A Big Relief

Using logic element technology to boost the flow (and pressure) capability of electro-proportional relief valve circuits

The Logic of Logic Elements

Effective use of logic elements is a key to designing cost-effective circuits, and is limited only by the imagination of the designer. Most experienced hydraulic circuit designers know and understand the many ways to apply logic elements. Those who are less familiar with logic elements but are always looking for the next best solution will benefit from this article. It focuses on normally closed, vent-to-open type of logic elements, like the new HLE10-CVO and its family; and proportional relief valves, like the new HPRV08-DAC and its family.

Logic elements, often called differential sensing valves, are pressure control devices. Like directional control valves, a spring bias holds the spool in one position (open or closed), and it is shifted by hydraulic pressure. Unlike directional control valves, logic elements are modulating devices (not on/off), that maintain a pressure differential. By themselves, logic elements perform no function but are building blocks for many circuits.

Creating a Big Relief

Proportional pressure relief valves (PRVs) are 2-way valves that provide a relief pressure as a function of electric current. Both normally-open (increasing pressure with increasing current), and normally-closed (decreasing pressure with increasing current) are available. With the growing market for proportional fan systems, this article will focus on the normally-closed design for fan speed control.

The normally-closed proportional relief valves are available in direct-acting and pilot operated designs. A direct-acting, normally-closed proportional relief valve, like PRV08-DAC and HPRV08-DAC, is used for low flow applications, like piloting a logic element. For high flow applications up to 180 LPM, internally pilot-operated cartridges are available, like PRV10-POC or PRV12-POC. If the flow requirements (or even pressure requirements) exceed that of the internally pilot-operated valves, then combining the direct acting PRV with the proper logic element is the next logical step.

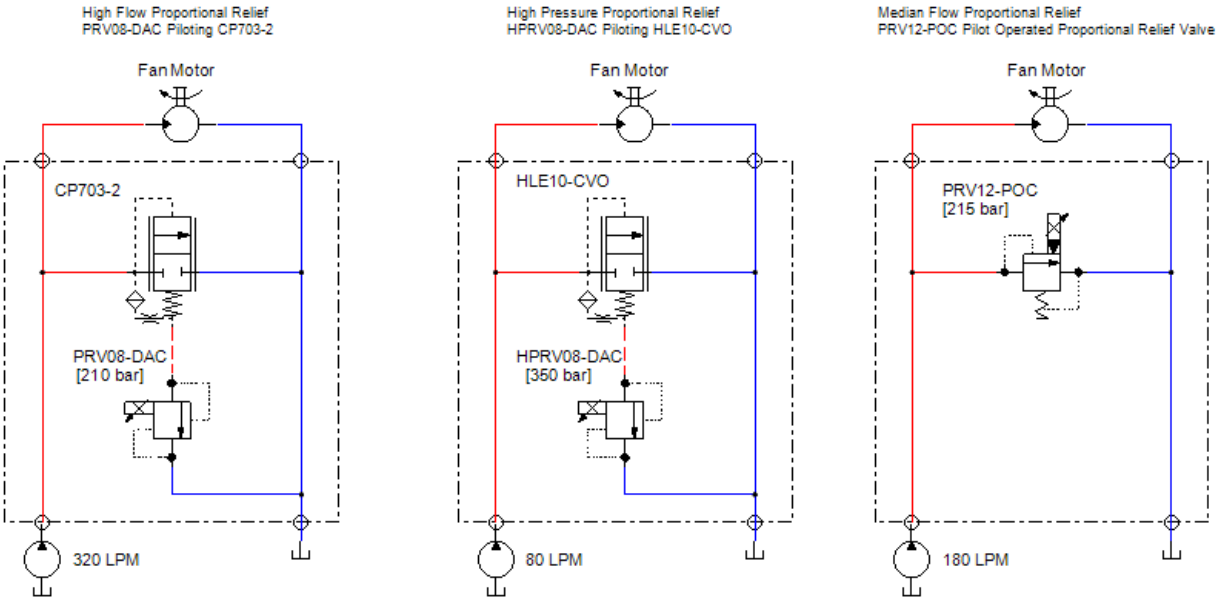
Common applications for normally-closed proportional relief valves are electro-proportional control of system relief pressure or a remote pressure compensator control for open circuit piston pumps, but where system requirements dictate full pressure with no electrical signal. Most fan drive systems require the fail-safe mode (no electrical current) to provide full fan speed, which makes normally closed PRV's ideal.

Schematic Examples

The example schematics show 3 different solutions to provide proportional fan speed control to a fan motor. The first two are combining a spool type, normally closed, vent-to-open logic element with a direct acting electro-proportional relief valve to create a proportional relief function - selecting the logic element size and pressure to match the system requirements. The third schematic shows the single valve advantage of the pilot-operated (smaller size and less space needed), but has flow (180 LPM) and pressure (210 bar) limitations.

The first schematic is the high flow example. If the system requires up to 380 LPM and 210 bar max pressure, then select proper the logic element to match the capacity, like CP703-2 in combination with a PRV08-DAC. For higher pressures requirements (middle schematic), select the HLE10-CVO with the HPRV08-DAC – both capable of 350 bar and will provide flow up to 100 LPM. The third schematic is for flows up to 180 LPM and when pressures of 210 bar or less are needed, using a single cartridge valve like pilot operated proportional relief valves PRV10-POC or PRV12-POC.

Combining a logic element (left) with a direct-acting proportional relief valve (right) provides high flow and high pressure solutions.



Examples of fan speed control using direct-acting proportional relief valves (PRVs) piloting a logic element - High Flow (left), High Pressure (middle). Example (right) showing a pilot-operated PRV.

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