TruePoint™ Compass Module HMR3500

The HMR3500 TruePoint™ compass module is a 3-axis digital compass solution with a customizable coordinate system for mounting in any desired orientation. Three Anisotropic Magneto-Resistive sensors and three MEMs accelerometers are combined to provide compass heading as well as pitch and roll angles.

The HMR3500 has provisions for hard and soft-iron correction algorithms to handle magnetic distortion effects. In addition a World Magnetic Model feature is provided to automatically add declination angle corrections for reference to true north (geographic north).
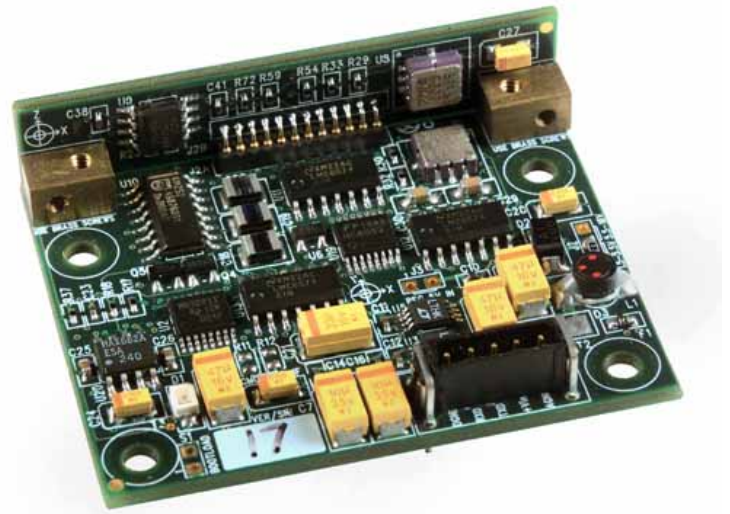
Honeywell provides product excellence and performance by introducing innovative solid-state magnetic sensor solutions. These are highly reliable, top performance products that are delivered when promised. Honeywell's magnetic sensor products provide real solutions you can count on.

FEATURES

▶ Precision Compass Accuracy

▶ Tilt-Compensated

▶ Update Rate to 25Hz

▶ Compact Solution in a 1.97" by 1.65" by 0.52" PCB Assembly

▶ Hard and Soft-Iron Compensation Routines

▶ World Magnetic Model Included

▶ -40° to +85°C Operating Temp Range

▶ +5 DC Supply Voltage Range

▶ Light Weight

▶ Customizable Coordinate System

▶ All Solid State Components

BENEFITS

▶ Better Than 1° Nominal Heading Accuracy (1σ), 0.1° Resolution

▶ ±89° Pitch and Roll, 360° Continuous Roll Capability

▶ Rapid Heading Computations for Guidance Applications

▶ Small Size for Tight Mounting Conditions, Minimal Layout Constraints

▶ User Driven Calibration to Null Stray Fields. A Single Routine for Both Hard and Soft Iron Corrections

▶ Choice of True North or Magnetic North References

▶ Consumer and Industrial Environment Uses

▶ Customizable to a Wide Variety of Power Sources

▶ 3.0 oz with Aluminum Housing, 0.6 oz PCB only

▶ 24 Custom Coordinate Orientations

▶ Rugged for User-Defined Orientation Plane

HMR3500

SPECIFICATIONS

Characteristics	Conditions	Min	Typ	Max	Units
Heading					
Accuracy	Level 0° to ±30° ±30° to ±80°	-	0.5 TBD TBD	1.0	deg (1σ)
Resolution			0.1		deg
Hysteresis			TBD		deg
Repeatability			TBD		deg
Pitch and Roll					
Roll Range	Default orientation, rotation about X-axis		±80°		deg
Pitch Range	Default orientation, rotation about Y-axis		±80°		deg
Accuracy	Over Pitch, Roll Ranges		TBD		deg (1σ)
Null Accuracy*	Level		±0.5		deg
Resolution			0.1		deg
Hysteresis			TBD		deg
Repeatability			TBD		deg
Magnetic Field					
Range	Maximum Magnetic Flux Density		0.8		gauss
Resolution			TBD		milli-gauss
Dip Angle	Earth's Vertical Field Component	-70		+70	deg
Electrical					
Input Voltage	Standard Product	2.5	5.0	5.2	volts DC
Current	At 5.0 volts DC	45	60	65	mA
Digital Interface					
UART	ASCII (1 Start, 8 Data, 1 Stop, 0 Parity) User Selectable Baud Rate	4800	9600	38,400	Baud
Update Rate	Continuous Heading Updates	0.05	10	25	Hz
Format	Bi-directional binary packet data protocol. Optional NEMA0183, HDG and HDT		RS-232		-
Physical					
Dimensions	Circuit Board Assembly		1.97 x 1.65 x 0.52		inches
Weight	HMR3500 PCB only HMR3500 with case, no cable		0.6 3.0		ounce ounces
Connector	5-pin, 2mm pin spacing				-
Environment					
Temperature	Operating Storage	-40 -55	- -	+85 +125	°C °C
Shock	Half sine cycle, 0.5msec			TBD	g
Vibration	Frequency Range TBD Hz			TBD	g
Reliability	Mil Handbook Prediction @ 25C		TBD		hours

Null zeroing prior to use of the HMR3500 and upon exposure to temperature excursions beyond the Operating Temperature limits is required to achieve highest performance.

HMR3500

PIN CONFIGURATION

Pin Number	Pin Name	Description
1	Ground	Power Supply Return and Ground Reference
2	RXD	RS-232 Receive Data
3	TXD	RS-232 Transmit Data
4	+Vin	Positive Power Supply Voltage Input
5	Ground	Ground Reference (for twisted pair routing with +Vin)

BASIC DEVICE OPERATION

The HMR3500 TruePoint™ Compass Module includes 3-axis Anisotropic Magneto-Resistive (AMR) sensors, 3-axis MEMS accelerometers, a temperature sensor, and 16-bit microprocessor with onboard Analog to Digital Converter (ADC). The HMR3500 is available as a printed circuit board assembly, or assembled in a black aluminum case with cable assembly. Additionally, the cable assembly can be ordered separately. A demonstration kit of the HMR3500 is available with the case, cable assembly, a CD of the CompassHost windows utility software for the user's personal computer.

The HMR3500 requires an external DC power supply for the red (positive) and black (ground) wires of the cable assembly. By feeding 5 volts at about 50 milli-amperes into the HMR3500, the compass will operate, and a red LED on the printed circuit board assembly will begin blinking at a 1Hz rate. Lack of a blinking LED or at a rapid rate is an indication of an error, and action should taken to cycle power on the compass electronics to reset the module.

As a factory default, the RS-232 interface is set at 9600 baud with one start bit, 8 data bits, one stop bit, and no parity bits. The HMR3500 does not require any hardware or software handshaking or related features. The baud rate can be changed by command after initial communication at the current baud rate.

The CompassHost utility software is a 32-bit Windows® application program that is provided with the HMR3500 demonstration kit, and can be used to evaluate the HMR3500's performance and demonstrate the compass features. With exception of the baud rate change command, the CompassHost is capable of sending and receiving all of the commands of the compass/computer interface. Host computers should be capable of running Windows 9x, ME, NT, 2000, XP and follow-on operating systems. An install program loads the executable file CompassHost.exe and ActiveX components. A readme.txt file is also included to describe the installation process.

PHYSICAL CHARACTERISTICS

The circuit board for the HMR3500 is 1.57 by 1.97 by 0.52 inches and composed of multi-layer, fiberglass-epoxy printed boards, with the main board horizontal and a vertical board for mounting the z-axis magnetic sensor and accelerometer. The vertical board is held orthogonal to the main board by two brass hardware blocks to ensure mechanical orthogonality.
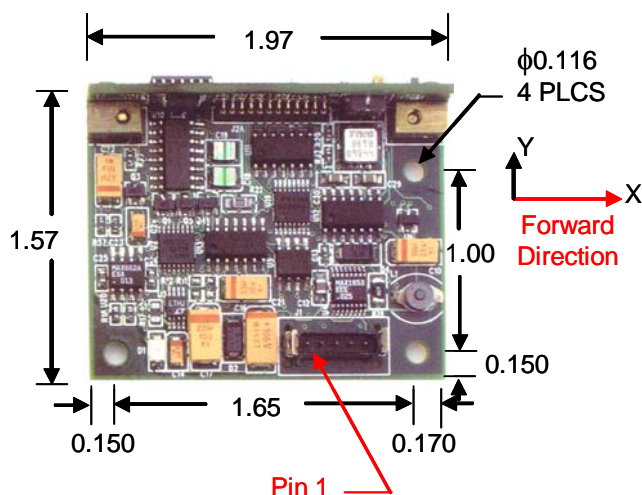

Figure 1
HMR3500 Top View and Dimensions

HMR3500

MOUNTING CONSIDERATIONS

The following is the recommend printed circuit board (PCB) footprint for the HMR3500. The reference direction (forward) is the right PCB assembly edge shown in Figure 1. Left to right, the interface connector is numbered pin 1 to pin 5 per the pin configuration table.

UNC 4-40 fastening hardware is recommended for mounting the printed circuit board with at least 0.125 inch nylon spacers to stand off the board from the mounting surface. Fastener hardware must be non-ferrous for full compass performance with brass or nylon screws the usual materials of choice.
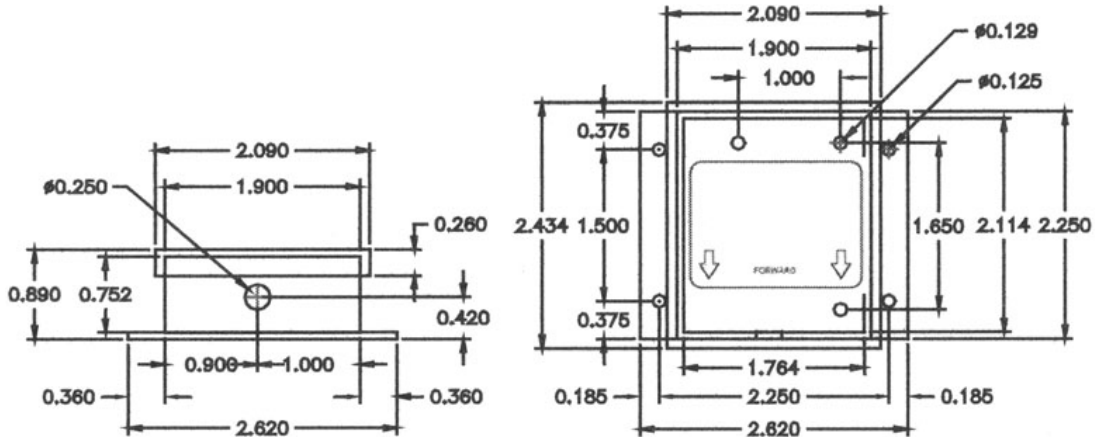
CASE DIMENSIONS (in inches)

Figure 2
HMR3500 Case Dimensions

CIRCUIT DESCRIPTION

The HMR3500 circuit design starts with a microprocessor powered by power supply sub-circuit that takes the input voltage and creates regulated power for the various other circuits in the HMR3500. Two 2-axis MEMS accelerometers are mounted horizontally and vertically to combine into a 3-axis tilt sensing sub-circuit. Each accelerometer outputs a Pulse-Width-Modulated (PWM) digital signal that the microprocessor measures for pitch and roll angles.

Besides an integral temperature sensor, a 2-axis and 1-axis magnetic sensor devices are mounted horizontally and vertically to create a 3-axis measurement of the incident magnetic field upon the sensors. Each sensor output is amplified and sent to a multiplexed input ADC residing inside the microprocessor. After digitizing, the magnetic signals are corrected for hard and soft-iron magnetic errors created by the environment to which the compass is attached.

Heading computation uses the magnetic and tilt information inputs after compensation for errors. From the basic magnetic heading, a declination value may be added to arrive at a geographic north referenced heading. An index offset value may also be added to correct for mechanical installation misalignment on the target platform.
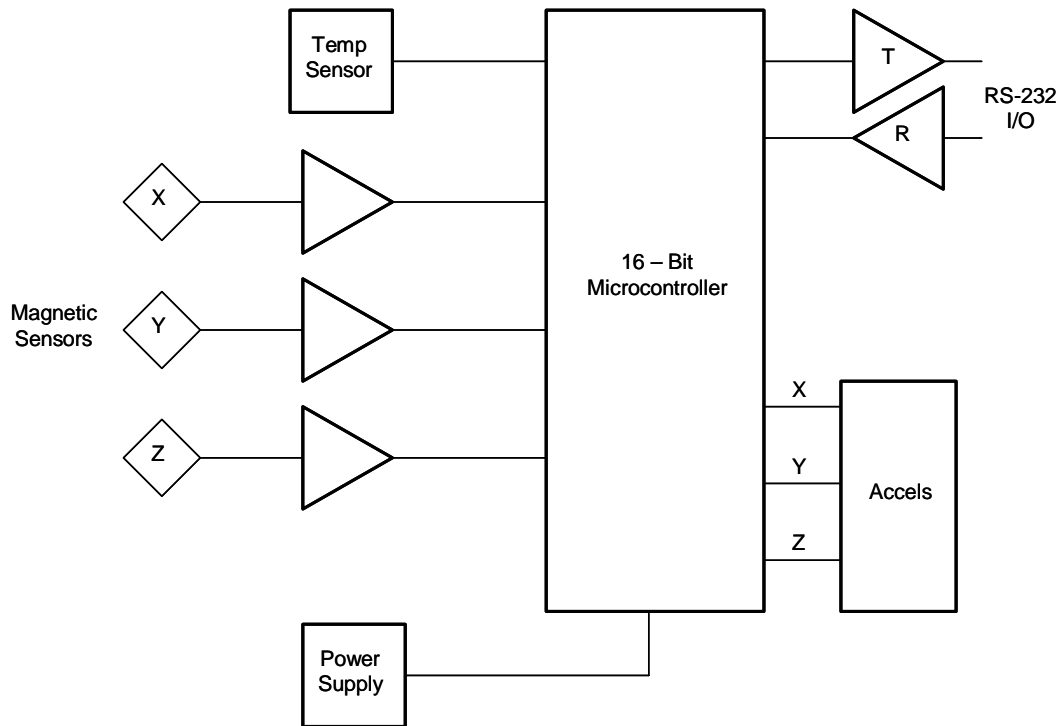
HMR3500

Figure 3
HMR3500 Block Diagram

UART COMMUNICATION INTERFACE

The 5-pin power supply and UART interface connector on the HMR3500, mates with a Harwin latching connector (Part # M80-8980505) per the pin configuration table earlier in this document. The interface hardware protocol is RS-232 without any further handshaking or hardware control lines.

Further HMR3500 interface commands and protocol are in the HMR3500 user's guide document.

TEST SOFTWARE DESCRIPTION

Computer test software is provided in the HMR3500 demonstration kit that will permit a thorough evaluation and demonstration of the compass capabilities. CompassHost is a 32-bit Windows test program. It is capable of sending and receiving all messages described in this manual except the BAUD message. It can display all messages received from the module in the main window with scrolling text. It has a small window summarizing the current status of the module and a graphic display of the current compass heading, roll, and pitch.

CompassHost can be run under Windows 9x, ME, NT 4.0, 2000 or their successors. One available serial port is required for communicating with the compass. Processor, memory, and disk space requirements are minimal.

The CompassHost software is not described in this datasheet, but given in depth description in the HMR3500 user's guide document.
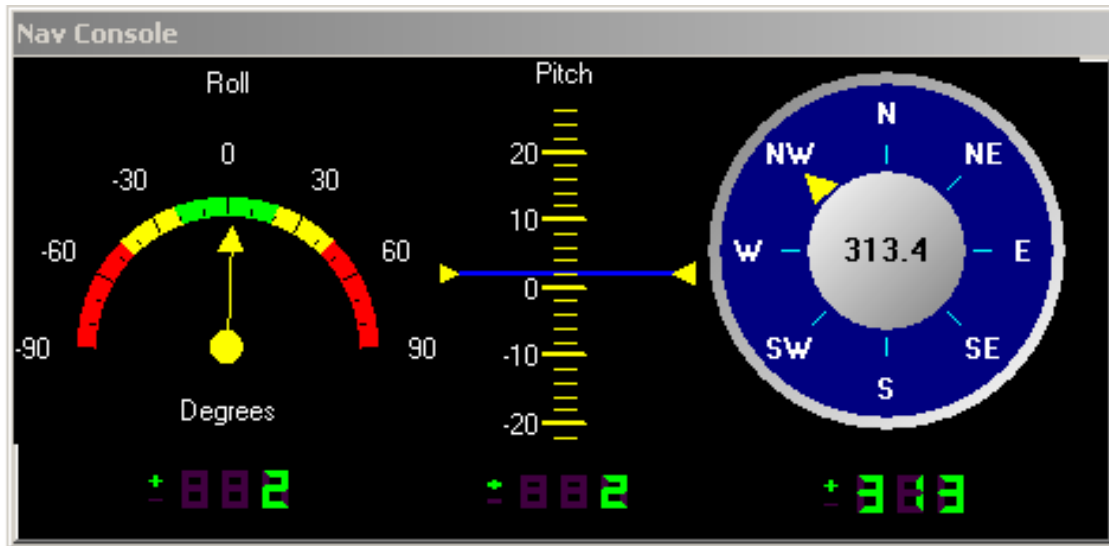
HMR3500

Figure 4
Compass Test Evaluation Software Display

ORDERING INFORMATION

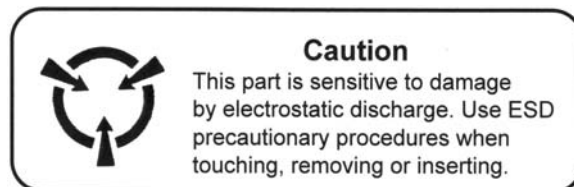| Ordering Number	Product
HMR3500 HMR3500 Demo	TruePoint Compass Module PCB Only (RS232 or CMOS output) TruePoint Compass Demonstration Kit

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 (763-954-2474 internationally).

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U.S. Patents 4,441,072, 4,533,872, 4,569,742, 4,681,812, 4,847,584 and 6,529,114 apply to the technology described

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

CAUTION: ESDS CAT. 1B