



**Weatherford**<sup>®</sup>

# ePIC<sup>™</sup> Rod Pump Controller



Intelligent rod pumping control for production optimization.

# ePIC Rod Pump Controller

Access to accurate, timely information is the key to preventing an uninformed, costly decision. Weatherford's production optimization division developed the ePIC rod pump controller (RPC) to provide improved decision making opportunities for operators of today's oilfields.

The RPC is part of a complete rod pump solution. Weatherford provides the unique combination of intelligent hardware controllers, communication systems, advanced desktop analysis, training and support.



## Exceptional Intelligence and Well Site Control

Proven technology has been expanded and enhanced in the ePIC RPC to provide the following advanced functions:

- Well site alarms and system diagnostics
- Selected pumping system alarms based on host analysis of well conditions
- Card area alarms for deep rod part detection and downhole friction identification
- Well site valve checks and CBE determination, available to host analysis systems
- Improved data storage and trending
- Enhanced data-logging function which allows any register to be logged at user defined intervals..
- Event and time stamped logging of alarms
- Read/modify any numeric parameter, execute command parameters

Additional technology available in the ePIC II version RPC includes:

- Serial variable speed drive (VSD) control interface
- Analog output added for control output to VSD
- Two extended communication ports for Modbus® protocol device scanning capability

When enabled, the VSD control algorithm closely monitors pump fillage on every stroke and makes quick decisions to speed up or slow the well down in order to maintain optimum pump fillage and efficiency.

The controllers, using patented automatic idle time optimization, can be used to continuously optimize cycle time, even adjusting for power outages, pump wear, tubing leaks or production kicks. Air balance control automatically balances pumping units. The peak energy control option can inhibit well operation during peak periods of higher energy costs. The power fail recovery method allows wells to pump down high fluid levels after power failures and the motor restart protection function prevents motor restart when condensation is present on motor windings.

Modbus is a registered trademark of Modbus-IDA organization.

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When a pumping system malfunction or alarm is detected either by the well site RPC or the host software, the controller can be configured to respond in a number of ways—from illuminating a flashing light on the controller box to shutting the well down. The RPC clearly defines both the identified fault and the action taken by the controllers so the operator can quickly and easily analyze the situation. Time consuming troubleshooting guesswork is eliminated.

## *Dynamic Interaction with Analytical Tools*

The registers are all available for analytical tools to read and write. This makes the results of any program written in the controller available to host-based analytical programs. The accuracy derived from this architecture allows for more exact analytical control at the well site and more exact analysis at the desktop.

The RPC's gross fluid production calculation includes user-defined pump efficiency values for both deep and shallow wells as well as using the calculated downhole pump stroke information from host software analysis of deep wells.

## **Simplified Setup and Maintenance**

- Improved and expanded well site configuration screens
- New three step load sensor calibration method
- Improved RPC interface access to energy management feature, communication diagnostics, continuous position sensor diagnostics and load cell setup and diagnostics

## **Enhanced Input/Output (I/O) Configuration**

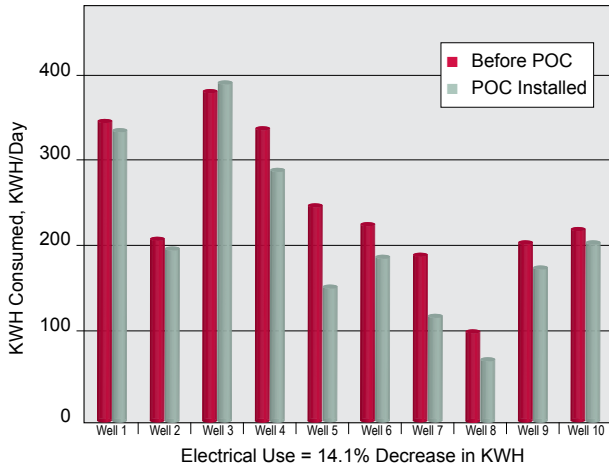
The RPCs include programmable I/O for unique analog, meter and discrete monitoring and control applications. With the ePIC RPC, operators can fine-tune their wells using operational set points and are notified of load-based and other alarms immediately.

- Simple new I/O configuration menu
- Improved analog I/O logging method
- Auto-acting I/O functions provide easily configured control capabilities
- Expanded event action options



# ePIC Rod Pump Controller

KiloWatt Hours/Day—Before and After RPC



## Field-Proven Technology

Weatherford is known worldwide for manufacturing and supporting reliable, stable and accurate electronics. The ePIC RPC takes the knowledge and experience gained from the CAC line of rod pump control products and combines them with new, innovative features to create a state-of-the-art RPC. Much of the ePIC technology is included in Weatherford's product line currently used by over 30,000 wells worldwide.

With inventive manufacturing processes based on years of experience, Weatherford has made this controller both robust and affordable. It provides the stability and durability needed for harsh operating environments without sacrificing the latest technological improvements for advanced rod pump control.

### ePIC RPC Highlights

- Controller commissioned with minimal effort
- Improved gross fluid calculation
- Advanced integration with host surveillance systems
- Robust data-logging and trending capabilities
- Valve checks and CBE determination
- Compatible with all Weatherford RPC products

## Open Technology

ePIC RPCs control virtually any rod-pumped lift system, including improved geometry pumping units, long stroke units (Rotaflex) and even wells using two stage downhole pumps.

### Backwards Compatibility

The ePIC RPC is fully compatible with all generations of Weatherford RPC products. This design feature allows the RPC to be installed using existing register configuration as a base. The configuration can then be expanded with the new features.

### Software Interfaces

ePIC RPCs are highly integrated with many industry leading host-based monitoring and analysis software packages (i.e. **LOWIS**™ Software, Shell Services International, Theta XSPOC™, SOFS, etc.). It also can be integrated directly to HMI applications such as Wonderware and Intellution®. With multiple communication protocols available, Weatherford's ePIC RPC is easily integrated into any host system.

# ePIC Rod Pump Controller

## Advanced Features for Intelligent Control

Control	
Feature	Benefit
Patented air balance control	Automatically optimizes and controls air cylinder pressure on air-balanced units.
Peak energy control functionality	Inhibits well operation during peak periods of high energy cost as determined by the operator.
Motor restart protection	Prevents motor restart when condensation is present on motor windings
Power fail recovery method	Inhibits selected load alarms following a loss of power to allow a well to pump down a high fluid level.
Programmable (auto-acting) I/O	Unique monitoring and control applications using analogs, meters, and discretes.
Multiple control methods	Point or quadrant, for lower right or upper left hand portions of the surface cards, and reverse pump-off.
Automatic idle time optimization	Improved determination of idle time adjusted for inflow based production.
Pump-up delay timer	Eliminates immediate pump-off due to incomplete pump fillage following well idle time.
Monitor only mode	Monitor dyno cards without regard for control setpoints or speed ranges. Ideal for dyno card generation with VFD controlled pumping system.
Works with all kinds of wells	Companies can standardize on one controller for heavy oil, sand, deviated holes, etc.

Analysis	
Feature	Benefit
Gross fluid or inferred production calculations	Accurate estimates of total fluid production from shallow and deep wells without complex well site configuration.
Available ESP operating mode	Allows the RPC to monitor submersible pump controllers.
System load analysis	Host based detection of load cell drift on changing downhole conditions.
Cycle and run time buffers	Easy access to historical data at the well site or using the host software.
Dynamometer card buffers	Access to event cards (Full, Current, Shutdown, etc.) and several cards stored leading up to the event.
Expanded alarm features	Host based alarms (torque, stress, pump efficiency, prime mover size, unbalance, etc.).
New stored card types and associated alarms	Card Area Alarm; Excessive Card Areas; and Hi-Hi, Hi, Low-Low, and Low loads.

Alarm	
Feature	Benefit
Extensive communications debugging capabilities	Capable of analyzing data at the well site to diagnose data transmission problems due to faulty radios, etc.

System Configuration	
Feature	Benefit
Improved well site configuration	Simple menu for configuration, data management, system diagnostics, and load cell calibration.
Upgradeable modular hardware design	Auxiliary I/O, communications, and local user interface options can be added in the field.
Flexible, expandable I/O	Three options available to allow the best match for individual wellsite applications.
Backward compatible parameter structure	Prevents incompatibility issues with older eP RPC equipment.
Basic three level password protection scheme	Provides security for access to critical RPC setup parameters and well control commands.
Optional enhanced graphic display and keypad	Menu driven user interface for configuration and review of system data including dyno cards, valve checks, and run times.
Available ESP operating mode	Allows the RPC to interface to submersible pump controllers.
Local graphic display	Provides readily understood messages relating to pump system conditions.
Digital rod load calibration	Operator no longer has to manually adjust potentiometers to calibrate the load sensor.
Automatic beam mounted load calibration	Simply enter the correct maximum and minimum loads, no complex multi-step program required.
Integrated single package design	Simplifies installation with all components in one unit.
Rugged hardware design	Manufactured to strict standards to ensure long life and reduced cost of ownership.
Sensor options	Position switch, continuous position sensor, polished rod load cell, and beam mounted sensor.

# ePIC Rod Pump Controller



## Specifications

<b>ePIC and ePIC II Rod Pump Controller</b>	
Enclosure	NEMA 4
Weight (lbs./kg)	22 (9.97), approximately
Input voltage range	120/240 VAC or 12 to 24 VDC
Frequency	47 to 63 Hz
Relay output	12 VDC
Operating temperature (°F/°C)	-40 to 185 (-40 to 85)
Printed circuit boards	Conformally coated to protect against moisture, H <sub>2</sub> S and salt air
Communication protocol	Operator selectable, CAC 8500 native, Modbus RTU or Modbus ASCII
<b>ePIC II Rod Pump Controller</b>	
Serial ports	Host, MMI, display and two extended communication ports
Analog output	One
Modbus scanning	Two scanners with 8 devices and 32 scan blocks available
VSD interface	Available with automatic configuration for ePAC VSD Available with manual configuration for other VSDs
<b>Transient Protection</b>	
Overvoltage/transient	Meets ANSI/IEEE C37.90.1-1989 protection specifications
Dynamometer card resolution	Samples and stores load and position data at 20 times-per-second for downhole analysis
Analog-to-digital conversion	Monolithic, successive approximation 12-bit A/D converter

## Oilfield Sensor Specifications

<b>Clamp on Beam Load Transducer (Beam Sensor)</b>	
Operating temperature (°F/°C)	-60 to 212 (-51 to 100)
Temperature effect on zero	±0.19 uV°F
Temperature effect on output	±0.0008% of full scale/°F
Combined accuracy	0.5% to 1.0% full scale
<b>DPS (Dual Position Sensor)</b>	
Analog output	0 to 5 Volts
Tilt range	±45° to ±22°
Accuracy	0.1 degree of tilt
Filters	Four selectable digital filters
Input voltage	8 to 15 VDC @ 14 mA
<b>Polished Rod Load Cell</b>	
Class	Quantitative strain gauge
Range (lb./kg)	0 to 30,000 (0 to 13,607) or 0 to 50,000 (0 to 22679)
Maximum error	±0.5% full scale
Operating temperature (°F/°C)	-70 to 190 (-55 to 88)

## Expansion I/O Boards

Board Number	Analog Inputs	Digital Inputs	Digital Outputs	Analog Outputs
1	2	2	2	0
2	4	4	4	0
3	8	4	4*	1

\*Can be configured as DI or DO





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