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Measuring Dissolved Solids Accurately

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Figure 1: Ultrameter II Models — Myron L Company manufactures two UMII models, the 6Psi and the 4P. The 6Psi measures pH and ORP in addition to dissolved solids and features an LSI/Hardness calculator.

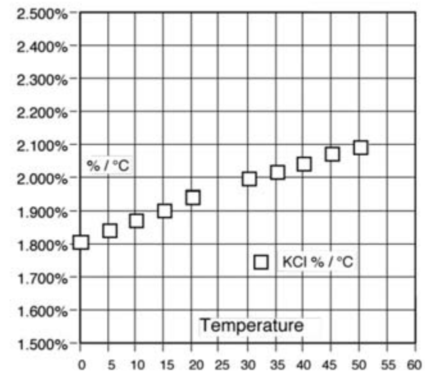

Figure 2: Example Temperature Compensation — The KCl values used for temperature compensation in the Ultrameter II vary with temperature accurately rather than using single average values.

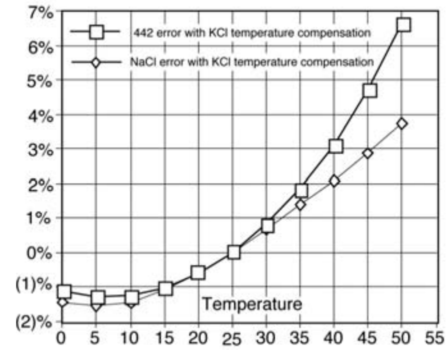

Figure 3: Example Error from Wrong Solution Selection — The graph illustrates the error that would result from selecting KCl for a solution that should be compensated as NaCl or as 442 in the range of 1000 µS.

Since 1957, the Myron L Company has designed and manufactured accurate, reliable, simple to use analytical instruments for a wide variety of water quality applications. Demanding uses range from testing boiler water to ultrapure water control and verification of dialysate for artificial kidney machines. Some of the company's analog handheld instruments are so reliable they have been in use for almost 50 years.

Ultrameter II digital handheld instruments are even more reliable, easier to use and more accurate than any of their previous analog meters. Their high performance not only sets them apart from other Myron L handheld meters, but puts them in a class superior to all other handheld water quality meters. (See Figure 1.)

Both the Ultrameter II 6Psi and 4P models measure conductivity, resistivity and Total Dissolved Solids (TDS) to within ±1% of READING over the entire measurement range (and better than ±0.1% at or near calibration). The Ultrameter II accomplishes this exceptional accuracy through the proper modeling of standard solution characteristics using built-in, proprietary conversion algorithms for temperature compensated readings and advanced conductivity cell design.

Pure water is a very poor conductor of electricity. Solutions with a high amount of dissolved solids conduct electricity very well because of the high amount of electrically charged particles or ions present. This makes conductivity a good indicator of the concentration of dissolved solids in solution. Resistivity (the inverse of Conductivity) is preferred when concentration of ions in solution is expected to be very low (e.g., ultrapure water). TDS is better for determining the actual number of particles in a solution. Since both resistivity and TDS measurements are based on conductivity, the accuracy of an instrument's conductivity measurement capability is paramount.

Solution conductivity varies greatly with temperature. This means the conductivity of the same solution at differing temperatures cannot be directly compared. Compensation to a common temperature, generally 25°C, is necessary, then, to create a basis for comparison. A very inaccurate way to do this is to use a generic temperature compensation slope, for example 2%/°C for naturally occurring water, that assumes changes in conductivity are directly proportional to changes in temperature. This is actually true only for a very narrow range of temperatures and doesn't take into account the behavior of solutions of varying ionic compositions.

Because temperature compensation values are unique to solution type, using the proper solution characteristics to model is critical to accurate conductivity readings. Rather than use a generic method, the Ultrameter II is preprogrammed with compensation algorithms for the three common salt solutions, KCl, NaCl, and 442™, that model the most encountered types of solutions. Based on extensive bench testing, these algorithms take into account critical points for changes in the behavior of the solutions in response to changes in temperature to get the best measurement possible (see Figure 2). Choosing the right solution compensation model for your application greatly affects accuracy, especially for hot or cold solutions (solutions outside the range of 15-20°C). If the wrong conversion algorithm is applied, increased error in the reading results (see Figure 3).

The type of solution compensation model selected is dependent on the application in which the Ultrameter II will be used. KCl is typically selected when historical data is based on KCl compensation. This is common in industrial applications where KCl is favored for its stability. Though the solution measured may not closely match the KCl standard, as long as the ionic composition of both the sample and the calibration standard used remain constant over time, relative changes in concentration will be accurate. NaCl is typically selected for brackish or sea water applications where the concentration of the sodium ion is very high. This model is also preferred for measuring dialysate, which contains a very high sodium component as well. 442™ is the best choice for freshwater applications. The 442™ standard is a proprietary formula specifically developed by the Myron L Company to model the characteristics of natural water. It contains sulfates, carbonates and chlorides, the three predominant components of "natural water," in naturally occurring proportions.

Figure 4: Extreme Accuracy On-the-Spot — The Ultrameter II is lightweight and compact, easy-to-calibrate and easy-to-use. It's also waterproof and buoyant, making it ideal for field testing. Store readings in memory and download wirelessly with optional bluDock™ accessory.

Conductivity cell construction also greatly affects the accuracy of measurements. The cell design must minimize polarization caused by the accumulation of ions near the electrodes. Some instruments attempt to solve this problem by coating electrodes with platinum black to increase current density, but platinum black is very easily scratched. This makes platinized cells a poor choice for viscous samples and suspensions that can damage the coating. Also, the cell constant of platinized cells drifts easily, requiring frequent calibration. The Ultrameter II avoids these issues by using electrodes made of durable stainless steel.

Some lower quality instruments also use a 2-wire cell that passes an electric current through a solution to determine the difference in voltage between the electrodes. This method is less accurate because the resistivity of the solution and the resistivity of the electrode are measured (due to polarization field effects on the electrodes). The Ultrameter II utilizes an advanced 4-wire cell technology that measures conductivity directly and needs only a negligible current to operate, eliminating the influence of electrode polarization. The Ultrameter II also employs a unique proprietary mechanism that further stabilizes the conductivity reading, setting it apart from all other instrumentation. FN

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