



**COMPRESSOR
CONTROLS
CORPORATION**

Series 3 Plus Antisurge Controller

for Axial and Centrifugal Compressors

Description

Every centrifugal or axial compressor has a characteristic combination of maximum head and minimum flow beyond which it will surge. Preventing this damaging phenomenon is one of a compressor control system's most important tasks. The Series 3 Plus Antisurge Controller is the ideal candidate for that job.

The only way to prevent surge is to recycle or blow-off a portion of the flow to keep the compressor away from its surge limit. Unfortunately, compressing this extra flow extracts a severe economic penalty. So the control system must be able to accurately determine how close the compressor is to surging so it can maintain an adequate but not excessive recycle flow rate.

Series 3 Plus Antisurge Controllers employ a unique combination of accurate surge prediction and tailored control responses that protect your compressors with the smallest possible margin of safety. The bottom line is less wasteful recycling (or blow-off) without sacrificing complete protection.

Patented Surge Protection

A compressor's surge limit is not fixed with respect to any one measurable variable, such as compression ratio or the pressure drop across a flow meter. Instead, it's a complex function that also depends on gas composition, suction temperature and pressure, rotational speed, and guide vane angle.

Series 3 Plus Antisurge Controllers calculate proximity-to-surge using a multi-variable function that is invariant to changes in all such variables. Because the specific function you need depends on which conditions are fixed and the configuration of your compressor, the controller offers a variety of keyboard-selectable standard configurations.

A surge control system should also tailor its response to the size of each disturbance, in order to prevent surge without upsetting the process or requiring a large, energy-wasting margin of safety. The Series 3 Plus Antisurge Controller achieves this goal with a variety of open and closed-loop control algorithms.

For small disturbances, proportional-integral control is used with provisions for preventing reset windup

Description, continued on rear panel

Benefits

Series 3 Plus Antisurge Controllers offer benefits you can't get from general-purpose controllers, including:

- **More economical operation of your compressor** because our advanced surge control methods allow the compressor to safely operate closer to its surge limit without unnecessary recycling
- **More precise control of your process** because the built-in loop decoupling algorithms allow companion Performance and Antisurge Controllers to be tuned faster and to counteract the potentially disruptive effects of antisurge control actions
- **Less compressor downtime** because our control algorithms eliminate unnecessary process trips due to surge or overload conditions

Benefits, continued on rear panel



Description, continued from front panel

when the valve is fully closed. Fast disturbances elicit a derivative response that increases the safety margin, thus accelerating the PI control response.

If that combination proves insufficient, our adaptive open-loop Recycle Trip® response steps opens the antisurge valve even further, using step sizes based on the instantaneous rate of approach to surge. This provides just enough added flow to prevent surge without unnecessary process disruption.

Finally, if unanticipated circumstances do produce a surge, our Safety On® response redefines the surge limit to stop that surge after a single cycle, then remains in effect to prevent future surges.

Summary of Features

The many built-in, keyboard-configurable features of the Series 3 Plus Antisurge Controller include:

- proximity to surge calculations automatically adapt to changing inlet conditions
- patented combination of open and closed-loop control responses provides maximum protection and optimal process efficiency
- keyboard selectable standard configurations adapt controller to your specific application
- integrated loop decoupling prevents interacting control loops from destabilizing your process
- limiting control of any two single-input variables consistent with surge protection
- automatic start-up and shut-down logic
- bumpless transfer between manual and automatic operating modes
- manual override prevents inadvertent compressor damage due to operator error
- input testing and fallback strategies keep your compressor on-line in the event of a transmitter failure
- tracking and self-test features allow smooth, automatic switching to redundant controllers in the event of a controller failure
- standard hardware simplifies maintenance and spare parts stocking
- Modbus interface enables communications with host computers or distributed control systems

Fast, Dedicated Hardware

Surge protection is further complicated by the speed at which surge develops. It can take only a fraction of a second for the compressor to move from a relatively safe operating point to one where surge is inevitable.

The Series 3 Plus Antisurge Controller's dedicated microprocessor-based hardware adjusts your compressor's proximity-to-surge 25 times per second, based on measurements made 200 times per second. In contrast, general-purpose controllers or pneumatic systems are just not up to this task.

Integrated Loop Decoupling

Process protection, efficiency and precision can be further improved by combining the Series 3 Plus Antisurge Controller with its companion *Series 3 Plus Performance Controller* [PB302].

Conventional controllers often interact to create flow and pressure oscillations that degrade system performance and reduce antisurge protection. In contrast, Series 3 Plus Control Systems feature integrated loop-decoupling algorithms that can prevent adverse interactions. As a result, their control loops can be tuned faster to achieve more precise control without sacrificing process stability.

Benefits, continued from front panel

- **Lower compressor repair costs** because elimination of damaging surges reduces the frequency of major repairs
- **More reliable operation** because fall-back control strategies permit continued surge protection even after transmitter failures
- **Simplified operation** because our Recycle Trip and Safety On control responses minimize operator involvement
- **Lower engineering costs** because the Series 3 Plus Antisurge Controller is designed specifically for compressor applications, thus eliminating custom software design and debugging costs and reducing startup expenses
- **Lower capital costs** because our surge and overload protection prolongs the life of your compressor

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