HydraForce SP10-57F Fast-Acting, Proportional, 3-Position 5-Way Valve for Autosteering Applications

The Growing Demand for Autoguidance Systems

In the previous 5 years, the market for Global Navigational Satellite Systems has doubled. The technology we depend on for agriculture, construction, mining, and other industries is getting smarter and more autonomous. With satelite guided autosteering systems, operators benefit from reduced fatigue, and precision enhances the quality of work. In precision farming, yield mapping ensures the exact amount of fertilizer is applied to the precise area of the field, and combines are able to track an optimized path through the crop. In mining, ore trucks can navigate the circuit from pit to pile and back with greater efficiency. In construction, graders and compactors complete their tasks in fewer passes, and compaction accuracy is improved.

While autosteering systems have their benefits, most require a human operator have the ability to gain control of the vehicle instantly. This is for safety reasons, and for routine tasks that the guidance system is unable to perform, such as navigating between fields or jobsites. When needed, there are several approaches available to switch between manual and automatic steering, including hydraulically and electically activated selector valves with or without position sensors.

Hybrid systems use a steering orbital in parallel with the autosteering valve. Steer-by-wire systems omit the orbital valve and allow operator control via an electronic input device such as a joystick, knob, or electronic steering wheel. Steer-by-wire allows enhanced controllability with features such as variable ratio steering that adjusts to the speed of the vehicle. Smart electronic controls may also enhance safety by predicting potential stability issues and damping erratic or unsafe operator inputs.

Faster 5-way Proportional Valve

At the heart of these autoguidance systems are proportional hydraulic controls that are able to operate with the highest speed and precision. HydraForce's new fast-acting 5-way, 3-position proportional valve: the SP10-57F, is a minimum overlap, proportional directional control valve with excellent response time.

For detailed information and specifications, visit www.hydraforce.com or contact your local HydraForce representative at www.hydraforce.com/distribs/world.htm

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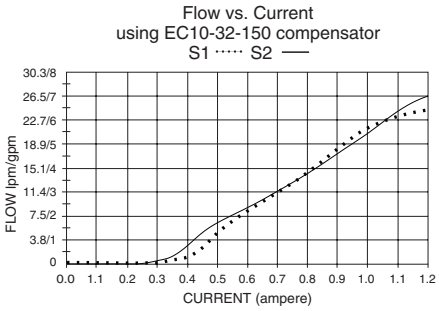
Performance

This valve is perfect for closed-loop autosteering control systems because it works well dynamically controlling the position of a steering cylinder. The satellite navigation system provides real-time feedback to close the control loop. A system like this continuously makes many minor adjustments each second. With a snappy pull-in response of 31 ms, and dropout of 6 ms, the SP10-57F is typically able to respond up to 25 Hz. The story doesn't end with fast response, this new spool design also provides one full amp of control resolution over the flow range of 0–26 lpm (0–7 gpm) and excellent linearity.

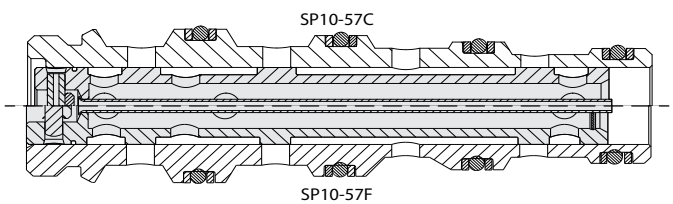


The 5-way proportional design of the SP10-57F includes an integral load signal at port 1. This pilot signal can communicate load pressure or even flow demand to a logic valve for priority flow-sharing or load-sensing systems. The benefit of using a 5-way valve is the bidirectional load signal does not require logic to determine the direction of operation. This saves a couple check valves and is a distinct advantage over CETOP/D03 valves which are dependent on a 4-port (P, T, A, B) interface pattern.

Overlap, Transition, Timing, and Leakage

Overlap in spool valves is a feature defined by the width of the spool sealing lands. It impacts the timing, transition, and leakage of a spool valve. *See illustration for comparison between C and F spool versions*. Timing is the relative difference in opening between ports as the spool shifts. Transition is open or closed as the valve changes position from neutral.

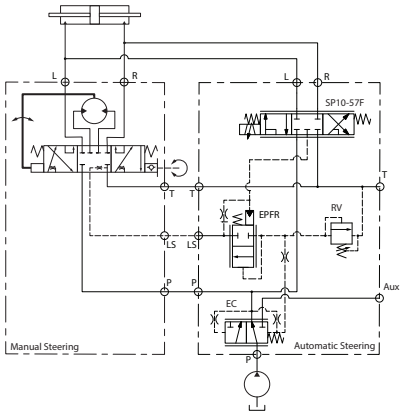
This valve is open in transition at S1 and slightly closed at S2. Circuit protection may be required if pressure spikes are noted. The minimum overlap of this valve leads to fast response, but greater leakage in the neutral position than with the typical C spool valves. When applied in an autosteering application, the valve is constantly making small corrections to maintain a straight course. Leakage is typically not a critical factor because the valve rarely rests in neutral during operation.



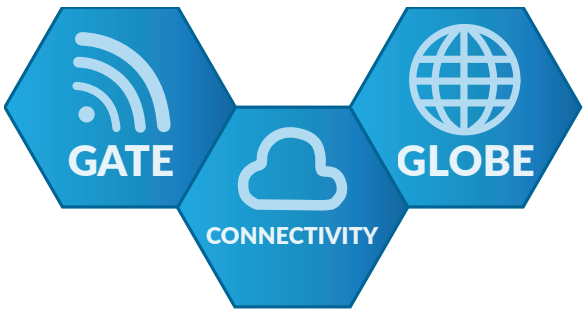
Application

The SP10-57F fast-acting, 5-way, proportional directional valve works in any directional control application where a fast response is needed and leakage is not a major concern. It was developed and optimized for steering control. It is easy to apply in parallel with an existing orbital metering valve *(see illustration)* or in a stand-alone configuration for steer-by-wire systems.

HydraForce offers a wide selection of auxiliary valves to provide associated functions such as load-holding, lockout/isolation, priority flow division, pump unloading, and pressure compensation. A complete valve package can be designed to mount directly on the steering orbital, or remotely located elsewhere on the vehicle.



Complete Vehicle Control System and IOT Platform



A flexible array of CANopen/SAE J1939 networked ECUs and valve drivers provide smart electronic controls for any function on the vehicle. In addition, the ETEL-1 remote access unit allows wireless data communication anywhere within range of a cellular network.

Through a partnership with Epec Oy of Finland, HydraForce offers a complete IoT and telematics platform for mobile equipment applications. This includes Epec's GatE secure access gateway, and GlobE cloud-based, remote management solutions.