Typical Problems in Industrial pH Measurement & Control - Part II

In the first part, the following topics were discussed: Electrical interference, Relay hunting, Limit and Proportional Control, In-line Calibration, Current Transmission.

A few more situations will be highlighted:

pH Measurement in Liquids with Hydrofluoric Acid

In certain processes Hydrofluoric (HF) is bound to be present. Typical cases would be like those in glass industries. pH measurements in such situations poses a problem. Since conventional pH electrodes are themselves made of glass, especially the 'bulb', in a short span of time depending on the concentration of the HF, the electrode dies. Most often the solution to this problem would be using electrodes made of high HF resistance glass. This, as one may see does not totally eliminate the problem. Logically, the best solution would be to use a material that is not attacked by HF. Antimony electrode, which is basically an ORP electrode can be used here. The solution is not as simple as it sounds. This is due to the fact that the property of the glass electrode is very different from that of the Antimony electrode. Therefore these electrodes cannot just be swapped, one in place of the other.

The alpha-pH1000 controller has the facility to switch from one to another and in that process change internally all the settings associated with the type of electrode, either glass or Antimony. This method, though not the best, is still a good and economical way to measure pH in HF environment.

Alarm Function

Most of the mid-range controllers these days come with a separate relay for the 'alarm' function. This relay generally activates if the measured parameter is out of either of the set points. What this means is that in the event there is a control action taking place, the alarm relay is also active and hence the alarming device be it a siren or a flashing light. As a result of this, generally there is not much attention given when the lights starts to flash or the siren starts to hoot. Invariably there is a reset switch wired up externally, which will be operated to stop the noise. We see therefore in such situations, the alarm device is looked at as a nuisance rather than a facility. How could we better utilize this feature.

Let us look at a practical situation. Assume that the low set point is fixed at 6 pH. When the pH drops to a value below 6, the set point relay gets activated and hence the chemical dosing starts. Under normal circumstances, the alarm relay also would have got activated and as long as the alarm condition exists, the siren keeps hooting. If by experience one would know how long it would take for the dosing action to correct the situation, say 2 minutes in this example, it would be great advantage if one could set a delay time of 2 minutes for the alarm relay to function. What this means in reality is that once the set point is exceeded, only the dosing pump starts and the alarm relay circuit starts the counter. If in 2minutes the problem did not get corrected, which may be due to airlock in the pump or empty chemical tank, then the alarm relay activates and therefore the siren or the flashing light This would be more meaningful.

Prevention of Chemical Wastage

In certain industries it becomes essential to monitor two parameters simultaneously and carry out corrective action based on one parameter first followed by the other. pH and ORP measurements would be a good example in 'electroplating' and 'swimming pool'. The pH is first adjusted to a specific level and then the ORP control is done. The practical problem one would face here is that the pH and ORP are independent. While the pH is being corrected, the ORP gets affected and vice versa. If it were possible to HOLD the ORP controller while the pH is being corrected and let it start the control only when the pH is within the acceptable limits, then that would result in a large saving of the chemicals. If this control process could be carried out automatically, it would be an added advantage.

ORP Measurements

ORP or Redox is the oxidation-reduction potential usually measured in millivolts. This is not a specific ion measurement since all the ions present in the liquid will contribute to the ORP potential. It can be seen therefore that in areas like wastewater treatment, the ORP in actual millivolt would not make much meaning. Instead if it was possible for the controller to measure the millivolt and display it as a relative percentage, then the transition from one state to another can be more easily seen. For this to be possible, the controller should be capable of operating in what is known as the ORP % mode, which is available in the alpha-pH1000 controller. The user can calibrate the unit with two liquids whose relative toxic levels are known and then use it to measure and control the ORP % value of the water being processed.

Manual Temperature Compensation

There are many instances where a temperature probe is not being used. This typically would be when there is no large variation in temperature of the process. It is still necessary to apply a compensation for correcting for the effect of temperature if the process temperature is going to be anything other than 25 ^{o}C. Most of the controllers these days have the facility of Manual Temperature Compensation (MTC). The drawback however in most of them is that there is only one setting for the MTC. If for example, the MTC is set to 40 ^{o}C and measurement is being carried out, the compensation corresponding to 40 ^{o}C would be applied. If now the user decides to carry out a calibration, care should be taken to reset the MTC to 25 ^{o}C. If this step is forgotten, then calibration would be wrong. This error may not be very high in case of pH measurements. However in Conductivity and Resistivity measurements, assuming that the temperature coefficient of the liquid is around 2% per ^{o}C, the error for a 15 ^{o}C variation could be as high as 30%. This would in no way be acceptable. A simple solution to this problem is by providing two settings for the MTC namely one for Process temperature and another for the Calibration. This way the controller can apply the correct compensation based on the mode, 'measurement' or 'calibration', in which it is operating.

This article was published in Asian Environmental Technology Vol. 8 Issue 5 (1998). Part II was published in Volume 9 Issue 1.