3DM-GQ4-45™

Tactical Grade GNSS-Aided Inertial Navigation System (GNSS/INS)

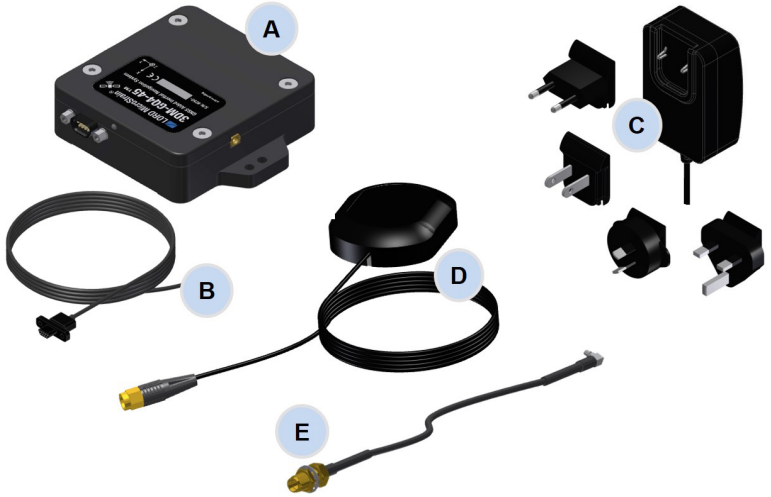
The 3DM-GQ4-45™ is a high-performance, GNSS-Aided Inertial Navigation System (GNSS/INS) that combines micro inertial sensors and a high-sensitivity embedded Global Navigation Satellite System (GNSS) receiver for use in a wide range of tactical grade applications, such as unmanned vehicle navigation, robotic control, platform stabilization, motion tracking and analysis, vehicle health monitoring, and device aiming.

The 3DM-GQ4-45™ utilizes the strengths of integrated multi-axis gyroscopes, accelerometers, and magnetometers in combination with GNSS, temperature, and pressure readings to provide highly accurate position, velocity, attitude (including heading), and inertial measurements.

The 3DM-GQ4-45™ communicates through a serial connection and is monitored by a host computer. A detachable GNSS antenna is plugged into the sensor and positioned with unobstructed line of sight to the sky to obtain satellite links. Sensor measurements and computed outputs can be viewed and recorded with the LORD MicroStrain® MIP™ Monitor software that is provided with system starter kits and also available as a free download from the LORD MicroStrain® website. Alternatively, users can write custom software with the open source data communication protocol. The data is time-aligned and available by either polling or continuous stream.

Figure 1 - 3DM-GQ4-45™ Sensor

The 3DM-GQ4-45™ can be purchased by itself or in a starter kit that includes everything needed to begin using it.



Item	Description	Quantity
A	3DM-GQ4-45™ Inertial Sensor	1
B	Communications cable (USB or RS232)	1
C	Power supply and plug adapters (for RS232 only)	1
D	GNSS antenna with attached cable (3m SMA)	1
E	GNSS antenna cable adapter (non-magnetic MMCX-to-SMA)	1
--	MIP™ Monitor Software Suite	1
--	User Documentation and Calibration Certificate	1

Table 1 - Starter Kit Components List

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The 3DM-GQ4-45™ sensor interfaces include a communications and power input connector and a GNSS antenna port. The sensor is mounted using the mounting and alignment holes as needed.

The indicators on the 3DM-GQ4-45™ include a device status indicator and the device information label. Table 2 - Indicator Behaviors describes the basic status indicator behavior. The device information label includes the sensor frame diagram (axis orientation), which will be critical during device installation.

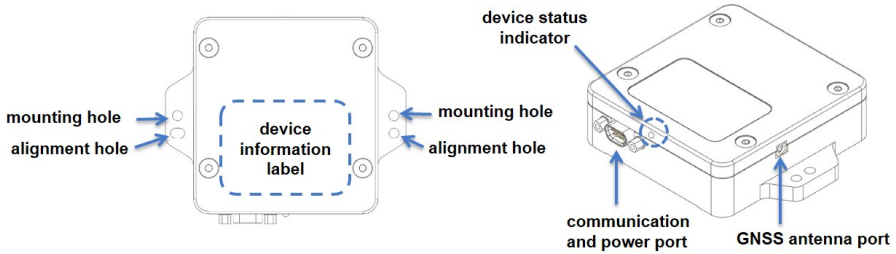

Figure 2 - Interface and Indicators

Indicator	Behavior	Device Status
device status indicator	OFF	no power applied
	rapid flash	streaming data with no GNSS lock
	steady blink	streaming data with GNSS lock
	slow pulse	idle mode, awaiting commands

Table 2 - Indicator Behaviors

QUICK START INSTRUCTIONS

NOTICE Do not put the 3DM-GQ4™ in contact with or in close proximity to magnets. Magnets may disrupt operation and cause magnetization of internal components, which can affect magnetometer performance. If magnetization is suspected, use a degaussing tool to demagnetize.

1. Install Software

NOTE

The MIP™ Monitor Software Suite includes hardware drivers required for 3DM-GQ4™ sensor operation. Sensors will not be recognized without these drivers installed.

The MIP™ Monitor Software Suite is included in the sensor starter kit and is available on the LORD MicroStrain® website.

1. Launch the software installation menu, and select and install each program one at a time. Follow the on-screen prompts to completion and reboot the computer when completed.

Figure 3 - Software Installation Menu

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2. Make System Connections

⚠CAUTION Power is applied to the sensor either through a host computer USB port or an external power supply, such as the one provided in the RS232 starter kit. Use only power supplies within the operating range of the sensor, or damage or injury could result. Once power is applied the sensor is on and active.

To acquire sensor data the following components are needed: 3DM-GQ4-45™ sensor, communication cable, power cable (as applicable for RS232 communications), GNSS antenna, GNSS antenna adapter cable, and a host computer with LORD MicroStrain® MIP™ Monitor installed.

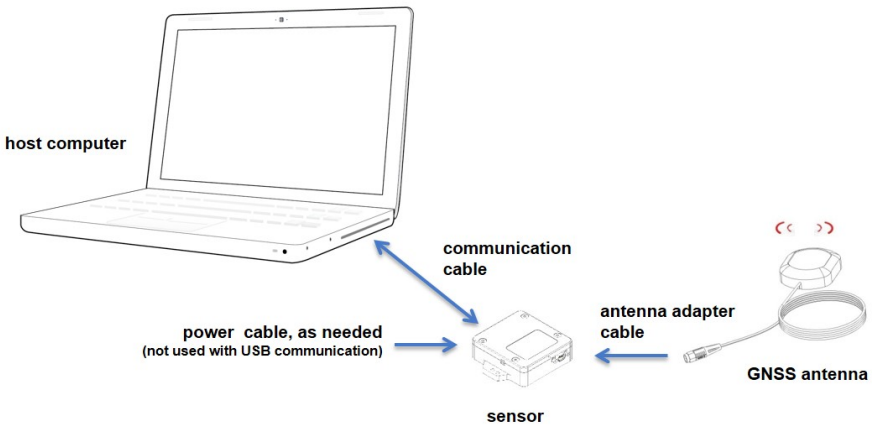

Figure 4 - System Connections

3. Start Software

The MIP™ Monitor software includes a main window with system information and menus, a device settings window, and several data monitoring windows.

The main window provides an overview of connected devices. Devices are selected by clicking on them. A device menu is available by right-clicking on the device name. The header row menu includes selections for data sampling, device settings, and advanced features such as selecting the communications mode. The icon toolbar includes buttons for Help Menu access, device refresh, and data sampling and recording.

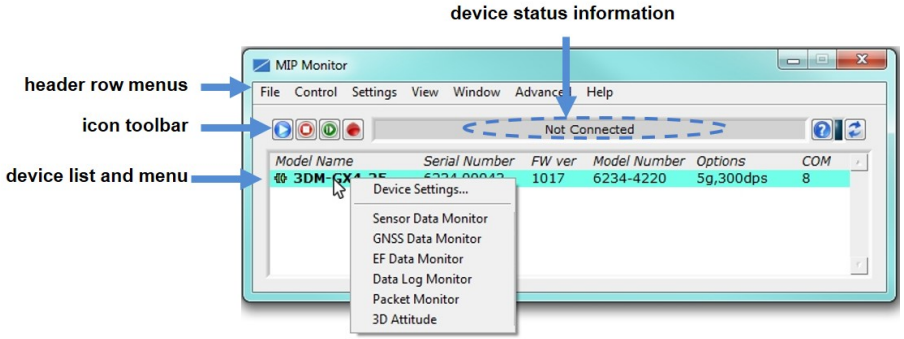

Figure 5 - Main Window

MIP™ Monitor also includes a mouse-over feature that provides explanations of the information and settings. This feature is enabled by selecting the question mark icon or Help button in any window.

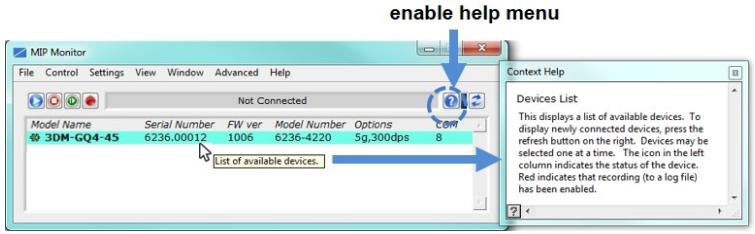

Figure 6 - Context Sensitive Help Menu

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4. Establish Sensor Communication

Once power has been applied to the sensor, it is on. The sensor selects the appropriate serial communication (USB or RS232) on power-up based on which cable is connected. If the hardware drivers have been installed, communication can be established using the MIP™ Monitor software interface. GNSS lock is not required to establish sensor communication.

1. Verify the sensor device status indicator is on.
2. The sensor should appear in the device list automatically when the software is running. The list includes the device information and communication port assignment . If the sensor is not automatically discovered, use the refresh button.

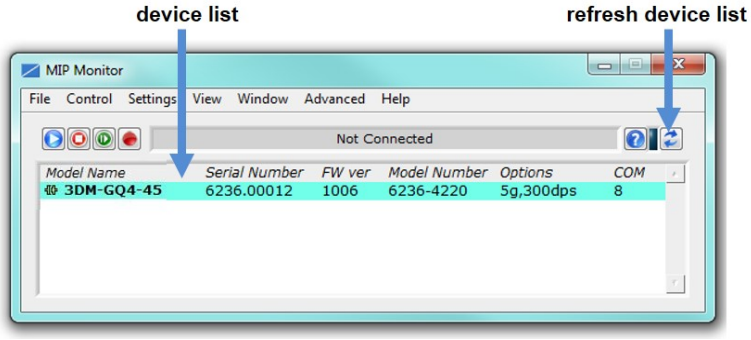

Figure 7 - Sensor Communication

NOTE

If data is not actively being exchanged between the sensor and host computer, the status message may display Not Connected. This indicates the port status, not the sensor availability. When commands are sent to the sensor, the software will automatically connect to it before sending the message.

5. Connect to GNSS Satellites

NOTE

The GNSS antenna requires unobstructed line of sight with the sky in order to achieve communication with the GNSS satellites.

Communication between the GNSS receiver and GNSS satellites is initiated when the 3DM-GQ4-45™ is first powered on. The status indicator on the device will blink differently to show if a satellite link has been established. The receiver will continuously search for satellites until a link is established. When the link is established the GNSS Monitor window in the MIP™ Monitor software will display the satellite and link statistics.

Communication with the satellites is required for proper sensor operation, although some measurement outputs will be available without it.

6. Select Sensor Settings

Device settings are stored in the sensor memory. Only the configuration options that are available for the type of sensor being used will be available in the configuration menus.

NOTE

When selecting sensor and estimation outputs to be recorded, communications bandwidth considerations should be taken into account, especially when using RS232 communications. Lower baud rates equate to lower communications bandwidth, which can be consumed quickly by selecting a large number of measurements at high sample rates. Overrunning the communications bandwidth will result in dropped communications packets and lost data.

1. To enter the settings menu, right-click on the sensor name, and select Device Settings:

   a. **Main menu tabs:** The main tabs break up the setting into broad functional groups for the types of measurement available. For the 3DM-GQ4-45™ these include calculated measurements (Estimation Filter), GNSS metrics (GNSS), and direct inertial sensor measurements (IMU/AHRS).

   b. **Message Format (first sub-menu tab):** Under each main menu tab there are additional sub-menu tabs, including the Message Format tab. The Message Format tab allows the user to select the measurement type to be displayed and recorded (b1) and the data rate (rate at which data is sent to the host computer) in samples/second (b2).

   c. **Measurement parameters (other sub-menu tabs):** Available sub-menu tabs besides the Message Format tab depend on the selected main menu tab. These tabs include the configurable settings for each measurement. GNSS

   d. **Scrolling:** used to navigate to additional sub-menus

   e. **Help menu:** Enable the context-sensitive help menu for explanations of specific settings.

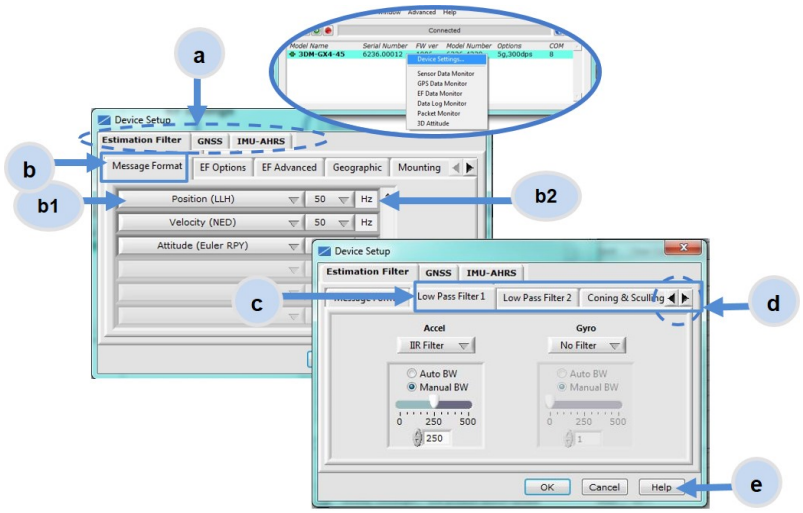

Figure 8 - Device Settings Menu

7. Save Sensor Configuration

Sensor settings are saved temporarily by selecting the OK button in the Device Setup window after configuration, but they are lost when the device is powered off. To save current settings in the device memory for the future, use the Save Current Settings feature.

First adjust the sensor settings to the desired values. Next select Settings > Save Current Settings from the main window. The setting will now remain intact when the sensor is powered off and then on again.

To recall the last saved settings select Settings > Load Startup Settings. To revert the settings back to the factory defaults, select Settings > Load Default Settings.

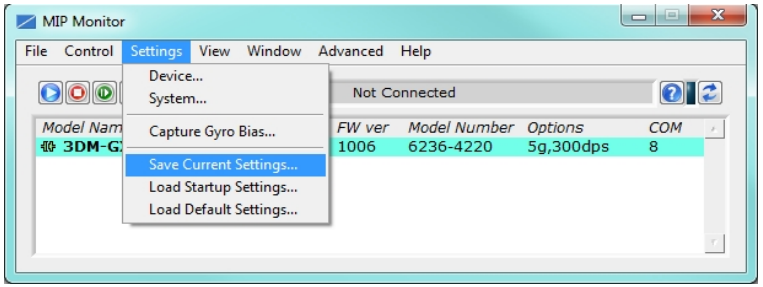

Figure 9 - Save Sensor Settings

8. Start Data Streaming and Recording

> **NOTE**
>
> During viewing and recording, only the outputs that are selected in the Message Format tabs in the Device Setup menu are displayed and recorded.

Throughout the MIP™ Monitor menus the same icons are used to control data streaming (sampling) and recording. These icons can be found in the MIP™ Monitor main window icon toolbar and in each data monitoring window. The same commands are also found in the main window Control menu.

sampling and recording controls (main window)

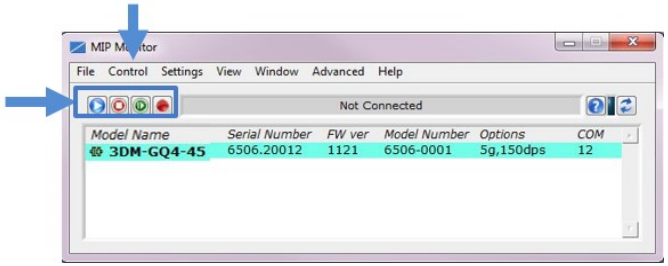

Figure 10 - Main Window Controls

Icon	Command
	Run: start data streaming
	Stop: end data streaming
	Step: sample single set of data
	Record: start and stop data recording

Table 3 - Sampling and Recording Controls

There are several data monitoring views available depending on what measurements are desired for monitoring and recording. Each view corresponds to one of the main categories in the Device Settings window. For example, the 3DM-GQ4-45™ includes Sensor Data Monitoring for the IMU/AHRS measurements, GNSS Monitoring for the GNSS metrics, and EF Monitoring for the Estimation Filter outputs

Data streaming must be started before data can be recorded, however it is not necessary to view it in a data monitoring window. In data monitoring windows, no data will be displayed until data streaming is started, and no data will be recorded (even if it is being viewed) until data recording is initiated (armed). In the example below, the y-axis of the graph indicates data points, the x-axis is the measurement units, and there is a tab for each measurement.

1. Right-click on the device in the main window and select Sensor Data Monitoring.
2. Press the Start Streaming icon to start sampling.

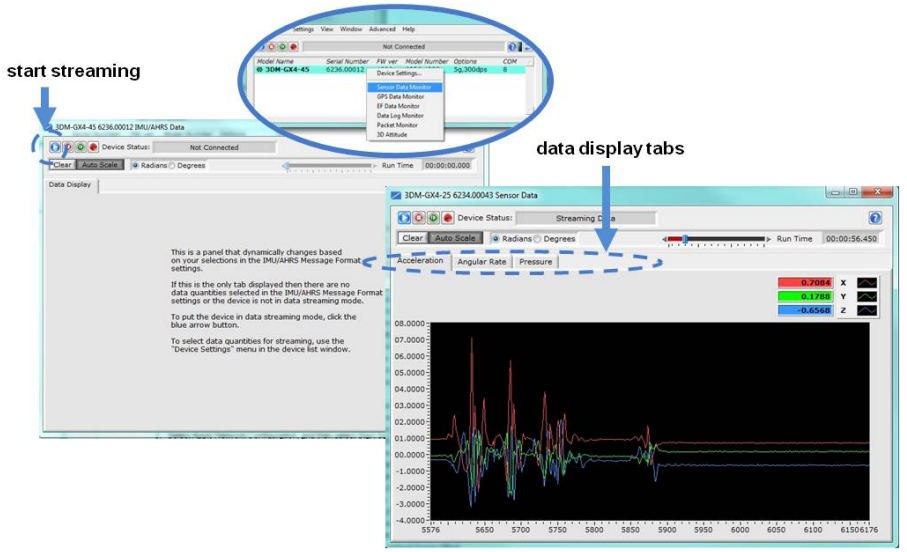

Figure 11 - Data Streaming

NOTE

If the data is recorded in Binary format it will require a translation program that utilizes the LORD MicroStrain® MIP™ Data Communications Protocol to make it user-readable.

3. To record data, select the Arm Recording icon at any time.
4. Select the type of data file to generate: Binary or CSV. The CSV file is the most common and can be viewed and processed by data editors such as Microsoft Excel ®.
5. To end recording, press the Arm Recording button again, and select OK in the confirmation prompt window.
6. Select the Stop Streaming icon to end sampling.
7. Use the red "X" in the upper right of the sensor monitoring window to exit monitoring mode.

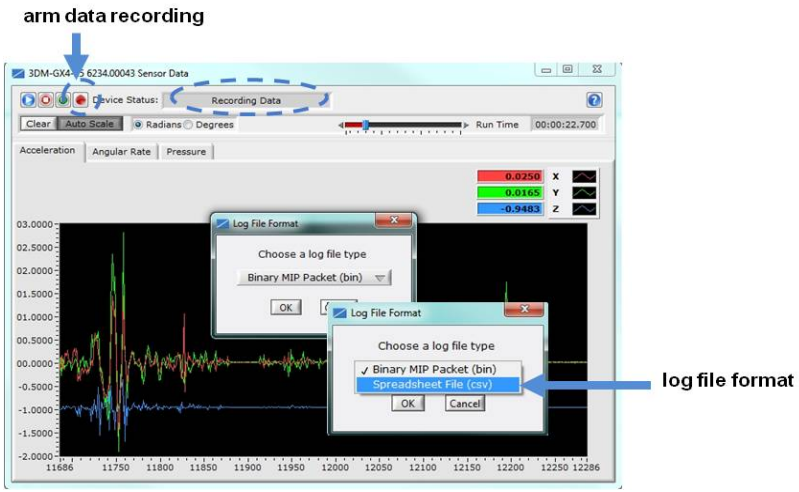

Figure 12 - Data Recording

9. View Data

Acquired data is stored in either Binary (.bin) or Comma Separated Values (.CSV) format, depending on what was selected at the initiation of data recording. The files can be found in the directory specified at that time or in the default directory on the host computer desktop.

CSV files can be viewed with Microsoft Excel, Quattro Pro, Open Office, or other CSV editors and spreadsheet programs.

Data recorded in Binary format requires a translation program utilizing the LORD MicroStrain® MIP™ Data Communications Protocol to make it user-readable.

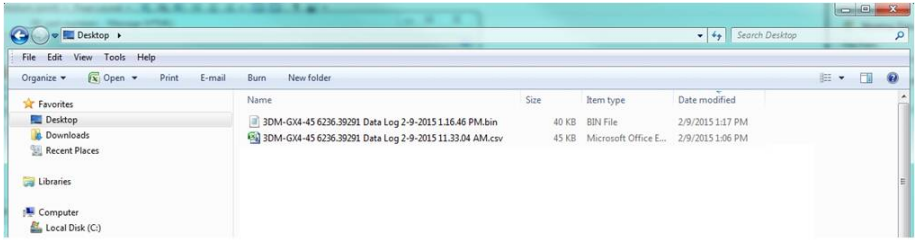

Figure 13 - Exploring Data

NOTE

Data in the data files is displayed in time sequence. If measurements are set to different data rates, not all time intervals will include a reading from each output that is being recorded.

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