



# $\mu$ Flow

## *Gas flow meter*

### **Operation and Maintenance Manual**





**$\mu$ Flow**

## **Release History**

Version 2.0, February 2022

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## TABLE OF CONTENTS

<b>1</b>	<b>PREFACE.....</b>	<b>1</b>
<b>2</b>	<b>GENERAL INFORMATION.....</b>	<b>2</b>
2.1	Conventional Gas Flow Meters.....	2
2.2	Advantages of $\mu$ Flow over Conventional Flow Meters.....	2
<b>3</b>	<b>DELIVERY CHECKS.....</b>	<b>4</b>
3.1	$\mu$ Flow Gas Meter Box Content.....	4
3.2	Optional Equipment.....	4
<b>4</b>	<b>PRE-COMMISSIONING.....</b>	<b>7</b>
<b>5</b>	<b>QUALITY RULES AND RECOMMENDATIONS.....</b>	<b>7</b>
<b>6</b>	<b>SAFETY CONSIDERATIONS.....</b>	<b>8</b>
<b>7</b>	<b>EQUIPMENT DESCRIPTION (DESIGN/FUNCTION).....</b>	<b>9</b>
7.1	$\mu$ Flow Gas Meter with Front Power and Analogue Output Port.....	10
7.2	$\mu$ Flow Gas Meter with Side Power and Analogue Output Port.....	11
7.3	Charger for the $\mu$ Flow Gas Flow Meter.....	12
7.4	$\mu$ Flow Gas Flow Meter Technical Characteristics.....	13
7.5	Data Logger System Technical Characteristics.....	14
<b>8</b>	<b>OPERATION.....</b>	<b>15</b>
8.1	Before Start up.....	15
8.2	Start up.....	18
8.3	Monitoring.....	18
8.4	End of Operation.....	19
<b>9</b>	<b>MAINTENANCE.....</b>	<b>19</b>
<b>10</b>	<b><math>\mu</math>FLOW SOFTWARE.....</b>	<b>20</b>
10.1	Installation of the $\mu$ Flow Data Logger Software (Windows 8).....	20
10.2	$\mu$ Flow Data Logger Software User Guide.....	34

## **1 PREFACE**

BPC Instruments AB (BPC) is a privately held company and market leader in the area of advanced control technologies for the commercial biogas industry, providing technologies and services that support the efficient design and operation of biogas plants & processes. The company was founded in 2006, bringing to market more than 15 years of industry leading research in the area of instrumentation, control and automation of anaerobic digestion processes.

At the end of 2009, BPC launched the Automatic Methane Potential Test System I (AMPTS I), a revolutionary product in the area of on-site lab equipment for methane potential analysis. The number of users of AMPTS I grew quickly and today there are users in more than 40 countries, located in the Americas, EMEA, and Asia Pacific regions. In April 2011 an updated version of the AMPTS was made commercially available and at the end of 2012 the BioReactor Simulator (BRS) was introduced to the market. As of January 2013, a new instrument ( $\mu$ Flow) for measuring ultra-low gas flows with high precision has been offered to the market.

The  $\mu$ Flow is a flow meter which has been designed for on-line, real-time monitoring of gases over a wide detection range and for most indoor laboratory scale applications. Suitable applications include biogas process studies, ethanol fermentation, dark fermentation for bio-hydrogen, and leak rate detection.

## **2 GENERAL INFORMATION**

Anaerobic biodegradation processes are gaining in interest among industry and local governments, due to their ability to produce energy and reduce sludge yields.

In the anaerobic biodegradation process, gas flow rate represents a key parameter for evaluating the performance of a process. In laboratory scale experiments, the bioreactor volume ranges from 1 to 50 l with a low gas production, especially during the start-up period, often within several hundreds millilitres per hour. Measuring such a low volume of gas accurately is not an easy task using commercially available gas flow meters since they do not measure such low flow rates.

A gas flow meter for laboratory-scale reactors has higher demands compared with a meter adapted for a large-scale anaerobic reactor. This includes no gas losses, stable calibration through time, and higher sampling rates, and ultimately more reliable gas measurements. The  $\mu$ Flow meets all the needs of the most demanding biogas/biofuel labs and user applications.

### **2.1 Conventional Gas Flow Meters**

Conventional gas flow meters (i) utilise techniques (e.g., thermal, Coriolis mass, ultrasonic, turbine, vortex shedding etc.) that measure parameters such as velocity or mass of the flowing stream to indirectly determine the volumetric flow or (ii) measure the volume of the gas directly by liquid displacement. Although use of the liquid displacement technique is simple and straightforward, errors associated with volume determination still exist when the investigated gas is soluble in the displaceable liquid and the barrier solution is in direct and continuous contact with the atmosphere. Moreover, in order to compare the data obtained from different laboratories, correction factors need to be included in volume calculations to obtain gas volumes at standard temperature and pressure, thus reducing or eliminating the error from this source.

### **2.2 Advantages of $\mu$ Flow over Conventional Flow Meters**

The  $\mu$ Flow provides several unique functionalities that are important for monitoring the gas flow rate during a biodegradation process:

- Large linear detection range (20 to 4000 ml/h) that fits perfectly with most lab- and small pilot-scale applications
- Real-time pressure and temperature compensation for gas flow rate and volume measurements ensure that all gas flow measurements are accurate
- Real-time gas flow rate and normalisation allow for gas measurements to be standardised

- Standard analogue current signal output for automatic data acquisition (4-20 mA)
- Low maintenance requirements
- LCD display for visualisation of variables
- The design and calibration delivers highly precise measurements
- One of the most cost competitive solutions on the market today.

### 3 DELIVERY CHECKS

At delivery, unpack and check that the contents match with what is listed below in the Section “Box Content”.

If the packaging or the equipment is broken or damaged at delivery, please:

- a) Document and take photos of the parts and packaging.
- b) Inform the transport company at the time of delivery.
- c) Make sure that the transport company documents the incident.
- d) Inform the seller of the incident.

#### 3.1 $\mu$ Flow Gas Meter Box Content

See also Chapter 7 (Equipment Description) for pictures of included parts.

1 flow meter

1 power adapter (input 100-240 V ~ 50/60 Hz, output 12 V DC / 0.5 A)

1 manual

#### 3.2 Optional Equipment

For automatic data logging of gas flow rate, BPC provides two different Data Logger systems together with the software for Microsoft Windows:

- (1) Data Logger with USB interface



## (2) Universal Data Logger with Ethernet interface



The hardware module includes eight analog current input channels for high-performance control and monitoring applications. The system features analogue current input ranges of 4 to 20 mA. To protect against signal transients, the module includes a channel-to-earth ground double isolation barrier for safety and noise immunity.

When deciding between a USB and Ethernet interface, it's important to weight the advantages and disadvantages of both.

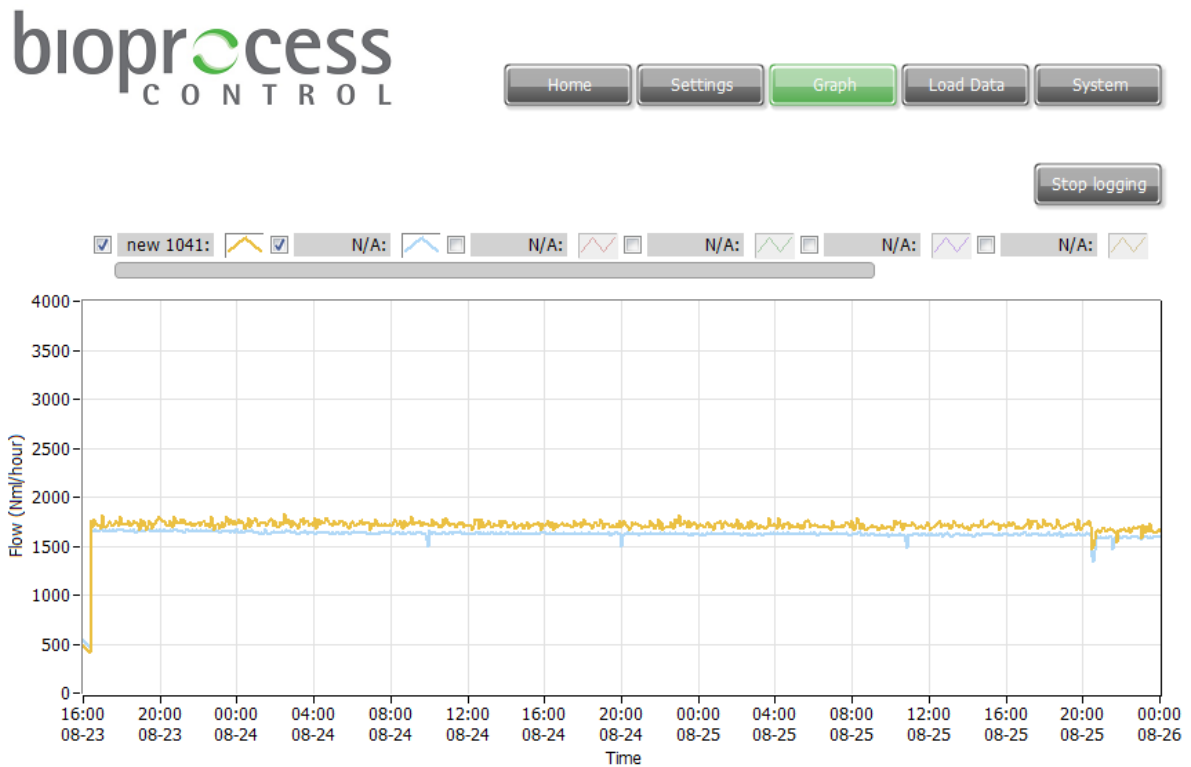
When it comes to the Data Logger unit with a USB interface, the most obvious benefit is cost. In addition, the USB instrument is easier to install and most PCs have plenty of USB ports to choose from. On the downside, the Data Logger with USB interface can only be accessed over a relatively short distance. In addition, the USB connection is not really designed for reliable data communication over a long period of time.

While slightly more expensive, the Universal Data Logger unit with Ethernet interface offers more functionality by allowing the user to set each channel to measure not only gas flow, but also temperature, pH and methane content. It also has a greater flexibility with regards to distance (cable length up to 100 m) between Data Logger and computer, as well as a more stable connection. (For more information about the Universal Data Logger, please read the Universal Data Logger Operation and Maintenance Manual.)

In short, if the aim of the  $\mu$ Flow user is to view real-time data, in the immediate vicinity of the device under test and store the data on the local hard driver, a Data Logger unit with USB interface is the economical choice. If, on the other hand, the user is interested in a product with more functionality, flexibility and reliability of data communication over a long period of time, the Universal Data Logger unit with an Ethernet interface is the best choice.

The Data Logger software automatically logs the gas flow rate, shows a real-time visualisation of the flow rate trend curve, as well as provides report generation. One Data Logger system can

support up to 8  $\mu$ Flow devices. A Data Logger unit is not included in the standard  $\mu$ Flow package. A screenshot of the software user interface is presented below.



## 4 PRE-COMMISSIONING

The following items are not included in the delivered  $\mu$ Flow, however they will/may be required to operate the flow meter:

- Data acquisition system available from BPC
- Additional wall socket adapters (plugs/contacts), as the ones supplied are according to European, US or UK standards, depending on original purchase order
- If the customer has a gas chromatograph and is interested in off-line biogas composition analysis, gas-sampling units can be ordered separately from BPC.



## 5 QUALITY RULES AND RECOMMENDATIONS

- The product guarantee provided corresponds to the guarantee stipulated on the confirmed product order form and shipping documentation
- For high accuracy measurements, the  $\mu$ Flow should not be exposed to mechanical vibrations and/or high frequency radio transmissions and should be placed on a level and stable surface
- Only the parts delivered with the product can be used with the system in order to guarantee the quality and performance of the product
- BPC reserves the right to correct any possible text and image errors as well as changes to technical data in this manual.

### Before Getting Started

- Read this manual before installing and using the equipment.
- Keep the instruction manual for future reference and make sure it is easily available for people who regularly use the  $\mu$ Flow.
- If the Universal Data Logger is used with the  $\mu$ Flow Gas Meter, please read the Universal Data Logger Operation and Maintenance Manual.

## **6 SAFETY CONSIDERATIONS**

The  $\mu$ Flow should be used in an environment with good ventilation, preferably in a laboratory fume hood, especially when this detection unit is connected to bioreactors, which are generating very high volumes of toxic or slightly aggressive gases.

Always be cautious when handling electrical devices close to water.

## **7 EQUIPMENT DESCRIPTION (DESIGN/FUNCTION)**

The  $\mu$ Flow is a flow meter for ultra-low gas flow detection. Its design and highly precise calibration delivers a measurement precision of  $\pm 1\%$ , with a resolution of about 10 ml. Therefore, the  $\mu$ Flow meets the needs of the most demanding biogas/biofuel labs and user applications.

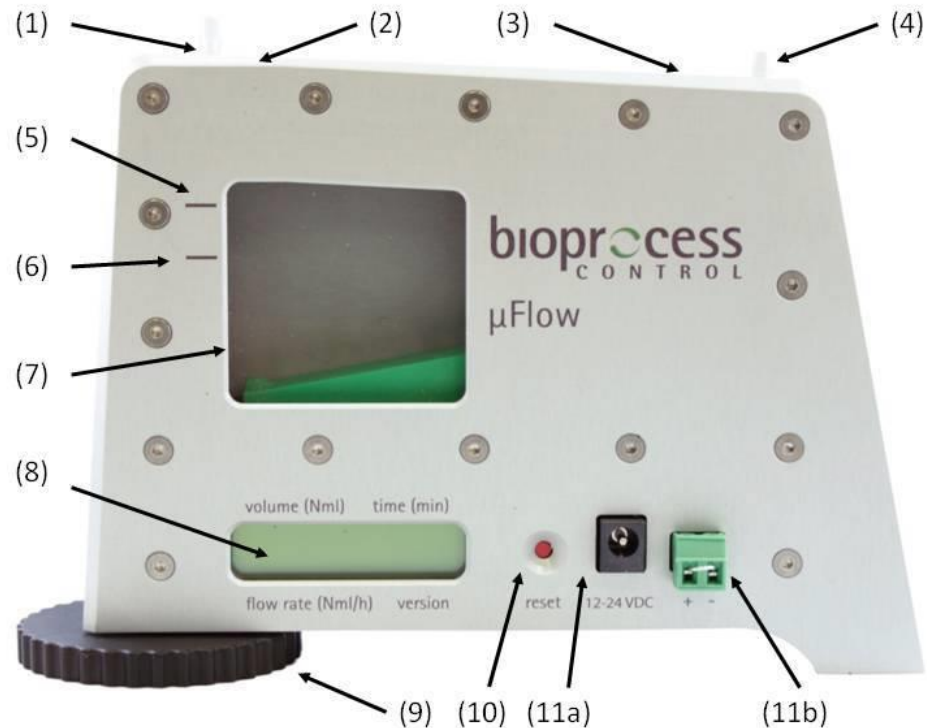
The unit contains a glass window, allowing for visual inspection of the flow cell movement, and has an adjustable foot to ensure the correct installation position for high precision measurements.

The measuring device works according to the principle of liquid displacement and buoyancy; a digital pulse is generated when a defined volume of gas flows through the device. The unit offers a standard signal output for automatic data acquisition and provides users with an embedded timer and reset button for easy logging of accumulated gas flow volume over a defined period of time.

The  $\mu$ Flow automatically normalises gas flow and volume measurements with real-time temperature and pressure compensation. This allows for gas measurements and data presentation to be standardised and thus, the impact of measurement conditions are minimised. The temperature and pressure of the gas are measured every time a flow cell opens, allowing the user to derive exact kinetic information compensated for any variation over time. The volumes are normalised to 0 °C and 1 atm.

There are two versions of the  $\mu$ Flow Gas Meter available. One has the power supply and analogue output connectors on the front (7.1), and the other has a combined port for power supply and analogue output on the side (7.2).

## 7.1 $\mu$ Flow Gas Meter with Front Power and Analogue Output Port



(1) Outlet for gas flow

(2) Level gauge

(3) Port for filling water

(4) Inlet for gas flow

(5) Maximum filling level indicator

(6) Minimum filling level indicator

(7) Glass window for visual inspection of the flow cell movement

(8) Liquid Crystal Display (LCD) for real time visualisation of normalised gas volume & flow rate, duration of the experiment and version of the software

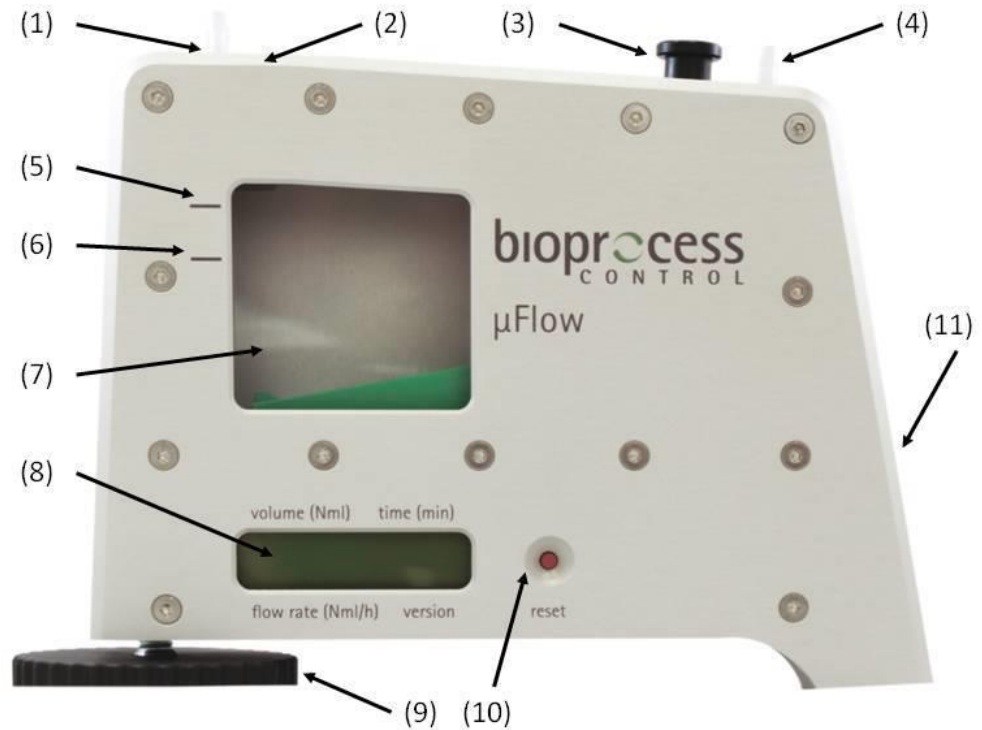
(9) Adjustable foot

(10) Button for instant pressure and temperature display (press for less than 5 seconds) and for resetting the timer (press for more than 5 seconds)

(11a) Power input

(11b) Standard signal output for automatic data acquisition

## 7.2 $\mu$ Flow Gas Meter with Side Power and Analogue Output Port



(1) Outlet for gas flow

(2) Level gauge

(3) Port for filling water

(4) Inlet for gas flow

(5) Maximum filling level indicator

(6) Minimum filling level indicator

(7) Glass window for visual inspection of the flow cell movement

(8) Liquid Crystal Display (LCD) for real time visualisation of normalised gas volume & flow rate, duration of the experiment and version of the software

(9) Adjustable foot

(10) Button for instant pressure and temperature display (press for less than 5 seconds) and for resetting the timer (press for more than 5 seconds)

(11) Combined power input and analogue output port

Angle view of the  $\mu$ Flow meter with the combined power input and analogue output port on the side:



### 7.3 Charger for the $\mu$ Flow Gas Flow Meter

The power input port is located at different positions on the two versions of the  $\mu$ Flow meters. The charger is inserted at (11b) on the front of the  $\mu$ Flow meter described in chapter 7.1, and at (11) on the side on the  $\mu$ Flow meter described in chapter 7.2.



## 7.4 $\mu$ Flow Gas Flow Meter Technical Characteristics

### GENERAL

Measuring resolution: 10 ml

Measuring range: 20 to 4000 ml/h

Signal output for flow rate: 4-20 mA

Repeatability: 1%

Working principle: liquid displacement & buoyancy

Built-in sensors: pressure and temperature

LCD display: normalised gas flow (NmL/h), volume (Nml) and time (min)

Materials: high quality aluminium

Dimension: 19×14×6 cm

Weight: 0.180 kg

Power supply: input 100-240 V ~ 50/60 Hz, output 12 V DC / 0.5 A

Usage: indoor applications for inert and slightly aggressive gases

### FEATURES

Large linear detection range (up to 4000 ml/h), which fits perfectly with most of lab- and small pilot-scale applications

Embedded timer and reset button for easy logging of accumulated gas volume over a defined period of time

Automatic gas flow and volume normalisation with real-time temperature and pressure compensation, which allow for gas measurement standardisation

Standard analogue current signal output (4-20 mA) for automatic data acquisition

Adjustable foot and horizontal gauge to ensure the correct installation position for high precision measurements

Glass window for visualisation of flow cell movement

Low maintenance requirements

Pre-calibration to ensure measurement accuracy

## 7.5 Data Logger System Technical Characteristics

The PC-based Data Logger system for  $\mu$ Flow consists of a hardware module controlled by an easy-to-use software program.

### DATA LOGGER HARDWARE

The hardware module has 8 plug & play terminal connectors that provide connections for 8 analog input channels. Each channel has an AI plug & play terminal to which you can connect a current signal. The module has a common terminal, COM that is internally connected to the isolated ground reference of the module.

The main characteristics of the hardware module are presented below:

- 8 analogue current input channels
- 4 to 20 mA programmable input ranges
- Universal Data Logger with Ethernet interface: 16-bit resolution, 200 kS/s aggregate sampling rate
- $\mu$ Flow Data Logger with USB interface: 12 bit resolution, 10 kS/s sampling rate
- Indoor application only
- Power adapter: input 100-240 V ~ 50/60 Hz, output 24 V DC /0.5 A or higher.

### DATA LOGGER SOFTWARE

The Data Logger software is needed in order for the Data Logger hardware to work with a PC. It is delivered on a USB card together with the Data Logger hardware. Please notice that the Data Logger software is delivered with a license control and can only work together with the Data Logger hardware delivered at the same time.



## 8 OPERATION

In this section, references are given to pictures in the Chapter 7 (Equipment Description) in the form of a number within parenthesis, e.g., (1).

### 8.1 Before Start up

#### INSTALLATION OF THE $\mu$ FLOW GAS METER

- a) Install the instrument on a flat and stable surface. Use appropriate instrumentation (i.e., bubble level device) to verify the horizontality of the surface and to adjust its position if it is needed.
- b) Use the adjustable foot (9) and the level gauge (2) to ensure the correct installation position.
- c) Fill up the measurement chamber with the packing liquid (e.g., deionised or distilled water) through the port specially designed for filling the packing liquid (3) by using a small syringe. It is also possible to fill the instrument through the gas flow inlet (4) with the help of a small syringe.
- d) Check the water level in the chamber. It should be within the limits of the marking. A water level below the minimum acceptable level (6) can cause errors in the measurement of the volume and flow rate of the gas.
- e) If the  $\mu$ Flow Gas Meter will be used as a stand-alone unit (i.e. without a Data Logger system) connect the power cable to the power connector on the front (11a) or to the combined power and analogue output port on the side (11), depending on what version of the  $\mu$ Flow Gas Meter is used. Then connect the power adapter to a power outlet. If the  $\mu$ Flow Gas Meter with the analogue output port on the front is used as a stand-alone unit, the green terminator plug must be inserted in the analogue output port (11b).
- f) If the unit will be connected to a Data Logger system, connect the power cable to either the power input (11a) and the analogue output cable to the port on the front (11b), or to the combined power and analogue output port on the side (11), again depending on which version is used.

When a Data Logger System is used, make sure that the end of the analogue output cable marked with blue (or grey for some versions) is always connected to the Data Logger, and not to the  $\mu$ Flow Gas Meter.

## INSTALLATION OF THE DATA LOGGER HARDWARE

- a) Connect the Data Logger to the computer. The Data Logger (in the left picture below) uses a USB interface, and the Universal Data Logger (in the right picture below) uses an Ethernet cable. (The pictures show the back of the devices.)



- b) It is very important that the blue (or grey for some versions) end of the analogue signal cable is used when inserting the cable into the port on the Data Logger. **Important:** If the Universal Data Logger is used, please refer to the Universal Data Logger Operation and Maintenance Manual, before connecting the signal cables. The Universal Data Logger has more options for measuring parameters and signal processing types.



The pictures below show the cable ports on the front of the Data Loggers. The Data Logger with a USB interface is shown to the left, and the Universal Data Logger with Ethernet interface to the right.



- c) Insert the other end of the analogue signal cable to a  $\mu$ Flow Gas Meter. **Important:** If the Universal Data Logger is used, please refer to the Universal Data Logger Operation and Maintenance Manual, before connecting the signal cables. The Universal Data Logger has more options for measuring parameters and signal processing types.
- d) If more reactors will be used in the experiment, repeat step b) and c) for each reactor and corresponding measuring device.
- e) When all reactors and gas meters have been connected, plug the power adapter into the power input at the back of the Data Logger. Then connect it to a wall socket. **Please note:** The characteristics for the power adapters for the Data Logger and the  $\mu$ Flow Gas Meter are different, so make sure to use the correct one. (See Chapter 7 for technical characteristics.)



- f) Enter the names and settings of the reactors in the Data Logger software. (See Software user guide chapter. If the Universal Data Logger is used, please refer to the Software chapter in Universal Data Logger Operation and Maintenance Manual.)

#### GAS PIPE CONNECTION

- a) Connect the gas generation source (e.g., bioreactor) to the gas flow inlet (4) preferably with a tube from material, which is air tight (e.g., Tygon®). The gas will leave the  $\mu$ Flow at the gas flow outlet (1). The off-gas can be collected in a gas bag if the measurement of the gas composition is of interest or it can be linked directly to a fume hood through a gas tube.
- b) Make sure the gas flow is within the measurement range of the flow meter.
- c) Connect the power supply (12 V DC / 0.5 A) to the gas meter and to a 100-240 V ~ 50/60 Hz standard power socket. The  $\mu$ Flow is ready for operation.

#### MOVING OF THE FILLED UNIT

- a) Care should be taken if the  $\mu$ Flow has to be moved after having been filled with packing liquid. In this case, transportation should be done in vertical position in order to avoid packing liquid from exiting the unit.

## 8.2 Start up

At this stage, it is assumed that the  $\mu$ Flow is already installed according to section 8.1, the gas source is connected to the inlet port of the gas flow and the power supply also is connected.

#### MEASURING DEVICE

- a) Check the instant pressure and temperature by pressing the reset button for approximately 2 seconds.
- b) Reset the timer just before starting a new experiment. This can be done by pressing the reset button (10) for more than 5 seconds or by disconnecting the power for the same interval of time.
- c) Check that the accumulated gas volume and the instant gas flow rate at the beginning of the experiment are displayed as 0 Nml and 0 Nml/h respectively.

## 8.3 Monitoring

#### MEASURING DEVICE

- a) Periodically check that the water level in the gas flow measuring device is within the recommended range.
- b) Fill up with additional deionised or distilled water to the recommended water level when necessary.
- c) Note periodically the parameters of interest (e.g., volume, flow rate, time duration of the experiment) by reading the values from the LCD screen of the system.

Important! If the instantaneous flow rate is out of range (i.e.  $\geq 4000$  Nml/h) the value displayed by the system will be marked with an asterisk (i.e., \* 4000). The same symbol will be displayed in front of the flow rate value if the corresponding value is not a measured value, but an estimated one. This situation can appear, for example, when the tubing from the gas source and the unit is disconnected and the last value for the flow rate is displayed after a corresponding interpolation.

## 8.4 End of Operation

- a) Note the total running time if this is of interest. In the displayed values, the last data collected will be from the last opening of a cell.
- b) If an automatic data acquisition system is connected to the unit, then generate a report. Download the report and open it to make sure that the report has been generated properly and that no errors occurred while downloading the file.
- c) Stop the logging by pressing the Stop button in the Graph page. Disconnect the power adapter from the wall socket. **Note:** When pressing the stop button, the experiment can no longer be continued.
- d) Disconnect the tube connection between the gas source (e.g., reactors) and the  $\mu$ Flow.
- e) Empty the water from the measurement chamber by opening the specific port (3) or the gas flow inlet port (4).

## 9 MAINTENANCE

When the carrier gas contains small particles, these particles can lead to sedimentation in the measuring chamber. When the experiment is stopped and the electrical connection and all the tubing are disconnected, the chamber can be cleaned by emptying and refilling the chamber using the proper port when the meter is kept upside down. The procedure is repeated until no sediments are present at the bottom of the chamber.

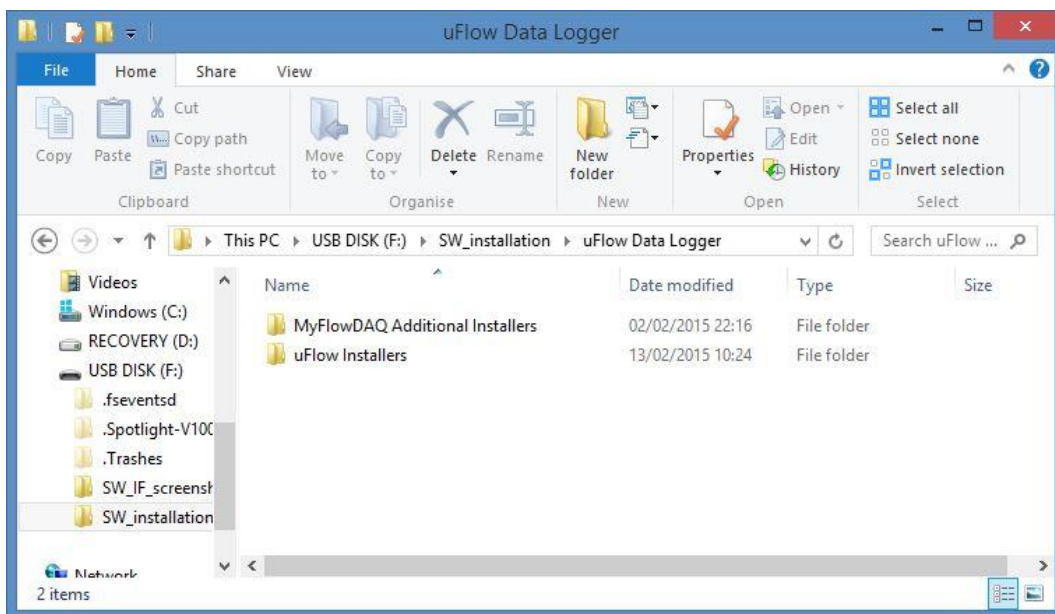
If the  $\mu$ Flow is not in use for a longer period, it is recommended to empty the measurement chamber and to store it in dry conditions.

## 10 $\mu$ FLOW SOFTWARE

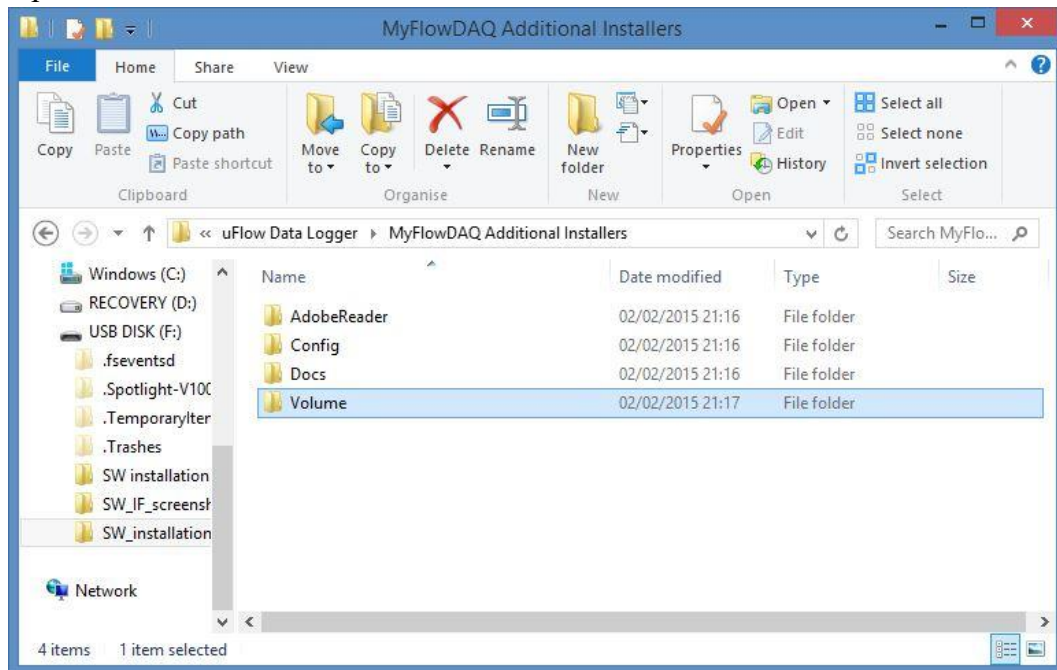
### 10.1 Installation of the $\mu$ Flow Data Logger Software (Windows 8)

The procedure below describes the installation of the  $\mu$ Flow Data Logger Software. The installation is divided into two steps. The files needed for the first part is collected in a folder called “MyFlowDAQ Additional Installers”, which also includes required installations of Adobe Reader and Open Office. The second part is collected in the “ $\mu$ Flow Installers”. (Installation instructions for the Universal Data Logger can be found in the Universal Data Logger Operation and Maintenance Manual.)

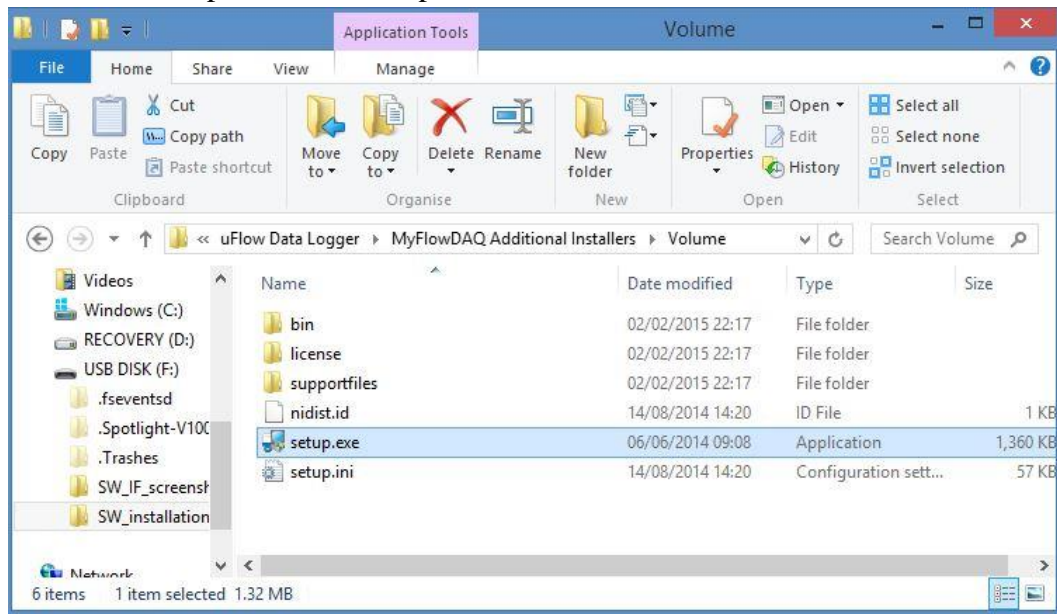
1. Insert the USB card with the  $\mu$ Flow Data Logger Software. Open the disk drive in Windows Explorer and open the “SW Installation folder”. Next, open the folder called “ $\mu$ Flow Data Logger”, and then the “MyFlowDAQ Additional Installers” folder.



2. Open the “Volume” folder.



3. Select the “setup.exe” file and open it.

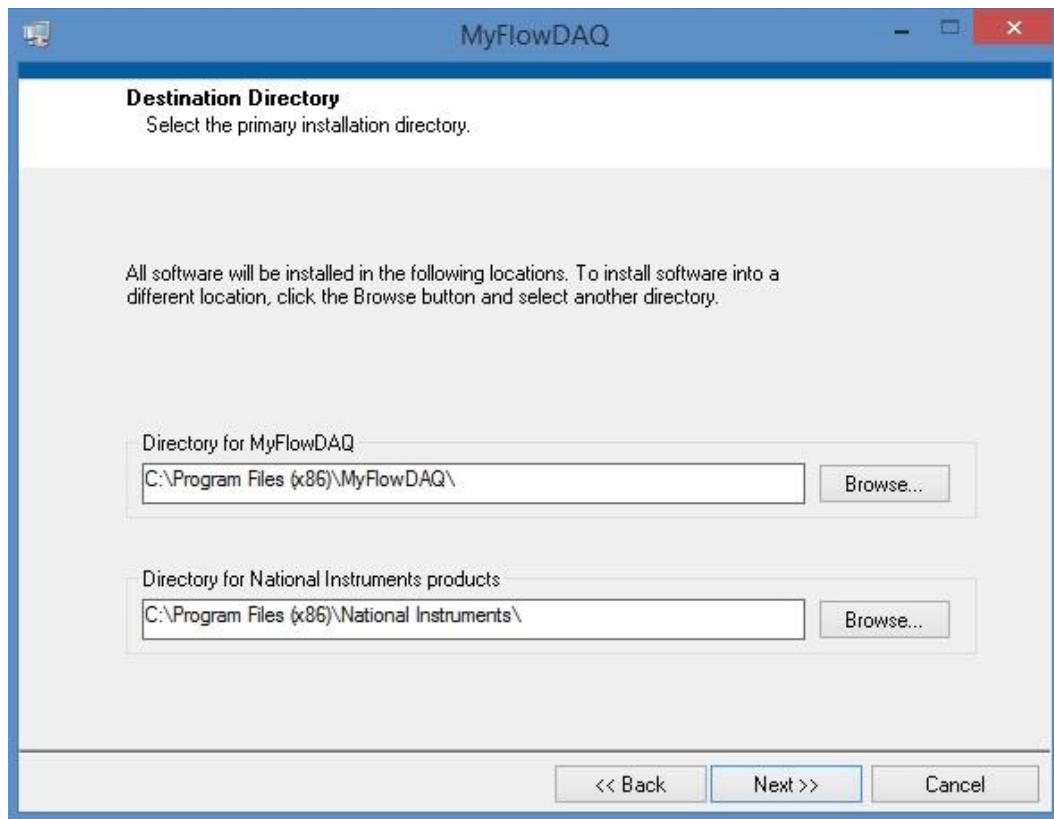


4. When the setup.exe file is opened, installation will be initialised, and a green bar will show the progress.

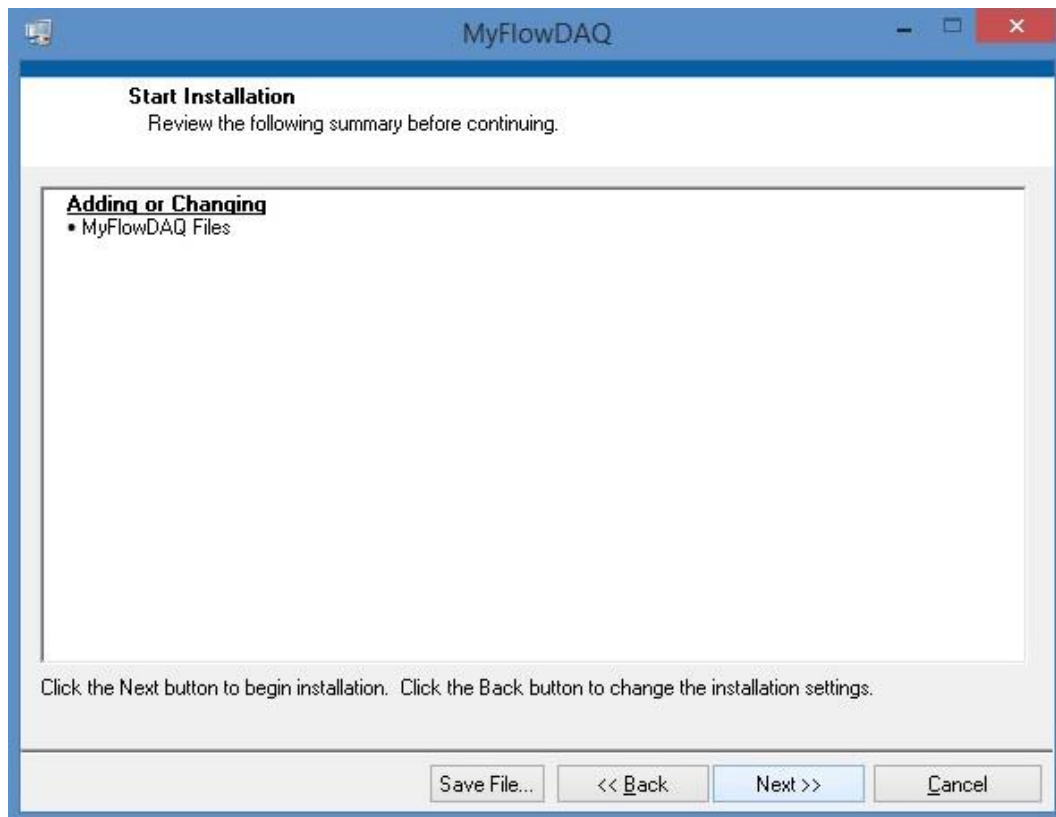


Select a destination directory for the “MyFlowData Logger” program files, and for the National Instrument products files that are part of the software.

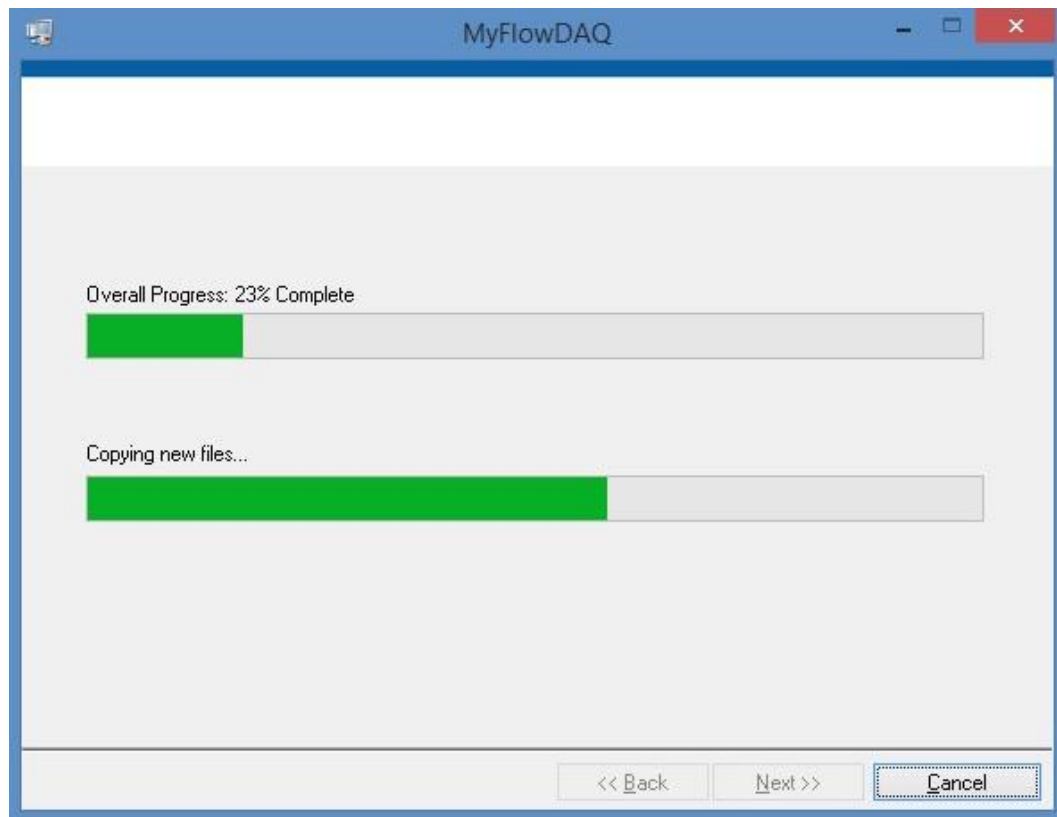
5. Click next.



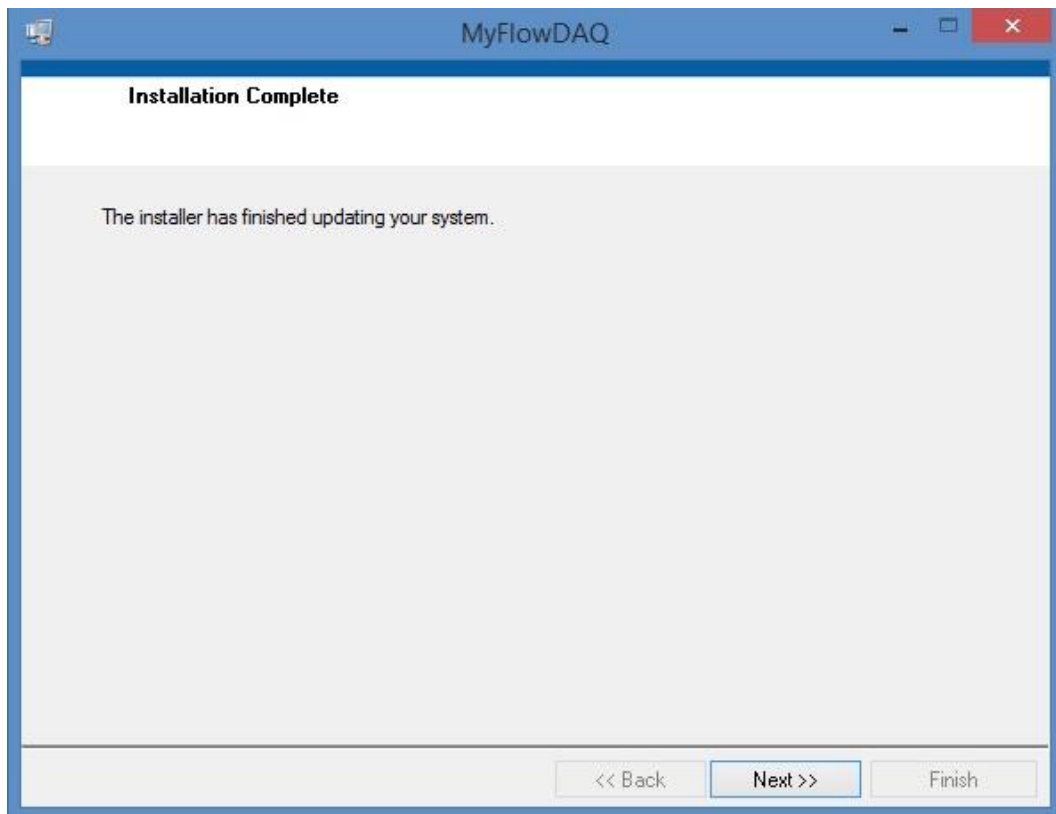
- When the installation summary shows up, start the installation by clicking “Next”.



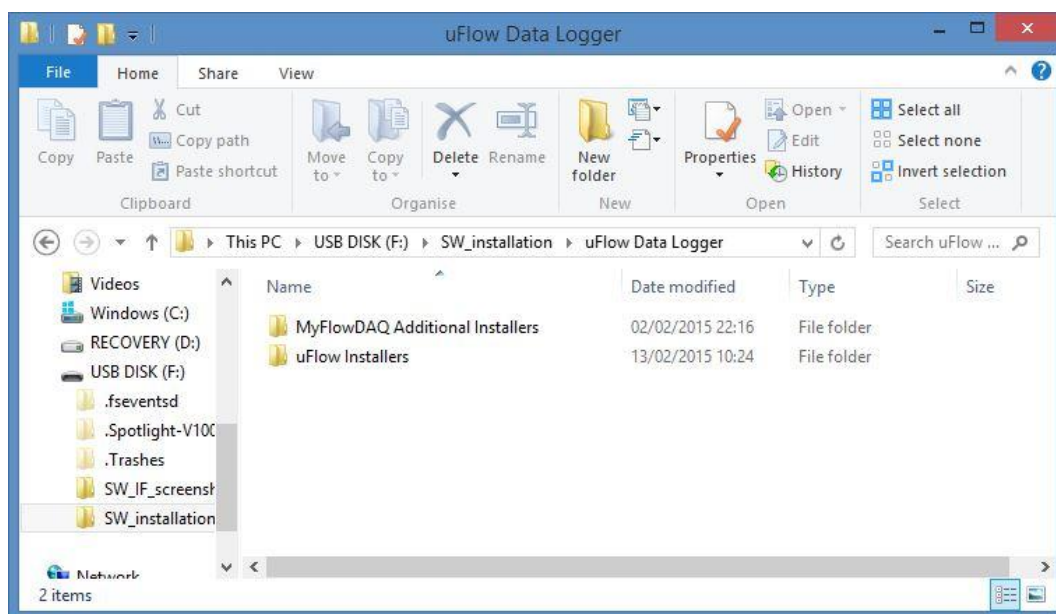
7. A window will show the installation progress.



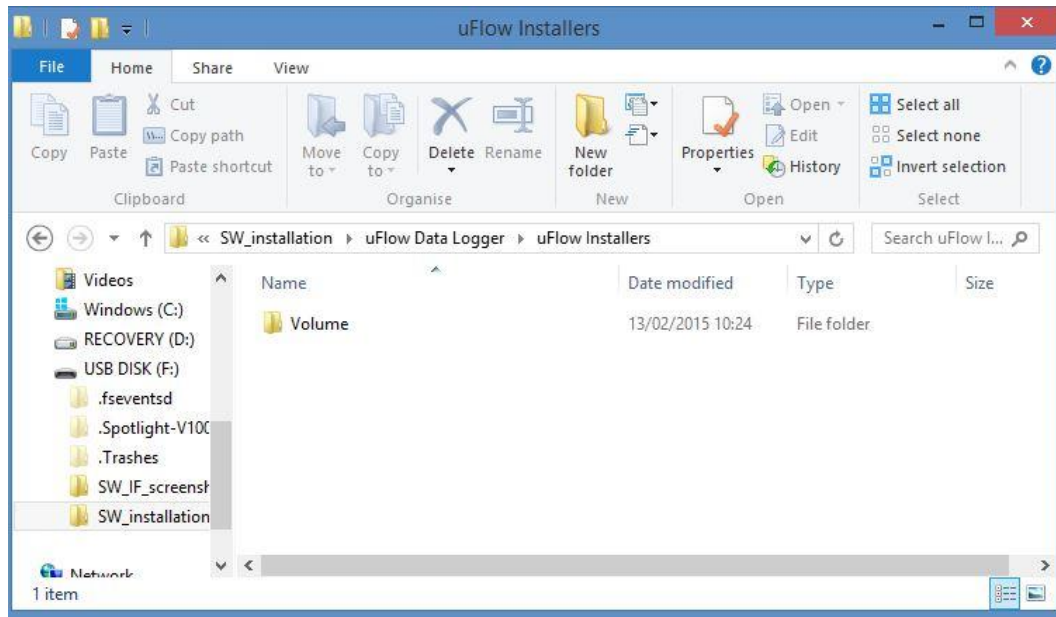
8. A message will follow when the installation is completed. Click “Next” to finalise.



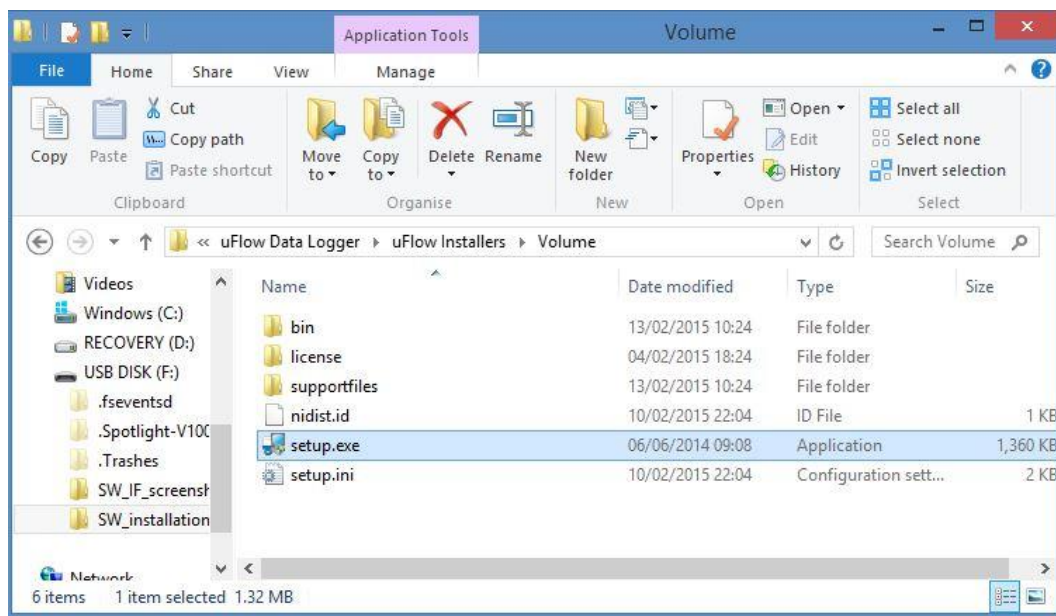
9. When the installation has been confirmed as successful, **restart the computer**.
10. Start the second part of the installation by opening the folder called “µFlow Installers”.



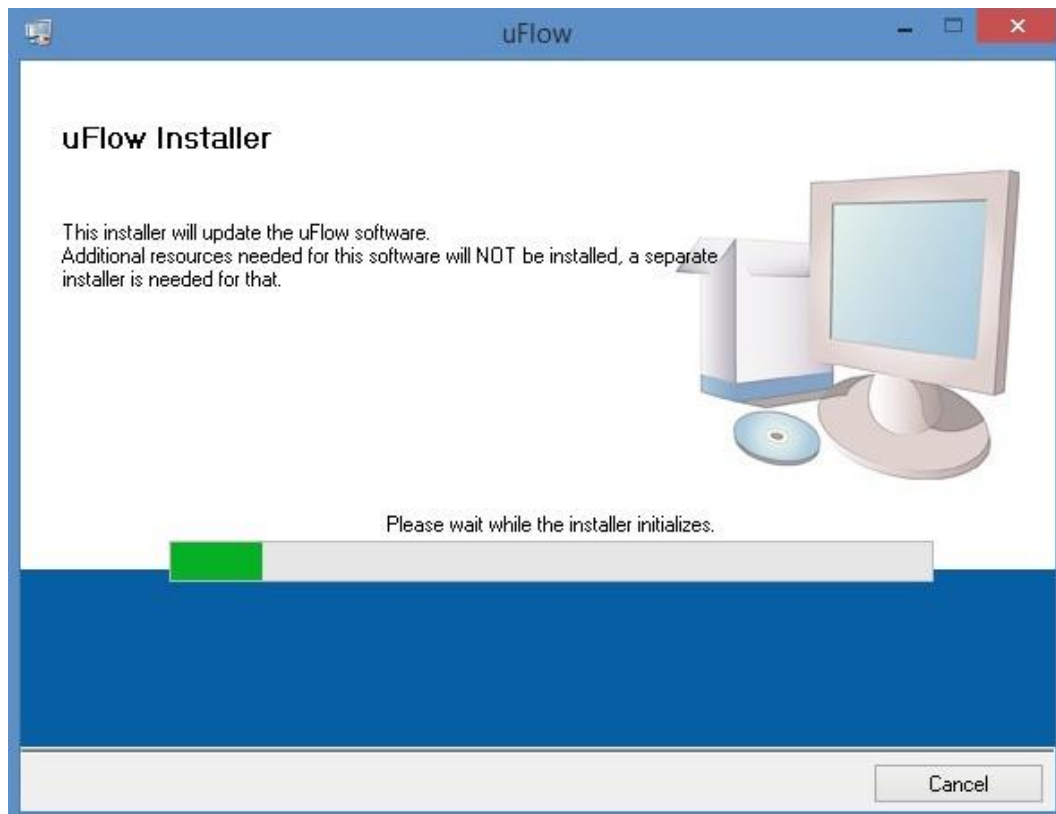
11. Open the “Volume” folder.



12. Select the setup.exe file and open it.



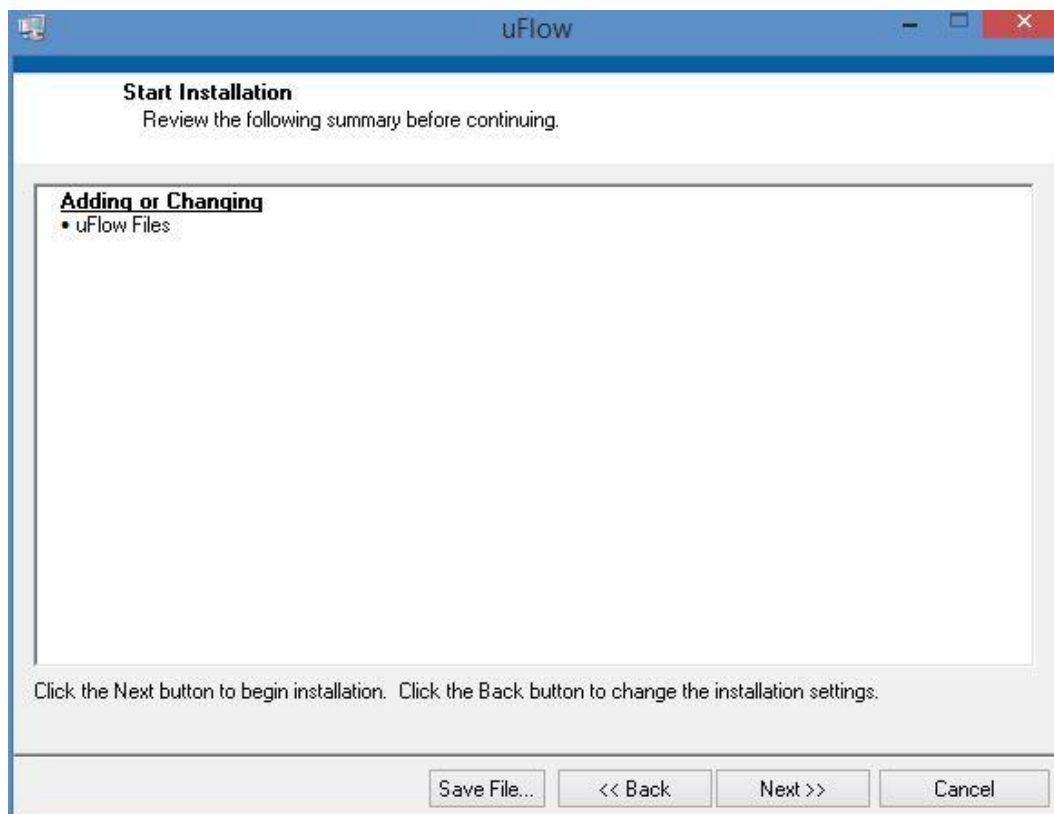
13. The installation is started, and a green status bar shows the progress.



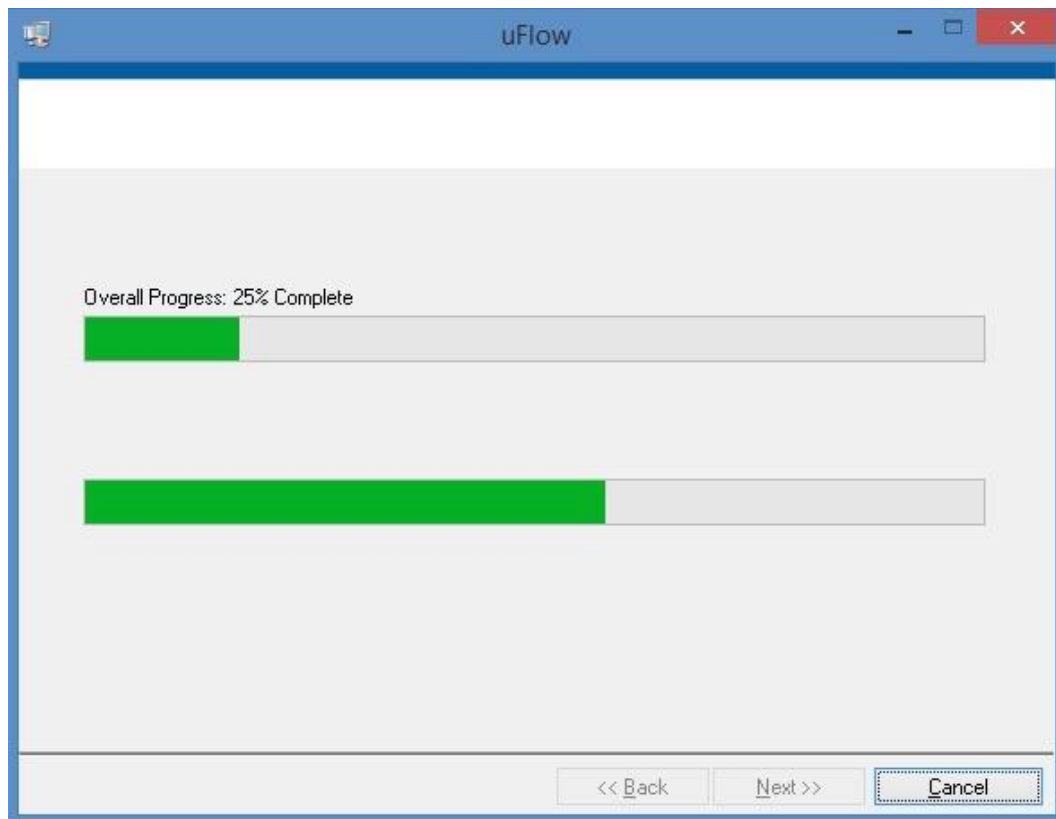
14. Select a destination directory for the files.



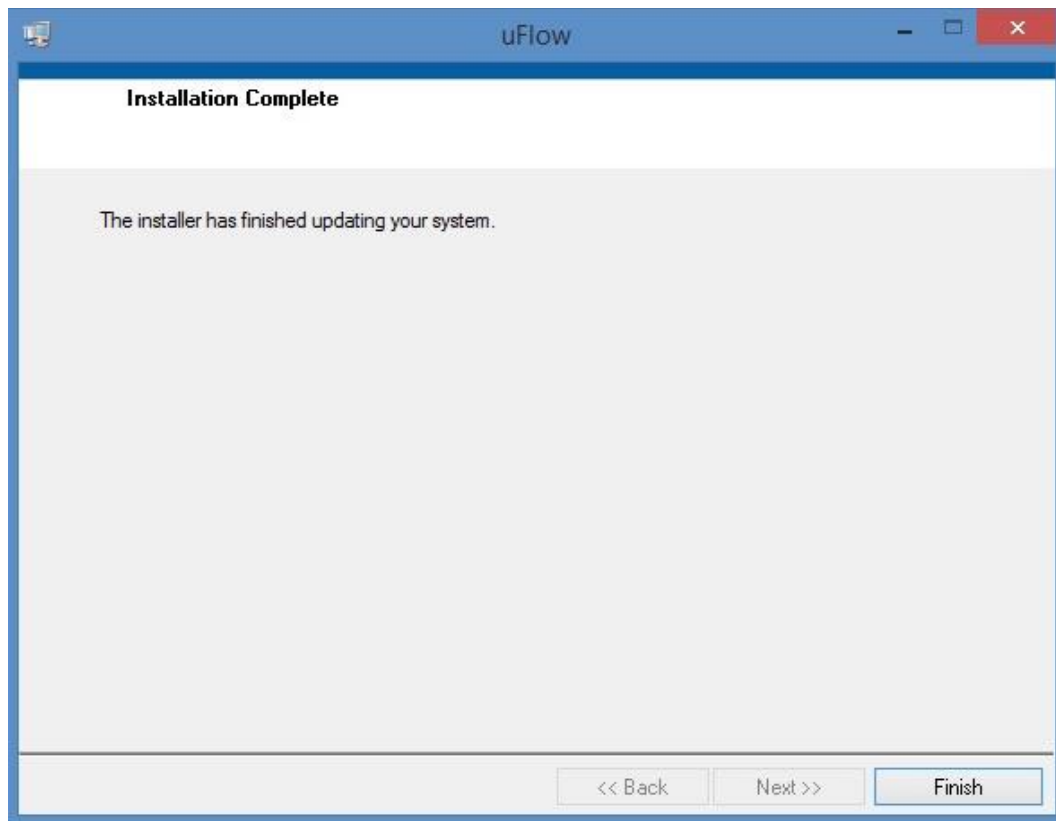
15. Start the installation by clicking “Next”.



16. The green status bars show the progress.

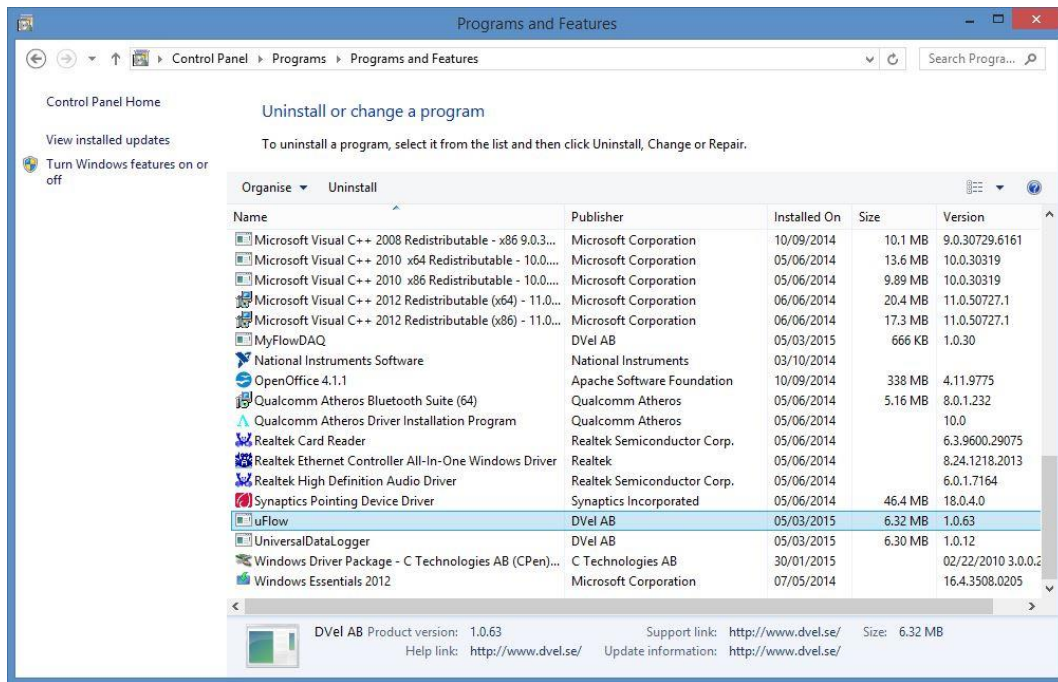


17. Click “Finish” to complete the installation.



18. When the software installation has finished, use the power adaptor to connect the Data Logger hardware to a power outlet. Connect the Data Logger to a computer by the USB cable.

19. The Data Logger software can be uninstalled in the Windows Control Panel. The National Instruments files need to be uninstalled separately.



## 10.2 $\mu$ Flow Data Logger Software User Guide

HOME



The software interface is organised in a number of pages, all reachable from the start page named “Home”. The pages are laid out in the same order that an experiment is set up, executed, monitored and finally documented.

The overview below describes the pages available, and their main functions:

### ***Home***

This page is shown when the software is started. The different pages can be accessed through the five tabs at the top. Under the tabs, links will lead the user to information such as the user manual, the technical specification and product information sheets.

### ***Settings***

In the Settings page, the user prepares an experiment by applying individual settings for each reactor/line (represented by channels in the Data Logger system).

### ***Graph***

The Graph page is where an experiment is started and stopped. The graph provides a visual representation of the gas flow rates vs. time. It is possible to scroll and zoom in the graph, and also to export pictures of it.

***Load Data***

The Load Data page allows the user to load data from a specific time interval, and to generate a report of it. The report contains experiment data for each reactor/line.


***System***

This page contains general information related to the software version, Data Logger hardware and contact details.

**DETAILED GUIDE FOR EACH PAGE**

In each page it is possible to find additional menus by right clicking in different areas. Not all the functions shown in these menus are activated in this application, and only the ones that are useful for experiments with the  $\mu$ Flow Gas Meter are explained here.

## SETTINGS



This page is used to set up an experiment.

Enter the name of the first reactor/line under “Channel 1”. (A channel name is limited to 10 characters.)

In the “Use” attribute, select “In use”.

Save the above settings by pressing the “Apply” button.

Repeat this procedure for all the channels that will be used in the experiment, and press “Apply” after each channel has been set.

The value of the current flow rate for each channel is also displayed. The value is a mean value over the last minute.

## GRAPH



This section shows the Graphs page.

### Start logging

To start data logging, the user has to press the green button labeled “Start logging”. The button will turn grey and it will change its name to “Stop logging”.

Under the “Start /Stop logging” button, there are checkboxes for all 8 channels. They can be used to hide and select which channels that should show up in the graph. Check the box to select that channel, and uncheck it to hide it. (Use the grey scrolling bar to find Channel 7 and 8.)

The graph shows the current flow rates for the selected channels. The values in the graph are updated every 15 min after starting the logging and are normalised to 1.0 atm and 0 °C.

### Stop logging

To stop data logging, press the button “Stop logging”. The button will turn green again and the system will stop recording any data. Stopping the data logging will not delete anything; it will only stop recording data until the “Start logging” button is pressed. All logged data will be stored in the database files.

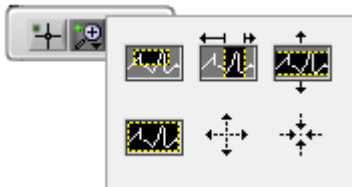
## Scrolling and zooming in the graph plot

By right clicking in the graph plot, a menu will show up. Choose “Visible Items” => “Graph palette” to find a bar with 3 buttons, where some zooming and scrolling tools will be found.



The button with the hand icon can be used to move the graph in any direction. A left mouse click that is held down while moving the mouse will move the graph according to the mouse movement. A right mouse click that is held down will start scrolling the graph when the cursor reaches any edge of the graph, to reveal more of the graph in that direction.

The button with a magnifying glass with a plus sign opens up 6 alternatives to zooming in/out and changing the scales of the graph.



1. The top left icon allows the user to resize the graph window to a smaller subset of the visible display by first clicking on the icon and then by clicking at a suitable point in the graph and then, while still holding down the mouse button, creating a square shape. The graph window will then zoom in to display the data contained within the square shape.
2. The top middle icon allows the user to resize the graph window in a similar way to the first option but with a focus on the x-axis. The y-axis will automatically adjust to an appropriate value.
3. The top right icon allows the user to resize the graph window in a similar way to the first option but with a focus on the y-axis. The x-axis will automatically adjust to an appropriate value.
4. The bottom left icon allows the user to resize the graph window to display all available data. To do this, click once on the icon.
5. The bottom middle icon allows the user to zoom in on the graph by first clicking on the icon and then clicking in the graph window.
6. The bottom right icon allows the user to zoom out on the graph by first clicking on the icon and then by clicking in the graph window.

### Right clicking in the graph area (selected commands)

*Clear graph* will just clear the curves in the graph view, but all data that has been recorded will be kept. The graph can be reloaded by pressing the “Load Data” button in the “Load Data” window. It may take a little longer for the data to show up in the Graph window, than it does in the “Load Data” window.

#### *AutoScale X*

Automatically scales the x-axis to contain all data.

#### *AutoScale Y*

Automatically scales the y-axis to contain all data.

#### *Export*

A picture of the current view of the graph can be exported as a picture, excel file, or added to the clipboard. (To export the experiment data, see the Load Data page guide.)

### Clicking on the icon associated with a specific graph (selected commands)

Left or right clicking the icon associated with a specific graph can reach additional software features. Selected functions will be described below.



#### *Plot Visible*

This option toggles the visibility of the selected plot and is equivalent to the user clicking on the checkbox located to the left of the specific line’s name.

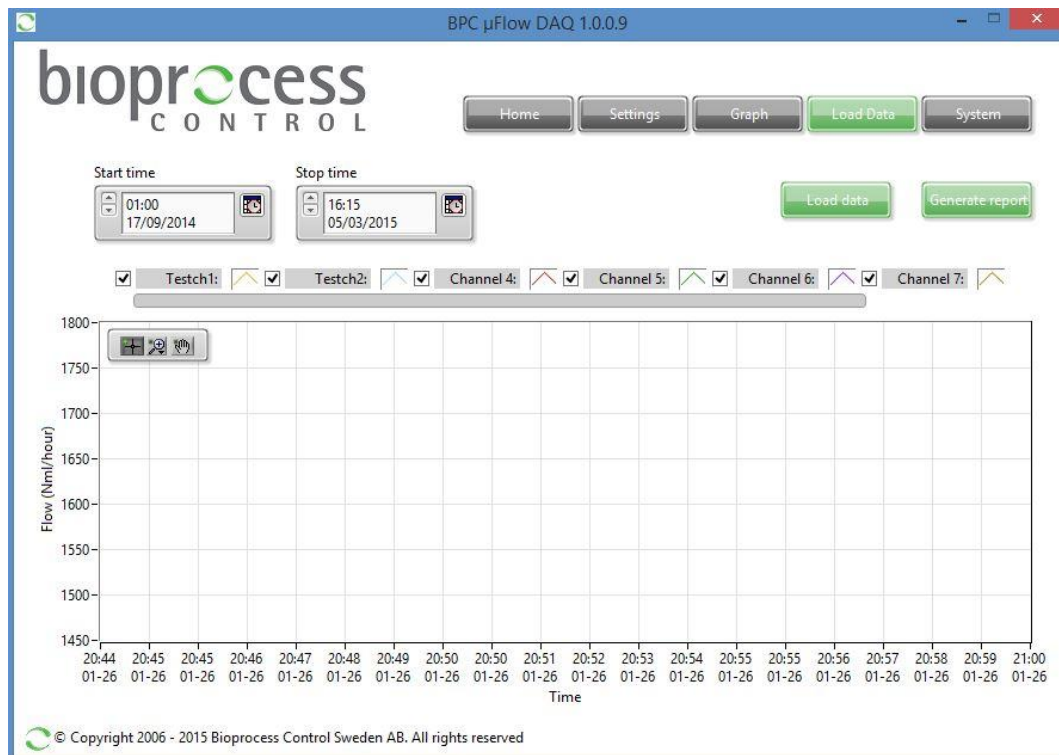
### *Colour*

This setting allows the user to define a different colour for the particular line.

### *Export*

A picture of the current view of the graph can be exported as a picture, excel file, or added to the clipboard. (To export the experiment data, see the Load Data page guide.)

## LOAD DATA



In the “Load Data” page it is possible to generate a report.

### **Load Data**

To start loading the data, choose the period of interest (i.e., start and stop times) and then press the button “Load Data”. The data for the selected time period will show up in the graph.

### **Generate Report**

By pressing the button “Generate report”, a pop-up window will be displayed with the following message: “*The data load in the graph is at an interval of 15 minutes. Choose at which interval you would like to save your report: 15 minutes, hour, or daily*”.

After selecting the unit for the time (e.g., quarter of hour, hour or day) and pressing “OK”, the data will be saved into a \*.csv (comma-separated values) file. The file can be opened and viewed through a spreadsheet program such as Microsoft Excel, Open Office Calc or Google Docs.

The flow rate for the selected flow cells is presented in Nml/h in the generated report.

### **Right clicking in the graph area (selected commands)**

*Clear Graph* will just clear the curves in the graph view, but all data that has been recorded will be kept. The graph can be reloaded by pressing the “Load Data” button in the “Load Data” window. It may take a little longer for the data to show up in the Graph window, than it does in the “Load Data” window.

#### *AutoScale X*

Automatically scales the x-axis to contain all data.

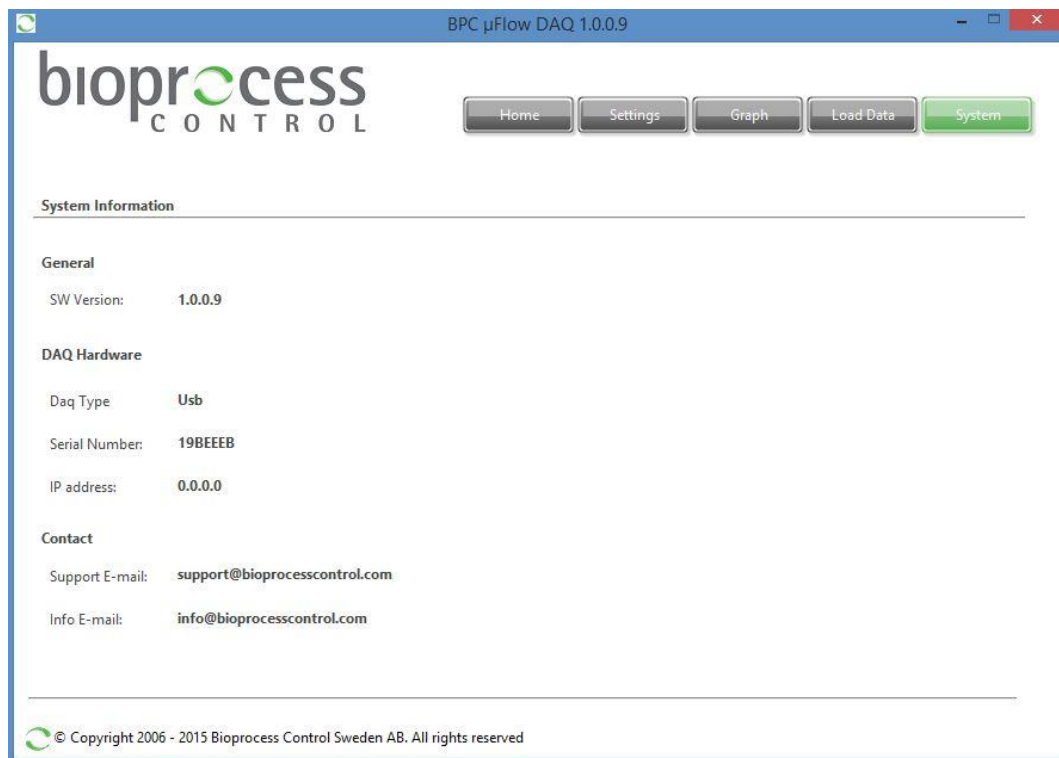
#### *AutoScale Y*

Automatically scales the y-axis to contain all data.

#### *Export*

A picture of the current view of the graph can be exported as a picture, excel file, or added to the clipboard. (To export the experiment data, see the Load Data page guide).

## SYSTEM



This section shows the System page. The page contains general information about the software, Data Logger hardware (i.e., serial number, IP address) and contact details for troubleshooting and support.