

FMA SERIES

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Issue B

MicroForce Sensors, Compensated/Amplified

DESCRIPTION

The FMA Series are piezoresistive-based force sensors offering a ratiometric digital output for reading force over the specified full scale force span and temperature range. They are fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and nonlinearity using an on-board Application Specific Integrated Circuit (ASIC). Direct mechanical coupling allows for easy interface with the sensor, coupling with tubing, membrane or a plunger, providing repeatable performance and a reliable mechanical interface to the application. All products are designed and manufactured according to ISO 9001 standards. These products offer a more stable output which is directly proportional to the force applied to the mechanically-coupled sphere.

The FMA Series is available with pocket tape and reel packaging.

VALUE TO CUSTOMERS

The FMA Series are designed to meet the customer's need for a compensated, amplified force sensor which provides digital outputs, a variety of force sensing ranges, a small, cost-effective format, and enhanced durability and accuracy. The flexible design provides multiple standard configurations over a wide operating temperature range.

DIFFERENTIATION

- Multiple force ranges allow the customer to choose the force range to maximize sensitivity and improve system resolution/performance
- Smaller package allows for space constrained applications
- Robust design provides enhanced durability in applications where overforce may exist
- Enhanced accuracy includes all errors due to force non-linearity, force hysteresis, and non-repeatability
- Reduced Total Error Band enhances system performance
- Digital output enhances performance through reduced conversion requirements and the convenience of direct interface to microprocessors
- Diagnostic functions allow the user to determine if the sensor is working correctly by detecting if electrical paths are broken or shorted inside the sensor
- Selectable supply voltages provide customers with design flexibility

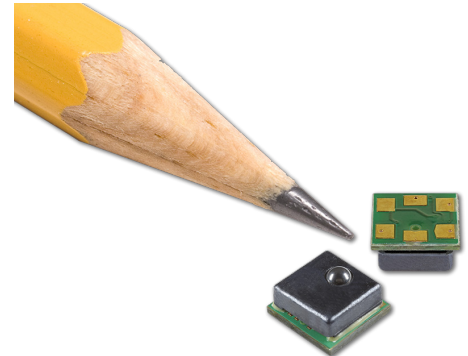
POTENTIAL APPLICATIONS

MEDICAL

- Infusion pumps
- Ambulatory pumps
- Enteral feeding pumps
- Kidney dialysis machines

INDUSTRIAL

- Load and compression sensing
- Touch panels
- Switch replacement
- Robotic equipment
- Weight measurement
- Force/grip measuring equipment



FEATURES

- Small form factor: 5 mm x 5 mm [0.20 in x 0.20 in]
- Accuracy: ± 2 %FSS typical
- SPI- or I²C-compatible digital output
- Fully calibrated and temperature compensated over a temperature range of 5°C to 50°C [41°F to 122°F]
- Available in a wide variety of standard and configurable force ranges
- Overforce: 3X force range
- Supply voltage: 3.3 Vdc typ. or 5.0 Vdc typ.
- Low power consumption: 14 mW
- Enhanced part-to-part repeatability
- Enhanced reliability
- Stable, stainless steel sphere interface
- Internal diagnostic functions available
- REACH and RoHS compliant



The FMA Series joins the FSA Series, FSG Series, FSS Series, FSS-SMT Series, TBF Series, and 1865 Series Force Sensors. To view the entire product portfolio, [click here](#).

Honeywell

MICROFORCE SENSORS, FMA SERIES

TABLE 1. ABSOLUTE MAXIMUM SPECIFICATIONS

CHARACTERISTIC	MINIMUM	TYPICAL	MAXIMUM	UNIT
Supply voltage	-0.3	—	6.0	Vdc
Voltage on any pin	-0.3	—	Vsupply + 0.3	V
Digital clock frequency:				
SPI	50	—	800	kHz
I ² C	100	—	400	
ESD susceptibility (human body model)	8	—	—	kV
Storage temperature range	-40 [-40]	—	85 [185]	°C °[F]
Overforce limit	—	—	3X force range ¹	—

¹Repeated exposure to the overforce may cause permanent damage to the sensor.

TABLE 2. OPERATING SPECIFICATIONS

CHARACTERISTIC	MINIMUM	TYPICAL	MAXIMUM	UNIT
Supply voltage (Vsupply) ^{1, 2, 3} :				
3.3 Vdc	3.0	3.3	3.6	Vdc
5.0 Vdc	4.75	5.0	5.25	
Supply current:				
3.3 Vdc	—	2.8	3.9	mA
5.0 Vdc	—	3.9	4.6	
Power input	—	20	—	mW
Operating temperature range ⁴	-40 [-40]	—	85 [185]	°C °[F]
Compensated temperature range ⁵	5 [41]	—	50 [122]	°C °[F]
Storage temperature range	-40 [-40]	—	85 [185]	°C °[F]
Startup time (power up to data ready)	—	—	3	ms
Response time	—	0.42	0.84	ms
SPI/I ² C voltage level:				
low	—	—	20	V _{supply}
high	80	—	—	
Pull up on SDA/MISO, SCL/SCLK, SS	1	—	—	kOhm
Accuracy ⁶	—	±2	—	%FSS ⁷ BFSL
Total Error Band ⁸	—	—	±8	%FSS
Output resolution	12	—	—	bits
Long term stability	—	±1.6	—	%FSS

¹Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.

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

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

⁴**Operating temperature range:** The temperature range over which the sensor will produce an output proportional to force.

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

⁶**Accuracy:** The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the force range with single load-unload cycle at 25°C. Includes all errors due to force non linearity, force hysteresis, and non repeatability.

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

⁸**Total Error Band (TEB):** Combined error from calibration, accuracy and temperature effects over the compensated temperature range at 5.0 V from 20 %FSS to 80 %FSS.