BRx6 Sensor Calibration Using SurvCE/SurvPC

OVERVIEW

The BRx6 internal sensors (tilt, accelerometer and compass) must be calibrated in order to use the electronic bubble and tilted pole corrections in SurvCE. This document describes in detail the process for calibrating the BRx6 internal sensors using SurvCE or SurvPC version 5.05 or higher.

The complete calibration consists of three steps: 1) Tilt Calibration, 2) Magnetic Spin and 3) Directional Incline (magnetic declination).

Step 1 calibrates the tilt sensors used by the electronic bubble or LDL (Live Digital Level) feature in SurvCE. If you only plan on using the leveling features like LDL (or electronic-bubble), level tolerance checking or auto store by leveling then you only need to perform Step 1 calibration.

Steps 2 and 3 calibrate the e-compass sensors in the BRx6 and are only required if you are planning to use SurvCE's tilted pole correction feature while taking GNSS measurements in SurvCE's Store Points or Stake functions.

NOTE: The magnetic calibrations (Steps 2 and 3) are valid for a limited geographic area, depending on the local magnetic field parameters. In general, the farther you go from the calibration point (in tens of miles or kilometers, not typically feet or meters), the more the calibration accuracy degrades. SurvCE contains a simple routine called "One Point Calibration Check" that makes it easy to validate the accuracy of magnetic calibration at a new location. With the BRx6 position FIXED, go to the Equip tab, select GPS Utilities, select Sensor Calibration, then select One Point Sensor Test.

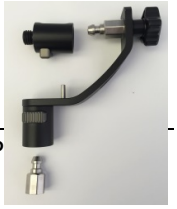
The One Point Sensor Test uses a two-step process to validate the magnetic calibrations. First, holding the pole vertical and steady, tap Start. The utility to average several FIXED positions to determine the current location. Second, lean the pole at an angle of not more than 30 degrees and rotate the receiver in different directions. The utility checks both the calculated position and elevation differences from the actual position established in point 1. As long as the position or elevation differences are less than 0.050 m (0.17 feet) with a tilt angle of 30 degrees of less, the magnetic calibration should be good. If the differences are greater the 0.050 m (0.17 feet) it would be a good idea to recalibrate the receiver before doing inclined pole corrections.

Lastly, the magnetic anomalies exist throughout the earth's surface. There may be locations where it is not impossible to use the BRx6's magnetic sensors or e-compass or to successfully calibrate the BRx6 sensors.

PREPARATION

The following equipment is required to complete all three calibration steps. Only items 1 and 2 are required for Step 1.

1. SurvCE or SurvPC version 5.05 or higher installed on your data collector
2. A quality, calibrated tribrach with accurate vials. A line vial is usually more accurate than a spherical vial. For Step 1, the tribrach can be set on a solid table or tripod, for Step 2 the tribrach should be mounted on a solid tripod.
3. Pole not less than two meters long with calibrated vial attached is required for Step 3 and can be used for Steps 1 and 2. The tilt sensor calibration will only be as accurate as the vials on the tribrach and pole.
4. A connection to a base station using the BRx6 internal radio, the BRx6 internal GSM cell modem or Data Collector Internet mode is required for step 3. It is best if the effective baseline distance is less than 1 kilometer (.6 miles).
5. Mini-rotary bracket assembly that is included with the BRx6 kit. The three mini-rotary bracket components are shown in this picture.



6. Fully charged BRx6 battery. Step 1 is not battery-dependent, but the e-compass calibration (steps 2 and 3) is tied to each individual battery in use and stored in the GNSS unit by a unique and internal battery ID. Steps 2 and 3 should be repeated for each battery that you will later use in a BRx6.
7. An open area free of strong magnetic fields and free of potential for high multipath. Examples of locations with strong magnetic fields might include metal fences, power transmission lines, antennas (WiMax, WiFi, ham radio, television, etc), railroad tracks, metal buildings, cars, and trucks. The farther you are away from a magnetic interference source the better, for example, is it better to be 20 meters (60 feet) from your vehicle than 5 meters (15 feet). If step 3 does not successfully complete the calibration, you may want to try a different location.

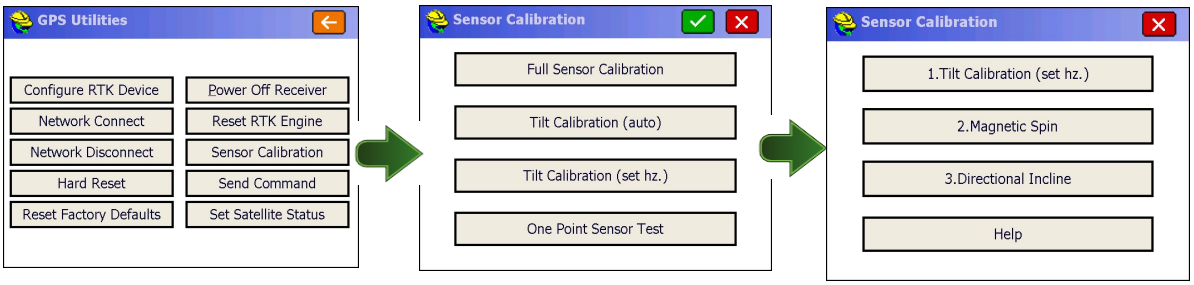
RUN SurvCE/SurvPC SOFTWARE

Turn on your BRx6.

Launch SurvCE on your data collector and connect to your Brx6. In Equip/Rover/Receiver, the *Use IMU* box must be checked. Setting the Antenna Height (Equip/Rover/Receiver), and connecting to the base station at this time will speed up the calibration process. If the quick release adapter will be used in Step 3, remember to add the 4 cm height of the quick release adapter to the Antenna Height. The BRx6 antenna offset is already hardcoded in the calibration tool, so it's not required to be part of the user entered value. For Step 3 a pole height of 2.0 meters or higher should be used.

Checking the Audible Alerts box in Equip/Configure/General will allow you to hear the alerts when each step of the calibration process is completed.

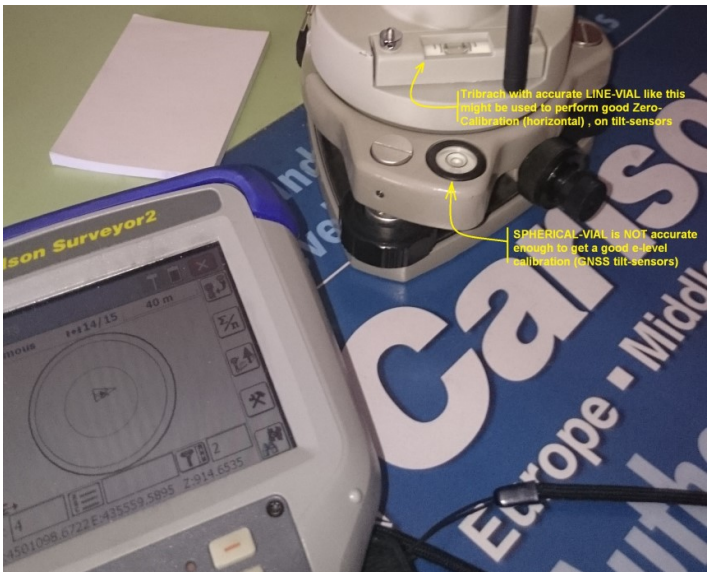
Once connected, go to Equip/GNSS Utilities. Press *Sensor Calibration* the button and then tap the *Full Sensor Calibration* button. Select “1. Tilt Calibration (set hz)”



STEP 1: Electronic Bubble Calibration

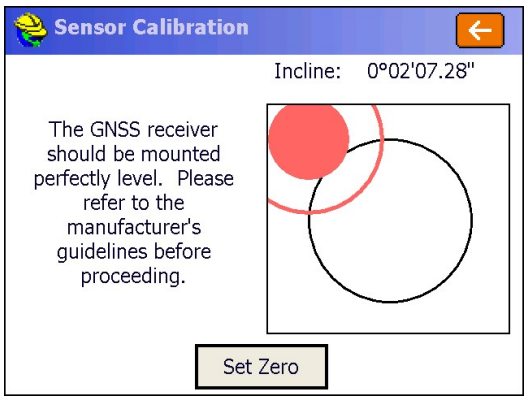
An accurate Electronic Bubble calibration will help insure successful and accurate calibrations in steps 2 and 3. The calibration step #1 can be performed either indoors or outdoors, as it is NOT affected by magnetic noise and it does not require either RTK corrections or the presence of GNSS signals.

The Brx6 can be mounted on either a tribrach or pole that has been leveled as accurately as possible. A high quality calibrated tribrach with an accurate line level in a rotating mount as shown below will provide the best calibration.

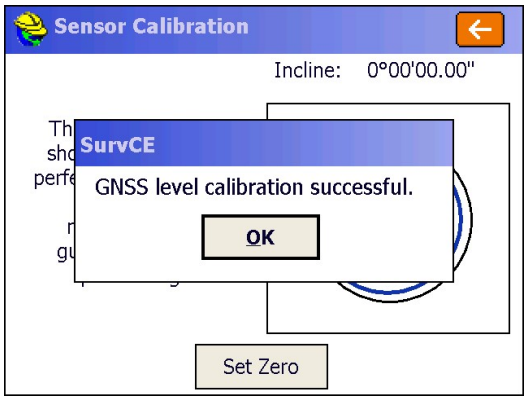


The first picture below is an exploded view of the BRx6 attached to a tribrach and the second picture shows the BRx6 and tribrach mounted on a tripod prior to performing the Step 1 calibration.

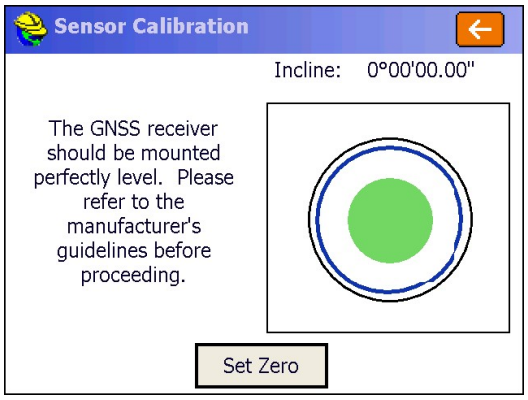
Once the BRx6 is horizontal and stable tap the *1. Tilt Calibration (set hz.)* button. This screen will appear:



Once you are sure the BRx6 receiver is level, tap the “Set Zero” button. When the tilt sensor calibration is completed, this message will be displayed.



Tap the “OK” button to close the message. The electronic bubble should now be centered.



The incline updated on the display will vary between 0°00’00.00” and 0°02’07.28”. Tap the *Orange Arrow* button to complete Step 1.

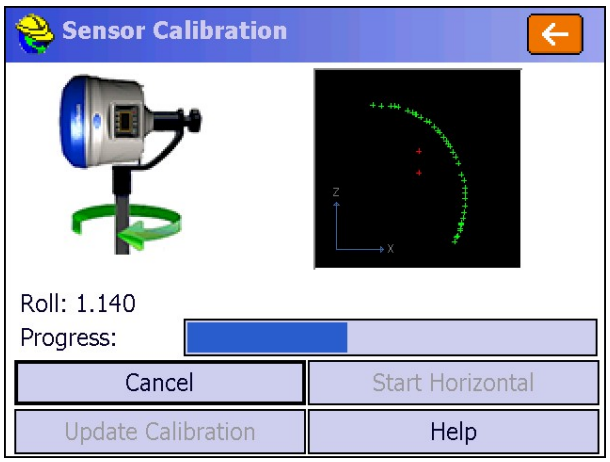
STEP 2: MAGNETIC STEP-BY-STEP

For Step 2 a tripod and tribrach can be used or a pole can be used. If a pole is used, you will need to keep the pole as vertical as possible while rotating the pole. A good way to keep the pole vertical while rotating is to grab the pole with one hand at face height while using the fingers of your second hand, to rotate the pole. If your pole is extendable, you can use a bipod to keep the pole vertical, and if you don’t lock the extendable top portion of the pole, you can rotate the top (extendable) section of the pole.

Attach the BRx6 to the mini-rotary bracket as shown in this exploded view. The second picture shows the BRx6/mini-rotary bracket/tribrach mounted on a tripod.

Tap the *2.Magnetic Spin* button to start Step 2. This screen appears:

With the BRx6 level, tap the *Start Vertical* button and slowly start rotating the pole as shown in the image on the data collector screen.

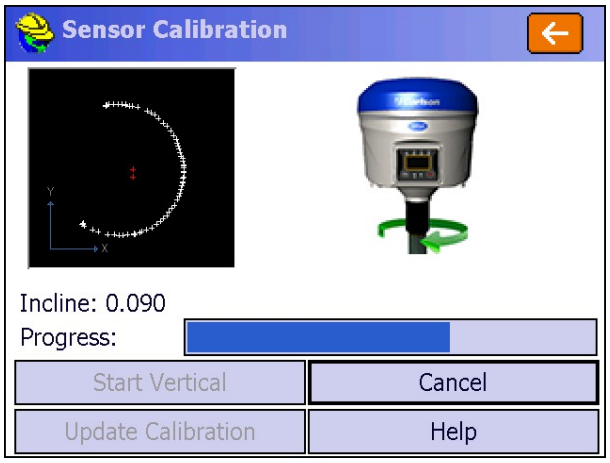


You will want to slowly rotate the BRx6 such that it takes at least 30 seconds to make one complete rotation. When Sensor Calibration app has gathered enough data, the data collector will beep, the Vertical progress bar will be full, and the *Start Horizontal* button will turn black.

Depending on the rotation speed more than rotation of the BRx6 may be required.

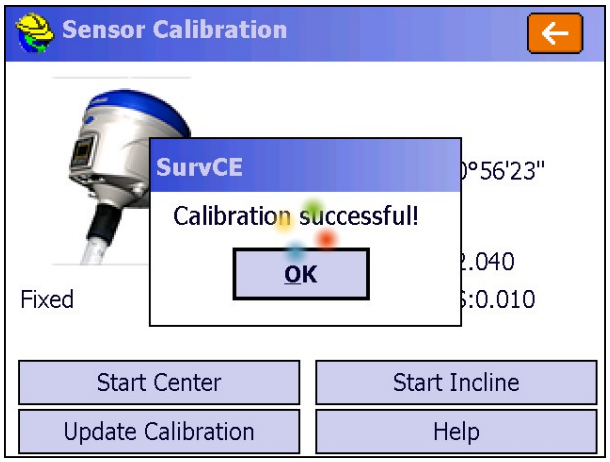
Once the Vertical rotation is complete, mount the BRx6 on the mini-rotary bracket as show below.

With the BRx6 still being level, tap the *Start Horizontal* button and again slowly rotate the pole as shown on the data collector screen below:



Continue slowly rotating the BRx6 until the Horizontal rotation is complete. When the Horizontal rotation is complete, the following screen will appear:

Tap the *Update Calibration* button to store the calibration values. When the calibration values have been stored this screen will be displayed.



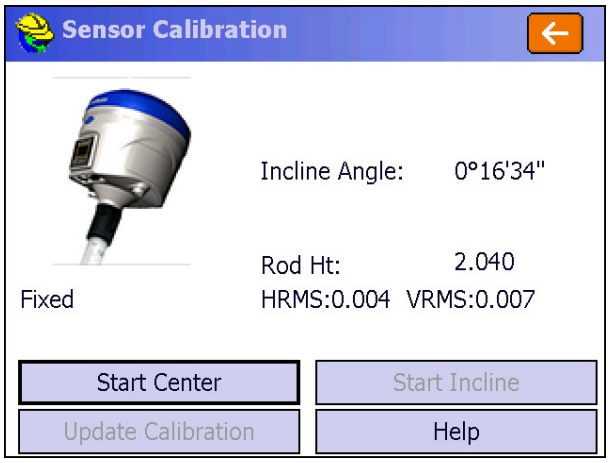
Tap the *OK* button and the *Orange Arrow* button to complete Step 2.

STEP 3: MAGNETIC ANGLE BIAS OR MAGNETIC DECLINATION CALIBRATION

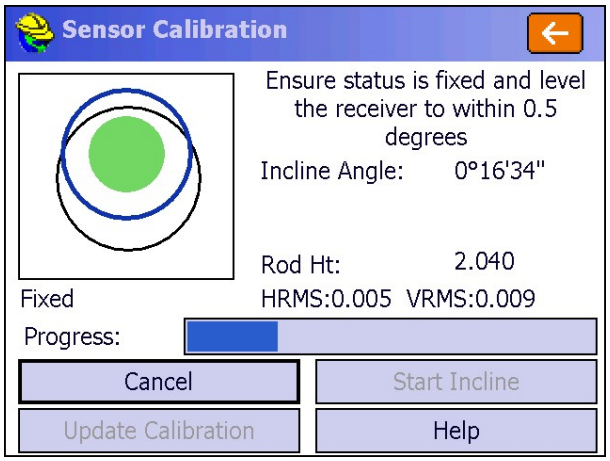
Before continuing with Step 3, make sure the unit is receiving an RTK FIX, is mounted on a pole and the correct pole height is entered into SurvCE.

A bipod can be used to hold the pole stationary and vertical as shown here.

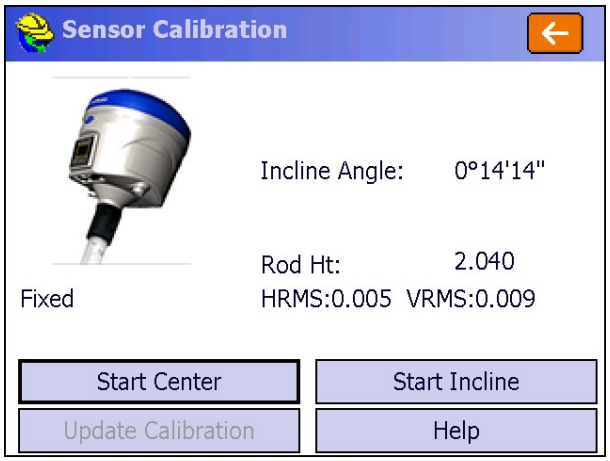
Tap the *3. Directional Incline* button to start the Step 3 calibration. The display will be similar to this:



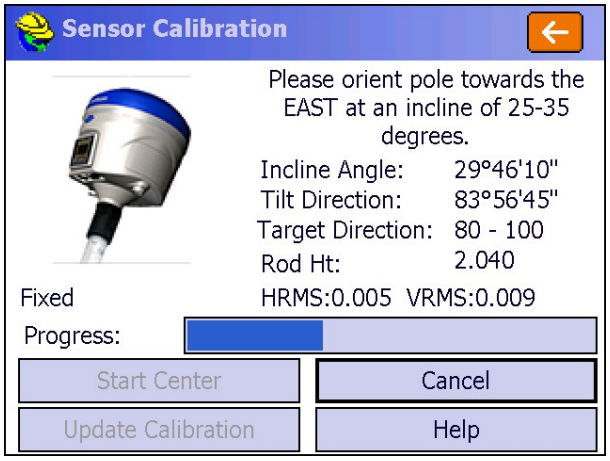
Making sure the pole is vertical (a bipod helps) and stationary, tap the *Start Center* button. If receiver is Fixed and within level tolerance, Sensor will collect and average 10 points with the progress bar advancing with each point captured.



If the receiver is not level or not FIXED, the points will not be captured and a warning message will be displayed. If points are not being captured, make the necessary adjustments as prompted on the display. When Center Pt data capture is complete, the display will show:



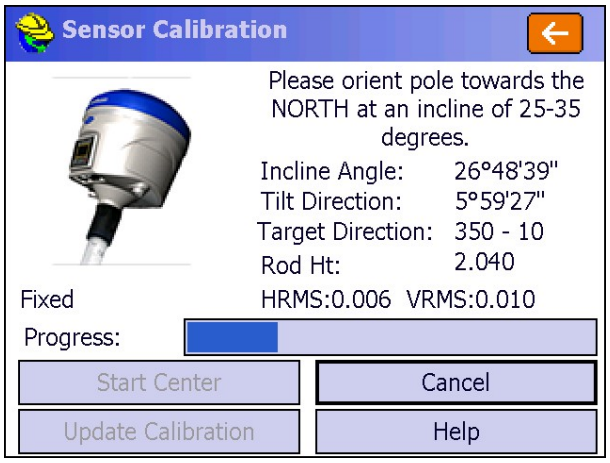
If a bipod was used to steady the pole, remove the bipod or collapse the legs so the pole can freely move in any direction. With the pole on the center point, tap the *Start Incline* button



The display will prompt you to incline the pole so it is pointing east with the pole tilted between 25 and 35 degrees. Once the pole is in the correct position, Sensor Calibration will start capturing 10 points with the progressing bar advancing each point. When the 10 points are captured, you will be prompted to point the inclined pole to the south, followed by west and north.

During this portion of the calibration, the pole is tilted 25-35 degrees, with you standing next to the point where the pole touches the ground and with the BRx6 display always facing you and you facing the cardinal direction (East, South, West, North) being collected as shown in the four picture sequence below (camera is facing south).

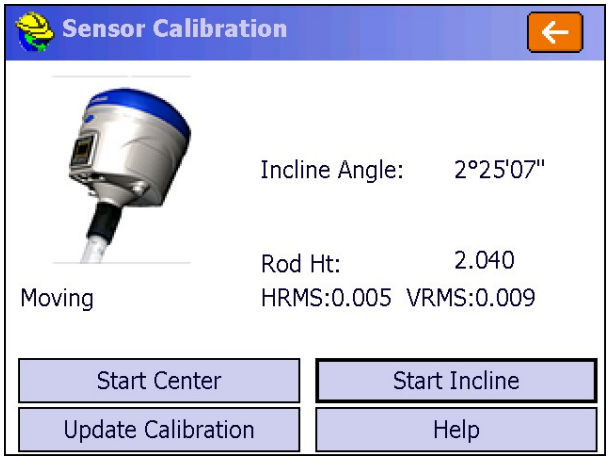
Here is a screen shot with the pole to the north:



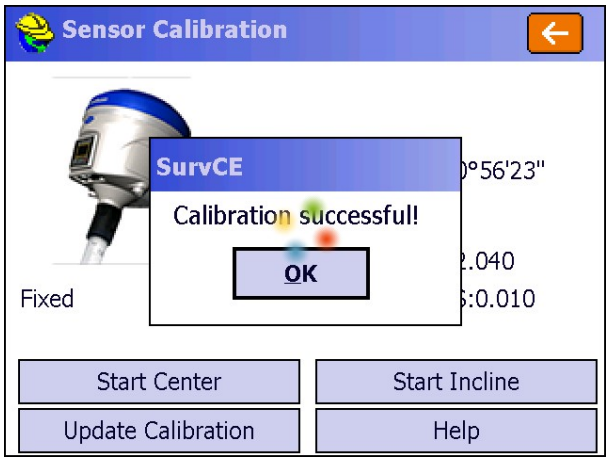
The Sensor Calibration display guides you during this process. If no points are being collected either the Tilt angle is incorrect (between 25 and 35 degrees) or the Target Direction (direction you are facing) is not correct. Once the pole and receiver are tilted correctly and pointing in the correct direction, the 10 points for that ordinal direction will be collected.

1) A compass in the pole may help for this step as you'll be directed to tilt the point within a few degrees approximation to the four cardinal directions (east, south, west, and north). With or without the pole compass, always read the values on screen as they will help you to get into the right tilt and compass direction ranges.
2) The Incline Angle shows the total-tilt angle in degrees, which should be in the 25-35 degrees range
3) The Tilt Direction is the direction of the main tilt referenced north in degrees. With a tolerance of +/- 10º, the info line in the top of the screen will be showing the accepted angle ranges on each direction (between 80º-100º when in east, 170º-190º when in south, and so on)

After collecting all four incline pole points, a screen similar to this will be displayed:



Tap the *Update Calibration* button. When the calibration values have been stored, this screen will be displayed.



Tap OK, and then tap the *Orange Arrow* button to complete the calibration.

The BRx6 sensors are now calibrated.

If multiple BRx6 batteries are used, steps 2 and 3 of the calibration process should be completed for each battery.