

# LIBERTY™ MAPPING

## LIBERTY™ MAPPING TOOLKIT

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Colchester, Vermont, U.S.A.

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**Polhemus  
40 Hercules Drive  
PO Box 560  
Colchester, VT 05446**

**From within the U.S. and Canada: (800) 357-4777**

**From outside the U.S. or Canada: (802) 655-3159**

**Fax #:(802) 655-1439**

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## **1. Introduction to Compensation Mapping**

Distortion is generated by highly conductive metals in the area of intended use. The Polhemus mapping process can be utilized to significantly reduce these distortions in most areas. The mapping process generally reduces the distortion errors by a factor of 25 or more. Since the errors can never be completely eliminated, best performance can be obtained by initially minimizing these distortions before mapping, then invoking mapping to reduce the residual errors.

Minimizing the distortion is done by selecting an installation site that is generally free of, or as far away as possible from, large metal objects such as file cabinets, desks, air conditioning duct work and the like. If the intended use of the tracking system is to operate over a large volume (using the Long Ranger® Source), note that most industrial floors and walls have internal steel reinforcement. In these cases a nonmetal stage or riser (constructed of 2x4's or the like and plywood; standard nails or screws can be used), may be required if operation to the stage/riser floor is desired. Stage heights of only four (4) inches seem to provide enough floor separation for most applications if the Long Ranger is being utilized. If the 2" or 4" Source is being used, more separation (a higher riser or stage) is required.

Moderate distortion of a magnetic field can be corrected through the use of Polhemus' mapping procedure. The basics of compensation mapping, also known as calibration, are simple. First create a mapping fixture where sensors are placed in known and fixed positions. Move this fixture to known locations in the environment. Compare the position and orientation (P&O) readings from the tracker to the known P&O readings of the fixture. This data is then used by the Polhemus PC Windows®-based mapping software to compute a correction algorithm that is loaded into the LIBERTY tracker.

There are two ways to develop a compensation map with the LIBERTY system. For small volumes (typically covered by a 2-inch source) the Polhemus QWIK-MAP fixture can be used. For larger volumes, (those covered by a Long Ranger or 4-inch source), a user-created custom mapping fixture can be used.

The unique difference between this mapping method and previous mapping methods used by Polhemus is that the origin and coordinate system is not referenced to the magnetic source position. The user defines the origin and coordinate system (see [MapCollect Application](#) on page [22](#)).

In this document [Ten Simple Steps to a LIBERTY Map: Using the Polhemus QWIK-MAP](#) (see page [3](#)) are given for compensating a small region, should the user choose to purchase a QWIK-MAP fixture. If a larger volume is needed, the same software package guides the user through the use of a custom mapping fixture.

The basic procedure for creating a map consists of the following steps:

1. Create a LIBERTY definition file (\*.ldf). This file defines the configuration of the mapping fixture. For the QWIK-MAP fixture this is predefined. If a custom mapping fixture is being used, an \*.ldf file is created using the [DefineFrame Application](#), page [15](#)





2. Securely place magnetic source in the desired location (the source must not move after mapping or a new map will be needed).
3. Collect data, then create the map using the Polhemus [MapCollect Application](#) on page [22](#).
4. Load map into the LIBERTY tracker and enable map.

## Ten Simple Steps to a LIBERTY Map: Using the Polhemus QWIK-MAP

1. Assemble Polhemus QWIK-MAP. See [Setting up the QWIK-MAP Fixture](#) on page 4. **QWIK-MAP is designed to use four sensors.** Customer-created custom mappers utilizing a special branch of the mapping software can use 4 to 16 sensors.

**IMPORTANT**

The floor grid must be a minimum of four points along each axis.  
Fewer points than this can cause faulty maps.

2. Secure QWIK-MAP fixture to base of area to be mapped.
3. Determine the location for source and secure (as far as practical from large metal objects, yet as close as possible to the area of operation).
4. Attach LIBERTY to Host PC via USB or RS232 (COM 1, 115,200 baud, no parity, no handshaking) and power up.
5. Select the *File->Use Polhemus QWIK-MAP Definitions* menu item or select the  button on the main toolbar. See [QWIK-MAP Setup](#), on page 10.
6. Set the directions for the three axes in the *Set Axis Direction for QWIK-MAP* dialog box. See [QWIK-MAP Setup](#) on page 10.
7. Place application in collection mode by selecting the *Collection->Collect Data* menu item or the  toolbar button. See [Data Collection](#) on page 11.
8. Place the mapper pole in the designated position and press the Enter key. Repeat for each point in the fixture. Be sure to fully insert the mapping pole at each position.
9. Create a map by selecting the *Data->Create Map* menu item or the  toolbar item. Specify a filename and ID for the new map being created. See [Map Creation](#) on page 12.
10. Load the map into LIBERTY by selecting the *Data->Load Map* menu item or the  toolbar item and selecting the map filename created in the previous step. Choose the map location where the map is to be loaded. See [Map Loading](#) on page 12.

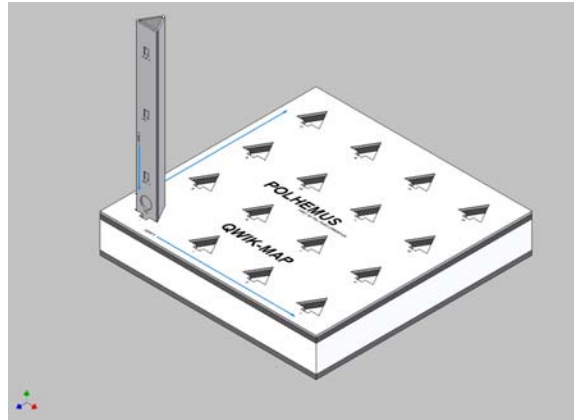
After the map has been created and loaded, compensation is turned on by using the `D<map number><enter>` command, where “*map number*” is the location specified in step 10. Use `D0<enter>` to turn compensation off. Compensation may also be turned on or off through the corresponding API calls in the SDK.

For a more detailed description of using the QWIK-MAP fixture, the MapCollect Software, or creating maps without the QWIK-MAP, see the following documentation.

**NOTE:** The QWIK-MAP fixture is intended to correct moderate distortion errors to the 1° and ¼-inch class of accuracy. Higher accuracies are achievable with precision mapping fixtures.

## 1.1 Setting up the QWIK-MAP Fixture

The Polhemus QWIK-MAP fixture is shown in [Figure 1](#).



**Figure 1 QWIK-MAP Setup**

This fixture can be purchased from Polhemus as a low-cost relaxed-accuracy mapping fixture. It allows the user to quickly and easily map an 18 in. x 18 in. x 18 in. (46 cm x 46 cm x 46 cm) volume using four sensors. It is intended to correct gross distortion errors to the 1° and ¼ in. (.3 cm) class of accuracy. Higher accuracies are achievable with precision mapping fixtures. The QWIK-MAP has a predefined configuration (\*.ldf) file that is delivered with the mapping software. It is important to set the sensors on the pole of the QWIK-MAP fixture correctly so the sensor placement corresponds to the configuration file. The following illustrations show the proper way of placing the sensors in the mapping pole.

Open up the pole triangle and firmly insert sensors in cutouts as shown in [Figure 2](#) and [Figure 3](#). Thread cables through round cutout as shown.



**Figure 2 Placing Sensors in the QWIK-MAP pole**



**Figure 3 Sensors placed in the QWIK-MAP pole**

It is important that the sensors are firmly inserted into the fixture exactly as shown. Note that Sensor 1 is facing in the opposite direction from the other three sensors.

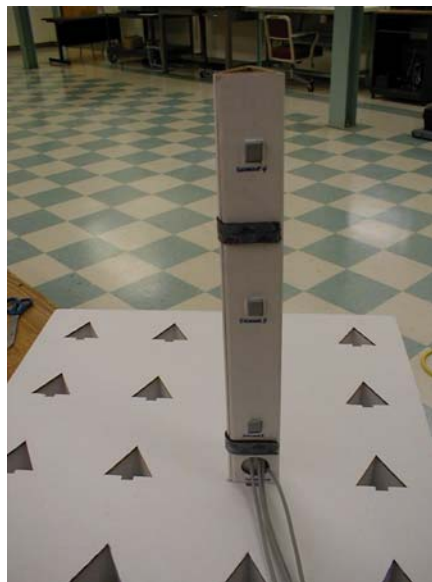


The next step is to fold the pole back into its triangle shape as shown in [Figure 4](#) and [Figure 5](#). Secure with hook and loop tape provided in the QWIK-MAP kit.



**Figure 4** Folding the QWIK-MAP triangle pole    **Figure 5** QWIK-MAP pole folded to its original position

Finally, insert the triangular pole fully into the base as shown in [Figure 6](#). You are now ready to proceed to the [MapCollect Application](#) section of this document.



**Figure 6** Inserting the QWIK-MAP pole into the base

## 1.2 Setting up a Custom Mapping Fixture

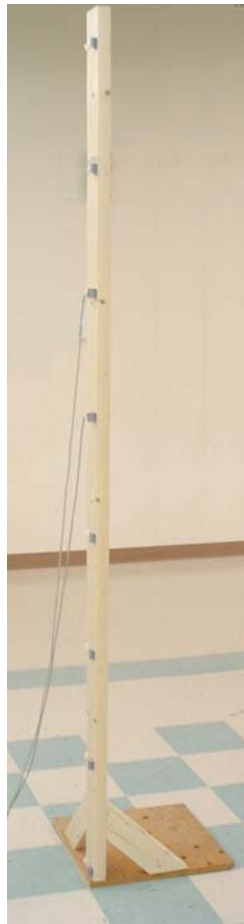
A custom mapping fixture can be used in lieu of the QWIK-MAP fixture. A custom fixture can use anywhere from 4 to 16 sensors. An example of a mapping pole fixture is shown in [Figure 7](#). The sensors do not have to be evenly spaced or in the same orientation. They only have to be known and stay in a fixed position. It is essential that the fixture be constructed of non-conductive (not just non-magnetic) material; e.g., do not use aluminum, except for fasteners (e.g. nails or screws). After the fixture is configured, a definition file \*.ldf for the fixture must be created, as explained in the [DefineFrame Application](#) section. After the \*.ldf is created the mapping process can proceed, as detailed in the [MapCollect Application](#) section.

**IMPORTANT**

The floor grid must be a minimum of four points along each axis.  
Fewer points than this can cause faulty maps.

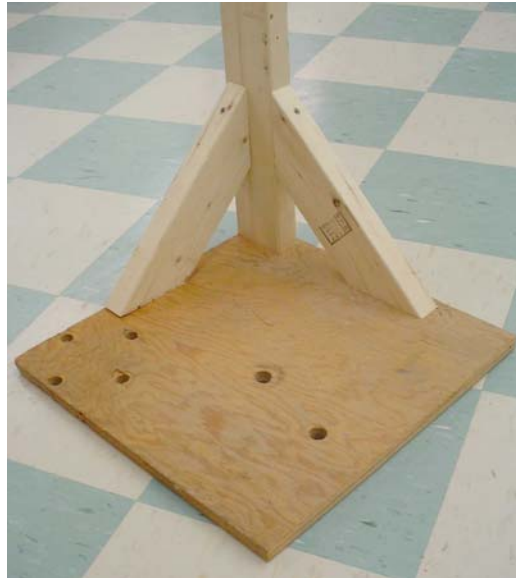
### 1.2.1 Constructing the Mapping Pole

Mapping poles can be constructed using a straight, flat-sided wooden pole or board (such as a 2x4), available from any lumber supplier (see [Figure 7](#).)



**Figure 7 Sample Mapping Pole**

The wooden pole is then mounted and braced to the corner of a base plate board, such as an 18” square of plywood; refer to [Figure 8](#).

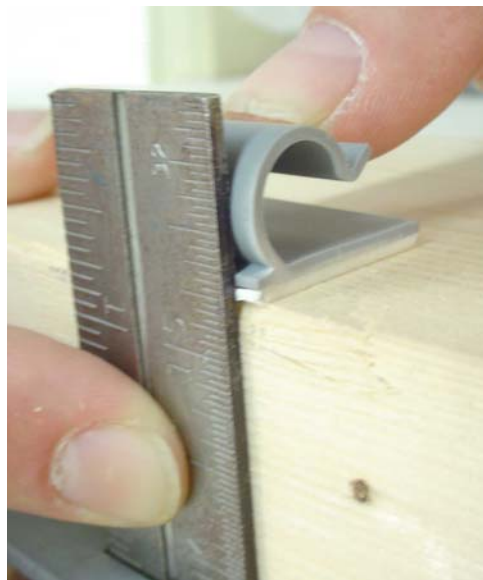


**Figure 8 Bracing the Mounting Pole**

The pole should be braced so as to be vertical at all times as the fixture is moved about the space to be mapped. A mapping pole can easily be assembled in a half hour or so.

### **1.2.2 Mounting the Sensor Clips**

Affix self-adhesive sensor clips to the wooden pole at regular spacing (such as 13” apart); see [Figure 9](#). (Polhemus can supply a kit of self-adhesive sensor clips to hold the sensors in place on the pole to aid in this process.) Carefully align the edge of the clips with the edge of the wooden pole. Eight sensors would cover about 8 feet of pole length.



**Figure 9 Positioning Sensor clips**

The sensors can then be clipped onto the pole in sequence, starting with sensor 1 in the lowest position. Carefully mount each sensor clip as shown in [Figure 10](#).



**Figure 10 Mounting the Sensor clips**

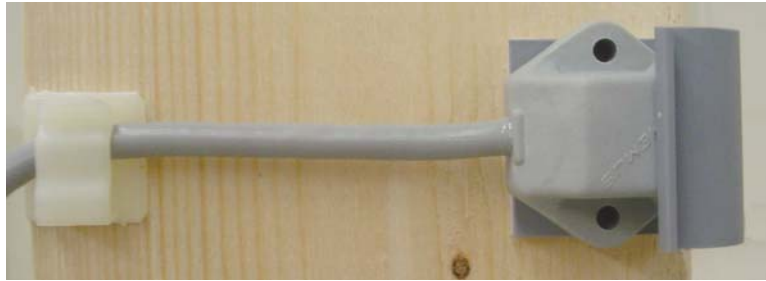
### **1.2.3 Affixing the Sensors**

Be precise in the seating of the sensors, placing them so that consistent rotation is achieved; see [Figure 11](#). (For example, set all sensors straight into the clip.) The rear edge of the sensor must be seated snugly at the base of the clip.



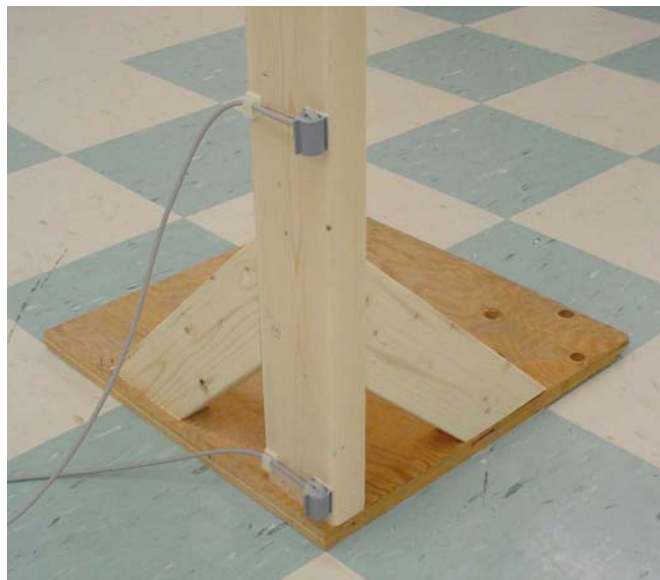
**Figure 11 Proper Sensor mounting in self-adhesive clip**

Route the sensor cable through the cable clip (as shown in [Figure 12](#)) so as to restrain the cable from moving the sensor head as the pole is moved throughout the space to be mapped.



**Figure 12 Routing Sensor cable through clips**

Construction of the mapping pole is then complete.



**Figure 13 Mapping Pole braced, with Sensors attached**

#### **1.2.4 Marking A Reference Grid**

A reference grid should be made on the floor (or base of the riser, if one is being used); tape or a chalk line can be used. Normally a 12-inch grid is used. Alternately, the intersections of floor tiles could be useful. In the mapping process the pole is moved and aligned to each grid point, and data from all sensors is taken at each pole location see [Floor Grid Definition](#) on page [17](#) for further instructions. Each location takes about 12-15 seconds to map, so a 10 foot x 10 foot area could be mapped in about ½ hour once the pole and grid are constructed.

## 1.3 Procedure to Create and Load a Map

### 1.3.1 Preparation


The first step in creating a map is to define the area to be mapped. Here are some questions to ask:

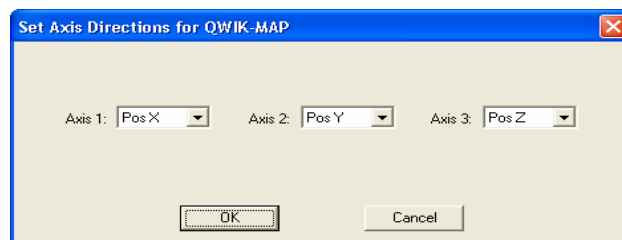
- How big of an area needs to be mapped?
- Can I use the QWIK-MAP or is a custom mapper needed?
- How many sensors are needed on the pole?
- How far apart do the grid points need to be?
- Where should the origin be placed?
- Are there specific axis configuration requirements (should X be pointing a specific way)?
- Where will the source be located?
- How much distortion correction is needed?

Keep in mind that the largest motion volume for the QWIK-MAP is 18 in. H x 18 in. W x 18 in. D.

If you will not be using the QWIK-MAP you will be required to create a custom \*.lmd file using the DefineFrame utility (DefineFrame.exe) that shipped with this package.

### 1.3.2 QWIK-MAP Setup

The user should keep in mind that the QWIK-MAP fixture is intended to correct distortion errors to the 1° and ¼ inch class of accuracy. Higher accuracies are achievable with precision mapping fixtures. Before collecting data the user must inform the MapCollect Application that the QWIK-MAP fixture is to be used. This is done by selecting the *File->Use Polhemus QWIK-MAP Definitions* menu item or selecting the  button on the main toolbar. When the QWIK-MAP option is selected the application will query the user for the direction of each axis. The QWIK-MAP fixture has three axes labeled Axis 1, Axis 2, and Axis 3. The user must identify which of these axes correspond to the X, Y, and Z axes respectively. This is done by entering the data into the Set Axis Directions for QWIK-MAP dialog box shown in Figure 14.




**Figure 14** Set Axis Directions window



Keep in mind, when selecting the vertical axis, that axis 3 is pointing down, in the opposite direction from the QWIK-MAP sensor pole. The three axes must comprise a right-hand coordinate system.

Make sure the QWIK-MAP fixture is taped or otherwise secured or stabilized to a non-metal base so the fixture can not move while data are being collected.

### 1.3.3 Custom Map Setup


If the user is not using the QWIK-MAP, then a custom \*.lmd file must be created using the [DefineFrame Application](#) shipped with this package (see Section 2, on page 15). All pole and grid definitions are contained in the \*.lmd file. The user informs the MapCollect application that a custom \*.lmd file is to be used by selecting the *File->Set Definition File* menu item or the  button on the main toolbar. This will allow the user to navigate to the \*.lmd file that should be used in the upcoming mapping session.


### 1.3.4 Data Collection



Before starting to collect data the source must be installed in a fixed location. Any location within specified distances to the mapped area is fine. The orientation of the source also is not important. However, once the data has been collected, the source may not be moved. Once a source has been moved, any maps previously created will no longer be valid. In other words, if multiple environments need to be used, consider purchasing a source for each one.

Finally, LIBERTY should be set up and all sensors and the source connected. LIBERTY should be connected to the host PC by RS232 in COM Port 1 at a baud rate of 115,200, or via USB connection. Turn on LIBERTY. Other COM Ports may be specified in the *Collection->Set COM Port* menu item.


The user should decide whether to use the High Distortion Mode or the Low Distortion Mode. This mode is set in the *Collection Menu*. The High Distortion Mode is valuable if the mapped area exhibits areas of very high distortion, but in areas of less distortion may create very noisy data. The High Distortion Mode is only available if the user has connected a “distortion mitigation technology (DMT)” source to the tracker. The user may have to try both modes in order to determine which will provide the better results. The default setting is High Distortion Mode but if a DMT source is not detected the mode will automatically be set to the Low Distortion Mode.

At this point data collection can begin. When the user selects the *Collection->Collect Data* menu item or the  toolbar button, LIBERTY will be placed into data collection mode and the data collection toolbar will be visible. (If the application cannot connect with LIBERTY, the application will show an error and remain in normal mode.) If a DMT source is being used and the High Distortion Mode has been set in the *Collection->High Distortion Mode* menu item, the user will be asked to move the sensor pole to a specific position for an additional calibration step. Once the data collection toolbar is visible, the user should move the sensor pole to the first grid point as indicated in the grid view. There are four different ways to direct the application to take data at the selected grid point:


1. Select the *Collection->Take Point* menu item.
2. Select the  item on the Data Collection toolbar.
3. Press the Enter key.
4. Double-click the mouse on the point to be collected.

The first three of these options will cause the application to select the next uncollected point after the data have been taken. Double-clicking the mouse on a point will collect the data at that point but will not change the point selection. Utilizing the Enter key can permit the data collection to move rapidly. If data are taken at the wrong point or the user wishes to re-take data at a particular point for any reason, that point may be selected with the mouse and the data re-taken in the same manner it was originally taken. If it is desired to erase one or more points the user can accomplish this by selecting the *Collection->Clear Point* or *Clear All Points* menu items or the  or  toolbar items respectively. When all grid points have been collected a LIBERTY map can be created.

### 1.3.5 Map Creation

When all the data have been collected the user can create a LIBERTY map by selecting the *Data->Create Map* menu item or the  toolbar item. The application will then query the user for a file name in which to store the map. This file will have a *\*.lmf* extension and is used to load maps into LIBERTY systems. When the user has specified a file, the application will ask the user to provide a map ID for this map. The map ID is how LIBERTY will identify the map to the user. Since a LIBERTY can store up to three maps, the ID is a convenient way for the user to distinguish between the maps. This ID should be less than 16 characters and should have some significance to the LIBERTY user. After the map ID has been provided, the application will use the collected data to create the LIBERTY map with the provided ID, and store it in the specified *\*.lmf* file.

### 1.3.6 Map Loading

Once the map is created, the next step would be to load the map into LIBERTY. However, the map to be loaded need not be the map just created. The MapCollect application will load any *\*.lmf* file that the user specifies. To initiate map loading, the user should select the *Data->Load Map* menu item or the  toolbar item. The application will then query the user for the *\*.lmf* file to be loaded. Once the *\*.lmf* file is selected the application will query LIBERTY for existing maps and present the user with a choice of locations to store the map in LIBERTY. LIBERTY has three “positions” for storing maps. Positions may not be skipped, but maps may be overwritten. For example, if LIBERTY has a map stored in Position 1, and another map is to be loaded, it must be placed in Position 1 or Position 2. Position 3 is not a valid choice as that would mean Position 2 would have been skipped. The application will not allow the user to load maps into invalid slots. The user specifies the storage slot for the map by making a selection in the *Choose Map Position* dialog shown in [Figure 15](#).

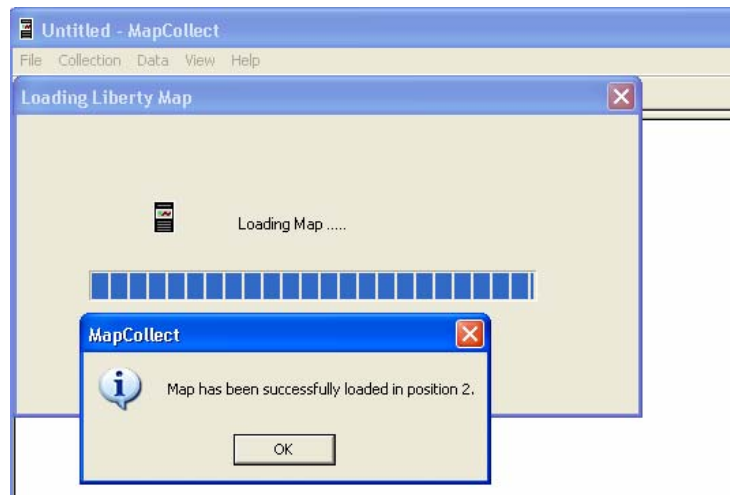




**Figure 15 Choose Map Position window**

In [Figure 15](#) LIBERTY has one map already stored in Position 1. The number of maps presently stored in LIBERTY is indicated by the text at the top of the dialog. Note that in this example, Position 3 is not a valid choice.

When the user selects the OK button on this dialog the application begins loading the map into LIBERTY. A progress bar is displayed to indicate the loading progress, as shown in [Figure 16](#). Loading typically takes less than five seconds.




**Figure 16 Successful loading of Map in position 2**

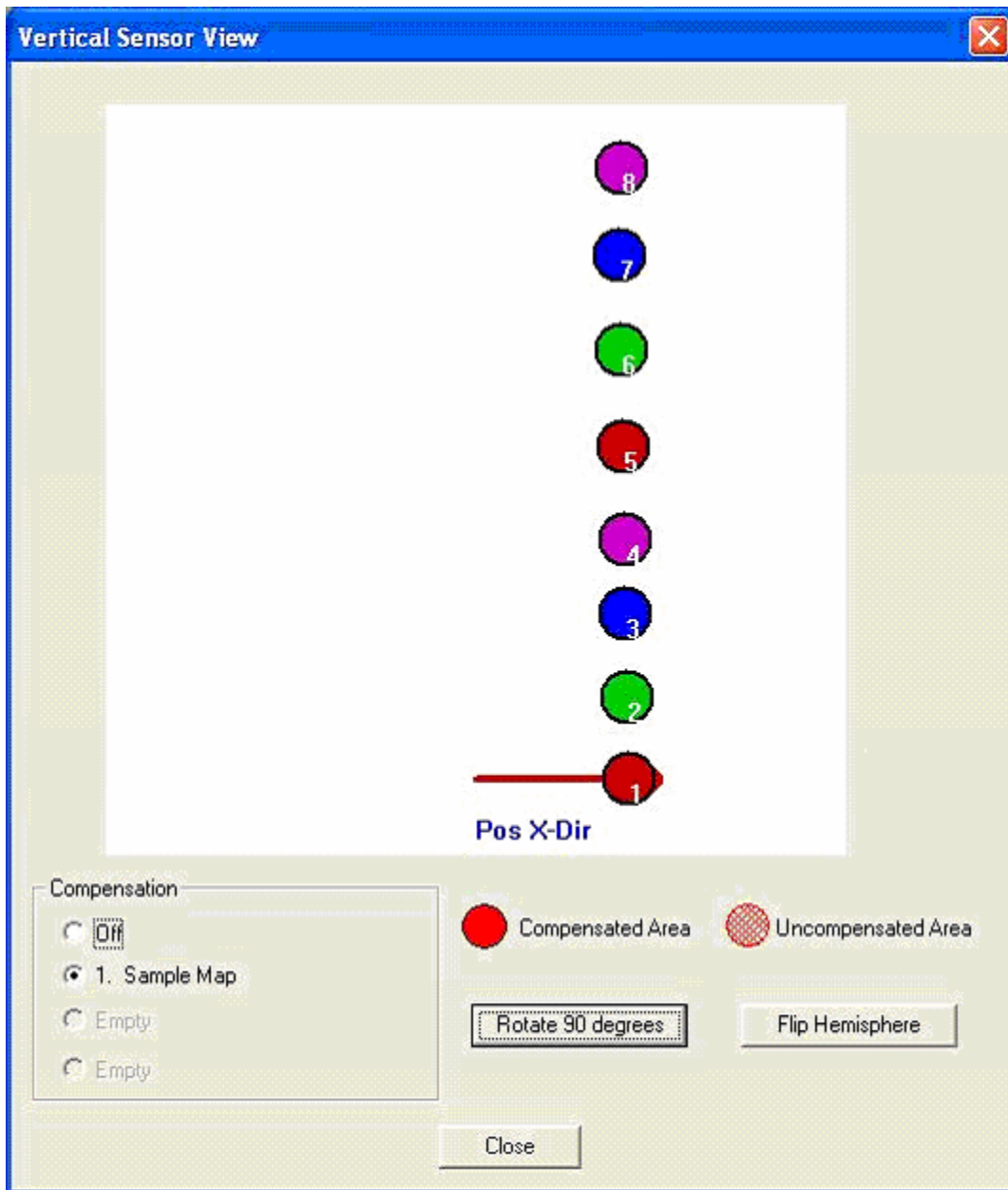
Upon successful loading, a message box similar to that in [Figure 16](#) will be displayed.

At this point a map has been successfully created and loaded by the MapCollect application. Compensation using this map can be started by sending LIBERTY a *dn<return>* command, where *n* is the position of the map (1-3, 0 turns compensation off), or by using the appropriate API function call.

### 1.3.7 Live Sensor View

Once a map has been loaded the user may select the Live Sensor View window to see the distortion correction being applied. This window will show the live position of each sensor on the pole. The vertical position will be relative to the highest sensor, the horizontal position will

be relative to the mapped area. The user may select to turn compensation off, or to change compensation from one map to another by selecting the appropriate choice. The user can invoke the Live Sensor View by selecting the *View->Live Graphical Data* menu item or the  toolbar item. [Figure 17](#) is a sample screen shot of the Live Sensor View. This example represents an eight-sensor pole with the positive X direction toward the right side of the screen. All the sensors are in the mapped area since they all are solid colors. If any were out of the defined map box they would appear hatched, as the legend indicates. The user may rotate the view by 90 degrees to see the other horizontal axis by selecting the *Rotate 90 degrees* button. In any case where the floor is not the zero vertical position, the user may need to select the *Flip Hemisphere* button to see all sensors.



**Figure 17** *Vertical Sensor View* window

Since all filtering is turned off when map collection is started, this output could appear a little jumpy. This may be corrected by re-powering LIBERTY, which will re-establish the default filtering.

## 2. DefineFrame Application



### 2.1 Description

The DefineFrame application is a utility that must be used to create a LIBERTY Mapping Definition (\*.lmd) file. The \*.lmd file is required when creating a custom LIBERTY distortion compensation map with the MapCollect application. These \*.lmd files define a custom pole/sensor configuration, as well as the horizontal grid that the user desires to collect data during the map creation. The user is not required to create a \*.lmd file if the Polhemus QWIK-MAP mapping fixture will be used. However, if the user requires an area that is larger than that which the QWIK-MAP provides, a mapping fixture must be created that meets the user's requirements. An example of a mapping pole can be seen in [Figure 7](#). An \*.lmd file must then be created using the DefineFrame application that defines the pole and the grid where the map data will be collected. By implementing this technique to define mapping regions, the user is allowed to create numerous pole and floor configurations depending on a location or situation, and then easily load the appropriate \*.lmd file at map creation. This section provides the procedure for using the DefineFrame application to create the necessary \*.lmd file.

Creating a map with LIBERTY allows much more flexibility than previous tracking products. The mapping reference frame is defined by the user and the source location is absolutely arbitrary (of course, the source should be located within the operational range for all points in the map and away from any metal distorters). The user defines all three axes of the reference frame. These axes do not need to correspond to the source reference frame. The user must, however, define a frame that follows the right-hand rule. A way to test this is to point the index finger of your right hand along the desired reference frame X-axis with your palm facing the Y-axis; your thumb will point to the Z-axis, as in [Figure 18](#).

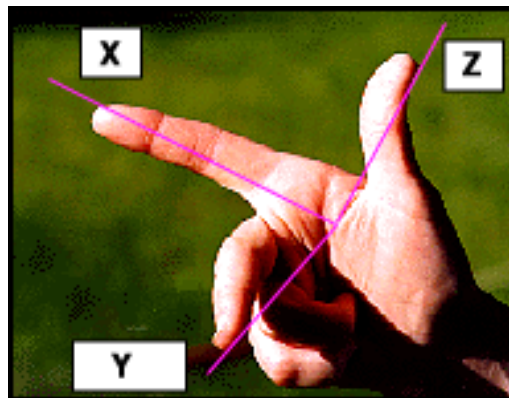
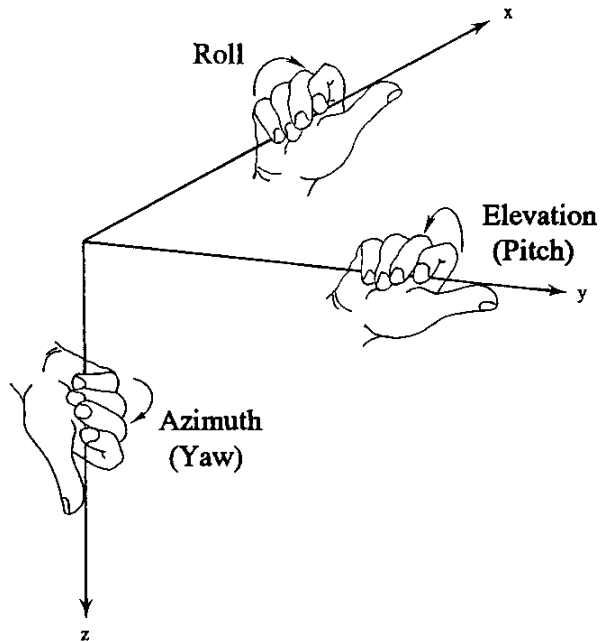


Figure 18 The “Right Hand Rule” demonstrated

Another example of the right hand rule will help you to remember the positive and negative rotation directions, as shown in [Figure 19](#). By wrapping your right hand around an axis in a reference frame that has been developed using the previously described right hand rule, the direction of positive rotation is indicated by the curl of the fingers.



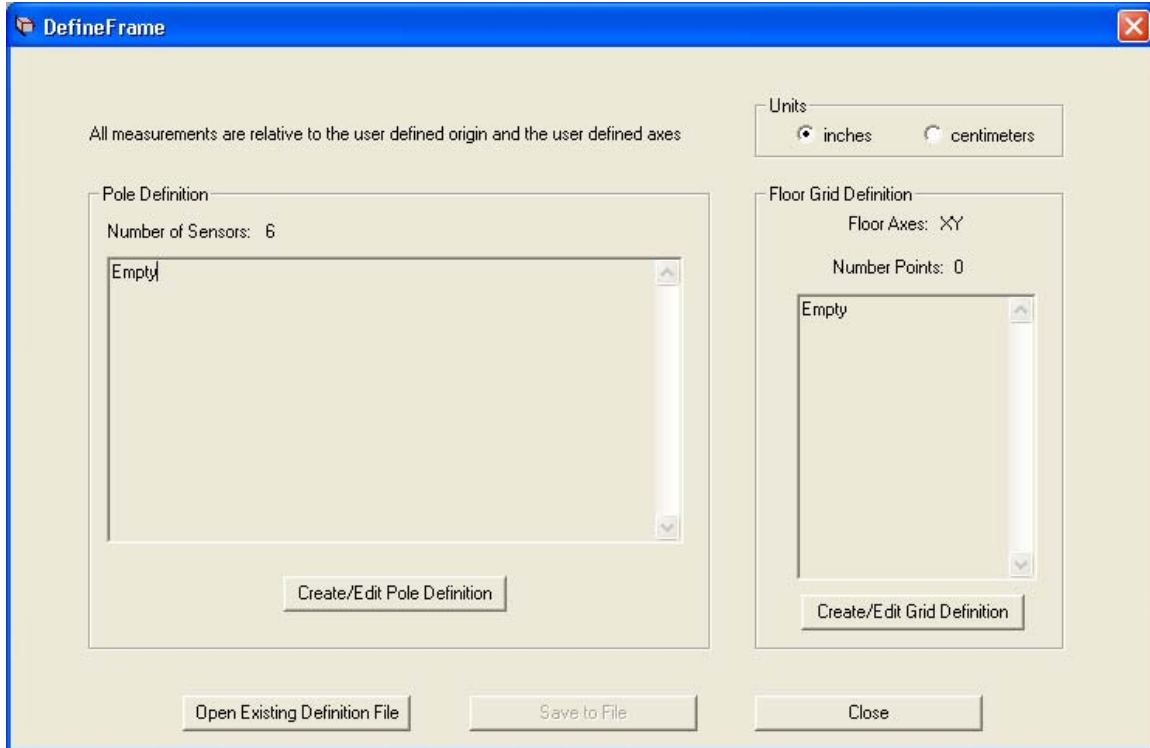
**Figure 19 Using the Right-Hand Rule**

Other than this requirement, the user is free to set the axes of the mapping frame in any Cartesian configuration. Additionally, the user will define the position of the origin of the mapping frame. When the map is created and being used by the LIBERTY system, the position and orientation values output will be referenced to the user-defined mapping origin and frame axes.

The DefineFrame application also may be used to edit existing \*.lmd files. Both horizontal grid changes and changes to the sensors/pole configuration may be made, or the user may use an existing file as the basis for a new file to be created.

## 2.2 Procedure for creating a \*.lmd file

When the DefineFrame application is started, the window shown in [Figure 20](#) will appear on the PC screen. Note that both the Pole Definition and the Floor Grid Definition are empty.

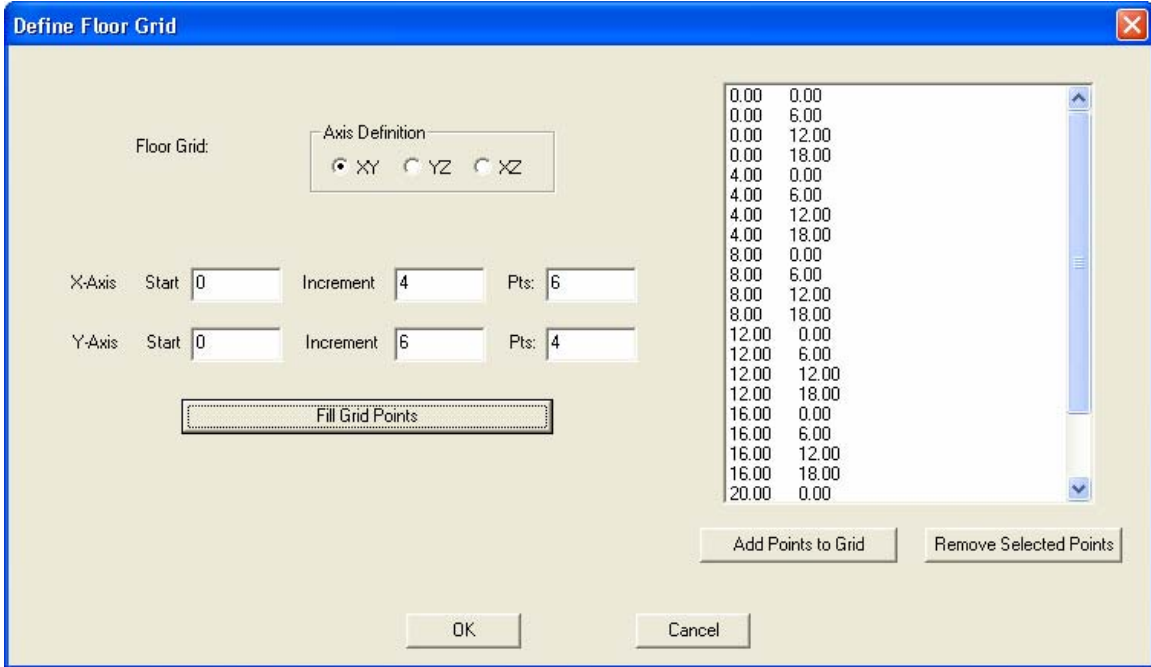


**Figure 20** *DefineFrame* Startup window

First select the units that will be used in the definitions. The application will default to inches, but may be changed to centimeters by selecting that choice in the *Units* box located at the top right portion of the window. Angle measurements are always in degrees.

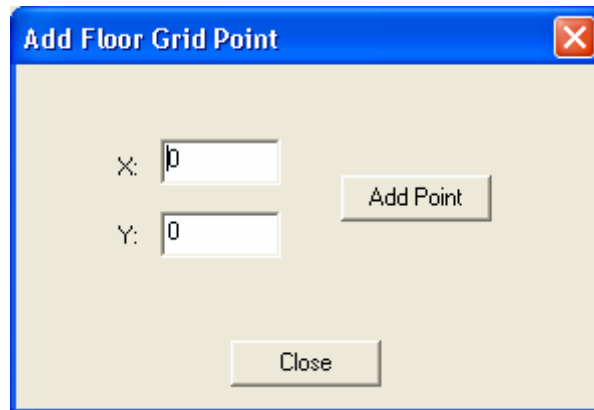
## 2.3 Floor Grid Definition

Next, a floor grid definition should be created. The floor grid is a collection of points located on the floor or stage/riser, relative to the user-defined origin and frame configuration, where the mapping pole will be placed during data collection. When the user selects the *Create/Edit Grid Definition* button the dialog box shown in [Figure 21](#) will be displayed. This is where the floor points for collection will be identified. The user should first define the two horizontal axes (the floor axes) by selecting the appropriate choice from the *Axis Definition* box of the *Define Floor Grid* screen. From this dialog box the user may add floor collection points in two ways. The first way is to select a start point, increment, and number of points per axis, for each axis of the floor grid. Then select the *Fill Grid Points* button. This will generate all the points that correspond to start, increment, and number of points supplied for each axis. The second way to add points is to select the *Add Points to Grid* button. This will display the *Add Floor Grid Point* dialog box ([Figure 22](#)). From this dialog box the user may add any individual floor point to the grid.



**Figure 21 Define Floor Grid window**

Finally, from the *Define Floor Grid* dialog the user may delete floor grid points. To delete a point the user can select the point from the list of points on the right, and select the *Remove Selected Points* button. Highlight and click on each point to select a group of points to be removed. This could be useful when editing an existing \*.lmd file.



**Figure 22 Add Floor Grid Point window**

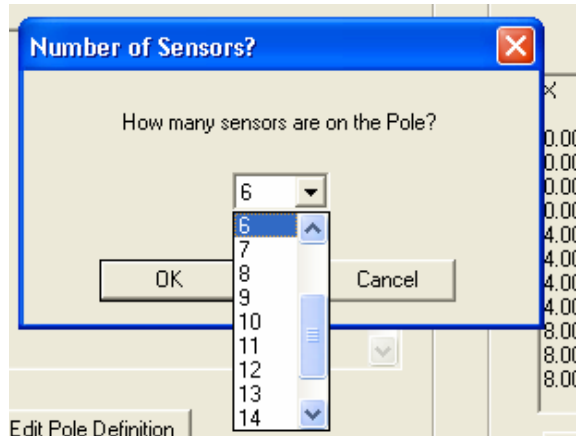
When the user selects the *OK* button, the *Define Floor Grid* dialog closes and the floor collection points are listed in the main application window.

**IMPORTANT**

The floor grid must be a minimum of four points along each axis.  
Fewer points than this can cause faulty maps.

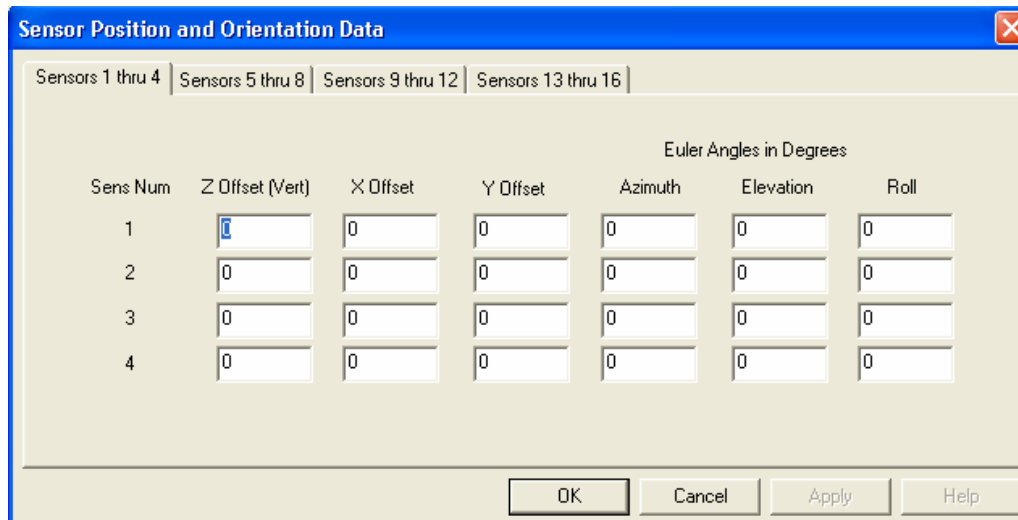
## 2.4 Pole Definition

After defining the floor/stage/riser grid, the mapping pole also must be defined. When the user selects the *Create/Edit Pole Definition* button the application will first query the user for the number of sensors attached to the pole, as shown in [Figure 23](#). The user may select a value between two and 16. After the user selects the number of sensors on the pole, the *Sensor Position and Orientation Data* dialog box shown in [Figure 24](#) will be displayed.



**Figure 23 Create/Edit Pole Definition: *Number of Sensors* window**

In [Figure 24](#), notice that there is a tab for each group of four sensors. The user is required to provide the offset data for each sensor on the pole. The user should pay very close attention to the sign of each value, especially on the vertical axis (first column). These values may actually decrease as the distance from the floor increases (when the vertical axis is positive in the down direction).



**Figure 24 *Sensor Position and Orientation Data* window**

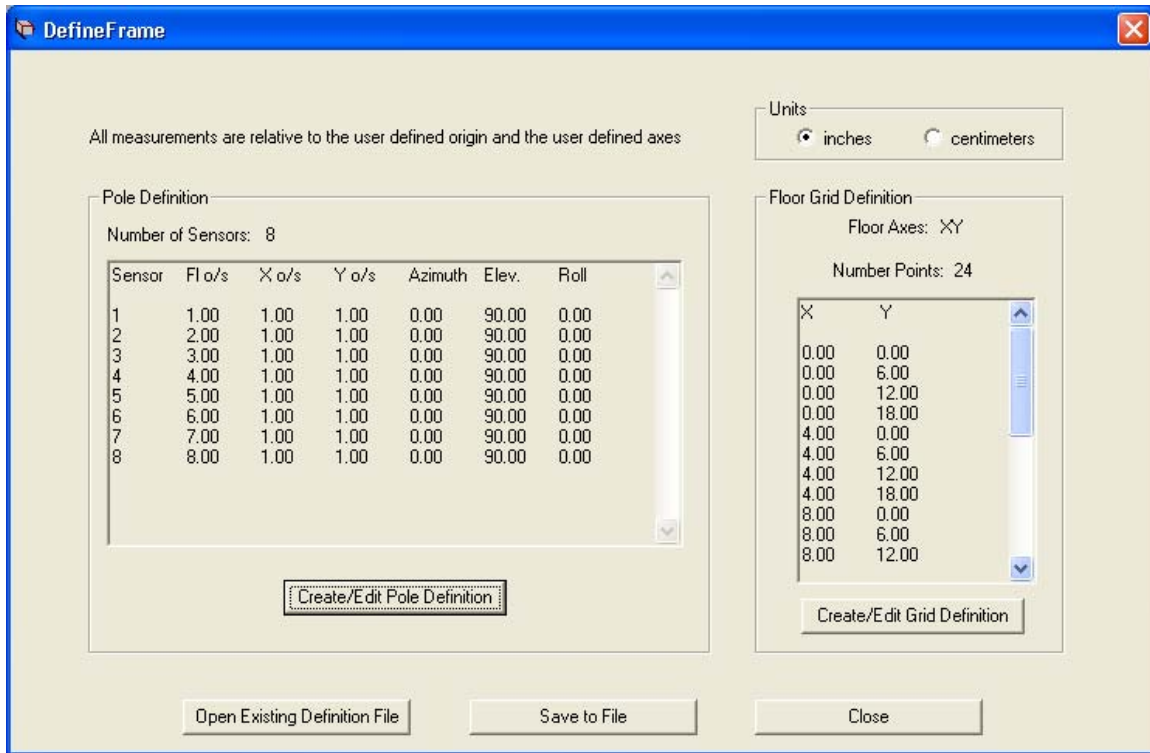
The vertical offsets are measured from the floor (or the zero position of the vertical axis if it is other than the floor). The horizontal offsets (second and third column) are measured from the center of the pole, so that when the pole is centered on the floor point, the actual sensor position



can be obtained by adding the floor point and the appropriate offset. This means that the offset may be a negative number.

In addition to the offset data the user must also provide the orientation data for the sensors. Euler angles for azimuth, elevation, and roll should be entered in the appropriate spaces. All angles must be in degrees. Again, these orientation values are relative to the user-defined reference frame and have no correlation to the position of the source during mapping.

When all offset and orientation data for each sensor on each tab has been entered and the user selects the *OK* button, the main window will be updated with the pole information. See the sample window in [Figure 25](#).

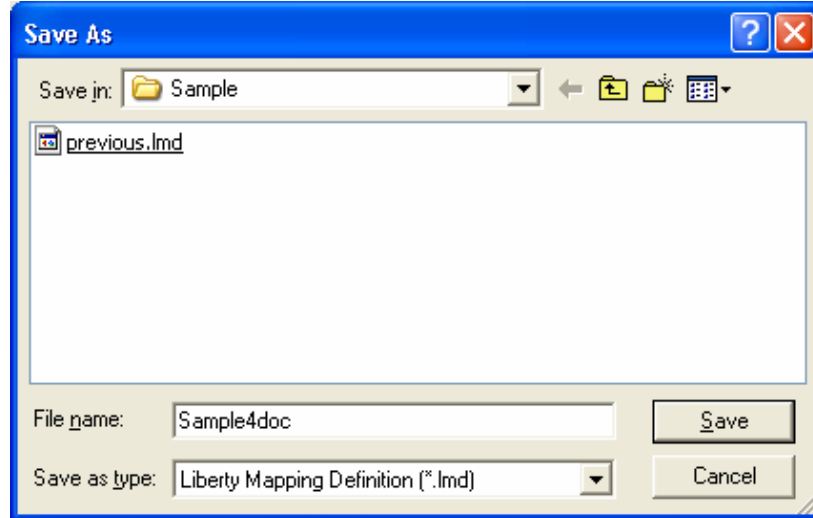


**Figure 25 Main window updated after Sensors have been updated**

## 2.5 Saving \*.lmd File

The final step is to save the \*.lmd file with the data just provided for the floor grid and the pole definitions. When the user selects the *Save to File* button, a *Save As* window will appear that will allow the user to save the \*.lmd file at the desired location, as shown in [Figure 26](#).





**Figure 26** *Save As* window to create \*.lmd file

## **2.6 Editing Previous Files**

Previously defined \*.lmd files may be loaded into the DefineFrame application for editing by selecting the *Open Existing Definition File* button. This will load the floor grid and pole definitions so that the user may edit these definitions and either change the existing file or save them as a new file.

Following the above procedure will create a binary \*.lmd file that can be read by the MapCollect application which will be used to create the compensation map used by LIBERTY trackers.

## 3. MapCollect Application



### 3.1 Description

The MapCollect application is a Windows-based host application that provides a Polhemus LIBERTY user with the ability to create and load distortion compensation maps into the LIBERTY system. LIBERTY is capable of holding three different compensation maps to allow for the flexibility of using the same LIBERTY in different or changing environments. Maps may be stored in LIBERTY, on a host PC as a LIBERTY Map File (\*.lmf), or both. The MapCollect application is used to create or load maps taken either with the Polhemus QWIK-MAP or as a customer-defined map volume. This application is to be used with a vertical configuration of two to 16 sensors. The Polhemus QWIK-MAP must be used with four sensors. This vertical bank of sensors is to be moved to various grid points on a floor, the QWIK-MAP, or some other horizontal plane defined by the user. At each grid point data are collected for all sensors to create a “cube” which will make up the map volume. The grid points need not be symmetrical; some may be two inches apart where others may be 12 inches apart. It all depends on the distortion and how dense a map the user desires. The QWIK-MAP defines a grid with symmetric points approximately six inches apart.

The user must use the MapCollect Application to collect all the data in the map volume. The application then can be used to create a LIBERTY compensation map. This map will be created in the form of a \*.lmf file. The application provides the user with a direct interface into LIBERTY to load and store the created map. Additionally, the application provides the user with the ability to erase ALL maps stored in the LIBERTY system. Graphical and textual interfaces are used to show mapping progress and to lead the user through the necessary steps.

The MapCollect application main window is divided into two sub-windows. One is a graphical representation of the horizontal or floor grid to be used for the mapping operation. As points are collected along this grid the icons representing the points will change to reflect the new status. The user can see the collection progress at a glance or which point to move to next. This window also provides the user with a means for retaking points or changing the selected point with the click of the mouse. This window is not visible on startup. It will become visible when either the QWIK-MAP option is selected, or a LIBERTY Map Definition file (\*.lmd) is loaded. The second window is a text-based, scrollable window which records all actions in real time. It will record the data for each point as it is collected, as well as the defined position of that point. This view is always visible at the bottom of the screen, and may be copied to file or printed. Either window may be enlarged or reduced to see more data.

An additional window may be invoked which will show the sensors’ position in real time relative to the map and each other. The scale of the window is the size of the map. This view allows the user to change the current map or turn off compensation. It also provides the user with a visual representation of how well the map is correcting in the user’s specific environment.

If the user is not employing the Polhemus QWIK-MAP with the MapCollect application, he/she must supply a custom \*.lmd file that was generated using the DefineFrame utility supplied with this application. This will define the floor grid orientation and the map area origin. The

coordinate system of the mapped area is completely user-defined. It is defined either by the \*.lmd file or the QWIK-MAP fixture. The source location and orientation is completely irrelevant other than that it must be within the specified distance to all points in the mapped area. If using the QWIK-MAP, the coordinate axes will be defined by the user before data collection begins. All axes must be defined such that the coordinate system is a right-hand system; see [Figure 18](#).

## **3.2 MapCollect Interface**

Following is a description of the user-interface items and controls of the application.

### **3.2.1 Menus**

#### **3.2.1.1 File**

*Set Definition File* Used to identify the \*.lmd file to be used to define the horizontal grid and sensor configuration. Only used if the Polhemus QWIK-MAP *is not* being used.

*Use Polhemus*

*QWIK-MAP Definitions* Used to notify the application that the QWIK-MAP *is* being used.

*Clear Screen* Clears the Main Text View window of the application.

*Save Screen to File* Saves the Main Text View window of the application to a file specified by the user.

*Print Screen* Prints the Main Text View window.

*Exit* Terminates the program. Any data collected in which a map has not yet been created will not be saved.

#### **3.2.1.2 Collection**

*Set COM Port* Allows the user to indicate which port to connect with when using RS232 communications.

*Set Hemisphere* Allows the user to force a hemisphere of operation.

*High Distortion Mode* Available with a “distortion mitigation technology” source only. Provides better compensation in areas of very high distortion, but may result in excessive noise in less distorted areas.

*Low Distortion Mode* Provides a less noisy solution when the mapped area is not heavily distorted.

*Collect Data* Puts the application into Data Collect Mode. This will establish communications with LIBERTY over either RS232 or USB. The Data Collection toolbar will become visible in this mode.

<i>Take Point</i>	Collects data for all sensors and assigns the data to the currently selected grid point.
<i>Clear Point</i>	This will clear the data for the selected point. To be used if data are incorrectly taken at the wrong grid point.
<i>Clear All Points</i>	This will clear the data associated with all the grid points. This would be used only if the user decides to start over.
<i>Quit Collection</i>	Takes the application out of Data Collection Mode. This will terminate the connection with LIBERTY and hide the Data Collection Toolbar. The user can return to the same collection point if he/she returns to Data Collection Mode before re-loading a *.lmd file.

### **3.2.1.3 Data**

<i>Create Map</i>	Selecting this will create a LIBERTY Map in the form of a *.lmd file using the data that was most recently collected. This will not be enabled until data for each grid point has been collected.
<i>Load Map</i>	This menu item will load any map created with this application (*.lmd file) into a LIBERTY system.
<i>Erase All Maps</i>	This will erase all the maps stored in the LIBERTY system. <b>Be careful with this one. Once erased, maps must be reloaded to be used again.</b>

### **3.2.1.4 View**




<i>Toolbar</i>	Allows the user to show or hide the toolbar.
<i>Status Bar</i>	Allows the user to show or hide the status bar.
<i>Live Graphical Data</i>	Invokes a new window that shows a live graphical view of the sensors. Sensors are represented by different colored balls that are solid if they are in the mapped area, and hatched if they are not (or if compensation is turned off).









### **3.2.1.5 Help**

<i>About MapCollect</i>	Displays the version number of the application.
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## **3.2.2 Toolbars**

### **3.2.2.1 Main Toolbar**

	Same as <i>File-&gt;Clear Screen</i> menu item
	Same as <i>File-&gt;Save Screen to File</i> menu item
	Same as <i>File-&gt;Print Screen</i> menu item

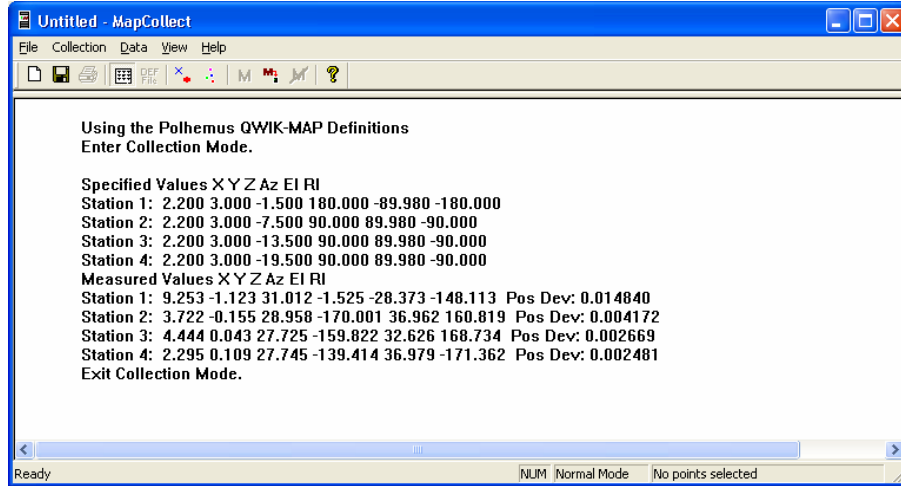
-  Same as *File->Use Polhemus QWIK-MAP* menu item
-  Same as *File->Set Definition File* menu item
-  Same as *Collection->Collect Data* menu item
-  Same as *View->Live Graphical Data* menu item
-  Same as *Data->Create Map* menu item
-  Same as *Data->Load Map* menu item
-  Same as *Data->Erase All Maps* menu item
-  Same as *Help->About MapCollect* menu item

### **3.2.2.2 Data Collection Toolbar**

-  Same as *Collection->Take Point* menu item
-  Same as *Collection->Clear Point* menu item
-  Same as *Collection->Clear All Points* menu item
-  Same as *Collection->Quit Collection* menu item

### **3.2.3 Main Text View**

The Main Text View is a window that records the actions that have been taken during the mapping operation. It will record the data collected from LIBERTY during collection, the \*.lmd file being used, and various other actions that have occurred. The text from this window may be saved to a file or printed at the user's discretion by selecting the appropriate menu/toolbar items. [Figure 27](#) is a sample of the main text window.



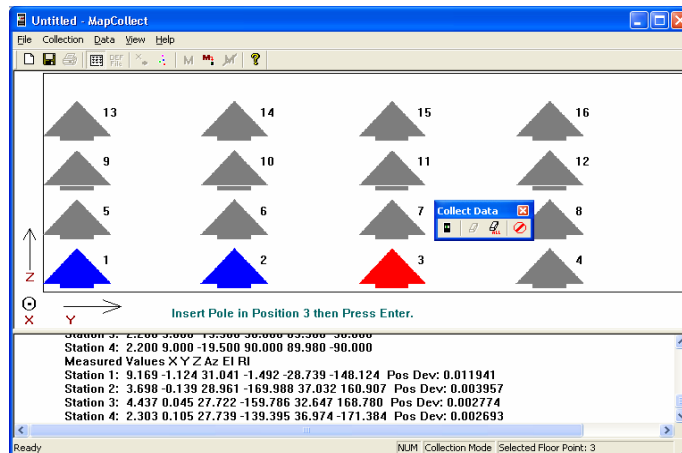
**Figure 27 Sample Main Text View window**

### 3.2.4 Grid View

The Grid View is a window that depicts the grid points of the map and shows the user the status of the collected points. The axes are labeled by arrows at the lower left corner of the grid. Note that the vertical axis is designated by  $\otimes$  to be positive in the down direction and by  $\odot$  to be positive in the up direction. These labels will change depending on the \*.lmd file definitions or the QWIK-MAP axes designations.

#### 3.2.4.1 QWIK-MAP View

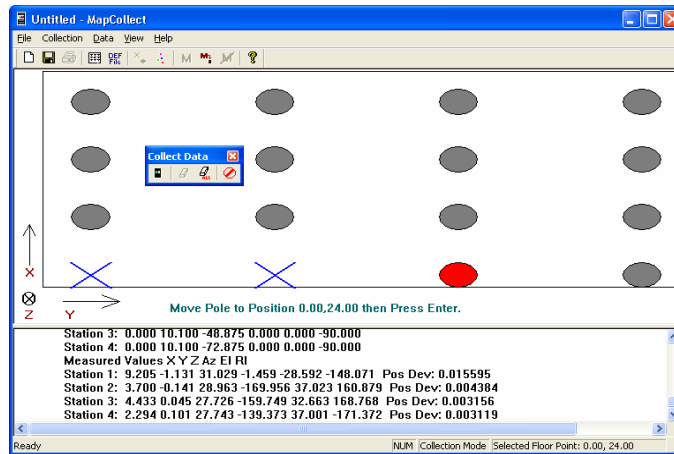
If the QWIK-MAP fixture is being used, each point is represented by an arrowhead. Each point is numbered corresponding to the numbers on the QWIK-MAP fixture. A gray arrowhead indicates an uncollected point, blue indicates a collected point, and a red arrowhead designates the currently selected point. A sample of this view is shown in [Figure 28](#). The first two points have been collected and the user is instructed to move the pole to position 3. Notice the Data Collection toolbar is floating in the Grid View Window, and the Main Text View Window is at the bottom of the main window.



**Figure 28 MapCollect Application during collection using QWIK-MAP**

### 3.2.4.2 Custom Map View

If a custom map is being collected, each floor point is represented by an ellipse if the point has not been collected, and an 'X' if the point has been collected. The current selected point will always be red (see [Figure 29](#)). In this example, the grid points located at 0,0 and 0,12 have been collected. The currently selected point is 0,24. The text under the grid instructs the user to which point to move the pole for the next grid point. Again, notice the Data Collection toolbar is floating in the Grid View Window, and the Main Text View Window at the bottom of the main window.



**Figure 29 MapCollect Application during collection of custom map**

### 3.2.5 Status Bar

As illustrated in the above screen shots, the status bar indicates whether the application is in Normal or Collection Mode. In Collection Mode the status bar will indicate the point that is currently selected, either by coordinate if using a custom \*.lmd, or by point number if using the QWIK-MAP.

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