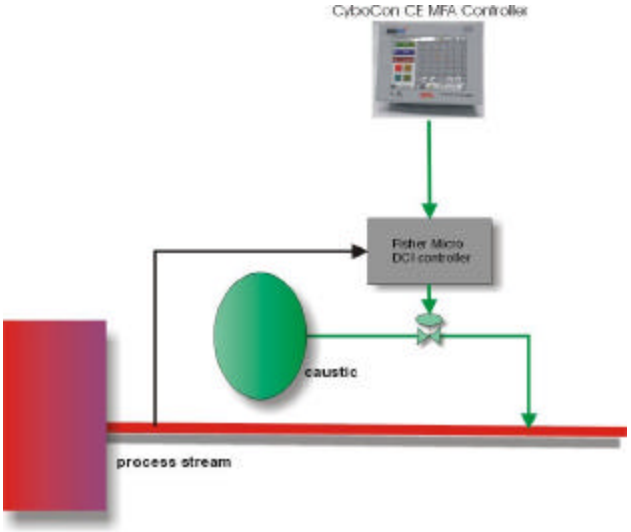
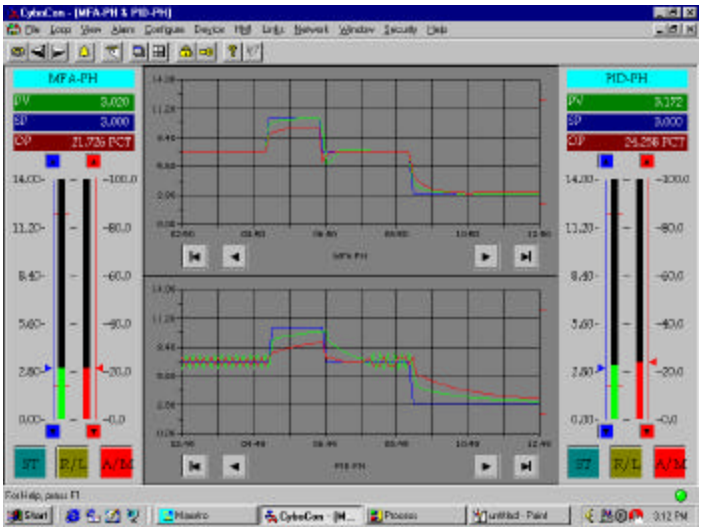
Model-Free Adaptive Control on pH Loops

Use of MFA Control	*Benefits*
Manipulates reagent flow intelligently and precisely.	Improves pH control by at least 50% reduction in variability.
Does not over-dose reagents	Chemical (acid and caustic water) consumption is sharply reduced.
Enables automatic control of pH value in all ranges	Environmental pollution and equipment corrosion are tremendously reduced.
Reduces product pH variation.	Product quality and production efficiency is improved.
Improves efficiency & productivity.	Full investment is returned in months if not sooner.





The trends compare MFA and PID control on the same strong-acid-strong-base pH processes. MFA (top) controls pH value tightly in all ranges at setpoint 7, 11, and 3. PID (bottom) is either sluggish or oscillating.

Case History: MFA pH Control at Rohm & Haas reported in Chemical Engineering Magazine

Rohm and Haas, a leading chemical company, is successfully using a MFA control system to control a problematic pH control loop in neutralization of an organic process stream. The cost savings is estimated at $170,000 per year. They also expect a reliability improvement due to reduced formation of solids, according to Teshome Hailu, control engineer at Rohm & Haas.

The stream to be neutralized was a two-phase stream with varying concentrations of acidic species. In general, pH control is difficult due to the nonlinearity of a pH loop and this measurement had significant noise.

The original system was designed with only one valve controlled by a Fisher Micro DCI controller. This introduced time delay problems. Because the plant is already running it would have been prohibitive to shut down operations. Ordinarily, re-engineering the process would require mathematical transformation of process data to create a linear solution. The recommended pH set point was 10.6; operators typically ran the process at 12 because the pH loop became unstable close to the recommended set point. Excess caustic from the higher pH resulted in solids formation in the downstream separation equipment. Setting the PID controller gain low enough to ensure stability near the recommended pH point also resulted in an extremely sluggish control response when a large upset pushed the pH far away from the neutrality region.

Staff decided to retain the Fisher controller and feed it a new input signal from a CyboCon CE Model Free Adaptive controller to compensate for the time delay. Once proper communication was established there was no complicated tuning, step testing, or data collection involved.

Improved pH control enabled them to lower the pH set point from 12 to 11. Not only were cost benefits achieved, operators also like the improved process upset handling capabilities. In addition, reduction of excess caustic and reduced solids formation meant an unquantified improvement in overall system reliability.

Other pH applications with CyboCon CE controllers, such as Chiron in California and Ultrafertil in Brazil, achieved similar results within a short ROI period.

