MOTION SENSOR SOFTWARE DEVELOPMENT KIT FOR LABVIEW™

USER’S GUIDE
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Intended Use

The LabVIEW™ software development kit is intended to provide a basic framework to collect acceleration and angular velocity data using Great Lakes NeuroTechnologies movement sensors and allow for the development of customized LabVIEW software for these sensors.

System Requirements

- PC with a Windows-based Operating System
- Bluetooth (v2.0 or greater) adapter
- Microsoft .NET 4.0 installation (available from http://www.microsoft.com)
- LabVIEW version 8.6 or greater

System Recommendations

- Microsoft PC with Windows 7
- 2 GB RAM
- 1024x768 or greater display resolution
- 1 GB or more available Hard Disk space
- Microsoft compatible keyboard and mouse or other pointing device
- Adobe Reader or Adobe Acrobat

Note: Macintosh and Linux operating systems are not supported.
Chapter 1: About This Software

The following document describes three LabVIEW programs and related SubVIs, which require a licensed copy of LabVIEW 8.6 or greater.

If you have not already, you can download the application and SDK software here www.glneurotech.com/motion-sensor-software. It is recommended that you look over the Wireless Motion Sensor Guide, which is located at the link provided above, to learn more about your sensor prior to use.

Starting with the GLNT_MotionCapture.exe program will allow you to quickly connect to and understand the function of your sensors. For custom applications we recommend that you use the GLNT_SingleSensor program as the framework for your LabVIEW development. You can use the FindSensorID program to easily obtain the MAC addresses of your sensors, which are needed for the computer to connect to the sensors.

A Word of Caution About LabVIEW Version

If you have version of LabVIEW that is older than 2012 you will need to change the LabVIEW.exe configuration file because the sensors use the .NET 4.0 framework. This is described by National Instruments here:

If you have an existing LabVIEW configuration file (LabVIEW.exe.config.) you will need to add the following text to allow it to run with the .NET 4.0 framework.

```xml
<?xml version ="1.0"?>
<configuration>
  <startup useLegacyV2RuntimeActivationPolicy="true">
    <supportedRuntime version="v4.0.30319"/>
  </startup>
</configuration>
OR
You can use the file that we included. Copy this file into your LabVIEW folder as shown in the following image.

[Image of LabVIEW folder contents]

This file is included with the SDK. Use it to allow older versions of LabVIEW to work with the .NET 4.0 framework.
Chapter 2: Identifying Your Sensor Using FindSensorID.vi

This program will assist you in identifying your sensors for connection. You will need to run this program to get the sensor’s MAC address to add to the GLNT_SingleSensor program. This FindSensorID program is embedded into the GLNT_MultiSensors program to help facilitation changing between different numbers of sensors. To use the FindSensorID program use the following steps. Your sensor ID is located on the sensor label.

1) First check that your sensor/sensors are on (blinking)
   a. If they are not, return them to the charge pad to awaken them and then remove them from the charge pad again.
2) Start the program and wait for the ‘Search Complete’ LED to turn on.

3) Select your sensors (between one and four sensors). If you sensor does not appear, select “Done” to stop the program, check that your sensor is on, and restart. Be careful not to select the same sensor twice, this will result in an error message when you try to connect.
4) Once you have selected your sensors, select ‘Done’. The sensor MAC addresses will be located in the text boxes below. The IDs that will appear correspond to the last four SN numbers on your sensor as shown in the figure at the bottom of this page.

5) A file with your sensor addresses will be placed in the ‘Sensors’ folder in the directory of the **FindSensorID.VI** in a file named ‘SensorID.txt’

This file will be used directly by the **GLNT_MultiSensors** program. However, if you plan on doing independent development from the **GLNT_SingleSensor** application you will need to use the MAC addresses that appear in the windows below and are also in the SensorID file. Additionally, another file ‘SensorName’ will be created with the four digit IDs of your sensors. This ID can also be found on the sensor as shown in the figure below.
**Chapter 3: Connecting to a Single Sensor with GLNT_SingleSensor.vi**

This program is a good place to start if you will be designing your own custom application in LabVIEW. **You will need to enter your sensor’s MAC address prior to starting the program.**

1) Check that your sensor/sensors are on (blinking)
   a. If they are not, return them to the charge pad to awaken them and then remove them from the charge pad again.

2) Start the program and wait for the ‘Sensors Ready’ LED to turn on.

3) Check your settings for your data collection application. When the LED is illuminated and the start button is flashing click ‘start’ to begin data collection.
4) Data will start to be collected from the sensors after you press ‘START’. Hitting ‘STOP’ will stop data collection and disconnect from the sensor.

If you are not using “Manual Stop” the program will automatically stop when the elapsed time is equal to the collection time or you can stop the program by pressing ‘Stop’. You will need to press the ‘Stop’ button if the ‘Manual Stop’ option is on.

5) If the Save Data option is on the program will bring up a menu to select the save name and location as shown. It is recommended that you save your data as a txt or dat file.

Select ‘OK’ to save your data
Chapter 4: Connecting to Multiple Sensors with GLNT_MultiSensors.vi

This program is more complex and will allow you to obtain data from one to four sensors. The program will also ask if you want to identify the sensors when you first start the program. This program should act as a good framework for development using multiple sensors in LabVIEW. Please note that due to general Bluetooth limitations, you can only stream data from up to seven Bluetooth devices at one time.

1) First check that your sensor/sensors are on (blinking)
   a. If they are not, return them to the charge pad to awaken them and then remove them from the charge pad again.

2) Open the program. Press the in the upper left to start the GLNT_MultiSensors program. The program will ask if you would like to search for sensors in order to assign them for use by the program. Once you have assigned the sensors once you will not need to complete this step unless you wish to change the number of sensors that you are using or the sensor assignment.

3) If you select no. The program will use the sensors that you have previously selected. If you select yes the following menu will appear.
4) Select your sensors by clicking on the sensor ID, the sensor select buttons and then ‘DONE’. Each sensor can only be selected once.

5) Check your settings for your data collection application.

6) When the LED is illuminated and the start button is flashing click ‘START’ to begin data collection.
7) Data will start to be collected from the sensors after you press ‘START’.
8) If the save data setting is on, after data collection a window will appear for you to choose the location to save the data.

9) The program will then return to the state from step 6. You can choose to record more data or select the ‘EXIT’ button to quit the program.
Chapter 6: Sensor Specific SubVIs

Motion sensor specific LabVIEW VIs were created with the goal of simplicity and each will only work with one sensor at a time. Please look over the GLNT_MultiSensors example to see how to run these blocks in parallel in order to connect to many sensors at a time.

**FindSensorID.vi**

This function is the same as the FindSensorID program, mentioned above, that can be run independently to determine the sensor ID and MAC addresses. This will populate the files that the main program uses to connect to the sensors.

**MAC ID**– In addition to saving the MAC ID and Sensor ID to files, you can also obtain an array of the MAC IDs directly.

**SensorCONNECT.vi**

This function initiates the initial connection to the sensor.

**Sensor MAC Address** – String with the sensors MAC address. This value can be obtained using the FindSensorID application.

**Kinesia Path** – This is the reference to the sensor object, which is needed for sending commands to the connected sensor.

**Is Connected?** – This tells if the sensor has successfully connected. If you are setting up multiple sensors the ‘Is Connected’ output can be very useful when connected to a series of indicator LEDs to help you quickly tell which sensor did not successfully connect. If a sensor did not connect than it is likely that the sensor has turned off.

**Error during initial connection process**- This output will provide details about any connection errors that occur.
**SensorSTART.vi**

This function initiates the data collection process for the sensor.

![Diagram of SensorSTART.vi](image)

**Kinesia Path In** - This is the reference to the sensor object that is obtained from the SensorCONNECT.vi.

**Error during initial connection process** - This input takes the connection errors from the SensorCONNECT VI.

**Kinesia Path Out** - This is the reference to the sensor object that continues the path to the next Kinesia object.

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**SensorLENGTH.vi**

This function determines the minimum amount of data received from each sensor and pulls that from each sensor. This ensures that the data read in SensorREAD.vi is the same length for all sensors. Difference between initiation times for up to four sensors is expected to be insignificant for most applications.

![Diagram of SensorLENGTH.vi](image)

**Kinesia Path In** - This is the reference to the sensor object that is obtained from the SensorSTART.vi.

**Min Data Length** - This output is the minimum data length that can be pulled from the sensor.

**Kinesia Path Out** - This is the reference to the sensor object that continues the path to the next Kinesia object.
**SensorREAD.vi**

This function reads the amount data obtained from the SensorLENGTH.vi. This outputs the data from the sensor.

**Kinesia Path In** - This is the reference to the sensor object that is obtained from the SensorSTART.vi.

**Min Data Length** - This input is the minimum data length that can be pulled from the sensor, which is obtained from the SensorLENGTH.vi.

**Data** - Is the data array from the sensor. The data will be ordered ax, ay, az, ωx, ωy, ωz.

**SensorSTOP.vi**

This function stops the data acquisition.

**Kinesia Path In** - This is the reference to the sensor.

**Kinesia Path Out** - This is the reference to the sensor object that continues the path to the next Kinesia object.

**SensorDISCONNECT.vi**

This function disconnects the sensor.

**Kinesia Path In** - This is the reference to the sensor.
Chapter 7: Other SubVIs

The example code also includes a few VIs, which are not needed for general sensor function but could be useful in your applications.

CheckConnect.vi

This function checks to see if it is receiving data from the sensor. The sensor may occasionally produce empty set data without any issue due to transmission rate. Please note that the sensor is still collecting at 64 Hz. This VI helps to determine if the connection is lost so that an error message can be produced.

- **Data**: This is the data from the sensor
- **Loop Index**: This is an index variable that is used to determine if the data variable is consistently empty.
- **Time**: This is the time variable. Ignore empty sets within the first two seconds.
- **New Loop Index**: This is the index variable that is used to determine if the data variable is consistently empty after it is modified based on the data received.
- **Disconnected?**: This is a Boolean indicator, which is true if the sensor is determined to be disconnected.

DataSavingInfo.vi

This function collects an interactive the information from the user about where to save the data that was collected and what name should be used.

- **Path for Saving**: This is the output path for the data that will be saved. For example the output could be: 'C:\GLNT\Subject Data\S001.xls'
DataSaving.vi

This function actually completes the saving process. Having this separated from the information gathering section will allow you flexibility to not use the DataSavingInfo.vi and set the information to constants if you do not wish to change the file name or saving location.

Data- This is the data from the sensor or sensors.
File Save Path- This is the path where the data will be saved.
Frequently Asked Questions (FAQs)

Q. LabVIEW cannot find ‘MotionSensorSDK.dll’ or another sub .VI.
A. When you first open LabVIEW it may have trouble finding these files. The files will be located in SubVIs folder included with the programs. Navigate LabVIEW to that folder and file. You should only need to do this once.

NOTE: If you receive an error after you have selected the “MotionSensorSDK.dll” file it is most likely because your LabVIEW version does not automatically support the .NET 4.0 framework. See page 4 of this guide for instructions.

Q. My computer cannot find/connect to my sensor.
A. There are several potential causes for this. Please note that you will only be able to connect to a maximum of seven Bluetooth devices at one time.
   1. Check that your computer’s Bluetooth is on and that your sensor is on.
   2A. If you are using the SingleSensor application,
      • Check that you have the MAC address correct for that sensor.
   2B. If you are using the MultiSensor program
      • Restart the program and identify your sensors by selecting yes when it asks to search for sensors.
   3. If this does not work, Place the sensor on the charge pad for a few minutes and then try again.
   4. Check that you have the latest version of your computer’s Bluetooth driver.

Please Contact Us With Any Questions or Comments Related to This Software
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Please include your LabVIEW version in any correspondence.