

Better performance comes from working together.



HYDRAFORCE
POWER FORWARD

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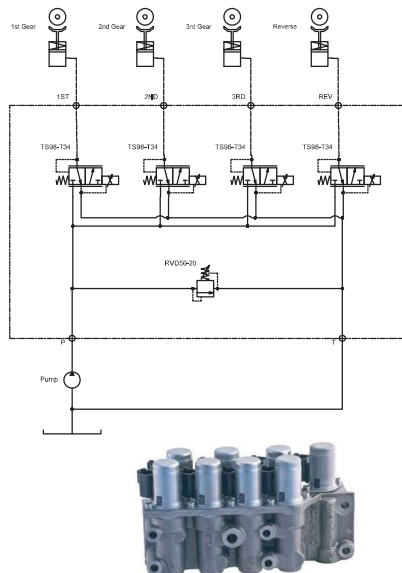
Efficient Electro-Hydraulic (EH) Control Solutions for Off-Highway Transmissions

Working with a specialized, full-line provider of electrohydraulic controls like HydraForce can give the transmission designer an advantage in size, cost, ease of installation, and fuel efficiency. With 28 years of transmission experience, HydraForce has provided numerous customized transmission solutions and is capable of functioning as a full partner in the development of new and improved transmission solutions.

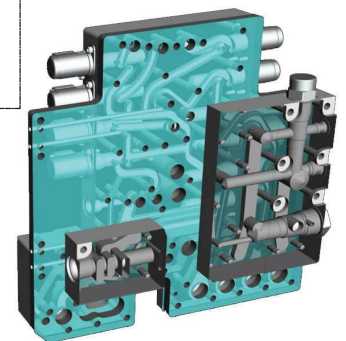
HydraForce provides a full line of contamination-resistant transmission valves that feature IP69K-rated coils and salt-spray resistant plating.

For the transmission market, HydraForce offers the following solutions:

- Pilot-operated proportional clutch solutions
- Direct-acting proportional clutch solutions
- On/Off clutch solutions
- Pressure regulation
- Pressure modulation
- Electronic controllers for clutch engagement, clutch fill and PTO functions
- Highly customizable packaging - block, casting and transmission interface
- Custom valve options available



Innovative transmission control solutions for any machine can be quickly configured with the full range of HydraForce electro-hydraulic control options.



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

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Transmission control plays a critical role in optimizing performance through all stages of a machine's operating cycle. A good control system can deliver power when it's needed and conserve power when it's not. Speed of response, smooth operation and the ability to deliver a variable pressure for smooth clutch engagement are also the hallmarks of a superior transmission control system.

Smooth clutch engagement results in smoother machine operation, driver comfort, increased fuel efficiency, productivity and longer life for both the clutch and the machine. And of course, controls should be designed to minimize hydraulic leakage in order to optimize fuel efficiency. Among the many control options for transmissions are proportional control with pilot-operated or direct-acting valves, simple on/off control with solenoid valves, and pressure regulation with logic elements that keep the supply of pressure stable despite fluctuations in oil flow.

Pilot-Operated Proportional Clutch Solutions

Two-stage, pilot-operated proportional pressure reducing/relieving valves offer a number of "pluses" for transmission clutch control. These valves consist of a solenoid-driven proportional pilot stage, which controls a main stage reducing/relieving spool function. Pilot-operated valves are available in flow ranges of 30 lpm (8 gpm) to 189 lpm (50 gpm) at pressures from 30 bar (435 psi) to 241 bar (3500 psi).

- Pilot-operated valves are widely available in the ideal flow range needed for transmission control and have low pressure drop at relatively high flows.
- Smaller coil and actuator sizes have lower current draw - less than 1 amp to reach maximum regulated pressure - and lower electrical cost.

Direct-Acting Proportional Clutch Solutions

Single-stage, direct-acting proportional valves are now available with flow ratings comparable to pilot-operated valves. The standard versions of direct-acting valves are capable of 0 to 19 lpm (0 to 5 gpm) and specialized models can now handle flows rates of up to 30 lpm (8 gpm). This provides adequate flow for clutch filling.

- Direct-acting valves have lower leakage rates, which allows the use of a smaller pump. And the use of a smaller pump provides additional reductions in the areas of fuel consumption, exhaust emissions and horsepower losses.
- Shorter main stage stroke and simpler design provides faster response than pilot-operated clutches.
- Direct-acting valves have fewer moving parts which equates to fewer modes of failure and less leakage potential.
- Contamination resistance. Friction disc wear can make transmissions susceptible to contamination and the higher actuator forces of direct-acting valves gives them an ability to "push through" contamination.

On/Off Clutch Solutions

HydraForce can provide on/off clutch solutions and control of ancillary functions that need to be "on" when the vehicle is in a "stopped" or "ignition-off" condition, such as:

- Four-wheel drive engagement
- Park brake
- Differential lock

SV98-T39 and SV98-T40 solenoid valves are well-suited for use in specialized low-pressure pilot systems or power shift transmission control. They are economical drop-in style, direct-acting solenoid valves that provide high flow, low pressure drop and low operating pressure. They have IP69-rated, continuous-duty solenoid coils with an corrosion-resistant coating.

Pressure Regulation

HydraForce has the widest variety of pressure regulating solutions, from single cartridge valves to a combination of valves in a custom manifold.

EPxx-S35 logic elements are used specifically in transmission pressure-regulating applications because they provide a relatively flat rate of pressure rise with large fluctuation in oil flow which makes your transmission more efficient. Choose from seven sizes, including several high-pressure models rated at 350 bar. EPxx-S35 valves have flow ratings ranging from 38 lpm for the EP08-S35 up to 379 lpm (100 gpm) for the EP20-S35 and HEP42-S35. A wide range of spring settings, manual override, and corrosion-resistant G-coating options are available.

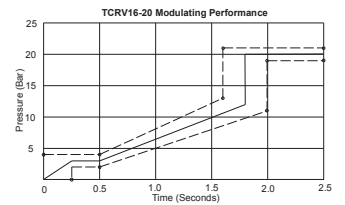
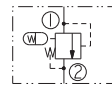
Pressure Modulation

For applications that need a simple and cost-effective way to modulate pressure, HydraForce offers the TCRV modulating valve. When paired with a cost-effective drop-in solenoid valve, it offers the benefits of proportional control without a complex proportional control algorithm.

TCRV16-20 is a clutch control ramp valve with constant inlet flow. Port 1 is installed in parallel to the clutch. With constant inlet flow at Port 1, the valve will build system pressure according to specified limits.



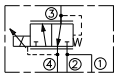
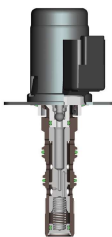
Custom TCRV modulating valve



Visit www.HydraForce.com for full specifications on these options for transmission control.

PILOT-OPERATED

The TS98-T34 pilot-operated proportional pressure reducing/relieving valve has a flow rating of 34 lpm (9 gpm), pressure drop (reducing) of 5.5 bar (80 psi), de-energized leakage of 550 ml/min and response time of 50 milliseconds.



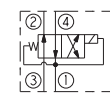
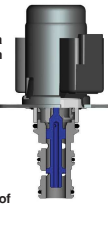
DIRECT-ACTING

The EHPR98 series of direct-acting proportional pressure reducing/relieving valves have flow ratings ranging from 0 to 19 lpm (0 to 5 gpm) for standard models and up to 30 lpm (8 gpm) for specials, de-energized leakage of 50 ml/min, and response time of 30 milliseconds, which is nearly faster than pilot-operated valves.



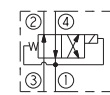
ON/OFF SOLUTIONS

The SV98-T39 solenoid valve has a flow rating of 30 lpm (8 gpm), operating pressure of 45 bar (650 psi) and response time of 50 milliseconds.



SV98-T39

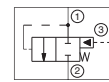
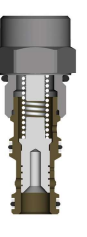
The SV98-T40 valve has a flow rating of 30 lpm (8 gpm), operating pressure of 30 bar (435 psi) and response time of 50 milliseconds.



SV98-T40

PRESSURE REGULATION

EPxx-S35 logic elements come in seven sizes with flow ratings from 38 lpm up to 379 lpm, operating pressures up to 350 bar and can be ordered with options such as various spring settings, manual override and corrosion-resistant G-coating.



Optimize your machine's powertrain systems and synchronize control of transmission clutch and engine speed with hydraulic cartridge valves.

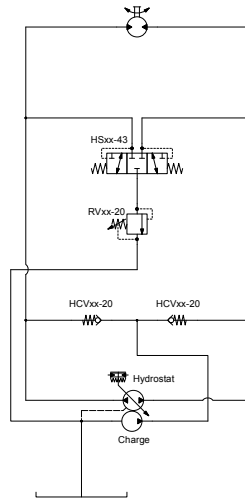
Hydrostatic Transmission

HydraForce offers many valves that will work in hydrostatic transmission circuits. High pressure check valves (such as the HCVxx-20 line) can be used in charging circuits to inject charge flow into the main loop. Hot shuttles pull oil from the low side of the circuit and feed it into flushing circuits which helps keep the loop oil fresh, filtered, and running at its optimum temperature.

HydraForce also offers an extensive line of relief valves and flow regulators to regulate the pressure and flow of the critical charging and flushing circuits. All of these components are rated to 350 bar with a 10% duty cycle at 420 bar which makes them perfect for hydrostatic applications.



Hydrostatic Transmission

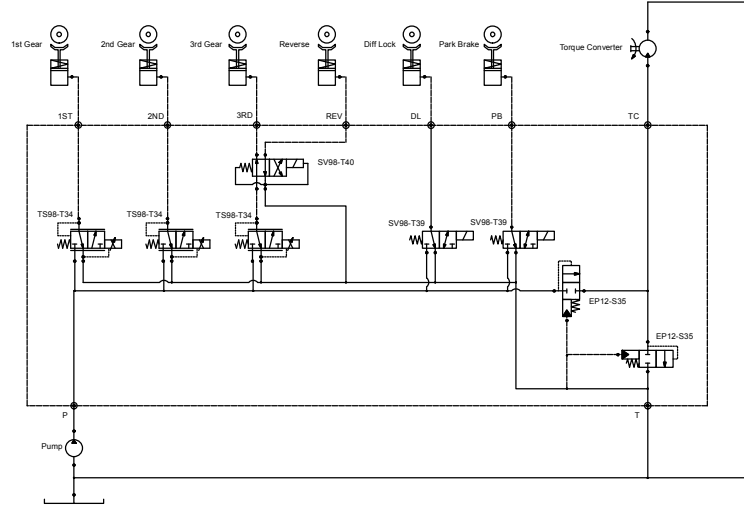


Electronically Controlled Modulation

HydraForce cartridge valves can be paired with an EVDR valve driver to provide electronically controlled modulation of a single speed transmission.

- Forward and reverse
- Modulated fill of the clutch
- Intuitive GUI allows for easy configuration
- Close the loop on throttle or brake pedal
- Inching and trolling functionality built in
- Modulating of forward or reverse clutch control valve

Multi-Speed Transmission



Multi-Speed Transmission

The flexibility of cartridge valving is demonstrated in a multi-speed transmission circuit that provides the full range of control possibilities. On/off clutch control, four-wheel drive and park brake engagement, and gear shifting can all be orchestrated with a mix of electroproportional valves, solenoid valves, and piloted spool-type directional elements.

The EPxx-S35 line of valves are very stable, high flow, pressure regulators used to provide oil to the valves that control the transmission's clutch packs and the torque converter.

The TS98-T34 electro-proportional valve is used to precisely ramp and engage the clutch packs for the smoothest possible shifting experience.

Usually there is a state in transmission gearing when the use of clutches are mutually exclusive. In this example, the 3rd gear and reverse are never engaged at the same time. Here we can use the SV98-T40 to allow a single TS98-T34 to control either clutch pack. This saves money by eliminating a proportional output and valve.

SV98-T39 solenoid valves provide a reliable and cost-effective method for controlling on / off pressure to accessories, such as parking brakes and differential locks.