Put Your Batch Controls On A Budget

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Batch controllers don't have to be expensive and complex. Cost-conscious designers, confronted with the price and complexity of high-end batch controllers, are looking for alternatives. They're finding that a new generation of simpler, less expensive devices—based on microprocessors—can handle many single function batch processing tasks.

Batch functions available in basic devices include analog valve positioning, in-progress flow-volume accumulation and safety alarms. In this article, we'll walk through a simple batch operation and show you how a basic batch controller automates it.

To operate a basic batch process you need a few straightforward functions: Open a valve; measure flow to a preset volume; then close the valve. You may also want niceties like gradual valve closure to prevent over-run and water hammer in large pipes, or proportional additive dosing while a tank is filling. When the batch is complete, you may want to trigger a follow-on step. You may want to send an alarm if a pump fails or flow is blocked.

Fill a tank and mix in an additive.

In this process, a 2,000 gallon tank is filled with fluid from a four inch pipe. Fluid flow begins when the ball valve opens. Slowly mix in an additive, in a specific proportion while the tank is filling, so that when the tank is full, the additive is well mixed. When the tank is nearly full, the valve begins to close slowly, to prevent over-run and water hammer.

A typical basic batch controller is the 5600 Batch Controller from +GF+ SIGNET. This device monitors flow volume by counting pulses from a simple insertion flow sensor. Built-in calibration functions make it easy to calibrate flow rate to volume after installation.

Control outputs include a programmable 4 to20 mA current loop to control valve position, a pulse train output to control a dosing system for the additive, and relay contacts to signal that the batch is ready.

The unit takes up 4 in. x 4 in. of panel space and runs on 12 to 24 Volts DC or AC. These simple, low-cost control devices can serve as building blocks for many batch applications.

Position valve and measure volume.

Pressing the ENTER key momentarily or closing the rear panel remote start contacts causes the current loop to come up to 20 mA flow and the ball valve opens. As fluid flows in the pipe, the flow sensor generates a pulse train with frequency proportional to flow rate. The batch controller converts flow rate into volume. Flow-rate to volume conversion factors can either use standard K-factors for the flow sensor, or an auto-calibration procedure that gives maximum batch accuracy.

The controller has been programmed to put out a pulse at a rear panel terminal for every 20 gallons that goes into the tank. The output pulse activates a dosing system that injects a measured quantity of additive. The dosage keeps the additive well-mixed and in the proper proportion throughout the filling cycle. Programming for a large number of small doses also cuts the cost of the additive pump and reduces potential waste. A drawback may be slightly longer cycle time.

As the tank fills, a high-visibility analog meter on the front panel of the controller shows percentage of batch completion. This lets the operator monitor the process at a glance from a distance. A front-panel digital display can be switched to show flow rate, volume delivered, percent of batch completion, or time to finish, in clearly labeled units.

As the batch nears 100 percent, the current loop signal gradually drops and the valve positioner begins to close the valve. This slows the rate of flow to give maximum batch accuracy and to eliminate water hammer in the piping.

At the 100 percent mark the valve closes completely. A relay contact in the controller sends a signal to the next process stage that the batch is complete. If flow in the pipe had stopped for a programmable interval any time before the batch was complete, the valve would have been closed immediately and a second relay contact would have actuated an alarm circuit.

Microprocessor architecture gives flexibility with simplicity.

There are several other ways to utilize this basic batch control unit. The microprocessor logic offers flexible options that are easy to select. Instead of current-loop analog positioning for a ball valve, relay contacts can be used to control a solenoid valve. To prevent over-run and water hammer, two solenoid valves can be used, controlled separately. The main valve closes as the batch nears completion. A secondary valve completes the fill, then closes also.

The current loop can be programmed to send a signal proportional to batch percentage completion, for remote monitoring. Or it could also send a single pulse at batch completion, triggering the next process.

The batch-complete signal can be programmed to come from the pulse train output or the secondary relay contact. The batch-complete signal can be used to start a second batch controller that would control processing of the contents of the tank.

If a process involves draining a tank rather than filling it, the dial face of the analog meter can be flipped easily. The reverse side starts at 100 percent and reads down to 0, showing amount of the batch remaining in the tank. All the programming is done with four front-panel keys and menus that appear on the digital display mounted below the analog meter.

Checklist for basic batch controllers.

When shopping for instrumentation, look for more than just hardware. Ease-of-use, flexibility for system design changes and vendor support can all contribute to holding down total life-cycle costs.

Here are some things to look for in basic batch control systems:

(1.) Microprocessor-based architecture for maximum flexibility.

(2.) All-digital electronics may give better accuracy with voltage variations than transistor logic (TTL)-based designs.

(3.) High-visibility analog readouts let operators monitor processes from a distance, for maximum plant productivity.

(4.) Digital displays should include clear markings for the engineering units they measure, whether it's gallons or seconds. Unlabeled numbers can cause confusion and errors.

(5.) Simple calibration and programming operations shorten learning curves and reduce mistakes. If you have a family of instruments from the same vendor, consistent programming models across devices will speed programming and reduce errors even more.

(6.) Controllers should accommodate both solenoid valves and ball valves with analog positioning.

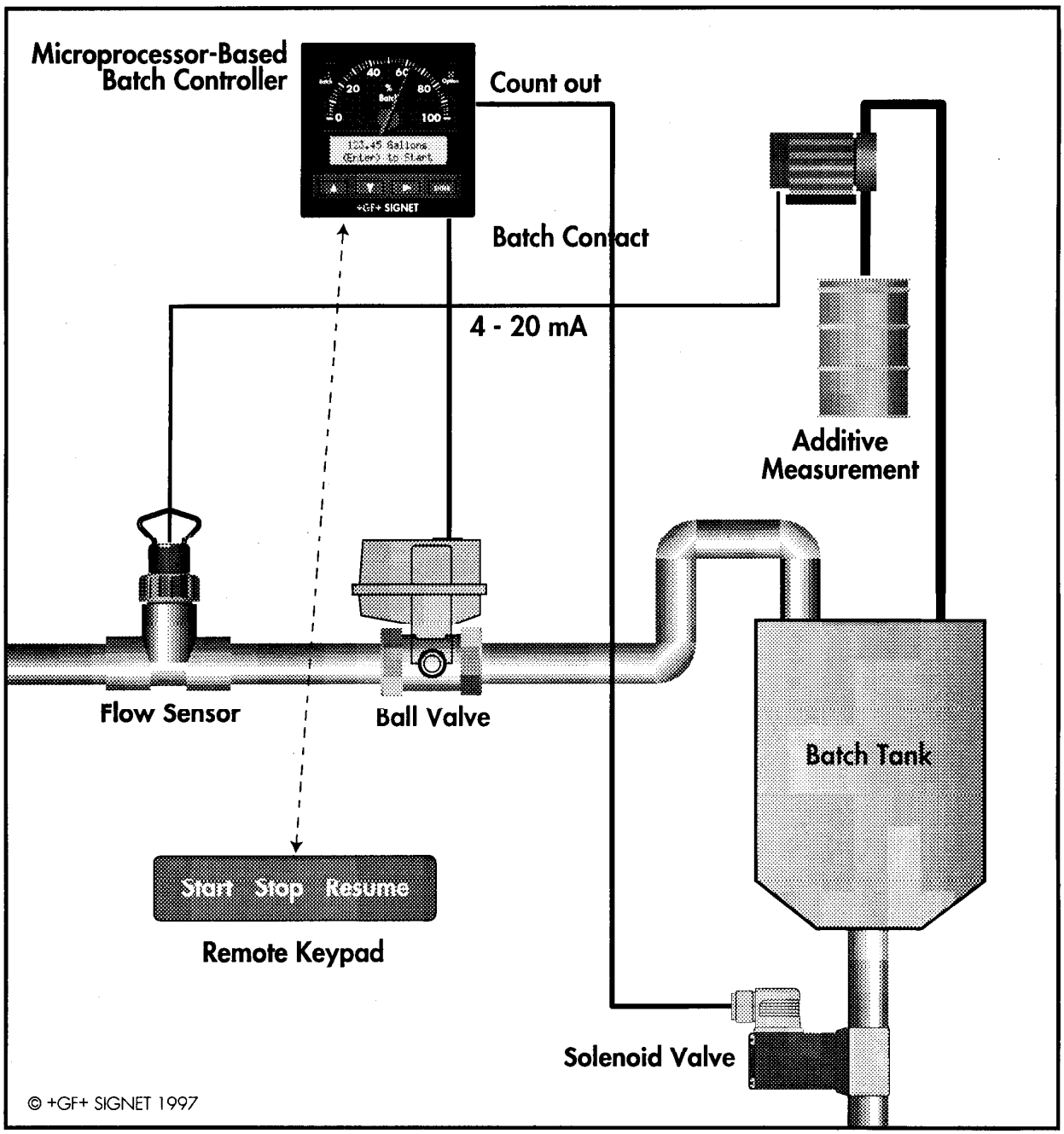
(7.) Check also for compatibility with a wide range of flow sensors. Look for a vendor who can help you with expertise in flow measurement and piping system design.

(8.) If you're designing equipment that may be shipped to Europe, be sure your digital instrumentation has appropriate CE certifications for EMI – both susceptibility and emissions and safety.

Get cost-effective solutions for many applications.

Complex processes may require a complex, high-end controller. But for many jobs, the flexibility and ease-of-use of these basic batch controllers can deliver very cost-effective solutions. Give them some thought on your next batch processing project.

Caption: Microprocessor logic gives basic batch controllers cost-effective flexibility in simple batch operations.



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