

APPLICATION NOTE

NEW SUPER CONTROL™ FUNCTIONS

Overview

Yokogawa first introduced its renowned SUPER CONTROL™ in industrial controllers over a decade ago. This is a *fuzzy logic* algorithm that eliminates overshoot from the desired set point and mimics the control expertise of the most experienced operator. Recently, the development engineers at Yokogawa released two additional SUPER CONTROL™ functions in the Enhanced GREEN series industrial controllers that provide even better control.

In a furnace control application, as the load changes or a set point change is made, the temperature may tend to become unstable and oscillate around set point. The traditional way to prevent this action was to install different sets of PID tuning parameters. The new SUPER CONTROL™ modes eliminate the control instability. Refer to the graphics below.



Load Change



Temperature Change

Auto Tune

Yokogawa has embedded an auto tune function in industrial controllers for years. After the auto tune function is initialized, the control output is alternately varied from 0% to 100%. The controller observes the response of the process input and provides the optimum PID tuning parameters at a single set point within the input range. Additionally, up to 8 different PID sets can be auto tuned within different zones of the input range.

Auto tune sometimes cannot be applied during operation due to a possible process upset. The two new SUPER CONTROL™ functions may be applied to provide optimum control even when auto tune cannot be used.

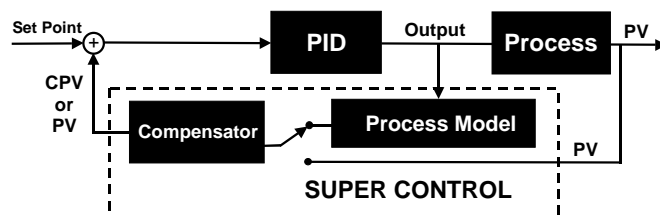
SUPER 2 & SUPER 3

How does it work?

Control instability occurs when the closed loop gain is greater than 1.0 or the deviation between the process variable and control output become 180° out of phase. The SUPER 2 or 3 functions observe any phase shift. If the input phase has changed from normal operating conditions, SUPER 2 or 3 computes a calculated PV (CPV) using a process model and suppresses hunting. The process model simulates the PV without any inherent dead time.

It is simply the first order lag time with gain. A compensation model switches between the measured process variable (PV) and the calculated process variable (CPV) as needed to prevent PV hunting. The control function block performs normal PID computation. Refer to the functional block diagram below.

SUPER CONTROL = 2 or 3



What is the difference between Super Control™ modes?

If SUPER CONTROL™ Mode 1 is selected, overshoot suppression is initialized. As the PV approaches a new target set point, the SUPER CONTROL™ observes the rate of change and installs “sub-set points” as the PV approaches set point to insure overshoot does not occur.

If SUPER Mode 2 is selected, this insures high stability at set point while sacrificing some response time to a set point change. The gain and lag time calculations differ from that in Mode 3.

If SUPER Mode 3 is used, response speed to a set point or load change is faster than Mode 2 with some sacrifice in stability as a new set point is entered and the process variable approaches that change.

SUPER CONTROL™ is another innovation by Yokogawa to provide the best possible PID control action in industrial applications.