Ground system

The ground system of oilfield drilling measurement instruments is the core platform for achieving geological guidance and real-time monitoring of drilling parameters, which is divided into two modules: ground data processing instrument and software processing system.

Composition of data processing equipment：

- **Ground interface box:** As the physical center for signal reception and processing, it is compatible with two underground data transmission modes: electromagnetic waves and mud pulses, and completes the demodulation, filtering, and digital conversion of raw signals. It is a physical bridge connecting underground instruments and ground computer systems.
- **Data acquisition and power supply unit:** integrates high-precision clock synchronization module and stable power supply system to ensure the timing consistency of underground instrument command issuance and data feedback, and supports long-term continuous operation.
- **Communication interface device:** It enables data exchange with other systems on the drilling platform (such as drilling rig control system and mud circulation monitoring system) through Ethernet, serial port, or wireless link.

Software Function System：

- **Human-Machine Interface:** Provides a graphical operating platform, supporting multi-window real-time display of directional parameters such as inclination angle, azimuth, and tool face angle, as well as formation parameter curves like natural gamma and resistivity.
- **Automatic Depth Tracking:** Based on drill pipe length and timestamps, it automatically calculates and updates the real-time depth of downhole measurement points, eliminating manual recording errors.
- **3D Visualization of Wellbore Trajectory:** Dynamically generate spatial models of wellbore trajectories to assist engineers in determining whether the drill bit deviates from the target reservoir, enabling precise geological steering.
- **Real-time Alarm and Risk Warning:** Monitor parameters such as abnormal drilling pressure, torque fluctuations, and downhole temperature exceedance with threshold thresholds, triggering automatic audible and visual alarms to prevent accidents like drill string leaks and wellbore instability.
- **Data Recording and Archiving:** Complete storage of all raw data and processing results, supporting multi-dimensional retrieval by time, well number, operational conditions, etc., providing a data foundation for subsequent geological analysis and drilling optimization.

System Workflow：

- Downhole instruments collect directional and formation data;
- Transmitted to the surface via mud pulse or electromagnetic wave method ;
- The ground interface box receives and decodes the signal;
- The software system completes data parsing, deep calibration, and parameter visualization;
- Engineers adjust drilling parameters based on real-time curves
- The command is transmitted to the downhole instrument to achieve closed-loop control;