

806434.361

LRP[®] — Linear Rod Pump Software



LRP[®] Reference Sensor Troubleshooting

Notices

Copyright © 2021 by Unico, Inc.

All Rights reserved. No part of this publication may be copied, reproduced, or reduced to any electronic media or machine-readable format without the prior written permission of Unico.

At the time of publication, features of the product described herein are protected by United States Patents numbered 7,168,924 and 7,321,211. Other patents are pending.

The information contained in the manual is considered accurate to the best knowledge of the supplier at the time of publication. The manufacturer assumes no liability for errors that may exist. The supplier reserves the right to change data and specifications without notice.

All trade designations are provided without reference to the rights of their respective owners.

Published in the United States of America.

Table of Contents

1	Reference Sensor Troubleshooting.....	4
1.1	Overview	4
1.2	Reference Input.....	5
1.3	REF ERROR Fault	6
1.4	REF ERROR Diagnostic Codes	7
1.5	Well ID and Reference Sensor	10
1.6	Proper Operation of Reference Sensor	10
1.7	Zero-Encoded Rack Example Chart – Well ID.....	10

1 Reference Sensor Troubleshooting

1.1 Overview

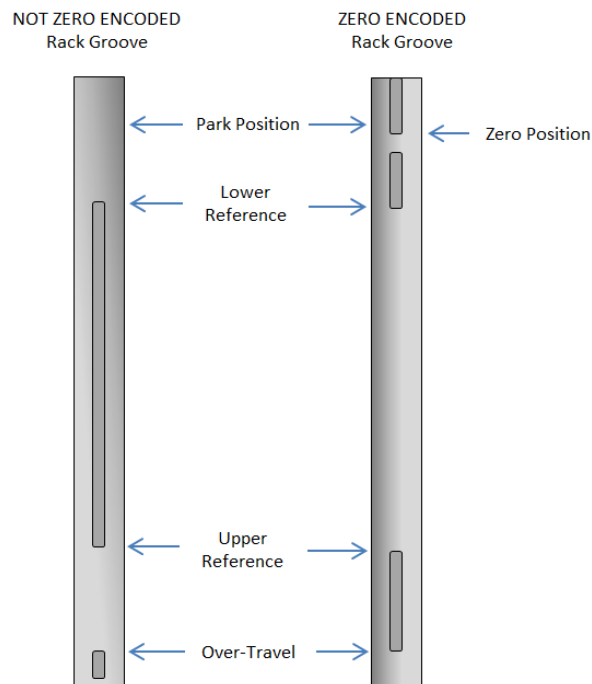
The LRP® mechanism position is referenced via a proximity sensor (referred to as reference sensor, or reference switch) located in the pinion box. Two reference events occur per stroke, one near the top of stroke, and one near the bottom of stroke. To function correctly, the sensor must be properly spaced and its wiring must be protected from electrical noise sources.

During normal operation, the controller will verify that the sensor is functioning properly. As part of that verification, the sensor must be detected twice per stroke, and the location of the sensor events must be within the **ref window tol** value of the expected position (as determined by the motor position). If the sensor is not detected within this expected window, the controller will generate a REF ERROR event, causing the unit to park and retry. A REF ERROR fault will be generated after consecutive retries. The pumping unit will park and wait for auto fault restart attempt.

The reference positions (**ref position up** and **ref position down** parameters) are automatically identified during the Well ID routine. These parameters can be found on the **Pumping Unit Menu** (**menu visibility** must be set to MAXIMIZE).

If **well id ref pos mode** parameter is set to DISABLE, then the **ref position up** and **ref position down** parameters must be manually entered prior to Well ID (will not be automatically identified).

The rack style is identified during Well ID. The **rack type** parameter will display either ZERO ENCODED (newer rack) or NOT ZERO ENCODED (traditional rack) after the first stroke of Well ID is complete. The racks grooves and positions are shown below:



1.3 REF ERROR Fault

A “REF ERROR” fault indicates one of the following conditions:

- A reference sensor problem -- spacing, wiring, electrical resistors, or electrical noise
- A stuck or binding condition, such as a stuck pump (which in turn causes the unit to not “see” the reference switch at the correct position)
- A motor position tracking problem, caused by improper motor wiring, improper set up, or incorrect **motor base rpm** or **mtr freq** values (which affects the motor slip)*

Note that a REF ERROR fault does not necessarily indicate a problem with the sensor!

The following recommendations are given in the Quick-Start Guide:

REF ERROR – The reference input was not received within the expected **ref window tol** target window identified during the last Well ID. The unit will immediately snug reference and try again. Check sensor wiring and spacing. This fault may indicate that Well ID is required (or was faulty), or that system is at torque limit. This fault will also occur if the **stroke id length** value is too small, preventing the unit from stroking up far enough to cross the sensor. This fault may also indicate a snug problem, where the unit did not extend completely down during the snug down – it may be necessary to increase the **snug torque limit**. (This is especially true of air counterbalanced units, where **snug air compensation** is used.) This fault may also indicate a feedback position tracking problem (not a reference sensor problem), caused by incorrect **base rpm** or **mtr freq** parameter values, which results in a bad **slip frequency** value – execute AC Test and double check motor base speed and frequency (might not be 60 Hz). If necessary, increase **ref window tol** parameter value.

To assist in troubleshooting the REF ERROR, the event history contains latched diagnostic values and codes, described below.

*If necessary, increase the **ref window tol** parameter value to eliminate REF INPUT LOSS faults caused by motor position tracking error.

1.4 REF ERROR Diagnostic Codes

REF ERROR or REF INPUT LOSS events and faults are logged in the event history. Diagnostic data are latched within the log and can be used to troubleshoot the cause of the REF ERROR. To see the diagnostic data, upload the event history and maximize the view, as shown below.

The **ref loss diag** (diagnostic) parameter is visible on the **Pumping Unit** or **Well ID** Menu. A message and diagnostic code is also available in the **running status** parameter on the Keypad Main Display and/or **lrp status** display.

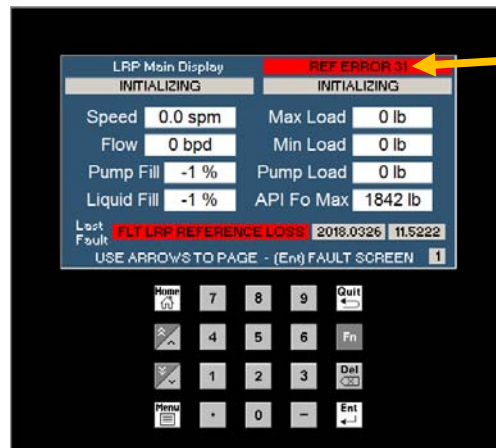
Event History Example:

ref input loss fault	Fault	1/9/2013 4:07:17 PM
ref loss diag	21	Diagnostic Codes
referenced dwn diag	0	
referenced up diag	0	
ref rise edge diag	0	
drive fbk pos diag	17.1551 inch	
ref position up	46.126 inch	
ref position down	12.057 inch	
motor torq percent latched	38 %	

Pumping Unit Menu Example:

Item	Value	Units
16 INT snug auto initiate	0	strokes
23 INT ref input polarity	INVERTED	
27 INT ref position up	42.000	inch
28 INT ref position down	16.000	inch
30 INT ref error	2.0733	inch
31 INT reference input	1	
34 INT reference state	REF GOOD	
35 INT lrp status	REF ERROR 31	
36 INT ref loss diag	31	
37 INT structural imbalance	-110	lb
38 INT API setpoint value	423	lb

Main Display Example:



“Ref Loss Diag”
(Reference Error
Diagnostic Code)

Ref Loss Diag Codes:

Diagnostic code indicating the nature of the fault, defined by the following values:

Code	Description
1	No initial reference input: The reference input value was 0 (rather than 1) after the snug down, indicating that the sensor is in the wrong state when the unit is in the parked (starting) position. This usually indicates bad wiring, a bad sensor, or the rack is not at bottom. If the problem is caused by poor sensor spacing (unlikely), then this code indicates the sensor is too far <u>out</u> with Unico unit, or too far <u>in</u> with AFCO unit.
21	In upstroke, and did not detect the lower sensor within the reference window. The reference input may have been too early, too late, or non-existent.
22	In upstroke, and did not detect the upper sensor: The unit was in the upstroke, and the motor position exceeded the upper reference position (plus window tol) without detecting the upper reference input.
23	The unit indexed to the top position without ever detecting the upper reference input.
24	In upstroke, and the upper sensor was detected too early. Either the sensor is faulty, or the racked unexpectedly dropped back down and it mistook the lower sensor for the upper sensor.
25	Over-stroke: The unit was in the upstroke, near the top of stroke, and the reference input was lost. This indicates that the over-stroke groove was detected. Check gear ratio, linear lead, and stroke id length.
26	Did not detect sensor in first upstroke of Well ID. Sensor was not detected within the first ½ of stroke id length distance of travel.
31	In down-stroke, and did not detect the upper sensor within the reference window. The reference input may have been too early, too late, or non-existent.
32	In down-stroke, and did not detect the lower sensor: The unit was in the down-stroke, and the motor position dropped below the lower reference position (minus window tol) without detecting the lower reference input.
33	In down-stroke, and the sensor was detected too early. Either the sensor is faulty, or the racked unexpectedly dropped down too quickly.

Latched data in the Event History Log for **Ref Loss Diag** Event:

referenced dwn diag:

This item records whether or not the “down” (lower) reference event occurred (0 = no, 1 = yes)

referenced up diag:

This item records whether or not the “up” (upper) reference event occurred (0 = no, 1 = yes)

drive fbk pos diag:

This item records the position of the motor at the time the REF INPUT LOSS fault was generated.

ref position up:

The upper reference position, as determined during the Well ID.

ref position down:

The lower reference position, as determined during the Well ID.

motor torq percent latched:

The motor torque (%) at the time the REF INPUT LOSS fault was generated. If this value is excessive, the unit might be binding.

1.5 Well ID and Reference Sensor

The **ref position up** and **ref position down** parameters are identified during the first stroke of the Well ID. These values can be viewed either on the Pumping Unit Menu (with **menu visibility** set to MAXIMIZE), or in the latched data of a REF INPUT LOSS event. These parameters represent the sensor positions as determined by the motor position feedback tracking during the Well ID.

If **well id ref pos mode** parameter is set to DISABLE, then the **ref position up** and **ref position down** parameters must be manually entered prior to Well ID (will not be automatically identified).

The validity of each reference sensor position is checked during the remainder of the Well ID routine. If the input sensor position is not valid, or the sensor is occurring at the wrong time during Well ID, a REF INPUT LOSS fault will be generated, and the **well id state** will display NO REF VERIFY.

1.6 Proper Operation of Reference Sensor

When the reference sensor is functioning properly, the unit will stroke without faulting. The **reference state** parameter (on the Pumping Unit Menu) will read GOOD REF, and the **meas ref position** parameter (on the Pumping Unit Menu) will latch values close to the **ref position up** and **ref position down** parameters as the unit strokes through the up and down sensor positions, respectively.

If the **meas ref position** parameter (for a particular reference edge) varies dramatically from the expected values (**ref position up** and **ref position down** parameters), then it is likely that a motor parameter is not correct. The motor parameters should be verified, and the AC Test and Well ID routines should be re-executed.

1.7 Zero-Encoded Rack Example Chart – Well ID

The following “Reference Input” Chart Recorder UCR illustrates the reference sensor sequence upon starting a Well ID from the parked position (with a ZERO ENCODED rack):

