

MEMS Capacitive Accelerometers

# Preliminary Data sheet – Tilt Application

## MS9001.D – MS90.5.D

30S.TS9X.A.03.10

### Features

**Extra small LCC20 packaging (8.9mm x 8.9mm)**  
**±15° and ±30° quasi linear measurement range**  
**Excellent stability**  
**Harsh Environment (shock, vibration, temperature)**  
**MIL-STD-833-E qualified**  
**Low power analog voltage output**  
**Brown out protected**

### Applications

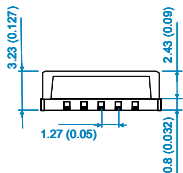
Directional drilling  
 Platform stabilization  
 Camera, antenna, turret, fire control platform...  
 Laser range finding  
 North finding  
 HMS (Helmet mount system)  
 Tilting train control

### Description

Colibrys low g MS9000 accelerometers are new extra small product designed for tilt applications in harsh environment and safety critical applications. These products come in a LCC20 (8.9mm x 8.9mm) ceramic package and in a variety of full scale acceleration from ±0.5g on demand to ±2g. These sensors can operate over extended temperature ranges with just a few milli ° of stability guaranteed over extended lifetime.

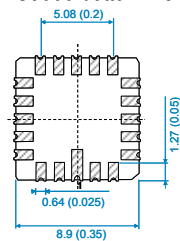
The Colibrys MS9000 accelerometer is a MEMS capacitive sensor, based upon a bulk micro-machined silicon element, a low power ASIC for signal conditioning, a micro-controller for storage of compensation values and a temperature sensor. The product is low power, calibrated, robust and stable and the electronic configuration provides a solid power on reset and ensures a full protection against brown-out.

MS9000 side view

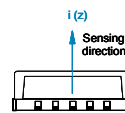


Typ. values mm (inch)

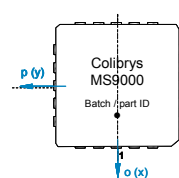
MS9000 bottom view



MS9000 side view



MS9000 top view



### Specifications

All values are specified at +20°C (+68°F) and 5.0 VDC supply voltage, unless otherwise stated

	Units	MS9001.D	Custom on demand MS90.5.D	
Full scale range	g	1	0.5	
Full scale range (non linear)	°	± 90°	± 30°	
Full scale range (quasi linear)	°	± 30°	± 15°	
<b>Packaging</b>				
Bias calibration	°	0.14	0.07	
One year bias stability @ 6000g [1]	° typ (max)	0.043 (0.14)	0.021 (0.07)	
One year bias stability @ 1000g [2]	° typ (max)	0.009 (0.043)	0.0012 (0.029)	
Bias temp. coefficient [2]	°/°C typ	0.003	0.0015	
	°/°C max	0.012	0.006	
Scale factor sensitivity (K1) (0°-15°)	mV/°	34.9	69.8	Note: See dedicated tilt application note on our web site to better understand the scale factor and linearity of our tilt sensors
Scale factor sensitivity (K1) (0°-30°)	mV/°	34.9 ± 5%	69.8 ± 5%	
One year scale factor stability [1] & [2]	ppm	300 (<1000)	300 (<1000)	
Scale factor temp. coefficient [3]	% / °C typ	0.01	0.01	
Input axis misalignment (Kp, Ko)	mrad max.	< 10	< 10	
	% max	1	1	
Resolution / Threshold (@ 1Hz)	°	0.003	0.0015	
Bandwidth [4]	Hz	0 to ≥ 100	0 to ≥ 100	
Noise spectral density in band	° / √Hz	0.0009	0.0005	
Resonant frequency	kHz	TBD	TBD	

[1]: One year stability defined according to IEEE 528-2001: turn on / on, storage at -55°C and 85°C, -40°C to 125°C T cycling, -55°C to 85°C unpowered harass, vibration, shock (6000g, single shock).

[2]: One year stability defined according to IEEE 528-2001: turn on / on, storage at -55°C and 85°C, -40°C to 125°C T cycling, -55°C to 85°C unpowered harass, vibration, shock (1000g, single shock).

[3]: Temperature coefficients are specified for a range of -40°C to 20°C, where temperature behavior is typically linear.

[4]: The bandwidth is defined as the frequency band for which the sensitivity has decreased by less than 3dB.

<b>Environmental</b>	MS9001.D	Custom on demand MS90.5.D
	Operating temperature range	-55°C to +125°C (-67°F to 255°F)
Reliability	Results based on MIL-HDBK-217, notice 2, are available on request.	
Shock resistance	Up to 6'000 g (0.15ms half-sine, single shock, not repetitive, in one direction o, p or l)	
Recovery time	< 1ms (1000g, half-sine period 1ms, shocks in direction i)	
Vibration	20 g rms, 20-2000 Hz (random noise, 30 minutes in each direction o, p, i)	
LCC packaging	The product has been qualified according to MIL-STD-883-G. Hermetic sealing is qualified at 5·10 <sup>-8</sup> atm·cm <sup>3</sup> /s	
ESD sensitivity	Class 2 (requirements MIL-STD-883-G, 1 Method 3015.7), HBM 2kV	
Proximity effect	The sensor is sensitive to external parasitic capacitance. Proximity of large metallic mass (typ accelerometer size in mm ranges) must be avoided to insure best performances.	

Note: LCC must be tightly fixed to the PCB, using the bottom of the housing as reference plan for axis alignment.

<b>Electrical</b>	
Input voltage (VDD – VSS)	2.5 to 5.5 VDC. The standard voltage for calibration is 5.0 VDC.
Output voltage range	From 0.5 to 4.5 VDC @ 5.0 VDC input voltage (2.5 V ± 10mV at 0g)
Operating current consumption	< 400 µA @ 5.0 VDC
Initialization & reset current consumption	Typ. 1500 µA @ 5.0 VDC during the initialization phase (less than 35 ms at room temperature)
Reset	The sensor is Brown out protected. A reset occurs when the power supply jumps more than +0.46 V with a slope >380V/s or if the power supply drops below 2.2V. The recovery time is typ. 25 ms (max 35 ms)
Output impedance / load	Min. 50 kΩ at Vout (pin 8) and VAGND (pin 5) Max. 50 pF at Vout (pin 8) and Max. 100 µF at VAGND (pin 5)

<b>Physical</b>	
Weight	Hermetically sealed LCC, 20 pins housing < 1.5 grams
Size	Typ. 8.9 x 8.9 x 3.23 mm (0.35 x 0.35 x 0.127 inch) Max. 9.2 x 9.2 x 3.5 mm (0.354 x 0.354 x 0.138 inch)

<b>Temperature sensor</b>	
Output Voltage at 20°C	Typ: 1.632 V
Sensitivity	Typ: -11.77 mV/°C
Long term stability	Max -0.03°C to +0.09°C (1000h @ 150°C)
Accuracy	± 5°C (From -40°C to 125°C)

### Block diagram and electrical connections

It is necessary to use decoupling capacitors [C] of 1µF each between VDD and VAGND and between VAGND and VSS,

placed as close as possible from the accelerometer. COG or X7R @ 5% capacitor types are recommended.

Pin	Description	Remarks
4	VDD	Power supply
5	VAGND	Accelerometer output reference voltage(VDD/2)
6	VSS	Ground
7	V0	Temperature sensor output
8	Vout	Accelerometer output signal
16	VPP (Colibrys internal calibration pin)	<b>Must</b> be connected to VSS
17	SCK (Colibrys internal calibration pin)	<b>Must</b> be connected to VSS
18	SDA (Colibrys internal calibration pin)	<b>Must</b> be connected to VSS

A detailed MS9000 Product Description (30D.MS9X.x.xx.xx) and further Application Notes are available on demand or on our web site.

standard MS9000 products wp4 1s-gl8203 Tm.001 T 393.9 TD.0ET8.h

In order to provide an ideal support to our customers, our



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