

LINEAR POSITION SENSOR MODULE

Features

- 0-69 mm Magnetic Travel (Magnet Dependent)
- Microprocessor Digital and Analog Data Outputs
- 0.1mm Accuracy (Magnet Dependent)
- 0.1mm Repeatability
- -40° to +85°C Operating Temperature Range
- Regulated 5 volt or unregulated 6 to 20 volt DC Supply Compatibility

General Description

The Honeywell HMR4007 is a high-resolution electronic linear position-sensing module capable of measuring extended range linear position by providing a digital indication of position of a target magnet. Advantages include insensitivity to shock and vibration, known position at power-on, ability to withstand large variations in the gap between the sensor and the magnet, and high sensitivity so lower cost magnets (such as AlNiCo or Ceramic) can be used.

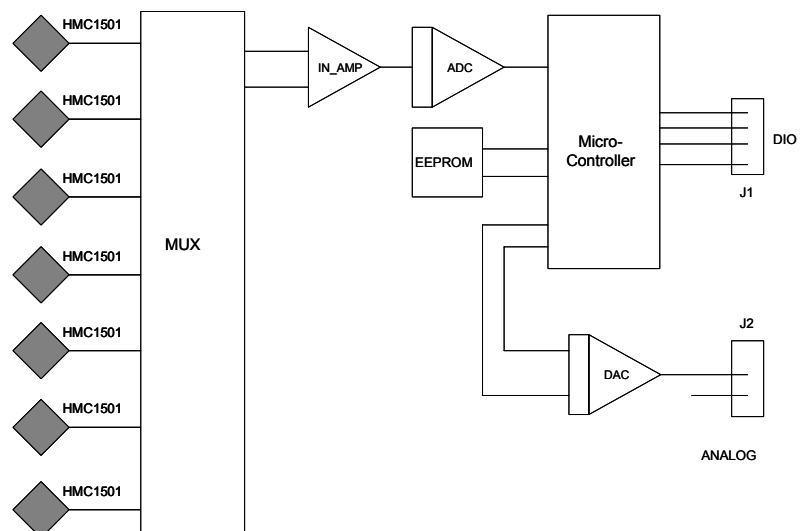
The HMR4007 is manufactured with Honeywell's HMC1501 magnetoresistive (MR) sensors in a stationary array, which provides better performance than Hall Effect devices and only needs a magnetic field source greater than 80 gauss.



APPLICATIONS

- Linear Displacement
- Shaft Position
- Potentiometer Replacement
- Fluidic Pumps

Block Diagram



SPECIFICATIONS

| Characteristics | Conditions | Min | Typ | Max | Units |
|-----------------|------------|-----|-----|-----|-------|
|-----------------|------------|-----|-----|-----|-------|

General

| | | | | | |
|---------------|---|-----|------|----------|----|
| Accuracy | | 0.2 | 0.1 | | mm |
| Resolution | | | 0.01 | | mm |
| Hysteresis | | | 0.01 | | mm |
| Repeatability | | | 0.01 | 0.1 | mm |
| Update Rate | | 10 | 30 | | Hz |
| Standoff | Distance (gap) between the target magnet and the sensor board | 0.1 | 5 | (note 1) | mm |

Magnetic Field

| | | | | | |
|-------------|--|----|----------------|--|-------|
| Range | magnetic field at the sensor array | 35 | 50 (note 1) | | gauss |
| length | apparent magnet length at sensor array | 23 | | | mm |
| Orientation | Axial = mag poles parallel to sensor array | | Axial (note 2) | | |

Electrical

| | | | | | |
|---------------|-------------|---|----|----|-----|
| Input Voltage | Unregulated | 5 | 10 | 28 | VDC |
| Current | | | 15 | 20 | mA |

Digital Interface

| | | | | | |
|-----------------|--|------|--|--------|-------------|
| Baud Rate | nonstandard synchronous serial interface | 1000 | | 21,000 | Bits / sec. |
| Signaling Level | TTL levels ("1") | 3.5 | | 5.0 | VDC |
| | ("0") | -0.3 | | 1.5 | VDC |
| Connector | In-Line 6-Pin Block (0.1" spacing) | | | | |

Analog Interface

| | | | | | |
|-----------------|------------------------------------|------|----|-----|-----|
| Analog Output | D/A output | 0 | | 2.5 | VDC |
| Update Rate | | 10 | 30 | | Hz |
| Signaling Level | TTL levels ("1") | 3.5 | | 5.0 | VDC |
| | ("0") | -0.3 | | 1.5 | VDC |
| Connector | In-Line 4-Pin Block (0.1" spacing) | | | | |

Physical

| | | | | | |
|------------|---|--|--------------------|--|-------|
| Dimensions | Circuit Board Assembly (including connectors) | | 40.0 x 80.0 x 12.0 | | mm |
| Weight | HMR4007 | | 16.5 | | grams |

Environment

| | | | | | |
|-------------|-----------|-----|---|------|----|
| Temperature | Operating | -40 | - | +70 | °C |
| | Storage | -55 | - | +125 | |

Note 1: A magnet of sufficient strength must be used to maintain a magnetic field strength of 35 gauss (min.) at the sensor array and an apparent magnet length of 23 mm.

Note 2: Sensor boards are factory calibrated in the axial mode using a 27mm length cylindrical magnet. Operation in the radial mode must be digitally reconfigured by the user.

PIN CONFIGURATION

| Pin Number | Pin Name | Description |
|------------|----------|-------------|
|------------|----------|-------------|

Digital Interface

| | | |
|---|----------|--|
| 1 | RTS | Serial Clock Output |
| 2 | Data_Out | Serial Data Output |
| 3 | Data_In | Serial Data Input |
| 4 | CTS | Serial Clock Input |
| 5 | Power | Unregulated Power Input (+6 to +28 VDC) (see note 1) |
| 6 | GND | Power and Signal Ground |

Analog Interface

| | | |
|---|----------------|--|
| 1 | Power | Unregulated Power Input (+6 to +28 VDC) (see note 1) |
| 2 | Analog Out | 0 - 2.5 VDC analog output |
| 3 | Position Valid | TTL level (0 = position invalid, 1 = position valid) |
| 4 | GND | Power and Signal Ground |

Jumper Block #1

| | | |
|-----|--------|---|
| 2-5 | Note 1 | Analog Output port selected as power source |
| 3-6 | Note 1 | Serial Communications port selected as power source |

Note 1: The board contains three interface connectors for digital and/or analog communications. Power is supplied to the board through any one of these connectors and is selected by jumper block #1. Only **ONE** of the three positions on JP1 should be shorted at a time. Shorting more than one may result in excessive power supply currents and board damage.

CIRCUIT DESCRIPTION

The HMR4007 Linear Position Sensor circuit board includes all of the basic sensors and electronics to provide a digital indication of position of a target magnet. The HMR4007 starts with an array of seven Honeywell HMC1501 single axis magnetoresistive (MR) sensors to determine the field geometry and direction of a target magnet attached to the moving part of a device under test. These sensors are supplied power by a constant voltage source, and the use of an array of sensors helps to maintain accuracy over temperature and run-out. The sensor outputs are routed to a multiplexed Analog to Digital Converter (ADC) integrated circuit. A microcontroller integrated circuit periodically queries the multiplexed ADC and performs sensor offset and gain corrections and computes the position of the target magnet as a function of the distance of travel along the long axis of the sensor board. The position data, along with an error bit, is available through the serial interface or is present on the Digital to Analog Converter (DAC) output port.

The serial interface is not needed in order to use the board's stand-alone analog output. The microcontroller also performs the external serial data interface and other housekeeping functions. An onboard EEPROM integrated circuit is employed as a nonvolatile storage to retain necessary data and configuration variables for best performance.

The HMR4007 uses an on-board low drop out (LDO) +5 volt regulator so that a regulated +5 volt power supply or an unregulated power supply in the range of +6VDC to +28VDC can be used. The power is supplied to the board through one of the three user ports being (serial, analog, or USB) and a jumper is used to select which port is the power source. Only one jumper should be in place at any one time as the board does not have over current protection and use of more than one jumper can result in excessive power supply currents and board damage.

PHYSICAL CHARACTERISTICS

The circuit board for the HMR4007 Linear Position Sensor is approximately 340mm by 80mm. A 6-pin right angle connector (J1) and two 4-pin connectors (J2, J3) protrude from the back of the board for user connections. Components on the top-side have a maximum height of 12mm. Figure 1 shows a typical circuit board with dimensions.

Parts Placement

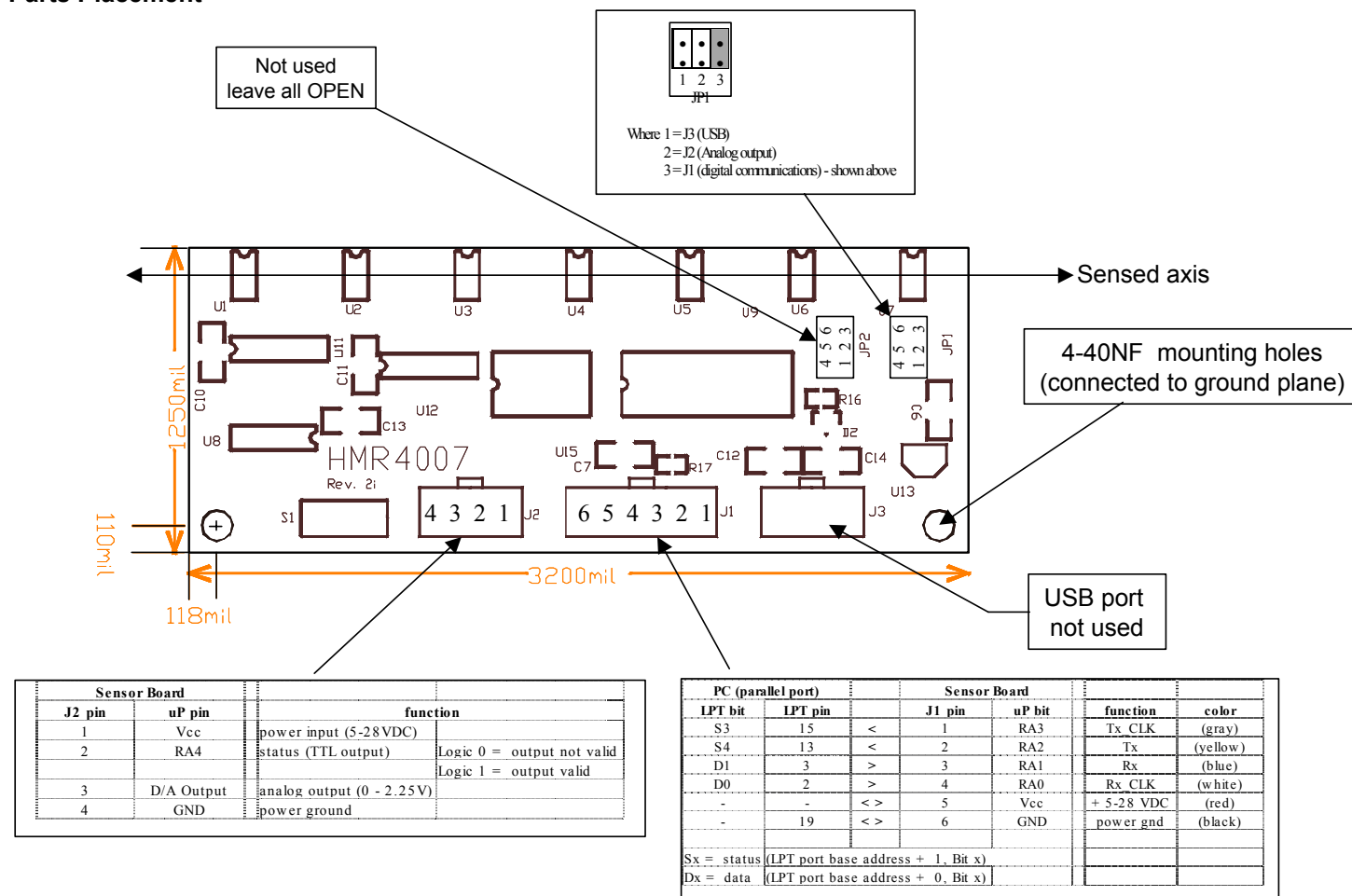


Figure 1 – Sensor board layout and connector pin designations

Mating Parts

Connectors J1, J2, and J3 mate with GC/Waldom C-Grid™ crimp-style shells and terminals. Polarized shells (with a locking tab) or unpolarized shells are available. The applicable GC/Waldom part numbers are:

| Connector | pins | Polarized shell | Unpolarized shell | Crimp terminals |
|-----------|------|-----------------|-------------------|-----------------|
| J1 | 6 | 50-57-9406 | 50-57-9006 | 16-02-0097 |
| J2 | 4 | 50-57-9404 | 50-57-9004 | 16-02-0097 |
| J3 | 4 | 50-57-9404 | 50-57-9004 | 16-02-0097 |

Ordering Information

| Ordering Number | Product |
|-----------------|-----------------|
| HMR4007 | PCB Module Only |

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