

# Spirit<sup>IT</sup> Flow-X

## Liquid Metric application

### Liquid\_Metric v3.1.0 (July 2020)

The Liquid\_Metric application version 3.1.0 has been released in July 2020.

The application is compatible with Flow-Xpress versions 3.0.0 and higher.

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.

#### Four separate application files

The Liquid\_Metric application is released in four different variations:

- **Liquid\_USC Master 3.1.0.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1, X/C)
- **Liquid\_Metric Master 3.1.0 loading.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1, X/C) with added loading functionality
- **Liquid\_Metric Master 3.1.0 v2 2runs.fxm**  
Application for version 2 flow computers with 2 runs (X/M or X/C).
- **Liquid\_Metric Master 3.1.0 v2 4runs.fxm**  
Application for version 2 flow computers with 4 runs (X/M or X/C).

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

### New Features/Changes

#### Optimised configuration displays

Configuration displays have been optimised, hiding all non-applicable settings. Because only settings are shown that are applicable to the specific configuration, setting up the flow computer is made much easier, avoiding confusion as much as possible.

## 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
On

Print verification report
Print verification report

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**OPERATION SETTINGS**

Control Type
Manual

Driver Current Time
10.00 s

Driver Current Max
5.200 mA

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**EROSION MONITOR**

Driver Current
4.837 mA

Meter erosion - Actual Value
3.360 mA

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**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
                    
```

## Recalculate 4 last batches

It is now possible to recalculate the 4 last batches, rather than the last batch only.

batch selected for recalculation
Last batch - 3

Print recalculated meter ticket
Print recalculated meter ticket

## Station recalculation

Station recalculation has been extended with recalculation of the station totalizers (formerly only recalculated run totalizers were reported). Furthermore, it is now possible to enter run specific standard density and BS&W values on the station recalculation display on systems without a common density and / or common BS&W.

Print recalculated meter tickets
Print recalculated meter tickets

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**STANDARD DENSITY - FORWARD**

Recalc batch standard density input unit
Density [kg/sm3]

Run 1 Fwd recalc batch standard density
801.123000

Run 2 Fwd recalc batch standard density
802.654000

### Retroactively apply standard density and / or BS&W override values

By selecting these options, it is not needed anymore to wait until a batch has been closed and the meter ticket has been generated, before entering the standard density and / or BS&W value for recalculation. The entered values will directly be used on the meter ticket, so it's not needed to create an extra recalculated ticket.

### Support for multivariable transmitters

Support has been added for multivariable transmitters that simultaneously measure temperature, pressure and differential pressure and communicate these through Modbus to the flow computer. By default, drivers for ABB 266 and Rosemount 4088 MVT's are included.

### IP address of Modbus devices configurable from flow computer display

It's not needed anymore to specify the IP addresses of Modbus TCP/IP devices in the Flow-Xpress software before writing the application to the flow computer. Now, as part of the parameters, IP addresses can be configured on the flow computer.

The screenshot shows a configuration interface with two main sections:

- COMMUNICATION STATUS**: A field labeled "Communication status" with a value of "OK".
- MODBUS ID - FLOW METER**: Two fields for configuration:
  - "Modbus IP address" with the value "10.0.1.100" and a small edit icon.
  - "Modbus server / slave ID" with the value "1" and a small edit icon.

# Liquid\_Metric v3.0.0 (June 2019)

The Liquid\_Metric application version 3.0.0 has been released in June 2019.

The application is compatible with Flow-Xpress versions 3.0.0 and higher.

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.

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- **Liquid\_Metric Master 3.0.0 loading.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1, X/C) with added loading functionality
- **Liquid\_Metric Master 3.0.0 abridged.fxm**  
Abridged application for multiple run flow computers (X/P2, X/P3, XP4, X/R2, X/R3). This application has the following restrictions: no reverse totals and averages, no hourly and period B totalizers and averages, station sampler logic only (no separate samplers for each run), number of products limited to 4.
- **Liquid\_Metric Master 3.0.0 v2 2runs.fxm**  
Application for version 2 flow computers with 2 runs (X/M or X/C).

## New Features/Changes

### 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\_Metric 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%)"/>

## Support of Caldon G3 ultrasonic flow meter

The Liquid\_Metric application now supports the Caldon G3 ultrasonic flow meter.

# Liquid\_Metric v2.3.0 / 2.3.1 (April 2018)

The Liquid\_Metric application versions 2.3.0 and 2.3.1 have been released in April 2018.

The applications are compatible with Flow-Xpress versions 2.1.0 and higher.

Besides the features and changes described below, these releases also contain around 130 minor improvements and bug-fixes.

For a complete list of changes please contact ABB.

## Three separate application files

The Liquid\_Metric application is released in three different variations:

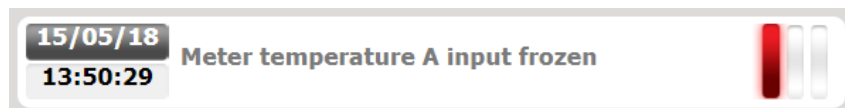
- **Liquid\_USC Master 2.3.0.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1, X/C)
- **Liquid\_Metric Master 2.3.0 loading.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1, X/C) with added loading functionality
- **Liquid\_Metric Master 2.3.1 abridged.fxm**  
Abridged application for multiple run flow computers (X/P2, X/P3, XP4, X/R2, X/R3). This application has the following restrictions: no reverse totals and averages, no hourly and period B totalizers and averages, station sampler logic only (no separate samplers for each run), number of products limited to 8.

## New Features/Changes

### 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 2.1.0 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 2.3.0 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.

Flow computer type	<span>i</span>	Run only	
Common density input	<span>i</span>	Run only	
Common viscosity input	<span>i</span>	Station / run	
		Proving / run	
		Station / proving / run	
		Station only	
		Proving only	
		Station / proving	
		Prover IO server	

**CONSTANTS**

### 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 2.3.0 it's possible to switch between volume based or mass based batching and loading.

Batch end command	Batch end command	
Batch units	tonne	

**BATCH STATUS**

Batch total	<span>i</span>	0
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### Prove required flags / alarms

From version 2.3.0 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	<span>i</span>	Enabled		Density change threshold	<span>i</span>	10 kg/sm <sup>3</sup>	
Density deviation period	<span>i</span>	5 min		Standard density change		6.4 kg/sm <sup>3</sup>	
Prove required - std. density change		False					

### Support of OIML-R22 International Alcoholometric tables for ethanol / water mixture

The Liquid\_Metric application now supports the OIML-R22 standard for mixtures of ethanol and water.

## Liquid\_Metric v2.2.0 (September 2016)

The Liquid\_Metric application version 2.2.0 has been released in September 2016.

Besides the features and changes described below, this release also contains around 130 minor improvements and bug-fixes.

For a complete list of changes please contact ABB.

# New Features/Changes

## Three separate application files

The Liquid\_Metric 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\_Metric Master 2.2.0 loading.fxm**  
Full application for single run flow computers (X/S, X/P1, X/R1) with added loading functionality
- **Liquid\_Metric Master 2.2.0 abridged.fxm**  
Abridged application for multiple run flow computers (X/P2, X/P3, XP4, X/R2, X/R3). This application has the following restrictions: no reverse totals and averages, no hourly and period B totalizers and averages, station sampler logic only (no separate samplers for each run), number of products limited to 8.

## Loading functionality

Liquid\_Metric 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

## 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. From this application version 2.2.0 alternatively the average meter factor method can be selected.

## Flow computer configuration report

From version Liquid\_Metric v2.2.0 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.



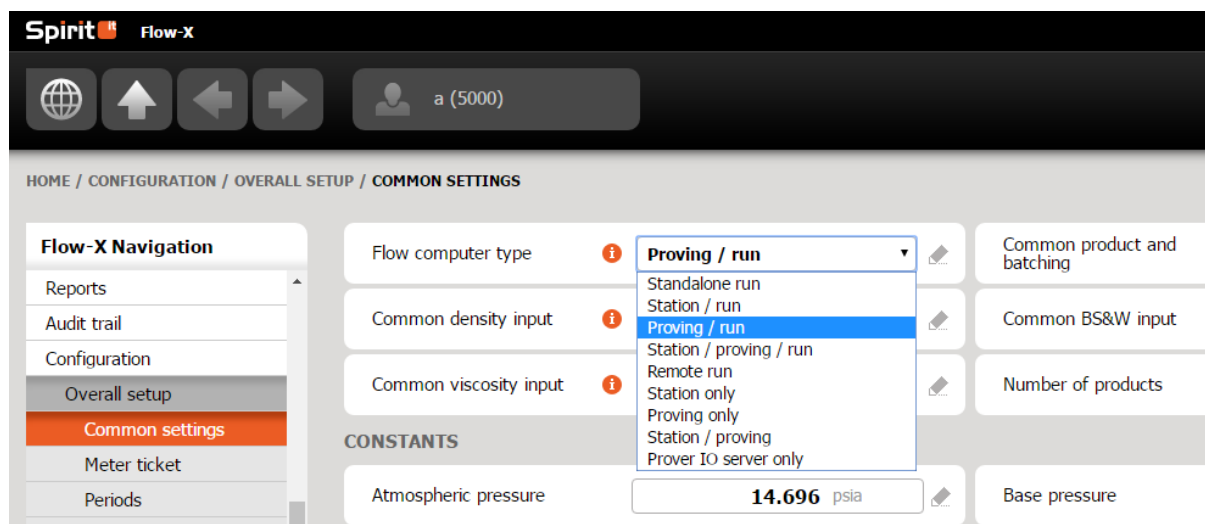
COMMON SETTINGS	Display: Configuration, Overall setup, Common settings
Flow computer type	Standalone run
Station product / batching	Disabled
Station density	Disabled
Station BS&W	Disabled
Station viscosity	Disabled
Nr. of products	1
Volume rollover [m3]	1000000000
Mass rollover [tonne]	1000000000
Mass 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

Because the configuration report is a large report containing a lot of data, it requires quite a lot of extra memory and is, therefore, only available in the Liquid\_USC Master 2.2.0.fxm and Liquid\_USC Master 2.2.0 loading.fxm files.

# Liquid\_Metric v2.1.0 (June 2015)

## 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.

## 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).

For mass meters, additionally the mass and density rounding rules from API MPMS 5.6 are applied.

## 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**.

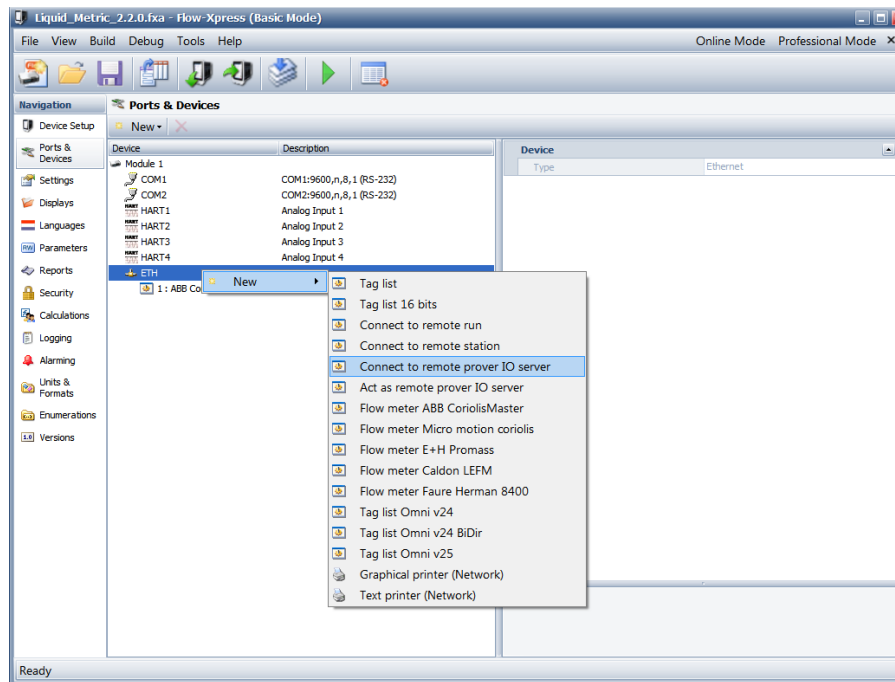
## Remote prover IO

From version 2.1.0 the Liquid\_Metric application supports remote prover functionality. In this concept a number of single stream flow computers are involved. On each of them both run and proving functionality are enabled, so each flow computer can prove its own meter. However, the prover IO (prover tempera-

tures, pressures, density, prove start command, valve commands, etc.) is only connected to one flow computer. All other flow computers are communicating to this 'remote prover IO server' flow computer in order to retrieve the process values and issue valve and prove commands.

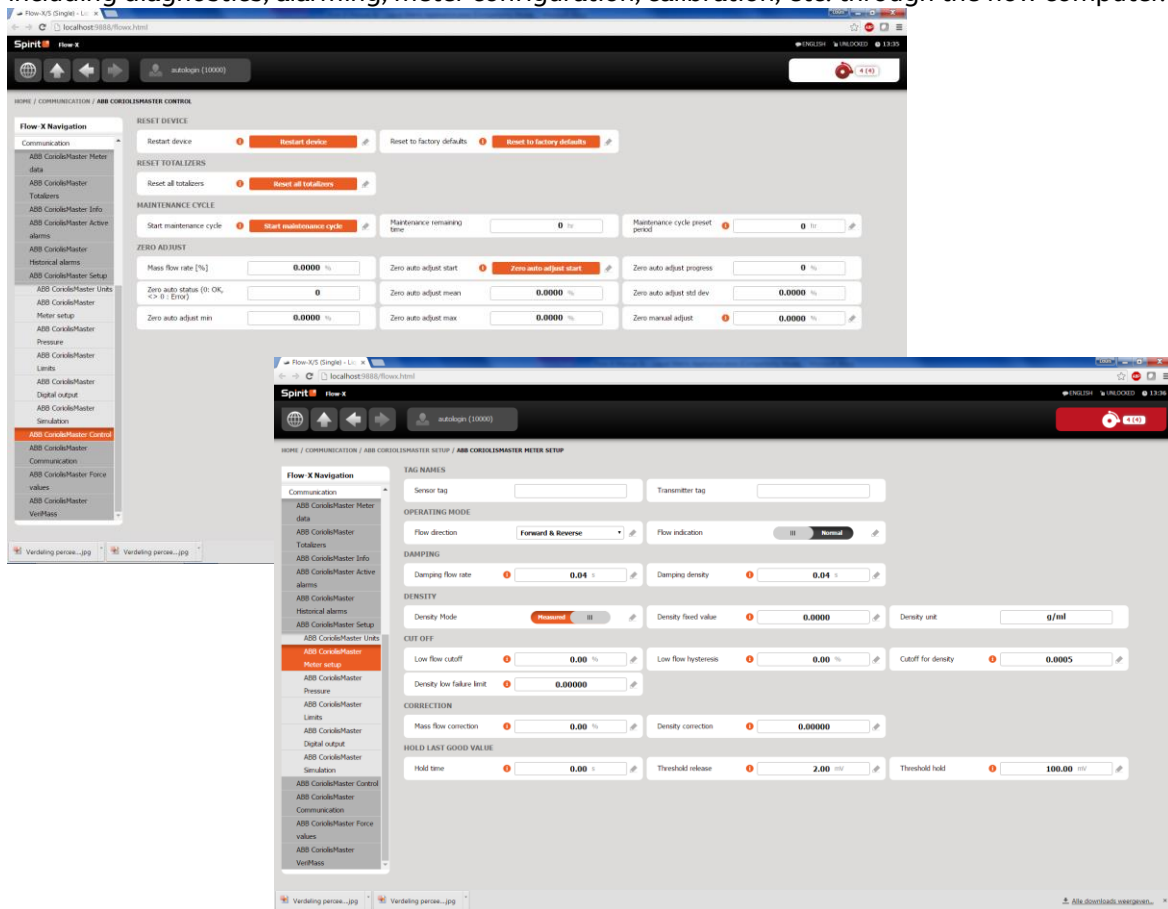
It's also possible to enable meter run functionality on the prover IO server flow computer as well. In this case the prover IO is used locally (for proving the run of the prover IO server FC itself) and remotely (for proving the other runs).

In order to be able to communicate to the remote 'prover IO server' the run flow computers must have the '**Connect to remote prover IO server**' driver configured. On the remote prover IO server FC the '**Act as remote prover IO server**' driver has to be enabled.



## Full support of ABB Coriolismaster meter

From version 2.1.0 the Liquid\_Metric application contains full support of the ABB Coriolismaster meter, including diagnostics, alarming, meter configuration, calibration, etc. through the flow computer.



# Liquid\_Metric v2.0.2 (October 2014)

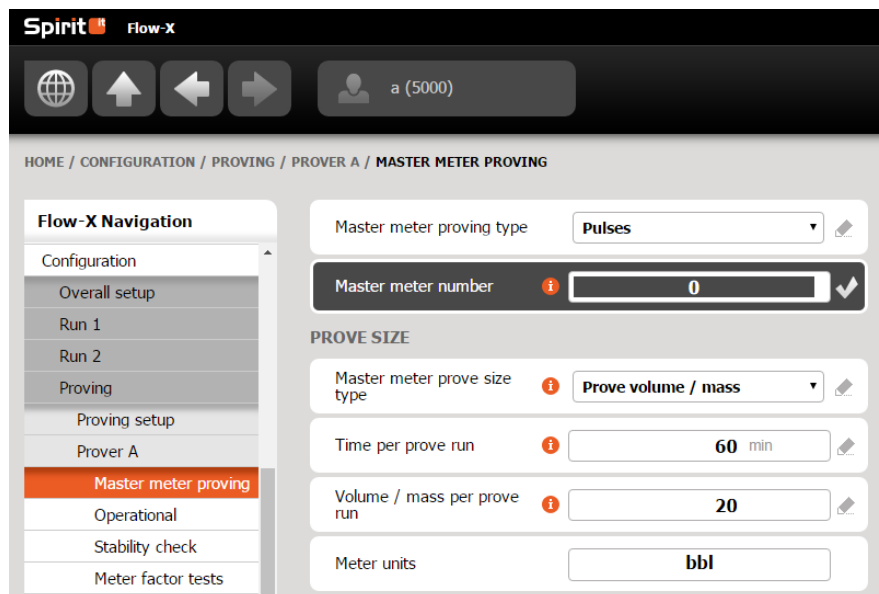
## Master meter proving in one module only (with limited functionality)

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'.



The screenshot displays the Spirit Flow-X software interface for configuring master meter proving. The top navigation bar includes the Spirit logo, 'Flow-X', and a user profile 'a (5000)'. The breadcrumb trail reads: HOME / CONFIGURATION / PROVING / PROVER A / MASTER METER PROVING. On the left, a 'Flow-X Navigation' sidebar lists menu items: Configuration, Overall setup, Run 1, Run 2, Proving, Proving setup, Prover A, Master meter proving (highlighted in orange), Operational, Stability check, and Meter factor tests. The main configuration area contains the following settings:

- Master meter proving type: Pulses
- Master meter number: 0
- PROVE SIZE section:
  - Master meter prove size type: Prove volume / mass
  - Time per prove run: 60 min
  - Volume / mass per prove run: 20
  - Meter units: bbl

# Liquid\_Metric v2.0.1 (April 2014)

## 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.

## 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.

