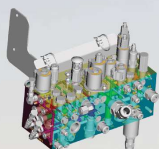


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Combine Harvesters.....Pages 4-7

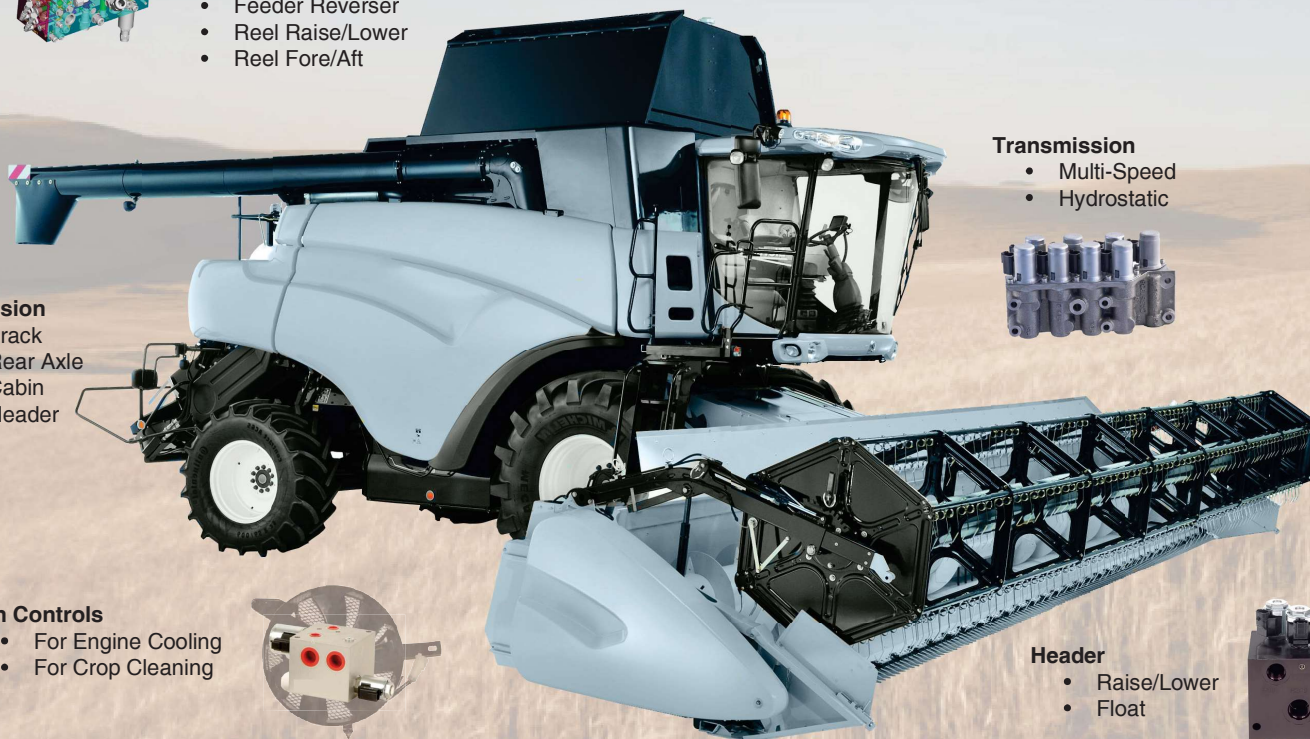
Main Controls

- Reel Controls
- Chaff Spreader
- Auger Swing
- Feeder Reverser
- Reel Raise/Lower
- Reel Fore/Aft



Suspension

- Track
- Rear Axle
- Cabin
- Header



Fan Controls

- For Engine Cooling
- For Crop Cleaning



Transmission

- Multi-Speed
- Hydrostatic



Header

- Raise/Lower
- Float



HydraForce technology is increasing the productivity of harvesting machines around the world. Precise control of cutting, chopping, shaking, sorting, spreading, conveying, brushing, raising and lowering is made possible with our comprehensive line of cartridge valves, custom manifolds, and high performance electronic controls.

Our electrohydraulic control solutions can help you deliver the highest yields of quality crop from any field, vineyard or orchard.

Innovative, custom-tailored control solutions provide a competitive advantage for agricultural equipment in the harvesting sector. Here are some of the many ways HydraForce controls can enhance your hydraulic equipment.

Cotton Harvesters– Page 8 Cotton Pickers



Balers and Digging Harvesters – Page 9 Compacting, Wrapping, Cutting Potato, Carrot and Beet Harvesters



Specialty Harvesters – Page 10-11 Sugar Cane Grape Olive Nut



The HydraForce Difference.....Page 12

- Highest quality guaranteed
- Speed to market
- Flexible and responsive
- Over 600 combined years of cartridge development experience
- Leading edge technology



COMBINE HARVESTING

Global population growth and limited arable land drives the demand for increased productivity in the agricultural equipment market. Farmers need machines that are smart, efficient, powerful and productive. This is especially true in the grain harvesting market.

HydraForce takes a full systems approach when solving equipment control challenges. Our wide range of technology allows us to quickly find simple solutions as well as manage the intricacies of a more complex control scheme that might involve custom electronic controls or the integration of hydraulics with engine management or global positioning technologies. From header to spreader, this design flexibility is the key to a competitive advantage in the marketplace.

Main Control

Grain harvesting depends on equipment that can combine the functions of reaping, threshing and winnowing, or separating the grain from the chaff. Today's combine harvesters have become more versatile than ever, with removable headers

to handle different grains, suspension and leveling systems to scale terrain, continuously variable transmissions that make efficient use of fuel and fan drives that provide engine cooling or crop cleaning.

The Main Control for a combine consolidates all harvesting functions the chaff spreader, reel drive, auger swing, feeder - reverser, reel raise/lower and reel fore/aft - ensuring efficient use of available horsepower.

A new function can be added without affecting existing functions, allowing the opportunity for additional dealer-installed options after the combine leaves the factory. Applying our broad range of logic elements can resolve common system issues, such as pressure spikes and unstable or erratic operation.

Header Control

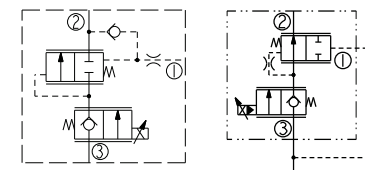
The lift, lower and tilt functions of the header are controlled with the cartridge valves in the Header Manifold. HydraForce can offer multi-function valves with integrated compensators and load sense capabilities to accomplish smooth and responsive raising/lowering of the header.

Precise electrohydraulic controls ensure the header follows terrain at a height that keeps dirt and debris out of the feed chute, providing maximum yield of good, clean crop. HydraForce can provide an optimally tuned custom manifold solution to provide smooth and responsive raising and lowering of the header. Alternative options can use a proportional pressure control valve to provide automatic pressure adjustment for a header, allowing it to travel over the crop at a specified harvesting height, regardless of differences in terrain.

During a harvesting operation, the combine header must be positioned as low as possible to the ground to get the greatest possible crop yield. No matter the requirements of your system, HydraForce can provide a "float" solution that will position your header high enough above the soil to prevent debris issues, but low enough to collect the crop.

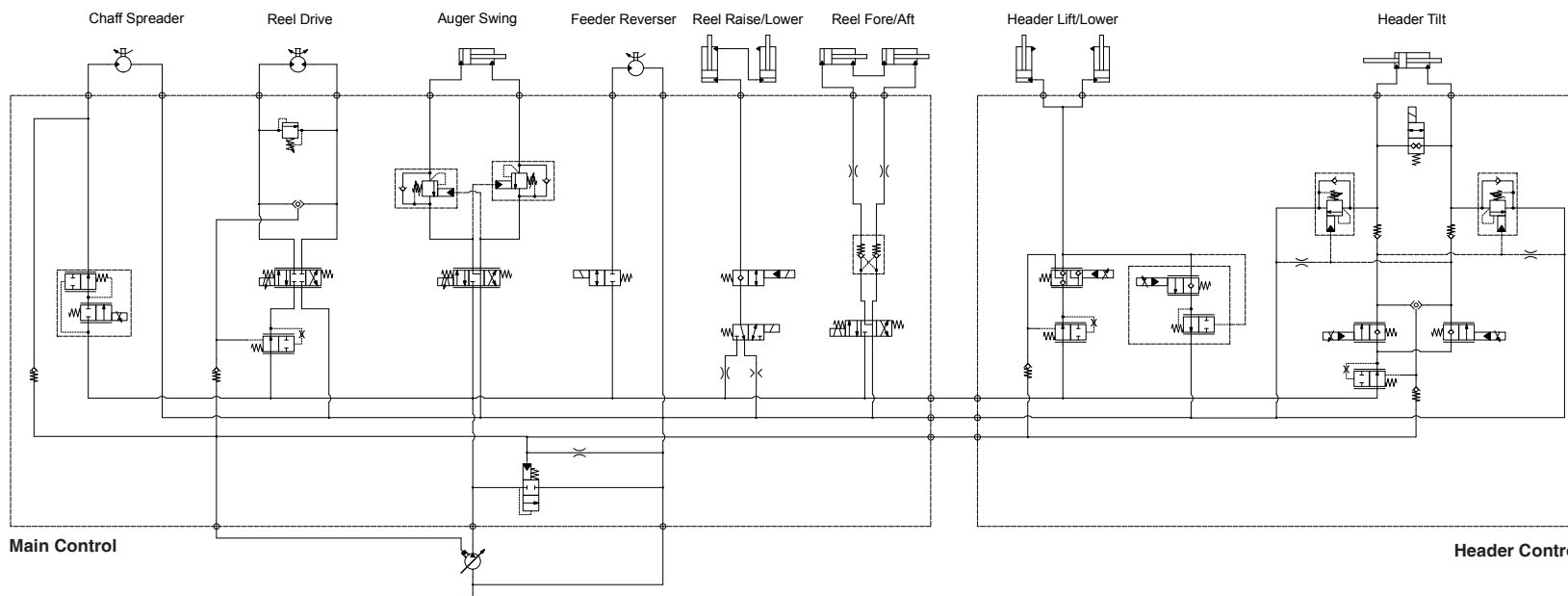
The New HSPEC Family

The new HSPEC family of multi-function cartridge valves ensures scalable flow capacity and precise control for any combine attachment. With three sizes and flow rates to choose from, the HSPEC valve offers design flexibility for proper control of position and pressure while harvesting or during transport.



HSPECxx-30 valves have a built-in post-compensator and load-sense valve, which enables more compact and efficient directional control packages. They come in several sizes and flow rates from 34 to 98 lpm (9 to 26 gpm).

HSPECxx-34 valves combine a proportional lowering valve with a pressure compensator and are ideal for lifting and lowering control of single-acting cylinders. The HSPECxx-34 valves provide an alternative to less efficient gravity-lowering systems. When combined with the HSPECxx-30 valves, you can create a compact, cost-effective flow-sharing circuit that enables efficient use of available horsepower while offering controlled load lowering.



SUSPENSION, POWERTRAIN, FAN DRIVE

Suspension

Combines and other harvesters that travel on rough terrain depend on suspension systems to protect the equipment and operator from vibration and shock. Cartridge valving and manifolds are used extensively in rear axle, cabin, header and even track suspension systems.

Track Suspension - Rice and other crops in wet or muddy fields are harvested more effectively by combines with tracks that distribute weight evenly across a field instead of wheels that are likely to get stuck. Suspended track systems are hydraulically powered and controlled with compact, efficient, and responsive cartridge valving.

Header Suspension - During transportation mode the header suspension system isolates the header from the rest of the machine. It allows the header to move and prevents the header oscillations from causing instability in the rest of the system.

HydraForce custom header ride control solutions can be integrated into the header height control manifold, or designed as a stand alone system.

The following options are available:

- Stand-alone or integrated
- Flow rates up to 260 lpm (70gpm)
- Dynamic or passive systems



Basic Suspension

This basic hydro-pneumatic suspension system is ideal for cabin or seat suspension.

- Single or double acting cylinder
- Accumulator
- Level control manifold
- Cartridge valves
- Pressure ratio 1:3 between min and max loaded axle

Advanced Suspension

Travelling over rough or uneven ground is typical for harvesters. When there is a high variance between minimum and maximum axle load, a more sophisticated axle suspension system is required, with a spring rate that adjusts continuously to driving speed, acceleration, and terrain.

- Single or double-acting system
- Independent accumulators for cylinder piston and rod side
- Constant or variable pressure on rod side
- Integral sensors
- Software development

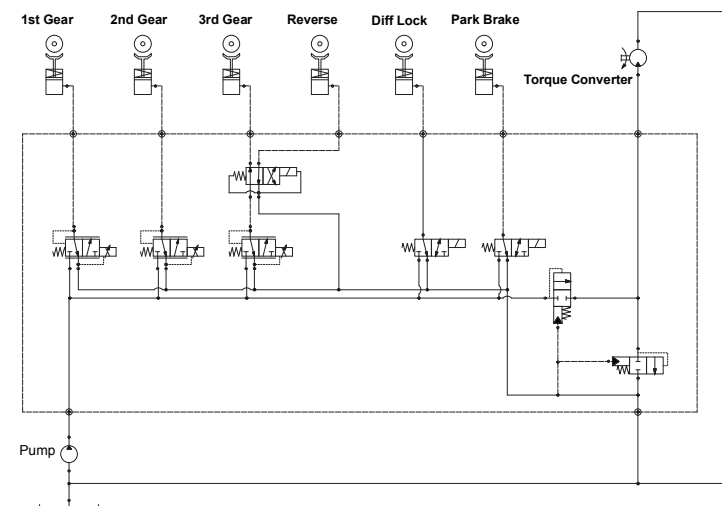
Powertrain

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 electro-proportional valves, solenoid valves, and piloted spool-type directional elements.

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

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 you can use a solenoid valve to allow a single proportional pressure control valve to control either clutch pack. This saves money by eliminating a proportional output and valve.

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

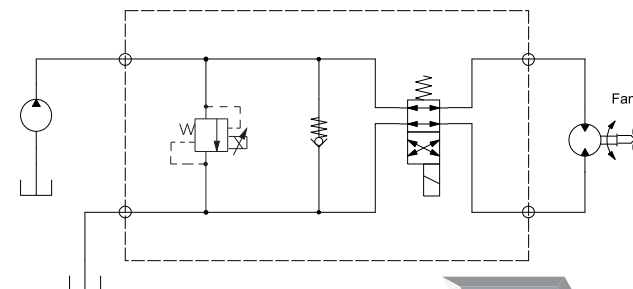


Fan Control

Fan drives controlled by hydraulic cartridge valves are quieter and run on less horsepower than mechanical fan drives, providing greater fuel economy for combines.

Control valves with multiple temperature inputs can be used to provide variable fan speed control depending on air temperature, load, and cooling requirements. If the radiator gets clogged, two-position, four-way solenoid valves can automatically reverse fan direction.

- Flow rates up to 190 lpm (50 gpm)
- Fail safe high or low
- Preconfigured controls available
- Reduce horsepower consumption by up to 30%



COTTON HARVESTERS, DIGGING HARVESTERS AND BALERS

Whether the crop is light, fluffy and grows above the ground, or heavy, dirty and grows below the ground, HydraForce cartridge valves can provide the range of adjustable controls needed for efficient harvesting of any crop from cotton to potatoes.

HydraForce has extensive experience developing main control manifolds for cotton harvesters including picking, conveying, baling, wrapping functions and proportional fan control that conserves energy when cleaning a light cotton crop and increases fan speed when handling a heavy cotton crop.

Cotton Harvesters

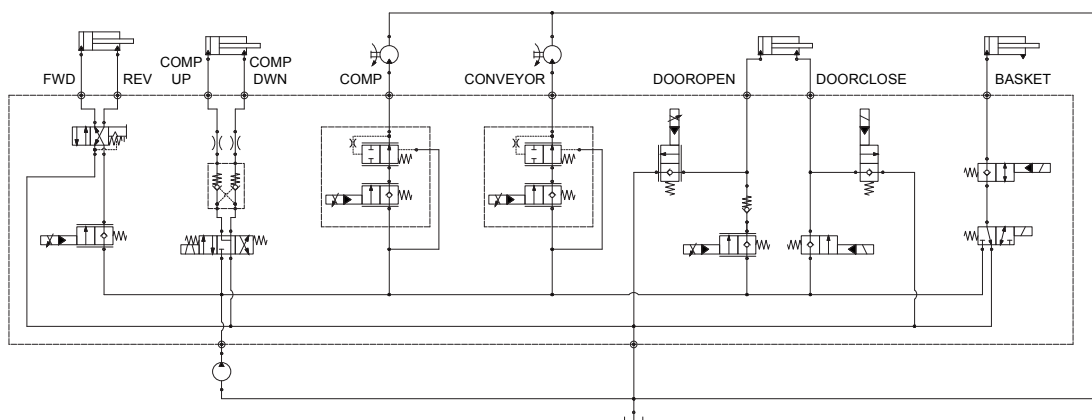
Proportional controls are attractive to the cotton harvesting market with its multitude of machine functions. Whether picking, stripping, or baling, efficient hydraulic control is the best solution for getting the highest yield from the field.

Proportional controls can conserve flow or pressure when harvesting or handling a light crop, and increase it for a heavy crop. This ability to adapt to dynamic load conditions also saves fuel.

HydraForce is the leader in electro proportional controls, with 2-, 3-, 4- and 5-way models for flow or directional control, with reducing/relieving, bidirectional, pressure-compensated, and load-sensing solutions.



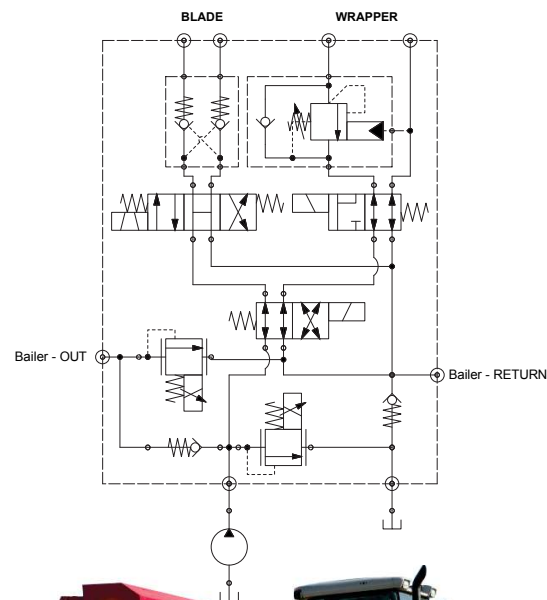
Cotton harvesters rely on cartridge valving for efficient control of the picking and cotton stripping operations.



Baler

Heavy bales of hay have a heavy reliance on hydraulics for compacting, wrapping and cutting. Our electrohydraulic solutions can provide fine control of hydraulically operated bale handling.

Proportional hydraulic control of the mechanisms for binding and wrapping bales is accomplished effectively with cartridge valves. Accurate proportional pressure control can ensure the correct bale density – soft in the center to allow enough air flow for drying, and hard on the outside to shed water.



Potato, Carrot and Beet Harvesters

Crops that grow underground, such as potatoes, carrots, and beets, require specialized harvesting equipment that trims or mows the plants first, then digs below the ground to harvest them.

Cartridge valves can provide the fine control required for these crops – whether cutting, digging, raising, lowering, or conveying. HydraForce has a solution that will perform in these demanding applications.



Potato harvesting can be done more carefully and controlled with cartridge valves.

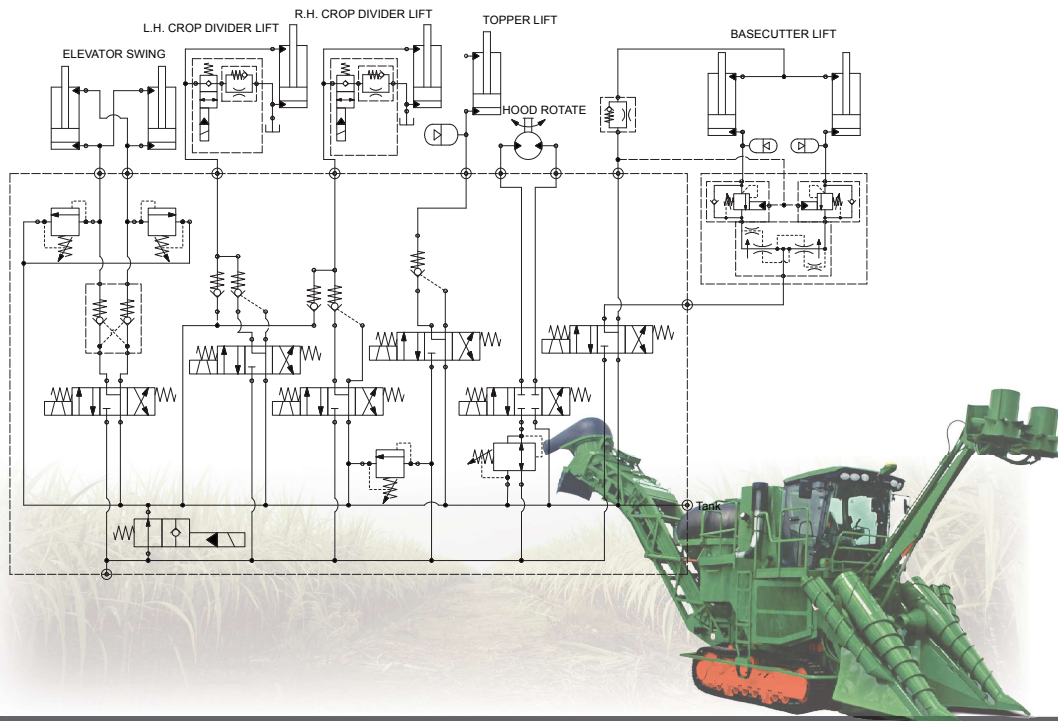
SPECIALTY HARVESTING

Sugarcane
Olive, Grape and Nut

Sugarcane Harvesters

Sugarcane is the world's largest crop and one of the toughest to harvest. It grows in the heat and humidity of tropical countries and can reach heights of 2 to 6 meters (6 to 19 feet). The stalks are tall and tough and must be trimmed at the top and cut at the base during harvest. Cleaner cane means higher quality and less equipment damage from debris, so extracting fans are used to blow away trash before the trimmed cane is collected. All of these functions - cutting, chopping, lifting, cooling, propulsion and suspension - must be done with high performance, high torque, high efficiency and low fuel consumption.

Sugar cane harvesters can be equipped with a variety of dealer-installed options, so their manifolds are designed with the flexibility to add cartridges and functions for the end user.



Sugar cane harvesting thrives on efficiency, since its intense operations require many high flow hydraulic circuits with logic elements. Proportional control cartridge valves provide an excellent way to achieve that efficiency.

Speed control of the elevator is another opportunity for the proportional control provided by cartridge valves. Fast speed is needed for a heavy crop and slower speed for a lighter crop. Being able to vary the speed as needed increases efficiency and extends the life of the elevator chain.

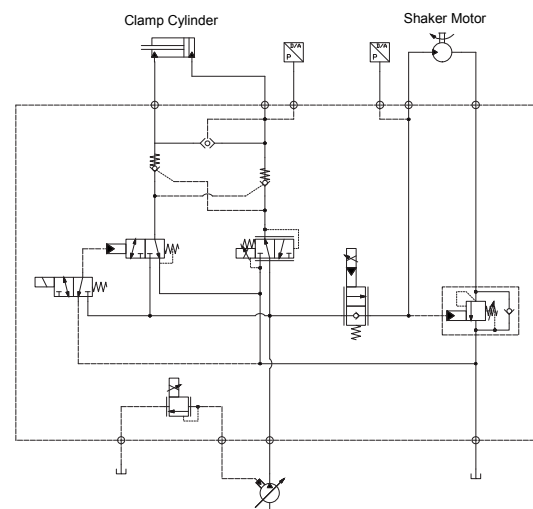
Large capacity flow controls in combination with numerous logic elements are especially useful for the sugarcane harvesting market, and HydraForce has the range of products to handle the most demanding requirements.

Olive, Grape and Nut Harvesters

Olives and nuts are harvested with machines that clamp to the tree and shake it. An umbrella-like collector is raised and opened to gather the crop. HydraForce can provide coordinated and smooth proportional control of the three electrohydraulic functions of clamping, shaking, and opening. Grapes, like olives, are a delicate crop that requires equipment capable of special handling and versatility. Hydraulic cartridge valves can handle the variety of controls needed on multi-function harvesting equipment that shakes the grapes off the vines, collects and conveys them, separates the leaves and stems, and prunes the vines.

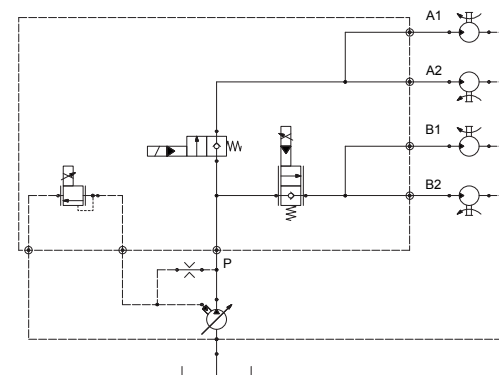
Shaker Control

Accurate and stable control of shaker speed is vital to vineyard harvesting. Shake too slow and crop is left on the tree or vine. Shake too fast and the plants and supporting trellises may be damaged. In some cases, vines or trees might have bare patches, so the shaker speed may need manual adjustment. This example shaker and clamp circuit provides stable and reliable speed and pressure control of the shaker motor and clamp function as the harvester moves through the field, and is able to compensate for the "end of row" or bare patches that can change the load demand on the motor.



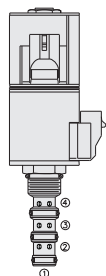
Fan Control

Fans are used by tree and vine harvesting equipment to help clean the crop, blowing away leaves and broken stems. The fan speed should be set to ensure a clean crop without wasting excess energy. The operator sets the speed of the upper and lower fans by adjusting the current supplied to the proportional pressure relief valve. Our range of low leakage solenoid and proportional valves can be applied for on/off control and variable speed control during the harvesting process.



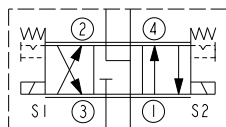
Hydraulic cartridge valves provide stable, efficient control of the shaker and cleaning fans of grape harvesting machines.

VALVES AND ELECTRONIC CONTROLS

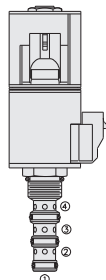


HSP10-47D

High Pressure Spool 4-Port,
3-Position, Closed Center

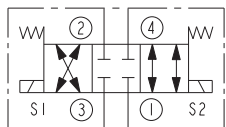


Flow: 37.9 lpm/10 gpm
Pressure: 350 bar (5075 psi)

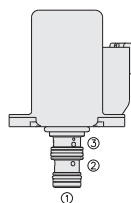


HSV10-47C

High Pressure Spool 4-Port,
3-Position, Closed Center

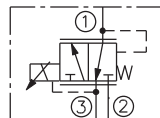


Flow: 37.9 lpm/10 gpm
Pressure: 350 bar (5075 psi)

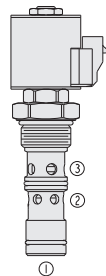


EHPR98-T3x

Proportional, Reducing / Relieving,
Drop-in

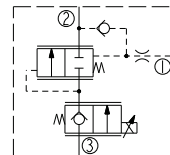


Flow: up to 19 lpm/5 gpm
*Custom options available with flows
up to 30 lpm/8 gpm*
Pressure: 241 bar (3500 psi)

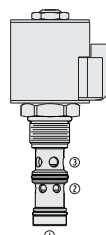


HSPECxx-30

Proportional Flow Control Valve with
Integral Compensator

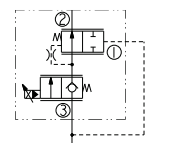


Flow: up to 132 lpm/35 gpm
Pressure: 350 bar (5075 psi)

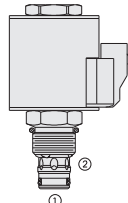


HSPECxx-34

Proportional Flow Control Valve with Integral
Compensator and Optional Load-Sense Check

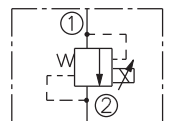


Flow: up to 115 lpm/30 gpm
Pressure: 350 bar (5075 psi)



TSxx-27

Proportional Pressure Control, Pilot-
Operated Relief



Flow: up to 189 lpm/50 gpm
Pressure: 241 bar (3500 psi)

U.S. Patent
6,267,350 & 7,137,406

Our Breadth of Product

As the largest manufacturer of hydraulic cartridge valves in the world, HydraForce offers an extensive range of solenoid, electro-proportional, directional, flow, and pressure control valves. In 2012, more than 200 new valves were introduced, including many high pressure and multi-function models. Cartridge valves for flow rates up to 570 lpm/150 gpm and operating pressures up to 350 bar/5,000 psi are sold individually, with housings or in manifold blocks. Valves can be custom-designed or standard product.

HydraForce designs, manufactures and supports valve, manifold and accessory products supported by heavy duty electronic machine control capabilities.

To request a free hydraulic integrated circuit (HIC) consultation, please visit:
<http://info.hydraforce.com/Free-Custom-Circuit-Consultation/>

Electronic Controls



The NEW ECU-0809 features 8 flexible sourcing outputs, 9 flexible inputs, and 4 feedback inputs. The controller is built on a powerful 32 bit microprocessor and features a diagnostic indicator, unlimited F-RAM and access to our updated Software Development Kit.

CORETEK PROGRAMMABLE MACHINE CONTROLLERS

The new CoreTek line of general-purpose programmable controllers can be used as stand-alone controllers or integrated with other CAN networked devices. They are designed to withstand the environmental demands of mobile off-highway equipment applications. They feature flexible input and output configuration and are capable of driving up to 3.0 amps per output pin.

CoreTek controllers are fully sealed within a compact cast aluminum housing. Operating temperature range is -40° to +70°C (-40° to 158°F) and no external cooling or heat dissipation is required.

CoDeSys™ Programming

CoDeSys or Controlled Development System is a complete development environment for Programmable Machine Controllers. The editors and debugging functions are based on the proven development program environments of advanced programming languages (such as Visual C++).

CoDeSys software is available as a free download from HydraForce:
<http://www.hydraforce.com/Electronics/>

CoDeSys software: Copyright © 3S - Smart Software Solutions GmbH

Model ECU-0710

Up to 27 inputs, consisting of digital, pulse, current measuring feedback and analog. A total of seven output configurations can be set, including six PWM or digital high-side drivers and a single low-side driver.

Model ECU-2415

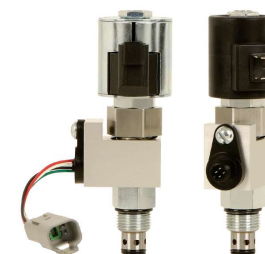
Up to 39 digital, pulse, current measuring feedback and analog inputs along with 24 outputs consisting of up to 24 PWM or digital high-side drivers.

Model ECU-2032

Up to 52 inputs and 20 outputs consisting of up to eight PWM or 20 digital high-side drivers.

Model ECU-2820

Up to 52 inputs and 28 outputs consisting of up to 24 PWM or digital high-side drivers and up to four digital low-side drivers.



SENSOR VALVES

Select HydraForce valves can be ordered with an integral position sensing option capable of transmitting an on or off signal. This new sensing solution was designed for interchangeable use with existing HydraForce cartridge valves, is compatible with manual override options and uses an industry standard cavity.

HEAVY DUTY SENSORS

HydraForce has accurate sensors designed for off-road applications. Our temperature sensors are thermistor style with padded resistors.
ERT 120 – Output Signal: 5427.9 to 436.3 ohms

Our pressure sensors have 1% total error band accuracy, are IP67 rated.
ERP035 – for pressure ranges up to 35 bar (500 psi)
ERP414 – for higher pressures up to 414 bar (6000 psi)