Installation Instructions for the
Honeywell Zephyr™ Digital Airflow Sensors
HAF Series—High Accuracy
±50 SCCM to ±750 SCCM

GENERAL INFORMATION

CAUTION
IMPROPER USE
Do not use to sense liquid flow.
Failure to comply with these instructions may result in product damage.

CAUTION
IMPROPER CLEANING
• Avoid cleaning the sensor; however, if it must be cleaned use isopropyl alcohol and dry the device thoroughly before use.
Cap the ports or connect housing to the ports before cleaning the sensor with alcohol. Using alcohol may remove the text on the sensor label; however, the label ID is hard coded inside the sensor.
• Do not use III Tri-chloroethane, methylene chloride, methyl pyrrolidone, or any oxidizing type acid such as formic acid.
• Do not use ultrasonic cleaning.
Failure to comply with these instructions may result in product damage.

CAUTION
LARGE PARTICULATE DAMAGE
Use a 5-micron filter upstream of the sensor to keep media flow through the sensor free of condensing moisture and particulates. Large, high-velocity particles or conductive particles may damage the sensing element.
Failure to comply with these instructions may result in product damage.

Table 1. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>-0.3 Vdc to 6.0 Vdc</td>
<td></td>
</tr>
<tr>
<td>Voltage on I/O output pin</td>
<td>-0.3 Vdc to Vsupply</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40 °C to 125 °C [-40 °F to 257 °F]</td>
<td></td>
</tr>
<tr>
<td>Maximum flow change</td>
<td>5.0 SLPM/s</td>
<td></td>
</tr>
<tr>
<td>Maximum common mode pressure</td>
<td>25 psi at 25 °C [77 °F]</td>
<td></td>
</tr>
<tr>
<td>Maximum flow</td>
<td>10 SLPM</td>
<td></td>
</tr>
</tbody>
</table>

NOTICE
Absolute maximum ratings are the extreme limits that the device will withstand without damage to the device. However, the electrical and mechanical characteristics are not guaranteed as the maximum limits (above recommended operating conditions) are approached, nor will the device necessary operate at absolute maximum ratings.

Table 2. Operating Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>3.3 Vdc ±10%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5.0 Vdc ±10%</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>40 mW max.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>65 mW max.</td>
<td></td>
</tr>
<tr>
<td>Compensated temperature range</td>
<td>0 °C to 50 °C [32 °F to 122 °F]</td>
<td>3</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-20 °C to 70 °C [-4 °F to 158 °F]</td>
<td></td>
</tr>
<tr>
<td>Warm-up time</td>
<td>30 ms</td>
<td>4</td>
</tr>
<tr>
<td>Calibration media</td>
<td>gaseous nitrogen</td>
<td>5</td>
</tr>
<tr>
<td>Bus standards</td>
<td>I²C fast mode (up to 400 kHz)</td>
<td></td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Maximum power: Is measured under the conditions of the highest supply voltage, VSupply + 10%, 70 °C, full scale flow and with the minimum load specified for that supply voltage.
2. Custom and extended compensated temperature ranges are possible. Contact Honeywell for details.
3. Warm-up time: The time to the first valid flow measurement after power is applied.
4. Default calibration media is dry nitrogen gas. Please contact Honeywell for other calibration options.
5. Refer to the Technical Note “I²C Communications with Honeywell Digital Airflow Sensors” for FC protocol information.

Table 3. Environmental Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>0% to 95% RH, non-condensing</td>
</tr>
<tr>
<td>Shock</td>
<td>100 g, 11 ms</td>
</tr>
<tr>
<td>Vibration</td>
<td>15 g at 20 Hz to 2000 Hz</td>
</tr>
<tr>
<td>ESD</td>
<td>Class 3B per MIL-STD 883G</td>
</tr>
</tbody>
</table>

Table 4. Wetted Materials

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers</td>
<td>high temperature polymer</td>
</tr>
<tr>
<td>Substrate</td>
<td>PCB</td>
</tr>
<tr>
<td>Adhesives</td>
<td>epoxy</td>
</tr>
<tr>
<td>Electronic components</td>
<td>silicon, gold</td>
</tr>
<tr>
<td>Compliance</td>
<td>RoHS, WEEE</td>
</tr>
</tbody>
</table>

Table 5. Recommended Mounting and Implementation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting screw: size</td>
<td>5-40</td>
</tr>
<tr>
<td></td>
<td>0.68 N m [6 in lb]</td>
</tr>
<tr>
<td>Silicone tubing for long port style</td>
<td>70 durometer; 0.125 inch inside diameter, 0.250 inch outside diameter</td>
</tr>
<tr>
<td>O-ring: short port style</td>
<td>AS568A, Size 7, Silicone, Shore A 70</td>
</tr>
<tr>
<td></td>
<td>AS568A, Size 10, Silicone, Shore A 70</td>
</tr>
<tr>
<td>Filter</td>
<td>5-micron filter upstream of sensor</td>
</tr>
</tbody>
</table>
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Figure 1. Wave Solder Profile

Max. temp. = 243 °C
Max. temp. = 205 °C

Digital Interface

For additional details on the use of Zephyr with digital output see the Technical Note “I2C Communications with Honeywell Digital Airflow Sensors”. The sensor uses the I2C standard for digital communication with a slave address specified in the Nomenclature and Order Guide in Figure 2. Following sensor power-up, each of the first two read sequences shown in Figure 9 will respond with 2 bytes of the unique 4-byte Serial Number. The first read after power-up will respond with the two most significant bytes of the Serial Number, while the second read will respond with the two least significant bytes of the Serial Number. For reliable performance, allow sensor to be powered for the sensor start-up time before performing the first read, then allow a 10 ms command response time before performing the second read.

Figure 2. Sensor I2C Read and Write Sequences

I2C Read: Slave responds to Master with data
Data Byte 0 (Most Significant) Data Byte 1 (Least Significant)

| SDA | A6 | A5 | A4 | A3 | A2 | A1 | A0 | SA | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | MA | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | MN | S |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| S   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

I2C Read: Master sends data to Slave
Command Byte

| SDA | A6 | A5 | A4 | A3 | A2 | A1 | A0 | SA | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | MA | SD | SC |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| S   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

Bit | Name | Description
--- |------|------------------------
S   | Start condition | Master pulls SDA from high to low while SCL remains high
S   | Stop condition | Master allows SDA to float from low to high while SCL remains high
A6  | Address bit | I2C Slave Address is the 7 Most Significant Bits for the first transmitted byte
1   | Read/write bit | Read = 1, Write = 0
D7  | Data bit | |
SA  | Slave ACK | Slave pulls SDA low
MA  | Master ACK | Master pulls SDA low
MN  | Master NACK | Master allows SDA to float high

After the power-up read sequence described above, the sensor will respond to each I2C read request with a 16-bit (2 byte) digital flow reading. Read requests taken faster than the Response Time (1 ms) are not guaranteed to return fresh data. The first two bits of each flow reading will be ‘00’.

The maximum sink current on SCL or SDA is 2 mA. Therefore, if the pull-up resistors are biased by V_{cc}, and if V_{cc} reaches the maximum supply voltage of 6 V, then the pull-up resistors for SCL and SDA must be greater than 3.0 kΩ to limit the sink current to 2 mA. The typical value for SCL and SDA pull-up resistors is 4.7 kΩ (this value depends on the bus capacitance and the bus speed).
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Figure 3. Mounting Dimensions (For reference only: mm [in.])

LF: Long port, fastener mount

SF: Short port, fastener mount

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Issue E
50045178

Mounting Footprint

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Honeywell Zephyr™ Digital Airflow Sensors
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Figure 3. Mounting Dimensions (continued)

SS: Short port, snap mount

Table 5. Pinout

<table>
<thead>
<tr>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCL</td>
<td>Vsupply</td>
<td>ground</td>
<td>SDA</td>
</tr>
</tbody>
</table>

Figure 4. Nomenclature and Order Guide

For example, a HAFBF0200C4AX5 part number defines a Honeywell Zephyr™ Digital Airflow Sensor, bidirectional forward flow optimized, long port, fastener mount, 200 SCCM, I²C output with address 0x49, 10% to 90% transfer function, 5.0 Vdc supply voltage.

HAF Series
Product Series
HAF Series
High Accuracy Airflow Sensor

B
Flow Direction
L
Port Style
F
Housing Style
0200
Flow Range

C
Unit
SCCM

4
Output Format
Digital I²C address:
0x49

A
Transfer Function
10% to 90% of Full Scale Output (FSO)

X
Reserved for Future Use

5
Supply Voltage
3.3 Vdc

The Long Port Port Style with the Snap Mount Housing Style is not a valid configuration.

The 200 SCCM Flow Range is available in the Long and Short Port Styles.

Apart from the general configuration required, other customer-specific requirements are also possible. Please contact Honeywell.
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⚠️ WARNING
PERSONAL INJURY
DO NOT USE these products as safety or emergency stop
devices or in any other application where failure of the product
could result in personal injury.
Failure to comply with these instructions could result in
dead or serious injury.

WARRANTY/REMEDY
Honeywell warrants goods of its manufacture as being free of
defective materials and faulty workmanship. Honeywell’s stan-
dard product warranty applies unless agreed to otherwise by
Honeywell in writing; please refer to your order acknowledgement
or consult your local sales office for specific warranty details. If
warranted goods are returned to Honeywell during the period of
coverage, Honeywell will repair or replace, at its option, without
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