Application Guide

XSeries G4 Plunger Application
rev. AA

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Table of contents

Table of contents

1.0 Overview

The ABB Totalflow Application within the XSeries Generation 4 hardware architecture allows the user to operate Plunger Lift Well site Hardware on Production Gas Well sites. It is intended to interface with plunger arrival switch, send on-off signals to production valve, and read well pressures and flow rate to determine optimum well plunger control conditions for well production. The Totalflow PCCU software is required to interface to the Totalflow G4 hardware for setup and configuration at the site.

The following diagram indicates the basic components of the system.
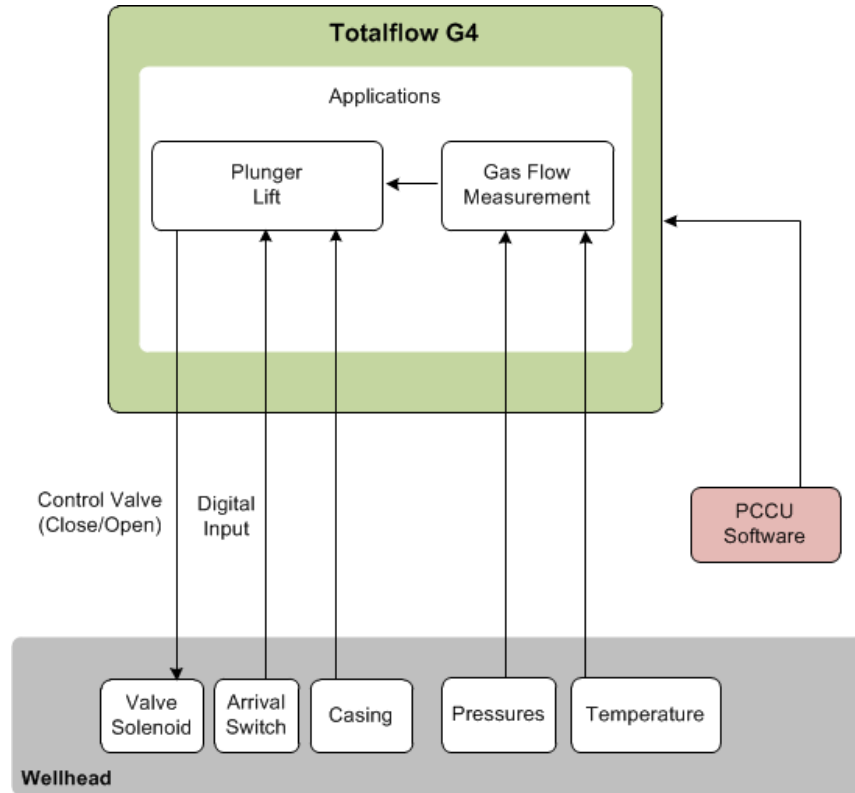
Figure 1 Basic System Components

1.1 How to use this guide

This document will instruct the user that is somewhat familiar with Plunger lift, how to setup and operate the ABB Totalflow Plunger Lift Application. We will go through basic start-up steps required to setup two (2) different Plunger Lift scenarios.

1.2 Assumptions

This guide focuses on the initial configuration of Plunger lift. Physical and electrical installation instructions are included in separate documents. The following is assumed:

– All components have been installed correctly

– End Devices have been calibrated

– All components have been wired correctly

  - To provide/receive signals

– Power has been provided and all the devices are up

- Minimal verification has been performed to ensure the devices are drawing the correct power voltages for their operation.
        - Proper grounding has been performed.
    – PCCU Software has been installed on the machine you plan to use to setup and configure the plunger application with and is configured properly to communicate locally to the XSeries G4 hardware.

1.3 Prerequisites

The procedures described in this document apply to the following:

– PCCU software version 7.31 and later

– PCCU interface cable; can be serial ,USB or IP

– XRC (G4) Part# 2103329-001 software version 2103132-039 and later

– XFC (G4) Part# 2103328-001 software version 2102861-045 and later

1.4 Background

1.4.1 Plunger Lift Background

Before getting into the installation of the Plunger Lift, it can sometimes be helpful to understand the concept behind the device. The plunger works in a manner similar to a pneumatic piston wherein it is caused by gravity to fall to the bottom of a well. Acting as a seal between the liquid and gas, the plunger settles to the bottom of the production tubing and allows liquid to accumulate above it. This accumulation of liquid restricts the flow of gas, slowing it down. The production valve is closed to allow down-hole pressure to build in the casing. After the pressure has built, the production valve is opened, and the casing pressure lifts the plunger and accumulated liquids to the surface. At the surface, separators remove the liquids from the gas. Once the volume of the flowing gas drops, it becomes necessary to choose a time or method of closing the production valve. Once closed, the plunger drops to the bottom of the production tube. With the plunger deployed and the well shut-in, the down-hole pressure builds, and the cycle is repeated.

The entire operation takes place by the simple expediency of opening or closing a valve. There are many options available for determining when to open and close the valve, and these options can "tune" the plunger to optimize well production.
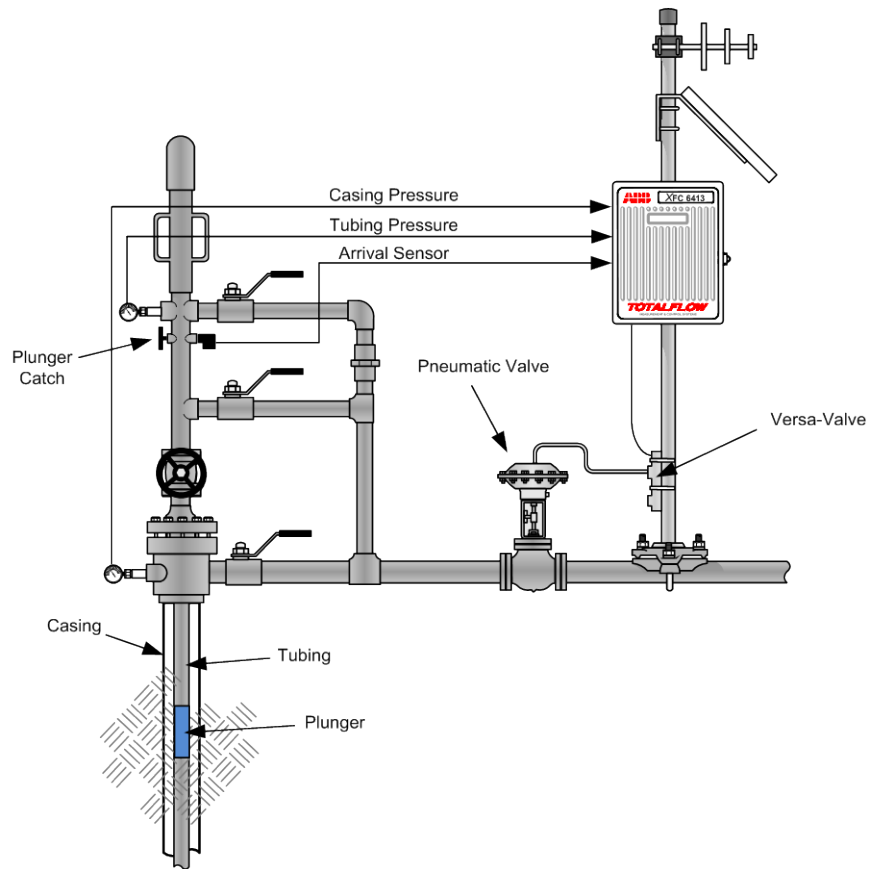
Figure 2 Plunger Site

1.4.2 **Procedure Overview**

The following general steps are needed from a system perspective for the Plunger Lift Application to be setup properly. The actual components required will depend on the specific scenario.

– Connect Components to Totalflow Device(wiring)
– Connect Totalflow Device using PCCU
– Add Applications to Device
– Program I/O setup (valve, arrival switch, etc.)
– Verify I/O operation
– Configure Plunger Application

2.0 Scenario 1- Plunger using "Timers" only

2.1 Timer Scenario Overview

In this scenario we will use only "Timers" within the Plunger Application to "Open" and "Close" the production valve. The ability to "Tune" the open and closed times of the valve for well optimization is not available in this "Timer" scenario. This is a very basic use of the Plunger Application and will not need information from the AGA-3 application such as Pressures and Flow rate to operate. We will however, need the "Plunger Arrival Switch" input (Pulse input) to sense plunger arrival and Digital Outputs 1 and 2 to "open" and "close" the production valve. The diagram listed shows the different "States" the Plunger Application will travel through in this scenario.
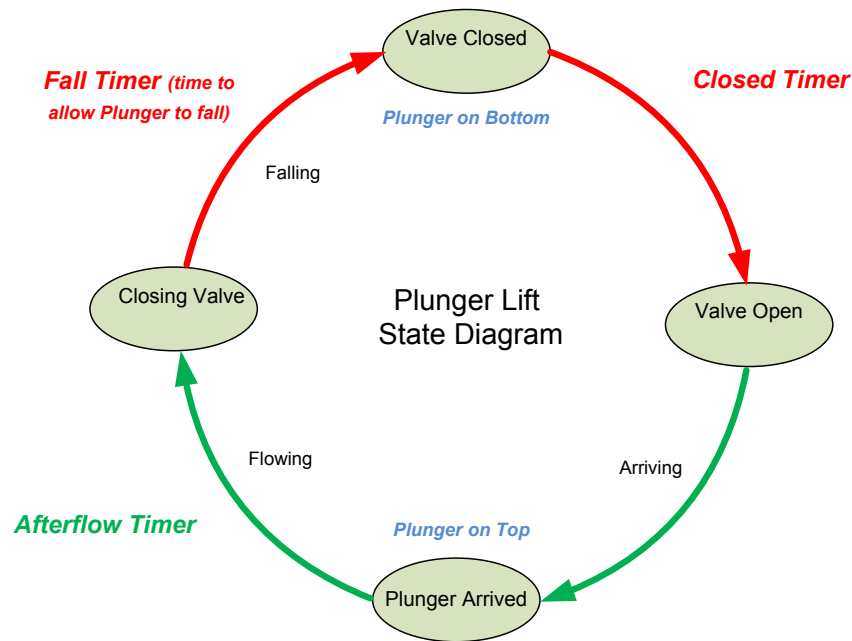
Figure 3 Plunger States

2.2 Assumptions

This particular example makes the following installation assumptions:

– A single upstream production valve (pneumatic/spring) is used.

– The production valve (pneumatic valve) will close on a system failure.(Failed State)= 4 consecutive non-arrivals of the plunger

– A Dual 12VDC 2-way solenoid valve is used to control the production valve. This is a control valve that uses a pressurized air supply to drive the production valve open and closed.

– An XFCG4 flow computer will interface to the 12VDC 2-way solenoid valve through the on-board Digital Outputs (DO1 > Open, DO2 > close) and use the on-board Pulse Input (PI1) for Plunger Arrival Switch (see Connect Components wiring section).

– An XFCG4 will be used to run the Plunger Application.

– This example will incorporate an arrival sensor and a plunger.

– The main production valve will *open* when following occurs; Plunger fall timer expires(25 min) + Closed timer expires(allows for bottom press to build,10min)

– The main production valve will *close* when the following occurs; Plunger arrival time (estimated 8 min) + Afterflow time (5 min) conditions have transpired.

– Well depth is 5,000 feet using 2⅜ inch tubing (1.998 I.D.). It is estimated that the plunger will take approximately 25 minutes to fall under normal loading conditions. This estimated "fall time" can be determined by calculating the depth of the well divided by 200 (ft. /min). {5000/200=25}

– "Optimization" or "Tuning" will not be an option in this "Timer only" Scenario.
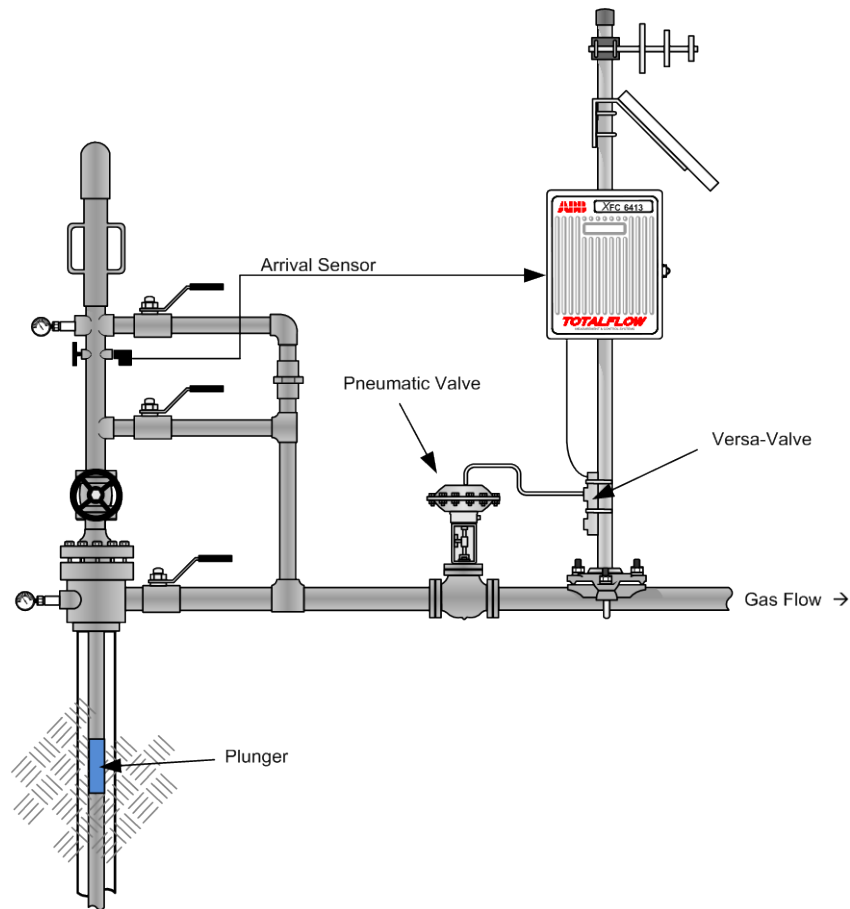
Figure 4 Plunger "Timer" site

2.3 Connect Components (wiring)

FYI

The wiring of the valve and plunger arrival switch depends on the X-Series device used and whether these are direct connections (onboard) or use extension modules. Wiring terminations should always be performed with the power off in the device.

1) The example used in this basic configuration case and shown in Figure (2-3) illustrates the connections required to use an XFC to control a single 2-way solenoid production valve with input from the plunger arrival switch. The diagram for this scenario shows direct connections to the board.

2) Connect the valve to the XFC's digital ouputs (DO1/DO2)

3) If deriving power from the XFC board connect the valve to J4- Pin2.

4) Connect the Plunger arrival switch on the XFC board on Pulse Input 1 (PI1)

5) After completing connections, turn on the power on the device

6) Verify power on sequence is correct, etc

7) Verify the arrival switch and valve I/O connections in the following procedures
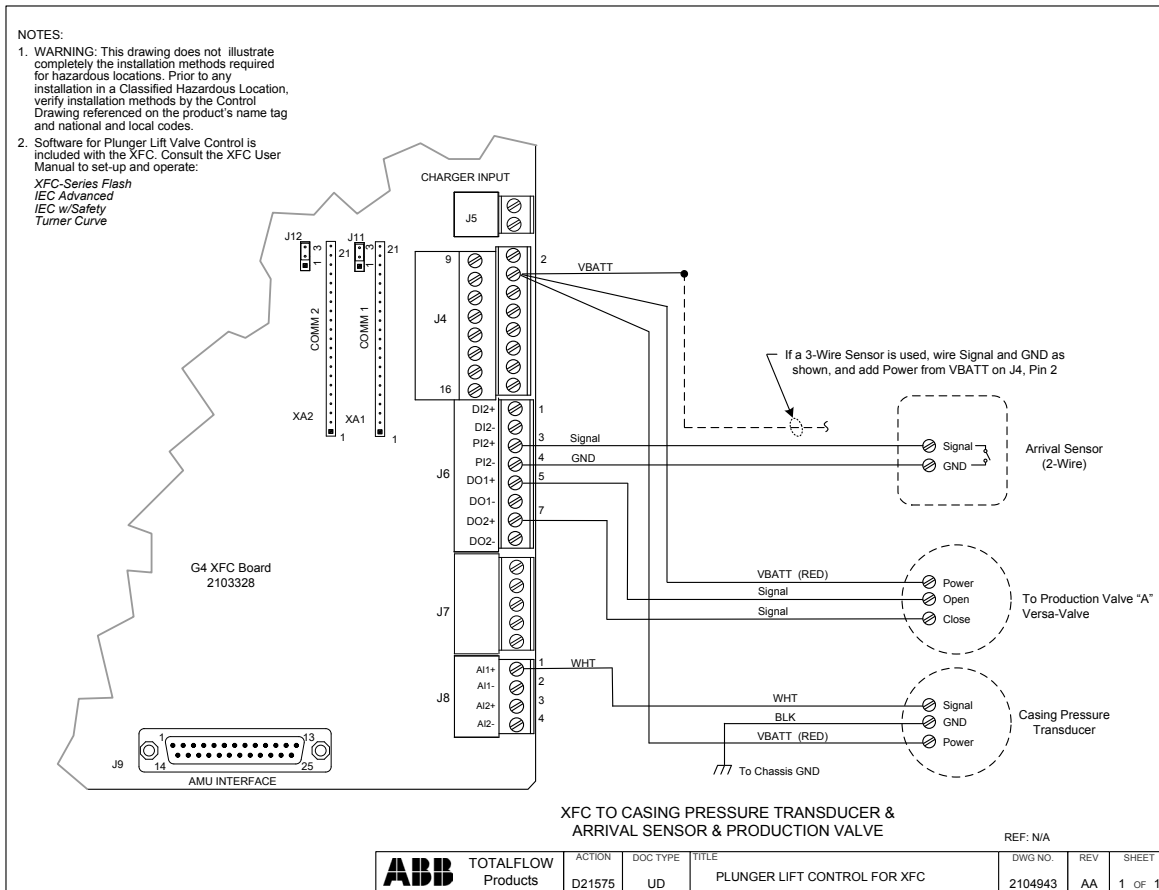
Figure 5 Plunger I/O wiring

2.4 Connect using PCCU

Verify you are able to connect with the device using PCCU and change view to prepare for configuration.

1) Connect laptop with PCCU software to the device.

2) Click the "Entry" button on the top menu bar and verify PCCU establishes a connection with the device.

3) Click on "View" at the top menu, and then choose "Expert" from the drop down list.
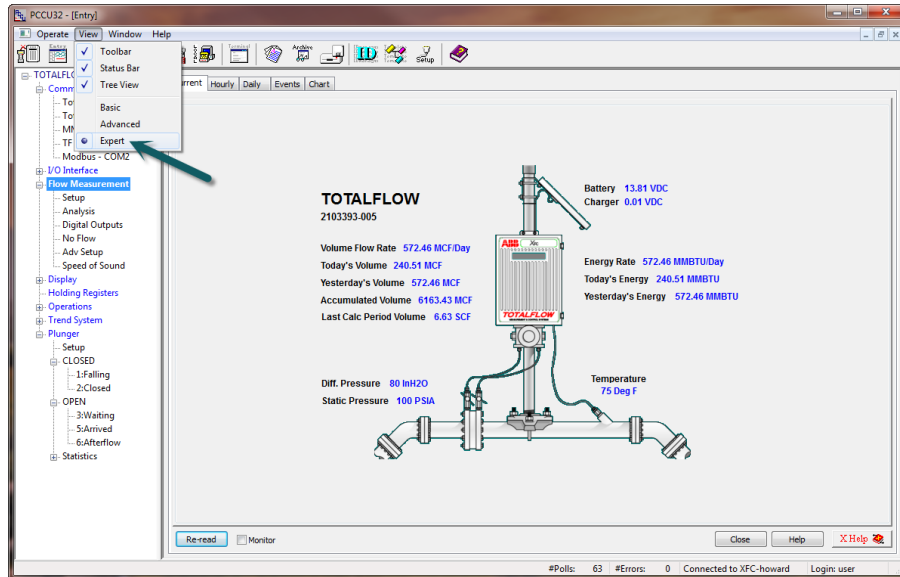
Figure 6 Plunger View Setup

2.5 Add the Plunger Application

Add the plunger application to begin configuration. The application is added by completing the following steps.

1) Click on the station name (top node on the tree view on the left). If this is a new installation the name is "TOTALFLOW"

2) Go to the Applications tab

3) Click "Add Application"

4) Choose "Plunger Control" from the drop down menu (the slot number is chosen automatically, the Plunger slot # is 121).

5) Click send to save.

6) Click Re-read to verify the application has been added in the slot indicated
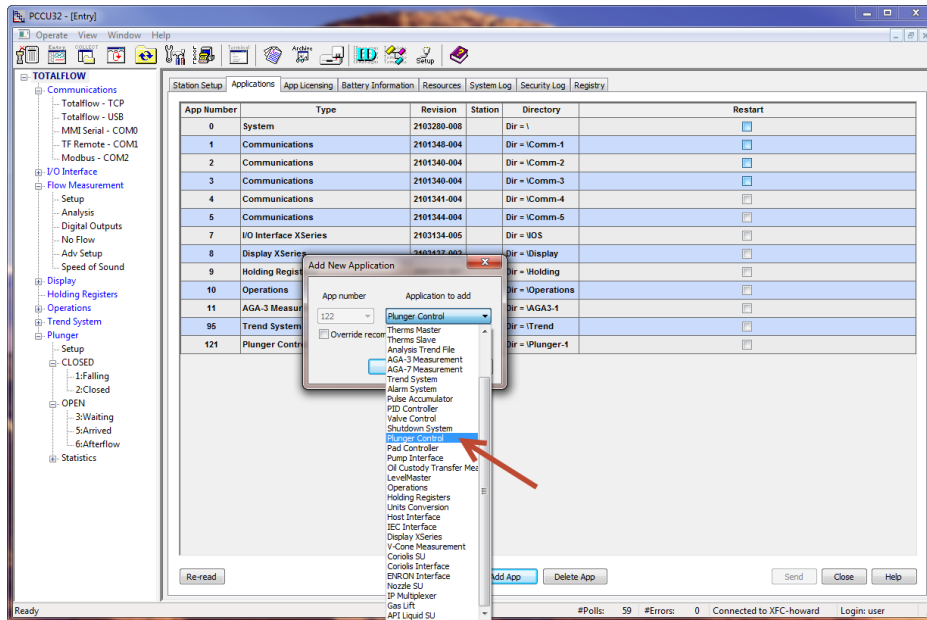
Figure 7 Add Plunger App

2.6 Plunger General Setup

The "General Setup" provides us a way to turn the Plunger App and Optimization on and off. The following steps are provided.

1) Go to Plunger>Setup>General Setup and "Disable" Plunger Control. We do not want the Plunger App to run until we have it set up completely.

2) Select "Disable" for Optimization. Until we have Plunger App and the associated Optimization (Tuning) parameters set up we need this feature disabled.
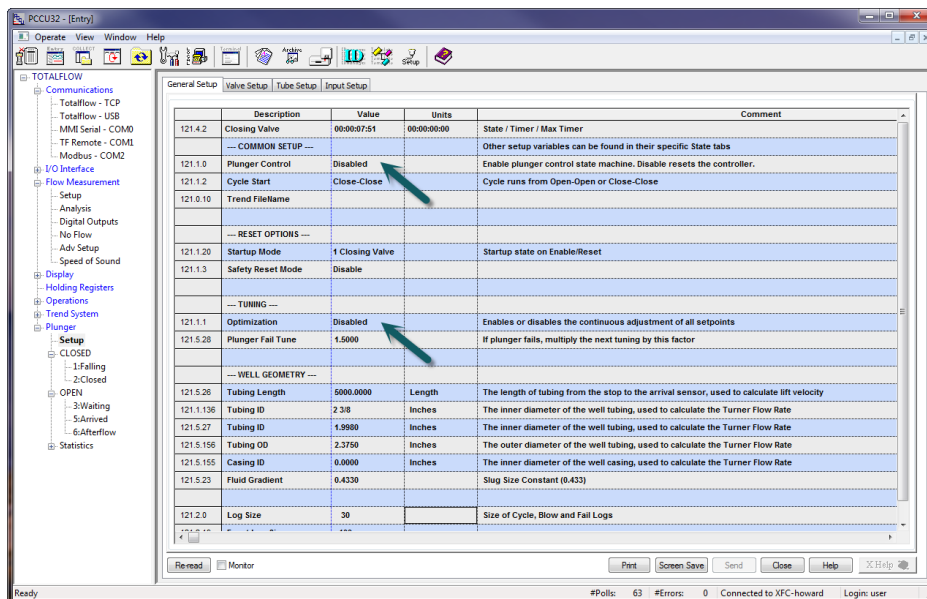
Figure 8 General Setup

2.7 Plunger Valve Setup

The "Valve Setup" will provide for necessary setup surrounding our production valve. The following steps are provided concerning the valve setup.

1) Go to Plunger>Setup>Valve Setup and verify that the "Valve Position" value field is set for "Upstream". This implies that the valve is *upstream* from the point at which we are taking the "line pressure" reading on the measurement tube.

2) "Valve Time Limit" needs to have a value of "5" entered. This is the time in seconds that the Digital Output will energize while *manually* operating the valve.

3) "Main Valve Type" allows for the type of outputs used for the valve. Enter "Latch-Two output" for our scenario. This means that two Digital Outputs will be used to operate the valve and that those outputs will remain "latched" or "on" till command is given to turn off.

4) "Main Open DO" value field should be set as "7.2.4".This represents the Digital Output # 1. "Main Close DO" value field should be set as "7.2.5". This would represent assignment of Digital Output # 2.

Figure 9 Valve Setup

2.8 Plunger Input Setup

The "Input Setup" will provide the Plunger Application necessary information for register location of the plunger arrival switch. The following is provided concerning this setup.

1) Go to Plunger>Setup>Input Setup and verify that "Detection Type" is set up for "Plunger".

2) Plunger arrival switch location needs to be established by entering "7.0.104" in the Register field in "Plunger Arrival PI". This will confirm use of Pulse Input # 1 for the arrival switch.
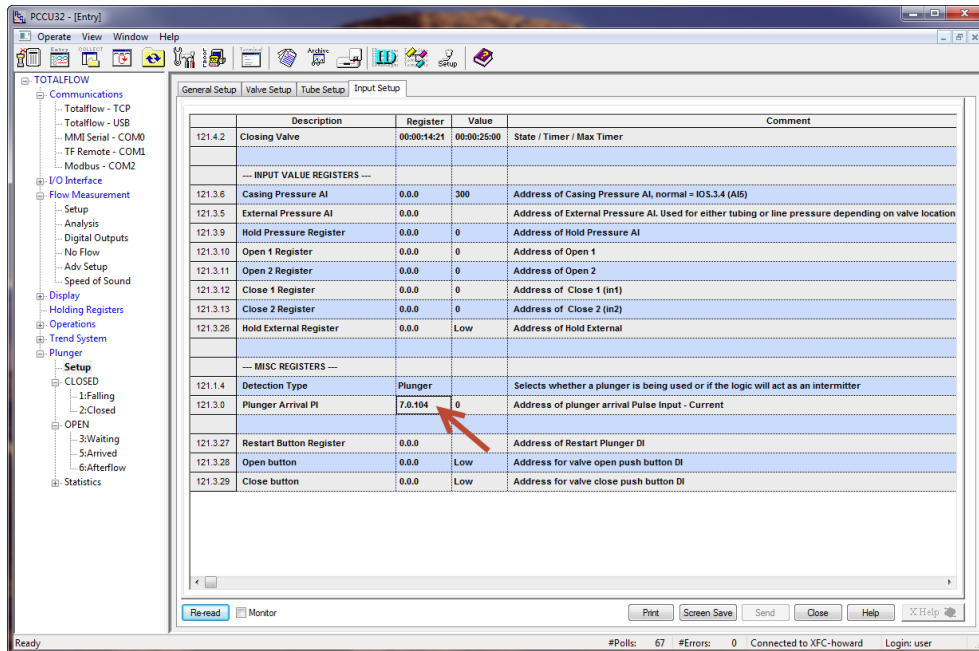
Figure 10 Input Setup

2.9 Verify (Test) I/O Operation

2.9.1 Test Arrival Switch

The true test of the Plunger arrival switch is confirmed by an indication by the plunger application that the plunger arrived during a normal plunger run. However, the user can perform a simple test to determine if the switch is working correctly prior to an actual plunger run by performing the following steps.

1) Verify that "Plunger Control" is in "Disable" mode in Plunger>General Setup.

2) Proceed to "I/O Interface" in the tree view and view the "Total Pulse Count" value field.

3) Using something metallic, a crescent wrench or valve handle, swipe up and down across the back of the switch to simulate a plunger arriving.

4) If the switch is good, "PI1" under "Total Pulse Count", should indicate an increase in pulse count.

2.9.2 Test valve output

In this scenario we will operate the Production valve from Digital Output 1 (open) and Digital output 2 (close) respectively. Use the following testing procedure to test the valve "open" and "closed".

1) Verify that "Plunger Control" is in "Manual" mode in Plunger>General Setup.

2) Go to Plunger>Setup>Valve Setup. One at a time select "Force OPEN" and then "Force CLOSE" and verify valve action.

3) Return Plunger mode to "Disable" upon completion of testing

2.10 Configure Plunger

The following steps will give the user specific instructions on setting up the Plunger "Timer" scenario using PCCU software.

2.10.1 Configure Plunger "Closed" condition

Now we are ready to setup our "Closed" conditions (valve is closed) that need to be met in order for the valve to OPEN. To begin,

1) Go to Plunger>CLOSED>1: Falling, and "ENABLE" in the tree view window.

2) Enter the "Plunger Fall Delay" time in the "Fall Timer" location. Our fall time in this scenario is 25 minutes.
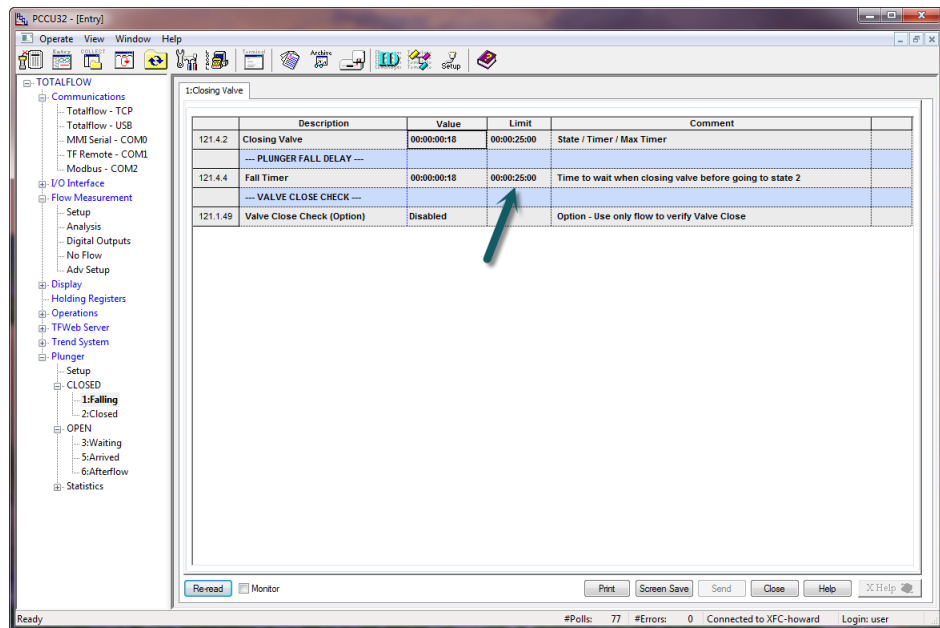
Figure 11 Fall Timer

3) Go to Plunger>CLOSED>2: Closed, and "Enable" the Closed Timer.

4) Enter 10 minutes in the "Closed Timer" field location. This will be the time we are allowing for the well to build pressure *after* plunger fall delay has occurred.
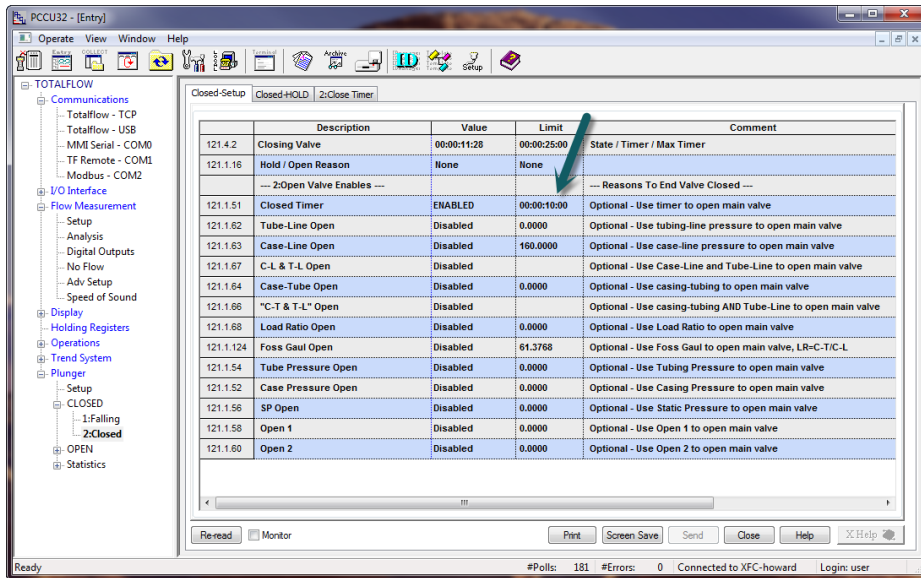
Figure 12 Closed Timer

2.10.2 Configure Plunger "OPEN" condition

1) Go to Plunger>OPEN>6:Afterflow, and "Enable" the "AfterFlow Timer Close (Option).

2) Set the "AfterFlow Timer Close (Option)" to 5 minutes. After the plunger arrives and this timer expires, the valve will CLOSE.
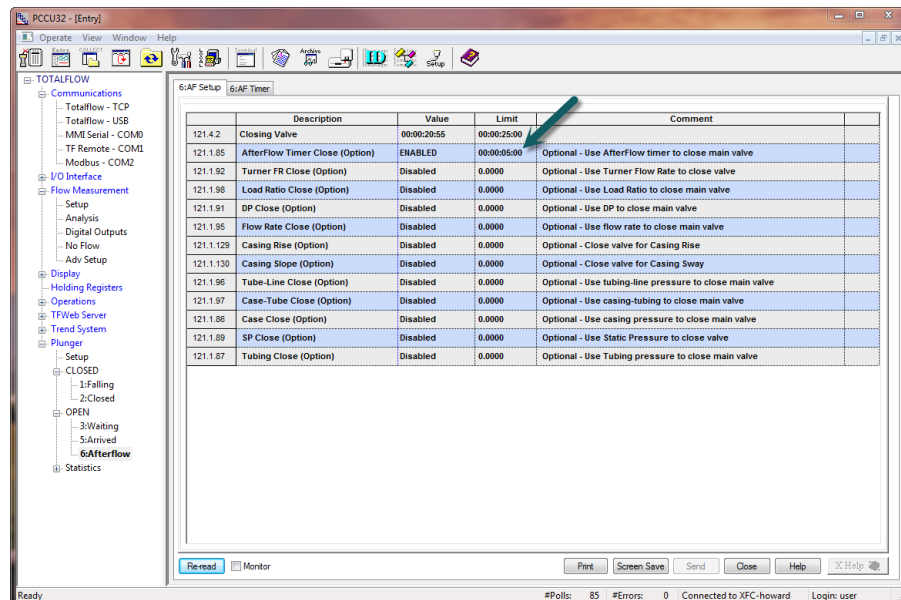
Figure 13 Afterflow Timer

2.10.3 Set the Plunger maximum arrival time

The "Max Arrival Time Limit" needs to be set in order for us to determine if a plunger fails to arrive, and therefore the plunger application will be in a "Failed" state which results in halting plunger control.

1) Go to Plunger > OPEN > 3:Waiting,

2) Set the time limit to a value greater than the longest expected plunger arrival time. In our sceneario, we will assume this value at 40 minutes.

3) Set the "Fail Limit" to a value of "3", which will then allow the plunger application to go into the "Failed" state after 4 continuous late arrivals.
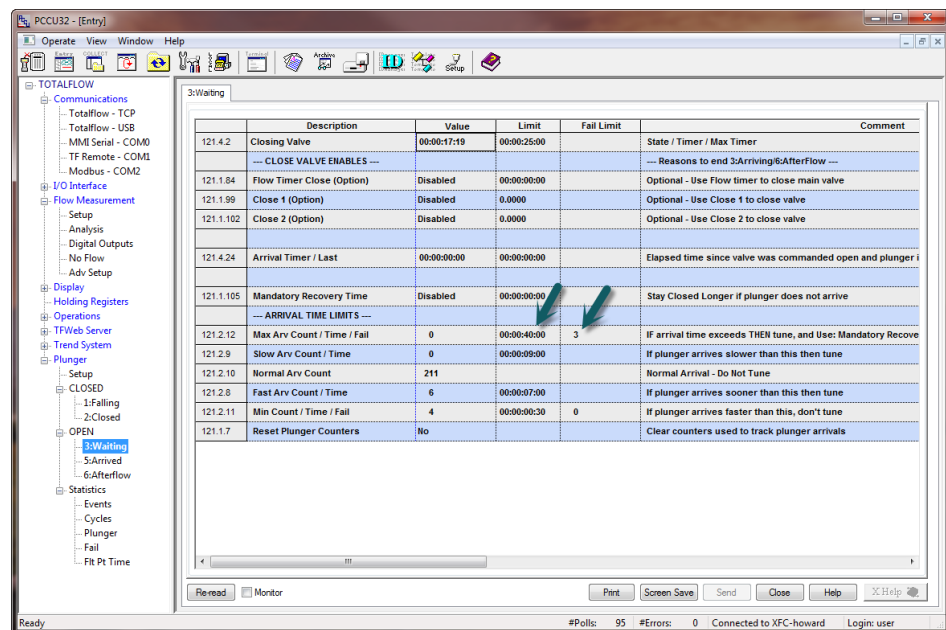
Figure 14 Max Arrival Time

2.10.4 Enable the Plunger Application

The final task in completing this scenario is to "Enable " the plunger application. To accomplish this:

1) Go to Plunger > Setup > General Setup, and select "Enabled" in the Plunger control value field. You should now see the plunger application begin in the "Closing Valve" state with timer counting up.

2) Select "Monitor" at the bottom left of your PCCU screen to have the screen update.

Figure 15 Enable Plunger App

2.10.5 View Plunger Application activity

To view activity of the Plunger application as it proceeds through the different states and to watch timers, use the "Summary View" tab. It can be located by selecting "Plunger" in the tree view.
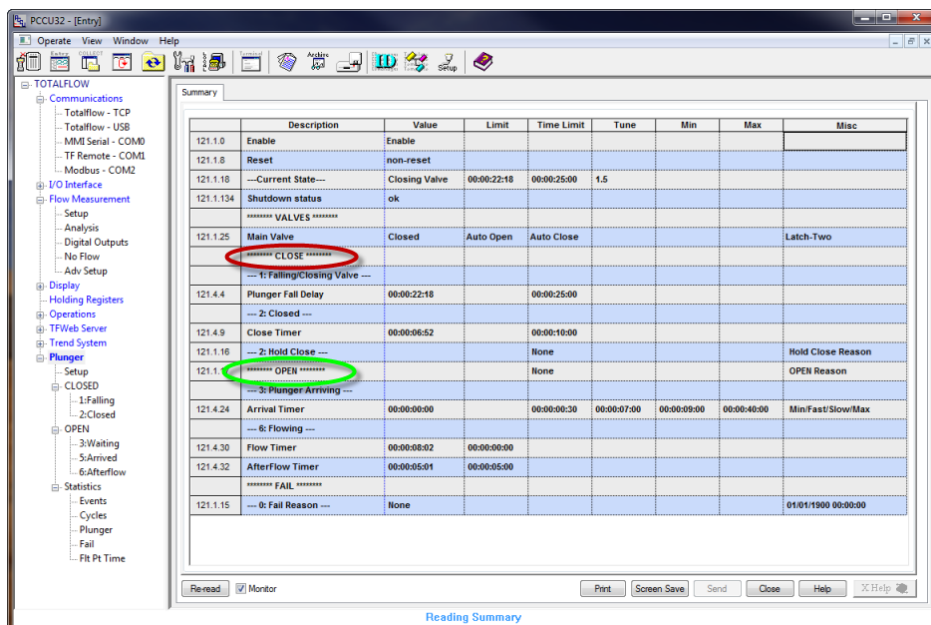
Figure 16 Summary View

3.0 Scenario 2- Plunger using "Casing-Line (Open) Flowrate (Close)

3.1 Casing-Line Scenario Overview

In this scenario we will use "Casing Pressure – Line Pressure" as the determining factor within the Plunger Application to "Open" and use "Flowrate" to determine when to "Close" the production valve. We will have the ability to "Tune" the open and closed times of the valve for well optimization in this scenario. The plunger application will also interface with the AGA-3 application which will provide Line Pressure and Flow rate values. In addition, we will need the "Plunger Arrival Switch" input (Pulse input) to sense plunger arrival, Digital Outputs 1 and 2 to "open" and "close" the production valve and a Casing Pressure transmitter to determine our casing pressure. The diagram listed shows the different "States" the Plunger Application will travel through in this scenario.
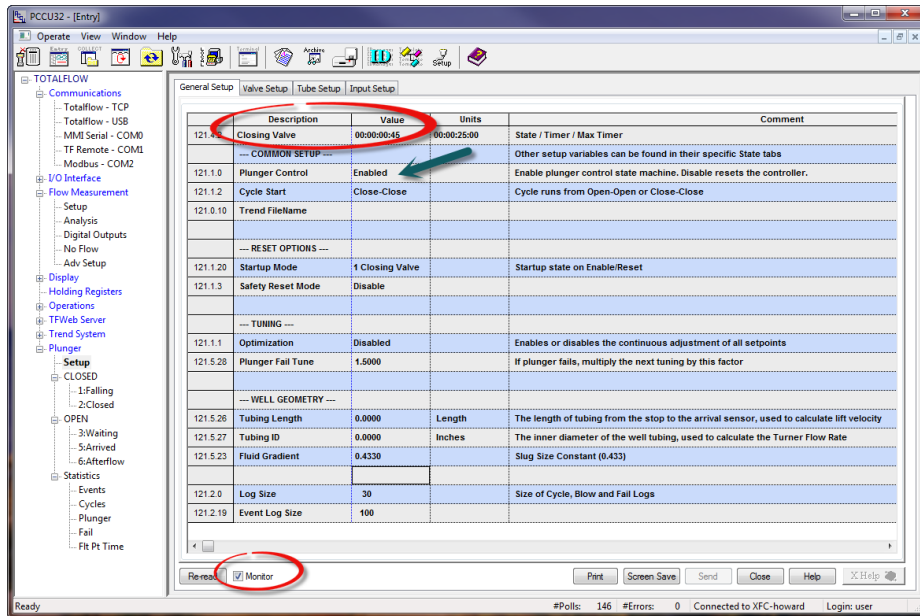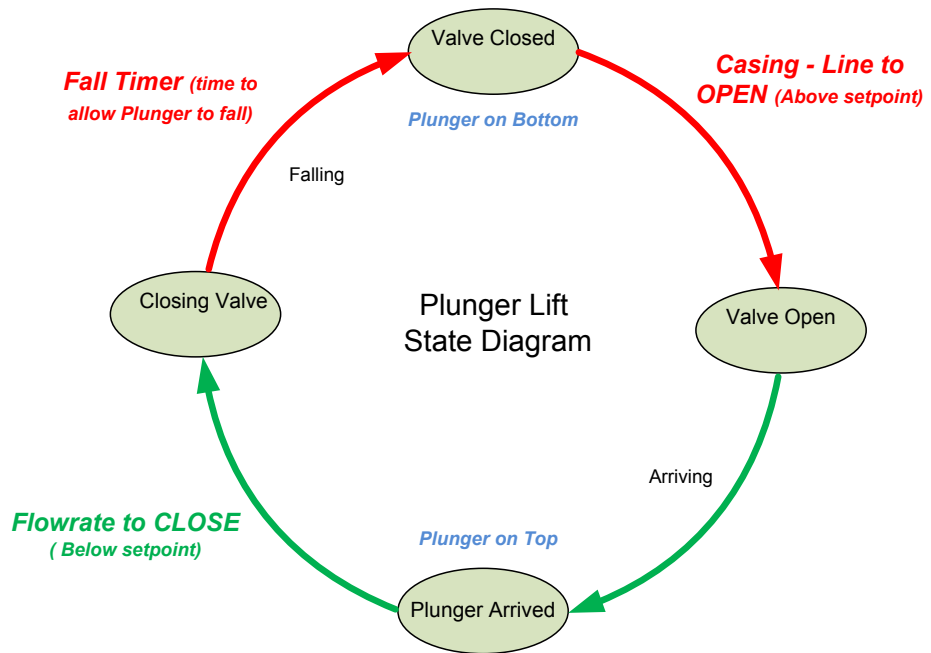

Figure 17 Plunger States

3.2 Assumptions

This particular example makes the following installation assumptions:

- A single upstream production valve (pneumatic/spring) is used.
- The production valve (pneumatic valve) will close on a system failure.(Failed State)= 4 consecutive non-arrivals of the plunger
- A Dual 12VDC 2-way solenoid valve is used to control the production valve. This is a control valve that uses a pressurized air supply to drive the production valve open and closed.
- An XFCG4 flow computer will interface to the 12VDC 2-way solenoid valve through the on-board Digital Outputs (DO1 > Open, DO2 > close) and use the

on-board Pulse Input (PI1) for Plunger Arrival Switch and use Analog Input # 1 for Casing Pressure (see Connect Components wiring section).

– An XFCG4 will be used to run the Plunger Application and the AGA-3 application.

– The main production valve will *open* when following occurs; Plunger fall timer expires(25 min) then, Casing Pressure – Line Pressure set point is exceeded for a minimum of 1 minute.

– The main production valve will *close* when the following occurs; Plunger arrival time (estimated 8 min) then, Flowrate is below set point for a minimum of 1 minute.

– Well depth is assumed to be 5,000 feet using 2⅜ inch tubing (1.998 I.D.). It is estimated that the plunger will take approximately 25 minutes to fall under normal loading conditions.

– "Optimization" or "Tuning" will be utilized in this Scenario.
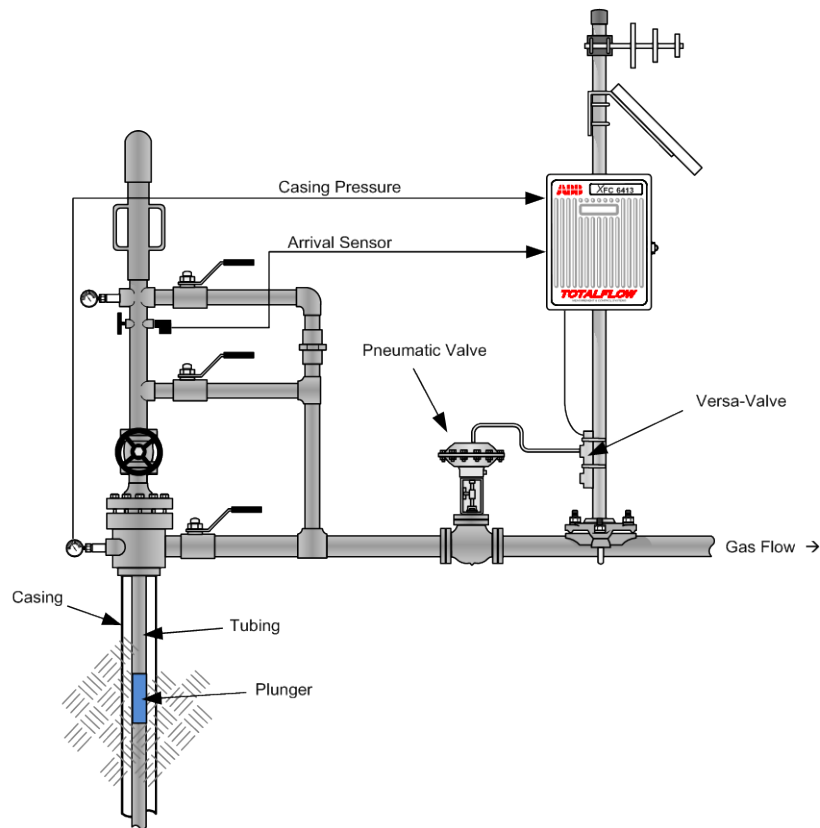
Figure 18 Plunger Site

3.3 Connect Components (wiring)

FYI

The wiring of the valve and plunger arrival switch depends on the XSeries device used and whether these are direct connections (onboard) or use extension modules. Wiring terminations should always be performed with the power off in the device.

1) The example used in this basic configuration case and shown in Figure (3-3) illustrates the connections required to use an XFC to control a single 2-way solenoid production valve with input from the plunger arrival switch. The diagram for this scenario shows direct connections to the board.

2) Connect the valve to the XFC's digital ouputs (DO1/DO2)

3) If deriving power from the XFC board connect the valve to J4- Pin2.

4) Connect the Plunger arrival switch on the XFC board on Pulse Input 1   (PI1)

5) Connect Casing Pressure transmitter on the XFC Board on Analog Input # 1 (AI1).

6) After completing connections, turn on the power on the device

7) Verify power on sequence is correct, etc

8) Verify the arrival switch and valve I/O connections in the following procedures
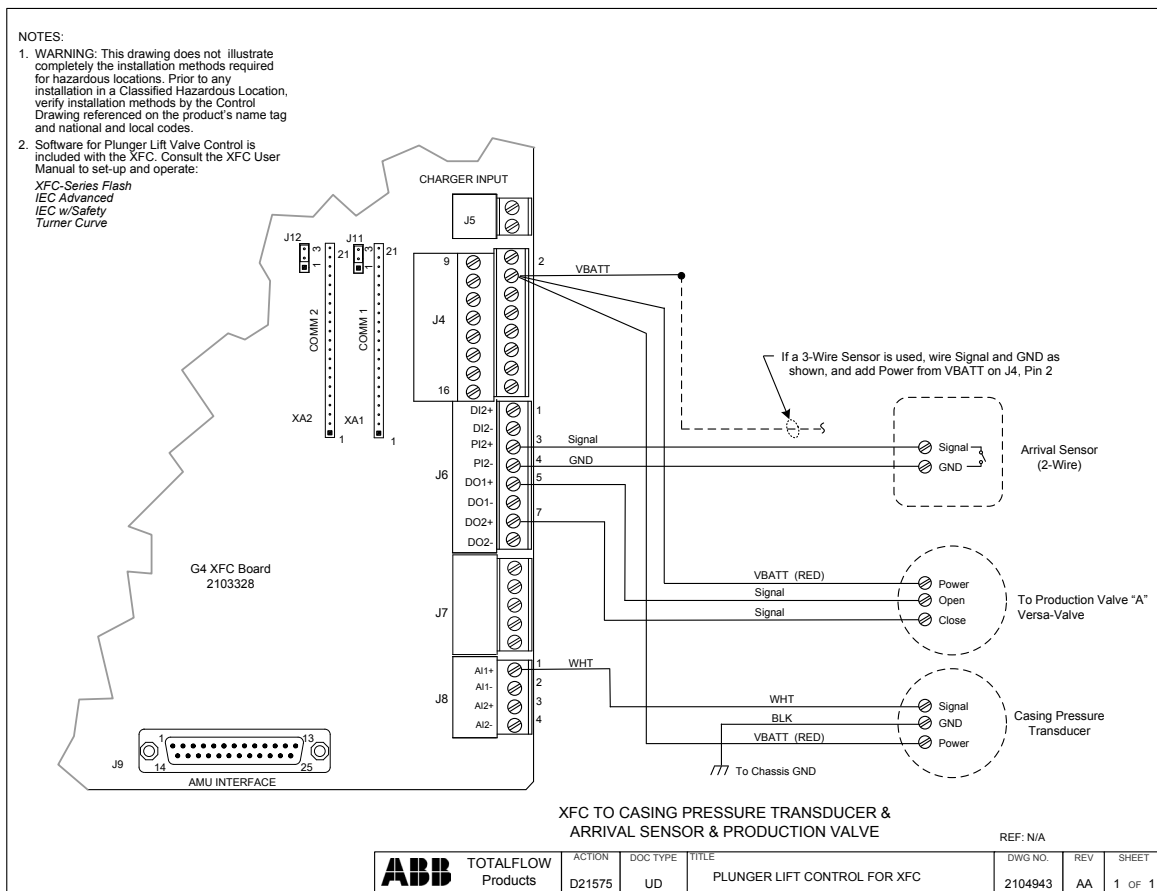
Figure 19 Plunger I/O wiring

3.4 Connect using PCCU

Verify you are able to connect with the device using PCCU and change view to prepare for configuration.

1) Connect laptop with PCCU software to the device.

2) Click the "Entry" button on the top menu bar and verify PCCU establishes a connection with the device.

3) Click on "View" at the top menu, and then choose "Expert" from the drop down list.
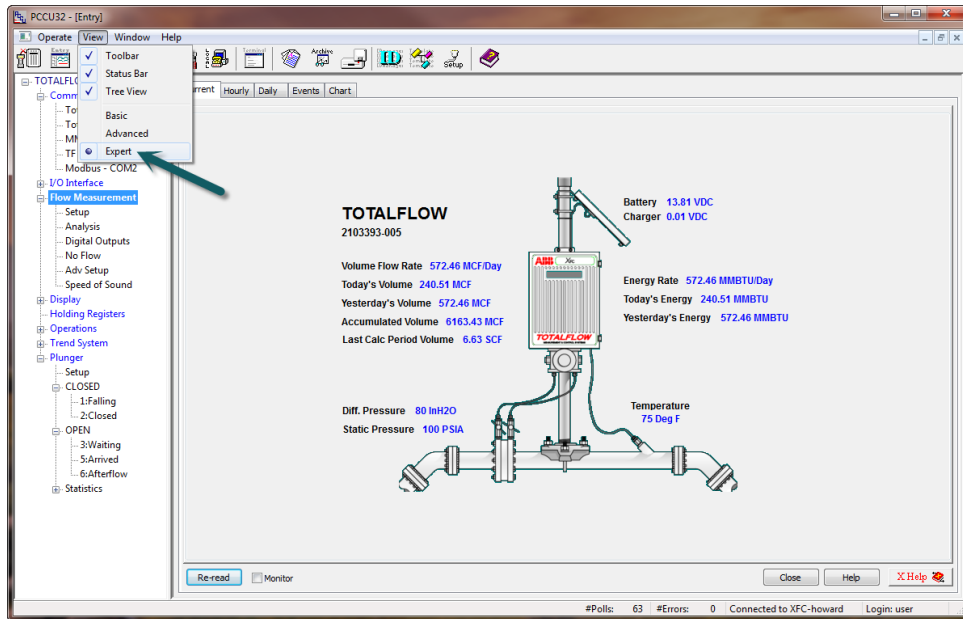
Figure 20 Plunger View Setup

3.5 Add the Plunger Application

Add the plunger application to begin configuration. The application is added by completing the following steps.

1) Click on the station name (top node on the tree view on the left). If this is a new installation the name is "TOTALFLOW"

2) Go to the Applications tab

3) Click "Add Application"

4) Choose Plunger Lift from the drop down menu (the slot number is chosen automatically, the Plunger slot # is 121).

5) Click send to save.

6) Click Re-read to verify the application has been added in the slot indicated
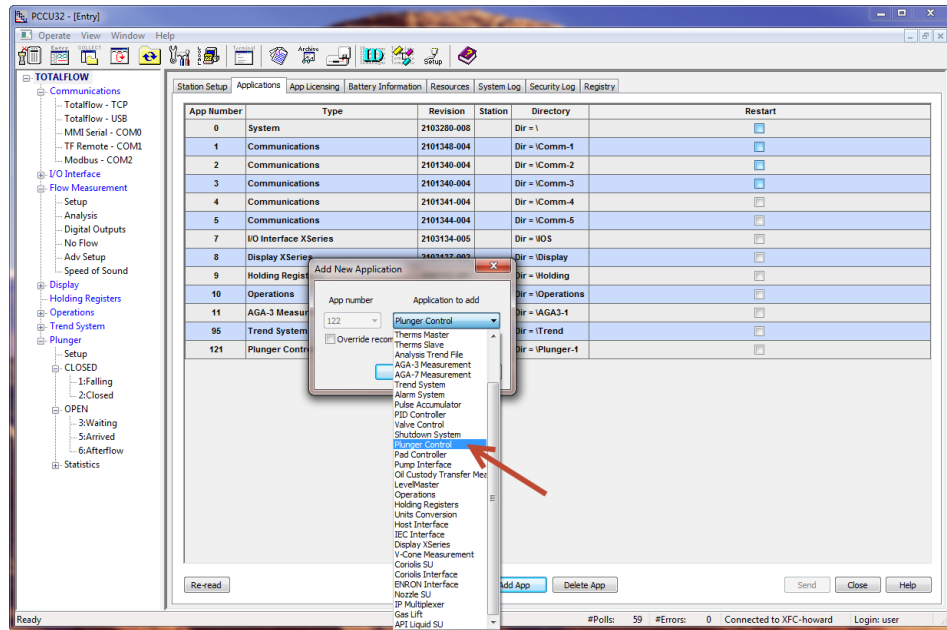
Figure 21 Add Plunger App

3.6 Add the AGA-3 Application

Add the AGA-3 application to the configuration. The application should be setup to indicate correct gas Flowrate at the plunger site.

1) Click on the station name (top node on the tree view on the left). If this is a new installation the name is "TOTALFLOW"

2) Go to the Applications tab

3) Click "Add Application"

4) Choose AGA-3 Measurement from the drop down menu (the slot number is chosen automatically, the AGA-3 slot # is 11).

5) Click send to save.

6) Click Re-read to verify the application has been added in the slot indicated

7) On the tree view, expand the station node (TOTALFLOW) and go to Flow Measurement >Setup>General Setup Tab

8) Verify that the setup is correct on all tabs within "Flow Measurement".

3.7 Plunger General Setup

The "General Setup" provides us a way to turn the Plunger App and Optimization on and off. The following steps are provided.

1) Go to Plunger>Setup>General Setup and "Disable" Plunger Control. We do not want the Plunger App to run until we have it set up completely.

2) Select "Disable" for Optimization. Until we have Plunger App and the associated Optimization (Tuning) parameters set up we need this feature disabled.
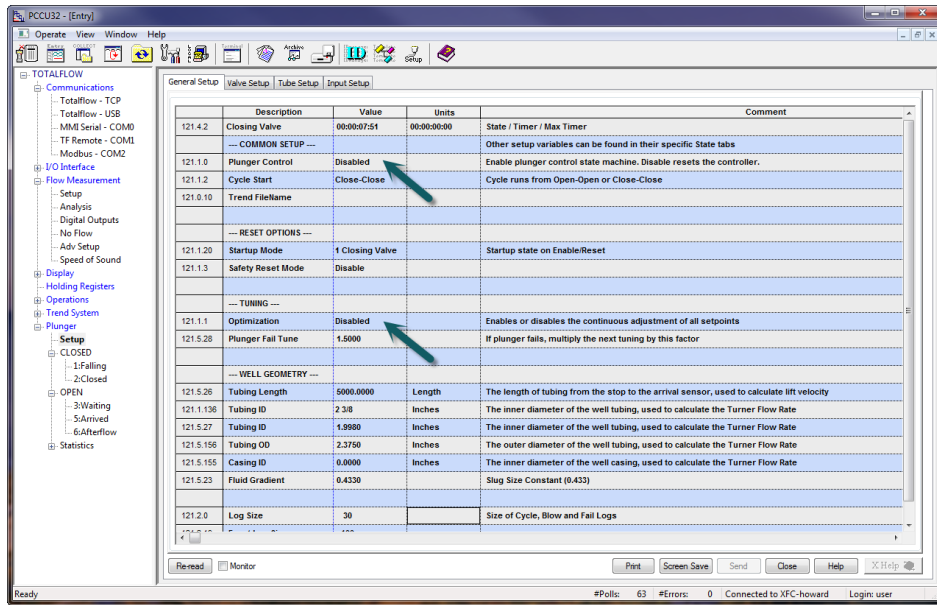
Figure 22 General Setup

3.8 Plunger Valve Setup

The "Valve Setup" will provide for necessary setup surrounding our production valve. The following steps are provided concerning the valve setup.

1) Go to Plunger>Setup>Valve Setup and verify that the "Valve Position" value field is set for "Upstream". This implies that the valve is *upstream* from the point at which we are taking the "line pressure" reading on the measurement tube.

2) "Valve Time Limit" needs to have a value of "5" entered. This is the time in seconds that the Digital Output will energize while *manually* operating the valve.

3) "Main Valve Type" allows for the type of outputs used for the valve. Enter "Latch-Two output" for our scenario. This means that two Digital Outputs will be used to operate the valve and that those outputs will remain "latched" or "on" till command is given to turn off.

4) "Main Open DO" value field should be set as "7.2.4".This represents the Digital Output # 1. "Main Close DO" value field should be set as "7.2.5". This would represent assignment of Digital Output # 2.

Figure 23 Valve Setup

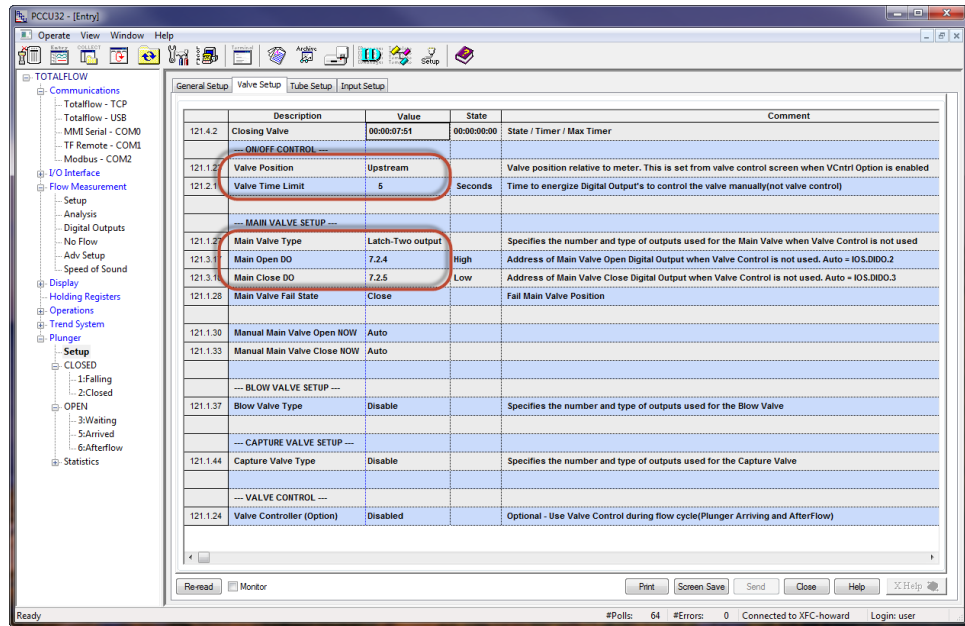## 3.9 Plunger Tube Setup

The "Tube Setup" will provide the Plunger Application necessary flow information required. The following is provided concerning the Tube setup.

1) Go to Plunger>Setup>Tube Setup and verify that the "Tube App" value field is set for "11". This verifies that our AGA-3 measurement tube is running in Application slot # 11.
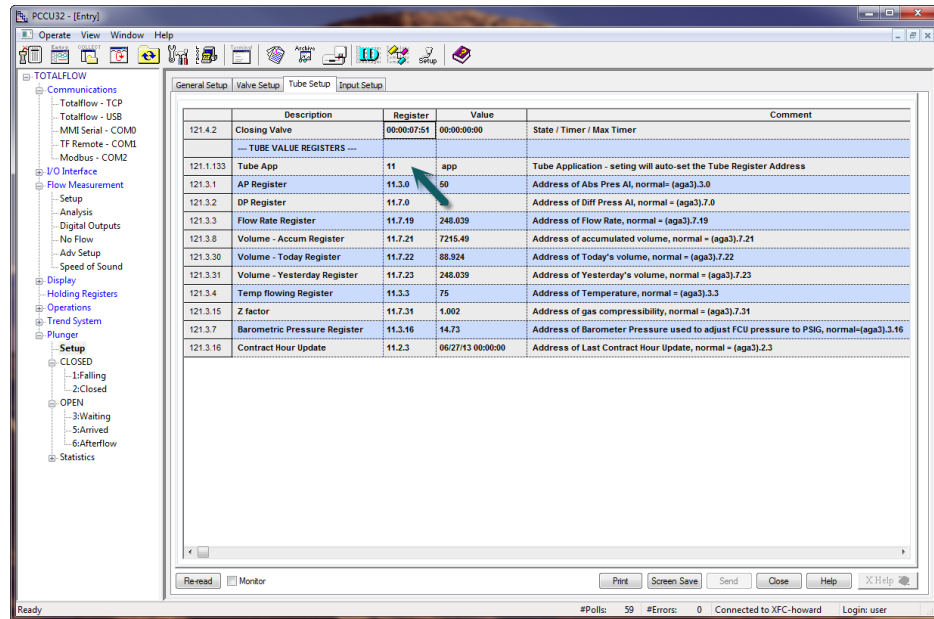

Figure 24 Tube Setup

3.10 Plunger Input Setup

The "Input Setup" will provide the Plunger Application necessary information for register locations of the Casing pressure transmitter and the plunger arrival switch. The following is provided concerning this setup.

1) Go to Plunger>Setup>Input Setup and verify that the "Casing Pressure AI" value field is set for "7.4.3". This selects Analog Input # 1 will be used for casing pressure.

2) Confirm that "Detection Type" is set up for "Plunger".

3) Plunger arrival switch location needs to be established by entering "7.0.104" in the Register field in "Plunger Arrival PI". This will confirm use of Pulse Input # 1 for the arrival switch.
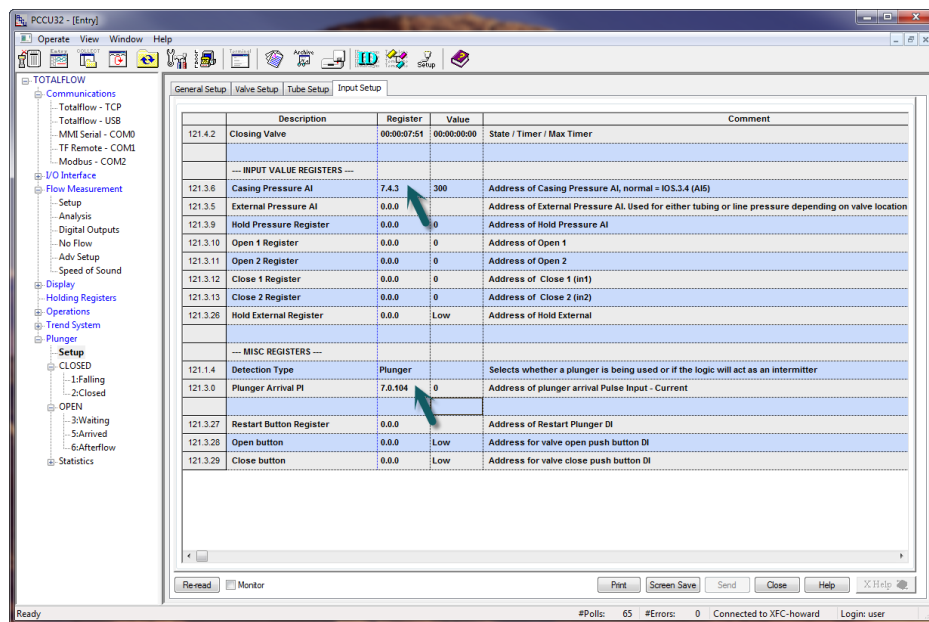
Figure 25 Input Setup

3.11 Verify (Test) I/O Operation

3.11.1 Test Arrival Switch

The true test of the Plunger arrival switch is confirmed by an indication by the plunger application that the plunger arrived during a normal plunger run. However, the user can perform a simple test to determine if the switch is working correctly prior to an actual plunger run by performing the following steps.

1) Verify that "Plunger Control" is in "Disable" mode in Plunger>General Setup.

2) Proceed to I/O Interface>Digital Inputs in the tree view and view the "Total Pulse Count" value field in PI1.

3) Using something metallic, a crescent wrench or valve handle, swipe up and down across the back of the switch to simulate a plunger arriving.

4) If the switch is working properly, "PI1" under "Total Pulse Count", should indicate an increase in pulse count.

3.11.2 **Test valve output**

In this scenario we will operate the Production valve from Digital Output 1 (open) and Digital output 2 (close) respectively. Use the following testing procedure to test the valve "open" and "closed".

1) Verify that "Plunger Control" is in "Manual" mode in Plunger>General Setup.

2) Go to Plunger>Setup>Valve Setup. One at a time select "Force OPEN" and then "Force CLOSE" and verify valve action.

3) Return Plunger mode to "Disable" upon completion of testing

3.11.3 **Test Casing Pressure input**

The Casing pressure input value will be read on the XFC on-board Analog Input (AI1).

1) Go to I/O Interface>Analog Inputs>AI1

2) Verify that "Value" indicates the current Casing Pressure expected.

3.11.4 **Test AGA-3 Measurement Values**

Flowrate and line pressure are required inputs to the Plunger Application in this scenario. Use the following step to verify values.

1) Go to Flow Measurement>Current, and verify that "Volume Flow Rate" and "Static Pressure" (Line Pressure) are correct per your gas flow conditions.

3.12 Configure Plunger

The following steps will give the user specific instructions on setting up the Plunger "Casing-Line" scenario using PCCU software.

3.12.1 **Configure Plunger "Closed" condition**

Now we are ready to setup our "Closed" conditions (valve is closed) that need to be met in order for the valve to OPEN. To begin,

1) Go to Plunger>CLOSED>1: Falling, and "ENABLE" in the tree view window.

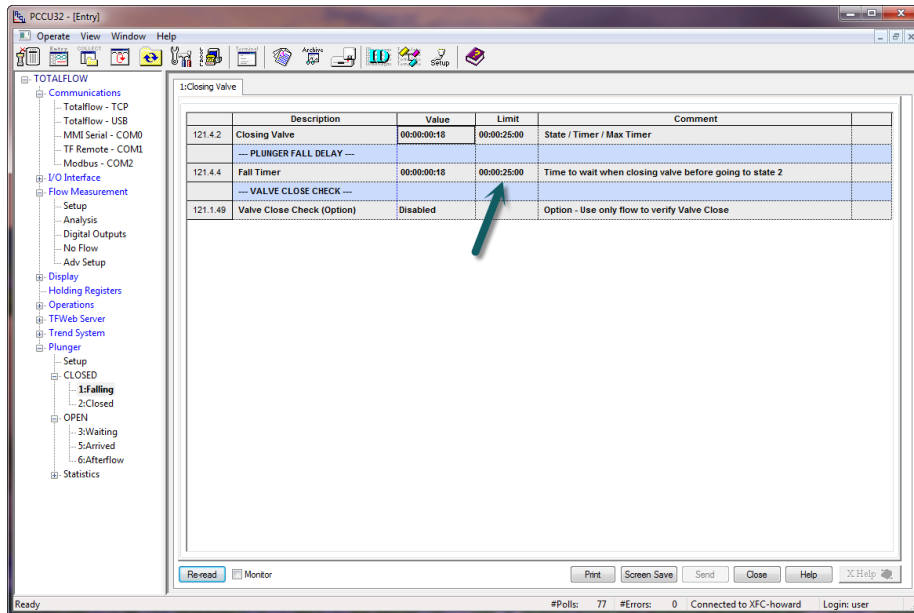2) Enter the "Plunger Fall Delay" time in the "Fall Timer" location. Our fall time in this scenario is 25 minutes.

Figure 26 Fall Timer

3) Go to Plunger>CLOSED>2: Closed, and "Enable" the "Case-Line Open".

4) Enter a value of "160" in the "Limit" field location. This will be the set point when exceeded, that the valve will open *after* plunger fall delay has expired.

5) Note: We are given in this scenario that our Casing pressure = 200# and that our Line pressure = 50#. Rule of thumb for a good place to start for determining "Casing-Line" set point is: Casing pressure x 80%= set point
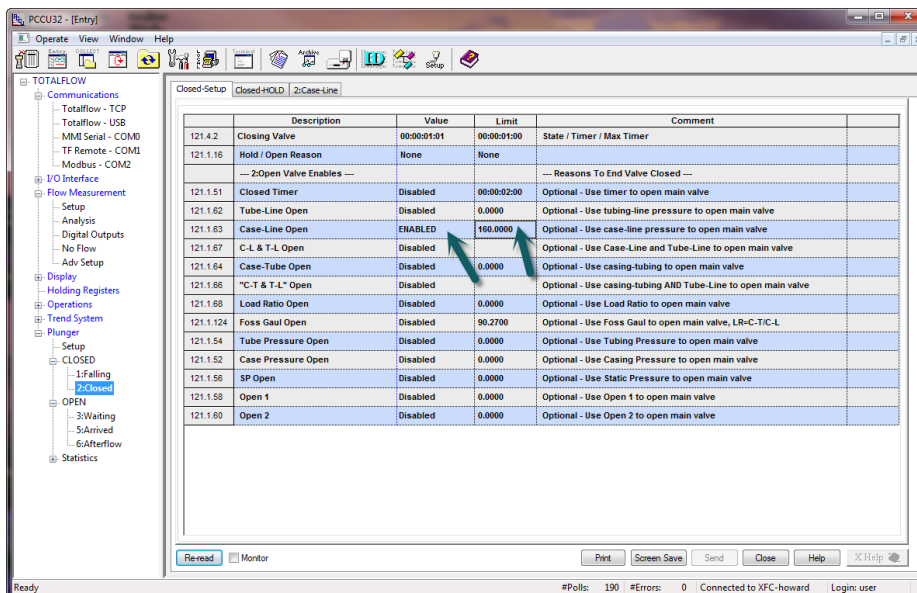
6) Casing pressure (200#) x 80%= 160# (set point)

Figure 27 Casing-Line Setup

3.12.2 **Configure Casing – Line Tuning Parameters**

Plunger Optimization (Tuning)

The goal of "Plunger Control" on a well is to reach a scenario with a minimum "off" time while at the same time allowing that liquids get lifted properly to the surface. This says that we want the well to be shut in just long enough for the plunger to hit the bottom and return again to the surface. To accomplish this, the ABB Totalflow Plunger Application has the ability to "tune" the "Casing-Line" set point (OPEN) as well as "tune" the Flowrate set point (CLOSE) conditions. The user has the capability in the application to set minimum and maximum tuning parameters as well as incremental step change amounts to precisely control the tuning process.

To complete the tuning set up, we need to enter our "Open Tune Amount, Max Tune and Min Tune settings. Use the following steps:

1) "Case-Line Open Tune Amount" will be set with a value of "2". This tuning amount value is determined by using a starting point of 2% of the set point value (160). It is always a good idea to make small changes initially in tuning.

2) "Case-Line Open Max.Tune" value will be entered as "185". This was determined by using a starting point of 15% of the set point (160).

3) "Case-Line Open Min.Tune" value should be set as "135". This was determined by using 15% of the set point (160) as a starting point.
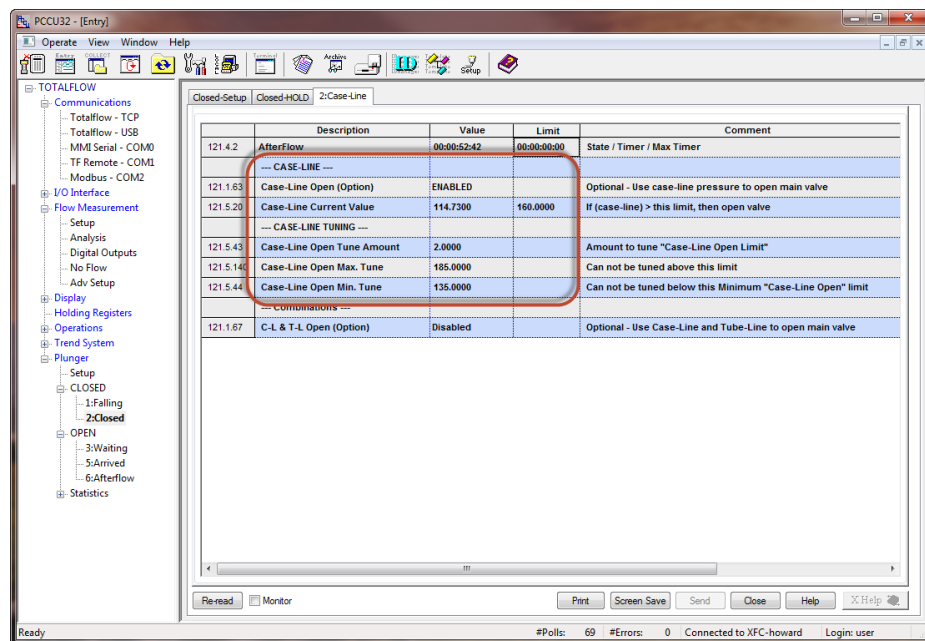

Figure 28 Casing-Line Tuning

3.12.3 **Configure Plunger "OPEN" condition**

Now we are ready to setup our "Open" conditions (valve is open) that need to be met in order for the valve to CLOSE. To begin,

1) Go to Plunger>OPEN> 6:Afterflow>6:AF Setup

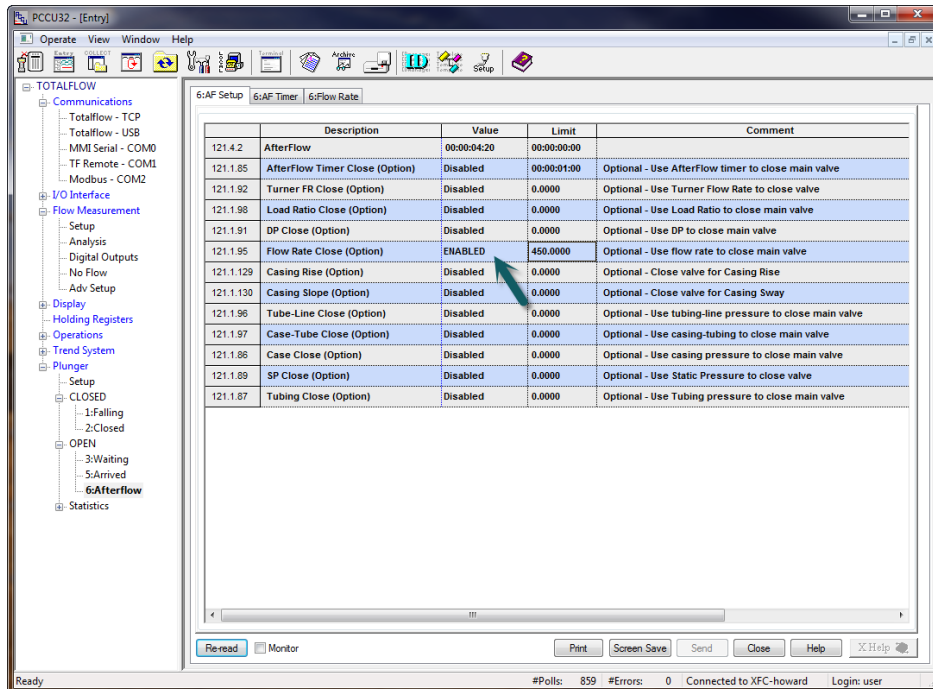2) Set the "Flow Rate Close (Option)" to "Enable".

Figure 29 Flowrate Close Setup

3.12.4 Configure Flowrate Tuning Parameters

To determine the Flowrate set point to **CLOSE** the valve, the user needs to consider the "critical velocity" condition of the well. Critical velocity is generally defined as the minimum gas velocity in the production tubing required to move liquid droplets upward. In this scenario, our flowing tubing pressure is 150 PSIG and the tubing is 2⅜ inch (1.998 I.D.). With this information we are able to use the "Critical Rate Curves" chart (located in the Reference Information section 4.0) to determine a good estimate of our critical velocity which is a Flowrate of 400 mcfd. Use the following steps to set up;

1) Go to Plunger > OPEN >6: Afterflow >6:Flow Rate, and enter "450" in the Limit field. The value of 450 is entered here so as to have the Flowrate shutoff *before* reaching the critical velocity rate of 400 mcfd.

2) Next, we need to enter a value in the "Flow rate Low Timer" field. We will enter a value of "1 minute" in the "Limit" field. With this setting,the Flowrate will now have to remain less than 450 mcfd for a period of 1 Minute for the valve to close.

3) "Flow Rate Limit Tune Amount" needs to be set at a value of "10". This setting determines that the tune amount will be in increments of 10mcfd.

4) "Flow Rate Limit Min.Tune" will be set as "400". This indicates that we will not allow the tuning to adjust below the 400 mcfd set point.

5) "Flow Rate Limit Max.Tune" will be set as "1000" in this scenario. This would indicate that the tuning will not allow adjustment over this limit.
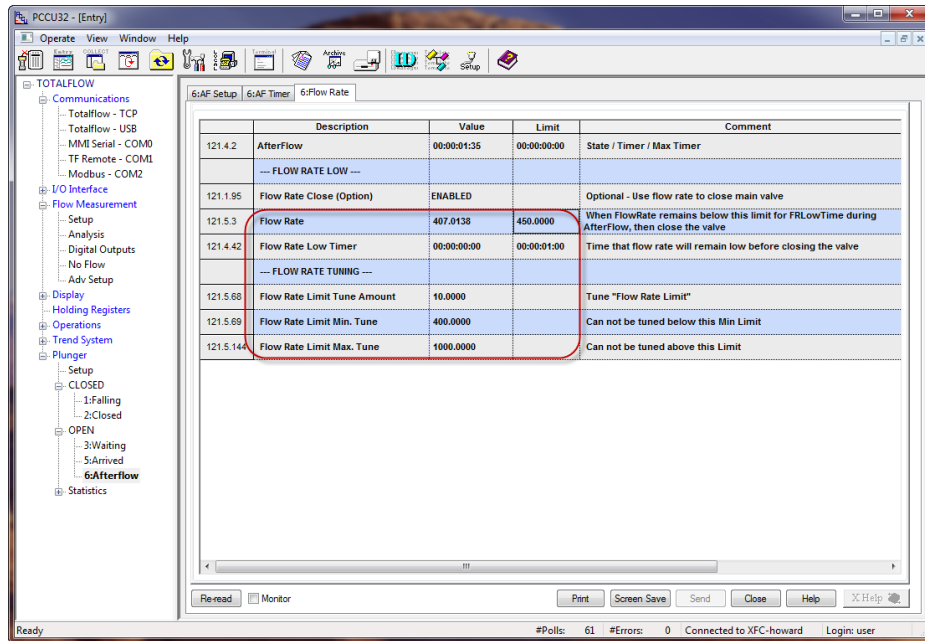
Figure 30 Flowrate Tuning Parameters

3.12.5 **Arrival Time Limits Parameters**

Arrival time limits need to be entered to allow the Plunger Application to define Max, Slow, Fast and Minimum arrival times for the plunger. In this scenario we will use the following to "estimate" the expected arrivals. Max= Well depth ft. /300ftmin (5000/300=16 minutes); Slow=5000/650=8 minutes; Fast=5000/850=6 minutes; Minimum = 5000 /1200=4 minutes

1) Go to Plunger > OPEN >3:Waiting, and enter "16" in the "Max Arv Count/Time/Fail" Limit field. The value of 16 entered here defines the time in minutes for a Max arrival. We also need to enter "Fail Limit" value of "3" in the "Fail Limit" field. This allows 4 late arrivals before putting Plunger in a "Failed" state.

2) "Slow Arv Count/Time" needs to have a value of "8" as determined in the calulation above.

3) "Fast Arv Count/Time" needs to have a value of "6" as determined in the calulation above.

4) "Min Arv Count/Time" needs to have a value of "4" as determined in the calulation above.
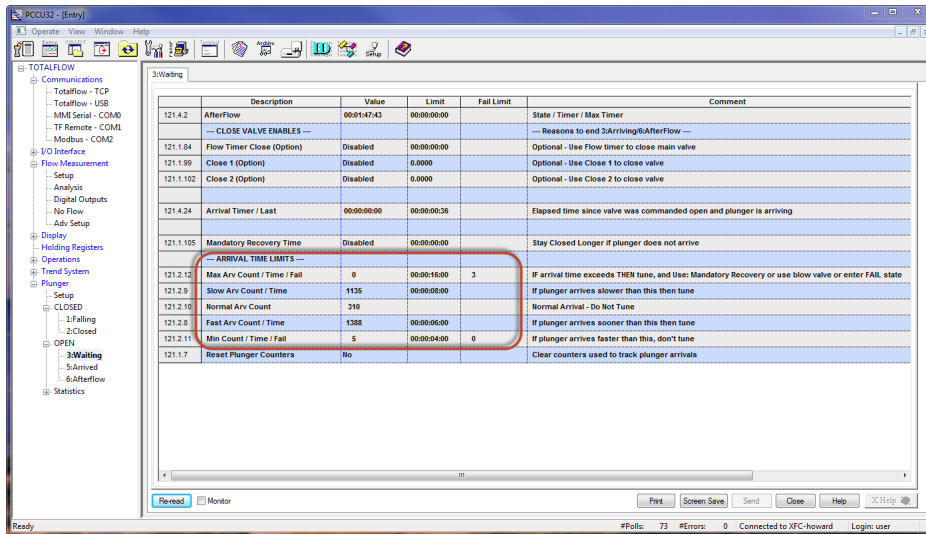
Figure 31 Arrival Time Limits

3.12.6 Enable the Plunger APP and Tuning

The final task in completing this scenario is to "Enable "the plunger application and to "Enable" Optimization (Tuning). To accomplish this:

1) Go to Plunger > Setup > General Setup, and select "Enabled" in the Plunger control value field. You should now see the plunger application begin in the "Closing Valve" state with timer counting up.

2) Next, proceed to "Optimization" and select "Enabled" in the Optimization Value field.
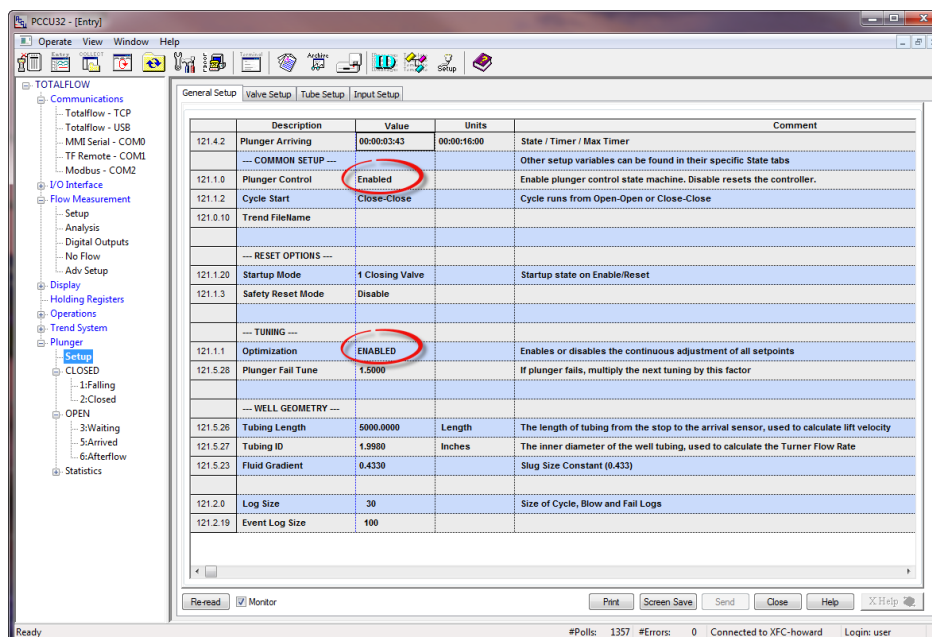

Figure 32 Enable Plunger App

3.12.7 View Plunger Application activity

To view activity of the Plunger application as it proceeds through the different states, Go to the tree view; Plunger>CLOSED>1.Falling" tab to view state 1 conditions.. Note: the top line of each state indicates the current state and timer status of the Plunger App when "monitor" is selected at the bottom left of your screen.
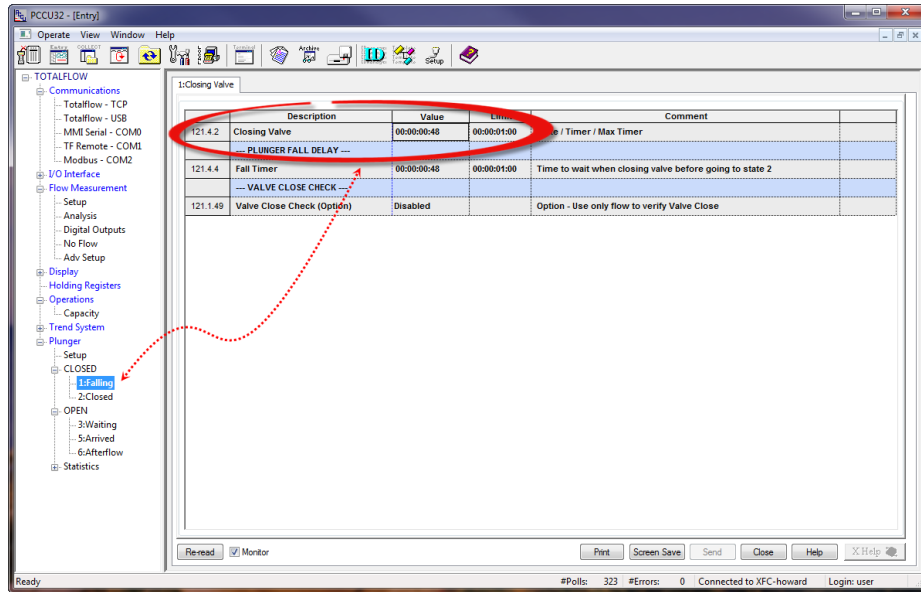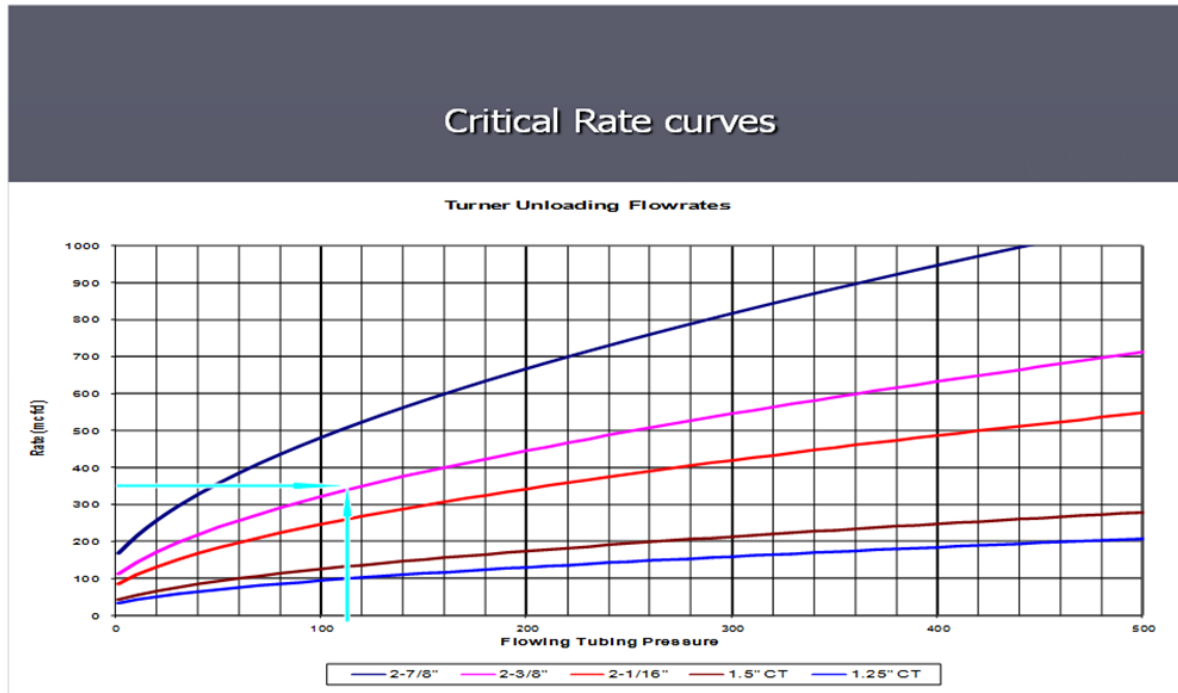

Figure 33 View Plunger State

4.0 Reference Information

Figure 34 Critical Rate Curve Chart

Table 1 Links to Drawings (ABB/Totalflow Website)

Base Board	I/O Description	Drawing #	ABB Web Site Link
TFIO DI-DO Module	Plunger Lift: Direct I/O option	2102981	Plunger DI-DO Wiring
XFC	XFCG4 6410/6411/6413/6414 (2103328 BD) TO DRUCK1040/1240GP/AP TRANSDUCER	2104128	XFC to Druck wiring
XFC	XFCG4 (2103328) BOARD PINOUTS	2104122	XFCg4 Board Pinouts
XFC	Plunger Lift Tubing/Casing & ON/OFF for XFC W Versa-Valves(DI-DO Module)	2103174	XFC to Casing-Tubing & Di/Do versa
XFC	XFCG4 (2103328 BOARD) COMM2 TO EXT MULTIVARIABLES W/RTD PROBE	2104126	XFC to XMV on com 2
XRC	Plunger Lift on/off for XRC,Tubing/Casing,DI-DO Module(Arrival Sensor)	2102983	XRC to Tubing/Casing
XRC	Plunger Lift Valve Control(wTubing, Casing, Arrival Sensor) using Valve	2102985	XRC to Vlv Ctl Module

Base Board	I/O Description	Drawing #	ABB Web Site Link
	Control Module		
XRC	XRCG4 (2103022 BD) COMM1 TO Ext MULTIVARIABLE W/RTD PROBE	2104127	XRC to XMV on com 1
XRC	XRCG4 (2103329 BD) AI TO 2-WIRE TRANSMITTER(ANALOG INPUT) W/EXTERNAL 12/24VDC POWER	2104337	XRC to Ext Xmitter with Ext Pwr

Document Title			
XSeries G4 Plunger Application			
Document No.	Rev. Ind.	No. of Pages	Page
2104945-001	AA	36	36