

## Installation Instructions for FSS Series Low Profile Force Sensor

Rev. B  
50000008

### OVERFORCE

#### CAUTION

##### EXCEEDING PRODUCT OVERFORCE RATING

- Ensure the overforce ratings given in Table 1 are not exceeded during any phase of sensor assembly to the board, as well as during the use of the sensor in the application.

**Failure to comply with these instructions may result in product damage.**

### CLEANING

#### CAUTION

##### IMPROPER CLEANING

- Ensure the appropriate cleaning fluids, such as alcohols or fluorinated solvents, are used based on the type of contaminants to be removed.

**Failure to comply with these instructions may result in product damage.**

### SOLDERING

#### CAUTION

##### IMPROPER SOLDERING

- Follow proper soldering procedures.
- Follow appropriate heat sinking methods.

**Failure to comply with these instructions may result in product damage.**

**Table 2. Soldering Specifications<sup>1</sup>**

Characteristic	Parameter
Temperature	315 °C [599 °F] max.
Duration	5 s max. per lead
SMT reflow profile	maximum peak SMT reflow temperature of 260 °C [500 °F] for 10 s

#### Note:

- The maximum temperature and duration to which the product may be exposed for processing the solder electrical connections.

**Table 1. Performance Characteristics (At 10 ±0.01 Vdc, 25 °C [77 °F].)<sup>1</sup>**

Characteristic	Unit	FSS005WNSX			FSS010WNSX			FSS015WNSR			FSS020WNST		
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
Force sensing range	N	0 to 5			0 to 10			0 to 15			0 to 20		
Excitation <sup>2</sup>	Vdc	3.3	10	12.5	3.3	10	12.5	3.3	10	12.5	3.3	10	12.5
Null offset <sup>3</sup>	mV	-30	0	+30	-30	0	+30	-30	0	+30	-30	0	+30
Null shift <sup>4</sup> (25 to 0°, 25 to 50° C)	mV	-	±0.5	-	-	±0.5	-	-	±0.5	-	-	±0.5	-
Span <sup>5</sup>	mV	330	360	390	330	360	390	330	360	390	330	360	390
Linearity (BFSL) <sup>6</sup>	% span	-	±0.5	-	-	±0.5	-	-	±0.5	-	-	±0.5	-
Sensitivity <sup>7</sup>	mV/V/N	6.6	7.2	7.8	3.3	3.6	3.9	2.2	2.4	2.6	1.65	1.8	1.95
Sensitivity shift <sup>8</sup> (25 °C to 0°, 25 °C to 50 °C)	% span	-	±5.0	-	-	±5.0	-	-	±5.0	-	-	±5.0	-
Repeatability <sup>9</sup>	% span	-	±0.2	-	-	±0.2	-	-	±0.2	-	-	±0.2	-
Response time (10 %FS to 90 %FS)	ms	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5
Input resistance	kΩ	4.0	5.0	6.0	4.0	5.0	6.0	4.0	5.0	6.0	4.0	5.0	6.0
Output resistance	kΩ	4.0	5.0	6.0	4.0	5.0	6.0	4.0	5.0	6.0	4.0	5.0	6.0
Plunger deflection	µm	-	26	-	-	28	-	-	33	-	-	39	-
Overforce <sup>10</sup>	N	-	-	15	-	-	30	-	-	45	-	-	60

#### Notes:

- All force-related specifications are established using dead weight or compliant force.
- The range of voltage excitation which can be supplied to the product to produce an output which is proportional to force but due to ratiometricity errors may not remain within the specified performance limits. Non-compensated force sensors, excited by constant current (1.5 mA) instead of voltage, exhibit partial temperature compensation of span.
- The output signal obtained when the zero force is applied to the sensor. Also known as "null" or "zero".
- The change in the null resulting from a change in temperature. It is not a predictable error as it can shift up and down from unit to unit. Change in temperature causes the entire output curve to shift up or down along the voltage axis.
- The algebraic difference between output signals measured at the upper and lower limits of the operating force range. Also known as "full scale output" or simply "span".

6. The maximum deviation of product output from a straight line fitted to output measured over the operating force range. The straight line through a set of points which minimizes the sum of the square of the deviations of each of the points from the straight line.
7. The ratio of output signal change to the corresponding input force change. Sensitivity is determined by computing the ratio of span to the specified operating force range multiplied by the supply voltage being used.
8. The maximum deviation in sensitivity due to changes in temperature over the operating temperature range, relative to sensitivity measured at 25 °C.
9. The maximum difference between output readings when the same force is applied consecutively, under the same operating conditions, with force approaching from the same direction within the operating force range.
10. Overforce is the maximum force which may safely be applied to the product for it to remain in specification once force is returned to the operating force range. Exposure to higher forces may cause permanent damage to the product. Unless otherwise specified, this applies to all temperatures within the operating temperature range.

**Table 3. Environmental Specifications**

Characteristic	Parameter
Operating temperature <sup>1</sup>	-40 °C to 85 °C [-40 °F to 185 °F]
Shock	qualification tested to 150 g
Vibration	qualification tested to 0 to 2 kHz, 20 g sine
MCTF <sup>2</sup> (Mean Cycles to Failure)	20 million at 25 °C [77 °F]
Output ratiometric	within supply range

**Notes:**

1. The temperature range over which the product may safely be exposed without excitation or force applied. Under these conditions the product will remain in specification after excursion to any temperatures in this range. Exposure to temperatures beyond this range may cause permanent damage to the product.
2. MCTF is a basic measure of reliability for a non-repairable device. It is the mean number of cycles to maximum operating force over which a sensor can be expected to operate until failure. The mean value is determined statistically from a probability distribution for failures based upon test data. MCTF may vary depending on the specific application in which a sensor is utilized.

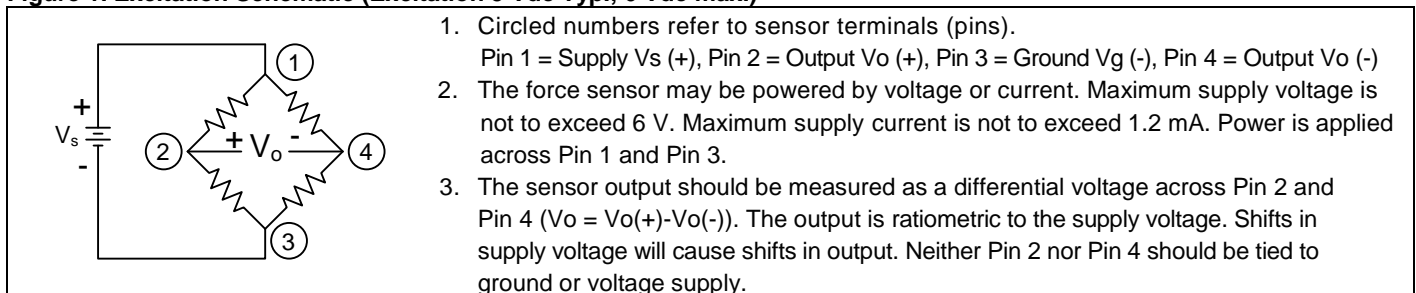
**Table 4. Absolute Maximum Ratings<sup>1</sup>**

Characteristic	Parameter
Storage temperature <sup>2</sup>	-40 °C to 100 °C [-40 °F to 212 °F]
ESD	Meets ESD Sensitivity Classification Level 3B

**Notes:**

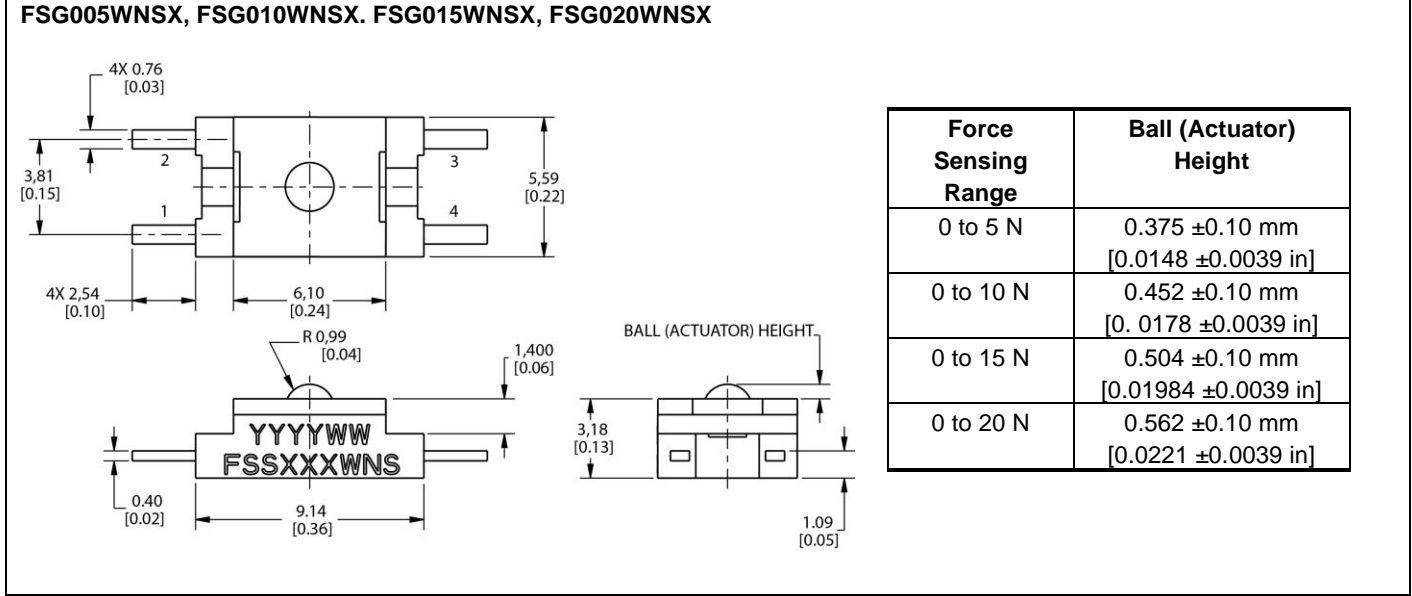
1. The product can withstand without damage to the product.
2. The temperature range over which the product will produce an output proportional to force but may not remain within the specified performance limits.

**Figure 1. Excitation Schematic (Excitation 5 Vdc Typ., 6 Vdc max.)**

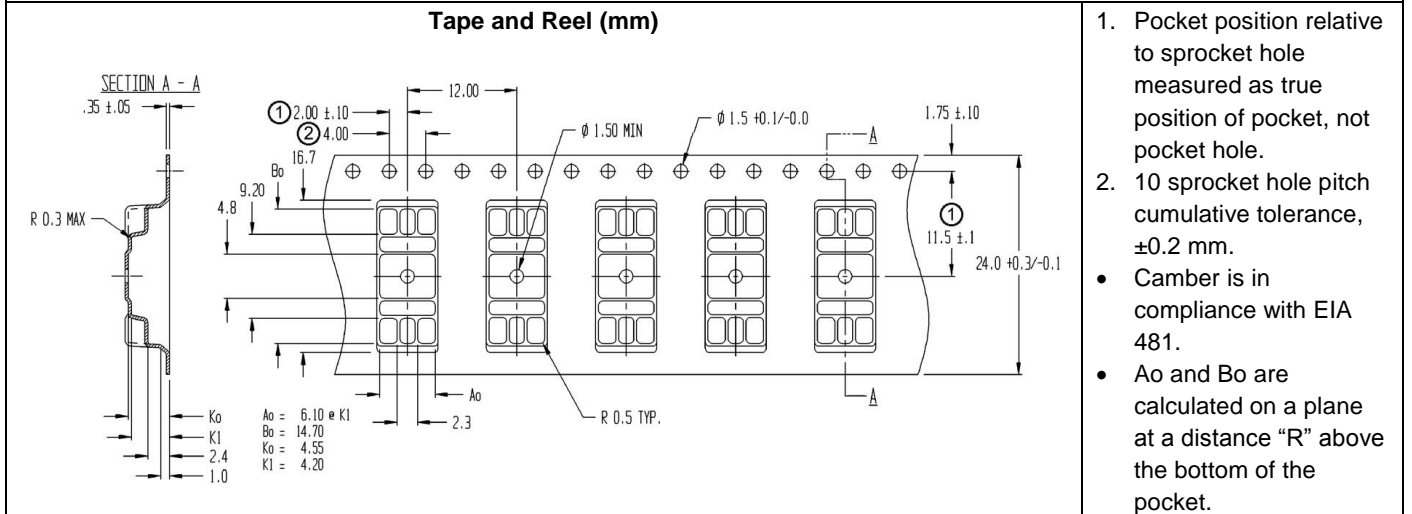
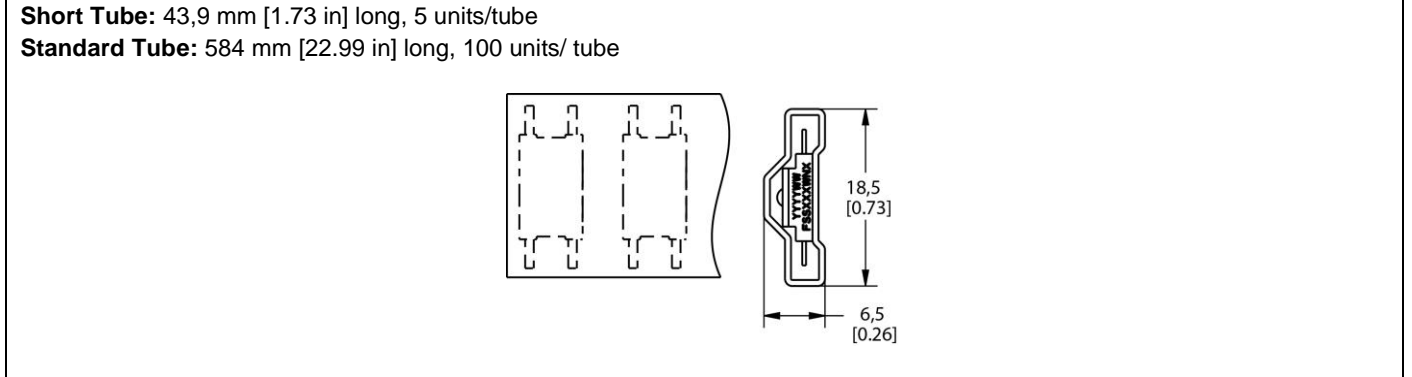


1. Circled numbers refer to sensor terminals (pins).  
Pin 1 = Supply  $V_s$  (+), Pin 2 = Output  $V_o$  (+), Pin 3 = Ground  $V_g$  (-), Pin 4 = Output  $V_o$  (-)
2. The force sensor may be powered by voltage or current. Maximum supply voltage is not to exceed 6 V. Maximum supply current is not to exceed 1.2 mA. Power is applied across Pin 1 and Pin 3.
3. The sensor output should be measured as a differential voltage across Pin 2 and Pin 4 ( $V_o = V_o(+)-V_o(-)$ ). The output is ratiometric to the supply voltage. Shifts in supply voltage will cause shifts in output. Neither Pin 2 nor Pin 4 should be tied to ground or voltage supply.

**Figure 2. Sensor Mounting Dimensions (For reference only: mm/[in].)**



**Figure 3. Packaging Dimensions (For reference only.)**



## 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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