Realift Rod Pump

Manual

Version: 5.00.0

Date: July 2021

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1 Legal Information

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

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3 Safety Information

Important information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising

out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Before you begin

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.
- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

- Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future reference.
- Test all software in both simulated and real environments.
- Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to help prevent accidental equipment damage.

Failure to follow these instructions can result in equipment damage.

Operation and adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer’s instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the

equipment manufacturer's instructions and the machinery used with the electrical equipment.

- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

Acceptable use

⚠ WARNING

UNACCEPTABLE USE

Do not use this solution as an integral part of a safety system. The components in this solution are not safety products.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

EQUIPMENT OPERATION HAZARD

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Use only Schneider Electric software or approved software with Schneider Electric hardware products.

Failure to follow these instructions can result in minor or moderate injury.

Important notices

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

Installation, adjustment, repair, and maintenance must be performed by qualified personnel.

Ensure power has been removed before servicing.

Failure to follow these instructions will result in death or serious injury.

4 About the Book

Audience

This manual is written for people who need to install and configure Realift Rod Pump. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

This manual describes how to use a Schneider Electric Magelis Human Machine Interface (HMI) to configure Realift Rod Pump Controller (RPC) operation. It is written for people who already understand:

- The physical set up of the well, including drive, pump, motor, rod, and sensor information including the operation and installation of sensors such as load cells, proximity sensors, and inclinometers
- The characteristics and relationships among flow, pressure, temperature, and signal noise in the well
- The mix of oil, water, gas, and solids typically found in the well and how this mix affects pump operation and well production.

Document scope

This manual describes:

- Connecting instrumentation, such as the proximity sensor or inclinometer, to the Realift RPC
- Using a Magelis HMI
- Configuring Realift Rod Pump parameters
- Controlling your pump
- Optimizing operation with dynamometer or dynagraph cards (dynacards)
- Viewing system status
- Viewing and creating trend graphs
- Changing passwords

Validity note

This document is valid for Realift Rod Pump version 5.00.0

Product related information

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise are allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death or serious injury.

5 Cybersecurity

Cybersecurity is a branch of network administration that addresses attacks on or by computer systems and through computer networks that can result in accidental or intentional disruptions. The objective of cybersecurity is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for intended users.

No single cybersecurity approach is adequate. Schneider Electric recommends a defense-in-depth approach. This approach layers the network with security features, appliances, and processes. The basic components of this approach are:

- Risk assessment: A systematic security analysis of the environment and related systems.
- A security plan built on the results of the risk assessment
- A multi-phase training campaign
- Network separation and segmentation: Physical separation of the control network from other networks, and the division of the control network itself into segments and security zones.
- System Access Control: Controlling access to the system with firewalls, authentication, authorization, and other software means, and traditional physical security measures such as video surveillance, fences, locked doors and gates, and locked equipment cabinets.
- Device hardening: The process of configuring a device against communication-based threats. Device hardening measures include disabling unused network ports, password management, access control, and the disabling of unnecessary protocols and services.
- Network monitoring and maintenance: An effective defense-in-depth campaign requires continual monitoring and system maintenance to meet the challenge of new threats as they develop.

Contact us

For more information, refer to the Schneider Electric Cybersecurity Support Portal at http://www.schneider-electric.com/b2b/en/support/cybersecurity/overview.jsp.

Additional Resources

Industrial Control Systems Cyber Emergency Response Team (ICS-CERT)
https://ics-cert.us-cert.gov

ICS-CERT Recommended Practices
https://ics-cert.us-cert.gov/Recommended-Practices

Center for Internet Security (CIS) Top 20 Critical Security Controls
https://www.cisecurity.org/cybersecurity-best-practices

FBI Cyber Crime
https://www.fbi.gov/investigate/cyber

Guide to Industrial Control Systems (ICS) Security
https://www.nist.gov/publications/guide-industrial-control-systems-ics-security

WaterISAC Water Security Network
https://www.waterisac.org

6 Introduction

The Schneider Electric Realift Rod Pump is an advanced rod pump controller (RPC) for automating control of a sucker rod pump. Realift Rod Pump provides automated control and feedback for pumpjacks (also known as sucker rod pumps, rod pumps, beam pumps, or artificial lift/rod pumps) in oil and gas fields. The Realift RPC can control one or two pumpjacks using one SCADAPack 474 RTU.

Realift Rod Pump is available as an application for the SCADAPack 474 RTU for use with a Magelis HMI, an Altivar drive, and other variable speed drives. It can be ordered as a complete ready-to-install panel with an Altivar drive.

This manual describes how to configure the Realift RPC using a Magelis HMI.

⚠ DANGER

ELECTRIC SHOCK HAZARD

- Read and understand this manual and the relevant drive installation manual before installing or operating the Realift Rod Pump system. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to wiring and grounding of all equipment.
- Many parts of the Realift Rod Pump system, including the printed circuit boards, operate at the line voltage. Do not touch. Use only electrically-insulated tools.
- Do not touch unshielded components or terminal strip connections with voltage present.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, and OSHA 1910.
- Before servicing the drive:
  - Follow the applicable lock out/tag out (LOTO) procedure.
  - Disconnect all power sources, including external control power.
  - Place a Do Not Turn On label on all power disconnects.
  - Lock all power disconnects in the open position.
- Install and close all covers before applying power or starting and stopping the drive.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Do not install or operate any equipment that appears damaged.

Failure to follow these instructions can result in minor or moderate injury.

The Realift Rod Pump system uses force measurements from a surface-mounted load sensor, a load cell, as the basis for control using a generic drive, a starter/contactor, or the Altivar.

The Realift Rod Pump system can use Downhole, Surface, Timed, or Hand Control Modes.

Commissioning the Realift Rod Pump for surface or downhole control requires prior installation of a load cell with either a 30 klbs kit or a 50 klbs kit, and a position sensing device.

6.1 System Components

Realift RPC is an advanced pump-off controller for automating a rod pump (RPC). It is comprised of the following components:

- A Schneider Electric SCADAPack 474 RTU that manages operation of the variable frequency drive (VFD) or contactor when an electric motor is used, or a starter when a motor is used without a VFD
- A Schneider Electric Magelis HMI panel that runs the Realift RPC application. The Realift RPC application lets you view, configure, and manage well operations. For details, see Using the Magelis HMI 45.

⚠ WARNING

LOSS OF CONFIGURATION CONTROL

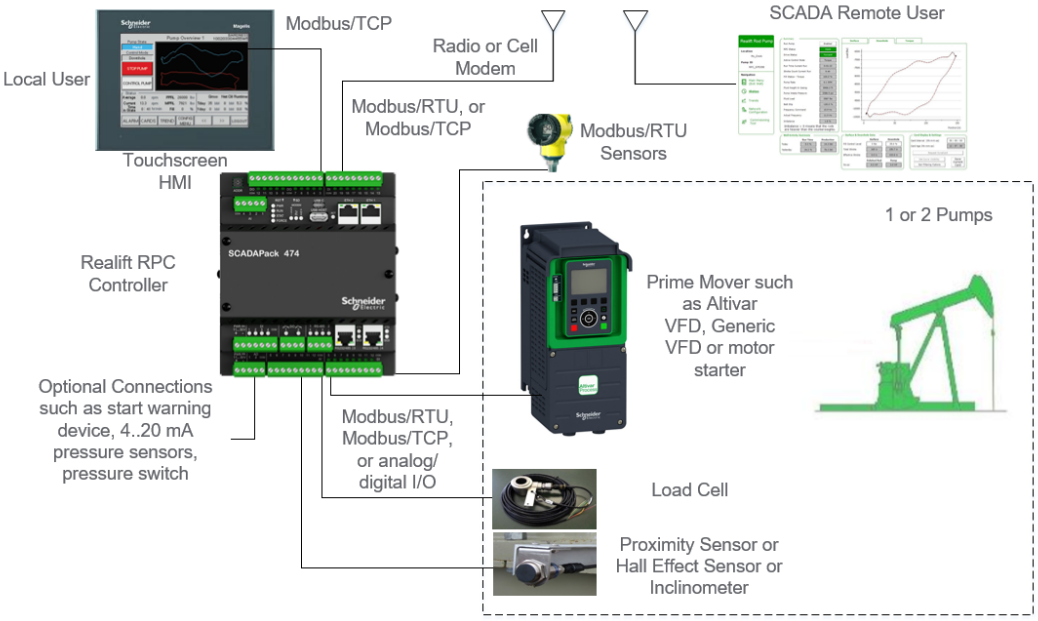
Storing and operating the Magelis HMI outside of its supported temperature ranges can render the Magelis HMI unusable.

To help maintain access to the Magelis HMI configuration parameters:

- Store the Magelis HMI at temperatures between -20 °C (-4 °F) and 60 °C (140 °F)
- Operate the Magelis HMI with a heater when temperatures are between -40 °C (-40 °F) and 0 °C (32 °F)
- Do not operate the Magelis HMI at temperatures below -40 °C (-40 °F), even with a heater
- Do not operate the Magelis HMI at temperatures above 55 °C (131 °F)

Failure to follow these instructions can result in death or serious injury.

The figure below shows an example of the Realift RPC components.



6.2 Typical Site Installation and Commissioning Workflow

See: Installation Checklists 135

Before arriving at the site

- The panel or enclosure should be physically mounted, provided with power, and tested
- The load cell and position sensor should be installed
- Obtain well data, such as taper length and material, pump diameter, and pumpjack dimensions

After arriving at the site

Physical Installation

1. Ensure that the load cell is installed.
2. Ensure that the position sensor, a proximity sensor or inclinometer, is installed.
3. Run wires from the sensors to the RPC.
4. Connect the RPC to the prime mover (VFD or starter/contactor).
5. Energize the system.
6. Confirm that the sensors work.

7. Confirm that the panel can control the prime mover.

Configuration

1. Enter the well information.
2. Enter the load cell and position sensor information.
3. Enter the VFD or starter/contactor information.
4. Start the pump in hand mode at a low speed and confirm cards appear and look normal.

   Abnormal cards may indicate misconfiguration or a well condition.
5. Set the RPC to timed mode using an on-time and off-time; if the pump was previously controlled by a timer, these times should be similar to the previous operation of the pump.

   This is useful for fallback mode. See the Timed Fallback 81 parameter.
6. Set the RPC to Automatic mode using a pump fillage method.
7. Monitor pump operation, on-site or using telemetry, until the pump reaches the target fillage level.

6.3 Realift Rod Pump Part Numbers

The Realift Rod Pump consists of a SCADAPack 474 RTU which can control the rod pump and collect data about its operation.

The Realift Rod Pump is delivered pre-installed on a SCADAPack 474 or may be added to an installed SCADAPack 474.

Part Number	Description
TBUM297147	SCADAPack Rod Pump Controller, Factory
TBUM297148	SCADAPack Rod Pump Controller, Upgrade

7 Getting Started

This manual describes how to get started with Realift RPC using a Magelis HMI. The information in this manual applies to Version 5.00.0 of the Realift Rod Pump.

⚠ DANGER

ELECTRIC SHOCK HAZARD

- Read and understand this manual and the relevant drive installation manual before installing or operating the Realift Rod Pump system. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to wiring and grounding of all equipment.
- Many parts of the Realift Rod Pump system, including the printed circuit boards, operate at the line voltage. Do not touch. Use only electrically-insulated tools.
- Do not touch unshielded components or terminal strip connections with voltage present.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, and OSHA 1910.
- Before servicing the drive:
  - Follow the applicable lock out/tag out (LOTO) procedure.
  - Disconnect all power sources, including external control power.
  - Place a Do Not Turn On label on all power disconnects.
  - Lock all power disconnects in the open position.
- Install and close all covers before applying power or starting and stopping the drive.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Do not install or operate any equipment that appears damaged.

Failure to follow these instructions can result in minor or moderate injury.

See:

- Setting up the SCADAPack 474 20

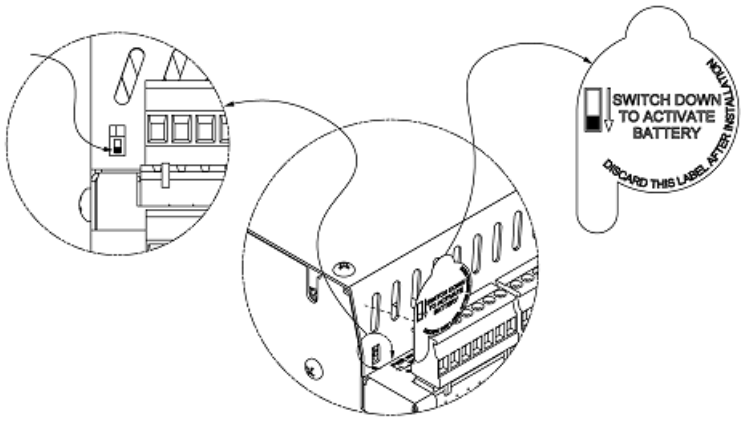
7.1 Setting up the SCADAPack 474

The following sub-sections provide instructions for setting up the SCADAPack 474. See also Appendix F - Adding RPC to a SCADAPack 474 175.

Step 1: Enable the RAM Back-up Battery

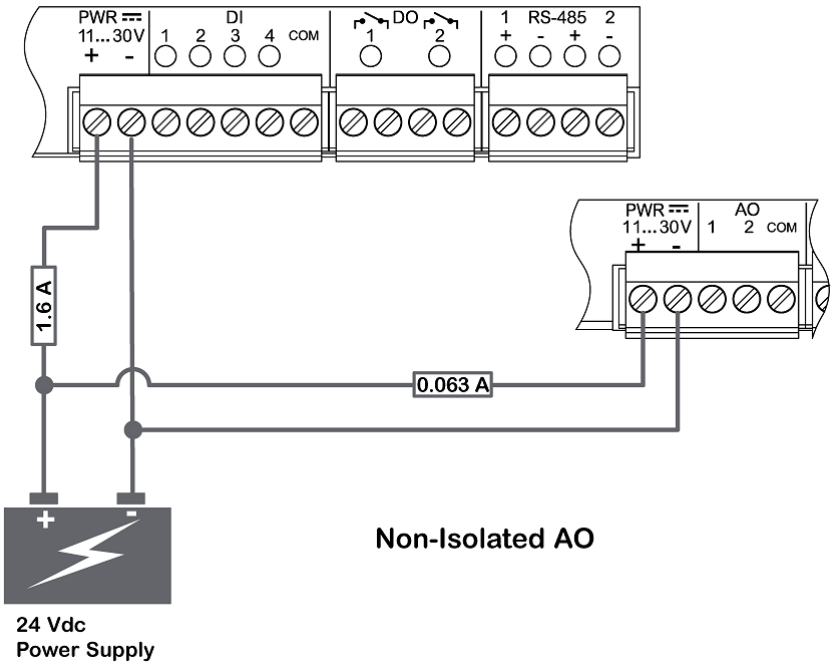
To begin using the SCADAPack 474

1. Carefully remove and discard the sticker.
2. Using a non-conductive tool, toggle the battery switch to the down (on) position.



Step 2: Power Connection

The SCADAPack 474 is designed for 12...30 Vdc operating voltages and is powered through a terminal connector shared with the digital/counter inputs. A SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) power supply is required.



Step 3: SCADAPack Connections

The I/O on the SCADAPack 474 is configurable.

The default configuration for Pump 1 is shown in the following table.

A default configuration for Pump 2 is not assigned.

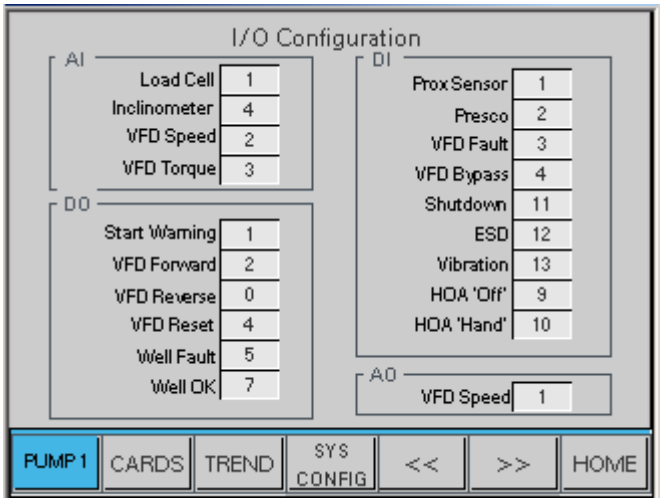
The following is a comprehensive list of RPC I/O points for one pump.

Digital Inputs	Digital Outputs	Serial Ports
DI-1 Proximity Sensor	DO-1 Start Warning	Serial 1 VFD or Sensors
DI-2 Presco	DO-2 VFD Forward	Serial 2 VFD or Sensors
DI-3 VFD Fault	DO-3	Serial 3 Modbus Server
DI-4 VFD Bypass	DO-4 VFD Reset	Serial 4 VFD
DI-5 Optional Sensors	DO-5 Well Fault	
DI-6 Optional Sensors	DO-6	
DI-7 Optional Sensors	DO-7 Well OK	
DI-8 Optional Sensors	DO-8	
DI-9 HOA 'Off'	DO-9	
DI-10 HOA 'Hand'		
DI-11 Shutdown		
DI-12 ESD		
DI-13		
DI-14		
DI-15		
DI-16		
Analog Inputs	**Analog Outputs**	
AI-1 Load Cell	AO-1 VFD Speed	
AI-2 VFD Speed	AO-2	
AI-3 VFD Torque		
AI-4 Inclinometer		
AI-5 Optional Sensors		
AI-6 Optional Sensors		
AI-7 Optional Sensors		
AI-8 Optional Sensors		

To view configurable I/O

On the **Pump Overview** screen, press **CONFIG MENU > System Configuration > I/O Status** and then press **>>**.

A value of 0 indicates that the I/O point is not used.



Step 4: Serial Port and Ethernet Connections

Serial Port Connections

- Serial 1: Connection to VFD or Sensors
- Serial 2: Connection to VFD or Sensors
- Serial 3: Connection to Modbus Server device
- Serial 4: Connection to VFD when using Serial communication

SCADAPack Ethernet Connections

The sections below describe the default settings. If you want to modify the network configuration for you installation, update the TCP/IP configuration of the SCADAPack 474 RTU and any other configured devices. In the SCADAPack Documentation Set in the SCADAPack x70 Configuration manual, see the Configuring IP Communication topic.

SCADAPack Ethernet 1 connection

SCADAPack Ethernet 1 can be used for communication with a VFD, network radio, cell modem, or the SCADAPack RemoteConnect configuration software.

SCADAPack Ethernet 1 is configured, by default, as follows:

- **IP Address**: 192.168.0.11
- **Net Mask**: 255.255.255.0

- **Gateway**: 192.168.50.1

SCADAPack Ethernet 2 Connection

SCADAPack Ethernet 2 is used for communication with the Magelis HMI.

SCADAPack Ethernet 2 is configured, by default, as follows:

- **IP Address**: 192.168.50.11
- **Net Mask**: 255.255.255.0
- **Gateway**: 192.168.50.1

Magelis HMI Connection

The Magelis HMI connects to the SCADAPack 474 Ethernet 2 port.

The Magelis HMI is configured, by default, as follows:

- **IP Address**: 192.168.50.30
- **Net Mask**: 255.255.255.0
- **Gateway**: 192.168.50.1

Altivar Ethernet Connection

When you have an Altivar VFD with Modbus/TCP support, you can connect the Realift RPC to it using Modbus/TCP:

1. Connect the Altivar into Ethernet 1 port of the SCADAPack 474.
2. On the Altivar, if using the default TCP/IP configuration, configure the Ethernet port as follows:

   IP Address: 192.168.0.31

   Net Mask: 255.255.255.0

   Gateway: 192.168.0.1

When you have an Altivar VFD and a network radio or cell modem use an Ethernet switch:

- Configure the VFD’s Ethernet port as per the network administrator’s instructions.

8 Connecting a Drive

Realift Rod Pump can be used with various types of variable frequency drives (VFD).

See:

- Connecting an Altivar Drive 26
- Connecting a Generic Drive 30
- Connecting a Starter/Contactor 32

8.1 Connecting and Configuring an Altivar Drive Using Modbus

Before beginning the procedure below, refer to the drive manual provided by the manufacturer for information about how to open and close the drive cover.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Connect a COM terminal to enclosure ground at only one point in the system. Connecting COM terminal to SCADAPack 474 ground is recommended.

Failure to follow these instructions can result in equipment damage.

- Consult the Altivar documentation or this table 27 to help you find where in the VFD keypad to enter each parameter. The Code shown below will help you find the right parameter.
- CD1, CD2, and CCS are hidden unless Control Mode is set to Separate
- Select Expert Mode on the Altivar Keypad for Set Cmd Switching and Freq Switching to same Channel. See the Altivar instructions
- The VFD needs to be power cycled for new communication settings to go into effect.

Enter the Altivar parameters from this table:

- Set the **Motor Parameters**
- For Ethernet communication, set the parameters in section **A**
- For Serial communication, set the parameters in section **B**
- For Ethernet and Serial communication, set the parameters in sections **A** and **B**
- In Realift Rod Pump, if the Drive Configuration HOA Type is ATV DI1/DI3, set the parameters in sections **C** and **D**
- In Realift Rod Pump, if the Drive Configuration HOA Type is Soft, set the parameters in sections **E** and **F**

Menu	Altivar 930 Desc.	ATV 71 Desc.	Required Value	Code
Motor Parameters				
	Motor Th Current	Mot. Therm. Current	Per Motor Nameplate	ITH
	Nominal Motor Power	Rated Motor Power	Per Motor Nameplate	nPr
	Nom Motor Voltage	Rated Motor Volt	Per Motor Nameplate	Uns
	Nom Motor Current	Rated mot current	Per Motor Nameplate	nCr
	Nominal Motor Freq	Rated motor freq	Per Motor Nameplate	FrS
	Nominal Motor Speed	Rated motor speed	Per Motor Nameplate	nSP
	Motor Standard	Std Mot Freq	As Required	BFR
	Max Frequency	Max Frequency	As Required	tFr
	2-Wire Type	2 Wire Type	Level	TCT
	Set Motor Control Type (CTT) to SVC V			
	Set ENA mode to Yes			
5.16 Error/Warning Handling (ATV71 Menu 1.8)				
	Automatic Restart	Automatic Restart	Yes	ATR
A: Required to enable Ethernet Comms into VFD				
	IP Mode Ether Embd	---	Fixed	
	IP address	---	192.168.0.12	
	Mask	---	255.255.255.0	
	Gateway	---	192.168.0.1	
B: Required to enable Serial Comms into VFD				
	Modbus format	Modbus format	8-N-1	TFO
	Modbus baud rate	Modbus baud rate	19200 kbps	TBR
	Modbus Address	Modbus Address	1	ADD
	Modbus time out	Modbus time out	30	TTO
C: Configures VFD for Control via Ethernet Comms				
	Control Mode	Profile	Separate	CHCF

	Cmd Channel 1	Cmd Channel 1	Terminals	CD1
	Cmd Channel 2	Cmd Channel 2	Embedded Ether (Com Card on ATV71)	CD2
	Ref Freq 1 Config	Ref 1 Channel	AI2	FR1
	Ref Freq 2 Config	Ref 2 Channel	Embedded Ether (Com Card on ATV71)	FR2
	Command Switching	Cmd Switching	DI3	CCS
	Freq Switch Assign	Ref 2 switching	DI3	RFC
D: Configures VFD for Control via Serial Comms				
	Control Mode	Profile	Separate	CHCF
	Cmd Channel 1	Cmd Channel 1	Terminals	CD1
	Cmd Channel 2	Cmd Channel 2	Modbus	CD2
	Ref Freq 1 Config	Ref 1 Channel	AI1	FR1
	Ref Freq 2 Config	Ref 2 Channel	Modbus	FR2
	Command Switching	Cmd Switching	DI3 (ATV71 LI3)	CCS
	Freq Switch Assign	Ref 2 switching	DI3 (LI3 ATV71) (May require setting expert access mode and confirming)	RFC
E: Simplified Setup for Control via Serial Comms if no HOA Switch is Present on the Panel				
	Control Mode	Profile (Channel Config)	Not Separate	CHCF
	Ref Freq 1 Config	Ref. 1 channel	Modbus	FR1
F: Simplified Setup for Control via Ethernet Comms if no HOA Switch is Present on the Panel				
	Control Mode	Profile (Channel Config)	Not Separate	CHCF
	Ref Freq 1 Config	Ref. 1 channel	Embedded Ether	FR1

Configuring Hardware Communication

Before beginning the procedure below, refer to the drive manual provided by the manufacturer for information about how to open and close the drive cover.

You can connect Realift Rod Pump using a SCADAPack 474 to the Altivar drive using:

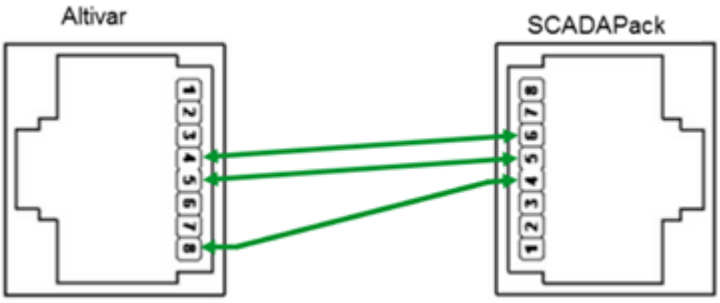
- Ethernet communication 24
- Serial communication

or using a generic drive. See Connecting a Generic Drive 30.

Serial Connection

If you want a serial connection to the VFD, connect it to SCADAPack Serial 4. Use a single twisted pair for the two data lines.

Make an RJ45 cable connecting Altivar pin 4 to SCADAPack x70 RTU pin 6, and Altivar pin 5 to SCADAPack x70 RTU pin 5.

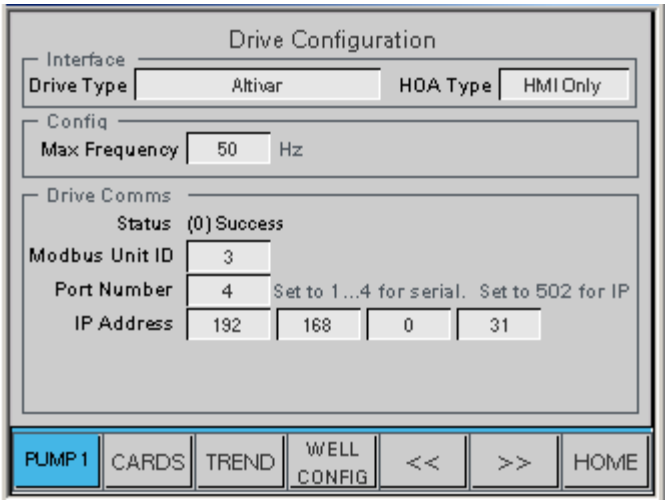


Altivar serial vs SCADAPack 474 serial pinouts:

Pin	SCADAPack 474 Comm 4	Altivar
1	+5V	
2	NC	
3	NC	
4	GND	D1
5	B (-)	D0
6	B (+)	
7	NC	
8	NC	Common

Configuring Communication Using the Magelis HMI

1. On the Home screen (**Pump Overview** screen), stop the pump by pressing **STOP PUMP**.
2. When the Stop Pump dialog is displayed press **Yes**.
3. Press **CONFIG MENU > Well Configuration > Drive**.



4. For the **HOA Type**, select one of the following:

   - If there is no HOA switch on the panel, choose **HMI Only**. This will allow you to control the system from the Magelis HMI display.
   - If there is a HOA switch in the panel, and it is connected to the Altivar according to the following table, then select **ATV DI1/DI3**. This will cause the Magelis HMI display to reflect the HOA switch status.

	LI-1/DI-1	**LI-3/DI-3**
Off	LOW	LOW
Hand	HIGH	LOW
Auto	HIGH	HIGH

5. Enter the **Modbus Unit ID** of the Drive.

   The Modbus Unit ID needs to be different from the SCADAPack 474 Unit Identifier.

6. Enter the **Port Number**:

   - For serial communication enter Serial Port number 4
   - For Ethernet communication enter 502

7. For Ethernet communication, enter the **IP Address** of the Altivar VFD.

8.2 Connecting a Generic Drive

Before beginning the procedure below, see the drive manual provided by the manufacturer for information about how to open and close the drive cover.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Connect a COM terminal to enclosure ground at only one point in the system. Connecting digital COM terminal to drive ground is recommended.

Failure to follow these instructions can result in equipment damage.

To connect a generic drive and proximity sensor to the Realift Rod Pump

1. Connect the following:
   a. Ensure the drive speed input is configured to accept a 4…20 mA signal and connect AO-1 to the speed input on the generic drive.
   b. AO-COM to the generic drive's speed input common.
   c. DO-4 to the external fault reset on the drive.
   d. DO-COM to the drive's return.
   e. One side of normally open contact DO-2 to drive +24 Vdc.
   f. The other side of normally open contact DO-2 to the forward control on the drive.
   g. DI-3 to drive status (fault condition) or to drive, or motor, if drive feedback is available.

      Connecting DI-3 enables you to monitor the status of a generic drive or starter/contactor.
   h. DI-COM to the drive's return.
   i. Ensure the drive speed feedback is configured to provide a 4…20 mA signal and connect it to AI-2 for speed feedback.

      This connection is recommended, but only needed if you are using the floating rod feature.
   j. Ensure the drive torque feedback is configured to provide a 4…20 mA signal and connect it to AI-3 for torque feedback.

      This connection is required for the counterbalance and imbalance calculations.
   k. If using speed and/or torque feedback, connect AI-COM to the drive's return.

8.3 Connecting a Starter/Contactor

NOTICE

UNINTENDED EQUIPMENT OPERATION

Connect a COM terminal to enclosure ground at only one point in the system. Connecting digital COM terminal to drive ground is recommended.

Failure to follow these instructions can result in equipment damage.

To connect a starter/contactor and proximity sensor to the Realift Rod Pump

1. Connect the following:
   a. DO-4 to the external fault reset on the drive.
   b. DO-COM to voltage required for Starter Run Command (often +24 Vdc).
   c. DO-2 to the forward control on the drive.
   d. DO-COM to the drive's return.
   e. DI-3 to drive status (fault condition) or to drive, or motor, if drive feedback is available.
   f. DI-COM to the drive's return.

      Connecting DI-3 enables you to monitor the status of a generic drive or starter/contactor.

9 Connecting the Position Sensor

Realift RPC can use a proximity sensor or an inclinometer to provide position information on the pump.

⚠ DANGER

PHYSICAL INJURY OR DEATH

The rod pump is a heavy piece of equipment. Before installing the position sensor or performing any maintenance to the rod pump, ensure the rod pump is stopped and braked.

Installing the position sensor requires two people: one to position the pumpjack and one to run the brake.

Failure to follow these instructions will result in death or serious injury.

See:

- Connecting a Proximity Sensor 33
- Connecting an Inclinometer 37

⚠ CAUTION

LOOSE CABLE CATCHING ON PERSONNEL OR MACHINERY

- Route the cable in such a way that it does not present a trip hazard or interfere with moving equipment or machinery
- Secure the cable in such a way that it will not come loose due to wind, weather, or other factors, and become a hazard.

Failure to follow these instructions can result in minor or moderate injury.

NOTICE

LOOSE CABLE CATCHING ON MACHINERY

- Route the cable in such a way that it does not interfere with moving equipment or machinery
- Secure the cable in such a way that it will not come loose due to wind, weather, or other factors.

Failure to follow these instructions can result in equipment damage.

9.1 Connecting a Proximity Sensor

The proximity sensor generates a once-per-stroke signal that the Realift Rod Pump uses to coordinate control algorithms. This signal indicates the start and end of each stroke.

See:

- Mounting Proximity Sensor Hardware 34

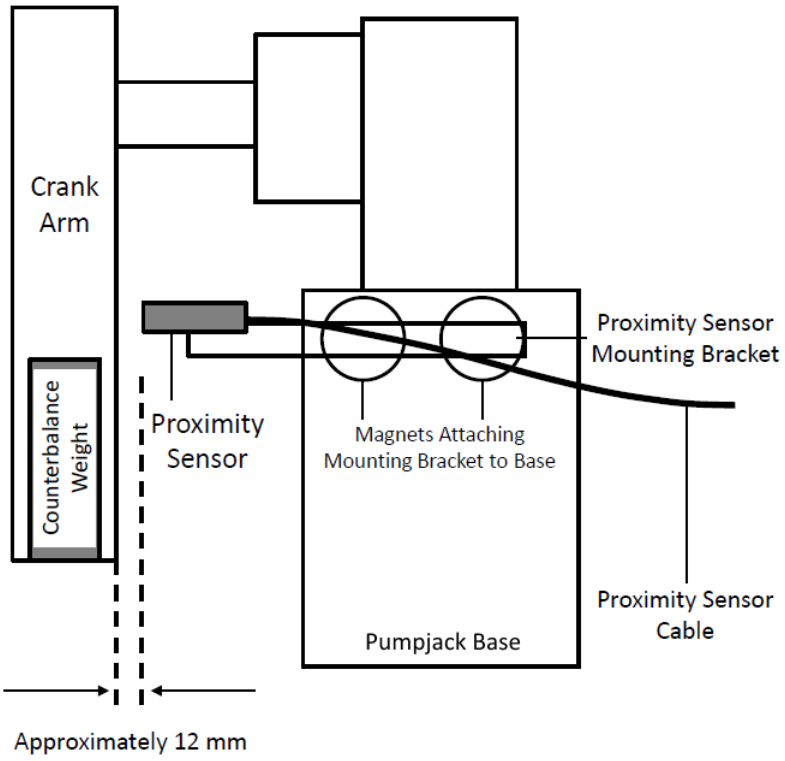
- Connecting the Proximity Sensor Cable to the SCADAPackx70 RTU 37

9.1.1 Mounting Proximity Sensor Hardware

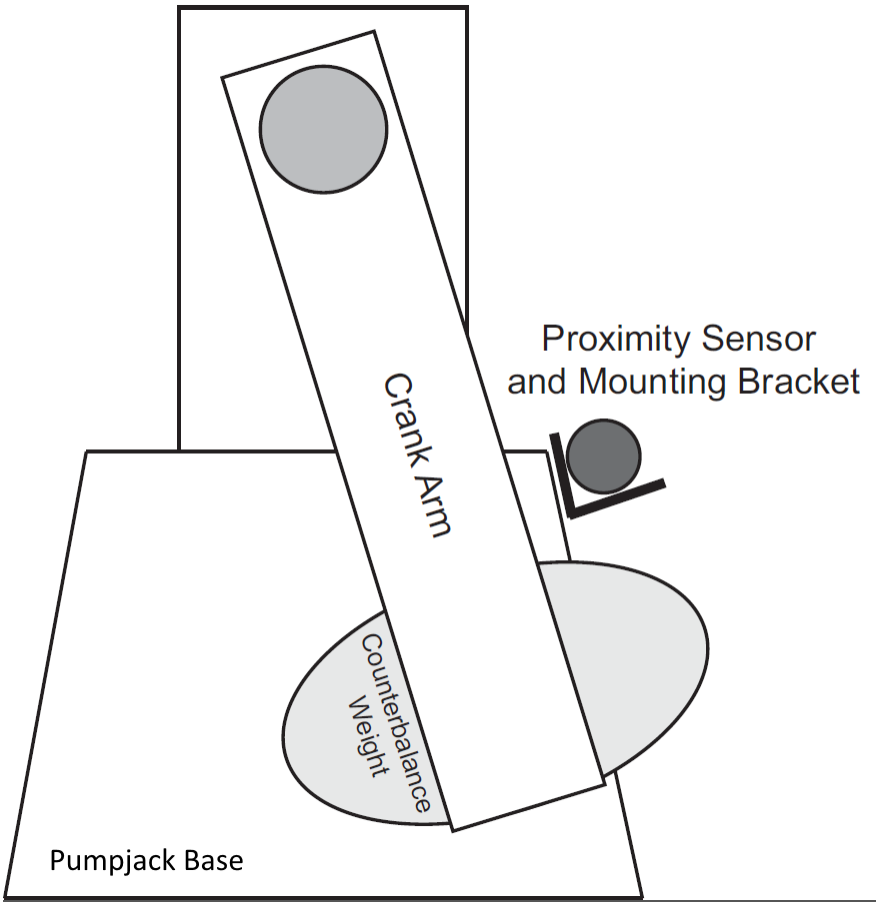
To mount the proximity sensor hardware

1. Attach the proximity sensor assembly to the pumpjack such that the proximity sensor is activated by the crank arm, but not the counterbalance weights.

   The figure below shows the proximity sensor assembly, end view.



The figure below shows the proximity sensor assembly, side view.



2. Confirm that the distance between the proximity sensor and the crank arm is approximately 12 mm (not less than 8 mm not greater than 16 mm) or approximately 0.5 in (not less than 0.3 in and not greater than 0.7 in). In areas prone to environmental conditions such as humidity and dust, the sensor should be placed closer to the crank arm.

The figures below show the installation of a proximity sensor.

The tight clearance between the sensor and the crank arm helps to provide the optimal possible signal when the crank arm passes the sensor.

9.1.2 Connecting the Proximity Sensor Cable to the SCADAPack 474 RTU

NOTICE

MOISTURE, DUST, OR CONTAMINATION ENTERING CABINET

Confirm that any hole drilled in the electrical enclosure complies with code requirements.

Failure to follow these instructions can result in equipment damage.

1. Run the proximity sensor cable from the proximity sensor to the panel or enclosure containing the Realift RPC.
2. After running the proximity sensor cable to the pumpjack enclosure, attach its four wires to the SCADAPack 474 RTU as follows:
   a. Connect the sensor's 24 V wire to +24V
   b. Connect the sensor's SIG wire to DI-1.
   c. Connect the sensor's return wire to -24V
   d. Connect the sensor's shield to the GND

9.2 Connecting an Inclinometer

The inclinometer provides a continuing signal measuring the angle of the pumpjack's walking beam; this angle corresponds to the position of the pump during the stroke that the Realift Rod Pump uses to coordinate control algorithms.

⚠ WARNING

PHYSICAL INJURY OR DEATH

The rod pump is a heavy piece of equipment. Before installing the inclinometer or performing any maintenance to the rod pump, ensure the rod pump is stopped and braked.

Ensure the person installing the inclinometer is qualified and has the appropriate safety equipment.

Failure to follow these instructions can result in death or serious injury.

NOTICE

MOISTURE, DUST, OR CONTAMINATION ENTERING CABINET

Confirm that any hole drilled in the electrical enclosure complies with code requirements.

Failure to follow these instructions can result in equipment damage.

1. Ensure the inclinometer is installed on the walking beam with its axis of measurement aligned with the walking beam.
2. Run the inclinometer sensor cable from the inclinometer to the panel or enclosure containing the Realift RPC.

3. After running the inclinometer sensor cable to the pumpjack enclosure, attach its four wires to the SCADAPack 474 RTU as follows:

   a. Connect the sensor's 24 V wire to +24V

   b. Connect the sensor’s signal wire to AI-4

   c. Connect the sensor’s return wire to -24V

   d. Connect the sensor’s shield to the GND.

10 Installing the Load Cell Sensor

A load cell with a spherical washer measures the load on the polished rod as it travels up and down. The load cell is installed on the pumpjack polished rod between the polished rod clamp and the carrier bar. A major component of the installation procedure is mounting the load cell on the polished rod. The load cell sensor needs to provide a 4...20 mA signal to the Realift Rod Pump, representing compressive loads from 0 lbs to the rated capacity of the load cell. A strain gauge load cell will need to use a strain gauge amplifier to provide a 4...20 mA signal to the Realift RPC.

The load cell should be installed onto the pumpjack only by trained, qualified personnel. The pumpjack polished rod needs to be properly supported to allow the installation of the load cell and the spherical washers between the polished rod clamp and the carrier bar.

⚠ WARNING

PHYSICAL INJURY OR DEATH

The rod pump is a heavy piece of equipment. Before installing the load cell or performing any maintenance to the rod pump, ensure the rod pump is stopped and braked.

Installing the load cell requires two people: one to position the pumpjack and one to run the brake.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

LOOSE CABLE CATCHING ON PERSONNEL OR MACHINERY

- Route the cable in such a way that it does not present a trip hazard or interfere with moving equipment or machinery
- Secure the cable in such a way that it will not come loose due to wind, weather, or other factors, and become a hazard

Failure to follow these instructions can result in minor or moderate injury.

NOTICE

LOOSE CABLE CATCHING ON MACHINERY

- Route the cable in such a way that it does not interfere with moving equipment or machinery
- Secure the cable in such a way that it will not come loose due to wind, weather, or other factors

Failure to follow these instructions can result in equipment damage.

See:

- Connecting the Load Cell Cable to the SCADAPack x70 RTU 40

10.1 Connecting the Load Cell Cable to the SCADAPack x70 RTU

NOTICE

MOISTURE, DUST, OR CONTAMINATION ENTERING CABINET

Confirm that any hole drilled in the electrical enclosure complies with code requirements.

Failure to follow these instructions can result in equipment damage.

1. Route the load cell cable from the load cell to the enclosure containing the Realift Rod Pump drive.
2. Secure the load cell cable using eye bolts, u-bolts, outdoor-rated cable ties, or similar fasteners.
3. If you are using a strain gauge load cell, connect the load cell cable to a strain gauge amplifier and configure it to provide a 4…20 mA signal.
4. Connect the load cell signal (or strain gauge amplifier output)cable to the following points on the SCADAPack 474 RTU:
   a. Connect the +24 Vdc wire to +24 Vdc in your panel or enclosure
   b. Connect the return wire to -24 Vdc in your panel or enclosure
   c. Connect the signal wire to AI-1
   d. Connect the ground to ground in your panel or enclosure

11 Installing HOA, Bypass, and Emergency Stop

Custom Hand Off Auto and Bypass controls

If needed, you can add custom Hand, Off, Auto, and Bypass controls to your installation.

The Realift RPC is designed to control the pumpjack's prime mover, and the HMI includes a virtual HOA switch. If you are using a physical HOA switch to control the pump's speed, for instance on your VFD panel, you should connect the HOA switch's hand contact to the Realift RPC's bypass input. This will indicate to the Realift RPC that you are bypassing the controller while ensuring the Realift RPC produces cards despite not controlling pump.

The Realift RPC bypass input can also be used to indicate that the prime mover (VFD) is being bypassed. This indicates to the Realift RPC that you are also bypassing the controller while ensuring the Realift RPC produces cards despite not controlling prime mover, and therefore the pump.

Connect the bypass signal to the following points on the SCADAPack 474 RTU:

- Connect the bypass signal to DI-4
- Connect the return to DI-COM

Emergency Stop

⚠ WARNING

UNACCEPTABLE USE

Do not use the Realift RPC as an integral part of a safety system. The components in this solution are not safety products.

Failure to follow these instructions can result in death or serious injury.

If you are using an emergency stop device, you need to ensure it is directly connected to the prime mover.

12 Completing the Realift Rod Pump Installation

To complete the Realift Rod Pump installation procedure

1. Close the main enclosure or panel door and secure the door lock.
2. Ensure that the HOA switch is set to the “Off” position.

The system is now ready for a qualified person to reapply power to the enclosure and drive.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this manual and the relevant drive installation manual before installing or operating the Realift Rod Pump system. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to wiring and grounding of all equipment.
- Many parts of the Realift Rod Pump system, including the printed circuit boards, operate at the line voltage. Do not touch. Use only electrically-insulated tools.
- Do not touch unshielded components or terminal strip connections with voltage present.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, and OSHA 1910.
- Before servicing the drive:
  - Follow the applicable lock out/tag out (LOTO) procedure.
  - Disconnect all power sources, including external control power.
  - Place a Do Not Turn On label on all power disconnects.
  - Lock all power disconnects in the open position.
- Install and close all covers before applying power or starting and stopping the drive.

Failure to follow these instructions will result in death or serious injury.

13 Configuring the Realift RPC

This section describes the key concepts you need to consider before configuring Realift RPC and the steps required to configure and start Realift RPC.

Before configuring Realift RPC for the first time, you need to:

- Determine the control method you want to use to manage the speed of your pump. See Control Methods 83.
- Determine the method you will use to determine the pump fillage to protect your system from operating in situations that could damage the pumping systems. See Controlling the Pump 78.
- Set up protections so that Realift RPC takes the appropriate action when configured limits are breached, but does not necessarily stop pump operation. See Configuring Sensors and Protections 88.
- Determine how Realift RPC reacts when unexpected conditions such as a power interruption occurs. See Controlling When Your Pump Restarts 86.

See the SCADAPack 474 Hardware Manual in the SCADAPack Documentation Set, to complete the following:

- Update firmware
- Change the configuration on the RTU
- Change the serial port or the Ethernet port
- Change the RTU address
- Upgrade the system
- Add a custom logic program

See:

- Starting Realift RPC 43
- Using the Magelis HMI 45
- Logging in to the Magelis HMI 49
- Verifying Communications 53
- Configuring the Drive 53
- Entering Well and Pump Information 57
- Controlling the Pump 78
- Configuring Sensors and Protections 88

13.1 Starting Realift RPC

Realift Rod Pump starts when power is applied to the components.

NOTICE

RISK OF EQUIPMENT DAMAGE

When power is cycled, wait at least 10 seconds before restoring the power to the Realift RPC. Switching the power OFF and ON quickly can damage the unit.

Failure to follow these instructions can result in equipment damage.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

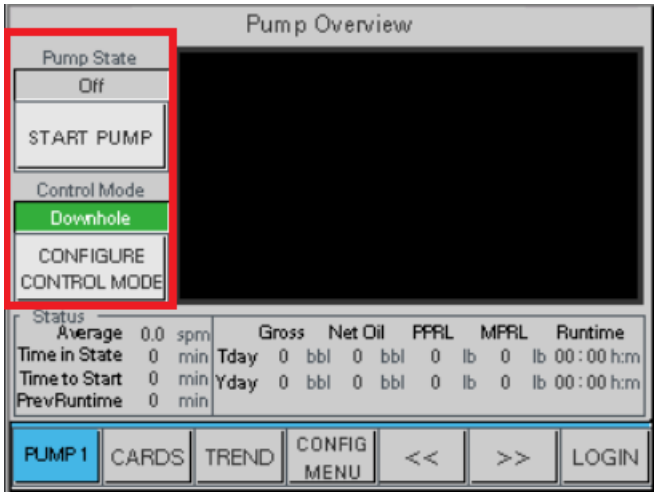
Each time Realift Rod Pump is powered up, if so configured, it can attempt to start the pump with the configured parameters.

If you do not want your pump to start, ensure that the Control Pump switch is set to Off.

Press STOP PUMP, then verify that the Pump State field on the Pump Overview screen reads Off to confirm the system is stopped.

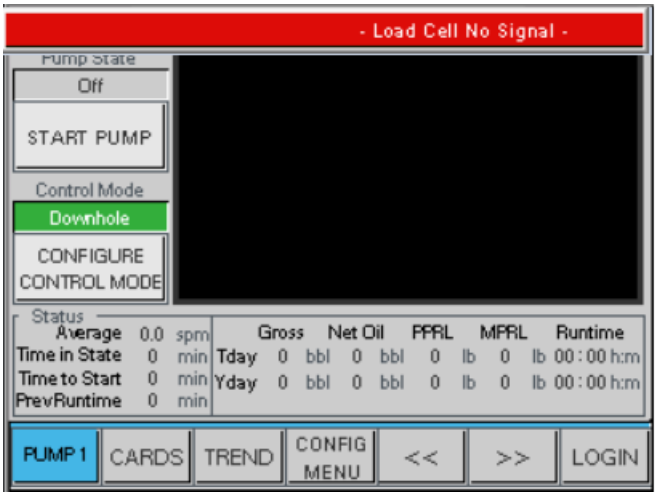
Failure to follow these instructions can result in death or serious injury.

When the system has finished loading, the **Pump Overview** screen is displayed. The figure below shows the location of the **Pump State** and **Control Mode** fields on the **Pump Overview** screen.



When Realift Rod Pump is on, you can explore the HMI screens and proceed with the initial configuration. For more information about the system status field, see Viewing System Status 96.

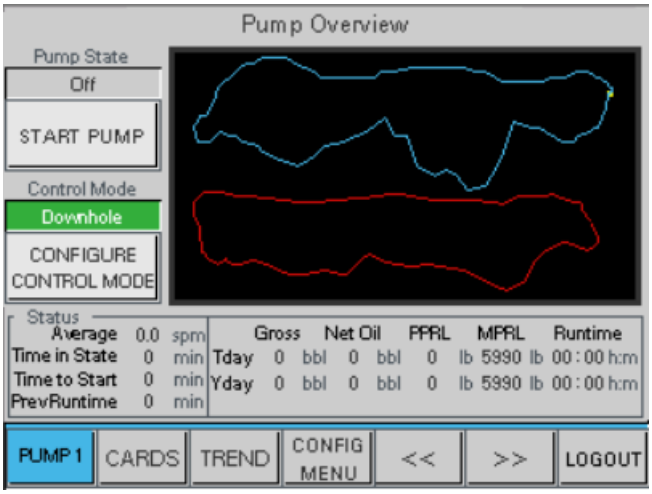
Any current alarm is displayed in a banner at the top of the screen. It is also displayed on the **Active Alarm Summary** screen. Once an alarm is cleared, it is no longer displayed on the **Active Alarm Summary** screen and is now displayed on the **Historical Alarms Summary** screen. For more information on the alarm summary screens, see Managing Alarms and Alerts 120.



13.2 Using the Magelis HMI

The Realift RPC provides a touch screen interface that gives you access to operational information and configuration parameters for your Realift Rod Pump.

When you first start Realift Rod Pump, the **Pump Overview** screen is displayed. After you configure the control method the values for those parameters are displayed on the **Pump Overview** screen.

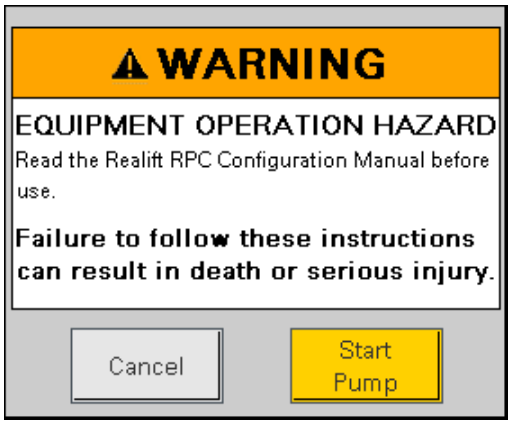


See also:

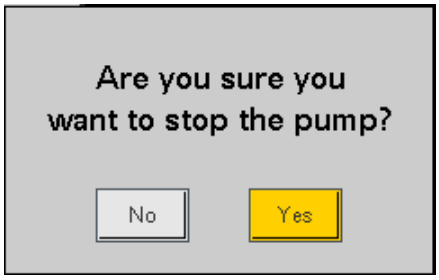
- Entering Information 46
- Changing from Pump 1 to Pump 2 47
- Displaying Realift RPC Software Version Information 48

The **Pump Overview** screen also gives you access to configuration parameters and status information for pump operation:

- **START PUMP:** Starts the pump with the currently configured settings. When pressed, the following warning appears:



- **STOP PUMP:** Stops the pump. When pressed, the following confirmation message appears:

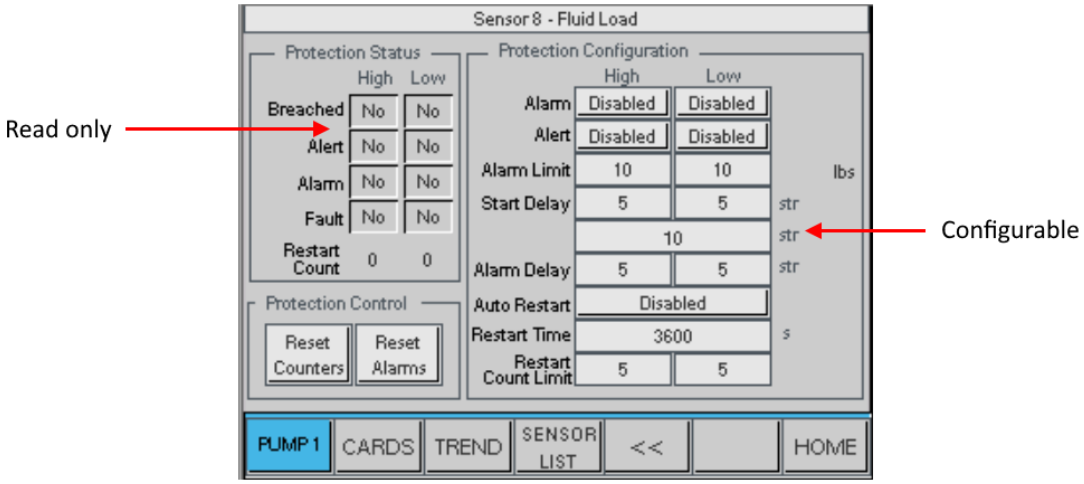


- **CONTROL PUMP:** Displays the Control Pump options, allowing you to change the control mode, speed, and target fillage. See Control Methods 83.
- **CARDS:** Displays the dynacards list. For more information, see Optimizing Operation with Dynagraph Cards 111.
- **TREND:** Displays the trend data options provided with Realift Rod Pump. For more information, see Viewing Trends 108.
- **CONFIG MENU:** Provides access to:
  - Well Configuration
  - System Configuration
  - Alarms and Alerts
- **<<** and **>>:** Moves backwards and forwards through the status screens for the Realift Rod Pump

To configure any of the parameters available through the CONFIG MENU, you need to log in as described in Logging in to the Magelis HMI 49.

13.2.1 Entering Information

Parameters that you can change are displayed with a light gray background and parameters that are for information only are displayed with a darker gray background.



When you select a parameter value with a light gray background, a numeric or alphabetic keypad is displayed. Numeric keypads show the minimum and maximum value for the parameter.

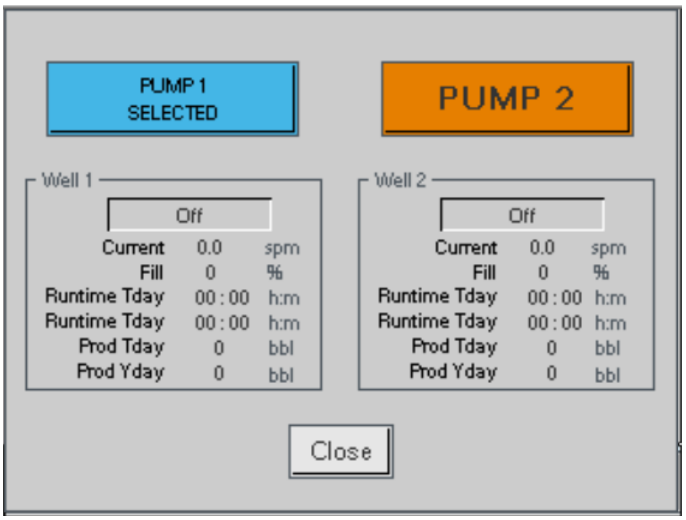
Enter the required information on the keypad, then press **Enter** to confirm your entry.

13.2.2 Changing from Pump 1 to Pump 2

If you have two pumps, you can change from PUMP 1 to PUMP 2 on the Pump Overview screen without logging in.

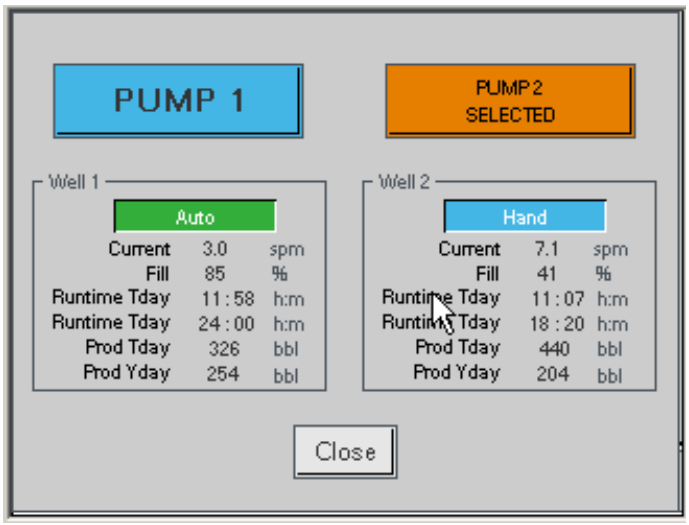
1. On the **Pump Overview** screen, press the **PUMP 1** button at the bottom left.

   The pump selection pop-up dialog is displayed. The currently selected pump is identified.



2. Press the **PUMP 2** button.

   The **Pump Overview** screen is displayed with PUMP 2 as the selected pump.

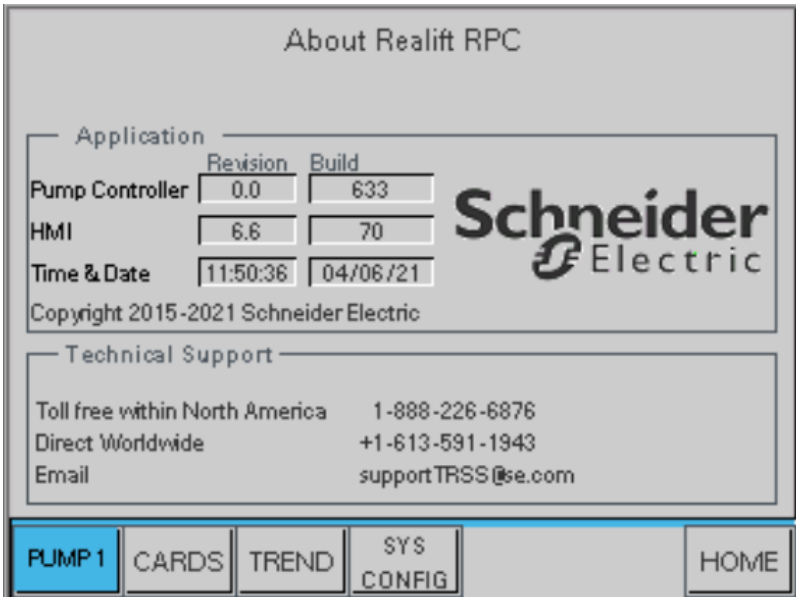


13.2.3 Displaying Realift RPC Software Version Information

The **About** screen, shown below, displays the application version and build number information of the SCADAPack x70 device.

To access the **About Screen**, select **CONFIG MENU > System Configuration > About.**

- **Pump Controller:** Displays the Revision and Build numbers of the pump controller
- **HMI:** Displays the Realift Rod Pump software Revision and Build numbers of the HMI
- **Time & Date:** Displays the time (24-hour clock) and date



13.3 Logging in to the Magelis HMI

Any HMI operator can start and stop the pump, view status, alarm, event and trend information, for the Realift Rod Pump; however, to configure most Realift Rod Pump parameters you need to log in to the HMI as Admin or Expert.

For more information about changing passwords, see Changing Passwords 51.

NOTICE

UNAUTHORIZED SYSTEM ACCESS

Change the default password immediately after logging in for the first time.

Failure to follow these instructions can result in equipment damage.

⚠ WARNING

UNAUTHORIZED SYSTEM ACCESS

In addition to passwords, use physical locks and a security system to help prevent unauthorized access to Realift Rod Pump and to help protect the physical security of the Realift Rod Pump components.

Change the default password immediately after logging in for the first time.

Failure to follow these instructions can result in death or serious injury.

Realift RPC User Accounts

Realift RPC provides four password-protected user accounts:

- 1 Expert account

- 1 Administrator account
- 2 Operator accounts (OP1 and OP2)

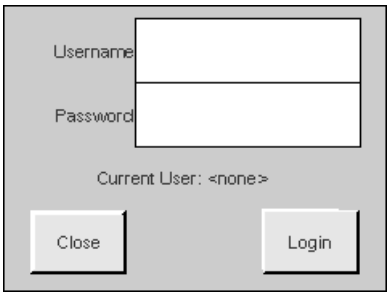
Each account type provides a different level of access privilege and is already created when you first start Realift RPC. You cannot create new user accounts or delete existing user accounts. Users who do not have an account can reset alarms, start and stop the pump, and view other parameters.

When you first log in, use the credentials described below. User names and passwords are case-sensitive.

User name	Password	Requirements
EXPERT	well1	Can modify everything
ADMIN	well2	Can modify everything except the EXPERT account's password
OP1	well3	Can change the control method used and the configuration of each control method
OP2	well4	Can change the control method used and the configuration of each control method

To log in to the Magelis HMI

1. On the **Pump Overview** screen, press **LOGIN**.

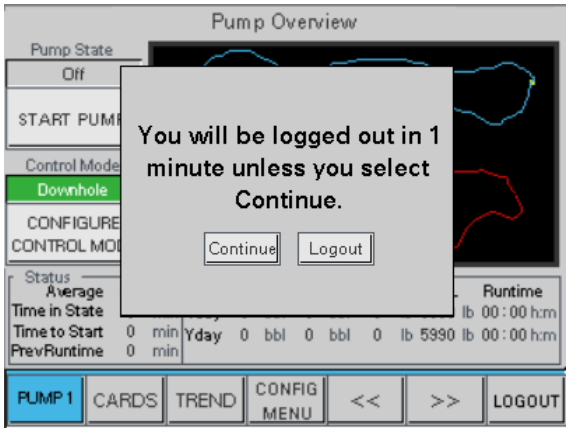


2. Press **Username**, use the keypad to enter the user name, and press **Enter**.
3. Press **Password**, use the keypad to enter the password, and press **Enter**.
4. Press **Login**.

   The **Current User** changes to **ADMIN** or **EXPERT**.

   The Magelis HMI automatically logs you out after 15 minutes of inactivity.
5. Press **Close** to return to the **Pump Overview** screen.

15 minutes after a user logs in, the Magelis HMI opens a pop-up dialog prompting you to **Continue** or to **Logout**, as shown below.



If there is no user feedback within one minute, the pop-up dialog automatically closes, the Magelis HMI logs the user out, and the active screen is changed to the **Pump Overview** screen.

If you select **Continue**, you remain logged in and the process will repeat 15 minutes later.

13.3.1 Changing Passwords

Use the **User Management** screen to change Realift RPC user account passwords.

⚠ WARNING

LOSS OF CONFIGURATION CONTROL

An Admin or Expert password is required to fully configure Realift Rod Pump.

To avoid loss of configuration control, record and store a copy of each user account password in a safe backup location for later retrieval, if needed.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNAUTHORIZED SYSTEM ACCESS

Change the default password immediately after logging in for the first time.

In addition to passwords, use physical locks and a security system to help prevent unauthorized access to the Realift Rod Pump and to help protect the physical security of the Realift Rod Pump components.

Failure to follow these instructions can result in equipment damage.

Changing account passwords

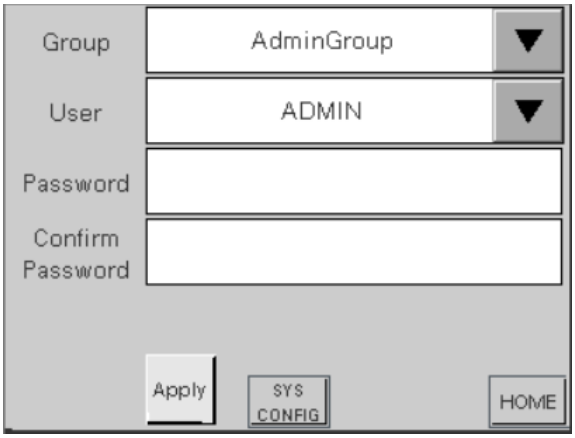
When you are logged in to the Magelis HMI, you can change the password for your user account and for user accounts with fewer privileges. The procedure below shows the screens for a user who is logged in as EXPERT. Follow the same steps if you are logged in as Admin.

The table below lists the accounts for which the Administrator and EXPERT users can change passwords.

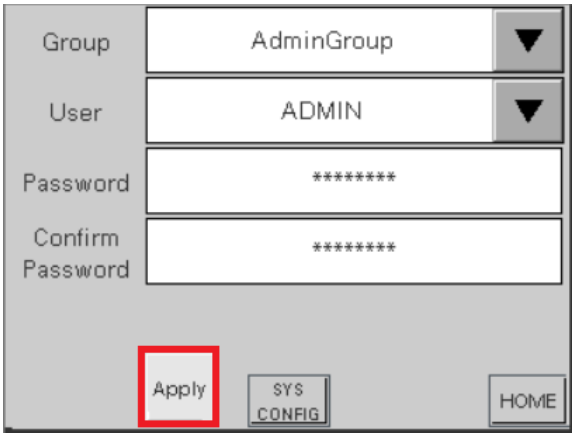
User Account	Can Change Password For
EXPERT	Expert Admin OP1 OP2
ADMIN	Admin OP1 OP2
OP1	OP1
OP2	OP2

To change the account password

1. Log in to the Magelis HMI, as described in Logging in to the Magelis HMI 49.
2. On the **Pump Overview** screen, press **CONFIG MENU > System Configuration > User Management**.



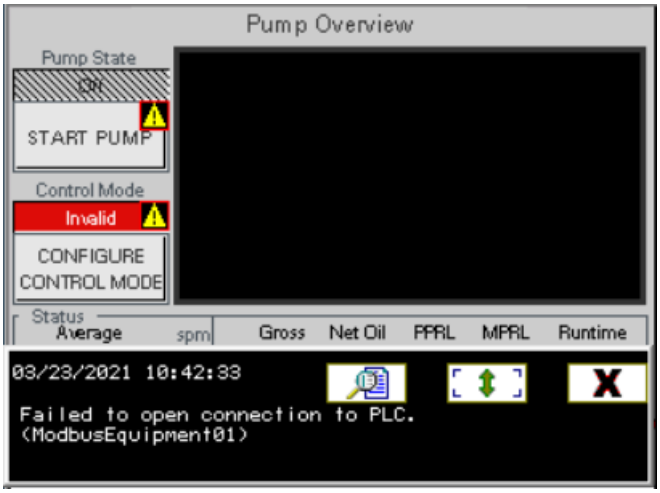
3. From the Group drop-down list, select the group that contains the user account for which you want to change the password.
4. From the User drop-down list, select the user for which you want to change the password.
5. Enter the New Password, then enter it again to confirm it.
6. Press **Apply**.



7. Press **Home** to return to the **Pump Overview** screen.

13.4 Verifying Communications

If the Realift Rod Pump cannot communicate properly with the Magelis HMI due to a configuration mismatch, the Magelis HMI displays an error message and alarm similar to the following image:



The alarms can also be seen on the **Active Alarm Summary** screen. The alarm persists until communication is restored. It then is no longer displayed on the **Active Alarm Summary** screen and is now displayed on the **Historical Alarms Summary** screen. For more information on the alarm summary screens, see Managing Alarms and Alerts 120.

Verify communications before you proceed.

There are several reasons why Realift Rod Pump may not be able to communicate properly, such as the RTU may not be powered up or physically connected to the Magelis HMI, the connection may be poor, or IP addresses or subnet masks may not match.

13.5 Configuring the Drive

After you have configured the connection settings between the computer and the Realift Rod Pump system, configure the drive's parameters.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Read and understand this manual and the manuals for your drive and pumpjack before operating the Realift Rod Pump system.
- Any changes made to parameter settings must be performed by qualified personnel.

Failure to follow these instructions can result in death or serious injury.

The screens available depend on whether you are using an RTU and Realift Rod Pump with an Altivar or a generic drive.

See:

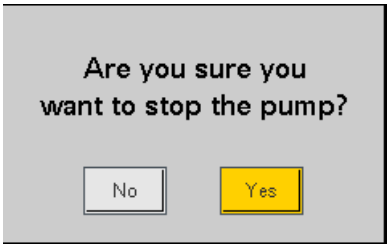
- Configuring the Interface for an Altivar Drive 54
- Configuring the Interface for a Generic Drive or Starter/Contactor 56

13.5.1 Configuring the Interface for an Altivar Drive

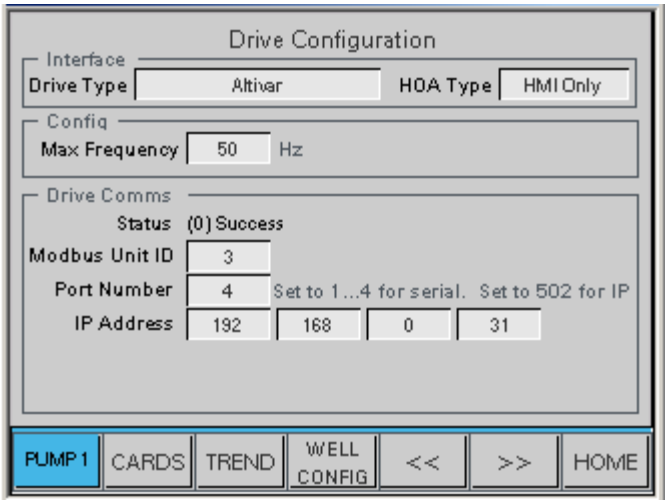
The Realift RPC is designed to support Altivar 61, 71, 320, 340, 600, and 900 model VFDs. Perform the following procedure to configure the Realift RPC for use with an Altivar VFD.

To configure the interface for an Altivar drive

1. On the **Pump Overview** screen, stop the pump by pressing **STOP PUMP**.



2. Press **Yes** and wait until the **Pump Status** is **Off**.
3. Press **CONFIG MENU > Well Configuration > Drive**.
4. In the **Interface** pane, press the **Drive Type** field.
5. Using the controls, select **Altivar**.



6. For the **HOA Type**, select one of the following:

   - If there is no HOA switch on the panel, choose **HMI Only**. This will allow you to control the system from the Magelis HMI display.
   - If there is a HOA switch in the panel, and it is connected to the Altivar according to the following table, then select **ATV DI1/DI3**. This will cause the Magelis display to reflect the HOA switch status.

	LI-1/DI-1	**LI-3/DI-3**
Off	LOW	LOW
Hand	HIGH	LOW
Auto	HIGH	HIGH

   The Magelis HMI display will reflect the HOA switch status.

7. Enter the **Modbus Unit ID** of the drive.

   The Modbus Unit ID needs to be different from the SCADAPack 474 Unit Identifier..

8. Enter the **Port Number**:

   - For serial communication enter Serial Port number 4
   - For Ethernet communication enter 502

9. For Ethernet communication, enter the **IP Address** of the Altivar VFD.

   If the **IP Address** field is used, you need to enter 502 as the **Port Number**.

10. Confirm that after properly configuring the VFD communication parameters that the Status indicates "Success" and no alarm banner is shown on the HMI.

Parameters

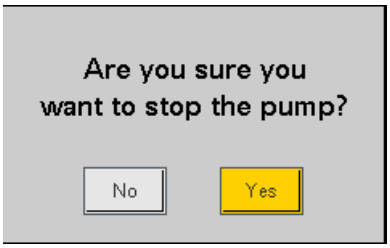
- **Drive Type**
  - Specifies the drive type to be configured
  - Valid Options: Altivar, Generic 0-20mA, Generic 4-20mA, Start Contactor
- **HOA Type**
  - Options: HMI Only, ATV DI1/DI3, RPC DI
  - If set to **HMI Only**, the Realift RPC configures the drive to use "channel 1 active" for the Reference 2 channel switching. Therefore you can switch the drive from Hand to Auto using the Magelis HMI. This is the recommended setting.
  - If set to **ATV DI/1/DI3**, the Realift RPC configures the drive to use "LI3" for the Reference 2 channel switching. This setting may be used if there is a physical HOA switch on the drive panel.
  - If set to **RPC DI**, the Realift RPC does not configure the Reference 2 channel switch setting on the drive. This setting should be used if a physical switch is employed on the drive panel and an atypical configuration is used on the drive. If this setting is used, you need to configure the channel switching directly on your drive.

13.5.2 Configuring the Interface for a Generic Drive or Starter/Contactor

Perform the following procedure to configure the interface for a generic drive or starter/contactor.

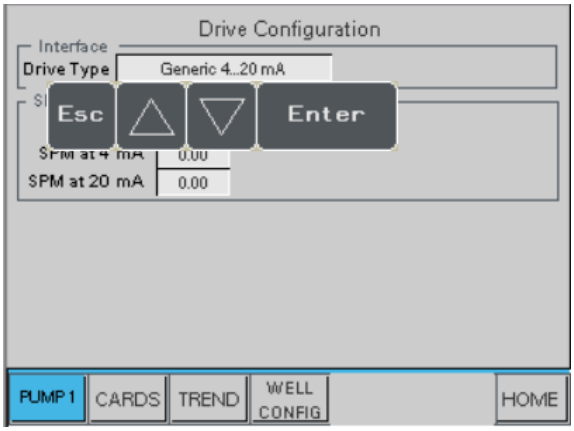
To configure the drive interface for a generic drive or starter/contactor

1. On the **Pump Overview** screen, stop the pump by pressing **STOP PUMP**.



2. Press **Yes** and wait until the **Pump Status** is **Off**.
3. Press **CONFIG MENU > Well Configuration > Drive**.
4. In the **Drive Interface** pane, press the **Drive Type** field.

   Controls are displayed that enable you to scroll through the drive types.



5. Press the up and down arrows until the drive type you want is displayed, and press **Enter**.

Parameters

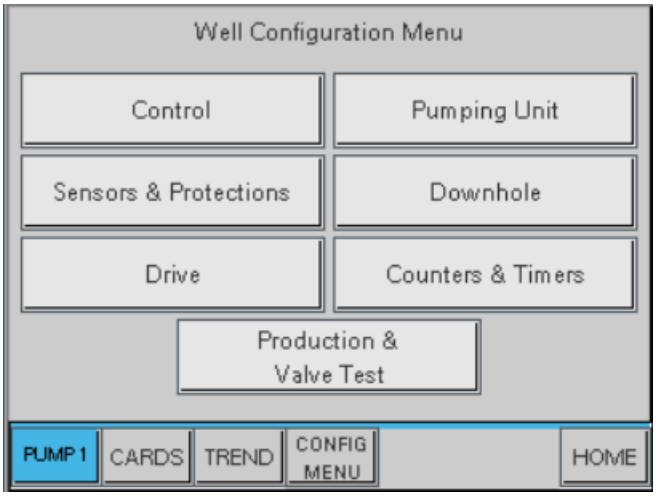
- **SPM Scaling Config**
  - **SPM at 0 mA** (Displayed for Generic 0...20 mA only): The speed of the pump with the AO signal on a 0...20 mA controlled VFD set to 0 mA; this normally is the minimum speed of the pump.
  - **SPM at 4 mA** (Displayed for Generic 4...20 mA only): The speed of the pump with the AO signal on a 4...20 mA controlled VFD set to 4 mA; this normally is the minimum speed of the pump.
  - **SPM at 20 mA**: The speed of the pump with the AO signal on a 4...20 mA or 0...20 mA controlled VFD set to 20 mA; this normally is the maximum speed of the pump.

13.6 Entering Well and Pump Information

You can configure the well data by pressing **CONFIG MENU > Well Configuration** from the **Pump Overview** screen.

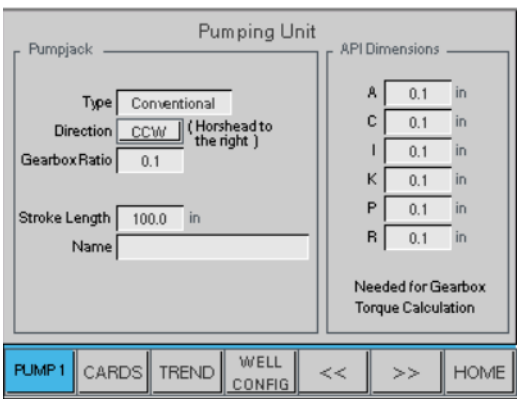
On the **Well Configuration Menu** screens you can:

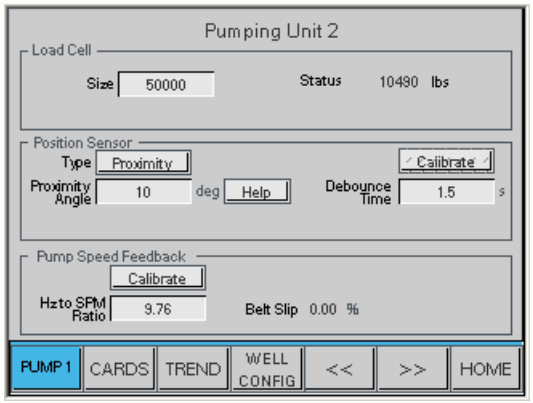
- Control the Pump 78
- Configure Sensors and Protections 88
- Configure the Drive 53
- Enter Pumping Unit Information 58
- Configure the Inclinometer 65
- Enter Downhole Parameters 66
- View Runtime Timers and Stroke Counters 103
- Enter Inferred Production Parameters 70
- Use Realift RPC to Conduct Valve and Counterbalance Tests 73



13.6.1 Entering Pumping Unit Information

Use the **Pumping Unit** screens to enter pumping unit information.





- To set the position sensor type 58
- If using a proximity sensor 61
- To manually set the proximity angle 61
- To manually determine the proximity sensor angle 64

To enter Pumping Unit information

1. Press **CONFIG MENU >Well Configuration > Pumping Unit**.

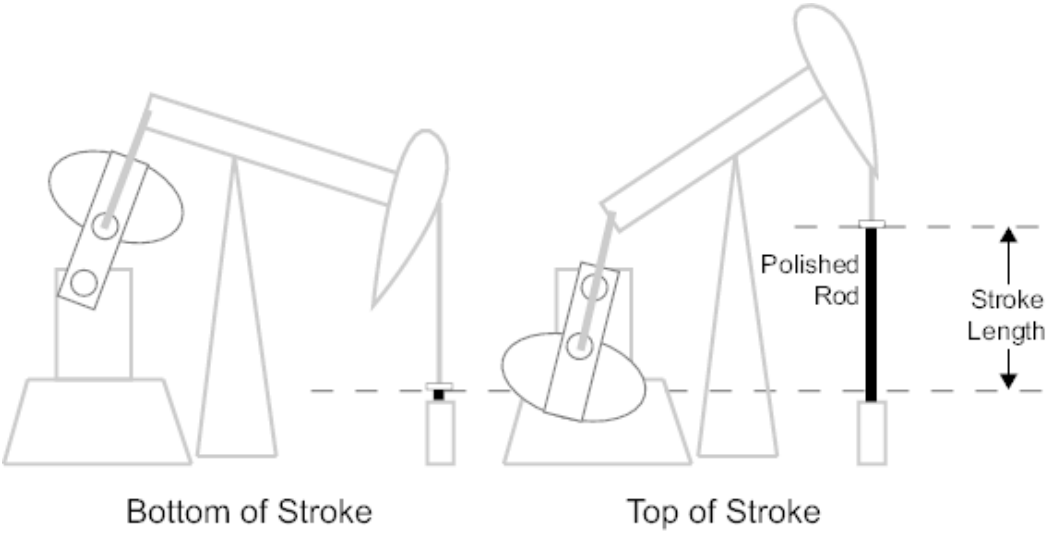
   The first **Pumping Unit** screen is displayed.

2. Press **>>** to display the next screen and continue configuring the parameters.
3. Configure the parameters, as described below.

Parameters

Pumpjack

- **Type**
  - Specifies the type of pumpjack in use
  - Valid options: Conventional, Mark II, Airbalanced
- **Direction**
  - The crank arm direction of rotation when the pumpjack is viewed from the side with the polished rod on the right.
  - Valid Options: CW (Clockwise), CCW (Counter Clockwise)
  - If you select Mark II as **Type**, the **Direction** parameter is automatically set to CCW
- **Gearbox Ratio**
  - Specifies the internal drive head gear ratio, expressed as x to 1. When a direct drive is used, the ratio should be 1.
  - Valid range: 0.1...100.0
- **Stroke Length**
  - Specifies the stroke length. You can determine the stroke length using the Stroke Length diagram, shown below.



- **Name**
  - An optional parameter where you can enter some identifying details about the well

API Dimensions

- **A, C, I, K, P, R**

- This optional parameter specifies the API dimensions and can be used to allow for a slightly more accurate dynacard shape. These dimensions are needed for Gearbox Torque. Alternatively, you can enter a stroke length. See Entering Stroke Length 66 for more information.
- Units: inches (in)
- Range: 0.0...1000.0

- **API Stroke Length**
  - Displays the API stroke length

Load Cell

NOTICE

UNINTENDED EQUIPMENT OPERATION

Using a wired load cell with pumps operating at 12 spm or greater can cause Pump Fillage calculations to become distorted. For pumps operating at this speed or greater, it is recommended that you either:

- Use a wireless load cell
- Run the pump in Timed mode

Failure to follow these instructions can result in equipment damage.

Size

- Specifies the load cell size
- Valid Options: 0...50000

Position Sensor

- **Type**
  - Specifies the type of position sensor
  - Valid Options (left-side field): Proximity, Inclinometer
  - Valid Options (right-side field when Inclinometer is selected): Analog, Pulse
- **Proximity Angle**
  - Indicates the proximity angle of the pumpjack. See To Calibrate the proximity angle 61 and To manually set the proximity angle 61 for more information about calculating the **Proximity Angle**.
  - Click **Help** for information about calculating the proximity angle
- **Calibrate**
  - Calibrates the proximity angle
  - The button is only available when the Realift RPC is running in Hand Mode
- **Debounce Time**

- Specifies a time in seconds where if a prox pulse occurs within this amount of time as the previous prox pulse is ignored. This helps to prevent numerous prox pulses on the same stroke from counting as multiple strokes.
- Valid Options: 0.1...25.5 seconds

Pump Speed Feedback

- **Calibrate**
  - Calibrates the Hz to SPM ratio
  - When calibration is active, the button is locked and the text changes to **Calibrating**
  - The button is only available when the Realift RPC is running in Hand Mode
- **Hz to SPM Ratio**
  - A calculated ratio of drive speed in Hz compared to pumpjack speed in strokes per minute (spm)
  - Displays the Hz to SPM ratio
- **Belt Slip**
  - Displays the measured belt slip by comparing it to the expected SPM based on commanded speed with actual observed SPM.

To calibrate the proximity angle

The Realift RPC can automatically calculate the proximity sensor angle.

1. Put the pump in **Hand** mode, as described in Control Methods 83, and run the pump at its slowest speed.
2. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Pumping Unit**.
3. Press **>>** to advance to **Pumping Unit 2**.
4. When the pump is at the top of a stroke, in the Position Sensor section of the screen press the **Calibrate** button.

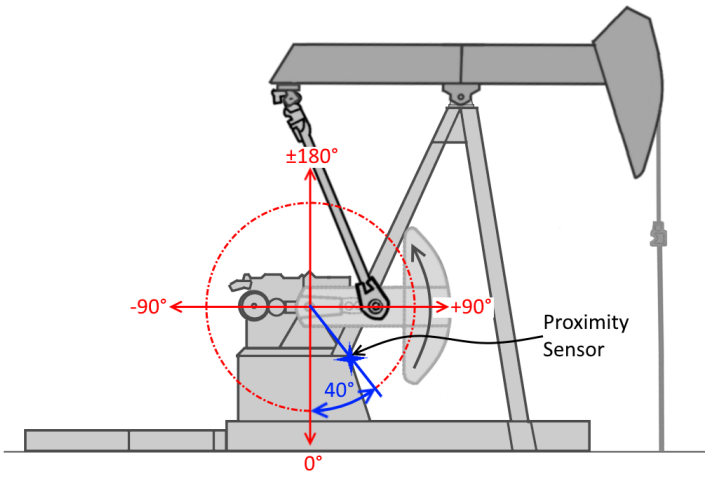
   A timer starts and records how long it takes for the pump head to move from the top position to when the proximity detector is activated. This time is then converted to degrees of rotation to determine the exact angle of the proximity switch.

To manually set the proximity angle

1. Determine the proximity angle using the procedure in this section.
2. Enter the resultant value into the **Proximity Angle** field.

The Realift Rod Pump uses the Proximity Angle to determine the location of the center axis of the Pitman Arm wrist pin relative to the position at which the crank arm first triggers the proximity sensor. The Proximity Angle is measured from the BDC in a counter-clockwise direction when viewing the pumpjack from its side with the polished rod on the right.

The figure below shows the proximity angle, conventional pumpjack.



Counterclockwise with proximity sensor to the right

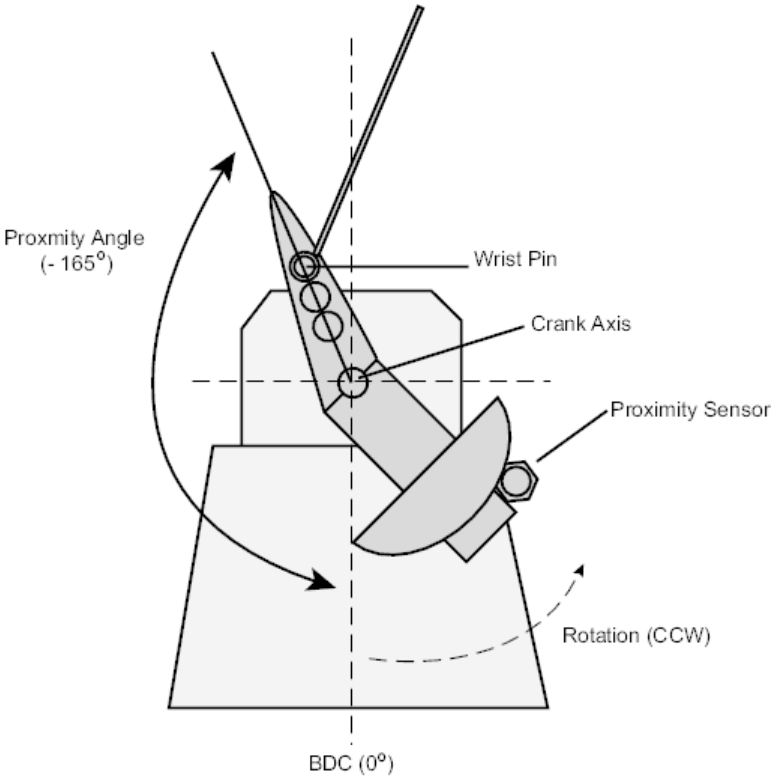
The direction of rotation dictates whether the Proximity Angle is positive or negative. A positive proximity angle means that the proximity sensor is triggered after the wrist pin is at Bottom Dead Center (BDC). A negative proximity angle means the proximity sensor is triggered before the wrist pin is at BDC. If the wrist pin is at BDC (i.e., straight down) when the proximity sensor is activated, the proximity angle is 0°. If the wrist pin is at Top Dead Center (TDC) when the proximity sensor is activated, the proximity angle is 180°.

In the figure above, the crank arm is rotating counter-clockwise and triggers the proximity sensor after it passes BDC. The Proximity Angle in this instance is positive (+).

The location of the Pitman Arm wrist pin can vary by design. The Mark II pumpjack places the wrist pin on the opposite side of the crank axis from the portion of the arm that is likely to trigger the proximity sensor. The angle that should be entered is the angle of the wrist pin side of the crank arm relative to BDC when the proximity sensor is triggered (see figure below).

A. If the unit was spinning CCW, Prox Angle = 45 degrees.

B. If the unit was spinning CW, Prox Angle = -45 degrees.



Set the Proximity Angle by determining the point at which the crank arm first triggers the proximity sensor during a stroke. It is recommended that someone else operate the pumpjack hand brake when performing the following procedure.

To manually determine the proximity sensor angle

NOTICE

INACCURATE DATA

The proximity angle is used in calculations to determine the load and the productivity of the well. Ensure that any tools you use to determine the proximity angle have been properly calibrated.

Failure to follow these instructions can result in inaccurate data.

1. Before you travel to the site ensure you have a tool you can use to measure angle in degrees such as a hand-held protractor with a plumb-bob or cell phone app.
2. At the site, set the pumpjack speed at or just above its minimum value.
3. Place the Realift Rod Pump in **Hand** mode and slowly rotate the crank arm.

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

- Read and understand this manual before operating the Realift Rod Pump system.
- Ensure that the pumpjack is stopped with handbrake engaged before approaching it to make observations, take measurements, or adjust the equipment.

Failure to follow these instructions can result in minor or moderate injury.

4. Stop the pump as the helper quickly applies the pumpjack brake, stopping the crank arm just as it triggers the proximity sensor.
5. After the pumpjack is stopped with the hand brake engaged, confirm that the DI-0 indicator on the SCADAPack 474 is on.

   With the crank arm held in place by the hand brake, the Proximity Angle can now be determined.
6. Measure the angle between the crank arm and the wrist-pin.
7. Adjust the number (possibly by subtracting it from 90) so that the level is indicated according to the following rules.

Degrees	Angle
0	Wrist pin Straight Down when prox is activated
180 or -180	Wrist pin Straight Up when prox is activated

Degrees	Angle

Positive	Wrist pin going Up when the prox is activated
Negative	Wrist pin going Down when the prox is activated

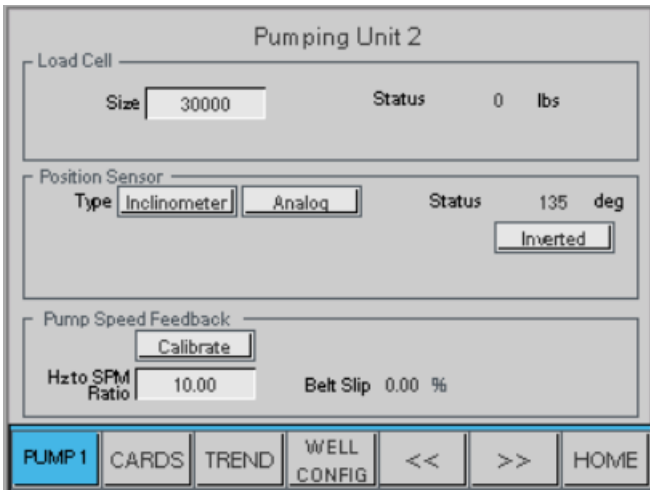
13.6.2 Configuring the Inclinometer

Confirm proper orientation of the inclinometer by pulling the brake at the top and bottom of the stroke:

- Higher degrees with horsehead up
- Lower (more negative) degrees with horsehead down

  You can measure these degrees on the **CONFIG MENU >Well Configuration > Pumping Unit > Pumping Unit 2** screen under Position Sensor

1. Press **CONFIG MENU > Well Configuration > Pumping Unit.**
2. Press **>>** to advance to the next screen.
3. In the **Position Sensor** frame,
   a. Press the left-side field for **Type** to display **Inclinometer**.
   b. Press the right-side field for **Type** to display **Analog**.



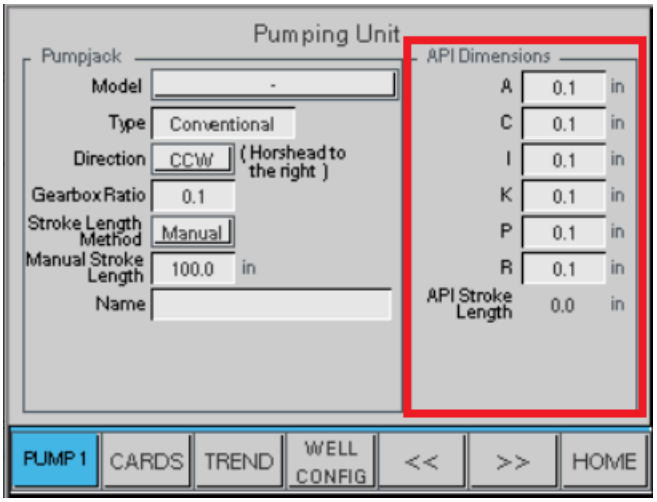
4. Take a screen shot or image of the dynacard shape:
   - If card shape is acceptable and high quality, the procedure is complete
   - If card shape is distorted, then continue with step 7
5. Press the right-side field for **Type** to display **Pulse**.
6. Below **Proximity Angle**, press the **Manual Angle** button to display **Auto Angle**.
7. Wait for the proximity angle number to automatically change to a new angle.

8. Press **Auto Angle** to display **Manual Angle** so that the angle does not continue changing.
9. Confirm that the card is similar to the one observed when **Inclinometer Analog** mode was used.

At this point, you can Increase and Decrease the angle slightly (less than 10 degrees from the auto calculated setpoint) until you find the card shape that is most like the card created when **Inclinometer Analog Mode** was selected.

13.6.3 Entering Stroke Length

API dimensions are used for the gearbox torque calculation. If you are not going to sue the gearbox torque calculation, you do not need to enter the API dimensions. The API dimensions are entered in the **Pumping Unit** screen.

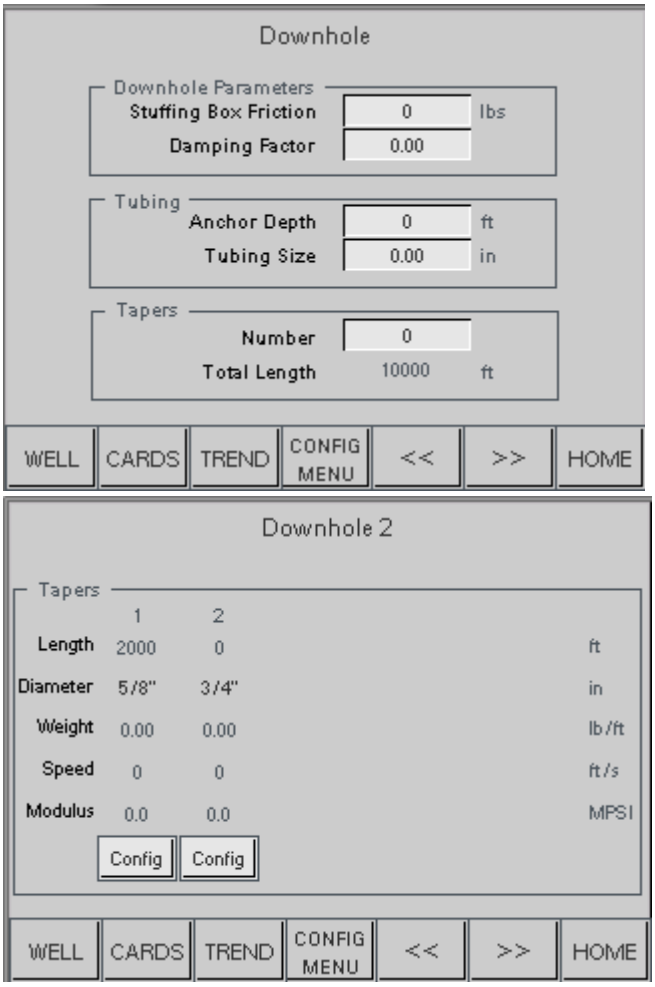


To enter the API dimensions

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Pumping Unit**.
2. Enter the appropriate measurements for that particular pumpjack.

13.6.4 Entering Downhole Parameters

Use the **Downhole** and **Downhole 2** screens to enter downhole parameters for the well.



To enter Downhole parameters

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Downhole**.
2. Configure the parameters, as described below.

Parameters

The following parameters appear on the **Downhole** and **Downhole 2** screens.

Downhole Parameters

- **Stuffing Box Friction**
  - The term for load added by friction where the polished rod enters the stuffing box. When the rod moves downward, the amount of force is added to the load cell reading. When the rod moves upward, the amount of force is subtracted from the load cell reading.
  - Units: pounds (lbs)

- Suggested value: 50...100 pounds

- **Damping Factor**
  - The downhole calculation parameter that affects the shape of the Downhole Card
  - Suggested value: 0.080

Tubing

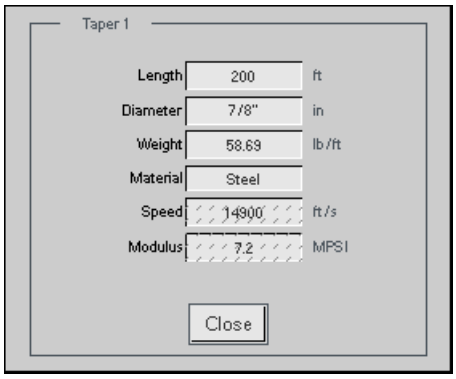
- **Anchor Depth**
  - The depth of the tubing anchor
  - Units: feet (ft)
- **Tubing Size**
  - The diameter of the tubing
  - Units: inches (in)

Tapers

- **Number**
  - The number of rod string sections currently installed in the well
- **Total Length**
  - The length of the tapers added together
- **Length**
  - The length of the rod string sections in the well, in feet (ft)
- **Diameter**
  - The diameter of the rod string sections in the well, excluding joints, in inches (in)
- **Weight**
  - The weight per foot of the rod tapers in the well, in pounds per foot (lb/ft)
- **Speed**
  - The speed at which the taper moves, in feet per second (ft/s)
- **Modulus**
  - The elasticity of the material of the rod string sections in the well
- **Config**
  - Displays the **Taper** configuration screen

Configuring tapers

To display the Taper configuration screen, press **Config** under the specific taper that you want to configure.



- **Length**
  - Specifies the length of the taper
  - Units: feet (ft)
- **Diameter**
  - Specifies the diameter of the taper
  - Units: inches (in)
  - Valid options: 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 2
- **Weight**
  - The weight per foot of the rod tapers in the well
  - Units: pounds per foot (lb/ft)
  - Typical values are shown in the table below. Rod string characteristics may vary.

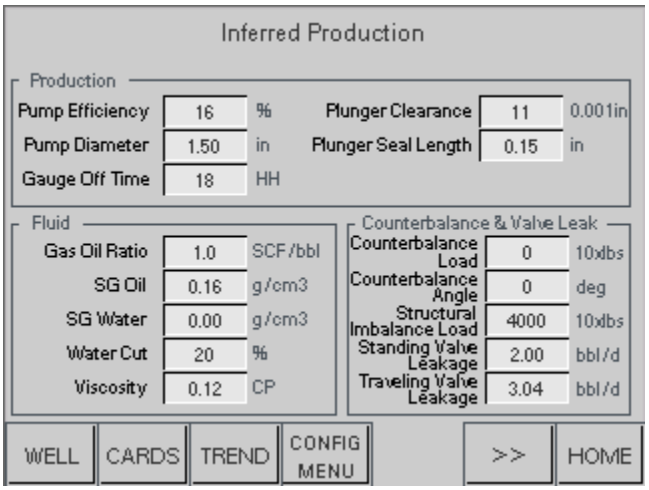
Rod Size (in)	Weight, Fiberglass (lbs/ft)	Weight, Steel (lbs/ft)
0	0.000	0.000
5/8	0.307	1.135
3/4	0.480	1.634
7/8	0.640	2.224
1	0.800	2.904
1 1/8	0.994	3.676
1 1/4	1.290	4.538
1 3/8	1.640	5.000

Rod Size (in)	Weight, Fiberglass (lbs/ft)	Weight, Steel (lbs/ft)
1 1/2	1.950	6.000
1 5/8	2.290	7.000
1 3/4	2.650	8.200
2	3.460	10.660

- **Material**
  - Specifies the material of which the rod taper is made
  - When set to Steel or Fiberglass, the Realift RPC automatically populates the **Weight, Speed,** and **Modulus** parameters
  - Valid options: Steel, Fiberglass, Other
- **Speed**
  - Displays the speed at which the taper moves
  - Units: feet per second (ft/s)
- **Modulus**
  - The elasticity of the material of the rod string sections in the well. A typical modulus for steel is 30.5 Mpsi (210.23 GPa). A typical modulus for fiberglass is 7.2 Mpsi (49.64 GPa). The modulus of the material used in your pump may vary.
  - Units: millions of psi (MPSI)

13.6.5 Entering Inferred Production Parameters

Realift RPC can estimate the production of your well. Configuring parameters on the **Inferred Production** screen, shown below, allows you to estimate gross production, net oil production, and net gas production.



To configure inferred production parameters

1. On the **Pump Configuration** screen, press **CONFIG MENU > Well Configuration > Production & Valve Test**.

   The **Inferred Production** screen is displayed.

2. Configure the parameters, as needed.

Parameters

Production

- **Pump Efficiency**
  - The Pump Efficiency Factor is multiplied by the theoretical production to result in the Realift RPC production values.
  - It is suggested to set the value to 80%, until enough time has elapsed that Realift RPC estimated production can be compared to actual production and the Pump Efficiency Factor adjusted accordingly.
  - Units: percentage (%)
- **Pump Diameter**
  - The diameter of the pump, used to calculate the gross production of the pump
  - Units: inches (in)
- **Gauge Off Time**
  - The time of day to start and end the 24-hour production accumulations. Enter the time on the 24-hour clock. For example, enter:
    - 2 for 2:00 am. For single-digit hours you can enter the leading 0, but it is not displayed.
    - 11 for 11:00 am
    - 22 for 10:00 pm
  - Every day at the specified time, Realift RPC determines the accumulated production for the previous 24 hours
  - Units: Hours (HH)
- **Plunger Clearance**
  - The amount of space between the plunger and the barrel
  - Typically, this value is between 0.003 and 0.008 inches
  - Units: inches (in)
- **Plunger Seal Length**
  - Displays the length of the plunger seal
  - Typically, this value is between 1 and 5 inches
  - Units: inches (in)

Fluid

- **Gas Oil Ratio**
  - The gas/oil ratio (GOR) is the ratio of the volume of gas that comes out of solution to the volume of oil at standard conditions
  - Units: standard cubic feet per barrel (SCF/bbl)
- **SG Oil**
  - Specific Gravity Oil
  - The measured density of oil in the well. This is used to calculate pump intake pressure and the fluid height in the casing.
  - Units: grams per cubic centimeter (g/cm^3)
- **SG Water**
  - Specific Gravity Water
  - The measured density of water in the well. This is used to calculate pump intake pressure and the fluid height in the casing.
  - This parameter is typically set to 1
  - Units: grams per cubic centimeter (g/cm^3)
- **Water Cut**
  - The ratio of water produced compared to the volume of total fluid produced from by the well.
  - Units: percentage (%)
- **Viscosity**
  - Specifies the fluid viscosity
  - Fluid viscosity should be determined by testing the fluid produced by the well. It may vary significantly, depending on the properties of the fluid and its temperature.
  - Units: Centipoise (CP)

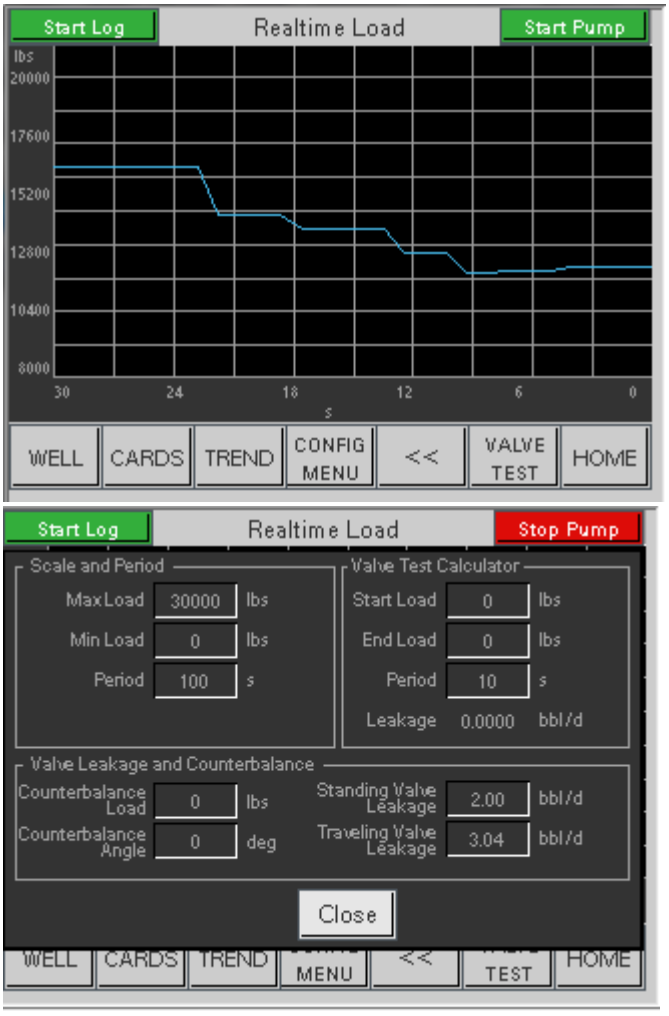
Counterbalance & Valve Leak

- **Counterbalance Load**
  - Specifies the counterbalance load of the pump
  - Units: 10 x pounds (10xlbs)
- **Counterbalance Angle**
  - Specifies the counterbalance angle of the pump
  - Units: degrees (deg)
- **Structural Imbalance Load**
  - Specifies the structural imbalance load
  - Units: 10 x pounds (10xlbs)

- **Standing Valve Leakage**
  - o Specifies the leakage of the standing valve
  - o Units: barrels per day (bbl/d)
- **Traveling Valve Leakage**
  - o Specifies the leakage of the traveling valve
  - o Units: barrels per day (bbl/d)

13.6.6 Using Realift RPC to Conduct Valve and Counterbalance Tests

You can use the Realift RPC to conduct valve and counterbalance tests. The **Realtime Load** and **Test Parameter** pop-up dialogs are shown below.



To perform a valve test

It is recommended that this procedure be performed with an assistant located at the pump.

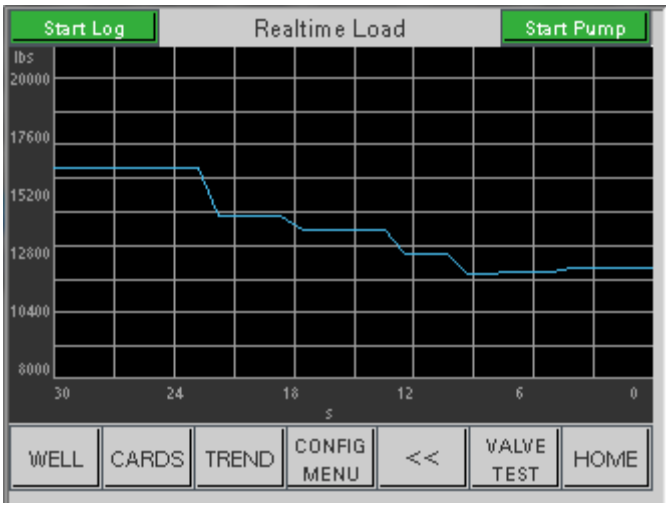
1. Run the pump at a slow and steady state for approximately four minutes.

2. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Production & Valve Test**.

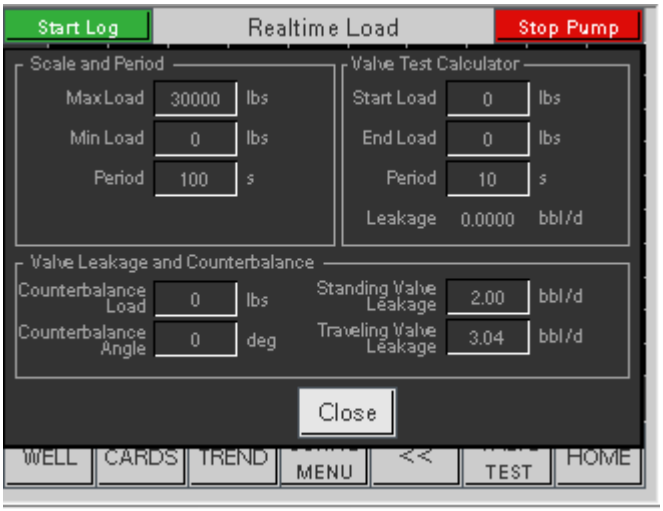
   The **Inferred Production** screen is displayed.

4. Press **>>**.

   The **Realtime Load** screen is displayed, as shown below.



5. Press **Stop Pump** and **Start Log**.
6. Allow the pumping unit to coast to a gentle stop and apply the brake:
   - For Traveling Valve measurement, stop the pump during the upstroke.
   - For Standing Valve measurement, stop the pump during the downstroke.
7. Monitor the changes of the load for 10 to 15 seconds.
8. Press **Stop Log**.
9. Press **Valve Test**.



11. Enter the **Start Load, End Load, and Period** values in the **Valve Test Calculator** section of the screen.

    The Leakage is displayed in bbl/s.

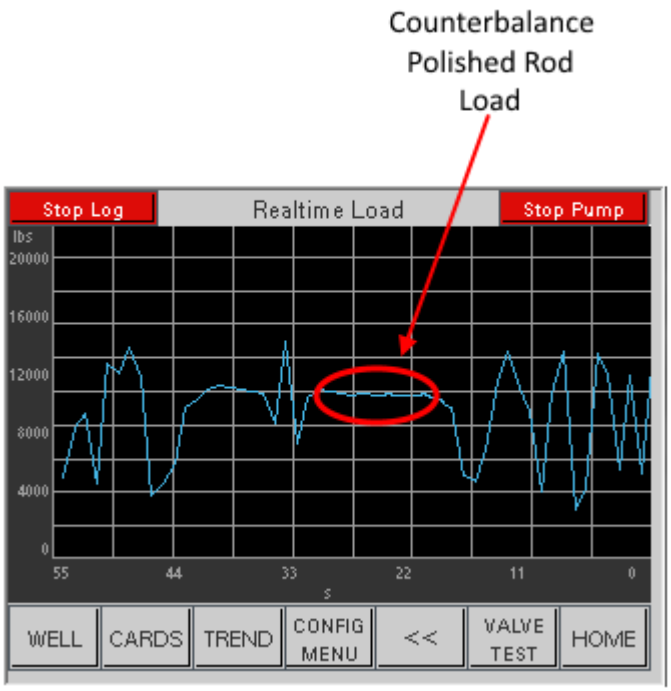
12. In the **Valve Leakage and Counterbalance** section of the screen, record the **Standing Valve** and **Traveling Valve** leakage values .

To perform a Counterbalance test

It is recommended that this procedure be performed with an assistant located at the pump.

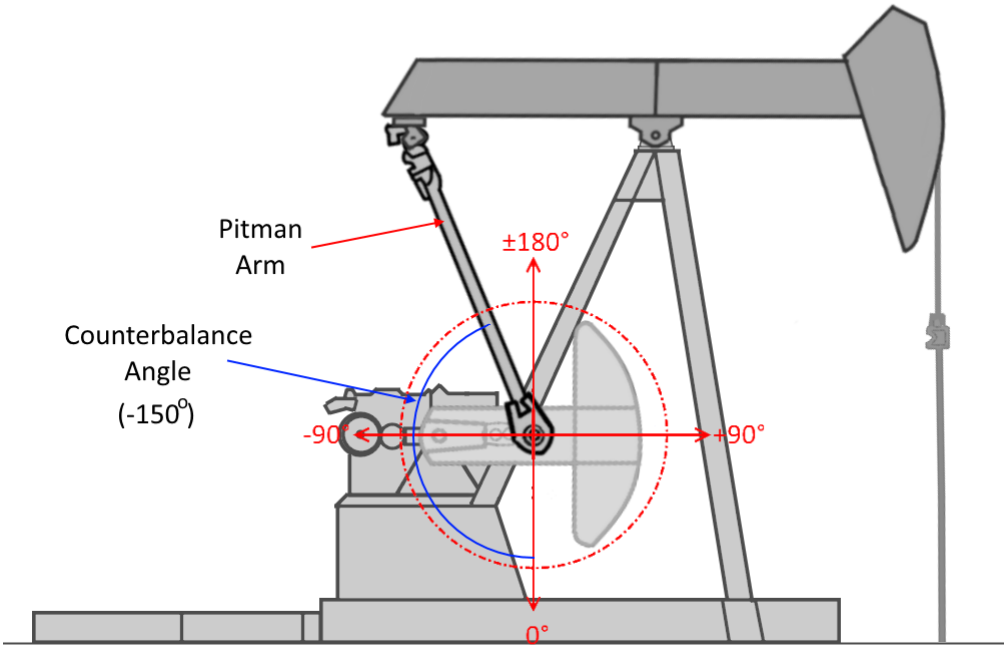
1. Put the pump in **Hand** mode, as described in Control Methods 83.
2. Run the pump at a steady state on its lowest speed.
3. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Production & Valve Test**.
4. Press **>>**.
5. Stop the pump during the upstroke with the crank at 90^{o} and gently apply the brake.
6. Alternately release and set the brake at intervals of a few seconds until the crank arm remains at rest.
7. Observe and record:

    a. The load on the polished rod, as show below.



    b. The angle of the Pitman arm of the pump.

The figure below shows the counterbalance angle for a pump running in counter-clockwise direction.



8. Press **Valve Test**.
9. Record the **Counterbalance Load** and **Counterbalance Angle** in the **Valve Leakage and Counterbalance** section.

Test Parameter pop-up dialog parameters

Scale and Period

- **Max Load**
  - Specifies the maximum load to be graphed
  - This value should be set to just above the expected value
  - Units: pounds (lbs)
- **Min Load**
  - Specifies the minimum load to be graphed
  - This value should be set to just below the expected value
  - Units: pounds (lbs)
- **Period**
  - Specifies the amount of time to be graphed.
  - Units: seconds (s)

- Range: 30...800

Valve Test Calculator

- **Start Load**
  - Specifies the load at the start of the valve test
  - Units: pounds (lbs)
- **End Load**
  - Specifies the load at the end of the valve test
  - Units: pounds (lbs)
- **Period**
  - Specifies the length of time for which the test was performed
  - Units: seconds (s)
- **Leakage**
  - Displays the calculated value of the valve leakage
  - Units: barrels per second (bbl/s)

Valve Leakage and Counterbalance

- **Counterbalance Load**
  - Specifies the counterbalance load
  - Enter the load determined by your counterbalance test
  - Units: pounds (lbs)
- **Counterbalance Angle**
  - Specifies the counterbalance angle
  - Enter the angle determined from your counterbalance test
  - Units: degrees (deg)
- **Standing Valve Leakage**
  - Specifies the standing valve leakage
  - Enter the value determined from your standing valve test
  - Units: barrels per day (bbl/d)
- **Traveling Valve Leakage**
  - Specifies the traveling valve leakage
  - Enter the value determined from your traveling valve test
  - Units: barrels per day (bbl/d)

13.7 Controlling the Pump

NOTICE

RISK OF EQUIPMENT DAMAGE

Running your pump too quickly without using downhole or surface control can cause your pump to continue running in situations such as fluid pound. It is recommended that you use the **Downhole** control method and set your Fillage minimum to no less than 85% to avoid fluid pound.

Failure to follow these instructions can result in equipment damage.

Use the **Control** configuration screens to configure the pump settings. Pump control settings determine how the Realift Rod Pump controls the pumpjack, including:

- What Control Method 83 is used
- When different controls take effect
- When speed is adjusted
- How the pump fillage is calculated
- How long the Realift Rod Pump system runs with a low pump fill before stopping and entering a **Pump Off** state
- Managing Your Pump if it has a Floating Rod 85
- Controlling When Your Pump Restarts 86

The **Control** screens are shown below.

To configure Pump Control settings

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Control**.
2. Configure the parameters, as described in Control parameters 79.
3. Press **>>**.
4. Configure the parameters, as described in Control 2 parameters 82.

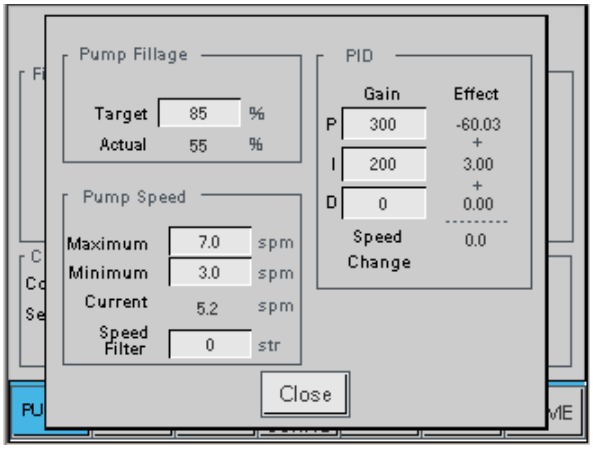
Control screen parameters

Fillage

- **Target**
  - Specifies the ideal pump fillage for the rod pump. Target values are determined through observation after configuration is complete and the Realift RPC is started for initial monitoring.
  - Units: percentage (%)

- Suggested value: 90%

- **Minimum**
  - Specifies the pump fillage where the Realift RPC detects a Pump Off state
  - Units: percentage (%)
  - Suggested value: 75%
- **Deadband**
  - The maximum change in pump fillage for which the Realift RPC does not compensate with a change in pump speed
  - Units: percentage (%)
  - Suggested value: 3%
- **Fill Base**
  - Displays the full range load percentage of the downhole card at which the Realift RPC, in the downstroke, starts to look for the slope change indicating plunger contact with fluid in the pump barrel. The adjustable fill base allows the Realift RPC to find accurate net stroke with a variety of unusual pump conditions. If net stroke calculation results do not appear to be reasonable, adjust the fill base up or down for more logical results.
  - Units: percentage (%)
  - The suggested value is 30%
- **PID Control**
  - Pressing **Configure** opens a pop-up dialog, which allows an Expert user to configure the PID algorithm to optimize the control algorithm. In general, this should not need to be modified.



The Realift RPC uses a proportional–integral–derivative controller (PID controller) to optimize the speed of the pump to match the fillage. A PID controller continuously calculates an error value as the difference between the target fillage and a measured fillage and applies a speed correction based on proportional (P), integral (I), and derivative D) terms.

- **P** gain is directly proportional to the current value of the target pump fillage minus the error value. The P term accounts for the differences between the target and present pump fillage stroke to stroke. The higher the P term, the greater the impact of fillage changes from stroke to stroke. Default value is 300.

- **I** gain should be set to be proportional to the past values of the target pump fillage minus the error value and integrates them over time to produce the I term. The I term seeks to eliminate the residual error by adding a control effect due to the historic cumulative value of the error. The higher the I term, the slower changes will be made to pump speed from stroke to stroke. Default value is 200.
- **D** gain should be set to be proportional to the anticipated impact of the trend of values of the target pump fillage minus the error value; this term anticipates the changing trend of pump fillage. The higher the D term, the faster changes will be made to pump speed from stroke to stroke. Typically, D gain may be set to 0. Default value is 0.

The P, I, and D effects displayed show the impact of the P, I, and D and components on the change in pump speed from the previous stroke. These terms can be used to tune the PID as the pump is running to ensure a suitable balance between responding to changes in pump fillage while limiting unnecessary pump speed changes.

Pump Speed

- **Maximum**
  - Specifies the fastest drive speed when the pump is in Auto Mode and is adjusting to the speed based on the pump fill.
  - Units: strokes per minute (spm)
  - Range: 0.1...20.0
- **Minimum**
  - Specifies the slowest drive speed when the pump is in Auto Mode and is adjusting to the speed based on the pump fill.
  - Units: strokes per minute (spm)
  - Range: 0.1...20.0
- **Hand/Timed**
  - Specifies the pump speed when in Hand or Timed mode
  - Units: strokes per minute (spm)
  - Range: 0.1...20.0

Control

- **Control Method**
  - Specifies the control method to use
  - See Control Methods 83
- **Timed Fallback**
  - Enables Timed Fallback
  - Signals from the proximity sensor or inclinometer, and load cell are used to generate dynacards. If this is enabled and the position sensor signal is lost, Realift RPC employs the timed control mode using the on time and off time entered to try to keep the pump running as efficiently as possible.

Control Strokes

- **Speed Filter**
  - Specifies the minimum number of strokes between speed changes
  - Units: strokes (str)
  - Suggested setting: 1 str
- **Pre-control**
  - Specifies the number of strokes the pumpjack runs at its start speed before the Realift RPC controls the speed
  - Units: strokes (str)
  - Suggested strokes vary with the number of strokes required for any start-up transient effects to disappear, but a typical value is 20 str
- **Pump Off**
  - When the pump detects a persistent pump fill at less than the Fill Min (such as a Pump Off situation), specifies the number of strokes the pump will continue to run before it finally switches to Pump Off and the pump stops
  - Units: strokes (str)
  - Suggested setting: 3 str

Control 2 screen parameters

Timed Control

- **On Time**
  - The amount of time the pump runs in **Timed Mode**. Select an appropriate **On Time**, even if **Timed** is not the preferred mode.
  - Units: minutes (min)
  - Range: 1...255
  - Suggested value: 30 min
- **Off Time**
  - Set this parameter large enough for the pump to refill to the required pump fill before restart.
  - If it is required that the system pump off periodically when in Timed mode, you can set Off Time to a non-zero value. Set it large enough for pump fill to increase slightly during the idle period. This reduces the potential for fluid pound and hammer to occur while your pumpjack is running.
  - Units: minutes (min)
  - Range: 1...255
  - Suggested Value: 30 min
- **Min Off Time**

- The minimum allowable time that the pump will remain in the off state before restarting when in Auto Off Time Adjust Mode
- Units: minutes (min)
- Suggested value: 5 min

- **Max Off Time**
  - The maximum allowable time that the pump will remain in the off state before restarting when in Auto Off Time Adjust Mode
  - Units: minutes (min)
  - Suggested value: 90 min
- **Auto Adjust**
  - Determines whether the system adjusts Pump Off Time based on operating conditions

Floating Rod

See Managing your pump if it has a floating rod 85 for more information.

Power Cycle Management

See Controlling when your pump restarts 86 for more information.

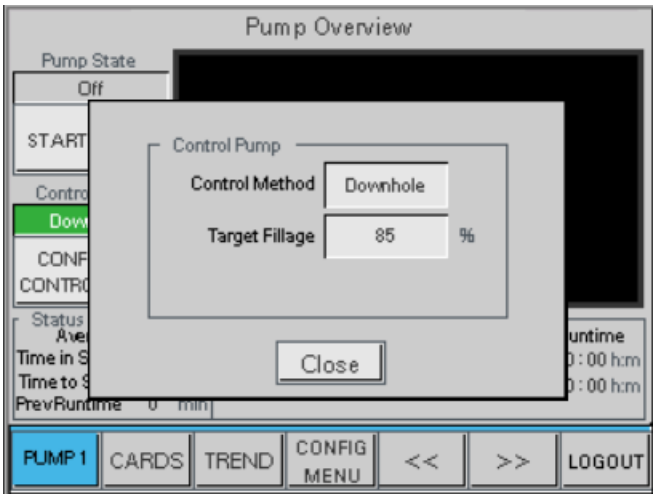
Pump Restart

See Controlling when your pump restarts 86 for more information.

13.7.1 Control Methods

The control method determines how Realift RPC manages its speed to regulate the flow and volume of fluid in the well.

You can select the control mode from the **Pump Overview** screen. The figure below shows the **Pump Overview** screen with the **Control Pump** pop-up dialog.



You have five options for controlling the well:

- **Downhole**
  - Realift Rod Pump system repeats running cycles until the Downhole Fill falls below the Fill Minimum for the Pump Off Count Limit, remaining off for Pump Off Time. While running, speed is increased if the Downhole Fill is above the Fill Target and decreased if below.
- **Surface**
  - Realift Rod Pump system repeats running cycles until the Surface Fill falls below the Fill Minimum for the Pump Off Count Limit, remaining off for Pump Off Time. While running, speed is increased if the Surface Fill is above the Fill Target and decreased if below.
- **Timed**
  - Realift Rod Pump operates as a timer, running for On Time and stopping for Pump Off Time, both of which are fixed, user-entered values.
- **Hand** (manual): The operator sets a speed and the pump runs at that speed unless stopped by the operator or an alarm.
- **Bypass**
  - Bypass describes a state where the pump is not being controlled by the Realift Rod Pump. In this state the RPC will not and cannot control the pump, but it will produce dynacards.

Timed mode optimization

When running in **Surface** or **Downhole mode**, the pump jack can maximize the off time in order to minimize power consumption due to restarting the pump.

To select the control mode

1. On the Pump Overview screen, press **CONTROL PUMP.**
2. Press the **Control Method** field.
3. Configure the remaining parameters, as described below.

Parameters

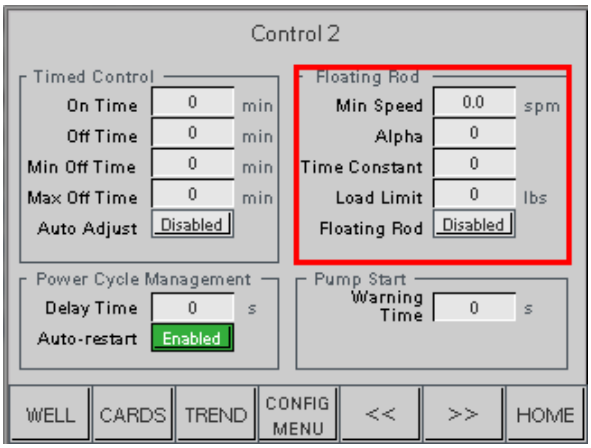
- **Control Method**
  - Specifies the method used to control the pump
  - Valid Options: Hand, Timed, Surface, Downhole, Bypass
- **On Time**
  - Specifies the length of time the pump should run when using the Timed control method
  - This parameter appears only when **Control Method** is set to **Timed**
  - Units: minutes (min)
- **Off Time**
  - Specifies the length of time the pump should not run when using the Timed control method

- This parameter appears only when **Control Method** is set to **Timed**
- Units: minutes (min)

- **Target Fillage**
  - Specifies the target fillage of the well
  - This parameter appears only when **Control Method** is set to **Downhole**, **Surface**, **Bypass**
  - Units: percentage (%)
- **Pump Speed**
  - The speed of the pump
  - This parameter appears only when **Control Method** is set to **Hand**
  - Units: strokes per minute (spm)

13.7.2 Managing Your Pump if it has a Floating Rod

You can enter the floating rod parameters on the **Control 2** screen.



The floating rod algorithm reduces downstroke speed if the minimum load is approached. The pump speed is reduced to the floating rod absolute minimum speed, or, if this is set to 0, stops if the minimum load is reached during the downstroke. **Alpha** determines how sharply the speed reduction occurs as the minimum load is approached.

Floating Rod detection does not work when the system is operating in Timed control mode. If the pump reverts to Timed control mode, configure the Realift Rod Pump Controller to run at a speed below that which may cause damage to the pump.

The **Belt Slip** protection should be disabled when **Floating Rod** is enabled.

Floating Rod control may be useful for wells that do not have heavy oil, but do have significantly deviated wellbores.

To enter the floating rod parameters

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Control**.

   The **Control** screen is displayed.

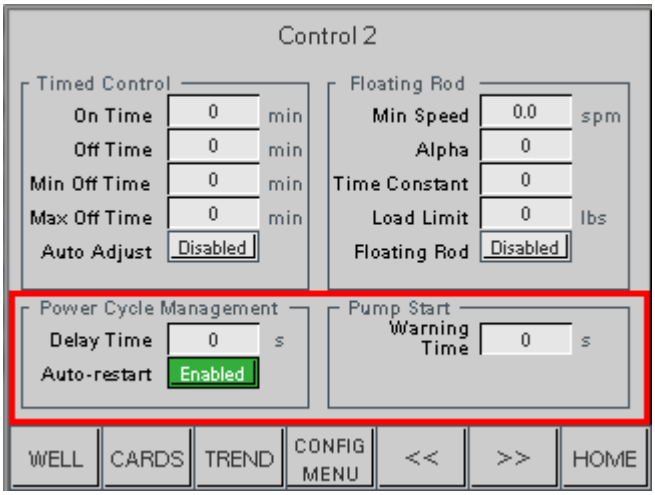
2. Press **>>** to display **Control 2**.
3. Enter the floating rod parameters by pressing the field and entering the parameter using the keypad that is displayed.

Parameters

- **Min Speed**
  - A speed, which may be zero, required for the safe mechanical operation of the system since the lubrication provided during the upstroke may not be sufficient if the downstroke speed is very low. This parameter is only used when Floating Rod is enabled and during the downstroke.
  - Units: strokes per minute (spm)
- **Alpha**
  - An exponential factor controlling the sharpness of the floating rod control when approaching the minimum load. Alpha controls how close the actual load needs to be to the load limit for the unit to operate at 50% speed. A high Alpha might cause the unit to operate more slowly than necessary, even when the load is much higher than the limit. A low Alpha might cause the rods to float because speed is not reduced until the load limit is nearly reached
- **Time Constant**
  - A constant of the speed command used in the floating rod algorithm. The speed command is filtered to prevent speed oscillations. Set the Filter TC value to the lowest value that prevents unwanted speed oscillations during the downstroke.
- **Load Limit**
  - The point at which the pump stops pushing the load down and lets it sink on its own
  - Unit: Pounds (lbs)
- **Floating Rod**
  - Controls whether the floating rod algorithm is enabled or not
  - Valid options: Disabled, Enabled

13.7.3 Controlling When Your Pump Restarts

Using the **Control 2** screen, you can control when your pump restarts after the power is cycled.



To control when the pump restarts

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Control**.
2. Press **>>** to display **Control 2**.
3. Enter the **Power Cycle Management** and **Pump Start** parameters by pressing the field and entering the parameter using the keypad that is displayed.

Power Cycle Management

- **Delay Time**
  - Specifies the amount of time before restarting the pump after a power cycle
  - When **Auto-restart** is enabled and power is cycled, the Realift RPC waits until the **Delay Time** has elapsed before automatically restarting the pump. This is used when there are multiple pumps on the same electrical grid to manage the electric load, limiting the surges created when the pumps restart.
  - The delay time is canceled if the user takes any manual action, for example, changing the control mode
  - Units: seconds (s)
- **Auto-restart**
  - Specifies whether **Auto-restart** is enabled or disabled
  - When enabled, the Realift RPC will restart the pump following a power cycle after the Delay Time has elapsed if and only if the pump had been running or stopped in a Pump Off state
  - When disabled, the pump will not restart after a power cycle until a user intervenes and starts the pump. Typically this parameter is set to Enabled.

Pump Start

- **Warning Time**

- If a Start Warning Indicator (SWI), such as a horn or flashing light is used, you can set the amount of time the unit delays starting up while the SWI operates
- Connecting the SWI to the pump controller is explained in the Realift Rod Pump Hardware Installation Manual
- Units: seconds (s)

13.8 Configuring Sensors and Protections

You can connect downhole and surface sensors to the system and configure the protection settings for those sensors using the **Sensor and Protections** screens. Connect the sensor before you configure its protection settings. Connecting a sensor tells Realift RPC that the sensor is wired to the SCADAPack x70 RTU in the cabinet.

You can change sensor and protection settings when the pump is running.

⚠ WARNING

UNACCEPTABLE USE

Do not use Realift RPC protections as an integral part of a safety system. The Realift RPC is not a safety product.

Failure to follow these instructions can result in death or serious injury.

After you configure the well data, you can set protections.

On the **Sensors and Protections** screens you can set operational limits that define when the Realift Rod Pump stops the pump to avoid hardware damage, if well operating conditions fall outside these limits.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Read and understand this manual before operating the Realift Rod Pump system.
- Any changes made to parameter settings must be performed by qualified personnel.

Failure to follow these instructions can result in death or serious injury.

The system reports a **Well Alarm** or **Well Fault** when a data value consistently falls outside of a defined range for a specified period of time or number of strokes. Well faults and alarms apply in hand and auto mode.

Changing the Realift Rod Pump from **Auto** to **Hand** mode while it is running resets the current values of the **Well Alarm Detection Count** to zero, but not the current values of the **Well Fault Detection Count**.

Changing the Realift Rod Pump from **Auto** to **Hand** mode while it is in a **Pump Off** state, for example, due to an alarm or a fault state, clears any existing alarms or faults and causes the pump to restart.

To access the Sensor and Protection screens

1. On the **Pump Overview** screen, press **CONFIG MENU > Well Configuration > Sensors & Protections**.
2. Press the name of the protection that you want to configure, as described in the following sections.
3. Press **>>** to move to the next screen of protections.
4. Set the limits, timers, and counters, as needed.

For details, see:

- Protection Overview 89
- Sensor and Protection Parameters 90

13.8.1 Protection Overview

The following table describes the available protections.

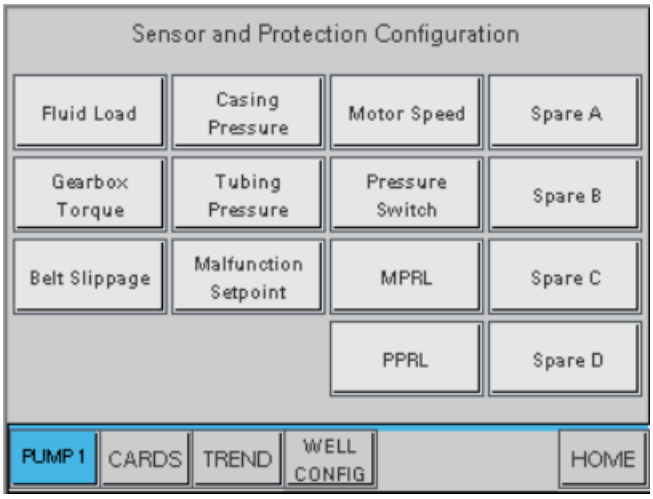
Protection	Per-Stroke/Timed	Source	High Available	Low Available	Restart when Breached	Notes
Fluid Load	Per-Stroke	Calculated	Yes	Yes	Yes	Calculated from dynacard
MPRL	Per-Stroke	Calculated	Yes	No	Yes	Calculated from dynacard
PPRL	Per-Stroke	Calculated	No	Yes	Yes	Calculated from dynacard
Belt Slippage	Per-Stroke	Calculated	Yes	No	Yes	Detected by constantly monitoring the speed feedback from the drive and the detected pump stroke period, and comparing the two values.
Malfunction Setpoint	Per-Stroke	Calculated	No	Yes	Yes	Calculated from dynacard[1]
Casing Pressure	Timed	Register, AI, Constant	Yes	Yes	Yes	Detected from a connected 4...20 mA or Modbus sensor if one is available. If no sensor is connected, the **Sensor Type** should be set to **Constant** and the **Predicted Casing Pressure** used.

Protection	Per-Stroke/Timed	Source	High Available	Low Available	Restart when Breached	Notes
Tubing Pressure	Timed	Register, AI, Constant	Yes	Yes	Yes	Detected from a connected 4...20 mA or Modbus sensor if one is available. If no sensor is connected, the **Sensor Type** should be set to **Constant** and the **Predicted Tubing Pressure** used.
Pressure Switch	Timed	DI1	Yes	Yes	No	Used to indicate an emergency shutdown or for devices such as pressure switches.
Motor Speed	Timed	Calculated	Yes	Yes	Yes	Connect a sensor that measures the motor speed of the prime mover.
Gearbox Torque	Per-Stroke	Calculated	Yes	Yes	Yes	Calculated from a dynacard provided the API dimensions, counterbalance load, counterbalance angle, and structural imbalance load have been entered by the user.
Spare A/B/C/D	Timed	Register, AI, DI	Yes	Yes	Yes	Can be configured and tagged to match additional sensors, such as vibration, used by the pump system.

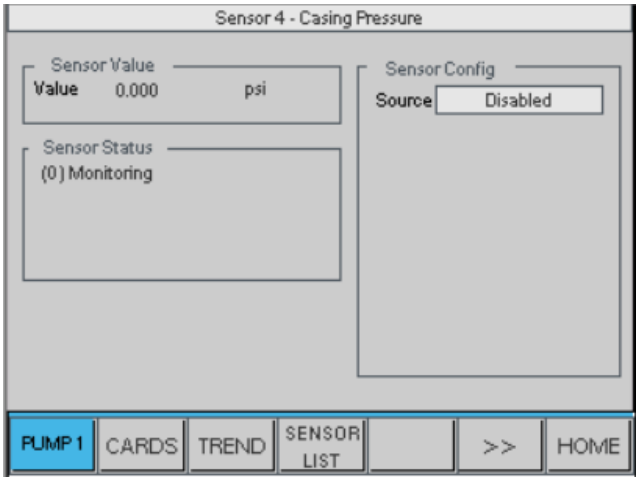
[1] The Malfunction Setpoint is an adjustable point that is placed inside the Surface Card that is violated when the top of the card (on the upstroke) falls below it. The Malfunction Setpoint should be placed at a stable point in the Surface Card aligned with a load value equivalent to the Rod Weight found on the Well Configuration screen. The location of the Malfunction Setpoint can be chosen by clicking the mouse at the desired location on the Surface Card or by entering the position and load values in the Malfunction Value column.

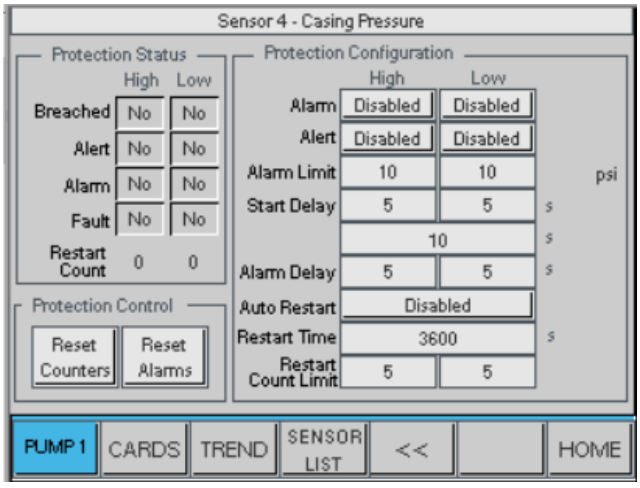
13.8.2 Sensor and Protection Parameters

Configure sensor and protections on the relevant Sensor and Protections configuration screen. The figure below displays the Sensor and Protection Configuration menu.



The parameters to be configured depend on the sensor type. The figures below display the **Casing Pressure** sensor and protection configuration screens.





Press the bar at the top of the screen to select another sensor using the up and down arrow buttons.

Screen 1 parameters

Sensor Value

- **Value**
  - Displays the latest scaled reading from the sensor

Sensor Status

- **Monitoring**: Indicates that the sensor is configured correctly and being monitored by the Realift RPC
- **Invalid**: Indicates that the sensor has not been configured correctly and is not being monitored by the Realift RPC

Name

- Specifies the name of the protection; only applies to Spare A/B/C/D
- Alarm banners and Trends display Spare A/B/C/D, and do not display the user-entered names

Sensor Config

- **Source**
  - Specifies the type of data provided to the sensor parameter in the Realift RPC.
  - If the sensor data is calculated, it is automatically provided by the Realift RPC.
  - Valid values: Disabled, Constant, DI, AI, Register
- **Malfunction Position**
  - Only displayed for Malfunction Setpoint
  - Specifies the stroke height, during upstroke, at which the malfunction load is assessed
  - Used to check for rod parts or other pump malfunctions that cause no fluid load to be picked up by the pump.
  - When Load Lines are enabled for dynacards, this value appears as an X on the **Dynacards** screen. See Viewing Dynacards 113 for more information.

Screen 2 parameters

Protection

- **Protection Status**
  - **Breached:** Indicates if the alarm limit is breached

- **Alert**: The Realift RPC generates alerts for enabled protections when the feedback values are outside of the limits defined for the protection and the Debounce Timer or counter has elapsed.
- **Alarm**: The Realift RPC generates alarms for enabled protections when the feedback values are outside of the limits defined for the protection and the Alarm Delay timer or counter has elapsed. When an alarm is generated, the Realift RPC will attempt to restart the pump after the restart timer has elapsed unless the alarm limit count has been exceeded.; if it has been exceeded a fault will be reported.
- **Fault**: The Realift RPC generates faults for enabled protections when the alarm limit count has been exceeded for a specified alarm. When a fault is active the pump will stop and not restart until the counter and alarms are reset.

- **Restart Count**
  - Indicates the number of alarms generated due to the breach of a threshold value. When this counter reaches the **Alarm Counter Limit**, the Realift RPC reports a fault, the pump is stopped, and cannot be restarted until the counter and alarm are reset.

Protection Control

- **Reset Counters**
  - Resets the counters for all protections to zero
- **Reset Alarms**
  - Resets the alarms for all protections to zero

Protection

- **Alarm**
  - Specifies whether alarm protection is enabled for the sensor.
  - Values:
    - Enabled: An alarm is generated when the sensor feedback values are outside of the user-defined limits. Alarms are listed on the Alarms screen, as described in Managing Alarms and Alerts 120, and indicated with red banners on Magelis HMI screens and red parameter values on status screens. Enabling an alarm automatically enables its corresponding alert.
    - Disabled: No alarms or faults are generated when a configured limit is breached.
  - When this parameter is changed, a message appears warning that protections on the Realift RPC should not be used as an integral part of a safety system, as shown below:
- **Alert**
  - Specifies whether alert protection is enabled for the sensor.
  - Values:
    - Enabled: If a protection limit is reached the alert is raised after the start delay and debounce time or counter has elapsed.

      If an alert is enabled, but not the corresponding alarm, the pump does not stop and no other action is taken while the alert is active.

    - Disabled: The protection is turned off. No alerts are generated, and no action is taken when a configured limit is breached.

- **Alarm Limit**
  - Specifies the high and low limits at which an alarm or alert is generated.
  - If the sensor type is set to DI, the high protection is active when the DI is a logic high, and the low protection is active when the DI is a logic low.
  - Some alarm limit values are scaled, for example MPRL/PPRL and Malfunction Setpoint.
- **Start Delay**
  - The amount of time or number of strokes that the protection is disabled, starting from the moment the Realift RPC attempts to restart the pump after an alarm. When this timer elapses, the protection is re-enabled.
  - If the timer or stroke count is set to 0, alarms are enabled starting with the first stroke.
  - Units: seconds (s), strokes (str)
- **Alarm Delay**
  - The amount of time that the Realift RPC waits before generating an alarm once the Debounce timer elapses and an alert has been generated. This delay allows the condition to correct itself before an alarm is generated. If this delay is set to 0, an alarm is generated immediately after the Debounce timer has elapsed.
  - Units: seconds (s), strokes (str)
- **Auto Restart**
  - Specifies whether the Realift RPC automatically resets the alarm and tries to restart the pump after an alarm is generated.
  - Values:
    - Enabled: After an alarm has been raised and the pump stopped, the Realift RPC will, if the restart does not exceed the restart count limit, attempt to restart the pump when the **Restart Time** has elapsed.
    - Disabled: After an alarm has been raised, the Realift RPC will stop the pump and report a fault. The Realift RPC will not restart the pump until the user intervenes to reset the alarms.
- **Restart Time**
  - The amount of time that the Realift RPC waits before automatically resetting the alarm and attempting to restart the pump. This timer is applied only when the Auto Restart function is enabled. If a configured limit remains breached, the restart action that the Realift RPC takes depends on the protection type.
  - Units: seconds (s)
- **Restart Count Limit**
  - The number of alarms that can be generated before the pump is stopped and cannot be restarted until the Restart Counter is reset. If the Restart Counter Limit is exceeded, the Realift RPC will stop the pump and report a fault.
  - If set to 0, the Realift RPC will not restart pump.

- **Mapping**
  - Specifies the point from which to map the sensor readings
  - If **Source** is set to **Register**, locate the parameter to be monitored in Appendix D - Communications Map 142 and enter its **Point Number** in the **Mapping** field. The sensor will read and process the register value as a signed Modbus integer.
  - If **Source** is set to **AI**, select the analog input to which your 4-20 mA sensor is connected. User-configurable sensors can be connected to AI3 (default), AI4, AI5, AI6, or AI7. When you change **Source** to Analog input, the Realift RPC will set the default mapping to AI3.
  - If **Source** is set to **DI**, enter the digital input to which your sensor is connected. User-configured sensors can be connected to DI4 (default), DI5, DI6, or DI7. When you change the source type to DI, the Realift RPC will set the default mapping to DI4
- **Parameter Value**
  - Specifies the constant value to be used when **Source** is configured as Constant.
- **20mA Value**
  - The parameter value at 20 mA. The Realift RPC uses this value to calibrate the sensor range and calculate the Scaled Value as a percentage based on the Raw Value, which is provided in mA.
  - This parameter appears only when **Source** is set to AI.
- **4mA Value**
  - The parameter value at 4 mA. The Realift RPC uses this value to calibrate the sensor range and calculate the Scaled Value as a percentage based on the Raw Value, which is provided in mA.
  - This parameter appears only when **Source** is set to AI.
- **Scale**
  - A value used to scale the fixed point of the sensor data used by the Realift RPC. The Realift RPC uses this value to calculate the Scaled value based on the Raw Value which is provided in mA. Normally this value should be set to 1.
  - Valid values: 0.0001, 0.001, 0.01, 0.1, 1 (default), 10, 100, 1000, 10000
- **Debounce**
  - The amount of time or strokes that the Realift RPC waits after a configured limit is initially breached before considering the threshold as violated. This delay allows temporary conditions, such as noise on a signal, to clear before any action is taken. If the Debounce timer passes, the limit is still breached, and the alarm delay is greater than 0, the Realift RPC generates an alert.
  - Units: seconds (s), strokes (str)

14 Viewing System Status

You can get an overview of Realift Rod Pump system operation from the Pump Overview 96, Sensor and Protection Overview 98, and Drive and Production Overview 100 screens. You can view these screens even when you are not logged in, although you need to be logged in to make changes to the parameters displayed.

The displayed screens can be divided into several categories:

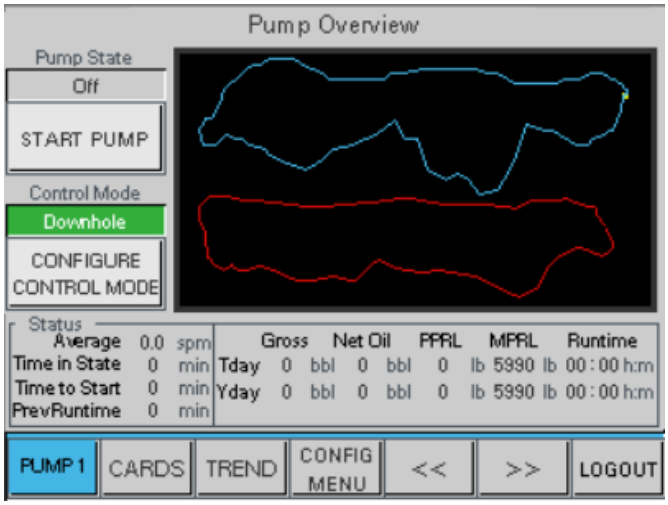
- The run status of the pump, including the **Pump Status** and the **Drive Status**
- A summary of various Realift Rod Pump parameters, including the active control mode, the pump fillage level, frequency command, pump rate, and fluid load
- A summary of protection statuses
- Surface and downhole data, including total, and effective strokes
- Drive parameters
- Runtime Timers and Stroke Counters 103

14.1 Pump Overview

To access the Pump Overview screen

- Press the **Home** button.

  The **Pump Overview** screen is displayed.



Parameters

- **Pump State**
  - o Displays the current state of Realift Rod Pump system operation. Pump status values are listed and defined in the table below:

Status	Action

Off	Realift RPC is **OFF** and the pump does not move
Hand	Realift RPC is running at a specified speed
Power Cycle Delay	Realift RPC has restarted and is waiting for the **Power Cycle Delay** to elapse prior to proceeding to the Auto startup sequence.
Power Cycle Stop	Realift RPC has restarted, and is waiting for an operator to restart the pump.
Alarm	Realift RPC is not running due to the detection of a Well Alarm and is waiting for the alarm delay time to elapse state prior to restarting the pump.
Fault	Realift RPC is not running due to the detection of a **Well Fault**. The pump will not restart until the well fault is reset.
Start Warning	Realift RPC activates the start warning digital output and any devices such as a light or annunciator connected to it for the **Start Warning** time prior to starting the pump.
Startup	Realift RPC is starting up, and the pump will run at the startup speed
Timed	Realift RPC is in **Timed** mode
Pump Off	Realift RPC is not running and is in **Pump Off** state. The Realift Rod Pump will restart once the **Pump Off** time has elapsed.
Bypass	Realift RPC is in **Drive Bypassed** state. The drive is disconnected from the motor and, if running, performs a freewheel stop. While in the bypass state, the Realift RPC does not control the operation of the drive or the pump, but will monitor the status of the pump.
Auto	Realift RPC is running in **Auto** mode using Surface or Downhole control.

- **Control Mode**
  - Displays the current state of the Realift Rod Pump
- **START/STOP PUMP**
  - Pressing the START/STOP button starts or stops the Realift Rod Pump
- **CONTROL PUMP**
  - Pressing the CONTROL PUMP button opens the Pump Control window

Status

- **Average Pump Speed**
  - Displays the average speed of the pump when it has been running during the current day (starting at the gauge off time)

- Units: strokes per minute (spm)

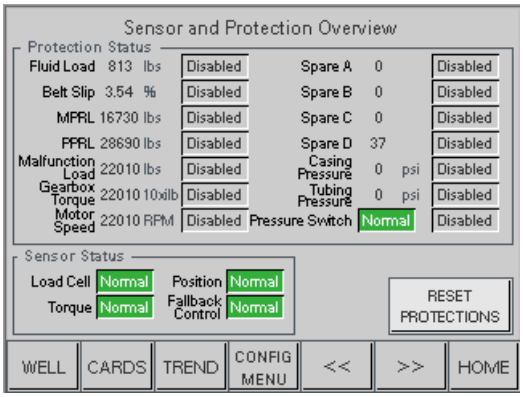
- **Current Pump Speed**
  - Displays the current speed of the pump
  - Units: strokes per minute (spm)
- **Fill**
  - Displays the current pump fillage
  - Current pump fillage is calculated using the downhole card, unless the pump is using Surface control. When using Surface control, the surface card is used for calculation.
  - Units: percent (%)
- **Runtime**
  - Displays the time the pump has been running since last turned on
  - Units: Hours and Minutes if less than 24 hours, Days and Hours if more than 24 hours
  - Format: HH:MM (less than 24 hours), DD:HH (greater than 24 hours)
- **Gross**
  - Displays the gross fluid production for the current day and for yesterday
  - Units: barrels (bbl)
- **Net Oil**
  - Displays the net oil production for the current day and for yesterday
  - Units: barrels (bbl)
- **PPRL**
  - Displays the highest PPRL recorded from a dynacard for the current day (starting at the gauge off time) and for yesterday
- **Runtime**
  - Displays the length of time that the pump has been running in the current day and for yesterday
  - Format: HH:MM if less than 24 hours, DD:HH if greater than 24 hours

14.2 Sensor and Protection Overview

You can view the status of sensors and protections using the **Sensor and Protection Overview** screen.

To access the Sensor and Protection Overview screen

- From the **Pump Overview** screen, press **>>** once.



Parameters

Protection Status

- **Fluid Load**
  - Displays the current **Fluid Load** sensor reading and status
- **Belt Slip**
  - Displays the current **Belt Slippage** sensor reading and status
- **MPRL**
  - Displays the current **MPRL** sensor reading and status
- **PPRL**
  - Displays the current **PPRL** sensor reading and status
- **Gearbox Torque**
  - Displays the current **Gearbox Torque** sensor reading and status
- **Motor Speed**
  - Displays the current **Motor Speed** sensor reading and status
- **Spare A/B/C/D**
  - Displays the current Spare sensor reading and status
  - If you have renamed the sensor, the new name appears on the screen
- **Casing Pressure**
  - Displays the current Casing Pressure sensor reading and status
- **Tubing Pressure**
  - Displays the current Tubing Pressure sensor reading and status
- **Pressure Switch**
  - Displays the current Pressure Switch sensor reading and status

Sensor Status

- **Load Cell**
  - Displays the current load cell sensor status
- **Torque**
  - Displays the current torque sensor status
- **Position**
  - Displays the current position sensor status
- **Fallback Control**
  - Displays the current fallback control status
- **Reset Protections**
  - Opens the reset protections screen

Reset Protections screen

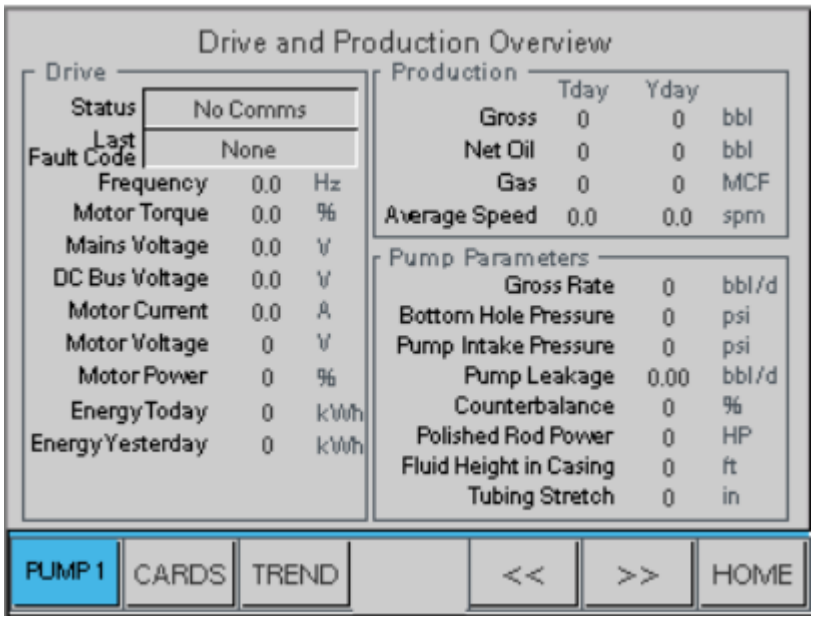
- **Reset Protections**
  - Resets protections
  - When active, the button turns red and is locked until the action is complete
- **Preset Protection Counters**
  - Resets protection counters to zero
  - When active, the button turns red and is locked until the action is complete

14.3 Drive and Production Overview

You can get an overview of well production and pump parameters using the **Drive and Production Overview** screen.

To access the Drive and Production Overview screen

- From the **Pump Overview** screen, press **>>** twice.



Parameters

Drive

The parameters that appear depend on the type of drive.

Parameter	Description	Appears for
Status	Displays the current state of the drive. Valid states: Forward, Ready, Normal, Waiting	Altivar Generic Start Contactor
Fault Code	Displays the current fault code displayed on the drive.	Generic Start Contactor
Last Fault Code	Displays the last fault code displayed on the drive.	Altivar
Frequency	Displays the speed at which the Realift RPC is currently running	Altivar
Mains Voltage	Displays the line voltage in Volts (V)	Altivar
DC Bus Voltage	Displays the DC Bus voltage in Volts (V)	Altivar
Motor Current	Displays the estimated effective motor current of the drive in Amperes (A)	Altivar

Motor Voltage	Displays the voltage of the drive motor in Volts (V)	Altivar
Motor Torque	Displays the torque of the drive motor as a percentage of the motor's rated torque	Altivar
Motor Power	Displays he motor power of the drive as a percentage of the motor's rated power	Altivar
Energy Today	Displays the amount of energy consumed by the drive today in kilowatt hours (kWh)	Altivar
Energy Yesterday	Displays the amount of energy consumed by the drive yesterday in kilowatt hours (kWh)	Altivar

Production

- **Gross**
  - Displays the gross production for today and yesterday
  - Units: Barrels (bbl)
- **Net**
  - Displays the net fluid production for today and yesterday
  - Units: barrels (bbl)
- **Gas**
  - Displays the total gas production for today and yesterday
  - Units: millions of Cubic Feet (MCF)
- **Average Speed**
  - Displays the average speed of the pumpjack
  - Units: strokes per minute (spm)

Pump Parameters

- **Gross Rate**
  - Displays the gross rate of production for the pump
  - Units: barrels per day (bbl/d)
- **Bottom Hole Pressure**
  - Displays the bottom hole pressure of the pump
  - Units: pounds per square inch (psi)
- **Pump Intake Pressure**
  - The pressure in the casing at the depth specified as the pump intake
  - Units: pounds per Square Inch (psi)

- **Pump Slippage**
  - Displays the pump slippage
  - Units: barrels per Day (bbl/d)
- **Counterbalance**
  - Displays the calculated value indicating the balance between the counter weight and the rod string weight.
  - Counterbalance is calculated per stroke, if torque feedback is available, using the formula:

    Counterbalance = 100% * (Maximum Upstroke Torque - Maximum Downstroke Torque) / Rated Torque
  - If Counterbalance is a positive value, the unit is rod-heavy or under balanced. If it is a negative value, the unit is crank-heavy or overbalanced. It is recommended that you assess the counterbalance of your well when the pump is pumped off or operating at a steady-state speed with constant well conditions.
  - Units: percentage (%)
- **Polished Rod Power**
  - The calculated value indicating the peak polished rod horsepower
  - Units: horsepower (HP)
- **Fluid Height in Casing**
  - The height of the fluid within the well casing
  - Units: feet (ft)
- **Tubing Stretch**
  - Displays the calculated value indicating the tubing stretch
  - Units: inches (in)

14.4 Viewing Runtime Timers and Stroke Counters

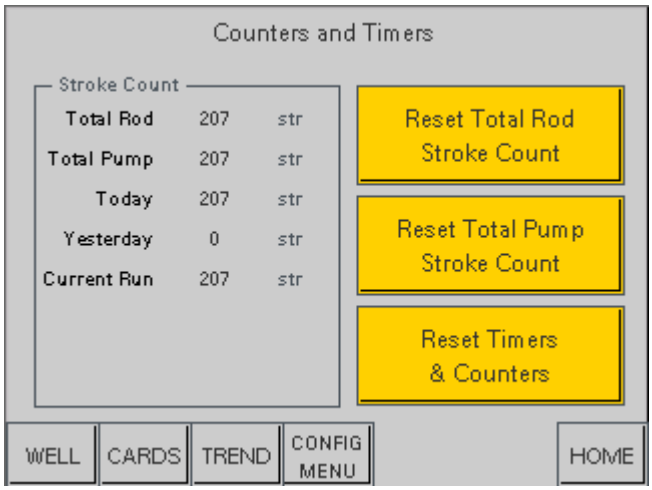
The **Counters and Timers** screen allows you to reset the stroke and runtime timers and counters for today and yesterday. The following runtime timers and counters are reset:

- Previous Runtime
- Runtime Today
- Average Pump Speed Today
- Energy Consumption Today
- Gas Production Today
- Net Production Today
- Maximum PPRL Today
- Minimum MPRL Today
- Stroke Count Today
- Runtime Yesterday
- Average Pump Speed Yesterday
- Energy Consumption Yesterday
- Gas Production Yesterday
- Gross Production Yesterday
- Net Production Yesterday
- Maximum PPRL Yesterday
- Minimum MPRL Yesterday
- Stroke Count Yesterday

The following procedures describe how to view and reset Runtime Timers and Stroke Counters 105.

To view Counters and Timers

- From the **Pump Overview** screen, press **CONFIG MENU >> Well Configuration >> Counters & Timers**.



Parameters

- **Total Rod**
  - Displays the total rod stroke count since the Reset Total Rod Stroke Count was last employed. This parameter is used to measure the current rod set's strokes and should be reset when the rods are changed.
- **Total Pump**
  - Displays the total (downhole) pump stroke count since the **Reset Total Pump Stroke Count** was last employed. This parameter is used to measure the current pump's strokes and should be reset when the pump is replaced.
- **Today**
  - Displays today's total stroke count
- **Yesterday**
  - Displays yesterday's total stroke count
- **Current Run**
  - Displays the total stroke count since the pump was last started
- **Reset Total Rod Stroke Count**
  - Resets the total rod stroke count to zero
- **Reset Total Pump Stroke Count**
  - Resets the total pump stroke count to zero
- **Reset Timers & Counters**

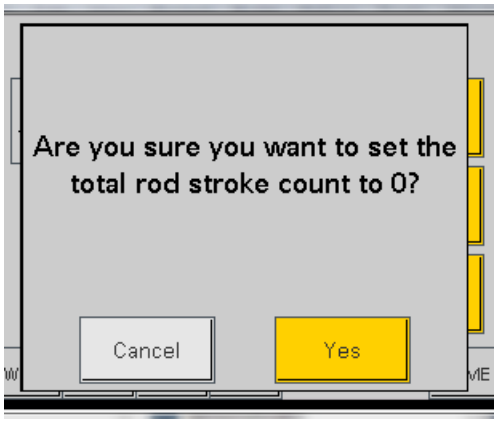
- Resets the stroke and runtime timers and counters to zero, excepting the rod and pump stroke counts

To reset Timers and Counters

On the **Counters and Timers** screen, press:

- **Reset Total Rod Stroke Count** to reset the total rod stroke count.

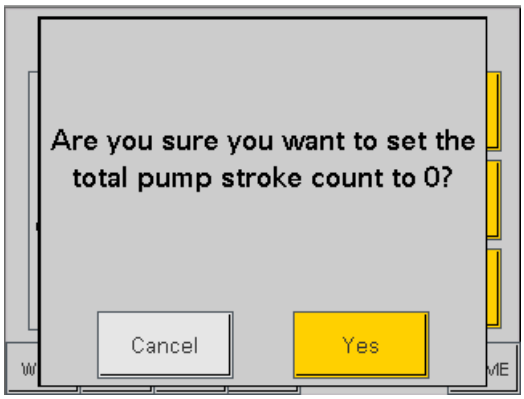
  A confirmation dialog appears, as shown below.



  Press **Yes** to continue with the reset, or **Cancel** to cancel the operation.

- **Reset Total Pump Stroke** count to reset the total pump stroke count.

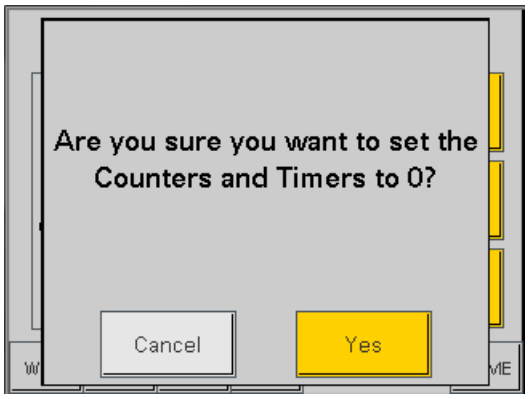
  A confirmation dialog appears, as shown below.



  Press **Yes** to continue with the reset, or **Cancel** to cancel the operation.

- **Reset Timers and Counters** to reset the stroke and runtime timers and counters.

  A confirmation dialog appears, as shown below.

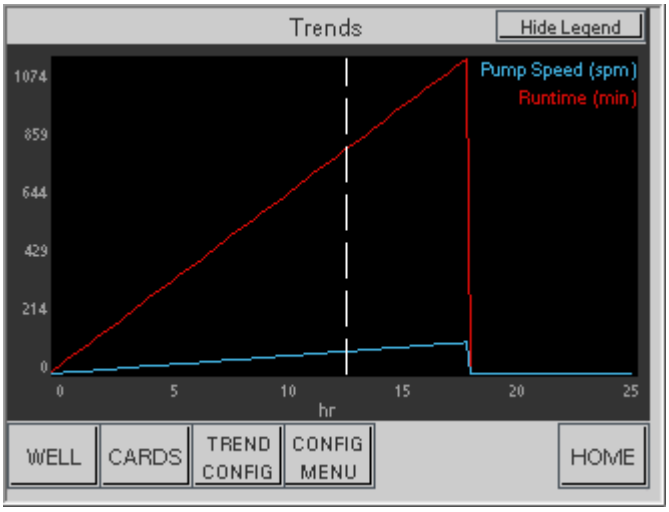


Press **Yes** to continue with the reset, or **Cancel** to cancel the operation.

15 Trends

The **Trend** screen provides the ability to track Realift Rod Pump and pump parameters over a period of time. It can be configured to show a series of parameters. You can view trend information without stopping the pump and without logging in to the Realift RPC.

An example of a **Trend** screen is shown below.

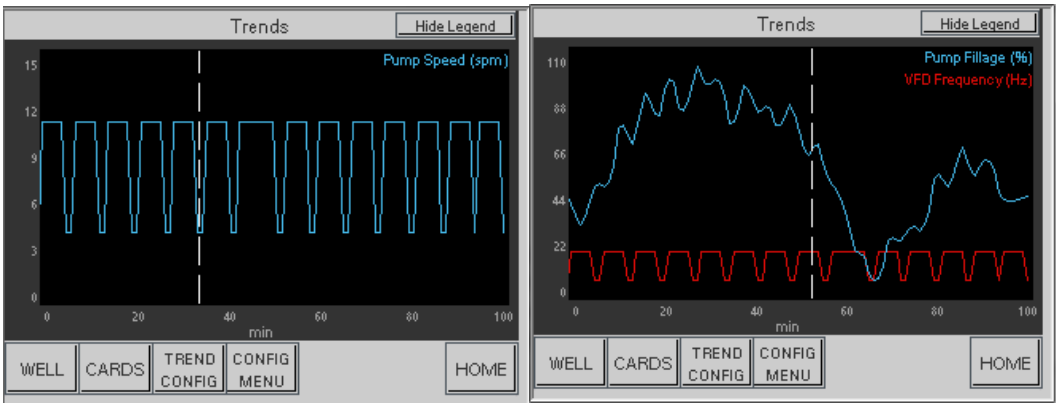


For more information, see:

- Trend Graph Layout 107
- Viewing Trends 108
- Real-Time Parameters Available for Trending 109

15.1 Trend Graph Layout

The graph format is the same for each trend provided on the **Trend Configuration** screen. The figures below show examples of trend graphs.



The X (Horizontal) axis) shows time.

The Y (Vertical) axis shows the minimum and maximum values of the parameters displayed.

The white vertical dashed line indicates the data sample being written.

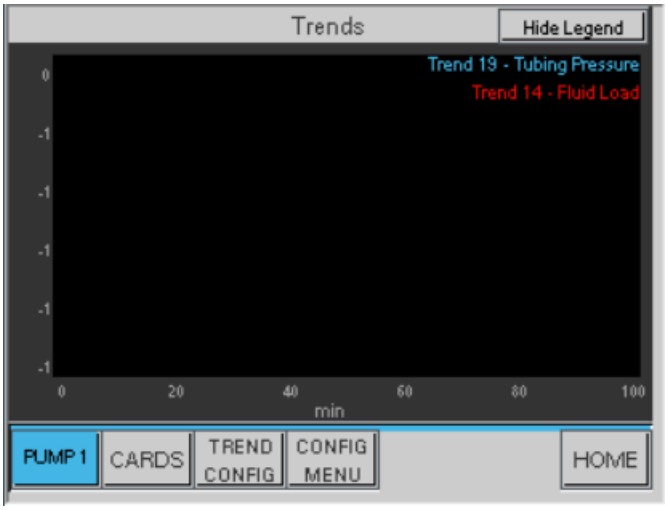
The parameters that are displayed are configured on the **Trend Configuration** screen.

15.2 Viewing Trends

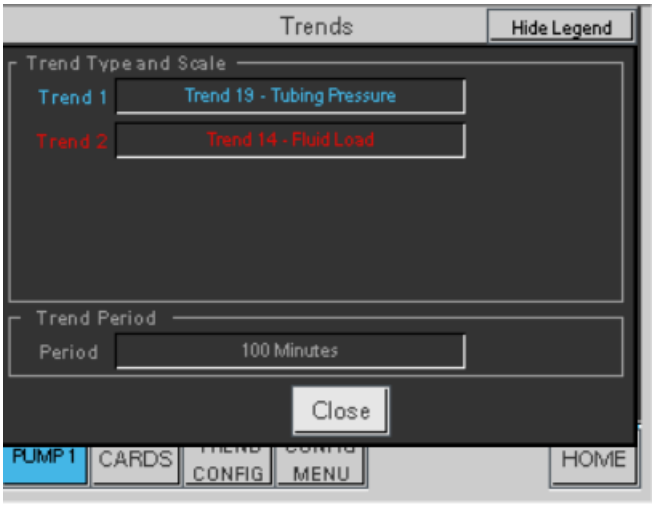
Realift Rod Pump records only significant changes in trends in the database. Therefore, if the current reading is not significantly different from the last recorded reading, the date and time listed under **Latest Data** are the date and time of the last significant change in the trend.

To view Trends

1. On the **Pump Overview** screen, press **TREND**.



2. Press **Trend Config**.



3. Select the trends to chart:

   a. Press the **Trend 1** field.

A keypad is displayed.

b. Press the up and down arrows to scroll through the parameters that can be displayed in the trend screen. For a list of the parameters available, see Real-Time Parameters Available for Trending 109.

c. Press the **Scale** field.

A keypad is displayed.

d. Enter the scale of the trend line to be charted.

e. If needed, repeat a to d to define another parameter to be displayed in the same trend screen.

4. Configure the time period that you want to view trends for:

a. Press the **Period** field.

A keypad is displayed.

b. Select the time period that you want to view trends for.

5. Press **Close**.

The trends you selected appear on the screen.

Parameters

- **Trend 1/2/3/4/5**
  - Specifies the parameter that you want to view the trend for
  - See Real-Time Parameters Available for Trending 109 for more information.
- **Scale**
  - A multiplier for the trend to allow the viewing of several trend lines with different values
  - Options:
    - x 1: Actual values are displayed
    - x 10: The values are multiplied by 10
- **Period**
  - Specifies the time period you want to view trends for
  - Options:
    - 100 minutes: The parameter values from the past 100 minutes are displayed in the Trend graph
    - 24 hours: The parameter values from the past 24 hours are displayed in the Trend graph
    - 100 days: The parameter values from the last 100 days are displayed in the Trend graph

15.3 Real-Time Parameters Available for Trending

You can select up to 5 of the following parameters to be displayed on the **Trends** screen.

- Gross Production Rate (bbl/day)
- Gross Production (bbl)
- Net Oil Production (bbl)
- Gas Production (MCF)
- VFD Mains Voltage (V)
- VFD DC Bus Voltage (V)
- VFD Frequency (Hz)
- Motor Torque (lbf)
- Motor Current (A)
- Motor Voltage (V)
- Motor Power (HP)
- Pump Speed (spm)
- Bottom Hole Pressure (psi)
- Pump Intake Pressure (psi)
- Fluid Height in Casing (ft)
- Counterbalance (lb)
- Fluid Load (lb/10)
- Belt Slippage (%)
- MPRL (lb/10)
- PPRL (lb/10)
- Pump Fillage (%)
- Runtime (min)
- Tubing Pressure (psi)
- Casing Pressure (psi)
- Spare A[1]
- Spare B[1]
- Spare C[1]
- Spare D[1]

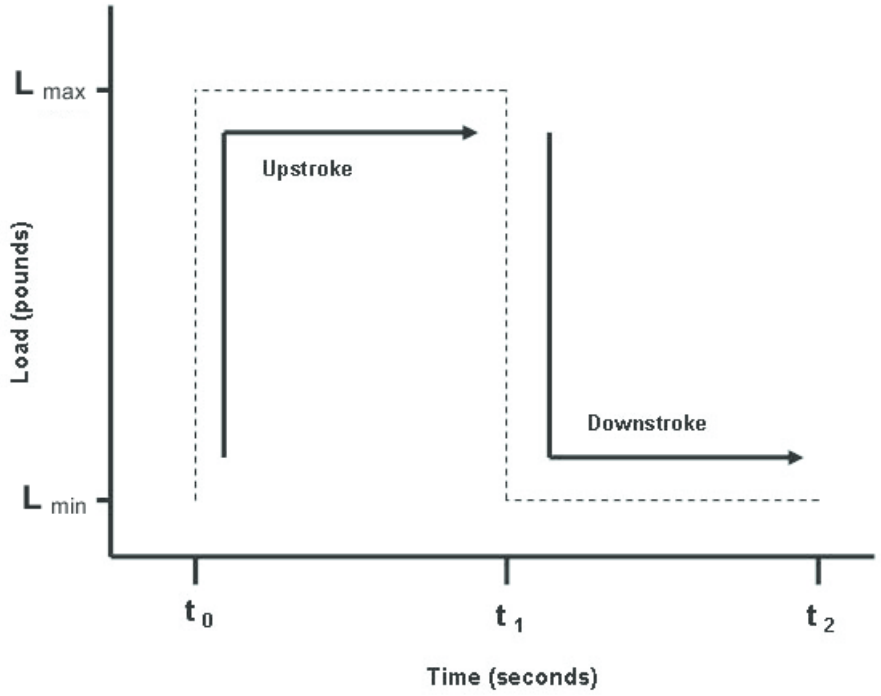
1- Configured names for Spare sensors do not appear in Trends.

16 Optimizing Operation with Dynacards

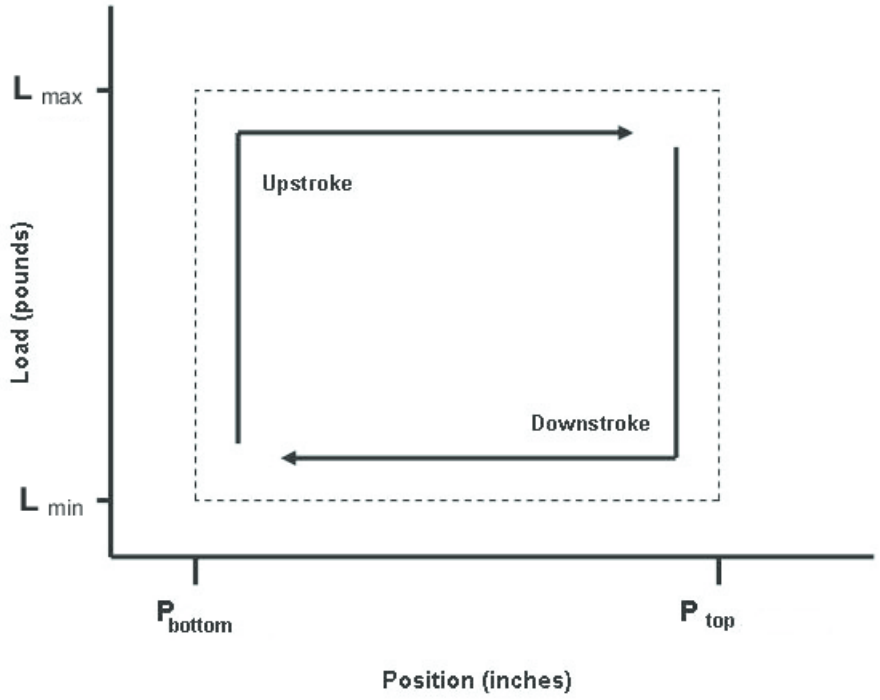
A dynacard is a graphical representation of the forces acting on the pump plunger as it moves upward and downward in the well, capturing and releasing fluid with each stroke. Surface and Downhole dynacards measure the load on the polished rod and this load is plotted in relation to the polished rod position as the pump moves through each stroke cycle. A complete stroke cycle is one up and down stroke.

The controller uses this data to create an x-y plot. By observing the graphs, you can collect information about the efficiency of your pump operation.

Rather than being a plot of Load vs. Time, as shown below,



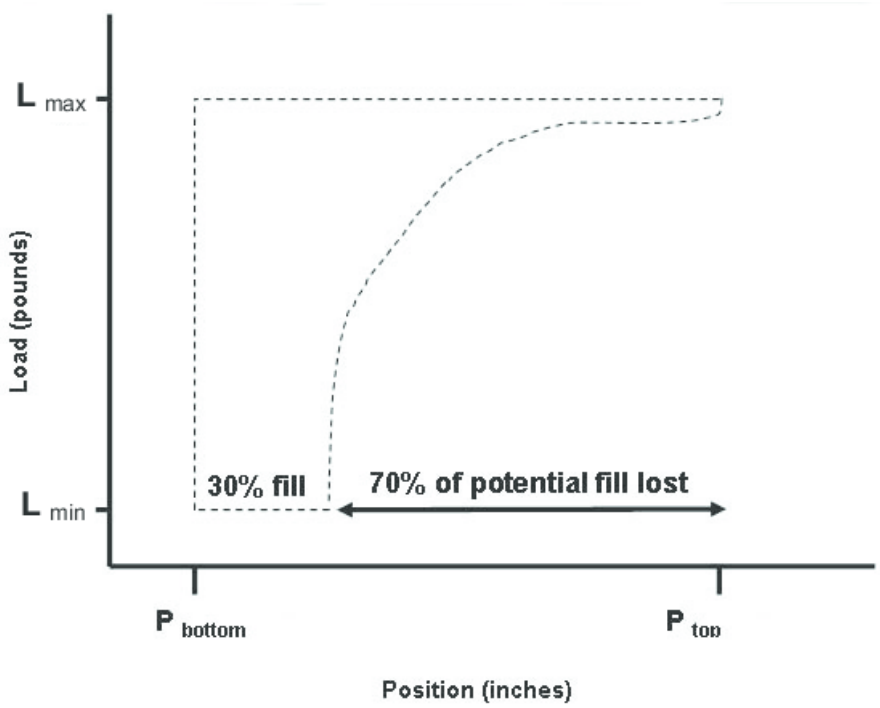
a dynacard is a plot of Load vs. Position, as shown below. The resulting shape is sometimes referred to as folded onto itself or a circular plot.



Ideally, the Realift RPC should have good fluid flow with valves working properly. The ideal card, as shown above, demonstrates the instantaneous increase in load from L_{min} to L_{max} as the pump plunger begins its upward stroke, the load remains constant as it travels to the top. As soon as the pump plunger starts back down, the load instantaneously falls back to L_{min} where it remains constant as the pump travels to its bottom position again.

If the traveling valve on the pump opens properly, the load falls instantly to L_{min} and remains constant for the entire downstroke (P_{top} to P_{bottom}) and fluid is transferred from the pump to the tubing. When the pump plunger reaches the bottom, the barrel is empty and the reciprocating motion of the pumpjack begins to lift the entire column of fluid up to the top again, causing more fluid to be pulled in from the reservoir through the standing valve.

When a condition such as low fluid level or trapped gas stops the traveling valve from opening properly as the plunger starts downward, transfer of the contents of the pump to the tubing does not begin at the top of the stroke. The fluid in the tubing descends with the traveling valve, maintaining the load at L_{max}, until fluid is encountered or the gas compresses enough to open the traveling valve. Only when the plunger re-immerses in the fluid can the traveling valve open and transfer of fluid through the traveling valve occur.



For more information, see:

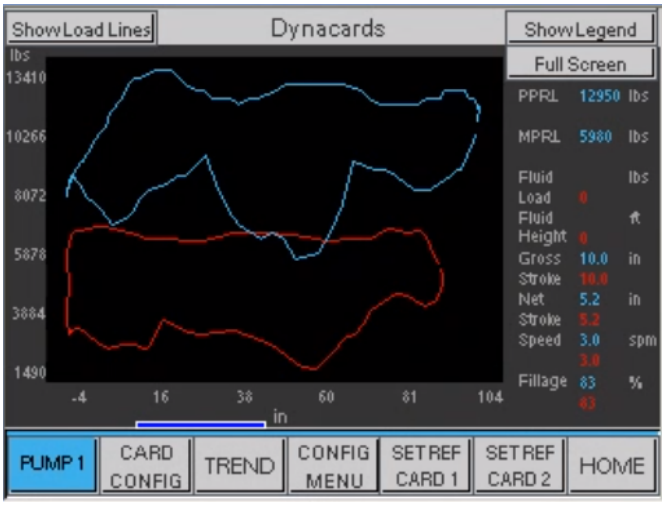
- Viewing Dynacards 113
- Automated Control Using Dynacards 116
- Reading Downhole cards 117
- Sample Downhole Card Shapes 118
- Reading surface cards 118

16.1 Viewing Dynacards

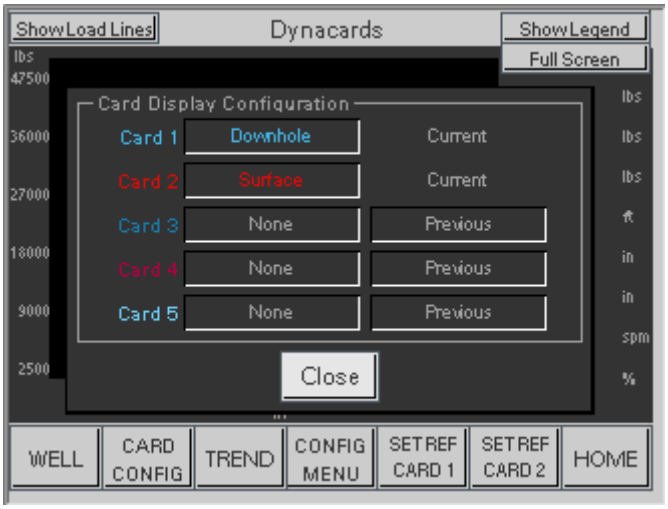
The Realift RPC can display up to five dynacards.

To view the Dynacards screens

1. On the **Pump Overview** screen, press **CARDS**.



2. Press **CARD CONFIG**.



3. Press the **Card 1** field.

   Controls are displayed that enable you to scroll through the available dynacards.

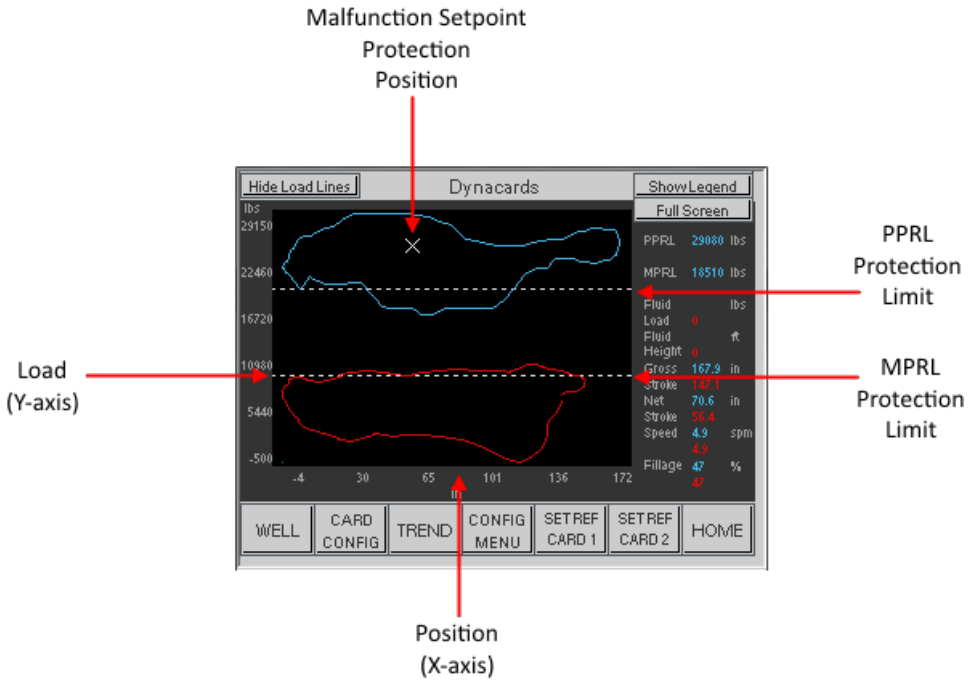
4. Select the dynacard you want to view and press **Enter**.
5. Press the **Period** field, if applicable.

   Controls are displayed that enable you to scroll through the available periods.

6. Select the period that you want to view and press **Enter**.
7. Repeat for each card you want to view, up to a maximum of five.

Dynacard graph layout

The figure below displays a dynacard example.



The graph format is the same for each dynacard provided on the **Dynacards** screen:

- The X (horizontal) axis displays the position in inches (in.)
- The Y (vertical) axis displays the load.

The PPRL and MPRL protection limits are indicated on the screen by two horizontal lines. The Malfunction Setpoint Protection position is indicated with an X.

The parameters that are displayed are configured on the **Card Display Configuration** screen.

Parameters

Dynacards

- **Show/Hide Load Lines**
  - o Displays or hides lines on the graph that indicate the PPRL and MPRL protection limits, and an X to indicate the Malfunction Setpoint Protection position.
- **Show/Hide Legend**
  - o Displays or hides the graph legend
- **Full Screen**
  - o Expands the Dynacard display to encompass the entire screen

- Press **Close** to exit Full Screen

- **CARD CONFIG**
  - Opens the **Card Display Configuration** window
- **SET REF CARD 1**
  - Saves the current downhole and surface cards as the Reference 1 Dynacards. These cards can be viewed later as the Reference 1 Dynacards.
  - This parameter is only applicable for Surface and Downhole cards.
- **SET REF CARD 2**
  - Saves the current downhole and surface cards as the Reference 2 Dynacards. These cards can be viewed later as the Reference 2 Dynacards.
  - This parameter is only applicable for Surface and Downhole cards.

Card Display Configuration

- **Card**
  - Specifies the dynacard type that you want to view
  - Options:
    - Surface
    - Downhole
    - Torque
- **Period**
  - Specifies the period for which you want to view the dynacard
  - This parameter is not applicable for Card 1 and Card 2, as they display the most recent dynacard
  - Options:
    - 100 Minutes
    - 24 Hours
    - 100 Days

16.2 Automated Control Using Dynacards

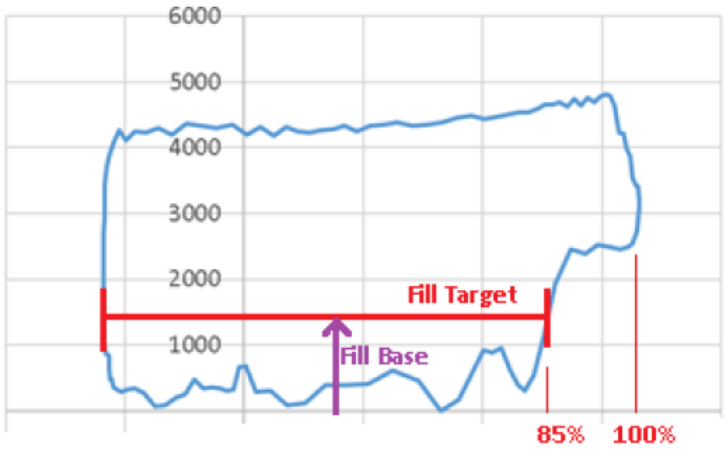
If you are using the Surface or Downhole control method, based on how much fluid there is in the well, the Realift RPC dynamically runs at the optimal Pump Speed.

- If the Pump Fill is greater than the Fill Target, Pump Speed is increased
- If the Pump Fill is less than the Fill Target, Pump Speed is decreased
- If speed decreases to Minimum Speed and Pump Fill continues to decrease from Target, Pump Speed is held at Minimum
- If Pump Fill is less than the minimum for Pump Off strokes, the unit will stop and will stay off until the Pump Off timer expires. The Pump Off timer for automatic control is the same timer as the Timed Mode Off timer.

Fill Base must be correctly set for the Realift RPC to correctly measure Pump Fill. Fill Base is the load percentage of the downhole card at which the Realift RPC, in the downstroke, starts to look for the slope change indicating plunger contact with fluid in the pump barrel. The adjustable fill base allows the Realift RPC to find accurate net stroke with a variety of unusual pump conditions.

See Controlling the Pump 78 for information on setting these parameters.

The default Fill Base of 30% is a good value for almost every application with very few exceptions. After using the Fill Base setting to measure Pump Fill, the Realift RPC then compares this measured Pump Fill with the Fill Target and uses the PID Control algorithm to control Pump Speed.

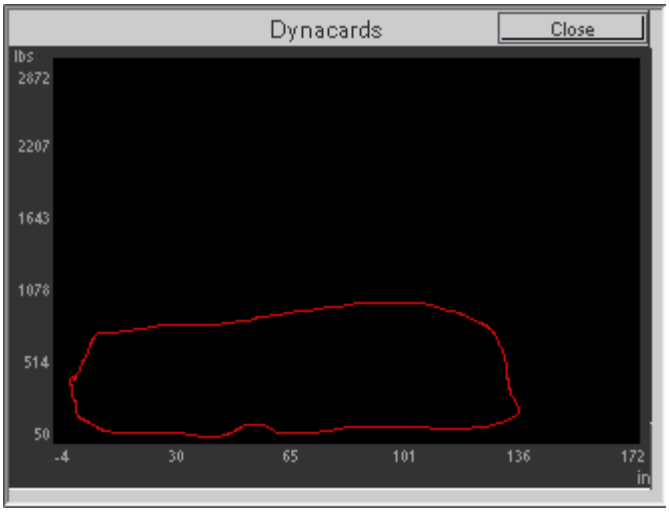


16.3 Reading Downhole Cards

Downhole control uses an advanced algorithm, employing Gibb's wave equation, to determine rod load at the bottom of the well. A Downhole card is a plot of Load vs Position at the load cell for one complete stroke that also corrects for rod stretching, flexing, and stress wave propagation.

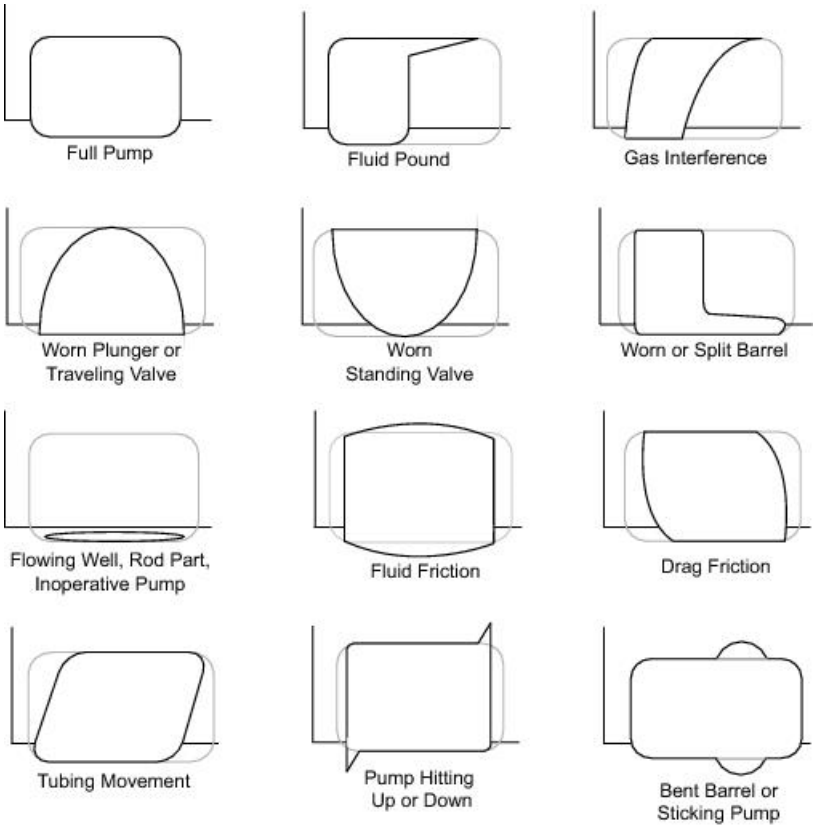
While acceptable well operation can be obtained by observing the surface load, the Downhole card is the preferred method to obtain optimal performance.

A Downhole card plot may resemble the plot shown in the figure below. Ideal Downhole cards have a roughly rectangular shape when the tubing is anchored. Downhole cards have a roughly parallelogram-like shape when the tubing is not anchored.



16.4 Sample Downhole Card Shapes

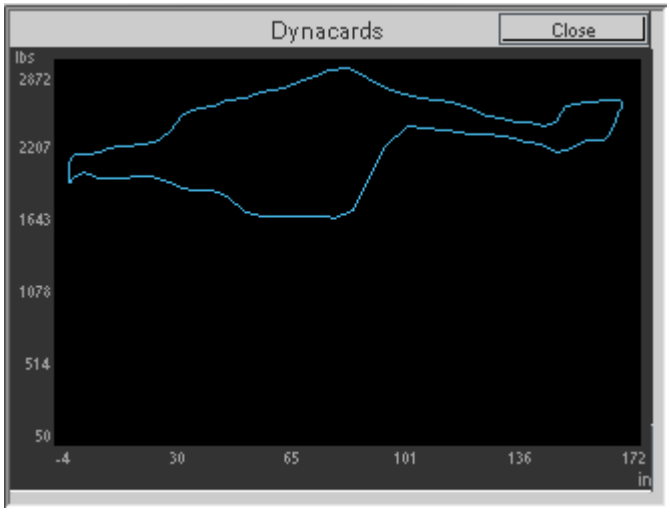
The figure below illustrates possible **Downhole** card shapes.



16.5 Reading Surface Cards

Surface control determines rod load at the surface of the well. A Surface card is a plot of Load vs Position at the load cell for one complete cycle. A Surface card plot can show the structure load and the rod load, but there may still be downhole problems that can affect the rod loads.

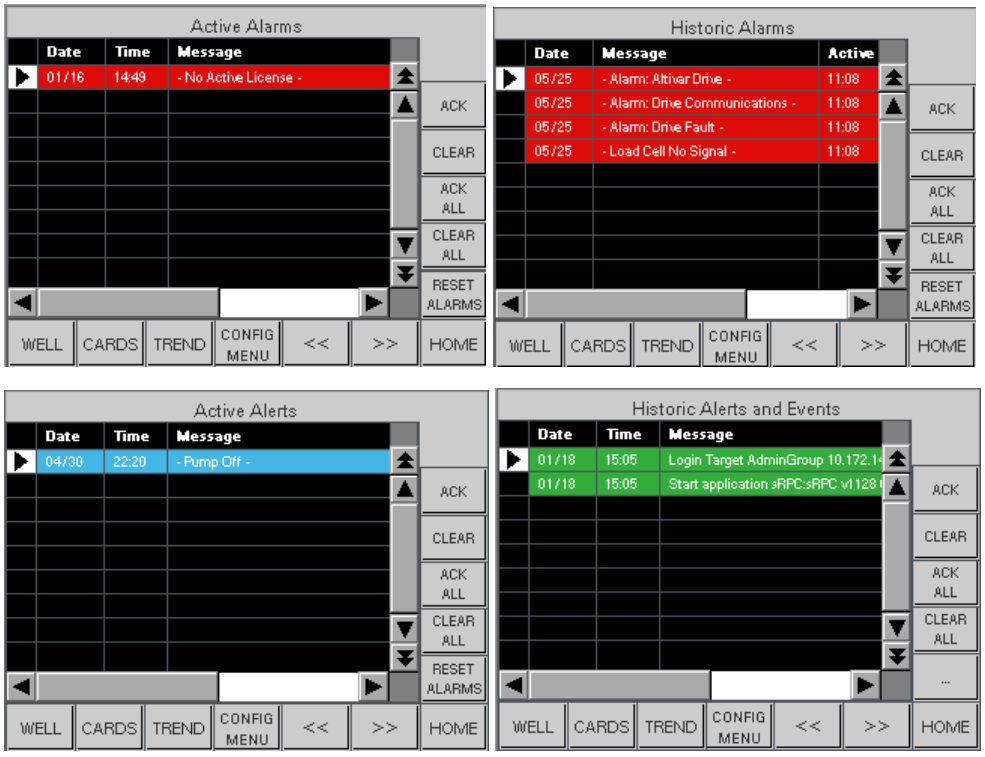
When viewing a **Surface** card, the plot may be similar to the **Surface** plot shown in the figure below.



17 Managing Alarms and Alerts

The **Alarm Summary** screens provide logs of alarms and faults. Active alarms are displayed on the active **Alarm Summary** screen. When the protection that caused the alarm returns to normal, the alarm is no longer displayed on the **Alarm Summary** screen and is now displayed on the **Historical Alarm Summary** screen.

- **Alarms**: Realift Rod Pump generates an alarm for each protection that is enabled when the measured value is outside of the limits defined for the protection. When an alarm is generated, it is added to the **Active Alarm Summary** screen in red.
- **Faults**: Realift Rod Pump generates a fault when the enabled protection has generated more than the defined number of alarms. When a fault is generated, it is added to the **Active Alert Summary** screen in red.



The following sections describe how to use the **Alarm Summary** screens.

See:

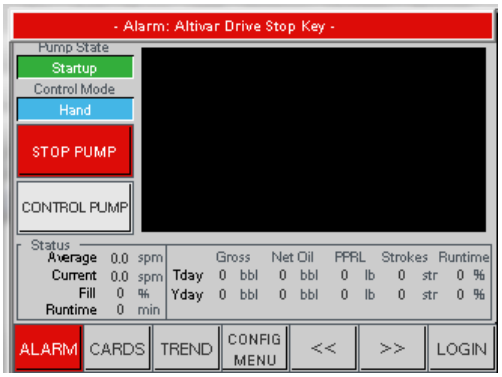
- Viewing Active and Historic Alarms and Events 120
- Using the Alarms and Alerts screens 121
- List of Alarms and Alerts 123

17.1 Viewing Active and Historic Alarms and Events

You can view and manage alarms, alerts, and events without stopping the pump and without logging in to Realift Rod Pump.

To access the alarm Summary screens when there is an active alarm

When an alarm or alert is active, a red **ALARM** button appears at the bottom of the screen and a banner describing the alarm or alert appears at the top, as shown below.



- On the **Pump Overview** screen, press **CONFIG MENU > Alarms and Alerts.**

To view historic alarms and events

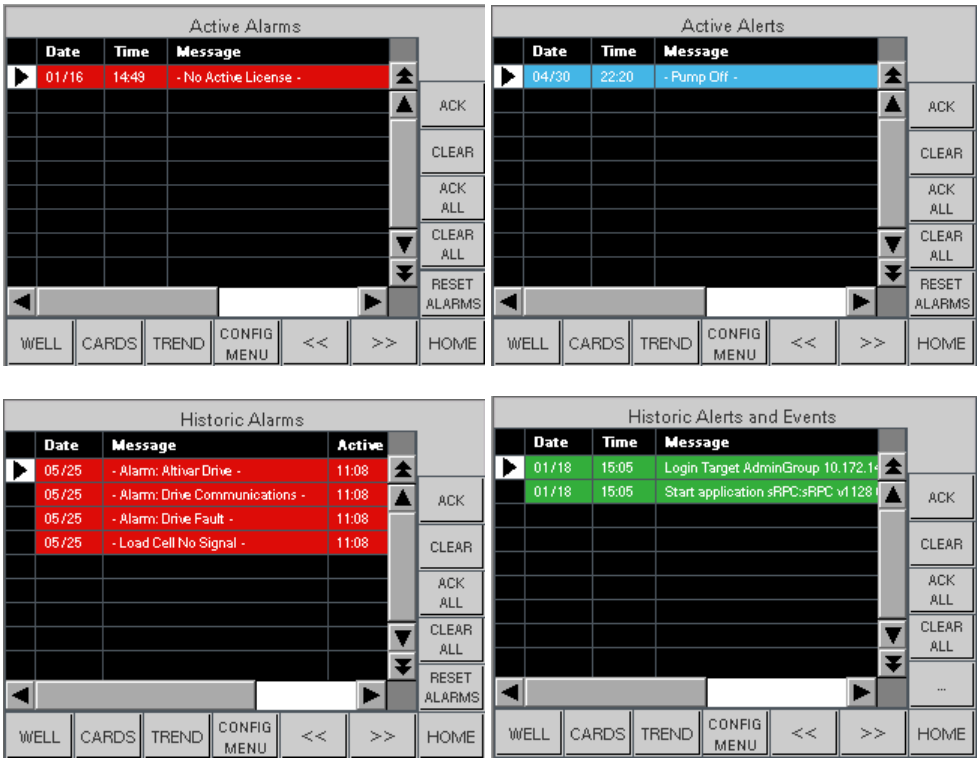
1. On the **Pump Overview** screen, press **CONFIG MENU > Alarms and Alerts**.

2. Press the **<<** and **>>** buttons to navigate to the alarm and alert summary screens.

   You can move the screen contents up and down or left and right by pressing the arrows in the scroll bars, or by pressing the white space in the scroll bars.

17.2 Using the Alarms and Alerts screens

The figures below show the Alarms and Alerts screens.



The following table describes the information contained on the **Alarms and Alerts** screens.

Column	Description
Date	The date the alarm or alert was detected
Time	The time the alarm or alert was detected
Message	A description of the alarm or alert
Active Time	The time the alarm or alert was active
ACK Time	The time the alarm or alert was acknowledged
RTN Time	The time the alarm or alert condition was removed

Alarms and alerts appear on the screen with different colors. The following table describes the Alarm and Alert colors.

Color	Description
Red	The alarm or alert is active and has not been acknowledged
Yellow	The alarm or alert has been acknowledged

Green	The alarm or alert has been cleared and the condition that caused the message is no longer present
Blue	The alert or event is active

To move the screen contents up and down or left and right, press the arrows in the scroll bars or press the white space in the scroll bars:

-  Moves the cursor to the top of the list of alarms or alerts
-  Moves the cursor up one entry in the list of alarms or alerts
-  Moves the cursor down one entry in the list of alarms or alerts
-  Moves the cursor to the bottom of the list of alarms or alerts
-  Scrolls the screen to the left
-  Scrolls the screen to the right

At the side of the Alarm Summary screens, there are the following additional options:

Button	Function	Description
	Acknowledge	Acknowledges the selected alarm or fault, indicating that you have read the message and are working to clear the condition that caused it.
	Clear	Clears the selected alarm. Cleared alarms no longer appear in the log.
	Acknowledge All	Acknowledges all alarms or alerts in the log.
	Clear All	Clears all alarms or alerts in the log.
	Reset Alarms	Resets the Alarms and Restart Counters on the RTU. Alarms are not cleared or acknowledged on the Magelis HMI. When Reset Alarms is active, the button is disabled and the text changes to "RESET ACTIVE." When the action is complete, the button unlocks and the text reverts to "RESET ALARMS."

17.3 List of Alarms and Alerts

Name	Type	Description

Altivar Drive	Alarm	The Altivar drive has reported a drive alarm or fault is active.
Drive Fault	Alarm	The VFD Fault input, DI2, is active indicating a drive fault.
Drive Communications	Alarm	There is no Modbus/RTU communication with the Altivar drive
No Active License or No Active Application	Alert	The SCADAPack x70 RTU is not licensed to run the RPC application, or no active application is on the SCADAPack x70 RTU
Load Cell No Signal	Alarm	The load cell input, AI0, is not reporting a load measurement.
Proximity Sensor No Signal	Alarm	While the pump is running, the proximity sensor has not reported a stroke within the previous 90 seconds.
Spare A High	Alarm	The Spare A protection has reported an alarm or fault.
Spare A Low	Alarm	The Spare A protection has reported an alarm or fault.
Spare B High	Alarm	The Spare B protection has reported an alarm or fault.
Spare B Low	Alarm	The Spare B protection has reported an alarm or fault.
Spare C High	Alarm	The Spare C protection has reported an alarm or fault.
Spare C Low	Alarm	The Spare C protection has reported an alarm or fault.
Spare D High	Alarm	The Spare D protection has reported an alarm or fault.
Spare D Low	Alarm	The Spare D protection has reported an alarm or fault.
Casing Pressure High	Alarm	The Casing Pressure protection has reported an alarm or fault.
Casing Pressure Low	Alarm	The Casing Pressure protection has reported an alarm or fault.
Tubing Pressure High	Alarm	The Tubing Pressure protection has reported an alarm or fault.
Tubing Pressure Low	Alarm	The Tubing Pressure protection has reported an alarm or fault.
Pressure Switch	Alarm	The Pressure Switch input, DI1, is active indicating an alarm or fault.

Malfunction Setpoint Load	Alarm	The Malfunction Point Load sensor has reported an alarm or fault.
Fluid Load High	Alarm	Following the previous stroke(s), the fluid load protection reported an alarm or fault.
Fluid Load Low	Alarm	Following the previous stroke(s), the fluid load protection reported an alarm or fault.
Belt Slip (Belt Slippage) High	Alarm	Following the previous stroke(s), the belt slippage protection reported an alarm or a fault.
Peak Polished Rod Level (PPRL) High	Alarm	Following the previous stroke(s), the (PPRL) protection reported an alarm or a fault.
Minimum Polished Rod Load (MPRL) High	Alarm	Following the previous stroke(s), the Minimum Polished Rod Load (MPRL) protection reported an alarm or a fault.
Pump Off	Alert	The Realift RPC is in a Pump Off state.

18 Configuration Management

Using the Configuration Management screen, shown below, you can:

- Save a well configuration
- Load a well configuration
- Apply Factory Default settings

NOTICE

DATA LOSS

Do not interrupt the data transfer while the USB drive is flashing.

Failure to follow these instructions can result in equipment damage.

NOTICE

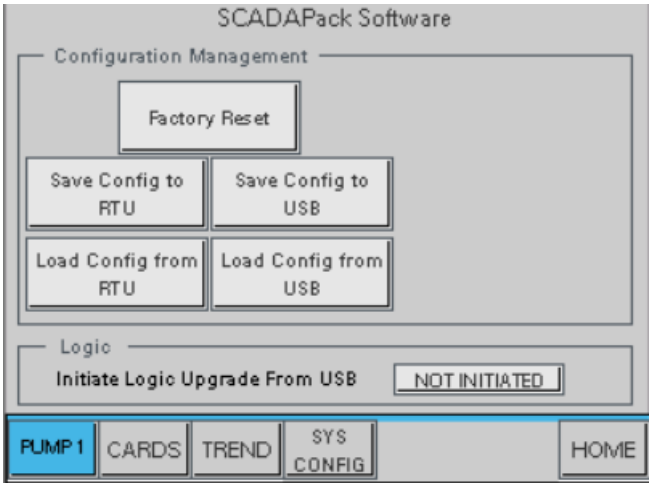
DATA LOSS

Do not interrupt the data transfer while the USB drive is flashing.

Failure to follow these instructions can result in equipment damage.

To access Configuration Management

- Press **CONFIG MENU > System Configuration > Configuration Management**.



To save a well configuration to the SCADAPack RTU

1. Press **Save Config to RTU**.
2. Press **Yes** to save the configuration.

The file will be saved on the RTU in the path /user/config.csv

To save a well configuration to a USB drive

1. Connect a FAT32 formatted USB drive to the SCADAPack RTU's device port.
2. Press **Save Config to USB**.
3. Press **Yes** to save the configuration.

   The file will be saved on the USB drive's root directory as config.csv

NOTICE

DATA LOSS

Well configuration data can be lost if you load a well configuration before saving your data.

Ensure that you have stored any data you want from the Realift RPC on an external device prior to loading a well configuration.

Failure to follow these instructions can result in lost data.

To load a well configuration from the SCADAPack RTU

1. Press **Load Config from RTU**.
2. Press **Yes** to load the configuration.

   The file will be loaded to the Realift RPC from the path /user/config.csv

To save a well configuration to a USB drive

1. Connect a FAT32 formatted USB drive to the SCADAPack RTU's device port.
2. Press **Load Config from USB**.
3. Press **Yes** to load the configuration.

   The file will be loaded to the Realift RPC from config.csv in the USB drive's root directory.

To apply Factory Default Settings

NOTICE

DATA LOSS

Applying the factory default settings to the Realift RPC configuration will delete any logged information stored on the Realift RPC's Magelis HMI and SCADAPack x70 device.

Ensure that you have stored any data you want from the Realift RPC on an external device prior to resetting it to factory settings.

Failure to follow these instructions can result in equipment damage.

1. Press **Apply Factory Default Settings**.
2. Press **Yes** to apply factory default settings.

To update logic using USB

You can update the Realift RPC application by loading it from a USB connected to the SCADAPack x70 RTU:

1. Copy **UPOC.RTZ** for the update to the root of a FAT32 formatted USB drive.
2. Insert the USB into the SCADAPack x70's USB port.
3. On the Magelis HMI, beside **Initiate Logic Upgrade From USB**, press the **Not Initiated** button to display **In Progress**.

19 Appendix A - Technical Details

The following information is provided:

19.1 Key Terms

The following table defines key terms used in this document.

Term	Expansion	Definition
ACK	Acknowledge	Recognition that an event has occurred.
API	American Petroleum Institute	A trade association that represents the USA's oil and natural gas industry.
BDC	bottom dead center	The position of minimum extension of a crank and a connecting rod, in which both are in the same straight line.
BHP	bottom hole pressure	The pressure measured at the pump intake.
BPS	bits per second	A measure used to show the average rate at which data is transferred between a computer and a data transmission system.
CW	clockwise	A motion that proceeds in the same direction as a clock's hands: from the top to the right, then down, then to the left, and back up to the top.
CCW	counter clockwise	A motion that proceeds in the opposite direction as a clock's hands: from the top to the left, then down, then to the right, and back up to the top.
DHCP	dynamic host configuration protocol	A client/server protocol that automatically provides an IP host with its IP address and other related configuration information, such as the subnet mask and default gateway.
ESD	emergency shut down	A system, usually independent of the main control system, that is designed to safely shut down an operating system.
ENA	energy adaptation	ENA System is a control profile designed for rotating machines with unbalanced load. It is used primarily for oil pumps.

GOR	gas oil ratio	The ratio of the volume of gas that comes out of solution to the volume of oil at standard conditions
HMI	human machine interface	The user interface in a manufacturing or process control system.
IP	internet protocol	The communications protocol of digital messages between computers across a single network or a series of interconnected networks.
kbps	kilobits per second	A measure of bandwidth representing thousands of bits per second.
MPRL	minimum polished rod load	The minimum load on the polished rod during upstroke.
PIP	pump intake pressure	The Pump Intake Pressure is calculated by utilizing the results of a dynamometer test, such as pump net lift (fluid loading), tubing pressure, tubing fluid gradient, pump run-in depth, and the area of a downhole pump.
PPRL	peak polished rod load	The maximum load on the polished rod during upstroke.
RTU	remote terminal unit	A microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA system by transmitting telemetry data to a client system, and by using messages from the client supervisory system to control connected objects.
SCADA	supervisory control and data acquisition	A system that monitors and controls industrial processes.
SG	specific gravity	The ratio of the density of a substance to the density of a reference substance.
STR	stroke	One complete round of the polished rod (surface stroke).
SPM	strokes per minute	The number of strokes the polished rod completes in one minute.
SRP	sucker rod pump	An artificial-lift pumping system using a surface power source to drive a downhole pump assembly.
TDC	top dead center	The position of maximum extension of a crank and a connecting rod, in which both are in the same straight line.

VFD	variable frequency drive	Used to control large electric motors by changing or maintaining the speed of the motor.

19.2 Measurement Units

Realift Rod Pump displays measurement values in imperial units.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Because Realift Rod Pump displays measurement values in imperial units, you may need to convert measurements to and from their metric equivalent.

Verify that values are entered in the appropriate measurement unit in Realift Rod Pump.

Failure to follow these instructions can result in equipment damage.

The following table summarizes the imperial measurement units used in Realift Rod Pump and provides the metric conversion.

Measurement Type	Imperial Measurement Unit	Metric Conversion
Area	square inches (in^2)	1 square inch (in^2) = 6.452 square centimeters (cm^2)
Density	grams per cubed centimeter (g/cm^3)	1 gram per cubed centimeter = 0.58 ounces per cubic inch (oz/in^3)
Diameter	inches (in)	1 inch (in) = 2.540 centimeters (cm)
Displacement	cubic inches (in^3)	1 cubic inch (in^3) = 16.387 cubic centimeters (cm^3)
Energy consumption	kilowatt hours (kWh)	1 kWh = 3.6 x 106 J; 1 kWh = 3412 BTU
Flow	barrels per day (bbl/d) barrels per 100 revolutions per minute (bbl/100 rpm)	1 barrel per day (bbl/d) = 0.159 cubic meters per day (m^3/d) 1 barrel per 100 revolutions per minute (bbl/100 rpm) = 0.159 meters cubed per 100 revolutions per minute (m^3/100 rpm)
Gas Volume	thousand cubic feet (MCF) standard cubic foot (SCF)	1 MCF = 28.3168 cubic meters (m^3) 1 SCF = 0.028 cubic meters (m^3)
Length/Depth	inches (in), feet (ft)	1 inch (in) = 2.540 centimeters (cm), 1 foot = 0.3048 meters (m)
Power	hydraulic horsepower	1 hydraulic horsepower (HP) = 0.745699872 kilowatts (kW)

Pressure	pounds per square inch (psi) megapounds per square inch (Mpsi)	1 pound per square inch (psi) = 6.894 kilopascals (kPa) 1 megapound per square inch (Mpsi) = 6894744.8 kilopascals (kPa)
Torque	foot pounds (lbf) inch pounds (in lb)	1 foot pound (lbf) = 1.356 Newton meters (Nm) 1 inch pound (in lb) = 0.1130 Newton meters (Nm)
Viscosity	centipoise (CP)	1 centipoise = 0.01 grams per centimeter-second
Volume	US barrels (bbl)	1 US barrel = 158.9873 liters (L)
Weight	pounds (lbs)	1 pound = 4.4482 Newtons (N)

19.3 User Privileges

The user privilege levels for each of the three types of users are described in the following table.

For each parameter, a user's privilege level can be:

- **Yes**: The user has the right to modify this parameter
- **No**: The user does not have the right to modify this parameter
- **Read-Only**: This parameter is displayed but cannot be modified

	Expert	**Admin**	**OP1**	**OP2**	**None**
Reset Protections	Yes	Yes	Yes	Yes	Yes
Well Configuration	Yes	Yes	Read-only	Read-only	Read-only
Update Expert password	Yes	No	No	No	Read-only
Update Admin password	Yes	Yes	No	No	Read-only
Update OP1 password	Yes	Yes	Yes	No	Read-only
Update OP2 password	Yes	Yes	No	Yes	Read-only
Trends	Yes	Yes	Yes	Yes	Yes

Drive Configuration	Yes	Yes	Read-only	Read-only	Read-only
Pump Configuration	Yes	Yes	Yes	Yes	Read-only
Sensors and Protections Configuration	Yes	Yes	Read-only	Read-only	Read-only
Counters and Timers	Yes	Yes	Read-only	Read-only	Read-only
Configuration management	Yes	Yes	Read-only	Read-only	Read-only

20 Appendix B - Installation Checklists

This topic provides the following installation checklists:

20.1 Preparing to Install Realift Rod Pump

Use this checklist to perform the Realift Rod Pump installation process.

General information

Checklist Item	Verification	
Are copies of the Realift Rod Pump Hardware Installation Manual, Configuration Manual, and wiring diagram available at the well site?	Y	N

Well information

Rod Taper Information (including Sinker Bars)					
Taper Number	**Material (steel or fiber)**	**Length (ft)**	**Diameter (in)**	**Weight (lbs/ft)**	**Modulus (Mpsi)**
1 (at the surface)					
2					
3					
4					
5					
6					

[1]Taper 1 is ground level.

[2]Weights for common rod sizes are listed in the Rod Pump Configuration Manual.

[3]The Modulus of Elasticity for steel is 30.5 Mpsi; the Modulus of Elasticity for fiberglass is 7.7 Mpsi.

Checklist Item	Verification	
Should the crank arm rotate clockwise (CW) or counter-clockwise (CCW) when viewed from the right-hand side?[1]	CW	CCW
What is the Stroke Length in inches?		in
What is the Pump Diameter in inches?		in
Is the pumping unit Conventional, Mark II, or Air-Balanced?		

[1]The Mark II always rotates CCW.

20.2 Assembling and Installing Hardware

Checklist item	Verification	
Have holes been created in the enclosure?	Y	N
Is the panel mounted?	Y	N
Is the proximity sensor installed and connected?	Y	N
Is a load cell installed and connected?	Y	N
Are any external sensors, such as a vibration, tank level sensor, bypass, or external fault, etc. properly connected?	Y	N
Are the enclosure components ready for power to be applied?	Y	N
Did you energize the enclosure after completing the installation?	Y	N

20.3 Generic Drive Configuration

Preparation

Checklist item	Verification	
Did you connect the laptop and establish a connection? (see the Realift Rod Pump Software Installation Manual)	Y	N
Did you resolve any Location and Pump ID conflicts? (see the Realift Rod Pump Commissioning Manual)	Y	N
Did you configure your VFD or motor controller?	Y	N

Configuration

Checklist item	Verification	
Did you connect the AO-0 to the speed input on the drive? (see Connecting a Drive 26)	Y	N
Did you connect the DO-1 to the forward control on the drive? (see Connecting a Drive 26)	Y	N
Did you connect the DO-3 to the external fault reset on the drive? (see Connecting a Drive 26)	Y	N
Did you verify that the digital ground on the SCADAPack x70 is connected to the drive digital ground (or signal return)?	Y	N
Did you connect the DI-2 to the Drive Status (Fault Condition) or drive (if drive feedback is available)? (see Connecting a Drive 26)	Y	N
Did you connect DI-12 to switch the Realift Rod Pump into or out of bypass mode (see SCADAPack Connections 22)?	Y	N
Did you connect DO-1 to a device that generates a start warning, which is generated before the rod pump starts (see SCADAPack Connections 22)?	Y	N
Did you connect DO-5 to a light or LED to indicate a sensor fault (see SCADAPack Connections 22)?	Y	N
Did you connect DO-7 to a device to indicate when the Realift Rod Pump is in pump off mode (see SCADAPack Connections 22)?	Y	N
Did you set Min Speed (speed at 0 or 4 mA)? (see the Realift Rod Pump Commissioning Manual)	Y	N

Did you set Max Speed (speed at 20 mA)? (see the Realift Rod Pump Commissioning Manual)	Y	N

20.4 Operational Test

Checklist item	Verification	
Did you test the HOA switch on your drive panel, if applicable?	Y	N
Did you set Run Pump to Enable?	Y	N
Did the pump rotate in the correct direction?	Y	N
Did the pump rotate in reverse?	Y	N
Did the pump rotate through a complete stroke?	Y	N
Did the pump rotate in the correct direction when tested in Bypass mode?	Y	N
Does the run light come on when the pump is running?	Y	N
Does the pump stop when remote disable is true?	Y	N
Does the pump stop when external fault is true?	Y	N

21 Appendix C - Commissioning Checklists

The topics in this section provide checklists for:

21.1 Security and Communications

Security

Checklist Item	Verification	
Did you update the passwords for the Magelis HMI?	Y	N
Did you install a lock on the Realift RPC panel?	Y	N

Communications

Checklist Item	Verification	
If you updated the IP addresses of the Magelis HMI and Realift RPC, did you confirm the devices are still communicating with each other?	Y	N
Have you verified your modem, radio, or network can communicate with the Realift RPC?	Y	N
Have you applied network security?	Y	N

21.2 Drive Configuration

Checklist Item	Verification	
Did you verify that the pumpjack moves in the correct direction when the drive is on?	Y	N
Did you verify the drive stops when the Realift RPC stops the pump?	Y	N
Did you verify the Realift RPC records a fault when the drive issues an alarm?	Y	N

Did you verify the Realift RPC can reset alarms on the drive?	Y	N
Did you verify you are receiving speed and torque feedback?	Y	N
Have you set protections such as torque on your VFD?	Y	N
Have you tested your bypass contactor?	Y	N

21.3 Well and Pumping Unit

Checklist Item	**Verification**	
Did you select the correct load cell size and type?	Y	N
Did you select the correct position and sensor type?	Y	N
Have you confirmed the proximity angle?	Y	N
Did you select the correct pumpjack model?	Y	N
Did you confirm the API dimensions? This is especially important when using configurable pumpjacks.	Y	N
Did you confirm the downhole configuration?	Y	N
Have you entered production and fluid configuration?	Y	N
Did you test the standing valve leakage, traveling valve leakage, and counterbalance?	Y	N

21.4 Control

Checklist Item	**Verification**	
If using surface or downhole control, did you configure timed fallback control?	Y	N
Have you selected your control method?	Y	N
Have you configured your deadband, control strokes, pump off time, and fill base?	Y	N
Have you configured power cycle management?	Y	N
Have you configured your start warning time and device?	Y	N
If you have heavy oil, have you configured and tested the floating rod control?	Y	N

21.5 Sensors and Protections

Checklist Item	Verification	
Have you enabled any alarms?	Y	N
Have you enabled any alerts?	Y	N
Have you considered if your pump should automatically restart after an alarm occurs?	Y	N
Have you confirmed you are receiving load cell data?	Y	N
Have you verified you are receiving position data?	Y	N
Have you confirmed other sensors such as the pressure switch or casing pressure sensor are providing data?	Y	N

21.6 Final Steps

Checklist Item	Verification	
Did you verify you can start and stop the pump?	Y	N
Did you verify the pump runs at the expected speed?	Y	N
Did you observe a normal pump-off cycle?	Y	N
Did you assess the shape of the dynacard?	Y	N
Did you verify the operation of your protections?	Y	N
Have you confirmed data such as gearbox torque, imbalance, and inferred production?	Y	N
Did you save and backup your configuration?	Y	N

22 Appendix D - Communications Map and Third Party Registers

See:

22.1 Communications Map

NOTICE

UNINTENDED EQUIPMENT OPERATION

Before using the information provided in the communications map below, ensure that you have applied appropriate network security to prevent unauthorized access to Realift RPC.

Failure to follow these instructions can result in equipment damage.

The table below provides details about the parameters used in Realift Rod Pump.

The Point # column is the DNP3 point number in the header bit.

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Syst.Config.iActiveWell	BYTE	0	20001	420001	0	Well	Reserved
Syst.Config.iCommand	BYTE	1	20001	420001	0		Saves or loads well configuration from file Min: 0 Max: 3 Default: 0
Syst.Config.iCardSource_01	BYTE	0	20002	420002	0	eCardSource	Controls dynacard displayed in buffer 1. Min: 0 Max: 3 Default: 0
Syst.Config.iCardSource_02	BYTE	1	20002	420002	0	eCardSource	Controls dynacard displayed in buffer 2. Min: 0 Max: 3 Default: 0
Syst.Config.iTrendSource_01	BYTE	0	20003	420003	0	eCardSource	Controls trend displayed in buffer 1. Min: 0

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
							Max: 3 Default: 0
Syst.Config.iTrendSource_02	BYTE	1	20003	420003	0	eCardSource	Controls trend displayed in buffer 2. Min: 0 Max: 3 Default: 0
Syst.Config.iSerialBaudRate	BYTE	0	20004	420004	0	eBaudrate	Serial 3 baud rate Min: 0 Max: 3 Default: 0
Well[0].Config.Altivar.bENA_Enabled	BOOL	0	20010	420010	0	T/F	
Well[0].Config.Altivar.bProtInputPhase	BOOL	1	20010	420010	0	T/F	
Well[0].Config.Altivar.bProtMotorThermal	BOOL	2	20010	420010	0	T/F	
Well[0].Config.Altivar.bProtOutputPhase	BOOL	3	20010	420010	0	T/F	
Well[0].Config.Altivar.bProtOvertemp	BOOL	4	20010	420010	0	T/F	
Well[0].Config.Altivar.bProtTorque	BOOL	5	20010	420010	0	T/F	
Well[0].Config.Altivar.bRatedFrequency	BOOL	6	20010	420010	0	T/F	TRUE if rated frequency is NOT 60 Hz (NEMA), FALSE if 50 Hz (IEC) Default: 1
Well[0].Config.Altivar.iAccelerationTime	BYTE	0	20011	420011	0	sec x 0.1	Min: 0 Max: 250 Default: 100
Well[0].Config.Altivar.iDecelerationTime	BYTE	1	20011	420011	0	sec x 0.1	Min: 0 Max: 250 Default: 100
Well[0].Config.Altivar.iENA_IntegralGain	BYTE	0	20012	420012	1	Gain	0..9999 on ATV

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
							Min: 0 Max: 254 Default: 100
Well[0].Config.Altivar.iENA_ProportionalGain	BYTE	1	20012	420012	1	Gain	0..9999 on ATV Min: 0 Max: 254 Default: 100
Well[0].Config.Altivar.iProtHighTorque	BYTE	0	20013	420013	1	%	low torque .. 300 on ATV Min: 0 Max: 30 Default:10
Well[0].Config.Altivar.iProtHighTorqueDelay	BYTE	1	20013	420013	2	sec	scaled to 0..9999 ms on ATV Min: 1 Max: 99 Default: 1
Well[0].Config.Altivar.iProtModbusAction	BYTE	0	20014	420014	0	eMB_Action	Min: 0 Max: 4 Default: 1
Well[0].Config.Altivar.iProtModbusFallbackSpeed	BYTE	1	20014	420014	1	Hz	scaled to 0.0...599.0 Hz on ATV Min: 0 Max: 60 Default: 0
Well[0].Config.Altivar.iProtMotorThermalLevel	BYTE	0	20015	420015	0	A	Default depends on drive size, 20 to 110% of drive rated current Min: 0 Max: 118 Default: 118
Well[0].Config.Altivar.iProtOutputPhaseTime	BYTE	1	20015	420015	0	sec	scaled to 0.5 to 10 s on ATV Min: 5 Max: 100 Default: 10

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.Altivar.iProtOvertempLevel	BYTE	0	20016	420016	0	%	Min: 0 Max: 118 Default: 100
Well[0].Config.Altivar.iProtUndervoltageTime	BYTE	1	20016	420016	2	sec	scaled to 0.2..999.9 on ATV Min: 1 Max: 250 Default: 1
Well[0].Config.Altivar.iHOA_Config	INT		20017	420017	2	sec	scaled to 0.2..999.9 on ATV Min: 1 Max: 250 Default: 1
Well[0].Config.Drive.iMaximumFrequency	BYTE	0	20018	420018	1	Hz	high speed on atv scaled to 10.0…599.0 on ATV Min: 10 Max: 250 Default: 50
Well[0].Config.Drive.iRatedSpeed	BYTE	1	20018	420018	0	%	scaled to 10.0...599.0 Hz on ATV Min: 10 Max: 250 Default: 100
Well[0].Config.Drive.iRatedCurrent	BYTE	0	20019	420019	0	A	Rated motor current Min: 0 Max: 250 Default: 0
Well[0].Config.Drive.iRatedPower	BYTE	1	20019	420019	0	kW/HP	Rated motor power Min: 0 Max: 250 Default: 0
Well[0].Config.Drive.iRatedVoltage	BYTE	0	20020	420020	0	V x 10	rated motor voltage in units of 10s of volts Min: 1 Max: 99 Default: 0

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.Drive.iType	BYTE	1	20020	420020	0	eDriveType	1 = Altivar Modbus 2 = Generic 0-20mA 3 = Generic 4-20mA 4 = Starter Contactor (Default)
Well[0].Config.Drive.iAbsoluteMaxFrequency	INT		20021	420021	0	Hz	max frequency on ATV Min: 0 Max: 251 Default: 90
Well[0].Config.Fill.iDeadband	BYTE	0	20022	420022	0	%	Min: 0 Max: 100 Defaullt: 5
Well[0].Config.Fill.iFillControlLevel	BYTE	1	20022	420022	0	%	When in downhole, or surface control, the change in pump fillage required to change pump speed Min: 0 Max: 100 Default: 30
Well[0].Config.Fill.iFillMinimum	BYTE	0	20023	420023	0	%	Min: 0 Max: 100 Default: 85
Well[0].Config.Fill.iFillTarget	BYTE	1	20023	420023	0	%	Min: 0 Max: 100 Default: 95
Well[0].Config.Fill.iSpeedChangeCount	BYTE	0	20024	420024	0	strokes	Min: 0 Max: 255 Default: 3
Well[0].Config.Fill.iSpeedMax	BYTE	1	20024	420024	1	spm	Min: 0.1 Max: 20 Default: 70
Well[0].Config.Fill.iSpeedMin	BYTE	0	20025	420025	1	spm	Min: 0.1 Max:15 Default: 30

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.Production.iGaugeOffTime	BYTE	0	20026	420026	0	Hr	Min: 0 Max: 23 Default: 0
Well[0].Config.Production.iPumpEfficiency	BYTE	0	20027	420027	0	%	Min: 1 Max: 100 Default: 1000
Well[0].Config.Production.iWaterCut	BYTE	1	20027	420027	0	%	Min: 0 Max: 100 Default: 0
Well[0].Config.Production.iGasOilRatio	INT		20028	420028	1	SPF:bbl	Min: 1 Max: 1000 Default: 1000
Well[0].Config.Production.iGravityOil	INT		20029	420029	2	g/cm3	Min: 0 Max: 9999 Default: 876
Well[0].Config.Production.iGravityWater	INT		20030	420030	2	g/cm3	Min: 0 Max: 9999 Default: 1000
Well[0].Config.Production.iFluidViscosity	INT		20033	420033	0	CP x 100	Determined in counterbalance test Min: 0 Max: 32000 Default: 1000
Well[0].Config.Production.iPumpDiameter	INT		20031	420031	0	T/F	reserved
Well[0].Config.Production.iPumpPlungerSealLength	INT		20032	420032	0	in x 10	Determined in counterbalance test Min: 0 Max: 32000 Default: 0
Well[0].Config.Production.iPumpPlungerClearance	INT		20034	420034	0	in x 1000	Determined in counterbalance test Min: 0

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
							Max: 32000 Default: 0
Well[0].Config.Protections[13].bAlarmEnableHigh	BOOL	0	20035	420035	0	T/F	
Well[0].Config.Protections[13].bAlarmEnableLow	BOOL	1	20035	420035	0	T/F	
Well[0].Config.Protections[13].bAlertEnableHigh	BOOL	2	20035	420035	0	T/F	
Well[0].Config.Protections[13].bAlertEnableLow	BOOL	3	20035	420035	0	T/F	
Well[0].Config.Protections[13].bAutoRestart	BOOL	4	20035	420035	0	T/F	
Well[0].Config.Protections[13].bClearAlarm	BOOL	5	20035	420035	0	T/F	
Well[0].Config.Protections[13].iAlarmDelayHigh	BYTE	0	20048	420048	0	sec/strokes	Min: 0 Max: 255 Default: 5
Well[0].Config.Protections[13].iAlarmDelayLow	BYTE	1	20048	420048	0	sec/strokes	Min: 0 Max: 255 Default: 5
Well[0].Config.Protections[13].iCountLimitHigh	BYTE	0	20061	420061	0	counts	Min: 0 Max: 255 Default: 5
Well[0].Config.Protections[13].iCountLimitLow	BYTE	1	20061	420061	0	counts	Min: 0 Max: 255 Default: 5
Well[0].Config.Protections[13].iStartDelayHigh	BYTE	0	20074	420074	0	sec/strokes	Min: 0 Max: 255 Default: 5
Well[0].Config.Protections[13].iStartDelayLow	BYTE	1	20074	420074	0	sec/strokes	Min: 0 Max: 255 Default: 5

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.Protections[13].iAutoRestartTime	INT		20087	420087	0	sec	Time between auto restarts in seconds Min: 0 Max: 32000 Default: 3600
Well[0].Config.Protections[13].iDebounce	INT		20100	420100	0	sec/strokes	Min: 0 Max: 3600 Default: 10
Well[0].Config.Protections[13].iThresholdHigh	INT		20113	420113	0		Units Depend on Sensor Min: 0 Max: 32000 Default: 10
Well[0].Config.Protections[13].iThresholdLow	INT		20126	420126	0		Units Depend on Sensor Min: 0 Max: 32000 Default: 10
Well[0].Config.PumpJack.iAPI_Model	BYTE	0	20139	420139		eAPI	Pumpjack type Min: 0 Max: 2 Default: 0
Well[0].Config.PumpJack.iLengthOverride	INT		20140	420140	1	in	Stroke length if entered manually Min: 0 Max: 32000 Default: 0
Well[0].Config.PumpJack.iA	INT		20141	420141	1	in	Min: 1 Max: 1000 Default: 1
Well[0].Config.PumpJack.iC	INT		20142	420142	1	in	Min: 1 Max: 1000 Default: 1
Well[0].Config.PumpJack.iI	INT		20143	420143	1	in	Min: 1 Max: 1000

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
							Default: 1
Well[0].Config.PumpJack.iK	INT		20144	420144	1	in	Min: 1 Max: 1000 Default: 1
Well[0].Config.PumpJack.iP	INT		20145	420145	1	in	Min: 1 Max: 1000 Default: 1
Well[0].Config.PumpJack.iR	INT		20146	420146	1	in	Min: 1 Max: 1000 Default: 1
Well[0].Config.PumpJack.iCounterbalance	INT		20147	420147	0	lbs	Determined in counterbalance test Min: 0 Max: 32000 Default: 0
Well[0].Config.PumpJack.iStructuralImbalance	INT		20148	420148	0	lbs	Specified by pumpjack manufacturer Min: 0 Max: 32000 Default: 0
Well[0].Config.PumpJack.iCounterbalanceAngle	INT		20149	420149	0	lbs	Determined in counterbalance test Min: 0 Max: 32000 Default: 0
Well[0].Config.PumpJack.iGearBoxRatio	INT		20150	420150	3	RATIO	Gearbox Ratio Min: 1 Max: 1000 Default: 1
Well[0].Config.RodFloat.iAlpha	BYTE	0	20151	420151	0	Alpha	Floating Rod Min: 1 Max: 255 Default: 1

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.RodFloat.iMinSpeed	BYTE	1	20151	420151	0	Hz	Floating Rod Min: 1 Max: 255 Default: 1
Well[0].Config.RodFloat.iTimeConstant	BYTE	0	20152	420152	0	msec	Floating Rod Min: 1 Max: 255 Default: 1
Well[0].Config.RodFloat.iLoadLimit	INT		20153	420153	-1	lbs	Floating Rod
Well[0].Config.Sensors[6].iScale	BYTE	0	20154	420154	0	Scale	Decimal places of sensor (ie 1 = 0.1, -1 = 10) Min: -5 Max: 5 Default: 0
Well[0].Config.Sensors[6].iSource	BYTE	1	20154	420154	0	eSOURCE	AI, DI, Register, Constant Min: 0 Max: 6 Default: 0
Well[0].Config.Sensors[6].iCalibrate20mA	INT		20160	420160	0	mA	If source AI Min: 0 Max: 32000 Default: 20
Well[0].Config.Sensors[6].iCalibrate4mA	INT		20166	420166	0	mA	If source AI Min: 0 Max: 32000 Default: 4
Well[0].Config.Sensors[6].iMapping	INT		20172	420172	0	DNP	Source of sensor data, DNP point number if register, or AI or DI if physical I/O Min: 0 Max: 32000 Default: 0

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.Tapers[6].iDiameter	INT		20178	420178	2	in	Min: 0 Max: 1000 Default: 1000
Well[0].Config.Tapers[6].iLength	INT		20184	420184	0	ft	Min: 1 Max: 32000 Default: 1000
Well[0].Config.Tapers[6].iModulus	INT		20190	420190	1	MPSI	Min: 1 Max: 32000 Default: 305
Well[0].Config.Tapers[6].iSpeedOfSound	INT		20196	420196	0	ft/sec	Min: 1 Max: 32000 Default: 1
Well[0].Config.Tapers[6].iWeight	INT		20202	420202	2	lbs/ft	Min: 1 Max:32000 Default: 100
Well[0].Config.Timed.iOffTime	INT		20208	420208	0	min	Min: 0 Max: 32000 Default: 15
Well[0].Config.Timed.iOffTimeMax	INT		20209	420209	0	min	Min: 0 Max: 32000 Default: 60
Well[0].Config.Timed.iOffTimeMin	INT		20210	420210	0	min	Min: 0 Max: 32000 Default: 15
Well[0].Config.Timed.iOnTime	INT		20211	420211	0	min	Min: 0 Max: 32000 Default: 15
Well[0].Config.ValveTest.iMode	BYTE	0	20212	420212	0	eValveMode	Reserved Min: 0 Max: 1 Default: 1

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.ValveTest.iTestTime	BYTE	1	20212	420212	2	sec	Reserved Min: 0 Max: 320 Default: 100
Well[0].Config.ValveTest.iLoadChange	INT		20213	420213	-1	lbs	Reserved Min: 0 Max: 320 Default: 5000
Well[0].Config.ValveTest.iLeakageStanding	INT		20214	420214			Default: 0
Well[0].Config.ValveTest.iLeakageTraveling	INT		20215	420215			Default: 0
Well[0].Config.bAutoAdjustTime	BOOL	0	20216	420216	0	T/F	Default: 0
Well[0].Config.bClockWise	BOOL	1	20216	420216	0	T/F	Default: 0
Well[0].Config.bDisablePowerCycleRestart	BOOL	2	20216	420216	0	T/F	Default: 0
Well[0].Config.bFallbackTimed	BOOL	3	20216	420216	0	T/F	Default: 1
Well[0].Config.bPositionActiveLow	BOOL	4	20216	420216	0	T/F	Default: 2
Well[0].Config.bLoadCell50K	BOOL	5	20216	420216	0	T/F	Default: 0
Well[0].Config.bLowProductionWell	BOOL	6	20216	420216	0	T/F	Default: 0
Well[0].Config.bRodFloat	BOOL	7	20216	420216	0	T/F	Default: 0
Well[0].Config.bUseAPI	BOOL	8	20216	420216	0	T/F	Default: 0
Well[0].Config.bUseAutoStartSpeed	BOOL	9	20216	420216	0	T/F	Default: 0
Well[0].Config.bWellSimulator	BOOL	10	20216	420216	0	T/F	Reserved

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.bWirelessLoadCell	BOOL	11	20216	420216	0	T/F	Reserved
Well[0].Config.iPreControlCount	BYTE	0	20217	420217	0	strokes	Min: 0 Max: 999 Default: 0
Well[0].Config.iPumpOffCount	BYTE	1	20217	420217	0	strokes	Min: 0 Max: 999 Default: 0
Well[0].Config.iPumpJackNumber	INT		20218	420218	1		Reserved
Well[0].Config.iDampingFactor	INT		20219	420219	2		Min: 0 Max: 32000 Default: 5
Well[0].Config.iPositionAngle	INT		20220	420220	0	deg	Proximity Switch Angle Min: 0 Max: 359 Default: 0
Well[0].Config.iPowerCycleDelay	INT		20221	420221	0	min	Min: 0 Max: 1440 Default: 0
Well[0].Config.iRodStringCount	INT		20222	420222	0	count	Min: 1 Max: 6 Default: 1
Well[0].Config.iStuffingBoxFriction	INT		20223	420223	0	lbs	Min: 0 Max: 32000 Default: 100
Well[0].Config.iTubingAnchorDepth	INT		20224	420224	-1	ft	Min: 0 Max: 32000 Default: 0
Well[0].Config.iTubingSize	INT		20225	420225	2	in	Min: 1 Max: 32000 Default: 100

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Config.iSpeedFeedback	BYTE	0	20226	420226	0		
Well[0].Config.iStartWarningTime	BYTE	1	20226	420226	0	sec	Min: 0 Max: 3600 Default: 0
Well[0].Control.bAlarmReset	BOOL	0	20250	420250	0	T/F	
Well[0].Control.bCalibrateProx	BOOL	1	20250	420250	0	T/F	
Well[0].Control.bCounterReset	BOOL	2	20250	420250	0	T/F	
Well[0].Control.bFactoryReset	BOOL	3	20250	420250	0	T/F	
Well[0].Control.bReadDriveConfiguration	BOOL	4	20250	420250	0	T/F	
Well[0].Control.bSaveReferenceCard1	BOOL	5	20250	420250	0	T/F	
Well[0].Control.bSaveReferenceCard2	BOOL	6	20250	420250	0	T/F	
Well[0].Control.bTotalizerTimerReset	BOOL	7	20250	420250	0	T/F	
Well[0].Control.bWriteDriveConfiguration	BOOL	8	20250	420250	0	T/F	
Well[0].Control.bWellEnabled	BOOL	9	20250	420250	0	T/F	
Well[0].Control.bCalibrateProxAngle	BOOL	10	20250	420250	0	T/F	
Well[0].Control.bCounterResetRods	BOOL	11	20250	420250	0	T/F	
Well[0].Control.bCounterResetPump	BOOL	12	20250	420250	0	T/F	
Well[0].Control.bLoadConfig	BOOL	13	20250	420250	0	T/F	

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Control.bSaveConfig	BOOL	14	20250	420250	0	T/F	
Well[0].Control.bLoadPumpjack	BOOL	15	20250	420250	0	T/F	Reserved
Well[0].Control.iHandSpeed	BYTE	0	20251	420251	1	spm	Min: 0 Max: 9000 Default: 0
Well[0].Control.iMode	BYTE	1	20251	420251	0	eMODE	Min: 0 Max: 3 Default: 0
Well[0].Control.iAnalytic	INT		20252	420252	0		Reserved
Well[0].Control.blnitialFactoryResetComplete	BOOL	0	20262	420262	0	T/F	Reserved
Well[0].Control.bDemoMode	BOOL	1	20262	420262	0	T/F	Reserved
PhysIO.PhsyIO.bDigitalInputs	BOOL		1000		0	T/F	
PhysIO.PhsyIO.iAnalogInputs	INT		3000		0	counts	
PhysIO.PhsyIO.bDigitalOutputs	BOOL		0		0	T/F	
PhysIO.PhsyIO.iAnalogOutputs	INT		4000		0	counts	
Syst.About.iBuild	BYTE	0	10001	320001	0		0 = no license 1 = SRPC
Syst.About.iVersion	BYTE	1	10001	320001	0	Build	Build Number
Syst.About.iType	INT		10002	320002	3	Version	4000 = 4.00.0
Syst.Clock.iYear	INT		10003	320003	0		Dynacard
Syst.Clock.iMonth	INT		10004	320004	0		Dynacard

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Syst.Clock.iDay	INT		10005	320005	0		Dynacard
Syst.Clock.iHour	INT		10006	320006	0		Dynacard
Syst.Clock.iMinute	INT		10007	320007	0		Dynacard
Syst.Status.iActiveWell	BYTE	0	10008	320008	0	Well	Reserved
Syst.Status.iCommand	BYTE	1	10008	320008	0	Well	
Syst.Status.iCardSource_01	BYTE	0	10009	320009	0	eCardSource	Indicates the card displayed in buffer 1
Syst.Status.iCardSource_02	BYTE	1	10009	320009	0	eCardSource	Indicates the card displayed in buffer 2
Syst.Status.iTrendSource_01	BYTE	0	10010	320010	0	eCardSource	Indicates the trend displayed in buffer 1
Syst.Status.iTrendSource_02	BYTE	1	10010	320010	0	eCardSource	Indicates the trend displayed in buffer 2
Syst.Status.iTrendPointerMinute	BYTE	0	10011	320011	0		Indicates the current minute of the trend
Syst.Status.iTrendPointerHour	BYTE	1	10011	320011	0		Indicates the current minute of the trend
Syst.Status.iTrendPointerDay	BYTE	0	10012	320012	0		Indicates the current minute of the trend
Syst.Cards[2].iFillage	INT		10050	320050	0		Dynacard
Syst.Cards[2].iFluidHeight	INT		10052	320052	0		Dynacard
Syst.Cards[2].iFluidLoad	INT		10054	320054	0		Dynacard
Syst.Cards[2].iGrossStroke	INT		10056	320056	0		Dynacard
Syst.Cards[2].iMPRL	INT		10058	320058	0		Dynacard
Syst.Cards[2].iNetStroke	INT		10060	320060	0		Dynacard

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Syst.Cards[2].iPPRL	INT		10062	320062	0		Dynacard
Syst.Cards[2].iSPM	INT		10064	320064	0		Dynacard
Syst.Cards[2].iCounterBalance	INT		10066	320066	0		Dynacard
Syst.Cards[2].iX	INT		10100	320100	0	in	Dynacard
Syst.Cards[2].iY	INT		10300	320300	-1	lbs	Dynacard
Well[0].Status.Drive.iDCBusVoltage	INT		10500	320500	0	V	
Well[0].Status.Drive.iFault	INT		10501	320501	0	eDriveFault	
Well[0].Status.Drive.iMainsVoltage	INT		10502	320502	0	V	
Well[0].Status.Drive.iMotorCurrent	INT		10503	320503	1	A	
Well[0].Status.Drive.iMotorPower	INT		10504	320504	1	kW/HP	
Well[0].Status.Drive.iMotorTorque	INT		10505	320505	1	%	
Well[0].Status.Drive.iMotorVoltage	INT		10506	320506	0	V	
Well[0].Status.Drive.iOutputFrequency	INT		10507	320507	1	Hz	Current speed of drive
Well[0].Status.Drive.iStatus	INT		10508	320508	0	eDriveStatus	
Well[0].Status.Protections[13].bAlarmHigh	BOOL	0	10509	320509	0	T/F	
Well[0].Status.Protections[13].bAlarmLow	BOOL	1	10509	320509	0	T/F	
Well[0].Status.Protections[13].bAlertHigh	BOOL	2	10509	320509	0	T/F	
Well[0].Status.Protections[13].bAlertLow	BOOL	3	10509	320509	0	T/F	

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Status.Protections[13].bBreachedHigh	BOOL	4	10509	320509	0	T/F	
Well[0].Status.Protections[13].bBreachedLow	BOOL	5	10509	320509	0	T/F	
Well[0].Status.Protections[13].bFaultHigh	BOOL	6	10509	320509	0	T/F	
Well[0].Status.Protections[13].bFaultLow	BOOL	7	10509	320509	0	T/F	
Well[0].Status.Protections[13].iAlarmCountHigh	BYTE	0	10522	320522	0	counts	
Well[0].Status.Protections[13].iAlarmCountLow	BYTE	1	10522	320522	0	counts	
Well[0].Status.Sensors[6].bFault	BOOL	0	10535	320535	0	T/F	
Well[0].Status.Sensors[6].iValue	INT		10541	320541	0		Units Depend on Sensor
Well[0].Status.Now.iEnergy	INT		10547	320547	0	Wh	Instantaneous
Well[0].Status.Now.iGasProduction	INT		10548	320548	0	SCF/day	Rate
Well[0].Status.Now.iGrossProduction	INT		10549	320549	1	bbl/day	Rate
Well[0].Status.Now.iNetProduction	INT		10550	320550	1	bbl/day	Rate
Well[0].Status.Now.iPumpSpeed	INT		10551	320551	1	spm	Current speed of the pump
Well[0].Status.Now.iRunTime	INT		10552	320552	0	%	Runtime of the pump since last started
Well[0].Status.Now.iPPRL	INT		10553	320553	0	%	
Well[0].Status.Now.iMPRL	INT		10554	320554	0	%	
Well[0].Status.Now.iStrokeCount	INT		10555	320555	0	%	Number of strokes since the pump was started
Well[0].Status.Today.iEnergy	INT		10556	320556	0	Watts	Accumulated

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Status.Today.iGasProduction	INT		10557	320557	0	SCF	Accumulated
Well[0].Status.Today.iGrossProduction	INT		10558	320558	1	bbl	Accumulated
Well[0].Status.Today.iNetProduction	INT		10559	320559	1	bbl	Accumulated
Well[0].Status.Today.iPumpSpeed	INT		10560	320560	1	spm	Average pump speed today
Well[0].Status.Today.iRunTime	INT		10561	320561	0	min	Runtime today
Well[0].Status.Today.iPPRL	INT		10562	320562	1	lbs	Largest PPRL recorded today
Well[0].Status.Today.iMPRL	INT		10563	320563	1	lbs	Accumulated
Well[0].Status.Today.iStrokeCount	INT		10564	320564	0	strokes	
Well[0].Status.Yesterday.iEnergy	INT		10565	320565	0	Watts	
Well[0].Status.Yesterday.iGasProduction	INT		10566	320566	0	SCF	Accumulated
Well[0].Status.Yesterday.iGrossProduction	INT		10567	320567	1	bbl	Accumulated
Well[0].Status.Yesterday.iNetProduction	INT		10568	320568	1	bbl	Accumulated
Well[0].Status.Yesterday.iPumpSpeed	INT		10569	320569	1	spm	Accumulated
Well[0].Status.Yesterday.iRunTime	INT		10570	320570	0	min	Average pump speed yesterday
Well[0].Status.Yesterday.iPPRL	INT		10571	320571	1	lbs	Runtime today
Well[0].Status.Yesterday.iMPRL	INT		10572	320572	1	lbs	Largest PPRL recorded yesterday
Well[0].Status.Yesterday.iStrokeCount	INT		10573	320573	0	strokes	Accumulated
Well[0].Status.bLoadFault	BOOL	0	10574	320574	0	T/F	No load cell feedback

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Status.bPositionFault	BOOL	1	10574	320574	0	T/F	No stroke reported within previous 60 s
Well[0].Status.bTorqueFault	BOOL	2	10574	320574	0	T/F	No stroke reported within previous 60 s
Well[0].Status.bPumpOffFault	BOOL	0	10575	320575	0	T/F	
Well[0].Status.bStartWarning	BOOL	1	10575	320575	0	T/F	
Well[0].Status.bStrokeComplete	BOOL	2	10575	320575	0	T/F	
Well[0].Status.bWellEnabled	BOOL	3	10575	320575	0	T/F	Reserved
Well[0].Status.bConfigComplete	BOOL	4	10575	320575	0	b	Reserved
Well[0].Status.bInitialFactoryResetComplete	BOOL	5	10575	320575	0	b	Reserved
Well[0].Status.bFallback	BOOL	6	10575	320575	0	b	Reserved
Well[0].Status.iBottomHolePressure	INT		10576	320576	0	psi	
Well[0].Status.iFillageActive	INT		10577	320577	0	%	
Well[0].Status.iGearboxTorque	INT		10578	320578	0	inch lbs x 1000	
Well[0].Status.iFluidHeightInCasing	INT		10579	320579	0	ft	
Well[0].Status.iGrossProductionRate	INT		10580	320580	0	bbl	
Well[0].Status.iHzToSPM	INT		10581	320581	3	RATIO	
Well[0].Status.iLoad	INT		10582	320582	-1	lbs	
Well[0].Status.iMode	INT		10583	320583	0	eSTATE	Status of RPC
Well[0].Status.iPosition	INT		10584	320584	1	in	

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Status.iProtectionAction	INT		10585	320585	0	eACTION	Indicates status of most severe active protection
Well[0].Status.iPumpIntakePressure	INT		10586	320586	0	psi	
Well[0].Status.iPolishedRodPower	INT		10587	320587	0	strokes	Reserved
Well[0].Status.iTargetSpeed	INT		10588	320588	1	spm	Speed the pump is supposed to be at
Well[0].Status.iTorque	INT		10589	320589	1	%	
Well[0].Status.iTubingStretch	INT		10590	320590	1	in	
Well[0].Status.iStrokeLength	INT		10591	320591	1	in	
Well[0].Status.iBeltSlip	INT		10592	320592	2	%	
Well[0].Status.iCounterBalance	INT		10593	320593	1	%	
Well[0].Status.iRatedTorque	INT		10594	320594	1	lbs	
Well[0].Status.iDownholeFluidLoad	INT		10595	320595	1	lbs	
Well[0].Status.iTimeInState	INT		10596	320596	0	min	The time the RPC has been in its current status
Well[0].Status.iTimeToRestart	INT		10597	320597	0	min	If stopped and will automatically restart, the time until which the rpc will restart
Well[0].Status.iAutoRestartSpeed	INT		10598	320598	1	spm	Auto restart speed calculated by RPC
Well[0].Status.iPreviousRuntime	INT		10599	320599	0	min	The duration which the pump was on before the previous stop
Well[0].Status.iStrokesTotalRod	DINT		10600	320600	0	strokes	The total number of strokes recorded by the rpc for the rod
Well[0].Status.iStrokesTotalPump	DINT		10602	320602	0	strokes	The total number of strokes recorded by the RPC for the pump

Name	Type	Bit	Point #	Modbus	Scale	Units	Notes
Well[0].Status.iMalfunctionLoad	INT		10604	320604	0	lbs/10	
Well[0].Status.iMotorSpeed	INT		10605	320605	0	rpm	
Well[0].Status.iPumpSlippage	INT		10606	320606	0	bbl/day	
Well[0].Status.iPumpSlippagePercent	INT		10607	320607	0	%	

22.2 Third Party Registers

To support SCADA systems that use the Lufkin Well Manager, Realift RPC provides a compatible card buffer feature to make historic and Dynacard data available as well as other control and status registers. These registers are available only for Pump 1.

See:

- Control and Status 163
- Protections and Violations 169

Control and Status

The following registers may be used to control and monitor your pump.

Modbus Address for Lufkin	Connection to SE RPC
2	Clear Alarms Flag
101	Host Stop Motor
102	Host Start Motor
103	sRPC Cards
104	sRPC Cards
105	sRPC Cards
106	sRPC Cards
107	sRPC Cards
108	sRPC Cards

109	sRPC Cards
110	sRPC Cards
111	sRPC Cards
800	sRPC Cards
801	sRPC Cards
10032	Well[0].Status.iMode = eSTATE_ALARM
10064	Well[0].Status.iMode = eSTATE_FAULT
10651	Well[0].Status.bPositionFault
10652	Well[0].Status.bLoadFault
10653	Well[0].Status.bPositionFault AND Well[0].Status.bLoadFault
30033	SCADAPack AI-0
30043	SCADAPack A I-1
30053	SCADAPack A I-2
30063	SCADAPack A I-3
30073	SCADAPack A I-4
30083	SCADAPack A I-5
32501	NEEDED FOR CARDS - -Well[0].Status.iMode
32502	Well[0].Status.iTimeInState / 60
32503	256 * Well[0].Status.iTimeInState
32504	Well[0].Config.Timed.iOffTime
32506	60000.0 / Well[0].Status.Now.iPumpSpeed
32508	ANY_TO_DINT(Well[0].Status.iLoad * 10)
32509	ANY_TO_DINT(Well[0].Status.iPosition * 10)
32515	Well[0].Status.Now.iStrokeCount
32516	Well[0].Status.iStrokesTotalRod / 65536

32517	AND_MASK(65535, Well[0].Status.iStrokesTotalRod
32518	Well[0].Status.iStrokesTotalPump / 65536
32519	AND_MASK(65535, Well[0].Status.iStrokesTotalPump)
32525	Well[0].Status.Now.iPumpSpeed * 10
32528	Well[0].Status.Protections[12].iAlarmCountLow
32529	Well[0].Status.Protections[7].iAlarmCountLow
32530	Well[0].Status.Protections[10].iAlarmCountHigh
32531	Well[0].Status.Protections[10].iAlarmCountLow
32534	Well[0].Status.Protections[12].iAlarmCountLow
32567	Well.Status.Today.iPPRL
32569	Well[0].Status.Today.iPPRL
32570	Well.Status.Today.iMPRL
32572	Well[0].Status.Today.iMPRL
32605	Well[0].Status.Yesterday.iGrossProduction * 10
32606	Well[0].Status.Today.iGrossProduction * 10
32607	Well[0].Status.Now.iRunTime
32610	Well[0].Status.Yesterday.iRunTime
32611	Well[0].Status.Today.iRunTime
32613	Well[0].Status.iDownholeFluidLoad
32614	Well[0].Status.iFillageActive
32615	Well[0].Status.Now.iPPRL
32616	Well[0].Status.Now.iMPRL
32617	Well[0].Cards_Surface[1].iGrossStroke
32618	Well[0].Cards_Downhole[1].iNetStroke
32621	Well[0].Status.iPolishedRodPower / 65536

32622	AND_MASK(Well[0].Status.iPolishedRodPower, 65535)
32629	Well[0].Status.iTubingStretch / 65536, FALSE)
32630	AND_MASK(Well[0].Status.iTubingStretch, 65535)
32638	Well[0].Status.Yesterday.iStrokeCount
32639	Well[0].Status.Today.iStrokeCount
37505	The last run time in units of 0.1 minutes. This means 384 means 38.4 minutes.
37506	The second to last run time in units of 0.1 minutes. This means 384 means 38.4 minutes.
37507	The third to last run time in units of 0.1 minutes. This means 384 means 38.4 minutes.
35749	Needed for Cards
35750	Needed for Cards
35751	Needed for Cards
35752	Needed for Cards
35753	Needed for Cards
35754	Needed for Cards
35755	Needed for Cards
36365	The last day of inferred gross production.
36366	The second last day of inferred gross production.
42177	Inferred Production - Stroke Length 20140 INT
42188	Inferred Production - Pump Diameter 20031 INT
42189	Inferred Production - IPA K Factor
42195	Needed for Cards
42196	Remote Control - Mode 0=Normal, 1=Timed, 2=Host
42197	Remote Control - Host Switch 0=Host Off, 1=Host On
42198	Well[0].Config.Timed.iOnTime/60

42199	MOD(Well[0].Config.Timed.iOnTime,60)
42200	Well[0].Config.Timed.iOffTime/60
42201	MOD(Well[0].Config.Timed.iOffTime,60)
42221	Protection Alarm Flags
42233	This is necessary for laod parameters to succesfully ready
42226	Load Parameters - Peak Load Limit
42228	Load Parameters - Minimum Load Limit
42233	Load Parameters - Peak Torque Limit (NOT IMPLEMENTED) but must be in the map.
42263	Well.Config.Fill.iFillControlLevel
42264	READ/WRITE Well.Config.Fill.iFillTarget (20023, B1) or Well.Config.Fill.iFillMinimum (20023, B0) (depending on Well[0].Config.Drive.iType)
42289	Tapers - Well[0].Config.iRodStringCount (Number Tapers) 20222 INT
42290	Tapers - Point DB ONLY - LUFKIN - Rod Types
42291	Tapers - Point DB ONLY - LUFKIN - Rod Types
42292	Tapers - Point DB ONLY - LUFKIN - Rod Types
42293	Tapers - Point DB ONLY - LUFKIN - Rod Types
42294	Tapers - Point DB ONLY - LUFKIN - Rod Types
42295	Tapers - Point DB ONLY - LUFKIN - Rod Types
42296	Tapers - Well.Config.Tapers[0].iLength 20184 INT
42297	Tapers - Well.Config.Tapers[1].iLength 20185 INT
42298	Tapers - Well.Config.Tapers[2].iLength 20186 INT
42299	Tapers - Well.Config.Tapers[3].iLength 20187 INT
42300	Tapers - Well.Config.Tapers[4].iLength 20188 INT
42301	Tapers - Well.Config.Tapers[5].iLength 20189 INT

42302	Tapers - Well.Config.Tapers[0].iDiameter 20178 INT
42304	Tapers - Well.Config.Tapers[1].iDiameter 20179 INT
42306	Tapers - Well.Config.Tapers[2].iDiameter 20180 INT
42308	Tapers - Well.Config.Tapers[3].iDiameter 20181 INT
42310	Tapers - Well.Config.Tapers[4].iDiameter 20182 INT
42312	Tapers - Well.Config.Tapers[5].iDiameter 20183 INT
42314	Tapers - Well.Config.Tapers[0].iWeight 20202 INT
42316	Tapers - Well.Config.Tapers[1].iWeight 20203 INT
42318	Tapers - Well.Config.Tapers[2].iWeight 20204 INT
42320	Tapers - Well.Config.Tapers[3].iWeight 20205 INT
42322	Tapers - Well.Config.Tapers[4].iWeight 20206 INT
42324	Tapers - Well.Config.Tapers[5].iWeight 20207 INT
42326	Tapers - Well.Config.Tapers[0].iModulus 20190 INT
42328	Tapers - Well.Config.Tapers[1].iModulus 20191 INT
42330	Tapers - Well.Config.Tapers[2].iModulus 20192 INT
42332	Tapers - Well.Config.Tapers[3].iModulus 20193 INT
42334	Tapers - Well.Config.Tapers[4].iModulus 20194 INT
42336	Tapers - Well.Config.Tapers[5].iModulus 20195 INT
42349	Well.Config.Protections[0].iThresholdHigh (SPARE A)
42606	NOT USED
42605	NOT USED
43104	NOTEPAD
43105	NOTEPAD
43106	NOTEPAD
43107	NOTEPAD

43108	NOTEPAD
43109	NOTEPAD
43110	NOTEPAD
43111	NOTEPAD
43112	NOTEPAD
43113	NOTEPAD
43114	NOTEPAD
43115	NOTEPAD
43116	NOTEPAD
43117	NOTEPAD
43118	NOTEPAD
43119	NOTEPAD
43120	NOTEPAD
43121	NOTEPAD
43122	NOTEPAD
43123	NOTEPAD

Protections and Violations

Host Mode violations are not employed since the Realift RPC uses normal violations in all modes. Normal violations are read only meaning the status is can be viewed using the alternate Modbus register assignments, but the configuration cannot be changed using an alternate register assignment.

Lufkin Description	Corresponding RPC Assignment
Peak Load	Well[0].Config.Protections[10].bAlarmEnableHigh; (PPRL)
Min Load	Well[0].Config.Protections[10].bAlarmEnableLow; (MPRL)
Logic Expression	Not available
Peak Torque	Not available

Low Motor RPM	Well[0].Config.Protections[12].bAlarmEnableLow; (Motor Speed)
No RPM	Not available – use low RPM
No Crank	Always enabled
Belt Slippage	Well[0].Config.Protections[9].bAlarmEnableHigh; (Belt Slippage)
Malfunction Setpoint	Well[0].Config.Protections[7].bAlarmEnableLow; (Malfunction Setpoint)
Pumpoff Setpoint	N/A - Always enabled (causes pumpoff)
Low Fluid	Well[0].Config.Protections[8].bAlarmEnableLow; (Fluid Load)
Pump Fillage Setpoint	Always enabled
Peak Power[1]	Well[0].Config.Protections[0].bAlarmEnableLow; (Spare A[1])

[1]Polished Rod power can be assigned to the Spare A protection. The Spare A violation, when enabled, can then be used for the Peak power violation. Configure Spare A to monitor register 10587 (Well.Status.iPolishedRodPower).

23 Appendix E - Simulating Using Vijeo

This section provides an alternate procedure for users who do not have a Magelis HMI or for users who prefer to work from the comfort of their vehicle while on-site.

Step 1: Install the RPC Magelis Program

The RPC Magelis HMI program runs on a virtual machine on your PC.

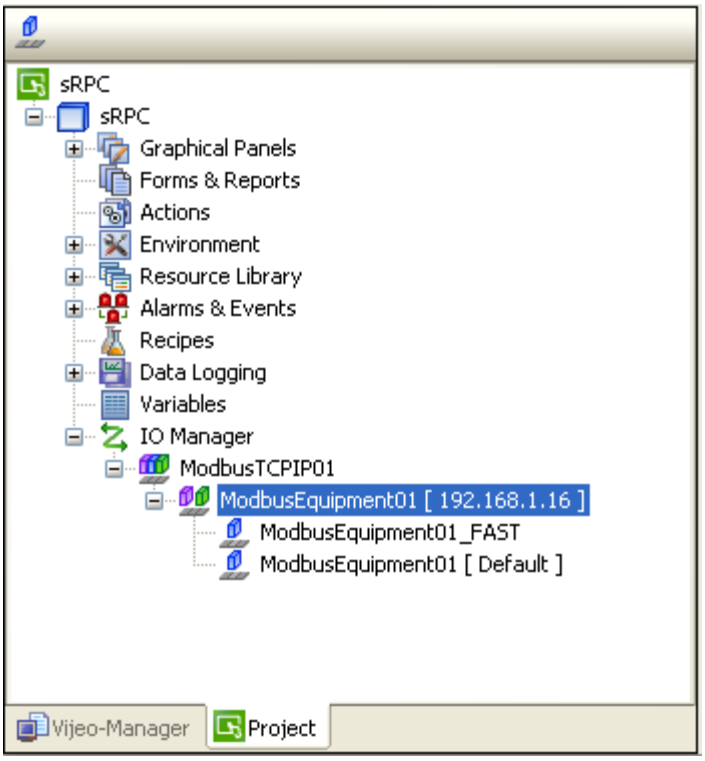
1. Install a new version of VirtualBox from the website https://www.virtualbox.org/wiki/Downloads.
2. Import the virtual machine **VijeoDesigner_651.ova** to VirtualBox and then run the virtual machine.
3. From within VirtualBox open Windows Explorer using **Start > All Programs > Accessories > Window Explorer**.
4. Navigate to **My Network Places > VirtualBox Shared Folders > \\Vboxsvr > \ \vboxsvr\c_drive**.
5. Copy the **sRPC.vdz** to the VirtualBox desktop.
6. Double-click the **sRPC.vdz** in desktop to open the Vijeo application.

Step 2: Modify, Build, and Run the Magelis Simulator Program

Before building and running the Magelis program simulator, the IP address used by the program needs to be set for communication with the SCADAPack 474.

1. In Vijeo, navigate to **IO Manager > ModbusTCPIP01 >> ModbusEquipment01** and double click.

   The **Equipment Configuration** dialog opens.
2. In the **Equipment Configuration** dialog set the **IP Address** to the IP Address of the SCADAPack 474.



3. To build the RPC Magelis Simulator, from the menu bar select **Build > Simulation**.

   The Vijeo-Designer Runtime will start.

   You will need to login to the Vijeo-Designer Runtime to perform most functions.

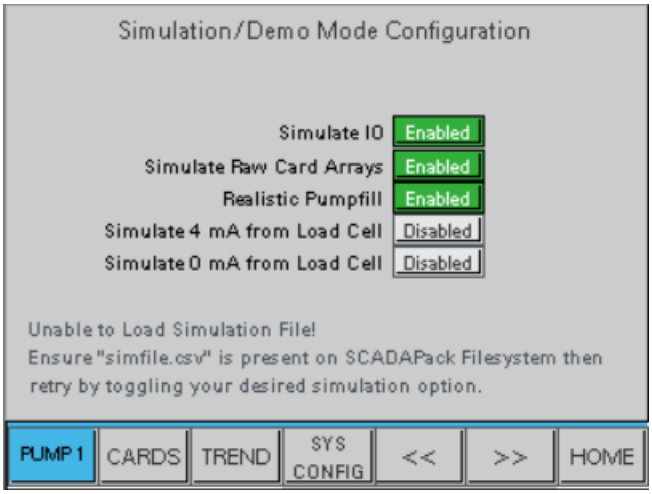
4. To log in to the Vijeo-Designer Runtime, on the **Pump Overview** screen, click **LOGIN**.
5. Click **Username** and use the keypad to enter **EXPERT**, then click **Enter**.
6. Click **Password** and use the keypad to enter **well1**, then click **Enter**.
7. Click **Login** and then click **Close**.
8. To load the configuration, on the **Pump Overview** screen, click **CONFIG MENU > System Configuration > Configuration Management**.
9. Click **Load Configuration From File**.

   The Defaults.csv and some settings appropriate for the well being simulated will load.

Step 3: Enable Simulation / Training Mode

The Simulation / Training Mode enables users to become familiar with the many features of the SCADAPack 474 RPC including the use and configuration of automatic downhole control. In this mode, the displayed downhole card does not match the indicated pumpfill, but instead comes from a pumpfill simulation.

1. In Vijeo Designer Runtime, select **CONFIG MENU > System Configuration > I/O Status**.
2. On the **I/O Status** screen, click **>>** twice to display the **Simulation/Demo Mode Configuration** screen.
3. Click the simulation mode buttons shown below to enable simulation of the RPC.

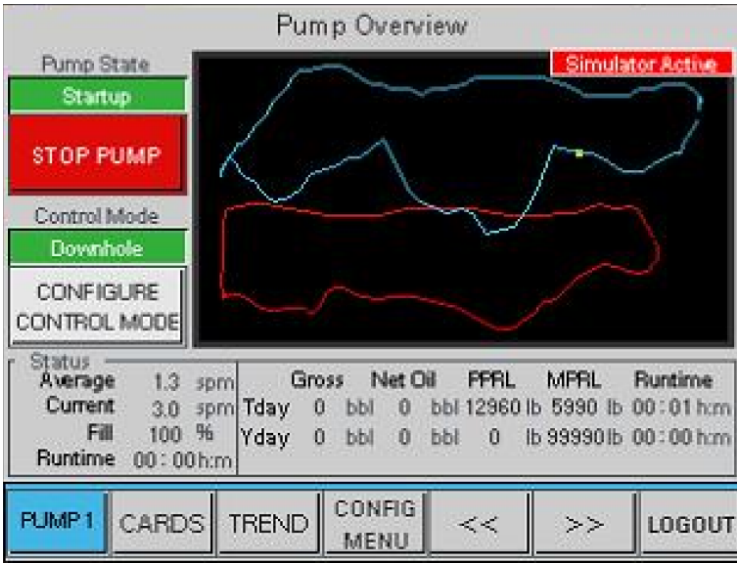


- Simulate IO: Used to simulate the Realift RPC I/O. When selected, the physical IO is not used and the internal simulated values are used instead. Load cell and proximity sensor values are simulated at pre-determined speeds.
- Simulate Raw Card Arrays: Used to simulate Dynacards and pump rates
- Realistic Pumpfill: Used to simulate pump fill operations
- Simulate 4 mA from Load Cell: Sets the load cell value at 5000 when Simulate IO option is not selected. When Simulate IO option is selected, this option does nothing.
- Simulate 0 mA from Load Cell: Used to simulate a load cell disconnection during Realift RPC operation

A pop-up window is displayed.

4. Press Yes to continue with simulation mode.

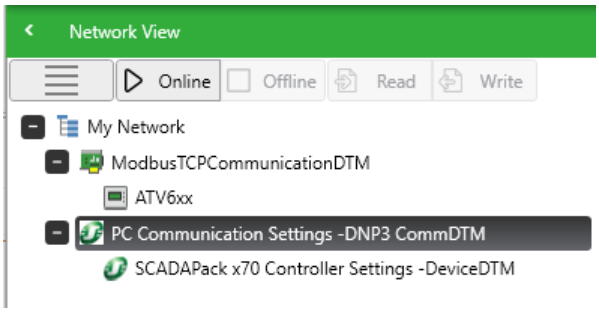
When the simulator is active, a notice will be displayed, as shown below.



24 Appendix F - Adding RPC to a SCADAPack 474

You need a USB series C-type cable to provide communications for local connection to the computer running the SCADAPack RemoteConnect configuration software.

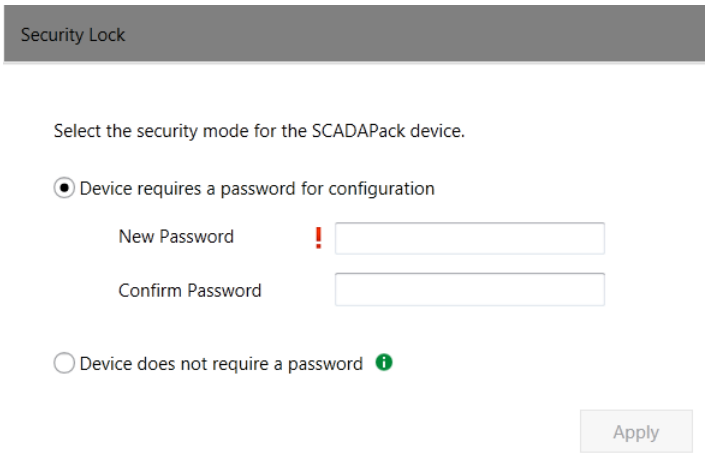
1. Connect the USB cable between your PC and the SCADAPack 474.
2. In **RemoteConnect Network View** double-click **PC Communication Settings – DNP3 CommDTM**.



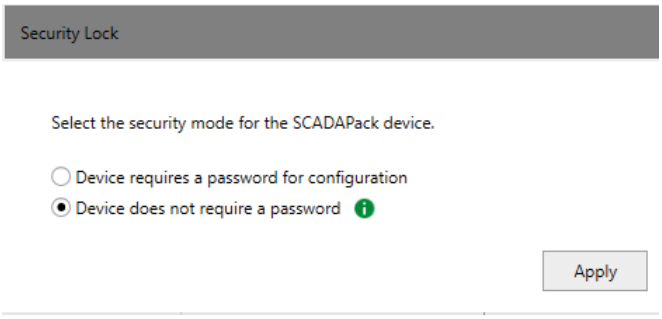
3. On the **Communications** tab, under **PC Communication Type**, select **DNP3 USB**.
4. In **USB Communication Settings**, ensure that the **Target DNP3 Address** is 0.

   Any other settings may be left at their default values.
5. Click **Apply**.
6. In **RemoteConnect Network View** select **SCADAPack x70 Controller Settings – DeviceDTM** and click **Online**.

   After RemoteConnect and the SCADAPack 474 are connected, the Security Lock dialog is opened.



7. For this initial setup select **Device does not require a password** and then click **Apply**.



8. In **RemoteConnect Network View** click **Write**.

   The complete RemoteConnect project is written to the SCADAPack 474. This will take a few minutes.

9. When the RemoteConnect file is written to the SCADAPack 474, on the Status tab, click **Refresh**.

24.1 Loading the RPC License

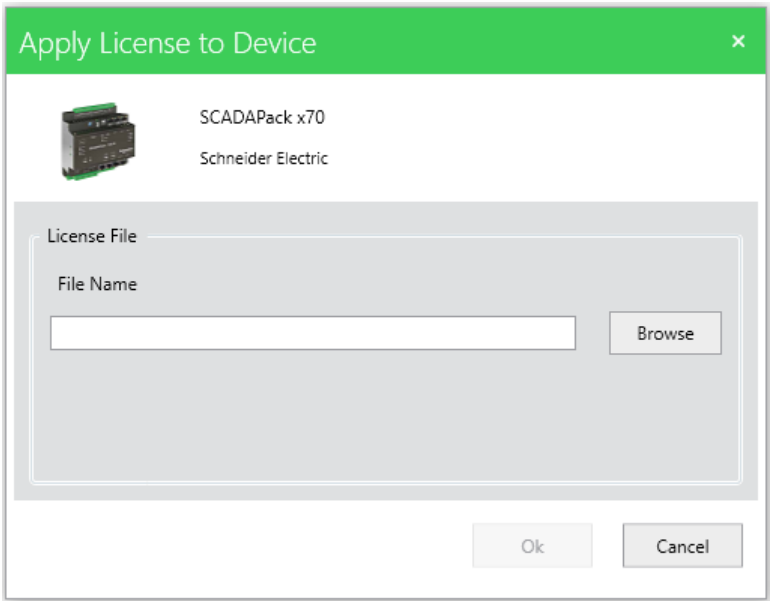
Use this procedure when the SCADAPack 474 does not have a license loaded at the factory.

The license file for the SCADAPack x70 device activates the purchased features on the device. This file is provided by your Schneider Electric representative.

Follow the procedure below to transfer the license file to the SCADAPack x70 device and apply its content.

To apply the license file to the SCADAPack 474

1. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Apply License to Device**.



2. In the **Apply License to Device** dialog, click **Browse** to navigate to the location where the license file is stored.

   The license file has a .lic extension.

3. In the **Open** dialog, select the license file, then click **Open**.

4. In the **Apply License to Device** dialog, click b.

   When the license is successfully applied to the device, the device needs to be restarted to activate some license options.

5. In the pop-up dialog, click **Yes** to confirm.

24.2 Copying Defaults.csv to the SCADAPack 474

The installation package includes the .csv files **Defaults.csv** and **simfile.csv**. These files need to be transferred to the SCADAPack 474.

1. In SCADAPack RemoteConnect ensure that RemoteConnect is **Online**.

2. In **RemoteConnect Network View** right-click **SCADAPack x70 Controller Settings – DeviceDTM** and select **Additional Functions**.

3. From the displayed list select **Write file to Device**.

4. Browse to the **Defaults.csv** file and click **Ok**.

5. Repeat this procedure for the **simfile.csv** file.

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