ABB MEASUREMENT & ANALYTICS | APPLICATION DESCRIPTION

Liquid transfer application

XSeries and *X*CORE applications

Operating the transfer of liquids through the Liquid Transfer unit while providing custody transfer quality liquid measurement.

Measurement made easy

01 Totalflow applications can be used with etiher a Totalflow XSeries device, or a Totalflow *X*CORE device.

Automation objective

The application provides automatic or manual operation of a Liquid Transfer unit. The main function of this control is to operate the transfer of liquids through the Liquid Transfer unit while providing custody transfer quality liquid measurement. The application also provides electronic historical trending for run tickets that is capable of being collected remotely. The user interface to this control operation includes:

- Touch screen
- Host operation via Cygnet
- Run ticket printing
- Alarm monitoring
- Emergency shutdown control
- Reservoir / well test control
- Trending of run tickets

ABB Totalflow continues to adapt this application to industry needs and can also adapt them to meet your requirements.

IEC-61131 Application setup

The IEC Liquid Transfer Application can be operated through the PCCU interface. After installing the application, it will appear on your Totalflow Tree. Expanding Liquid Transfer will give you the sub-branch(s) for setup and configuration.

In the Liquid Transfer branch you will be able to expand to see the “Setup” branch.

In the Liquid Transfer branch level, the following tabs are available:

- Liquid Transfer Commands
- Batch Setup
- Proving Mode
- Liquid Transfer State
- Current Batch Data

Transfer States

"Current State" can display the following states:

Idle – Ready & Waiting State (No alarms)
Running – Permissives available, transferring product.
Completed and Waiting – Load volume reached, Valve closing and waiting for low flow rate to be reached for completion of batch.

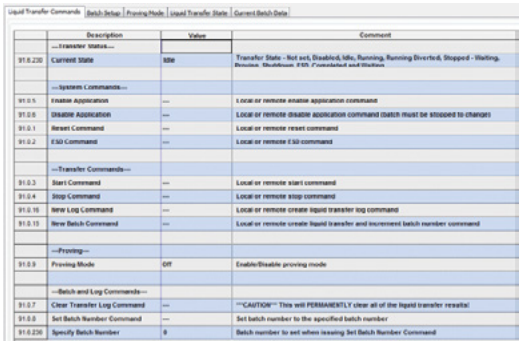
Running Diverted – BS&W High setpoint reached & product diverted back to source
Stopped - Waiting – Product diverted, batch stopped and waiting for low flow rate to be reached.

Proving – Check meter mode for proving meter accuracy

Shutdown ESD – Shutdown condition has been met. ESD command or Disable command has been issued. The unit will stop and the current batch will end.

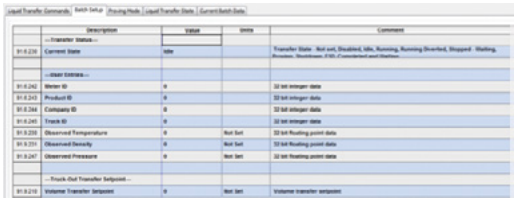
Transfer Commands

- Start
- Stop Command
- New Log Command
- New Batch Command



Proving

- Proving Mode
- Batch and Log Commands
- Clear Transfer Log Command
- Set Batch Number Command
- Specify Batch Number



Proving Mode

Note: If the system does not use a separate discharge pump, PID control will be given to the charge pump. To specify the usage of a discharge pump, go to Advance Setup and select the proper option for "Discharge Pump Present" parameter. Depending on the selection chosen, either the "Discharge Pump PID" or the "Charge Pump PID" controls will display.

Also supported:

- Proving Mode PID control (with Discharge Pump)
- Proving Mode PID control (without Discharge Pump)

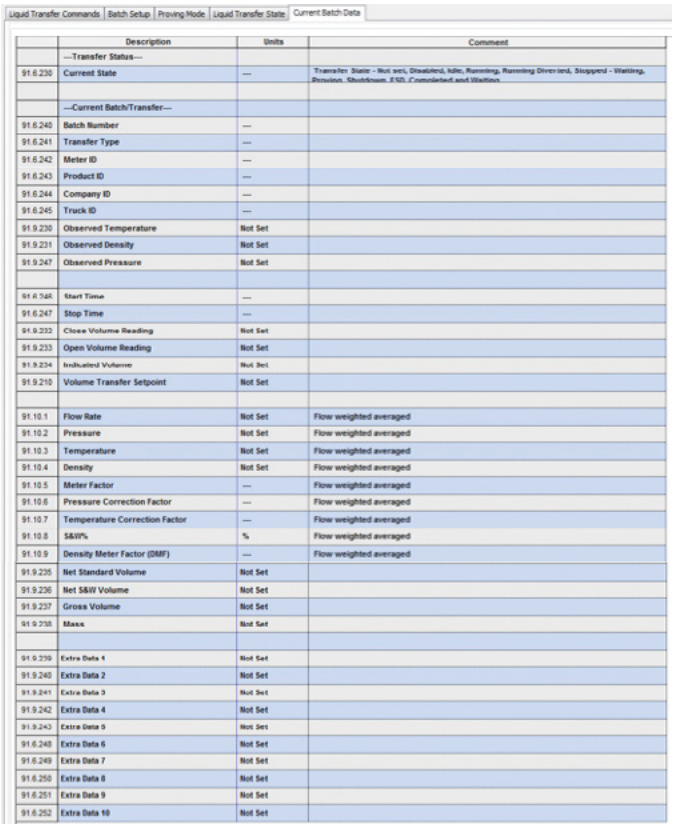
Liquid Transfer State

This tab displays a collection of run time information about the status of the system: Transfer States, System Devices, System Controls, System Shutdown Statuses, and Liquid Transfer Volume Totals. For System Controls, depending on transfer mode and either tank level/volume control or limit switch tank control have been enabled, different system control parameters are shown to reflect what is selected.

In the System Shutdown Status section, the Discharge Pump Output Tolerance Shutdown status will also be shown if the discharge pump operation mode is set to VFD. PID information is also shown for the charge pump and discharge pump if the respective pump operation modes are set to VFD.

Current Batch Data

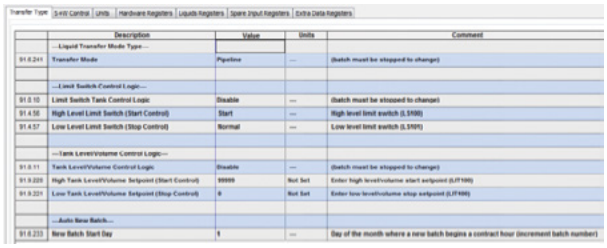
This tab displays data recorded for the current batch. The data is updated during a running batch. When the batch is completed, the information is recorded in the liquid transfer logs.



	Description	Units	Comment
	---Transfer Status---		
91.6.230	Current State	---	Transfer State - Not set, Disabled, Idle, Running, Running Diverted, Stopped - Waiting, Paused, Shutdown, ESD, Completed and Waiting
	---Current Batch/Transfer---		
91.6.240	Batch Number	---	
91.6.241	Transfer Type	---	
91.6.242	Meter ID	---	
91.6.243	Product ID	---	
91.6.244	Company ID	---	
91.6.245	Truck ID	---	
91.9.230	Observed Temperature	Not Set	
91.9.231	Observed Density	Not Set	
91.9.247	Observed Pressure	Not Set	
91.6.246	Start Time	---	
91.6.247	Stop Time	---	
91.9.232	Close Volume Reading	Not Set	
91.9.233	Open Volume Reading	Not Set	
91.9.234	Indicated Volume	Not Set	
91.9.210	Volume Transfer Setpoint	Not Set	
91.10.1	Flow Rate	Not Set	Flow weighted averaged
91.10.2	Pressure	Not Set	Flow weighted averaged
91.10.3	Temperature	Not Set	Flow weighted averaged
91.10.4	Density	Not Set	Flow weighted averaged
91.10.5	Meter Factor	---	Flow weighted averaged
91.10.6	Pressure Correction Factor	---	Flow weighted averaged
91.10.7	Temperature Correction Factor	---	Flow weighted averaged
91.10.8	S&W%	%	Flow weighted averaged
91.10.9	Density Meter Factor (DMF)	---	Flow weighted averaged
91.9.235	Net Standard Volume	Not Set	
91.9.236	Net S&W Volume	Not Set	
91.9.237	Gross Volume	Not Set	
91.9.238	Mass	Not Set	
91.9.239	Extra Data 1	Not Set	
91.9.240	Extra Data 2	Not Set	
91.9.241	Extra Data 3	Not Set	
91.9.242	Extra Data 4	Not Set	
91.9.243	Extra Data 5	Not Set	
91.6.248	Extra Data 6	Not Set	
91.6.249	Extra Data 7	Not Set	
91.6.250	Extra Data 8	Not Set	
91.6.251	Extra Data 9	Not Set	
91.6.252	Extra Data 10	Not Set	

Setup
In this branch, you will be able to expand to see the Advance Setup and Alarms Setup branches.

On the Setup branch level, the following tabs are available:
- Transfer Type
- S+W Permissive
- Units
- Hardware Registers
- Liquids Registers
- Charge Pump PID (available when charge pump operation mode is set to VFD)
- Discharge Pump PID (available when discharge pump operation mode is set to VFD)
- Spare Input Registers
- Extra Data Registers



Liquid Transfer Mode Type
Transfer mode – Pipeline/Truck Out. Select the desired transfer method. Transfer mode cannot be changed when system is in one of the running states.

Pipeline Transfer Mode
Pipeline transfer is used as an automatic transfer to a pipeline. Pipeline transfer can be controlled by either Start/Stop limit switches (LS100/LS101), or the tank level/volume transmitter (LIT100).

When the start command is issued while the system is in the “Idle” state, a new batch will be created. If the system controls for either the limit switches or level/volume transmitters are met depending on which method of control has been enabled, the unit will start transfer. If neither Start/Stop limit switches (LS100/LS101), nor the tank level/volume transmitter (LIT100) controls are enabled, the system will remain in the “Idle” state when a start command is issued and no new batch created.

A loss of the system control does not end the batch. The system will go to “Stopped - Waiting” state with pumps and valves operation set to stop transfer. When the permissive becomes available, the system will resume transfer in “Running” state.

When Contract Hour is reached, the data will be logged and the batch continues, a new batch will not be created.

If a shutdown condition occurs, ESD have been issued or a Disable command have been issued, the unit will stop and the current batch will end.

Truck Out Transfer Mode
Truck out transfer is used for transferring to a truck. An operator can set a transfer amount or start/stop the Liquid Transfer unit manually.

Truck ground (XS100) can be used as a start control for the Liquid Transfer by enabling it in the hardware register definitions. Start push button (PB101) can be configured as a trigger to start the liquid transfer. Likewise, Stop push button (PB102) can be configured as a trigger to stop the Liquid Transfer system.

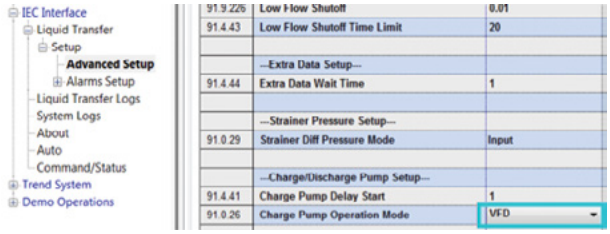
When the Start command is issued, the Liquid Transfer unit will start and a new batch will be created. The operator can set the Volume Transfer Setpoint in the Liquid Transfer Commands tab. When the indicated volume reaches the setpoint, transfer will stop. The unit can also be stopped anytime by issuing a stop command or triggering the stop push button. When the unit stops, the batch is ended and data logged to the Liquid Transfer Logs.

A loss of the truck ground does not end the batch. The system will go to “Stopped - Waiting” state with pumps and valves operation set to stop transfer. When the truck grounded signal indicates that the truck is grounded, the system will resume transfer in “Running” state.

If a shutdown condition occurs, ESD have been issued or a Disable command have been issued, the unit will stop and the current batch will end.

Advanced Setup

On the Advanced Setup branch level, the following tab is available:



PID Control
- Enable VFD on Charge/Discharge Pump Setup
- Ensure PID App is set in 101 for Charge
- Ensure PID App is set in 102 for Discharge

Sampler Control
- Enable Sampler
- Sampler Volume Sample Setpoint
- Sampler Valve Open Timer Setpoint

Sampler control is to coordinate when each sample is to be taken and how long each sample is to be taken. Each time the indicated volume accumulation reaches the volume sample setpoint, the sampler valve (SOV102) will open for the duration specified by the valve open timer setpoint.
For example: Activate sample valve open at every 1 barrel of volume for 5 seconds.

Alarms Setup
In this branch, you will be able to expand to see the Digital and Analog branches.

System Alarm
For each digital or analog input, when the alarm is enabled and when the alarm condition is met, if the alarm condition persist beyond the specified time limit, an alarm will be triggered.
An alarm is non-latching, meaning if the alarm condition is cleared, the alarm will clear automatically without any user reset. Alarms conditions are evaluated in any of the system states.

System Shutdown
For each digital or analog input, when the shutdown is enabled and when the shutdown condition is met, if the shutdown condition persist beyond the specified time limit, a shutdown will be triggered. If the start-up bypass is enabled for the input, the shutdown condition is ignored for a specified time duration after a batch start. A shutdown is latching, meaning if the shutdown condition is cleared, the shutdown will not clear until a user reset. Shutdown conditions are only evaluated in running system states (Running, Running Diverted, Proving, and Stopped - Waiting).

Digital

On the Digital branch level, the following tab is available:
- Alarms (Digital)
- Shutdowns (Digital)

Alarms (Digital)
This tab allow users to configure digital alarm conditions for the digital inputs.

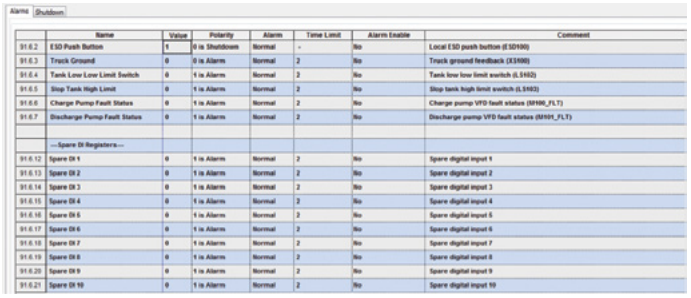


Figure 1: Digital – Alarms

Shutdowns (Digital)
This tab allow users to configure digital shutdown conditions for the digital inputs.

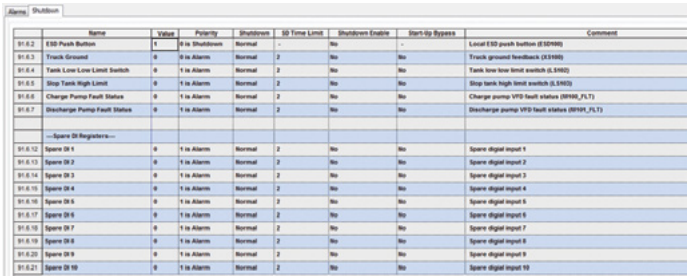


Figure 2: Digital – Shutdowns

Analog

On the Analog branch level, the following tab is available:

- Low Alarms (Analog)
- Low Shutdowns (Analog)
- High Alarms (Analog)
- High Shutdowns (Analog)

Low Alarms (Analog)

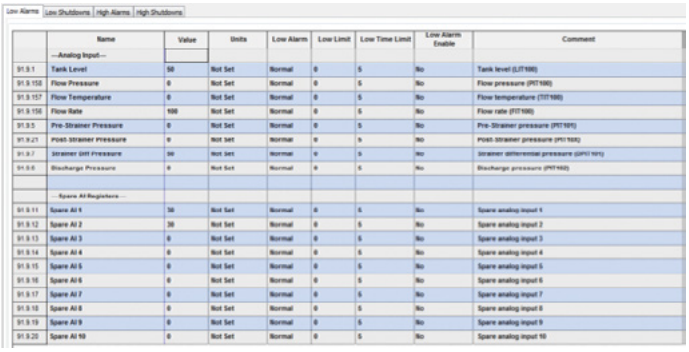


Figure 3: Analog – Low Alarms

This tab allow users to configure analog low alarm conditions for the digital inputs.

Low Shutdowns (Analog)

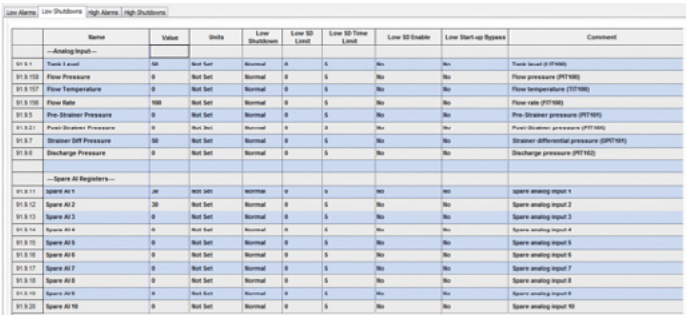


Figure 4: Analog – Low Shutdowns

This tab allow users to configure analog low shutdown conditions for the digital inputs.

High Alarms (Analog)

Low Alarms | Low Shutdowns | High Alarms | High Shutdowns

	Name	Value	Units	High Alarm	High Limit
	---Analog Input---				
91.9.1	Tank Level	50	Not Set	Normal	99999
91.9.158	Flow Pressure	0	Not Set	Normal	99999
91.9.157	Flow Temperature	0	Not Set	Normal	99999
91.9.156	Flow Rate	100	Not Set	Normal	99999
91.9.5	Pre-Strainer Pressure	0	Not Set	Normal	99999
91.9.21	Post-Strainer Pressure	0	Not Set	Normal	99999
91.9.7	Strainer Diff Pressure	50	Not Set	Normal	99999
91.9.6	Discharge Pressure	0	Not Set	Normal	99999
	---Spare AI Registers---				
91.9.11	Spare AI 1	30	Not Set	Normal	99999
91.9.12	Spare AI 2	30	Not Set	Normal	99999
91.9.13	Spare AI 3	0	Not Set	Normal	99999
91.9.14	Spare AI 4	0	Not Set	Normal	99999
91.9.15	Spare AI 5	0	Not Set	Normal	99999
91.9.16	Spare AI 6	0	Not Set	Normal	99999
91.9.17	Spare AI 7	0	Not Set	Normal	99999
91.9.18	Spare AI 8	0	Not Set	Normal	99999
91.9.19	Spare AI 9	0	Not Set	Normal	99999
91.9.20	Spare AI 10	0	Not Set	Normal	99999

Figure 5: Analog – High Alarms

This tab allow users to configure analog high alarm conditions for the digital inputs.

High Shutdowns (Analog)

Low Alarms | Low Shutdowns | High Alarms | High Shutdowns

	Name	Value	Units	High Shutdown	High SD Limit	High SD Time Limit
	---Analog Input---					
91.9.1	Tank Level	50	Not Set	Normal	99999	5
91.9.158	Flow Pressure	0	Not Set	Normal	99999	5
91.9.157	Flow Temperature	0	Not Set	Normal	99999	5
91.9.156	Flow Rate	100	Not Set	Normal	99999	5
91.9.5	Pre-Strainer Pressure	0	Not Set	Normal	99999	5
91.9.21	Post-Strainer Pressure	0	Not Set	Normal	99999	5
91.9.7	Strainer Diff Pressure	50	Not Set	Normal	99999	5
91.9.6	Discharge Pressure	0	Not Set	Normal	99999	5
	---Spare AI Registers---					
91.9.11	Spare AI 1	30	Not Set	Normal	99999	5
91.9.12	Spare AI 2	30	Not Set	Normal	99999	5
91.9.13	Spare AI 3	0	Not Set	Normal	99999	5
91.9.14	Spare AI 4	0	Not Set	Normal	99999	5
91.9.15	Spare AI 5	0	Not Set	Normal	99999	5
91.9.16	Spare AI 6	0	Not Set	Normal	99999	5
91.9.17	Spare AI 7	0	Not Set	Normal	99999	5

Figure 6: Analog – High Shutdowns

This tab allow users to configure analog high shutdown conditions for the digital inputs.

PID Tolerance

On the PID Tolerance branch level, the following tab is available:

- Alarms (PID Tolerance)
- Shutdowns (PID Tolerance)

Alarms (PID Tolerance)

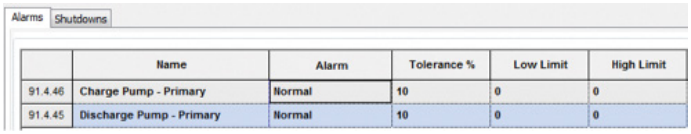


Figure 7: PID Tolerance – Alarms

This tab allow users to configure PID tolerance alarm conditions for the PID loops used.

Shutdowns (PID Tolerance)

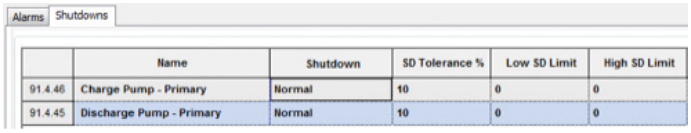


Figure 8: PID Tolerance – Shutdowns

This tab allow users to configure PID tolerance shutdown conditions for the PID loops used.

Liquid Transfer logs

On the Liquid Transfer Logs branch level, the following tab is available:

- Batch Log

Batch Log

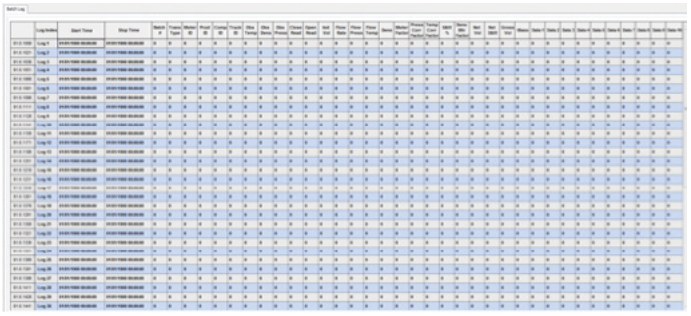


Figure 9: Batch Log

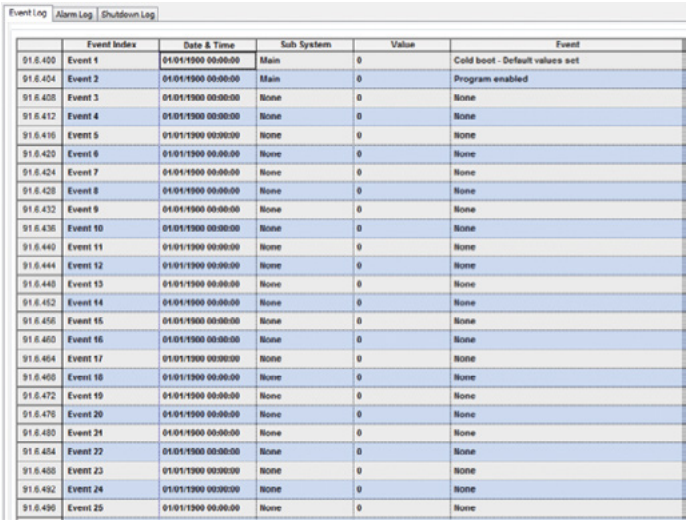
This tab allow users to view past batch logs. The logs contain final information of previous batches. The data that are in the Current Batch Data tab under Liquid Transfer will be recorded here after the batch is completed or a new log condition is triggered. A new log condition is triggered for Pipeline transfer contract hour and using the Send New Values & Log Command in the Proving Mode tab under Liquid Transfer. A maximum of 50 logs are recorded. If logs exceeds 50, the oldest logs will be deleted as new logs are recorded. All logs can be deleted permanently by using the Clear Transfer Log Command in the Liquid Transfer Commands tab under Liquid Transfer.

System logs

On the System Logs branch level, the following tab is available:

- Event Log
- Alarm Log
- Shutdown Log

Event Log

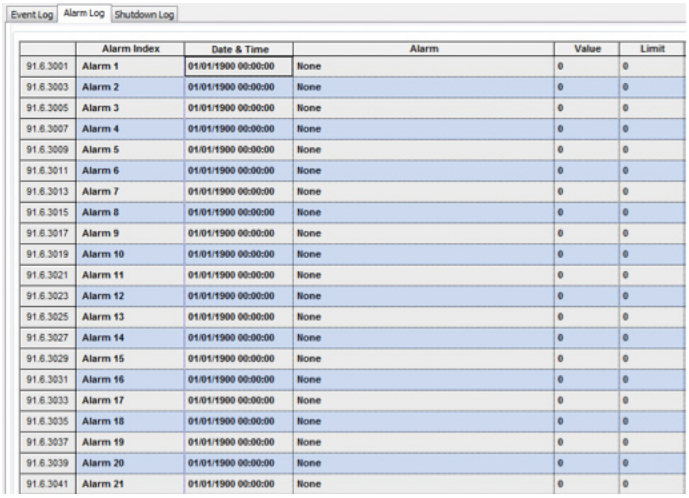


	Event Index	Date & Time	Sub System	Value	Event
91.6.400	Event 1	01/01/1900 00:00:00	Main	0	Cold boot - Default values set
91.6.404	Event 2	01/01/1900 00:00:00	Main	0	Program enabled
91.6.408	Event 3	01/01/1900 00:00:00	None	0	None
91.6.412	Event 4	01/01/1900 00:00:00	None	0	None
91.6.416	Event 5	01/01/1900 00:00:00	None	0	None
91.6.420	Event 6	01/01/1900 00:00:00	None	0	None
91.6.424	Event 7	01/01/1900 00:00:00	None	0	None
91.6.428	Event 8	01/01/1900 00:00:00	None	0	None
91.6.432	Event 9	01/01/1900 00:00:00	None	0	None
91.6.436	Event 10	01/01/1900 00:00:00	None	0	None
91.6.440	Event 11	01/01/1900 00:00:00	None	0	None
91.6.444	Event 12	01/01/1900 00:00:00	None	0	None
91.6.448	Event 13	01/01/1900 00:00:00	None	0	None
91.6.452	Event 14	01/01/1900 00:00:00	None	0	None
91.6.456	Event 15	01/01/1900 00:00:00	None	0	None
91.6.460	Event 16	01/01/1900 00:00:00	None	0	None
91.6.464	Event 17	01/01/1900 00:00:00	None	0	None
91.6.468	Event 18	01/01/1900 00:00:00	None	0	None
91.6.472	Event 19	01/01/1900 00:00:00	None	0	None
91.6.476	Event 20	01/01/1900 00:00:00	None	0	None
91.6.480	Event 21	01/01/1900 00:00:00	None	0	None
91.6.484	Event 22	01/01/1900 00:00:00	None	0	None
91.6.488	Event 23	01/01/1900 00:00:00	None	0	None
91.6.492	Event 24	01/01/1900 00:00:00	None	0	None
91.6.496	Event 25	01/01/1900 00:00:00	None	0	None

Figure 10: Event Log

This tab allow users to view Event logs. The event that occurred will be logged with the time of occurrence and event description. If the event is related to a specific batch, the batch number will be displayed, else a 0 is displayed.

Alarm Log

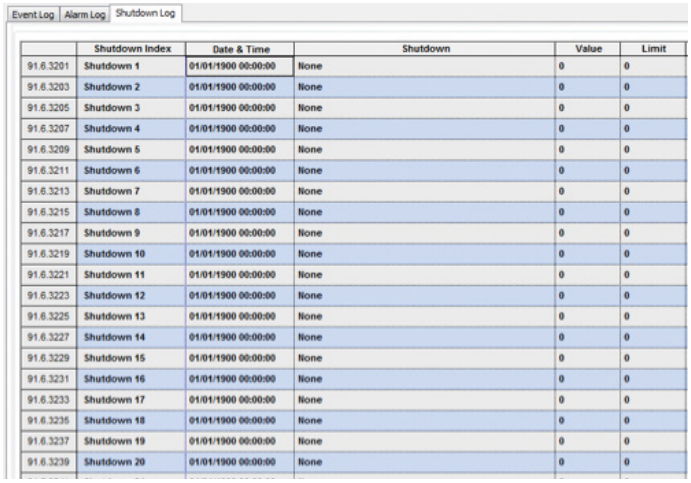


	Alarm Index	Date & Time	Alarm	Value	Limit
91.6.3001	Alarm 1	01/01/1900 00:00:00	None	0	0
91.6.3003	Alarm 2	01/01/1900 00:00:00	None	0	0
91.6.3005	Alarm 3	01/01/1900 00:00:00	None	0	0
91.6.3007	Alarm 4	01/01/1900 00:00:00	None	0	0
91.6.3009	Alarm 5	01/01/1900 00:00:00	None	0	0
91.6.3011	Alarm 6	01/01/1900 00:00:00	None	0	0
91.6.3013	Alarm 7	01/01/1900 00:00:00	None	0	0
91.6.3015	Alarm 8	01/01/1900 00:00:00	None	0	0
91.6.3017	Alarm 9	01/01/1900 00:00:00	None	0	0
91.6.3019	Alarm 10	01/01/1900 00:00:00	None	0	0
91.6.3021	Alarm 11	01/01/1900 00:00:00	None	0	0
91.6.3023	Alarm 12	01/01/1900 00:00:00	None	0	0
91.6.3025	Alarm 13	01/01/1900 00:00:00	None	0	0
91.6.3027	Alarm 14	01/01/1900 00:00:00	None	0	0
91.6.3029	Alarm 15	01/01/1900 00:00:00	None	0	0
91.6.3031	Alarm 16	01/01/1900 00:00:00	None	0	0
91.6.3033	Alarm 17	01/01/1900 00:00:00	None	0	0
91.6.3035	Alarm 18	01/01/1900 00:00:00	None	0	0
91.6.3037	Alarm 19	01/01/1900 00:00:00	None	0	0
91.6.3039	Alarm 20	01/01/1900 00:00:00	None	0	0
91.6.3041	Alarm 21	01/01/1900 00:00:00	None	0	0

Figure 11: Alarm Log

This tab allow users to view Alarms logs. The alarm that occurred will be logged with the time of occurrence and alarm description. The value of the analog or digital input that caused the alarm and the limit of which it has exceeded are also displayed.

Shutdown Log


Event Log | Alarm Log | Shutdown Log

	Shutdown Index	Date & Time	Shutdown	Value	Limit
91.6.3201	Shutdown 1	01/01/1900 00:00:00	None	0	0
91.6.3203	Shutdown 2	01/01/1900 00:00:00	None	0	0
91.6.3205	Shutdown 3	01/01/1900 00:00:00	None	0	0
91.6.3207	Shutdown 4	01/01/1900 00:00:00	None	0	0
91.6.3209	Shutdown 5	01/01/1900 00:00:00	None	0	0
91.6.3211	Shutdown 6	01/01/1900 00:00:00	None	0	0
91.6.3213	Shutdown 7	01/01/1900 00:00:00	None	0	0
91.6.3215	Shutdown 8	01/01/1900 00:00:00	None	0	0
91.6.3217	Shutdown 9	01/01/1900 00:00:00	None	0	0
91.6.3219	Shutdown 10	01/01/1900 00:00:00	None	0	0
91.6.3221	Shutdown 11	01/01/1900 00:00:00	None	0	0
91.6.3223	Shutdown 12	01/01/1900 00:00:00	None	0	0
91.6.3225	Shutdown 13	01/01/1900 00:00:00	None	0	0
91.6.3227	Shutdown 14	01/01/1900 00:00:00	None	0	0
91.6.3229	Shutdown 15	01/01/1900 00:00:00	None	0	0
91.6.3231	Shutdown 16	01/01/1900 00:00:00	None	0	0
91.6.3233	Shutdown 17	01/01/1900 00:00:00	None	0	0
91.6.3235	Shutdown 18	01/01/1900 00:00:00	None	0	0
91.6.3237	Shutdown 19	01/01/1900 00:00:00	None	0	0
91.6.3239	Shutdown 20	01/01/1900 00:00:00	None	0	0

Figure 12: Shutdown Log

This tab allow users to view Shutdown logs. The shutdown that occurred will be logged with the time of occurrence and shutdown description. The value of the analog or digital input that caused the shutdown and the limit of which it has exceeded are also displayed.

The IEC Liquid Transfer unit is compatible with the Beijer or Red Lion Touch Screen panel. Beijer or Red Lion Touch Screen panels contain Totalflow Remote Protocol capabilities.

Login

By default, there is an administrator account which gives access to changing alarm settings, system settings, and printing reports. The default account is: admin, password: admin.

Appendix A

Liquid calculations
The Liquid Transfer IEC application described in this document requires that an “API Liquid SU” measurement application is enabled and **configured correctly** in the ABB Totalflow Flow Computer or RTU. The setup/configuration for all units of measure, product type, as well as source of density and if flowing/observed/base conditions is configured in the “API Liquid SU” application.

The “API Liquid SU” application performs the calculations for liquid product measurement per API standards, such as Ctl, Cpl, Mass, Indicated Volume (IV), Gross Standard Volume (GSV), S&W volume, and Net Standard Volume (NSV) that the Liquid Transfer IEC application requires to compile a batch/run measurement ticket. The “API Liquid SU” application retrieves all required inputs and performs all calculations once per second using full double precision math and accumulates all volume and mass accumulators every second.

The data that the Liquid Transfer IEC application retrieves from the “API Liquid SU” application is currently in single precision format. Variables that will be averaged and logged within the Liquid Transfer IEC application are all flow weighted averages (FWA). The Liquid Transfer IEC application retrieves the Opening Reading values from the “API Liquid SU” application when the IEC batch/run transfer begins and continues to read these values every second to provide a flow rate during the transfer. When the transfer is ended, the Closing Reading values are retrieved from the “API Liquid SU” application and the IV, GSV, S&W volume, and NSV are calculated by simply subtracting the Opening values from the Closing values and logged in the Liquid Transfer IEC application. A copy is also stored in the standard Totalflow Trend System.

Correction factors for products with 100 to -10 API Gravity @60°F (610.6 to 1163.5 kg/m3 @ 60°F or .61120 to 1.16464 Relative Density @ 60°F) are calculated per API 11.1, “Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils”.

Correction factors for Light Hydrocarbons are calculated per API Chapter 11.2.2, “Compressibility Factors for Hydrocarbons: .350-.637 Relative Density (60°F/60°F) and -50°F to 140°F Metering Temperature” for Pressure Correction (Cpl); and API Chapter 11.2.4 “Temperature Correction for the Volume of NGL and LPB, Tables 23E, 24E, 53E, 54E, 59E, and 60E; GPA Technical Publication TP-27” for Temperature Correction (Ctl) for products between .350-.688 Relative Density.

Water volumes correction factors are calculated per API Chapter 11.4.1, “Density of Water and Water Volumetric Correction Factors for Water Calibration of Volumetric Provers”.

Disclaimer
Volumes are calculated per API standards in the “API Liquid SU” application and have been verified against the equations provided in API 11.1 for Crude oil products. The “API Liquid SU” application data logs in the flashes listed below are not in full compliance with MPMS API Chapter 21- Flow Measurement Using Electronic Metering Systems, Section 2- Electronic Liquid Volume Measurement Using Positive Displacement and Turbine Meters” (API 21.2).

Averages in the following flashes (or earlier part numbers) are **not Flow Weighted** but are linear averages in the “API Liquid SU” app… **the IEC app log averages are Flow Weighted**. All “API Liquid SU” measurement application logs in later versions of flashes that those listed below are Flow Weighted and API 21.2 compliant.

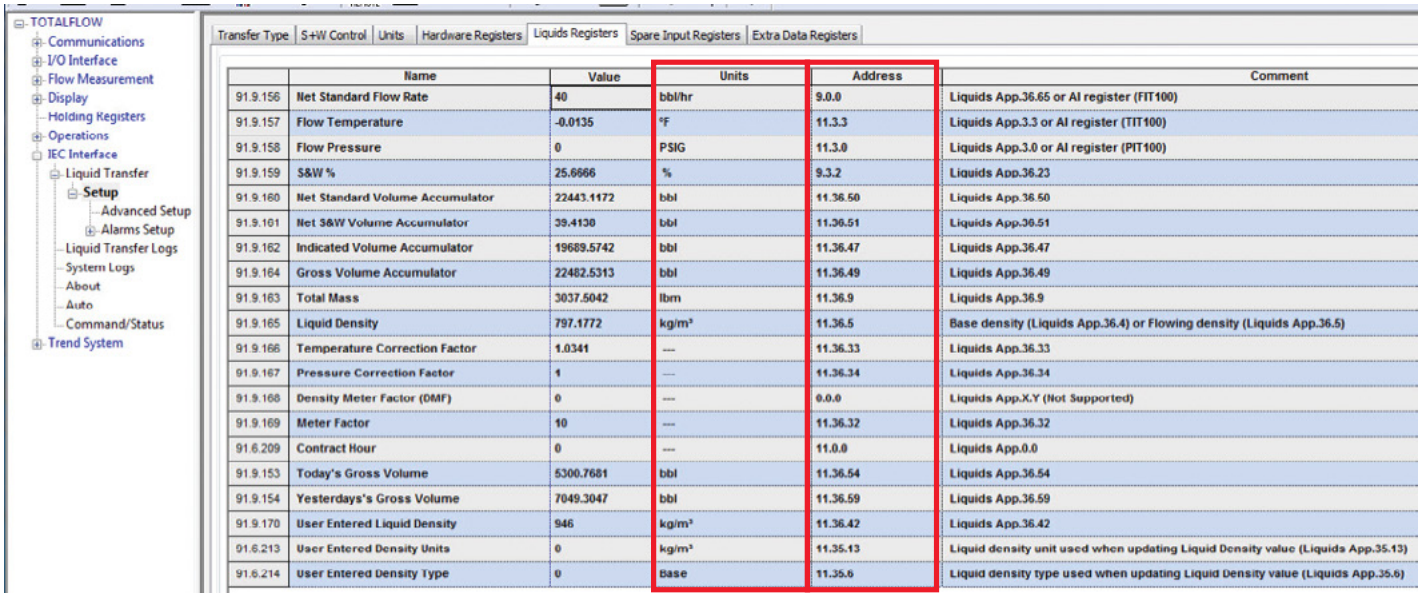
XFC – 2102861-059, 2104339-024, 2105151-001, 2105152-001
XRC – 2103132-059, 2104340-024, 2105153-001, 2105154-001
µFLO – 2104497-019, 2104498-019
XFC EX – 2104158-032, 2104159-032

The Liquid Transfer IEC application logs the variables listed in API 21.2 as required variables for a Quantity Transaction Record (QTR) as well as those shown in examples of meter tickets in API 12.2 “Calculations of Liquid Petroleum Quantities Measured by Turbine or Displacement Meters”. However, several of the logged variables are currently “Informational” only and not used in the calculation of GSV or NSV.

Currently, none of the Liquid Transfer IEC log records specify the units of measure and in the case of Density, the source or measured condition is not specified. **The user should be aware of these limits and use the application as it meets their respective needs and or requirements.** Specifics regarding each logged variable are listed in Appendix B.

The IEC Liquid Transfer application is user configurable and it is critical that the user verifies that all registers are setup correctly.

1. The user must configure the “API Liquid SU” application for the correct product type to be measured and verify that all units of measurement are per the user’s requirements.
2. The user must configure the “Setup; Liquid Registers” in the IEC Liquid Transfer application to access the appropriate registers from the “API Liquid SU” application. These are outlined in the Blue Box shown below. Each item in the outlined Blue Box must have the correct register of the appropriate “API Liquid SU” application entered. **It is the user’s responsibility to verify that these are correctly configured.** Changes to these settings are not logged in any event log. **These registers MUST be correct for the IEC Liquid Transfer to provide the correct information to the Batch/Run Tickets.** The “Units” that are shown in the Yellow Box are informational only and do not change the Values shown to the left nor are the “Units” shown in the Batch/Run Ticket.
3.



	Name	Value	Units	Address	Comment
91.9.156	Net Standard Flow Rate	40	bbl/hr	9.0.0	Liquids App.36.65 or AI register (FIT100)
91.9.157	Flow Temperature	-0.0135	°F	11.3.3	Liquids App.3.3 or AI register (TIT100)
91.9.158	Flow Pressure	0	PSIG	11.3.0	Liquids App.3.0 or AI register (PIT100)
91.9.159	S&W %	25.6666	%	9.3.2	Liquids App.36.23
91.9.160	Net Standard Volume Accumulator	22443.1172	bbl	11.36.50	Liquids App.36.50
91.9.161	Net S&W Volume Accumulator	39.4130	bbl	11.36.51	Liquids App.36.51
91.9.162	Indicated Volume Accumulator	19689.5742	bbl	11.36.47	Liquids App.36.47
91.9.164	Gross Volume Accumulator	22482.5313	bbl	11.36.49	Liquids App.36.49
91.9.163	Total Mass	3037.5042	lbm	11.36.9	Liquids App.36.9
91.9.165	Liquid Density	797.1772	kg/m³	11.36.5	Base density (Liquids App.36.4) or Flowing density (Liquids App.36.5)
91.9.166	Temperature Correction Factor	1.0341	---	11.36.33	Liquids App.36.33
91.9.167	Pressure Correction Factor	1	---	11.36.34	Liquids App.36.34
91.9.168	Density Meter Factor (DMF)	0	---	0.0.0	Liquids App.X.Y (Not Supported)
91.9.169	Meter Factor	10	---	11.36.32	Liquids App.36.32
91.6.209	Contract Hour	0	---	11.0.0	Liquids App.0.0
91.9.153	Today's Gross Volume	5300.7681	bbl	11.36.54	Liquids App.36.54
91.9.154	Yesterdays's Gross Volume	7049.3047	bbl	11.36.59	Liquids App.36.59
91.9.170	User Entered Liquid Density	946	kg/m³	11.36.42	Liquids App.36.42
91.6.213	User Entered Density Units	0	kg/m³	11.35.13	Liquid density unit used when updating Liquid Density value (Liquids App.35.13)
91.6.214	User Entered Density Type	0	Base	11.35.6	Liquid density type used when updating Liquid Density value (Liquids App.35.6)

Appendix B

Batch/Run ticket items

The batch or run ticket contains final information of previous batches or runs. Data in the “Batch Logs” tab under Liquid Transfer will be recorded when the batch/run is completed or a new log condition is triggered. A new log condition is triggered for Pipeline transfer at contract hour and/or by using the Send New Values and Log command in the Proving mode tab under Liquid Transfer. A max of 50 logs are recorded within the IEC application. Data from these logs is retrievable by “register access” only. If the logs exceed 50 then the oldest logs will be deleted as new logs are recorded. All logs can be deleted permanently by using the Clear Transfer Log Command in the Liquid Transfer command tab under Liquid Transfer. The IEC application logs are not retrievable using PCCU or WinCCU. Correction factors for products with 100 to -10 API Gravity@60°F (610.6 to 1163.5 kg/m3 @ 60°F or .61120 to 1.16464 Relative Density @ 60°F) are calculated per API 11.1, “Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils”.

Batch/Run ticket definitions

IEC Liquid Transfer application logs

Batch/Run Ticket Item	Description	User Configurable	Data Type	Batch/ Run Ticket Record #1 Register See Note (1)	Batch/ Run Ticket Record #2 Register See Note (2)
Batch Number	Unique batch or run ticket number	Starting number is configurable. Each following batch will increment	Int 32	91.6.1000	91.6.1015
Transfer type	Type choices = Truck Out or Pipeline	Yes	Int 32	91.6.1001	91.6.1016
Meter ID	Numeric Only. User enterable and is specific to the IEC Liquid Transfer app. This is NOT the Meter ID that may be assigned to the “API Liquid SU” application	Yes	Int 32	91.6.1002	91.6.1017
Product ID	Numeric Only. It is vital that the user correctly identifies the product using only the Selections that are in the “API Liquid SU” app and that it is the same	Yes See Note (2)	Int 32	91.6.1003	91.6.1018
Company ID	Numeric Only.. entered by the user in the Liquid Transfer IEC application	Yes	Int 32	91.6.1004	91.6.1019
Truck ID	Numeric Only entered by the user in the Liquid Transfer IEC application	Yes	Int 32	91.6.1005	91.6.1020
Observed Temperature	This is a user entered value in the Liquid Transfer IEC application and is NOT used in any calculations. Informational ONLY at this time.	Yes	32 Bit Flt	91.9.1000	91.9.1015
Observed Density	This is a user entered value in the Liquid Transfer IEC application and is NOT used in any calculations. Informational ONLY at this time.	Yes	32 Bit Flt	91.9.1001	91.9.1016
Observed Pressure	This is a user entered value in the Liquid Transfer IEC application and is NOT used in any calculations. Informational ONLY at this time.	Yes	32 Bit Flt	91.9.1014	91.9.1029
Start Time	Julian time or # of seconds since 1/1/1970	No	Int 32	91.6.1006	91.6.1021
Stop Time	Julian time or # of seconds since 1/1/1970	No	Int 32	91.6.1007	91.6.1022
Closing Indicated Volume Reading	The register is user configurable in the IEC Liquid Transfer app “Setup” and must be verified by the user as being correct. It should be the register for the Indicated Volume accumulator in the “API Liquid SU” app and is a snapshot of the accumulator at the end of the ticket	Yes; only the register from which the values are read		91.9.1002	91.9.1017

Open Indicated Volume Reading	The register is user configurable in the IEC Liquid Transfer app "Setup" and must be verified by the user as being correct. It should be the register for the Indicated Volume accumulator in the "API Liquid SU" app and is a snapshot of the accumulator at the beginning of the ticket	Yes; only the register from which the values are read		91.9.1003	91.9.1018
Indicated Volume	Difference between the Closing Volume Reading and the Opening Volume Reading	No. The accumulator register is configurable	32 Bit Flt	91.9.1004	91.9.1019
Flow Rate	The register where this data is obtained is user configurable in the IEC Liquid Transfer app "Setup" as the Net Standard Flow rate	Yes; only the register from which the values are read	32 Bit Flt	91.10.1000	91.10.1015
Pressure	The register where this data is obtained is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the pressure used in the "API Liquid SU" app. Flow Weighted Average is logged. **No units are shown.**	Yes; only the register from which the values are read	32 Bit Flt	91.10.1001	91.10.1016
Temperature	The register where this data is obtained is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the temperature used in the "API Liquid SU" app. Flow Weighted Average is logged. **No units are shown.**	Yes; only the register from which the values are read	32 Bit Flt	91.10.1002	91.10.1017
Density	The register where this data is obtained is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the density used in the "API Liquid SU" app. Flow Weighted Average is logged. **No units are shown.** The log record does not identify if this value is at base conditions or flowing conditions.	Yes; only the register from which the value is read. User must select a different register depending on Base or Flowing conditions	32 Bit Flt	91.10.1003	91.10.1018
Meter Factor	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the Meter Factor used in the "API Liquid SU" app. Flow Weighted Average is logged.	Yes; only the register from which the values are read	32 Bit Flt	91.10.1004	91.10.1019
Press Correction Factor	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the Cpl used in the "API Liquid SU" app. Flow Weighted Average is logged.	Yes; only the register from which the values are read	32 Bit Flt	91.10.1005	91.10.1020
Temp Correction Factor	The register where is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the Ctl used in the "API Liquid SU" app. Flow Weighted Average is logged.	Yes; only the register from which the values are read	32 Bit Flt	91.10.1006	91.10.1021

S&W%	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the S&W% used in the "API Liquid SU" app. Flow Weighted Average is logged.	Yes; only the register from which the values are read	32 Bit Flt	91.10.1007	91.10.1022
Density Meter Factor	Not currently implemented in calculations			91.10.1008	91.10.1023
Net Standard Volume	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the register for Net Standard Volume Accumulator used in the "API Liquid SU" app. The volume is the difference between a snapshot of this register at the beginning of a ticket and a snapshot of this register at the end of a ticket.	No. The accumulator register is configurable	32 Bit Flt	91.9.1005	91.9.1020
S&W Volume	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the register for Sediment and Water Volume Accumulator used in the "API Liquid SU" app. The volume is the difference between a snapshot of this register at the beginning of a ticket and a snapshot of this register at the end of a ticket.	No. The accumulator register is configurable	32 Bit Flt	91.9.1006	91.9.1021
Gross Volume	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the register for Gross Standard Volume Accumulator used in the "API Liquid SU" app. The volume is the difference between a snapshot of this register at the beginning of a ticket and a snapshot of this register at the end of a ticket.	No. The accumulator register is configurable	32 Bit Flt	91.9.1007	91.9.1022
Mass	The register is user configurable in the IEC Liquid Transfer app Setup. User must verify that it is the register for Mass Accumulator used in the "API Liquid SU" app. The volume is the difference between a snapshot of this register at the beginning of a ticket and a snapshot of this register at the end of a ticket.	No. The accumulator register is configurable	32 Bit Flt	91.9.1008	91.9.1023
Extra Data 1	User Definable	Yes	32 Bit Flt	91.9.1009	91.9.1024
Extra Data 2	User Definable	Yes	32 Bit Flt	91.9.1010	91.9.1025
Extra Data 3	User Definable	Yes	32 Bit Flt	91.9.1011	91.9.1026
Extra Data 4	User Definable	Yes	32 Bit Flt	91.9.1012	91.9.1027
Extra Data 5	User Definable	Yes	32 Bit Flt	91.9.1013	91.9.1028
Extra Data 6	User Definable	Yes	Int 32	91.6.1008	91.6.1023
Extra Data 7	User Definable	Yes	Int 32	91.6.1009	91.6.1024
Extra Data 8	User Definable	Yes	Int 32	91.6.1010	91.6.1025
Extra Data 9	User Definable	Yes	Int 32	91.6.1011	91.6.1026
Extra Data 10	User Definable	Yes	Int 32	91.6.1012	91.6.1027

[Note 1] Batch/Run ticket records increment by 15 Register Addresses for each batch/run ticket.
[Note 2] Product ID selection is vital to correctly identifying the product using only the Selections that are in the "API Liquid SU" app and that the selection is the same.

Product	ID (Enumerated List)
Crude Oil	0
Fuel Oil	1
Jet Fuel	2
Transition/Diesel	3
Gasoline	4
Lube Oil	5
Special Application	6
Water	7
Light Hydros	8

Standard Trend Logs

A Standard ABB Totalflow Trend is also available which has a copy of each the Batch/Run Tickets that were generated by the IEC Liquid Transfer application. There are two additional items logged in the standard ABB Totalflow Trend.

1. Time stamp of when the data was transferred to the Trend from IEC
2. The sequence number of the Batch or Run ticket row in the Trend. This trend can be collected with PCCU, WinCCU or the TCI for data to 3rd party host systems

The order in which the data is logged in the standard Trend system is in a different order than the IEC Liquid Transfer Batch/Run ticket.

Data Path

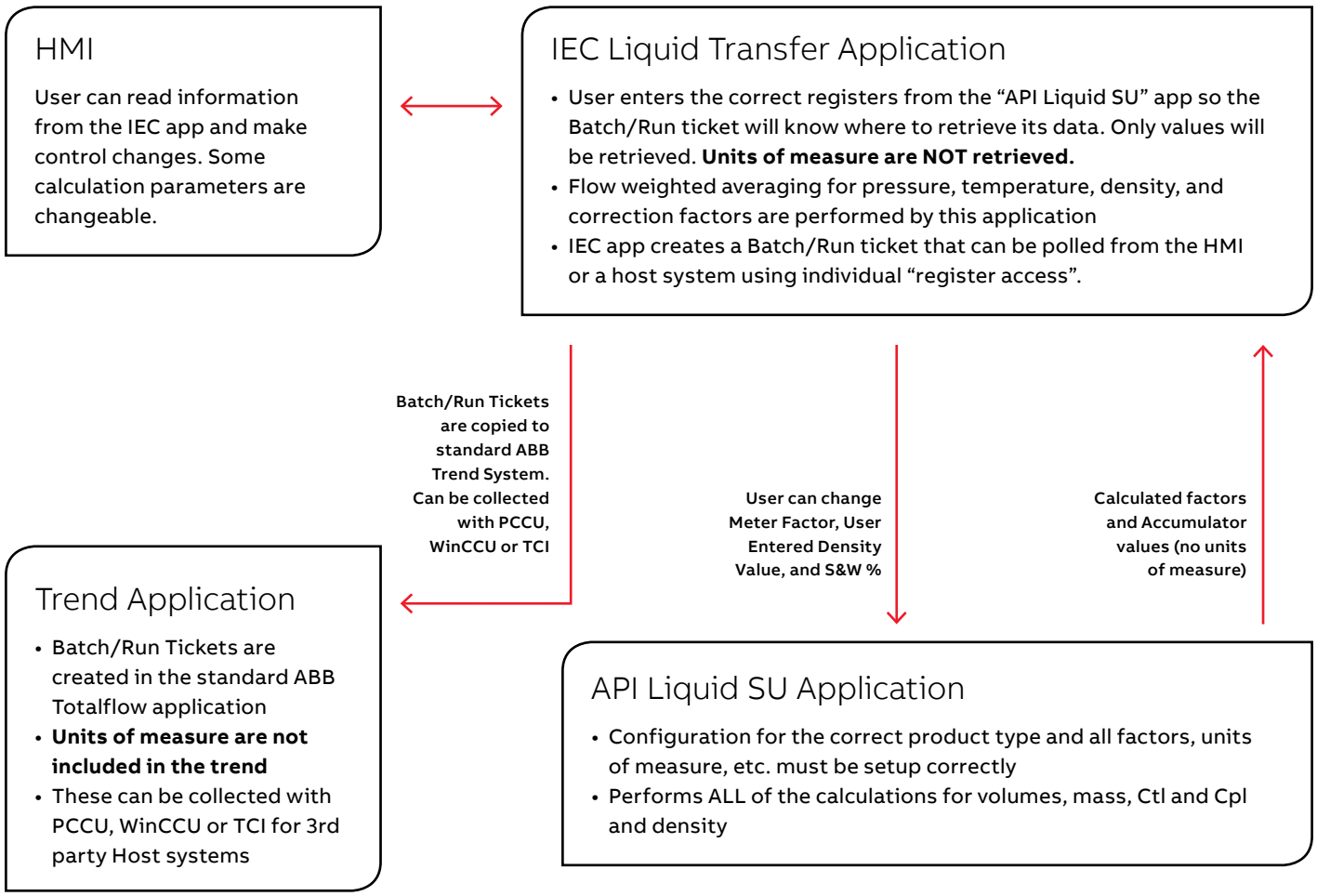


ABB Inc.
Measurement & Analytics
Quotes: totalflow.inquiry@us.abb.com
Orders: totalflow.order@us.abb.com
Training: totalflow.training@us.abb.com
Support: totalflowsupport@us.abb.com
+1 800 442 3097 (opt. 2)

Main Office
7051 Industrial Boulevard
Bartlesville, OK 74006
Ph: +1 918 338 4888

California Office
4300 Stine Road
Suite 405-407
Bakersfield, CA 93313
Ph: +1 661 833 2030

Kansas Office
2705 Centennial Boulevard
Liberal, KS 67901
Ph: +1 620 626 4350

Texas Office – Odessa
8007 East Business 20
Odessa, TX 79765
Ph: +1 432 272 1173

Texas Office – Houston
3700 West Sam Houston
Parkway South, Suite 600
Houston, TX 77042
Ph: +1 713 587 8000

Texas Office – Pleasanton
150 Eagle Ford Road
Pleasanton, TX 78064
Ph: +1 830 569 8062

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AD/2101123-EN – Rev. B 09.2018