Guardian™

Automation,
Control and
Monitoring

Artificial Lift

We deliver a field-proven, highly-engineered, comprehensive resource for artificial lift equipment and packaged solutions all over the world. Our breakthrough innovations in hydraulic rod pumping systems, progressing cavity pump systems and automation controls & monitoring are changing the way operators view their long-term production through artificial lift. Our artificial lift professionals will collaborate with you to properly evaluate well conditions and provide customized solutions, helping you to optimize your production for the life of your wells. Let us be your new 24/7 production partner.

Automation, Control & Monitoring

Whether you're managing hydraulic rod pumps, progressing cavity pumps or conventional pump jacks, we offer a full line of automation, control and monitoring options to maximize production and profitability. Even in the harshest conditions, our field-proven units are easy to read and operate, while delivering feature-rich technology – giving operators complete management, flexibility and control over well production. Our powerful processors, using the latest modeling and production optimization software, enable our customers to gain complete access and control over their production operations and well data. Access your information either on-site or via remote well control & monitoring, using satellite, cellular and radio with web-enabled communications.

Aftermarket

Our products are backed by the reliability and responsiveness of our aftermarket group. Highly trained field service technicians are on call to handle on-site service needs 24 hours a day, seven days a week.

Our services include:

- Equipment Installation & Commissioning

- On-site service repair

- Remote diagnostic service

Guardian™ Variable Frequency Drive (VFD)

We provide a complete set of products and services for optimization, monitoring, and control of various artificial lift systems

Guardian is a Variable Frequency Drive (VFD) package specifically designed to operate Progressing Cavity Pump (PCP) and Sucker Rod Pump (SRP) systems in the harshest of conditions with maximum efficiency and flexibility. Transform the Guardian into the GII Plus by adding the Advanced Control Manager (ACM), unleashing the power to optimize your well.

Our ACM was designed to minimize downtime and to provide the logic and control functionality needed to diagnose, prevent, adjust, and repair problems automatically eliminating the need for multiple trips to the site. Performance and production information is stored in a local data repository which can easily be displayed in a simple browser-based user interface. When automated action is taken, detailed information is captured and retained allowing the operator complete view of well events.

The ACM provides multiple control strategies and layers of protection. Pump efficiency, fluid gravity, well deviation, well depth, flow line pressure, intake pressure, and fluid temperature are just a few factors that can impact the effectiveness of control logic. By automatically adjusting the control logic to account for these and many other factors, we can provide superior control that does not require constant attention of field personnel.

Pump optimization is implemented in the Guardian system to maximize production while still maximizing pump life. We provide a variety of downhole and surface sensor systems that easily integrate with the Guardian system. Customer field connections can be integrated by tying into built-in terminal blocks, thus allowing interface with virtually any existing system.

Artificial lift applications can be very dynamic and change in a matter of seconds. Guardian II has been built by using the vast pumping and control experience of field operators, production engineers, and our technical staff. Our automation systems provide safe operating conditions, reduce down time and optimize the well production.

Guardian™ Variable Frequency Drive (VFD)

Available in GII, GII Plus, and GII Permanent Magnet Motor (PMM)

Features
- Versatile application and outstanding performance in the hardest conditions
- Adaptable to changing well conditions
- Simple installation and startup
- User friendly interface
- Flowline and casing pressure inputs
- Maximizes energy efficiency
- Presco automatic restart (connect up to two Presco)†
- Programmable backspin time and automatic restart†
- Counterbalances weight adjustment reporting‡
- Real-time position and torque display‡
- Support for extreme climate conditions
- Multispeed options for customizing up and downstroke speeds‡
- Automatic pump fill detection on each stroke‡
- Belt slippage prevention and detection‡
- Detailed fault history with real date timestamp
- Energy meter reports KWh consumption
- ON/OFF timer control‡

Benefits
- Remote pump monitoring and control capabilities
- Interactive communication between the operator and the well
- Real time well diagnostic and control functionality

Accessories
- Harmonic filters
- Surface pressure sensors (flowline/casing)
- Downhole pressure sensors
- Flow switches and meters (thermal/coriolis)
- Load cells‡
- Position sensors‡
- Braking resistors‡
- Communications (satellite/cellular/radio)
- Running/fault lights
- Power line in/motor/Presco connectors
- Motors
- Totally enclosed fan cooled (TEFC) or TEXP

† - Guardian™ PC Pump Controller Only
‡ - Guardian™ Rod Pump Controller Only

Standard Configurations
- Main line circuit breaker
- Lightning arrester
- 5% line reactor
- Control transformer
- Accessible terminal connections
- Low maintenance

Security
- Restrict access based upon user roles
- Detailed change log to track configuration changes and updates

Safety and Performance
- Simple and easy to use operator interfaces
- Automatic, non-moving A/C motor tuning
- cULu Listed enclosure
- Local graphing / plotting of performance information
- Safe access to data and diagnostic interface ports

Services
- Highest level of support and training at preferred locations

Control Methods (GII Plus Model)
- Automatically changes speed of the pump to optimize well performance through control methods
- Setup primary and secondary control methods to operate simultaneously
- Downhole pressure sensors
- Fluid over pump
- High-torque control
- Production flow
- Flowline and casing pressure
- Tank level
- Dynamometer Cards (SRP)

Hydraulic Pump Controller

Our Hydraulic Pump Controller provides economical pump-off control of hydraulic sucker-rod pumping systems. Using sophisticated modeling and control software and a powerful processor, we designed our HPC to compute surface and downhole conditions to best regulate the starting, stopping, or speed adjustment of the pumping unit. Comprehensive monitoring and reporting capabilities provide daily gauging, fault and event logging, a user-configurable data sampler, and more. HPC units are rugged and have been designed to withstand the harsh environments of the oil patch.

Features and Benefits
• User-friendly, full color touch-screen display
• Automatic optimization
• Maximum pump fill
• Communicates over wifi or cellular modem

Hardware
• 12V DC/24V DC AC supply input
• State-of-the-art expandable controller
• Weatherproof design
• Rugged NEMA 4X Stainless Steel Enclosure
• -40° C to 125° C
• 7" Color Graphic Touch Panel Display
• External SD Micro Memory Card Storage
• Field replaceable CPU
• Optimized to work with NOV Pumping Units
• Firmware Field Upgradable

Sensors
• Pressure Transducers
• Linear Displacement Transducer
• Red Beacon Alarm Indicator

Communications
• Standard Ethernet Communications
• Modbus RTU/TCP Protocol
• Cellular Modem Option
• Satellite Communication Option

Control
• Pump-off Control
• Timer Control
• Automatic Re-start Capability
• Adaptive Pump Control

Data Collecting/Reporting
• Well production/performance report
• Time-stamped event/fault logging
• Time-stamped user-definable data sampler
• Web-based monitoring/control

Third-party head-end software interface (Case, Theta)

Inputs/Outputs
• Field configurable I/O
• Four Isolated Analog Inputs
• Two Isolated Analog Outputs
• Ten Discrete Inputs

Six Discrete Outputs

Displays
• Simplified Well Configuration
• Full Color Graphic Display of all key functions including:
    • Rod load limits
    • Pump velocity
    • Pump position
    • Pump load
    • Pump fill
    • Pump stroke
    • Daily fluid production
    • Daily leakage loss
    • Daily average pump fill
    • Daily average pump speed
    • Pump intake pressure
    • Discharge pressure
    • Tubing pressure
   • Casing pressure
    • Fluid level
    • Fluid flow

Performance Monitoring

Our proprietary software, OnSite™, allows field operators to monitor and manage key aspects of all pumps deployed. With this software, operators can quickly assess the status of a field, drill down on problems, and review detailed performance data from an easy to use application. If problems occur, a responsible party or group can be notified when the pump is not operating within the specified limits by email, text messaging, or via callout center.

OnSite is designed to retain a central repository of detailed performance information collected over an extended time frame. This permits engineers and operators to review operational efficiencies and locate trends to predict problems or analyze the effectiveness of changes made to the wells operations. In addition to retaining and retrieving long term performance data a real-time view of all monitored pumps is provided.
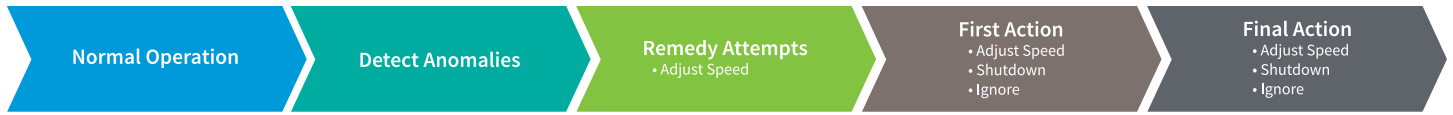
Pump performance data is collected in a variety of methods, which include serial MODBUS and MODBUS over TCP/IP, by means of direct connect, satellite, cellular, and radio.

More than just monitoring, OnSite provides remote two-way communications between the operator and the pump, permitting speed adjustments within operating parameters and remote start / stop of a pump when a communication network is deployed. Optional cameras can be added to the monitoring service to help diagnose faults without having to visit the site and helps assure site safety and environmental procedures are being applied.

Legend:
- Rod Torque (ftlb)
- Rod Speed (rpm)
- Casing Pressure Monitor (psi)

Time (in hours)
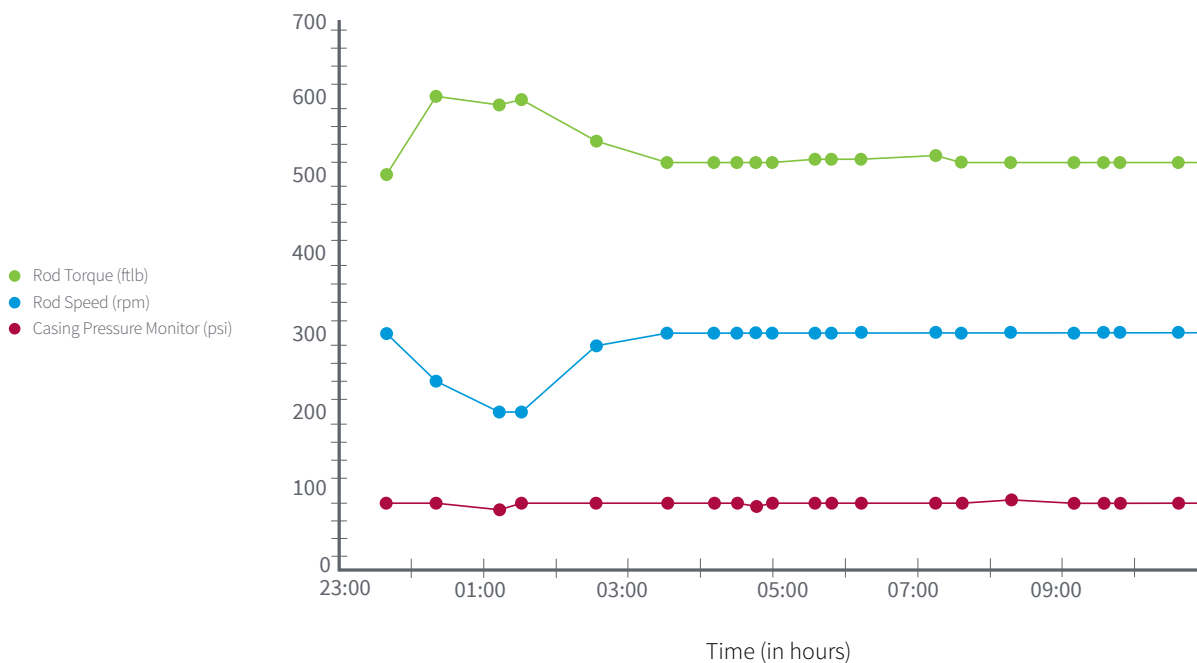
Communications

Guardian™ can easily be implemented into existing SCADA networks. If required, it can adapt its setup to appear as any type of legacy system currently implemented, which reduces the effort required to configure back end systems for pump monitoring and control.

| Normal Operation | Detect Anomalies | Remedy Attempts
• Adjust Speed | First Action
• Adjust Speed
• Shutdown
• Ignore | Final Action
• Adjust Speed
• Shutdown
• Ignore |

Touch and go!
OnSite™ software being used on a touchscreen tablet. Also available on desktop and most mobile touchscreen devices.

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