MODULATOR

HIGH-SPEED TRANSMITTER FOR MUD-PULSE TELEMETRY

A CONTINUOUS WAVE TRANSMITTER PROVIDES A DATA TRANSFER RATE THROUGH THE MUD-PULSE TELEMETRY AT A SPEED OF 4 BPS OR HIGHER.

The modulator of the Corvette-3 LWD system is a high-speed transmitter providing a high depth sampling rate of the data transfer to the surface system at high rates of penetration. The device provides real-time transmission of azimuthal images from LWD tools.

The modulator is a device encompassing a continuous-rotation rotary valve that generates a sinusoidal pressure wave within the drill pipe. A phase shift of this wave serves as the unit of transmitted information.

The carrier frequency of the signal is programmed on the surface. In case of interference in the range of the specified carrier frequency during drilling, an operator can change the carrier frequency from the surface using downlinking capabilities of the system.

GENERAL CHARACTERISTIC

The modulator is compatible with the entire range of BHA diameters. Switching to a different diameter requires the installation of a valve of the corresponding diameter in the modulator.

The modulator has a special routing (software algorithm) for automatic removal of foreign objects entering the valve assembly.

For critical operating conditions, the modulator switches to a pulser mode. This transmission mode encodes data in separate pressure pulses with modulation of the pulse position (pulse-position modulation).

DESIGN CHARACTERISTICS

Valve parts are made of special hard alloys. The modulator employs a brushless motor designed for use while drilling to rotate the valve.

The modulator design includes an external pressure compensator that increases the reliability of the pulsator at great depths and eliminates the change in its operating characteristics with increasing depth.

The modulator valve design uses hard-alloy consumables available for purchase on the Russian market from 3rd-party suppliers.

The drilling-fluid circulation is detected both by the drilling-fluid pressure and the vibration of the assembly. The technique increases the reliability of mud flow detection and reduces the number of false positives.

Parameter	Value / Range
Sub O.D.	89, 105, 121, 172, 203, 241 mm
Length	2.0 m
Modulator O.D.	48 mm
Maximum Temperature	+120°C (+150°C as per request)
Maximum Pressure	80 MPa (100 MPa as per request)
Valve Shaft Speed	4 rps
Data Transmission Rate	4 bps
Sand Content	
- Recommended	< 1%
- Maximum Allowed	3%
LCM Tolerance	150 kg/m³ medium nut plug
Detection of Mud Flow	– by a change in absolute pressure – by the presence of a periodic signal from the pump strokes – by assembly vibration