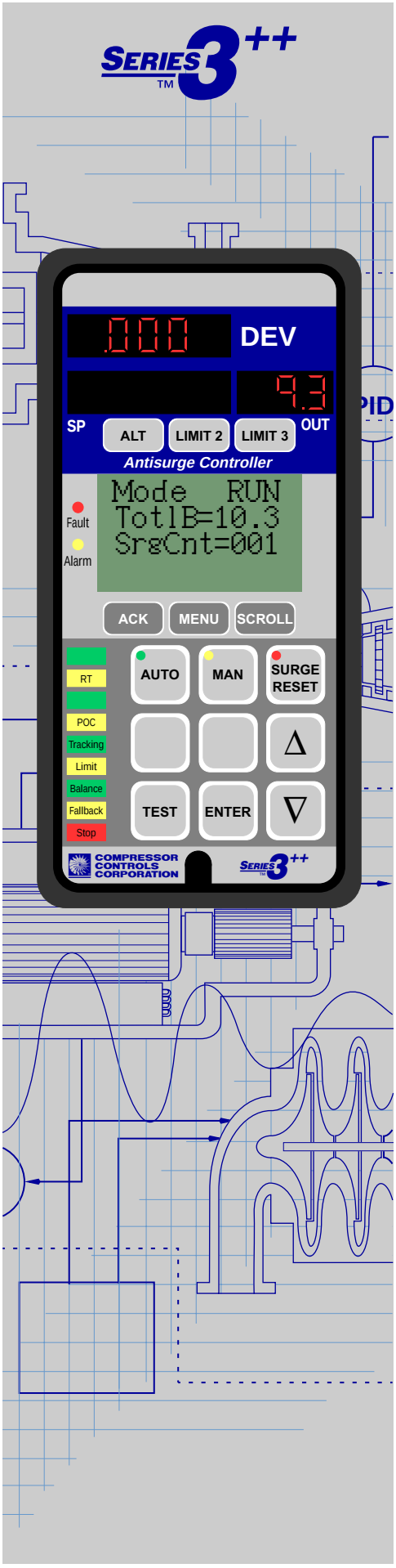

Antisurge Controller

for Centrifugal and Axial Compressors

COMPRESSOR CONTROLS CORPORATION

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

The only way to prevent surge is to recycle or blow-off enough flow to keep the compressor away from its surge limit, but compressing that extra flow is costly. To maintain an adequate but not excessive flow rate, a controller must accurately determine how close the compressor is to surging and tailor its response to the size and speed of any disturbances. CCC pioneered and is the world's most experienced supplier of such technologies.

Pioneering 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, temperatures and pressures, rotational speed, and guide vane angle. So Series 3^{++} Antisurge Controllers calculate proximity-to-surge using a multivariable application function that is invariant to all such changes. Because the best function for your process depends on which conditions are fixed and the available measurements, an easily-selectable variety of such field-proven "fA modes" is provided.

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. To that end, the Series 3^{++} Antisurge Controller applies a combination of open and closed-loop control algorithms:

- For small disturbances, proportional-integral control is used with provisions for preventing reset windup .
- 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 trigger surging, our Safety On® response redefines the safety margin to stop it after a single cycle, then remains in effect to prevent future surges.

COMPRESSOR CONTROLS CORPORATION

Features:

- ***selectable proximity-to-surge functions adapt controller to changing process conditions***
- ***combined open and closed-loop control responses provide maximum protection and optimal process efficiency***
- ***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 manual and automatic operating modes***
- ***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***

Fast, Dedicated Hardware

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

The Series 3^{++} Antisurge Controller's purpose-built hardware adjusts its outputs 25 times every second, based on measurements made every 5.0 milliseconds. In contrast, general-purpose controllers are just too slow for this task.

Integrated Loop Decoupling

Process protection, efficiency and precision can be further improved by combining Series 3^{++} Antisurge Controllers with companion Performance Controllers (see PB3302).

Independent control loops often interact to create pressure and flow oscillations that degrade performance and impair antisurge protection. In contrast, Series 3^{++} Systems feature built-in 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

Series 3^{++} Antisurge Controllers offer benefits you can't get from general-purpose controllers, including:

- More economical operation of your compressor because our 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 downtime because our control algorithms eliminate unnecessary process trips due to surge or overload conditions
- Lower compressor repair costs because elimination of damaging surges reduces the frequency of major repairs
- More reliable operation because fall-back 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^{++} 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 features prolong the life of your compressor.