

Sparton Digital Compasses

Unique Features

Sparton's SP3004D digital compass integrates 3-axis magneto-inductive sensors with 3-axis accelerometers to provide highly accurate heading output independent of platform orientation. Standard features include an industry leading Adaptive In-Field Magnetic Calibration Algorithm, 2-D & 3-D Manual Calibration Capability, Selectable Baud Rate, True North Heading based on built-in World Magnetic Model, Full 360 degree Rollover Capability, Selectable Digital Filtering, Motion Stabilization, Rapid Initialization and Full Encapsulation.

The Sparton digital compass monitors the magnetic field conditions and automatically corrects for magnetic field distortions using its proprietary Adaptive In-Field Magnetic

Calibration feature. Calibration settings are initialized at the factory where errors associated with the compass platform itself are corrected. When in actual use, magnetic anomalies cause distortions in the observed field. The Sparton digital compass monitors the magnetic field conditions and uses an adaptive algorithm to automatically correct for these distortions during in-field calibration. The compass accuracy is improved until no further corrections can be made.

The Sparton digital compass can provide True North Heading when given the current magnetic variation. It can also calculate the magnetic variation when provided positional information (latitude, longitude, altitude, time). True North



Heading is calculated using the World Magnetic Model and positional data provided. The algorithm consists of a 12th order spherical harmonic model that is incorporated into our digital compass. Coefficients for the model are updated every 5-years. The algorithm corrects for magnetic fluctuations in the Earth's core only and does not account for magnetic anomalies in the local geography or from atmospheric storms.

The Sparton digital compass measures the 3-dimensional magnetic and acceleration field conditions and mathematically corrects the magnetic readings based on the compass orientation. Magnetic heading is based on a level condition relative to the surface of the Earth. When the compass platform is tilted, an incorrect heading would result if left uncompensated.

The Sparton digital compass compensates the magnetic readings for tilt in any orientation. The compass combines the magnetic and acceleration vectors to derive a 3-dimensional reference frame for the platform. Roll, pitch, and heading (yaw) information are then derived based on the resultant reference frame orientation. This process gives the ability to provide an accurate magnetic heading for full 360 Degree Rollover Capability.

The heading, pitch, and roll outputs from the compass are compensated for variable motion conditions



providing Motion Stabilization. Most compasses measure the direction of acceleration from Earth's gravity to determine a level orientation for tilt compensation. Acceleration caused by platform movement can induce errors in heading determination. Since the Sparton digital compass calculates a 3-dimensional reference frame based on the magnetic and acceleration inputs, it is inherently immune to motion on two of the three dimensions. Motion in the third dimension is suppressed using a proprietary stabilization algorithm and dynamic digital filtering.

The Sparton digital compass features Rapid Initialization after start-up. Neither the magnetometers nor the MEMS accelerometers require any preconditioning before use. Since the sensors are also temperature insensitive, there is no need for temperature compensation. Measurements are quickly collected and filtered allowing data to be processed rapidly at startup for applications requiring fast time-to-first-fix.

Sparton digital compasses are fully encapsulated in potted modules. The potting is an electrically insulating, thermally conductive epoxy. This permits use in harsh environments where moisture, shock, or vibration may be a concern, including Unmanned Underwater Vehicles, Unmanned Aerial Vehicles, or Autonomous Underwater Vehicles.

In addition to standard 3-D calibration, the SP3004D includes a revolutionary 2-D calibration algorithm to optimize performance and allow fast, accurate, in-field, on-equipment calibration for platform based applications. When

manual in-field calibration is performed, the compass will analyze the data and determine by itself if there is enough data for a 3-D calibration. If not, it will perform the 2-D calibration. The selection is transparent to the user. The 2-D calibration is for applications which have limited pitch and roll capability. In order to perform the 2-D cal, you would rotate the compass in a level, horizontal plane a full 360 degrees. If you give the compass your latitude and longitude before the calibration, it will compute the magnetic field parameters at your location and use that information during the 2-D cal to improve the overall calibration accuracy. Further, user selectable Baud Rates (up to 115,200 Baud) and Dynamic Filter (on/off settings) are now included.

The Sparton digital compass has a host of additional features that provide enhanced performance. In addition to providing a highly accurate heading output, the compass provides absolute 3-D magnetic field strength, pitch and roll, X, Y, and Z acceleration components, and temperature. The digital compass is compact, measuring 3.9cm x 3.9cm x 1.9cm with connectors, to allow use in space sensitive applications. A Serial Peripheral Interface (SPI) port is available and is intended for use in embedded applications. A RS232 port is also available with on-board level translation. Eight digital input/output ports and four analog inputs are available for general-purpose use. Analog inputs are digitized to 12-bits. The compass circuitry runs on 3.3 volts requiring only 36 milliwatts of power to operate. The compass also



has an on-board regulator to handle voltage inputs from 5 to 24 volts.

Sparton's SP3002D digital compass was developed as a lower priced alternative for applications requiring a lesser degree of precision. Standard features include 2D & 3D Manual Calibration, Selectable Baud Rate, True North Heading when given magnetic variation, Full 360 degree Rollover Capability, Selectable Digital Filtering, Rapid Initialization, and Full Encapsulation.

Through innovative design of both hardware and software, the Sparton SP3004D digital compass offers superior performance and flexibility. The digital compass provides heading accuracy over full mission dynamics. With its rapid initialization feature, it provides virtually instantaneous, accurate heading data upon start-up. The full rollover capability ensures accurate heading regardless of platform attitude. Motion compensation provides accurate heading, pitch and roll output under variable motion conditions. The compass also provides enduring mission accuracy. The automatic magnetic calibration feature corrects for hard and soft magnetic field distortions during operation. The magnetic variation correction provides a continuous true heading output. These features facilitate mission accuracy required by any device even in the harshest environments. The Sparton SP3004D digital compass truly offers significant performance enhancements over standard digital compasses and is in a feature class by itself.

