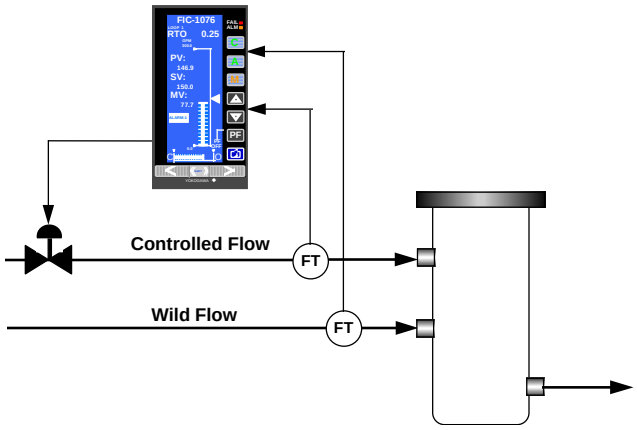
APPLICATION NOTE

YS170 Ratio Control

BACKGROUND

In process operations, there are instances where ratio control is required to maintain a consistent blend of two or more components. This control action is used in chemical, food & beverage, and pharmaceutical batching operations. Although a ratio control strategy is not new or highly sophisticated, the development of microprocessor-based process controllers has permitted better control, more flexibility and a more desirable operator interface. Below is a diagram showing a typical ratio control for a batch reactor application.



VERSATILE OPERATOR INTERFACE

The Yokogawa YS170 Programmable Loop Controller is a digital control station that incorporates a state-of-the-art LCD display for operator viewing and controller configuration. Several screens are available: A standard

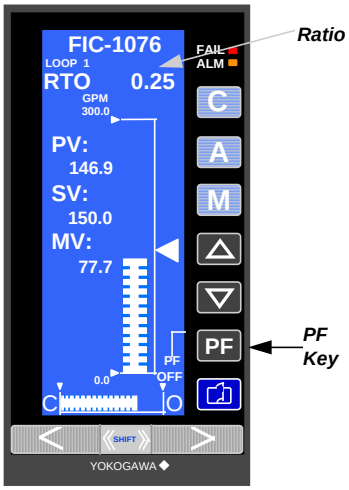
LOOP display indicates the process variable (PV), set point (SV) and output (MV). A tag name or descriptor is shown at the top of the display and the PV and SV are scaled in engineering units. A second LOOP display may be used as well as two TREND displays.

The versatility of the YS170 front panel display allows a ratio controller to be viewed in several ways. Two examples are shown here. The first is referred to in this text as Style A ratio control. The second is Style B. Both allow easy operator interaction and process viewing.

Style A allows full ratio control functionality on a single LOOP display. The ratio can be viewed in a data window at the top of the screen. A three character description is assigned to the left and the current ratio in numeric form is shown at the right. The ratio can be calculated and viewed in two forms: controlled flow/wild flow or the inverse. In either case, the appropriate ratio is viewed in the data window. Refer to the drawing on the right showing the LOOP display format.

In the Style A configuration, pressing the PF (Programmable Function) Key allows change to the ratio setting or local controlled flow. A PF indicator in the lower right side of the screen designates the status of the PF key, ON or OFF. The controller can be configured to allow ratio setting while the indicator is ON or OFF. In either case, the /\ & \/ keys on the front panel increase or decrease the value. When in the local control flow mode, the set point is shown numerically next to SV and the < indicator at the right side of the screen varies accordingly. The ratio is shown in the data window at the top of the screen. The operator functions are simple to understand.

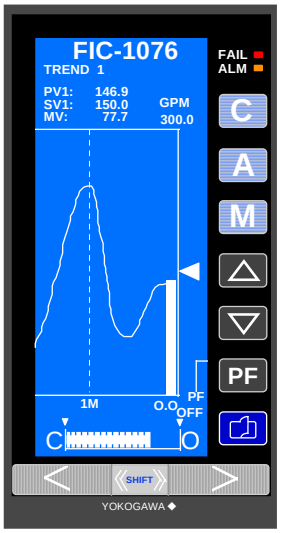
Style A Ratio



A second operators' screen is available for viewing, a TREND display. Pressing the PAGE key below the PF button allows this screen to be observed. This trends the process variable (controlled flow) over a user-selectable time base. One of eight (8) sample rates are available, from once per second to one sample every thirty (30) minutes. The ratio setting cannot be viewed from this panel, but the added benefit of trending the controlled flow over time is important to most operations personnel. Refer to the TREND display drawing on the following page.

The second LOOP display can be configured to show the wild flow. By pressing the PAGE key from the LOOP 1 display, the LOOP 2 screen

is observed. The wild flow can be shown in bar graph and numeric format. Additionally, the TREND 2 screen exhibits the wild flow input over a selected time base, as previously discussed with the controlled flow.

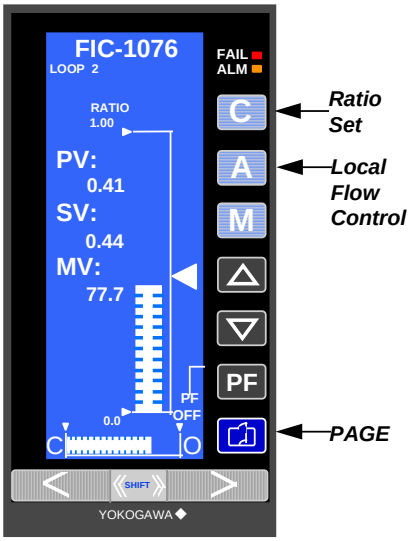


Style B ratio uses both LOOP displays, the first showing the controlled flow and the second the ratio in a bar graph and numeric format. The operator presses the PAGE key from the LOOP 1 display to observe the ratio. Pressing the C button allows ratio setting of the controlled flow using the /\ and \/ keys. Pressing the A key by-passes the ratio control and permits local flow control. Refer to the drawing of the Style B LOOP 2 display below.

RATIO PROGRAMMING

The ratio control program and configuration is developed and loaded into the controller using a personal computer and the Yokogawa YSS10-210 Programming Software Package. The PC is connected to the controller from a serial communications port to an RS232C port integral to the controller.

Style B Ratio



The YS170 is a state-of-the-art programmable loop controller. A complete library of function modules is available for use in a custom control strategy. To implement a ratio control, the program need not be lengthy or complex, but can be very powerful. Extended function modules are resident in the PID control block and can be used to regulate and override the normal control action as required.

For example, high and/or low ratio deviation limits can be integrated into the program. If the ratio were to exceed a preset value, a discrete output can be activated to allow remote alarming or automatic override. Additionally, high and/or low alarms for controlled and wild flow and a velocity (rate-of-change) limit can be implemented. Bumpless transfer between the local set point and ratio setting can be incorporated.

Other powerful features include a self tuning control (STC) algorithm, which may be useful during start up of the controller. This model allows the controller to calculate new tuning parameters (P+I+D) should the controlled flow exceed a preset dead band around the desired ratio.

SUMMARY

The YS170 Programmable Loop Controller incorporates the ability to modify operator screens for specific needs. Two examples have been discussed here, but other formats can be implemented. A library of powerful function modules permits optimum flexibility when developing a ratio control strategy.