Technical reference

Totalflow® products
Totalflow Web Interface (TWI) software
Help notes v1.0 Oct. 3, 2014

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Get Connected

Overview

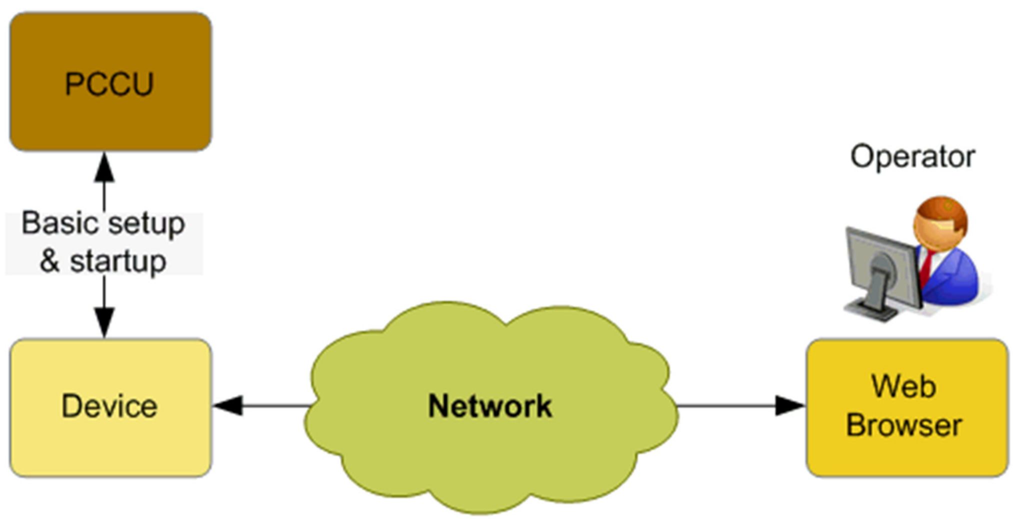
ABB Totalflow Web Interface (TWI) is developed to enable users to browse, monitor, and update various configuration and statistical values of the Totalflow devices, using a web browser.

The TWI design is a system-wide solution. What this means to the user is that the capability exists to handle an operation in its entirety; from the overall facility to the individual components that comprise the facility. ABB Totalflow has adopted a three-tiered design approach to enable users to gain both a system-wide perspective of their operations, and also a component-wide perspective that looks at individual segments of the operations as a whole.

The three-tiered design approach starts at the facility level. The facility is the entirety of the operation and all that the facility encompasses. From this high-level view, the TWI enables users to further examine the facility by showing all sub-facilities that make up the facility whole.

A sub-facility can be viewed as similar components, such as separators, plunger lifts, etc., that have been grouped together. The TWI gives users the ability to view, monitor, and manage these sub-facilities as individual components. Using this method, users can affect certain items without impacting the facility as a whole. From the sub-facility view, users can drill down further to view the stations that individually comprise the sub-facility. These stations can be wells, tanks, or other individual components that are gathered in the sub-facility.

The TWI provides the user with monitoring and management capabilities from a facility view, a sub-facility view, and/or an individual station view. In this way, the scope of the TWI allows the user to view every facet of the operation.



This instruction will assist the user familiar with PCCU Software and Totalflow Devices, how to set up and operate the TWI. These basic steps are required to initially set up the TWI and connect to a Totalflow Device.

Additional resources

Additional publications for TWI are available for free download from www.abb.com/totalflow:

TWI Help file technical reference	ML/2105166
TWI: The next generation user interface sales sheet	SS 2101159 TWI

Additionally, TWI Help files are available via:

- Customer Document Index DVD shipped with some orders: Insert the DVD into the laptop's drive. Select 'Installation & Operation Manuals' from the main screen and locate the appropriate material in PDF format.
- PCCU software: PCCU > Help > TWI Help
- TWI Operator CD: Click on TWI Help button to install help files on your local PC/Laptop

The following is assumed in preparation for its setup and operation:

- Device needs “TFWeb Server” application and Web-enabled Flash installed.

- Device needs "Facility Management" application instantiated.
- Device has connectivity using PCCU.
- Device's Ethernet / network interface is configured.
- Device has a valid IP address.
- Device applications are configured.

Prerequisite requirements are identified as follows:

- Use PCCU version 7.28 or later.
- Use the applicable supported browser version (see table below):

Browser	Version
Internet Explorer (IE)	9.0, 10 or later
Firefox	5.0 or later
Chrome	14.0 or later
Safari	5.0 or later

For the XFC G4 (XSeries Flow Computer) and XRC G4 (X Series Remote Controller), there will be two different file installation packages provided. One package includes the *flash and web pages* and the other the *web pages only.* For this initial startup both the flash and web package are required to be installed.

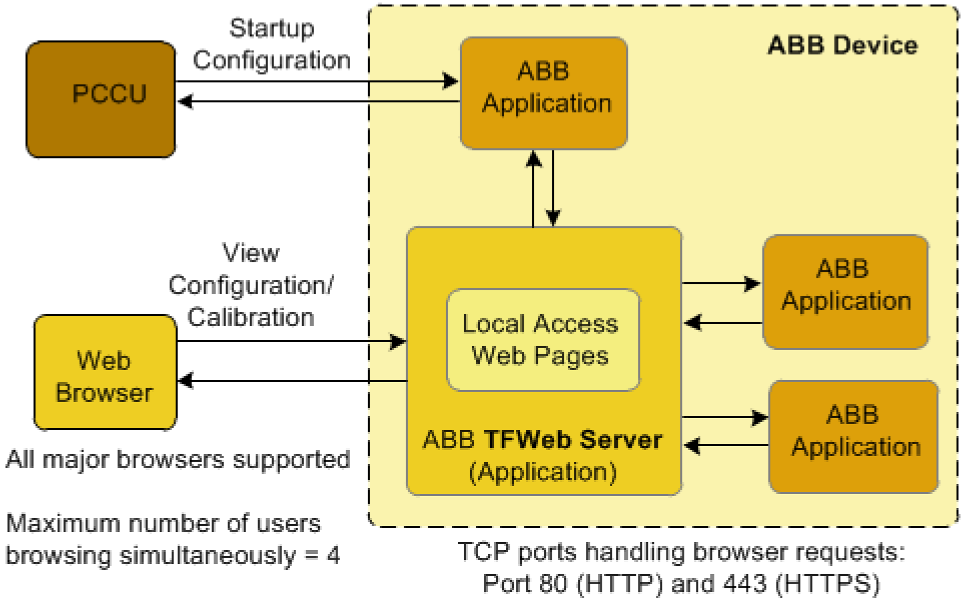
Ensure to download the software package that is specific for the device type, and also note that the 32 MB "Engine Card" is installed and is the proper version.

Device Type	Board Part #	Flash Version	Engine Card Version
XFC US	2103328-001	2105151-001 or later	2103639-003
XFC SU	2103328-001	2105152-001 or later	2103639-003
XRC US	2103329-001	2105153-001 or later	2103639-003
XRC SU	2103329-001	2105154-001 or later	2103639-003

TFWeb Server application

Application description (principle of operation)

The following block diagram shows the main components of the application:



Procedure Overview

Device (PCCU)

- Connect to Totalflow with PCCU.
- Load appropriate web-enabled flash.
- Install applications in Totalflow.
- Setup IP Address.

NOTE: It should be noted that the user is not able to add applications while using the TWI system.

Client (Browser)

- Configure Browser and ensure Browser is a supported version.
- Test / verify connectivity from web server to device.
- Add webpage package (using web interface) to upload web packages onto the device.

NOTE: Web package contains screens operator will see when connecting via the browser.

Webpage functionality (screens)

The following lists the many applications and screens supported by the TWI. For information about each of these screens go to the Help files tab, once connected to the Totalflow device.

Screen/Application	Screen/Application
About	PID
AGA3	Plunger
AGA7	Plunger SU
AGA3 SU	Pulse Accumulator
AGA7 SU	Shutdown

Screen/Application	Screen/Application
Alarm	Station App
Analysis Trend	Station Dashboard
API Liquid SU	Sub-facility Dashboard
Coriolis Interface	Tanks
Coriolis SU	Therms Master
Data Points	Therms Slave
Deployment	Trends
Events	Unsupported Browser
Facility and Station Configuration	User Management
Facility Dashboard	Valve Controller
Facility Management	VCONE
Gas Lift	VCONE SU
I/O App	Web Server Configuration
Login	XMV

Installation and Configuration of Web Application on the XFC

Verify PCCU connection and setup in Expert view.

- Connect to the XFC local port or via the network.
- Start PCCU.
- Click on Entry button.
- If connection is successful (PCCU main screen shows), click on View on the top menu.
- Change view to “Expert” from the dropdown menu. A warning dialog box will request that you answer Yes to continue to Expert mode. Click Yes.

Backup Configuration (Station) files

If the device has been operational or the initial file configuration has been completed, back up the configuration by using "Save and Restore" configuration.

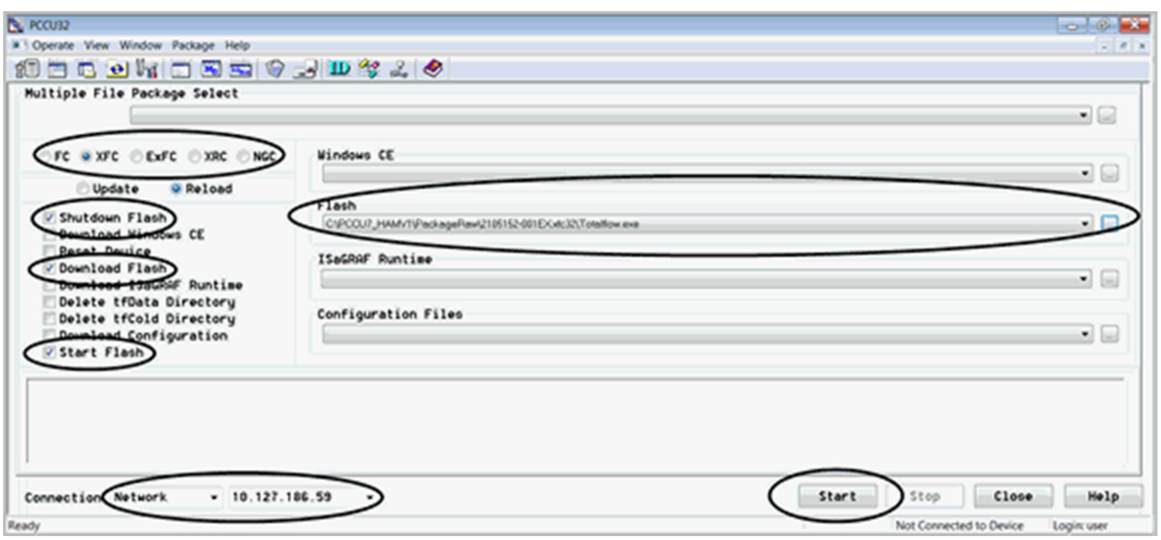
Upgrade Device Flash with PCCU.

The unit will need the proper version of Flash software. Follow this procedure to update the Flash. Since this a first-time installation, the Totalflow device must be configured first before attempting connection by the TWI. PCCU is also further needed for configuration changes or additions required to each application setup. The TWI's main function is that of an interface for operations. Any configuration changes made while performing this setup must be backed up using normal save/restore procedures.

- Connect to the Totalflow Device.
- Load the correct Flash for device used. (See table below.)
- Download the required software version onto the laptop or the system used to connect to the unit. Use the following chart to ensure the proper version of Flash is loaded on the device.

Device Type	Flash Package
XFC US	2105151-001EX.xfc or later
XFC SU	2105152-001EX.xfc or later
XRC US	2105153-001EX.xrc or later
XRC SU	2105154-001EX.xrc or later

- If connected to the unit with PCCU, disconnect. The 32-bit loader option is not available while connected to the unit.
- Once disconnected from the unit, on the tool bar, click on the 32-bit loader button.
- Select the device type radio button in PCCU32 window.



- Click the Browse button (...) to locateand select the software files.
- Check the Shutdown Flash checkbox (Totalflow.exe).
- Check the Download Flash checkbox (Totalflow.exe).
- Check the Start Flash checkbox (Totalflow.exe).
- Go to the connection and select the interface used for the update.

    - If using the network connection, insert the IP address or DNS name of the device next to the connection. Upgrade is faster if using Ethernet.
    - Click Start and observe the status messages to verify PCCU connects to the device and able to begin the upgrade. If the update is successfully completed the message "Operation Complete" displays.
- Click the close button to exit 32-bit loader.
- Restart communication with Totalflow device.
    - Go to (Station ID)>Registry tab in the Tree View and verify that the Flash software P/N has been updated to the correct version.

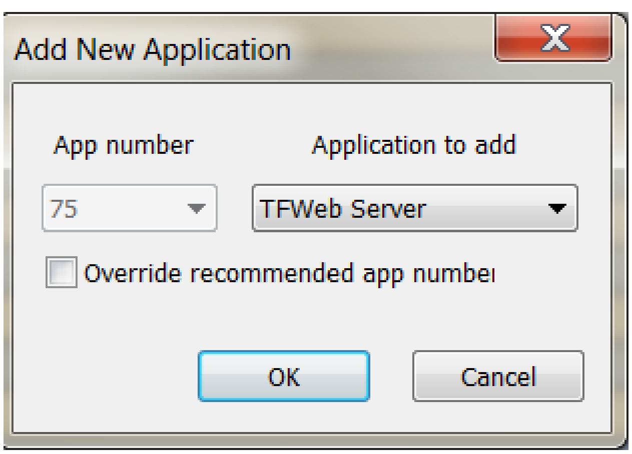
Configure IP Address for Device

The Totalflow G4 allows connections through the Internet. This type of connectivity can be performed one of two ways: direct connection from the PC or through a network using a DCHP server and a network ID. A specific IP address will need to be configured using the following procedure:

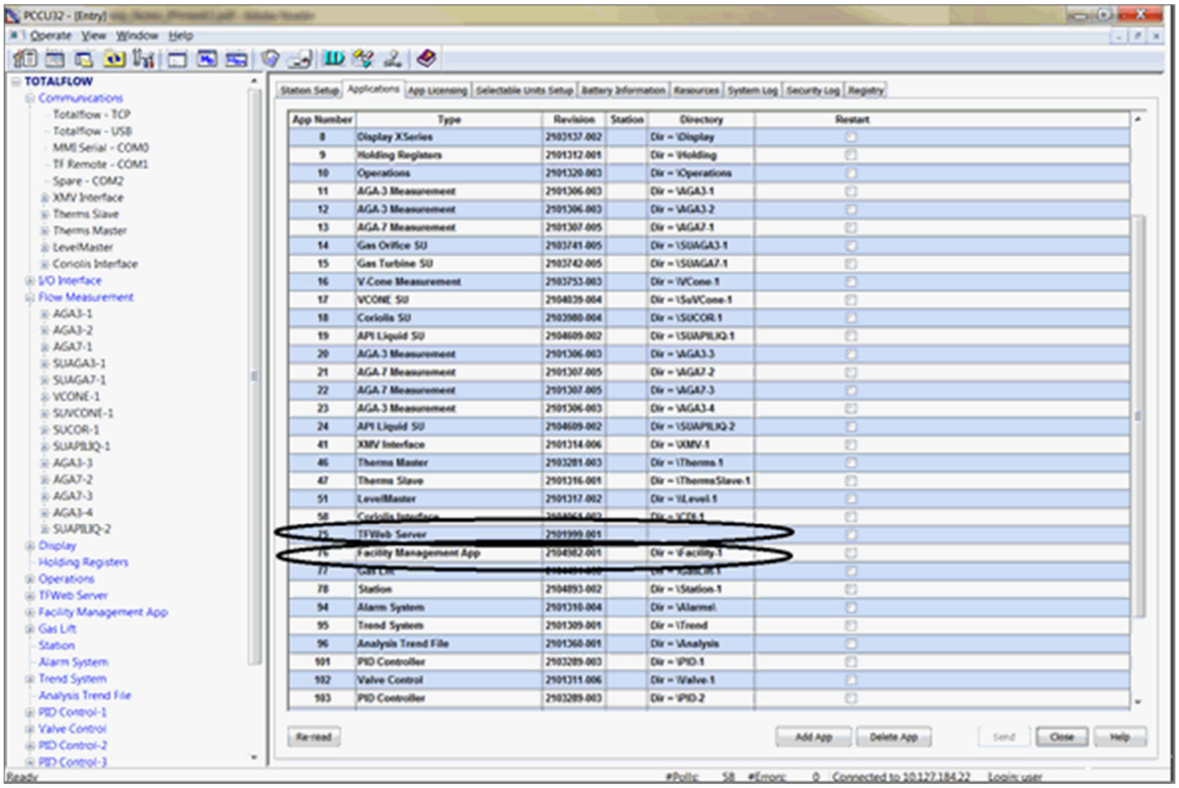
- Connect to the Totalflow Device.
- Proceed to the station (ID node)>Communications>Network in the tree view.
- In the Enable DHCP field enter “Yes” or No” depending on your IP Network configuration.
- In the IP Address field, type in the address for the device and select the Send command.
- Push the RESET button on the device OR remove power from the device in order to perform a Warm Boot. This will set the new IP address in the device.

Add the Web Application

- Go to the station (ID node)> Applications tab.
- Click the Add Application button.
- Click the Application to Add to display the drop down list.
- Locate and choose the TFWeb Server application from the dropdown list. The application will automatically be assigned to the next application number.

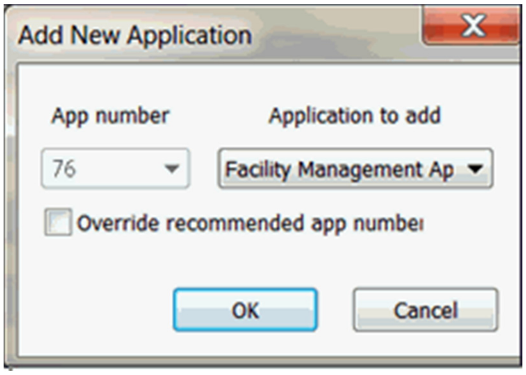


- Click the OK button to commit changes.
- Click re-read to verify the application has been added and it now appears in the application list associated with the correct application number. The application is also added to the configuration tree view on the left and should be added under the “System” applications.



Repeat the previous steps to add the Facility Management application.

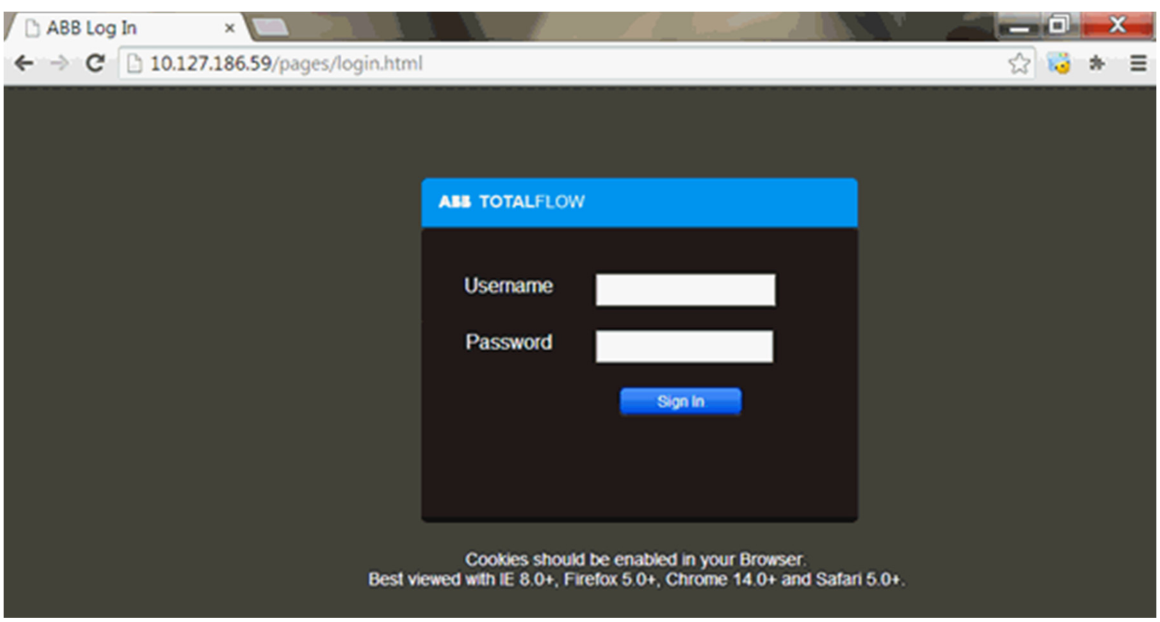
- Go to station (ID node) > Applications tab.
- Click the Add Application button.
- Click the Application to Add to display the drop down list.
- Locate and select Facility Management App from the dropdown list. The application maybe assigned to any slot. In this instance we have used application number 76.



- Click the OK button to commit the changes.
- Click re-read to verify the application has been added and it now appears in the application list associated with the correct application number. The application is also added to the configuration tree view on the left and should be added under System applications

Verify browser initial access to the web server.

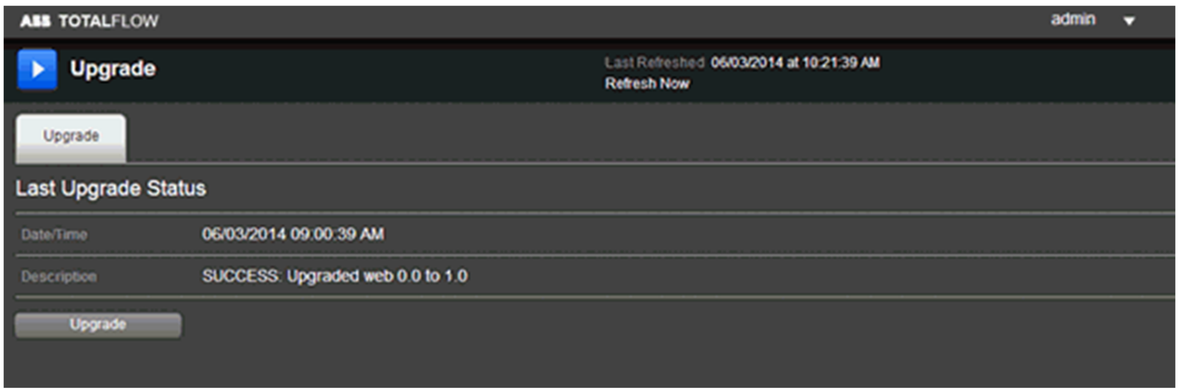
- Choose any of the browsers supported. If the browser installed in your system is not the correct version, download and install a browser that is.
- Start the browser.
- Configure "Cookies" to be "Turned On". Please refer to your browser's Help for information to get cookies as this is browser specific.
- Enter the following URL http://<device IP> (ENTER). A web page displays asking the user to login. If the login screen displays, the browser is able to connect to the web server.



- Enter the default user credentials (Username: admin, and Password: admin). Upon login user will be redirected to http://<device IP>/pages/admin.html.

Upload webpage (package).

- Upon successful login, proceed to Operator>Administration>Upgrade tab, and select “Upgrade”.



- Click on the Upgrade button and choose either of the provided packages (e.g. 2105151-001-Web1.0.xfc, if using the XFC board).

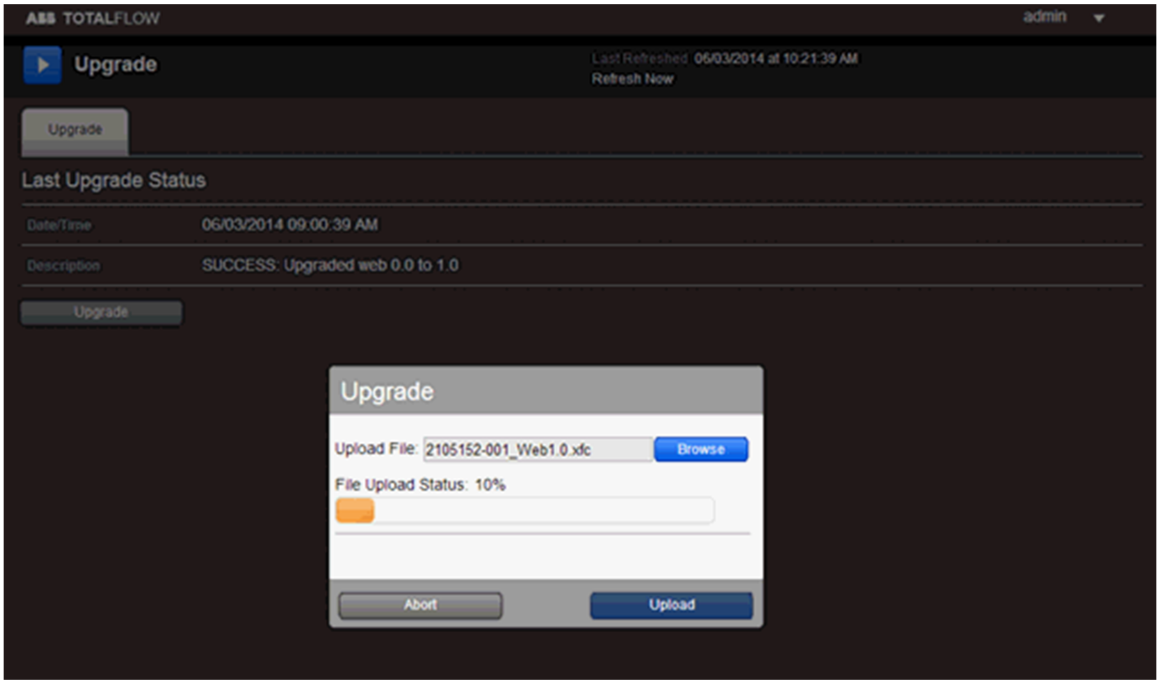
Device Type	Flash & Web Package	Web Page Package
XFC US	2105151-001_TF_2105155-001_Web1.0.xfc32 or later	2105155-001_Web1.0.xfc32 or later
XFC SU	2105152-001_TF_2105155-001_Web1.0.xfc32 or later	2105155-001_Web1.0.xfc32 or later
XRC US	2105153-001_TF_2105155-001_Web1.0.xrc32 or later	2105155-001_Web1.0.xrc32 or later
XRC SU	2105154-001_TF_2105155-001_Web1.0.xrc32 or later	2105155-001_Web1.0.xrc32 or later

- Click the Browse button to locate the web page package.

- Select the correct web page package from Table 5 for your device. Ensure that file extension (*.xrc32 or *.xfc32) coincides with the device type.

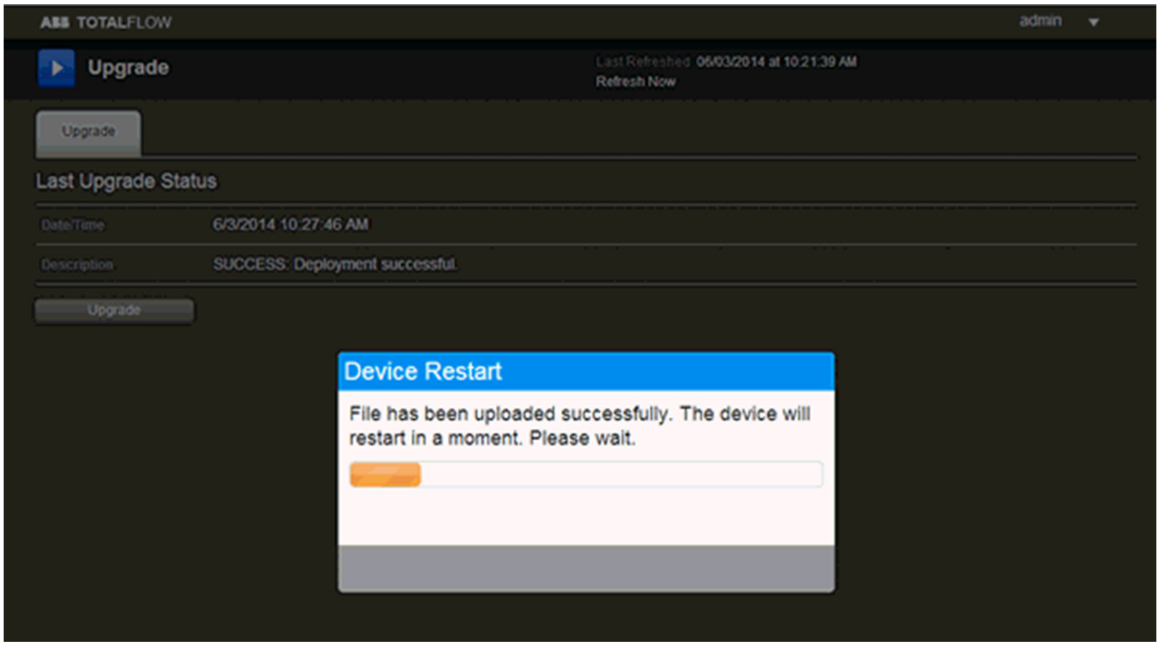
Note: XRC and XFC packages will be different and clearly identified in the file name.

- Select the Upload button.

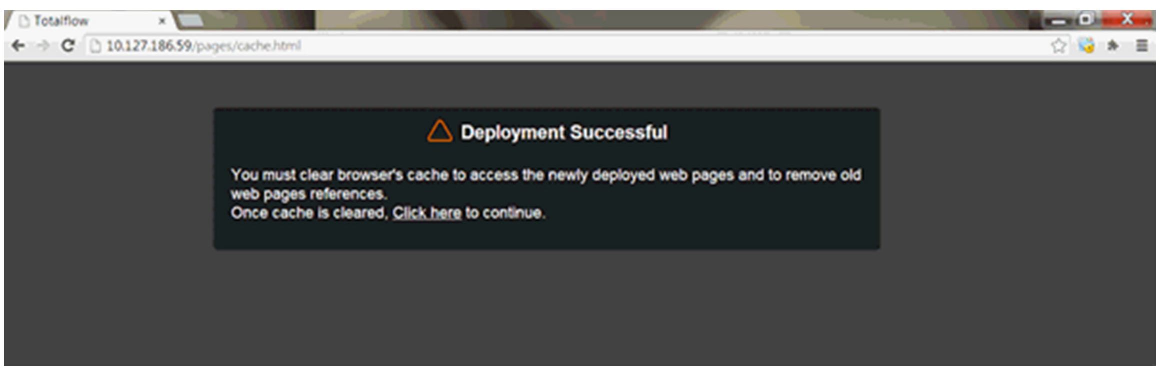


Note: The upload process may take a few minutes to complete. After file upload completes, the file extraction occurs.

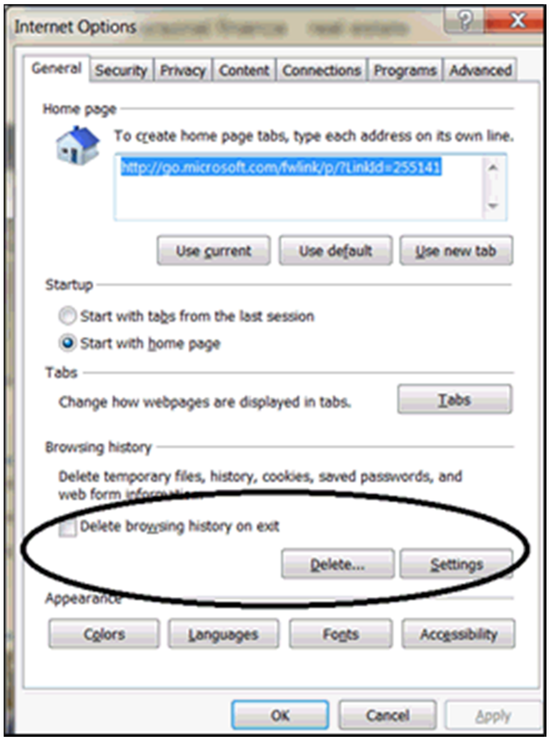
- Verify File Upload Status, which indicates the upload completion percentage during the upload process.
- Verify extraction completes successfully and the device restarts.

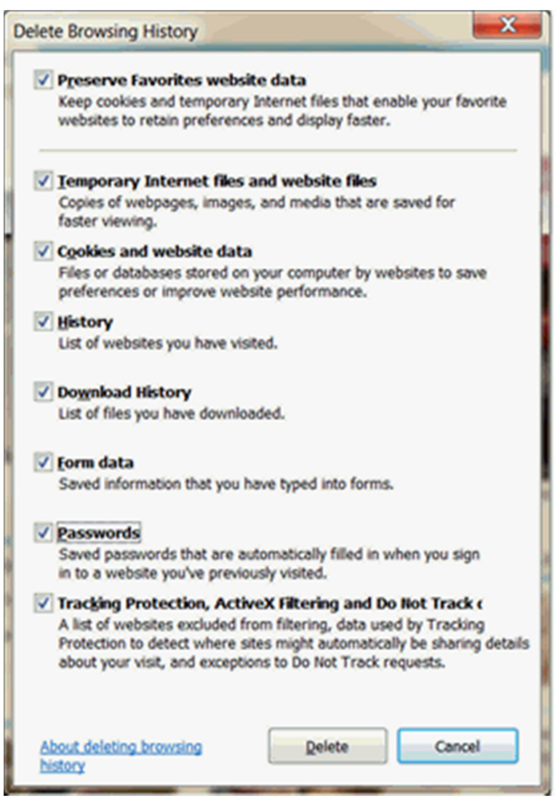


• Upon successful restart, the browser redirects to a page with a message to clear the cache. This enables access to the just uploaded web pages.

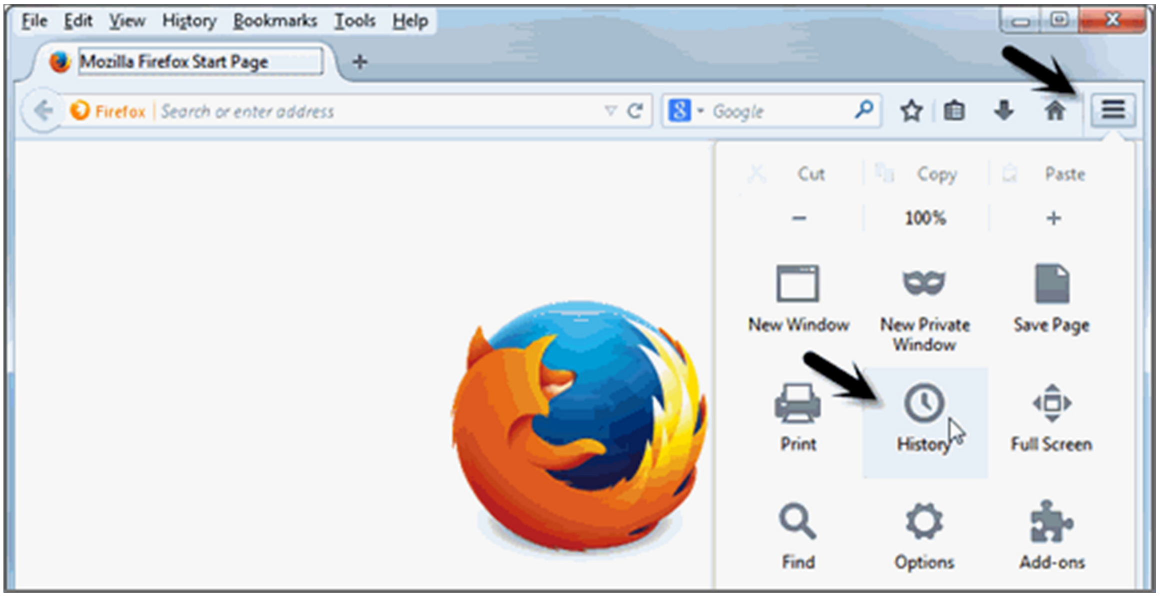


- Clear the Internet Explorer browser cache when using Internet Explorer.
- Select Tools > Internet Options from Internet Explorer main menu to display Internet Options popup box
- Select Delete button under Browsing history to display Delete Browsing History popup box.
- Check all checkboxes as shown and select Delete button.

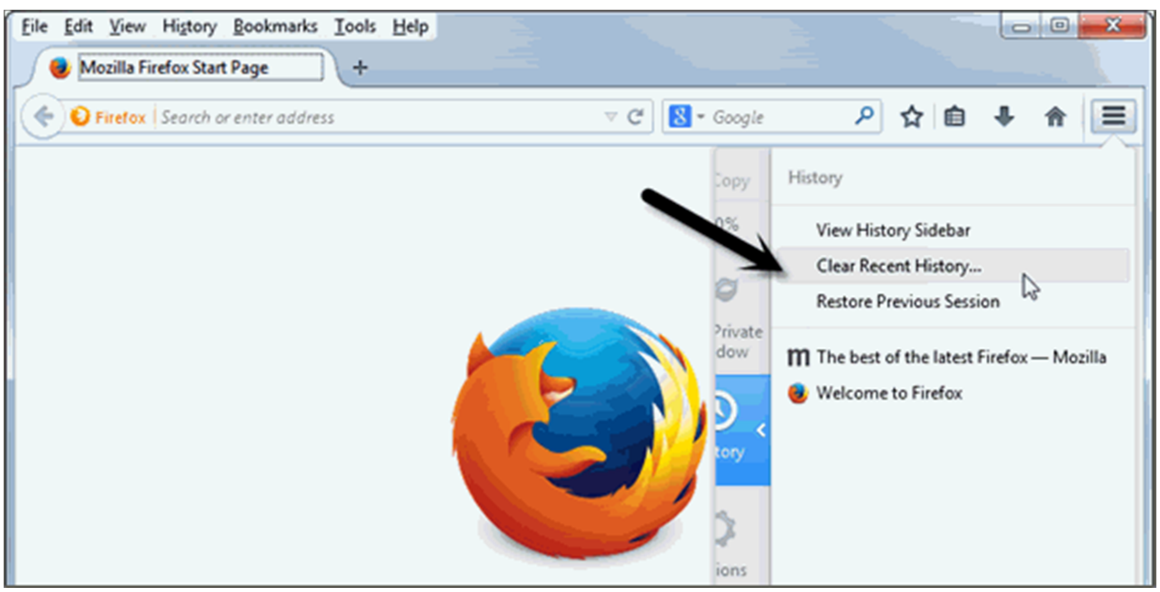

Internet Options
General
Security
Privacy
Content
Connections
Programs
Advanced
Home page
To create home page tabs, type each address on its own line.
http://go.microsoft.com/fwlink/p/?LinkId=255141
Use current
Use default
Use new tab
Startup
Start with tabs from the last session
Start with home page
Tabs
Change how webpages are displayed in tabs.
Tabs
Browsing history
Delete temporary files, history, cookies, saved passwords, and web form information.
Delete browsing history on exit
Delete...
Settings
Appearance
Colors
Languages
Fonts
Accessibility
OK
Cancel
Apply


Delete Browsing History
Preserve Favorites website data
Keep cookies and temporary Internet files that enable your favorite websites to retain preferences and display faster.
Temporary Internet files and website files
Copies of webpages, images, and media that are saved for faster viewing.
Cookies and website data
Files or databases stored on your computer by websites to save preferences or improve website performance.
History
List of websites you have visited.
Download History
List of files you have downloaded.
Form data
Saved information that you have typed into forms.
Passwords
Saved passwords that are automatically filled in when you sign in to a website you've previously visited.
Tracking Protection, ActiveX Filtering and Do Not Track
A list of websites excluded from filtering, data used by Tracking Protection to detect where sites might automatically be sharing details about your visit, and exceptions to Do Not Track requests.
About deleting browsing history
Delete
Cancel

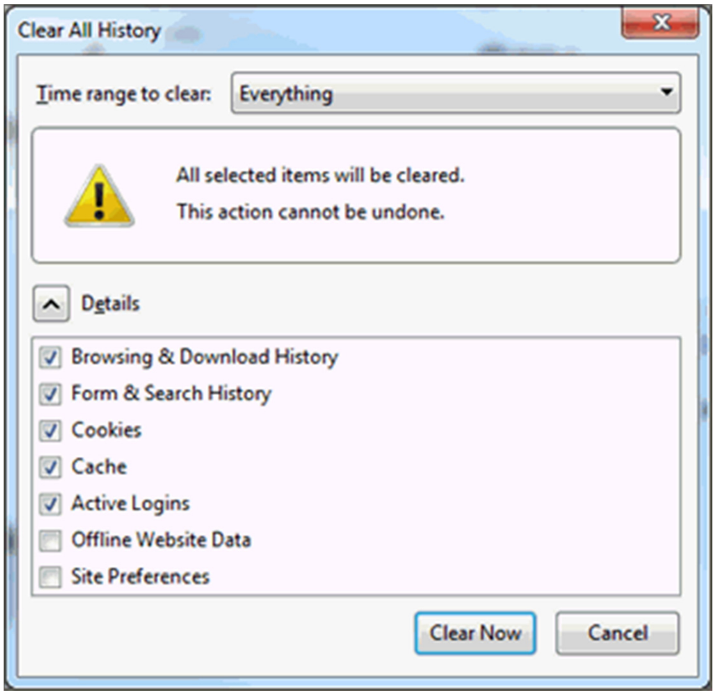
Clear Firefox browsing history when using Mozilla Firefox.
Click Menu button at top-right corner of Firefox window to display menu.



Select History > Clear Recent History to display Clear All History popup box .



Select Clear Recent History from menu. Clear All History popup box displays.



Select Time range to clear to Everything.

Click appropriate boxes and select Clear Now button.

Verify browser access to the web server. Once the web application is added and enabled in the device, and the web page package added, verify access to the web pages (screens) to ensure normal operations.

- After cache has been cleared, re-insert the device URL again: http://<device IP>(ENTER)
  The URL request is redirected to http://<device IP>/pages/login.html .

- Enter default credentials at the login prompt (admin, admin).

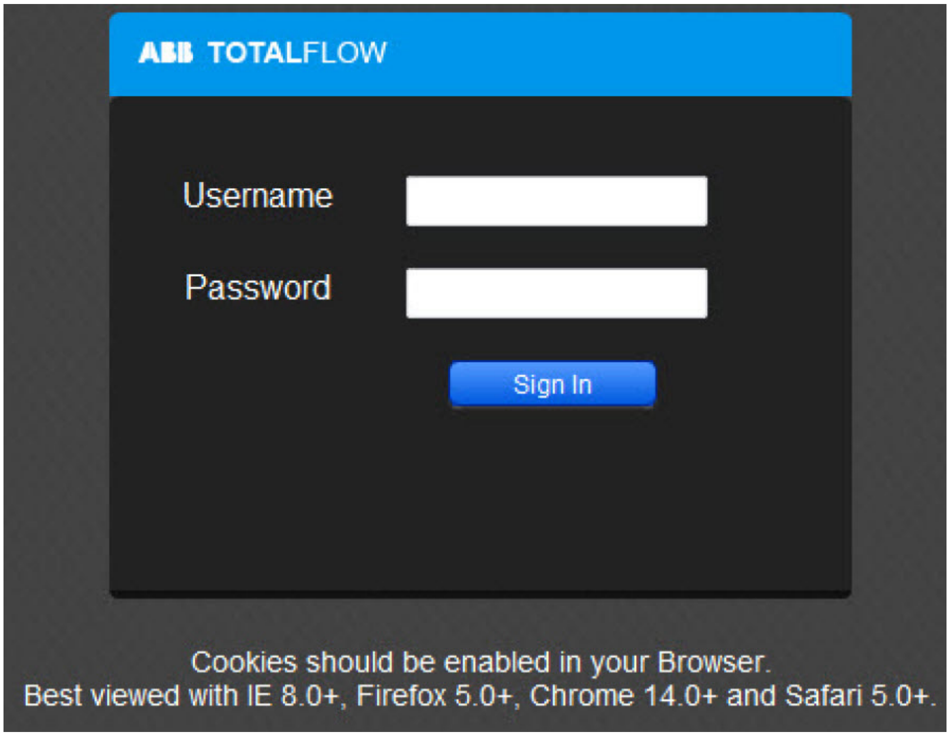
- Verify the default home screen displayed is the Facility Dashboard.

Login

Overview

In order to use the TWI, the user must log in using the appropriate screen as displayed below. The Username and Password must be entered in the appropriate fields as identified by the Administrator, then clicking on the Sign In button. If the user has problems logging in, the Administrator must be contacted to assist the user in resetting the Username/Password.

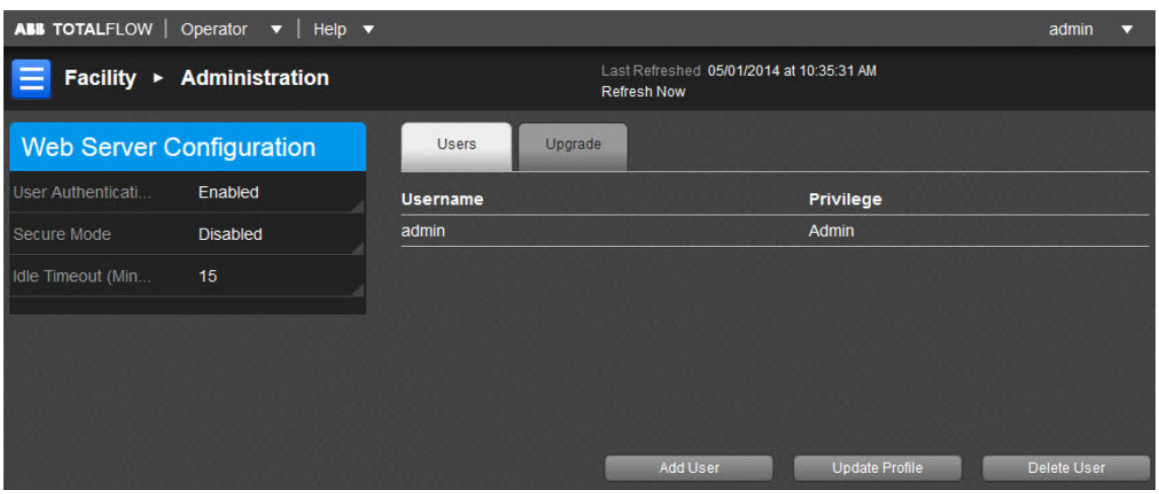
It's important to remember the Username is not case-sensitive but the Password is.



Administration

Overview

The Administration window serves as a multi-functional area where the user can establish multiple components from one centralized location.

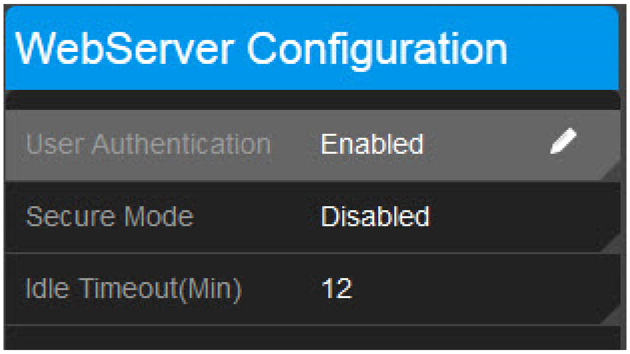


Upon entering the Administration window, the user notices that there are several sections available to them: Users, Upgrade and WebServer Configuration. Based on the user's preference, they can then click on the corresponding tabs or edit fields to change the individual parameters contained within each section.

The following details these individual sections and the parameters that are contained therein. Click on the preferred link to view the information regarding that particular section.

WebServer Configuration

The WebServer Configuration section is in place as a means for the system administrator to manage the various individuals using the TWI.



The system administrator can select User Authentication, Secure Mode and/or Idle Timeout (Min). Each of these sections can be edited by clicking on the Pencil icon. This brings up a corresponding dialog box where changes can be made to that particular section.

The sections and their purposes are described below as follows:

User Authentication

The User Authentication section enables the administrator to set login requirements for individuals that are using the TWI. After the administrator has elected to modify this section by clicking the Pencil icon, a User Authentication dialog box displays. It is here that the administrator can either establish user name/password requirements for the system (Enable) or decline password requirements for entry into the TWI (Disable). Upon making a change to the User Authentication section, click the Save button to ensure the changes are implemented. Note the message in red indicating that the action (Enable or Save) is effective from the next session.

Secure Mode

The Secure Mode section enables the administrator to set the security methodology for the TWI. After the administrator has elected to modify this section by clicking the Pencil icon, the Secure Mode dialog box displays. The Secure Mode section operates using two different methods. If the administrator selects Enable, the TWI site transitions to HTTPS. This transition signifies that Secure Mode has been established. If the administrator elects to Disable Secure Mode, this transitions the site to HTTP. Upon making a change to the Secure Mode section, click the Save button to ensure the changes are implemented. Note the message that any change to the status of the Secure Mode will log the user off the current session.

Idle Timeout (Min)

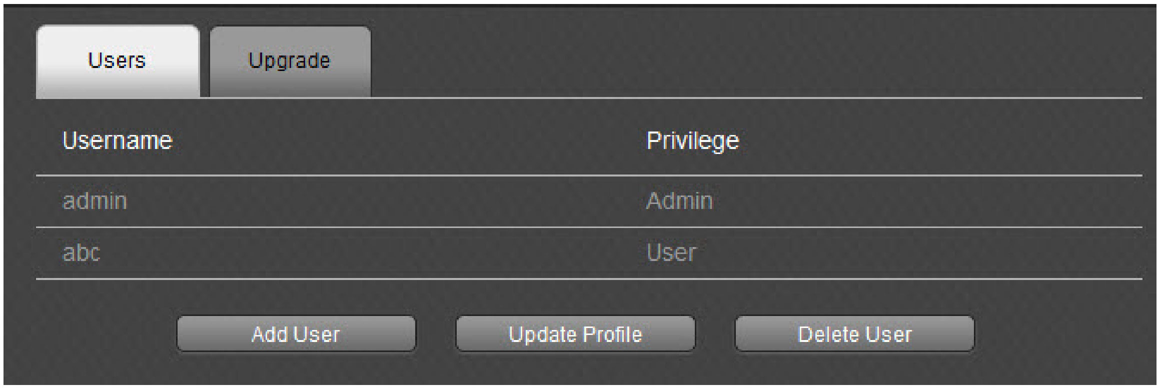
The Idle Timeout (Min) section enables the administrator to set the amount of idle time that the TWI remains active before closing (a range from 2-30 minutes)Selecting any value outside of the range will cause a range error to display .

After the administrator has elected to modify this section by clicking the Pencil icon, the Idle Timeout dialog box displays. The administrator can then use the available text box to enter the desired Timeout value (in minutes) for the TWI to remain active. Upon making a change to the Idle Timeout section, click the Save button to ensure the changes are implemented.

When the user is within one minute from the end of the duration selected a message does display as follows in an orange box: "Session is about to expire. Do you want to continue the session? No Yes."

Users Tab

The Users section enables a system administrator to create users and their corresponding password and system privileges, update and/or change the settings on pre-existing users and delete users out of the TWI system.



Currently, there are two (2) user types: Administrator and User. Administrators are granted the ability to create, modify and delete users. Users do not have this functionality. Additionally, if an individual is assigned the User designation, the Administration section is completely closed to them.

NOTE: Passwords are per device not per individual PC. In other words, multiple devices can be reached by an individual PC, but the user is only allowed to view those devices that they have been assigned access (passwords) to.

Add User

The following information details the steps necessary for creating a new user and assigning them a password and privileges:

Step 1	Within the Users tab, click the Add User button. The Add User dialog box displays.
Step 2	Within the dialog box, the administrator needs to assign a user name and password for the new user being created. Upon completion, the administrator needs to re-type the password for system verification.
Step 3	Next, the administrator needs to assign a Privilege level for the new user being created. Click the down arrow in the corresponding parameter field. From the drop-down menu, select the Privilege type.
Step 4	Upon completion, click the Add User button to save the newly created user into the system. This takes the administrator back to the Users tab. The user that was just created will display in the Users column.

Update Profile

In the event that certain parameters need to be changed for an individual user, the following instructions walk the administrator through the steps for completing this task.

Step 1	Within the Users tab, click the Update Profile button. The Update Profile dialog box displays.

Step 2	Within the dialog box, the administrator can select the user being modified from the corresponding parameter field's drop-down menu.
Step 3	Once the user has been selected, the administrator can move to the Attribute field. From the drop-down menu, the administrator can select either Privilege or Password. If the administrator has elected to change the password, the dialog box expands to allow for a new password to be entered. If the administrator has elected to change the user's privilege, the dialog box expands to allow for a new privilege to be assigned to the selected user.
Step 4	Upon completion of the preferred action, click the Update button. This takes the administrator back to the Users tab. The changes are then reflected in the Users column.

Delete User

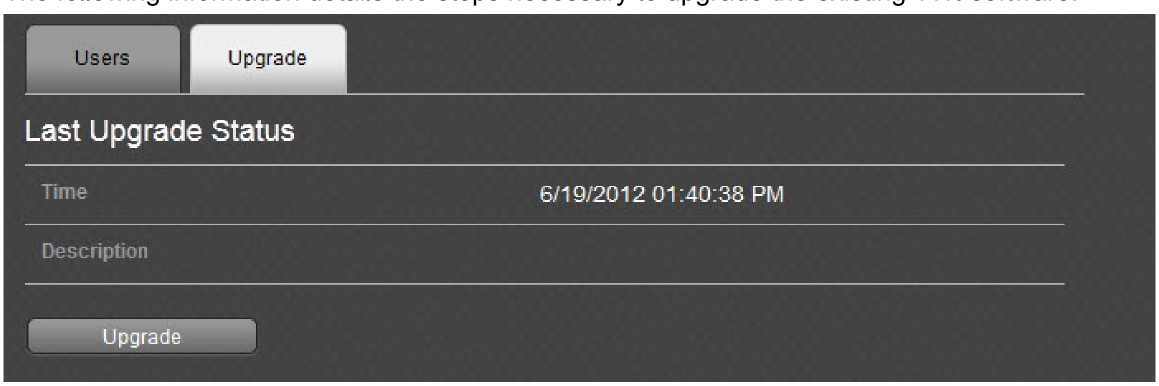
The following are the steps necessary to delete a user form the system.

Step 1	Within the Users tab, click the Delete User button. The Delete User dialog box displays.
Step 2	In the dialog box, select the user that is to be deleted from the corresponding parameter field's drop-down menu.
Step 3	Upon selection, click the Delete User button. The user is then deleted out of the system. The administrator is automatically taken back to the Users tab. The user that was deleted is no longer displayed in the Users column.

Upgrade Tab

Upgrade Tab

The following information details the steps necessary to upgrade the existing TWI software:



The Upgrade section enables an administrator to browse to a corresponding file on their local machine and then upload that particular file to a device. The file type will have an .xfc32 or .xrc32 extension. If a different file type other than .xfc is selected, a dialog box displays and informs the administrator that they need the .xfc file type before they can proceed. Additionally, there should be enough disk space to facilitate the uploading of the .xfc file. Traditionally, the space required is three times the size of the .xfc file being uploaded.

A valid .xfc file is comprised of one of the following:

- Web pages + part number (If this is selected to be uploaded, the device reboots once. After the reboot has occurred, the uploaded pages are automatically used)

- Web pages + part number + totalflow.exe + TfExeInfo (If this is selected to be uploaded, the device will reboot once. After these reboots occur, the uploaded web pages and the totalflow.exe are automatically used)

NOTE: In cases where the web pages are not already present in the device, the administrator is automatically taken to the Upgrade section after logging into the system.

Step 1	After the administrator has moved to the Upgrade section, click the Upgrade button. The Upgrade dialog box displays.
Step 2	In the dialog box, click the Browse button. A File Upload dialog box displays. Navigate to where the corresponding file is located.
Step 3	Once the file is located, select the file. Upon selection, click the Open button.
Step 4	With the file path displayed in the Browse parameter field, click the Upload File button. The selected file is then uploaded to the device.

Facility Dashboard

Overview

The production hierarchy manifests itself on three levels: Facility, Sub-Facility and Station. Here on the Facility Dashboard screen displays key information needed to generate reports and produce accurate information from the Facility. With this information, the user is able to monitor data from production (total and selected sub-facility) for the production cycle selected. Tank levels including Height Remaining data as well as more general information regarding quick task status are displayed on the right side of the screen. Underneath the Production display is information relating to the selected tab.

At the top of the screen are navigational icons common to all screens. There is an Operator pulldown menu with four screen options: Facility Management Application, Configuration, Administration and SU Setup. These are shortcuts to those selected screens.

To the right of that menu is a Help pulldown menu which gives access to the Help screens and About (System Information).

Continuing further to the right is Refresh Now which is a selectable link to refresh the screen.

Last to the right is the Monitoring Off pulldown menu to identify the monitoring frequency (in seconds) or turn monitoring off.

Above this button is a pulldown menu identified with the user's name (in this instance "Admin") which allows the user to log out of the system.

Application Carousel

Below the Facility path and above the Production section is the Application Carousel with up to eight application icons (boxes) with individual information displayed. Selecting any icon itself will take the user to the individual page for that application.

There is no limit to the number of apps able to be displayed in the Application Carousel.

Note the same applications listed horizontally across the top of the page in the colored square icons are the same listed under the Tree View. From this screen, there are two ways available to access the same application page: (1) from the Tree View list or (2) from the individual icons. If there is not enough space to display all the application icons, clicking on the right-facing triangle at the end of the carousel will cause them to slide to the left and be replaced by the remaining application icons. Then clicking on the left-facing triangle at the opposite end of the carousel will cause the newly displayed icons to slide to the right and be replaced by the original application icons.

Production

The Production chart displayed is for a selected sub-facility for Today's and Yesterday's production. If the Site Map is loaded in the device, it will be displayed automatically instead of the production display in all Dashboard screens (Facility, Sub-Facility and Station) as pictured below. By selecting the Tree View icon, the user can call up the production display.

If the Site Map is not loaded in the device, the regular production data is displayed including the graph and tank information. In the upper left corner of the production display is the SVG icon. Using this icon, the user will receive an error message if trying to call up the production display (graph). If the Site Map is loaded, selecting the SVG icon will display the UI Editor.

Moving to the right, one will note the Volume and Energy icons. Either display can be selected for the graph. Volume displays the gas, oil hydrocarbon and/or water. Energy displays gas only. The graph can be set up for a 14-day or 7-day cycle by clicking on the desired option in the upper right corner of the production graph. The color-coded graph shows Total Volume/Energy for last 14/7 days in orange for all the sub-facility and stations under them and in gray for the current sub-facility. The user can hover the mouse over the colors of each bar of the graph and the applicable display will indicate the date with production value. Also displayed on the chart area is the numerical value of yesterday's total production per measured element. The arrow below labelled SubFacility 1 will take the user directly to that screen (and hierarchy level).

Below the chart are five tabs with related information as follows:

Alarms	Any Alarms with the applications associated with the facility, sub-facilities or wells are displayed here. Critical (Fault and System Fault Severity) alarms have a filled red triangle, while General and Warning alarms have an unfilled orange triangle. Clicking on any individual alarm will take the user to the Alarms screen for facility.
Events	Any events associated with the applications of the facility/sub-facility/wells are listed here along with their date/time information. Clicking on the Events tab will take the user to the Events screen for Facility.
Data Points	Any data points with their measured values are displayed. Clicking on any of the values displayed will take the user to the dedicated Data Points screen.
System Apps	Selecting any of the applications displayed from the System Apps tab will take the user directly to the related screen.
Unassociated Apps	Selecting any of the applications displayed from the Unassociated Apps tab will take the user directly to the related screen.

Tanks

Storage tanks of this facility are displayed in iconic form to the right of the chart. A maximum of fifteen tank icons can be displayed here at one time. Below these icons is the selectable Tank icon. Clicking here will take the user directly to the Tanks screen under LevelMaster. Note below the link the oil and water levels (in blue) are represented along with the height remaining.

Facility Apps

Note the applications available and displayed for this facility (from the Application Carousel):

- AGA3-1
- Station
- SUAGA7-1
- PID Control
- Valve Control
- Shutdown
- LevelMaster
- Therms Master
- Therms Slave

• Coriolis Interface
• Pulse Accumulator
• Plunger
• Plunger SU
• Trends
• Events
• Data Points

If there is a Trends or Alarms occurrence running in PCCU, there will be an app in all the associated Facility, Sub-Facility and Station (Well) Dashboards.

Quick Tasks

Below the Tanks display is a Quick Tasks status of the following:

Facility Shutdown	If needed, the user may shut down the entire facility by selecting the Choose icon. A red triangle shows the facility would be in shutdown mode. By selecting the Choose icon again, the user may restart the facility and the red triangle would be replaced with a green icon indicating the change of status back to the Facility in running mode.

Sub-Facility Dashboard

Overview

The production hierarchy manifests itself on three levels: Facility, Sub-Facility and Station. Here on the Sub-Facility Dashboard screen displays key information needed to generate reports and produce accurate information from the Sub-Facility. With this information, the user is able to monitor data from production (Sub-Facility and selected Station) for the production cycle selected.

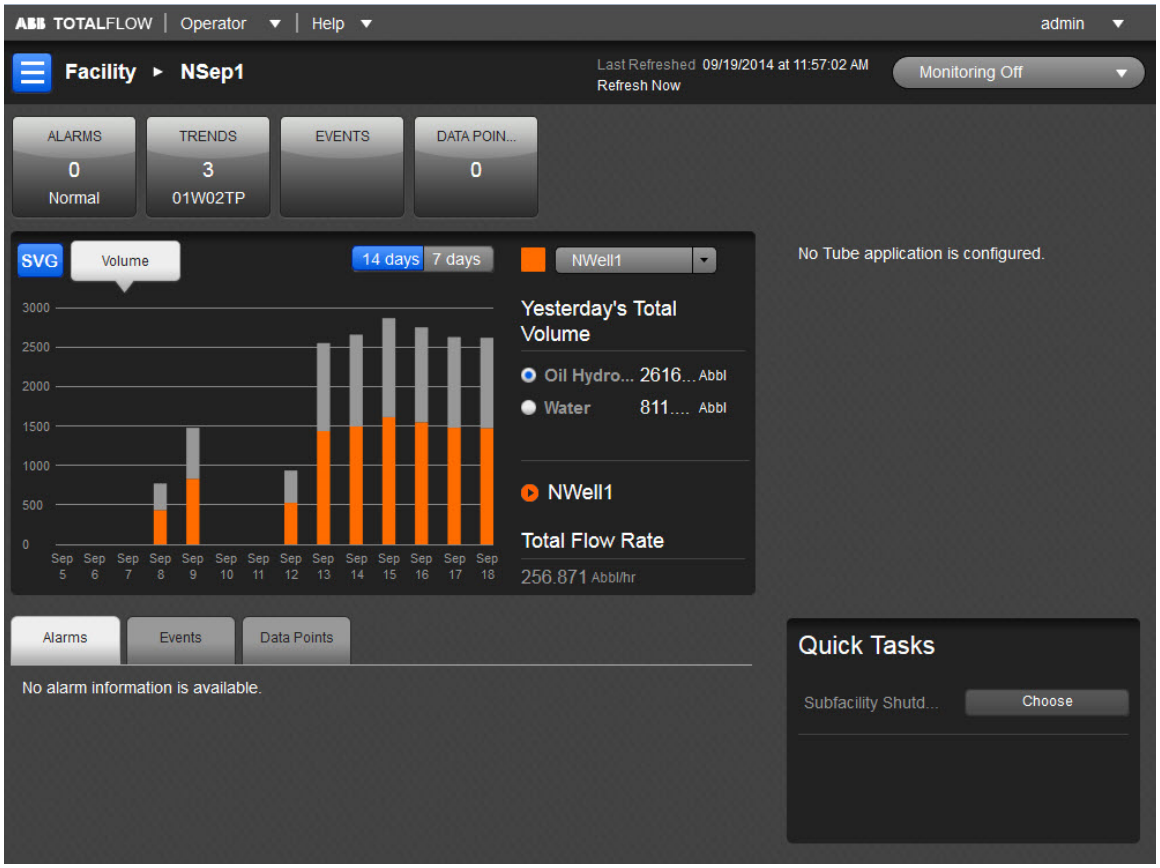
At the top of the screen are navigational icons common to all screens. There is an Operator pulldown menu with four screen options: Facility Management Application, Configuration, Administration and SU Setup. These are shortcuts to those selected screens.

To the right of that menu is a Help pulldown menu which gives access to the Help screens and About (System Information).

Continuing further to the right is Refresh Now which is a selectable link to refresh the screen.

Last to the right is the Monitoring Off pulldown menu to identify the monitoring frequency (in seconds) or to turn monitoring off.

Above this button is a pulldown menu identified with the user's name (in this instance "Admin") which allows the user to log out of the system.



Application Carousel

Below the Facility path and above the Production section is the Application Carousel with up to eight application icons (boxes) with individual information displayed. Selecting any icon itself will take the user to the individual page for that application.

There is no limit to the number of apps able to be displayed in the Application Carousel.

Note the same applications listed horizontally across the top of the page in the colored square icons are the same listed under the Tree View. From this screen, there are two ways available to access the same application page: (1) from the Tree View list or (2) from the individual icons. If there is not enough space to display all the application icons, clicking on the right-facing triangle at the end of the carousel will cause them to slide to the left and be replaced by the remaining application icons. Then clicking on the left-facing triangle at the opposite end of the carousel will cause the newly displayed icons to slide to the right and be replaced by the original application icons.

Production

The Production chart displayed is for a selected sub-facility for Today's and Yesterday's production. If the Site Map is loaded in the device, it will be displayed automatically instead of the production display in all Dashboard screens (Facility, Sub-Facility and Station) as pictured below. By selecting the Tree View icon, the user can the call up the production display.

If the Site Map is not loaded in the device, the regular production data is displayed including the graph and tank information. In the upper left corner of the production display is the SVG icon. Using this icon, the user will receive an error message if trying to call up the production display (graph). If the Site Map is loaded, selecting the SVG icon will display the UI Editor.

Either the Volume or Energy display can be selected for the graph. Volume displays the gas, oil hydrocarbon and/or water. Energy displays gas only. The color-coded graph shows Total Volume/Energy for last 14/7 days in orange for selected station and in gray for the current sub-facility. The user can hover the mouse over the colors of each bar of the graph and the applicable display will indicate the date with production value. Also displayed on the chart area is the numerical value of yesterday's total production. Below the Yesterday's Total Volume is displayed parameters for volume or energy depending on what has been displayed to the right of the graph. The arrow labeled Station 1 will take the user directly to that Station Dashboard screen (and hierarchy level). And below that the value of the total production is displayed.

Below the chart are three tabs with related information as follows:

Alarms	Any alarm history for any tank or well is displayed here. Critical (Fault and System Fault Severity) alarms have a filled red triangle, while General and Warning alarms have an unfilled orange triangle. Clicking on any individual alarm will take the user to the Alarms screen.
Events	Any events tied to Well 1 are listed here along with their date/time information. Clicking on the Events tab will take the user to the Events screen.
Data Points	Any data points with their measured values are displayed. Clicking on any of the values displayed will take the user to the dedicated Data Points screen.

Measurement Tubes

Here is displayed the default application for the Sub-Facility. These would be the measurement tubes and would be instantiated in the following order of preference: AGA3, AGA7, SUAGA3 and SUAGA7. The four values associated with measurement are displayed to the right of the Production display as follows with a graphic history of the individual value to its side. Parameters are SP, DP, Temp,Today’s Volume for Orifice type tubes and SP, Pulse Count, Temp, Today’s Volume for Turbine type tubes and Flowing Pressure, Pulse Count, Flowing Temp, Today’s Indicated Volume for Liquid Tube Type along with their respective sparklines.

Static Pressure	Displays the static pressure (PSIG).
Differential Pressure	Displays the differential pressure (PSIG or PSIA).
Temperature	Displays temperature (Degrees F.).
Today's Volume	Displays today's volume (MCF/day).

Sub-Facility Apps

Note the applications available and displayed for this sub-facility (from the Application Carousel):

- PID Control
- AGA3-3
- SUAPILIQ-1
- Trends
- Events
- Data Points

If there is a Trends or Alarms occurrence running in PCCU, there will be an app in all the associated Facility, Sub-Facility and Station (Well) Dashboards.

Quick Tasks

The user may select the following Quick Task displayed below the tube parameter display:

Sub-Facility Shutdown	The user may shut down as needed the entire sub-facility by selecting the Choose icon. A red triangle shows the sub-facility would be in shutdown mode. By selecting the Choose icon again, the user may restart the sub-facility and the red triangle would be replaced with a green icon indicating the change of status back to running mode. Selecting Choose again would change it back in shutdown.

Station Dashboard

Overview

The purpose of the Station Dashboard is to display information pertinent to a selected individual well and its production. The selected well from the Facility Dashboard is Station 1.

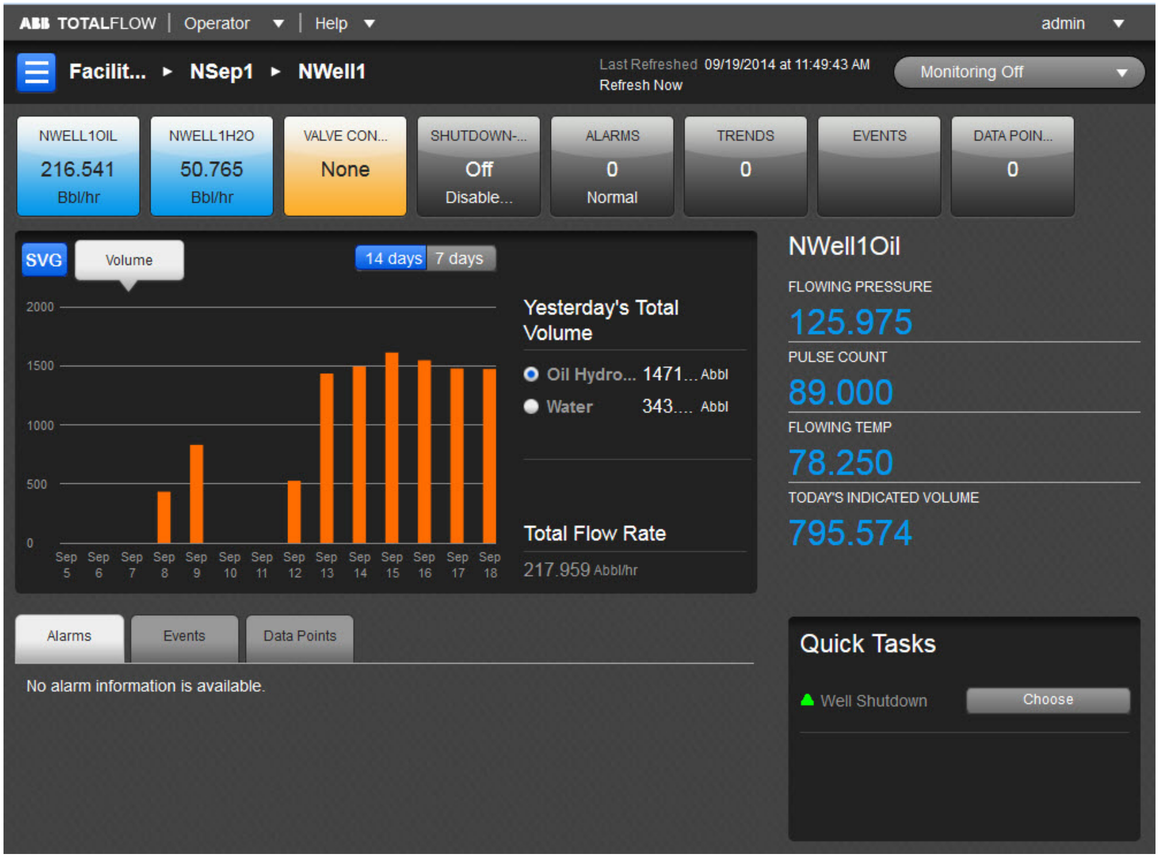
At the top of the screen are navigational icons common to all screens. There is an Operator pulldown menu with four screen options: Facility Management Application, Configuration, Administration and SU Setup. These are shortcuts to those selected screens.

To the right of that menu is a Help pulldown menu which gives access to the Help screens and About (System Information).

Continuing further to the right is Refresh Now which is a selectable link to refresh the screen.

Last to the right is the Monitoring Off pulldown menu to identify the monitoring frequency (in seconds) or to turn monitoring off.

Above this button is a pulldown menu identified with the user's name (in this instance "Admin") which allows the user to log out of the system.



Application Carousel

Below the Facility path and above the Production section is the Application Carousel with up to eight application icons (boxes) with individual information displayed. Selecting any icon itself will take the user to the individual page for that application.

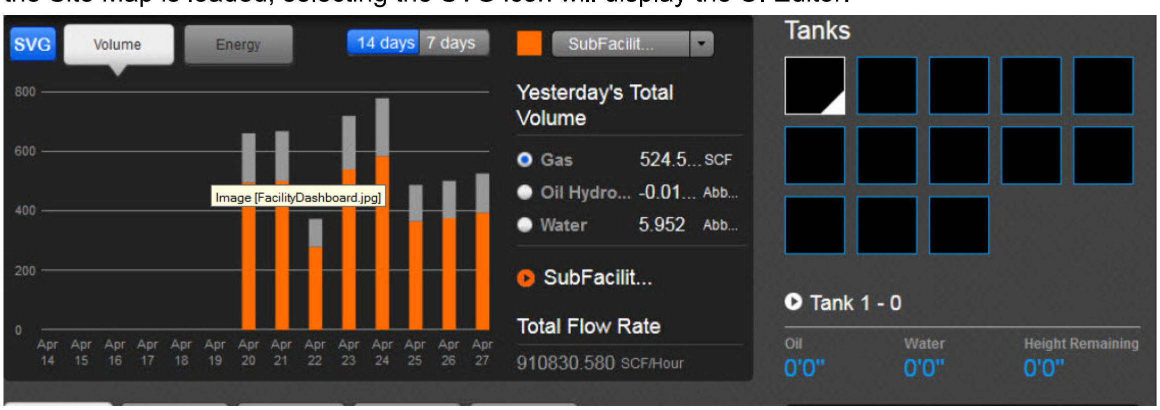
There is no limit to the number of apps able to be displayed in the Application Carousel.

Note the same applications listed horizontally across the top of the page in the colored square icons are the same listed under the Tree View. From this screen, there are two ways available to access the same application page: (1) from the Tree View list or (2) from the individual icons. If there is not enough space to display all the application icons, clicking on the right-facing triangle at the end of the carousel will cause them to slide to the left and be replaced by the remaining application icons. Then clicking on the left-facing triangle at the opposite end of the carousel will cause the newly displayed icons to slide to the right and be replaced by the original application icons.

Production

The Production chart displayed is for a selected sub-facility for Today's and Yesterday's production. If the Site Map is loaded in the device, it will be displayed automatically instead of the production display in all Dashboard screens (Facility, Sub-Facility and Station) as pictured below. By selecting the Tree View icon, the user can the call up the production display.

If the Site Map is not loaded in the device, the regular production data is displayed including the graph and tank information. In the upper left corner of the production display is the SVG icon. Using this icon, the user will receive an error message if trying to call up the production display (graph). If the Site Map is loaded, selecting the SVG icon will display the UI Editor.



Either the Volume or Energy display can be selected for the graph. Volume displays the gas, oil hydrocarbon and/or water. Energy displays gas only. The color-coded bar graph shows the selected well's production for all sampled days in the cycle (either 7 or 14 days as selected by the user). Since at the station level, the production only comes from the assigned well (station), there is no other production displayed and thus no gray portion of the bars on the graph. The user can hover the mouse over any bar of the graph and the applicable display will indicate the date with production value. Below the Yesterday's Total Volume is displayed parameters for volume or energy depending on what has been displayed to the right of the graph.

Below the chart are three tabs with related information as follows:

Alarms	Alarms if any associated with the applications of the current well is displayed here. Selecting the arrow will call up the Alarms page for the current well. (Not available from this page)
Events	Any events tied to the current well are listed here along with their date/time information and description. Hovering over any of the entries will display an arrow. Selecting the arrow will call up the Events page. (Not available from this page)
Data Points	Data points with their standards of measurement are displayed here. (Not available from this page)

Measurement Tubes

Here is displayed the default application for the default well (Station 1). These would be the measurement tubes and would be instantiated in the following order of preference: AGA3, AGA7, SUAGA3 and SUAGA7. The four values associated with measurement are displayed to the right of the Production display as follows with a graphic history of the individual value to its side. Parameters are SP, DP, Temp, Today's Volume for Orifice type tubes and SP, Pulse Count, Temp, Today's Volume for Turbine type tubes and Flowing Pressure, Pulse Count, Flowing Temp, Today's Indicated Volume for Liquid Tube Type along with their respective sparklines.

Static Pressure	Displays the static pressure (PSIG).
Differential Pressure	Displays the differential pressure (PSIG or PSIA).
Temperature	Displays temperature (Degrees F.).
Today's Volume	Displays today's volume (MCF/hr).

Station Apps

Note the applications available and displayed for this station (from the Application Carousel):

• AGA3-2

• Gas Lift

• Trends

• Events

• Data Points

Quick Tasks

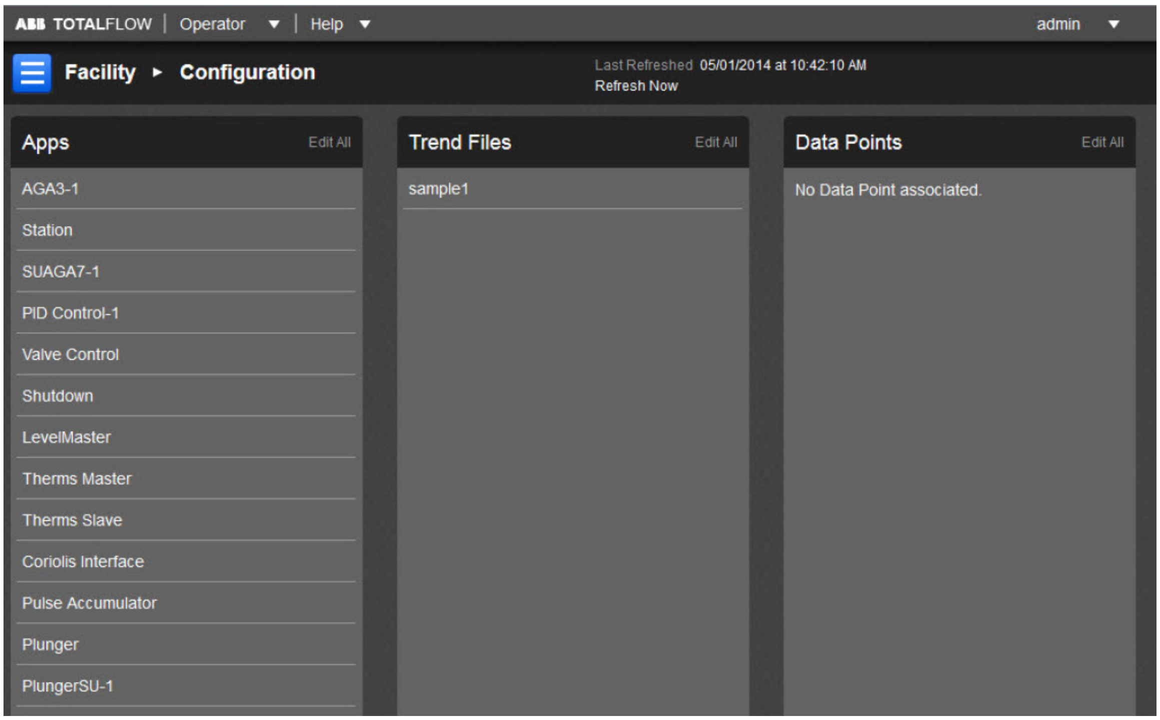
The user may select the following Quick Task displayed below the tube parameter display:

Well Shutdown	If needed, the user may shut down a designated well by selecting the Choose icon. A red triangle shows the facility would be in shutdown mode. By selecting the Choose icon again, the user may restart the well and the red triangle would be replaced with a green icon indicating the change of status back to the well in running mode. Selecting Choose again would place the well back in shutdown.

Configuration

Overview

Configuration enables the user to associate/disassociate the applications that have been assigned to the various stations and the facility itself within the TWI system. Configuration works in concert with PCCU32. By selecting the Facility Dashboard's Operator pulldown menu, the Configuration option can be selected to display this screen. Upon entering Configuration, the user will see the Configuration screen for the facility. For navigating to the Configuration screen for either the Sub-Facility or Station, the user needs to navigate to the respective screen and then click on the Configuration option available from the Operator pulldown menu.



On opening the well sections and/or the facility section, there are three tabs that the user can select from: Apps, Trend Files, and Data Points.

Apps

The Apps list is the area where the user can view all of the application station groups that were established in PCCU32 along with a list of all the available applications that are associated with the well/facility that the user is connected to. For example, the user can have a group (G1) that contains Well 1. Well 1 can then have applications associated with it such as LevelMaster.

NOTE: Although the user will see every application that is available on the device, not all of the applications are available for use with the TWI.

NOTE: A disassociated application is available across the facility and all the stations for association. Once the application is associated with the station, it is removed from the facility and other stations.

Application grouping takes place within PCCU32. Once the applications have been assigned to a station, the user can move to the TWI and see the station and the applications that are specifically tied to them. Select Edit All to select or deselect. Assigned applications are indicated by a check mark.

Those applications that are supported by the TWI but have not been assigned a group are placed under the Facility section.

Within each station section is an Edit button. When selected, this allows the user to activate the applications within the corresponding section. The user can then associate or disassociate applications within that individual section. Selecting an application will associate an application within the TWI. Deselecting an application will turn it off within the TWI. After the user has performed the preferred actions, click the Save button to save the changes to the system.

Trend Files

The Trend Files area enables the user to assign specific trend files or de-select them to run for an established application group. The trend files are first established in PCCU32. Once they have been created, the user can move to the TWI and view the trend files. The user will need to click the Edit All button to activate all of the trend files. It is then just a matter of selecting the trend files to attach to the specific station group. Upon completion, the user would click the Save button to save the action.

NOTE: The trend file is visible to all stations and is available to be associated with them.

The user will then need to move to the Facility Dashboard, and click on the station group that the trend file(s) were attached to. This takes the user to the Station Group information window. Click on the Trends tab to see the trend file(s) information, based off of the type of trend file(s) that were selected by the user previously.

Data Points

The Data Points area within the Station Configuration enables the user to establish data points for either the facility or the station groups. The following details the steps for performing this action:

Step 1	In the Data Points tab, click the Edit All button. This will initialize the Data Points section. Upon initialization, click the Add button.
Step 2	In the Description field, enter in a description for the data point.
Step 3	Next, move to the register field. The user will need to enter in the app/array/register.
Step 4	Based on the units that the user wants the data point to be measured in, type the engineering units in the corresponding Units parameter field.
Step 5	Upon completion, click the Save button. This will save the newly created data point.
Step 6	The user can create further data points for the station group or facility by repeating steps 1-5. To delete a data point, click the x icon next to the desired Data Point(s). This will delete the data point from the station or facility.

Introduction

The *Totalflow Web UI* (TWI) represents a leap forward for ABB in our continuing efforts to provide the right information to our customers when they need it. Using the latest technology, the TWI is geared as the perfect solution for oil and gas operations and equipment management.

The modern user interface design is tightly integrated with unique hardware capabilities and powerful embedded algorithms that enable the user to perform many functions right from their laptop. With the continuing evolution of technology, users have become accustomed to highly intuitive software on a multitude of different devices and platforms. With the vision to see that this trend will continue, ABB has created a user-centric software experience that takes into account all human factors, interaction designs, information modeling and more to create the best user experience possible.

Overview

The TWI is designed as a system-wide solution. What this means to the user is that the TWI is geared to handle an operation in its entirety, from the overall facility to the individual components that comprise the facility. ABB Totalflow has adopted a three-tiered design approach to enable users to gain both a system-wide perspective of their operations and also a component-wide perspective that looks at individual segments of the operations as a whole.

The three-tiered design approach starts at the facility level. The facility is the entirety of the operation and all that it encompasses. From this high-level view, the TWI enables users to further examine the facility by showing all sub-facilities that make up the whole of the facility. A sub-facility can be viewed as similar components, such as separators, Plunger Lifts, etc., that have been grouped together. The TWI gives users the ability to view, monitor and manage these sub-facilities as individual components. Using this method, users can affect certain items without impacting the whole of the facility. From the sub-facility view, users can then drill down further to view the stations that individually comprise the sub-facility. These stations can be wells, tanks or other individual components that are gathered in the sub-facility.

The TWI provides the user with monitoring and management capabilities from a facility view, a sub-facility view and/or an individual station view. In this way, the *Totalflow Web UI*'s scope allows the user to view every facet of their operation.

Additionally, the user can also find various default applications that come bundled with the TWI. These applications (Pad Controller, Shutdown System, LevelMaster, etc.) allow the user to establish certain parameters that will affect the corresponding components within the facility.

NOTE: It should be noted that the user is not able to turn on any application within the TWI system.

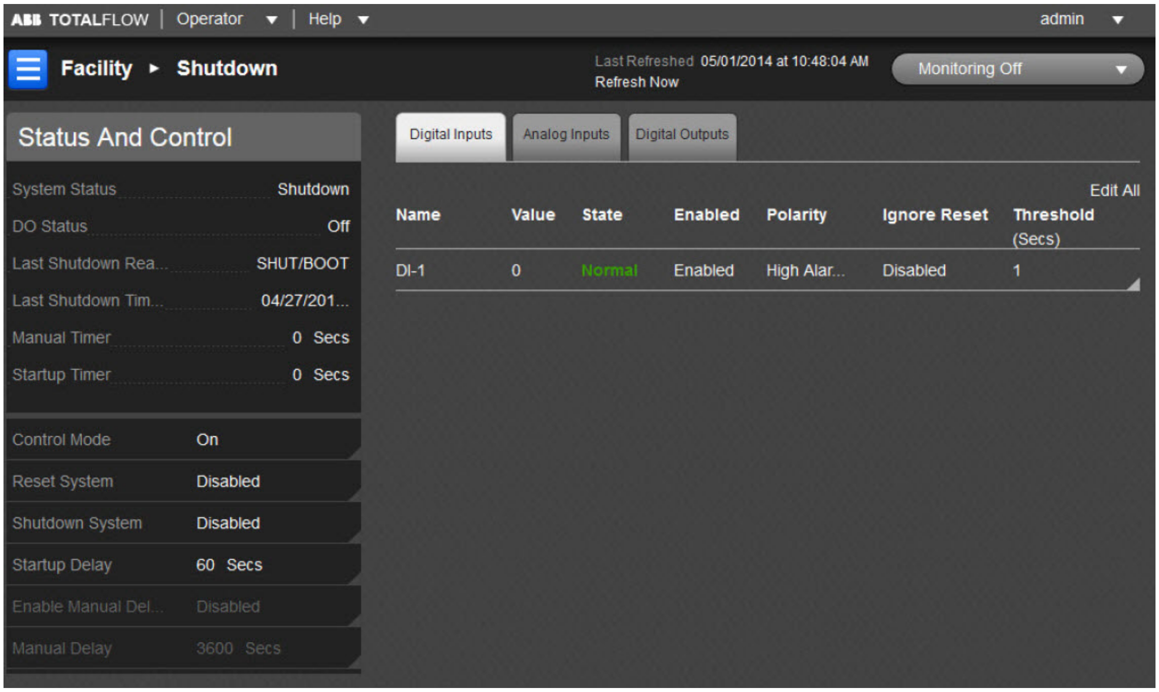
Hopefully this be of help to you in your use of the TWI.

Shutdown

Overview

The Pad Shutdown System is an application that is designed to enable the user to perform a shutdown of various components within a pad. A pad (facility) can be viewed as a physical plot of land where various equipment (wells, tanks, separators, etc.) resides. The user can perform a shutdown of these components on the pad, whether it is a single component, a group of components or the whole facility.

The TWI Local Access component is designed to work in concert with PCCU32. What this means is that the user establishes the parameters for the Pad Shutdown System within PCCU32, and the TWI provides the user with an overview of the parameter readings gathered from those parameters established in PCCU32.



Status and Control

From the Facility Dashboard, the user can view standard information regarding Status and Control after selecting the Facility Shutdown Quick Task.

Status

Under the Status section the user sees the following:

System Status	This System Status parameter field displays the current state of the system. The statuses that can be listed are as follows: • Disabled - When displayed, this informs the user that the Pad Shutdown System application has been disabled. • Manual - During the initial application setup in PCCU32, the system will read the various inputs and will inform the user that an alarm condition exists without performing an actual pad shutdown. • Running - Informs the user that the system is functioning normally with no alarms present. • Startup - Indicates the very beginning of the Run state. Various, non-critical alarms are ignored until the system stabilizes. • Shutdown - Indicates that the pad is in a Shutdown state.

DO Status	This is a standard DO that is set to On when the system is in operation. The field will continue to display On when the system is in a Run state; however, if there is a power loss, a shutdown will occur.
Last Shutdown Reason	Shows the reason for the last shutdown that occurred within the system.
Last Shutdown Time	Shows the date/time for the last shutdown that occurred within the system.
Manual Timer	Prevents the system from inadvertently staying in the Manual state. The system will switch from Manual to Enabled when the timer expires.
Startup Timer	Starts counting down from the value entered in the Startup Value parameter when the system is reset. The timer will not start counting down if any DI or AI that has Startup Holding selected is in alarm.

Control

Under the Control section the user sees and may select the following:

Control Mode	Enables the user to establish the shutdown mode. The available options are as follows: • ON • OFF • Manual - When selected by the user, this option enables the user to view the current inputs but does not allow for a shutdown to occur.
Reset System	The Reset System option is selected when the system needs to be re-enabled after a Shutdown System was initiated. This essentially restarts the system unless there is an alarm that is in a critical state.
Shutdown System	When selected by the user, the system will begin the shutdown sequence.
Startup Delay	This establishes how long to wait between well openings.
Enable Manual Delay	When selected by the user, the Manual Delay Timer/Limit (secs) parameter field displays. Within this field, the user can set the time limit before there is a switch from Manual to Enabled. This is a check system for instances where the system has been placed in Manual mode (for example, if the user is servicing the equipment and does not want to disable the system completely) and has inadvertently not been re-enabled. The system will then wait for the designated time frame and then re-enable the Pad Shutdown System.
Manual Delay	This configurable field enables the user to set the time limit before there is a switch from Manual to Enabled.

Digital Inputs

The Digital Inputs tab displays the established parameters for the Pad Shutdown System.

Name	Displays the unique name for the corresponding digital input that was established within PCCU32.
Value	Displays the current value of the digital input and is set as either 0 or 1.
State	Displays the current state that the digital input is in. If an alarm is active the text color will be red, if there is no alarm, the text color will be green.
Enabled	Allows the user to set whether the corresponding digital input is enabled or disabled.
Polarity	Shows the state of the digital input that will cause an alarm (0/1).
Ignore Reset	Enables the user to establish that the system cannot be reset until the alarm is cleared and a reset is selected; otherwise, the digital input is not checked until the Threshold has expired.
Threshold	Allows the user to establish a time delay wherein the alarm has to remain on for the corresponding amount of time (in seconds) before a shutdown occurs.

Analog Inputs

The Analog Inputs tab displays the established parameters for the Pad Shutdown System. The analog inputs have limit settings: Low Limit and High Limit. A trip timer is available; the value has to be outside the limit for a certain period of time (Threshold) before the alarm occurs.

Name	Displays the unique name for the corresponding analog input that was established within PCCU32.
Value	Displays the current value of the analog input.
Units	Displays the character string that the user established in PCCU32 from which to label the unit type.
State	Displays the current state that the analog input is in. If an alarm is active the text color will be red, if there is no alarm, the text color will be green.
Enabled	Specify whether the corresponding analog input is enabled or disabled.
Low Limit	Enter a value that will cause a low limit alarm if the current value goes below this value.
Hi Limit	Enter a value that will cause a high limit alarm if the current value goes above this value.
Ignore Reset	Enables the user to establish that the system cannot be reset until the alarm is cleared and a reset is selected; otherwise, the digital input is not checked until the Threshold has expired.

Threshold	Allows the user to establish a timed delay wherein the alarm has to remain on for the corresponding amount of time (in seconds) before a shutdown occurs.

Digital Outputs

The Digital Outputs section displays the established parameters for the Pad Shutdown System. Within PCCU32, the digital outputs can be configured to trigger off of three different states of shutdown:

- Shutdown - The system is shut down. Only a reset will bring it out.
- Startup - The system has been reset and is running but may not be stable.
- Run - The system is running, stable and not in an alarm state.

Name	Displays the unique name for the corresponding digital output that was established within PCCU32.
Value	The Value field displays the current value of the digital output.

Tanks

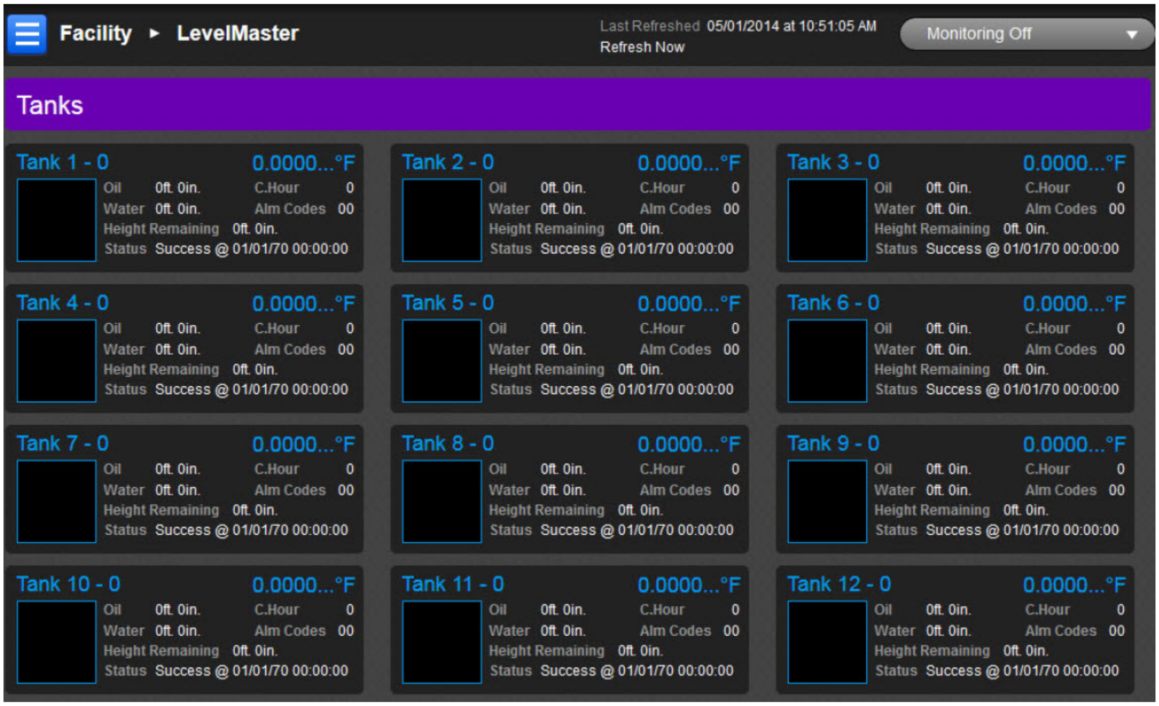
Overview

The LevelMaster Model 7100 Digital Level Sensor is designed to address the unique custody-measurement and operational needs of tank-level management. Using a combination of innovative software and hardware features, the LevelMaster provides both an accurate level gauge and measurement for components ranging from oil, gas, water, wastewater, flood warning and chemical applications. Once installed, the LevelMaster can then help to ensure accurate sales, prevent spills, increase safety and reduce operating expense.

The LevelMaster consists of a sensor tube, 1.95 inches (48.25 mm) in diameter, that sits on the bottom and extends through the top of the container. One or two floats are used to sense the levels by sliding up or down the sensor tube. Each float accurately measures the level of the respective fluids over the full vertical range of the sensor tube. The standard accuracy of the reading is to the nearest +/- 0.1 inch, the high accuracy is to the nearest +/- 0.10. Additionally, the temperature is also provided along with the fluid level readings.

The TWI component is designed to work in concert with PCCU32. This means that the user defines the setup parameters for the LevelMaster within PCCU32, and the TWI provides the user with an overview of the parameter readings gathered from the various tanks.

This screen is accessible from the Facility Dashboard by selecting the Levelmaster icon from the display of large square icons at the top of the screen. Selecting any tank icon from the Facility Dashboard will accomplish the same purpose.



Depending on the number of tanks that the user has established in PCCU32, the user sees up to 15 tanks displayed within the Tanks section on the Facility Dashboard. Here on the Tanks application screen all the tanks can be displayed. Each tank is treated as its own individual unit, and the user can see composite information regarding that individual tank. This also includes alarm indications (note tanks 1-0, 3-0 and 4-0).

The information displayed is as follows:

Name	This is the name that the user has established for the specific tank.
Oil	This value displayed in feet and inches represents the oil level present in the tank.
Water	This value displayed in feet and inches represents the water level present in the tank.
Height Remaining	This reading displays the unused volume that exists within the tank.

To gain further information regarding tank readings, the user can click on the tank's name. This is a link that takes the user to the LevelMaster tab. Within this tab, the user can view information regarding each of the specific tanks. Only one LevelMaster application is supported.

The information columns are as follows:

Tank ID	This is the LevelMaster's numerical ID, as specified in the LevelMaster Request Block file within PCCU32.
Name	This is the name that the user has established for the specific tank.
Temp	This reading represents the temperature value of the fluids within the tank.

C. Hour	This field represents the contract hour in military time (0-23). The contract hour is the start of the day for daily volumes.
Poll Status	This field displays the status of the last poll. The available status types are: • Success - Data was retrieved successfully. • Time-out - The program timed-out without retrieving data. • Invalid ID - There was no tank ID that matched the specific one being polled. • CRC Error - The data was corrupted.
Poll Time	This represents the time of the last successful poll.
Alarm Codes	The Alarm Codes field displays any alarms that are occurring with the specific tank. An orange unfilled triangle icon indicates a General or Warning fault. A red filled icon indicates a Fault and System fault severity.
Oil	This value displayed in feet and inches represents the oil level present in the tank and is displayed in the blue fill of the tank.
Water	This value displayed in feet and inches represents the water level present in the tank and is displayed in the blue fill of the tank icon.
Height Remaining	This reading displays the unused volume that exists within the tank and is displayed in black in the icon.

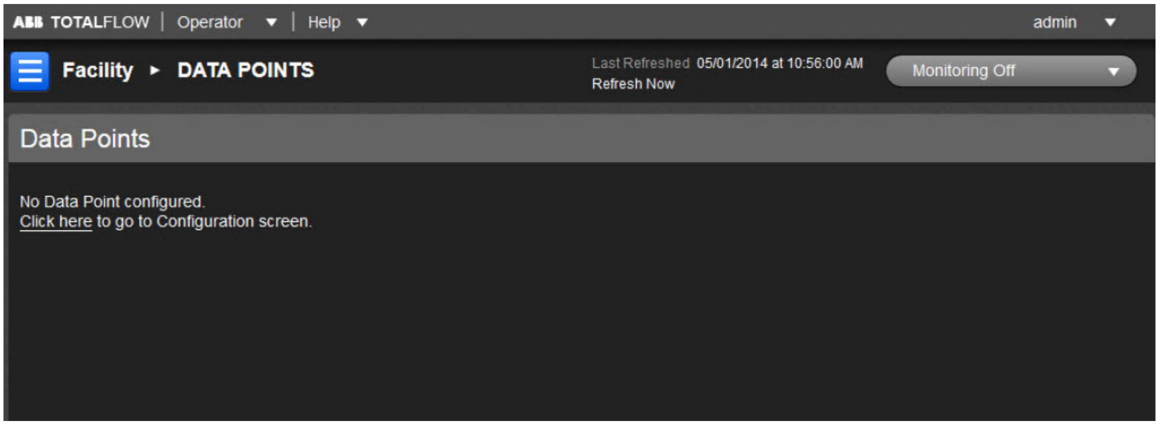
Data Points

Overview

The Data Points page will have a list of name/value items. These names will be listed in the .XML file along with the registers to read for their value.

Auto-populated fields display the names with their values.

In order to access this screen from the Facility screen, click the right arrow on the far right of the display of all application box icons twice. Select the last icon from the left (Data Points).



The user will see the following fields within the Data Points page:

Description	This is the name assigned to the Data Point.
Value	This is the value assigned to the Data Point.

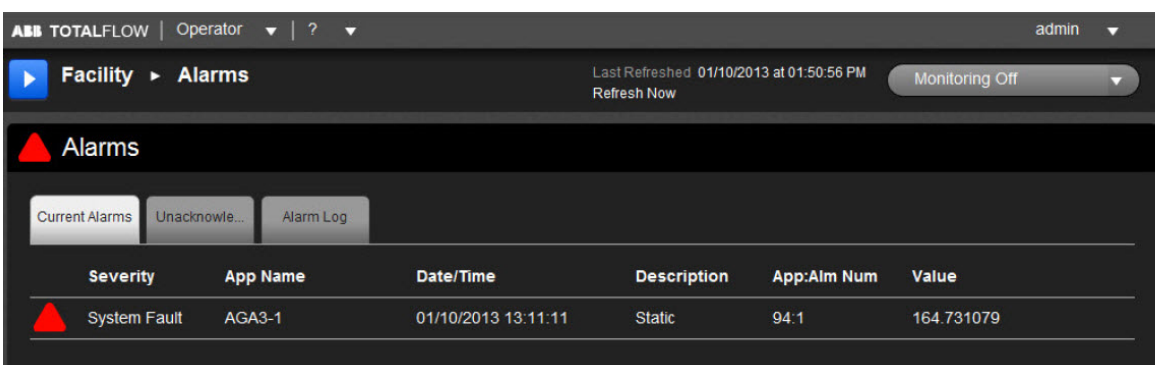
Alarms

Overview

The Alarms/Events tab is the area where the user can view information about alarm conditions or events that have happened within the system. The majority of the fields that the user encounters are for informational purposes only. Alarms are established within PCCU32 and can then be viewed within the TWI. A triangular icon displays for alarms. An unfilled triangle represents a general alarm. A filled triangle (in red) represents a critical alarm.

The Alarms page is divided under three tabs. They are as follows:

Current Alarms



The following parameters are displayed with their descriptions:

Severity	This field displays the severity of the alarm. The Severity types are as follows: • General - Indicates that an alarm exists but is not critical to the operation. • Warning - This indicates that an alarm exists but is not critical; however, unexpected results may occur.

	• Fault - Fault indicates that a problem exists that will affect the outcome of the results and may only be on a single stream. Typical issues include Calculation Error, Unnormalized Totals, etc. The results will not be updated on affected streams.
Application Name	This describes the application where the alarm occurred.
Date/Time	Date and time that the alarm was logged.
Description	This is a short description of the alarm.
App: Alarm No.	This displays the application number where the alarm system was instantiated in PCCU32.
Value	The value displayed in this field represents the variable that caused the alarm. The value is based on the input register in reference to the threshold that was assigned in PCCU32.

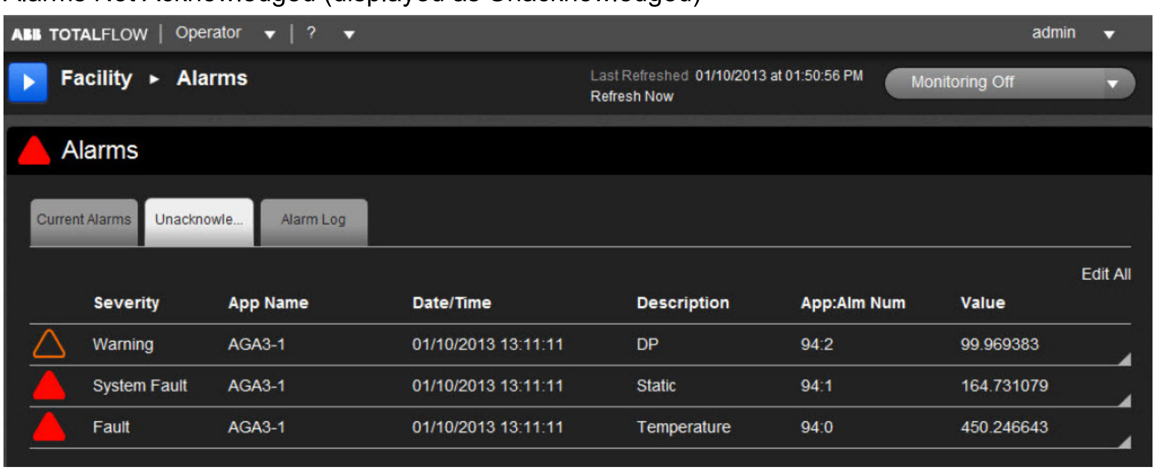
Alarm Codes

The following represents the alarm codes that the user may see within the Alarm column:

Code	Description
AH	Absolute Pressure High Operational Limit Violation for at least one second during the log period.
AL	Absolute Pressure Low Operational Limit Violation for at least one second during the log period.
DH	Differential Pressure High Operational Limit Violation for at least one second during the log period.
UH	Uncorrected Volume High Operational Limit Violation for at least one second during the log period.
DL	Differential Pressure Low Operational Limit Violation for at least one second during the log period.
UL	Uncorrected Volume Low Operational Limit Violation for at least one second during the log period
ZF	Zero Flow for at least one second during the log period.
BF	Back Flow for at least one second during the log period. Occurs when differential pressure is at least three (3) inches below zero.
RS	Remote Sense for at least one second during the log period.
AC	Auxiliary Contact tripped sometime during the log period.
TE	Temperature Error - The temperature measurement is out of the A/D convertor range. The A/D convertor was not able to digitally represent the measured signal from the specified temperature input. This occurs when the temperature reaches 10% below or 10% above the FCU's 0-200 degree scale for some part of this log period. When the A/D reaches its limit, it uses its default temperature range. The flow computer comes from the factory pre-programmed to a 60 degree default temperature but can be re-programmed to another value with PCCU32.
AE	Absolute Pressure Error - The absolute pressure signal from the transducer is out of the conversion range of the A/D convertor. The A/D convertor converts the analog voltage from the transducer to a digital signal that accurately represents the measured value by the transducer. The alarm occurs when the absolute pressure is > approximately 115% full scale (FS) for some part of the log period. These percentages are approximate only due to temperature effects. The transducer has a built-in stop at 15% above FS. Everything above this point is seen as an FS value.

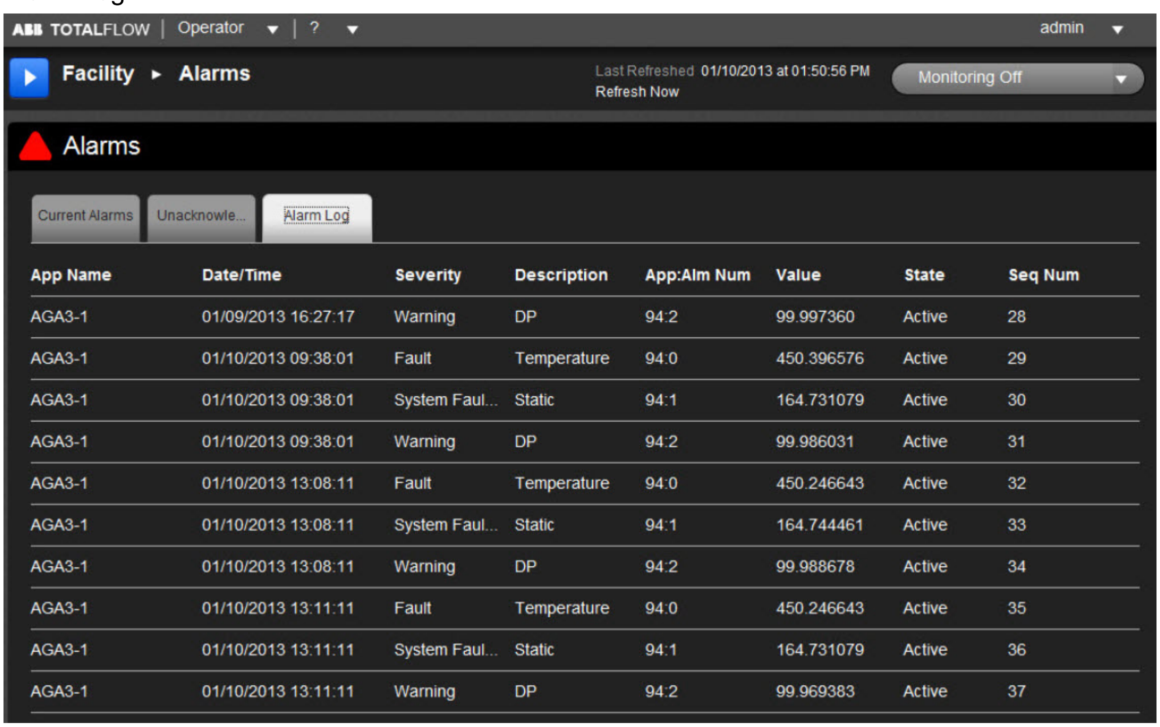
DE	Differential Pressure Error - The differential pressure signal from the transducer is out of the conversion range of the A/D convertor. The A/D convertor converts the analog voltage from the transducer to a digital signal that accurately represents the measured value by the transducer. The alarm occurs when the differential pressure is > approximately 115% full scale (FS) for some part of the log period. These percentages are approximate only due to temperature effects. The transducer has a built-in stop at 15% above FS. Everything above this point is seen as an FS value.
LC	Low Charger - Charge voltage is less than (+) 0.4 Vdc above the battery voltage.
LL	The lithium battery on the flow computer is below minimum capacity for maintaining RAM memory in the event that power is disconnected.
AN	Alternate Fixed Analysis - Live analysis data is being used, and the Live Analysis Period (seconds) has been exceeded since the last live analysis data has been received. The flow computer must be attached to a stream for this alarm to display.
MG	Methane Gravity Method of Supercompressibility calculation was used for the log period indicated. The flow computer must be attached to a stream for this alarm to display.
CE	Calculation Error - The CE alarm bit is set when a calculation function stops due to an unexpected result. This can occur when the flow computer calculates Cd: the iterative steps fail to converge on a solution. It can occur in calculating Fpv when the iterative density calculation fails to converge on a density for the given composition inputs. The calculated value will be used even though the alarm bit is set. The alarm should alert the user to view any input values that affect the calculation.
TH	High Temperature Operational Limit Violation for at least one second during the Log Period.
TL	Low Temperature Operational Limit Violation for at least one second during the Log Period.
FH	High Flow Rate Operational Limit Violation for at least one second during the Log Period.
FL	Low Flow Rate Operational Limit Violation for at least one second during the Log Period.

Alarms Not Acknowledged (displayed as Unacknowledged)



Severity	This field displays the severity of the alarm. The Severity types are as follows: • General - Indicates that an alarm exists but is not critical to the operation. • Warning - This indicates that an alarm exists but is not critical; however, unexpected results may occur. • Fault - Indicates that a problem exists that will affect the outcome of the results and may only be on a single stream. Typical issues include Calculation Error, Unnormalized Totals, etc. The results will not be updated on affected streams.
Application Name	This describes the application where the alarm occurred.
Date/Time	Date and time that the alarm was logged.
Description	This is a short description of the alarm.
App: Alarm No.	This displays the application number where the alarm system was instantiated in PCCU32.
Value	The value displayed in this field represents the variable that caused the alarm. The value is based on the input register in reference to the threshold that was assigned in PCCU32.

Alarm Log



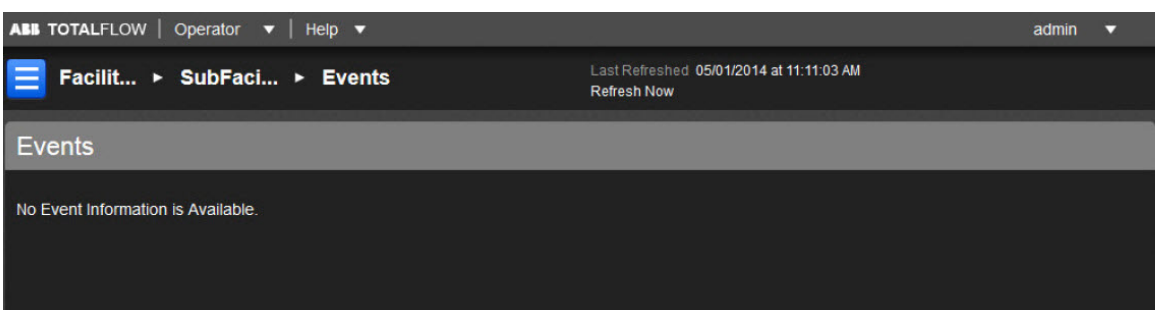
The following parameters are displayed with their descriptions:

Application Name	This describes the application where the alarm occurred.
Date/Time	Date and time that the alarm was logged.
Severity	This field displays the severity of the alarm. The Severity types are as follows: • General - Indicates that an alarm exists but is not critical to the operation. • Warning - This indicates that an alarm exists but is not critical; however, unexpected results may occur. • Fault - Fault indicates that a problem exists that will affect the outcome of the results and may only be on a single stream. Typical issues include Calculation Error, Unnormalized Totals, etc. The results will not be updated on affected streams. • System Fault - This indicates that a potential maintenance problem exists. Typical system faults can include Low or High Carrier or Sample Pressure, Low or High Oven Temperature, etc. The alarm will typically affect calculations; therefore, results will not be updated while this condition exists.
Description	This is a short description of the alarm.
App: Alarm No.	This displays the application number where the alarm system was instantiated in PCCU32.
Value	The value displayed in this field represents the variable that caused the alarm. The value is based on the input register in reference to the threshold that was assigned in PCCU32.
State	This field displays whether the alarm is Active or Inactive.
Seq Num	This parameter's field represents a number that is then incremented for each additional alarm logged.

Events

Overview

The Events section enables the user to view events that have occurred within the selected device.



The information displayed includes:

App Name	This describes the application that caused the event.
Date/Time	Date and time of the event.
Description	Provides a description of the event.
Old Value	This is the value or condition prior to the event change. For AP or DP check, the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	Value or condition entered by the technician. For AP or DP check, the test pressure applied on the transducer.
Seq Nr	-1 or n/a if not available; otherwise, the number sequence from the oldest to the newest event.

PID Control

Overview

The PID Control is a calculation-driven application that involves three (3) parameters: the Proportional, the Integral and the Derivative. These three parameters combine to form the PID calculation. The proportional value determines the reaction to the current error. The integral value determines the reaction based on the sum of recent errors. The derivative determines the reaction based on the rate at which the error has been changing. The weighted sum of these three actions is used to adjust the process via a control element such as the position of a control valve or the power supply of a heating element.

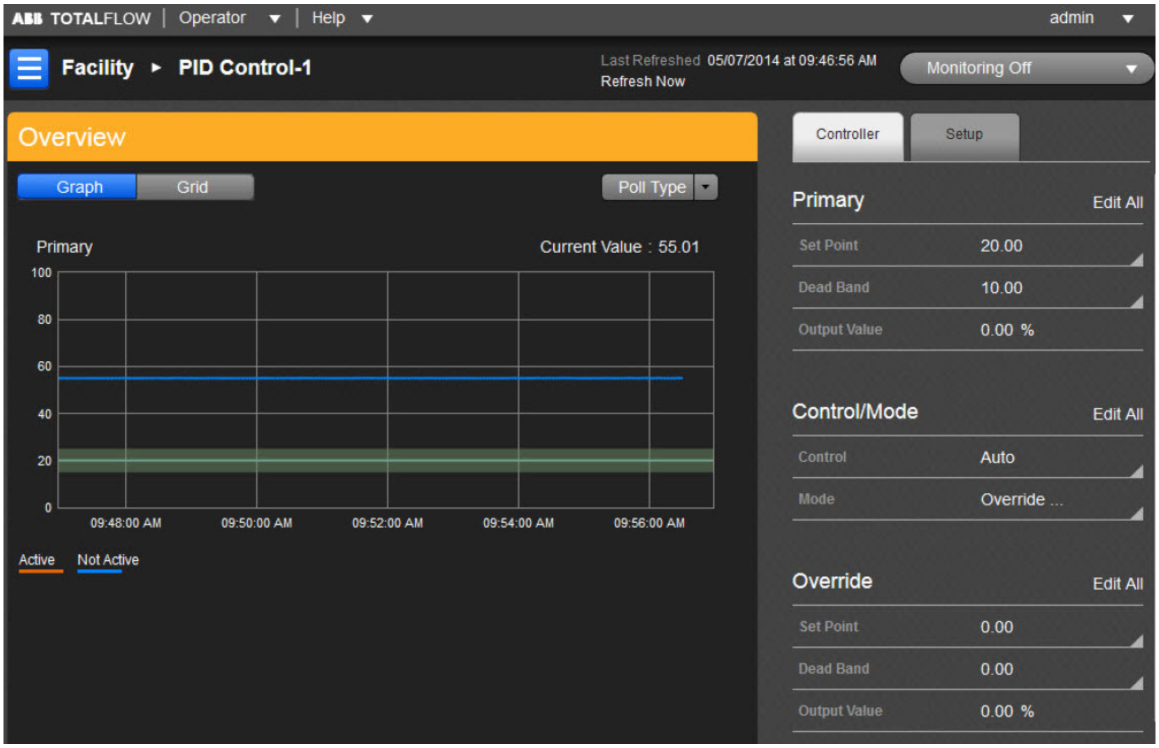
By tuning these three constants in the PID algorithm, the controller can provide control actions designed for specific process requirements. The response of the controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller overshoots the set point and the degree of system oscillation.

NOTE: The use of the PID algorithm for control does not guarantee optimal control of the system or system stability.

Some applications may require using only one or two of the parameters to provide the appropriate system control. This is achieved by setting the gain of the undesired control outputs to zero. A PID controller is called a PI, PD, P or I controller in the absence of the respective control actions. PI controllers are particularly common, since derivative actions are very sensitive to measurement noise. Additionally, the absence of an integral value may prevent the system from reaching its target value due to a control action.

The TWI system is designed to enable users to affect certain parameters that work in conjunction with the PID Control application.

In order to access this screen from the Facility screen, click the right arrow on the far right of the display of all application box icons. Select the first icon from the left (PID Control).



In this control application, there is no inherent capability to trend from its webpage. The association of this app and its trended file(s) must be done in PCCU32. These file(s) must be built in the Trend application's Trend File Editor including file naming and including all selected variables to trend with their App/Array/Registers. The user can then associate the trend file built and named with the control app by going under the app's Setup tab and assigning it the same trend file name. Thus from the webpage it uses the same name to call up the correct file from the Trend System application and display as required the data in graph or grid format. The choice is available to the user in what format to view the data. The user has the choice to display data in Real Time or Historical mode.

If electing to display in Historical mode, the following variables must be included:

1	Primary-PV
2	Units [Optional]
3	Primary-SetPoint
4	Primary-DeadBand
5	Override-PV
6	Units [Optional]
7	Override-SetPoint
8	Override-DeadBand
9	Primary-Override-Flag

The PID Control screen has two main sections: the Controller and Setup sections. Both of these sections are discussed in detail below.

Controller

Primary

Parameter	Description
Setpoint	This field enables the user to enter a setpoint value for the process variable.
Deadband	Creates a "band" above and below the setpoint. A value of 5 will create a band that is 2.5 units above and 2.5 units below the setpoint. As long as the process variable is within this deadband, typically no PID controller output changes are made. However if the Deadband Factor specified on the Advanced tab is used, the controller will continue to exercise control even within the deadband.
Output Value	Displays the Output value. This value is the signal controlling the controlled process.

Control / Mode

Parameter	Description
Control	Select either Manual or Auto. In Manual mode, the user can set the PID output manually, using the Output scale slider. To achieve a smooth transfer between Auto and Manual mode, the setpoint is equal to the measured value (PV). The error (SP - m) would be zero. As such, there would be no interruption.
Mode	Displays the parameter value that is being controlled. The process value (e.g., flow rate) is controlled by opening and closing a valve.

Override

Parameter	Description
Setpoint	The Deadband creates a "window" in which the PID Controller maintains the system output. Generally, as long as the process variable is within this deadband window, no corrective measures are undertaken by the PID Controller. However, if the deadband factor is initiated, the Controller will continue to exercise control over the process variable while in the deadband window. The deadband defaults to 0 and the deadband gain defaults to 1. These default values are equivalent to not having a deadband.
Deadband	Setting the Deadband Factor to a value of 0.0 is the same as not changing the output while operating inside of the deadband. Use a value of 0 and 1 to reduce the change effect but still limit valve changes. Setting this factor to a valve greater than 1 will increase the total gain and make output response larger than normal (high gain preset action). This factor only affects the controller output when the process variable is within the user specified deadband.
Output Value	This read-only field details the Output Value. This value is the signal controlling the controlled process.

Advanced

Loop Interval	This variable represents the frequency at which the PID controller calculates an output. Although this parameter can be changed, it is highly recommended that the default value of 1 second be used. Changing the Loop Interval affects the Proportional, Integral, Derivative and Primary/Override Derivative Filter parameters. It also affects the Primary/Override Output Scale Factor when using digital control.
Minimum Control Time	This parameter represents the minimum amount of time that one of the PID controllers (Primary/Override) will have exclusive rights to the output value. The time is restarted each time that the output switches selection. No output switches can take place until the timer expires. The default and recommended time is 1 second.
Controller Reset Mode	Defines the operating mode that will be entered after a power fail/restart, cold start or warm start of the PID controller. · Auto - Controllers will resume control after reset. · Manual - Controllers are placed in manual mode and no changes are made to the controller output after reset.

Setup

The Setup section enables the user to establish additional parameters for the PID Controller. The Setup section is divided into Primary and Override. The parameters within these sections will only affect those components.

Primary

Parameter	Description
Primary PV	The Primary Process Variable displays the parameter value that is being controlled. The process variable, (e.g. flow rate) is controlled by opening and closing a valve. The value is stored in App/Array/Register 11.7.19
Primary PV Units	These units are expressed in MCF/Day
Setpoint Low Limit	Enter a low limit value for the setpoint range of the Override PID Controller.
Setpoint High Limit	Enter a high limit value for the setpoint range of the Override PID Controller.
Ramp Rate	Enter the setpoint ramp rate which limits the amount the Override PID Controller can ramp the setpoint from one value to the next.
Derivative Filter	The Derivative Filter is used to filter out noise within the process variable. This allows for better derivative control and reduces the effects of system noise. The default for this value is set to 1.0.
Deadband Factor	This user-defined field is the gain factor to be used within the deadband of the controller. A value of 1.0 is equivalent to not having a deadband. Setting the value to 0.0 is equivalent to turning the feature off. A value between 0 and 1 reduces the overall gain and limits process (i.e., valve) changes. Setting this to

	a factor greater than 1 increases the total gain and output response. This factor only effects the controller output when the process variable is within the user-specified deadband.
Proportional	Proportional, sometimes referred to as Gain, makes a change to the output that is proportional to the current error value. The larger the error signal (PV - SP) the larger the correction that will be made to the manipulated variable. Large gains can cause a system to become unstable. Low gains can cause the system to respond too slowly to system disturbances.
Integral	The Integral (Reset) accumulates the instantaneous error value over a defined period of time and provides correction based on this accumulated error. The amount of correction is based on the Integral value. When used in conjunction with the Gain factor, the Integral value helps to drive toward the set point, eliminating steady-state error. Since the Integral value is based on past error values, it can cause overshoot of the preset value.
Derivative	The rate of change error signal is the basis of the Derivative (Rate) factor. The Derivative factor tends to slow the rate of change of the process variable. The behavior tends to reduce the possibility of overshoot, due to the Integral factor.
Scale Factor	Enter the setpoint ramp rate which limits the amount the Override Controller can ramp the setpoint from one value to the next. A positive value of Scale Factor results in "direct" action. A negative value results in "reverse" action.

Override

Parameter	Description
Override PV	Enter the register used for the Override Process Variable used by the Override PID Controller.
Override PV Units	Enter the engineering units for the Override Process Variable.
Setpoint Low Limit	Enter a low limit value for the setpoint range of the Override PID Controller.
Setpoint High Limit	Enter a high limit value for the setpoint range of the Override PID Controller.
Ramp Rate	Enter the setpoint ramp rate which limits the amount the Override PID Controller can ramp the setpoint from one value to the next.
Derivative Filter	The Derivative Filter is used to filter out noise within the process variable. This allows for better derivative control and reduces the effects of system noise. The default for this value is set to 1.0.
Deadband Factor	This user-defined field is the gain factor to be used within the deadband of the controller. A value of 1.0 is equivalent to not having a deadband. Setting the value to 0.0 is equivalent to not having gain control within the deadband. A value between 0 and 1 reduces the overall gain and limits process (i.e., valve) changes. Setting this to a factor greater than 1 increases the total gain and output response. This factor only effects the controller output when the process variable is within the user-specified deadband.
Override Threshold	Override Threshold is an override setpoint adjustment that allows for early detection of the output select. Also, this setting allows the Override PID Controller to stay in control longer before switching back to the Primary PID control. This parameter is only used during Override Control of the Primary PID.

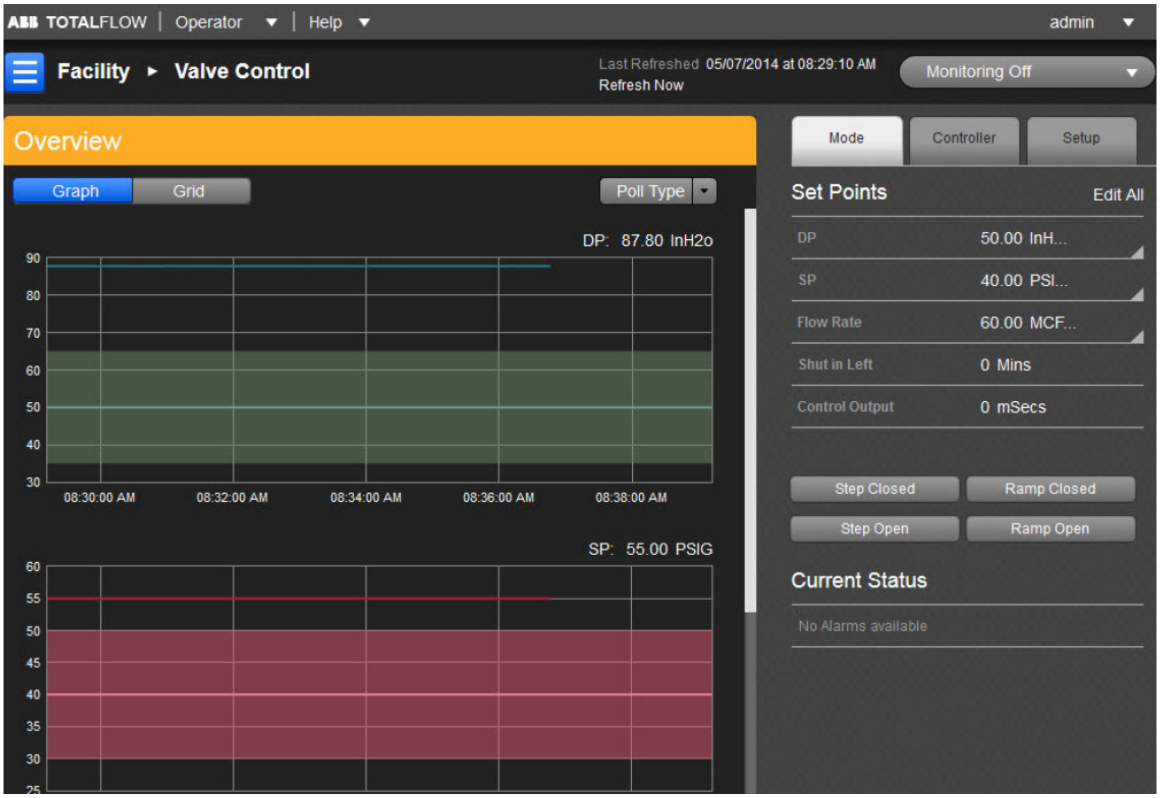
Type	The user has two selections that can be made: • High - After both PIDs have calculated the next value and presented that value to the selector, the selector will pass the higher value to the X-out and the process being controlled (i.e., a valve). • Low - After both PIDs have calculated their next value and presented that value to the selector, the selector will pass the lower value to the X-out and the process being controlled (i.e., a valve).
Proportional	Proportional, sometimes referred to as Gain, makes a change to the output that is proportional to the current error value. The larger the error signal (PV - SP) the larger the correction that will be made to the manipulated variable. Large gains can cause a system to become unstable. Low gains can cause the system to respond too slowly to system disturbances.
Integral	The Integral (Reset) accumulates the instantaneous error value over a defined period of time and provides correction based on this accumulated error. The amount of correction is based on the Integral value. When used in conjunction with the Gain factor, the Integral value helps to drive toward the set point, eliminating steady-state error. Since the Integral value is based on past error values, it can cause overshoot of the preset value.
Derivative	The rate of change error signal is the basis of the Derivative (Rate) factor. The Derivative factor tends to slow the rate of change of the process variable. The behavior tends to reduce the possibility of overshoot, due to the Integral factor.
Scale Factor	Enter the setpoint ramp rate which limits the amount the Override Controller can ramp the setpoint from one value to the next. A positive value of Scale Factor results in "direct" action. A negative value results in "reverse" action.

Valve Control

Overview

Valve Control is an application-specific, input/output feature offered by ABB Totalflow for use in the ABB Totalflow-line of flow computers. The Valve Control application provides automatic feedback control of differential pressure (DP), static pressure (SP) and flow rate. This serves the purpose of the user being able to position a flow valve to maintain a preferred value of DP, SP or flow rate.

The TWI system is designed to enable users to affect certain parameters that work in conjunction with the Valve Control application.



Valve Control Overview

In regards to the Valve Control, it can be helpful to look at the entire Valve Control cycle in order to receive a well-rounded idea of what occurs. Once this is established, the user can better understand how the overall system works and how the Valve Control application works in conjunction with the system components to create a seamless control system.

The cycle starts with a look at the overall process plant. A process plant can contain a variety of different control loops that are all associated with one another. These control loops then work in conjunction with one another to create a product that is offered for sale. Since the sale of the product often relies on its

DP	Plots the Differential Pressure (InH2O)	Associated PCCU Register: VC.2.19
DP - Set Point	Plots the exact point at which the Differential Pressure is to maintained by the controller (InH2O)	Associated PCCU Register: VC.2.10
DP - Deadband	Specifies a range around the DP SetPoint within which the controller will take no action.	Associated PCCU Register: VC.2.11
SP	Plots the raw line (static or absolute) pressure values (PSIA).	Associated PCCU Register: VC.2.18
SP - Set Point	Plots the exact point at which the static/absolute pressure is to be maintained by the controller (PSIA)	Associated PCCU Register: VC.2.3
SP - Dead Band	Specifies a range around the SP SetPoint within which the controller will take no action.	Associated PCCU Register: VC.2.4
Flow Rate	Plots the single point for each cycle (if an arrival has occurred) in minutes. (MCF/Day).	Associated PCCU Register: VC.2.33
Flow Rate - Setpoint	Plots the exact point at which the FlowRate is to be maintained by the controller (MCF/Day)	Associated PCCU Register: VC.2.14

Flow Rate - Dead Band	Specifies a range around the FlowRate SetPoint within which the controller will take no action.	Associated PCCU Register: VC.2.15

NOTE: It should be noted that, while the help files use the term "actuator", this component can go by many different names to include "stepper motor" or "digitally controlled pressure regulator".

Navigation

The Valve Control window is laid out in a similar fashion to other windows found within the TWI. Upon first entering the Valve Control screen, the user is within the Mode tab. There are two other tabs that are available: Controller and Setup. Clicking on any of the available tabs takes the user to that particular area. Within each of the tabs resides certain parameter fields that the user can manipulate based on their specific needs. When the user hovers their cursor over a particular field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

The following details the individual tabs that the user encounters within the Valve Control screen and the various parameters that are contained within each. Click on the preferred link below to view the information regarding that particular tab or item.

Overview

Upon first entering the Valve Control window, the user will see the Overview section. The Overview section is comprised of three graphs that represent the reading for differential pressure (DP), static pressure (SP) and flow rate. Using the vertical scroll bar, the user can look at the graphical representations of each of these components. There is a highlighted horizontal line in each of the graphs. This represents the Deadband for the corresponding Setpoint (SP). Additionally, the user can hover their cursor over any portion of the graph line to see a popup indicator giving the date/time and reading for the particular point that was selected. The user can also hover their cursor over the Deadband line to see the established date/time and setting for the Deadband.

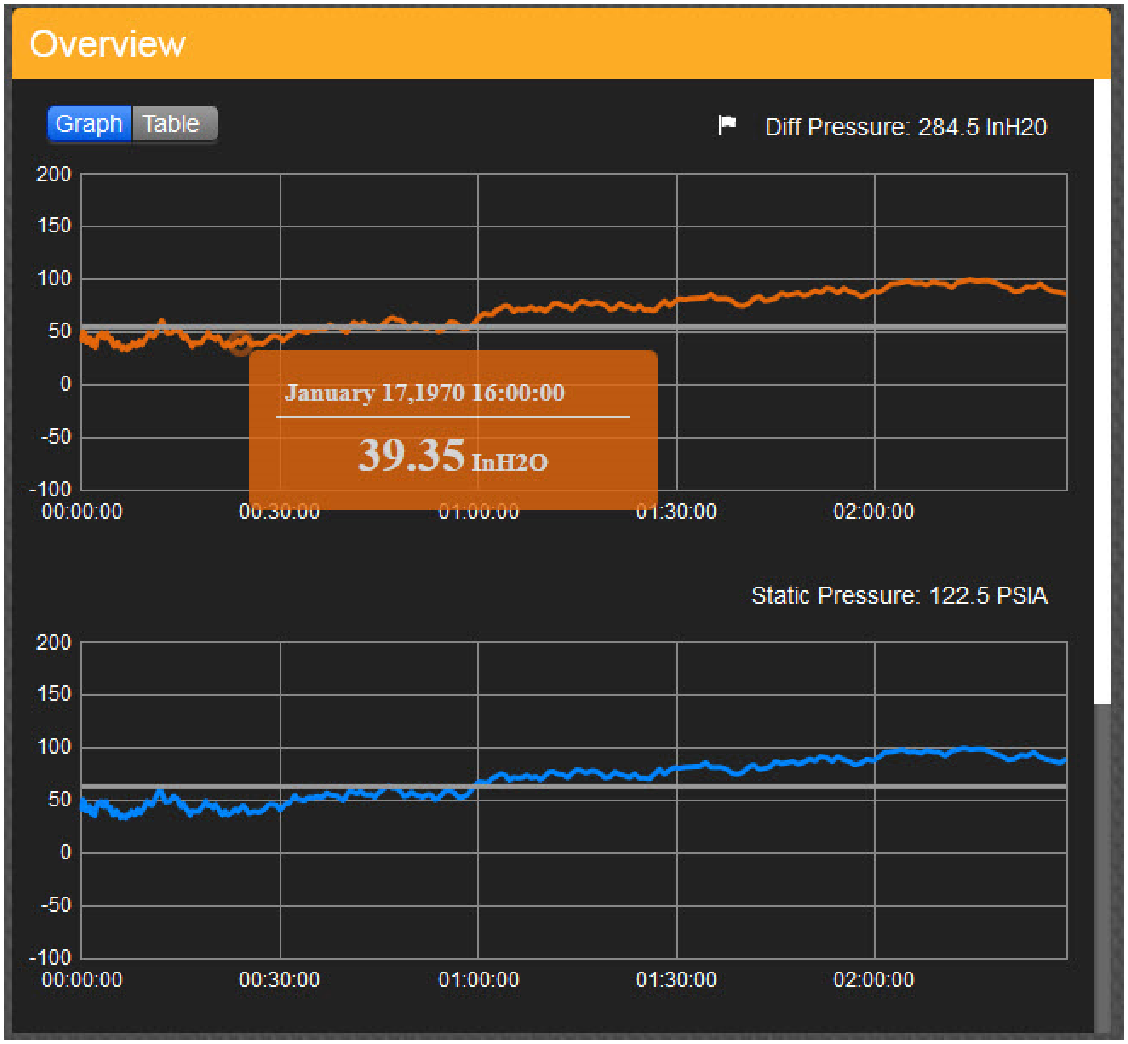
The user is also given an option to view the information for DP, SP or flow rate in a table format. The user can click on the Table button to initiate this view; otherwise, the default view remains as a graphical format.

The choice is available to the user in what format to view the data. One can choose to display in Graph or Grid with Graph being the default. The user also has the choice to display data in Real Time or Historical mode.

If electing to display in Historical mode, the following variables must be included:

1	DP
2	Units [Optional]
3	DP- SetPoint
4	DP- DeadBand
5	SP
6	Units [Optional]
7	SP- SetPoint

8	SP- DeadBand
9	Flow Rate
10	Units [Optional]
11	Flow Rate - SetPoint
12	Flow Rate - DeadBand

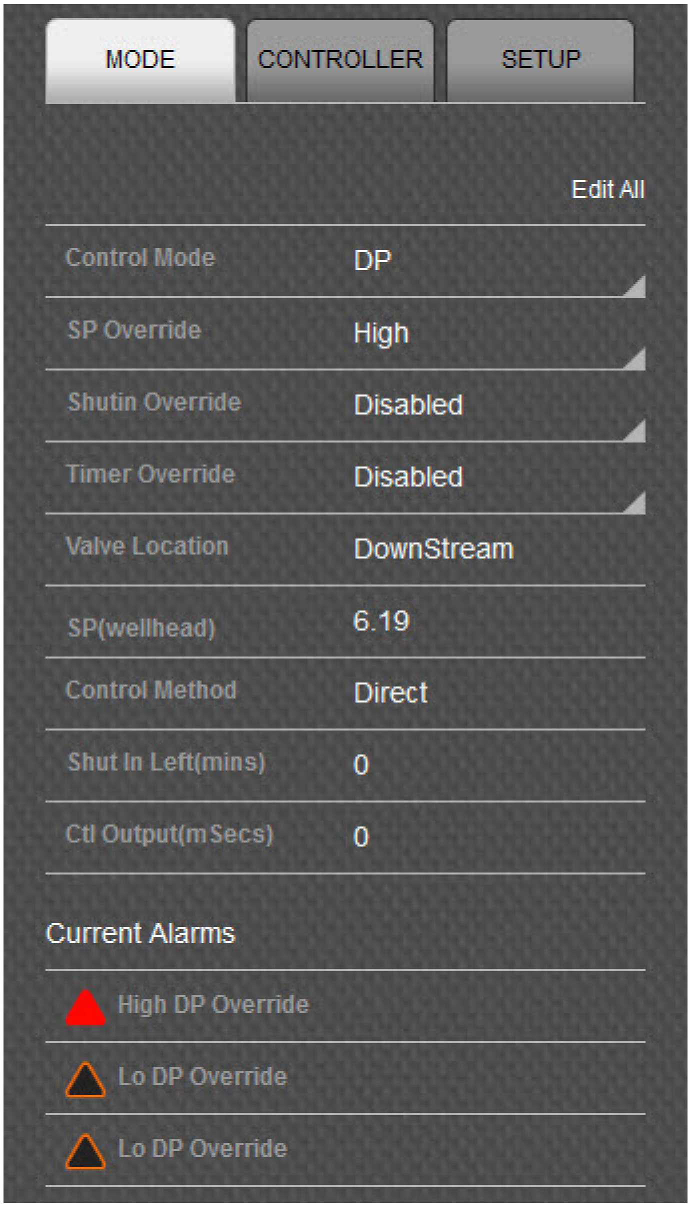


Mode Tab

The Mode tab is the area within the *Totalflow Web UI* system that enables the user to establish parameters that affect the overall control mode of the Valve Control system. Additionally, the Mode tab also includes a Current Alarms section that allows the user to view any alarms that might be occurring within the system.

All of the available parameters are displayed in a column format. When the user hovers their cursor over a particular parameter field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

If the user elects to change singular parameters and clicks the Pencil icon, a parameter dialog box displays. Within that dialog box, the user can change the parameter to a preferred value. Upon completion, click the Save button to initiate the change.



The following will detail the parameter fields that the user can expect to encounter within the Mode tab:

Control Mode	The Control Mode parameter field enables the user to establish the control mode that is to be monitored by the process variable. The modes available to the user are as follows: • None - No control.

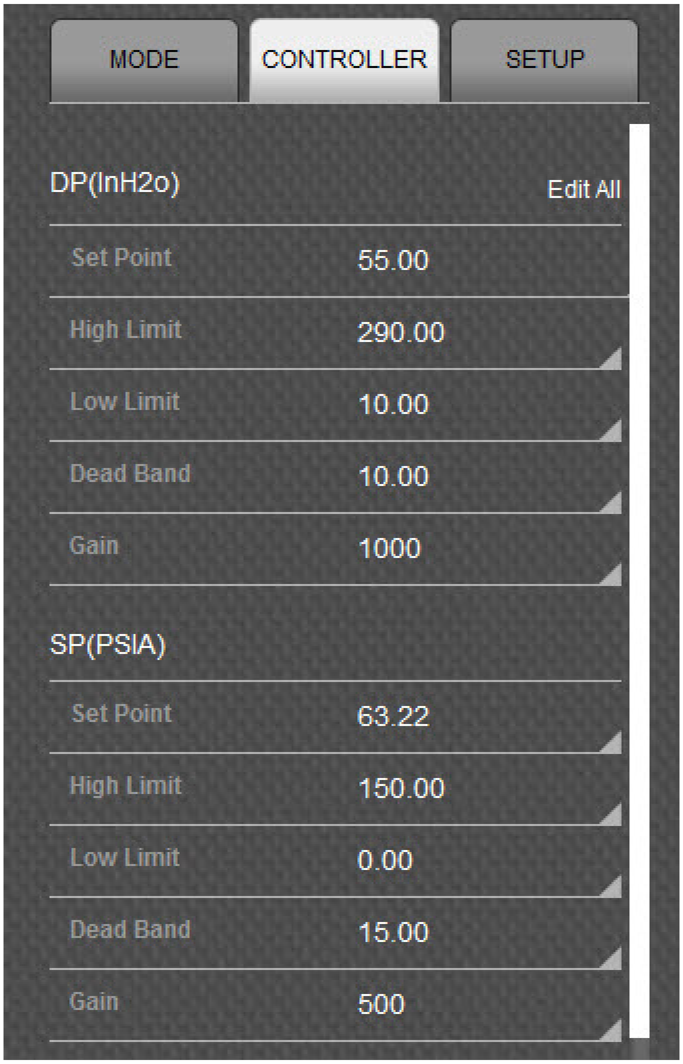
	• DP - When selected, this signifies that the controller is turned on and the automatic feedback control action is in progress and controlling on the DP set point. • SP - When selected, this signifies that the controller is turned on and the automatic feedback control action is in progress and controlling on the SP set point. • Flow Rate - Flow rate means that the controller is turned on and the automatic feedback control action is in progress and is controlling on the flow rate set point.
Shut-In Left (mins.)	The Shut-In Left parameter field displays the amount of time (in minutes) that is left due to a shut-in condition. Once the timer is activated by a DP Low Shut-In condition, the display shows the time remaining before a restart command is issued.
Ctl Output (mSecs)	This read-only field displays the controller output (in milliseconds - digital mode only).

Controller Tab

As discussed earlier, the controller component is responsible for taking the information regarding the process variable and then making adjustments to the system to return the process variable to where it needs to be, following a disturbance. The Valve Control, in turn, is used to control conditions such as SP, DP or flow rate by partially opening or closing in response to the signals received from the Controller tab. It is within the Controller tab that the user establishes the signal parameters that enable the Valve Control to function properly.

All of the available parameters are displayed in a column format. A vertical navigation bar enables the user to quickly move up or down the column to locate the parameter field that they happen to be looking for. When the user hovers their cursor over a particular parameter field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

If the user elects to change singular parameters and clicks the Pencil icon, a parameter dialog box displays. Within that dialog box, the user can change the parameter to a preferred value. Upon completion, click the Save button to initiate the change.



The following will detail the parameter fields that the user can expect to encounter within the Controller tab. Depending on what the user elects to use as the Control method (DP, SP or Flow Rate), the parameter fields are the same, regardless of which Control method is selected.

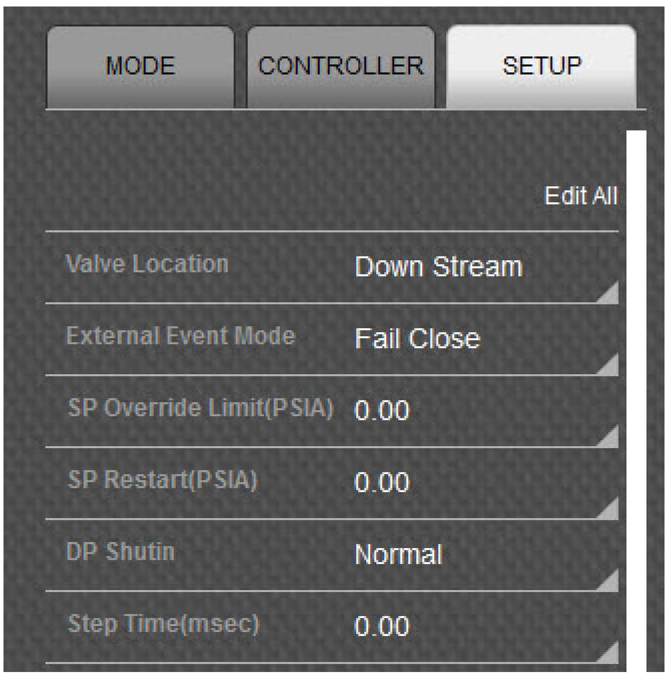
Set Point	The Set Point represents the value at which the process variable is to be maintained by the controller. The Set Point has the same engineering units as the process variable.
High Limit	The High Limit represents the process variable's upper limit for control. This is the highest value at which the process variable can be controlled. The High Limit has the same engineering units as the process variable.
Low Limit	The Low Limit represents the process variable's lower limit for control. This is the lowest value at which the process variable can be controlled. The Low Limit has the same engineering units as the process variable.
Dead Band	The Dead Band specifies the range around the set point within which the controller will take no action. The Dead Band has the same engineering units as the process variable. For example, if the set point is 50 and the dead band is set to 5, the controller will take no action when the process variable is between 45 and

	55. The dead band is important for maintaining the integrity of the system's battery capacity.
Gain	The Gain is the maximum allowable controller output for any one control action. As a general rule, use 1/2 the control valve's travel time from a full open to a full closed state. Gain has the same engineering units in milliseconds (digital mode).

Setup Tab

The Setup tab is the area where the user can establish parameters that affect the Valve Control. All of the available parameters are displayed in a column format. A vertical navigation bar enables the user to quickly move up or down the column to locate the parameter field that they happen to be looking for. When the user hovers their cursor over a particular parameter field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

If the user elects to change singular parameters and clicks the Pencil icon, a parameter dialog box displays. Within that dialog box, the user can change the parameter to a preferred value. Upon completion, click the Save button to initiate the change.



The following will detail the parameter fields that the user can expect to encounter within the Setup tab:

Control Mode	Select the appropriate Contol Mode from the drop down list. None - No Control. DP - Controller is turned on, automatic feedback control action is in progress controlling the DP setpoint. SP - Controller is turned on, automatic feedback control action is in progress controlling the SP setpoint. Flowrate - Controller is turned on, automatic feedback control action is in progress controlling the Flowrate setpoint.

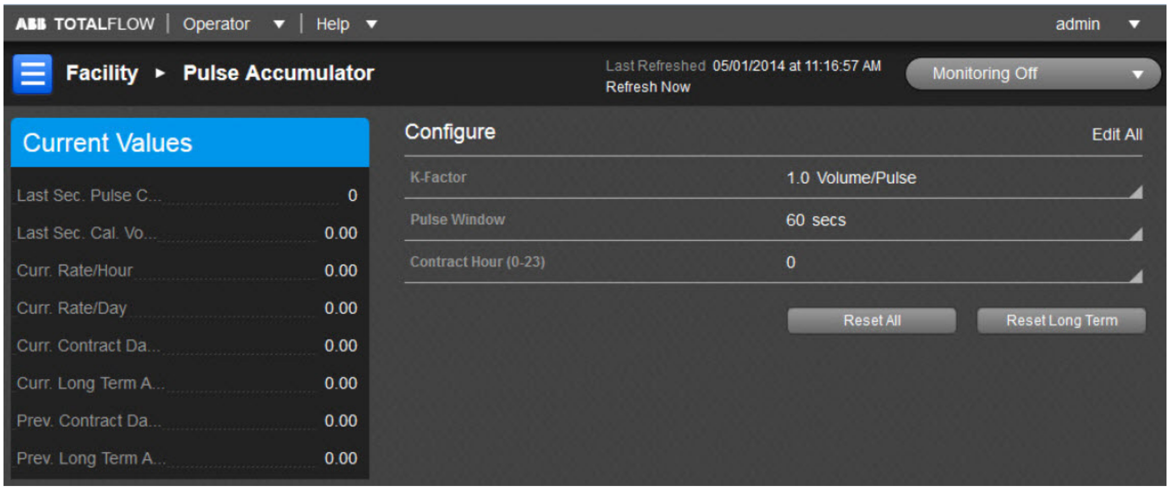
	Nominations - Controller is turned on, automatic feedback control action is in progress controlling the Flowrate setpoint.
SP Override	If set to Enable High the SP controller will override when the pressure exceeds this value. If set to Enable Low the SP controller will override when the pressure drops below this value.
Shut-in Left	Displays the amount of time left due to a shut in condition.
Shut-in Override	Checks for DP and SP override shutin.
Timer Override	Selects the Timer Override option. Acts as an on/off timer using the Open/Close times on the Parameters screen. Can be overridden by other Override conditions.
Control Method	Displays the current Control Method. None - No control method in progress. Direct - DP, SP or Flow Rate. Nominations - Nominations.
Valve Location	The Valve Location parameter field enables the user to establish the location of the valve, in relation to the flow computer. The options available are either Upstream or Downstream.
External Event Mode	The External Event Mode parameter field is designed to give the user the ability to select the externally applied signal that causes the valve to either Fail Closed or Restart Controller. These occur within a Fail Closed Shut-In condition.
SP Override Limit (psia)	Within this parameter field, the user can set the pressure value that causes the SP controller to move into an override state. This field works in conjunction with the SP Override field located in the Mode tab. Based on what the user has selected (High/Low) within the Mode tab, the SP Override Limit value moves into the override state if the pressure value is either exceeded or drops below the established value.
SP Restart Limit	Expressed as SPRST value, when the Static Pressure falls below this value, the selected process variable's output will be used and the controller is restarted.
DP Shut-In	The DP Shut-in parameter field allows the user to select the method used to generate a restart command if the controller is in a Fail Closed Shut-In condition. If the user selects Reactive on SP High, this enables a restart command to occur when the SP reaches a high limit, timer or external event.
Step Time (mSec)	The Step Time represents a period, in milliseconds, used when a Step Open or Step Closed command is processed. This period is also used when a valve is initially opened from a full closed position. The default value is set to zero (0.00). the range is 65535 milliseconds (digital mode).
Control Output	This parameter field represents the controller output value.
Open Time (Min.)/Open Time Remaining	The Open Time/Open Time Remaining parameter fields represent the setup parameters for the timer function. These parameters are observed when the Timer Controller mode is activated. The valve opens or closes, as determined by the associated times. During the open time, the active controller is determining the valve position. During the close time, the valve is closed until either the close timer has elapsed or the controller is turned off.
Valve Action	The Valve Action parameter field allows the user to either set the valve action to Direct or Reverse. If Reverse is selected, the valve is driven in the opposite direction than what would be encountered had the user selected

	Direct. For example, if the valve is set to Direct, the valve is opening. It would then be closing in Reverse mode.
Analog Valve Enable	Within the Analog Valve Enable parameter field, if the user is driving the valve actuator using an analog output, they would need to set the field to Enable; otherwise, leave the parameter field at Disabled.
DP Shut-In Period	The DP Shut-In Period parameter field enables the user to establish a timer setting that is used with the DP Low Shut-In mode. This can be set from 0 to 255 minutes or hours. The time units that the user prefers (in hours) are selected in the Shut-In Timer Unit parameter.
DP Low Time	This field represents the duration, in minutes, used by the controller logic to determine if a DP Shut-In condition exists. If the DP is below the established low limit for the time specified, the DP Shut-In condition exists, and the valve is ramped closed. The controller checks for the condition when in Auto/Shut-In mode. The default is set to zero (0) minutes. The range is 65535 minutes.
Shut-In Timer Unit	The Shut-In Timer Unit parameter field enables the user to program the shut-in units to either hours or minutes. This is used to determine the amount of time to leave the controller off after a shut-in due to low DP.
Low Battery Valve Action	This parameter field allows the user to determine the valve action after a low battery value is reached. There are two (2) available options that the user can select. Close forces the valve closed. Freeze holds the valve in the last position.
Battery Low Limit (Volts)	The Battery Low Limit parameter field is a user-configurable field that represents the low voltage threshold used by the controller's logic to detect a Low Battery condition.
Pipe ID (in.)	The Pipe ID parameter field represents the internal diameter, in inches, of the pipe run between the wellhead and the metering point.
Pipe Length (ft.)	The Pipe Length parameter field represents the distance, in feet, between the wellhead and the metering point.
Close Time	Close Time is observed by the controller when the Timer Controller mode is activated.
Close Time Remaining	The Close Time Remaining represents the amount of Close Time remaining. Close Time is observed by the controller when the Timer Controller mode is activated. The valve opens or closes and is determined by the valve position.
Analog Valve Delay	The Analog Valve Delay parameter field represents a value, in milliseconds, that specifies a delay between the time a valve output action is completed and the time that the control algorithm is allowed to run again. This delay is required to ensure that the control algorithm has updated input data as a result of its last output action. The delay is defaulted to a value specified by the device's configuration files. <u>Under no circumstances should the value be below 1000 milliseconds (1 second)</u>. This is due to the fact that there is no advantage for the value to be any smaller. Additionally, it is feasible that, if there is little or no delay, the outputs on the TFIO Valve Control module could be damaged. This scenario would happen if the Valve control motor is still coasting to a stop from the previous control output and the next output action drove it in the opposite direction. This causes a spike in the current. The Process Variable updates once per second within G3 and G4 devices.
Analog Valve Integrator	The Analog Valve Integrator represents the value that is either added to or subtracted from the 4-20 mA range to ensure that it moves closer to the established Set Point.

Pulse Accumulator

Overview

The Pulse Accumulator application is designed to count pulses and then return an instantaneous volume calculation, based on the number of pulses that were accumulated. Within the TWI, the user can view these pulse counts along with the calculated volume. Additionally, the user can also establish the K-Factor, Pulse Window and Contract Hour.



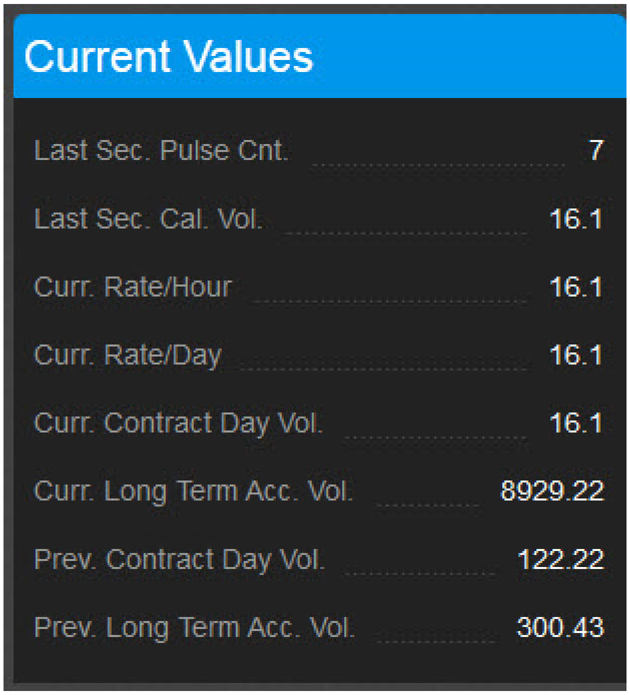
Navigation

The Pulse Accumulator window is laid out in a similar fashion to other windows found within the TWI. Upon first entering the Pulse Accumulator screen, the user is can see the Current Values section and the Configure section. The Configure section contains parameter fields that the user can manipulate based on their specific needs. When the user hovers their cursor over a particular field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

The following details the individual sections that the user encounters within the Pulse Accumulator screen and the various parameters that are contained within each section. Click on the preferred link below to view the information regarding that particular section.

Current Values Section

The Current Values section displays the pulse accumulator values that pertain to specific parameters. The values displayed are read-only. The values are displayed in column format.



The values that the user can view are as follows:

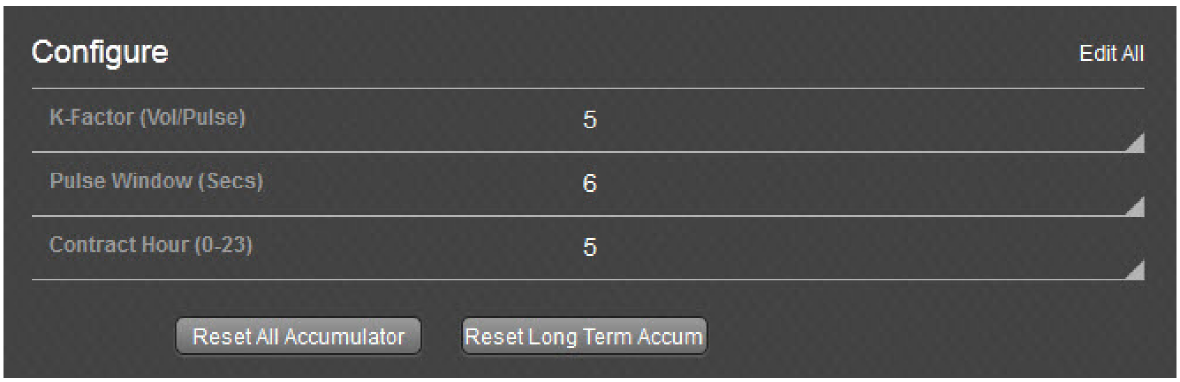
Last Second Pulse Count	This parameter field displays the accumulated pulse count that was amassed over the last one (1) second.
Last Second Calculated Volume	This field displays the volume (pulses x K-Factor) that was accumulated over the last second.
Current Rate/Hour	The Current Rate/Hour parameter field displays the calculated rate per hour and uses the previous window period (previous window value x 3600/seconds of Pulse window).
Current Rate/Day	This field displays the calculated rate per day and uses the previous window period (previous window value x 86400/seconds of Pulse window).
Current Contract Day Volume	This parameter field displays the current volume accumulated since the start of the contract day.
Current Long Term Accumulated Volume	This field displays the accumulated volume since the last accumulator reset.
Previous Contract Day Volume	The Previous Contract Day Volume parameter field displays the updated information from the Current Contract Day Volume parameter field when the contract day ends or when the Reset All Accumulators is initiated.
Previous Long Term Accumulated Volume	This field displays the updated information from the Current Long Term Accumulated Volume parameter field at the time of the last Reset Long Term Accumulator, Reset All Accumulators or an accumulator rollover was initiated.

Configure Section

The Configure section within the Pulse Accumulator tab enables the user to establish certain parameters that directly affect the Pulse Accumulator application.

All of the available parameters are displayed in a column format. When the user hovers their cursor over a particular parameter field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

If the user elects to change singular parameters and clicks the Pencil icon, a parameter dialog box displays. Within that dialog box, the user can change the parameter to a preferred value. Upon completion, click the Save button to initiate the change.



These parameters are as follows:

K-Factor (Vol/Pulse)	The K-Factor is a correction factor for pulse meters. It helps to determine the value of the pulse, based on the turbine that the user happens to be utilizing. Please see the manufacturing specifications to determine the K-Factor. Upon determination, place the number in the corresponding parameter field. The K-Factor for the *Totalflow Web UI* component measures the volume per pulse. Each second, the accumulated pulses are multiplied by the K-Factor to produce a scaled value.
Pulse Window (Secs)	The Pulse Window parameter field enables the user to establish the amount of time (in seconds) in which to count pulses before applying the K-Factor. The accumulated value (pulses per second multiplied by the K-Factor) is then totaled and displayed for the user.
Contract Hour	This parameter field enables the user to enter in the Contract Hour in military time (0-23). The Contract Hour represents the start of the day for daily volumes.
Reset Long Term Accumulator	When selected by the user, this updates the Previous Long Term Accumulators from the Current Long Term Accumulators and zeroes out the Current Long Term Accumulators.

Reset All Accumulators	When selected by the user, this resets all accumulators. All previous values are updated from associated current values. Additionally, all times are updated to the new reset time.

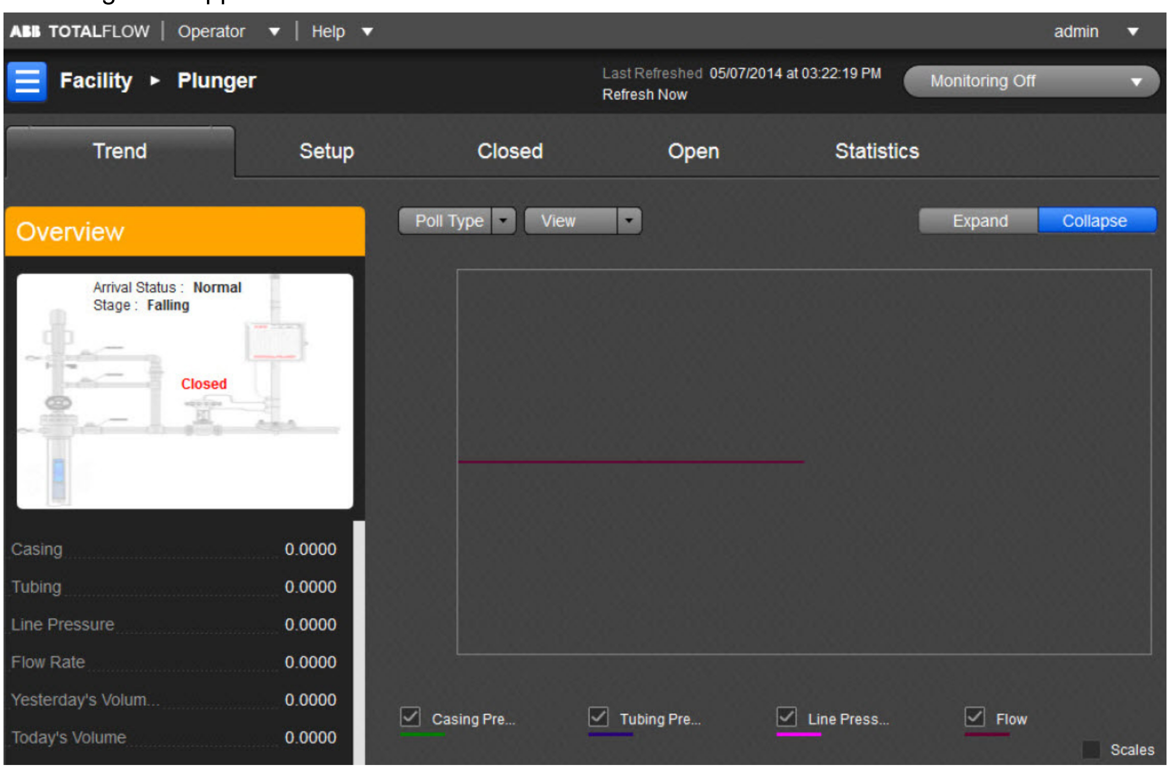
Plunger Lift

Overview

The Plunger Lift application works in a manner similar to a pneumatic piston, wherein it is caused by gravity to fall to the bottom of the well. Acting as a seal between the liquid and the 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 and slows it down. The production valve is closed to allow down-hole pressure to build in the casing. After the pressure has built up, 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 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, causing the cycle to repeat.

Read-only fields display values for Casing/Tubing/Line pressures, Flow Rate and Yesterday's/Today's volumes.

The TWI system is designed to enable users to affect certain parameters that work in conjunction with the Plunger Lift application.



Navigation

The Plunger Lift window is laid out in a similar fashion to other windows found within the TWI. Upon first entering the Plunger Lift screen, the user is within the Trend tab. There are five other tabs that are available: Trend, Setup, Closed, Open and Statistics. Clicking on any of the available tabs takes the user to that particular area. Within each of the tabs resides information and/or certain parameter fields that the user can manipulate, based on their specific needs. When the user hovers their cursor over a particular field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

The following details the individual tabs that the user encounters within the Plunger Lift screen and the various parameters that are contained within each. Click on the preferred link below to view the information regarding that particular tab or item.

Overview

Casing	Plots the raw casing pressure values (PSIA). Associated PCCU Register (5.5)
Tubing	Plots the raw tubing pressure value. Associated PCCU Register (5.6)
Line Pressure	Plots the raw line (static) pressure values (PSIA). Associated PCCU Register (5.7)
Flow Rate	Plots the single point for each cycle (if an arrival has occurred) in minutes (SCF/Hr). Associated PCCU Register (5.8)
Yesterday's Volume	Displays yesterday's contract day volume.
Today's Volume	Displays the Volume from the start of the Contract Day.
Shutdown Status	Displays as either OK or in Shutdown.
Fail Reason Value	The top row displays the current state of the controller in the Description column followed by the current timer time for the current state followed by the time limit for the current state. Controller states: · Fail – Indicates that plunger has failed to arrive. · Closing Valve – Indicates that the production valve is closing, and the system is waiting for the plunger fall delay to expire. · Valve Closed – Indicates the plunger fall delay has expired, and the system is waiting for an open valve condition to be initiated. · Plunger Arriving – Indicates that the production valve has opened, and the system is waiting for the plunger to arrive. · Blow Valve – Indicates that the plunger has not yet arrived, blow valve conditions have been met and a secondary valve has been opened. · Plunger Arrived – This is an instantaneous state that indicates that the plunger has arrived. · AfterFlow – Indicates that the production valve is open, the plunger has arrived, gas is flowing and close conditions are waiting to be met.
Fail Reason Date	Provides the date/time of the last Fail Reason.
Timer	Displays the elapsed time since the valve was last commanded open and the plunger arriving.
Max Timer	Displays the maximum amount of time to wait for the plunger to arrive.

Trend

In this control application, there is no inherent capability to trend from its webpage. The association of this app and its trended file(s) must be done in PCCU32. These file(s) must be built in the Trend application's Trend File Editor including file naming and including all selected variables to trend with their App/Array/Registers. The user can then associate the trend file built and named with the control app by going under the app's Setup tab and assigning it the same trend file name. Thus from the webpage it uses the same name to call up the correct file from the Trend System application and display as required the data in graph or grid format.

The Trend tab gives the user a graphical representation of the measurements and trends for the valve. The user may select the Poll Type button to display either Historical or Real Time data. One may also use the View button to select either the Grid or Graph view. The user may click on any of the check marks to the left of the variables along the bottom of the view to either display or hide the individual variable(s). The user also may use a mouse rollover on any of the displayed trends (must be in Graph view and polling Historical Data) to show the individual reading for selected times. Finally the display itself may be collapsed or expanded by selecting the corresponding button function in the upper right corner of the screen.

If electing to display in Historical mode, the following variables must be included:

1	Casing
2	Units [Optional]
3	Tubing
4	Units [Optional]
5	Line
6	Units [Optional]
7	Flow Rate
8	Units [Optional]

The individual parameters can be displayed with or without measurement scales. To add the scales to the background, the Scales icon to the lower right of the parameter legend would need to be selected. Selecting it again would hide the scales.

Setup

General

Common Setup

Plunger Control	Allows for the plunger control types to be set. The types are as follows: · Off – This control type prevents the logic from running. Resets the controller. · Manual – This setting allows for the manual operation of both the production and blow valves. Additionally, it also allows for the input valves to be read. · On – This control type initializes the logic from Startup mode and begins operation.

Cycle Start	Within this field the user can add time to off-time (shut-in period) to ensure the Plunger Lift runs according to the time cycles.
Trend File Name	Enter a name here and setup a trend file in the Trend System application. Using the same name will allow the web user interface to display the trend information when viewing the Plunger application information.

Tuning

Optimization	Enables and disables the continuous adjustment of all setpoints. Options are either Disabled or Enabled. If Optimization has not been enabled, it will be the sole option under Tuning. Once optimized, the Plunger Fail Tune option will display. If Optimization is de-selected, the Plunger Fail Tune option will disappear.
Plunger Fail Tune	If a plunger happens to fail, this field allows the user to set this factor which is then consequently multiplied against the next tuning.

Reset OptionsStartup Mode	Select the startup state after a controller reset. · 1 Closing Valve - Startup in the Closing Valve state (State 1). · 6 AfterFlow - Startup in the AfterFlow state (State 6). · Previous State - Startup in the state at the time of the reset occurred.
Safety Reset Mode	In this field if the plunger is disabled by the safety system or disabled due to max arrivals allowed being exceeded. This control is used to reset plunger controls.

Well Geometry

Tubing Length	This is a user configurable field that enables the establishment of the length of the tubing from the stop to the arrival sensor. This is subsequently used to calculate the lift velocity.
Tubing Inner Diameter	This is a user configurable field that establishes the inner diameter of the well tubing. This is then used to calculate the Turner Flow Rate.
Fluid Gradient	Within this user-defined field the user can set the constant that is utilized to calculate slug size.
Log Size	This is a user configurable field that establishes the number of cycle, blow and fail logs that are kept.
Event Log Size	Enter the number of event logs for the system to keep.

Valve

On/Off Control

Valve Position	User-defined as Upstream or Downstream depending on direction in relation to the valve.

Valve Time Limit	This is the amount of time to manually energize the open and close DOs to either open or close the production, blow and capture valves. This is not to be confused with valve control. Enter time in seconds.

Main Valve Setup

Valve Type	Select the type of valve used for the production valve. · Latch-One output - Only one digital output is used to both open and close the valve. Latch signifies that the DO remains closed when energized until told to open. · Latch-Two output - Two digital outputs are used, one to open the valve and one to close the valve. Latch signifies that the DOs remain closed when energized until told to open. · Pulse-Two output - Two digital outputs are used, one to open the valve and one to close the valve. Pulse signifies that the DO is only energized for a short duration as specified by the "Valve Time Limit" above.
Open DO	User-defined with the app/array/register for Open DO.
Close DO	User-defined with the app/array/register for Close DO.
Valve Fail State	User-defined as None, Close, or Open.
Manual Valve Open Now	Select either Auto or Force Open.
Manual Valve Close Now	Select either Auto or Force Close.

Blow Valve Setup

BV Type	Specify the number and type of outputs that are used by the blow valve. The selected options are set to Pulse-Two Output, Latch-One Output or Latch-Two Output.

Capture Valve Setup

Capture Valve Type	This is simply an Enable or Disable function with no setup required other than if you have a Capture Valve, it needs to be set up in Valve Setup under the Setup tree-view item. When enabled, Catch Mode will put the well in a permanent Closed Hold mode after it completes its flow cycle. If a Capture Valve is used, the plunger is kept captured during this time. When the Plunger Catch Mode is disabled, the plunger is released and normal cycle operation resumes. User-defined with a selection of Pulse-Two output, Latch-One output, Latch-Two output, or Disable.

Valve Control

VC Option	Decide whether or not to use the valve control during flow cycle (plunger arriving and AfterFlow). Available options are set to Enabled or Disabled.

Tube

Tube

Value Registers

Tube App	Setting will auto-set the Tube Register Address
AP Register	Establishes the address of the absolute pressure analog input. Normal = AGA3.1.15.
DP Register	Specifies the address of the differential pressure analog input. Normal = AGA3.5.0.
Flow Rate Register	Can set the address of the flow rate. Normal = AGA3.5.19.
Volume Accumulator Register	Can set the address of the accumulated volume. Normal = AGA3.5.21.
Volume Today Register	User-defined with the Volume Today app/array/register.
Volume Yesterday Register	User-defined with the Volume Yesterday app/array/register.
Tf Register (Temperature)	Specify the address of the temperature. Normal = AGA3.1.0.
Z Factor	Specifies the address of gas compressibility. Normal = AGA3.5.31.
Barometer Pressure Register	Can set the address of the barometer pressure that is used to adjust FCU pressure to PSIG. Normal = AGA3.3.16.
Contract Hour Update Register	Specifies the address of the last contract hour update. Normal = AGA3.1.86.

Input

Input Value Registers

Casing Pressure AI	Can set the address of the casing pressure analog input. Normal = IOS.3.4 (A15).
External Pressure AI	Can set the address of the external pressure analog input. This is then used for either tubing or line pressure depending on the valve location.
Hold Pressure	Specifies the address of the hold pressure analog input.
Open 1	Can set the address of open 1.
Open 2	Can set the address of open 2.
Close 1	Can set the address of close 1 (in1).
Close 2	Can set the address of close 2 (in2).
Hold External	Can set the address of the hold external.

Misc Registers

Detection Type	Select whether a plunger is used or if the logic acts as an intermitter. The available options are set to either I/O or Intermit.
Plunger Arrival Pulse Input	Can set the address of plunger arrival pulse input.
Restart Button	Can set the address of the restart plunger digital input.
Open Button	Can set the address for the valve open push button digital input.
Close Button	Can set the address for the valve close push button digital input.

Closed

Falling

Valve Close Check

Enable VC Check	Enable the VC Check by selecting the empty box. Otherwise, selecting the checked box will disable the VC Check.

Plunger Fall Delay

Fall Timer	The Fall Timer will display the days/hours/minutes/seconds.
Fall Delay Limit	Set the Fall Timer display with the days/hours/minutes/seconds. This is the time to wait when closing the valve before going to state 2.

Closed Setup

Closed Setup

Open On	The primary reason for this screen is to provide optional ways to open the closed production valve using one of the following parameters (to open on):
Tube Line	This option uses the tubing-line pressure differential to open the production valve. The User can select the Open on Tube Line box to cause a new tab (Tube-Line) to appear for setting up this option.
Case Line	This option uses the casing-line pressure differential to open the production valve. The User can select the Open on Case Line box to cause a new tab (Case-Line) to appear for setting up this option.
Case Tube	This option uses the casing-tubing pressure differential to open the production valve. This option uses the casing-tube pressure differential to open the production valve. The User can select the Open on Case Tube box to cause a new tab (Case-Tube) to appear for setting up this option.
Load Ratio	This option uses the Load Ratio to open the production valve. The User can select the Open on Load Ratio box to cause a new tab (Load Ratio) to appear for setting up this option.
Foss Gaul	This option uses the Foss Gaul equation to open the production valve. The User can select the Open on Foss Gaul box to cause a new tab (Foss Gaul) to appear for setting up this option.
Tube Pressure	This option uses the tubing pressure to open the production valve. The User can select the Open on Tube Pressure box to cause a new tab (Tube Pressure) to appear for setting up this option.
Casing Pressure	This option uses the casing pressure to open the production valve. The User can select the Open on Casing Pressure box to cause a new tab (Casing Pressure) to appear for setting up this option.
SP	This option uses the static pressure to open the production valve. The User can select the Open on SP box to cause a new tab (SP) to appear for setting up this option.
Open1	This option uses a timer and a register that can be pointed to any variable to open the production valve. The user sets a limit for the variable and the amount of time the

	value of the variable can be above or below the variable limit. The User can select the Open on Open 1 box to cause a new tab (Open 1) to appear for setting up this option. This option can be used in conjunction with Open 2 and have 2 different sets of criteria to open the valve on whichever criteria is met first.
Open2	This option uses a timer and a register that can be pointed to any variable to open the production valve. The user sets a limit for the variable and the amount of time the value of the variable can be above or below the variable limit. The User can select the Open on Open 2 box to cause a new tab (Open 2) to appear for setting up this option. This option can be used in conjunction with Open 1 and have 2 different sets of criteria to open the valve on whichever criteria is met first.
Close Timer	This option uses a timer to open the production valve. The User can select the Open on Closed Timer box to cause a new tab (Closed Timer) to appear for setting up this option.

Plunger Fall Delay

Hold Reason	The Value column displays reasons the plunger is in Hold (valve closed).
Open Reason	The Limit column displays the last reason the valve was opened.

Closed Hold

Closed Hold

Hold Plunger Fall	This option is basically the same as the Fall Timer used in State 1 (Closing Valve) with the exception that this option is in State 2 (Closed). This option will keep the production valve closed for the Limit time entered even if conditions have been met to open the valve. This option would replace the Fall Timer in State 1 and not be used in conjunction.
Mandatory Recovery	The User enables this option by selecting the Enable Mandatory Recovery Time box. When enabled, it will run after a plunger non-arrival and keep the well in a closed state to allow the pressure time to recover. The User selects whether to use 1 Cycle, 2 Cycle or 3 Cycle times or Fixed to enter a fixed amount of time.
Total Cycle	Option of using an amount of time between valve open to valve open to operate the well. · Fixed - The user enters a time in the Total Cycle Timer Limit column for the desired total cycle time. The close time is adjusted automatically each cycle to make up the difference between the open time and the total cycle time. Open time can be the result of any option and thus not restricted to a timer. · Auto - Uses the Flow Timer Close option found under "Open \ Open Setup" for the open time and the Closed Timer option found under "2:Closed \ Closed Setup" for the close time. The limit value of each option is added together to get the Total Cycle Time which will be displayed as the Total Cycle Timer Limit value. Each option has to be enabled of course and a Limit time entered.
Hold Once	Option of delaying the well operation once for a single amount of time. Options are 1 Cycle, 2 Cycle, 3 Cycle, or Fixed for a fixed amount of time. Selecting Enable and Send will display the "2:Hold Once" tab for setup.
Hold External	Option to hold the valve closed until enabled by an external input such as a digital input. Selecting the Hold External box will display the "Hold External" tab for setup.
Hold Schedule	Option to hold the valve closed until enabled by a schedule. Selecting the Hold Schedule (Hold on Pad Controller) box will display the "Hold Schedule" tab for setup.
Hold Pressure	The User selects whether to hold when the Hold Value pressure is lower (Hold Low) than the Hold Value Limit or hold when it is higher (Hold High).

Hold Close 1	This option supports an input called "Close 1" which would typically be a pressure but could be a digital input. The setup options are split into two functions, close the production valve when it's open and hold it closed for some period. The input value is tested to see if it is above or below a specified value and the value must be above or below the specified value for a user specified amount of time. "Close 1" and "Close 2" can both be used at the same time and whichever has its criteria met first will drive or hold the valve.
Hold Close 2	This option supports and input called "Close 2" which would typically be a pressure but could be a digital input. The setup options are split into two functions, close the production valve when its open and hold it closed for some period. The input value is tested to see if it is above or below a specified value and the value must be above or below the specified value for a user specified amount of time. "Close 1" and "Close 2" can both be used at the same time and whichever has its criteria met first will drive or hold the valve.
Hold High Line	This option uses high line pressure to close the production valve and either keep closed or re-open. Enable/Disable in the Value column.
Time of Day	This option allows the user to set up to four different time spans each day to put the well into Hold mode. Enable/Disable in the Value column. The Limit column indicates Yes or No whether in Hold mode or not.
Plunger Catch Mode	This option when enabled will keep the production valve closed until the option is disabled. This typically allows for closing in the well after a plunger catch.
Hold Reason	The Value column displays reasons the plunger is in Hold (valve closed).
Open Reason	The Limit column displays the last reason the valve was opened.

Open

Open Setup

Open Setup

Plunger catch mode	This is simply an Enable or Disable function with no setup required other than if you have a Capture Valve; it needs to be setup in Valve Setup under the Setup tree-view item. When enabled, Catch Mode will put the well in a permanent Closed Hold mode after it completes its flow cycle. If a Capture Valve is used, the plunger is kept captured during this time. When the Plunger Catch Mode is disabled, the plunger is released and normal cycle operation resumes.
Flow Timer	This is a timer option that allows the well to flow for specified period of time each cycle before closing the production valve.
Close 1	Close 1 Hold option: Value Column - Displays the Close 1 input current value. Limit Column - The Close 1 value must be below/above this Close 1 Limit value for the Close 1 timer Limit time. Time Limit Column - Displays the Hold Close 1 Time Limit. Misc Column - Displays the Close 1 Open Action. This is how Close 1 will release hold.

Close 2	Close 1 Hold option: Value Column - Displays the Close 2 input current value. Limit Column - The Close 2 value must be below/above this Close 2 Limit value for the Close 2 timer Limit time. Time Limit Column - Displays the Hold Close 2 Time Limit. Misc Column - Displays the Close 2 Open Action. This is how Close 2 will release hold.
Blow Cushion	Value Column - Displays the Blow Valve Cushion Timer which is the elapsed time since the plunger arrived while in Blow Valve state. Time Limit Column - Displays the Blow Valve Cushion Time Limit which is the time to wait after the plunger arrives while in Blow Valve state. After this time limit, open the production valve and close the blow valve.

Waiting

Close Valve Enables

Flow Timer Close	Option of using a timer as the means of closing the production valve.
Flow Cycle Time Limit	The time begins when the production valve is opened and ends when the Limit time has elapsed. This will include arrival time for the plunger and AfterFlow time which is after the plunger arrives.
Close 1	This option which uses the Close 1 input provides two primary uses. It can be used to hold the production valve closed and/or release it when in the Closed state (State 2). It can also be use to Close the production valve when in the Waiting/Arrival (State 3) or AfterFlow (State 6).
Close 1 Close Limit	Displays the current Close 1 value and the Close Limit value. · Value column - Current Close 1 Value. · Limit column - Hold closed if Close 1 Value is below/above (Close Action) this Limit for Close 1 Timer Limit.
Close 2	This option which uses the Close 2 input provides two primary uses. It can be used to hold the production valve closed and/or release it when in the Closed state (State 2). It can also be use to Close the production valve when in the Waiting/Arrival (State 3) or AfterFlow (State 6).
Close 2 Open Limit	Displays the current Close 2 value and the Open Limit value. · Value column - Current Close 2 Value. - Limit column - Close 2 value must be above/below this Limit value based on Close 2 Action for Close 2 Timer Limit to close valve.
Arrival Timer	The Value column displays the elapsed time since the production valve was commanded open and until the plunger arrives. Then the timer will reset.
Last Plunger Arrival	Displays the time of the last plunger arrival. The value is set in the following format: dd:hh:mm:ss.
Non-Arrivals Count	Displays the elapsed time since the valve was commanded open and the plunger is arriving.
Max Non-Arrivals Count	Counts the consecutive number of arrival times that were greater than the Max Arrival Time. The value is automatically reset if the plunger arrival time is less than the Max Arrival Time.

Arrival Time Limits

Max Arrival Time	The Value column displays the number of consecutive times the arrival time exceeded the maximum arrival time. The count will reset if the arrival time is less than the maximum time.
Slow Arrival Time	The Value column displays the number of counts where the arrival time fell below the Slow Arrival Time Limit. The count will reset if an arrival time is greater than the Slow Limit Time. Also, tuning will occur if the plunger arrival is slower than the Slow Arrival Time Limit.
Fast Arrival Time	The Value column displays the number of counts where the arrival time exceeded the Fast Arrival Time Limit. The count will reset if an arrival time is slower than the Fast Arrival Limit Time. Also, tuning will occur if the plunger arrival is faster than the Fast Arrival Time Limit.
Min Arrival Time	The Value column displays the number of consecutive arrival counts where the arrival time fell below the minimum arrival time. The count will reset if the arrival time is greater than the minimum time.

High Line

High Line	Option to use high line pressure as a way to close the production valve and adjust the close time.

Arrived

Plunger Swab

Plunger Swab (Option)	The Swabbing section's Enable first field is optional and user-defined from which the user can enable the use of the plunger to swab. When set to Enable, the plunger will begin tripping on the next cycle, repeating the drop phase on the next arrival. Options are either Yes or No.
Swab Runs Completed	The Swab Run Count is the read-only field that displays the number of swab runs completed to date.
Swab Runs Setpoint	When the user enables the Swabbing option, this user-defined field allows the user to set the number of swab runs that need to be completed.
Swab Now	To swab now, select Yes and Send. At the start of or during AfterFlow, the production valve will close immediately and stay closed through its normal close time and then commence swabbing. The number of swabs is as specified in the Limit column for Total Runs.
Total Cycles	Cycles left until maintenance
Total Cycles Left Till Maintenance	The Value column will display the total number of cycles ran until the Plunger Counter Reset. When the Total Cycles equals the number specified by the user in the Limit column, the Cycle Status on the Summary screen will display the word Maintenance.

Plunger Arrived

First Run Count	Displays the Value column counts up to the Limit value entered by the user in the Limit column. On each plunger arrival, the count will increment and the production valve will close, not allowing the Plunger application to go into the AfterFlow state. After the Value column count reaches the Limit value, AfterFlow and normal operation commences on the next cycle.
First Run Limit	The User defines the Limit value by entering it here. On each plunger arrival, the count will increment and the production valve will close, not allowing the Plunger application to go into the AfterFlow state. After the Value column count reaches the Limit value, AfterFlow and normal operation commences on the next cycle.

After Flow

After Flow Setup

After Flow Timer	This option uses a timer during After Flow to close the production valve.
Turner Flow Rate	This option uses the Turner flow rate to close the production valve.
Load Ratio	This option uses the Load Ratio which must be below a specified value for a specified amount of time to close the production valve.
DP	This option uses the differential pressure which must be below a specified value for a specified amount of time to close the production valve.
Flow Rate	This option uses the flow rate which must be below a specified value for a specified amount of time to close the production valve.
Casing Rise	This option closes the production valve when the Casing Delta Value (current casing pressure average minus previous casing pressure average) is above the user specified Casing Delta Limit at the end of the user specified Casing Rise Timer Limit.
Tube Line	This option will close the production valve when the tubing pressure minus the line pressure is less than the user specified limit value.
Casing Pressure	This option uses low casing pressure to close the production valve if it is below a user specified value.
SP	This option uses the static pressure to close the production valve if is above or below a user specified limit for a specified amount of time.
Tubing Pressure	This option uses the tubing pressure to close the production valve if is above or below a user specified limit for a specified amount of time.

Casing Slope	This option closes the production valve when the Casing Slope value is above the specified Casing Slope Limit at the end of the specified Casing Slope Timer Limit.
Case Tube	This option will close the production valve when the casing pressure minus the tubing pressure is less than the user specified pressure differential limit.

Blow Valve (if Tab Displayed)

BV Plunger Arriving

BV Plunger Arrival Timer Option	Option to use plunger arrival time to open the blow valve. This is not the Blow Valve state (state 4).
BV Plunger Arrival Time Limit	Enter the time to wait for the plunger arrival before opening the blow valve (not state 4).
Flow Rate BV Option	Option to use flow rate to open the blow valve.
Flow Rate	Displays the flow rate as measured by the flow computer.
Flow Rate BV Limit	Enter the flow rate limit that will initiate the blow valve opening once the flow rate falls below the entered amount.
Flow Rate BV Low Timer	Displays the elapsed time since the flow rate has been below the Flow Rate Blow Valve Limit.
Case BV Option	Option to use the casing pressure to open the blow valve.
Casing	Displays the current casing pressure.
Case BV Open Limit	Enter a value to open the blow valve when the casing pressure falls below this set amount.
DP BV Option	Option to use differential pressure to open the blow valve.
DP	Displays the current differential pressure.
DP BV Limit	Enter a low limit for the differential pressure which will open the blow valve when the pressure falls below this value.

SETUP BLOW VALVE

Fail BV State	Returns the production valve state from valve control, or the last command sent to the valve when not using valve control.

BV During Wait for Arrival

BV Plunger Arrival Timer Option	Option to use plunger arrival time to open the blow valve.
Flow Rate BV Option	Option to use flow rate to open the blow valve.
Case BV Option	Option to use casing pressure to open the blow valve.
DP BV Option	Option to use differential pressure to open the blow valve.

Blow Valve

BV State Option	Option of enabling the blow valve state when the plunger arrival fails.
BV Curtail Option	Option to disable venting of the wells during certain hours of the day.
BV Cushion Option	Option of enabling the blow valve cushion timer, plus closes the production valve when in the Blow Valve state (State 4).

Blow Valve Statistics (if Tab Displayed)

Blow Count

Blow Count	This screen displays a table of time stamps and cycle times of the blow valve occurrences.

Time Stamp

Time Stamp	Displays the Date/Time of each blow valve occurrence
Cycle Time	Displays the Cycle Time of each blow valve occurrence

Blow Valve Help (if Tab Displayed)

Blow Valve Help

BLOW VALVE State	Displays the last command sent to the blow valve.

BV - Plunger Arrival Time

BV Plunger Arrival Timer Option	Option to open the blow valve when the plunger arrival time is later than normal.
BV Plunger Arrival Time Limit	Enter a time that is longer than the normal arrival time but not as long as the maximum arrival time which would be considered a failure. If the arrival timer reaches this Limit time before the plunger arrives, the blow valve will open.

BV DP Low

DP Blow Valve Option	Option to use differential pressure to open the blow valve
DP	Displays the current differential pressure.
DP BV Limit	Enter a DP value that would open the blow valve when the differential pressure falls below this value.

BV Casing Pressure Low

Case Blow Valve	Option to use casing pressure as a condition to open the blow valve.
Casing	Displays the current casing pressure.
Open Limit	Enter a casing pressure which will open the blow valve when the pressure falls below this set amount.

BV Flow Rate Low Time

Flow Rate BV Option	Option to use flow rate to open the blow valve.
Flow Rate	Displays the current flow rate.
Flow Rate BV Limit	Enter a flow rate limit that will initiate the blow valve opening once the flow rate falls below the entered amount for the amount of time specified by the Low Time Limit.
Low Time Limit	Enter a time frame that the flow rate must remain below before opening the blow valve.
Low Timer	Displays the elapsed time since the flow rate was below the established limit. Timer will reset if flow rate goes above Flow Rate BV Limit before reaching the Flow Rate BV Low Time Limit.

Statistics

Inputs/Strings

Inputs - Measurement

Plunger Arrival Value	Displays the number of elapsed seconds for the plunger arrival.
Cal Hold?	Displays Yes or No.

Inputs - Pressures

AP (AP at APvcb)	User-defined field for Absolute Pressure
DP	User-defined field for Differential Pressure
Line Pressure	User-defined field for Line Pressure
Tube (Tubing)	User-defined field for Tubing Pressure
Case (Casing)	User-defined field for Casing Pressure

Barometer Pressure	User-defined field for Barometric Pressure (PSIG)

Inputs - Derived Values

Tube Line	Current tubing minus line pressure differential.
Case Line	The Value column displays the casing minus line pressure.
Case - Tube	Current casing minus tubing pressure differential.
Load Ratio Current Value	Current load ratio value. (Case-tube)/(Case-Line)
Foss Gaul Multiplied	The Value column is the Foss Gaul multiplier which is used for tuning. The Limit column displays the Foss Gaul multiplied value which is the FG Raw Value times FG Multiplier.
Turner Flow Rate Multiplied	The Value column displays the multiplier that is multiplied against the calculated Turner unloading rate to determine the flow rate at which the valve will be closed. The Limit column displays the raw Turner calculated flow rate which is the flow rate that will carry fluids to the surface.
Hold Input Value	Value used to determine if valve should be held closed.
Open 1 Value	User defines the Open 1 value (app/array/register) used for plunger.
Open 2 Value	User defines the Open 2 value (app/array/register) used for plunger.
Close 1 Value	User defines the Close 1 value (app/array/register) used for plunger.
Close 2 Value	User defines the Close 2 value (app/array/register) used for plunger.

Inputs

Valve Controller

VC Cmd	Displays the values for Valve Control Controller as set up in PCCU (VCI Cmd1)
VC Features	Displays the parameter settings for Valve Control as set up in PCCU (Features1)

Strings

Current State	Displays the current state of the controller. Controller current states are as follows: · Fail – Indicates that plunger has failed to arrive. · Closing Valve – Indicates that the production valve is closing, and the system is waiting for the plunger fall delay to expire. · Valve Closed – Indicates the plunger fall delay has expired, and the system is waiting for an open valve condition to be initiated. · Plunger Arriving – Indicates that the production valve has opened, and the system is waiting for the plunger to arrive. · Blow Valve – Indicates that the plunger has not yet arrived, blow valve conditions have been met and a secondary valve has been opened. · Plunger Arrived – This is an instantaneous state that indicates that the plunger has arrived. · AfterFlow – Indicates that the production valve is open, the plunger has arrived and close conditions are waiting to be met.
Max. State Timer	Displays the maximum timer time for the current state.
State Timer	Displays the current timer time for the current state followed by the time limit for the current state.
Max. O/C Timer (max open/close timer)	Displays the Open/Close maximum time limit.
O/C Timer (current open/close timer)	Displays the Open/Close time counter.

In Tube/In Plunger

In Tube - Tube Values

Temperature	Enter temperature value.
Flow rate	Enter flow rate value.
Volume - Accum	Enter accumulated volume value.
Today's Volume	Enter today's volume value.
Yesterday's Volume	Enter yesterday's volume value.
Z factor	Enter z factor value.

In Tube - Contract Hour

Last Contract Hr Update	Displays the date/time stamp of the update.
Tube Last Contract Time	Displays the date/time stamp of the last contract time.
Log Time	Displays the Log Time (dd: hh:mm:ss).
Day End Flag	Enter the value for the Day End Flag (Wait or Log).

In Plunger

Total Cycles	Displays the total cycles.
Total Plunger Travel	Displays the total plunger travel.
Plunger Arrivals Today	Displays the plunger arrivals today.
Last Lift Velocity	Displays the last lift velocity.
Reset Date/Time	Displays the reset date/time.
Reset Plunger Counters	User defined as No or Reset.

Events

Time Stamp	Displays the Time Stamp of the Event.
Reason	Displays the Reason that caused the Event.
Value	Displays the app/array/register associated with the event.

Total Cycles

Averages

Average Close Time	Displays the average closing time of the last ten plunger arrivals.
Average Close Case	Displays the average closing casing pressure of the last ten plunger arrivals.
Average Close Tube	Displays the average closing tubing pressure of the last ten plunger arrivals.
Average Close Line	Displays the average closing line pressure of the last ten plunger arrivals.
Average Close FR	Displays the average closing flow rate of the last ten plunger arrivals.
Average Close Vol	Displays the average closing volume of the last ten plunger arrivals.
Average Open Time	Displays the average opening time of the last ten plunger arrivals.
Average Open Case	Displays the average opening casing pressure of the last ten plunger arrivals.
Average Open Tube	Displays the average opening tubing pressure of the last ten plunger arrivals.
Average Open Line	Displays the average opening line pressure of the last ten plunger arrivals.
Average Open Vol	Displays the average opening volume of the last ten plunger arrivals.
AR Time	Displays the time it takes for the plunger to arrive.

Total CC

Close Stamp	Displays the Date/Time Stamp at the time of valve closure.
Close Reason	Displays the reason for valve closure.
Close Time	Displays the time at valve closure.
Close Case	Displays the closing casing pressure.
Close Tube	Displays the closing tubing pressure.

Close Line	Displays the closing line pressure.
Close Flow Rate	Displays the closing flow rate.
Close Volume	Displays the closing volume.
Open Stamp	Displays the Date/Time Stamp at the time of valve opening.
Open Reason	Displays the reason for valve opening.
Open Time	Displays the time at valve opening.
Open Case	Displays the casing pressure at valve opening.
Open Tube	Displays the tubing pressure at valve opening.
Open Line	Displays the line pressure at valve opening.
Open Volume	Displays the volume at valve opening.
AR Stamp	Displays the Date/Time Stamp of the valve arrival.
AR Status	Displays the Status of the valve arrival.
AR Time	Displays the Time of the valve arrival.

Total OO (if displayed)

Open Stamp	Displays the Date/Time Stamp at the time of valve opening.
Open Reason	Displays the reason for valve opening.
Open Time	Displays the time at valve opening.
Open Case	Displays the open casing pressure.
Open Tube	Displays the open tubing pressure.
Open Line	Displays the open line pressure.
Open Flow Rate	Displays the opening flow rate.
Open Volume	Displays the opening volume.
Close Stamp	Displays the Date/Time Stamp at the time of valve closure.
Close Reason	Displays the reason for valve closure.
Close Time	Displays the time at valve closure.
Close Case	Displays the casing pressure at valve closure.
Close Tube	Displays the tubing pressure at valve closure.
Close Line	Displays the line pressure at valve closure.
Close Volume	Displays the volume at valve closure.
AR Stamp	Displays the Date/Time Stamp of the valve arrival.
AR Status	Displays the Status of the valve arrival.
AR Time	Displays the Time of the valve arrival.

Current/Daily Cycles

Current Cycles - Open Valve

Open Stamp	Displays Date/Time Stamp at time of valve opening.
Open Reason	Displays reason for opening valve.
Open Time	Displays time of valve opening.
Open Case	Displays casing pressure value at time of valve opening.

Open Tube	Displays tube pressure value at time of valve opening.
Open Line	Displays line pressure value at time of valve opening.
Open Volume	Displays volume value at time of valve opening.

Current Cycles - Plunger Arrival

AR Stamp	Displays the date/time stamp of the plunger arrival.
AR Status	Displays the status of the plunger arrival (i.e. Normal)
Average Case	Displays the average casing pressure for the last ten plunger arrivals.
Average Tube	Displays the average tubing pressure for the last ten plunger arrivals.
Average Line	Displays the average line pressure for the last ten plunger arrivals.
Average FR	Displays the average flow rate for last ten plunger arrivals.

Current Cycles - Close Valve

Close Stamp	Displays Date/Time Stamp at time of valve closure.
Close Reason	Displays reason for closing valve.
Close Time	Displays time of valve closure.
Close Case	Displays casing pressure value at time of valve closure.
Close Tube	Displays tube pressure value at time of valve closure.
Close Line	Displays line pressure value at time of valve closure.
Close Flow Rate	Displays flow rate value at time of valve closure.
Close Volume	Displays volume value at time of valve closure.

Current Cycles - Open Valve

Open Stamp	Displays the Date/Time stamp at the time of valve opening.
Open Reason	Displays the Reason for valve opening.

Daily Cycles

Today's Volume	Displays volume value since contract hour.
Yesterday's Volume	Displays volume value during previous contract day.
Total Cycles Since Reset	Displays number of total cycles since last reset.
Plunger Arrivals Today	Displays the total count of plunger arrivals that occurred since the contract hour.
Plunger Arrivals Yesterday	Displays the total count of plunger arrivals that occurred on the previous contract day.
Closed Today	Displays time closed during the contract day.
Closed Yesterday	Displays time closed during the previous contract day.
Open Today	Displays time open during the contract day.

Open Yesterday	Displays time open during the previous contract day.
Open Time Today	Displays % of available time open during the contract day.
Open Time Yesterday	Displays % of available time open during the previous contract day.
Close Time Today	Displays % of available time closed during the contract day.
Close Time Yesterday	Displays % of available time closed during the previous contract day.

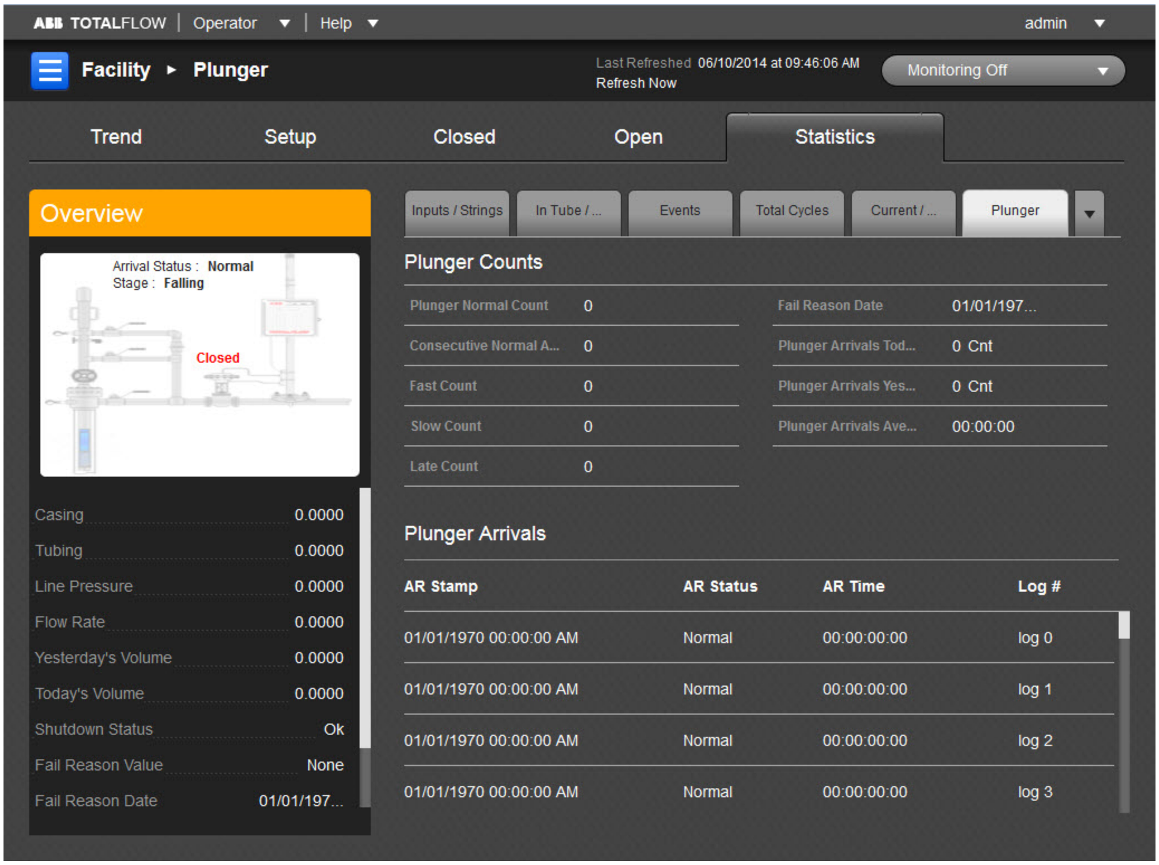
Plunger

Plunger Counts

Plunger Normal Count	Keeps count of the number of times the plunger arrived within the Slow and Fast Arrival times. The count will increment until cleared by the Clear Plunger Counters.
Consecutive Normal Arrivals	The Value column displays the number of consecutive arrival counts where the arrival time is between the Slow Arrival Time Limit and the Fast Arrival Time Limit. The count will reset if an arrival is outside this limit.
Fast Count	Keeps count of the number of times the plunger exceeded its Fast Arrival time. The count will increment until cleared by the Clear Plunger Counters.
Slow Count	Keeps count of the number of times the plunger arrived below its Slow Arrival Time. The count will increment until cleared by the Clear Plunger Counters.
Late Count	Displays the total number of late arrivals since the last reset plunger counter command was executed.
Fail Reason Date	Displays the Date/Time Stamp of the Fail Reason Date.
Plunger Arrivals Today	Displays the count of Plunger Arrivals since the Contract Hour.
Plunger Arrivals Yesterday	Displays the count of Plunger Arrivals for the previous Contract Day.
Plunger Arrivals Average Time	Displays the average arrival times for the last ten plunger arrivals.

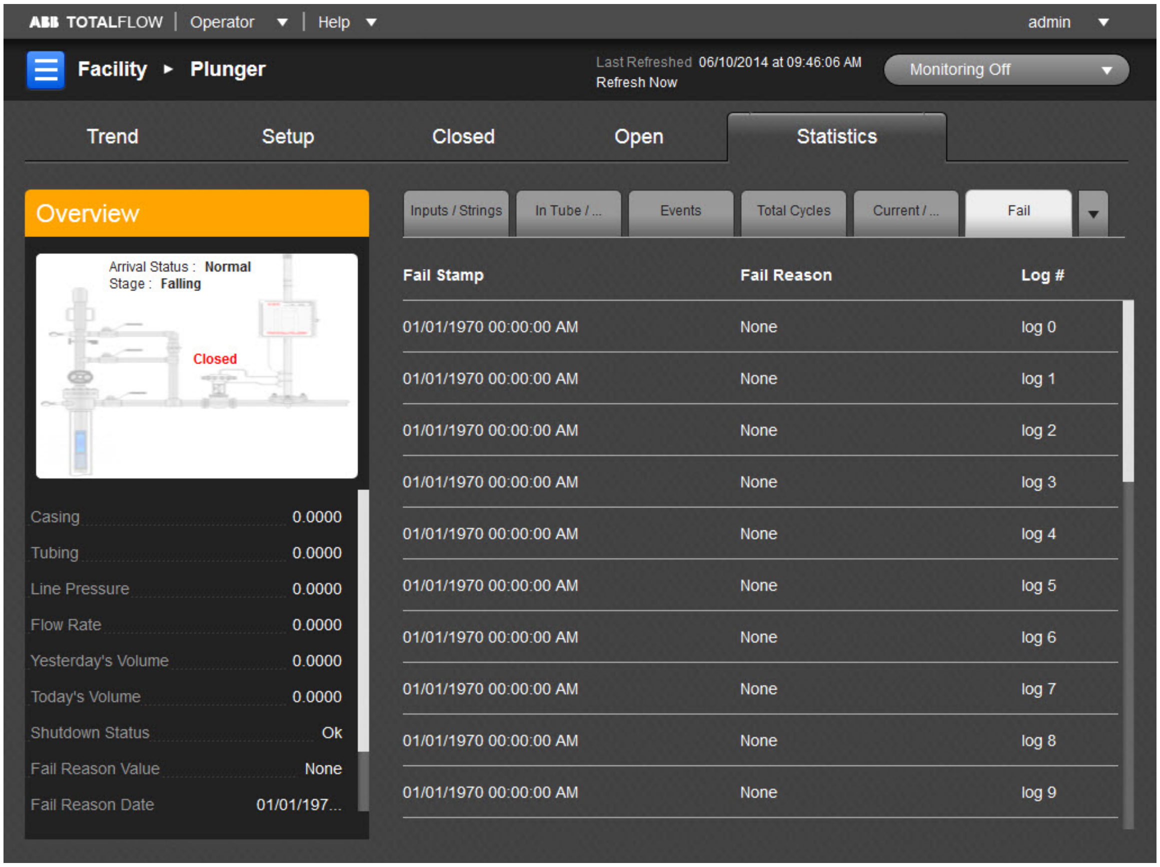
Plunger Arrivals

Log AR Stamp	Displays the Date/Time Stamp of the plunger arrival for the individual log entry.
Log AR Status	Displays the Status of the plunger arrival (i.e. Normal) for the individual log entry.
Log AR Time	Displays the Time (elapsed seconds) of the plunger arrival for the individual log entry.
Log #	Displays the number of the Log entry.



Fail

Fail Log Fail Stamp	Displays the Date/Time Stamp of the failed action.
Fail Log Fail Reason	Displays the Reason for the failed action.
Log #	Displays the number of the Log entry.



*Flt Pt Time Limits*Status

Max State Timer	Displays the state's maximum time limit.
State Timer	Displays the state's time counter.
Max OC Timer	Displays the Open/Close maximum time limit.
OC State Timer	Displays the Open/Close time counter.

Open Limits

Flow Cycle Time Limit	The Value field displays the timer value as it counts up toward the Limit value in the Limit field.
After Flow Time Limit	Displays the AfterFlow Timer Limit which will close the production valve when the AfterFlow Timer reaches this limit.
Evaluation Time Limit	The Value column displays the time that has elapsed since plunger arrival. When this value becomes equal to the Evaluation Time entered in the Limit field by the user, the Evaluation Flag is set to On.
Turner Low Time Limit	The Value column displays the amount of time that the current flow rate has been below Turner Flow Rate x Turner Rate multiplier. The timer is reset if the flow rate goes above the threshold. The flow rate has to be below for the amount of time entered in the Limit column.
Casing Rise Time Limit	Displays the Casing Delta Value Limit. The delta value must be above the Casing Delta Value Limit for the amount of time specified in the Casing Rise Timer Limit, before the valve is closed.
Casing Evaluation Time Limit	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Delta Value is above the Casing Delta Limit. If at any time before reaching the Casing Rise Timer

	Limit, the Casing Average falls below the Casing Delta Limit, the timer is reset and commences counting again. If the counter reaches the Casing Rise Timer Limit and the Casing Average is above the Casing Delta Limit, the production valve will close.
Casing Slope Time Limit	Displays the Casing Slope Timer Limit. The Casing Slope Value must be above the Casing Slope Value Limit for the time specified by the Casing Slope Timer Limit before closing the production valve.
Load Ratio Time Limit	Displays the Load Ratio Timer Limit. The Load Ratio must be below the Load Ratio Limit value for this limit time before the production valve is closed.
DP Low Time Limit	Displays the DP Low Timer Limit. The current differential pressure must be above/below the DP Limit value for this DP Low Timer Limit amount of time before the production valve will close.
Flow Rate Time Limit	The Value column displays the current flow rate. If the flow rate remains below the user specified Flow Rate Time Limit in the Limit column for the Flow Rate Timer Limit amount of time, the production valve will close.
Tubing Close Time Limit	Displays the Tubing Close Timer Limit. The current tubing pressure must be above/below the Tubing Limit value for this Tubing Close Timer Limit time before the production valve will close.
SP Close Time Limit	Displays the SP Close Timer Limit. The SP Current Value must be above/below the SP Limit value for the SP Timer Limit time before the production valve will close.
Close1 Time Limit	Time that Close 1 must be above/below the Close 1 Limit before the valve is closed.
Close1 Hold Time Limit	Time that Close 1 will DELAY a Hold or Force Open (not Hold Value).
Close2 Time Limit	Time that Close 2 must be above/below the Close 2 Limit before the valve is closed.
Close2 Hold Time Limit	Time that Close 2 will cause a HOLD.

Close Limits

Plunger Fall Limit	Time Limit field displays time limit for the fall time.
Valve Close Check Time	The Limit data is for setting the amount of time the flow rate has to stay above the Valve Close Check Setpoint before a valve close failure is declared.
Hold Timer Limit	May replace Plunger Fall Delay.
Hold Once Time Limit	The Limit data allows for the entry of the time if Fixed will be used. The fixed time needs to be entered before enabling the Fixed option. The Limit column will also display the computed hold time if the 1 Cycle, 2 Cycle or 3 Cycle option is used.
Close Cycle Limit	Enter the delay time in the Limit field to keep the valve closed after being closed.
SP Open Time Limit	The Limit field is for entering the SP Limit time. The SP Current Value must be above/below the SP Limit value for the SP Limit time before the production valve will open.
Mandatory Close Time Limit	The Limit field will either display the time computed when the 1, 2, or 3 Cycle is selected or allow the user to enter a time when Fixed is selected.
Load Ratio Open Time Limit	The Limit field displays the user entered amount of time that the Load Ratio must be below the Load Ratio Limit value to open the valve. However, even

	if the timer reaches this Limit time, the casing pressure must be greater than the line pressure x Casing-Line Multiplier to open the valve.
Tubing Open Time Limit	The Limit field is the time the tubing pressure must be above or below the Tube Open Limit pressure before the valve is opened.
Casing Open Time Limit	The Limit field which is the time the casing pressure must be above or below the Casing Open Limit pressure before the valve is opened.
Foss Gaul Time Limit	Time Limit field - Displays the Limit Time. The production valve will open if the casing minus line pressure is less than the Foss Gaul Multiplied Value for this Limit Time.
Open1 Open Time Limit	The Limit field displays and allows user entry of the Open 1 Limit time which is the time the Open 1 Current value must be above/below the Open 1 Limit value before opening the valve.
Open2 Time Limit	The Limit field displays and allows user entry of the Open 2 Limit time which is the time the Open 2 Current value must be above/below the Open 2 Limit value before opening the valve.
Total Cycle Time Limit	The Limit field displays the total cycle time which is the total of the Flow Timer time and the Closed Timer time for the Auto mode or displays and allows for the user entered total cycle time for the Fixed mode.
High Line Close Time Limit	The Value field displays the elapsed time since the valve closed. The Limit field is for entering the time or delay since the valve closed before initiating the High Line Open Action parameter.
High Line Open Time Limit	The Value column displays the elapsed time since the production valve opened. The Limit field is for entering a time to wait after the production valve opens before checking the high line pressure and taking any actions.
Close1 Time Limit	Time that Close 1 must be above/below the Close 1 Limit before the valve is closed.
Close1 Hold Time Limit	Time that Close 1 will DELAY a Hold or Force Open (not Hold Value).
Close2 Time Limit	Time that Close 2 must be above/below the Close 2 Limit before the valve is closed.
Close2 Hold Time Limit	Time that Close 2 will cause a HOLD.

Flt Pt Timers

Arrival Times

Arrival Timer	Displays the elapsed time since the valve was last commanded open. The User will select a time format and enter the time in the Value field.
Max Arrival Limit	The Limit field is for the user entry of the Max Arrival Time Limit.
Slow Arrival Limit	The Limit field is for the user entry of the Slow Arrival Time Limit.
Fast Arrival Limit	The Limit field is for the user entry of the Fast Arrival Time Limit.
Min Arrival Limit	The Limit field is for the user entry of the Minimum Arrival Time Limit.

Open Timers

Flow Cycle Time Timer	The Value column displays the timer value as it counts up toward the Limit value in the Limit field. The Limit value is entered by the user and is the total open or flow time. The time begins when the production valve is opened and ends when the Limit time has elapsed. This will include arrival time for the plunger and AfterFlow time which is after the plunger arrives.
After Flow Timer	The Value column displays the timer which commences counting at the beginning of the AfterFlow state. AfterFlow starts when the plunger arrives. The counter counts up to the Limit value entered in the Limit column by the user. Limit time is the amount of flow time requested by the user during the AfterFlow state.
Evaluation Timer	The Value column displays the time that has elapsed since plunger arrival. When this value becomes equal to the Evaluation Time entered in the Limit column by the user, the Evaluation Flag is set to On.
Turner Low Timer	The Value column displays the amount of time that the current flow rate has been below Turner Flow Rate x Turner Rate multiplier (see above regarding Packer Well selection). The timer is reset if the flow rate goes above the threshold. The flow rate has to be below for the amount of time entered in the Limit column.
Casing Rise Timer	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Delta Value is above the Casing Delta Limit. If at any time before reaching the Casing Rise Timer Limit, the Casing Average falls below the Casing Delta Limit, the timer is reset and commences counting again. If the counter reaches the Casing Rise Timer Limit and the Casing Average is above the Casing Delta Limit, the production valve will close.
Casing Slope Timer	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Slope Value is above the Casing Slope Limit. If at any time before reaching the Casing Slope Timer Limit, the Casing Slope falls below the Casing Slope Limit, the timer is reset and commences counting again when the Casing Slope is above the Limit. If the counter reaches the Casing Slope Timer Limit and the Casing Slope is above the Casing Slope Limit, the production valve will close.
Load Ratio Close Timer	The Value column displays a counter which will commence counting at the plunger arrival time and count up to the user entered Load Ratio Close Limit time. The Load Ratio must be below the Load Ratio Limit value for this limit time before the production valve is closed.
DP Low Timer	The Value column displays a timer that commences counting at the plunger arrival time if the current DP is below the DP Limit value. The counter will continue to count until the DP Low Timer Limit is reached. At this point the production value is closed. If at any time, the DP raises above the DP Limit value, the counter is reset and only starts counting again if the DP falls below the DP Limit value while in the AfterFlow state.
Flow Rate Timer	The Value column displays a timer that commences counting at the plunger arrival time if the Flow Rate is below the Flow Rate Limit value. The counter will continue to count until the Flow Rate Low Limit time is reached. At this point the production value is closed. If at any time, the Flow Rate rises above the Flow Rate Limit value, the counter is reset and only starts counting again if the Flow Rate falls below the Flow Rate Limit value while in the AfterFlow state.

Tubing Close Timer	If the current tubing pressure is above/below (per Close Action) the tubing pressure Limit value, the Value column timer will commence counting up to the Tubing Close Timer Limit time. If the counter reaches the Limit value, the production valve will close. If the tubing pressure changes such that it does not meet the Close Action criteria, the counter will reset and wait until the Close Action criteria is met again.
SP Close Timer	The Value column displays a counter which commences counting when the SP Current Value is above/below the SP Limit value as specified by the SP Action parameter. If the counter reaches the SP Limit time, the production valve will close. If the static pressure changes such that it is not above/below the SP Limit value per the SP Action, the counter will reset and wait until the pressure reaches its Limit pressure again and commence counting.
Close1 Timer	Displays the current Close 1 Timer value and Timer Limit.
Close2 Timer	Displays the current Close 2 Timer value and Timer Limit.

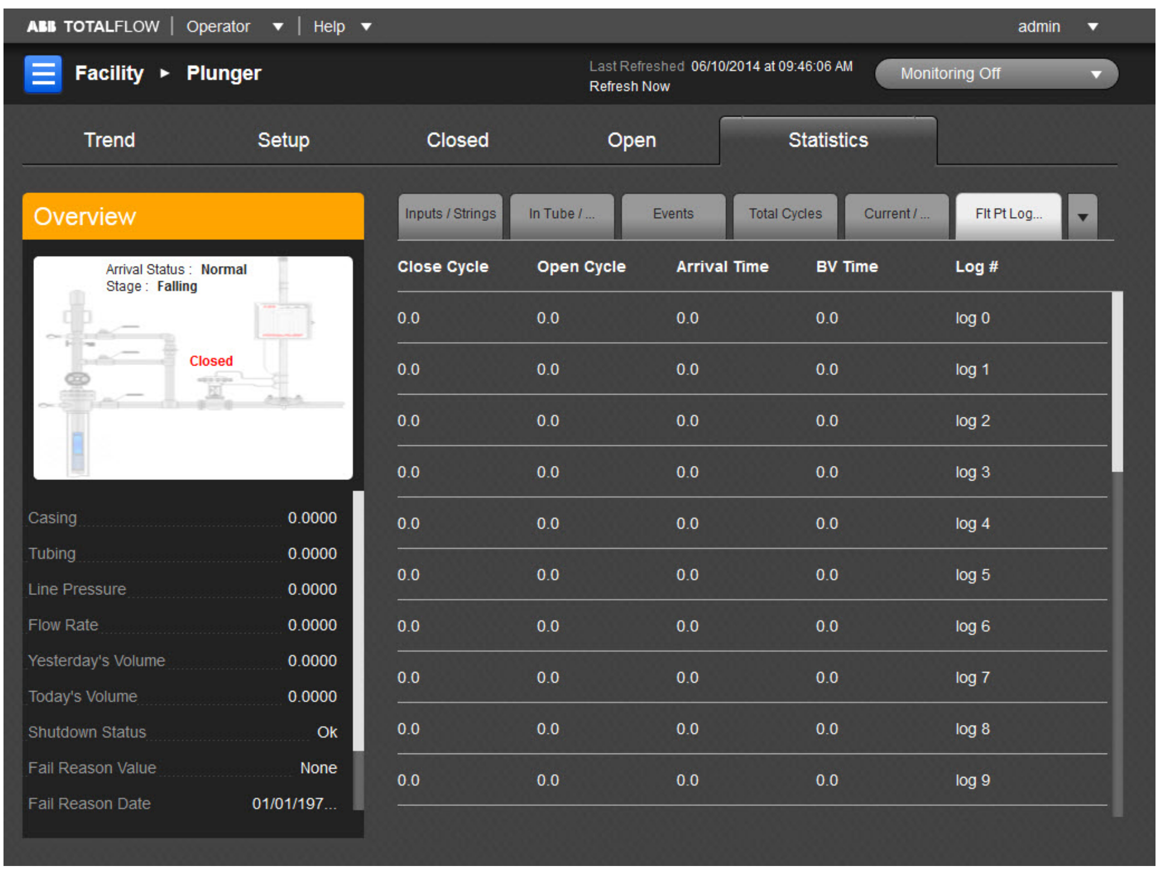
Close Timers

Plunger Fall Timer	The Value field displays the elapsed time since the production valve was closed. This is a time delay to allow enough time for the plunger to reach the bottom after closing the production valve before going to State 2 (Closed).
Valve Close Check Timer	The Value field is a timer which displays the amount of time that the flow rate has stayed above the Valve Close Check Setpoint.
Hold Once Timer	The Value field displays the timer which starts at zero and runs through the duration of the Hold Once operation.
Closed Timer	Displays the elapsed time in the Value field since the valve was commanded closed and for the duration of the Limit value.
SP Open Time Timer	The Value field displays the amount of time the SP Current Value has been above/below the SP Limit Value as selected by the Static Pressure Action parameter.
Mandatory Close Timer	The Value field displays a timer that tracks the time from the beginning of the Active state up to the end of the Limit time.
Load Ratio Open Timer	The Value field displays a timer that commences counting when the Load Ratio drops below the Load Ratio Limit value and continues counting until it reaches the time entered in the Limit column. If the Load Ratio should move back above the Load Ratio Limit, the timer will reset and only commence counting again when Load Ratio again drops below the Load Ratio Limit.
Tubing Open Timer	The Value field displays the Limit timer which starts when the Low or High Open condition is met to open the valve and counts up to the Limit time (Limit field).
Casing Open Timer	The Value field displays the Casing Open timer which starts when the Low or High Open condition is met to open the valve and counts up to the Casing Open Limit time (Limit field).
Foss Gaul Timer	The Value field displays the amount of time that the casing minus line is less than the Foss Gaul Multiplied Value.
Open1 Open Timer	The Value field displays a timer which is the amount of time that the Open 1 Current Value is above/below the Open 1 Limit value based on the Open Action selection. The timer increments until it reaches the Open 1 Timer Limit which will trigger the opening of the valve.
Open2 Open Timer	The Value field displays a timer which is the amount of time that the Open 2 Current Value is above/below the Open 2 Limit value based on the Open

	Action selection. The timer increments until it reaches the Open Timer Limit which will trigger the opening of the valve.
Total Cycle Timer	The Value field is a timer that starts at the beginning of the open time and runs until it reaches the end of the total cycle time, resets and starts again with the next open.
Close1 Timer	The Value field displays the current Close 1 Timer value and is the amount of time in Hold or time value that has been above/below the Close 1 Limit.
Close2 Timer	The Value field displays the current Close 2 Timer value and is the amount of time in Hold or time Value has been above/below the Close 2 Limit.

Flt Pt Log Times

Log Close Cycle	Displays the elapsed time of the close valve cycle for each log entry.
Log Open Cycle	Displays the elapsed time of the open valve cycle for each log entry.
Log Arrival Time	Displays the elapsed time for the plunger arrival for each log entry.
Log BV Time	Displays the elapsed time since the plunger arrived in the Blow Valve state for each log entry.
Log #	Displays the number of the Log entry.



Plunger SU

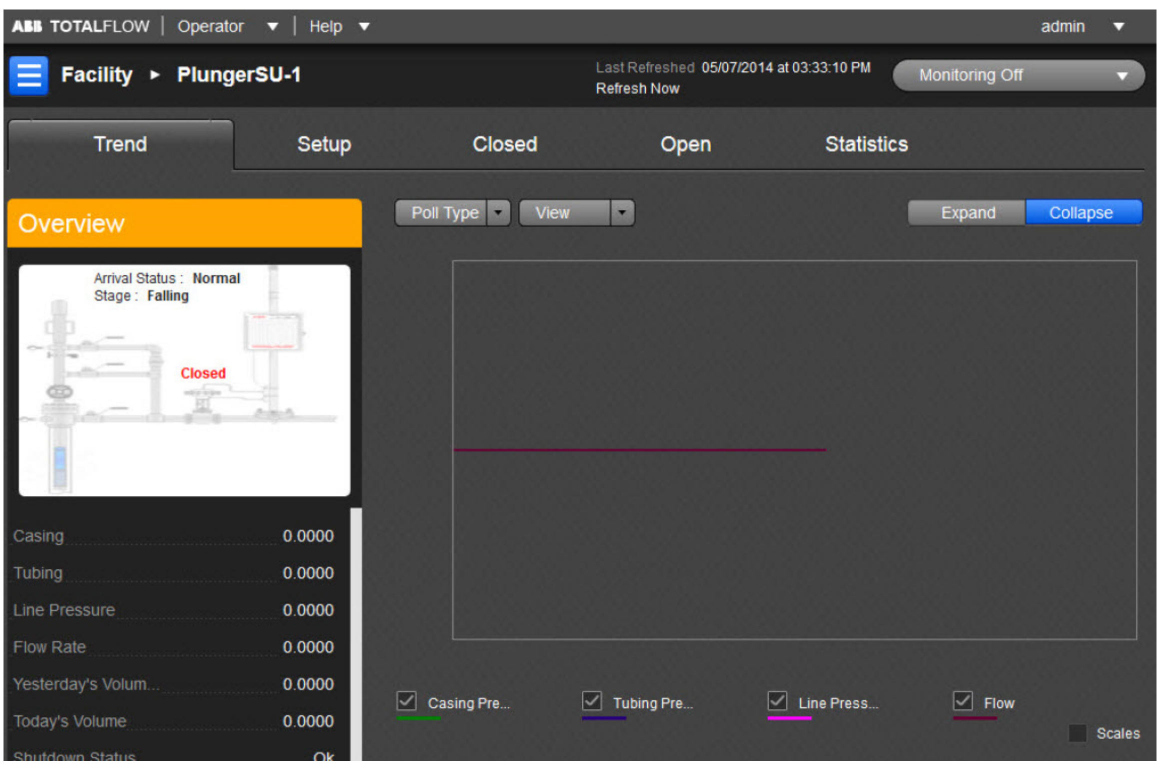
Overview

The Plunger Lift application works in a manner similar to a pneumatic piston, wherein it is caused by gravity to fall to the bottom of the well. Acting as a seal between the liquid and the 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 and slows it down. The production valve is closed to allow down-hole pressure to build in the casing. After the pressure has built up, 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 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, causing the cycle to repeat.

Read-only fields display values for Casing/Tubing/Line pressures, Flow Rate and Yesterday's/Today's volumes.

The TWI system is designed to enable users to affect certain parameters that work in conjunction with the Plunger Lift application.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measured in inH2O here in one market but in another country's market may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added to the AGA-3 and AGA-7. Thus the new nomenclature of SUAGA-3 is to signify this functionality.



Navigation

The Plunger Lift window is laid out in a similar fashion to other windows found within the TWI. Upon first entering the Plunger Lift screen, the user is within the Trend tab. There are five other tabs that are available: Trend, Setup, Closed, Open and Statistics. Clicking on any of the available tabs takes the user to that particular area. Within each of the tabs resides information and/or certain parameter fields that the user can manipulate, based on their specific needs. When the user hovers their cursor over a particular field and a Pencil icon displays, this signifies that this is a field that can be changed. If there is no Pencil icon displayed, this represents a read-only field. If the user wishes to save time instead of searching for those fields that can or cannot be edited, they can click the Edit All button. This opens a dialog box that has all of the fields that the user can affect.

The following details the individual tabs that the user encounters within the Plunger Lift screen and the various parameters that are contained within each. Click on the preferred link below to view the information regarding that particular tab or item.

Overview

Casing	Plots the raw casing pressure values (PSIA). Associated PCCU Register (5.5)
Tubing	Plots the raw tubing pressure value. Associated PCCU Register (5.6)
Line Pressure	Plots the raw line (static) pressure values (PSIA). Associated PCCU Register (5.7)
Flow Rate	Plots the single point for each cycle (if an arrival has occurred) in minutes (SCF/Hr). Associated PCCU Register (5.8)
Yesterday's Volume	Displays yesterday's contract day volume.
Today's Volume	Displays the Volume from the start of the Contract Day.
Shutdown Status	Displays as either OK or in Shutdown.
Fail Reason Value	The top row displays the current state of the controller in the Description column followed by the current timer time for the current state followed by the time limit for the current state. Controller states: · Fail – Indicates that plunger has failed to arrive. · Closing Valve – Indicates that the production valve is closing, and the system is waiting for the plunger fall delay to expire. · Valve Closed – Indicates the plunger fall delay has expired, and the system is waiting for an open valve condition to be initiated. · Plunger Arriving – Indicates that the production valve has opened, and the system is waiting for the plunger to arrive. · Blow Valve – Indicates that the plunger has not yet arrived, blow valve conditions have been met and a secondary valve has been opened. · Plunger Arrived – This is an instantaneous state that indicates that the plunger has arrived. · AfterFlow – Indicates that the production valve is open, the plunger has arrived, gas is flowing and close conditions are waiting to be met.
Fail Reason Date	Provides the date/time of the last Fail Reason.
Timer	Displays the elapsed time since the valve was last commanded open and the plunger arriving.
Max Timer	Displays the maximum amount of time to wait for the plunger to arrive.

Trend

In this control application, there is no inherent capability to trend from its webpage. The association of this app and its trended file(s) must be done in PCCU32. These file(s) must be built in the Trend application's Trend File Editor including file naming and including all selected variables to trend with their App/Array/Registers. The user can then associate the trend file built and named with the control app by going under the app's Setup tab and assigning it the same trend file name. Thus from the webpage it uses the same name to call up the correct file from the Trend System application and display as required the data in graph or grid format.

The Trend tab gives the user a graphical representation of the measurements and trends for the valve. The user may select the Poll Type button to display either Historical or Real Time data. One may also use the View button to select either the Grid or Graph view. The user may click on any of the check marks to the left of the variables along the bottom of the view to either display or hide the individual variable(s). The user also may use a mouse rollover on any of the displayed trends (must be in Graph view and polling Historical Data) to show the individual reading for selected times. Finally the display itself may be collapsed or expanded by selecting the corresponding button function in the upper right corner of the screen.

If electing to display in Historical mode, the following variables must be included:

1	Casing
2	Units [Optional]
3	Tubing
4	Units [Optional]
5	Line
6	Units [Optional]
7	Flow Rate
8	Units [Optional]

The individual parameters can be displayed with or without measurement scales. To add the scales to the background, the Scales icon to the lower right of the parameter legend would need to be selected. Selecting it again would hide the scales.

Setup

General

Common Setup

Plunger Control	Allows for the plunger control types to be set. The types are as follows: · Off – This control type prevents the logic from running. Resets the controller. · Manual – This setting allows for the manual operation of both the production and blow valves. Additionally, it also allows for the input valves to be read. · Off – This control type initializes the logic from Startup mode and begins operation.

Cycle Start	Within this field the user can add time to off-time (shut-in period) to ensure the Plunger Lift runs according to the time cycles.
Trend File Name	Enter a name here and setup a trend file in the Trend System application. Using the same name will allow the web user interface to display the trend information when viewing the Plunger application information.

Tuning

Optimization	Enables and disables the continuous adjustment of all setpoints. Options are either Disabled or Enabled. If Optimization has not been enabled, it will be the sole option under Tuning. Once optimized, the Plunger Fail Tune option will display. If Optimization is de-selected, the Plunger Fail Tune option will disappear.
Plunger Fail Factor Tune	If a plunger happens to fail, this field allows the user to set this factor which is then consequently multiplied against the next tuning.

Reset Options

Startup Mode	Select the startup state after a controller reset. · 1 Closing Valve - Startup in the Closing Valve state (State 1). · 6 AfterFlow - Startup in the AfterFlow state (State 6). · Previous State - Startup in the state at the time of the reset occurred.
Safety Reset Mode	In this field if the plunger is disabled by the safety system or disabled due to max arrivals allowed being exceeded. This control is used to reset plunger controls.

Well Geometry

Tubing Length	This is a user configurable field that enables the establishment of the length of the tubing from the stop to the arrival sensor. This is subsequently used to calculate the lift velocity.
Tubing Inner Diameter	This is a user configurable field that establishes the inner diameter of the well tubing. This is then used to calculate the Turner Flow Rate.
Fluid Gradient	Within this user-defined field the user can set the constant that is utilized to calculate slug size.
Log Size	This is a user configurable field that establishes the number of cycle, blow and fail logs that are kept.
Event Log Size	Enter the number of event logs for the system to keep.

Valve

On/Off Control

Valve Position	User-defined as Upstream or Downstream depending on direction in relation to the valve.
Valve Time Limit	This is the amount of time to manually energize the open and close DOs to either open or close the production, blow and capture valves. This is not to be confused with valve control. Enter time in seconds.

Main Valve Setup

Valve Type	Select the type of valve used for the production valve. · Latch-One output - Only one digital output is used to both open and close the valve. Latch signifies that the DO remains closed when energized until told to open. · Latch-Two output - Two digital outputs are used, one to open the valve and one to close the valve. Latch signifies that the DOs remain closed when energized until told to open. · Pulse-Two output - Two digital outputs are used, one to open the valve and one to close the valve. Pulse signifies that the DO is only energized for a short duration as specified by the "Valve Time Limit" above.
Open DO	User-defined with the app/array/register for Open DO.
Close DO	User-defined with the app/array/register for Close DO.
Valve Fail State	User-defined as None, Close, or Open.
Manual Valve Open Now	Select either Auto or Force Open.
Manual Valve Close Now	Select either Auto or Force Close.

Blow Valve Setup

BV Type	Specify the number and type of outputs that are used by the blow valve. The selected options are set to Pulse-Two Output, Latch-One Output or Latch-Two Output.

Capture Valve Setup

Capture Valve Type	This is simply an Enable or Disable function with no setup required other than if you have a Capture Valve, it needs to be set up in Valve Setup under the Setup tree-view item. When enabled, Catch Mode will put the well in a permanent Closed Hold mode after it completes its flow cycle. If a Capture Valve is used, the plunger is kept captured during this time. When the Plunger Catch Mode is disabled, the plunger is released and normal cycle operation resumes. User-defined with a selection of Pulse-Two output, Latch-One output, Latch-Two output, or Disable.

Valve Control

VC Option	Decide whether or not to use the valve control during flow cycle (plunger arriving and AfterFlow). Available options are set to Enabled or Disabled.

Tube

Tube Value Registers

Tube App	Setting will auto-set the Tube Register Address
AP Register	Establishes the address of the absolute pressure analog input. Normal = AGA3.1.15.
DP Register	Specifies the address of the differential pressure analog input. Normal = AGA3.5.0.
Flow Rate Register	Can set the address of the flow rate. Normal = AGA3.5.19.
Volume Accumulator Register	Can set the address of the accumulated volume. Normal = AGA3.5.21.
Volume Today Register	User-defined with the Volume Today app/array/register.
Volume Yesterday Register	User-defined with the Volume Yesterday app/array/register.
Tf Register (Temperature)	Specify the address of the temperature. Normal = AGA3.1.0.
Z Factor	Specifies the address of gas compressibility. Normal = AGA3.5.31.
Barometer Pressure Register	Can set the address of the barometer pressure that is used to adjust FCU pressure to PSIG. Normal = AGA3.3.16.
Contract Hour Update Register	Specifies the address of the last contract hour update. Normal = AGA3.1.86.

Input

Input Value Registers

Casing Pressure AI	Can set the address of the casing pressure analog input. Normal = IOS.3.4 (A15).
External Pressure AI	Can set the address of the external pressure analog input. This is then used for either tubing or line pressure depending on the valve location.
Hold Pressure	Specifies the address of the hold pressure analog input.
Open 1	Can set the address of open 1.
Open 2	Can set the address of open 2.
Close 1	Can set the address of close 1 (in1).
Close 2	Can set the address of close 2 (in2).
Hold External	Can set the address of the hold external.

Misc Registers

Detection Type	Select whether a plunger is used or if the logic acts as an intermitter. The available options are set to either I/O or Intermit.
Plunger Arrival Pulse Input	Can set the address of plunger arrival pulse input.
Restart Button	Can set the address of the restart plunger digital input.
Open Button	Can set the address for the valve open push button digital input.
Close Button	Can set the address for the valve close push button digital input.

Closed

Falling

Valve Close Check

Enable VC Check	Enable the VC Check by selecting the empty box. Otherwise, selecting the checked box will disable the VC Check.

Plunger Fall Delay

Fall Timer	The Fall Timer will display the days/hours/minutes/seconds.
Fall Delay Limit	Set the Fall Timer display with the days/hours/minutes/seconds. This is the time to wait when closing the valve before going to state 2.

Closed Setup

Closed Setup

Open On	The primary reason for this screen is to provide optional ways to open the closed production valve using one of the following parameters (to open on):
Tube Line	This option uses the tubing-line pressure differential to open the production valve. The User can select the Open on Tube Line box to cause a new tab (Tube-Line) to appear for setting up this option.
Case Line	This option uses the casing-line pressure differential to open the production valve. The User can select the Open on Case Line box to cause a new tab (Case-Line) to appear for setting up this option.
Case Tube	This option uses the casing-tubing pressure differential to open the production valve. This option uses the casing-tube pressure differential to open the production valve. The User can select the Open on Case Tube box to cause a new tab (Case-Tube) to appear for setting up this option.
Load Ratio	This option uses the Load Ratio to open the production valve. The User can select the Open on Load Ratio box to cause a new tab (Load Ratio) to appear for setting up this option.

Foss Gaul	This option uses the Foss Gaul equation to open the production valve. The User can select the Open on Foss Gaul box to cause a new tab (Foss Gaul) to appear for setting up this option.
Tube Pressure	This option uses the tubing pressure to open the production valve. The User can select the Open on Tube Pressure box to cause a new tab (Tube Pressure) to appear for setting up this option.
Casing Pressure	This option uses the casing pressure to open the production valve. The User can select the Open on Casing Pressure box to cause a new tab (Casing Pressure) to appear for setting up this option.
SP	This option uses the static pressure to open the production valve. The User can select the Open on SP box to cause a new tab (SP) to appear for setting up this option.
Open1	This option uses a timer and a register that can be pointed to any variable to open the production valve. The user sets a limit for the variable and the amount of time the value of the variable can be above or below the variable limit. The User can select the Open on Open 1 box to cause a new tab (Open 1) to appear for setting up this option. This option can be used in conjunction with Open 2 and have 2 different sets of criteria to open the valve on whichever criteria is met first.
Open2	This option uses a timer and a register that can be pointed to any variable to open the production valve. The user sets a limit for the variable and the amount of time the value of the variable can be above or below the variable limit. The User can select the Open on Open 2 box to cause a new tab (Open 2) to appear for setting up this option. This option can be used in conjunction with Open 1 and have 2 different sets of criteria to open the valve on whichever criteria is met first.
Close Timer	This option uses a timer to open the production valve. The User can select the Open on Closed Timer box to cause a new tab (Closed Timer) to appear for setting up this option.

Plunger Fall Delay

Hold Reason	The Value column displays reasons the plunger is in Hold (valve closed).
Open Reason	The Limit column displays the last reason the valve was opened.

Closed Hold

Closed Hold

Hold Plunger Fall	This option is basically the same as the Fall Timer used in State 1 (Closing Valve) with the exception that this option is in State 2 (Closed). This option will keep the production valve closed for the Limit time entered even if conditions have been met to open the valve. This option would replace the Fall Timer in State 1 and not be used in conjunction.
Mandatory Recovery	The User enables this option by selecting the Enable Mandatory Recovery Time box. When enabled, it will run after a plunger non-arrival and keep the well in a closed state to allow the pressure time to recover. The User selects whether to use 1 Cycle, 2 Cycle or 3 Cycle times or Fixed to enter a fixed amount of time.
Total Cycle	Option of using an amount of time between valve open to valve open to operate the well. · Fixed - The user enters a time in the Total Cycle Timer Limit column for the desired total cycle time. The close time is adjusted automatically each cycle to

	make up the difference between the open time and the total cycle time. Open time can be the result of any option and thus not restricted to a timer. · Auto - Uses the Flow Timer Close option found under "Open \ Open Setup" for the open time and the Closed Timer option found under "2:Closed \ Closed Setup" for the close time. The limit value of each option is added together to get the Total Cycle Time which will be displayed as the Total Cycle Timer Limit value. Each option has to be enabled of course and a Limit time entered.
Hold Once	Option of delaying the well operation once for a single amount of time. Options are 1 Cycle, 2 Cycle, 3 Cycle, or Fixed for a fixed amount of time. Selecting Enable and Send will display the "2: Hold Once" tab for setup.
Hold External	Option to hold the valve closed until enabled by an external input such as a digital input. Selecting the Hold External box will display the "Hold External" tab for setup.
Hold Schedule	Option to hold the valve closed until enabled by a schedule. Selecting the Hold Schedule (Hold on Pad Controller) box will display the "Hold Schedule" tab for setup.
Hold Pressure	The User selects whether to hold when the Hold Value pressure is lower (Hold Low) than the Hold Value Limit or hold when it is higher (Hold High).
Hold Close 1	This option supports an input called "Close 1" which would typically be a pressure but could be a digital input. The setup options are split into two functions, close the production valve when it's open and hold it closed for some period. The input value is tested to see if it is above or below a specified value and the value must be above or below the specified value for a user specified amount of time. "Close 1" and "Close 2" can both be used at the same time and whichever has its criteria met first will drive or hold the valve.
Hold Close 2	This option supports and input called "Close 2" which would typically be a pressure but could be a digital input. The setup options are split into two functions, close the production valve when its open and hold it closed for some period. The input value is tested to see if it is above or below a specified value and the value must be above or below the specified value for a user specified amount of time. "Close 1" and "Close 2" can both be used at the same time and whichever has its criteria met first will drive or hold the valve.
Hold High Line	This option uses high line pressure to close the production valve and either keep closed or re-open. Enable/Disable in the Value column.
Time of Day	This option allows the user to set up to four different time spans each day to put the well into Hold mode. Enable/Disable in the Value column. The Limit column indicates Yes or No whether in Hold mode or not.
Plunger Catch Mode	This option when enabled will keep the production valve closed until the option is disabled. This typically allows for closing in the well after a plunger catch.
Hold Reason	The Value column displays reasons the plunger is in Hold (valve closed).
Open Reason	The Limit column displays the last reason the valve was opened.

Open

Open Setup

Open Setup

Plunger catch mode	This is simply an Enable or Disable function with no setup required other than if you have a Capture Valve; it needs to be setup in Valve Setup under the Setup tree-view item. When enabled, Catch Mode will put the well in a permanent Closed Hold mode after it completes its flow cycle. If a Capture Valve is used, the plunger is kept captured during this time. When the Plunger Catch Mode is disabled, the plunger is released and normal cycle operation resumes.
Flow Timer	This is a timer option that allows the well to flow for specified period of time each cycle before closing the production valve.
Close 1	Close 1 Hold option: Value Column - Displays the Close 1 input current value. Limit Column - The Close 1 value must be below/above this Close 1 Limit value for the Close 1 timer Limit time. Time Limit Column - Displays the Hold Close 1 Time Limit. Misc Column - Displays the Close 1 Open Action. This is how Close 1 will release hold.
Close 2	Close 1 Hold option: Value Column - Displays the Close 2 input current value. Limit Column - The Close 2 value must be below/above this Close 2 Limit value for the Close 2 timer Limit time. Time Limit Column - Displays the Hold Close 2 Time Limit. Misc Column - Displays the Close 2 Open Action. This is how Close 2 will release hold.
Blow Cushion	Value Column - Displays the Blow Valve Cushion Timer which is the elapsed time since the plunger arrived while in Blow Valve state. Time Limit Column - Displays the Blow Valve Cushion Time Limit which is the time to wait after the plunger arrives while in Blow Valve state. After this time limit, open the production valve and close the blow valve.

Waiting

Close Valve Enables

Flow Timer Close	Option of using a timer as the means of closing the production valve.
Flow Cycle Time Limit	The time begins when the production valve is opened and ends when the Limit time has elapsed. This will include arrival time for the plunger and AfterFlow time which is after the plunger arrives.
Close 1	This option which uses the Close 1 input provides two primary uses. It can be used to hold the production valve closed and/or release it when in the Closed state (State 2). It can also be used to Close the production valve when in the Waiting/Arrival (State 3) or AfterFlow (State 6).
Close 1 Close Limit	Displays the current Close 1 value and the Close Limit value. · Value column - Current Close 1 Value. Limit column - Hold closed if Close 1 Value is below/above (Close Action) this Limit for Close 1 Timer Limit.

Close 2	This option which uses the Close 2 input provides two primary uses. It can be used to hold the production valve closed and/or release it when in the Closed state (State 2). It can also be used to Close the production valve when in the Waiting/Arrival (State 3) or AfterFlow (State 6).
Close 2 Open Limit	Displays the current Close 2 value and the Open Limit value. · Value column - Current Close 2 Value. - Limit column - Close 2 value must be above/below this Limit value based on Close 2 Action for Close 2 Timer Limit to close valve.
Arrival Timer	The Value column displays the elapsed time since the production valve was commanded open and until the plunger arrives. Then the timer will reset.
Last Plunger Arrival	Displays the time of the last plunger arrival. The value is set in the following format: dd:hh:mm:ss.
Non-Arrivals Count	Displays the elapsed time since the valve was commanded open and the plunger is arriving.
Max Non-Arrivals Count	Counts the consecutive number of arrival times that were greater than the Max Arrival Time. The value is automatically reset if the plunger arrival time is less than the Max Arrival Time.

Arrival Time Limits

Max Arrival Time	The Value column displays the number of consecutive times the arrival time exceeded the maximum arrival time. The count will reset if the arrival time is less than the maximum time.
Slow Arrival Time	The Value column displays the number of counts where the arrival time fell below the Slow Arrival Time Limit. The count will reset if an arrival time is greater than the Slow Limit Time. Also, tuning will occur if the plunger arrival is slower than the Slow Arrival Time Limit.
Fast Arrival Time	The Value column displays the number of counts where the arrival time exceeded the Fast Arrival Time Limit. The count will reset if an arrival time is slower than the Fast Arrival Limit Time. Also, tuning will occur if the plunger arrival is faster than the Fast Arrival Time Limit.
Min Arrival Time	The Value column displays the number of consecutive arrival counts where the arrival time fell below the minimum arrival time. The count will reset if the an arrival time is greater than the minimum time.

High Line

High Line	Option to use high line pressure as a way to close the production valve and adjust the close time.

Arrived

Plunger Swab

Plunger Swab (Option)	The Swabbing section's Enable first field is optional and user-defined from which the user can enable the use of the plunger to swab. When set to Enable, the plunger will begin tripping on the next cycle, repeating the drop phase on the next arrival. Options are either Yes or No.
Swab Runs Completed	The Swab Run Count is the read-only field that displays the number of swab runs completed to date.

Swab Runs Setpoint	When the user enables the Swabbing option, this user-defined field allows the user to set the number of swab runs that need to be completed.
Swab Now	To swab now, select Yes and Send. At the start of or during AfterFlow, the production valve will close immediately and stay closed through its normal close time and then commence swabbing. The number of swabs is as specified in the Limit column for Total Runs.
Total Cycles	Cycles left until maintenance
Total Cycles Left Till Maintenance	The Value column will display the total number of cycles ran until the Plunger Counter Reset. When the Total Cycles equals the number specified by the user in the Limit column, the Cycle Status on the Summary screen will display the word Maintenance.

Plunger Arrived

First Run Count	Displays the Value column counts up to the Limit value entered by the user in the Limit column. On each plunger arrival, the count will increment and the production valve will close, not allowing the Plunger application to go into the AfterFlow state. After the Value column count reaches the Limit value, AfterFlow and normal operation commences on the next cycle.
First Run Limit	The User defines the Limit value by entering it here. On each plunger arrival, the count will increment and the production valve will close, not allowing the Plunger application to go into the AfterFlow state. After the Value column count reaches the Limit value, AfterFlow and normal operation commences on the next cycle.

After Flow

After Flow Setup

After Flow Timer	This option uses a timer during After Flow to close the production valve.
Turner Flow Rate	This option uses the Turner flow rate to close the production valve.
Load Ratio	This option uses the Load Ratio which must be below a specified value for a specified amount of time to close the production valve.
DP	This option uses the differential pressure which must be below a specified value for a specified amount of time to close the production valve.
Flow Rate	This option uses the flow rate which must be below a specified value for a specified amount of time to close the production valve.
Casing Rise	This option closes the production valve when the Casing Delta Value (current casing pressure average minus previous casing pressure average) is above the user specified Casing Delta Limit at the end of the user specified Casing Rise Timer Limit.

Tube Line	This option will close the production valve when the tubing pressure minus the line pressure is less than the user specified limit value.
Casing Pressure	This option uses low casing pressure to close the production valve if it is below a user specified value.
SP	This option uses the static pressure to close the production valve if is above or below a user specified limit for a specified amount of time.
Tubing Pressure	This option uses the tubing pressure to close the production valve if is above or below a user specified limit for a specified amount of time.
Casing Slope	This option closes the production valve when the Casing Slope value is above the specified Casing Slope Limit at the end of the specified Casing Slope Timer Limit.
Case Tube	This option will close the production valve when the casing pressure minus the tubing pressure is less than the user specified pressure differential limit.

Blow Valve (if Tab Displayed)

BV Plunger Arriving

BV Plunger Arrival Timer Option	Option to use plunger arrival time to open the blow valve. This is not the Blow Valve state (state 4).
BV Plunger Arrival Time Limit	Enter the time to wait for the plunger arrival before opening the blow valve (not state 4).
Flow Rate BV Option	Option to use flow rate to open the blow valve.
Flow Rate	Displays the flow rate as measured by the flow computer.
Flow Rate BV Limit	Enter the flow rate limit that will initiate the blow valve opening once the flow rate falls below the entered amount.
Flow Rate BV Low Timer	Displays the elapsed time since the flow rate has been below the Flow Rate Blow Valve Limit.
Case BV Option	Option to use the casing pressure to open the blow valve.
Casing	Displays the current casing pressure.
Case BV Open Limit	Enter a value to open the blow valve when the casing pressure falls below this set amount.
DP BV Option	Option to use differential pressure to open the blow valve.
DP	Displays the current differential pressure.
DP BV Limit	Enter a low limit for the differential pressure which will open the blow valve when the pressure falls below this value.

SETUP BLOW VALVE

Fail BV State	Returns the production valve state from valve control, or the last command sent to the valve when not using valve control.

BV During Wait for Arrival

BV Plunger Arrival Timer Option	Option to use plunger arrival time to open the blow valve.
Flow Rate BV Option	Option to use flow rate to open the blow valve.
Case BV Option	Option to use casing pressure to open the blow valve.
DP BV Option	Option to use differential pressure to open the blow valve.

Blow Valve

BV State Option	Option of enabling the blow valve state when the plunger arrival fails.
BV Curtail Option	Option to disable venting of the wells during certain hours of the day.
BV Cushion Option	Option of enabling the blow valve cushion timer, plus closes the production valve when in the Blow Valve state (State 4).

Blow Valve Statistics (if Tab Displayed)

Blow Count

Blow Count	This screen displays a table of time stamps and cycle times of the blow valve occurrences.

Time Stamp

Time Stamp	Displays the Date/Time of each blow valve occurrence
Cycle Time	Displays the Cycle Time of each blow valve occurrence

Blow Valve Help (if Tab Displayed)

Blow Valve Help

BLOW VALVE State	Displays the last command sent to the blow valve.

BV - Plunger Arrival Time

BV Plunger Arrival Timer Option	Option to open the blow valve when the plunger arrival time is later than normal.
BV Plunger Arrival Time Limit	Enter a time that is longer than the normal arrival time but not as long as the maximum arrival time which would be considered a failure. If the arrival timer reaches this Limit time before the plunger arrives, the blow valve will open.

BV DP Low

DP Blow Valve Option	Option to use differential pressure to open the blow valve
DP	Displays the current differential pressure.
DP BV Limit	Enter a DP value that would open the blow valve when the differential pressure falls below this value.

BV Casing Pressure Low

Case Blow Valve	Option to use casing pressure as a condition to open the blow valve.
Casing	Displays the current casing pressure.
Open Limit	Enter a casing pressure which will open the blow valve when the pressure falls below this set amount.

BV Flow Rate Low Time

Flow Rate BV Option	Option to use flow rate to open the blow valve.
Flow Rate	Displays the current flow rate.
Flow Rate BV Limit	Enter a flow rate limit that will initiate the blow valve opening once the flow rate falls below the entered amount for the amount of time specified by the Low Time Limit.
Low Time Limit	Enter a time frame that the flow rate must remain below before opening the blow valve.
Low Timer	Displays the elapsed time since the flow rate was below the established limit. Timer will reset if flow rate goes above Flow Rate BV Limit before reaching the Flow Rate BV Low Time Limit.

Inputs - Measurement

Plunger Arrival Value	Displays the number of elapsed seconds for the plunger arrival.
Cal Hold?	Displays Yes or No.

Statistics

Inputs/Strings

Inputs - Pressures

AP (AP at APvcb)	User-defined field for Absolute Pressure
DP	User-defined field for Differential Pressure

Line Pressure	User-defined field for Line Pressure
Tube (Tubing)	User-defined field for Tubing Pressure
Case (Casing)	User-defined field for Casing Pressure
Barometer Pressure	User-defined field for Barometric Pressure (PSIG)

Inputs - Derived Values

Tube Line	Current tubing minus line pressure differential.
Case Line	The Value column displays the casing minus line pressure.
Case - Tube	Current casing minus tubing pressure differential.
Load Ratio Current Value	Current load ratio value. (Case-tube)/(Case-Line)
Foss Gaul Multiplied	The Value column is the Foss Gaul multiplier which is used for tuning. The Limit column displays the Foss Gaul multiplied value which is the FG Raw Value times FG Multiplier.
Turner Flow Rate Multiplied	The Value column displays the multiplier that is multiplied against the calculated Turner unloading rate to determine the flow rate at which the valve will be closed. The Limit column displays the raw Turner calculated flow rate which is the flow rate that will carry fluids to the surface.

Inputs - External Inputs

Hold Input Value	Value used to determine if valve should be held closed.
Open 1 Value	User defines the Open 1 value (app/array/register) used for plunger.
Open 2 Value	User defines the Open 2 value (app/array/register) used for plunger.
Close 1 Value	User defines the Close 1 value (app/array/register) used for plunger.
Close 2 Value	User defines the Close 2 value (app/array/register) used for plunger.

Inputs - Valve Controller

VC Cmd	Displays the values for Valve Control Controller as set up in PCCU (VCI Cmd1)
VC Features	Displays the parameter settings for Valve Control as set up in PCCU (Features1)

Strings

Current State	Displays the current state of the controller. Controller current states are as follows: · Fail – Indicates that plunger has failed to arrive. · Closing Valve – Indicates that the production valve is closing, and the system is waiting for the plunger fall delay to expire.

	· Valve Closed – Indicates the plunger fall delay has expired, and the system is waiting for an open valve condition to be initiated. · Plunger Arriving – Indicates that the production valve has opened, and the system is waiting for the plunger to arrive. · Blow Valve – Indicates that the plunger has not yet arrived, blow valve conditions have been met and a secondary valve has been opened. · Plunger Arrived – This is an instantaneous state that indicates that the plunger has arrived. · AfterFlow – Indicates that the production valve is open, the plunger has arrived and close conditions are waiting to be met.
Max. State Timer	Displays the maximum timer time for the current state.
State Timer	Displays the current timer time for the current state followed by the time limit for the current state.
Max. O/C Timer (max open/close timer)	Displays the Open/Close maximum time limit.
O/C Timer (current open/close timer)	Displays the Open/Close time counter.

In Tube/In Plunger

In Tube - Tube Values

Temperature	Enter temperature value.
Flow rate	Enter flow rate value.
Volume - Accum	Enter accumulated volume value.
Today's Volume	Enter today's volume value.
Yesterday's Volume	Enter yesterday's volume value.
Z factor	Enter z factor value.

In Tube - Contract Hour

Last Contract Hr Update	Displays the date/time stamp of the update.
Tube Last Contract Time	Displays the date/time stamp of the last contract time.

Log Time	Displays the Log Time (dd:hh:mm:ss).
Day End Flag	Enter the value for the Day End Flag (Wait or Log).

In Plunger

Total Cycles	Displays the total cycles.
Total Plunger Travel	Displays the total plunger travel.
Plunger Arrivals Today	Displays the plunger arrivals today.
Last Lift Velocity	Displays the last lift velocity.
Reset Date/Time	Displays the reset date/time.
Reset Plunger Counters	User defined as No or Reset.

Events

Time Stamp	Displays the Time Stamp of the Event.
Reason	Displays the Reason that caused the Event.
Value	Displays the app/array/register associated with the event.

Total Cycles

Averages

Average Close Time	Displays the average closing time of the last ten plunger arrivals.
Average Close Case	Displays the average closing casing pressure of the last ten plunger arrivals.
Average Close Tube	Displays the average closing tubing pressure of the last ten plunger arrivals.
Average Close Line	Displays the average closing line pressure of the last ten plunger arrivals.
Average Close FR	Displays the average closing flow rate of the last ten plunger arrivals.
Average Close Vol	Displays the average closing volume of the last ten plunger arrivals.
Average Open Time	Displays the average opening time of the last ten plunger arrivals.
Average Open Case	Displays the average opening casing pressure of the last ten plunger arrivals.
Average Open Tube	Displays the average opening tubing pressure of the last ten plunger arrivals.
Average Open Line	Displays the average opening line pressure of the last ten plunger arrivals.
Average Open Vol	Displays the average opening volume of the last ten plunger arrivals.
AR Time	Displays the time it takes for the plunger to arrive.

Total CC

Close Stamp	Displays the Date/Time Stamp at the time of valve closure.

Close Reason	Displays the reason for valve closure.
Close Time	Displays the time at valve closure.
Close Case	Displays the closing casing pressure.
Close Tube	Displays the closing tubing pressure.
Close Line	Displays the closing line pressure.
Close Flow Rate	Displays the closing flow rate.
Close Volume	Displays the closing volume.
Open Stamp	Displays the Date/Time Stamp at the time of valve opening.
Open Reason	Displays the reason for valve opening.
Open Time	Displays the time at valve opening.
Open Case	Displays the casing pressure at valve opening.
Open Tube	Displays the tubing pressure at valve opening.
Open Line	Displays the line pressure at valve opening.
Open Volume	Displays the volume at valve opening.
AR Stamp	Displays the Date/Time Stamp of the valve arrival.
AR Status	Displays the Status of the valve arrival.
AR Time	Displays the Time of the valve arrival.

Total OO (if displayed)

Open Stamp	Displays the Date/Time Stamp at the time of valve opening.
Open Reason	Displays the reason for valve opening.
Open Time	Displays the time at valve opening.
Open Case	Displays the open casing pressure.
Open Tube	Displays the open tubing pressure.
Open Line	Displays the open line pressure.
Open Flow Rate	Displays the opening flow rate.
Open Volume	Displays the opening volume.
Close Stamp	Displays the Date/Time Stamp at the time of valve closure.
Close Reason	Displays the reason for valve closure.
Close Time	Displays the time at valve closure.
Close Case	Displays the casing pressure at valve closure.
Close Tube	Displays the tubing pressure at valve closure.
Close Line	Displays the line pressure at valve closure.
Close Volume	Displays the volume at valve closure.
AR Stamp	Displays the Date/Time Stamp of the valve arrival.

AR Status	Displays the Status of the valve arrival.
AR Time	Displays the Time of the valve arrival.

Current/Daily Cycles

Current Cycles - Open Valve

Open Stamp	Displays Date/Time Stamp at time of valve opening.
Open Reason	Displays reason for opening valve.
Open Time	Displays time of valve opening.
Open Case	Displays casing pressure value at time of valve opening.
Open Tube	Displays tube pressure value at time of valve opening.
Open Line	Displays line pressure value at time of valve opening.
Open Volume	Displays volume value at time of valve opening.

Current Cycles - Plunger Arrival

AR Stamp	Displays the date/time stamp of the plunger arrival.
AR Status	Displays the status of the plunger arrival (i.e. Normal)
Average Case	Displays the average casing pressure for the last ten plunger arrivals.
Average Tube	Displays the average tubing pressure for the last ten plunger arrivals.
Average Line	Displays the average line pressure for the last ten plunger arrivals.
Average FR	Displays the average flow rate for last ten plunger arrivals.

Current Cycles - Close Valve

Close Stamp	Displays Date/Time Stamp at time of valve closure.
Close Reason	Displays reason for closing valve.
Close Time	Displays time of valve closure.
Close Case	Displays casing pressure value at time of valve closure.
Close Tube	Displays tube pressure value at time of valve closure.
Close Line	Displays line pressure value at time of valve closure.
Close Flow Rate	Displays flow rate value at time of valve closure.
Close Volume	Displays volume value at time of valve closure.

Current Cycles - Open Valve

Open Stamp	Displays the Date/Time stamp at the time of valve opening.
Open Reason	Displays the Reason for valve opening.

Daily Cycles

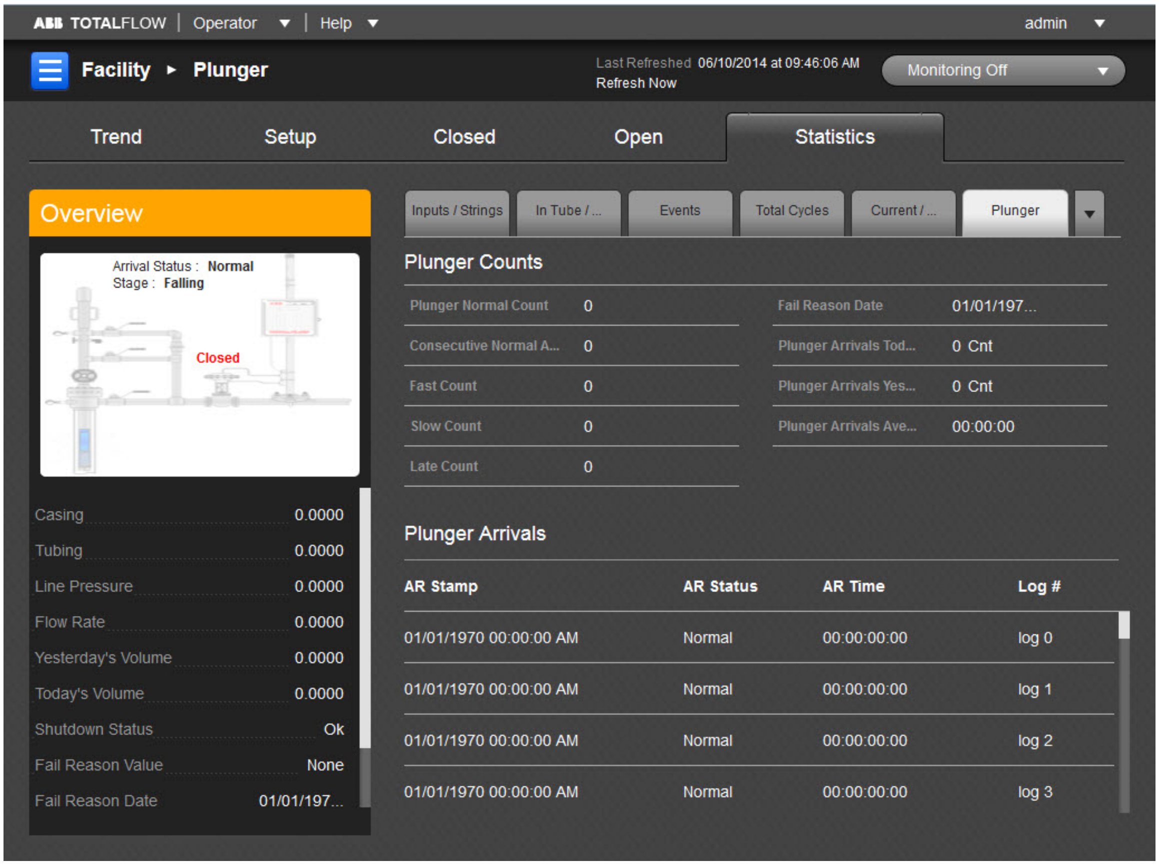
Today's Volume	Displays volume value since contract hour.
Yesterday's Volume	Displays volume value during previous contract day.

Total Cycles Since Reset	Displays number of total cycles since last reset.
Plunger Arrivals Today	Displays the total count of plunger arrivals that occurred since the contract hour.
Plunger Arrivals Yesterday	Displays the total count of plunger arrivals that occurred on the previous contract day.
Closed Today	Displays time closed during the contract day.
Closed Yesterday	Displays time closed during the previous contract day.
Open Today	Displays time open during the contract day.
Open Yesterday	Displays time open during the previous contract day.
Open Time Today	Displays % of available time open during the contract day.
Open Time Yesterday	Displays % of available time open during the previous contract day.
Close Time Today	Displays % of available time closed during the contract day.
Close Time Yesterday	Displays % of available time closed during the previous contract day.

Plunger

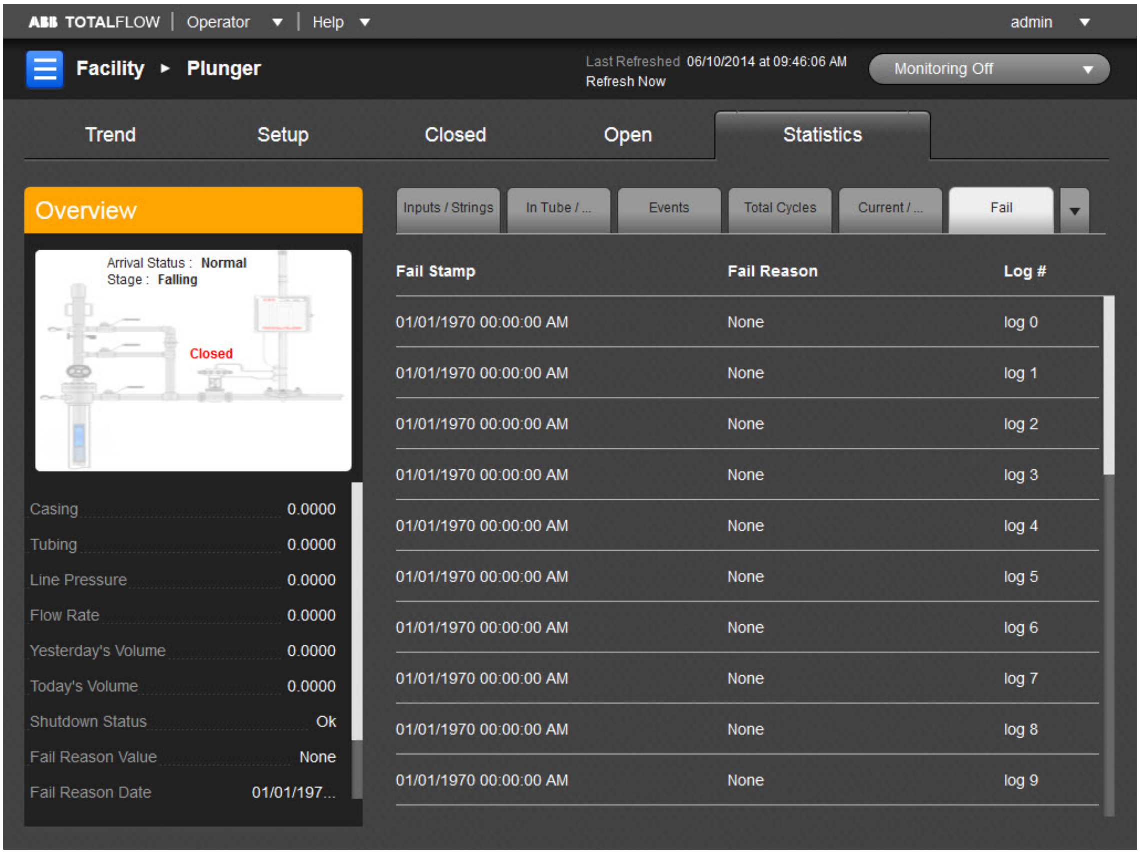
Plunger Counts

Plunger Normal Count	Keeps count of the number of times the plunger arrived within the Slow and Fast Arrival times. The count will increment until cleared by the Clear Plunger Counters.
Consecutive Normal Arrivals	The Value column displays the number of consecutive arrival counts where the arrival time is between the Slow Arrival Time Limit and the Fast Arrival Time Limit. The count will reset if an arrival is outside this limit.
Fast Count	Keeps count of the number of times the plunger exceeded its Fast Arrival time. The count will increment until cleared by the Clear Plunger Counters.
Slow Count	Keeps count of the number of times the plunger arrived below its Slow Arrival Time. The count will increment until cleared by the Clear Plunger Counters.
Late Count	Displays the total number of late arrivals since the last reset plunger counter command was executed.
Fail Reason Date	Displays the Date/Time Stamp of the Fail Reason Date.
Plunger Arrivals Today	Displays the count of Plunger Arrivals since the Contract Hour.
Plunger Arrivals Yesterday	Displays the count of Plunger Arrivals for the previous Contract Day.
Plunger Arrivals Average Time	Displays the average arrival times for the last ten plunger arrivals.



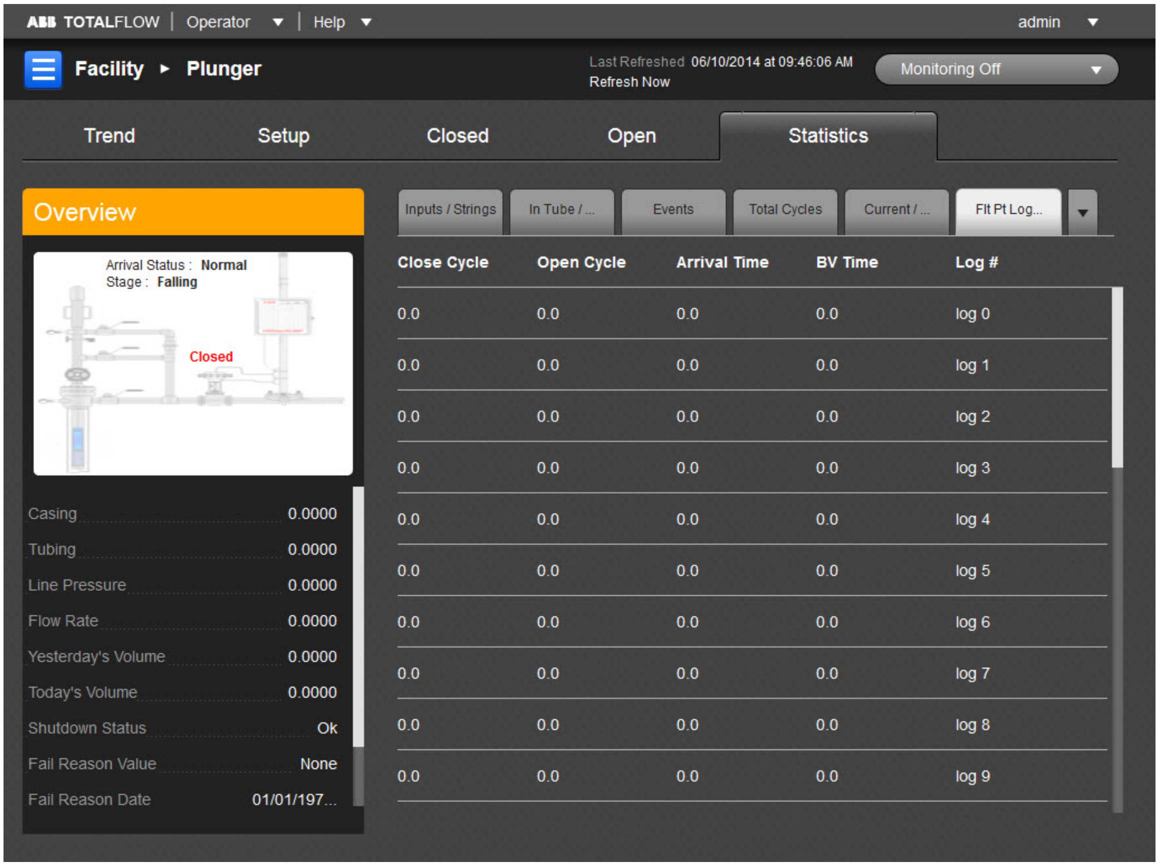
Plunger Arrivals

Log AR Stamp	Displays the Date/Time Stamp of the plunger arrival for the individual log entry.
Log AR Status	Displays the Status of the plunger arrival (i.e. Normal) for the individual log entry.
Log AR Time	Displays the Time (elapsed seconds) of the plunger arrival for the individual log entry.
Log #	Displays the number of the Log entry.



Fail

Fail Log Fail Stamp	Displays the Date/Time Stamp of the failed action.
Fail Log Fail Reason	Displays the Reason for the failed action.
Log #	Displays the number of the Log entry.



Flt Pt Time Limits

Status

Max State Timer	Displays the state's maximum time limit.
State Timer	Displays the state's time counter.
Max OC Timer	Displays the Open/Close maximum time limit.
OC State Timer	Displays the Open/Close time counter.

Open Limits

Flow Cycle Time Limit	The Value field displays the timer value as it counts up toward the Limit value in the Limit field.
After Flow Time Limit	Displays the AfterFlow Timer Limit which will close the production valve when the AfterFlow Timer reaches this limit.
Evaluation Time Limit	The Value column displays the time that has elapsed since plunger arrival. When this value becomes equal to the Evaluation Time entered in the Limit field by the user, the Evaluation Flag is set to On.
Turner Low Time Limit	The Value column displays the amount of time that the current flow rate has been below Turner Flow Rate x Turner Rate multiplier. The timer is reset if the flow rate goes above the threshold. The flow rate has to be below for the amount of time entered in the Limit column.

Casing Rise Time Limit	Displays the Casing Delta Value Limit. The delta value must be above the Casing Delta Value Limit for the amount of time specified in the Casing Rise Timer Limit, before the valve is closed.
Casing Evaluation Time Limit	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Delta Value is above the Casing Delta Limit. If at any time before reaching the Casing Rise Timer Limit, the Casing Average falls below the Casing Delta Limit, the timer is reset and commences counting again. If the counter reaches the Casing Rise Timer Limit and the Casing Average is above the Casing Delta Limit, the production valve will close.
Casing Slope Time Limit	Displays the Casing Slope Timer Limit. The Casing Slope Value must be above the Casing Slope Value Limit for the time specified by the Casing Slope Timer Limit before closing the production valve.
Load Ratio Time Limit	Displays the Load Ratio Timer Limit. The Load Ratio must be below the Load Ratio Limit value for this limit time before the production valve is closed.
DP Low Time Limit	Displays the DP Low Timer Limit. The current differential pressure must be above/below the DP Limit value for this DP Low Timer Limit amount of time before the production valve will close.
Flow Rate Time Limit	The Value column displays the current flow rate. If the flow rate remains below the user specified Flow Rate Time Limit in the Limit column for the Flow Rate Timer Limit amount of time, the production valve will close.
Tubing Close Time Limit	Displays the Tubing Close Timer Limit. The current tubing pressure must be above/below the Tubing Limit value for this Tubing Close Timer Limit time before the production valve will close.
SP Close Time Limit	Displays the SP Close Timer Limit. The SP Current Value must be above/below the SP Limit value for the SP Timer Limit time before the production valve will close.
Close1 Time Limit	Time that Close 1 must be above/below the Close 1 Limit before the valve is closed.
Close1 Hold Time Limit	Time that Close 1 will DELAY a Hold or Force Open (not Hold Value).
Close2 Time Limit	Time that Close 2 must be above/below the Close 2 Limit before the valve is closed.
Close2 Hold Time Limit	Time that Close 2 will cause a HOLD.

Close Limits

Plunger Fall Limit	Time Limit field displays time limit for the fall time.
Valve Close Check Time	The Limit data is for setting the amount of time the flow rate has to stay above the Valve Close Check Setpoint before a valve close failure is declared.
Hold Timer Limit	May replace Plunger Fall Delay.
Hold Once Time Limit	The Limit data allows for the entry of the time if Fixed will be used. The fixed time needs to be entered before enabling the Fixed option. The Limit column will also display the computed hold time if the 1 Cycle, 2 Cycle or 3 Cycle option is used.
Close Cycle Limit	Enter the delay time in the Limit field to keep the valve closed after being closed.

SP Open Time Limit	The Limit field is for entering the SP Limit time. The SP Current Value must be above/below the SP Limit value for the SP Limit time before the production valve will open.
Mandatory Close Time Limit	The Limit field will either display the time computed when the 1, 2, or 3 Cycle is selected or allow the user to enter a time when Fixed is selected.
Load Ratio Open Time Limit	The Limit field displays the user entered amount of time that the Load Ratio must be below the Load Ratio Limit value to open the valve. However, even if the timer reaches this Limit time, the casing pressure must be greater than the line pressure x Casing-Line Multiplier to open the valve.
Tubing Open Time Limit	The Limit field is the time the tubing pressure must be above or below the Tube Open Limit pressure before the valve is opened.
Casing Open Time Limit	The Limit field which is the time the casing pressure must be above or below the Casing Open Limit pressure before the valve is opened.
Foss Gaul Time Limit	Time Limit field - Displays the Limit Time. The production valve will open if the casing minus line pressure is less than the Foss Gaul Multiplied Value for this Limit Time.
Open1 Open Time Limit	The Limit field displays and allows user entry of the Open 1 Limit time which is the time the Open 1 Current value must be above/below the Open 1 Limit value before opening the valve.
Open2 Time Limit	The Limit field displays and allows user entry of the Open 2 Limit time which is the time the Open 2 Current value must be above/below the Open 2 Limit value before opening the valve.
Total Cycle Time Limit	The Limit field displays the total cycle time which is the total of the Flow Timer time and the Closed Timer time for the Auto mode or displays and allows for the user entered total cycle time for the Fixed mode.
High Line Close Time Limit	The Value field displays the elapsed time since the valve closed. The Limit field is for entering the time or delay since the valve closed before initiating the High Line Open Action parameter.
High Line Open Time Limit	The Value column displays the elapsed time since the production valve opened. The Limit field is for entering a time to wait after the production valve opens before checking the high line pressure and taking any actions.
Close1 Time Limit	Time that Close 1 must be above/below the Close 1 Limit before the valve is closed.
Close1 Hold Time Limit	Time that Close 1 will DELAY a Hold or Force Open (not Hold Value).
Close2 Time Limit	Time that Close 2 must be above/below the Close 2 Limit before the valve is closed.
Close2 Hold Time Limit	Time that Close 2 will cause a HOLD.

Flt Pt Timers

Arrival Times

Arrival Timer	Displays the elapsed time since the valve was last commanded open. The User will select a time format and enter the time in the Value field.
Max Arrival Limit	The Limit field is for the user entry of the Max Arrival Time Limit.
Slow Arrival Limit	The Limit field is for the user entry of the Slow Arrival Time Limit.
Fast Arrival Limit	The Limit field is for the user entry of the Fast Arrival Time Limit.
Min Arrival Limit	The Limit field is for the user entry of the Minimum Arrival Time Limit.

Open Timers

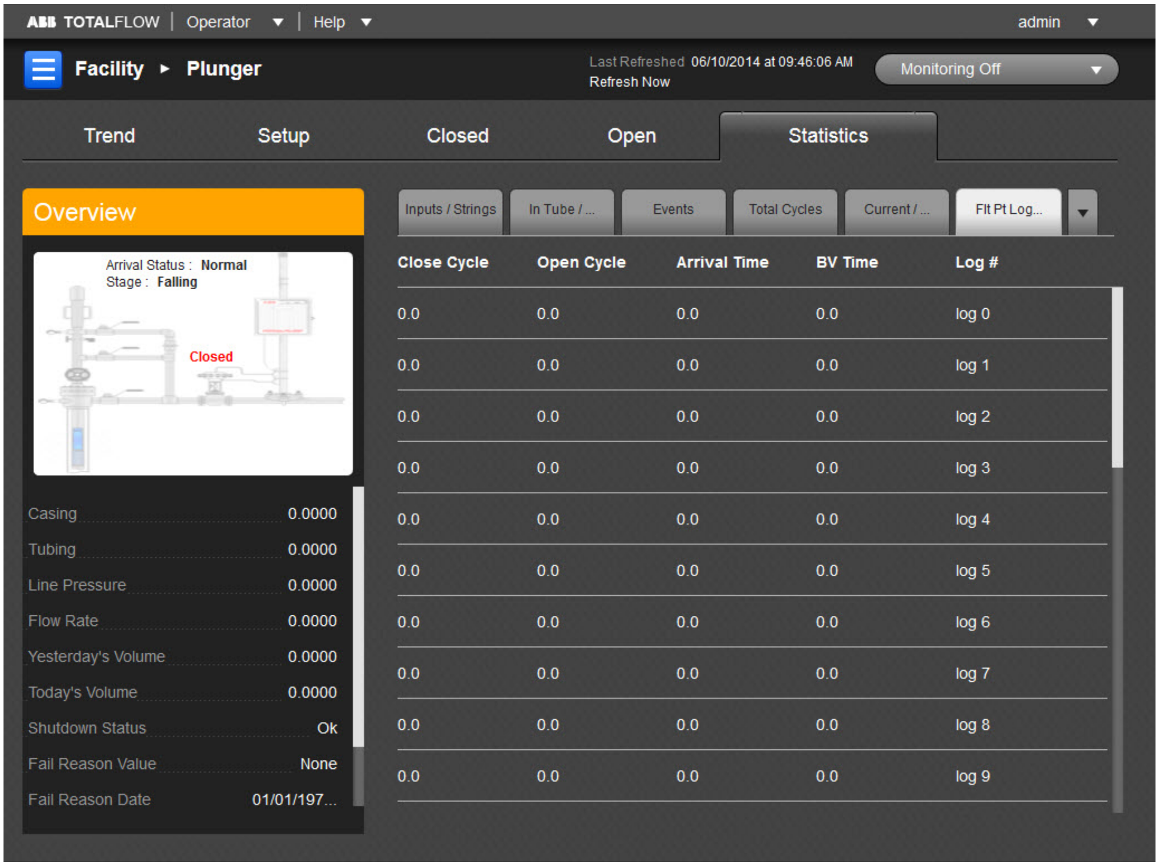
Flow Cycle Time Timer	The Value column displays the timer value as it counts up toward the Limit value in the Limit field. The Limit value is entered by the user and is the total open or flow time. The time begins when the production valve is opened and ends when the Limit time has elapsed. This will include arrival time for the plunger and AfterFlow time which is after the plunger arrives.
After Flow Timer	The Value column displays the timer which commences counting at the beginning of the AfterFlow state. AfterFlow starts when the plunger arrives. The counter counts up to the Limit value entered in the Limit column by the user. Limit time is the amount of flow time requested by the user during the AfterFlow state.
Evaluation Timer	The Value column displays the time that has elapsed since plunger arrival. When this value becomes equal to the Evaluation Time entered in the Limit column by the user, the Evaluation Flag is set to On.
Turner Low Timer	The Value column displays the amount of time that the current flow rate has been below Turner Flow Rate x Turner Rate multiplier (see above regarding Packer Well selection). The timer is reset if the flow rate goes above the threshold. The flow rate has to be below for the amount of time entered in the Limit column.
Casing Rise Timer	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Delta Value is above the Casing Delta Limit. If at any time before reaching the Casing Rise Timer Limit, the Casing Average falls below the Casing Delta Limit, the timer is reset and commences counting again. If the counter reaches the Casing Rise Timer Limit and the Casing Average is above the Casing Delta Limit, the production valve will close.
Casing Slope Timer	The Value column displays a timer that commences counting after the Evaluation Limit time has expired and if the Casing Slope Value is above the Casing Slope Limit. If at any time before reaching the Casing Slope Timer Limit, the Casing Slope falls below the Casing Slope Limit, the timer is reset and commences counting again when the Casing Slope is above the Limit. If the counter reaches the Casing Slope Timer Limit and the Casing Slope is above the Casing Slope Limit, the production valve will close.

Load Ratio Close Timer	The Value column displays a counter which will commence counting at the plunger arrival time and count up to the user entered Load Ratio Close Limit time. The Load Ratio must be below the Load Ratio Limit value for this limit time before the production valve is closed.
DP Low Timer	The Value column displays a timer that commences counting at the plunger arrival time if the current DP is below the DP Limit value. The counter will continue to count until the DP Low Timer Limit is reached. At this point the production value is closed. If at any time, the DP raises above the DP Limit value, the counter is reset and only starts counting again if the DP falls below the DP Limit value while in the AfterFlow state.
Flow Rate Timer	The Value column displays a timer that commences counting at the plunger arrival time if the Flow Rate is below the Flow Rate Limit value. The counter will continue to count until the Flow Rate Low Limit time is reached. At this point the production value is closed. If at any time, the Flow Rate rises above the Flow Rate Limit value, the counter is reset and only starts counting again if the Flow Rate falls below the Flow Rate Limit value while in the AfterFlow state.
Tubing Close Timer	If the current tubing pressure is above/below (per Close Action) the tubing pressure Limit value, the Value column timer will commence counting up to the Tubing Close Timer Limit time. If the counter reaches the Limit value, the production valve will close. If the tubing pressure changes such that it does not meet the Close Action criteria, the counter will reset and wait until the Close Action criteria is met again.
SP Close Timer	The Value column displays a counter which commences counting when the SP Current Value is above/below the SP Limit value as specified by the SP Action parameter. If the counter reaches the SP Limit time, the production valve will close. If the static pressure changes such that it is not above/below the SP Limit value per the SP Action, the counter will reset and wait until the pressure reaches its Limit pressure again and commence counting.
Close1 Timer	Displays the current Close 1 Timer value and Timer Limit.
Close2 Timer	Displays the current Close 2 Timer value and Timer Limit.

Close Timers

Plunger Fall Timer	The Value field displays the elapsed time since the production valve was closed. This is a time delay to allow enough time for the plunger to reach the bottom after closing the production valve before going to State 2 (Closed).
Valve Close Check Timer	The Value field is a timer which displays the amount of time that the flow rate has stayed above the Valve Close Check Setpoint.
Hold Once Timer	The Value field displays the timer which starts at zero and runs through the duration of the Hold Once operation.
Closed Timer	Displays the elapsed time in the Value field since the valve was commanded closed and for the duration of the Limit value.
SP Open Time Timer	The Value field displays the amount of time the SP Current Value has been above/below the SP Limit Value as selected by the Static Pressure Action parameter.
Mandatory Close Timer	The Value field displays a timer that tracks the time from the beginning of the Active state up to the end of the Limit time.

Load Ratio Open Timer	The Value field displays a timer that commences counting when the Load Ratio drops below the Load Ratio Limit value and continues counting until it reaches the time entered in the Limit column. If the Load Ratio should move back above the Load Ratio Limit, the timer will reset and only commence counting again when Load Ratio again drops below the Load Ratio Limit.
Tubing Open Timer	The Value field displays the Limit timer which starts when the Low or High Open condition is met to open the valve and counts up to the Limit time (Limit field).
Casing Open Timer	The Value field displays the Casing Open timer which starts when the Low or High Open condition is met to open the valve and counts up to the Casing Open Limit time (Limit field).
Foss Gaul Timer	The Value field displays the amount of time that the casing minus line is less than the Foss Gaul Multiplied Value.
Open1 Open Timer	The Value field displays a timer which is the amount of time that the Open 1 Current Value is above/below the Open 1 Limit value based on the Open Action selection. The timer increments until it reaches the Open 1 Timer Limit which will trigger the opening of the valve.
Open2 Open Timer	The Value field displays a timer which is the amount of time that the Open 2 Current Value is above/below the Open 2 Limit value based on the Open Action selection. The timer increments until it reaches the Open Timer Limit which will trigger the opening of the valve.
Total Cycle Timer	The Value field is a timer that starts at the beginning of the open time and runs until it reaches the end of the total cycle time, resets and starts again with the next open.
Close1 Timer	The Value field displays the current Close 1 Timer value and is the amount of time in Hold or time value that has been above/below the Close 1 Limit.
Close2 Timer	The Value field displays the current Close 2 Timer value and is the amount of time in Hold or time Value has been above/below the Close 2 Limit.



Flt Pt Log Times

Log Close Cycle	Displays the elapsed time of the close valve cycle for each log entry.
Log Open Cycle	Displays the elapsed time of the open valve cycle for each log entry.
Log Arrival Time	Displays the elapsed time for the plunger arrival for each log entry.
Log BV Time	Displays the elapsed time since the plunger arrived in the Blow Valve state for each log entry.
Log #	Displays the number of the Log entry.

Trend System

Overview

It is now possible to create trend files not only in PCCU32 but also with the web. In addition the created files can be assigned to stations, sub-facilities and facilities using configuration or FMA.

There are two major tabs for this application: Trend File and Setup

Trend File

The Trend Files pulldown menu, located under the Trend File table, allows the user to assign specific trend files to run for an established application group. Only two files can be selected for view at a time: one above and one below. In this example, the two files selected are 01W02TP (upper) and 02W01PR (lower).

Each chart has two buttons over the right side as follows to control display of information:

View	This button controls the display of data. The user may select either Grid or Graph.
Poll Type	This button controls the time source of the data. The user may select either Historical or Real Time.

Using the mouse to hover over the displayed data, the color-coded variables on the graph show date/time and value for any point selected. In this graph only one variable is displayed (Meter Temp in the upper graph and Gas DP in the lower one).

A maximum of four variables can be plotted per graph at one time with the multiple y axis. The Options icon is located in the lower right corner of the graph and displayed only if there are more than four variables resident with the file. It allows the user to click on the icon and display an overlay of all variables present and change, if desired, the variables to display.

Setup

From the Setup section, on the right side of the screen, the user can also add new Trend files using the first icon on the right side, modify an existing file with the second option or delete a file with the third. The following fields are read only and display information about the selected analysis file:

File Name	The user-defined name of the Trend File displays.
Description	A description of the Trend File displays with a user-defined description of the trend file (up to 25 characters).
Default	The default is either enabled or disabled by clicking on a check box from the Modify Trend box.
Scan Status	The following are options for the Scan Status pulldown menu from the Modify Trend box: Off, On, OnTime, Trigger-AutoReset, Trigger-Freeze, Freeze, Frozen or Register.*
Scan Period	This defaults to one second but is able to be changed by the user from the Modify Trend box.
Log Period	This defaults to one second but is able to be changed by the user from the Modify Trend box.
No. of Variables	This displays the number of variables assigned to the Trend File. The user can add or delete variables from the Modify Trend box.
No. of Records	This displays the number of records assigned to the Trend File. You need to enter the number of records you want although there may be a default.
Required Space	This displays the space required for the selected Trend File.

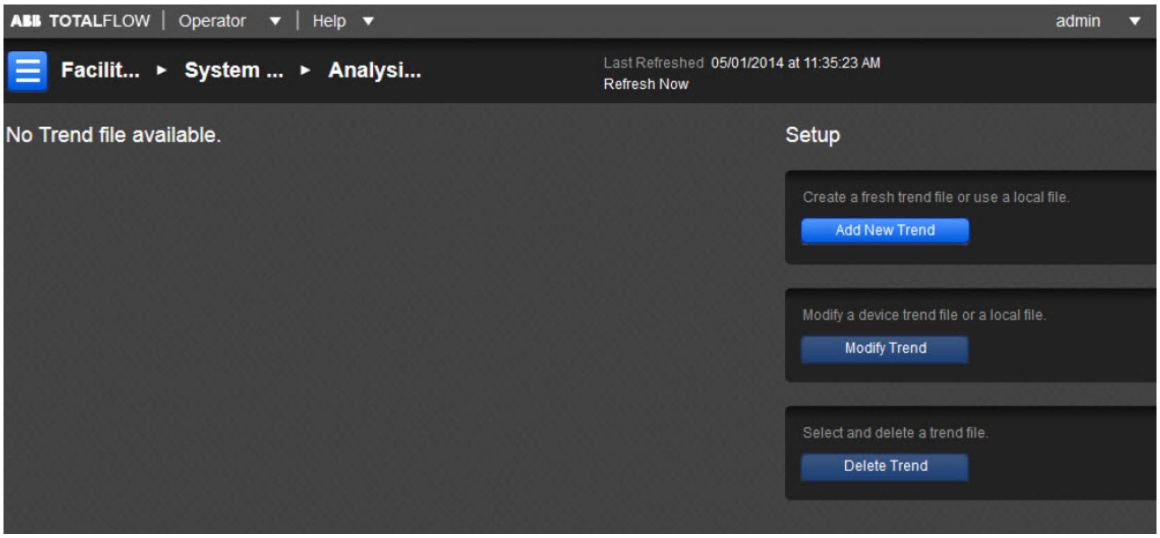
*The options for the Scan Status are defined as follows:

Off	No scanning or data logging occurs.
On	Scan and Log as specified by the Scan Period and Log Period.
OnTime	Log at specified time of day as specified by Log Time. Log Period becomes Log Time with this selection.
Trigger - AutoReset	Log while triggered. Resume logging if trigger returns after loss of trigger. Triggering mechanism is a trend variable specified by Log Trigger.
Trigger - Freeze	Waits for trigger to start logging at which time enters Freeze state and keeps logging until trigger is lost. Enters the Frozen state with loss of trigger but will continue to log data for the amount of time as specified in Freeze Delay.
Freeze	Freeze is more of a status condition meaning that the trigger condition is met, and data is being logged; however, the Scan Status may have been put in the Frozen state intentionally by a Modbus Register or an App/Array/Register.
Frozen	Frozen is more of a status condition indicating that the trigger has been lost and logging will cease; however, the Scan Status may have been put in the Frozen state intentionally by a Modbus Register or an App/Array/Register.
Register	Logging is controlled by the specified App/Array/Register. A window will appear to the right of the Scan Status to enter the App/Array/Register. Expected values from the App/Array/Register are: 0 - Off, 1 - On, 2 - Ontime, 3 - Trigger-AutoReset, 4 - Trigger-Freeze, 5 - Freeze & 6 - Frozen.

Analysis Trend File

Overview

The Trend Analysis File is used in conjunction with the Natural Gas Chromatograph (NGC) to analyze for customers the quality of the gas measured. The user can modify information to modify or create a new file using the trend buttons provided.



Setup

From the Setup section, the user can change the Trend Analysis file displayed. From the right side of the screen, the user can add a new Trend file using the first icon on the right side, modify an existing file with the second option or delete a file with the third.

The following fields are read-only:

File Name	The name of the Trend File displays.
Description	A description of the Trend File displays.
Flow Weight	If Enable displays, all components will be Flow Weighted as opposed to using a mean average of the sampled values. When Flow Weighted, each sampled value is multiplied times the Flow Rate, the products of these multiplications are added together and divided by the sum of the flow rates. If disabled, Flow Weighting is not applied.
Tube App #	The Tube App # displayed is changed as needed from the Tube App # box in the Modify Trend box.
Sample Source	Either Tube or Therms displays. If Therms is displayed, the user can change the Stream assignment from the Modify Trend box. Therms is not available for display if Flow Weight is Enabled.
Scan Period	This field defaults to one second but is able to be changed by the user from the Modify Trend box.
Log Period	This field defaults to one second but is able to be changed by the user from the Modify Trend box.

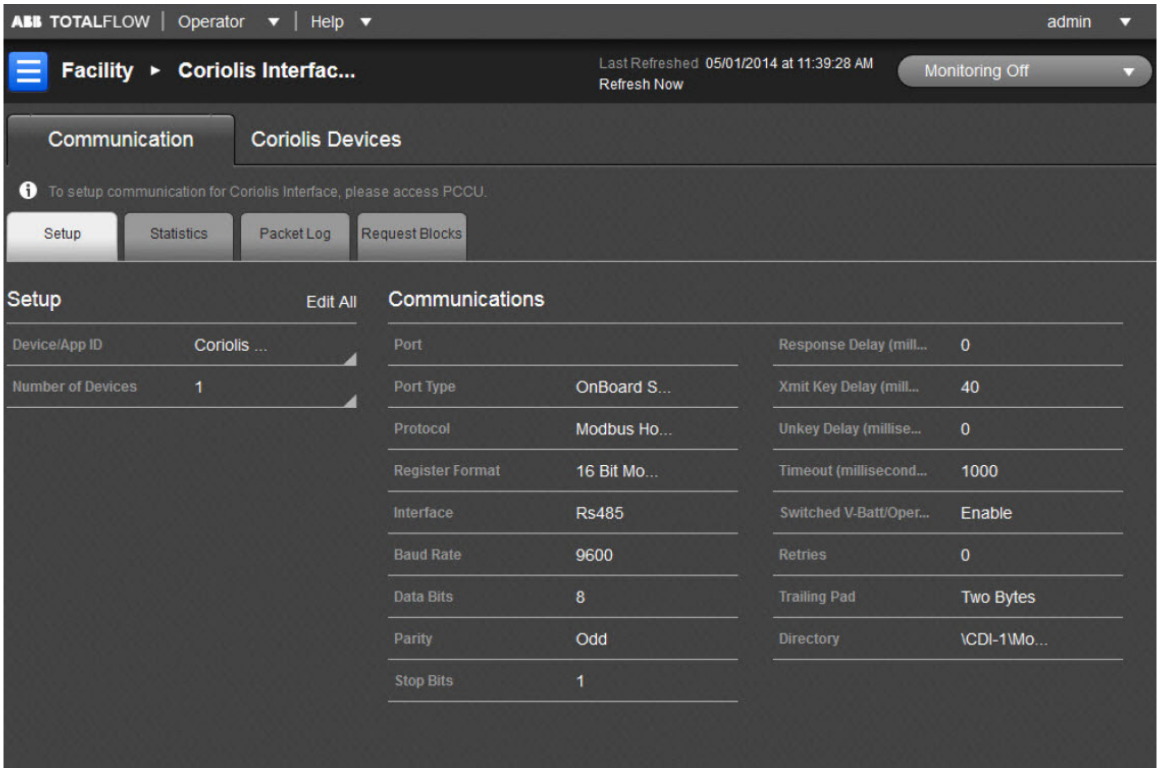
Scan Status	The following are options for the Scan Status pulldown menu from the Modify Trend box: (Tube selected as Sample Source: Off, Sync w/Log Period or Synch w/Day Period) or (Therms selected as Sample Source: Off, On or OnTime)
No. of Records	This displays the number of records assigned to the Trend File.
No. of Components	This displays the number of components assigned to the Trend File.
Required Space	This displays the space required for the selected Trend File.
Component Type	Display as Gross, Detailed or Custom. Selecting Gross or Detailed defaults to the standard components used by these two F(pv) methods. Modifying either list from the Modify Trend Box will cause Custom to display. When the file is opened at a later date, the Custom display indicates to the User that neither the Gross nor Detailed list is available to change and needs to be Custom built by the User. The list is generated by using the Increase/Decrease box for Min and Max percentages of each component.

Coriolis Interface

Overview

The ABB Totalflow XSeries Coriolis (Gas) application allows an XSeries device (XFC or XRC) to interface with an ABB Coriolis transmitter and perform volume and corrected mass calculations. Mass flow from the Coriolis device, retrieved via Modbus protocol, is requested and utilized by the interface application to calculate corrected volume. Daily logs, hourly logs, characteristics and event logs are collectable, both locally and remotely from the Coriolis application's historical data (i.e. corrected volume, corrected mass, uncorrected mass, energy and alarms).

PCCU (local PC user Configuration and Collection software) provides the user interface to the Totalflow XSeries device for configuration, calibration, collection and viewing of historical data, as well as the ability to view and edit parameters resident in the transmitter. The Coriolis Interface allows the user to enter the calibration pressure (PCal) and pressure effect (PEffect), which are then applied to mass flow to produce the corrected mass flow.



Communication

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

There are two major sections on the Coriolis Interface title page: Communication and Coriolis Devices. On this, the Communication section, four tabs are displayed (Setup, Statistics, Packet Log and Request Blocks) across the top of the page. Each tab with its relevant information is discussed as follows:

Setup

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

Setup

Device/App ID	Enter the name of the device with its App ID.
Number of Devices	Enter the number of devices instantiated with the device.

Communications

Port	Enter the Serial Port that will be used for the Coriolis interface. This will typically be COM2.
Port Type	Select the type of port from the drop-down list. · OnBoard Serial - Select if using one of the serial communication ports located physically on the device's main electronic's board. · TCP/IP Client - Select if using the Ethernet port.

	· TFIO Serial - Select when using a TFIO communications module referred to as a Communications Interface Module (CIM). These will be mounted on a rail external to the main electronics board.
Protocol	Select a protocol from the drop-down menu. · Modbus Host (ASCII) - Select when communicating with a Slave using Modbus ASCII protocol. · Modbus Host (RTU) - Select when communicating with a Slave using Modbus RTU protocol. · Modbus/TCP Client - A TCP Client initiates conversations with the server by asking the server to perform a task.
Register Format	(Host and Slave) Select the appropriate format from the drop-down list. · 32 Bit Totalflow - 32 bit values are transferred as a single 32 bit register. Register list entries are biased one greater than standard Modbus (7002 = 7001 Standard). · 32 Bit - 32 bit values are transferred as a single 32 bit register. · 16 Bit Modicon - 32 bit values are transferred as two consecutive 16 bit registers. · 16 Bit Word Swapped - 32 bit values are transferred as two consecutive 16 bit registers and swaps the order of the registers. · 16 Bit ROS Modulo 10000 - Multiplies the floating point number by 1000 and then divides by 10000. The integer portion (before the decimal point) goes into the first 16 bit register and the fractional portion (after the decimal point) goes in the second 16 bit register.
Interface	Select the interface type from the drop-down list that will be used on this port. Available selections are: · RS232 - Select if communicating via RS232. · RS485 - Select if communicating via RS485. · RS422 - Select if communicating via RS422.
Baud Rate	Click in the Value column, and select the Baud Rate from the drop-down list. Range is from 1200 to 115200.
Data Bits	Selections are 7 or 8 data bits.
Parity	Selections are None, Odd or Even
Stop Bits	Selections are 1 or 2 stop bits.
Response Delay (ms)	Response Delay has to do with the turnaround time when responding to a Coriolis device. Its possible that, for example, a flow computer may respond before the Coriolis device is ready to receive data. In this case, a delay is needed before data is sent to the Coriolis device. If needed start with a short time, such as 10 milliseconds.
Xmit Key Delay (ms)	Typically used when communicating via radio but can affect any communications equipment; this is a delay time to allow a radio's transmitter to stabilize after being keyed up before data is transmitted. This can typically be left at the default time of 420 milliseconds.
Unkey Delay (ms)	Typically used when communicating via radio but can affect any communications equipment; this is a delay time to keep the radio's transmitter keyed up after the last data bit is transmitted. It can typically be set at approximately 10 milliseconds.
Timeout (ms)	If having problems communicating, enter a value here from 40 - 100 milliseconds. This is the largest gap tolerated between characters within a packet. If this time expires, any partial packet is discarded, and the protocol looks for the beginning of a new packet.

Switched V-Batt/Operate	This parameter selects the mode for Switched V-Batt and Operate. Both Switched V-Batt and Operate are switched voltage outputs and come from the same source with the exception that Operate has an on-board 500 ohm current limiting resister in series with it. They will turn on and off at the Listen Cycle frequency and is controlled by the communication Schedule if used. · Enable - Allows the outputs to switch on and off with the Listen Cycle time. Additionally, allows the output to be controlled by the communication's schedule. · Disable - Disables the outputs. · Always ON - Causes the outputs to be on all the time.
Retries	When initiating requests, specify the number of times to retry if the initial request fails.
Trailing Pad	Trailing Pad allows the user to add zeroes to the end of a transmission sequence to make sure the transmission is accomplished before the remote device tries to respond. This is more for devices that have a quick turnaround time. This can be used in place of having an Unkey Delay. Select 2 bytes, 3 bytes or 4 bytes from the drop-down list.
Directory	Specify a directory and path in the device for Request Block files. Typically, this would be under the directory associated with the communication port being used. Typically a default directory will already be specified.

Statistics

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

Previous Poll Loop Time	Displays the last poll loop time. If multiple devices, the time to poll all devices.
Minimum Poll Loop Time	Keeps the minimum poll loop time of all polls.
Maximum Poll Loop Time	Keeps the maximum poll loop time of all polls.
No. of Polls	The number of times the device tried to communicate with the devices.
No. of Errors	Displays the total number of times that communication with the polled devices was not successful.
No. of Late Completions	Displays the number of times the communication's poll failed to retrieve data from the device or devices within the scan time allotted. For example, if polling multiple devices once a second, then all the devices must be polled and data retrieved within the second. If the user is seeing multiple late completions, try reducing the time slightly on one of the parameters mentioned above. If the Number of Errors start to increase after changing a parameter, increase it until the Number of Errors stop. If Late Completions are still happening, try reducing one of the other parameters using the same scenario.
No. of Interrupts	Displays the total number of transmit/receive interrupts.
No. of Characters Received	Displays a running total of received bytes from the devices
No. of Characters Transmitted	Displays a running total of transmitted bytes to the devices.
Thread Priority	Displays the priority of the protocol task.
1st Priority	Displays the priority of the interrupt service thread.

Packet Log

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

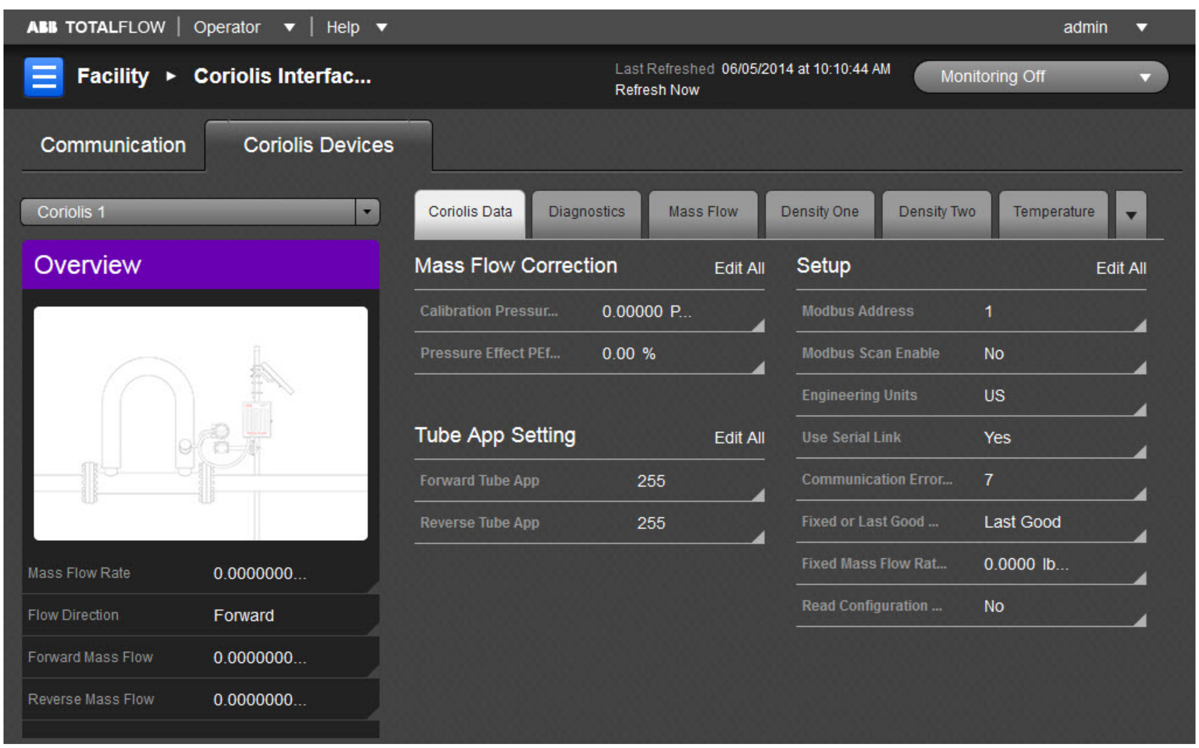
The Packet Log tab is included for troubleshooting purposes only. The information provided has only to do with Totalflow Remote protocol or Modbus protocol. Other than the number of errors and polls that are displayed at the bottom of the screen, the user would need a Totalflow Remote protocol and/or a Modbus document to understand the information that gets displayed. You might however be asked by a customer service representative for information provided on this screen.

The information displayed on the screen is provided from a file maintained in the device. You can specify the number of records that are kept in the file by selecting one of the values for the Log Size from its pulldown menu to ensure only the newest records are kept. To receive any updated information after initially viewing the screen, you will be required to either click the Re-read button or check the Monitor button. The information displayed will only change if additional polls have occurred since the last time the information was read.

Request Blocks

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

The Request Blocks tab is for setting up information to poll a remote Totalflow device. The procedure is currently performed in PCCU.



Coriolis Devices

There are two major sections on the Coriolis Interface main page: Communication and Coriolis Devices.

The drop-down menu in the upper left corner in the page allows the user to select the tube to be instantiated. Below this menu is a display of key flow parameters as follows:

Mass Flow Rate	This parameter displays the calculated mass flow rate through the Coriolis meter independent of the direction. The field is auto-populated by the application.
Flow Direction	Forward or Backward are the possible directions displayed depending on the polarity of the data. Positive polarity designates forward flow and negative polarity designates reverse flow.
Forward Mass Flow	This parameter is the Mass Flow Rate value from above, if forward flow, but is converted to kilograms per second for use by the Coriolis measurement application.
Reverse Mass Flow	This parameter is the Mass Flow Rate value from above, if reverse flow, but is converted to kilograms per second for use by the Coriolis measurement application.

On this, the Coriolis Devices section, six tabs (Coriolis Data, Diagnostics, Mass Flow, Density One, Density Two and Temperature are displayed across the top of the page. A seventh (TSeries) tab is available with the pulldown arrow from the Temperature tab.

Each tab with its relevant information is discussed as follows:

Coriolis Data

Mass Flow Correction

Calibration Pressure PCal	This is the pressure at which the meter was calibrated; therefore, this defines the pressure at which there will be no effect on the calibration factor. Enter the calibration pressure from the designated Sensor Calibration document. If calibration pressure is not offered, enter a default of 30 PSIG.
Pressure Effect PEffect	Enter the pressure effect for flow. Obtain the pressure effect values from the Product Data sheet for the user's particular sensor. Typically, the value ranges are from -0.001 to -0.002%. At this time, PEffect MUST be entered as a positive (+) value. The Coriolis software automatically changes the value to negative. PCCU will display the value as positive under the Mass Flow Correction tab in the Characteristics section of the Historical Data.

Tube App Setting

Forward Tube App	The parameter enables the user to specify the application number for Forward Coriolis Measurement tube. See the Applications tab located under the Station ID for this information. A Coriolis Measure application must be running for each forward and reverse application. Coriolis meters are bidirectional; therefore, a meter may require both a forward and reverse application.
Reverse Tube App	Enables the user to specify the application number used for the Reverse Coriolis Measurement tube. See the Applications tab located under the Station ID for this information. A Coriolis Measurement application must be running for each forward and reverse application. Coriolis meters are bidirectional; therefore, a meter may require both a forward and reverse application.

Setup

Modbus Address	Enter a unique Modbus address for each Coriolis device.

Modbus Scan Enable	When set to Yes, this parameter allows the Coriolis device to start communications between the Coriolis device and the flow computer.
Engineering Units	This parameter indicates whether the Coriolis meter is configured to provide data in US or SI (European) units. This parameter is configured by the user.
Use Serial Link	Coriolis meter data is available via a Modbus serial link or through a Pulse Input. Select Yes from the drop-down menu to use the Modbus link or No to use a Pulse Input.
Communication Errors Limit	Specify the number of consecutive communication errors allowable. Whenever the limit is met, either the fixed or last good value, as specified below, will be used.
Fixed or Last Good Value on Error	The user is given the option of selecting either Last Good or Fixed value to be used as the Mass Flow Rate, under the General tab, whenever the Communication Errors Limit is met.
Fixed Mass Flow Rate Value	If the user has selected Fixed Value to be used for the Mass Flow Rate, the value entered here will replace the Mass Flow Rate value under the General tab.
Read Configuration Parameters	Select Yes from the drop-down menu to read all configuration parameters from the Coriolis transmitter. Values may be confirmed by clicking the Mass Flow, Density and Temperature tabs found in Configuration on the Coriolis Interface tree.

Diagnostics

General

Current Comm Status	The current communication status for this particular device.
Number of Polls	This parameter displays the number of attempted Modbus requests for the current Alarm Cycle.
Number of Errors	Displays the number of communication errors for the current Alarm Cycle.
Number of Polls	This displays the number of attempted Modbus requests for the current Contract Day.
Number of Errors	This parameter displays the number of communication errors for the current Contract Day.
Consecutive Comm Error Limit Met	When the number of consecutive communication errors is met, the value displayed reverts to Yes. The first good communications value causes this to automatically switch back to No.

Device Alarm

Transmitter Electronics Failure	The Coriolis Device Alarms screen is the area where the user can find information on any failures or resets that have occurred with a device. If any value is set to Yes within any of the alarm types, the alarm is posted to the tube's Historical Data Daily and Log Period Collect. When the failure or reset is resolved, the value is automatically changed back to No.
Zeroing In Progress	
Slug Flow	
Power Reset Occurred	
Transmitter Configuration Changed	
Transmitter Configuration Warming Up	
EPROM Checksum Failure	
RAM Diagnostics Failure	
Sensor Failure	

Temperature Sensor Failure	
Input Overrange	
Frequency/Pulse Output Saturated	
Transmitter Not Configured	
Real-Time Interrupt Failure	
Primary mA Output Saturated	
Secondary mA Output Saturated	
Primary mA Output Fixed	
Secondary mA Output Fixed	
Density Overrange	
Zeroing Failure	
Zero Value Too High	
Zero Value Too Low	

Mass Flow

Damping Period	The number of seconds over which the reported mass flow rate will change to reflect 63% of the change in the actual process. The default is set to 3.2 seconds. The user is able to input a new value into the Value field and then send the new value to the Coriolis meter by selecting Yes in the last column and clicking the Send button.
Low Flow Cutoff	This value will be considered zero mass flow rate by the Coriolis meter. The user is able to input a new value into the Value field and then send the new value to the Coriolis meter by selecting Yes in the last column and clicking the Send button. The default is set to 0.0 with a recommended setting of 0.5 - 1.0% of the sensor's rated maximum flow rate.
Flow Calibration Factor FCF	This is a required value that characterizes the Coriolis meter for the particular sensor it is using.
Flow Temperature Coefficient FT	One of the required values that characterizes the Coriolis meter for the particular sensor it is using.
Meter Factor	The adjustment to be applied to the mass flow process variable. The default is set to 0.0.
Mechanical Zero	This parameter displays the zero value derived from the most recent zero procedure.

Density One

Measured Density	This parameter details the density read per second from the Coriolis device.
Damping Period	The number of seconds over which the reported mass flow rate will change to reflect 63% of the change in the actual process. The default is set to 3.2 seconds. The user is able to input a new value into the Value field and then send the new value to the Coriolis meter by selecting Yes in the last column and clicking the Send button.
Low Density Cutoff	The density value at which the Coriolis application considers zero density. The default is set at 200 kg/m3 (12.48 lb/ft3). The range is specified between 0-500 kg/m3 (312.14 lb/ft3).

Slug Duration	The number of seconds the Coriolis waits for a slug flow condition (outside the slug flow limits) to return to normal (inside the slug flow limits). The default is set to 0.0 with a range from 0.0 to 60.0 seconds.
High Slug Limit	The density value above which a condition of slug flow exists. Typically, this is the highest point in the normal density range of the process. The default is set to 5.0 g/cm3, with a range of 0.0 - 10.0 g/cm3. The user needs to use g/cm3 to configure this parameter, even if configured.
Low Slug Limit	The density value below which a condition of slug flow will exist. Typically, this is the lowest point in the normal density range of the process.
Density Meter Factor	The adjustment to be applied to the density process variable.

Density Two

Flowing Density Factor FD	FD is the correction factor for the effect of flow on density. Enter the FD value stamped on the sensor tag. Default value is 0.0.
Temperature Coefficient DTC	DTC is one of the values required to characterize certain meters for the particular sensor it is using. If your sensor tag does not show a DTC or TC value, enter the last 3 digits of the density calibration factor.
Low Density Calibration D1	D1 is one of the values required to characterize certain meters for the particular sensor it is using. Enter the Dens A or D1 value from the calibration certificate. This value is the line-condition density of the low-density calibration fluid. Some meters use air.
Temperature Corrected Tube Period K1	K1 is one of the values required to characterize certain meters for the particular sensor it is using. If your sensor tag does not show a K1 value, enter the first 5 digits of the density calibration factor. Example: From the Sensor tag, the Density Calibration Factor, denoted as Dens Cal Factor, is 12345678901.44. Enter 67890.
High Density Calibration D2	D2 is one of the values required to characterize certain meters for the particular sensor it is using. Enter the Dens B or D2 value from the calibration certificate. This value is the line-condition density of the high-density calibration fluid. Some meters use water.
Temperature Corrected Tube Period K2	K2 is one of the values required to characterize certain meters for the particular sensor it is using. If your sensor tag does not show a K2 value, enter the second 5 digits of the density calibration factor. Example: From the Sensor tag, the Density Calibration Factor, denoted as Dens Cal Factor, is 12345678901.44. Enter 67890.

Temperature

Damping Period	The number of seconds over which the reported mass flow rate will change to reflect 63% of the change in the actual process. The default is set to 3.2 seconds. The user is able to input a new value into the Value field and then send the new value to the Coriolis meter by selecting Yes in the last column and clicking the Send button.
Calibration Slope	This field details the slope value used to adjust the temperature process variable.

Calibration Offset	This field details the offset value used to adjust the temperature process variable.
External Temperature	Yes: Temperature data from Coriolis sensor is used. No: The temperature data from a different temperature device is used. If Enabled is specified, a Source field displays. Use the select TLP dialog box to specify the temperature source. The Value field displays the current temperature value for the specified source.

TSeries

Temperature Corrected Tube Period K3	See Micro Motion's® T-Series manual for K3 calibration.
Temperature Corrected Tube Period K4	See Micro Motion's® T-Series manual for K4 calibration.
Density Calibration D3	See Micro Motion's® T-Series manual for D3 calibration.
Density Calibration D4	See Micro Motion's® T-Series manual for D4 calibration.
FTG	See Micro Motion's® T-Series manual.
FFQ	See Micro Motion's® T-Series manual.
DTG	See Micro Motion's® T-Series manual.
DFQ1	See Micro Motion's® T-Series manual.
DFQ2	See Micro Motion's® T-Series manual.

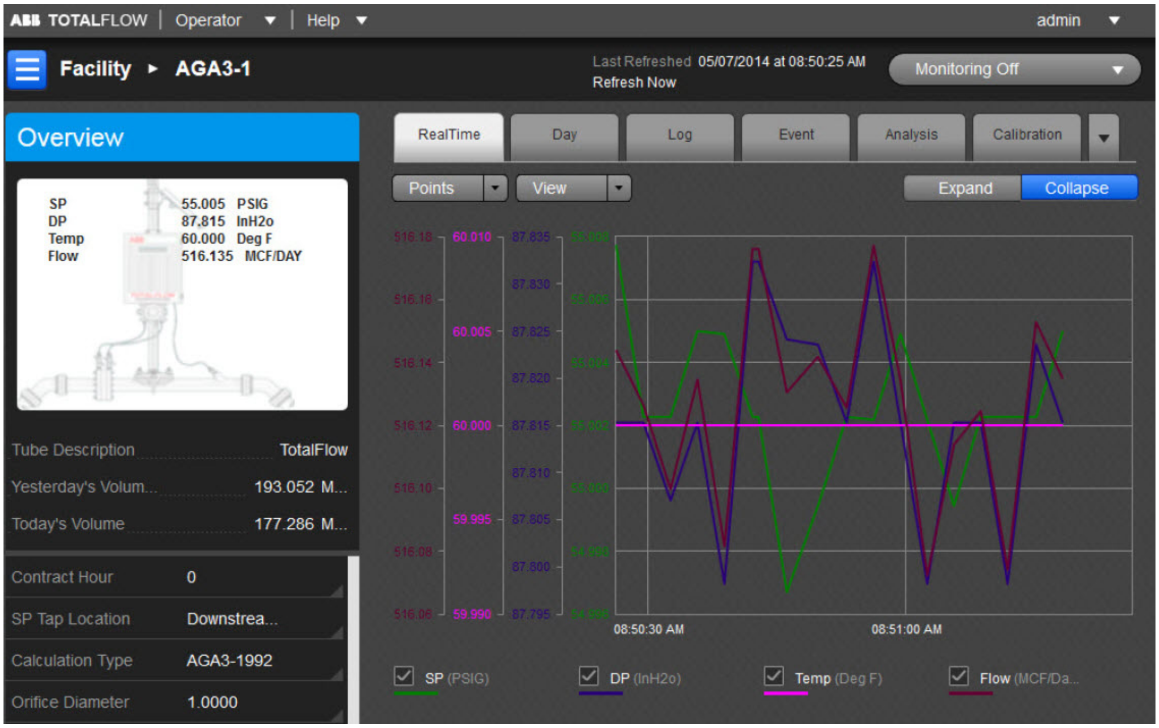
AGA-3

Overview

The Totalflow® Fourth Generation XSeries flow computers (XFCG4) provide functionality though the convergence of RTU, PLC and flow computer concepts. The XFCG4 represents a unique milestone in the development of remote, low power measurement and control devices. All XFCG4 units feature multi-tube capacity --up to eight per individual unit or 20 tubes per unit in special cases-- with custody-transfer measurement features. The flexibility of these units, including backward compatibility with legacy Totalflow systems, allows the user to increase productivity and improves asset utilization.

While the XFCG4 is designed for either differential (orifice) or pulse (linear) metering, the following information concentrates solely on differential pressure as it regards the AGA-3 standard. The AGA-3 standard provides a procedure for the measurement of natural gas, hydrocarbons and other related fluid flows using flange tap and pipe tap orifice meters. Additionally, AGA-3 provides the standards for the construction and installation of orifice plates, meter tubes and associated fittings and the instructions for computing the flow of natural gas and hydrocarbon fluids through orifice meters.

The standard, user-configurable calculations include AGA-3 (1985 vintage), AGA-3 (1992 vintage), Nx19, AGA-8-Gross and AGA-8-Detail methods for computing supercompressibility. It should be noted that all measurement, math and data storage functions either meet or exceed the requirements of the API 21.1 Electronic Gas Flow Measurement standard and Industry Canada Legal Metrology Branch.



The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) AGA-3 measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Tube Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Flow Rate	This field displays the estimated flow rate based on the current integral (portion of the flow rate equation that is integrated each second) and the last calculated integral multiplier.

The user can establish the parameters for the AGA-3 application using the read/write fields provided. These parameters are as follows:

Contract Hour	The contract hour is the start of the day for daily volumes expressed in military time (0-23).
SP Tap Location	From the drop-down list, select the location (upstream, downstream) of the SP tap in relation to the orifice plate.
Calculation Type	Select the desired calculation type (e.g., AGA3-2012)

Orifice Diameter	Enter the orifice diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
FPV Method	Select the desired supercompressibility method. (NX19 fixed FtFp, NX19 GCN, NX19 GCNM, NX19 Auto, etc.) Available Fpv methods are: · AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and Carbon Dioxide. · AGA8 Gross Method 2 - This method uses Relative Density, Nitrogen and Carbon Dioxide. · AGA8 Detail 92 - This method basically supports a total analysis. · ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

The graph includes the four variables displayed in individual colors: Static Pressure (SP), Differential Pressure (DP), Temperature and Flow Rate.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. Seventh (Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (Orifice) and eleventh (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information) or select the remaining tabs. Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated displays of each variable would be charted on the graph. By clicking on the individual variable's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the density of the displayed graph, the higher the number of points, the more accurate the graph displayed.

The View button can be used to either display the variable in a Graph (as currently shown) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Graph or Grid format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

DP	This field represents the differential pressure. The value shown is the average of one second samples for the day.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
DP Min	Minimum Differential Pressure recorded during the Contract Day.
DP Max	Maximum Differential Pressure recorded during the Contract Day.
DP Percent Low	Displays the percentage of time the Differential Pressure was below the low limit during the Contract Day.
DP Percent Hi	Displays the percentage of time the Differential Pressure was above the high limit during the Contract Day.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day

TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Back Flow	Number of one second samples where DP is at least three inches below zero.

Log

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

DP	This field represents the differential pressure (in H2O).
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Number of one second samples where DP is below zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 percent).
Period Time	If Log Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor

	time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Date/Time	Displays the date and time to the nearest second for the beginning of the event.
Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For a DP or SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For a DP or SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis or Advanced Setup. The user can opt to view any option by selecting the corresponding button.

In Fixed analysis, the user can use the Edit All option to the right of any of the sections on the screen to edit each or all of the fields to set the individual percentage of each variable.

These sections include the Composition Elements, Gas Properties and Others.

The Composition Elements deal with those potential components of the gas being measured. The user would enter the percentage of the whole that each component would represent. The aggregate of all measurement input should be 100%.

The Gas Properties section fields are either set by the user or displayed in the field itself. These six fields are as follows:

Heating Value	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	Ratio of the density of the material to the density of the water
Viscosity	A default standard value of .010268 is used but can be edited by the user.
Pressure Base	1 atmosphere / 14.696 PSIA or 101.325 kPa 1 atmosphere / 14.696 PSIA or 101.325 kPa. The Base Pressure is based on the API 11.1 standards.
Temperature Base	60 degrees F base temperature is based on the API 11.1 standards
Z of Air	Z of Air measured at the contractual values for pressure base and temperature base. Enter a value for the Z or Air. This is the compressibility of air at a reference temperature (Typ. 60 degrees). The default standard is .99959.

The Others section also has three editable fields as follows:

FPV Method	FPV method is then squared (Fpv2) to derive the compressibility factor (Fs) for pulse meters. • Available FPV methods are: • AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and Carbon Dioxide. • AGA8 Gross Method 2 - This method uses Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. • ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi • For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.
Fp for NX19 Fpv	Calculate and enter the value here for Fp to include the Pressure Base factor in the volume calculations.
Ft for NX19 Fpv	Calculate and enter the value here for Ft to include the Temperature Base factor in the volume calculations.

In Live analysis, the user relies on real time data as displayed in each field under the Live column. As in Fixed Analysis, the aggregate of all the values displayed should be 100% The same values are displayed in each.

The Advanced Setup option includes both the Analysis and Therms Setup.

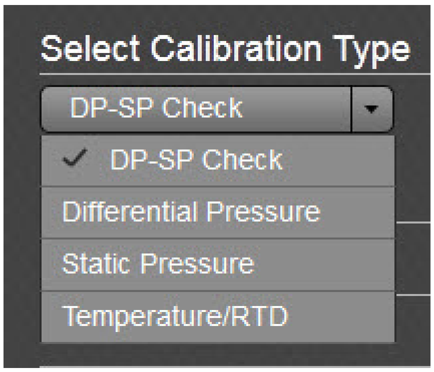
In the Analysis Setup, the first three user defined fields deal with the type, error conditions and wait time for live data. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer
Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.
Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check.

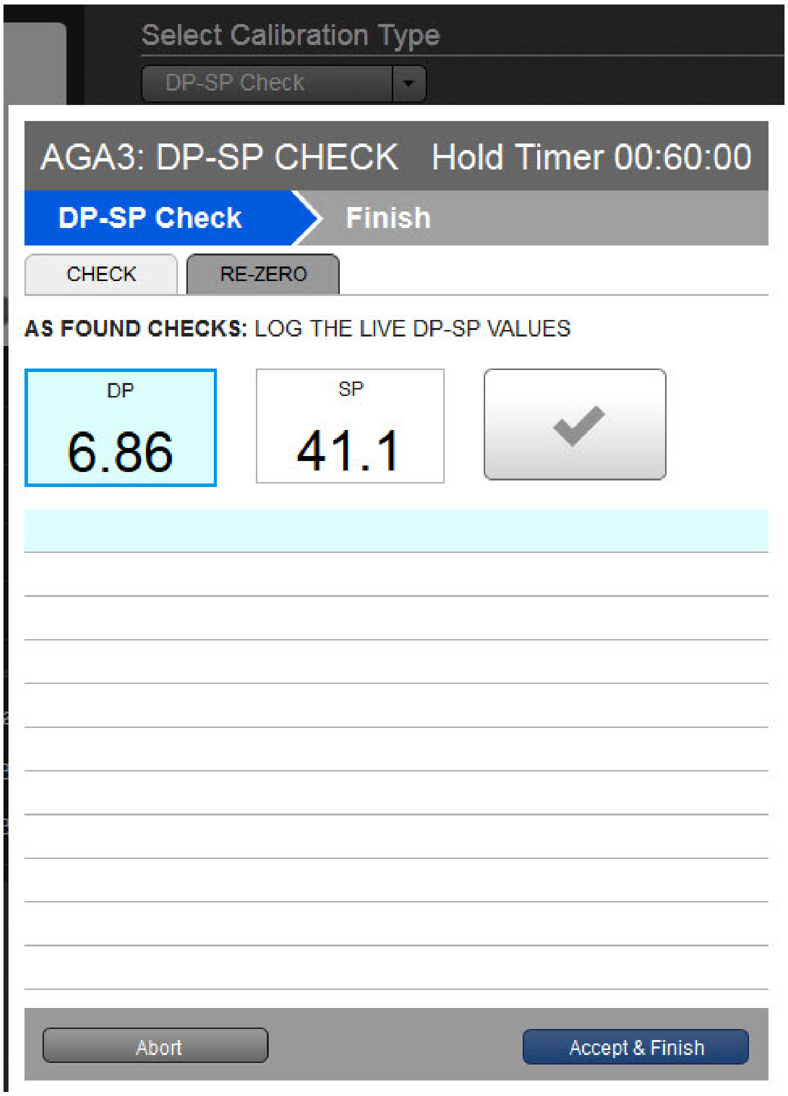


To start the calibration, select the type. Note the display of the Calibration Options fields changes depending on the calibration type selected as follows:

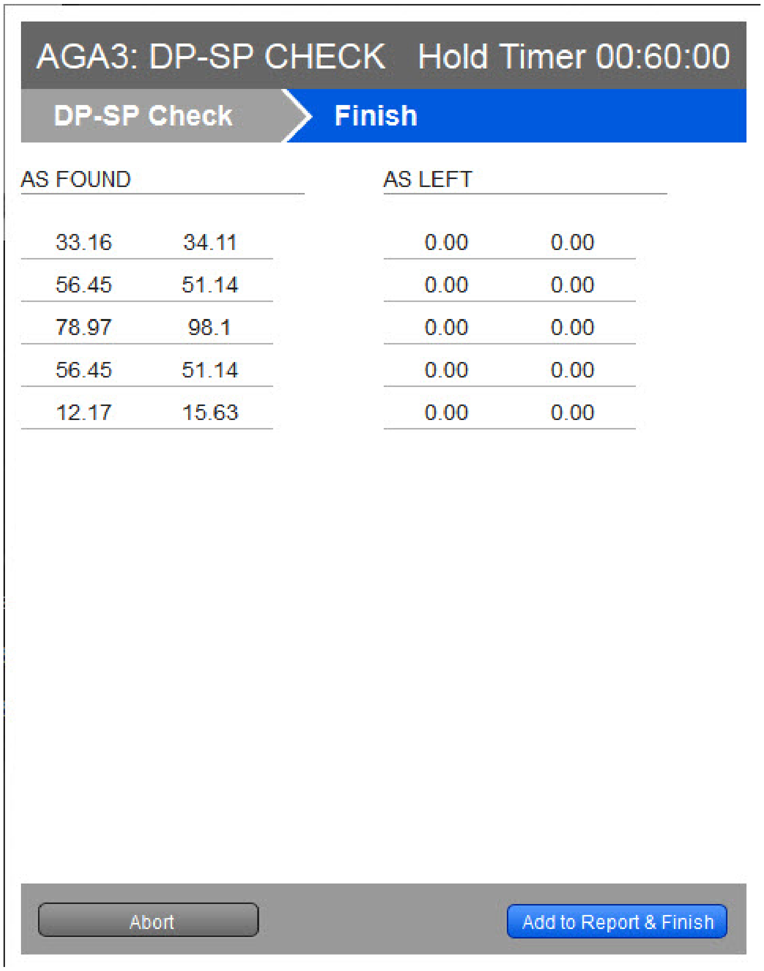
Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timer	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points depending on the desired accuracy of the calibration. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate using Absolute?	This option is simply an aid for doing checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new

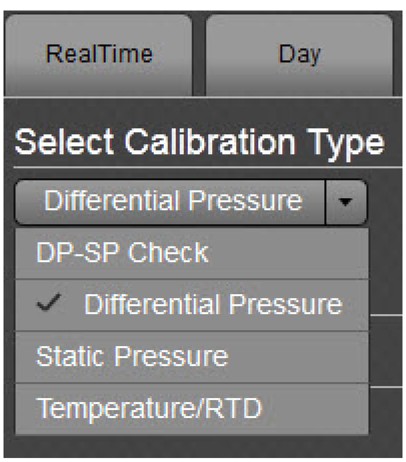
	value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

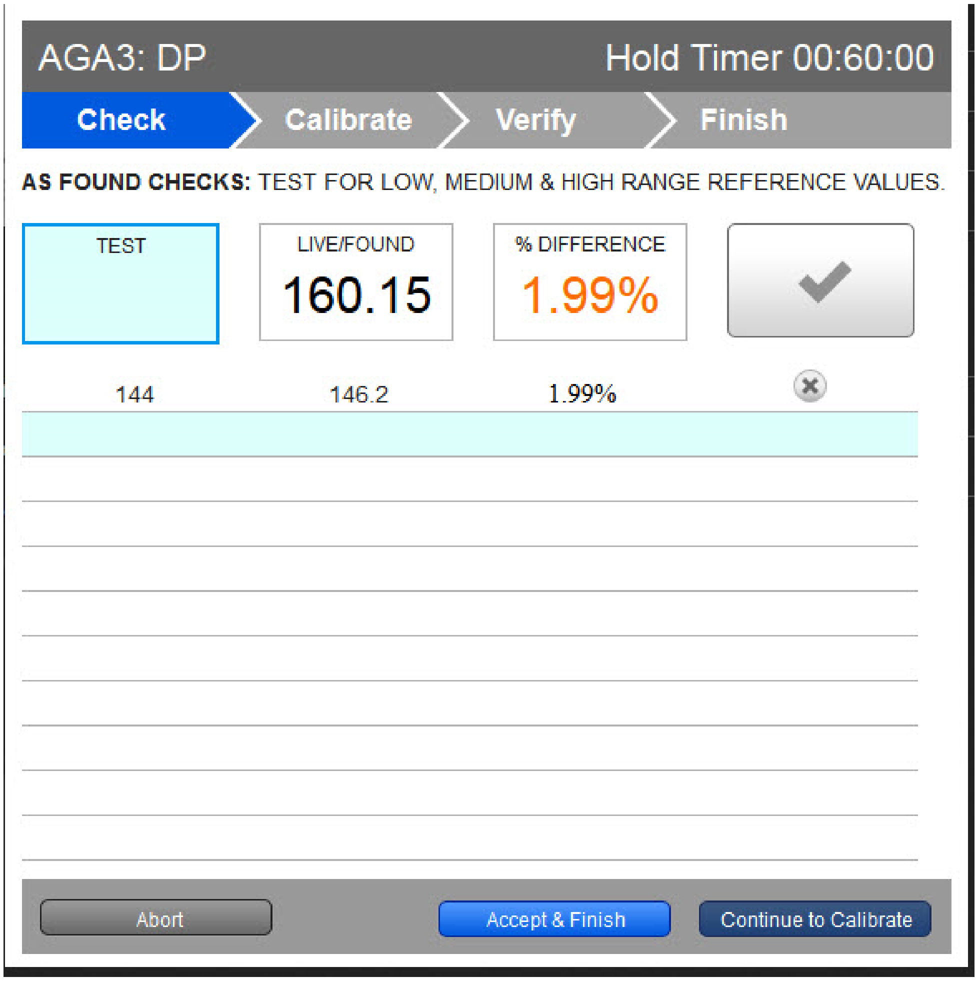
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process.



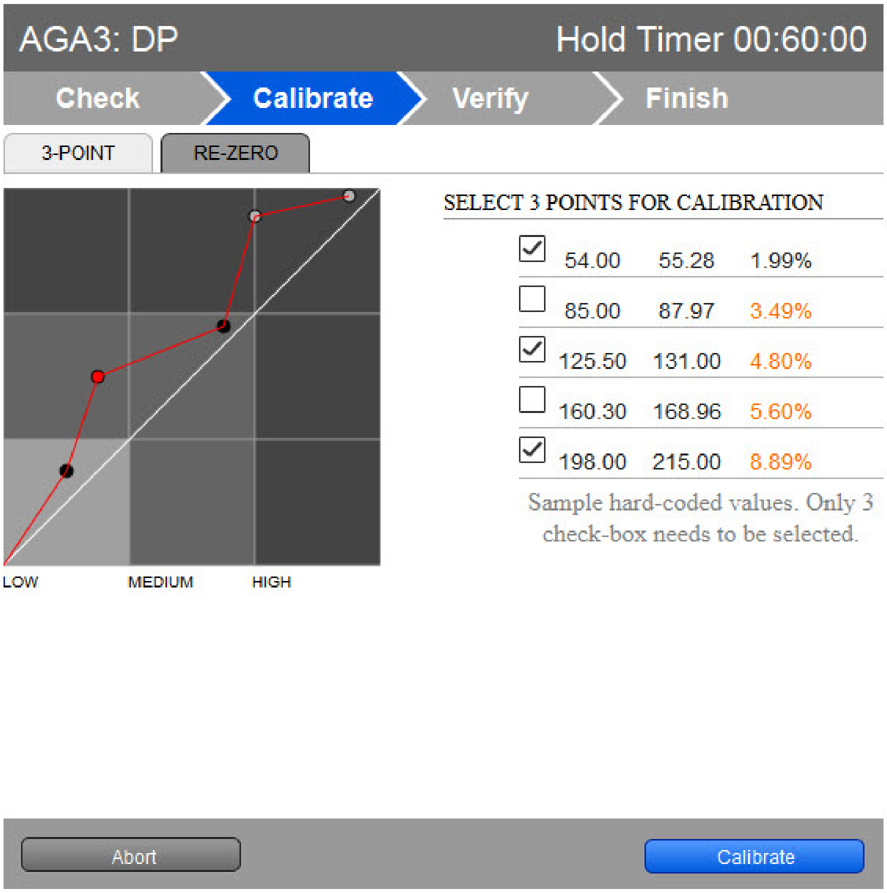
The DP-SP Check screen was designed as a troubleshooting tool so that the static pressure could be varied while at the same time, recording the differential pressure. Any significant change in the DP while changing the SP indicates a problem. The applied static pressure will be displayed in the SP window as well as the differential pressure in the DP window. Clicking on the check mark box will accept the pressures. Repeat the process to enter the number of static pressure points desired. If it's decided that a re-zero is needed before any more checks, click the RE-ZERO tab and a screen will appear to allow the user to re-zero the transducer and return to the Checks screen. The RE-ZERO function shifts up or down the calibration range so that the low end is true zero. The buttons with X's can be used to delete the selected entries from the log until the desired entries are input. Select the Accept & Finish button to complete the entry process which will save the checks as the "As Found" and "As Left" and log the check events. The user can now "Abort" to finish or select the "Add to Report & Finish" button to send the data to reports and finish.


AGA3: DP-SP CHECK
Hold Timer 00:60:00
DP-SP Check
Finish
AS FOUND
AS LEFT
33.16 34.11
56.45 51.14
78.97 98.1
56.45 51.14
12.17 15.63
0.00 0.00
0.00 0.00
0.00 0.00
0.00 0.00
0.00 0.00
Abort
Add to Report & Finish

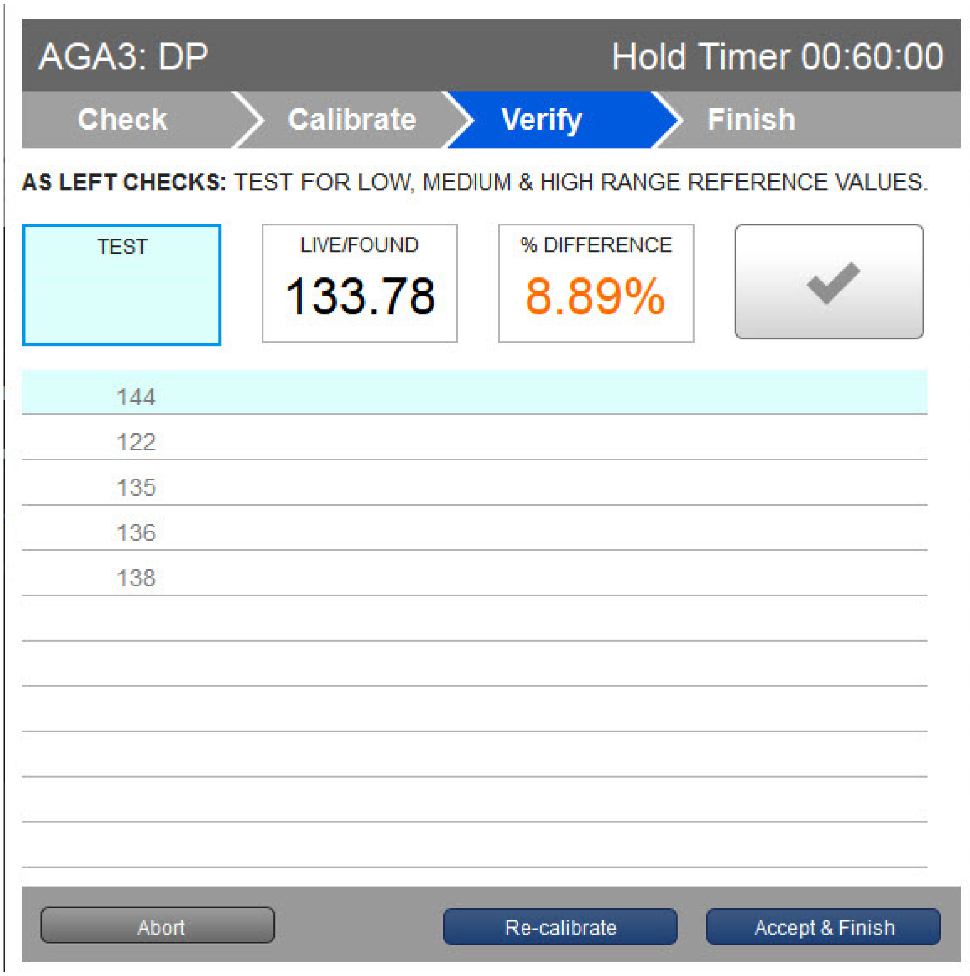

RealTime
Day
Select Calibration Type
Differential Pressure
DP-SP Check
Differential Pressure
Static Pressure
Temperature/RTD



The DP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.



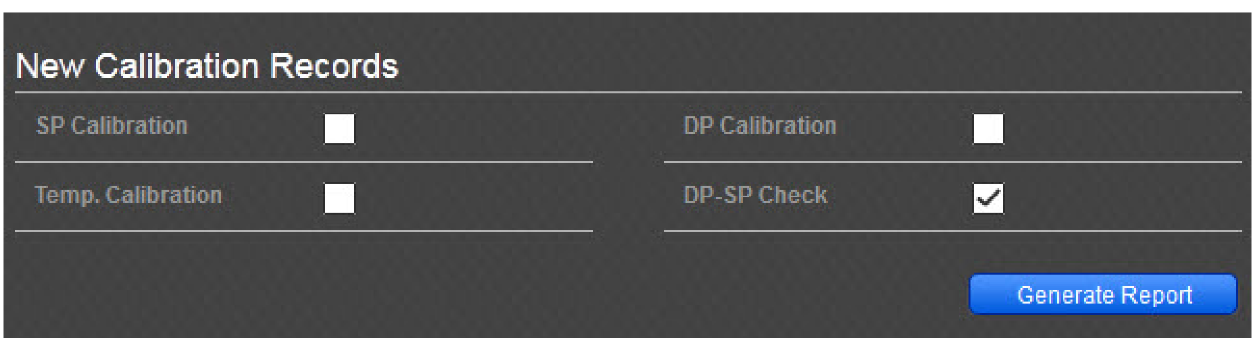
If the user elected to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. Click the Calibrate button to continue.



After the calibration, the user will need to do additional checks referred to as "Verify." Use the same procedure as when doing the first checks, typically using the same pressures. If satisfied after doing the verify checks, selecting the Accept & Finish button will complete this calibration. If not satisfied, the user can select the Re-calibrate button to return to the Calibrate screen. If the user wants to start the process over, the Abort button would be selected instead.

With the SP Calibration Check, the process is the same as the DP check.

The final Calibration Check is the Temperature/RTD. The process is also the same as the DP Calibration Check and the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following eight (8) areas of fields are accessible to the user:

- Constants
- Factors
- Density
- Commands
- Log Capacity
- Setup
- Current Values
- Limits

The following information is provided in relation to all parameters and their fields:

Constants

Orifice Diameter	Enter the orifice diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Pressure Base (Pb)	Enter the Pressure Base in the units specified. A specific Pressure Base value may be required because of contractual agreements.
Auxiliary Factor (Faux)	This value is used when the Faux factor is turned on. Faux is simply a multiplication factor times the computed gas volume that can be used to correct for a known error condition. This factor is typically used for what is referred to as the Full Well Stream Factor. This is used to adjust the computed gas volume downward to account for the portion of the measured stream that is liquid.
Fixed Cd	If Use Calc Cd is not selected, this fixed value for Coefficient of Discharge is used. A typical value is 0.600.
Use Fixed Sp On Error	Select Yes to use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value; otherwise, select No.
Fixed Sp	Enter a static pressure to be used when the Use Fixed Sp On Error field is selected.
Z of Air @ Tb and Pb	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure.
SP Tap Location	Select the location (upstream, downstream) of the Sp tap in relation to the orifice plate.

Temperature Base (Tb)	Enter the Temperature Base. A specific Temperature Base may be required because of contractual agreements.
Viscosity	A default standard value of .010268 is used but can be edited by the user.
Specific Heat Ratio	Enter the Specific Heat Ratio. This is Cp divided by Cv. A typical value is 1.3
Orifice Coef Exp	Select the Orifice Plate material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an orifice plate is used that consists of a different material, the user must select "Other" and enter an Expansion Coefficient in the units as specified by the Expansion variable group on the Units tree view item. Move the decimal point 6 places to the right and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Exp Coef	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E -6.
DP Zero Cutoff	Enter the value in units as specified by the Units column. A decimal point is allowed. No volume calculations will occur when DP is below this value.
Basic Orifice Factor (Fb)	Used in the AGA-3 1985 equation when Fb Calculation is set to Auto on the Factors tab. Re-calculated by PCCU when the orifice size, pipe size, tap type or tap location is changed.
Orifice Material	Select between Stainless or Monel for the orifice plate material. Used in AGA-3 1985 equation.
Tap Type	Select Flange or Pipe tap. Used in AGA-3 1985 equation.

Factors

Use Fpv	Compressibility factor - Select Yes for the flow computer to calculate, and use this factor based on the Fpv method selected.
Use Y	Expansion factor (Y) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Fw	Water Vapor factor (Fw) - Select Yes for the device to calculate, and use this factor in the volume calculations. Used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is water in vapor phase. If supported, see the Water Constants tab for additional setup.
Use Faux	Full Well Stream Factor (Faux) - Select Yes for the device to use the Faux value entered by the user in the Constants tab. Typically, used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating the volume. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream is typically determined by a Full Well Stream Test. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.
Use Calc Cd	Coefficient of Discharge factor (Cd) - Select Yes for the device to calculate, and use this factor in the volume calculations. Selecting No will cause the device to use a Fixed Cd, which by default is .6, but can be edited by the user in Constants.

Use Fpb	Pressure Base factor (Fpb) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Ftb	Temperature Base factor (Ftb) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Fg	Specific Gravity factor (Fg or Fgr) - Select Yes for the device to calculate, and use this factor in the volume calculations
Use Fb	Basic Orifice factor (Fb) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Fb Calculation	Auto - The device automatically calculates Fb when the Orifice Diameter or Pipe Diameter is changed. This is the recommended method for standard transducer type units. Manual - The user will be required to enter an Fb on the Constants tab.
Use Ftf	Flowing Temperature factor (Ftf) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Fr	Reynolds Number factor (Fr) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Fa	Orifice Thermal Expansion factor (Fa) - Select Yes for the device to calculate, and use this factor in the volume calculations.

Density

Base Condition Density Source	Select one of three sources to use for the density for base conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density. · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable.
Base Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for base conditions.
Flowing Condition Density Source	Select one of four sources to use for the density for flowing conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable.

	· Live Measured - This method assumes density is brought via an external source such as a densitometer. If used, specify the app/array/register for the Live Density Input Register
Flowing Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for flowing conditions.
Live Density Input Register	Specify the App/Array/Register for the source of the density value if Live Measured was selected as the Density Source for flowing condition. If an on-board analog input or TFIO module is used for the input, the address can be found under the I/O Interface tree-view item.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	The ID field represents the unique identifier for the device. As devices can have multiple flow calculations (tubes) running simultaneously, each one of these will have their own ID.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period.
Tube Description	Enter alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Vol Calc Period	Displays and/or allows the selection of the Volume Calculation Period. This is the rate at which the volume is calculated based on one second averages of equation parameters such as SP, DP, Temperature, etc. Earlier devices offered several time selections whereas newer faster devices may be locked at one second. For devices that still provide multiple Vol. Calc. Periods, the time can be the same as, but should never be greater than the Log Period. If not the same, the Log Period should always be an even multiple of the Vol. Calc. Period.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Dp Zero Cutoff	Enter the value in units as specified. A decimal point is allowed. No volume calculations will occur when DP is below this value.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: 0 C / 32 F and 1.01325 bar / 14.695949 psi 15 C / 59 F and 1.01325 bar / 14.695949 psi 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2.
Sp/Dp Averaging	Select Linear or Square Root averaging from the drop-down list. The following explanation applies to the Differential Pressure, Static Pressure and Temperature. • Linear - Sums the samples and divides by the number of samples.

	• Square Root - Sum of the square root of the samples divided by the number of samples and squared.
Calculation Type	Select one of the calculation types: · AGA3-1985 - Adheres to American Gas Association's Report No. 3, 1985. · AGA3-1992 - Adheres to American Gas Association's Report No. 3, 1992 / American Petroleum Institute's Report 14.3. · AGA3-2012 - Adheres to American Gas Association's Report No. 3, 2012 / American Petroleum Institute's Report 14.3.
Vol. Unit - Flow Rate	Select the volume unit and associated flow rate unit from the list. The first unit is the volume and the second is the flow rate unit. Selections are paired as shown: · MCF - SCF/Hr · MCF - MCF/Day · MMCF - MCF/Hr · MMCF - MMCF/Day
Hold Timeout	Sets a time duration that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 01:00:00 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.
Last Analysis Time	Displays the last date/time that a live analysis was received.

Current Values

Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Flow Rate	Estimated flow rate based on the current Integral and the last calculated integral multiplier.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the average value of the Extension is multiplied by the Integral Multiplier resulting in the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Each Volume Calculation Period volume is then added to the accumulated volume until zeroed by a Reset Volume command or an accumulator rollover happens.
Yesterday's Energy	Prior Contract Day’s energy.
Today's Energy	The sum of energy quantities accumulated since the beginning of the contract day. At each Volume Calculation Period, the energy quantity is calculated by multiplying the period volume by the energy content.
Accumulated Energy	Running total of the Energy which is updated at the end of each Volume Calculation Period. See Today’s Energy above for the calculation procedure.

Yesterday's Mass	Prior Contract Day's Mass
Today's Mass	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume / Flowing Density Flowing Density is either calculated or user entered. Each Volume Calculation Period Mass is added to the current Mass for the duration of the Contract Day.
Accumulated Mass	Running total of the calculated Mass which is updated at the end of each Volume Calculation Period. See Today’s Mass for the calculation procedure.
Mass Rate	The estimated flow rate times the mass content (fixed or from live analysis).
Energy Rate	The estimated flow rate times the energy content (fixed or from live analysis).
Last Calculated Value	Update frequency of the last calculated values is based on the Volume Calculation Period (typically 1 sec.) as specified on the General tab.
Last Calculated Energy	Energy for the last Volume Calculation Period. See Today’s Energy for the calculation procedure.
Last Calculated Mass	Mass for the last Volume Calculation Period. See Today’s Mass for the calculation procedure.

Limits

The Limits tab allows the user to enter High and Low Limits for Static Pressure, Differential Pressure, Temperature, and Flow Rate. When a low or high limit is exceeded, an alarm is entered into the Daily Flow record noting the day of the occurrence and also in the Log Period record noting which Log Period of that day the occurrence happened.

Another use of the limits is to operate digital outputs based on the high or low limit. The XSeries series flow computers (XFC) have two digital outputs which can be used and an XRC has four of which two can be operated based on the limits. These operations are setup on the Digital Outputs tree-view item.

Sp High Limit	Enter the static pressure high limit.
Sp Low Limit	Enter the static pressure low limit.
Dp High Limit	Enter the differential pressure high limit.
Dp Low Limit	Enter the differential pressure low limit.
Tf High Limit	Enter the total flowing temperature high limit.
Tf Low Limit	Enter the total flowing low limit.
Flow High Limit	Enter the flow rate high limit.
Flow Low Limit	Enter the flow rate low limit.

Adv Setup

Adv Setup

Static Pressure	Enter the App/Array/Register for Static Pressure.
Diff Pressure	Enter the App/Array/Register for Differential Pressure.
Temperature	Enter the App/Array/Register for Flowing Temperature.
Static Pressure Type	Select whether the static is coming from a Gauge or Absolute device.

RTD Installed	Enter Yes if using an RTD for temperature.
Use Fixed Temperature	Enter Yes to use a Fixed Temperature instead of measured.
Fixed Temperature	Enter the Fixed Temperature value.

No Flow

Digital Input	Enter the App/Array/Register used for the No Flow condition.
DI Action	Select whether an Open or Closed contact represents the No Flow condition.
Flow State	Indicate Flow or No Flow based on the digital input.

Speed of Sound

Speed of Sound Calculation	Select either Disabled or Enabled
Speed of Sound	Displayed in feet/second

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on DP Low	If set to Yes, the digital output will be tripped on the DP Low alarm. Alarm limits are set in the Limits tab.
Trip on DP High	If set to Yes, the digital output will be tripped on the DP High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on Fr Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on Fr High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.

DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

Orifice

The user can select the Orifice tab to change the Orifice Plate. The first option would be to ensure all read/write fields have the correct value selected. These fields are as follows:

Orifice Diameter	Enter the orifice diameter size in dimensional units.
Hold Timeout	The user defines the duration of the Hold Timeout (default 60 minutes) to change the orifice plate.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Sp Tap Location	This read only field displays the location (upstream, downstream) of the Sp tap in relation to the orifice plate. Specified on Configuration tab.
Tap Type	In this field, available displayed values for this read only field for Tap Type are: 1. No DP - No live differential pressure provided 2. Flange - Flange type taps 3. Corner - Corner taps 4. D-D/2 - D and D/2 taps 5. Custom - User must enter a value specified on Configuration tab.

Once all the fields are showing the desired values, the user must first select the Hold button to set the timer at 60 minutes. The flow pressure is then held for that period of time to allow the user to change the orifice plate. The user then presses the Change Orifice Plate button and changes the orifice plate. Once finished, the user would select the Flowing button to resume flow.

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Volume	Displayed in SCF (standard cubic feet)
Mass	Displayed in lbm (pounds of mass)

Energy	Displayed in MBtu (thousands of British thermal units)
Real Specific Gravity	Displayed as a ratio of the density of the sample to the density of water
Fluid Viscosity	Displayed in cP (centipoise), a unit of viscosity
Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Contract Baro	Displayed in PSIA (pounds per square inch absolute)
Pressure Base	Displayed in PSIA (pounds per square inch absolute)
Temperature Base	Displayed in Degrees F.
Base Compressibility	Display follows one of four existing base conditions.
Flowing Compressibility	Calculated from the Base Compressibility
Super Compressibility	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "supercompressibility factor"or Fpv.
Fip	Fip (Female Iron Pipe Connection) is the adaptor and will accept the pipe into its fitting
Live Static Pressure	Displays last live reading in PSIA (pounds per square inch absolute)
Static Pressure	Displays last static pressure reading in PSIA (pounds per square inch absolute)
Differential Pressure	Displays last differential pressure reading in INH2O (inches of water)
Live Temperature	Displays last live temperature reading in degrees F.
Flowing Temperature	Displays last flowing temperature reading in degrees F.
Orifice Expansion Coefficient	Select the Orifice material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an Orifice is used of a different type material, the user must select "Other", and enter an Expansion Coefficient (inches per Deg. F). Move the decimal point six places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Expansion Coefficient	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E-6.
Pipe Inside Diameter	Displays pipe inside diameter in inches
Orifice Inside Diameter	Displays orifice inside diameter in inches
Faux	Displays faux or fpv (supercompressibility) value
Y Expansion Factor	Displays Y (expansion factor), used in volume calculations
Specific Heat Ratio	Displays the ratio of Cp divided by Cv
Water Vapor Factor (Fw)	Displays the water vapor factor (Fw)

C-Prime Static Factor (cp_s)	The Static Factor value displays here.
C-Prime (cp)	The portion of the flow rate equation that is computed each Vol. Calc. Period.
Live Flowing Density	Assumes not using fixed data but live data from an external source
Base Density	Displays the Base Density used from the Start Date/Time to the End Date/Time.
Flowing Density	Displays the average Flowing Density used from the Start Date/Time to the End Date/Time.
Temperature Corrected Pipe/Orifice Ratio (Beta)	The Pipe/Orifice Ratio corrected for temperature
Velocity of Approach	This parameter is often referred to as the velocity of approach factor and dividing the coefficient of discharge by that parameter (as was done above) produces the flow coefficient. Methods also exist for determining the flow coefficient as a function of the beta function and the location of the downstream pressure sensing tap. For rough approximations, the flow coefficient may be assumed to be between 0.60 and 0.75. For a first approximation, a flow coefficient of 0.62 can be used as this approximates to fully developed flow.
Discharge Coefficient (Cd)	Coefficient of Discharge factor (Cd) - Select Yes for the flow computer to calculate and use this factor in the volume calculations. Selecting No will cause the flow computer to use a Fixed Cd which is entered on the Constants tab.

AGA-7

Overview

The Totalflow® Fourth Generation XSeries flow computers (XFCG4) provide functionality though the convergence of RTU, PLC and flow computer concepts. The XFCG4 represents a unique milestone in the development of remote, low power measurement and control devices. All XFCG4 units feature multi-tube capacity --up to eight per individual unit or 20 tubes per unit in special cases-- with custody-transfer measurement features. The flexibility of these units, including backward compatibility with legacy Totalflow systems, allows the user to increase productivity and improves asset utilization.

While the XFCG4 is designed for either differential (orifice) or pulse (linear) metering, the following information concentrates solely on pulse metering as it regards the AGA-7 standard.

The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) AGA-7 measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed are as follows:

Tube Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected AGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Calculation Type	Displays the type of flow calculation.

The user can establish the parameters for the AGA-7 application using the read/write fields provided. These parameters are as follows:

Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
K Factor	K Factor specifies the number of pulses required per volume of liquid. To get the Indicated Volume, the number of pulses is divided by the K Factor or multiplied by the inverse of the K Factor depending on whether the K Factor method is set to Quantity/Pulse or Pulse/Quantity.

Flow Period (Seconds)	Flow Period is a read only window which displays the time period in seconds. Flow Period is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Aux Factor (Faux)	This value is used when the Use Faux parameter is turned on below. This is a multiplication factor which directly affects the volume calculation. For example, a value of .9 would cause a 10% reduction in the calculated volume. Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation. An example would be a linear meter calibration shift.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: · NX19 fixed FtFp - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method but the user must manually calculate and enter Ft and Fp. · NX19 GCN - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method. · NX19 GCNM - Uses NX19 Gravity, Carbon Dioxide, Nitrogen and Methane method. · NX19 Auto (GCN or GCNM) - This method automatically switches to GCNM method if Gravity exceeds .75 and/or Carbon Dioxide or Nitrogen exceed 15%. · AGA8 Gross 92 - This is one of the newer and recommended Fpv methods assuming only Specific Gravity, Carbon Dioxide and Nitrogen are used. · AGA8 Detail 92 - This method supports total analysis. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. The seventh (Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (K Factor) and eleventh (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates. These variables include: SP, Pulse Count, Temperature and Flow.

The Points button is used to set the range of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Volume	This field displays the totalized volume (MCF).
Avol	Uncorrected volume for the Contract Day. The uncorrected volume for each Volume Calculation Period of the Contract Day is added together to produce a Daily uncorrected volume.
Energy	This value represents the sum of energy quantities (MMBTU).
Cnt Min	Displays the minimum counts that occurred during any Flow Period during the Contract Day.
Cnt Max	Displays the maximum counts that occurred during any Flow Period during the Contract Day.
AVol Percent Low	Percentage of the time that the Uncorrected Volume is below the Uncorrected Volume Low Limit. Limits are set on the Limits tab of the Setup tree view item.
AVol Percent Hi	Percentage of the time that the Uncorrected Volume is above the Uncorrected Volume High Limit. Limits are set on the Limits tab of the Setup tree view item.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.

Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device’s processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).

Log

The Log tab provides information for the log period records (typically hourly) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable). A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Avol	Uncorrected volume for the Contract Day. The uncorrected volume for each Volume Calculation Period of the Contract Day is added together to produce a Daily uncorrected volume.
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Flow Time is a read only window which displays the time period in seconds. Flow Time is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device’s processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Date/Time	Displays the date and time to the nearest second for the beginning of the event.
Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For example, using an SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For example, using an SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt for either analysis method by selecting the corresponding button.

In Fixed analysis, the user can use the left Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The Gas Properties section fields are either set by the user or displayed in the field itself. These five fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.
Pressure Base	The default is 14.73 PSIA. The Base Pressure is based on the API 11.1 standards.
Temperature Base	60 degrees F base temperature is based on the API 11.1 standards
Z of Air	Z of Air measured at the contractual values for pressure base and temperature base. Enter a value for the Z or Air. This is the compressibility of air at a reference temperature (Typ. 60 degrees). The default standard is .99959.

The Others section has three editable fields as follows:

FPV Method	Select the supercompressibility (Fpv) method from the drop-down list. This option is only available in devices supporting the Extended Characteristic mode. By default, the NX19 Fpv method is used all other times. The value calculated by the selected FPV method is then squared (Fpv2) to derive the compressibility factor (Fs) for pulse meters. Available Fpv methods are: · NX19 fixed FtFp - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method but the user must manually calculate and enter Ft and Fp. · NX19 GCN - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method. · NX19 GCNM - Uses NX19 Gravity, Carbon Dioxide, Nitrogen and Methane method.

	· NX19 Auto (GCN or GCNM) - This method automatically switches to GCNM method if Gravity exceeds .75 and/or Carbon Dioxide or Nitrogen exceed 15%. · AGA8 Gross 92 - This is one of the newer and recommended Fpv methods assuming only Specific Gravity, Carbon Dioxide and Nitrogen are used. · AGA8 Detail 92 - This method supports total analysis. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.
Fp for NX19 Fpv	Calculate and enter the value here for Fp to include the Pressure Base factor in the volume calculations.
Ft for NX19 Fpv	Calculate and enter the value here for Ft to include the Temperature Base factor in the volume calculations.

In Live analysis, the user relies on real time data as displayed in each field under the Live column.

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Update frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

The Advanced Setup option includes both the Analysis and Therms Setup.

In the Analysis Setup, the first three user defined fields deal with the type and duration of the analysis type selected. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

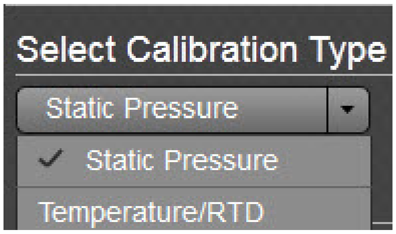
The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer data, select None. Selecting a stream will cause what is referred to as an Attachment. This logs an event in the Event file, sets the analysis period from 0 to 1 hour and sets a bit to tell the unit to use Live Analysis from the analyzer.
Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.

Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

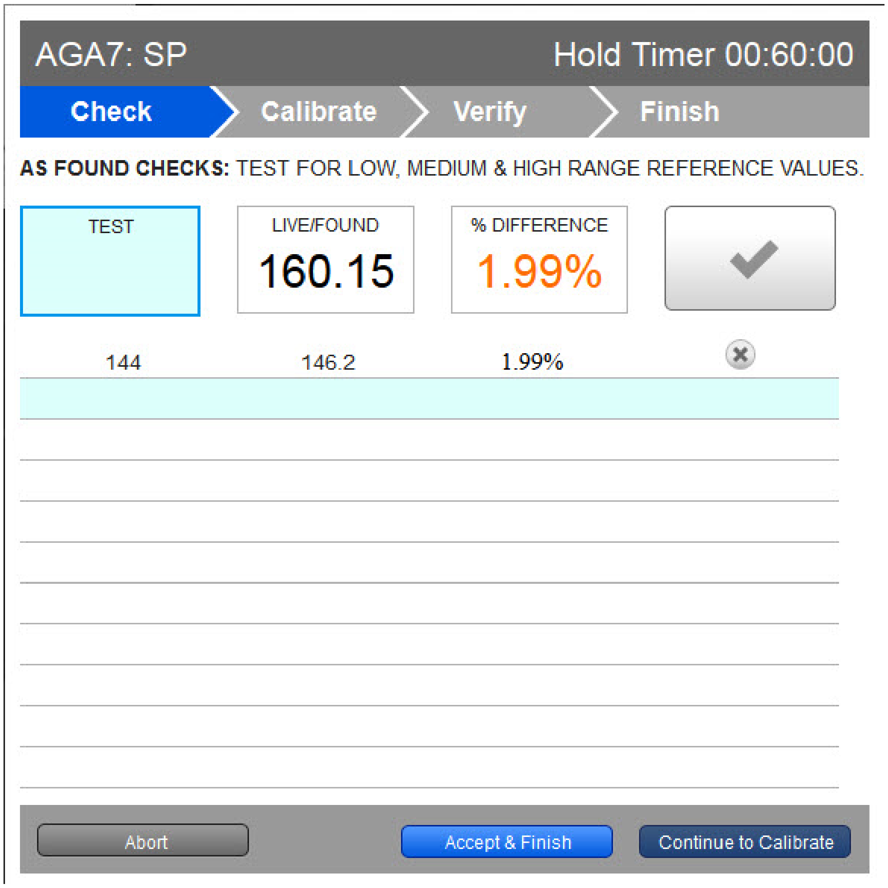
The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check.



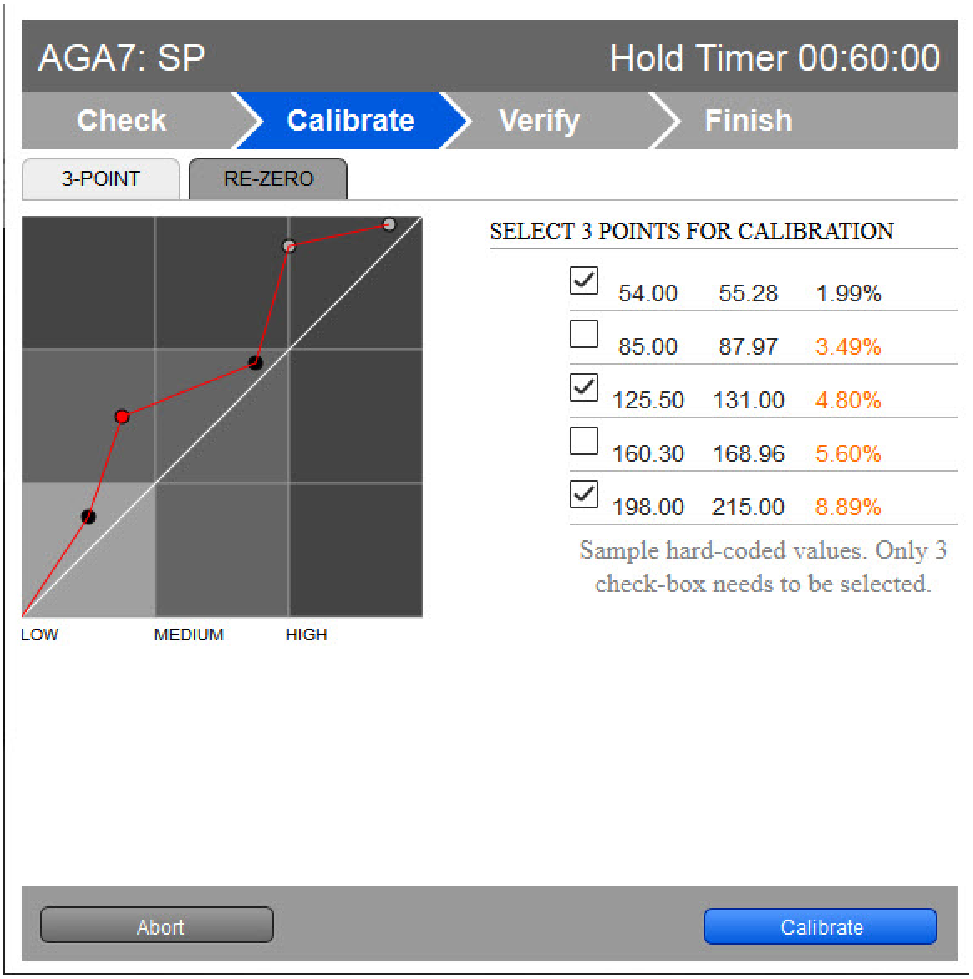
To start the calibration, select the type. Note the display of the Calibration Options fields change depending on the calibration type selected as follows:

Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timeout	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate using Gauge?	This option is simply an aid for doing Static Pressure checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

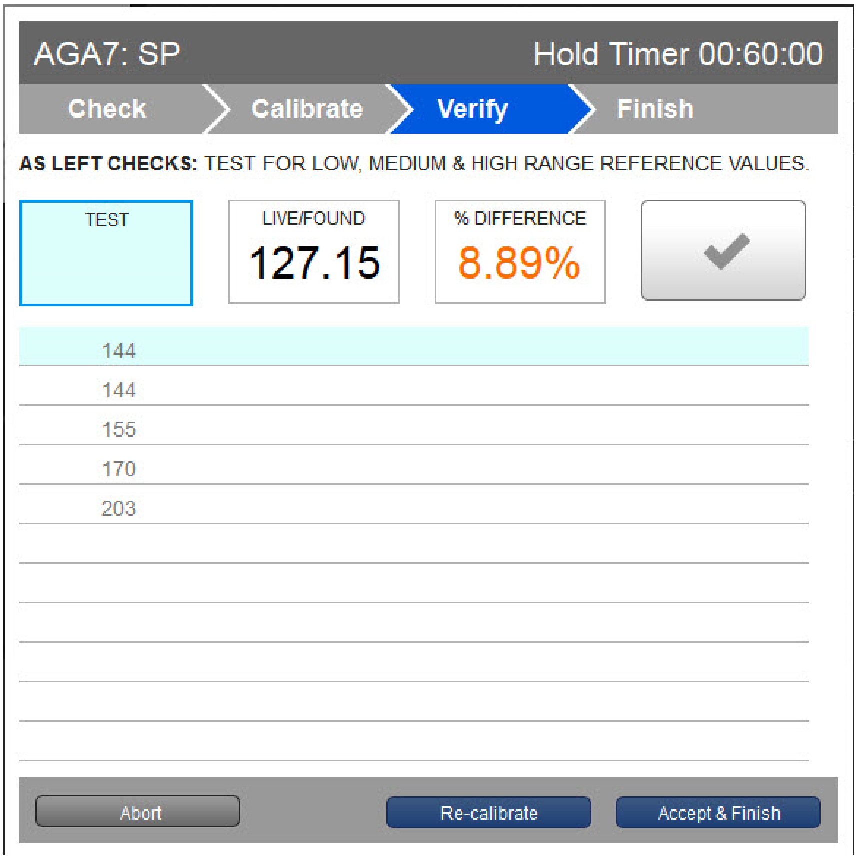
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process.



The SP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.

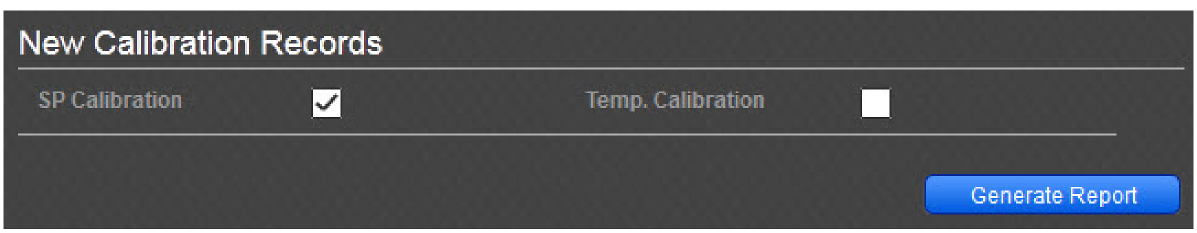


If the user elected to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. If needed, use the RE-ZERO function to shift up or down the calibration range so that the low end is true zero. Click the Calibrate button to continue.



If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

The final Calibration Check is the Temperature/RTD. This process is also the same as the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following five (5) areas of fields are accessible to the user:

- Constants
- Factors

- Setup
- Current Values
- Limits

The following information is provided in relation to all parameters and their fields:

Constants

Fixed Sp Value	Click in the Fixed Sp field and enter a static pressure to be used when the Use Fixed Sp On Error field is selected.
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure.
Pressure Base	Enter the Pressure Base in the units specified. A specific Pressure Base value may be required because of contractual agreements.
Temperature Base (Tb)	Enter the Temperature Base in the units as specified by the Units column. A specific Temperature Base may be required because of contractual agreements.
Auxiliary Factor (Faux)	This value is used when the Faux factor is turned on. Faux is simply a multiplication factor times the computed gas volume that can be used to correct for a known error condition. This factor is typically used for what is referred to as the Full Well Stream Factor. This is used to adjust the computed gas volume downward to account for the portion of the measured stream that is liquid.
K Factor	K Factor specifies the number of pulses required per volume of liquid. To get the Indicated Volume, the number of pulses is divided by the K Factor or multiplied by the inverse of the K Factor depending on whether the K Factor method is set to Quantity/Pulse or Pulse/Quantity.

Factors

Use Fpc	Select Yes to use the Pressure Correction Factor (Fpc). Calculated by dividing the Volume Calculation Period average SP by the Pressure Base.
Use Ftc	Select Yes to use the Temperature Correction Factor (Ftc). Calculated by dividing the Temperature Base by the Volume Calculation Period average temperature.
Use Fs	Select Yes to use the Compressibility Factor (Fs). Fs is equal to Fpv^2. Fpv is based on the Fpv method selected in General tab and analysis data.
Use Faux	Full Well Stream Factor (Faux) - Select Yes for the device to use the Faux value entered by the user in the Constants tab. Typically, used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating the volume. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream is typically determined by a Full Well Stream Test. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.

Density

Base Condition Density Source	Select one of three sources to use for the density for base conditions:

	· Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density. · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable.
Base Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for base conditions.
Flowing Condition Density Source	Select one of four sources to use for the density for flowing conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable. · Live Measured - This method assumes density is brought via an external source such as a densitometer. If used, specify the app/array/register for the Live Density Input Register
Flowing Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for flowing conditions.
Live Density Input Register	Specify the App/Array/Register for the source of the density value if Live Measured was selected as the Density Source for flowing condition. If an on-board analog input or TFIO module is used for the input, the address can be found under the I/O Interface tree-view item.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.

Set Uncorrected Volume to >	Enter the provided value of the Uncorrected Volume.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	The ID field represents the unique identifier for the device. As devices can have multiple flow calculations (tubes) running simultaneously, each one of these will have their own ID.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Calculation Type	Displays the type of flow calculation which is API Liquid. This is a read-only parameter.
Fpv Method	Select the supercompressibility (Fpv) method from the drop-down list. Available Fpv methods are: · NX19 fixed FtFp - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method but the user must manually calculate and enter Ft and Fp.

	· NX19 GCN - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method. · NX19 GCNM - Uses NX19 Gravity, Carbon Dioxide, Nitrogen and Methane method. · NX19 Auto (GCN or GCNM) - This method automatically switches to GCNM method if Gravity exceeds .75 and/or Carbon Dioxide or Nitrogen exceed 15%. · AGA8 Gross 92 - This is one of the newer and recommended Fpv methods assuming only Specific Gravity, Carbon Dioxide and Nitrogen are used. · AGA8 Detail 92 - This method supports total analysis. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Display Rate	Select either "per hour", "per day" or "per flow period". This dictates what flow rate units are used on the flow computer's display.
Corrected Vol Unit	Select one of the following options from the drop-down menu. This dictates what Corrected Volume Units are used on the flow computer's display. · scf = Standard cubic feet. · dscf = scf / 10 · cscf = scf / 100 · mscf = scf / 1,000 · dmscf = scf / 10,000 · cmscf = scf / 100,000 · mmscf = scf / 1,000,000
Uncorrected Vol Unit	Select one of the following options from the drop-down menu. This dictates which Uncorrected Volume Units are used on the flow computer's display. · acf = Actual cubic feet. · dacf = acf / 10 · cacf = acf / 100

	· macf = acf / 1,000 · dmacf = acf / 10,000 · cmacf = acf / 100,000 · mmacf = acf / 1,000,000
Meter Factor Select	Select whether the turbine meter or device generating the pulses is designed to output pulses based on pulses per volume or volume per pulse and makes that selection here. The K-factor for the device is entered in Calibration mode.
Flow Period (Seconds)	Flow Period is a selectable time period used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period is not included in the log period averages. This variable can also be entered in the 'Calibration' section.
Hold Timeout (Seconds)	Sets a time duration (in seconds) that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 3600 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.

Current Values

Uncorrected Flow Rate	Updated at the end of each Flow Period. This is counts for the Flow Period times the K Factor.
Energy Rate	Updated at the end of each Flow Period. Generated by multiplying the Flow Rate times the energy content (fixed or from live analysis).
Mass Rate	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume / Flowing Density The Flowing Density is either calculated or user entered.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected AGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected AGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period corrected volume is then added to the Accumulated Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Last Calc. Volume	At the end of the Volume Calculation Period, the average value of the extension is multiplied by the Integral Multiplier resulting in the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period.

Yesterday's Energy	Prior Contract Day's energy.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Accumulated Energy	Running total of the Energy which is updated at the end of each Volume Calculation Period. See Today's Energy above for the calculation procedure.
Last Calc. Energy	Energy for the last Volume Calculation Period. See Today's Energy above for the calculation procedure.
Yesterday's Mass	Prior Contract Day's Mass. See Today's Mass above for the calculation procedure.
Today's Mass	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume / Flowing Density Flowing Density is either calculated or user entered. Each Volume Calculation Period Mass is added to the current Mass for the duration of the Contract Day.
Accumulated Mass	Running total of the calculated Mass which is updated at the end of each Volume Calculation Period. See Today's Mass above for the calculation procedure.
Last Calc. Mass	Mass for the last Volume Calculation Period. See Today's Mass above for the calculation procedure.
Yesterday's Uncorr Vol	Prior Contract Day's uncorrected volume. See Today's UC Volume for the calculation procedure.
Today's Uncorrected Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Accumulated Uncorr Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is added to the Accumulated UC Volume. This continues until zeroed by the Reset Volume command or an accumulator
Last Calc. Uncorrected Volume	At the end of the Volume Calculation Period, the average value of the extension is multiplied by the Integral Multiplier resulting in the flow rate for the Volume Calculation Period. The counts for the period are then multiplied by the K Factor to produce the Uncorrected Volume. The flow rate is then multiplied by the Volume Calculation Period.

Limits

Sp High Limit	This represents the higher limit of the static pressure value that can be sent to the tube application.
Sp Low Limit	This represents the lower limit of the static pressure value that can be sent to the tube application.
Tf High Limit	This represents the higher limit of the total flowing temperature value that can be sent to the tube application.
Tf Low Limit	This represents the lower limit of the total flowing value that can be sent to the tube application.
Flow High Limit	This represents the higher limit of the flow value that can be sent to the tube application.
Flow Low Limit	This represents the lower limit of the flow value that can be sent to the tube application.

Uncorr Vol High Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The High Limit for the uncorrected value is set in this field to specify which values can be sent to the application.
Uncorr Vol Low Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The Low Limit for the uncorrected value is set in this field to specify which values can be sent to the application.

Adv Setup

Adv Setup

Static Pressure	Displays the current scaled static pressure.
Pulse Input	Enter the Pulse Input register here.
Temperature	Snapshot of the current flowing temperature.
Static Pressure Type	Select whether the static pressure is coming from a Gauge or Absolute pressure device.
Use Fixed Static	Select Yes to use the Fixed Static Pressure instead of a measured pressure. Used for AGA-7 tubes when static pressure is not available.
Fixed Static	Enter a value to be used when the Use Fixed Static is set to Yes.
RTD Installed	Select Yes if you are using an RTD for flowing temperature.
Use Fixed Temp	Select Yes to use the Fixed Temperature instead of a measured temperature.
Fixed Temp	Enter a value to be used when the Use Fixed Temperature is set to Yes. The Fixed Temperature will also be used in case of an RTD error if setup on the Fixed Values On Errors tab.

No Flow

Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DI Action	Select whether an Open Contact or a Closed Contact constitutes a No Flow condition.
Flow State	Displays the Flow State as Flow or No Flow based on the Digital Input specified above and the DI Action selected.

Speed of Sound

Speed of Sound Calculation	Speed of Sound is calculated based on AGA-10 specifications and is provided to the user to use as they see fit and is not used by the NGC for any subsequent calculations. Pressure and temperature are two additional parameters required for the calculation which are not typically available in the NGC. This screen allows for the entry of registers if the two values are brought via an external source, or permits the user to enter a fixed value for either or both parameters.
Speed of Sound	Displays the calculated value of the Speed of Sound based on AGA-10 specifications.

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on ACF Low	If set to Yes, the digital output will be tripped on the ACF Low alarm. Alarm limits are set in the Limits tab.
Trip on ACF High	If set to Yes, the digital output will be tripped on the ACF High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on FR Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on FR High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Volume	Displayed in SCF (standard cubic feet)	C-Prime Static Factor (cp_s)	The Static Factor value displays here.
Uncorrected Volume	Sum of all the volume quantities calculated for each Volume Calculation Period during the Contract Day. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume.	C Prime (cp)	The portion of the flow rate equation that is computed each Vol. Calc. Period.
Mass	Displayed in lbm (pounds of mass)	Faux	Faux defaults to 1.00000 but can be changed in the Constants tab by the user.
Energy	Displayed in MBtu (thousands of British thermal units)	Temperature Correction Factor (Ftc)	Displays the average Temperature Correction (Ftc) Factor from the Start Date/Time to the End Date/Time.
Real Specific Gravity	Displayed as a ratio of the density of the sample to the density of water	Pressure Correction Factor (Fpc)	Displays the average Pressure Correction (Fpc) Factor from the Start Date/Time to the End Date/Time.
Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.	Base Compress	Displays the Compressibility factor which is a factor that is used to account for the deviation of a gas from volumetric ideality (non ideal gas behavior). Three methods are used in the Totalflow NGC. NX-19, AGA 8, AGA5.
Live Static Pressure	Displays last live reading in PSIA (pounds per square inch absolute)	Flowing Compress	Calculated from the Base Compressibility
Static Pressure	Displays last static pressure reading in PSIA (pounds per square inch absolute)	(Supercompress)^2	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying

			amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "supercompressibility factor"or Fpv.
Contract Baro Pressure	The barometric pressure should display 14.730 PSIA	Live Flowing Density	Displays the Live Flowing Density used from the Start Date/Time to the End Date/Time.
Pressure Base	Displayed in PSIA (pounds per square inch absolute)	Base Density	Displays the Base Density used from the Start Date/Time to the End Date/Time.
Temperature Base	Displayed in Degrees F.	Flowing Density	Measured or Calculated from the provided Base Density.
Live Temperature	Displays the value of live temperature	Pulse Count	Displays the total pulses from the Start Date/Time to the End Date/Time.
Flowing Temperature	Displays the average Flowing Temperature from the Start Date/Time to the End Date/Time.	ACF	Uncorrected Flow converted to Actual Cubic Feet (ACF) for use by the totalflow device

SUAGA-3

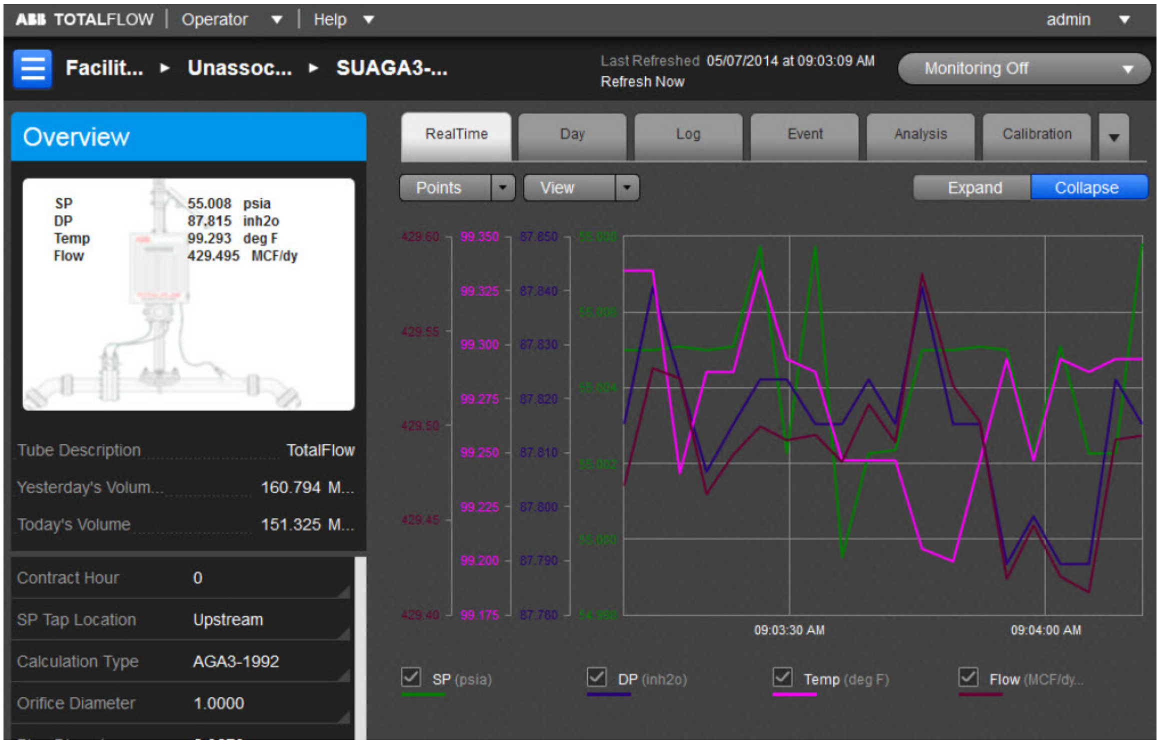
Overview

The Totalflow® Fourth Generation XSeries flow computers (XFCG4) provide functionality though the convergence of RTU, PLC and flow computer concepts. The XFCG4 represents a unique milestone in the development of remote, low power measurement and control devices. All XFCG4 units feature multi-tube capacity --up to eight per individual unit or 20 tubes per unit in special cases-- with custody-transfer measurement features. The flexibility of these units, including backward compatibility with legacy Totalflow systems, allows the user to increase productivity and improves asset utilization.

While the XFCG4 is designed for either differential (orifice) or pulse (linear) metering, the following information concentrates solely on differential pressure as it regards the AGA-3 standard. The AGA-3 standard provides a procedure for the measurement of natural gas, hydrocarbons and other related fluid flows using flange tap and pipe tap orifice meters. Additionally, AGA-3 provides the standards for the construction and installation of orifice plates, meter tubes and associated fittings and the instructions for computing the flow of natural gas and hydrocarbon fluids through orifice meters.

The standard, user-configurable calculations include AGA-3 (1985 vintage), AGA-3 (1992 vintage), Nx19, AGA-8-Gross and AGA-8-Detail methods for computing supercompressibility. It should be noted that all measurement, math and data storage functions either meet or exceed the requirements of the API 21.1 Electronic Gas Flow Measurement standard and Industry Canada Legal Metrology Branch.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measured in inH2O here in one market but in another country's market may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added to the AGA-3 and AGA-7. Thus the new nomenclature of SUAGA-3 is to signify this functionality.



The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) AGA-3 measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Tube Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.

The user can establish the parameters for the AGA-3 application using the read/write fields provided. These parameters are as follows:

Contract Hour	The contract hour is the start of the day for daily volumes expressed in military time (0-23).
SP Tap Location	From the drop-down list, select the location (upstream, downstream) of the SP tap in relation to the orifice plate.
Calculation Type	Select the desired calculation type (e.g., AGA3-2012)
Orifice Diameter	Enter the orifice diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
FPV Method	Select the desired supercompressibility method. (NX19 fixed FtFp, NX19 GCN, NX19 GCNM, NX19 Auto, etc.) Available Fpv methods are: · AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and Carbon Dioxide. · AGA8 Gross Method 2 - This method uses Relative Density, Nitrogen and Carbon Dioxide. · AGA8 Detail 92 - This method basically supports a total analysis. · ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. Seventh (Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (Orifice) and eleventh (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information) or select the remaining tabs. Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated displays of each variable would be charted on the graph. By clicking on the individual variable's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the density of the displayed graph, the higher the number of points, the more accurate the graph displayed.

The View button can be used to either display the variable in a Graph (as currently shown) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Graph or Grid format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

DP	This field represents the differential pressure. The value shown is the average of one second samples for the day.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
DP Min	Minimum Differential Pressure recorded during the Contract Day.
DP Max	Maximum Differential Pressure recorded during the Contract Day.
DP Percent Low	Displays the percentage of time the Differential Pressure was below the low limit during the Contract Day.
DP Percent Hi	Displays the percentage of time the Differential Pressure was above the high limit during the Contract Day.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.

TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Back Flow	Number of one second samples where DP is at least three inches below zero.

Log

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

DP	This field represents the differential pressure (in H2O).
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Period Time	Displays the time in seconds for the Contract Day. If the system was functioning continuously with no down time, this number should be 86400.

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Date/Time	Displays the date and time to the nearest second for the beginning of the event.
Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For a DP or SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For a DP or SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt to view either analysis method by selecting the corresponding option as well as the Advanced Setup option.

In Fixed analysis, the user can edit all in the left Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The right Gas Properties column has two read/write fields that can be selected and edited as well. These two fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.

The Others section also has one editable fields as follows:

FPV Method	FPV method is then squared (Fpv2) to derive the compressibility factor (Fs) for pulse meters. • Available FPV methods are: • AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and Carbon Dioxide. • AGA8 Gross Method 2 - This method uses Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. • ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi

	♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi • For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

In Live analysis, the user relies on real time data as displayed in each field under the Live column. As in Fixed Analysis, the aggregate of all the values displayed should be 100% The same values are displayed in each.

The values in the Calc column display the last calculated values and last used component analysis. Updated frequency of the last calculated values is based on the Volume Calculation Period.

The Advanced Setup option includes both the Analysis and Therms Setup.

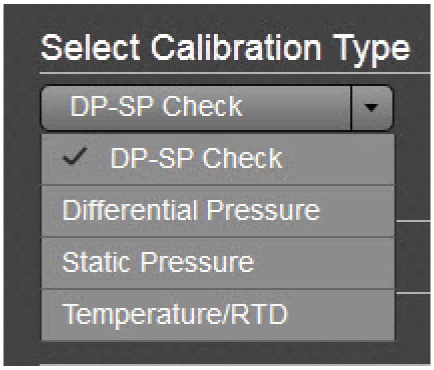
In the Analysis Setup, the first three user defined fields deal with the type, error conditions and wait time for live data. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer
Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.
Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

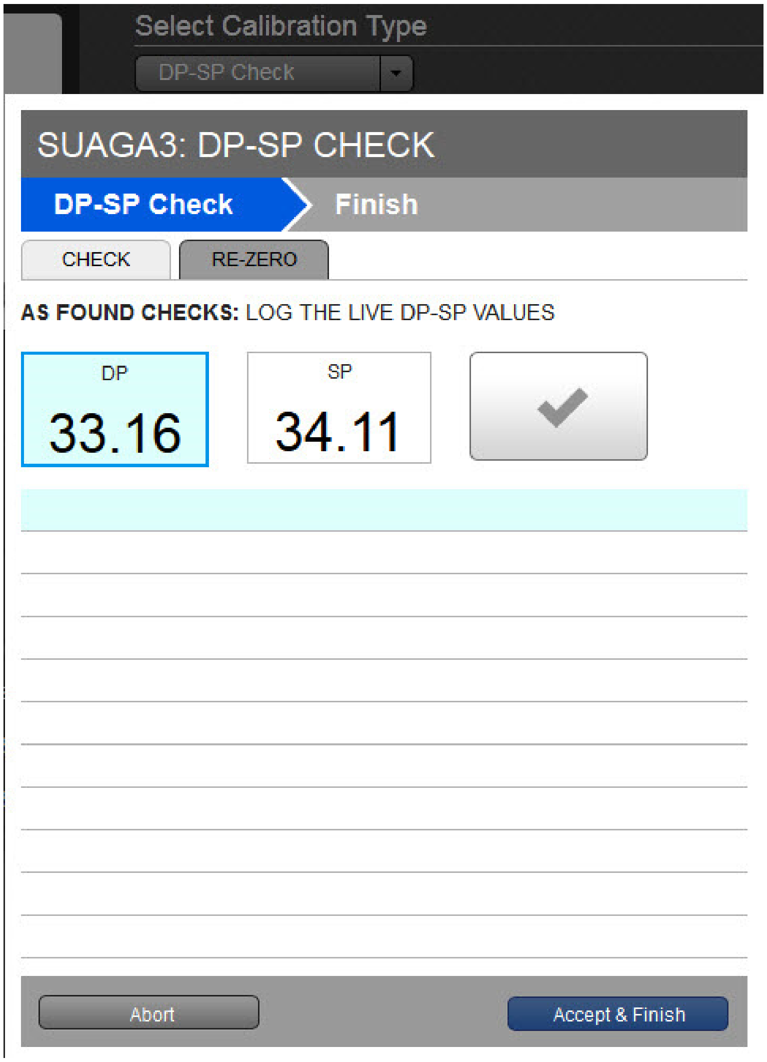
The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check. The options for the checks are as follows:



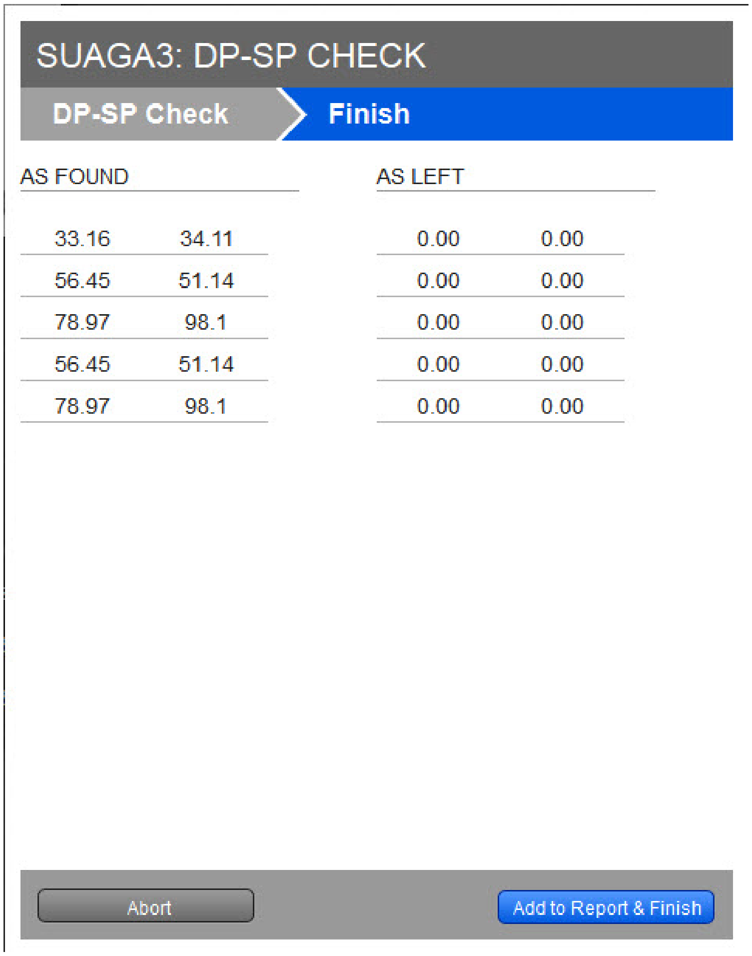
To start the calibration, select the type. Note the display of the Calibration Options fields changes depending on the calibration type selected as follows:

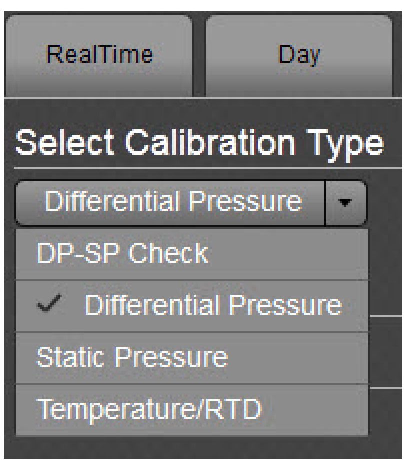
Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timer	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points depending on the desired accuracy of the calibration. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate in Gauge?	This option is simply an aid for doing checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

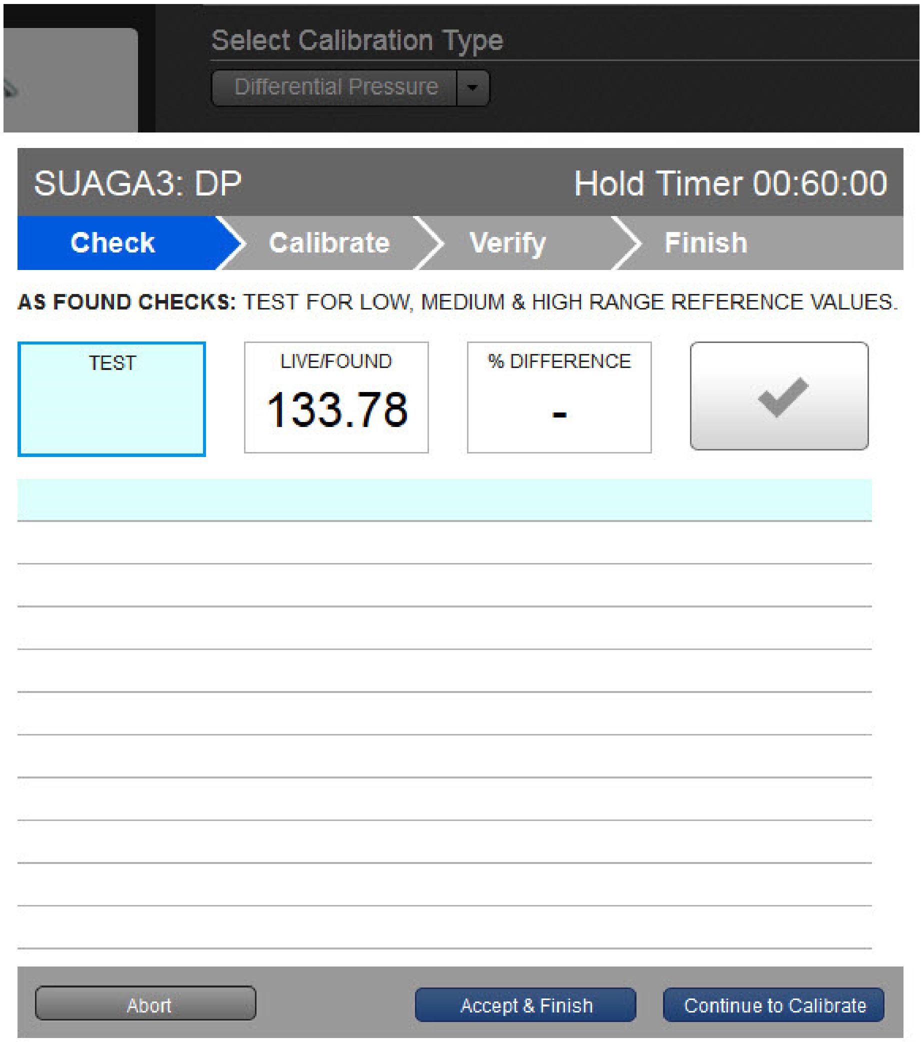
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process.



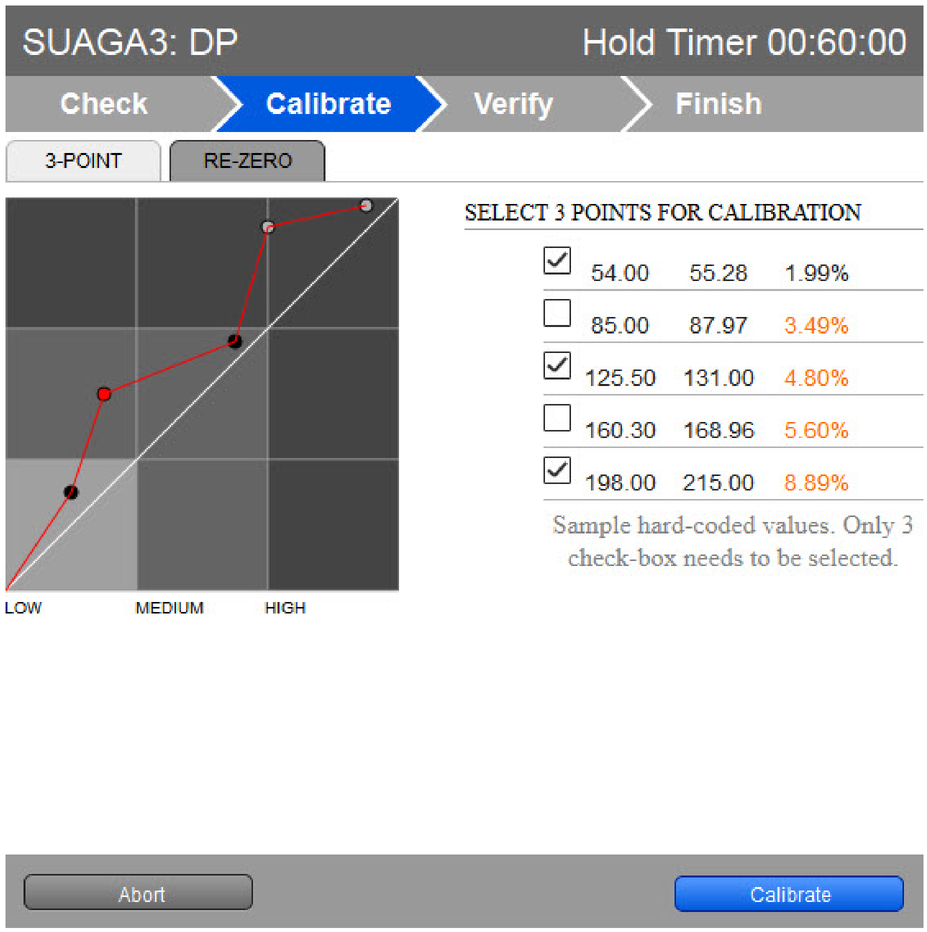
The DP-SP Check screen was designed as a troubleshooting tool so that the static pressure could be varied while at the same time, recording the differential pressure. Any significant change in the DP while changing the SP indicates a problem. The applied static pressure will be displayed in the SP window as well as the differential pressure in the DP window. Clicking on the check mark box will accept the pressures. Repeat the process to enter the number of static pressure points desired. If it's decided that a re-zero is needed before any more checks, click the RE-ZERO tab and a screen will appear to allow the user to re-zero the transducer and return to the Checks screen. The RE-ZERO function shifts up or down the calibration range so that the low end is true zero. The buttons with X's can be used to delete the selected entries from the log until the desired entries are input. Select the Accept & Finish button to complete the entry process which will save the checks as the "As Found" and "As Left" and log the check events. The user can now "Abort" to finish or select the "Add to Report & Finish" button to send the data to reports and finish.


SUAGA3: DP-SP CHECK
DP-SP Check
Finish
AS FOUND
AS LEFT
33.16 34.11
56.45 51.14
78.97 98.1
56.45 51.14
78.97 98.1
0.00 0.00
0.00 0.00
0.00 0.00
0.00 0.00
0.00 0.00
Abort
Add to Report & Finish

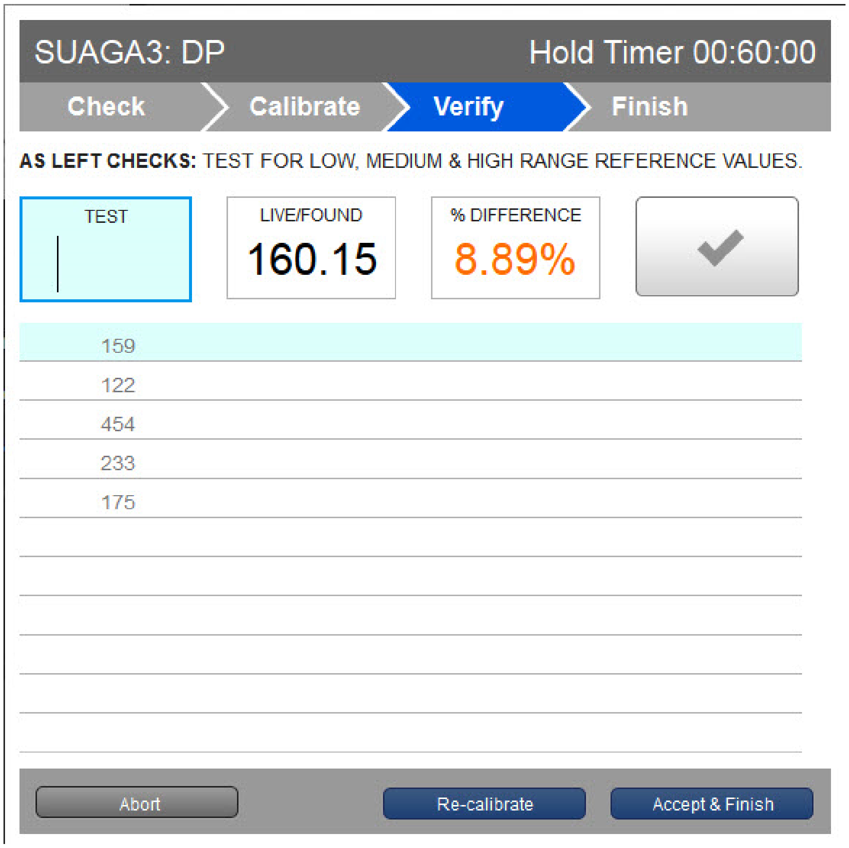

RealTime
Day
Select Calibration Type
Differential Pressure
DP-SP Check
Differential Pressure
Static Pressure
Temperature/RTD



The DP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.



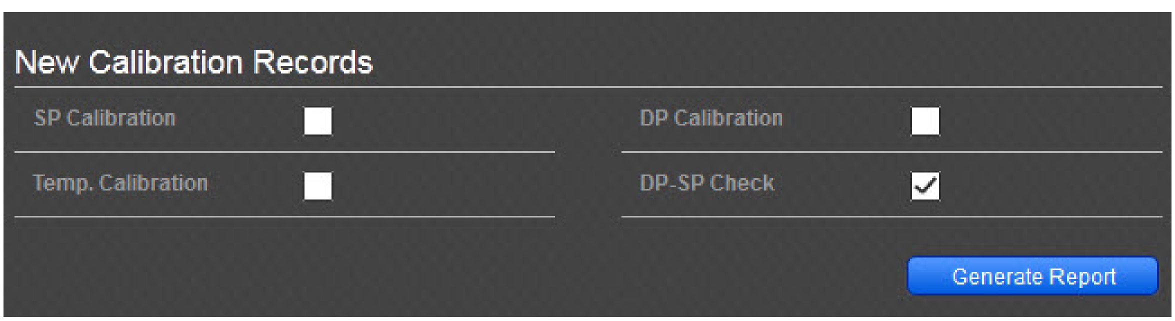
If the user elected to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. Click the Calibrate button to continue.



After the calibration, the user will need to do additional checks referred to as "Verify." Use the same procedure as when doing the first checks, typically using the same pressures. If satisfied after doing the verify checks, selecting the Accept & Finish button will complete this calibration. If not satisfied, the user can select the Re-calibrate button to return to the Calibrate screen. If the user wants to start the process over, the Abort button would be selected instead.

With the SP Calibration Check, the process is the same as the DP check.

The final Calibration Check is the Temperature/RTD. The process is also the same as the DP Calibration Check and the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following ten (10) areas of fields are accessible to the user:

- Constants
- Factors
- Density
- Commands
- Fixed Values on Errors
- Log Capacity
- Setup
- Current Values
- Limits
- Water Constants

The following information is provided in relation to all parameters and their fields:

Constants

Orifice Diameter	Enter the orifice diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Pressure Base (Pb)	Enter the Pressure Base in the units specified. A specific Pressure Base value may be required because of contractual agreements.
Auxiliary Factor (Faux)	This value is used when the Faux factor is turned on. Faux is simply a multiplication factor times the computed gas volume that can be used to correct for a known error condition. This factor is typically used for what is referred to as the Full Well Stream Factor. This is used to adjust the computed gas volume downward to account for the portion of the measured stream that is liquid.
Fixed Cd	If Use Calc Cd is not selected, this fixed value for Coefficient of Discharge is used. A typical value is 0.600.
Use Fixed Sp On Error	Select Yes to use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value; otherwise, select No.
Fixed Sp	Enter a static pressure to be used when the Use Fixed Sp On Error field is selected.
Z of Air @ Tb and Pb	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure.
SP Tap Location	Select the location (upstream, downstream) of the Sp tap in relation to the orifice plate.
Temperature Base (Tb)	Enter the Temperature Base. A specific Temperature Base may be required because of contractual agreements.
Viscosity	A default standard value of .010268 is used but can be edited by the user.

Specific Heat Ratio	Enter the Specific Heat Ratio. This is Cp divided by Cv. A typical value is 1.3
Orifice Coef Exp	Select the Orifice Plate material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an orifice plate is used that consists of a different material, the user must select "Other" and enter an Expansion Coefficient in the units as specified by the Expansion variable group on the Units tree view item. Move the decimal point 6 places to the right and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Exp Coef	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E -6.
DP Zero Cutoff	Enter the value in units as specified by the Units column. A decimal point is allowed. No volume calculations will occur when DP is below this value.
Basic Orifice Factor (Fb)	Used in the AGA-3 1985 equation when Fb Calculation is set to Auto on the Factors tab. Re-calculated by PCCU when the orifice size, pipe size, tap type or tap location is changed.
Orifice Material	Select between Stainless or Monel for the orifice plate material. Used in AGA-3 1985 equation.
Tap Type	Select Flange or Pipe tap. Used in AGA-3 1985 equation.

Factors

Use Calc Cd	Coefficient of Discharge factor (Cd) - Select Yes for the device to calculate, and use this factor in the volume calculations. Selecting No will cause the device to use a Fixed Cd, which by default is .6, but can be edited by the user in Constants.
Use Y	Expansion factor (Y) - Select Yes for the device to calculate, and use this factor in the volume calculations.
Use Fpv	Compressibility factor - Select Yes for the flow computer to calculate, and use this factor based on the Fpv method selected.
Use Fw	Water Vapor factor (Fw) - Select Yes for the device to calculate, and use this factor in the volume calculations. Used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is water in vapor phase. If supported, see the Water Constants tab for additional setup.
Use Faux	Full Well Stream Factor (Faux) - Select Yes for the device to use the Faux value entered by the user in the Constants tab. Typically, used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating the volume. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream is typically determined by a Full Well Stream Test. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.

Density

Base Condition Density Source	Select one of three sources to use for the density for base conditions:

	· Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density. · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable.
Base Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for base conditions.
Flowing Condition Density Source	Select one of four sources to use for the density for flowing conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable. · Live Measured - This method assumes density is brought via an external source such as a densitometer. If used, specify the app/array/register for the Live Density Input Register
Flowing Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for flowing conditions.
Live Density Input Register	Specify the App/Array/Register for the source of the density value if Live Measured was selected as the Density Source for flowing condition. If an on-board analog input or TFIO module is used for the input, the address can be found under the I/O Interface tree-view item.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is

	similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Fixed Values on Errors

Use Fixed Sp on Error	Select Yes to use or No to not use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value.
Fixed Sp Value	Enter the Static Pressure value to be used if Use Fixed Sp On Error is set to Yes and the Static Pressure has exceeded the Sp High Error or dropped below the Sp Low Error value.
Sp High Error	Enter the value to be used for the Static Pressure High Error.
Sp Low Error	Enter the value to be used for the Static Pressure Low Error.
Use Fixed DP on Error	Select Yes to use or No to not use the Fixed DP Value if the Differential Pressure exceeds the Dp High Error value or drops below the Dp Low Error value.
Fixed DP Value	Enter the Differential Pressure value to be used if Use Fixed Dp On Error is set to Yes and the DP Pressure has exceeded the DP High Error or dropped below the DP Low Error value.
DP High Error	Enter the value to be used for the Differential Pressure High Error.
DP Low Error	Enter the value to be used for the Differential Pressure Low Error.
Use Fixed Tf on Error	Select Yes to use or No to not use the Fixed Tf Value if the Flowing Temperature exceeds the Tf High Error value or drops below the Tf Low Error value.
Fixed Tf Value	Enter the Flowing Temperature value to be used if Use Fixed Tf On Error is set to Yes and the Flowing Temperature has exceeded the Tf High Error or dropped below the Tf Low Error value.
Tf High Error	Enter the value to be used for the Flowing Temperature High Error.
Tf Low Error	Enter the value to be used for the Flowing Temperature Low Error.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	The ID field represents the unique identifier for the device. As devices can have multiple flow calculations (tubes) running simultaneously, each one of these will have their own ID.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period.
Tube Description	Enter alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Vol Calc Period	Some devices offer volume calculation options of 1, 2, 5, 10, 20, 30 and 60 seconds/minutes whereas newer devices are locked in at one second. This is the rate at which the volume is calculated based on one second averages of SP, DP, and Temperature. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: 0 C / 32 F and 1.01325 bar / 14.695949 psi 15 C / 59 F and 1.01325 bar / 14.695949 psi 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2.
Sp/Dp Averaging	Select Linear or Square Root averaging from the drop-down list. The following explanation applies to the Differential Pressure, Static Pressure and Temperature. • Linear - Sums the samples and divides by the number of samples. • Square Root - Sum of the square root of the samples divided by the number of samples and squared.
Calculation Type	Select one of the calculation types: · AGA3-1985 - Adheres to American Gas Association's Report No. 3, 1985. · AGA3-1992 - Adheres to American Gas Association's Report No. 3, 1992 / American Petroleum Institute's Report 14.3.

	· AGA3-2012 - Adheres to American Gas Association's Report No. 3, 2012 / American Petroleum Institute's Report 14.3.
Hold Timeout	Sets a time duration that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 01:00:00 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.
Heating Value Method	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated Volume or Mass times the Heating Value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
Last Analysis Time	Displays the last date/time that a live analysis was received.

Current Values

Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the average value of the Extension is multiplied by the Integral Multiplier resulting in the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Each Volume Calculation Period volume is then added to the accumulated volume until zeroed by a Reset Volume command or an accumulator rollover happens.
Tube Description	Enter alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Yesterday's Energy	Prior Contract Day’s energy.
Flow Rate	Estimated flow rate based on the current Integral and the last calculated integral multiplier.
Today's Energy	The sum of energy quantities accumulated since the beginning of the contract day. At each Volume Calculation Period, the energy quantity is calculated by multiplying the period volume by the energy content.
Accumulated Energy	Running total of the Energy which is updated at the end of each Volume Calculation Period. See Today’s Energy above for the calculation procedure.
Yesterday's Mass	Prior Contract Day's Mass
Today's Mass	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume / Flowing Density Flowing Density is either calculated or user entered. Each Volume Calculation Period Mass is added to the current Mass for the duration of the Contract Day.

Accumulated Mass	Running total of the calculated Mass which is updated at the end of each Volume Calculation Period. See Today's Mass for the calculation procedure.
Mass Rate	The estimated flow rate times the mass content (fixed or from live analysis).
Energy Rate	The estimated flow rate times the energy content (fixed or from live analysis).
Last Calculated Value	Update frequency of the last calculated values is based on the Volume Calculation Period (typically 1 sec.) as specified on the General tab.
Last Calculated Energy	Energy for the last Volume Calculation Period. See Today's Energy for the calculation procedure.
Last Calculated Mass	Mass for the last Volume Calculation Period. See Today's Mass for the calculation procedure.

Limits

The Limits tab allows the user to enter High and Low Limits for Static Pressure, Differential Pressure, Temperature, and Flow Rate. When a low or high limit is exceeded, an alarm is entered into the Daily Flow record noting the day of the occurrence and also in the Log Period record noting which Log Period of that day the occurrence happened.

Another use of the limits is to operate digital outputs based on the high or low limit. The XSeries series flow computers (XFC) have two digital outputs which can be used and an XRC has four of which two can be operated based on the limits. These operations are setup on the Digital Outputs tree-view item.

Sp High Limit	Enter the static pressure high limit.
Sp Low Limit	Enter the static pressure low limit.
Dp High Limit	Enter the differential pressure high limit.
Dp Low Limit	Enter the differential pressure low limit.
RTD High Limit	Enter the RTD temperature high limit.
RTD Low Limit	Enter the RTD temperature low limit.
Flow High Limit	Enter the flow rate high limit.
Flow Low Limit	Enter the flow rate low limit.

Water Constants

Use Fixed H2O	Select Yes to use the water vapor content value as specified by Fixed H2O Content in lieu of the device calculating the water vapor content.
Fixed H2O Content	Enter a value that will be used as a fixed value for the water vapor content. The above parameter Use Fixed H2O will need to be set to Yes for the fixed value to be used.
H2O Bias	Enter an offset for calculation of Fw. If using Fw, but unfamiliar with this bias parameter, use the default value.
Last Calculated Fw	Displays the Last Fw value calculated by the device.

Adv Setup

Adv Setup

Static Pressure	Displays the current scaled static pressure.
Differential Pressure	Enter the DP value here.
Temperature	Enter the current flowing temperature.

Static Pressure Type	Select whether the static pressure is coming from a Gauge or Absolute pressure device.
Use Fixed Static	Select Yes to use the Fixed Static Pressure instead of a measured pressure. Used for AGA-7 tubes when static pressure is not available.
Fixed Static	Enter a value to be used when the Use Fixed Static is set to Yes.
RTD Installed	Select Yes if you are using an RTD for flowing temperature.
Use Fixed Temp	Select Yes to use the Fixed Temperature instead of a measured temperature.
Fixed Temp	Enter a value to be used when the Use Fixed Temperature is set to Yes. The Fixed Temperature will also be used in case of an RTD error if setup on the Fixed Values On Errors tab.

No Flow

Digital Input	Enter the App/Array/Register used for the No Flow condition.
DI Action	Select whether an Open or Closed contact represents the No Flow condition.
Flow State	Indicate Flow or No Flow based on the digital input.

Speed of Sound

Speed of Sound Calculation	Select either Disabled or Enabled
Speed of Sound	Displayed in feet/second

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on DP Low	If set to Yes, the digital output will be tripped on the DP Low alarm. Alarm limits are set in the Limits tab.
Trip on DP High	If set to Yes, the digital output will be tripped on the DP High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on Fr Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on Fr High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.

Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

Orifice

The user can select the Orifice tab to change the Orifice Plate. The first option would be to ensure all read/write fields have the correct value selected. These fields are as follows:

Orifice Diameter	Enter the orifice diameter size in dimensional units.
Hold Timeout	The user defines the duration of the Hold Timeout (default 60 minutes) to change the orifice plate.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Sp Tap Location	This read only field displays the location (upstream, downstream) of the Sp tap in relation to the orifice plate. Specified on Configuration tab.
Tap Type	In this field, available displayed values for this read only field for Tap Type are: 1. No DP - No live differential pressure provided 2. Flange - Flange type taps 3. Corner - Corner taps 4. D-D/2 - D and D/2 taps 5. Custom - User must enter a value specified on Configuration tab.

In addition to these read/write fields there are four read only fields displayed as follows:

Temperature	Current temperature reading
Pipe Ref Temp	As temperatures can cause the pipe size to change, the Pipe Reference Temperature represents the actual temperature at which the pipe size was measured.
Orifice Plate Exp. Coefficient	A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel).

	If an orifice plate is used that consists of a different material, the user must select Other and enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Orifice Pipe Exp. Coefficient	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E -6.

Once all the fields are showing the desired values, the user must first select the Hold button to set the timer at 60 minutes. The flow pressure is then held for that period of time to allow the user to change the orifice plate. The user then presses the Change Orifice Plate button and changes the orifice plate. Once finished, the user would select the Flowing button to resume flow.

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Qm	Base Mass
Qv	Base Volume
Volume	Displayed in SCF (standard cubic feet)
Mass	Displayed in lbm (pounds of mass)
Energy	Displayed in MBtu (thousands of British thermal units)
Xpt_Volp	Displayed value in H2O.psia/R
Real Specific Gravity	Displayed as a ratio of the density of the sample to the density of water. This value should be at the contracted pressure and temperature bases. All Fpv methods. The Specific gravity or Base gravity, as it is called in liquid calculations, defaults to .658 but an accurate gravity if known should be entered.
Specific Heat Ratio	Displayed as the ratio of the specific heat at a constant pressure (Cp) to the specific heat at a constant volume (Cv). A standard value is 1.3.
Fluid Viscosity	Displayed in cP (centipoise), a unit of viscosity
Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Contract Baro	Displayed in PSIA (pounds per square inch absolute)
Pressure Base	Displayed in PSIA (pounds per square inch absolute)
Temperature Base	Displayed in Degrees F.
Base Compressibility	Display follows one of four existing base conditions.
Flowing Compressibility	Calculated from the Base Compressibility
Super Compressibility	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions

	ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "supercompressibility factor"or Fpv.
Fip	Fip (Female Iron Pipe Connection) is the adaptor and will accept the pipe into its fitting
Live Static Pressure	Displays last live reading in PSIA (pounds per square inch absolute)
Static Pressure	Displays last static pressure reading in PSIA (pounds per square inch absolute)
Differential Pressure	Displays last differential pressure reading in INH2O (inches of water)
Live Temperature	Displays last live temperature reading in degrees F.
Flowing Temperature	Displays last flowing temperature reading in degrees F.
Faux	Displays faux or fpv (supercompressibility) value
Water Vapor Factor (Fw)	Displays the water vapor factor (Fw)
Orifice Reference Temperature	As temperatures can cause the orifice size to change, the Orifice Reference Temperature represents the actual temperature at which the orifice size was measured.
Pipe Reference Temperature	As temperatures can cause the pipe size to change, the Pipe Reference Temperature represents the actual temperature at which the pipe size was measured.
Orifice Expansion Coefficient	Select the Orifice material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an Orifice is used of a different type material, the user must select "Other", and enter an Expansion Coefficient (inches per Deg. F). Move the decimal point six places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Expansion Coefficient	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E-6.
Pipe Inside Diameter	Displays pipe inside diameter in inches
Temperature Corrected Orifice ID	The Orifice ID corrected for temperature
Orifice Inside Diameter	Displays orifice inside diameter in inches
Y Expansion Factor	Displays Y (expansion factor), used in volume calculations
Specific Heat Ratio	Displays the ratio of Cp divided by Cv
C-Prime Static Factor (cp_s)	The Static Factor value displays here.
C-Prime (cp)	The portion of the flow rate equation that is computed each Vol. Calc. Period.
Live Flowing Density	Assumes not using fixed data but live data from an external source
Base Density	Displays the Base Density used from the Start Date/Time to the End Date/Time.
Flowing Density	Displays the average Flowing Density used from the Start Date/Time to the End Date/Time.

Temperature Corrected Pipe/Orifice Ratio (Beta)	The Pipe/Orifice Ratio corrected for temperature
Velocity of Approach	This parameter is often referred to as the velocity of approach factor and dividing the coefficient of discharge by that parameter (as was done above) produces the flow coefficient. Methods also exist for determining the flow coefficient as a function of the beta function and the location of the downstream pressure sensing tap. For rough approximations, the flow coefficient may be assumed to be between 0.60 and 0.75. For a first approximation, a flow coefficient of 0.62 can be used as this approximates to fully developed flow.
Reynold's Number	Defined for different situations where a fluid is in relative motion to a surface including fluid properties of density and viscosity plus a velocity and an internal diameter
Discharge Coefficient (Cd)	Coefficient of Discharge factor (Cd) - Select Yes for the flow computer to calculate and use this factor in the volume calculations. Selecting No will cause the flow computer to use a Fixed Cd which is entered on the Constants tab.
Heating Value Select	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated volume or mass by the heating value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
AIR	Generally the mole percentage of AIR displayed here is related to the mole percentage of N2 (the chief component of air).
C6+ (Index Split Mode)	This affects both the NGC setup as far as the C6+ split and what C6+ information is sent to an external Modbus device. User Defined C6+ Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus includes the split values as well as the C6+ value. Pre-defined C6+ Splits - If you select one of the four predefined split percentages, the NGC will use this selection for the split. If information is sent to an external Modbus device, it will include the C6+ value and a code representing the same split percentages. User Defined C6+ Not Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus device includes the split values but not the C6+ value.

SUAGA-7

Overview

The Totalflow® Fourth Generation XSeries flow computers (XFCG4) provide functionality though the convergence of RTU, PLC and flow computer concepts. The XFCG4 represents a unique milestone in the development of remote, low power measurement and control devices. All XFCG4 units feature multi-tube capacity --up to eight per individual unit or 20 tubes per unit in special cases-- with custody-transfer measurement features. The flexibility of these units, including backward compatibility with legacy Totalflow systems, allows the user to increase productivity and improves asset utilization.

While the XFCG4 is designed for either differential (orifice) or pulse (linear) metering, the following information concentrates solely on pulse metering as it regards the SUAGA-7 standard.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measurement (inH2O) but in another country may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added to the AGA-3 and AGA-7. Thus the new nomenclature of SUAGA-7 is to signify this functionality.

The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) AGA-7 measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Tube Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected AGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Calculation Type	Displays the type of flow calculation.

The user can establish the parameters for the SUAGA-7 application using the read/write fields provided. These parameters are as follows:

Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
K Factor	K-Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measuring hardware. Therefore, the number of pulses is multiplied by the K-Factor to get the actual cubic feet which is the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions thus corrected volume. This variable can also be entered in the Calibration section.
Flow Period	Flow Period is a read only window which displays the time period in seconds. Flow Period is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period.
Aux Factor (Faux)	This value is used when the Use Faux parameter is turned on below. This is a multiplication factor which directly affects the volume calculation. For example, a value of .9 would cause a 10% reduction in the calculated volume. Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation. An example would be a linear meter calibration shift.
Fpv Method	Select the supercompressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: • 0 C / 32 F and 1.01325 bar / 14.695949 psi • 15 C / 59 F and 1.01325 bar / 14.695949 psi • 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi • 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. The seventh (Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (K Factor) and eleventh (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates. These variables include: SP, Pulse Count, Temperature and Flow.

The Points button is used to set the range of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter. The information displayed is sectioned for one day per row with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Avol	Uncorrected volume for the Contract Day. The uncorrected volume for each Volume Calculation Period of the Contract Day is added together to produce a Daily uncorrected volume.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Cnt Min	Displays the minimum counts that occurred during any Flow Period during the Contract Day.
Cnt Max	Displays the maximum counts that occurred during any Flow Period during the Contract Day.
Avol Percent Low	Percentage of the time that the Uncorrected Volume is below the Uncorrected Volume Low Limit. Limits are set on the Limits tab of the Setup tree view item.

Avol Percent Hi	Percentage of the time that the Uncorrected Volume is above the Uncorrected Volume High Limit. Limits are set on the Limits tab of the Setup tree view item.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the Contract Day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).

Avol	Uncorrected volume for the Contract Day. The uncorrected volume for each Volume Calculation Period of the Contract Day is added together to produce a Daily uncorrected volume.
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Flow Time is a read only window which displays the time period in seconds. Flow Time is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Period Time	Displays the total seconds from Start Date/Time to End Date/Time when there was flow. Flow is defined as any Flow Period (1 sec.) that contained pulses. Displays the time period in seconds (86400 secs = full day).

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Date/Time	Displays the date and time to the nearest second for the beginning of the event.
Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For example, using an SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For example, using an SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt for either analysis method by selecting the corresponding button.

In Fixed analysis, the user can use the Edit All option from the Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The right Gas Properties column has two read/write fields that can be selected and edited as well. These two fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.

The Others section only has one editable field as follows:

FPV Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2

In Live analysis, the user relies on real time data as displayed in each field under the Live column.

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Update frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

The Advanced Setup is comprised of the Analysis Setup and the Therms Setup.

In the Analysis Setup, the first three user defined fields deal with the type and duration of the analysis type selected. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

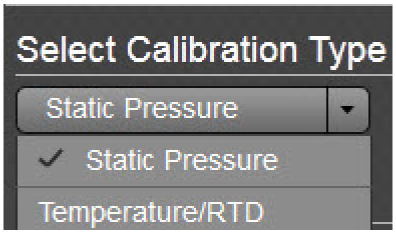
The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer data, select None. Selecting a stream will cause what is referred to as an Attachment. This logs an event in the Event file, sets the analysis period from 0 to 1 hour and sets a bit to tell the unit to use Live Analysis from the analyzer.
Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the

	analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.
Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check.

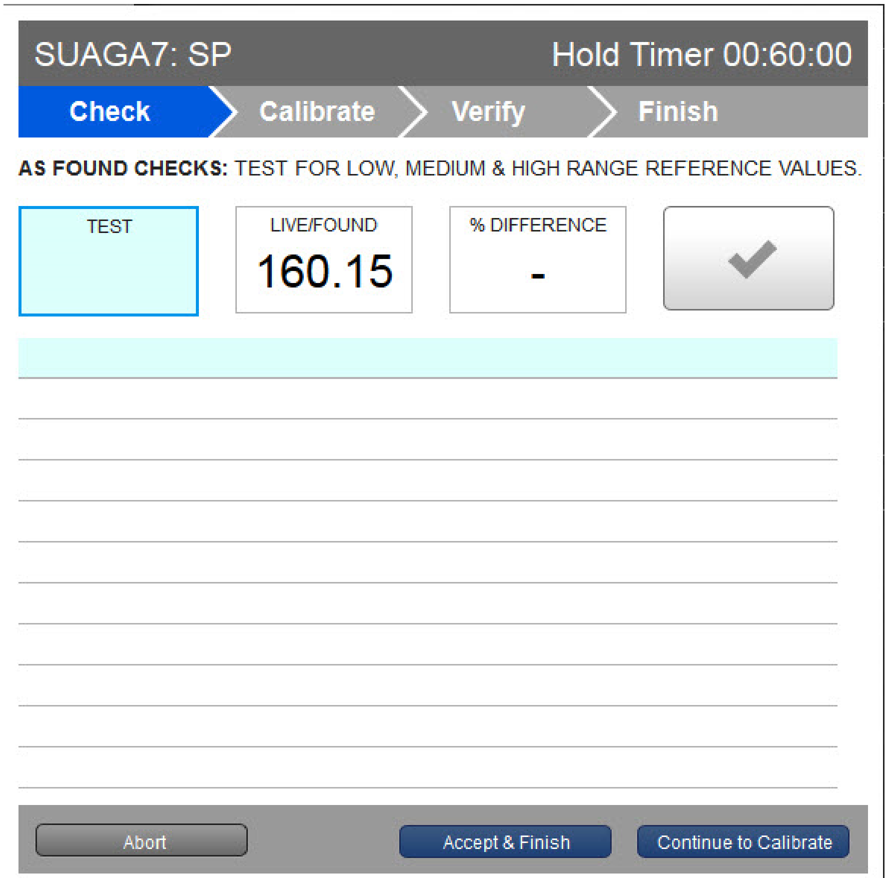


To start the calibration, select the type. Note the display of the Calibration Options fields change depending on the calibration type selected as follows:

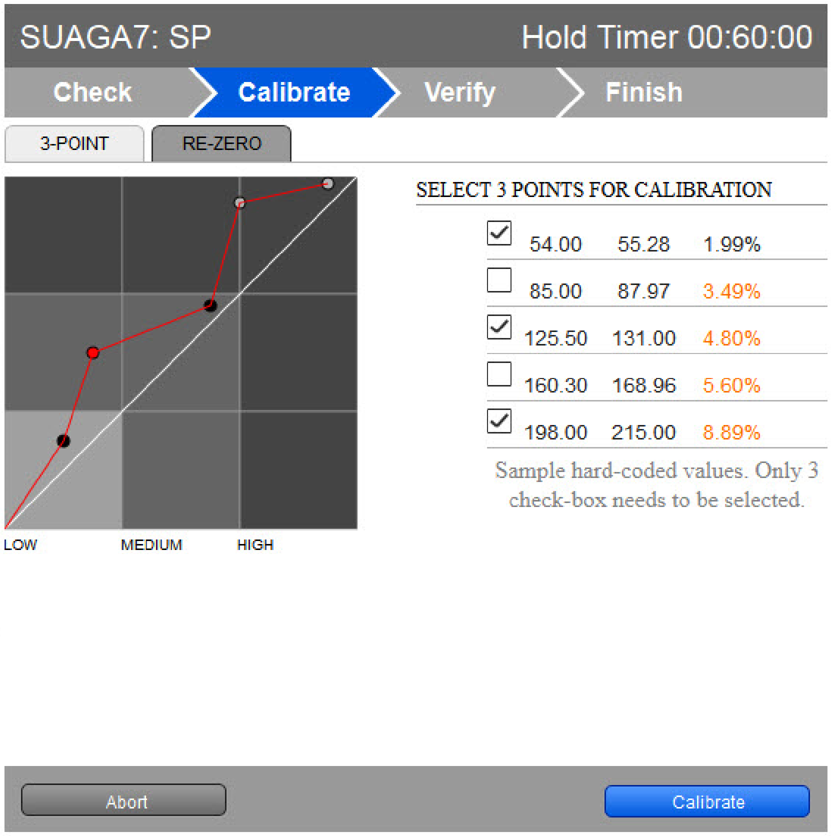
Do you want to calibrate in Absolute?	This option is simply an aid for doing Static Pressure checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timeout	When the user chooses to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Temperature Bias	If the user chooses to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to

	enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

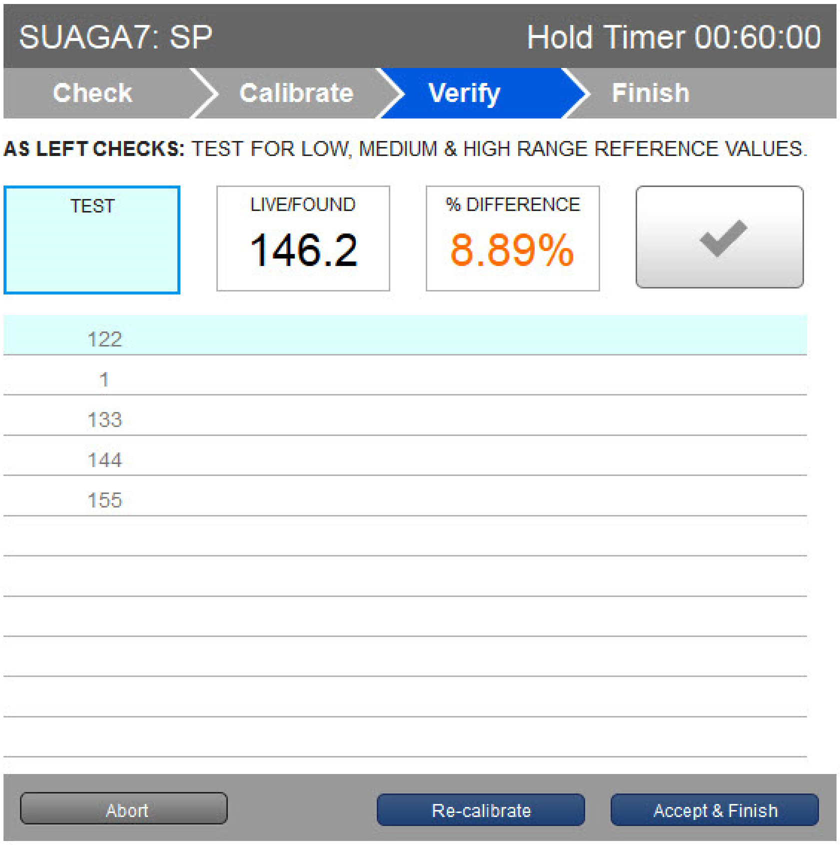
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process. The tube goes into the Hold state and the hold timer value for that tube is displayed on the right corner of the tab (defaults to 3600 seconds or one hour).



The SP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.

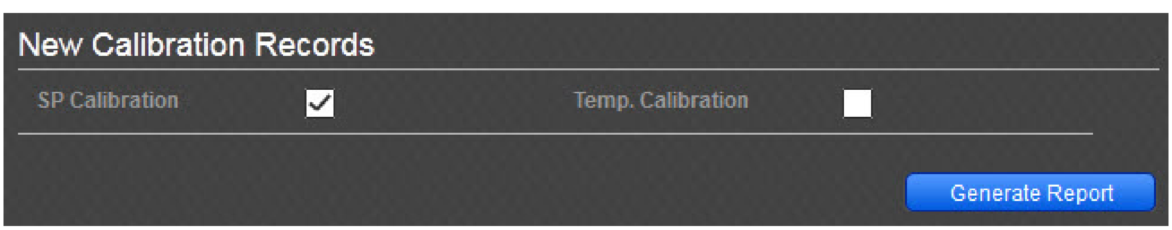


If the user chooses to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. If needed, use the RE-ZERO function to shift up or down the calibration range so that the low end is true zero. Click the Calibrate button to continue.



If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

The final Calibration Check is the Temperature/RTD. This process is also the same as the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration. The following nine (9) areas of fields are accessible to the user:

- Constants

- Factors
- Setup
- Density
- Current Values
- Commands
- Fixed Values on Errors
- Log Capacity
- Limits

The following information is provided in relation to all parameters and their fields:

Constants

Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure.
Pressure Base (Pb)	Enter the Pressure Base in the units specified. A specific Pressure Base value may be required because of contractual agreements.
Temperature Base (Tb)	Enter the Temperature Base in the units as specified by the Units column. A specific Temperature Base may be required because of contractual agreements.
Z of Air Ratio @ Tb and Pb	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Auxiliary Factor (Faux)	This value is used when the Faux factor is turned on. Faux is simply a multiplication factor times the computed gas volume that can be used to correct for a known error condition. This factor is typically used for what is referred to as the Full Well Stream Factor. This is used to adjust the computed gas volume downward to account for the portion of the measured stream that is liquid.
K Factor	K-Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measuring hardware. Therefore, the number of pulses is multiplied by the K-Factor to get the actual cubic feet which is the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions thus corrected volume. This variable can also be entered in the Calibration section.

Factors

Use Fpc	Select Yes to use the Pressure Correction Factor (Fpc). Calculated by dividing the Volume Calculation Period average SP by the Pressure Base.
Use Ftc	Select Yes to use the Temperature Correction Factor (Ftc). Calculated by dividing the Temperature Base by the Volume Calculation Period average temperature.
Use Fs	Select Yes to use the Compressibility Factor (Fs). Fs is equal to Fpv^2. Fpv is based on the Fpv method selected in General tab and analysis data.
Use Faux	Full Well Stream Factor (Faux) - Select Yes for the device to use the Faux value entered by the user in the Constants tab. Typically, used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating the volume. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream

	is typically determined by a Full Well Stream Test. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.

Setup

Device/APP ID	Enter up to ten alpha-numeric characters for the Device/APP ID. This identifies the specific application or flow calculation. A Station or device can have multiple flow calculations running simultaneously, and each of those will have their own Device/APP ID.
Tube Description	Enter alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period. This option is only valid in devices supporting the new database (DB2) and when in the Extended Characteristic mode. A default period of one hour is used all other times.
Flow Period	Flow Period is a read only window which displays the time period in seconds. Flow Period is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Calculation Type	Displays the type of flow calculation which is API Liquid. This is a read-only parameter.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: • 0 C / 32 F and 1.01325 bar / 14.695949 psi • 15 C / 59 F and 1.01325 bar / 14.695949 psi

	• 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi • 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2.
K-Factor Type	Specify whether input pulses are Volume per Pulse or Pulse per Volume.
Heating Value Method	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated Volume or Mass times the Heating Value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
Last Analysis Time	If using live analysis, this is the time and date that a last good live analysis was received.
Hold Time Out (Seconds)	Sets a time duration (in seconds) that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 3600 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.

NOTE: Engineering units are established on the Selectable Units Setup tab accessible by clicking on the Station ID. The Station ID is the very top name on the tree-view.

Density

Base Condition Density Source	Select one of three sources to use for the density for base conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density. · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable.
Base Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for base conditions.
Flowing Condition Density Source	Select one of four sources to use for the density for flowing conditions: · Calculated from Real Specific Gravity - This selection causes the Specific Gravity to be picked up from the Fixed or Live Analysis data section and used to calculate the density · Calculated from AGA8 Detail - This selection uses the AGA8 Detail Fpv method and requires that the AGA8 Detail Fpv method be used as selected on the General tab. · User Entered - If used, the entered value needs to match up with the Real Specific Gravity in the Analysis section. Enter the value in the User Entered Density field as shown below. This selection is not recommended if any of the other methods are viable. · Live Measured - This method assumes density is brought via an external source such as a densitometer. If used, specify the app/array/register for the Live Density Input Register

Flowing Condition User Entered Density	Enter the density to be used if User Entered was selected as the Density Source for flowing conditions.
Live Density Input Register	Specify the App/Array/Register for the source of the density value if Live Measured was selected as the Density Source for flowing condition. If an on-board analog input or TFIO module is used for the input, the address can be found under the I/O Interface tree-view item.

Current Values

Current Uncorrected	Select either Volume/Pulse or Pulses/Volume. When Volume/Pulse is selected, pulses are multiplied by the K-Factor to calculate the uncorrected (actual) volume. When Pulses/Volume is selected, pulses are multiplied by the reciprocal of the K-Factor to calculate the uncorrected (actual) volume.
Current Mass Flow Rate	The Mass Flow Rate is the Mass Volume for the Volume Calculation Period.
Current Energy Flow Rate	The Indicated Flow Rate times the Heating Value.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Uncorrected Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Mass	Updated at the end of each Volume Calculation Period. Each Volume Calculation mass is added to the current mass for the duration of the Contract Day.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Yesterday's Uncorrected Volume	Prior Contract Day’s uncorrected volume. See Today’s UC Volume for the calculation procedure.
Yesterday's Mass	Prior Contract Day’s Mass.
Yesterday's Energy	Prior Contract Day’s energy.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period corrected volume is then added to the Accumulated Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Uncorrected Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K

	Factor to produce an uncorrected volume which is added to the Accumulated UC Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Mass	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the mass is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Energy	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the energy is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Last Calculated Volume	Volume for the last Volume Calculation Period.
Last Calculated Uncorrected Volume	Uncorrected Volume for the last Volume Calculation Period.
Last Calculated Mass	Mass for the last Volume Calculation Period.
Last Calculated Energy	Energy for the last Volume Calculation Period.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.
Set Uncorrected Volume to >	Enter the provided value of the Uncorrected Volume.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Fixed Values on Errors

Use Fixed Sp on Error	Select Yes to use or No to not use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value.
Fixed Sp Value	Enter the Static Pressure value to be used if Use Fixed Sp On Error is set to Yes and the Static Pressure has exceeded the Sp High Error or dropped below the Sp Low Error value.
Sp High Error	Enter the value to be used for the Static Pressure High Error.
Sp Low Error	Enter the value to be used for the Static Pressure Low Error.
Use Fixed Tf on Error	Select Yes to use or No to not use the Fixed Tf Value if the Flowing Temperature exceeds the Tf High Error value or drops below the Tf Low Error value.
Fixed Tf Value	Enter the Flowing Temperature value to be used if Use Fixed Tf On Error is set to Yes and the Flowing Temperature has exceeded the Tf High Error or dropped below the Tf Low Error value.
Tf High Error	Enter the value to be used for the Flowing Temperature High Error.
Tf Low Error	Enter the value to be used for the Flowing Temperature Low Error.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Limits

Sp High Limit	This represents the higher limit of the static pressure value that can be sent to the tube application.
Sp Low Limit	This represents the lower limit of the static pressure value that can be sent to the tube application.
Tf High Limit	This represents the higher limit of the total flowing temperature value that can be sent to the tube application.
Tf Low Limit	This represents the lower limit of the total flowing value that can be sent to the tube application.
Flow Rate High Limit	This represents the higher limit of the flow rate value that can be sent to the tube application.
Flow Rate Low Limit	This represents the lower limit of the flow rate value that can be sent to the tube application.
Uncorr Vol High Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The High Limit for the uncorrected value is set in this field to specify which values can be sent to the application.
Uncorr Vol Low Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The Low Limit for the uncorrected value is set in this field to specify which values can be sent to the application.

Adv Setup

Adv Setup

Static Pressure	Displays the current scaled static pressure.
Pulse Input	If Pulse Input Vol or Pulse Input Mass was selected for the Flow Input Type, enter the pulse input register here.
Temperature	Snapshot of the current flowing temperature.
Static Pressure Type	Select whether the static pressure is coming from a Gauge or Absolute pressure device.
Use Fixed Static	Select Yes to use the Fixed Static Pressure instead of a measured pressure. Used for AGA-7 tubes when static pressure is not available.
Fixed Static	Enter a value to be used when the Use Fixed Static is set to Yes.
RTD Installed	Select Yes if you are using an RTD for flowing temperature.
Use Fixed Temp	Select Yes to use the Fixed Temperature instead of a measured temperature.
Fixed Temp	Enter a value to be used when the Use Fixed Temperature is set to Yes. The Fixed Temperature will also be used in case of an RTD error if setup on the Fixed Values On Errors tab.

No Flow

Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DI Action	Select whether an Open Contact or a Closed Contact constitutes a No Flow condition.
Flow State	Displays the Flow State as Flow or No Flow based on the Digital Input specified above and the DI Action selected.

Speed of Sound

Speed of Sound Calculation	Speed of Sound is calculated based on AGA-10 specifications and is provided to the user to use as they see fit and is not used by the NGC for any subsequent calculations. Pressure and temperature are two additional parameters required for the calculation which are not typically available in the NGC. This screen allows for the entry of registers if the two values are brought via an external source, or permits the user to enter a fixed value for either or both parameters.
Speed of Sound	Displays the calculated value of the Speed of Sound based on AGA-10 specifications.

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on ACF Low	If set to Yes, the digital output will be tripped on the ACF Low alarm. Alarm limits are set in the Limits tab.
Trip on ACF High	If set to Yes, the digital output will be tripped on the ACF High alarm. Alarm limits are set in the Limits tab.

Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on FR Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on FR High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

K Factor

The K Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measuring hardware. Therefore, the number of pulses is multiplied by the K Factor to get the actual cubic feet which is known as the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions thus corrected volume. This variable can also be entered in the Calibration section.

Note: Items that require engineering units have a Variable Group number in the Description column beside the description. The user may need to change units for a particular Variable Group or change the Multiplier for a Variable Group which is done on the Units tree-view item under the corresponding measurement tube. Click on the Units tree-view item, and note that all tabs have a left-hand column that contains the Application, Array, Register numbers (xx.xx.xx), and in this case, the last set of numbers match the associated Variable Group number. If the user needs to change the engineering units, they would click on the Units tree-view item, and look at the left column of each tab to locate the

Variable Group whose last set of numbers as represented by "yy" (xx.xx.yy) match the Group number they are looking for. Keep in mind that changing the Units for a particular Variable Group will typically affect more than one item.

After selecting the K Factor tab, the first choice is to determine the K Factor Mode under the General Setup section. Options are either Single Point or Multi Point. In this case the Single Point was selected and displays in the upper right hand corner of the screen (green). The Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse) .

The following information explains the remaining portions of the Single Point page:

Single Point K Factor Points	This field is read only. There is no access to selecting calibration points unless in Multi Point mode.
MultiPoint K Factor Setup	Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on
General Setup	The following read/write fields are active and defined in Single Point mode: • Multi Point Calibration Enable - the user can elect to enable or cancel a Multi Point calibration • K Factor Type - the user can define the K Factor as either Quantity/Pulse or Pulse/Quantity
Single Point K Factor	The user is enabled to define the K Factor in the Single Point mode

If the user selects instead the Multi Point option under the K Factor Mode (General Setup), Multi Point will display (green) in the upper right corner of the screen. Again, the Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse) . A major change in the Overview part of the screen is that Dynamic K displays in the read-only field where K Factor had displayed previously.

The following information explains the remaining portions of the Multi Point page:

MultiPoint K Factor Points	Up to 11 points can be defined by the user for these fields but the Edit All convention must be used since no single row edits are able to be defined individually only collectively.
MultiPoint K Factor Setup	The two following fields are defined: • Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on • Calibration Points - displayed as read/write by the user.
General Setup	The following read/write fields are active and defined in Multi Point mode: • Multi Point Enable - the user can elect to enable or cancel a Multi Point calibration

	• K Factor Type - the user can define the K Factor as either Pulse/Quantity or Quantity only
Single Point K Factor	This field is read only in Multi Point mode.

There will also be two buttons available to the user: Abort Calibration (Cancel) and Complete Calibration (Commit).

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Volume	Displayed in SCF (standard cubic feet)	Temperature Correction Factor (Ftc)	Displays the average Temperature Correction (Ftc) Factor from the Start Date/Time to the End Date/Time.
Uncorrected Volume	Sum of all the volume quantities calculated for each Volume Calculation Period during the Contract Day. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume.	Pressure Correction Factor (Fpc)	Displays the average Pressure Correction (Fpc) Factor from the Start Date/Time to the End Date/Time.
Mass	Displayed in lbm (pounds of mass)	Base Compressibility	Displays the Compressibility factor which is a factor that is used to account for the deviation of a gas from volumetric ideality (non ideal gas behavior). Three methods are used in the Totalflow NGC. NX-19, AGA 8, AGA5.
Energy	Displayed in MBtu (thousands of British thermal units)	Flowing Compressibility	Calculated from the Base Compressibility
Real Specific Gravity	Displayed as a ratio of the density of the sample to the density of water	(Supercompress)^2	The value calculated by the selected fpv method squared (fpv2) to derive the compressibility factor (Fs) for pulse meters
Intentionally left blank	Intentionally left blank	Supercompressibility	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute

			pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "Supercompressibility factor" or Fpv.
Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.	Live Flowing Density	Displays the Live Flowing Density used from the Start Date/Time to the End Date/Time.
Live Static Pressure	Displays last live reading in PSIA (pounds per square inch absolute)	Base Density	Displays the Base Density used from the Start Date/Time to the End Date/Time.
Static Pressure	Displays last static pressure reading in PSIA (pounds per square inch absolute)	Flowing Density	Measured or Calculated from the provided Base Density.
Contract Baro Pressure	The barometric pressure should display 14.730 PSIA	Pulse Count	Displays the total pulses from the Start Date/Time to the End Date/Time.
Pressure Base	Displayed in PSIA (pounds per square inch absolute)	ACF	Uncorrected Flow converted to Actual Cubic Feet (ACF) for use by the totalflow device
Temperature Base	Displayed in Degrees F.	K Factor	K-Factor specifies the number of pulses required per volume of liquid. To get the Indicated Volume, the number of pulses is divided by the K-Factor or multiplied by the inverse of the K- Factor depending on whether the K-Factor Method is set to Quantity/Pulse or Pulse/Quantity.
Live Temperature	Displays the value of live temperature	Dynamic K	Displays the current K-Factor based on the current pulse frequency when Monitor box is

			checked or the Re-read button is clicked. This assumes a successful multipoint calibration has been done and the multipoint calibration feature is turned on.
Flowing Temperature	Displays the average Flowing Temperature from the Start Date/Time to the End Date/Time.	Heating Value Selected	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated Volume or Mass times the Heating Value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
C-Prime Static Factor (cp_s)	The Static Factor value displays here.	Energy Vol Based	Using the heating value times volume to calculate the energy
Intentionally left blank	Intentionally left blank	Energy Mass Based	Using the heating value times mass to calculate the energy
C Prime (cp)	Constant Pressure (Cp) divided by Constant Volume (Cv) yields the Specific Heat Ratio	Air	Generally the mole percentage of AIR displayed here is related to the mole percentage of N2 (the chief component of air).
Faux	Faux defaults to 1.00000 but can be changed in the Constants tab by the user.	C6+ (Index Split Mode)	This affects both the NGC setup as far as the C6+ split and what C6+ information is sent to an external Modbus device. User Defined C6+ Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus includes the split values as well as the C6+ value. Pre-defined C6+ Splits - If you select one of the four predefined split percentages, the NGC will use this selection for the split. If information is sent to an external Modbus device, it will include the C6+ value and a code representing the same split percentages. User Defined C6+ Not Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus device includes the split values but not the C6+ value.

SU Coriolis

Overview

Coriolis flow meters can be used for the measurement of natural gas flow.

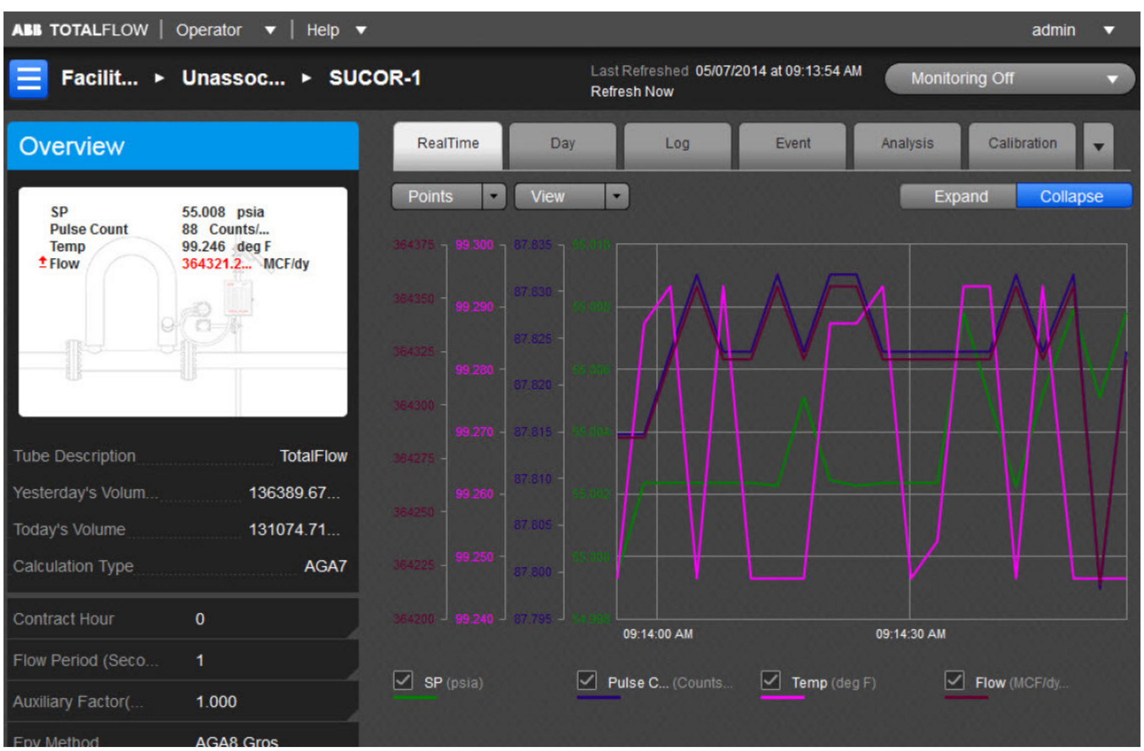
A Coriolis meter is usually one or more pipes with longitudinally or axially displaced section(s) that are excited to vibrate at resonant frequency. Coriolis meters are used with liquids and gases. When the fluid within the displaced section is at rest, both the upstream and downstream portion of the displaced section will vibrate in phase with each other. The frequency of this vibration is determined by the overall density of the pipe (including its contents). This allows the meter to measure the flowing density of the gas in real time. Once the fluid begins to flow, however, the Coriolis effect comes into play. This effect implies a relationship between the phase difference in the vibration of the upstream and downstream sections and the mass flow rate of the fluid contained by the pipe.

Again, owing to the amount of inference, analog control and calculation intrinsic to a Coriolis meter, the meter is not complete with just its physical components. There are actuation, sensing, electronic and computational elements that must be present for the meter to function.

Coriolis meters can handle a wide range of flow rates and have the unique ability to output mass flow - this gives the highest accuracy of flow measurement currently available for mass flow measurement. Since they measure flowing density, Coriolis meters can also infer gas flow rate at flowing conditions.

American Gas Association Report No. 11 provides guidelines for obtaining good results when measuring natural gas with a Coriolis meter.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measured in inH2O here in one market but in another country's market may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added. Thus the new nomenclature of SU Coriolis is to signify this functionality.



The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) SUAGA-7 measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Tube Description	Enter up to 24 alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected AGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Calculation Type	Displays the type of flow calculation. This is a read-only parameter.

The user can establish the parameters for the SU Coriolis application using the read/write fields provided. These parameters are as follows:

Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
K Factor	This specifies the mass flow per pulse. As such, the number of pulses is multiplied by the K-Factor to yield the mass per unit time (i.e., kg/s)
Flow Period	Flow Period is a read only window which displays the time period in seconds. Flow Period is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Aux Factor (Faux)	This value is used when the Use Faux parameter is turned on. This is a multiplication factor which directly affects the volume calculation. For example, a value of .9 would cause a 10% reduction in the calculated volume. Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation. An example would be a linear meter calibration shift.
Fpv Method	Select the supercompressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses Relative Density, N 2 and CO2. • AGA8 Detail 92 - This method basically supports a total analysis.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. The seventh

(Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (K Factor) and eleventh (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the range of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Mass	Uncorrected Mass for the Contract Day. The uncorrected mass for each Volume Calculation Period of the Contract Day is added together to produce a Daily uncorrected Mass.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.

Cnt Min	Displays the minimum counts that occurred during any Flow Period during the Contract Day.
Cnt Max	Displays the maximum counts that occurred during any Flow Period during the Contract Day.
Mass Percent Low	Percentage of the time that the Uncorrected Mass is below the Uncorrected Mass Low Limit.
Mass Percent Hi	Percentage of the time that the Uncorrected Mass is above the Uncorrected Mass High Limit.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is below zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

Count	This field represents the total number of counts for the flow period.
SP	This field represents the static pressure.
TF	This field represents the flowing temperature.
Mass	This field represents the totalized mass.
Volume	This field represents the totalized volume.
Energy	This value represents the sum of energy quantities.
Flow Time	Flow Time is a read only window which displays the time period in seconds. Flow Time is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Period Time	Displays the total seconds from Start Date/Time to End Date/Time when there was flow. Flow is defined as any Flow Period (1 sec.) that contained pulses. Displays the time period in seconds (86400 secs = full day).

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Description	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For example, using an SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For example, using an SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt for either analysis method by selecting the corresponding button.

In Fixed analysis, the user can use the left Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The right Gas Properties column has two read/write fields that can be selected and edited as well. These two fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.

The Others section only has one editable field as follows:

FPV Method	Select the supercompressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses Relative Density, N2 and CO2. • AGA8 Detail - This method basically supports a total analysis.

In Live analysis, the user relies on real time data as displayed in each field under the Live column. In case of error in real time, data is defaulted to the Fixed column data.

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Update frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

The Advanced Setup is comprised of the Analysis Setup and the Therms Setup.

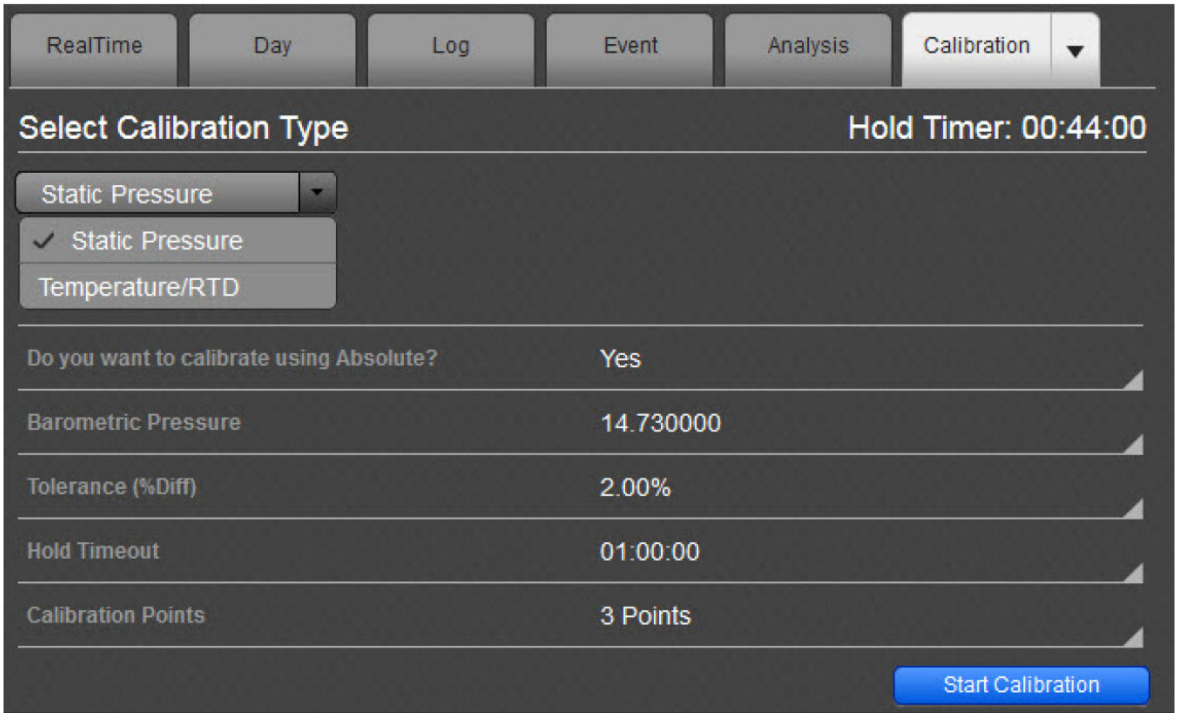
In the Analysis Setup, the first three user defined fields deal with the type and duration of the analysis type selected. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer data, select None. Selecting a stream will cause what is referred to as an Attachment. This logs an event in the Event file, sets the analysis period from 0 to 1 hour and sets a bit to tell the unit to use Live Analysis from the analyzer.
Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.
Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check.



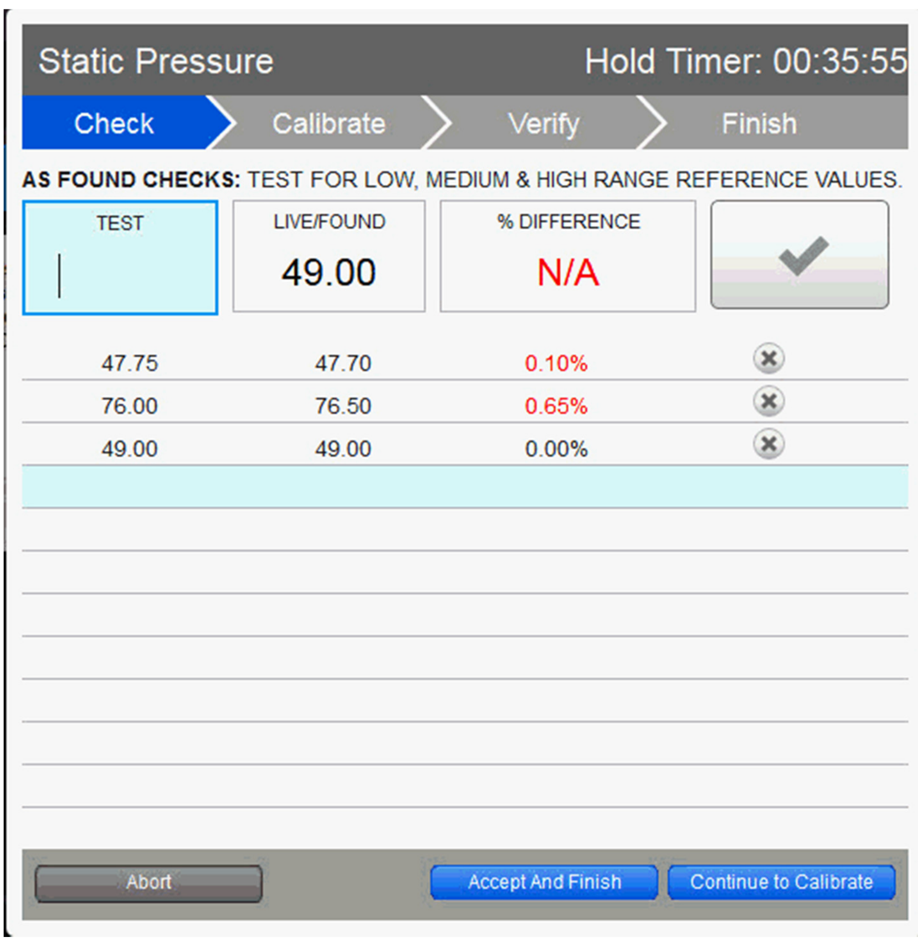
To start the calibration, select the type. Note the display of the Calibration Options fields change depending on the calibration type selected as follows:

Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timeout	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate in Absolute?	This option is simply an aid for doing Static Pressure checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)

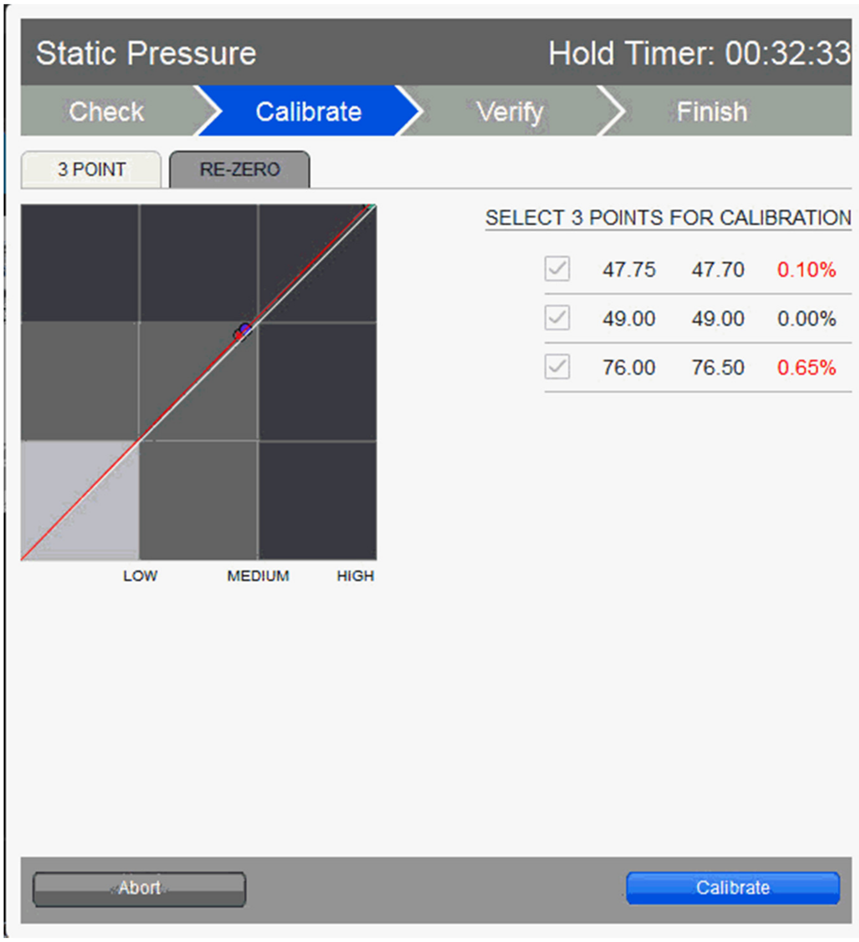
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

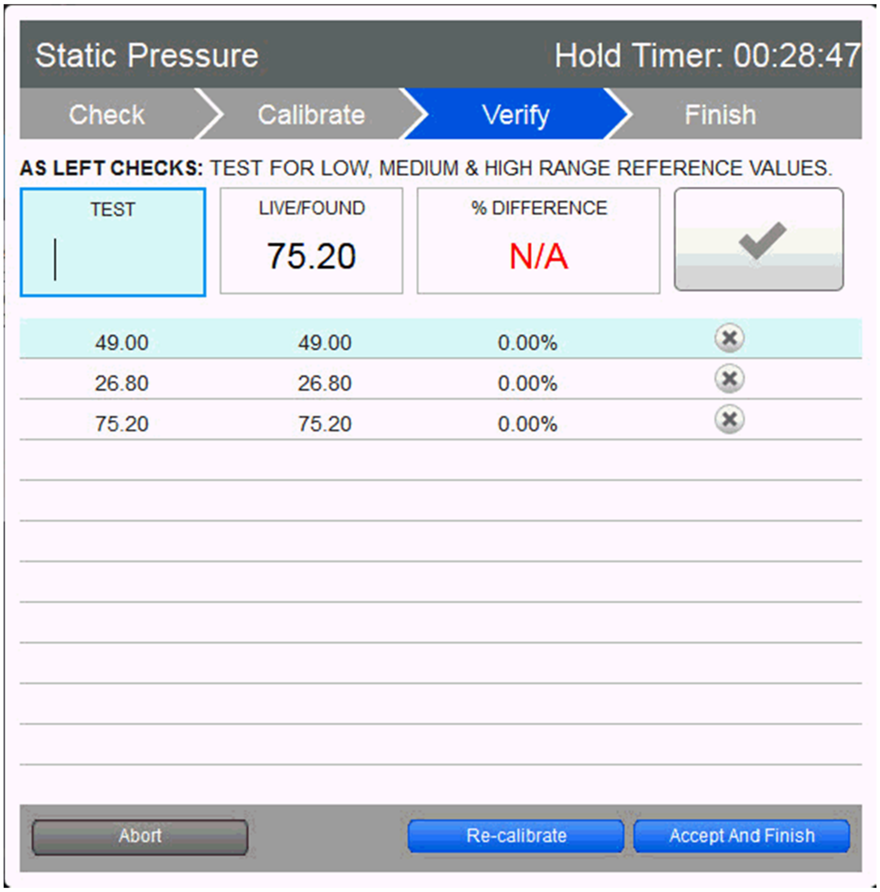
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process. The tube goes into the Hold state and the hold timer value for that tube is displayed on the right corner of the tab (defaults to 3600 seconds or one hour).

The SP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.



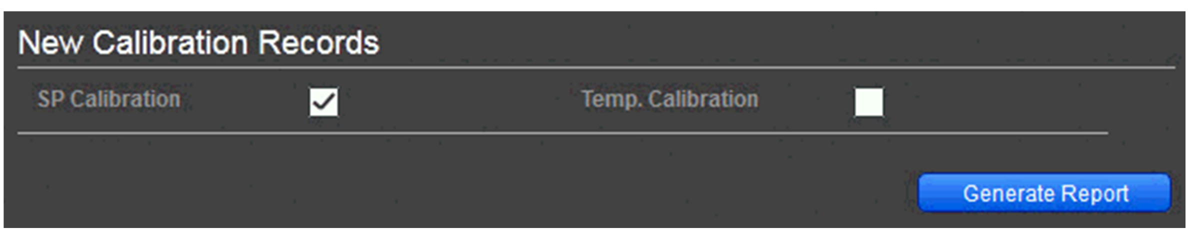
If the user chooses to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. Click the Calibrate button to continue.





If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

The final Calibration Check is the Temperature/RTD. This process is also the same as the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following seven (7) areas of fields are accessible to the user:

• Constants

• Commands
• Fixed Values on Errors
• Log Capacity
• Setup
• Current Values
• Limits

The following information is provided in relation to all parameters and their fields:

Constants

Fixed SP Value	This is the Sp value used in the volume calculations if the Use Fixed Sp value is selected in the Adv Setup or Calibration section. This variable can also be entered in the Calibration Setup screen.
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure.
Pressure Base (Pb)	Enter the Pressure Base in the units specified. A specific Pressure Base value may be required because of contractual agreements.
Temperature Base (Tb)	Enter the Temperature Base in the units as specified by the Units column. A specific Temperature Base may be required because of contractual agreements.
Z Base of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
K Factor	This specifies the mass flow per pulse. As such, the number of pulses is multiplied by the K-factor to yield the mass per unit time (i.e., kg/s)
Auxiliary Factor (Faux)	This value is used when the Use Faux parameter is turned on below. This is a multiplication factor which directly affects the volume calculation. For example, a value of .9 would cause a 10% reduction in the calculated volume. Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation.
Use Faux	Select Yes for the device to use the Faux value entered above.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.

Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Fixed Values on Errors

Use Fixed Sp on Error	Select Yes to use or No to not use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value.
Fixed Sp Value	Enter the Static Pressure value to be used if Use Fixed Sp On Error is set to Yes and the Static Pressure has exceeded the Sp High Error or dropped below the Sp Low Error value.
Sp High Error	Enter the value to be used for the Static Pressure High Error.
Sp Low Error	Enter the value to be used for the Static Pressure Low Error.
Use Fixed Tf on Error	Select Yes to use or No to not use the Fixed Tf Value if the Flowing Temperature exceeds the Tf High Error value or drops below the Tf Low Error value.
Fixed Tf Value	Enter the Flowing Temperature value to be used if Use Fixed Tf On Error is set to Yes and the Flowing Temperature has exceeded the Tf High Error or dropped below the Tf Low Error value.
Tf High Error	Enter the value to be used for the Flowing Temperature High Error.
Tf Low Error	Enter the value to be used for the Flowing Temperature Low Error.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	Enter up to ten alpha-numeric characters for the Device/APP ID. This identifies the specific application or flow calculation. A Station or device can have multiple flow calculations running simultaneously, and each of those will have their own Device/APP ID.

Tube Description	Enter alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period.
Flow Period	Flow period is a selectable time period used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period is not included in the log period averages. This variable can also be entered in the Calibration section.
Calculation Type	Displays the type of flow calculation. This is a read-only parameter.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: • AGA8 Gross Method 1 - This method uses: Gross Heating Value, Relative Density and CO2. • AGA8 Gross Method 2 - This method uses: Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: • 0 C / 32 F and 1.01325 bar / 14.695949 psi • 15 C / 59 F and 1.01325 bar / 14.695949 psi • 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi • 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2.
Heating Value Method	Select either Volume Based or Mass Based. The heating method is multiplied times the volume or the mass to calculate the energy.

Current Values

Current Mass Flow Rate	The Mass Flow Rate is the Mass Volume for the Volume Calculation Period.

Corrected Volume	(see Today's Volume)
Current Energy Flow Rate	The Indicated Flow Rate times the Heating Value.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Uncorrected Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Mass	Updated at the end of each Volume Calculation Period. Each Volume Calculation mass is added to the current mass for the duration of the Contract Day.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Yesterday's Uncorrected Volume	Prior Contract Day's uncorrected volume. See Today's UC Volume for the calculation procedure.
Yesterday's Mass	Prior Contract Day's Mass.
Yesterday's Energy	Prior Contract Day's energy.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period corrected volume is then added to the Accumulated Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Uncorrected Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is added to the Accumulated UC Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Mass	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the mass is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Energy	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the energy is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Last Calculated Volume	Volume for the last Volume Calculation Period.
Last Calculated Uncorrected Volume	Uncorrected Volume for the last Volume Calculation Period.

Last Calculated Mass	Mass for the last Volume Calculation Period.
Last Calculated Energy	Energy for the last Volume Calculation Period.

Limits

Sp High Limit	This represents the higher limit of the static pressure value that can be sent to the tube application.
Sp Low Limit	This represents the lower limit of the static pressure value that can be sent to the tube application.
Tf High Limit	This represents the higher limit of the total flowing temperature value that can be sent to the tube application.
Tf Low Limit	This represents the lower limit of the total flowing value that can be sent to the tube application.
Flow Rate High Limit	This represents the higher limit of the flow rate value that can be sent to the tube application.
Flow Rate Low Limit	This represents the lower limit of the flow rate value that can be sent to the tube application.
Uncorr Vol High Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The High Limit for the uncorrected value is set in this field to specify which values can be sent to the application.
Uncorr Vol Low Limit	At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume. The Low Limit for the uncorrected value is set in this field to specify which values can be sent to the application.

Adv Setup

Adv Setup

Static Pressure	This is the source register for the live Flowing Pressure.
Pulse Input	This is the source register for the Pulse Input. On-board pulse input registers can be found on the Digital Inputs tab under the I/O Interface tree-view item.
Temperature	This is the source register for the live Flowing Temperature.
Static Pressure Type	Select whether the static pressure is coming from a Gauge or Absolute pressure device.
Use Fixed Static Pressure	Select Yes to use the Fixed Static Pressure instead of a measured pressure. Used for AGA-7 tubes when static pressure is not available.
Fixed Static Pressure	This is the Static Pressure value used in the flow calculations if the Use Fixed Static is set to Yes.
RTD Installed	Set to Yes if the Flowing Temperature is brought in live via an outside source such as an RTD, analog input, etc.
Use Fixed Temperature	Yes will cause the Fixed Temperature to be used in flow calculations.
Fixed Temperature	Enter a value for the Fixed Temperature which will be used if the Use Fixed Temperature option is set to Yes.

No Flow

Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DI Action	Select whether an Open Contact or a Closed Contact constitutes a No Flow condition.
Flow State	Displays the Flow State as Flow or No Flow based on the Digital Input specified above and the DI Action selected.

Coriolis Setup

Coriolis Device	The Coriolis Device field is a drop-down list where the user will set the device number that corresponds to the Mass Flow Register of that device. For example, if the user has three tubes instantiated, the first tube would have a Coriolis Device selection of Device 1, the second tube would have a Coriolis Device selection of Device 2, etc. In instances where the user elects to have a bidirectional tube, each forward and reverse application tube pair should correspond to one device.
Flow Register	Specify the address of the tube's flow rate register. This would typically be the tube's application number above plus the standard Volume Flow Rate register 7.19. (xx.7.19)

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on ACF Low	If set to Yes, the digital output will be tripped on the ACF Low alarm. Alarm limits are set in the Limits tab.
Trip on ACF High	If set to Yes, the digital output will be tripped on the ACF High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on FR Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on FR High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.

DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

K Factor

The K Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measuring hardware. Therefore, the number of pulses is multiplied by the K Factor to get the actual cubic feet which is known as the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions thus corrected volume. This variable can also be entered in the Calibration section.

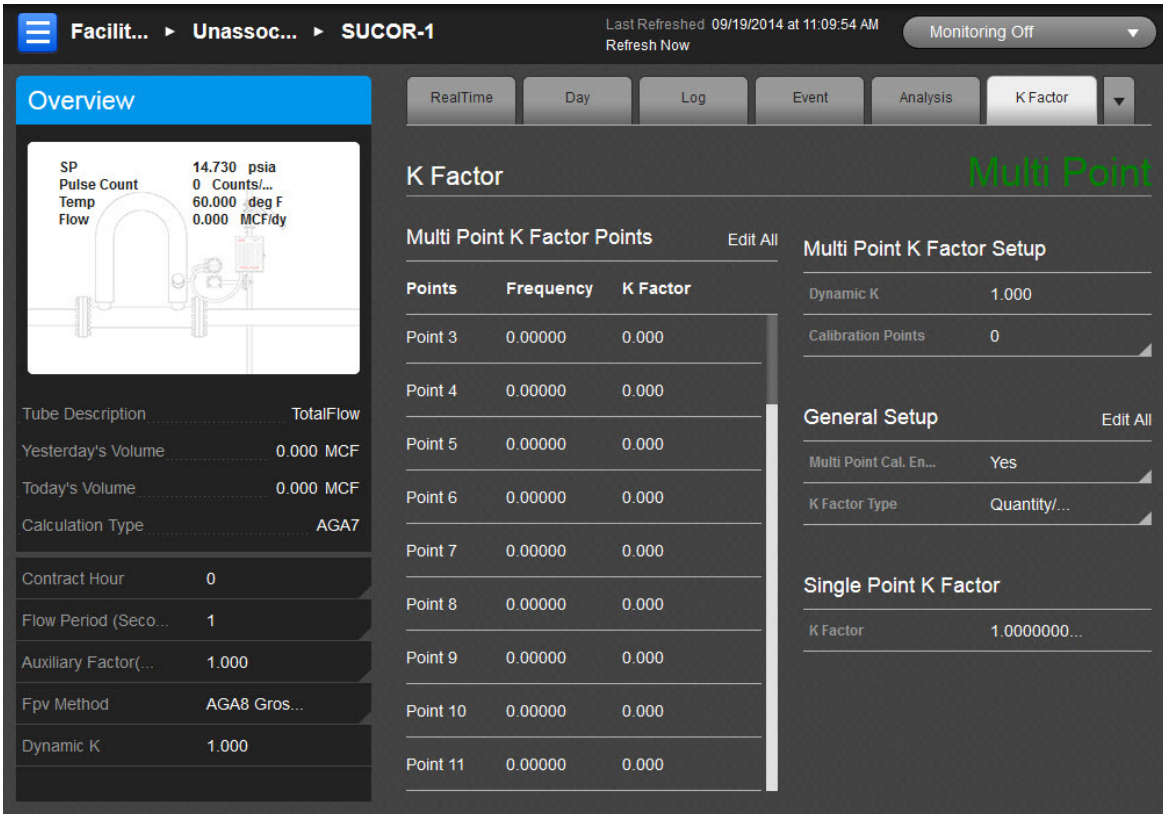
Note: Items that require engineering units have a Variable Group number in the Description column beside the description. The user may need to change units for a particular Variable Group or change the Multiplier for a Variable Group which is done on the Units tree-view item under the corresponding measurement tube. Click on the Units tree-view item, and note that all tabs have a left-hand column that contains the Application, Array, Register numbers (xx.xx.xx), and in this case, the last set of numbers match the associated Variable Group number. If the user needs to change the engineering units, they would click on the Units tree-view item, and look at the left column of each tab to locate the Variable Group whose last set of numbers as represented by "yy" (xx.xx.yy) match the Group number they are looking for. Keep in mind that changing the Units for a particular Variable Group will typically affect more than one item.

After selecting the K Factor tab, the first choice is to determine the K Factor Mode under the General Setup section. Options are either Single Point or Multi Point. In this case the Single Point was selected and displays in the upper right hand corner of the screen (green). The Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse) .

The following information explains the remaining portions of the Single Point page:

Single Point K Factor Points	This field is read only. There is no access to selecting calibration points unless in Multi Point mode.
MultiPoint K Factor Setup	Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on
General Setup	The following read/write fields are active and defined in Single Point mode: • Multi Point Calibration Enable - the user can elect to enable or cancel a Multi Point calibration

	• K Factor Type - the user can define the K Factor as either Quantity/Pulse or Pulse/Quantity
Single Point K Factor	The user is enabled to define the K Factor in the Single Point mode



If the user selects instead the Multi Point option under the K Factor Mode (General Setup), Multi Point will display (green) in the upper right corner of the screen. Again, the Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse) . A major change in the Overview part of the screen is that Dynamic K displays in the read-only field where K Factor had displayed previously.

The following information explains the remaining portions of the Multi Point page:

MultiPoint K Factor Points	Up to 11 points can be defined by the user for these fields but the Edit All convention must be used since no single row edits are able to be defined individually only collectively.
MultiPoint K Factor Setup	The two following fields are defined: • Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on • Calibration Points - displayed as read/write by the user.
General Setup	The following read/write fields are active and defined in Multi Point mode: • Multi Point Enable - the user can elect to enable or cancel a Multi Point calibration

	• K Factor Type - the user can define the K Factor as either Pulse/Quantity or Quantity only
Single Point K Factor	This field is read only in Multi Point mode.

There will also be two buttons available to the user: Abort Calibration (Cancel) and Complete Calibration (Commit).

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Last Calc Vol	Displayed in SCF (standard cubic feet)	Last Calc Prime (cp)	Displays Constant Pressure (Cp) divided by Constant Volume (Cv) yields the Specific Heat Ratio
Last Calc Mass	Displayed in lbm (pounds of mass)	Last Calc Faux	Faux defaults to 1.00000 but can be changed in the Constants tab by the user.
Last Calc UMass	Displayed in lbm (pounds of mass)	Last Calc Temperature Correction Factor (Ftb)	Displays the Last Calculated Temperature Base Factor (Ftb)
Last Calc Energy	Displayed in MBtu (thousands of British thermal units)	Last Calc Pressure Correction Factor (Fpb)	Displays the Last Calculated Pressure Correction (Fpb) Factor
Last Calc Real Gravity	Displayed as a ratio of the density of the sample to the density of water	Last Calc Base Compressibility	Displays the Last Calculated Base Compressibility value
Last Calc Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.	Last Calc Flowing Compressibility	Displays the Last Calculated Flowing Compressibility value
Last Calc Input AP	Displays last live reading in PSIA (pounds per square inch absolute)	Last Calculated (Supercompress)^2	Displays the Last Calculated Supercompressibility value
Last Calc AP	Displays last static pressure reading in PSIA (pounds per square inch absolute)	Last Calc Base Density	Displays the Last Calculated Base Density value

Last Calc Pressure Base	Displayed in PSIA (pounds per square inch absolute)	Last Calc K Factor	Displays the Last Calculated K Factor value
Last Calc Temperature Base	Displays in Degrees F.	Last Calc Pulse Count	Displays the Last Calculated total number of pulses
Last Calc Input Temperature	Displays in Degrees F.	Heating Value Selected	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated Volume or Mass times the Heating Value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
Last Calc Flowing Temperature	Displays in Degrees F.	Energy Vol Based	Using the heating value times volume to calculate the energy
Last Calc Cp_s		Energy Mass Based	Using the heating value times mass to calculate the energy
		Gravity	The Specific gravity or Base gravity, as it is called in liquid calculations, defaults to .658 but an accurate gravity if known should be entered.

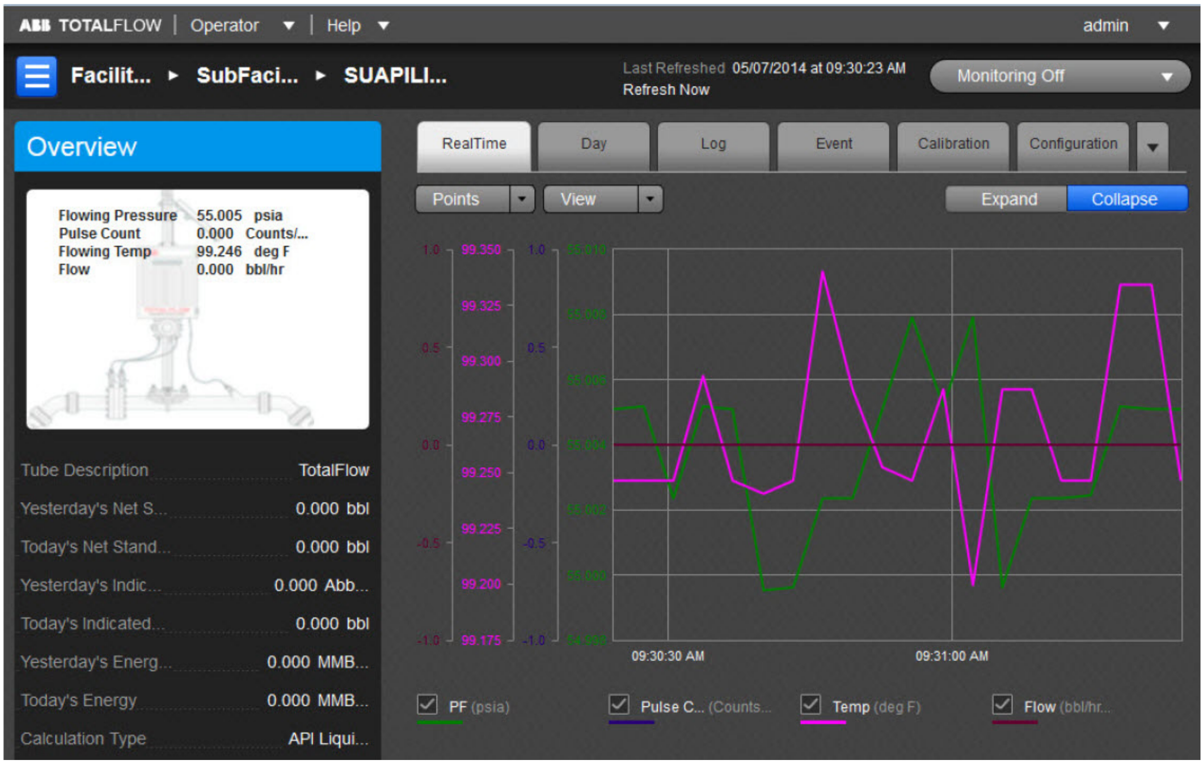
SU Liquid

Overview

Oil and natural gas wells require the removal of liquids as part of the production process. Liquid removal can be accomplished through the use of an electric motor driven pump.

Expert monitoring and control of the electric motor is a key requirement to insure the safe and extended operation of the pumping system. Equally important, is the need to measure the produced liquid, the natural gas, and the holding tank levels, and the need to control the gas sales.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measurement (inH2O) but in another country may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added to the AGA-3 and AGA-7. Thus the new nomenclature of SUAGA-7 is to signify this functionality.



The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) SULiquid measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Tube Description	Enter up to 24 alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Yesterday's Net Standard Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Net Standard Volume	Displays the total Net Standard Volume from the Start Date/Time to the End Date/Time.
Yesterday's Indicated Volume	Displays Yesterday's total Indicated Volume from the Start Date/Time to the End Date/Time.
Today's Indicated Standard Volume	Displays Today's total Indicated Standard Volume from the Start Date/Time to the End Date/Time
Yesterday's Energy	Prior Contract Day's energy.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Calculation Type	Displays the type of flow calculation which is API Liquid. This is a read-only parameter.

The user can establish the parameters for the SULiquid application using the read/write fields provided. These parameters are as follows:

Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
K Factor	K Factor specifies the number of pulses required per volume of liquid. To get the Indicated Volume, the number of pulses is divided by the K Factor or multiplied by

	the inverse of the K Factor depending on whether the K Factor method is set to Volume/Pulse or Pulse/Volume.
Meter Factor	Select whether the turbine meter or device generating the pulses is designed to output pulses based on pulses per volume or volume per pulse and enter that value here. The K-factor for the device is entered in Calibration mode.
Flow Period (Seconds)	Flow Period is fixed at one second for API Liquid tubes. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period is not included in the log period averages. This variable can also be entered in the Calibration section.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Calibration. The seventh (Adv Setup), eighth (Digital Output), ninth (K Factor) and tenth (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Configuration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the range of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

Pulses	This field represents the total number of counts for the flow period.
PF	This field represents the Flowing Pressure. The value shown is the average of one second samples for the day.

TF	This field represents the Flowing Temperature. The value shown is the average of one second samples for the day.
Indicated Volume	Displays the total Indicated Volume for the Contract Day. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an Indicated Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Net Standard Volume	Displays the total Net Standard Volume from the Start Date/Time to the End Date/Time.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Pulse Min	Displays the minimum recorded pulses in any flow period (1 sec) from the Start Date/Time to the End Date/Time.
Pulse Max	Displays the maximum recorded pulses in any flow period (1 sec) from the Start Date/Time to the End Date/Time.
IV Percent Low	Percentage of the time that the Indicated Volume is below the Indicated Volume.
IV Percent Hi	Percentage of the time that the Indicated Volume is above the Indicated Volume High Limit.
PF Min	Displays the minimum Flowing Pressure recorded by a one second sample during the Contract Day.
PF Max	Displays the maximum Flowing Pressure recorded by a one second sample during the Contract Day.
PF Percent Low	Displays the percentage of time the Flowing Pressure was below the low limit during the Contract Day.
PF Percent Hi	Displays the percentage of time the Flowing Pressure was above the high limit during the Contract Day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device’s processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

Pulses	This field represents the total number of counts for the flow period.
PF	This field represents the Flowing Pressure. The value shown is the average of one second samples for the day.
TF	This field represents the Flowing Temperature. The value shown is the average of one second samples for the day.
IV	Displays the total Indicated Volume for the Contract Day. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an Indicated Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
NSV	Displays the total Net Standard Volume from the Start Date/Time to the End Date/Time.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Flow Time	Flow Time is a read only window which displays the time period in seconds. Flow Time is used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the log period averages and therefore no volume during that flow period. Flow Period can also be viewed in the Entry Mode under the tube's Setup/General tab.
Period Time	Displays the total seconds from Start Date/Time to End Date/Time when there was flow. Flow is defined as any Flow Period (1 sec.) that contained pulses. Displays the time period in seconds (86400 secs = full day).

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Date/Time	This field displays the date/time of the event.
Event	This field displays the type of event that occurred.

Old Value	This field represents the value or condition that existed prior to the event. For example, using an SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For example, using an SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

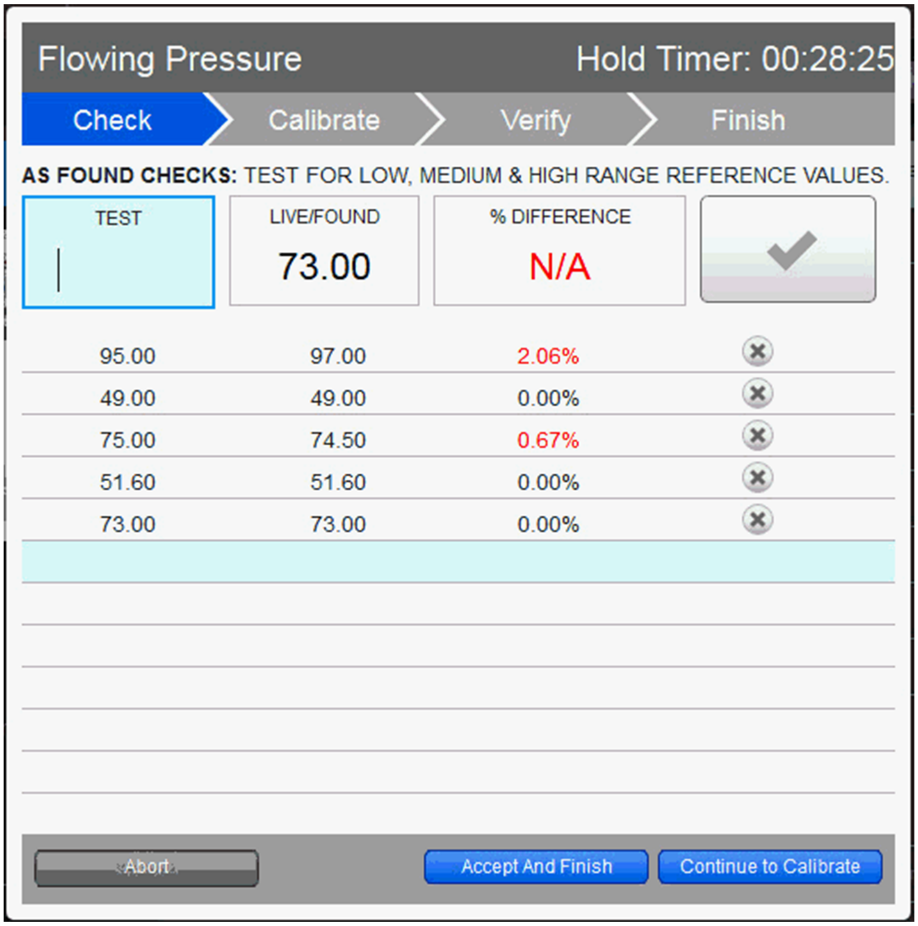
Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check.

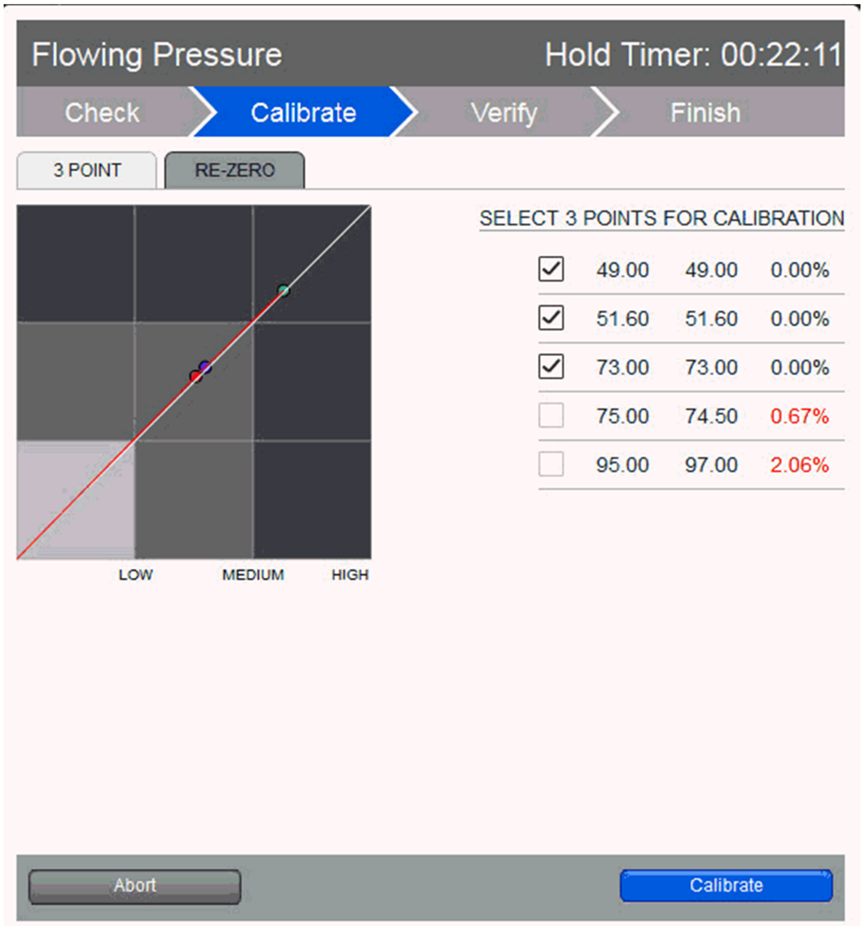
To start the calibration, select the type. Note the display of the Calibration Options fields change depending on the calibration type selected as follows:

Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timeout	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate in Absolute?	This option is simply an aid for doing Static Pressure checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

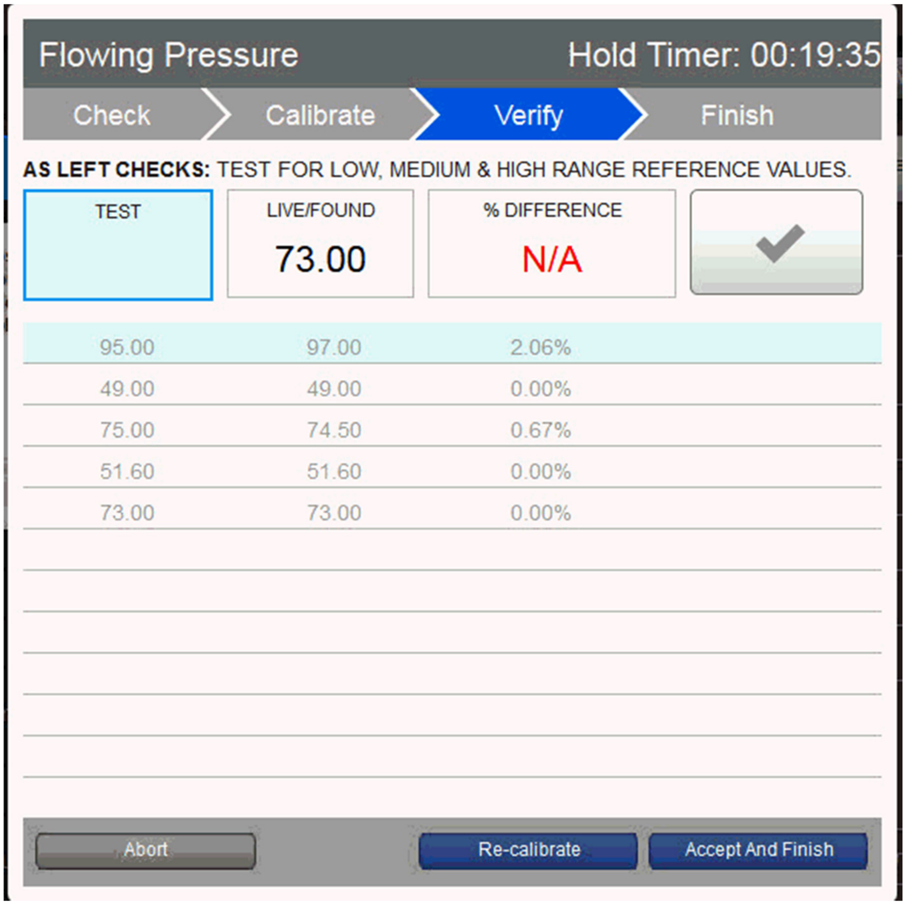
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process. The tube goes into the Hold state and the hold timer value for that tube is displayed on the right corner of the tab (defaults to 3600 seconds or one hour).



The Flowing Pressure (FP) Calibration Check screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.

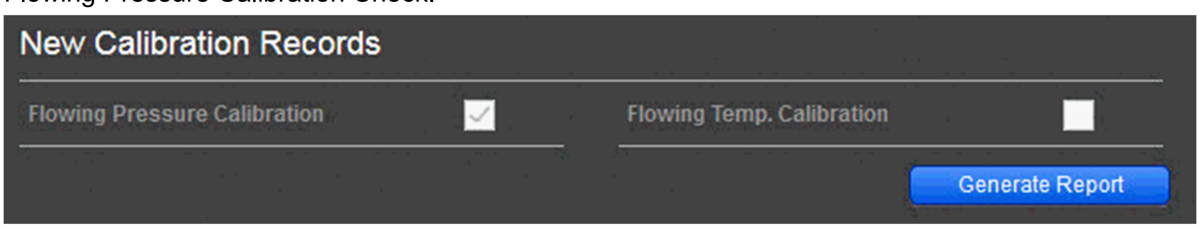


If the user chooses to calibrate, the Calibrate screen will display with the points plotted and listed in a table. If a 3-point calibration had been selected in setup but had done more than three checks, the user would have the option to check the boxes of desired points to use for the calibration. If however, a 3-point calibration was set up and three checks were done, naturally there is no option. Click the Calibrate button to continue.



If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

The final Calibration Check is the one for Flowing Temperature. This process is also the same as the Flowing Pressure Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following eight (8) areas of fields are accessible to the user:

- Constants

- Commands
- Fixed Values on Errors
- Log Capacity
- Setup
- Current Values
- Limits
- Liquids

The following information is provided in relation to all parameters and their fields:

Constants

Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure.
K Factor	K Factor specifies the number of pulses required per volume of liquid. To get the Indicated Volume, the number of pulses is divided by the K Factor or multiplied by the inverse of the K Factor depending on whether the K Factor method is set to Volume/Pulse or Pulse/Volume.
Pipe Diameter (ID)	Inside diameter of the pipe where it is connected to the liquid meter. Pipe diameter is for informational purposes only and is not used in any calculations.
Use Meter Correction Factor	Select Yes to use the Meter Correction Factor entered below. A meter's performance will change over time, this change can be due to mechanical wear or to a change in the physical properties of the liquid being metered. Therefore a meter is proved or verified to establish its meter factor (MF), which is used to adjust the indicated volume of a meter during a transfer.
User Entered Meter Correction Factor	If Use Meter Correction Factor was set to Yes, enter the Meter Correction Factor here.
Heating Value @ Tb and Pb	The user can enter a heating value or use the default of 1000. Heating value is multiplied times either the volume or mass depending on which was selected on the General tab to obtain the energy value.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator.

	· Begins a new flow file daily record.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Fixed Values on Errors

Use User Entered Flowing Pressure on Error	Select Yes or No on whether to use the User Entered Flowing Pressure Value when a high or low error occurs.
User Entered Flowing Pressure Value	If Use User Entered Flowing Pressure On Error is set to Yes, enter a flowing pressure value to be used when a high or low error occurs.
Flowing Pressure High Error	Enter a value that will cause a Flowing Pressure High Error condition.
Flowing Pressure Low Error	Enter a value that will cause a Flowing Pressure Low Error condition.
Use User Entered Flowing Temp on Error	Select Yes or No on whether to use the User Entered Flowing Temperature Value when a high or low error occurs.
User Entered Flowing Temp Value	If Use User Entered Flowing Temp On Error is set to Yes, enter a flowing temperature value to be used when a high or low error occurs.
Flowing Temperature High Error	Enter a value that will cause a Flowing Temperature High Error condition.
Flowing Temperature Low Error	Enter a value that will cause a Flowing Temperature Low Error condition.

NOTE: Engineering units are established on the Selectable Units Setup tab accessible by clicking on the Station ID. The Station ID is the very top name on the tree-view.

Liquid

Liquid Type	Select the type of liquid from the drop-down list. If the liquid being metered does not fit one of the standard categories, Special Appl. can be selected, however, the user must enter a value for the Liquid Thermal Expansion

	Factor shown below. Special Applications generally apply to fairly pure products and have been tested to establish a specific thermal expansion factor. Available selections are: · Crude Oil - Adheres to API 11.1 · Fuel Oil - Adheres to API 11.1 · Jet Fuel - Adheres to API 11.1 · Transition/Diesel - Adheres to API 11.1 · Gasoline - Adheres to API 11.1 · Lube Oil - Adheres to API 11.1 · Special Appl - Adheres to API 11.1 · Water - Adheres to API 11.1 · Light Hydros - Adheres to API 11.2
Equilibrium Vapor Pressure	Enter a value for the Equilibrium Vapor Pressure. This factor is only used for liquids with an equilibrium vapor pressure greater than atmospheric, the equilibrium vapor pressure will be subtracted from the pressure input values before entering the calculation routines.
Sediment and Water Type	Select whether the Sediment & Water is Measured or User Entered.
Sediment and Water Percentage	If User Entered was selected for the Sediment & Water Type, enter a percentage value for the Sediment & Water content here.
Thermal Expansion Factor Type (Alpha60)	Select either Calculated or User Entered. User Entered may be used if the Alpha 60 for the measured liquid is known, but is required if Special Appl was selected above as the Liquid Type.
User Entered Thermal Expansion Factor (Alpha60)	If User Entered was selected for the Thermal Expansion Factor Type, enter a value here. Used typically because the Special Appl. category was selected above and an Expansion Factor has been established for the liquid.
Density Type	Select whether the Density Type is to be Measured or User Entered.
User Entered Density Type	If User Entered was selected for the Density Type, select either Base/Standard or Flowing. The Base/Standard condition is a defined combination of temperature and pressure at which liquid volumes are expressed for purposes of custody transfer. Flowing density is a user entered value based on a known or measured temperature and pressure.
Enter Density/Gravity As	If User Entered was selected for the Density Type, one of the four Density/Gravity methods (kg/m3, g/cc, Specific Gravity, API Gravity) was selected and will be represented by the Raw User Entered Density/Gravity value below. Setup was on the Liquids tab of Entry mode Setup.
Raw User Entered Density/Gravity	If Density Type is User Entered, enter a Density/Gravity value for the liquid representing the units or method as selected above.
Converted Density in User Unit	If Density Type is User Entered, this cell displays the converted units. The Raw User value entered above is converted to system units chosen on the Selectable Units Setup tab.(.e.g., the raw user value could be entered as API Gravity, and the converted value would be displayed as lbm/ft3) if selected in the Selectable Units Setup.
Use Temp Correction Factor (Ctl)	Select Yes or No as to whether or not to use the Temperature Correction Factor.

Temp Correction Factor Type (Ctl)	Select whether the Temperature Correction Factor is to be Calculated or User Entered.
User Entered Temp Correction Factor (Ctl)	If you specified above to Use Temp Correction Factor and specified User Entered, enter that value here.
Use Pressure Correction Factor (Cpl)	Select Yes or No as to whether or not to use the Pressure Correction Factor.
Pressure Correction Factor Type (Cpl)	Select whether the Pressure Correction Factor Type is to be Calculated or User Entered.
User Entered Pressure Correction Factor (Cpl)	If you specified above to Use Pressure Correction Factor and specified User Entered, enter that value here.
Base Pressure	Select one of the Base pressures from the list. These pressures are from the API 11.1 standards.
Base Temperature	Select one of the Base temperatures from the list. These temperatures are from the API 11.1 standards.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	Enter up to ten alpha-numeric characters for the Device/APP ID. This identifies the specific application or flow calculation. A Station or device can have multiple flow calculations running simultaneously, and each of those will have their own Device/APP ID.
Tube Description	Enter up to 24 alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Vol Calc Period	This is the frequency at which the volume is calculated based on one second averages of flowing pressure, flowing temperature and one second Flow Period counts.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file.
Flow Period (Seconds)	Flow Period is fixed at 1 second for API Liquid tubes. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period is not included in the log period averages. This variable can also be entered in the Calibration section.
Calculation Type	Displays the type of flow calculation which is API Liquid. This is a read-only parameter.

K-Factor Type	Select whether the K Factor is based on Quantity per Pulse or Pulse per Quantity. The actual K Factor value is entered on the Constants tab.
Heating Value Method	Select either Volume Based or Mass Based. The heating method is multiplied times the volume or the mass to calculate the energy.
Ticket Number	This is a manually entered number assigned by an operator to a measurement ticket using the company's numbering system. The measurement ticket is used in a batch mode and is a written acknowledgement of the transfer of a particular amount of liquid and serves as the legal document of transfer.
Meter Body Serial Number	Enter the serial number of the primary metering device. This is the serial number on the body of the meter. Changing this serial number will cause an event in the Events record.
Meter Internals Serial Number	Enter the serial number of the internal mechanism. Changing this serial number will cause an event in the Events record.

Current Values

Today's Indicated Volume	Updated at the end of each Volume Calculation Period. At the end of each Calculation Period, the counts for the period are multiplied times the K Factor to produce an Indicated Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Indicated Standard Volume	Updated at the end of each Volume Calculation Period. · Indicated Std. Volume = Counts per period x K Factor · Indicated Std. Volume = Indicated x Ctl & Cpl Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Gross Standard Volume	Updated at the end of each Volume Calculation Period. · Indicated Volume = Counts per period x K Factor · Indicated Std. Volume = Indicated Volume x Ctl & Cpl · Gross Std. Volume = Indicated Std. Volume x Meter Factor Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Net Standard Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Sediment and Water Volume	At the end of each Volume Calculation Period, Sediment & Water Volume is calculated using the equation: S&W Volume = GSW-[GSW*(1-(%S&W/100))] GSW=Gross Std. Volume %S&W=user entered % of Sediment & Water. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.

Today's Mass	Updated at the end of each Volume Calculation Period. Each Volume Calculation mass is added to the current mass for the duration of the Contract Day.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Yesterday's Indicated Volume	Prior Contract Day's Indicated Volume. (See Today's Indicated Volume above for the calculation procedure.)
Yesterday's Indicated Standard Volume	Prior Contract Day's Indicated Standard Volume. (See Today's Indicated Standard Volume above for the calculation procedure.)
Yesterday's Gross Standard Volume	Prior Contract Day's Gross Standard Volume. (See Today's Gross Standard Volume above for the calculation procedure.)
Yesterday's Net Standard Volume	Prior Contract Day's Net Std. Volume. (See Today's Net Std. Vol. for calculation procedure.)
Yesterday's Sediment and Water Volume	Prior Contract Day's Sediment and Water Volume. (See Today's Sediment and Water Volume above for the calculation procedure.)
Yesterday's Mass	Prior Contract Day's Mass.
Yesterday's Energy	Prior Contract Day's energy.
Accumulated Indicated Volume	Running total of the Indicated Volume which is updated at the end of each Volume Calculation Period. See Today's Indicated Volume above for the calculation procedure.
Accumulated Indicated Standard Volume	Running total of the Indicated Standard Volume which is updated at the end of each Volume Calculation Period. See Today's Indicated Standard Volume above for the calculation procedure.
Accumulated Gross Standard Volume	Running total of the Gross Standard Volume which is updated at the end of each Volume Calculation Period. See Today's Gross Standard Volume above for the calculation procedure.
Accumulated Net Standard Volume	Running total of the Net Standard Volume which is updated at the end of each Volume Calculation Period. See Today's Net Standard Volume above for the calculation procedure.
Accumulated Sediment and Water Volume	Running total of the Sediment and Water Volume which is updated at the end of each Volume Calculation Period. See Today's Sediment and Water Volume above for the calculation procedure.
Accumulated Mass	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the mass is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Energy	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the energy is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Last Calculated Indicated Volume	Volume for the last Volume Calculation Period.
Last Calculated Indicated Standard Volume	Uncorrected Volume for the last Volume Calculation Period.

Last Calculated Gross Standard Volume	Updated at the end of each Volume Calculation Period: · Counts per period x K Factor = Indicated Volume · Indicated Volume x Ctl & Cpl = Indicated Std. Volume · Indicated Std. Volume x Meter Factor = Gross Std. Volume
Last Calculated Net Standard Volume	Updated at the end of each Volume Calculation Period: · Counts per period x K Factor = Indicated Volume · Indicated Volume x Ctl & Cpl = Indicated Std. Volume · Indicated Std. Volume x Meter Factor = Gross Std. Volume · Gross Std. Volume x Sediment & Water Factor = Net Std. Volume
Last Calculated Sediment and Water Volume	At the end of each Volume Calculation Period, Sediment & Water Volume is calculated using the equation: S&W Volume = GSW-[GSW*(1-(%S&W/100))] GSW=Gross Std. Volume %S&W=user entered % of Sediment & Water.
Last Calculated Mass	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume / Flowing Density The Flowing Density is either calculated or user entered.
Last Calculated Energy	At the end of each Volume Calculation Period, Energy is calculated using the equation: Energy = Indicated Volume x Heating Value.

Limits

Flowing Pressure High Limit	This represents the higher limit of the Flowing Pressure value that can be sent to the tube application.
Flowing Pressure Low Limit	This represents the lower limit of the Flowing Pressure value that can be sent to the tube application.
Flowing Temp High Limit	This represents the higher limit of the total Flowing Temperature value that can be sent to the tube application.
Flowing Temp Low Limit	This represents the lower limit of the total Flowing Temperature value that can be sent to the tube application.
Gross Flow Rate High Limit	Displays the Gross Flow Rate High Limit as specified on the Limits tab of Entry mode Setup.
Gross Flow Rate Low Limit	Displays the Gross Flow Rate Low Limit as specified on the Limits tab of Entry mode Setup.
Ind. Vol. High Limit	Enter a high limit value for the Indicated Volume. Only displayed if Flow Input Type is volume based.
Ind. Vol. Low Limit	Enter a low limit value for the Indicated Volume. Only displayed if Flow Input Type is volume based.

Adv Setup

Adv Setup

Flowing Pressure Input	Enter the current scaled flowing pressure.

Use User Entered Flowing Pressure	Select Yes if a Flowing Pressure value is to be entered.
User Entered Flowing Pressure	Enter a value to be used when the Use User Entered Flowing Pressure is set to Yes.
Flowing Pressure Type	Select whether the Flowing Pressure is coming from a Gauge or Absolute pressure device.
Flowing Temp Input	Enter the current Flowing Temperature value.
Use Fixed Flowing Pressure	Select Yes to use the Fixed Flowing Pressure instead of a measured pressure.
RTD Installed	Select Yes if you are using an RTD for flowing temperature.
Use User Entered Flowing Temperature	Select Yes if a Flowing Temperature is to be used.
User Entered Flowing Temperature	Enter the Flowing Temperature if different than the default of 60 Degrees F.
Flow Input Type	Enter one of the Flow Input Types: (Pulse Input Volume, Pulse Input Mass, Volume Flow Rate, or Mass Flow Rate).
Pulse Input	If Pulse Input Volume or Pulse Input Mass was selected for the Flow Input Type, enter the pulse input register here.

No Flow

Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DI Action	Select whether an Open Contact or a Closed Contact constitutes a No Flow condition.
Flow State	Displays the Flow State as Flow or No Flow based on the Digital Input specified above and the DI Action selected.

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on Indicated Vol/Period Mass Low	If set to Yes, the digital output will be tripped on the Indicated Volume or Calculation Period Mass low alarm.
Trip on Indicated Vol/Period Mass High	If set to Yes, the digital output will be tripped on the Indicated Volume or the Calculation Period Mass high alarm.
Trip on PF Low	If set to Yes, the digital output will be tripped on the Flowing Pressure Low alarm. Alarm limits are set in the Limits tab.
Trip on PF High	If set to Yes, the digital output will be tripped on the Flowing Pressure High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.

Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on Gross FR Low	If set to Yes, the digital output will be tripped on the Gross Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on Gross FR High	If set to Yes, the digital output will be tripped on the Gross Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2

(Same as Digital Output 1)

K Factor

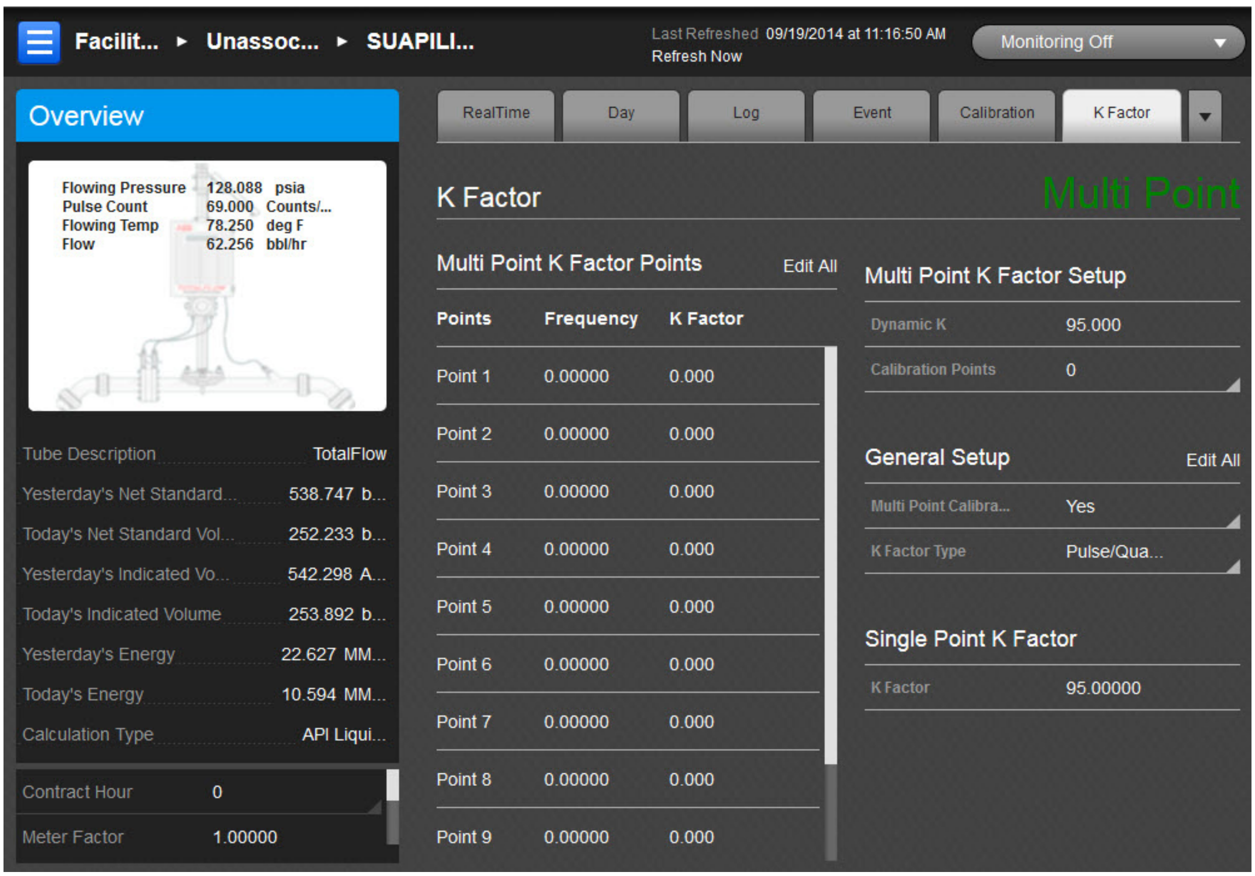
The K Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measuring hardware. Therefore, the number of pulses is multiplied by the K Factor to get the actual cubic feet which is known as the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions thus corrected volume. This variable can also be entered in the Calibration section.

Note: Items that require engineering units have a Variable Group number in the Description column beside the description. The user may need to change units for a particular Variable Group or change the Multiplier for a Variable Group which is done on the Units tree-view item under the corresponding measurement tube. Click on the Units tree-view item, and note that all tabs have a left-hand column that contains the Application, Array, Register numbers (xx.xx.xx), and in this case, the last set of numbers match the associated Variable Group number. If the user needs to change the engineering units, they would click on the Units tree-view item, and look at the left column of each tab to locate the Variable Group whose last set of numbers as represented by "yy" (xx.xx.yy) match the Group number they are looking for. Keep in mind that changing the Units for a particular Variable Group will typically affect more than one item.

After selecting the K Factor tab, the first choice is to determine the K Factor Mode under the General Setup section. Options are either Single Point or Multi Point. In this case the Single Point was selected and displays in the upper right hand corner of the screen (green). The Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse).

The following information explains the remaining portions of the Single Point page:

Single Point K Factor Points	This field is read only. There is no access to selecting calibration points unless in Multi Point mode.
MultiPoint K Factor Setup	Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on
General Setup	The following read/write fields are active and defined in Single Point mode: • Multi Point Calibration Enable - the user can elect to enable or cancel a Multi Point calibration • K Factor Type - the user can define the K Factor as either Quantity/Pulse or Pulse/Quantity
Single Point K Factor	The user is enabled to define the K Factor in the Single Point mode



If the user selects instead the Multi Point option under the K Factor Mode (General Setup), Multi Point will display (green) in the upper right corner of the screen. Again, the Factor Type is then selected depending on whether the number of pulses is divided by the K Factor (Volume/Pulse) or multiplied by the inverse of the K Factor (Quantity/Pulse) . A major change in the Overview part of the screen is that Dynamic K displays in the read-only field where K Factor had displayed previously.

The following information explains the remaining portions of the Multi Point page:

MultiPoint K Factor Points	Up to 11 points can be defined by the user for these fields but the Edit All convention must be used since no single row edits are able to be defined individually only collectively.

MultiPoint K Factor Setup	The two following fields are defined: • Dynamic K - displays the current K factor assuming a successful multipoint calibration has been completed and the multipoint calibration feature has been turned on • Calibration Points - displayed as read/write by the user.
General Setup	The following read/write fields are active and defined in Multi Point mode: • Multi Point Enable - the user can elect to enable or cancel a Multi Point calibration • K Factor Type - the user can define the K Factor as either Pulse/Quantity or Quantity only
Single Point K Factor	This field is read only in Multi Point mode.

There will also be two buttons available to the user: Abort Calibration (Cancel) and Complete Calibration (Commit).

Last Calculated Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Indicated Flow Rate	The Indicated Flow Rate is the Indicated Volume for the Volume Calculation Period. (See Indicated Volume below.)	Pressure Correction Factor	Cpl for the Volume Calculation Period depending how it is setup on the Liquids tab is either calculated or is a user entered value. For calculation method see the appropriate API document.
Indicated Standard Flow Rate	The Indicated Std. Flow Rate is the Indicated Std. Volume for the Volume Calculation Period.	Combined T and P Factor (Ctpl)	The Combined T & P Factor is calculated by the equation: Ctpl = Ctl x Cpl
Gross Standard Flow Rate	The Gross Std. Flow Rate is the Gross Std. Volume for the Volume Calculation Period. (See Gross Std Volume below.)	Compressibility Factor (Fp)	This is the compressibility factor of liquid in a meter at normal operating conditions.
Net Standard Flow Rate	The Net Std. Flow Rate is the Net Std. Volume for the Volume Calculation Period.	Thermal Expansion Factor	Thermal expansion factor of the liquid @ 60 degrees F. Either user entered or calculated.
Sediment and Water Flow Rate	The Sediment & Water Flow Rate is the Sediment & Water Volume for the Volume Calculation Period.	Temperature at 1968 Standard (Tf68)	This temperature is the value used in calculating Ctl. Calculations adhering to API standards, use the temperature scale based on the 1968 standard (IPTS-68). Therefore, this temperature is a

			conversion from the measured temperature which adheres to the 1990 standard (ITS-90).
Mass Flow Rate	The Mass Flow Rate is the Mass Volume for the Volume Calculation Period.	Temperature at 1990 Standard (Tf90)	This is the measured temperature. Current temperature measurement devices are calibrated using the 1990 standard (ITS-90 temperature scale) as published by the International Committee for Weights and Measurements.
Energy Flow Rate	The Indicated Flow Rate as shown times the Heating Value.	Base Pressure	The accepted base pressure in the U.S. is 14.696 psia.
Indicated Volume	Updated at the end of each Volume Calculation Period. · Counts per period x K Factor = Indicated Volume	Base Temperature	The accepted base temperature in the U.S. is 60 degrees F.
Indicated Standard Volume	Updated at the end of each Volume Calculation Period. · Counts per period x K Factor = Indicated Volume · Indicated Volume x Ctl & Cpl = Indicated Std. Volume	Base Density	Calculated from Flowing Density if provided.
Gross Standard Volume	Updated at the end of each Volume Calculation Period. · Counts per period x K Factor = Indicated Volume · Indicated Volume x Ctl & Cpl = Indicated Std. Volume · Indicated Std. Volume x Meter Factor = Gross Std. Volume	Flowing Density	Measured or Calculated from the provided Base Density.
Net Standard Volume	Updated at the end of each Volume Calculation Period: · Counts per period x K Factor = Indicated Volume · Indicated Volume x Ctl & Cpl = Indicated Std. Volume · Indicated Std. Volume x Meter Factor = Gross Std. Volume · Gross Std. Volume x Sediment & Water Factor = Net Std. Volume	Pipe Diameter (ID)	Entered by user.
Sediment and Water Volume	At the end of each Volume Calculation Period, Sediment & Water Volume is calculated using the equation:	Sediment and Water Correction Factor	Displays the Sediment & Water Correction Factor (CSW). CSW is calculated by the following formula: CSW = [1 - (%S&W/100)]

	S&W Volume = GSW-[GSW*(1-(%S&W/100))] GSW=Gross Std. Volume %S&W=user entered % of Sediment & Water.		%S&W is the user entered or measured percent of sediment & water.
Mass	At the end of each Volume Calculation Period, Mass is calculated using the equation: Mass = Indicated Volume x Flowing Density The Flowing Density is either calculated or user entered.	Heating Value Method	Volume Based or Mass Based as specified on the General tab.
Energy	At the end of each Volume Calculation Period, Energy is calculated using the equation: Energy = Indicated Volume x Heating Value.	Density Iteration	Converged - Calculation of Ctl and/or Cpl had converged within 15 iterations. Not converged - Calculation of Ctl
Temperature Correction Factor (Ctl)	Ctl for the Volume Calculated Period depending how it is setup on the Liquids tab is either calculated or is a user entered value. For calculation method see the appropriate API document.	Volume Correction Error Code	0 - No error 1 - Density out of standards range. 2 - No Alpha60 value. 3 - Temperature out of range. 4 - Pressure out of range. 5 - Alpha60 out of range.

NOTE: Engineering units are established on the Selectable Units Setup tab accessible by clicking on the Station ID. The Station ID is the very top name on the tree-view.

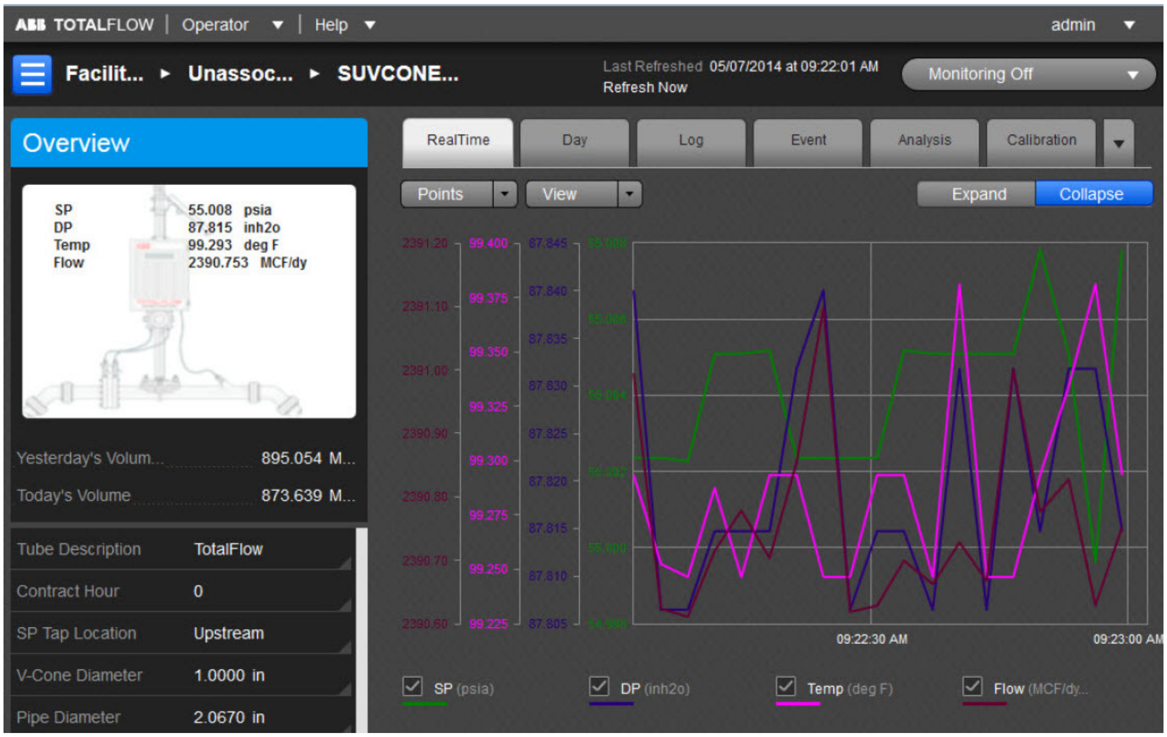
SU V-Cone

Overview

The SU V-Cone is a differential pressure type flow meter with a unique design that conditions the flow prior to measurement.

Differential pressure is created by a cone placed in the center of the pipe. The cone is shaped so that it “flattens” the fluid velocity profile in the pipe, creating a more stable signal across wide flow downturns. Flow rate is calculated by measuring the difference between the pressure upstream of the cone at the meter wall and the pressure downstream of the cone through its center.

Outside of the United States, requirements for standards of measurement may differ from existing domestic standards in the oil and gas industry. For example DP measured in inH2O here in one market but in another country's market may be measured in kg/cm2 instead. To meet such need in the overseas markets, a Selectable Unit (SU) functionality has been added. Thus the new nomenclature of SU V-Cone is to signify this functionality.



The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) V-Cone measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.

The user can establish the parameters for the V-Cone application using the read/write fields provided. These parameters are as follows:

Tube Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
SP Tap Location	From the drop-down list, select the location (upstream, downstream) of the Sp tap in relation to the orifice plate.
V-Cone Diameter	Enter the V-Cone diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Fpv Method	Select the desired supercompressibility method.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. The seventh (Configuration), eighth (Adv Setup), ninth (Digital Output), tenth (V-Cone), eleventh (V-Cone Sizing) and twelfth (Last Calc Values) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the value of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

DP	This field represents the differential pressure. The value shown is the average of one second samples for the day.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Integral	Within this user-defined field the user can elect to hold the valve closed until the Integral enables. The options available are either Enabled or Disabled.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the

	energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
DP Min	Minimum Differential Pressure recorded during the Contract Day.
DP Max	Maximum Differential Pressure recorded during the Contract Day.
DP Percent Low	Displays the percentage of time the Differential Pressure was below the low limit during the Contract Day.
DP Percent Hi	Displays the percentage of time the Differential Pressure was above the high limit during the Contract Day.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Back Flow	Number of one second samples where DP is at least three inches below zero.

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

It is possible to use the mouse to zoom a desired portion of the graph by holding down the left button, rolling the mouse to define the desired area and releasing the left button to capture the area. That portion of the graph will then display proportionately over that area. By selecting the now active House icon to the left of the Expand button, the graph will re-display to its original position.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

DP	This field represents the differential pressure (in H2O).
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Period Time	Displays the time in seconds for the Contract Day. If the system was functioning continuously with no down time, this number should be 86400.

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For a DP or SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For a DP or SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt for either analysis method by selecting the corresponding option as well as the Advanced Setup option.

In Fixed analysis, the user can use the left Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The right Gas Properties column has two read/write fields that can be selected and edited as well. These two fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.

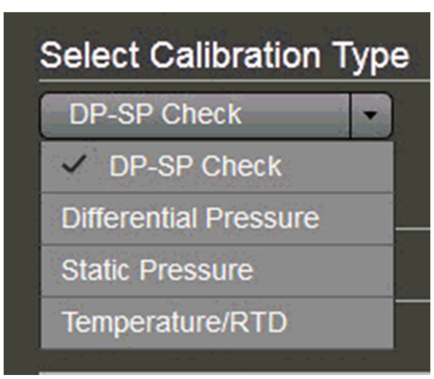
The Others section only has one editable field as follows:

FPV Method	FPV method is then squared (Fpv2) to derive the compressibility factor (Fs) for pulse meters. Available FPV methods are: • NX19 fixed FtFp=0 • NX19 GCN=2 • NX19 GCNM=3 • NX19 Auto=1 • AGA8 Gross Method92=11 • AGA8 Detail 92=12 • ISO 12213-2 • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi • For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check. The options for the checks are as follows:

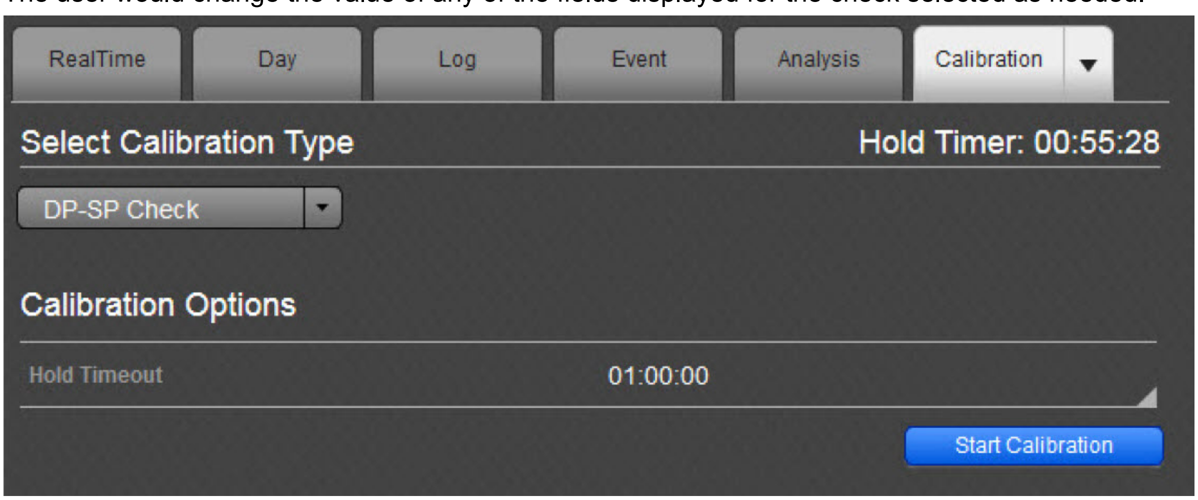
• DP-SP Check
• Differential Pressure
• Static Pressure
• Temperature/RTD



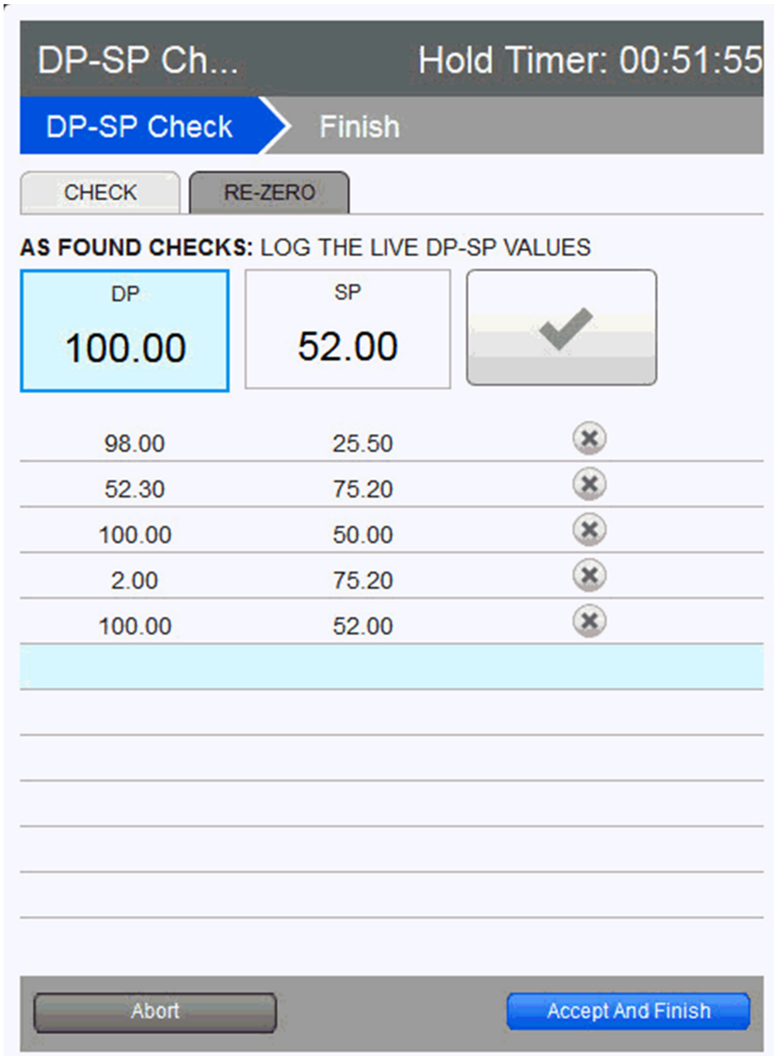
To start the calibration, select the type. Note the display of the Calibration Options fields changes depending on the calibration type selected as follows:

Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timeout	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points depending on the desired accuracy of the calibration. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate in Absolute?	This option is simply an aid for doing checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device's display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

The user would change the value of any of the fields displayed for the check selected as needed.

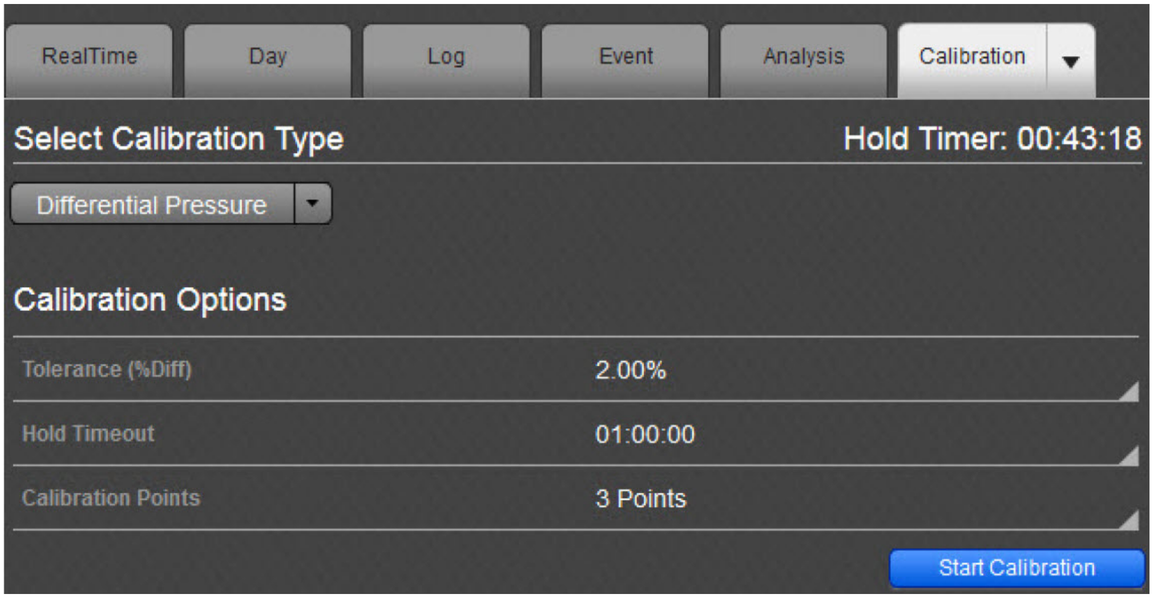


Then the Start Calibration button would be selected to start the process. The tube goes into the Hold state and the hold timer value for that tube is displayed on the right corner of the tab (defaults to 3600 seconds or one hour).



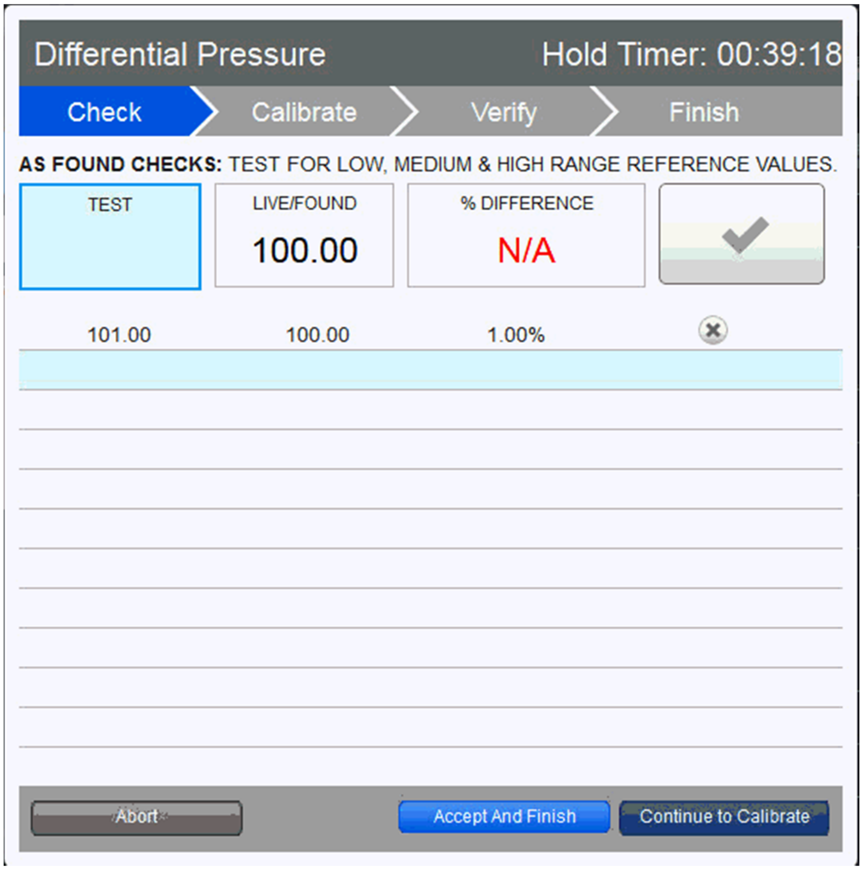
The DP-SP Check screen was designed as a troubleshooting tool so that the static pressure could be varied while at the same time, recording the differential pressure. Any significant change in the DP while changing the SP indicates a problem. The applied static pressure will be displayed in the SP window as well as the differential pressure in the DP window. Clicking on the check mark box will accept the pressures. Repeat the process to enter the number of static pressure points desired. If it's decided that a re-zero is needed before any more checks, click the RE-ZERO tab and a screen will appear to allow the user to re-zero the transducer and return to the Checks screen. The buttons with X's can be used to delete the selected entries from the log until the desired entries are input. Select the Accept & Finish button to complete the entry process which will save the checks as the "As Found" and "As Left" and log the check events. The user can now "Abort" to finish or select the "Add to Report & Finish" button to send the data to reports and finish.

Selecting the Add to Report & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

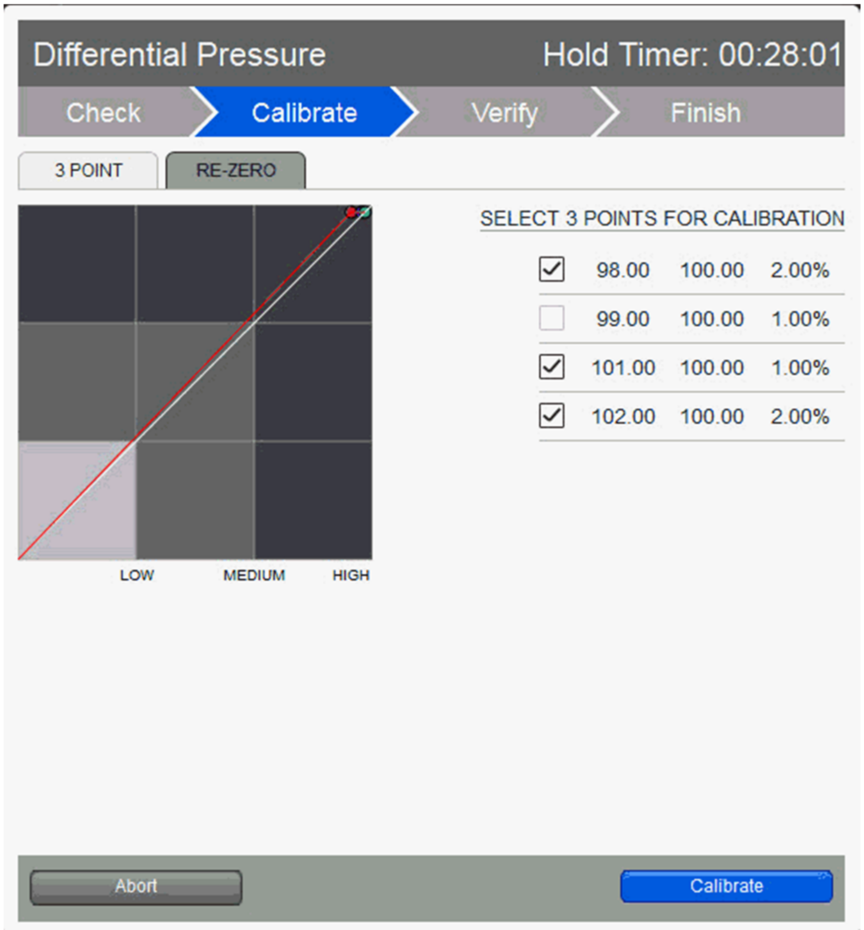


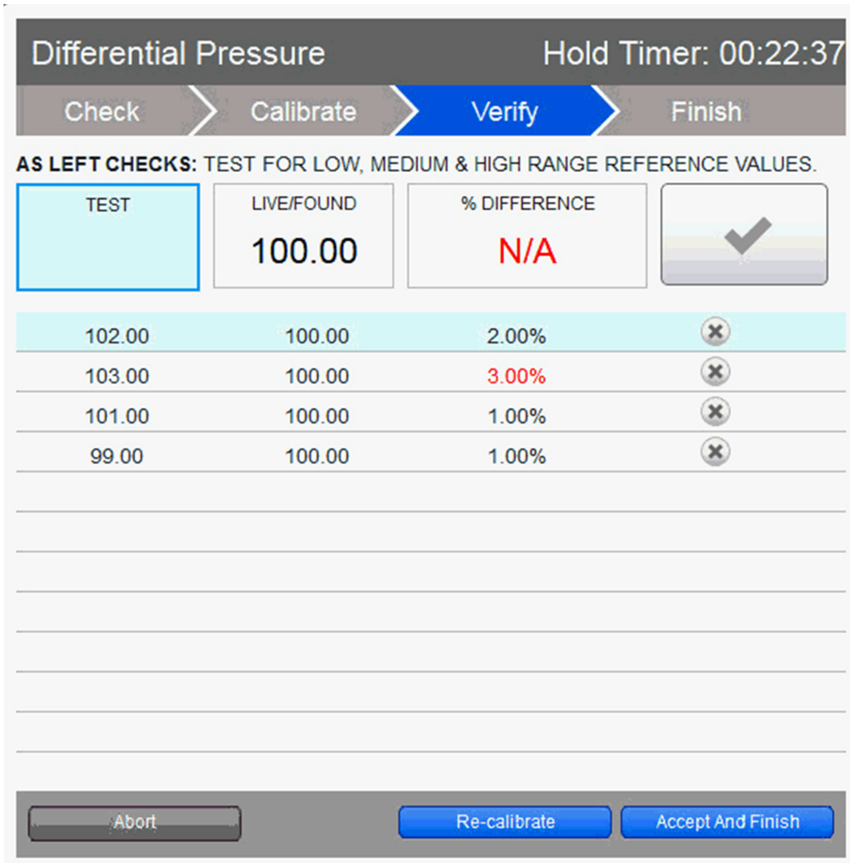
Next select the Differential Pressure Calibration Check and modify the read/write fields if necessary. Then click the Start Calibration to begin. Again the tube goes into the Hold state and the hold timer value for that tube is displayed on the right corner of the tab (defaults to 3600 seconds or one hour).

With the Differential Pressure (DP) Calibration Check, the As Found checks are entered by selecting a low, medium and high value. This is done by selecting a test value and selecting a Check mark to enter the value. The % of difference will also display. Repeat the process to enter the number of points desired. If satisfied the Accept & Finish button is selected and the As Found and As Left values are displayed.

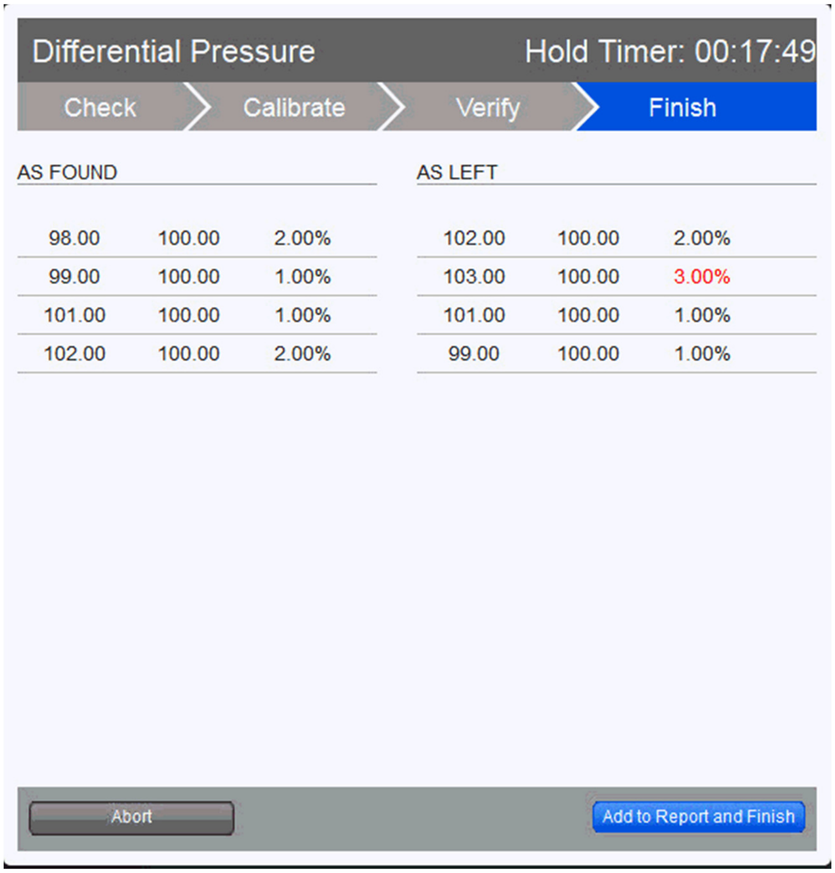


The DP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.


Differential Pressure
Hold Timer: 00:28:01
Check
Calibrate
Verify
Finish
3 POINT
RE-ZERO
SELECT 3 POINTS FOR CALIBRATION
98.00 100.00 2.00%
99.00 100.00 1.00%
101.00 100.00 1.00%
102.00 100.00 2.00%
LOW
MEDIUM
HIGH
Abort
Calibrate

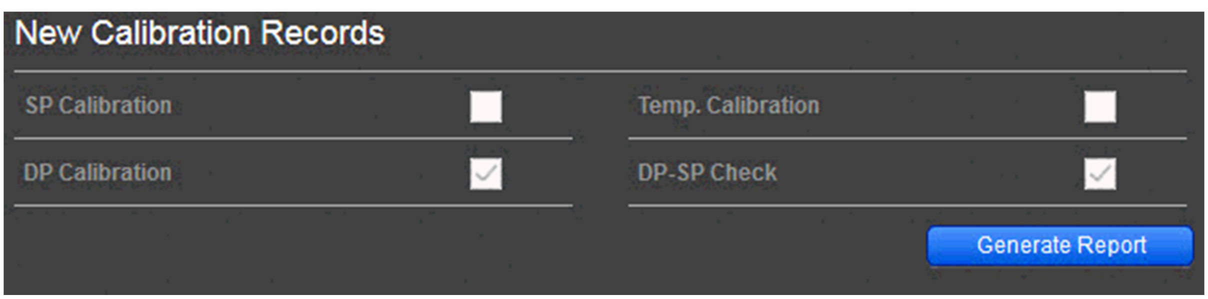


If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.



With the SP Calibration Check, the process is the same as the DP check.

The final Calibration Check is the Temperature/RTD. The process is also the same as the DP Calibration Check and the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following nine (9) areas of fields are accessible to the user:

• Constants
• Factors
• Commands
• Fixed Values on Errors
• Log Capacity
• Setup
• Current Values
• Limits
• Water Constants

The following information is provided in relation to all parameters and their fields:

Constants

Barometric Pressure	Enter a value in the units as specified by the Units column. This value is subtracted from Absolute pressure readings when calibrating in Gauge pressure and for displaying the Static pressure in Gauge pressure on the device's display. This value can also be entered on the calibration screen when calibrating in Gauge pressure.
Dp Zero Cutoff	Enter the value in units as specified. A decimal point is allowed. No volume calculations will occur when DP is below this value.
SP Tap Location	Select from the drop-down list, the location (upstream, downstream) of the SP tap in relation to the V-Cone position.
V-Cone Diameter	Enter the orifice diameter size in dimensional units as specified.
Pipe Diameter	Enter the pipe diameter size in dimensional units as specified in the Units column.
V-Cone Ref Temp	Enter the Reference Temperature for the V-Cone in the temperature units as specified on the Units column.
Pipe Ref Temp	Enter the Reference Temperature for the Pipe in the temperature units as specified on the Units column.
Pressure Base (Pb)	Enter the Pressure Base in the units as specified by the Units column. A specific Pressure Base value may be required because of contractual agreements.
Temperature Base (Tb)	Enter the Temperature Base in the units as specified by the Units column. A specific Temperature Base may be required because of contractual agreements.
Auxiliary Factor (Faux)	This value is used when the Faux factor is turned on under the Factors tab. Faux is simply a multiplication factor times the computed gas volume that can be used to correct for a know error condition. This factor is typically used for what is referred to as the Full Well Stream Factor which is used to adjust the computed gas volume downward to account for the portion of the measured stream that is liquid.
Z of Air	Enter a value for the Z of Air. One default standard is .99959.
Viscosity	Enter the Viscosity in the units as specified by the Units column.
Specific Heat Ratio	Enter the Specific Heat Ratio. This is Cp divided by Cv. A typical value is 1.3
V-Cone Exp. Coef.	Select the V-Cone material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an orifice plate is used of a different type material, the user must select Other.

	A dialog box will display and enable the user to set a pre-defined value or a custom value. Move the decimal point six places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Exp. Coef.	Select the pipe material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If pipe is used of a different type material, the user must select Other. A dialog box will display and enable the user to set a pre-defined value or a custom value. Move the decimal point six places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E -6.
Fixed Cd	If Use Calc Cd is not selected in the Factors tab, this fixed value for Coefficient of Discharge is used. A typical value is 0.600.

Factors

Use Calc Cd	Coefficient of Discharge factor (Cd) - Select Yes for the flow computer to calculate and use this factor in the volume calculations. Selecting No will cause the flow computer to use a Fixed Cd which is entered on the Constants tab.
Use Y	Expansion factor (Y) - Select Yes for the flow computer to calculate and use this factor in the volume calculations.
Use Fpv	Compressibility factor - Select Yes for the flow computer to calculate and use this factor based on the Fpv method selected in the General tab. (Not for NIST14)
Use Fw	Water Vapor factor - Used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is water in vapor phase. If enabled, Fw is computed by the flow computer. If supported, see the Water Constants tab for additional setup.
Use Faux	Faux - Typically used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating C'. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream is typically determined by a Full Well Stream Test. The Faux factor is entered under the Constants tab. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.

NOTE: Although factors (Faux and Fw) are being used by some companies, they have not been adopted by any standards committee.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator.

	· Begins a new flow file daily record.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Fixed Values on Errors

Use Fixed Sp on Error	Select Yes to use or No to not use the Fixed Sp Value if the Static Pressure exceeds the Sp High Error value or drops below the Sp Low Error value.
Fixed Sp Value	Enter the Static Pressure value to be used if Use Fixed Sp On Error is set to Yes and the Static Pressure has exceeded the Sp High Error or dropped below the Sp Low Error value.
Sp High Error	Enter the value to be used for the Static Pressure High Error.
Sp Low Error	Enter the value to be used for the Static Pressure Low Error.
Use Fixed DP on Error	Select Yes to use or No to not use the Fixed DP Value if the Differential Pressure exceeds the Dp High Error value or drops below the Dp Low Error value.
Fixed DP Value	Enter the Differential Pressure value to be used if Use Fixed Dp On Error is set to Yes and the DP Pressure has exceeded the DP High Error or dropped below the DP Low Error value.
DP High Error	Enter the value to be used for the Differential Pressure High Error.
DP Low Error	Enter the value to be used for the Differential Pressure Low Error.
Use Fixed Tf on Error	Select Yes to use or No to not use the Fixed Tf Value if the Flowing Temperature exceeds the Tf High Error value or drops below the Tf Low Error value.
Fixed Tf Value	Enter the Flowing Temperature value to be used if Use Fixed Tf On Error is set to Yes and the Flowing Temperature has exceeded the Tf High Error or dropped below the Tf Low Error value.
Tf High Error	Enter the value to be used for the Flowing Temperature High Error.
Tf Low Error	Enter the value to be used for the Flowing Temperature Low Error.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.

Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	Enter up to ten alpha-numeric characters for the Device/APP ID. This identifies the specific application or flow calculation. A Station or device can have multiple flow calculations running simultaneously, and each of those will have their own Device/APP ID.
Tube Description	Enter up to 24 alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.
Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period. This option is only valid in devices supporting the new database (DB2) and when in the Extended Characteristic mode. A default period of one hour is used at all other times.
Calculation Type	Displays the type of flow calculation which is API Liquid. This is a read-only parameter.
Fpv Method	Supercompressibility factor (Fpv) - Select Yes for the device to calculate Fpv based on the NX19 method and use it in the volume calculations.
SP/DP Averaging	Select Linear or Square Root averaging from the drop-down list. The following explanation applies to the Differential Pressure, Static Pressure and Temperature. · Linear - Sums the samples and divides by the number of samples. · Square Root - Sum of the square root of the samples divided by the number of samples and squared.
Last Analysis time	Displays the last date/time that a live analysis was received.
Heating Value Method	The Heating Value Method parameter field enables the user to select the heating value based on either Volume or Mass calculations. This informs the software whether to multiply the volume or the mass by the heating value.
Hold Time Out (Seconds)	Sets a time duration (in seconds) that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 3600 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.

Current Values

Static Pressure	Displays and/or allows entry of the Static Pressure register used in flow calculations.
Differential Pressure	Displays and/or allows entry of the Differential Pressure register for AGA-3 used in flow calculations.
Temperature	Displays and/or allows entry of the Flow Temperature register used in flow calculations.
Flow Rate	Estimated flow rate based on the current Integral and the last calculated integral multiplier.
Current Mass Flow Rate	The Mass Flow Rate is the Mass Volume for the Volume Calculation Period.
Current Energy Flow Rate	The Indicated Flow Rate times the Heating Value.
Today's Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Mass	Updated at the end of each Volume Calculation Period. Each Volume Calculation mass is added to the current mass for the duration of the Contract Day.
Today's Energy	Updated at the end of each Volume Calculation Period. The sum of energy quantities accumulated since the beginning of the contract day. At the end of each Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Yesterday's Mass	Prior Contract Day’s Mass.
Yesterday's Energy	Prior Contract Day’s energy.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the counts for the period are multiplied times the K Factor to produce an uncorrected volume which is then multiplied times the currently selected SUAGA-7 factors (See Factors tab under Setup) to produce a Corrected Volume. Each Volume Calculation Period corrected volume is then added to the Accumulated Volume. This continues until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Mass	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the mass is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Accumulated Energy	Updated at the end of each Volume Calculation Period. At the end of each Volume Calculation Period, the energy is added to the current running total until zeroed by the Reset Volume command or an accumulator rollover happens.
Last Calculated Volume	Volume for the last Volume Calculation Period.
Last Calculated Mass	Mass for the last Volume Calculation Period.
Last Calculated Energy	Energy for the last Volume Calculation Period.

Limits

Sp High Limit	This represents the higher limit of the static pressure value that can be sent to the tube application.
Sp Low Limit	This represents the lower limit of the static pressure value that can be sent to the tube application.
Dp High Limit	This represents the higher limit of the differential pressure value that can be sent to the tube application.
Dp Low Limit	This represents the lower limit of the differential pressure value that can be sent to the tube application.
RTD High Limit	This represents the higher limit of the total flowing temperature value that can be sent to the tube application.
RTD Low Limit	This represents the lower limit of the total flowing temperature value that can be sent to the tube application.
Flow Rate High Limit	This represents the higher limit of the flow rate value that can be sent to the tube application.
Flow Rate Low Limit	This represents the lower limit of the flow rate value that can be sent to the tube application.

Water Constants

Use Fixed H2O	Select Yes to use the water vapor content value as specified by Fixed H2O Content in lieu of the device calculating the water vapor content.
Fixed H2O Content	Enter a value that will be used as a fixed value for the water vapor content. The above parameter Use Fixed H2O will need to be set to Yes for the fixed value to be used.
H2O Bias	Enter an offset for calculation of Fw. If using Fw, but unfamiliar with this bias parameter, use the default value.
Last Calculated Fw	Displays the Last Fw value calculated by the device.

Adv Setup

Adv Setup

Static Pressure	Enter the App/Array
Diff Pressure	Enter the App/Array
Temperature	Enter the App/Array
Static Pressure Type	Enter Absolute or Gauge
RTD Installed	Enter No
Use Fixed Temperature	Enter Yes
Fixed Temperature	Enter Temperature value

No Flow

Digital Input	Enter the App/Array
DI Action	Enter Disabled or Enabled
Flow State	Flow displayed

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on DP Low	If set to Yes, the digital output will be tripped on the DP Low alarm. Alarm limits are set in the Limits tab.
Trip on DP High	If set to Yes, the digital output will be tripped on the DP High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on Fr Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on Fr High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2
(Same as Digital Output 1)

V-Cone Sizing

The user can select the Orifice tab to change the Orifice Plate. The first option would be to ensure all read/write fields have the correct value selected. These fields are as follows:

V-Cone Diameter	Enter the V-cone diameter size in dimensional units.
Pipe Diameter	Displays the pipe diameter size in dimensional units.
Sp Tap Location	Displays the location (upstream, downstream) of the Sp tap in relation to the V-Cone plate.
Hold Time Out	Default to one hour but can be edited by the user.

Once all the fields are showing the desired values, the user must first select the Hold button to set the timer at 60 minutes. The flow pressure is then held for that period of time to allow the user to change the orifice plate. The user then changes the orifice plate. Once finished, the user would select the Flowing button to resume flow.

V-Cone

V-Tube Type	Enter tube type (Precision or Wafer Cone).
No. of Cd Table Entries	Specify the number of pairs (Reynolds number and associated Cd numbers) entered when the Use Calc Cd is set to Yes (see Factors).
Reynold's Number #1	Enter the Reynold's Number value of the first pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #1	Enter the Flow Coefficient value of the first pair (Reynold's Number and Flow Coefficient).
Reynold's Number #2	Enter the Reynold's Number value of the second pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #2	Enter the Flow Coefficient value of the second pair (Reynold's Number and Flow Coefficient).
Reynold's Number #3	Enter the Reynold's Number value of the third pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #3	Enter the Flow Coefficient value of the third pair (Reynold's Number and Flow Coefficient).
Reynold's Number #4	Enter the Reynold's Number value of the fourth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #4	Enter the Flow Coefficient value of the fourth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #5	Enter the Reynold's Number value of the fifth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #5	Enter the Flow Coefficient value of the fifth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #6	Enter the Reynold's Number value of the sixth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #6	Enter the Flow Coefficient value of the sixth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #7	Enter the Reynold's Number value of the seventh pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #7	Enter the Flow Coefficient value of the seventh pair (Reynold's Number and Flow Coefficient).
Reynold's Number #8	Enter the Reynold's Number value of the eighth pair (Reynold's Number and Flow Coefficient).

Flow Coefficient #8	Enter the Flow Coefficient value of the eighth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #9	Enter the Reynold's Number value of the ninth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #9	Enter the Flow Coefficient value of the ninth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #10	Enter the Reynold's Number value of the tenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #10	Enter the Flow Coefficient value of the tenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #11	Enter the Reynold's Number value of the eleventh pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #11	Enter the Flow Coefficient value of the eleventh pair (Reynold's Number and Flow Coefficient).
Reynold's Number #12	Enter the Reynold's Number value of the twelfth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #12	Enter the Flow Coefficient value of the twelfth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #13	Enter the Reynold's Number value of the thirteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #13	Enter the Flow Coefficient value of the thirteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #14	Enter the Reynold's Number value of the fourteenth first pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #14	Enter the Flow Coefficient value of the fourteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #15	Enter the Reynold's Number value of the fifteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #15	Enter the Flow Coefficient value of the fifteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #16	Enter the Reynold's Number value of the sixteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #16	Enter the Flow Coefficient value of the sixteenth pair (Reynold's Number and Flow Coefficient).

Last Calc Values

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

Qm	Base Mass
Qv	Base Volume
Volume	Displayed in SCF (standard cubic feet)
Mass	Displayed in lbm (pounds of mass)
Energy	Displayed in MBtu (thousands of British thermal units)
Xpt_Volp	Displayed value in H2O.psia/R

Real Specific Gravity	Displayed as a ratio of the density of the sample to the density of water. This value should be at the contracted pressure and temperature bases. All Fpv methods. The Specific gravity or Base gravity, as it is called in liquid calculations, defaults to .658 but an accurate gravity if known should be entered.
Specific Heat Ratio	Displayed as a ratio of the density of the sample to the density of water
Fluid Viscosity	Displayed in cP (centipoise), a unit of viscosity
Zbase of Air	Z of Air at the contractual values for pressure base and temperature base. The user would enter a value for the Z of Air. This is the compressibility of air at a reference temperature (typically 60 degrees F.) The default standard is .99959.
Pressure Base	Displayed in PSIA (pounds per square inch absolute)
Temperature Base	Displayed in Degrees F.
Base Compressibility	Display follows one of four existing base conditions.
Flowing Compressibility	Calculated from the Base Compressibility
Super Compressibility	A factor used to account for the following effect: Boyle's law for gases states that the specific weight of a gas is directly proportional to the absolute pressure, the temperature remaining constant. All gases deviate from this law by varying amounts, and within the range of conditions ordinarily encountered in the natural gas industry, the actual specific weight under the higher pressure is usually greater than the theoretical. The factor used to reflect this deviation from the ideal gas law in gas measurement with an orifice meter is called the "supercompressibility factor"or Fpv.
Fip	Fip (Female Iron Pipe Connection) is the adaptor and will accept the pipe into its fitting
Live Static Pressure	Displays last live reading in PSIA (pounds per square inch absolute)
Static Pressure	Displays last static pressure reading in PSIA (pounds per square inch absolute)
Live Differential Pressure	Displays last Live rather than Fixed Differential Pressure (PSIA)
Differential Pressure	Displays last differential pressure reading in INH2O (inches of water)
Live Temperature	Displays last live temperature reading in degrees F.
Flowing Temperature	Displays last flowing temperature reading in degrees F.
Faux	Displays faux or fpv (supercompressibility) value
Water Vapor Factor (Fw)	Displays the water vapor factor (Fw)
V-Cone Reference Temperature	As temperatures can cause the V-Cone size to change, the V-Cone Reference Temperature represents the actual temperature at which the V-Cone size was measured.
Pipe Reference Temperature	As temperatures can cause the pipe size to change, the Pipe Reference Temperature represents the actual temperature at which the pipe size was measured.
Pipe Expansion Coefficient	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel). If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E-6.

Pipe Inside Diameter	Displays pipe inside diameter in inches
Temperature Corrected V-Cone ID	The V-Cone Diameter corrected for temperature
Y Expansion Factor	Displays Y (expansion factor), used in volume calculations
V-Cone Diameter	Displays V-Cone diameter in inches
Temperature Corrected V-Cone Diameter	V-Cone Diameter corrected for temperature
Temperature Corrected Pipe/Orifice Ratio (Beta)	The Pipe/Orifice Ratio corrected for temperature
Y Expansion Factor	Displays Y (expansion factor), used in volume calculations
Velocity of Approach	This parameter is often referred to as the velocity of approach factor and dividing the coefficient of discharge by that parameter (as was done above) produces the flow coefficient. Methods also exist for determining the flow coefficient as a function of the beta function and the location of the downstream pressure sensing tap. For rough approximations, the flow coefficient may be assumed to be between 0.60 and 0.75. For a first approximation, a flow coefficient of 0.62 can be used as this approximates to fully developed flow.
Reynold's Number	Defined for different situations where a fluid is in relative motion to a surface including fluid properties of density and viscosity plus a velocity and an internal diameter
Discharge Coefficient (Cd)	Coefficient of Discharge factor (Cd) - Select Yes for the flow computer to calculate and use this factor in the volume calculations. Selecting No will cause the flow computer to use a Fixed Cd which is entered on the Constants tab.
C-Prime Static Factor (cp_s)	The Static Factor value displays here.
C-Prime (cp)	The portion of the flow rate equation that is computed each Vol. Calc. Period.
Live Flowing Density	Assumes not using fixed data but live data from an external source
Base Density	Displays the Base Density used from the Start Date/Time to the End Date/Time.
Flowing Density	Displays the average Flowing Density used from the Start Date/Time to the End Date/Time.
Heating Value Select	Select either Volume Based or Mass Based. This tells the software whether to multiply the calculated volume or mass by the heating value which is found on the Fixed or Live Analysis tabs and provides the total heating value for the period.
AIR	Generally the mole percentage of AIR displayed here is related to the mole percentage of N2 (the chief component of air).
C6+ (Index Split Mode)	This affects both the NGC setup as far as the C6+ split and what C6+ information is sent to an external Modbus device. User Defined C6+ Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus includes the split values as well as the C6+ value. Pre-defined C6+ Splits - If you select one of the four predefined split percentages, the NGC will use this selection for the split. If information is sent

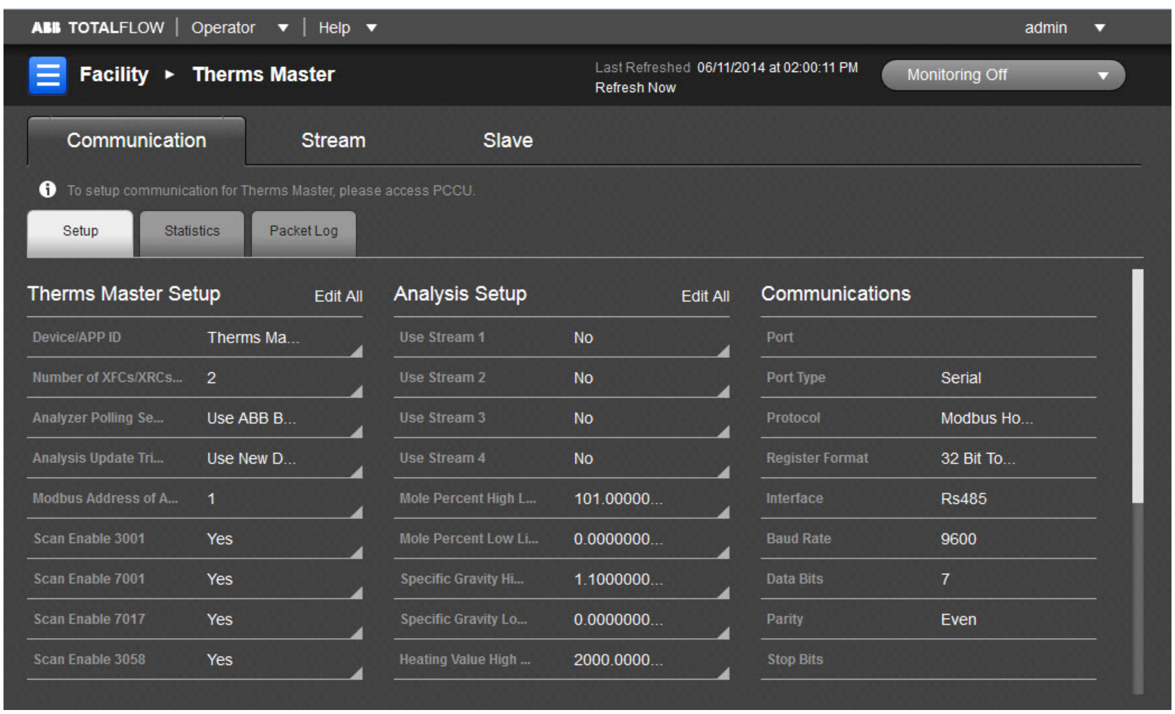
	to an external Modbus device, it will include the C6+ value and a code representing the same split percentages. User Defined C6+ Not Reported - With this selection, the user specifies the C6+ split percentages for the NGC. Information sent to an external Modbus device includes the split values but not the C6+ value.

Therms Master

Overview

Therms is in reference to the analysis being provided by an analyzer which is interfaced to a device called the Master. The Master can use the analysis and/or pass the analysis along to other devices known as Slaves.

There are two basic Therms Interfaces or applications: The one that runs on the Master or Host device and the one that runs on the Slave devices. A Modbus Host protocol must be running on the Master device's communication port being used, and a Modbus Slave protocol must be running on the Slave's communication port. These protocols can be Modbus ASCII or Modbus RTU. The Master device receives analysis data from the Totalflow BTU Transmitter or compatible analyzer, saves the analysis in its Live Analysis registers and sends the analysis on to the Slave devices.



Communication

There are three major sections on the Therms Master main page: Communication, Stream and Slave.

On this, the Therms Master section, three tabs (Setup, Statistics and Packet Log) are displayed horizontally across the top of the page. Each tab with its relevant information is discussed as follows:

Setup

NOTE: Remember in order to setup communication for Therms Master, please access PCCU.

Therms Master Setup

Device/APP ID	Enter either Use New Data Flag or Use Cycle Time
No. of XFCs/XRCs	Enter the value of the Modbus Address of Analyzer.
Analyzer Polling Selection	Enter one of the following: Use ABB BTU 8000 Poll, Use ABB NGC/ Daniel 2251 Poll , Use Daniel 2350A Poll
Analysis Update Trigger	Enter either Use New Data Flag or Use Cycle Time
Modbus Address of Analyzer	Enter the value of the Modbus Address of Analyzer.
Scan Enable 3001	If set to Yes, ABB analyzer addresses 3001-3088 are polled. If polling a Daniels 2251 compatible analyzer, addresses 3001-3059 are polled.
Scan Enable 7001	If set to Yes, Addresses 7001-7016 are polled.
Scan Enable 7017	If set to Yes, Addresses 7017-7040 are polled.
Scan Enable 3058	If set to Yes, this is a write function to clear the New Data Flag in the external analyzer.
Scan Enable 7200	If set to Yes, retrieves status information from ABB Totalflow analyzers only.

Analysis Setup

Use Stream 1	Enter either Yes or No (Yes causes the Therms Master application to notify any internal tube application using Stream 1 when updated Stream 1 data is available.)
Use Stream 2	Enter either Yes or No (Yes causes the Therms Master application to notify any internal tube application using Stream 2 when updated Stream 2 data is available.)
Use Stream 3	Enter either Yes or No (Yes causes the Therms Master application to notify any internal tube application using Stream 3 when updated Stream 3 data is available.)
Use Stream 4	Enter either Yes or No (Yes causes the Therms Master application to notify any internal tube application using Stream 4 when updated Stream 4 data is available.)
Mole Percent High Limit	Enter the value of the Mole Percent High Limit (Enables the user to set the mole percent high limit from which to reject analysis prior to being used in measurement tube flow calculations. If any individual component exceeds this limit, the analysis is rejected.)
Mole Percent Low Limit	Enter the value of the Mole Percent Low Limit (Enables the user to set the mole percent low limit from which to reject analysis prior to being used in measurement tube flow calculations. If any individual component exceeds this limit, the analysis is rejected.)
Specific Gravity High Limit	Enter the value of the Specific Gravity High Limit (Enables the user to set the Specific Gravity high limit from which to reject analysis prior to being used in measurement tube flow calculations. This value should be at the contracted pressure and temperature bases.)
Specific Gravity Low Limit	Enter the value of the Specific Gravity Low Limit (Enables the user to set the specific gravity low limit from which to reject analysis prior to being used in

	measurement tube flow calculations. This value should be at the contracted pressure and temperature bases.)
Heating Value High Limit	Enter the value of the Heating Value High Limit (Enables the user set the specific heating value high limit from which to reject analysis prior to being used in measurement tube flow calculations.)
Heating Value Low Limit	Enter the value of the Heating Value Low Limit (Enables the user set the specific heating value low limit from which to reject analysis prior to being used in measurement tube flow calculations.)
Data Error	Displays Yes or No (read only) (Informs the user when a rejection has occurred. If an error does occur, the field is color coded red and will display Yes; otherwise, the field is color coded green and displays No.)

Communications

Port	The Port that will be used for the Therms interface displays depending on the COM assignment as follows: COM2: XFCs have a COM1: and COM2: XRCs have a COM1: COM2: and COM3:. If using TCP/IP, this will be the IP address and port number (e.g., 10.127.185.174/508).
Port Type	The current Port Type will display from the following list: · OnBoard Serial - Select if using one of the serial communication ports located physically on the device's main electronic's board. · TCP/IP Client - Select if using the Ethernet port located physically on the device's main electronic's board. The Protocol will need to be set to Modbus/TCP Client. · TFIO Serial - Select when using a TFIO communications module referred to as a Communications Interface Module (CIM). These will be mounted on a rail external to the main electronics board. (Not for NGC)
Protocol	The Protocol assigned will display from the following list: · Modbus Host (ASCII) - Select when communicating with a Slave using Modbus ASCII protocol. · Modbus Host (RTU) - Select when communicating with a Slave using Modbus RTU protocol. · Modbus/TCP Client - Select when communication with a Slave via the Ethernet port. The Port Type will need to be set to TCP/IP Client.
Register Format	The Register Format assignment will display from the following list: There are multiple selections as shown below. Typically when a Totalflow device is communicating with another Totalflow device, 32 Bit Totalflow will be employed. If communicating with a third party device that requires a different format, select that format. The important thing to remember is that the Host and Slave is set for the same format. · 32 Bit Totalflow - 32 bit values are transferred as a single 32 bit register. Register list entries are biased one greater than standard Modbus (7002 = 7001 Standard). · 32 Bit - 32 bit values are transferred as a single 32 bit register. · 16 Bit Modicon - 32 bit values are transferred as two consecutive 16 bit registers. · 16 Bit Word Swapped - 32 bit values are transferred as two consecutive 16 bit registers and swaps the order of the registers. · 16 Bit ROS Modulo 10000 - Multiplies the floating point number by 1000 and then divides by 10000. The integer portion (before the decimal point) goes into the first

	16 bit register and the fractional portion (after the decimal point) goes in the second 16 bit register.
Interface	The interface type is assigned from one of the following selections: · RS232 - Select if the port is connected to a radio or an RS232 device. · RS485 - Select if communicating via RS485. · RS422 - Select if communicating via RS422.
Baud Rate	A range of the Baud Rate displays from a value of 1200 to 115200.
Data Bits	Displays Number of Data Bits (7 or 8)
Parity	Displays Parity (None, Even or Odd)
Stop Bits	Displays Number of Stop Bits (1 or 2)
Response Delay (milliseconds)	Response Delay is a delay that is on the front end of communications between devices. It can be used by the device initiating a request and/or by the device responding to the request. Either way, it delays the start of communication to another device. Set to zero for no delay or enter a delay value in milliseconds. In the case of polling multiple Therms Slaves, there may need to be a short delay to allow one slave to respond before polling another. Typically 10 milliseconds works well when polling multiple slaves.
Xmit Key Delay (milliseconds)	Typically used when communicating via radio but can affect any communications equipment; this is a delay time to allow a radio's transmitter or any transceiver to stabilize after being keyed up before data is transmitted. It can typically be set at approximately 10 milliseconds.
UnKey Delay (milliseconds)	Typically used when communicating via radio but can affect any communications equipment; this is a delay time to keep the radio's transmitter keyed up after the last data bit is transmitted. It can typically be set at approximately 10 milliseconds.
Timeout (milliseconds)	If having problems communicating, enter a value here typically from 40 - 100 milliseconds. This is the largest gap tolerated between characters within a packet. If this time expires, any partial packet is discarded, and the protocol looks for the beginning of a new packet.
Switched V-Batt/Operate	This parameter selects the mode for how Switched V-Batt and Operate. Both Switched V-Batt and Operate are switched voltage outputs and come from the same source with the exception that Operate has an on-board 500 ohm current limiting resister in series with it. They will turn on and off at the Listen Cycle frequency and is controlled by the communication Schedule if used. · Enable - Allows the outputs to switch on and off with the Listen Cycle time and be controlled by the communications Schedule. · Disable - Disables the outputs. · Always ON - Causes the outputs to be on all the time.
Retries	When initiating requests, specify the number of times to retry if the initial request fails.
Trailing Pad	Trailing Pad allows the user to add zeroes to the end of a transmission sequence to make sure the transmission is accomplished before the remote device tries to respond. This is more for devices that have a quick turnaround time. This can be used in place of having an Unkey Delay. Select 2 bytes, 3 bytes or 4 bytes from the drop-down list.
Alt Comm Port	The Alternate Port feature can be used to communicate with different devices on the same communication port (i.e., COM1, CIM0, etc.). The Coriolis, XMV and Therms Master are the only applications that support the Alternate Port feature.

	For example, if the XMV application has been instantiated and is using CIM0 for the communication path, the Therms Master and Coriolis applications can share that physical port. To add the Coriolis or Therms Master application to the CIM0 port, set the Port to None and the Alternate Port parameter to CIM0. When using the Alternate Port, all the devices MUST communicate using the same protocol (i.e., same protocol, same baud rate, same stop and start bits, same delays and timeouts). NOTE: The main issue in using the Alternate Port feature is that the various devices MUST communicate using the same protocol.
Comm Directory	Specify a directory and path in the device for Request Block files. Typically, this would be under the directory associated with the communication port being used. Typically a default directory will already be specified.

Statistics

NOTE: Remember in order to setup communication for Coriolis Interface, please access PCCU.

Statistics

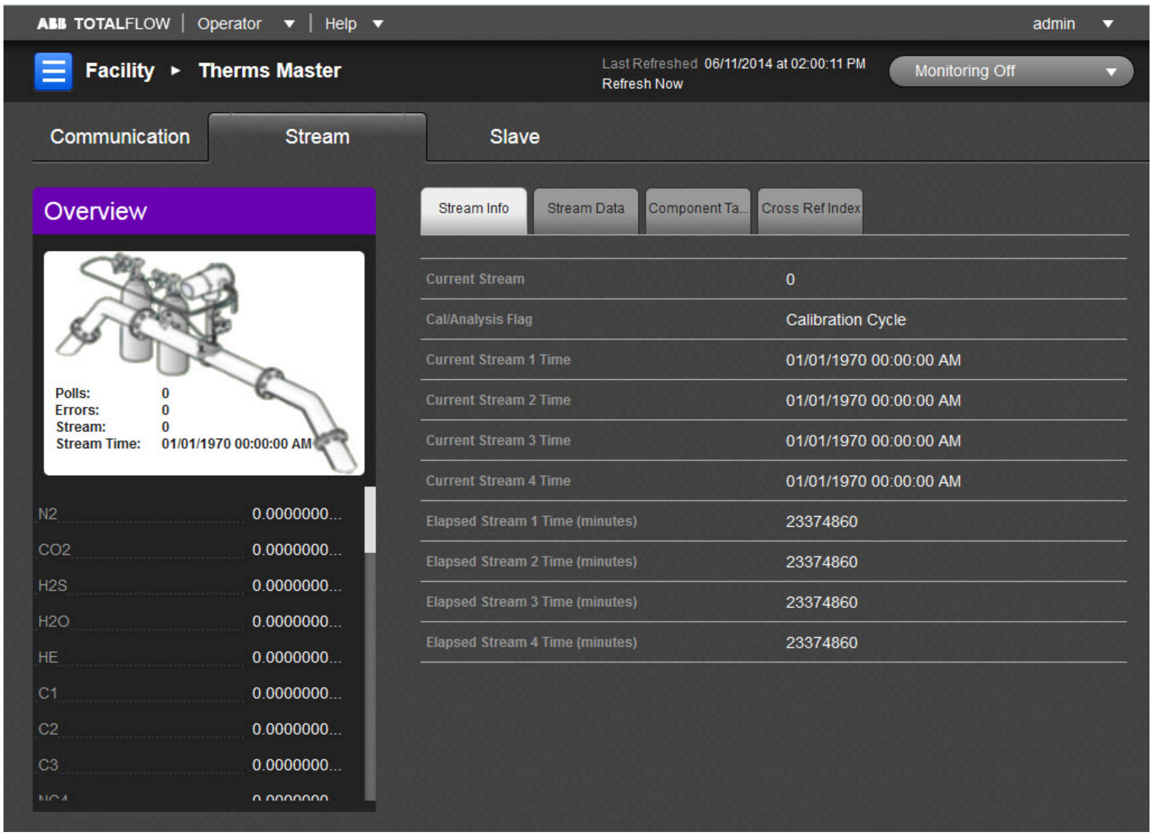
Previous Poll Loop Time	Displays the last poll loop time. If multiple devices, the time to poll all devices.
Minimum Poll Loop Time	Keeps the minimum poll loop time of all polls.
Maximum Poll Loop Time	Keeps the maximum poll loop time of all polls.
Number of Polls	The number of times the device tried to communicate with another device.
Number of Errors	The number of times the device tried to communicate with another device but was unsuccessful.
Number of Late Completions	Displays the number of times the communication's poll failed to retrieve data from the device or devices within the scan time allotted. For example, devices such as XMVs may be polled once a second and data must be retrieved within the second. If the user is seeing multiple late completions, try reducing the time slightly on one of the parameters mentioned above. If the Number of Errors start to increase after changing a parameter, increase it until the Number of Errors stop. If Late Completions are still happening, try reducing one of the other parameters using the same scenario.
Number of Interrupts	Displays the total number of transmit/receive interrupts.
Number of Characters Received	Displays a running total of received bytes from the devices.
Number of Characters Transmitted	Displays a running total of transmitted bytes to the devices.
Thread Priority	Displays the priority of the protocol task.
1ST Priority	Displays the priority of the interrupt service thread.

Packet Log

NOTE: Remember in order to setup communication for Therms Master, please access PCCU.

The Packet Log tab is included for troubleshooting purposes only. The information provided has only to do with Totalflow Remote protocol or Modbus protocol. Other than the number of errors and polls that are displayed at the bottom of the screen, the user would need a Totalflow Remote protocol and/or a Modbus document to understand the information that gets displayed. You might however be asked by a customer service representative for information provided on this screen.

The information displayed on the screen is provided from a file maintained in the device. You can specify the number of records that are kept in the file by selecting one of the values for the Log Size from its pulldown menu to ensure only the newest records are kept. To receive any updated information after initially viewing the screen, you will be required to either click the Re-read button or check the Monitor button. The information displayed will only change if additional polls have occurred since the last time the information was read.



Stream

There are three major sections on the Therms Master main page: Communication, Stream and Slave.

The read-only fields on the left side of the page display the percentage of composition of all the listed components.

On this, the Therms Master Stream section, four tabs (Stream Info, Stream Data, Component Tables and Cross Ref Index) are displayed horizontally across the top of the page. Each tab with its relevant information is discussed as follows:

Stream Info

These fields are all read only and display stream only data as follows:

Current Stream	Stream Number displays
Call/Analysis Flag	Calibration or Analysis Cycle Flag displays
Current Stream 1 Time	Date/Time of Current Stream 1 displays
Current Stream 2 Time	Date/Time of Current Stream 2 displays

Current Stream 3 Time	Date/Time of Current Stream 3 displays
Current Stream 4 Time	Date/Time of Current Stream 4 displays
Elapsed Stream 1 Time (mins)	Date/Time of Elapsed Stream 1 displays (mins)
Elapsed Stream 2 Time (mins)	Date/Time of Elapsed Stream 2 displays (mins)
Elapsed Stream 3 Time (mins)	Date/Time of Elapsed Stream 3 displays (mins)
Elapsed Stream 4 Time (mins)	Date/Time of Elapsed Stream 4 displays (mins)

Stream Data

The composition of all four streams is displayed in these read only fields.

Component Tables

Select which set of component indexes to use to map the stream component data. For the Totalflow Btu Transmitter, Index 1-16 is used. For a Danalyzer, either index (1-16 or 17-32) can be used based on a bit setting in a register; therefore, if using a Danalyzer and unsure, refer to the Danalyzer documentation.

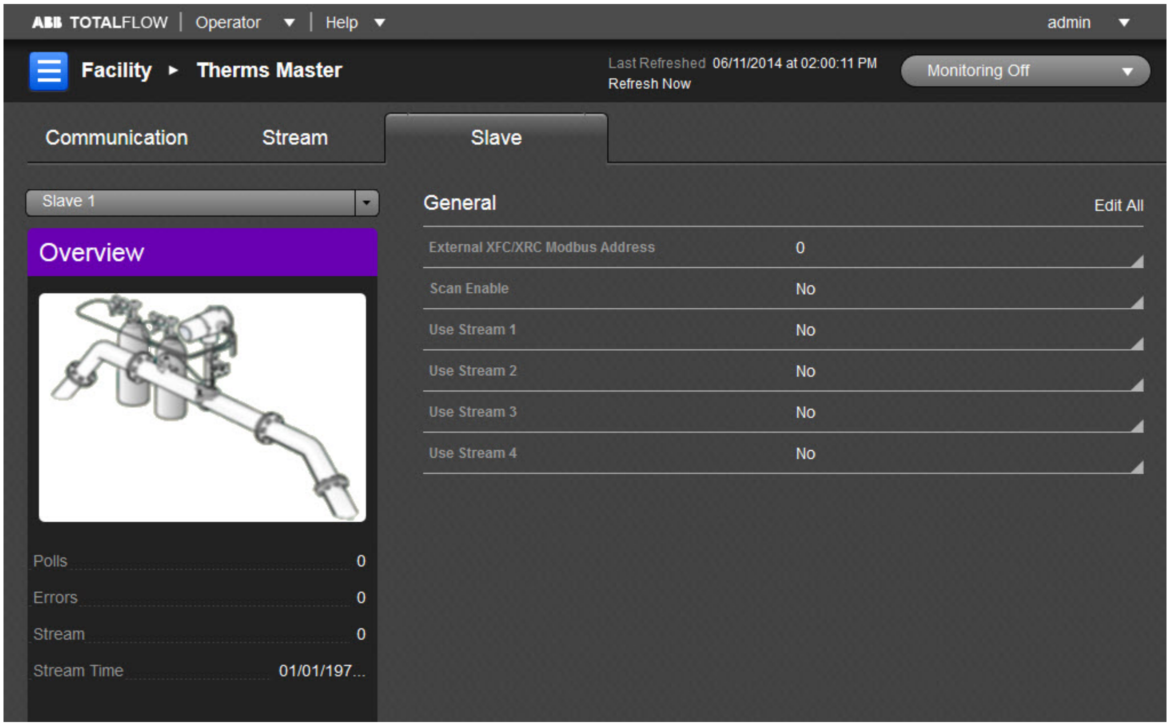
Component	This column displays the sequence number which is the order the components are received from the analyzer.
Value	Displays the value in Mole % read from the analyzer.
Index (3001-3016)	Displays the component identifier of components in the 3001-3016 address range.
Mapping Index (3001-3016)	Displays the index number of the particular component shown in the 3001-3016 address range.
Index (3017-3032)	Displays the component identifier of components in the 3017-3032 address range.
Mapping Index (3017-3032)	Displays the index number of the particular component shown in the 3017-3032 address range.

Cross Ref Index

These fields are read/write, allowing the user to key information for each component from the Component Table. The numbered Component row includes Index Mapping and Xref (3001-3016) and Index Mapping and Xref (3017-3032).

Component	This column displays the sequence number which is the order the components are received from the analyzer.
Index Mapping (3001-3016)	Displays the component index numbers returned from Modbus addresses 3001 - 3016 of the polled analyzer. These index numbers represent components and are typically standard among analyzers; however, variations can be found.
Xref (3001-3016)	Entry in this column is only required if a component index number or numbers received from the analyzer do not match the standard index numbers used by the Therms Master application. In case of a mismatch, the user would enter the Therms index number here that represents the component that the received number represents.
Index Mapping (3017-3032)	Displays the component index numbers returned from Modbus addresses 3017 - 3032 of the polled analyzer. For ABB analyzers, these will be the same numbers as registers 3001 - 3016.
Xref (3017-3032)	Entry in this column is only required if a component index number or numbers received from the analyzer do not match the standard index numbers used by the Therms Master application. In case of a mismatch, the user would enter the Therms

	index number here that represents the component that the received number represents.



Slave

This information tells the Therms Master application about a slave device. The number of slaves is specified on the Therms Master Setup screen. Each slave will have this setup information.

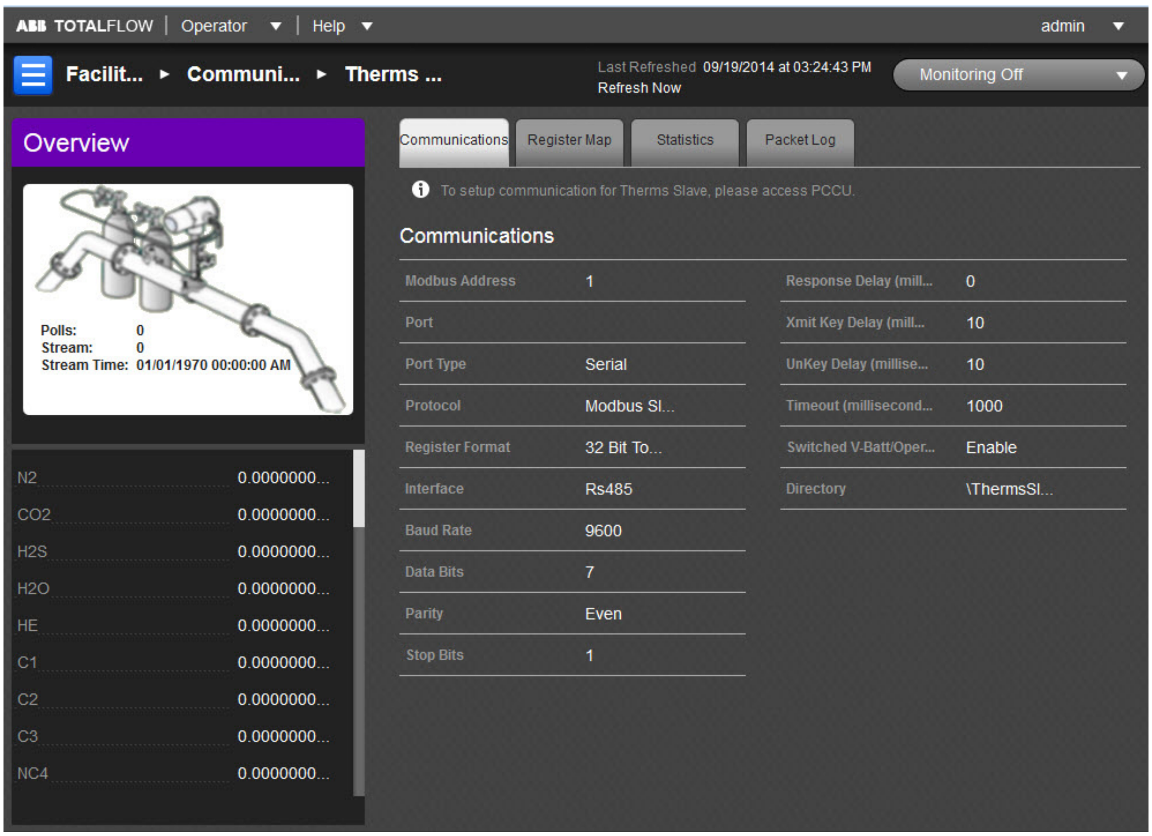
External XFC/XRC Modbus Address	Enter the Modbus address of the external slave device. Each slave device must have a unique Modbus address. Typically, this is a number from 1 to 247.
Scan Enable	Must be set to Yes for the Master to send analysis data to this slave device.
Use Stream 1	Set to Yes if the Master is to send Stream 1 data to the slave device whose Modbus address is specified above.
Use Stream 2	Set to Yes if the Master is to send Stream 2 data to the slave device whose Modbus address is specified above.
Use Stream 3	Set to Yes if the Master is to send Stream 3 data to the slave device whose Modbus address is specified above.
Use Stream 4	Set to Yes if the Master is to send Stream 4 data to the slave device whose Modbus address is specified above.

Therms Slave

Overview

Therms is in reference to the analysis being provided by an analyzer which is interfaced to a device called the Master. The Master can use the analysis and/or pass the analysis along to other devices known as Slaves.

There are two basic Therms Interfaces or applications: The one that runs on the Master or Host device and the one that runs on the Slave devices. A Modbus Host protocol must be running on the Master device's communication port being used, and a Modbus Slave protocol must be running on the Slave's communication port. These protocols can be Modbus ASCII or Modbus RTU. The Master device receives analysis data from the Totalflow BTU Transmitter or compatible analyzer, saves the analysis in its Live Analysis registers and sends the analysis on to the Slave devices.



On the left side of the screen is a read only table for each individual component. The user can scroll up and down to see each individual component and its percentage of the total.

Four tabs (Communications, Register Map, Statistics and Packet Log) are displayed horizontally across the top of the page. Each tab with its relevant information is discussed as follows:

Communications

Modbus Address	Enter the Slave Modbus address.
Port	Enter the Port that will be used for the Therms interface. This will typically be COM2:. XFCs have a COM1: and COM2:. XRCs have a COM1:, COM2: and COM3:.
Port Type	Select a port type from the drop-down list.

	· OnBoard Serial - Select if using one of the serial communication ports located physically on the device's main electronic's board. · TCP/IP Client - Select if using the Ethernet port located physically on the device's main electronic's board. A TCP Client initiates conversations with the server by asking the server to perform a task. · TFIO Serial - Select when using a TFIO communications module referred to as a Communications Interface Module (CIM). These will be mounted on a rail external to the main electronics board.
Protocol	Select a protocol from the drop-down menu. · Modbus Slave (ASCII) - Select when communicating with a Host using Modbus ASCII protocol. · Modbus Slave (RTU) - Select when communicating with a Host using Modbus RTU protocol. · Modbus/TCP Client - Select when communication with a Slave using Modbus/TCP Client protocol.
Register Format	Select the appropriate format from the drop-down list. There are multiple selections as shown below. Typically when a Totalflow device is communicating with another Totalflow device, 32 Bit Totalflow will be used. If communicating with a third party device that requires a different format, select that format. The important thing to remember is that the Host and Slave must be set for the same format. - 32 Bit Totalflow - 32 bit values are transferred as a single 32 bit register. Register list entries are biased one greater than standard Modbus (7002 = 7001 Standard). · 32 Bit - 32 bit values are transferred as a single 32 bit register. · 16 Bit Modicon - 32 bit values are transferred as two consecutive 16 bit registers. · 16 Bit Word Swapped - 32 bit values are transferred as two consecutive 16 bit registers and swaps the order of the registers. · 16 Bit ROS Modulo 10000 - Multiplies the floating point number by 1000 and then divides by 10000. The integer portion (before the decimal point) goes into the first 16 bit register and the fractional portion (after the decimal point) goes in the second 16 bit register.
Interface	Select the interface type from the drop-down list that will be used on this port. Available selections are: · RS232 - Select if the port is connected to a radio or an RS-232 device. · RS-485 - Select if communicating via RS-485. · RS-422 - Select if communicating via RS-422.
Baud Rate	Click in the Value column, and select the Baud Rate from the drop-down list. Range is from 1200 to 115200.
Data Bits	Selections are 7 or 8 data bits.
Parity	Selections are None, Odd and Even.
Stop Bits	Selections are 1 or 2 stop bits.
Response Delay (milliseconds)	Response Delay is a delay that is on the front end of communications between devices. It can be used by the device initiating a request and/or by the device responding to the request. Either way, it delays the start of communication to another device. Set to zero for no delay or enter a delay value in milliseconds. The analyzer may turnaround too quickly transmitting data before the external device is ready to receive.

Xmit Key Delay (milliseconds)	Typically used when communicating via radio but can affect any communication equipment; this is a delay time to allow a radio's transmitter to stabilize after being keyed up before data is transmitted. This can typically be left at the default time of 420 milliseconds.
UnKey Delay (milliseconds)	Typically used when communicating via radio but can affect any communication equipment; this is a delay time to keep the radio's transmitter keyed up after the last data bit is transmitted. This can typically be left at the default time of 40 milliseconds.
Timeout (milliseconds)	If having problems communicating, enter a value here from 40 - 100 milliseconds. This is the largest gap tolerated between characters within a packet. If this time expires, any partial packet is discarded, and the protocol looks for the beginning of a new packet.
Switched V-Batt/Operate	This parameter selects the mode for how Switched V-Batt and Operate. Both Switched V-Batt and Operate are switched voltage outputs and come from the same source with the exception that Operate has an on-board 500 ohm current limiting resister in series with it. They will turn on and off at the Listen Cycle frequency and is controlled by the communications Schedule if used. · Enable - Allows the outputs to switch on and off with the Listen Cycle time and be controlled by the communications Schedule. · Disable - Disables the outputs. · Always ON - Causes the outputs to be on all the time.
Directory	Displays the path of the Comm Directory for Request Block files.

Register Map

NOTE: Remember in order to setup communication for Therms Slave, please access PCCU.

Use the pulldown menu to select the correct register file (by year).

File Configuration

Register Type	Select the data Register Type. Different data types will require a different register map for each data type. • Int 16 - 16 bit integer. • Int 32 - 32 bit integer. • Float - 32 bit Floating Point. (Typical) • Bool - 8 bit Boolean, known as Coils in Modbus protocol. • Structure - Generic structure. • EnronDayHr - Enron's Daily/Hourly record structure. • EnronEvent - Enron's Event record structure.
Map Type	Select the Map Type. List - List assumes the Totalflow registers are not sequential so they must be manually entered. The user must specify a Totalflow register in the Registers area for each Modbus register. The Totalflow register in the first slot will be associated with the first Modbus register entered in Map Start. The Totalflow register listed in

	the second slot will be associated with the next sequential Modbus register although the remaining Modbus registers are not shown. Array - When specifying the beginning Totalflow register, it is assumed the remaining Totalflow registers are in sequential order. The remaining registers will not be listed in the Registers area.
Map Start	Enter the Map Start address. This is the starting Modbus register number and subsequent registers sequence from there. For example: if you enter a starting number of 7001 and enter 5 for the # Registers, the assigned Modbus registers are 7001, 7002, 7003, 7004 & 7005.
No. of Registers	Specifies the number of registers to act upon beginning with the Starting Register.
Buffered	Checking the Buffered box typically comes down to: Check the box if polling a small List or Array at fast intervals. If not, do not check.

Registers

Each read only field contains the registry information for the selected year. Information is available from 2001-2044 (per individual file year).

Standard Therms Slave register map:

- Register Type = Float
- Map Type = Array
- Map Start = 2001
- # Registers = 44
- In the Register column of the Registers table enter (xx.100.0) for Modbus register 2001, where xx is the Application number. The Application number for Therms in an NGC is typically 19 and 46 for XFC or XRC device. This can be verified by looking at the Applications tab which is on the Station ID (top tree view item in Entry Setup) and Viewing the Advanced mode.

Statistics

NOTE: Remember in order to set up communication for Therms Slave, please access PCCU.

Statistics

Number of Polls	The number of times the device tried to communicate with another device.
Number of Interrupts	Displays the total number of transmit/receive interrupts.
Number of Characters Received	Displays a running total of received bytes from the devices.
Number of Characters Transmitted	Displays a running total of transmitted bytes to the devices.
Thread Priority	Displays the priority of the protocol task.
1ST Priority	Displays the priority of the interrupt service thread.

Packet Log

NOTE: Remember in order to set up communication for Therms Slave, please access PCCU.

The Log Size pulldown menu is used to set the size of individual packet logs.

The number of each poll is posted here. As well is listed the Communication Directory.

The Packet Log tab is included for troubleshooting purposes only. The information provided has only to do with Totalflow Remote protocol or Modbus protocol. Other than the number of errors and polls that are displayed at the bottom of the screen, the user would need a Totalflow Remote protocol and/or a Modbus document to understand the information that gets displayed. You might however be asked by a customer service representative for information provided on this screen.

The information displayed on the screen is provided from a file maintained in the device. You can specify the number of records that are kept in the file by selecting one of the values for the Log Size and only the newest records are kept. To receive any updated information after initially viewing the screen, you will be required to either click the Re-read button or check the Monitor button. The information displayed will only change if additional polls have occurred since the last time the information was read.

V-Cone

Overview

The V-Cone is a differential pressure type flow meter with a unique design that conditions the flow prior to measurement.

Differential pressure is created by a cone placed in the center of the pipe. The cone is shaped so that it “flattens” the fluid velocity profile in the pipe, creating a more stable signal across wide flow downturns. Flow rate is calculated by measuring the difference between the pressure upstream of the cone at the meter wall and the pressure downstream of the cone through its center.

The user can also use the general information displayed as a snapshot of the current existing values for each parameter listed. There can be up to eight (8) V-Cone measurement applications instantiated per comm channel on the XFCG4 board. The fields displayed here are as follows:

ID	The ID field represents the unique identifier for the device. As devices can have multiple flow calculations (tubes) running simultaneously, each one of these will have their own ID.
Description	This is the user-designated description of the tube. This serves as an aid for the user when there is more than one tube application running in a single device.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.

The user can establish the parameters for the V-Cone application using the read/write fields provided. These parameters are as follows:

Contract Hour	The Contract Hour is the start of the day for daily volumes. Enter the Contract Hour in military time (0 - 23).
SP Tap Location	From the drop-down list, select the location (upstream, downstream) of the Sp tap in relation to the orifice plate.
Calculation Type	Select the desired calculation type.
V-Cone Diameter	Enter the V-Cone diameter size in dimensional units.
Pipe Diameter	Enter the pipe diameter size in dimensional units.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: · NX19 fixed FtFp - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method but user must manually calculate and enter Ft and Fp. · NX19 GCN - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method. · NX19 GCNM - Uses NX19 Gravity, Carbon Dioxide, Nitrogen and Methane method.

	· NX19 GCN or GCNM - This method automatically switches to GCNM method if Gravity exceeds .75 and/or Carbon Dioxide or Nitrogen exceeds 15%. · AGA8 Gross 92 - This is the default method when selecting the AGA3-1992 equation. This is one of the newer and recommended Fpv methods, assuming only Specific Gravity, Carbon Dioxide and Nitrogen are used. · AGA8 Detail 92 - This method supports total analysis. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

The six tabs displayed horizontally at the top of the page include important displayed data as well as read/write fields the user would need to set up functions such as Analysis or Calibration. The seventh (Configuration), eighth (Adv Setup), ninth (Digital Output) and tenth (Orifice) tabs are accessible by selecting the pulldown arrow to the right of the Calibration tab. The user can re-select the arrow to re-display the Calibration tab (information). Each tab with relevant information is discussed as follows:

RealTime

Here the color-coordinated parameters are charted either on graph or grid. By clicking on the individual parameter's box below the chart, it will be displayed or removed from the chart as the situation dictates.

The Points button is used to set the value of the displayed cycle measured.

The View button can be used to either display the parameter in a Graph (default) or a Grid format.

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Day

The Day tab displays information for the user that is based on the accumulated daily totals for the meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters possible to display from the Options icon are as follows:

DP	This field represents the differential pressure. The value shown is the average of one second samples for the day.
SP	This field represents the static pressure. The value shown is the average of one second samples for the day.
TF	This field represents the flowing temperature. The value shown is the average of one second samples for the day.
Volume	The Volume values are the sum of all the volume quantities that are calculated for each Volume Calculation Period during the Contract Day.
Integral	Within this user-defined field the user can elect to hold the valve closed until the Integral enables. The options available are either Enabled or Disabled.
Energy	This value represents the sum of energy quantities (MMBTU) that are accumulated since the beginning of the Contract Day. This is updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the energy quantity is calculated by multiplying the Volume Calculation Period volume by the energy content.
DP Min	Minimum Differential Pressure recorded during the Contract Day.
DP Max	Maximum Differential Pressure recorded during the Contract Day.
DP Percent Low	Displays the percentage of time the Differential Pressure was below the low limit during the Contract Day.
DP Percent Hi	Displays the percentage of time the Differential Pressure was above the high limit during the Contract Day.
SP Min	Minimum Static Pressure recorded during the Contract Day.
SP Max	Maximum Static Pressure recorded during the Contract Day.
SP Percent Low	Displays the percentage of time the Static Pressure was below the low limit during the Contract Day.
SP Percent Hi	Displays the percentage of time the Static Pressure was above the high limit during the day.
TF Min	Minimum Temperature recorded during the Contract Day
TF Max	Maximum Temperature recorded during the Contract Day
TF Percent Low	Displays the percentage of time the Temperature was below the low limit during the Contract Day.
TF Percent Hi	Displays the percentage of time the Temperature was above the high limit during the Contract Day.
Period Time	If Day Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Back Flow	Number of one second samples where DP is at least three inches below zero.

Log

The Log tab provides information for the log period records (typically hourly records) for the selected meter.

The Day button allows the user to set the number of days displayed at one time.

The user can select the View button to display the charted information in a Grid (default) or Graph format. The user can hover the mouse cursor over any portion of the graph display to display the value and date/time of the variable reading. (This can also be done for any of the displayed variables on the graph.)

There is an option to expand/collapse the Graph view. The Expand button shall expand the graph to full screen. The Collapse button will return the graph to normal view.

Legends are selectable under graph. In case the graph has more than four parameters, an option is provided on the bottom of the graph to select up to four possible variables for plotting in overlay and once selected, they will be shown on the bottom of the graph as legends (selectable) . A minimum of one variable is to be selected.

The parameters displayed in this chart are as follows:

DP	This field represents the differential pressure (kg/cm2).
SP	This field represents the static pressure (PSIA).
TF	This field represents the flowing temperature (Deg F).
Integral	The Integral value represents the portion of the flow rate equation that is integrated each second. The volume period computation made by the computer is the product of C and the integrated extension (AGA 1985) or the integral multiplier and the integrated extension (AGA 1992).
Volume	This field displays the totalized volume (MCF).
Energy	This value represents the sum of energy quantities (MMBTU).
Flow Time	Number of one second samples where DP is above zero cutoff, divided by the number of one second samples in a day, times 100 (rounded to the nearest .5 seconds).
Period Time	If Log Period, enter the frequency at which the trend data is logged. The format is hh:mm:ss in which one second is the fastest allowable time. It is recommended that Log Periods not be set faster than is necessary to conserve the device's processor time. Also, the more frequent the Log Periods, the faster the available memory of the device is used.

Event

The Event tab provides a table of events from the selected meter. The information is presented as one line per event with a date and time stamp.

The Day button allows the user to set the number of days displayed at one time.

The parameters displayed in this chart are as follows:

Event	This field displays the type of event that occurred.
Old Value	This field represents the value or condition that existed prior to the event. For a DP or SP check, this shows the actual reading (manually entered by the technician) when a test pressure is applied.
New Value	This field represents the value or condition entered by the technician. For a DP or SP check, this is the test pressure applied on the transducer.
SN	If displayed, this is a sequence number assigned to each event. The numbers should be in sequence and if there is a gap in the sequence, it could signal a problem.

Analysis

The Analysis tab provides information on the composition elements and other parameters of either Fixed or Live analysis. The user can opt for either analysis method by selecting the corresponding option as well as the Advanced Setup option.

In Fixed analysis, the user can use the left Composition Elements column to edit each or all of the read/write fields to set the individual percentage of each element.

The right Gas Properties column has two read/write fields that can be selected and edited as well. These two fields are as follows:

Heating Value @ Tb and Pb	Calculation of Energy is based on Volume or Mass. Energy is calculated by multiplying the Heating Value times the Volume or Mass.
Real Specific Gravity	This value should be at the contracted pressure and temperature bases.

The Others section only has one editable field as follows:

FPV Method	FPV method is then squared (Fpv2) to derive the compressibility factor (Fs) for pulse meters. • Available FPV methods are: • AGA8 Gross Method 1 - This method uses Gross Heating Value, Relative Density and Carbon Dioxide. • AGA8 Gross Method 2 - This method uses Relative Density, Nitrogen and Carbon Dioxide. • AGA8 Detail 92 - This method basically supports a total analysis. • ISO 12213-2 - This method supports total analysis as specified in the international standard ISO 12213-2. • SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi • For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.

In Live analysis, the user relies on real time data as displayed in each field under the Live column.

The values in the Calc column display the last calculated values of variables that are specific to volume calculations. Updated frequency of the last calculated values is based on the Volume Calculation Period. The data displayed varies depending on the type of device and is for informational purposes only. Some of the information displayed will be familiar to the user, while others will not. As this is the case, the information presented is likely to be more useful to a Totalflow customer service representative than a field user.

The Advanced Setup option includes both the Analysis and Therms Setup.

In the Analysis Setup, the first three user defined fields deal with the type and duration of the analysis type selected. The multiple configuration parameters default to use the fixed values although multiple options are available for the user.

The Therms Setup allows the user to select the fields to assign required values for the assigned fields. These fields are defined as follows:

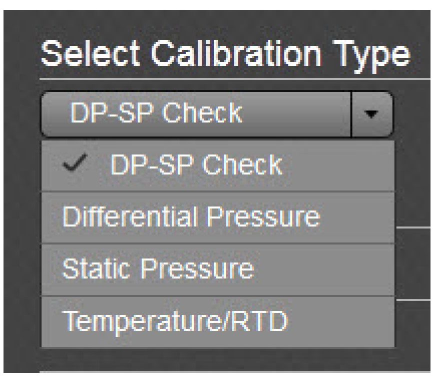
Attached to Stream #	If using analyzer data from a Master, select the stream number to use. If not using analyzer

Stream ID	Enter four numeric numbers to help uniquely define the measurement tube's stream ID (e.g., 1234). Each measurement tube must have a unique stream ID. The tube's complete stream ID is composed of the four digit stream ID assigned here, the analyzer Modbus ID and the stream number currently attached (e.g., 1234-01-01).
Analyzer Modbus ID or Btu Stream Unit #	If this tube application is running on a flow computer, enter the Modbus ID of the external Therms analyzer. If this tube application is running on an NGC and the source of the analysis data is a Btu application, enter the Btu Unit Number. If this tube application is running on an NGC and the source of the analysis data is a Therms application, enter the Modbus ID of the external Therms analyzer.
Stream Source App	Enter the application number of the application providing the analysis information. This can be a Therms Master, Therms Slave or a Btu Stream application. A Btu Stream application only applies to an NGC.

Calibration

The Calibration tab provides necessary information to assist the user in completing the calibration process and a resulting report. With the tab selected, the Select Calibration Type button is initially selected to display the desired calibration check. The options for the checks are as follows:

• DP-SP Check
• Differential Pressure
• Static Pressure
• Temperature/RTD

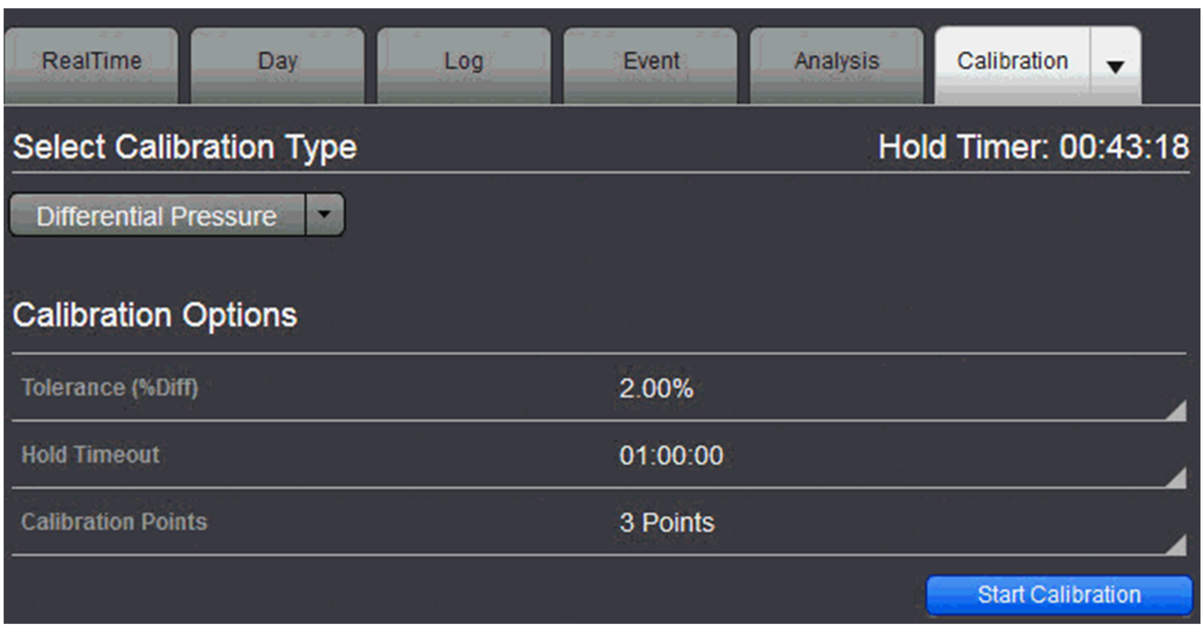


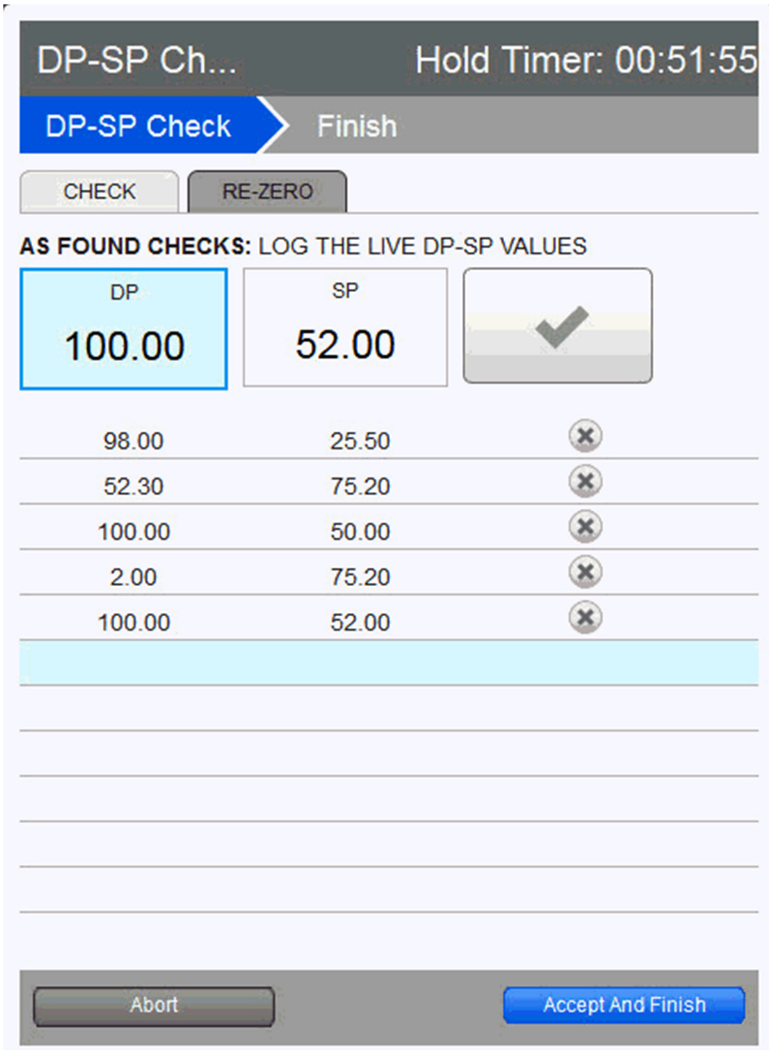
To start the calibration, select the type. Note the display of the Calibration Options fields changes depending on the calibration type selected as follows:

Tolerance (% Diff)	The user selects a tolerance value equal to a desired % of the range; a warning message will display if the difference between the measured value and entered value exceeds this value. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Hold Timer	When the user elects to move into Calibration mode, the tube immediately moves into Hold Timer mode. The Hold Time Out (seconds) field allows the user to set a time frame (in seconds) from which to take the tube out of hold. The default is set to 3600 seconds (1 hour), but the user can establish a different time frame based on their individual needs. It should be noted that the timer starts as soon as the user moves into Calibration mode. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)

Calibration Points	The user would select the number of calibration points from this field. Options are 3 Points or 5 Points depending on the desired accuracy of the calibration. With the setup complete, the 3 or 5 point Target pressure values will be calculated for convenience. These are suggested because of being evenly spaced across the calibration range, but it is not mandatory that these be used. (applies to the following calibration checks: DP-SP, Differential Pressure, Static Pressure, Temperature/RTD)
Do you want to calibrate in Gauge?	This option is simply an aid for doing checks. Selecting gauge allows the user to enter values directly from the test pressure without having to add the barometric pressure which is automatically included. (applies to the following calibration checks: Static Pressure)
Barometric Pressure	This value is subtracted from Absolute pressure readings when calibrating the static pressure in gauge pressure and for displaying the static pressure in gauge on the device’s display. This value is also entered on the calibration screen when calibrating in gauge pressure. (applies to the following calibration checks: Static Pressure)
Temperature Bias	If the user elects to use Temperature/RTD as a calibration method, select the Temperature Bias field under Calibration Options. This allows the user to enter a new value. The RTD's temperature will always be biased by this value. (applies to the following calibration checks: Temperature/RTD)

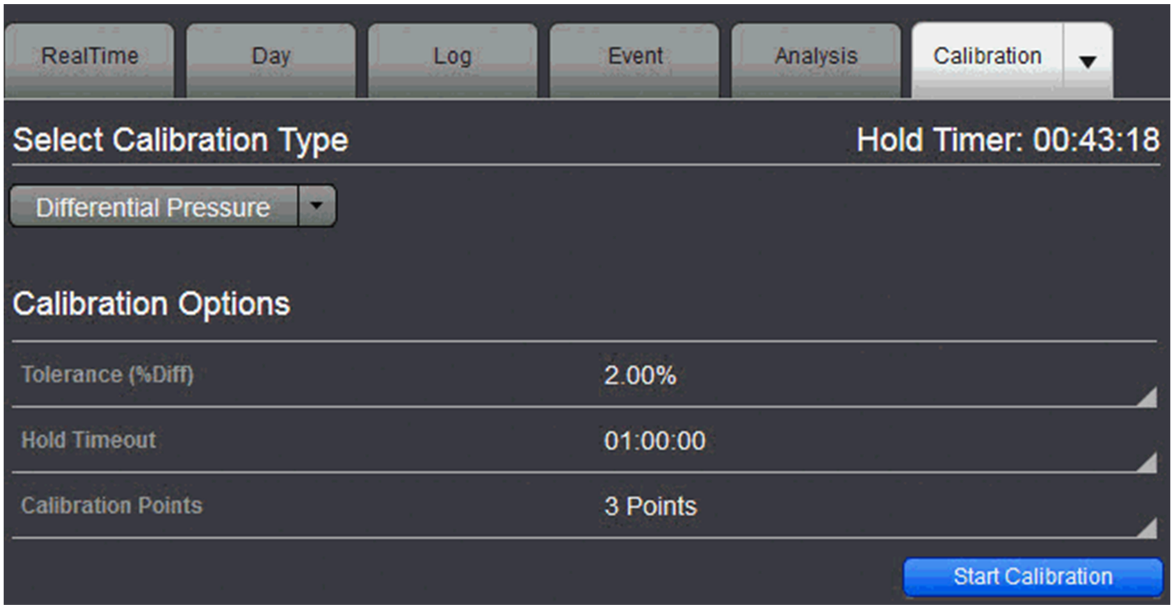
The user would change the value of any of the fields displayed for the check selected as needed. Then the Start Calibration button would be selected to start the process.





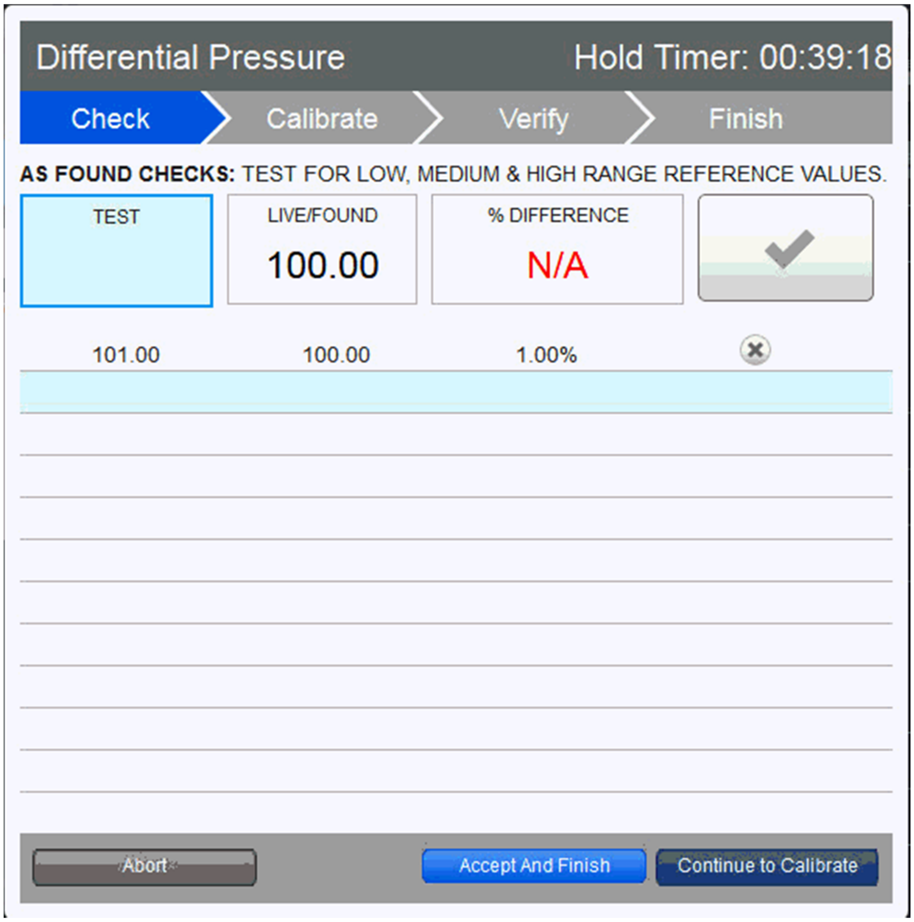
The DP-SP Check screen was designed as a troubleshooting tool so that the static pressure could be varied while at the same time, recording the differential pressure. Any significant change in the DP while changing the SP indicates a problem. The applied static pressure will be displayed in the SP window as well as the differential pressure in the DP window. Clicking on the check mark box will accept the pressures. Repeat the process to enter the number of static pressure points desired. If it's decided that a re-zero is needed before any more checks, click the RE-ZERO tab and a screen will appear to allow the user to re-zero the transducer and return to the Checks screen. The buttons with X's can be used to delete the selected entries from the log until the desired entries are input. Select the Accept & Finish button to complete the entry process which will save the checks as the "As Found" and "As Left" and log the check events. The user can now "Abort" to finish or select the "Add to Report & Finish" button to send the data to reports and finish.

Selecting the Add to Report & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.

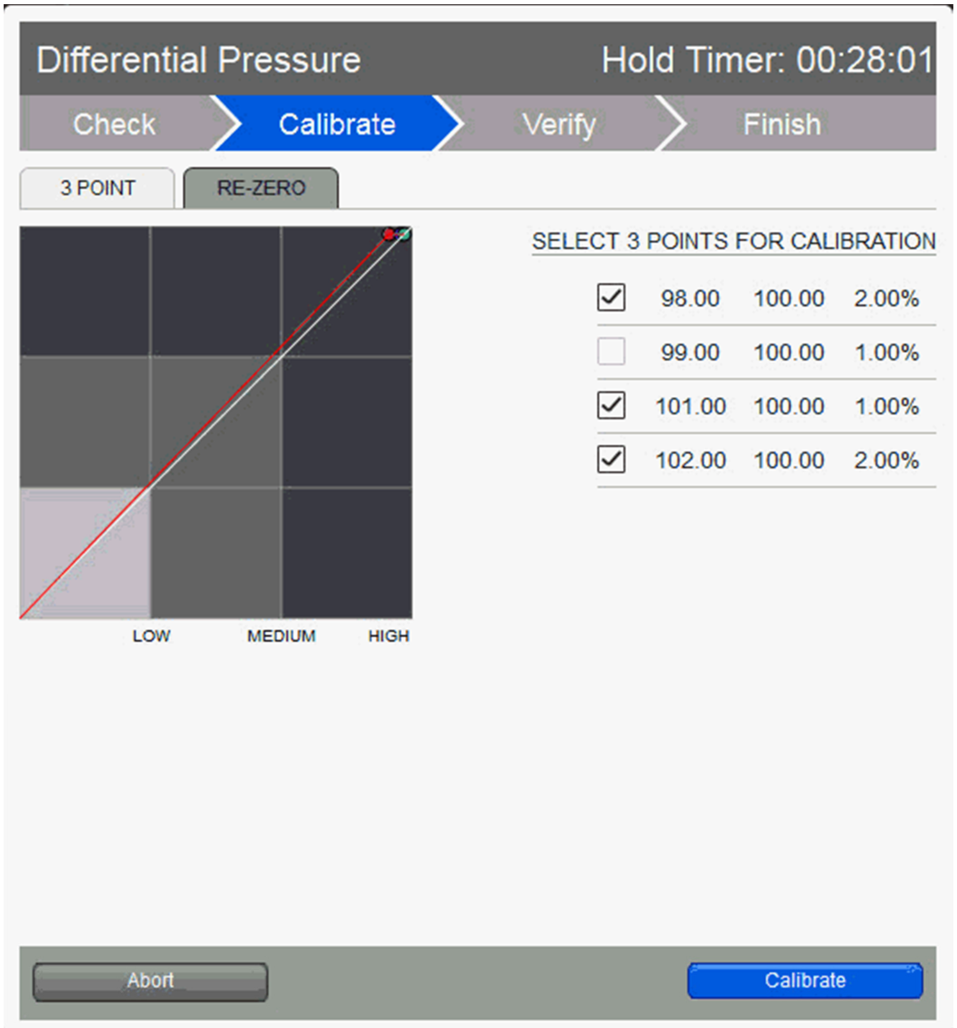


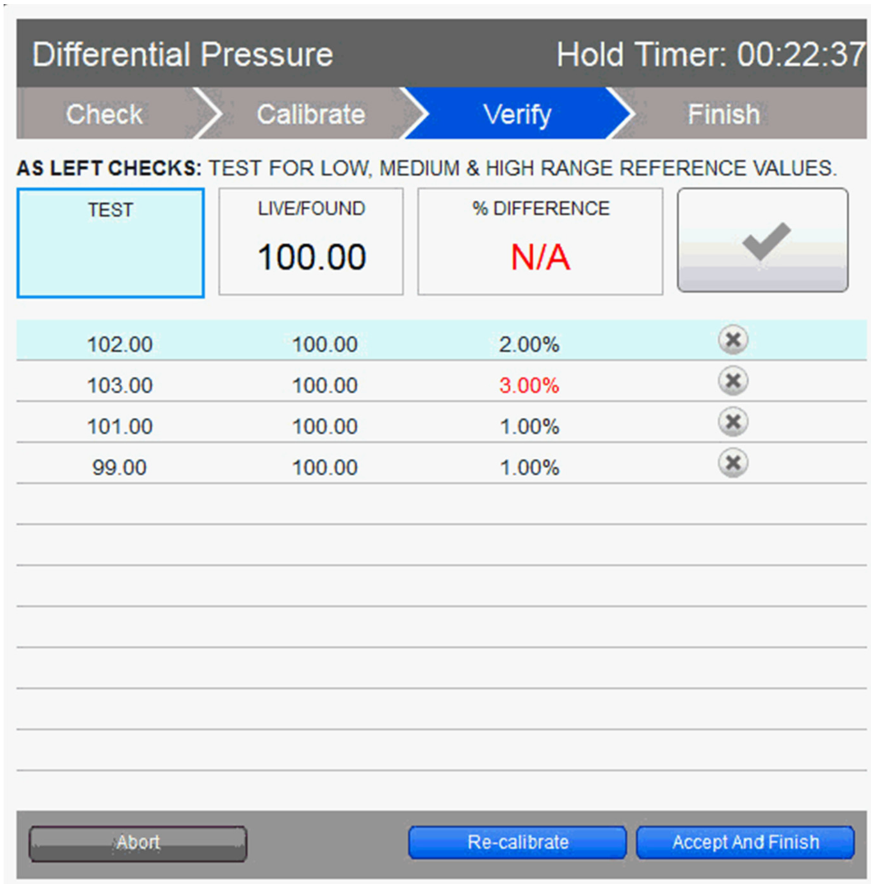
Next select the Differential Pressure Calibration Check and modify the read/write fields if necessary. Then click the Start Calibration to begin.

With the Differential Pressure (DP) Calibration Check, the As Found checks are entered by selecting a low, medium and high value. This is done by selecting a test value and selecting a Check mark to enter the value. The % of difference will also display. Repeat the process to enter the number of points desired. If satisfied the Accept & Finish button is selected and the As Found and As Left values are displayed.

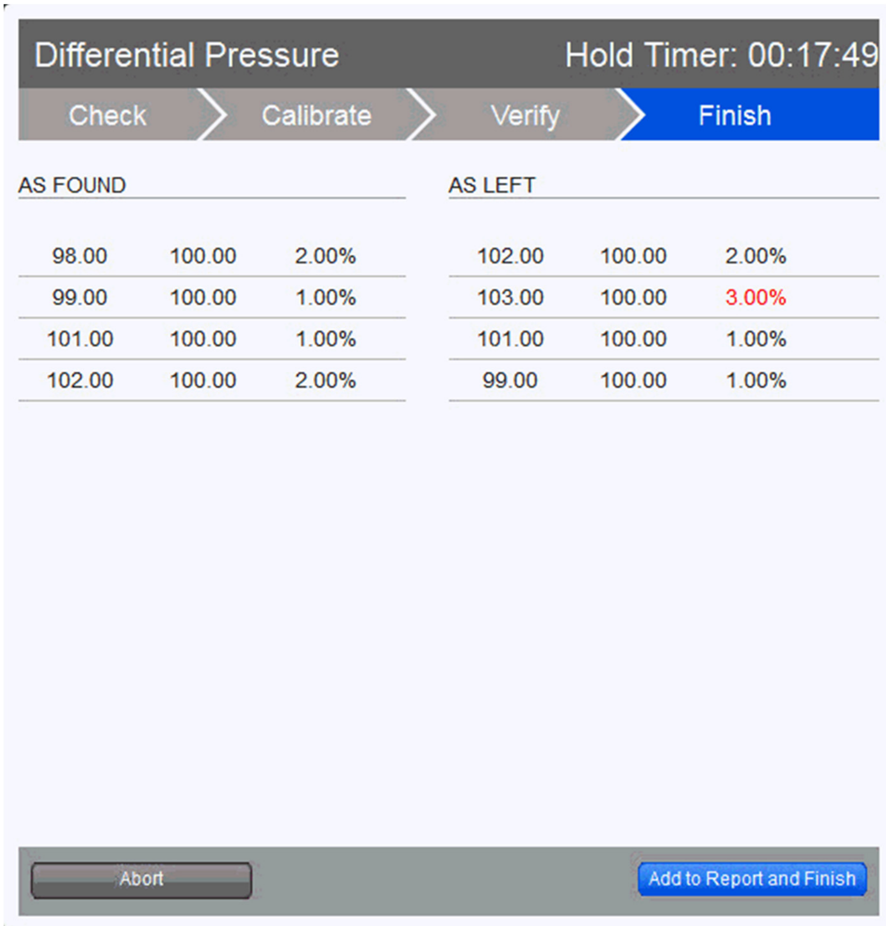


The DP Calibrate screen allows for doing checks or doing checks and a calibration. Start with doing checks and then continue with the calibration if needed. The As Found checks are created by applying different test pressures across the calibration range. For each test pressure applied, enter the test pressure in the Test box and click the Check Mark. The live reading will be displayed in the Live/Found box and be captured along with the entered Test value when the Check Mark is clicked. The % difference between the Test value and the live value will also be displayed. Repeat the process to enter the number of points desired. If checks are all that are required, click "Accept and Finish" or "Continue to Calibrate" to do a calibration.


Differential Pressure
Hold Timer: 00:28:01
Check
Calibrate
Verify
Finish
3 POINT
RE-ZERO
SELECT 3 POINTS FOR CALIBRATION
98.00 100.00 2.00%
99.00 100.00 1.00%
101.00 100.00 1.00%
102.00 100.00 2.00%
LOW
MEDIUM
HIGH
Abort
Calibrate

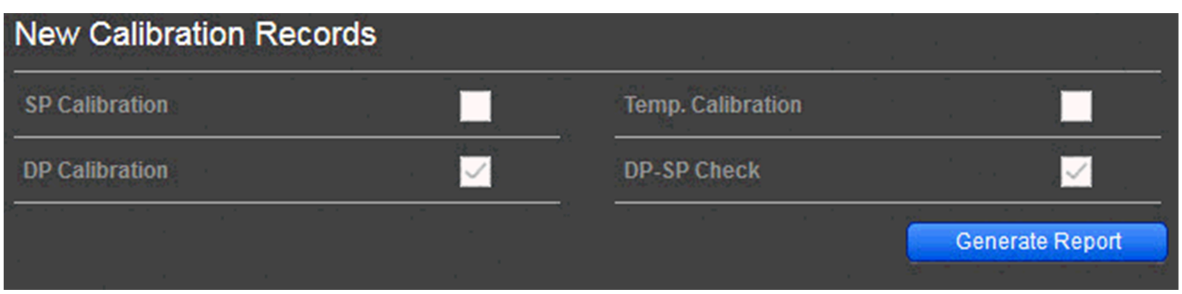


If the user is satisfied at this point, the Accept & Finish button is selected. If not satisfied, the user can select the Re-calibrate button until satisfied. Selecting the Accept & Finish button will complete this calibration. If the user wants to start the process over and not accept the entries, the Abort button would be selected instead.



With the SP Calibration Check, the process is the same as the DP check.

The final Calibration Check is the Temperature/RTD. The process is also the same as the DP Calibration Check and the SP Calibration Check.



With a completed calibration, the appropriate box or boxes would be checked. The user could then select the Generate Report button to generate a report in HTML.

Configuration

The user can select the Configuration tab to access the read/write and read only fields used to set up data needed for configuration.

The following seven (7) areas of fields are accessible to the user:

- Constants
- Factors
- Commands
- Log Capacity
- Setup
- Current Values
- Limits

The following information is provided in relation to all parameters and their fields:

Constants

Barometric Pressure	Enter a value in the units as specified by the Units column. This value is subtracted from Absolute pressure readings when calibrating in Gauge pressure and for displaying the Static pressure in Gauge pressure on the device's display. This value can also be entered on the calibration screen when calibrating in Gauge pressure.
Dp Zero Cutoff	Enter the value in units as specified. A decimal point is allowed. No volume calculations will occur when DP is below this value.
SP Tap Location	Select from the drop-down list, the location (upstream, downstream) of the SP tap in relation to the V-Cone position.
V-Cone Diameter	Enter the orifice diameter size in dimensional units as specified.
Pipe Diameter	Enter the pipe diameter size in dimensional units as specified in the Units column.
Pressure Base (Pb)	Enter the Pressure Base in the units as specified by the Units column. A specific Pressure Base value may be required because of contractual agreements.
Temperature Base (Tb)	Enter the Temperature Base in the units as specified by the Units column. A specific Temperature Base may be required because of contractual agreements.
Z of Air @ Tb and Pb	Z of Air at the contractual values for pressure base and temperature base. Enter a value for the Z of Air. This is the compressibility of air at a reference temperature (Typ. 60 degrees). One default standard is .99959.
Auxiliary Factor (Faux)	This value used when the Faux factor is turned on under the Factors tab. This factor is typically used as the Full Well Stream factor. See the 1992 Factors for more information on Faux.
Viscosity	Enter the Viscosity in the units as specified by the Units column.
Specific Heat Ratio (cp/cv)	Enter the Specific Heat Ratio. This is Cp divided by Cv. A typical value is 1.3
V-Cone Exp. Coef.	Select the V-Cone material type from the drop-down list. A standard expansion coefficient is used based on the material type. Three standard material types are provided (Stainless Steel, Monel and Carbon Steel). If an orifice plate is used of a different type material, the user must select Other. A dialog box will display and enable the user to set a pre-defined value or a custom value. Move the decimal point six places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times 10 -6.
Pipe Coef Exp	A standard expansion coefficient is used based on the material type. Three standard material types are available (Stainless Steel, Monel & Carbon Steel).

	If pipe is used of a different type material, the user must enter an Expansion Coefficient in units. Move the decimal point 6 places to the right, and enter in the format of (x.xx) which is then scaled by the flow computer to x.xx times E - 6.
Fixed Cd	If Use Calc Cd is not selected in the Factors tab, this fixed value for Coefficient of Discharge is used. The default value is .8 but can be edited.
Fixed Ap	Click in the Fixed Ap field and enter the absolute pressure to be used (14.73 PSIA). This value can be edited by the user.

Factors

Use Calc Cd	Coefficient of Discharge factor (Cd) - Select Yes for the flow computer to calculate and use this factor in the volume calculations. Selecting No will cause the flow computer to use a Fixed Cd which is entered on the Constants tab.
Use Y	Expansion factor (Y) - Select Yes for the flow computer to calculate and use this factor in the volume calculations.
Use Fpv	Supercompressibility factor - Select "Yes" for the flow computer to calculate, and use this factor based on the Fpv method selected on the General tab.
Use Fw	Water Vapor factor - Used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is water in vapor phase. If enabled, Fw is computed by the flow computer.
Use Faux	Faux - Typically used as a Full Well Stream factor which is used to adjust the computed gas volume downward to account for the portion of the measured fluid stream that is liquid. The user enters a value which will be used as a direct multiplier when calculating C'. For example, a value of 0.9 would result in a volume reduction of 10%. The percentage liquids in the stream is typically determined by a Full Well Stream Test. The Faux factor is entered under the Constants tab. Since Faux is a direct multiplier to the volume, it can be used for any correction to the volume not accounted for in the basic equation.

NOTE: Although factors (Faux and Fw) are being used by some companies, they have not been adopted by any standards committee.

Commands

Reset Volume	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Volume:

	· Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event with the accumulator value before zeroing the accumulator. · Zeroes the total volume accumulator. · Begins a new flow file daily record.
Reset Log Period	Select Yes from the drop-down menu, and click the Send button. The user will be asked to confirm the request. Answer Yes for the request to be carried out. This is similar to a Reset Volume, except the volume accumulator is not zeroed. A typical use for this command is just prior to an orifice plate change on a gas orifice meter. The device reacts, as follows, to a Reset Log Period: · Completes all computations for the present flow file daily record. · Stores date/time and partial log period's volume into its historical record. · Logs an event in the Event file. · Begins a new flow file daily record.
Set site code	Enter up to seven numerical digits, and a decimal point is allowed anywhere among the digits. A site code entry enters an event in the event file using the site code number. This number can represent anything to the user as some function performed at the site.

Log Capacity

Maximum # Daily Records	Enter the maximum number of Daily Records that the device will store. The default of 50 is recommended.
Maximum # Log Period Records	Enter the maximum number of Log Period Records that the device will store. The default of 970 is recommended. 970 allows for 40 days of hourly records. One Log Period Record is used no matter what the Log Period time.
Maximum # Event Records	Enter the maximum number of Event Records that the device will store. Each entry into the Event file is a record.

Setup

Device/APP ID	Enter up to ten alpha-numeric characters for the Device/APP ID. This identifies the specific application or flow calculation. A Station or device can have multiple flow calculations running simultaneously, and each of those will have their own Device/APP ID.
Tube Description	Enter up to 24 alphanumeric characters for a description of the tube. This is helpful when there is more than one tube application running in a single device.
Contract Hour	Enter the contract hour in military time (0 - 23). The contract hour is the start of the day for daily volumes.
Vol Calc Period	Select the volume calculation period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 seconds/minutes. This is the rate at which the volume is calculated based on one second averages of SP, DP and Temperature. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be greater than the log period. If not the same, the log period should always be an even multiple of the volume calculation period.

Log Period	Select the log period from the drop-down list. Options are 1, 2, 5, 10, 20, 30 and 60 minutes. This is the rate at which the calculated volumes are logged to the historical file. Unless otherwise required, the default of 60 minutes is recommended. This period can be the same as but should never be less than the volume calculation period. If not the same, it should always be an even multiple of the volume calculation period. This option is only valid in devices supporting the new database (DB2) and when in the Extended Characteristic mode. A default period of one hour is used at all other times.
Fpv Method	Select the compressibility (Fpv) method from the drop-down list. Available Fpv methods are: · NX19 fixed FtFp - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method but user must manually calculate and enter Ft and Fp. · NX19 GCN - Uses NX19 Gravity, Carbon Dioxide and Nitrogen method. · NX19 GCNM - Uses NX19 Gravity, Carbon Dioxide, Nitrogen and Methane method. · NX19 GCN or GCNM - This method automatically switches to GCNM method if Gravity exceeds .75 and/or Carbon Dioxide or Nitrogen exceeds 15%. · AGA8 Gross 92 - This is the default method when selecting the AGA3-1992 equation. This is one of the newer and recommended Fpv methods, assuming only Specific Gravity, Carbon Dioxide and Nitrogen are used. · AGA8 Detail 92 - This method supports total analysis. · SGERG88 - This method adheres to the international standard ISO 12213-3. For this method to be viable, one of the following base conditions must exist: ♣ 0 C / 32 F and 1.01325 bar / 14.695949 psi ♣ 15 C / 59 F and 1.01325 bar / 14.695949 psi ♣ 15.555556 C / 60 F and 1.01592 bar / 14.734674 psi ♣ 15.555556 C / 60 F and 1.01560 bar / 14.730033 psi For detailed information on these methods, see the American Gas Association, Report No. 8 / American Petroleum Institute Chapter 14.2 and/or ISO Standards 12213-2 and 12213-3.
Vol. Unit - Flow Rate	Select the volume unit and associated flow rate unit from the list. The first unit is the volume and the second is the flow rate unit. Selections are paired as shown: · MCF - SCF/Hr · MCF - MCF/Day · MMCF - MCF/Hr · MMCF - MMCF/Day
SP/DP Averaging	Select Linear or Square Root averaging from the drop-down list. The following explanation applies to the Differential Pressure, Static Pressure and Temperature. · Linear - Sums the samples and divides by the number of samples. · Square Root - Sum of the square root of the samples divided by the number of samples and squared.
Hold Time Out (Seconds)	Sets a time duration (in seconds) that informs the device how long to remain in Hold when the user is in Calibration mode. The default is set to 3600 (1 hr.). This is primarily protection against getting side-tracked and forgetting to take the unit

	out of Hold. This pertains to any tube that is put in Hold while in Calibration mode.

Current Values

Static Pressure	Displays the current Static Pressure value (PSIA)
Differential Pressure	Displays the current Differential Pressure value (InH2O)
Temperature	Displays the current Temperature value (Degrees F.)
Flow Rate	Displays the current Flow Rate for this particular log record (MCF/day).
Energy Flow Rate	Displays the current Energy Flow Rate value (MBTU/Hr)
Today's Volume	This value is updated at the end of each Volume Calculation Period. The Volume Calculation Period represents the rate at which the volume is calculated based on one second averages of the static pressure, differential pressure and temperature. At the end of this period, the average value of the extension (portion of the flow rate equation that is integrated each second) is multiplied by other factors in the AGA-3 equation to arrive at the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Every Volume Calculation Period volume is added to the current volume for the duration of the Contract Day.
Today's Energy	At the end of each Volume Calculation Period, Energy is calculated using the equation: Energy = Indicated Volume x Heating Value Each Volume Calculation Period Energy is added to the current Energy for the duration of the Contract Day.
Yesterday's Volume	This is the prior Contract Day's volume. The Contract Day is defined as a 24-hour period that establishes the parameters for a complete day.
Yesterday's Energy	Prior Contract Day’s energy.
Accumulated Volume	Updated at the end of each Volume Calculation Period. At the end of the Volume Calculation Period, the average value of the Extension is multiplied by the Integral Multiplier resulting in the flow rate for the Volume Calculation Period. The flow rate is then multiplied by the Volume Calculation Period. Each Volume Calculation Period volume is then added to the accumulated volume until zeroed by a Reset Volume command or an accumulator rollover happens.
Last Calculated Period Volume	Volume for the last Volume Calculation Period.

Limits

Sp High Limit	This represents the higher limit of the static pressure value that can be sent to the tube application.
Sp Low Limit	This represents the lower limit of the static pressure value that can be sent to the tube application.
Dp High Limit	This represents the higher limit of the differential pressure value that can be sent to the tube application.
Dp Low Limit	This represents the lower limit of the differential pressure value that can be sent to the tube application.
RTD High Limit	This represents the higher limit of the total flowing temperature value that can be sent to the tube application.

RTD Low Limit	This represents the lower limit of the total flowing temperature value that can be sent to the tube application.
Flow Rate High Limit	This represents the higher limit of the flow rate value that can be sent to the tube application.
Flow Rate Low Limit	This represents the lower limit of the flow rate value that can be sent to the tube application.

Adv Setup

Adv Setup

Static Pressure	Displays and/or allows entry of the Static Pressure register used in flow calculations.
Diff Pressure	Displays and/or allows entry of the Differential Pressure register for AGA-3 or Pulse Input register for AGA-7 used in flow calculations.
Temperature	Displays and/or allows entry of the Flow Temperature register used in flow calculations.
Static Pressure Type	Select whether the static pressure is coming from a Gauge or Absolute pressure device.
Use Fixed Static	Select Yes to use the Fixed Static pressure instead of a measured pressure. Used for AGA-7 tubes when static pressure is not available.
Fixed Static	Enter a value to be used when the Use Fixed Static is set to Yes.
RTD Installed	Select Yes if you are using an RTD for flowing temperature.
Use Fixed Temperature	Select Yes to use the Fixed Temperature instead of a measured temperature.
Fixed Temperature	Enter a value to be used when the Use Fixed Temperature is set to Yes. The Fixed Temperature will also be used in case of an RTD error if setup on the Fixed Values On Errors tab.

No Flow

Digital Input	Enter the digital input register address (format 0.0.0). This can be either one of the two on-board digital inputs or a digital input from one of the optional external modules.
DI Action	Select whether an Open Contact or a Closed Contact constitutes a No Flow condition.
Flow State	Displays the Flow State as Flow or No Flow based on the Digital Input specified above and the DI Action selected.

Speed of Sound

Speed of Sound Calculation	Select either Disabled or Enabled
Speed of Sound	Displayed in meters/second

Digital Output

Digital Output 1

Digital Output	Specify the output register for Digital Output 1 or Digital Output 2 depending on the tab selected.
Volume Setpoint	Enter the Volume Setpoint in MCF for tripping of the digital output by the Volume Setpoint command.
Trip on Volume Setpoint	If set to Yes, the digital output will be tripped each time the Volume Setpoint is reached.
Trip on DP Low	If set to Yes, the digital output will be tripped on the DP Low alarm. Alarm limits are set in the Limits tab.
Trip on DP High	If set to Yes, the digital output will be tripped on the DP High alarm. Alarm limits are set in the Limits tab.
Trip on SP Low	If set to Yes, the digital output will be tripped on the SP Low alarm. Alarm limits are set in the Limits tab.
Trip on SP High	If set to Yes, the digital output will be tripped on the SP High alarm. Alarm limits are set in the Limits tab.
Trip on TF Low	If set to Yes, the digital output will be tripped on the Flowing Temperature Low alarm. Alarm limits are set in the Limits tab.
Trip on TF High	If set to Yes, the digital output will be tripped on the Flowing Temperature High alarm. Alarm limits are set in the Limits tab.
Trip on Fr Low	If set to Yes, the digital output will be tripped on the Flow Rate Low alarm. Alarm limits are set in the Limits tab.
Trip on Fr High	If set to Yes, the digital output will be tripped on the Flow Rate High alarm. Alarm limits are set in the Limits tab.
Trip on Charger Low	If set to Yes, the digital output will be tripped on the Low Charger alarm. The Low Charger alarm happens automatically if the charging source is removed or cannot maintain an adequate battery voltage.
Trip on Digital Input	If set to Yes, the digital output will be tripped if the Digital Input specified below is set to a 1 (senses a closed contact).
Digital Input	Specify a digital input register (format 0.0.0) for the Trip on Digital Input option.
DO Action	Select whether the digital output is to act as a Normally Open or Normally Closed contact.
Auto Reset	If set to Yes, the digital output will reset after the Auto Reset Delay time has elapsed. If set to No, Auxiliary Contact 1 will remain tripped until manually reset.
Auto Reset Delay (Sec)	Specify the amount of time in seconds Auxiliary Contact 1 will reset after being opened or closed by some action. Auto Reset must be set to Yes.
Current State	Displays the current state of the digital output as Open or Closed.
Manual Operation	This function allows the user to manually operate the digital output. This might be done for testing purposes. If the DO Action parameter above is set to Normally Open, Trip will close the digital output, and Clear will open the digital output. If the DO Action parameter is set to Normally Closed, Trip will open the digital output and Clear will close it.

Digital Output 2
(Same as Digital Output 1)

Orifice Change

The user can select the Orifice tab to change the Orifice Plate. The first option would be to ensure all read/write fields have the correct value selected. These fields are as follows:

V-Cone Diameter	Enter the V-cone diameter size in dimensional units.
Pipe Diameter	Displays the pipe diameter size in dimensional units.
Sp Tap Location	Displays the location (upstream, downstream) of the Sp tap in relation to the V-Cone plate.
Hold Time Out	Default to one hour but can be edited by the user.

Once all the fields are showing the desired values, the user must first select the Hold button to set the timer at 60 minutes. The flow pressure is then held for that period of time to allow the user to change the orifice plate. The user then changes the orifice plate. Once finished, the user would select the Flowing button to resume flow.

V-Cone

V-Tube Type	Enter tube type (Precision or Wafer Cone).
No. of Cd Table Entries	Specify the number of pairs (Reynolds number and associated Cd numbers) entered when the Use Calc Cd is set to Yes (see Factors).
Reynold's Number #1	Enter the Reynold's Number value of the first pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #1	Enter the Flow Coefficient value of the first pair (Reynold's Number and Flow Coefficient).
Reynold's Number #2	Enter the Reynold's Number value of the second pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #2	Enter the Flow Coefficient value of the second pair (Reynold's Number and Flow Coefficient).
Reynold's Number #3	Enter the Reynold's Number value of the third pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #3	Enter the Flow Coefficient value of the third pair (Reynold's Number and Flow Coefficient).
Reynold's Number #4	Enter the Reynold's Number value of the fourth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #4	Enter the Flow Coefficient value of the fourth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #5	Enter the Reynold's Number value of the fifth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #5	Enter the Flow Coefficient value of the fifth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #6	Enter the Reynold's Number value of the sixth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #6	Enter the Flow Coefficient value of the sixth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #7	Enter the Reynold's Number value of the seventh pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #7	Enter the Flow Coefficient value of the seventh pair (Reynold's Number and Flow Coefficient).
Reynold's Number #8	Enter the Reynold's Number value of the eighth pair (Reynold's Number and Flow Coefficient).

Flow Coefficient #8	Enter the Flow Coefficient value of the eighth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #9	Enter the Reynold's Number value of the ninth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #9	Enter the Flow Coefficient value of the ninth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #10	Enter the Reynold's Number value of the tenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #10	Enter the Flow Coefficient value of the tenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #11	Enter the Reynold's Number value of the eleventh pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #11	Enter the Flow Coefficient value of the eleventh pair (Reynold's Number and Flow Coefficient).
Reynold's Number #12	Enter the Reynold's Number value of the twelfth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #12	Enter the Flow Coefficient value of the twelfth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #13	Enter the Reynold's Number value of the thirteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #13	Enter the Flow Coefficient value of the thirteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #14	Enter the Reynold's Number value of the fourteenth first pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #14	Enter the Flow Coefficient value of the fourteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #15	Enter the Reynold's Number value of the fifteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #15	Enter the Flow Coefficient value of the fifteenth pair (Reynold's Number and Flow Coefficient).
Reynold's Number #16	Enter the Reynold's Number value of the sixteenth pair (Reynold's Number and Flow Coefficient).
Flow Coefficient #16	Enter the Flow Coefficient value of the sixteenth pair (Reynold's Number and Flow Coefficient).

Calibration Report

Overview

Under the Calibration tab the user can run calibration and then generate a report from the same screen. Many of the fields are auto-populated during calibration and the user can add the results of a physical examination if required by tube type. Displayed here is an example of a Calibration report with much of the data already included.

Calibration Report

Report Date		Collection Time	

Section 1 - Meter

Device ID	AGA3-1	Field	
Location	Texas	State	
System		Producer	
		Purchaser	

Section 2 - Setup

Current Plate Size	1.00 in	Pressure Base	15.2	Temperature Bias	60 deg F
Pipe Size	2.067	Tap Type	Flange	Temperature Base	60.5 deg F
Atmos. Pressure	14.73 psia	SP Tap Location	Upstream	Specific Gravity	0.6

	Yes	No		Yes	No		Yes	No
Plate Inspected?			Dirty			Nicked?		
Edges Sharp?			Plate Mic'd			Warped?		
Seal Ring Damaged?			Pitted			Bevel Downstream		

Section 3 - Calibration Data

DIFFERENTIAL				STATIC PRESSURE				TEMPERATURE			
FOUND		LEFT		FOUND		LEFT		FOUND		LEFT	
Test	Meter	Test	Meter	Test	Meter	Test	Meter	Test	Meter	Test	Meter
10.43	43.12	6.97	19.54	34.54	12.78	13.12	67.87	12.78	65.20	14.55	21.17
21.33	7.12	22.11	11.45	23.39	72.18	7.75	87.08	14.44	51.12	84.45	65.52
8.05	10.12	55.41	98.10	42.13	65.07	47.71	22.17	19.98	14.39	34.67	87.90
41.19	23.67	54.20	71.14	45.52	50.00	61.17	9.99	98.18	10.97	80.02	47.97
10.0	21.87	63.65	40.09	49.91	29.89	47.16	34.54	21.22	56.66	65.23	10.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DP CHECK WITH PRESSURE ON SP			
FOUND		LEFT	
DP	SP	DP	SP
23.34	67.77	55.55	23.32
39.98	40.01	51.41	55.63
27.87	31.67	89.45	17.19

CAL RANGE		
DP	SP	Temp
0.00	0.00	0.00
0.00	0.00	0.00

Gas Sample Taken	Yes	No
H2S Analysis Done	Yes	No
PPM or %		
H2O Analysis Done	Yes	No

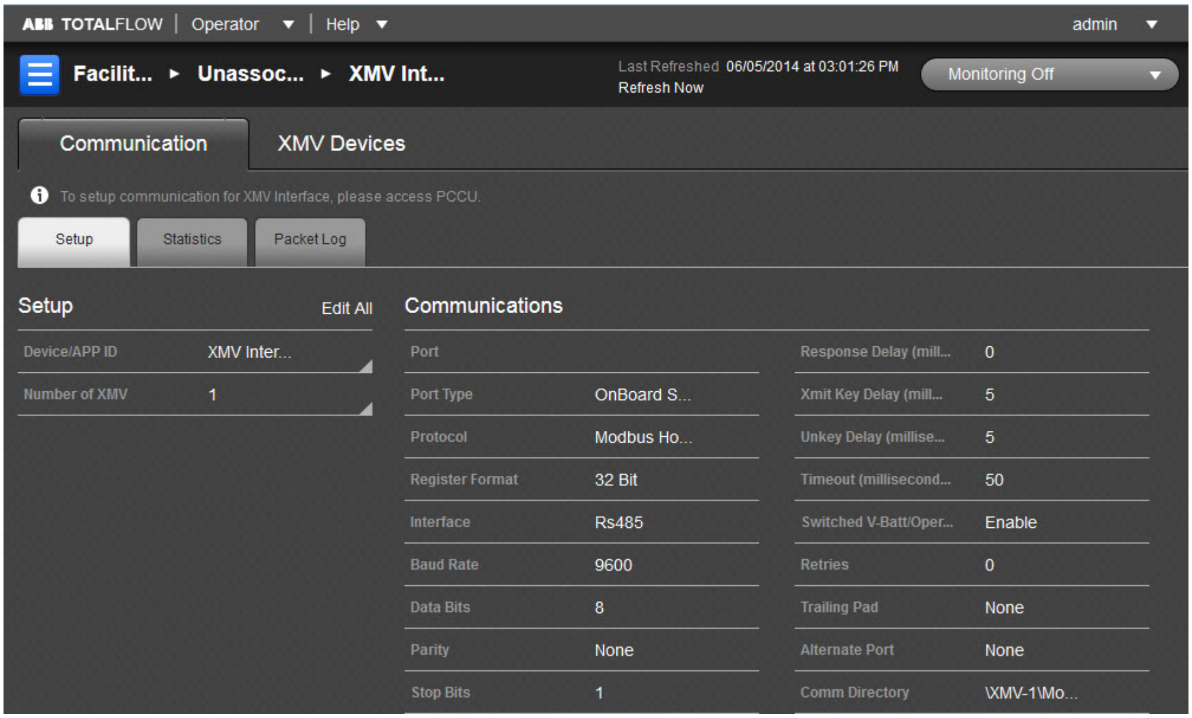
The following are the sections of the Calibration Report:

- Section 1: Meter - Information provided by the user identifying the individual meter
- Section 2: Setup - Input provided by the user impacting the calibration data generated
- Section 3: Calibration Data - the data generated by PCCU as a result of running the calibration

XMV Interface

Overview

The XMV Interface is an application for accessing an external multiple variable device that provides SP, DP and Temperature data.



Communication

Some of the parameters on this tab have options that can be selected and some where values can be entered. Where possible, default values are provided and recommended, but some installations may require different settings. Some parameters are fixed and for display purposes only. Parameters displayed may vary depending on the View level displayed.

To set up communication for XMV Interface, please access PCCU first.

Setup

Setup

Device/APP ID	The user can assign a name to the Device/APP ID or leave it at the default of XMV Interface. This is not like the typical Device/APP ID but rather a name that gets displayed in the tree-view of Entry mode for the user's reference.

Number of XMV	Enter the number of XMV transmitters up to a maximum of 8. Totalflow determined that eight XMV devices was the maximum number allowed per port to reliably return values within a 1 second time frame. AGA standards require that custody transfer applications retrieve values once a second. This being the case, If the user requires more than eight devices, they will need to instantiate an additional XMV Interface application and assign it to a different communications port.

XMV Setup

Type	Select the type of device to display from the XMV Setup screen.

Communications

Port	Type in the serial port that will be used to communicate with the XMVs. The port entered will be determined by the Port Type entered as shown below. • Port Type = OnBoard Serial - Enter COM1:, COM2: or COM3: if XRC. • Port Type = TFIO Serial - Enter CIM0:, CIM1:, etc. when using a TFIO communication's module. CIM number is based on the module's switch setting. • Port Type = TCP/IP - Currently XMVs do not support TCP/IP.
Port Type	The Port Type displays from the following list as shown below: • OnBoard Serial - Select if using one of the serial communication ports located physically on the device's main electronic's board. • TFIO Serial - Select when using a TFIO communications module referred to as a Communications Interface Module (CIM). These will be mounted on a rail external to the main electronics board. • TCP/IP - Select if using the Ethernet® port. (XMVs currently do not support Ethernet).
Protocol	Communication with XMVs is via Modbus Host (RTU) protocol.
Register Format	Select the appropriate format from the drop-down list. At the time of this writing, four XMVs were supported (ABB's 266CS, 267CS, Foxboro® Invensys IMV25 and Rosemount® 3095FB). If communicating with only ABB XMVs, use the default 32 Bit format. If communicating with Foxboro IMV25s, you must select 16 Bit Word Swapped or if you have a mixture that includes the Foxboro, you must select 16 Bit Word Swapped. Also, when using Foxboro units or a mixture that includes Foxboro units, set the Modbus Register to 401 on each XMV Setup tab; as opposed to 21 for the 32 Bit format with the exception of the Rosemount® 3095FB which uses 7401 for 32 Bit. 6. 32 Bit Totalflow - 32 bit values are transferred as a single 32 bit register. Register list entries are biased one greater than standard Modbus (7002 = 7001 Standard). 7. 32 Bit - 32 bit values are transferred as a single 32 bit register.

	8. 16 Bit Modicon® - 32 Bit values are transferred as two consecutive 16 bit registers. 9. 16 Bit Word Swapped - 32 Bit values are transferred as two consecutive 16 bit registers and swaps the order of the registers. 10. 16 Bit ROS Modulo 10000 - Multiplies the floating point number by 1000 and then divides by 10000. The integer portion (before the decimal point) goes into the first 16 bit register and the fractional portion (after the decimal point) goes in the second 16 bit register. Modbus® and Modicon® are registered trademarks of Schneider Automation, Inc. Foxboro® is a registered trademark of the Foxboro Company. Rosemount® is a registered trademark of Rosemount Inc.
Interface	Set to RS-485 for the XMV Interface. Available selections are: • RS-232 - Select if the port is connected to a radio or an RS-232 device. • RS-485 - Select if communicating via RS-485. • RS-422 - Select if communicating via RS-422. • Modem - Select if communicating via modem.
Baud Rate	Although the range displayed allows Baud Rates up to 115200, the applicable range for XMVs is1200 to 38400. The default Baud Rate of 9600 is required for the XMV devices to be polled and data retrieved within the 1 second requirement, especially if there is the full complement of 8 XMVs. The ABB 267/269CS and Rosemount® 3095FB are limited to 9600 baud. The ABB 266CS and the Invensys IMV25 are capable of 38400 baud. The baud rates for all XMVs must be set the same and match the baud rate set here.
Data Bits	Eight (8) data bits for XMV communication.
Parity	No parity for XMV communication.
Stop Bits	One (1) Stop Bit for XMV communication.
Response Delay (milliseconds)	Response Delay is a delay that is on the front end of communications between devices. It can be used by the device initiating a request and/or by the device responding to the request. Either way, it delays the start of communication to another device. Set to zero for no delay or enter a delay value in milliseconds. In the case of polling multiple XMVs, there may need to be a short delay to allow one XMV to respond before polling another XMV. Typically, 10 milliseconds works well when polling multiple XMVs at 9600 baud.
Xmit Key Delay (milliseconds)	Originally used when communicating via radio but can affect any communications equipment; this is a delay time to allow a radio or communication’s interface to stabilize after being turned on before data is transmitted. Typically 5 or 10 milliseconds works well for XMVs.
Unkey Delay (milliseconds)	Originally used when communicating via radio but can affect any communications equipment; this is a delay time to keep the radio or communication’s interface turned on after the last data bit is transmitted. Typically 5 milliseconds works well for XMVs. This value should never be more than the Response Delay on the individual XMV Setup screens.
Timeout (milliseconds)	This can be the maximum time tolerated between a request and response from the XMV or the largest gap tolerated between characters within a packet. If this time expires, any partial packet is discarded and the protocol looks for the beginning of a new packet. Typically 100 milliseconds works well for XMVs when

	using on-board communication ports, but for TFIO communication modules, 150 milliseconds is recommended.
Switched V-Batt Operate	This parameter selects the mode for how Switched V-Batt, Operate functions. Most devices have a V-Batt and Operate signal with the exception of the XFC6200EX which has Com1sw for Comm Port 1 and Com2sw for Comm Port 2. These are FET outputs which are either open or switched to ground. V-Batt and Operate are switched voltage outputs with the exception that Operate has an on-board 500 ohm current limiting resister in series with it. • Enable - Allows the outputs to switch on and off with the Listen Cycle time and be controlled by the communication schedule. • Disable - Disables the outputs but does not prohibit the other port from controlling the outputs. • Always ON - Causes the outputs to be on all the time. • Always OFF - Causes the outputs to be off all the time.
Retries	When initiating requests, specify the number of times to retry if the initial request fails. Allow for at least one retry.
Trailing Pad	Trailing Pad allows the user to add zeroes to the end of a transmission sequence to make sure the transmission is completed before the remote device tries to respond. This is more for devices that have a quick turnaround time. This can be used in place of having an Unkey Delay. Select 2 bytes, 3 bytes or 4 bytes from the drop-down list. (Not recommended for communications with XMVs.)
Alternate Port	The Alternate Port feature can be used to communicate with different devices on the same communication port (i.e., COM1, CIM0, etc.). The Coriolis, XMV and Therms Master are the only applications that support the Alternate Port feature. For example, if the XMV application has been instantiated and is using CIM0 for the communication path, the Therms Master and Coriolis applications can share that physical port. To add the Coriolis or Therms Master application to the CIM0 port, the Port sets to None and the Alternate Port parameter to CIM0. When using the Alternate Port, all the devices MUST communicate using the same protocol (i.e., same protocol, same baud rate, same stop and start bits, same delays and timeouts). NOTE: The main issue in using the Alternate Port feature is that the various devices MUST communicate using the same protocol.
Comm Directory	Displays a directory/path in the device for Request Block files. Typically, this would be under the directory associated with the communication port being used. The default directory is created based on the Protocol selected on this Setup tab.

Statistics

Number of Polls	Displays the number of times the device tried to poll the XMVs.
Number of Errors	Displays the number of times the device tried to poll the XMVs but was not successful. If the user sees excessive errors, try increasing the time the parameters mentioned above. This will be a trial and error method changing one parameter at a time while monitoring this error count.
Number of Late Completions	Displays the number of times the communication polls failed to retrieve data from all the XMVs within one second. The XMVs are polled once a second, and data must be retrieved within the second. If the user is seeing multiple

	late completions, try reducing the time slightly on one of the parameters mentioned above. If the Number of Errors start to increase after changing a parameter, increase it until the Number of Errors stop. If Late Completions are still happening, try reducing one of the other parameters using the same scenario.
Previous Poll Loop Time	Displays the last poll loop time. If multiple devices, displays the time to poll all devices.
Minimum Poll Loop Time	Keeps the minimum poll loop time of all polls.
Maximum Poll Loop Time	Keeps the maximum poll loop time of all polls.
Number of Interrupts	Displays the total number of transmit/receive interrupts.
Number of Characters Received	Displays a running total of received bytes from the devices.
Number of Characters Transmitted	Displays a running total of transmitted bytes to the devices.
Number of Parity Errors	Displays a running total of the number of Parity Errors. Parity errors means the data with parity error was corrupted.
Number of Framing Errors	Displays a running total of the number of Framing errors. A framing error occurs when a byte of data is received, but it is not in the format expected. Make sure the communications parameters are the same for the flow computer and the device.
Number of Overrun Errors	Displays a running total of Overrun errors. Overrun errors typically means the flow computer did not or could not handle the amount of traffic coming in.
Thread Priority	Displays the priority of the protocol task.
1st Priority	Displays the priority of the interrupt service thread.

Packet Log

The Packet Log tab is included for troubleshooting purposes only. The information provided has only to do with Totalflow Remote protocol or Modbus protocol. Other than the number of errors and polls that are displayed at the bottom of the screen, the user would need a Totalflow Remote protocol and/or a Modbus document to understand the information that gets displayed. You might however be asked by a customer service representative for information provided on this screen.

The information displayed on the screen is provided from a file maintained in the device. You can specify the number of records that are kept in the file by selecting one of the values for the Log Size and only the newest records are kept. To receive any updated information after initially viewing the screen, you will be required to either click the Re-read button or check the Monitor button. The information displayed will only change if additional polls have occurred since the last time the information was read.

XMV Devices

Overview

The external multivariable transmitter (XMV) provides Differential Pressure, Static Pressure and Temperature values via Modbus protocol to the host device. The XMV transmitter data is typically assigned to existing measurement tube applications.

A Modbus Request Block is set up for each XMV transmitter that exists. The Request Blocks are files generated by the Modbus Host Request Block Editor which are then downloaded to the Modbus directory under the Com port being used. The Com port has to be set to Modbus Host (RTU) protocol. The Request Block can run up to once per second to poll and retrieve data from its associated transmitter. Request Blocks can also be setup to write back items to display on the transmitter's display.

When the XMV Interface application is turned on from the PCCU Entry Mode, default data locations for five XMV Transmitters are assigned. There are three locations for the Raw Values that are returned from the transmitters and three locations for Scaled Values. Scaled Values have gone through their respective calibrations which were previously configured in the PCCU Calibration Mode.

XMV 1	Select the name of the device from the pulldown menu.
Description	Displays the description or name for this particular XMV device.
No of Polls	Displays the number of times the device tried to poll the XMVs.
No of Errors	Displays the number of times the device tried to poll the XMVs but was not successful. If the user sees excessive errors, try increasing the time the parameters mentioned above. This will be a trial and error method changing one parameter at a time while monitoring this error count.

Setup

Description	Enter up to 24 alphanumeric characters as a description or name for this particular XMV device.
Modbus Address	Enter a unique Modbus address for each XMV device (typically 1 - 247).
Modbus Register	Starting register in the XMV for the data that is to be retrieved. This is 21 on ABB XMVs and 401 for Foxboro IMV25. If you have a mixture of ABB and Foxboro units, you must use register 401 and set the Register Format on the "XMV Interface/Communications/Setup" to 16 Bit Word Swapped.
Scan	Enables or disables scanning of the device.
Factory Units	Specify whether the raw data coming back from the XMV is in Metric or English units. For ABB XMVs, the data is typically Metric units and is then scaled to English units as shown on the Values tab. Foxboro units typically return data in English units. If the raw data is in English units, no scaling is required, and the English units are passed on.
Differential Pressure	This is meant as a display flag for which calibration method is being used (Field or Factory). However, the user has the option of selecting Field or Factory calibration data. The selection will default to Factory until the unit has been calibrated in the field. Field can be selected and Sent, but the display will flip back to Factory if no Field calibration has been done. After a Field calibration, Field will be displayed and used but either could then be selected. Factory would typically only be selected for troubleshooting purposes.
Static Pressure	This is meant as a display flag for which calibration method is being used (Field or Factory). The selection will default to Factory until the unit has been calibrated in the field. Field can be selected and Sent, but the display will flip back to Factory if no Field calibration has been done. After a Field calibration, Field will be displayed and used but either could then be selected. Factory would typically only be selected for troubleshooting purposes.

Temperature	This is meant as a display flag for which calibration method is being used (Field, Factory or Bias). The selection will default to Factory until the unit has been calibrated in the field. If only a Bias was added, it displays Bias. If a full calibration was done, it will display Field. If a bias was added after the field calibration, Field will be displayed, but the bias will be added to the Field calibration.
Display Scroll	By default, Differential, Static and Temperature are written out to the XMV. If this parameter is enabled, the display will scroll through these three items. Disable will turn off the display.
Number of Custom Displays	Specify the number of display items to potentially be displayed on the XMV's display. Each display item will need to be set up on the Displays tab. The Displays tab is not visible until a non-zero value is entered here and sent. Creating any custom displays will replace the three Differential, Static and Temperature default displays. To display them, the user will need to create a custom display for them as well.

Values

Status	Displays the status of the selected device.
Raw Differential Pressure	Displays differential pressure value direct from the transmitter and prior to calibration.
Raw Static Pressure	Displays static pressure value direct from the transmitter and prior to calibration.
Raw Temperature	Displays the temperature value direct from the transmitter and prior to calibration.
Scaled Differential Pressure	Displays the calibrated differential pressure value.
Scaled Static Pressure	Displays the calibrated static pressure value.
Scaled Temperature	Displays the scaled temperature value after a Centigrade to Fahrenheit conversion (no calibration required.

Range Check

Range Check Enable	Must be set to Enable in order to perform the Range Check procedure from the XMV.
Dp Range	Enter the differential pressure range values to establish the range limit checked against incoming readings.
Ap Range	Enter the absolute static pressure range values to establish the range limit checked against incoming readings.
Tf Range	Enter the temperature range values to establish the range limit checked against incoming readings.

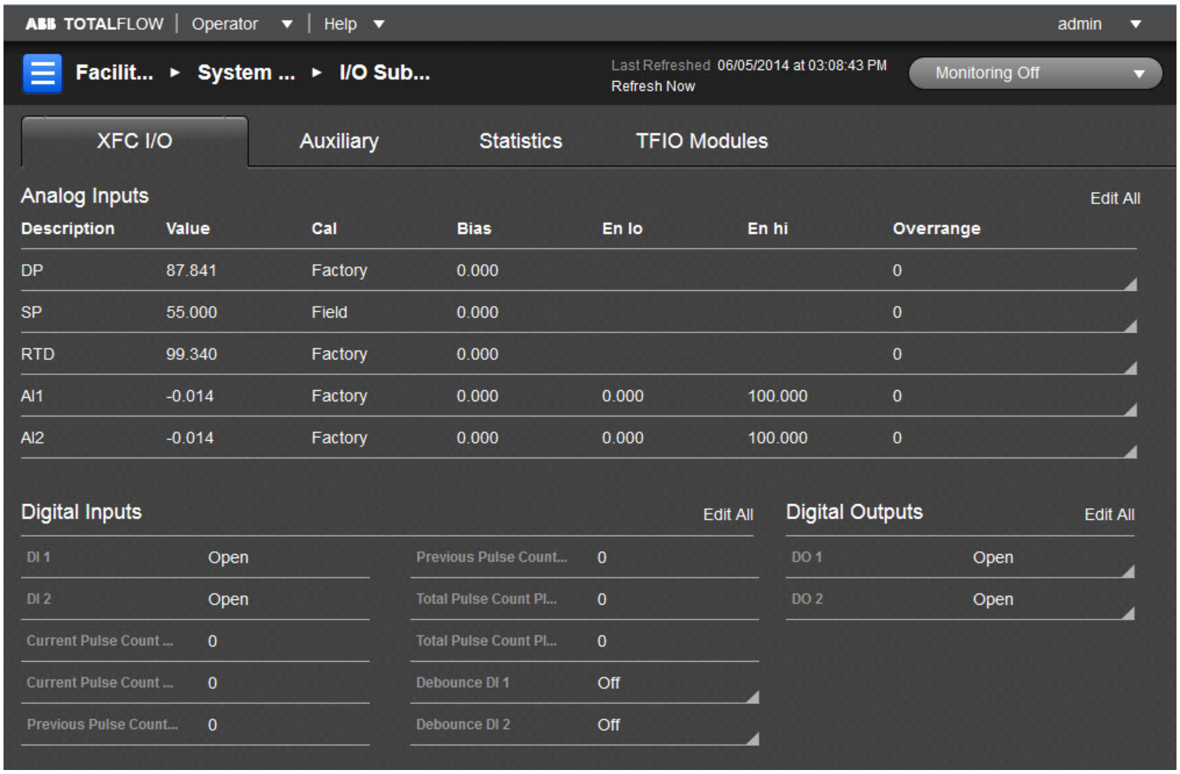
Write Lock Configuration

Modbus Write Lock	The Write Lock Configuration tab enables the user to disable the keys on the XMV for configuration only so that configuration data is not reconfigured due to an interruption. Within this tab, the user can elect to have these keys turned on or off. If Write Lock On is selected, the XMV prohibits writing to the configuration registers. The normal read polling continues as normal, but Modbus set polls to the XMV will be ignored, and configuration changes using the buttons will be disallowed. If the user sets the Write Lock Off parameter, configuration changes are allowed. Additionally, there are two status messages. The Write Lock Status Unknown statement will display when the XMV Write Lock status is polled, and the returned state does not agree with the state that the XSeries device is currently set to. In this way, the user can establish that there is a synchronicity issue. The user can set the Write Lock to the desired state, and click Send. If the XMV accepts the change, when the user re-reads the file, the XMV Write Lock state and the XSeries Write Lock state will agree. The Write Lock Comm Error message will display if there is an issue with the communication port connections and/or setup. NOTE: In the XMV Setup, if the Scan is set to Disabled, the Modbus polls to the XMV Write Lock are disabled. As such, to use this function, the user will need to have this parameter (Scan) set to enable to use this feature. Also, the Write Lock mode stays on after a power down/ power up situation.

I/O Sub-System

Overview

This is the application which handles the scanning of all I/O. There will typically only be one instance of I/O Subsystem running and must not be turned off.



XFC I/O

Analog Inputs

Analog inputs for the XFC and microFLO include data for fixed assignments such as differential pressure, static pressure and temperature. Additionally, there are two general purpose analog inputs (AI 1 & AI 2) on the XFC one on the microFLO EX with onboard terminals that can be used for any purpose. The XRC has five general purpose analog inputs (AI 1 - AI 5) with on-board terminals that can be used for anything.

Description	Displays the name of the AI. Fixed inputs on an XFC will be DP, SP and RTD. The two AIs that have onboard terminals and available for use are AI 1 & AI 2. The XRC will have AI 1 - AI 5.
Value	Displays the value as read by the input in engineering units based on the range the AI was calibrated.
Calibration	This column can display Factory, Field or Bias. The default will be Factory until a calibration is done in the field. After a field calibration, Field will be displayed and the field calibration data used unless Factory is selected and Sent. Both sets of calibration data are available for use, based on the one selected. A field calibration can be as simple as entering values for Engr Low and Engr High or a full range calibration in the Calibration mode. Bias is simply for display purposes and indicates a bias was entered for the AI in Calibration mode, since a bias cannot be entered here. If Bias is displayed, it also indicates that the AI is using a field calibration.
Bias	The Bias column will display a value if a bias value was entered in the Calibrate mode. The bias value will only be displayed if Field or Bias is displayed in the Calibration

	column. A bias is not allowed for the factory calibration, thus no bias will be displayed if Factory is selected.
Engr Low and Engr High	Analog inputs such as AI 1 and AI 2 on the XFC, AI 1 on the microFLO EX or AI 1 - AI 5 on the XRC are fairly accurate (+/- 2%) as they come from the factory. If the user has an application where this accuracy is sufficient, a value can be entered representing engineering units for Engr Low and Engr High and Sent creating a field calibration of this range. This is in lieu of having to provide a calibration signal and doing a full calibration in the Calibration mode.
Overrange	Any values over the range of the calibration will display.

Digital Inputs

Digital Inputs	The two digital inputs on the XFC and one input on the microFLO EX can be used as digital inputs for an open/close condition or as a pulse input for pulses counted over a period of time. The XRC has four digital inputs. The first two inputs (DI1 & DI2) on a G3 XRC can also be either digital inputs or pulse inputs, but the second two (DI3 & DI4) are digital inputs only. On the G4 XRC, all four digital inputs can be used as either digital inputs or pulse inputs. DI1 and DI2 on the XFC and DI1 thru DI4 on the XRC display the status as either Open or Closed when used as digital inputs. Closed means the input sees a low impedance to ground such as a closed contact as opposed to an Open, which is a high impedance to ground or an open contact.
Pulse Inputs	When the DIs are used as pulse inputs, there are three different register sets: Current, Previous and Total. The Current count register contains the current counts since the last time the register was read. When read, the Current count register value moves to the Previous count register and gets added to the Total count register. The Current count register is zeroed and begins counting pulses again. The Previous count register always contains the Current count register’s last value. The Total count register will continue to add pulses until its capacity is reached, at which time the count will roll-over and start again.
Debounce	When connected to an XFC, a Debounce tab is displayed. This allows the user to turn Debounce on or off. Turning Debounce on connects a capacitor across the input circuitry, which reduces the chance of false signals caused by contact chatter from the source. On XRCs, Debounce is controlled by on-board jumpers.

Digital Outputs

These outputs display the status of DOs on any device which has digital outputs. Closed would represent low impedance or a contact closure as opposed to Open which would be high impedance or an open contact. The DOs can be manually Opened or Closed.

Auxiliary

Analog and Digital

Auxiliary I/O displays a combination of analog values and digital status conditions. Most are status conditions (read-only) except for the following:

G4 XFC

· LCD power can be turned on or off.

G3 XRC

· Aux Switched VBatt can be turned on or off.

G4 XRC

· Switched VBatt 1 and Switched VBatt 2 can be turned on or off.

· Aux Power can be turned on or off.

· LCD Power can be turned on or off.

G4 microFLO EX

· Switched VBatt 1 and Switched VBatt 2 can be turned on or off.

· LCD Power can be turned on or off.

Aux Switched VBatt on the G3 XRC and Aux Power as its called on the G4 XRC are in addition to the Switched VBatts assigned to the communications modules. On the G4 XRC, Switched VBatt 1 & 2 are assigned to communications modules 1 & 2 respectively. Aux Switched VBatt and Aux Power will turn off if the unit goes to Sleep and back on when woke up. It will also return to its last status after a Warm Start. The default condition after a Cold Start is off; however, if a Save/Restore has been done, it will come back up to its status prior to the Save/Restore operation. Switched VBatt 1 & 2 will turn off if the unit goes to Sleep and back to its original status when woke up.

Statistics

IIC Bus Usage

Usage Description	Displays the IIC Device or the TFIO Module. Displays as "Channel:Address Description" format. Example - "1:42 DIO Module" or "3:D0 IIC Device".
Usage Value	Bus Usage for the device or module is average of the percentage of time used by the device based on 1000 millisecond time frames.
Reads	Displays the total number of successful bytes read since the last cold start or Reset Statistics initiated by the user.
Writes	Displays the total number of successful bytes written since the last cold start or Reset Statistics initiated by the user.
Errors	Displays the total number of read/write errors since the last cold start or Reset Statistics initiated by the user.
Status	Displays the total number of read/write errors since the last cold start or Reset Statistics initiated by the user.

There is a Reset Statistics button which can be selected to zero all statistical data and commence recording again.

IIC Diagnostics

There is a Reset Diagnostics button which can be selected to zero all diagnostic data and commence recording data again.

AMU Statistics

Scans Started	Total number of 1 second scans since last cold boot or when zeroed by user.
Scans Finished	Total number of 1 second scans that were complete since last cold boot or when zeroed by user. Typically this count is 1 behind the Scans Started.
A/D Transfers	Total number of bytes transferred (4 bytes/16 channels) since last cold boot or when zeroed by user.
A/D Interrupts	Total number of A/D end of conversion interrupts since last cold boot or when zeroed by user.
Interrupt Timeouts	Total number of missed end of conversion interrupts since last cold boot or when zeroed by user.
A/D Start Failures	The difference between the number of Scans Started and Scans Finished since last cold boot or when zeroed by user.
Previous Scan Interval	Time of last scan in milliseconds. Needs to be less than 1000 ms. (16 A/D channels scanned)
Minimum Scan Interval	Minimum measured scan interval in milliseconds since last cold boot or when zeroed by user. Needs to be less than 1000 ms.
Maximum Scan Interval	Maximum measured scan interval in milliseconds since last cold boot or when zeroed by user. Needs to be less than 1000 ms.

TFIO Modules

This screen displays the total number of TFIO modules and the number of each type connected to the device. The Module List displays the firmware part number/revision of each module. The pulldown menu is used to select any of the following modules:

VC Modules	The Valve Control module is a software-configurable, combination I/O module specifically tailored for valve control applications. The module incorporates six (6) general purpose DI/DO/PI input/outputs, two source mode digital outputs and one 4-20 mA sink/source mode analog output.
AO Modules	The Analog Output module is a configurable, 4-point 4-20 mA analog output module. Each point can be configured to either sink or source a 4-20 mA signal using either an internal or external power source.
AI Modules	The Analog Input module is a configurable, 8-point analog input module. Each point can be configured to be a 0-10V voltage input or a 0-20 mA current input.
DI/DO Modules	The Combo Digital module is configurable 8-point digital I/O module. Each point can be either a digital input, digital output or a pulse input.

TI Modules	Displays the number of both Thermocouple and RTD modules. RTD modules are a 4-point RTD designed to monitor standard 4-wire 100 ohm platinum RTD probes. The thermocouple module is a 4-point module which can be configured to be either J or K type.
CI Modules	The Communications Interface module is software configurable serial interface capable of communicating via RS-232, RS-422 or RS-485.

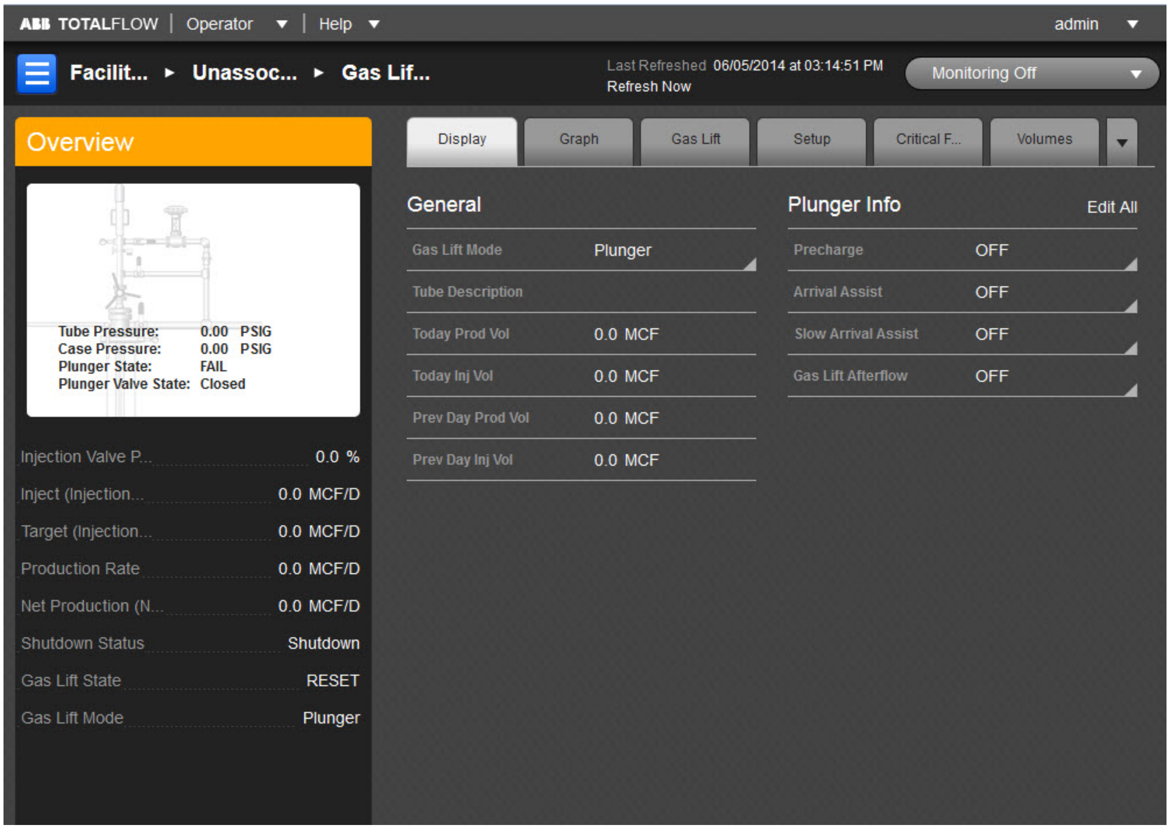
Gas Lift

Overview

Gas Lift is an artificial lift technique that is used on wells with liquid loading programs. These problems consist of the gas-to-oil ratio (GOR) not being sufficient to sustain other forms of artificial lift. In its simplest form, gas lift adds externally introduced high pressure gas to the well bore to increase the velocity of the gas in the tubing. This then helps to carry the fluids to the surface. While many variations exist, this typically involves introducing high pressure gas into the tubing annulus.

ABB's Gas Lift application is used in either Manual or Critical Rate mode. In Manual mode, the operator notifies the system on how much high gas pressure to add to the system to aid in the lift process. In Critical Rate mode, the system is placed into a more intelligent operating mode. Critical Rate mode monitors the current production rate and compares it to a calculated critical rate. Gas is injected at a user-specified percentage that reflects the difference between the current flow and the shortfall rate. Critical Rate mode is an ongoing calculation and only injects the necessary amount of gas to overcome the current loading situation.

Gas Lift can also be combined with other forms of artificial lift, including Plunger Lift. This can help to augment the operation and overcome the challenges of low GOR wells.



Overview

Injection Valve Position	Displays the injection valve position as a percentage of open.
Inject (Injection Flow Rate)	Displays the injection flow rate in MCF/Day as measured by the injection tube application. The tube applications are specified on the Gas Lift Setup tab.
Target (Injection Setpoint)	Displays the setpoint sent to the Valve Control application.
Production Rate	The Production Flow Rate represents the actual gross flow rate as measured by the production tube application as specified on the Setup tab.
Net Production (Net Flow Rate)	Displays the Production Flow Rate minus the Injection Flow Rate.
Shutdown Status	Displays the Hold Status as Hold or Run. The Pad Controller application can put the status in Hold or the user can click in the Value 1 column and put the system in Hold or Run. Hold causes the injection valve to close.
Gas Lift State	This read-only field (Gas Lift State) monitors the state of the Gas Lift Assist and then displays that corresponding state. Possible states are as follows: · Closed - Closed state indicates that the inject and main valve are closed. · Open - Inject valve is closed after opening of the main valve. · Arrival - Inject valve is open for Arrival Assist and the system is awaiting the arrival of the plunger. · Cleanup - After the plunger has arrived, the Cleanup state signifies the time frame to continue injecting gas to retrieve any residual liquid.

	· Afterflow - The Afterflow state indicates that the production valve is open, the injection valve is open for Afterflow assist, the plunger has arrived and close conditions are waiting to be met. · Manual - The Manual state signifies that the Gas Lift application is in Manual mode. This means that the inputs are being read but no automatic outputs are being triggered. A setpoint for the injection rate would have to be entered and sent by the user. · Critical - The Critical state signifies that the system is below the setpoint for the critical rate and the system is awaiting a Closed state. · Wait - If Afterflow Assist is disabled, the plunger has arrived, injection valve is closed and the system is waiting for Close condition. · Slow - The Slow state indicates that if the plunger is slow and has yet to arrive, the injection valve is open for Slow Arrival Assist.. · Hold - Indicates the injection valve is held closed by the Pad Controller application or manually set by the user. · Shutdown - Indicates that the Shutdown application has been initialized and holding the injection valve closed. · Reset - The Reset state indicates that the device has gone through a warm or cold start and no other state has been activated. · Cleanup Close - Cleanup phase has forced the plunger valve to close.
Gas Lift Mode	There are 6 different modes of operation of the Gas Lift application. · Off - The Gas Lift application is not running. · Manual - User sets the injection flow rate. · Critical - The injection flow rate is automatically adjusted to keep the production flow rate above the critical rate. · Plunger - The injection flow rate is automatically adjusted as needed during plunger cycles. · Intermittent - Control the injection valve with a programmable On/Off cycle. · Step Rate Test - Control the injection valve with a series of programmable on/off cycles.

Display

General

Gas Lift Mode	This user-defined field has the following modes: • OFF - Gas Lift not used • Manual - Injection only. User sets the injection flow rate. • Critical - Injection only. The flow rate is automatically adjusted to keep it above the critical rate. • Plunger - Combination of Gas Lift and Plunger. The flow rate is automatically adjusted as needed during plunger cycles. • Intermittent - Controls the injection valve with a programmable On/Off cycle. • Step Rate Test - Controls the injection valve with a series of programmable on/off cycles.
Tube Description	Displays the tube assigned to this application.

Today Prod Vol	Displays the current day's production volume measured in millions of cubic feet.
Today Inj Vol	Displays the current day's injection volume measured in millions of cubic feet.
Prev Day Prod Vol	Displays the previous day's production volume measured in millions of cubic feet.
Prev Day Inj Vol	Displays the previous day's injection volume measured in millions of cubic feet.

Plunger Info

Precharge	If enabled, this option injects gas into the casing beginning when the well is closed in and the user specified low pressure is present. Injection continues until the user specified high pressure is reached, at which time production flow commences.
Arrival Assist	If enabled, the inject valve is opened when the main valve is opened, then the inject valve is closed after the plunger arrives plus any Cleanup time.
Slow Arrival Assist	If enabled, this option will open the injection valve to assist the plunger, if it is slow to arrive.
Gas Lift Afterflow	If enabled, this option opens the injection valve when the production flow rate falls below the critical flow rate.

Graph

Poll Type	Select either Historical or Real Time.
View	Select either Graph or Grid display mode.
Expand/Collapse	Select either button to expand or collapse the graph display.
Variables	The graph trends three variables: production flow rate, injection flow and critical flow rate. One can remove the display of any variable(s) by selecting its check marked box.

Gas Lift

The Gas Lift tab is the area where the user can view and also change certain parameter values within the Gas Lift itself.

Main

Gas Lift Enable	Enables the user to either enable (On) or disable (Off) the Gas Lift application.
Gas Lift State	This read-only field monitors the state of the Gas Lift Assist and then displays that corresponding state. Possible states are as follows: · Closed - Closed state indicates that the inject and main valves are closed. · Open - Inject valve is closed after opening of the main valve. · Arrival - Inject valve is open for Arrival Assist and the system is awaiting the arrival of the plunger.

	· Cleanup - After the plunger has arrived, the Cleanup state signifies the time frame to continue injecting gas to retrieve any residual liquid. · Afterflow - The Afterflow state indicates that the production valve is open, the injection valve is open for Afterflow assist, the plunger has arrived and close conditions are waiting to be met. · Manual - The Manual state signifies that the Gas Lift application is in Manual mode. This means that the inputs are being read but no automatic outputs are being triggered. A setpoint for the injection rate would have to be entered and sent by the user. · Critical - The Critical state signifies that the system is below the setpoint for the critical rate and the system is awaiting a Closed state. · Wait - If Afterflow Assist is disabled, the plunger has arrived, injection valve is closed and the system is waiting for Close condition. · Slow - The Slow state indicates that if the plunger is slow and has yet to arrive, the injection valve is open for Slow Arrival Assist.. · Hold - Indicates the injection valve is held closed by the Pad Controller application or manually set by the user. · Shutdown - Indicates that the Shutdown application has been initialized and holding the injection valve closed. · Reset - The Reset state indicates that the device has gone through a warm or cold start and no other state has been activated. · Cleanup Close - Cleanup phase has forced the plunger valve to close.
Gas Lift Mode	There are 6 different modes of operation of the Gas Lift application. · Off - The Gas Lift application is not running. · Manual - User sets the injection flow rate. · Critical - The injection flow rate is automatically adjusted to keep the production flow rate above the critical rate. · Plunger - The injection flow rate is automatically adjusted as needed during plunger cycles. · Intermittent - Control the injection valve with a programmable On/Off cycle. · Step Rate Test - Control the injection valve with a series of programmable on/off cycles.
Critical Flow Rate	Displays the Critical Flow Rate after the Critical Multiplier is applied.
Critical Multiplier	This multiplier can be modified as needed by the user to create the Critical Flow Rate (see above).
Hold Status	Displays the Hold Status as Hold or Run. The Pad Controller application can put the status in Hold or the user can click in the Value 1 column and put the system in Hold or Run. Hold causes the injection valve to close.
Current Date/Time	Displays the current date and time from the device.
Production Flow Rate	The Production Flow Rate represents the actual gross flow rate as measured by the production tube application.
Production Tube Description	Description of the Production Tube that measures the gross flow rate.
Inject Flow Rate	Value 1 column displays the injection flow rate as measured by the Injection Tube application. Value 2 displays the setpoint sent to the Valve Control application.
Injection Setpoint	Displays the Injection Setpoint sent to the Valve Control application.

Injection Tube Description	Measures the Injection Flow Rate.
Net Flow Rate	Displays the Production Flow Rate minus the Injection Flow Rate.
Inject Valve Position	Displays the injection valve position as percent of open.
Inject AP	Displays the Absolute Pressure as measured by the injection tube application.
Inject Pressure	Displays the Absolute Pressure as measured by the injection tube application minus the Barometric Pressure.
Prod Line Pressure	Displays the Absolute Pressure as measured by the production tube application minus the Barometric Pressure.
Casing Pressure	Displays the current casing pressure.
Tubing Pressure	Displays the current tubing pressure.

Setup

Setup

The Setup tab displays and enables the user to setup parameters required by the Gas Lift application. The parameters shown will vary somewhat based on the Gas Lift Mode selected.

Gas Lift Mode	Displays and/or allows the selection of the different modes of the Gas Lift application. The available selections are as follows: · Off - Gas Lift not used. · Manual - Injection only. User sets the injection flow rate. · Critical - Injection only. The flow rate is automatically adjusted to keep it above the critical rate. · Plunger - Combination of Gas Lift and Plunger. The flow rate is automatically adjusted as needed during plunger cycles. · Intermittent - Open/Close the Injection valve with a series of settable On/Off cycles. · Step Rate Test - Open and close the injection valve via a series of settable On/Off cycle times.
Gas Lift Enable	Allows the user to either enable (On) or disable (Off) the Gas Lift Application.
Event Log Size	Sets the number of items to display in the Event log. Any action that causes a state change is logged.
Production Tube App	Specify the production tube application by entering its application number here. To verify the number, click on the Station ID which is the very top item in the tree-view and click on the Applications tab.
Injection Tube App	Specify the injection tube application by entering its application number here. To verify the number, click on the Station ID which is the very top item in the tree-view and click on the Applications tab.
Plunger App	Specify the Plunger application if used by entering its application number here. To verify the number, click on the Station ID which is the very top item in the tree-view and click on the Applications tab.
Injector Valve Control App	Specify the Valve Control application that will be used to control the injection valve by entering its application number here. To verify the number, click on the Station ID which is the very top item in the tree-view and click on the Applications tab.

Shutdown App	Specify the Shutdown System application if used by entering its application number here. To verify the number, click on the Station ID which is the very top item in the tree-view and click on the Applications tab.
Setpoint Time Limit	Set the frequency as to how often the flow rate setpoint is written to the injection valve control application.
Setpoint Timer Remaining	Displays the remaining time left.
Trend File Name	This field enables the user to set the trend file name which would be used in conjunction with the Trend System application.
Gas Lift State as String	This is a user-entered field and is used for the PCCU Display application.

Critical Flow

General

Gas Lift Mode	Displays and/or allows the selection of the different modes of the Gas Lift application. The available selections are as follows: · Off - Gas Lift not used. · Manual - Injection only. User sets the injection flow rate. · Critical - Injection only. The flow rate is automatically adjusted to keep it above the critical rate. · Plunger - Combination of Gas Lift and Plunger. The flow rate is automatically adjusted as needed during plunger cycles. · Intermittent - Open/Close the Injection valve with a series of settable On/Off cycles. · Step Rate Test - Open and close the injection valve via a series of settable On/Off cycle times.
Gas Lift State	This read-only field monitors the state of the Gas Lift Assist and then displays that corresponding state. Possible states are as follows: · Closed - Closed state indicates that the inject and main valve are closed. · Open - Inject valve is closed after opening of the main valve. · Arrival - Inject valve is open for Arrival Assist and the system is awaiting the arrival of the plunger. · Cleanup - After the plunger has arrived, the Cleanup state signifies the time frame to continue injecting gas to retrieve any residual liquid. · Afterflow - The Afterflow state indicates that the production valve is open, the injection valve is open for Afterflow assist, the plunger has arrived and close conditions are waiting to be met. · Manual - The Manual state signifies that the Gas Lift application is in Manual mode. This means that the inputs are being read but no automatic outputs are being triggered. A setpoint for the injection rate would have to be entered and sent by the user. · Critical - The Critical state signifies that the system is below the setpoint for the critical rate and the system is awaiting a Closed state. · Wait - If Afterflow Assist is disabled, the plunger has arrived, injection valve is closed and the system is waiting for Close condition.

	· Slow - The Slow state indicates that if the plunger is slow and has yet to arrive, the injection valve is open for Slow Arrival Assist.. · Hold - Indicates the injection valve is held closed by the Pad Controller application or manually set by the user. · Shutdown - Indicates that the Shutdown application has been initialized and holding the injection valve closed. · Reset - The Reset state indicates that the device has gone through a warm or cold start and no other state has been activated. · Cleanup Close - Cleanup phase has forced the plunger valve to close.
Critical Flow Rate Multiplied	Displays the Critical Flow Rate Multiplied value.
Critical Flow Rate Raw	Displays the Critical Flow Rate before being multiplied by the Critical Flow Rate Multiplier.

Constants

Critical Flow Rate Gas Density	Displays the Gas Density used for Critical Flow Rate calculations.
Critical Flow Rate Water Density	Displays the Water Density used for Critical Flow Rate calculations.
Critical Flow Rate - Gas Gravity	Displays the Gas Gravity used for Critical Flow Rate calculations.
Critical Flow Rate - Z at Ref	The Z factor is provided by the production application register source as specified on the Registers tab.

STD Constants

Critical Flow Rate - K1	Displays the Critical Flow Rate constant for the K1 resistance coefficient.
Critical Flow Rate - K2	Displays the Critical Flow Rate constant for the K2 resistance coefficient.
Critical Flow Rate - K3	Displays the Critical Flow Rate constant for the K3 resistance coefficient.

Setup

Plunger Type	This information is provided by the Plunger application if enabled. If not, enables the user to select the plunger type. The available options are: · Intermitter - This signifies that no plunger is being used. · Plunger - This means that there is a physical plunger associated with the well.

Turner Mode	This information is provided by the Plunger application if enabled. If not, the user can select if either tubing pressure, the difference between the casing and static pressure or the casing pressure alone is used to calculate the Turner flow rate.
Critical Flow Rate Case-Line Limit	Casing minus the line pressure limit as entered by the user.
Tubing Length	The tubing length is provided by the Plunger application if applicable or can be entered by user if Plunger application not used.
Tubing ID	The tubing ID is provided by the Plunger application if applicable or can be entered by user if Plunger application not used.

Inputs

Casing Pressure	Displays the casing pressure from the source as specified by the register below.
Casing Pressure Register	Specify the register (app, array, reg) which is the source of the casing pressure.
Tubing Pressure	Displays the tubing pressure from the source as specified by the register below.
Tubing Pressure Register	Specify the register (app, array, reg) which is the source of the tubing pressure.

Volumes

Volumes

The Volumes tab is used for information only. The total current (Today Volumes) and previous day volumes are displayed into three columns. The columns are as follows:

Production Tube Description	This value represents the total amount, measured by tube.
Injection Tube Description	This value is the measure of gas injected into the well by tube.
Yesterday's Production Volume	This value represents the previous Production Volume.
Yesterday's Injection Volume	This value represents the previous Injection Volume.
Yesterday's Net Volume	This value represents previous Production Volume minus the previous Injection Volume.
Today's Production Volume	This value represents current Production Volume.
Today's Injection Volume	This value represents current Injection Volume.
Today's Net Volume	This value represents Production volume minus the Injection Volume.

Step Rate Test

Step Rate Test

Gas Lift Mode	This parameter field represents a global on/off switch for all of the options within the Gas Lift application. The available selections are as follows: · Off - Gas Lift not used. · Manual - Injection only. User sets the injection flow rate. · Critical - Injection only. The flow rate is automatically adjusted to keep it above the critical rate. · Plunger - Combination of Gas Lift and Plunger. The flow rate is automatically adjusted as needed during plunger cycles. · Intermittent - Control the injection valve with a programmable On/Off cycle. · Step Rate Test - Control the injection valve with a series of programmable on/off cycles.
Gas Lift State	Displays the current state of the Gas Lift application. When running Intermittent Cycle or the Step Rate Test, Open and Closed is the only viable states and refers to the state of the injection valve which is controlled by the On and Off Times. Other than these two exceptions, the possible states are as follows: · Closed - Closed state indicates that the inject and main valves are closed. · Open - Inject valve is closed after opening of the main valve. · Arrival - Inject valve is open for Arrival Assist and the system is awaiting the arrival of the plunger. · Cleanup - After the plunger has arrived, the Cleanup state signifies the time frame to continue injecting gas to retrieve any residual liquid. · Afterflow - The Afterflow state indicates that the production valve is open, the injection valve is open for Afterflow assist, the plunger has arrived and close conditions are waiting to be met. · Manual - The Manual state signifies that the Gas Lift application is in Manual mode. This means that the inputs are being read but no automatic outputs are being triggered. A setpoint for the injection rate would have to entered and sent by the user. · Critical - The Critical state signifies that the system is below the setpoint for the critical rate and the system is awaiting a Closed state. · Wait - If Afterflow Assist is disabled, the plunger has arrived, injection valve is closed and the system is waiting for Close condition. · Slow - The Slow state indicates that if the plunger is slow and has yet to arrive, the injection valve is open for Slow Arrival Assist.. · Hold - Indicates the injection valve is held closed by the Pad Controller application. · Shutdown - Indicates that the Shutdown application has been initialized and holding the injection valve closed. · Reset - The Reset state indicates that the device has gone through a warm or cold start and no other state has been activated. · Cleanup Close - Cleanup phase has forced the plunger valve to close.
Enable Step Rate Test	Select Run to start the test or Stop to stop the test.

Number of Steps	A Step Number row is provided for the number of steps specified for the Number Of Steps below. On Time, Inject Rate and Off Time are the only user inputs required for each step. The other parameters will update as new data is available and by clicking the Re-read button or checking the Monitor box.
Step Timer	Displays the elapsed time for each of the On/Off steps. The timer will reset after each On Time and each Off Time for each step.
Injection Setpoint	Displays the injection setpoint during each of the steps. The setpoint will only be displayed for a step when the valve is open. The setpoint will match the Inject Rate for the current step.
Current Step #	Displays the currently active step. The current step is also shown as Active in the Step # rows above.
Injection Flow Rate	Displays the injection flow rate in MCF/Day as measured by the injection tube application. The tube applications are specified on the Gas Lift Setup tab.
End of Test Timestamp	Displays the Date/Time stamp for when the test has concluded or will show the Date/Time if stopped prematurely.
End of Test Mode	Specify from the drop-down list the mode for Gas Lift to enter after the test has ended.
End of Test Inject Flow Rate	Displays the injection flow rate at the end of the End of Test mode. This will not be applicable to all modes.

Number of Steps

Enter the number of steps of On/Off and Inject rates that the test is to perform. Do this initially and click the Save button. This will cause a row to be displayed for the setup of each step.

Registers

The Registers tab is for specifying registers required by the Gas Lift application. Registers required are for the following applications. (The addresses should automatically fill based on application numbers entered on the Setup tab.)

- Production Tube App
- Injection Tube App
- Plunger App
- Injector Valve Control App

Events

The Events tab displays a log of the latest number of events as specified on the Setup tab. Any state change will create an event.

Selectable Units

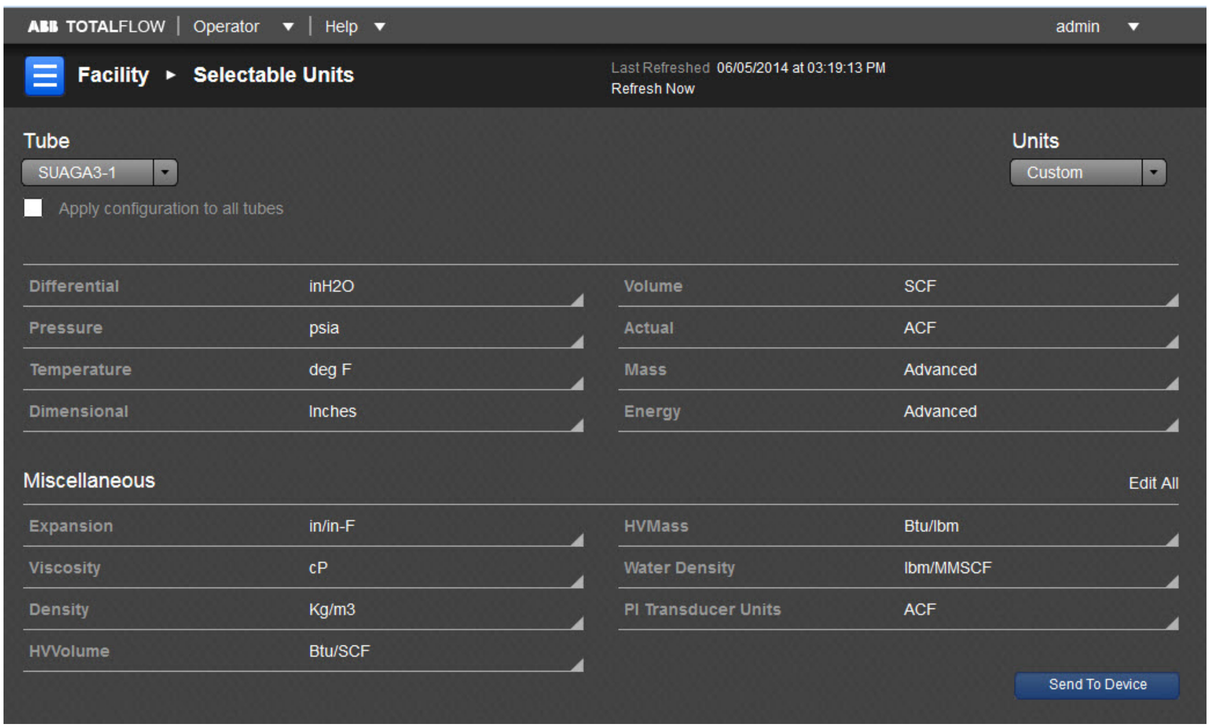
Overview

Selectable Units is a feature that allows the user to select the desired engineering units to use as a basis for calculations, local display and protocol output. The engineering unit selections include standard U.S. and Metric system units as well as additional selections depending on the application.

Selecting U.S. or Metric will involve a default unit for each different variable group but each group can be modified to the user's liking. Only applications that are turned on (instantiated) will be displayed for selection in the Tube window and only applications that support Selectable Units will be shown.

After all settings are made, selecting the Send to Device button relays those changes to the device. A message will appear to remind the user that any historical data will be erased and changes may be required in the tube application setup. Pressure and Temperature calibrations should be required using the new units.

The different groupings as shown below such as Differential, Volume, Pressure, etc. are referred to as Variable Groups. Each Variable Group has a set number of units that can be selected by clicking in the window of each group. For reference all the Variable Groups and their engineering units can be viewed in the Selectable Units table.



Selectable Units Setup

By pulling down the Operator menu and selecting SU Setup, the Selectable Units Setup screen displays.

Tube

From the Tube pulldown menu, the appropriate Selectable Units (SU) measurement tube can be selected. If choices will apply to all tubes, select the Apply configuration to all tubes box.

Custom Setup

Regardless of which group of engineering units are selected, the Units pulldown menu default option will change automatically to Custom to inform the user that changes have taken place within the tab and that something other than the default settings have been selected. Also, if the user needs to go into the Advanced setup screens to make changes, the affected variable group will display Advanced in its window.

Advanced Setup

In selected variable group menus such as Volume and Pressure, there is an Advanced option available with the other selectable options. When the Advanced option is selected, the variety of options can be changed individually or collectively. These tabs enable the user to fine tune the standard variables that are shown.

Miscellaneous

The individual Miscellaneous variable values can be changed by the user for any of the displayed groups. If desired, all of these values are also available collectively from the Miscellaneous Edit All option.

Selectable Units Table

The following table lists the Conversion Groups with their associated Variable Groups and associated engineering Units. Conversion functions made by the Units Conversion application are grouped according to the Conversion Groups listed below. Conversion Groups have a specific set of engineering units assigned to them. Variable Groups are then assigned to specific Conversion Groups and thus use the engineering units assigned to the Conversion Group. The Variable Groups that are grouped together are assigned to the Conversion Group to their left. The engineering units that are grouped together are all selections for each one of the Variable Groups to their left.

Conversion Groups	Variable Groups	Units	Unit Description
Dimensional	Dimensional	Millimeters Inches Feet Meters	millimeters inches feet meters
Pressure	AP Transducer Units DP Transducer Units Static Pressure Differential Pressure Barometric Pressure	kPa InH2O mbar InHg psia bar mmHg psfa MPa Pa Kg/cm2	kilopascals inches of water millibars inches of mercury pounds per square inch absolute bars millimeters of mercury pounds per square feet absolute megapascals Pascals Kilograms per centimeter squared
Temperature	Temperature	Deg C Deg F Deg R Deg K	degrees Celsius degrees Fahrenheit degrees Rankin degrees Kelvin
Expansion	Expansion	mm/mm-C in/in-F ft/ft-F m/m-C	millimeters per millimeter deg C inches per inches deg F feet per foot deg F

		mm-mmK m/m-K	meters per meter deg C millimeters per millimeter deg K meters per meter deg K
Viscosity	Viscosity	cP lbm/ft-s Pa-s lbf-s/in2 lbf-s/ft2 kgf-s/m2 dyn-s/cm2 Pa	centipoise pound mass per foot second pascal seconds pound force seconds per square inch pound force seconds per square foot kilogram force seconds per square meter dyne force seconds per square centimeter pascals
Density	Density Water Density	kg/m3 lbmft3 lb/US Gallon lb/UK Gallon kg/Sdm3 g/cm3 g/m3 kg/kl lbm/MMSCF kg/Mm3	kilograms per cubic meter pound mass per cubic ft pounds per US gallon pounds per UK gallon kilograms per standard cubic decimeter grams per cubic centimeter grams per cubic meter Kilograms per kiloliter pound mass per million standard cubic feet Kilograms per million cubic meters
HVVolume	HVVolume	MJ/m3 Btu/SCF Btu/MCF Btu/MMCF J/m3 kJ/m3 thrm/US Gallon thrm/UK Gallon thrm/Cngal Btu/USgal Btu/UKgal Btu/Canadian Gal kcal/m3 ftb/US Gallon kcal/cm3	megajoules per cubic meter Btu per standard cubic feet Btu per thousand cubic feet Btu per million cubic feet joules per cubic meter kilojoules per cubic meter therms per US gallon therms per UK gallon therms per Canadian gallon Btu per US gallon Btu per UK gallon Btu per Canadian gallon kilocalories per cubic meter foot pounds per US

			gallon kilocalories per cubic centimeter
HVMass	HVMass	MJ/kg Btu/lbm kJ/kg cal/g cal/lbm	megajoules per kilogram Btu per pound mass kilojoules per kilogram calories per gram calories per pound mass
Mass	Base Mass Log Mass Total Mass Base Mass Flow Rate Mass Flow Rate	kg lbm	kilograms pound mass
Volume	Base Volume Log Volume Total Volume Base Volume Flow Rate Volume Flow Rate	Sm3 SCF bbl Canadian Gallon UK Gallon US Gallon Scm3 SkL	standard cubic meters @ base conditions standard cubic feet barrels Canadian gallons UK gallons US gallons standard cubic centimeters @ base conditions standard kiloliters @ base conditions
AVolume	Actual Base Volume Actual Log Volume Actual Total Volume Actual Base Volume Flow Rate Actual Volume Flow Rate	m3 ACF Abbl ACanadian Gallon AUK Gallon AUS Gallon AkL	actual cubic meters actual cubic feet actual barrels actual Canadian gallons actual UK gallons actual US gallons actual kiloliters
Energy	Base Energy Log Energy Total Energy Base Energy Flow Rate Energy Flow Rate	MJ Btu MBtu MMBtu J kJ GJ quad therm KW-hour ch-hour CV-hour hp-hour Chu kcal cal ft-lbf ft-pdl erg	megajoules Btu thousand Btu million Btu joules kilojoules gigajoules quad therms kilowatt hours ch hours CV hours horse power hours Chu kilocalories calories foot pound force foot poundal erg

		Mcal Gcal	megacalories gigacalories
Percent	Percent	Percent	percent
Mole Percent	Mole Percent	Mole Percent	mole percent
Date/Time	Date/Time	mdy hms dmy hms ymd hms	month/day/year hour:minutes:seconds day/month/year hour:minutes:seconds year/month/day hour:minutes:seconds
Time	Elapsed Time	Seconds Minutes Hours Days Milliseconds Microseconds	Seconds Minutes Hours Days One thousandth of a second One millionth of a second
Battery	Voltage	volts microvolts millivolts	volts one millionth of a volt one thousandth of a volt
Current	Current	Amps milliAmps microAmps	amps one thousandth of an amp one millionth of an amp
Decibel	Decibel	db	decibels
Velocity	Velocity	m in ft miles cm mm	meters inches feet miles centimeters millimeters

Tree View

Overview

This Tree View hierarchy is accessed by selecting the Tree View icon from the top of the page. This icon is available on every screen from the same location to facilitate navigation. It also has a toggle function which displays the Tree View or hides it depending on the situation. The initial display will show the following choices:

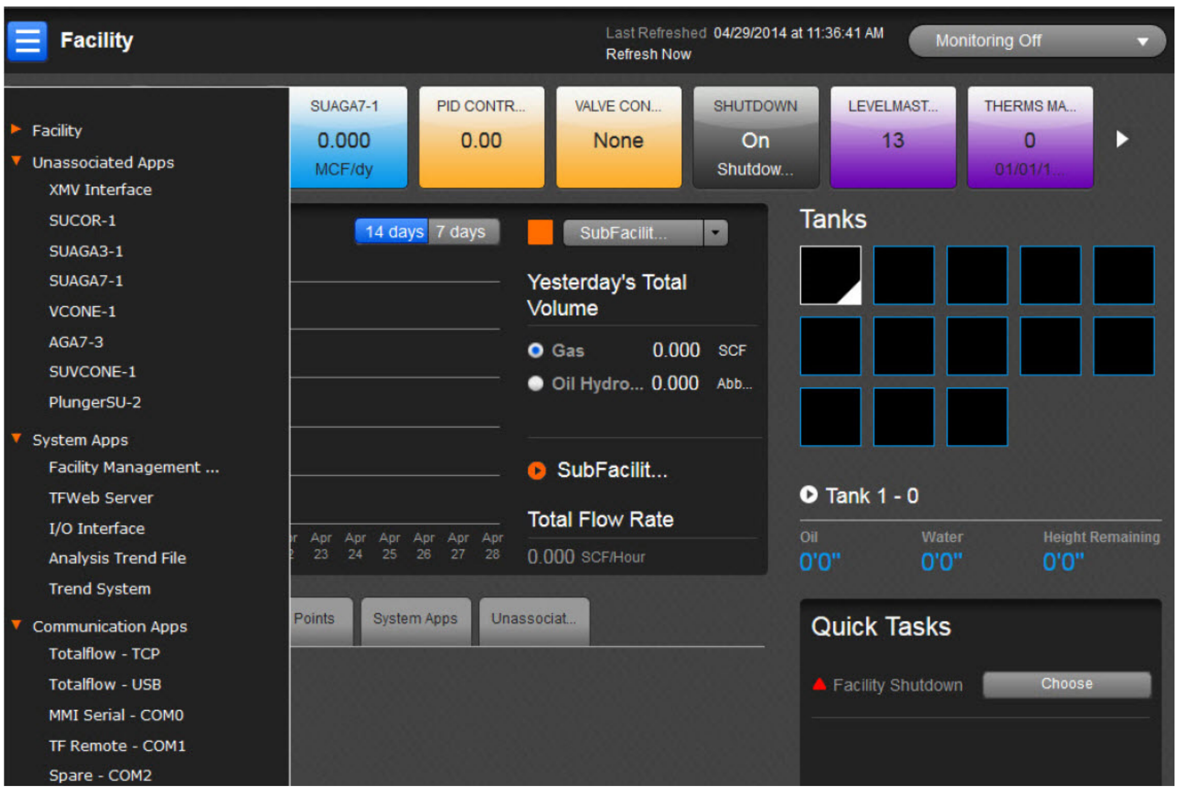
- Facility
- System Apps
- Communication Apps
- Unassociated Apps

The Tree View allows the user to view all applications associated with the Facility organization from the Facility to the Sub-Facility to the Station. Also all applications not associated with the Facility hierarchy are available for access to include the following application groups: System Apps (e.g., Trend System), Communication Apps (e.g., Totalflow/TCP) and Unassociated Apps (e.g., AGA-3).

The triangular orange icon before any option in the Tree View will point to the right when there are options not displayed. Selecting the triangular orange icon will display those options and the icon will then point down. Selecting any of these hidden options will take the user to the appropriate Facility hierarchy screen.

If there is no icon before an option, that option is an application. Selecting it will take the user to its associated application screen.

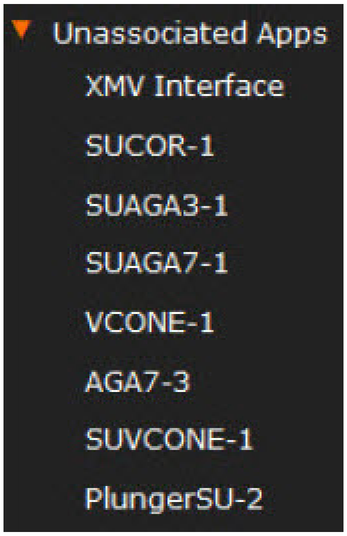
Selecting the triangular icon again will reverse the previous action, (display the open items if they are hidden or hide them if displayed) leaving the icon to point appropriately.



Facility

If the Facility option were open and the SubFacility 1 and SubFacility 2 closed in Tree View, the following applications (15) are listed as organic to the Facility proper:

AGA3-1	SUAGA7-1	PID Control	Valve Control	Shutdown
LevelMaster	Therms Master	Therms Slave	Coriolis Interface	Pulse Accumulator
Plunger	Plunger SU	Trends	Events	Data Points

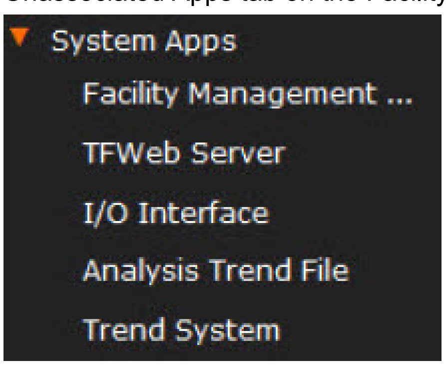


Unassociated Apps

With the Unassociated Apps open, the following applications (8) display:

- XMV Interface
- SUCOR-1
- SUAGA3-1
- SUAGA7-1
- VCONE-1
- AGA7-3
- SUVCONE-1
- PlungerSU-2

On the Facility Dashboard screen, under the Unassociated tab, the same applications are listed. From this screen are two ways to access the Unassociated Apps: (1) from Tree View or (2) from the Unassociated Apps tab on the Facility Dashboard screen.



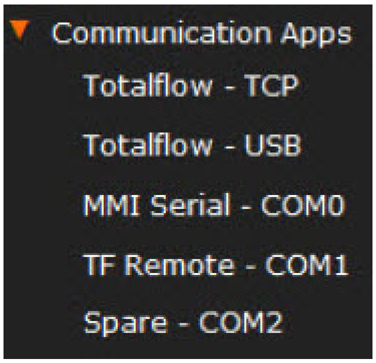
System Apps

With the System Apps open, its following applications (5) display:

- Facility Management App
- TFWeb Server
- I/O Interface

- Analysis Trend File
- Trend System

On the Facility Dashboard screen, under the System Apps tab, three of the same applications are listed (I/O Interface, Analysis Trend File and Trend System). A fourth (Facility Management App) is accessible from the Operator pulldown menu. Again, this underscores two ways to access the System Apps: (1) from Tree View or (2) from the System Apps tab or the Operator pulldown menu on the Facility Dashboard screen. The fifth option (TF WebServer) is only accessible from Tree View.



Communication Apps

With the Communication Apps open, its following applications (5) display:

- Totalflow - TCP
- Totalflow - USB
- MMI Serial - COM0
- TF Remote - COM1
- Spare - COM2

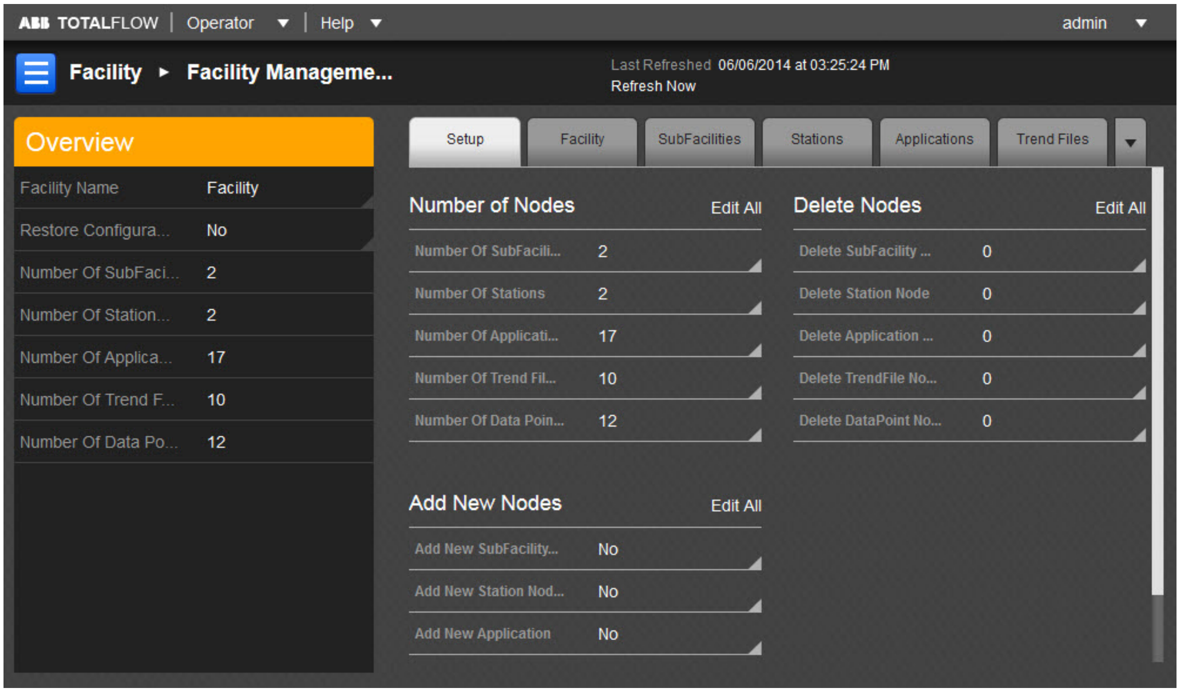
The Communication Apps are only accessible from Tree View.

Facility Management

Overview

Facility Management actually applies to the three levels or nodes of the facility hierarchy:

- Facility
- Sub-Facility
- Station



Overview

Here are displayed the two read/write fields for the Facility Management application Overview as follows:

Facility Name	Enter the Name given to this Facility (up to 31 characters alphanumeric).
Restore Configuration	Enter Yes or No. Enabling this option (Yes) will restore application table data in facility management application and existing configuration will be discarded.*

*It's important to note that the Restore function brings over the application table data from PCCU which overwrites the existing configuration in the facility management application. All trend files will be brought over as well.

If there is a PAD Controller in PCCU, the Groups will become the Sub-Facility (2nd) level and the Wells will become the Station (3rd) level. There is only one facility and it becomes the first level.

If there is no PAD Controller in PCCU, there will be no Group concept. All parents of Applications (on the Applications tab in PCCU) will move to the Sub-Facility (2nd) level. Again, there is only one facility and it becomes the first level.

There can only be a maximum of one Facility. Here are displayed the five read-only fields for the Facility Management application Overview as follows:

Number of Sub-Facilities	Displays the number of Sub-Facilities included in this Facility (maximum number of Sub-Facilities is 32).
Number of Stations	Displays the number of Stations included in this Facility (maximum number of Stations is 64).
Number of Applications	Displays the number of Applications instantiated at this Facility (maximum number of Applications is 256).
Number of Trend Files	Displays the number of Trend Files created for this Facility (maximum of Trend Files is 256).

Number of Data Points	Displays the number of Data Points identified for this Facility (maximum number of Data Points is 256).

Setup

Number of Nodes

The following column terms are used for the Number of Nodes section:

Number of Sub-Facilities	Enter the number of Sub-Facilities included in this Facility.
Number of Stations	Enter the number of Stations included in this Facility.
Number of Applications	Enter the number of Applications instantiated at this Facility.
Number of Trend Files	Enter the number of Trend Files created for this Facility.
Number of Data Points	Enter the number of Data Points identified for this Facility.

Add New Nodes

The following column terms are used for the Add New Nodes section:

Add New Sub-Facility Node	Enter Yes or No depending on whether adding a new Sub-Facility Node.
Add New Station Node	Enter Yes or No depending on whether adding a new Station Node.
Add New Application	Enter Yes or No depending on whether adding a new Application.
Add New Trend File Node	Enter Yes or No depending on whether adding a new Trend File Node.
Add New Data Point Node	Enter Yes or No depending on whether adding a new Data Point Node.

Delete Nodes

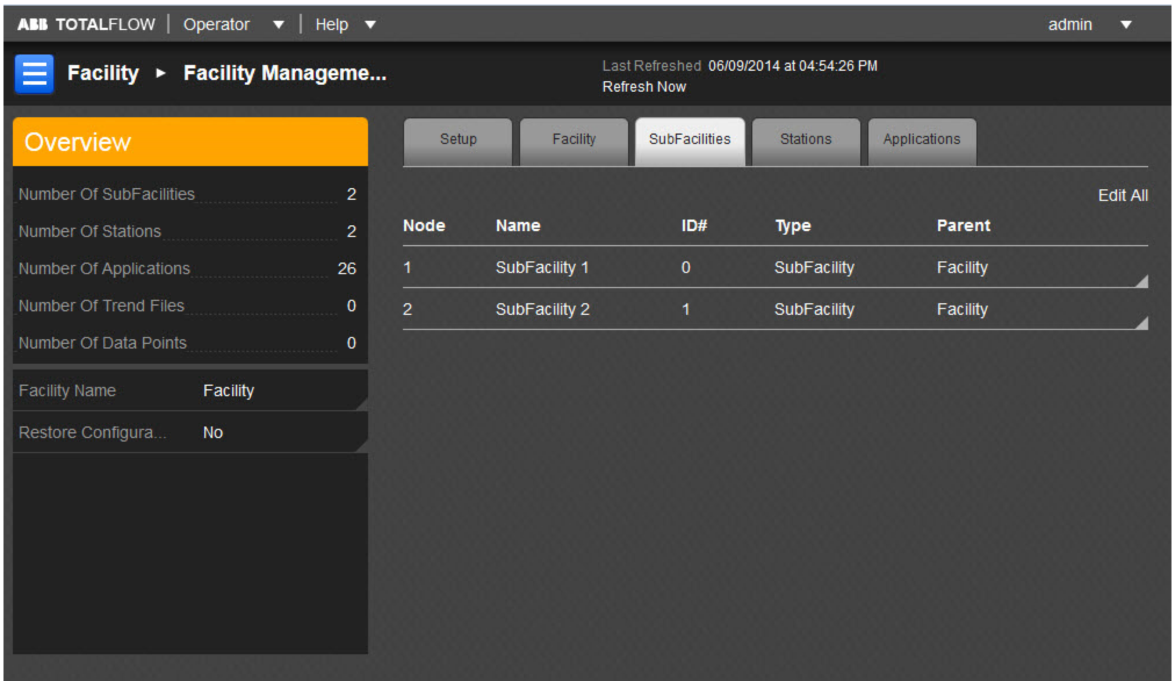
The following column terms are used for the Delete Nodes section:

Delete Sub-Facility Node	Enter the number of the Sub-Facility Node to be deleted.
Delete Station Node	Enter the number of the Station Node to be deleted.
Delete Application Node	Enter the number of the Application Node to be deleted.
Delete Trend File Node	Enter the number of the Trend File Node to be deleted.
Delete Data Point Node	Enter number of the Data Point Node to be deleted.

Facility

The following column terms are used for the Facility tab:

Node	Displays the number of the Facility Node.
Name	Enter the Name selected for this Facility (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the ID number of the device.
Type	Displays the Type of Node involved (Facility).
Parent	This is for future use.



Sub-Facilities

The following column terms are used for the Sub-Facility tab:

Node	Displays the number of the Sub-Facility Node.
Name	Enter the Name selected for this Sub- Facility (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the unique identifier of the node (e.g. Station).
Type	Displays the Type of Node involved (Sub-Facility).
Parent	Enter the type of parent if any (Facility).

Stations

The following column terms are used for the Stations tab:

Node	Displays the number of the Station Node.

Name	Enter the Name selected for this Station (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the ID number of the device.
Type	Displays the Type of Node involved (Station).
Parent	Enter the type of parent if any (Sub-Facility).

Applications

The following column terms are used for the Applications tab:

Node	Displays the number of the Application Node.
Name	Displays the Name for this Application (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the ID number of the device.
Type	Displays the Type of Node involved (Application).
Parent	Enter the name of the Parent if any (Assorted: Facility, Sub-Facility, Station).
App Slot	Displays the number of the Application Slot.
Associated App Slot	(For Future Use)

Data Points

If the number of Data Points are zero, the Data Points tab will not appear. The following column terms are used for the Data Points tab:

Node	Displays the number of the Data Point Node.
Name	Enter the Name of the individual Data Point (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the ID# of each device.
Type	Displays the Type of Application.
Parent	Enter the name of the Parent if any of each individual Data Point.
Register	Enter the app/array/register of each Data Point.
Unit	Enter up to ten characters for the name of the units. Ten characters assumes nine places for Data and a space between the Data and the Units. In lieu of entering text, a String Register can be entered that contains the text.
Associated App Slot	Enter the Associated App Slot number for each Data Point.
X Location	Enter the X location for its (Data Point) location on the page.
Y Location	Enter the Y location for its (Data Point) location on the page.
Point Type	Signifies type of Data Point (e.g., string, integer, etc.)
Attribute1	(for future use)
Attribute2	(for future use)
Attribute3	(for future use)
Attribute4	(for future use)

Trend Files

If the number of Trend files are zero, the Trend Files tab will not appear. The following column terms are used for the Trend Files tab:

Node	Displays the number of the Trend File Node.
Name	Enter the Name for each Trend File (square or angular brackets not allowed in the Name of the Node).
ID#	Displays the ID# of each device.
Type	Displays the Type of Trend File.
Parent	Enter the name of the Parent if any of each Trend File.
File Name	Enter the File Name for each Trend File.
Associated App Slot	Enter the number for each Associated Application Slot.

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Totalflow® products Totalflow Web Interface (TWI) software Help notes v1.0 Technical reference			
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