

Drilling Control Automation & Instrumentation



JELEC

**INNOVATION AND TECHNOLOGY
DRIVING SIMPLICITY AND EFFICIENCY**

ADEOS - Advanced Drilling Efficiency Optimization Drilling Control, Automation &

Drilling Control System

The Drilling Control System (DCS) is at the heart of your drilling rig operations. At Jelec we focus on research that improves the operating environment. Our DCS provides safe operations, user friendly controls and optimized efficiency of the equipment and drilling process.

An open-architecture is one of the main features for the system. The capability to customize applications to suit your requirements and for rig personnel to make modifications to the system without requiring Jelec personnel on-site. All system data is available for on-site or remote monitoring and interface with any 3rd party system.

Our system can be customized to suit your specific requirements (e.g. condition monitoring based on motor current and vibration is available for predictive maintenance).

DRAWWORKS CONTROL

Drawworks Control Systems (AC / DC, single / multi motor) are engineered for both new-builds and retrofit projects. Our control system is universal and can be made to fit any drawworks. We can provide you with assistance and guidance in specifying the key characteristics (e.g. drilling line, drum, motor HP) needed to maximize performance and increase efficiency.

Our standard off-the-shelf solution integrates the controller, auxiliary starters and inverter. A remote IO panel located near the drawworks is utilized to gather all related field signals.

TOP DRIVE CONTROL

Top Drive Control Systems include integrated power and control cubicles, locally mounted remote IO, and condition monitoring. State-of-the-art algorithms are developed in-house for the Top Drive Control System software.

MUD PUMP CONTROL

Mud Pump Control Systems include integrated power and control cubicles, locally mounted remote IO, and condition monitoring. In-house developed software ensures optimized performance and efficient operation while offering advanced functions (e.g. mud pump synchronization, down link interface).

KPI / REPORTING

Our control system tracks the current status of the rig (e.g. drilling, tripping) and any events (e.g. on/off slips). From this data, the system reports Key Performance Indicators (KPIs), such as time to make a connection. The system allows you to identify the areas of concern (e.g. compare crew performance).

While the concept is nothing unusual, the automatic generation of KPIs directly from the control system simplifies the operational duties typically manually calculated.

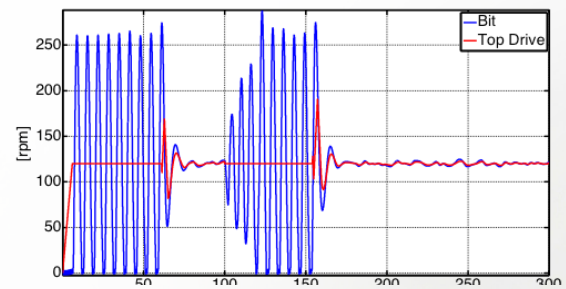


n Solution Instrumentation

STICK SLIP PREVENTION SYSTEM (Patent pending)

Stick-slip is an important source of issues and severe risks during drilling operations. It is caused by important differences between dynamic and static friction on the bit, leading to important tear and wear and affecting drilling performance.

Jelec has designed an efficient, performant and robust Stick Slip Prevention System (SSPS) based on nonlinear control techniques and advanced estimation scheme. The SSPS uses the measurements of the top drive torque and speed and adapts accordingly the top drive speed to mitigate stick slip and provide advanced monitoring of the operation. The system is designed to be connected to any Top Drive.



DIRECTIONAL DRILLING OPTIMIZER SYSTEM (Patent pending)

Large friction on the drillstring can occur for directional drilling leading a high Torque and Drag. This can have a considerable impact for the efficiency of the drilling operations. Jelec has developed an innovative system allowing to considerably reduce the friction on the drillstring by vibrating the top drive with smart/advanced and evaluative control patterns. This technology optimize significantly the Rate of Penetration while ensuring the desired tool face orientation.

DRILL FLOOR EQUIPMENT

ROTARY TABLE

Our DCS provides control of both hydraulic and electrically driven rotary tables. A full instrumentation package is supplied and for reduction of cost and footprint, VFD assignments are utilized.

IRON ROUGHNECK

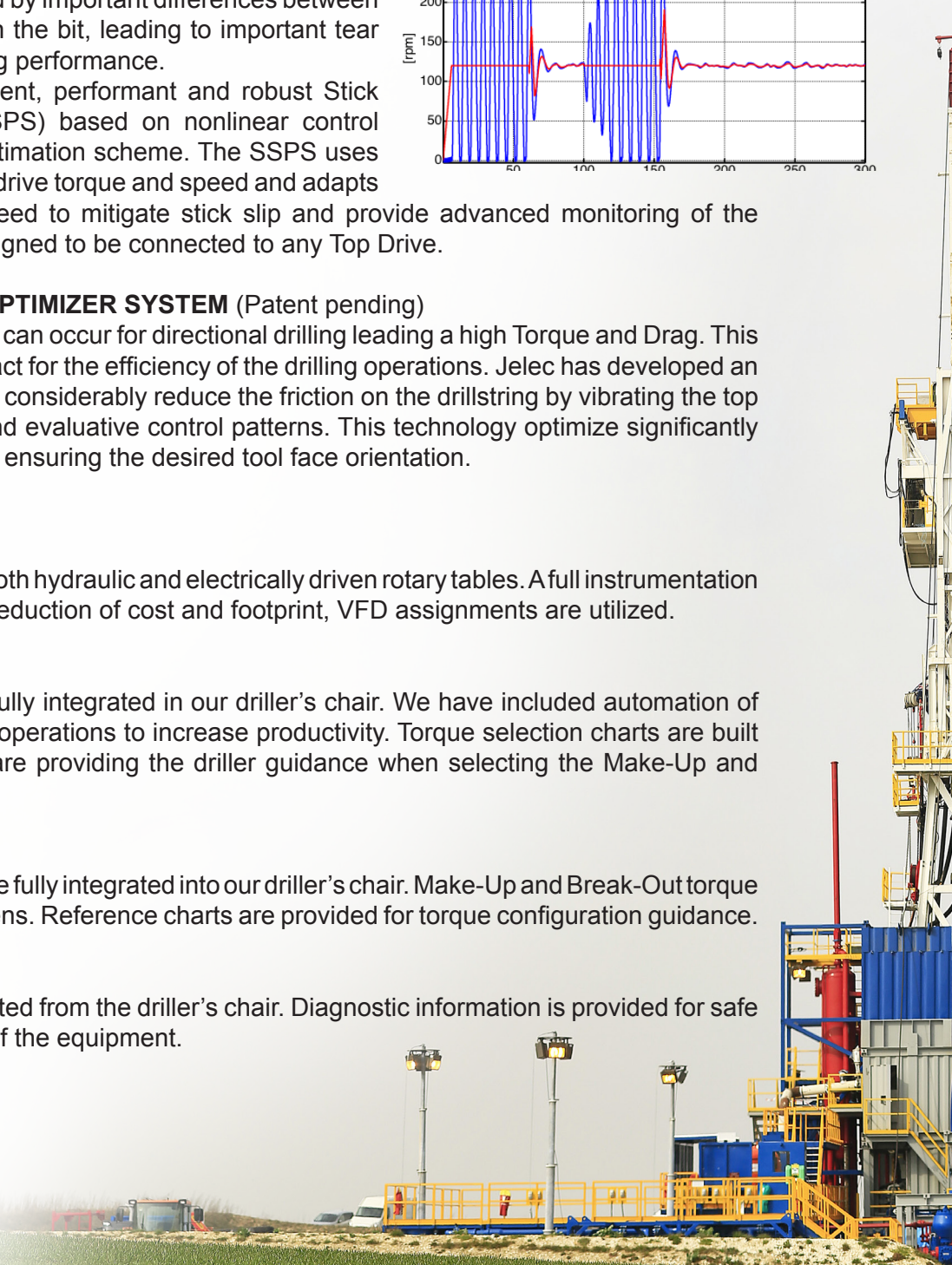
Iron roughneck controls are fully integrated in our driller's chair. We have included automation of the Make-Up and Break-Out operations to increase productivity. Torque selection charts are built into the Jelec Control Software providing the driller guidance when selecting the Make-Up and Break-Out torque.

HYDRAULIC CATHEAD

Hydraulic Cathead controls are fully integrated into our driller's chair. Make-Up and Break-Out torque is configurable via touchscreens. Reference charts are provided for torque configuration guidance.

POWER SLIPS

The power slips can be operated from the driller's chair. Diagnostic information is provided for safe operation and maintenance of the equipment.



Drilling & Mud Logging Instrumentation

We find that a key element to process efficiently comes from the accuracy of the data obtained while monitoring the process. Our drilling instrumentation plays a most crucial role as even the most sophisticated control or automation systems will not perform well without reliable and accurate data.



ADVANCED DRILLING PARAMETERS

Our system provides advanced drilling parameters to fill the gap of the conventional drilling instrumentation.

Key Advanced Drilling Parameters include:

- True hookload
- True WOB
- Torque & drag
- Pick up / slack off weight
- Free rotating torque and weight
- Residual cuttings / Depth of cut
- Equivalent Circulating Density
- Total Gas

Key Advanced Drilling Functionalities include:

- Sensor Validation (Cross Checking)
- Early Kick Detection
- Washout Detection

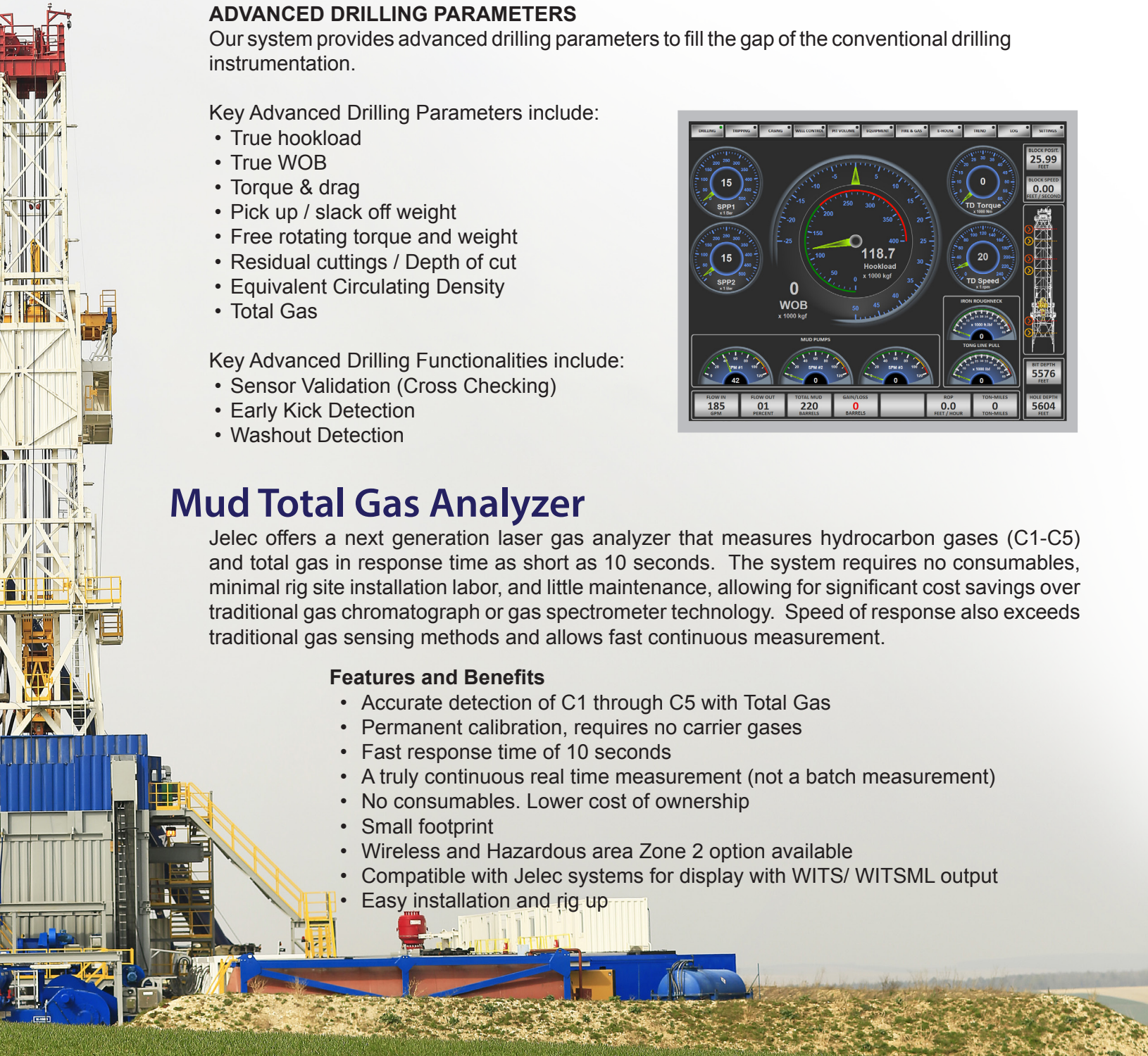


Mud Total Gas Analyzer

Jelec offers a next generation laser gas analyzer that measures hydrocarbon gases (C1-C5) and total gas in response time as short as 10 seconds. The system requires no consumables, minimal rig site installation labor, and little maintenance, allowing for significant cost savings over traditional gas chromatograph or gas spectrometer technology. Speed of response also exceeds traditional gas sensing methods and allows fast continuous measurement.

Features and Benefits

- Accurate detection of C1 through C5 with Total Gas
- Permanent calibration, requires no carrier gases
- Fast response time of 10 seconds
- A truly continuous real time measurement (not a batch measurement)
- No consumables. Lower cost of ownership
- Small footprint
- Wireless and Hazardous area Zone 2 option available
- Compatible with Jelec systems for display with WITS/ WITSML output
- Easy installation and rig up

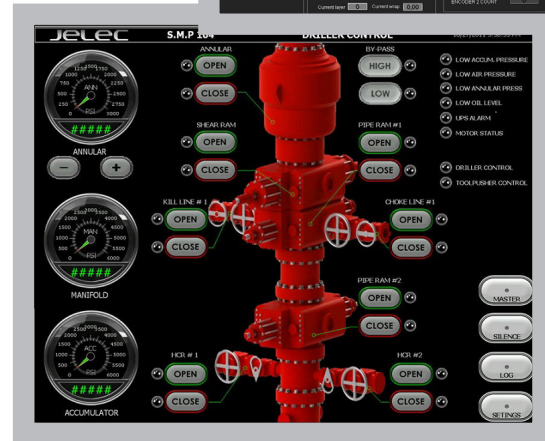
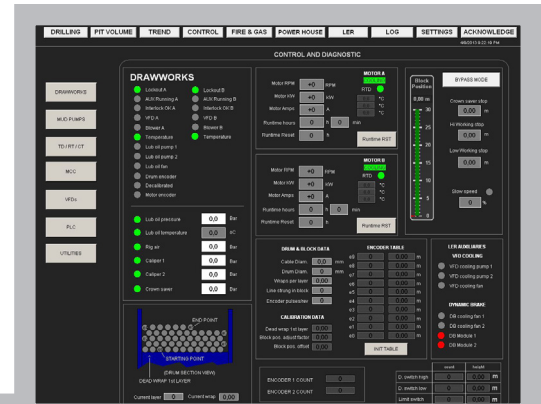


Drilling Automation

Automation enables higher operation efficiency and drilling optimization. A large section of our research and development at Jelec is focused around automation. Each task we can safely automate allows the driller to focus more on the real task at hand: drilling the well. Automated drill floor or drilling processes usually require a single manufacturer package. The Jelec DCS offers a fully integrated automation package for different brands of equipment according to your preferences. We designed a user friendly HMI to display meaningful alarms and status enabling the driller to easily track the progress of the automation system.

Key automation tasks included in our DCS are:

- Auto-driller:
 - WOB, ROP, and pressure based modes
- Auto-connection:
 - Make/Break connections at a specified torque
- Auto-tripping:
 - Trip in and out of the hole
- Auto-Friction test
 - Measures torque and drag at each connection
- Auto-Downlinking:
 - Test downhole tools at specified intervals
- Auto-Reciprocating:
 - Efficiently clean cuttings from the hole



Driller's Cabin

In collaboration with customers, Jelec designs and provides custom-fit Driller's Cabin for safe and hazardous areas.

Jelec Driller's Cabin contains the following control, monitoring and communication equipment:

- Driller's Cyber Chair
- Assistant Driller's Chair
- Drilling Control (Dwks, Top Drive, Mud Pumps...)
- Drilling & Mud Logging Instrumentation
- Rig Floor Equipment Remote Control (Hyd. Cathead, Iron Roughneck, Power Slips...)
- BOP Control Panel
- Choke Control Panel
- Integrated CCTV System
- Gas Detection System
- Communication Equipment (Telephone, Talkback, PAGA...)

JELEC

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