ACHIEVING PUMP OFF CONTROL AND REMOTE SURVEILLANCE FOR MARGINAL PRODUCERS

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INTRODUCTION

For years, producers have used traditional pump off controllers (POCs) and variable frequency drives (VFDs) as their primary method of pump off control, surveillance, and well optimization. Rising development costs of these traditional methods have limited the use of these devices to the more prolific, higher producing wells. With increasing downhole repair costs and limited resources, it is becoming more important for operators to detect pump-off and have remote surveillance on marginal, low volume wells. ChampionX developed the SMARTEN™ Lite rod pump controller to address this industry challenge with a low-cost solution for low producing wells where traditional automation methods are not economical.

OVERVIEW

The SMARTEN Lite controller provides full remote surveillance capabilities with start and stop functions, and cloud-based data visualization including run time, cycles, inferred production, flowline pressure and strokes per minute (SPM). The device accurately detects pump off through a series of proprietary algorithms and logic based on the operating speed of the unit and is easily installed in less than an hour. With SMARTEN Lite, marginal wells can be operated more cost effectively with reduced electrical costs and fluid pound by detecting pump off, increased production by reducing downtime, and with better staff efficiency by enabling the “pump by exception” model.

APPLICATIONS

- Low producing, marginal wells
- Wells leveraging timers
- Wells leveraging other low-cost solutions
- Wells with no automation

SMARTEN LITE VS. ALTERNATIVE SOLUTIONS

Mechanical timers are still in widespread use today. Ease of install and costs are the primary advantages. The disadvantage is that the pumping unit runs and stops on a hard-coded time, rather than inflow and outflow. This results in the well running too long (most often the case) and associated downhole fluid pound, unnecessary wear on surface equipment such as motor, unit bearings and wrist pins, and wasted electricity. Not running the unit long enough could result in loss of production.

Other low-cost solutions attempt to detect an empty pump condition with various methods, but most fall short. The primary difference in SMARTEN Lite and other low-cost solutions is data visibility. Through field-based data collection and cloud-based

visualization, the operator can remotely see all of their wells and run status on the screen, without having to physically visit the wellsite.

INSTALLATION & COMMUNICATION

The unit can typically be installed in less than thirty minutes, which also contributes to cost efficiency since the labor is significantly reduced compared to a traditional POC with a load cell which can take up to roughly four hours. All the cables have quick connectors and field wiring is therefore minimal. The only sensor that is used is a hall effects sensor which signals when the crank arm passes by with a magnet.

Actual photo of device

Figure 1 – SMARTEN Lite controller installation

BENEFITS

Electrical savings: With SMARTEN Lite, the unit runs just long enough to empty the wellbore, then shuts the unit down for a predetermined, operator-set idle time. Most often, wells on timer, or with no automation run much longer than needed. Figures 2 and 3 shows two wells in the Permian Basin with SMARTEN Lite installed.

Figure 2 – The operator observed an average of 45% reduction in electrical costs.

Figure 3 – The operator observed an average of 35% reduction in electrical costs.

Increased production: While most wells on timer run longer than necessary, there are those that do not run long enough. For example, if the pump begins to wear, the timer

doesn't auto adjust to run longer to compensate for the lower efficiency. Additionally, with instant notification of downed wells, lost production from downtime is significantly reduced.

Improved staff efficiency: With limited resources, many companies are adopting the 'pump by exception' model. The idea is to utilize automation to prioritize the wells that require a physical site visit. Having remote capability and visualization, the need to physically be onsite is minimized. Additionally, for wells with timers, the need for fluid level measurements are reduced.

Reduced failures: By having the ability to idle the well when pump off is first detected, fluid pound is greatly reduced, therefore reducing downhole failures.

Identification of operational disruptions: By measuring the strokes per minute (SPM) to the thousandth decimal (X.XXX), several operational issues are identified. Figures 3 and 4 demonstrate the effects of belt slippage and closed casing valves on SPMs.

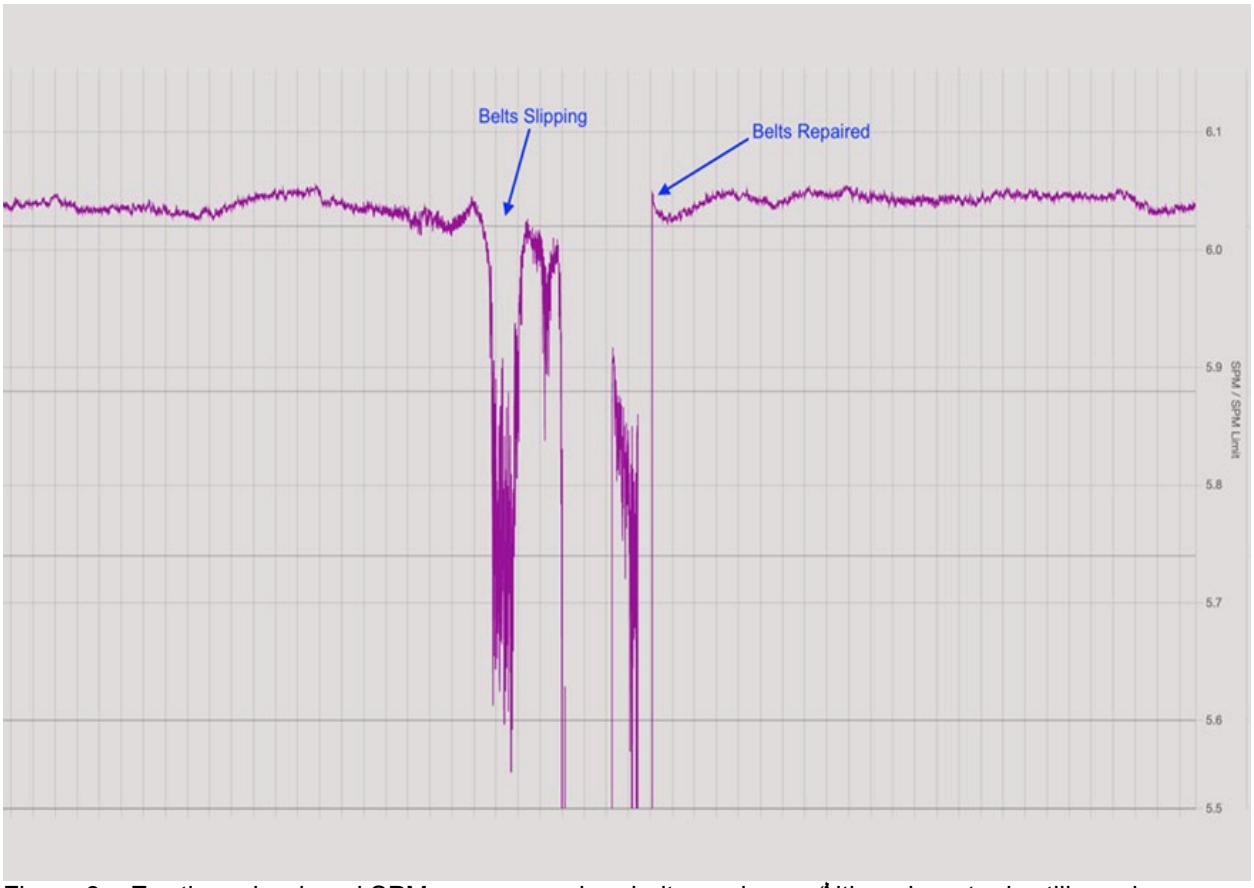


Figure 3 – Erratic and reduced SPMs are seen when belts are loose. Although motor is still running, actual unit rotations are reduced.

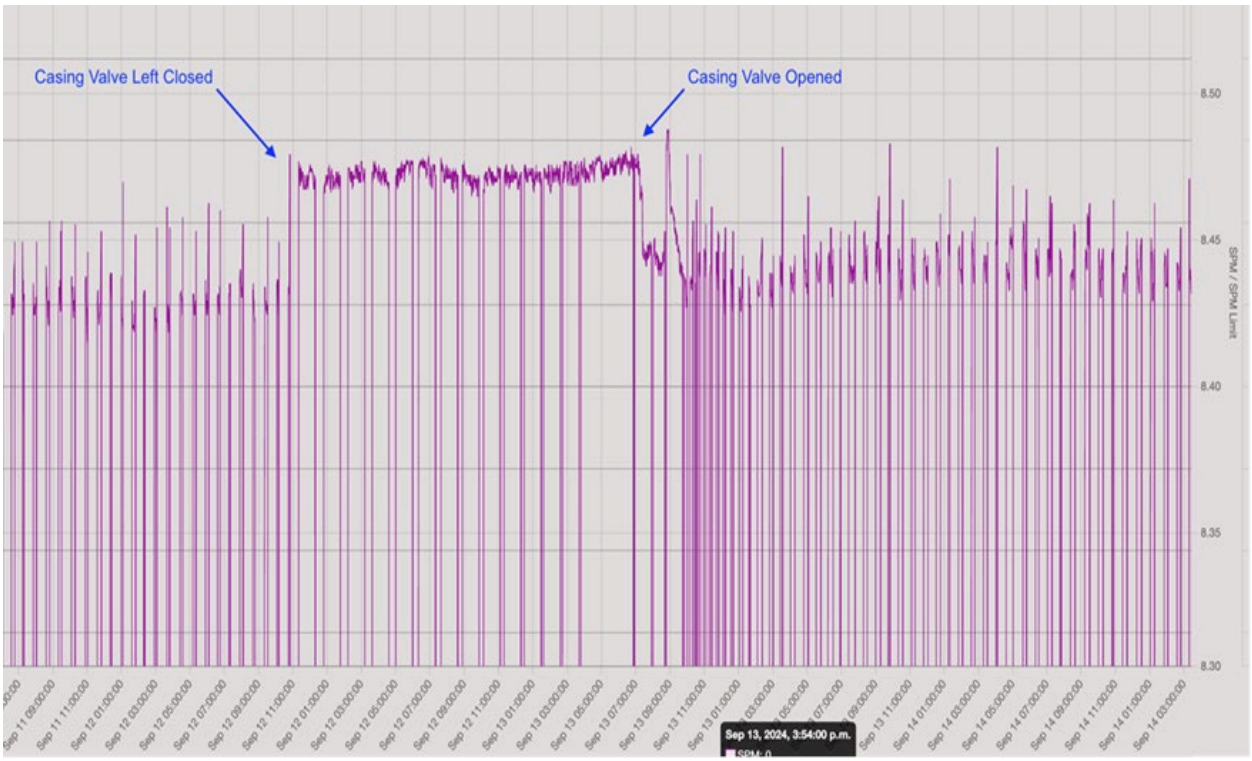


Figure 4 – Increased SPMs are seen when casing valve is left closed. A lighter fluid load is evident with closed casing valve; therefore, increased SPMs.

SCREEN FUNCTIONALITY

The software platform consists of only three primary sections: setup, dashboard, and the analysis charts and graphs, displayed in Figures 5, 6, and 7, respectively.

Set up: In addition to remote start and stop functions, the set up screen shows a glimpse of current state, inferred production, runtime, and SPM. This screen is where you select mode and timer settings, perform system configuration, and enter physical parameters such as pump size and stroke length.

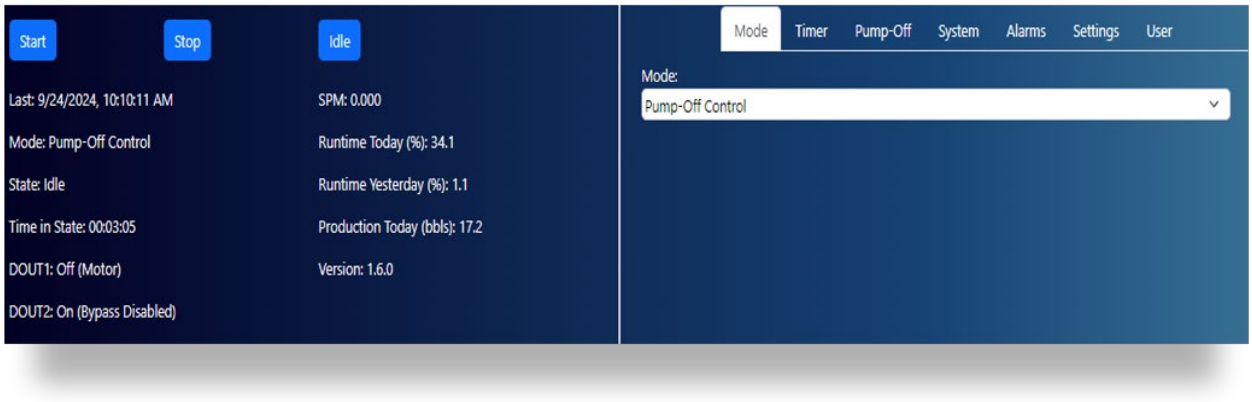
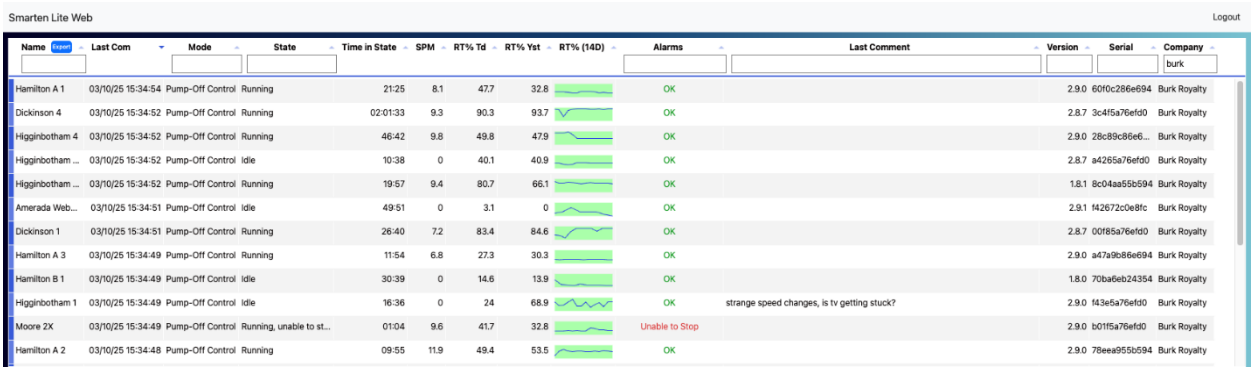


Figure 5 – Snapshot of the initial set up screen

Dashboard: – The dashboard provides the operator a holistic visual of all the wells that have a SMARTEN Lite installed, including the mode, run state, time in state, and alarms. The RT% today can be compared to RT% yesterday to determine any variances in run time.



Name	Last Com	Mode	State	Time in State	SPM	RT% Td	RT% Yst	RT% (14D)	Alarms	Last Comment	Version	Serial	Company
													burk
Hamilton A 1	03/10/25 15:34:54	Pump-Off Control	Running	21:25	8.1	47.7	32.8		OK		2.9.0	60f0c286e694	Burk Royalty
Dickinson 4	03/10/25 15:34:52	Pump-Off Control	Running	02:01:33	9.3	90.3	93.7		OK		2.8.7	3c4f5a76efd0	Burk Royalty
Higginbotham 4	03/10/25 15:34:52	Pump-Off Control	Running	46:42	9.8	49.8	47.9		OK		2.9.0	28c89c86e6...	Burk Royalty
Higginbotham ...	03/10/25 15:34:52	Pump-Off Control	Idle	10:38	0	40.1	40.9		OK		2.8.7	a4265a76efd0	Burk Royalty
Higginbotham ...	03/10/25 15:34:52	Pump-Off Control	Running	19:57	9.4	80.7	66.1		OK		1.8.1	8c04aa55b594	Burk Royalty
Amerada Web...	03/10/25 15:34:51	Pump-Off Control	Idle	49:51	0	3.1	0		OK		2.9.1	f42672c0e8fc	Burk Royalty
Dickinson 1	03/10/25 15:34:51	Pump-Off Control	Running	26:40	7.2	83.4	84.6		OK		2.8.7	00f85a76efd0	Burk Royalty
Hamilton A 3	03/10/25 15:34:49	Pump-Off Control	Running	11:54	6.8	27.3	30.3		OK		2.9.0	a47a9b86e694	Burk Royalty
Hamilton B 1	03/10/25 15:34:49	Pump-Off Control	Idle	30:39	0	14.6	13.9		OK		1.8.0	70ba6eb24354	Burk Royalty
Higginbotham 1	03/10/25 15:34:49	Pump-Off Control	Idle	16:36	0	24	68.9		OK	strange speed changes, is tv getting stuck?	2.9.0	f43e5a76efd0	Burk Royalty
Moore 2X	03/10/25 15:34:49	Pump-Off Control	Running, unable to st...	01:04	9.6	41.7	32.8		Unable to Stop		2.9.0	b01f5a76efd0	Burk Royalty
Hamilton A 2	03/10/25 15:34:48	Pump-Off Control	Running	09:55	11.9	49.4	53.5		OK		2.9.0	78eea955b594	Burk Royalty

Figure 6 – Actual dashboard of wells with Smarten Lite

Analysis charts: This chart shows seven run cycles of a well (purple line). The green line is the SPM 'setpoint.' When the SPM (measured with high precision) reaches the limit, the well is idled. In addition to SPM, the inferred production, run time, cycles and other important parameters can be charted.

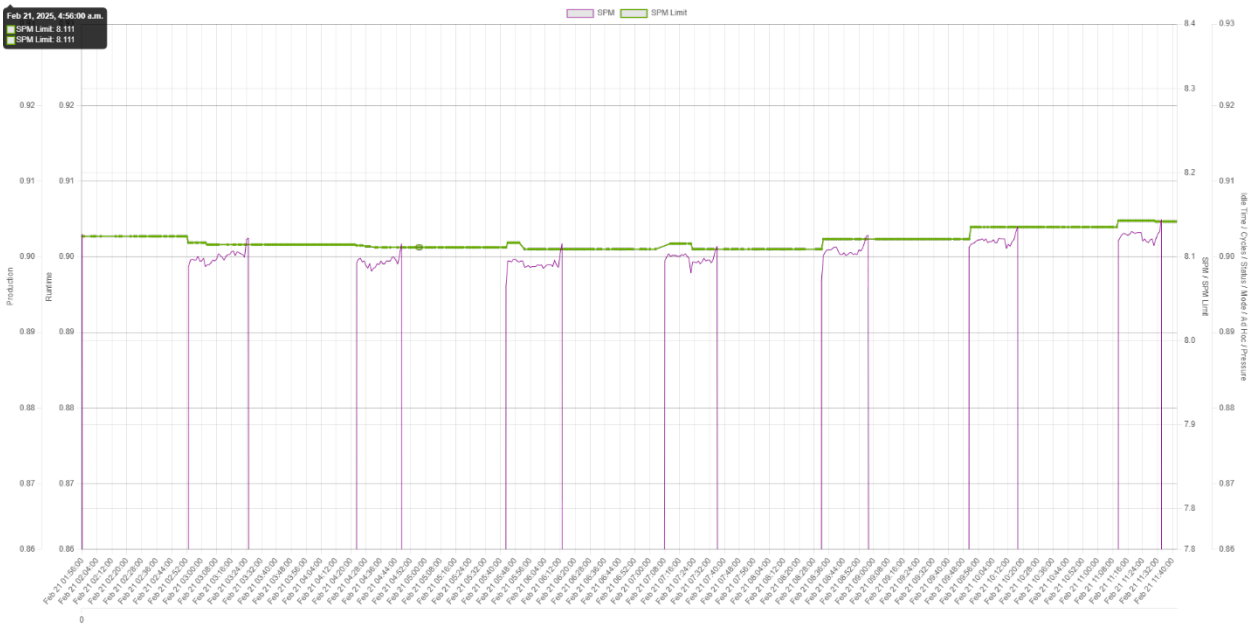


Figure 7 – Snapshot of SPMs

CONCLUSIONS

Reviewing the data from several SMARTEN Lite controller installs across West Texas, Oklahoma, Wyoming, and California, we were able to validate our hypothesis on key KPI metrics, including:

- Verifying the accuracy of pump-off control measurements
- Enabling remote surveillance helped limit the number of well site visits
- Identifying operational disruptions/human errors, such as invertedly leaving well in “hand” or “off” modes.

The SMARTEN Lite rod pump controller has been a valuable alternative solution for Burk on wells that are deemed uneconomical for full dynamometer pump off control systems.

ACKNOWLEDGEMENT

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