

## **Well Test Application**

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Manual Version 1.08

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## Introduction

Accurate measurement of production from a well is of paramount importance to oil and gas producers. Schneider Electric's Realflo line of flow computers provide accurate measurement in a feature packed, easy to use, and extensible package. As of version 6.91, Realflo has support for liquids measurement and batching. These new features, along with the existing Realflo natural gas flow computer, provide a robust platform on which to build a full featured well testing application.

Although the latest version of Realflo has support for batch history and liquids flow measurement, there is no support for changing the configuration of a flow run before starting a batch. This feature is necessary for multi-well pad testing, truck loading, or numerous other use cases where the same instrumentation, piping and separation path is used to perform measurement on different oil and gas product types.

The Well Test Application solves this problem, and others, to allow for well testing when using Realflo. Key features of the Well Test Application include:

- Create a database of up to 32 different well tests. Each well test can contain up to 6 runs in any combination of gas, liquid or water.
- Each run in a well test is highly configurable with its own purge time, oil density, water density, shrinkage factors, gas composition and others.
- Save the configuration of the Well Test Application from one RTU and upload it to another RTU, greatly reducing deployment time when configuring multiple RTUs.
- The Well Test Application can be fully configured and controlled from any HTML5 compliant web browser over both ethernet and serial connections. Using a serial connection does require a terminal server (ethernet to serial converter), however.
- Built on top of the Realflo measurement engine, which is API compliant. The Well Test Application does not do any measurement calculations, it simply configures the core Realflo measurement engine as required and presents the data generated by Realflo.
- Test results from the Well Test Application are available over Modbus, in SCADAPack Datalog format, and in CSV format from the RTU's file system.
- All test results and configuration are stored in non-volatile memory in the RTU, which means that no Well Test Application configuration or data is lost during a power outage.
- Fully automatic mode where tests are started and accepted automatically. No user intervention or local HMI is required in this mode.
- Easy integration with SCADA hosts, as all test control features and data is available over Modbus.
- Holds 128 accepted test results in non-volatile memory on the RTU. Holds around 64 kBytes of accepted test results in .CSV format on disk on the RTU.
- Superb integration with Schneider Electric's ClearSCADA SCADA host software for a complete measurement solution which can retrieve events, alarms, and all history to the SCADA host.
- Allows user ladder code in the RTU to start, stop, accept or reject well tests. User ladder code can also be written for local site control.

Configuration of Realflo and associated sensors and meters is beyond the scope of this manual. Realflo must be configured correctly for the Well Test Application to be usable.

## Revision History

**June 27, 2015**

**Manual Version 0.1**

Section	Comment
All	First draft

**August 3, 2015**

**Manual Version 0.2**

Section	Comment
<a href="#">Compatibility and Prerequisites</a>	Added compatibility section for version 0.003 and 0.004 of the application
<a href="#">Configure Well Test Database</a>	Changed the number of Well Tests that are supported by the application

**August 24, 2015**

**Manual Version 0.3**

Section	Comment
<a href="#">Modbus</a>	Added information about Acknowledge Events coil.

**September 18, 2015**

**Manual Version 1.0**

Section	Comment
All	Completely modified manual for version 1.0 release

**November 21, 2015**

**Manual Version 1.01**

Section	Comment
<a href="#">Installation</a>	Modified instructions on how to upgrade the program
<a href="#">Application Release Notes</a>	Added section
<a href="#">Compatibility and Prerequisites</a>	Added support for Realflo 6.93.1

**November 30, 2015**

**Manual Version 1.02**

Section	Comment
<a href="#">Application Release Notes</a>	Added notes for application version 1.006

<a href="#">Modbus</a>	Completely revamped this section. Added sections to cover specific functionality, like managing gas compositions or purge limits
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**January 11, 2016**  
**Manual Version 1.03**

Section	Comment
<a href="#">Compatibility and Prerequisites</a>	Validated application version 1.006 against Realflo 6.93.2.

**January 27, 2016**  
**Manual Version 1.04**

Section	Comment
<a href="#">Revision History</a>	Added comments for version 1.007
<a href="#">Modbus</a>	Clarified how to start and stop tests from SCADA, HMI and a user program.

**February 21, 2016**  
**Manual Version 1.05**

Section	Comment
<a href="#">Modbus</a>	Moved Accepted Test Results to a different set of Modbus registers. The structure is the same, but the addresses have changed
<a href="#">Compatibility and Prerequisites</a>	Clarified that Internet Explorer is not supported and verified that latest Telepace firmware is supported.

**August 30, 2016**  
**Manual Version 1.06**

Section	Comment
<a href="#">Application Release Notes</a>	Documented bug fix for version 1.009

**November 12, 2016**  
**Manual Version 1.07**

Section	Comment
<a href="#">Application Release Notes</a>	Documented bug fix for version 1.010

**September 10,**  
**Manual Version 1.08**

Section	Comment
<a href="#">Application Release Notes</a>	Updated Release notes

**March 11, 2021,**  
**Manual Version 1.09**

Section	Comment
<a href="#">Application Release Notes</a>	Updated Release notes

## Application Release Notes

**September 19, 2015**

**Application Version 1.000**

1. Initial release of the application.

**October 28, 2015**

**Application Version 1.001**

1. Fixed a bug where the array that holds the DLOG numbers was not being initialized after a power failure or program restart. This prevented the DLOGs from being written to as test data was generated.

**October 31, 2015**

**Application Version 1.003**

1. Added an extra wait state in after getting contract units and configuring the gas comp. This should result in well tests not being started because of a gas comp configuration change failure.
2. Modified licensing so that a license file can have a generic name as well as a name with a serial number. License files generated going forward will have the controller ID in the file name.

**November 9, 2015**

**Application Version 1.004**

1. Fixed a bug where the power went out during a well test the batch wouldn't be stopped before trying to start a new batch when trying to start a well test after power is restored. Now, every time a well test is started, when the Well Test Application is in the Starting state, all batches are stopped.

**November 21, 2015**

**Application Version 1.005**

1. Added purge volumes to the browser based operation interface. This interface now shows the purge volume and purge limit for each run.
2. Added two phase flow time to the Test Result section.
3. Tested with Realflo 6.93.1

**December 2, 2015**

**Application Version 1.006**

1. Added the ability to view purge volumes and purge limits for the current well test over Modbus.
2. Changed the way that gas compositions can be viewed and updated over Modbus. Added features to make it easier to integrate with a generic HMI or SCADA host.
3. Added the ability to view and change purge limits for all of the runs in a given well test over Modbus.
4. Add the ability to view and change the configuration of liquid product types over Modbus.

**January 28, 2016**

**Application Version 1.007**

1. Added additional validation when starting a test to ensure that liquid configurations are read correctly from Realflo.
2. Added additional delay when reading a liquid configuration from Realflo to make the process more reliable and give Realflo more time to respond.

**February 21, 2016**  
**Application Version 1.008**

1. If the datalog configuration doesn't match the expected configuration when the program is started then datalogs that are required by the Well Test Application will be created with the correct configuration. Previously, datalogs were created only once, when the program was first downloaded. By creating, or attempting to create datalogs when the program is started, extra downloads, which can be very time consuming, can be avoided.
2. The Accepted Test Results from the Well Test Application were using the same Modbus registers as the status information. The registers used by the Accepted Well Tests have been moved to resolve this conflict.

**August 30, 2016**  
**Application Version 1.009**

1. Fixed a bug where the Well Test Application would constantly try to start execution of a Realflo run in the Purge state even when the run's measurement type was set to none. In other words, in the Well Test Application, a well test run should be disabled when the measurement type is set to none and all of the settings should be ignored. That didn't happen in this case and is now fixed.

**November 12, 2016**  
**Application Version 1.010**

1. Added an event log entry when entering the accept/reject state.
2. Added some code to prevent duplicate test results from being generated when a test is accepted.

**November 20, 2017**  
**Application Version 1.011**

1. Fixed bug that did not properly copy Realflo Input Configuration registers from actual to proposed.

**June 1, 2018 Application**  
**Application Version 1.012**

1. Added support for Realflo 6.95 and 6.96.

**September 17, 2019**  
**Application Version 1.013**

1. Added support for running SCL WellTest and SCADASuite on the same RTU.

**July 28, 2020**  
**Application Version 1.014**

1. Refactored Accept/Reject code and added event logging.

**March 11, 2021**  
**Application Version 1.015**

1. Fixed bug that would occasionally revert Well On Test Modbus register value to previous value when changed

## Compatibility and Prerequisites

The Well Test Application is written in the C programming language and compiled to execute on Schneider Electric SCADAPack 300 series RTUs. The Well Test Application is designed to work with Schneider Electric's Realflo computer application. A supported version of Realflo must be installed and licensed on the target RTU for the Well Test Application to be useful.

### Application Version 1.000 to 1.014

These versions of the Well Test Application are compatible with the following RTUs.

- SCADAPack 350
- SCADAPack 357
- SCADAPack 330
- SCADAPack 334
- SCADAPack 4203DS

These versions of the Well Test Application are compatible with the following versions of the Realflo application. Versions of Realflo that are not listed are not supported.

### Application Version 1.000 to 1.014

These versions of the Well Test Application are compatible with the following RTUs.

- Version 6.96.2
- Version 6.95.1
- Version 6.93.2
- Version 6.93.1
- Version 6.91.5
- Version 6.92.1
- Version 6.91.5

### Application Version 1.000 to 1.011

These versions of the Well Test Application are compatible with the following RTUs.

- Version 6.93.2
- Version 6.93.1
- Version 6.92.2
- Version 6.92.1
- Version 6.91.5

These versions of the Well Test Application are compatible with the following versions of RTU firmware. Firmware versions that are not listed are not supported.

- Telepace firmware version 1.74.1
- Telepace firmware version 1.75.1118

## Browser Compatibility

The Well Test Application is compatible with newer versions of Chrome, Safari, Firefox and their mobile variants. The Well Test Application is not compatible with any version of Microsoft Internet Explorer.



## Installation

The Well Test Application is installed on the SCADAPack RTU via Schneider Electric Telepace Studio software. Without this software, installation of the Well Test Application on the RTU is not possible.

It is assumed that the user has an advanced level of expertise with SCADAPack RTUs and the Telepace Studio configuration and programming environment.

To install the Well Test Application on the RTU follow the steps below.



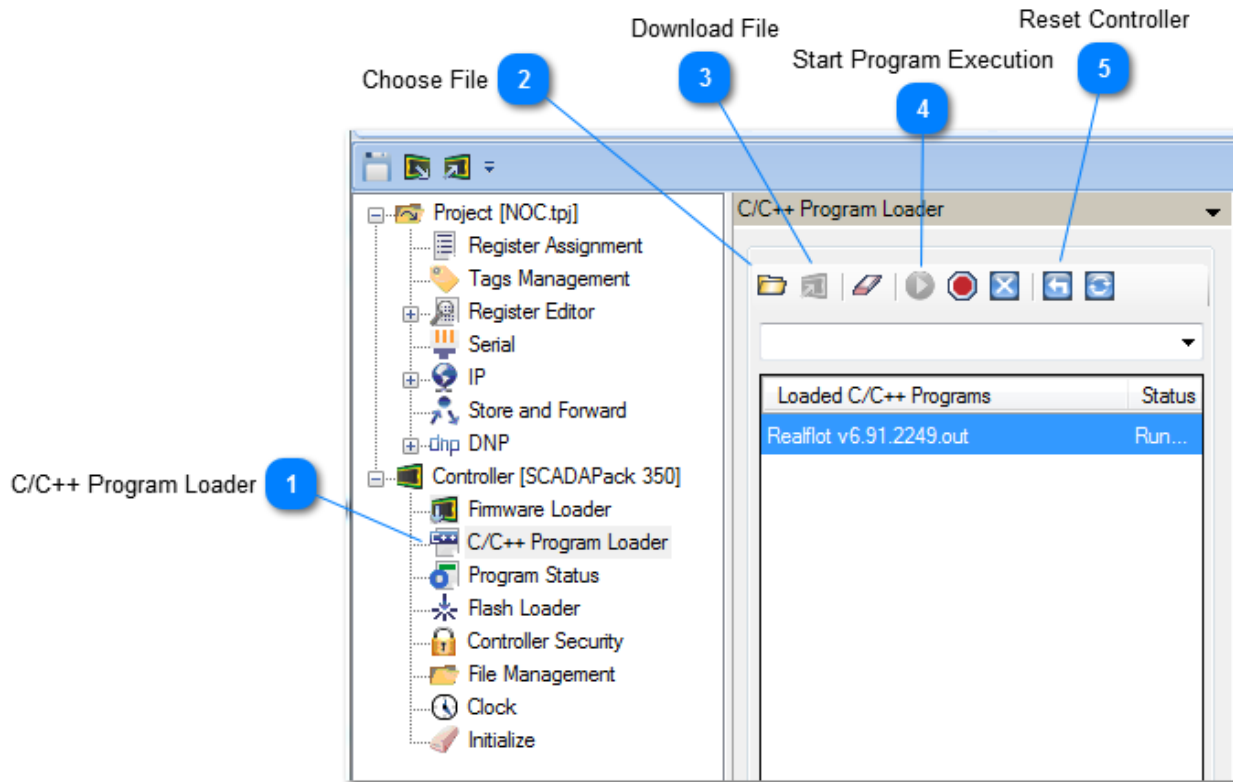
**Downloading the Well Test Application to the RTU clears the accepted test results, so make sure that all accepted tests are copied from the RTU before downloading the program.**

1. Verify that your RTU is supported and that it has a supported firmware version as shown in the [Compatibility Section](#).
2. Start Telepace Studio and connect to the RTU. Any type of connection (USB, serial, ethernet) is acceptable.
3. Choose the C/C++ Program Loader. This example already has the Realflo executable loaded on the RTU, but this isn't required. The Well Test Application can be loaded on the RTU before Realflo or vice versa.
4. Click the Choose File button and choose the Well Test Application executable file. Each target RTU type has a specific executable file.
5. Click the Download File button to copy the file to the RTU. This might take a few minutes. The process is more involved than simply copying the file to the RTU. The executable file is dynamically linked to the RTU's operating system as the download occurs.
6. Choose the executable file file in the Loaded C/C++ Programs window and click the Start Program Execution button. The Status will change to running.

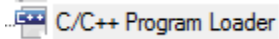


**The executable file for the Well Test Application contains the name of the RTU or the RTU family and the executable version. For example for SCADAPack 350 or 357, and executable version 1.000, the file name will be WellTestSp35x\_v1.000.out. For SCADAPack 330 or 334 and executable version 1.000, the file name is WellTestSp33x\_v1.000.out**

The Well Test Application is now downloaded and executing on the RTU.



## 1 C/C++ Program Loader



Choose this option to load and manage loaded C/C++ programs on the RTU

## 2 Choose File



Click this button to choose a C/C++ program executable to copy to the RTU

## 3 Download File



Click this button to download the selected C/C++ executable file to the RTU.

## 4 Start Program Execution



Click this button to start execution of the C/C++ program that is in focus

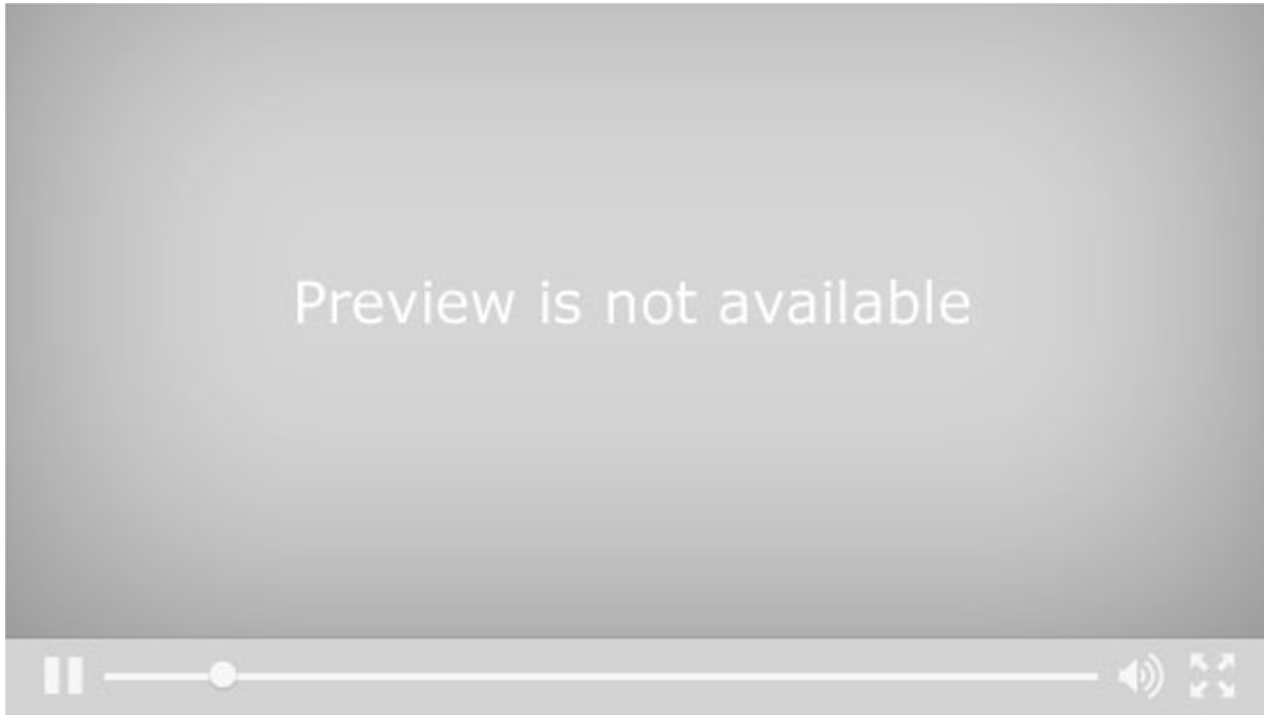
## 5 Reset Controller



Click this button to reset the controller. Communications will not be available while the controller is reset. Take careful note of the communications settings in the RTU before resetting it.

## Video Example

The video below shows how to install the Well Test Application on a SCADAPack RTU using Telepace Studio.



## Upgrading To A Newer Version

When upgrading to a new version of the Well Test Application, follow the directions below:

1. Ensure that the Well Test program is the Waiting state. Stop all tests underway and accept or reject any completed tests.
2. Start Telepace Studio, connect to the RTU and navigate to the C\C++ Program Loader screen.
3. Highlight the Well Test Application executable and stop the program.
4. Delete the program on the RTU.
5. Reset the controller using the reset button as shown in control (5) above. This step is generally not required, but if you get an "Unresolved Symbols" error when downloading the program, it is required to reset the controller from this interface. Power cycling is not effective.
6. Write the new executable file to the RTU.

## Troubleshooting

The installation and upgrade process is usually trouble free, but since it's impossible to predict the state of your RTU before installation, it's possible that the program may download to the RTU, but not execute correctly. When this occurs, the most common symptom is that it's not possible to connect to the Well Test Application using a browser. If this occurs, we recommend using Telepace Studio to update the firmware on the device, even if the update is to the same version of the firmware that is already installed. A hard initialization isn't required when doing this, and the state of RealFlo is usually preserved. This mechanism solves problems with the initialization of release of non-volatile memory, including memory used by datalogs.



## Licensing

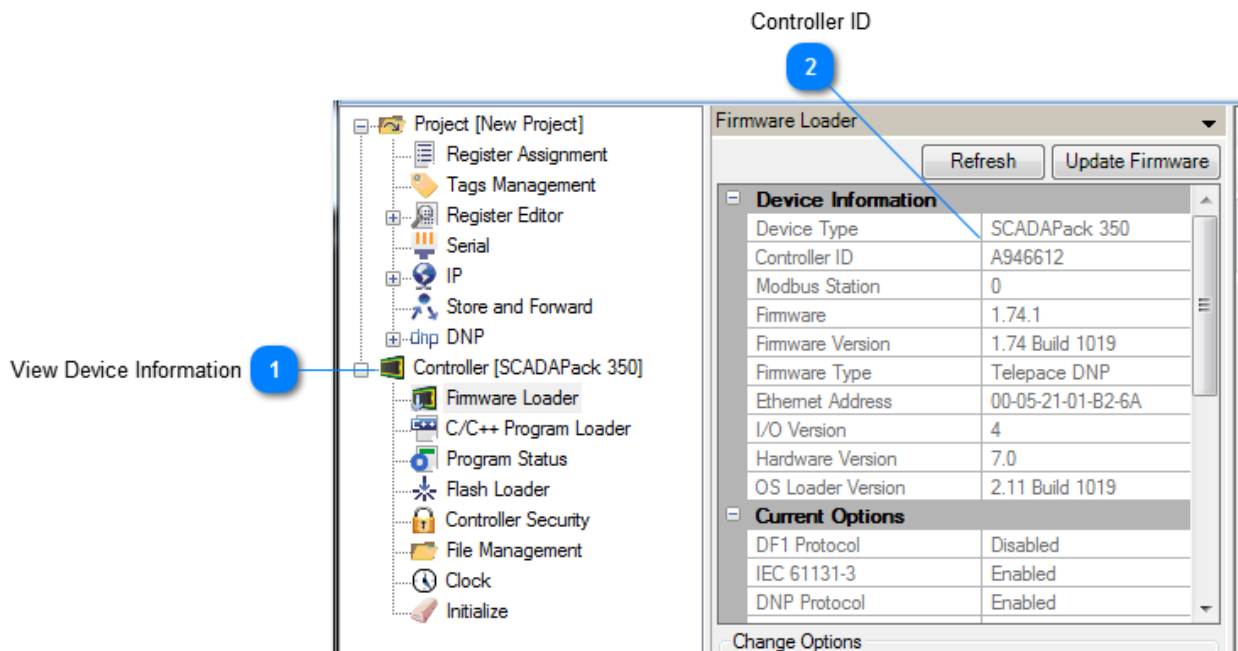
The Well Test Application is a licensed product. A license file allows the Well Test Application to execute on a specific RTU for a specified amount of time.

The program will run without any limitations for 7 days after it is downloaded to the RTU if no license file is found. This allows for a seven day demonstration period where all functionality is available. A valid license can be installed at any time during or after the trial period. After the license expires, all data and configuration is still available, but it is not possible to start a test.

### Obtaining a License

The Controller ID of the RTU where you want to run the Well Test Application is required to generate a license. This information can be found by connecting the RTU via Telepace Studio and viewing the Device Information.

Once you have the Controller ID, send that to us and we will send you back a license file that you can copy to the RTU. All license files are named wtLic.hex, regardless of the Controller ID or the expiration time contained within the license file.



### 1 View Device Information

Controller [SCADAPack 350]

Click here to show the device information in the pane on the right

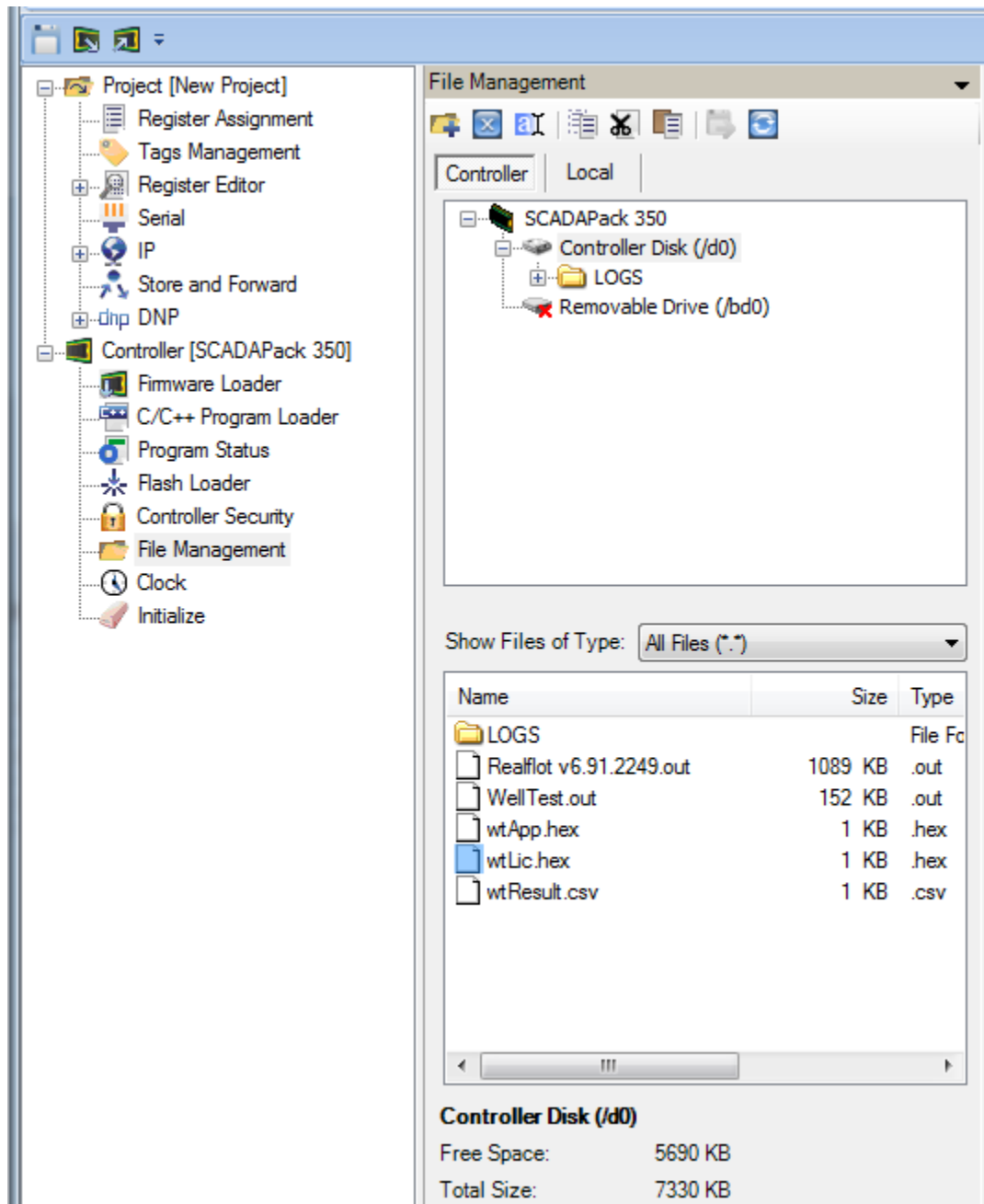
### 2 Controller ID

A946612

The Controller ID is required to generate a license file

### Copying the License to the RTU

Use Telepace Studio to copy the license file, named wtLic.hex, to the root folder of the embedded drive on the RTU. The license file must be in the same folder as the WellTest.out executable file, as shown below.



## Verifying the License Status

The Well Test Application checks for a valid license file about once per hour at the top of the hour. The result of the license file check is written to the Well Test Application Event Log. The header on the configuration pages also shows the status of the license. See the Configuration section for more details on the Event Log and how to view configuration pages.

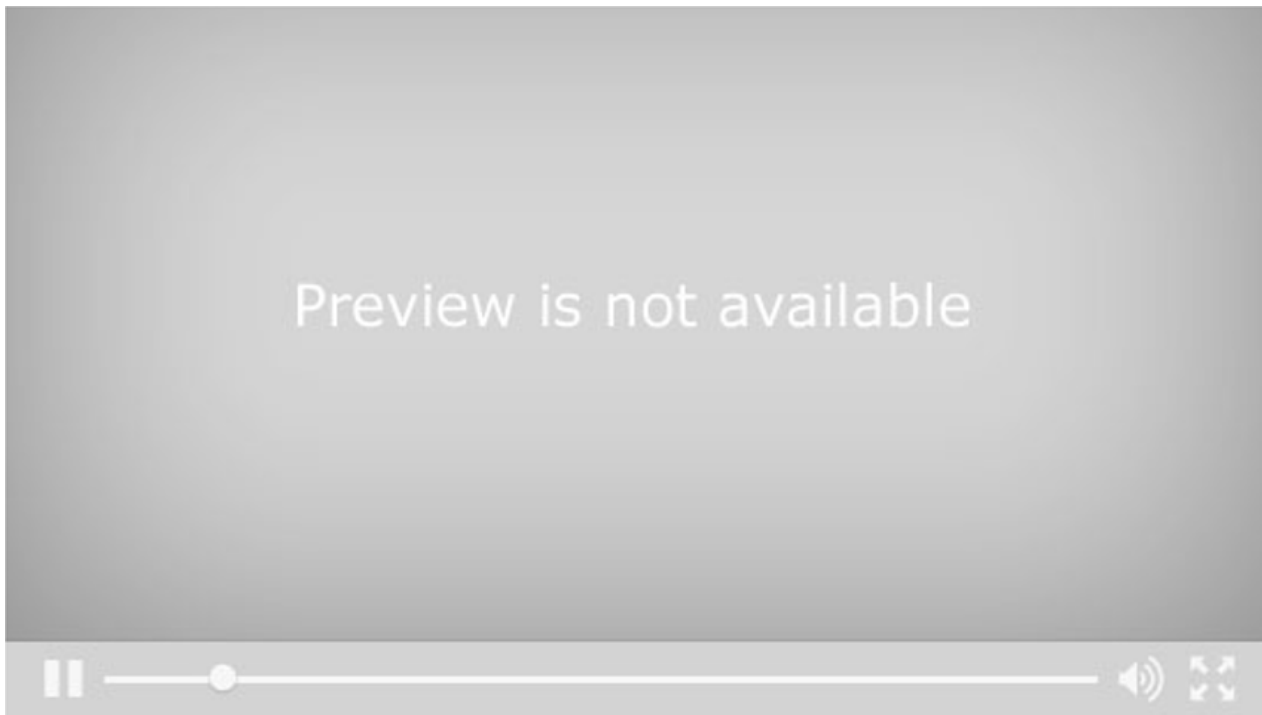
The Well Test Application also checks for a valid license when the program is first started. To force a license check, use the C\C++ Program Loader to stop and then start the Well Test Application. The status of the license can then be viewed in the Event Log or in the header on any configuration page.



**Make sure that there is no well on test, and that the Well Test Application is in the Waiting start before stopping and starting the program, otherwise data loss may occur.**

### Video Example

The video below shows how to find the Controller ID of a SCADAPack and then how to copy a license file to the RTU and verify the license details. Telepace Studio is used to communicate with the SCADAPack and Firefox is used to view web pages from the RTU.



## Configuration

One of the primary purposes of the Well Test Application is to store information about different gas and liquid products so that RealFlo can be configured with the correct information about the product in the measurement path before a well test is started. As such, it is possible to store information about gas compositions, water cut meters, liquid product types and well tests on the RTU via the Well Test Application configuration interface.

Configuration of the Well Test Application is done through a web browser and no software other than an HTML5 compliant web browser with Javascript enabled is required to configure the application. This browser based approach means that the Well Test Application can be configured from a laptop or handheld device like a phone or a tablet, and can be configured remotely as long a connection can be made to the RTU.

Note that it is also possible to read and update the gas compositions stored by the Well Test Application using the Modbus protocol. See the [Modbus](#) section for more details. All other configuration occurs exclusively through the browser based interface.

The Well Test Application supports browser based configuration over both ethernet and serial ports. Ethernet is always enabled, while serial support can be optionally enabled. When serial support is enabled, the Well Test Application will take exclusive control of the com3 serial port on the RTU. Serial support also requires the use of a terminal server (ethernet to serial converter) of some type, since the browser will only make an ethernet connection to specified IP Address and port. Serial support can be enabled and disabled by setting a Modbus register. See th section for more details.

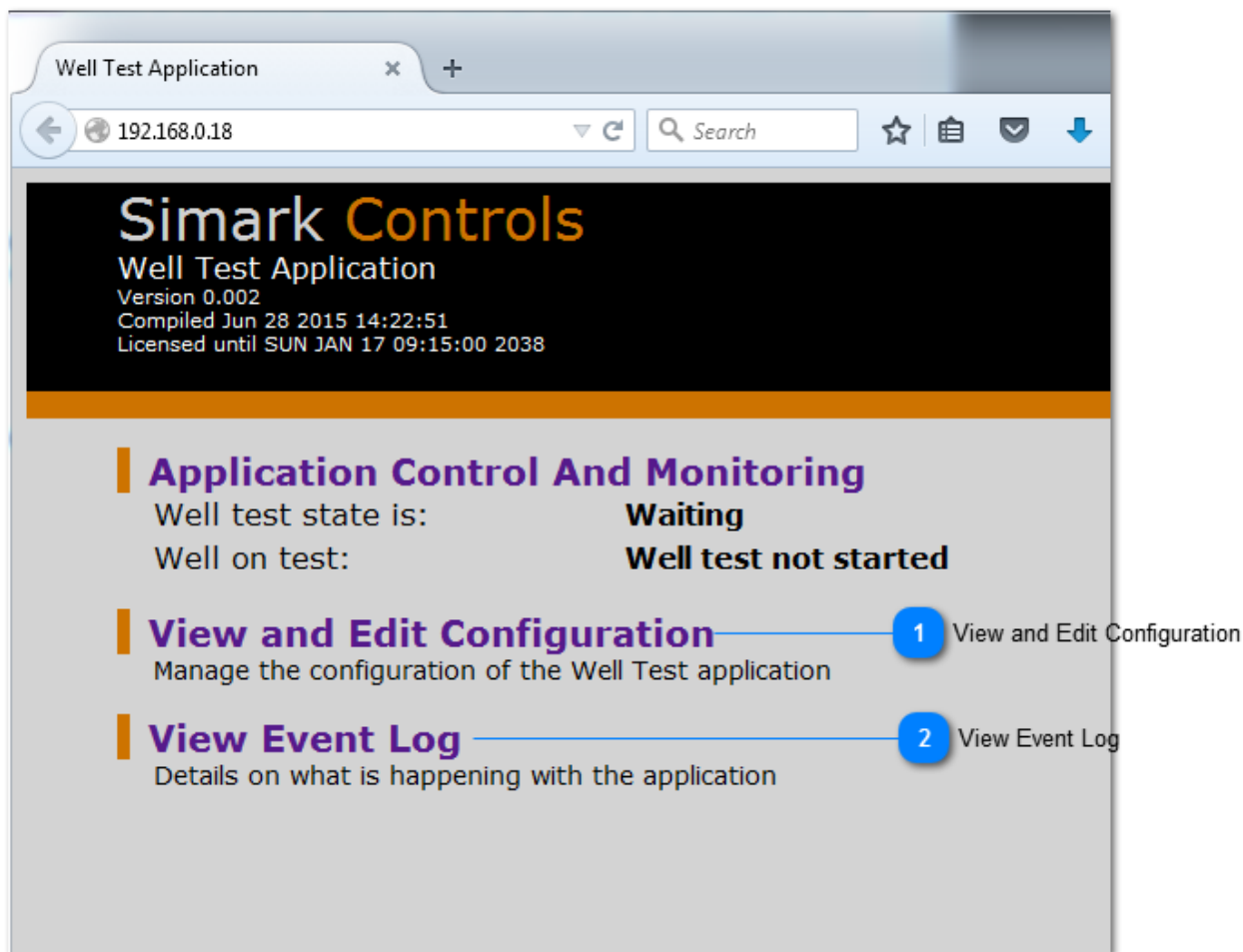
All configuration information is stored in the a file named wtApp.hex on the flash drive in the RTU. Telepace Studio or the browser based interface can be used to download this file from the RTU or to upload a previously saved configuration to the RTU.

To Configure the Well Test Application, download the application to the RTU and make sure that it is running as described in the [Installation](#) section. Use Telepace Studio to make note of the RTU's IP Address, or get the IP Address of the terminal server if using a serial connection. Start your HTML5 compliant web browser, ensure Javascript is enabled, and connect to the RTU through the browser. You should see a screen like the one below.



**SCADAPack has no built-in support for serving web pages. The browser server component in the Well Test Application is low performance and can only handle a single connection at a time.**





## 1 View and Edit Configuration

### View and Edit Configuration

Click here to go to the configuration main page. From the configuration main page you can create gas compositions, liquid product types, well tests as well as download accepted well test results and upload and download the Well Test Application configuration.

## 2 View Event Log

### View Event Log

Click here to go to the to the Well Test Application Event Log. This is a time stamped list of important events.

## Troubleshooting

If the browser cannot connect to the RTU, and the Well Test Application configuration interface is not displayed, the instructions below will help troubleshoot the issue. It might also be useful to see the Troubleshooting section in the [Installation](#) section.

1. Verify the IP Address of the RTU or the the terminal server and confirm that this is the IP Address that you are attempting to connect to with the browser. When connected by ethernet, the Well Test Application will always listen for connections on port 80, which is the default port used by browsers for http requests. For terminal server connections, ensure that the listening port on the terminal server is port 80, or that the URL in the browser is written to use a custom port number.
2. For serial connections through a terminal server, ensure that serial support is enabled. When enabled, the Well Test Application will always listen for http requests on com3. See the [Modbus](#) section for details.
3. For ethernet connections, verify that you can ping the IP Address of the RTU from the device that you are trying to connect from. If ping is successful, but a connection cannot be established, you likely have the wrong port number or there is a firewall that is blocking TCP/IP connections between your device and the RTU.
4. Double check that the Well Test Application was installed correctly on the RTU and that the program status is in the Running state. See the [Installation](#) section for details.
5. Verify that the RTU hardware and RTU firmware version are supported as described in the [Compatibility and Prerequisites](#) section. Make sure that the prerequisites are met by the specific version of the Well Test Application executable that you are using.
6. For serial connections, verify that the cabling between the terminal server and RTU is correct. Examine the Tx and Rx LEDs on the RTU to see if requests are making it to the RTU.
7. For serial connections, ensure that the baud rate of the serial side of the terminal server is set to 115200 baud, 8 data bits, no parity and 1 stop bit.

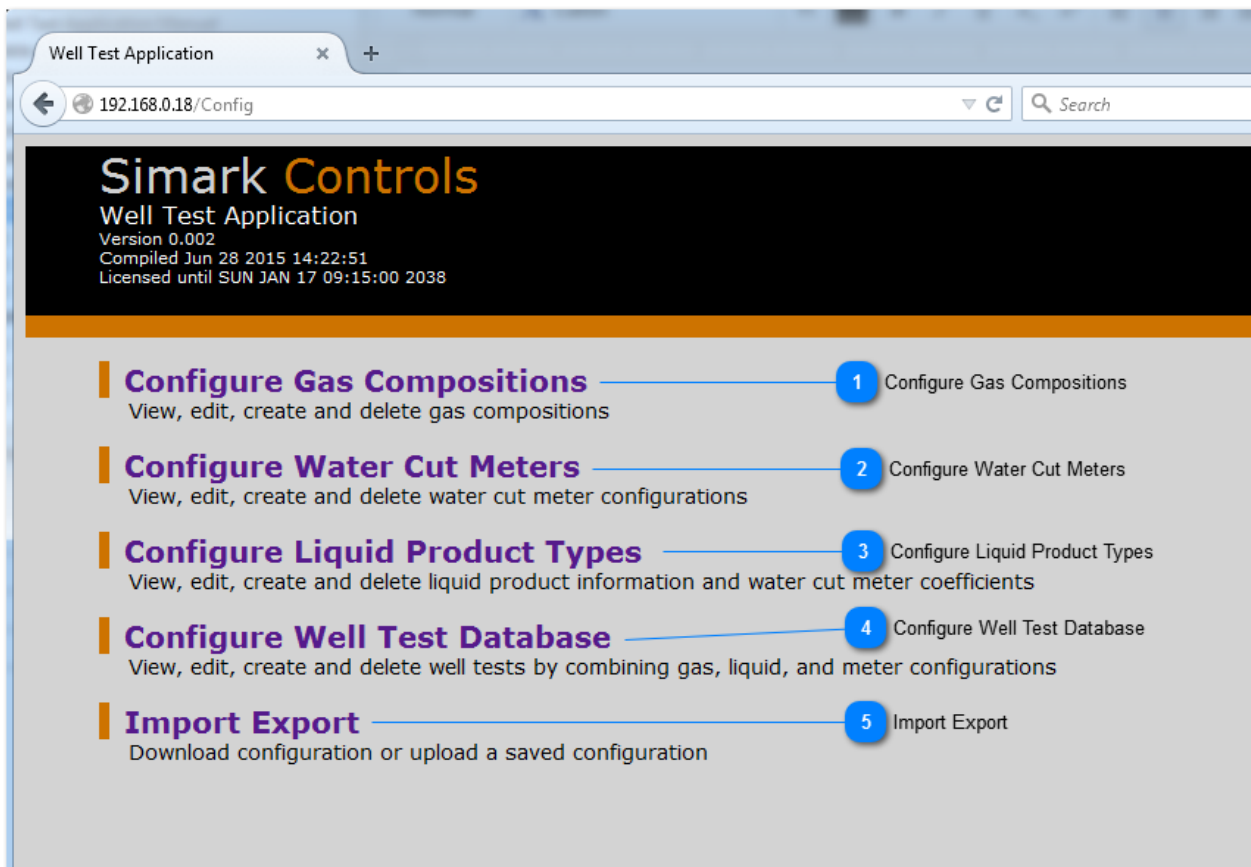
## Configuration Main Page

The Well Test Application is configured via the links on this page. The idea is to store some basic configuration information, like a gas composition, or a the details of a liquid product type, and then use these stored components to build the well test database. This approach allows for the reuse of the basic configuration information across multiple well tests. For example, if a all of the wells on the pad share a gas composition, then you only need to create one gas composition and can reference this single gas composition in all well tests.



**All configuration examples use a fictional 4 well pad to help demonstrate concepts more clearly. Wells on this pad are labeled 14-36A, 14-36B, 14-36C and 14-36D. When first started, the Well Test Application will have no configuration.**

Each of the options on the main configuration page is described below.



1

### Configure Gas Compositions

#### Configure Gas Compositions

Click here to view, edit, create and delete gas compositions. Once created, gas compositions can be referenced by a well test.

2

## Configure Water Cut Meters

### Configure Water Cut Meters

Click here to configure water cut meters. Water cut meters only need to be configured in the Well Test Application if you want to configure a water cut meter before starting a well test. If the water cut meter configuration is fixed across all wells on the pad, there is no need to create a water cut meter. Water cut meters are referenced by liquid product types.

3

## Configure Liquid Product Types

### Configure Liquid Product Types

Click here to view, edit, create and delete liquid product types. A liquid product type holds information like base oil and water densities, shrinkage factors, etc. Once created, liquid product types can be reference by a well test.

4

## Configure Well Test Database

### Configure Well Test Database

Click here to view, edit, create or delete well tests. Well tests hold the configuration for all of the runs in a test. Typically, you would create gas compositions and liquid product types before creating well tests.

5

## Import Export

### Import Export

Click here to download the Well Test Application configuration from the RTU, or to upload a previously saved configuration. You can also download accepted test results in CSV from the page behind this link.

## Configure Gas Compositions

From this page you can view, create, edit and delete gas compositions. Gas compositions are referenced by well tests. You can create up to 32 different gas compositions. Gas compositions can also be edited and read over Modbus, but cannot be created over Modbus. See the [Modbus](#) section for more details.



### 1 Add a New Gas Composition

#### Add a New Gas Composition

Click here to add a new gas composition.

### 2 Configured Gas Compositions

[14-36A - Details](#)

[14-36B - Details](#)

[14-36C - Details](#)

[14-36D - Details](#)

This section shows a list of the configured gas compositions. Click a gas composition name to see the details, edit the composition, or delete the gas composition

## Add or Edit a Gas Composition

The screen below is shown when you add a new gas composition or edit an existing gas composition.

Well Test Application

192.168.0.18/EditGasComp?comp= Search

# Simark Controls

Well Test Application  
Version 0.002  
Compiled Jun 28 2015 14:22:51  
Licensed until SUN JAN 17 09:15:00 2038

Name/Description: GasComp004

Methane: 1

Nitrogen: 0

Carbon Dioxide: 0

Ethane C<sub>2</sub>H<sub>6</sub>: 0

Propane C<sub>3</sub>H<sub>8</sub>: 0

Water: 0

Hydrogen Sulfide: 0

Hydrogen: 0

Carbon Monoxide: 0

Oxygen: 0

i-Butane: 0

n-Butane: 0

i-Pentane: 0

n-Pentane: 0

n-Hexane: 0

n-Heptane: 0

n-Octane: 0

n-Nonane: 0

n-Decane: 0

Helium: 0

Argon: 0

Normalize Gas Composition

Submit Changes

1 Name/Description

2 Composition Values

3 Normalize Gas Composition

4 Submit Changes

**1 Name/Description**

GasComp004

Edit the gas composition name here to something meaningful. The name must be less than 63 characters long and must contain only ASCII (basic) characters.

**2 Composition Values**

1	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	
0	

Enter the gas composition values in these fields. The sum of all values must be 1.0, so values should be entered as decimal numbers and not percent. Any single value must be between the range of 0 to 1.0, however, depending on the configuration of the gas run in Realflo, it is possible that Realflo will reject the gas composition as entered here.

For example, by default, the allowable range of Hydrogen Sulfide in Realflo is 0 to 0.0002 , but the Well Test Application will allow you to create a gas composition with a Hydrogen Sulfide component of 1.0.

The Well Test Application verifies that configuration changes are accepted by Realflo when starting a new well test, so if a specific gas composition is rejected by Realflo the well test will not start and you will see information on why in the Well Test Application [Event Log](#).



3

### Normalize Gas Composition

Normalize Gas Composition

Click here to automatically apply a correction factor to all of the non-zero gas composition values so that they sum to 1.0.

4

### Submit Changes

Submit Changes

Click here to upload the gas composition values to the Well Test Application on the RTU. Upload will fail if the gas composition does not sum to 1.0

## View a Gas Composition

A screen like the one below is shown when you view an existing gas composition.

Well Test Application

192.168.0.18/ShowGasComp?comp Search

# Simark Controls

Well Test Application  
Version 0.002  
Compiled Jun 28 2015 14:22:51  
Licensed until SUN JAN 17 09:15:00 2038

Gas Composition Name: **14-36A**  
Gas Composition Number: **0**

[Delete This Gas Composition](#) **1** Delete Gas Composition  
[Edit This Gas Composition](#) **2** Edit Gas Composition

Methane:	<b>0.7500</b>
Nitrogen:	<b>0.2500</b>
Carbon Dioxide:	<b>0.0000</b>
Ethane C <sub>2</sub> H <sub>6</sub> :	<b>0.0000</b>
Propane C <sub>3</sub> H <sub>8</sub> :	<b>0.0000</b>
Water:	<b>0.0000</b>
Hydrogen Sulfide:	<b>0.0000</b>
Hydrogen:	<b>0.0000</b>
Carbon Monoxide:	<b>0.0000</b>
Oxygen:	<b>0.0000</b>
i-Butane:	<b>0.0000</b>
n-Butane:	<b>0.0000</b>
i-Pentane:	<b>0.0000</b>
n-Pentane:	<b>0.0000</b>
n-Hexane:	<b>0.0000</b>
n-Heptane:	<b>0.0000</b>
n-Octane:	<b>0.0000</b>
n-Nonane:	<b>0.0000</b>
n-Decane:	<b>0.0000</b>
Helium:	<b>0.0000</b>
Argon:	<b>0.0000</b>

1

## Delete Gas Composition

### Delete This Gas Composition

Click here to delete this gas composition. Deletion will fail if the gas composition is referenced in a well test. Remove any references to this gas composition in all well tests before deleting it.

2

## Edit Gas Composition

### Edit This Gas Composition

Click here to edit this gas composition. See [Add or Edit a Gas Composition](#) for details.

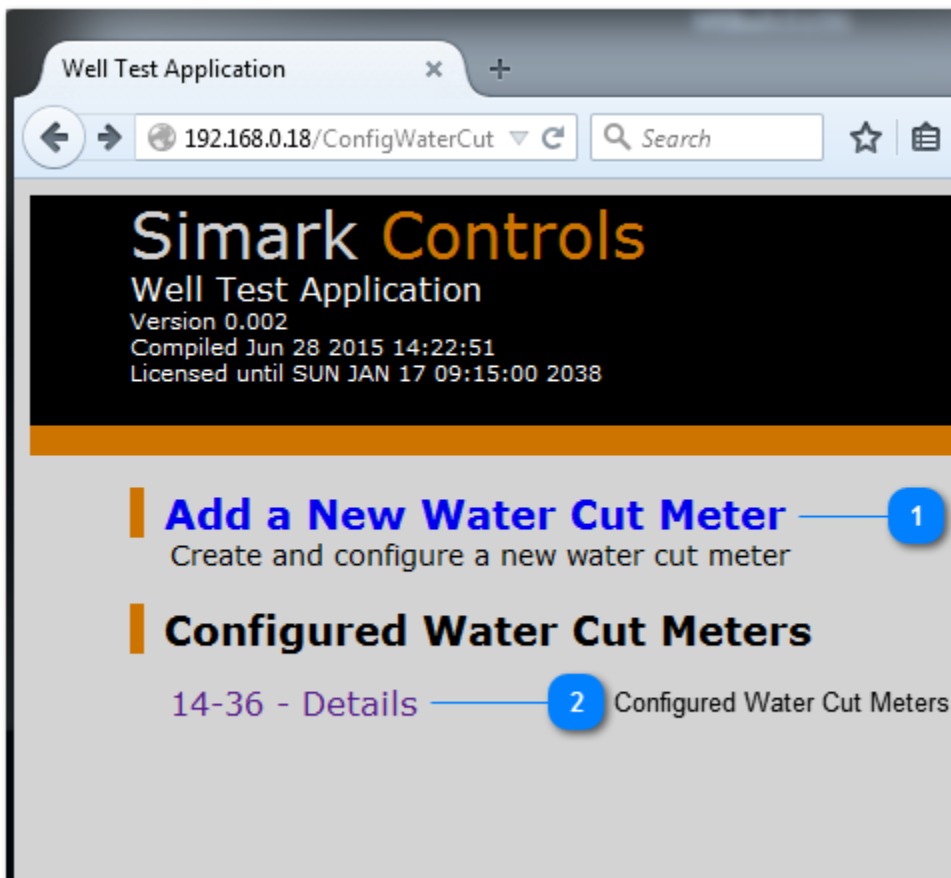
## Configure Water Cut Meters

From this page you can view, create, edit and delete water cut meters. Water cut meters are referenced by well tests. You can create up to 8 different water cut meters. The configuration of a water cut meter in the Well Test Application is fairly basic. The only options are the meter type and the configuration port for the meter. The actual configuration coefficients for the meter, or the configuration current, is stored in a liquid product type.

The creation of water cut meters is optional. Even if a water cut meter exists, if the configuration is fixed and does not need to be changed on a per well test basis, then there is no need to create water cut meters in the Well Test Application.



Only generic meter types and analog output configuration ports are supported. Analog outputs do not exist on a 4203DS, and as such, the 4203DS does not support water cut meter configuration using an analog output.



Add a Water Cut Meter

Configured Water Cut Meters

1

### Add a Water Cut Meter

#### Add a New Water Cut Meter

Click here to add a new water cut meter.



## Configured Water Cut Meters

### 14-36 - Details

This section shows a list of the configured water cut meters. Click a water cut meter to see the details, edit the meter, or delete the meter

## Add or Edit a Water Cut Meter

The screen below is shown when you add a new water cut meter or edit an existing water cut meter.



Only generic meter types and analog output configuration ports are supported. Analog outputs do not exist on a 4203DS, and as such, the 4203DS does not support water cut meter configuration using an analog output.

**Simark Controls**  
Well Test Application  
Version 0.002  
Compiled Jun 28 2015 14:22:51  
Licensed until SUN JAN 17 09:15:00 2038

Name/Description:  1 Name/Description

Meter Type:  2 Meter Type

Config Port:  3 Configuration Port

1

### Name/Description

Edit the water cut meter name here to something meaningful. The name must be less than 63 characters long and must contain only ASCII (basic) characters.

2

### Meter Type

Choose the water cut meter type here. Only generic meter types are supported at this time. In the future, the Well Test Application will download meter correction coefficients to the water cut meter before starting a well test.

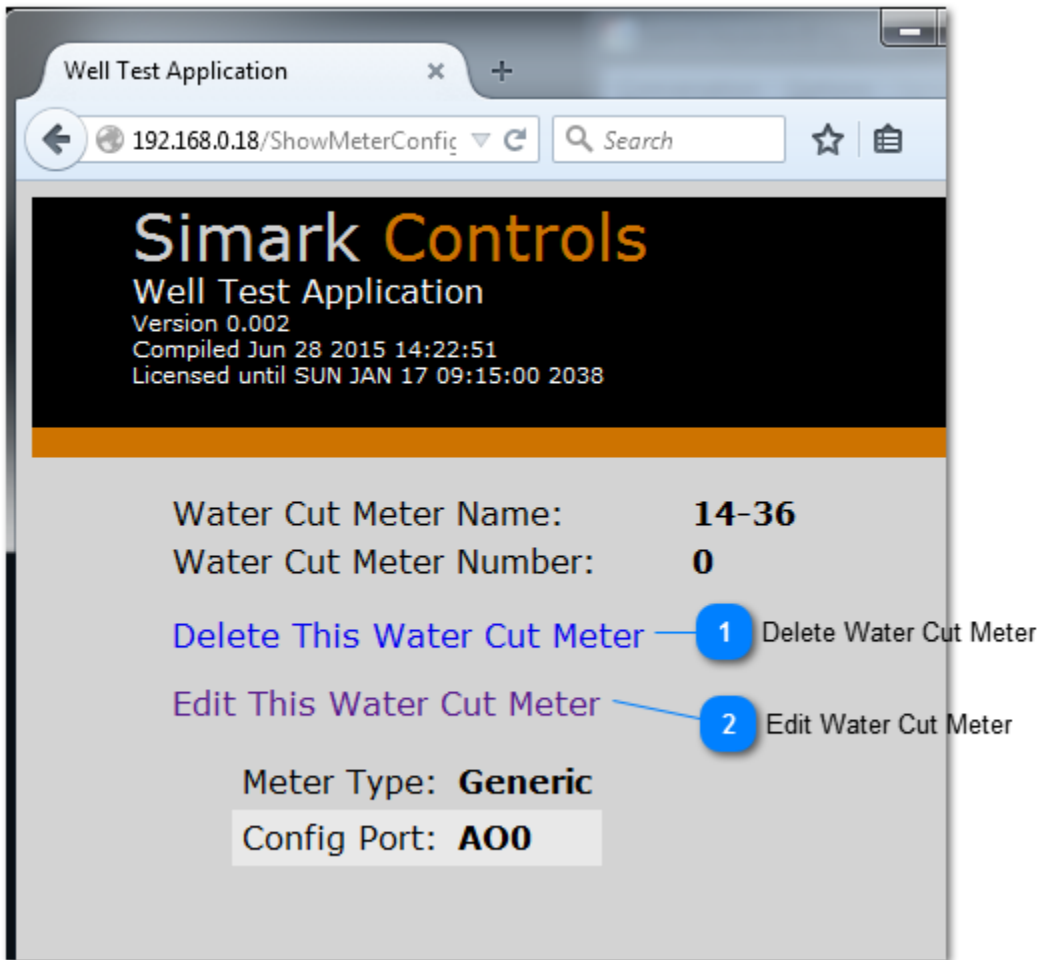
3

### Configuration Port

Choose the configuration port for the water cut meter. Only analog outputs are supported at this time. In the future, the Well Test Application will download meter correction coefficients to the water cut meter over a serial connection before starting a well test. For now, the Well Test Application will set an analog output on the RTU to a current as specified in the liquid product type. The water cut meter will see this current on its analog input and load the right set of correction coefficients.

## View a Water Cut Meter

A screen like the one below is shown when you view an existing water cut meter.



1

### Delete Water Cut Meter

[Delete This Water Cut Meter](#)

Click here to delete this water cut meter. Deletion will fail if the water cut meter is referenced in a well test. Remove any references to this water cut meter in all well tests before deleting it.

2

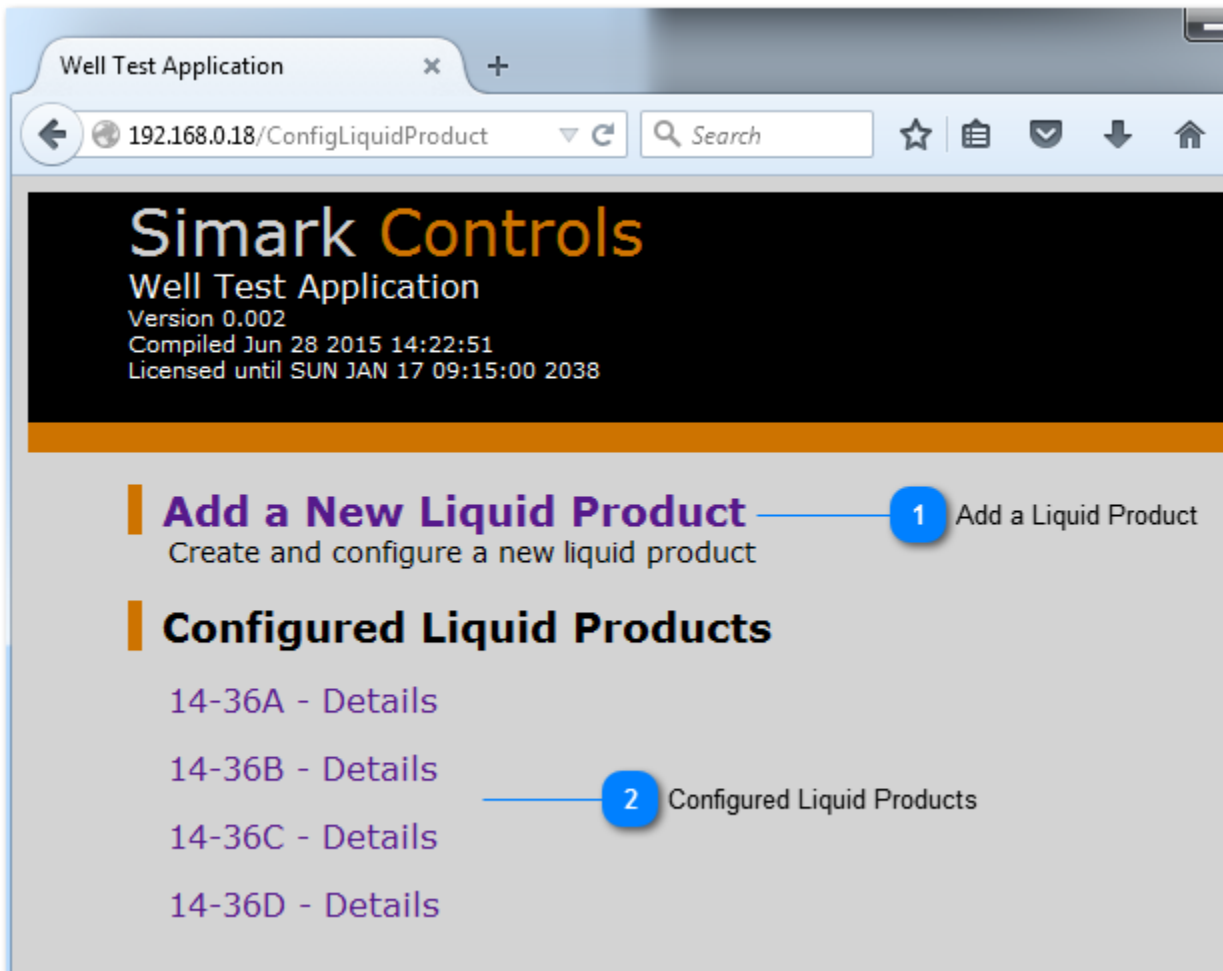
### Edit Water Cut Meter

[Edit This Water Cut Meter](#)

Click here to edit this water cut meter. See [Add or Edit a Water Cut Meter](#) for details.

## Configure Liquid Product Types

From this page you can view, create, edit and delete liquid product types. Liquid products are referenced by well tests. You can create up to 32 different liquid product types.



### 1 Add a Liquid Product

#### Add a New Liquid Product

Click here to add a new liquid product type.

### 2 Configured Liquid Products

- 14-36A - Details
- 14-36B - Details
- 14-36C - Details
- 14-36D - Details



This section shows a list of the configured liquid product types. Click a liquid product name to see the details, edit the liquid product, or delete the liquid product.

## Add or Edit a Liquid Product

The screen below is shown when you add a new liquid product or edit an existing liquid product.

Well Test Application

192.168.0.18/EditLiquidProduct?product=1024

**Simark Controls**  
Well Test Application  
Version 0.002  
Compiled Jun 28 2015 14:22:51  
Licensed until SUN JAN 17 09:15:00 2038

Name/Description: LiquidProduct04

Base Density Oil (EU): 1000

Base Density Water (EU): 1000

Low Density Threshold (EU): 0

Low Density Hysteresis (s): 0

Config Current (AOx, mA): 4

User Factor Oil: 1

User Factor Water: 1

Constant density (EU): 0

Constant Water Cut (%): 0

Submit Changes

- 1 Name/Description
- 2 Base Density Oil
- 3 Base Density Water
- 4 Low Density Threshold
- 5 Low Density Hysteresis
- 6 Configuration Current
- 7 User Factor Oil
- 8 User Factor Water
- 9 Constant Density
- 10 Constant Water Cut
- 11 Submit Changes

1

### Name/Description

LiquidProduct04

Edit the liquid product name here to something meaningful. The name must be less than 63 characters long and must contain only ASCII (basic) characters.

2

### Base Density Oil

1000

Enter the base density of oil in the liquid product here. The value should be in the same units as used in Realflo. This value can be left at 0 if the Realflo liquid run that you plan on configuring with this liquid product type does not use an inferred water cut calculation.

This value maps to the Base Density Oil field on the Water Cut tab in a liquid flow run configuration window in the Realflo configuration application.

Screen grab from Realflo configuration application, liquid flow run configuration, Water Cut tab:

Proposed	
Base Density Oil	1000
Base Density Water	1000

3

## Base Density Water

Enter the base density of water in the liquid product here. The value should be in the same units as used in Realflo. This value can be left at 0 if the Realflo liquid run that you plan on configuring with this liquid product type does not use an inferred water cut calculation.

This value maps to the Base Density Water field on the Water Cut tab in a liquid flow run configuration window in the Realflo configuration application.

Screen grab from Realflo configuration application, liquid flow run configuration, Water Cut tab:

Proposed	
Base Density Oil	1000
Base Density Water	1000

4

## Low Density Threshold

Enter the low density threshold for two phase flow detection when using the Realflo Algorithm Detection option. This value is in the same units as in the Realflo configuration application. If the two phase flow detection option is not using the Realflo algorithm, this option can be left at 0.

This value maps to the Low Density Threshold field on the Liquids tab in a liquid flow run configuration window in the Realflo configuration application.

Screen grab from the Realflo configuration application, liquid flow run configuration, Liquids tab:

Proposed	
Two-Phase Detection Type	Realflo Algorithm Detection
Two-Phase Detection Register	0
Low Density Threshold	0
Low Density Hysteresis	0
Two-Phase Flow Time History	Batch History User Data 5

5

## Low Density Hysteresis

Enter the low density hysteresis for two phase flow detection when using the Realflo Algorithm Detection option. This value is always in seconds. If the two phase flow detection option is not using the Realflo algorithm, this option can be left at 0.

This value maps to the Low Density Hysteresis field on the Liquids tab in a liquid flow run configuration window in the Realflo configuration application.

Screen grab from the Realflo configuration application, liquid flow run configuration, Liquids tab:

6

## Configuration Current

Enter the water cut meter configuration current in mA here. When a well test that references this liquid product type is started, if the well test references a water cut meter, the analog output referenced in the water cut meter configuration will be set to this current.

If no water cut meter is used, or the water cut meter configuration is fixed, this value can be ignored.

7

## User Factor Oil

Enter a user factor for oil measurements here. This is also referred to as shrinkage. This value has no units. If no user factor is desired then this value must be set to 1.

This value maps to the User Factor: Oil field on the Liquids tab in a liquid flow run configuration window in the Realflo configuration application.

Screen grab from the Realflo configuration application, liquid flow run configuration, Liquids tab:

8

## User Factor Water

Enter a user factor for water measurements here. This is also referred to as shrinkage. This value has no units. If no user factor is desired then this value must be set to 1.

This value maps to the User Factor: Water field on the Liquids tab in a liquid flow run configuration window in the RealFlo configuration application.

Screen grab from the RealFlo configuration application, liquid flow run configuration, Liquids tab:

* User Factor: Water	<input type="text" value="1"/>
* User Factor: Oil	<input type="text" value="1"/>

9

## Constant Density

Enter a constant density for the liquid product here. This value is in the same units as in the RealFlo configuration application. If the density Input Type is not configured to be Constant in RealFlo, this value can be left empty.

This value maps to the Default Value field on the Density tab in a liquid flow run configuration window in the RealFlo configuration application.

Screen grab from the RealFlo configuration application, liquid flow run configuration, Density tab:

Proposed	
* Input Type	<input type="text" value="Constant"/>
* Input Register	<input type="text" value="2"/>
Input at Zero Scale	<input type="text" value="0"/>
Input at Full Scale	<input type="text" value="32767"/>
Density at Zero Scale	<input type="text" value="0"/>
Density at Full Scale	<input type="text" value="500"/>
Value	<input type="text" value="0"/>

10

## Constant Water Cut

Enter a constant water cut for the liquid product here. This value is in percent. If the Water Cut Mode is not Direct Water Cut, and the Input Type is not configured to be Constant in RealFlo, this value can be left empty.

This value maps to the Value field on the Water Cut tab in a liquid flow run configuration window in the RealFlo configuration application.

Screen grab from the RealFlo configuration application, liquid flow run configuration, Water Cut tab:

Proposed	
Water Cut Mode	Direct Water Cut
* Input Type	Constant
* Input Register	2
Input at Zero Scale	0
Input at Full Scale	32767
Water Cut at Zero Scale	0
Water Cut at Full Scale	100
Value	0

## 11 Submit Changes

Submit Changes

Click here to upload the configuration of the liquid product type to the Well Test Application on the RTU.

## View a Liquid Product

A screen like the one below is shown when you view an existing liquid product.

# Simark Controls

## Well Test Application

Version 0.002  
Compiled Jun 28 2015 14:22:51  
Licensed until SUN JAN 17 09:15:00 2038

Liquid Product Name: **14-36A**

Liquid Product Number: **0**

[Delete This Product](#) 1 Delete Liquid Product

[Edit This Product](#) 2 Edit Liquid Product

Base Density Oil (EU): **700.0000**

Base Density Water (EU): **975.0000**

Low Density Threshold (EU): **0.0000**

Low Density Hysteresis (s): **0**

Config Current (AOx, mA): **4.0000**

User Factor Oil: **0.9950**

User Factor Water: **0.9970**

Constant density (EU): **0.0000**

Constant Water Cut (%): **0.0000**

1

### Delete Liquid Product

[Delete This Product](#)

Click here to delete this liquid product. Deletion will fail if the liquid product is referenced in a well test. Remove any references to this liquid product in all well tests before deleting it.

2

### Edit Liquid Product

[Edit This Product](#)

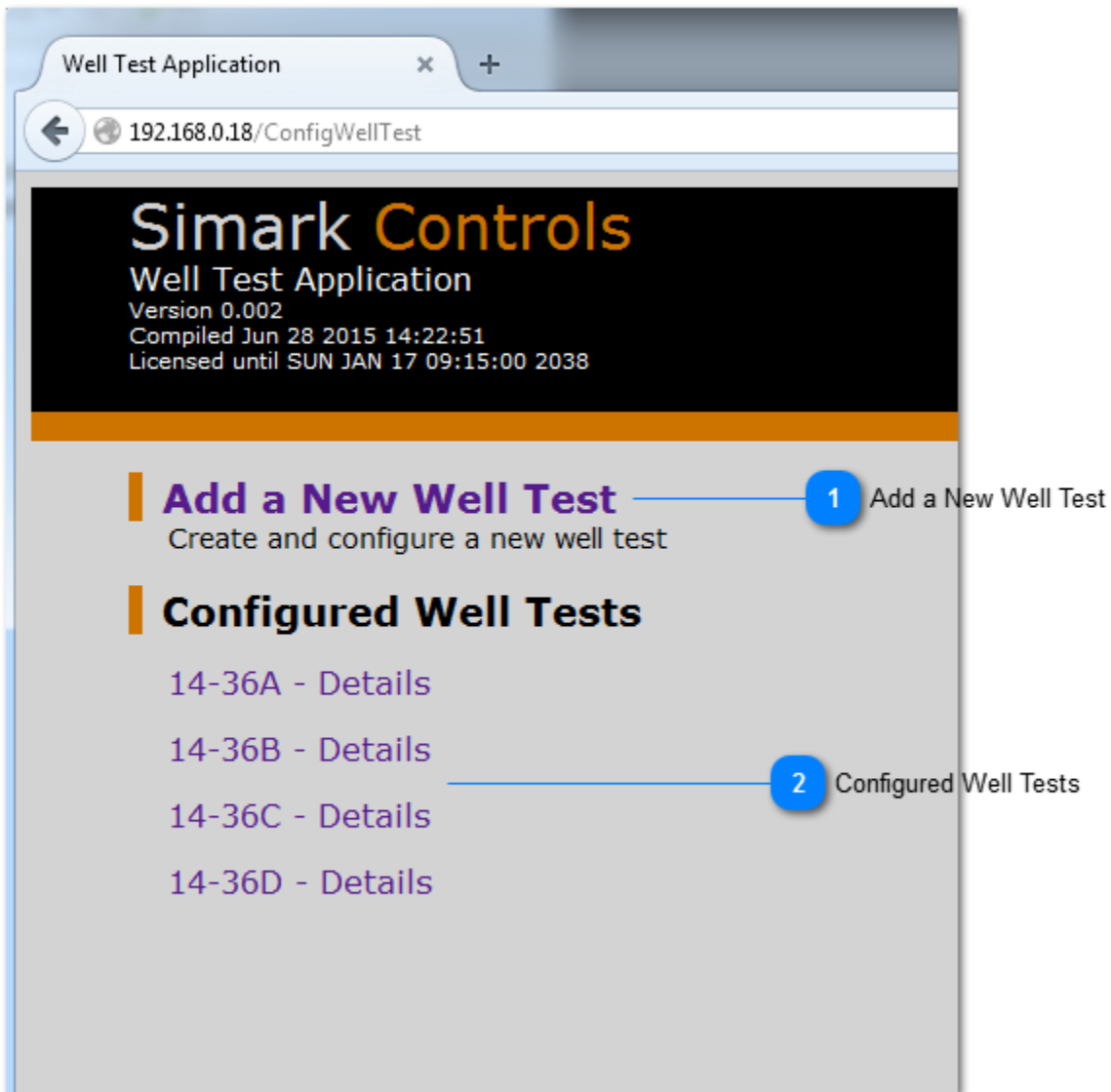
Click here to edit this liquid product. See [Add or Edit a Liquid Product](#) for details.





## Configure Well Test Database

From this page you can view, create, edit and delete well tests. A well test consists of up to 6 different run configuration. Each run configuration in a well test is mapped to a Realflo run. When a well test is started, Realflo is reconfigured with the stored run configuration. The Well Test Application can store up to 32 well tests, and each well test can store configurations for up to 6 runs of any type (gas or liquid.)



### 1 Add a New Well Test

#### Add a New Well Test

Click here to add a new well test.

### 2 Configured Well Tests

[14-36A - Details](#)

[14-36B - Details](#)

[14-36C - Details](#)

[14-36D - Details](#)

This section shows a list of the configured well tests. Click a well test name to see the details, edit the well test, or delete the well test

## Add a Well Test

The screen below is shown when you add a new well test.

The screenshot shows a web browser window titled 'Well Test Application' with the URL '192.168.0.18/EditWellTest?test=1024'. The application header displays 'Simark Controls Well Test Application', 'Version 0.002', 'Compiled Jun 28 2015 14:22:51', and 'Licensed until SUN JAN 17 09:15:00 2038'. The main content area features a 'Show All Well Tests' link and a 'Go to the main well test configuration page' instruction. Below this, there are four numbered callouts pointing to specific form elements: 1. 'Name/Description' points to a text input field containing 'WellTest04'. 2. 'Descriptive Fields' points to two stacked text input fields for 'Well Name' and 'Company'. 3. 'Duration' points to a spinner control for 'Test Duration (h)' set to '24'. 4. 'Submit Changes' points to a button labeled 'Submit Changes'.

### 1 Name/Description

A close-up of the 'Name/Description' input field, which contains the text 'WellTest04' and a small icon to its right.

Edit the well test name here to something meaningful. The name must be less than 63 characters long and must contain only ASCII (basic) characters.

### 2 Descriptive Fields

A close-up of the 'Descriptive Fields' section, showing two stacked text input fields for 'Well Name' and 'Company'.

The Well Name and Company fields are descriptive fields for your own use. They are not used by the Well Test Application, although they are stored in the application's configuration. These fields can be left empty.

### 3 Duration

A close-up of the 'Duration' spinner control, which shows the value '24' and has up/down arrows.

Enter the test duration for this well test in decimal hours. When started, this will test will be stopped after the number of hours in the this field has elapsed

4

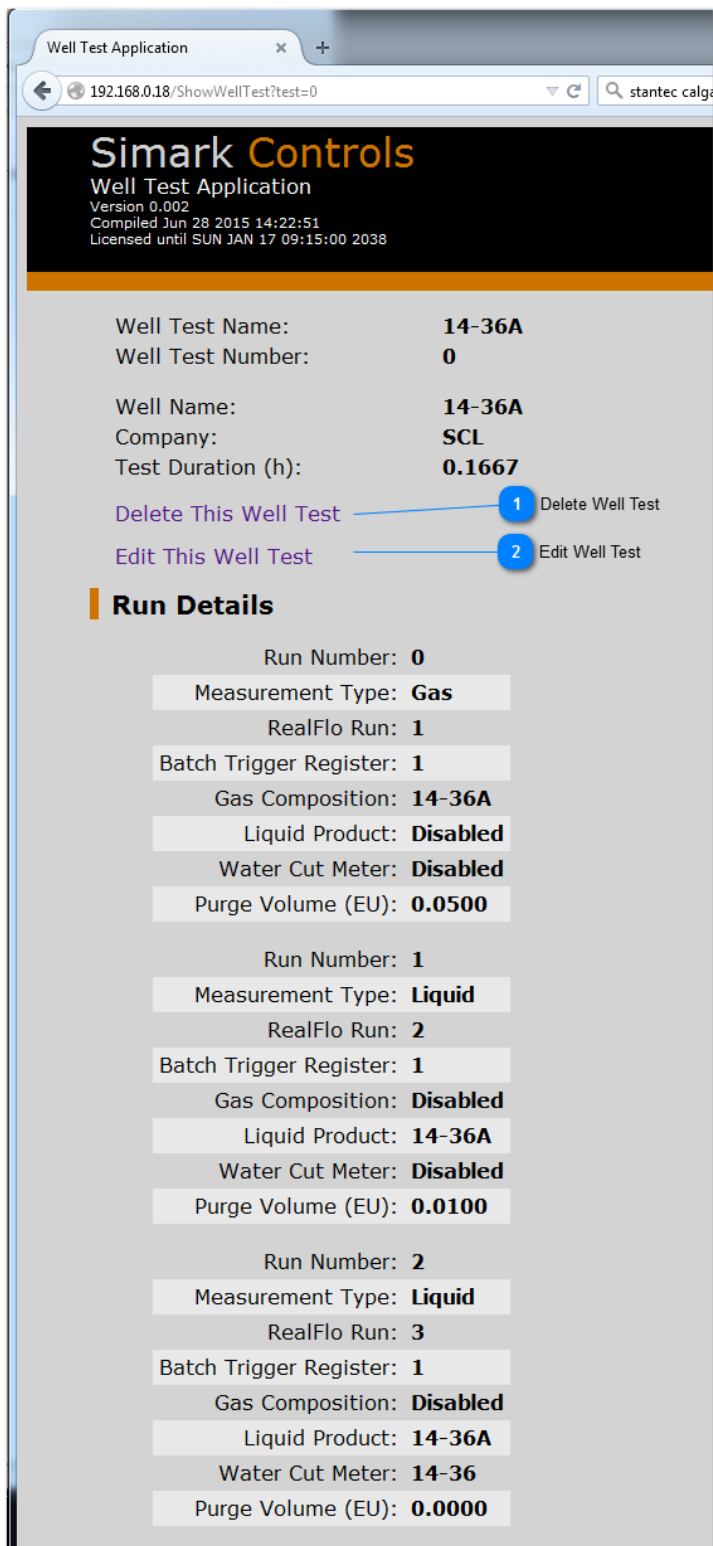
### Submit Changes

Submit Changes

Click here to upload the well test values to the Well Test Application on the RTU.

## **View Test Details**

The screen below is displayed when you view the details of a well test. This well test has 3 runs already configured, but when a new well test is first created, it will have no runs configured.



## 1 Delete Well Test

Delete This Well Test

Click here to delete this well test. Deleting a well test doesn't delete the referenced gas compositions, water cut meters or liquid product types.

2

Edit Well Test

Edit This Well Test

Click here to edit this well test. From here, you can add, edit or delete run configurations.

## Edit a Well Test

The screen below is shown when you edit a well test. This well test already has three runs configured, which is why there are options to edit or delete the individual runs in the well test.

The screenshot shows the 'Simark Controls Well Test Application' interface. The browser address bar displays '192.168.0.18/EditWellTest?test=0'. The application header includes the title 'Simark Controls Well Test Application', version '0.002', and compilation details. The main content area features a 'Show All Well Tests' link (labeled 1) with the description 'Go to the main well test configuration page'. Below this is a form for editing well test information (labeled 2) with fields for 'Name/Description' (14-36A), 'Well Name' (14-36A), 'Company' (SCL), and 'Test Duration (h)' (0.16667). A 'Submit Changes' button is located below the form. The 'Add a Run to This Test' section (labeled 3) includes the description 'Add a gas, liquid or water run to this well test' and links for 'Edit Run 0', 'Edit Run 1' (labeled 4), and 'Edit Run 2'. The 'Edit Run 1' link is associated with the label 'Configured Well Test Runs'.

1

### Show All Well Tests

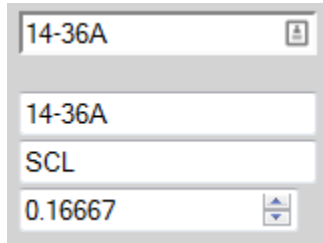
## Show All Well Tests

Click here to go back to the main well test configuration page. As multiple runs are added or reconfigured, clicking the back button in the browser to get back to the main well test configuration is tedious. This link will take you directly there.

2

### Edit Well Test Information





14-36A
14-36A
SCL
0.16667

These fields are described in the [Add a Well Test](#) section.

3

### Add a Run

#### Add a Run to This Test

Click here to add a new run to this well test. A well test run holds the configuration for a single gas or liquid run. When the well test is started, the Well Test Application configures runs in Realflo to match the configuration that is stored in the application.

Although the most common case is just to have 1 gas and 1 liquid run, each well test can have up to 6 runs for maximum flexibility. Each run is independently configured to hold configuration for a gas, or liquid flow run.

4

### Configured Well Test Runs

Edit Run 0  
Edit Run 1  
Edit Run 2

This section shows a list of the configured well test runs. Click a run name to see the details, edit the run, or delete the run

## Add or Edit a Well Test Run

The screen below is shown when you add a run to a well test or edit an existing well test run.

The screenshot shows a web browser window titled "Well Test Application" with the URL "192.168.0.18/EditRun?test=0&run=0". The application header displays "Simark Controls Well Test Application", "Version 0.002", "Compiled Jun 28 2015 14:22:51", and "Licensed until SUN JAN 17 09:15:00 2038". The main form contains the following fields and controls:

- Measurement Type:** A dropdown menu currently set to "Gas".
- RealFlo Run:** A numeric input field set to "1".
- Batch Trigger Register:** A numeric input field set to "1".
- Gas Composition:** A dropdown menu set to "14-36A".
- Liquid Product:** A dropdown menu set to "Disabled".
- Water Cut Meter:** A dropdown menu set to "Disabled".
- Purge Volume (EU):** A numeric input field set to "0.05".
- Submit Changes:** A button at the bottom left of the form.

Numbered callouts (1-8) point to the following elements:

- Measurement Type
- Realflo Run
- Gas Composition
- Liquid Product
- Water Cut Meter
- Purge Volume
- Submit Changes (button)
- Batch Trigger Register

1

### Measurement Type

A close-up of the "Measurement Type" dropdown menu, showing the word "Gas" selected.

Use this field to select the measurement type for this well test run. The measurement type determines what other fields need to be populated for this run. For example, if the Measurement Type is gas, then the Gas Composition field should be populated with a reference to a gas composition and the Liquid Product field is ignored. If the Measurement Type is Liquid, then the Liquid Product field should be populated with a reference to a Liquid product and the Gas Composition field can be ignored.

The value in this field must match the value in Realflo for the Realflo run number in the Realflo Run field.

Although Water is an option here, there is no configuration held in the Well Test Application for water runs, so choosing water here means that the run is essentially skipped.

2

### Realflo Run

Use this field to choose which Realflo run is configured when the well test is started. This field tells the Well Test Application which Realflo run to configure when the well test that this run belongs to is started. If the run number here is incorrect, and the Measurement Type field for this run does not match the Measurement Type in Realflo, unexpected behavior will occur.

3

### Gas Composition

If the Measurement Type is Gas, you should use the drop down box to choose a gas composition. When the well test that this run belongs to is started, the Well Test Application will configure the Realflo run number in the Realflo Run field with the referenced gas composition.

If the Measurement Type is not Gas, this field can be ignored.

4

### Liquid Product

If the Measurement Type is Liquid, you should use the drop down box to choose a liquid product type. When the well test that this run belongs to is started, the Well Test Application will configure the Realflo run number in the Realflo Run field with the information from the referenced liquid product.

If the Measurement Type is not Liquid, this field can be ignored.

5

### Water Cut Meter

If the Measurement Type is Liquid, and there is a water cut meter which needs to be configured before a well test is started, use this field to select the water cut meter. The Well Test Application application will configure the water cut meter with the information from the liquid product in the Liquid Product field.

For example, if the selected liquid product has a water cut meter configuration current of 5.0 mA, and the water cut meter is configured to use port AO0 (analog out 0), then when the well test is started the Well Test Application will set the current on AO0 to 5 mA.

6

### Purge Volume

Use this field to configure the purge volume for this run. After the well test is started, and the configuration of Realflo is complete, the Well Test Application will accumulate flow for each run. When the accumulated flow is greater than this threshold for all runs in the well test, a new Realflo batch history is started.

Setting this value to 0 means that the purge will be marked as complete immediately when the well test is started. In the usual case where a well test has multiple runs, you can configure 1 run, all runs, or no runs to have a non-zero purge volume. Purge is complete when the accumulated flow for all runs exceeds the configured threshold.

The Purge Volume is in the same units as Volume units for the Realflo run.

## 7 Submit Changes

Submit Changes

Click here to upload the well test run values to the Well Test Application on the RTU.

## 8 Batch Trigger Register

1

Enter the value of the batch trigger register for the Realflo Run in this field. This value tells the Well Test Application which register it needs to control to start and stop batch history in Realflo.

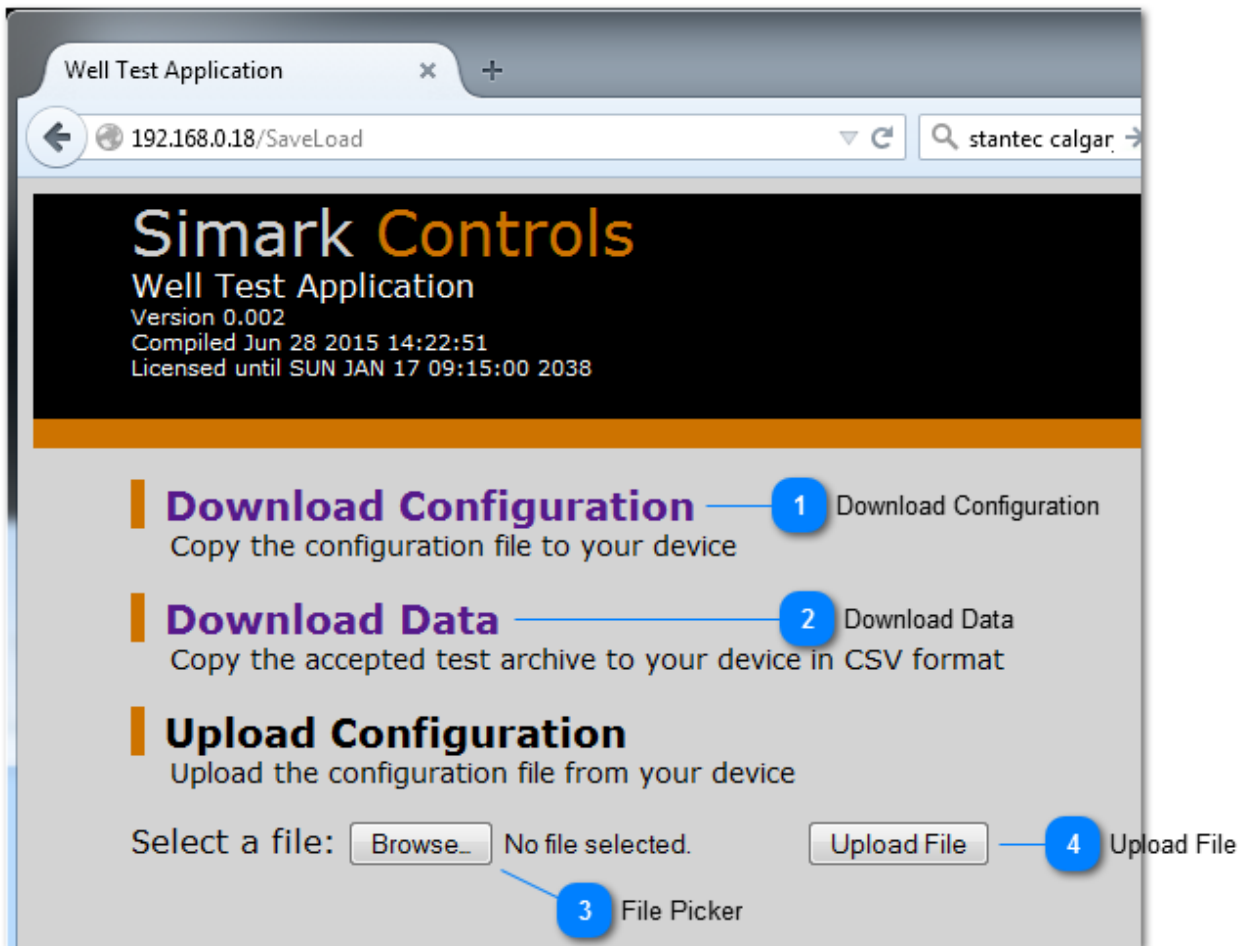
The batch trigger register can be found in the Realflo configuration application, on the Batch tab of the flow run configuration, as shown below.

The screenshot shows a software interface with a tabbed menu at the top. The tabs are: Inputs, Differential Pressure, Static Pressure, Temperature, Contract, AGA-8, AGA-8 Hexanes+, AGA-3 (1992), and Batch. The 'Batch' tab is currently selected. Below the tabs, there is a table with two columns: 'Proposed' and 'Actual'. The table has two rows: 'QTR Identifier' and 'Batch Trigger Register'. The 'Batch Trigger Register' row shows the value '1' in the 'Proposed' column. To the right of the table, there is a 'Copy' button.

	Proposed	Actual
QTR Identifier		
Batch Trigger Register	1	

## Import Export

From this page you can Download the configuration from the RTU, upload a previously saved configuration the RTU and download accepted well test results from the RTU in CSV format.



1

### Download Configuration

#### Download Configuration

Click here to download the Well Test Application configuration. The default file name is wtApp.hex and the file format is a tightly packed binary.

This file can be found in the root folder of the embedded drive on the RTU, and as such, you can use another method, such as Telepace Studio or FTP to copy the file from the RTU.

2

### Download Data

#### Download Data

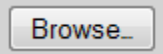
Click here to download a .CSV formatted file of accepted test results. The Well Test Application will periodically purge this file so as to keep the file size around 64 kBytes. Older tests will be removed first, so the file will always

have the latest test results. This file may not always have 128 test results in it because of the variability in size of text files.

Accepted test results are stored in a file named wtResult.csv in the root folder of the embedded drive on the RTU. As such, you can use another method, such as Telepace Studio or FTP to copy the file from the RTU.

3

### File Picker

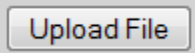
A rectangular button with a light gray background and a thin border, containing the text "Browse\_" in a standard sans-serif font.

Click here to choose a previously saved configuration file to upload the RTU. Take care to only upload files that have been saved from a compatible version of the Well Test Application. If a very large or an incorrectly formatted is uploaded using this mechanism the unexpected operation might occur.

The configuration file, which is named wtApp.hex, can be copied to the RTU over Telepace Studio or via FTP. This is a foolproof way of getting the configuration file onto the RTU. If you use this mechanism, stop and then start execution of the Well Test Application to force the application to load the new configuration file.

4

### Upload File

A rectangular button with a light gray background and a thin border, containing the text "Upload File" in a standard sans-serif font.

Click this button after choosing a file using the file picker to upload the Well Test Application configuration file to the RTU. On an upload request, the current Well Test Application configuration file on the RTU is deleted and replaced with the new file. The new file is automatically loaded into the Well Test Application after being copied to disk.



**A previously saved configuration cannot be uploaded to the RTU over a serial connection. Use Telepace Studio to copy the configuration file directly to the RTU and then stop and start the Well Test Application to force the new file to be loaded. View the Event Log to see if the configuration file was loaded correctly.**

## Application Event Log

The Event Log pages shows a list of time stamped events. Some events are simply informational, while others indicate when the Well Test Application has encountered unexpected conditions. The Event Log is meant to help the user understand what is happening with the Well Test Application.

The Event is stored in non-volatile memory, and as such, the contents are persistent across program restarts and power outages. The Event Log is initialized when the Well Test Application is downloaded to the RTU, however.

The Event Log has a maximum size of 64 entries. Old entries are deleted as new entries are made.

The screenshot shows a web browser window with the title 'Well Test Application'. The address bar displays '192.168.0.19/Event'. The page header features the 'Simark Controls' logo and the text 'Well Test Application', 'Version 1.000', 'Compiled Sep 18 2015 05:28:00', and 'Licensed until FRI SEP 25 08:52:02 2015'. The main content area lists the following events:

- FRI SEP 18 09:00:01 2015 **License expires FRI SEP 25 08:52:02 2015**
- FRI SEP 18 08:52:09 2015 **Contract units run 3 METRIC4**
- FRI SEP 18 08:52:07 2015 **Contract units run 2 METRIC4**
- FRI SEP 18 08:52:05 2015 **Contract units run 1 METRIC1**
- FRI SEP 18 08:52:02 2015 **Loaded configuration**
- FRI SEP 18 08:52:02 2015 **HW ver 3.0, type:11**
- FRI SEP 18 08:52:02 2015 **Event log initialized**
- FRI SEP 18 08:52:02 2015 **Datalog create 0 0 0 0 0 0 0**
- FRI SEP 18 08:52:02 2015 **NV mem 1 1 1 1 1**

## Operation

### Application Overview

The Well Test Application works with the Realflo measurement engine to easily enable multi-well testing. The details of exactly what the Well Test Application does to accomplish this are discussed below. The discussion below assumes that both the application and Realflo are fully and correctly configured and available for operation.

1. The Well Test Application starts in the Waiting state. In this state, it waits for a Start Test command. Realflo calculates flow in this state based on however it's configured, whether that is a default configuration or the configuration from the last well test that was successfully started.
2. A Start Command is issued or Automatic Well Testing is enabled. Both of these commands can be issued over Modbus. When this occurs, the Well Test Application gets the desired well test number from another Modbus register. This register cannot be modified until the Well Test Application enters the waiting state again.
3. The Well Test Application moves to the Starting state. It configures flow runs in Realflo based on the configuration of the well test that is being executed. This is an involved process and can take up to 1 minute, depending on how many runs need to be configured. The Well Test Application does look at the current configuration of the run in Realflo and compare it to the desired configuration. It only undertakes configuration if the actual configuration is different than the desired configuration. You can look in the [Event Log](#) to see what is occurring. The test can be stopped manually in this state. If this occurs, the Well Test Application goes back to the Waiting state. Realflo may be in a half-way configured state if this occurs. Configuration changes are not rolled back.
4. If Realflo accepts the desired configuration, the Well Test Application moves to the Purge state. If Realflo rejects the desired configuration, the test is stopped and the Well Test Application moves back to the Waiting state. The test can be stopped manually in the Purge state. If this occurs, the Well Test Application just goes back to the Waiting state.
5. In the Purge state, the Well Test Application accumulates flow from each configured run and compares it the configured purge volume for each run in the well test configuration. When the actual accumulated volume exceeds the desired threshold for a given flow run, the flow run is marked as "purge complete." When all runs are marked as purge complete, the Well Test Application starts a new batch in Realflo and moves to the Testing state.
6. If all batches can be started in Realflo, the Well Test Application stays in the Testing state until the test duration, as configured in the well test, expires. Once the test is complete, the Well Test Application closes the Realflo batch and moves to the Accept or Reject Test state. The test can also be stopped manually in the Testing state. If this occurs, the Well Test Application closed the Realflo batch and goes to the Accept or Reject Test state.
7. In the Accept or Reject Test state, if automatic testing is enabled, the test result is automatically accepted and the next well in the configured well tests is automatically put on test. If automatic testing is disabled, the Well Test Application waits in this state until the Accept or Reject command is issued over Modbus.
8. If the Accept command is issued, the Well Test Application takes the batch history from Realflo and does three things: it appends the test result to SCADAPack Datalog, it writes the test history to a circular buffer in non-volatile memory, and it appends the test history to a .CSV file on the RTU's filesystem. The Well Test Application then goes back to the waiting state.
9. If the Reject command is issued, the Well Test Application just moves to the Waiting state. Rejected test results are still available in the Realflo batch history.

### Operational Interfaces

Configuration of the Well Test Application takes place solely through the browser based interface, but operation of the Well Test Application can occur in a few different ways, including:

1. The browser based interface has a very simple, fixed user interface that allows an operator to choose the well on test, start and stop tests, accept or reject tests, see the state of the program, and view test results. This is the simplest user interface, and is included in the core product.



2. All operational commands and status information, like changing the well on test, starting and stopping tests, accepting and rejecting tests, seeing the test status, and viewing accepted test results are also available via the Modbus protocol. Values are stored in Modbus registers. Interface to the Well Test Application over Modbus where a flexible and configurable user interface is required. By making operational information and commands accessible over Modbus, end users can build interfaces that are tailored to their needs. This also makes it possible to control the Well Test Application and get test results into a SCADA host with ease.
3. By using a Schneider Electric ClearSCADA SCADA host. ClearSCADA has tight integration with Realflo and SCADAPack RTUs. This tight integration makes interfacing with Realflo and the Well Test Application trivial. It also allows for advanced features, like built-in backfilling of accepted test results after a communications outage.

These options are discussed in detail in this section.



**All operational examples use a fictional 4 well pad to help demonstrate concepts more clearly. Wells on this pad are labeled 14-36A, 14-36B, 14-36C and 14-36D. When first started, the Well Test Application will have no configuration.**

## Browser Based Operational Interface

The operational interface can be found by clicking the Application Control and Monitoring link from the main page of the configuration interface. This page is shown in the [Configuration](#) section. After you click this link, a page like the one below is shown.

Unlike the configuration web pages, this page is not static and uses Javascript to update itself without doing a complete page refresh. This page gets new data from the Well Test Application every 5 seconds. As the state of a well test changes, the user interface is automatically updated to only show relevant options. For example, the Start Test button is only shown when there is no test underway. When a test is underway, the Stop Test button is shown.



**A well test cannot be started from the browser operational interface without creating a small automation program in the RTU. When the Start Command is issued from the browser interface a contact is closed, but the Well Test Application needs a coil to be set to actually start. The contact must be connected to the coil with a horizontal shunt (at a minimum), for a well test to actually start. This was done to allow user code to execute in between issuing a command from the user interface and actually starting a well test. See the [Modbus](#) section for details**

Well Test Application
192.168.0.18/Control
Search

# Simark Controls

Well Test Application  
Version 0.010  
Compiled Sep 15 2015 11:26:34  
Licensed until TUE SEP 22 17:29:49 2015

Page update time: **3.8 seconds ago** 14 Page Update Time

Update count: **45** 15 Update Count

## Test Control

Well on test: **12-16A** 1 Well on Test

Well test state: **Waiting** 2 Well Test State

Automatic testing: **Disabled** 3 Automatic Testing Status

Time in state (hh:mm:ss): **00:00:13** 4 Time in State

Start command time: **FRI SEP 18 09:31:45 2015** 5 Start Command Time

Purge complete time: **FRI SEP 18 09:32:53 2015** 6 Purge Complete Time

Scheduled test end time: **FRI SEP 18 09:42:53 2015** 7 Scheduled Test End Time

Test time left (hh:mm:ss): **00:00:00** 8 Time Left

12-16A Choose Well 9 Choose Well

Start Test 10 Test Control

Enable Auto Testing 11 Automatic Test Control

## Current Values

Type	Vol. Flow Rate	Water Cut(%)
Run 1 <b>Gas</b>	125.4349 E3m3/day	
Run 2 <b>Liquid</b>	0.0671 E3m3/day	<b>37.3852</b>
Run 3 <b>Water</b>	0.2842 m3/hr	

12 Current Values

## Last Test Result

Type (Vol. EU)	Total Vol.	Vol. Oil	Vol. Water	Flow Time (hh:mm:ss)
Run 1 <b>Gas (E3m3)</b>	0.4472			<b>00:05:08</b>
Run 2 <b>Liquid (m3)</b>	0.0057	<b>0.0034</b>	0.0021	<b>00:05:08</b>
Run 3 <b>Water (m3)</b>	0.0243			<b>00:05:08</b>

13 Test Result

1

## Well on Test

**Well on test: 12-16A**

This field shows which well test will be executed when the Start command is issued, or the well that is currently being tested if testing is underway. In the Accept/Reject state, this field shows the well test name that was just completed.

## 2 Well Test State

**Well test state: Waiting**

This field shows the current status of the Well Test Application. Valid values are Waiting, Starting Test, Purging, Test in Progress, Stopping and Waiting for Test Acceptance. For details, see the [Modbus](#) section.

## 3 Automatic Testing Status

**Automatic testing: Disabled**

This field shows the value of the Automatic Testing command. Possible values are Enabled or Disabled. In Automatic testing mode, the Well Test Application program starts a well test, waits for testing to complete, automatically accepts the test results, and then starts the next configured well test. This allows for a completely automated testing mode that does not require user intervention.

## 4 Time in State

**Time in state (hh:mm:ss): 00:00:13**

This field shows the time that the Well Test Application has spent in this Well Test State. The value should constantly be incrementing and is updated once every 5 seconds. If this value does not automatically increase, then communications to the RTU have probably been lost.

## 5 Start Command Time

**Start command time: FRI SEP 18 09:31:45 2015**

This field shows the time of the last Start Test command.

## 6 Purge Complete Time

**Purge complete time: FRI SEP 18 09:32:53 2015**

This field shows the time that the purge completed for the last test, or the test currently underway. In this example, the Well Test Application is Purging, and purge is not yet complete for this test, so the value is for the last test that was executed.

## 7 Scheduled Test End Time

**Scheduled test end time: FRI SEP 18 09:42:53 2015**

This field shows the predicted end time for the test that is currently underway. This field is populated after the Purge is complete and the test duration is known. If a test is ended manually, this field is not updated. In other words, it is not the actual test end time but the predicted end time.

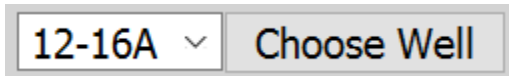
## 8 Time Left

**Test time left (hh:mm:ss): 00:00:00**

When the Well Test State is Test in Progress, and a well test is underway, this field will show the test time left. When the Well Test State is Purging, this field will show the purge time remaining until testing begins.

9

### Choose Well

A screenshot of a user interface element. It consists of a rectangular box with a light gray border. Inside the box, on the left, is a dropdown menu showing '12-16A' with a small downward arrow to its right. To the right of the dropdown menu is a button with the text 'Choose Well'.

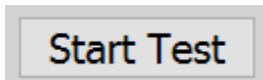
Use these two controls to change the well test that will be executed when the Start command is issued. The drop down box shows a list of all of the configured well tests in the system. If no well tests are configured, this box will be empty.

The Choose Well button uploads the well test selection to the Well Test Application in the RTU. After clicking this button, wait 5 seconds, and verify that the selection was accepted by matching the selection to the value in the Well On Test field.

These controls are only available when the Well Test State is Waiting. The well cannot be changed when the Well Test Application is in any other state.

10

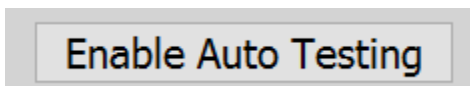
### Test Control

A screenshot of a single button with a light gray border and the text 'Start Test' in the center.

A button in this location is used to issue a Start or Stop test command. The button is updated automatically depending on the state of the Well Test Application. When the Well Test State is Waiting, this button reads Start Test and allows the user to start a Test. When in any other state except for the Waiting to Test Acceptance State, this button reads Stop Test and allows the user to stop the test in progress.

11

### Automatic Test Control

A screenshot of a single button with a light gray border and the text 'Enable Auto Testing' in the center.

A button in this location is used to enable or disable automatic testing mode. When automatic testing is enabled, this button will read Disable Auto Testing. When automatic testing is disabled, as shown in this screen grab, the button will read Enable Auto Testing.

Automatic testing can be enabled or disabled at any time.

12

### Current Values

## Current Values

	Type	Vol. Flow Rate	Water Cut(%)
Run 1	<b>Gas</b>	125.4349 E3m3/day	
Run 2	<b>Liquid</b>	0.0671 E3m3/day	<b>37.3852</b>
Run 3	<b>Water</b>	0.2842 m3/hr	

This section shows the instantaneous values for the runs that are configured for the currently selected well test. For gas or water runs, just the flow is shown, while for liquid runs, the flow and water cut are shown. Values are in the same units as in Realflo.



Changing the selected well test does NOT cause Realflo to be configured. Realflo configuration only occurs when a well test is started. As such, these values might not be accurate because the configuration is not updated for the current well test until the well test is successfully started. To force a configuration change in Realflo, start the test, wait until the Purging state is entered, and then stop the test.

13

## Test Result

### Last Test Result

	Type (Vol. EU)	Total Vol.	Vol. Oil	Vol. Water	Flow Time (hh:mm:ss)
Run 1	<b>Gas (E3m3)</b>	0.4472			<b>00:05:08</b>
Run 2	<b>Liquid (m3)</b>	0.0057	<b>0.0034</b>	0.0021	<b>00:05:08</b>
Run 3	<b>Water (m3)</b>	0.0243			<b>00:05:08</b>

When the Well Test State is Waiting, Starting, Purging or Waiting for test acceptance, this section shows the last test result and the values will not change.

When a test is underway, and the Well Test State is Testing, this section shows the values for the test in progress and the volumes will be increasing.

The values are in the same units as in Realflo.

14

## Page Update Time

Page update time: **3.8 seconds ago**

This field shows how long ago the data on the page was updated. Script that runs in the browser requests new data from the RTU every 5 seconds or so. This field assure the operator that communications to the RTU are good and the data is not stale.

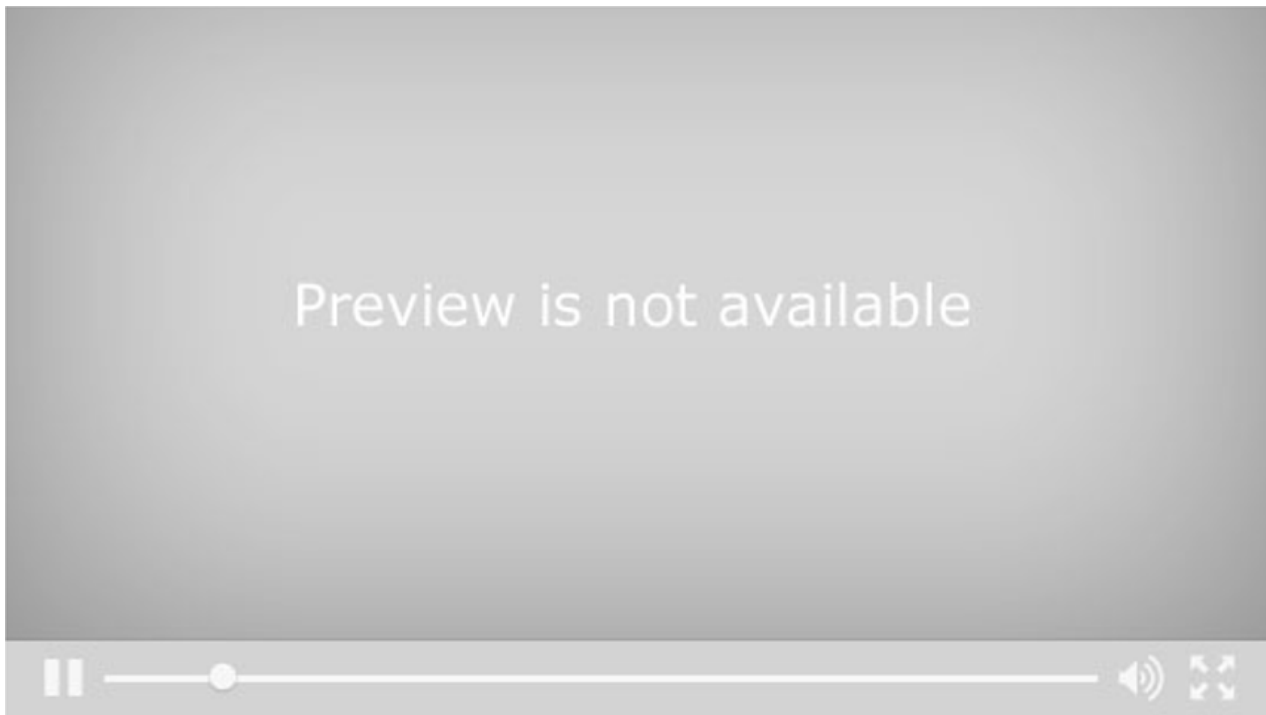
## 15 Update Count

Update count: **45**

The value in this field is incremented each time the web browser successfully retrieves new data from the RTU. This value is generated by script that runs on the browser and starts from 0 every time the page is loaded or reloaded.

### Video Demonstration

The video below demonstrates the browser based operational interface.



## Accept or Reject Test

When the Well Test State is Waiting for test acceptance, the user interface screen looks like the one below. This is the only state in which the Accept Test and Reject Test buttons are shown.



Well Test Application
192.168.0.18/Control
Search

# Simark Controls

Well Test Application  
Version 1.000  
Compiled Sep 18 2015 05:27:57  
Licensed until FRI SEP 25 16:04:49 2015

Page update time: **3.7 seconds ago**  
Update count: **152**

## Test Control

Well on test: **12-16A**  
Well test state: **Waiting for test acceptance**  
Automatic testing: **Disabled**  
Time in state (hh:mm:ss): **00:01:32**  
Start command time: **FRI SEP 18 10:30:02 2015**  
Purge complete time: **FRI SEP 18 10:31:01 2015**  
Scheduled test end time: **FRI SEP 18 10:41:01 2015**  
Test time left (hh:mm:ss): **00:00:00**

1 Accept Test  
2 Reject Test

## Current Values

Type	Vol. Flow Rate	Water Cut(%)
Run 1 <b>Gas</b>	125.4349 E3m3/day	
Run 2 <b>Liquid</b>	0.0671 m3/hr	<b>37.3852</b>
Run 3 <b>Water</b>	0.2842 m3/hr	

## Last Test Result

Type (Vol. EU)	Total Vol.	Vol. Oil	Vol. Water	Flow Time (hh:mm:ss)
Run 1 <b>Gas (E3m3)</b>	0.8740			<b>00:10:02</b>
Run 2 <b>Liquid (m3)</b>	0.0112	<b>0.0067</b>	0.0041	<b>00:10:02</b>
Run 3 <b>Water (m3)</b>	0.0475			<b>00:10:02</b>

1 Accept Test

## Accept Test

When a test is complete, the user can choose to Accept the test results. If the Accept command is issued, the Well Test Application takes the batch history from Realflo and does three things: it appends the test result to SCADAPack Datalog, it writes the test history to a circular buffer in non-volatile memory, and it appends the test history to a .CSV file on the RTU's file system. The Well Test Application then goes back to the waiting state. When automatic testing is enabled, test results are automatically accepted.

2

## Reject Test

### Reject Test

When a test is complete, the user can choose to Reject the test results. If the Reject command is issued, the Well Test Application just moves to the Waiting state. Rejected test results are still available in the Realflo batch history, but are not available via the other mechanisms described above.

## Modbus

The Well Test Application can be controlled and configured via Modbus registers in the RTU. Registers can be read from and written to using any protocol that is supported by the SCADAPack RTU.



**All floating point values are formatted with the high bytes in the low register and the low bytes in the high register. For example, if the floating value is 4.36, the hex value is 0x408b851f. If the floating point value is in registers 30001 and 30002, the two high bytes (0x408b) are copied to register 30001 and the remaining two bytes (0x851f) are copied to the register 30002.**

## Register Summary

The Well Test Application uses the following Modbus registers, inclusive of the ending register.

### **Digital Outputs (Coils)**

3800 to 3812, 13 total

### **Digital Inputs (Contacts)**

14080 to 14084, 5 total

### **Status Registers (Input Registers)**

34352 to 34483, 132 total

### **Configuration Registers (Holding Registers)**

42142 to 42248, 106 total

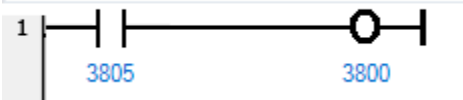
## General Registers

Registers that are not documented elsewhere in the manual are documented in this section.

### Digital Outputs (Coils)

This section covers registers in the 1 to 9999 address range. In the Notes below, the term "set" means to write a 1 to the coil while the term "clear" means to write a 0 to the coil.

Address	Name	Note
3800	Start or Stop Test	Set this register to start a test and clear this register to stop a test. This register is not cleared automatically by the Well Test Application. It is strongly recommended to use register 3805 to start and stop tests from SCADA, an HMI, or a user program. If using Telepace, do not tie this register to a rail. Forcing this register to 1 will not allow a test to stop cleanly. Forcing this register to 0 will never let tests start.
3801	Accept Test	Set this register to accept a test result. The register is cleared automatically by the Well Test Application. The Accept Test command can only be sent when in the Waiting for test acceptance state. In any other state, the register will just be cleared.
3802	Reject Test	Set this register to reject a test result. The register is cleared automatically by the Well Test Application. The Reject Test command can only be sent when in the Waiting for test acceptance state. In any other state, the register will just be cleared.
3803	Enable Serial	Set this register to enable browser support on com3. When this register is set, the Well Test Application will completely control com3 and the port cannot be used for any other purpose.
3804	Automatic Testing	Set this register to enable Automatic testing mode and clear this register to disable Automatic testing mode. In Automatic testing mode, well tests are automatically started and test results are automatically accepted by the Well Test Application. All well tests are executed sequentially.
3805	Start or Stop Command from browser user interface	<p>Use this register to start and stop tests from HMI, SCADA or a user program. When a test is complete, the Well Test Application clears this register to indicate that the test is complete. If this register is forced, or tied to a rail, then the test will not end cleanly.</p> <p>When the Start command is issued from the browser based user interface, this register is set. When the Stop command is issued from the browser based user interface, this register is cleared.</p> <p>User logic can be placed in between this register and register 3800. <b>The two registers must ultimately be connected for the Well Test Application to work correctly.</b></p> <p>Example ladder logic for the simplest case is shown below. User logic can be added between the contact and the coil, but the Well Test Application writes to 3805 and reads from 3800, so the signal must be able to pass through whatever network the user creates.</p>

		
3806	Acknowledge Events	<p>Set this coil to have the Well Test Application acknowledge events from the Realflo event journal, and allow older events to be overwritten by newer events. Realflo will prevent configuration changes if the number of pending configuration changes will cause entries in the Realflo event journal to be overwritten. The Well Test Application reconfigures Realflo before each well test, so if events from the Realflo event journal are never acknowledged, it will not be possible to start a well test. By setting this coil, if the number of unacknowledged events for a run are greater than 650, the Well Test Application will acknowledge all of the unacknowledged events in the Realflo event journal.</p> <p>When this coil is cleared, the Well Test Application will not do anything with the Realflo event journal. In this case, it is incumbent on the user to periodically acknowledge events in the Realflo event journal so that older events can be overwritten by new ones, and the Well Test Application can correctly configure Realflo before a new well test.</p>

## Digital Inputs (Contacts)

This section covers registers in the 10001 to 19999 address range.

Address	Name	Note
14081	IsLicensed	When this register is set the Well Test Application is licensed. When this register is cleared, the Well Test Application does not have a valid license.

## Status Registers (Input Registers)

This section covers registers in the 30001 to 39999 address range.

Address	Name	Value Type	Note
34400	Well Test State	INT16	<p><b>0 = none</b> This state exists briefly when the application first starts</p> <p><b>1 = Waiting</b> In this state the application can be configured and the application is waiting for the Start command to be issued.</p> <p><b>2 = Starting</b> In this state the application is configuring Realflo to match the desired configuration as stored in the well test that was started.</p> <p><b>3 = Purging</b> In this state the application is accumulating the flow for each run until the measured volume exceeds the configured purge volume threshold. When the purge is complete, a new batch history record is triggered in Realflo.</p> <p><b>4 = Testing</b> In this state, the application waits for the configured test duration to expire. When the testing time expires, the application moves to the Stopping state.</p> <p><b>5= Stopping</b> This state only occurs very briefly. In this state, the batch history in Realflo is stopped and the application moves to the Waiting for test acceptance state.</p> <p><b>6= Waiting for Test Acceptance</b> In this state the application waits for an Accept Test or Reject Test command. One of these commands must be issued to exit this state and return back to the Waiting state.</p>
34402,34403	Time in State	INT32	This set of registers holds the time in state in seconds. This is the time spent in the current Well Test State. This value is reset when a state change occurs
34404, 34405	Start Command Time	INT32	This is the time that the last Start Command was issued. This is seconds since January 1, 1970.
34406, 34407	Purge End Time	INT32	This is the time that the purge ended for the last test or the current test, depending on whether purge is actually complete for the test in progress. This is seconds since January 1, 1970.
34408	Accepted Well Test Count	INT16	This holds the number of accepted tests in the accepted test history

34410, 344161	Scheduled Test End Time	INT32	This holds the scheduled test end time for the last test or the current test, depending on whether the purge is actually complete for the test in progress. This value is updated only when the purge is complete. This is seconds since January 1, 1970.
34412, 34413	Test Time Left	INT32	This holds the time left in the current test. This value is only populated when the Well Test State is Testing, otherwise it is 0. This is in seconds.
34414, 34415	License Expiration Time	INT32	This is the time that the license is due to expire. The value is in seconds from January 1, 1970.

### Configuration Registers (Holding Registers)

This section covers registers in the 40001 to 49999 address range.

Address	Name	Value Type	Note
42200	Well On Test	INT16	<p>Read or write the well test that will be executed when the Start command is issued. This value cannot be written when a well test is underway. Each configured well test has an associated number which can be found when you view a well test's configuration. Enter that number in this register.</p> <p>Screen of a well test number from a test's configuration page:</p> <div style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Well Test Name: <b>14-36A</b></p> <p>Well Test Number: <b>0</b></p> </div>
42203, 42204	Offset to UTC	float	Write the local time offset to UTC in decimal hours to this register. This is useful when the clock on the RTU is set to UTC, but you want the user interface and test results in local time. For example, the offset to UTC in the summer for Mountain Time is -6.0.

## Accepted Test Results

### Accepted Test Results

This section covers all the registers related to showing the accepted test results over Modbus. One register is used to select the well test to show results for , and another register is used to select the index of the test. Based on these two input registers, the Well Test Application copies the requested test results to a set of Modbus registers. Using this mechanism, all accepted tests can be viewed or retrieved.

#### Control Registers

Address	Name	Value Type	Note
42201	Accepted Tests - Well Test Number	INT16	Write the number of the well test for which to retrieve test results. Write 255 to retrieve results for all well tests. This register makes it easy to retrieve test results for just one a multiwell pad.
42202	Accepted Tests -Well Test Index	INT16	Write the index of the accepted test number that you want to retrieve in this register. 0 is the newest test, 1 is the next newest, and so on.

#### Examples

To retrieve the newest test result for all wells, write 255 to register 42201 and 0 to register 42202. As well tests are accepted, and new records are created, the results registers will always hold the newest test result.

To retrieve the newest test result for a specific well test, write the number of well test to register 42201 and write 0 to register 42202.

To retrieve the third to last result for all wells, write 255 to register 42201 and 2 to register 42202.

To iterate through all test results, write 255 to register 42201 and update the index. Wait at least 3 seconds between each write to the index register for updated results to show up in the results registers. The total number of accepted well test results in memory is in the register at address 34458.

#### Results Registers

The Well Test Application is constantly scanning the accepted test results control registers and copying the desired test results to a set of results registers. Each accepted test has a set of registers for general information about the test, and then 6 sets of registers for the actual values from each run in a well test. If runs in a well test are unused, the values will be zeroed out.

#### General Information

Address	Name	Value Type	Note
34280, 34281	Time stamp	INT32	This register contains the test end time. The value represents seconds from January 1, 1970.
34282	Batch ID	INT16	This is the Realflo Batch ID for the test result. This makes it possible to easily correlate this result with the batch history in Realflo.
34283	Well Test Number	INT16	This is the number of the well test that was executed to generate these results
34284, 34285	Test Duration	float	This is the test duration in decimal hours. This value does not include the purge time .



34286	Time stamp month	INT16	This is month of the time stamp of the test end time. 0 = January, 1 = February, etc.
34287	Time stamp month day	INT16	This is the day of the month of the time stamp of the test end time. Valid values are 1 to 31.
34288	Time stamp year	INT16	This is the year of the time stamp of the test end time. The value is in years from 1900, so 115 = 2015
34289	Time stamp hour	INT16	This is the hour of the time stamp of the test end time. Valid values are 0 to 23.
34290	Time stamp minutes	INT16	This is the minutes of the time stamp of the test end time. Valid values are 0 to 59
34291	Time stamp seconds	INT16	This the seconds of the time stamp of the test end time. Valid values are 0 to 59.

### Run Information

Each well test in the Well Test Application can have up to 6 runs configured. Memory is reserved in the RTU for results from all 6 runs, even if runs are never used. Additionally, each run may be gas, liquid, or water. In the case of gas or water runs, only the flow time and test volume is logged. In the case of liquid runs, the flow time, net volume, net oil and net water are logged.

Because any run in a well test may be any type, and results must be shown for all possible combinations, each run result reserves a set of registers for the flow time and 4 floating point values.

### Well Test Run 1 Results Registers

Address	Name	Value Type	Note
34296, 34297	Flow Time	INT32	This register contains the flow time from Realflo for the run. Normally, this would match the test duration unless flow stopped during the test for some reason. This value is in seconds.
34298, 34299	Value1	float	Gas: Flow volume at base conditions Liquid: Gross standard volume Water: Net Standard Volume: water
34300, 34301	Value2	float	Gas: Average temperature Liquid: Net Standard Volume: oil Water: Average temperature
34302, 34303	Value3	float	Gas: Average static pressure Liquid: Net Standard Volume: water Water: Average CTL: water
34304, 34305	Value4	float	Gas: Average differential pressure (AGA-3 and V-Cone only) Liquid: Indicated volume (IV) Water: Unused, reserved
34306, 34307	Value5	float	Gas: Unused, reserved Liquid: Average density at standard conditions (input units) Water: Unused, reserved

34308, 34309	Value5	float	Gas: Unused, reserved Liquid: Average temperature Water: Unused, reserved
34310, 34311	Value6	float	This value is unused and reserved for all run types

Well test run2 results start at register  $34296 + (1 * 16) = 34312$

Well test run3 results start at register  $34296 + (2 * 16) = 34328$

Well test run4 results start at register  $34296 + (3 * 16) = 34344$

Well test run5 results start at register  $34296 + (4 * 16) = 34360$

Well test run6 results start at register  $34296 + (5 * 16) = 34376$

## Manage Gas Compositions

Registers that are used to view and manage gas compositions are described below.

### Digital Outputs (Coils)

This section covers registers in the 1 to 9999 address range. In the Notes below, the term "set" means to write a 1 to the coil while the term "clear" means to write a 0 to the coil.

Address	Name	Note
3807	Update Gas Composition	Set this coil to update a gas composition. The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended. The values in the new gas composition holding registers and the value of the Gas Composition Number to Set register must be valid before setting this coil. A gas composition cannot be updated when the Well Test Application is in the Starting state.
3810	Read Gas Composition	<p>Set this coil to read a gas composition and copy the values from the application to Modbus holding registers. The gas composition number to read is read from a holding register.</p> <p>The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended</p>

### Digital Inputs (Contacts)

This section covers registers in the 10001 to 19999 address range. In the Notes below, the term "set" means that the contact's value is 1 and the term "clear" means that the contact's value is 0.

Address	Name	Note
14082	Gas Composition Change Failure	<p>This contact is set when the last gas composition change attempt via Modbus was not accepted. Normally this happens because the sum of the gas composition is not 1, but a failure can also occur when an attempt to update the gas composition is made when the Well Test Application is in the Starting state.</p> <p>This contact only reflects changes made over Modbus. Changes made via the browser interface do not cause any changes to the value of this contact.</p> <p>This contact is cleared when the gas composition is successfully updated over Modbus.</p>

### Status Registers (Input Registers)

This section covers registers in the 30001 to 39999 address range. Registers in this range are used to view a gas composition. These registers will always reflect the values of the selected gas composition without any user intervention.

Address	Name	Value Type	Note
34416	Gas Composition	INT16	This register contains the number of the gas composition that is populated in the gas composition display registers. Use this register to verify that the

	Number Displayed		gas composition that is copied to the status registers is the one that was requested. A mismatch between the requested value and the actual value can occur if the requested value is out of range or not enabled.
34418, 34419	Methane	float	Methane for displayed gas composition
34420, 34421	Nitrogen	float	Nitrogen for displayed gas composition
34422, 34423	Carbon Dioxide	float	Carbon Dioxide for displayed gas composition
34424, 34425	Ethane	float	Ethane C <sub>2</sub> H <sub>6</sub> for displayed gas composition
34426, 34427	Propane	float	Propane C <sub>3</sub> H <sub>8</sub> for displayed gas composition
34428, 34429	Water	float	Water for displayed gas composition
34430, 34431	H <sub>2</sub> S	float	Hydrogen Sulfide for displayed gas composition
34432, 34433	Hydrogen	float	Hydrogen for displayed gas composition
34434, 34435	CO	float	Carbon Monoxide for displayed gas composition
34436, 34437	Oxygen	float	Oxygen for displayed gas composition
34438, 34439	i-Butane	float	i-Butane for displayed gas composition
34440, 34441	n-Butane	float	n-Butane for displayed gas composition
34442, 34443	i-Pentane	float	i-Pentane for displayed gas composition
34444, 34445	n-Pentane	float	n-Pentane for displayed gas composition
34446, 34447	n-Hexane	float	n-Hexane for displayed gas composition
34448, 34449	n-Heptane	float	n-Heptane for displayed gas composition
34450, 34451	n-Octane	float	n-Octane for displayed gas composition
34452, 34453	n-Nonane	float	n-Nonane for displayed gas composition
34454, 34455	n-Decane	float	n-Decane for displayed gas composition
34456, 34457	Helium	float	Helium for displayed gas composition
34458, 34459	Argon	float	Argon for displayed gas composition

### Configuration Registers (Holding Registers)

This section covers registers in the 40001 to 49999 address range. Use these registers to view and update a gas composition. Viewing a gas composition in these registers requires user intervention. Actual values are only copied to the holding registers when the Read Gas Composition coil is set.

Address	Name	Value Type	Note
42205	Gas Composition Number to Display	INT16	Write the number of the gas composition that you want to display to this register. The actual gas composition is written to a set of status registers.

42206	Gas Composition Number to Set	INT16	Write the number of the gas composition that you wish to update here. The gas composition is not actually updated the correct coil is set.
42207, 42208	Methane	float	Methane for gas composition to update
42209, 42210	Nitrogen	float	Nitrogen for gas composition to update
42211, 42212	Carbon Dioxide	float	Carbon Dioxide for gas composition to update
42213, 42214	Ethane	float	Ethane C <sub>2</sub> H <sub>6</sub> for gas composition to update
42215, 42216	Propane	float	Propane C <sub>3</sub> H <sub>8</sub> for gas composition to update
42217, 42218	Water	float	Water for gas composition to update
42219, 42220	H <sub>2</sub> S	float	Hydrogen Sulfide for gas composition to update
42221, 42222	Hydrogen	float	Hydrogen for gas composition to update
42223, 42224	CO	float	CO for gas composition to update
42225, 42226	Oxygen	float	Oxygen for gas composition to update
42227, 42228	i-Butane	float	i-Butane for gas composition to update
42229, 42230	n-Butane	float	n-Butane for gas composition to update
42231, 42232	i-Pentane	float	i-Pentane for gas composition to update
42233, 42234	n-Pentane	float	n-Pentane for gas composition to update
42235, 42236	n-Hexane	float	n-Hexane for gas composition to update
42237, 42238	n-Heptane	float	n-Heptane for gas composition to update
42239, 42240	n-Octane	float	n-Octane for gas composition to update
42241, 42242	n-Nonane	float	n-Nonane for gas composition to update
42243, 42244	n-Decane	float	n-Decane for gas composition to update
42245, 42246	Helium	float	Helium for gas composition to update
42247, 42248	Argon	float	Argon for gas composition to update

## Examples

### How do I view a gas composition using the status registers?

1. Write the number of the gas composition that you want to view to the Gas Composition Number to Display register.
2. If the requested gas composition number is valid, and the requested gas composition is enabled, the Well Test Application will copy the gas composition values to the status registers.
3. Verify that the value in the Gas Composition Number to Display register, which is the requested value, matches the value in the Gas Composition Number to Display register.

### How do I view a gas composition using the holding registers?

1. Write the number of the gas composition that you want to view to the Gas Composition Number to Set register.
2. Set the Read Gas Composition coil.
3. If the requested gas composition number is valid, and the requested gas composition is enabled, the Well Test Application will copy the gas composition values to the holding registers. The values will not be reloaded until the Read Gas Composition coil is set again, and any changes that occur due to another user, or someone using the browser based interface, will not be reflected until the Read Gas Composition coil is set.
4. The value in the Gas Composition Number to Set register is updated by the Well Test Application to reflect the gas composition number that was actually copied to the holding registers. This might not match the requested value if the requested value was not valid.

#### **How do I update a gas composition using the holding registers?**

1. Use the directions above to populate the holding registers with the current gas composition values. This is an optional step.
2. Write the number of the gas composition that you want to update to the Gas Composition Number to Set registers.
3. Update the holding registers with the new gas composition values.
4. Set the Update Gas Composition coil.
5. Check the value of the Gas Composition Change Failure contact.
6. Verify the new values by reading the gas composition using the instructions above.

## Manage Purge

Registers that are used to view and manage purge volumes and limits are described below.

### Digital Outputs (Coils)

This section covers registers in the 1 to 9999 address range. In the Notes below, the term "set" means to write a 1 to the coil while the term "clear" means to write a 0 to the coil.

Address	Name	Note
3808	Update Purge Limits	Set this coil to update purge limits for the runs in a well test. The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended. The new purge limits holding registers and the value in the Purge Limits to Set register must be valid before setting this coil. Purge limits cannot be updated when the Well Test Application is in the Starting state.
3811	Read Purge Limits	<p>Set this coil to read a set of purge limits and copy the values from the application to Modbus holding registers. The well test number to read the purge limits from is read from the Purge Limits to Set holding register.</p> <p>The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended.</p>

### Digital Inputs (Contacts)

This section covers registers in the 10001 to 19999 address range. In the Notes below, the term "set" means that the contact's value is 1 and the term "clear" means that the contact's value is 0.

Address	Name	Note
14083	Purge Limits Change Failure	<p>This contact is set when the last purge limits change attempt via Modbus was not accepted. Normally this happens because the a new purge limit is not within the allowable range of 0 to 5000, but a failure can also occur when an attempt to update the purge limits is made when the Well Test Application is in the Starting state.</p> <p>This contact only reflects changes made over Modbus. Changes made via the browser interface do not cause any changes to the value of this contact.</p> <p>This contact is cleared when the purge limits are successfully updated over Modbus.</p>

### Status Registers (Input Registers) - View Purge Volumes and Limits

This section covers registers in the 34460 to 34483 address range. Registers in this range are used to view the purge volumes and purge limits for the current well test

Address	Name	Value Type	Note
34460, 34461	Purge Volume Run 0	float	This register holds the actual purge volume for run 0 for the current well test. When the Well Test Application is in the Purge state, this value will normally be increasing, assuming that there is flow and the purge limit is not set to 0

			for this run. This value should normally be constant when not in the Purge state. The units are the same as the units for volume for the run in Realflo.
34462, 34463	Purge Volume Run 1	float	See Purge Volume Run 0, except that this value is for run 1 for the current well test.
34464, 34465	Purge Volume Run 2	float	See Purge Volume Run 0, except that this value is for run 2 for the current well test.
34466, 34467	Purge Volume Run 3	float	See Purge Volume Run 0, except that this value is for run 3 for the current well test.
34468, 34469	Purge Volume Run 4	float	See Purge Volume Run 0, except that this value is for run 4 for the current well test.
34470, 34471	Purge Volume Run 5	float	See Purge Volume Run 0, except that this value is for run 5 for the current well test.
34472, 34473	Purge Limit Run 0	float	This register holds the purge limit for run 0 for the current well test. This value is updated when the Well Test Application moves from the Starting to the Purging state.
34474, 34475	Purge Limit Run 1	float	See Purge Limit Run 0, except that this value is for run 1 for the current well test.
34476, 34477	Purge Limit Run 2	float	See Purge Limit Run 0, except that this value is for run 2 for the current well test.
34478, 34479	Purge Limit Run 3	float	See Purge Limit Run 0, except that this value is for run 3 for the current well test.
34480, 34481	Purge Limit Run 4		See Purge Limit Run 0, except that this value is for run 4 for the current well test.
34482, 34483	Purge Limit Run 5		See Purge Limit Run 0, except that this value is for run 5 for the current well test.

### Status Registers (Input Registers) - Manage Purge Limits

This section covers registers in the 34385 to 34397 address range. Registers in this range are used to view the purge limits for a user selectable well test. These registers will always reflect the values of the selected gas composition without any user intervention.

Address	Name	Value Type	Note
34385	Purge Limits Number Displayed	INT16	This register contains the well test number for the purge limits that are populated in the purge limits display registers. Use this register to verify that the purge limits that are copied to the status registers are the ones from the well test that was requested. A mismatch between the requested value and the actual value can occur if the requested well test value is out of range or not enabled.



34386, 34387	Purge Limit Run 0	float	The current purge limit for run 0 for the requested well test. The value is in the same units as volume for the run in Realflo. For example, if the volume for this run in Realflo is m3, then the limit will be interpreted as being in m3.
34388, 34389	Purge Limit Run 1	float	See Purge Limit Run 0, except that this value is for run 1 for the selected well test.
34390, 34391	Purge Limit Run 2	float	See Purge Limit Run 0, except that this value is for run 2 for the selected well test.
34392, 34393	Purge Limit Run 3	float	See Purge Limit Run 0, except that this value is for run 3 for the selected well test.
34394, 34395	Purge Limit Run 4	float	See Purge Limit Run 0, except that this value is for run 4 for the selected well test.
34396, 34397	Purge Limit Run 5	float	See Purge Limit Run 0, except that this value is for run 5 for the selected well test.

### Configuration Registers (Holding Registers)

This section covers registers in the 40001 to 49999 address range. Use these registers to view and update the purge limits for all runs in a well test. Viewing the purge limits in these registers requires user intervention. Actual values are only copied to the holding registers when the Read Purge Limits coil is set.

Address	Name	Value Type	Note
42249	Purge Limits to Display	INT16	Write the number of the well test that you want to display the purge limits for to this register. The actual purge limits written to a set of status registers.
42199	Purge Limits to Set	INT16	Write the number of the well test that you want to update the purge limits for to this registers. The purge limits are not actually updated until the Update Purge Limits coil is set
42186, 42187	New Purge Limit Run 0	float	The new purge limit for run 0.
42188, 42189	New Purge Limit Run 1	float	The new purge limit for run 1.
42190, 42191	New Purge Limit Run 2	float	The new purge limit for run 2.
42192, 42193	New Purge Limit Run 3	float	The new purge limit for run 3.
42194, 42195	New Purge Limit Run 4		The new purge limit for run 4.
42196, 42197	New Purge Limit Run 5		The new purge limit for run 5.

### Examples

### **How do I view purge limits for a well test using the status registers?**

1. Write the number of the well test that you want to view to the purge limits for to the Purge Limits to Display to Display register.
2. If the requested well test number is valid, and the requested well test is enabled, the Well Test Application will copy the purge limits to the status registers.
3. Verify that the value in the Purge Limits to Display register, which is the requested value of the well test to display values for, matches the value in the Purge Limits Number Displayed register.

### **How do I view purge limits for a well test using the holding registers?**

1. Write the number of the well test that you want to view the purge limits for to the Purge Limits to Set register.
2. Set the Read Purge Limits coil.
3. If the requested well test number is valid, and the requested well test is enabled, the Well Test Application will copy the purge limits to the holding registers. The values will not be reloaded until the Read Purge Limits coil is set again, and any changes that occur due to another user, or someone using the browser based interface, will not be reflected until the Read Purge Limits coil is set.
4. The value in the Purge Limits to Set register is updated by the Well Test Application to reflect the purge limits for the well test number that was actually copied to the holding registers. This might not match the requested value if the requested value was not valid.

### **How do I update purge limits for a well test using the holding registers?**

1. Use the directions above to populate the holding registers with the current purge limits for a well test. This is an optional step.
2. Write the number of the well test that you want to update the purge limits for to the Purge Limits to Set registers.
3. Update the holding registers with the new purge limit values.
4. Set the Update Purge Limits coil.
5. Check the value of the Purge Limits Change Failure contact.
6. Verify the new values by reading the purge limits using the instructions above.

## Manage Liquid Products

Registers that are used to view and manage liquid products are described.

### Digital Outputs (Coils)

This section covers registers in the 1 to 9999 address range. In the Notes below, the term "set" means to write a 1 to the coil while the term "clear" means to write a 0 to the coil.

Address	Name	Note
3809	Update Liquid Product	Set this coil to update the values for a liquid product. The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended. The new liquid product values holding registers and the value in the Liquid Product to Set register must be valid before setting this coil. A liquid product configuration cannot be updated when the Well Test Application is in the Starting state.
3812	Read Liquid Product	<p>Set this coil to read the configuration of a liquid product and copy the values from the application to Modbus holding registers. The liquid product number to read is taken from the Liquid Product to set holding register.</p> <p>The coil is cleared automatically by the Well Test Application, so a pulse is not required or recommended.</p>

### Digital Inputs (Contacts)

This section covers registers in the 10001 to 19999 address range. In the Notes below, the term "set" means that the contact's value is 1 and the term "clear" means that the contact's value is 0.

Address	Name	Note
14084	Liquid Product Change Failure	<p>This contact is set when the last liquid product change attempt via Modbus was not accepted. Normally this happens because one of the values in the liquid product's configuration failed validation, but a failure can also occur when an attempt to update a liquid product is made when the Well Test Application is in the Starting state.</p> <p>This contact only reflects changes made over Modbus. Changes made via the browser interface do not cause any changes to the value of this contact.</p> <p>This contact is cleared when the purge limits are successfully updated over Modbus.</p>

### Status Registers (Input Registers)

This section covers registers in the 30001 to 39999 address range. Registers in this range are used to view the configuration of a user selectable well test. These registers will always reflect the values of the selected gas composition without any user intervention.



For additional information on the meaning of the values look at the [Add or Edit a Liquid Product](#) section.

Address	Name	Value Type	Note
34351	Liquid Product Number Displayed	INT16	This register contains the liquid product number for the values that are populated in the liquid product display registers. Use this register to verify that the liquid product values that are copied to the status registers are the ones from the liquid product was requested. A mismatch between the requested value and the actual value can occur if the requested liquid product value is out of range or not enabled.
34352, 34353	Base Density Oil	float	This register displays the base density of oil for the selected liquid product. The units are assumed to be the same as the one used in Realflo.
34354, 34355	Base Density Water	float	This register displays the base density of water for the selected liquid product. The units are assumed to be the same as the one used in Realflo.
34356, 34357	Low Density Threshold	float	This register displays the low density threshold for the selected liquid product. The units are assumed to be the same as the one used in Realflo.
34358	Low Density Hysteresis	UINT16	This register displays the low density hysteresis for the selected liquid product. The units are seconds.
34359, 34360	Configuration Current	float	This register displays the configuration current for the selected liquid product. The units are mA.
34361, 34362	User Factor Oil (Shrinkage)	float	This register displays the user factor oil for the selected liquid product. This value has no units.
34363, 34364	User Factor Water (Shrinkage)	float	This register displays the user factor water for the selected liquid product. This value has no units.
34365, 34366	Constant Density	float	This register displays the constant for the selected liquid product. The units are assumed to be the same as the one used in Realflo.
34367, 34368	Constant Water Cut	float	This register displays the constant water cut for the selected liquid product. The units are percent.

### Configuration Registers (Holding Registers)

This section covers registers in the 40001 to 49999 address range. Use these registers to view and update liquid products. Viewing the liquid product configuration in these registers requires user intervention. Actual values are only copied to the holding registers when the Read Liquid Product coil is set.

Address	Name	Value Type	Note
42175	Liquid Product to Display	INT16	Write the number of the liquid product that you want to display the configuration for to this register. The actual values are written to a set of status registers.

42174	Liquid Product to Set	INT16	Write the number of the liquid product that you want to update to this registers. The liquid product configuration is not actually updated until the Update Liquid Product coil is set
42142, 42143	New Base Density Oil	float	This register holds the new value of the base density oil liquid product configuration parameter. The units are assumed to be the same as the one used in Realflo.
42144, 42145	New Base Density Water	float	This register holds the new value of the base density water liquid product configuration parameter. The units are assumed to be the same as the one used in Realflo.
42146, 42147	New Low Density Threshold	float	This register holds the new value of the low density threshold liquid product configuration parameter. The units are assumed to be the same as the one used in Realflo.
42148	New Low Density Hysteresis	UINT16	This register holds the new value of the low density hysteresis liquid product configuration parameter. The units are seconds.
42149, 42150	New Configuration Current	float	This register holds the new value of the configuration current liquid product configuration parameter. The units are mA.
42151, 42152	User Factor Oil (Shrinkage)	float	This register holds the new value of the user factor oil liquid product configuration parameter. This value has no units.
42153, 42154	User Factor Water (Shrinkage)	float	This register holds the new value of the user factor water liquid product configuration parameter. This value has no units.
42155, 42156	New Constant Density	float	This register holds the new value of the constant density liquid product configuration parameter. The units are assumed to be the same as the one used in Realflo.
42157, 42158	New Constant Water Cut	float	This register holds the new value of the constant density liquid product configuration parameter. The units are percent.

## Examples

### How do I view the configuration of a liquid product using status registers?

1. Write the number of the liquid that you want to view to the Liquid Product to Display register.
2. If the requested liquid product number is valid, and the requested liquid product is enabled, the Well Test Application will copy the configuration of the liquid product to the status registers.
3. Verify that the value in the Liquid Product to Display register, which is the requested value of the liquid product to display values for, matches the value in the Liquid Product Number Displayed register.

### How do I view the configuration of a liquid product using the holding registers?

1. Write the number of the liquid product that you want to view to the Liquid Product to Set register.
2. Set the Read Liquid Product coil.
3. If the requested liquid product number is valid, and the requested liquid product is enabled, the Well Test Application will copy the configuration of the liquid product to the holding registers. The values will not be

reloaded until the Read Liquid Product coil is set again, and any changes that occur due to another user, or someone using the browser based interface, will not be reflected until the Read Liquid Product coil is set.

4. The value in the Liquid Product to Set register is updated by the Well Test Application to reflect the configuration of the liquid product that was actually copied to the holding registers. This might not match the requested value if the requested value was not valid.

#### **How do I update the configuration of a liquid product using the holding registers?**

1. Use the directions above to populate the holding registers with the current configuration of a liquid product. This is an optional step.
2. Write the number of the liquid product that you want to update to the Liquid Product to Set registers.
3. Update the holding registers with the new liquid product configuration values.
4. Set the Update Liquid Product coil.
5. Check the value of the Liquid Product Change Failure contact.
6. Verify the new values by reading the liquid product configuration using the instructions above.

## ClearSCADA

Schneider Electric's ClearSCADA SCADA Host software has tight integration with SCADAPack RTUs and Realflo flow computers. Using ClearSCADA as a SCADA host makes it very easy to control tests and retrieve accepted test results. Because of the tight integration between ClearSCADA and Realflo, time stamped test results can be retrieved from the RTU after a communications loss and filled into ClearSCADA's historic record, which means that not data is lost due to communications outages. An additional beneficial effect of this tight integration is that duplicate records do not occur and the history in the host is clean.

To be clear, ClearSCADA is not required to use the Well Test Application, and the Well Test Application can interface with any SCADA host that supports the Modbus protocol, but using ClearSCADA allows for extremely fast system deployment and clean and easy retrieval of test results.

A demo project showing how to interface ClearSCADA to the Well Test Application and Realflo has been developed. A detailed discussion on how to use ClearSCADA is well beyond the scope of this manual, but an overview for those who are familiar with ClearSCADA is included below.

ClearSCADA 2015 R1 or newer is supported, because the project relies on liquids support in the Realflo driver.

To use the demo project, make sure the Realflo driver is installed and operational in ClearSCADA. Import the .sde file and configure the communications object in ClearSCADA to poll your RTU. Right click the MAIN mimic from the database bar, choose Display, and you should see a screen like the one below. It is necessary to display the mimic so that the mimic script that generates the query for the Accepted Test Results section can run.

1

Test Control and Monitoring

2

Last Test Result

4

Current Values

TEST CONTROL AND MONITORING

Test Status

Testing

Time in State

145 s 0.04 h

Well On Test

14 - 36 B

Start Command Time

19 Sep 2015 10:32:03

Purge End Time

19 Sep 2015 10:33:10

Scheduled End Time

31 Dec 1969 17:00:00

Time Left

456 s 0.13 h

Last Test End Time

19 Sep 2015 10:31:50

Stop Test

Change Well On Test

Enable Auto Testing

Disable Auto Testing

Accept Test

Reject Test

3

Test Controls

LAST TEST RESULT

Demand Poll

RUN 1 - GAS

Vol. at Base Conditions 0.874036 E3m3

RUN 2 - LIQUID

Gross Standard Volume 0.011226 m3

Net Standard Volume Oil 0.006678 m3

Net Standard Volume 0.004104 m3

RUN 3 - WATER

Net Standard Volume 0.047518 m3

CURRENT VALUES

RUN 1 - GAS

132.919 E3m3/day

RUN 2 - LIQUID

0.067125 m3/hr

RUN 3 - WATER

0.284138 m3/hr

Demand Poll

5

Accepted Test Results

ACCEPTED TEST RESULTS - ALL WELLS

Demand Poll

Time	Batch ID	Well on Test	Duration (h)	Gas Volume (E3m3)	Gas Flow Time (s)	Liq Vol (m3)	Liq Net Oil (m3)	Liq Net Water (m3)	Liq Flow Time (s)	Water Vol (m3)	Water Flow Time (s)
9/19/2015 10:31:50.000 AM	1179	0	0.166944444179535	0.874035775661469	602	0.011225519701805	0.00667767599225044	0.00410422962150918	602	0.047515154442272	602
9/19/2015 10:20:28.000 AM	1178	1	0.166944444179535	0.926151633263634	602	0.011252114340863	0.00614238018169999	0.00408615455105901	602	0.0475162975490093	602
9/19/2015 10:09:07.000 AM	1177	0	0.166944444179535	0.874034081591797	602	0.011225623078643	0.0066776848390149	0.00410432275384665	602	0.04751809596113205	602
9/19/2015 9:57:45.000 AM	1176	1	0.166944444179535	0.926179945468903	602	0.0112257478758693	0.00614263210445642	0.00408643348217011	602	0.04751865538309585	602
9/19/2015 9:46:25.000 AM	1175	0	0.166944444179535	0.874030590057373	602	0.0112258549779654	0.00667779333809484	0.00410444140747491	602	0.0475191131068475	602
9/19/2015 9:35:03.000 AM	1174	1	0.166944444179535	0.926172912128019	602	0.0112259313464165	0.0061427834443748	0.004086464608147615	602	0.0475193671982153	602
9/18/2015 10:41:02.000 AM	1173	0	0.166944444179535	0.874024271965027	602	0.0112262880429626	0.00667789671570063	0.0041047464664083	602	0.0475212596356869	602
9/18/2015 9:38:00.000 AM	1172	0	0.0852777880904648	0.447166085243225	308	0.00574355432763696	0.00341656128875911	0.00210002437233925	308	0.0243125893175602	308
9/18/2015 9:31:32.000 AM	1171	1	0.166944444179535	0.9261594414711	602	0.0112259887501264	0.00614260323345661	0.00408661574668503	602	0.0475195311009884	602
9/18/2015 9:20:12.000 AM	1170	0	0.16666667163372	0.872563183307648	601	0.0112091931362152	0.00666658859699965	0.00409772666171193	601	0.04744893165280819	601
9/18/2015 9:08:54.000 AM	1169	1	0.166944444179535	0.92616206407547	602	0.0112257674336433	0.00618123631740557	0.00415091115380904	602	0.0475190089775005	602
9/18/2015 8:57:38.000 AM	1168	0	0.166944444179535	0.874018788337708	602	0.011225623078643	0.0066776800857025	0.004104048377891064	602	0.0475182006225324	602
9/18/2015 8:46:15.000 AM	1167	1	0.166944444179535	0.926115930080414	602	0.011225501772356	0.00614320448217853	0.00408539226353168	602	0.0475153289735317	602
9/18/2015 8:34:55.000 AM	1166	0	0.16666667163372	0.872587512569427	601	0.01120676590476	0.0066676662631512	0.0040961669639945	601	0.0474361144006252	601

Well Test Application Demo

Licensed, 9/25/2015 10:04:49.000 AM

View Application Configuration

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License Status

7

Application Configuration

## 1 Test Control and Monitoring

TEST CONTROL AND MONITORING

Test Status

Testing

Time in State

145 s 0.04 h

Well On Test

14 - 36 B

Start Command Time

19 Sep 2015 10:32:03

Purge End Time

19 Sep 2015 10:33:10

Scheduled End Time

31 Dec 1969 17:00:00

Time Left

456 s 0.13 h

Last Test End Time

19 Sep 2015 10:31:50

Well Test Application  
Manual Version 1.08  
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This section shows the status of the Well Test Application. Points in ClearSCADA are used to poll the status registers from the Well Test Application directly. Script is used to turn Unix time stamps into understandable time stamps.

2

## Last Test Result

LAST TEST RESULT		Demand Poll
RUN 1 - GAS		
Vol. at Base Conditions	0.874036 E3m3	
RUN 2 - LIQUID		
Gross Standard Volume	0.011226 m3	
Net Standard Volume Oil	0.006678 m3	
Net Standard Volume	0.004104 m3	
RUN 3 - WATER		
Net Standard Volume	0.047518 m3	

This section shows the value of points that hold the batch history from Realflo. The batch history contains both accepted and rejected test results. Batch history is retrieved by the Realflo driver in ClearSCADA and stored in points.

The Demand Poll button calls a script that executes the Get Batch History command on all three flow run objects in the demo. To ensure that the last test result is show before accepting or rejecting a test, click the demand poll button.

3

## Test Controls

Stop Test	Change Well On Test
Enable Auto Testing	Disable Auto Testing
Accept Test	Reject Test

This section is used to control the the Well Test Application. These buttons are connected to points that communicate with the RTU using the Modbus protocol. Buttons are enabled or disabled depending on the value of the Test Status.

4

## Current Values

## CURRENT VALUES

### RUN 1 - GAS

132.919 E3m3/day

### RUN 2 - LIQUID

0.067125 m3/hr

### RUN 3 - WATER

0.284138 m3/hr

Demand Poll

This section shows the instantaneous readings of flow from Realflo. The Realflo driver in ClearSCADA is used to easily retrieve this data. The Demand Poll button is used to call the Refresh method on the Outstation.

5

## Accepted Test Results

Time	Batch ID	Well on Test	Duration (h)	Gas Volume (E3m3)	Gas Flow Time (s)	Liq Vol (m3)	Liq Net Oil (m3)	Liq Net Water (m3)	Liq Flow Time (s)	Water Vol (m3)	Water Flow Time (s)
9/19/2015 10:31:50.000 AM	1179	0	0.166944444179535	0.874035775661469	602	0.0112255197018385	0.00667767599225844	0.00410422962158918	602	0.0475175194442272	602
9/19/2015 10:20:28.000 AM	1178	1	0.166944444179535	0.926151633262634	602	0.0112252114340663	0.00614238018169999	0.00488615455105981	602	0.0475162975490093	602
9/19/2015 10:09:07.000 AM	1177	0	0.166944444179535	0.874034881591797	602	0.0112256230786443	0.0066776848398149	0.00410432275384665	602	0.0475180596113205	602
9/19/2015 9:57:45.000 AM	1176	1	0.166944444179535	0.926179945460903	602	0.0112257478758693	0.00614263210445642	0.00488643348217011	602	0.0475186593830585	602
9/19/2015 9:46:25.000 AM	1175	0	0.166944444179535	0.874030590057373	602	0.0112258549779654	0.00667779333889484	0.00410444149747491	602	0.047519131868475	602
9/19/2015 9:35:03.000 AM	1174	1	0.166944444179535	0.926172912120819	602	0.0112259313464165	0.0061427834443748	0.00488646468147635	602	0.0475193671882153	602
9/18/2015 10:41:02.000 AM	1173	0	0.166944444179535	0.874024271965027	602	0.0112262880429626	0.00667789671570063	0.0041047646664083	602	0.0475212596356869	602
9/18/2015 9:38:00.000 AM	1172	0	0.0852777808904648	0.447166805243225	308	0.00574355432763696	0.00341656128875911	0.00210002437233925	308	0.0243125893175602	308
9/18/2015 9:31:32.000 AM	1171	1	0.166944444179535	0.9261594451771	602	0.0112259897501264	0.00614260323345661	0.00488661974668503	602	0.0475195311009084	602
9/18/2015 9:20:12.000 AM	1170	0	0.16666667163372	0.872563183307648	601	0.0112071931362152	0.006666585969965	0.00409772666171193	601	0.0474403165280819	601
9/18/2015 9:08:54.000 AM	1169	1	0.166944444179535	0.92616206407547	602	0.01122574336433	0.00681823631748557	0.00410991153889894	602	0.0475189089775085	602
9/18/2015 8:57:38.000 AM	1168	0	0.166944444179535	0.874018788337708	602	0.0112256230786443	0.0066776800057025	0.00410440377891064	602	0.0475182086229324	602
9/18/2015 8:46:15.000 AM	1167	1	0.166944444179535	0.926115930808414	602	0.011225301772356	0.00614320440217853	0.00488539226353168	602	0.0475153289735317	602
9/18/2015 8:34:55.000 AM	1166	0	0.16666667163372	0.872507512569427	601	0.011206766598476	0.00666768662631512	0.00409616669639945	601	0.0474361144006252	601

This embedded list is used to show the accepted test results. Points in ClearSCADA are used to retrieve accepted tests (for stamps and no duplicates), so it is possible to create a query where results are grouped by the Time column.

Script is used to assemble the query that generates this view.

The Demand Poll button in this section calls the DLOG Scan method on the Outstation object. After executing a demand p

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## License Status

Licensed, 9/25/2015 10:04:49.000 AM

The Well Test Application license status is pulled into points and displayed here.

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## Application Configuration

View Application Configuration

This text has a pick action configured to navigate to the Well Test Application main configuration page. This allows you to configure the Well Test Application on the RTU without leaving the SCADA environment.

## Accepted Test Results

There are a few ways to extract accepted test results from the Well Test Application, including Modbus, SCADAPack Datalog, and a .CSV formatted file which is stored on the RTU's file system. The results format is the same for test results over Modbus and via datalog. Test results in the .CSV file use a different format. Each mechanism is discussed in more detail below.

### Results over Modbus and Datalog

Each accepted test has a set of values for general information about the test, and then 6 sets of values for the actual results from each run in a well test. If runs in a well test are unused, the values will be zeroed out or empty.

#### General Information

The general information for each accepted test includes the test end time, the Realflo Batch ID, the number of the well test that was executed, and the test duration in decimal hours. One general information section is stored for each accepted test result.

#### Run Results

Each well test can have up to 6 runs configured, and there is no limitation on the type of each run. Each run record in an accepted well test has the following format: flow time in seconds, value1, value2, value3 and value4, and value5. All run types have the flow time field populated. For gas and water runs, value1 contains the volume result of the test and value2, value3, and value4 are unused. For liquid runs, value1 contains the gross volume of the test, value2 contains the net oil volume, value 3 contains the net water volume and value is unused.

This type of mechanism, where space is reserved for each run even though certain run types might not use the space, allows for a extensible system with few limitations on the configuration.

All units are in the same format as the configured contract or input units in Realflo. If test results in Realflo are in m3, the values in the run results will be in m3.

### Results over Modbus

See the Accepted Test Results section in the Modbus section for details on how to retrieve accepted test results over [Modbus](#). Common use cases for this would be for a local user interface (HMI) or any SCADA system that supports the Modbus protocol.

### Results from Datalog

Accepted test results are stored in Datalog format on the RTU. Results in this format can be retrieved using Schneider Electric SCADALog software or through Schneider Electric ClearSCADA software. The ClearSCADA demo shows how to retrieve the data using ClearSCADA. See the [ClearSCADA](#) section for more details.

The General Information is stored in Datalog 9  
Well test run1 results are stored in Datalog 10  
Well test run2 results are stored in Datalog 11  
Well test run3 results are stored in Datalog 12  
Well test run4 results are stored in Datalog 13  
Well test run5 results are stored in Datalog 14  
Well test run6 results are stored in Datalog 15

### Datalog Definitions

	Datalog 9	Datalogs 10 to 15
Field 1	Timestamp, test end time	Timestamp, test end time
Field 2	Batch ID	Flow time in seconds

<b>Field 3</b>	Well test number	Gas: Flow volume at base conditions Liquid: Gross standard volume Water: Net Standard Volume: water
<b>Field 4</b>	Test duration in hours	Gas: Average temperature Liquid: Net Standard Volume: oil Water: Average temperature
<b>Field 5</b>	unused	Gas: Average static pressure Liquid: Net Standard Volume: water Water: Average CTL: water
<b>Field 6</b>	unused	Gas: Average differential pressure (AGA-3 and V-Cone only) Liquid: Indicated volume (IV) Water: Unused, reserved
<b>Field 7</b>	unused	Gas: Unused, reserved Liquid: Average density at standard conditions (input units) Water: Unused, reserved
<b>Field 8</b>	unused	Gas: Unused, reserved Liquid: Average temperature Water: Unused, reserved

## Results from the Filesystem

Accepted test results are stored in a .CSV formatted file on the RTU's file system. See the Download Data topic in the [Import Export](#) section for more details.

The .CSV is formatted as shown below and contains all of the values from RealFlo's batch history. A line is written for each run in a well test. The Test Number column is used to determine which lines belong to which test. The Batch ID column can also be used to determine which lines belong to a given test, or batch, but depending on how RealFlo and the Well Test Application are configured, the Batch ID might be different for runs within a test.

The first few lines in the .CSV file contain a description of the values and depend on the type of measurement that was made.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1										Value01	Value02	Value03	Value04	Value05	Value06	Value07	Value08	Value09	Value10	Value11	Value12	Value13	Value14
2				Gas:						Vol	Mass	Energy	Est	Temp	SP	DP	Pulses	Rel Density	NA	NA	NA	NA	Units
3				Liquid:						Indicated Vol	Gross Vol	Net Oil Vol	Net Water Vol	Temp	Pres	Density	Water Cut	CTL:Oil	CPL:Oil	CTL:Water	Meter Factor	K Factor	Units
4				Water:						Indicated Vol	NA	NA	Net Water Vol	Temp	NA	NA	NA	NA	NA	CTL:Water	Meter Factor	K Factor	Units
5																							
6	Test Number	Run Number	Well On Test	Measurement Type	Batch Id	Start Time(m-d-y h:m:s)	End Time	Flow Time(s)	Test Duration(s)	Value01	Value02	Value03	Value04	Value05	Value06	Value07	Value08	Value09	Value10	Value11	Value12	Value13	Value14
7	0	1	12-16A	Gas	804	9/15/2015 12:00	9/15/2015 12:10	602	601	0.874	646.5046	27.8895	4074.3765	96.2639	9729.3057	285.0235	0	0.6111	0	0	0	0	132
8	0	2	12-16A	Liquid	804	9/15/2015 12:00	9/15/2015 12:10	602	601	0.012	0.0112	0.0067	0.0041	96.2639	4864.6528	845.8021	37.3715	0.9308	1.0058	0.9639	1	-1	462
9	0	3	12-16A	Water	804	9/15/2015 12:00	9/15/2015 12:10	602	601	0.0493	0	0	0.0473	96.2639	0	0	0	0	0	0.9639	1	-1	462
10	1	1	12-16B	Gas	805	9/15/2015 12:12	9/15/2015 12:22	602	601	0.9261	619.8637	34.4299	3906.3845	96.264	9729.3037	285.0117	0	0.5548	0	0	0	0	132
11	1	2	12-16B	Liquid	805	9/15/2015 12:12	9/15/2015 12:22	602	601	0.012	0.0112	0.0061	0.0049	96.264	4864.6519	845.8021	43.577	0.9308	1.0058	0.9639	1	-1	462
12	1	3	12-16B	Water	805	9/15/2015 12:12	9/15/2015 12:22	602	601	0.0493	0	0	0.0473	96.264	0	0	0	0	0	0.9639	1	-1	462
13	2	1	12-16A	Gas	806	9/15/2015 12:23	9/15/2015 12:33	602	601	0.8739	646.4831	27.8886	4074.2383	96.2638	9729.3018	285.0042	0	0.6131	0	0	0	0	132

## Videos

This section links to all of the videos in this manual

[Installation](#)

[Licensing](#)

[Browser Based Operational Interface](#)