Honeywell

MAGNETIC SENSORS PRODUCT CATALOG

Compassing and Magnetometery Solutions

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.

Sensing Earth's Magnetic Field

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 Honeywell's magnetic sensor products operate on nearly any platform.

Honeywell combines the time-tested reliability of our technology with industry proven solid-state magnetic sensors.

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 compasses. These products are developed and manufactured in accordance with ISO and 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 8 gauss (0.8 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 magnetic sensor-based products are excellent solutions in many applications other than simple magnetic field compassing, such as platform leveling or proximity detection.

Magnetoresistive sensors have capabilities that include:

- Detecting and measuring the strength of a magnetic field
- Using Earth's field for compassing and navigation
- Position sensing – linear, angular and rotary displacement
- Current Sensing

Applications

- **Compassing**
  Automotive, GPS, Watches, Antenna Positioning, Binoculars, Goggles, Thermal Imaging, Laser Range Finders, Surveying
- **Navigation**
  Vehicle Navigation Systems, Air/ Marine/Land, Drones, Radio Controlled Helicopters & Aircraft
- **Position Sensing**
  Valve Control, Displacement Sensing, Water Metering
- **Vehicle Detection**
  Parking Meters, Electronic Traffic Signals
- **Security**
  Metal Detectors, Magnetic Anomaly Detection
- **Others**
  Medical Devices, Current Sensors, Etc.

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 microgauss.

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 / 1052L	HMC1022, 1052L	HMC1052L / 1022, 1002
Compassing- Automotive	HMC1022/ 1052L	HMC1022/ 1052L	HMC1052L / 1022
Compassing- Hand Held, GPS	HMC1022 / 1052L	HMC1022, 1052L	HMC1052L / 1022
Attitude Reference	HMC1002 / 1022, 1052L	HMC1002, 1022 / 1052L	HMC1052L / 1022 / 1002
Metal Detectors	HMC1021S / 1041Z / 1052L	HMC1021S, 1041Z / 1052L	HMC1021S / 1041Z / 1052L
Vehicle/Traffic Detection	HMC1021S / 1041Z / 1052L	HMC1041Z / 1021S /1052L	HMC1052L / 1041Z, 1021S / 1001
Current Sensing	HMC1021S / 1052L / 1052L		
Vertical (Z- axis) Sensing	HMC1001, 1021Z, 1051Z / 1051ZL / 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.

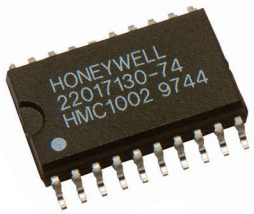
Low Field High Precision Linear 1- and 2- Axis Analog Magnetic Sensors
HMC1001 / HMC1002 / HMC1021S / HMC1021Z / HMC1022

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 µgauss. The sensors offer a small, low cost, high sensitivity and high reliability solution for low field magnetic sensing.

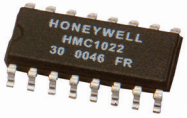
The Honeywell HMC100X family of magnetoresistive sensors offers extreme sensitivity and reliability for high performance applications.

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 µgauss.

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.



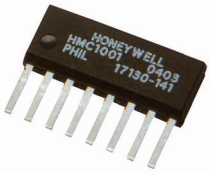
HMC1002



HMC1022

HMC1021S

HMC1021Z



HMC1001

Honeywell's Magnetoresistive Components Application Matrix

	ANALOG				
	HMC100X	**HMC102X**	**HMC104X**	**HMC105X**	**Units**
Sensitivity*	3.2	1.0	1.0	1.0	mV/V/Gauss
Field Range**	± 2	± 6	± 6	± 6	Gauss
Field Resolution**	27	85	120	120	µGauss
Linearity (± 1G)	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	12.7x7.3x2.5	10x3.9x1.5	3x3x0.8	3x3x1	mm
Board Area (2 Axis)	128	60	10	15	mm2

* 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.

Honeywell's magnetic sensors are optimized for low-cost and include several miniature package configurations; one axis (HMC1041Z, HMC1051Z, HMC1051ZL), two axis (HMC1052L), and three-axis (HMC1053).

Small Size 1-, 2- and 3- Axis Analog Magnetic Sensors
HMC1041Z / HMC1051Z / HMC1051ZL / HMC1052L / HMC1053

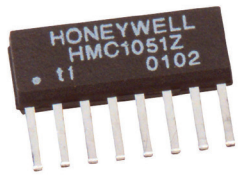
The HMC104X and HMC105X family of magnetoresistive sensors are ideal solutions for applications requiring high precision and small sensors. These sensors offer a compact and highly reliable solution for low field magnetic sensing.

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

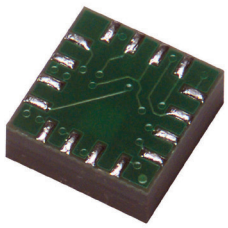
Each of the magneto-resistive sensors are configured as a four-element wheatstone bridge to convert magnetic fields to differential output voltages and include patented on-die straps for offset and set/reset functions.

The 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 GPS receivers and watches.

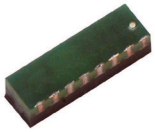
For more information visit our website at www.magneticsensors.com

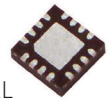


HMC1051Z

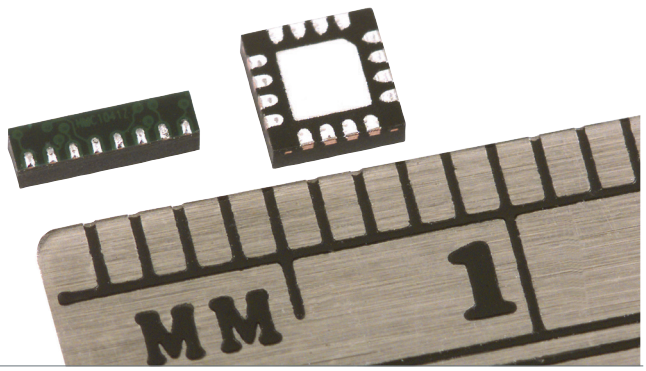

HMC1053


HMC1041Z


HMC1051ZL


HMC1052L

HMC1041Z and HMC1052L

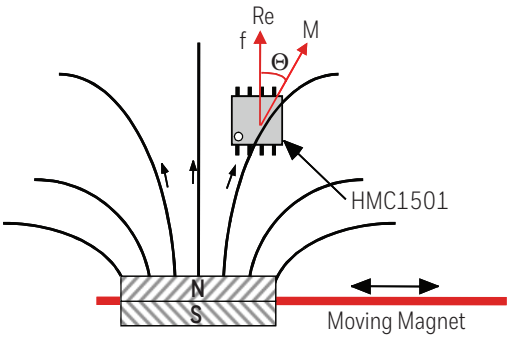


Magnetic Position Sensors HMC1501 / HMC1512

Linear, Angular, Rotary Displacement Sensors HMC1501 / HMC1512

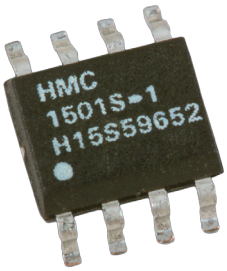
The HMC15XX family of saturated mode magnetoresistive sensors are non-contact sensors capable of measuring the angular direction of a magnetic field with resolution beyond 0.07°. The sensors measure only field direction to avoid insensitivities to temperature, shock, and vibration and magnetic-source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

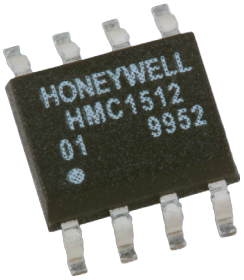
Magnetic position sensors measure the angle and direction of a magnetic field vs. the strength and direction of a magnetic field.



Features and Benefits

- Non-contact, power on position sensor
- Low power ~ 5mW
- 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 ±45° with <0.07° resolution.
HMC1512 - Angular range of ±90° with <0.05° resolution.

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

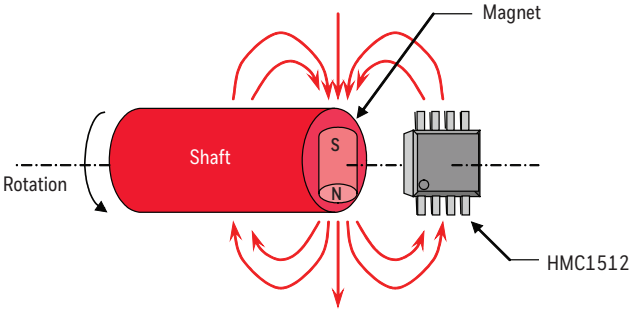
Size: SOIC-8 surface mount packages

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

For more information about Honeywell's Position Sensors visit our website at at www.magneticsensors.com and see application note AN211.

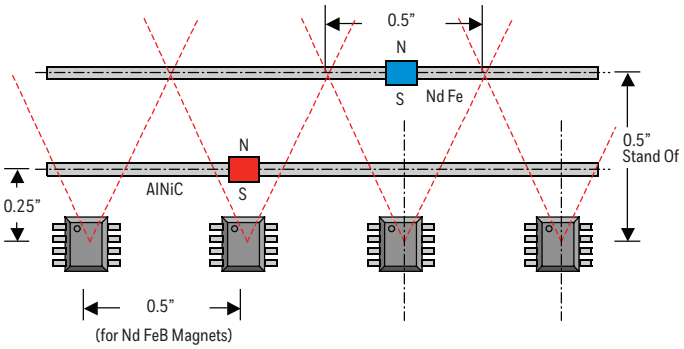
Available in Tape and Reel

Shaft Position Detection



+/- 90 Degrees with a single HMC1512
Full 360 Degree Sensing with an Additional Hall Sensor

Linear Position Sensor Using Multiple HMC1501 or HMC1512



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 1KHZ 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.

Three-Axis Magnetometers HMC2003 / HMR2300

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 0.75 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 ±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: ±2 Gauss

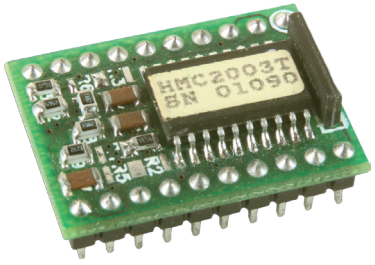
Flexible: Microcontroller-based sensor system with RS232 or RS485 interfaces.

Simple to use: Just plug and play.

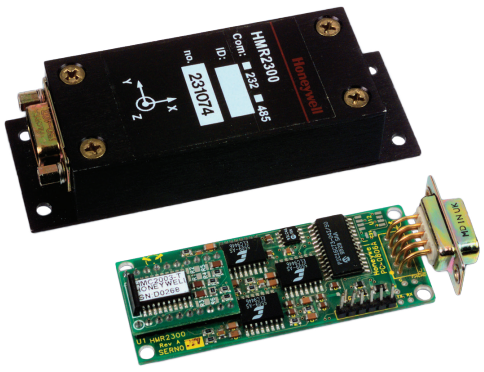
Field resolution: <70 µGauss

Accuracy over ±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.



HMC2003



HMR2300

HMR2300 Demo Kit

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. 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. The HMR3500 offers a soft iron calibration routine to compensate for magnetic distortion due to induced magnetism in nearby ferrous materials. 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 Solution

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.

Honeywell's Compassing Solutions Matrix

	3 AXIS WITH TILT COMPENSATION			
	HMC6343	HMR3300	HMR3000	HMR3500 TRUEPOINT™
Accuracy (At Level)*	± 2º	± 1º	± 0.5º	± 1º
Size	9x9x1.9mm	1"x1.45"x0.4"	1.5"x4.2"x0.88"	2"x1.5"x0.5"
Tilt Range	± 80º	± 60º	± 40º	± 80º
Resolution	0.1º	0.1º	0.1º	0.1º
Repeatability	0.3º	± 0.4º	± 0.3º	TBD
Interface	I2C	UART/SPI	RS232/485	RS232
Power	2.7 to 3.6 V	6 to 15 VDC	6 to 15 VDC	5V to 12V Nom.
Temp Range	-40º to 85ºC	-40º to 85ºC,	-20º to 70ºC	0º to 70ºC
Magnetic Field Range	± 1.5G	± 2G	± 1G	± 0.7G
Hard Iron Cal	Y	Y	Y	Y
Soft Iron Cal	N	N	N	Y
World Magnetic Model	N	N	N	Y

*Typical

Digital Compass Solutions HMC6343

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 compass solutions. The HMC6343 contains all sensors, microcontroller, 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

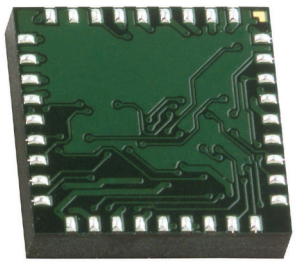
For more information or application notes, visit our website at www.magneticsensors.com

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.

HMC6343



HMR3000

HMR3000 Demo Kit

HMR3300 Digital Compass Solution

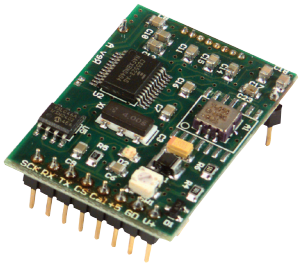
The Honeywell HMR3300 compass solution is a compact printed circuit board that plug into platforms with a UART interface and communicate data in ASCII format. The HMR3300 is a 3-axis, tilt compensated electronic compass that adds a 2-axis accelerometer for enhanced performance up to a ±60° tilt range. Response time for the HMR3300 is 8Hz.

A development kit is available for the HMR3300, which includes a plug-in circuit board with an RS232 output.

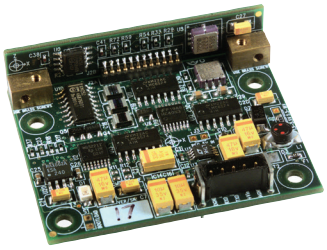
HMR3500 TruePoint™ Digital Compass Solution

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.



HMR3300



HMR3500

HMR3300 Demo Kit

HMR3500 Demo Kit

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.

Export Classification Matrix

ECCN #	Product Name
6A996	HMC1001, HMC1002, HMC2003, HMR2300
EAR99	HMC1021S, HMC1021Z, HMC1022, HMC1041Z, HMC1051Z, HMC1052L, HMC1053, HMC1501, HMC1512, HMC6343
7A994	HMR3000, HMR3300, HMR3500

Find out more

For more information on Honeywell's Magnetic Sensors visit us online at: www.magneticsensors.com or contact us at 800-323-8295.

Reduction of Hazardous Substances (RoHS) Compliance

Visit our website at www.magneticsensors.com for the latest updates on RoHS compliance.

Ask us about Honeywell's additional precision sensor solutions:

- High Accuracy Precision Barometers
- Precision Pressure Transducers (Including ruggedized and explosion proof models)
- RF Microwave Attenuator and Switches
- High Temperature Electronics
- Thermal Switches and Accelerometers

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