Sutron Barometer Calibration Procedure Using the Druck DPI740

Procedure Number: SOP # 5.4.1.4 (A1)
Created: August 17, 2012
Created By: Lynn Asbeck, The Met Team
Approved By: Manoj Samant
Revised: Caleb Gostnell, February 28, 2020

1. **Title** Sutron Barometer Calibration Procedure Using the Druck DPI740

2. **Purpose** The following procedure documents how to install a new Sutron field barometer in a Sutron Xpert data collection platform and how to calibrate an already-installed barometer in the field. Calibrations are performed in the field to ensure that the highest quality data is disseminated from the sensors.

3. **Background/History** NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) maintains a network of water level, oceanographic, and meteorological sensors throughout the United States and its territories. While CO-OPS's primary focus is on water levels, the network of meteorological sensors provides important ancillary information to scientists, modelers, marine users, local community managers and other NOAA partners. Annual calibration of the installed field barometers is necessary to maintain appropriate data quality.

   This document supersedes the *Barometer Calibration Guidelines for Sutron Xpert DCP Systems* published November 2008 and the *Sutron Accubar Barometer Field Calibration* published February 2008.

   In these previous versions, the installed barometer was compared to a handheld barometer using a local comparison at the height of the installed barometer. Data was then converted in the Sutron Xpert data collection platform to reflect atmospheric pressure at mean sea level (MSL) by applying an offset. This new procedure uses the internal conversion capability of the handheld barometer to compare the barometric pressure of both instruments at MSL. This change eliminates performing calculations in the field and takes into account local temperature when determining the calibrated atmospheric pressure at MSL.

4. **Scope/Applicability** This procedure applies to all CO-OPS personnel who service or install barometers at water level or meteorological stations, whether personnel are in-house or under a maintenance contract or task order. CO-OPS partners who maintain independent stations with barometers are strongly encouraged to adopt the guidelines in this SOP when performing barometer calibrations.

5. Main Processes

Calibration of the field barometer should be performed using a NIST-certified handheld barometer once a year during the annual inspection. Processes include:

1. Install barometer and determine elevation of barometer above Mean Sea Level (or above IGLD in the Great Lakes, which is approximately equal to MSL).
2. Compare the readings of the handheld barometer and the installed barometer.
3. Enter this calibrated value into the Xpert.
4. Note the barometer offset value in the Xpert and the date and time in UTC.
5. Enter this offset value and date and time into the appropriate site report.

6. Detailed Sub-Processes/Checklists

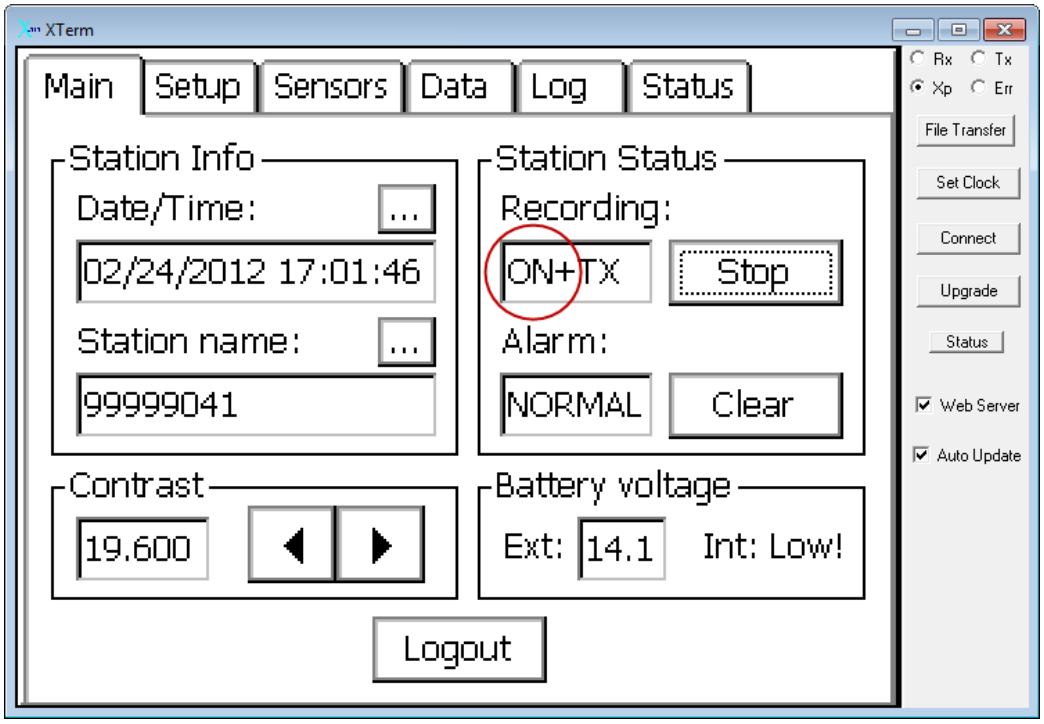
Barometer Setup For New Installations Only:

1. Install the new barometer in the Sutron Xpert data logger enclosure. Ensure that the barometer is vented to atmosphere via tubing that extends outside the data logger enclosure.

2. Tie in the barometer to the existing benchmark network via leveling and steel tape measurements. Obtain the barometer height above station datum (or above IGLD at Great Lakes stations) For more information or if this station has no nearby benchmark network, consult the *Procedure to Establish a Meteorological Sensor Reference Mark and to Measure Meteorological Sensor Heights* SOP for additional guidance.

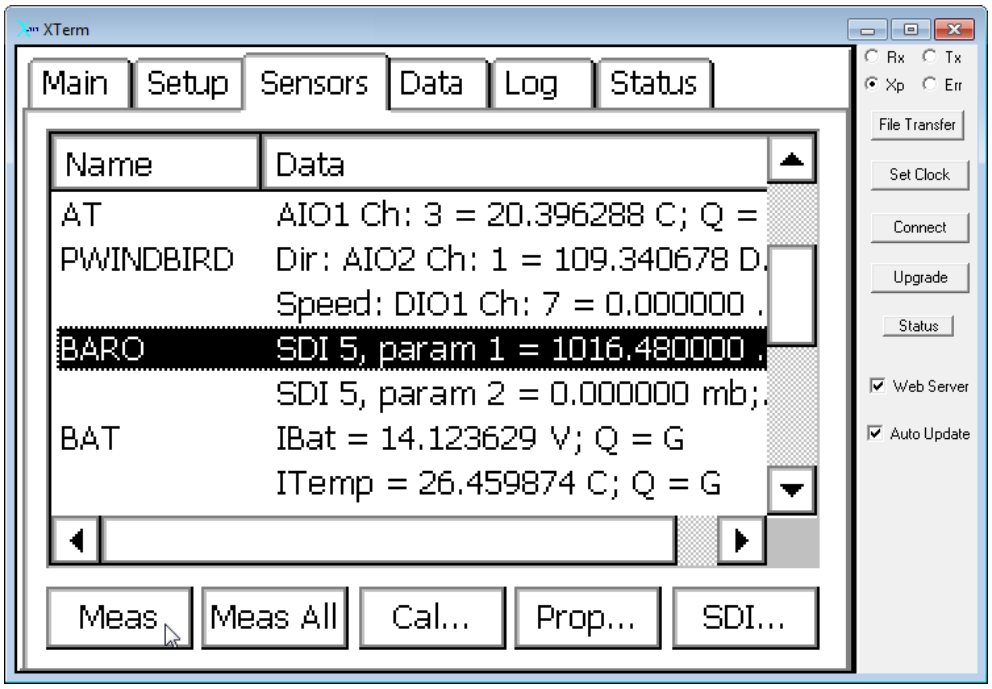
3. For non-Great Lakes stations, convert this height above station datum to the height above mean sea level (MSL) using the conversion listed in the Project Instructions or from the Engineering Division. Great Lakes stations do not need this extra conversion since IGLD is approximately equal to MSL.

4. Make sure the Xpert is running, using the appropriate setup files, and that logging is **ON**.



5. Set the handheld barometer to **LOCAL** mode (press the **MODE** button until **LOCAL** appears in lower left of screen). Confirm that the reading is in millibars.

6. Choose the **Sensors** tab on the Xpert screen, find the **BARO** entry and choose **Meas** to update the barometer reading.

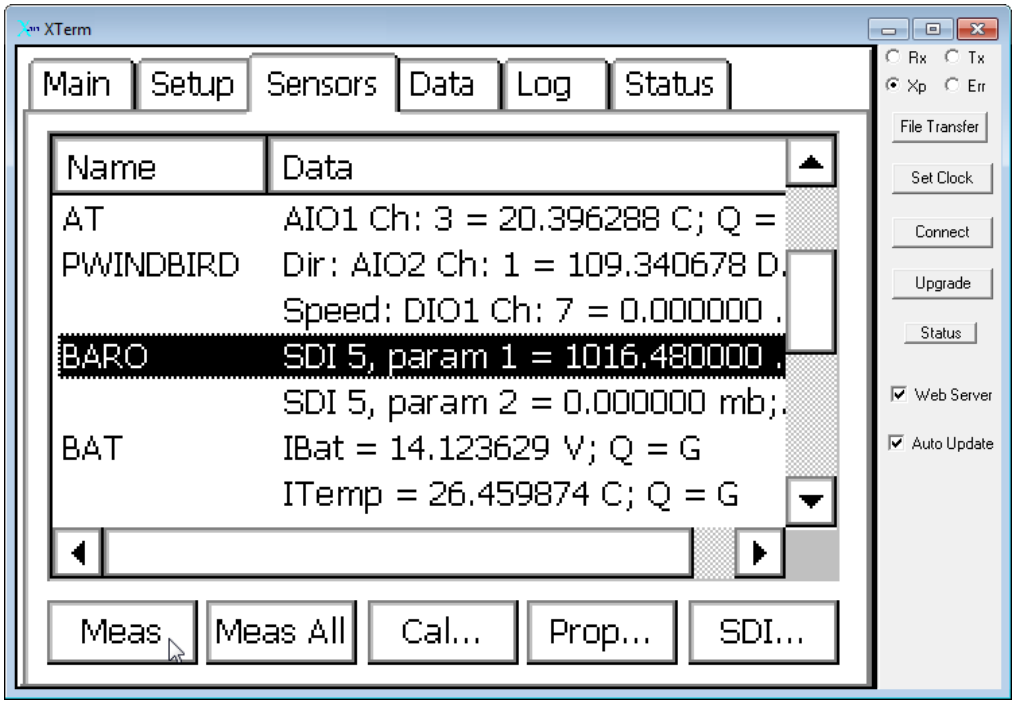


7. After measuring is finished, hold the handheld barometer near the installed barometer and confirm that two are within +/- 5 mbar of each other for coastal stations, and have a difference of -5 to 30 mbar for Great Lakes stations. This is to check that the barometer has not been damaged in shipping.

Field Calibration of Barometers (New or Existing)

The barometric pressure value shown in the Xpert is adjusted by an offset to read pressure in millibars at mean sea level (MSL). Rather than using a reading from the handheld barometer at the height of the installed barometer to manually calculate the offset, this field calibration procedure uses an internal conversion in the handheld barometer to compare both barometers at MSL. This internal conversion also takes into account the effect of local air temperature, input by the field technician.

1. Ensure that the Xpert is running and logging is **ON**. Navigate to the **Sensors** tab and find the **BARO** entry. Click on **Meas** to update the barometer's value.



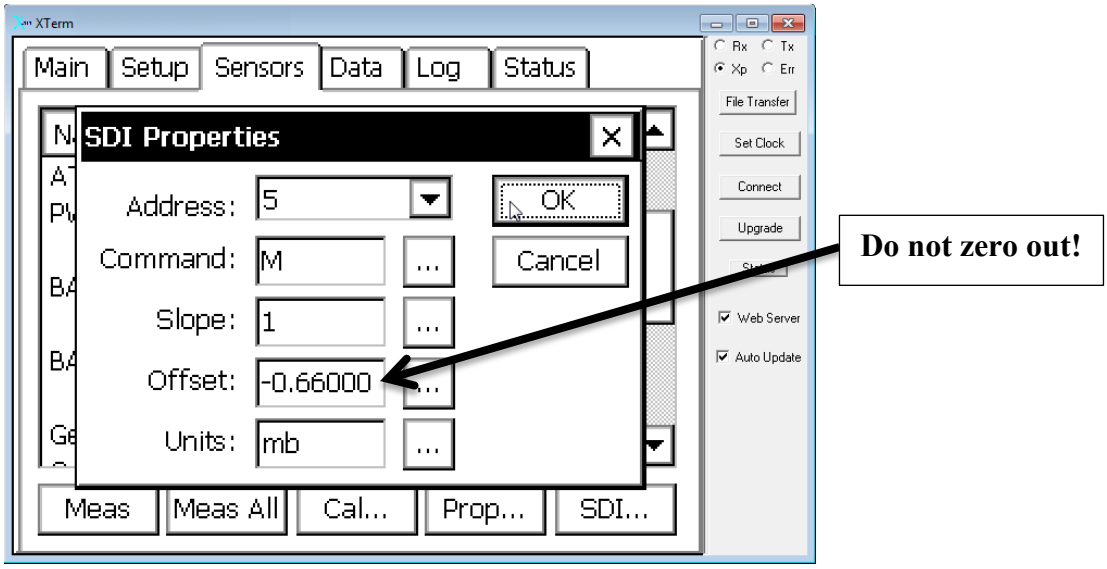
2. Set the handheld barometer to **SEA** level mode using the height of the barometer above mean sea level, from the SM checklist, and the measured ambient temperature. See Appendix A for details on configuring the handheld barometer.

3. Hold the handheld barometer with the air pressure input port (metal fitting at the top) centered over the middle of the installed barometer. Let the readings stabilize for about 20 seconds. Note the reading on your handheld unit.

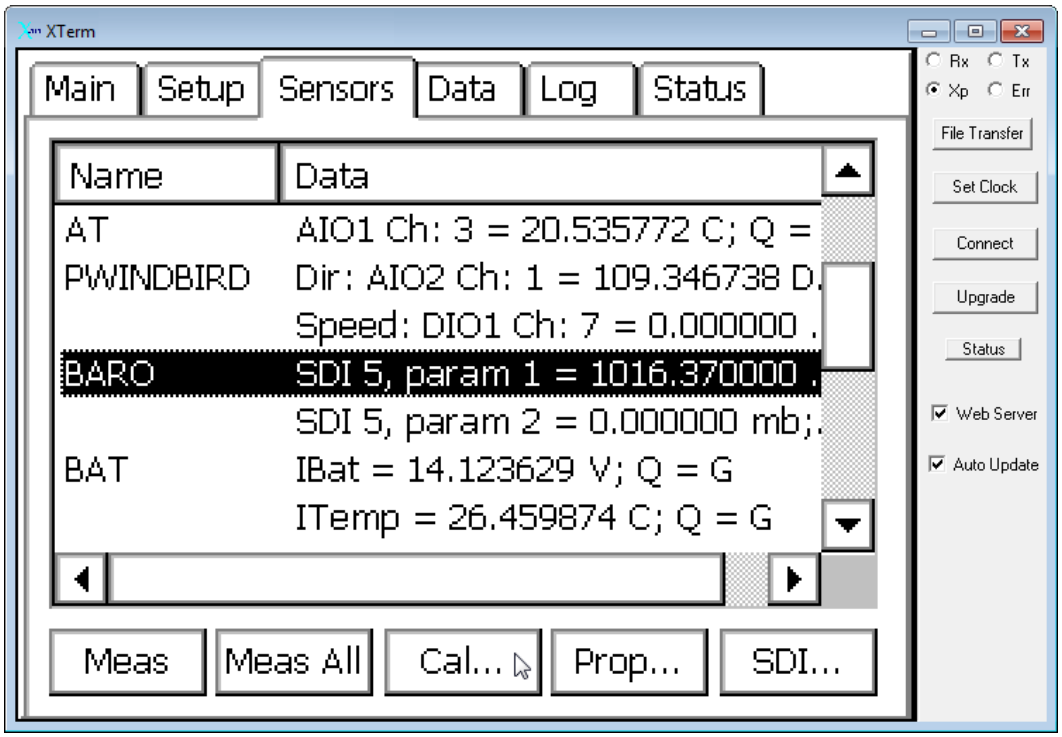
4. **[FOR EXISTING UNITS ONLY]** If the reading on the installed barometer is within **0.6 mbar** of the reading on the handheld barometer, you are finished. If the difference is between **0.6 mbar** and **1.0 mbar**, continue on with the calibration procedure below. If the difference is greater than **1.0 mbar**, replace the barometer and start the procedure from the beginning.

   These adjustment criteria are based on the accuracy and precision of the handheld and installed barometers.

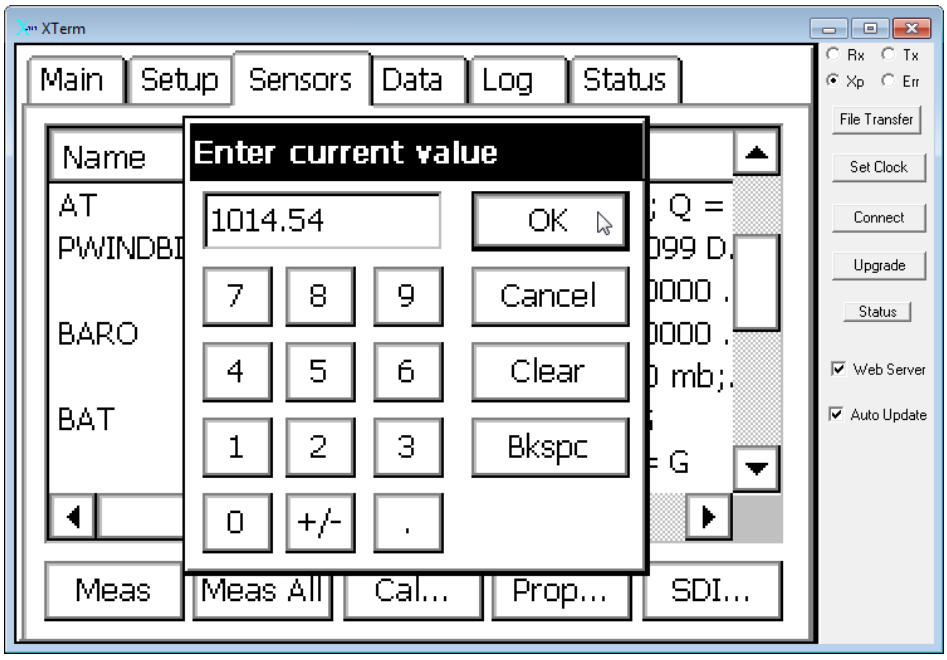
NOTE: There is no need to 'zero out' the barometer offset value during this calibration procedure, or make any change to the offset. Instead, the following procedure will cause the offset value to automatically update within the DCP. Crews are only required to copy over that value to the Esite report for documentation. If the offset is zeroed out, the previous year's calibration is lost and the barometer will likely need a full recalibration (because it will fall outside of the 0.6 mbar criteria). When retaining the offset in the Xpert, the calibration procedure starts from an assumption of "some calibration from last year," rather than starting from an assumption of "no calibration at all." This makes it more likely that the difference between the handheld and installed barometers will fall into the less than 0.6 mbar difference level and no further action will be needed.



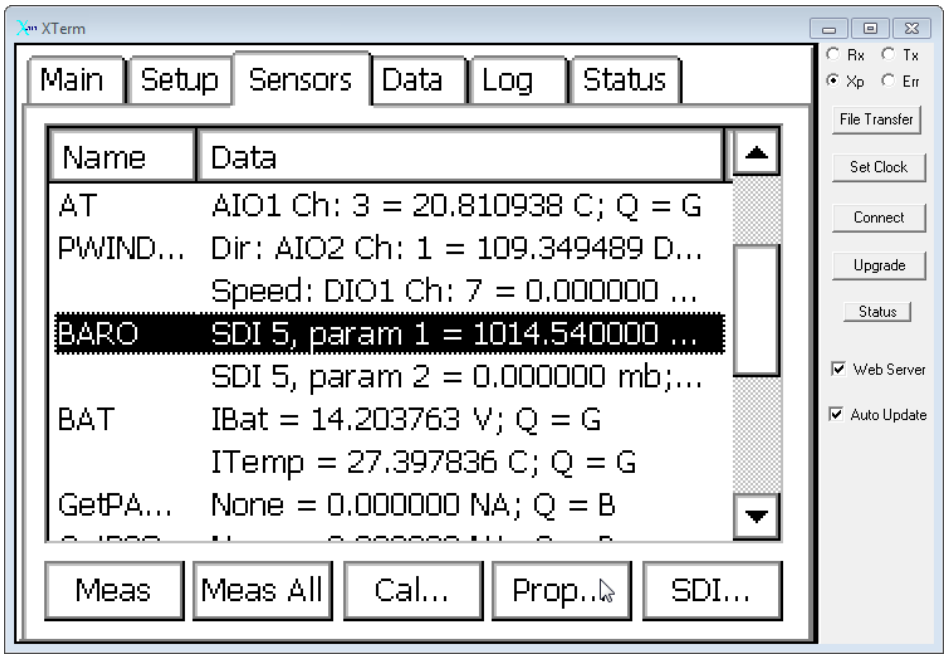
5. For new installations or to recalibrate existing installed barometers, press the **Cal…** button in the Xpert to get to the barometer calibration screen.



6. Enter in the real-time value of the handheld barometer and press **OK** to calibrate. The Xpert's hourglass will appear; this process may take a little while.

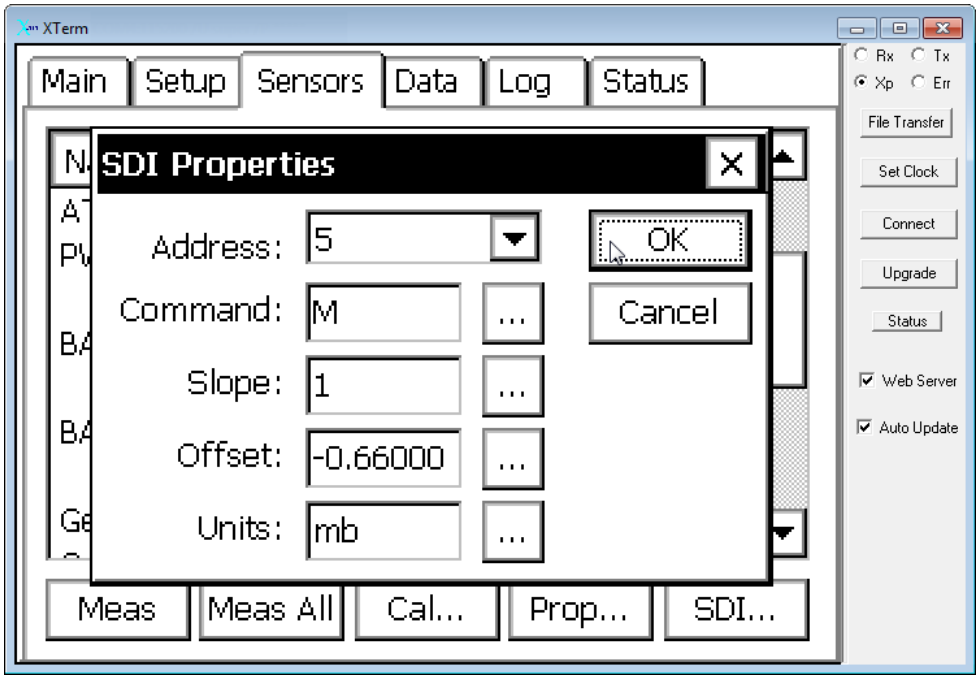


7. When back on the **Sensors** tab, choose the **Prop…** button to see the barometer properties.



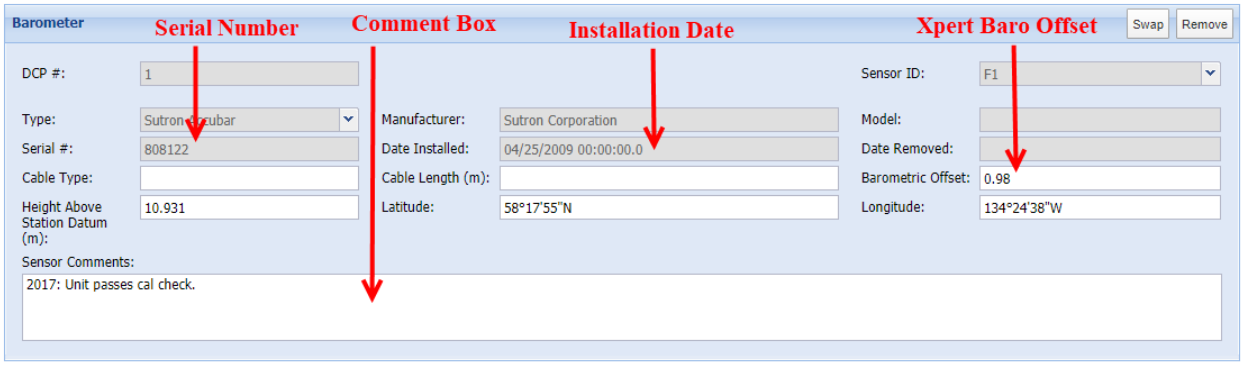
8. Choose **Yes** to stop logging.

9. **Record** the value of the barometer offset (but do not change). This should roughly be in the range of -1.0 to 1.0. Ensure the other settings on this page are correct as shown below. Contact SIL or CIL for assistance with questions about other settings on this tab.



10. Choose **OK** to close the **SDI Properties** page and click **Yes** to restart recording.

11. Under the Barometric Pressure field in the "Sensors" tab of the eSite report, enter the barometer offset from the Xpert's **SDI Properties** screen and verify the unit's serial number in the corresponding boxes. If the unit has just been installed, note the date and time of installation in the appropriate box. In the comment box, record the UTC date and time of calibration and the barometric pressures in millibars shown on the handheld and installed units at the time of calibration. Additional details about the calibration or status of the sensor can also be included in the comment box.



Note: Partners or personnel working under a maintenance contract or task order should follow this procedure as closely as practicable and should use a barometer that has a NIST-certified annual calibration with accuracy of ±0.004 inHg absolute, or better. The barometer should also be able to internally convert to read at MSL by taking into account the height of the handheld unit and local temprature.

7. **Quality Assurance/Control** The Field Crew Chief will ensure that the hand held barometer NIST-certified annual calibration date is within one year and all field and documentation requirements are met. The Data Monitoring and Assessment Team (DMAT) can identify any suspect barometric data and can validate barometer calibration against nearby stations before data is disseminated. The Operational Engineering Team will ensure the required documentation of barometer calibration is met.

8. **Management/Responsibility** The Field Operations Division Branch Chiefs who oversee field crew activities have the responsibility of ensuring that all CO-OPS field crews are properly equipped and trained to perform and/or supervise this task. Task Managers have oversight responsibilities for contractors and ensure CO-OPS requirements are met as required. The CO-OPS Meteorological Team in the Oceanography Division is responsible for establishing the barometric data acquisition requirements and updating this SOP.

APPENDIX A

WORKING WITH THE DRUCK DPI740 HANDHELD FIELD BAROMETER

Check the DPI740 baro settings before entering the installed barometer elevation:

- Adjust the barometer to accept height input in meters
  1. Press the **MODE** button until **ALTITUDE** appears in the lower left corner of the screen.
  2. Press the **F2** button until **m** appears in the lower right corner of the screen.
  3. Press the **MODE** button to return to the main measurement window.

- Adjust the barometer to read in millibars
  1. First try pressing **F2** to choose **mbar** from one of the three pre-set measurement units.
  2. If **mbar** does not appear when scrolling with **F2**, press the **SET** button and then **F2** to get to unit selection.
  3. The barometer can store three separate units you wish to measure in. Scroll through the choices using **F2** until you reach **mbar**. Press **SET** to select.
  4. The barometer then gives you the option to choose the two other pre-set units. Either set them at an appropriate unit or press **SET** twice to use the default units and return to the main measurement window.
  5. If needed press **F2** to scroll through the three unit types you have just set to get to millibars.

Enter the installed barometer elevation into the DPI740:

- Set the barometer to **SEA** level mode
  1. Press the **MODE** button until **SEA** appears in the lower left of the screen.
  2. Enter in the height of your installed barometer above MSL (or if in the Great Lakes then enter the height of the installed barometer above Station Datum) by selecting the **F1** button under **SEA** and then the **F2** button under **SET_QFF**. Use the **F1** and **F2** keys to select the appropriate height and then press **SET**.
  3. Use a handheld thermistor thermometer to determine ambient temperature and set this temperature value in the handheld barometer. To do this, use the **F1** and **F2** keys to select the appropriate temperature and then press **SET**. The handheld barometer is now set to read the pressure adjusted to mean sea level.