

Calibration of the High Purity 8362 sc pH Electrode

Introduction

The calibration of online low conductivity pH probes can be extremely time-consuming. After exposure to a high ionic strength calibration buffer, equilibration back to the low ionic strength process water can take hours. In order to avoid this delay, ASTM D5128 recommends a routine calibration with a grab sample and a standardized laboratory electrode. The portable Hach® HQD meter and low ionic strength PHC281 Intellical™ electrode can be used to quickly calibrate the Hach 8362 sc process pH electrode. This application note describes how to perform this routine calibration.

Background

A critical water quality indicator in the high purity/low ionic strength water produced for the steam cycle is pH. Accurate online pH measurement allows power generators to monitor the effectiveness of pH treatment strategies. The 8362 sc High Purity Water pH Panel is designed to provide the most reliable and accurate pH monitoring system for these low conductivity matrices. The conductive flow chamber and stainless steel construction minimize interference from streaming potentials. The self-pressurized gel electrolyte reference electrode minimizes error from electrolyte contamination. The high-quality temperature probe and seven pre-loaded matrix temperature compensation calibration curves ensure the best accuracy in these temperature-sensitive matrices.¹

Initial and ongoing calibration of pH electrodes is essential for obtaining accurate measurements. Calibrations are performed with buffer solutions prepared at known concentrations. These buffers have a much higher ionic strength than high-purity steam cycle water. This significant difference in strength makes calibration of a low ionic strength electrode time consuming. The electrode must equilibrate with the high ionic strength buffers for the calibration, and then re-equilibrate with the low ionic strength process water.



Figure 1: 8362 sc pH Panel

ASTM D5128 recommends three to four hours of re-equilibration after exposing the electrode to the calibration buffer. While this delay is unavoidable during initial calibration, much quicker ongoing calibrations may be performed with grab samples following ASTM D5464.

¹ Pre-loaded matrices recommended in ASTM D5128 and VGB-S-006-00-2012-09-EN. Available with 9500/SC200 Ultrapure Controller only.

Grab Sample Calibration

After the initial calibration and equilibration of the 8362 sc process electrode, ongoing calibration can be conducted with a grab sample and a standardized laboratory electrode. The grab sample pH is measured with the lab electrode. This value is compared with the pH measurement from the process electrode. If there is a difference, then the process electrode calibration is adjusted such that the pH values match. The initial calibration slope is not modified only the zero offset. This standardized lab measurement and calibration can be easily conducted at the 8362 sc panel with a portable HQD meter and low ionic strength PHC281 Intellical electrode (Figure 3).

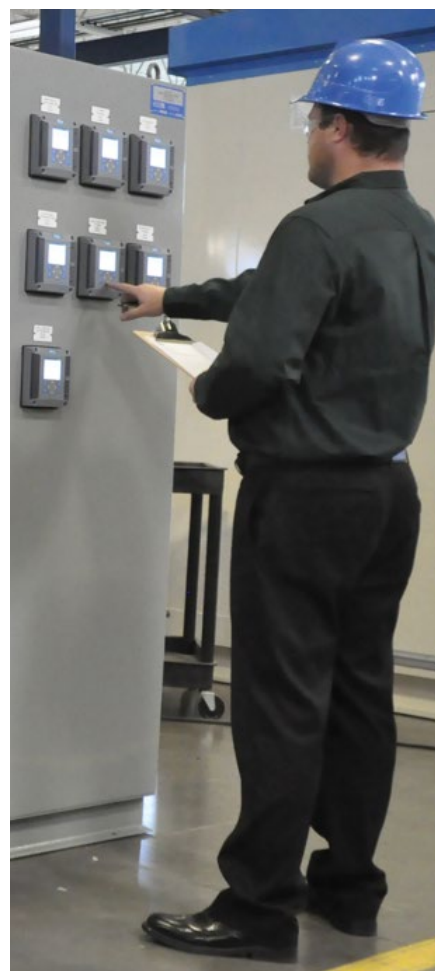


Figure 2: Grab sample calibration

Several precautions must be taken to ensure that the grab sample is representative and that the process measurement isn't affected.

Sampling Precautions

- Low ionic strength pH measurements are extremely sensitive to temperature. The grab sample must be the same temperature as the process sample. The grab sample line should be as short as possible to minimize temperature differences.
- Because fluctuations in the flow rate through the process cell will affect the pH measurement, it is essential that the grab sample not interfere with this flow. This is generally accomplished by leaving the grab sample line always open to the sample sink. A grab sample line should be plumbed into the inlet of the 8362 sc sample cell.
- Dissolution of atmospheric carbon dioxide into the grab sample will alter the sample pH. Carbon dioxide reacts with water to form carbonic acid, lowering the pH of the sample. In order to eliminate this interference the grab sample line is placed in the bottom of a large beaker which is allowed to constantly overflow into the sink. The measurement is taken at the bottom of the beaker, ensuring that any carbon dioxide contamination is not present in the measurement environment.
- The lab electrode must equilibrate to the low ionic strength environment and temperature of the grab sample before a measurement can be made. Allow the electrode to equilibrate for 15 minutes prior to measurement.
- The HQD meter is programmed with the Nernst temperature compensation. The 8362 sc must also be set to the Nernst temperature compensation mode for an accurate grab sample calibration.

Ongoing Calibration Procedure

1. Take a side-stream sample from a tap as close to the 8362 sc as possible.
2. Introduce the sample to the bottom of a large (500 mL) beaker through a clean tube extending to the bottom of the beaker. (Make the tube as short as possible between the beaker and the sample tap.)
3. Allow the beaker to overflow.
4. Place the previously calibrated PHC281 electrode from the portable HQD meter into the beaker.
5. Overflow for at least 15 minutes before taking a reading.
6. Compare the reading on the HQD meter to the reading on the 8362 sc controller. If the values are different, perform a single point calibration through the controller so that it matches the standardized lab measurement.

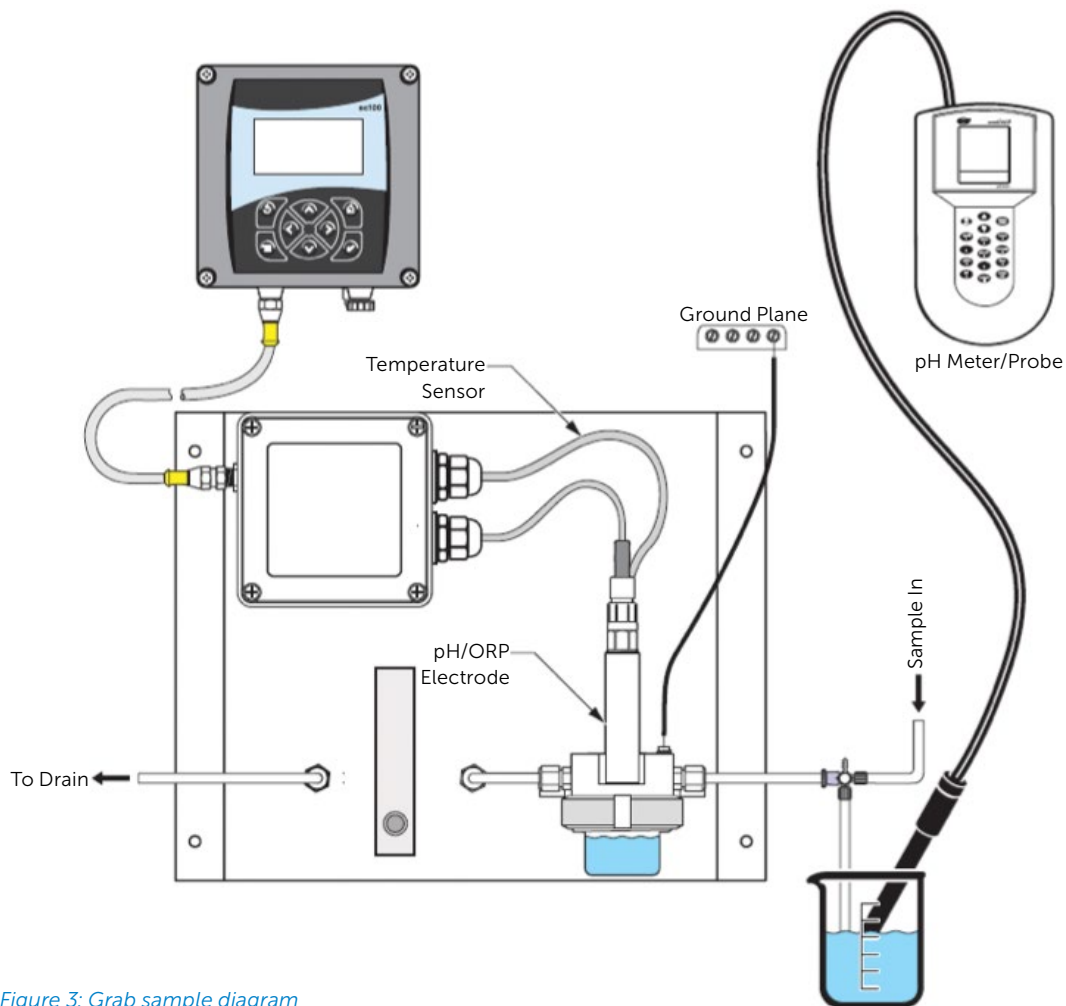


Figure 3: Grab sample diagram

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