BeyondHMI

Dual Flow Computer Library

Overview

The Beyond HMI Dual Flow Computer Library (BhiLibDualFc) for Wago e!COCKPIT is the ideal flow computer for production separators. This library provides natural gas and crude oil flow computing features for Wago e!COCKPIT programs. The flow computer features conform to API 21.1 standards for electronic flow measurement. Data is transferred from the PLC using industry-standard CFX files. These files can be directly imported into hydrocarbon accounting systems.

The library supports a single (1) gas meter run and up to two (2) liquid meter runs. The liquid meters can be used to measure either crude oil or water.

The library performs API-compliant calculations for either custody-transfer (API 12) or allocation (API 20.1) meters.

For applications that require multiple gas meter runs, the Beyond HMI Gas Flow Computer library (BhiLibGasFc) is available.

The BhiLibDualFc 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.

Library Features for Natural Gas Flow Computing

For gas calculations, the library uses the concept of stations and meters. Stations describe gas properties and base conditions. Meters are assigned to Stations. At present, only orifice meters are supported.

Meter Calculations	Orifice flow calculations	per AGA-3 (2013)
	Meter calculation frequency	Full calc performed once per second
	Calculated parameters	Volume, Mass, Energy
	Aggregated values available	Flow Rate, Current Hour Total, Last Hour Total, Today Total, Yesterday Total, Current Month Total, Prior Hour Total, Lifetime Total
Gas Property Calculations	Supercompressibility and Density	per AGA-8 GERG (2017)
	Gas Property Calculation Frequency	Full calc performed once per second
Supported Meter Configurations	Orifice Meter	Flange taps, Upstream static pressure tap only
Contract Hour	Configurable	Per station
Units of Measure	Customary U.S. units only	Inches, psi, inches of water (68 degrees), degrees F, flow rates per day, volumes in MSCF, energy in MMBTU, mass in Mlbs
Diagnostics	Station calculations	Z_s, $Density_s$, Z_b, $Density_b$, Gas Gravity from Composition – corrected for standard conditions
	Meter configuration	Z_f, $Density_f$, , R_e, C_d, E_v, Y_1, F_{pv} , Temperature-corrected Orifice size, Tube size, Beta
	Configuration validation Features	Library validates configuration and provides error/warning messages

Library Features for Crude Oil Flow Computing

For oil calculations, the library supports meter input as either a flow rate or an accumulated volume. Input can be related to either mass or indicated volume. This arrangement accommodates Coriolis, Turbine, and Positive Displacement meters.

Meter Calculations		per API 12.2 for custody transfer or API 20.1 for allocation
	Meter calculation frequency	Full calc performed once per second
	Calculated Parameters: custody transfer	Indicated Quantity, Indicated Volume, Gross Volume, Gross Standard Volume, Net Standard Volume, S&W Volume, Gross Mass
	Calculated Parameters: allocation	Indicated Quantity, Indicated Volume, Gross Volume, Gross Theoretical Oil Volume, Net Theoretical Oil Volume, Gross Theoretical Water Volume, Theoretical Flash Gas Volume
	Aggregated values available	Flow Rate, Current Hour Total, Last Hour Total, Today Total, Yesterday Total, Current Month Total, Prior Hour Total, Lifetime Total
Oil Property Calculations	Liquid Correction Factors (CRUDE OIL ONLY)	per API 11.1 Table A (2004)
Water Property Calculations	Water Correction Factor	per API 20.1
Supported Meter Configurations		Coriolis, Turbine, Positive Displacement
Contract Hour	Configurable	Per meter
Units of Measure	Customary U.S. units only	psig, degrees F, API gravity, barrels per day, mass in lbs
Diagnostics	Correction Factors	Corrected Density, CTL, CPL, CTPL, CSW, Standard Density

Generic Library Features

Data Retention	per API 21.1	Periodic (hourly) history, events, alarms
	Periodic history retention	Configurable by meter. Minimum of 35 days – ranging to file system capacity
	Event retention	256 events per meter per "day"
	Alarm retention	64 alarms per meter per "day"
Data Transfer Method (Collection)	Via CFX files	Quorum/FLOWCAL Common File Exchange Format (CFX) 8.5.0
		Minimum of 1 CFX per day
		Per API 21.1, new file is created whenever calculation parameters are changed
		CFX file stored on PLC file system (password protected)
	Manual/Local collection	Users with limited permissions and network access can copy CFX files from the PLC to another computer for transfer to hydrocarbon accounting system
	Remote/SCADA collection	Via secure FTP or SSH
SCADA Interface	Implemented in PLC program	
Configuration Loading/Transfer	Via text file	Library provides features to save configuration to file
		Library provides features to load all or part of the configuration from file
Power Loss Behavior	Configuration is retained	PLC persistent memory
	Flow History is retained	PLC persistent memory and file system
	Flow that occurs while PLC is not powered	Not measured
	When power is restored	Broken *day* is saved as CFX file and calculations resume
Licensing	Free for developer	Library file is free and can be added to any Wago e!COCKPIT instance
	Runtime Licensed	Library generates a site code

		Beyond HMI, Inc. generates a license file from site code
		License file is installed on the PLC. License is perpetual but only usable on that PLC.
		Library features will execute for about 4 days after restart in *trial mode*. License must be installed before this period expires or data will be lost (unrecoverable).