3-AXIS ANALOG MAGNETOMETER

HMC2003

Honeywell

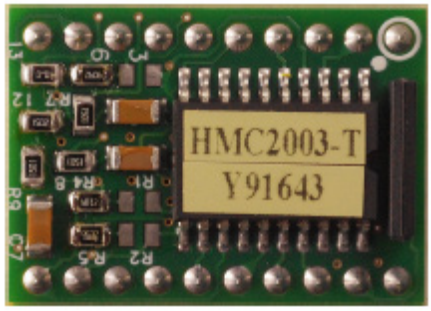
3-AXIS
ANALOG MAGNETOMETER

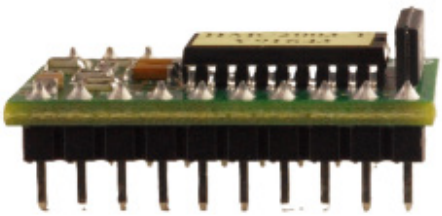
HMC2003

The Honeywell HMC2003 is a high sensitivity, factory calibrated, analog 3-axis magnetometer. Honeywell's most sensitive magneto-resistive sensors (HMC1001 and HMC1002) are utilized to provide the reliability and precision of this magnetometer design.

The HMC2003 interface is all analog with critical nodes brought out to the pin interfaces for maximum user flexibility. The internal excitation current source and selected gain and offset resistors, reduces temperature errors plus gain and offset drift. Three precision low-noise instrumentation amplifiers with 1kHz low pass filters provide accurate measurements while rejecting unwanted noise.

Applications include: General Low-Field Magnetometry, Precision Compassing, Navigation Systems, UAV, Attitude Reference, Traffic Detection, Proximity Detection and Medical Devices

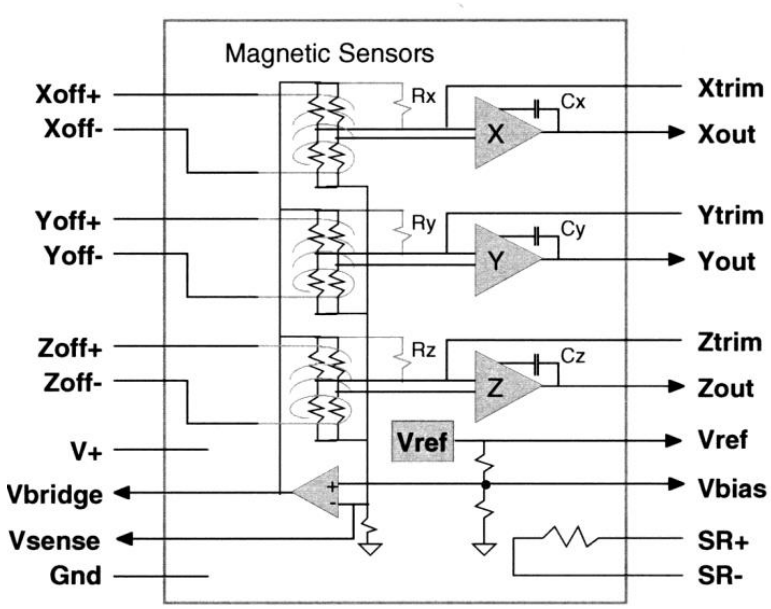




FEATURES

- 20-pin Wide DIP Footprint (1" by 0.75")
- Precision 3-axis Capability
- Factory Calibrated Analog Outputs
- 40 micro-gauss to ±2 gauss Dynamic Range
- Analog Output at 1 Volt/gauss (2.5V @ 0 gauss)
- Onboard +2.5 Volt Reference
- +6 to +15 Volt DC Single Supply Operation
- Very Low Magnetic Material Content
- -40° to 85°C Operating Temperature Range

BLOCK DIAGRAM



HMC2003

SPECIFICATIONS

CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Magnetic Field					
Sensitivity[2]		0.98	1	1.02	Volts
Null Field Output[2]		2.3	2.5	2.7	V
Resolution[3]			40		µgauss
Field Range[2]	Maximum Magnetic Flux Density	-2		2	gauss
Output Voltage[2]	Full Scale Range	3.92		4.08	V
Bandwidth[3]			1		kHz
Errors					
Linearity Error[1, 2]	±1 gauss Applied Field Sweep1 ±2 gauss Applied Field Sweep2		0.5 2	2	%FS
Hysteresis Error[2]	3 Sweeps across ±2 gauss		0.2		%FS
Repeatability Error[2]	3 Sweeps across ±2 gauss		0.2		%FS
Power Supply Effect[3]	PS Varied from 6 to 15V With ±1 gauss Applied Field Sweep			0.1	%FS
Offset Strap					
Resistance[5]	Cross field = 0.5 gauss, Happlied = ±3 gauss			10.5	ohms
Sensitivity[2]			47.5		mA/gauss
Current[3]				200	mA
Set/Reset Strap					
Resistance[5]	2 µ-sec pulse		4.5	6	ohms
Current[3]	0.1% duty cycle	2.0	3.2	4.5	amp
Tempcos					
Field Sensitivity[3]			-600		ppm/°C
Null Field[3]	Set/Reset Not Used Set/Reset Used		±400 ±100		ppm/°C
Environments					
Temperature[3]	Operating Storage	-40 -55	- -	+85 +125	°C °C
Vibration[3]			2		g rms
Electrical					
Supply Voltage[4]		6		15	VDC
Supply Current[2]				20	mA

(1) By Design

(2) Tested in Production. Unless otherwise stated, test conditions are as follows: Power Supply = 12VDC, Ambient Temp = 25°C, Set/Reset switching is active except stated otherwise.

(3) Characterized

(4) Transient protection circuitry should be added across V+ and Gnd if an unregulated power supply is used.

(5) Tested in Production at the Sensor Level (HMC1001 and HMC1002)

* Units: 1 gauss = 1 Oersted (in air) = 79.58 A/m = 10E5 gamma

HMC2003

General Description

Honeywell's three axis factory-calibrated analog magnetometer uses three permalloy magneto-resistive sensors and custom interface electronics to measure the strength and direction of an incident magnetic field. These sensors are sensitive to magnetic fields along the length, width, and height (X, Y, Z axis) of the 20-pin dual-in-line magnetometer package. Fields can be detected less than 40 microgauss and up to ±2 gauss. Analog outputs are available for each X, Y and Z axis. With the sensitivity and linearity of this magnetometer, changes can be detected in the earth's magnetic field to provide compass headings or attitude sensing. The high bandwidth of this magnetometer allows for anomaly detection of vehicles, planes, and other ferrous objects at high speeds.

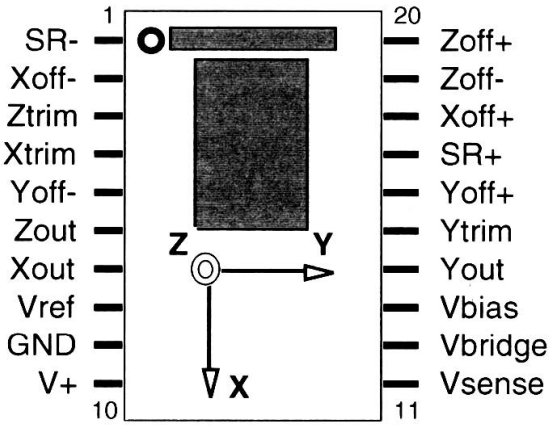
The HMC2003 is packaged on a small printed circuit board (1" by 0.75") and has an on-chip +2.5 voltage reference that operates from a single 6 to 15V supply. The HMC2003 is ideal for applications that require two- or three-axis magnetic sensing and have size constraints and need a magnetic transducer (magnetometer) front-end. Note that the calibration resistor values will vary, or an abscense of some resistor components, is likely due to individual factory calibration.

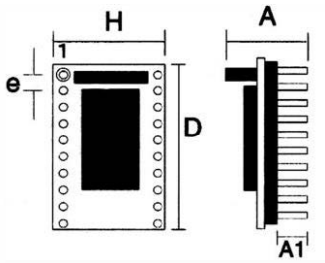
Integrated with the sensor elements composed of wheatstone bridge circuits, are magnetically coupled straps that replace the need for external field coils and provide various modes of operation. The Honeywell patented integrated field offset straps (Xoff+ and Xoff-, etc.) can be used electrically to apply local magnetic fields to the bridges to buck, or offset an applied incident field. This technique can be used to cancel unwanted ambient magnetic fields (e.g. hard-iron magnetism) or in a closed loop field nulling measurement circuit. The offset straps nominally provide 1 gauss fields along the sensitive axis per 48mA of offset current through each strap.

The HMC2003's magnetic sensors can be affected by high momentary magnetic fields that may lead to output signal degradation. In order to eliminate this effect, and maximize the signal output, a magnetic switching technique can be applied to the bridge using set/reset pins (SR+ and SR-) that eliminates the effect of past magnetic history. Refer to the application notes that provide information on set/reset circuits and operation.

Honeywell advises that the following pins be left unconnected: Xtrim, Ytrim, Ztrim, Vbias, Vbridge, and Vsense. These pins are designated for factory calibration. Additionally, if the user does not intend to utilize the offset pins, they should also remain unconnected. This practice will help minimize noise and prevent errors resulting from unintended inputs.

PINOUT DIAGRAM AND PACKAGE DRAWING



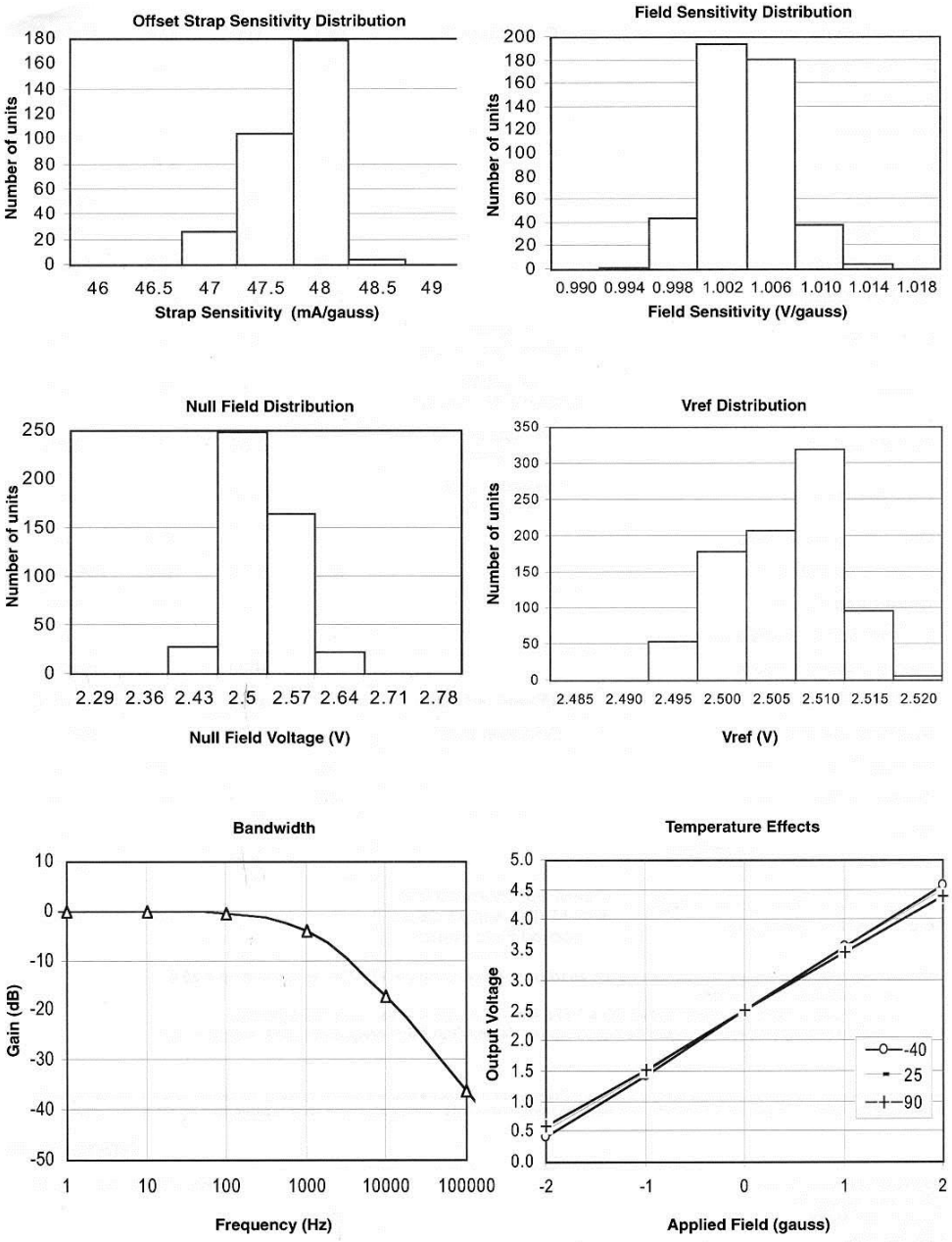


SYMBOL	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	10.92	11.94	0.43	0.47
A1	2.92	3.42	0.115	0.135
D	25.91	27.30	1.02	1.075
e	2.41	2.67	0.095	0.105
H	18.03	19.69	0.71	0.775
H1	15.11	15.36	0.595	0.605

ORDER INFORMATION

ORDERING NUMBER	PRODUCT
HMC2003	Three-Axis Factory-Calibrated Analog Magnetometer

Caution
This part is sensitive to damage by electrostatic discharge. Use ESD precautionary procedures when touching, removing or inserting.



For More Information

For more information on Honeywell's Magnetic Sensors visit us online here or contact us at 800-323-8295 or PlymouthSupport@honeywell.com

The application circuits herein constitute typical usage and interface of Honeywell product. Honeywell does not warranty or assume liability of custome-rdesigned circuits derived from this description or depiction.

Honeywell reserves the right to make changes to improve reliability, function or design. Honeywell does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others.

Honeywell Aerospace Technologies
12001 Highway 55
Plymouth, MN 55441
Tel: 800-323-8295
aerospace.honeywell.com
PlymouthSupport@honeywell.com

PDS-42011 Rev. A
N61-3127-000-001 | 08/25

THE FUTURE IS WHAT WE MAKE IT

Honeywell