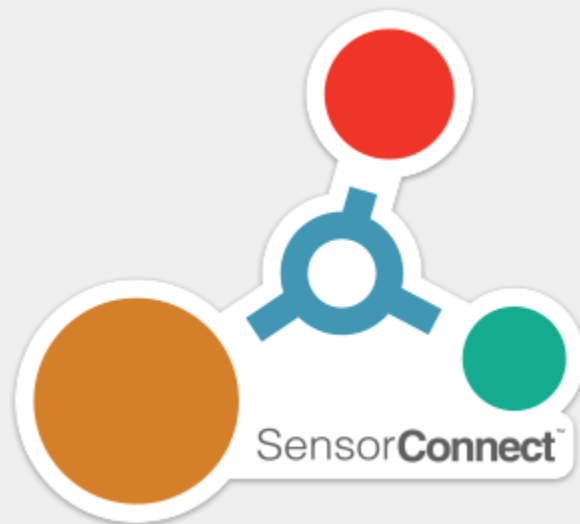


LORD Sensing USER MANUAL

SensorConnect for MIP Monitor Users

version 12.3.0



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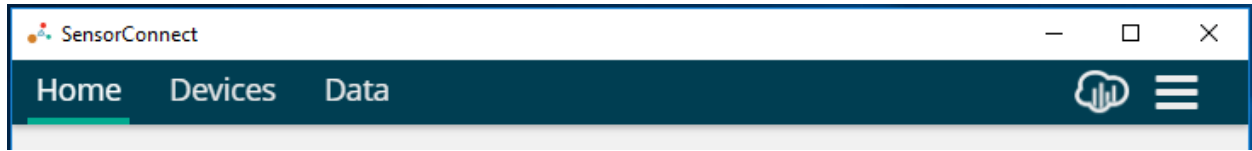
Introduction - Supported Devices

SensorConnect provides a convenient easy to use graphic user interface for connection to the Lord MicroStrain Inertial Protocol (MIP) products listed below. All currently available wireless nodes and gateways are also supported.

Product	Standard Model Number	Minimum NAV Firmware Version
3DM-GX5-10	6255-4250	1.1.69
3DM-GX5-15	6254-4220	1.1.69
3DM-GX5-25	6253-4220	1.1.69
3DM-GX5-35	6252-4220	1.1.68
3DM-GX5-45	6251-4220	1.1.68
3DM-CX5-10	6275-4210	1.1.69
3DM-CX5-15	6274-4260	1.1.69
3DM-CX5-25	6273-4260	1.1.69
3DM-CX5-45	6271-4260	1.1.68
3DM-CV5-10	6259-4210	1.1.69
3DM-CV5-15	6258-4260	1.1.69
3DM-CV5-25	6257-4260	1.1.69
3DM-GQ4-45	6250-4220	1.1.00
3DM-RQ1-45	6239-4270	1.1.00

SensorConnect can connect to and communicate with most MIP devices, but you may experience limited functionality or unexpected behaviors with devices not specified above. MIP Monitor software should be used for a more consistent experience with earlier devices, such as the GX3 and GX4 series.

Basic Navigation



Main Navigation Bar

The main navigation bar is always visible and allows you to quickly jump to the three main areas of the application:

- [Home](#): select and manage data repositories
- [Devices](#): manage and configure sensors
- [Data](#): view sensor data

Additional options available on the main navigation bar:

- [SensorCloud](#): log in to your SensorCloud account to access cloud data devices
- [General Info](#): view information about your current SensorConnect installation (version, license info, etc.)

Data Management

If SensorConnect is running and your device is connected, all data streamed from that device is recorded.

Data Repositories ?					
Active	Data Repo	Created	Last Used		
<input checked="" type="checkbox"/>	Default Data Repository	2019/06/26 10:36:11 AM	2019/06/26 10:36:11 AM		

Data Repositories

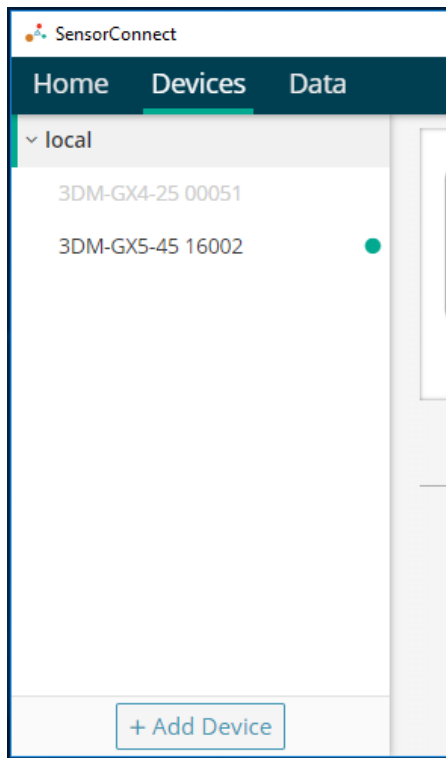
A data repository is a directory where data is stored. From the Home tab, you can create new, delete existing, or import repositories. This is also where you select which repository is active. All new data is saved to the active repository.

Creating and utilizing multiple repositories allows you to separate your data logically so it is easier to find and manage later.

Connecting Devices

Connected devices are viewed on the Devices tab down the left-hand side of the screen.

In MIP Monitor, MIP devices are automatically recognized and added on refresh. SensorConnect handles connections differently based on connection type.



USB Connections

Devices connected through USB are found automatically and added to the device list.

Serial Port Connections

Devices connected via serial port need to be manually added with the Add Device button at the bottom of the device list.

Devices connected using a serial-to-USB adaptor also need to be added manually.

Status Indicators

Greyed out sensor names indicate that device is not currently connected.

A **blue dot** next to the sensor name indicates that device is currently streaming data.

Disconnect a Device

When you select a device in the list, the device info sidebar and options are displayed.

The Disconnect button is at the bottom of the info sidebar – clicking it releases the port for communication with other applications, and the Disconnect button is replaced with a Reconnect button. If you disconnect the device, SensorConnect cannot communicate with it again until you click Reconnect.

Device Options

On the Devices tab, clicking on a sensor in the devices list displays additional information as well as available options for the selected sensor.

The screenshot shows the 'Options' page for a 3DM-GX5-45 16002 sensor. The interface is divided into several sections:

- Navigation:** Home, Devices (selected), Data
- Device List:** Base Station 21263, Base Station 00001, Base Station 54392, 3DM-GX5-45 16002 (selected), 3DM-GX4-45 54564
- Device Information:**
 - Model: 3DM-GX5-45 6251-7720
 - Serial: 6251.16002
 - Firmware: 1.1.58
 - Options: 20g,900dps
 - Connection: Serial, COM9, 115200
 - Last Communication: 23 hours ago
 - Last Known State: Sampling
- Control:** Sampling, Set To Idle, Resume
- Setup:** Configure, Initialize/Reset Estimation Filter, UART Baud Rate (115200), Save/Load Settings
- Advanced:** Calibration Report, Monitor Bytes
- Buttons:** + Add Device, Disconnect

- [Sampling](#): configure message format and start streaming
- [Set to Idle](#): set device to idle mode (stop streaming or wake from sleep mode)
- [Resume](#): reverts device to mode prior to Set to Idle
- [Configure](#): change device settings
- [Initialize/Reset Estimation Filter](#): initialize or reset the estimation filter
- [UART Baud Rate](#): change the device baud rate
- [Save/Load Settings](#): save or load startup and default settings, or export/import device settings to/from a file
- [Calibration Report](#): opens the calibration report in your default browser (if available)
- [Monitor Bytes](#): view raw bytes of communication packets to and from the device, setup streaming bytes to a .bin file

Streaming Data

The Message Format setting for each data set is found by clicking Sampling in Device Options on the Devices tab of SensorConnect.

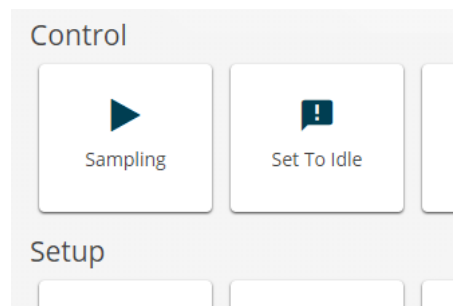
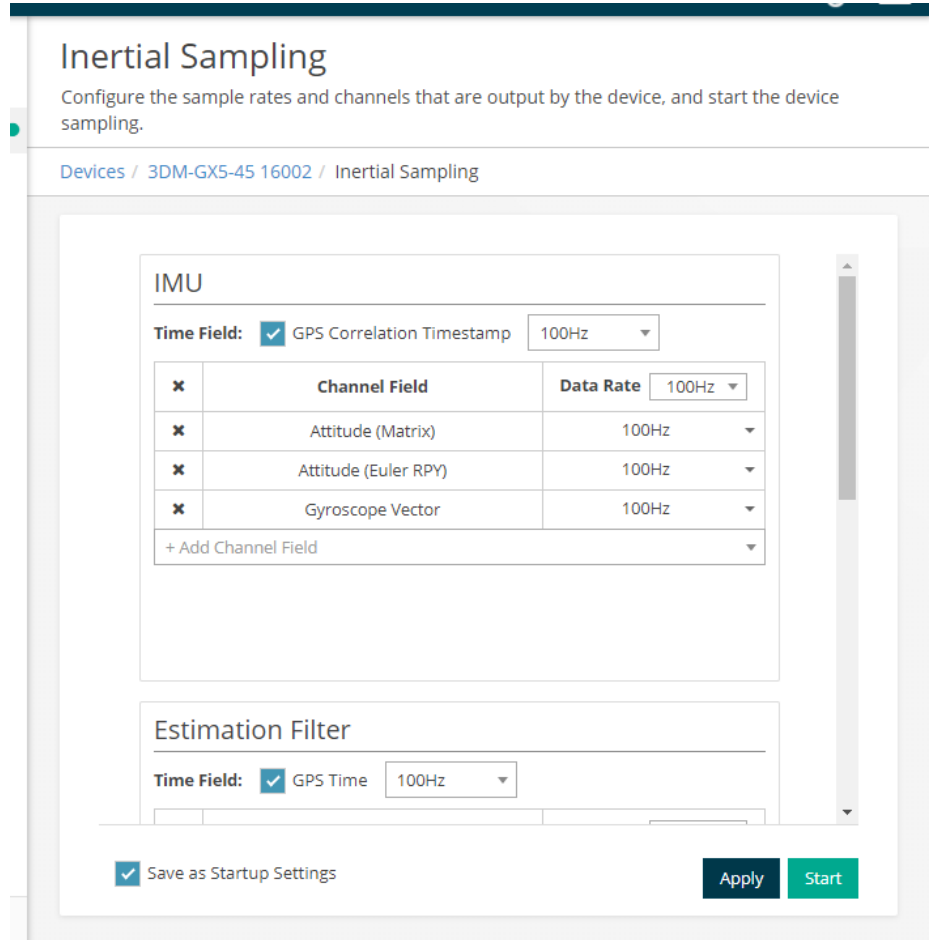
Message Format

Each supported data set has a section to select which descriptors (Channel Fields) should be output by the device and at what sample rate. Streaming the GPS time for each data set will result in better timestamping.

Start Streaming

Both Apply and Start will configure the message format on the device. Select 'Save as Startup Settings' to save the specified format as startup settings.

To enable streaming, click Start.



Stop Streaming

To stop streaming, click Set To Idle under Control on the main Device Options screen.

Recording Data

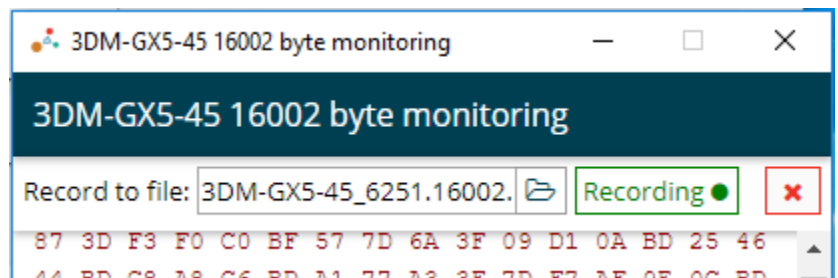
SensorConnect records all data to the active data repository (see [Data Management](#)) – if the device is connected and streaming, that data is saved and can be accessed again later through SensorConnect.

There are currently two options for outputting data to standard file formats:

- Log streaming data to a [binary file](#)
- Export recorded data to [CSV](#)

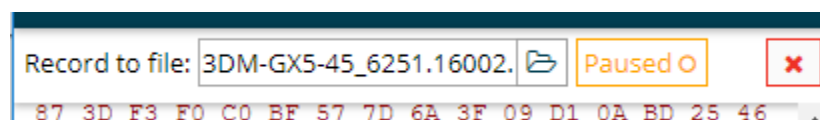
Log data to binary file

At the top of the Byte Monitoring window (Monitor Bytes from the main Device Options screen – see [Viewing Data](#)) there is a ‘Record to file’ field. Click the folder button to browse to the desired directory and name your .bin file. The target file name appears in the ‘Record to file’ field and a Recording indicator displays.



As long as the Byte Monitoring window is open and the Recording indicator is on, the raw bytes output from the device will be written to the target file.

To pause recording, click the Recording indicator button – it turns yellow and indicates it is paused. To resume, click the Recording indicator button again.

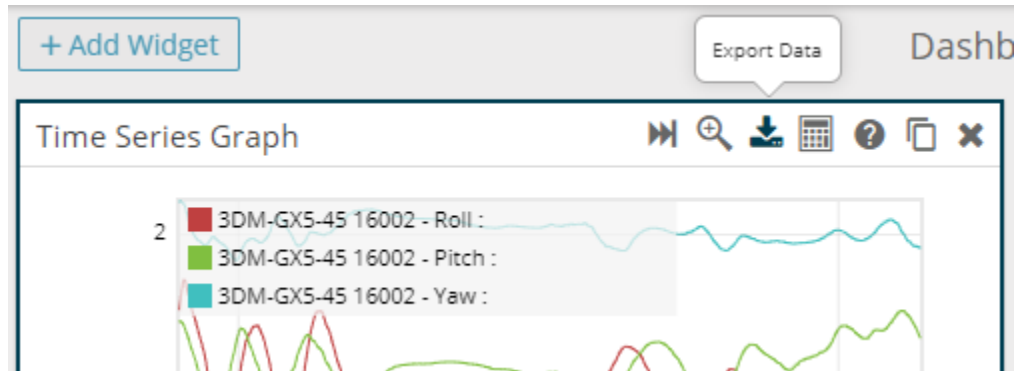


Start a new file at any time by clicking the folder button and choosing a new file name. To stop recording and close the file, click the red X button to the right of the Recording indicator.

Recording Data (continued)

Export data to CSV

Previously recorded data can be exported to CSV from Dashboard widgets on SensorConnect's Data tab (see [Viewing Data](#) for additional details).



From a Time Series Graph widget, select the channels you want to include in the CSV. Zoom in to the time range you wish to export and click the Export Data button in the widget title bar.

From a Matrix Display widget, select a matrix or quaternion channel that you want to export and click the Export Data button in the widget title bar. Only the selected channel is included in the CSV file.

In the CSV Export dialog, you may edit the selected time range, and specify what date format you prefer. When Export is clicked, choose the desired directory and name for the CSV file, then click Save.

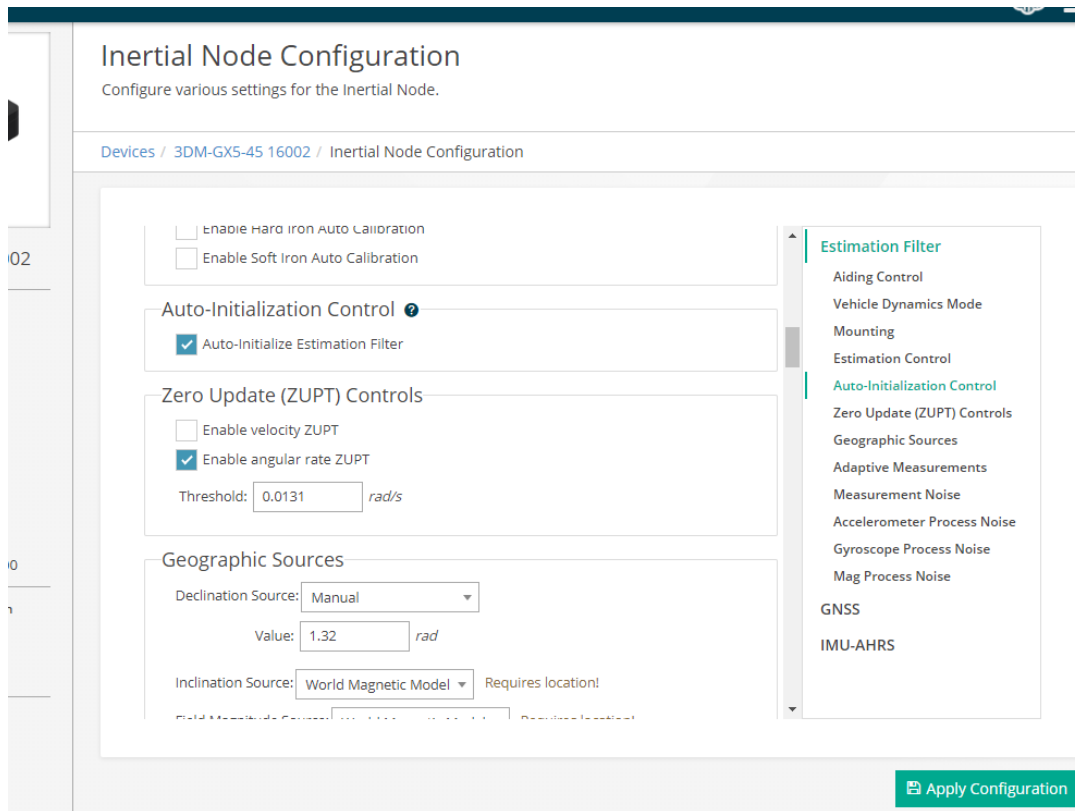
Device Settings

The Device Settings can be accessed by choosing a sensor on the Devices tab and selecting Configure, under Setup, in the Options menu.

Message Format Configuration

The Message Format settings are not included in the Configure section, they are available in the Sampling section (see [Streaming Data](#)).

Configuration



The rest of the device-supported settings found in MIP Monitor's Device Settings dialog can be found on the Configure screen. Use the navigation panel on the right side of the screen to jump to a specific setting or command set.

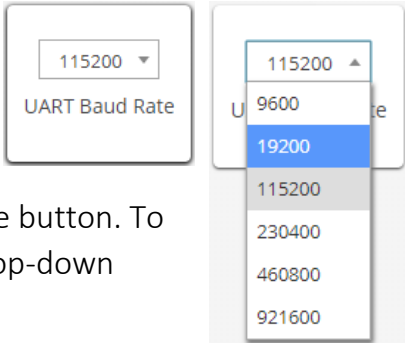
On load, the screen displays the settings values as they are currently configured on the device. To send changes to the device, click the Apply Configuration button.

The configuration can be exported to a file or saved as device startup settings on the Save/Load Settings screen (see [Save and Load Settings](#)).

Device Settings (continued)

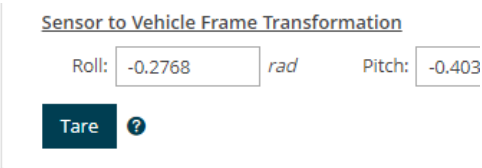
UART Baud Rate

The device and connection baud rate can be configured directly from the main Device Options menu. In MIP Monitor this setting is found on the System Settings dialog from the Settings menu. The currently configured UART Baud Rate is displayed in the drop-down menu on the button. To change the baud rate, select the desired value from the drop-down menu and then click Apply on the confirmation dialog.



- [Capture Gyro Bias](#)
- [Tare Mounting Orientation](#)
- [Capture Auto Mag Cal](#)

The automatic calibration commands can be found on the Configure screen adjacent to the setting or settings that are affected when the command is run. When one of these commands is run, the affected settings values are updated to display the results. Unlike making manual changes to these fields, the calibration command buttons apply the affected values to the device automatically, without clicking the Apply Configuration button.



<i>Command</i>	<i>Section</i>	<i>Affected Values</i>
Tare Orientation	Estimation Filter / Mounting	Sensor to Vehicle Frame Transformation
Capture Gyro Bias	IMU-AHRS / Accelerometer/Gyro Bias	Gyroscope Bias
Capture Auto Mag Calibration	IMU-AHRS / Iron Calibration	Hard Iron Offset Soft Iron Matrix

The prerequisite settings as well as recommendations for best results can be found by clicking the tooltip icon next to each of the command buttons.

Initialize and Reset Estimation Filter

The Estimation Filter can be initialized or reset on the Initialize/Reset Estimation Filter screen, accessible from the Device Options menu under Setup. Entering this screen sets the device to idle.

The screenshot shows the 'Initialize/Reset Estimation Filter' screen for device '3DM-CV5-25 69048'. It is divided into two main sections: 'Configuration' and 'Current State Info'.
Configuration:

- Auto-Initialization Control:** A checkbox for 'Auto-Initialize Estimation Filter' is checked.
- Aiding Control:**
 - Heading:** Radio buttons for 'None' (checked), 'Use Magnetometer', and 'Use External Heading Messages'.
 - Pitch/Roll:** A checkbox for 'Gravity Vector Aiding' is checked.

Current State Info:

- Filter Status:** Status is 'Initialization'. Status Flags: 'Attitude Not Initialized'. A 'Reset' button is present.
- Estimated Values:** A table showing current values:

	Heading/Yaw	Pitch	Roll
Attitude:	0.000000	-0.000000	0.000000
	rad	rad	rad
- Set Initial Attitude/Heading:** Input fields for Heading/Yaw (rad) (1.52), Pitch (rad) (0), and Roll (rad) (0). A checkbox for 'Use accelerometers to determine initial pitch and roll' is checked. An 'Apply Initial Values' button is present.

An 'Apply Configuration' button is located at the bottom center of the configuration section.

Configuration

A few settings from the Estimation Filter command set are available from this screen because they directly impact filter initialization. These settings are also available from the Configure screen. Like on the Configure screen, changes are not sent to the device until the Apply Configuration button is clicked.

Current State

While on this screen, the filter status and estimated attitude and position (when relevant) are constantly polled to help determine why the filter is not initialized and, once initialized, whether the attitude and position values are being output correctly.

This close-up shows the 'Filter Status' and 'Estimated Values' sections.
Filter Status: Status is 'Running - Solution Valid'. A 'Reset' button is present.
Estimated Values: A table showing current values:

	Heading/Yaw	Pitch	Roll
Attitude:	1.521208	0.000130	-0.004818
	rad	rad	rad

Initialize and Reset Estimation Filter (continued)

Reset

To reset the filter, click the Reset button in the Filter Status section.

Initialize

To initialize the filter heading, enter the initial attitude value into the Set Initial Attitude/Heading section and click Apply Initial Values.

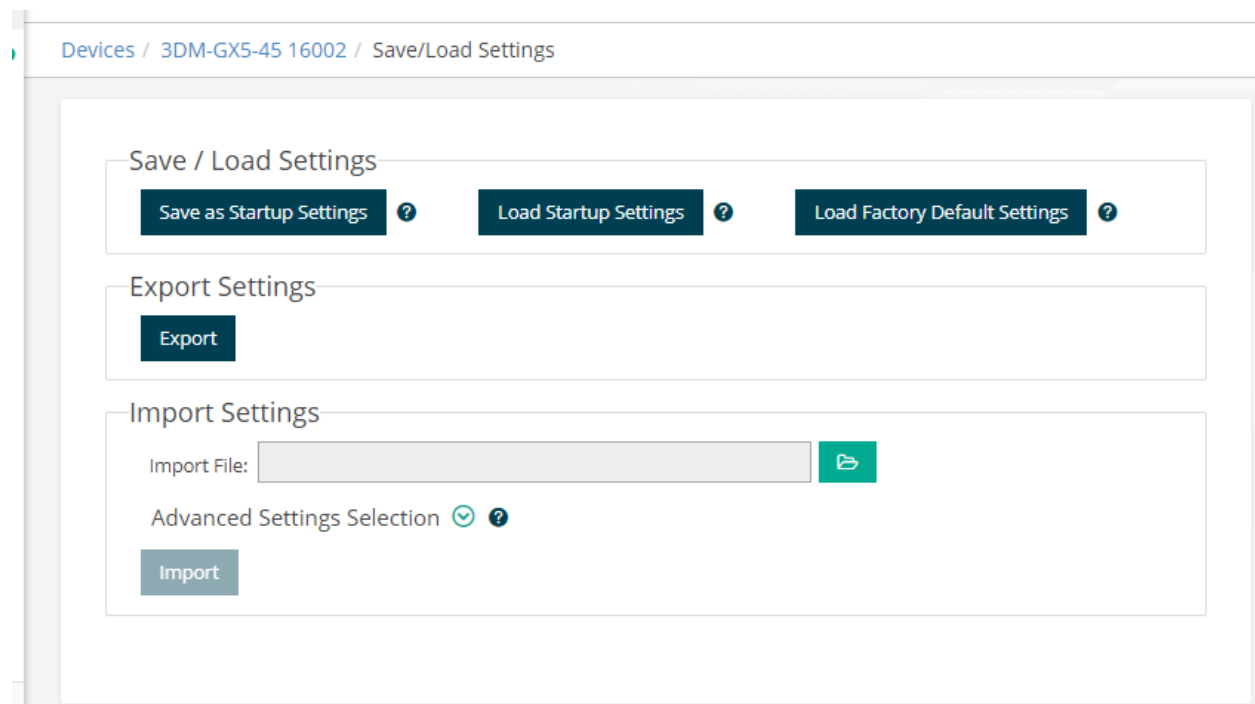
Set Initial Attitude/Heading ?

Heading/Yaw (rad)	Pitch (rad)	Roll (rad)
<input type="text" value="-2.3"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Use accelerometers to determine initial pitch and roll

If you want to only specify heading and automatically determine initial pitch and roll, check the 'Use accelerometers...' option before clicking Apply.

Save and Load Settings



Load Default Settings

To apply the factory default settings to the device, click the 'Load Factory Default Settings'. The device's current settings will be lost unless you save them as startup settings or export them to a file.

Save or Load Startup Settings

The 'Save as Startup Settings' button sets the device's startup configuration to the currently set values. The current startup settings will be overwritten.

The 'Load Startup Settings' button reverts any configuration changes made since startup (or the most recent save as startup). The device's current settings will be lost unless you export them to a file.

Export Settings to File

To save the current device settings to a file that can later be applied to this or another MIP device, click the Export button. Settings files generated by SensorConnect are .json files and are not compatible with MIP Monitor.

Save and Load Settings (continued)

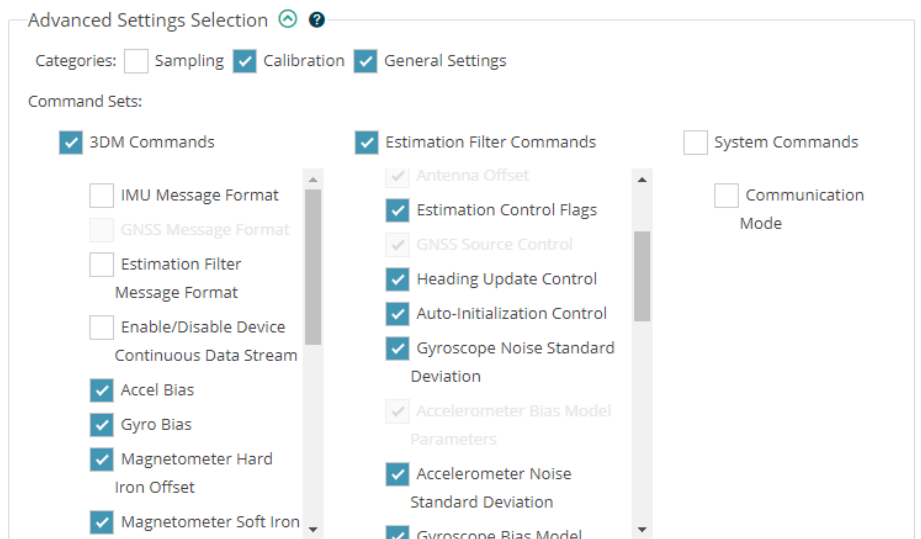


Load Settings from File

SensorConnect cannot read MIP Monitor .ini settings files. To convert these files, load them onto a device using MIP Monitor, then re-export the settings with SensorConnect.

To load settings from a file, select a file in the Import Settings section. Details about the selected file, including the model of the device the settings were exported from, are read from the file and displayed. You can load configurations across models, but only device-supported settings will be applied.

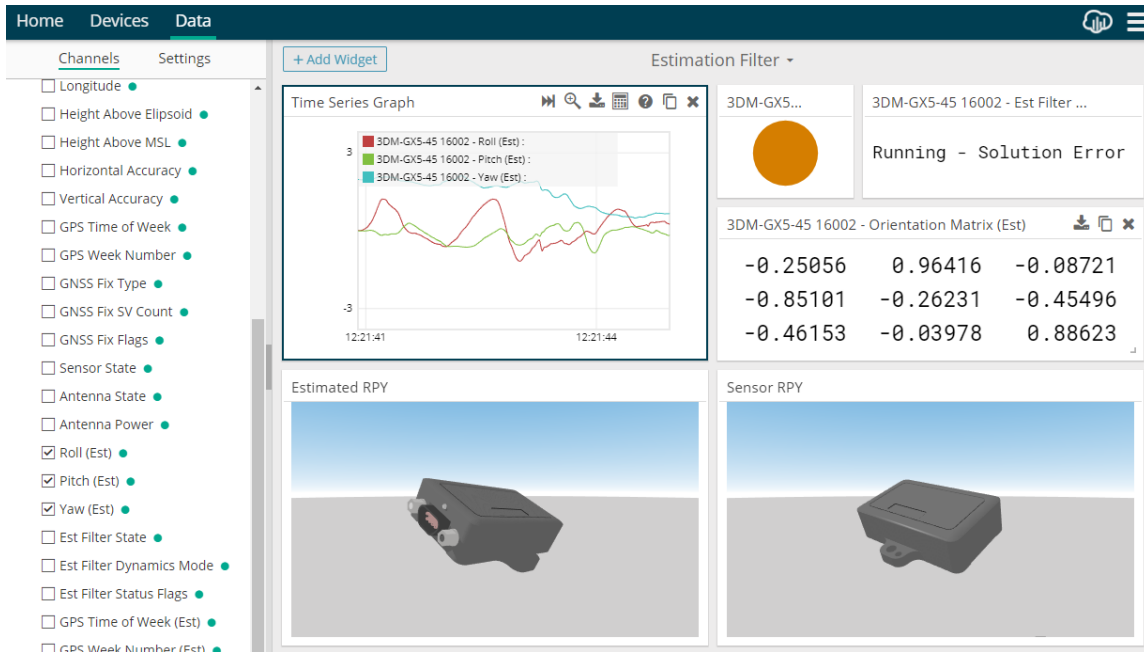
If you click on the Advanced Settings Selection drop-down, all of the device's supported settings are displayed. Only checked settings will be applied when loading from the selected file. Selecting or deselecting a category or command set applies that action to all the settings within that group. If a setting is not present in the selected file, it will be greyed out.



Click Import to load all the selected settings from the chosen file to the device.

Viewing Data

While MIP Monitor has static views for each data set, SensorConnect allows you to create custom dashboards to visualize your data. All data that is being streamed is collected and stored by SensorConnect. The dashboard allows you to view past and live data, perform custom analysis, take notes, etc.

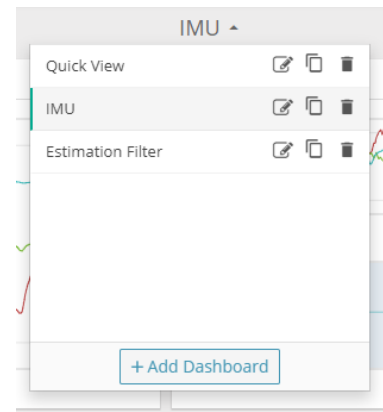


Dashboards and Widgets

Dashboards are created and managed on the Data tab and contain widgets, which are configurable data visualizers. Widget options include, but are not limited to, time series graphs, numeric and text displays, gauges, etc.

When you add a widget to a dashboard and select it, the configuration panel on the left of the screen displays all the channels that can be added to the widget, as well as the different settings options that can be applied on the Settings tab. Channels that are currently streaming data are indicated by a blue dot.

Data from across different data sets or different devices can be displayed on the same dashboard, or, in some cases, within the same widget. Multiple dashboards can be created to quickly switch between different views by clicking the dashboard title at the top of the screen.

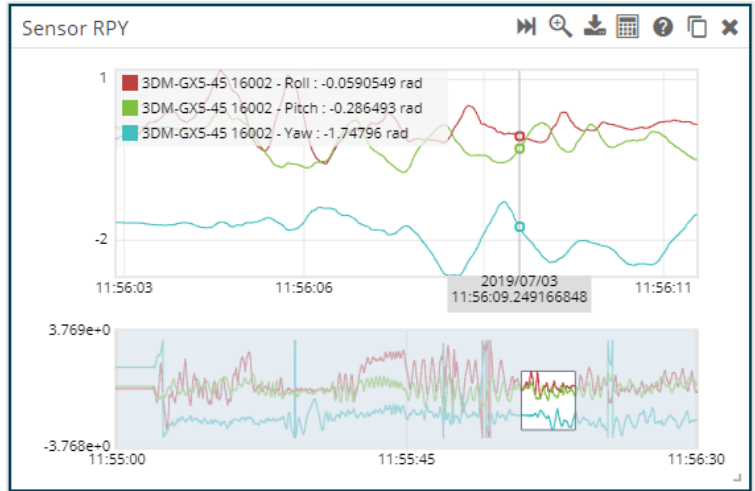


Viewing Data (continued)

Time Series Widget

Most of the dashboard widgets display the latest data value as it is streaming, but the Time Series graph widget allows you to view and analyze both incoming data, and all past data in the active repository for the selected channels.

This widget displays and navigates through very large data sets almost instantly, making it easy to both view trends over the entire data set and zoom in to analyze a handful of data points at a specific event. It also provides access to export data to CSV

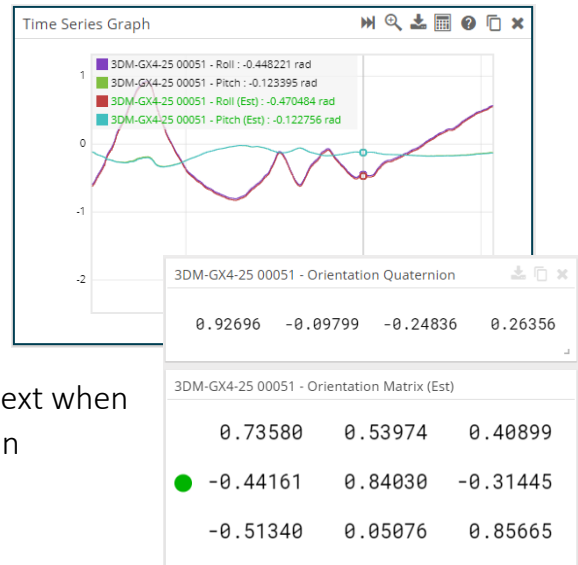


(see [Recording Data](#)) and MathEngine data analysis tools to automatically calculate FFTs or descriptive stats that represent the selected time range.

Data Validity

Some data fields include information about the validity of the data. In MIP Monitor invalid values are indicated by highlighting the field red. In SensorConnect validity is shown in the below-listed widgets with a validity indicator dot (green – valid, red – invalid). When there is no valid flag in the data field, the indicator will not be displayed.

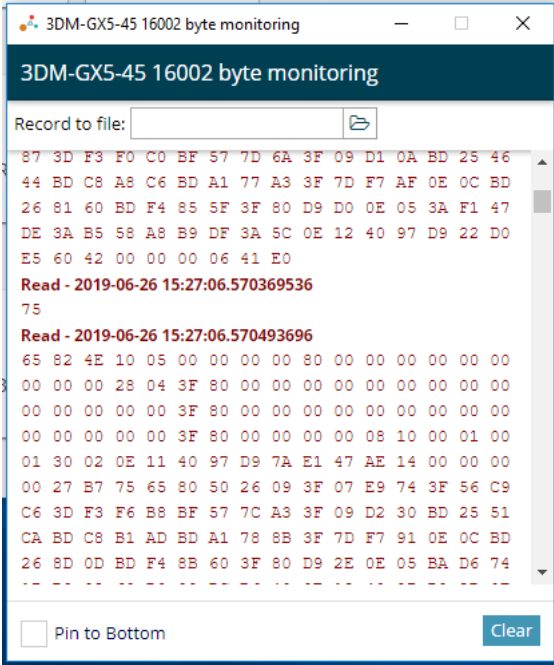
- Numeric Display
- Matrix Display
- Text Chart
- Time Series Graph
 - o Validity is indicated by red/green legend text when hovering over a specific value instead of an indicator dot



Viewing Data (continued)

Packet Monitor

To monitor the bytes from the packets being written to and read from the device, click on Monitor Bytes in the main Device Options under Advanced. This launches a separate



window that can remain open as you use SensorConnect or stream data.

Text from this window can be highlighted and copied out – the Read/Write labels and time stamps are removed from the text on copy. To view or select past data, uncheck 'Pin to Bottom' at the bottom of the window to enable scrolling.

This window is also used to record the bytes read from the device to a binary file. Simply select a file location and give it a name in the 'Record to File' field at the top of the window. See [Recording Data](#) for more details.

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