

Digital Hydraulics™ Downhole Control System

REMOTELY CONTROL AND MANAGE EVEN THE MOST COMPLEX RESERVOIRS

OVERVIEW

Halliburton Intelligent Completion's Digital Hydraulics™ multi-drop downhole control system that provides simple and reliable zonal control for even the most complex reservoirs. Digital Hydraulics system allows up to six flow control devices to be controlled from only three hydraulic control lines, making a large number of tubing hanger penetrations unnecessary and reducing the complexity of, and risk to, operations and logistics.

Digital Hydraulics system can control any flow control tool in the field-proven Halliburton Completion Tools inventory.

APPLICATION

The Digital Hydraulics system is ideally suited for intelligent well applications with three to six zones that demand all-hydraulic control.

The Digital Hydraulics system can be used to control simple open/ close interval control valves (ICVs) or lubricator valves (LVs) to provide on/off flow control from each zone. When combined with the Accu-Pulse™ module and the HVC-ICV, the Digital Hydraulics system can provide variable flow control to multiple zones.

HOW THE SYSTEM WORKS

The Digital Hydraulics system is a patented design that uses the logical absence or presence of pressure (hydraulic code) to communicate between a surface controller and the downhole tools.

Existing pressure greater than 2,000 psi is represented by a "1" and pressure less than 500 psi is represented by a "0." Depending on the sequence of 1s and 0s, communication to a particular flow control device is established with the Digital Hydraulics system.

Each flow control device is paired with a decoder that is designed to respond to its own unique code and to reject all other codes or sequences. Using this method, the communication between the surface controller and the downhole tools maintains its integrity – even when conditions such as temperature changes, long control lines, fluids and leaks can cause other hydraulic communication methods to fail.

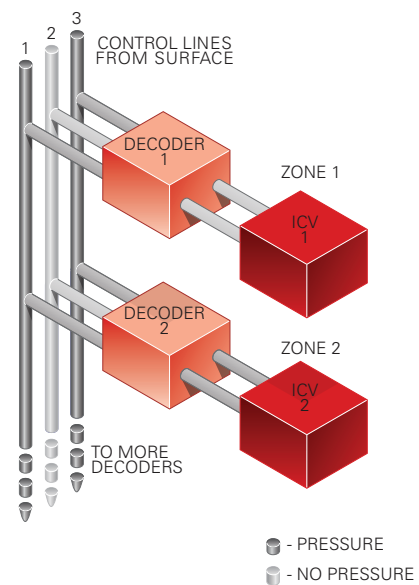
A three-line Digital Hydraulics system is capable of independently controlling up to six control devices through the sequenced application of pressure on two of the three control lines.

FEATURES

- » Three control lines for up to six downhole devices
- » Can be deployed with non-integrated systems and fiber optics
- » Supports "fail-as-is" device types
- » Independent of tubing or annulus pressure
- » Valve sequence is not pressure-dependent
- » No setting depth limitations
- » Optional modular circulation device to enable hydraulic fluid re-circulation or change out

BENEFITS

- » Reduce control line costs
- » Reduce rig time through greater facilitation of completion installation and retrieval
- » Achieve high activation forces for flow control devices in both directions



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QUALIFICATION TESTING

The Digital Hydraulics control system has successfully passed extensive in-house deepwell simulation testing. The tool has been cycled over 10,000 times in a simulated 257°F/125°C well at 18,000 ft. Following these tests, the tools were stripped and fully inspected. No excessive wear, which could have resulted in failure during long-term, frequent downhole operation, was observed.

Digital Hydraulics™ Downhole Control System Specifications

Device/Zone	Line 1	Line 2	Line 3
A/1		1st	2nd
B/2	2nd		1st
C/3	1st	2nd	
D/4		2nd	1st
E/5	1st		2nd
F/6	2nd	1st	

SURFACE CONTROL

The surface equipment for Digital Hydraulics system is designed as part of the Halliburton Digital Infrastructure supervisory application, SmartWell® Master™ system. A fully automated surface hydraulic system, controlled from a central location, allows control of the Digital Hydraulics system from a local or remote control station.

The SmartWell Master system translates the Digital Hydraulics system logic into standard central control room operations. This translation allows operators to easily monitor and control multiple completions, as well as an individual zone within an intelligent well completion.

The SmartWell Master system features standard displays specifically designed for:

- » Hydraulic supply modules
- » Well control modules
- » Permanent downhole monitoring
- » Alarming
- » Trending

In addition, a standard well configuration panel shows which wells are configured for the project, and a standard alarm banner displays the most recent real-time alarms which have been raised. Tabs are available at the top of the screen to allow easy switching between displays.



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Digital Hydraulics™ Downhole Control System Specifications

Digital Hydraulics™ Control System	
Number of Control Lines	3
Number of Double Acting Tools	6
Maximum Setting Depth	No practical limitations
Temperature Rating	350°F/180°C
Surface Control System	Automated or manual
Maximum Operating Pressure	10,000 psi
Maximum Hydraulic Chamber Rating	15,000 psi
Facilities	Land, platform, and subsea
Control Devices	Any Halliburton ICV
Working Fluid	Water based hydraulic control fluid
Re-Circulation/Fluid Change-Out	Optional

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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