



The Amazing Measurement - BBB (Borrow)

Advanced pH Measurement and Control by Greg McMillan and Robert Cameron

Reviewed by Nick Sands

It is often said that pH control is more complicated than the average control loop. In the 3rd edition of *Advanced pH Measurement and Control*, Greg McMillan and Robert Cameron explain the complications, and there are many. McMillan is an ISA fellow, a former "Control Engineer of the Year", one of the first inductees in to the "Process Control Hall of Fame", an affiliate professor at Washington University in St. Louis, and because he shares his 33 years of experience at Monsanto and Solutia, one of ISA's most prolific authors. This is neither the first nor the last review of one of McMillan's books. Robert Cameron is a process control engineer with over 19 years of experience with Bailey Controls, Monsanto/Solutia and GE Silicones.

Advanced pH Measurement and Control is logically organized into 8 chapters covering things from the essentials of pH measurement to control valves and control strategies. The first chapter gives an overview of the rest of the book. pH is negative of the base 10 log of the hydrogen ion activity, usually equal to the concentration. In a water based solution the pH is normally between 0 and 14, but for other solutions the pH can range from -10 to 50, giving it the amazing rangeability of normally 14 orders of magnitude or more. pH measurement is also logarithmic, giving it a characteristic s-shaped curve, and even within a seemingly linear segment, there is still an s-shaped curve. The tremendous rangeability of the measurement puts tremendous turndown requirements on the valves.

The next chapters detail the chemistry behind pH measurement and the titration curves that show the nonlinear relationship between the amount of reagent and the pH, highlighting the difference between laboratory measurements and field measurements. The chapter on electrodes details the features and resistances of many different types of electrodes. This chapter is followed by a chapter on mixing, highlighting the benefits of static mixers and back-mixing.

No McMillan book is complete with a section on control valves and the problem of stick-slip. This book is no exception. With pH applications the performance requirements for control valves can be demanding. The limits of valve performance can determine the limits of control. The last chapters cover how the choice of reagent and reagent concentration can help in determining control performance. Finally, control strategies can impact the performance of a pH application.

McMillan and Cameron reveal the many factors that affect measurement of pH. While an automation professional's library is incomplete without at least a few of McMillan's books, this one is targeted just as it is titled, for those that need an advanced understanding of pH applications. It is full of useful information but the complex sentences can be difficult to follow. At \$85 (member price from ISA.org), this is a must buy for engineers working with many pH applications and a good borrow (BBB) for the rest of us.