

MicroStrain®

Quick Start Guide



3DM-GX3® Soft & Hard Iron Calibration

Overview

Most models of the 3DM-GX3® series contain a magnetometer. The magnetometer values are available as fully calibrated outputs and are also used to correct heading drift in the Orientation Matrix, Euler Angles and Quaternion outputs. The 3DM-GX3® has been carefully designed to eliminate as many ferro-magnetic components as possible to prevent distortions in the readings of the earth's magnetic field which can cause errors in the magnetometer output. In addition, the magnetometer is factory calibrated on non-magnetic stages in order to compensate for any remaining internal sources of error. However, these measures can only compensate for error sources that are internal to the device; they cannot compensate for errors that may be introduced externally by mounting structures or adjacent devices. Careful mounting of the 3DM-GX3® can avoid external magnetic anomalies caused by sources such as coils, magnets, and ferrous metal structures and mounting components (steel nuts and bolts). Often these sources are hard to avoid or are hidden and so a field calibration of the magnetometer after final installation is highly recommended. This can be accomplished using MicroStrain's **3DM-GX3® Soft & Hard Iron Calibration software**.

Caution

Starting with 3DM-GX3® firmware version 1.1.27, the user has the option of turning off the heading correction and/or the magnetometer. The default setting is to have both turned on. Please make sure the magnetometer is turned **ON** before calibrating.

Instructions

Before starting, make sure you have installed the 3DM-GX3® Soft & Hard Iron Calibration software from the installation CD or from the installer downloadable at www.microstrain.com.

- 1) Connect the 3DM-GX3® to your computer using either the RS-232 communication cable and power supply or the USB communication cable. If you have not already done so, follow the instructions in the 3DM-GX3® Quick Start Guide on the installation CD to make sure the device is properly installed and communicating with your computer.
- 2) If you are calibrating a **3DM-GX3®-35 (AHRS+GPS)**, place it in AHRS Direct communications mode using the following steps:
 - a. Launch the 3DM-GX3® Monitor 2 software.
 - b. Select the device from the device pane.
 - c. Click Advanced. Click Communications Mode. Click AHRS Direct as shown in *Figure 1*.
 - d. Close the 3DM-GX3® Monitor 2 software.

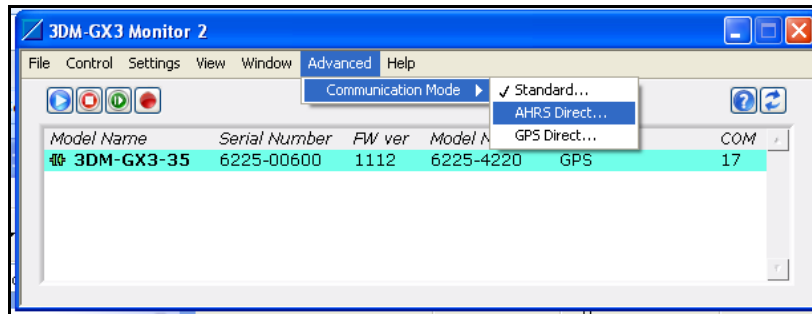


Figure 1

- 3) Launch the 3DM-GX3[®] Soft & Hard Iron Calibration software.
- 4) The 3DM-GX3[®] Soft & Hard Iron Calibration Main window will appear. If you have a 3DM-GX3[®] connected, it will appear in the Attached Devices list as shown in *Figure 2*. If you add a device after the application has been launched, you must click the Refresh Device List button for the new device to appear. If you are calibrating a 3DM-GX3[®] -35, it will appear as a 3DM-GX3[®] -25 in the device list.

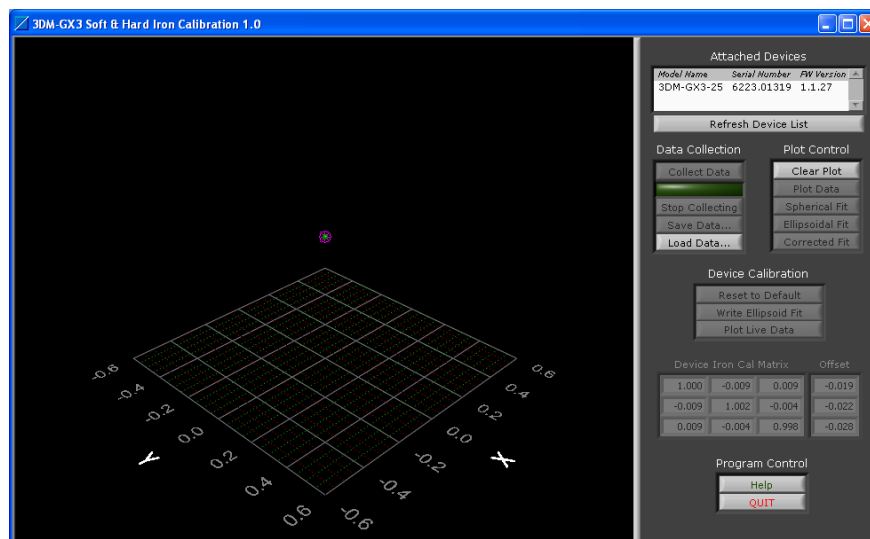


Figure 2

- 5) Select the device to calibrate. This enables several of the controls in the screen. Collecting data is very easy; just follow this basic sequence of calibration steps:
 - a. Click Collect Data to start collecting data.
 - b. Move the device in all possible orientations to collect data. As you move the device, points will appear on the display in 3D.
 - c. Click Stop Collecting.
 - d. Click Spherical Fit and/or Ellipsoid Fit to show the calculated calibration result.
 - e. Click Corrected Fit to show how the corrected data will look.
- 6) You may repeat this sequence as many times as you wish until you are happy with the result. Click Write Spherical/Ellipsoid Fit to write the calibration to the device. The actual calibration values written to the device will be displayed in the Device Iron Cal Matrix and Offset panels.

- 7) After writing the calibration, you can view real time calibrated output by clicking Plot Live Data.

Example

Below is a series of screen shots (*Figures 3-8*) showing a sample sensor calibration. The sensor used for this example has a steel nut taped to the housing. As you can see from the screen shots, this steel nut causes a strong offset and a slight ellipsoid deformation to occur.

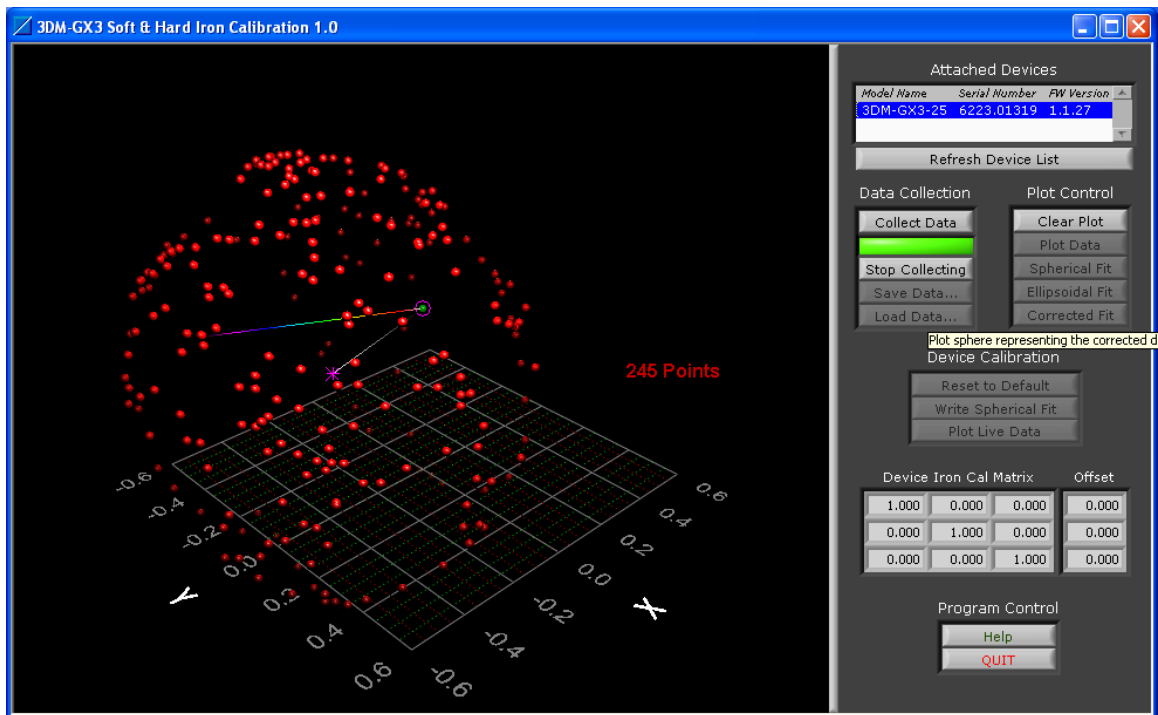


Figure 3 - Collecting Data

Notice how the purple “star” representing the center of the data sphere is offset from the “circle” which represents the center of the sensor. Normally, these should be superimposed.

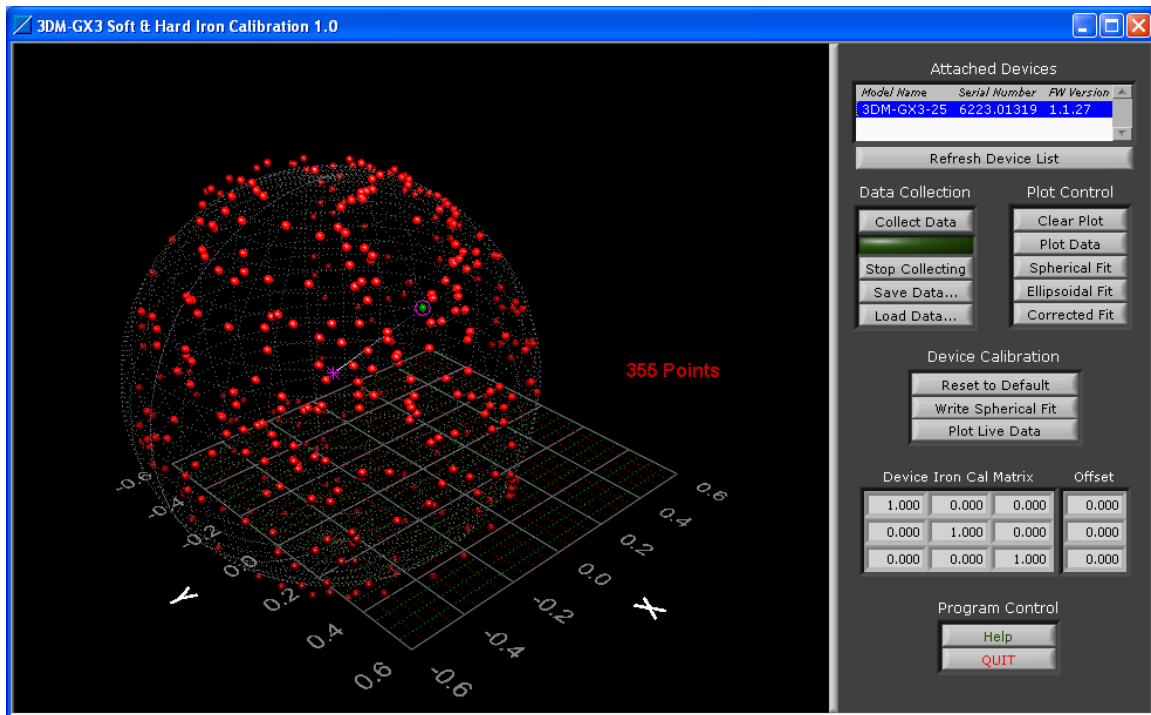


Figure 4 - Spherical Fit

The sphere fits pretty well but some of the points are not on the surface of the sphere.

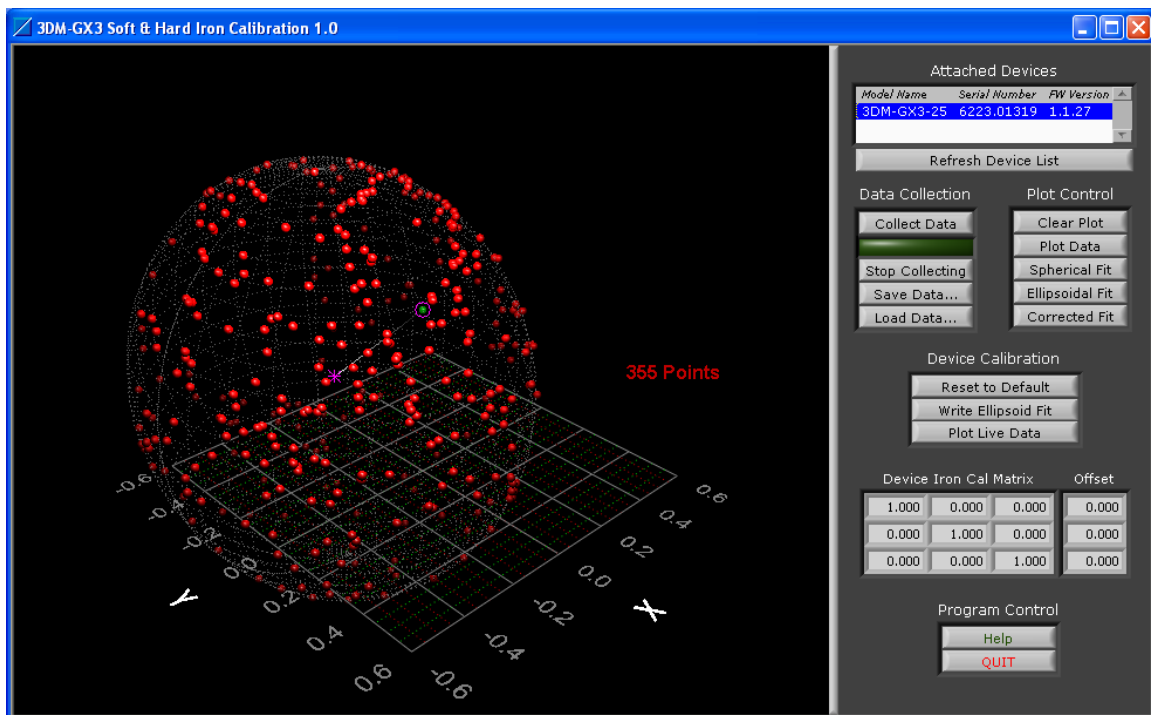


Figure 5 - Ellipsoidal Fit

The ellipsoid fit captures many of the points that were not on the surface of the spherical fit.

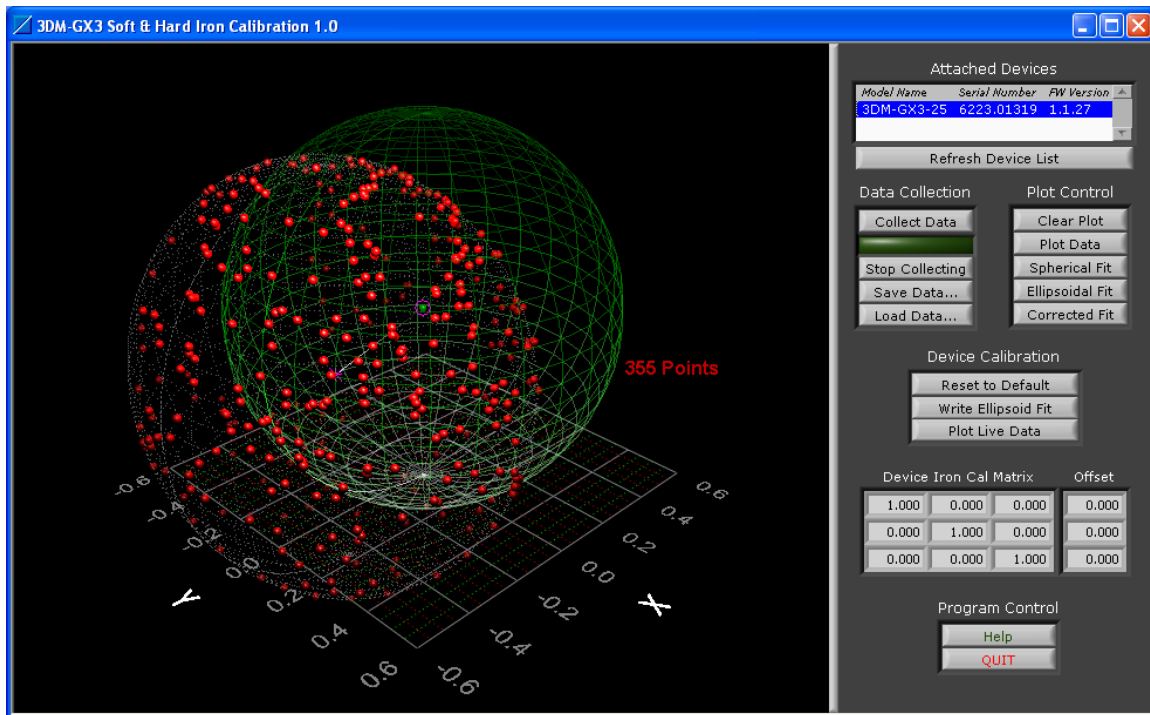


Figure 6 - Corrected Fit

The green sphere shows what the calibrated data should look like.

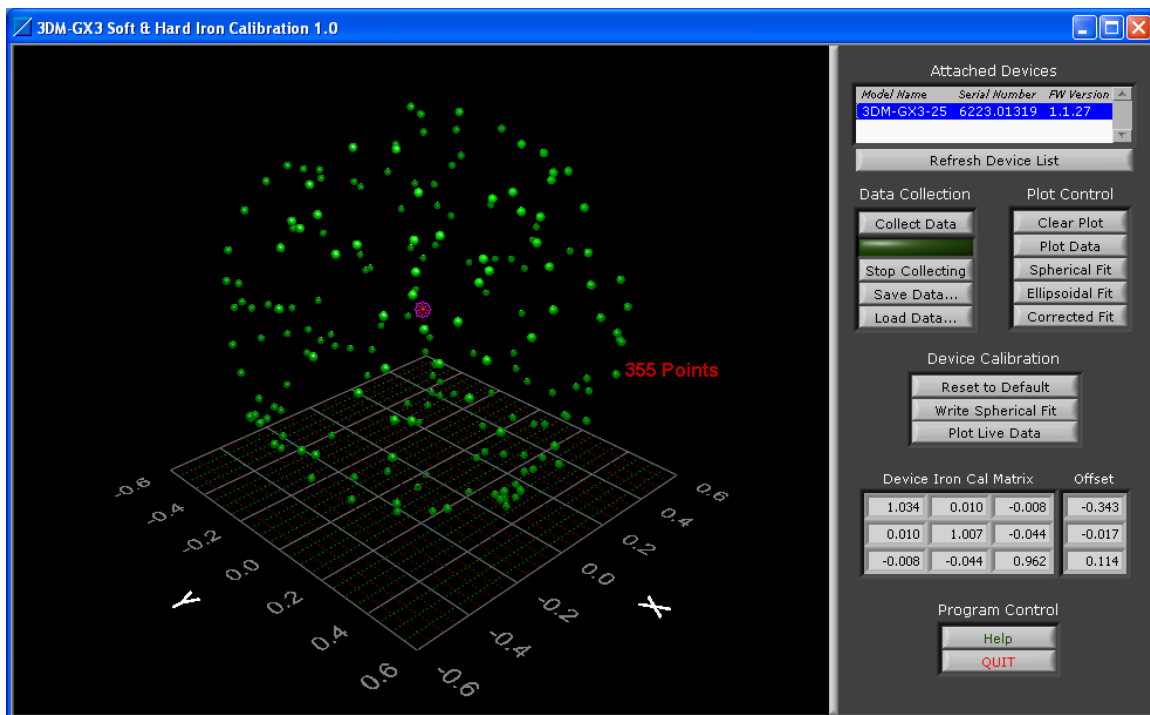


Figure 7 - Plot Live Data

The green points represent data taken after the calibration is written to the device. Notice the values in the Device Iron Cal Matrix and Offset.

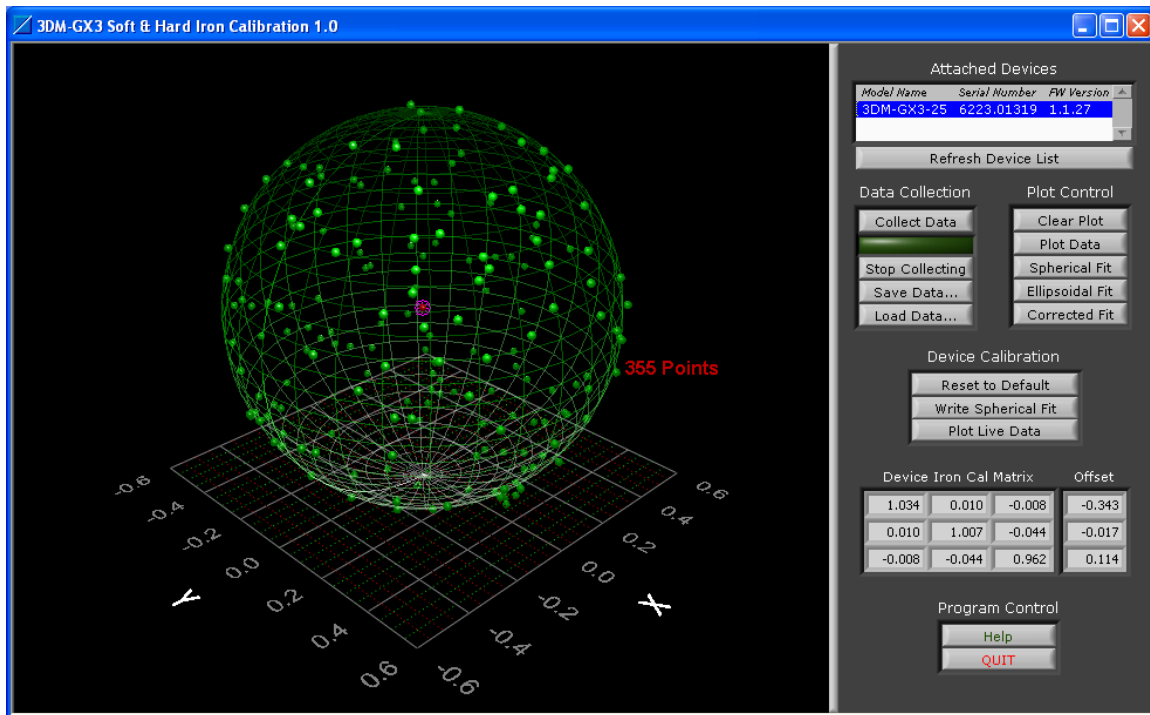


Figure 8 - Live Data and Corrected Fit

This shows how the corrected data fits to the ideal sphere.

Tips

- You may interactively rotate the data point display at anytime using the mouse – just click anywhere in the 3D data display and drag in the direction you would like to rotate.
- A context sensitive Help window is available by clicking Help. A window will appear and the help text will change as you move the mouse over different controls.
- The purple “star” represents the center of a sphere that the collected data is creating. This star changes position often early in the data collection process. If the star stops changing location as you rotate your sensor about its axis, this indicates that a good estimate of the magnetic field offset has been determined.
- We recommend that you use this tool often during the development of your application. Mounting changes or changes in surroundings may make a difference in the magnetometer output and by using this application you can see the magnetic effects and correct for them as necessary. It will help give you a feel for what effects you need to be concerned about and which ones are of little concern.
- You may save the data collected at any time by clicking Save Data... This will create a CSV (comma separated records) spreadsheet. You can load saved data using the Load Data... control to view previously collected and saved data.
- For applications that are restricted to 2D motion, the spherical fit is recommended. The ellipsoid fit requires a greater degree of 3D data.
- If your application requires metal mounting hardware or housings, use brass, aluminum, or 300 series stainless steel. Materials such as steel, iron, ferrite, current carrying conductors, magnets, etc. should be kept as far as possible from the device.

Congratulations!

You are off and running! MicroStrain Support Engineers are always available by phone, email or SKYPE to assist you in any way we can.

Caution

Do not bring the 3DM-GX3[®] into contact or close proximity with magnets. Magnets will at a minimum disrupt the sensor's operation and can cause permanent damage to its components. Many GPS antennas have a magnetic base; the antenna we provide does not. If you substitute a GPS antenna and its base is magnetic, please keep it away from the 3DM-GX3[®] (and don't pack them together).