Electronic Load Controlled Pump
eLCP

Parker

ENGINEERING YOUR SUCCESS.

The flexible solution for multi-axis

eLCP at a glance:

- Electronic p/Q pump controller
- Constant flows independent of loads and with a wide adjustment range
- Flows of between 0.1 and 10,000 l/min can be controlled

Benefits for users:

- Precision
- Stability
- Energy efficiency
- Cost reduction
- Operational safety

presses: eLCP

The trend with presses is moving towards complete processing of workpieces. Aside from the main axis this also requires additional axes that start to function independently of each other and differ significantly in terms of cylinder dimensions, natural frequencies, and the masses to be moved.

The challenge: high resolution and stability

The electrically adjustable so-called p/Q pump control is frequently used to control the flows of the individual axes. It uses the pump to control the pressure and flow. However, its adjustability does not extend to the resolution capacity of valves. Precision can be increased by combining a high-resolution proportional valve with a traditional load sensing control, in which the pump regulates the differential pressure via the valve. Vibration problems are known to occur with this which are triggered by different friction coefficients in the seals in cylinders and column guides.

Parker's approach: the electronic Load Controlled Pump

Parker has now introduced a new solution to the problem: the electronic load compensation "electronic Load Controlled Pump" (eLCP), in which the hydraulic feedback is replaced by an electrical one. The pressure that appears behind an orifice downstream of the pump is fed back electronically to the proportional pressure valve of the pump control. As such the changing masses or forces of connected consumer loads such as hydraulic cylinders and motors have no impact on the speed of the consumer load. The flow at the valve outlet is constant and remains independent of any additional disturbance variables, such as variations in leakage oil rates in the pump and in the e-motor speeds. No differential pressure occurs at the orifice in static state, e.g. with pressure maintenance. A TDA proportional throttle valve is used to control the volume flow with which the oil flow can be set precisely in the range between 0.1 l/min and 10,000 l/min depending on the design size using step response times of less than 20 milliseconds.

Simple, precise, and energy-efficient flow control

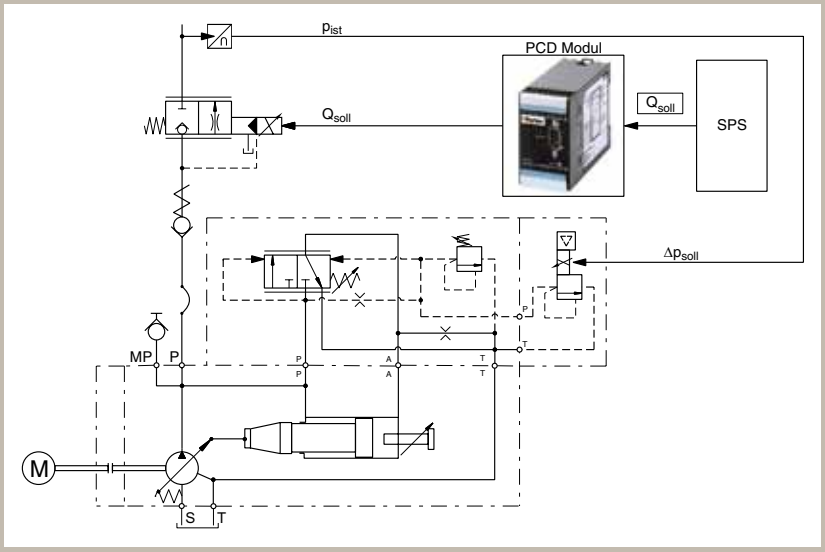
Use of the electronic Load Controlled Pump permits flexible flow control for the different axes and often avoids elaborate closed loop speed or position-control loops. The eLCP allows a separate differential pressure to be allocated to each individual function of the press. It works in the optimum energetic range with maximum precision in each case and also satisfies the different natural frequencies of the axes at the same time.

The eLCP does not need a pilot oil pump and therefore also saves energy. The TDA proportional valve determines the system dynamic, which allows standard three-phase motors to be used. The speed can be adjusted in line with the operating cycle of the press using a Parker AC30V inverter. This results in an energy-efficient system based on the electronic Load Controlled Pump.

One concept, three versions: eLCP

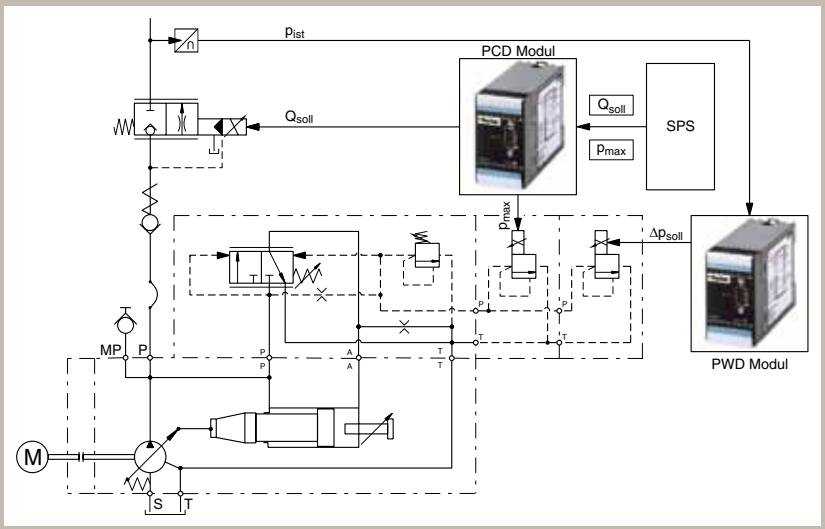
Version 1

- RE series proportional pressure valve with onboard electronics for pressure signal processing and controlling the pump pressure controller
- PCD series electronic module with TDA series proportional throttle valve for flow control



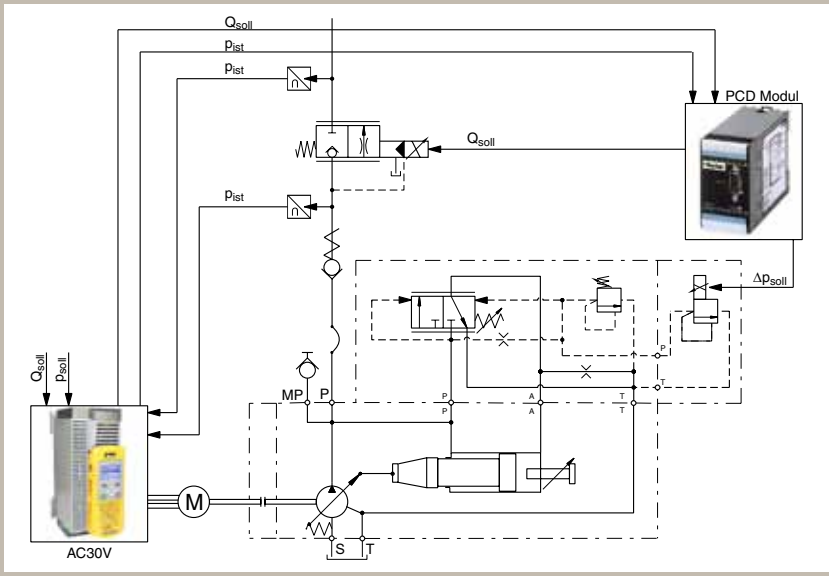
Version 2

- PWD and PCD series electronic modules for pressure signal processing
- Two RE series proportional pressure valves for controlling the pump pressure controller and for continuous maximum pressure relief
- TDA series proportional throttle valve for flow control



Version 3

- AC30V series inverter for p/Q control, pressure signal processing, and controlling the TDA series proportional throttle valve
- PCD series electronic module for pressure signal processing



A comparison of the design versions

Characteristics	Version 1 Prop. pressure valve with OBE and prop. throttle valve	Version 2 Two prop. pressure valves with electronic module and prop. throttle valve	Version 3 Inverter with speed-controlled pump and prop. throttle valve	Comments
Volume flow – variable	X	X	X	Flow of the throttle valve continuously adjustable using setpoint setting
Filter time constant for pressure signal – static	X	X	X	Filter time constant adjustable via parameters using ProPxD software upon commissioning
Offset pressure Δp – static	X	X	X	Differential pressure of the throttle valve adjustable via parameters using ProPxD software upon commissioning
Maximum pressure p_{max} – variable	–	X	X	Maximum pressure limit continuously adjustable using setpoint setting
Offset pressure Δp – variable	–	–	X	Differential pressure of the throttle valve continuously adjustable using setpoint setting
Filter time constant for pressure signal – variable	–	–	X	Filter time constant continuously adjustable using setpoint setting
Motor/pump speed – variable	–	–	X	Motor and pump speed variable adjustable using setpoint setting
Q_{max} maximum flow – variable	–	–	X	Maximum flow continuously adjustable using setpoint setting
Pressure sensor speed	1	1	2	There is normally a pressure sensor located in the hydraulic system pressure line, meaning that an additional one is generally only required for version 3

The components: tried and trusted

Users of an electronic Load Controlled Pump from Parker are in safe hands: each individual component has proven its reliability in a wide range of applications.

Pressure sensors
Long-term stability, immunity to interference, a sturdy design, a variety of available versions as well as high standards of quality are the features of SensoControl® pressure sensors. The enclosure along with all parts in contact with the media are made from stainless steel and enable wide-ranging media compatibility.

Pressure sensors SGP01

Throttle valves
The 2-way proportional throttle valves from the TDA series are used to control large oil flows. The valve flows through from B to A as standard, meaning that it is free from leaks in the zero command position from B to A. The pilot control does not require any pilot oil in this position.

2-way proportional throttle valves series TDA

Pressure valves
Pressure relief valves from the RE06M*W series are proportional valves that are direct operated and are typically used to control flows of less than 3 l/min remotely. The proportional pressure valves controlled directly from the RE06M*T (NG06) series with integrated electronics are based on the functionality of the PCD digital amplifier modules. The valves are set at nominal values from the factory. The set values can also be configured using the freely available software ProPxD.

Proportional pressure valve RE06M*W
Proportional pressure valve RE06M*T

Electronic modules
The Parker PxD electronic module series for proportional valves without onboard electronics can be installed quickly in compact spaces. Aside from good reproducibility, the digital circuit design enables optimum adjustment to proportional DC valves via a convenient operating software.

Electronic modules series PxD

and from one source

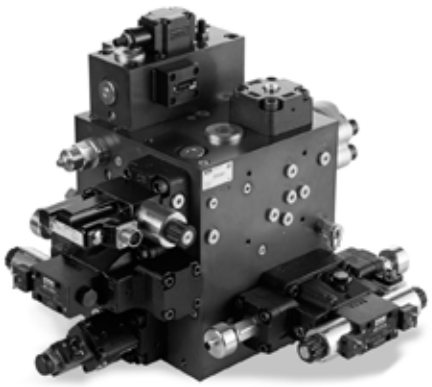
Pumps
Parker axial piston pumps offer a high degree of efficiency in a full displacement position. Under high pressures a reduced replacement angle causes a reduction to the required drive torque. With a small e-motor, you therefore have the option of achieving a large flow at low pressure or a small flow under high pressure.

Axial piston pump

Motors
Asynchronous standard motors are characterized by their versatility, robustness, a tremendous power spectrum, and high efficiency. Their simple design offers maximum flexibility and minimum cost when installing.

Asynchronous standard motor

PPCC series press control blocks
The new generation of press control modular manifolds from the PPCC series meets the highest energy efficiency and functionality demands while adhering to the established safety concept, and is suitable for practically all hydraulic press types. The new basic manifold concept guarantees increased flexibility and a significant reduction in pressure losses. Many functional versions can be implemented without additional manifolds.



Press control manifold series PPCC

Drive Controlled Pumps
The Drive Controlled Pump system solutions from Parker are speed-variable hydraulic pump systems. They essentially consist of a drive unit (inverter and electronic control system), an asynchronous or synchronous servo motor, and a hydraulic pump. They enable a central, controlled hydraulic supply for all drives. With this they also provide the exact power at all times required in the cycle.

Drive Controlled Pump with synchronous motor, vane pump and inverter AC30V


WICKE
WKP 8000 S

The eLCP: successful in practice

The range of press designs is extremely broad. As a result, there are also numerous options for employing an electronic Load Controlled Pump. The system has now shown itself to be successful in practice. Our customer WICKERT Maschinenbau GmbH, a leading supplier of presses and press systems, has already successfully tested the system in practice:

Using the Parker eLCP system has resulted in new options for WICKERT Maschinenbau related to reproducibility and precision when using standard presses. Press pressures with a tolerance of ± 1.5 bar and position accuracy levels of ± 0.3 mm can be achieved for our standard press construction kit of 600 – 30,000 kN, with piston diameters of 180 – 1,100 mm.

Greater precision with reduced power consumption

The eLCP system enables both the press cylinder axis (maximum press forces up to 30,000 kN with a piston diameter of 1,100 mm) as well as all drive functions for the auxiliary axes installed to be moved precisely and reproducibly in position and speed via just one TDA proportional throttle valve. The generally product-dependent auxiliary axes like lifting cylinder, ejector, separator or the diverse tool functions and the swiveling tables are often driven by a wide range of versions of double acting cylinders or oscillating engines. The energy losses in the presses and consequently the cooling capacity have been significantly reduced by the variable differential pressure, resulting in reduced power consumption in the drive.

Quiet operation, compact design

Electrical components are no longer built onto the pump in the eLCP system and therefore no cables need to be routed there. As a result the pump can be installed in the oil reservoir in design V1, thereby reducing noise and optimizing space, without resulting in any disadvantages related to servicing. WICKERT and the machine operators gain further benefits from the electrical signal chain, as any potential adjustments required e.g. following changes to process conditions can be implemented remotely via the PLC.

The technical data for the Wickert press WKP 8000 S helps to illustrate this:

***Press cylinder** Ø 630 mm*

- *Pressing force range between 800 and 8,000 kN (25..256 bar)*
- *Pressing force accuracy of ± 60 N*
- *Press speed of between 0.5 and 7 mm*
- *Positioning accuracy ± 0.3 mm*

***Rapid speed cylinder** 2 x Ø 125/80 mm*

- *Movement speed of between 1 and 150 mm/s*
- *Positioning accuracy ± 0.5 mm*

***Auxiliary axes** ø 50/32 mm*

- *Movement speed of between 15 and 150 mm/s*
- *Positioning accuracy ± 0.5 mm*

The technical data stated above illustrates that high levels of precision and reproducibility can be achieved with a purely controlled system across a wide range from the main axis to the auxiliary axes with the simplest technology and maximum ease of maintenance.

Conclusion:

eLCP with an adjustable axial piston pump can be used wherever constant flows independent of load are required in hydraulic systems with a wide adjustment range.

Lots of good reasons for deploying an eLCP

Strengths	Benefits for users
Extremely precise controls for flow resolution > 1:1000 and from approx. 100 cm^3/min to several thousand liters	Precise control of both large and small flows with the same proportional throttle valve. Closed loop speed or position controls can frequently be avoided as a result.
Dynamic behavior is not dependent on the pump control time	Increased stability as a fast proportional valve controls the flow
The quantity conveyed is independent of the quantity of leakage oil in the pump	Greater precision, since changing quantities of leakage oil in the pump are fully compensated by different operating conditions
Isolation of the load, vibration-free with high dynamics	Longer lifetime and stable operation, including with rapid changes in the control variables – disruptive influences are avoided through the electronic return of the load
Delta p can be adjusted to any function. Minimal differential pressures can be achieved	Higher energy efficiency
The pressure-controlled variable displacement pump in combination with the proportional throttle valve can be operated without a separate control oil pump	Higher energy efficiency, significant cost reductions
No hydraulic line required for load sensing	Cost savings since electrical cabling is cheaper than hydraulic pipes and hose lines
Pump possible in V1 design with external proportional pressure relief valve	No electronic components and cables below oil
No pre-tension manifold and no load sensing orifice required	Cost savings and increased operating safety
No need for mechanical adjustments or adjusted or replaced orifices. Set values can be copied and transferred electronically	Cost reductions as a result of short commissioning times. The adjustment parameters can be transferred easily to systems with a similar design
Hydraulic and electronic components are available as standard catalogue items	Convenient procurement and short delivery times
Can be combined with the speed-variable Drive Controlled Pump system	Energy optimized drive with even greater energy efficiency

Convinced? We will gladly develop an individual solution for you.

Regardless of whatever your requirements or challenges are, we can develop a customized eLCP solution for you to your specifications.

Designing a hydraulic system is more complex as a result of the electronic Load Controlled Pump. However, the eLCP also provides brand new options related to efficient machine cycle configurations. To do this, we offer you our professional support right from the beginning. Together with you we will develop a solution with components that are perfectly coordinated with each other.

Our services are comprehensive

All that we need from you are the process flows for your machines. Regardless of whatever your requirements or challenges are, we can develop a customized solution for you to your specifications from the Parker product range.

Want to learn more?

We would be happy to help you. Please simply get in touch with the Parker sales office for your area.

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