

DESCRIPTION

The Honeywell HPM Series Particulate Matter Sensor is a laser-based sensor which detects and counts particles using light scattering. The detection concentration range is $0 \mu\text{g}/\text{m}^3$ to $1,000 \mu\text{g}/\text{m}^3$. A laser light source illuminates a particle as it is pulled through the detection chamber. As particles pass through the laser beam, the light reflects off the particles and is recorded on the photo or light detector. The light is then analyzed and converted to an electrical signal to calculate particle concentration. The Honeywell particle sensor provides information on the particle concentration for given particle concentration range.

VALUE TO CUSTOMERS

- Enables the ability to more accurately and cost-competitively monitor or control environmental particulate
- Industry-leading long life of 10 years of continuous use
- Proven EMC performance enables the ability to perform more accurately in a variety of tough industrial environments
- Faster response time of <6 s allows the HPM Series to respond to environmental conditions in real time
- Enhanced reliability allows for use in harsh environments

FEATURES

- Laser-based light scattering particle sensing
- Concentration range: $0 \mu\text{g}/\text{m}^3$ to $1,000 \mu\text{g}/\text{m}^3$
- Fully calibrated
- EMC: Heavy industrial level IEC61000
- Response time: <6 s
- Supply current: 80 mA max.
- Output signal: UART (Universal Asynchronous Receiver/Transmitter)
- PM2.5, PM10 output (standard); PM1.0, PM2.5, PM4.0, PM10 output (compact)
- RoHS compliant
- REACH compliant

DIFFERENTIATION

- Long life of 10 years offers a more stable operation for continuous usage
- Proven EMC performance, based on IEC61000 stable operation, $\pm 15\%$ accuracy (PM2.5)



POTENTIAL APPLICATIONS

- HVAC (commercial and residential)
- Indoor air quality monitors
- Handheld air quality monitors
- Air purifiers (commercial and residential)
- Automotive cabin air purifiers

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Table 1. Specifications

| | Standard HPMA115S0-XXX | Compact HPMA115C0-003 HPMA115C0-004 |
|---|---|--|
| Characteristic |  |  |
| Operating principle | laser scattering | |
| Detection ^{1,2} | PM2.5, PM10 | PM1.0, PM2.5, PM4.0, PM10 |
| Output data ^{1,2} | PM2.5 in $\mu\text{g}/\text{m}^3$, PM10 in $\mu\text{g}/\text{m}^3$ | PM1.0 in $\mu\text{g}/\text{m}^3$, PM2.5 in $\mu\text{g}/\text{m}^3$, PM4.0 in $\mu\text{g}/\text{m}^3$, PM10 in $\mu\text{g}/\text{m}^3$ |
| Concentration range | 0 $\mu\text{g}/\text{m}^3$ to 1,000 $\mu\text{g}/\text{m}^3$ | |
| Accuracy (at 25°C ±5°C): 0 $\mu\text{g}/\text{m}^3$ to 100 $\mu\text{g}/\text{m}^3$ 100 $\mu\text{g}/\text{m}^3$ to 1000 $\mu\text{g}/\text{m}^3$ | PM2.5: ±15 $\mu\text{g}/\text{m}^3$ PM2.5: ±15 % | PM2.5: ±15 $\mu\text{g}/\text{m}^3$; PM1.0, PM4.0, PM10: ±25 $\mu\text{g}/\text{m}^3$ PM2.5: ±15 %; PM1.0, PM4.0, PM10: ±25%; |
| Response time | <6 s | |
| Supply voltage ³ | 5 V ±0.2 V | |
| Switching frequency max. | 100 kHz | |
| Ripple amplitude max. | 20 mV | |
| R.M.S noise max. | 1 mV (noise bandwidth 10 MHz) | |
| Standby current (at 25°C ±5°C) | <20 mA | |
| Supply current (at 25°C ±5°C) | <80 mA | |
| Inrush current max. (at 25°C ±5°C) | 600 mA | |
| Temperature: operating storage | -20°C to 50°C [-4°F to 122°F] -30°C to 65°C [-22°F to 149°F] | -20°C to 70°C [-4°F to 158°F] -40°C to 85°C [-40°F to 185°F] |
| Humidity (operating and storage) | 0 %RH to 95 %RH non-condensing | |
| Output protocol ⁴ | UART; baud rate: 9600, databits: 8, stopbits: 1, parity: no | |
| Operating time: continuous mode intermittent mode | 10 years depends on duty cycle | |
| Laser class | Laser Class 1: IEC/EN 60825-1: 650 nm | |
| ESD | ±4 kV contact, ±8 kV air per IEC 61000-4-2 | |
| Radiated immunity | 1 V/m (80 MHz to 1000 MHz) per IEC 61000-4-3 | |
| Fast transient burst | ±0.5 kV per IEC61000-4-4 | |
| Immunity to conducted disturbances radiated emissions | 3 V per IEC61000-4-6 | |
| Radiated emissions | 40 dB 30 MHz to 230 MHz; 47 dB 230 MHz to 1000 MHz per CISPR 14 | |
| Conducted emissions | 0.15 MHz to 30 MHz in compliance with CISPR 14 | |
| Dimensions (L X W X H) | 43 mm x 36,00 mm x 23,7 mm [1.69 in x 1.42 in x 0.93 in] | 44 mm x 36 mm x 12 mm [1.73 in x 1.42 in x 0.48 in] |

¹ PM2.5 is particulate matter $\leq 2.5 \mu\text{m}$ in diameter; PM10 is particulate matter $\leq 10 \mu\text{m}$ in diameter.

² PM1.0 in $\mu\text{g}/\text{m}^3$, PM4.0 in $\mu\text{g}/\text{m}^3$, and PM10 in $\mu\text{g}/\text{m}^3$ are calculated from PM 2.5 readings.

³ Power supply output should contain one de-coupling capacitor (22 μF), and two ceramic capacitors (100 nF, 10 nF), if ripple amplitude max. or R.M.S. noise max. exceeds specifications.

⁴ Contact Honeywell for other output options.

**CLASS 1
LASER PRODUCT**

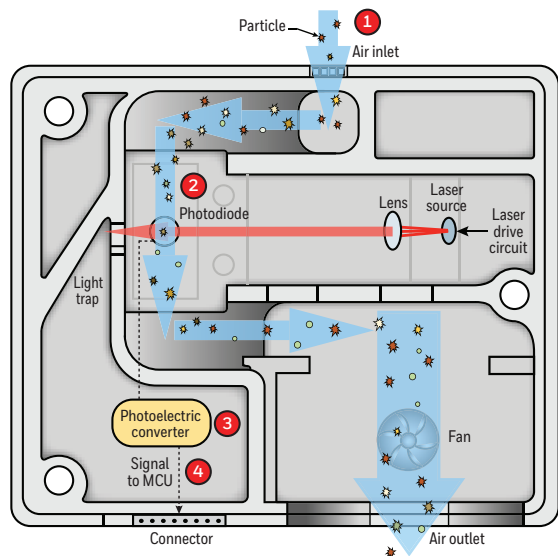
Table 2. Order Guide

| Catalog Listing | Description |
|-----------------|---|
| HPMA115S0-XXX | HPM Series PM2.5 Particulate Matter Sensor, standard size, UART output |
| HPMA115C0-003 | HPM Series PM2.5 Particulate Matter Sensor, compact size, UART output, air inlet and air outlet on same side |
| HPMA115C0-004 | HPM Series PM2.5 Particulate Matter Sensor, compact size, UART output, air inlet and air outlet on opposite sides |

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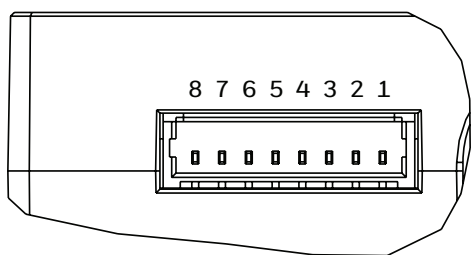
Figure 1. HPM Series Operation (standard version shown top down)



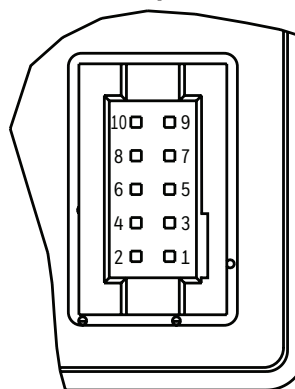
- 1 Fan draws in air through inlet.
- 2 Air passes through the laser where the light reflected off the particles is captured by the photodiode.
- 3 The photodiode passes information to the photoelectric converter. The photoelectric converter processes the signal from the particles into density.
- 4 Signal is transmitted to micro control unit where a proprietary algorithm processes the data and supplies outputs for the density of the particulate ($\mu\text{g}/\text{m}^3$).

Table 3. Standard and Compact Connector Pinout

Standard



Compact



| Pin | Name | Description | Pin | Name | Description |
|-----|------------------|------------------------------|-----|------------------|--|
| 1 | V _{OUT} | power output (+3.3 V/100 mA) | 1 | V _{OUT} | power output (+5 V) (output max.: 300 mA) |
| 2 | V _{CC} | power input (5 V) | 2 | V _{CC} | power input (+5 V) |
| 3 | N/A | N/A | 3 | GND | ground |
| 4 | N/A | N/A | 4 | GND | ground |
| 5 | RES | reserved for future use | 5 | RES | reserved for future use |
| 6 | TX | UART TX output (0 V - 3.3 V) | 6 | N/A | N/A |
| 7 | RX | UART RX input (0 V - 3.3 V) | 7 | RX | UART RX input (0 V - 3.3 V) |
| 8 | GND | ground | 8 | N/A | N/A |
| - | — | — | 9 | TX | UART TX output (0 V - 3.3 V) |
| - | — | — | 10 | SET | reserved for future use |

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Table 4. Standard Version Customer Use Protocol¹

| Command Length (Bytes) | HEAD | LEN | CMD | Data | CS | Example |
|--|------|------|------|---|--|----------------------------|
| Read Particle Measuring Results | | | | | | |
| Send | 0x68 | 0x01 | 0x04 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 04 93 |
| Response, Pos ACK | 0x40 | 0x05 | 0x04 | “DF1, DF2, DF3, DF4 PM2.5 = DF1 * 256 + DF2 PM10 = DF3 * 256 + DF4” | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 40 05 04 00 30 00 31 56 |
| Response, Neg ACK | | | | | | 0x9696 |
| Start Particle Measurement | | | | | | |
| Send | 0x68 | 0x01 | 0x01 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 01 96 |
| Response, Pos ACK | | | | | | 0xA5A5 |
| Response, Neg ACK | | | | | | 0x9696 |
| Stop Particle Measurement² | | | | | | |
| Send | 0x68 | 0x01 | 0x02 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 02 95 |
| Response, Pos ACK | | | | | | 0xA5A5 |
| Response, Neg ACK | | | | | | 0x9696 |
| Set Customer Adjustment Coefficient | | | | | | |
| Send | 0x68 | 0x02 | 0x08 | DF1: 30 ~ 200 (Default, 100) | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 02 08 64 2A |
| Response, Pos ACK | | | | | | 0xA5A5 |
| Response, Neg ACK | | | | | | 0x9696 |
| Read Customer Adjustment Coefficient | | | | | | |
| Send | 0x68 | 0x01 | 0x10 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 10 87 |
| Response, Pos ACK | 0x40 | 0x02 | 0x10 | DF1: 30 ~ 200 (Default, 100) | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 40 02 10 64 4A |
| Response, Neg ACK | | | | | | 0x9696 |
| Stop Auto Send | | | | | | |
| Send | 0x68 | 0x01 | 0x20 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 20 77 |
| Response, Pos ACK | | | | | | 0xA5A5 |
| Response, Neg ACK | | | | | | 0x9696 |
| Enable Auto Send³ | | | | | | |
| Send | 0x68 | 0x01 | 0x40 | NA | CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 40 57 |
| Response, Pos ACK | | | | | | 0xA5A5 |
| Response, Neg ACK | | | | | | 0x9696 |

¹Product life may vary depending on the specific application in which the sensor is utilized.

²Shuts down the fan, helping to extend the life of the product.

³See Table 6 for data format.

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Table 5. Standard Version Data Format (Protocol Length: 32 Bytes)

| Byte Number | Head0 | Head0 | Head0 |
|-------------|------------|-------|---|
| Byte0 | Head0 | 0x42 | fixed |
| Byte1 | Head1 | 0x4d | |
| Byte2 | Len_H | ... | Frame Length = $2 \times 13 + 2(\text{data length} + \text{checksum length})$ |
| Byte3 | Len_L | ... | |
| Byte4 | Data0_H | ... | reserve |
| Byte5 | Data0_L | ... | |
| Byte6 | Data1_H | ... | PM2.5 concentration (standard particulate matter) |
| Byte7 | Data1_L | ... | |
| Byte8 | Data2_H | ... | PM10 concentration (standard particulate matter) |
| Byte9 | Data2_L | ... | |
| Byte10 | Data3_H | ... | reserve |
| Byte11 | Data3_L | ... | |
| Byte12 | Data4_H | ... | reserve |
| Byte13 | Data4_L | ... | |
| Byte14 | Data5_H | ... | reserve |
| Byte15 | Data5_L | ... | |
| Byte16 | Data6_H | ... | reserve |
| Byte17 | Data6_L | ... | |
| Byte18 | Data7_H | ... | reserve |
| Byte19 | Data7_L | ... | |
| Byte20 | Data8_H | ... | reserve |
| Byte21 | Data8_L | ... | |
| Byte22 | Data9_H | ... | reserve |
| Byte23 | Data9_L | ... | |
| Byte24 | Data10_H | ... | reserve |
| Byte25 | Data10_L | ... | |
| Byte26 | Data11_H | ... | reserve |
| Byte27 | Data11_L | ... | |
| Byte28 | Data12_H | ... | reserve |
| Byte29 | Data12_L | ... | |
| Byte30 | CheckSum_H | ... | Checksum = Head0+Head1+Len_H+Len_L+Data0_H+...+Data12_L |
| Byte31 | CheckSum_H | ... | |

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Table 6. Compact Version Customer Use Protocol¹

| Command Length (Bytes) | HEAD | LEN | CMD | Data | CS | Example |
|--|--------|------|------|--|---|--|
| Read Particle Measuring Results | | | | | | |
| Send | 0x68 | 0x01 | 0x04 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 04 93 |
| Response, Pos ACK | 0x40 | 0x05 | 0x04 | DF1-DF8, DF9~ DF12 reserved PM1.0 = DF1 * 256 + DF2 PM2.5 = DF3 * 256 + DF4 PM4.0 = DF5 * 256 + DF6 PM10 = DF7 * 256 + DF8 | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 40 0D 04 00 30 00 31 00 32 00 33 00 00 00 00 E9 |
| Response, Neg ACK | 0x9696 | | | | | |
| Start Particle Measurement | | | | | | |
| Send | 0x68 | 0x01 | 0x01 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 01 96 |
| Response, Pos ACK | 0xA5A5 | | | | | |
| Response, Neg ACK | 0x9696 | | | | | |
| Stop Particle Measurement² | | | | | | |
| Send | 0x68 | 0x01 | 0x02 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 02 95 |
| Response, Pos ACK | 0xA5A5 | | | | | |
| Response, Neg ACK | 0x9696 | | | | | |
| Set Customer Adjustment Coefficient | | | | | | |
| Send | 0x68 | 0x02 | 0x08 | DF1: 30 ~ 200 (Default, 100) | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 02 08 64 2A |
| Response, Pos ACK | 0xA5A5 | | | | | |
| Response, Neg ACK | 0x9696 | | | | | |
| Read Customer Adjustment Coefficient | | | | | | |
| Send | 0x68 | 0x01 | 0x10 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 10 87 |
| Response, Pos ACK | 0x40 | 0x02 | 0x10 | DF1: 30 ~ 200 (Default, 100) | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 40 02 10 64 4A |
| Response, Neg ACK | 0x9696 | | | | | |
| Stop Auto Send | | | | | | |
| Send | 0x68 | 0x01 | 0x20 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 20 77 |
| Response, Pos ACK | 0xA5A5 | | | | | |
| Response, Neg ACK | 0x9696 | | | | | |
| Enable Auto Send³ | | | | | | |
| Send | 0x68 | 0x01 | 0x40 | NA | CS = MOD (((65536-(HEAD+LEN+CMD+DATA)), 256) | 68 01 40 57 |
| Response, Pos ACK | 0xA5A5 | | | | | |
| Response, Neg ACK | 0x9696 | | | | | |

¹Product life may vary depending on the specific application in which the sensor is utilized.

²Shuts down the fan, helping to extend the life of the product.

³See Table 7 for data format.

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Table 7. Compact Version Data Format (Protocol Length: 32 Bytes)

| Byte Number | Head0 | Head0 | Head0 |
|-------------|------------|-------|--|
| Byte0 | Head0 | 0x42 | fixed |
| Byte1 | Head1 | 0x4d | |
| Byte2 | Len_H | ... | Frame Length = 2x13+2(data length + checksum length) |
| Byte3 | Len_L | ... | |
| Byte4 | Data0_H | ... | PM1.0 concentration (standard particulate matter) |
| Byte5 | Data0_L | ... | |
| Byte6 | Data1_H | ... | PM2.5 concentration (standard particulate matter) |
| Byte7 | Data1_L | ... | |
| Byte8 | Data2_H | ... | PM4.0 concentration (standard particulate matter) |
| Byte9 | Data2_L | ... | |
| Byte10 | Data3_H | ... | PM10 concentration (standard particulate matter) |
| Byte11 | Data3_L | ... | |
| Byte12 | Data4_H | ... | reserve |
| Byte13 | Data4_L | ... | |
| Byte14 | Data5_H | ... | reserve |
| Byte15 | Data5_L | ... | |
| Byte16 | Data6_H | ... | reserve |
| Byte17 | Data6_L | ... | |
| Byte18 | Data7_H | ... | reserve |
| Byte19 | Data7_L | ... | |
| Byte20 | Data8_H | ... | reserve |
| Byte21 | Data8_L | ... | |
| Byte22 | Data9_H | ... | reserve |
| Byte23 | Data9_L | ... | |
| Byte24 | Data10_H | ... | reserve |
| Byte25 | Data10_L | ... | |
| Byte26 | Data11_H | ... | reserve |
| Byte27 | Data11_L | ... | |
| Byte28 | Data12_H | ... | reserve |
| Byte29 | Data12_L | ... | |
| Byte30 | CheckSum_H | ... | Checksum = Head0+Head1+Len_H+Len_L+Data0_ |
| Byte31 | CheckSum_L | ... | H+...+Data12_L |

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CAUTION

PRODUCT DAMAGE

Ensure adherence to all installation instructions.

Failure to comply with these instructions could result in product damage.

NOTICE

IMPROPER INSTALLATION

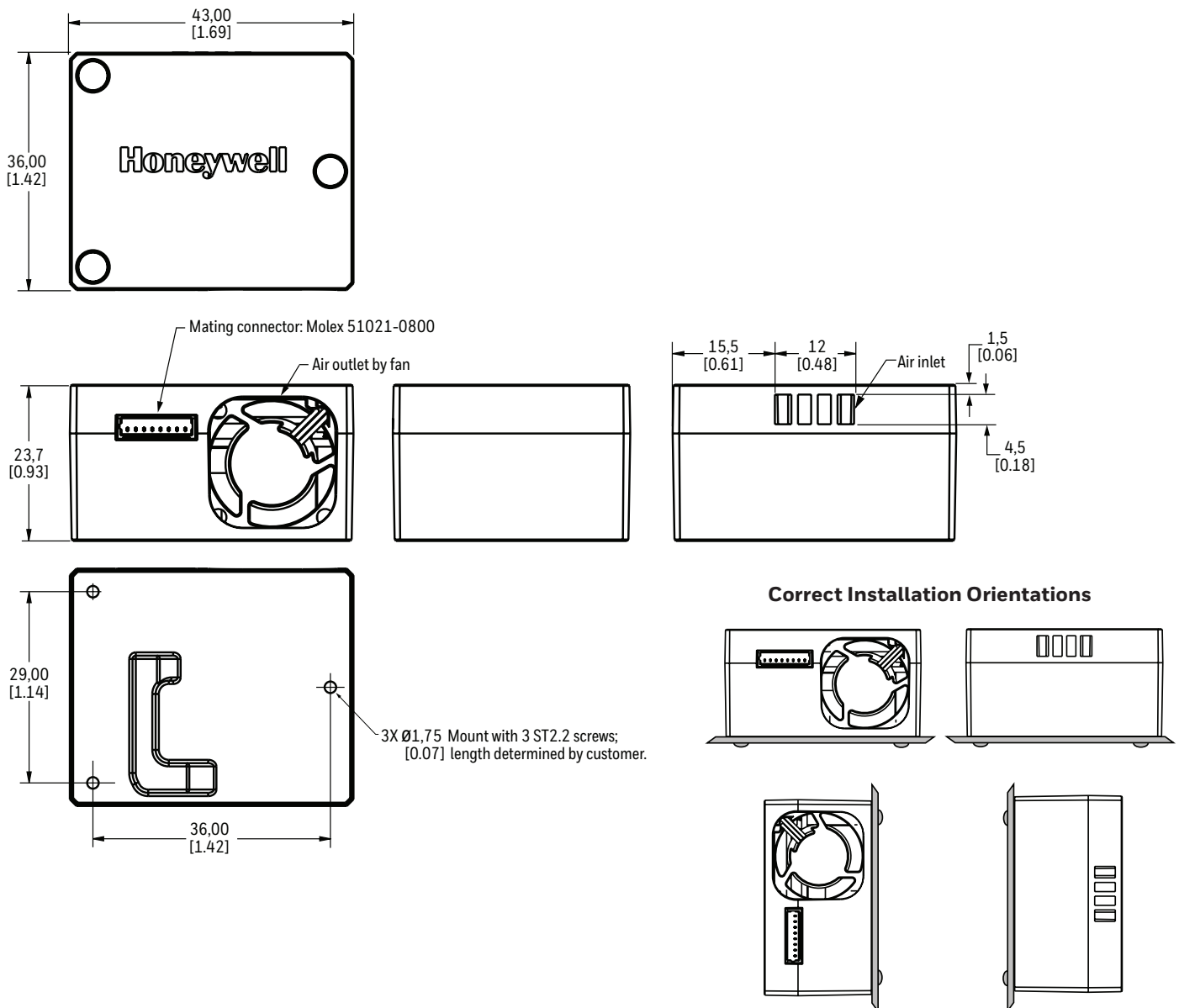
To avoid particulate settling or accumulation at the air outlet or air inlet, which may affect product sensitivity and accuracy, ensure that the HPM Series Particle Sensor:

- Is installed correctly according to Figure 2, 3, or 4.
- Is installed such that the air inlet and air outlets are not blocked and that the flow of air through the sensor is neither reduced nor increased.

Product Installation

Install the product to the desired surface using the screw size shown in the applicable figure.

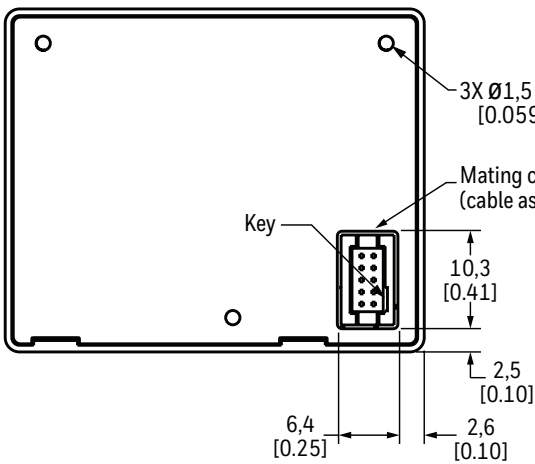
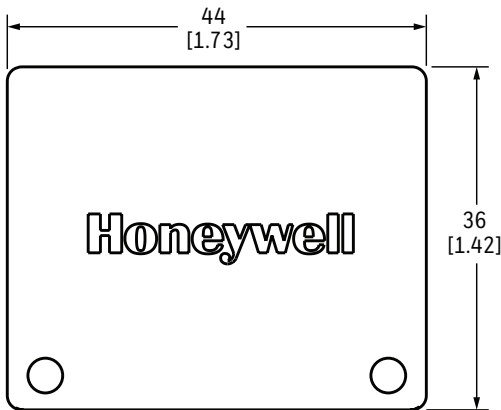
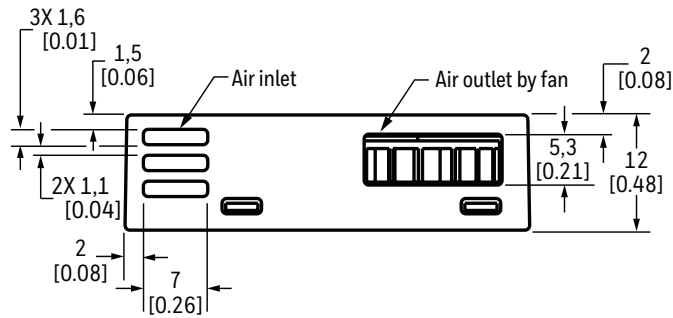
Figure 2. Standard Mounting Dimensions and Correct Installation Orientations (For reference only. (mm/[in])



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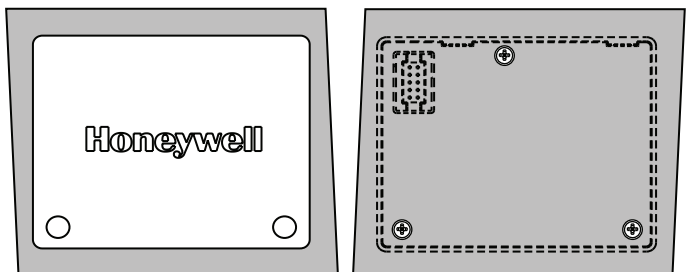
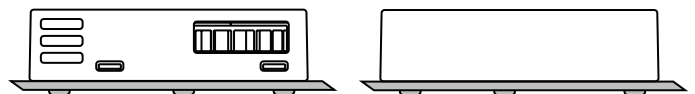
Figure 3. Compact Version HPM115CO-003 Mounting Dimensions and Correct Installation Orientations
(For reference only: mm/[in])



Mount with three 1,8 [0.071] self-tapping screws; max. engagement is 3,5 [1.138].

Mating connector: Samtec SFSD-05-28-H-5.00-SR (cable assembly) or SFM-105-02-H-D (surface mount)

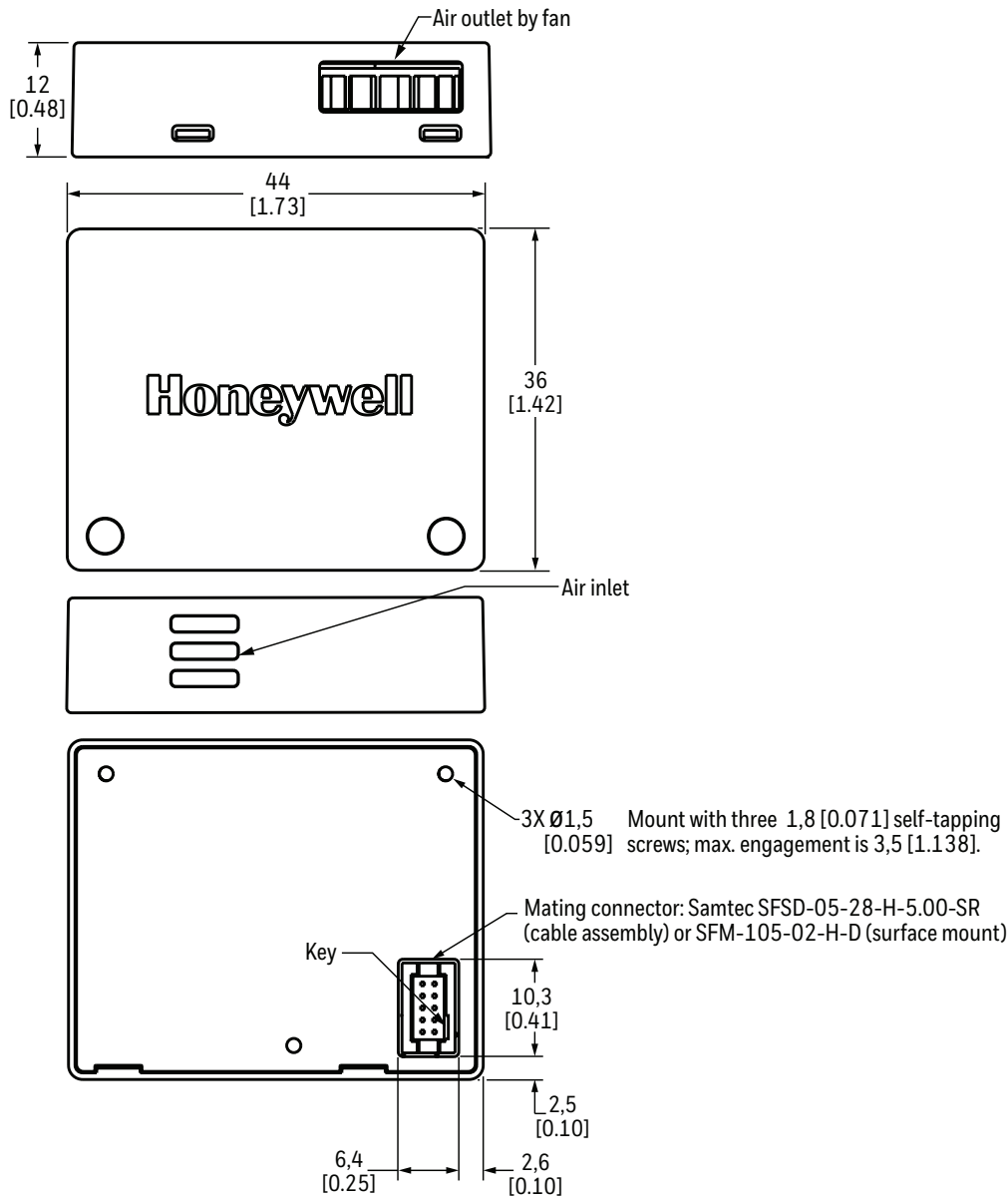
Correct Installation Orientations



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Figure 4. Compact Version HPMA115CO-004 Mounting Dimensions and Correct Installation Orientations
(For reference only: mm/[in])



Correct Installation Orientations

