

Spirit^{IT} Flow-X

Liquid USC application

Liquid_USC v4.0.1 (June 2021)

Bugfix version, includes about 10 fixes, including:

- Compile errors when opening application in older versions of Excel
- Calibration values for differential pressure transmitters were not stored
- Spurious deviation alarms during calibration of differential pressure transmitters
- Sampler pulse output was not working correctly in some cases
- Sometimes, with repeatability limit mode 'Progressive (uncertainty limit)', prove runs that were just out of limits were accepted anyway
- Incorrect density read from Caldon 8-path ultrasonic meter
- Always use rounded Ctpl to calculate standard volume

Liquid_USC v4.0.0 (April 2021)

The Liquid_USC application version 4.0.0 has been released in April 2021.

This application requires Flow-Xpress 3.2.0 or later.

Besides the features and changes described below, this release also contains around 30 minor improvements and bug-fixes.

For a complete list of changes please contact ABB.

Two separate application files

The Liquid_USC application is released in two different variations:

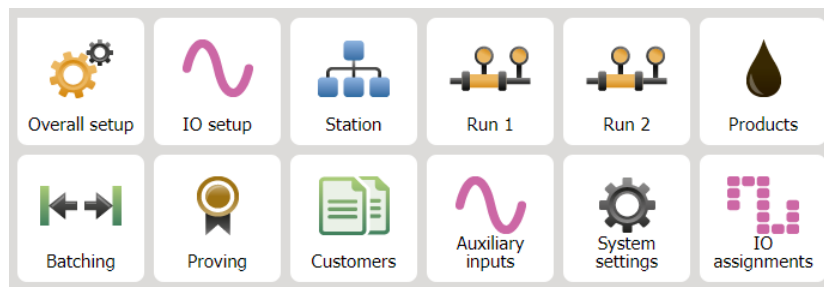
- **Liquid_USC Master 4.0.0.fxm**
Application for single run flow computers (X/C, X/M, X/P1) or multiple run flow computers (one run per module). Loading functionality is available and can be facultatively used.
- **Liquid_USC Master 4.0.0 v2 2runs.fxm**
Application for version 2 flow computers with 2 runs (X/C, X/M, X/P1). Loading functionality is available and can be facultatively used.

No 'abbreviated' version (for version 1 multiple run flow computers) has been released.

New Features/Changes

New menu structure for improved ease of configuration

Configuration has been made easier, using a more intuitive menu structure. All configuration parameters are now collected within one configuration menu which can be followed top down to configure the complete flow computer. **Furthermore**, configuration displays have been optimised, hiding all non-applicable settings and thus avoiding confusion as much as possible.



Improved 'IO assignment' display.

The 'IO assignment' display, which provides a complete overview of all assigned IO, now also shows configuration errors like 'incorrect input type', 'incorrect module', 'incorrect unit' etc.

Analog inputs	
R1 Meter temperature - Run	<input type="text" value="Ain 1 *UNITS*"/>
R1 Meter pressure - Run	<input type="text" value="Ain 2 *TYPE*"/>
Digital inputs	
R1 Meter pulse input A	<input type="text" value="Dig 1"/>
R2 Meter pulse input A	<input type="text" value="*MODULE*"/>
R1 Meter pulse input B	<input type="text" value="Dig 2"/>
Digital outputs	
R1 Pulse output 1 - Run	<input type="text" value="Dig 9"/>

Support of non-standard transmitter units

Now transmitters with non-standard units (like temperature transmitters in kPa, or temperature transmitters in °C) can be easily used, making use of the new capability to convert the input into the right units.

Analog inputs			
Analog input 1 type	<input type="text" value="4-20 mA"/>	Analog input 1 tag	<input type="text" value="PT-102"/>
Analog input 1 unit type	<input type="text" value="Pressure"/>	Analog input 1 pressure unit	<input type="text" value="kPa"/>
Analog input 1 averaging	<input type="text" value="Arithmetic mean"/>	Analog input 1 zero scale	<input type="text" value="0"/>
Analog input 1 full scale	<input type="text" value="5000"/>	Analog input 1 low fail limit	<input type="text" value="-2.5 %span"/>
Analog input 1 high fail limit	<input type="text" value="102.5 %span"/>		

New calibration / verification procedure

The application is provided with a new, extended procedure for calibration, verification and zeroing of process inputs, analog inputs, PT100 inputs, analog outputs and multivariable transmitters. Selection is by 'Meter run' (for process inputs) or by 'IO module' (for IO points). Inputs selected for calibration, verification or zero offset adjustment can be frozen before the calibration is started. Up to 5 calibration and up to 8 verification points are supported. Calibration results are stored at the end of the calibration sequence and a calibration / verification report is generated.

Input selection			
Selected run	<input type="text" value="1"/>		
Deselect	<input type="button" value="Deselect"/>		
Selected input			
Selected input	<input type="text" value="Meter pressure"/>	Frozen value	<input type="text" value="145.0377 psi"/>
Uncorrected value	<input type="text" value="145.0377 psi"/>	Corrected value	<input type="text" value="145.0377 psi"/>
Zero offset			
Zero offset	<input type="text" value="0.0000 psi"/>	Set zero offset value	<input type="text"/>
Set zero offset	<input type="button" value="Set zero offset"/>	Reset zero offset	<input type="button" value="Reset zero offset"/>
Clear calibration data			
Clear calibration data	<input type="button" value="Clear calibration data"/>		
Calibration / Verification			
Start calibration	<input type="button" value="Start calibration"/>	Start verification	<input type="button" value="Start verification"/>

Verification report for ABB Coriolismaster meter

The Flow-X closely works together with the ABB Coriolismaster Verimass technology to safeguard the meter's health and accuracy. The Verimass functionality can be fully controlled from the flow computer display and the flow computer can create a meter verification report that contains detailed diagnostic data on the meter's behaviour.

VeriMass On/Off	<input type="checkbox"/> On	Print verification report	Print verification report
OPERATION SETTINGS			
Control Type	<input type="radio"/> III <input checked="" type="radio"/> Manual	Driver Current Max	<input type="text" value="5.200 mA"/>
Driver Current Time	<input type="text" value="10.00 s"/>		
EROSION MONITOR			
Driver Current	<input type="text" value="4.837 mA"/>	Meter erosion - Actual Value	<input type="text" value="3.360 mA"/>

```

ABB Coriolismaster Verification Report

Verification VeriMass: Erosion monitor
VeriMass group           OK
Erosion monitor         On
Baseline fingerprint    5.200      mA
Tolerance level         4.235      mA
Baseline last period    3.360      mA

Meter specific information
Transmitter tag         FM-258

User settings
Qm max                  5.12      g/s
  
```

Liquid_USC v3.0.0 (November 2019)

The Liquid_USC application version 3.0.0 has been released in November 2019.

This application requires Flow-Xpress 3.0.0 or later.

Besides the features and changes described below, this release also contains around 150 minor improvements and bug-fixes.

For a complete list of changes please contact ABB.

New Features/Changes

Three separate application files

The Liquid_USC application is released in three different variations:

- **Liquid_USC Master 3.0.0.fxm**
Full application for single and multiple run flow computers (one run per module)
- **Liquid_USC Master 3.0.0 loading.fxm**
Full application for single and multiple run flow computers (one run per module) with added loading functionality
- **Liquid_USC Master 3.0.0 v2 2runs.fxm**
Application for version 2 flow computers with 2 runs running in one module (X/M or X/C).

Multistream application for version 2 hardware

With the release of version 2 hardware (X/M and X/C), which has much more memory available, it has become possible to control more than one run from one Flow-X module. The new Liquid_USC v2 2runs application supports up to 2 runs on a single X/M or X/C flow computer.

SNTP Time Synchronization

From this application version, the Flow-X supports time synchronization with one or more NTP time servers. Both servers on local networks and on the Internet are supported. It's possible to configure communication with up to four separate NTP servers.

PERIOD DEFINITION	
SNTP period duration (days)	<input type="text" value="1"/>
SNTP time of day (hh:mm)	<input type="text" value="01:33"/>
NTP SERVER 1	
NTP server 1 - hostname / IP-address	<input type="text" value="0.nl.pool.ntp.org"/>
NTP server 1 - port number	<input type="text" value="123"/>
NTP SERVER 2	
NTP server 2 - hostname / IP-address	<input type="text" value="1.nl.pool.ntp.org"/>
NTP server 2 - port number	<input type="text" value="123"/>

Automatic HART slave ID lookup

With this new feature, finding the configured slave ID of a connected HART transmitter is made very simple. Just tell the flow computer to search for a transmitter, upon which flow computer starts a search on the HART loop and reports back any transmitter it has found.

SELECTED HART INPUT	
HART device	<input type="text" value="No device"/>
SCAN HART ID	
HART slave ID	<input type="text" value="0"/>
Communication status	<input type="text" value="OK"/>
Scan from slave ID 0	<input type="button" value="Scan from slave ID 0"/>
Abort scan	<input type="button" value="Abort scan"/>
Continue scan	<input type="button" value="Continue scan"/>
Max scan time	<input type="text" value="15 s"/>
Scanning wait time	<input type="text" value="0 s"/>
Scanning active	<input type="text" value="No"/>
HART TRANSMITTER INFO	
Manufacturer	<input type="text" value="0"/>
Device ID	<input type="text" value="0"/>
Variable 1 units	<input type="text" value="0"/>

Prove result test based on API 13.2 Control Chart

For this test the flow computer maintains an API 13.2 control chart with the last 10 proved meter factors. Before accepting a new meter factor, it is added to the chart and a check is done against the selected probability range.

CONTROL CHART MF TEST	
Control chart MF test	<input checked="" type="checkbox" value="Enabled"/>
Control chart MF test limits	<input type="text" value="Warning (90%)"/>

Input frozen alarms for all process inputs

The application now features 'input frozen' alarms for all live process inputs like meter temperature, meter pressure, density, differential pressure etc.

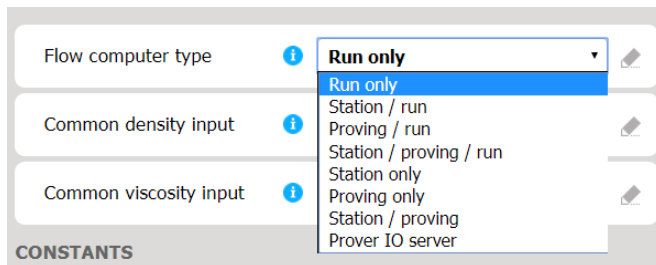
If enabled, the logic checks whether the inputs are varying within a configurable time span. If an input value hasn't changed during this time span, the flow computer creates an 'input frozen' alarm.



Removed FC type 'Remote run'

In the previous application version 2.2.0 a common configuration parameter 'FC type' has been introduced, which enables or disables the run, station and proving functionality of the flow computer. One of the options was 'remote run', which configured the flow computer as a 'remote run' to another flow computer that was serving as station or proving flow computer.

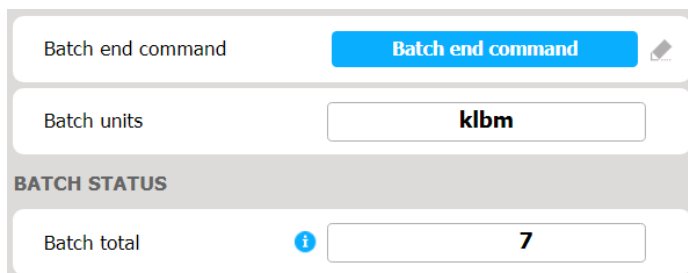
In the new application version 3.0.0 this functionality is still available, but the FC type 'remote run' has been removed from the selection list. Now it suffices to configure the remote run as 'Run only' (and configure the 'Connect to remote station' Modbus list). Please refer to the application manual for more information.



Mass based batching / loading

In previous versions of the application, batching was solely done on a volume basis. The batch size was entered as a volume, the batch progress was reported as a volume, the batch size reached alarm was based on volume and the optional auto batch end on batch size reached was acting on volume. Likewise, the optional loading logic was solely based on volume.

From version 3.0.0 it's possible to switch between volume based or mass based batching and loading.



Prove required flags / alarms

From version 3.0.0 it's possible to configure prove required flags that are raised if the actual flowrate, standard density, meter temperature or meter pressure deviates more than a configurable amount from the values at the last prove, or if a configurable maximum flow between proves has been exceeded. These flags can be read by an external system or used in custom logic to create an auto prove command. Alternatively, prove required alarms can be switched on to signal the operator that a prove is required.

DENSITY	
Prove required flag on density change III	Density change threshold 10 kg/sm ³
Density deviation period 5 min	Standard density change 6.4 kg/sm ³
Prove required - std. density change	False

Flow computer configuration report

From version Liquid_USC v3.0.0 it is possible to generate a configuration report directly from the flow computer. This report contains an extensive overview of the flow computer's configuration settings.

```

COMMON SETTINGS          Display: Configuration, Overall setup, Common settings
Flow computer type       Standalone run
Station product / batching Disabled
Station density          Disabled
Station BS&W             Disabled
Station viscosity        Disabled
Nr. of products          1
Volume rollover [m3]    1000000000
Mass rollover [tonne]   1000000000
Mass totals type         Mass in vacuum
Dis. totals on inactive Yes
Flow 0 on inactive       No
Auto reset maint totals No
Reverse totals           Disabled
Dis. alarms on inactive Yes
Dis. alarms on maint     Yes
Deviation alm delay [s] 10
MID compliance           Disabled
Allow overrides           Yes
Date format              dd/mm/yy
Time set inhibit [s]     30

CALCULATION SETTINGS    Display: Configuration, Overall setup, Meter ticket
API 12.2.2 Meas tickets Disabled
Implement MF retroact.   Disabled
API rounding             Disabled
Use last good corr factors Yes
Calc. extrapolation      Yes
Calc. out of range alms Enabled
Averaging method         Flow weighted on gross volume
Volume totals dec places 3
Mass totals dec places   3
CTL dec places           6
CPL dec places           6
CCF dec places           6

BATCH SETTINGS          Display: Configuration, Overall setup, Common settings
Allow batch end if inact. Yes

```

Liquid_USC v2.2.0 (April 2016)

The Liquid_USC application version 2.2.0 has been released in April 2016.

Besides the features and changes described below, this release also contains around 200 minor improvements and bug-fixes.

For a complete list of changes please contact ABB.

New Features/Changes

Three separate application files

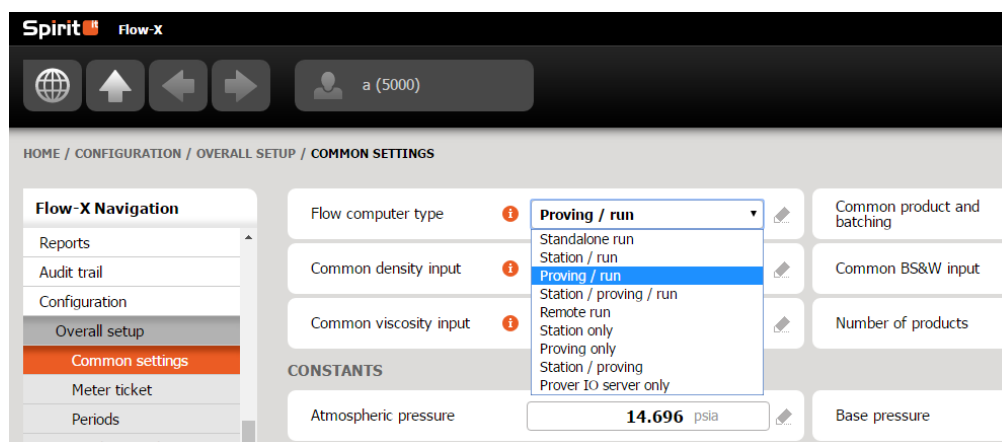
The Liquid_USC application is released in three different variations:

- **Liquid_USC Master 2.2.0.fxm**
Full application for single run flow computers (X/S, X/P1, X/R1)

- **Liquid_USC Master 2.2.0 loading.fxm**
Full application for single run flow computers (X/S, X/P1, X/R1) with added loading functionality
- **Liquid_USC Master 2.2.0 abridged.fxm**
Abridged application for multiple run flow computers (X/P2, X/P3, XP4, X/R2, X/R3, X/R4). This application has the following restrictions: no reverse totals and averages, no hourly and period B totalizers and averages, no station sampler logic only, number of products limited to 8, no support of dP meters (orifice, venturi, etc.).

Parameter 'FC type' for easy configuration of run/station/proving combinations

In previous application versions enabling / disabling of the run, station and proving functionality was done by setting several parameters on a number of different displays. In this new version these parameters have been replaced by one global parameter 'FC type' on the common settings display. Based on this parameter the flow computer enables or disables the run, station and proving functionality and shows the appropriate display screens for configuration and operation. For more information please refer to the application manual.



When upgrading a flow computer from a previous application version to this new version, please remember to set this parameter accordingly.

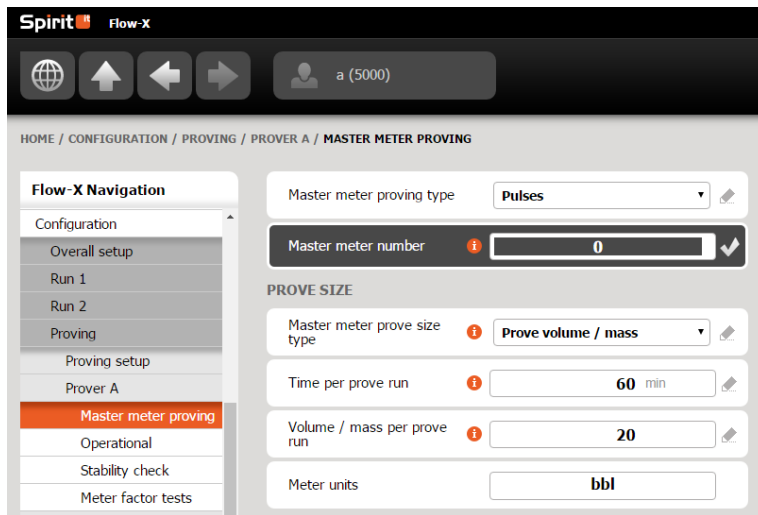
Master meter proving in one module only (with limited functionality)

Formerly for master meter proving at least 2 modules were required: one for the meter under prove and one for the master meter. In this new application version it's also possible to do master meter proving using one single module, albeit with limited functionality:

- Only for master meters that give pulses
- Meter pulse input B is used for the master meter pulses, so only one pulse of the meter under prove can be used (no dual pulse)
- There's no master meter K-factor curve and only one master meter factor curve.
- No meter body correction or viscosity correction on the master meter.

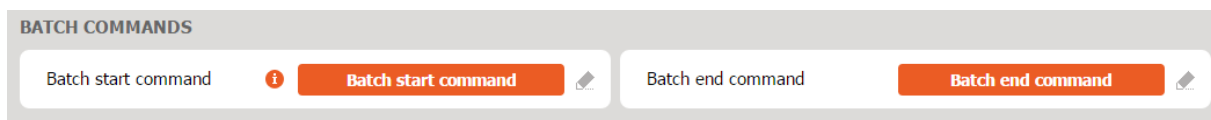
When using separate modules for the master meter and the meter under prove, the master meter is treated as a full-blown meter without any restrictions.

Master meter proving in one module only is enabled by selecting master meter nr. '0'.



Batch start command

In former application versions there was only a **Batch end command**. This command closed the active batch and immediately opened the next batch. Now there's an option to use separate Batch start and Batch end commands. When using this option the next batch is only opened when the Batch open command is activated. Any flow between the closing of the batch and the opening of the next batch is not counted in the batch totals.



Implementation of API MPMS 12.2.2 / 12.2.3 rounding rules

This version includes a new option to apply the API MPMS 12.2.2 rounding rules for meter tickets and the API MPMS 12.2.3 rounding rules for prove reports. When this option is enabled the results of each calculation step are rounded to the number of digitals specified in the API standard, before they are used in the next calculation step.

API MPMS 12.2.2 requires the batch to be recalculated after closing, because the calculations are based on the average batch process values. Therefore, when 'API 12.2.2 Measurement Tickets' compliance is enabled, a batch recalculation is conducted by the flow computer and a **recalculated meter ticket** is printed (instead of the normal meter ticket).

Apply meter factor retroactively

A new option makes it possible to apply a meter factor retroactively. This means that the end-of-batch meter factor is retroactively applied to the whole batch. With this option it is possible to use the meter factor that is obtained from a prove during the execution of a batch to the whole batch, including the part before the prove was conducted.

As this option requires the batch to be recalculated after closing, the results will be printed on the **recalculated meter ticket**.

Average Meter Factor method for pipe and compact proving

API MPMS 12.2.3 allows for two different meter factor calculation methods:

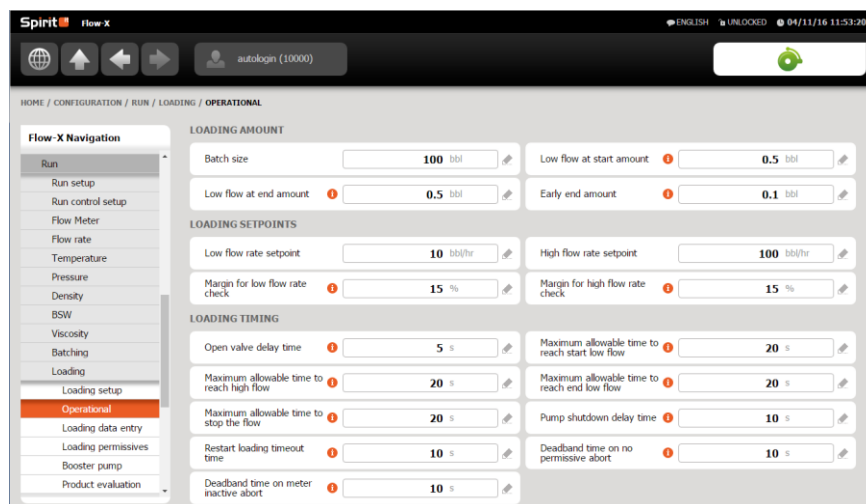
- the **average data method** (calculating the proved meter factor from input data averaged over all prove runs)
- the **average meter factor method** (calculating the proved meter factor as the average of the individually calculated run meter factors)

Formerly for pipe and compact proving the Flow-X only was supporting the average data method. In this application version alternatively the average meter factor method can be selected.

Loading functionality

Liquid_USC Master 2.2.0 loading.fxm contains the following added loading functionality:

- Loading data entry
- Loading sequence with optional low flow start, high flow and optional low flow end stages.
- 4 loading commands (start loading, stop loading, finish loading, emergency shutdown) through user interface and / or digital inputs
- Ground connected permissive, 4 extra digital input permissives
- Data entry permissives, max. BS&W permissive, 3 custom permissives
- Flow control by means of flow control valve or two stage valve
- Control of inlet and outlet valves
- Pump control
- Booster pump control (analog or digital)
- Divert valve control



Remote station / remote run configuration

Several flow computers can be set up to operate in a remote station / remote run configuration. In this configuration one flow computer is set up as a remote station that is communicating to a number of (max. 8) remote run flow computers. Each flow computer is running a separate application. Inter-FC communication is done through Modbus TCP/IP. All station functionality is executed by the remote station flow computer, all run functionality is executed by the individual remote run flow computers.

Remote station functionality may include:

- Station totalizing based on the totalizer data from the individual remote runs
- Read data from station transmitters (density, BS&W and/or viscosity transmitters connected to the remote station flow computer) and send the process values to all remote run flow computers
- Prove a remote meter run, using a pipe, compact or small volume prover, and send the resulting meter factor to the remote run flow computer
- Prove a remote meter run against a local or remote master meter and send the resulting meter factor to the remote run flow computer
- Station batch control
- Station flow control
- Station sampler control

Dedicated **connect to remote run** and **connect to remote station** Modbus drivers are available to handle inter-FC communication.

