

# **LACT Library User Manual**

## **Overview**

BhiLibLACT is a library which provides supporting features to the LACT program, such as:

- API 12 flow (2019) calculations for crude oil, fuel oils, jet fuel, or gasolines
- GPA 8217 (2019) for NGL and LPG
- API 21.1 data retention, alarming, and event logging
- Batching and batch reporting
- User/Driver authentication
- Multiple alternate totalizers
- Ticket printing – configurable formats
- Emailing of batch reports

The BhiLibLACT library uses runtime licensing. A license is required for each PLC which executes the library code. The program will run for approximately 4 days in trial mode before a license is required. Licenses must be purchased from Beyond HMI, Inc.

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## **Current Day History**

Calls the visualization for reviewing periodic history for gas meters for the current *day*. A *day* can contain up to 25 hours of data, or less – if a configuration change has been made.

## **Ad hoc Batches**

Calls the visualization which displays the current and previous ad hoc batches. Ad hoc batches are those which are started and stopped by the host program. These are different from calendar batches – which are based on calendar days and months.

## **Daily Batches**

Calls the visualization which displays the current day and prior day batch information.

## **Monthly Batches**

Calls the visualization which displays the current month and prior month batch information.

## **Events**

Calls the visualization for reviewing meter events

## **Alarms**

Calls the visualization for reviewing meter alarms

## **Batch Description**

Calls the visualization for modifying descriptive information about the active or stopped batch

## **Retrieve a Batch**

Calls the visualization for retrieving an historical ad hoc batch and displaying its attributes.

## **Alternate Totalizers**

Calls the visualization for configuring and viewing totals from alternate totalizers.

## **Admin**

Calls the visualization for viewing license status information and calling other screens which support other “admin level”

## **Back**

Returns to the visualization in your PLC program from which the LACT menu was called

## Oil Meter Screen – Custody Transfer (Custody Xfer)

The oil meters screen contains several tabs. The **Custody Xfer** tab displays live calculated results for the meter – when the meter is calculating for custody-transfer.

Oil Meter Screen

**Oil Meter 0**  Enabled ● Back

Custody Xfer	Main	Advanced	Ranges	Diagnostic	Cal Rpt Params	Calibration					
	Indicated Quantity	Indicated Vol [BPD]	Gross Vol [BPD]	GrossStd Vol [BPD]	Net Std Vol [BPD]	S&W Vol [BPD]	Gross Mass [lbd]				
Flow Rate	13305.601	13305.601	13305.601	13118.602	13088.429	30.173	3793239.250				
		[BBL]	[BBL]	[BBL]	[BBL]	[BBL]	[lbd]				
Current Hour	8.35	8.35	8.35	8.24	8.22	0.02	2381.75				
Last Hour	324.48	324.48	324.48	319.86	319.12	0.74	92504.12				
Today	8.4	8.4	8.4	8.2	8.2	0.0	2381.8				
Yesterday	567.7	567.7	567.7	559.6	558.3	1.3	161838.3				
Current Month	797	797	797	786	784	2	227230				
Previous Month	0	0	0	0	0	0	0				
Total	797	797	797	786	784	2	227230				
Sp	32.70	Density	42.300	Temperature	88.30	S&W	0.23	Pulses	85316	Rate	13305.601

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### Oil Meter Screen – Custody Xfer

#### Meter Description Text Box\*

This text box is used to modify the common descriptive name of the currently-selected meter.

#### Enabled\*

Use this check box to enable/disable the meter. Disabled meters are ignored by the library.

#### Status Indicator ●

Displays the configuration status of the meter. When the meter is enabled, the library internally verifies the configuration. If the configuration is correct, the indicator will be green. If the indicator is orange, see the Diagnostic tab for details about identified configuration issues. Note that some of the indicated issues are only warnings.

#### Indicated Quantity

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Values in this column represent the raw meter values. These will be in either barrels or pounds – depending upon whether the meter is providing raw input related to volume or density.

## **Indicated Volume**

Values in this column represent raw meter values – in volume units. If the meter is reporting in volume units, these numbers will be identical to those in the indicated quantity column. The screen displays the relevant units of measure.

## **Gross Volume**

Values in this column represent the indicated volume adjusted for meter factor. The screen displays the relevant units of measure.

## **Gross Standard Volume**

Values in this column represent the gross volume – corrected for temperature and pressure. The screen displays the relevant units of measure.

## **Net Standard Volume**

Values in this column represent the gross standard volume, minus the amount of S&W. The screen displays the relevant units of measure.

## **S&W Volume**

Values in this column represent the amount of S&W for the meter. The screen displays the relevant units of measure.

## **Gross Mass**

Values in this column represent the gross mass measured through the meter. The screen displays the relevant units of measure.

## **Flow Rate**

Values in this row represent the *ten-second averaged* calculated flow rate – as of the last successful calculation. The screen displays the relevant units of measure.

These values will update at ten-second intervals.

If the meter input is a flow rate (see **Meter Input is a Flow Rate**), these values will be based on the average of the input flow rates over the preceding ten-second period.

If the meter input is an accumulation (see **Meter Input is a Flow Rate**), these values will be based on differentiation of the meter accumulation over the preceding ten-second period.

## **Current Hour**

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Values in this row represent the accumulated quantity for the current hour. An hourly period is initiated when the PLC clock indicates a change of hour. The screen displays the relevant units of measure.

## **Last Hour**

Values in this row represent the accumulated quantity for the previous hour. An hourly period is initiated when the PLC clock indicates a change of hour. The screen displays the relevant units of measure.

## **Today**

Values in this row represent the accumulated quantity for the current contract day. The hour at which the contract day changes is configurable – by station. The contract day changes at the *beginning* of the configured hour. The screen displays the relevant units of measure.

## **Yesterday**

Values in this row represent the accumulated quantity for the previous contract day. The hour at which the contract day changes is configurable – by station. The contract day changes at the *beginning* of the configured hour. The screen displays the relevant units of measure.

## **Current Month**

Values in this row represent the accumulated quantity for the current contract month. The contract month changes on the first day of each calendar month - at the *beginning* of the configured contract hour. The screen displays the relevant units of measure.

## **Previous Month**

Values in this row represent the accumulated quantity for the previous contract month. The contract month changes on the first day of each calendar month - at the *beginning* of the configured contract hour. The screen displays the relevant units of measure.

## **Total**

Values in this row represent the accumulated quantity for the lifetime of the flow computer installation. This value is not resettable by supported features. The screen displays the relevant units of measure.

## **Sp**

Displays the live static pressure being used by the library for oil correction factor calculations. This is the value used for both density pressure and meter pressure. It should be supplied to the library in psig.

## **Density**



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Displays the live density for the meter conditions. It should be supplied to the library in API gravity.

## **Temperature**

Displays the live temperature being used by the library for oil correction factor calculations. The screen displays the relevant units of measure. It should be supplied to the library in degrees F.

## **S&W**

Displays the live S&W content of the fluid. It should be supplied to the library in percent.

## **Pulses**

Displays the live raw accumulated pulse quantity used by the library for oil flow calculations – when the meter is providing accumulated pulses. If the input from the meter is in flow rate, this number will be zero.

## **Rate**

Displays the live raw flow rate used by the library for oil flow calculations. When the meter is providing a flow rate, this value is the flow rate from the meter. If the input from the meter is in accumulated pulses, this number is a pseudo-rate calculated by differentiating the change in input units over a ten-second.

## Oil Meter Screen - Main

The oil meters screen contains several tabs. The **Main** tab is used to configure most of the important meter parameters.

The screenshot displays the 'Main' tab of the 'Oil Meter 12' configuration screen. At the top, the meter name 'Oil Meter 12' is shown in a black box, followed by an 'Enabled' checkbox which is checked, and a green status indicator. A 'Back' button is located in the top right corner. Below the title bar, there are several tabs: 'Custody Xfer', 'Main', 'Advanced', 'Ranges', 'Diagnostic', 'Cal Rpt Params', and 'Calibration'. The 'Main' tab is active. The configuration is organized into four main sections: 'Meter Identity' (with fields for Meter Serial Nbr: TEST8217, Flow Computer ID, First Delivery Date, and CFX Product Code: CRUDE OIL), 'Meter Inputs' (with Meter Type: Coriolis, Units Conversion: BBL in/ BBL out, and checkboxes for Meter Input is in Mass, Meter Input is a Flow Rate, S&W from Standard Conditions, and Supplied Rate is Hourly), 'Behavior Options' (with Contract Hour: Midnight, and checkboxes for Display Rates As Hourly and Automatically Finalize Batches), and 'Calculation Standard' (with a dropdown menu set to GPA 8217 (2019) NGL and LPG). The BeyondHMI logo is visible in the bottom right corner.

*Oil Meter Screen – Main Tab*

### **Meter Description Text Box\***

This text box is used to modify the common descriptive name of the currently-selected meter.

### **Enabled\***

Use this check box to enable/disable the meter. Disabled meters are ignored by the library.

### **Status Indicator**



Displays the configuration status of the meter. When the meter is enabled, the library internally verifies the configuration. If the configuration is correct, the indicator will be green. If the indicator is orange, see the Diagnostic tab for details about identified configuration issues. Note that some of the indicated issues are only warnings.

### **Meter Serial Number\***

Use this field to specify the meter serial number. Meter serial numbers must be unique at each installation. Each meter on the PLC must have a unique serial number.

*Note: CFX files for the different meters are organized on the PLC file system by meter serial number. Therefore, it is important to configure this parameter*

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*correctly and – more importantly – to avoid changing it unless absolutely necessary. Meter serial numbers should not contain spaces.*

## **Flow Computer ID**

Specify the Flow Computer ID to associate with this station. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **First Delivery Date**

Specify the first date of oil delivery through this meter. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **CFX Product Code\***

This product name is passed to FLOWCAL through the CFX file. It must match a product code already configured in the end-user's FLOWCAL system. The library defaults to a product code of "Crude Oil".

## **Contract Hour\***

Specify the hour when the contract day changes. The contract day will change at the *beginning* of the configured hour.

## **Display Rates As Hourly**

By default, flow rates and flow rate no-flow thresholds are displayed as daily rates. Use this check box to display rates in hourly form.

## **Automatically Finalize Batches\***

By default, when a batch is stopped, it remains in stopped state until an explicit command is issued to finalize the batch. This stage between stopping and finalizing provides an opportunity for a truck driver (for instance) to enter grind-out results for the batch before the batch parameters are frozen.

If you wish for batches to be stopped and finalized at the same instant, check this box.

## **Meter Type**

Specify the type of primary element being used. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Units Conversion\***

Specify the units of measure supplied by the meter primary input vs the units that should be used for presenting and accumulating volumes.

The library uses the selection made in this drop-down list along with the **Meter Input is in Mass** selection to determine how to convert meter element values to the proper units of volume.

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The table below explains how to configure these settings.

Form of values provided from meter element	Meter Input is in Mass Checkbox	UOM of values provide from the meter	Desired output and accumulations UOM	Selection in Units Conversion dropdown
Mass	Checked	Lbm	Gallons	BBL in/Gal Out or Gal in/Gal out
Mass	Checked	Lbm	BBLs	BBL in/BBL Out or Gal in/BBL out
Volume	Unchecked	Gallons	Gallons	Gal in/Gal Out
Volume	Unchecked	Gallons	BBLs	Gal in/BBL Out
Volume	Unchecked	BBLs	Gallons	BBL in/Gal Out
Volume	Unchecked	BBLs	BBLs	BBL in/BBL Out

## **Meter Input is in Mass\***

The library will accept meter input in mass or volume. If the meter input is in volume, leave this box unchecked. If the meter input is in mass, check this box.

## **Meter Input is a Flow Rate check box\***

The library will accept meter input as a flow rate or as accumulated (totalizer) value. If the meter input is an accumulated volume or mass, leave this box unchecked. If the meter input is in volume or mass flow rate, check this box.

## **S&W from Standard Conditions check box\***

Indicates whether the value provided for S&W was derived at standard conditions – such as from a grind-out (if checked) or the S&W is a “live” value - derived at/near meter temperature and pressure (if unchecked).

## **Supplied Rate is Hourly\***

By default, if the meter is set to accept a rate value as an input (vs accumulation) then the library assumes that the rate is a daily rate. Check this box if the supplied input rate is an hourly rate.

## **Calculation Standard**

Specify the type of calculation the meter should perform. Options are described in the table below:

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Selection	CTL	CPL
API 11.1 (2019) Crude Oil	API 11.1.6.2 (2019) – crude oil	API 11.1.6.2 (2019) – crude oil
API 11.1 (2019) Fuel Oil	API 11.1.6.2 (2019) – fuel oil	API 11.1.6.2 (2019) – fuel oil
API 11.1 (2019) Gasoline	API 11.1.6.2 (2019) – gasoline	API 11.1.6.2 (2019) – gasoline
API 11.1 (2019) Jet Fuel	API 11.1.6.2 (2019) – jet fuel	API 11.1.6.2 (2019) – jet fuel
GPA 8217 (2019) NGL and LPG	GPA 8217 (2019) – T23E	API 11.1.6.2 (2019) – crude oil
AGA8 Part 2 (2017) Density	Uses either known standard density or calculated standard density and either calculated or measured flowing density to correct indicated quantity to standard quantity	

## Oil Meter Screen - Advanced

The oil meters screen contains several tabs. The **Advanced** tab is used to configure additional meter parameters.

Oil Meter Screen

Oil Meter 12  Enabled ● Back

Custody Xfer | Main | **Advanced** | Ranges | Diagnostic | Cal Rpt Params | Calibration | Extended

**Meter Signal**

K-Factor 10000.0000 Pulses/BBL

Meter Factor 1.0000

Pulse Source Roll Over 0

Meter is Pressure Compensated

Meter is Temperature Compensated

**Setpoints**

Low Flow Cutoff Setpoint 0.1

Backflow Cutoff Setpoint 0.0

Restart Calendar Batches

**Other Input Factors**

Density Factor 1.0000

S&W Factor 1.0000

**Misc**

Max Data Retention Days 35

Force Day Rollover

Meter Has RTD

RTD is In Use

Meter Temperature is Live

Power Source AC

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### *Oil Meter Screen – Advanced Tab*

#### **Meter Description Text Box\***

This text box is used to modify the common descriptive name of the currently-selected meter.

#### **Enabled\***

Use this check box to enable/disable the meter. Disabled meters are ignored by the library.

#### **Status Indicator** ●

Displays the configuration status of the meter. When the meter is enabled, the library internally verifies the configuration. If the configuration is correct, the indicator will be green. If the indicator is orange, see the Diagnostic tab for details about identified configuration issues. Note that some of the indicated issues are only warnings.

#### **K-Factor\***

Indicate the factor used to convert linear meter pulses to velocity or accumulation units. The K-factor entered in this field must be in either pulses per barrel or pulses per pound – depending upon how the **Meter Input is in Mass** parameter is set.

## **Meter Factor\***

Indicate the meter factor derived from meter proving. This field is used in calculation of gross volume.

## **Pulse Source Roll Over\***

Enter the value at which the accumulator rolls over to zero. If the meter has an internal accumulator which is being used, enter the value at which the meter accumulator rolls over. If the meter is supplying pulses to a device or module which counts the pulses, enter the value at which this device or module rolls over. If the meter input is a flow rate, this field is not used. If the meter input is an accumulation, this value is used to detect and account for meter accumulator rollover.

## **Meter is Pressure Compensated checkbox**

Indicate whether the meter is pressure compensated. This field is passed to FLOWCAL in the CFX file. It is not used by the current version of the flow computer library.

## **Meter is Temperature Compensated checkbox**

Indicate whether the meter is temperature compensated. This field is passed to FLOWCAL in the CFX file. It is not used by the current version of the flow computer library.

## **Low Flow Cutoff Setpoint\***

Indicate the cutoff point to trigger no flow override. For oil meters, this threshold is applied to the indicated quantity flow rate (barrels per day or pounds per day).

If the meter input is a flow rate (see **Meter Input is a Flow Rate**), this threshold is compared to the meter input flow rate. If the meter input is a rate below this setpoint, no volume will accumulate.

If the meter input is an accumulation (see **Meter Input is a Flow Rate**), this threshold is compared to the pseudo-rate calculated by the library (pulse change of a ten second period converted to a daily flow rate). If the meter pseudo-rate below this setpoint, no volume will accumulate.

## **Backflow Cutoff Setpoint**

Indicate the cutoff point to indicate backflow. For oil meters, this threshold is applied to the indicated quantity flow rate (barrels per day or pounds per day). This field is passed to FLOWCAL in the CFX file. It is not used by the current version of the flow computer library.

## **Restart Calendar Batches**

Pressing this button causes the current daily batch and current monthly batch to end. A new daily batch and a new monthly batch are started.

## **Density Factor\***

Indicate the factor to apply to the input density – as derived during proving.

## **S&W Factor\***

Indicate the factor to apply to the input BS&W percentage – as derived during proving/calibration.

## **Max Data Retention Days\***

Indicate the number of days of data to save in the PLC file system. If this value is left less than 35 days for an enabled meter, the library will change it to 35. The value can be set larger than 35 days.

## **Force Day Rollover checkbox**

Check this box to trigger an immediate “rollover” of data for the current day into a CFX file. Should be used sparingly.

## **Meter Has RTD check box**

Indicates whether the meter is equipped with an RTD (usually true). This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **RTD in use**

Indicates whether the meter RTD is being used to supply temperature values (usually true). This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Temperature is Live**

Indicates whether the temperature values are live (usually true). It is not used by the flow computer library.

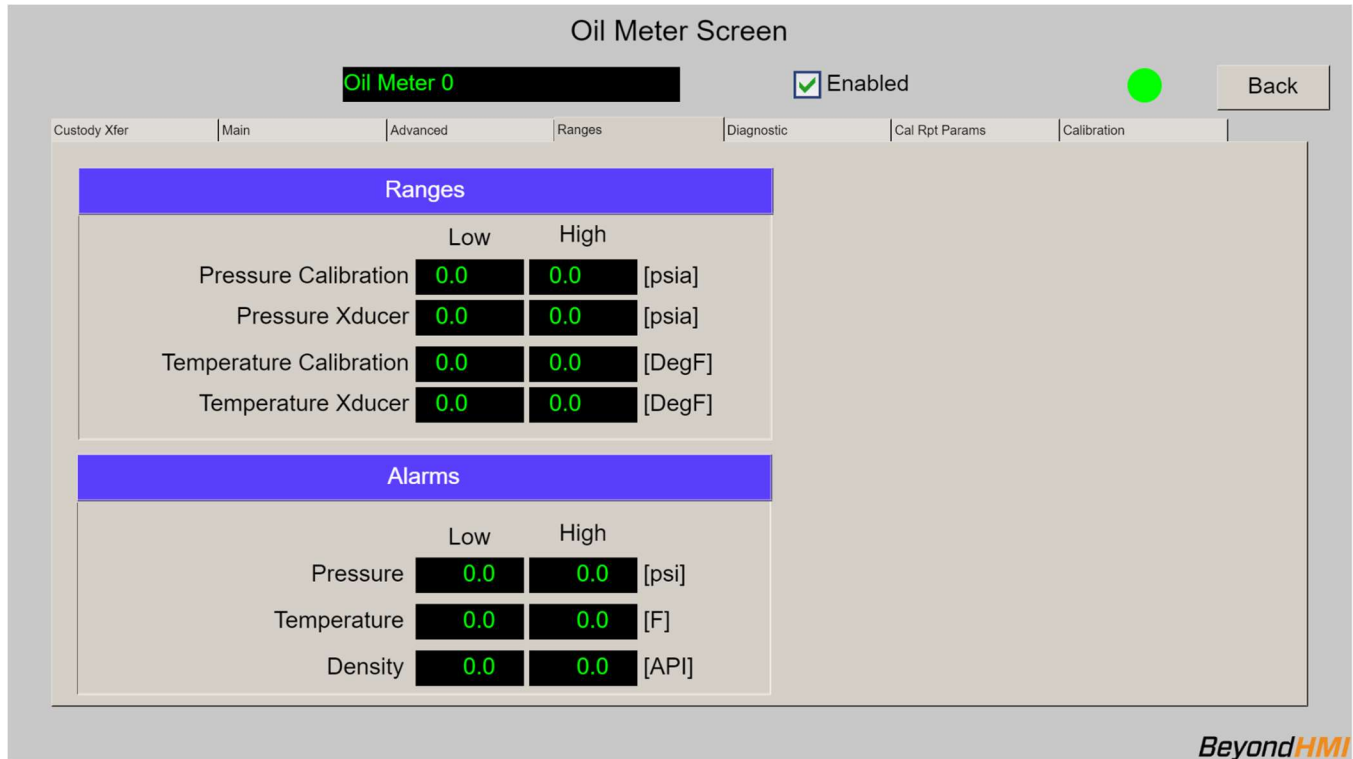
## **Power Source Combo Box**

Use this combo box to specify the power source for the station. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.



## Oil Meter Screen - Ranges

The oil meters screen contains several tabs. The **Ranges** tab is used to configure parameters related to sensor ranges and alarm levels.



*Oil Meter Screen – Ranges Tab*

### **Meter Description Text Box\***

This text box is used to modify the common descriptive name of the currently-selected meter.

### **Enabled\***

Use this check box to enable/disable the meter. Disabled meters are ignored by the library.

### **Status Indicator**



Displays the configuration status of the meter. When the meter is enabled, the library internally verifies the configuration. If the configuration is correct, the indicator will be green. If the indicator is orange, see the Diagnostic tab for details about identified configuration issues. Note that some of the indicated issues are only warnings.

### **Pressure Calibration**

Enter the low and high ranges for calibration of the meter's static pressure signal – if applicable. Applies to most meter types. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Pressure Xducer**

Enter the low and high ranges for absolute ranges of the meter's static pressure sensor - if applicable. Applies to most meter types. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Temperature Calibration**

Enter the low and high ranges for calibration of the meter's temperature signal – if applicable. Applies to most meter types. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Temperature Xducer**

Enter the low and high ranges for absolute ranges of the meter's temperature sensor - if applicable. Applies to most meter types. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## **Pressure Alarm\***

Enter the low and high alarm levels for the static pressure signal. These values are used to trigger alarm events in the flow computer's API 21.1 alarm logs. The static pressure alarm uses the calculation static pressure [in psia] as the basis for triggering alarms. If the meter's **Static Pressure Measurement Type** is set to **gauge**, then the static pressure alarm logic will reference the static pressure value provided by the PLC program *plus* atmospheric pressure.

## **Temperature Alarm\***

Enter the low and high alarm levels for the temperature signal. These values are used to trigger alarm events in the flow computer's API 21.1 alarm logs.

## **Density Alarm**

Enter the low and high alarm levels for the density signal. This field is passed to FLOWCAL in the CFX file. It is not used by the flow computer library.

## Oil Meter Screen - Diagnostic

The oil meters screen contains several tabs. The **Diagnostic** tab displays live diagnostic and internal calculation values from the library.

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*Oil Meter Screen – Diagnostic Tab*

### Meter Description Text Box\*

This text box is used to modify the common descriptive name of the currently-selected meter.

### Enabled\*

Use this check box to enable/disable the meter. Disabled meters are ignored by the library.

### Status Indicator

Displays the configuration status of the meter. When the meter is enabled, the library internally verifies the configuration. If the configuration is correct, the indicator will be green. If the indicator is orange, see the Diagnostic tab for details about identified configuration issues. Note that some of the indicated issues are only warnings.

### Static Pressure

Displays the static pressure value being used by the library for oil flow calculations.

## **Corrected Density**

Displays the meter density value – with the density factor applied – in multiple units of measure.

## **Standard Density**

Displays the calculated standard density value – based on correction for temperature and pressure.

## **Uncorrected S & W**

Displays the input BS&W percentage.

## **Corrected S & W**

Displays the BS&W percentage with the correction factor applied.

## **CTLw**

Displays the library-calculated API 11.1 correction for temperature of the water.

## **CPLw**

Displays the library-calculated API 11.1 correction for pressure of the water.

## **CTPLw**

Displays the combined CTLw and CPLw

## **CTL**

Displays the library-calculated API 11.1 correction for temperature of the oil.

## **CPL**

Displays the library-calculated API 11.1 correction for pressure of the oil.

## **CTPL**

Displays the combined CTL and CPL

## **CSW**

Displays the library-calculated correction for sediments and water.

## **Valid Crude Oil**

Displays a check when the oil API gravity provided to the library is within the valid range for crude oil – as defined by API 11.1. The valid range is -10 to 100 degrees API.

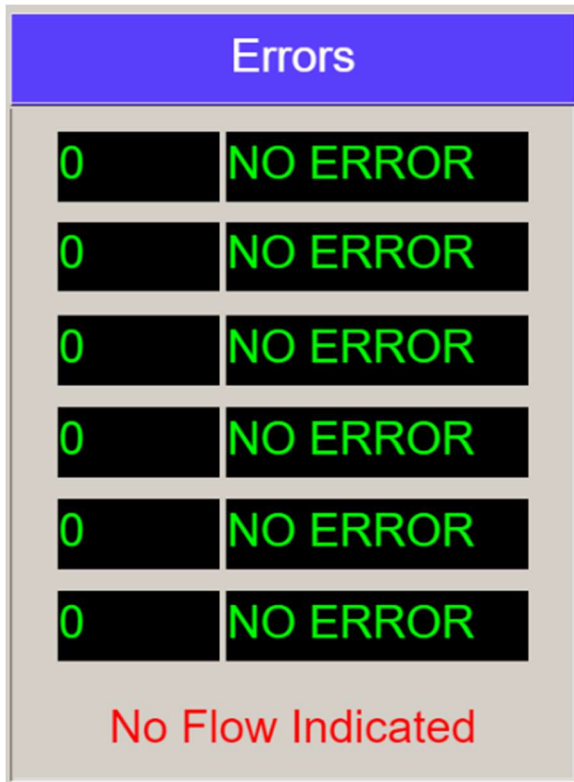
## **Error Codes and Messages**

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The library reports up to five Errors/Warnings for each meter. If more than five Errors/Warnings exist, only five will be displayed. Each Error/Warning is represented by a code number and a short text message. The table below provides further details for each Error/Warning. Note that Errors must be corrected before calculations can resume for the meter, whereas Warnings are only for informational purposes.

Code	Text	Error or Warning	Description and Suggestions
0	NO ERROR		Meter is functioning without errors or warnings
1021	CONVERGE FAIL	Error	The API 11.1 density calculation failed to converge. Contact Beyond HMI.
1022	OIL CTPL FAIL	Error	The oil correction factor calculations failed. Check that all oil properties and pressure and temperature are realistic.
1023	WTR CTPL FAIL	Error	The water correction factor calculations failed. Check that all S&W present and pressure and temperature are realistic.
1024	BAD S&W PCNT	Error	The corrected S&W fraction is less than 0.0 or greater than 1.0. Check that all S&W present and pressure and temperature are realistic.
1025	COMPOSITION	Error	The meter is configured to use AGA8 Part 2 compositional density calculations but configured mole fractions produce a sum which is not equal to 1.0000.

## No Flow Indicated



When the input value for the meter is below no flow cutoff threshold, this text will appear – as a warning/notification. See **Low Flow Cutoff Setpoint** for more information about library behavior in this state.

## Oil Meter Screen – Cal Rpt Params

The oil meters screen contains several tabs. The **Cal Rpt Params** tab displays a set of static parameters which will be saved with a calibration or verification report. These fields are for documentation purposes only. They are not used for library calculations or CFX reporting. They are only used when a calibration or verification report is committed to memory. They also serve a secondary purpose for attributes of a batch.

Oil Meter Screen

Oil Meter 0  Enabled ● Back

Custody Xfer | Main | Advanced | Ranges | Diagnostic | Cal Rpt Params | Calibration

Meter Calibration Parameters

Producer Name

Purchaser Name

Lease Name

Well / Facility Name

Well / Facility Number

SP Transducer Make/Model

Tmpr Transducer Make/Model

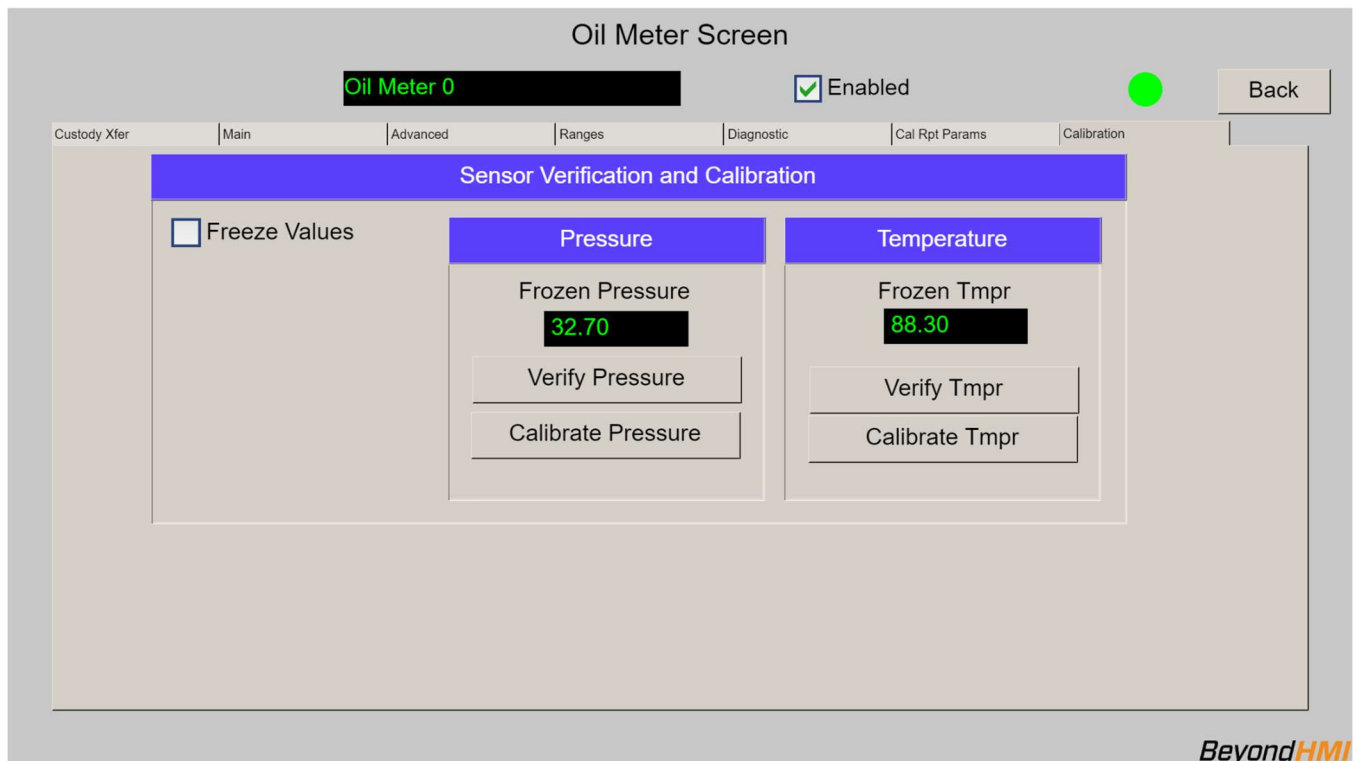
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*Oil Meter Screen – Cal Rpt Params Tab*

## Oil Meter Screen - Calibration

The oil meters screen contains several tabs. The **Calibration** tab is used to initiate a calibration or a verification of one of the analog input signals.

*By default, all input signals are directly translated to process variables. If calibration is performed in the sensor and a digital interface is used to obtain values from the sensor, it is not necessary to calibrate signals in the BHI library. If calibration is performed in the BHI library, a transfer function will be applied to that signal until another calibration is performed on that signal.*



*Oil Meter Screen – Calibration Tab*

### **Freeze Values Checkbox\***

Before calibrating or verifying, check this box to freeze all input signals. After calibration/verification, uncheck this box so the library uses live input values for flow calculations.

### **Frozen Pressure**

This text box displays the frozen pressure value being used by the flow calculations.

### **Frozen Tmpr**

This text box displays the frozen temperature value being used by the flow calculations.

### **Verify Pressure Button**

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Use this button to initiate a verification of the static pressure signal.

## **Verify Tmpr Button**

Use this button to initiate a verification of the temperature signal.

## **Calibrate Pressure Button**

Use this button to initiate a calibration of the static pressure signal.

## **Calibrate Tmpr Button**

Use this button to initiate a calibration of the temperature signal.



## Oil Meter Screen - Extended

The oil meters screen contains several tabs. The **Extended** tab is used to configure the AGA-8 Part2 (2017) properties calculations.

*Changes made on the Extended screen must be committed to persistent memory. After making changes on this screen be sure to check the Commit checkbox and wait for the box to become unchecked*

The screenshot shows the 'Oil Meter Screen' interface with the 'Extended' tab selected. The 'Configuration' section includes dropdown menus for 'Pressure Input' (psia), 'Density Input' (Kg/M3), and 'Live Density Source' (Calculated). It also shows 'Atmospheric' pressure at 14.3 and 'Constant Standard Density' at 800.0 [Kg/m3]. The 'Mole Fractions' section lists various components with their respective values, such as Methane (0.000000), Nitrogen (0.000000), Carbon dioxide (1.000000), and Total (1.000000). A 'Commit Needed' checkbox is visible next to the mole fractions table.

*Oil Meter Screen – Extended Tab*

### **Pressure Input\***

Designate whether the input pressure signal is in psia or psig.

### **Density Input\***

Designate whether the input density is in API gravity or Kg/M3.

### **Atmospheric\***

Designate the value to use in converting between psia and psig.

### **Standard Density Source\***

Designate whether the standard density will be entered as a Constant value or whether it will be calculated from composition and standard conditions.

Standard Density Source

Constant Standard Density  [Kg/m3]

## Constant Standard Density\*

If appropriate, designate a value for standard density [Kg/M3].

Standard Density Source

Standard Temperature  [F]

Live Density Source

Standard Pressure  [psia]

## Standard Temperature\*

If standard density is to be calculated by the library, provide the standard temperature [degrees F].

## Standard Pressure\*

If standard density is to be calculated by the library, provide the standard pressure [psia].

## Live Density Source\*

Indicate whether the Live ("flowing") density is to be sourced from a densitometer or if the library is to calculate density from the flowing pressure and temperature.

## Mole Fractions\*

Provide the compositional information for the flowing fluid.

*Compositional information should be provided as mole fractions – totaling to 1.0, rather than percentages (which would total to 100.0).*

*The screen calculates a total at the end of the list. This total must be 1.000 before the changes can be committed.*

## Commit Needed

This check box indicates that changes have been made, but not committed to persistent memory. This checkbox will be unchecked after a successful **commit**.

## Commit

Use this checkbox to initiate storage of any changes to persistent memory. The calculations will not use your changes until you **commit** them.

*Changes made on the Extended screen must be committed to persistent memory. After making changes on this screen be sure to check the Commit checkbox and wait for the box to become unchecked*

## Reset

Use this checkbox to retrieve value on this screen from persistent memory.

*The Reset Operation will overwrite any changes you have made, but not committed.*

## Meter Verification Screen

The **Meter Verification** screen is displayed after you select one of the **Verify...** buttons from the **Calibration Tab** of the **Meter** screen. The screen supports up to 6 verification points.

*Meter signals should be set to the Frozen state before performing verifications.*

The screenshot shows the 'Meter Verification' screen. At the top, there is a title 'Meter Verification'. Below it is a table with 5 columns: Action, Actual, Expected, Deviation, and Deviation %. There are 6 rows, numbered 1 to 6. All values in the table are 0.00. Below the table, there are three input fields: 'Normal Value' (0.00), 'Tester Value' (0.00), and 'Live Reading' (32.70). Below these, there are two more input fields: 'Deviation' (32.70) and 'Deviation %' (100.000 [%]). At the bottom, there are three buttons: 'Log Verify', 'Complete Verification', and 'Cancel Verification'. The BeyondHMI logo is in the bottom right corner.

	Action	Actual	Expected	Deviation	Deviation %
1		0.00	0.00	0.00	0.00
2		0.00	0.00	0.00	0.00
3		0.00	0.00	0.00	0.00
4		0.00	0.00	0.00	0.00
5		0.00	0.00	0.00	0.00
6		0.00	0.00	0.00	0.00

Normal Value: 0.00

Tester Value: 0.00

Live Reading: 32.70

Deviation: 32.70      Deviation %: 100.000 [%]

Log Verify      Complete Verification

Cancel Verification

*Meter Verification Screen*

### Normal Value

This is a “memo only” field for BLM calibration/verification reports. It is not used by the library – except to display on the verification report.

### Tester Value\*

Enter the reference value being applied to the signal.

### Log Verify Button\*

Use this button to signal that the verification point is ready to be saved for the verification report.

## Complete Verification Button\*

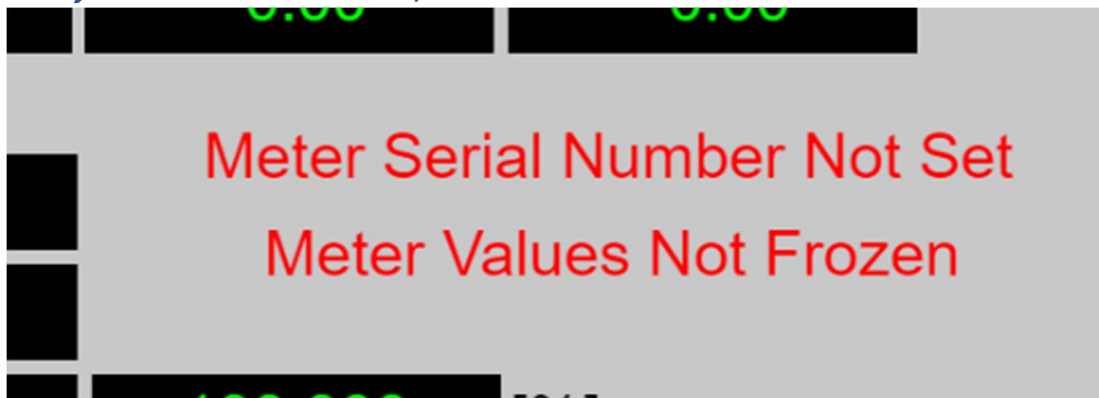
Use this button to signal that you have logged all verification points and you are ready to commit the verification to the database.

*You must proceed through the Completion process to get the verification points saved to persistent memory – where they will be available for generating a verification report.*

## Cancel Verification Button

Use this button to cancel a verification.

*If you cancel a verification, all data related to that verification will be lost.*



## Meter Values Not Frozen message

This message will appear if you have not frozen the meter signals prior to attempting a verification. If you see this message, cancel the verification, freeze meter signals, and restart the verification process.

## Meter Serial Number Not Set message

This message will appear if you have not configured the meter serial number on the meter screen – main tab. If you see this message, cancel the verification, properly configure the meter, and restart the verification process.

## Meter Calibration Screen

The **Meter Calibration** screen is displayed after you select one of the **Calibrate...** buttons from the **Calibration Tab** of the **Meter** screen. The screen supports up to 6 verification points.

*Meter signals should be set to the Frozen state before performing calibrations.*

Meter Calibration

	Action	As Found	As Left	Deviation	Deviation %
1		0.00	0.00	0.00	0.00
2		0.00	0.00	0.00	0.00
3		0.00	0.00	0.00	0.00
4		0.00	0.00	0.00	0.00
5		0.00	0.00	0.00	0.00
6		0.00	0.00	0.00	0.00

Normal Value **0.00**

Tester Value **0.00**

Live Reading **32.70**

Deviation **32.70** **100.000** [%]

*BeyondHMI*

*Meter Calibration Screen*

### Normal Value

This is a “memo only” field for BLM calibration/verification reports. It is not used by the library – except to display on the calibration report.

### Tester Value\*

Enter the reference value being applied to the signal.

### Set Zero Button\*

Use this button to signal that the current live reading and tester values are to be used as the low range calibration point.

### Set Span Button\*

Use this button to signal that the current live reading and tester values are to be used as the high range calibration point.

## Set Mid Button\*

Use this button to signal that the current live reading and tester values are to be used as reference mid-points for the calibration.

## Complete Calibration Button\*

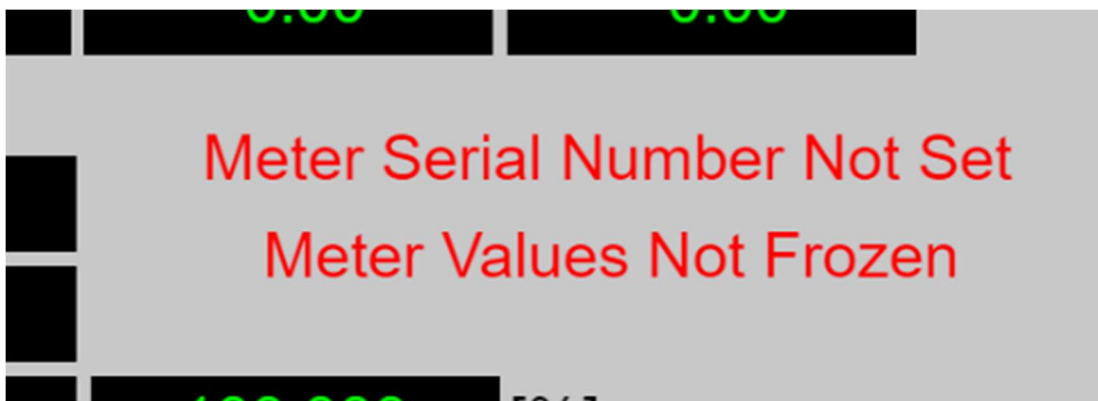
Use this button to signal that you have logged all calibration points and you are ready to commit the calibration to the database.

*You must proceed through the Completion process to get the calibration points saved to persistent memory – where they will be used by the BHI library to scale input values and will be available for generating a calibration report.*

## Cancel Calibration Button

Use this button to cancel a calibration.

*If you cancel a calibration, all data related to that calibration will be lost.*



## Meter Values Not Frozen message

This message will appear if you have not frozen the meter signals prior to attempting a calibration. If you see this message, cancel the calibration, freeze meter signals, and restart the calibration process.

## Meter Serial Number Not Set message

This message will appear if you have not configured the meter serial number on the meter screen – main tab. If you see this message, cancel the calibration, properly configure the meter, and restart the calibration process.

## Verification and Calibration Report Description Screen

The **Verification and Calibration Report Description** screen is displayed after you select one of the **Complete...** buttons on either the **Meter Verification** or the **Meter Calibration** screens.

*The information entered on this screen is optional. However, you **MUST use the Commit button** to save your verification or calibration data to the database*

Verification and Calibration Report Description

Tester	
Name	████████████████████
Contact Info	████████████████████
Affiliation	████████████████████
Remarks	████████████████████

Witness	
Name	████████████████████
Contact Info	████████████████████
Affiliation	████████████████████
Remarks	████████████████████

Validation Equipment	
Make/Model	████████████████████
Accuracy	████████████████████
Range	████████████████████
Last Calibration Date	████████████████████
Prior Inspection Date/Time	████████████████████
Prior Inspection Condition	████████████████████
Prior Verification Date/Time	████████████████████
Prior Calibration Date/Time	████████████████████

*BeyondHMI*

### *Meter Verification and Calibration Report Description Screen*

#### **Commit Verification/Calibration Button\***

Use this button to signal that you are ready to commit the data to the database.

*You must proceed through the Completion process and Commit changes (even if you do not enter any data on this screen) to get the verification or calibration points saved to persistent memory.*

#### **Cancel Verification/Calibration Button**

Use this button to cancel a verification or calibration.

*If you cancel a verification or calibration, all related data will be discarded.*

## Oil Meter Current Day Periodic History Screen

The oil meter current day periodic history screen can be used to review API 21.1 periodic history for an oil meter for the current day.

Current Day Periodic Oil History

Show Most Recent Periodic History Back

Index of First Record to Display **0** Index of Current Active Record **1**

Periodic Index	Start Timestamp	End Timestamp	Duration [sec]	Flowing [sec]	Tmpr	S&W [%]	Pulses	IndVol	GVol	GSV	NSV	S&W	CTPL
0	05/27/2021 14:45:28	05/27/2021 15:00:00	871	871	88.3	0.23	1338260	134.1	134.1	132.2	131.9	0.30	0.98595
1	05/27/2021 15:00:00	05/27/2021 15:21:20	1281	1281	88.3	0.23	1972740	197.3	197.3	194.5	194.1	0.45	0.98595
2	N/A	N/A	0	0	0.0	0.00	0	0.0	0.0	0.0	0.0	0.00	0.00000
3	N/A	N/A	0	0	0.0	0.00	0	0.0	0.0	0.0	0.0	0.00	0.00000

BeyondHMI

### *Oil Current Day Periodic History Screen*

The library maintains a buffer 25 periodic history records for each meter. Each periodic history record is meant to contain up to one hour of flow data. However, these history records are broken/changed any time a significant parameter change is made. So, the periodic history log may contain records including less than one hour of data.

The first periodic record for the meter is stored at periodic index zero. Subsequent periods are stored at indices with increasing numbers. The periodic history is not a circular buffer. This data is not overwritten until the previous days' worth of data has been archived to a cfx file.

For long term data retention, periodic history is copied to the .cfx files. A new cfx file is created at least once per day (after contract day change), or when a major configuration change is made to the meter or its station. Once periodic data is archived to a cfx file, the PLC program has no facilities for displaying that data.

The current day periodic history screen can be used to view portions of the current day's periodic history for a meter. Four records are displayed at one time. The user can navigate through the entire 25 record log using this screen – viewing 4 records at one time. The user can change position in the periodic history log by changing the **Index of First Record to Display** parameter on the screen. In the example above, the **Index of First Record to Display** parameter is set to zero. As a result, alarms zero through 3 are displayed. If the **Index of First Record to Display** parameter were changed to 5, for example, the screen would refresh – showing records 5, 6, and 7.



# BeyondHMI

The logic behind this screen can handle “rollover”. For example, if the **Index of First Record to Display** parameter were changed to 23, the screen would refresh and records 23, 24, 25, and zero would be displayed.

If you wish to view the 4 most recent periods, check the **Show Most Recent Periodic History** check box and the screen will refresh – displaying the 4 most recent records (the single most recent record will be at the bottom of the list).

The **Index of Current Active Record** parameter reveals the current position of the periodic history logic – within the buffer.

*The data elements displayed on this screen are just a small subset of the values collected and stored in API 21.1 history.*

## **Show Most Recent Periodic History check box**

Check this box to force the screen to refresh – showing the most recent periodic history records in the log.

## **Index of First Record to Display**

Enter a number in this box (0 through 25) to cause the screen to update – showing periodic history records at a specific location within the buffer. The refreshed list will start with the periodic history record number you enter.

## **Index of Current Active Record**

This read-only field displays the position where the library is currently accumulating flow information.

## **Periodic Index**

Displays the periodic index number (0-25).

## **Start Timestamp**

Displays the local timestamp at which the period began.

## **End Timestamp**

Displays the local timestamp at which the period ended.

## **Duration**

Displays the elapsed time between Start Timestamp and End Timestamp.

## **Flow**

Displays the amount of flowing time accumulated during the period.

## **Tmpr**

# BeyondHMI

This field displays the indicated-volume-average of the temperature during the period.

## **S&W %**

This field displays the indicated-volume-average of the sediments and water percentage during the period.

## **Pulses**

This field displays the pulses accumulated during the period.

## **IndVol**

This field displays the indicated volume accumulated during the period.

## **GVol**

This field displays the gross volume accumulated during the period.

## **GSV**

This field displays the gross standard volume accumulated during the period.

## **NSV**

This field displays the net standard volume accumulated during the period.

## **S&W**

This field displays the sediments and water volume accumulated during the period.

## **CTPL**

This field displays the indicated-volume-average of the correction for temperature and pressure of the oil.

## **Adhoc Batches Screen**

The Adhoc Batch screen displays data from the currently active batch and the prior batch.

Driver-Entered		Adhoc Batches		Active Batch	Prior Batch
Producer		Start	2021-05-27 14:56:42	2021-05-27 14:56:29	
Purchaser		Close	2021-05-27 14:56:53	2021-05-27 14:56:37	
Lease		Indicated Volume	1.69	1.23	
Well/Facility		Gross Volume	1.69	1.23	
Number		Net Volume	1.67	1.21	
Alt S&W	0.00 [%]	S&W Volume	0.00	0.00	
Alt Density	0.00 [API]	FWA Pressure	32.70	32.70	
Density Tempr	0.00 [F]	FWA Temperature	88.30	88.30	
		FWA Corrected Density	42.30	42.30	
		Flow Seconds	11	8	
		Duration Seconds	11	8	
		Batch ID	2	1	
		Start Pulses	1931545.00	1911525.00	
		End Pulses	1948485.00	1923845.00	

Finish Previous Batch

Back

BeyondHMI

## Adhoc Batches Screen

*If no batch is active, the Active Batch column will be invisible.*

*The data elements displayed on this screen are just a small subset of the values collected during the batch*

### Producer

Driver-entered field to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

### Purchaser

Driver-entered field to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

### Lease

Driver-entered field to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

### Well/Facility

Driver-entered field to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

## **Number**

Driver-entered field to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

## **Alt S&W**

Driver-entered BS&W percent to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

## **Alt Density**

Driver-entered density to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

## **Density Tempr**

Driver-entered temperature indicating at what temperature the density was measured to be stored with the batch and made available for report printing. This field can be edited until the batch is finalized. At finalization, the value in this field is saved with the batch and this data-entry field is cleared.

## **Active Batch**

Values in this column represent the current, active batch. If no batch is active, the display of these elements will be hidden.

## **Prior Batch**

Values in this column represent the prior batch – which is in stopped state or finalized state.

## **Start**

Timestamp when the batch started.

## **Close**

Timestamp when the batch was closed or stopped.

## **Indicated Volume**

Accumulated indicated volume for the batch

## **Gross Volume**

Accumulated gross volume for the batch

## **Net Volume**

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Accumulated net standard volume for the batch

## **S&W Volume**

Accumulated volume of BS&W for the batch

## **FWA Pressure**

Flow-weighted average pressure during the batch (based on “indicated volume flow weighting”)

## **FWA Temperature**

Flow-weighted average temperature during the batch (based on “indicated volume flow weighting”)

## **FWA Corrected Density**

Flow-weighted average corrected density during the batch (based on “indicated volume flow weighting”)

## **Flow Seconds**

Number of seconds of flow exceeding the no-flow cutoff from the batch

## **Duration Seconds**

Elapsed time in seconds of the batch

## **Batch ID**

The library-assigned batch number for the batch

## **Start Pulses**

Raw pulse count at the beginning of the batch

## **End Pulses**

Raw pulse count at the end of the batch

## **Daily Batches Screen**

The Daily Batches screen displays data from the currently day batch and the prior day batch.

Daily Batches

	Today	Yesterday
Start	1970-01-01 00:00:00	1970-01-01 00:00:00
Close	2021-05-27 15:13:56	1970-01-01 00:00:00
Indicated Volume	1224.60	0.00
Gross Volume	1224.60	0.00
Net Volume	1204.47	0.00
S&W Volume	2.78	0.00
FWA Pressure	11.64	0.00
FWA Temperature	88.30	0.00
FWA Corrected Density	42.30	0.00
Flow Seconds	7412	0
Duration Seconds	7969	0
Batch ID	0	0
Start Pulses	0.00	0.00
End Pulses	3523905.00	0.00

*BeyondHMI*

*Daily Batches Screen*

*The data elements displayed on this screen are just a small subset of the values collected during the batch*

**Today**

Values in this column represent the current day's batch.

**Yesterday**

Values in this column represent the prior day's batch.

**Start**

Timestamp when the batch started.

**Close**

Timestamp when the batch was closed or stopped.

**Indicated Volume**

Accumulated indicated volume for the batch

**Gross Volume**

Accumulated gross volume for the batch

## **Net Volume**

Accumulated net standard volume for the batch

## **S&W Volume**

Accumulated volume of BS&W for the batch

## **FWA Pressure**

Flow-weighted average pressure during the batch (based on “indicated volume flow weighting”)

## **FWA Temperature**

Flow-weighted average temperature during the batch (based on “indicated volume flow weighting”)

## **FWA Corrected Density**

Flow-weighted average corrected density during the batch (based on “indicated volume flow weighting”)

## **Flow Seconds**

Number of seconds of flow exceeding the no-flow cutoff from the batch

## **Duration Seconds**

Elapsed time in seconds of the batch

## **Batch ID**

The library-assigned batch number for the batch

## **Start Pulses**

Raw pulse count at the beginning of the batch

## **End Pulses**

Raw pulse count at the end of the batch

## **Monthly Batches Screen**

The Monthly Batches screen displays data from the currently and prior months.

Monthly Batches

	This Month	Last Month
Start	1970-01-01 00:00:00	1970-01-01 00:00:00
Close	2021-05-27 15:17:23	1970-01-01 00:00:00
Indicated Volume	1256.48	0.00
Gross Volume	1256.48	0.00
Net Volume	1235.82	0.00
S&W Volume	2.85	0.00
FWA Pressure	12.17	0.00
FWA Temperature	88.30	0.00
FWA Corrected Density	42.30	0.00
Flow Seconds	7619	0
Duration Seconds	8176	0
Batch ID	0	0
Start Pulses	0.00	0.00
End Pulses	3842685.00	0.00

*BeyondHMI*

*Monthly Batches Screen*

*The data elements displayed on this screen are just a small subset of the values collected during the batch*

**This Month**

Values in this column represent the current month's batch.

**Last Month**

Values in this column represent the prior month's batch.

**Start**

Timestamp when the batch started.

**Close**

Timestamp when the batch was closed or stopped.

**Indicated Volume**

Accumulated indicated volume for the batch

**Gross Volume**



Accumulated gross volume for the batch

## **Net Volume**

Accumulated net standard volume for the batch

## **S&W Volume**

Accumulated volume of BS&W for the batch

## **FWA Pressure**

Flow-weighted average pressure during the batch (based on “indicated volume flow weighting”)

## **FWA Temperature**

Flow-weighted average temperature during the batch (based on “indicated volume flow weighting”)

## **FWA Corrected Density**

Flow-weighted average corrected density during the batch (based on “indicated volume flow weighting”)

## **Flow Seconds**

Number of seconds of flow exceeding the no-flow cutoff from the batch

## **Duration Seconds**

Elapsed time in seconds of the batch

## **Batch ID**

The library-assigned batch number for the batch

## **Start Pulses**

Raw pulse count at the beginning of the batch

## **End Pulses**

Raw pulse count at the end of the batch

## Event Screen

The event screen can be used to review API 21.1 events for an oil or gas meter.

Meter Events

Show Most Recent Events

Index of First Event to Display 252
                         
 Index of Next Event that program will Populate 6

Event Index	Timestamp	Table	Item	Old Value	New Value
252	N/A	0	0	N/A	N/A
253	N/A	0	0	N/A	N/A
254	N/A	0	0	N/A	N/A
255	N/A	0	0	N/A	N/A
0	05/27/2021 13:00:14	0	49	0.0	1.0
1	05/27/2021 13:00:14	0	48	0.0	1.0
2	05/27/2021 13:00:14	0	31	0.0	1.00000001
3	05/27/2021 13:00:14	1	62	0.0	1.0
4	05/27/2021 13:00:14	1	62	0.0	1.0
5	05/27/2021 13:00:43	0	48	1.0	10000.0

*BeyondHMI*

### *Events Screen*

The library maintains a circular buffer 256 events for each meter. The first event is stored at event index zero. Subsequent events are stored at indices with increasing numbers. When event 255 has been populated and another event needs to be logged, event index zero is overwritten.

For long term data retention, events are copied to the .cfx files each time a .cfx file is created. This file creation occurs at least once per day (after contract day change), or when a major configuration change is made to the meter or its station.

The event screen can be used to view portions of the event log for a meter. Ten events are displayed at one time. The user can navigate through the entire 256 event log using this screen – viewing 10 events at one time. The user can change position in the event log by changing the **Index of First Event to Display** parameter on the screen. In the example above, the **Index of First Event to Display** parameter is set to zero. As a result, events zero through 9 are displayed. If the **Index of First Event to Display** parameter were changed to 55, for example, the screen would refresh – showing events 55 through 64.

The logic behind this screen can handle “rollover”. For example, if the **Index of First Event to Display** parameter were changed to 250, the screen would refresh and events 250 through 255 followed by events zero through 3 would be displayed.

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If you wish to view the 10 most recent events, check the **Show Most Recent Events** check box and the screen will refresh – displaying the 10 most recent events (the single most recent event will be at the bottom of the list).

The **Index of Next Event that program will Populate** parameter reveals the current position of the Event logic – within the circular buffer.

## **Show Most Recent Events check box**

Check this box to force the screen to refresh – showing the most recent events in the log.

## **Index of First Event to Display**

Enter a number in this box (0 through 255) to cause the screen to update – showing events at a specific location within the circular buffer. The refreshed list will start with the event number you enter.

## **Index of Next Event that program will Populate**

This read-only field displays the position where the next event will be logged.

## **Event Index**

Displays the event index number (0-255).

## **Timestamp**

Displays the local timestamp at which the event was recorded.

## **Table and Item**

The combination of Table and Item represent a specific parameter. This combination indicates which parameter was changed. The Table/Item combinations are defined by Quorum Software and are part of the CFX file specification. This specification is subject to a Nondisclosure Agreement. Therefore, it cannot be reproduced here. For more information, contact Quorum Software.

## **Old Value and New Value**

These represent the *Before* and *After* values of the parameter which was changed.

## Alarms Screen

The alarms screen can be used to review API 21.1 alarms for a meter.

Meter Alarms

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Show Most Recent Alarms

Index of First Alarm to Display 2      Index of Next Alarm that program will Populate 12

Alarm Index	Timestamp	AlarmCode	New State	Value
2	05/27/2021 13:00:53	Tempr	High	88.3
3	05/27/2021 13:00:57	Low Flow	Off	266.112
4	05/27/2021 13:25:03	Low Flow	On	0.0
5	05/27/2021 13:33:38	Static Prs	High	2.89E-42
6	05/27/2021 13:33:38	Tempr	High	88.3
7	05/27/2021 13:33:43	Low Flow	Off	2993.76
8	05/27/2021 14:35:18	Low Flow	On	0.0
9	05/27/2021 14:35:45	Static Prs	High	32.7
10	05/27/2021 14:35:45	Tempr	High	88.3
11	05/27/2021 14:35:57	Low Flow	Off	10977.119

*BeyondHMI*

### *Alarms Screen*

The library maintains a circular buffer 64 alarms for each meter. The first alarm is stored at alarm index zero. Subsequent alarms are stored at indices with increasing numbers. When event 63 has been populated and another alarm needs to be logged, alarm index zero is overwritten.

For long term data retention, alarms are copied to the .cfx files each time a .cfx file is created. This file creation occurs at least once per day (after contract day change), or when a major configuration change is made to the meter or its station.

The alarm screen can be used to view portions of the alarm log for a meter. Ten alarms are displayed at one time. The user can navigate through the entire 64 alarm log using this screen – viewing 10 alarms at one time. The user can change position in the alarm log by changing the **Index of First Alarm to Display** parameter on the screen. In the example above, the **Index of First Alarm to Display** parameter is set to zero. As a result, alarms zero through 9 are displayed. If the **Index of First Alarm to Display** parameter were changed to 25, for example, the screen would refresh – showing alarms 25 through 34.

The logic behind this screen can handle “rollover”. For example, if the **Index of First Alarm to Display** parameter were changed to 60, the screen would refresh and alarms 60 through 63 followed by alarms zero through 5 would be displayed.

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If you wish to view the 10 most recent alarms, check the **Show Most Recent Alarms** check box and the screen will refresh – displaying the 10 most recent alarms (the single most recent alarm will be at the bottom of the list).

The **Index of Next Alarm that program will Populate** parameter reveals the current position of the Alarm logic – within the circular buffer.

## **Show Most Recent Alarm check box**

Check this box to force the screen to refresh – showing the most recent alarms in the log.

## **Index of First Alarm to Display**

Enter a number in this box (0 through 63) to cause the screen to update – showing alarms at a specific location within the circular buffer. The refreshed list will start with the alarm number you enter.

## **Index of Next Alarm that program will Populate**

This read-only field displays the position where the next alarm will be logged.

## **Alarm Index**

Displays the alarm index number (0-63).

## **Timestamp**

Displays the local timestamp at which the alarm was set or cleared.

## **Alarm Code**

Indicates which alarm is involved:

- Diff Prs
- Static Prs
- Tempr
- Low Flow
- Back Flow
- Low Btry

## **New State**

Indicates the state change which triggered the alarm:

- Off
- On
- High
- Low

## **Value**

Indicates the value of the relevant parameter at the time of the state change.

## Batch Description Screen

The library provides 24 text fields which can be used-as needed in recording ad hoc batch information:

- 16 each “short text” attributes of 15 characters or less
- 8 each “long text” attributes of 31 characters or less

As mentioned, these fields can be used for any purpose that is useful to the host-program’s needs. For instance, one of the “long text” fields could be used to record the truck river’s name along with a batch.

The Batch Description Screen allows entry of any or all of these text values for the “relevant” batch. The fields on this screen can be edited while the batch is active, or after it has been stopped – but before the batch has been finalized. Once the batch is finalized, the values in these fields are permanently saved with the batch and these data-entry field are cleared.

Note that some of these fields are the same fields which can be edited on the Oil Meter-Cal Rpt Params screen and on the Ad hoc Batches screen.

The screenshot displays the 'Batch Descriptive Information' screen. It features a grid of text input fields. On the left side, there are fields for 'Producer', 'Purchaser', 'Lease', 'Well/Facility Number', and 11 'Short String Label' fields (0-10). On the right side, there are fields for 'Alt S&W' (value 0.00 [%]), 'Alt Density' (value 0.00 [API]), 'Density Tempr' (value 0.00 [F]), 5 'Short String Label' fields (11-15), 'Truck Driver Name', and 7 'Long String Label' fields (1-7). A 'Back' button is located in the top right corner. The BeyondHMI logo is visible in the bottom right corner of the screenshot.

### *Batch Description Screen*

*The LACT library’s authorization file features permit designation of default values to be pre-populated in these text fields – based on the log-in user. For more information about authorization file features, please see the user manual for Beyond HMI’s (free) BLTool (“BLT”) Windows program.*

## Retrieve a Batch Screen

The Retrieve a Batch screen provides a means of viewing historical ad hoc batches

The screenshot shows the 'Retrieved Adhoc Batch' screen. At the top, there is a 'Batch to Retrieve' field with the value '0' and a 'Result' field with the value 'Success'. A 'Back' button is located in the top right corner. The screen is divided into three main sections: Producer/Purchaser/Lease/Well/Facility/Number, Start/Close/Indicated Volume/Gross Volume/Net Volume/S&W Volume/FWA Pressure/FWA Temperature/FWA Corrected Density/Flow Seconds/Duration Seconds/Batch ID/Start Pulses/End Pulses, and Long String Labels (0-7). There are also fields for Alt S&W, Alt Density, and Density Tempr. The 'BeyondHMI' logo is in the bottom right corner.

### Retrieve a Batch Screen

*Note: For a batch to be retrieved, it must be stored on the PLC. Depending upon data retention configuration, batches will eventually get deleted from the PLC to avoid overfilling the file system*

#### Batch to Retrieve

The value in this text box is typically zero. To retrieve a batch from the historical database, enter the Batch ID of the batch you wish to retrieve. The library will attempt to load the batch and will then reset the value in this box to zero.

#### Result

This box displays the result of the last retrieval operation.

## Alternate Totalizers Screen

The Alternate Totalizers screen provides a means of configuring and viewing alternate totalizers. There are 12 alternate totalizers. They are indexed from [0] to [11].

Alternate Totalizers

0 - Alt Totalizer 0 Alt Totalizer 0  Enabled Back

	Indicated Quantity	Indicated Vol [BBL]	Gross Vol [BBL]	GrossStd Vol [BBL]	Net Std Vol [BBL]	S&W Vol [BBL]	Gross Mass [lbm]
Current Hour	321.90	321.90	321.90	317.37	316.64	0.73	91768.74
Last Hour	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Today	321.9	321.9	321.9	317.4	316.6	0.7	91768.7
Yesterday	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current Month	322	322	322	317	317	1	91769
Previous Month	0	0	0	0	0	0	0
Total	322	322	322	317	317	1	91769

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*Alternate Totalizers Screen*

**Drop-down box**

The dropdown box allows you to select which totalizer you want to configure or view.

**Totalizer Description Edit box**

You can provide a meaningful description for each totalizer. The descriptions are defaulted, but the default descriptions can be overwritten by typing into this control.

**Enabled Check box**

This check box displays the enabled/disabled status of the totalizer – indicating whether the totalizer is currently set to accumulate flow. This check box is editable.

**Indicated Quantity**

Values in this column represent the raw meter values. These will be in either barrels or pounds – depending upon whether the meter is providing raw input related to volume or density.

**Indicated Volume**

Values in this column represent raw meter values – in volume units. If the meter is reporting in volume units, these numbers will be identical to those in the indicated quantity column. The screen displays the relevant units of measure.

**Gross Volume**



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Values in this column represent the indicated volume adjusted for meter factor. The screen displays the relevant units of measure.

## **Gross Standard Volume**

Values in this column represent the gross volume – corrected for temperature and pressure. The screen displays the relevant units of measure.

## **Net Standard Volume**

Values in this column represent the gross standard volume, minus the amount of S&W. The screen displays the relevant units of measure.

## **S&W Volume**

Values in this column represent the amount of S&W for the meter. The screen displays the relevant units of measure.

## **Gross Mass**

Values in this column represent the gross mass measured through the meter. The screen displays the relevant units of measure.

## **Current Hour**

Values in this row represent the accumulated quantity for the current hour for the specific totalizer. An hourly period is initiated when the PLC clock indicates a change of hour. The screen displays the relevant units of measure.

## **Last Hour**

Values in this row represent the accumulated quantity for the previous hour for the specific totalizer. An hourly period is initiated when the PLC clock indicates a change of hour. The screen displays the relevant units of measure.

## **Today**

Values in this row represent the accumulated quantity for the current contract day for the specific totalizer. The hour at which the contract day changes is configurable – by station. The contract day changes at the *beginning* of the configured hour. The screen displays the relevant units of measure.

## **Yesterday**

Values in this row represent the accumulated quantity for the previous contract day for the specific totalizer. The hour at which the contract day changes is configurable – by station. The contract day changes at the *beginning* of the configured hour. The screen displays the relevant units of measure.

## **Current Month**

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Values in this row represent the accumulated quantity for the current contract month for the specific totalizer. The contract month changes on the first day of each calendar month - at the *beginning* of the configured contract hour. The screen displays the relevant units of measure.

## Previous Month

Values in this row represent the accumulated quantity for the previous contract month for the specific totalizer. The contract month changes on the first day of each calendar month - at the *beginning* of the configured contract hour. The screen displays the relevant units of measure.

## Total

Values in this row represent the accumulated quantity for the specific totalizer for the lifetime of the flow computer installation. This value is not resettable by supported features. The screen displays the relevant units of measure.

## Admin Screen

The admin screen exposes a number of administrative features. It also provides links to the screens where library configurations can be saved to file and/or loaded from file.

The screenshot displays the 'Flow Computer Admin Functions' interface. It features a 'Back' button in the top right corner. The main content is organized into three sections, each with a blue header bar:

- Licensing:** Shows 'Site Code' as 'HOFR0DHGF7CLOVFS5HGB7C1HOFR0DHG' and 'License Check Result' as a green circle. Below this is a file path: '/home/user/HOFR0DHGF7CLOVFS5HGB7C1HOFR0DHG\_lactLicense.bhil'.
- Status/Diagnostic:** Shows 'FSS' as '5' and 'User Access Level' as '5'.
- Daily Batch Report Email:** Contains several fields: 'Sender email' (yoursender@gmail.com), 'Sender Name' (Sender Name), 'Sender Password' (sender password), 'Server' (smtp.gmail.com), 'Port' (587), 'Unit Description' (Unit descriptio), 'Recipient email' (first recipient), and 'cc email' (second recipient).

At the bottom, there are two buttons: 'Edit Text Labels' and 'Advanced'. The 'BeyondHMI' logo is visible in the bottom right corner of the interface.

### Admin Screen

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*Note: The BhiLibLACT library utilizes runtime licensing. It must be licensed on every PLC where it runs. Licenses are obtained from beyond HMI, Inc.*

The library reads parameters from the PLC which are unique to each PLC specimen. From these parameters, the library generates a Site Code. This represents a unique identifier for the PLC. The license key is unique to the PLC processor. It is not influenced by installed I/O modules or firmware version.

## **Site Code**

A unique identifier for the PLC specimen. Use this to request a runtime license.

## **License Check Result**

If this indicator is green, then a valid license has been detected. If not green, then the program is either running in *trial* mode or is disabled – awaiting a license.

For more information about runtime licensing of the BhiLibLACT library, see the *Licensing* section of this document.

## **FSS**

This text box displays a code which is relevant to Beyond HMI in the event that troubleshooting is needed. Under normal circumstances, this value should start at zero and increment to a number less than 20, then reset. Because it changes very quickly, you may not see all intervening values.

## **User Access Level**

This text box displays the access level of the currently logged-in user. This value is related to the user authentication features of the library – which have no other HMI components.

## **Daily Batch Report Email Settings**

The settings in this section apply to emailing of the daily batch summary report (.csv) file. If you do not wish to use this emailing feature, leave these settings blank.

### **Sender email**

Enter the email account to be used by the PLC for sending email.

### **Sender Name**

This text will appear in the “from” area of the email.

### **Sender Password**

Enter the password for the sending email account.

### **Server**

Enter the URL for the host email service to which the email should be sent.

## **Port**

Enter the port number to use when sending to the server.

## **Unit Description**

Enter text identifying this LACT unit. This text will be used in the email header and in the .csv attachment file name.

## **Recipient email**

Enter the primary recipient email address.

## **cc email**

Enter the secondary recipient email address.

## **Notes about the Email Feature**

The email feature was tested with a Gmail account as the sender. The Gmail account must be configured in the following way:

- The password you enter must be a Google “App Password”. If the account is configured with multi-factor authentication, you will have the option of enabling and generating app passwords in your account administration section of your google account.
- The account must be configured to allow POP for all emails

Also, sending via Gmail was successful when:

- The email server was configured to be ‘smtp.gmail.com’
- The port was set to 587

## **Buttons**

### **Edit Text Labels button**

Invokes the display which is used to edit the user-defined text fields in the library.

### **Advanced button**

Invokes the advanced Administration display.

## **User String Labels Screen**

The library provides 24 text fields which can be used-as needed in recording ad hoc batch information:

- 16 each “short text” attributes of 15 characters or less
- 8 each “long text” attributes of 31 characters or less

As mentioned, these fields can be used for any purpose that is useful to the host-program’s needs. For instance, one of the “long text” fields could be used to record the truck river’s name along with a batch.

The User String Labels screen allows an administrator to assign a label/description to each of these 24 text fields. Note that the text fields have default values but you can change these labels/descriptions at will.

**Tip: by default, all 24 of the user text fields and their associated labels (the labels you can modify on this screen) will print on the default .pdf report which is generated by the BHI Lib Tool (BLT). If you are not using all of these fields and prefer to have some of them omitted from the default .pdf report, use the exact text 'NULL' (four characters, all caps, no quotation marks) in the label description on the User Text Labels screen.**



*User String Labels Screen*

## Advanced Admin Screen

The Advanced Admin screen exposes functions for PLC program maintenance. Please use caution when using the functions on this screen.

DO NOT USE THESE FUNCTIONS UNLESS YOU HAVE FAMILIARIZED YOURSELF WITH THE CONSEQUENCES

Save Maintenance File

Restore Configuration

Restore Accums, Events, Alarms

Restore Batches

Force Maintenance Recovery

### *Advanced Admin Screen*

When the Host PLC program needs to be changed, there is potential for loss of accumulator data that the Flow computer library uses. To prevent this loss, a special sequence of events must be followed when changing the host PLC program. The procedure is as follows:

*Note: The following steps must be executed in order. Please read and study the entire procedure list before beginning PLC program maintenance.*

### **Procedure for modifying the host PLC program after commissioning**

#### **Stop physical flow**

In order to prevent loss of accumulated flow, all processes for all meters must be shut-in to prevent flow while the PLC program is being maintained.

Failure to follow this step may result in lost flow accumulation.

#### **Save a maintenance file**

Check the **Save Maintenance File** checkbox on the Advanced Admin screen. Wait for the checkbox to be unchecked. This indicates that a maintenance file has been saved to the PLC file system.

#### **Perform PLC program maintenance**

At this point, you are free to make changes to the PLC program and load those changes onto the PLC.

#### **Force Maintenance Recovery**

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*Note: You can record some or all of the PLC attributes using the check-boxes described below.*

Check the **Force Maintenance Recovery** checkbox on the Advanced Admin screen. Wait for the checkbox to be unchecked. This indicates that meter accumulators have been recovered from the maintenance file.

## **Resume physical flow**

At this point, process flow can be resumed without loss of accumulated volume.

## **Selectively restoring attributes**

Before the **Force Maintenance Recover** checkbox can be checked, one or more of the following check boxes must be checked to indicate the combination of parameters you want to recover

### **Restore Configuration**

Restores meter configuration parameters.

### **Restore Accums, Events, Alarms**

Restores flow accumulations as well as API 21.1 events and alarms

### **Restore Batches**

Restores active and prior ad hoc batches as well as both daily batches and both monthly batches.

## Licensing

The BhiLibLACT library utilizes runtime licensing. Each PLC upon which it runs must have a license. Licenses are obtained from Beyond HMI, Inc.

### Trial Mode

Upon startup, the library will run in trial mode for approximately 4 days. While in trial mode, the library is fully functional. After the 4 day period passes – and if no license is installed - the library will stop calculating flow.

If the PLC program is stopped and restarted, the 4 day trial period begins again. Therefore, PLC program developers should be able to develop and test programs without needing a license for their development PLCs.

### Steps to Obtain a Runtime License

To fully license the BhiLibLACT library on a PLC, the following steps must be executed:

- Include library features in a PLC program (*reference other instructions in the LACT\_DG\_yyyy\_mm\_dd document available from Beyond HMI*)
- Install the PLC program on the target PLC specimen
- Open the library's Admin screen and capture the Site Code
- Transmit the site code to Beyond HMI, Inc. and provide payment information
  - Please use [info@beyond-hmi.com](mailto:info@beyond-hmi.com) to initiate contact with us.
- Wait for Beyond HMI, Inc. to return a license file
- Use the free BLT software to log into the PLC as 'root' and install the license file on the PLC
- Open the library's Admin screen and confirm that the license check result is green

Licenses are perpetual. No maintenance fee is required. Licenses are keyed to a site code and are not portable between PLCs. Please contact Beyond HMI if you need to move a license to another PLC.



## Collecting CFX Files from the PLC

The CFX files generated by the BhiLibLACT library are saved into meter-specific directories underneath the PLC's /home/user/ directory. Each meter is given its own directory. The name of the directory is taken from the **Meter Serial Number** parameter for that meter.

For example, if two meters are configured at a certain PLC installation and one meter is given **Meter Serial Number** 'METER\_1' and the other is given **Meter Serial Number** 'METER\_2', then the following directories will be created:

- /home/user/METER\_1
- /home/user/METER\_2

And the CFX files for each meter will be stored within their respective directories.

The CFX files in these directories will be named using format YYYYMMDDQQ.CFX

Where:

- YYYYMMDD is the year, month, and day of the *gas/oil day* for which the data applies.
- QQ is a sequence number generated by the program/library – beginning with 00.

Any person or local/remote process with the password for the 'user' profile on the PLC should be able to read/copy CFX files from these sub-directories to another computer.

The free BLT software can be used to transfer files from the PLC to your PC.

For a WINDOWS-like interface to the PLC directory system, products like WinSCP can be easily configured to use Secure FTP to interact with the PLC file system. The PLC must be configured to support whichever file transfer protocol you intend to permit field measurement technicians to use.

### Deleting CFX Files From the PLC

There should be no reason to manually delete CFX files from the PLC directories. Files can be copied from the PLC file system to another computer but should not be 'cut' or deleted from the PLC directories. Normally, only a user with access to the 'root' profile would have the ability to delete these files.

The library contains logic to prune the files in the meter subdirectories. By setting the **Max Data Retention** parameter for the meter, you can control this pruning. In order to enforce API 21.1 standards, the **Max Data Retention** parameter cannot be set below 35 days. If you set the parameter to a lower value, it will be overridden later. Data pruning typically occurs once per day – at about 8 minutes after the contract hour.

## FAQ

### Will the library calculate and accumulate flow in the reverse direction for oil meters?

No. The library will calculate flow rate and accumulate volume as long as the indicated quantity flow rate is greater than or equal to the **Low Flow Cutoff Setpoint**. When the indicated quantity falls below this rate, the library will continue to accumulate volume and mass – if the meter input is in volume or mass accumulation. If accumulated quantity decreases, the library assumes that the meter has rolled over.

### How can I prevent counting *phantom* volume that accumulates on an oil meter when flow is stopped?

Coriolis meters can produce “pulses” or accumulated volume – even when blocked-in. This results in *phantom* flow and accumulation which is not indicative of real flow.

Your meter manufacturer’s technical staff can provide procedures for “zeroing” the meter. Additionally, the meter or meter transmitter may have a “low flow cutoff” feature which causes the meter to report zero flow rate and no accumulation during times when flow is not present.

If you desire additional protection from *phantom* flow readings, configure the low flow cutoff setpoint for the meter within the Beyond HMI library. This feature inhibits accumulation of flow when either the actual flow rate - for meters that provide a rate to the library - or the pseudo-rate (differentiated from ten-second change in meter accumulation) – for meters that provide an accumulation to the library – fall below the specified setpoint.

### The User manual says that if I set the *Max Data Retention* days to a value of less than 35, the library will change it to 35. But I don’t see that happening. Why Not?

The data retention logic only runs once per calendar day. Before checking to see whether CFX files need to be deleted from the archive, the library validates the **Max Data Retention** days. This validation logic will change the **Max Data Retention** days – if necessary, but this process only occurs once per calendar day.