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LRP[®] — Linear Rod Pump Software



**Fluid-Over-Pump and Pump-Intake-
Pressure Controller Quick Reference**

Notices

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1 Introduction

The Optimizer Mode has an option to control speed based on FOP (fluid over pump) estimate. Similar to the Optimizer FOP Control, the Optimizer Mode also has an option to control speed based on PIP sensor (pump intake pressure sensor).

2 Nomenclature

Throughout this document, drive setup parameters are shown in **bold** type. Menus are shown **Highlighted**.

3 FOP Estimate Control

This control is based on fluid over pump estimate (not sensor). See section on “PIP Sensor Control” for sensor mode.

Set **optimz source** to FOP ESTIMATE on the **Optimizer** Menu (maximize visibility to see this parameter). **FOP** related parameters will become visible. Pump Fill parameters will disappear.

Set **FOP setpoint** to the desired fluid level over pump. Set **FOP down rate limit** to the desired FOP draw-down rate in ft/hr. **FOP up rate limit** is the desired FOP build-up rate. **FOP cmd** parameter is the rate-limited command level. **FOP ki** and **FOP kp** parameters determine the response.

Upon turning the motor on (must be in Auto / Optimize mode), the unit will run at **optimz start spm** for 25 strokes. On stroke #26, **FOP cmd** will be set equal to the **fluid over pump monitor**, and the pumping speed will slowly adapt to track **fluid over pump monitor** to **FOP cmd**. **FOP cmd** will slowly ramp to the **FOP setpoint**.

To improve the starting speed (on stroke #26), enter the IPR (inflow performance) data in the Simulate Menu, and set **FOP IPR Reference** parameter on in **Optimize** mode to ENABLE. The IPR data include: **reservoir prs**, **bubble point prs**, **well test prs**, and **well test flow**. The starting speed will be referenced from the IPR (for improved response). If **bubble point prs** is unknown, set it to zero. If **well test prs** is unknown, set it to zero, and enter **well test flow** as the expected BPD when the well fluid level is at the pump.

POC shutoff (pump-off controller) features will function normally during this mode.

If **FOP setpoint** is set to zero, the Optimizer will automatically transition from FOP control mode to traditional Pump Fill control mode when the **FOP cmd** has ramped to zero. This is Draw-Down control mode – no FOP control after the controlled draw-down to zero feet.



It is imperative that **fluid over pump monitor** tracks adequately. Install tubing and casing pressure sensors. Properly set **rod friction**. Calibrate **fluid over pump monitor**. Be mindful of FOP estimate error tolerance, despite calibration.

When **optimz source** parameter is set to FOP ESTIMATE, the “FOP..” parameters will become visible, shown below:

Item	Value	Units
1	OPTMZ SLOWER	
2	OPTIMIZED SPEED	
3	SLOWER	
4	3.2	spm
5	PUMPED OFF	
6	88	%
7	85	%
8	FOP ESTIMATE	
11	5.0	spm
20	ENABLE	
21	65	%
22	6	strokes
23	0	strokes
24	10	mins
25	45	mins
28	0.00	mins
34	0	ft
35	100	ft
36	2.00	ft/hr
37	10.00	ft/hr
38	DISABLE	
39	0.050	gain
40	2.000	gain
41	76	ft

3.1 FOP Setpoint and Command

Set **FOP setpoint** parameter to the desired fluid over pump level (feet). This is the requested FOP.

The **FOP cmd** parameter will slowly ramp to the **FOP setpoint** value based on the **FOP down rate limit** (feet/hr drawing down) and **FOP up rate limit** (feet/hr building down). This is the commanded FOP. The **FOP cmd** parameter will be set to -1 upon turning the motor on (for the first 25 strokes).

After the motor is turned on, at stroke #26, **FOP cmd** will be set equal to the **fluid over pump monitor**. If the **fluid over pump monitor** is zero, the **FOP cmd** will be set to 1 foot, thus preventing the unit from transitioning from FOP to normal Optimize mode – see next section on Draw-Down control.

The FOP controller always controls to the **FOP cmd**. Keep this in mind when troubleshooting the speed command. Compare **fluid over pump monitor** to **FOP cmd**.

There is no way to force the **FOP cmd** value equal to the **FOP setpoint** parameter. It can be forced to the **fluid over pump monitor** by cycling the motor off and on.

3.2 Draw-Down Control

If **FOP setpoint** is set to zero, the Optimizer will automatically transition from FOP control mode to traditional Pump Fill control mode when the **FOP cmd** has ramped to zero. This is Draw-Down control mode – no FOP control after the controlled draw-down to zero feet.

If the **FOP setpoint** is changed back to a non-zero value, the unit will return to FOP control, and the FOP command will start ramping up.

3.3 POC Controls

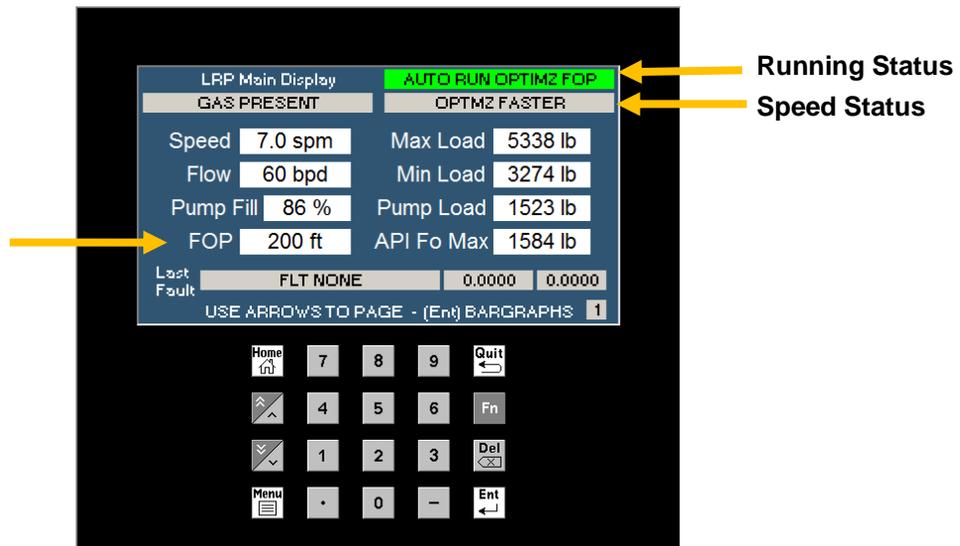
Pump Off Controller will operate normally during FOP control mode, allowing the unit to be shut off if Pump Fill drops low

3.4 Keypad Interface

During FOP control mode, the Main Display will show FOP estimate (**fluid over pump monitor**) rather than Gas Fill. The **running status** will display AUTO RUN OPTIMZ FOP during FOP control mode.

If the **fluid over pump monitor** is within 30 feet of **FOP cmd**, the **speed status** will display FOP TRACKING. Otherwise it will display the typical OPTIMZ FASTER, OPTIMZ SLOWER, OPTIMZ MAX SPM, OPTIMZ MIN SPM, etc.

FOP cmd is not displayed on the Main Display. If desired, it can be displayed on the User Display screen (user programmable screen).



3.5 IPR Feed Forward Term

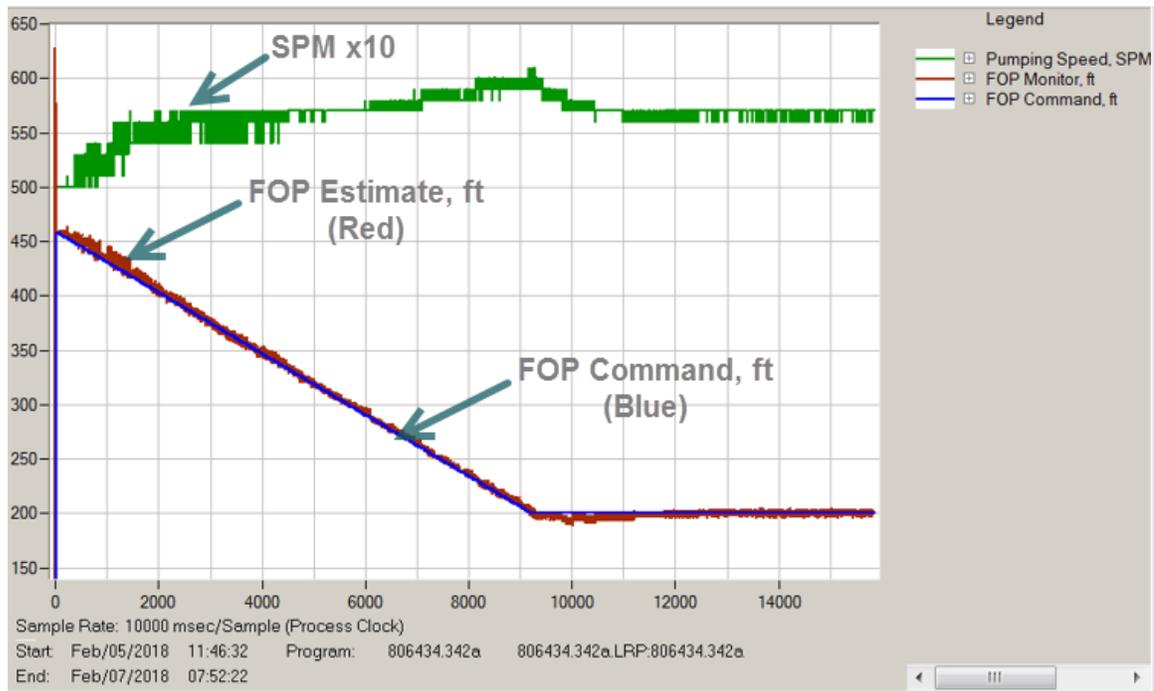
To improve the starting speed (on stroke #26), enter the IPR (inflow performance) data in the Simulate Menu, and set **FOP IPR Reference** parameter on in **Optimize** mode to ENABLE. The IPR data include: **reservoir prs**, **bubble point prs**, **well test prs**, and **well test flow**. The starting speed will be referenced from the IPR (for improved response). If **bubble point prs** is unknown, set it to zero. If **well test prs** is unknown, set it to zero, and enter **well test flow** as the expected BPD when the well fluid level is at the pump.

This will improve the performance of the controller, by “dead beating” the speed command.

If entering the IPR parameters are not an option, it is best to set the **optimz start speed** to a low value.

3.6 Charting

Use the Fluid Level.ucr chart file to record the system performance:



3.7 Tuning the FOP Controller

PI tuning loop is controlled by **FOP ki** and **FOP kp** parameter values.

4 PIP Sensor Control

This control is based on a downhole sensor. See section 3 “FOP estimate Control” for sensorless mode.

Similar to the Optimizer FOP Control, the PIP SENSOR Mode will control speed based on PIP sensor (pump intake pressure sensor). Set **optimz source** to PIP SENSOR on the **Optimizer Menu** (maximize visibility to see this parameter). **PIP** related parameters will become visible. Pump Fill parameters will disappear. The **PIP setpoint** parameter defines the desired target pump intake pressure. Operation is identical to Optimizer FOP Control (but uses **PIP** prefixed parameters and sensor feedback).

Keywords:

Linear Rod Pump

LRP

Fluid Over Pump

Pump Intake Pressure

FOP

PIP

Fluid Level

Draw Down

Optimizer

Sensorless

Sensor-less

Sensor free

