

## Maximizing Accuracy in Water Level Monitoring with Dynamic Density Correction

Jon Thomas, Technical Support, In-Situ Inc.  
July 2007

### Introduction

In-Situ's Aqua TROLL<sup>®</sup> 200 water quality instrument measures and records Conductivity, Pressure, and Temperature. Using these three sensors, many derived parameters are available, such as Water Level, Actual Conductivity, Specific Conductivity, Salinity, Total Dissolved Solids, Resistivity, and Density. The Aqua TROLL 200 may be configured to automatically and continuously correct water level readings to compensate for changes in water density due to changing salinity. This feature greatly improves accuracy of water level measurements in estuaries and coastal waters, where salinity is temporally and spatially variable.

### Gravitational Correction Factor

In order to convert pressure measurements to water level measurements, two factors are required: water density and acceleration due to gravity at the location of interest.

Water density is a function of temperature and quantity of dissolved solids. Tables are available in text books and on the internet to show the density of pure water at various temperatures. In a laboratory, water density may be measured with a hydrometer. The Aqua TROLL 200 calculates water density using readings from the temperature and conductivity sensors. For complete details on the equations used for the density calculation, refer to In-Situ's Tech Note "Aqua TROLL 200 Measurement Methodology."

Acceleration due to gravity is a function of latitude and elevation. Gravity is weaker at lower latitudes:  $9.78 \text{ m/s}^2$  at the equator,

compared to about  $9.83 \text{ m/s}^2$  at the poles. Gravity is weaker at higher altitudes; this is due to an increased distance from the center of the earth. For complete details on the equations used for the gravitational acceleration calculation, refer to In-Situ's Tech Note "Water Level Accuracy - Correcting for Errors Due to Gravitational Acceleration and Liquid Density."

### Use Win-Situ 5 to Configure the Level Parameter Settings

The control software for the Aqua TROLL 200 is Win-Situ<sup>®</sup> 5 for the PC, or Win-Situ Mobile for the RuggedReader<sup>®</sup> Pocket PC. For simplicity, this tech note will describe how to perform all actions using Win-Situ 5; Win-Situ Mobile has the exact same functionality as Win-Situ 5. For assistance using Win-Situ Mobile, consult the Help Menu.

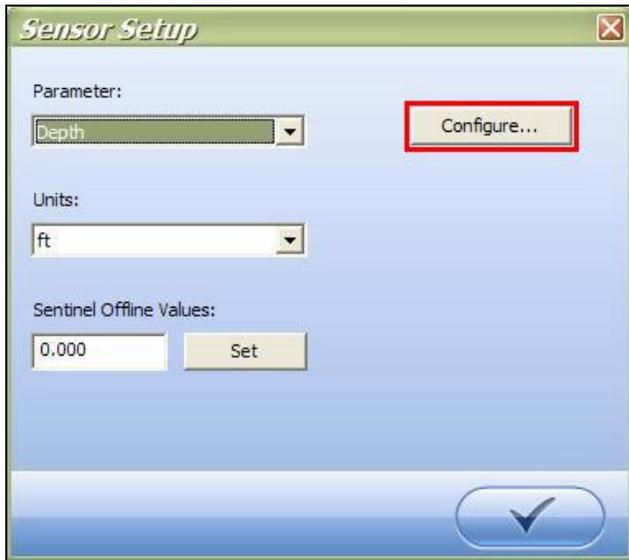
1) Establish a connection with the Aqua TROLL 200 using Win-Situ 5 and click the Sensors Tab:



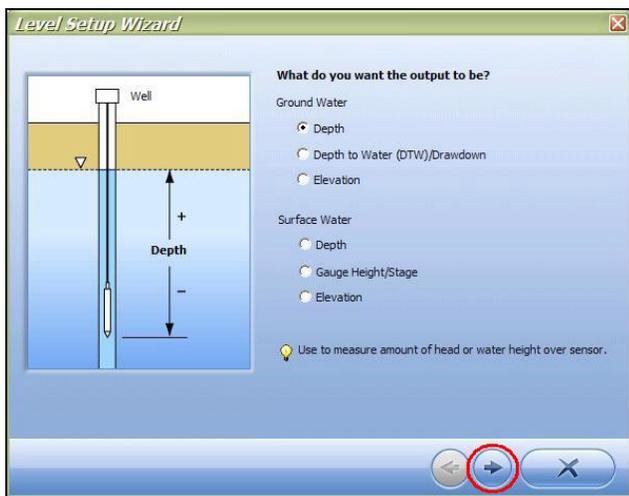
2) Click the 'Pres/Conductivity' sensor to highlight it. Then click the Sensor Setup Icon, which looks like a wrench:



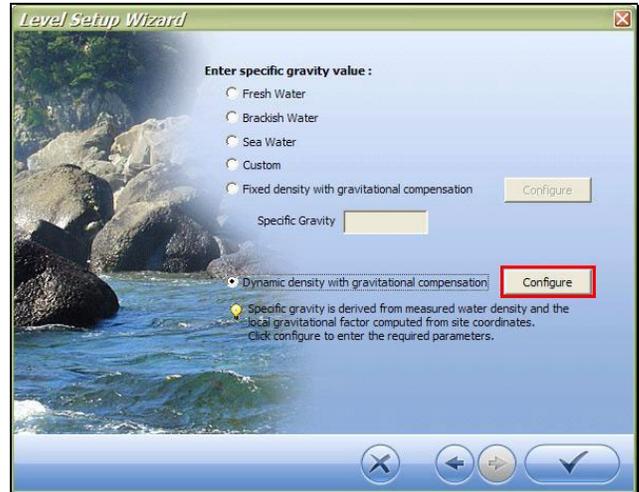
3) On the new Sensor Setup Window, use the pull-down menu for 'Parameter' to select the Level channel, which may be named 'Depth' or 'Level-DTW' or 'Level-Surface.' Complete details about Level channel modes may be found in the software's Help Menu or the Aqua TROLL 200 Operator's Manual. Click the 'Configure' button to advance.



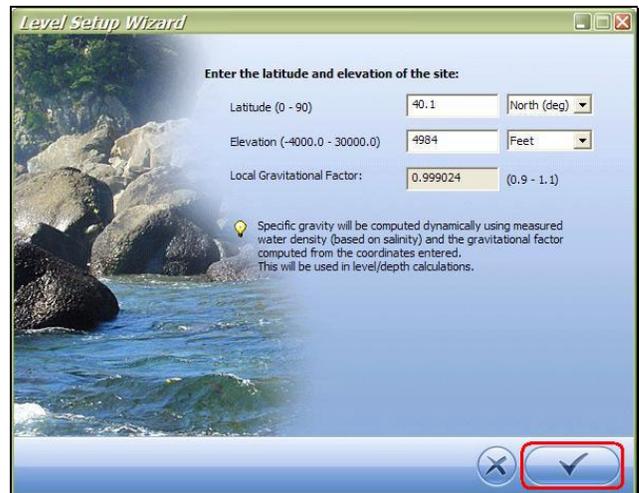
4) On the following screen, select the desired output mode and click the right-pointing arrow. If the user selects any mode other than 'Depth,' the next screen will prompt for level reference settings. Consult the software's Help Menu or the Aqua TROLL 200 Operator's Manual for more information about level reference settings. If needed, click the left-pointing arrow at any time to go back one screen.



5) The next screen shows six radio buttons, which define the options for specific gravity. Click the bottom-most radio button, labeled 'Dynamic density with gravitational compensation.' The next screen should appear automatically; in the event that it does not, click the 'Configure' button.



6) Enter the Latitude and Elevation on the following screen. Use the pull-down menus as needed to change the units of each value. The software automatically calculates and displays the Local Gravitational Factor. Click the checkmark icon to close the Level Setup Wizard and save all settings. If needed, the user may click the 'X' button at any time to exit the Level Setup Wizard and revert to previous settings.



## Conclusion

Using Win-Situ 5 or Win-Situ Mobile control software, the Aqua TROLL 200 water quality instrument may be configured to automatically compensate each water level reading to adjust for changes in water density. Typically due to changes in salinity, this feature greatly improves accuracy of water level measurements in estuary and coastal applications, or any environment in which the water density is variable.

## Further Reading

Please review the following documents for more information about the Aqua TROLL 200, its operation, accuracy specifications, and measurement methodology. All documents are available for free download from In-Situ's website.

- Operator Manual: Aqua TROLL 200
- Software Help Menus: Win-Situ 5 or Win-Situ Mobile
- Tech Note: Aqua TROLL 200 Conductivity Accuracy
- Tech Note: Aqua TROLL 200 Measurement Methodology
- Tech Note: Water Level Accuracy – Correcting for Errors Due to Gravitational Acceleration and Liquid Density

### **For more information, contact In-Situ Inc.**

221 East Lincoln Avenue  
Fort Collins, CO 80524  
Toll-Free 1-800-446-7488 (U.S. & Canada)  
Internet: [www.in-situ.com](http://www.in-situ.com)

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