BeyondHMI

Tank Supervisor Library

Overview

The Beyond HMI Tank Supervisor Library (BhiLibTank) for Wago e!COCKPIT provides a number of common functions inherent to oilfield stock tank monitoring and control.

Features including:

- Calculating oil and water heights and volumes
- Incorporation of tank strapping tables
- Filtering of tank gauger inputs to reduce impact of spurious gauger readings
- Automatic detection of withdrawals from tanks (loadouts)
- Simple pump controller blocks to control product transfer to a pipeline

The BhiLibTank 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.
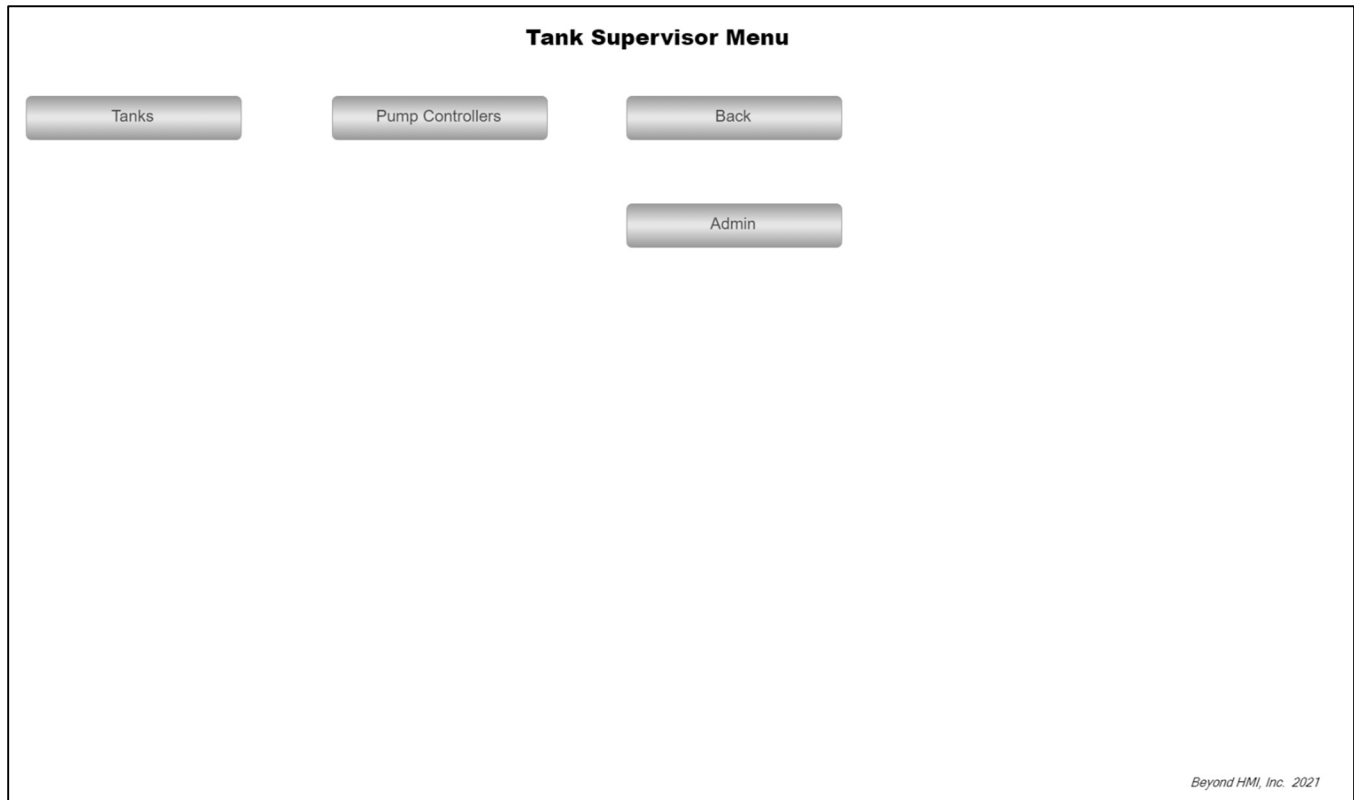
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Contents

Configuring the Library

Configuration is usually performed via Codesys Visualizations included in the library. Your program's Visualizations must provide a link to the Tank Supervisor Menu screen (see Developer Guide for further details).

Main Menu

The main menu provides navigation to all of the features of the library.

Visualization Main Menu

Tanks

Calls the visualization for status and configuration of tanks

Pump Controllers

Calls the visualization for status and configuration of pump controllers

Back

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

Admin

Calls the visualization for viewing administrative and license status information

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Tanks Screen

The tank screen displays both configuration and status information for each tank.

Tanks Screen

Tank Combo Box

This combo box is used to specify which tank you wish to view.

Tank Text Box

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

Enabled

Use this check box to enable/disable the tank.

Primary Liquid Combo Box

This combo box is used to specify whether the tank is an oil or water tank.

Tank Height Box

This text box is used to specify the total height of the tank. Tank gauger readings above this value will be ignored.

Tank Has Interface Measurement

If the tank has both "top" and "interface" gaugers, check this box. Otherwise, leave this box unchecked.

Number of Instances Box

In most cases this box will contain one (1). However, if multiple tanks are of similar geometry, are equalized, and share a common gauger, they can be treated as a single "tank" by specifying the tank count here.

Barrels per Foot Box

Use this box to specify the linear factor for converting tank heights to volumes. This number is only used if no tank strapping table is selected.

Strapping Table Combo Box

This combo box lists all of the tank strapping files that are properly installed on the PLC. Select which strapping table you wish to use for the tank. If you wish to simply use a **Barrels per Foot** factor, select "No Table".

See the BLT software user manual for details about how to load strapping tables onto the PLC.

Filter Interval Box

This box controls the timing of the tank gauger input filter. It should be set to the time period for updates from the tank gauger(s). For instance, if the tank gauger is wired to the PLC, specify 1-second filtering. If the tank gauger is wireless and only updates every 15 seconds, specify 15-second filtering.

Top [ft] Box

Displays the "top" raw gauger reading that has been passed to the library for this tank.

Interface [ft] Box

Displays the "interface" raw gauger reading that has been passed to the library for this tank.

Oil [ft] Box

Displays the calculated height of oil in the tank. This value is calculated using the filtered "top" and filtered "interface" values.

Water [ft] Box

Displays the calculated height of water in the tank. This value is calculated using the filtered "top" and filtered "interface" values.

Oil [BBL] Box

Displays the calculated volume of oil in the tank. This value is calculated using the filtered values.

Water [BBL] Box

Displays the calculated volume of water in the tank. This value is calculated using the filtered values.

Top "As 1/4ths of an Inch" Box

These boxes display the filtered top level – converted to feet, inches, and 1/4ths of an inch. The decimal values are rounded to the nearest 1/4th of an inch.

Interface "As 1/4ths of an Inch" Box

These boxes display the filtered interface level – converted to feet, inches, and 1/4ths of an inch. The decimal values are rounded to the nearest 1/4th of an inch.

Oil "As 1/4ths of an Inch" Box

These boxes display the filtered oil height – converted to feet, inches, and 1/4ths of an inch. The decimal values are rounded to the nearest 1/4th of an inch.

Water "As 1/4ths of an Inch" Box

These boxes display the filtered water height – converted to feet, inches, and 1/4ths of an inch. The decimal values are rounded to the nearest 1/4th of an inch.

Top "As 1/8ths of an Inch" Box

These boxes display the filtered top level – converted to feet, inches, and 1/8ths of an inch. The decimal values are rounded to the nearest 1/8th of an inch.

Interface "As 1/8ths of an Inch" Box

These boxes display the filtered interface level – converted to feet, inches, and 1/8ths of an inch. The decimal values are rounded to the nearest 1/8th of an inch.

Oil "As 1/8ths of an Inch" Box

These boxes display the filtered oil height – converted to feet, inches, and 1/8ths of an inch. The decimal values are rounded to the nearest 1/8th of an inch.

Water "As 1/8ths of an Inch" Box

These boxes display the filtered water height – converted to feet, inches, and 1/8ths of an inch. The decimal values are rounded to the nearest 1/8th of an inch.

Loadout [BBL] Today

This box displays the accumulated quantity of loadouts detected since gauge-off. For this total, each loadout is rounded to the nearest even BBL and those rounded values are accumulated. This field is only updated if **Automatic Loadout Detection** is enabled.

Loadout [BBL] Yesterday

This box displays the accumulated quantity of loadouts detected during the prior production day - as determined by gauge-off hour. This value is populated with a copy of the **Loadout [BBL] Today** value at gauge-off. This field is only updated if **Automatic Loadout Detection** is enabled.

Loadout [BBL] Month

This box displays the accumulated quantity of loadouts detected during the current production month - as determined by gauge-off hour. For this total, each loadout is rounded to the nearest even BBL and those rounded values are accumulated. This field is only updated if **Automatic Loadout Detection** is enabled.

Loadout [BBL] Previous Month

This box displays the accumulated quantity of loadouts detected during the prior production month - as determined by gauge-off hour. This value is populated with a copy of the **Loadout [BBL] Month** value at gauge-off on the first day of the month. This field is only updated if **Automatic Loadout Detection** is enabled.

Automatic Loadout Detection Group

Enabled Checkbox

Check this box to enable automatic loadout detection for this tank.

Filter Interval

This value should be set to about twice the tank's **Filter Interval** value – or larger.

Minimum Loadout Rate

Specify the minimum volume flow rate to trigger a loadout. This factor helps control the influence of "noise" on the loadout detection. If the library is detecting false loadouts, increase this value.

Minimum Loadout Rate

Specify the minimum volume quantity to trigger a loadout. This factor helps control the influence of "shrinkage" and temperature fluctuation on the loadout detection. If the library is detecting false loadouts, you might need to increase this value.

Active Loadout Start

If a loadout is in progress, this field will be visible and will contain the timestamp of when the loadout started.

Active Loadout Barrels

If a loadout is in progress, this field will be visible and will contain the current count of number of barrels loaded.

Previous Loadout Start

When a loadout ends, information from **Active Loadout Start** is moved to this field. Also note that on loadout completion, a loadout record is saved within the PLC. Even though the ability to view loadouts on this screen is limited to the most recently completed loadout, the historical record is maintained and this data is accessible with Beyond HMI's BLT software.

Previous Loadout End

When a loadout ends, the ending timestamp is displayed in this field. Also note that on loadout completion, a loadout record is saved within the PLC. Even though the ability to view loadouts on this screen is limited to the most recently completed loadout, the historical record is maintained and this data is accessible with Beyond HMI's BLT software.

Previous Loadout Barrels

When a loadout ends, information from **Active Loadout barrels** is moved to this field. Also note that on loadout completion, a loadout record is saved within the PLC. Even though the ability to view loadouts on this screen is limited to the most recently completed loadout, the historical record is maintained and this data is accessible with Beyond HMI's BLT software.

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Pump Controllers Screen

The pump controllers screen displays both configuration and status information for each pump controller.

Pump Controllers Screen

Controller Combo Box

This combo box is used to specify which pump Controller instance you wish to view.

Controller Text Box

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

Enabled

Use this check box to enable/disable the pump controller.

Source Tank Combo Box

In this combo box, select the tank which will provide level information for making decisions about operating the pump in automatic control mode.

Pump On High Level Text Box

In this text box, specify the level at which the pump should be latched on.

Pump Off Low Level Text Box

In this text box, specify the level at which the pump should be stopped.

Filtered Top Level

This text box displays the current filtered top level of the specified tank (the level used in the pump control logic).

HOA Hand State

This checkbox indicates whether the HOA "Hand" signal (as passed to the library by the host program) is active.

HOA Auto State

This checkbox indicates whether the HOA "Auto" signal (as passed to the library by the host program) is active.

Permissive State

This checkbox indicates whether the "Permissive" signal (as passed to the library by the host program) is active.

Commanded Output State

This checkbox indicates the state of the controller logic.

Admin Screen

The admin screen exposes global parameters/functions and features related to runtime licensing of the BhiLibTank library.

Tank Supervisor Admin Functions

Back

☐ Update Tank Strapping Tables

Gauge-off Hour   Midnight ▾

Data Retention Days   7

Advanced

Site Code   HOFR0DHGF7CLLOVFS5HGB7C1HOFR0DHG

License Check Result 🟢

FSS   3

Strapping Table Load Status   More Strapping Tables than Allocated Memory

/home/user/HOFR0DHGF7CLLOVFS5HGB7C1HOFR0DHG_tankLicense.bhil

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Admin Screen

Update Tank Strapping Tables Check Box

Checking this box forces the library to reload the strapping tables from installed files. This process is automatically performed when the host program (and library) start-up on the PLC.

Note: If you load a new strapping table with the BLT software, you need to go to this screen and request an update of the tank strapping tables.

Gauge-off Hour Combo Box

Use this Combo box to specify the global gauge-off hour for the PLC. The tank data will be gauged off at the *beginning* of this hour.

Data Retention Days

Use this box to specify the number of days for which loadout data is retained. This value applies to all tanks. The library includes a data retention feature which deletes files after the specified number of days to prevent cluttering the file system. Values as low as 1 can be specified. The default value is 7 days.

Strapping Table Load Status

This box displays the result of the last strapping table load operation. If this field contains any message other than "Success", then some remediation is required. Contact beyond HMI for more assistance.

Note: The BhiLibTank 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 BhiLibTank library, see the *Licensing* section of this document.

Advanced Admin Screen

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

Tank Supervisor Advanced Admin Functions

Back

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

☐ Save Maintenance File

☐ Clear Tank Loadout Accums

☐ Force Maintenance Recovery

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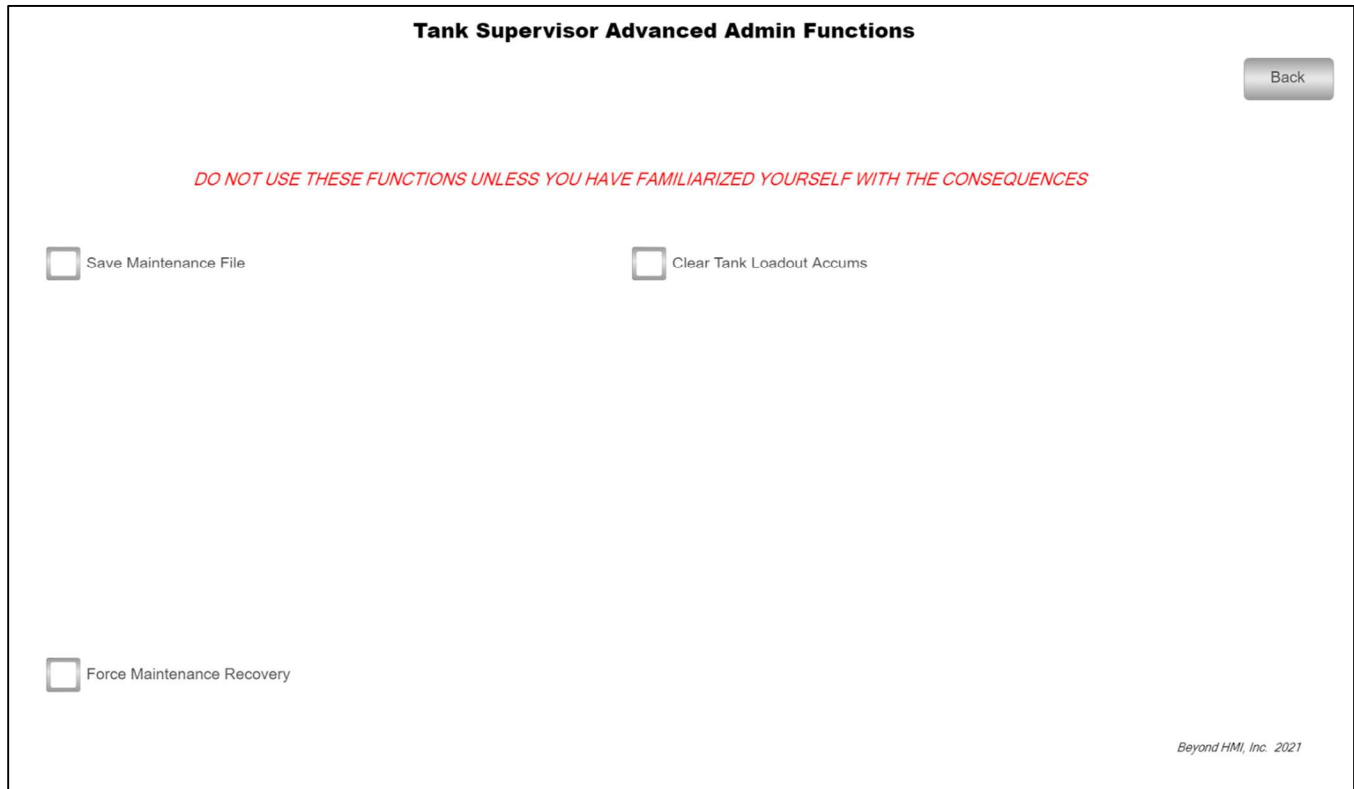
Advanced Admin Screen

Clear Tank Loadout Accums Checkbox

If you check this box, the controller will reset the loadout volume accumulations (Today, Yesterday, Current Month, Previous Month) for **all** tanks. When the reset process is finished, this box will be unchecked.

When the Host PLC program needs to be changed, there is potential for loss of configuration and accumulator data that the 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.

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

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.

Licensing

The BhiLibTank 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.

If the PLC program is stopped and restarted, the 4-day trail 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 BhiLibDualFc library on a PLC, the following steps must be executed:

Note: This process utilizes the BLT software available for free download at www.Beyond-HMI.com

- Include library features in a PLC program (*reference other instructions in the Developer's Guide 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 to initiate contact with us.
- Wait for Beyond HMI, Inc. to return a license file
- Download Beyond HMI's BLT program from www.Beyond-HMI.com and get it running on a PLC connected to the same network as the PLC.
- Use the BLT program. Connect to the PLC as 'root'
- Install the license file using BLT (see BLT user manual for more details)
- 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.

FAQ