INSTRUCT

SRP Intelligent Controller User Manual

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Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Sensia be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Sensia cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Sensia with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Table of Contents

Chapter 4

Using the INSTRUCT SRP Local HMI

Chapter 5

Operation

Chapter 6

Troubleshooting

Appendix A

Specifications

Appendix B

Wiring Diagrams

Appendix C

Site Survey Template

This manual describes well protection features and system responses that are provided by the INSTRUCT SRP* controller. These features and responses provide protection for the rod pump mechanical unit and well when abnormal operating conditions are detected.

ATTENTION: You must have a basic understanding of electrical circuitry and familiarity with rod pump mechanical units to install, configure, operate, or troubleshoot the INSTRUCT SRP systems. If not, you must obtain the proper training before using this product.

Summary of Changes

This manual contains new and updated information as indicated in the following table.

Topic	Page
Updated cover	Cover Page
Updated Additional Resources table	10
Updated catalog numbers	Throughout
Updated OptiLift RPC to INSTRUCT SRP	Throughout
Deleted Help Display 1: Application Information (originally Figure 237)	204
Replaced all images with OptiLift RPC branding	Throughout

Who Should Use This Manual?

Use this manual if you design, install, configure, or troubleshoot rod-pump control systems that use the INSTRUCT SRP. This manual introduces you to the key components of the INSTRUCT SRP, and describes installation, configuration, operation, and troubleshooting of the controller.

Purpose of This Manual

This manual provides information that is required for the use of the INSTRUCT SRP with the following motor control configurations:

- Across-the-line motor starter or soft starter
- A variable frequency drive (VFD) that uses a 4…20 mA analog speed reference command
- Capability to control and update runtime parameters over and Ethernet network with PowerFlex® 750 drives.

Detailed information regarding integration with a PowerFlex® 753 variable frequency drive is not in this manual. This information is explained in the user manual for the drive.

This document also does not give a detailed explanation of the mechanical operation of a well or the configuration of variables.

Technical Support Options

A one-year TechConnect^{SM} contract is provided with your INSTRUCT SRP. This contract is renewable for continued support.

Additional Resources

These documents contain additional information concerning related products from Sensia and Rockwell Automation.

Resource	Description
ISaGRAF website, http://www.isagraf.com	Offers ISaGRAF software support.
QRATE iXC2 High Performance Edge Controller V7 **(For a copy of this document, contact your local Sensia representative**.	Describes the procedures for installation, wiring, and system configuration of the QRATEiXC2 controller.
PowerFlex 750-Series AC Drives Programming Manual, publication 750-PM001	Provides details on PowerFlex® 753 drive parameters.
Remote Data Acquisition Controllers Product Profile, publication **(For a copy of this document, contact your local Sensia representative**	Provides information on the iSensGP and iSensT2 sensors.

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Chapter **1**

About the INSTRUCT SRP Solution

Equipment Overview

The INSTRUCT SRP* controller (previously known as Optilift™ RPC) provides control, protection, and monitoring for one sucker rod pump well. Control and protection are applied based on user-configured parameters and real-time sensor data. Fixed or variable speed systems can be controlled with one of seven operation modes. Operation modes range from basic operation that allows you to turn the pump on or off, to more complex modes that adjust operating speed to maximize your oil production.

Based on collected data and calculations the controller performs, decisions are made depending on the selected operation mode. The data that is collected from sensors on the pump allow the controller to generate a surface card (load and position). The controller takes the collected surface card and well characteristics and uses this information to generate a downhole card. The downhole card is analyzed and a pump fillage is calculated.

Protection is done internally via configurable alarms and faults. You can also provide an external signal to terminate operation from other site equipment such as an E-stop or vibration sensor.

The INSTRUCT SRP provides a host of features that can be controlled and monitored locally and remotely. Local control is achieved with the PanelView™ terminal. Remote control is achieved through the web server interface or supervisory control and data acquisition (SCADA) system with supported protocols.

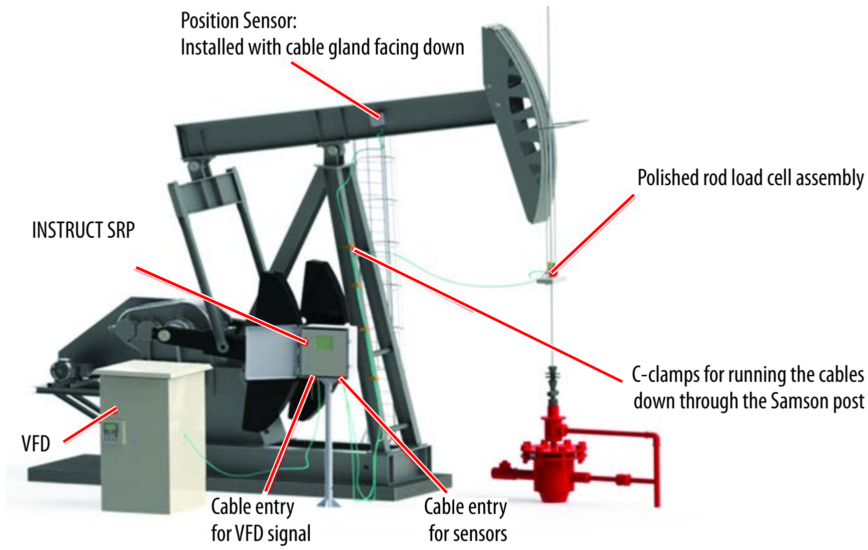
The I/O of your INSTRUCT SRP can be expanded by using FLEX™ I/O modules. These modules are connected through your EtherNet/IP™ network and configured using the vMiConfig tool. For details on vMiConfig, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

The INSTRUCT SRP is connected-production ready and if an Ethernet network is present it can connect to your system using the MQTT application. For details on MQTT, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Typical Installation

The INSTRUCT SRP is intended to be installed in an outdoor environment that is not classified as a hazardous location. The enclosure design helps protect the PanelView terminal, and other internal components, from weather conditions. The INSTRUCT SRP can be mounted in various ways such as pole-mount, wall-mount, or within a power package (see page 19). The power and control wiring enter through the bottom of the enclosure. Outdoor exposure requires the system to be grounded. Figure 1 shows an example of how the INSTRUCT SRP can be installed.

Figure 1 - Typical Sucker-rod Pump with INSTRUCT SRP System



Option for Low Temperature Operation

The optional heater is recommended if you intend to operate below the temperature range of the INSTRUCT SRP. The heater extends the operating temperature for internal components down to -40 °C (-40 °F). At this lower temperature, the PanelView terminal may not operate as expected. Remote connectivity is recommended for configuration at lower temperatures.

Equipment Specification

For enclosure dimensions, materials, ratings, and weight information, see Enclosure Specifications on page 313.

Well Operation Modes

The INSTRUCT SRP has seven operation modes that control the operation and protection of system components. Four operation modes are for fixed speed operation (Table 1) and three operation modes are for variable speed operation (Table 2).

Table 1 - Operation Modes for Fixed Speed Systems

Operation Mode	Description
1. Fixed Speed Pump Off	This mode uses the surface card and a pump-off control (POC) setpoint. The POC is a configured load and position. When the POC setpoint is within the surface card, the motor run command is issued. When the POC setpoint is outside the surface card, the motor is commanded to stop. A motor RUN command is then automatically issued after a configured time period.
2. Fixed Speed Timer	This mode works as a timer. The timer has a run and rest time that you must configure.
3. Fixed Speed Pump Fillage	This mode sends a command to stop the well for a rest period after a number of successive downhole cards has been detected with the calculated pump fillage below the desired target pump fillage. You must set the desired rest time, pump fillage setpoint, and the number of cards with low fillage to be detected before the INSTRUCT SRP sends a command to stop the pump and set it to Rest state.
4. Fixed Speed Manual	This mode gives you basic run/stop motor control. It allows you to start and stop your pump manually.

Table 2 - Operation Modes for Variable Speed Systems

Operation Mode	Description
5. Variable Speed Pump Off	This mode uses the surface card, a pump-off control (POC) setpoint, and POC deadband to regulate the speed of the pump. When any part of the POC deadband is outside the surface card, the speed of the pump is adjusted.
6. Variable Speed Pump Fillage	This mode uses the pump fillage calculated from the downhole card, fillage setpoint, and fillage deadband to regulate the speed of the pump. When the calculated pump fillage is outside the predefined pump fillage deadband, the speed of the pump is adjusted.
7. Variable Speed Manual	This mode gives you basic run/stop motor control. It also allows you to start and stop your pump manually. You must set the run speed.

For detailed information on configuration and parameters, see Use the INSTRUCT SRP Web Server on page 33 and Using the INSTRUCT SRP Local HMI on page 115.

ISAGRAF

The INSTRUCT SRP is equipped to support ISAGRAF® projects. ISAGRAF is an industrial automation technology that is used to create standalone controller or distributed control systems. ISAGRAF is highly scalable and flexible to work on the hardware platform and operating system of your choice.

Visit www.isagraf.com to download the ISAGRAF software. The ISAGRAF website contains helpful training videos on the Support page. To view your project, see ISAGRAF Project on page 113.

Communication Protocol (Modbus)

The INSTRUCT SRP supports various communication protocols. It supports Modbus RTU and Modbus TCP. Configuration details are on page 48. The INSTRUCT SRP provides two Ethernet communication ports (LAN1 and LAN2). One Ethernet port can be used for Modbus TCP for SCADA communication, and the other Ethernet port for local configuration through the web server on your laptop. See page 29 for Communication port details.

WMP Gateway Features

The INSTRUCT SRP can communicate with wireless transmitters for pressure and temperature through the wireless messaging protocol (WMP). The WMP is a proprietary long-range wireless protocol that supports 2.4 GHz and 900 MHz frequencies. The WMP protocol is intended for use with the Sensia iSens line of wireless devices.

When the INSTRUCT SRP is ordered with the optional WMP functionality, it handles wireless communications. The INSTRUCT SRP gateway module handles all wireless communication through WMP. Figure 64 on page 59 shows the parameters that you must configure through the gateway module in order for the INSTRUCT SRP to communicate with a wireless transmitter.

User-supplied Components

You must supply the following components to get the most accurate data from your INSTRUCT SRP.

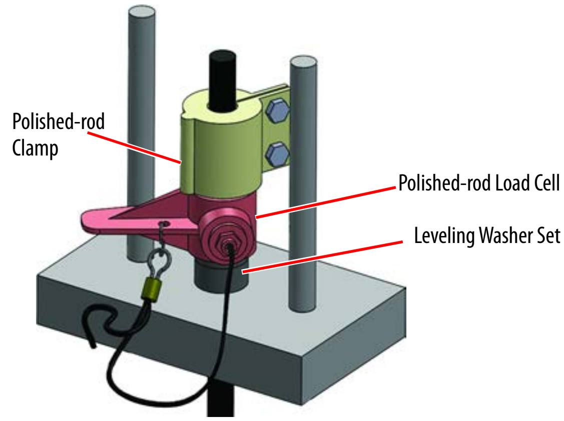
Polished-rod Load Cell

The polished-rod load cell measures the weight on the rod string. The INSTRUCT SRP can operate with two different load cell sizes (13,608 kg [30,000 lb] and 22,680 kg [50,000 lb]). The INSTRUCT SRP provides an excitation voltage level to the load cell (see page 313 for voltage range). You configure the load cell as part of the setup process (see page 313).

ATTENTION: Properly trained, qualified personnel must install the load cell. Incorrect installation can result in erroneous load detection and damage to equipment.

The typical installation of a polished-rod load cell is shown in Figure 2.

Figure 2 - Load Cell Assembly

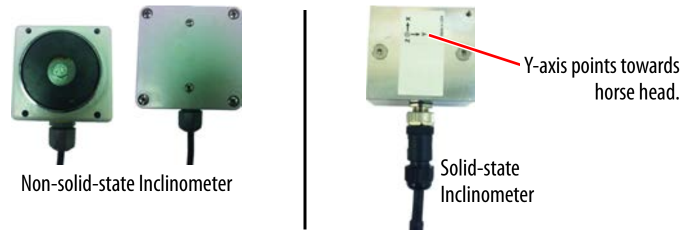


Walking Beam Inclinometer

The inclinometer measures the angle of the walking beam. The inclinometer is magnet-mounted along the walking beam between the fulcrum and the horse head.

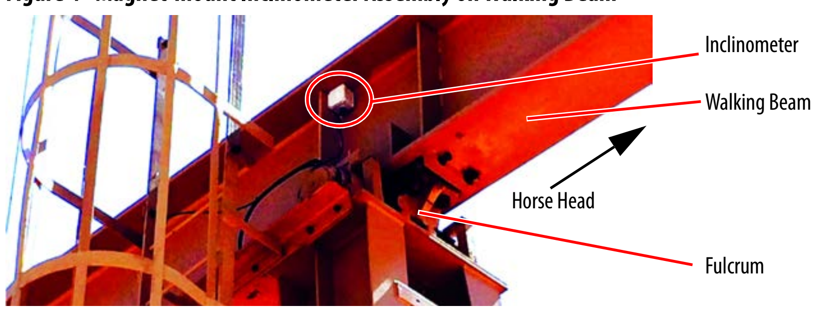
A solid-state or non-solid state inclinometer (Figure 3) can be used with the INSTRUCT SRP. Solid-state inclinometers are recommended for installations that require extra durability.

Figure 3 - Magnet-mount Inclinometer Options



In a typical installation of an inclinometer, the horse head of the walking beam is to the right of the inclinometer box and the signal cable exits the bottom of the box (Figure 4). For input voltage, see page 313.

Figure 4 - Magnet-mount Inclinometer Assembly on Walking Beam



Hall Effect Sensor

Hall effect sensors must be mounted with magnets at the crank arm and motor shaft. The Hall effect sensor at the crank arm allows the INSTRUCT SRP to determine whether the pump has reached the bottom of the stroke. The Hall effect sensor at the motor shaft allows the INSTRUCT SRP to determine the motor RPM. The sensors are synchronized together to allow the INSTRUCT SRP to determine the polished rod position and the belt slippage. The belt slippage calculation feature can only be determined when both Hall effect sensors are installed.

With only one Hall effect sensor is mounted on the crank arm (none on the motor shaft), the INSTRUCT SRP can determine the polished rod position but not belt slippage.

Figure 5 - Hall Effect Sensors Kit

Install and Connect INSTRUCT SRP Hardware

Before You Begin

This section provides the information that is required to mount and wire the INSTRUCT SRP* controller.

ATTENTION: The following information is a guide for proper installation. Sensia cannot assume responsibility for the compliance or the noncompliance to any code, national, local, or otherwise for the proper installation of this INSTRUCT SRP or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

It is recommended that you conduct a site survey to determine a suitable location to install the INSTRUCT SRP (See Site Survey Template on page 319). This survey collects the physical and electrical characteristic of the site equipment. During the site survey, an equipment layout must be drawn.

Handling the INSTRUCT SRP Package

Use care when lifting the INSTRUCT SRP for mounting.

ATTENTION: To guard against possible personal injury and/or equipment damage:

- Do not allow any part of the INSTRUCT SRP or lifting mechanism to contact electrically charged conductors or components.
- Do not subject the INSTRUCT SRP to high rates of acceleration or deceleration while transporting to the mounting location or when lifting.
- Do not allow personnel or their limbs directly underneath the INSTRUCT SRP when it is being lifted and mounted.

You must consider the specifications in Table on page 313 when mounting the INSTRUCT SRP.

INSTRUCT SRP Overview

Figure 6 - Front View

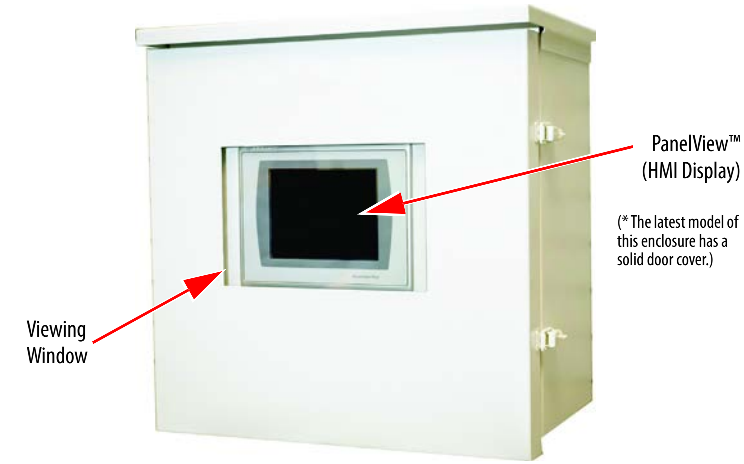


Figure 7 - Bottom View

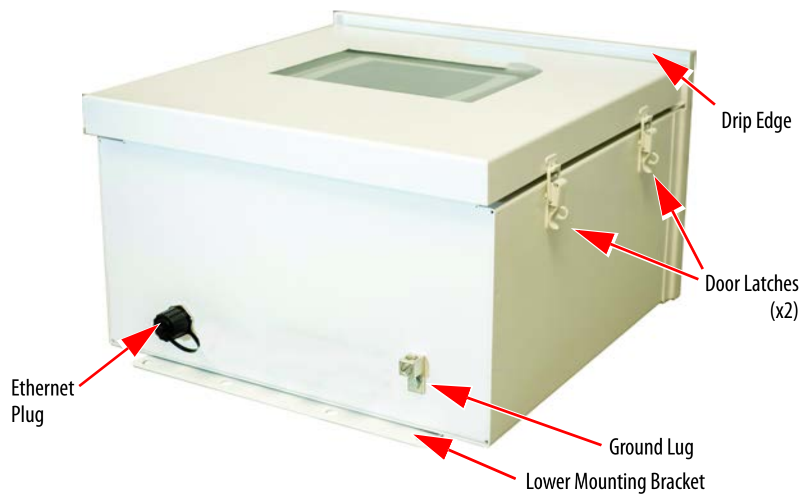
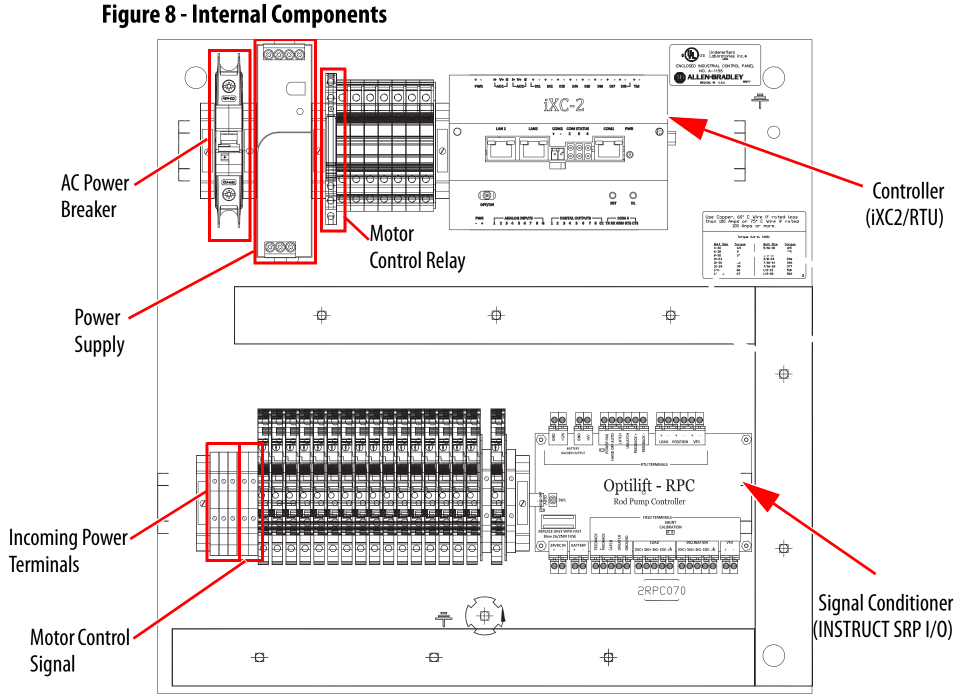


Figure 8 - Internal Components



Mount the INSTRUCT SRP Unit

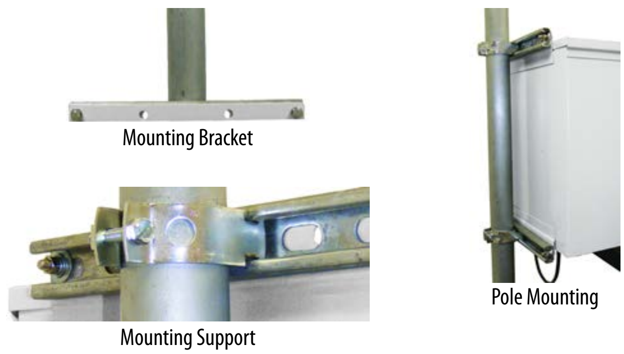
IMPORTANT	Mounting hardware is not included with the INSTRUCT SRP.

Mounting Considerations

The INSTRUCT SRP can be pole- or wall-mounted.

On the back of the enclosure, there is an upper and lower mounting bracket each with four holes. You must mount the INSTRUCT SRP in a vertical orientation as shown in Figure 9.

Figure 9 - Mounting Detail



Mounting Procedure

ATTENTION: Allow only qualified personnel to install or maintain the INSTRUCT SRP. Failure to comply can result in personal injury and/or equipment damage.

ATTENTION: Certify that the INSTRUCT SRP is installed with the HMI facing North. Prolonged exposure to ultraviolet rays can cause degradation and HMI failure.

To install the INSTRUCT SRP, perform the following steps:

1. Remove the INSTRUCT SRP from its shipping container. Follow the handling recommendations on page 17.
2. Inspect the equipment for any damage during transportation.
3. Identify the upper and lower section of the INSTRUCT SRP.
4. If you are pole mounting the device, attach Unistrut® horizontally on the back wall of the enclosure using screws through the holes in the mounting bracket. Place this assembly on a 5.08 cm (2 in.) pipe and attach it with pipe brackets. The minimum height from the floor to the bottom of the panel must be 1.52 m (5 ft).

5. If you are wall mounting the device, two screws through each mounting bracket are sufficient.

Connect Wiring

This section explains how to wire the components of the INSTRUCT SRP. Three size 8 holes are available in the enclosure for wire entry.
See INSTRUCT SRP Wiring on page 316 for a fully wired INSTRUCT SRP wiring diagram.

ATTENTION: Allow only qualified personnel to install or maintain the INSTRUCT SRP. Failure to comply can result in personal injury and/or equipment damage.

Required Tools

The following equipment catalog numbers are recommended:

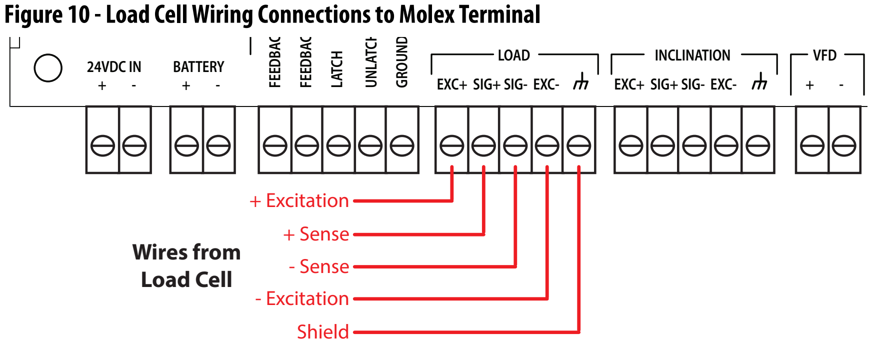
Table 3 - Tools

Catalog Number	Description
1492-N90	A flathead terminal block screwdriver with hardened 3 mm (0.12 in.) diameter blade.
1492-KWC	A wire-cutting tool that attaches to the screwdriver.

Polished Rod Load Cell

The load cell has a five-wire cable that connects to the INSTRUCT SRP I/O. The wires are mounted inside the enclosure on the signal conditioning card (Figure 10). For details on how to configure your load cell, see page 313.

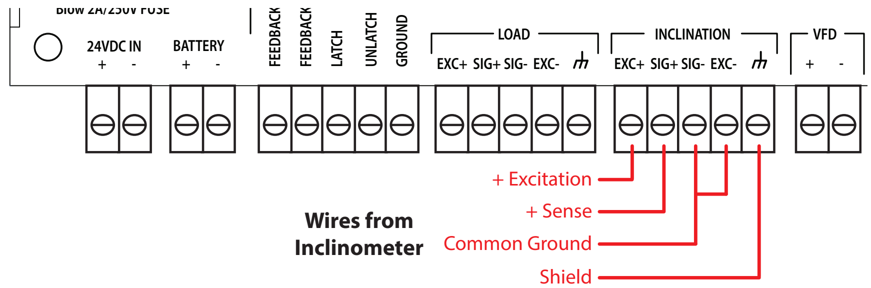
Figure 10 - Load Cell Wiring Connections to Molex Terminal



Walking Beam Inclinometer

The inclinometer has a three-wire cable that connects to the INSTRUCT SRP. The wires are mounted to the signal conditioning card (Figure 11). Common ground is the signal (-) and excitation (-).

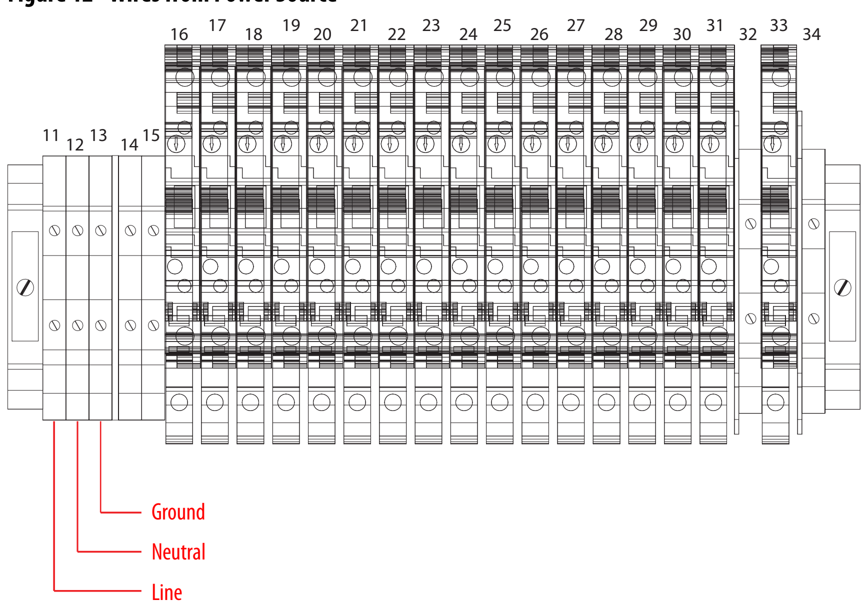
Figure 11 - Inclinometer Wiring Connections to Molex Terminal



Incoming Power

The incoming power is a three-wire signal from the power source. The power source must supply power in the range of 100...240V AC, 50/60 Hz. The load signal is wired to a circuit breaker and is routed to a 24V DC power supply.

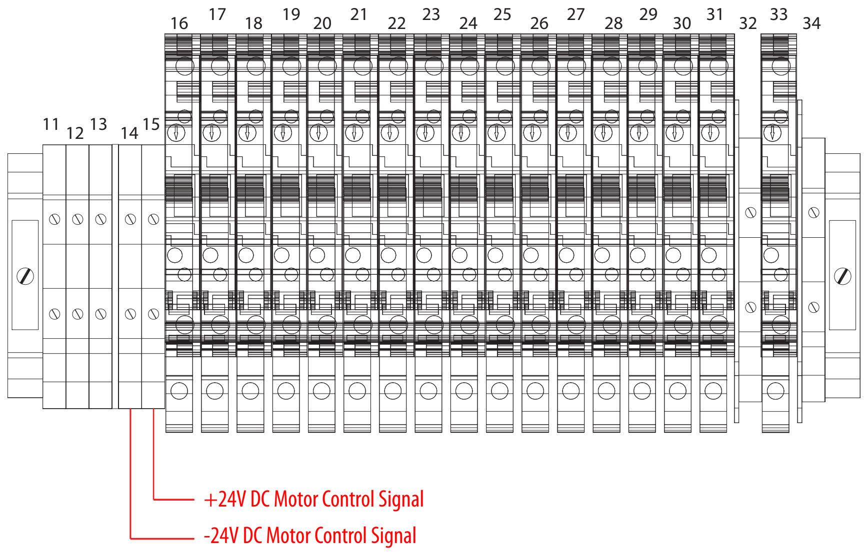
Figure 12 - Wires from Power Source



Motor Run/Stop Command

The default wiring of the INSTRUCT SRP manages the motor with a 24V powered output (Figure 13) with a maximum output of 1 A. A Run command from the INSTRUCT SRP corresponds to a 24V signal in the motor control signal terminals, while a stop command corresponds to a 0V signal.

Figure 13 - 24V DC Motor Run/Stop Control Terminals



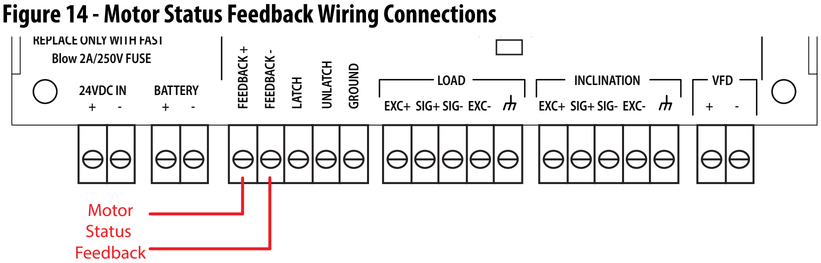
ATTENTION: The default wiring of the INSTRUCT SRP uses a ON/OFF (24V/0 V) signal to control your motor.

Motor Run/Stop Status Feedback Wiring

IMPORTANT	When used with a PowerFlex® 753/755 drive, this wiring is not required.

Motor feedback wiring is found on the INSTRUCT SRP I/O board, which helps the INSTRUCT SRP detect Run and Stop conditions. Feedback + and Feedback -signals are wired directly to the board (Figure 14). A 5...24 V DC signal and its return signal can be used to provide feedback to the INSTRUCT SRP. To detect the signal, the signal must be powered (24V DC).

Figure 14 - Motor Status Feedback Wiring Connections



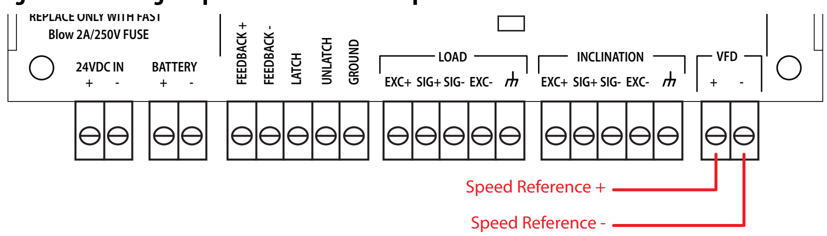
VFD Speed Control

IMPORTANT When used with a PowerFlex 753/755 drive, this wiring is not required.

TIP The speed reference signal is only used with a variable speed drive.

The INSTRUCT SRP can control a variable speed motor by commanding the motor to run and providing an analog speed reference signal to your variable speed drive. An analog 4…20 mA sourcing signal is sent to denote the lowest to highest speed reference that is based on the configuration of the VFD. The two wires of the speed reference signal are shown in Figure 15. To learn how to configure the minimum and maximum control frequency, see VFD Configuration on page 83.

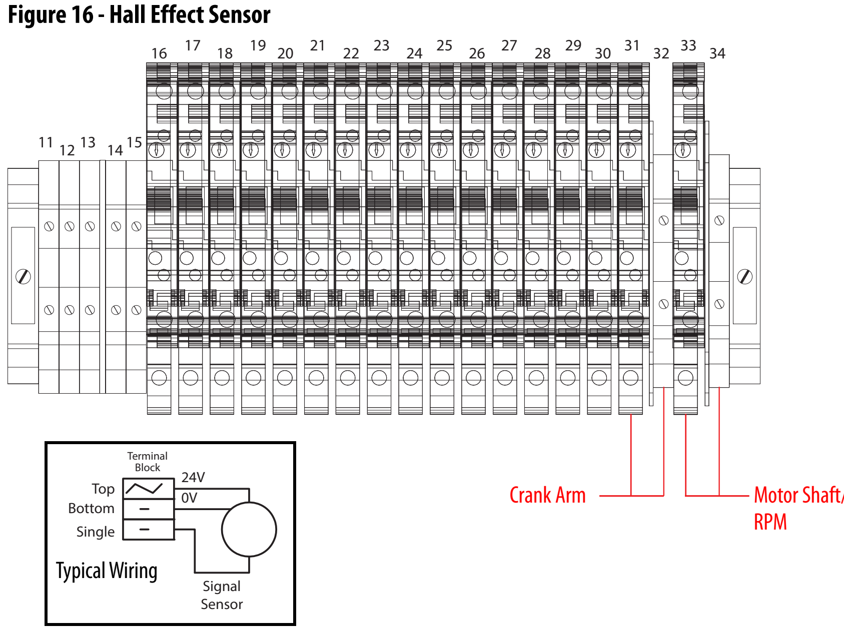
Figure 15 - Analog Output 4…20 mA to VFD Speed Reference



Hall Effect Sensor

The Hall effect sensors connect to terminal blocks. There are two terminal blocks (31/32) for the crank arm sensor that are wired to DI6 of the controller. There are also two terminal blocks (33/34) for the motor shaft (RPM) sensor that are wired to DI9 of the controller. Both sets of terminal blocks are shown in Figure 16.

Figure 16 - Hall Effect Sensor



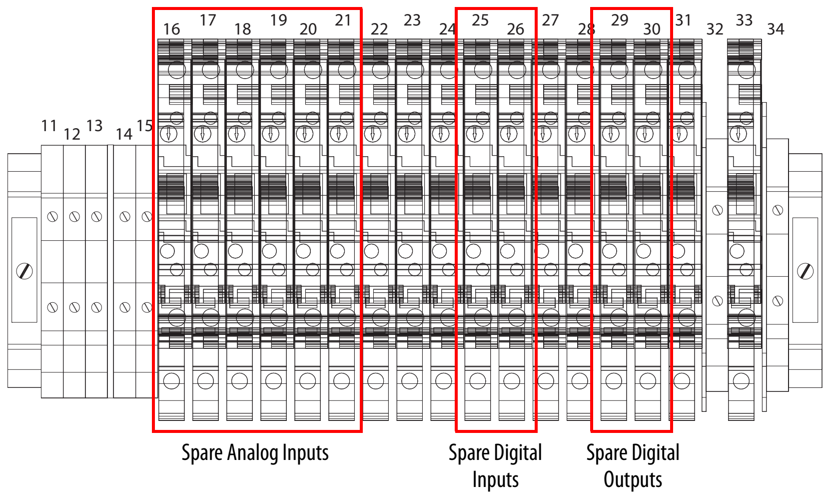
Optional I/O Wiring

The INSTRUCT SRP can monitor and control additional user-supplied signals. Additional signals are wired to the corresponding terminal blocks shown in Figure 17. The system has the following spare channels:

- Six analog inputs
- Two digital inputs
- Four digital outputs

For details on spare channels, see page 25.

Figure 17 - Spare Channels



The spare signals are configured with the web server (I/O Configuration on page 50), wired directly to the controller, and logic expressions are written using ISAGRAF® software. The INSTRUCT SRP is equipped to support ISAGRAF projects.

TIP The internal 24V DC power supply must be used to power source your field devices. The maximum 24V field current draw including the 24V DC ON/OFF output is 1.5 A.

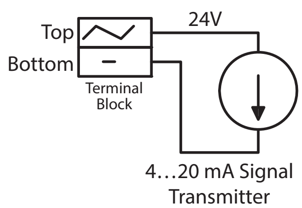
Spare Analog Inputs

Six analog inputs (AI) are available for use. Configure the analog inputs (AI2, AI4, AI5, AI6, AI7, and AI8) by channel to be either 0…5V DC or 1…5V DC. See Analog Input Configuration (AI2, AI4, AI5, AI6, AI7, and AI8) on page 51 for details about input configuration.

All analog input channels must have a common return. Figure 17 on page 24 shows the location of the AI terminals.

IMPORTANT	For a detailed wiring example and DIP switch settings, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Figure 18 - Analog Input Typical Wiring



IMPORTANT	The resistor [1] configuration that is shown in Figure 18 works for one channel (shown for Channel 2, but it can be any of the eight channels). If multiple channels, extra terminals and wiring must be added.

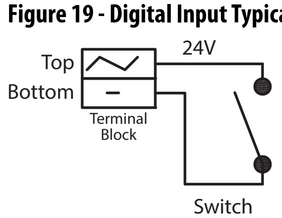
(1) The resistor is sized based on the transmitter being powered from the INSTRUCT SRP 24V DC supply due to the common return for all eight signals. The resistor must be 250 Ω, 3 W (to handle short circuit current), and 0.1% tolerance. The exposed resistor leads must be covered in insulated tubing.

Spare Digital Inputs

Two digital inputs (DI) are available for use. The digital inputs (DI7 and DI8) are isolated.

All digital input channels must have a common return. Figure 17 on page 24 shows the location of the DI terminals.

Figure 19 - Digital Input Typical Wiring



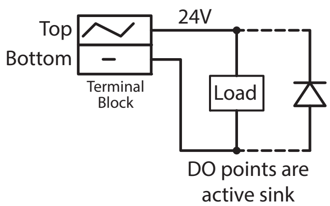
IMPORTANT	For a detailed wiring example, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Spare Digital Outputs

Four digital outputs (DO) are available for use. The digital outputs (DO5[1], DO6[1], DO7, and DO8) are sinking digital output type. When the DO is active, the load is pulled to ground.

All digital output channels must have a common ground reference. Figure 17 on page 24 shows the location of the DO terminals.

Figure 20 - Digital Output Typical Wiring



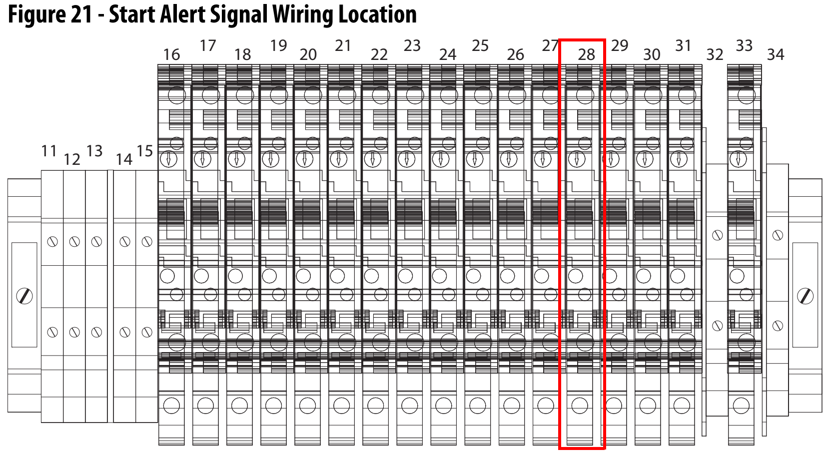
IMPORTANT	For a detailed wiring example, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Wiring for a Start Alert

The INSTRUCT SRP has a safety feature that allows you to connect a sounder or strobe to serve as a motor start alert. The signal duration that is presented can be configured. See Configure Motor Alert Delay Time on page 204 for details on motor start alert delay time configuration.

Figure 21 shows where to wire a sounder or strobe that is installed as the motor start alert signal. The INSTRUCT SRP allows you to configure the alert time through the DO4 channel (sinking) which provides a ground for your sounder or strobe. You can power your sounder or strobe with the INSTRUCT SRP internal power.

Figure 21 - Start Alert Signal Wiring Location



(1) Wired to terminal block. DO5 to terminal 29 and DO6 to terminal 30.

DI4 Aux Wiring for Customer-supplied Stop Operation Signals

The INSTRUCT SRP has a safety feature that allows you to stop operation by having the pumping unit coast to a stop.

Figure 22 shows the location of DI4 into which a stop operation signal can be wired. Kill switches come with three terminals: COM, N.O., and N.C.

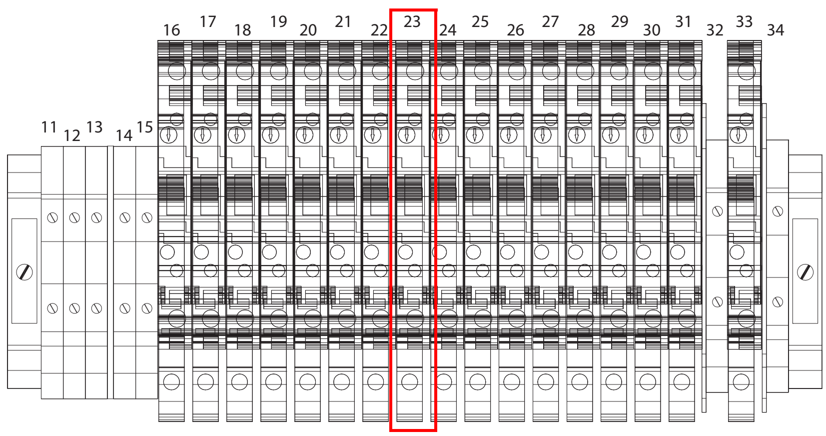
- Connect the COM terminal of a kill switch to -DI4.
- Connect the N.C. terminal of the kill switch to +DI4.

ATTENTION: See INSTRUCT SRP Wiring on page 316 for proper wiring of a customer-supplied kill signals with motor control signal interrupt.

IMPORTANT The DI4 AUX Fault Active configuration must be set as Active LOW. See Configure DI4/DI5 Aux Fault Alarm on page 208 for more details.

ATTENTION: We recommend a spill-warning environmental switch for spillage to avoid any spills at the well site.

Figure 22 - DI4 Wiring for Customer-supplied Kill Switch Signal



DI5 Aux Wiring for Optional Emergency Stop (E-stop) Switch

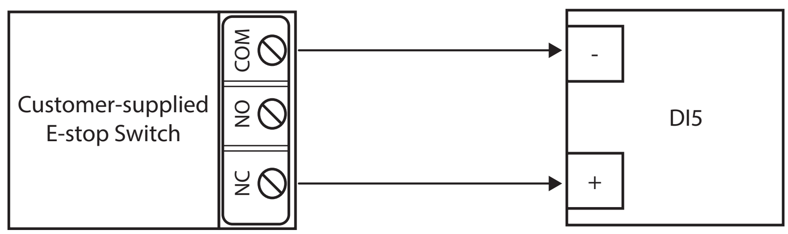
Figure 23 shows how to wire an E-stop switch signal to DI5. E-stop switches come with three terminals: COM, N.O., and N.C.

- Connect the COM terminal of the E-stop switch to -DI5.
- Connect the N.C. terminal of the E-stop switch to +DI5.

ATTENTION: See INSTRUCT SRP Wiring on page 316 for proper wiring of customer-supplied kill signals with motor control signal interrupt.

IMPORTANT The DI5 AUX Fault Active configuration must be set as Active LOW. See Configure DI4/DI5 Aux Fault Alarm on page 208 for details.

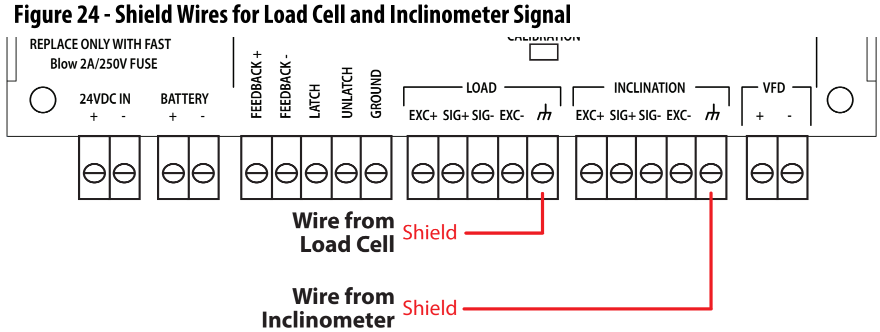
Figure 23 - DI5 Wiring for E-stop Switch Signal



Shielded Cables

Certain I/O connections require shielded cables to help reduce the effects of electrical noise. Ground each shield at one end only. A shield that is grounded at both ends forms a ground loop, which causes a processor fault. Each component inside the INSTRUCT SRP assembly is grounded to the backplane. The shield wires of the load cell and inclinometer must be connected to the INSTRUCT SRP I/O board shield terminals (Figure 24). If the analog output is used for speed control, the shield must be attached to the backplane ground bolt.

Figure 24 - Shield Wires for Load Cell and Inclinometer Signal



Ground Lug

The cabinet ground lug (Figure 7 on page 18) is attached to the backplane ground from inside the INSTRUCT SRP enclosure. The ground lug must be wired to a grounded copper bar outside the cabinet.

Communication Ports

The INSTRUCT SRP is equipped with a controller that has Ethernet and serial communication ports. Two ports are used by other hardware within the enclosure.

Table 4 - Unavailable Ports

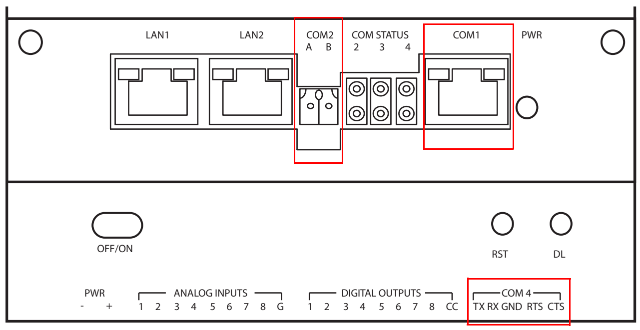
Port	Function
LAN1	Connected to the PanelView display [1]. Default IP address is 192.168.0.82.
COM3	Connected to the internal I/O card of the INSTRUCT SRP.

(1) If used in an integrated power package, a switch is required.

Three serial COM ports (COM1 [RS-232], COM2 [RS-485], and COM4 [RS-232]) and one Ethernet port (LAN2 - default IP address is 192.168.1.83) are available to fit your communication needs.

The default slave ID for Modbus communication is 1 (see COM Port on page 45).

Figure 25 - Controller Communication Ports



COM1 (RS-232)

COM1 requires a RJ45-to-DB9 adapter for RS-232 communication. See Figure 26 for details of this connection and Table 5 for pin identification. COM1 can be used as RTU Slave or can be connected to one third-party device. Wire this port by connecting RX, TX, and GND. For hardware handshake, it is necessary to wire Request to Send (RTS) and Clear to Send (CTS) lines. To verify or edit your COM settings, go to the COM Port Configuration web server page (page 45).

Figure 26 - Pinouts

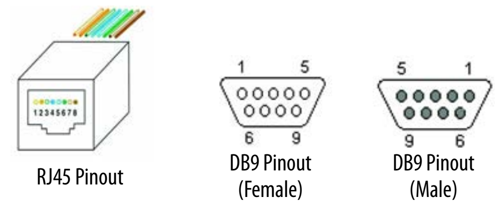


Table 5 - RJ45-to-DB9 Pin Identification

RJ45 Pin Number	Color	DB9 Pin Number	Signal Name
1	White-Orange	4	DTR out
2	Orange	N/C	—
3	White-Green	6	DSR in
4	Blue	5	GND
5	White-Blue	3	TXD out
6	Green	2	RXD in
7	White-Brown	7	RTS out
8	Brown	8	CTS in

COM2 (RS-485)

COM2 is available on the controller as RS-485. RS-485 is used as Modbus Slave or as Modbus Master to any third-party slave device. It can connect multiple third-party devices. It makes two-wire half-duplex connections only.

The controller has a pair of status indicators for COM2 communication status. When COM2 is communicating, the two status indicators blink (green for TX and yellow for RX).

COM4 (RS-232)

COM4 can be used as Modbus Slave or as Modbus Master to any wireless third-party device. RX, TX, and GND connections are used to communicate with one third-party device. For hardware handshake, wire the RTS and CTS lines as well. To verify or edit your COM settings, go to the COM Port Configuration web server page (page 45).

Ethernet Ports (LAN2)

The controller has one available 10/100 auto-sensing Ethernet port. This port is accessed via the Ethernet plug on the bottom of the enclosure (Figure 7 on page 18). Straight Ethernet cables or crossover can be used for both device to personal computer and device-to-device communication. This port has status indicators for TX/RX. Table 6 shows the signal connection.

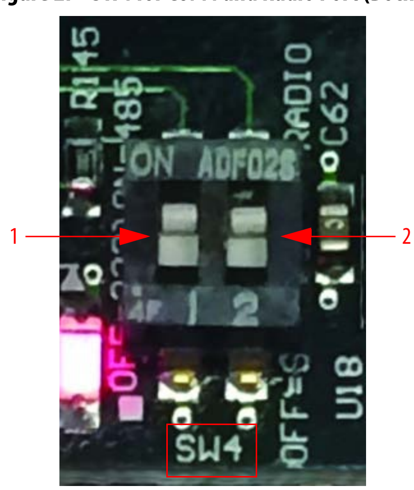
Table 6 - Signal Connections

Ethernet RJ45	Signal
1	TX+
2	TX-
3	RX+
6	RX-

WMP Hardware Configuration

The INSTRUCT SRP controller can be equipped with an optional radio. This configuration is an ETO offering that enables WMP communication. A DIP switch allows you to select the serial communication standard default (RS-232 or RS-485) and enable/disable radio communication for WMP features (Figure 27) manually. The DIP switch is on the back of the controller unit (with cover removed). Toggle between ON/OFF to change settings.

Figure 27 - SW4 for COM4 and Radio Port (Both Switches in ON Position)



Item	Description
1	**Serial Communication Standard (DIP switch 1):** The default position is OFF (RS-232). Toggle to ON position to use RS-485.
2	**Radio ON/OFF (DIP switch 2):** The default position is OFF (radio capabilities disabled). Toggle to ON position if you are using WMP.

Notes:

Use the INSTRUCT SRP Web Server

Configuration Methods

You must use the following two configuration methods to commission the INSTRUCT SRP* controller successfully.

- Web server
  - Recommended for quick configuration when you know the INSTRUCT SRP configuration parameters
  - Network configuration, download configuration, communication configuration, and firmware update are exclusive to the web server (1)
  - Time and date configuration
  - WMP gateway configuration
  - Allows remote monitoring of well status, including production data, alarms, and current card
- Local HMI (see Using the INSTRUCT SRP Local HMI on page 115)

Configuration Using Web Server

To configure your INSTRUCT SRP with the web server, you must power up your system and set it to preconfiguration state before logging on to the web server.

Set INSTRUCT SRP to Preconfiguration State

1. Confirm that all inputs are securely connected to the correct terminals.
2. Verify that the supplied power voltage to the INSTRUCT SRP is correct.
3. Verify that the INSTRUCT SRP breaker is switched to the ON position.
4. The Operator display (or your selected default display) is shown automatically.

(1) Configuration can be done remotely with appropriate setup.

Log in to Web Server

To log in to the web server, you must do the following:

- Configure the LAN network settings of your computer
- Access the web server with a browser

Configure LAN Network Settings

IMPORTANT	The following steps require a computer with a Windows® 7 (or newer) operating system.

1. With the INSTRUCT SRP powered up, connect the Ethernet port on your computer to the LAN2 port of the INSTRUCT SRP with an RJ45 Ethernet cable. Use the Ethernet plug on the bottom of the enclosure to access LAN2.

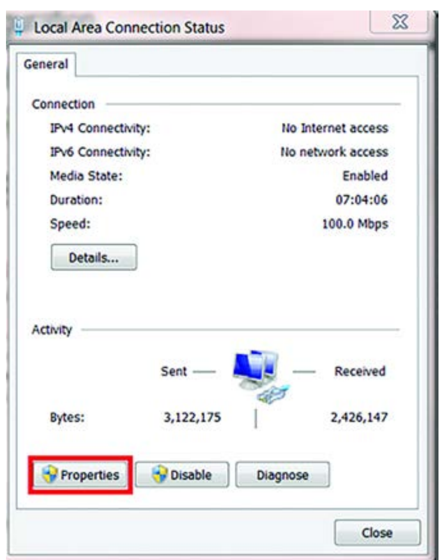
Figure 28 - RJ45 Connector

Bottom of Controller Enclosure

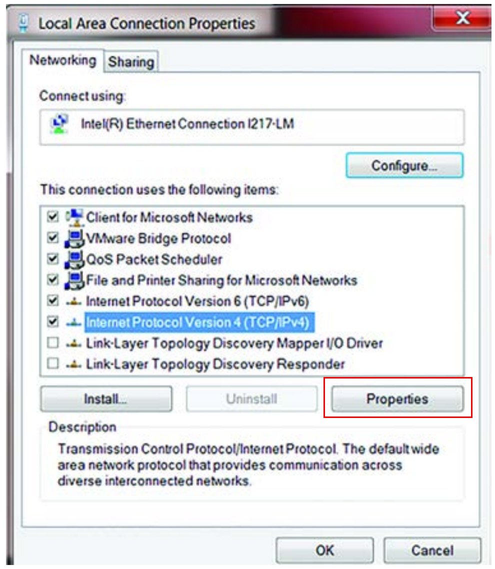
Laptop

IMPORTANT	Take note of your network connection settings; you must restore them after configuration of the INSTRUCT SRP.

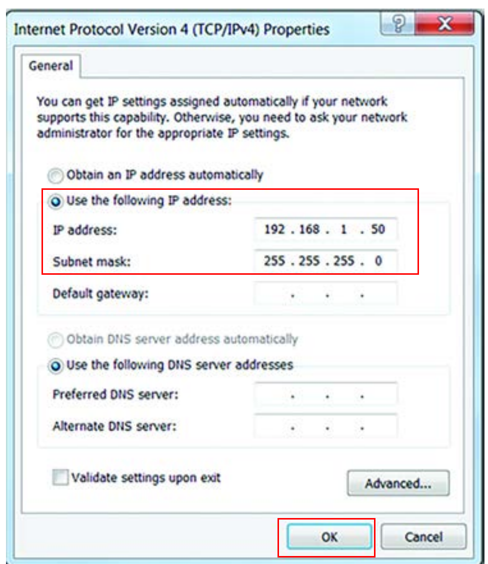
2. Configure the computer network adapter from Control Panel>Network and Sharing Center>Change Adapter Settings.
3. Double-click your Local Area Connection and then click Properties.



4. Select Internet Protocol Version 4 and click Properties.



5. Click Use the Following IP address and enter an IP address(1) and subnet mask 255.255.255.0 and click OK on each window to complete the LAN setting changes.



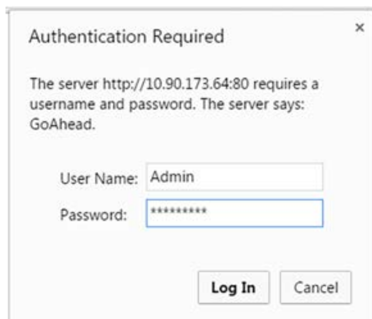
(1) If the computer is connected to the LAN1 port, use 192.168.0.XX. If the computer is connected to the LAN2 port, use 198.168.1.XX. The computer must have an IP address on the same network as the LAN port to which it is connected.

Access Web Server

IMPORTANT	For optimal functionality, use Chrome™ or Firefox™ as your browser.

1. Use a web browser to enter the IP address of either LAN1 or LAN2 depending on which LAN port the computer is connected to. The default LAN IP addresses are:
   - LAN1 — https://192.168.0.82 (connected to PanelView™ display)
   - LAN2 — https://192.168.1.83 (default for upgrades and configuration)
2. When you are prompted for the authentication, enter the default user name and password:
   - **User Name:** Admin
   - **Password:** vMiRtu800

Figure 29 - Web Server Credentials



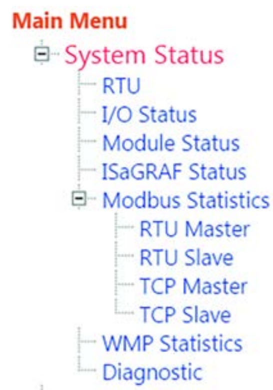
3. Once you are granted access to the web server, the Controller Well Status page (Figure 30) is displayed.

Figure 30 - Controller Well Status Screen

System Status

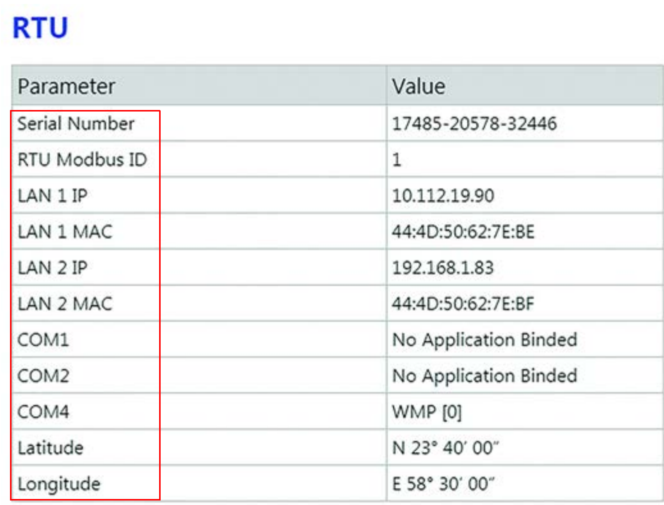
The System Status pages provide you with overall status information for your controller and associated communication statistics. WMP and Modbus statistics are important tools that help you troubleshoot communication problems.

Figure 31 - System Status Menu Structure



RTU

Figure 32 - RTU



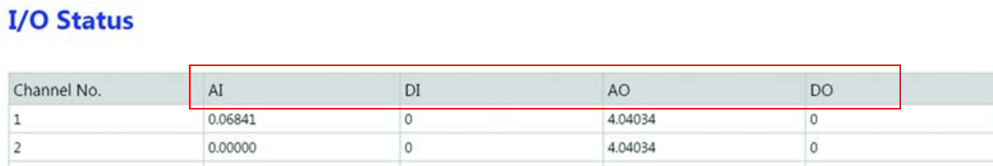
RTU

Parameter	Value
Serial Number	17485-20578-32446
RTU Modbus ID	1
LAN 1 IP	10.112.19.90
LAN 1 MAC	44:4D:50:62:7E:BE
LAN 2 IP	192.168.1.83
LAN 2 MAC	44:4D:50:62:7E:BF
COM1	No Application Binded
COM2	No Application Binded
COM4	WMP [0]
Latitude	N 23° 40′ 00″
Longitude	E 58° 30′ 00″

Row	Description
1	**Serial Number:** The unique serial number of the controller.
2	**RTU Modbus ID:** The Modbus Slave ID of the controller.
3	**LAN1 IP:** The IP address of LAN1 Ethernet port.
4	**LAN1 MAC:** The media access control (MAC) ID of LAN1 Ethernet port.
5	**LAN2 IP:** The IP address of LAN2 Ethernet port.
6	**LAN2 MAC:** The MAC ID of LAN2 Ethernet port.
7	**COM1:** The application that is bound to COM1.
8	**COM2:** The application that is bound to COM2.
9	**COM4:** The application that is bound to COM4 (WMP is the default).
10	**Latitude:** The user-entered latitude to pinpoint the location of the controller.
11	**Longitude:** The user-entered longitude to pinpoint the location of the controller.

I/O Status

Figure 33 - I/O Status



I/O Status

Channel No.	AI	DI	AO	DO
1	0.06841	0	4.04034	0
2	0.00000	0	4.04034	0

Column	Description
1	**AI:** The real-time voltage or current reading for Analog Input Channels 1…8.
2	**DI:** The real-time digital status (0 or 1) for Digital Input Channels 1…9.
3	**AO:** The real-time voltage or current output that is supplied at Analog Output Channel 1 & 2.
4	**DO:** The real-time digital output status (0 or 1) for Digital Output Channels 1…8.

Module Status

Figure 34 - Module Status

Module Status

Ghost Version	1.0120
Suite Firmware Version	8.219.5

Module Name	Status	Version	Fault Status
RTU Kernel	✓	1.0155	NA
MessageLogger	✓	1.0111	NA
AlarmManager		Not Running	NA
DataLogger		Not Running	NA

Item	Description
1	**Ghost Version:** The Linux Ghost version number of the controller.
	Suite Firmware Version: The suite firmware revision number of the controller.
2	**Status:** The status of the specified module. If module is not active, this checkbox is cleared.
	Version: The version number of each module. Not Running is displayed if the module status is not selected to run.
	Fault Status: The reason that the module has stopped running. If the module is running or not selected to run in RTU Kernel, Fault Status is displayed as NA.

ISAGRAF Status

Figure 35 - ISAGRAF Status

ISaGRAF Status

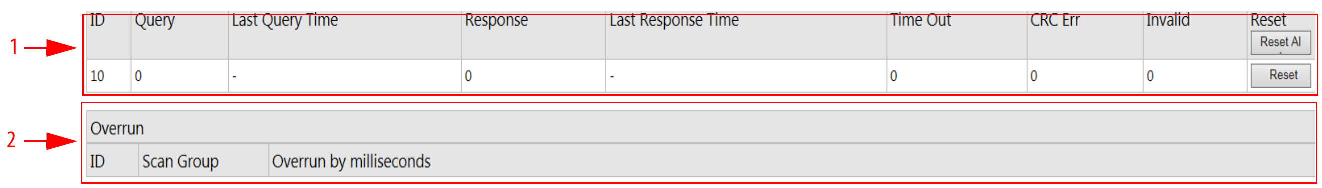
Resource ID	Status	Version	Cycle Count	Current Time	Prog Time	Max Time	Overrun
1	INACTIVE	0	0	0 ms	0 ms	0 ms	0
2	INACTIVE	0	0	0 ms	0 ms	0 ms	0
3	INACTIVE	0	0	0 ms	0 ms	0 ms	0
4	INACTIVE	0	0	0 ms	0 ms	0 ms	0

Column	Description
1	**Resource ID:** The resource identification number that is defined in ISAGRAF® Workbench for each resource
2	**Status:** The running status of a resource (Inactive, Active, or Error).
3	**Version:** The version number of the resource. The number increases by one each time the resource is recompiled and deployed.
4	**Cycle Count:** The total number of cycles the resource runs.
5	**Current Time:** The time that a resource has spent in the current cycle.
6	**Prog time:** The maximum time that is used by a resource to run a cycle.
7	**Max Time:** The cycle time that is defined in ISAGRAF workbench.
8	**Overrun:** The number of times a resource has overrun (the execution time exceeds the program time).

Modbus Statistics

RTU and TCP Master

Figure 36 - RTU and TCP Master



Item	Description
1	**ID:** The slave device Modbus ID
	Query: The number of queries that are sent to slave device.
	Last Query Time: The time of last sent query.
	Response: The number of responses that are received from slave device.
	Last Response Time: The time of last received response.
	Time Out: The number of time outs in sent queries.
	CRC Err: The number of cyclic redundancy check (CRC) errors in received responses.
	Invalid: The number of invalid (non-available Modbus registers) responses.
	Reset: Reset statistics to zero for the specified slave device. **Reset All:** Reset statistics to zero for all slave devices.
2	**Over Run ID:** The slave device Modbus ID for which over run (execution time exceeded scan time) occurred.
	Over Run Scan Group: The scan group number for which over run occurred.
	Over Run by mSec: The number of milliseconds by which execution time exceeded scan time.

RTU and TCP Slave

Figure 37 - RTU and TCP Slave

MB_RTU_SLAVE Statistics

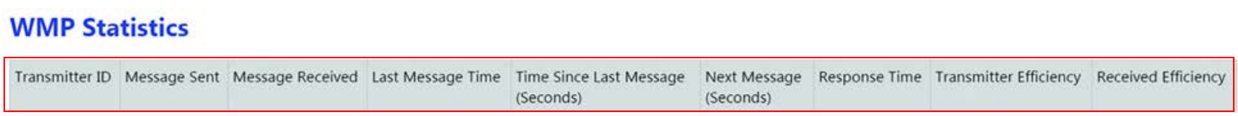
ID	Query	Last Query Time	Response	Last Response Time	CRC Err	Invalid	Reset
							Reset All
1	0	01/01/1970 - 04:00:00	0	01/01/1970 - 04:00:00	0	0	Reset
247	0	01/01/1970 - 04:00:00	0	01/01/1970 - 04:00:00	0	0	Reset

Column	Description
1	**ID:** The Modbus ID.
2	**Query:** The number of queries received.
3	**Last Query Time:** The time of last received query.
4	**Response:** The number of responses sent.
5	**Last Response Time:** The time of last sent response.
6	**CRC Err:** The number of CRC errors in received query.
7	**Invalid:** The number of invalid (non-available Modbus registers) requests in received query.
8	**Reset:** Reset statistics to zero for the specified Modbus ID. **Reset All:** Reset statistics to zero for all Modbus IDs.

WMP Statistics

The WMP Statistics page (Figure 38) shows the communication efficiency between the wireless transmitters and the gateway.

Figure 38 - WMP Statistics



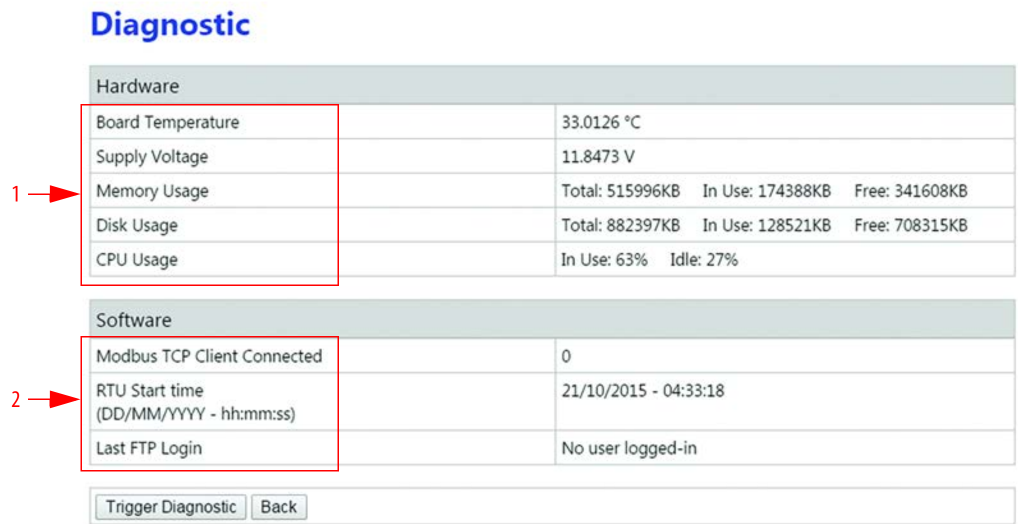
WMP Statistics

Transmitter ID	Message Sent	Message Received	Last Message Time	Time Since Last Message (Seconds)	Next Message (Seconds)	Response Time	Transmitter Efficiency	Received Efficiency

Column	Description
1	**Transmitter ID:** The wireless transmitter ID of the registered transmitter.
2	**Messages Sent:** The number of messages the gateway sends to the registered transmitter.
3	**Messages Received:** The number of messages the gateway receives from the registered transmitter.
4	**Last Message Time:** The time of last message that is received from the registered transmitter.
5	**Time Since Last Message (Seconds):** The number of seconds since the last received message from the registered transmitter.
6	**Next Message (Seconds):** The number of seconds until the next scheduled message to be received from the registered transmitter.
7	**Response Time:** The number of milliseconds that the transmitter takes to respond to a request from the gateway.
8	**Transmitter Efficiency:** The ratio of number of messages the transmitter receives to the number of messages the transmitter sends.
9	**Received Efficiency:** The ratio of number of messages the gateway receives from the registered transmitter to the number of messages the transmitter sends.

Diagnostic

Figure 39 - Diagnostic

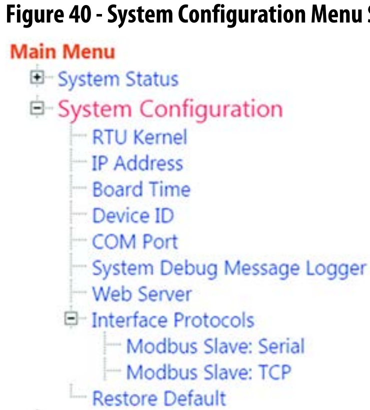


Item	Description
1	**Board Temperature:** The temperature of the controller board in °C.
	Supply Voltage: The currently supplied voltage to the controller.
	Memory Usage: The memory usage for modules running (in KB).
	Disk Usage: The disk usage for modules running (in KB).
	CPU Usage: The percentage of controller CPU usage.
2	**Modbus TCP Client Connected:** The number of TCP client users that are connected to the controller.
	RTU Start Time: The date and time of last power on cycle of the controller.
	Last FTP Login: The last user who logged in through FTP connection.

System Configuration

The System Configuration pages allow you to configure advanced controller settings such as IP address, COM port settings, and interface protocols. The Restore Default page allows you to restore your system to factory settings.

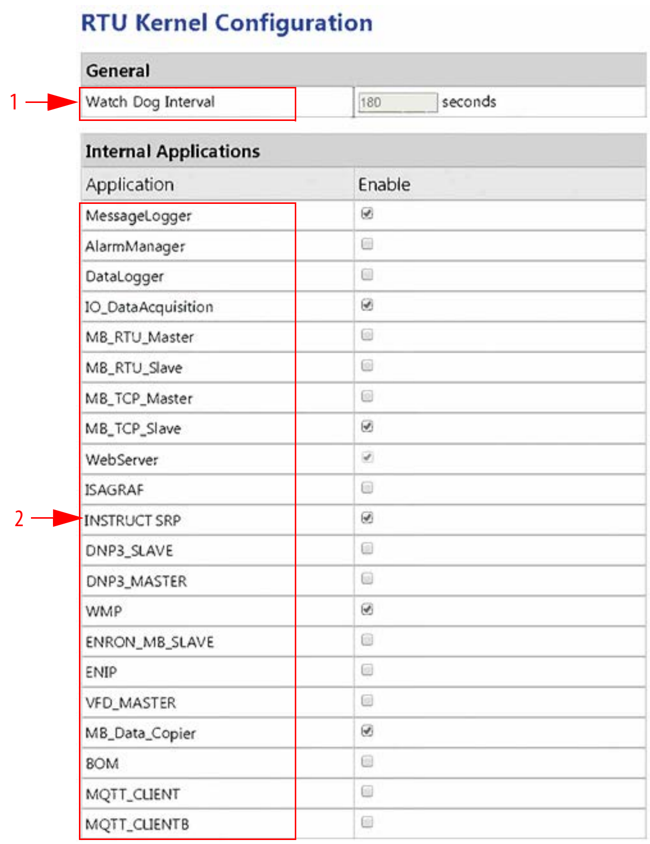
Figure 40 - System Configuration Menu Structure



RTU Kernel

A list of applications currently in the controller. When checked, the application is enabled and automatically starts on power-up.

Figure 41 - RTU Kernel



Item	Description
1	**Watch Dog Interval:** The time that the software watch-dog timer checks RTU Kernel. This time is fixed to 180 seconds and is not configurable.
2	**MessageLogger:** The Message Logger module.
	AlarmManager: The Alarm Manager module.
	DataLogger: The Data Logger module.
	IO_DataAcquisition: The I/O board module. This application must always be enabled.
	MB_RTU_Master: The Modbus RTU master module.
	MB_RTU_Slave: The Modbus RTU slave module. This application defaults to enabled.
	MB_TCP_Master: The Modbus TCP master module.
	MB_TCP_Slave: The Modbus TCP slave module. This application defaults to enabled.
	Web Server: The web server application module. This application must always be enabled.
2	**ISAGRAF:** The ISAGRAF application module. This application defaults to disabled. Enable this module as required if ISaGRAF logic is required in the controller. If this module is disabled, no ISaGRAF project can be uploaded to the controller.
	INSTRUCT SRP: The INSTRUCT SRP application module. This application must always be enabled.
	DNP3_SLAVE: The DNP3 slave module. (1)
	DNP3_MASTER: The DNP3 master module. (1)
	WMP: The WMP application module. This application must always be enabled. This module is used for the WMP communication to the wireless transducers while the controller is acting as a WMP gateway.
	ENRON_MB_SLAVE: The Enron Modbus Slave module. (1)
	ENIP: The EtherNet/IP module. (1)
	VFD_MASTER: The WMP application module. This application must always be enabled. This module is used for the WMP communication to the wireless transducers while the controller is acting as a WMP gateway.
	MB_Data_Copier: The Modbus Data Copier module.
	BOM: The Black Oil Model module.
	MTTQ_CLIENT: First instance of MQTT client module.
	MTTQ_CLIENTB: Second instance of MQTT client module.

(1) You must use vMiConfig to configure DNP3 (slave and master), Enron Modbus slave, or ENIP successfully when they are enabled. For vMiConfig instructions, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

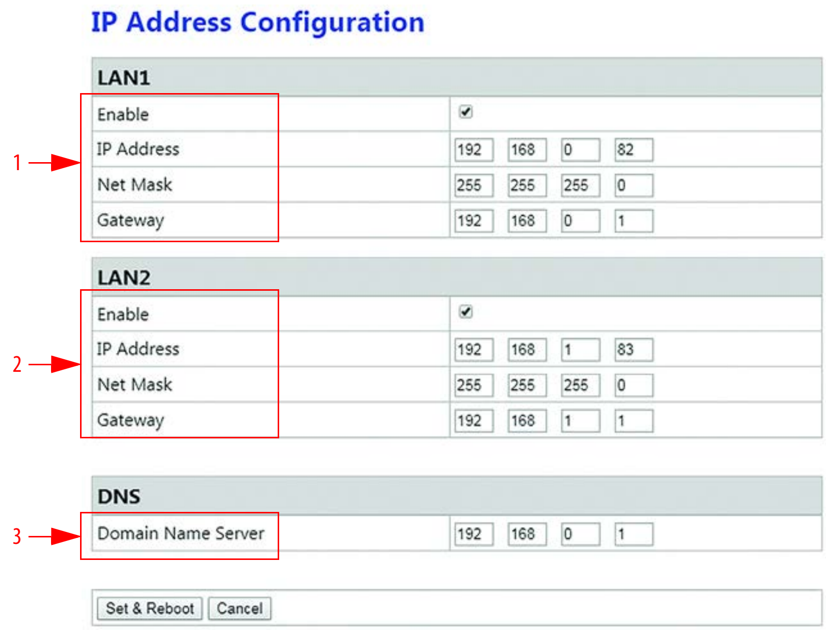
IP Address

ATTENTION: To avoid personal injury and/or machine damage, verify that the well is in Stopped State before attempting to change your IP configuration. See Fixed Speed Quick Start Configuration on page 225.

You can change the IP configuration of LAN1 and LAN2 ports from the IP Address Configuration screen (Figure 42) under System Configuration.

After changing the IP, click Set & Reboot for changes to take effect.

Figure 42 - IP Address



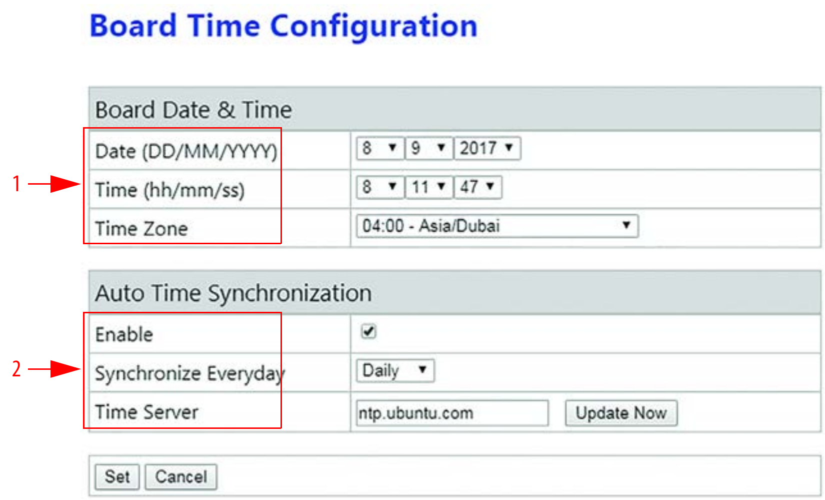
Item	Description
1	**Enable:** Check the box to enable (or clear it to disable) LAN1.
	IP Address: The IP address for LAN1.
	Net Mask: The subnet mask for LAN1.
	Gateway: The gateway IP that is connected to LAN1.
2	**Enable:** Check the box to enable (or clear it to disable) LAN2.
	IP Address: The IP address for LAN2.
	Net Mask: The subnet mask for LAN2.
	Gateway: The gateway IP that is connected to LAN2.
3	**Domain Name Server:** The domain server name that is connected to the controller.

Board Time

When the INSTRUCT SRP is first commissioned, the board time must be set. Configure the date and time and choose the correct time zone from the pull-down menu (Figure 43), and click Set.

TIP For automatic time synchronization, verify that the INSTRUCT SRP is on a network with an enabled time server.

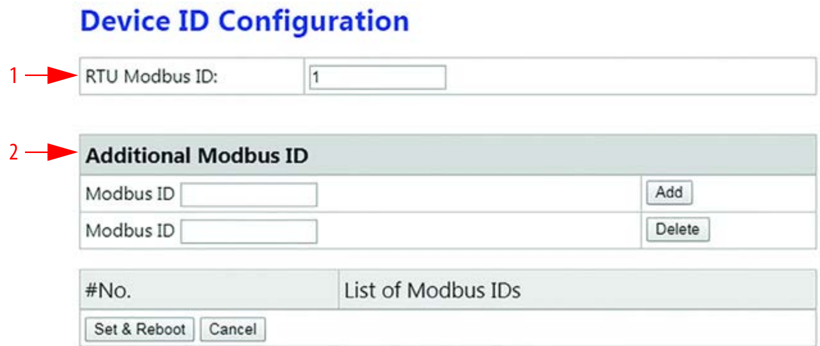
Figure 43 - Board Time



Item	Description
1	**Date (DD/MM/YYY):** The date to be displayed.
	Time (hh/mm/ss): The time to be displayed.
	Time Zone: The time zone where the INSTRUCT SRP is installed.
2	**Enable:** When checked, the Auto Time Synchronization is enabled.
	Synchronize Everyday: Select whether to auto synchronize the time: Daily or Hourly.
	Time Server: The address of your network time server.

Device ID

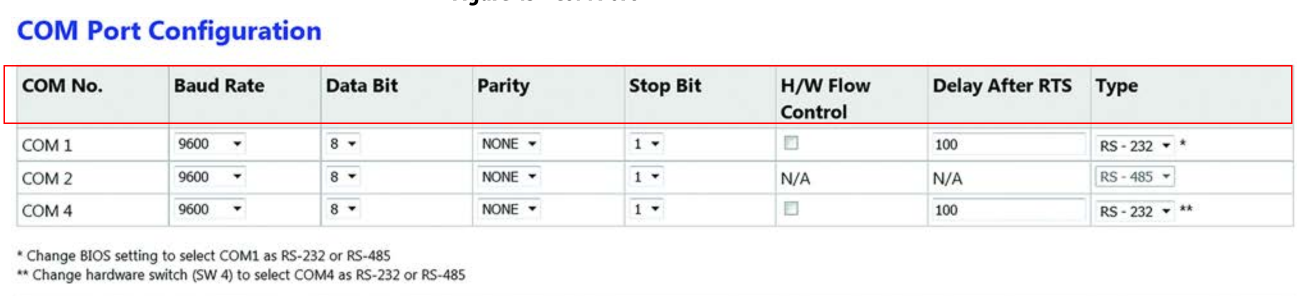
Figure 44 - Device ID



Item	Description
1	**RTU Modbus ID:** The Modbus slave ID of the INSTRUCT SRP used for Modbus communication.
2	**Additional Modbus ID:** Additional Modbus ID can be created which you can use for ISaGRAF applications.

COM Port

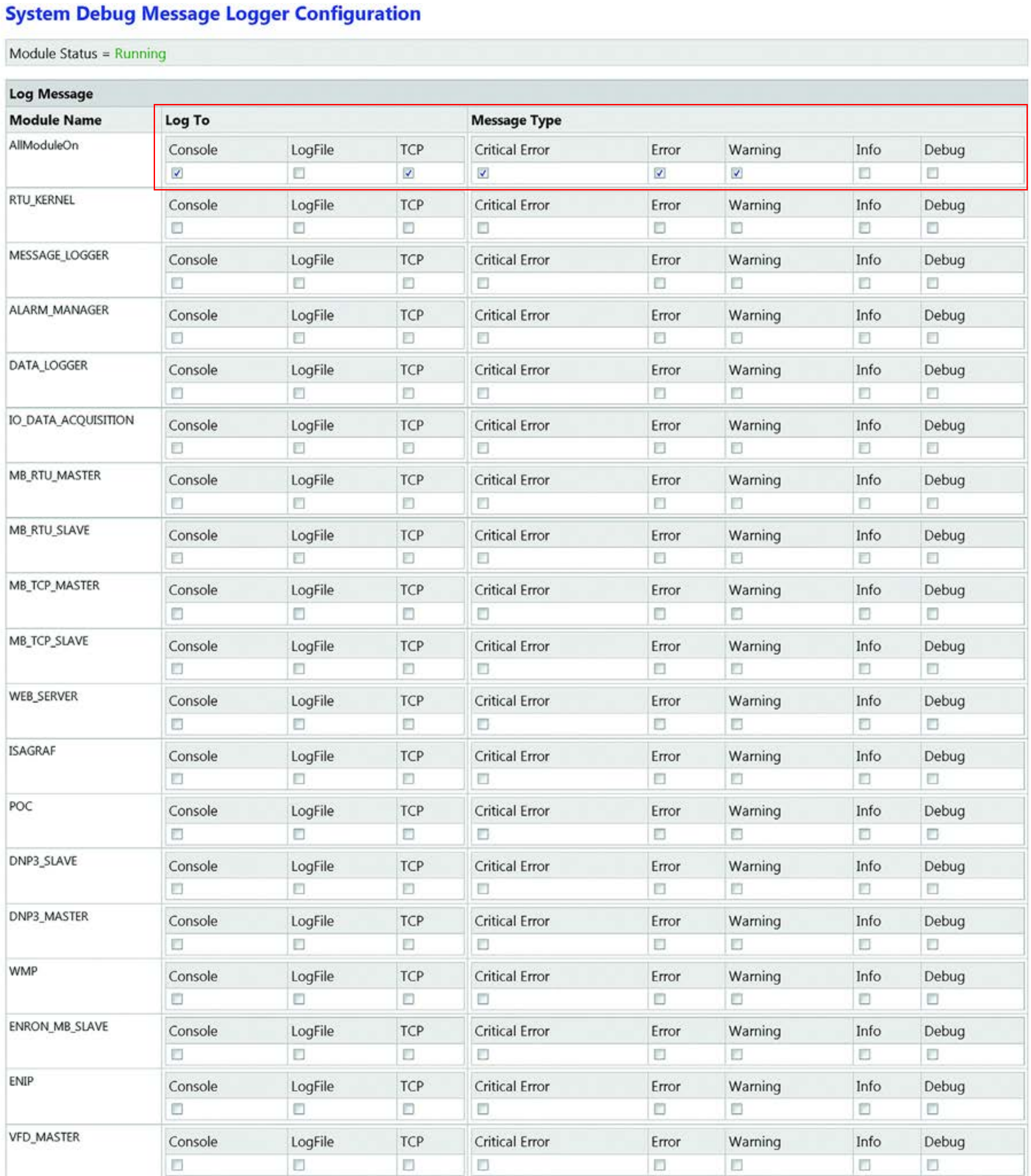
Figure 45 - COM Port



Column	Description
1	**COM No.:** The physical COM from the controller.
2	**Baud Rate:** The communication rate for the COM port serial communication.
3	**Data Bit:** The data bit for the COM port serial communication.
4	**Parity:** The parity for the COM port serial communication.
5	**StopBit:** The StopBit for the COM port serial communication.
6	**H/W Flow Control:** This option is enabled when device communication to this COM port requires flow control.
7	**Delay After RTS:** The number of milliseconds of RTS delay before it is sent to the serial device connected to this COM port.
8	**Type:** The type of serial communication for this COM port (RS-232 or RS-485).

System Debug Message Logger

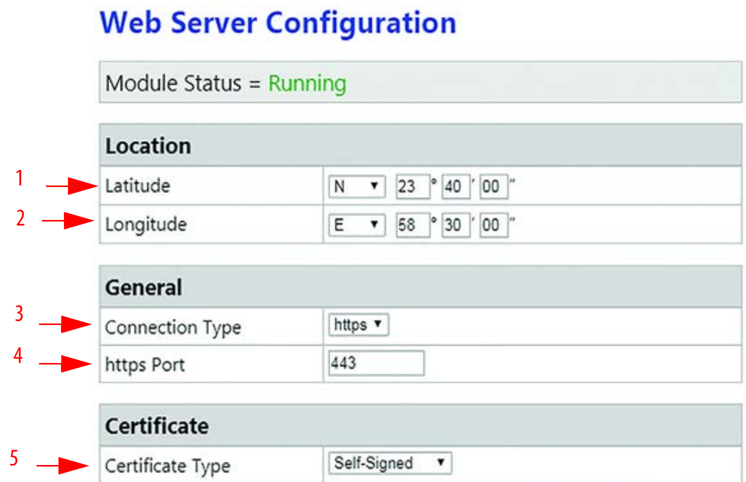
Figure 46 - System Debug Message Logger



Column	Description	Column	Description
Log To		**Message Type**	
1	**Console:** Display the system debug messages on monitor through VGA port.	5	**Error:** Generate system debug message for all errors messages.
2	**LogFile:** Save the system debug messages to Message.csv log file.	6	**Warning:** Generate system debug message for all warning messages.
3	**TCP:** Display the system debug message over TCP Port 8000.	7	**Info:** Generate system debug message for all info messages.
4	**Critical Error:** Generate system debug message for all critical error messages.	8	**Debug:** Generate system debug message for all debug messages.

Web Server

Figure 47 - Web Server



Item	Description
1	**Latitude:** The user-entered latitude of the location of the controller.
2	**Longitude:** The user-entered longitude of the location of the controller.
3	**Connection Type:** You can select between a secure (https) and a non-secure (http) connection type. By default a secure (https) connection is selected.
4	**http/https Port:** A user-configurable web server port for secure (https) or non-secure (http) connections. The default value for this port is 80 for non-secure (http) connections, and 443 for secure (https) connections.
5	**Certificate Type:** The Certificate type options are Self-signed and User Supplied. If self-signed certificate is selected, then the controller generates a self-signed certificate for its own IP address. If User Supplied certificate is selected, then you have to upload following three files in PEM format: • CA certificate • Server key • Server certificate

The QRATE iXC2 High Performance Edge Controller User Manual uses HTTPS to authenticate the web server and protect the privacy and integrity, of the exchanged data, while the data is in transit. The bidirectional encryption of communication, between a client and server, helps protect against eavesdropping and tampering. The QRATE iXC2 Controller supports two certification methods, Self-signed and User Supplied. The definitions of each can be found in the description table, above.

Certificates must be signed by a trusted certificate authority (CA) for the web browser to accept it without warning. The CA certifies that the certificate holder is the operator of the web server that presents it. Web browsers are generally distributed with a list of signing certificates, of major CA, so that they can verify certificates signed by them. The CA is an entity that issues digital certificates. A digital certificate certifies the ownership of a public key by the named subject of the certificate. This certification allows others to rely on signatures, or assertions, which are made about the private key that corresponds to the certified public key. A CA acts as a trusted third party-trusted both by the subject (owner) of the certificate and the party that relies on the certificate. The format of these certificates is specified by the X.509 standard.

Interface Protocols

The INSTRUCT SRP supports Modbus RTU, Modbus TCP, EtherNet/IP[1], DNP3[1] (slave and master), and Enron Modbus[1] slave. The INSTRUCT SRP has two Ethernet communication ports (LAN1 and LAN2). One Ethernet port is used for connection to the PanelView™ terminal, and the other Ethernet port for local configuration through the web server. The IP address is set through web server, see IP Address on page 43.

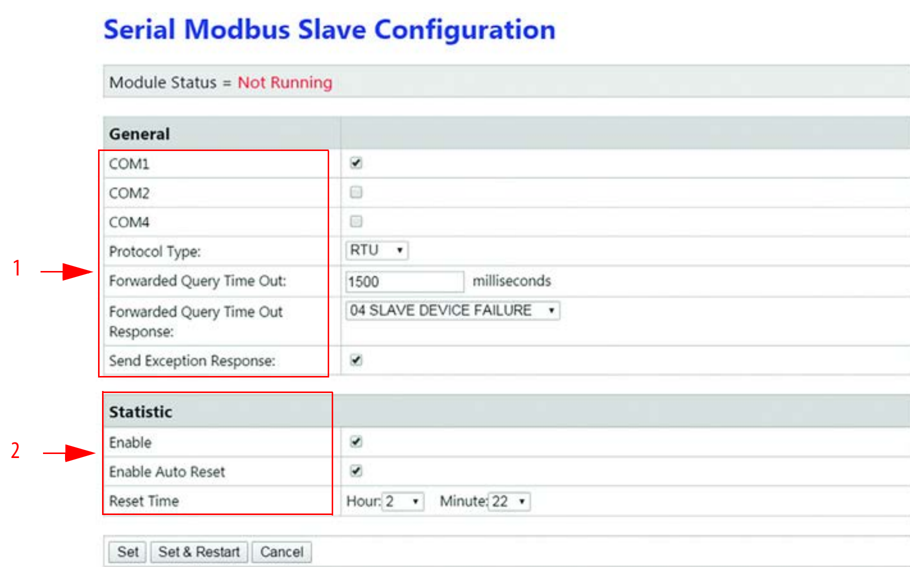
TIP The INSTRUCT SRP can support up to two MQTT clients.

IMPORTANT See Modbus mapping registers in Appendix D on page 325.

The INSTRUCT SRP has three serial ports, two RS-232 ports, and one RS-485 port that support Modbus RTU protocol. All serial ports support either Modbus RTU Slave or Master. You can set the COM ports configuration through the web server (Figure 48 on page 48).

Serial Modbus Slave Configuration

Figure 48 - Serial Modbus Slave Configuration



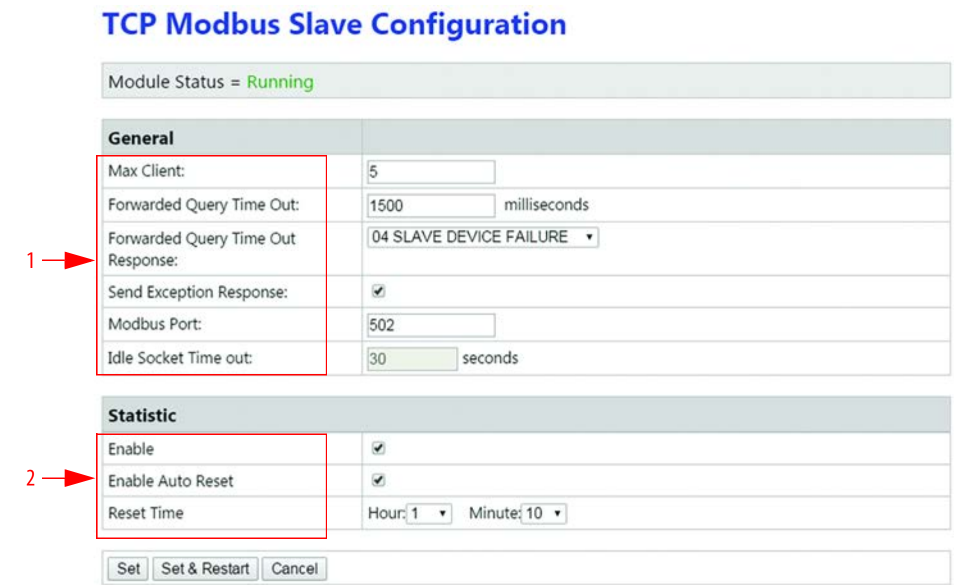
Item	Description
1	**COM1/COM2/COM4:** Check the box to enable COM1/COM2/COM4, respectively.
	Protocol Type: Select RTU or ASCII Modbus Protocol type.
	Forwarded Query Time Out: The maximum time the RTU Slave Module waits before sending an exception for a query that is forwarded from Modbus client to a Slave Device.
	Forwarded Query Time Out Response: Select the Exception Message to send to Modbus Client.
	Send Exception Response: Check the box to send an exception response to Modbus Client.

(1) You must use vMiConfig to configure DNP3 (slave and master), Enron Modbus slave, or ENIP successfully when they are enabled. For vMiConfig instructions, see the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Item	Description
2	**Enable:** Check the box to generate communication statistics.
	Enable Auto Reset: Check the box to reset communication statistics everyday at a specified time.
	Reset Time: The time of the day to reset communication statistics.

TCP Modbus Slave Configuration

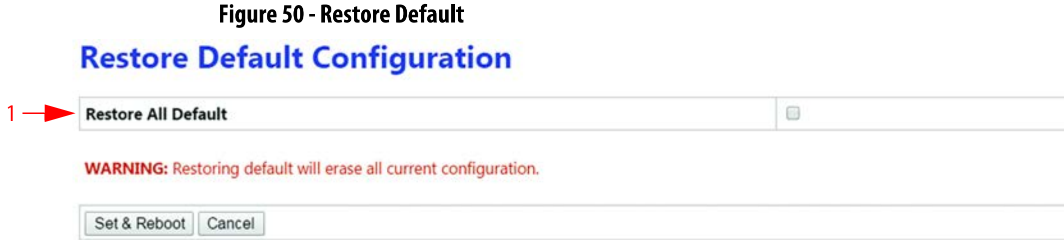
Figure 49 - TCP Modbus Slave Configuration



Item	Description
1	**Max Client:** The maximum number of Modbus clients that can connect to the controller.
	Forwarded Query Time Out: The maximum time the RTU Slave Module waits before sending an exception for a query that is forwarded from Modbus client to a Slave Device.
	Forwarded Query Time Out Response: Select the Exception Message to send to Modbus Client.
	Send Exception Response: Check the box to send an exception response to Modbus Client.
	Modbus Port: TCP port number that is used for Modbus TCP Slave.
	Idle Socket Time out: The maximum time the TCP Slave port waits before closing the TCP Socket.
2	**Enable:** Check the box to generate communication statistics for TCP Slave Module.
	Enable Auto Reset: Check the box to reset communication statistics everyday at specified time.
	Reset Time: The time of the day to reset communication statistics.

Restore Default

Figure 50 - Restore Default

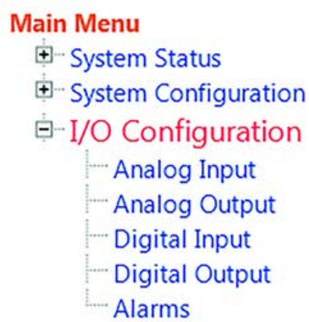


Item	Description
1	**Restore All Default:** To restore all default system settings, check the box and select Set & Reboot.

I/O Configuration

The I/O Configuration pages allow you to modify individual I/O channels. The default I/O configuration is set to work with the INSTRUCT SRP application. Any change to non-spare channels modifies how your INSTRUCT SRP operates.

Figure 51 - I/O Configuration Menu Structure



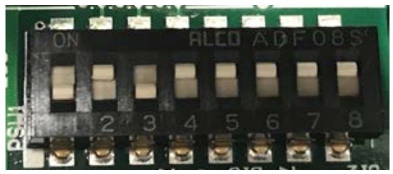
The following I/O channels are preconfigured and allocated for the INSTRUCT SRP

Input/Output	Description
AI1	Load cell signal *(do not modify)*
AI3	Position inclinometer signal *(do not modify)*
A01	VFD 4…20 mA speed command signal *(do not modify)*
DI1	Motor feedback signal *(do not modify)*
DI2	HOA signal status *(do not modify)*
DI3	Power loss signal when battery is used for future expansion *(do not modify)*
DI4	Customer-supplied kill signal
DI5	Customer-supplied E-stop switch
DI6	Hall effect crank arm sensor
DI9	Hall effect motor shaft/RPM sensor
D01	Motor control (for non-latching relay)
D02	Motor control (latch for motor Run command)
D03	Motor control (unlatch for motor Stop command)
D04	Buzzer alert signal from Start alert

Analog Input Configuration (AI2, AI4, AI5, AI6, AI7, and AI8)

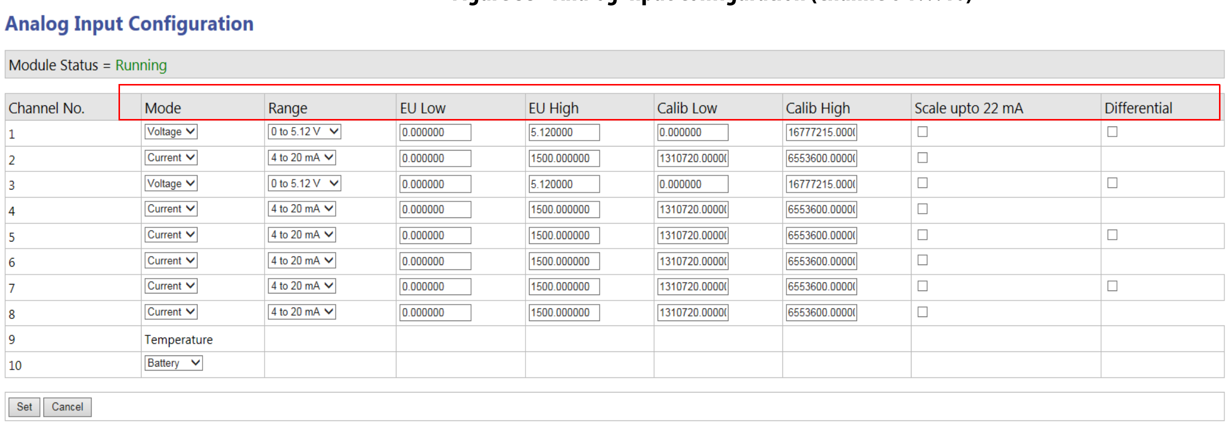
You must verify that the switches for the analog channels are properly set. When the switch is in the ON (up) position, the input is in Current mode. In the OFF (down) position, the input is in Voltage mode. Figure 52 shows AI1, AI2,AI3, and AI8 in Voltage mode while AI4,AI5,AI6, and AI7 are in Current mode.

Figure 52 - Analog Channel Switches



IMPORTANT To access the switches, you must open the controller enclosure. See the QRATE iXC2 High Performance Edge Controller User Manual. For a copy of this manual, contact your local Sensia representative.

Figure 53 - Analog Input Configuration (Channels 1…10)



Analog Input Configuration

Module Status = Running

Channel No.	Mode	Range	EU Low	EU High	Calib Low	Calib High	Scale upto 22 mA	Differential
1	Voltage	0 to 5.12 V	0.000000	5.120000	0.000000	16777215.000	☐	☐
2	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	
3	Voltage	0 to 5.12 V	0.000000	5.120000	0.000000	16777215.000	☐	☐
4	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	
5	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	☐
6	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	
7	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	☐
8	Current	4 to 20 mA	0.000000	1500.000000	1310720.0000	6553600.0000	☐	
9	Temperature							
10	Battery							

Set Cancel

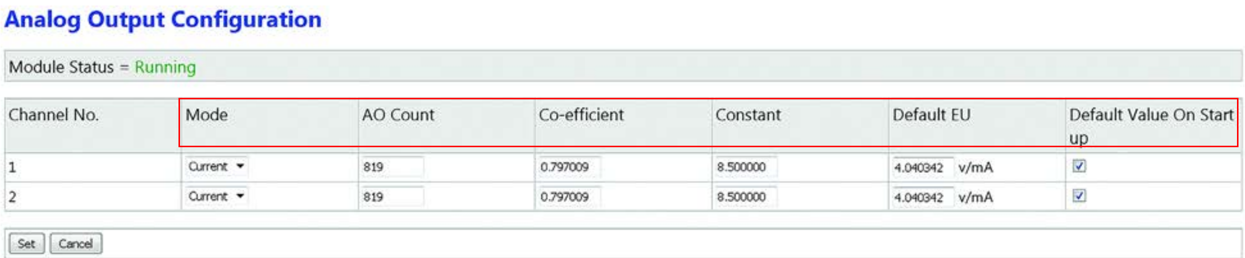
Column	Description
1	**Mode:** (1) Channels 1…8 - Select whether the analog input channel reads Current or Voltage signal. Channel 9 - This parameter defaults to display temperature and is not configurable. Channel 10 - Select whether Battery (supply voltage) or Humidity data is displayed.
2	**Range:** The range of the analog input signal into the particular AI.
3	**EU Low:** The engineering unit (EU) low value for the signal into the analog input.
4	**EU High:** The EU high value for the signal into the analog input.
5	**Calib Low:** The calibration for the AI channel *(do not modify)*.
6	**Calib High:** The calibration for the AI channel *(do not modify)*.
7	**Scale Up to 22 mA:** Check the box to scale engineering data for analog current inputs up to a maximum value of 22 mA. When cleared, the engineering data is only scaled up to 20 mA.
8	**Differential:** Whether the corresponding Analog Input Channel reads single ended or differential analog input signal. Applicable only for Channels 1, 3, 5, and 7.

(1) See the QRATE iXC2 High Performance Edge Controller User Manual for DIP Switch settings. For a copy of this manual, contact your local Sensia representative.

IMPORTANT	To change the AI channel configuration, and switches, the top cover of the QRATE iXC2 High Performance Edge Controller must be removed. By default, AI1 and AI3 are in Voltage while the rest of the channels are in current mode.

Analog Output Configuration (AO2)

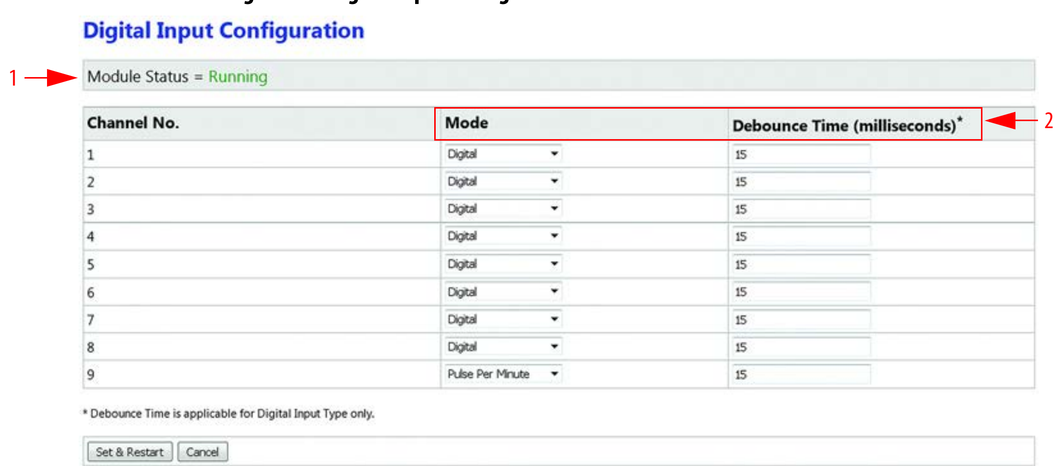
Figure 54 - Analog Output Configuration



Column	Description
1	**Mode:** The analog output (AO) type for AO2 can be either Current or Voltage.
2	**AO Count:** The raw count for calibration that comes preconfigured *(do not modify)*.
3	**Coefficient:** The coefficient for the AO that is used internally for calibration that comes preconfigured (*do not modify)*.
4	**Constant:** The calibration constant for the AO that is used internally for calibration that comes preconfigured (*do not modify)*.
5	**Default EU:** The output value on the AO upon rebooting the controller.
6	**Default Value On Startup:** When checked, the Analog output defaults to the "Default EU" value.

Digital Input Configuration (DI7 and DI8)

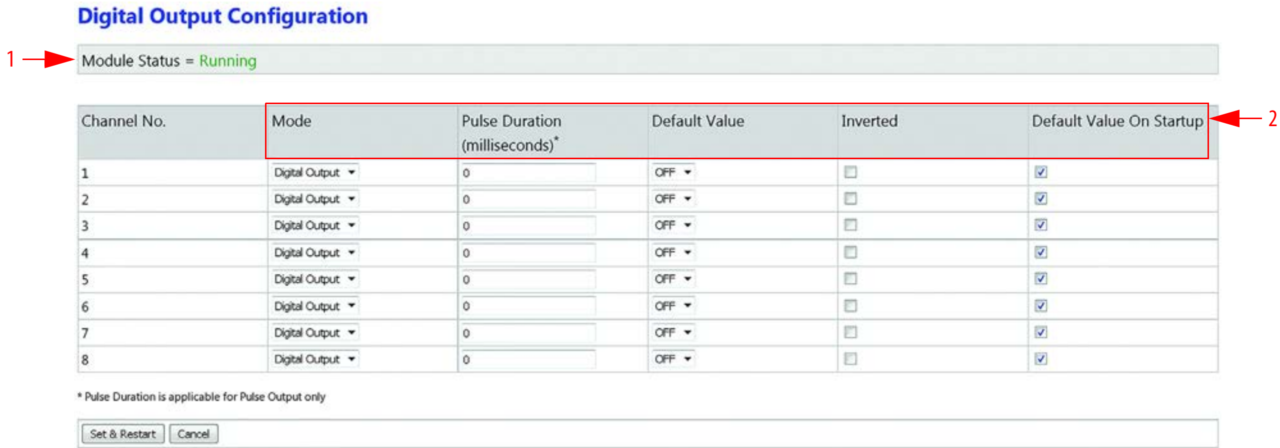
Figure 55 - Digital Input Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Mode:** The digital input (DI) type can be Digital, Pulse Counter, or Pulse Accumulation (Channel 9 also includes Pulse Per Minute).
	Debounce Time: The minimum time (in ms) that a DI detects a signal before declaring any action.

Digital Output Configuration (DO5, DO6, DO7, and DO8)

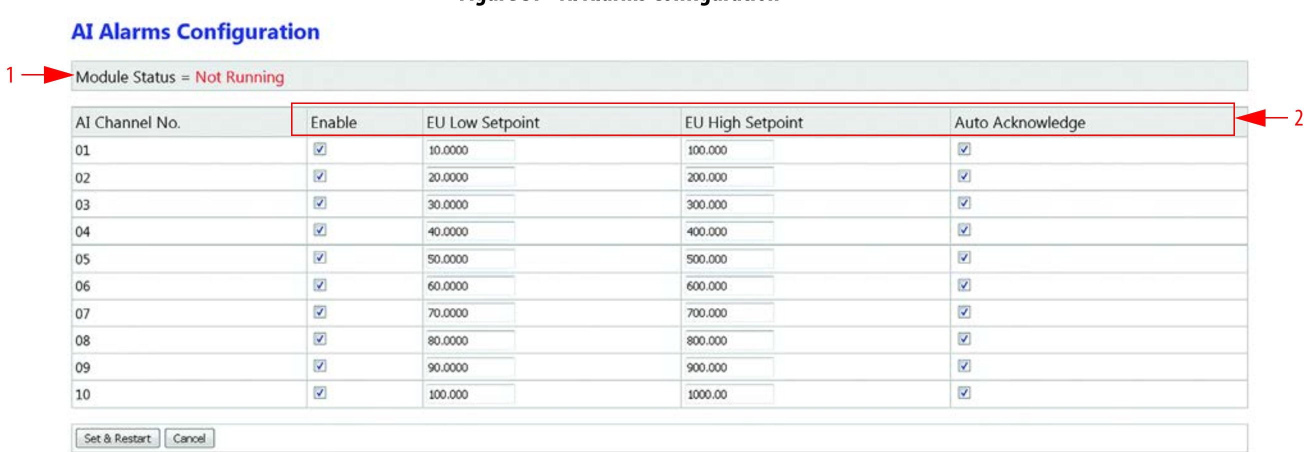
Figure 56 - Digital Output Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Mode:** The digital output (DO) type can be Digital Output or Pulse Output.
	Pulse Duration (ms): Duration the digital output state stays On when in Pulse Output Mode.
	Default Value: The default value for the digital output (DO) at startup of the controller.
	Inverted: When checked, if the DO is active, the value shows low. Only modify this value when required by the application.
	Default Value On Startup: When checked, the controller uses the specified default value upon rebooting.

Alarms

Figure 57 - AI Alarms Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Enable:** When checked, the alarm for the corresponding AI Channel is enabled. When cleared, no alarm is generated.
	EU Low Setpoint: EU Low Limit to trigger an Alarm for the corresponding channel.
	EU High Setpoint: EU High Limit to trigger an Alarm for the corresponding channel.
	Auto Acknowledge: When checked, the alarm resets automatically when the EU data is back in accepted range.

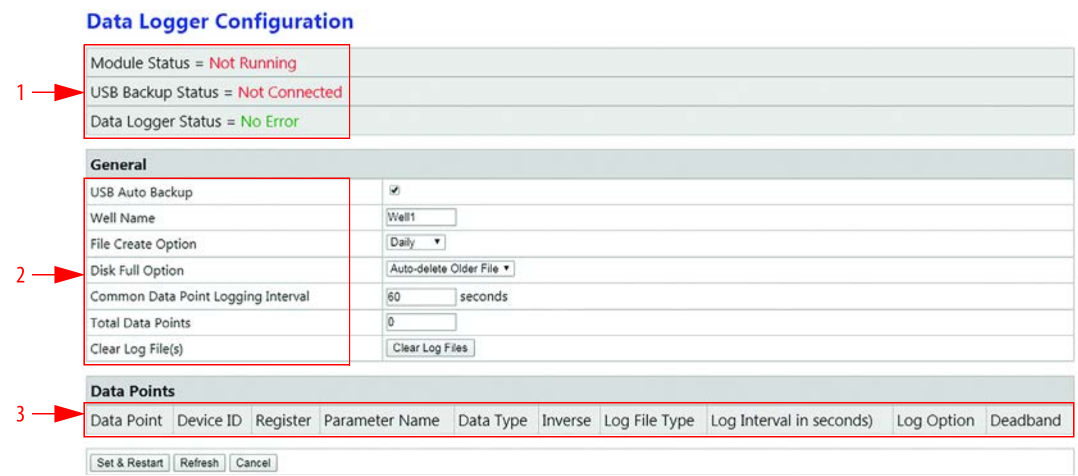
Data Logger

The Data Logger module is responsible for the data logging and data backup features. It records the I/O data and any third-party Modbus data with a date and UNIX time stamp.

The General section of the Data Logger Configuration page can be modified to include custom settings, with additional options to enable/disable Modbus Logging.

The Data logger records a maximum of 50,000 records. The values are then stored in a FIFO format with the latest value at the top. When the limit is reached, a new Common Log File is created and the last available Common Log File is renamed as backup. A maximum of one log-backup file is created.

Figure 58 - Data Logger

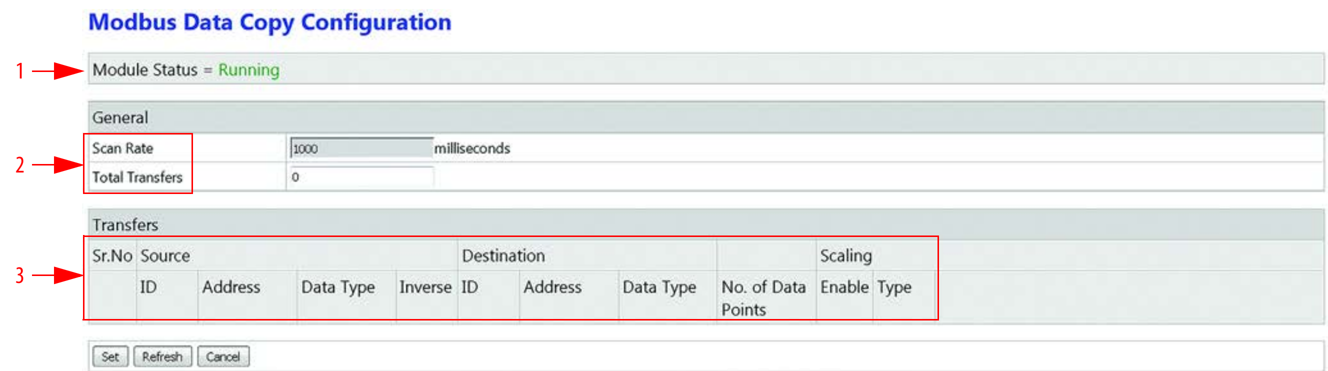


Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
	USB Backup Status: Displays the backup status. It has six options: • *Not Connected:* USB is not detected • *Connected:* USB has been detected • *Backup Successful:* Data log files have been successfully backed up onto the USB • *Error:* Error occurred while backing up Data log files to the USB • *Backup in Progress:* Backing up of Data log files to the USB is in progress • *USB Lib Initialization Failed:* USB Library Initialization failed at Start Up.
	Data Logger Status: If there is any error or if the disk size limit is reached, this displays those statuses. It has three options: • *No Error:* No Error • *Disk Full:* Disk Size has reached limit. Oldest File is deleted or no data logging is done depending upon user configuration • *No Older File to Delete:* If you have selected “Auto-delete Oldest File,” when the disk has reached the limit and there are no other oldest files than the Current file, this error is displayed.
2	**USB Auto Backup:** The controller supports two types of USB Backup Option (Automatic and Manual-Trigger). When a checkbox is checked, Automatic Backup Option is selected. By default this backup is enabled. • *Automatic:* Whenever a USB is connected to the controller, the Data Logger module backs up the files to the USB by creating a folder. The name of the folder is the Well name along with the date and time stamp. If Well1 is the well name and the data backup starts at 23rd March 2017 10:50:40 AM, the name of the folder is Well1_20170323105040. You must disconnect and then reconnect the USB to start another backup. If you leave the USB connected to the controller, then subsequent automatic backups do not happen. • *Manual-Trigger:* If a USB drive is connected, you can trigger the manual backup anytime. For this, you have to write to the Modbus register. Similar to Automatic Backup, a folder is created with the well name and time stamp and all log files are downloaded.
	Well Name: The name that you give to the well for easier identification.
	File Create Option: When the backup file is created. Select from Daily, Weekly, or Monthly.
	Disk Full Option: The action that is taken with the backup disk is full. Select Auto-delete Older File or Stop Data Logging.
	Common Data Point Logging Interval: The time interval at which data points are saved in log file when in Common Log File Type mode.
	Total Data Points: The number of data points to be logged. Maximum of 100 data points can be logged simultaneously.
	Clear Log File(s): Click button to clear all log files. To clear the log, a password is required. The password is “21485”.
3	**Data Point:** The number of data points logged.
	Device ID: Modbus Device ID of the data point to be logged.
	Register: Modbus Register Type and Address of the data point to be logged.
	Parameter Name: Name of the log file for corresponding data point when in Single Log File Type mode.
	Data Type: Data type of the data point to be logged.
	Inverse: Whether the data type of the data point to be logged is inverted (big-endian mode).
	Log File Type: Whether to log each data point in separate files or all data points in one common log file.
	Log Interval (seconds): Time interval at which data points are saved in log file when in Single Log File Type mode.
	Log Option: Whether to save the data point to the log file at set interval or whenever the value of the data point changes. Applicable only for Single Log File Type mode.
	Deadband: The absolute value, by which if the parameter value changes then the parameter is logged. It is applicable for On Change and On Interval and Change log option. For CS and IS Modbus registers, this parameter is not available.

Modbus Data Copy

Modbus Data Copy allows you to copy data from a source address to a new Destination Address (fixed to iXC2-RTU ID 1). This functionality is useful for transferring data from wireless registers (WMP registers) to a new destination address (ID 1).

Figure 59 - Modbus Data Copy

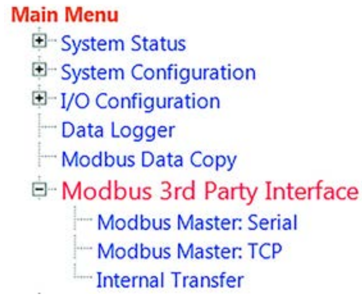


Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Scan Rate:** Frequency (in ms) at which data is copied from the source address to the destination address. Fixed to 1000 ms.
	Total Transfers: Total number of transfers to be executed (Max of 100).
3	**Sr. No:** The number of transfers logged.
	Source
	ID: Modbus Device ID of the Source Register.
	Address: Modbus Register Type and Address of the Source Register.
	Data Type: Data type of the Source Register.
	Inverse: Whether the Data Type of Source Register is inverted (big-endian mode)
	Destination
	ID: Modbus Device ID of the Destination Register. Fixed to iXC2-RTU ID.
	Address: Modbus Register Type and Address of the Destination Register.
	Data Type: Data type of the Destination Register.
	No. of Data Points: Number of consecutive Registers to be copied in one transfer (Max of 100).
	Scaling
	Enable: Scale the source data before copying to the destination register.
	Type: Whether to scale the data in Factor mode or Range mode. When in factor mode, data is scaled with the following formula: Destination Data = (Source Data * Factor) + Offset When in Range mode, the data is scaled with the following formula: Destination Data = [(Source Data – Source Min) * (Destination Max – Destination Min) / (Source Max - Source Min)] + Destination Min

Modbus Third-party Interface

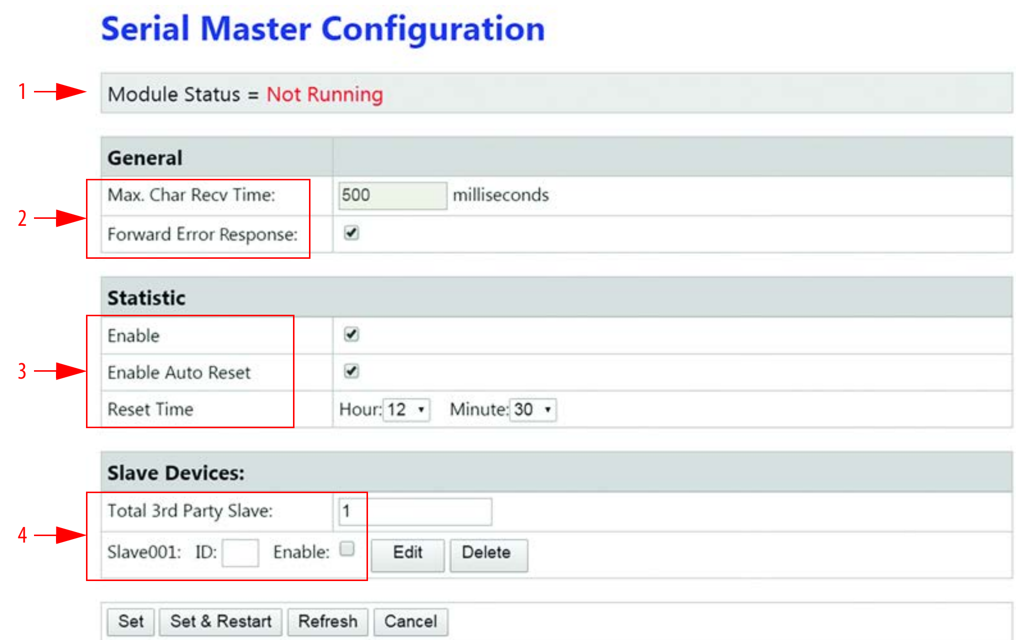
The Modbus Third-party Interface pages allow you to configure Modbus and TCP communication settings.

Figure 60 - Modbus Third-party Interface Menu Structure



Modbus Master: Serial

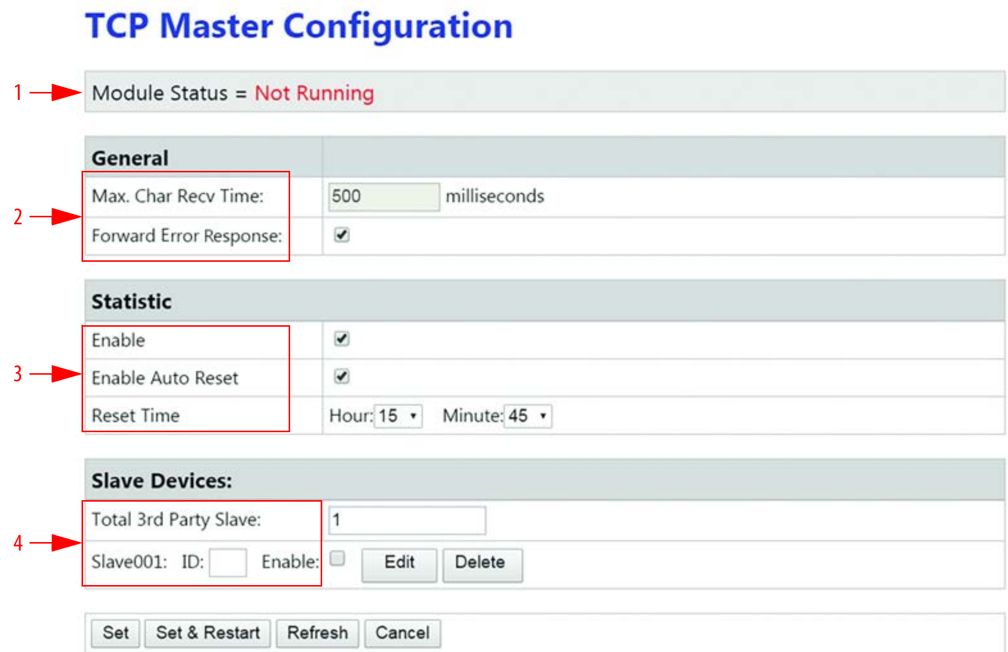
Figure 61 - Modbus Master: Serial



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Max Char Recv Time:** The time difference that is allowed between two consecutive bytes. If the time gap is more, the query is discarded.
	Forward Error Response: Whether to forward an error response that is received from Slave Device to Modbus Slave Module
3	**Enable:** Whether to generate communication statistics for Serial Master Module.
	Enable Auto Reset: Whether to reset communication statistics automatically every 24 hours at specified time.
	Reset Time: Time of the day to reset communication statistics.
4	**Total 3rd Party Slave:** Total number of Slave Devices that the Serial Master Module polls.
	Slave ID: Modbus device ID of slave device to be polled.
	Slave Enable: This checkbox enables polling of the corresponding slave device.

Modbus Master: TCP

Figure 62 - Modbus Master: TCP



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Max Char Recv Time:** The time difference that is allowed between two consecutive bytes. If the time gap is more, the query is discarded.
	Forward Error Response: Whether to forward an error response that is received from Slave Device to Modbus Slave Module.
3	**Enable:** Whether to generate communication statistics for TCP Master Module.
	Enable Auto Reset: Whether to reset communication statistics automatically every 24 hours at specified time.
	Reset Time: Time of the day to reset communication statistics.
4	**Total 3rd Party Slave:** Total number of Slave Devices that the Serial Master Module polls.
	Slave ID: Modbus device ID of slave device to be polled.
	Slave Enable: This checkbox enables polling of the corresponding slave device.

Internal Transfer

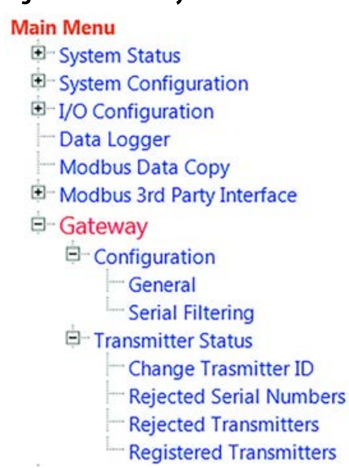
Figure 63 - Internal Transfer

Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Total 3rd Party Slave:** Total number of Slave Devices that the Serial Master Module polls.
	Slave ID: Modbus device ID of slave device to be polled.
	Slave Enable: This checkbox enables polling of the corresponding slave device.

Gateway

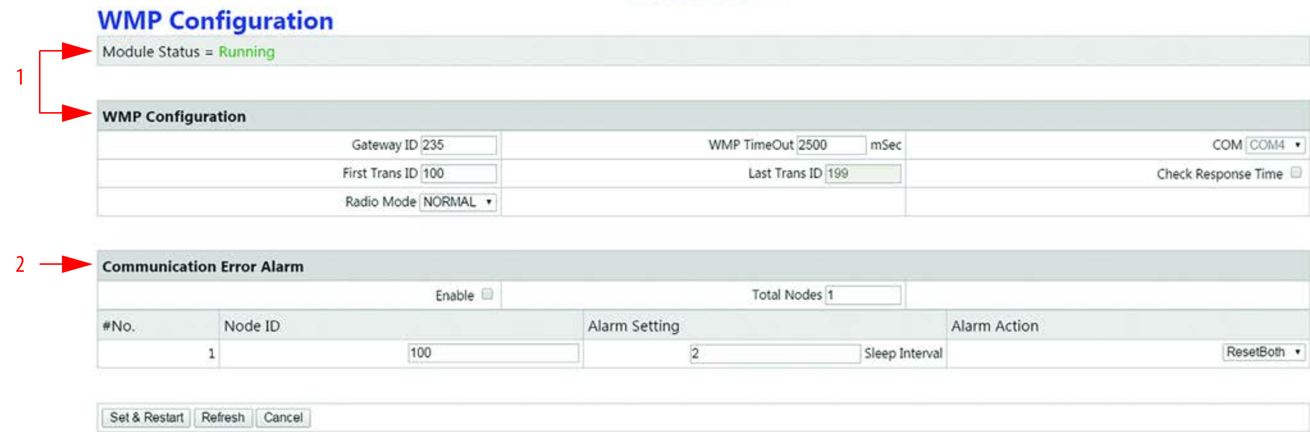
The Gateway pages allow you to configure and monitor transmitter status directly from your controller. See WMP Gateway Features on page 14 for more information.

Figure 64 - Gateway Menu Structure



Configuration — General

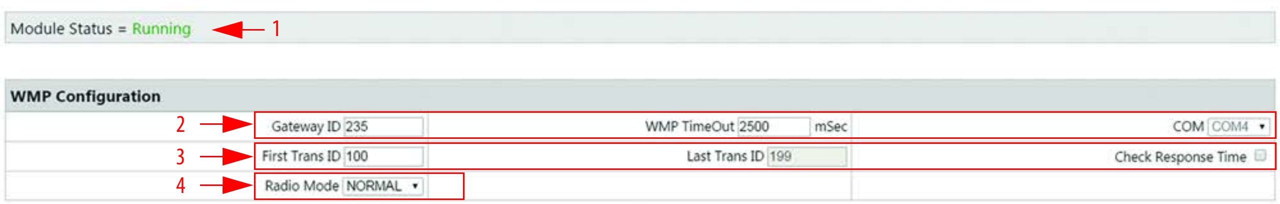
Figure 65 - General Gateway Configuration



Item	Description
1	Module Status and WMP Configuration (page 60)
2	Communication Error Alarm (page 61)

WMP Configuration

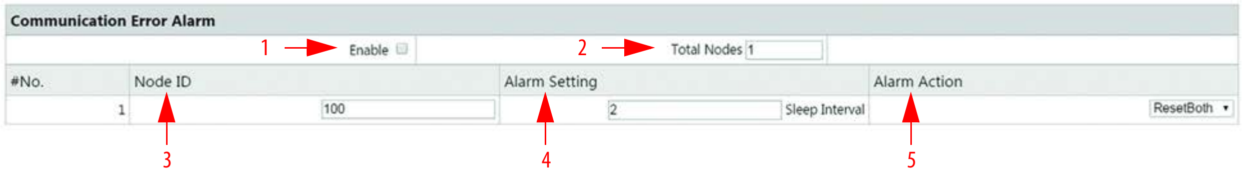
Figure 66 - WMP Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Gateway ID:** The Slave ID of the gateway that allows WMP communication between the wireless transmitters and the gateway. This same ID must be configured as the primary Gateway ID in the transmitters.
	WMP Timeout: The time that the gateway waits for a response from any transmitter before timing out.
	COM: The COM port that is assigned for WMP protocol communication. COM4 port is the default WMP communication port.
3	**First Transmitter ID:** The transmitter ID of the first wireless transmitter. The value defaults to 100.
	Last Transmitter ID: The transmitter ID of the last wireless transmitter.
	Check Response Time: This feature is used to measure the response time. Response time is the time that it takes a message from the WMP gateway to reach a registered transmitter. This feature is used to discover any communication issues between the gateway and transmitters. Larger response times signal that there is a communication problem.
4	**Radio Mode:** A form of data security for the messages that are sent over radio. You can choose from three radio modes: • *Radio Mode:* WMP messages are sent over the Zigbee radio. • *Normal Mode:* WMP messages are sent in the radio-message format. • *API Mode:* WMP messages are encapsulated in the API message frame that has its own error-checking format. API mode also gives other info, like signal strength, for that particular message.

Communication Error Alarm

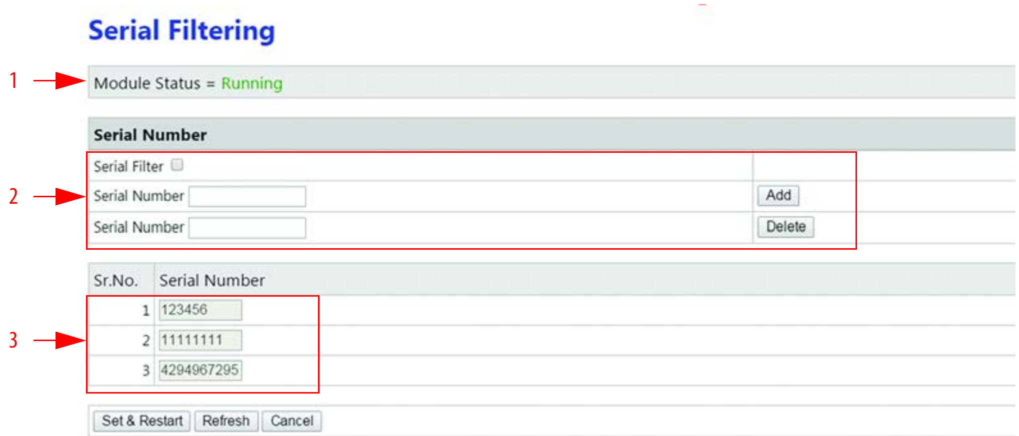
Figure 67 - Communication Error Alarm



Item	Description
1	**Enable**: If this box is checked, the Communication Error Alarm feature is enabled. If enabled, then only the gateway generates an alarm if it does not receive a message from the registered transmitter for a configured time interval. This feature is used to check the communication status between gateway and transmitters.
2	**Total Nodes:** The total number of transmitters
3	**Node ID:** The Modbus ID of the registered transmitter. If the gateway does not receive a message from this transmitter for the configured time interval, it generates an alarm for the node. It can set a relay or buzzer depending upon the connection.
4	**Alarm Setting:** A user-configured time interval. If gateway does not receive a message from the registered transmitter for the configured amount of time, it generates an alarm. This value is a multiple of the sleeping interval of the registered transmitter. The sleeping interval is the time when transmitter wakes up and sends the basic data message to the gateway.
5	**Alarm Action:** The action to be performed when the gateway generates an alarm for the Communication Error. The action can be set to: None, Reset Raw Data, Reset EU Data, or Reset Both. When Reset Both is selected, the values are reset to 0.

Configuration — Serial Filtering

Figure 68 - Serial Filtering

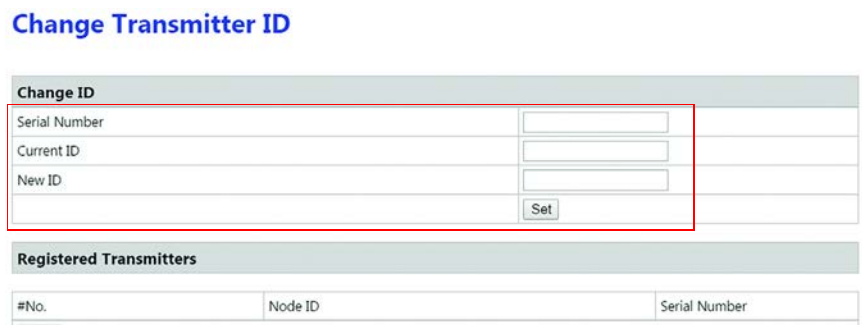


Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Serial Filter:** Each wireless transmitter has a unique serial number. When the Serial Filter is enabled, the WMP gateway filters out all serial numbers that are not on the serial number list.
	Serial Number Add: Used to add a serial number to the serial number list. This addition is done to help prevent the WMP gateway from filtering out a particular serial number.
	Serial Number Delete: Used to delete a serial number from the serial number list. This deletion is done to help the WMP gateway filter out a previously added serial number.
3	**Serial Number:** The serial number list that is used by the WMP gateway to recognize, or filter out, wireless transmitters.

Transmitter Status — Change Transmitter ID

The Node ID of any of the currently communicating wireless transmitter can be changed by specifying its serial number, current ID, and a new ID. Click Set to save your changes.

Figure 69 - Change Transmitter ID



Transmitter Status — Rejected Serial Numbers

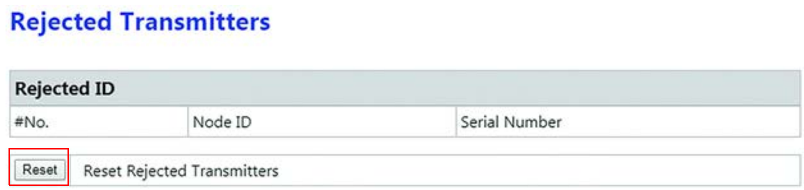
This page displays a list of serial numbers that have been rejected when serial filtering is enabled. This list can be cleared by clicking the Reset button. This list populates again if wireless transmitters with filtered out serial numbers are still communicating with the WMP gateway.

Figure 70 - Rejected Serial Numbers

Transmitter Status — Rejected Transmitters

This screen displays a list of rejected wireless transmitters. This list can be cleared by clicking the Reset button. This list populates again the next time that wireless transmitters get rejected.

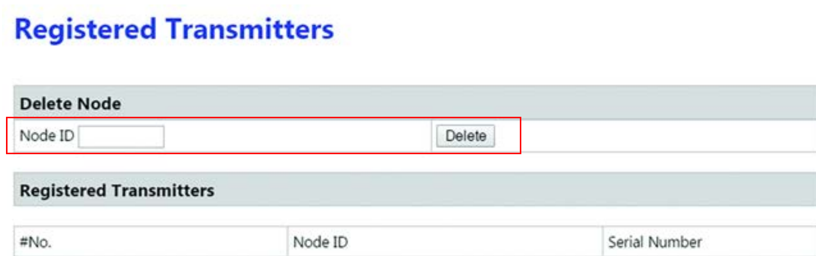
Figure 71 - Rejected Transmitters



Transmitter Status — Registered Transmitter

This screen displays a list of any wireless transmitters that have successfully registered with the WMP gateway. To remove a wireless transmitter from the list, enter the Node ID and click Delete.

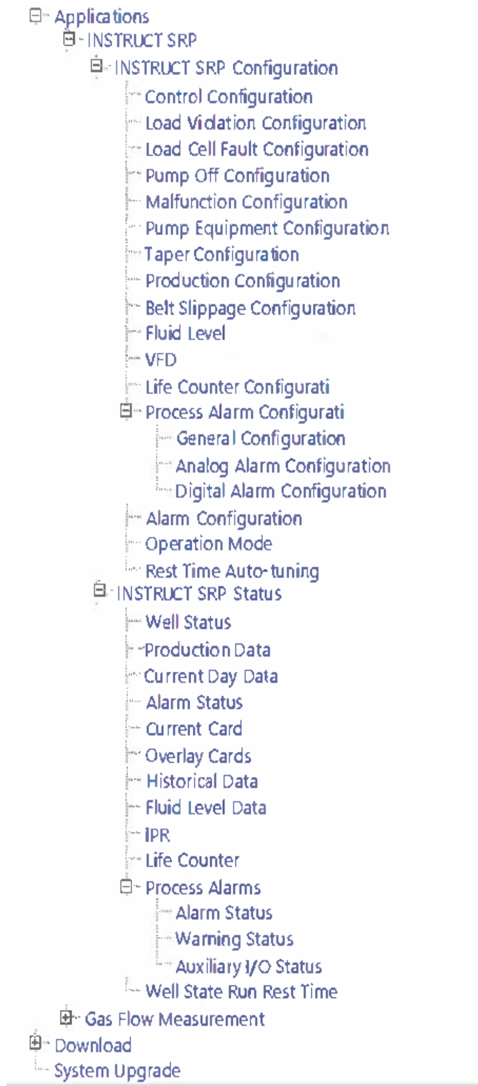
Figure 72 - Registered Transmitters



Applications — INSTRUCT SRP>INSTRUCT SRP Configuration

The Applications pages contain the INSTRUCT SRP applications that you use to configure (INSTRUCT SRP Configuration) and monitor (INSTRUCT SRP Status on page 99) your well. The Set button on each application screen triggers the configuration update in the controller.

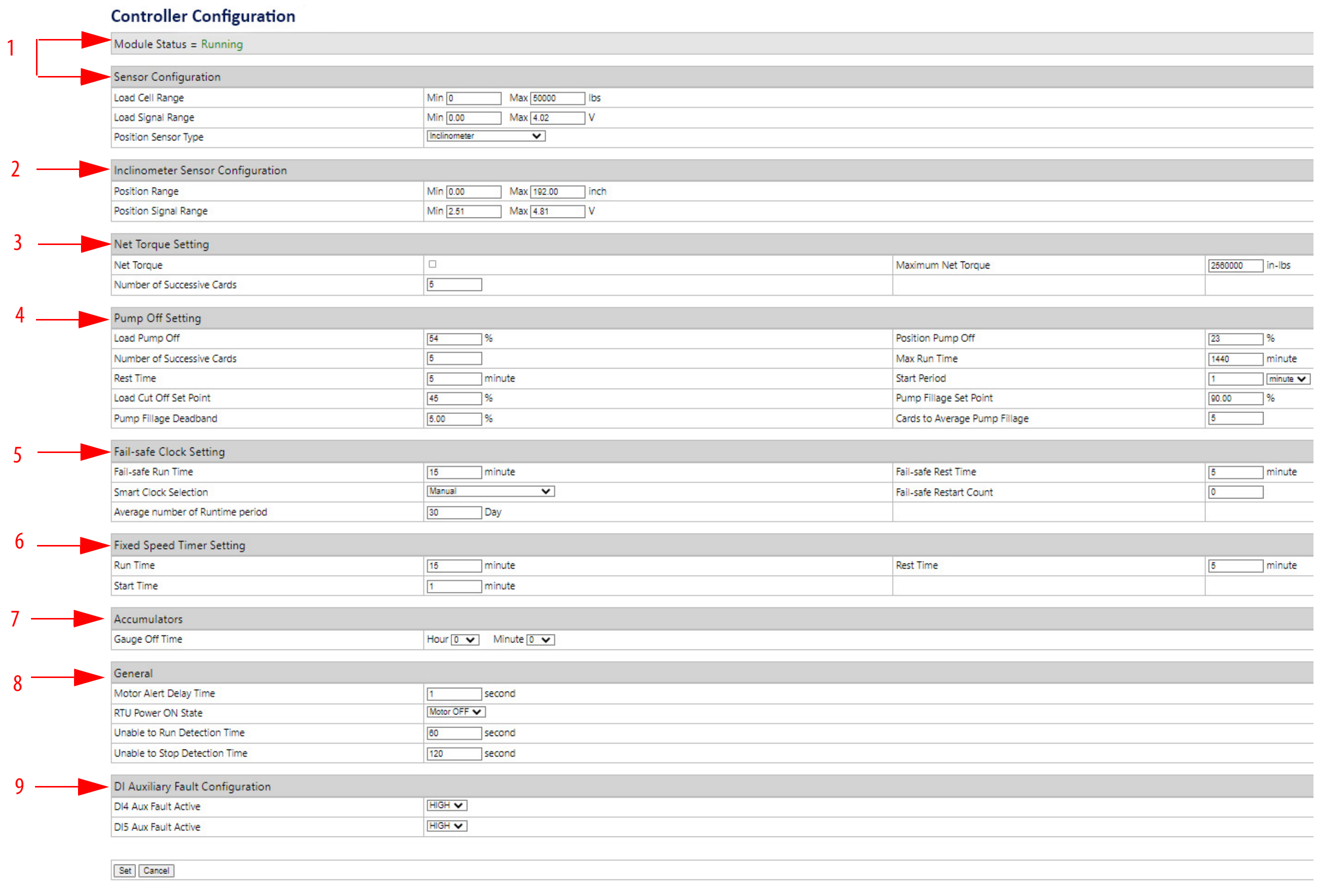
Figure 73 - Applications Menu Structure



Controller Configuration

Control configuration parameters are vital for effective control and monitoring of your well and must be set during commissioning. These parameters require fine-tuning after starting your well.

Figure 74 - Controller Configuration



Item	Description
1	Module Status and Sensor Configuration (page 66)
2	Position Sensor Configuration (page 66)
3	Net Torque Setting (page 68)
4	Pump Off Setting (page 69)
5	Fail-safe Clock Setting(page 70)
6	Fixed Speed Timer Setting (page 70)
7	Accumulators (page 71)
8	General (page 71)
9	DI Auxiliary Fault Configuration (page 72)

Sensor Configuration

The sensor configuration parameters include load cell-specific settings. You can configure these parameters to trigger an associated alarm action. Use the Alarm Configuration display (page 167) to configure an associated alarm action. Alarm configuration is only available through the local HMI display.

Figure 75 - Sensor Configuration

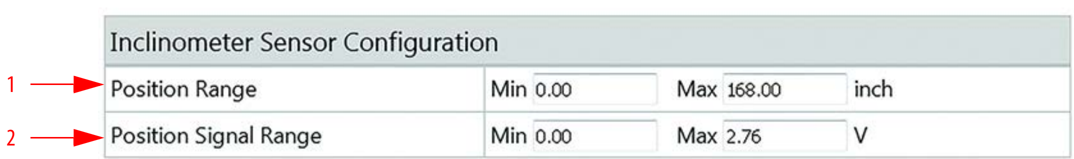
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Load Cell Range (Min/Max):** The value for the load range that the load cell supports. The INSTRUCT SRP supports both a 30,000 lb (13,607 kg) load cell and the more commonly used 50,000 lb (22,680 kg) load cell.
3	**Load Signal Range (Min/Max):** The load voltage range is equivalent to 0…4.02V by default. Do not modify this value unless there is an offset in the load values.
4	**Position Sensor Type:** Select your position sensor from the following options: Inclinometer, Hall Effect Crank Arm, Hall Effect Crank Arm/RPM, and Proximity/RPM.

Position Sensor Configuration

This table changes based on your position sensor selection in the Sensor Configuration table (Figure 75).

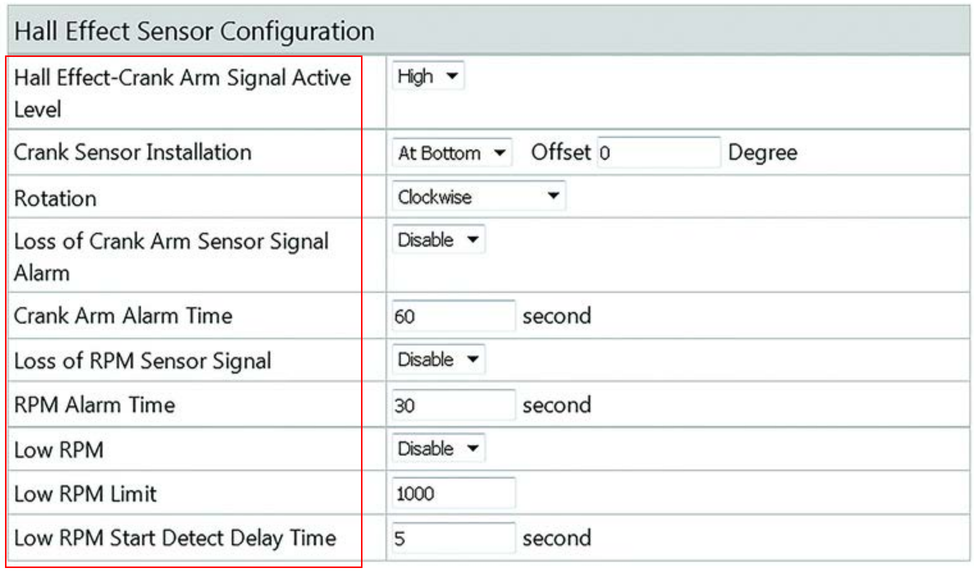
- Inclinometer (Figure 76)
- Hall Effect - Crank Arm and Hall Effect - Crank Arm/RPM (Figure 77)
- Proximity/RPM (Figure 78)

Figure 76 - Inclinometer Configuration



Item	Description
1	**Position Range:** The minimum/maximum value of inclinometer position range. This value denotes the min/max stroke length or range the inclinometer travels. (Range = 0…400 in.)
2	**Position Signal Range:** The minimum/maximum value of inclinometer signal. This value is in volts or mA depending upon the input type of the position channel AI 3. (Range = 0…22 mA or 0…5.12V)

Figure 77 - Hall Effect - Crank Arm and Crank Arm/RPM Configuration

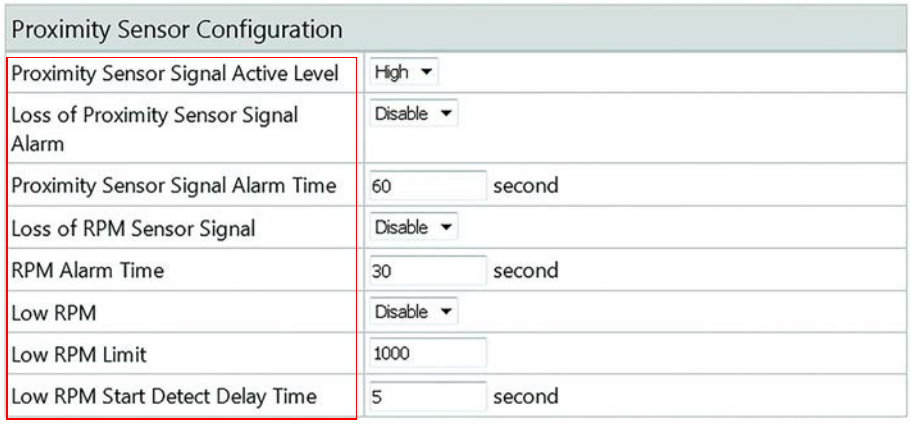


IMPORTANT	These parameters are only shown when Hall Effect - Crank Arm or Hall Effect - Crank Arm/RPM is selected as the position sensor type (Figure 75).

Row	Description
1	**Hall Effect-Crank Arm Signal Active Level:** Used to set the crank arm DI active status as High. For example, if the DI is 1, then only it detects the alarm or Low. If the DI is 0, then it only detects the alarm.
2	**Crank Sensor Installation:** Used to set the crank sensor location whether At Bottom or On Top.
3	**Rotation:** Used to set the crank rotation type as clockwise or counter-clockwise.
4	**Loss of Crank Arm Sensor Signal Alarm:** Enable/disable the alarm that is raised when the Hall Effect Crank Arm Sensor trigger does not come within the user-configurable time.
5	**Crank Arm Alarm Time:** The duration for which if there is no trigger from the crank arm then it sets the Alarm bit and the configured Alarm action is taken. (Range = 0…300)
6	**Loss of RPM Sensor Signal** (1)**:** Enable/disable the alarm that is raised when the RPM value is zero for 10 seconds or a new card is generated but the RPM is zero.
7	**RPM Alarm Time** (1)**:** The duration for which if the RPM count that is received from RPM sensor is not varying then the Alarm bit is set and the configured alarm action is taken.
8	**Low RPM** (1)**:** Enable/disable the alarm that is raised when the calculated RPM is less than the user-configured low RPM limit.
9	**Low RPM Limit** (1)**:** Used to set Low RPM alarm limit such that if the current RPM is less than this value the Low RPM alarm is generated.
10	**Low RPM Start Detect Delay Time** (1)**:** The duration for which the INSTRUCT SRP waits after starting before beginning the detection of low RPM alarms.

(1) Available with Hall Effect - Crank Arm /RPM position sensor type only.

Figure 78 - Proximity/RPM Configuration



IMPORTANT	These parameters are only shown when Proximity/RPM is selected as the position sensor type (Figure 75 on page 66).

Row	Description
1	**Proximity Sensor Signal Active Level:** Used to set the proximity sensor DI active Status as High. For example, if the DI is 1 then only it detects the alarm or Low. If the DI is 0, then only it detects the alarm. It is same as Hall Effect Crank Arm Signal.
2	**Loss of Proximity Sensor Signal Alarm:** When enabled, an alarm is raised to indicate that the proximity sensor signal for Linear pumps has failed.
3	**Proximity Sensor Signal Alarm Time:** The time duration for which if there is no trigger from the proximity sensor then it sets the Alarm bit and the configured Alarm action is taken. It is same as Crank Arm Alarm Time.
4	**Loss of RPM Sensor Signal:** Enable/disable the alarm that is raised when the RPM value is zero for 10 seconds or a new card is generated but the RPM is zero.
5	**RPM Alarm Time:** The duration for which if the RPM count that is received from RPM sensor is not varying then the Alarm bit is set and the configured alarm action is taken.
6	**Low RPM:** Enable/disable the alarm that is raised when the calculated RPM is less than the user-configured low RPM limit.
7	**Low RPM Limit:** Used to set Low RPM alarm limit such that if the current RPM is less than this value the Low RPM alarm is generated.
8	**Low RPM Start Detect Delay Time:** The duration for which the INSTRUCT SRP waits after starting before beginning the detection of low RPM alarms.

Net Torque Setting

The Net Torque settings control the maximum net torque that can have an associated alarm action when triggered.

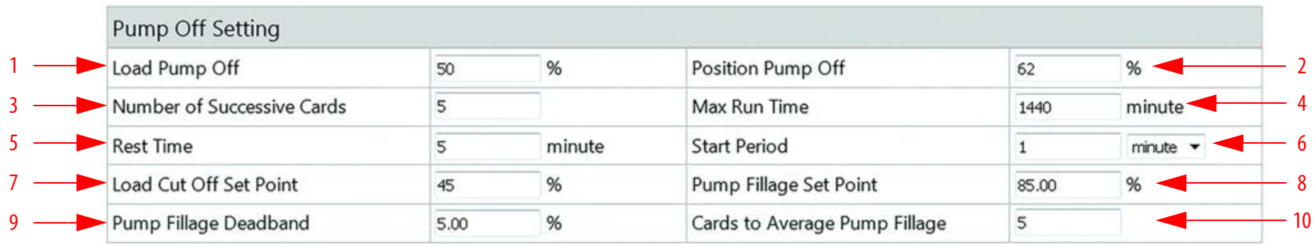
Figure 79 - Net Torque Setting

Item	Description
1	**Net Torque:** When this box is checked, the feature is enabled and settings can be adjusted. The INSTRUCT SRP raises an alarm and performs the configured alarm action after the configured number of cards with the maximum net torque violation.
2	**Maximum Net Torque:** The maximum net-torque value limit (in in•lb) for detection of maximum net torque violation.
3	**Number of Successive Cards:** The number of consecutive cards in which the maximum net torque must be violated before taking the configured alarm action.

Pump Off Setting

The Pump Off settings are used to provide optimal control during Variable or Fixed Speed Pump Off operation modes. Some of these parameters, such as Rest Time, are used only if the device is running in Fixed Speed Pump Off operation mode.

Figure 80 - Pump Off Setting

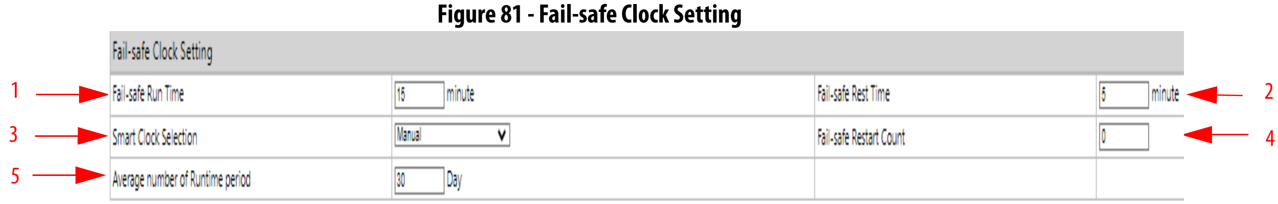


Item	Description
1	**Load Pump Off:** The percentage of load on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This percentage is calculated away from the minimum load.
2	**Position Pump Off:** The percentage of position on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This percentage is calculated away from the minimum position.
3	**Number of Successive Cards:** The number of consecutive pump-off cards that must be detected before stopping the pump. A value of 0 shuts down the well immediately after detecting a pump-off condition.
4	**Max Run Time:** The maximum number of minutes the INSTRUCT SRP allows the well to run. If this number is set to 1440 minutes by default, the INSTRUCT SRP does not enforce any maximum runtime.
5	**Rest Time:** The number of minutes the well is at rest with the motor off before attempting to start the well again.
6	**Start Period:** The number of minutes (or strokes) that the INSTRUCT SRP waits before it checks for pump-off conditions in the cards and applies control to the well. This start period allows the well to stabilize before checking for pump-off conditions. The start period can be set as either number of minutes or strokes. You can set it depending on the type of well and well conditions.
7	**Load Cut Off Set Point:** This parameter allows the INSTRUCT SRP to calculate the pump fillage accurately when looking for the effective stroke-inflection point. For example, if it is set to 45%, the INSTRUCT SRP starts reading from 45% between the end of upstroke to the beginning of the downstroke of the downhole card.
8	**Pump Fillage Set Point:** The percentage that you enter for the desired target pump fillage. The INSTRUCT SRP slows down or speeds up the pump based on the comparison between the current calculated pump fillage percent and the target pump fillage percent. If the current pump fillage is above the pump fillage setpoint, the INSTRUCT SRP speeds up the pumping unit to allow the well to achieve the target pump fillage. If the current pump fillage is below the target pump fillage, the INSTRUCT SRP slows down the pump to allow the well to fill back up to the target fillage.
9	**Pump Fillage Deadband:** This percentage is used to calculate and compare the pump fillage to the current pump fillage. This value allows the INSTRUCT SRP to decide whether to maintain, increase, or decrease the pumping speed. For instance, if the current pump fillage is within ±3% of the target fillage, the INSTRUCT SRP does not change the pumping speed unless it falls outside of the ±3% deadband. If the pump fillage number is below the pump fillage deadband, the INSTRUCT SRP slows down. The INSTRUCT SRP speeds up if the pump fillage number is above the deadband.
10	**Cards to Average Pump Fillage:** The number of cards that are used to calculate the average pump fillage. This value defaults to five cards. Increase this value as needed for greater pump fillage accuracy.

Fail-safe Clock Setting

The Fail-safe Clock settings control operation when the INSTRUCT SRP falls into a fail-safe state. The position-indicator error feature during Fixed Speed Pump Off triggers this state. This feature must be enabled as an associated alarm action for the position indicator error through the local HMI alarm configuration.

Figure 81 - Fail-safe Clock Setting



Item	Description
1	**Fail-safe Run Time:** The number of minutes that the well operates in clock mode.
2	**Fail-safe Rest Time:** The number of minutes that the well remains at rest in clock mode.
3	**Smart Clock:** When this box is checked, Smart Clock is enabled. The INSTRUCT SRP calculates the runtime whenever the unit is in Fixed Speed Pump Off mode. Otherwise, it uses the user-defined clock runtime. The calculated runtime is based on an average of the past 24 hours run cycles. • **Manual:** Indicates the manually set time clock Rest Time. • **Start Clock Calculated:** This method will employ the automatically calculated Rest time from the selected Algorithm. • **Average Runtime Calculated:** The fail-safe runtime will be automatically calculated based on the average runtime period of the past 30 days. The number of days to calculate the average runtime period is set by the user.
4	**Fail-safe Restart Count:** The number of times the INSTRUCT SRP commands the motor to start after shutdown due to an alarm detected in this state. **Note:** If Fail-safe Restart Count is set to 0, the controller will run in Fail-Safe state without limitation.
5	**Average Number of Runtime Period**: The number of days used to calculate the average runtime.

IMPORTANT

If Average Run Time Calculated option is selected, the Fail-safe Run Time will be calculated based on the last user configurable days of average run time. The number of days can be from 1...90 days.

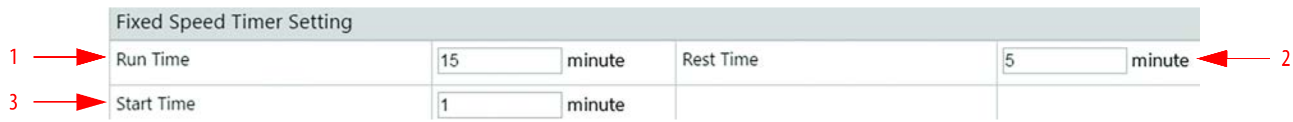
The calculated time will be the average of the user-configurable days of average run time. If any of the calculated value is 0, the user-configured Run Time will be used.

If the controller is in Fail-safe Run state, for any of the load or position sensor failure and the other sensor also fails (if because of load sensor it was in Fail-safe Run and now position sensor failure is detected or vice versa), the controller will move to Shut-down state.

Fixed Speed Timer Setting

The Fixed Speed Timer settings are only used when running in Fixed Speed Timer operation mode.

Figure 82 - Fixed Speed Timer Setting



Item	Description
1	**Run Time:** The number of minutes that the well runs in Manual Timer operation mode before it cycles OFF to Rest state.
2	**Rest Time:** The number of minutes that the well rests in Manual Timer operation mode before it cycles ON to Run state.
3	**Start Time:** The number of minutes allowed for the well to stabilize in Manual Timer operation mode before the well starts checking for alarms and other conditions. This time is kept at 1 minute to allow the well to stabilize.

Accumulator Setting

Accumulator settings (Gauge Off Time) are used to offset the calculation of totals for a day and are not frequently changed.

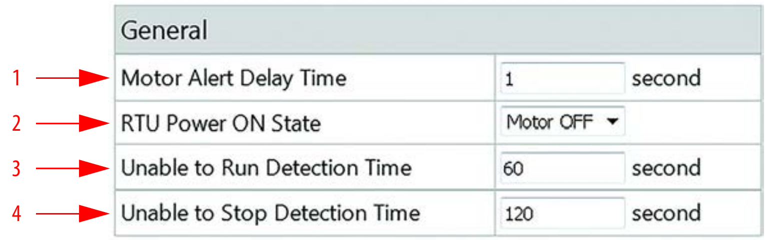
Figure 83 - Accumulator Setting

Item	Description
1	**Gauge Off Time:** The time of day the data buffer is totaled. This setting determines when to do the calculation cutoff for the data accumulators.

General Setting

General settings (Motor Alert Delay Time) are linked to sounder or strobe, such as your DO4 alert signal (Wiring for a Start Alert on page 26), before the motor start command is sent.

Figure 84 - General Setting

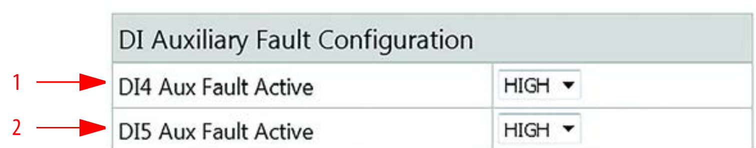


Item	Description
1	**Motor Alert Delay Time:** The duration that is set for an alert signal through DO4 before commanding the motor to start. The delay allows visual or audible 24V DC hardware that is wired into DO4 to send an alert signal before commanding the motor to start. If this value is set to 0, the INSTRUCT SRP does not go through the Motor Alert state
2	**RTU Power ON State:** Used to select the default state when the INSTRUCT SRP reboots. If Motor OFF is selected, the motor is OFF upon rebooting the INSTRUCT SRP. If Auto-start is selected, the motor auto starts by default after rebooting the INSTRUCT SRP.
3	**Unable to Run Detection Time:** The duration set for which if the actual card is not detected. For example, if the position signal and load signal are not changing after the Motor ON command is given, the well goes to Unable to Run state. (Range = 60…900)
4	**Unable to Stop Detection Time:** The duration set for which if the actual card is detected. For example, if the position signal and load signal are changing dynamically after the Motor OFF command is given, the well goes to Unable to Stop state. (Range = 60…900)

DI Auxiliary Fault Configuration

DI Auxiliary Fault Configuration allows you to enable a safety feature that allows you to stop operation by having the pumping unit coast to a stop.

Figure 85 - DI Auxiliary Fault Configuration

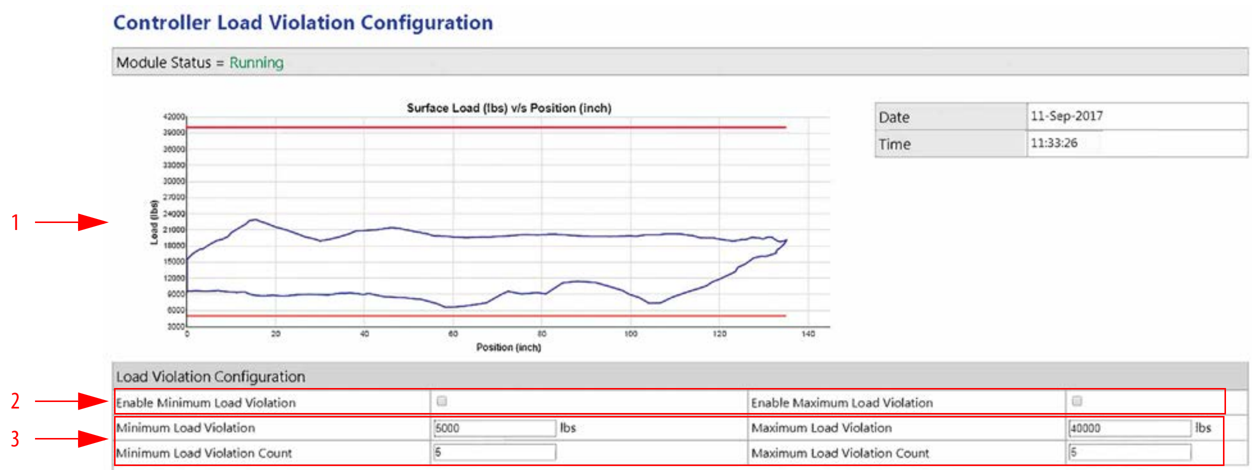


Item	Description
1	**DI4 Aux Fault Active:** This alarm is raised when the DI4 signal is lost or detected depending on the configuration for "High" or "Low" set for the digital input channel. The DI4 channel is used for any customer-supplied kill switch signal to stop the motor.
2	**DI5 Aux Fault Active:** This alarm is raised when the DI5 signal is lost or detected depending on the configuration for "High" or "Low" set for the digital input channel. The DI5 channel is reserved for an optional E-stop button to stop the motor.

Controller Load Violation Configuration

Load Violation Configuration allows you to set values, enable, and disable the minimum/maximum load violation alarms.

Figure 86 - Controller Load Violation Configuration

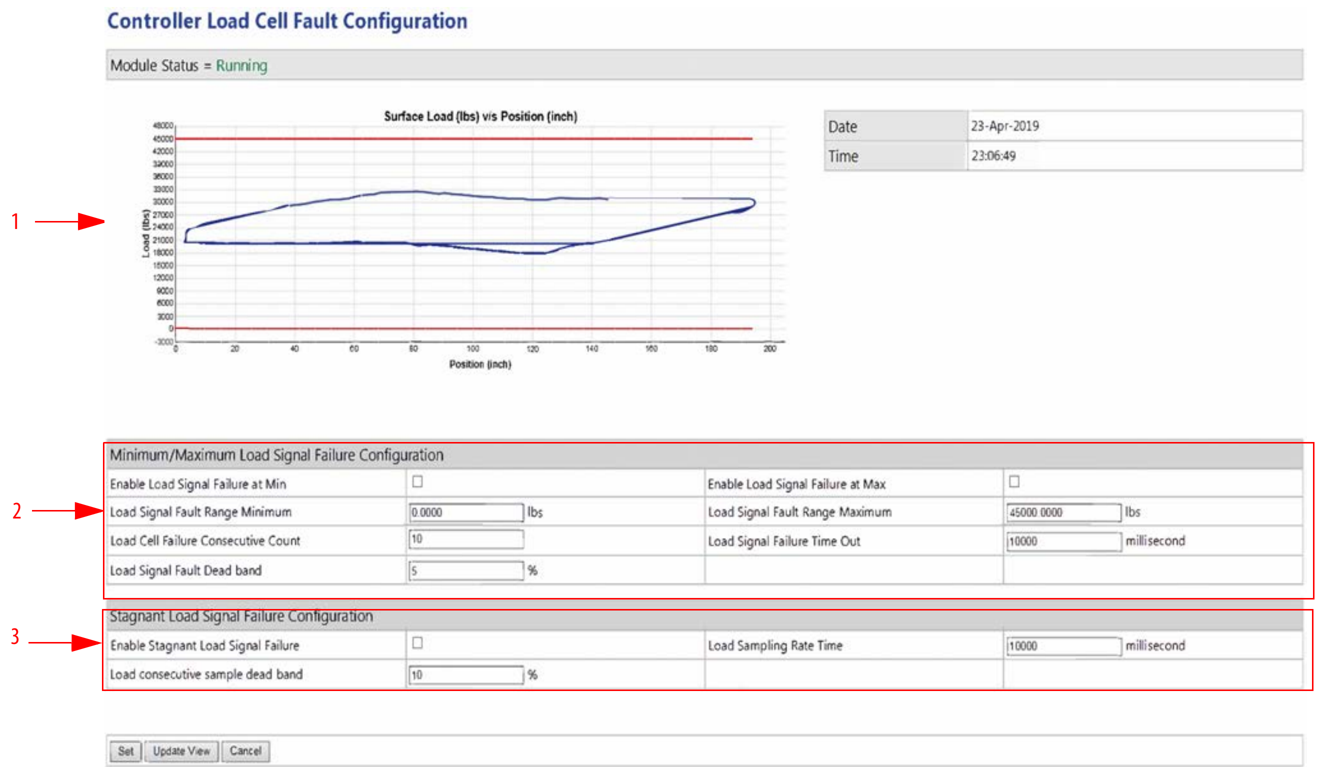


Item	Description
1	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.
2	**Enable Min/Max Load Violation:** When checked, these load violations are enabled.
3	**Max/Min Load Violation:** When enabled, the INSTRUCT SRP checks for load minimum and maximum violations. When a load violation is found, the INSTRUCT SRP raises an alarm and performs the configured alarm action. The red lines on the cards indicate the upper and lower limits.
	Max/Min Load Violation Count: The number of times the maximum or minimum load violations must be found before an alarm is raised.

Controller Load Cell Fault Configuration

The load Cell Fault Configuration allows you to configure the parameters for load cell failure detection if there is a load cell sensor error or failure.

Figure 87 - Controller Load Cell Fault Configuration

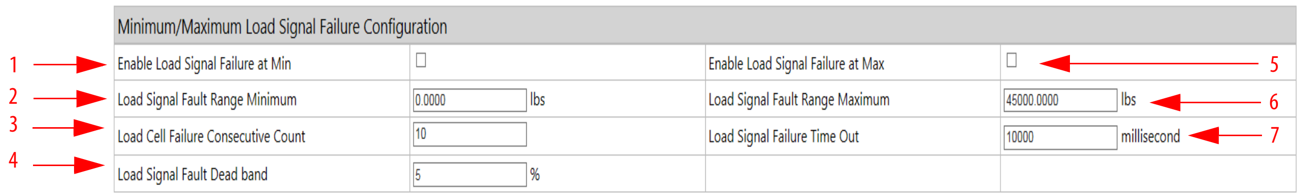


Item	Description
1	Surface Card Plot
2	Minimum/Maximum Load Signal Failure Configuration (page 75)
3	Stagnant Load Signal Failure Configuration (page 75)

Minimum/Maximum Load Signal Failure Configuration

This is the lower/upper limit for the load signal in lbs. to detect and declare a "load signal error" alarm. This value is a float value.

Figure 88 - Minimum/Maximum Load Signal Failure Configuration

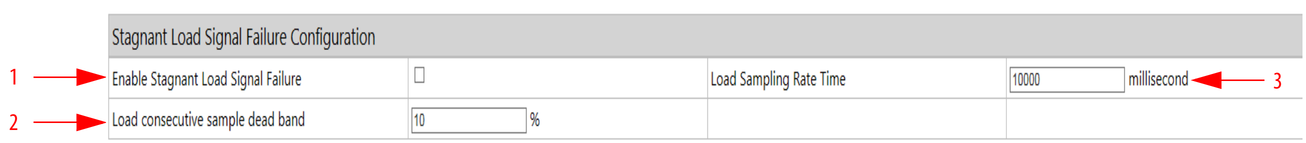


Item	Description
1	**Enable Load Signal Failure at Min:** Enables the Load signal failure at Minimum detection feature.
2	**Load Signal Fault Range Minimum:** Detected when the load signal falls into the user defined range for the detection of this alarm for a user defined period of time into the minimum range set by the user for the detection of this fault.
3	**Load Cell Failure Consecutive Count:** Dictates the number of consecutive failures or violations that must be detected before declaring a "load cell signal failure" alarm. This value shall range from 0 to 100. This is applicable to Load Cell Signal failure at Min and Load Cell Signal Failure at Max alarms only.
4	**Load Signal Fault Dead band:** The load signal error dead band for the upper and lower limit is in percentage. The upper limit dead band in percentage of the maximum upper limit shall be added to the upper limit value to create an upper zone. The lower limit dead band in percentage of the minimum value shall be subtracted from lower limit value to create the lower zone. This parameter is an integer value.
5	**Enable Load Signal Failure at Max:** Enables the load signal failure at Maximum detection feature.
6	**Load Signal Fault Range Maximum:** Detected when the load signal falls into the user defined range for the detection of this alarm for a user defined period of time into the maximum range set by the user for detection of this fault.
7	**Load Signal Failure Time Out:** This value is in seconds and it ranges from 0 to 65000 seconds. When this value is exceeded the alarm will be triggered and declared. This value confirms the alarm if the condition is detected for this amount of time configured in seconds. Putting 0 value for this parameter shall disabled this timeout. This is applicable to Load Cell Signal failure at Min and Load Cell Signal Failure at Max alarms only.

Stagnant Load Signal Failure Configuration

The third alarm that declares when a signal is stagnant, or not varying, as defined by the dead-band below and the time duration.

Figure 89 - Stagnant Load Signal Failure Configuration



Item	Description
1	**Enable Stagnant Load Signal Failure:** Enables the stagnant load signal failure. This feature detects when the consecutive load samples are not varying within a set deadband for a set rate load sampling rate of change time.
2	**Load consecutive sample dead band:** This signal is within the dead band, defined by this value for a period longer than the "load sampling rate time" to be declared as a stagnant load signal failure condition. If the position samples values are changing, which indicates that the pump is moving, but the load remains not varying outside of the load sample dead band, a stagnant load signal failure condition exists.
3	**Load Sampling Rate Time:** Dictates the rate of change between consecutive sample readings of each load sample. If the load value changes within a dead band, then this is stagnant load signal failure condition.

Controller Pump Off Configuration

The pump off configuration is used to provide optimal control during Variable or Fixed Speed Pump Off operation modes.

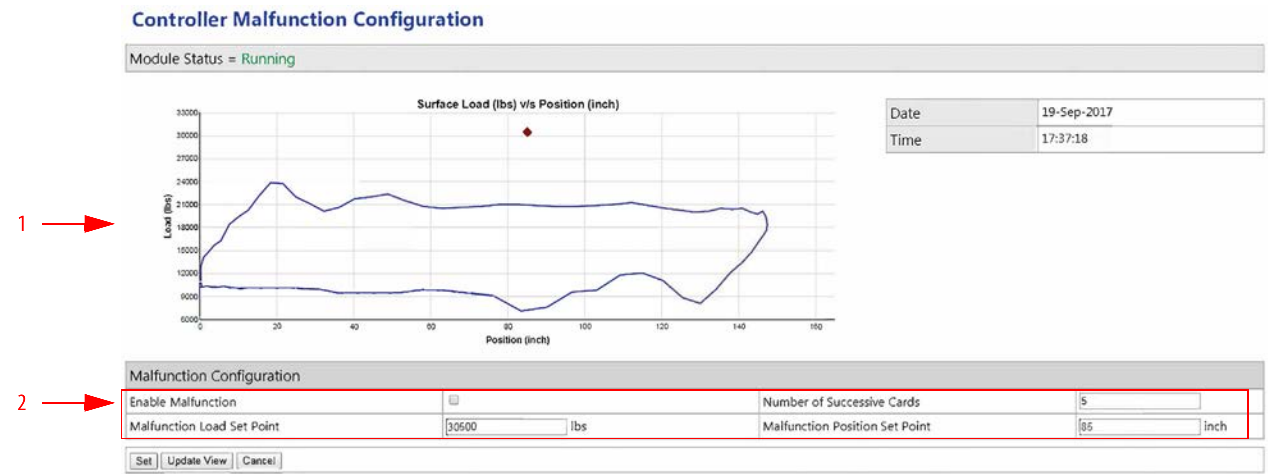
Figure 90 - Controller Pump Off Configuration

Item	Description
1	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.
2	**Load Pump Off:** The percentage of load on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This percentage is calculated away from the minimum load.
	Position Pump Off: The percentage of position on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This percentage is calculated away from the minimum position.
	Number of Successive Cards: The number of consecutive cards in which the load or position pump off must be violated before taking the configured alarm action.

Controller Malfunction Configuration

The malfunction configuration controls the malfunction setpoint feature, which can have an associated alarm action when triggered.

Figure 91 - Controller Malfunction Configuration

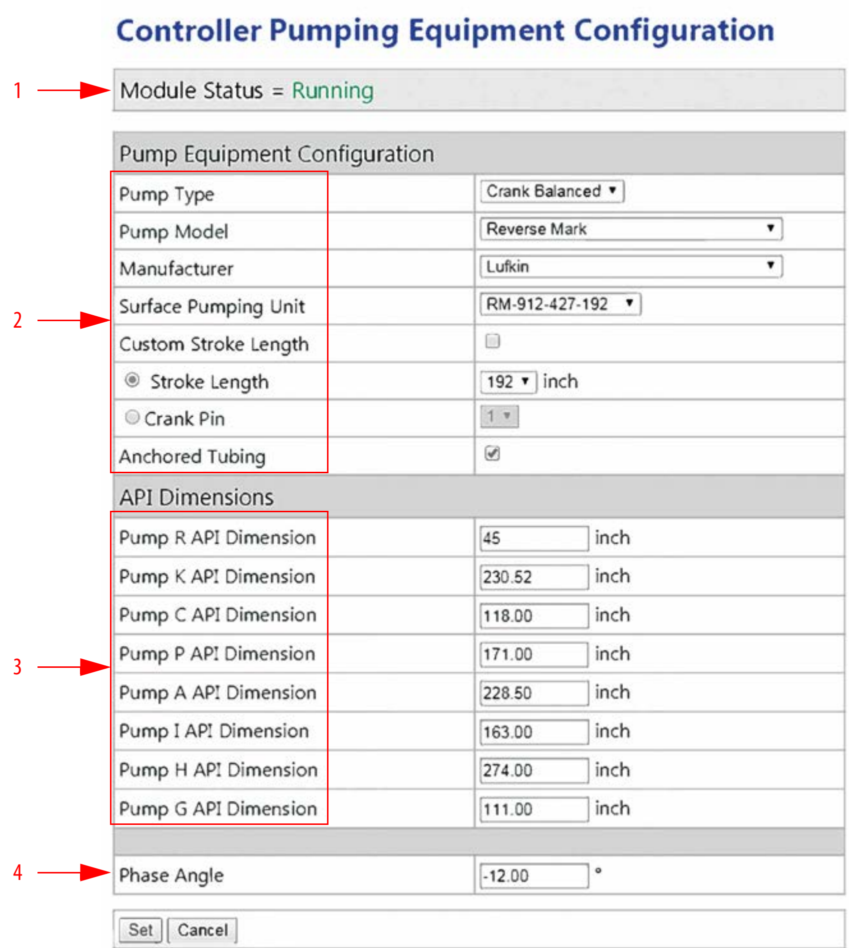


Item	Description
1	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.
2	**Enable Malfunction:** When this box is checked, the feature is enabled and settings can be adjusted. The INSTRUCT SRP raises an alarm and performs the configured alarm action after a preset number of cards with the malfunction setpoint violation.
	Number of Successive Cards: This value sets the number of cards in which the malfunction setpoint must be violated before performing the configured alarm action.
	Malfunction Load Set Point: This value corresponds to the load on the setpoint (in lb).
	Malfunction Position Set Point: This value corresponds to the position on the setpoint (in inches).

Pump Equipment Configuration

Pump Equipment Configuration allows you to select a pumping unit from the local INSTRUCT SRP database. Equipment configuration affects overall accuracy and functionality in the INSTRUCT SRP, so you must verify that accurate information is entered upon commissioning.

Figure 92 - Pump Equipment Configuration



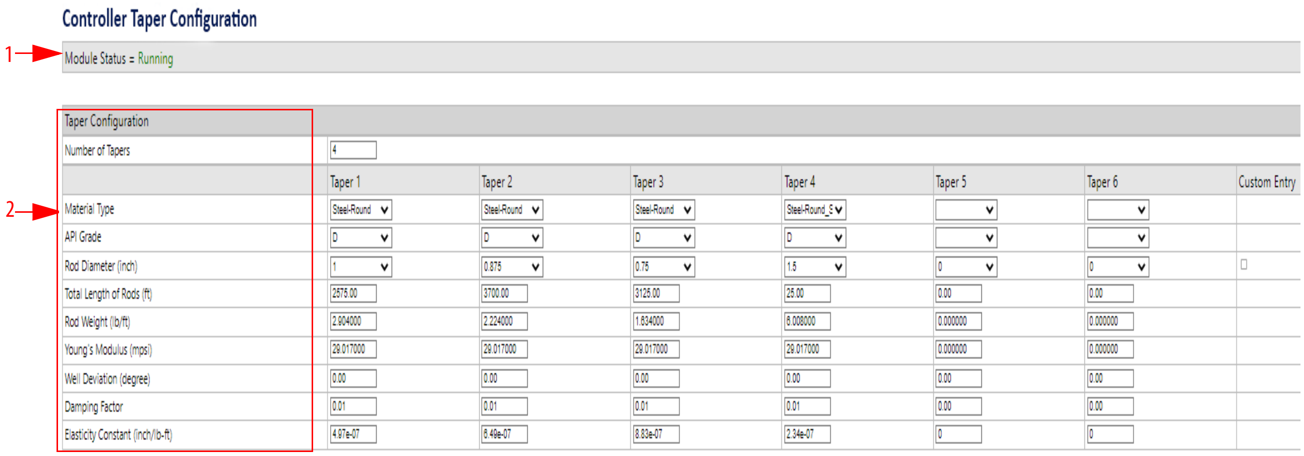
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Pump Type:** Used to select the pumping unit from the menu. Options include Crank Balanced, Beam Balanced, Air Balanced, and Linear.
	Pump Model: Used to select the pumping model from the menu. See Figure 138 on page 116 for details.
	Manufacturer: Used to select the manufacturer for a selected pump type and pump model. See Figure 164 on page 140 for details.
	Surface Pumping Unit: The INSTRUCT SRP has a predefined list of American Petroleum Institute (API) unit information in the database. If your unit does not exist in the predefined list, you can manually enter your pumping unit via the HMI display.
	Custom Stroke Length: Enable by checking this box to type a custom stroke length.
	Stroke Length: The stroke length depends on each pumping unit. Some pumping units have three or four stroke length options. Enter the correct surface stroke length to obtain accurate surface measurements. Incorrect stroke length results in erroneous results for surface and downhole calculations. When Custom Stroke Length is enabled, you can type in your stoke length.
	Crank Pin: Select the crank pin position on your well.
	Anchored Tubing: Enable by checking this box if anchored tubing is being used in the well.
3	**API Dimensions:** The API dimensions (R, K, C, P, A, I, H, and G) of your Pump Unit.
4	**Phase Angle:** An offset angle value in degrees on the Crank angle. This value is provided by the pump manufacturer for each pumping unit.

Controller Taper Configuration

Taper Configuration is vital for downhole calculations from the surface card. Incorrect information yields erroneous downhole calculations and decreases overall accuracy of the INSTRUCT SRP.

IMPORTANT	Tapers must be configured in variable speed pump fillage and fixed speed pump fillage operation modes.

Figure 93 - Controller Taper Configuration



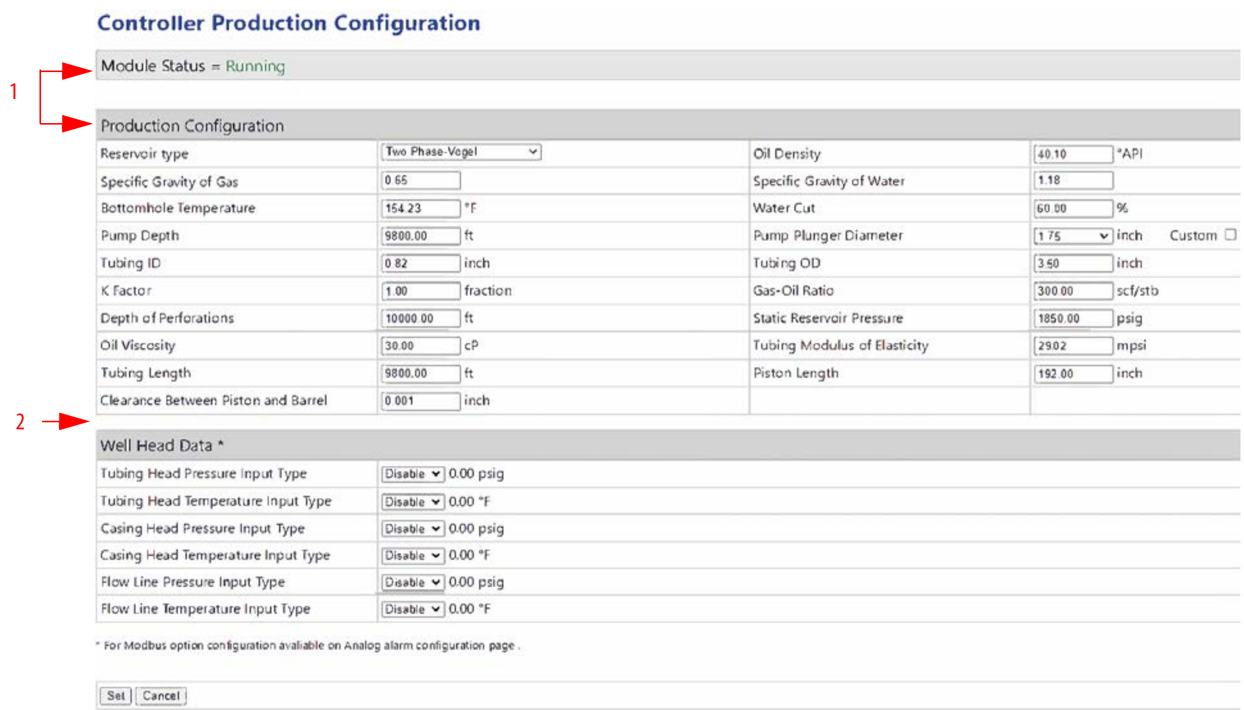
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Number of Tapers:** The number of rod tapers in the rod string. [1]
	Material Type: The rod material can be fiberglass-round, steel-round, and steel elliptical. There is an option for adding a steel sinker-bar, indicated by Steel-Round_SB. A steel-round sinker bar is added to the last taper.
	API Grade: Specify the appropriate API rod grade by selecting it from the available options from the database. The API grade database has a list of most commonly used API grade rods for sucker-rod pump applications. This option is not available via local HMI configuration.
	Rod Diameter (inch): Enter the rod diameter in inches by selecting it from the pull-down menu. The most commonly used diameters for API rods are available in the pull-down menu. To enter a custom diameter, check the Custom Entry checkbox.
	Total Length of Rods (ft): Specify the total length of rods in feet in each taper.
	Rod Weight (lb•ft): The database automatically calculates and populates the rod weight (in lb•ft).
	Young's Modulus (ksi): The database automatically calculates and populates the Young's modulus (in ksi).
	Well Deviation (degree): If the well is deviated, specify the estimated well deviation (in degrees) at each section of the rod tapers.
	Damping Factor: Enter the correct damping factor for calculating the downhole card. This value must be equal across all six tapers. The damping factor allows for adjustment of incorrect downhole cards due to any forces that dampen the rod string vibrations. Obtain the damping factor from the software program that was used for deigning the well rod string. This value is kept by default between 0.01…0.1.
	Elasticity Constant (inchlb-ft): This is the elastic constant of the Rod Taper Material.

(1) When a continuous single taper rod is used, enter a value of 1 and enter the material and the length of the entire rod string as one rod taper.

Production Configuration

Production Configuration parameters help achieve accurate well production data. Production data is presented on the Pump Data display on the PanelView terminal (page 127) and Well Status on the web server (page 99).

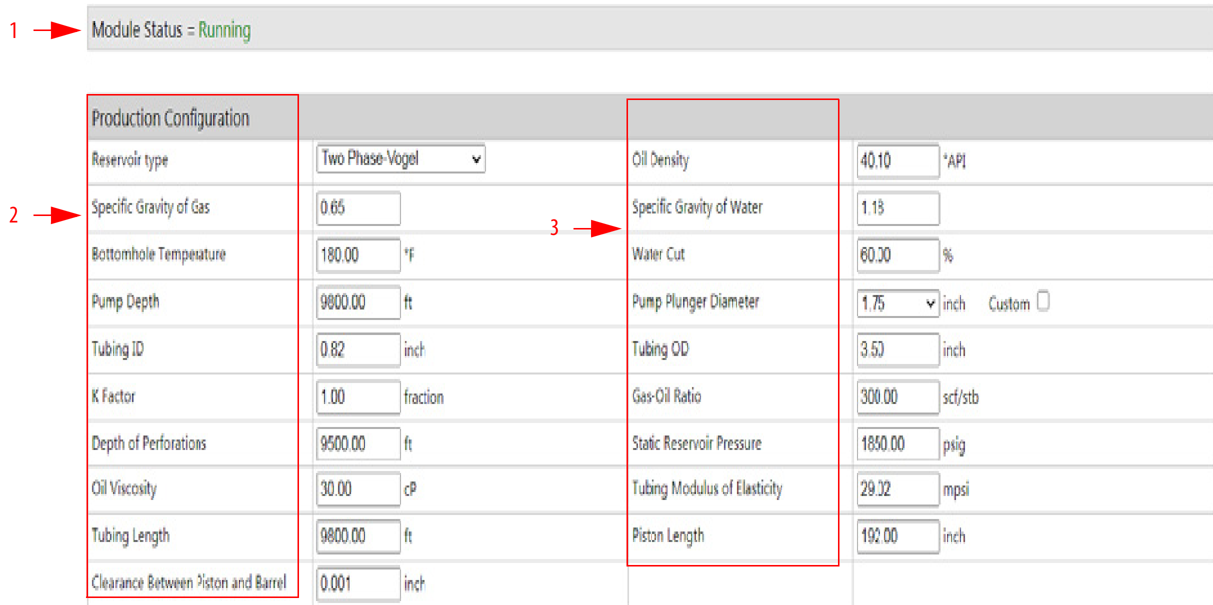
Figure 94 - Production Configuration



Item	Description
1	Module Status and Production Configuration (page 81)
2	Well Head Data (page 82)

Production Configuration

Figure 95 - Production Configuration

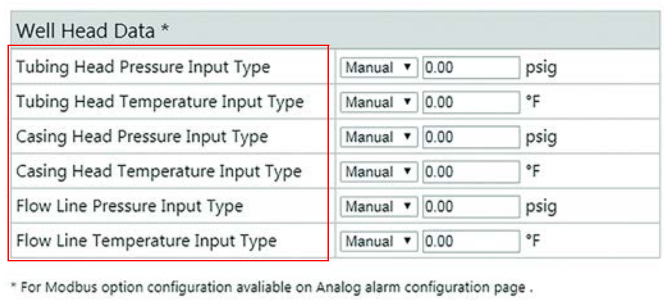


Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Reservoir type:** The model type for calculating the inflow performance relationship (IPR). Options are Single Phase - Straight Line or Two Phase - Vogel.
	Specific Gravity of Water: You must enter the correct specific gravity of water that is produced. The specific gravity of the water is used in the production estimate. You can get this data from well test reports.
	Bottom Hole Temperature: You must enter the correct bottom hole temperature to obtain accurate production estimates from the calculations. You can get this data from well test reports.
	Pump Depth: The vertical pump depth from the surface to the pump intake is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results. You can get this information from the well completion data.
	Tubing ID: The appropriate tubing inside diameter (ID) must be selected from the data for the calculations. The INSTRUCT SRP database has the most commonly used tubing sizes. If your tubing size does not exist in the database, you can manually enter it via the HMI display.
	K Factor: This is a factor between 0 and 1 to adjust and compensate for the inferred production.
	Depth of Perforations: Used for providing the Depth of Perforation. (Range = 0...50,000)
	Oil Viscosity: This is the oil viscosity in Centipoise.
	Tubing Length: This is the length of the tubing of the well in Inches.
	Clearance Between Piston and Barrel: This is the space between the piston and the barrel of the SRP well.

Item	Description
3	**Oil Density:** The oil density of the produced oil per API degree must be entered correctly for a correct oil production estimate. You can get this data from well test reports.
	Specific Gravity of Water: The specific gravity of water that is produced which is used in the production estimate.
	Water Cut: You must enter the correct water cut to obtain accurate production estimates from the calculations. You can get this data from well test reports.
	Pump Plunger Diameter: The pump plunger diameter is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results. You can get this information from the well completion data. To enter a custom diameter, check the Custom checkbox.
	Tubing OD: This is the outer diameter of the tubing in Inches.
	Gas-Oil Ratio: Used obtain accurate production estimates from the calculations.
	Static Reservoir Pressure: The static pressure of the well to obtain accurate production estimates from the calculations.
	Tubing Modulus of Elasticity: This is the material's young modulus of the tubing in MPSI.
	Piston Length: This is the length of the piston of the pump in Inches.

Well Head Data

Figure 96 - Well Head Data

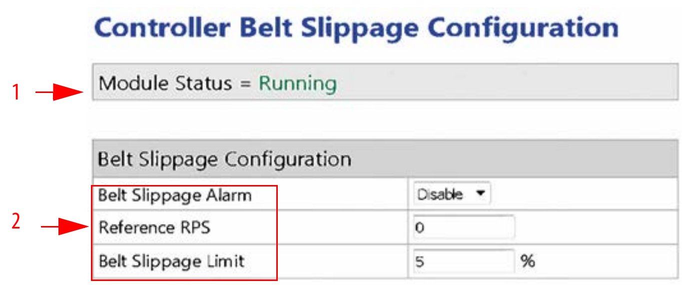


Row	Description
1	**Tubing Head Pressure Input Type:** Select Manual to enter your own value (in psig). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as tubing head pressure.
2	**Tubing Head Temperature Input Type:** Select Manual to enter your own value (in °F). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as tubing head temperature.
3	**Casing Head Pressure Input Type:** Select Manual to enter your own value (in psig). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as casing head pressure.
4	**Casing Head Temperature Input Type:** Select Manual to enter your own value (in °F). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as casing head temperature
5	**Flow Line Pressure Input Type:** Select Manual to enter your own value (in psig). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as flow line pressure.
6	**Flow Line Temperature Input Type:** Select Manual to enter your own value (in °F). Select Remote Input to get the reading from the wireless or wired sensor that is installed and assigned as flow line temperature

Belt Slippage Configuration

Belt Slippage Configuration allows you to raise a warning when the motor revolutions per strokes raise above the configured allowable belt slippage limit.

Figure 97 - Belt Slippage Configuration

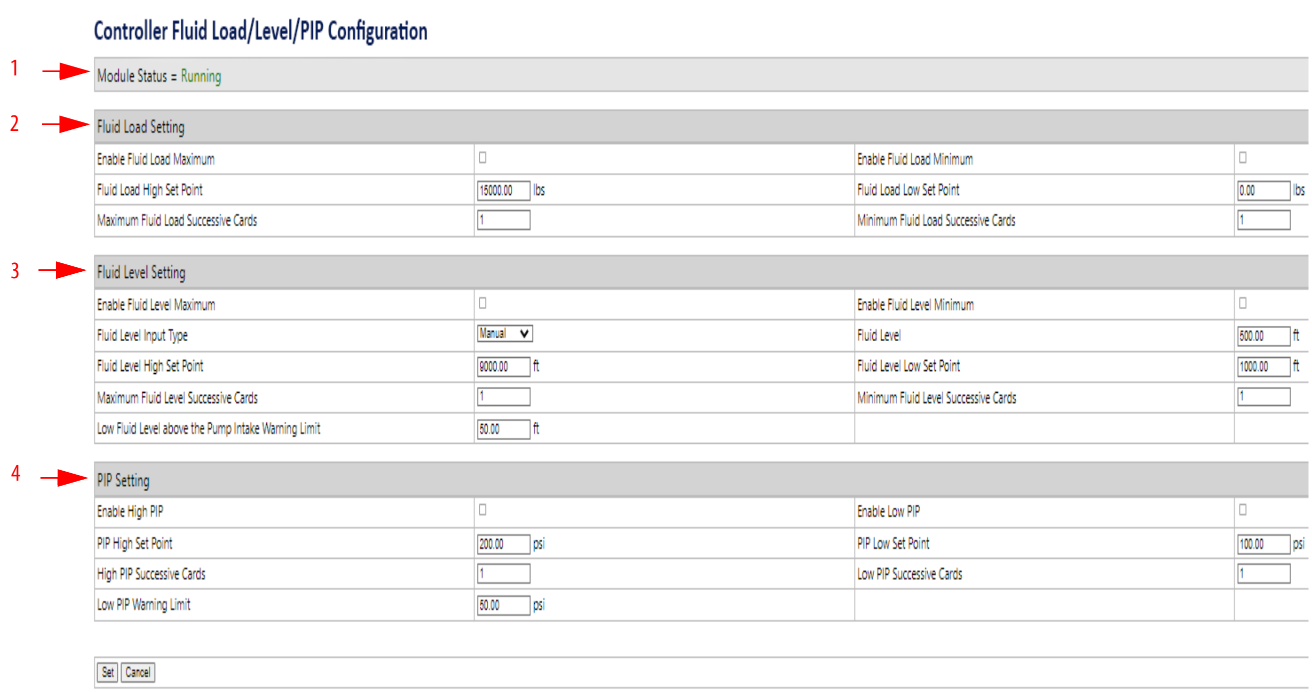


Row	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Belt Slippage Alarm:** Select whether to Enable or Disable the Belt Slippage Alarm.
	Reference RPS: Reference RPS value is used to calculate the percentage belt slippage.
	Belt Slippage Limit: If the calculated belt slippage is more than the reference belt slippage by this limit, then the belt slippage alarm is generated.

Fluid Load/Level/PIP Configuration

Fluid Load/Level/PIP Configuration allows you to set a critical parameter that determines the flowing bottom hole pressure, opportunities of production increase, and helps protect the pumping system against pump off conditions.

Figure 98 - Fluid Load/Level/PIP Configuration

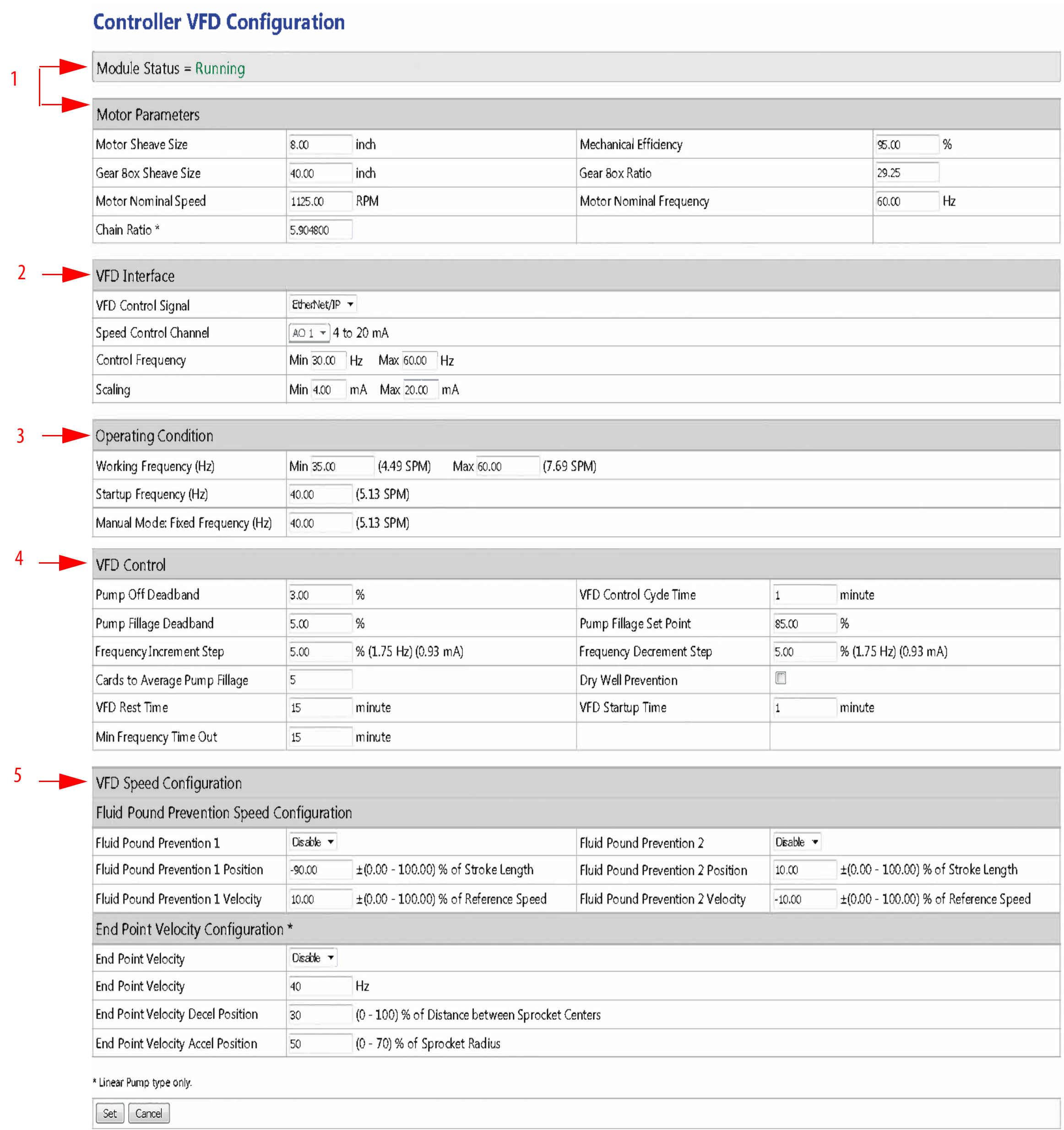


Row	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Enable Fluid Load Maximum:** This enables the maximum fluid load limit alarm.
	Enable Fluid Load Minimum: This enables the minimum fluid load limit alarm.
	Fluid Load High Set Point: This is the high value for the fluid load maximum limit in Lbs. when the actual value crosses above this limit for a defined number of cards, an alarm is triggered.
	Fluid Load Low Set Point: This is the low value for the fluid load minimum limit in Lbs. when the actual value crosses below this limit for a defined number of cards, an alarm is triggered.
	Maximum Fluid Load Successive Cards: This is the number successive number of cards that will be detected with maximum fluid load above the set limit before triggering an alarm.
	Minimum Fluid Load Successive Cards: This is the number successive number of cards that will be detected with minimum fluid load below the set limit before triggering an alarm.
3	**Enable Fluid Load Maximum:** This enables the maximum fluid level alarm.
	Enable Fluid Load Minimum: This enables the minimum fluid level alarm.
	Fluid Level Input Type: This is the selection of the value for the fluid level calculation. It can be calculated automatically, or just manually entered in Feet.
	Fluid Level High Set Point: This is the high limit for the fluid level value that must be crossed above to trigger an alarm.
	Fluid Level Low Set Point: This is the low limit for the fluid level value that must be crossed below to trigger an alarm.
	Maximum Fluid Level Successive Cards: This is the number of successive cards that will be detected with high fluid level before an alarm is triggered.
	Minimum Fluid Level Successive Cards: This is the number of successive cards that will be detected with low fluid level before an alarm is triggered.
	Low Fluid Level above the Pump Intake Limit: Low fluid level above the pump intake warning is generated if calculated fluid level is greater than, or if the calculated submergence is less than, this value.
4	**Enable High PIP:** This enables the PIP high level limit for the PIP alarm.
	Enable Low PIP: This enables the PIP low level limit for the low PIP alarm.
	PIP High Set Point: This is the low set point value to trigger an alarm when the PIP value crosses above this set value
	PIP Low Set Point: This is the low set point value to trigger an alarm when the PIP value crosses below this set value.
	High PIP Successive Cards: This is the number of successive cards that is needed for the high PIP alarm to trigger.
	Low PIP Successive Cards: This is the number of successive cards that is needed for the low PIP alarm to trigger.
	Low PIP Warning Limit: This is lower limit for a warning to be trigger when the PIP detected on every card falls below this value.

VFD Configuration

Upon commissioning, you must enter the proper pumping equipment configuration. This section presents the equipment configuration parameters on the web server.

Figure 99 - VFD Configuration

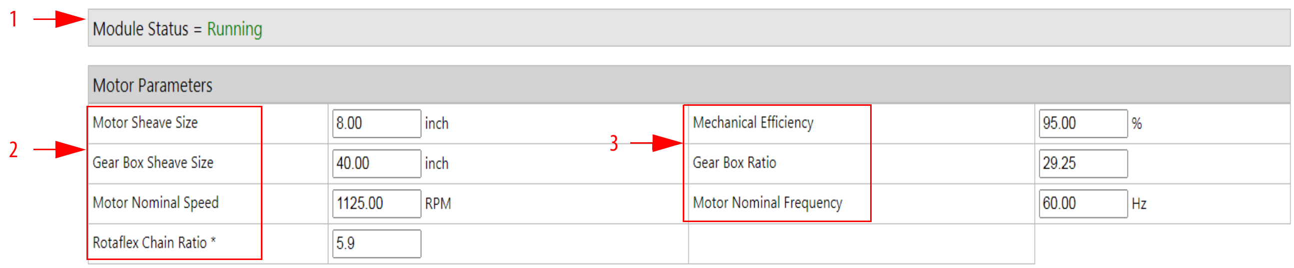


Item	Description
1	Module Status and Motor Parameters (page 86)
2	VFD Interface (page 87)
3	Operating Condition (page 87)
4	VFD Control (page 88)
5	VFD Speed Configuration (page 89)

Motor Parameters

Accurate configuration of motor parameters helps the INSTRUCT SRP detect a strokes per minute (SPM) error warning, which comes from a mismatch between measured SPM and SPM from the VFD-commanded frequency.

Figure 100 - Motor Parameters



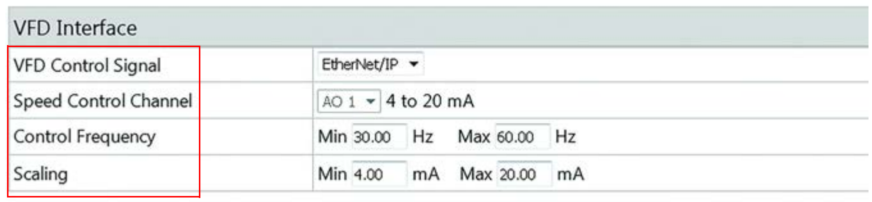
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Motor Sheave Size:** Specify the correct sheave size in inches. The size is used for calculating the estimated expected SPM from the commanded frequency.
	Gear Box Sheave Size: Specify the correct gearbox sheave size in inches. The size is used for calculating the estimated expected SPM from the commanded frequency.
	Motor Nominal Speed: Specify the correct nominal speed in revolutions per minute (RPM). The speed is used for calculating the estimated expected SPM from the commanded frequency.
	Chain Ratio (1)**:** The ratio that is provided by the manufacturer of the Linear pumping unit. The INSTRUCT SRP uses the chain ratio to calculate the position of the polished rod. This value is automatically calculated, but it can also be manually configured.
3	**Mechanical Efficiency:** The mechanical efficiency of the pumping unit and the speed reducer. (Range = 0…100)
	Gear Box Ratio: Specify the correct gearbox ratio. This ratio is used for calculating the estimated expected SPM from the commanded frequency.
	Motor Nominal Frequency: Specify the correct nominal frequency in hertz. The frequency is used for calculating the estimated expected SPM from the commanded frequency.

(1) Linear pump type only.

VFD Interface

VFD Interface settings are used to give the VFD a control frequency operating range using corresponding control signals from a 4…20 mA range to the VFD.

Figure 101 - VFD Interface



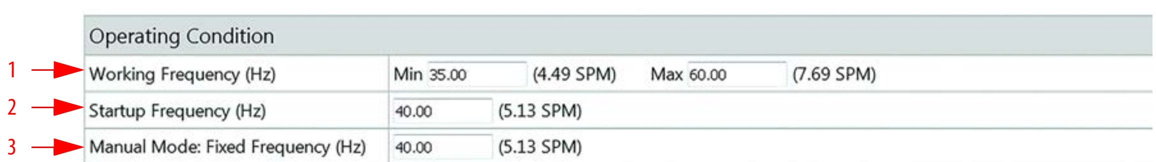
Row	Description
1	**VFD Control Signal:** Used to select the VFD Control Signal for controlling VFD. Options available are Hardwired and EtherNet/IP(1).
2	**Speed Control Channel:** Select the appropriate channel for controlling the VFD speed. The VFD can be controlled through analog outputs (AO) from the INSTRUCT SRP through AO1 from 0…5V DC or 4…20 mA. The INSTRUCT SRP can control the VFD via Modbus RTU. In this case, the INSTRUCT SRP is the master Modbus RTU device and the VFD is the slave Modbus TCP device. If Modbus RTU is the preferred control method for the VFD, then you must configure the proper registers and enter the Modbus ID of the VFD. The AO1 is set to 4…20 mA and calibrated for use with the PowerFlex® drive by default. Any other drive using Modbus must be integrated properly.
3	**Control Frequency, Min/Max:** The minimum/maximum output frequency corresponding to a 4 mA control signal that is sent to the VFD from the INSTRUCT SRP for speed regulation. The minimum/maximum control frequency of the VFD must match the minimum/maximum control frequency in the INSTRUCT SRP for a signal of 4 mA. This parameter applies for a hardwired or EtherNet/IP control signal.
4	**Scaling, Min:** Keep this value as the default 4 mA because it corresponds to the minimum output signal from the INSTRUCT SRP to the VFD for the frequency control command. **Scaling, Max:** Keep this value as the default 20 mA because it corresponds to the maximum output signal from the INSTRUCT SRP to the VFD for the frequency control command.

(1) EtherNet/IP is only applicable to PowerFlex® 753 and 755 drives.

Operating Condition

Use Operating Condition parameters to adjust the operating conditions of the VFD. These parameters are independent of the operation mode.

Figure 102 - Operating Condition

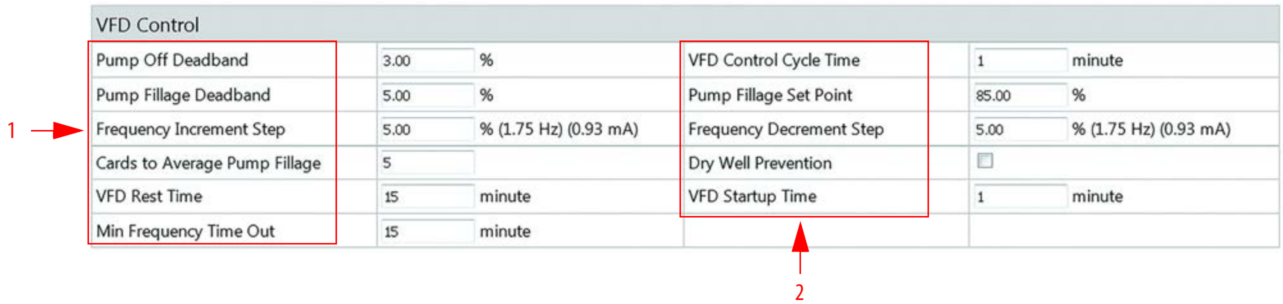


Item	Description
1	**Working Frequency (Hz), Min/Max:** This frequency corresponds to the minimum/maximum working SPM. These values are automatically calculated from the minimum/maximum working SPM. If the minimum/maximum working frequency is entered, the minimum/maximum working SPM is automatically calculated from the minimum/maximum working frequency instead.
2	**Startup Frequency (Hz):** The frequency that the INSTRUCT SRP commands from the VFD to run whenever the INSTRUCT SRP starts.
3	**Manual Mode: Fixed Frequency (Hz):** The commanded frequency that the VFD maintains in variable speed manual operation mode. The INSTRUCT SRP commands the VFD to operate at this fixed frequency until this value is changed.

VFD Control

VFD Control parameters help achieve accurate control and appropriate response in various operation modes. Like many of the control parameters, these settings require fine-tuning during commissioning and startup.

Figure 103 - VFD Control

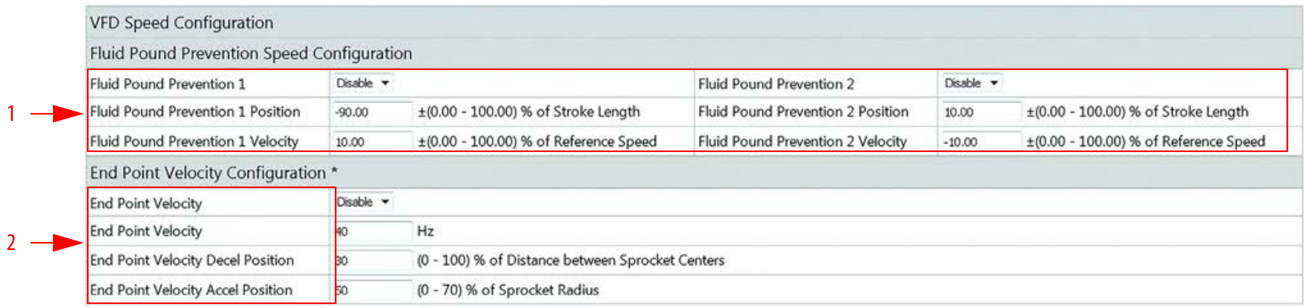


Item	Description
1	**Pump Off Deadband:** This percentage is used by the INSTRUCT SRP to decide whether to maintain, increase, or decrease the pumping speed based on pump-off conditions. The INSTRUCT SRP maintains the current speed if downstroke intersection point falls inside of the deadband. The INSTRUCT SRP speeds up the pump if the downstroke intersection point falls outside to the right of the deadband. The INSTRUCT SRP slows down the pump if the downstroke intersection falls outside to the left of the deadband.
	Pump Fillage Deadband: This percentage is used to calculate and compare the pump fillage to the current pump fillage. This value allows the INSTRUCT SRP to decide whether to maintain, increase, or decrease the pumping speed. For instance, if the current pump fillage is within ±3% of the target fillage, the INSTRUCT SRP does not change the pumping speed unless it falls outside of the ±3% deadband. If the pump fillage number is below the pump fillage deadband, the INSTRUCT SRP slows down. The INSTRUCT SRP speeds up if the pump fillage number is above the deadband.
	Frequency Increment Step: The percentage of the minimum working frequency increment step size that the INSTRUCT SRP sends to the VFD for increasing the speed.
	Cards to Average Pump Fillage: The number of cards that are used to calculate the average pump fillage. This value defaults to five cards. Increase this value as needed for greater pump fillage accuracy.
	VFD Rest Time: The time that the well remains shut down in REST state until the INSTRUCT SRP commands the VFD to RUN the well again.
	Minimum Frequency Timeout: The time period that the INSTRUCT SRP waits before shutting down after detecting that the VFD is running at minimum frequency without reaching the target pump fillage or pump-off setpoint.
2	**VFD Control Cycle Time:** The time (in minutes) that the INSTRUCT SRP waits before it sends another command to increase or decrease the speed to reach the target pump fillage or the target pump-off setpoint. After the time has elapsed, the INSTRUCT SRP checks for the pump fillage or the target pump-off setpoint again to decide whether to adjust the speed. This value is adjusted depending on the operating conditions of the well. Some wells need more time than others to stabilize.
	Pump Fillage Set Point: The percentage that you enter for the desired target pump fillage. The INSTRUCT SRP slows down or speeds up the pump based on the comparison between the current calculated pump fillage percent and the target pump fillage percent. If the current pump fillage is above the pump fillage setpoint, the INSTRUCT SRP speeds up the pumping unit to allow the well to achieve the target pump fillage. If the current pump fillage is below the target pump fillage, the INSTRUCT SRP slows down the pump to allow the well to fill back up to the target fillage.
	Frequency Decrement Step: The percentage of the minimum working frequency decrement step size that the INSTRUCT SRP sends to the VFD to decrease the speed.
	Dry Well Prevention: When this feature is enabled, the INSTRUCT SRP commands the VFD to shut down after a preset time period if the well is not reaching its target pump fillage or target pump-off setpoint value and the VFD frequency is already running at minimum speed.
	VFD Startup Time: The time period (in minutes) that the INSTRUCT SRP waits before it checks for dry well condition and applies control to the well. This time period allows the well to stabilize before checking for any condition.

VFD Speed Configuration

VFD Speed Configuration helps prevent fluid pound and allows you to set the endpoint velocity [(2)].

Figure 104 - VFD Speed Configuration



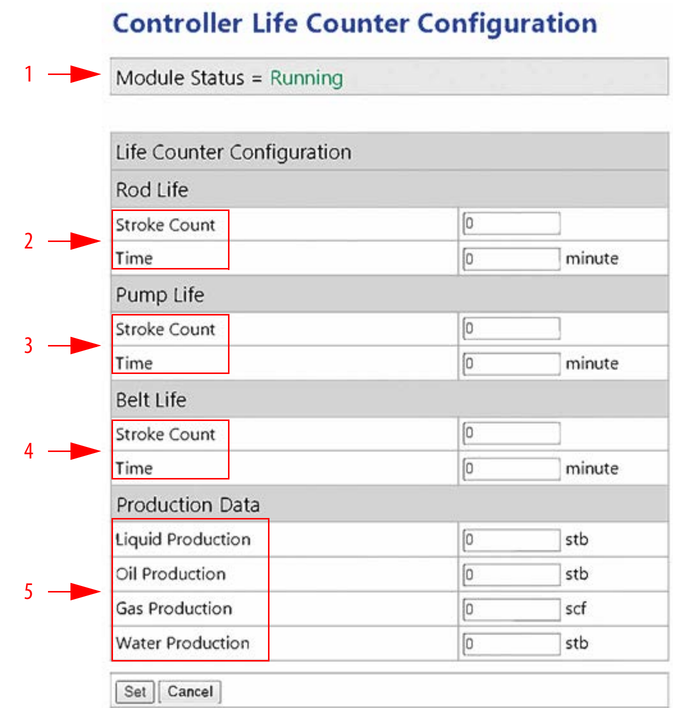
Item	Description
1 [(1)]	**Fluid Pound Prevention 1/2:** Select whether to Enable/Disable the Fluid Pound Prevention 1/2 features.
	Fluid Pound Prevention 1/2 Position: The percent of stroke length at which the speed varies as per the Fluid Pound Prevention Velocity 1/2 setting.
	Fluid Pound Prevention 1/2 Velocity: The percentage of Reference Speed by which the speed varies at the Fluid Pound Prevention Position 1/2.
2 [(2)]	**End Point Velocity:** Select whether to Enable or Disable the Endpoint Velocity feature.
	End Point Velocity: The fixed speed that is applied while traveling through the corner.
	End Point Velocity Decel Position: The percent of stroke length of the straight portion of the stroke where the speed starts decelerating before entering the corner.
	End Point Velocity Accel Position: The percent of the sprocket radius where the speed starts accelerating before exiting the corner.

(1) Only available when Hall Effect/RPM or Proximity/RPM position sensors are used.
(2) Only available when Proximity/RPM position sensors are used with a linear pump type.

Life Counter Configuration

Life counter configuration allows you to set a start value for each respective life counter. The life counter resumes from a set value.

Figure 105 - Life Counter Configuration



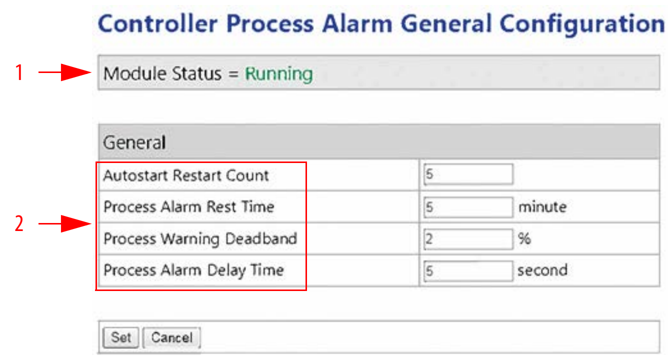
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Rod Life Stroke Count:** The value entered here is used to set a start value for rod life stroke counter.
	Rod Life Time: The value entered here is used to set a start value for rod life time counter.
3	**Pump Life Stroke Count:** The value entered here is used to set a start value for the pump life stroke counter.
	Pump Life Time: The value entered here is used to set a start value for the pump life time counter.
4	**Belt Life Stroke Count:** The value entered here is used to set a start value for the belt life stroke counter.
	Belt Life Stroke Count: The value entered here is used to set a start value for the belt life time counter.
5	**Production Data Liquid Production:** This parameter counts and accumulates the liquid production that is calculated, you can reset this value to zero through a coil status register.
	Production Data Oil Production: This parameter counts and accumulates the oil production that is calculated, you can reset this value to zero through a coil status register.
	Production Data Gas Production: This parameter counts and accumulates the gas production that is calculated, you can reset this value to zero through a coil status register.
	Production Data Water Production: This parameter counts and accumulates the water production that is calculated, you can reset this value to zero through a coil status register.

Process Alarm Configuration

Process alarm configuration allows you to configure analog and digital process alarms.

General Configuration

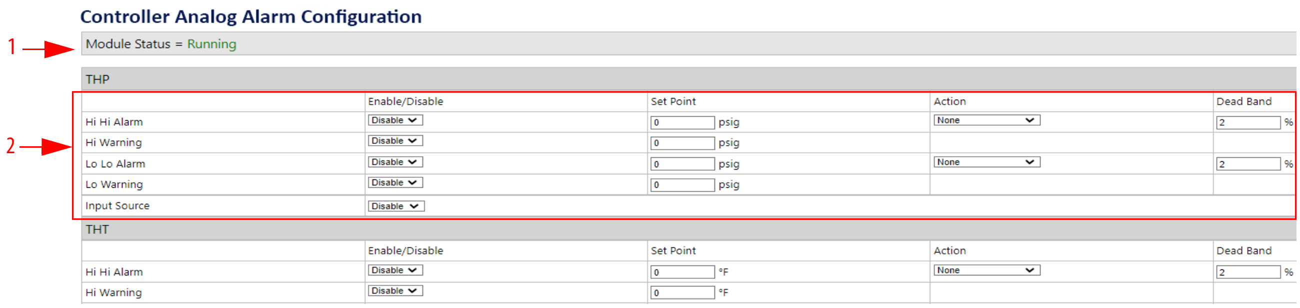
Figure 106 - General Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Autostart Restart Count:** When AutoStart condition exists the INSTRUCT SRP tries to restart the motor this many run/rest cycles before permanently shutting it down. If this is 0, then the INSTRUCT SRP continues the run/rest cycle indefinitely.
	Process Alarm Rest Time: Number of minutes the controller keeps the motor OFF when a process alarm with AutoStart-Shutdown alarm action is generated.
	Process Alarm Warning Deadband: It is used for all process warnings.
	Process Alarm Delay Time: When the INSTRUCT SRP starts, it waits for this many seconds before starting the detection of process alarms.

Analog Alarm Configuration

Figure 107 - Analog Alarm Configuration



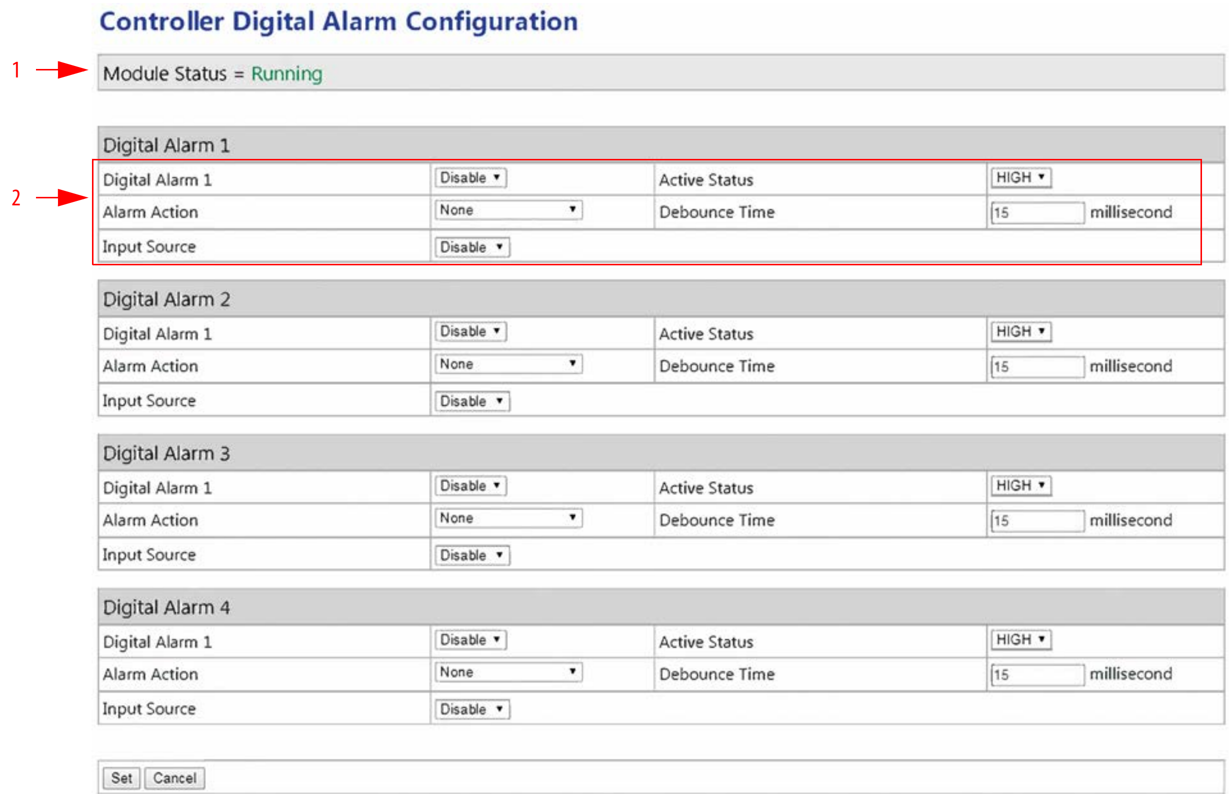
Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2[1]	**Hi Hi Alarm:** Select from No Action, Shutdown, Shutdown-Auto Restart. The setpoint (in psi) is the HiHi limit to trigger an alarm for the corresponding channel. The deadband (in %) resets the HiHi alarm. In order for HiHi alarm to reset, the process parameter value must read less than: Setpoint - (setpoint x [deadband/100]).
	Hi Warning: The setpoint to trigger high warning for corresponding process parameter.
	Lo Lo Alarm: Choose from No Action, Shutdown, Shutdown-Auto Restart. The setpoint (in psi) is the LoLo limit to trigger an alarm for the corresponding channel. The deadband (in %) resets the LoLo alarm. In order for LoLo alarm to reset, the process parameter value must read more than: Setpoint + (setpoint x [deadband/100])
	Lo Warning: The setpoint to trigger low warning for corresponding process parameter.
	Input Source: Select the source of the alarm from the following options. • Disable: The alarm is disabled. • Real: Allows you to select the source analog input. • Manual: Allows you to enter a numeric value to test your alarm. (Default is 0) • Modbus[2]: Allows you to configure the source ID, HR/IR address, and data type.

(1) These attributes can be modified for THP, THT, CHP, CHT, FLP, FLT, and Aux Process 1…4.

(2) Can be an internal or external (third-party) source.

Digital Alarm Configuration

Figure 108 - Digital Alarm Configuration



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Digital Alarm 1…4:** Use to enable or disable any of the four digital alarms.
	Active Status: Set the digital alarm active status as High or Low.
	Alarm Action: The action to be performed when the digital alarm is raised. Select from None, Shutdown, or Autostart-Shutdown.
	Debounce Time: The minimum time (in ms) that a DI detects a signal before declaring any action.
	Input Source: Select the source of the alarm from the following options. • Disable: The alarm is disabled. • Real: Allows you to select the source digital input. • Manual: Select LOW or HIGH to test your alarm. • Modbus[1]: Allows you to configure the source ID, HR/IR address, and data type.

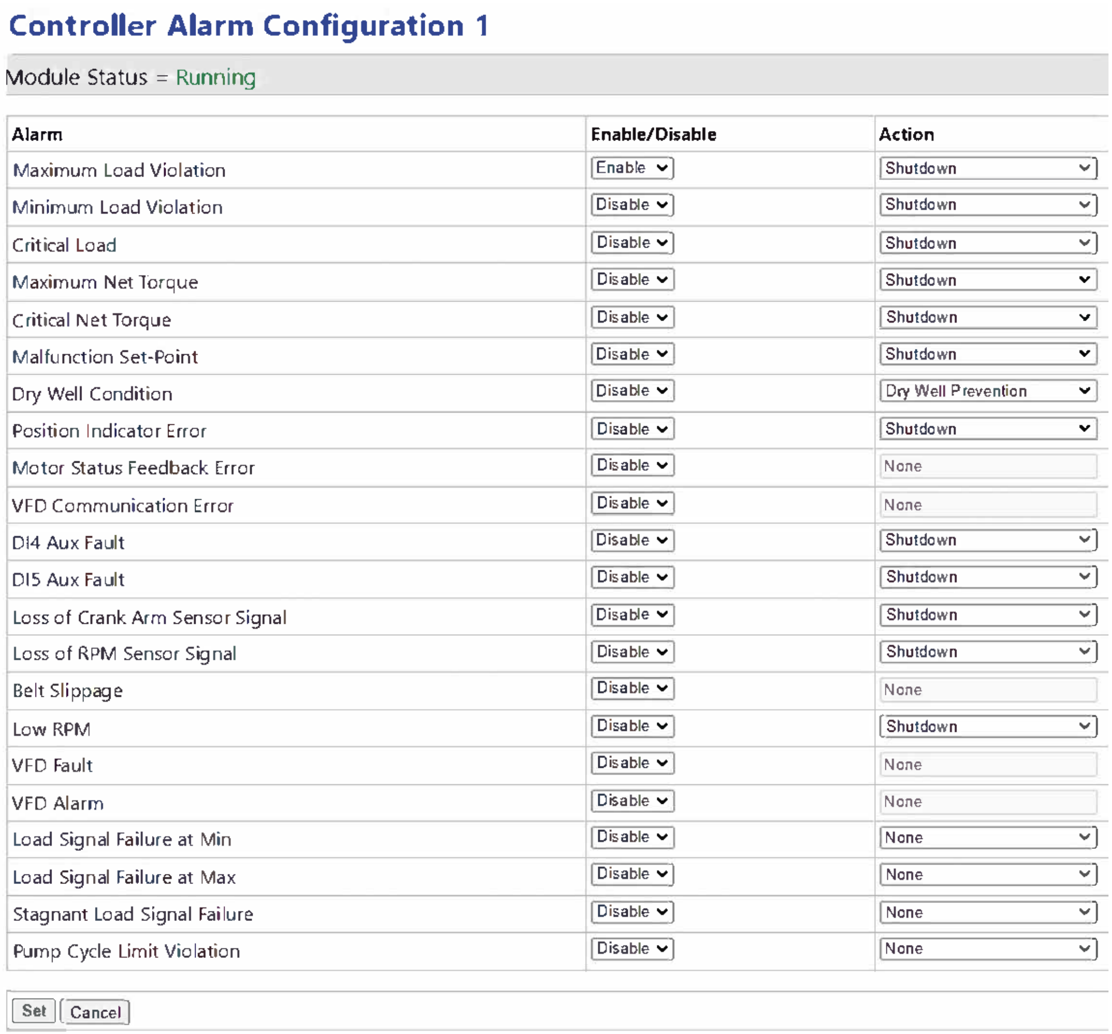
(1) Can be an internal or external (third-party) source.

Alarm Configuration

Alarm configuration allows you to enable/disable system alarms and set the action to take when the alarm has been raised.

Alarm Configuration 1

Figure 109 - Alarm Configuration 1



Controller Alarm Configuration 1

Module Status = Running

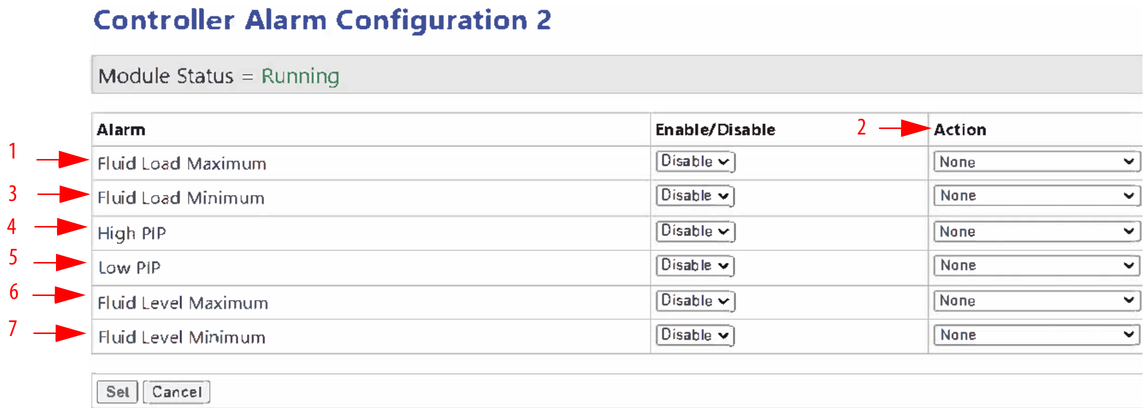
Alarm	Enable/Disable	Action
Maximum Load Violation	Enable	Shutdown
Minimum Load Violation	Disable	Shutdown
Critical Load	Disable	Shutdown
Maximum Net Torque	Disable	Shutdown
Critical Net Torque	Disable	Shutdown
Malfunction Set-Point	Disable	Shutdown
Dry Well Condition	Disable	Dry Well Prevention
Position Indicator Error	Disable	Shutdown
Motor Status Feedback Error	Disable	None
VFD Communication Error	Disable	None
DI4 Aux Fault	Disable	Shutdown
DI5 Aux Fault	Disable	Shutdown
Loss of Crank Arm Sensor Signal	Disable	Shutdown
Loss of RPM Sensor Signal	Disable	Shutdown
Belt Slippage	Disable	None
Low RPM	Disable	Shutdown
VFD Fault	Disable	None
VFD Alarm	Disable	None
Load Signal Failure at Min	Disable	None
Load Signal Failure at Max	Disable	None
Stagnant Load Signal Failure	Disable	None
Pump Cycle Limit Violation	Disable	None

Set Cancel

For a description of parameters, see Alarm Configuration on page 167.

Alarm Configuration 2

Figure 110 - Alarm Configuration 2

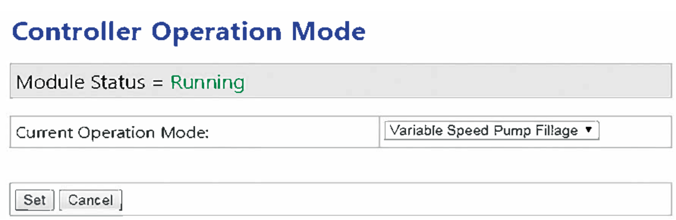


Item	Description
1	**Fluid Load Maximum:** This enables the fluid load maximum alarm to be triggered when a maximum fluid load limit is violated.
2	**Action:** None is for not action taken when the alarm is triggered. Shutdown causes the well to shut down as soon as the alarm is detected.
3	**Fluid Load Minimum:** This enables the fluid load minimum alarm to be triggered when a minimum fluid load limit is violated.
4	**High PIP:** This enables the high PIP alarm to be triggered when the high PIP limits is violated.
5	**Low PIP:** This enables the low PIP alarm to be triggered when the low PIP limits is violated.
6	**Fluid Level Maximum:** This enables the fluid level maximum alarm to be triggered when a maximum fluid level limit is violated.
7	**Fluid Level Minimum:** This enables the fluid level minimum alarm to be triggered when a minimum fluid level limit is violated.

Operation Mode

The Operation mode page allows you to change the operation mode of your INSTRUCT SRP.

Figure 111 - Operation Mode

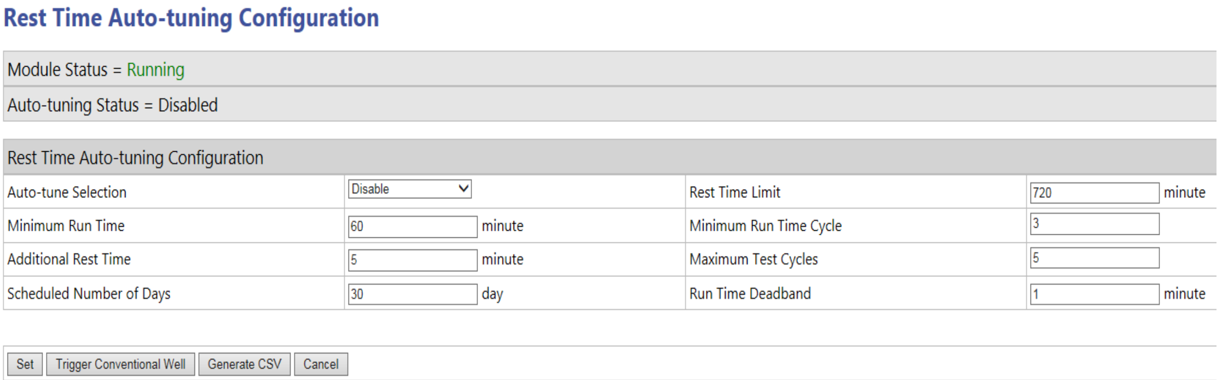


For a description of operation modes, see Well Operation Modes on page 13.

Rest Time Auto-tuning

The Rest Time Auto-tuning page allows you to enable, disabled, and configure the Rest time Auto-tuning feature.

Figure 112 - Rest Time Auto-tuning Configuration

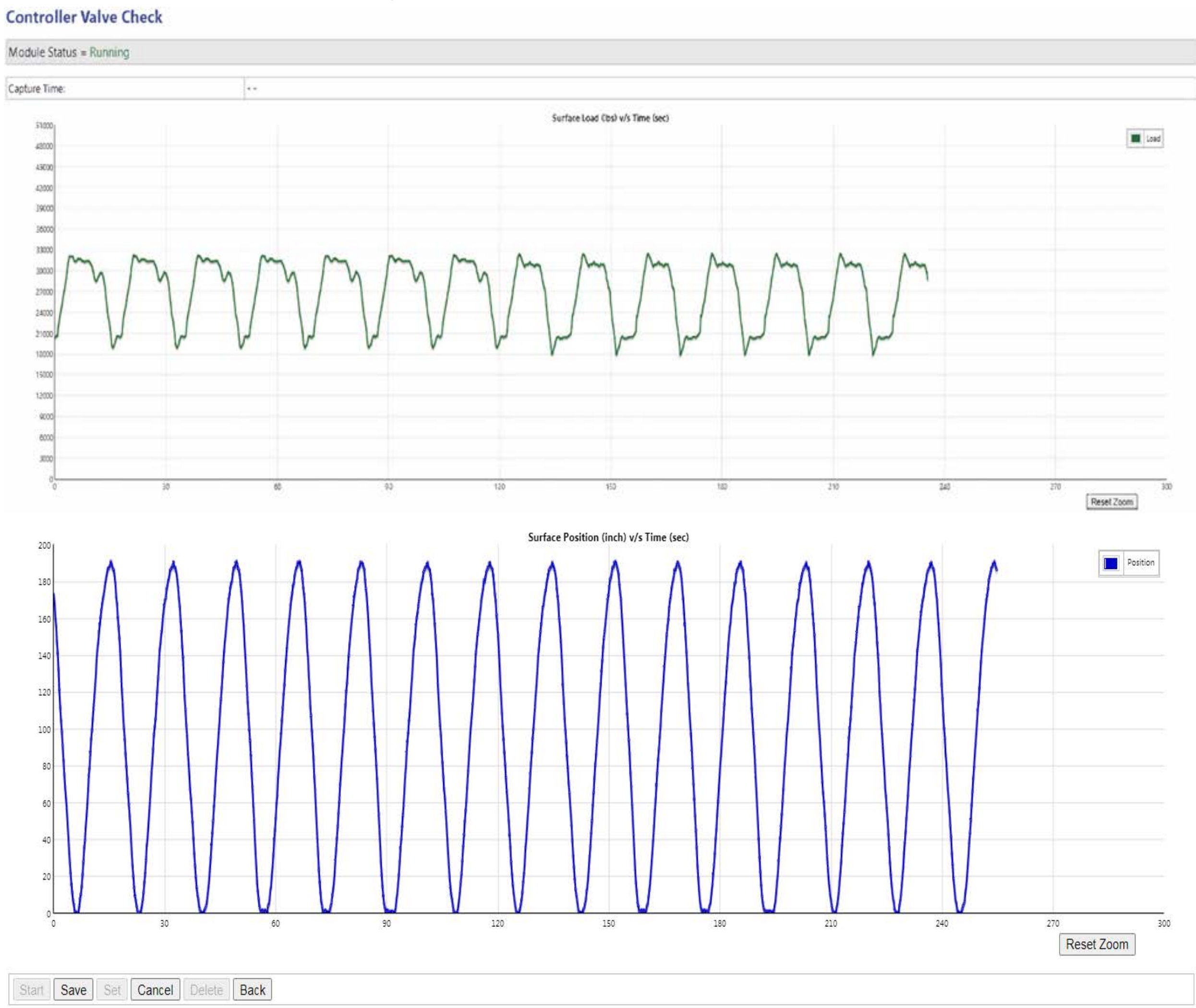


Item	Description
1	**Module Status:** This indicates whether the module is running.
2	**Auto-tuning Status:** The Status can be "RTO Found" or "Could not find RTO". This is to indicate whether the algorithm could find the Optimal run time. A status of "Interrupted", it indicates that the Rest Time Auto-tuning process has been interrupted by the user or due to an alarm.
3	**Auto-tune Selection:** There are 2 method, conventional and unconventional. -The conventional well type the additional Rest Time in each cycle will be added to the Rest time. If the Rest time remains constant (+/- "Run time deadband" in minutes) for minimum Run Time Cycles, then the Rest time will be considered as the Optimal Rest time. If the Optimal Rest time is not found within the maximum test cycles then, it will be updated with a warning. For Unconventional well, if the Run time is less than the minimum runtime for the minimum run time cycle, the additional rest time will be added to the Rest time. Once the runtime is more than minimum runtime, the Rest time will revert back to the original user configured Rest time.
	Minimum Run Time: this is value is used in the unconventional well algorithm to determined whether the additional rest time will be added to the initial Rest time
	Additional Rest Time: the additional rest time is the step size in minutes that will be added to the initial Rest time that will become the optimal Rest time.
	Scheduled Number of Days: This counter triggers the next well test to run the algorithm from the initial Rest time.
	Rest Time Limit: The maximum Rest Time limit that is allowed before the auto tuning process is aborted.
	Minimum Run Time Cycle: The current run time for a cycle is more than the original run time, the Rest time will revert back to the initial rest time.
	Maximum Test Cycles: Indicates how many cycles will the test cycle run if the Optimum Rest time is not found.
	R**un Time Deadband:** The time interval in minutes which decides whether the Run Time is constant or not changing to decide the Rest time is Optimal.
4	**Trigger Conventional Well:** This button will start the conventional well algorithm once the auto-tune selection has been made for the Conventional Well.
5	**Generate CSV:** This button will generate a CSV file with all the Run and Rest time calculated with the Rest Auto-tune algorithm.

Valve Check

The Valve Check page allows you to perform a standing valve and traveling valve test.

Figure 113 - Valve Check

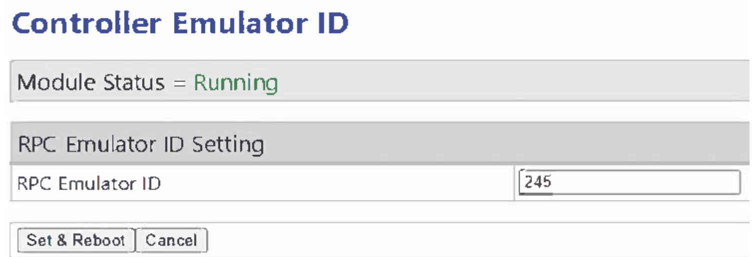


For a description of Valve Check operations, see [Operate the Valve Check on page 294](#).

Emulator ID

The Emulator ID is set for the ISaGRAF program to run third-party controller emulation for Modbus. The Modbus parameters, where they are common, are only emulated.

Figure 114 - Emulator ID

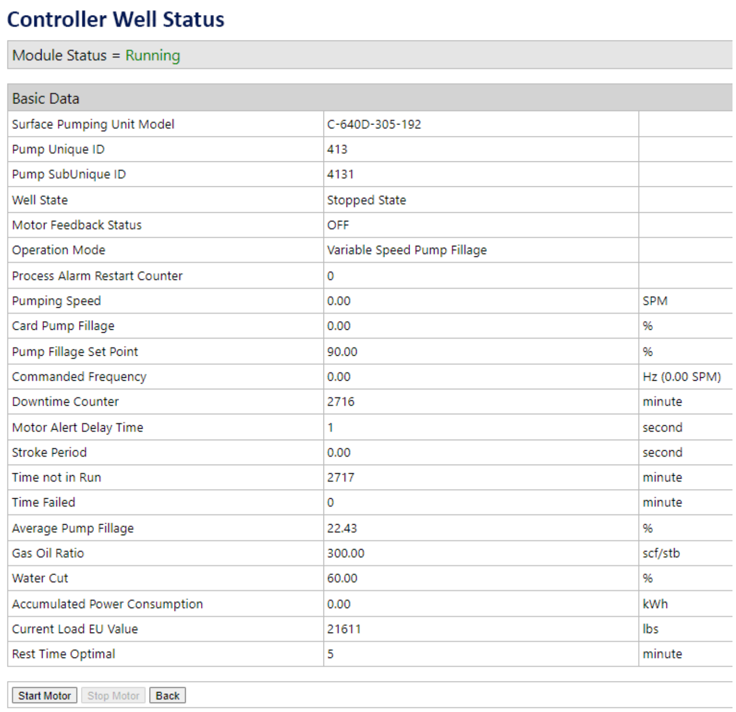


Applications > INSTRUCT SRP> INSTRUCT SRP Status

The Applications pages contain the INSTRUCT SRP applications that you use to configure (Controller Configuration on page 64) and monitor (INSTRUCT SRP Status) your well. The Set button on each application screen triggers the configuration update in the controller.

Well Status

Figure 115 - Basic Data



Controller Well Status

Module Status = Running

Basic Data		
Surface Pumping Unit Model	C-640D-305-192	
Pump Unique ID	413	
Pump SubUnique ID	4131	
Well State	Stopped State	
Motor Feedback Status	OFF	
Operation Mode	Variable Speed Pump Fillage	
Process Alarm Restart Counter	0	
Pumping Speed	0.00	SPM
Card Pump Fillage	0.00	%
Pump Fillage Set Point	90.00	%
Commanded Frequency	0.00	Hz (0.00 SPM)
Downtime Counter	2716	minute
Motor Alert Delay Time	1	second
Stroke Period	0.00	second
Time not in Run	2717	minute
Time Failed	0	minute
Average Pump Fillage	22.43	%
Gas Oil Ratio	300.00	scf/stb
Water Cut	60.00	%
Accumulated Power Consumption	0.00	kWh
Current Load EU Value	21611	lbs
Rest Time Optimal	5	minute

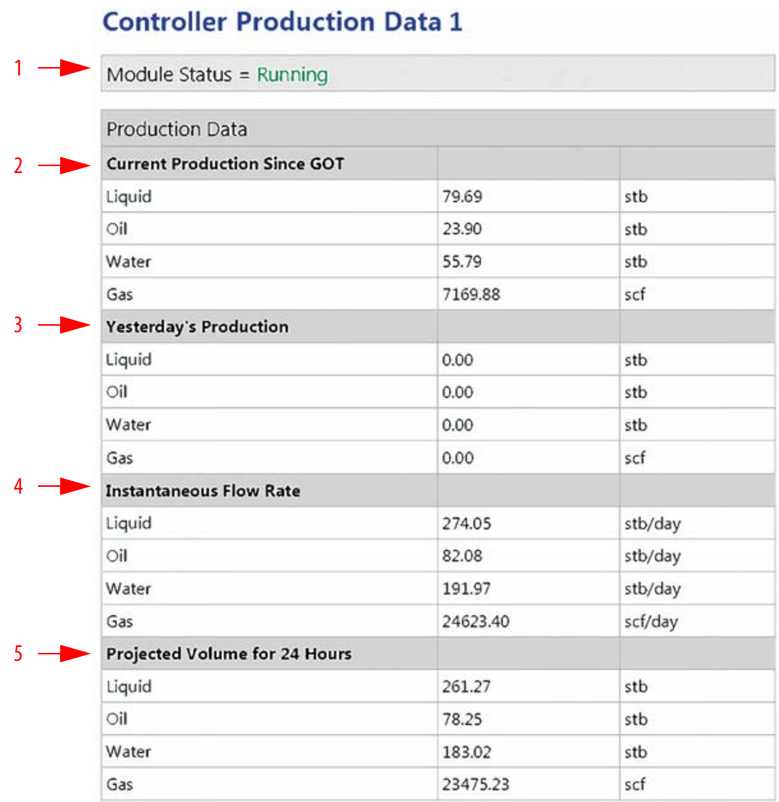
Start Motor | Stop Motor | Back

Row	Description
1	**Surface Pumping Unit Model:** Pump model that is selected either from the INSTRUCT SRP internal pumping unit database or the pump configuration you customized.
2	**Pump Unique ID:** Depicts the unique number from the pump database.
3	**Pump Subunique ID:** Based on the Crank Pin. If out of R1, R2, R3 and R4, R2 is selected and Pump Unique ID is 101, then 1012 is updated here.
4	**Well State:** Current state of the well.
5	**Motor Feedback Status:** Current motor feedback status.
6	**Operation Mode:** The well control mode of the INSTRUCT SRP.
7	**Pumping Speed:** Current pump speed in strokes per minute.
8	**Current RPS:** Current revolutions per stroke value. Only available when Hall Effect/RPM or Proximity/RPM position sensors are used.
9	**Current RPM:** Current revolutions per minute value that is based on the time period between two pulses from sensor. Only available when Hall Effect/RPM or Proximity/RPM position sensors are used.
10	**Card Pump Fillage:** Current pump fillage calculated from the downhole card.
11	**Pump Fillage Set Point:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP either slows down or speeds up the pump based on the comparison between the current calculated Pump Fillage percent and the target Pump Fillage percent.
12	**Commanded Frequency:** The current frequency the INSTRUCT SRP is sending through the AO (4…20 mA) to the VFD. For example, if the frequency range is 0…60 Hz, then the corresponding signal would be 4…20 mA. Commanded frequency for 20 mA would be 60 Hz in this case.
13	**Downtime Counter:** The current time for which motor is off.
14	**Motor Alert Delay Time:** The delay before the INSTRUCT SRP starts the motor when user commands it to start.
15	**Stroke Period:** The number of seconds it takes to complete each stroke cycle.
16	**Time Not in Run:** Counts and accumulates the minutes not in Run or Start state. This value resets to zero automatically when it falls in Run or Start state.
17	**Time Failed:** Counts and accumulates the minutes spent in Unable to Run or Shutdown state. This value resets to zero automatically when it falls in Run or Start state.
18	**Average Pump Fillage:** The moving average pump fillage level for 50 cards.
19	**Gas Oil Ratio:** Used obtain accurate production estimates from the calculations.

Row	Description
20	**Water Cut:** You must enter the correct water cut to obtain accurate production estimates from the calculations. You can get this data from well test reports.
21	**Accumulated Power Consumption:** This accumulated value is automatically calculated in the VFD parameter 14 in kWh transferred from the drive. The Elapsed kWh in the drive is accumulated automatically in parameter 14.
22	**Current Loaded EU Value:** Current load EU value is displayed here.
23	**Start/Stop Motor:** When clicked, these buttons start and stop the motor.
24	**Rest Time Optimal:** This value in minutes indicates that Optimal rest time found by the Rest time auto-tuning feature.

Production Data 1

Figure 116 - Production Data 1



Controller Production Data 1

Module Status = Running

Production Data		
Current Production Since GOT		
Liquid	79.69	stb
Oil	23.90	stb
Water	55.79	stb
Gas	7169.88	scf
Yesterday's Production		
Liquid	0.00	stb
Oil	0.00	stb
Water	0.00	stb
Gas	0.00	scf
Instantaneous Flow Rate		
Liquid	274.05	stb/day
Oil	82.08	stb/day
Water	191.97	stb/day
Gas	24623.40	scf/day
Projected Volume for 24 Hours		
Liquid	261.27	stb
Oil	78.25	stb
Water	183.02	stb
Gas	23475.23	scf

Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Current Production Since GOT:** The total accumulated liquid, oil, water, and gas volume for the well from the current day.
3	**Yesterday's Production:** The total accumulated liquid, oil, water, and gas volume for the well from yesterday.
4	**Instantaneous Flow Rate:** The current estimated flow rate of liquid, oil, water, and gas from the well.
5	**Projected Volume for 24 Hours:** The total projected liquid, oil, water, and gas volume from the well

Production Data 2

Figure 117 - Production Data 2

Controller Production Data 2

Module Status = Running

Production Data		
Instantaneous Output		
Specific Gravity of Fluid	1.04	
Specific Gravity of the Oil	0.82	
Elastic Constant of tubing material	4.54753e-08	inch/lb-ft
Tubing Stretch	4.34	inch
Plunger Overtravel	4.58	inch
Rod String Stretch	67.20	inch
Downhole Plunger Stroke Length-Calculated	125.04	inch
Corrected Plunger Diameter	1.75	inch
Formation Volume Factor (Oil)	1.56	bbl/stb
Formation Volume Factor (Water)	1.01	bbl/stb
Gas in Solution	1105.39	scf/stb
Differential Pressure across Standing Valve	224.69	psig
Net Stroke Length	158.99	inch
Gross Stroke Length	155.79	inch
Pump Slippage	0.00	bpd
Pump Efficiency	102.05	%
Pump Net Flowrate	204.77	bpd

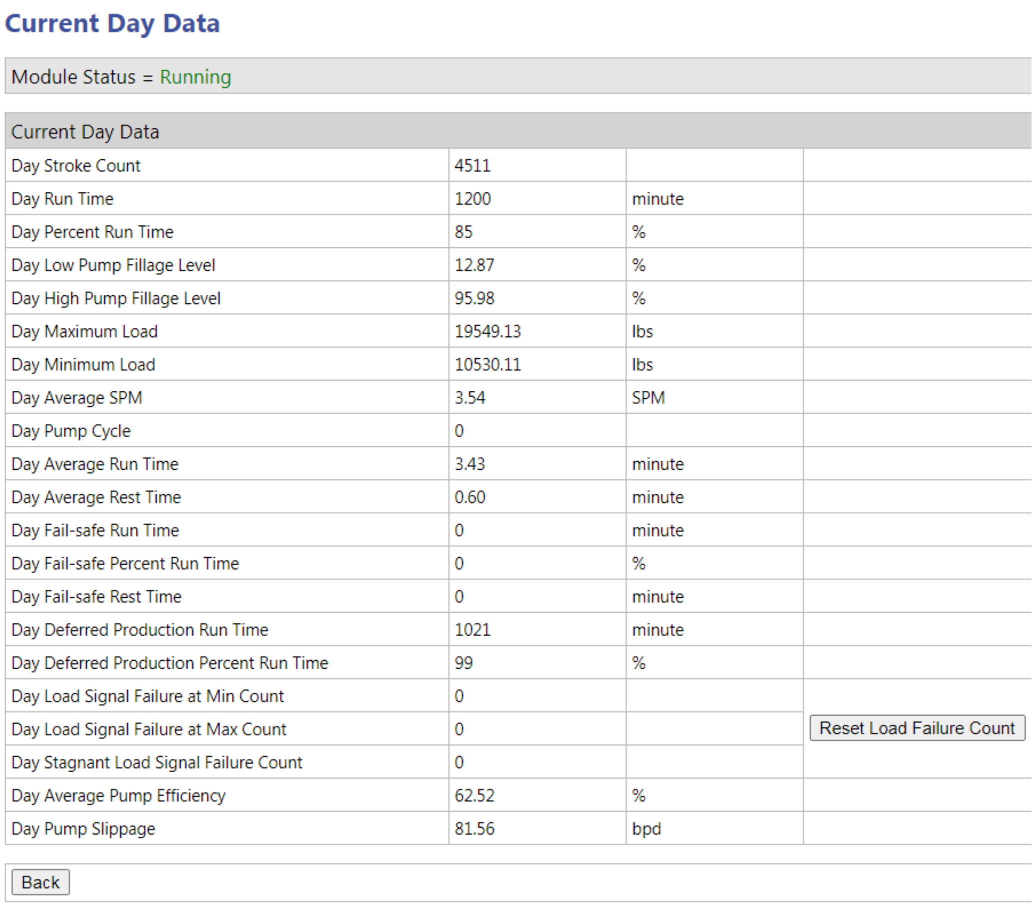
Back

Row	Description
1	**Production Data:** this is the instantaneous data calculated for production from the fluid properties and the equipment configuration for every stroke.
2	**Specific Gravity of Fluid:** this is the specific gravity of the fluid extracted from the well that is calculated.
3	**Specific Gravity of the Oil:** this is the specific gravity of the oil manually entered by the user on the Production Configuration screen.
4	**Elastic Constant of tubing material:** This is user entered data from the production configuration screen.
5	**Tubing Stretch:** this is the calculated tubing stretch from the data entered on the production configuration page.
6	**Plunger Overtravel:** this is the calculated pump over travel on every stroke.
7	**Rod String Stretch:** this is the calculated rod string stretch for every stroke.
8	**Downhole Plunger Stroke Length-Calculated:** This is the calculated stroke length for the pump plunger.
9	**Corrected Plunger Diameter:** this is the pump plunger diameter corrected after the calculation. This value is calculated and accounted for the pump clearance.
10	**Formation Volume Factor (Oil):** This value calculated from the data entered on the production screen for oil which is based on the condition at the pump intake conditions and fluid properties.
11	**Formation Volume Factor (Water):** This value calculated from the data entered on the production screen for water which is based on the condition at the pump intake conditions and fluid properties.
12	**Gas in Solution:** this is the amount of gas contained in the oil volume this is calculated at the pump intake conditions and fluid properties.
13	**Differential Pressure across Standing Valve:** this is the calculated pressure drop across the standing valve. This is the difference in pressure across the pump barrel and the pump intake.
14	**Net Stroke Length:** this is the net stroke length calculated on every stroke from the downhole/ pump card.

Row	Description
16	**Gross Stroke Length:** this is the gross stroke length calculated on every stroke from the downhole card/pump card.
17	**Pump Slippage:** This is the pump slippage for the pump calculated on every stroke.
18	**Pump Efficiency:** This is the calculated pump efficiency on every stroke.
19	**Pump Net Flowrate:** this is the calculated pump flow rate on every stroke.

Current Day Data

Figure 118 - Current Day Data



Current Day Data

Module Status = Running

Current Day Data			
Day Stroke Count	4511		
Day Run Time	1200	minute	
Day Percent Run Time	85	%	
Day Low Pump Fillage Level	12.87	%	
Day High Pump Fillage Level	95.98	%	
Day Maximum Load	19549.13	lbs	
Day Minimum Load	10530.11	lbs	
Day Average SPM	3.54	SPM	
Day Pump Cycle	0		
Day Average Run Time	3.43	minute	
Day Average Rest Time	0.60	minute	
Day Fail-safe Run Time	0	minute	
Day Fail-safe Percent Run Time	0	%	
Day Fail-safe Rest Time	0	minute	
Day Deferred Production Run Time	1021	minute	
Day Deferred Production Percent Run Time	99	%	
Day Load Signal Failure at Min Count	0		
Day Load Signal Failure at Max Count	0		Reset Load Failure Count
Day Stagnant Load Signal Failure Count	0		
Day Average Pump Efficiency	62.52	%	
Day Pump Slippage	81.56	bpd	

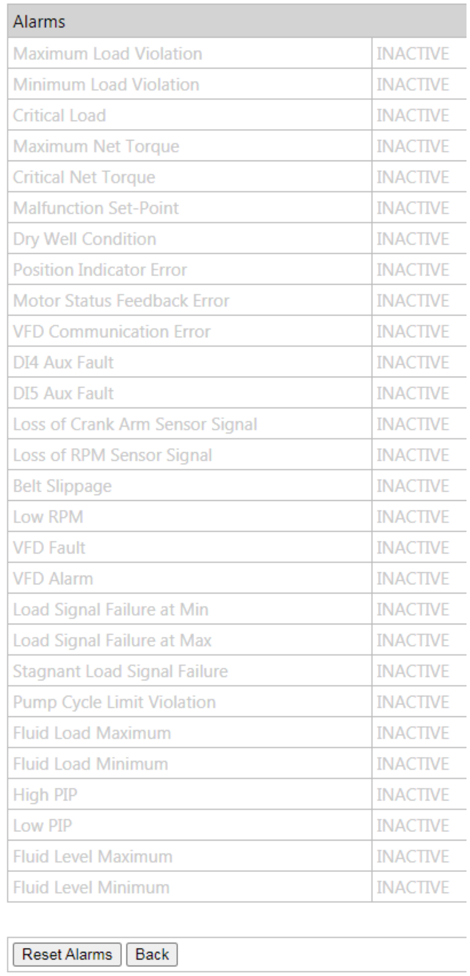
Back

Row	Description	Row	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.	13	**Day Fail-safe Run Time:** This is the daily Run time while fail-safe State.
2	**Day Stroke Count:** Total number of strokes in a day.	14	**Day Fail-safe Percent Run Time:** This is the percent run time for the day calculated when in Fail-safe state.
3	**Day Run Time:** Total runtime in a day.	15	**Day Fail-safe Rest Time:** This is the Rest time for day when in Fail-Safe state.
4	**Day Percent Run Time:** Total percent of runtime in a day.	16	**Day Deferred Production Run Time:** This is the run time calculated by adding the normal run time and the Run time in Fail-safe State together.
5/6	**Day Low/High Pump Fillage Level:** The high and low pump fillage level percentage in a day.	17	**Day Deferred Production Percent Run Time:** This is the percent run time calculated from the normal Run time and the fail-safe run time.
7/8	**Day Maximum/Minimum Load:** The maximum/minimum load in a day.	18/19	**Day Load Signal Failure at Min/Max Count:** This is total load signal failure count at minimum/maximum for the day since GOT.

Row	Description	Row	Description
9	**Day Average SPM:** The total accumulated Average SPM in a day.	20	**Day Stagnant Load Signal Failure Count:** This is total number of stagnant load signal failures for the day.
10	**Day Pump Cycle:** The number of cycles the pump has turned ON/OFF since GOT. This parameter resets to zero at GOT.		
11	**Day Average Run Time:** This is the average Run time for the day.	21	**Day Average Pump Efficiency:** This is the moving average of the pump efficiency, it gets updated on every stroke.
12	**Day Average Rest Time:** This is the average Rest time for the day.	22	**Day Pump Slippage:** This is the portion of the fluid produced that slips through the pump on every stroke due to clearance and wear.

Alarm Status

Figure 119 - Alarm Status

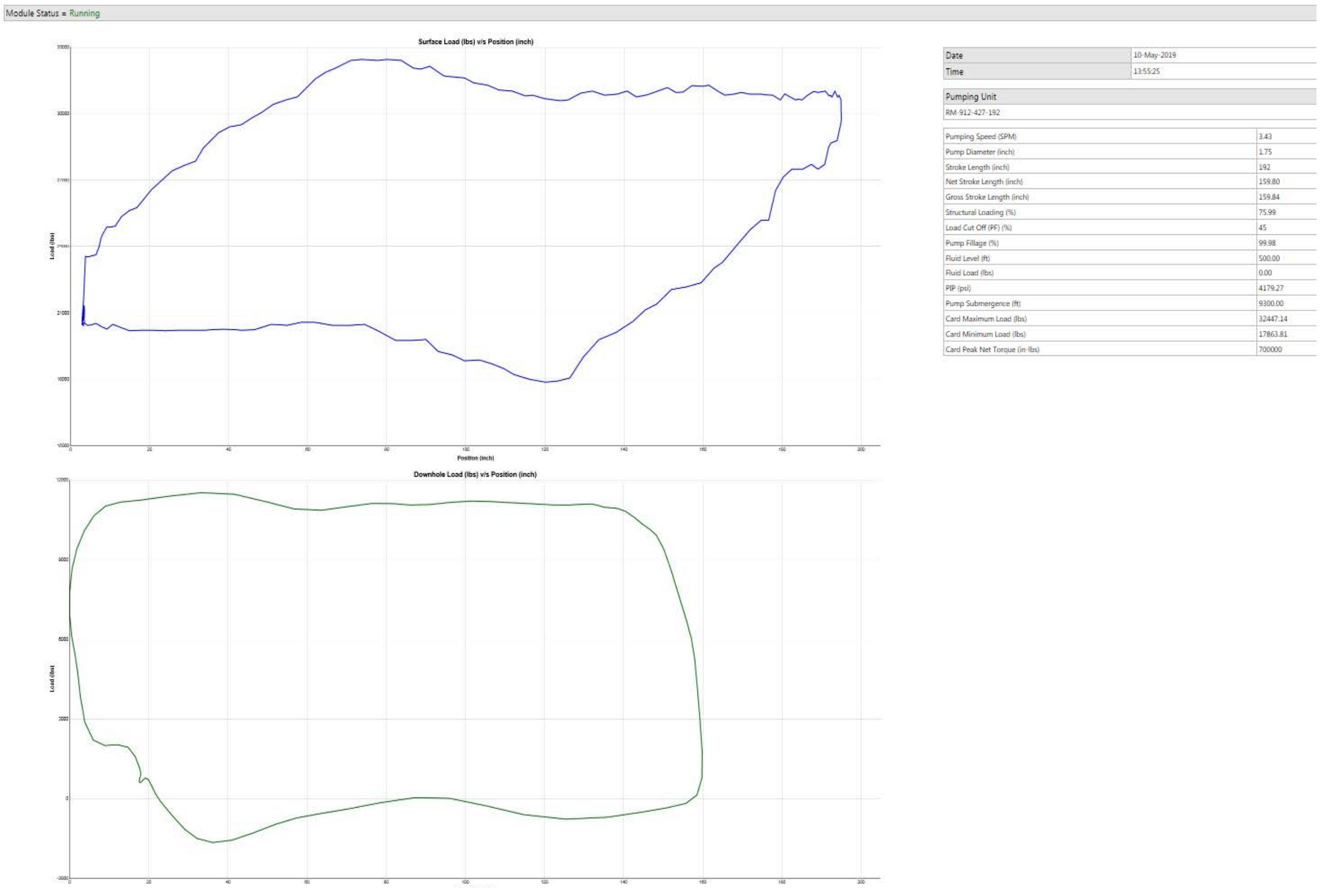


Item	Description
1	**Load Signal Failure at Min:** This alarm gets triggered when the load signal falls below the minimum limit for the load signal failure.
2	**Load Signal Failure at Max:** This alarm gets triggered when the load signal falls above the maximum limit for the load signal failure.
3	**Stagnant Load signal Failure:** This alarm gets triggered when the consecutive load signal samples remain within the band for more than the load sampling rate time.
4	**Pump cycle Limit Violation:** this alarm gets triggered when the number of pump cycles in a day is more than the user configured limit.
5/6	**Fluid Load Maximum/Minimum:** This enables the fluid load minimum (or maximum) alarm to be triggered when a minimum (or maximum) fluid load limit is violated.
7/8	**High/Low PIP:** This enables the high PIP (and low PIP) alarm to be triggered when the high PIP (and low PIP) limits is violated.
9/10	**Fluid Level Maximum/Minimum:** This enables the fluid level maximum (and minimum) alarm to be triggered when a maximum (and minimum) fluid level limit is violated.

For a description of the other alarm parameters, see Alarm Configuration on page 167.

Current Card

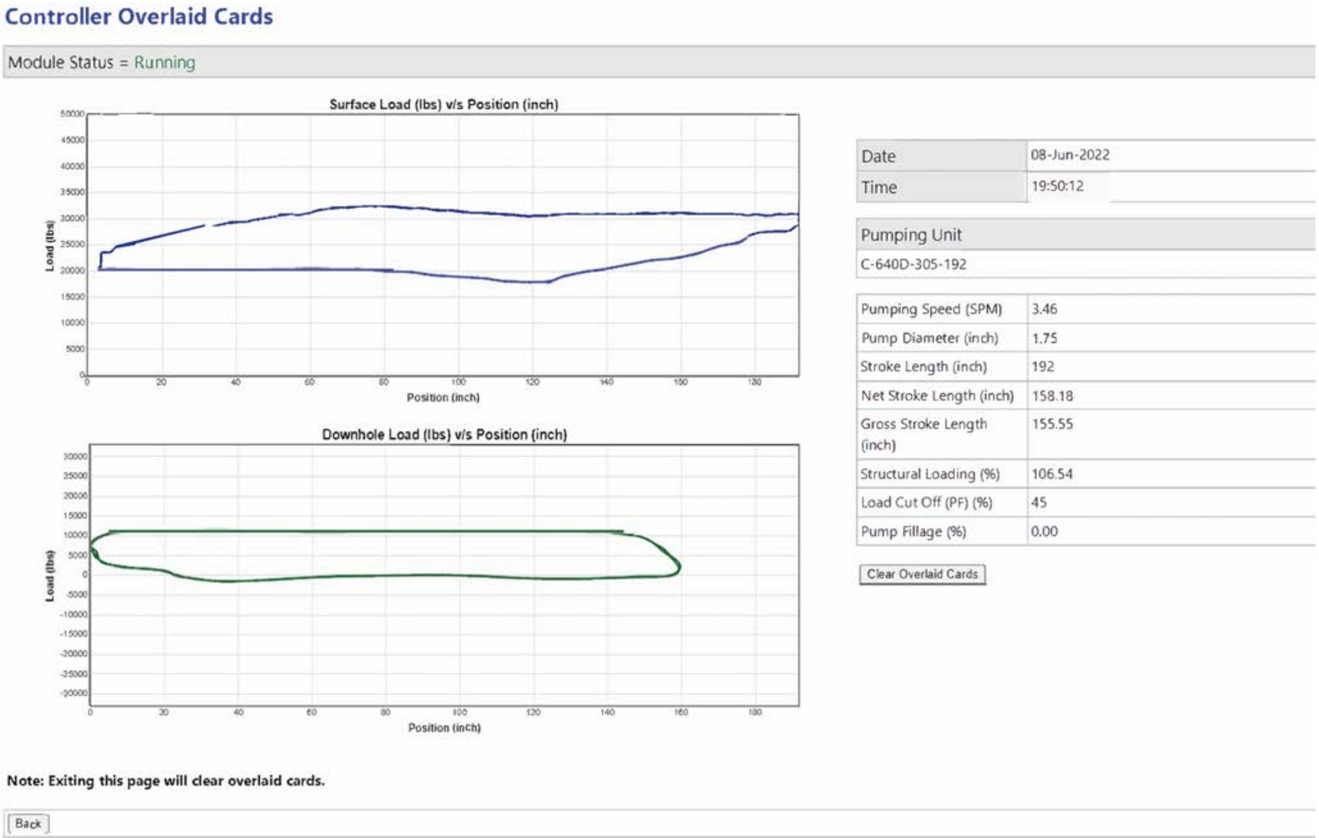
Figure 120 - Current Card



Row	Description
1	**Pumping Speed:** Current pump speed in strokes per minute.
2	**Pump Diameter:** The pump plunger diameter is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results.
3	**Stroke Length:** The stroke length depends on each pumping unit. Some pumping units have three or four stroke length options. Enter the correct surface stroke length to obtain accurate surface measurements. Incorrect stroke length results in erroneous results for surface and downhole calculations. When Custom Stroke Length is enabled, you can type in your stoke length.
4	**Net Stroke Length:** The value that is provided by the inflection point on the downstroke where the downhole pump comes in contact with the fluid. This value is used for the calculation of the pump fillage.
5	**Gross Stroke Length:** The maximum value for the pump plunger displacement.
6	**Structural Loading:** The load value in percent on the pumping structure.
7	**Load Cut Off:** This parameter allows the INSTRUCT SRP to calculate the Pump Fillage accurately when looking for the effective stroke-inflection point. For instance, if it is set to 45%, the INSTRUCT SRP starts looking from 45% between the End of upstroke to the beginning of the downstroke of the downhole card.
8	**Pump Fillage:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP either slows down or speeds up the Pump based on the comparison between the current calculated Pump Fillage percent and the target Pump Fillage percent.
9	**Fluid Level:** The correct fluid level to obtain accurate production estimates from the calculations. One can get this data from well test reports. This setting is enabled when the 'Calculated Fluid Level' checkbox is unchecked.
10	**Fluid Load:** The current value of fluid load (lb).
11	**PIP:** The current pump intake pressure.
12	**Pump Submergence:** The current pump submergence level.
13/14	**Card Maximum/Minimum Load:** The maximum/minimum load value limit (in pounds) for detection of load violations.
15	**Card Peak Net Torque:** The maximum absolute value of the torque the gearbox of the pumping unit experiences during a complete stroke.

Overlaid Cards

Figure 121 - Overlaid Card

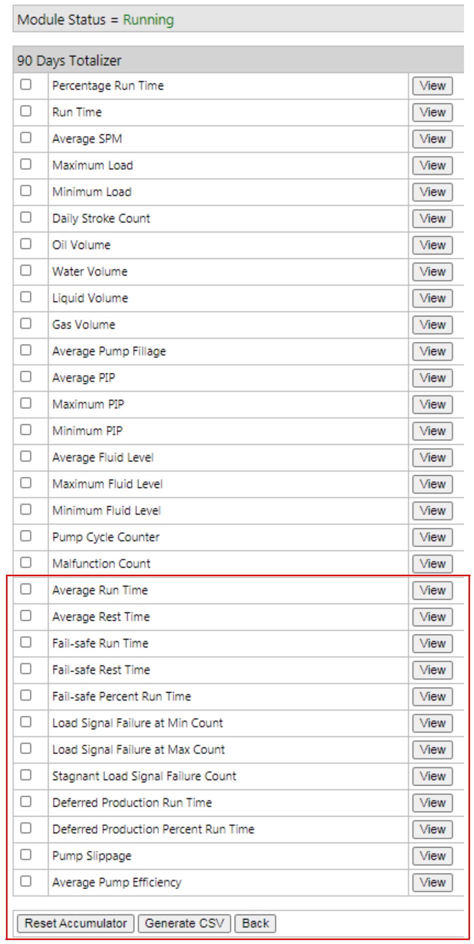


For a description of parameters, see Current Card on page 105.

Historical Data

A list of 90-day totalizer charts is listed in Figure 123 on page 108.

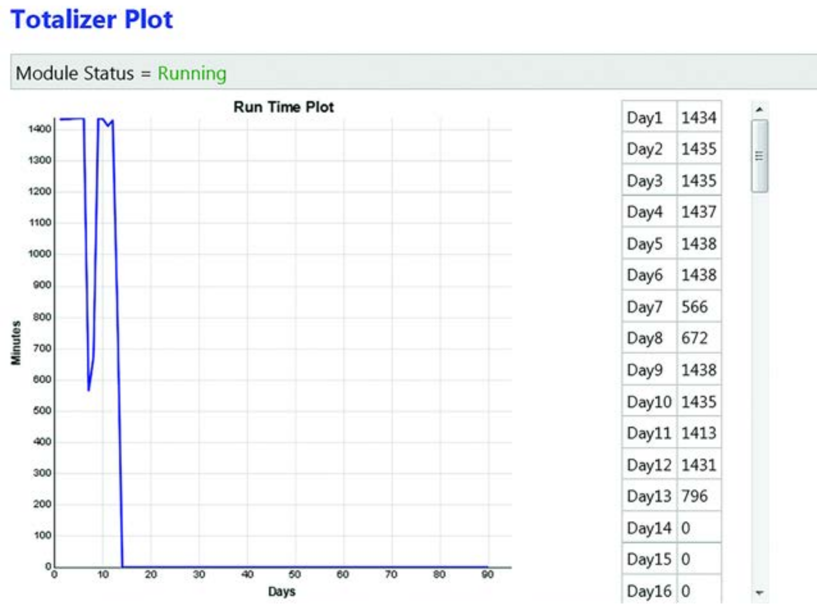
Figure 122 - Historical Data



Item	Description
1	**Average Run Time:** This is the average Run time for the day.
2	**Average Rest Time:** This is the average Rest time for the day.
3	**Fail-safe Run Time:** This is the daily Run time while fail-safe state.
4	**Fail-safe Rest Time:** This is the Rest time for day when in Fail-Safe state.
5	**Fail-safe Percent Run Time:** This is the percent run time for the day calculated when in Fail-safe state.
6	**Load Signal Failure as Min/Max Count:** This is the total load signal failure count at minimum/ maximum for the day since GOT.
7	**Stagnant Load Signal Failure Count:** This is total number of stagnant load signal failures for the day.
8	**Deferred Production Run Time:** This is the run time calculated by adding the normal run time and the Run time in Fail-safe State together.
9	**Deferred Production Percent Run Time:** This is the percent run time calculated from the normal Run time and the fail-safe run time.
10	**Pump Slippage:** This is the pump slippage for the pump calculated on every stroke.
11	**Average Pump Efficiency:** This is the calculated pump efficiency on every stroke.

For a description of the additional parameters, see Figure 159 on page 135.

Figure 123 - Example 90-day Totalizer Chart



Fluid Level Data

Figure 124 - Fluid Level Data

Controller Fluid Level Data

Module Status = Running

Current Data		
Fluid Load	0.00	lbs
Fluid Level	500.00	ft
Pump Submergence	9300.00	ft
Pump Intake Pressure	4179.27	psi
Specific Gravity of Fluid	1.04	

Current Day Data Since GOT				
	Avg	**Max**	**Min**	**Unit**
Pump Intake Pressure	4179.27	4179.27	4179.27	psi
Fluid Level	500.00	500.00	500.00	ft

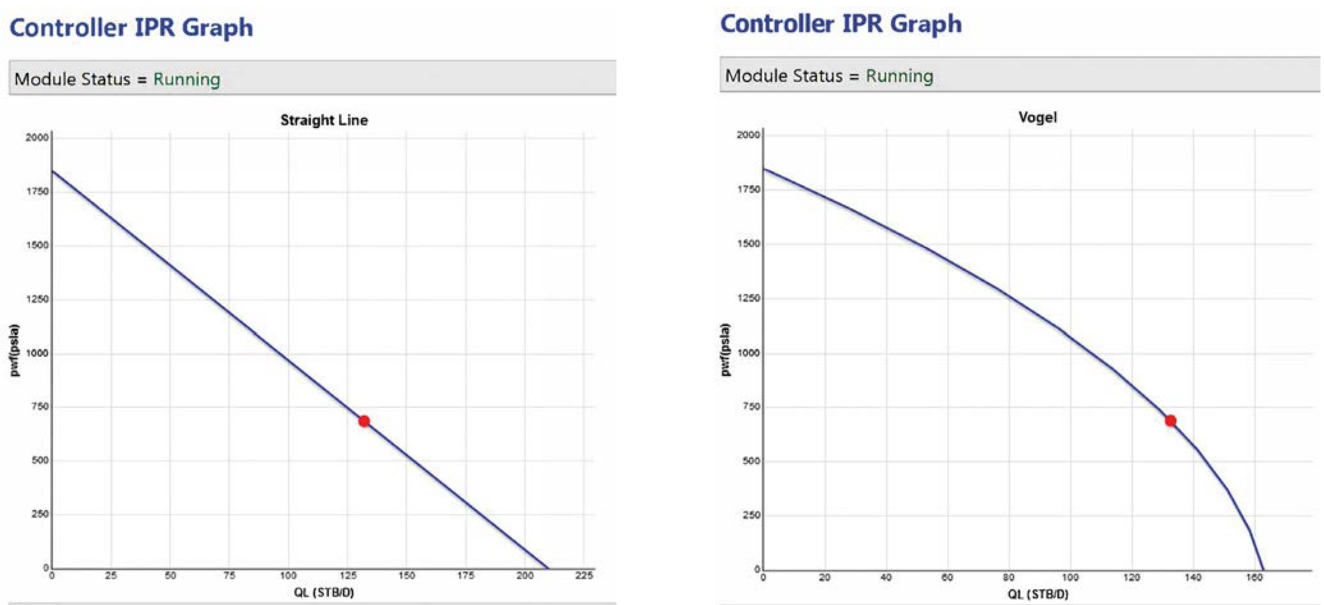
Last Day Data Since GOT				
	Avg	**Max**	**Min**	**Unit**
Pump Intake Pressure	4179.27	4179.27	4179.27	psi
Fluid Level	500.00	500.00	500.00	ft

Warnings	
Fluid Load Calculation Error	INACTIVE
Low Fluid Level above the Pump Intake	INACTIVE
Low Pump Intake Pressure	INACTIVE
Fluid Level Out of Range	INACTIVE

For a description of parameters, see Fluid Level Data on page 133.

IPR

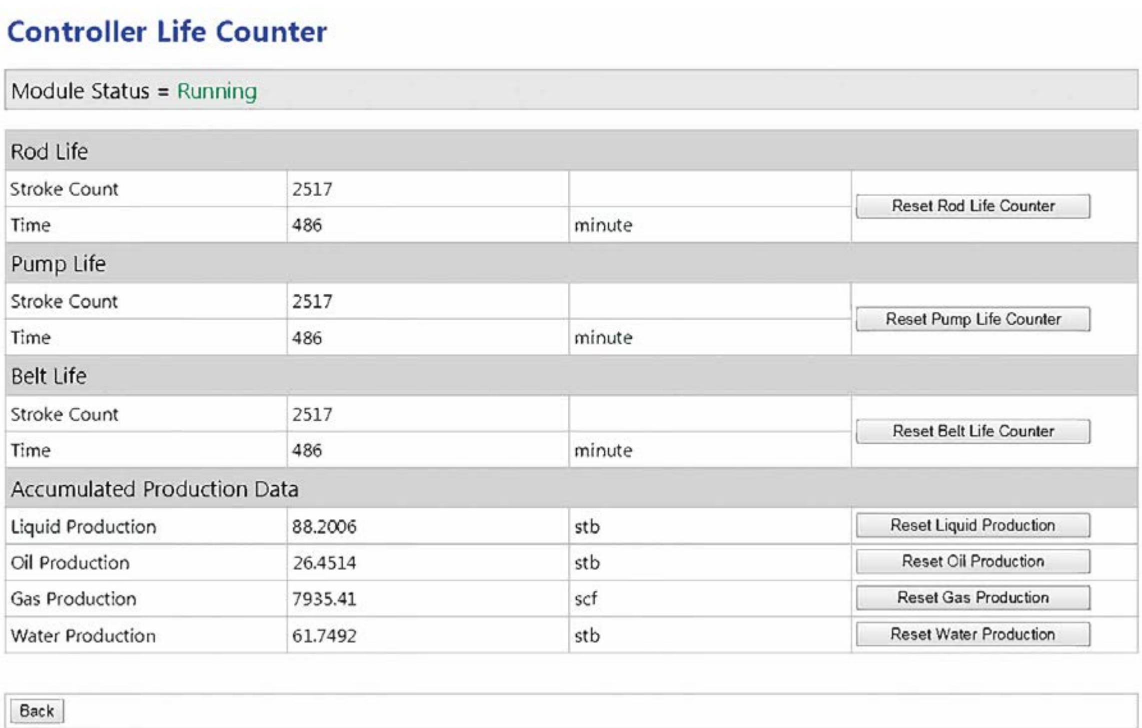
Figure 125 - IPR



For more information, see Production IPR on page 134.

Life Counter

Figure 126 - Life Counter



Controller Life Counter

Module Status = Running

Rod Life			
Stroke Count	2517		Reset Rod Life Counter
Time	486	minute	
Pump Life			
Stroke Count	2517		Reset Pump Life Counter
Time	486	minute	
Belt Life			
Stroke Count	2517		Reset Belt Life Counter
Time	486	minute	
Accumulated Production Data			
Liquid Production	88.2006	stb	Reset Liquid Production
Oil Production	26.4514	stb	Reset Oil Production
Gas Production	7935.41	scf	Reset Gas Production
Water Production	61.7492	stb	Reset Water Production

Back

For a description of parameters, see Life Counter Configuration on page 90.

Process Alarms

The process alarm pages allow you to view the status of all alarms, warnings, and auxiliary I/O.

Alarm Status

Figure 127 - Alarm Status

Controller Process Alarm Status

Module Status = Running

Alarms	
THP Hi Hi Alarm	INACTIVE
THP Lo Lo Alarm	INACTIVE
THT Hi Hi Alarm	INACTIVE
THT Lo Lo Alarm	INACTIVE
CHP Hi Hi Alarm	INACTIVE
CHP Lo Lo Alarm	INACTIVE
CHT Hi Hi Alarm	INACTIVE
CHT Lo Lo Alarm	INACTIVE
FLP Hi Hi Alarm	INACTIVE
FLP Lo Lo Alarm	INACTIVE
FLT Hi Hi Alarm	INACTIVE
FLT Lo Lo Alarm	INACTIVE
AUX Process 1 Hi Hi Alarm	INACTIVE
AUX Process 1 Lo Lo Alarm	INACTIVE
AUX Process 2 Hi Hi Alarm	INACTIVE
AUX Process 2 Lo Lo Alarm	INACTIVE
AUX Process 3 Hi Hi Alarm	INACTIVE
AUX Process 3 Lo Lo Alarm	INACTIVE
AUX Process 4 Hi Hi Alarm	INACTIVE
AUX Process 4 Lo Lo Alarm	INACTIVE
DI Process 1 Alarm	INACTIVE
DI Process 2 Alarm	INACTIVE
DI Process 3 Alarm	INACTIVE
DI Process 4 Alarm	INACTIVE

For a description of alarms, see Alarm Configuration on page 119.

Warning Status

This page shows the status of all system Hi and Lo warnings.

Figure 128 - Warning Status

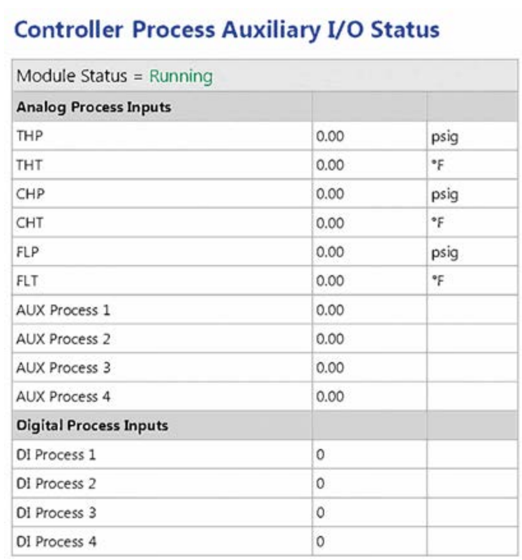
Controller Process Warning Status

Module Status = Running	
Warnings	
THP Hi Warning	INACTIVE
THP Lo Warning	INACTIVE
THT Hi Warning	INACTIVE
THT Lo Warning	INACTIVE
CHP Hi Warning	INACTIVE
CHP Lo Warning	INACTIVE
CHT Hi Warning	INACTIVE
CHT Lo Warning	INACTIVE
FLP Hi Warning	INACTIVE
FLP Lo Warning	INACTIVE
FLT Hi Warning	INACTIVE
FLT Lo Warning	INACTIVE
AUX Process 1 Hi Warning	INACTIVE
AUX Process 1 Lo Warning	INACTIVE
AUX Process 2 Hi Warning	INACTIVE
AUX Process 2 Lo Warning	INACTIVE
AUX Process 3 Hi Warning	INACTIVE
AUX Process 3 Lo Warning	INACTIVE
AUX Process 4 Hi Warning	INACTIVE
AUX Process 4 Lo Warning	INACTIVE

For a description of alarms, see Analog Alarm Configuration on page 92.

Auxiliary I/O Status

Figure 129 - Auxiliary I/O Status



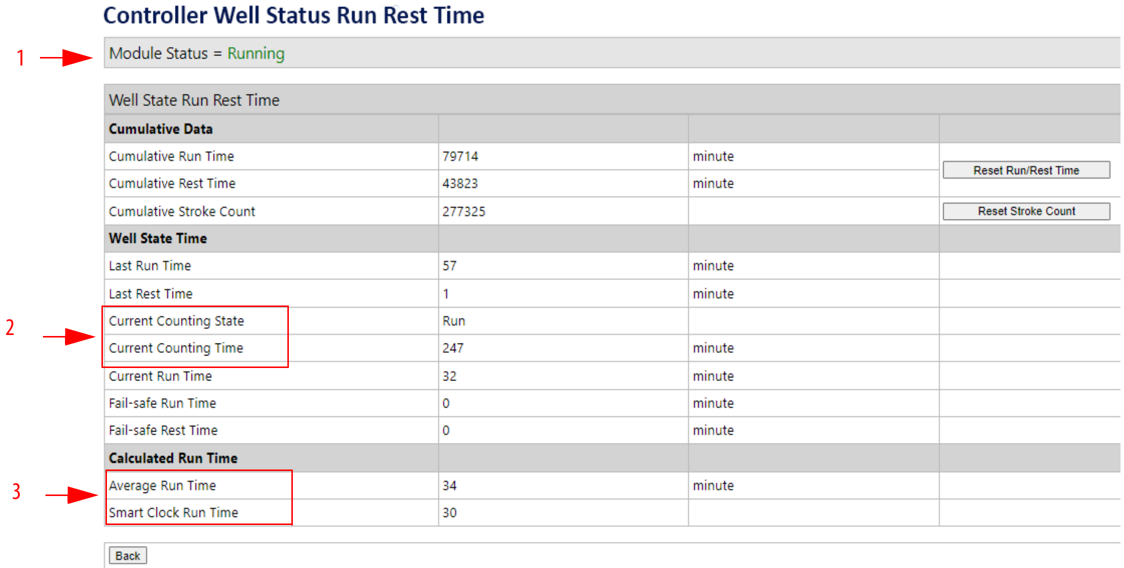
Controller Process Auxiliary I/O Status

Module Status = Running		
Analog Process Inputs		
THP	0.00	psig
THT	0.00	°F
CHP	0.00	psig
CHT	0.00	°F
FLP	0.00	psig
FLT	0.00	°F
AUX Process 1	0.00	
AUX Process 2	0.00	
AUX Process 3	0.00	
AUX Process 4	0.00	
Digital Process Inputs		
DI Process 1	0	
DI Process 2	0	
DI Process 3	0	
DI Process 4	0	

For a description of auxiliary I/O, see Analog Alarm Configuration on page 92.

Well State Run Rest Time

Figure 130 - Well State Run Rest Time



Item	Description
1	**Module Status:** Indicates whether the INSTRUCT SRP that is connected to the controller is running. This indication is helpful for diagnostics.
2	**Current Counting State:** The current well state.
	Current Counting Time: The current counting time in particular well state.
3	**Average Run Time:** This value is calculated based on the user defined number of days. This average run time will be used as Fail-safe run time when this is selected as calculated fail-safe run time.
	Smart Clock: This value is calculated based on an average of the past 24 hours run cycles of the Fixed Speed Pump Off and Pump fillage modes to be used as Fail-safe run time.

For a description of the other parameters, see Historical Data on page 130 and Figure 200 on page 175

Download

The Download pages allow you to download controller configurations to your computer. You can use the downloaded files for archival purposes or to restore previous configurations. For ISAGRAF projects and logs, right-click the file you would like to save to your computer and choose Save As...

Figure 131 - Download Menu Structure

ISAGRAF Project

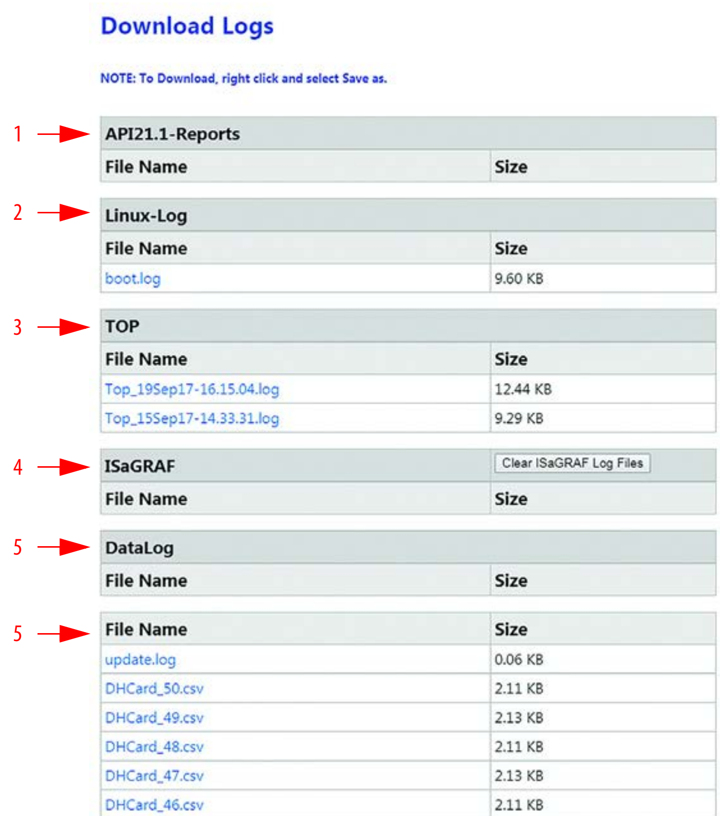
If an ISAGRAF project is available, click the file that is listed to download.

Figure 132 - ISaGRAF Project

Logs

When log files are created, they are stored and displayed here. Click a file that is listed to download.

Figure 133 - Logs



Item	Description
1	**API21.1-Reports:** When the API21.1-Reports are generated, they are displayed here.
2	**Linux-Log:** Linux startup sequence log when last powered on.
3	**TOP:** Process information log.
4	**ISaGRAF:** Files that are created by ISaGRAF application are displayed here
5	**DataLog:** When the Data logger feature is enabled, files are displayed here.
6	**File Name:** The last 50 Surface and Downhole cards can be downloaded here.

Configuration

Click the file that is listed to download the configuration file (.cfz). This feature allows you to save the existing configuration of the controller. It is recommended to use this configuration file across the suite firmware, which is the same version, or the most recent version.

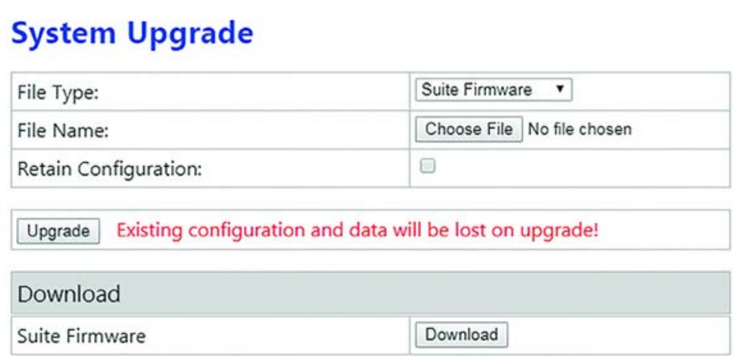
Figure 134 - Download Configuration

IMPORTANT	If you have multiple INSTRUCT SRP units of the same version, you can upload the same configuration file to the other INSTRUCT SRP units so they have the identical configurations.

System Upgrade

If you do not plan to retain configuration, record all preconfigured parameters in the existing INSTRUCT SRP before upgrading the suite firmware. This record is especially important if it is running in a well. You can record the existing configuration for the INSTRUCT SRP with screen shots.

Figure 135 - System Upgrade



IMPORTANT	If the Retain Configuration checkbox is cleared during upgrade, all well parameter configurations in the INSTRUCT SRP are reset and the controller is reset to the factory default settings when the INSTRUCT SRP suite firmware is upgraded. If the Retain Configuration checkbox is checked, all compatible parameters between the old and the upgraded suite firmware revision are retained.

For details on updating the Suite Firmware, see Upgrade the INSTRUCT SRP Suite Firmware on Web Server on page 289.

Using the INSTRUCT SRP Local HMI

Configuration Methods

You must use the following two configuration methods to commission the INSTRUCT SRP* controller successfully.

- Local Human Machine Interface (HMI)
  - Recommended for control parameter adjustment using surface card readings
  - Alarm configuration, variable frequency drive (VFD) parameter configuration, VFD status, and calibration of peripherals are exclusive to local HMI
  - Allows you to adjust settings based on real-time well-site data
  - Manual or database configuration of your pumping unit
- Web server (see Use the INSTRUCT SRP Web Server on page 33)

PanelView Plus 7 Terminal

You can navigate the HMI displays on the PanelView™ Plus 7 terminal (Figure 136).

Figure 136 - PanelView Plus 7 Terminal

The HMI display structure is shown in Figure 138 on page 117.

Navigation

The PanelView terminal facilitates user navigation through a centralized icon toolbar. The following are the main displays:

Icon	Description	Page
	Operator Display	118
	Configuration Display	143
	Alarm Display	191
	Trend Display	194
	Help Display	204

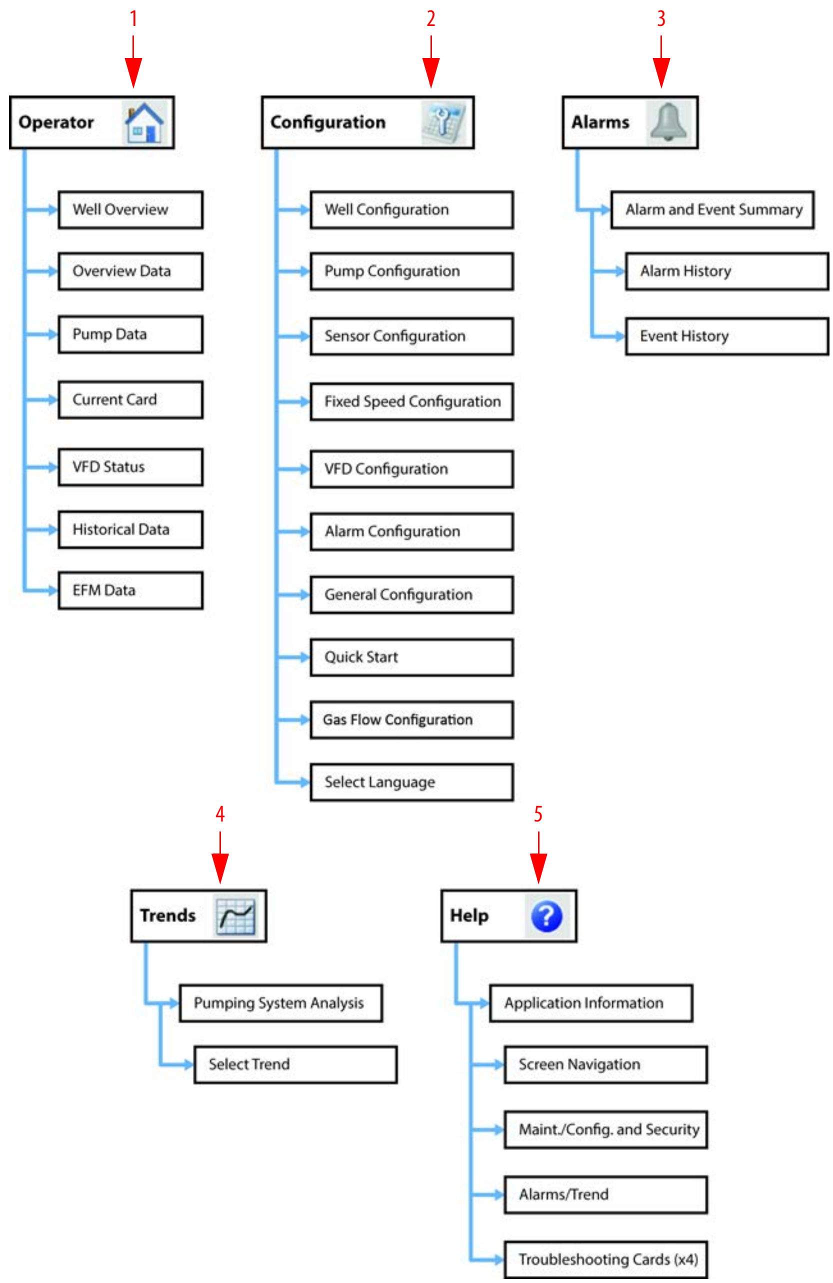
Each main display contains at least one page, where pages are equivalent to displays. To access a particular display, press the corresponding icon.

For simple and quick navigation, you can Access and progress through the pages of a display by pressing the arrows at the bottom of the display. Notice the green dot at the center bottom of each display for orientation. Navigation arrows are available on most displays and loop at end of sequence.

Figure 137 - Navigation Arrows and Page Dots

HMI Display Overview

Figure 138 - General HMI Display Structure

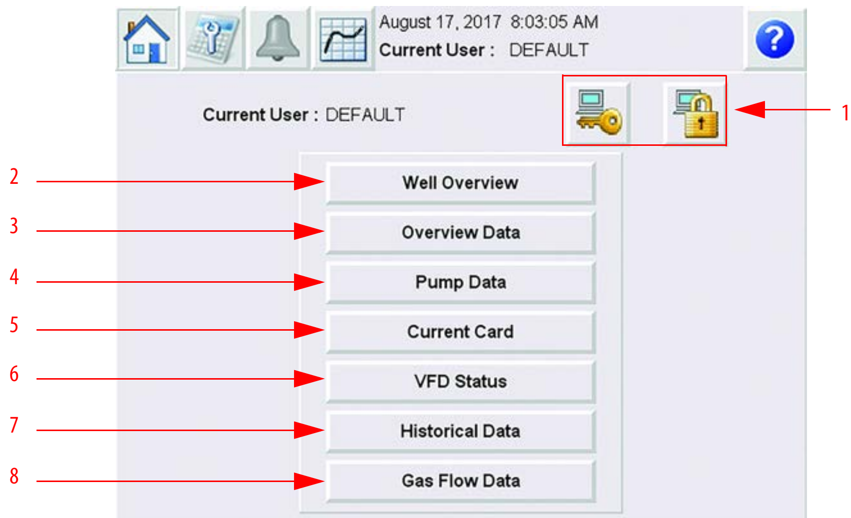


Item	Description
1	Operator Display (page 118)
2	Configuration Display (page 143)
3	Alarm Display (page 191)
4	Trend Display (page 194)
5	Help Display (page 204)

Operator Display

The Operator display is the first display that appears. You can press a navigation button to access the Well Overview, Overview Data, Pump Data, Current Card, VFD Status, and Historical Data displays.

Figure 139 - Operator Display



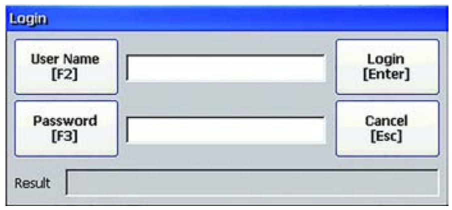
Item	Description
1	Login/Logout (page 119)
2	Well Overview (page 120)
3	Overview Data (page 121)
4	Pump Data (page 129)
5	Current Card (page 134)
6	VFD Status (page 135)
7	Historical Data (page 136)
8	Gas Flow Data (page 142)

Login/Logout

IMPORTANT	The INSTRUCT SRP initially loads and is operational without logging in. On load, the initial user account is 'Default'.

The Login button () allows you to change your current user login. For a list of user roles, see User Administration on page 205.

Figure 140 - Login

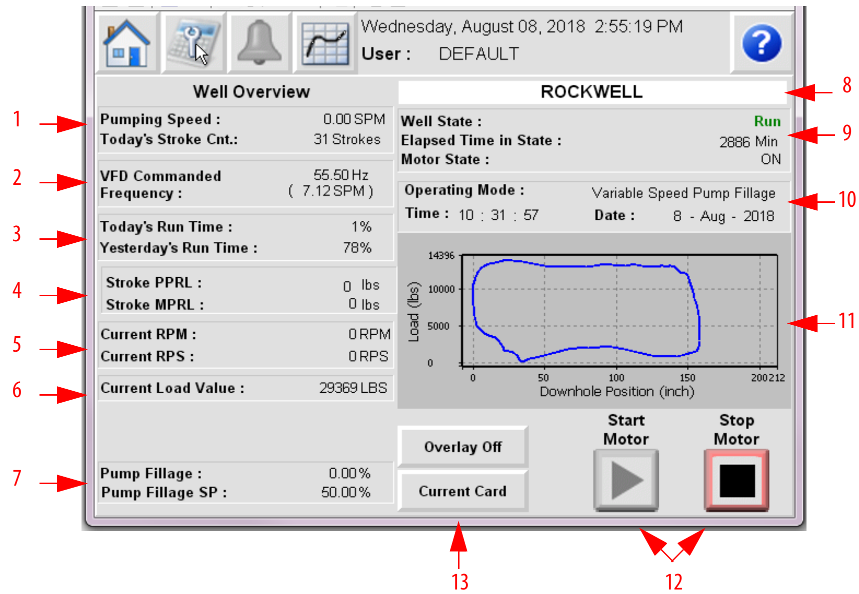


To help prevent unauthorized access to the system, press the Logout button () to return to the Default user role.

Well Overview

The Well Overview display provides the overview of all parameters that are required for INSTRUCT SRP operation in different modes.

Figure 141 - Well Overview



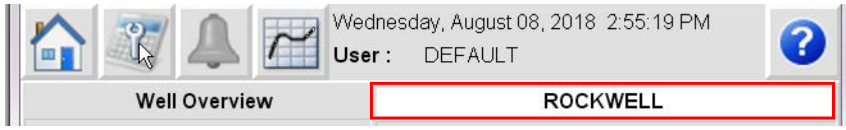
Item	Description
1	**Pumping Speed:** The real-time strokes per minute (SPM) measured from the surface card. It is 0 if cards are not detected.
	Today's Stroke Count: The total number of strokes in a day.
2 (1)	**VFD Commanded Frequency:** The frequency that the INSTRUCT SRP commands the VFD to go to or sets in the VFD in the form of 4…20 mA signal or over EtherNet/IP.
3	**Today's Run Time:** The number of minutes that the well has run in any 24-hour period.
	Yesterday's Run Time: The number of minutes that the well ran in yesterday's 24-hour period. At gauge of time (GOT), the current day accumulated runtime is transferred to this parameter.
4	**Stroke PPRL:** The maximum load reading in surface card.
	Stroke MPRL: The minimum load reading in surface card.
5	**Current RPM:** The current revolutions per minute value that is based on the time period between two pulses from sensor.
	Current RPS: The current revolutions per stroke value.
6	**Current Load Value:** The current load value (in pounds).
7	**Pump Fillage:** The ratio between the current volume of liquid in the pump barrel and the maximum stroke length of the downhole pump. Pump Fillage is calculated from the most current downhole card.
8	**Well Name Display:** The name of the well that is in operation
9	**Well State:** The current state of the well: Start, Run, Rest, Shutdown, Stopped, Fail-safe Run, Fail-safe Rest, HOA, Motor Alert, Stopping, Unable To Stop, or Unable to Run.
	Elapsed Time in State: The time the well spent in a particular well state.
	Motor State: The current motor state (ON or OFF).
10	**Operating Mode:** Current operation mode of the well.
11	**Surface Card/Downhole Card Plot(2):** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.
12	**Start Motor:** Press to start the INSTRUCT SRP operation in the configured controller state.
	Stop Motor: Press to stop the motor when in a Run state.
13	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots.
	Current Card/Downhole Card: Press to toggle between the current card and downhole card.

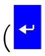
(1) Appears only when pump is in a VFD operation mode.

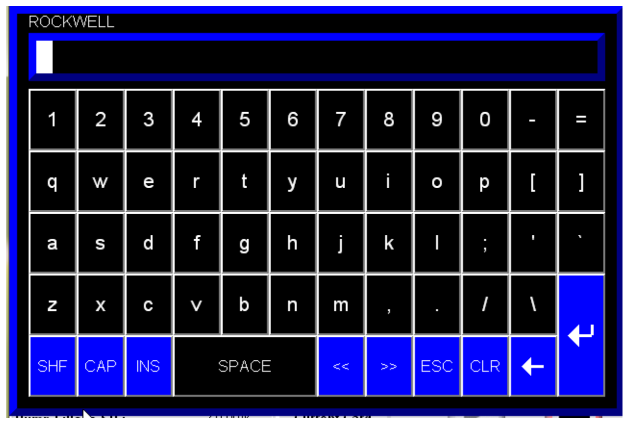
(2) The firmware suite is preloaded with default cards from the factory.

Change Well Name

1. Press the field that contains the well name.



2. Enter new name in the popup keypad. Press Enter ().



Overview Data

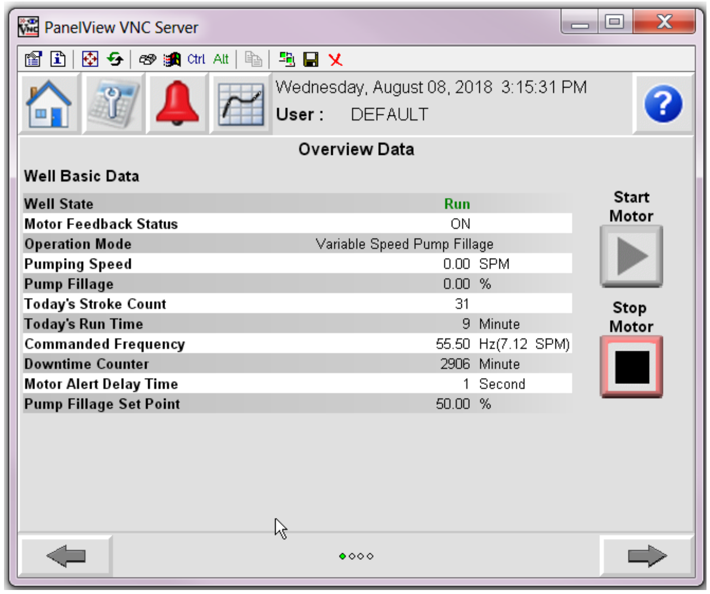
The Overview Data display has four pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display. The information that is shown differs based on the operating mode.

ATTENTION: To avoid personal injury and/or machine damage, verify that the well is in “Stopped State” before attempting to select/change operation mode. The state can be confirmed from the Well Basic Data display.
To put the INSTRUCT SRP in “Stopped State,” see Start and Stop the Motor on page 272.

Well Basic Data

The Well Basic Data display consists of two pages that show various parameters for fixed speed and variable speed modes. The parameters that appear differ depending on the operating mode that is selected.

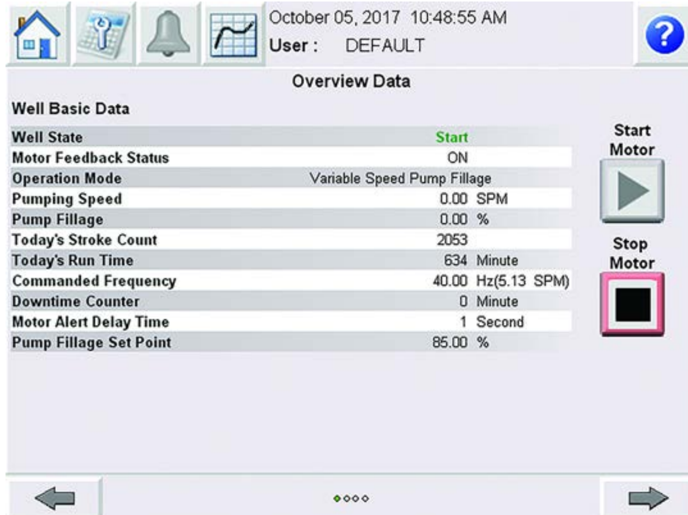
Figure 142 - Overview Data Display 1: Well Basic Data (Fixed Speed) (1)



Row	Description
1	**Well State:** The current state of the well: Start, Run, Rest, Shutdown, Stopped, Fail-safe Run, Fail-safe Rest, HOA, Motor Alert, Stopping, Unable To Stop, or Unable to Run. For details on the states, see INSTRUCT SRP Status Indicators on page 309.
2	**Motor Feedback Status:** The current motor status (ON or OFF).
3	**Operation Mode:** The current operation mode of the well.
4	**Pumping Speed:** The real-time SPM measured from the surface card. It is 0 if cards are not detected.
5	**Pump Fillage:** The ratio between the current volume of liquid in the pump barrel and the maximum stroke length of the downhole pump. Pump Fillage is calculated from the most current downhole card.
6	**Today's Stroke Count:** The total number of strokes in a day.
7	**Today's Run Time:** The number of minutes that the well has been running in any 24 hr period.
8	**Load Pump Off Set Point:** The current load pump-off setpoint percentage.
9	**Position Pump Off Set Point**: The current position pump-off setpoint percentage.
10	**Commanded Frequency:**
11	**Downtime Counter:** The number of minutes that the well has been down.
12	**Motor Alert Delay Time:** The duration set for an alert signal through DO4 before starting the motor. The delay allows visual or audible 24V DC hardware that is wired into DO4 to send an alert signal before starting the motor.
13	**Pump Fillage Set Point:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP either slows down or speeds up the pump based on the comparison between the current calculated Pump Fillage percent and the target Pump Fillage percent (Fixed Speed Pump Fillage only).

(1) The Stop Operation button is used to stop the INSTRUCT SRP manages functionality, including your pump. The Stop Operation functionality is only available when your Well State is not in a Run state. You can instead use the Stop Motor button when at a Run state. The Stop Operation button remains available even after the well has been stopped. You can verify that the correct operation was performed by reviewing the Well State.

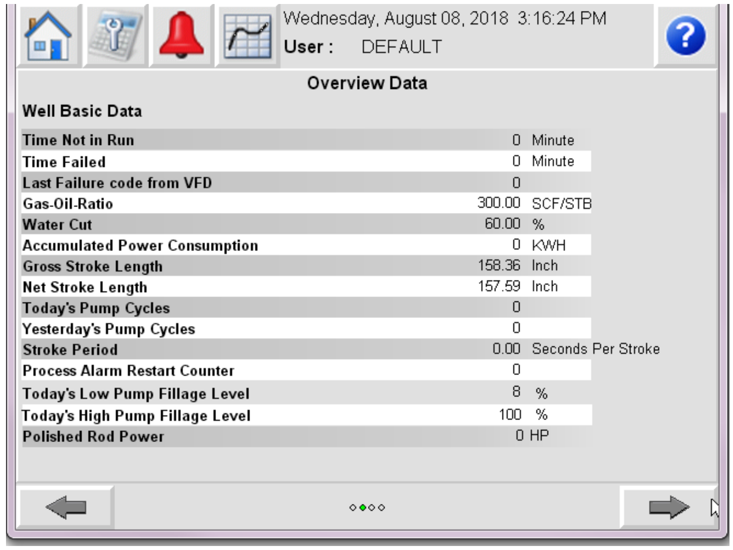
Figure 143 - Overview Data Display 1: Well Basic Data (Variable Speed) (1)



Row	Description
1	**Well State:** The current state of the well: Start, Run, Rest, Shutdown, Stopped, Fail-safe Run, Fail-safe Rest, HOA, Motor Alert, Stopping, Unable To Stop, or Unable to Run. For details on the states, see INSTRUCT SRP Status Indicators on page 309.
2	**Motor Feedback Status:** The current motor status (ON or OFF).
3	**Operation Mode:** The current operation mode of the well.
4	**Pumping Speed:** The real-time SPM measured from the surface card.
5	**Pump Fillage:** The estimated pump fillage calculated from the downhole card.
6	**Today's Stroke Count:** The total number of strokes in a day.
7	**Today's Run Time:** The number of minutes that the well has been running in any 24-hour period.
8	**Load Pump Off Set Point:** The current load pump-off setpoint percentage.
9	**Position Pump Off Set Point**: The current position pump-off setpoint percentage.
10	**Commanded Frequency:** The current frequency the INSTRUCT SRP is sending through the AO (4…20 mA) to the VFD. For example, if the frequency range is 0…60 Hz, then the corresponding signal would be 4…20 mA. Commanded frequency for 20 mA would be 60 Hz in this case.
11	**Downtime Counter:** The number of minutes that the well has been down.
12	**Motor Alert Delay Time:** The duration that is set for an alert signal through DO4 before starting the motor. The delay allows visual or audible 24V DC hardware that is wired into DO4 to send an alert signal before starting the motor.
13	**Pump Fillage Setpoint:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP either slows down or speeds up the pump based on the comparison between the current calculated Pump Fillage percent and the target Pump Fillage percent (Variable Speed Pump Fillage mode only).

(1) The Stop Operation button is used to stop the INSTRUCT SRP manages functionality, including your pump. The Stop Operation functionality is only available when your Well State is not in a Run state. You can instead use the Stop Motor button when at a Run state. The Stop Operation button remains available even after the well has been stopped. You can verify that the correct operation was performed by reviewing the Well State (Row 2).

Figure 144 - Overview Data Display 2: Well Basic Data

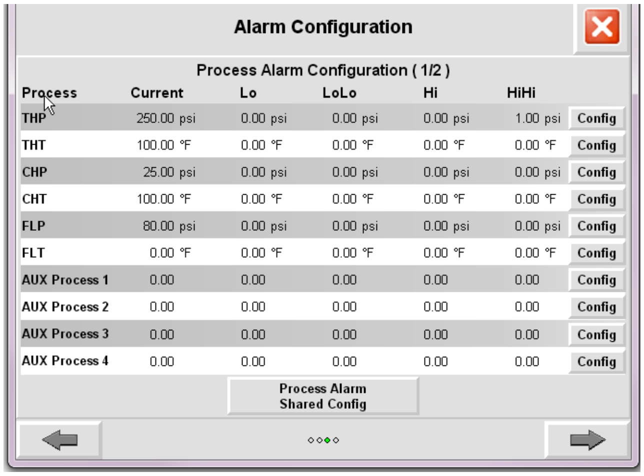


Row	Description
1	**Time Not in Run:** Counts and accumulates the time (in minutes) not in Run or Start state. This value resets to zero automatically when it falls in Run or Start state.
2	**Time Failed:** Counts and accumulates the time (in minutes) spent in Unable to Run or Shutdown state. This value resets to zero automatically when it falls in Run or Start state.
3	**Last Failure Code from VFD:** Shows the last failure code for the VFD. This parameter is polled directly from the drive from parameter 951.
4	**Gas-Oil Ratio:** Used obtain accurate production estimates from the calculations.
5	**Accumulated Power Consumption:** This accumulated value is automatically calculated in the VFD parameter 14 in kWh transferred from the drive. The Elapsed kWh in the drive is accumulated automatically in parameter 14.
6	**Gross Stroke Length:** The maximum value for the pump plunger displacement.
7	**Net Stroke Length:** The value that is provided by the inflection point on the downstroke where the downhole pump comes in contact with the fluid. This value is used for the calculation of the pump fillage.
8	**Today's Pump Cycles:** The number of cycles the pump has turned ON/OFF since GOT. This parameter resets to zero at GOT.
9	**Yesterday's Pump Cycles:** The number of cycles the pump has turned ON/OFF for the previous day.
10	**Stroke Period:** The number of seconds it takes to complete each stroke cycle.
11	**Process Alarm Restart Counter:** The number of restarts the INSTRUCT SRP has attempted so far when in AutoStart action for the process alarms.
12/ 13	**Today's Low/High Pump Fillage Level:** The high and low pump fillage level percentage for the current day.
14	**Polished Rod Power:** The power that is calculated at the polished rod. It is represented by the area of the surface card.

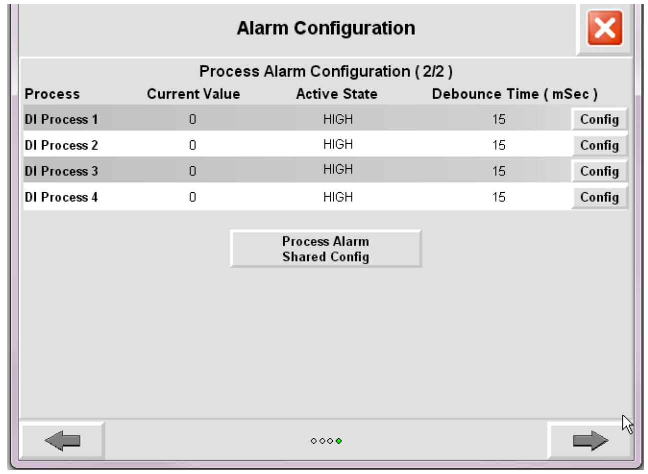
Alarm Configuration

Use the two Alarm Configuration displays to adjust alarms as needed. Press the Config button (Figure 146 on page 126 and Figure 147 on page 127) to modify alarm settings. The Process Alarm Shared Config button allows you to adjust configurations that all alarms share (Figure 148 on page 128).

Figure 145 - Process Alarm Configuration



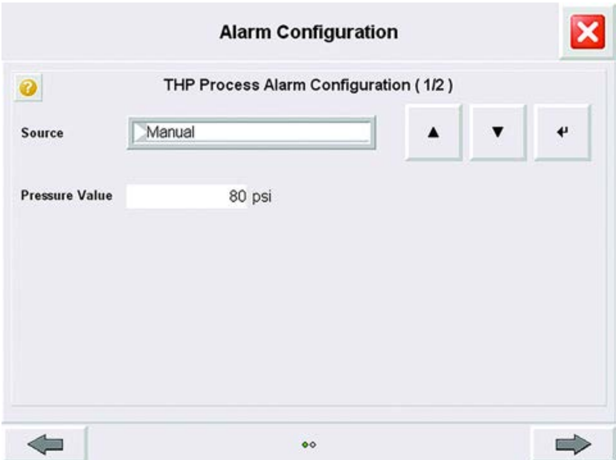
Display 3



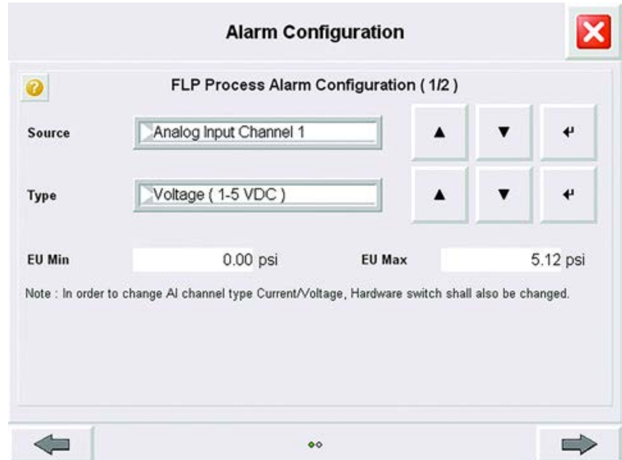
Display 4

Row	Description
Display 3	
1/2	**THP/THT:** The Current column shows the reading from the wireless or wired sensor that is installed and assigned as tubing head pressure (THP) and tubing head temperature (THT).
3/4	**CHP/CHT:** The Current column shows the reading from the wireless or wired sensor that is installed and assigned as casing head pressure (CHP) and casing head temperature (CHT).
5/6	**FLP/FLT:** The Current column shows the reading from the wireless or wired sensor that is installed and assigned as flow line pressure (FLP) and flow line temperature (FLT).
7… 10	**AUX Process 1…4:** Four spare tags for Process parameters that are available for you to rename and link to a process parameter sensor. Current column shows the reading from the wireless or wired sensor that is installed and assigned to that particular process parameter.
Display 4	
1… 4	**DI Process 1…4:** Four spare tags for Process discrete signals that are available for you to rename and link to a process parameter sensor. Current column shows the status from the wireless or wired sensor that is installed and assigned as that particular process parameter.

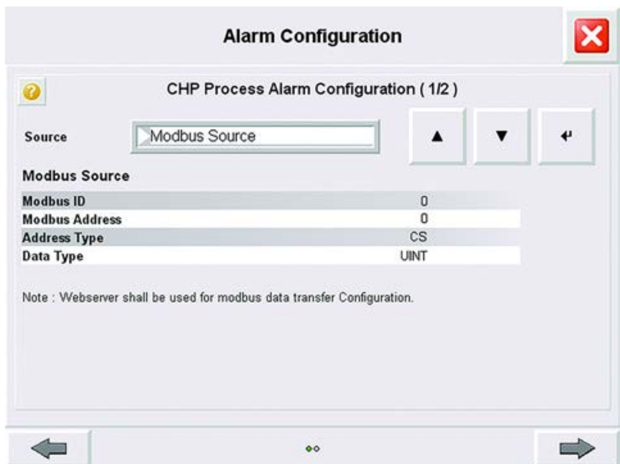
Figure 146 - Configuration Button Display 1



Manual



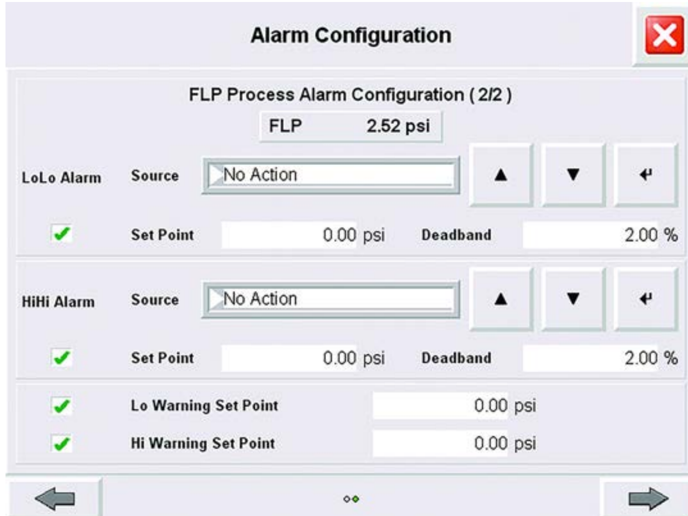
Analog Input Channel 1…8



Modbus Source

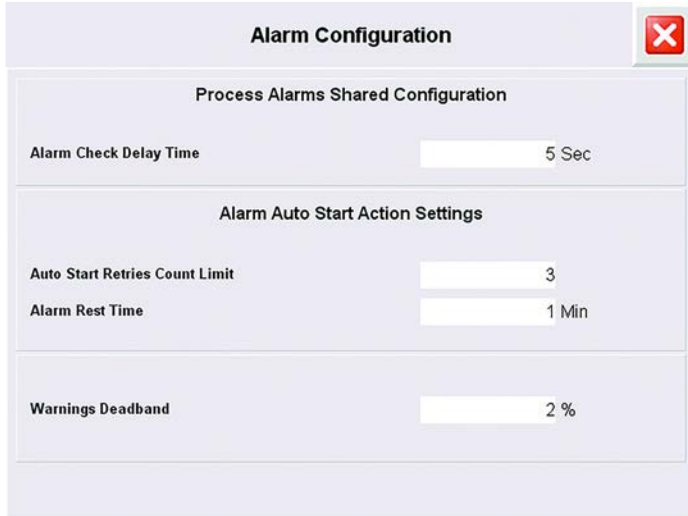
Row	Description
1	**Source:** Select from the available options: Disabled, Analog Input Channel 1…8, Manual, and Modbus Source
Manual	
2	**Pressure Value:** A user-configured fixed pressure value. This value is used if physical sensor is unavailable. This value is used for further INSTRUCT SRP parameter calculations.
Analog Input Channel 1…8	
2	**Type:** Choose from Voltage (1…5V DC) or Current (0…20 mA).
3	**EU Min/Max:** The engineering value set for the minimum/maximum pressure or temperature the analog input card receives.
Modbus Source	
2	**Modbus ID:** Modbus Slave ID of the third-party device or internal RTU from which the data is brought to the Process parameter.
3	**Modbus Address:** The address where the data is located.
4	**Address Type:** The Modbus address type can be Coil, Discrete Input, Input Register, or Holding Register.
5	**Data Type:** The type of data that is transferred to process parameter.

Figure 147 - Configuration Button Display 2



Row	Description
1	**LoLo Alarm:** Choose from No Action, Shutdown, Shutdown-Auto Restart. The setpoint (in psi) is the LoLo limit to trigger an alarm for the corresponding channel. The deadband (in %) resets the LoLo alarm. In order for LoLo alarm to reset, the process parameter value must read more than: Setpoint + (setpoint x [deadband/100])
2	**HiHi Alarm:** Choose from No Action, Shutdown, Shutdown-Auto Restart. The setpoint (in psi) is the HiHi limit to trigger an alarm for the corresponding channel. The deadband (in %) resets the HiHi alarm. In order for HiHi alarm to reset, the process parameter value must read less than: Setpoint - (setpoint x [deadband/100]).
3	**Lo Warning Set Point:** The setpoint to trigger Low warning for corresponding process parameter.
4	**Hi Warning Set Point:** The setpoint to trigger high warning for corresponding process parameter.

Figure 148 - Process Alarm Shared Configuration



Row	Description
1	**Alarm Check Delay Time:** If this value is set, no alarm is checked and raised after the INSTRUCT SRP transitions from Process Rest state to Motor Alert state or Start state before sending a motor start command unless this delay time has expired.
Alarm Auto Start Action Settings	
2	**Auto Start Retries Count Limit:** The maximum number of counts the motor is restarted before it is shut down before the operator intervenes.
3	**Alarm Rest Time:** For alarm action Alarm Enable-Shutdown AutoStart, the system attempts to restart the motor only when this time lapses.
4	**Warnings Deadband:** If any of the process signal LO warnings are triggered - In order for it reset, the value must read more than the setpoint + setpoint*(ProcessWarningdeadband/100). If any of the process signal HI warnings are triggered - In order for it reset, the value reads less than the setpoint - setpoint*(ProcessWarningdeadband/100).

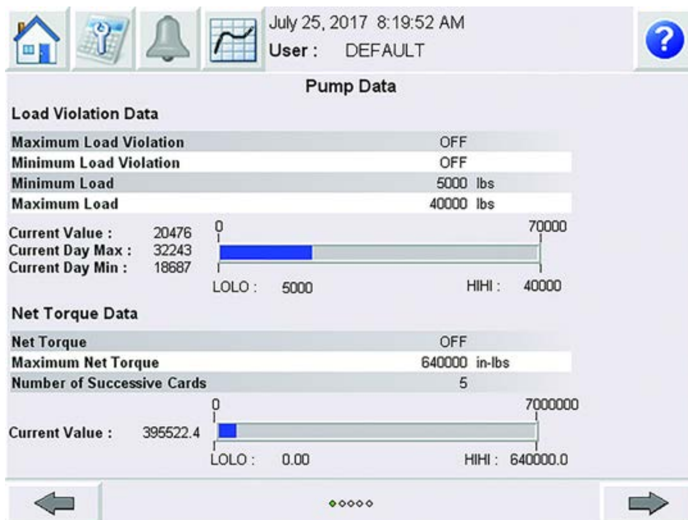
Pump Data

The Pump Data display has five pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Load Violation and Net Torque Data

This display shows the load violation and net torque data that are configured on the Load Violation Setting and Net Torque Setting Configuration displays. This display shows the current load value, current day load maximum value, current day load minimum value, and current net torque value. This display also shows the current load and current net torque value in a bar graph along with its LoLo and HiHi limits.

Figure 149 - Pump Data Display 1: Load Violation and Net Torque Data

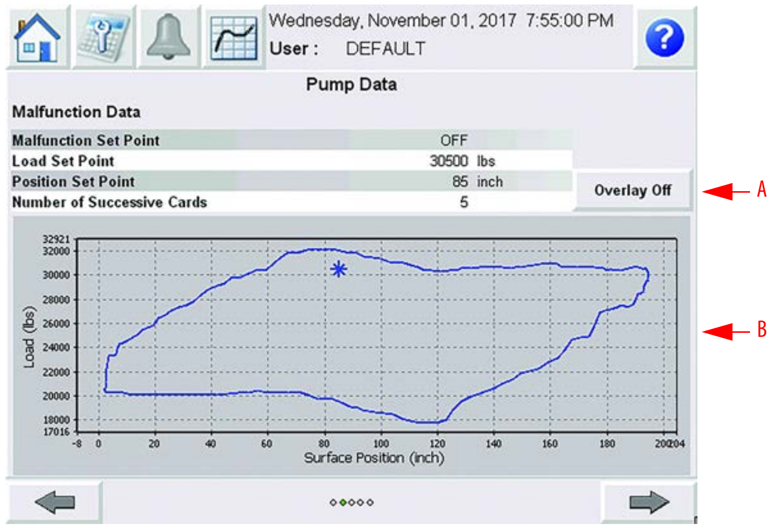


Row	Description
Load Violation Data	
1/2	**Maximum/Minimum Load Violation:** When these load violations are enabled, the INSTRUCT SRP checks for load minimum and maximum violations. When a load violation is found, the INSTRUCT SRP raises an alarm and performs the configured alarm action. Figure 149 shows the load violation setting. The red lines indicate the upper and lower limits.
3	**Minimum Load:** The minimum load value limit (in pounds) for detection of the minimum load violation.
4	**Maximum Load:** The maximum load value limit (in pounds) for detection of maximum load violation.
5	**Current Value/Day Max/Day Min:** The current, daily maximum, and daily minimum load value.
Net Torque Data	
6	**Net Torque:** When enabled, the INSTRUCT SRP raises an alarm and performs the configured alarm action after a preset number of cards with the maximum net torque violation.
7	**Maximum Net Torque:** The maximum net-torque value limit (in in•lb) for detection of maximum load violation.
8	**Number of Successive Cards:** The number of consecutive cards in which the maximum net torque must be violated before the INSTRUCT SRP declares an alarm and performs the configured alarm action.

Malfunction Data

This display shows the malfunction data that is configured on Malfunction Setting configuration display. This display shows the current malfunction setpoint with a blue cross hair on a surface card.

Figure 150 - Pump Data Display 2: Malfunction Data

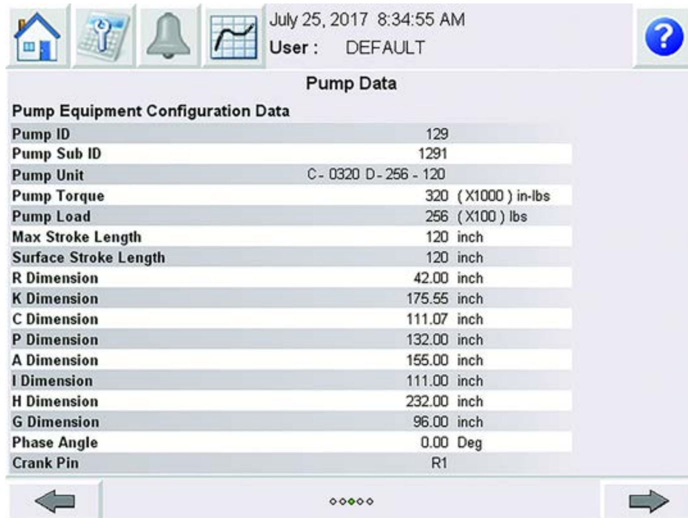


Row	Description
1	**Malfunction Set Point:** When this feature is enabled, the INSTRUCT SRP raises an alarm and performs the configured alarm action after a preset number of cards with the malfunction setpoint violation.
2	**Load Set Point:** The load on the setpoint as shown in Figure 150.
3	**Position Set Point:** The position on the setpoint as shown in Figure 150.
4	**Number of Successive Cards:** The number of consecutive cards in which the malfunction setpoint must be violated before the INSTRUCT SRP declares an alarm and performs the configured alarm action.
Item	**Description**
A	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots.
B	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If SPM is 3, the refresh rate is 10 seconds.

Pump Equipment Configuration Data

This display shows the pump equipment configuration data that is configured on Pump Equipment Configuration display under the Pump Configuration section.

Figure 151 - Pump Data Display 3: Pump Equipment Configuration Data

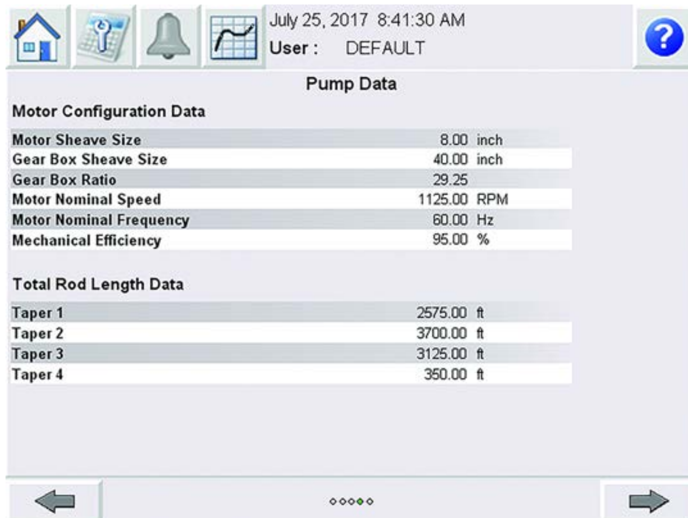


Row	Description
1	**Pump ID:** The Pump ID value that is used internally for ConnectedProduction™ to identify the pump in its database.
2	**Pump Sub ID:** The Pump Sub ID value that is used internally for ConnectedProduction to identify the pump in its database.
3	**Pump Unit:** It displays the selected pump unit in the form of Unit Number. This unit is made by the combination of Pump Type, Pump Model, and Manufacturer.
4	**Pump Torque:** The Torque value of the searched pump unit.
5	**Pump Load:** The load value of the searched pump unit.
6	**Max Stroke Length:** The maximum stroke length value of the searched pump unit.
7	**Surface Stroke Length:** The polished rod displacement value during an upstroke or downstroke for the searched pump unit.
6…13	**R, K, C, P, A, I, H, and G Dimension:** The corresponding API dimension of searched pump unit.
14	**Phase Angle:** An offset angle value in degrees on the Crank angle. This value is provided by the pump manufacturer for each pumping unit.
15	**Crank Pin:** Attaches the pitman arm to the crank arm. The current stroke is being used determines crank pin placement, it usually has three positions for the three available stroke lengths for the pumping unit.

Motor Configuration Data

This display shows the motor configuration data that is configured on Pump Configuration display and the rod length for each configured taper.

Figure 152 - Pump Data Display 4: Motor Configuration and Total Rod Length Data



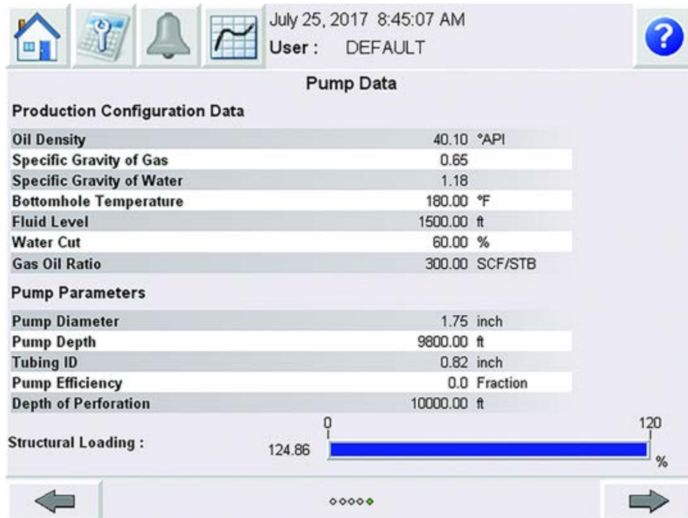
Row	Description
Motor Configuration Data	
1	**Motor Sheave Size:** The sheave size (in inches). The size is used for calculating the estimated expected SPM from the commanded frequency.
2	**Gear Box Sheave Size:** The gearbox sheave size (in inches). The size is used for calculating the estimated expected SPM from the commanded frequency.
3	**Gear Box Ratio:** The gearbox ratio. This ratio is used for calculating the estimated expected SPM from the commanded frequency.
4	**Motor Nominal Speed:** The nominal speed in revolutions per minute (RPM). The speed is used for calculating the estimated expected SPM from the commanded frequency.
5	**Motor Nominal Frequency:** The nominal frequency (in Hz). The frequency is used for calculating the estimated expected SPM from the commanded frequency.
6	**Mechanical Efficiency:** The mechanical efficiency of the pump unit and the speed reducer.
Total Rod Length Data	
7…12	**Taper 1…6 Rod Length:** The total length of rods in Taper 1…6 (in feet).[1]

(1) The number of tapers that are configured determine the number of rods that are displayed.

Product Configuration Data and Pump Parameters

This display shows the production configuration data and pump parameters data that are configured on Fluid Properties and Pump Parameters Configuration displays.

Figure 153 - Pump Data Display 5: Production Configuration Data and Pump Parameters

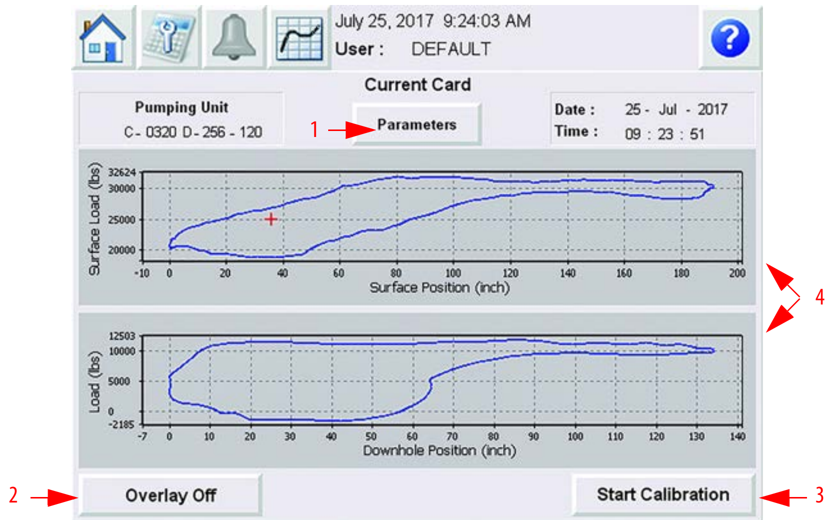


Row	Description
Production Configuration Data	
1	**Oil Density:** The oil density of the produced oil per API degree entered for a correct oil production estimate.
2	**Specific Gravity of Gas:** The specific gravity of gas that is produced which is used in the production estimate.
3	**Specific Gravity of Water:** The specific gravity of water that is produced which is used in the production estimate.
4	**Bottomhole Temperature:** Used to obtain accurate production estimates from the calculations.
5	**Fluid Level:** Used to obtain accurate production estimates from the calculations.
6	**Water Cut:** Used to obtain accurate production estimates from the calculations.
7	**Gas Oil Ratio:** Used obtain accurate production estimates from the calculations.
Pump Parameters	
8	**Pump Diameter:** The pump plunger diameter is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results.
9	**Pump Depth:** The vertical pump depth from the surface to the pump intake is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results.
10	**Tubing ID:** The appropriate tubing inside diameter (ID) must be selected from the data for the calculations. The INSTRUCT SRP database has the most commonly used tubing sizes. This value is the Tubing ID entered from the Configuration display.
11	**Pump Efficiency:** The value that is entered in Configuration display (Figure 173 on page 151).
12	**Depth of Perforation:** The value that is entered in Configuration display (Figure 173 on page 151).
13	**Structural Loading:** The load value in percent on the pumping structure.

Current Card

This display shows the current data that is obtained from the current surface and downhole card.

Figure 154 - Current Card

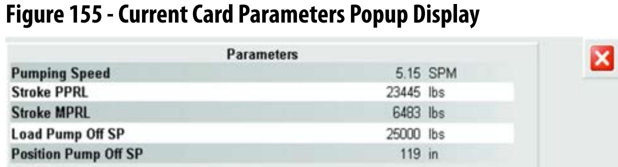


Item	Description
1	**Parameters:** Displays the current surface and downhole card data (Figure 155).
2	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots. **Note:** Up to 15 cards can be overlaid.
3	**RPS Synchronization** (1)**:** Press to initiate the RPS synchronization process. **Start Calibration:** Press to start the calibration of the inclinometer. Once the calibration is in process, a display with the calibration position voltage values appears. To complete the calibration process, press Accept. To reject the calibrated values, press Reject.
4	**Surface Card/Downhole Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.

(1) Only available in Run state when the position sensor type is either Hall Effect-Crank Arm/RPM or Proximity/RPM.

Press the Parameters button to open a popup display that shows the current data that is obtained from the current surface and downhole card. The parameters that are displayed on the Parameter popup depend on the operating mode of the well.

Figure 155 - Current Card Parameters Popup Display



Row	Description
1	**Pumping Speed:** The measured speed of the current stroke.
2	**Stroke PPRL:** Peak Polished Rod Load (Surface card maximum load value) in selected card.
3	**Stroke MPRL:** Minimum Polished Rod Load (Surface card minimum load value) in selected card
4	**Load Pump Off SP:** The Load Pump Off EU setpoint for the Pump Off condition in Fixed Speed and Variable Speed Pump Off mode.
5	**Position Pump Off SP:** The Position Pump Off EU setpoint for the Pump Off condition in Fixed Speed and Variable Speed Pump Off mode.

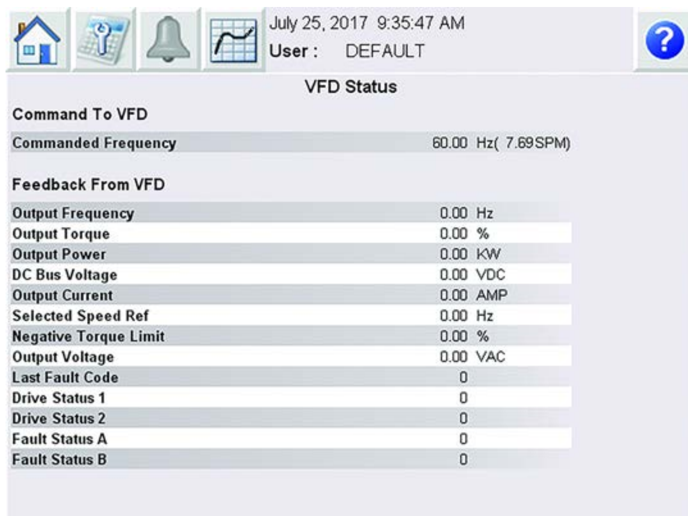
VFD Status

VFD status display is available for internal parameter adjustment and status updates exclusive to PowerFlex® drives.

IMPORTANT	A catalog number 20-750-ENET-R communication card is required on your PowerFlex drive to enable communication.

The VFD Status display (Figure 156) presents the INSTRUCT SRP commanded frequency in the form of a 4…20 mA analog output (AO) signal. This display also shows the status parameters that are read through an EtherNet/IP connection from the PowerFlex drive. For details on VFD status, see your PowerFlex drive user manual.

Figure 156 - VFD Status Display



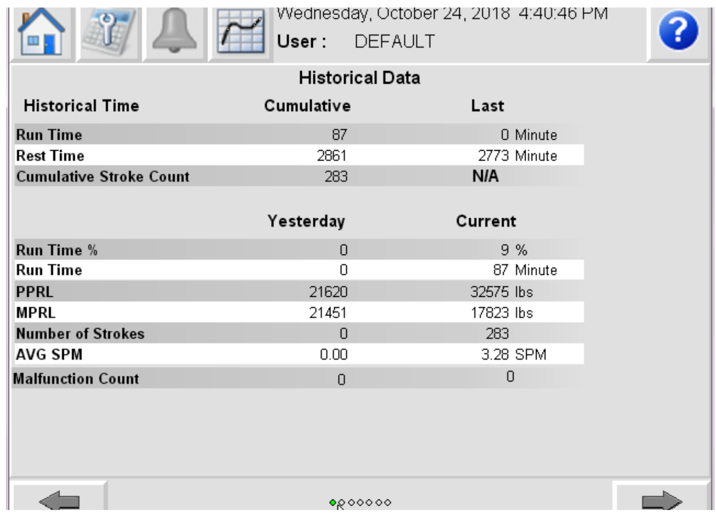
Historical Data

The Historical Data display has seven pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Historical Time

This display ([Figure 157](#)) shows the cumulative/last runtime and rest time and cumulative stroke count. Yesterday's and current runtime percent, runtime, PPRL, MPRL, number of strokes, average SPM are also shown on this display.

Figure 157 - Historical Data Display 1: Historical Time

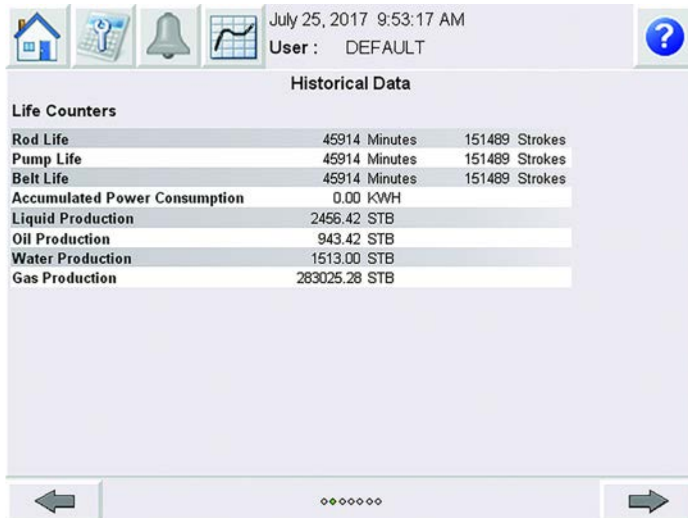


Row	Description
1	**Run Time:** • Cumulative - The total accumulated minutes of runtime since commissioning of the controller. • Last - The time the well was in Run state before last shutdown.
2	**Rest Time:** • Cumulative - The total accumulated minutes of rest time since the last commissioning of the controller. • Last - The time the well has been in Rest state before last shutdown.
3	**Cumulative Stroke Count:** The total number of strokes since commissioning of the controller.
4	**Run Time %:** • Yesterday - The total accumulated Runtime Percentage from yesterday. • Current - The total accumulated Runtime Percentage for the current day.
5	**Run Time:** • Yesterday - The total accumulated runtime from yesterday. • Current - The total accumulated runtime for the current day.
6	**PPRL:** • Yesterday - The total accumulated Peak Polished Rod Load value from yesterday. • Current - The total accumulated Peak Polished Rod Load value for the current day.
7	**MPRL:** • Yesterday - The total accumulated Minimum Polished Rod Load value from yesterday. • Current - The total accumulated Minimum Polished Rod Load value for the current day.
8	**Number of Strokes:** • Yesterday - The total accumulated Number of Strokes from yesterday. • Current - The total accumulated Number of Strokes for the current day.
9	**Average SPM:** • Yesterday - The total accumulated Average SPM from yesterday. • Current - The total accumulated Average SPM for the current day.
10	**Malfunction Count:** • Yesterday - The total number of malfunctions from yesterday. • Current - The total accumulated malfunctions for the current day.

Life Counters

This display shows the total life and production values since commissioning. You can also reset the life counters from this display.

Figure 158 - Historical Data Display 2: Life Counters

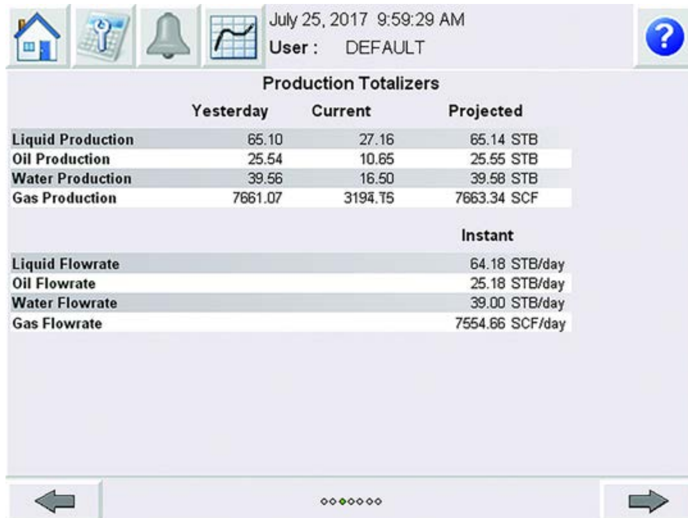


Row	Description
1	**Rod Life:** The time and the stroke cycles of the rod.
2	**Pump Life:** The time and the stroke cycles of the pump jack.
3	**Belt Life:** The time and the stroke cycles of the belt.
4	**Accumulated Power Consumption:** This value is polled directly from the Powerflex 750 drive from parameter 14 “Elapsed KWH”. This parameter cannot be reset from the INSTRUCT SRP.
5	**Liquid Production:** This parameter counts and accumulates the liquid production that is calculated. You can reset this value to zero through a coil status register.
6	**Oil Production:** This parameter counts and accumulates the oil production that is calculated. You can reset this value to zero through a coil status register.
7	**Water Production:** This parameter counts and accumulates the water production that is calculated. You can reset this value to zero through a coil status register.
8	**Gas Production:** This parameter counts and accumulates the gas production that is calculated. You can reset this value to zero through a coil status register.
9	**Reset Life Counters:** Press this button to reset all values on this display to zero.

Production Totalizers

This display shows yesterday's, current, and projected production of liquid, oil, water, and gas. It also displays the instant liquid, oil, water, and gas flowrates.

Figure 159 - Historical Data Display 3: Production Totalizers

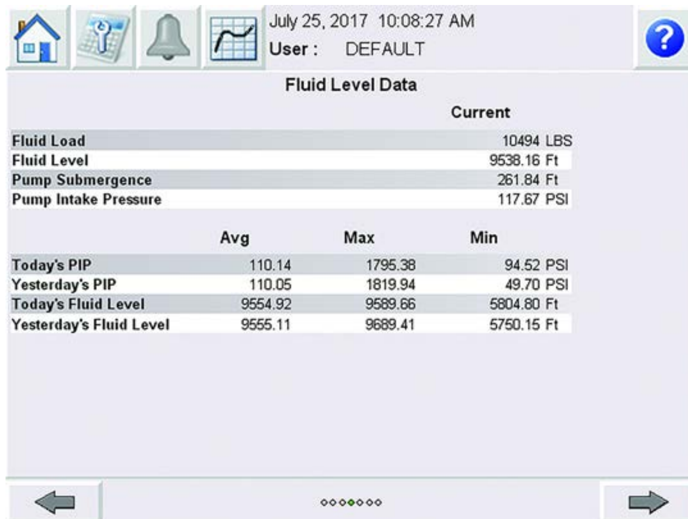


Row	Description
1	**Liquid Production:** • Yesterday - The total accumulated Liquid Volume from the well from yesterday. • Current - The total accumulated Liquid Volume from the well for the current day since GOT. • Projected - The total projected Liquid Volume from the well.
2	**Oil Production:** • Yesterday - The total accumulated Oil Volume from the well from yesterday. • Current - The total accumulated Oil Volume from the well for the current day since GOT. • Projected - The total projected Oil Volume from the well.
3	**Water Production:** • Yesterday - The total accumulated Water Volume from the well from yesterday. • Current - The total accumulated Water Volume from the well for the current day since GOT. • Projected - The total projected Water Volume from the well.
4	**Gas Production:** • Yesterday - The total accumulated Gas Volume from the well from yesterday. • Current - The total accumulated Gas Volume from the well for the current day since GOT. • Projected - The total projected Gas Volume from the well.
5	**Liquid Flowrate (Instant):** The current estimated liquid flowrate.
6	**Oil Flowrate (Instant):** The current estimated oil flowrate.
7	**Water Flowrate (Instant):** The current estimated water flowrate.
8	**Gas Flowrate (Instant):** The current estimated gas flowrate.

Fluid Level Data

This display shows the fluid level data including the current fluid load, fluid level, pump submergence, and pump intake pressure. It also shows the average/maximum/minimum for today's/yesterday's PIP, and fluid level.

Figure 160 - Historical Data Display 4: Fluid Level Data



Row	Description
1	**Fluid Load:** The current value of fluid load (lb).
2	**Fluid Level:** The current fluid level that is calculated from Downhole card.
3	**Pump Submergence:** The current pump submergence level.
4	**Pump Intake Pressure:** The current pump intake pressure that is calculated from the current fluid level.
5/6	**Today's/Yesterday's PIP:** The average/maximum/minimum pump intake pressure from the current/previous day.
7/8	**Today's/Yesterday's Fluid Level:** The average/maximum/minimum fluid level from the current/previous day.

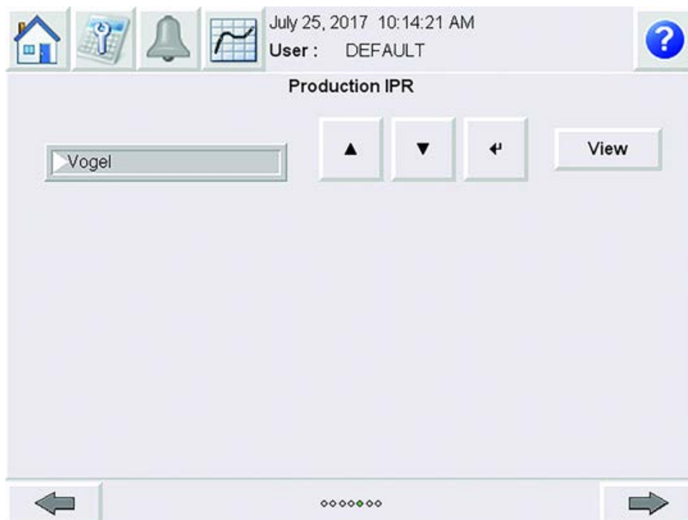
Production IPR

This display allows you to navigate to the two production IPR graphs:

- IPR straight line
- IPR two-phase reservoir (Vogel).

To select either graph, press the up (▲)/down (▼) buttons to choose the desired graph and then press the Enter (↵) button. Once the desired graph is selected, press the View button to view the graph.

Figure 161 - Historical Data Display 5: Production IPR



The IPR graphs displays IPR versus OFR card for IPR straight line and two-phase reservoir (Vogel). The IPR graphs are updated automatically. The refresh rate is half of the SPM. The current IPR and OFR values are indicated on the graph with a red crosshair.

Figure 162 - IPR Graphs

90-day Accumulator

The last two Historical Data displays let you navigate to the historical data faceplates listed in the table following Figure 163.

The View button is used to navigate to the historical data faceplates. These historical data faceplates show the last 90 days of accumulated values for each parameter. This data is saved locally in the INSTRUCT SRP data accumulator.

Figure 163 - Historical Data Displays 6 and 7: 90-day Accumulators

Display 6

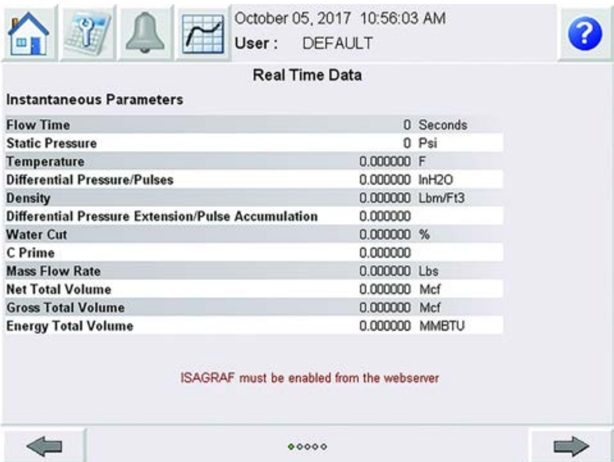
Display 7

Row	Description
Display 6	
1	**Pump Cycle ON/OFF:** Displays a graph of pump on/off cycles (accumulated at GOT) for the last 90 days.
1	**Runtime:** Displays a graph of runtime per day (accumulated at GOT) for the last 90 days.
2	**% Runtime:** Displays a graph of percentage runtime per day (accumulated at GOT) for the last 90 days.
3	**Liquid Volume:** Displays a graph of liquid volume per day (accumulated at GOT) for the last 90 days.
4	**Oil Volume:** Displays a graph of oil volume per day (accumulated at GOT) for the last 90 days.
5	**Water Volume:** Displays a graph of water volume per day (accumulated at GOT) for the last 90 days.
6	**Gas Volume:** Displays a graph of gas volume per day (accumulated at GOT) for the last 90 days.
7	**Daily Stroke Count:** Displays a graph of daily stroke count per day (accumulated at GOT) for the last 90 days.
Display 7	
1/2	**Minimum/Maximum Load:** Displays a graph of minimum/maximum load per day (accumulated at GOT) for the last 90 days.
3	**Average Pump Fillage:** Displays a graph of average pump fillage per day (accumulated at GOT) for the last 90 days.
4	**Average SPM:** Displays a graph of average SPM per day (accumulated at GOT) for the last 90 days.
5	**Average/Minimum/Maximum PIP:** Displays a graph of average/minimum/maximum PIP per day (accumulated at GOT) for the last 90 days.
6	**Average/Minimum/Maximum Fluid Level:** Displays a graph of average/minimum/maximum fluid level per day (accumulated at GOT) for the last 90 days.
7	**Reset Accumulators:** Press this button to reset the 90-day accumulated data.

Gas Flow Data

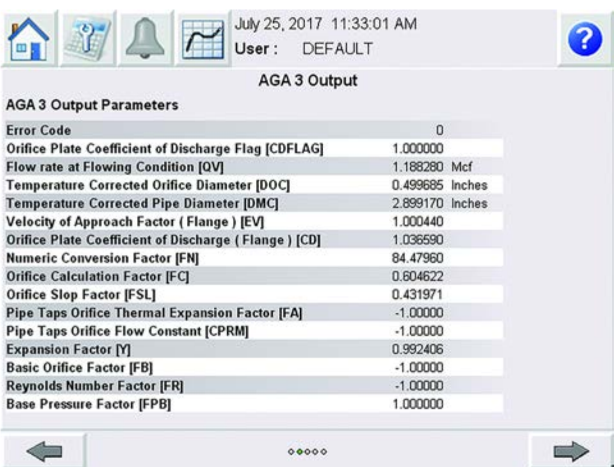
The Gas Flow Data display has five pages. These displays show real-time data that is collected from EFM calculations. To configure gas flow alarms, see Gas Flow Alarm Configuration on page 190.

Figure 164 - Gas Flow Data Displays

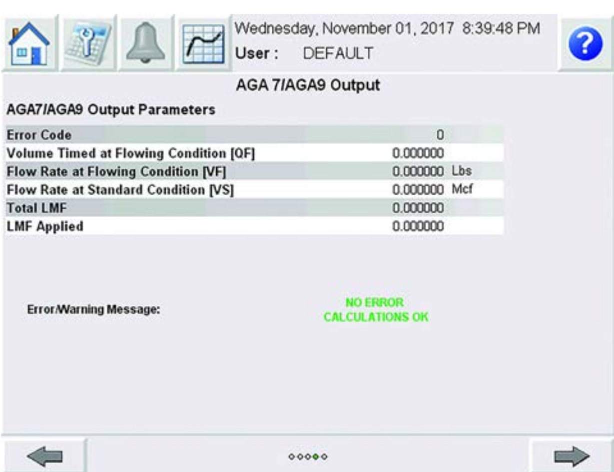


Display 1: Instantaneous Parameters

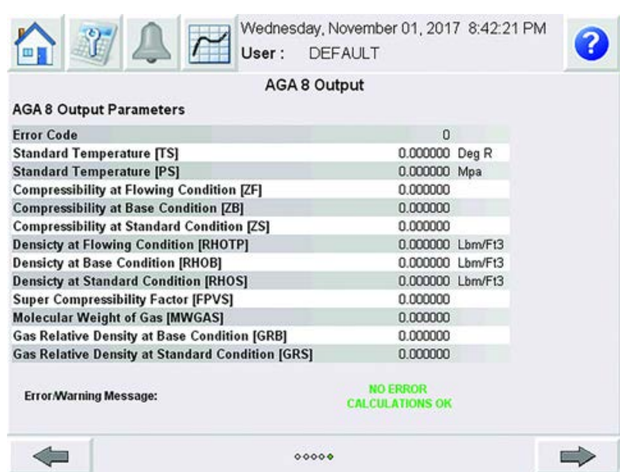
IMPORTANT	ISaGRAF must be running to enable this application.



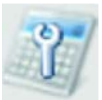
Displays 2 and 3: AGA 3 Output Parameters



Display 4: AGA 7/AGA 9 Output Parameters



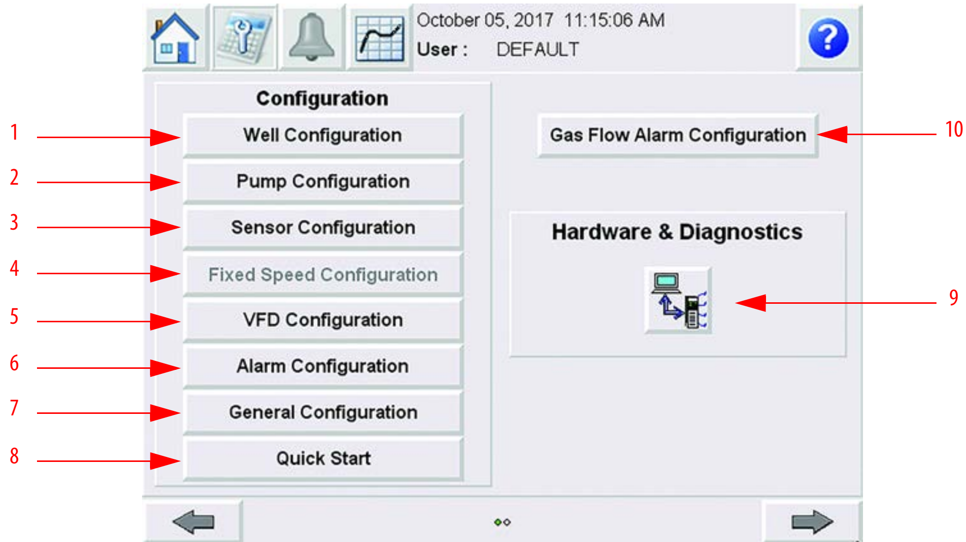
Display 5: AGA 8 Output Parameters



Configuration Display

The Configuration display provides the navigation links listed in the table following Figure 165.

Figure 165 - Configuration Display 1



Item	Description
1	Well Configuration (page 144)
2	Pump Configuration (page 146)
3	Sensor Configuration (page 157)
4	Fixed Speed Configuration (page 161)
5	VFD Configuration (page 166)
6	Alarm Configuration (page 173)
7	General Configuration (page 182)
8	Quick Start (page 207)
9	Hardware & Diagnostics (page 187)
10	Gas Flow Alarm Configuration (page 190)

Press the right arrow to access the User Control display. This display lets you log in, log out, or change user passwords. For more information on this display, see User Administration on page 205.

Figure 166 - Configuration Display 2: User Control

Well Configuration

ATTENTION: To avoid personal injury and/or machine damage, verify that the well is in "Stopped State" before attempting to select/change operation mode. The state can be confirmed from the *Well Basic Data* display.
To put the INSTRUCT SRP in "Stopped State," see Start and Stop the Motor on page 272.

Operation Mode

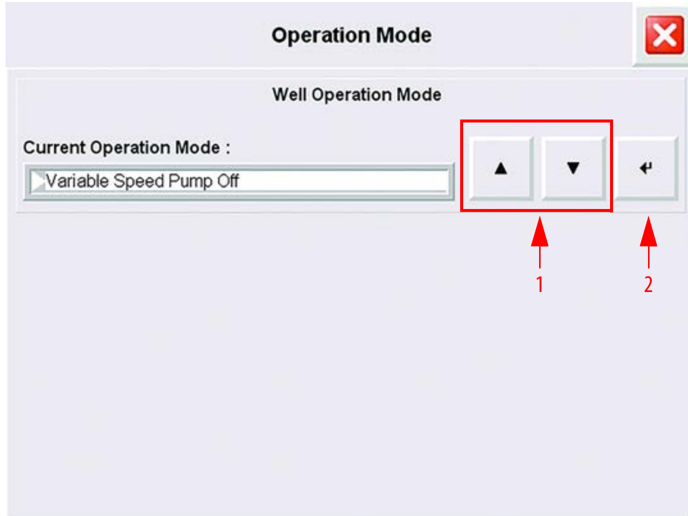
This display lets you select one of the following well operation mode options:

- Fixed Speed Timer
- Fixed Speed Pump Fillage
- Fixed Speed Pump Off
- Fixed Speed Manual
- Variable Speed Pump Fillage
- Variable Speed Manual
- Variable Speed Pump Off

To select an operating mode, use the up (▲)/down (▼) buttons to choose the desired mode and press the Enter (↵) button. The selected operation mode is highlighted with a white background.

For definitions of Operation Modes, see Well Operation Modes on page 13.

Figure 167 - Operation Mode (in Stopped State)



Item	Description
1	**Up/Down Arrow Buttons** [(1)]**:** Press these arrow buttons to choose an operation mode from the list.
2	**Enter Button** [(1)]**:** Press to select operation mode.

(1) If Novemberyour well is running, these buttons do not appear.

Pump Configuration

The Pump Configuration display has 8…13 pages (depending on how many tapers are configured). Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

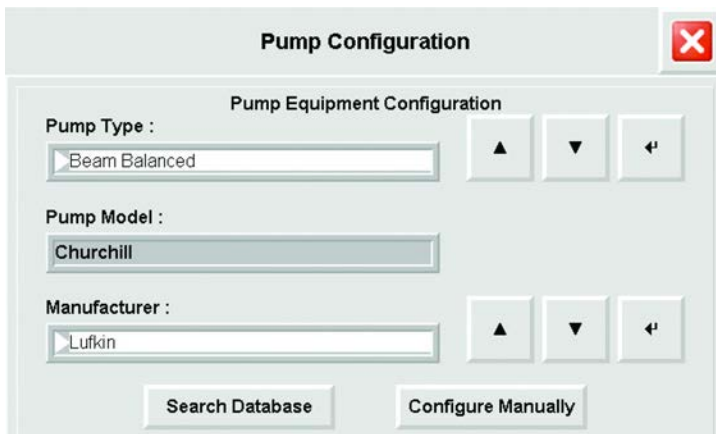
IMPORTANT	You must complete all parts of pump configuration to properly commission the well.

Pump Equipment Configuration

On this display (Figure 168), you can search the local INSTRUCT SRP database for common API unit dimensions or configure the pump equipment manually.

The pump can also be configured manually. Standard API dimensions are specific to the pumping unit and can be found in the pumping unit documentation.

Figure 168 - Pump Configuration Display 1: Pump Equipment Configuration

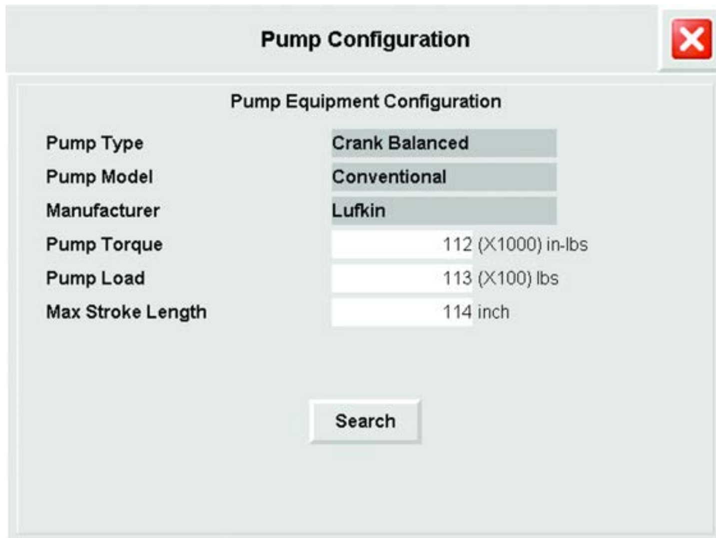


Row	Description
1	**Pump Type:** Used to select the pumping unit from the menu. Options include Crank Balanced, Beam Balanced, Air Balanced, and Linear.
2	**Pump Model:** Used to select the pumping model from the menu. • Crank Balanced Pump type options: Conventional, Mark II, Reverse Mark, Ampscot, Maximizer, Maximizer II, Enhanced Geometry, Front Mounted, and TorqMax. • Beam Balanced Pump type options: Churchill Pump Model. • Air Balanced Pump type options: Air Balanced. • Linear Pump type options: 900, 1100, 1150, and 1151.
3	**Manufacturer:** Used to select the manufacturer for a selected pump type and pump model. • Crank Balanced Conventional Model: Lufkin, Vulcan, LS PetroChem, and Other. • Crank Balanced Mark II and Reverse Mark Models: Lufkin and Other • Crank Balanced Ampscot, Maximizer, and Maximizer II Models: Weatherford and Other • Crank Balanced Enhanced Geometry Model: LS PetroChem and Other • Crank Balanced Front Mounted Model: Vulcan and Other • Crank Balanced TorqMax Model: Schlumberger and Other • Beam Balanced Churchill Model and Air Balanced Model: Lufkin and Others • Linear 900, 1100, 1150 and 1151 Models: Weatherford
4	**Search Database:** This button lets you configure the INSTRUCT SRP automatically with the pumping unit dimensions from the internal database. While using the search database option, you must enter the correct pumping unit type, pumping model, manufacturer, allowable design torque, load, and maximum stroke length. Once the unit is found in the database, the dimensions R, K, C, P, A, and I for the selected pumping unit are displayed. See Figure 169 on page 147 for details.
5	**Configure Manually:** When selected, a screen with all pump equipment dimensions appears. You can edit the pump torque, load, stroke length, and dimensions (R, K, C, P, A, and I) from this screen. Once the correct information is entered, you must press Set to configure it successfully. See Figure 171 on page 149 for details.

This faceplate (Figure 169) appears when the Search Database button is pressed on Pump Configuration display (Figure 168 on page 146). Here, you can enter the maximum allowable pump torque, pump load, and stroke length.

When the Search button is pressed, several default parameters and dimensions (R, K, C, P, A, and I) are populated on a new screen if the search is successful.

Figure 169 - Search Database

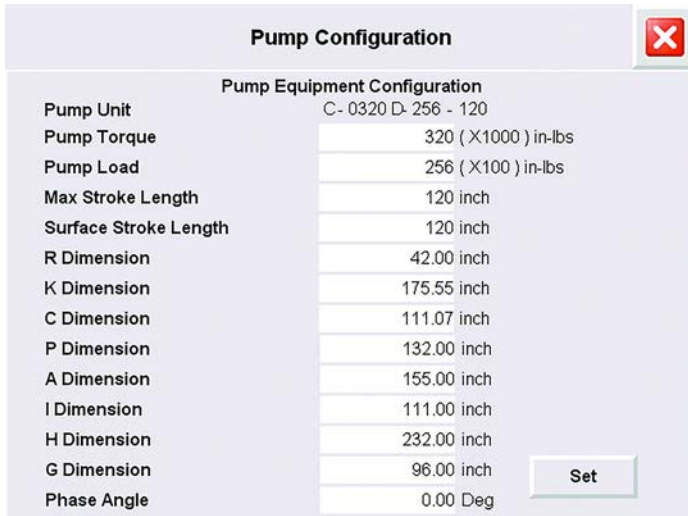


Row	Description
1	**Pump Type:** The Pump Type selected on the Pump Equipment Configuration display (Figure 168 on page 146).
2	**Pump Model:** The Pump Model that is selected on the Pump Equipment Configuration display (Figure 168 on page 146).
3	**Manufacturer:** The Manufacturer that is selected on the Pump Equipment Configuration display (Figure 168 on page 146).
4	**Pump Torque:** The torque value of a particular pump unit that is required.
5	**Pump Load:** The load value of a particular pump unit that is required.
6	**Max Stroke Length:** The maximum stroke length value of a particular pump unit that is required.
7	**Search:** The Search button starts the search for the pumping unit in the internal database. Once a pump that meets the specified requirements is found, the standard dimensions are loaded. You can configure the values.

This faceplate (Figure 170) appears after a successful pump search. You can configure the variables as required by your well system.

When the parameters are configured and the Set button is pressed, all configured values are saved in the database in the respective parameters. The configured pumping unit is then set as the active pumping unit.

Figure 170 - Pump Configuration



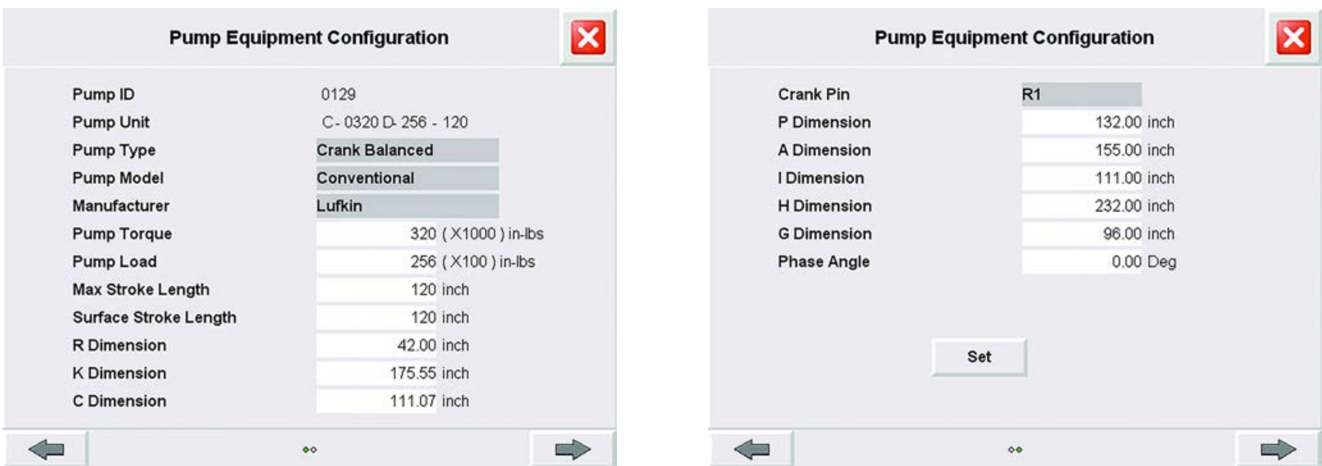
Row	Description
1	**Pump Unit:** It displays the selected Pump Unit in the form of Unit Number. This Unit is made by the combination of Pump Type, Pump Model, and Manufacturer.
2	**Pump Torque:** The torque value of the searched pump unit.
3	**Pump Load:** The Load value of the searched pump unit.
4	**Max Stroke Length:** The maximum stroke length value of the searched pump unit.
5	**Surface Stroke Length:** Polished rod displacement value during an upstroke or downstroke for the searched pump unit.
6…11	**R, K, C, P, A, I, H, and G Dimension:** API dimension of searched pump unit.
12	**Phase Angle:** An offset angle value (in degrees) on the crank angle. This value is provided by the pump manufacturer for each pumping unit.
13	**Set:** When pressed, this button updates all pumping unit parameters that are configured on this screen to the internal database and sets the pumping unit as the active pump.

This two-page faceplate (Figure 171) appears when the Configure Manually button is pressed on Pump Equipment Configuration display (Figure 168 on page 146).

The Manual Configuration faceplate lets you configure pump torque, pump load, maximum stroke length, surface stroke length, API dimensions (R, K, C, P, A, I, H, and G), and phase angle. It displays the pump ID, pump unit, pump type, pump model, and manufacturer as per the selection done on Pump Equipment Configuration display.

Once the parameters are configured as required, press the Set button to update all pump unit parameters in the local database.

Figure 171 - Manual Configuration



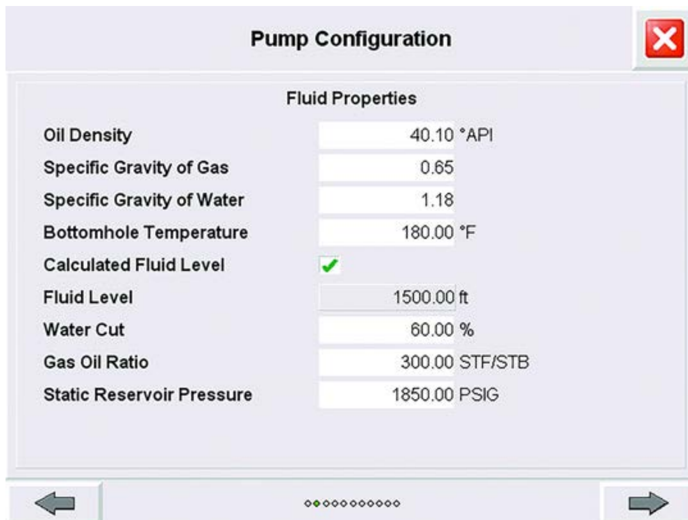
TIP See Figure 170 on page 148 for parameter definitions.

Fluid Properties

This display lets you configure the fluid parameters such as oil density, specific gravity of gas, specific gravity of water, bottomhole temperature, calculated fluid level control, fluid level, water cut, gas-oil ratio, and static reservoir pressure.

These parameters help to achieve accurate well production data and are used for calculating the estimated oil, water, and total flow rate. The information must be entered in the proper units.

Figure 172 - Pump Configuration Display 2: Fluid Properties



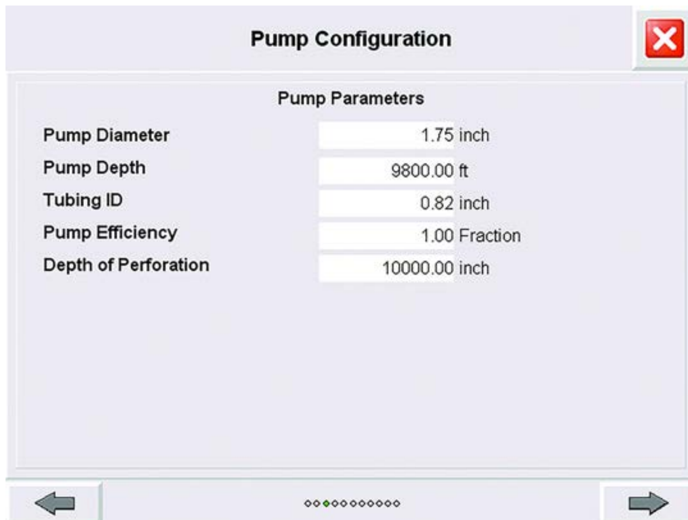
Row	Description
1	**Oil Density:** The oil density of the produced oil per API degree must be entered correctly for a correct oil production estimate. One can get this data from well test reports.
2	**Specific Gravity of Gas:** The specific gravity of gas that is produced which is used in the production estimate. This data can be found in the well test reports.
3	**Specific Gravity of Water:** The specific gravity of water that is produced which is used in the production estimate. This data can be found in the well test reports.
4	**Bottomhole Temperature:** The bottomhole temperature to obtain accurate production estimates from the calculations. One can get this data from well test reports.
5	**Calculated Fluid Level:** When checked, this feature allows calculated fluid level from the fluid level calculation in production calculation. When cleared, it allows the system to use the user-configured fluid level in the production calculation.
6	**Fluid Level:** The correct fluid level to obtain accurate production estimates from the calculations. One can get this data from well test reports. This setting is enabled when the 'Calculated Fluid Level' checkbox is unchecked.
7	**Water Cut:** The correct water cut to obtain accurate production estimates from the calculations. One can get this data from well test reports.
8	**Gas Oil Ratio:** The Gas Oil Ratio to obtain accurate production estimates from the calculations.
9	**Static Reservoir Pressure:** The Static Pressure of the Well to obtain accurate production estimates from the calculations.

Pump Parameters

This display lets you configure the Pump Diameter, Pump Depth, Tubing ID, Pump Efficiency, and Depth of Perforation.

These parameters help to achieve accurate well production data and are used for calculating the estimated oil, water, and total flow rate. All information must be entered in the proper units.

Figure 173 - Pump Configuration Display 3: Pump Parameters



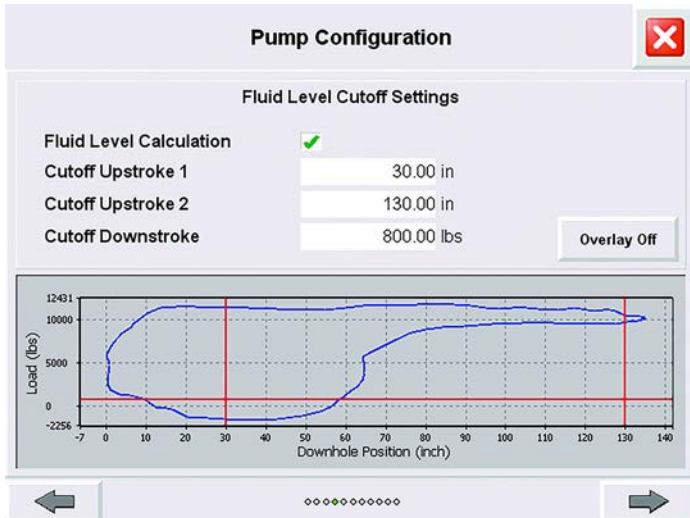
Row	Description
1	**Pump Diameter:** The pump plunger diameter is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results. This information is found in the well completion data.
2	**Pump Depth:** The vertical pump depth from the surface to the pump intake is used for the downhole calculations. Incorrect information yields erroneous downhole calculation results. This information is found in the well completion data.
3	**Tubing ID:** The appropriate tubing inside diameter (ID) must be selected from the data for the calculations. The INSTRUCT SRP database has the most commonly used tubing sizes. If your tubing size does not exist in the database, you can manually enter it via the HMI display.
4	**Pump Efficiency:** It is used for providing the Volumetric Pump Efficiency. (Range = 0…1)
5	**Depth of Perforation:** It is used for providing the Depth of Perforation. (Range = 0…50,000)

Fluid Level Cutoff Setting

This display lets you configure a reasonable range of load data on the downstroke and upstroke section of the downhole card. It also provides to enable or disable the fluid level calculation feature.

In general, the cutoff points are the position values corresponding to the load transfer to the traveling valve during the upstroke and to the standing valve during the downstroke.

Figure 174 - Pump Configuration Display 4: Fluid Level Cutoff Settings



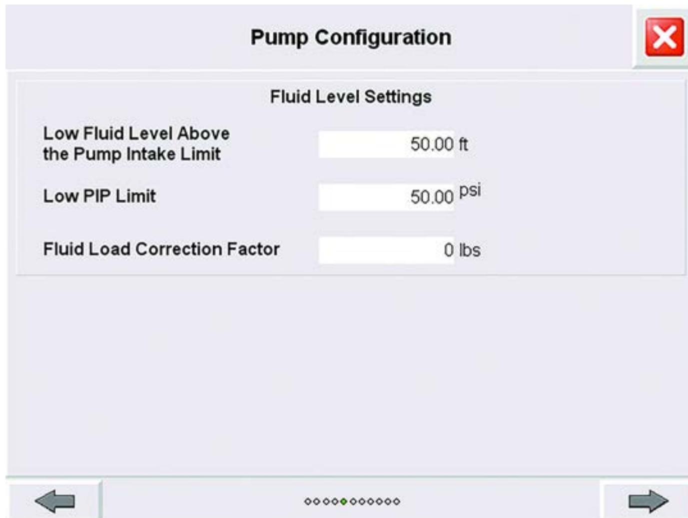
Row	Description
1	**Fluid Level Calculation:** When checked, this feature allows calculated fluid level from the fluid level calculation in production calculation. When cleared, it allows the system to use the user-configured fluid level in the production calculation.
2	**Cutoff Upstroke 1:** The lower position value at which load is transferred to the traveling valve and it is closed. This value is the first inflexion point on the upstroke.
3	**Cutoff Upstroke 2:** The last inflexion point on the upstroke when the traveling valve starts open and downstroke begins.
4	**Cutoff Downstroke:** The downstroke load cutoff value.
5	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots.
6	**Surface Card/Downhole Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.

Fluid Level Settings

This display lets you configure low fluid level above pump intake limit, low PIP limit, and fluid load correction factor.

These parameters are used in the generation of low fluid level and low PIP warnings.

Figure 175 - Pump Configuration Display 5: Fluid Level Settings



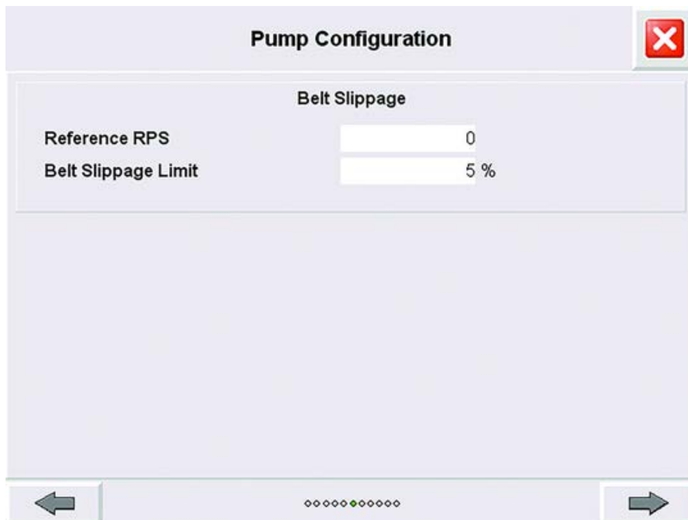
Row	Description
1	**Low Fluid Level above the Pump Intake Limit:** Low fluid level above the pump intake warning is generated if calculated fluid level is greater than, or if the calculated submergence is less than, this value.
2	**Low PIP Limit:** Low PIP Warning is generated if calculated PIP is less than this value.
3	**Fluid Load Correction Factor:** The correction factor for fluid load.

Belt Slippage

This display lets you provide a reference RPS and belt slippage error percentage to detect a belt slippage alarm.

This display shows current measured RPS and provides a method for RPS synchronization. When the RPS Synchronization button is pressed, the system provides you with a reference RPS that is measured during the RPS synchronization. If this value is accepted, then it is saved as a reference RPS against which belt slippage alarm is detected.

Figure 176 - Pump Configuration Display 6: Belt Slippage



Row	Description
1	**Reference RPS:** Reference RPS value is used to calculate the percentage belt slippage.
2	**Belt Slippage Limit:** If the calculated belt slippage is more than the reference belt slippage by this limit, then the belt slippage alarm is generated.

Motor Configuration

This display lets you configure motor parameters such as motor sheave size, mechanical efficiency, gearbox sheave size, gearbox ratio, motor nominal speed, and motor nominal frequency.

Accurate motor configuration helps ensure that the INSTRUCT SRP can detect a strokes per minute (SPM) error alarm. This alarm comes from a mismatch between measured SPM and SPM from the VFD-commanded frequency.

The number of tapers are also configured from this display.

Figure 177 - Pump Configuration Display 7: Motor Configuration

Row	Description
1	**Motor Sheave Size:** The size (in inches) is used for calculating the estimated expected SPM from the commanded frequency.
2	**Mechanical Efficiency:** The mechanical efficiency of the pumping unit and the speed reducer. (Range = 0…100).
3	**Gear Box Sheave Size:** The size (in inches) is used for calculating the estimated expected SPM from the commanded frequency.
4	**Gear Box Ratio:** This ratio is used for calculating the estimated expected SPM from the commanded frequency.
5	**Motor Nominal Speed:** The nominal speed (in revolutions per minute [RPM]) is used for calculating the estimated expected SPM from the commanded frequency.
6	**Motor Nominal Frequency:** The frequency (in Hz) is used for calculating the estimated expected SPM from the commanded frequency.
7	**Number of Tapers:** The number of rod tapers in the rod string. (Range = 0… 6) [1]

(1) When a continuous single taper rod is used, enter a value of 1 and enter the material and the length of the entire rod string as one rod taper (Figure 178 on page 156).

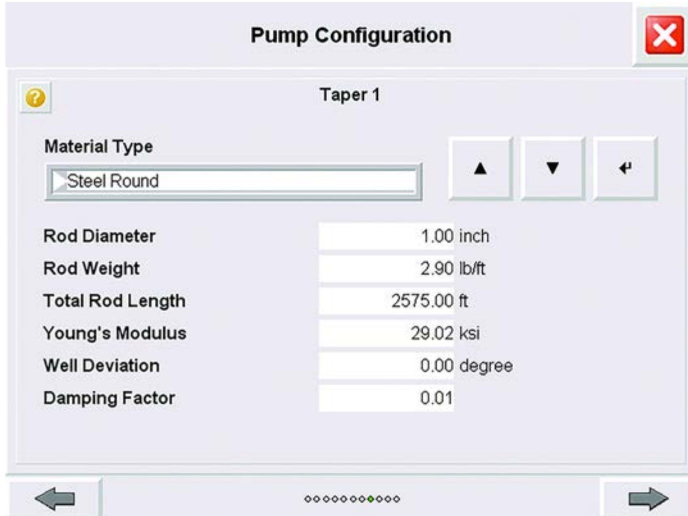
Taper Configuration

These displays let you configure the taper parameters. Taper configuration is vital for downhole calculations from the surface card. Incorrect information yields erroneous downhole calculations and decreases overall accuracy of the INSTRUCT SRP.

Each taper is configured on another display. You can navigate to each display with the left and right arrow buttons at the bottom of the display.

The number of taper configuration displays that are visible depends on the number of tapers that are entered in Figure 177 on page 155.

Figure 178 - Pump Configuration Display 8…13: Taper Configuration



Row	Description
1	**Material Type:** The rod material options include: • Fiberglass round • Steel elliptical • Steel round There is an option for adding a steel sinker-bar, indicated by Steel-Round_SB. A steel-round sinker bar is added to the last taper.
2	**Rod Diameter:** Enter the rod diameter (in inches) by selecting it from the database. The most commonly used diameters for API rods are available in the database.
3	**Rod Weight:** Specify the rod weight (in lb•ft) for each taper.
4	**Total Rod Length:** Specify the total length of rods (in feet) in each taper.
5	**Young's Modulus:** Specify the Young's Modulus for each taper.
6	**Well Deviation:** If the well is deviated, specify the estimated well deviation (in degrees) at each section of the rod tapers.
7	**Damping Factor:** Enter the correct damping factor for calculating the downhole card. This value must be equal across all tapers. The damping factor allows for adjustment of incorrect downhole cards due to any forces that dampen the rod string vibrations. The damping factor can be obtained from the software program that was used for deigning the well rod string. This value is kept by default between 0.01…0.1.

Sensor Configuration

The Sensor Configuration display has two pages that let you configure your position and load sensors. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

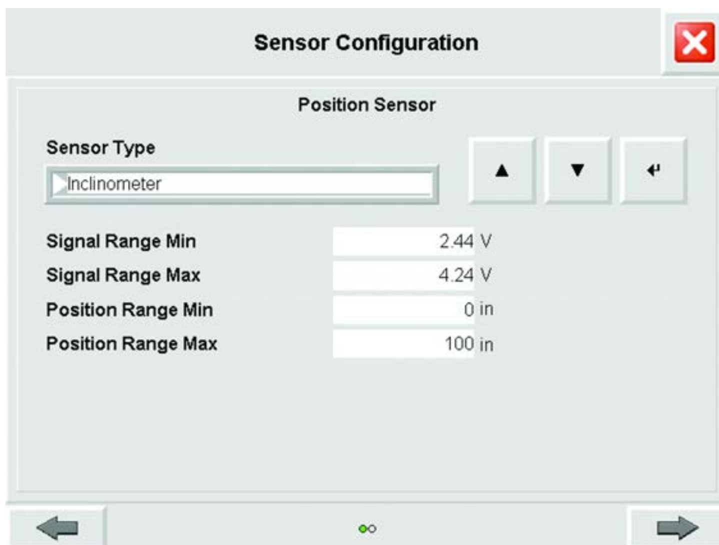
Position Sensor

This display lets you configure position sensor settings. It provides selection of the following position sensor types:

- Inclinometer (Figure 179)
- Hall Effect-Crank Arm (Figure 180 on page 158)
- Hall Effect-Crank Arm/RPM (Figure 181 on page 159)
- Proximity/RPM Sensors (Figure 182 on page 160)

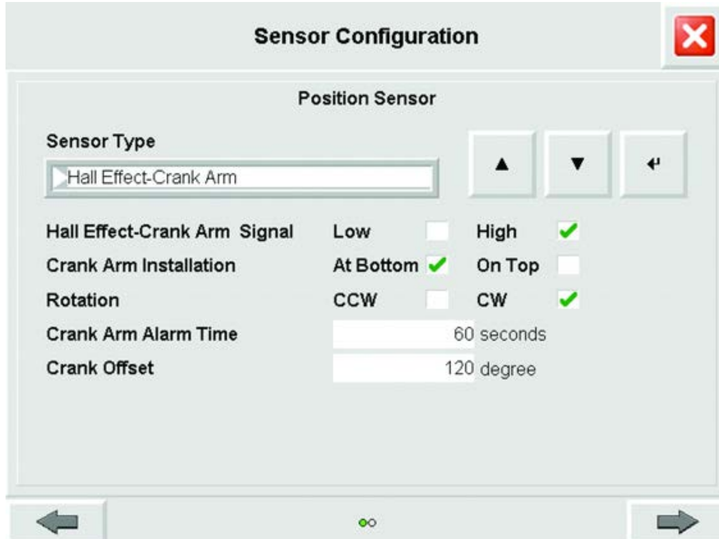
You can select the position sensor type from the menu with the up (▲)/ down (▼) and Enter (↵) buttons. The sensor type determines the configuration parameters that are shown.

Figure 179 - Position Sensor: Inclinometer



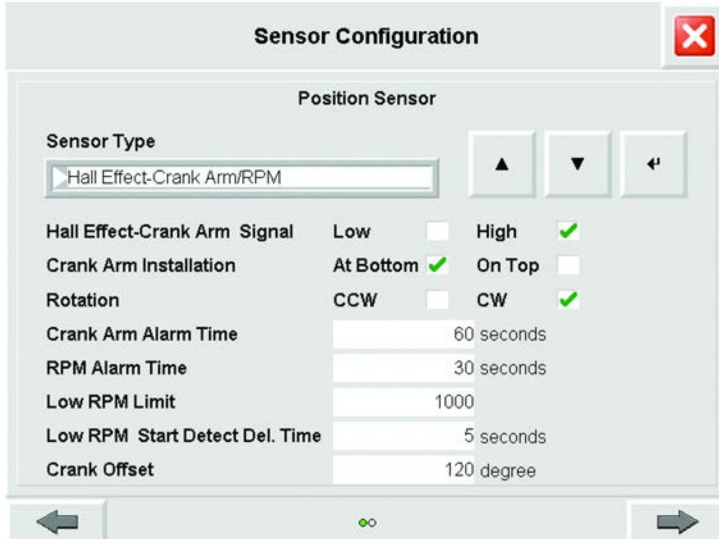
Row	Description
1	**Sensor Type:** Used to select the sensor type from Inclinometer, Hall Effect-Crank Arm, Hall Effect-Crank Arm/RPM, and Proximity/RPM Sensors.
2	**Signal Range Min:** The minimum value of inclinometer signal. This value is in Volts or mA depending upon the input type of the position channel AI 3. (Range = 0…22 mA or 0…5.12V)
3	**Signal Range Max:** The maximum value of inclinometer signal. This value is in Volts or mA depending upon the input type of the position channel AI 3. (Range = 0…22 mA or 0…5.12V)
4	**Position Range Min:** The minimum value of inclinometer position range. This value denotes the minimum stroke length or range the inclinometer travels. (Range = 0…400 in.)
5	**Position Range Max:** The maximum value of inclinometer position range. This value denotes the minimum stroke length or range the inclinometer travels. (Range = 0…400 in.)

Figure 180 - Position Sensor: Hall Effect - Crank Arm and Crank Arm/RPM



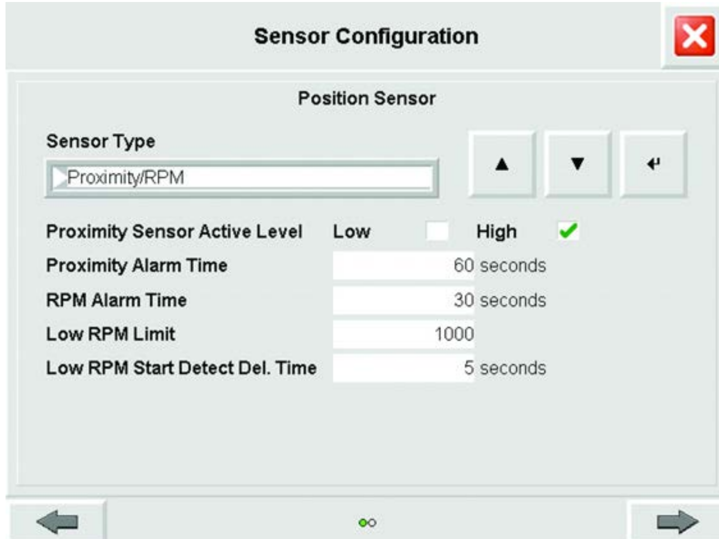
Row	Description
1	**Sensor Type:** Used to select the sensor type from Inclinometer, Hall Effect-Crank Arm, Hall Effect-Crank Arm/RPM, and Proximity/RPM Sensors.
2	**Hall Effect Crank Arm Signal:** Used to set the crank arm DI active status as High. For example, if the DI is 1, then only it detects a High or Low signal.
3	**Crank Arm Installation:** Used to set the crank sensor location whether At Bottom or On Top of the stroke.
4	**Rotation:** Used to set the crank rotation type as clockwise or counter-clockwise.
5	**Crank Arm Alarm Time:** The duration for which if there is no trigger from the crank arm then it sets the Alarm bit and the configured Alarm action is taken. (Range = 0…300)
6	**Crank Offset:** Used to set crank angle deviation. (Range = -180…180)

Figure 181 - Position Sensor: Hall Effect - Crank Arm/RPM



Row	Description
1	**Sensor Type:** Used to select the sensor type from Inclinometer, Hall Effect-Crank Arm, Hall Effect-Crank Arm/RPM, and Proximity/RPM Sensors.
2	**Hall Effect Crank Arm Signal:** Used to set the crank arm DI active status as High. For example, if the DI is 1, then only it detects a High or Low signal.
3	**Crank Arm Installation:** Used to set the crank sensor location whether At Bottom or On Top of the stroke.
4	**Rotation:** Used to set the crank rotation type as clockwise or counter-clockwise.
5	**Crank Arm Alarm Time:** The duration for which if there is no trigger from the crank arm then it sets the Alarm bit and the configured Alarm action is taken. (Range = 0…300)
6	**RPM Alarm Time:** The duration for which if the RPM count that is received from RPM sensor is not varying then the Alarm bit is set and the configured alarm action is taken.
7	**Low RPM Limit:** Used to set Low RPM alarm limit such that if the current RPM is less than this value the Low RPM alarm is generated.
8	**Low RPM Start Detect Delay Time:** The duration for which the INSTRUCT SRP waits after starting before beginning the detection of low RPM alarms.
9	**Crank Offset:** Used to set crank angle deviation. (Range = -180…180)

Figure 182 - Position Sensor: Proximity/RPM



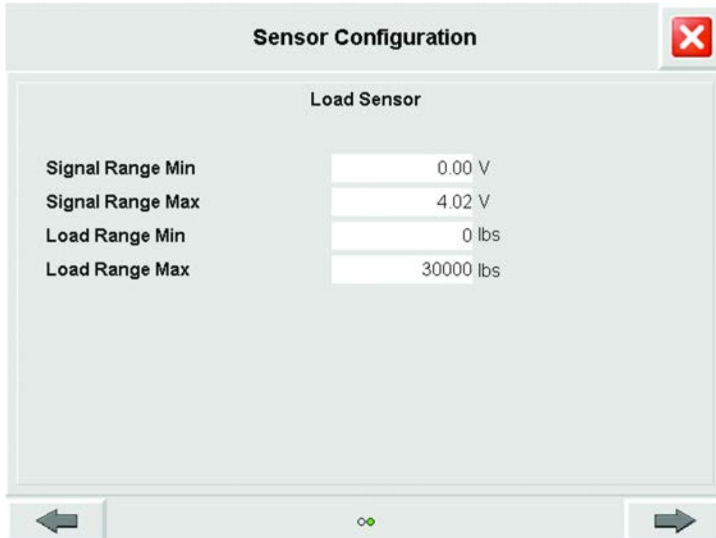
IMPORTANT The Proximity/RPM sensor type is only applicable to Linear pumping units.

Row	Description
1	**Sensor Type:** Used to select the sensor type from Inclinometer, Hall Effect-Crank Arm, Hall Effect-Crank Arm/RPM, and Proximity/RPM Sensors.
2	**Proximity Sensor Active Level:** Used to set the proximity sensor DI active status as High. For example, if the DI is 1, then only it detects a High or Low signal.
3	**Proximity Alarm Time:** The time duration for which if there is no trigger from the proximity sensor then it sets the Alarm bit and the configured Alarm action is taken. It is the same as Crank Arm Alarm Time.
4	**RPM Alarm Time:** The duration for which if the RPM count that is received from RPM sensor is not varying then the Alarm bit is set and the configured alarm action is taken.
5	**Low RPM Limit:** Used to set Low RPM alarm limit such that if the current RPM is less than this value the Low RPM alarm is generated.
6	**Low RPM Start Detect Delay Time:** The duration for which the INSTRUCT SRP waits after starting before beginning the detection of low RPM alarms.

Load Sensor

This display lets you configure load sensor settings (signal range or load range).

Figure 183 - Load Sensor



Row	Description
1/2	**Signal Range Min/Max:** The minimum/maximum value of load cell signal range. This value is in volts or mA depending upon the input type of the load channel AI1. (Range = 0…22 mA or 0…5.12V)
3/4	**Load Range Min/Max:** The minimum/maximum value of load cell range (in pounds). (Range = 0…50,000 [min], 30,000…50,000 [max])

Fixed Speed Configuration

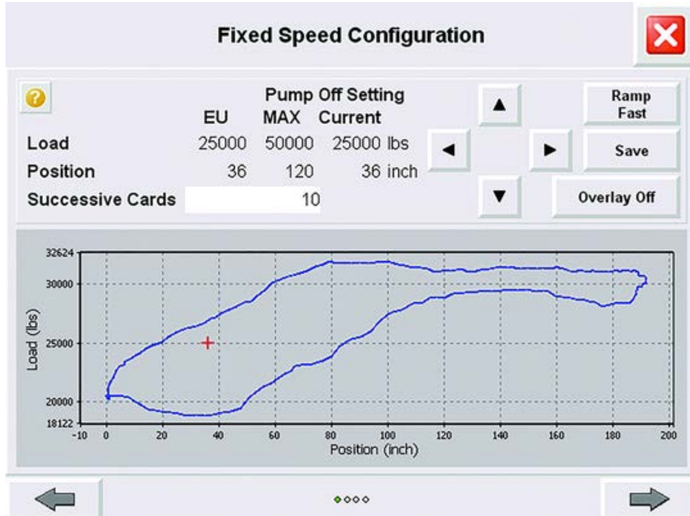
The Fixed Speed Configuration display has two pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Pump Off Setting

On this display, when the pump off load and position value is set using the up/down (for load) and right/left (for position) ramp buttons, the corresponding load and position pump off points are shown on the Pump Off card with a red crosshair. The pump off values that are selected using the arrow buttons are shown in the current value column. Once you are satisfied with the pump off point values, you can press the Save button to save the selected pump off points to the INSTRUCT SRP. These points are used for further pump off condition detection. Once saved the selected pump off point load and position values are reflected in the EU value column. The maximum allowed load and position are also displayed for your reference.

You must set the number of successive cards that the INSTRUCT SRP lets the well run after a pump-off condition is detected. A value of 1 shuts down the well immediately after detecting a pump-off condition.

Figure 184 - Fixed Speed Configuration Display 1: Pump Off Setting



Row	Description
1	**Load:** The load on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This value is converted to percentage and is calculated away from the minimum load when the Save button is pressed. (Range: 0…100)
2	**Position:** The Position on the surface card where the pump-off setpoint is placed for the well to shut off once a pump-off condition is detected. This value is converted to percentage and is calculated away from the minimum position. (Range: 0…100)
3	**Successive Cards:** The number of consecutive pump-off cards that must be detected before stopping the pump. A value of 1 shuts down the well immediately after detecting a pump-off condition. (Range: 1…10)
4	**Ramp Left/Right Buttons:** Used to set the value of Position Pump off Set Point. **Ramp Up/Down Buttons:** Used to set the value of Load Pump off Set Point.
5	**Ramp Fast/Slow Button:** This button is used to toggle between two ramping speeds for both Load and Position ramp buttons.
6	**Save Button:** When the Save button is pressed, the pump-off setpoint is saved in the desired location on the surface card. The pump-off setpoint card can then be recalled from the Pumping System Analysis display (page 194).
7	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots.
8	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.

POC Time Setting

This display (Figure 185) lets you configure the fixed speed configuration parameters for pump off controller (POC) mode such as startup period, max runtime, and rest time.

The unit of startup period can be selected as stroke or minute with the up/down buttons.

Figure 185 - Fixed Speed Configuration Display 2: POC Time Setting

Row	Description
1	**Startup Period:** The time that the INSTRUCT SRP waits in Start state before checking for a pump-off condition. The startup period allows gassy wells to settle before checking for a pump-off condition. The startup period can be set in number of minutes or strokes. The default start period is 1 minute. (Range = 0…20 minutes or strokes)
2	**Max Run Time:** The time (in minutes) that the INSTRUCT SRP allows the well to run in POC mode. This value is kept by default at 1440 minutes to cycle the well for a day. (Range = 1…1440)
3	**Rest Time:** The time (in minutes) that the well rests when it enters Rest state after a pump-off condition is detected. (Range = 1…1440)

Fixed Speed Timer Setting

The manual timer setting has to be preconfigured before operating the well in Fixed Speed Timer operation mode.

Set the start time, runtime, and the rest time properly to operate the well in Fixed Speed Timer operation mode. Press the Enter ( ) button on the popup keypad to configure the Fixed Speed Timer settings successfully.

Figure 186 - Fixed Speed Configuration Display 4: Fixed Speed Timer Setting

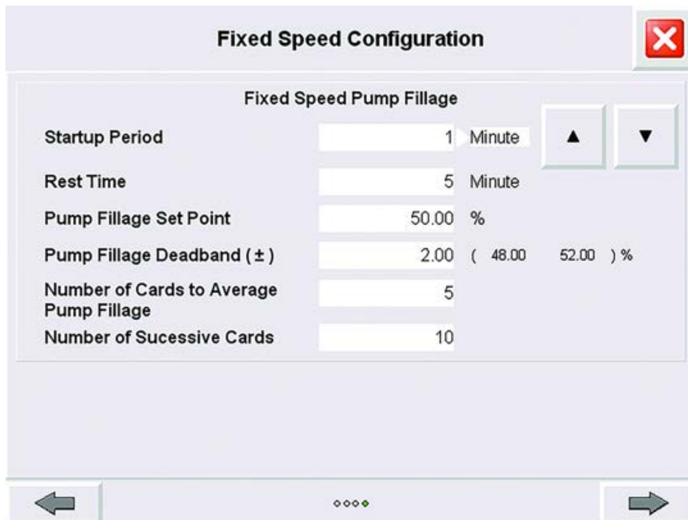
Row	Description
1	**Start Time:** The number of minutes to allow the well to stabilize in Fixed Speed Timer mode before the well starts checking for alarms and other conditions. This time is kept at 1 minute to allow the well to stabilize. (Range = 0…20)
2	**Run Time:** The number of minutes that the well runs in Fixed Speed Timer mode before it cycles OFF to Rest state. (Range = 0…21 days, 0…23 hr, 1…59 min.)
3	**Rest Time:** The number of minutes that the well rests in Fixed Speed Timer mode before it cycles ON to Run state. (Range = 0…21 days, 0…23 hr, 1…59 min.)

Fixed Speed Pump Fillage

This display lets you configure all parameters that are required to operate the well in Fixed Speed Pump Fillage mode.

In Fixed Speed Pump Fillage mode, the INSTRUCT SRP sends a command to stop the well for a rest period after a number of successive downhole cards has been detected with the calculated pump fillage below the desired target pump fillage.

Figure 187 - Fixed Speed Configuration Display 5: Fixed Speed Pump Fillage



Row	Description
1	**Startup Period:** The time that the INSTRUCT SRP waits in Start state before checking for a pump-off condition. The startup period allows gassy wells to settle before checking for a pump-off condition. The startup period can be set in number of minutes or strokes. The start period is kept at 1 minute by default. (Range = 0…20)
2	**Rest Time:** The time (in minutes) that the well rests when it enters Rest state after a pump-off condition is detected. (Range = 1…1440)
3	**Pump Fillage Set Point:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP shuts down the pump when the current calculated Pump Fillage percent falls below the target Pump Fillage percent after the configured number of successive cards. (Range = 0…100)
4	**Pump Fillage Deadband:** This percentage is used to calculate and compare the Pump Fillage Setpoint to the current Pump Fillage. This calculation helps the INSTRUCT SRP decide whether to send the pump to rest or keep the pump running. If the current pump fillage is within ±3% of the target fillage, the INSTRUCT SRP does not put the pump in rest unless it falls below of the ±3% deadband. If the pump fillage number is below the pump fillage deadband, the INSTRUCT SRP puts the pump to rest. The INSTRUCT SRP keeps the pump running if the pump fillage number is above the deadband. (Range = 0…100)
5	**Number of Cards to Average Pump Fillage:** The number of cards that are used to calculate the average Pump Fillage. This value defaults to five cards. Increase this value as needed for greater Pump Fillage accuracy. (Range = 1…50)
6	**Number of Successive Cards:** The number of consecutive cards in which the calculated Pump Fillage is lower than the configured Pump Fillage Setpoint before the INSTRUCT SRP shuts down the pump. (Range = 1…10)

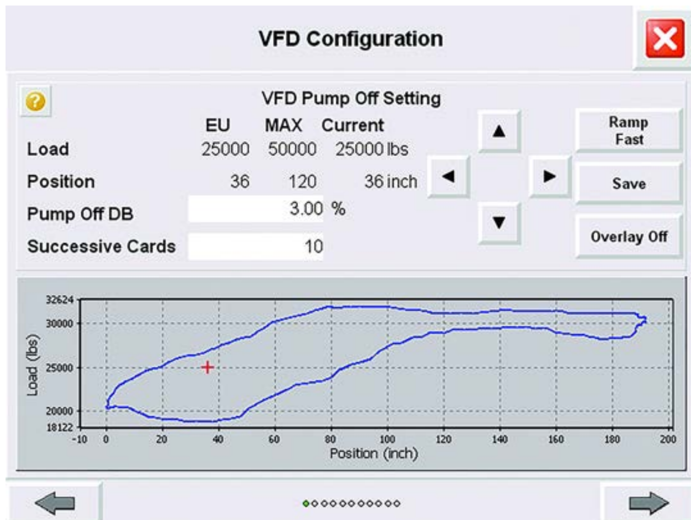
VFD Configuration

The VFD Configuration display has 11 pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

VFD Pump off Setting

This display helps visualize control parameters relative to the surface card during Variable Speed Pump Off operation mode.

Figure 188 - VFD Configuration Display 1: VFD Pump Off Setting

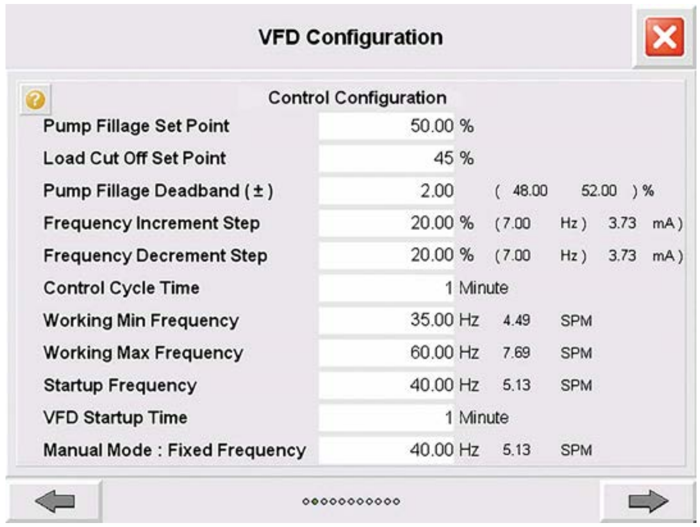


Row	Description
1	**Load:** The maximum permissible Load value, Current Load Pump Off Setpoint set using the Ramp Up/Down buttons and the EU value of the Load Pump Off Setpoint.
2	**Position:** The maximum permissible Position value, Current Position Pump Off Setpoint set using the Ramp Left/Right buttons and the EU value of the Position Pump Off Setpoint.
3	**Pump Off DB (Deadband):** This percentage is used by the INSTRUCT SRP to decide whether to maintain, increase, or decrease the pumping speed based on pump-off conditions. The INSTRUCT SRP maintains the current speed if downstroke intersection point falls inside of the deadband. The INSTRUCT SRP speeds up the pump if the downstroke intersection point falls outside to the right of the deadband. The INSTRUCT SRP slows down the pump if the downstroke intersection falls outside to the left of the deadband.
4	**Successive Cards:** The number of cards in which the strokes can fall outside the deadband before speed is adjusted.
5	**Ramp Left/Right Buttons:** Used to set the value of Position Pump off setpoint. **Ramp Up/Down Buttons:** Used to set the value of Load Pump off setpoint.
6	**Ramp Fast/Slow:** This button is used to toggle between two ramping speeds for both Load and Position ramp buttons.
7	**Save:** When the Save button is pressed, the pump-off setpoint is saved in the desired location on the surface card. Then, the pump-off setpoint card can be recalled from the Pumping System Analysis display (page 194).
8	**Overlay Off/Overlay On:** Press to toggle between one plot and overlay plots.
9	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.

Control Configuration

This display lets you configure parameters to verify accurate control and appropriate response in variable-speed operation modes. These settings require fine-tuning during commissioning and startup.

Figure 189 - VFD Configuration Display 2: Control Configuration

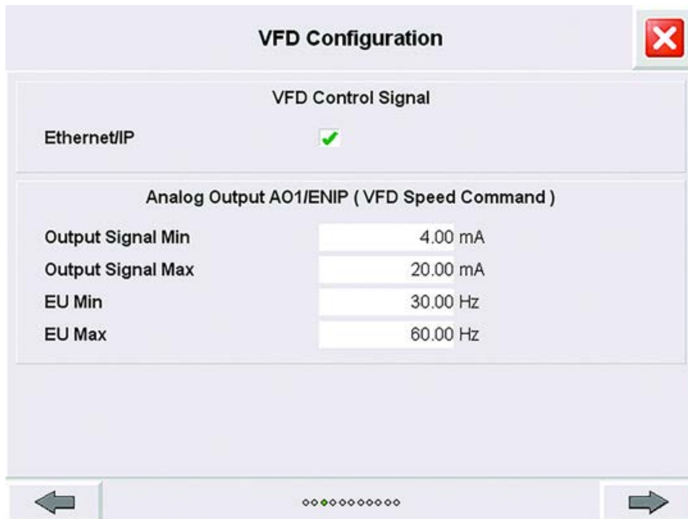


Row	Description
1	**Pump Fillage Set Point:** The value (in percent) of the desired target Pump Fillage. The INSTRUCT SRP either slows down or speeds up the Pump based on the comparison between the current calculated Pump Fillage percent and the target Pump Fillage percent.
2	**Load Cut Off Set Point:** This parameter allows the INSTRUCT SRP to calculate the Pump Fillage accurately when looking for the effective stroke-inflection point. For instance, if it is set to 45%, the INSTRUCT SRP starts looking from 45% between the End of upstroke to the beginning of the downstroke of the downhole card.
3	**Pump Fillage Deadband:** This percentage is used to calculate and compare the Pump Fillage to the current Pump Fillage. This allows the INSTRUCT SRP to decide whether to maintain, increase, or decrease the pumping speed. For instance, if the current Pump Fillage is within ±3% of the target Fillage, the INSTRUCT SRP does not change the pumping speed unless it falls outside of the ±3% deadband. If the pump fillage number is below the Pump Fillage Deadband, the INSTRUCT SRP slows down. The INSTRUCT SRP speeds up if the pump fillage number is above the deadband.
4	**Frequency Increment Step:** The percentage of the minimum working frequency increment step size that the INSTRUCT SRP sends to the VFD to increase speed.
5	**Frequency Decrement Step:** The percentage of the minimum working frequency decrement step size that the INSTRUCT SRP sends to the VFD to decrease speed.
6	**Control Cycle Time:** The time (in minutes) that the INSTRUCT SRP waits before it sends another command to increase or decrease the speed to reach the target Pump Fillage or the target pump-off setpoint. After the time has elapsed, the INSTRUCT SRP checks for the Pump Fillage or the target pump-off setpoint again to decide whether to adjust the speed. This value is adjusted depending on the operating conditions of the well. Some wells need more time than others to stabilize.
7	**Working Min Frequency:** The INSTRUCT SRP does not allow the frequency to go below the minimum working frequency during normal operation. The minimum working frequency helps prevent the VFD from going below this limit when the INSTRUCT SRP slows the pump down. This parameter also corresponds to the minimum working SPM allowed.
8	**Working Max Frequency:** The INSTRUCT SRP does not allow the frequency to go above the maximum working frequency during normal operation. The maximum working frequency helps prevent the VFD from going above this limit when the INSTRUCT SRP speeds up the pump. This parameter also corresponds to the maximum working SPM allowed.
9	**Startup Frequency:** The initial frequency at which the INSTRUCT SRP commands the VFD to run whenever the INSTRUCT SRP starts.
10	**VFD Startup Time:** The time period that the INSTRUCT SRP waits before it checks for a dry well condition and applies control to the well. This time period allows the well to stabilize before checking for any condition.
11	**Manual Mode: Fixed Frequency:** The commanded frequency that the VFD maintains in Variable Speed Manual operation mode. The INSTRUCT SRP commands the VFD to operate at this fixed frequency until this value is changed.

VFD Control Signal and VFD Speed Command

This display lets you configure the VFD control signal for controlling the VFD. It also lets you configure the analog output characteristics of the defined VFD Speed Command.

Figure 190 - VFD Configuration Display 3: VFD Control Signal and VFD Speed Command



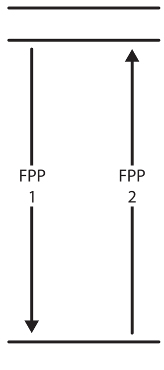
Row	Description
1	**EtherNet/IP** [1]**:** Used to select the VFD Control Signal for controlling VFD. Options available are Hardwired and EtherNet/IP.
2	**Output Signal Min:** The minimum output signal from the 4…20 mA signal for speed command to the VFD; it must be kept at 4 mA.
3	**Output Signal Max:** The maximum output signal from the 4…20 mA signal for speed command to the VFD; it must be kept at 20 mA.
4/5	**EU Min/Max:** The engineering value corresponding to 4…20 mA and EtherNet/IP. This value is the minimum/maximum frequencies in the range.

(1) Only applicable to PowerFlex 753 drives.

Fluid Pound Prevention

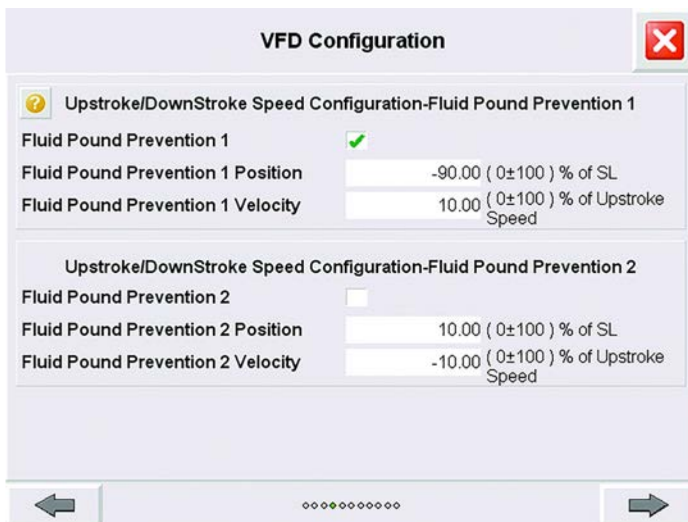
This display lets you configure the upstroke and downstroke speed to help prevent fluid pound. This feature is applicable only when Hall Effect/RPM or Proximity/RPM position sensors are used.

Table 7 - Fluid Pound Prevention



Feature	Description
Fluid Pound Prevention 1 (FPP 1) (Drop Portion of Stroke)	• The barrel is pushing into the collected fluid. • The rate of decent slows to lessen the stress that is placed on the pumping system. • Speed percentage is configurable within this zone. • The start of the speed adjustment is configurable (percentage of stroke length)
Fluid Pound Prevention 2 (FPP 2) (Lift Portion of Stroke)	• The barrel is lifting the collected fluid. • The rate of ascent increases to compensate for a reduced drop time. • Speed percentage is configurable within this zone. • The start of the speed adjustment is configurable (percentage of stroke length)

Figure 191 - VFD Configuration Display 4: Fluid Pound Prevention

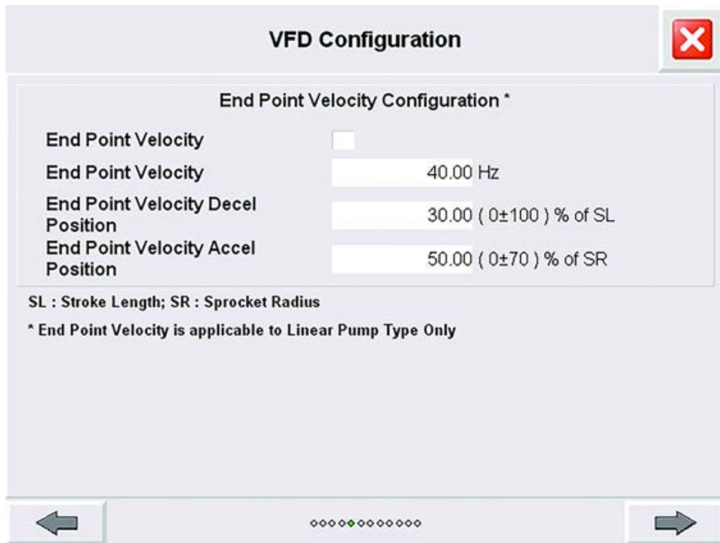


Row	Description
1	**Fluid Pound Prevention 1:** Check this box to enable the Fluid Pound Prevention 1 feature.
2	**Fluid Pound Prevention 1 Position:** The percent of stroke length at which the speed varies as per the Fluid Pound Prevention Velocity 1 setting.
3	**Fluid Pound Prevention1 Velocity:** The percent of reference speed by which the speed varies at the Fluid Pound Prevention Position 1.
4	**Fluid Pound Prevention 2:** Check this box to enable the Fluid Pound Prevention 2 feature.
5	**Fluid Pound Prevention 2 Position:** The percent of stroke length at which the speed varies as per the Fluid Pound Prevention Velocity 2 setting.
6	**Fluid Pound Prevention 2 Velocity:** The percent of reference speed by which the speed varies at the Fluid Pound Prevention Position 2.

End Point Velocity Configuration

This display allows you to configure the End Point Velocity feature. This feature is applicable only when Proximity/RPM position sensors are used with a linear pump type.

Figure 192 - VFD Configuration Display 5: End Point Velocity Configuration



Row	Description
1	**End Point Velocity:** Check this box to enable the End Point Velocity feature.
2	**End Point Velocity:** The fixed speed that is applied while traveling through the corner
3	**End Point Velocity Decel Position:** The percent of stroke length of the straight portion of the stroke where the speed starts decelerating before entering the corner
4	**End Point Velocity Accel Position:** The percent of the sprocket radius where the speed starts accelerating before exiting the corner.

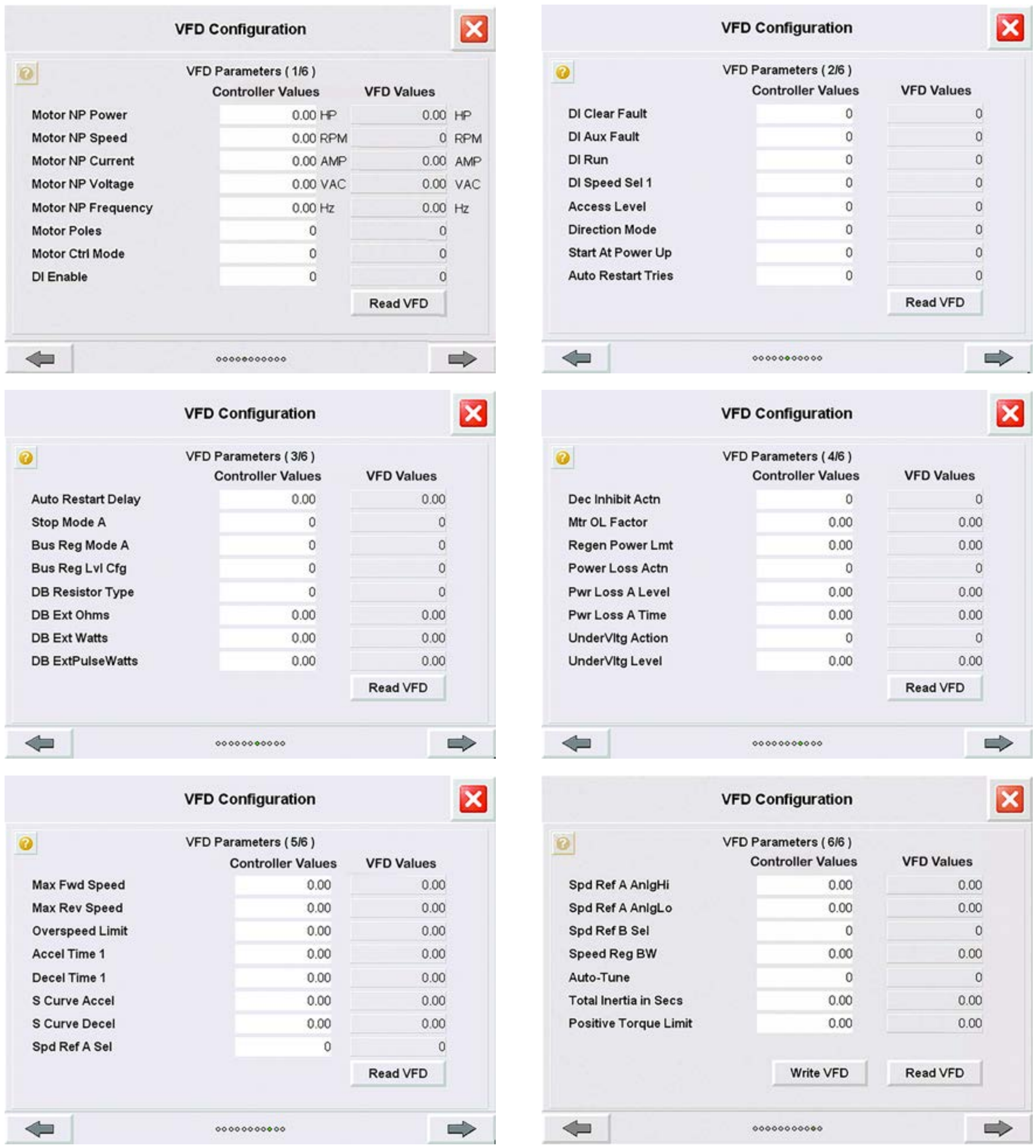
VFD Parameters

This display shows the values that are read from the PowerFlex 753 drive. These parameters are configured on the VFD during commissioning and are adjusted as needed. The parameters are polled through Modbus by the INSTRUCT SRP. For details on VFD parameters, see the PowerFlex 753 programming manual (publication 750-PM001).

ATTENTION: The VFD parameters can only be modified when the VFD is stopped. Never modify while VFD is running.

Press the Read VFD button on the VFD Parameters displays to read the current VFD parameters. After configuring the parameters, press the Write VFD button on the last parameter display to send the updated values to the VFD.

Figure 193 - VFD Configuration Display 6…11: VFD Parameters

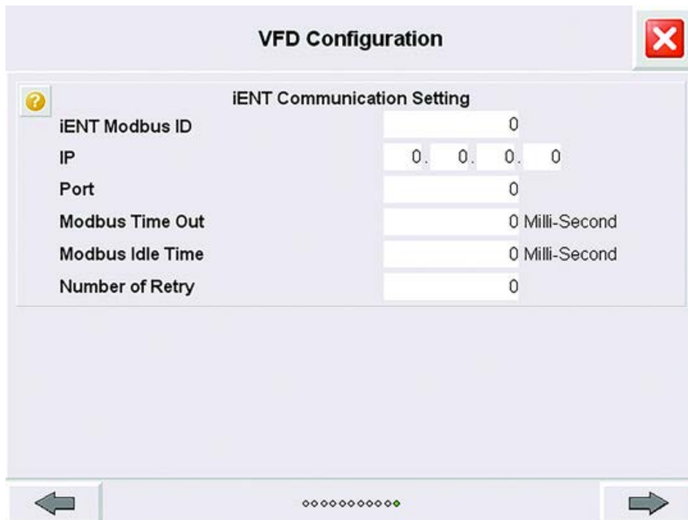


iENT Communication Setting

On this display, iENT Communication Settings let you change the VFD interface communication parameters to the 1759-iENT gateway using Modbus TCP to read the parameters of the VFD. The default communication comes factory-configured. Only qualified technical personnel can adjust it.

IMPORTANT	iENT Communication Settings are for older firmware revisions. With the latest firmware release, the 1759-iENT gateway and this configuration display are no longer required.

Figure 194 - VFD Configuration Display 12: iENT Communication Setting



Row	Description
1	**iENT Modbus ID:** The iENT Modbus ID required for iENT Communication.
2	**IP:** The IP address of the iENT.
3	**Port:** The iENT Modbus Port Number.
4	**Modbus Time Out:** The Modbus Time Out period (in milliseconds) for the Communication between VFD Master and VFD.
5	**Modbus Idle Time:** The interval (in ms) for which the VFD Master remains idle before sending the next message to VFD.
6	**Number of Retry:** The number of times the VFD Master retries sending a query if it fails.

Alarm Configuration

The Alarm Configuration display has five pages. Progress through multiple pages of a display by pressing the arrows at the bottom of the display.

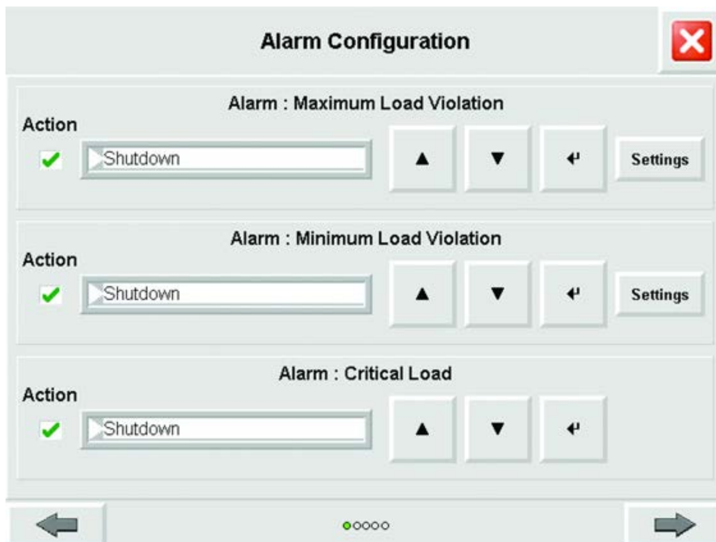
Load Violation and Critical Load

This display lets you enable and disable maximum load violation, minimum load violation, and critical load alarms by pressing the Action checkbox.

The alarms are also linked to an action, which can be No Action or Shutdown. Press the up ( )/down ( ) buttons to select the needed action and press the Enter ( ) button to set the action.

Press the Settings button of maximum and minimum load violation to show the Load Violation Setting display (Figure 196).

Figure 195 - Alarm Configuration Display 1: Load Violation and Critical Load



Row	Description
1	**Maximum Load Violation:** The actual load value goes above the limit that is set for maximum load violation, an alarm is raised. If the well is shut down due to maximum load violation, you must reset the error before attempting to operate the well again.
2	**Minimum Load Violation:** If the actual load value goes below the limit that is set for minimum load violation, an alarm is raised. If the well is shut down due to minimum load violation, you must reset the error before attempting to operate the well again.
3	**Critical Load:** This alarm is raised when a load that is detected at the polished rod is equal to or greater than the recommended capacity of the pumping unit structure. For example, a value equal to or greater than 36,500 lb (16,556 kg) would be the critical load value for a pumping unit with API designation C-640D-365-144.

On the Load Violation Setting faceplates, you can enable the maximum and minimum load violation features and their corresponding trigger boundaries. The associated alarm actions are set on the Alarm Configuration display (Figure 195). You must reset the alarm before attempting to operate the well again.

Figure 196 - Load Violation Setting

Row	Description
1	**Enable Load Violation (Minimum/Maximum):** When checked, these load violations are enabled. The INSTRUCT SRP checks for load minimum and maximum violations. When a load violation is found, the INSTRUCT SRP raises an alarm and performs the configured alarm action. The red lines in the cards indicate the upper and lower limits.
2	**Minimum/Maximum Load:** The minimum/maximum load value limit (in pounds) for detection of the minimum load violation.
3	**Load Violation Count:** The number of times the maximum or minimum load violations must be found before an alarm is raised.
4	**Show Limits:** Pressing this button updates the load limit red lines in the Surface Card Plot.
5	**Save:** Pressing this button saves the limits to your INSTRUCT SRP.
6	**Surface Card Plot:** The single plot is updated automatically. The refresh rate is half of the SPM. If the SPM is 3, the refresh time is 10 seconds.

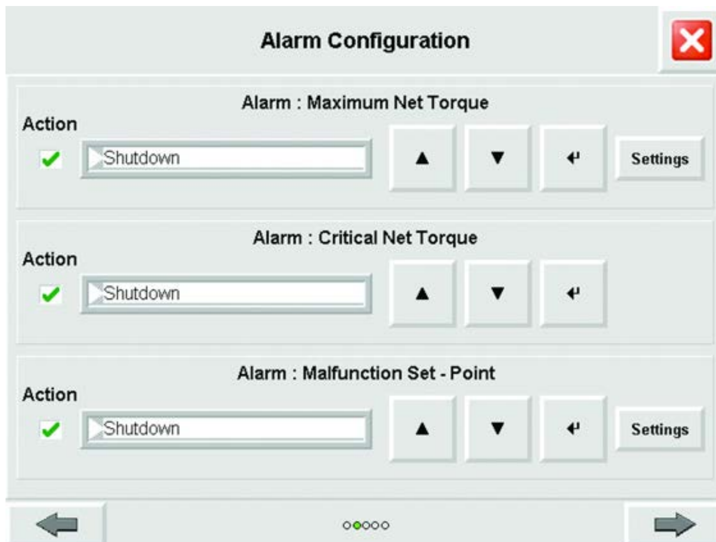
Net Torque and Malfunction Setpoint

This display lets you enable and disable maximum net torque, critical net torque, and malfunction setpoint alarms by pressing the Action checkbox.

The alarms are also linked to an action, which can be No Action or Shutdown. The actions are selected from the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons.

Pressing the Settings button of maximum net torque and malfunction setpoint takes you to the Net Torque Setting (Figure 198 on page 176) and Malfunction Setting faceplates (Figure 199 on page 177), respectively.

Figure 197 - Alarm Configuration Display 2: Net Torque and Malfunction Setpoint

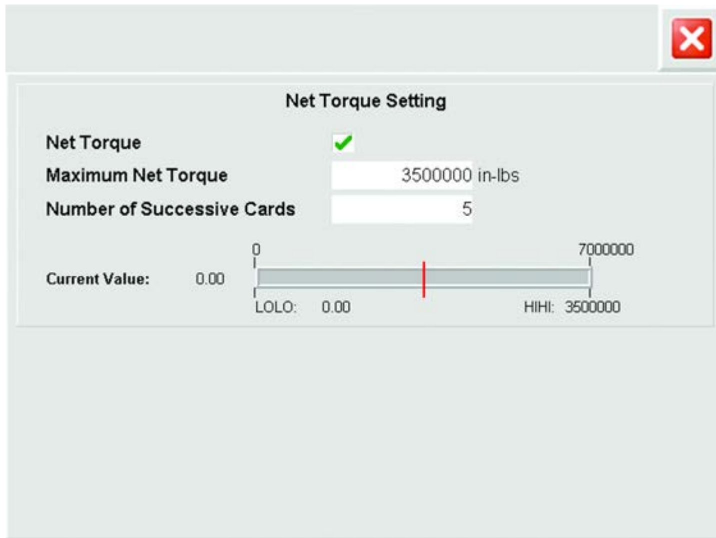


Row	Description
1	**Maximum Net Torque:** This alarm is raised when the actual calculated net torque at the gearbox goes above the limit that is set for the net torque violation.
2	**Critical Net Torque:** This alarm is raised when the net torque that is detected at the gearbox rod is equal to or greater than the recommended capacity of the gearbox. For example, a value of 72,310 N•m (640,000 in•lb) would be the critical net torque value for a pumping unit with API designation C-640D-365-144.
3	**Malfunction Set Point:** This alarm is raised if a malfunction setpoint violation is detected on the upstroke of the surface card. After a preset number of violations, the well performs the configured action.

On the Net Torque Setting faceplate, you can control the maximum net torque feature that can have an associated alarm action when triggered.

The HiHi and LoLo setpoints along with the current value of net torque are also represented in the bar graph.

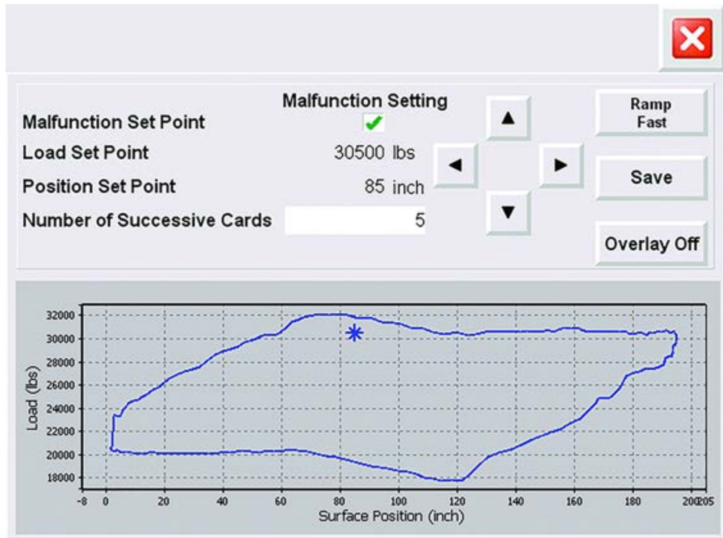
Figure 198 - Net Torque Setting



Row	Description
1	**Net Torque:** When enabled (checked), the INSTRUCT SRP raises an alarm and performs the configured alarm action after a preset number of cards with the maximum net torque violation.
2	**Maximum Net Torque:** The maximum net torque value limit (in in•lb) for detection of maximum load violation.
3	**Number of Successive Cards:** The number of consecutive cards in which the maximum net torque must be violated before declaring an alarm and performing the configured alarm action. (Range 0…10)
4	**Current Value:** A display of the current value of net torque.

On the Malfunction Setting faceplate, you can control the malfunction setpoint feature that has an associated alarm action when triggered. You can enable and adjust this feature directly from the Malfunction Setting display (Figure 197).

Figure 199 - Malfunction Setting



Row	Description
1	**Malfunction Set Point:** When enabled (checked), the INSTRUCT SRP raises an alarm and performs the configured alarm action after a preset number of cards with the malfunction setpoint violation.
2	**Load Set Point:** The value of load malfunction setpoint.
3	**Position Set Point:** The value of position malfunction setpoint.
4	**Number of Successive Cards:** The number of consecutive cards in which the malfunction setpoint must be violated before declaring an alarm and performing the configured alarm action. (Range = 1…10)
5	**Ramp Left/Right Buttons:** Used to set the value of position malfunction setpoint. **Ramp Up/Down Buttons:** Used to set the value of load malfunction setpoint.
6	**Ramp Fast/Slow:** Used to toggle between two ramping speeds for both load and position ramp buttons.
7	**Save:** Press to save the malfunction setpoint in the desired location on the surface card.

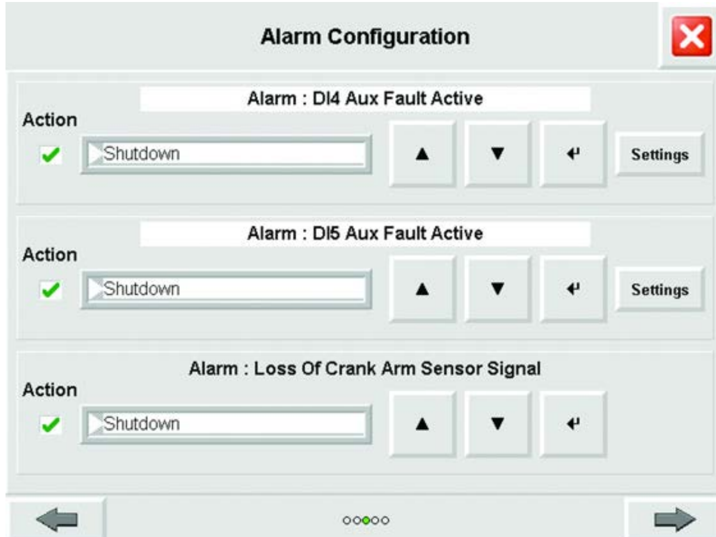
Aux Fault and Loss of Crank Arm Sensor

This display lets you enable and disable DI4 aux fault, DI5 aux fault, and loss of crank arm sensor signal alarms using the Action checkbox on the display. The alarm name of DI4 aux fault and DI5 aux fault alarms can also be changed from this display.

The alarms are also linked to an action, which can be No Action or Shutdown. The actions are selected from the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons.

Pressing the Settings button of DI4 aux fault active and DI5 aux fault active takes you to the DI4 Auxiliary Fault Configuration and DI5 Auxiliary Fault Configuration faceplates (Figure 201), respectively.

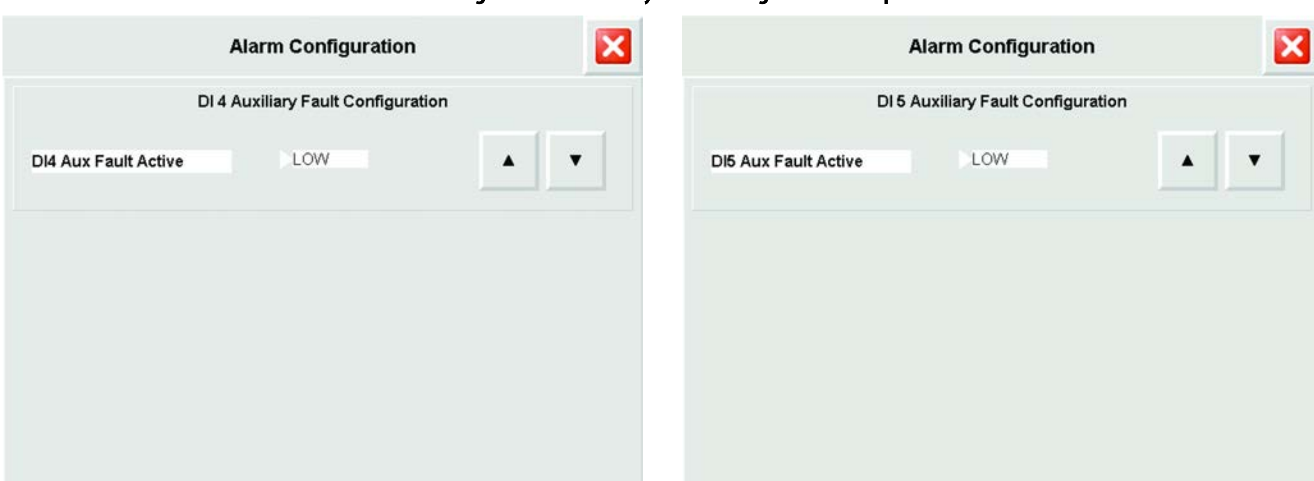
Figure 200 - Alarm Configuration Display 3: Aux Fault and Loss of Crank Arm Sensor



Row	Description
1	**DI4 Aux Fault:** This alarm is raised when the DI4 signal is lost or detected depending on the configuration for "High" or "Low" set for the digital input channel. The DI4 channel is used for any customer-supplied kill switch signal to stop the motor.
2	**DI5 Aux Fault:** This alarm is raised when the DI5 signal is lost or detected depending on the configuration for "High" or "Low" set for the digital input channel. The DI5 channel is reserved for an optional E-stop button to stop the motor.
3	**Loss of Crank Arm Sensor Signal:** This alarm is raised when the Hall Effect Crank Arm Sensor trigger does not come within the user configurable time.

The DI 4 and DI 5Auxiliary Fault Configuration faceplates let you configure the DI 4 and DI 5 auxiliary fault active status either as High or Low. Press the up (▲)/down (▼) buttons to make your selection.

Figure 201 - Auxiliary Fault Configuration Faceplates



Row	Description
1	**DI4/DI5 Aux Fault:** Use to set the DI 4 or DI 5 active status as High or Low. This state is selected using the up/down arrow keys.

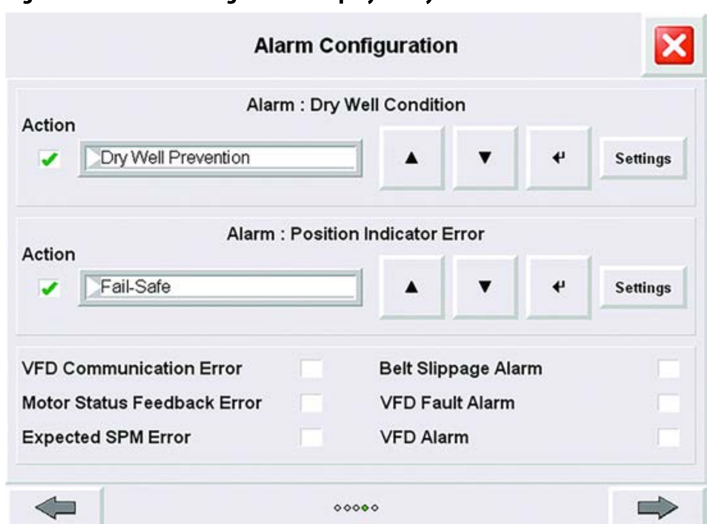
Dry Well Condition and Position Indicator Error

This display lets you enable and disable dry well condition, position indicator error, VFD communication error, motor status feedback error, expected SPM error, belt slippage alarm, VFD fault alarm, and VFD alarm by pressing the Action checkbox.

The Dry Well Condition and Position Indicator Error alarms are also linked to an action, which can be No Action and Dry Well Prevention for dry well prevention alarm and No Action, Shutdown, Fail-safe, and Run VFD at Minimum Frequency for position indicator error alarm. The actions are selected from the menu for each alarm by pressing the up (▲)/down (▼) and Enter (↵) buttons.

When the Dry Well Prevention (for dry well condition) or Fail-safe (for position indicator error) actions are selected, a Settings button appears. Pressing the Settings button takes you to the Dry Well Prevention (Figure 203 on page 180) Fail-safe Time Setting faceplates (Figure 204 on page 181).

Figure 202 - Alarm Configuration Display 4: Dry Well Condition and Position Indicator Error

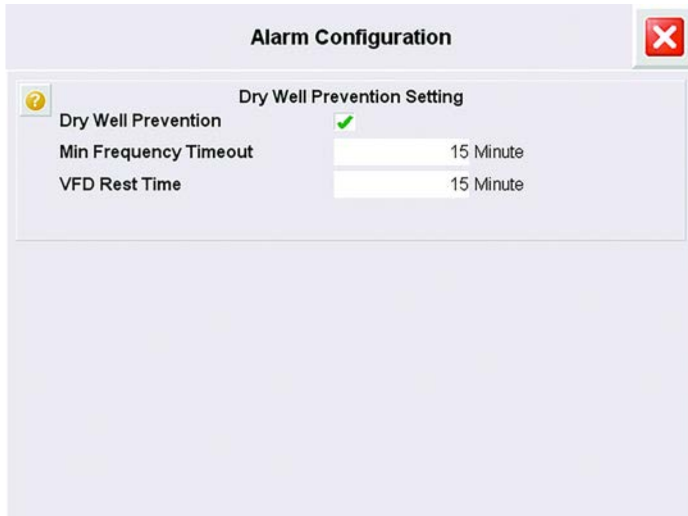


Row	Description
1	**Dry Well Condition:** This alarm is present when a dry well condition is present. When the Dry Well Condition feature is enabled, the INSTRUCT SRP shuts down the VFD after a preset time if the well is not reaching the target Pump Fillage or target pump-off setpoint value and the VFD frequency is already running at minimum speed.
2	**Position Indicator Error:** If an incomplete card or no cards are detected due to position signal error, a Position Indicator Error alarm is raised. This alarm resets when the condition ceases to exist. Check the inclinometer signal for any anomalies. This alarm has the additional options of Fail-safe(1) and Minimum Speed. Fail-safe is as fall-back mode only selectable in the Fixed Speed Pump Off mode. When Minimum Speed is selected, the INSTRUCT SRP commands the VFD to run at the minimum working speed in any variable speed mode.
3	**VFD Communication Error:** This alarm appears when the INSTRUCT SRP is unable to read the VFD parameters from the VFD.
4	**Motor Status Feedback Error:** This alarm is raised if the INSTRUCT SRP fails to detect a motor feedback signal for ON/OFF status. If the command is sent to the motor to Start or Stop and the feedback signal indicates the opposite, the INSTRUCT SRP raises this alarm.
5	**Expected SPM Error:** The expected SPM error appears when there is a mismatch between the measured SPM from the surface card and the SPM calculated from the commanded frequency. The condition appears when there is a difference of more than set limit of SPM deadband between the calculated SPM from the VFD frequency and the measured current surface card SPM. This alarm resets automatically when the condition ceases to exist.
6	**Belt Slippage Alarm:** This alarm is raised when the calculated belt slippage percentage is more than the user-configured belt slippage limit.
7	**VFD Fault Alarm:** Faults read directly from the Powerflex 753/755 drive through EtherNet/IP.
8	**VFD Alarm:** Alarms read directly from the Powerflex 753/755 drive through EtherNet/IP.

(1) Fail-safe is available in the following operation modes: fixed speed timer, fixed speed pump fillage, variable speed pump off, and variable speed pump fillage.

The Dry Well Prevention Setting display lets you verify the appropriate response when a dry well condition occurs while the feature is enabled. A dry well prevention state is an associated action that is configured through the Alarm Configuration display (page 173).

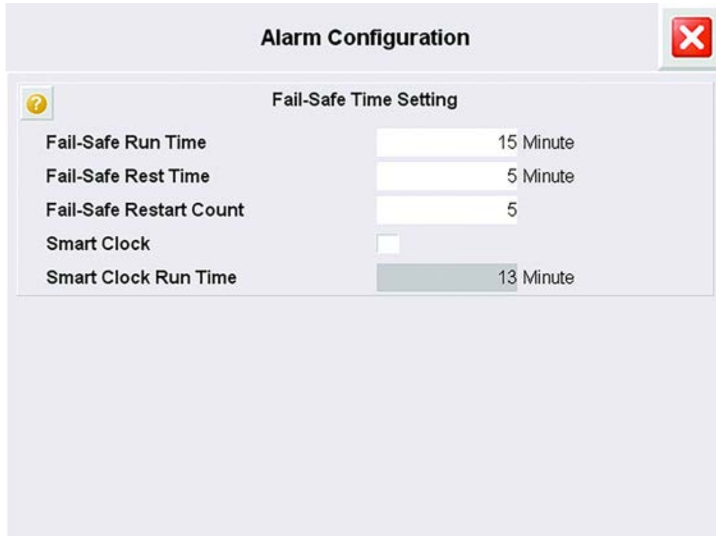
Figure 203 - Dry Well Prevention Setting



Row	Description
1	**Dry Well Prevention:** When this feature is enabled, the INSTRUCT SRP commands the VFD to shut down after a preset time if the well is not reaching its target Pump Fillage or target pump-off setpoint value and the VFD frequency is already running at minimum speed.
2	**Min Frequency Timeout:** The time period that the INSTRUCT SRP waits before shutting down after detecting that the VFD is running at minimum frequency without reaching the target Pump Fillage or pump-off setpoint.
3	**VFD Rest Time:** The time that the well remains shut down in Rest state until the INSTRUCT SRP commands the VFD to RUN the well again.

The Fail-safe Time Setting display (=.) lets you configure the fail-safe configuration parameters for fixed speed modes.

Figure 204 - Fail-safe Time Setting



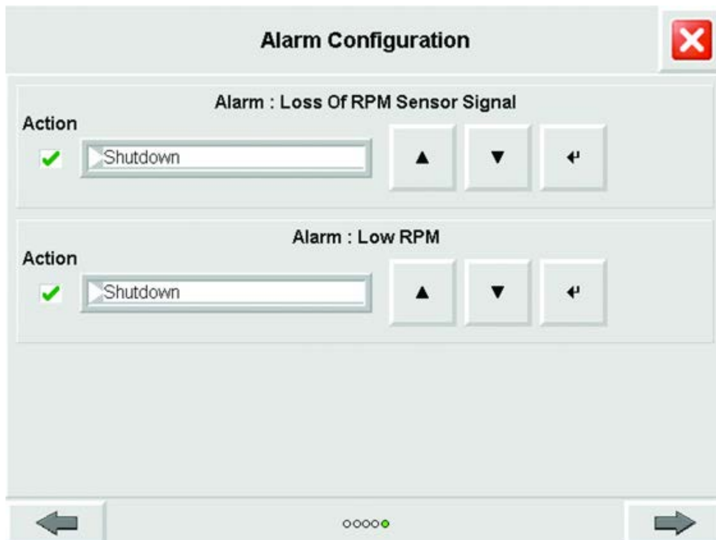
Row	Description
1	**Fail-safe Run Time:** When operating in POC mode, the INSTRUCT SRP falls into Fail-safe state if a fault condition that prevents the INSTRUCT SRP from monitoring the well position indicator error is detected. To cycle the well, you must specify the runtime and the rest time. The Fail-Safe Runtime is the time that the well stays in Run state before going into Rest state. (Range = 1…1440)
2	**Fail-safe Rest Time:** When operating in Fixed Speed Pump Off mode, the INSTRUCT SRP falls into Fail-safe state if a fault condition that prevents the INSTRUCT SRP from monitoring the well position indicator error is detected. To cycle the well, you must specify the runtime and the rest time. The Fail-Safe Rest time is the time that the well stays in Rest state before going into Run state. (Range = 1…1440)
3	**Fail-safe Restart Count:** The number of times that the INSTRUCT SRP attempts to start the motor if an error that causes it to shut down after it has sent the start command is detected again. (Range = 0…10)
4	**Smart Clock:** When enabled, the current runtime of the INSTRUCT SRP is calculated based on an average of the past 24 hours run cycles of the Fixed Speed Pump Off mode. The INSTRUCT SRP also displays Fail-safe state.
5	**Smart Clock Run Time:** The current calculated runtime for smart clock.

Loss of RPM Sensor and Low RPM

This display lets you enable and disable loss of RPM sensor signal and low RPM alarms by pressing the Action checkbox.

The alarms are linked to an action, which can be No Action or Shutdown. The actions are selected from the menu for each alarm by pressing the up (▲)/ down (▼) and Enter (↵) buttons.

Figure 205 - Alarm Configuration Display 5: Loss of RPM Sensor and Low RPM



Row	Description
1	**Loss of RPM Sensor Signal:** This alarm is triggered if a signal from the RPM Hall Effect sensor cannot be detected within a user-defined time window value (No RPM Detect timeout) in seconds. The default value is 20 seconds.
2	**Low RPM:** This alarm is raised when the calculated RPM is less than the user configured low RPM limit.

General Configuration

The General Configuration display has three pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

RTU Power On State and Default Screen

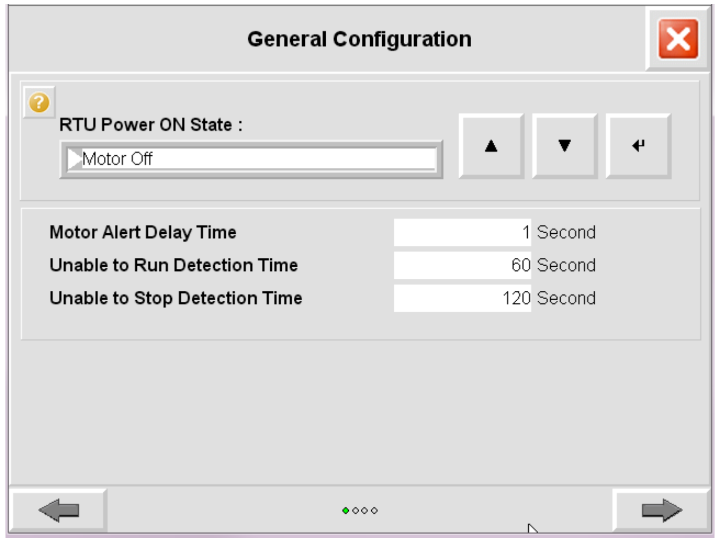
This display lets you set the default motor state when the INSTRUCT SRP reboots. You can select the motor state from the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons.

This display also lets you select the default screen from the options that are listed in the table following Figure 206 by pressing the up (▲)/down (▼) and Enter (↵) buttons.

You can also configure the following from this display:

- The interval for which DO4 is enabled before starting the motor in any mode.
- The delay time for unable to run motor signal and unable to stop motor signal.

Figure 206 - General Configuration Display 1: RTU Power On State

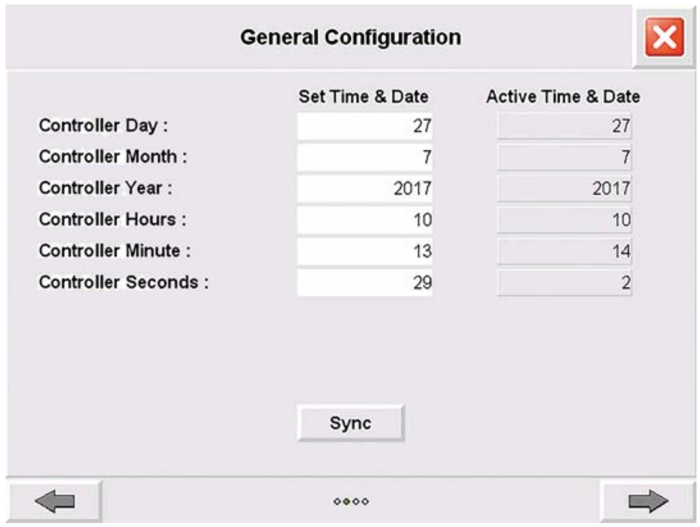


Row	Description
1	**RTU Power ON State:** Used to select the default state when the INSTRUCT SRP reboots. • Motor OFF: The motor is OFF upon rebooting the INSTRUCT SRP • Auto-start: The motor auto starts by default after rebooting the INSTRUCT SRP.
2	**Motor Alert Delay Time:** The duration set for an alert signal through DO4 before commanding the motor to start. This delay allows a visual or audible 24V DC hardware that is wired into DO4 to send an alert signal before the commanding the motor to start. (Range = 0…60)
3	**Unable to Run Detection Time:** The duration set for which if the actual card is not detected. For example, position signal and load signal are not changing after the "Motor ON" command is given, Well goes to 'Unable to Run' State. (Range = 60…900)
4	**Unable to Stop Detection Time:** The duration set for which if the actual card is detected. For example, position signal and load signal are changing dynamically after the "Motor OFF" command is given, Well goes to 'Unable to Stop' State. (Range = 60…900)

Time and Date

This display contains the current (active) time and date settings of the system. This display lets you modify the time and date. When you enter new time and date values in the Set Time and Date column and press the Sync button, the new system time and date are set. Once new Active Time and Date are synced, all Set Time and Date fields become 0.

Figure 207 - General Configuration Display 2: Time and Date



Row	Description
1	**Controller Day:** The new day value to be set in the system. This value is set in the system when the Sync button is pressed. The current day value is displayed next to the input field and appears dimmed. (Range = 1…31)
2	**Controller Month:** The new month value to be set in the system. This value is set in the system when the Sync button is pressed. The current month value is displayed next to the input field and appears dimmed. (Range = 1…12)
3	**Controller Year:** The new year value to be set in the system. This value is set in the system when the Sync button is pressed. The current year value is displayed next to the input field and appears dimmed. (Range = 1…4095)
4	**Controller Hours:** The new hours value to be set in the system. This value is set in the system when the Sync button is pressed. The current hours value is displayed next to the input field and appears dimmed. (Range = 0…23)
5	**Controller Minutes:** The new minutes value to be set in the system. This value is set in the system when the Sync button is pressed. The current minutes value is displayed beside input field and appears dimmed. (Range = 0…59)
6	**Controller Seconds:** The new seconds value to be set in the system. This value is set in the system when the Sync button is pressed. The current Seconds value is displayed next to the input field and appears dimmed. (Range = 0…59)

Gauge Off Time

This display lets you configure gauge off time. Gauge off time (GOT) is used to offset the calculation of totals for a day. The INSTRUCT SRP consists a number of data accumulators, GOT allows you to set the time of day when the data buffer is totaled.

It also displays the current GOT hour and minute set in the INSTRUCT SRP system in the display fields present beside the configuration fields.

Figure 208 - General Configuration Display 3: Gauge Off Time Configuration

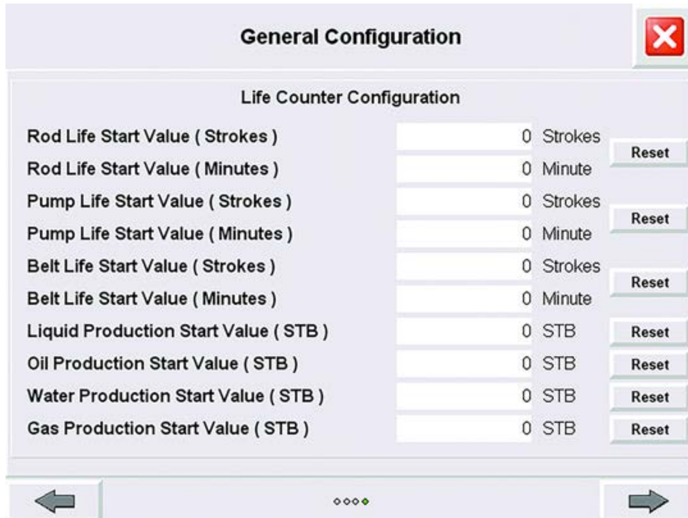
Row	Description
1	**Gauge Off Time Hour:** The hour of day at which the data buffer is totaled. This setting determines when to do the calculation cutoff for the data accumulators.
2	**Gauge Off Time Minute:** The minute of hour at which the data buffer is totaled. This setting determines when to do the calculation cutoff for the data accumulators.
3	**Set:** Once the new Gauge Off Time hour and minute values are configured and Set button is pressed, the newly configured values are written in the INSTRUCT SRP.

Life Counter Configuration

This display lets you set the initial value to start counting from (if a nonzero value is needed). Enter an initial value or the value where the life counter starts counting from for each parameter shown.

Press the Reset button to reset the parameter values that have been collected since commissioning (or previous reset).

Figure 209 - General Configuration Display 4: Life Counter Configuration



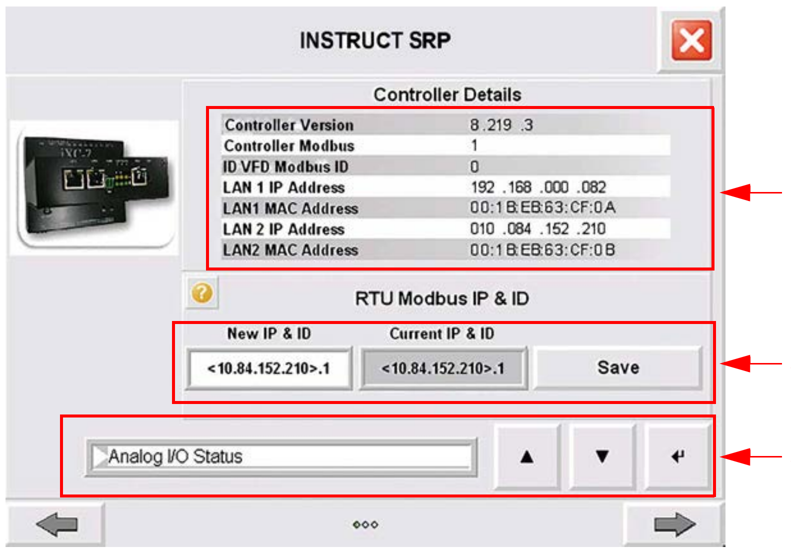
Hardware and Diagnostics

The Hardware and Diagnostics display has three pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Controller Details

This display provides hardware and software details of the INSTRUCT SRP. It also provides navigation to the Analog I/O Status and Digital I/O Status faceplates. To select an I/O Status faceplate, use the up ( )/down ( ) and Enter ( ) buttons.

Figure 210 - Controller Details

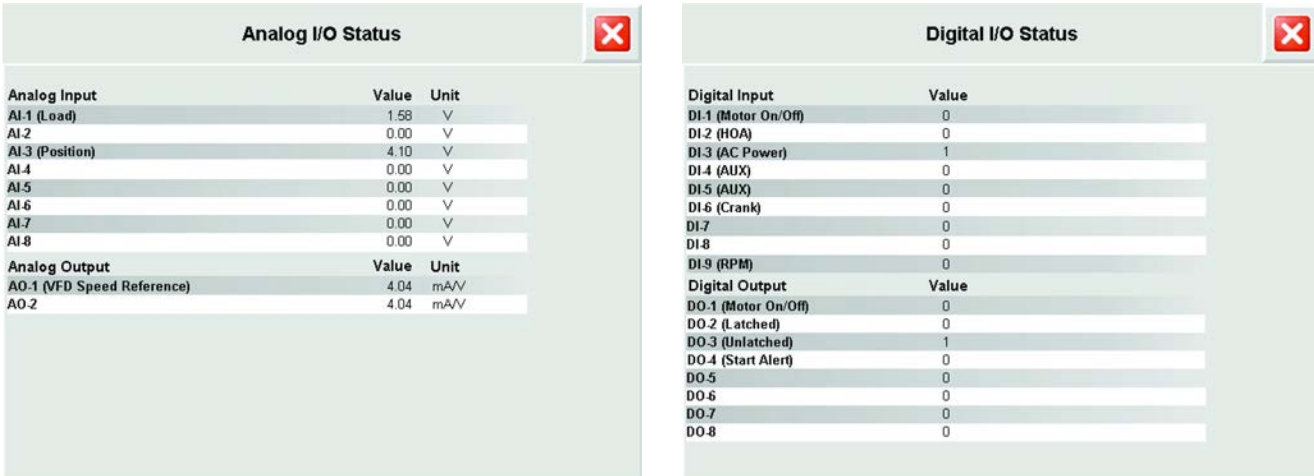


Row	Description
1	**Controller Parameters:** Current controller parameters that are stored in the INSTRUCT SRP.
2	**RTU Modbus IP & ID:** Used to change or update the IP or ID address of your PanelView terminal to enable communication with the controller after the IP or ID have been changed in the controller through the web server.
3	**Analog/Digital I/O Status:** Use the up/down arrow and enter button to make your selection.

The Analog I/O Status faceplate shows the status of all analog inputs (in V) and outputs (in mA/V).

The Digital I/O Status faceplate shows the status of all digital inputs and outputs. The values for the digital I/Os can be 1 for high or 0 for low.

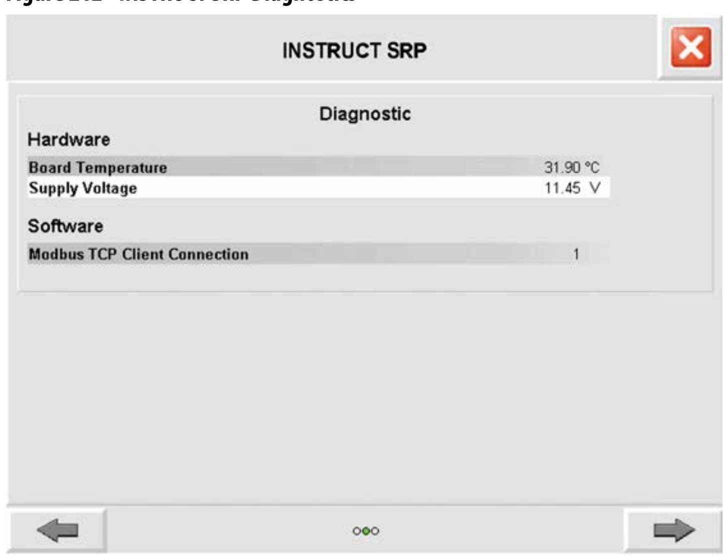
Figure 211 - Analog and Digital I/O Status



INSTRUCT SRP Diagnostics

This display shows information that is related to hardware and software diagnostics such as board temperature, supply voltage, and Modbus TCP client connection.

Figure 212 - INSTRUCT SRP Diagnostics

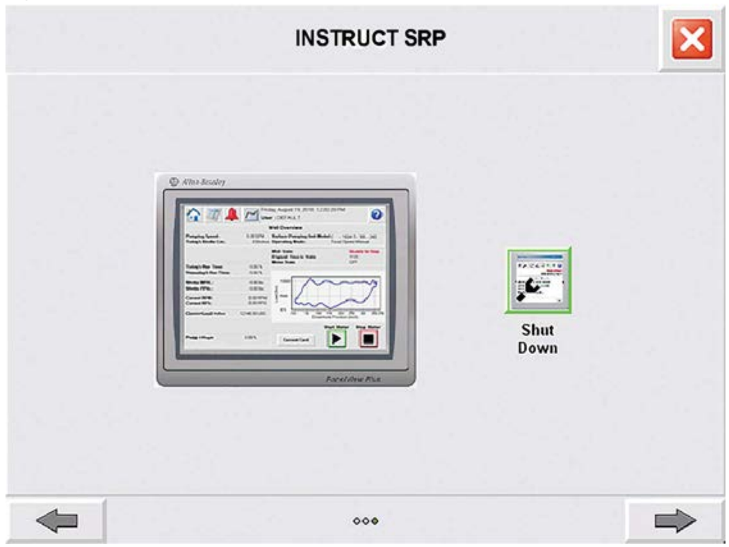


Row	Description
1	**Board Temperature:** The temperature of the controller board.
2	**Supply Voltage:** The currently supplied voltage to the controller.
3	**Modbus TCP Client Connection:** The number of TCP client users that are connected to the controller.

INSTRUCT Shutdown

This display allows you to shut down the Panel View HMI display application (.MER) by pressing the Shut Down button.

Figure 213 - INSTRUCT SRP Shutdown



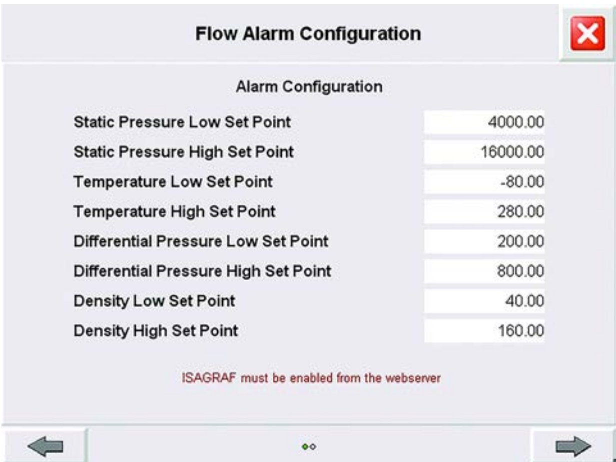
IMPORTANT	If the Shut Down button is pressed, or selected, this action halts the INSTRUCT SRP application on the PanelView terminal**2**‘\31 However, the INSTRUCT SRP application, on the QRATE iXC2 High Performance Edge Controller, will continue to *=8=8*run without interruption.

Gas Flow Alarm Configuration

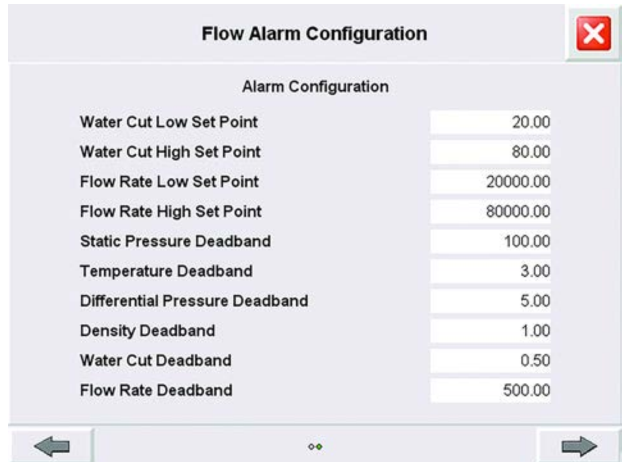
IMPORTANT	ISAGRAF® must be running to enable this application.

Use the Gas Flow Configuration displays to configure alarm setpoints. Press the number field that you would like to configure. Enter a new value in the popup keypad and press the Enter ( ) button to set the value.

Figure 214 - Gas Flow Configuration Display 1/2: Alarm Configuration



Display 1



Display 2

Row	Description
Display 1	
1/2	**Static Pressure Low/High Set Point:** If the detected low/high static pressure is outside the values set here (plus the deadband set on Display 2), an alarm is raised.
3/4	**Temperature Low/High Set Point:** If the detected low/high temperature is outside the values set here (plus the deadband set on Display 2), an alarm is raised.
5/6	**Differential Pressure Low/High Set Point:** If the detected low/high differential pressure is outside the values set here (plus the deadband set on Display 2), an alarm is raised.
7/8	**Density Low/High Set Point:** If the detected low/high density is outside the values set here (plus the deadband set on Display 2), an alarm is raised.
Display 2	
1/2	**Water Cut Low/High Set Point:** If the detected low/high water cut is outside the values (and deadband) set here, an alarm is raised.
3/4	**Flow Rate Low/High Set Point:** If the detected low/high flow rate is outside the values (and deadband) set here, an alarm is raised.
5… 10	**Static Pressure, Temperature. Differential Pressure, Density, Water Cut, and Flow Rate Deadband:** These percentages are used to calculate and compare the setpoint to the current value. If the values fall outside the setpoint plus the deadband, the controller decides whether to raise an alarm.

Alarm Display

The Alarm Configuration display has three pages that provide information of past alarms and events that your INSTRUCT SRP has encountered. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Alarm and Event Summary

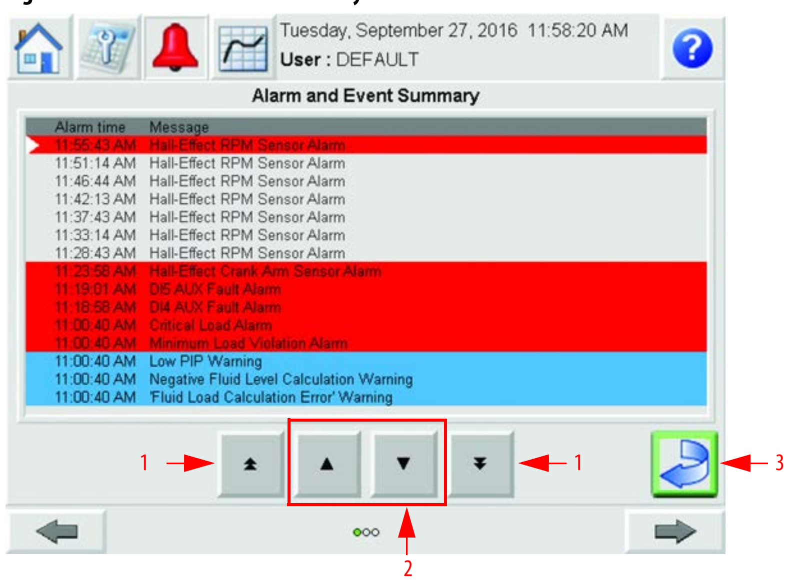
This display shows the Alarms and Events that have occurred in INSTRUCT SRP.

Active alarms are displayed as black text with a red blinking background, active events are displayed as black text with a blinking blue background. Inactive alarms are displayed as black text with a solid gray background.

The row up/down and page up/down buttons are provided to navigate the list. The Reset button is used to reset all active alarms.

For details on alarm definitions, see Alarm Configuration on page 173.

Figure 215 - Alarm and Event Summary



Row	Description
1	**Page Up/Down Buttons:** Press to scroll up and down a page.
2	**Row Up/Down Buttons:** Press to scroll up and down a row.
3	**Reset Button:** Used to reset all active alarms.

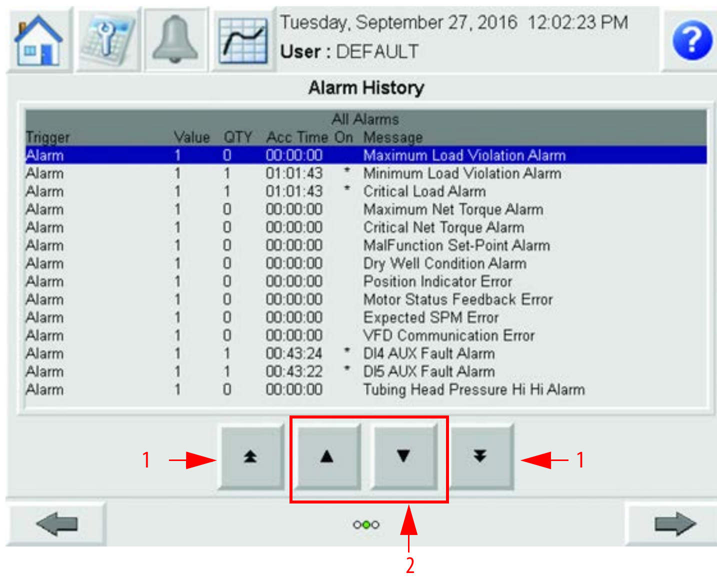
Alarm History

This display shows the history of all alarms that have occurred in INSTRUCT SRP.

It shows the Trigger, Value, Quantity, Accumulated Time of Alarm, Current active/inactive status, and Alarm Message. The row up/down and page up/down buttons are provided to navigate the list.

For details on alarm definitions, see Alarm Configuration on page 173.

Figure 216 - Alarm History



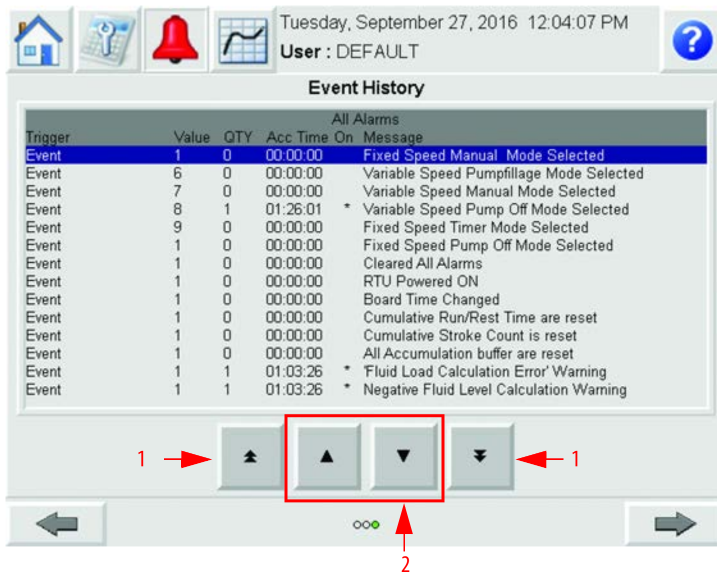
Row	Description
1	**Page Up/Down Buttons:** Press to scroll up and down a page.
2	**Row Up/Down Buttons:** Press to scroll up and down a row.

Event History

This display shows the history of all events that have occurred in INSTRUCT SRP.

It shows the trigger, value, quantity, accumulated time of event, current active/inactive status, and event message. The row up/down and page up/down buttons are provided to navigate the list.

Figure 217 - Event History



Row	Description
1	**Page Up/Down Buttons:** Press to scroll up and down a page.
2	**Row Up/Down Buttons:** Press to scroll up and down a row.

Trend Display

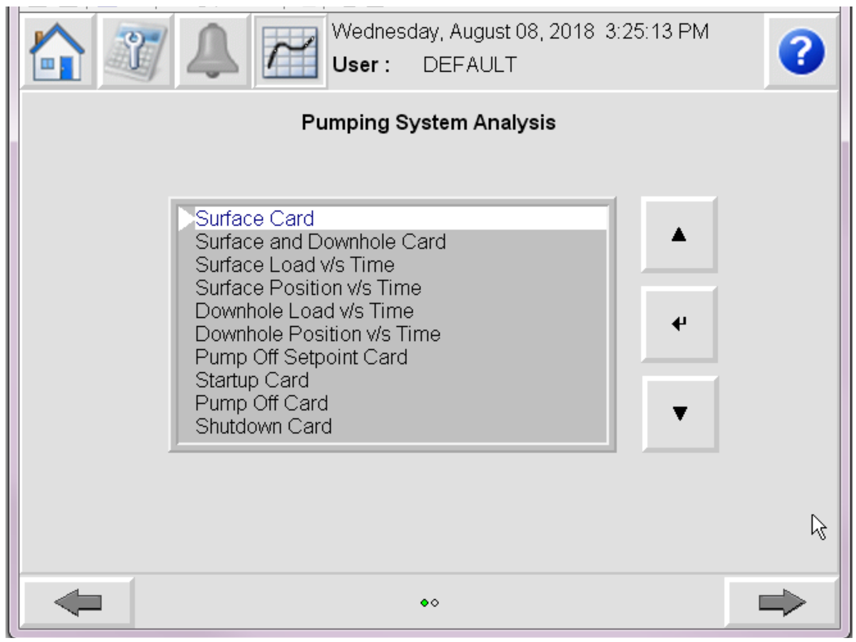
The Trend display has two pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Pumping System Analysis

This display provides navigation links to the saved cards. These displays contain graphs for INSTRUCT SRP analysis, saved POS cards, and troubleshooting cards for various well fault conditions.

The cards of a particular type are selected from the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons. Once the card is selected, it is highlighted with a white background. Press the View button to access this information.

Figure 218 - Trend Display 1: Pumping System Analysis



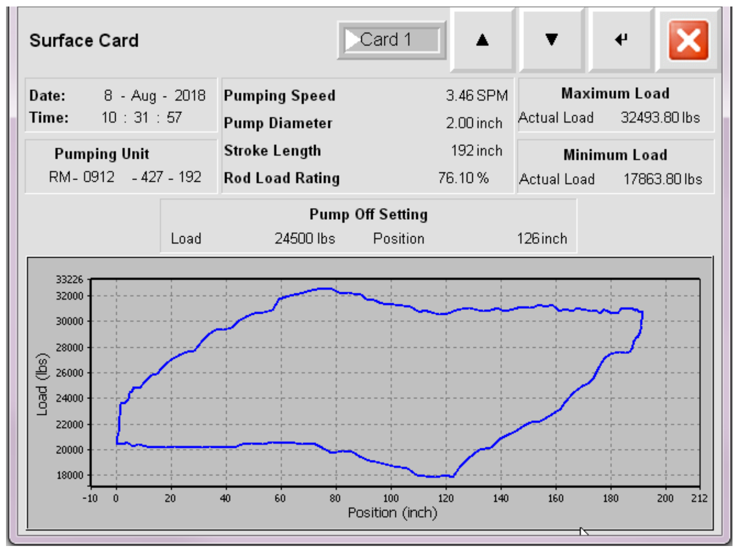
Row	Description
1	**Surface Card (Figure 219 on page 195):** This card processes the incoming load and position data from load and position sensors, respectively. It is the plot of load against position for one full pump cycle (upstroke and downstroke). The Surface Card display shows the pump-off setpoint, the peak loads, and the minimum loads for the surface card.
2	**Surface and Downhole Card (Figure 220 on page 195):** An example of current data that is obtained from the surface and downhole cards is displayed in these cards.
3	**Surface Load - Time Card (Figure 221 on page 196):** The plot of collected load cell data for one stroke cycle.
4	**Surface Position - Time Card (Figure 222 on page 196):** The plot of position signal for one stroke cycle.
5	**Downhole Load - Time Card (Figure 223 on page 197):** The plot of the calculated downhole load for one stroke cycle. Downhole load conditions can be monitored via this plot.
6	**Downhole Position - Time Card (Figure 224 on page 197):** The plot of the calculated downhole position for one stroke cycle. Downhole position conditions can be monitored via this plot.

IMPORTANT	The cards are navigated within the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons.

The analysis cards that are available for selection include:

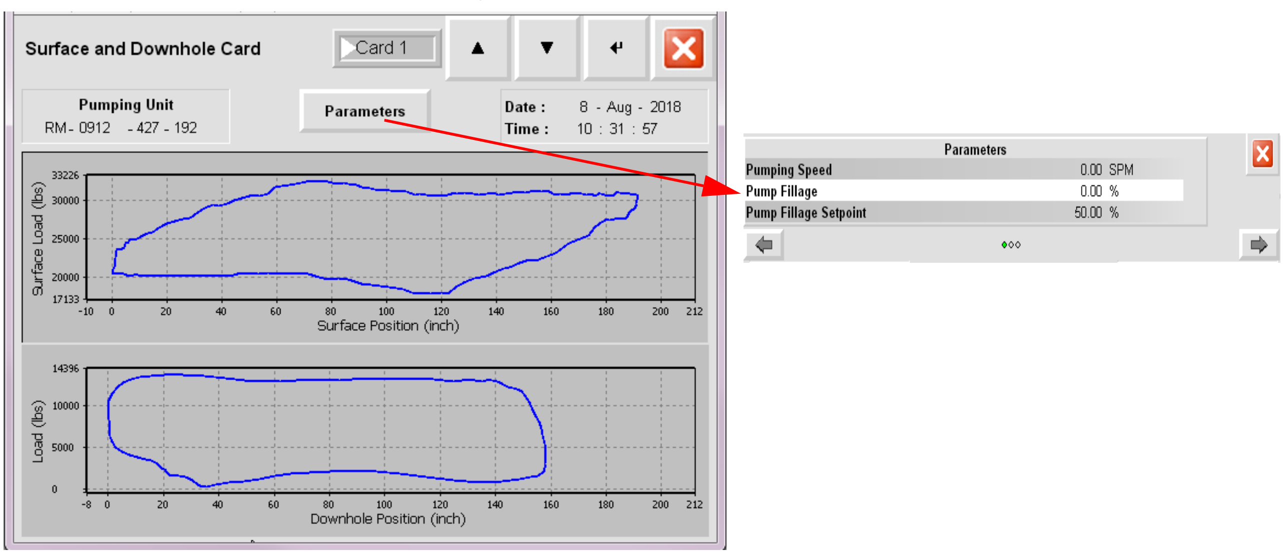
- Surface Card

Figure 219 - Surface Card



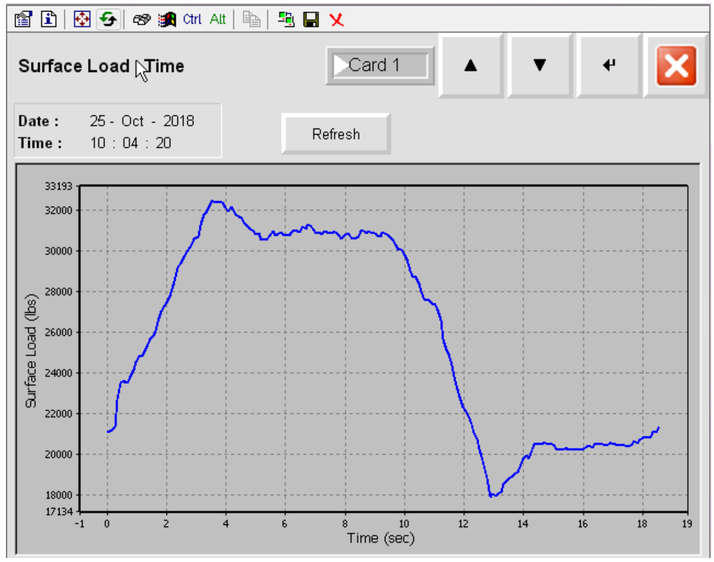
- Surface and Downhole Card

Figure 220 - Surface and Downhole Card



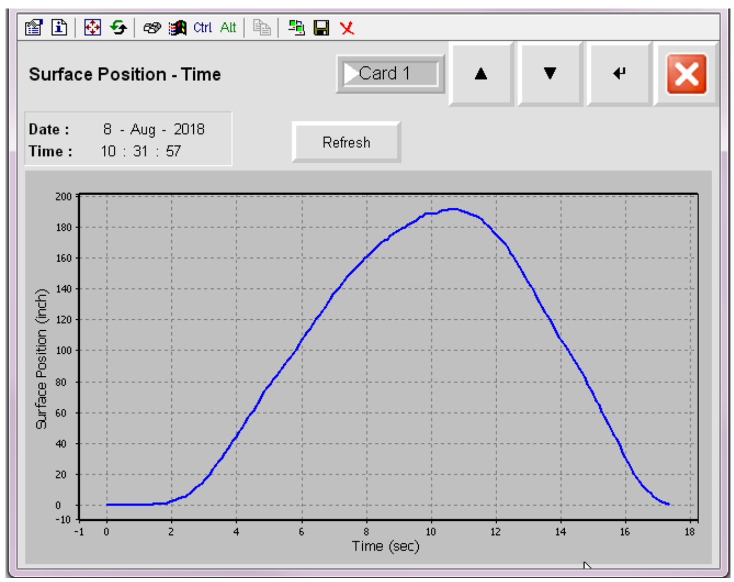
- Surface Load - Time Card

Figure 221 - Surface Load - Time Card



- Surface Position - Time Card

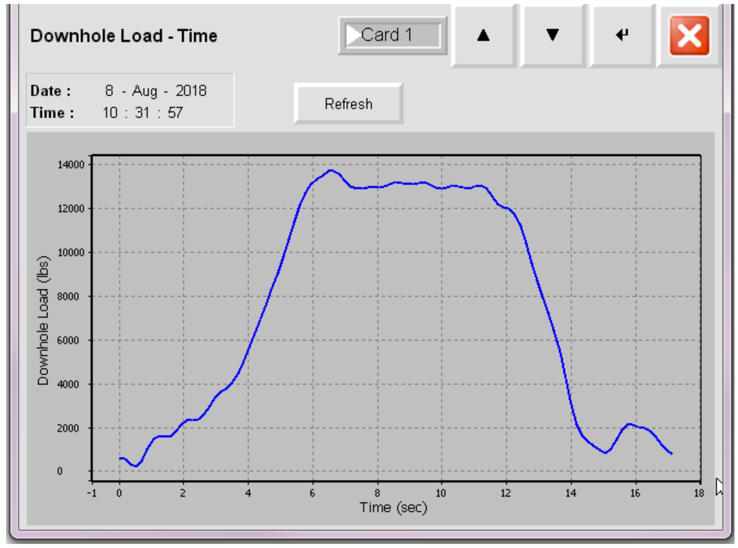
Figure 222 - Surface Position - Time Card



The actions are selected from the menu by pressing the up (▲)/down (▼) and Enter (↵) buttons. Then, hit the Refresh button.

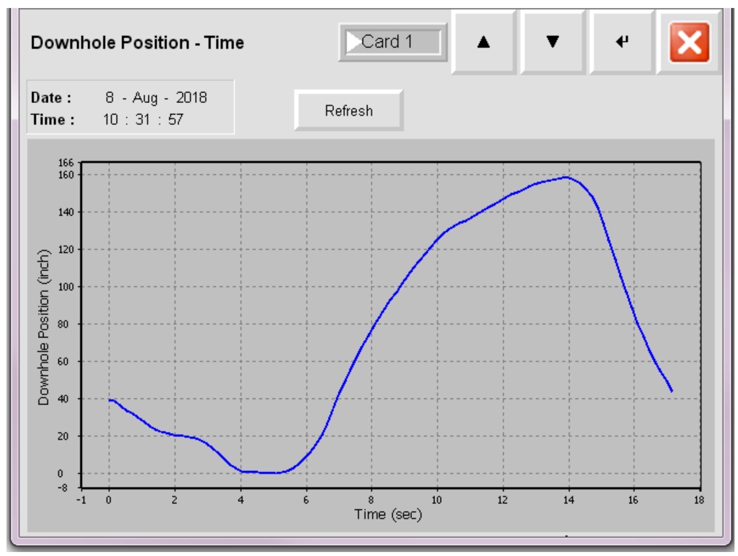
- Downhole Load - Time Card

Figure 223 - Downhole Load - Time Card



- Downhole Position - Time Card

Figure 224 - Downhole Position - Time Card

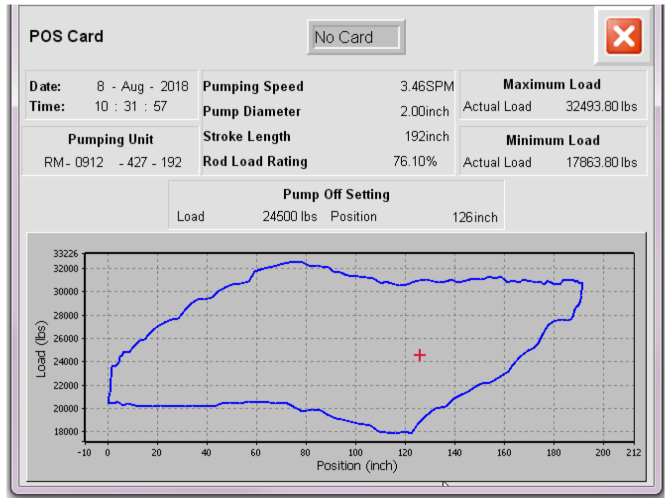


POS Card

This display shows one of the last 10 cards (based on your selection in Pumping System Analysis on page 194) that are saved when the pump off setpoint has been changed through Set & Save POS Card from Pump off Setting display.

These saved cards are used for future adjustments of the pump-off setpoint on the surface card.

Figure 225 - Pump Off Setpoint Card

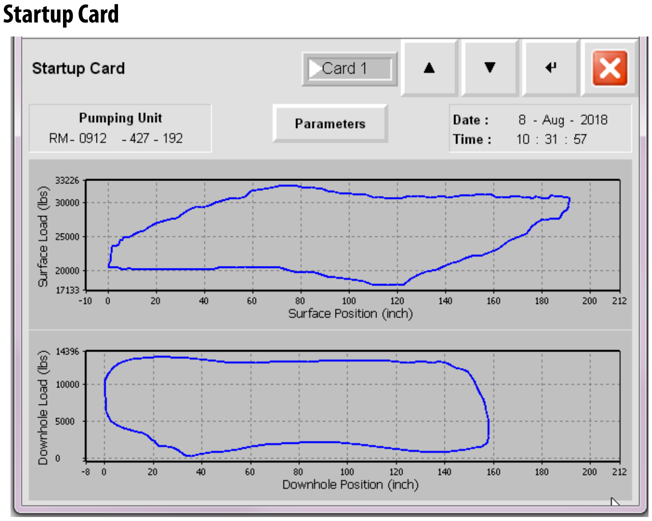


Startup Card

This display shows one of the last 25 cards (based on your selection in Pumping System Analysis on page 194) that are collected during the Start State period for each cycle. These cards are applicable to all modes.

Press the Parameters button to open up a faceplate that displays load pump-off set point, measured RPS, MPRL, position pump off set point, PPRL, pump fillage, pump fillage set point, pumping speed, RPM from hall effect, structural loading, and VFD commanded frequency depending on the operation mode selected.

Figure 226 - Startup Card

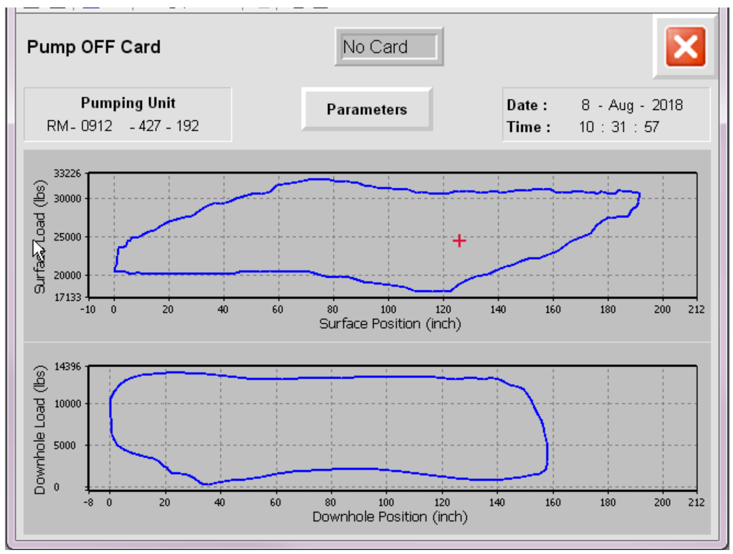


Pump Off Card

This display shows one of the last 50 cards (based on your selection in Pumping System Analysis on page 194) that are saved for each cycle when a pump-off condition is detected and the well is shutdown. These cards are applicable only to Fixed Speed Pump Off mode.

Press the Parameters button to open a faceplate that shows the tubing head pressure/temperature, casing head pressure/temperature, flow line pressure/temperature, load and position pump off setpoint, measured RPS, MPRL, PPRL, pump fillage, pump fillage setpoint, pumping speed, RPM from Hall effect, structural loading, and VFD commanded frequency. The parameters that are shown depends on the selected operation mode.

Figure 227 - Pump Off Card

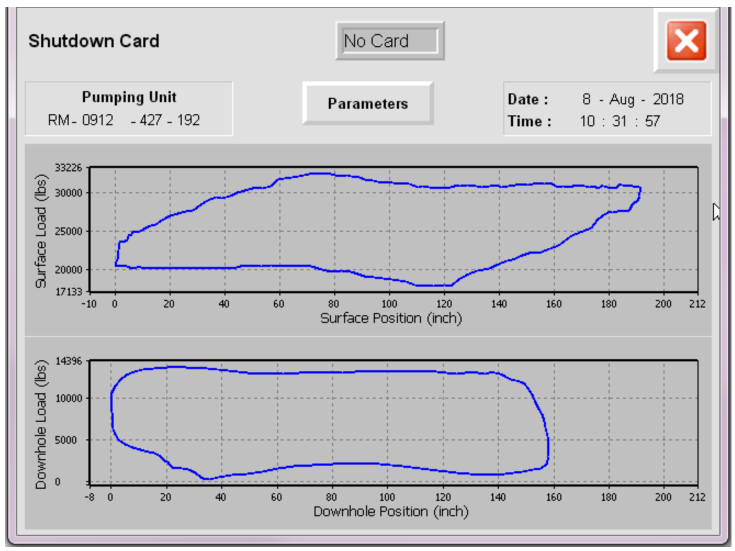


Shutdown Card

This display shows one of the last 10 cards (based on your selection in Pumping System Analysis on page 194) that are recorded during shutdown when a detected alarm or fault causes the shutdown.

Press the Parameters button to open a faceplate that shows load pump-off setpoint, measured RPS, MPRL, position pump off setpoint, PPRL, pump fillage, pump fillage setpoint, pumping speed, RPM from Hall effect, structural loading, and VFD commanded frequency. The parameters that are shown depends on the selected operation mode.

Figure 228 - Shutdown Card



Select Trend

This display lets you navigate to faceplates that show the current value and trends over the past 24 hours for the following:

<table>
<tr><th>Trend</th><th>Page</th></tr>
<tr><td>Pump Fillage</td><td rowspan="2">Figure 230 on page 201</td></tr>
<tr><td>Pressure</td></tr>
<tr><td>Motor RPM from Hall Effect</td><td rowspan="2">Figure 231 on page 202</td></tr>
<tr><td>VFD Commanded Frequency</td></tr>
<tr><td>SPM</td><td rowspan="2">Figure 232 on page 202</td></tr>
<tr><td>Yesterday's Run Time</td></tr>
<tr><td>Yesterday's PPRL and MPRL</td><td rowspan="2">Figure 233 on page 202</td></tr>
<tr><td>Yesterday's Average SPM</td></tr>
<tr><td>Temperature</td><td rowspan="2">Figure 234 on page 203</td></tr>
<tr><td>RPS</td></tr>
<tr><td>Pump Intake Pressure</td><td rowspan="2">Figure 235 on page 203</td></tr>
<tr><td>Fluid Level</td></tr>
<tr><td>VFD Current Output</td><td>Figure 236 on page 203</td></tr>
</table>

The trends are selected from the list in Figure 229 by pressing the up ( )/ down ( ) and Enter ( ) buttons.

On each trend faceplate, the trend values can be scrolled using home ( ), end ( ), move left ( ), move right ( ), and pause ( ) buttons. The Next Pen button is used to change the trend minimum and maximum values. This button is used only when multiple pens are configured in the trend.

Figure 229 - Trend Display 2: Select Trend

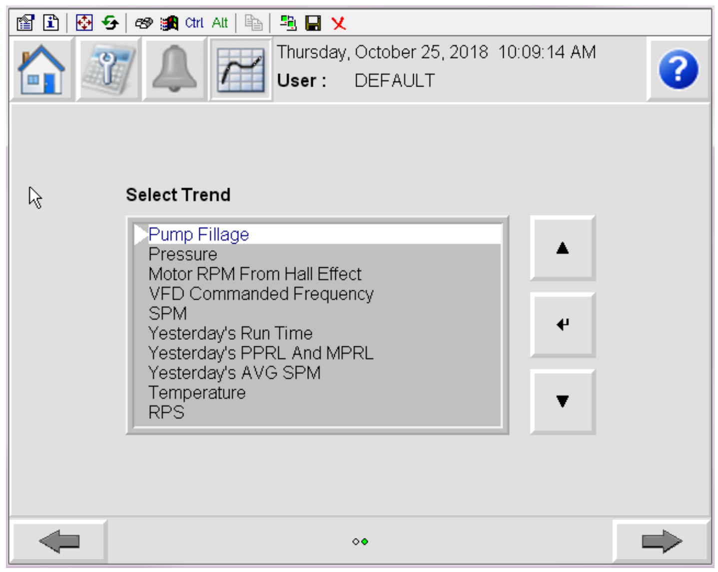


Figure 230 - Pump Fillage and Pressure Trend

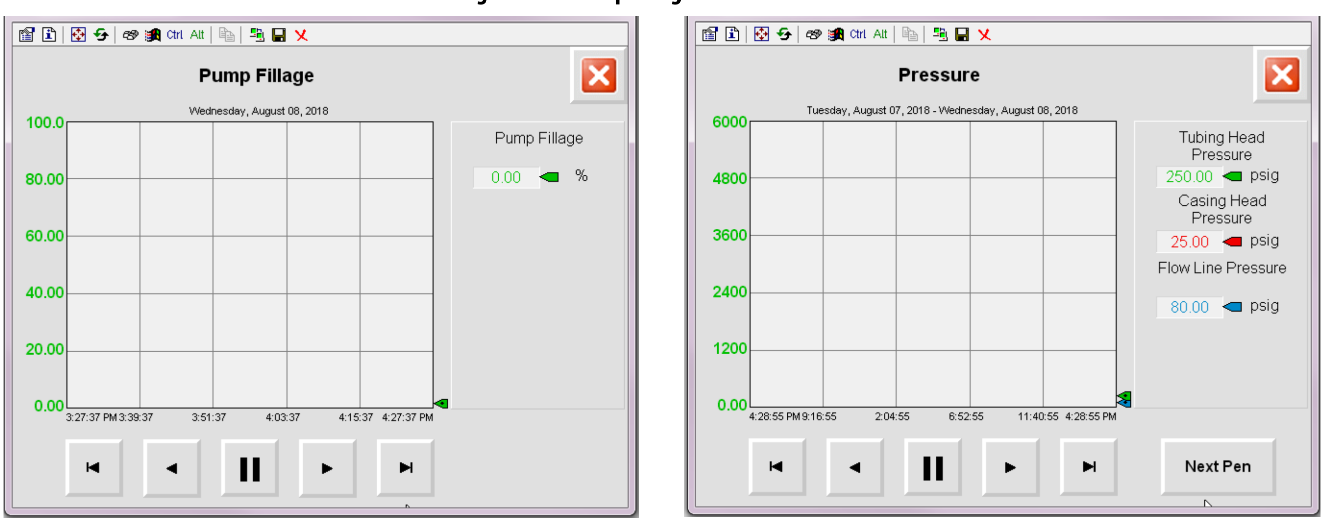


Figure 231 - Motor RPM from Hall Effect and VFD Commanded Frequency Trend

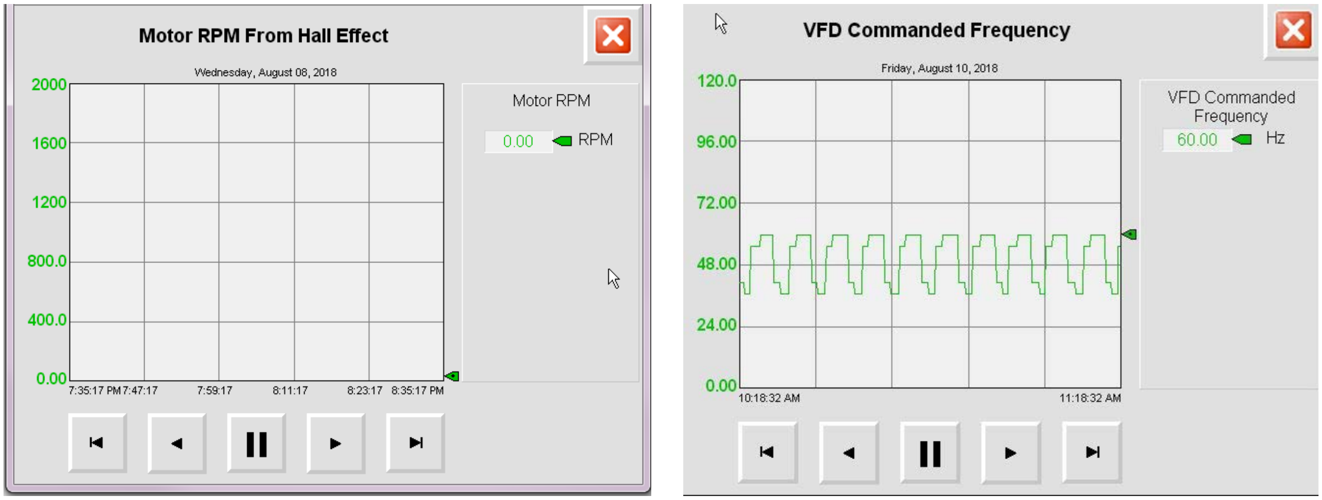


Figure 232 - SPM and Yesterday's Run Time Percentage Trend

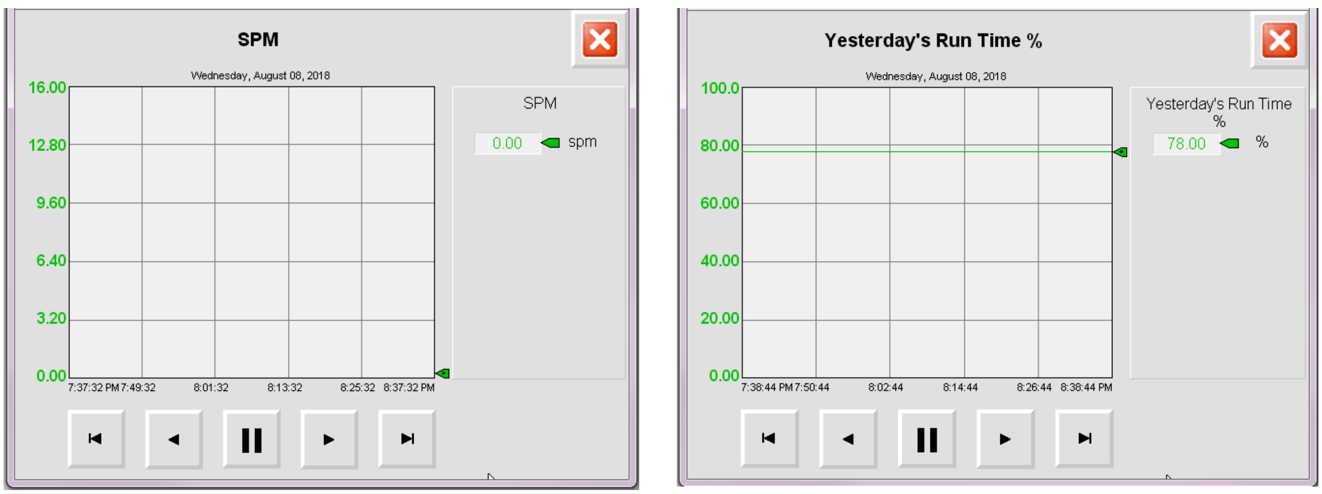


Figure 233 - Yesterday's PPRL/MPRL and Yesterday's Average SPM Trend

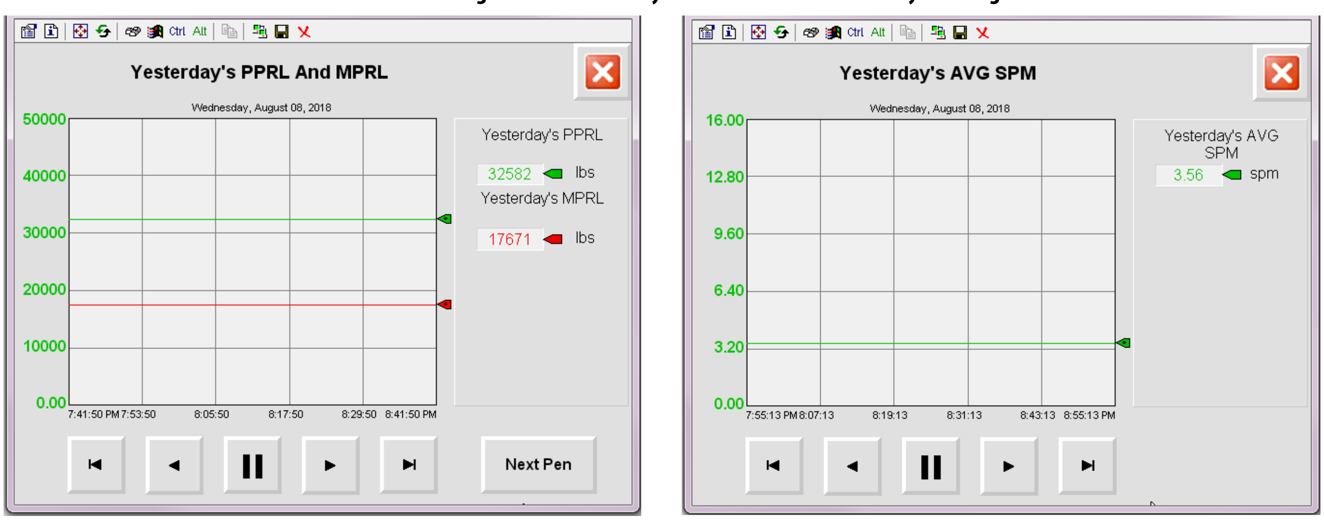


Figure 234 - Temperature and RPS Trend

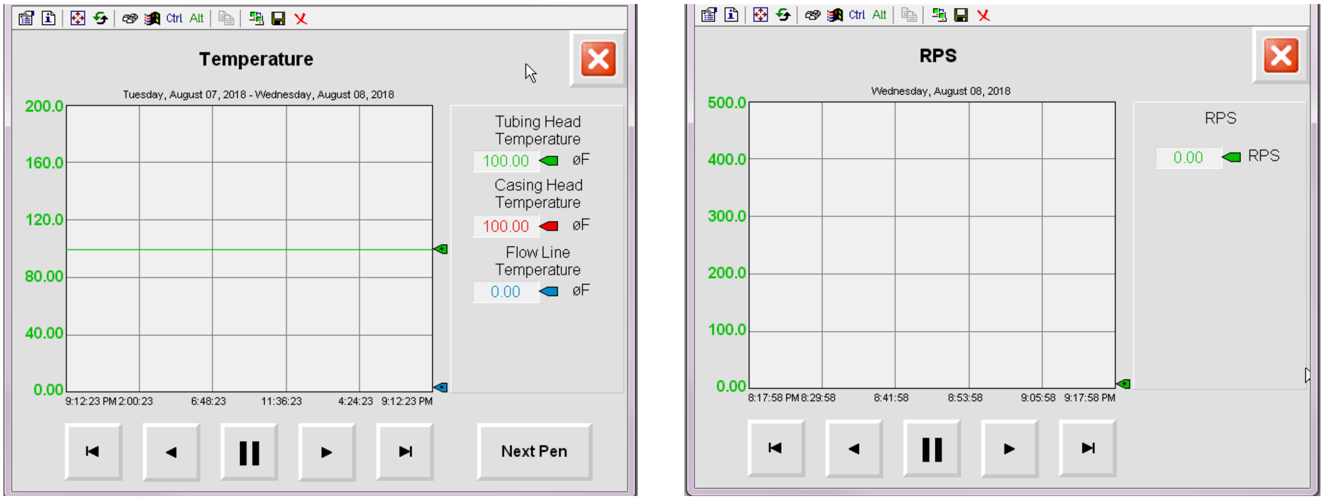


Figure 235 - Pump Intake Pressure and Fluid Level Trend

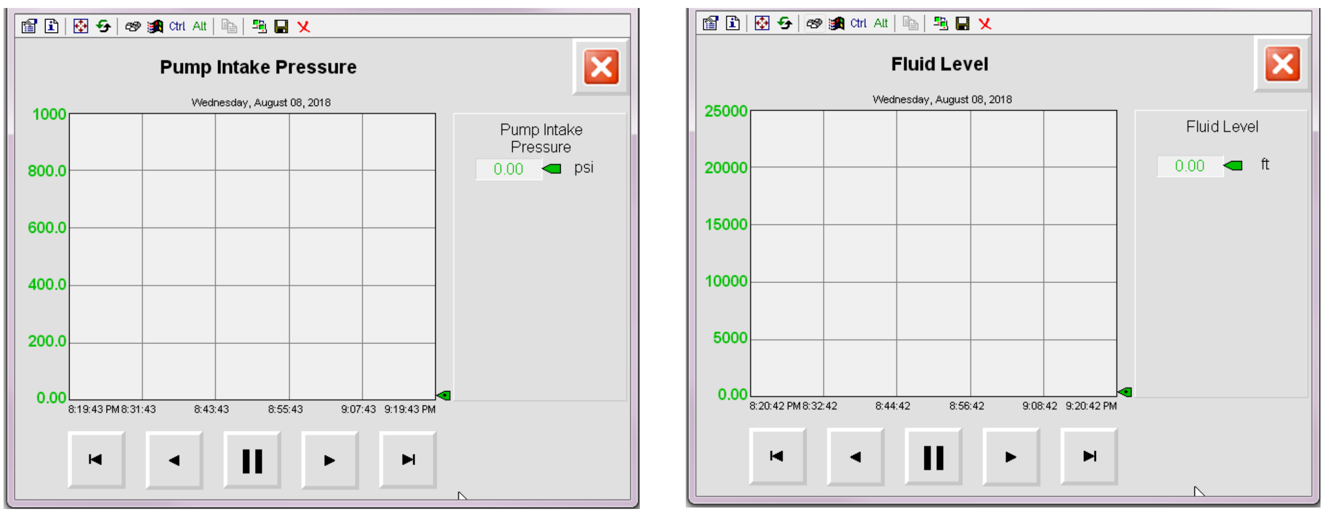
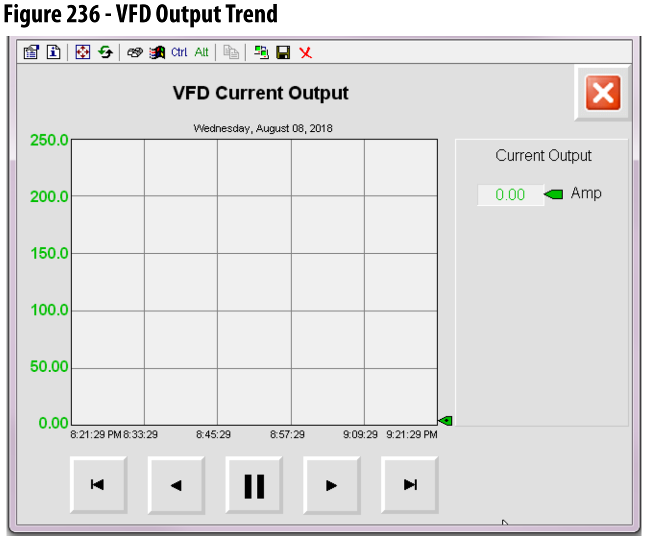


Figure 236 - VFD Output Trend



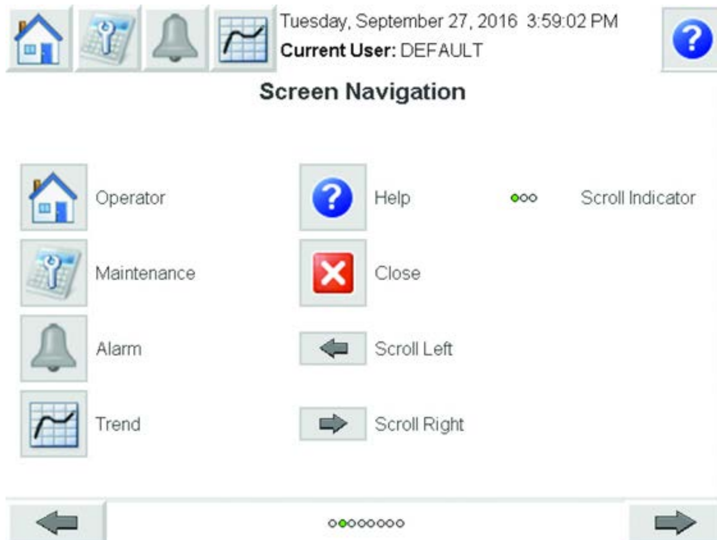
Help Display

The Help display has eight pages. Access and progress through the pages of a display by pressing the arrows at the bottom of the display.

Screen Navigation

This display describes all screen navigation symbols that are used in the INSTRUCT SRP application.

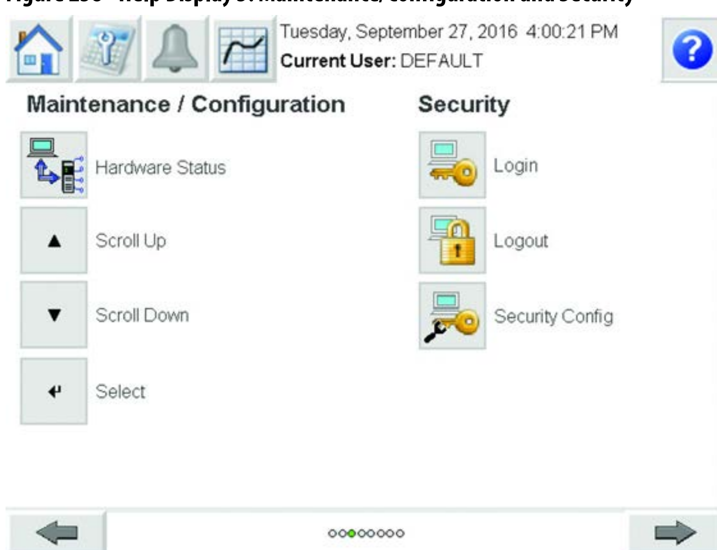
Figure 237 - Help Display 2: Screen Navigation



Maintenance/Configuration and Security

This display describes all maintenance/configuration and security symbols that are used in the INSTRUCT SRP application.

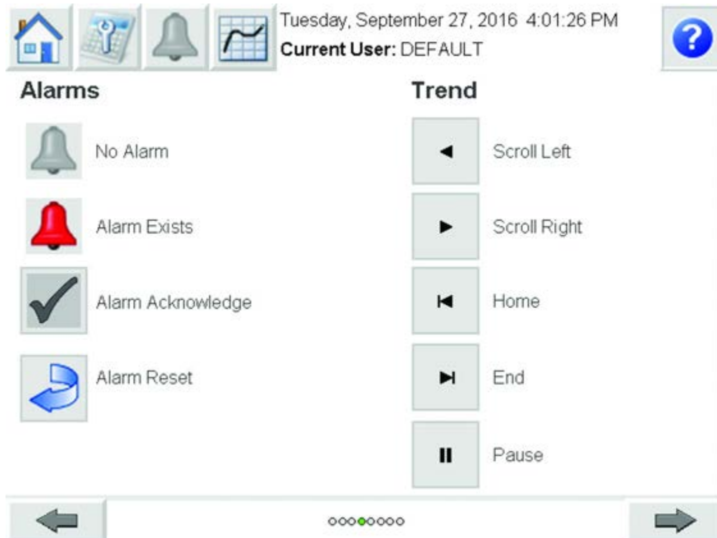
Figure 238 - Help Display 3: Maintenance/Configuration and Security



Alarms and Trend

This display describes all alarms and trend symbols that are used in the INSTRUCT SRP application.

Figure 239 - Help Display 4: Alarms and Trends

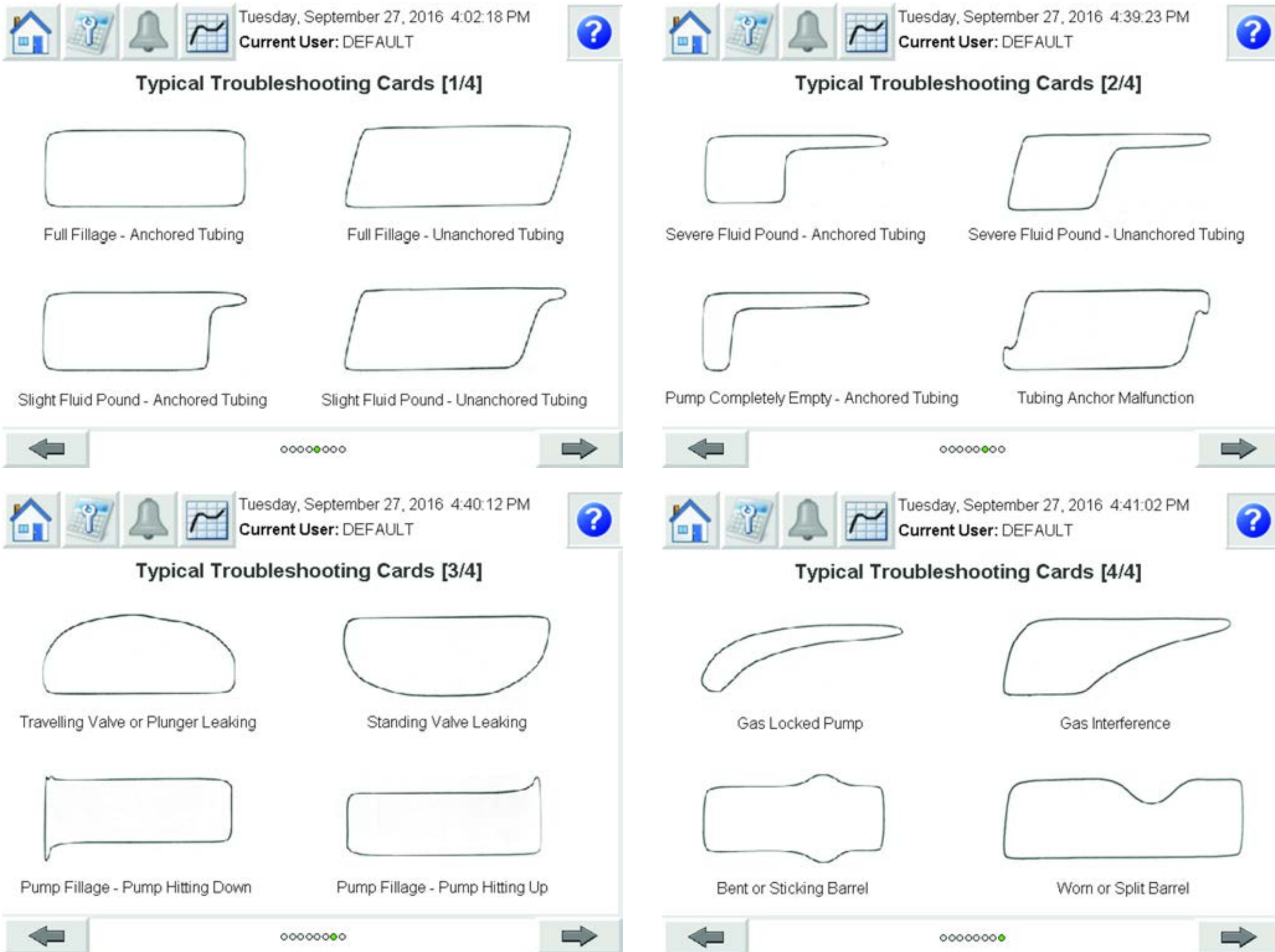


Troubleshooting Cards

These displays are sets of typical downhole cards that are used as a guide to define any deviation from the expected performance of the pump.

You must record as much information as possible to troubleshoot the well. This information includes mechanical state of the well, production data, and the most recent dynamometer cards.

Figure 240 - Help Displays 5…8: Troubleshooting Cards



Operation

Introduction

Operation of the INSTRUCT SRP* controller involves several processes that are described in the following sections. Main activities of operation include:

Startup Checklist

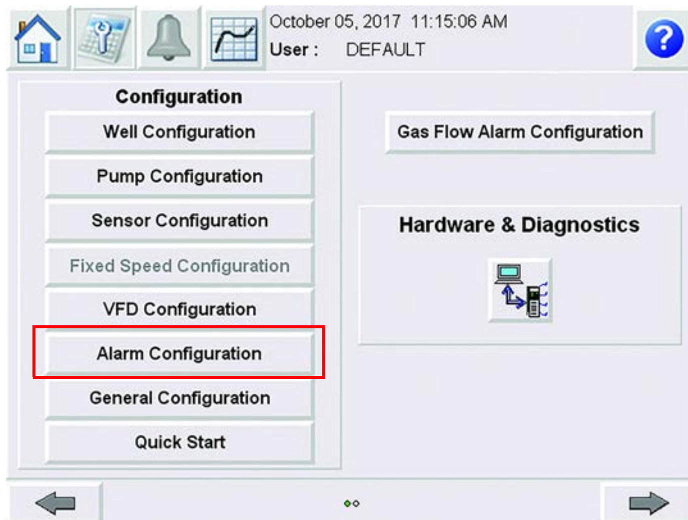
1. Confirm that all inputs are securely connected to the correct terminals.
2. Verify that the supplied power voltage to the INSTRUCT SRP is correct.
3. Verify that the INSTRUCT SRP breaker is switched to the ON position.
4. The Operator display is the first display to appear.

Configure Digital I/O

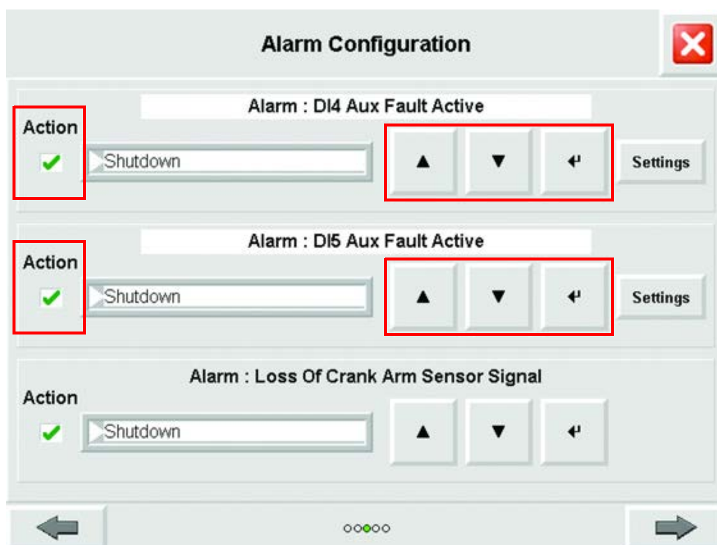
This section describes the steps to configure the optional I/O wiring of DI4 and DI5. See Connect Wiring on page 20 for all required wiring.

Configure DI4/DI5 Aux Fault Alarm

1. Press the Configuration tab ( ).
2. Press the Alarm Configuration button.



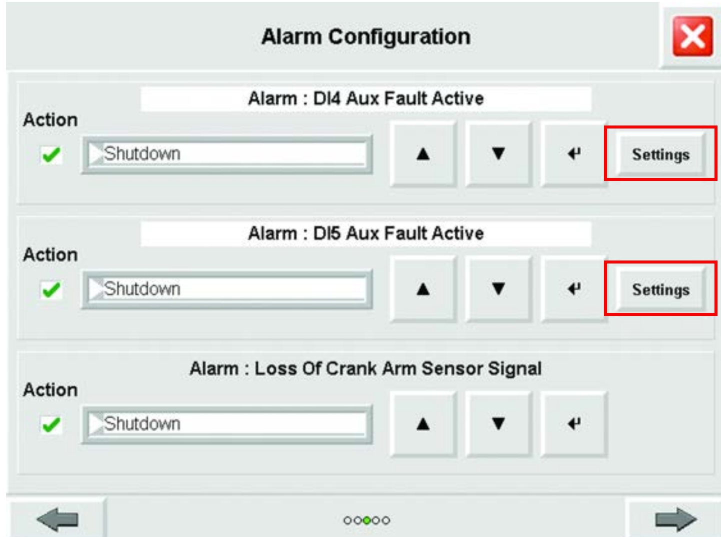
3. Press the right arrow ( ) two times to get to DI Aux Fault display.
4. Press the Action checkbox to enable (checked) or disable (cleared) the alarms.



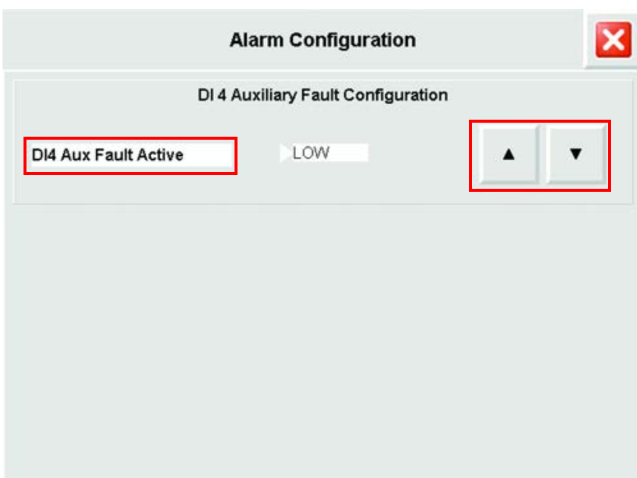
Use the up (▲)/down (▼) arrow buttons to select the alarm action.

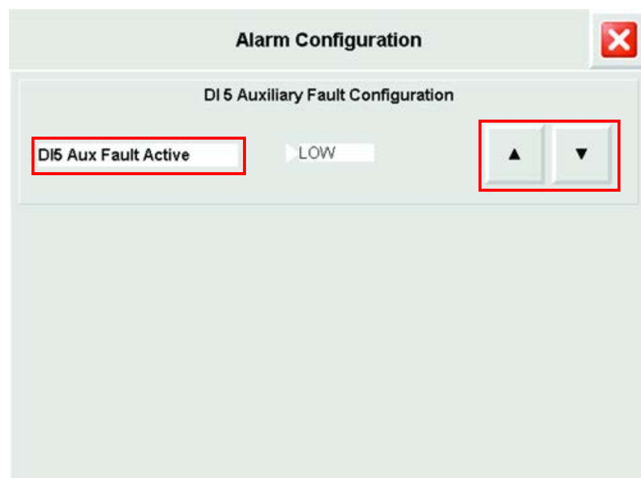
Press the Enter (↵) button to set the alarm action.

5. Press the Settings button to configure DI4 or DI5 Aux Fault.



6. Use the up ( )/down ( ) arrow buttons to set the Aux Fault alarm to High or Low. Press the text field to change the name of the alarm with the popup keyboard. Press the Enter ( ) button to save the name.

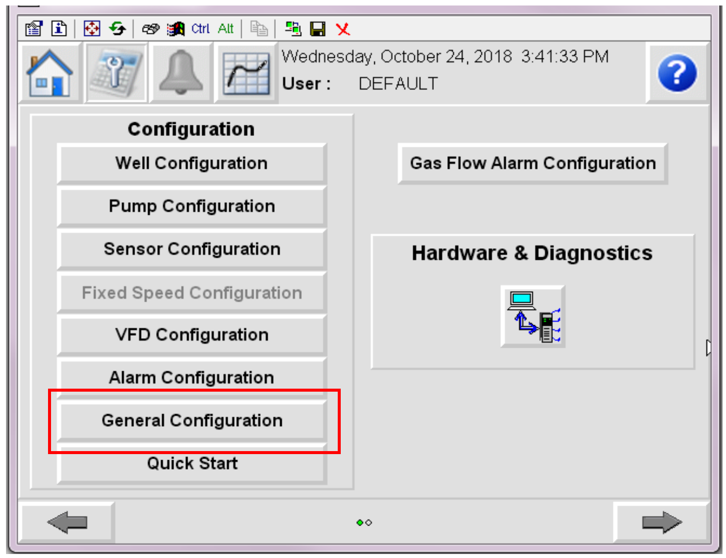




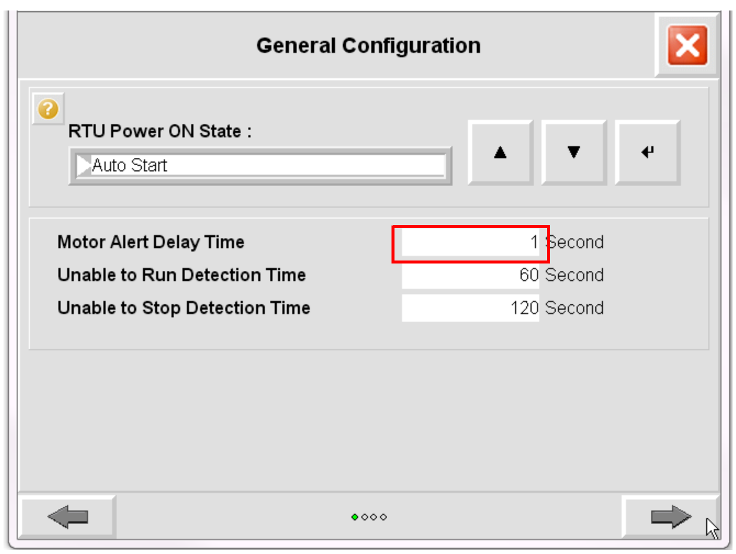
7. Press the Close button ( ) to return to the Alarm Configuration display.

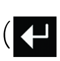
Configure Motor Alert Delay Time

1. Press the Configuration tab ().
2. Press the General Configuration button.



3. Set the Motor Alert Delay Time by pressing the number field.



4. Enter a new value in the popup keypad. Press the Enter () button to set the value and return to the General Configuration display.

IMPORTANT	If this value is set to 0, the INSTRUCT SRP does not go through the Motor Alert state.

User Administration

The INSTRUCT SRP loads and is operational without logging in. On load, the initial user account is Default. The HMI has seven user roles that can be used.

IMPORTANT	For security reasons, we recommend that you change the default passwords.

Table 8 - User Roles

User Role	Default Password
Default (not logged in)	—
Operator	operator
Supervisor	supervisor
Maintenance	maintenance
Engineer	engineer
Administrator	administrator
Admin	admin

Change Password

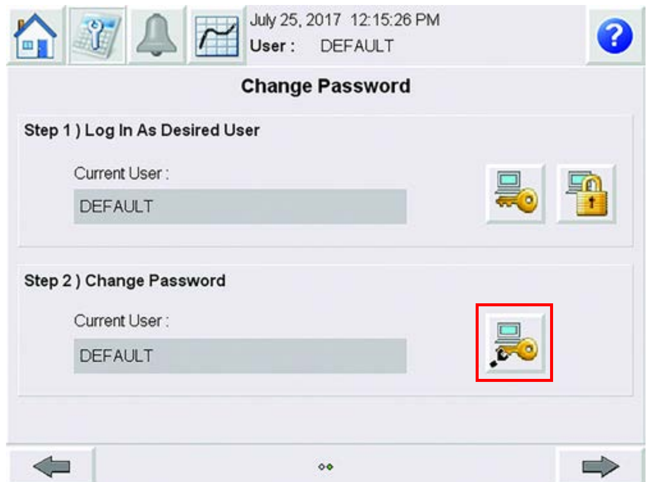
The HMI application has default user account information, however, it is possible to change the password for a specific user role. To update the password, follow these steps.

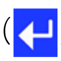
IMPORTANT	If you forget passwords, you have to disable passwords through Modbus or a factory reset of your INSTRUCT SRP.

1. Press the Configuration tab ().
2. Press the right arrow () to access the User Control display.

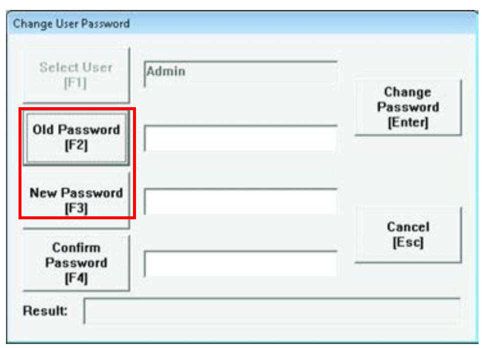
IMPORTANT	The Default user is not allowed to change password. User account types are fixed and are not user-configurable.

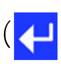
3. Press the Change Password button (). A Change Password dialog box appears.



4. Press Old Password to enter the current password on the popup keyboard. Press Enter ().

5. Press New Password to enter the new password on the popup keyboard. Press Enter ().



6. Press Confirm Password to enter the new password on the popup keyboard again. Press Enter ().

7. Press the Change Password button to set the new password. The password change status shows in the Result field at the bottom of the dialog box.

Quick Start

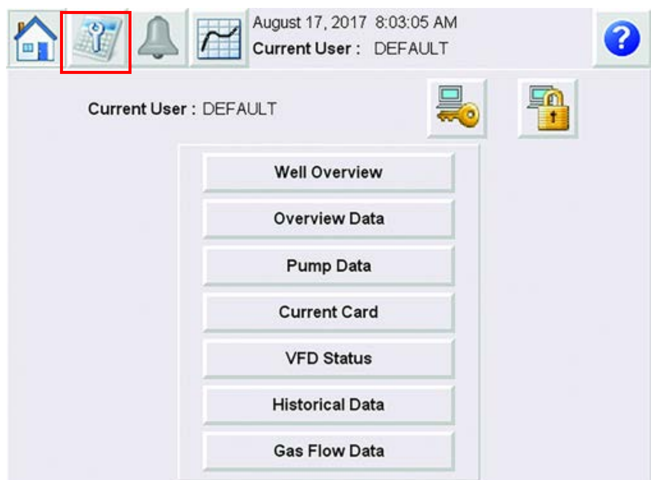
Quick Start configuration contains all required configurations and settings to commission your INSTRUCT SRP.

To navigate the Quick Start configuration displays:

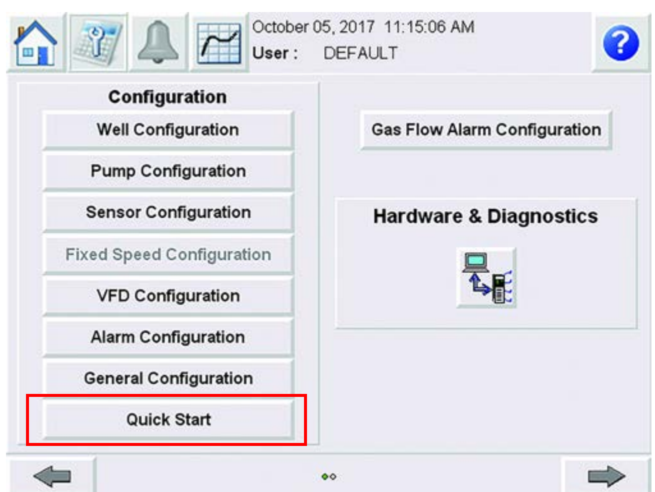
- Press the right arrow () to move to the next screen and the left arrow () to move to the previous screen.
- Press the Help button () for more information about the display you are on.
- Press the Exit button () on any Quick Start display to return to the default screen. Upon exiting, all changes you have made are saved to your INSTRUCT SRP.

When you first start up your INSTRUCT SRP, the Operator display appears as the default screen.

1. To access Quick Start, press the Configuration button.



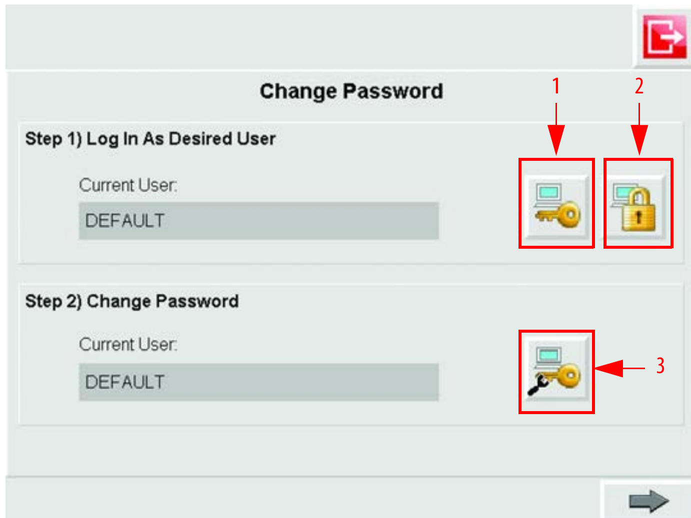
2. On Configuration display, press the Quick Start button.



User Control

Quick Start configuration starts with the User Control display. When your INSTRUCT SRP initially loads, the Current User is set as Default.

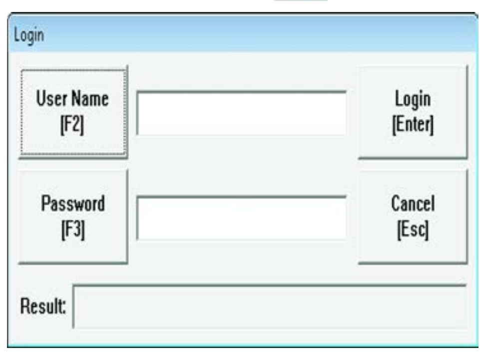
Figure 241 - Quick Start: User Control



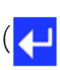
Item	Description
1	Login Button (page 214)
2	Logout Button (page 215)
3	Change Password Button (page 215)

User Login

1. Press the Login button (), to make the Login dialog box appear.



2. Press the User Name button, a keyboard appears.

   Type the user name and press Enter () on the keyboard.

   TIP User names are not case-sensitive.

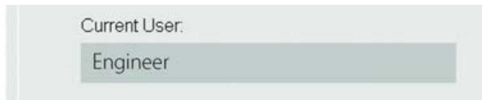
3. Press the Password button, a keyboard appears.

   Type the password and press Enter () on the keyboard.

   TIP Passwords are case-sensitive.

4. Press Login Button.

   If the entered user name and password are correct, the user name is displayed in the Current User field.

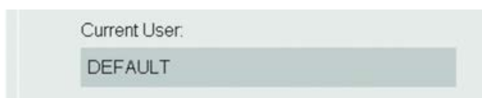
   If the user name and password are incorrect, the message "User authentication failed" appears in the dialog box.

   TIP You are allowed unlimited login attempts.

User Logout

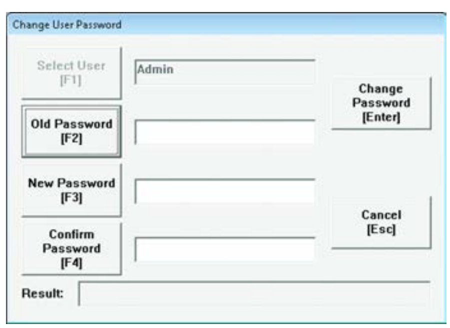
To help prevent unauthorized access to the system, we recommend logging out when you finish system configuration.

1. Press the Logout button ().
2. The Current User field reverts to Default.

Change Password

1. Press the Change Password button (). A Change Password dialog box appears.

   For detailed instructions, see Change Password on page 211.

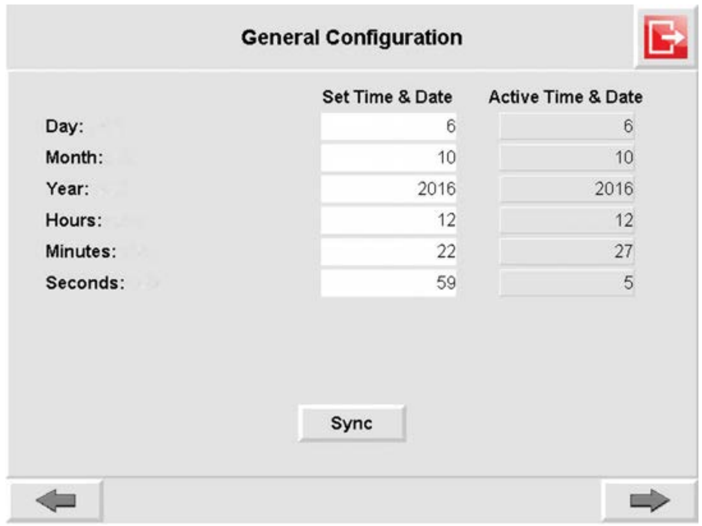
IMPORTANT The Default user is not allowed to change password. User account types are fixed and are not user-configurable.

2. Press the right arrow () to continue.

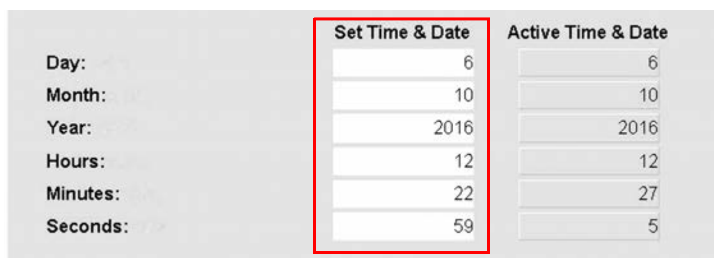
INSTRUCT SRP General Configuration

This display contains the current (active) time and date settings of the system. This display lets you modify the time and date.

Figure 242 - Quick Start: Time and Date



1. Press a field in the Set Time and Date column and enter new value in the popup keypad. Press Enter ( ).



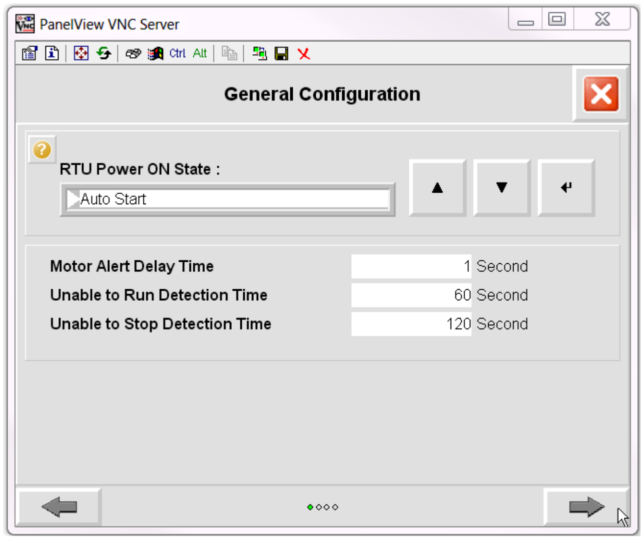
2. When all values have been set, press the Sync button. The new system time and date are set. Once new Active Time and Date are synced, all Set Time and Date fields become 0.

3. Press the right arrow ( ) to continue.

RTU Power On Screen

This display lets you set the default motor state when the INSTRUCT SRP reboots, select the default screen, and configure the motor alert delay time and unable to stop/run detection time. For definitions of parameters, see Figure 202 on page 177.

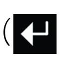
Figure 243 - Quick Start: RTU Power On State and Default Screen



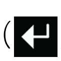
1. Select the RTU Power ON State from the menu with the up ()/ down () and Enter () buttons.

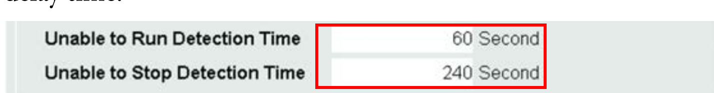
   Once selected, the text is highlighted with a white background.

2. Press the field next to Motor Alert Delay Time.
   A keypad appears.

3. Enter a number (range = 0…60) and press Enter () to set the interval for which DO4 is enabled before starting the motor in any mode.

4. Press the fields next to Unable to Run Detection Time and Unable to Stop Detection Time.
   A keypad appears.

5. Enter a number (range = 60…900) and press Enter () to set the delay time.

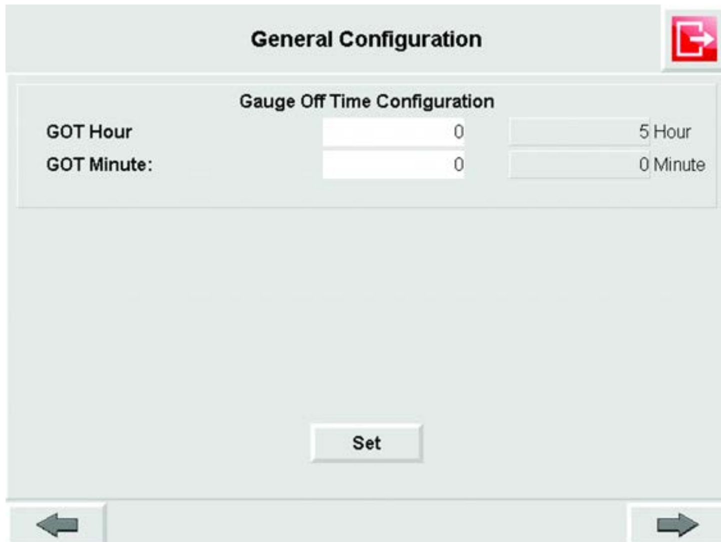


6. Press the right arrow () to continue.

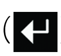
Gauge Off Time

The third General Configuration display lets you configure gauge off time (GOT). Gauge off time (GOT) is used to offset the calculation of totals for a day. The INSTRUCT SRP consists of a number of data accumulators, GOT lets you set the time of day when the data buffer is totaled.

Figure 244 - Quick Start: Gauge Off Time Configuration



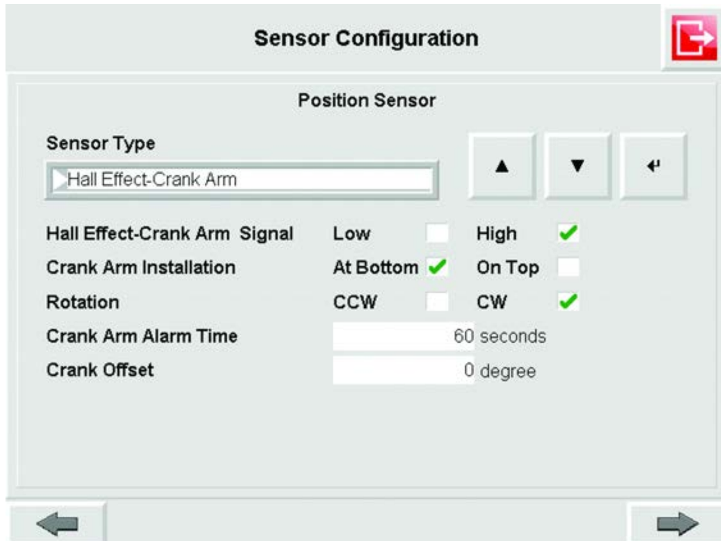
1. Press the fields next to GOT Hour and GOT Minute.
   A keypad appears.

2. Enter a number (hour range = 0…23, minute range = 0…59) and press Enter ().
3. Press the Set button make the new hour and minute of GOT active.

4. Press the right arrow () to continue.

Position Sensor

Figure 245 - Quick Start: Position Sensor



1. Choose the Sensor Type from the menu with the up ( )/down ( ) button.
2. Press the Enter ( ) button to select the Sensor Type.

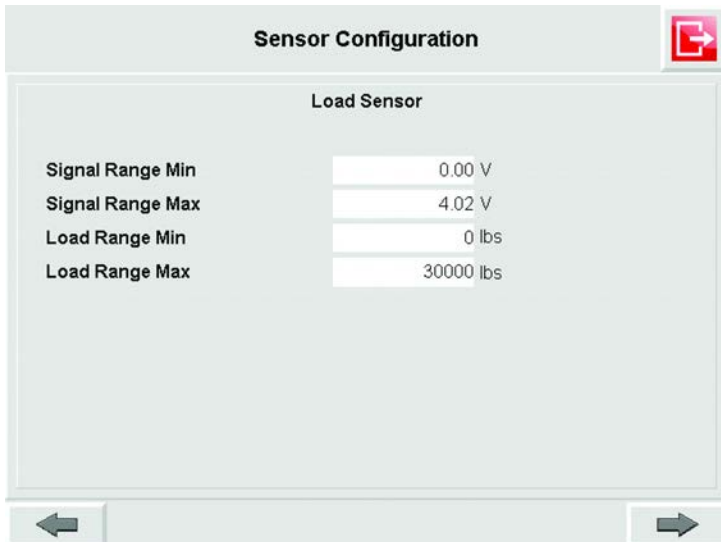
   Once selected, the text is highlighted with a white background.

   The parameters that are displayed change based on selection of Sensor Type. For definitions of parameters and ranges, see Sensor Configuration on page 151.
3. Press checkboxes to check and clear them and press fields to enter a value on the popup keypad to configure as required for your system. Press Enter ( ) on the keypad to save value.
4. Press the right arrow ( ) to continue.

Load Sensor

The Load Sensor configuration display lets you configure load sensor settings. For parameter definitions and ranges, see Figure 179 on page 155.

Figure 246 - Quick Start: Load Sensor

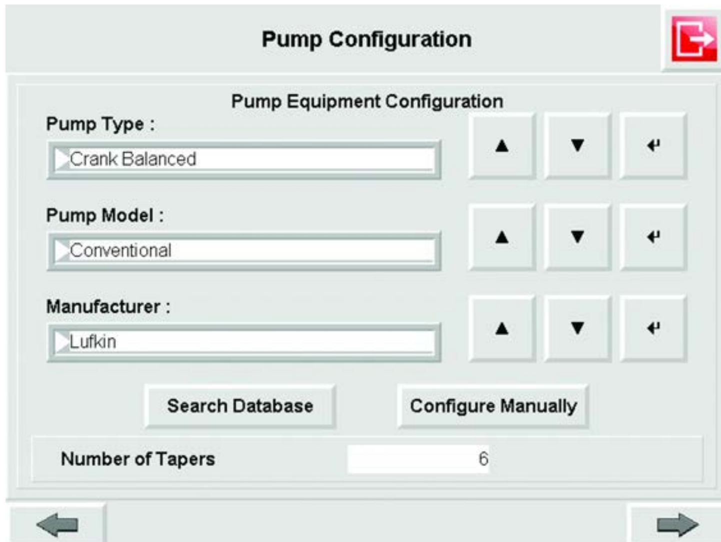


1. Press the fields to enter a value on the popup keypad to configure the signal and load range for your system. Press Enter ( ) on the keypad to save value.
2. Press the right arrow ( ) to continue.

Pump Equipment Configuration

On this display, you can search the local INSTRUCT SRP database for common API unit dimensions or configure the pump equipment manually. You can also set the number of tapers. For parameter options and definitions, see Figure 164 on page 140.

Figure 247 - Quick Start: Pump Equipment Configuration



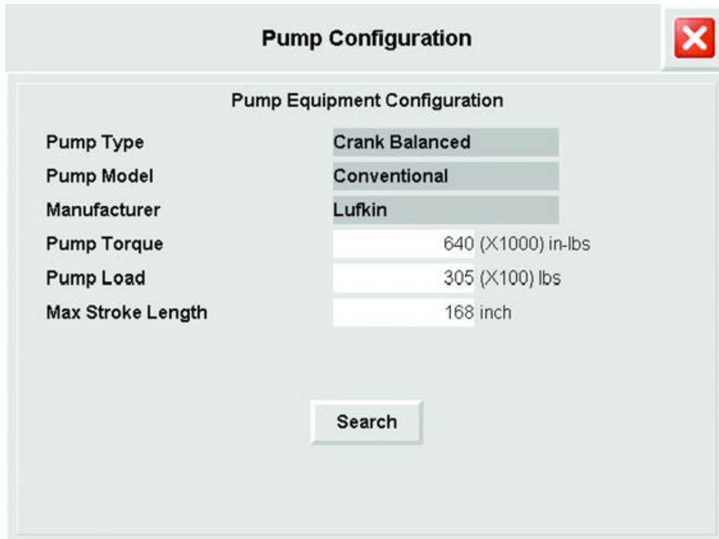
1. Select the pump type, pump model, and manufacturer from the menus with the up (▲)/down (▼) and Enter (↵) buttons. The options available in each menu depends on previous selections.
   The selected option is highlighted with a white background.
2. After your selections have been made, you can click the Search Database (page 222) or Configure Manually (page 223) buttons.

3. Set the number of tapers by pressing the field to enter a value (range is 0…6) on the popup keypad. Press Enter (↵) on the keypad to save the value.
4. Press the right arrow (➡) to continue.

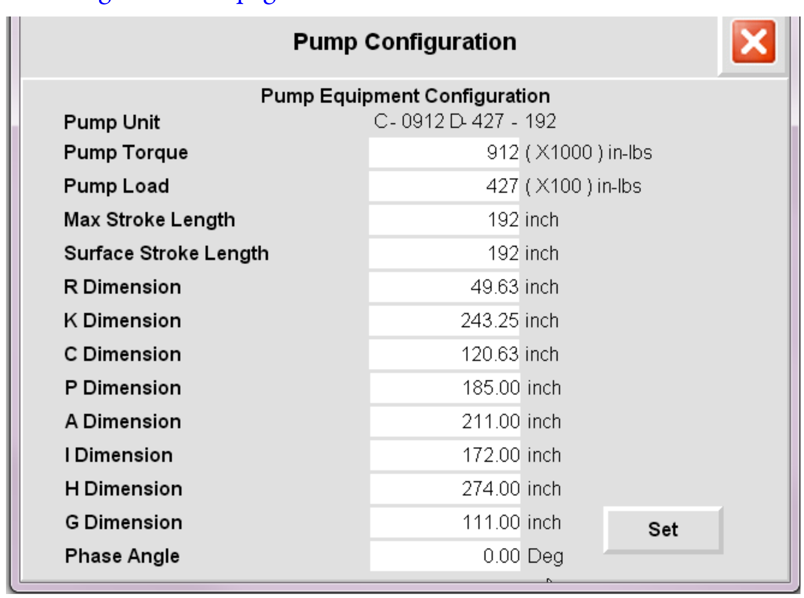
Search Database

This faceplate appears when the Search Database button is pressed on the Pump Equipment Configuration display (Figure 247).

Figure 248 - Search Database



1. Enter the maximum allowable pump torque, pump load, and stroke length by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values.
2. Press the Search button.
   - If your search is unsuccessful, click the Search Again button to return to Figure 248. Reconfigure parameters as described in Step 1.
   - If your search is successful, press Continue.
     Several default parameters and dimensions (R, K, C, P, A, and I) are populated on the next faceplate. For parameter definitions, see Figure 165 on page 141.



3. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values.

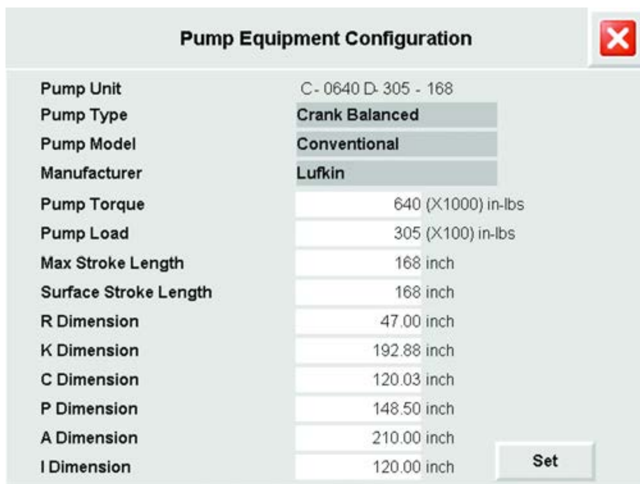
4. Press the Set button to save all configured values to the database in the respective parameters. The configured pumping unit is also set as the active pumping unit.

5. Press the Close button ( ) to return to the Pump Equipment Configuration display (Figure 247 on page 221).

Configure Manually

This faceplate appears when the Configure Manually button is pressed on the Pump Equipment Configuration display (Figure 247 on page 221).

Figure 249 - Configure Manually



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values.
   For parameter ranges and definitions, see Figure 167 on page 143.

IMPORTANT	Standard API dimensions are specific to the pumping unit and can be found in the pumping unit documentation.

2. Press the Set button to save all configured values to the database in the respective parameters. The configured pumping unit is also set as the active pumping unit.

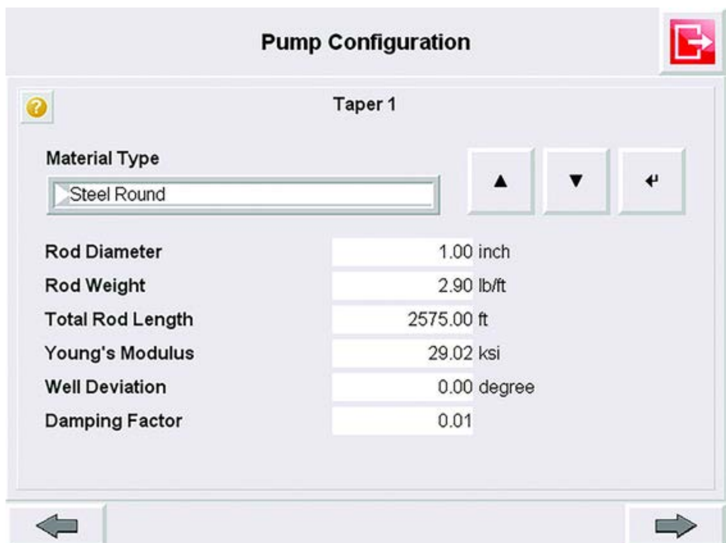
3. Press the Close button ( ) to return to the Pump Equipment Configuration display (Figure 247 on page 221).

Taper Configuration

Taper configuration is vital for downhole calculations from the surface card. Incorrect information yields erroneous downhole calculations and decreases overall accuracy of the INSTRUCT SRP. Each taper is configured on a separate display. Navigated to each taper display with the left ( ) and right ( ) arrow buttons.

IMPORTANT	The number of Taper Configuration displays that appear is dependent on the number of tapers that are entered in Figure 247 on page 221.

Figure 250 - Quick Start: Taper Configuration

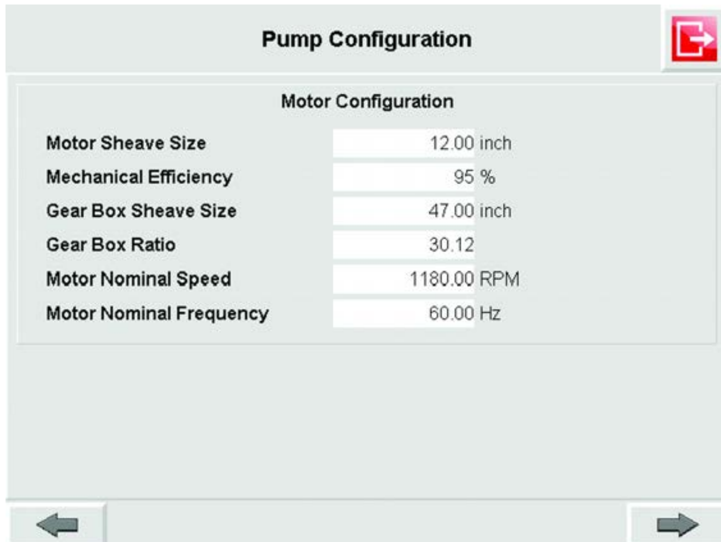


1. Select the material type from the menus with the up ( )/down ( ) and Enter ( ) buttons.
   The selected option is highlighted with a white background.
2. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter options and definitions, see Figure 174 on page 150.
3. Press the right arrow ( ) to continue.

Motor Configuration

The Motor Configuration display lets you configure parameters that assure that the INSTRUCT SRP can detect a strokes per minute (SPM) error alarm. This alarm comes from a mismatch between measured SPM and SPM from the VFD-commanded frequency.

Figure 251 - Quick Start: Motor Configuration



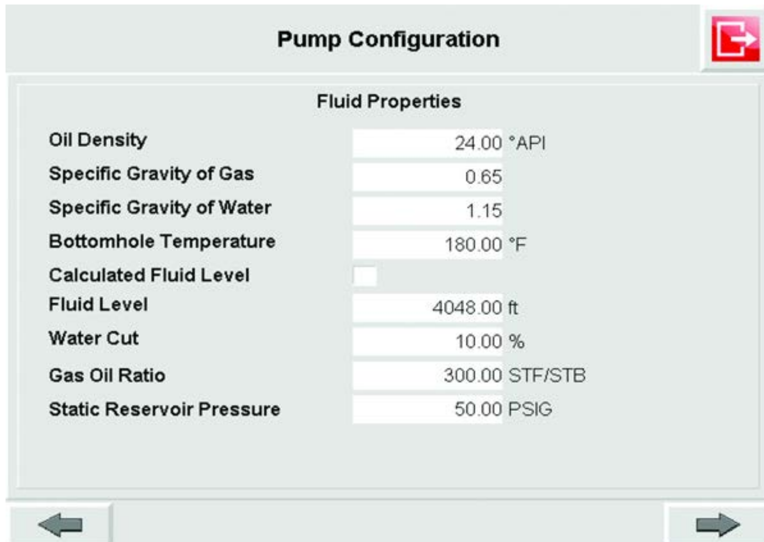
1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 173 on page 149.

2. Press the right arrow ( ) to continue.

Fluid Properties

The Fluid Properties display lets you configure parameters that are used for calculating the estimated oil, water, and total flow rate. These parameters also help achieve accurate well production data.

Figure 252 - Quick Start: Fluid Properties

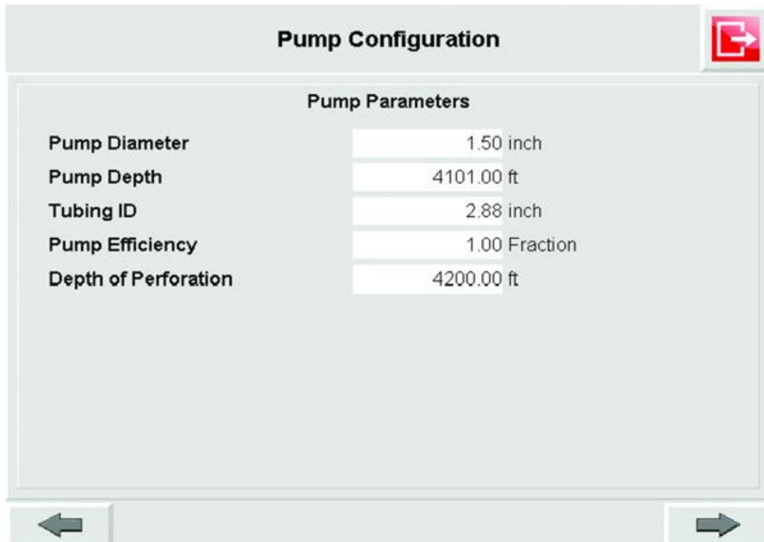


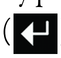
1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 168 on page 144.
2. Press the right arrow ( ) to continue.

Pump Parameters

The Pump Parameters display lets you configure parameters that are used for calculating the estimated oil, water, and total flow rate. These parameters also help achieve accurate well production data.

Figure 253 - Quick Start: Pump Parameters



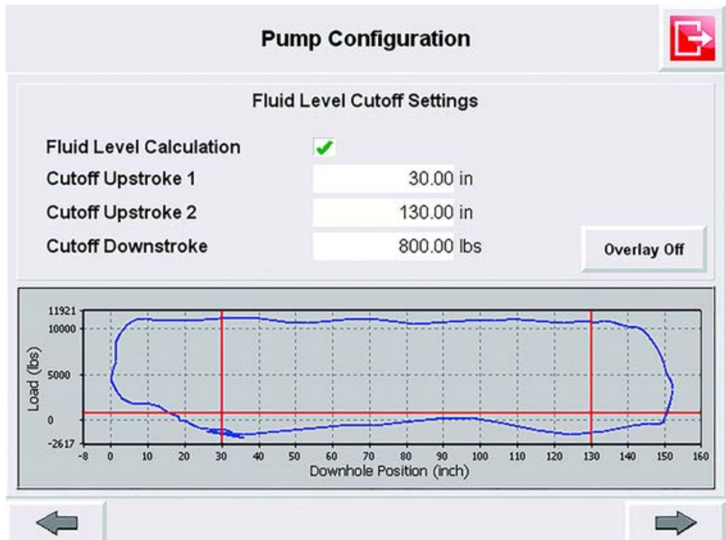
1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter () on the keypad to save values. For parameter ranges and definitions, see Figure 169 on page 145.

2. Press the right arrow () to continue.

Fluid Level Cutoff Settings

The Fluid Level Cutoff Settings display lets you configure a reasonable range of load data on the downstroke and upstroke section of the downhole card.

Figure 254 - Quick Start: Fluid Level Cutoff Settings

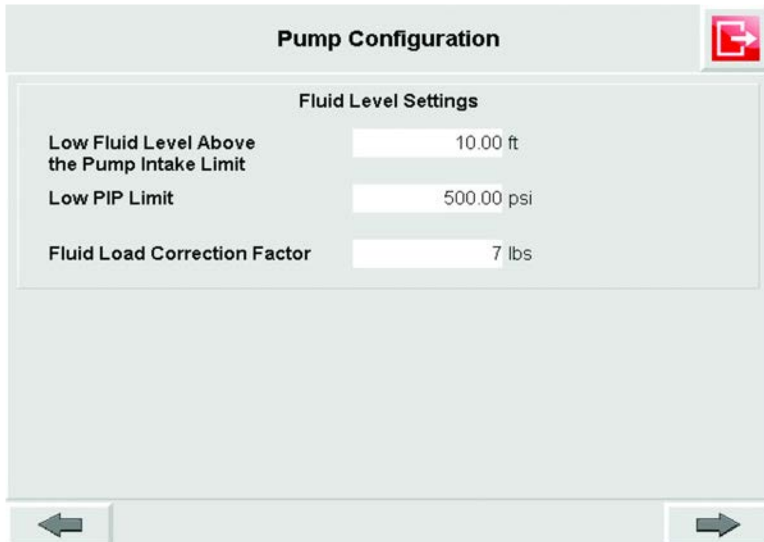


1. Press the Fluid Level Calculation checkbox to enable (checked) or disable (cleared) this feature.
2. Configure the upstroke and downstroke parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 170 on page 146.
3. Press the right arrow ( ) to continue.

Fluid Level Settings

The Fluid Level Settings display lets you configure parameters that are used in the generation of Low Fluid Level and Low PIP warnings.

Figure 255 - Quick Start: Fluid Level Settings



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 171 on page 147.

2. Press the right arrow ( ) to continue.

Well Operation Mode

The Well Operation Mode display lets you select the well operation mode.

IMPORTANT	You cannot change the operation mode until the motor is stopped. Press the Stop Motor button on the next Quick Start display or see Start and Stop the Motor on page 278.

Figure 256 - Quick Start: Well Operation Mode

1. Select the operation mode from the menu with the up (▲)/down (▼) and Enter (↵) buttons. For operation mode details, see Figure 163 on page 139.
   The selected option is highlighted with a white background.
2. Press the right arrow (➡) to continue.

For fixed speed operation modes, continue to Fixed Speed Quick Start Configuration on page 231.

For variable speed operation modes, continue to Variable Speed Quick Start Configuration on page 239.

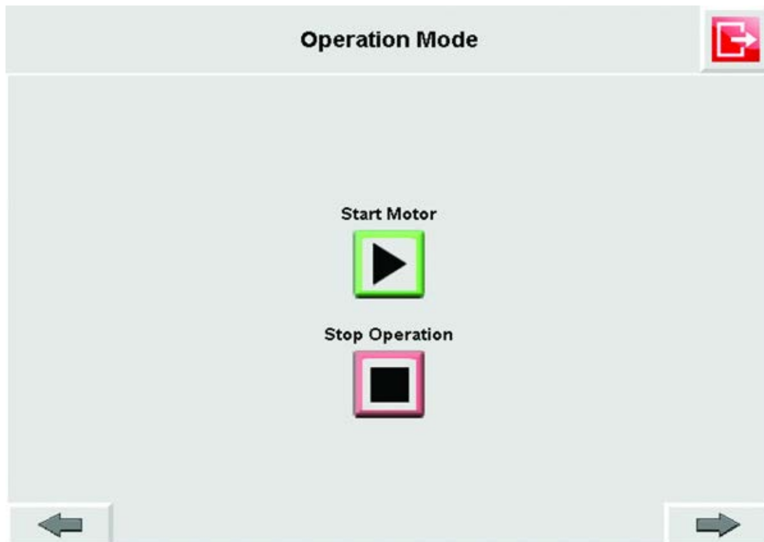
Fixed Speed Quick Start Configuration

These displays appear when a fixed speed operation mode is selected in Figure 256 on page 230.

Start and Stop the Motor

This display lets you start and stop the INSTRUCT SRP operation.

Figure 257 - Quick Start: Start/Stop (with Motor Stopped)



- Start the Motor
  a. To start the motor, press the Start Motor button.

IMPORTANT	If the Start Motor button is dimmed, the motor is on.

  b. Press the right arrow () to continue.

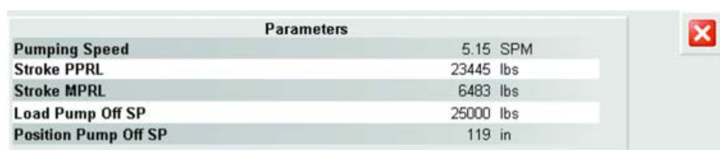
- Stop the Motor/Operation
  a. When the motor is running, press the Stop Motor button to stop the motor.
  b. When the motor is stopped, press the Stop Operation button to stop the INSTRUCT SRP control functionality, including the pump. The Stop Operation button remains available even after the well has been stopped.
  c. Press the right arrow () to continue.

Current Card

This display shows the current Surface and Downhole cards.

Figure 258 - Quick Start: Current Card

1. Each single plot is updated automatically. The refresh rate is half of the SPM.
2. Press the Parameters button to see a faceplate with the current data that is obtained from the current surface and downhole card. The parameters that are displayed in the Parameter faceplate depend on the operating mode of the well.



3. Press the Close button ( ) to return to the Current Card display (Figure 258).

The button on the lower right of the Current Card display changes based on the sensor type:

IMPORTANT	If the Start Calibration or RPS Synchronization buttons are dimmed, you must start the motor to make them active. See Start and Stop the Motor on page 231 (fixed speed) or page 243 (variable speed).

- Inclinometer - The button is Start Calibration.
  a. Press the Start Calibration button.
  b. Once the calibration is in process, a screen with the calibration position voltage values appears.

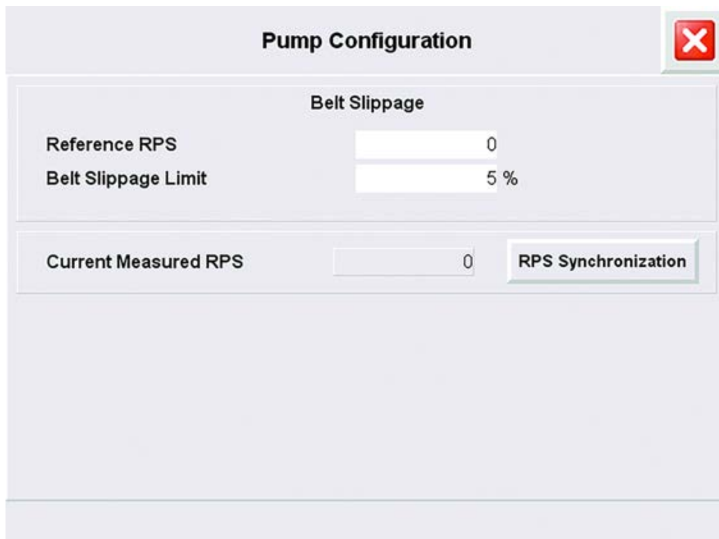
IMPORTANT	Verify that the X-axis coordinate of the surface card starts at zero. If not, repeat the calibration process. If correctly installed, the values for the position inclinometer voltage range between 2.5…4.5V depending on the stroke length of the pump.

c. Complete the calibration process by pressing Accept or Reject.

- Hall Effect - Crank Arm / RPM and Proximity / RPM Sensor sensor types - The button is RPS Synchronization.

   a. Press the RPS Synchronization button to access the Belt Slippage display (Figure 259).

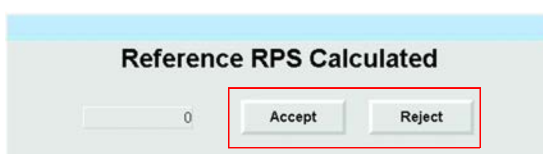
Figure 259 - Quick Start: Belt Slippage



   b. Press the RPS Synchronization button.

   The system provides you with a reference RPS that is measured during the RPS synchronization.

   c. To complete the synchronization process, select Accept. To reject the values, press Reject.
   If this value is accepted, then it is saved as the reference RPS against which the belt slippage alarm is detected.



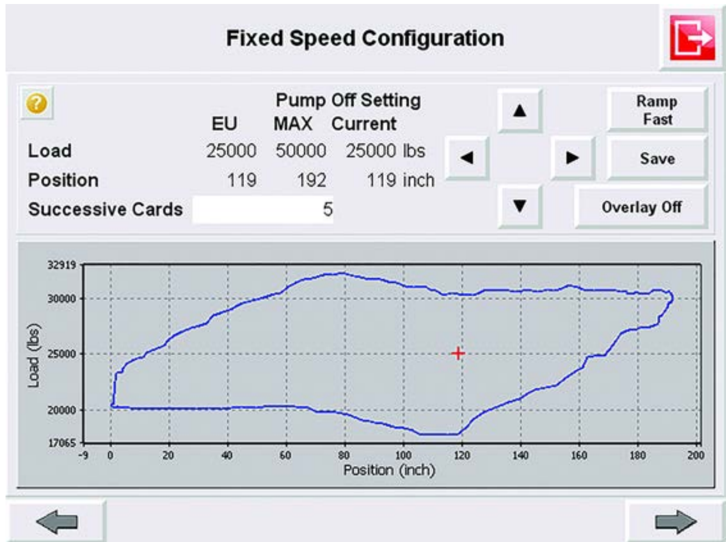
   d. Press the Close button () to return to the Current Card display (Figure 258 on page 232).

4. Press the right arrow () to continue.

Pump Off Setting

This display appears in the Quick Start configuration only when well is in the Fixed Speed Pump Off operation mode.

Figure 260 - Quick Start: Pump Off Setting



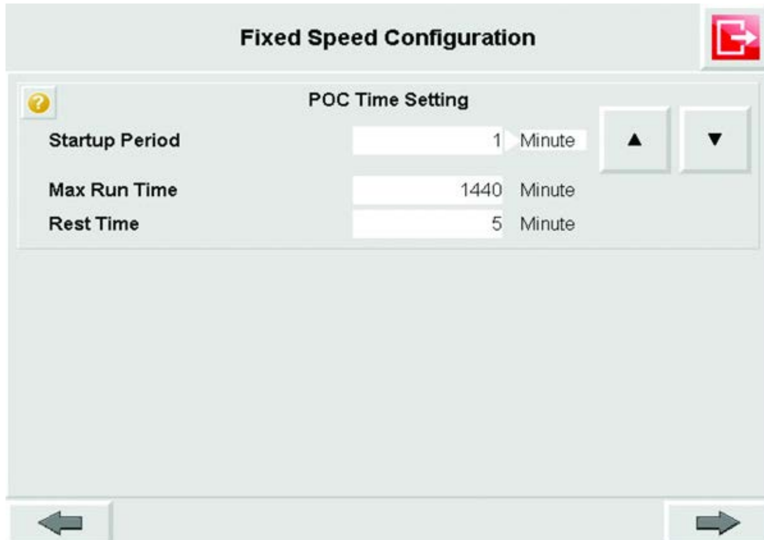
1. Set the load values by pressing the up (▲)/down (▼) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.
2. Set the position values by pressing the left (◄)/right (►) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.

IMPORTANT	The default mode (Ramp Slow) changes the load by 100 lb and position by 1 in. increments. Press the Ramp Fast button to change the load by 500 lb and the position by 5 in. increments.

3. Press the Save button to save the pump off points to the INSTRUCT SRP system.
   These points are used for further pump off condition detection. Once saved, the selected pump off point load and position values are shown in the EU column. The maximum allowed load and position are also displayed for your reference.
4. Press the Successive Cards field to enter a value on the popup keypad. A value of 1 shuts down the well immediately (maximum of 10). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 180 on page 156.
5. Press the right arrow (➡) to continue.

POC Time Setting

Figure 261 - Quick Start: POC Time Setting

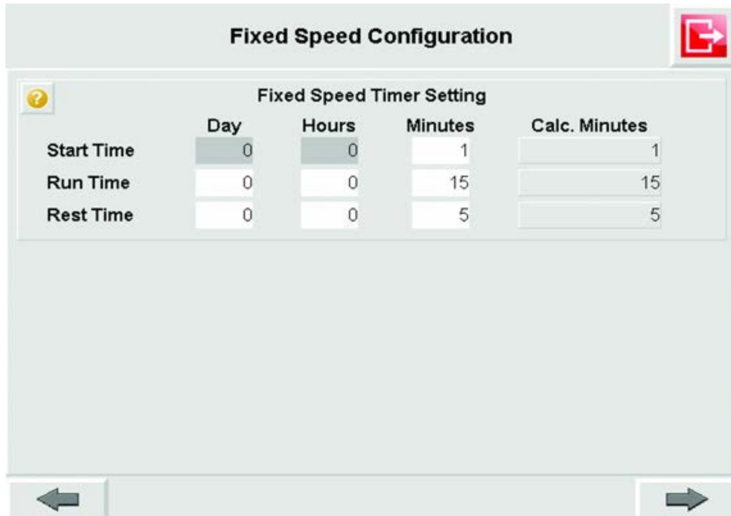


1. Set the startup period units (strokes or minutes) by pressing the up ( )/down ( ) buttons.
2. Configure the rest of the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 181 on page 157.
3. Press the right arrow ( ) to continue.

Fixed Speed Timer Setting

This display appears in the Quick Start configuration only when well is in the Fixed Speed Timer operation mode.

Figure 262 - Quick Start: Fixed Speed Timer Setting

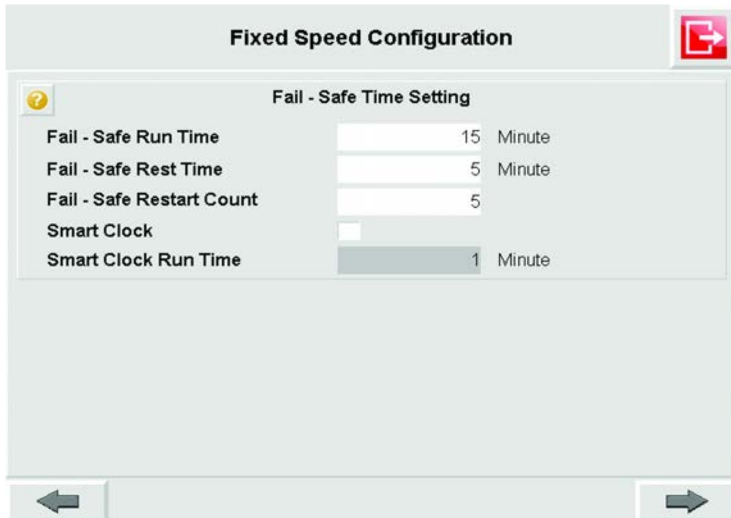


1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 186 on page 164.
2. Press the right arrow ( ) to continue.

Fail-safe Time Setting

This display appears in the Quick Start configuration when well is in the Fixed Speed Pump Fillage, Fixed Speed Pump Off, and Fixed Speed Manual operation mode.

Figure 263 - Quick Start: Fail-safe Time Setting



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 200 on page 175.

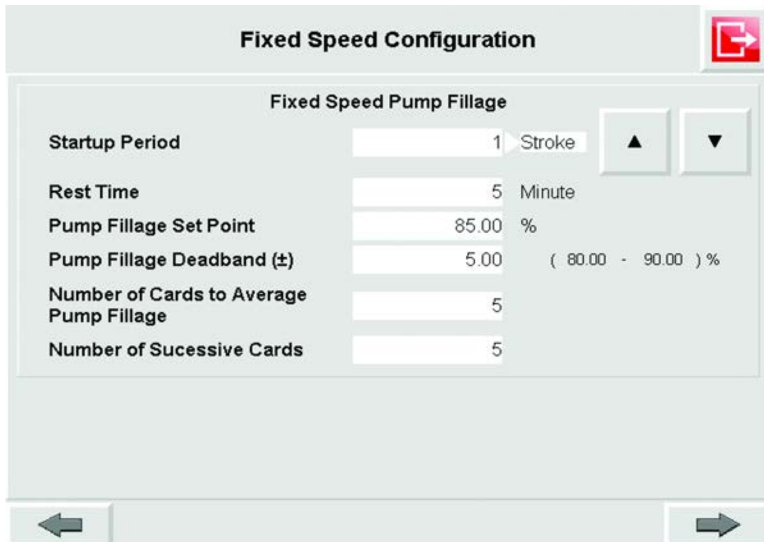
2. Press the right arrow ( ) to continue.

IMPORTANT	If your operation mode is not set to Fixed Speed Pump Fillage, the right arrow takes you to Alarm Configuration on page 247.

Fixed Speed Pump Fillage

In Fixed Speed Pump Fillage mode, the INSTRUCT SRP sends a command to stop the well for a rest period after a number of successive downhole cards has been detected with the calculated Pump Fillage below the target Pump Fillage.

Figure 264 - Quick Start: Fixed Speed Pump Fillage



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 183 on page 157.
2. Press the right arrow ( ) to continue to Alarm Configuration on page 247.

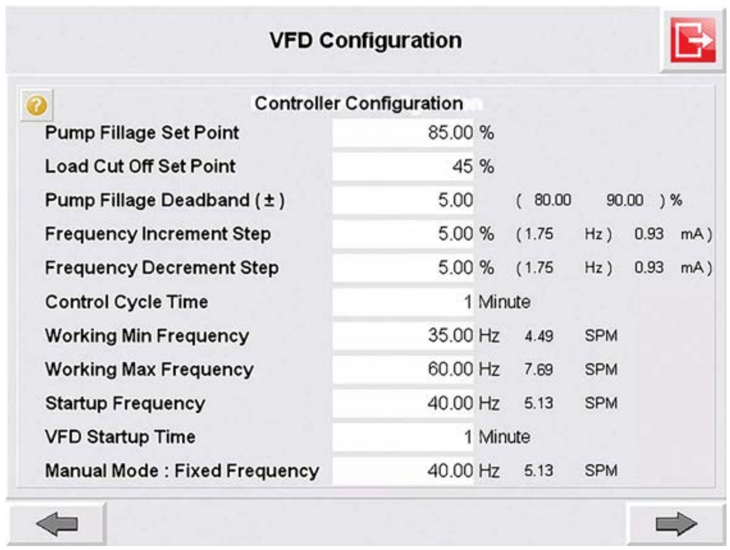
Variable Speed Quick Start Configuration

These displays appear when a variable speed operation mode is selected on the Well Operation Mode display ([Figure 256 on page 230](#)).

Controller Configuration

The Controller Configuration parameters verify accurate control and appropriate response in variable-speed operation modes. These settings require fine-tuning during commissioning and startup.

Figure 265 - Quick Start: Controller Configuration



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see [Figure 185 on page 161](#).
2. Press the right arrow ( ) to continue.

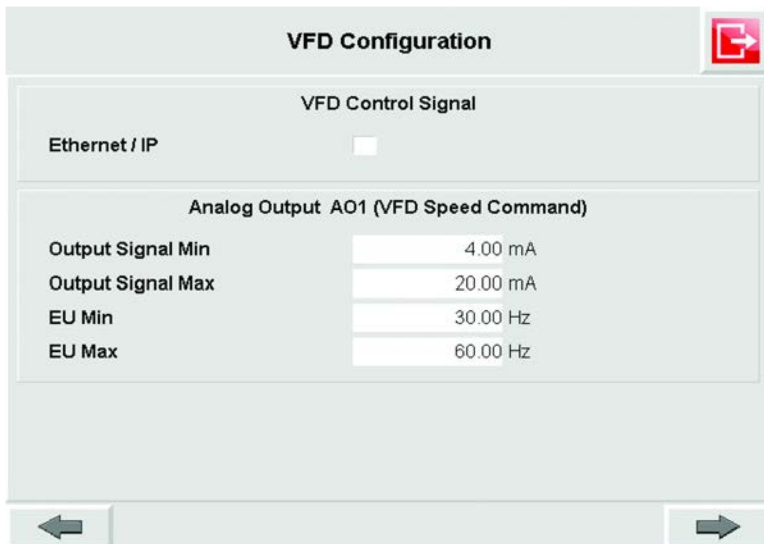
VFD Control Signal and VFD Speed Command

The VFD Control Signal checkbox allows you to enable or disable the VFD control signal.

The Analog Output configuration allows you to configure characteristics of the defined VFD Speed Command.

IMPORTANT	The EU min/max apply to both 4…20 mA signal and EtherNet/IP.

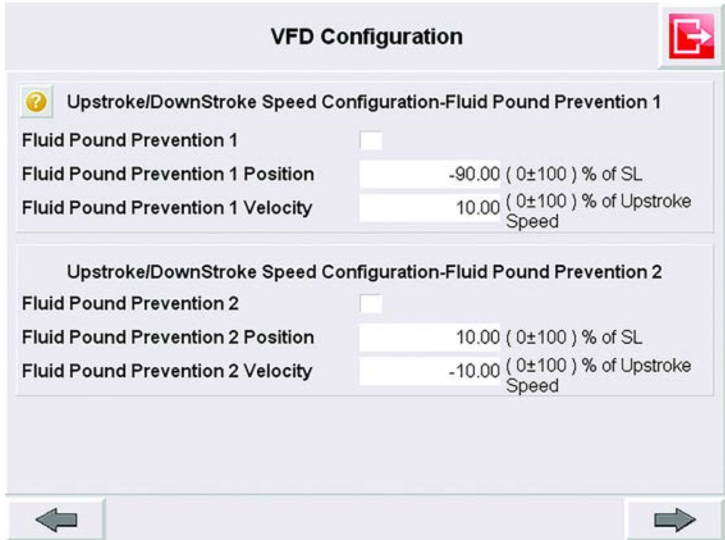
Figure 266 - Quick Start: VFD Control Signal and VFD Speed Command



1. Press the EtherNet/IP™ check box to enable (checked) or disable (cleared) the VFD Control Signal.
2. Configure the Analog Output parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 186 on page 162.
3. Press the right arrow ( ) to continue.

Fluid Pound Prevention

Figure 267 - Quick Start: Fluid Pound Prevention

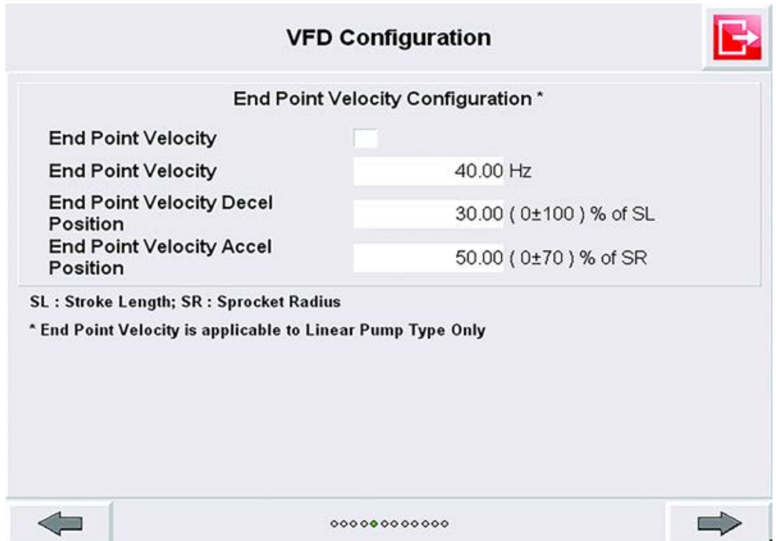


1. Press the Fluid Pound Prevention 1 and 2 checkboxes to enable (checked) or disable (cleared) these features.
2. Configure the Position and Velocity parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 187 on page 163.
3. Press the right arrow ( ) to continue.

Only available when Hall Effect/RPM or Proximity/RPM position sensors are used.

End Point Velocity Configuration

Figure 268 - Quick Start: End Point Velocity Configuration



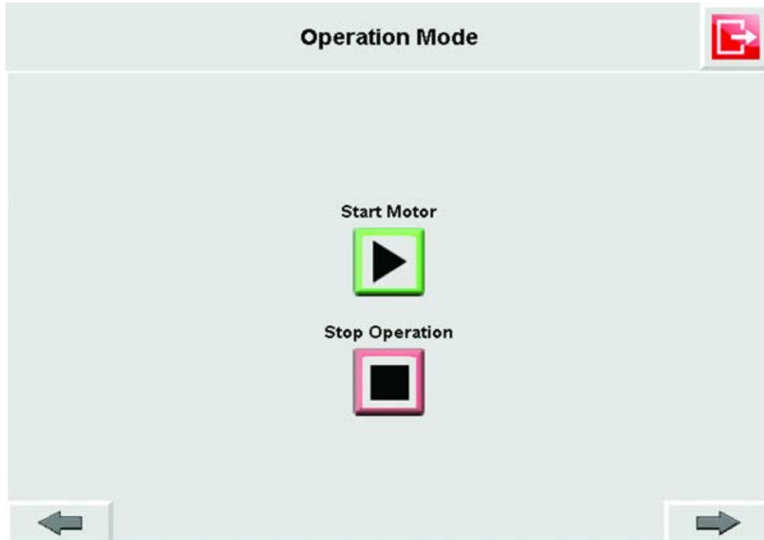
1. Press the End Point Velocity checkbox to enable (checked) or disable (cleared) this feature.
2. Configure the remaining parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 188 on page 164.
3. Press the right arrow ( ) to continue.

This configuration is only available when Proximity/RPM position sensors are used with a linear pump type

Start and Stop the Motor

This display lets you start and stop the INSTRUCT SRP operation.

Figure 269 - Quick Start: Start/Stop (with Motor Stopped)



- Start the Motor
  a. To start the motor, press the Start Motor button.

IMPORTANT	If the Start Motor button is dimmed, the motor is on.

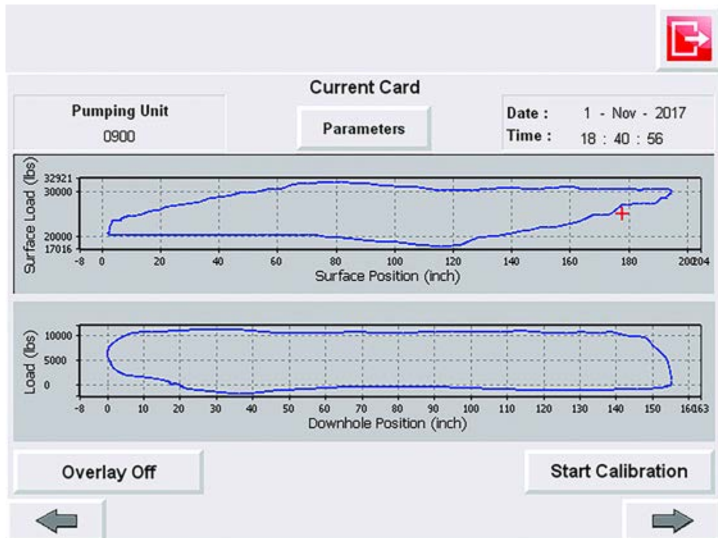
  b. Press the right arrow () to continue.

- Stop the Motor/Operation
  a. When the motor is running, press the Stop Motor button to stop the motor.
  b. When the motor is stopped, press the Stop Operation button to stop the INSTRUCT SRP control functionality, including the pump. The Stop Operation button remains available even after the well has been stopped.
  c. Press the right arrow () to continue.

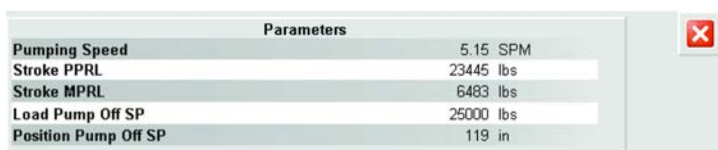
Current Card

This display shows the current Surface and Downhole cards.

Figure 270 - Quick Start: Current Card



1. Each single plot is updated automatically. The refresh rate is half of the SPM.
2. Press the Parameters button to see a faceplate with the current data that is obtained from the current surface and downhole card. The parameters that are displayed in the Parameter faceplate depend on the operating mode of the well.



3. Press the Close button () to return to the Current Card display (Figure 270).

The button on the lower right of the Current Card display changes based on the sensor type:

IMPORTANT	If the Start Calibration or RPS Synchronization buttons are dimmed, you must start the motor to make them active. See Start and Stop the Motor on page 231 (fixed speed) or page 243 (variable speed).

- Inclinometer - The button is Start Calibration.
  a. Press the Start Calibration button.
  b. Once the calibration is in process, a screen with the calibration position voltage values appears.

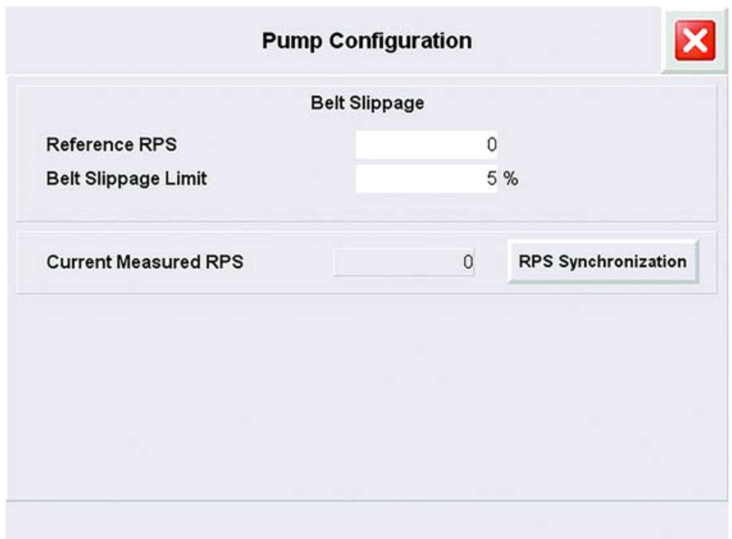
IMPORTANT	Verify that the X-axis coordinate of the surface card starts at zero. If not, repeat the calibration process. If correctly installed, the values for the position inclinometer voltage range between 2.5…4.5V depending on the stroke length of the pump.

c. Complete the calibration process by pressing Accept or Reject.

- Hall Effect - Crank Arm/RPM and Proximity/RPM Sensor sensor types - The button is RPS Synchronization.

  a. Press the RPS Synchronization button to access the Belt Slippage display (Figure 271).

Figure 271 - Quick Start: Belt Slippage



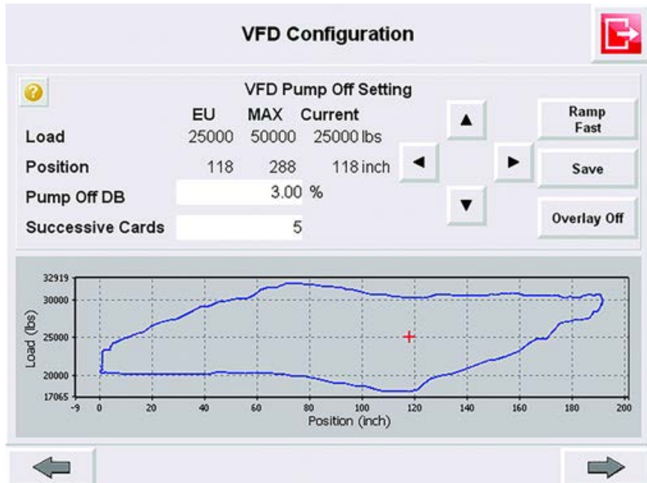
  b. Follow the instructions on page 233 to complete the RPS synchronization.

4. Press the right arrow () to continue.

VFD Pump Off Setting

VFD Pump Off settings help you visualize control parameters relative to the surface card and only appear in the Variable Speed Pump Off operation mode.

Figure 272 - Quick Start: VFD Pump Off Setting



1. Set the load values by pressing the up (▲)/down (▼) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.
2. Set the position values by pressing the left (◄)/right (►) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.

IMPORTANT	The default mode (Ramp Slow) changes the load by 100 lb and position by 1 in. increments. Press the Ramp Fast button to change the load by 500 lb and the position by 5 in. increments.

3. Press the Save button to save the pump off points to the INSTRUCT SRP system.
   These points are used for further pump off condition detection. Once saved, the selected pump off point load and position values are shown in the EU column. The maximum allowed load and position are also displayed for your reference.
4. Press the Pump Off Deadband (DB) field to enter a value on the popup keypad (range = 0…100). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 184 on page 160.
5. Press the Successive Cards field to enter a value on the popup keypad. A value of 1 shuts down the well immediately (maximum of 10). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 184 on page 160.

   TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

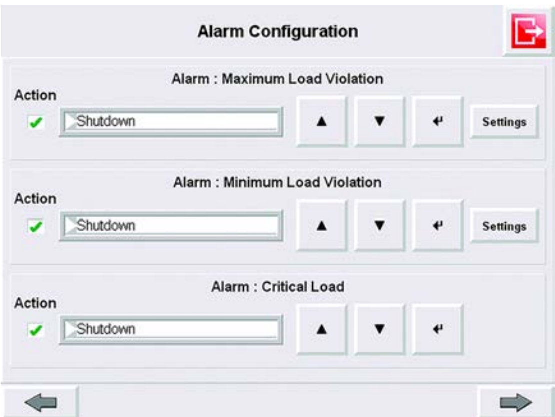
6. Press the right arrow (➡) to continue.

Alarm Configuration

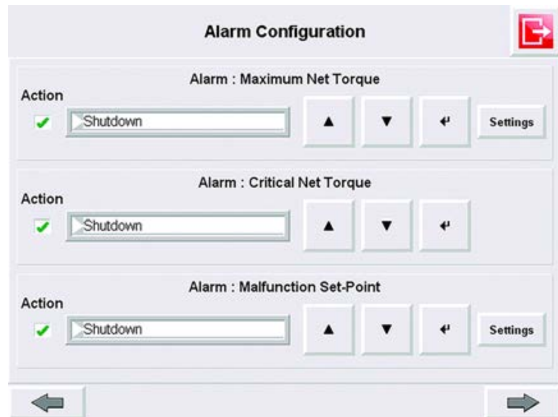
The next five displays let you configure alarms actions.

IMPORTANT	For alarms with a Settings button, adjust the alarm settings (step 1 on page 248) before enabling the alarm.

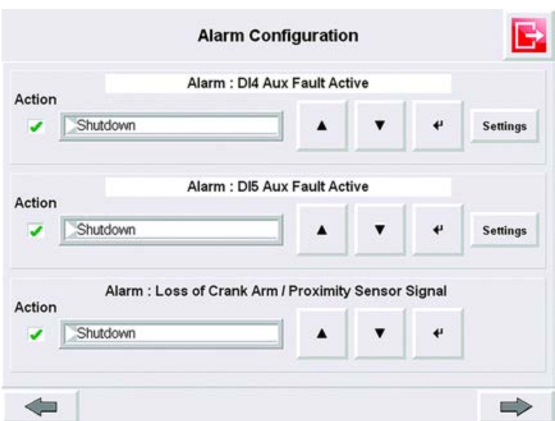
Figure 273 - Quick Start: Alarm Configuration



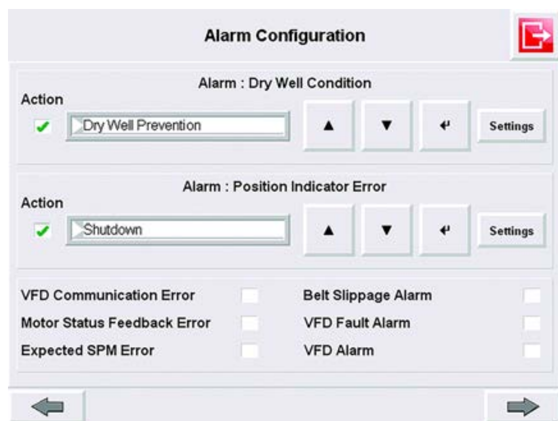
Display 1 (definition: page 167, operation: page 249)



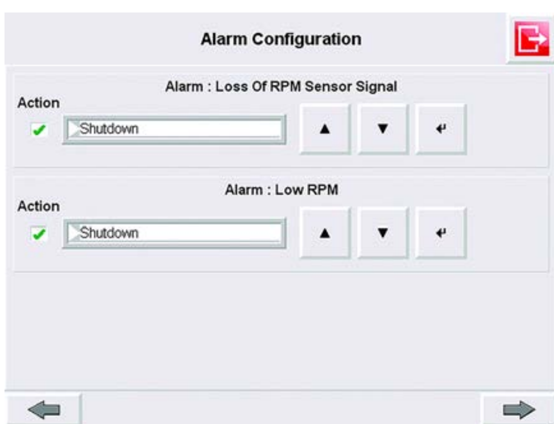
Display 2 (definition: page 167, operation: page 250 and 251)



Display 3 (definition: page 172, operation: page 252)



Display 4 (definition: page 173, operation: page 253 and 254)



Display 5 (definition: page 176)

1. Configure alarms by pressing the Settings button for the following:
    - Max/min load violation (Figure 274 on page 249)
    - Max/min net torque (Figure 275 on page 250)
    - Malfunction setpoint (Figure 276 on page 251)
    - DI4/DI5 auxiliary fault (Figure 277 on page 252)
    - Dry well condition (Figure 278 on page 253)
    - Position indicator error (Figure 279 on page 254)
2. Press the Action checkboxes to enable (checked) or disable (cleared) the corresponding alarms.

3. Select an alarm action from the menus by pressing the up ()/ down () buttons. For action options and definitions, see the following:

Alarm Display	Page
Display 1	167
Display 2	169
Display 3	172
Display 4	173
Display 5	176

Once selected, the text is highlighted with a white background.

IMPORTANT The action menus are only visible when the Action is enabled (checked).

4. After alarms are configured and enabled, press the right arrow () to continue to Pump Data on page 255.

Load Violation Setting

The red lines that are shown in the current card mark the current minimum and maximum load settings.

Figure 274 - Load Violation Setting

1. Press the Enable Load Violation checkboxes to enable (checked) or disable (cleared) the corresponding alarms.

2. Press the minimum and/or maximum load fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter definitions, see Figure 192 on page 168.

3. To set the number of times before the alarm is triggered, press the minimum and/or maximum Load Violation Count field to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values.

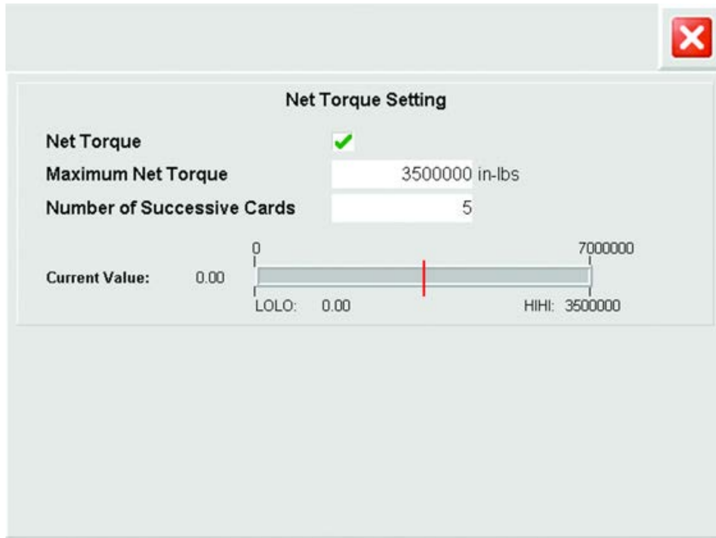
4. To update the red lines that show the current load limits, press the Show Limits button.

5. To load the new limits to your INSTRUCT SRP system, press the Save button.

6. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).

Net Torque Setting

Figure 275 - Net Torque Setting

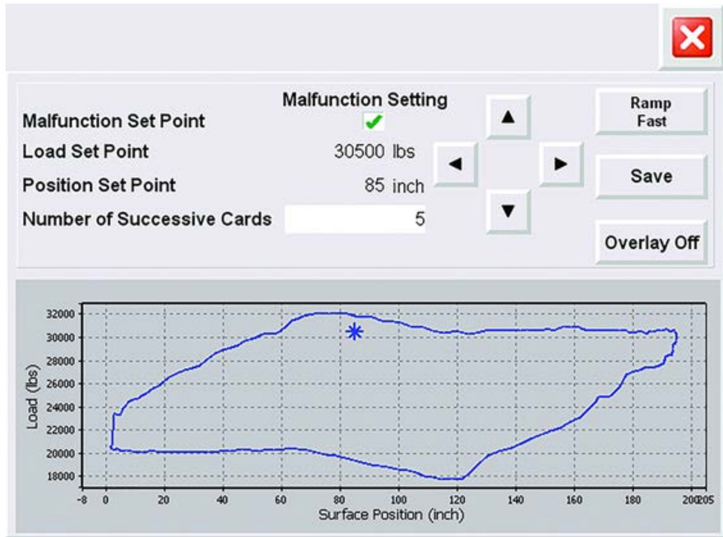


1. Press the Net Torque checkbox to enable (checked) or disable (cleared) the feature.
2. Press the Maximum Net Torque and Number of Successive Cards fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 194 on page 170.

   When a value is changed, the Current Value bar graph at the bottom of the display is updated.
3. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).

Malfunction Setting

Figure 276 - Malfunction Setting



1. Press the Malfunction Setpoint checkbox to enable (checked) or disable (cleared) the feature.
2. Set the load values by pressing the up ( )/down ( ) buttons. The selected value is shown in the Current column and the position is shown as a blue asterisk.
3. Set the position values by pressing the left ( )/right ( ) buttons. The selected value is shown in the Current column and the position is shown as a blue asterisk.

IMPORTANT	The default mode (Ramp Slow) changes the load by 100 lb and position by 1 in. increments. Press the Ramp Fast button to change the load by 500 lb and the position by 5 in. increments.

4. Press the Save button to save the setpoints to the INSTRUCT SRP system.
5. Press the Number of Successive Cards field to enter a value on the pop-up keypad. Press Enter ( ) on the keypad to save the value. For parameter definitions, see Figure 195 on page 171.

TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

6. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).

DI4/DI5 Auxiliary Fault Configuration

Figure 277 - DI4/DI5 Auxiliary Fault Configuration

1. If needed, press the Aux Fault Active field.

   A keyboard appears.

2. Type the desired name and press Enter ( ) on the keyboard.

   The keyboard disappears.

3. Set the status (HIGH or LOW) by pressing the up ( )/down ( ) buttons.

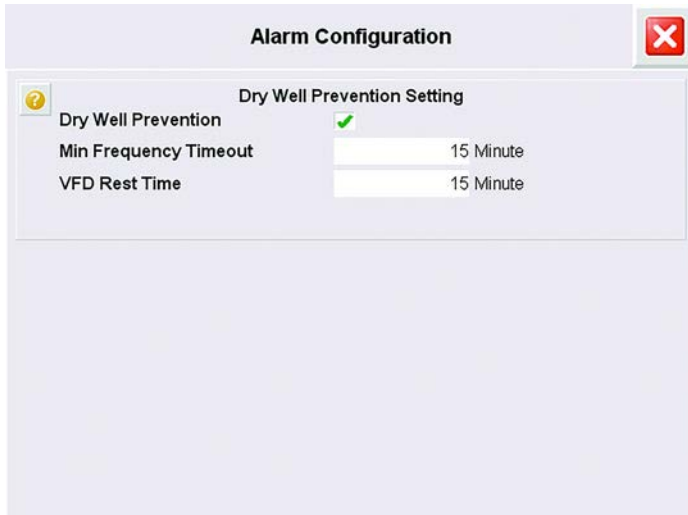
   The new status is selected automatically when changed.

4. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).

Dry Well Condition

When enabled, Dry Well Prevention settings are used to verify the appropriate response when a dry well condition occurs.

Figure 278 - Dry Well Prevention Setting

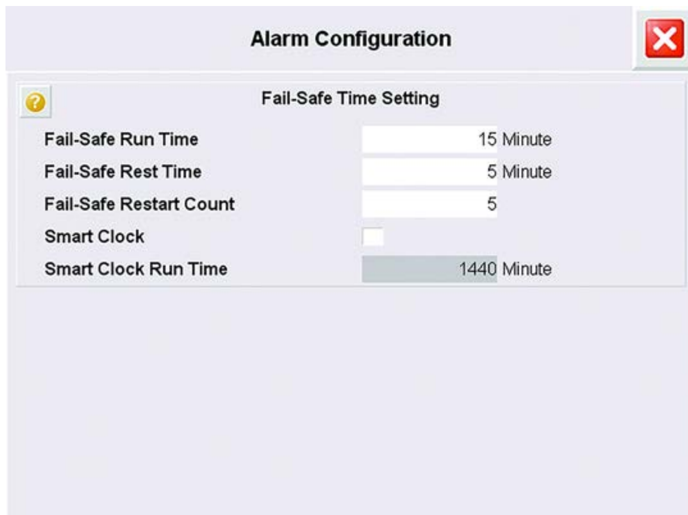


1. Press the Dry Well Condition checkbox to enable (checked) or disable (cleared) the feature.
2. Press the Min Frequency Timeout and VFD Rest Time fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 190 on page 166.
3. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).

Position Indicator Error

1. Press the Position Indicator Error checkbox to enable (checked) or disable (cleared) the feature.
2. With the Fail-Safe selected as the action, you must configure the parameters as needed (Figure 279) for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 200 on page 175.

Figure 279 - Position Indicator Error — Fail-safe Action



3. Press the Close button ( ) to return to the Quick Start Alarm Configuration display (Figure 273 on page 247).
4. Press the right arrow ( ) to continue.

Pump Data

The Pump Data displays are used to confirm that the settings that you configured through the Quick Start have been done correctly.

Figure 280 - Quick Start: Pump Data Displays

1. Press the right arrow ( ) to advance through the Pump data displays.
2. To edit values, return to the corresponding Quick Start page.
3. Press the exit button ( ) to return to the Operator display.

Configure the Rod Pump

The pump can be configured either using a local human machine interface (HMI) screen or the remote web server.

Via Web Server

See Configuration Using Web Server on page 33 for how to configure the Rod Pump through web server.

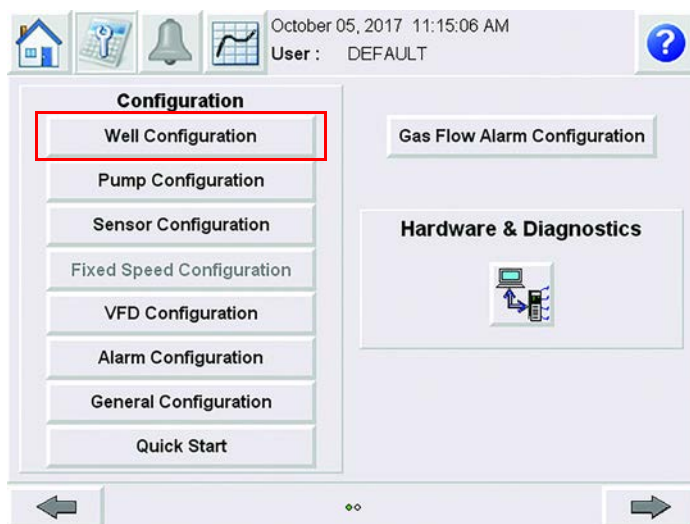
Via Local HMI Display

See Quick Start on page 213.

Change the Operation Mode

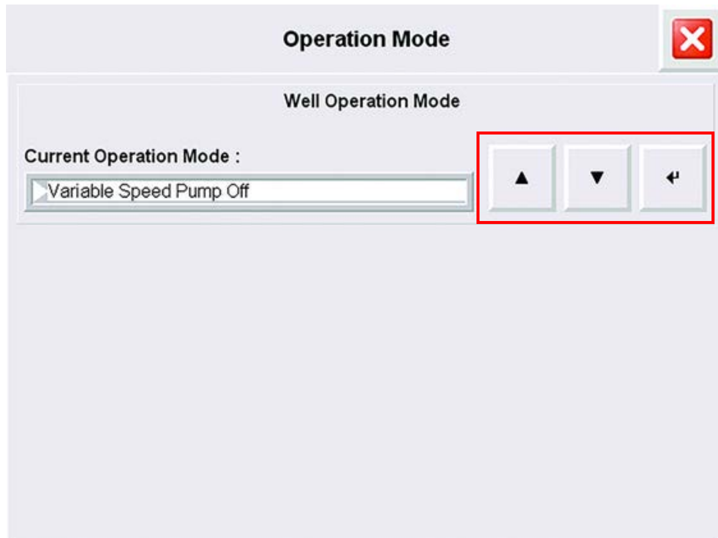
IMPORTANT You cannot change the operation mode until the motor is stopped. See Start and Stop the Motor on page 278.

1. Press the Configuration tab ().
2. Press the Well Configuration button.



3. Press the up (▲)/down (▼) arrow buttons to select the Operation Mode. Press the Enter (↵) button to set the mode.

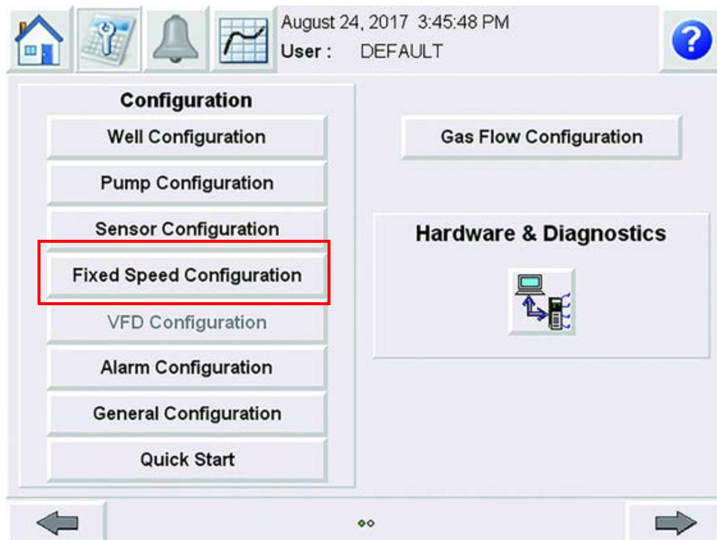
IMPORTANT	You cannot change the operation mode until the motor is stopped. The Current Operation Mode appears dimmed when the motor is running. See Start and Stop the Motor on page 278.



Fixed Speed Mode

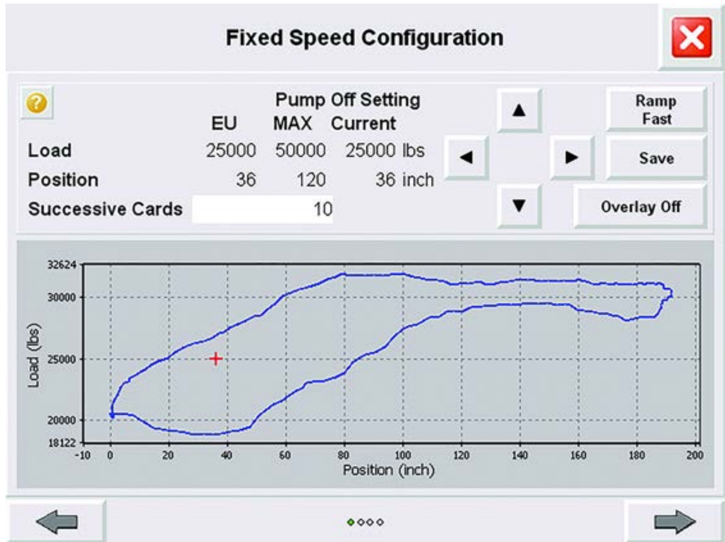
This section shows the parameters that must be configured for fixed speed modes. First, you must set your INSTRUCT SRP to one of the four fixed speed operation modes (see Change the Operation Mode on page 256).

1. Press the Configuration tab ().
2. Press the Fixed Speed Configuration button.



Pump Off Setting

Figure 281 - Configuration Display



TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

1. Set the load values by pressing the up (▲)/down (▼) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.

2. Set the position values by pressing the left (◄)/right (►) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.

IMPORTANT The default mode (Ramp Slow) changes the load by 100 lb and position by 1 in. increments. Press the Ramp Fast button to change the load by 500 lb and the position by 5 in. increments.

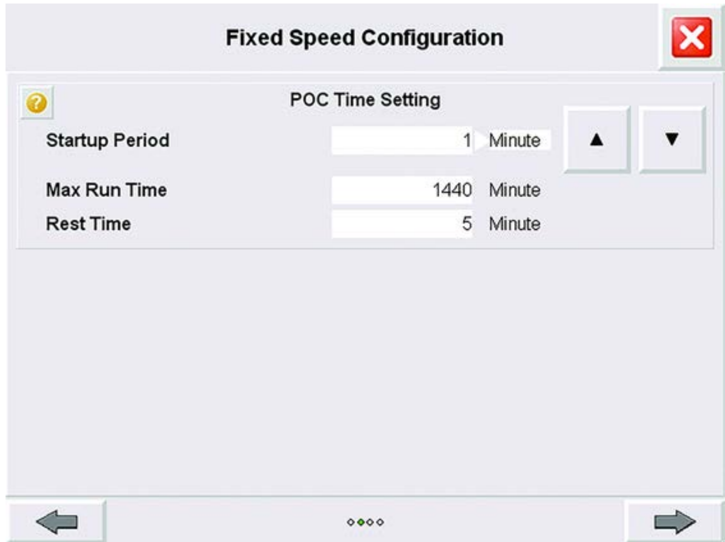
3. Press the Save button to save the pump off points to the INSTRUCT SRP system.
   These points are used for further pump off condition detection. Once saved, the selected pump off point load and position values are shown in the EU column. The maximum allowed load and position are also displayed for your reference.

4. Press the Successive Cards field to enter a value on the popup keypad. A value of 1 shuts down the well immediately (maximum of 10). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 184 on page 162.

5. Press the right arrow (➡) to continue.

POC Time Setting

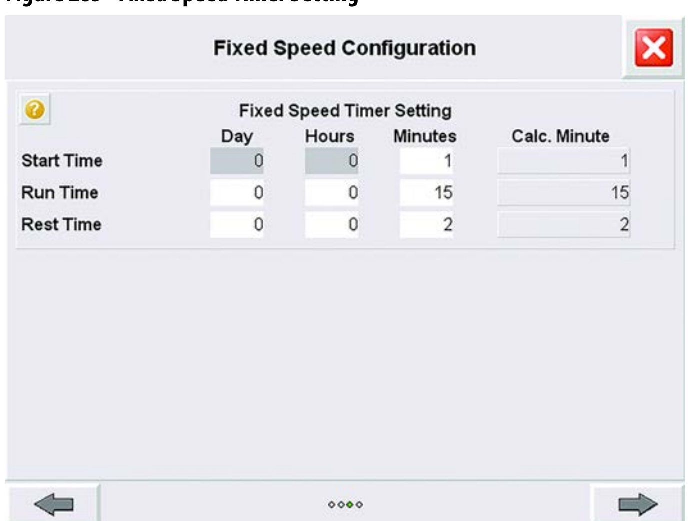
Figure 282 - POC Time Setting



1. Set the startup period units (stroke or minute) by pressing the up (▲)/down (▼) buttons.
2. Configure the rest of the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter (↵) on the keypad to save values. For parameter ranges and definitions, see Figure 185 on page 163.
3. Press the right arrow (➡) to continue.

Fixed Speed Timer Setting

Figure 283 - Fixed Speed Timer Setting

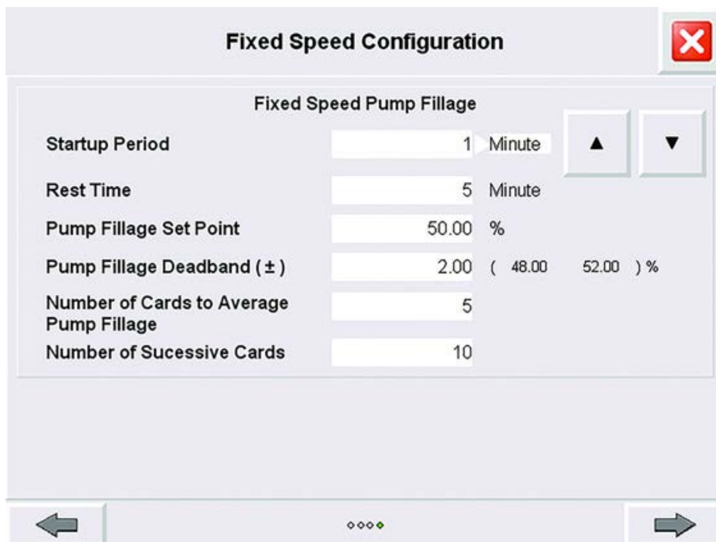


1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 186 on page 164.
2. Press the right arrow ( ) to continue.

Fixed Speed Pump Fillage

In Fixed Speed Pump Fillage mode, the INSTRUCT SRP sends a command to stop the well for a rest period after a number of successive downhole cards has been detected with the calculated Pump Fillage below the target Pump Fillage.

Figure 284 - Fixed Speed Pump Fillage

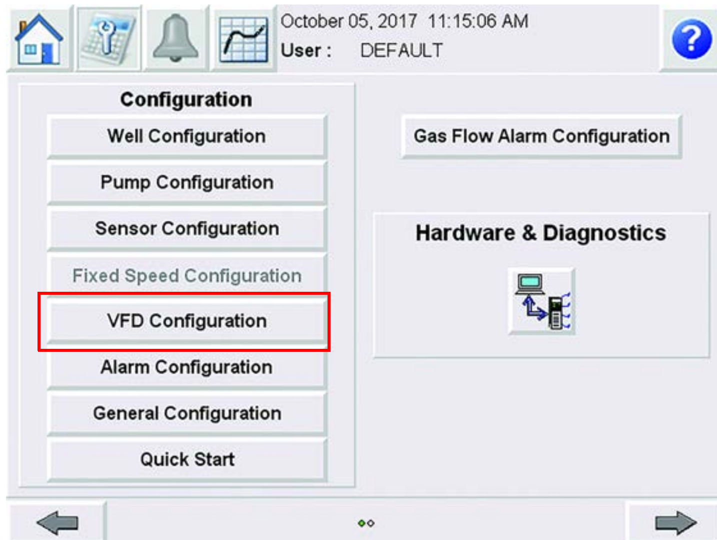


1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 187 on page 165.
2. Press the Close ( ) button to return to the Configuration tab.

Variable Speed Mode

This section shows the parameters that must be configured for variable speed modes. First, you must set your INSTRUCT SRP to one of the three variable speed operation modes (see Change the Operation Mode on page 256).

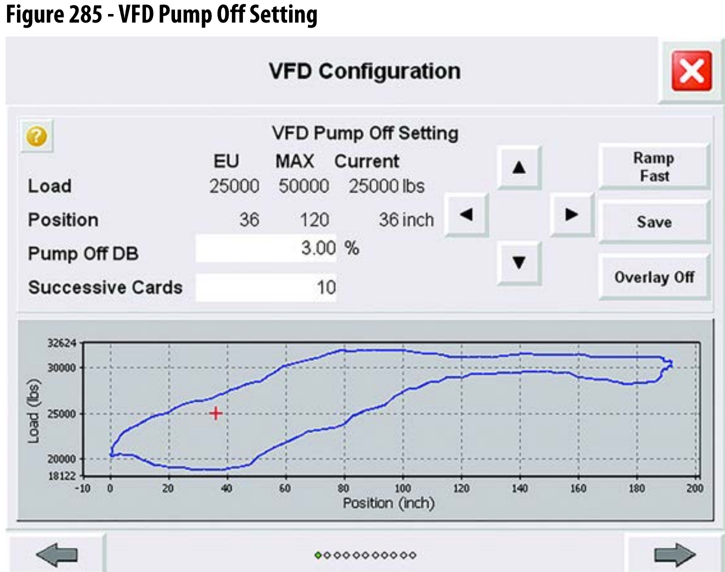
1. Press the Configuration tab ().
2. Press the VFD Configuration button.



VFD Pump Off Setting

VFD Pump Off settings help you visualize control parameters relative to the surface card during Variable Speed Pump Off operation mode.

Figure 285 - VFD Pump Off Setting



TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

1. Set the load values by pressing the up (▲)/down (▼) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.
2. Set the position values by pressing the left (◄)/right (►) buttons.
   The selected value is shown in the Current column and the position is shown as a red plus sign.

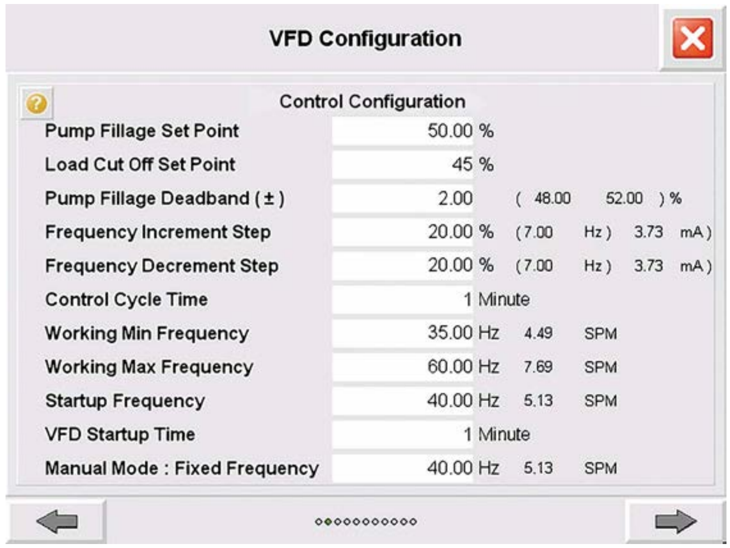
IMPORTANT	The default mode (Ramp Slow) changes the load by 100 lb and position by 1 in. increments. Press the Ramp Fast button to change the load by 500 lb and the position by 5 in. increments.

3. Press the Save button to save the pump off points to the INSTRUCT SRP system.
   These points are used for further pump off condition detection. Once saved, the selected pump off point load and position values are shown in the EU column. The maximum allowed load and position are also displayed for your reference.
4. Press the Pump Off Deadband (DB) field to enter a value on the popup keypad (range = 0…100). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 184 on page 160.
5. Press the Successive Cards field to enter a value on the popup keypad. A value of 1 shuts down the well immediately (maximum of 10). Press Enter (↵) on the keypad to save values. For parameter definitions, see Figure 184 on page 160.
6. Press the right arrow (➡) to continue.

Control Configuration

The Control Configuration parameters verify accurate control and appropriate response in variable-speed operation modes. These settings require fine-tuning during commissioning and startup.

Figure 286 - Control Configuration



1. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 189 on page 167.
2. Press the right arrow ( ) to continue.

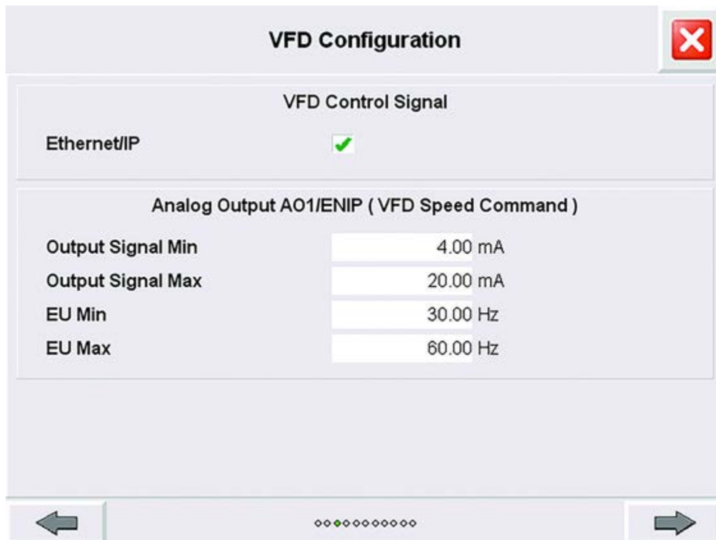
VFD Control Signal and VFD Speed Command

The VFD Control Signal checkbox allows you to enable or disable the VFD control signal that controls the VFD.

The Analog Output configuration allows you to configure characteristics of the defined VFD Speed Command.

IMPORTANT	The EU min/max apply to both 4…20 mA signal and EtherNet/IP.

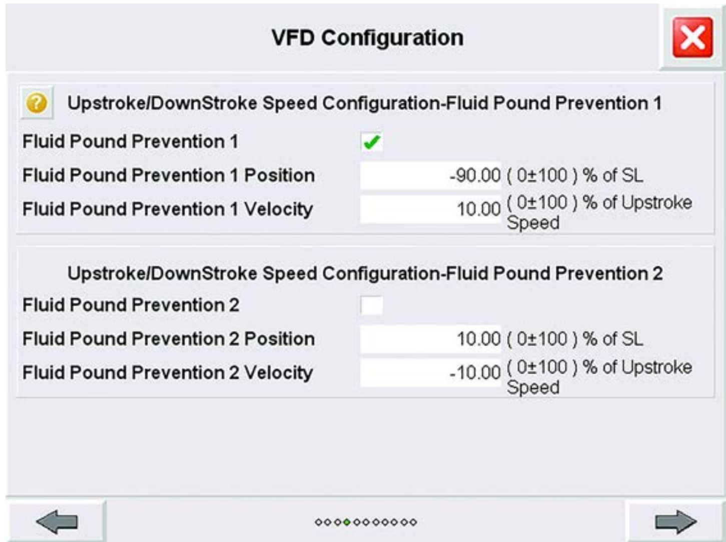
Figure 287 - VFD Control Signal and VFD Speed Command



1. Press the EtherNet/IP™ check box to enable (checked) or disable (cleared) the VFD Control Signal.
2. Configure the Analog Output parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter () on the keypad to save values. For parameter ranges and definitions, see Figure 190 on page 168.
3. Press the right arrow () to continue.

Fluid Pound Prevention

Figure 288 - Fluid Pound Prevention

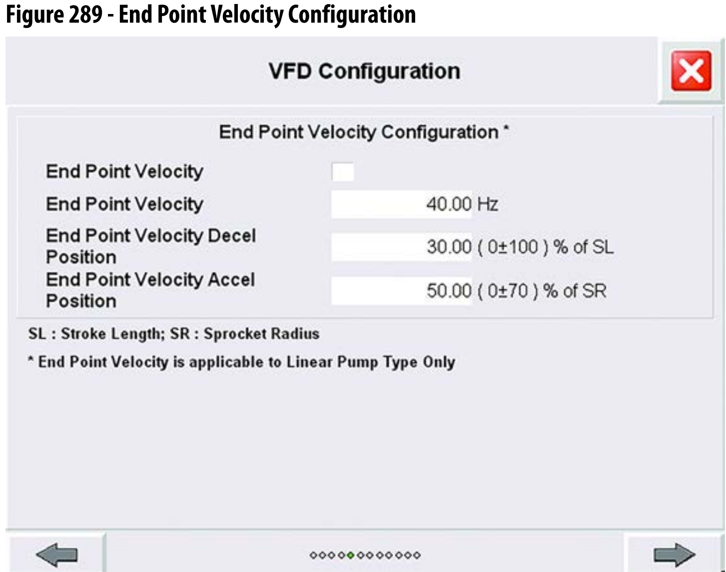


1. Press the Fluid Pound Prevention 1 and 2 checkboxes to enable (checked) or disable (cleared) these features.
2. Configure the Position and Velocity parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 191 on page 169.
3. Press the right arrow ( ) to continue.

Only available when Hall Effect/RPM or Proximity/RPM position sensors are used.

End Point Velocity Configuration (1)

Figure 289 - End Point Velocity Configuration



(1) Only available when Proximity/RPM position sensors are used with a linear pump type.

1. Press the End Point Velocity checkbox to enable (checked) or disable (cleared) this feature.
2. Configure the remaining parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter ranges and definitions, see Figure 192 on page 170.
3. Press the right arrow ( ) to continue.

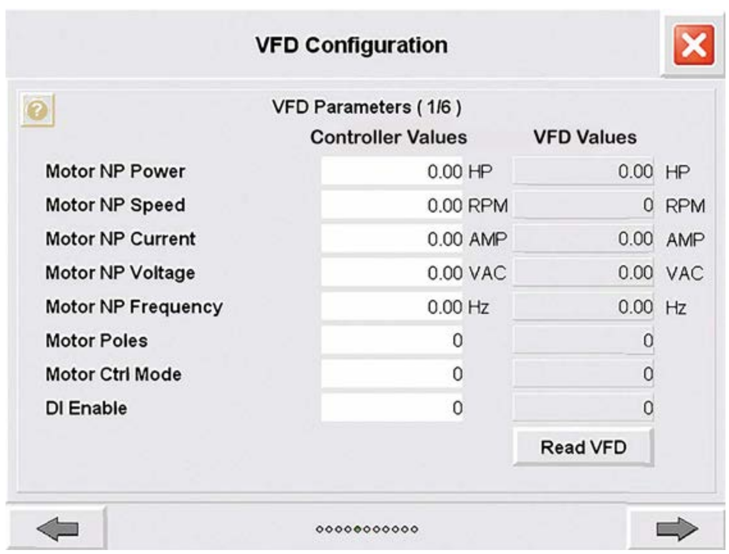
VFD Parameters

The INSTRUCT SRP can read and write certain VFD parameters. This access is available to help you fine-tune or troubleshoot your pumping system. The preferred method of writing VFD parameters is through your PowerFlex® drive. Parameter details can be found in your PowerFlex programming manual (publication 750-PM001).

See Configure VFD Parameters on page 268 for details.

ATTENTION: The VFD parameters can only be modified when the VFD is stopped. Never modify while VFD is running.

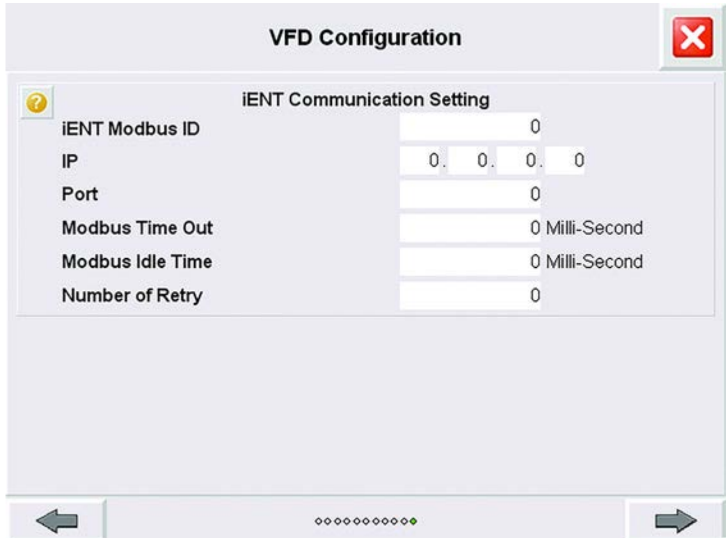
Figure 290 - VFD Parameters Example



iENT Communication Setting

This display lets you change the VFD interface communication parameters to the 1759-iENT gateway using Modbus TCP to read the parameters of the VFD. The default communication comes factory-configured. Only qualified technical personnel can adjust it.

Figure 291 - iENT Communication Setting



4. Configure the parameters as needed for your well by pressing the fields to enter a value on the popup keypad. Press Enter ( ) on the keypad to save values. For parameter definitions, see [Figure 190 on page 166](#).

5. Press the Close ( ) button to return to the Configuration tab.

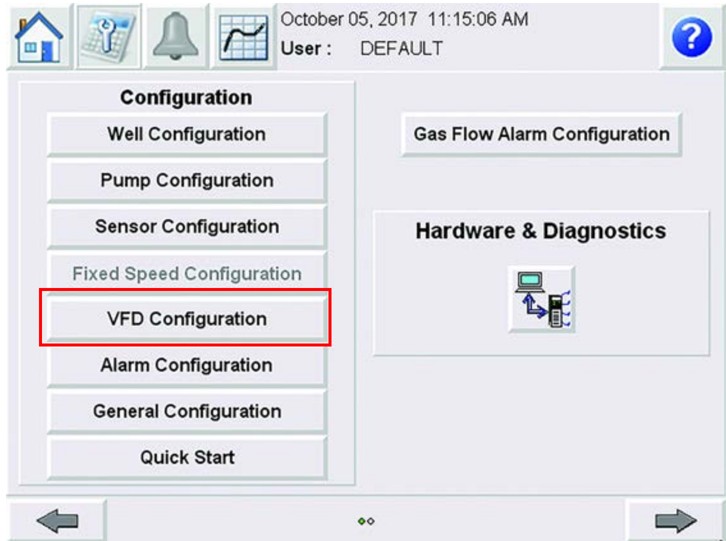
Configure VFD Parameters

The INSTRUCT SRP can read and write certain VFD parameters. This access is available to help you fine-tune or troubleshoot your pumping system. The preferred method of writing VFD parameters is through your PowerFlex drive. Parameter details can be found in your PowerFlex programming manual ([publication 750-PM001](#)).

ATTENTION: The VFD parameters can only be modified when the VFD is stopped. Never modify while VFD is running.

1. Press the Configuration tab ( ).

2. Press the VFD Configuration button.



3. Press the right arrow ( ) until you reach first VFD Parameters display (shown in step 5).

IMPORTANT VFD parameters are applicable to PowerFlex 753/755 drives. If you communicate with the drive with EtherNet/IP, these parameters can be read from your drive.

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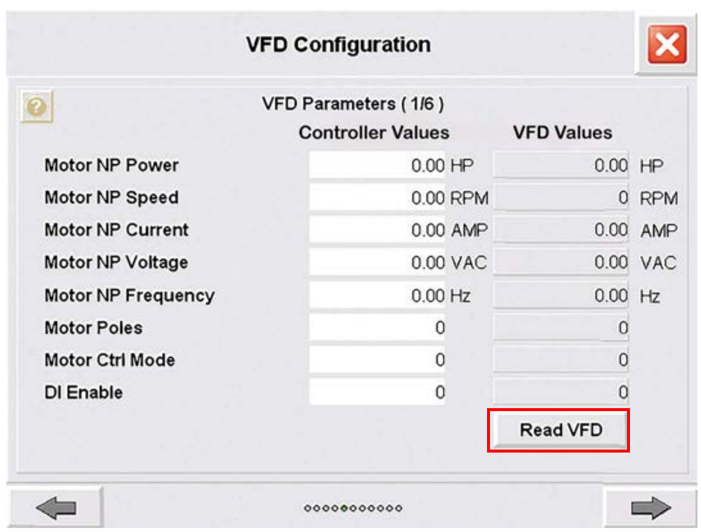
4. Press the left ( ) and right ( ) arrows to navigate between the six VFD parameter screens.

5. Press the Read VFD button to read the current VFD parameters.

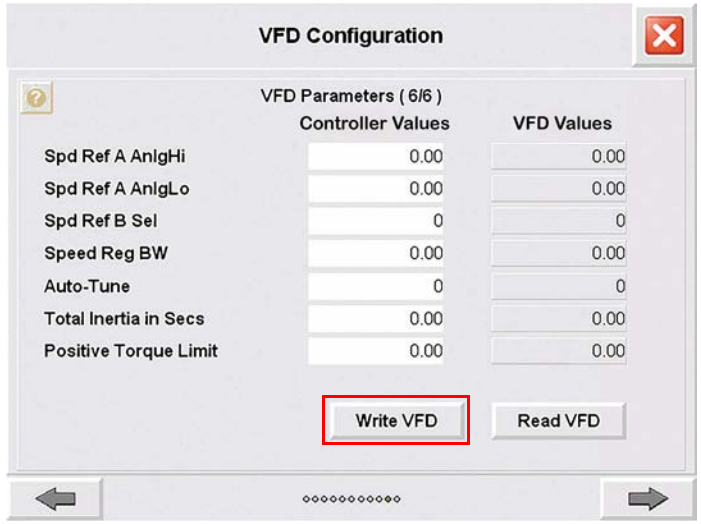


6. Press an controller Values field and enter a new value in the popup keypad. Press the Enter ( ) button to set the value.

7. Configure other VFD parameters as needed.

8. When finished, navigate to the VFD Parameters (6/6) display using the arrow buttons.

9. Press the Write VFD button to send the updated values to the VFD.



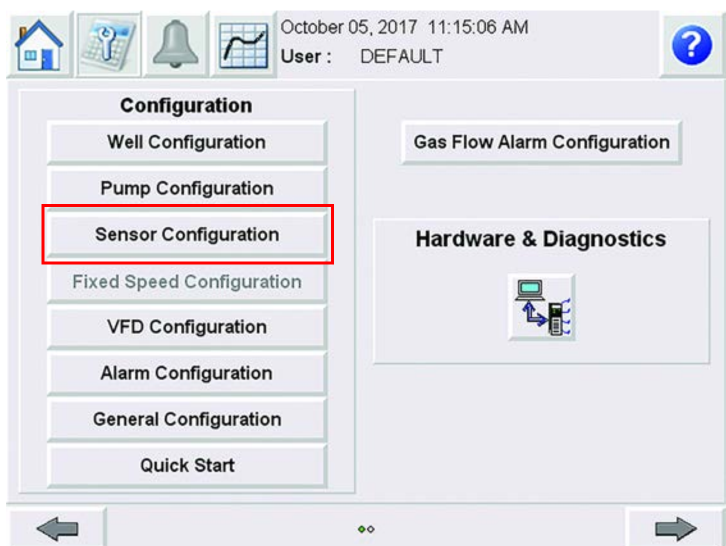
10. Press the Read VFD button to verify that the updated values have been written to the VFD (VFD Values column).

11. Press the Close () button to return to the Configuration tab.

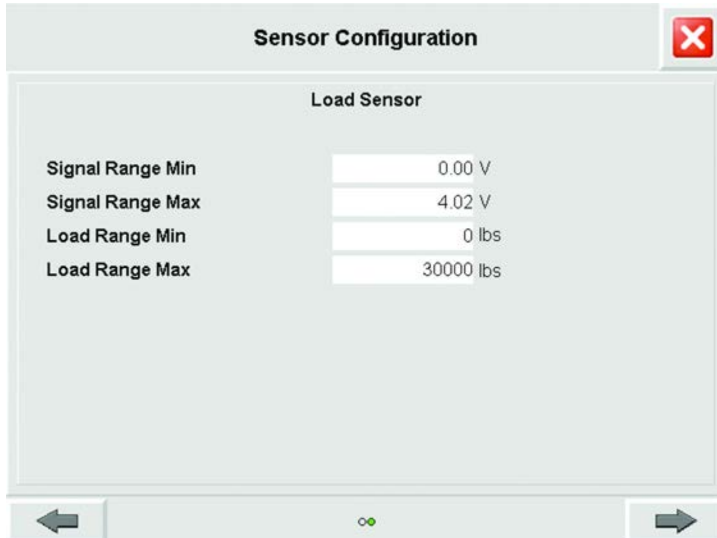
Configure Load Cell

1. Press the Configuration tab ().

2. Press the Sensor Configuration button.



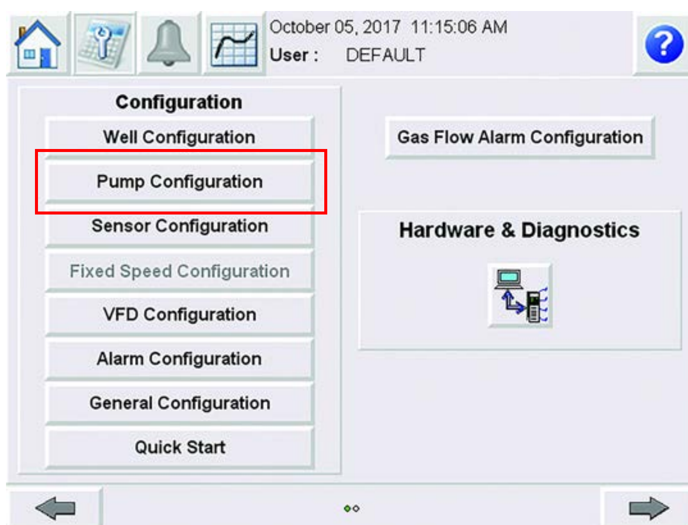
3. Press the right arrow ( ) once to get to the Load Sensor display.



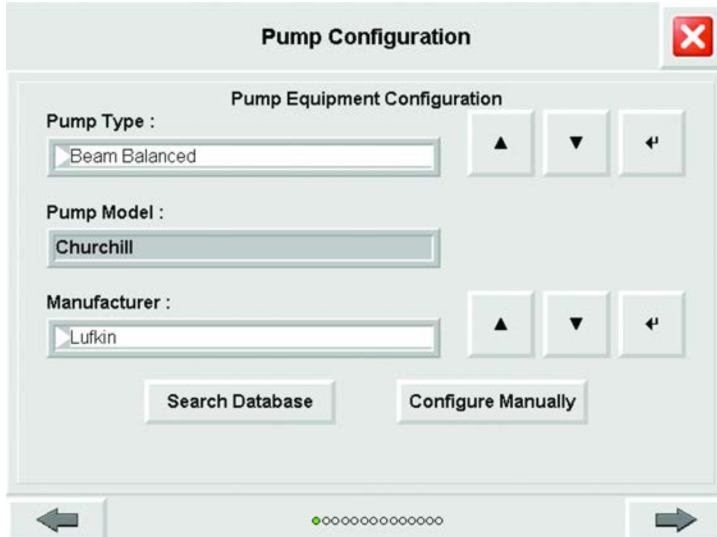
4. Press a field to configure the parameter value with the popup keypad.
5. Press the Enter ( ) button to set the value.
6. Press the Close ( ) button to return to the Configuration tab.

Configure Pump

1. Press the Configuration tab ( ).
2. Press the Pump Configuration button.



3. Select your Pump Type, Pump Model, and Manufacturer. For details, see Pump Equipment Configuration on page 146.

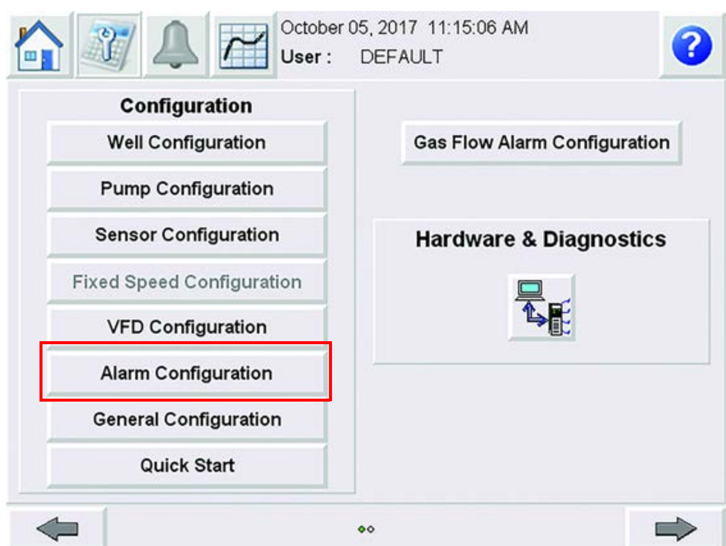


4. Press the Close ( ) button to return to the Configuration tab.

Configure Alarm

These settings correspond to associated alarm actions that are set on the Alarm Configuration display. To access alarm configuration:

1. Press the Configuration tab ( ).
2. Press the Alarm Configuration button.

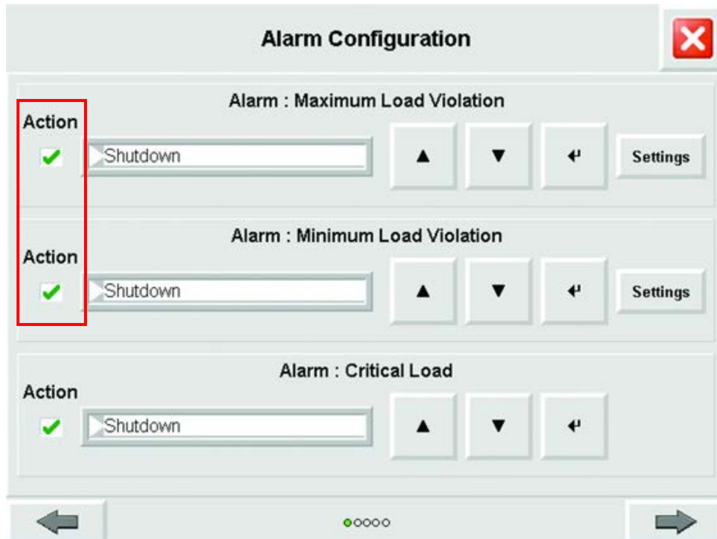


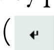
For a description of alarms, see Alarm Configuration on page 167.

Load Violation Limits

After following steps 1 and 2 under Configure Alarm on page 272, set your load violation alarms by following these steps.

1. Press the Action checkboxes to enable (checked) or disable (cleared) the minimum/maximum load violation alarms.



2. Select an alarm action from the menu by pressing the up ()/ down () buttons. Press the Enter () button to select the action. The text is highlighted with a white background when selected.

IMPORTANT	The alarm action menu is only visible when the Action is enabled (checked).

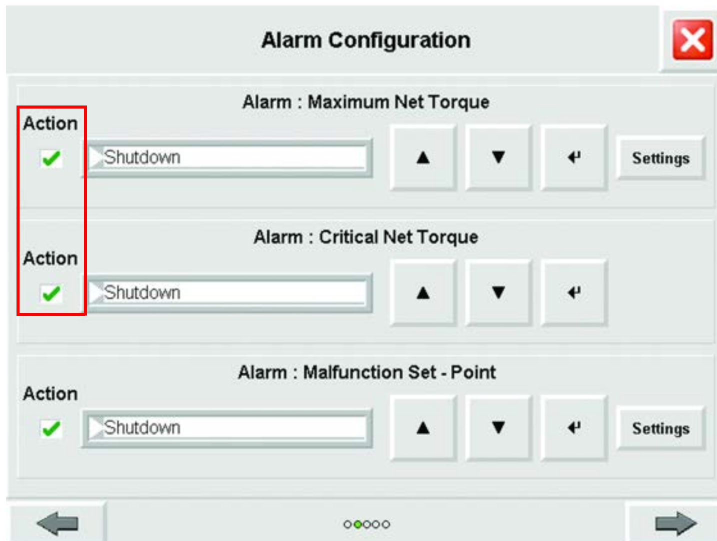
3. Press the Settings button. The Load Violation setting faceplate appears. See Load Violation Setting on page 249 for details on settings.

4. When complete, press the Close () button to return to the Configuration tab.

Net Torque Setting

After following steps 1 and 2 under Configure Alarm on page 272, set your net torque alarms by following these steps.

1. Press the right arrow ( ) once to get to the Alarm Configuration display with the net torque alarms.
2. Press the Action checkboxes to enable (checked) or disable (cleared) the Net Torque alarms.



3. Select an alarm action from the menu by pressing the up (▲)/ down (▼) buttons. Press the Enter (↵) button to select the action. The text is highlighted with a white background when selected.

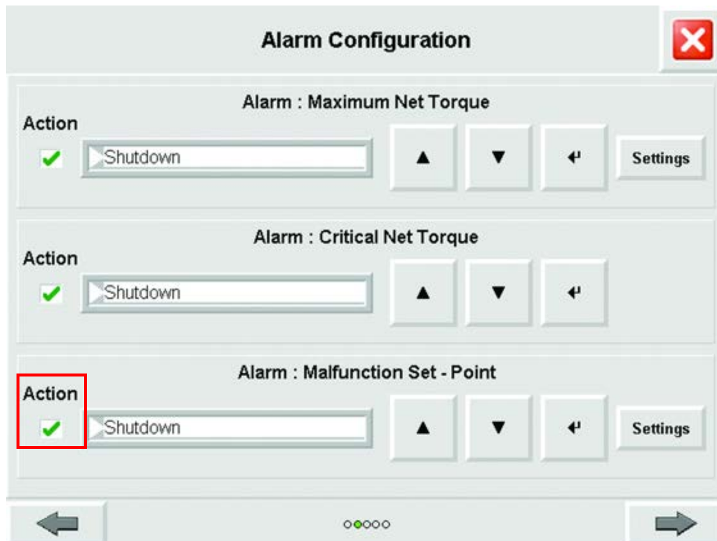
IMPORTANT The action menu is only visible when the Action is enabled (checked).

4. Press the Settings button. The Net Torque setting faceplate appears. Follow the instructions on Net Torque Setting on page 250.
5. When complete, press the Close ( ) button to return to the Configuration tab.

Malfunction Setpoint

After following steps 1 and 2 under Configure Alarm on page 272, set your malfunction setpoint alarm by following these steps.

1. Press the right arrow ( ) once to get to the Alarm Configuration display with the malfunction setpoint alarm.
2. Press the Action checkbox to enable (checked) or disable (cleared) the malfunction setpoint alarm.



3. Select an alarm action from the menu by pressing the up ( )/ down ( ) buttons. Press the Enter ( ) button to select the action. The text is highlighted with a white background when selected.

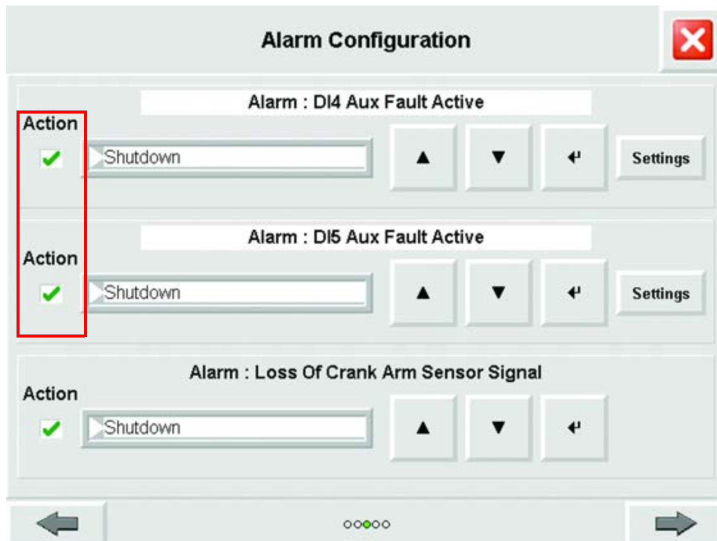
IMPORTANT The action menu is only visible when the Action is enabled (checked).

4. Press the Settings button. The Malfunction Setpoint setting faceplate appears. Follow the instructions on Malfunction Setting on page 251.
5. When complete, press the Close ( ) button to return to the Configuration tab.

DI4/DI5 Aux Fault

After following steps 1 and 2 under Configure Alarm on page 272, set your DI4 and DI5 Aux Fault Active alarm by following these steps.

1. Press the right arrow ( ) twice to get to the Alarm Configuration display with the DI4 and DI5 Aux Fault Active alarms.
2. Press the Action checkbox to enable (checked) or disable (cleared) the alarms.



3. Select an alarm action from the menu by pressing the up ( )/ down ( ) buttons. Press the Enter ( ) button to select the action. The text is highlighted with a white background when selected.

IMPORTANT	The action menu is only visible when the Action is enabled (checked).

4. Press the Settings button. The selected DI Aux Fault configuration faceplate appears. Follow the instructions on DI4/DI5 Auxiliary Fault Configuration on page 252.

5. When complete, press the Close ( ) button to return to the Configuration tab.

Dry Well Condition

After following steps 1 and 2 under Configure Alarm on page 272, set your Dry Well Prevention alarm by following these steps.

1. Press the right arrow ( ) three times to get to the alarm configuration display with the Dry Well Prevention alarm.
2. Press the Action checkbox to enable (checked) or disable (cleared) the alarm.

3. Select an alarm action from the menu by pressing the up ( )/ down ( ) buttons. Press the Enter ( ) button to select the action. The text is highlighted with a white background when selected.

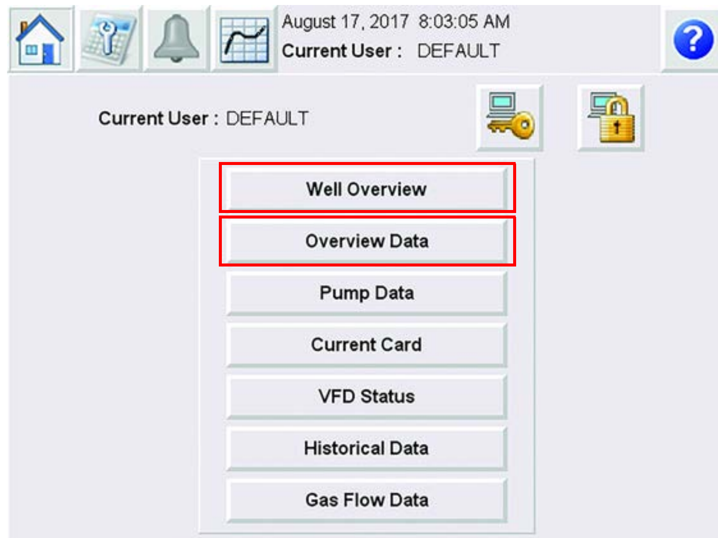
IMPORTANT	The action menu is only visible when the Action is enabled (checked).

4. Press the Settings button. The Dry Well Prevention setting faceplate appears. Follow the instructions on Dry Well Condition on page 253.
5. When complete, press the Close ( ) button to return to the Configuration tab.

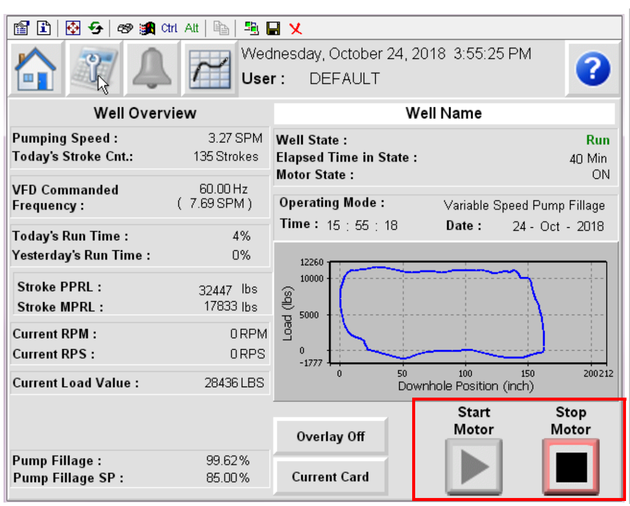
Start and Stop the Motor

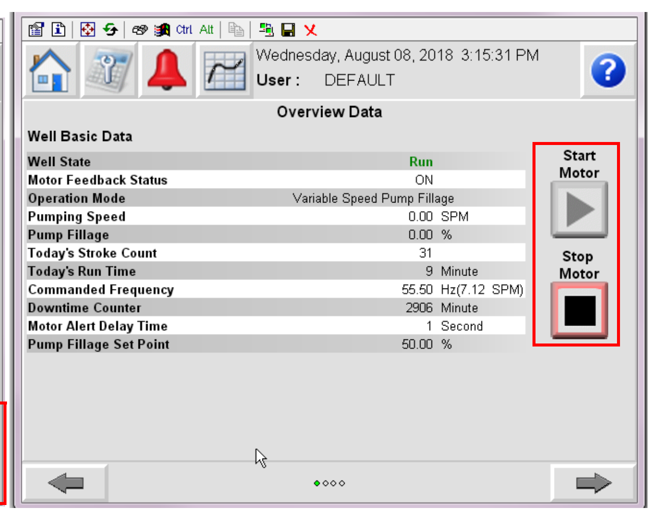
ATTENTION: To avoid personal injury and/or equipment damage, verify that it is safe to start the motor before performing this process.

1. Press the Operator tab ().
2. Press either the Well Overview or Overview Data buttons.



3. Press the Start or Stop Motor buttons.

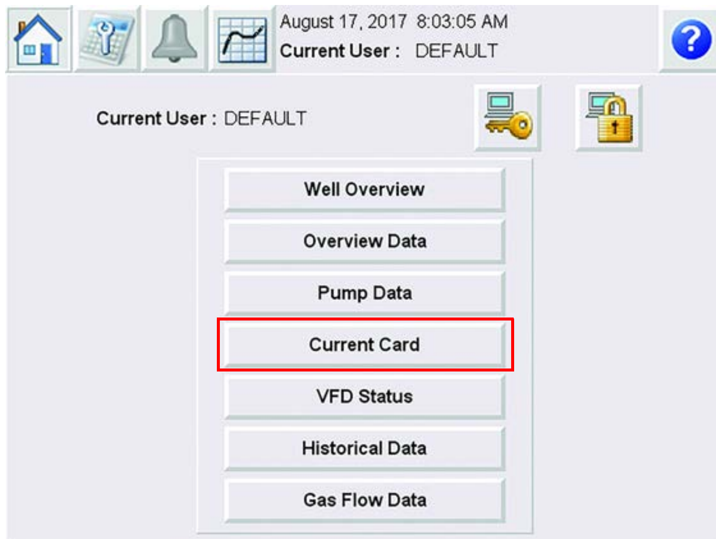




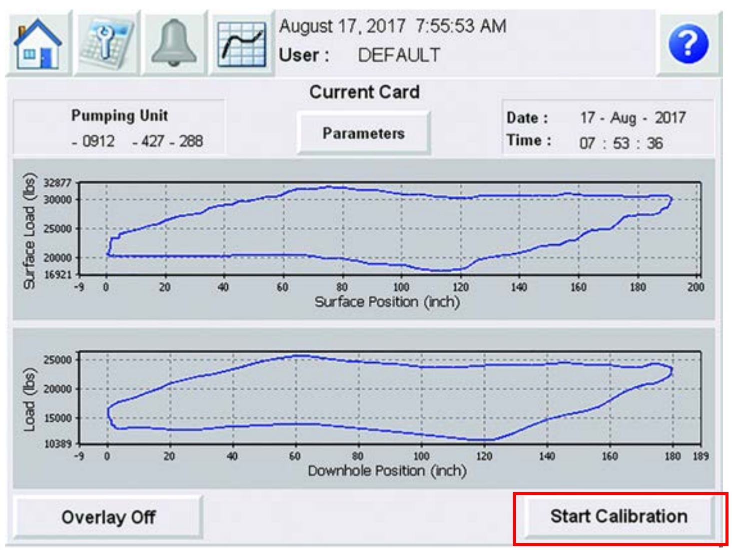
Calibrate the Inclinometer

IMPORTANT Well must be running to calibrate the inclinometer. See Start and Stop the Motor on page 278.

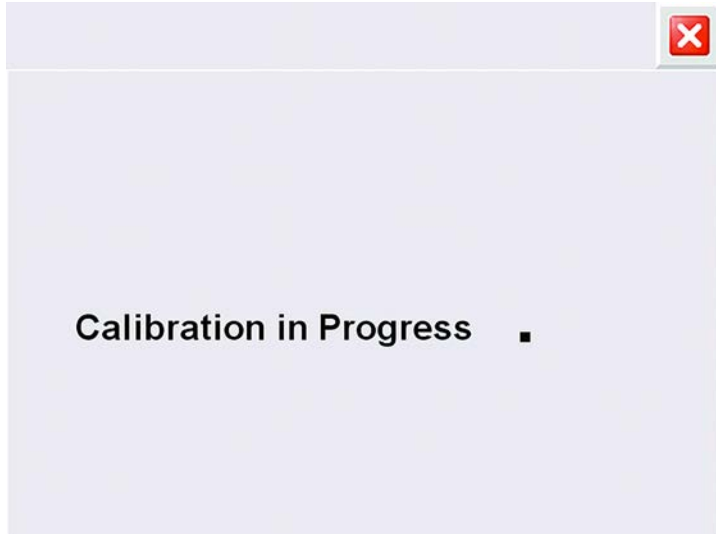
1. Press the Operator tab ().
2. Press the Current Card button.



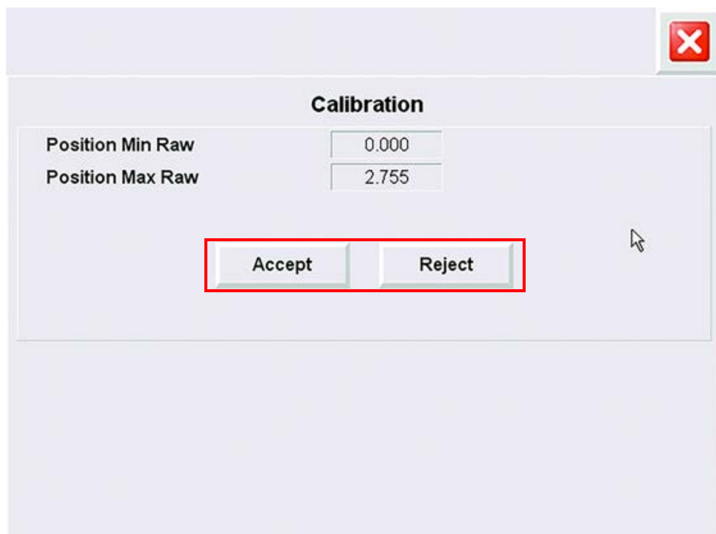
3. Press the Start Calibration button.



Calibration begins.



4. To complete the calibration process, press the Accept or Reject button.

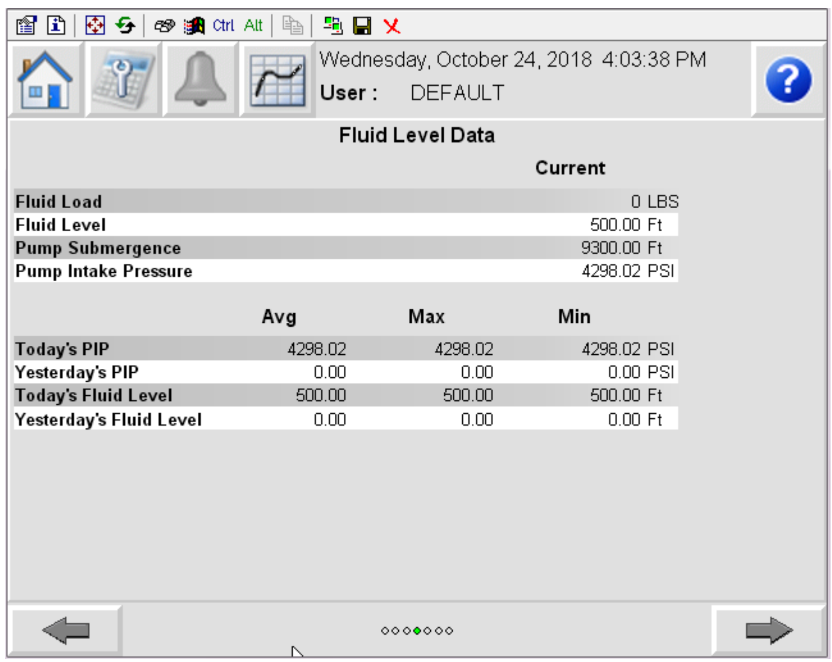


5. Press the Close () button to return to the Current Card display.

View Fluid Level Properties

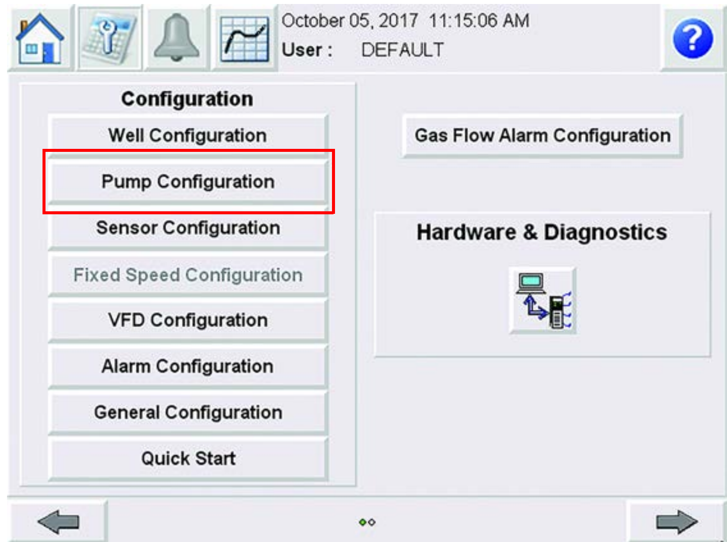
1. Press the Operator tab ().
2. Press the Historical Data button.

3. Press the right arrow () three times to get to the Fluid Level Data display.

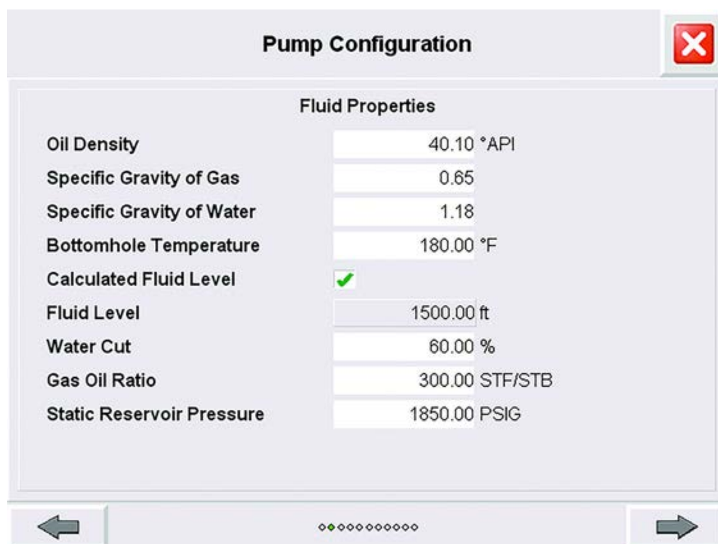


Configure Fluid Level Properties

1. Press the Configuration tab ( ).
2. Press the Pump Configuration button.



3. Press the right arrow ( ) once to get to the Fluid Properties display.

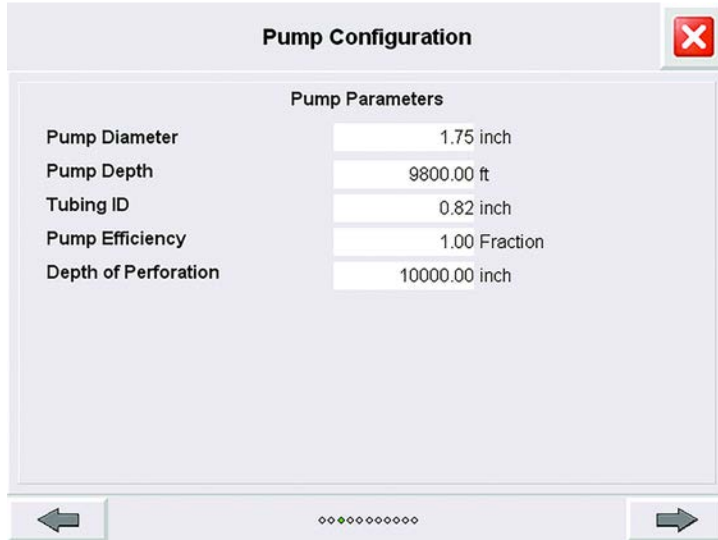


4. Press a field to configure the parameter value with the popup keypad.

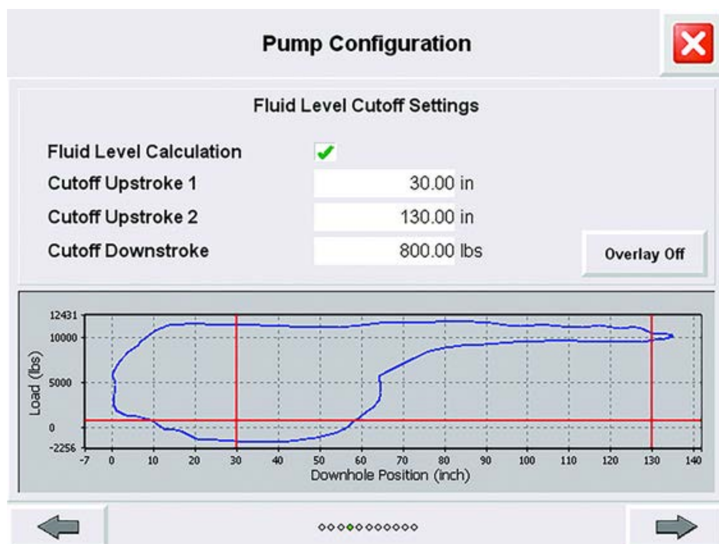
IMPORTANT If the Fluid Level field appears dimmed, clear the Calculated Fluid Level checkbox.

5. Press the Enter ( ) button to set the value.

6. When finished, press the right arrow ( ) to get to the Pump Parameters display.



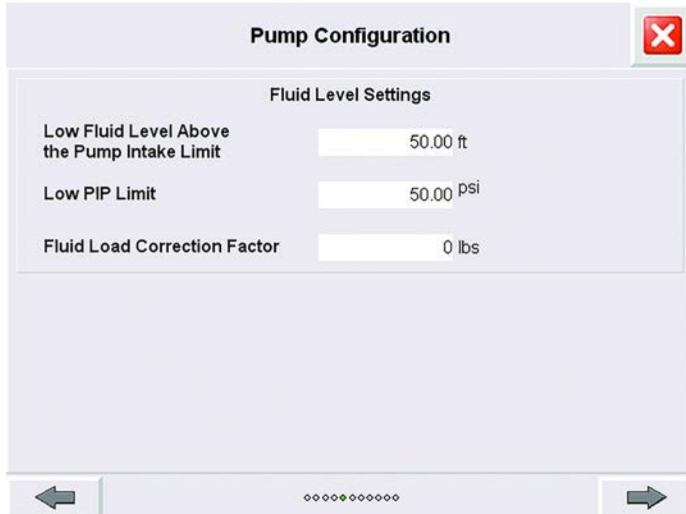
7. Press a field to configure the parameter value with the popup keypad.
8. Press the Enter ( ) button to set the value.
9. When finished, press the right arrow ( ) to get to the Fluid Level Cutoff Settings display.



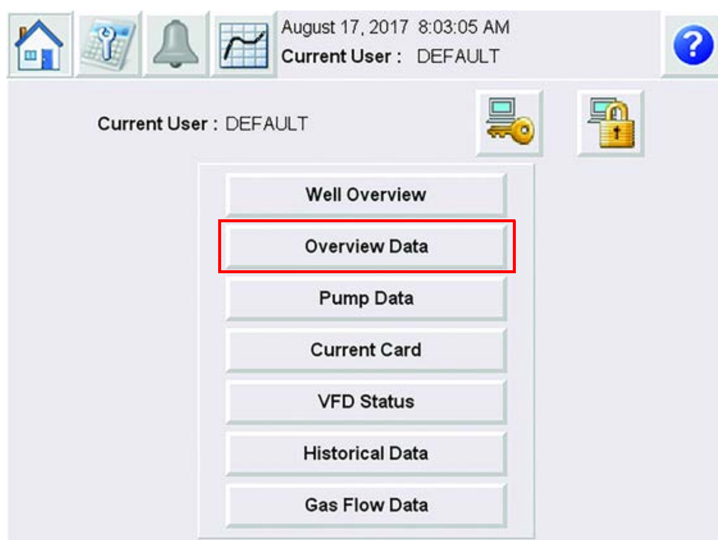
TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

10. Press a field to configure the parameter value with the popup keypad.
11. Press the Enter ( ) button to set the value.

12. When finished, press the right arrow ( ) to get to the Fluid Level Settings display.

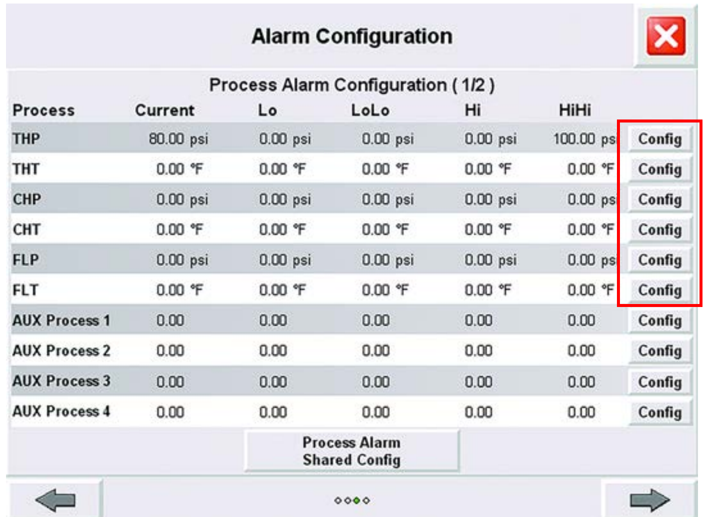


13. Press a field to configure the parameter value with the popup keypad.
14. Press the Enter ( ) button to set the value.
15. Press the Close ( ) button to return to the Configuration display.
16. Press the Operator tab ( ).
17. Press the Overview Data button.

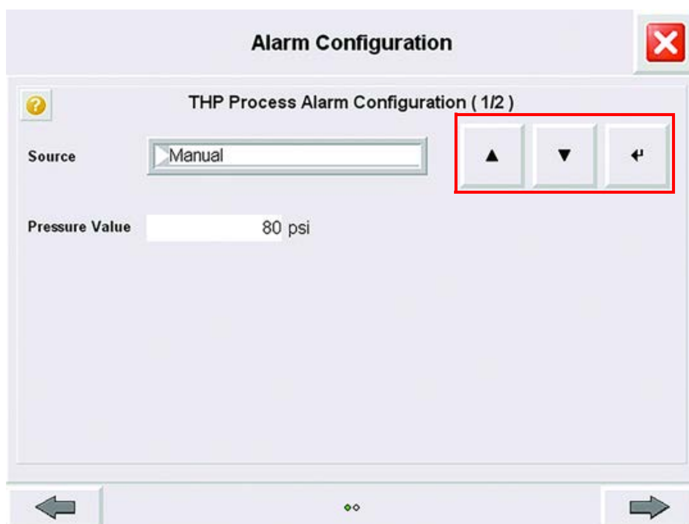


18. Press the right arrow ( ) two times to get to the Process Alarm Configuration display.

19. Press the Config button to modify alarm settings for tubing head pressure (THP), tubing head temperature (THT), casing head pressure (CHP), casing head temperature (CHT), flow line pressure (FLP), and flow line temperature (FLT).



20. Select the source of the alarm by pressing the up (▲)/down (▼) buttons. Press the Enter (↵) button to select the source. The text is highlighted with a white background when selected.



21. Press a field to configure the parameter value with the popup keypad. For parameter definitions, see Alarm Configuration on page 125.

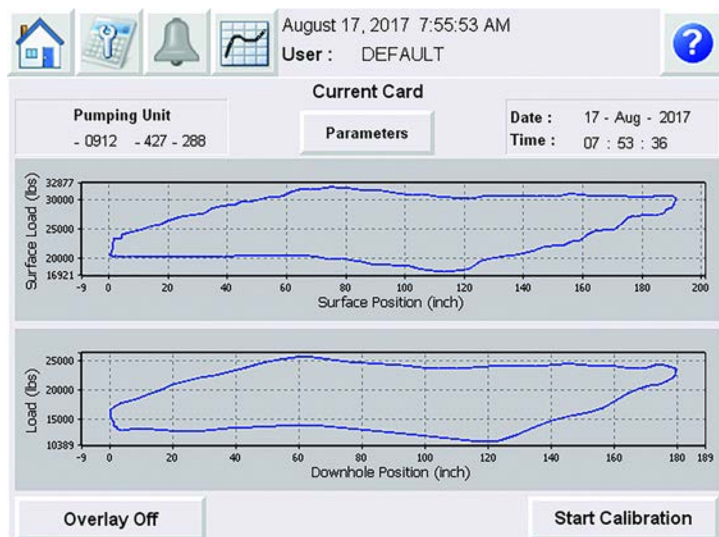
22. Press the Enter (↵) button to set the value.

23. When finished, press the Close (✕) button to return to the Operator display.

View the Surface and Downhole Card

1. Press the Operator tab ().
2. Press the Current Card button.

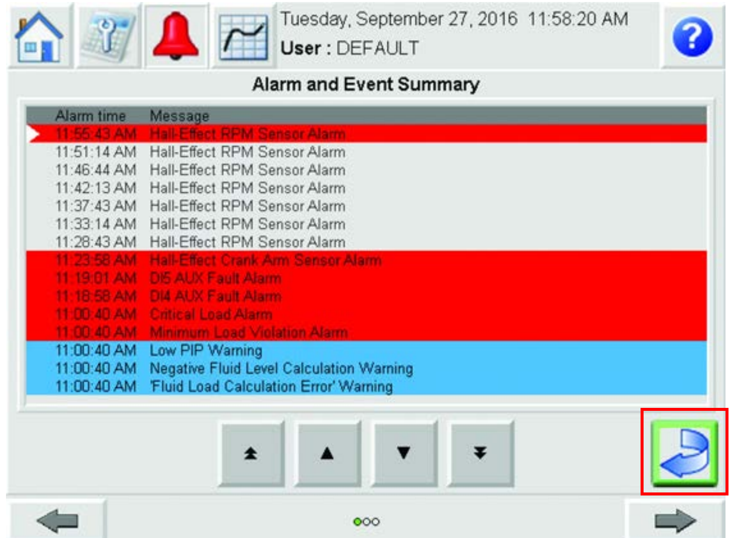
3. The current card is updated automatically. The refresh rate is half of the SPM.



TIP To toggle between one plot and continuous overlay plots, press the Overlay Off/On button.

View Alarm Status and Clear Alarm

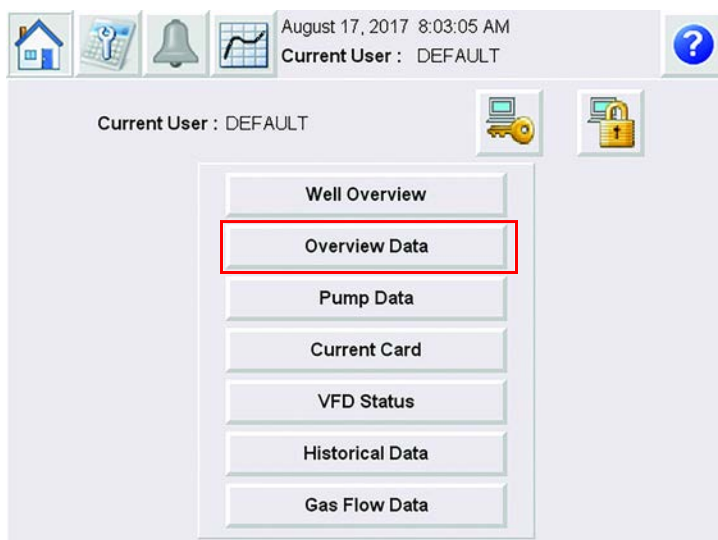
1. Press the Alarm tab ().
2. Press the Reset button to clear all active alarms.



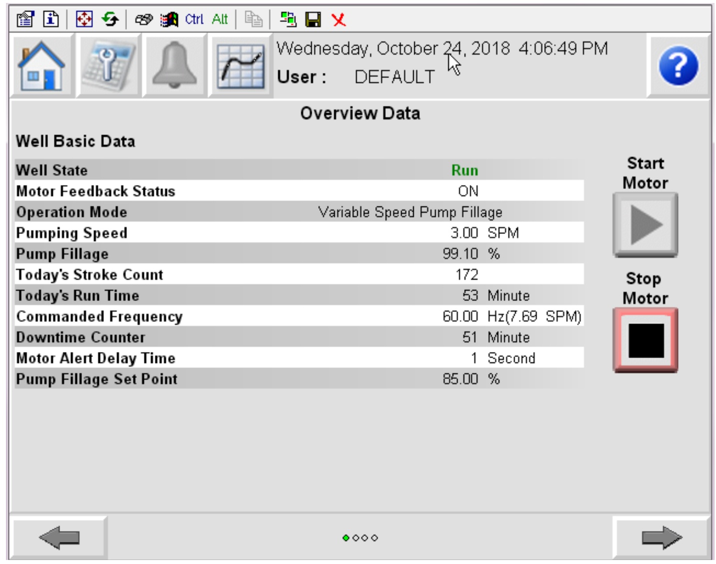
For alarm definitions, see Alarm Configuration on page 173.

View Well Statistics

1. Press the Operator tab ().
2. Press the Overview Data button.



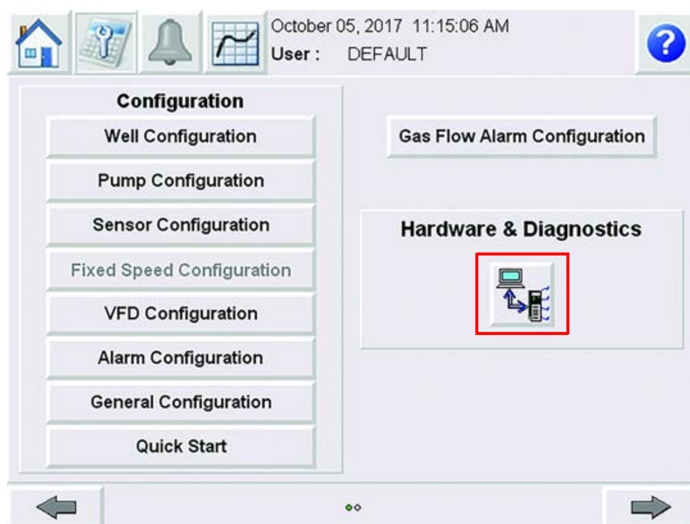
The Well Basic Data display appears. (1)



For parameter definitions, see [Well Basic Data on page 122](#).

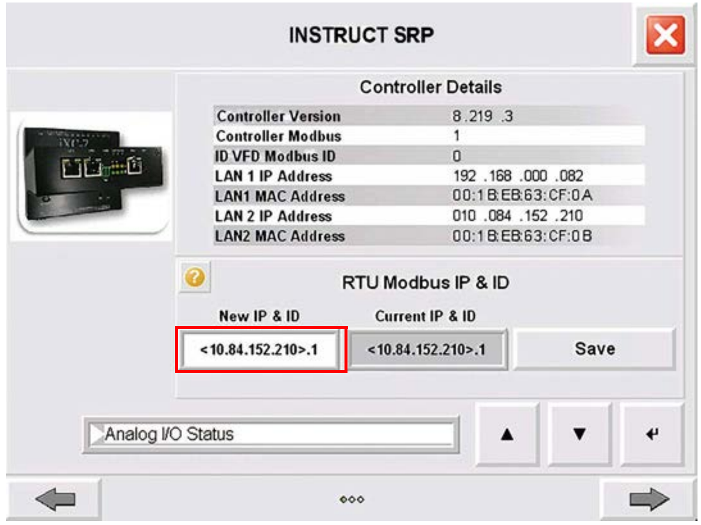
Configure the RTU Modbus IP and ID

1. Press the Configuration tab ().
2. Press the Hardware & Diagnostic button.



(1) Parameters differ based on the operation mode.

3. Press the New IP & ID field.



Enter the new IP and ID in the popup keyboard and press the Enter ( ) button to close the keyboard.

IMPORTANT	The format of your new IP must be <*xxx.xxx.xxx.xxx*> and the format of the ID must be ".1".

4. Press the Save button to set the new IP and ID.

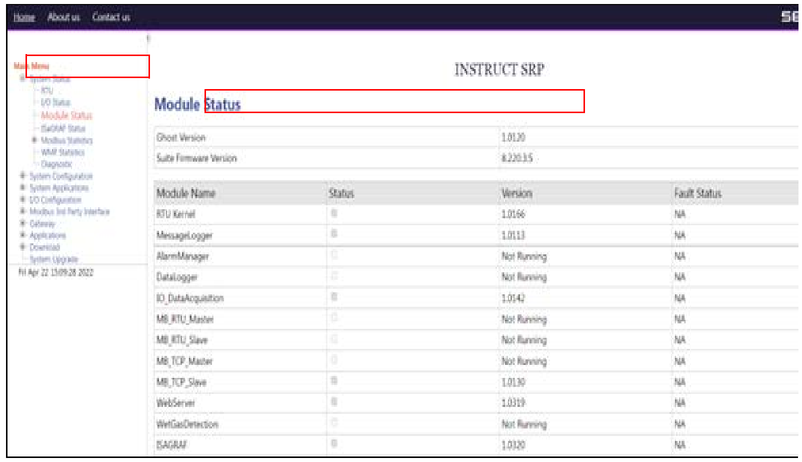
5. Press the Close ( ) button to return to the Configuration display.

Upgrade the INSTRUCT SRP Suite Firmware on Web Server

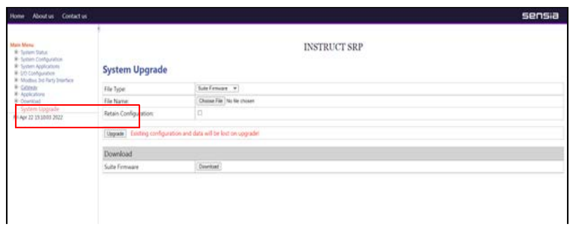
Before upgrading the suite firmware, check your current firmware revision. Verify the upgrade that you are installing is not the same as your current suite firmware revision.

IMPORTANT	Before upgrading your firmware, download your current configurations (see Download Current Configuration on page 293). You can also make a backup of your existing firmware by clicking the Download button (see Download Current Suite Firmware on page 292).

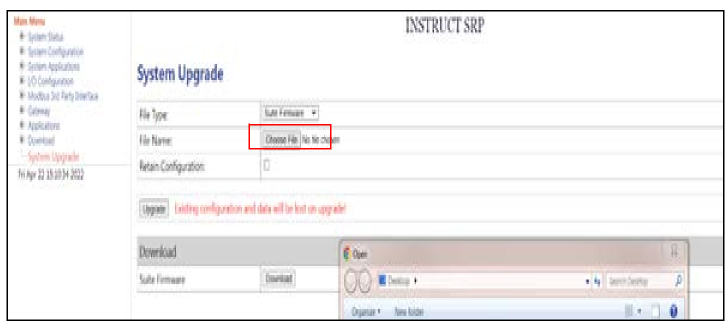
1. Use the left navigation tree to access System Status > Module Status. Your current suite firmware is displayed.



2. On the left navigation tree in the web server, click System Upgrade.



3. Select Suite Firmware from the File Type pull-down menu and click Browse.



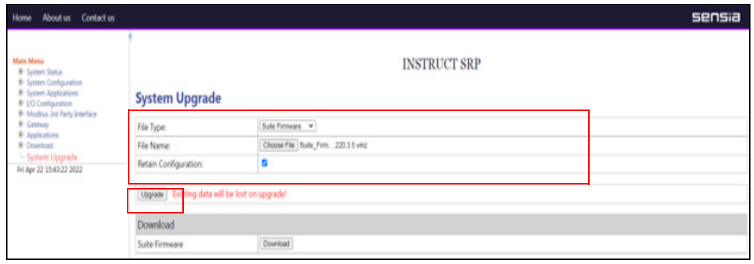
   The File Upload window appears. Navigate to the upgrade file named "iXC2.vmz".

4. Verify that the System Upgrade options are correctly completed with the following settings.
   - **File Name:** iXC2.VMZ
   - **Retain Configuration** [(1)]**:** Use this checkbox to specify if you want to keep the current configuration of your INSTRUCT SRP. For more information, see Retain Configuration Checkbox on page 292.

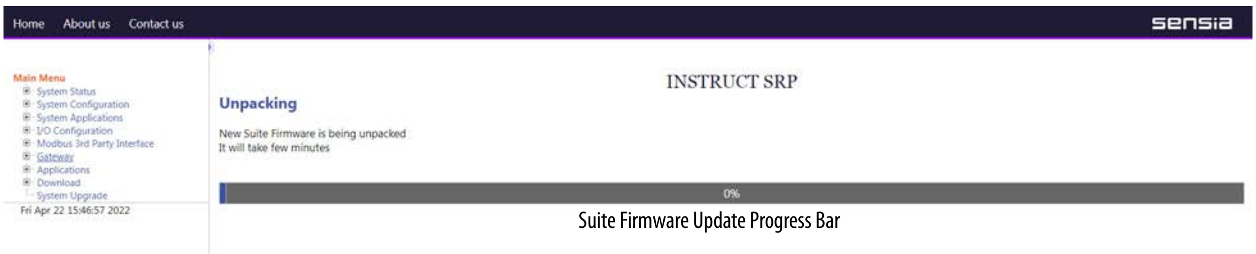
IMPORTANT	We do not recommend downgrading the firmware. Downgrading can cause unwanted controller behavior.

(1) This option retains only existing values and configuration. Any ISAGRAF projects or vMiConfig projects are not retained after the firmware is upgraded. We recommend that you check the Retain Configuration checkbox when upgrading your suite firmware.

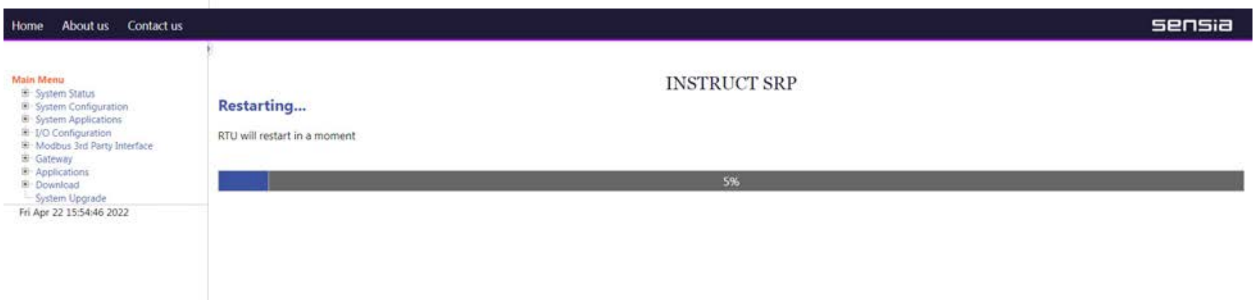
5. Click Upgrade.



6. When the update starts, a status bar indicates the progress for the entire process, including the restart period after the upgrade.



Suite Firmware Update Progress Bar



Restart Progress Bar After Suite Firmware Update


Module Status

Ghost Version	1.0120
Suite Firmware Version	8.219.5

Module Name	Status	Version	Fault Status
RTU Kernel	✓	1.0155	NA
MessageLogger	✓	1.0111	NA
AlarmManager	☐	Not Running	NA
DataLogger	☐	Not Running	NA

Suite Firmware Revision Verification After Upgrade Process

Reminders

- Calibrate the inclinometer of the well from the Current Card display (page 128) while the well is running. Run this calibration right after upgrading your suite firmware. See Calibrate the Inclinometer on page 279.
- Any other configurations that are made before you upgrade the firmware are reset to system defaults. Use the following process to download your current configurations.

Retain Configuration Checkbox

When using the Retain Configuration checkbox during a firmware suite upgrade:

- You must verify that all modules, except web server and INSTRUCT SRP, are disabled while you update the firmware suite.

IMPORTANT	Data logger module must not be running while retaining the configuration during a firmware suite upgrade. It can cause web server to hang due to USB data logging.

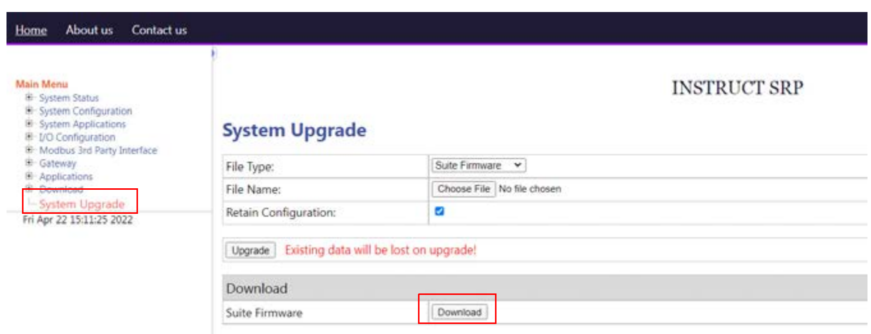
- Only the configuration of the INSTRUCT SRP module is retained in the current release (8.219.5) when upgrading from suite 8.217.6. and 8.217.3. The following parameters are not retained:
  - Fluid level calculation enable/disable
  - Fluid level input type
  - Static reservoir pressure
  - Reservoir type
  - All process alarm variables
  - Pump unique ID and sub-ID
  - Crank pin
- Retain Configuration only supports upgrading to a higher suite version.

IMPORTANT	Downgrading firmware suite to a lower version is not supported.

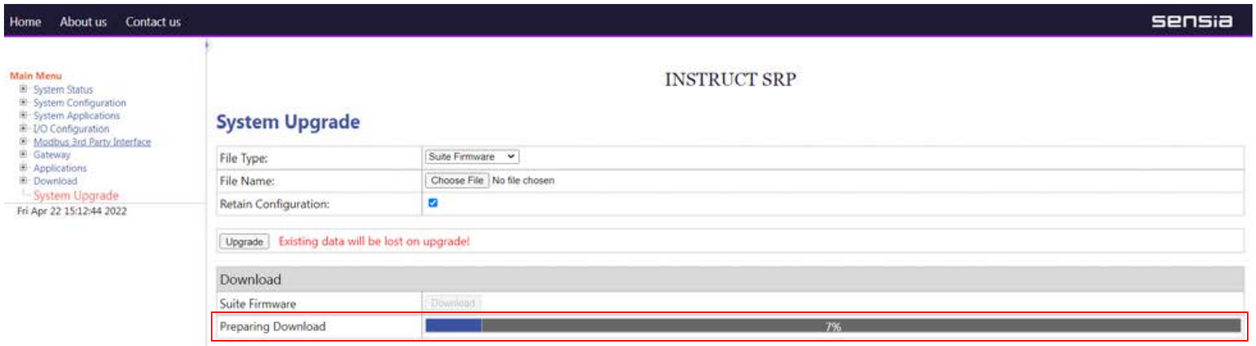
- Data is not retained when a firmware suite is upgraded.

Download Current Suite Firmware

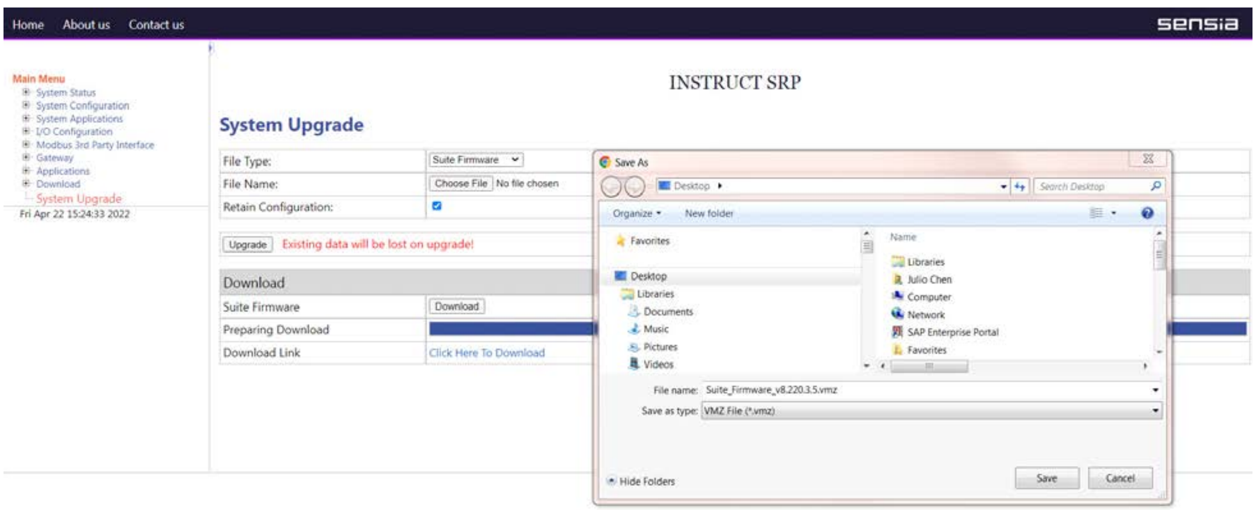
1. Use the left navigation tree to access System Upgrade. In the Download section, the Download button is used to download suite firmware.



2. Click Download. When the download starts, a status bar indicates the progress for the entire process. The download takes several minutes.



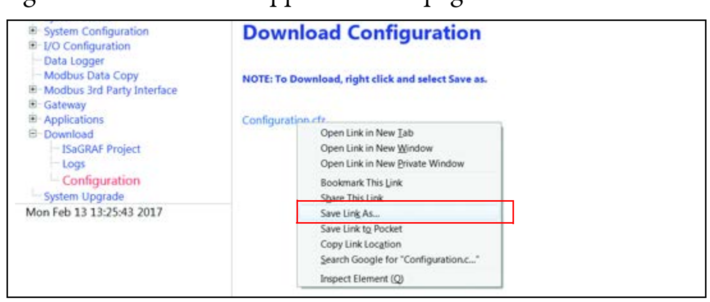
3. After it finishes loading, right-click and select “Save link as”.



Download Current Configuration

1. Use the left navigation tree to access Download > Configuration.

2. Right-click the file that appears on the page and select Save Link As...

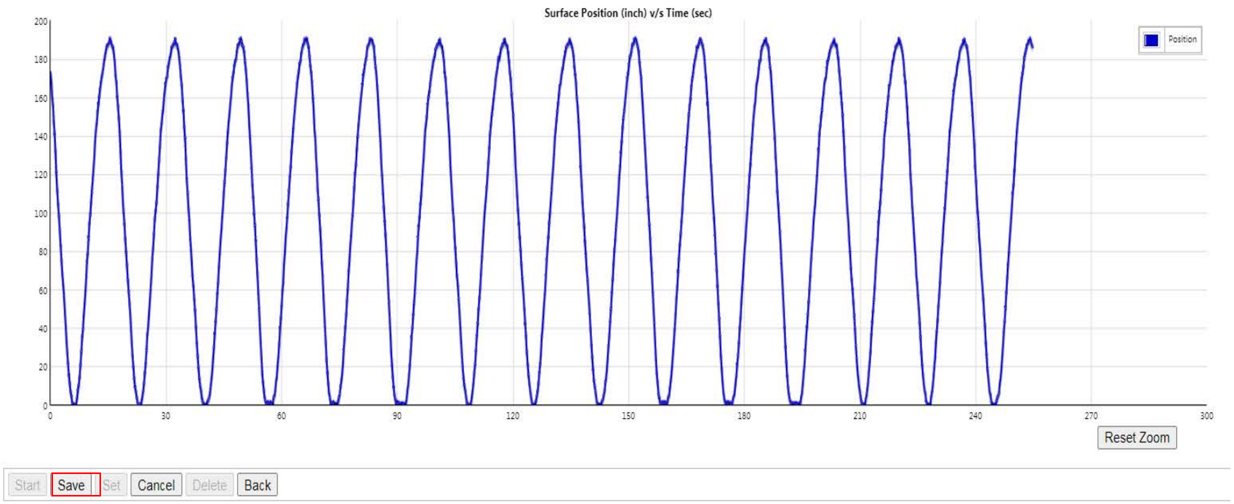


3. Save the configuration file to your computer.

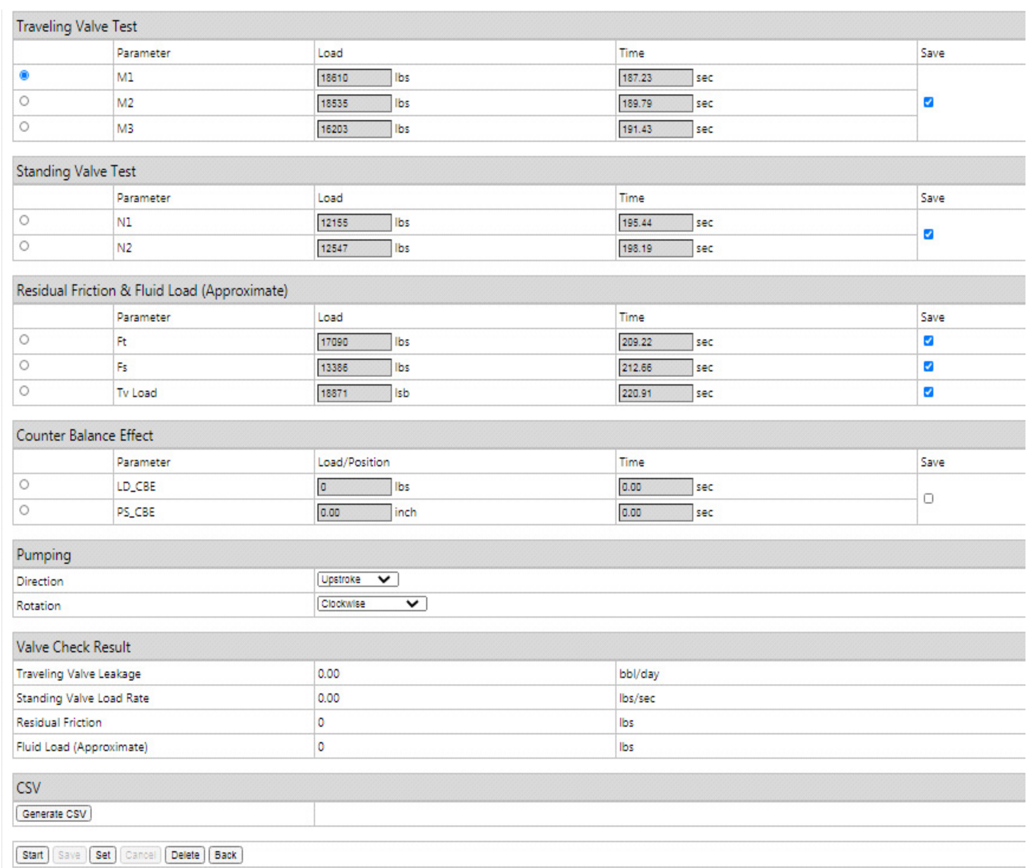
Operate the Valve Check

To operate the Valve Check, follow these instructions.

1. Click "Start" to run the valve test module.
2. After the valve test module completely captures the data, a Save button will appear.



3. A menu will appear that allows you to select each parameter to mark it off the Surface Load chart.



4. Select each icon on the left-hand side "blue" dot for the parameter to calculate off the chart.

5. After each parameter is marked off, make sure to select "Save" from the parameter on the right-hand side.

Traveling Valve Test

1. In order to successfully perform the traveling valve test, and obtain the value for the leakage calculation, the M1, M2, M3 values should be marked on the load chart and saved.
2. The points must be marked as the pumping unit is stopped, heading upstroke in the middle and left off for the controller, to acquire data after the Start button is selected for the data collection to begin.
3. Once, the data collection is done, the points of reference M1, M2, and M3 should be marked on the load plot. The following image provides an example on where each point might be selected from the load plot.

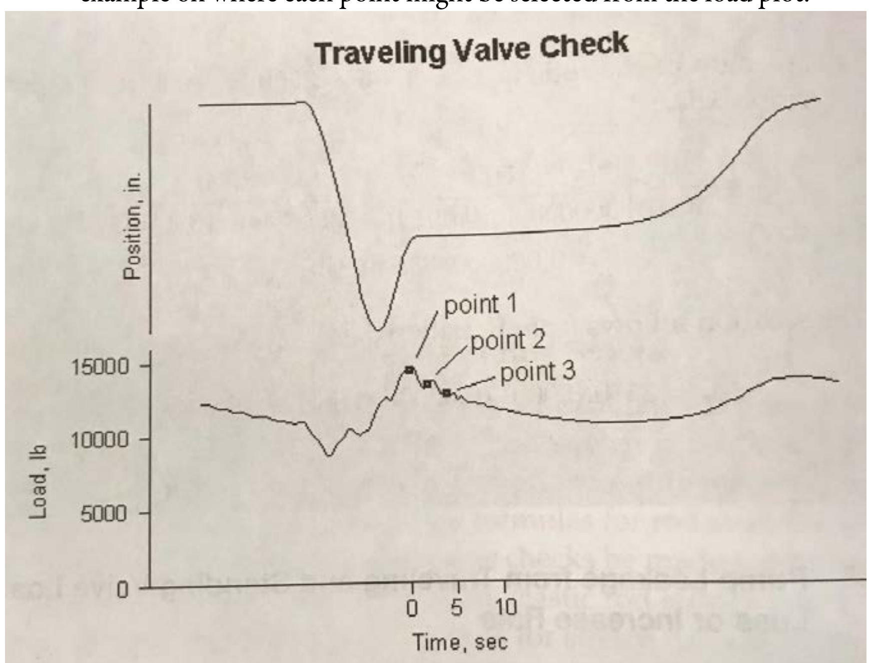


Figure 292 - Traveling Valve Check

4. Traveling Valve Check Points load points to Calculate Leakage[1].
   a. M1: this value is the first point that is marked of the load chart after the data is capture to determine the leakage of the traveling valve.
   b. M2: this value is the second point that is marked of the load chart after the data is capture to determine the leakage of the traveling valve.
   c. M3: this value is the third point that is marked of the load chart after the data is capture to determine the leakage of the traveling valve.

(1) S. Gibbs, ROD PUMPING Modern Methods of Design, Diagnosis, and Surveillance, USA: BookMasters Inc, 2012.

5. Standing Valve Test: the standing valve test is performed with the well stopped heading downstroke. The load rate change is calculated from the load change between two selected points N1 and N2. The rate of change of the load dropping should be relatively uniform and slow.
   a. N1: this value represents the first load point selected for the calculation of the load/seconds rate.
   b. N2: this value represents the second load point selected for the calculation of the load/seconds rate.
6. Residual Friction & Fluid Load
   a. Ft: This value is the leak off traveling valve load marked on the load chart while performing the Traveling valve test. This value is the value that is marked on the load chart while the well is stopped heading upstroke, but several minutes must be waited before marking this point for the load. The traveling valve load must be stable and it must already have all the fluid "leaked" off hence this value is called the Leak off traveling valve load.
   b. Fs: This is the standing valve load that is marked off on the Downstroke during the standing valve test. The Fs value is marked off when testing the standing valve after the load has stabilized.
   c. Tv Load: The traveling valve load is marked on the load chart with during when the traveling valve is full before all the fluid is leaked off.
7. Counter Balance effect: the well must be stopped in a neutral position on the way upstroke or Downstroke with the load stabilized for this test.

IMPORTANT The counter balance effect test can only be performed using a continuous analog position measurements as the inclinometer. Continuous measurement for position is needed.

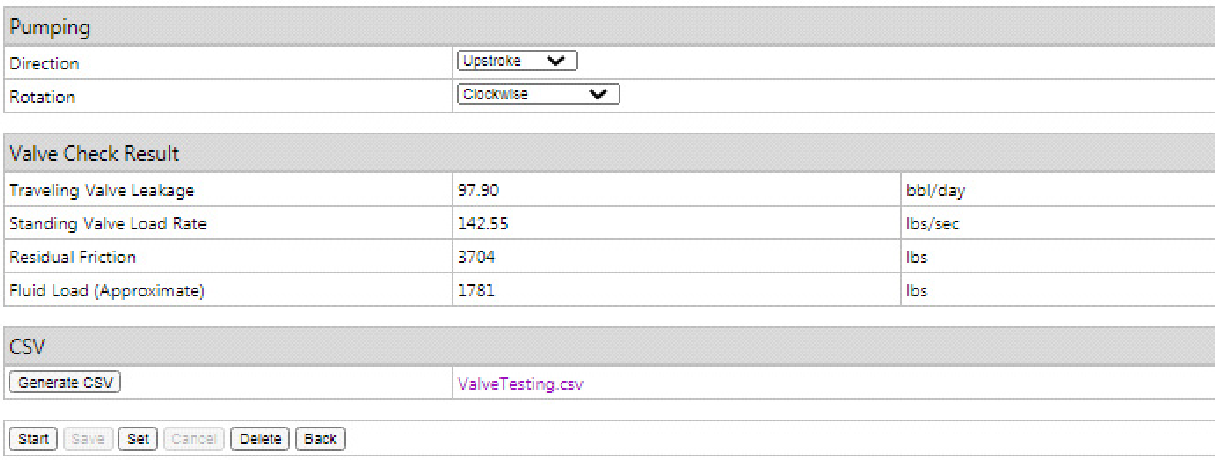
   a. LD_CBE: The LD_CBE option must be selected from the table and the load must be marked on the chart using the vertical line corresponding to the LD_CBE color.
   b. PS_CBE: The PS_CBE option must be selected from the table and the position corresponding to the same point for position to LD_CBE must be marked on the position chart that is below the load chart.
8. Pumping
   a. Direction: this is the direction where the well was going before being stopped when performing the counter balance effect test.
   b. Rotation: this is the rotation of the crank arm of the well, it can be clockwise or counterclockwise.
9. Valve Check Result
   a. Traveling Valve Leakage: this is the resulting leakage calculation from the traveling valve test.
   b. Standing valve load rate: this is the standing valve load result calculated during the Standing valve test.

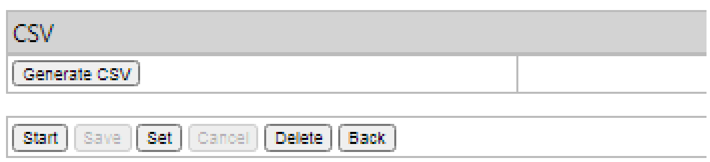
c. Residual friction: the residual friction is calculated from the Residual friction & fluid load determination in part 3 of the Valve test in the webserver.

d. Fluid load (approximate): the fluid load is calculated from the Residual friction & fluid load determination in part 3 of the Valve test in the webserver.

10. If the user selects, “Generate CSV” it generates all the values collected during the valve check along with all the resulting calculations.

11. After all the values have been confirmed, and “Save” has been selected for each parameter, the calculation will execute when “Set” is selected from the lower-left corner of the webpage.





Button	**Description**
Generate	This generates a CSV file with all the inputs and output data of the calculations from the valve tests.
Start	This button starts the process of the data collection of the valve test, the data collection takes about 5 minutes.
Save	Save the data that is collected during the valve test. This button is only available after the QRATE iXC2 High Performance Edge Controller has finished collecting the data.
Set	This button will trigger the calculation for the valve test results, only use this button after the lines are marked and the reference points are saved for each parameters of the valve test. When the “Set” button is selected, the webpage will refresh.
Cancel	This button once selected will cancel or interrupt the data collection during the valve test after it has started.
Delete	The delete button will clear all data out of the valve test webpage.
Back	This button takes you back to the previous menu.

Integrate Powerflex 753/755 VFD

Table 9 shows the tools that are required for integration.

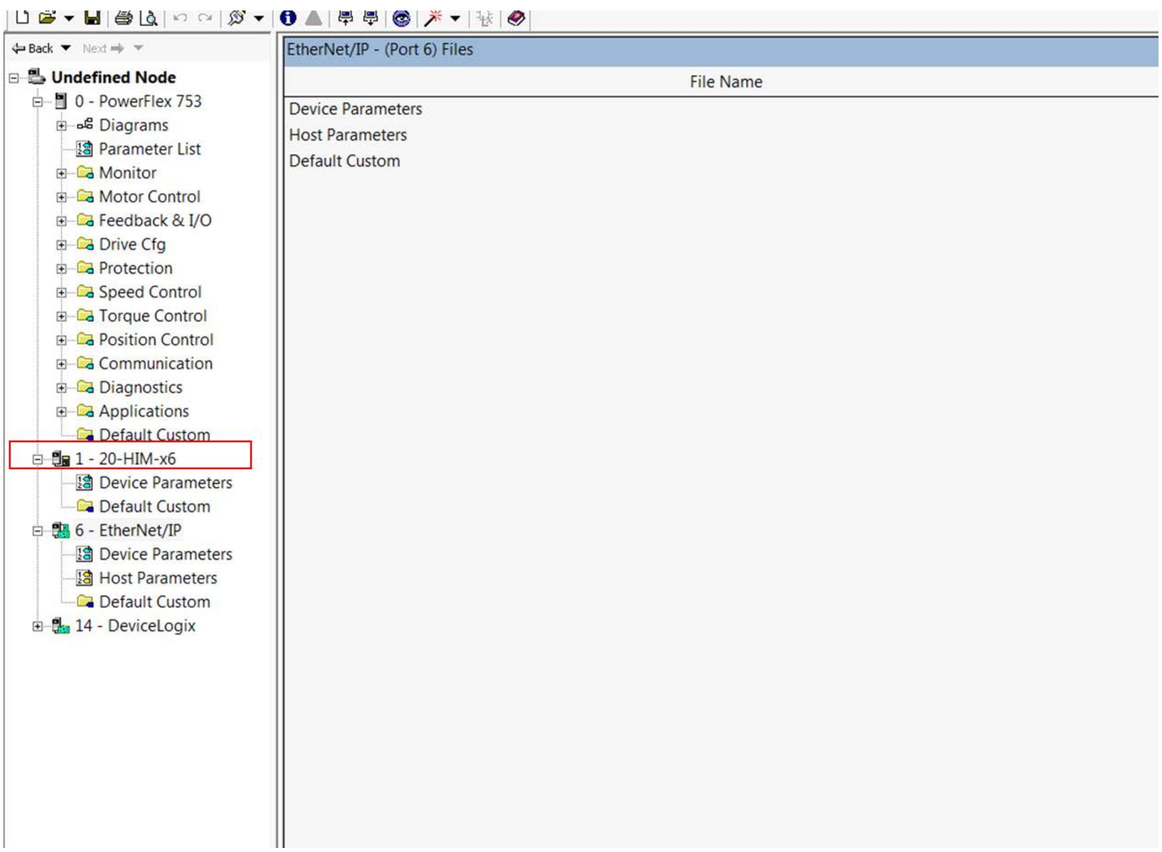
Table 9 - Powerflex Integration Tools

Tools
INSTRUCT SRP Suite FW (latest release)
vMiConfig Software (latest release)
PowerFlex 753/755 vMiConfig project file
Drive Executive or CCW software (latest version) for the PowerFlex 753/755
Ethernet Cables (6 ft at least)
PowerFlex Drive ENET-R Card (20-750-ENETR)

Enet-R Card

Make sure to install the Enet-R card onto Slot 6 of the PowerFlex 753/755 VFD. The Data Links depends on the Position of the Enet-R card in the PowerFlex Slot.

Figure 293 - Enet-R Installed on Slot 6 of PowerFlex 753/755

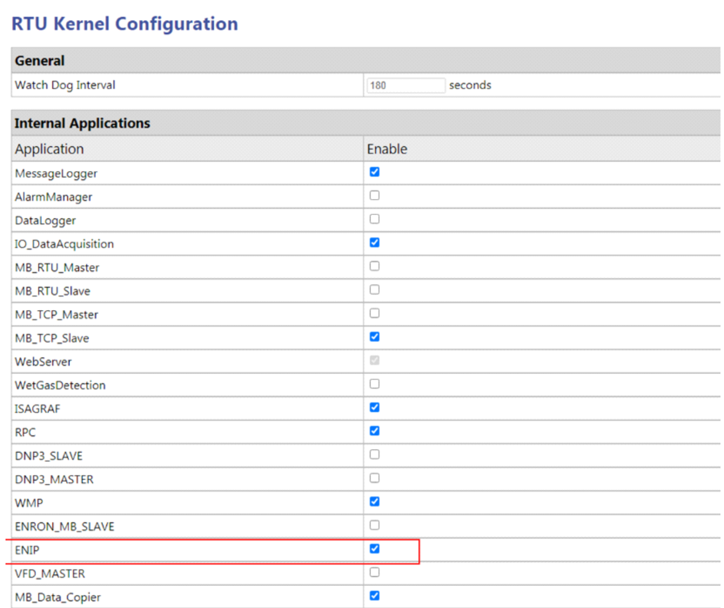


Load the Configuration File

To load the configuration file, follow these steps.

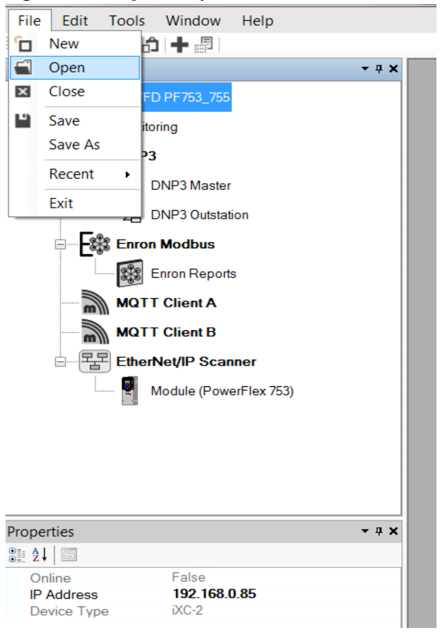
1. Open the Webserver of the INSTRUCT SRP using LAN 1 Port.
2. Open the Chrome browser and type the factory IP, https://192.168.0.82
3. Use "Admin" as user name and "vMiRtu800" as the password.
4. Ensure that the ENIP Module is active, under the RTU Kernel, in the QRATE iXC2 High Performance Edge Controller. This module will allow the QRATE iXC2 Controller to communicate to vMiConfig.
5. Make sure the LAN2 Port of the QRATE iXC2 Controller is connected to the Enet-R port of the VFD.
6. Certify that the laptop network card is connected to the LAN1 port of the QRATE iXC2 Controller.

Figure 294 - ENIP Module



7. Open the vMiConfig Software and open the file named ".vmj" template file for the PowerFlex 753/755 drive. This file allows the configuration and link up of Modbus registers to Datalinks messages from the VFD.

Figure 295 - Open Project File

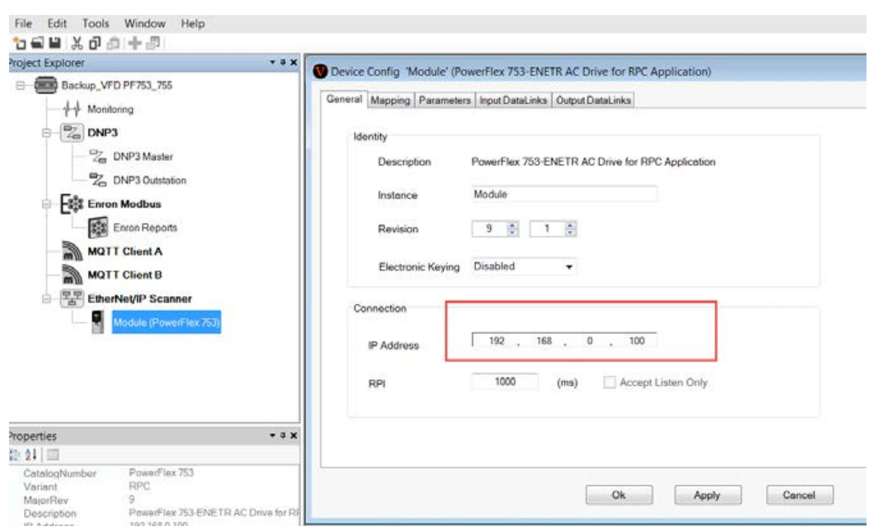


8. Set the IP address of the PowerFlex 753/753 port of the Enet-R card to communicate with LAN2 of the QRATE iXC2 High Performance Edge Controller, which is 192.168.1.83 by default. The VFD can be set to any IP 192.168.1.XXX. The VFD must be connected directly to LAN2 port of the QRATE iXC2 Controller.

9. Select the drive and right-click the Drive icon under the Ethernet/IP Scanner.

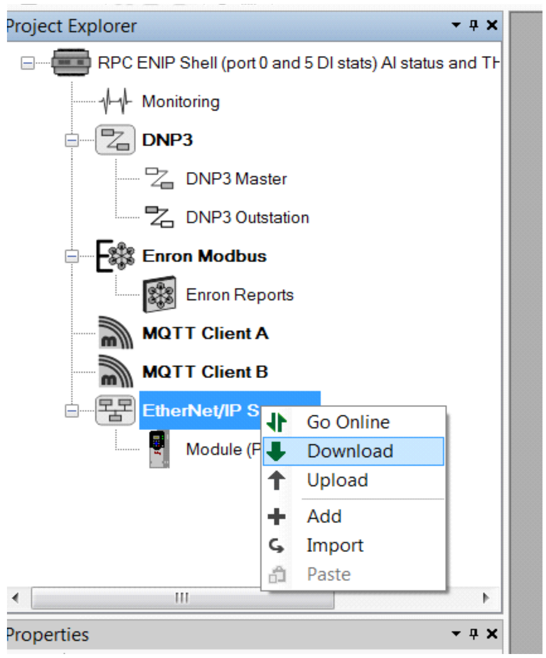
10. Define the IP of the VFD and click Apply and OK to complete the LAN setting changes.

Figure 296 - VFD Communication IP from Enet-R card Port



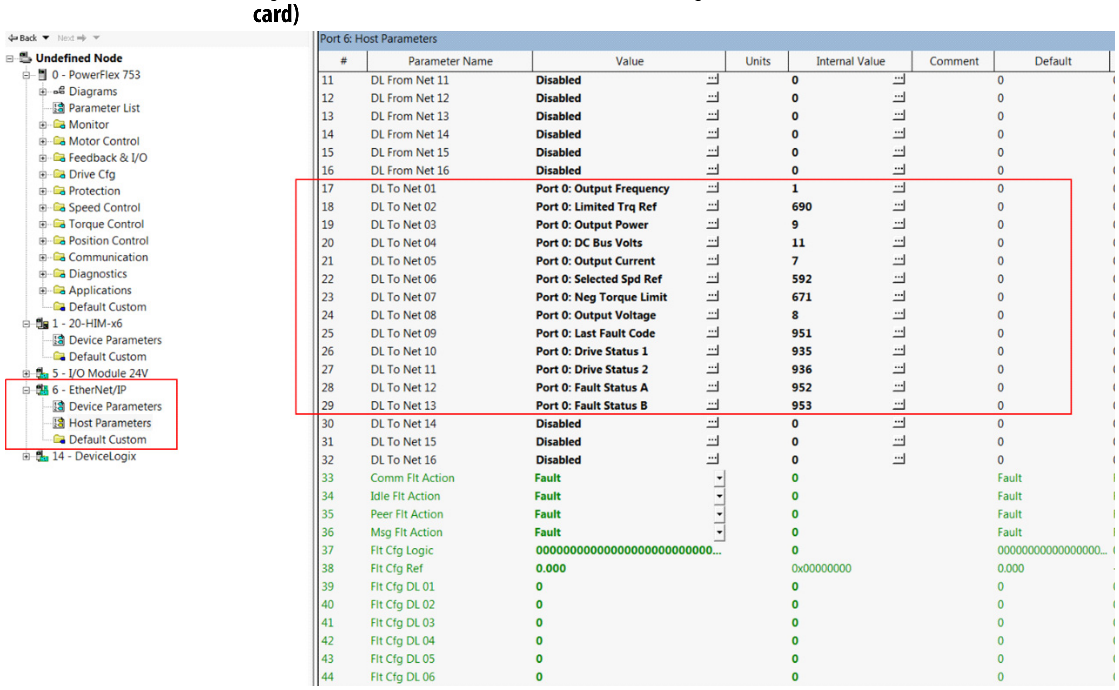
11. Right-click the Ethernet/IP Scanner Icon and select Download.

Figure 297 - Downloading the Configuration to the QRATE iXC2 High Performance Edge Controller to talk to the VFD Drive



12. Open Drive Executive or CCW (Connected Work Bench) for the PowerFlex 753/755 VFD.
    a. Go to the Enet-R Card configuration.
    b. Configure the input data links from the VFD Enet-R card as presented in Figure 298.

Figure 298 - PowerFlex 753/753 Data Links Configuration on Port 0 (Location of the Enet-R card)

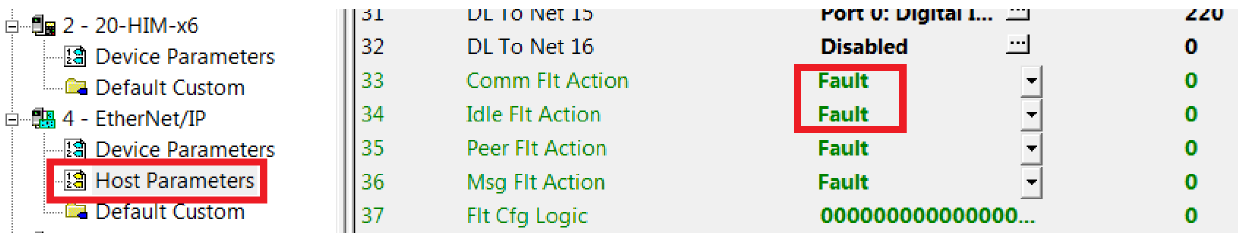


VFD Comm Fault Action and Idle Fault Action Parameter

If the Ethernet/IP communication between the INSTRUCT SRP and the PowerFlex 753/755 is lost, the PowerFlex 753/755 can detect the COMM failure and take action. The configuration is accomplished through parameter 33 and 34, of Ethernet/IP Host Parameters list, of the PowerFlex 753/755.

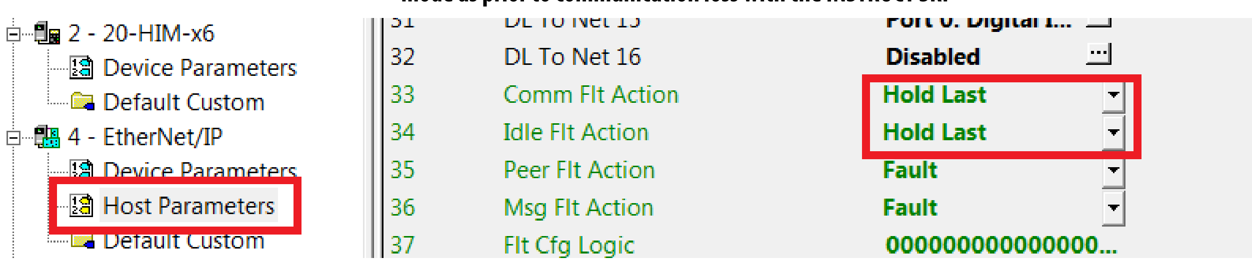
If parameters 33 and 34 are configured with “FAULT” value as shown on the following figure, the VFD will fault and stop the motor from running if the communication is lost with the INSTRUCT SRP. It is recommended by default to set parameters 33 and 34 to “FAULT” value as shown on the picture below. If the VFD is Faulted, it requires operator intervention to restart it.

Figure 299 - Recommended default values for COMM FLT Action (33) and Idle FLT Action (34)



On the other hand, if the parameters 33 and 34 are set with a value “HOLD LAST” as shown on the following figure, the VFD will stay in RUN if the communication with the INSTRUCT SRP is lost. The VFD will stay in STOP if the VFD was in STOP before the communication is lost. The “HOLD LAST” value for parameters 33 and 34 must be treated with caution as the pump jack will keep running if the INSTRUCT SRP communication with the VFD is lost.

Figure 300 - Values for COMM FLT Action (33) and Idle FLT Action (34) to keep the VFD in same mode as prior to communication loss with the INSTRUCT SRP

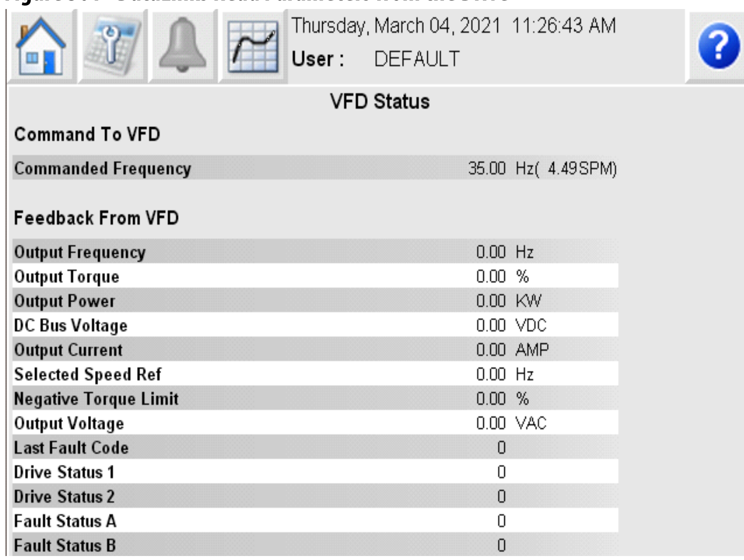


Validate Communication

Follow these instructions to validate the communication.

1. After the vMiConfig file has been downloaded to the QRATE iXC2 High Performance Edge Controller, and the Data links are configured in the PowerFlex 753/755, validate the communication through the Panel View “VFD Status” screen.
2. The VFD Output Frequency should match the output frequency displayed on the VFD.

Figure 301 - DataLinks Read Parameters from the Drive



3. vMiConfig should show a green VFD Icon if the PowerFlex 753/755 VFD is successfully communicating to the QRATE iXC2 Controller.

Figure 302 - Online Communication to the Powerflex VFD

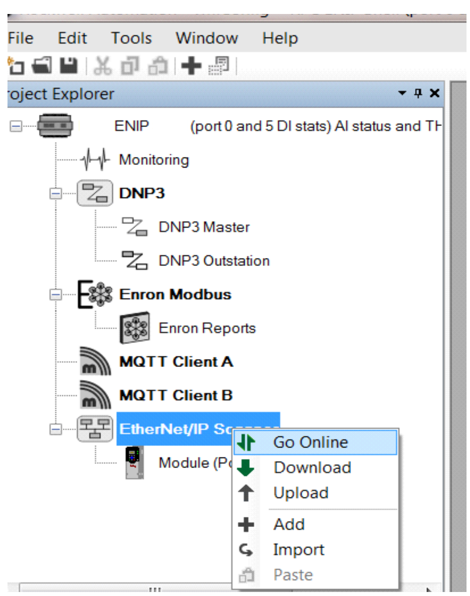
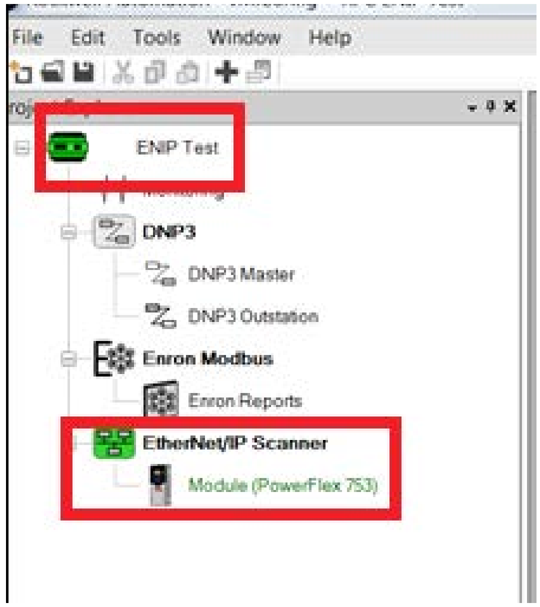


Figure 303 - Good Communication Indicator to the PowerFlex 753/755

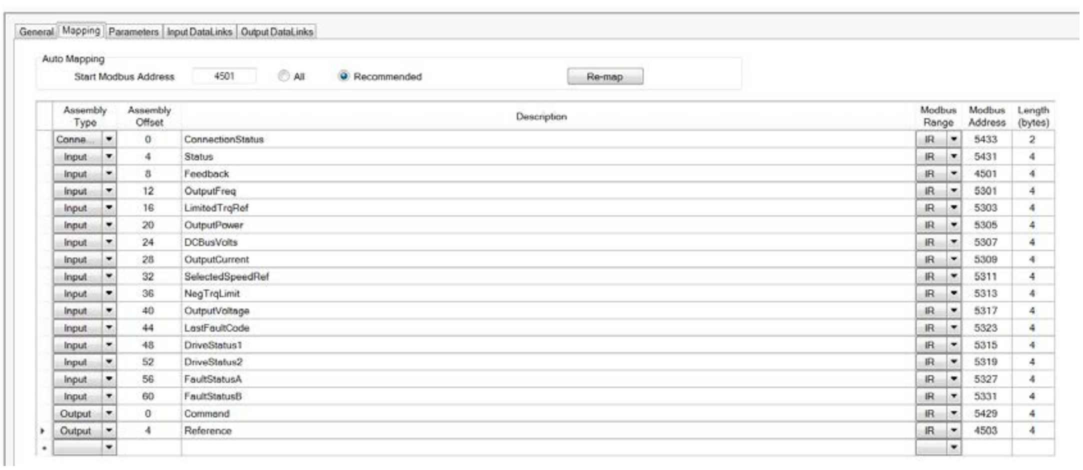


Class 1 Pre-mapped Real Time Based Messages

Figure 304 shows the parameters for Class 1 messages that are previously mapped. These are real-time messages from the drive.

IMPORTANT	Do not modify the configuration for the parameters below as this could result in communication malfunction with the VFD.

Figure 304 - Class 1 Message Parameters



General | Mapping | Parameters | Input DataLinks | Output DataLinks

Auto Mapping

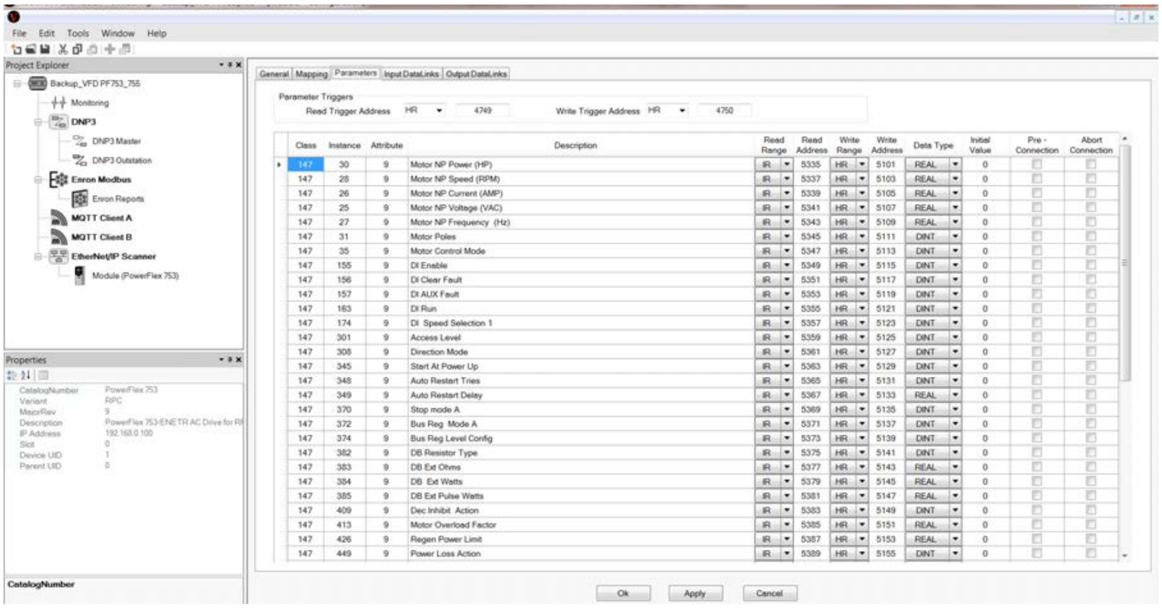
Start Modbus Address 4501 All Recommended Re-map

Assembly Type	Assembly Offset	Description	Modbus Range	Modbus Address	Length (bytes)
Conne...	0	ConnectionStatus	IR	5433	2
Input	4	Status	IR	5431	4
Input	8	Feedback	IR	4501	4
Input	12	OutputFreq	IR	5301	4
Input	16	LimitedTrqRef	IR	5303	4
Input	20	OutputPower	IR	5305	4
Input	24	DCBusVolts	IR	5307	4
Input	28	OutputCurrent	IR	5309	4
Input	32	SelectedSpeedRef	IR	5311	4
Input	36	NegTrqLimit	IR	5313	4
Input	40	OutputVoltage	IR	5317	4
Input	44	LastFaultCode	IR	5323	4
Input	48	DriveStatus1	IR	5315	4
Input	52	DriveStatus2	IR	5319	4
Input	56	FaultStatusA	IR	5327	4
Input	60	FaultStatusB	IR	5331	4
Output	0	Command	IR	5429	4
Output	4	Reference	IR	4503	4

Trigger-based Class 3 Message Parameters

Figure 305shows the tab of all Class 3 parameters that are trigger-based to execute a read and a write. These parameters are used exclusively for configuration, as they are all mapped to Modbus Input and holding registers that are used for configuration.

Figure 305 - Class 3 Message Trigger-based Parameters



Input Data Links

Figure 306 shows the pre-defined data links from the VFD Drive. The data links use Class 1 real time messages to communicate to the QRATE iXC2 High Performance Edge Controller. The list below presents a predefined list that are not to be modified. Additional Data links can be added to the list below.

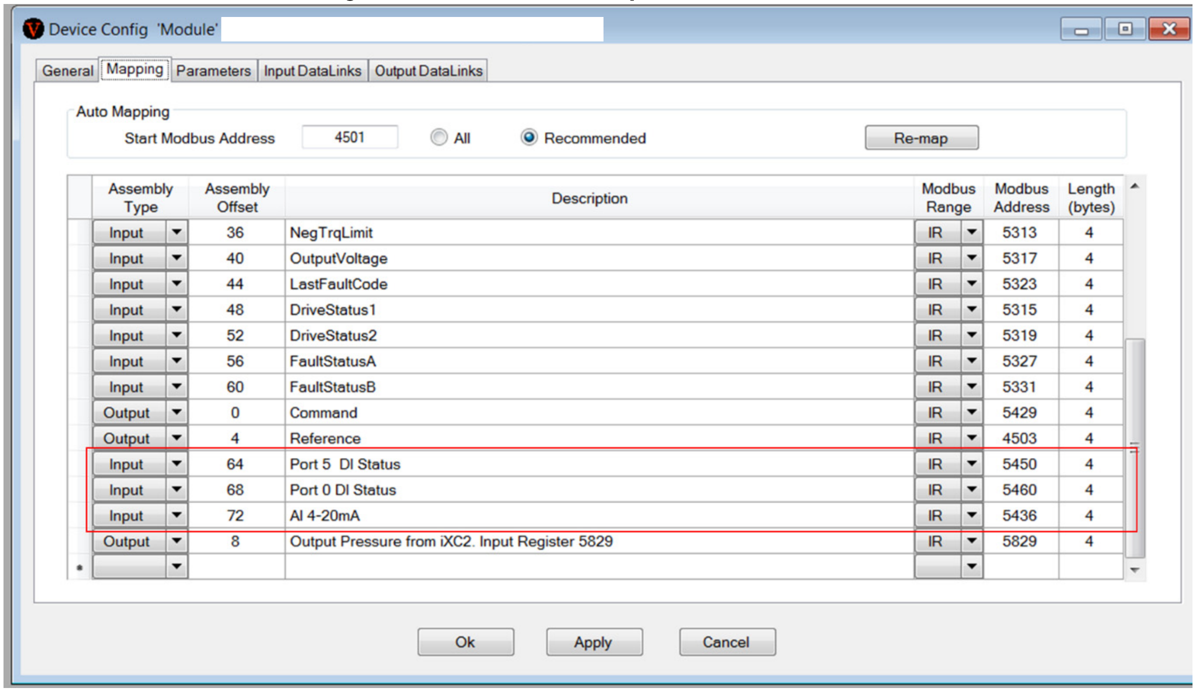
The PowerFlex 753/755 VFD must contain the same data links as listed in Figure 305, the VFD parameters for Datalinks must match the vMiConfig parameters in the same order.

There are extra Input data links that can be consumed from the drive for other parameters for Datalinks 13,14, and 15.

While adding more Datalinks, they must be added to the tab “Mapping” presented in Figure 304. There are offset values that must be calculated to match the Datalinks position. The Offet are counted every 4 numbers starting from the existing ones in use since each Datalinks takes 4 bytes.

The following example presents 3 extra Datalinks that were added. Notice that the offset is 64, 68, and 72. The Modbus registers needs to be allocated as well in the case below Input Registers 5450, 5460 and 5436.

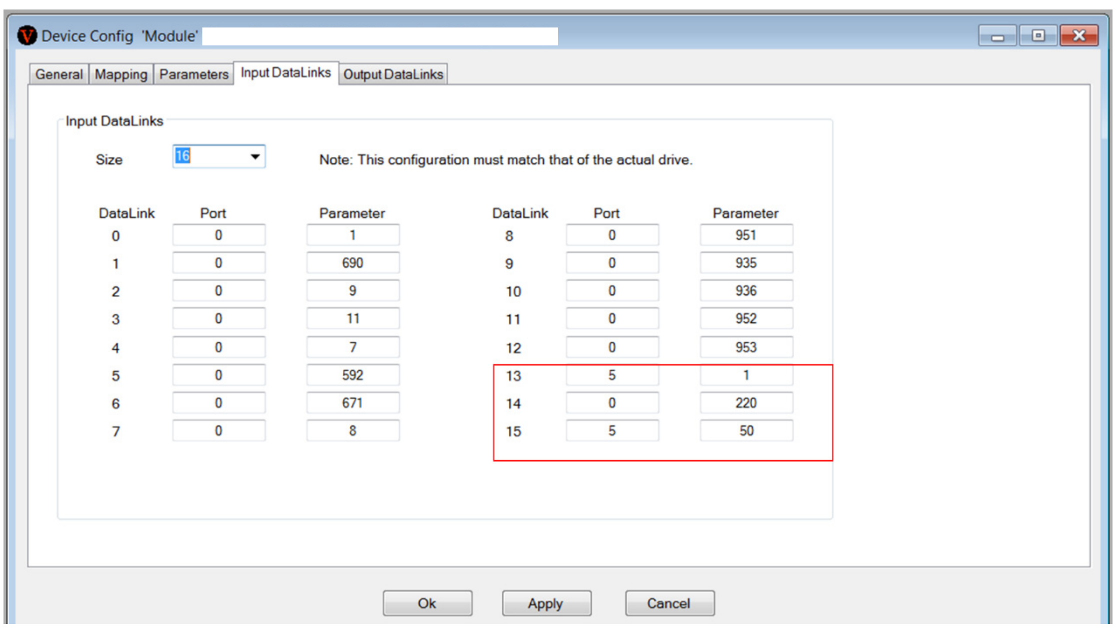
Figure 306 - Datalinks as Extra Inputs



Assembly Type	Assembly Offset	Description	Modbus Range	Modbus Address	Length (bytes)
Input	36	NegTrqLimit	IR	5313	4
Input	40	OutputVoltage	IR	5317	4
Input	44	LastFaultCode	IR	5323	4
Input	48	DriveStatus1	IR	5315	4
Input	52	DriveStatus2	IR	5319	4
Input	56	FaultStatusA	IR	5327	4
Input	60	FaultStatusB	IR	5331	4
Output	0	Command	IR	5429	4
Output	4	Reference	IR	4503	4
Input	64	Port 5 DI Status	IR	5450	4
Input	68	Port 0 DI Status	IR	5460	4
Input	72	AI 4-20mA	IR	5436	4
Output	8	Output Pressure from iXC2. Input Register 5829	IR	5829	4

The corresponding Data Input Data links are for 13,14 and 15 which corresponds to the offset 64, 68, and 72 from Figure 304. Note that the Datalinks point to port 0, which is the port where the Enet-R card is installed physically.

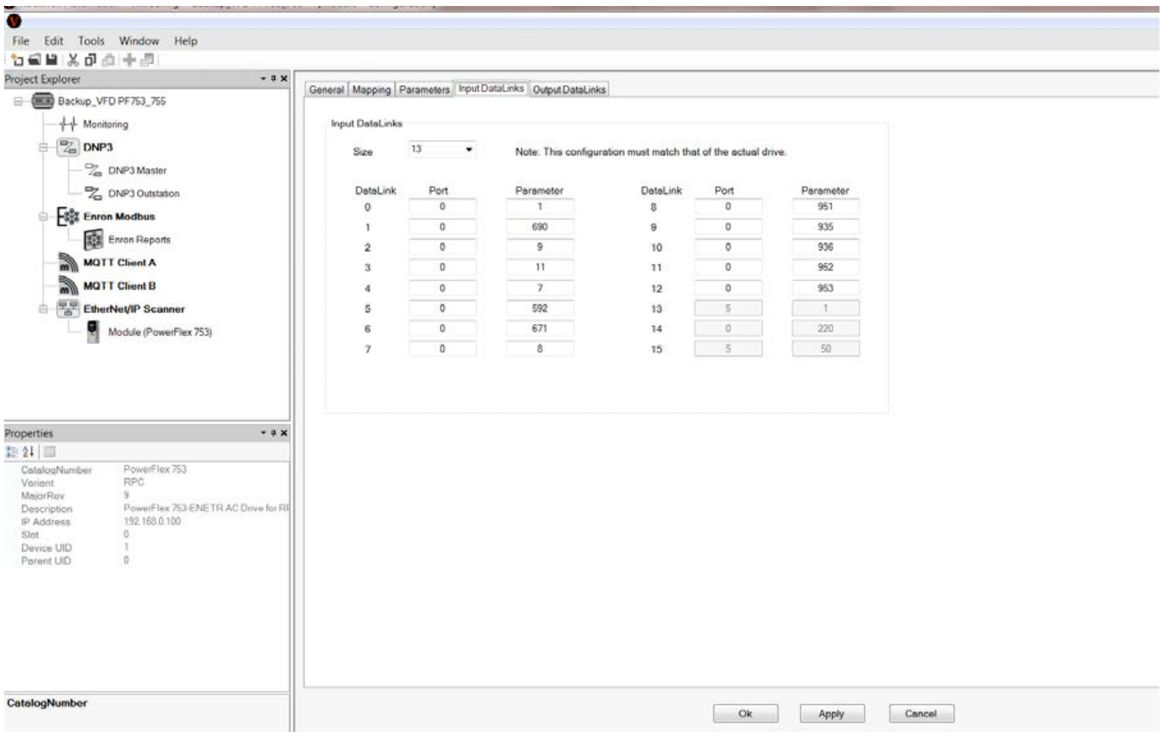
Figure 307 - Extra Input Data Links



DataLink	Port	Parameter	DataLink	Port	Parameter
0	0	1	8	0	951
1	0	690	9	0	935
2	0	9	10	0	936
3	0	11	11	0	952
4	0	7	12	0	953
5	0	592	13	5	1
6	0	671	14	0	220
7	0	8	15	5	50

IMPORTANT	Do not modify data links unless needed from the VFD. Modifying the Datalinks and its position in the communication table below can cause a loss of communication between the VFD and QRATE iXC2 High Performance Edge Controller.

Figure 308 - Input Datalinks



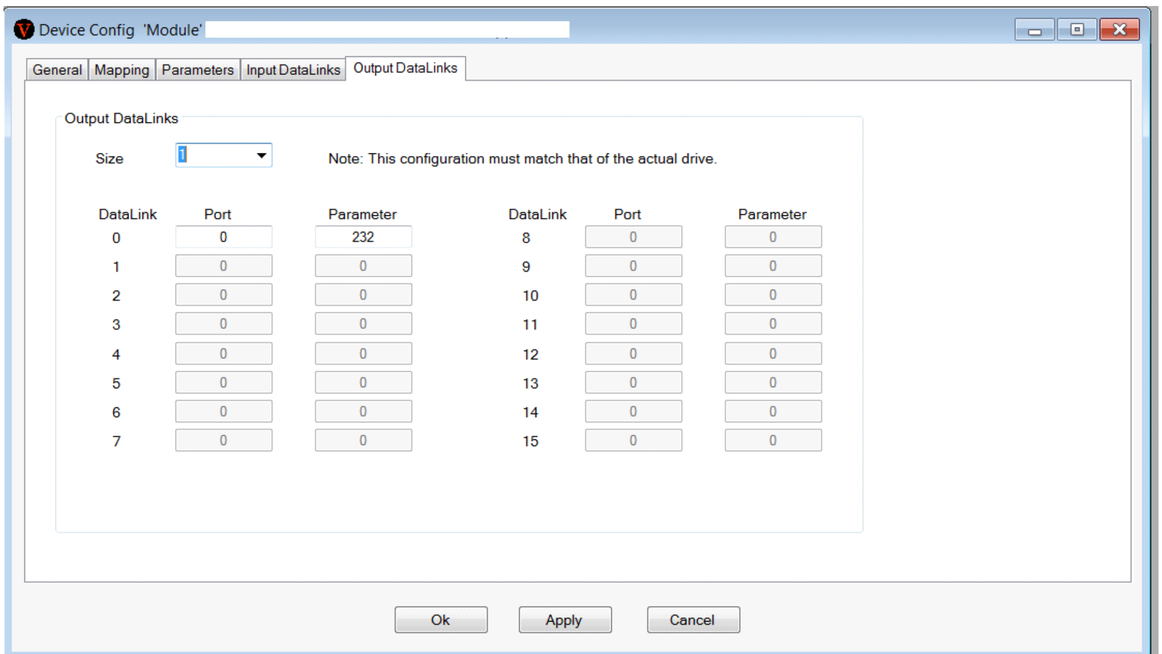
Output Datalinks

No Output Datalinks are used for the controller Application. There are up to 16 output data links that can be used and configured.

While Configuring data links, the Output Offset must be determined and added to the Mapping tab page presented in Figure 304 under the mapping tab.

The following example shows the Output Data Links that was configured. Note that the Datalinks are directed to port 0 as this is the port where the Enet-R card is installed. The same Datalinks must match from the VFD.

Figure 309 - Output Datalinks



Troubleshooting

This section serves as a guide for qualified personnel with proper training to troubleshoot INSTRUCT SRP* controller components and wiring.

INSTRUCT SRP Status Indicators

The INSTRUCT SRP can be set to one of the following nine states. The current state can be checked on the Well Basic Data (page 122) and Well Overview (page 120) displays.

Table 9 - INSTRUCT SRP States

State	Description
Stopping	The motor is in the process of coming to a stop.
Unable to Stop	This state indicates that the pump has failed to stop after a fixed time interval of 240 seconds from when the INSTRUCT SRP sends the stop command.
Stopped	In this state, the INSTRUCT SRP application is stopped. This state is also the initial configuration state. After the INSTRUCT SRP has been installed, it must be configured. No control is performed in any mode until the INSTRUCT SRP is configured with a set of well parameters, put into a well operation mode, and Start Motor is selected. If any parameters or configurations require changes, the INSTRUCT SRP must be put into stopped state by selecting Stop Operation from Well Operation Mode display (page 121).
Motor Alert	Before starting the motor, the INSTRUCT SRP waits during the preconfigured Motor Alert Delay time. The INSTRUCT SRP then switches the D04 signal ON and thereafter switches OFF after the delay time expires.
Start	Shortly after the motor is turned ON, the INSTRUCT SRP enters into a Start state. No control commands are acknowledged in this state.
Unable to Run	This state indicates that the pump has failed to start after a fixed time interval of 60 seconds from when the INSTRUCT SRP sends the Start command. There is not further action and the Well State remains in "Pump unable to Run" state.
Run	In this state, the INSTRUCT SRP controls and monitors the well. Based on the well condition, the INSTRUCT SRP responds accordingly.
Rest	Depending on the well condition, such as Pump Off, Dry Well, or after the runtime expires (Manual Timer mode), the INSTRUCT SRP switches to the preconfigured Rest state. This state is applicable in Fixed Speed Pump off, Fixed Speed Manual Timer, VFD Pump Off, and VFD Pump Fillage operation modes.
Fail-safe Run	The system switches to this state when a position indicator error happens. This state occurs if the motor is running in Fixed Speed Pump Off mode and the alarm action for a position indicator error is configured to take a fail-safe action. You can configure the runtime in this state or depend upon the last 24-hour run/rest history if the smart clock feature is enabled.
Fail-safe Rest	After the fail-safe runtime expires, the INSTRUCT SRP switches to the preconfigured Fail-safe Rest state.
HOA	If the Hand-Off-Auto (HOA) switch is wired to the INSTRUCT SRP I/O Board and is ON, the INSTRUCT SRP well state changes to the HOA state. In this state, the INSTRUCT SRP application is bypassed.
Shutdown	The INSTRUCT SRP switches to this state if an error condition occurs (for example, all critical alarms or AUX-faults). Unless the conditions are cleared or you manually reset the alarms, the motor cannot be switched ON.

Incomplete and Erroneous Surface Cards

An incomplete or erroneous surface cards commonly appear as a horizontal straight line with no variation on the surface card. To identify the specific cause, refer to the load and position indicator inputs (load cell and inclinometer).

Troubleshoot Load Cell

To troubleshoot the load cell, follow these steps:

- With the INSTRUCT SRP I/O powered on, verify the excitation voltage to the load cell across EXC+ and EXC- is approximately 5V DC. If the excitation voltage is 0V DC, the INSTRUCT SRP I/O needs replacement. Contact your local Sensia sales office for more information.
- With the INSTRUCT SRP I/O powered on, verify the voltage from the load cell across SIG+ and SIG- remains between 0…10 mV. The voltage decreases on downstroke and increases on upstroke. If the load cell voltage is 0 mV, verify continuity of the load cell. If the load cell voltage remains constant at a value greater than 0 mV on upstroke and downstroke, the load cell could be faulty.
- Verify input voltage from the load cell to the controller (Controller Details on page 187). The load cell input voltage (AI1) varies between 0…4.02V DC. The voltage decreases on the downstroke and increases on the upstroke. If the voltage observed on AI1 channel is 0V DC or remains at a constant value, verify that the controller I/O has been configured properly (Sensor Configuration on page 66). If configured properly, the controller I/O needs replacement. Contact your local Sensia sales office for more information.

Troubleshoot Inclinometer

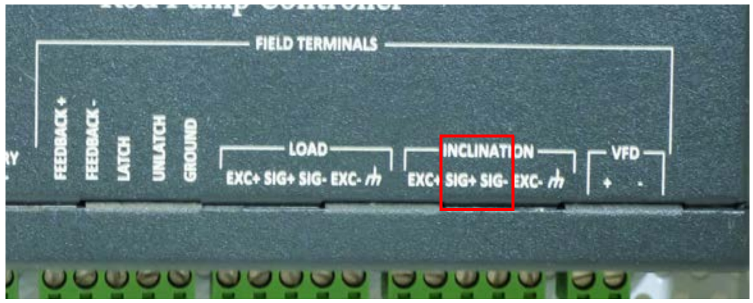
1. Verify that the inclinometer is positioned correctly.

Figure 310 - Inclinometer Positioning on I-Beam

2. With the INSTRUCT SRP I/O powered on, compare EXC signals (EXC+ and EXC-) on the INSTRUCT SRP I/O to EXC signals on the inclinometer Molex® connector. Verify that your inclinometer Pinout configuration is consistent with specification.

3. Measure and observe the voltage signal (SIG+ and SIG-) on the INSTRUCT SRP I/O (Figure 311) and inclinometer Molex connector (Figure 312). The signal voltage increases as the horse head moves up and decreases as it moves down between 3.48...4.5 V. If the voltages are not within this desired range, recheck the inclinometer position.

Figure 311 - Inclinometer INSTRUCT SRP I/O Wiring



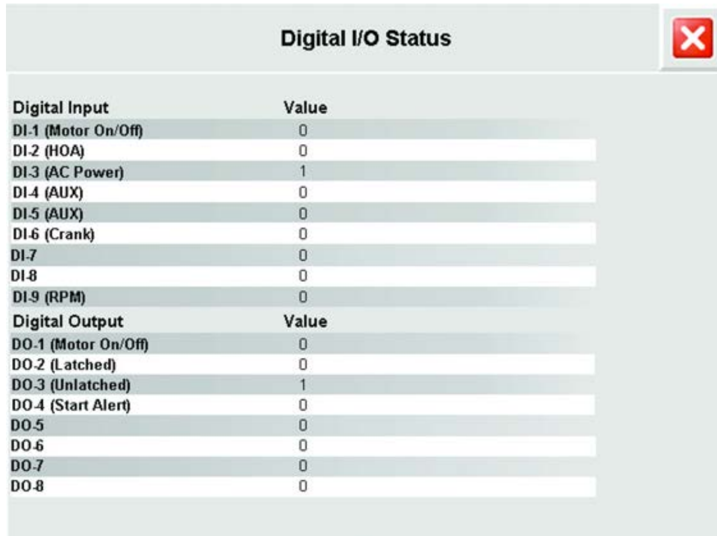
4. If a no voltage signal is detected through the Molex connector, verify wiring on the inclinometer board (Figure 312) and check that all wires are secured properly.

Figure 312 - Internal Pinout of Inclinometer

Troubleshoot Hall Effect Sensors

1. Verify that the Hall effect crank arm and motor shaft/RPM sensors are properly wired (see Figure 16 on page 23).
2. Verify that your Hall effect sensors are properly installed with their magnets properly mounted. When mounted correctly, the magnets pass in front of each sensor when the crank arm and motor shaft rotate. A 24V signal must be measured when the magnet is properly aligned with the Hall effect sensors.
3. Measure the voltage across +24V and -24V of the terminals that supply power to the Hall effect crank arm and motor shaft/RPM sensors. The voltage must measure about around 24V. If the voltage is 0V for either sensor, verify that the Hall effect sensor is properly wired (see Figure 16 on page 23).
4. Measure the voltage across SIG (signal) and -24V of both Hall effect sensors with the magnets in front of the sensors. The voltage across SIG and -24V must measure around 24V.

5. Verify that the signals for both Hall effect sensors that are sent to the controller I/O board are "High" (value equals 1) when both magnets are in front of the Hall effect sensors. The digital input status for DI6 (crank arm) and DI9 (motor shaft - RPM) can be verified on the Digital I/O Status display (see Controller Details on page 181).



Motor Not Starting

- Issue a start motor command (see Start and Stop the Motor on page 272). Verify that the relay status indicator is on.
- Check the connectivity to the terminals.
- Check that all trip/fault conditions are cleared.
- Check the motor start alert delay value. Wait until delay time as elapsed.
- If relay status indicator light does not come on, contact TechConnect Support or Sensia Support.

IMPORTANT If you have a PowerFlex® drive (or power package), check the Run command on the drive and the EtherNet/IP communication between the drive and the INSTRUCT SRP.

Motor Status Feedback Error

Verify that the motor feedback signal (~24V DC) is present when motor is ON by measuring the Feedback terminals in the INSTRUCT SRP I/O. If the motor feedback signal is not present, the motor status feedback error alarm is raised.

Specifications

Enclosure Specifications

Table 10 - Enclosure Specifications

Attribute	Value
Dimensions (H x W x D)	46 x 46 x 29 cm (18 x 18 x 11.5 in.)
Material	Steel (with white paint)
Ratings	IP14, NEMA 3R
Weight (Fully Equipped)	Display: 22.7 kg (50 lb) No display: 21.5 kg (47.4 lb)

IMPORTANT Install the INSTRUCT SRP* controller in areas that are not classified as hazardous locations.

Hall Effect Sensor

Table 11 - Hall Effect Sensor Specification

Attribute	Value
Operating temperature	-40…185 °F(-40…85 °C)
Supply Voltage	4.5…24V DC
Output	Sinking, up to 25 mA of Current
Sensitivity	~350 Gauss

Load Cell

Table 12 - Load Cell Specifications

Attribute	Value
Operating Temperature	-40…+80 °C (-40…+175 °F)
Output	2 mV/V Nominal differential signal (700 Ω Wheatstone bridge)
Excitation voltage	5…15V DC
Range	0…22,680 kg (0…50,000 lb)

Inclinometer

Table 13 - Inclinometer Specifications

Attribute	Value	
	Solid-state	Non-solid-state
Operating Temperature	-40…+85 °C (-40…+185 °F)	-40…+85 °C (-40…+185 °F)
Range	±45°	±60°
Supply Voltage	5…36V DC	5…16V DC
Output Range	0.2…4.8V	30 mV/deg

Motor Control Relays

Table 14 - Solid-state Relay Specifications

Attribute	Value	
Coil Ratings	Operate	12V DC, 110 mA
	Release	12V DC, 50 mA
Coil Resistance	Operate	110 Ω
	Release	235 Ω
Contact Rated Load	Resistive load	220V AC, 3 A
	Inductive load	220V AC, 0.8 A
Maximum Switching Voltage	Resistive load	250V AC
	Inductive load	250V AC
	Resistive load	24V DC, 3 A
	Inductive load	24V DC, 1.5 A
	Inductive load	AC: 3 A
Maximum Switching Current	Resistive load	AC: 3 A
	Resistive load	DC: 3 A
	Inductive load	DC: 3 A
Maximum Switching Power	Resistive load	AC: 660VA
	Inductive load	AC: 176VA

Standards Compliance

- UL 508A
- c-UL 508A

Wiring Diagrams

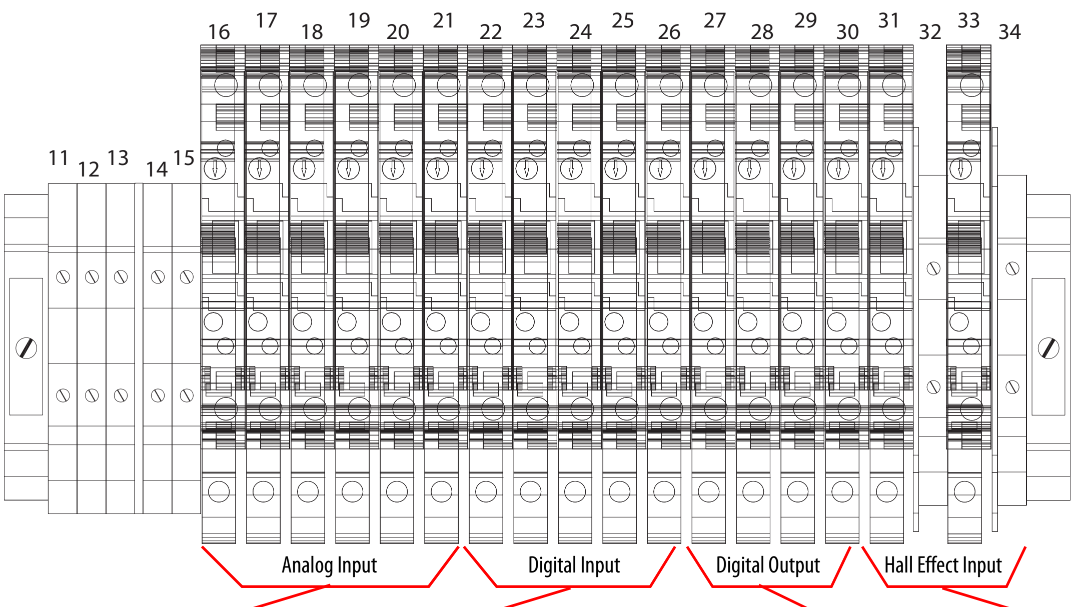
Motor Control Wiring Options

ATTENTION: The wiring options that are described in this section require rewiring INSTRUCT SRP* controller internal components. Only allow properly trained and qualified personnel to attempt rewiring.

The factory-configured motor control output is a switched 24V DC output. For a dry contact output, you have two options.

- Mount a new 24V DC coil relay in the cabinet and wire the relay to the powered output terminals.
- Carefully remove the factory-configured wiring to the relay contact and connect the motor control wiring directly to the relay contact.

Terminal Block Allocation



TB	Description
16	Spare AI2
17	Spare AI4
18	Spare AI5
19	Spare AI6
20	Spare AI7
21	Spare AI8

TB	Description
22	Auto/Off DI2
23	Aux DI4
24	Aux DI5
25	Spare DI7
26	Spare DI8

TB	Description
27	Motor On/Off Status DO1
28	Start Alert DO4
29	Spare DO5
30	Spare DO6

TB	Description
31/ 32	Crank Location D16
33/ 34	Motor RPM DI9

INSTRUCT SRP Wiring

Figure 313 - Fully Wired INSTRUCT SRP

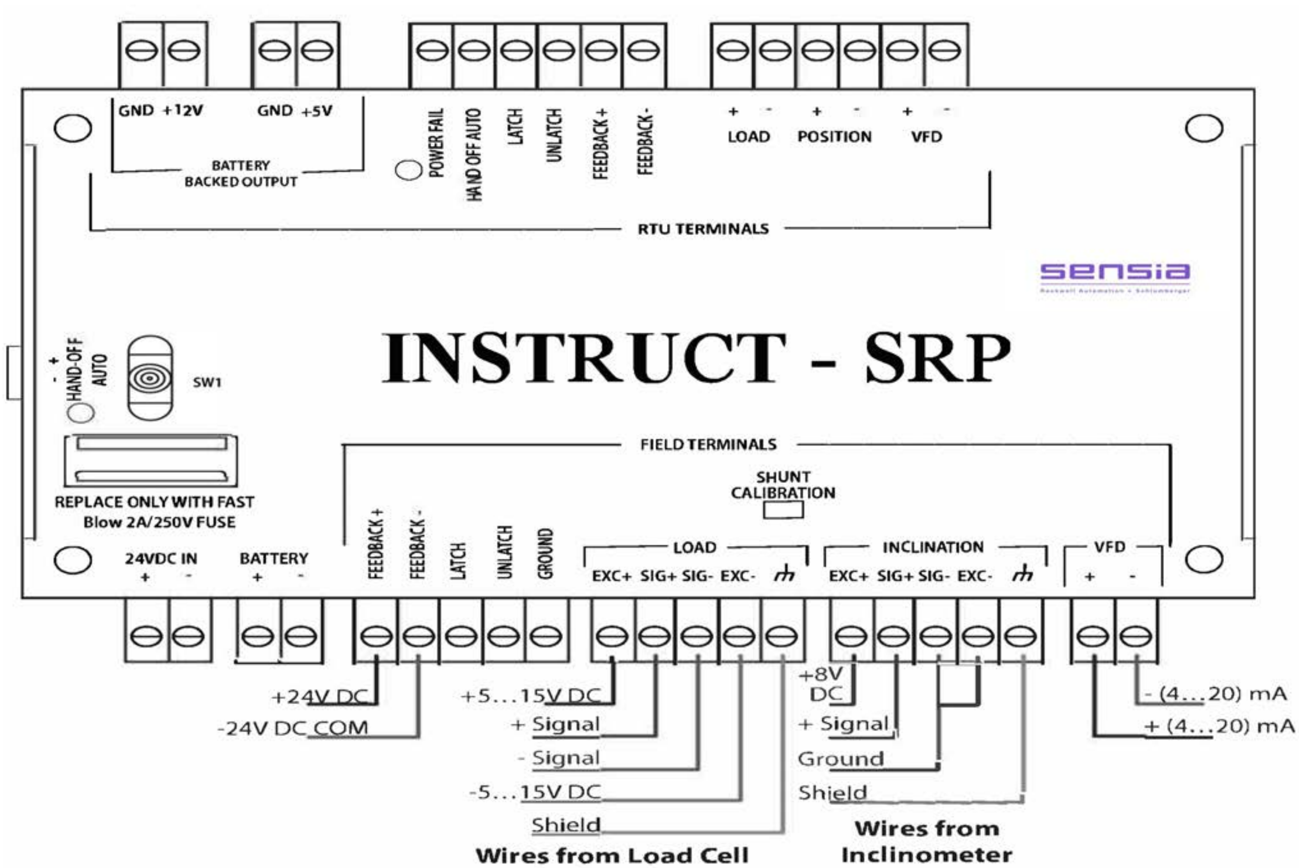
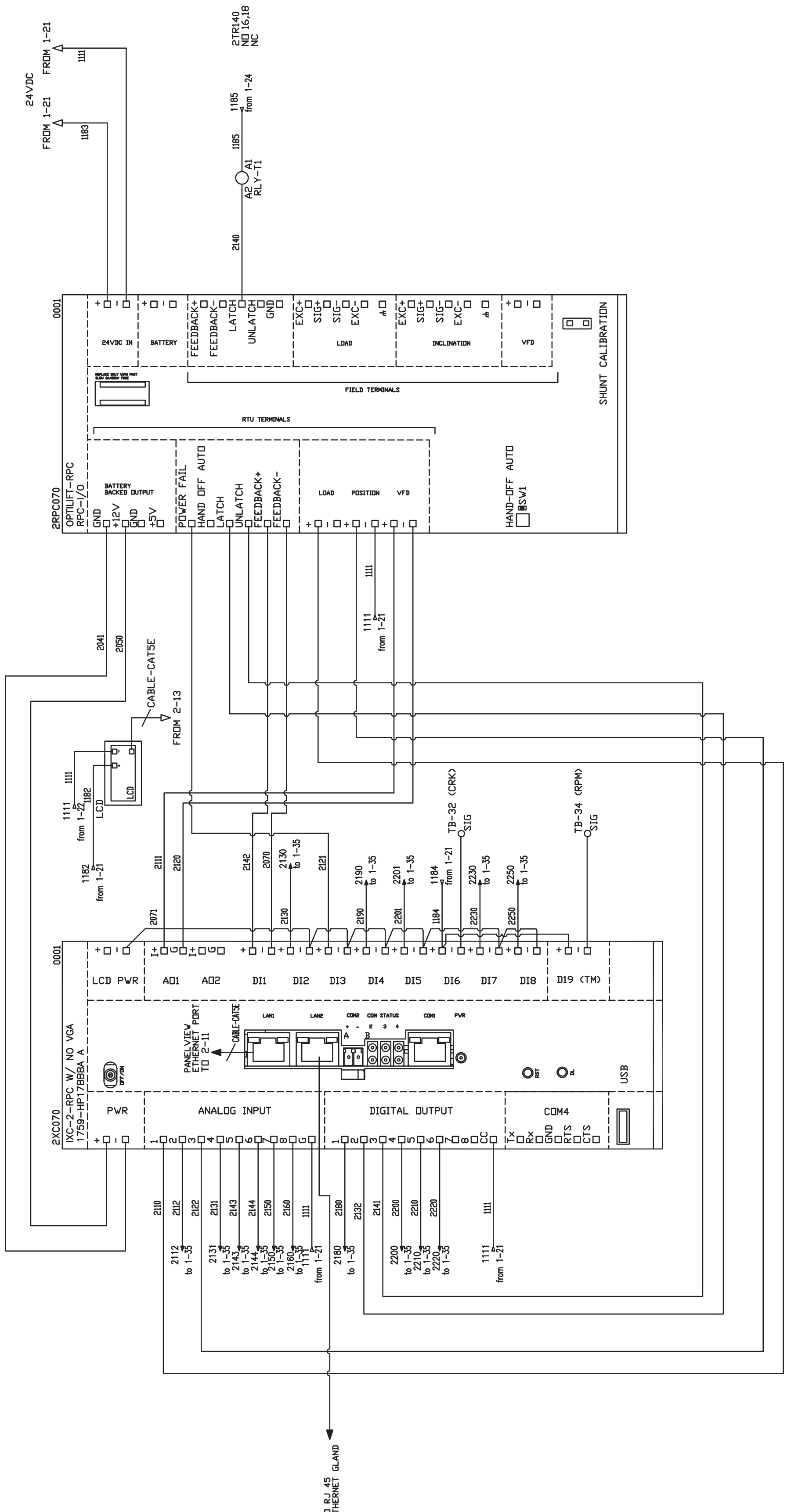
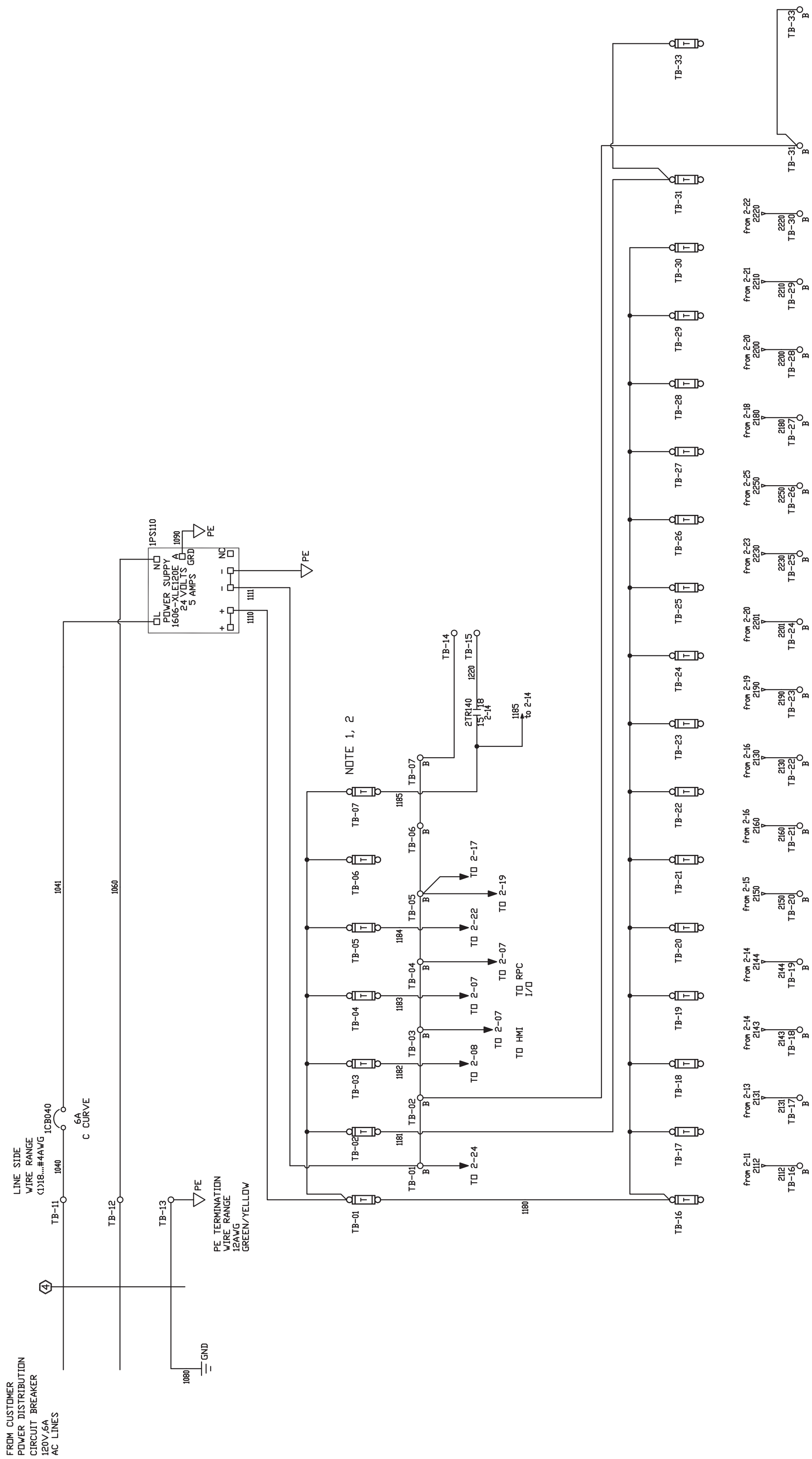


Figure 314 - INSTRUCT SRP Wiring Overview



Power Distribution

Figure 315 - INSTRUCT SRP Power Distribution



Site Survey Template

INSTRUCT SRP Validation Sheet

The site survey template helps to record all proper pump equipment information that is required to commission an INSTRUCT SRP* controller. The information is entered on the Pump Configuration display (page 146). The site survey sheet also provides additional information about the existing conditions and process information of the well.

INSTRUCT SRP WORK SHEET	
Date	7/15/2020
Rev	14
Parameters in **BOLD** letters are mandatory for INSTRUCT SRP Configuration	
Well Name:	
Pumping Unit	
Beam Pumping Unit	
Rotaflex Pumping Unit	
Manufacturer:	
Model:	
Name Plate:	
Actual (Current) Stroke Length:	
Crank Rotation (Clockwise or Counter Clockwise)	
For Belt Driven Linear Pumps Only	
Sprocket Radius:	
Chain Length:	
Distance between Sprocket Centers:	
I/O Expected to/from Sentry Controller	
Any Cornering Speed Needed? What Speed?	
Braking Safety PLC system Type?, provide documentation	
Pumping Unit API Dimensions (Required when Pumping Unit is not in the Database)	
Pumping Unit Type:	
Crank Rotation:	
R Dimension:	
K Dimension:	
C Dimension:	
P Dimension:	
A Dimension:	
I Dimension:	
H Dimension:	
G Dimension:	
Phase Angle:	

Motor	
Manufacturer:	
Part Number:	
Electric	
Gas	
Motor type:	
Motor Sheave Size (IN):	
Gear Box Sheave Size (IN):	
Motor nominal speed (RPM):	
Jack Shaft (Intermediate Speed Reducer)	
Input Jack Shaft Sheave Size (IN)	
Output Jack Shaft Sheave Size (IN)	
Mechanical Efficiency%:	
Gear box ratio:	
Motor Nominal Frequency (Hz):	
Horse Power (HP):	

Variable Frequency Drive (VFD)	
VFD Required?	
Existing VFD?	
Manufacturer:	
Part No.:	
Communication Protocol	
4-20mA Available	
Digital Input Run/Stop Command available?	
Typical Min and Max VFD Working Frequency?	

Controller						
Existing controller needs to be replaced?						
Manufacturer:						
Model No.:						

Type of Control Desired (Optional)	
Fixed Speed Pump Off	
Fixed Speed Timer	
Fixed Speed Pump Fillage	
Fixed Speed Manual	
Variable Speed Pump Off	
Variable Speed Pump Fillage	
Variable Speed Manual	

Operating Conditions	
Power Comes from:	
Electric Grid	
On-site Generator	
Power Supply Voltage (Vac):	
Power Supply Frequency:	
Operating Temperature:	
Operating Humidity:	

Load Cell	
Load Cell Required?	
Existing Load Cell Manufacturer: Part No: Load Cell Signal Output Range: Load Cell Input Voltage Range: Load Cell Range:	
Inclinometer	
Existing inclinometer Manufacturer: Part No: Voltage Input Range: Signal Output Range:	
Inclinometer Required?	
Proximity Switch (Rotaflex Only)	
Existing Proximity Switch? Manufacturer: Part No: Voltage Input Range:	
Proximity Sensor Needed?	
Hall Effect Sensors	
Required for Crank Arm? (not applicable for Rotaflex)	
Existing Hall Effect Crank Arm Sensor? Manufacturer: Part No: Voltage Input Range:	
Hall Effect Required for RPM at Motor Shaft?	
Existing Hall Effect RPM Sensor? Manufacturer: Part No: Voltage Input Range:	
Hall Effect on Crank Installation on Top or Bottom of Stroke?	
Wired/Wireless Sensors (Optional)	
Not Needed	
Must integrate with existing sensors (*) Types: Qty:	
Wireless Sensors Needed? (*)	
1. Pressure Sensors. If yes, How many: Range: Output signal:	
2. Temperature sensors. If yes, How Many: Range: Output signal:	

AUX Shut-in	
Existing Shut-in Signals?	
Signal type:	
Types:	
Qty:	
SCADA	
SCADA Software Required	
Existing SCADA? Supplier/Brand of Existing SCADA:	
Communication Protocol Type?	

GENERAL INFORMATION

Process Information	
Oil Density (API):	
Gas Specific Gravity:	
Water Specific Gravity:	
Bottomhole Temperature (F):	
Fluid Level from Surface (ft): (echometer Data)	
Fluid Level from Surface (ft): (From Dynamometer)	
Water Cut (%):	
Gas-Oil-Ratio (SCF/STB):	
Static Reservoir Pressure (PSIG):	
Pump Plunger Diameter (IN):	
Pump Depth (ft):	
Tubing Inner Diameter (inches):	
Pump Efficiency:	
Depth of Perforations (ft):	
Well Deviation (Degrees):	
Damping Factor:	
Anchored Tubing? Y/N	
Current Pumping Speed (SPM):	
Pump Intake Pressure (PSI):	
Echometer Test report available (Y/N)	
Fluid Load (LBS):	
Tubing Head Temperature (F):	
Casing Head Temperature (F):	
Flowline Temperature (F):	
Tubing Head Pressure (PSI):	
Casing Head Pressure (PSI):	
Flowline Pressure (PSI):	

Rod Tapers Information:						
Number of Tapers:						
Sections	**Taper 1**	**Taper 2**	**Taper 3**	**Taper 4**	**Taper 5**	**Taper 6/ Sinker Bar**
Manufacturer Name:						
Sucker Rod API Material Type						
Sucker Rod API Grade						
Sucker Rod Diameter (IN)						
Young Modulus for the Material (Ksi)						
Sucker Rod Weight (LB/Ft)						
Total Length of Rods (FT):						
Historic Operational Information						
Sand						
Paraffin						
Scale						
Asphaltenes						
Emulsion						
H2S						
Gassy Well						
CO2						
Pump Balancing (is the pump balanced?)						
Vertical or Horizontal Well Type?						
Production Data						
Fluid Production in BPD						
Oil Production in BPD						
Water Production in BPD						
Gas Production in SCF						
Historical Dynagraph						
Are Surface and Downhole cards available? Provide Surface and downhole cards if available						
Typical Pumping Speed range:						
Typical Pump Fillage:						
Spare IO's						
IO's Required?						
Number and Type of IO's Required:						
Remarks and Comments						
Completed By:						
Date:						

Notes:

The following terms and abbreviations are used throughout this manual.

Acoustic Survey A type of sonic log that records the travel time of sounds through the annular space of a well between the casing and the tubing. It is used to determine fluid level and anomalies in the well.

Air Balanced Units The surface pumping unit in which an air cylinder instead of counterweights achieves system balancing.

API American Petroleum Institute

API Pumps Classification The nomenclature suggested by the American Petroleum Institute to describe the components of a downhole pump. This description includes the tubing size, pump plunger size, barrel length, setting assembly type and location, and length of extensions.

API RP 11L American Petroleum Institute, Recommended Practice. Design calculation for sucker-rod pumping system.

API Spec 11E American Petroleum Institute, Specification for Pumping Units. This specification provides the requirements and guidelines for the design and rating of beam pumping units for use in the petroleum and natural gas industry. This specification includes all components between the carrier bar and the speed-reducer input shaft.

Artificial Lift The production system that assists the well in lifting the fluids from downhole to the surface by adding energy with a pump or injecting either fluids or gases into the well. It is used when the reservoir energy is not enough to raise the fluids to the surface at an economical rate.

Barrel

1. The cylindrical part of a sucker-rod pump in which the piston-like plunger moves up and down.
2. A unit of volume measure (abbreviation: bbl) equivalent to 42 US gallons (159 liters).

Beam Balanced Pumping Unit A beam pumping unit that has a counterbalance weight on the walking beam.

Beam Pumping Unit A machine that is designed specifically for sucker-rod pumping. An engine or motor is mounted in the unit to power a rotating crank. The crank moves a horizontal member (walking beam) up and down to produce a reciprocating motion. This motion is transmitted to the downhole pump through the sucker rod string. The surface pumping unit has counterweights installed on the cranks for balancing.

Bottom Hole Pressure The pressure at the bottom of the well. Generally, it is considered as the static reservoir pressure.

Card Interpretation The process of analyzing the surface and downhole cards to detect problems and troubleshoot the pumping system.

Casing The steel pipe that is placed in an oil and gas well that is in contact with the formation. The casing has the following functions.

- To help prevent collapse of the wall of the hole
- To help prevent movement of the fluids from one formation to another
- To improve the efficiency of extracting hydrocarbons from the well

The casing is made with special alloys to avoid corrosion. Diameter varies from 11.4…62.2 cm (4.5…24.5 in.). Length varies from 4.9…14.6 m (16…48 ft).

Counterbalance Effect The effect of counterweights on a beam pumping unit. The approximate ideal counterbalance effect is equal to half the weight of the liquid plus the buoyant weight of the rods.

Counterbalance Weight/ Counterweight A weight that is applied to compensate for existing weight force. On pumping units in oil production, counterweights are used to offset the weight of the column of sucker rods and fluids on the upstroke of the pump, and the weight of the rods on the downstroke.

Coupling A metal collar with internal threads that are used to join two sections of threaded pipe or rod.

Crank Angle The angle that is measured from the top of the crank arm when it is on the vertical position to the clockwise or counterclockwise position, depending on the crank arm rotation.

Crank Balanced Pumping Unit A beam pumping unit that has the counterweights on the crank arm.

Damping Factor A coefficient that is used for the numerical solution of the damped wave equation to account for energy losses due to friction between the rod string and the fluid in the tubing.

Deadband The defined range where the current state is maintained and no commands are sent to the motor.

Dynamometer Card/Dynagraph The plot of the measured rod load at the various positions through a full stroke. The load is displayed in pounds of force and the position in inches.

Effective Stroke Length The distance traveled by the plunger across the barrel. Also, it is the effective pump fillage when the barrel is partially full due to gas presence, spacing, or inflow issues.

Estimated Production Mass or volume flowing per unit of time that is calculated from the pump size, effective stroke at the pump, pumping speed, and fluids properties.

Flowing Bottom Hole Pressure Pressure at the bottom of the well bore during production, just in front of the well perforations.

Fluid Level Distance between well head and the surface of the liquid in the tubing or the casing in a well. The static fluid level is taken when the well is not producing and has stabilized. The dynamic level is the point to which the static level drops under producing conditions.

Fluid Load The load on the pump plunger from the weight of the fluid inside the tubing.

Fluid Pound The pumping condition where the pump barrel is partially full of fluid and the plunger hits the surface of the fluid inside the barrel during the downstroke.

Free Gas The amount of gas out of the liquid matrix (not in solution) that is coming from the reservoir and/or is generated by pressure reduction in the well and travels from the perforations of the well to the pump intake.

Gas Anchors The gas separators that are installed at the pump intake to avoid gas interference and gas locking.

Gas Interference The pumping condition where the plunger compresses the free gas present inside the barrel with the subsequent loss of pumping efficiency.

Gas Lock The pumping condition where the amount of free gas is such as the pump loses the ability to generate the pumping action.

GOT Gauge Off Time

Hall Effect Sensor A transducer that varies the output voltage in response to a magnetic field. The crank arm sensor is used for positioning. The motor shaft/RPM sensor is used to detect speed.

HMI Human Machine Interface

HOA Hand-Off-Auto selector switch

ID Inside Diameter

Inclinometer An instrument that measures the angle of the walking beam. The polished rod position is calculated using this angle and the pumping unit geometry.

Inflow Performance Relationship (IPR) The relationship between the liquid inflow or production rate and the flowing pressure at the bottom of a producing well.

ksi Kilopound per square inch.

Minimum Polished Rod Load The lowest load that is imposed on the polished rod throughout a complete sucker-rod pump cycle.

Modbus A way to transmit information over serial lines between electronic devices. Modbus RTU is derived from master/slave architecture, while Modbus TCP runs on Ethernet.

Motor Frequency The motor speed in Hertz when actuated by a variable frequency drive.

NEMA National Electrical Manufacturers Association

OD Outside Diameter

Peak Net Torque The maximum absolute value of the torque the gearbox of the pumping unit experiences during a complete stroke.

Peak Polished Rod Load The highest load that is imposed on the polished rod throughout a complete sucker-rod pump cycle.

Permissible Load Diagram The graphic representation of the maximum polished rod load that creates a torque at the gearbox equal to the rated torque of the gearbox when the polished rod is at specific position of the stroke.

PF Pump Fillage

PLC Programmable Logic Controller

Plunger/Piston Cylindrical sliding piece that is moved by or that moves against fluid pressure within the pump barrel. It consists of a hollow tube with the traveling valve and some form of seal on the outside.

Plunger Slippage The loss, or return, of fluid through the clearance between the plunger and barrel walls.

Plunger Stroke Length The total distance traveled by the plunger inside the barrel of the pump. This stroke accounts for stretch due to the weight of the fluid, weight of the sucker rod string, and the tubing movement for unanchored tubing installations.

PO Pump Off

POC Pump Off Controller

Polished Rod The steel bar that connects the sucker rod strings with the pumping unit. It is covered with chrome to help prevent leaking at the stuffing box.

Polished Rod Load The load that is imposed on the polished rod throughout a complete sucker-rod pump cycle.

Polished Rod Power The power that is expended at the polished rod. It is the power necessary to lift the fluid at a certain flow rate to the surface and to overcome both friction in the well and the dynamic rod loads.

POS Pump Off Setpoint

Prime Mover The primary source of power driving the surface pumping unit. This source could be an electric motor or an internal-combustion engine.

Productivity Index The slope of the inflow performance relationship (IPR). The unitary volume of fluid that could be produced by every unit of pressure reduction in the reservoir.

Pump/Downhole Card The collection of load-position pairs that are calculated at pump depth. The load-position data that is measured in surface is converted into downhole data by the use of the wave equation. There are several methods to solve this equation (Fourier Series, Numerical Methods, and so on). This card represents the performance of the pump and is used to troubleshoot and optimize the pump.

Pump Displacement The volume of fluid that the pump displaces during a complete pump stroke.

Pump Fillage The ratio between the effective fluid displacement and the total plunger displacement of the downhole pump. It is a measure of the pump efficiency.

Pump Off The well condition where the level of fluid is below the pump intake. In this scenario, the well is not able to flow.

Pump Setting Depth Vertical distance from the surface to the pump intake.

Pump Standing Valve A fixed ball-and-seat valve at the lower end of the working barrel of a sucker rod pump. The standing valve and its cage do not move.

Pump Traveling Valve A ball-and-seat valve that moves with the sucker rod string. On the upstroke, the ball is seated, supported the fluid load. On the downstroke, the ball is unseated, which allows fluid to enter into the production column.

Pumping Speed The number of pumping cycles in stroke per minutes (SPM)

Pumping Unit The machine that imparts reciprocating motion to a string of sucker rods extending to the positive-displacement pump at the bottom of a well. It is usually a beam arrangement where a crank is attached to a speed reducer drive.

RPC Rod pump controller

RPM Revolutions per minute

RTU Remote terminal unit

SCADA Supervisory Control and Data Acquisition

Sinker Bars Larger diameter rods or bars that are placed at the bottom of the sucker rod string to provide weight and increase stiffness at the bottom to help prevent the sucker rod from buckling.

Speed Reducers/Gear Reducer/Gearboxes The system of gears that the prime mover drives and that transmit rotation and power to the crank of a beam pumping unit.

SPM Strokes per minute

Stroke Length The distance between the lowest and the highest position of the polished rod during a complete pumping cycle.

Sucker Rod A special steel or fiberglass pumping rod. Lengths are 7.6 or 9.1 m (25 or 30 ft). However, smaller sizes (pony rods) are available (0.6, 1.2, 1.8, or 2.4 m [2-, 4-, 6-, 8-ft]). Diameters varies from 12.7…31.8 mm (0.5…1.25 in.). Sucker rods are threaded on each end and manufactured to dimension standards and metal specifications set by API. There is also a continuous sucker rod with no couplings to tie the rods.

Sucker Rod Pump The downhole assembly that is used to lift fluid to the surface by the reciprocating action of the sucker rod string. Basic components consist of a barrel, plunger, standing valve, traveling valve, and hold-down assembly.

Sucker Rod String Several rods screwed together create the sucker rod string. This rod string is the mechanical link between the surface pumping unit and the pump at the bottom of the well. It is run inside the tubing.

Surface Card The collection of position-load pairs that are measured through a position and load sensor. An inclinometer measures position while a load gauge device measures load.

Tapered Sucker Rod String The sucker rod string in which the rods have different diameters. The combination of sizes is defined based on a stress analysis. A well could have up to four tapered sections.

Tubing The pipe that connects the reservoir with the surface. The downhole pump is installed inside or connected to the tubing. The fluids travel from the discharge of the pump to surface across the annular space that the tubing and the sucker rod string that is placed inside the tubing creates. Diameter varies from 1.5…4.5 in. (38.1…114.3 mm). Standard length is 30 ft (9.1 m) but smaller pieces of tubing (pup joints) are used to adjust it to the desired depth.

Tubing Anchor A device that is installed at the tubing downhole to keep the tubing from being moved up and down by the pumping action.

Variable Frequency Drive (VFD) An electrical device that provides speed control of a motor by output frequency changes. It can also provide protection, torque control, and energy regeneration.

Well Testing The series of activities that are performed to measure the oil, gas, and water flow rates and the flowing bottomhole pressure, temperature, fluid properties, and productivity of a producer well.

WMP Wireless Messaging Protocol

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