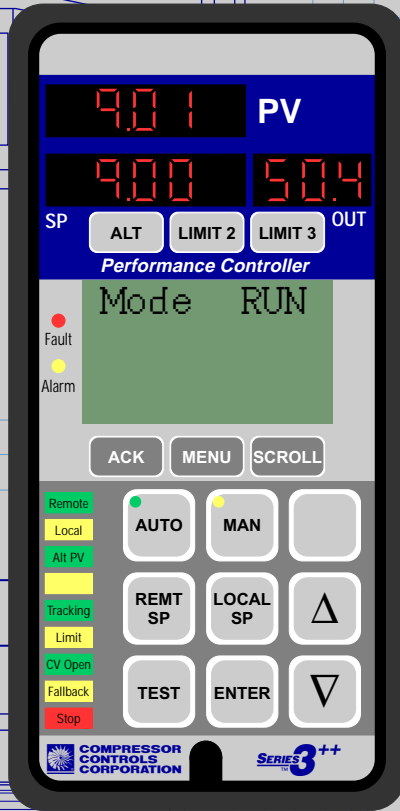


SERIES 3⁺⁺
TM



Performance Controller

for Centrifugal and Axial Compressors



The Series 3⁺⁺ Performance Controller is designed and easily configured to precisely and reliably:

- control any single-input capacity measurement, such as a pressure or flow rate;
- calculate and control the compression ratio or pressure- and temperature-compensated mass flow rate;
- manipulate the compressor's proximity-to-surge in response to changes in the output of a load-sharing master.

The Performance Controller can also improve compressor and process reliability by limiting critical pressures, temperatures, speeds or other variables to avoid overload, overspeed or over-temperature trips. Plus, its loop-decoupling, load-sharing and coordinated start-up and shut-down features make it the ideal companion to our Series 3⁺⁺ Antisurge Controller (see [PB3301](#)).

Integrating Performance and Antisurge Control

Axial and centrifugal compressors require at least two control loops, one to manipulate the speed, inlet valve or guide-vanes to match compressor throughput to process requirements, and one to manipulate a recycle or blow-off valve to avoid surge. Close coordination is required to prevent loop interactions from creating pressure and flow oscillations that can degrade both the control precision and the surge protection.

Performance and Antisurge Controllers use a dedicated serial communication link to notify each other of their control actions. Each can then adjust its own output so that it compliments rather than impairs the control actions of its companion controllers. This decoupling action enables them to provide more reliable surge protection and improved performance control. Because they do not operate at cross purposes, the control loops can be tuned faster to achieve both high speed and stable control.

Achieving Optimal Load Distribution

Combining Performance and Antisurge Controllers also enables you to use our innovative load-sharing algorithms for multiple compressor applications.

A Series 3⁺⁺ load-sharing control system consists of one Station Performance Controller, a Load-Sharing Performance Controller for each compressor, and an Antisurge Controller for each compressor or compressor section.



Features:

- *primary control of a single-input process measurement, pressure- and temperature-compensated mass flow rate, compression ratio, or a load-sharing variable based on the compressor proximity to surge*
- *integrated loop decoupling prevents interacting loops from destabilizing your process*
- *limiting control of any two single-input variables*
- *coordinated start-up and shut-down sequencing*
- *bumpless transfer between local or remote set point and manual or automatic operation*
- *manual override prevents inadvertent compressor damage due to operator error*
- *fallback strategies keep your compressor online in the event of input failures*
- *optional, automatic switching to redundant controllers in the event of critical failures*
- *standard hardware simplifies maintenance and parts stocking*
- *Modbus RTU or TCP interface for DCS/SCADA communication*

The Station Controller indirectly regulates the a capacity control variable (for example, discharge header pressure) by sending its control response (the station control signal) to the Antisurge and Load-Sharing Performance Controllers. They, in turn, directly manipulate the compressor control elements.

Depending on its proximity to surge, each unit's Antisurge and/or Load-Sharing Controllers apply appropriate gains to the station control signal and adds the results to their own control actions. For example, when the discharge pressure is too low, a Load-Sharing Performance Controller might speed up its compressor while the Antisurge Controllers reduce their recycle rates. This would yield an immediate pressure increase.

In addition, Load-Sharing Performance Controllers use their local PID loops to drive the operating points of all of the compressors to a common distance from their respective surge limits.

This approach optimizes overall process efficiency by avoiding unnecessary recycle or blow-off. Load distribution occurs automatically, even when compressors are being loaded or idled or when their thermodynamic efficiencies change.

Conventional load-sharing strategies employing base-loading, pressure-to-flow cascade, or biasing of one controller's output are far less effective, if they work at all. Such systems commonly experience load oscillations that degrade control precision. They also produce a less efficient load distribution in which the least-loaded compressors are more likely to surge.

Benefits

Series 3⁺⁺ Performance Controllers offer many benefits you can't get from conventional, general-purpose controllers, including:

- **More precise control** because the built-in loop-decoupling algorithms allow the Performance Controllers to avoid process disruptions caused by Antisurge Controller actions
- **Less compressor downtime** because our process-limiting and manual-override algorithms eliminate unnecessary process trips due to overload conditions or inadvertent operator errors
- **More reliable operation** because fall-back strategies permit continued capacity regulation even after transmitter failures
- **Optimal efficiency in multi-compressor applications** because our load-sharing algorithms eliminate unnecessary recycling
- **Simplified operation** due to automation of start-up, shut-down, and load-sharing procedures
- **Lower engineering costs** because the Series 3⁺⁺ Performance Controller is designed specifically for compressor applications, thus eliminating custom software design and debugging costs and reducing startup expenses