

B-Series Air Velocity Sensor

USER GUIDE



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1 General Information

1.1 Overview

Thank you for your purchase of a DegreeC B-Series Sensor, a versatile and rugged, high-performance air velocity sensor that measures real-time air velocity and directionality values in both analog and digital communication outputs.



Designed with conformal coated electronics and sealed enclosures, our sensor products are suitable for demanding applications, including those in corrosive or alkaline environments. With their robust, splash proof design and UV tolerant construction, the B-Series sensors are designed to handle a wide range of product and process control air flow applications. Additionally, the B-Series is configured to order, with a variety of velocity ranges, mechanical lengths, and output communication styles available.

1.2 Features

1.2.1 Mechanical Features

- Two available mounting styles: Standard clamp or special gland fitting used for mounting sensor assembly, without need for screws, or hands inside the duct.
- Optimized flow geometry with segregation of velocity and temperature elements for highest accuracy.
- Aerodynamic cross section to minimize flow disturbance.
- Robust, sealed probe assembly uses corrosion and UV resistant materials.
- Printed insertion depth markers and flow direction arrow.
- Conformal coated sensing elements for environmental protection.
- Remote head models available for compact applications or design-in embedded sensing needs.
- RoHS compliant
- CE certified

1.2.2 Electrical & Performance Features

- Industry-leading air velocity performance, with repeatability within $\pm 1\%$.
- Quick Average velocity reading for fastest control system response.
- Wide voltage input options 4.5 – 15VDC or 24VAC/VDC.
- Multiple digital outputs available.
- Multi-sensor addressing capability.
- Intelligent, built-in customizable averaging/smoothing functions.
- <10 second start-up time and 400ms response time.
- May be configured as an airflow switch with open drain output.
- Both air velocity and temperature analog outputs may be configured as voltage or current.

2 Product Specifications

2.1 General Specifications

Operating Temperature	B300: 0°C to 60°C (32°F to 140°F) B500 -10°C to 60°C (14°F to 140°F)**
Storage Temperature	-40°C to 105°C (-40°F - 221°F)
Air Velocity Range	-20m/s to +20m/s (-4000 fpm to +4000 fpm)
Relative Humidity	5 – 95%
Repeatability	± 1% of reading (under identical conditions)
Temperature Accuracy	± 1°C*
Response Time	400ms
Airflow Averaging Time	Configurable (3 second default)
Start-up Time	<10 s
Velocity & Temperature Output	0-5V, 0-10V, 0-20mA, or 4-20mA output
Digital Output	UART or I ² C available for flow and temperature info.
Alarm Output	Open drain, configurable trip point
Communication	I ² C (400KHz) or 3.3V UART
Cable Length	1.8m (6ft)
Housing Construction	Polycarbonate (PC), UL94-V0 (head), UL94-HB (housing)
Wire Gauge	22 AWG
Environmental Protection	IP65 electronics, including conformal coated sensing element
Standard Dimension	Selectable lengths (See Hardware Configuration section.)

*The air velocity sensor uses a hot bead algorithm, and at low velocities, the error in air temperature measuring grows due to self-heating effects. The air temperature accuracy is specified as a function of velocity:

- at velocities > 0.5 m/s [100 fpm] = ± 1°C [1.8°F]
- at velocities < 0.5 m/s [100 fpm] = ± 2°C [3.6°F]

**A wider operating temperature range is possible with the B500 models.

Temperature Compensation: The B-Series is a thermal airflow sensor; it is sensitive to changes in air density and indicates velocity with reference to a set of standard conditions (21°C (70°F), 760mmHg (101.325kPa), and 0%RH). The B-Series has been designed so that when used over the stated temperature compensation range, the sensor indicates very close to actual air velocity and minimal compensation is only required to account for changes in barometric pressure or altitude.

Range	Accuracy*	Deadband**
-1.0 to 1.0 m/s (-200 to 200 fpm)	± (1% of reading + 0.05 m/s [10 fpm])	-0.15 to 0.15 m/s (-30 to 30 fpm)
-10 to 10 m/s (-2,000 to 2,000 fpm)	± (4% of reading + 0.10 m/s [20 fpm])	-0.5 to 0.5 m/s (-100 to 100 fpm)
-20 to 20 m/s (-4,000 to 4,000 fpm)	± (5% of reading + 0.15 m/s [30 fpm])	-1.0 to 1.0 m/s (-200 to 200 fpm)

Table 1 Air Velocity Performance

*within compensation range

**range of velocities where the direction and velocity are not discernible by the sensor

2.2 Model Specifications

Degree Controls offers two models of the B-Series Air Velocity Sensor. The choice of model depends on the user's voltage range and current requirements, as noted below:

Name	Input Voltage Range	Current Consumption
B300	4.5 – 15VDC	< 100mA nominal @ 12V
B500	24VAC/DC $\pm$ 20%	< 65mA nominal @ 24V

Table 2 Input Voltage Range & Current Consumption

2.3 Hardware Configuration

Length	1 = 203mm [8.0"], max insertion depth = 160mm [6.3"] 2 = 305mm [12.0"], max insertion depth = 263mm [10.4"]
Velocity Profile	A = -1.0 to 1.0 m/s (-200 to 200 fpm) B = -10 to 10 m/s (-2,000 to 2,000 fpm) C = -20 to 20 m/s (-4,000 to 4,000 fpm)
Output Configuration, Analog	0 = No analog 1 = 0–5 VDC air velocity output only 2 = 0–5 VDC air velocity and air temperature (dual outputs) 3 = 0–10 VDC air velocity output only 4 = 0–10 VDC air velocity and air temperature (dual outputs) 5 = 0–20 mA air velocity output only 6 = 0–20 mA air velocity and air temperature (dual outputs) 7 = 4–20 mA air velocity output only 8 = 4–20 mA air velocity and air temperature (dual outputs)
Communication	0 = No digital communication 1 = UART communication output 2 = I2C communication output
Fitting	0 = No fitting 1 = Gland Nut 2 = °C Clamp

Table 3 Ordering Information

3 Wiring Information

3.1 Configured with Analog Output and UART Digital Communication

Wire Color	Wire Gauge	Description
Red	22 AWG	Power
Black		Ground
White		Velocity Analog Output
Green*		Temperature Analog Output
Orange		UART Receive (RX)
Blue		UART Transmit (TX)
Brown**		Open Drain Alarm

*Only for dual analog

**While the B300 and B500 can be configured as open drain switches; please see the Switch Series manual for purpose-built airflow switches.

3.2 Configured Only with UART Output

Wire Color	Wire Gauge	Description
Red	22 AWG	Power
Black		Ground
White		UART Receive (RX)
Green		UART Transmit (TX)

3.3 Configured Only with I²C Output

Wire Color	Wire Gauge	Description
Red	22 AWG	Power
Black		Ground
White		SCL
Green		SDA

Caution:

The B300/500 sensors **do not** have polarity protection. **Do not** connect positive voltage to ground lead.

Notes:

1. For I²C communication, external pull-up resistors to +3.3V for SDA and SCL are required. The B300/B500 does not have internal pull-up resistors.
2. For RS232 communication, an external level shifter is required to convert 3.3V TTL to RS232 voltage levels. The B300/B500 RX and TX signals are 3.3V TTL.

4 Mechanical Information

4.1 Probe Sensor Head Mechanical Drawings

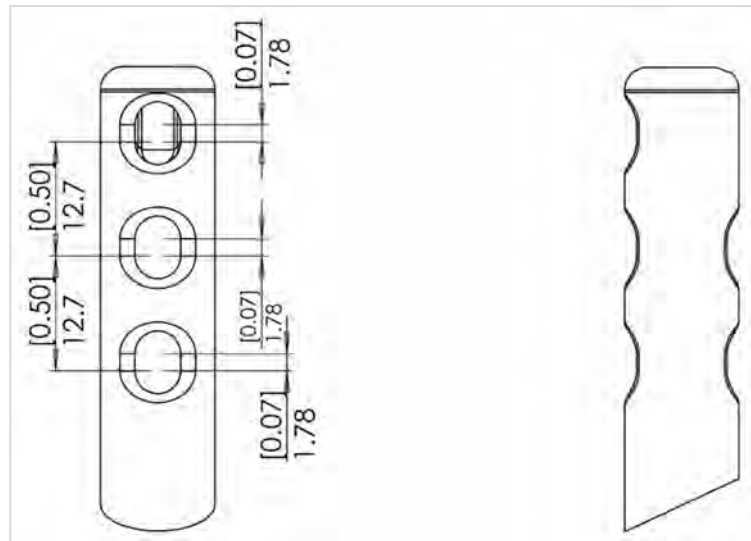


Figure 1 B-Series Sensor Head, [inch] mm

4.2 °C Clamp Mechanical Drawing

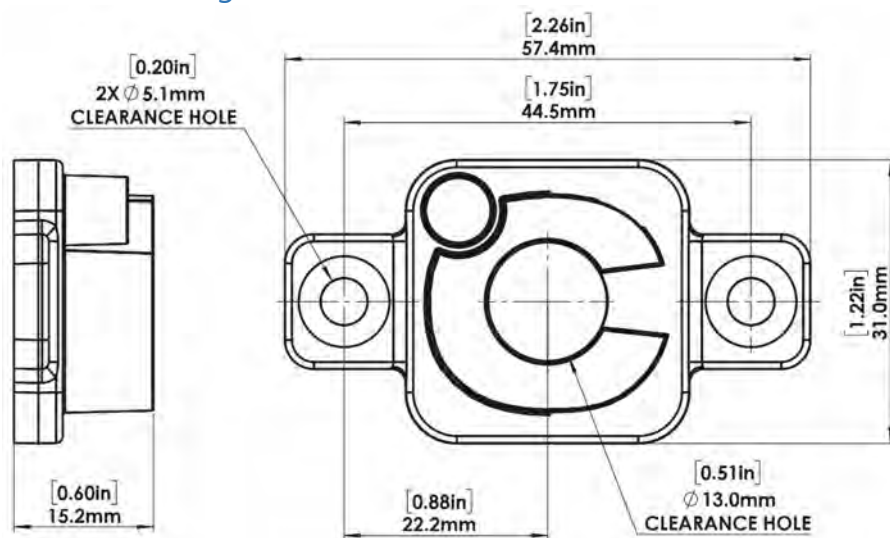


Figure 2 °C Clamp

5 Mounting and Positioning

5.1 Probe Style Sensors: B300/B500

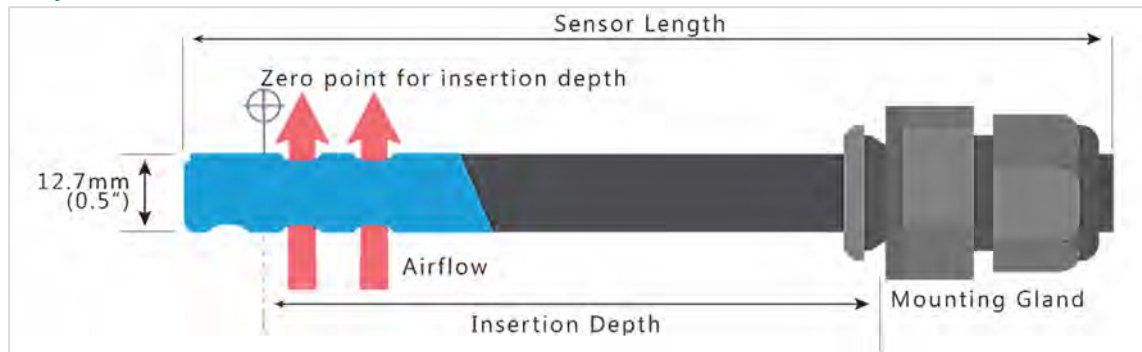


Figure 3 Probe-Style Sensor Dimensions

Note: Multiple sensor lengths are available to accommodate insertion depths of 30mm [1.25"] to 245mm [9.6"]. See figure above for insertion "zero point" datum.

The B-Series probe-style sensor utilizes either a °C Clamp or Gland fitting for installation. Please follow the below instructions for optimal installation.

5.1.1 Gland Installation

1. Drill a 13/16" (20mm) hole into the surface you wish to install the sensor into.
 - Follow the below instructions to install the sensor via Gland fitting.
2. Adjust the sensor's insertion depth (use the printed ruler on the sensor's body for reference) and tighten the gland nut onto the sensor body ("**A**" in figure below).
3. Insert the sensor into the drilled hole, wider flange first ("**B**" in figure below), then rotate into position, ensuring that the sensor is facing the intended direction.
4. Tighten the mounting nut ("**C**" in figure below) in the left-hand direction.



Figure 4 B-Series Sensor with Gland Fitting

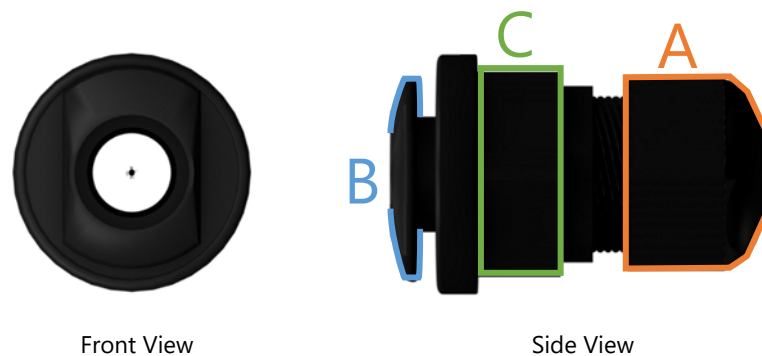


Figure 5 Gland Nut Mounting

5.1.2 °C Clamp Installation

1. Mark the sensor hole and screw positions per Step 1 of the °C Clamp installation figure, below.
2. Drill a 17/32" (14mm) hole through the surface you wish to install the sensor into.
3. Drill two pilot holes for the °C Clamp fastening screws. (°C Clamp, Degree Controls P/N: 64500AS011)

4. Secure the °C Clamp with two screws (not provided).
5. Insert the sensor into the °C Clamp and adjust the sensor's insertion depth (use the printed ruler on the sensor's body for reference), ensuring that the airflow indicators (arrows on the blue or orange head; see section Airflow Direction) are facing in the intended direction.
6. Using the provided screw, tighten the °C Clamp onto the sensor body to cinch in place.



Figure 6 Sensor with °C Clamp Fitting



Figure 7 °C Clamp

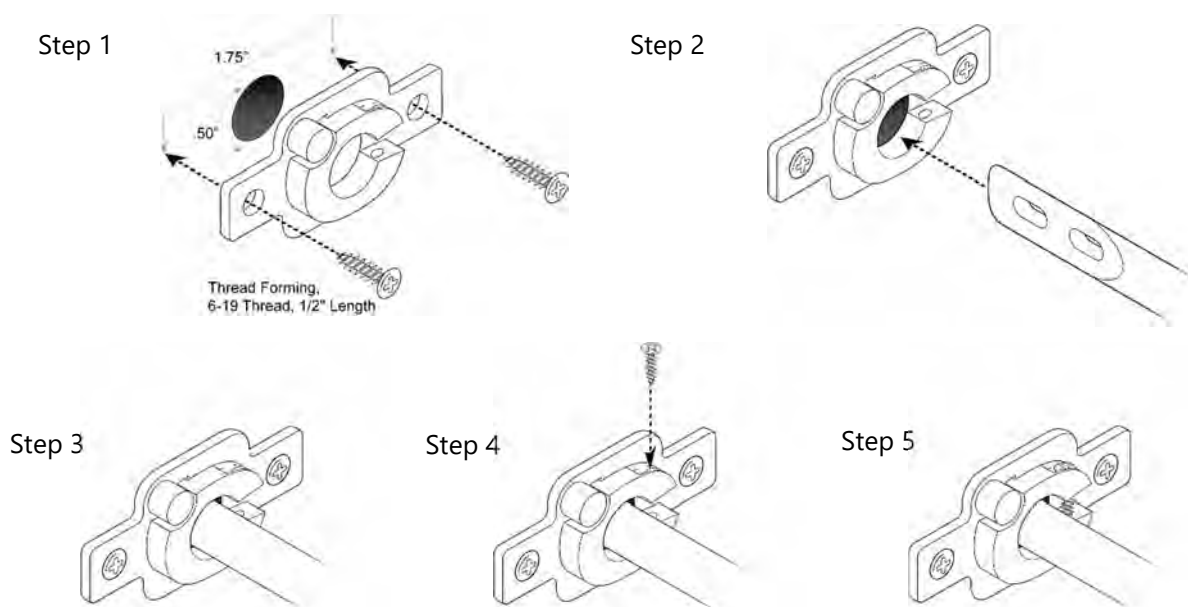


Figure 8 °C Clamp Installation

5.1.3 Airflow Direction

To ensure that the sensor performs within its published specifications, proper mounting precautions must be followed:

- The central airflow cavity that surrounds the flow thermistor must be oriented perpendicular to the airflow being monitored.
- When monitoring air velocity within a pipe or duct, mount the sensor so that the main flow cavity is in the center of the pipe or duct. Avoid mounting the sensor in turbulent locations caused by elbows, duct size changes, etc. If airflow turbulence causes excessive airflow reading variation, increasing the *Sample Time (index 63)* may solve the problem.



Figure 9 Direction of Airflow

6 Communication

The B-Series sensors support two methods of communication: UART and I²C. The choice of communication is set up at DegreeC prior to shipment.

6.1 UART

The communication protocol described below is for communication between a master host and the slave sensor product. This protocol is used to read/write configuration variables and to read process variables from the sensor.

- The host can configure the sensor by transmitting a "Memory Write" command which contains the memory index and the new data within the command.
- The host reads configuration variables using the "Memory Read" command.
- For multi-byte configuration variables, the data format is "little endian". The lowest address is the least significant byte.

Four process system variables (Velocity, Tamb, Power, and Raw Velocity) can also be read from the sensor using the "Read Velocity", "Read Tamb", "Read Power", and "Read Raw Velocity" commands, as noted below.

Hardware

The sensor's UART RX and TX signals are digital signals from the internal processor's UART at 3.3V TTL voltage levels. To convert to true RS232 signals, an external level shifter is required.

Configuration

UART configuration is fixed at 19200 baud rate, 8 data bits, no parity, 1 stop bit.

Protocol

The sensor is a slave device and supports several different commands. Both transmit and reply command message lengths are four bytes. The fourth byte is a checksum byte to verify message integrity. The checksum byte is determined by performing an "exclusive or" logic operation of the first three bytes. The table below defines the seven host commands supported and the appropriate sensor reply.

Password Protection

Memory locations designated as (RWP) in the Memory Map require two consecutive Memory Write commands to change the setpoint.

- Command #1: Memory Write 0xAA to the Password (index 83).

- Command #2: Memory Write the new value to the password protected register. If valid, sensor will accept the commands and write the new value. The Password (index 83) is automatically reset to 0xFF, the protected default state.

	Command: Host to Sensor				Response: Sensor to Host			
Byte	1	2	3	4	1	2	3	4
Read Velocity	1	0	0	checksum	Velocity (Hi)	Velocity (Lo)	0	checksum
Read Tamb	2	0	0	checksum	Tamb (Hi)	Tamb (Lo)	0	checksum
Read Power	3	0	0	checksum	Power (Hi)	Power (Lo)	0	checksum
Memory Write	6	Memory Index	Data	checksum	Memory Index	Data	0	checksum
Memory Read	7	Memory Index	0	checksum	Memory Index	Data	0	checksum
Read Raw Velocity	9	0	0	checksum	Velocity Raw (Hi)	Velocity Raw (Lo)	0	checksum
RESET	12	0	0	checksum	n/a	n/a	n/a	n/a

Table 4 UART: Process System Variables

Caution:

- If the sensor receives a message with an invalid command byte or an invalid checksum, the message will be discarded and the sensor will not reply.
- If the sensor receives a partial message, the message will be discarded and the sensor will not reply.
- The host should use the "Read Velocity", "Read Tamb", "Read Power", and "Read Raw Velocity" commands to read these double-byte variables.
- When reading the double-byte process variables Velocity (index 67), Raw Velocity (index 69), T Ambient Temperature (index 71), T Flow Temperature (index 73), Power Average (index 75), using the single-byte "Memory Read" command, read the Low Byte first, then read the High Byte. This prevents a "byte mismatch" reading error.

6.2 I²C

The communication protocol described below is for communication between the I²C master host and the I²C slave sensor. This protocol is used to read/write configuration variables and to read process variables from the sensor. Reading and writing to the sensor uses the same protocol that is commonly used to read and write to EEPROMs. For multi-byte configuration and process variables, the data format is "little-endian", the low order byte of the number is stored in memory at the lower address.

6.2.1 Configuration

The protocol sequence is as follows:

- Each sensor starts out with a default Address of 192. This address may be changed to an arbitrary 8-bit value by writing to the sensor's I²C address register and cycling power.
- The I²C commands for the sensors are defined as per the following tables:

1	7	1	1	8	1	8	1	1
S	Slave Address	Wr	A	Sub Address		Data Byte	A	P
S								
Slave Address								
Wr								
A								
Sub Address								
Data Byte								
P								

Table 5 I2C: Write Byte

1	7	1	1	8	1	1	8	1	1	8	1	1
S	Slave Address	Wr	A	Sub Address	A	S	Slave Address	Rd	A	Data Byte	A	P
S												
Slave Address												
Wr												
Rd												
A shaded												
Sub Address												
Data Byte												
A non-shaded												
P												

Table 6 I2C: Write Byte

1	7	1	1	8	1	1	8	1	1	8	1	8	1	1
S	Slave Address	Wr	A	Sub Address	A	S	Slave Address	Rd	A	Data Lo Byte	A1	Data Hi Byte	A2	P
S														
Slave Address														
Wr														
Rd														
A shaded														
Sub Address														
Data Byte Lo														
A1 non-shaded														
Data Byte Hi														
A2 non-shaded														
P														

Table 7 I2C: Read Byte(s)

Caution:

If there is a communication failure in the midst of a read/write sequence, it is NECESSARY to issue a "Stop" bit before resuming communication with a new "Start" bit.

I²C Command Restrictions

- The write cycle only supports a single-byte write cycle. Multiple-byte write cycles are not supported.
- The read cycle supports a single and a double-byte read cycle. Read cycles (greater than two) are not supported.

I²C Address

The sensor supports a 7-bit address which is shifted left to become the 7 most significant bits of the Slave Address Byte. The default value (after shifting) is 0xC0 (192) for write operations and 0xC1 (193) for read operations. This base address is password protected and can be changed by performing a "Write Byte" command to I²C Base Device Address (index 0) with the new base address. The new base address will become active after the next power cycle.

Password Protection

Setpoints designated as (RWP) in the Memory Map require two consecutive I²C write commands to change the setpoint.

- Command #1: Write 0xAA to the Password (index 83).
- Command #2: Write the new value to the password protected register. If valid, the Sensor will accept the commands and write the new value. The Password (index 83) is automatically reset to 0xFF, the protected default state.

7 Analog Outputs

7.1 Velocity Analog Output (Voltage)

The sensor velocity is translated to an analog voltage with a configurable range. The output voltage that corresponds to the *Velocity High Range* (index 52) is determined by setting *Vout Maximum* (index 59) to the desired voltage, units are in millivolts. As the converted *Velocity* (index 67) goes from 0 mm/s to *Velocity High Range* (index 52), *Vout* goes from 0 to *Vout Maximum* (index 59).

Output voltage functionality at velocities exceeding the *Velocity High Range* (index 52) is configurable by setting bit 0 of the *Config Flags* (index 10). With bit 0 set to 0, *Vout* is clamped at *Vout Maximum* (index 59). With bit 0 set to 1, *Vout* is not clamped and will continue to rise in a linear fashion at Velocities exceeding the *Velocity High Range* (index 52). By default, bit 0 of the *Config Flags* (index 10) is set to 0 (clamped). See the figure below for the *Vout* functionality as bit 0 is set to 0 (clamped) and 1 (not clamped):

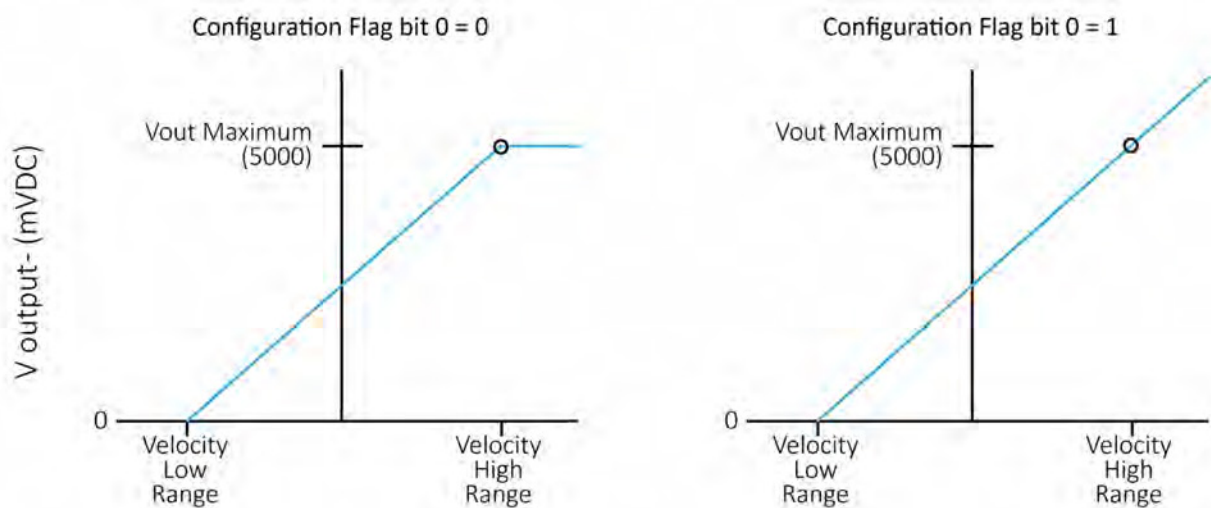


Figure 10 Vout (0 – 5V) with and without Clamping

Note: Velocities below -Velocity Maximum are always clamped to 0V.

For sensors without communications, the velocity can only be determined by measuring *Vout* and calculating the velocity per the equation below:

$$\text{Velocity} = -\text{VelocityMax} + \frac{\text{Vout} \times (\text{VelocityMax} \times 2)}{\text{VMax}}$$

Figure 11 Velocity Calculation Equation using Voutput

The Velocity High Range and Vout Maximum can be obtained from the sensor part number. For example, if the sensor model is "B300-2-A-1-0-1", the Velocity High Range is 1000 mm/s (1.0 m/s) and the Vout Maximum is 5V. In this case, if Vout is 3VDC, then the velocity can be calculated per the following equation:

$$\text{Velocity} = -\text{VelocityMax} + \frac{\text{Vout} \times (\text{VelocityMax} \times 2)}{\text{VMax}}$$

$$\text{Velocity} = -1 \text{ m/s} + \frac{3\text{V} \times (1 \text{ m/s} \times 2)}{5\text{V}}$$

Velocity is therefore **0.2 m/s**.

Voutput: The Voutput value of the B300/500 sensor can also be obtained by the host reading *Voutput* (index 77) via the communication port. Units are in (mv).

Caution:

- Vout accuracy specification is only valid within the specified operational airflow range of the B300 and B500 and outside of their deadband. See the Air Velocity Performance table in Product Specifications.
- With the Voutput "not clamped" option, the output voltage is NOT limited to Vout Maximum.

Analog Scaling: The 300 series sensor has the temperature output scaled from 0-100C. The 500 series sensor has the temperature scaled from -25 to 75C. The 300 and 500 series sensors both have their velocity output scaled to the calibrated range, however it starts from 0 m/s, for convenience.

7.1.1 Velocity Analog Output (Voltage) Example

Note: By default, DegreeC sensors are calibrated in metric format.

- Application airflow range is -10m/s – 10 m/s.
- Output voltage at 10 m/s is 5.0V.
- At airflow velocities exceeding 10m/s, the output voltage should not exceed 5.0V (Note: Only if *Config Flags* [register 10] bit 0 = 0).

For this application, the Velocity Range of -10 – 10 m/s specifies a type "B" Velocity Profile, and the voltage of 5.0V specifies an Output Configuration Type "1" or "3". In this case let's assume this is an air velocity only output with an 8.3" tube, so an appropriate model is "B300-3-B-1-0-1". The table below lists the internal register configuration for this model.

Name	Index (decimal)	Value	Description
Configuration Flag	10	0b00000000	Please see section Memory Map
Velocity Deadband Limit	50,51	500	Standard Velocity Low Range of 500 mm/s
Velocity High Range	52,53	10000	Standard Velocity High Range of 10000 mm/s
Vout Maximum	59,60	5000	Sets Vout maximum when Velocity equals Velocity High Range
Velocity	67,68	6000	Velocity of last conversion is 6000 mm/s
Voutput	77,78	4000	Vout in (mv)

Table 8 Internal Memory Map Parameters for Analog Out Example

7.2 Velocity Analog Output (Current)

7.2.1 0-20 mA

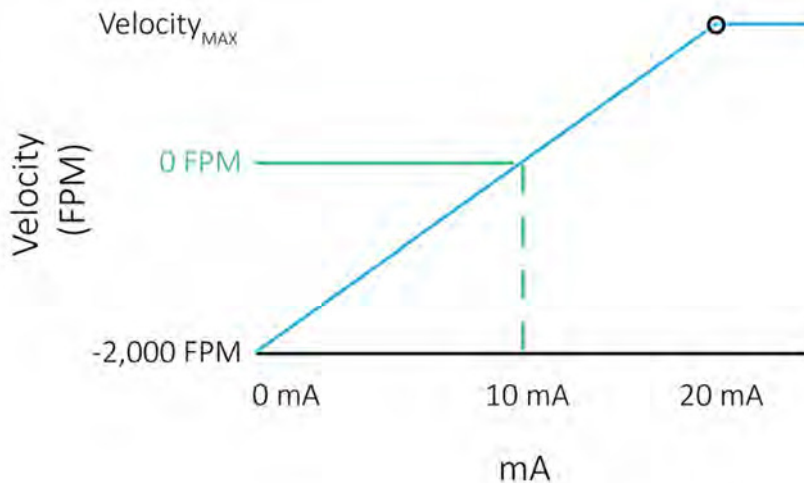


Figure 12 0-20 mA Example

$$\text{Velocity} = -\text{VelocityMax} + \frac{V_{\text{Iout}} \times \text{VelocityMax}}{10}$$

Figure 13 0-20 mA Calculation Equation

7.2.2 4-20 mA

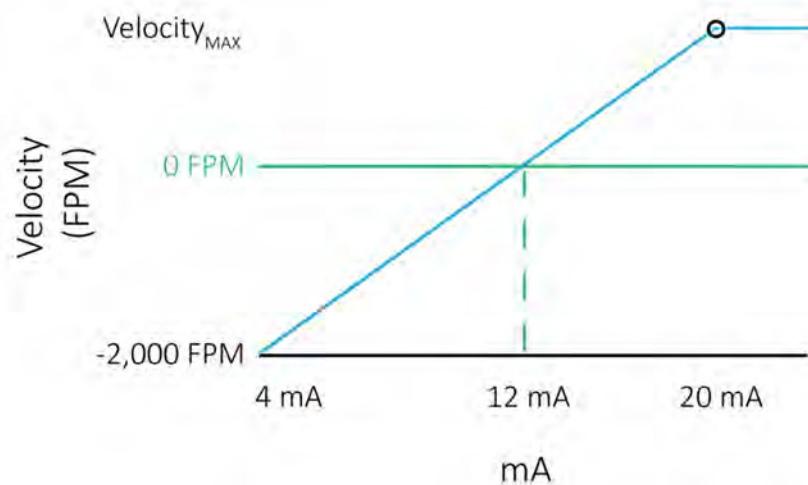


Figure 14 4-20 mA Example

$$\text{Velocity} = -\text{VelocityMax} + \frac{(\text{Vlout} - 4) \times \text{VelocityMax}}{8}$$

Figure 15 4-20 mA Calculation Equation

7.2.3 Velocity Analog Output (Current) Example

For a B Calibration Range solution when utilizing a 4-20 mA output, simply plug in the values found in the Calibration Range table below:

If the mA reading is 8 mA for example:

- B Cal. Range Vout Maximum is 10 m/s

Plug in the numbers into the 4-20 mA formula as follows:

$$\text{Velocity} = -10 \text{ m/s} + \frac{(8 \text{ mA} - 4) \times 10 \text{ m/s}}{8}$$

Velocity is therefore **-5 m/s**.

Calibration Range	V _{OUT} Max
A	1.0 m/s
B	10.0 m/s
C	20.0 m/s

Table 9 Calibration Rangel Table

Note: If the current outputs are unable to drive the desired current AND the sensor is configured for current out (i.e. Config Flags [Index 10] bits 1 and 2 have not been set), bit 6 in Memory Location 66 will be set. (However, only if the current output error bit is set in the config. register).

7.3 Temperature Analog Output

The sensor temperature is translated to an analog voltage with a fixed range. The output voltage that corresponds to the Temperature High Range (100 °C for the B300, 75°C for the B500) is determined by setting *Tout Maximum* (index 61) to the desired voltage, units are in millivolts. As the converted *T Ambient Average* (index 71) goes from 0 °C to 100 °C (B300 example), Tout goes from 0 to *Tout Maximum* (index 61). The linear conversion graph for the (0 - 5V) and the (0 - 10V) ranges are displayed below.

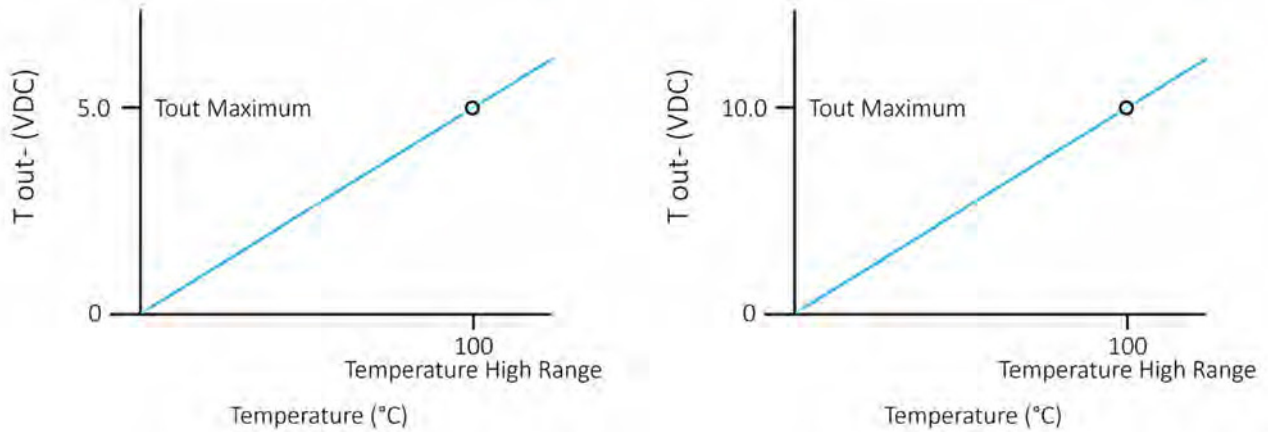


Figure 16 Temperature Analog Output: Toutput for (0 - 5V) and (0 - 10V)

Note, for sensor models with analog temperature outputs, Register 10, Bit 3 can be set or cleared to change analog output scaling of temperature:

- If Register 10 Bit 3 = 0, the temperature is scaled from 0°C to 100°C.
- If Register 10 Bit 3 = 1, the temperature is scaled from -25°C to 75°C.

For sensors without communications, the temperature can only be determined by measuring Tout and calculating the temperature per the equation below.

$$\text{Temperature (}^{\circ}\text{C)} = \frac{\text{Tout} * \text{TemperatureRange(}^{\circ}\text{C)}}{\text{ToutMaximum(VDC)}} = \frac{\text{Tout} * 100}{\text{ToutMaximum(VDC)}}$$

Figure 17 Temperature Analog Output: Temperature Calculation Equation

Tout: The Tout value of the B300/B500 sensor can also be obtained by the host reading *Toutput* (index 79) via the communication port. Units are in (mv).

Caution:

- Tout accuracy specification is only valid within the specified operational temperature range of the sensor.

7.3.1 Temperature Analog Example

Requirements using the B300 as an example:

- Application temperature range is 0 – 100 °C. (Note: B300 temperature range.)
- Output voltage at 100°C should be 5.0V.

In this example, the Tout signal measures 1.418 VDC. The equation below calculates the corresponding temperature. The table below lists the internal register configuration for this model.

$$\text{Temperature (°C)} = \frac{\text{Toutput} * 100}{\text{Tout Maximum}} = \frac{1.418 * 100}{5} = 28.36 \text{ °C}$$

Figure 18 Temperature Analog Output: Tout vs Temperature Example

Name	Index (decimal)	Value	Description
Tout Maximum	61,62	5000	Sets Tout maximum when Temperature equals Temperature High Range (100 °C)
T Ambient Average	71,72	2836	Temperature of last conversion is 28.36°C
Toutput	77,78	1418	Tout in (mv)

Table 10 Temperature Analog Output: Internal Database Parameters for Temperature Analog Example

8 Sensor Registers

The sensor setpoints and process parameters can be accessed by reading and writing into the memory map using the appropriate serial communications interface. The table below provides specific details for these parameters:

8.1 Memory Map

Index		Type	Size	Name/Description	Default
Dec	Hex				
0	0x00	RWP	1	I²C Base Device Address: (used in I ² C Communication Mode Only).	0xC0
1	0x01	RO	1	Communication Mode: 5=UART 6=I ² C	per Model P/N
2	0x02	RW	1	Reserved for Alarm Upgrade	0
3	0x03	RW	2	Reserved for Alarm Upgrade	0
5	0x05	RW	2	Reserved for Alarm Upgrade	0
7	0x07	RW	1	Reserved for Alarm Upgrade	0
8	0x08	RW	1	Reserved for Alarm Upgrade	0
9	0x09	RW	1	Reserved for Alarm Upgrade	0
10	0x0A	RW	1	Configuration Flag: (bit mapped) bit 0: 0=Vout clamped at VoutMaximum; 1=Vout NOT clamped at VoutMaximum bit 1: 0=Vout set to 0v if sensor failure detected; 1=Vout set to VoutMaximum if sensor failure detected bit 2: 0=Tout set to 0v if ambient sensor failure detected; 1=Tout set to ToutMaximum if ambient sensor failure detected bit 3: 0 Tout Scaled from 0-100°C; 1: Tout Scaled from -25-75°C bit 5: 0 0-20mA current out; 1: 4-20mA current out bit 6: 0 enable current output error; 1: disable current output error	0
11	0x0B	RO	1	Calibrated (0=UNCALIBRATED, 1=CALIBRATED)	1
12	0x0C	RO	4	Reserved	ID Data
16	0x10	RO	4	Reserved	ID Data
20	0x14	RO	4	Serial Number: Combination of the Date Code (aka Year Week; Index 24), Work Order (Index 30) number, and Serial Number (i.e. the order in which a particular sensor was processed on a Work Order).	ID Data
24	0x18	RO	6		ID Data
30	0x1E	RO	4		ID Data
34	0x22	RWP	4	Multidrop UART Address: 1 Byte Identifier which can be used as an address for support of multidrop UART communications protocol. A value of 0 means that multidrop messages will be ignored. In order to set this byte, Sensor Power Average (address 75) must be over 35mW.	0
35	0x23	RO	1	Reserved	CAL Data

36	0x24	RO	1	Reserved	CAL Data
37	0x25	RO	1	Reserved	CAL Data
38	0x26	RO	4	Reserved	CAL Data
42	0x2A	RO	4	Reserved	CAL Data
46	0x2E	RO	1	Reserved	CAL Data
47	0x2F	RO	1	Tamb Velocity High Offset: Used to calculate Tamb, (sbbb.bbbb)	CAL Data
48/49	0x30	RO	2	Reserved	CAL Data
50	0x32	RO	2	Velocity Deadband Limit: From Model P/N, (mm/sec)	CAL Data
52	0x34	RO	2	Velocity High Range: From Model P/N, also used to determine V output, (mm/sec)	CAL Data
54	0x36	RO	1	Reserved	CAL Data
55	0x37	RO	1	Reserved	CAL Data
56	0x38	RO	1	Reserved	CAL Data
57	0x39	RO	1	Reserved	CAL Data
58	0x3A	RO	1	Reserved	CAL Data
59	0x3B	RW	2	Vout Maximum: Vout maximum voltage, (mv) Defines Vout when Velocity reading equals Velocity High Range Set to 5000 for 0 – 5V output Set to 10000 for 0 – 10V output	Per Model P/N
61	0x3D	RW	2	Tout Maximum: Tout maximum voltage, (mv) Defines Tout when Temperature reading equals Temperature High Range, 100°C Set to 5000 for 0 – 5V output Set to 10000 for 0 – 10V output	Per Model P/N
63	0x3F	RW	1	Sample Time: Determines the sample time (sec) used to calculate the rolling average velocity. Value range is (0 to 9), results in sample times (0.4 sec to 9.0 sec). Examples: 0=.4 sec, 1=1.0 sec, 2=2.0 sec, 3=3.0 sec, 4=4.0 sec, 5=5.0 sec., 6=6.0 sec., 7=7.0 sec., 8=8.0 sec., 9=9.0 sec.	3
64	0x40	RO	2	Firmware Version: B300 and B500 have the same firmware.	TBD

66	0x42	RO	1	Status: (bit mapped) bit 0: not used bit 1: Flow bead Control Error bit 2: Voutput Control Error, disabled if VoutMaximum=0 bit 3: Ambient Temperature Sensor Error bit 4: Air Flow Temperature Sensor Error bit 5: Toutput Control Error, disabled if ToutMaximum=0 bit 6: 0: current output drive error enabled; 1: current output drive error disabled bit 7: not used	N/A
67	0x43	RO	2	Velocity: Velocity measured from last conversion cycle, (mm/s)	N/A
69	0x45	RO	2	Raw Velocity Reading: Unfiltered velocity measurement (mm/s)	N/A
71	0x47	RO	2	T Ambient Average: Temperature measured from the last conversion cycle, (°C * 100) Example: A temperature of 31.2°C would be represented as 3120	N/A
73	0x49	RO	2	T Flow Temperature: Temperature of the flow thermistor, (°C * 100)	N/A
75	0x4B	RO	2	Power Average: Calculated power to maintain Tflow setpoint, (mw * 100) Example: A power value 28.62 mw would be represented as 2862	N/A
77	0x4D	RO	2	Vout: Voutput voltage, (mv)	N/A
79	0x4F	RO	2	Tout: Toutput voltage, (mv)	N/A
81	0x51	RO	1	Reserved for Alarm Upgrade	N/A
82	0x52	RO	1	Reserved for Alarm Upgrade	N/A
83	0x53	RW	1	Password: To write to RWP type items, this Password register must first be set to 0xAA. Then a second write command can write to the RWP item. Password is automatically reset to 0xFF after any command accessing index 0 thru 82.	0xFF

Notes:

- 1 RW are Read/Write setpoint variables.
- 2 RWP are Read/Write setpoint variables that are Password protected.
- 3 RO are Read Only variables.
- 4 When sensor registers are referenced within this document, the sensor register Name and Index will be italicized with the index number displayed within parenthesis. For example, the Sample Time at index 63 would be depicted as *Sample Time (index 63)*. The index number will be in decimal format.