇

```
Calcd Offset 2
        0
```

⬇

```
Calcd Gain 2
1.000
```

12. In the Operator Menu, press **UP or DOWN** to scroll to the K-Factor Configuration submenu.

```
  Temp Bal Config
→KFactor Config
```

13. Press **ENTER**.

14. Press **UP or DOWN** to scroll through the submenu options and make any necessary updates. See Table 12 for a description of the K-Factor Configuration submenu selection options and their configurable options.

Menu Timeout

The Menu Timeout submenu is used to select a time in minutes after which the device backlight dims and the device returns to normal operation mode if no activity is detected in the Operator Menu.
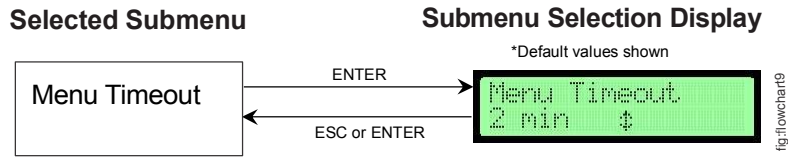
Figure 14: Menu Timeout Flowchart

Table 13: Menu Timeout Submenu Selection and Configurable Option

Menu Timeout Submenu Selection	Configurable Option
Menu Timeout	Select from 0 to 30 minutes. A value of 0 indicates the display never times out and the backlight is always on.

1. In the Operator Menu, press **UP or DOWN** to scroll to the Menu Timeout submenu.

2. Press **ENTER**.

3. Make any necessary updates to the submenu selection. See Table 13 for a description of the Menu Timeout submenu selection option and its configurable option.

BACnet Network Configuration

The BACnet Network Configuration submenu turns BACnet on or off and configures parameters based on the BACnet type.
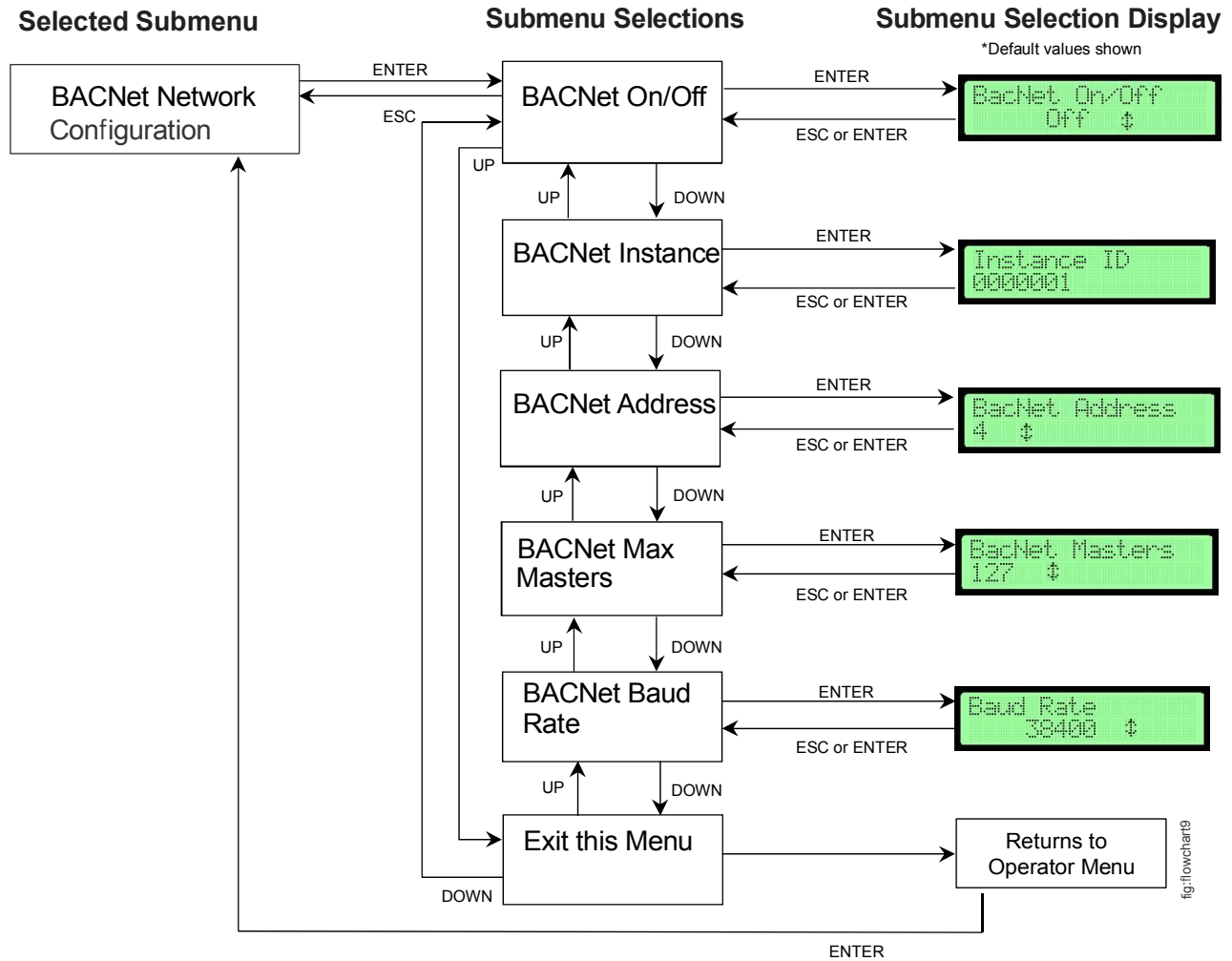

Figure 15: BACnet Configuration Flowchart

Table 14: BACnet Network Configuration Submenu Selections and Configurable Options

BACnet Network Configuration Submenu Selections	Configurable Options
BACnet On/Off	Select On or Off.
BACnet Instance	Update the currently selected value. The instance number must be unique from all BACnet devices on the entire system. The range of values is 1 to 4,194,302.
BACnet Address	Select a value between 4 and 127. Holding down the button increases the rate the value updates.
BACnet Max Mast	Select a value between 1 and 127. Holding down the button increases the rate the value updates.
BACnet Baud Rate	Select the 9,600, 19,200, 38,400 (default), or 76,800 baud rate.

1. In the Operator Menu, press **UP or DOWN** to scroll to the BACnet Network Configuration submenu.

2. Press **ENTER**.
3. Scroll through the submenu options and make any necessary updates. See Table 14 for a description of the BACnet Network Configuration submenu selection options and their configurable options.

BACnet Flow Alarm Configuration

The BACnet Flow Alarm Configuration submenu is only available when BACnet is on (see *BACnet Network Configuration*). Alarm parameters can be configured including high and low alarms, setpoints, and alarm delay.
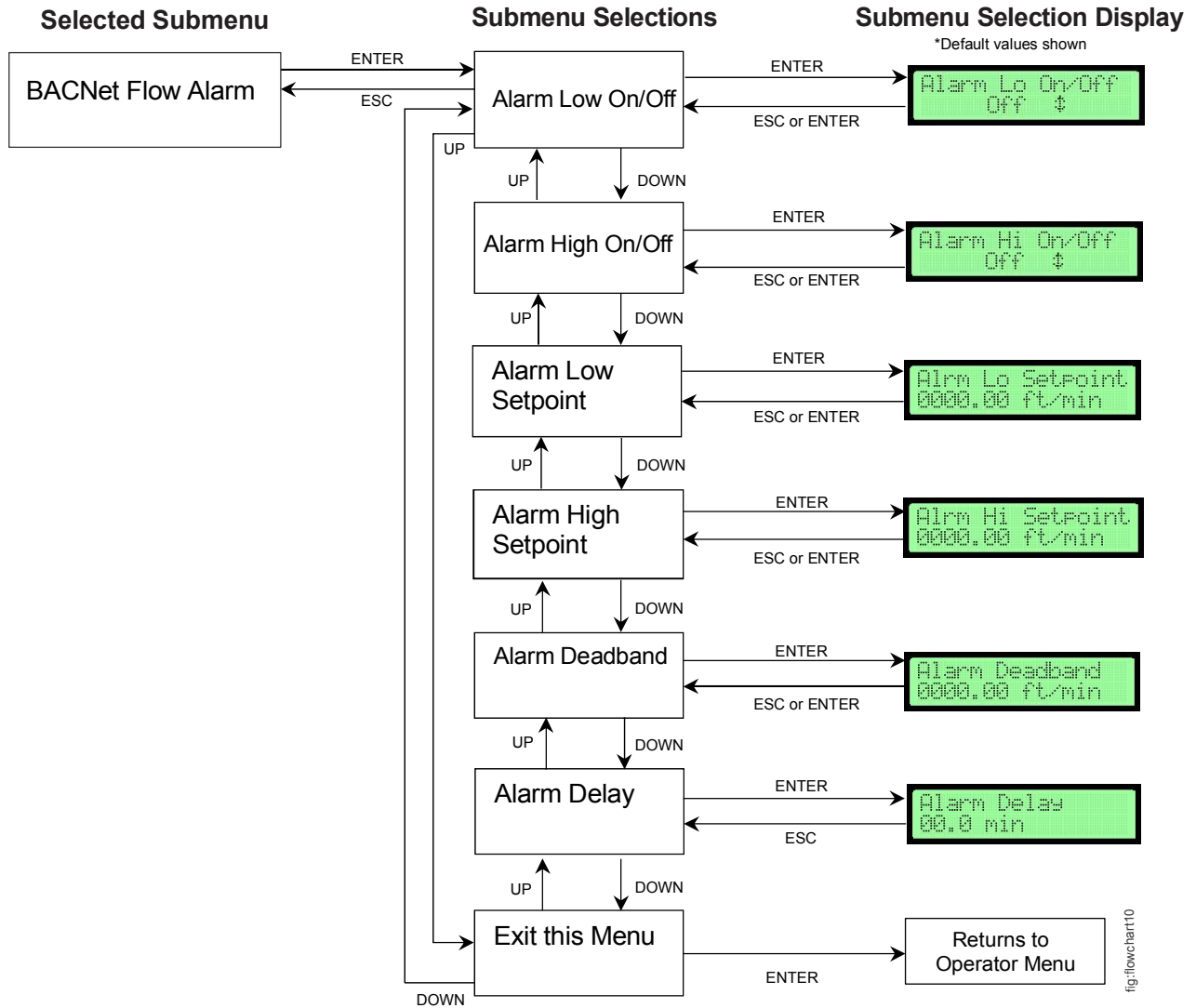
Figure 16: BACnet Flow Alarm Configuration Flowchart

Table 15: BACnet Flow Alarm Configuration Submenu Selection and Configurable Options (Part 1 of 2)

BACnet Flow Alarm Configuration Submenu Selections	Configurable Options
Alarm Low On/Off	Select On or Off.
Alarm High On/Off	Select On or Off.
Alarm Low Setpoint	Choose a value the flow must go below for an alarm condition to exist.
Alarm High Setpoint	Choose a value the flow must surpass for an alarm condition to exist.

Table 15: BACnet Flow Alarm Configuration Submenu Selection and Configurable Options (Part 2 of 2)

BACnet Flow Alarm Configuration Submenu Selections	Configurable Options
Alarm Deadband Setpoint	Choose a value of flow the controller must reach above the Alarm Low Setpoint for Alarm Low or below the Alarm High Setpoint for Alarm High before an activated alarm resets. The display units are the same as those chosen in the *Display Configuration* submenu and flow configuration.
Alarm Delay	Select the amount of time between any alarm condition and the BACnet Flow Alarm Low and High activation. This value is adjustable between 0 and 10 minutes.

1. In the Operator Menu, press **UP or DOWN** to scroll to the BACnet Flow Alarm Configuration submenu.

2. Press **ENTER**.

3. Scroll through the submenu options and make any necessary updates. See Table 15 for a description of the BACnet Flow Alarm Configuration submenu selection options and their configurable options.

BACnet Temperature Alarm Configuration

The BACnet Temperature Alarm Configuration submenu is only available when BACnet is on (see *BACnet Network Configuration*). In this submenu, you can configure temperature parameters including high and low alarms, setpoints, and alarm delay.
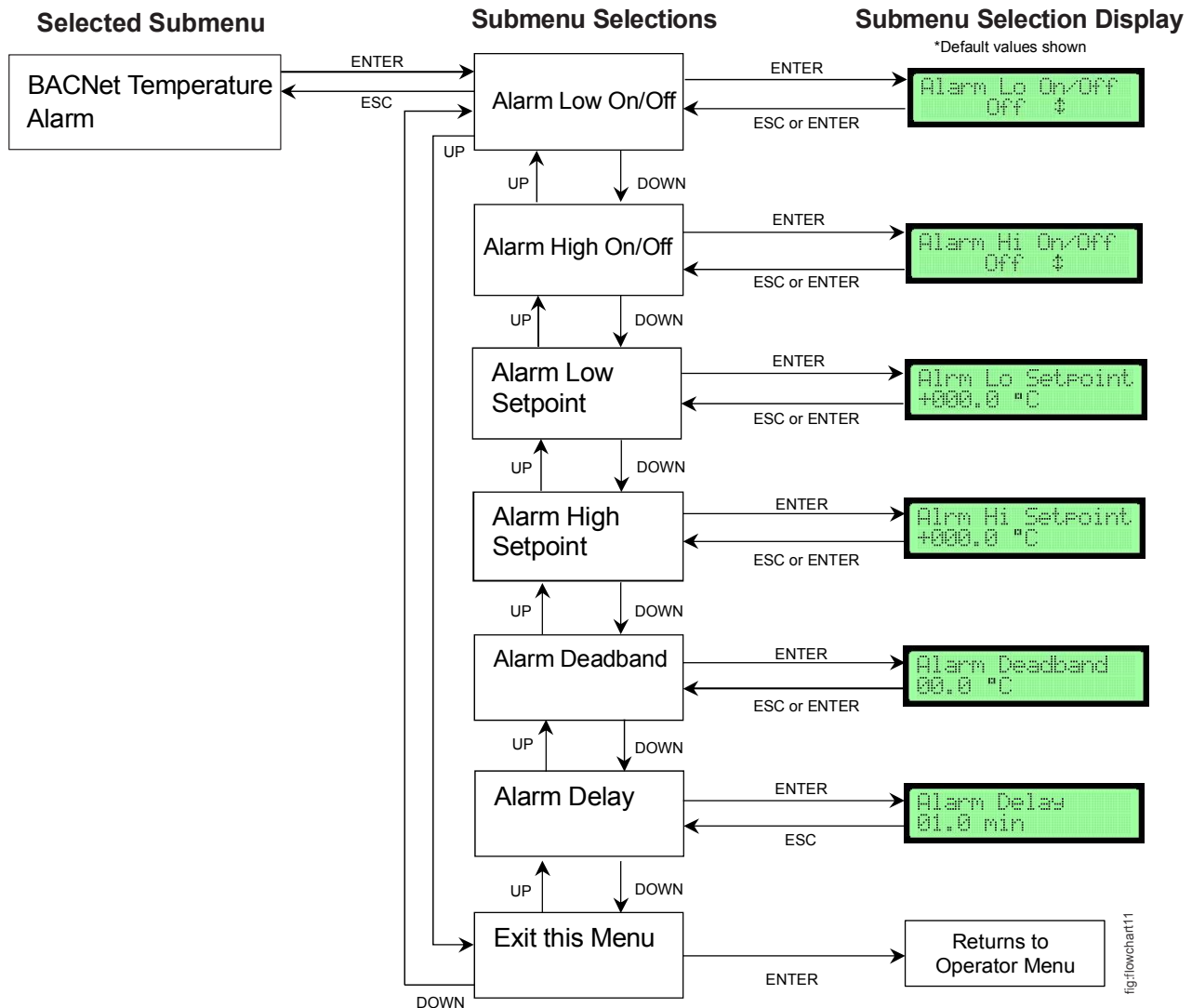

Figure 17: BACnet Temperature Alarm Configuration Flowchart

Table 16: BACnet Temperature Alarm Configuration Submenu Selections and Configurable Options (Part 1 of 2)

BACnet Temperature Alarm Configuration Submenu Selections	Configurable Options
Alarm Low On/Off	Select On or Off.
Alarm High On/Off	Select On or Off.
Alarm Low Setpoint	Choose a value the temperature must go below for an alarm condition to exist.
Alarm High Setpoint	Choose a value the temperature must surpass for an alarm condition to exist.

Table 16: BACnet Temperature Alarm Configuration Submenu Selections and Configurable Options (Part 2 of 2)

BACnet Temperature Alarm Configuration Submenu Selections	Configurable Options
Alarm Deadband Setpoint	Choose a value of temperature the controller must reach above the Alarm Low Setpoint for Alarm Low or below the Alarm High Setpoint for Alarm High before an activated alarm resets. The display units are the same as those chosen in the *Display Configuration* submenu.
Alarm Delay	Select the amount of time between any alarm condition and the BACnet Temperature Alarm Low and High activation. This value is adjustable between 0 and 10 minutes.

1. In the Operator Menu, press **UP or DOWN** to scroll to the BACnet Temperature Alarm Configuration submenu.
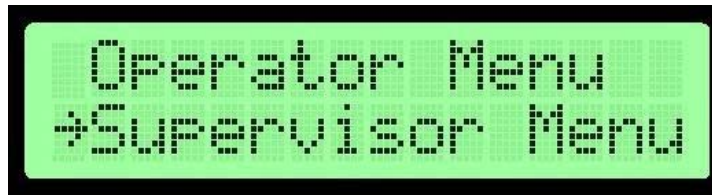

2. Press **ENTER**.

3. Scroll through the submenu options and make any necessary updates. See Table 16 for a description of the BACnet Temperature Alarm Configuration submenu selection options and their configurable options.

Navigating the Supervisor Menu

The Supervisor Menu is used to enable or disable probes and individual sensors, scan all sensors for status updates, and perform diagnostics on alert conditions. It is also used to restore the device to a preinstallation state.

1. When the TDP05K Airflow Measuring System's LCD screen displays the average temperature and average velocity or volume, press **MENU** and **UP or DOWN** until the arrow is next to the Supervisor Menu.

```
 Operator Menu
→Supervisor Menu
```

2. Press **ENTER** to access the Supervisor Menu settings.

    a. If the Supervisor PIN is enabled, the LCD screen displays the following message.

```
 Enter SUPV PIN
 0000
```

   (1) Enter the 4-digit PIN to access the Supervisor Menu. PIN entry is made one digit at a time beginning with the leftmost digit. Press **UP or DOWN** to scroll through the numbers 0 through 9.

   (2) When the correct number is displayed, press **ENTER** to select the digit. The cursor automatically moves to the next position. If an error is made after pressing ENTER, press ESC to go back and change the digit.

   Note: If the PIN is not correctly entered, the display returns to normal operation.

    b. If the Supervisor PIN is not enabled, the Supervisor Menu selections display.

   Note: See *Enable, Disable, and Change the Supervisor PIN* for more information about enabling the PIN.

3. Press **UP or DOWN** to scroll through the available menu selections. See Table 17 for a list of Supervisor Menu selections and their descriptions.

Note: Each Supervisor Menu submenu has submenu selections in which you can access the configurable options.

Table 17: Supervisor Menu Submenus (Part 1 of 2)

| Supervisor Menu Submenus (Actual Display Name)	Description
Enable Supervisor PIN (Enable Supv PIN)	When enabled, prevents unauthorized access to the Supervisor Menu.
Change Supervisor PIN (Change Supv PIN)	Set or change the Supervisor Menu PIN.
Sensor Management (Sensor Mgmt)	Scans the probe network for active and enabled sensors and enables or disables individual sensors. It also displays the probe status and each sensor's velocity and temperature reading.
Reset Sensors (Reset Sensors)	Allows the cycle of power to the sensors.

Table 17: Supervisor Menu Submenus (Part 2 of 2)

Supervisor Menu Submenus (Actual Display Name)	Description
Factory Default (Factory Default)	Restores the device to the factory-default settings. Any previous settings made in the Operator and Supervisor Menus are reset including dimensions, the Operator PIN, and custom text.
Exit Supervisor Menu (Exit Supv Menu)	Returns the display to normal operation.

Enable, Disable, and Change the Supervisor PIN

The Enable Supervisor PIN and Change Supervisor PIN menu options are used to enable or disable the Supervisor Menu PIN and change the current PIN.

Note: The PIN is not set or enabled on a device with factory-default settings.
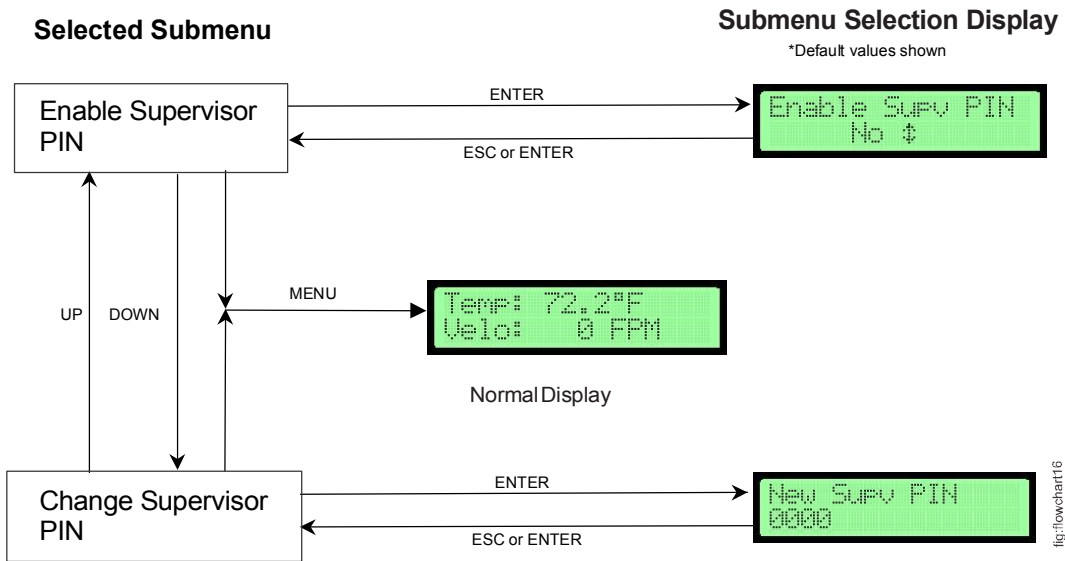
Figure 18: Supervisor PIN Flowchart

Note: If the Enable Supervisor PIN option is selected, the Supervisor Menu can only be accessed with a PIN.

To enable or disable the PIN:

1. Enter the Enable Supervisor PIN submenu.
2. Press **UP or DOWN** to choose Yes to enable the PIN or No to disable the PIN.
3. Press **ENTER** to confirm the selection.

To update the PIN:

1. Enter the **Change Supervisor PIN** submenu.
2. Press **UP or DOWN** to scroll to display the numbers 0 through 9.
3. When the correct number is displayed, press **ENTER** to select the digit. The cursor automatically moves to the next position. If an error is made after pressing ENTER, press ESC to return to the previous digit.
4. Enter the last digit and press **ENTER** to store the PIN number. The display returns to the Supervisor Menu submenu display. Alternatively, press ESC to return to the Supervisor Menu without updating the PIN.

Note: If the PIN settings are enabled, the PIN number must be entered each time the Supervisor Menu is entered.

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Sensor Management

The Sensor Management submenu is used to scan the sensor network for active sensors and enable or disable individual sensors. This submenu also displays each sensor's velocity and temperature reading.
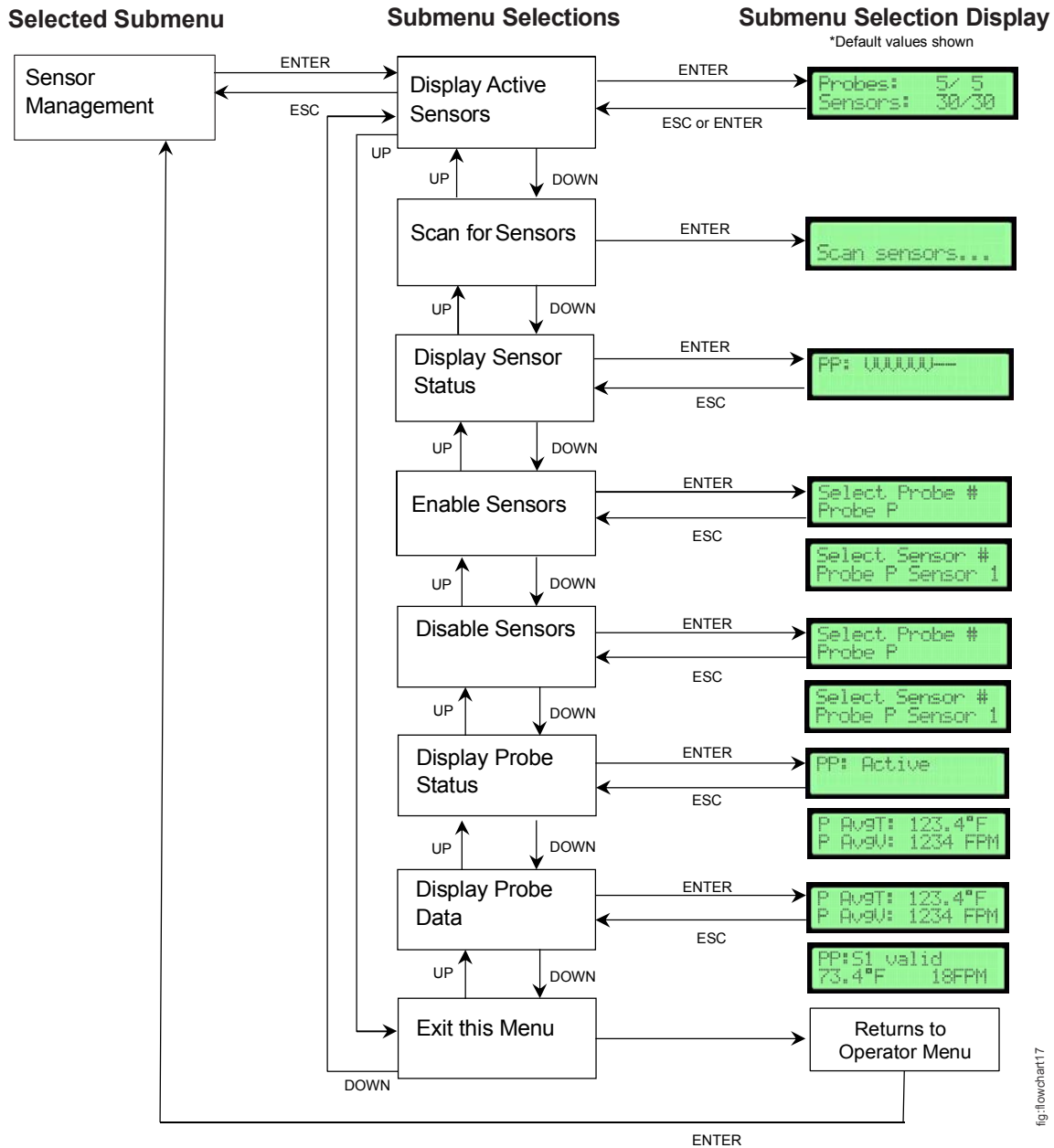
Figure 19: Sensor Management Flowchart

Table 18: Sensor Management Submenu Selections and Configurable Options or Display Screens

Sensor Management Submenu Selections	Configurable Options or Display Screen
Display Active Sensor	Display screen indicates the number of active and total probes and sensors.
Scan for Sensor	Scan for sensors and restart all devices on the network. The primary probe restarts last. After restarting, the primary probe returns to normal operation.
Display Sensor Status	Select the probe addresses on the probe network (P, 0 through F)[1]. V indicates a valid address and D indicates a disabled address.
Enable Sensors	Select between probes (P, 0 through F)[1] then select between sensors. Choose the sensor (1 through 8) to enable.
Disable Sensors	Select between probes (P, 0 through F)[1] then select between sensors. Choose the sensor (1 through 8) to disable.
Display Probe Status	Select between probes (P, 0 through F)[1] to choose the probe on line 2 of the screen. Display indicates the probe's average temperature and velocity (FPM) from the probe data screen.
Display Probe Data	Select between probes (P, 0 through F)[1]. Display shows the individual sensor data. Select between sensors (1 through 8).

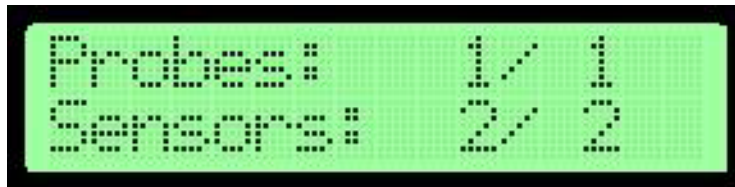1. The primary probe (P) is displayed first. Ancillary probes use hexadecimal (base 16) numbering.

1. In the Supervisor Menu, press **UP or DOWN** to scroll to the Sensor Management submenu. Press **ENTER**.

2. Press **UP or DOWN** to scroll to Display Active Sensor.

3. Press **ENTER**. The display indicates the number of active probes and sensors. In this example, one probe is active and enabled and two out of two sensors are valid and enabled.

4. Press **ESC or ENTER** to return to the Sensor Management submenu.

5. Press **UP or DOWN** to scroll to the **Scan for Sensors** submenu selection. Press **ENTER**. When this option is selected, the primary probe sends scan and restart commands to all ancillary probes on the wired probe network. The primary probe then restarts to detect all probes and sensors and updates the inventory.

```
Disp Active Sen
→Scan for Sensor
```

6. Press **ENTER** to scan for sensors.The primary probe provides scan and restart commands to the network.

```
Scan sensors...
```

7. Once the warm-up is complete, the display returns to the normal operation mode. Press **MENU**.

8. Press **UP or DOWN** to scroll to the Supervisor Menu. Press **ENTER**.

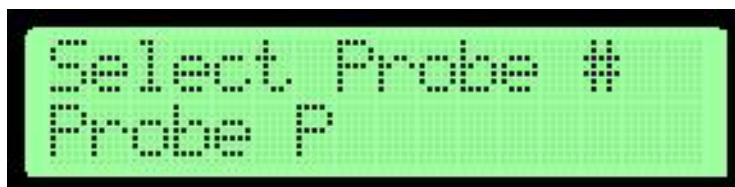9. Press **UP or DOWN** to scroll to the Display Sensor Status submenu.

```
Scan for Sensor
→Disp Sens Statu
```

10. Press **ENTER**. The display indicates the following message:

```
PP: VVVVVV—
```
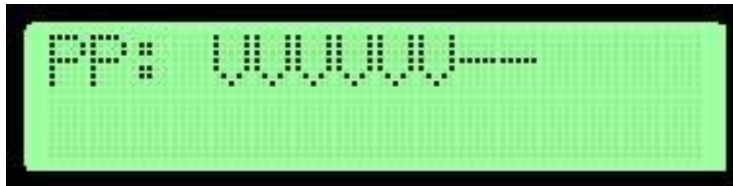
11. Press **UP or DOWN** to scroll to the probe to display on line 1 of the display.

12. Press **ESC**. The display returns to the Sensor Management submenu.

13. Press **UP or DOWN** to scroll to the Enable Sensors submenu selection. Press **ENTER**.

```
→Enable Sensors
 Disable Sensors
```

14. Scroll to display the correct probe number on line 2 and press **ENTER**.

```
Select Probe #
Probe P
```

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15. Press **UP or DOWN** to display the sensor numbers that are enabled by selecting this option and press **ENTER**.

```
Select Sensor #
Probe P Sensor 2
```

16. Press **ESC**. The display returns to the Sensor Management submenu.

17. Scroll to the **Disable Sensors** submenu selection and press **ENTER**.

```
 Enable Sensors
→Disable Sensors
```

18. Follow Steps 13 and 14 to disable the sensors.

19. Press **UP or DOWN** to scroll to the **Display Probe Status** submenu selection.

```
→Disp Probe Stat.
 Disp Probe Data
```

20. Press **ENTER**. The display indicates:

```
PP: Active
```

21. Press **UP or DOWN** to scroll to the probe that are displayed on line 1 of the display with this selection. Press **ENTER**. The display shows the probe data.

```
P AvgT: 123.4°F
P AvgV: 1234 FPM
```

22. Press **ENTER** to view the status and values of individual sensors on the selected probe. Press **UP or DOWN** to scroll through the sensors (1 through 8). Press **ESC** to return to the Probe Data screen.

```
PP:S1 valid
73.4 F     18FPM
```

23. Press **UP or DOWN** to scroll the menu display to the remaining probes, or press **ESC** to return to the Sensor Management menu.

Note: In the Sensor Management submenu, press UP or DOWN to scroll to the Display Probe Data submenu selection and press ENTER to display the probe data without going through the Probe Status submenu selection.

24. Press **UP or DOWN** to scroll to **Exit this Menu** and press **ENTER** to return to the Supervisor Menu.

Reset Sensor Network

The Reset Sensor Network submenu is used to reset all the sensors on the network and cycle power to the devices for an inventory. It also re-enables any disabled probes or sensors on the network.
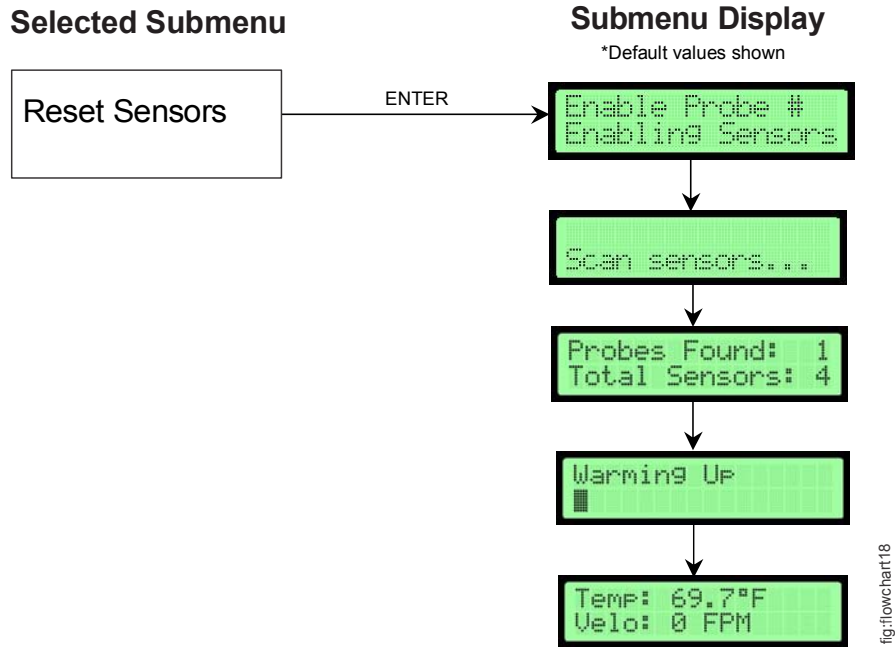
Selected Submenu   **Submenu Display**
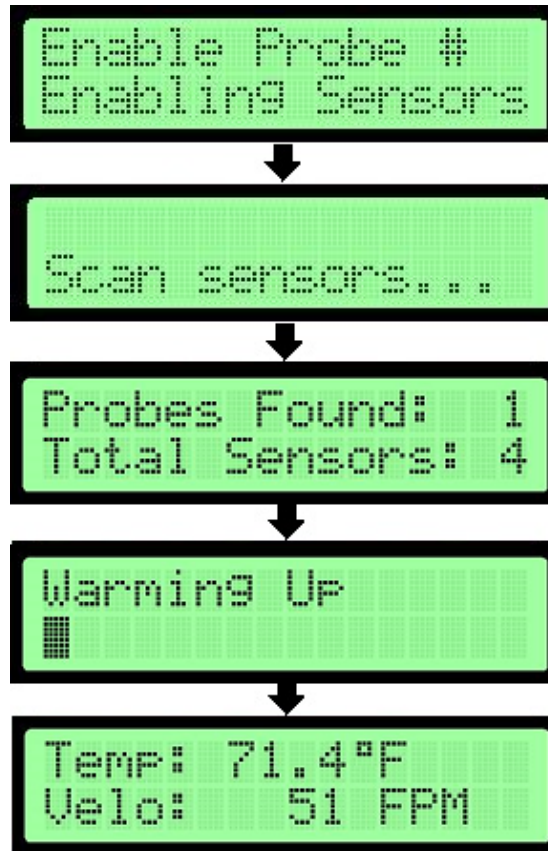*Default values shown*

Figure 20: Reset Sensor Network Flowchart

Table 19: Reset Sensor Network Submenu Selections and Display Screens

Reset Sensor Network Submenu Selection	Display Screens
Reset Sensors	Primary probe commands all probes to reenable all sensors and to restart. Primary probe performs a sensor scan and reenables sensors to get an inventory from the probe network. Primary probe returns to normal operation.

1. In the Supervisor Menu, press **UP or DOWN** to scroll to the **Reset Sensors** submenu.

2. Press **ENTER**. The display indicates:

```
Enable Probe #
Enabling Sensors
```

↓

```
Scan sensors...
```

↓

```
Probes Found:    1
Total Sensors:  4
```

↓

```
Warming Up
▓
```

↓

```
Temp: 71.4°F
Velo:    51 FPM
```

The primary probe automatically resets all the sensors and devices and then restarts. After warming up, the primary probe returns to the normal operation mode.

Factory Default Reset

The Factory Default Reset submenu is used to reset all settings to the original factory-default settings.

Note: After a Factory Default Reset, any unique configuration settings must be re-entered if they are different from the default settings.
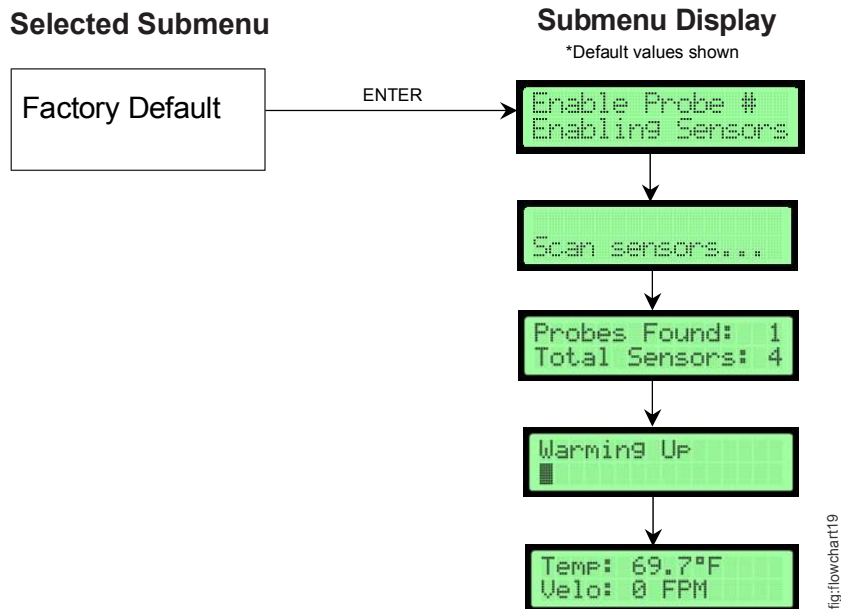
Selected Submenu   **Submenu Display**
Default values shown
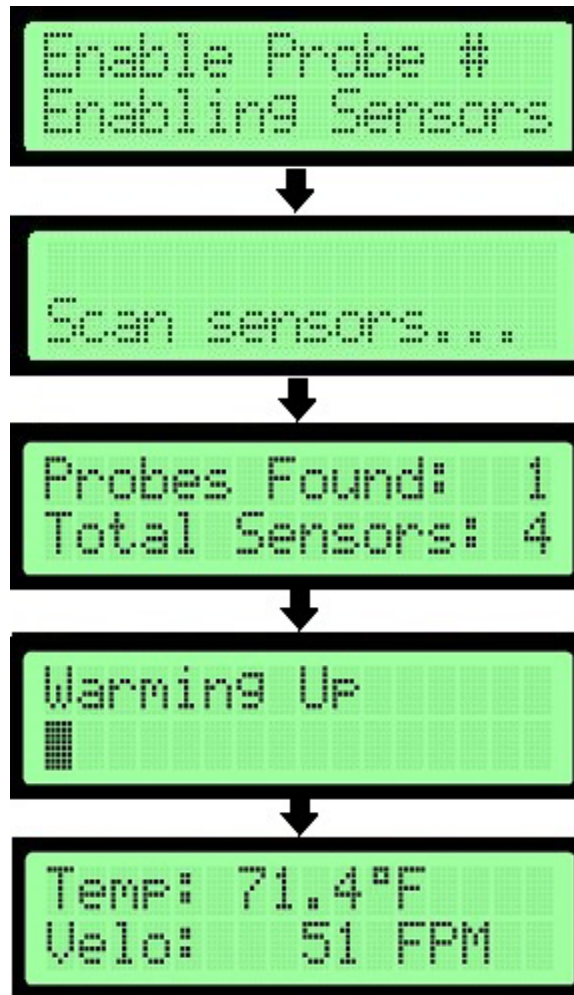

Figure 21: Factory Default Reset Flowchart

Table 20: Factory Default Reset Submenu Selection and Display Screens

Factory Default Reset Submenu Selection	Actions and Display Screens
Factory Default	Cycle power from probe to re-enable all sensors and restart the auxiliary devices. Perform a local sensor scan and re-enable local sensors to get an inventory from the probe network. Display returns to normal operation and factory-default settings are restored.

1. In the Supervisor Menu, press **UP or DOWN** to scroll to the Factory Default submenu.

2. Press **ENTER**. The display indicates:

```
┌────────────────────────┐
│ Enable Probe #          │
│ Enabling Sensors        │
└────────────────────────┘
           │
           ▼
┌────────────────────────┐
│                         │
│ Scan sensors...         │
└────────────────────────┘
           │
           ▼
┌────────────────────────┐
│ Probes Found:       1   │
│ Total Sensors:   4      │
└────────────────────────┘
           │
           ▼
┌────────────────────────┐
│ Warming Up              │
│ ▓                       │
└────────────────────────┘
           │
           ▼
┌────────────────────────┐
│ Temp: 71.4°F            │
│ Velo:    51 FPM         │
└────────────────────────┘
```

The primary probe automatically resets all the sensors and devices and then restarts. After warming up, it returns to the normal operation mode. All settings are restored to their factory-default state.

Troubleshooting

Problem	Possible Cause	Corrective Action
Airflow readings do not match what T&B is reporting	Turbulant or Air flowing two directions through the plane of the air measurement station	Use Automatic Kfactor Configuration and use 1 point calibration if only gain is required. If flow is non-linear use two or three-point calibration feature
		Install additional probes to provide more sensing points.
No Diplay	No Power	Verify 24VAC power at power terminal. Make sure the ribbon cable is fully seated in the board's socket. Visually check to make sure membrain is pluged in to display board in lid.
Number of PROBES shown when power is applied is incorrect.	Probe network Not wired correctly or plug is plugged into the wrong port. Two Ancillary Probes may have the same addresses, look at rotary dial on ancillary probes.	Pin out is shield, minus, plus, shield, minus, plus. Look at drawings and make sure left and right are not swapped. AO, Probe Network and BACNET ports on the primary will all fit each other's plugs. Make sure connections are made to the correct point on the board
No BACnet communication with the BAS	Network wires terminated to incorrect point or wrong connector	Pin out is shield, minus, plus, shield, minus, plus. Look at drawings and make sure left and right are not swapped.
	Not Configured correctly	Verify configuration parameters match what is required to communicate with the BAS

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