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Honeywell Zephyr Digital Aiflow Snesors Installation Guide

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Contents

General Information

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

PRODUCT DAMAGE
Do not dissemble these products. Failure to comply with these instructions may result in product damage.

IMPROPER CLEANING

- Avoid cleaning the sensor; however, if it must be cleaned, use is propyl 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-chloromethane, methylene chloride, methyl pyridine, 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.

Specifications

Materials Specifications

Characteristic	Parameter
Wetted materials	glass reinforced (GR) thermoplastic polymer, gold, silicon, silicon dioxide, silicon nitride, epoxy, PCB epoxy composite
Housing	GR thermoplastic polymer
Substrate	PCB
Adhesives	epoxy
Electronic components	silicon, gold
Compliance	RoHS, WEEE

Environmental Specifications

Characteristic	Parameter
Humidity	0% to 95% RH, non-condensing
Shock	30 g, 6 ms
Vibration	1.33 g at 10 Hz to 500 Hz
ESD	ESD IEC6100-4-2 air discharge up to 8 kV, or direct contact discharge up to 4 kV
Radiated immunity: 20 , 50, 100 , 200, 300 SLPM 10, 15 SLPM	Level 3 from 80 MHz to 1000 MHz per IEC61000-4-3 1 m shielded cable with 3 cm exposed leads at connector 1 m shielded cable with 3 cm exposed leads at connector and 280 Ohm at MHz ferrite bead

Recommended Mounting and Implementation

Recommended Mounting and Implementation	
Characteristic	**Parameter**
Mounting screw size	10-32
Mounting screw torque	1,13 N m [20 in-lb]
Electrical connection	6 pin SIP connector
Pneumatic connection	manifold mount, 22 mm OD tapered male fitting, G 3/8 female threaded fitting

Absolute Maximum Ratings1

Absolute Maximum Ratings1	
Characteristic	**Parameter**
Supply voltage	-0.3 Vdc to 11.0 Vdc
Voltage on digital I/O output pins	-0.3 Vdc to 3.0 Vdc2
Storage temp. range	-40°C to 100°C [-40°F to 212°F]
Maximum flow change	10,000 SLPM/s
Maximum common mode pressure	4 bar	60 psi at 25°C [77°F]
Maximum flow	350 SLPM

1. 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 necessarily operate at absolute maximum ratings.
2. Digital I/O pins are diode protected at this voltage up to 2 mA. Digital bus voltage may exceed this value if the maximum digital bus current is limited to 2 mA or less. The maximum bus current is generally determined by the bus pull-up resistors

Operating Specifications

Operating Specifications	
Characteristic	**Parameter**
Supply voltage	3 Vdc to 10 Vdc
Supply current	20 mA max.
Power: 3 Vdc 10 Vdc	60 mW max. 200 mW max.
Calibrated temperature range1	0°C to 50°C [32°F to 122°F]
Operating temperature range	-20°C to 70°C [-4°F to 158°F]
Full scale (FS) flow2	10, 15, 20, 50, 100, 200, 300 SLPM
Calilbrated flow range	0 to 10, 0 to 15, 0 to 20, 0 to 50, 0 to 100, 0 to 200, 0 SLPM to 300 SLPM
Calibration gas	clean, dry air

Accuracy3 0%FS to 14.3%FS 14.3%FS to 100%FS	0.5%FS 3.5%reading
Total Error Band:4 10, 15, 20, 50, 100, 200 SLPM: 0%FS to 12.5%FS 12.5%FS to 100%FS 300 SLPM only: 0%FS to 12.5%FS 12.5%FS to 66.7%FS 66.7%FS to 100%FS	0.5%FS 4.0%reading 0.5%FS 4.0%reading 7.0%reading
Null accuracy5	±0.5%FS
Flow response time6	1 ms
Warm up time7	35 ms
Resolution: 10 SLPM 15 SLPM 20 SLPM 50 SLPM 100 SLPM 200 SLPM 300 SLPM	0.02 SLPM 0.03 SLPM 0.003 SLPM 0.008 SLPM 0.015 SLPM 0.029 SLPM 0.043 SLPM
Proof pressure	10.3 bar | 150 psig
Burst pressure	13.7 bar | 200 psig
Bus standards8	I2C fast mode (up to 400 kHz)
Reverse polarity protection	no

1. Custom and extended temperature compensated ranges are possible. Contact Honeywell for details.
2. Honeywell standard for mass flow rate units is SLPM, which has reference conditions of 0°C and 1 atm. Custom units are given as LPM with listed reference conditions at the first mention.
3. Accuracy is the maximum deviation in output from nominal over the entire calibrated flow range at 25ºC. Errors include Offset, Full Scale Span, Linearity, Flow Hysteresis, and Repeatability.
4. Total Error Band (TEB) is the maximum deviation in output from nominal over the entire calibrated flow range and temperature range. Total Error Band includes all Accuracy errors, as well as all temperature effects over the compensated temperature range, including Temperature Offset, Temperature Span and Thermal Hysteresis.
5. Null Accuracy is the maximum deviation in output from nominal at null flow over the entire calibrated temperature range.

6. Response time: time to electrically respond to any mass flow change at the micro bridge airflow transducer (response time of the transducer may be affected by the pneumatic interface).
7. Warm-up time: time to the first valid flow measurement after power is applied.
8. Refer to the Technical Note "I2C Communications with Honeywell Digital Airflow Sensors" for I2C protocol information.

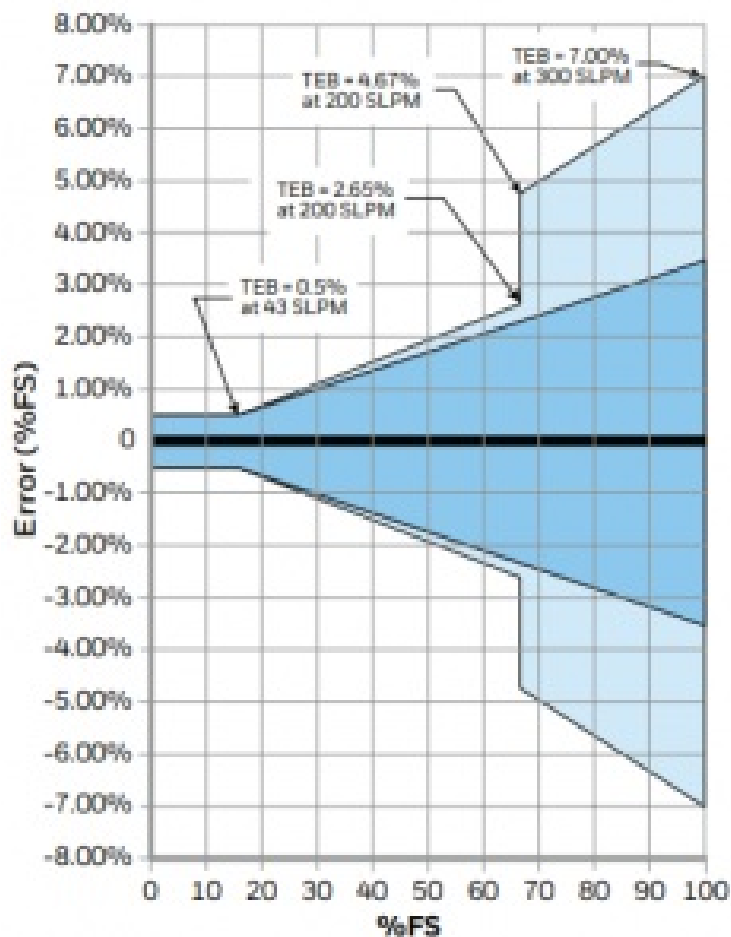**Accuracy and Total Error Band 10, 15, 20, 50, 100, 200 SLPM**
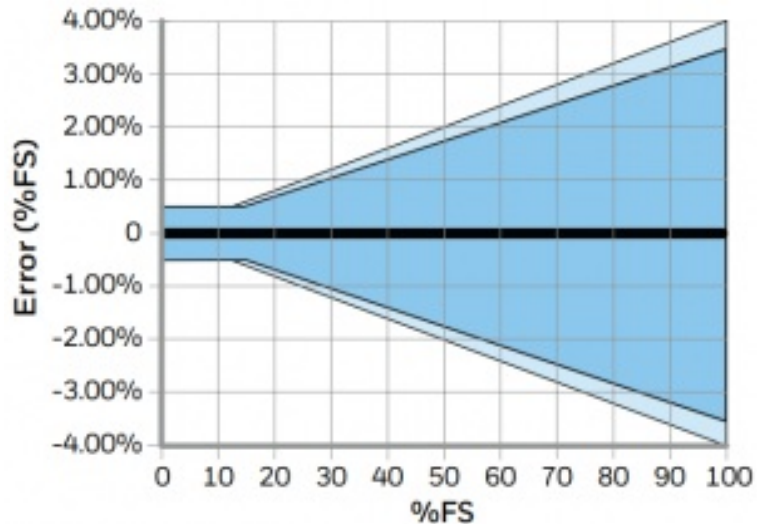
━━━ Ideal

▭ **Accuracy:**
0%FS to 14.3%FS = 0.5%
14.3%FS to 100%FS = 3.5%

▭ **Total Error Band:**
0%FS to 12.5%FS = 0.5%
12.5%FS to 100%FS = 4.0%

300 SLPM only.

Ideal

Accuracy:
0%FS to 14.3%FS (0 SLPM to 43 SLPM) = 0.5%
14.3%FS to 100%FS (43 SLPM to 300 SLPM) = 3.5%

Total Error Band:
0%FS to 14.3%FS (0 SLPM to 43 SLPM) = 0.5%
14.6%FS to 66.7%FS (44 SLPM to 200 SLPM) = 4.0%
66.7%FS to 100%FS (200 SLPM to 300 SLPM) = 7.0%

Ideal Transfer Function

Table 6. Ideal Transfer Function	
Item	**Equation**
Digital Output Code	16384 * [0.1 + 0.8 * (Flow Applied/Full Scale Flow)]
Flow Applied	Full Scale Flow * [(Digital Output Code/16384) − 0.1]/0.8

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 datasheet

Nomenclature and Order Guide. Following sensor power-up, each of the first two read sequences shown in Figure 2 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 startup time before performing the first read, then allow a 10 ms command response time before performing the second read.

Sensor I2C Read and Write Sequences

I2C Read: Slave responds to Master with data

I2C Read: Master sends data to Slave

Bit	Name	Description
S (green)	Start condition	Master pulls SDA from high to low while SCL remains high
S (orange)	Stop condition	Master allows SDA to float from low to high while SCL remains high
A6	Address bit	I 2C Slave Address is the 7 Most Significant Bits for the first transmitted byte
1	Read/write bit	Read = 1, Write = 0
	Data bit	Read = 1, Write = 0
D7	Slave ACK	Slave pulls SDA low
SA	Master ACK	Master pulls SDA low
MA		
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', while non-flow responses (such as error and status codes) will begin with '11'. There are several user commands available as shown in Table 7. Following an I2C write sequence of a user command, the sensor will respond to the next I2C read request with a 16-bit response. Possible responses to user commands can be seen in Table 8.

User Command Descriptions

Command Byte (Hexadecimal)	Command Name	Command Description	Command Response Time (Max.)
0x01	Get Serial Number	Next two read requests will each return two bytes of the sen- sor's unique 4-byte Serial Number.	10 ms
0x02	Power On Reset	Force Power-On reset of sensor microcontroller.	20 ms
0x03	Checksum	Calculates EEPROM Checksum and compares to production Checksum value. If the values match, the next read request will respond with 0xCCA5. Otherwise, the next read will respond with 0xCC90.	1 s

Sensor Response Descriptions

Sensor Response (Hexadecimal)	Response Name	Response Description
0xCCA5	POSACK	non-response command was executed successfully
0xCC99	Bad Command	command byte was not recognized
0xCC9A	BadParam	command sent with incorrect parameter bytes
0xCC9B	Failure	command failed during execution
0xCC90	Bad Check sum	checksum did not match stored value
0xCCBB	Busy	sensor is busy calculating the checksum value

The maximum sink current on SCL or SDA is 2 mA. Therefore, if the pull-up resistors are biased by VDD, and if VDD reaches the maximum supply voltage of 6 V, then the pull-up resistors for SCL and SDA must be greater than 3.0 k Ohm to limit the sink current to 2 mA. The typical value for SCL and SDA pull-up resistors is 4.7 k Ohm (this value depends on the bus capacitance and the bus speed).
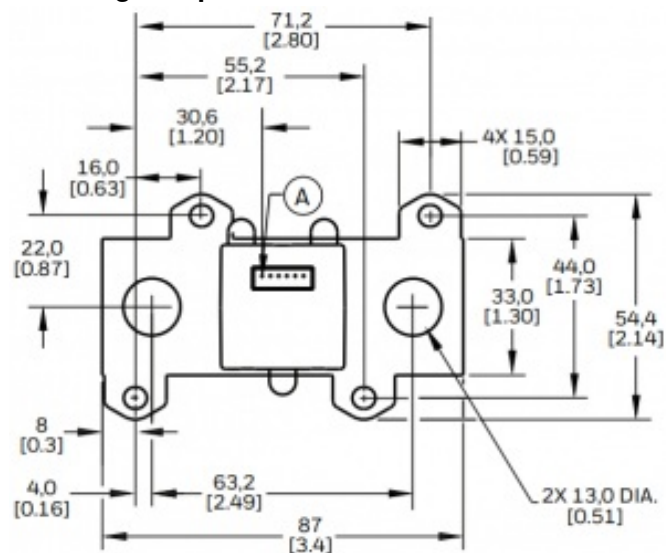
Mounting Dimensions (For reference only: mm [in].)
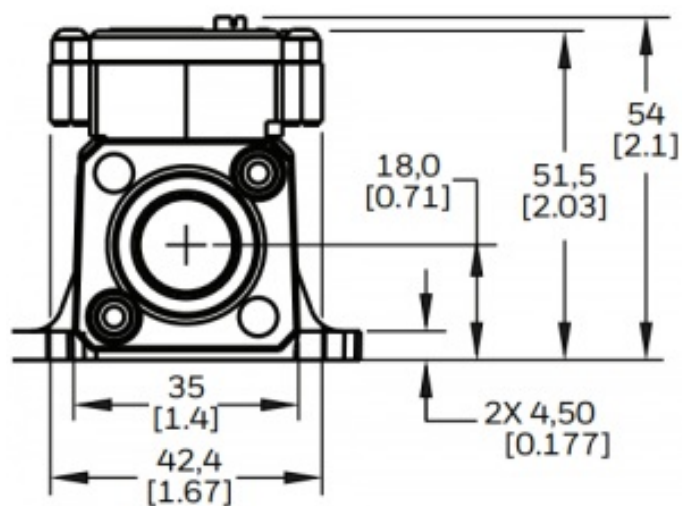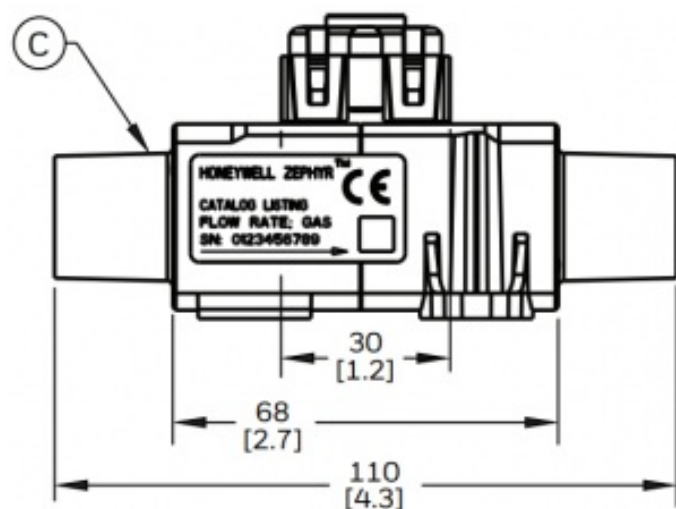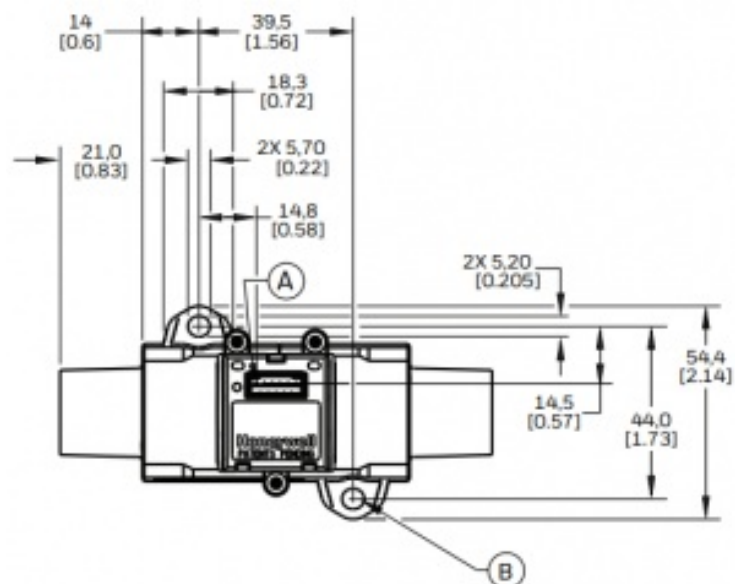
**Port Style: Manifold Mount**
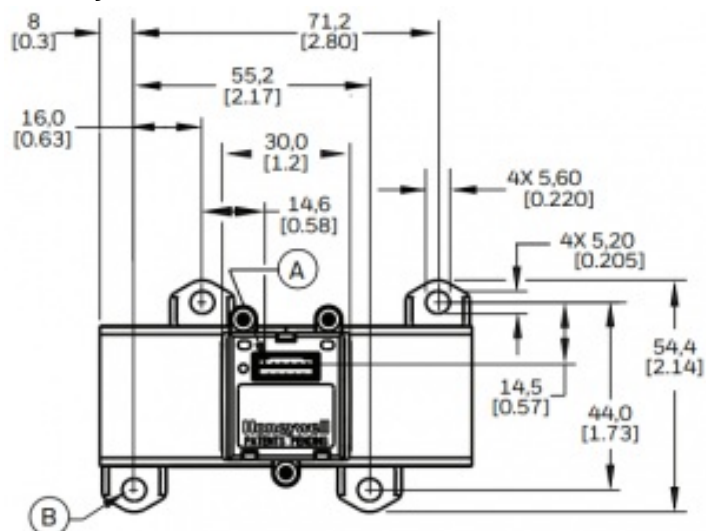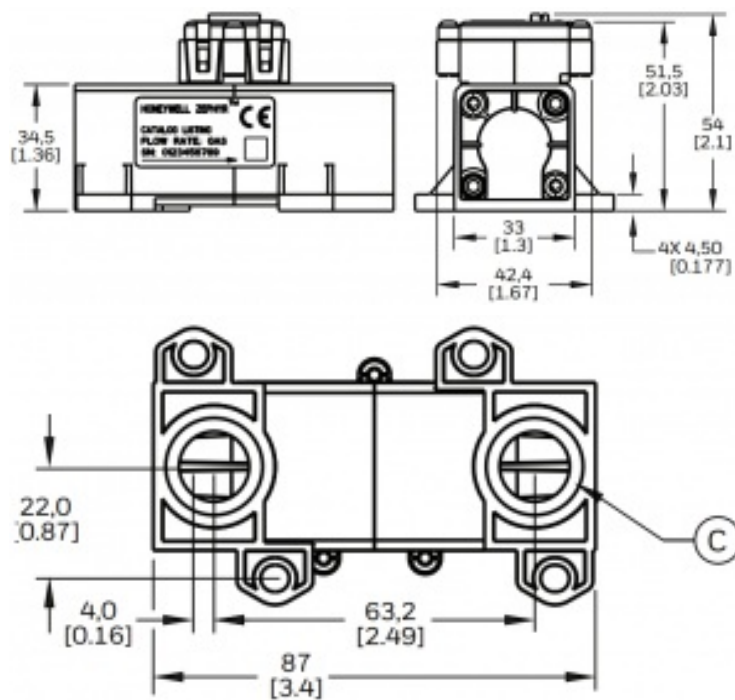
Mounting Footprint

1. **(A)** Pin 1.
2. **(B)** 4X 10-32 pan head screws 1,13 N m [20 in-lb] torque.
3. **(C)** 2X Gland for O-Ring AS568-113, 13,94 mm ID x 2,62 mm [0.549 in ID x 0.103 in W. Two O-rings, AS568A-113 Durometer A65 to A80 Silicon or Viton, are required to seal sensor to manifold. O-rings are not included.
4. **(D)** Flow channel
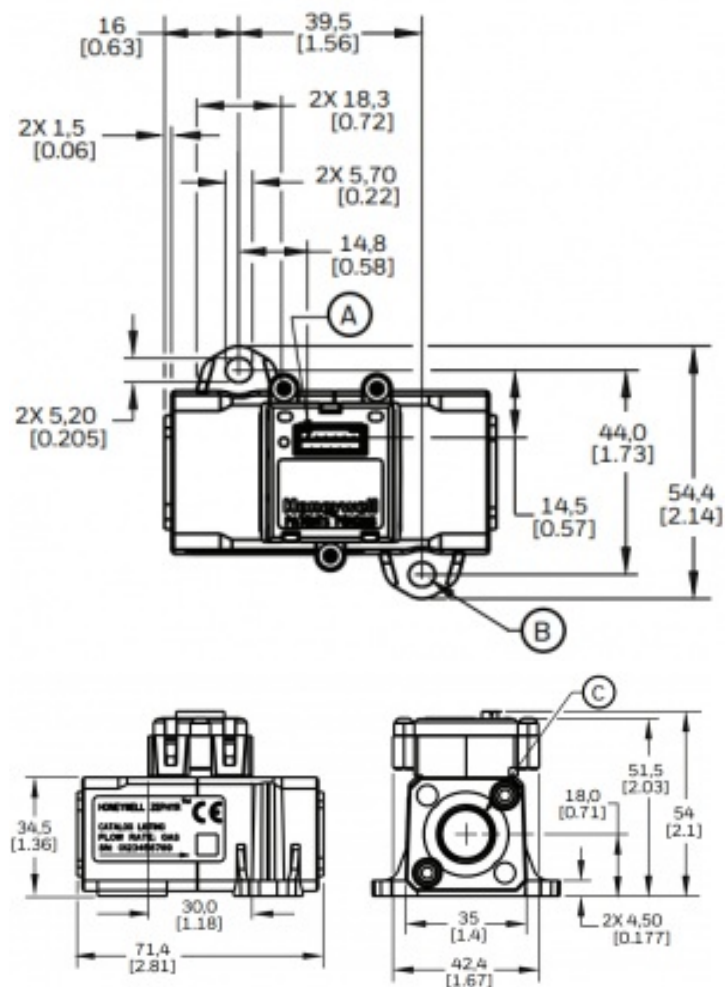
Port Style: 22 mm OD Tapered Male Fitting per ISO 5356
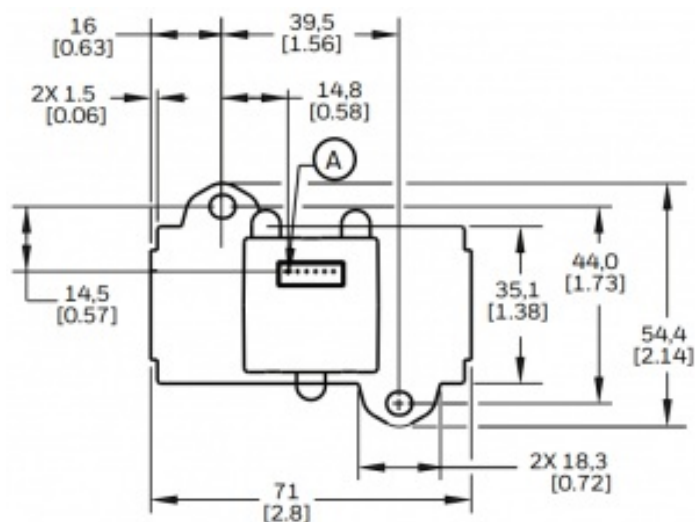
Mounting Footprint
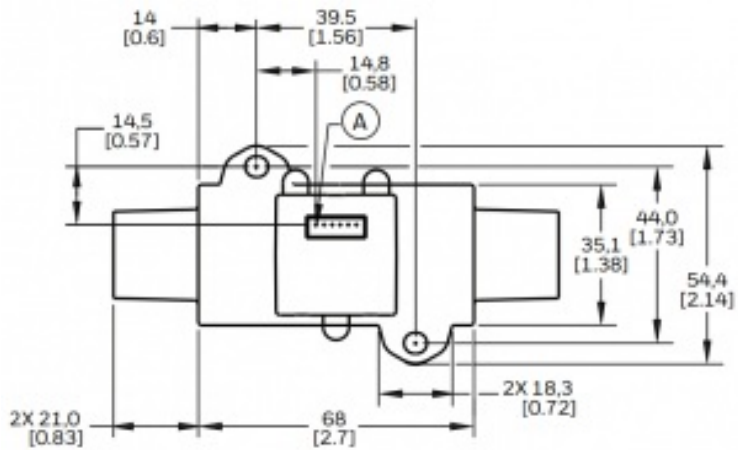
1. **(A)** Pin 1.

2. **(B)** 2X 10-32 pan head screws 1,13 N m [20 in-lb] torque.

3. **(C)** 15 mm ID/22 mm OD tapered fitting per ISO 5356.

Mounting Dimensions (For reference only: mm [in], continued.)

Port Style: G 3/8 Female Threaded Fitting per ISO 1179.

Mounting Footprint

1. **(A)** Pin 1.
2. **(B)** 2X 10-32 pan head screws 1,13 N m [20 in-lb] torque.
3. **(C)** ISO 1179 G3/8, recommended torque is 1,7 ±0,6 N m [15 ±5 in-lb]. Electrical connector part number is JST (Japan Solderless Terminals) B6B-PH-K-S. Mating connector part numbers are JST PHR-6 (socket) and JST SPH-002T-P0.5L (crimp terminal).

Pinout (Digital Function)

Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6
NC	SCL	VVDD	ground	SDA	NC

⚠ 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 death or serious injury

Warranty

Warranty/Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard 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 charge those items that Honeywell, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

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Documents / Resources

Honeywell Zephyr Digital Aiflow Snesors [pdf] Installation Guide
Zephyr Digital Aiflow Snesors, 50080060, HAF Series High Accuracy, 10 SLPM, 15 SLPM, 20 SLPM, 50 SLPM, 100 SLPM, 200 SLPM, 300 SLPM

References

- **H** **Products - Advanced Sensing Technologies | Honeywell**