This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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Hemisphere GPS Precision GPS Applications



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| | | | | |
|---|---|---|---|---|
| 6,111,549 | 6,397,147 | 6,469,663 | 6,501,346 | 6,539,303 |
| 6,549,091 | 6,631,916 | 6,711,501 | 6,744,404 | 6,865,465 |
| 6,876,920 | 7,142,956 | 7,162,348 | 7,277,792 | 7,292,185 |
| 7,292,186 | 7,373,231 | 7,400,956 | 7,400,294 | 7,388,539 |
| 7,429,952 | 7,437,230 | 7,460,942 | | |

Other U.S. and foreign patents pending.

# Contents

# Overview

This quick reference guide provides information to get you up and running quickly with your MV102 GPS Compass. For more detailed information on using the MV102 refer to the MV102 GPS Compass User Guide.

This guide consists of the following sections:

- "Parts List" below describes the parts in your MV102 GPS Compass kit
- "Additional Documentation" below provides information for additional MV102 documentation
- "Installation Considerations" on page 2 contains recommendations for where to place your MV102, dimensions of the unit, VHF interference, and mounting options
- "Mounting Orientation" on page 4 describes parallel and perpendicular orientations
- "Alignment" on page 5 describes how to align the MV102
- "Connecting the MV102 to External Devices" on page 12 provides information on the included power/data cable and how to connect to serial ports
- "Configuration" on page 14 lists basic configuration information
- "Supplemental Sensors" on page 14 describes the purpose of and calibration procedures for the sensors
- "Common Commands and Messages" on page 15 lists commands and messages common to MV102 (for more information on commands and messages see the GPS Technical Reference from www.hemispheregps.com)

# Parts List

In addition to this Quick Reference Guide (which is included in the MV102 kit), installing the MV102 GPS Compass requires the following:

- MV102 GPS Compass
- Kit (accessory item) containing the following:
  - Power/data cable (15 m)
  - Clamp
  - Screw
  - Washer
- Serial-to-NMEA 2000 adapter, PN 710-0104-000#

# Additional Documentation

For more in-depth information on the MV102 GPS Compass you can download the MV102 User Guide.

# Installation Considerations

Refer to the MV102 GPS Compass User Guide for more detailed installation instructions.

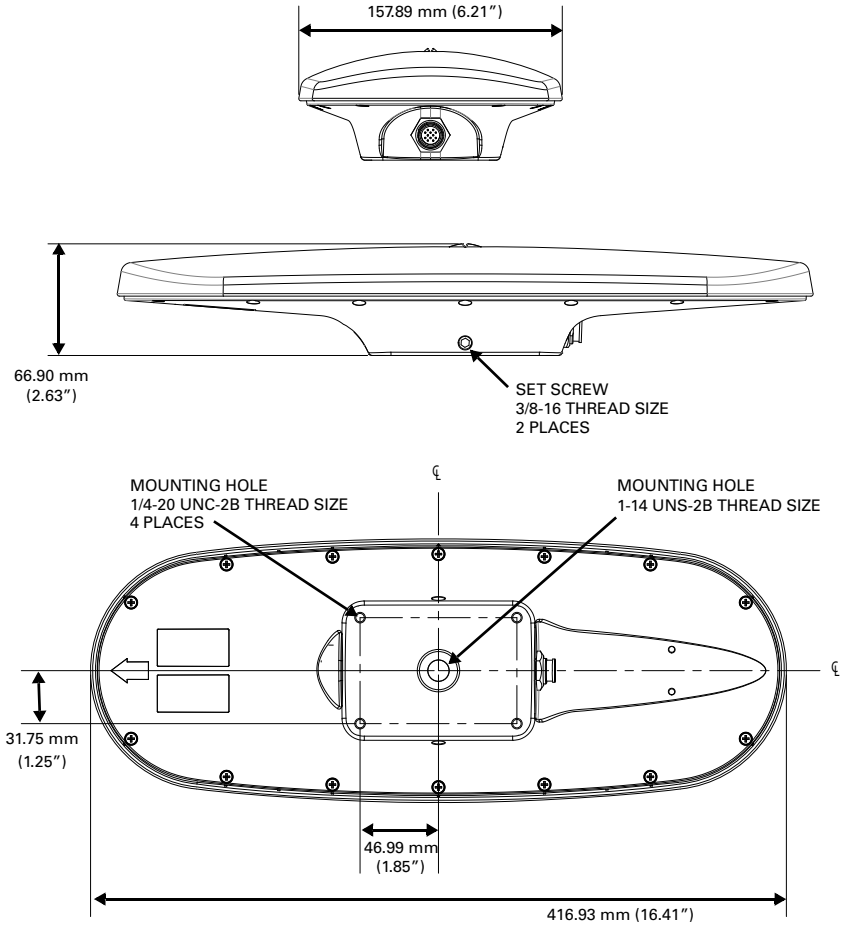
## Location

Proper location is important to obtain a high-precision GPS reading. Choose an installation location using either the pole or fixed mount where the MV102:

- Has a clear view of the sky
- Is away from other electronics and antennas
- Has enough cable to reach a power source
- Is on a level plane

## Dimensions

The following drawing illustrates the physical dimensions of the MV102.

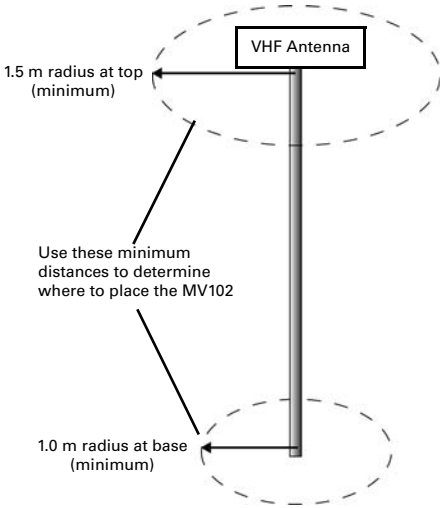


## VHF Interference

VHF interference from such devices as cellular phones and radio transmitters may interfere with GPS operation. For example, if installing the MV102 near marine radios consider the folowing:

- VHF marine radio working frequencies (Channels 1 to 28 and 84 to 88) range from 156.05 to 157.40 MHz. The L1 GPS working center frequency is 1575.42 MHz. The bandwidth is +/- 2MHz to +/- 10 MHz, which is dependent on the GPS antenna and receiver design.
- VHF marine radios emit strong harmonics. The 10th harmonic of VHF radio, in some channels, falls into the GPS working frequency band, which may cause the SNR of GPS to degrade significantly.
- The radiated harmonic signal strength of different brands/ models varies.
- Follow VHF radio manufacturers' recommendations on how to mount their radios and what devices to keep a safe distance away.
- Handheld 5W VHF radios may not provide suitable filtering and may interfere with the MV102's operation if too close.

Before installing the MV102 use the following diagram to ensure there are no nearby devices that my cause VHF interference.




## Mounting Options

***Hemisphere GPS does not provide the mounting hardware.**

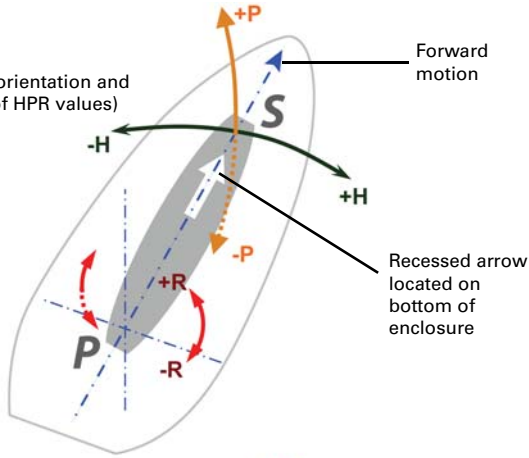
The MV102 allows for two different mounting options: flush mount and pole mount.

- Flush mount - The bottom of the MV102 contains four holes for flush mounting the unit to a flat surface (see "Dimensions" on page 2).
- Pole mount - The bottom of the MV102 contains a mounting hole (1" thread, 0.9" depth) for easy pole mounting. Hand tighten (do not overtighten). The set screws on the long sides of the base (see diagram above) allow you to secure the MV102 in place (3/16" Allen wrench not included).

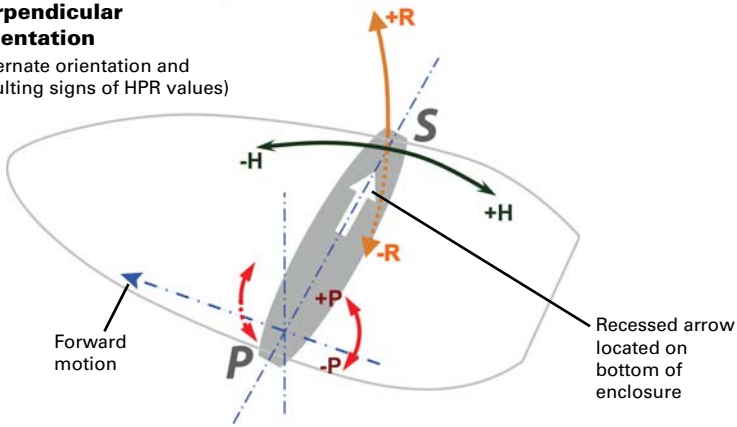
# Mounting Orientation

The MV102 outputs heading, pitch, and roll readings regardless of the orientation of the antennas. However, the relation of the antennas to the boat's axis determines whether you will need to enter a heading, pitch, or roll bias. The primary antenna is used for positioning and the primary and secondary antennas, working in conjunction, output heading, pitch, and roll values.

**Parallel Orientation**
(recommended orientation and resulting signs of HPR values)




**Perpendicular Orientation**
(alternate orientation and resulting signs of HPR values)



# Alignment

The top of the MV102 enclosure incorporates sight design features to help you align the enclosure with respect to an important feature on your vessel.

To use the sights, center the small post on the opposite side of the enclosure from you, within the channel made in the medallion located in the center of the enclosure top as shown in Figure 1 and Figure 2. Alignment accuracy when looking through the long site (Figure 1) is approximately +/- 1°, while alignment through the short site (Figure 2) is approximately +/- 2.5°.

**Figure 1: Long site alignment**

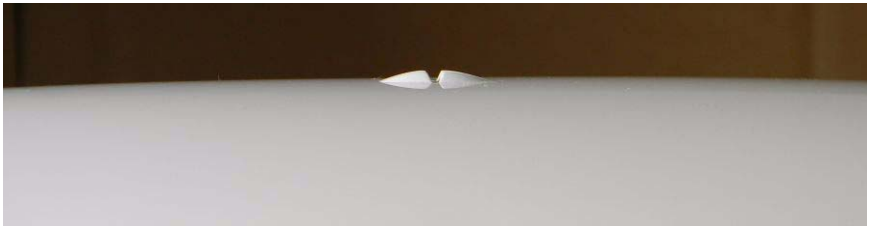


**Figure 2: Short sight alignment**

# Ports

The MV102 offers either serial port or NMEA 2000 port functionality.

## Serial Ports

The MV102 offers position and heading data via two full-duplex (bi-directional) RS-232 serial ports. Besides outputting data, these ports are used for firmware upgrades.

### Selecting Baud Rates and Message Types

When selecting your baud rate and message types, use the following calculation to determine your baud rate for your required data throughput.

Messages * Message output rate * Message length (bytes) * bits in byte
Ex: 5 * 20Hz * 40 bytes * 10 = 40,000 bits/sec

For information on message output rates refer to GPS Technical Reference available from the Hemisphere GPS website at www.hemispheregps.com.

### Configuring the Ports

You may configure Port A or Port C of the GPS receiver to output any combination of data that you want. Port A can have a different configuration from Port C in terms of data message output, data rates, and the baud rate of the port. This allows you to configure the ports independently based upon your needs.

The CAN processor that controls Port C is by default programmed into NMEA 2000 mode. You must configure Port C as a serial port to use the MV102 with two serial ports. Port A is always a serial port. To configure Port C as a serial port refer to Table 1 on page 7.

For example, if you want one generalized port and one heading-only port, you can configure the ports as follows:

- Port A to have GPGGA, GPVTG, GPGSV, GPZDA, and GPHDT all output at 1 Hz over a 9600 baud rate
- Port C to have GPHDT and GPROT output at their maximum rate of 20 Hz over a 19200 baud rate

A personal computer (PC) typically uses a DB9-male connector for RS-232 serial port communications.

---

**Note:** For successful communications use the 8-N-1 protocol and set the baud rate of the MV102's serial ports to match that of the devices to which they are connected. Flow control is not supported.

---

### Recommendations for Connecting to Other Devices

When interfacing to other devices, ensure the transmit data output from the MV102 is connected to the data input of the other device. The signal grounds must also be connected.

There is likely little reason to connect the receive data input of the MV102 to another device unless it is able to send configuration commands to the MV102. Since the MV102 uses proprietary NMEA 0183 commands for control over its configuration, the vast majority of electronics will not be able to configure its settings unless the other device has a terminal setting where you can manually issue commands.

## NMEA 2000 Port

By default, Port C is configured as a NMEA 2000 port with the default baud rate of 57600.

To use MV102 for NMEA 2000 you have to connect the included serial-to-NMEA 2000 adapter (P/N 710-0104-000#) to the unit. Figure 3 shows the adapter. Insert the 12-pin connector of the adapter into the male end of the 12-pin connector on the MV102 by aligning the keys. You can then attach the adapter to the unit using the supplied screws (machine, 8-32, ½", PPHC, SS) and washer (washer, flat, #8, SS). The 5-pin male Micro-C connector connects to your NMEA 2000 drop cable.

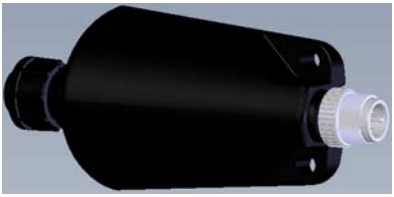


**Figure 3: Serial-to-NMEA 2000 adapter**

Table 1 lists the commands used to configure Port C back to serial or NMEA 2000 when necessary. You can only send these commands using Port A.

**Table 1: Commands for changing Port C (must be sent through Port A)**

| Command | Reply | Description |
|---|---|---|
| $JRELAY,PORTC,$JSERIALMODE | $>JSERIALMODE,ENABLED<br>$>resetting | Switch Port C to serial |
| $JRELAY,PORTC,$JN2KMODE | $>JN2KMODE,ENABLED<br>$>resetting | Switch Port C to NMEA 2000 |

Table 2 shows the requested PGNs with the MV102 in NMEA 2000 mode.

**Table 2: Received messages based on a request**

| PG No. (PGN) | Description | Level | Default Update Rate (msec) | Freq (Hz) |
|---|---|---|---|---|
| 059392 | ISO Acknowledgement<br>Used to acknowledge the status of certain requests addressed to a specific ECU. | B | On Request | On Request |
| 059904 | ISO Request<br>Request the transmission of a specific PGN, addressed or broadcast. | B | On Request | On Request |
| 060928 | ISO Address Claim<br>Used to identify to other ECUs the address claimed by an ECU. | B | On Request | On Request |

**Table 2: Received messages based on a request (*continued)***

| PG No. (PGN) | Description | Level | Default Update Rate (msec) | Freq (Hz) |
|---|---|---|---|---|
| 126996 | Product Information<br>NMEA 2000 database version supported, manufacturer's product code, NMEA 2000 certification level, Load Equivalency number, and other product-specific information. | B | On Request | On Request |
| 126464 | Receive/Transmit PGNs group function<br>The Transmit / Receive PGN List Group type of function is defined by first field. The message will be a Transmit or Receive PGN List group function. | B | On Request | On Request |
| 129538 | GNSS Control Status<br>GNSS common satellite receiver parameter status. | B | On Request | On Request |
| 129545 | GNSS RAIM Output<br>Used to provide the output from a GNSS receiver's Receiver Autonomous Integrity Monitoring (RAIM) process. The Integrity field value is based on the parameters set in PGN 129546 GNSS RAIM Settings. | B | On Request | On Request |
| 129546 | GNSS RAIM Settings<br>Used to report the control parameters for a GNSS Receiver Autonomous Integrity Monitoring (RAIM) process. | B | On Request | On Request |

Table 3 shows the transmitted PGNs with their default update rate with the MV102 in NMEA 2000 mode.

**Table 3: Transmitted messages**

| PG No. (PGN) | Description | Level | Default Update Rate (msec) | Freq (Hz) |
|---|---|---|---|---|
| 126992 | System Time<br>The purpose of this PGN is twofold: To provide a regular transmission of UTC time and date. To provide synchronism for measurement data. | B | 1000 | 1 |

**Table 3: Transmitted messages (*continued*)**

| PG No. (PGN) | Description | Level | Default Update Rate (msec) | Freq (Hz) |
|---|---|---|---|---|
| 127250 | Vessel Heading<br>Heading sensor value with a flag for True or Magnetic. If the sensor value is Magnetic, the deviation field can be used to produce a Magnetic heading, and the variation field can be used to correct the Magnetic heading to produce a True heading. | B | 100 | 10 |
| 127251 | Rate of Turn<br>Rate of change of the Heading. | B | 100 | 10 |
| 127257 | Attitude<br>Provides a single transmission that describes the position of a vessel relative to both horizontal and vertical planes. This would typically be used for vessel stabilization, vessel control and onboard platform stabilization. | B | 1000 | 1 |
| 127258 | Magnetic Variation<br>Message for transmitting variation. The message contains a sequence number to allow synchronization of other messages such as Heading or Course over Ground. The quality of service and age of service are provided to enable recipients to determine an appropriate level of service if multiple transmissions exist. | | 1000 | 1 |
| 128259 | Speed<br>Provides a single transmission that describes the motion of a vessel. | B | 1000 | 1 |
| 129025 | Position, Rapid Update<br>Provides latitude and longitude referenced to WGS84. Being defined as single frame message, as opposed to other PGNs that include latitude and longitude and are defined as fast or multi-packet, this PGN lends itself to being transmitted more frequently without using up excessive bandwidth on the bus for the benefit of receiving equipment that may require rapid position updates. | B | 100 | 10 |
| 129026 | COG & SOG, Rapid Update<br>Single frame PGN that provides Course Over Ground (COG) and Speed Over Ground (SOG). | B | 250 | 4 |

**Table 3: Transmitted messages (*continued*)**

| PG No. (PGN) | Description | Level | Default Update Rate (msec) | Freq (Hz) |
|---|---|---|---|---|
| 129027 | Position Delta, High Precision Rapid Update<br>The "Position Delta, High Precision Rapid Update" Parameter Group is intended for applications where very high precision and very fast update rates are needed for position data. This PGN can provide delta position changes down to 1 mm with a delta time period accurate to 5 msec. | B | 100 | 10 |
| 129028 | Altitude Delta, High Precision Rapid Update<br>The "Altitude Delta, High Precision Rapid Update" Parameter Group is intended for applications where very high precision and very fast update rates are needed for altitude and course over ground data. This PG can provide delta altitude changes down to 1 millimeter, a change in direction as small as 0.0057°, and with a delta time period accurate to 5 msec. | B | 100 | 10 |
| 129029 | GNSS Position Data<br>Conveys a comprehensive set of Global Navigation Satellite System (GNSS) parameters, including position information. | B | 1000 | 1 |
| 129033 | Time & Date<br>Single transmission that provides UTC time, UTC Date, and Local Offset. | B | 1000 | 1 |
| 129539 | GNSS DOPs<br>Provides a single transmission containing GNSS status and dilution of precision components (DOP) that indicate the contribution of satellite geometry to the overall positioning error. There are three DOP parameters reported: horizontal (HDOP), Vertical (VDOP), and time (TDOP). | B | 1000 | 1 |
| 129540 | GNSS Sats in View<br>GNSS information on current satellites in view tagged by sequence ID. Information includes PRN, elevation, azimuth, SNR, defines the number of satellites; defines the satellite number and the information. | B | 1000 | 1 |

# Powering the MV102

## Power Considerations

For best performance use a clean and continuous power supply. The MV102 power supply features reverse polarity protection but will not operate with reverse polarity.

Additional power specifications include:

- Input voltage: 6 to 36 VDC
- Power consumption: ~ 3 W nominal
- Current consumption: 320 mA @ 9 VDC
  240 mA @ 12 VDC
  180 mA @ 16 VDC
- Power isolation: Isolated to enclosure

## Connecting to a Power Source

---

**Note:** This section refers to powering the unit via serial connection. To power the unit via NMEA 2000 connection, following the standard procedure for powering up via NMEA 2000.

---

Before you power up the MV102 you must terminate the wires of the power cable as required. There are a variety of power connectors and terminals on the market from which to choose, depending on your specific requirements.

---

**⚠WARNING:** Do not apply a voltage higher than 36 VDC. This will damage the receiver and void the warranty.

---

To interface the MV102 power cable to the power source:

- Connect the red wire of the cable's power input to DC positive (+)
- Connect the black wire of the cable's power input to DC negative (-)

The MV102's smart antenna will start when an acceptable voltage is applied to the power leads of the extension cable.

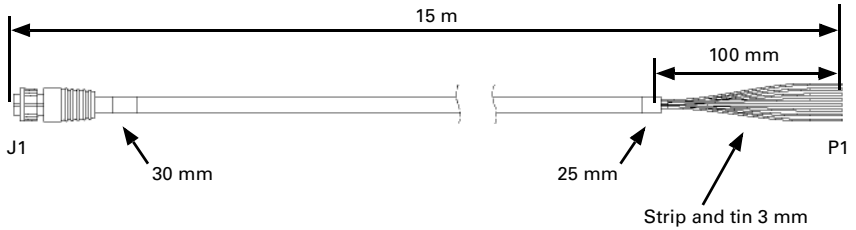
## Electrical Isolation

The MV102's power supply is isolated from the communication lines and the PC-ABS plastic enclosure isolates the electronics mechanically from the vessel (addressing the issue of vessel hull electrolysis).

# Connecting the MV102 to External Devices

## Power/Data Cable

The MV102 uses a single 15 m (49 ft) cable for power and data input/output.




The receiver end of the cable is terminated with an environmentally sealed 12-pin connection; the opposite end is unterminated and requires field stripping and tinning.

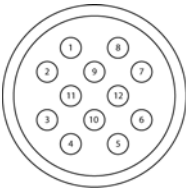



Table 4 shows the cable's pinout specifications.

**Table 4: Power/data cable pinout**

| Pin | Function | Wire Color |
|---|---|---|
| 1 | Port C, RS-232 female DB9 pin 2, device out | White |
| 2 | Port C, RS-232 female DB9 pin 3, device in | Green |
| 3 | N/C | N/C |
| 4 | N/C | N/C |
| 5 | Power input | Red |
| 6 | N/C | N/C |
| 7 | Signal ground | Yellow |
| 8 | Port A, RS-232 female DB9 pin 3, device in | Brown |
| 9 | Port A, RS-232 female DB9 pin 2, device out | Blue |
| 10 | Power ground | Black |
| 11 | CH_GND | Drain |
| 12 | N/C | N/C |

# Default Parameters

Table 5 and Table 6 provide details on the default port settings, available baud rates, differential age, elevation mask, and default differential mode. Use the $JSAVE command to save changes you make to the MV102's configuration for the changes to be present in subsequent power cycles.

**Table 5: Default port settings**

| Port | Baud Rate | NMEA Messages | Update Rate |
|---|---|---|---|
| Port A (RS-232) | 19200 | GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT | 1 Hz |
| Port C (RS-232) | 19200 | GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT | 1 Hz |
| Power RED (+), BLK (-) | 6 - 36 VDC | | |
| **Note:** The default update rate for NMEA 0183 messages is 1 Hz. 10 Hz is the standard maximum rate, but you can purchase a subscription to upgrade the output rate to 20 Hz. | | | |

**Table 6: Additional default settings**

| Parameter | Specification |
|---|---|
| Max DGPS age (correction age) | 2700 seconds |
| Elevation mask | 5° |
| Differential mode | SBAS (WAAS/EGNOS) |

# Configuration

Use a terminal program or PocketMax3 (available at www.hemispheregps.com) to connect to a serial port for additional configuration requirements. Use default baud rate of 19200 bps and 8-N-1 protocol.

- Change baud rate of either port to match that of the external equipment to which the MV102 is connected. After changing the baud rate, you must close the terminal program and reconnect at the speed selected.
- Configure NMEA messages to be output on the appropriate port.
- Select differential source.
- Input heading bias (-180° to +180°) to compensate for any offset from the centerline.
- Input bias for tilt (-15° to +15°) to compensate for any offset from horizontal.
- Enable/disable supplementary sensors (default is GYROID and TILTAID on).
- Use the $JSAVE command to save the configuration changes when finished.

# Supplemental Sensors

A pair of tilt sensors and a gyro are integrated in the MV102. The user can turn either the tilt sensors or the gyro on or off. However, the system's performance is optimized with both the tilt sensors and the gyro on.

| Sensor | Purpose | Calibration Procedure |
|---|---|---|
| Gyro aid | Smooth rate of turn:<br>Provides alternate source of heading for up to 3 min when GPS lock is lost<br>Shortens heading reacquisition time | Will self-calibrate after several minutes<br>To manually calibrate:<br>1. After heading is computed<br>2. Send $JATT,GYROAID,YES<br>3. Spin Vector for 1 min at less than 15°/sec<br>4. Leave unit stationary for 4 min<br>**Note:** You do not need to recalibrate with standard use since the gyro selects the calibration. |
| Tilt aid | Smooths rate of heading<br>Reduces startup and reacquisition times for obtaining heading | Precalibrated during manufacture<br>To recalibrate:<br>1. Ensure Vector is level<br>2. Send $JATT,TILTCAL |

| Feature | Normal Operation | Coasting (no GPS) |
|---|---|---|
| Heading | GPS | Gyro |
| Heave | GPS | None |
| Pitch | GPS | Inertial sensor |
| Roll | Inertial sensor | Inertial sensor |

# Common Commands and Messages

**Note:** When selecting your baud rate and message types, use the following calculation to determine your baud rate for your required data throughput.

Messages * Message output rate * Message length (bytes) * bits in byte
Ex: 5 * 20Hz * 40 bytes * 10 = 40,000 bits/sec

For information on message output rates refer to GPS Technical Reference available from the Hemisphere GPS website at www.hemispheregps.com.

**Table 7: Commands**

| Command | Description |
|---|---|
| $JAGE | Specify maximum DGPS (COAST) correction age (6 to 8100 seconds) |
| $JAPP | Query or specify receiver application firmware |
| $JASC | Specify ASCII messages to output to specific ports |
| $JBAUD | Specify RS-232, RS-422 (output) communication rate |
| $JBIN | Specify binary messages to output to specific ports |
| $JDIFF | Query or specify differential correction mode |
| $JGEO | Query or specify SBAS for current location and SBAS satellites |
| $JI | Query unit's serial number and firmware versions |
| $JOFF | Turn off all data messages |
| $JQUERY,GUIDE | Query accuracy suitability for navigation |
| $JRESET | Reset unit's configuration to firmware defaults. **$JRESET clears all parameters.** See the MV102 GPS Compass User Guide for more information. |
| $JSAVE | Save session's configuration changes |

In Table 8 the Info Type value is one of the following: P = Position; V = Velocity, Time; H = Heading, Attitude; S = Sats, Stats, Quality

**Table 8: NMEA 0183 and other messages**

| Message | Info Type | Description | IEC Approved Message |
|---|---|---|---|
| $GPDTM | P | Datum reference | Yes |
| $GPGGA | P | GPS position and fix data | Yes |
| $GPGLL | P | Geographic position - lat/long | Yes |
| $GPGNS | P | GNSS position and fix data | Yes |

**Table 8: NMEA 0183 and other messages (*continued)***

| Message | Info Type | Description | IEC Approved Message |
|---|---|---|---|
| $GPGRS | S | GNSS range residual (RAIM) | Yes |
| $GPGSA | S | GNSS DOP and active satellites | Yes |
| $GPGST | S | GNSS pseudo range error statistics and position accuracy | Yes |
| $GPGSV | S | GNSS satellites in view | Yes |
| *$GPHDG | H | Provides magnetic deviation and variation for calculating magnetic or true heading | Yes |
| *$GPHDM | H | Magnetic heading (based on GPS-derived heading and magnetic declination) | No |
| *$GPHDT | H | GPS-derived true heading | Yes |
| $GPHEV | H | Heave value (in meters) | Yes |
| $GPRMC | P | Recommended minimum specific GNSS data | Yes |
| *$GPROT | H | GPS-derived rate of turn (ROT) | Yes |
| $GPRRE | S | Range residual and estimated position error message | Yes |
| $GPVTG | V | COG and ground speed | Yes |
| $GPZDA | V | Time and date | Yes |
| $PASHR | H | Time, heading, roll, and pitch data in one message | No |
| $PSAT,GBS | S | Satellite fault detection (RAIM) | Yes |
| $PSAT,HPR | H | Proprietary NMEA message that provides heading, pitch, roll, and time in single message | No |
| $PSAT,INTLT | H | Proprietary NMEA message that provides the pitch and roll measurements from the internal inclinometers (in degrees) | Yes |
| $RD1 | S | SBAS diagnostic information | Yes |
| $TSS1 | H | Heading, pitch, roll, and heave message in the commonly used TSS1 message format | No |
| * You can change the message header for the HDG, HDM, HDT, and ROT messages to either GP or HE using the $JATT,NMEAHE command. For more information refer to the Hemisphere GPS Technical Reference available at www.hemispheregps.com. | | | |

**Table 9: Binary messages**

| $JBIN Message | Description |
|---|---|
| 1 | GPS position |
| 2 | GPS DOPs |
| 80 | SBAS |
| 93 | SBAS ephemeris data |
| 94 | Ionosphere and UTC conversion parameters |
| 95 | Satellite ephemeris data |
| 96 | Code and carrier phase |
| 97 | Processor statistics |
| 98 | Satellites and almanac |
| 99 | GPS diagnostics |

**Table 10: Parameters specific to $JATT command**

| Parameter | Description | Query | Specify |
|---|---|---|---|
| COGTAU | Set/query COG time constant (0.0 to 3600.0 s) | X | X |
| CSEP | Query antenna separation | X | |
| EXACT | Enable/disable internal filter reliance on the entered antenna separation | X | X |
| FLIPBRD | Turn the flip feature on/off | X | X |
| GYROAID | Enable/disable gyro | X | X |
| HBIAS | Set/query heading bias (-180.0° to 180.0°) | X | X |
| HELP | Show the available commands for GPS heading operation and status | X | |
| HIGHMP | Set/query the High Multipath setting for use in poor GPS environments | X | X |
| HRTAU | Set/query ROT time constant (0.0 to 3600.0 s) | X | X |
| HTAU | Set/query heading time constant (0.0 to 3600.0 s) | X | X |
| LEVEL | Query or enable/disable level operation | X | X |
| MSEP | Manually set or query antenna separation | X | X |
| NEGTILT | Query or enable/disable negative tilt | X | X |
| NMEAHE | Query for the message headers or change the HDG, HDM, HDT, and ROT message headers between GP and HE | X | X |
| PBIAS | Set/query pitch/roll bias (-15.0° to 15.0°) | X | X |
| PTAU | Set/query pitch time constant (0.0 to 3600.0 s) | X | X |
| ROLL | Query or configure for roll or pitch GPS orientation | X | X |
| SEARCH | Force a new GPS heading search | | X |

**Table 10: Parameters specific to $JATT command (*continued)***

| Parameter | Description | Query | Specify |
|---|---|---|---|
| SPDTAU | Set/query speed time constant (0.0 to 3600.0 s) | X | X |
| SUMMARY | Display a summary of the current Crescent Vector settings | X | |
| TILTAID | Query or enable/disable accelerometer, pre-calibrated | X | X |
| TILTCAL | Calibrate accelerometers | | X |

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