

COMPASSING, MAGNETOMETRY AND DEAD  
RECKONING SOLUTIONS

## Sensing Earth's magnetic field



## Honeywell delivers real sensor solutions you can count on

Honeywell's Magnetic Sensors are among the most sensitive and reliable low-field sensors in the industry. Our magnetic sensors are designed to accurately detect the direction and magnitude of external magnetic fields for compassing and magnetometry applications. From discrete sensors for low-cost, high volume applications, to high performance solid-state compasses, magnetometers and dead reckoning solutions, Honeywell magnetic sensor products operate on nearly any platform.

Honeywell combines the time-tested reliability of our technology with new and innovative solid-state magnetic sensors and dead reckoning solutions. Our sensors are ruggedly designed to function optimally in a wide variety of environments and products.

Honeywell offers a full line of magnetic sensor components, modules and solutions. These products are developed and manufactured in accordance to Six Sigma methodologies. We understand customer needs and aim to exceed expectations. All of our products are backed by Honeywell, a global leader in sensor manufacturing, technology and quality.





## Honeywell magnetic sensors utilize world-class technology

Honeywell's magnetic sensors, designed with Anisotropic Magnetoresistive (AMR) technology, provide significant advantages over traditional sensors. They are extremely sensitive, low field, solid-state magnetic sensors designed to measure direction and magnitude of Earth's magnetic fields, from 27 micro-gauss to 6 gauss (0.6 milli-Tesla).

Our magnetoresistive sensors are sensitive enough to determine the change in magnetic fields due to the presence of nearby ferromagnetic objects. With a bandwidth up to 5MHz, our sensors detect vehicles and other ferrous objects, even at high speeds.

Honeywell's dead reckoning navigation products provide a practical and cost-effective means for positioning in GPS-denied environments. Our advanced DRM® technology for personnel on foot utilizes algorithms that include human motion modeling, gyro stabilization, Kalman filter-based calibration and data blending. Low power consumption and small size make DRM® products very effective in critical man-portable applications.

Honeywell's magnetic sensor-based products are excellent solutions in many applications other than simple magnetic field compassing, such as platform leveling or proximity detection.

Applications include:

- Compassing
  - Automotive, GPS and dead reckoning, mobile phones, PDAs, & watches

- Attitude reference
  - Aircraft systems, UAVs, magnetic field detection
- Dead reckoning
  - Pedestrian, vehicle navigation and GPS denied applications
- Position sensing
  - Valve controls, measuring equipment, displacement sensing
- Vehicle detection
  - Parking meters, Railroad signaling devices, electronic traffic signals
- Security
  - Metal detectors, magnetic anomaly detectors
- Others
  - Medical, current sensors, non-contact switches





Honeywell's magnetoresistive sensors are able to sense Earth's magnetic field (~0.6 gauss) and provide the sensitivity for enhanced accuracy and performance. Honeywell offers 1-, 2- and 3- axis magnetic sensors for low field linear applications and small size.

## Features and benefits of HMC components

**Reliable:** Honeywell's HMC components have a proven Wheatstone bridge configuration that converts magnetic fields into a millivolt output. These wheatstone bridges are passive components that don't emit any fields or broadband noise. HMC components are extremely shock and vibration tolerant. Potential failure modes may be related to electro-static discharge due to customer handling.

**Resolution:** The HMC sensors feature very low noise floors for their size. Typical resolution ranges from 27 to 120 micro-gauss.

**Solid-state:** The usage of semiconductor processes allows us to manufacture the smallest sensor devices to reduce board assembly costs and improve reliability and ruggedness compared to larger wire wound fluxgates.

**Cost effective:** Semiconductor manufacturing allows us to fabricate millions of these high performance solutions in a cost efficient way. Our sensors are specifically designed to be an affordable solution for high volume OEM applications.

**Set/Reset Straps:** Patented on-chip set/reset straps reduce effects of temperature drift, non-linearity errors and loss of signal output due to the presence of high magnetic fields. This feature provides the benefit of an insurance policy against high stray fields.

**Offset Straps:** Patented on-chip offset straps may be used to eliminate the effects of hard iron distortion, and to implement a closed loop magnetometer circuit for high performance applications.

### Honeywell's Magnetoresistive Components Application Matrix

Design Criteria for HMC Components			
Application	Size (Small/Smaller/Smallest)	Price (Low/Lower/Lowest)	Performance (Good / Better / Best)
General Compassing	HMC1022/1043/1042, 1052	HMC1043/1022, 1042/1052	HMC1052/1022, 1042/1002
Compassing- Automotive			HMC1052/1042/1022
Compassing- Hand Held, GPS			HMC1052/1022/1042, 1043
Attitude Reference	HMC1002/1022/1043, 1042	HMC1002, 1043/1022/1042	HMC1042/1022/1002, 1043
Metal Detectors	HMC1021S/1041Z/1042, 1052	HMC1021S, 1041Z/1042/1052	HMC1021S, 1041Z, 1052/1042
Vehicle/Traffic Detection	HMC1021S/1041Z/1052	HMC1041Z/1021S/1052	HMC1052 /1041Z, 1021S/1001
Current Sensing	HMC1021S/1042/1052		
Vertical (Z- axis) Sensing	HMC1001, 1021Z, 1051Z/1041Z	HMC1001/1051ZL, 1051Z/1021Z, 1041Z	HMC1051Z, 1051ZL/1021Z, 1041Z/1001
Position Sensing	HMC1501, 1512	HMC1512/1501	HMC1501,1512

Last digit in part number suffix denotes the number of axis on the sensor.

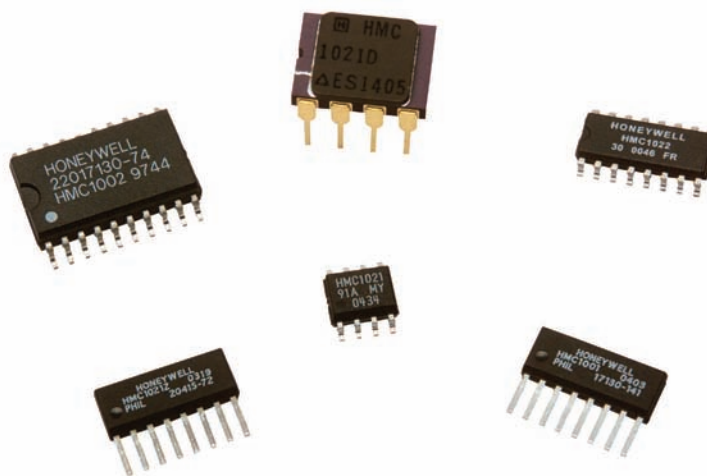
# Low Field Linear 1- and 2- Axis Magnetic Sensors HMC1001 / HMC1002 / HMC1021S / HMC1021Z / HMC1021D / HMC1022

The HMC100X and HMC102X magnetic sensors families are our legacy products that emphasize performance over size. Configured as a four-element wheatstone bridge, these magnetoresistive sensors convert magnetic fields to a differential output voltage, capable of sensing magnetic fields as low as 27  $\mu$ gauss. The sensors offer a small, low cost, high sensitivity and high reliability solution for low field magnetic sensing.

The Honeywell HMC100X family of magnetoresistive sensors offers extreme sensitivity and reliability for high performance applications. They are an ideal solution for linear, low-field magnetic sensing due to its capabilities to convert magnetic field strengths into a differential output voltage, and sensing magnetic fields as low as 27  $\mu$ gauss.

The HMC102X family of magnetoresistive sensors converts magnetic fields to a linear representation of output voltage, offering a cost effective solution for automotive and hand-held compassing applications. These sensors offer a smaller, low cost, high sensitivity and high reliability solution for magnetic field strength sensing.

Included in the HMC102X family is a high temperature magnetic sensor, the HMC1021D. The advantages of the HMC1021D include high-temperature operation, low magnetic field detection range, and a non-magnetic package. Capable of sensing magnetic field strength and direction down to 85 micro-gauss, this sensor offers a compact and highly reliable solution for low field magnetic sensing.



## Honeywell's Magnetoresistive Components Specification Matrix

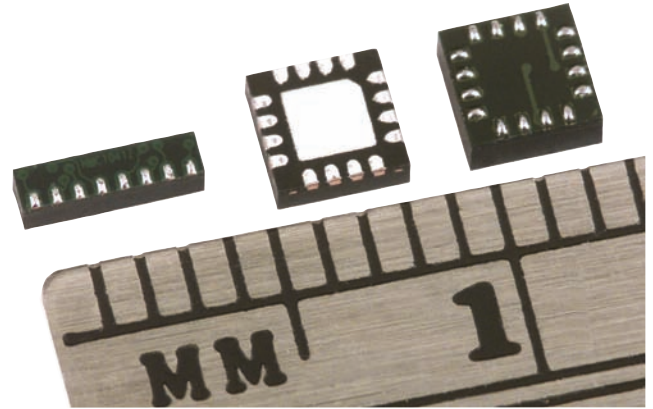
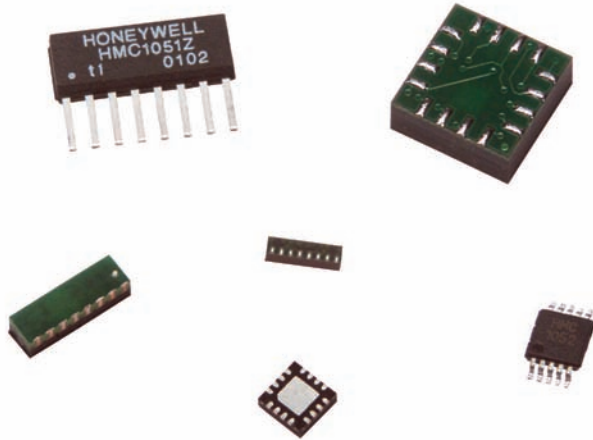
	HMC100X	HMC102X	HMC104X	HMC105X	Units
Sensitivity*	3.2	1.0	1.0	1.0	mV/V/Gauss
Field Range**	$\pm 2$	$\pm 6$	$\pm 6$	$\pm 6$	Gauss
Field Resolution**	27	85	120	120	$\mu$ Gauss
Linearity ( $\pm 1$ G)	0.1	0.05	0.05	0.05	% FS
Supply Voltage (typ.)	5 - 12	5 - 25	1.8 - 25	1.8 - 25	Volts
Set/Reset Current	3.0	0.5	0.5	0.5	Amps
Offset Strap Coil Constant	51	4.6	10	10	mA/gauss
Orthogonal Axis Alignment	1.5	1	<0.01	<0.01	Degree
Cross Axis Effect	0.5	0.3	0.3	3	%
Size	12.7 x 7.3 x 2.5	10 x 3.9 x 1.5	3 x 3 x 0.8	3 x 3 x 0.8	mm
Board Area (2 Axis)	128	60	10	10 - 15	mm <sup>2</sup>

\* Sensitivity: If the sensitivity is defined as 1.0 mV/V/gauss, in the presence of a 1 gauss magnetic field with 3 volts applied to the sensor, the output of the sensor will be 3 mV. If in the presence of only 0.5 gauss magnetic field, the output of the sensor would be 1.5 mV.

\*\* For reference purposes, the earth's magnetic field is typically 0.6 gauss.

# Small Size 1-, 2- and 3- Axis Magnetic Sensors

## HMC1041Z / HMC1042L / HMC1043 / HMC1051Z / HMC1051ZL / HMC1052 / HMC1052L / HMC1053



HMC1041Z, HMC1042L/1052L, HMC1043

Our newest magnetic sensors, the HMC104X and HMC105X family of magnetoresistive sensors are the ideal solutions for applications requiring ultra small sensors. These sensors offer a compact and highly reliable solution for low field magnetic sensing.

Honeywell's ultra small magnetic sensors are optimized for low-cost and include several miniature package configurations: one axis (HMC1041Z, HMC1051Z, HMC1051ZL), two axis (HMC1042L, HMC1052, HMC1052L), and three-axis (HMC1043, HMC1053). The advantages of these patented chips include orthogonal precision two-axis sensing (HMC1042L and HMC1052L) in miniature surface mount packages. Each of the

magnetoresistive sensors are configured as a four-element wheatstone bridge to convert magnetic fields to differential output voltages, and include patented on-die straps for offset and set/reset functions.

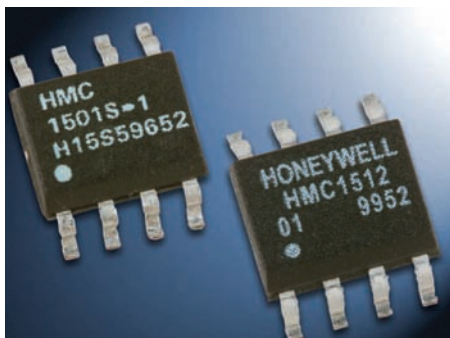
The newest additions to Honeywell Magnetic Sensors are the HMC1041Z, HMC1042L, and HMC1043 magnetic sensors designed for low field magnetic sensing. The HMC104X family of very small size magnetoresistive sensors permits cost effective, high performance and space-efficient personal navigation system designs for small, portable products like hand-held devices. The subminiature size and low-height (1.05 mm) of the HMC1041Z makes this sensor ideal for highly integrated, portable products like

wireless phones, GPS receivers, and watches. The HMC1042L is a high performance, 2 axis sensor in a 3 x 3 x 0.8mm LCC package. The HMC1043 incorporates three magnetoresistive sensors in a 3 x 3 x 1.4 mm 16-pin LCC package. This cost effective, precision sensor combination is perfect for consumer electronics to aerospace applications in which tilt-compensated compassing is required.

For more information visit our website at  
[www.honeywell.com/magneticsensors](http://www.honeywell.com/magneticsensors)

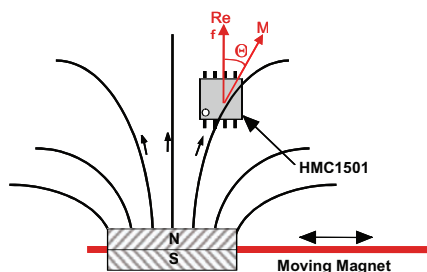
# Magnetic Position Sensors

## HMC1501 / HMC1512



### Linear, Angular, Rotary Displacement Sensors HMC1501 / HMC1512

The HMC15XX family of saturated mode magnetoresistive sensors are non-contact sensors capable of measuring the angular direction of a magnetic field with resolution beyond  $0.07^\circ$ . The sensors measure only field direction to avoid insensitivities to temperature, shock, and vibration and magnetic-source gap variations. Unlike encoder devices, these sen-



sors know the exact position and do not require indexing. Rare Earth magnets such as Neodymium or samarium cobalt types can be substituted with cost-effective Alnico or ceramic type magnets in typical applications such as linear displacement, angular displacement, motor control, and valve position.

Magnetic position sensors measure the angle and direction of a magnetic field vs. the strength and direction of a magnetic field.

### Features and benefits

- Non-contact, power on position sensor
- Low power  $\sim 5\text{mW}$
- Insensitive to field strength variations in magnet
- Wide range of span possible
- No moving parts
- Linear, angular and rotary applications
- No need to procure expensive rare-earth magnets

### Angular range:

HMC1501 - Angular range of  $\pm 45^\circ$  with  $< 0.07^\circ$  resolution.

HMC1512 - Angular range of  $\pm 90^\circ$  with  $< 0.05^\circ$  resolution.

**Speed:** These saturated mode sensors retain a DC to 5MHz frequency response with a minimum of 80 gauss magnetic field applied.

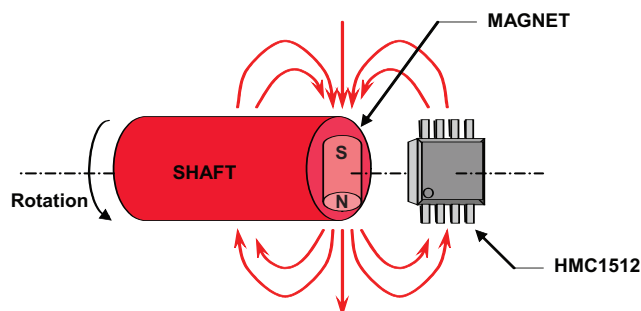
**Size:** SOIC-8 surface mount packages

**Signal output:** Full scale output range of 120mV when provided with a 5V supply

*Available in Tape and Reel*

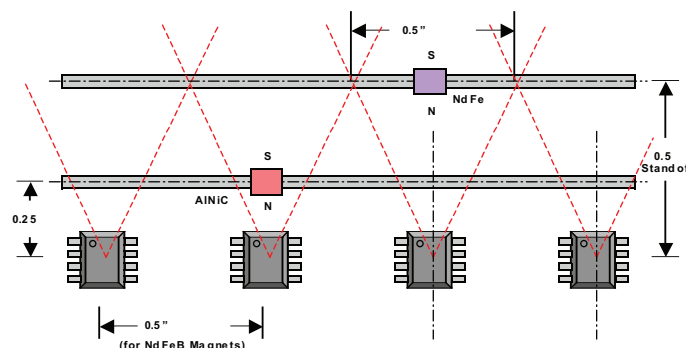
For more information about Honeywell's Position Sensors visit our website at [www.honeywell.com/magneticsensors](http://www.honeywell.com/magneticsensors) and see application note AN211.

### Shaft Position Detection



$\pm 90$  Degrees with a single HMC1512  
Full 360 Degree Sensing with an Additional Hall Sensor

### Linear Position Sensor Using Multiple HMC1501 or HMC1512



# Three-Axis Magnetometers

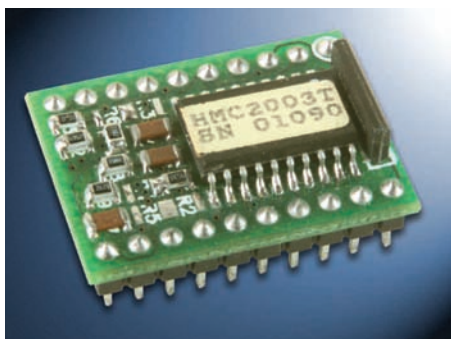
## HMC2003 / HMR2300 / HMR2300R



Honeywell magnetometers provide an excellent means of measuring both magnetic field intensity and direction, using our proven Anisotropic Magnetoresistive (AMR) sensors. These solutions offer both static and alternating field measurements up to 5MHz and permit magnetometer designs emphasizing advantages of small size, high sensitivity, fast response, low cost, and reliability over other magnetometer alternatives.

Magnetometer applications include process control, laboratory instrumentation, anomaly detection, traffic and vehicle detection, security systems, compassing, magnetic ink recognition, current sensing, and motion detection.





### HMC2003 3-Axis Analog Magnetometer

The HMC2003 is a complete, 3-axis magnetometer with analog output in a 20-pin hybrid DIP package. With Honeywell's sensitive HMC1001 and HMC1002 magnetoresistive sensors, and precision instrumentation amplifiers, it measures x, y and z-axis magnetic fields. In addition, Honeywell's patented on-chip offset and set/reset straps are accessible for consistent and advanced processing applications.

#### Features and benefits

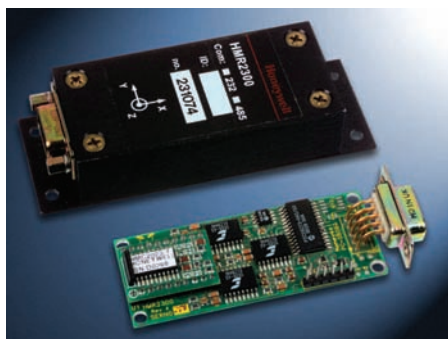
**Small size:** DIP-20 footprint (1 in. x 75 in.) allows easy insertion into system-level boards, reducing development costs.

**Solid state:** All components are solid state and DC operated, improving reliability, EMI performance, and ruggedness compared to fluxgate sensors.

**Dynamic range:** Accurately measures field from 40 microgauss to  $\pm 2$  gauss with factory calibrated 1V/gauss outputs.

**Low noise:** Instrumentation amplifiers with 1kHz low pass filters rejects unwanted noise.

**Internal voltage reference:** An externally accessible +2.5V (zero gauss) reference improves measurement accuracy and stability. An on-board excitation current source reduces temperature errors for consistent performance.



### HMR2300 Smart Digital Magnetometer

With extremely low magnetic field sensitivity ( $<70$  micro-gauss,  $<7$  nano-Tesla) capability and a user configurable command set, the HMR2300 solves a variety of problems in custom applications. Honeywell's 3-axis smart digital magnetometer detects the strength and direction of the external magnetic field and interfaces with computer/controller digital ports. Three independent magnetic sensors are oriented orthogonally to sense the x, y and z-axis magnitudes of the magnetic field. The bridge outputs are then converted to a 16-bit digital value using an internal A/D converter.

#### Features and benefits

**Field range:**  $\pm 2$  Gauss

**Flexible:** Microcontroller-based sensor system with RS232 or RS485 interfaces.

**Simple to use:** Just plug and play

**Field resolution:**  $<70$   $\mu$ Gauss

**Accuracy over  $\pm 1$  Gauss:**  $<0.5\%$  FS output rate selectable: 10 to 154 Samples/Sec.

**Demo Kits** - A Development Kit includes one magnetometer module in an aluminum enclosure, cabling with power supply, Windows™ demonstration software for a remote PC, and a user's guide.



### HMR2300R 3-Axis Strapdown Magnetometer

The HMR2300R detects the direction and strength of Earth's magnetic field and communicates the x, y and z components directly via serial bus. Due to Honeywell's round strapdown design as opposed to a gimbaled flux valve, it has no moving parts to damage or wear out during severe flight conditions. The HMR2300R offers an ideal replacement for flux valve sensors in avionics systems. Also includes 55 bytes of EE prom locations available for data storage.

#### Features and benefits

**Flexibility:** RS422 or RS485 interface choices

**Accuracy:**  $<70$  micro-gauss resolution

# Integrated Compassing Solutions

Our extensive experience in fabricating magnetoresistive sensors allows us to develop electronic compass modules that are suited for land, sea and airborne applications. Honeywell offers a complete line of HMR compass modules from the basic HMR3200 two-axis electronic compass to the HMR3600 with  $\pm 80$  degrees of tilt compensation. Our HMR compass modules offer high accuracy compassing solutions.

Applications include land or maritime navigation, GPS receivers, laser rangefinders, robotic vehicles, antenna alignment, camera control and other personal, vehicle, and aircraft platforms.

Development kit versions are offered for each HMR compass product for evaluation and demonstration needs.

## Hard Iron & Soft Iron Calibration

Each compass product includes hard iron calibration routines to compensate for distortion due to nearby ferrous objects and stray fields, such as vehicles. Hard iron calibration is compensation for magnetic distortion due to permanent magnets or D.C. electromagnetic effects. Soft iron calibration is compensation for magnetic distortion due to induced magnetism in nearby ferrous metals. Common magnetic materials include: iron, steel, nickel and cobalt. Materials such as aluminum, titanium, brass and plastics cause no magnetic interference.

## 2-Axis vs. 3-Axis Compass Solutions

Electronic compass solutions solve for magnetic heading by measuring the earth's horizontal magnetic field. By keeping the 2-axis modules approximately level, maximum heading accuracy is achieved. For applications where compass modules will not be level, a 3-axis, tilt compensated compassing solution is recommended. These 3-axis compass modules perform an "electronic gimbaling" function by adding the third magnetic axis and a tilt sensor for a gravity vector reference. Tilt sensors are made of either fluidic sensors or MEMS (Micromachined Electro-Mechanical Systems) accelerometers. Quality of the tilt measurement contributes to precision compass outputs. For specialized compass solutions, Honeywell offers the HMC line of linear-mode magnetic field sensor devices to create two and 3-axis compass designs.

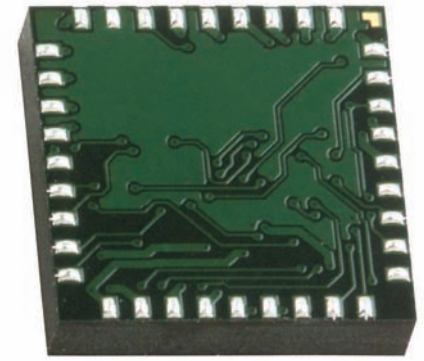
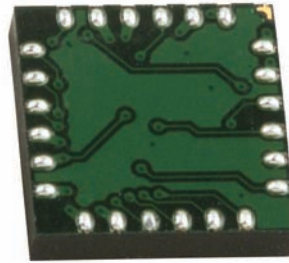
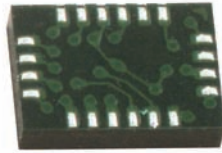
For more information or application notes, visit our website at [www.honeywell.com/magneticsensors](http://www.honeywell.com/magneticsensors).

# Digital Compass Solutions

## HMC6042

## HMC6352

## HMC6343



### HMC6042 Magnetic Sensor Circuit

The HMC6042 magnetic sensor circuit with a 3-axis ASIC is a multi-chip module that combines our HMC1042L sensor and CMOS analog amplifiers for a low cost integrated sensor for digital compassing. Packaged in a 3.6 x 5.0 x 1.0mm LCC, the HMC6042 operates on 2.7 to 3.6 volt supplies and can be used as a stand-alone 2-axis compass or combined with a HMC1041Z to create a 3-axis compass.

#### Applications

- GPS receivers
- Antenna positioning
- Hand held devices
- OEM compassing/pointing
- Magnetometry

#### Features and benefits

**Integration:** 2 axis magnetic sensors with amplification and set/reset circuitry

**Size:** HMC6042 comes in a miniature (3.6 x 5.0 x 1.0mm LCC) 20-Pin LCC Package

**Performance:** Capable of modest to high performance applications. Contingent upon the support circuits and ADC used with this sensor circuit.

### HMC6352 Digital Compass Solution

The Honeywell HMC6352 digital compass solution is the first true "compass in a chip" package. This 6.5mm x 6.5mm x 1.5mm multi-chip LCC module uses an I2C serial interface to supply heading data to host processors. The HMC6352 is a miniature chip-scale module that can drop-in to your platforms for the ultimate in electronic functionality. Containing the complete 2-axis sensors, analog, and digital electronics, the HMC6352 also contains all the firmware for heading computation and calibration for minimal design effort. The combination of the complete compass solution in a small, low-cost package makes the HMC6352 ideal for consumer electronics with quick to market emphasis.

#### Applications

- Consumer electronics
- Hand held devices (cell phones, PDAs, watches, handheld GPS)
- Compassing
- Integration with GPS
- Vehicle compassing and telematics
- Satellite dish antenna positioning

#### Features and benefits

**Integration:** Drop-in, plug and play feature allows for more high volume production. 2-Axis Magnetic Sensors with Electronics and Microprocessor

**Size:** HMC6352 comes in a Miniature (6.5 x 6.5 x 1.4mm) 24-Pin LCC Package

**Power:** 2.5 to 5.2 volt supply voltage for battery operation

**Performance:** 2.5 to 3 degrees typical compassing accuracy.

### HMC6343 Digital Compass Solution

The Honeywell HMC6343 digital compass circuit is a 3-axis magnetic and 3-axis accelerometer compassing solution with tilt compensation. This 9.0mm x 9.0mm x 1.9mm multi-chip module has a I2C UART interface plus command compatibility with the HMR3300/3400 compass solutions. The HMC6343 contains all sensors, micro-controller, and analog support circuits; plus all the firmware for heading computation and hard-iron calibration.

#### Applications

- Consumer electronics
- Hand held devices (cell phones, PDAs, watches, handheld GPS)
- Compassing
- Integration with GPS
- Vehicle compassing and telematics
- Satellite dish antenna positioning

#### Features and benefits

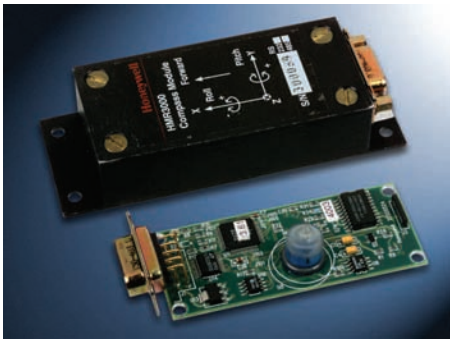
**Integration:** Drop-in, plug and play feature allows for more high volume production. 3-Axis Magnetic Sensors plus 3-axis accelerometers with Electronics and Microprocessor

**Size:** HMC6343 comes in a Miniature 9.0 x 9.0 x 1.9mm Pin LCC Package

**Power:** 2.6 to 3.7 volt supply voltage for battery operation

**Performance:** 2.5 to 3 degrees typical compassing accuracy at level

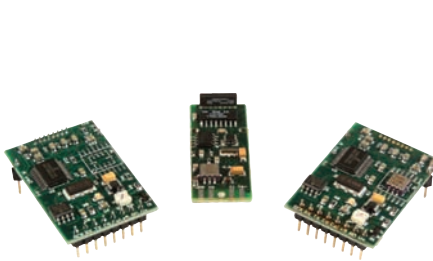




### HMR3000 Digital Compass Solution

The HMR3000 is an electronic compass module that provides heading, pitch and roll output for attitude reference systems. Honeywell's solid state magnetoresistive sensors make this strapdown compass both rugged and reliable. The HMR3000 achieves a response time up to 20 Hertz allowing for faster updates compared to gimbaled flux gates.

An optional development kit is available for the HMR3000 with power supply, serial port cable and PC demo software.



### HMR3200 / HMR3300 / HMR3400 Digital Compass Solutions

The Honeywell HMR3200, HMR3300, and HMR3400 compass solutions are compact printed circuit boards that plug into platforms with a UART interface and communicate data in ASCII format. The HMR3200 provides a horizontal or vertical oriented electronic compass using 2-axis magnetic field sensing. The HMR3300 is a 3-axis, tilt compensated electronic compass that adds a 2-axis accelerometer for enhanced performance up to a  $\pm 60^\circ$  tilt range. The HMR3400 is a reduced size version of the HMR3300 offering lower

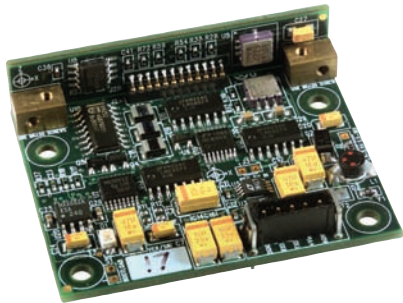
power consumption and increased miniaturization. Response time for the HMR3200 is 15Hz and the HMR3300/HMR3400 is 8Hz.

Development kits are available for the HMR3200 & HMR3300, which include a plug-in circuit board with an RS232 output.

### Honeywell's Compassing Solutions Matrix

	2 Axis		3 Axis with Tilt Compensation			
	HMC6352	HMR3200	HMC6343	HMR3300	HMR3400	HMR3000
Accuracy (At Level)	2.5°	1°	3°	1°	1°	0.5°
Size	6.5x6.5x1.5mm	1"x1.45"x0.4"	9x9x1.9mm	1"x1.45"x0.4"	0.6"x1.5"	1.5"x4.2"x0.88"
Tilt Range	NA	NA	$\pm 80^\circ$	$\pm 60^\circ$	$\pm 60^\circ$	$\pm 40^\circ$
Resolution	0.5°	0.1°	0.1°	0.1°	0.1°	0.1°
Repeatability	$\pm 1^\circ$	$\pm 0.2^\circ$	TBD	$\pm 0.4^\circ$	$\pm 0.4^\circ$	$\pm 0.3^\circ$
Interface	I <sup>2</sup> C	UART/SPI	I <sup>2</sup> C	UART/SPI	UART/SPI	RS232/485
Power	2.7 to 5.2 V	6 to 15 VDC	2.7 to 3.6 V	6 to 15 VDC	5 VDC, 25mA	6 to 15 VDC
Temp Range	-20° to 70°C	-40° to 85°C	-40° to 125°C	-40° to 85°C	-40° to 85°C	-20° to 70°C
Hard Iron Cal	Y	Y	Y	Y	Y	Y
Soft Iron Cal	N	N	N	N	N	N
Gyro Stabilized*	N	N	N	N	N	N
World Magnetic Model	N	N	N	N	N	N

\*Gyro Stabilization eliminates errors in magnetic heading caused by transient magnetic disturbances. Compass module software automatically blends gyro and



**HMR3500 TruePoint™ Digital Compass Solution**

The Honeywell HMR3500 electronic compass is a 3-axis digital compass module with azimuth accuracy of 1 degree with 0.1 degree resolution and 0.5 degree repeatability, tilt range of ± 80°. HMR3500 includes closed loop magnetometers, world magnetic model for declination, configurable mounting orientation, hard and soft iron compensation. Update rates to 25 Hz for pitch, roll and heading.

A development kit is available, which includes DB9 data and power cable, RS232 interface, Windows® CompassHost test software, and manual with software protocol message descriptions.



**HMR3600 μPOINT® Gyro-Stabilized Digital Compass Solution**

The Honeywell HMR3600 is a gyro-stabilized digital magnetic compass that combines the latest gyro technology with advanced digital magnetic compass hardware and software. HMR3600 features a MEMS silicon rate gyro built into the z-axis. The benefit of gyro stabilization is the ability to overcome magnetic transient disturbances. HMR3600 includes closed loop magnetometers, hard and soft iron compensation, world magnetic model for declination (variation), and high mechanical shock tolerance.

A development kit is available, which includes DB-9 serial data and power cable, user manual, Windows® host test program with data recording and graphic data display, direct RS232 interface and, alternate connector attachment boards and brass base plate with mounting screws and strain relief. This is an ITAR restricted product and requires an export license to ship outside the United States.

HMR3500 TruePoint™	HMR3600 μPOINT®
1°	0.5°
2"x1.5"x0.5"	1"x1.04"x0.54"
± 80°	± 80°
0.1°	0.1°
TBD	TBD
RS232	RS232
5V to 12V Nom.	5 VDC ± 5%
0° to 70°C	-40° to 85°C
Y	Y
Y	Y
N	Y
Y	Y

compass data together.

# Dead Reckoning Modules

## DRM® 4000 / DRM® 5 / DRM® Core/ Gyro DRM®



Honeywell's Dead Reckoning Modules (DRM®) provide positioning data for personnel on foot (pedestrians) in environments where GPS data is either unreliable or cannot be used. The DRM® units provide reliable, self-contained positioning data, in a compact, efficient form factor, that can be easily attached and carried by persons on foot. These products are provided as components for integration with other equipment such as RF data links and map displays.

The DRM® is a miniature, self-contained, electronic navigation unit that provides the user's position relative to an initialization point. The DRM® is the first commercially available and practical implementation of drift-free dead reckoning navigation for use by personnel on foot. It is specifically designed to supplement GPS receivers during signal outages. You still know where personnel are located even when GPS is blocked by nearby buildings, heavy foliage, or even inside many structures.

The DRM® products contain options including a tilt-compensated magnetic compass, electronic pedometer and barometric altimeter to provide a continuous deduced position. A microprocessor performs dead reckoning calculations and includes a Kalman filter to combine the dead reckoning data with GPS data when it is available. The filter and other proprietary algorithms use GPS data to calibrate dead reckoning sensors for typical dead reckoning accuracy of 2% to 5% of distance traveled, entirely without GPS. Options for the system integrator include a selection of voltage input ranges, CMOS or RS232 interface, data logging, and special software functions. In addition to horizontal position data, compass azimuth, tilt (pitch and roll), and barometric altitude are available.

Calibration after integration with other electronics during product manufacturing is required. These devices are intended for use by personnel on foot, and are not for use on vehicles.



## DRM® 4000 Dead Reckoning Module

Honeywell's newest and most advanced pedestrian navigation product is the DRM 4000 designed for GPS-denied man-portable navigation. The DRM 4000 is a smaller, lower cost product enabling a wider variety of usage scenarios from previous designs. The DRM 4000 is a state-of-the-art dead reckoning device using patented motion classification algorithms to analyze walking motion, and compensate for unique user kinematics as required. The 2 x 2 x 0.5 inch size of the DRM 4000 enables man-portable applications like personnel tracking, disaster relief operations, safe pathway guidance and mapping tasks. Applications include: first responders, public safety, police and fire, forestry, medical patients, utility workers and more.

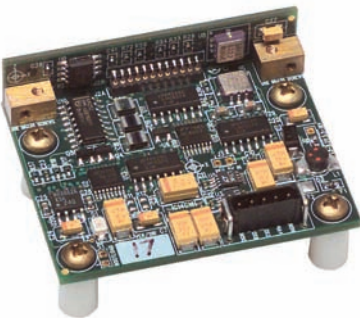


The DRM 4000 provides an internal Kalman filter for integrating onboard sensors plus external GPS data (NMEA0183 format), and nominally provides position accuracy of 2% of distance traveled with GPS and sensors. The sensors onboard include 3 gyros, 3 accelerometers, 3 magnetometers, and a barometric altimeter for both horizontal and vertical position location. By combining the DRM 4000 with a GPS receiver, position location is ascertained in normal, GPS-denied, and GPS reflection environments. DRM 4000 is available as an OEM circuit card assembly with an RS 232 interface.

## DRM® 5 Dead Reckoning Module for Personnel Positioning

Our advanced dead reckoning module, with an integral GPS receiver, DRM-5, incorporates MEMS gyros, accelerometers, magnetometers, altimeter and GPS receiver in a compact circuit card assembly. The DRM-5 is a miniature, self-contained electronic navigation unit that provides the user's position relative to an initialization point. When GPS is available, the built-in 16-channel receiver provides calibration factors for the on-board sensors. When GPS cannot be used, DRM-5 continues to provide reliable position coordinates seamlessly, so that the user may be unaware that GPS has dropped out. Applications include: military, public safety, police and fire, forestry, medical patients, utility workers and more.

A development kit is available and includes: a 16-channel GPS receiver, antenna, all dead reckoning functions and sensors, waterproof housing attached to a web belt, long-life Li-Ion rechargeable battery, Windows® based test and demonstration software, and user manual. This is an ITAR restricted product and requires an export license to ship outside the United States.



## DRM® Core Dead Reckoning Module for Personnel Positioning

The DRMcore contains the core navigation functions of Honeywell's Dead Reckoning products. Functions provided include 2-dimensional horizontal navigation, and compass azimuth. DRMcore does not include an altimeter or GPS receiver on the circuit module, but will accept external GPS position input, derived from a user's GPS receiver. Customers can specify mounting orientation. DRMcore is available as an OEM circuit card assembly.

## Gyro DRM® Dead Reckoning Module for Personnel Positioning

The GyroDRM is a gyro-aided dead reckoning module for personnel on foot, based on the DRM® technology. The GyroDRM includes a GPS receiver and altimeter. The single axis gyro reduces the sensitivity of the unit to transient magnetic disturbances in the environment. It provides reliable, self-contained position data when navigating in areas where GPS signals are difficult to receive. GyroDRM includes data logging memory with storage capability of up to 32K data records. An external event marker push-button is provided to simplify data collection. Log files may be easily downloaded to a computer and analyzed using standard spreadsheet programs. The evaluation kit includes test software and is supplied in a housing with belt clip, re-chargeable Li-Ion battery, and charger.



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Export Classification Compliance Number (ECCN) Matrix

All products included in this catalog are subject to United States export regulations. For products subject to the Export Administration Regulations (EAR), an Export Control Classification Numbers (ECCN) is listed below. The schedule B number for our magnetic sensor products is 9014.10.9080.

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Export Classification Matrix

ECCN #	Product Name
6A996	HMC1001, HMC1002, HMC2003, HMR2300, HMR2300r
EAR99	HMC1021D, HMC1021S, HMC1021Z, HMC1022, HMC1041Z, HMC1042L, HMC1043, HMC1051Z, HMC1052, HMC1052L, HMC1053, HMC1055, HMC1501, HMC1512, HMC6052, HMC6042, HMC6352, HMC6343
7A994	HMR3000, HMR3200, HMR3300, HMR3400, HMR3500, DRMcore, GyroDRM, DRM4000
ITAR Restricted	HMR3600, DRM - 5

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U.S. Patents 4,441,072; 4,533,872; 4,569,742; 4,681,812; 4,847,584; 5,583,776; 6,529,114; 6,813,582; 6,842,991; and 7,005,584 apply to the technology described. Other patents pending.

