

# Installation Instructions for the Honeywell Force Sensors FSA Series Compensated/Amplified

**32311097**  
Issue B

**Table 1. Operating Specifications**

| Characteristic                                                                   | Analog      |            |             | Digital     |            |             | Unit                   |
|----------------------------------------------------------------------------------|-------------|------------|-------------|-------------|------------|-------------|------------------------|
|                                                                                  | Min.        | Typ.       | Max.        | Min.        | Typ.       | Max.        |                        |
| Supply voltage ( $V_{\text{supply}}$ ): <sup>1, 2, 3</sup><br>3.3 Vdc<br>5.0 Vdc | 3.0<br>4.75 | 3.3<br>5.0 | 3.6<br>5.25 | 3.0<br>4.75 | 3.3<br>5.0 | 3.6<br>5.25 | Vdc                    |
| Supply current:<br>3.3 Vdc<br>5.0 Vdc                                            | —<br>—      | 2.0<br>2.6 | —<br>—      | —<br>—      | 2.8<br>3.9 | 3.9<br>4.6  | mA                     |
| Power input                                                                      | 13          |            |             | 20          |            |             | mW                     |
| Operating temperature range <sup>4</sup>                                         | 0 [32]      | —          | 70 [158]    | 0 [32]      | —          | 70 [158]    | °C [°F]                |
| Compensated temperature range <sup>5</sup>                                       | 5 [41]      | —          | 50 [122]    | 5 [41]      | —          | 50 [122]    | °C [°F]                |
| Storage temperature range                                                        | -40 [-40]   | —          | 85 [185]    | -40 [-40]   | —          | 85 [185]    | °C [°F]                |
| Startup time (power up to data ready)                                            | —           | —          | 5           | —           | —          | 3           | ms                     |
| Response time                                                                    | —           | 1          | —           | —           | 0.42       | 0.84        | ms                     |
| Clipping limit:<br>upper<br>lower                                                | —<br>2.5    | —<br>—     | 97.5<br>—   | —<br>—      | —<br>—     | —<br>—      | % $V_{\text{supply}}$  |
| SPI/I <sup>2</sup> C voltage level:<br>low<br>high                               | —<br>—      | —<br>—     | —<br>—      | —<br>80     | —<br>—     | 20<br>—     | % $V_{\text{supply}}$  |
| Pull up on SDA/MISO, SCL/SCLK, SS                                                | —           | —          | —           | 1           | —          | —           | kOhm                   |
| Accuracy <sup>6</sup>                                                            | —           | —          | ±3          | —           | —          | ±3          | %FSS <sup>7</sup> BFSL |
| Total Error Band <sup>8</sup>                                                    | —           | —          | ±5          | —           | —          | ±5          | %FSS                   |
| Output resolution                                                                | —           | —          | —           | 12          | —          | —           | bits                   |
| Long term stability <sup>9</sup>                                                 | —           | ±1.3       | —           | —           | ±1.3       | —           | %FSS                   |

<sup>1</sup>Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.

<sup>2</sup>Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified operating voltage.

<sup>3</sup>The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

<sup>4</sup>Operating temperature range: The temperature range over which the sensor will produce an output proportional to force.

<sup>5</sup>Compensated temperature range: The temperature range over which the sensor will produce an output proportional to force within the specified performance limits.

<sup>6</sup>Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the force range at 25°C [77°F]. Includes all errors due to force non-linearity, force hysteresis, and non-repeatability.

<sup>7</sup>Full Scale Span (FSS): The algebraic difference between the output voltage at full scale force and the output at zero force.

<sup>8</sup>Total Error Band (TEB): Combined error from calibration, accuracy and temperature effects over the compensated temperature range at 5.0 V from 15 %FSS to 95 %FSS.

<sup>9</sup>Long-term stability after 1000 hr of operation at 25°C [77°F].

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**Table 2. Environmental Specifications**

| Characteristic    | Parameter                                      |
|-------------------|------------------------------------------------|
| Humidity          | 0% to 95% RH, non-condensing                   |
| Vibration         | MIL-STD-202, Method 214, Condition 1E (16.9 G) |
| Shock             | MIL-STD-202, Method 213, Condition F (1500 G)  |
| Life <sup>1</sup> | 1 million full scale force cycles minimum      |

<sup>1</sup>Life may vary depending on specific application in which the sensor is utilized.

**Table 3. Materials<sup>1</sup>**

| Component             | Material                       |
|-----------------------|--------------------------------|
| Covers                | high temperature polyamide     |
| Plunger               | stainless steel 316            |
| Substrate             | alumina, ceramic               |
| Adhesives             | epoxy, silicone                |
| Electronic components | ceramic silicon, glass, solder |

<sup>1</sup>Contact Honeywell customer service for detailed material information.

**Table 4. Absolute Maximum Specifications**

| Characteristic                                                | Min.                      | Max.                      | Unit    |
|---------------------------------------------------------------|---------------------------|---------------------------|---------|
| Supply voltage                                                | -0.3                      | 6.0                       | Vdc     |
| Voltage on any pin                                            | -0.3                      | $V_{\text{supply}} + 0.3$ | V       |
| Digital interface clock frequency:<br>SPI<br>I <sup>2</sup> C | 50<br>100                 | 800<br>400                | kHz     |
| ESD susceptibility (human body model)                         | 2                         | —                         | kV      |
| Storage temperature range                                     | -40 [-40]                 | 85 [185]                  | °C [°F] |
| Overforce limit                                               | —                         | 6804 [15]                 | g [lb]  |
| Minimum operating voltage                                     | 2.8 Vdc                   |                           |         |
| Lead soldering time and temperature                           | 4 s max. at 220°C [428°F] |                           |         |

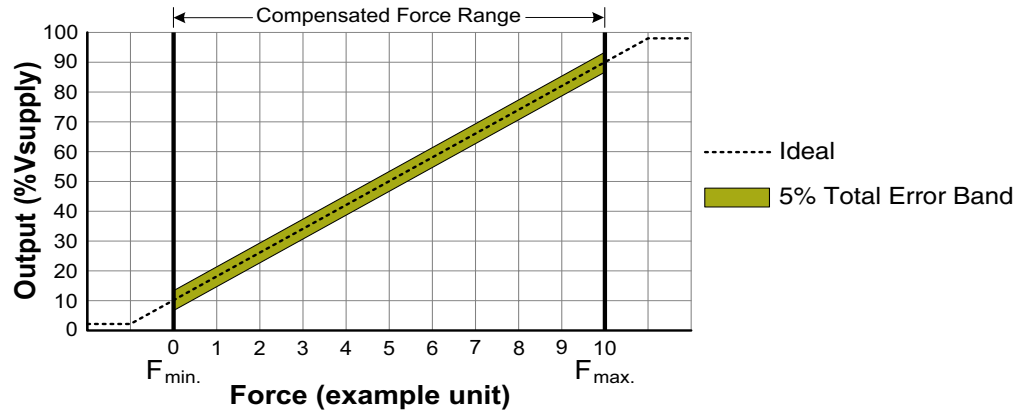
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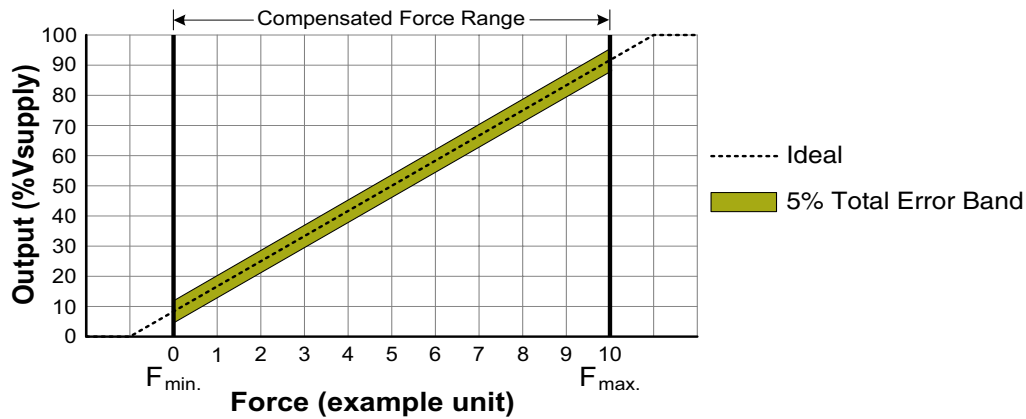
Figure 2. Transfer Function Limits<sup>1</sup>

### Analog Version



$$\text{Output (V)} = \frac{0.8 \times V_{\text{supply}}}{\text{Force}_{\text{range}}} \times (\text{Force}_{\text{applied}}) + 0.10 \times V_{\text{supply}}$$

### Digital Version



$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{\text{Force}_{\text{range}}} \times (\text{Force}_{\text{applied}}) + 10\%$$

<sup>1</sup>Transfer Function "A" is shown. See Figure 1 for other available transfer function options.

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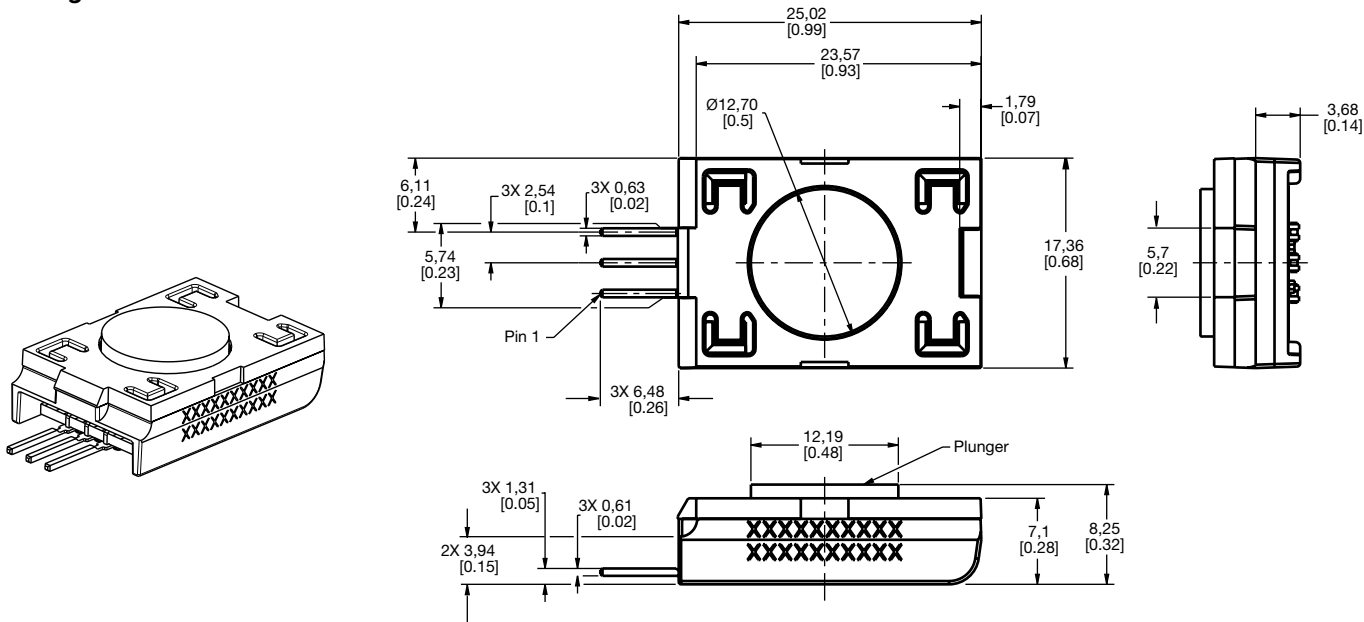
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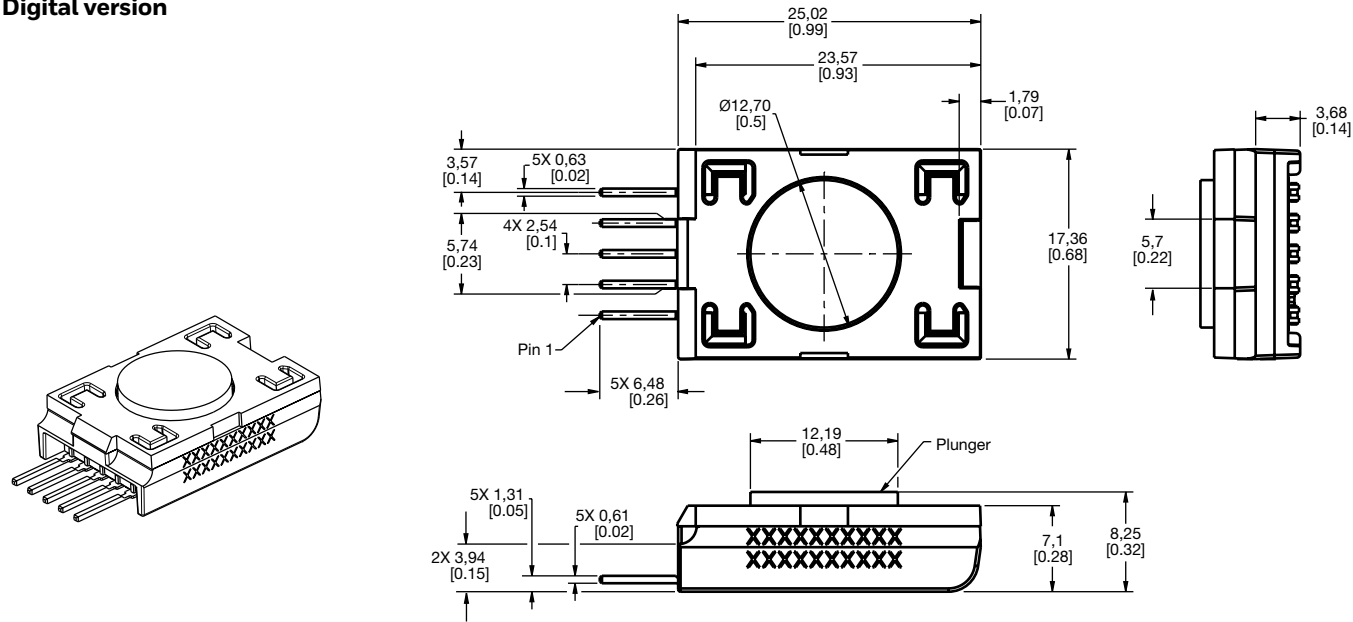
Figure 2. Mounting Dimensions (For reference only: mm/in.)

Analog version



| Function | Pin 1               | Pin 2            | Pin 3 |
|----------|---------------------|------------------|-------|
| analog   | V <sub>supply</sub> | V <sub>out</sub> | GND   |

Digital version



| Function         | Pin 1 | Pin 2               | Pin 3 | Pin 4 | Pin 5 |
|------------------|-------|---------------------|-------|-------|-------|
| SPI              | GND   | V <sub>supply</sub> | SS    | MISO  | SCLK  |
| I <sup>2</sup> C | GND   | V <sub>supply</sub> | N/C   | SDA   | SCL   |

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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 death or serious injury.**

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## **Honeywell Sensing and Internet of Things**

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