Control Arts
Control Software Review
February, 1999 Volume 4, Issue 1

North American manufacturers now know the perils of ignoring quality control in their plants. Such was not always the case – Juran and other quality control pioneers initially faced resistance from most manufacturers in their efforts to implement quality control programs.

Why did the engineers and managers ignore the quality issue? Generally, one (or all) of the following reasons were given:

- The quality of our process is fine.
- There is no penalty for poor quality.
- We plan to improve quality later.

Of course, none of this was true, and the companies that succeeded were the ones who broke with tradition and changed their manufacturing processes to improve quality.

Now, what is the quality of your alarm system? Are you even measuring anything to indicate how well it's performing? Are the operators saying the same thing about your alarm system as car buyers said about General Motors in 1982?

There is a solution. The Control Arts Alarm History Analysis program contains tools for monitoring alarm system performance and identifying poor alarms. Read on in the next column for more details

à Spotlight à Alarm History Analysis 3.1

New analysis, new capabilities, new insights! Version 3.1 of the Control Arts Alarm History Analysis contains tools to help develop an effective alarm system and ensure that it stays in tune.

Version 3.1 now incorporates PVs from the plant database into the analysis. In this way, the relationship between the alarms and the underlying process can be understood.

Even better, you can determine if your PV alarms are set properly. For example, assume your process has a metallurgical constraint at 800°F and normally runs at 700°F. What should the high alarm setting be? It depends on 2 things:

- How quickly can operators return the process to safe conditions when an alarm occurs?
- What is the normal variation in the process?

Setting the alarm too high could result in violating the 800°F metallurgical constraint as insufficient warning is given to the operators. Setting the alarm too low could result in excessive and distracting alarming — as the alarm goes off even when

(Continued on page 2)

The Ups and Downs of Level Control

What's the best way of maintaining your process on spec? Often, the best solution is to prevent, or at least attenuate, disturbances from affecting the process.

Usually this is not possible with software, but there is one place where control can make a big difference in disturbance reduction – surge vessel level control. After all, surge vessels are often explicitly built for disturbance attenuation. The challenge is to design a controller that makes use of the vessel capacity to smooth out the disturbances.

Figure 1 shows a typical level configuration. The specific problem is to *minimize* the rate of change of the outlet flow by *maximizing* the surge capacity of the vessel, i.e., keeping the level between the Max and Min bounds.

Generally, the 3 types of controllers for doing this are:

PI Control
This is the most common technique for controlling level, as the algorithm is familiar and resides in the DCS. Trouble is, it usually exhibits tight control, so that any disturbances are quickly passed along (i.e., the vessel acts like a pipe). Why? The main reason is that the PID algorithm is designed to keep a PV at a setpoint, not to let a level float between bounds. You can detune your controller to let the vessel absorb swings (Control Arts has tuning algorithms for doing this), but in some sense you're fitting a square peg into a round hole.

DMC Control
On the surface, DMC appears well suited for the task of level flow smoothing, as you can set the LP bounds to the desired upper and lower values, while allowing the regulatory part to smooth out

(Continued on page 2)

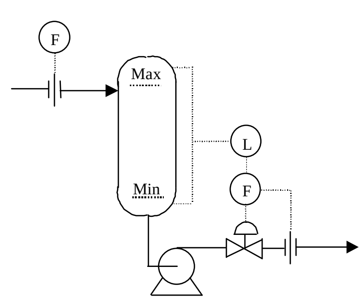

Figure 1: Surge Vessel – The variation in outlet flow should be less than the variation in inlet flow.

The Ups and Downs of Level Control (continued)

the swings.

Unfortunately, DMC's do not work this way. The regulatory part acts the same as a PI controller – it merely maintains a PV at setpoint. This setpoint comes from the LP, and will usually be at one of the constraints. Therefore, you should set both constraints at a single desired steady state value (generally 50%). Bottom line: the DMC is nothing more than a PI controller. And one that performs poorly as DMC controllers tend to have excessive integral action – the last thing you want in a surge level controller.

Optimal Surge Controller

The level control problem can be thought of as a non-linear constrained minimization problem, i.e., there's a non-linear function to minimize (the outlet flow variation), there are constraints (the upper and lower limits on the level), and there's a model (a volume balance around the vessel).

Do you need sophisticated optimization routines running on a VAX to solve this problem? Fortunately, the answer is no – in fact, the problem is solved using only one equation! That means the AM can easily handle the calculations, even at a one second sampling interval. And tuning is almost trivial – just specify the vessel dimensions, upper and lower limits, and you're done.

Of course, Control Arts has a package containing the algorithm ready to deploy. Nothing works better on surge vessel levels. Not only that, it's as easy to operate as a APM con-

Alarm History Analysis Version 3.1 (continued)

the process is not moving into a danger zone.
But who knows what the alarm setting should be? The design engineers may know metallurgical constraints, but they don't know the dynamics or disturbances of the process or the operator response times. What you need is a plot showing 2 things: the probability of an alarm occurring as the PV reaches higher values, and how much hotter did the process get once an alarm occurred. An example of this plot is shown in Figure 2. Note that the plot shows both probabilities; the curve for PV's less than the alarm value indicate the probability that the process will alarm if the corresponding PV reaches this value; the curve for PV's above the alarm value indicate the probability the process will hit the corresponding PV if it does go into alarm.

That's just one of the extra features available in Version 3.1 of Alarm History Analysis. There are other PV analysis tools, expanded reporting features, and operator move analysis tools. And now the program reads in Honeywell process schematic files so you can display your results on a familiar schematic display. Call today for a brochure outlining the many features

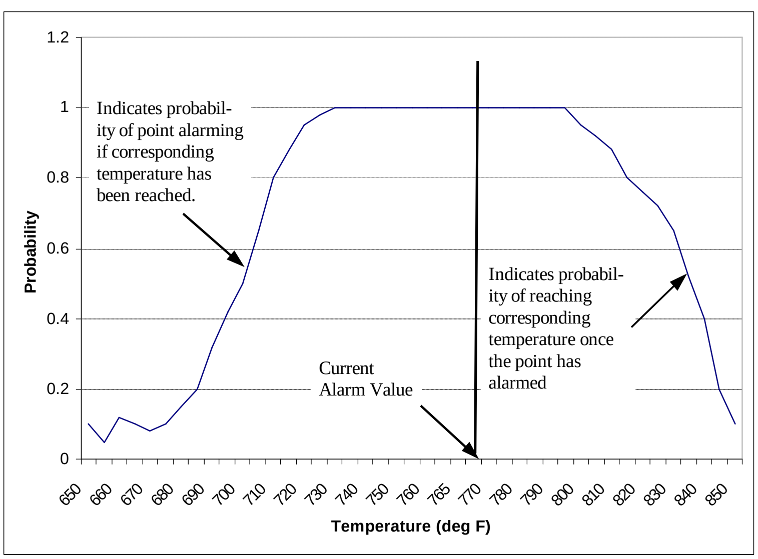

Figure 2. A graph of Alarm-related probabilities against PV gives a good indication of the best setting for the alarm. The current alarm value should be lowered as the process always alarms once the temperature rises above 730, and always reaches at least 800+ once the

Control Arts Information

Contact:
Dr. Alan Hugo
AlanHugo@ControlArtsInc.com

Address:
616 Bobbie Drive
Danville, CA 9452

Phone: (925) 838-2062
Fax: (925) 838-1866
Web: www.ControlArtsInc.com