Binary Pump Module

High pressure dual reagent delivery module

Asynt

CONTENTS.

1. SAFETY:

1.1 General Safety Considerations

Read the User Manual before using this instrument

The Asynt Binary Pump Module is designed to work under ambient temperature conditions in a properly ventilated environment only.

The Asynt Binary Pump Module should only be operated by suitably technically competent users.

Risk of electric shock. The casework should not be opened under any circumstances without first disconnecting the mains electricity power supply.

The Uniqsis Binary Pump Module contains no user serviceable parts, and the casework should not be opened by the user without first consulting Uniqsis Ltd.

If it is suspected that any liquid has entered the unit, the unit should be switched off at the main electrical supply socket and the mains plug disconnected immediately. *Note:* ensure that the mains plug is accessible at all times.
Please contact Uniqsis Ltd for advice before reconnecting the unit to the mains power supply.

When plumbed with the stainless steel tubing supplied, the Asynt Binary Pump Module can safely withstand pressures up to 300 bar. Note: if perfluoropolymer tubing is fitted, this limit will be reduced considerably. The unit is supplied with a specified maximum pressure rating of 100 bar (or 200 bar to special order), and will automatically stop if this pressure is exceeded under any conditions. The total volume of liquid contained at high pressure at any time within the unit is always less than 2.0 ml.

If the Binary Pump Module is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.2 Installation

The Binary Pump Module is designed for chemical synthesis applications. It should only be used in a laboratory facility and be located within a suitable vented enclosure such as a fume hood that has a bunded base which is impervious to any solvents and reagents being used.

Caution heavy! This unit weighs 19kg. To avoid the risk of strain or injury it is recommended that the Binary Pump Module should be removed from its shipping case by laying the case on its side and sliding the unit out horizontally. Remove the foam end supports and the protective polythene bag and then, using 2 people, carefully lift the unit and install in a suitable fume cupboard.

Reagent solution and solvent stock bottles may be placed in the containment tray on top of the Binary Pump Module. This is a bunded tray with a PTFE liner to minimise any damage to paintwork that might be caused by inadvertent solvent spillages. All spillages should be cleaned up immediately

Users should wear suitable personal protective equipment; specifically accredited laboratory safety glasses, a laboratory coat and suitable gloves when handling chemical reagents and solvents.

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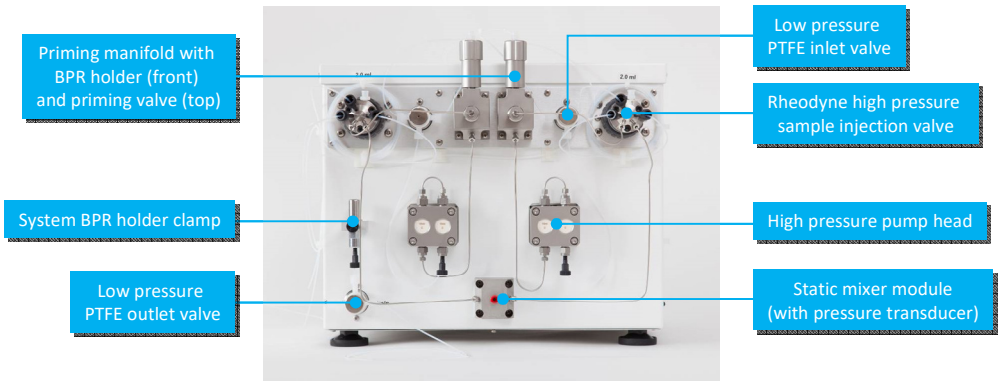
2. INTRODUCTION:

The Asynt Binary Pump Module (BPM) is a high pressure, dual channel pumping and reagent delivery module. It can be used to add 2 additional flow channels to an existing FlowSyn (upgrade to 4 flow input channels), or as a standalone module to build a custom flow reactor setup.
It is also the core component of **FlowLab Plus** flow reactor systems.



It is a high quality unit constructed of epoxy-coated stainless steel casework, and may be utilised for a wide range of reagent delivery and dosage applications.




Additionally, the unit features a mixer and a switchable outflow fitted with a back pressure regulator. In this way, the BPM is able to control reagent inputs and manage the output from any flow reactor modules.

The unit is designed to integrate with the Polar Bear *Plus* Flow™, GSM™ and HotCoil™ reactor modules available from Asynt; which can be controlled using the BPM software.

It has the following specification:

- Dual high pressure HPLC pumps (10 ml/min or 50 ml/min pump heads)
- Stainless steel flow path as standard (PTFE or Hastelloy® optional)
- P_{max} 0-100 bar as standard (0-200 bar optional)

And has the following features:

- Low pressure PTFE inlet selection valves (solvent/reagent)
- Chemically resistant high pressure sample injection valves
- 3 Chemically resistant pressure sensors (Hastelloy/ceramic)
- Integrated mixer module
- Low pressure PTFE outlet valve (waste/collect)
- Prime 'on-the-fly' capability
- Automatic air bubble, check valve fault detection
- Chemically inert back pressure regulator cartridges (5, 10, 30, 50 bar available)
- Integrates directly with a fraction collector

2.1 General Features:

Right hand side panel.

1. Mains power connection socket with integral fuse holder (2x3.15A; 5x20mm ceramic).
2. On/Off rocker switch.
3. RS232 9 pin male sub-D serial connector (for connection to the computer running the BPM control software).
4. RJ45 Ethernet socket (alternative connection to the computer running the BPM control software).
5. Tubing retaining clamps.

Left hand side panel.

1. Tubing retaining clips.

Rear panel.

1. GSIOC serial port socket for connection to Fraction Collector (lower connector).
2. RS232 9 pin male sub-D serial connector (spare; not assigned).

2.2 Using the BPM as an Upgrade to FlowSyn:

When employed as an upgrade to an existing FlowSyn, the BPM is controlled through the FlowSyn user interface. However, in this configuration, only **manual control** is possible i.e. automated experiments cannot be run.
If fully automated control of all 4 flow channels is required, then it is necessary to purchase the optional **FlowControl II** software. This may also be connected wirelessly.

[**FlowControl™** is a powerful user control interface that allows any number of completely independent flow experiments to be run in sequence with real-time graphing and logging of key experimental parameters. **FlowControl Auto-LF** can control liquid handlers that will automatically fill sample loops with reagents, thereby allowing fully combinatorial experiments].

2.3 Using the BPM as a Standalone Pumping Module

In standalone mode, the BPM is controlled by dedicated software running on a laptop.
The standard pump software provides manual control of the entire pump and valve options, allowing a single automated experiment to be run – with an automated wash sequence if required.

This software can also control up to four of the optional reactor modules available to build a modular flow reactor system around the Binary Pump Module.

2.4 Using the BPM in a FlowLab Plus™ system

When the Binary Pump Module is controlled directly using **FlowControl II** software, many different flow reactor systems may be constructed by adding additional modules. Up to 4 reactor modules and 4 individual pump channels may be included. Multiple sequential experiments are possible and reaction products can be collected automatically using a fraction collector. Sample collection can be controlled using the Flow-UV inline UV/Vis spectrophotometer.
Modules that are compatible with FlowControl + BPM '**FlowLab Plus'** systems include: 1. Reactor Modules: up to 4 modules selected from: HotCoil, HotChip, Polar Bear Plus Flow, Polar Bear Plus GSM. 2. Pump Modules: another BPM, or up to 2x standalone HPLC pumps. 3. Fraction Collectors: Gilson FC203 (single rack), Gilson FC204 (4 rack). 4. Auto-LF: Uniqsis automated sample loop filling upgrade package. 5. Flow-UV: in-line UV-Vis detector.

3. SETTING UP THE BINARY PUMP MODULE

3.1 General Comments on Fittings:

The white and blue ferrules are both made of PTFE; the different colours are to aid in correctly fitting the tubing to the BPM as received.

Three types of 'plastic fittings' are used; the choice is determined by the pressure likely to be encountered and the port size (10-32 tapered or ¼-28 flat-bottomed):

(i). **Super flangeless** PTFE (white). For flat-bottomed ports (1/4-28). These have the yellow ferrule and stainless steel retaining ring. The end of the nut has a recess. These are high pressure fittings with the advantage that the tubing never becomes attached to the nut, which is always free to turn and therefore does not twist the tubing.

(ii). **Flangeless fittings** PTFE (white). For flat-bottomed ports (1/4-28). These have a white or blue ferrule. The end of the nut is indented with a taper. These are low pressure fittings. The nut becomes attached to the tubing on tightening. Before re-fitting, it is advisable to 'break' the seal between the nut and ferrule with a finger nail to allow the nut to rotate and thereby avoid twisting the tubing on tightening.

(iii). **SealTight fittings** PEEK (black). For tapered ports (10-32). These are high pressure tapered fittings and are supplied with a white ETFE tapered ferrule. No spanner is needed, these fittings can be adequately tightened by hand, and the nut remains free to rotate following unscrewing.

Two types of stainless steel fittings are used:

(i). **Short nuts and ferrules** 316 SS (10-32). These are high pressure stainless steel fittings. They are tightened using a ¼" spanner in order to swage the ferrule to the stainless steel tubing. The nut remains free to rotate, but the ferrule is permanently attached to the tubing.

(ii). **Rheodyne** 316 SS (10-32). Long nuts and ferrules. As above but with longer ferrules designed specifically to fit the ports in Rheodyne injection valves.

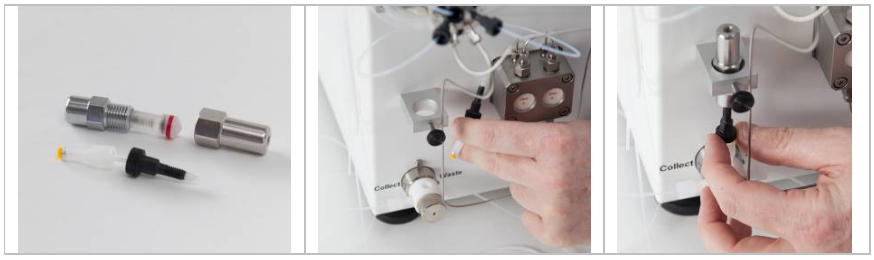
3.2 Binary Pump Module Assembly Instructions:

The Binary Pump Module is shipped with all tubing and the priming valve 'stems' packed separately to avoid damage.

We recommend that the BPM is plumbed using the pre-configured tubing supplied. Please use the ¼" spanner supplied in the Accessory Kit, and follow the illustrated assembly instructions below:

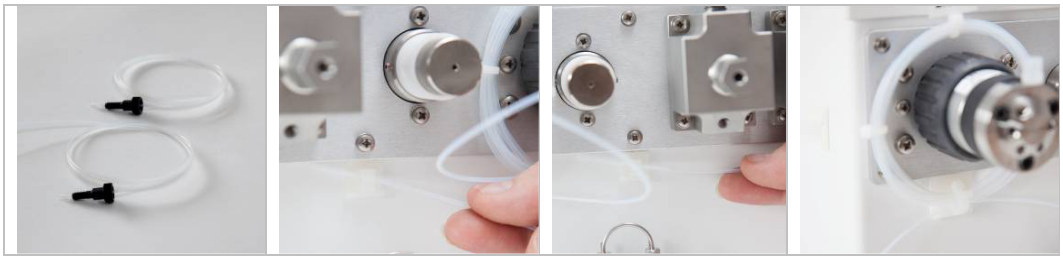
1. **Fit the priming valve stems**. Moisten the 'O'-rings with a drop of water to assist in assembly and avoid damage when inserting into the manifold ports, as shown:

2. **Fit the stainless steel BPR holder**. First fit the short length of tubing to the outlet valve using the white PTFE fitting. Then insert the BPR holder through the bracket (large end upwards!) onto the tubing and tighten the black SealTight nut. Secure the BPR holder to its retaining bracket by screwing in the black-capped screw, ensuring that the tubing is not tight and under strain.



3. **Fit the sample loops**, as shown. Sample loops may be conveniently retained by the large plastic clips fitted below the injection valves. *Please note:* to avoid rupture, the 2 ml PTFE sample loops supplied should only be used at pressures below 500 psi. Stainless steel sample loops must be fitted for use at higher pressures. Uniqsis can supply these in a range of different sizes.

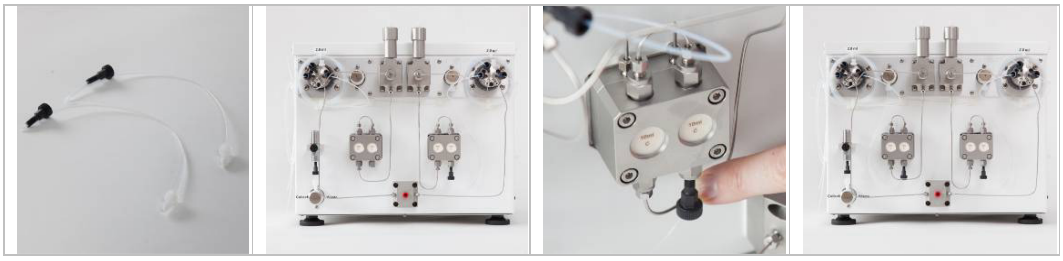
4. **Fit the PTFE drain tubing**. These are fitted to port 6 of each Rheodyne injection valve. The drain tubing can be run to either side of the Binary Pump Module and routed through the retaining clips to the sides of the instrument for tidiness. Thread the longer length of tubing through the small plastic retaining clips located just below the manifold assembly.



5. **Binary Pump Module with PTFE flow path (UQ1022T) .** A PTFE tubing set with pre-cut lengths of tubing that are terminated with the appropriate fittings is supplied with the pump module. The tubing is supplied in bags which are labelled to indicate where the tubing is to be fitted.

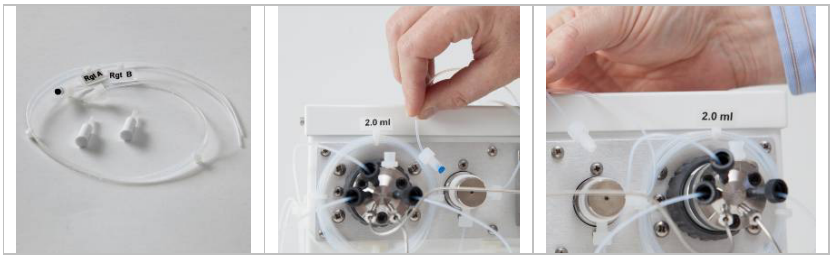
Binary Pump Module with stainless steel flow path (UQ1022) . Fit the pre-formed stainless steel tubing supplied, as shown. Do not over-tighten the metal fittings, they should be tightened until resistance is felt, and then a further ¼ of a turn is usually sufficient to afford a leak-tight seal. Note that the connections between the pump outlets and the Rheodyne valves are of identical lengths. This is to ensure that the lengths and volumes of the flow paths between the pump outlets and the mixer block are the same.

6. Fit the PTFE tubing between the inlet valves and pump heads. When fitting the black SealTight nut to the left hand pump head, push the metal tubing back slightly and fit it to the front, as shown below:



7. **Fit the PTFE Solvent inlet tubing set**. Ensuring that the tubing is positioned behind the vertical priming valve metal stems, the tube with the **blue** ferrule should be inserted into the LHS of the right hand inlet valve (B). The tube with the **white** ferrule should be inserted into the LHS of the left hand inlet valve (A).

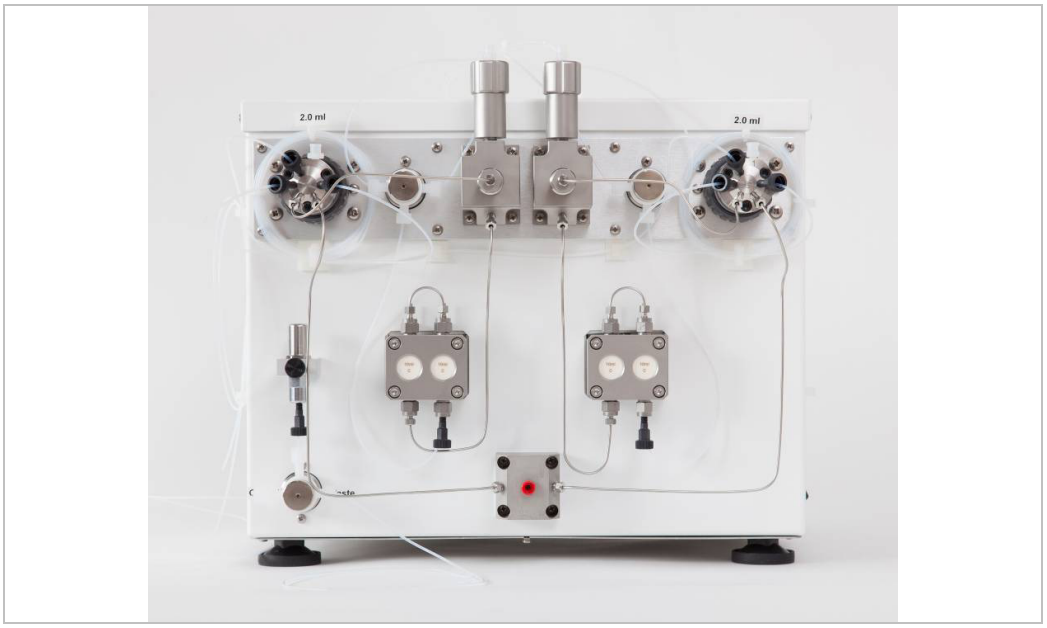
8. **Fit the PTFE Reagent inlet tubing set**. Ensuring that the tubing is positioned behind the vertical priming valve metal stems, the tube with the **blue** ferrule should be inserted into the RHS of the right hand inlet valve (B). The tube with the **white** ferrule should be inserted into the RHS of the left hand inlet valve (A).



9. **Inlet filters**. It is strongly recommended that the inlet filters supplied are fitted to all solvent and reagent inlet lines. Push the tubing through the hole in the bottle cap before pushing it into the 1/8” od tubing of the filter assembly.

10. **Outlet Valve tubing**. A length of PTFE ‘Waste’ and ‘Collect’ tubing is supplied with the unit.

11. **Testing.** Having fitted all the tubing, fully **prime** (to remove all air bubbles from the fluidic inlets) and test run the assembled pump with isopropanol to check that all the fittings are properly secured and do not leak. Temporarily fit a reactor, or alternatively a short length of tubing between the mixer and the outlet BPR.



Note: each pump manifold is fitted with a 10 bar chemically inert BPR cartridge as standard. The pressure can be adjusted slightly by removing the respective stainless steel outlet tubing inserting a 1.5 mm Allen key into the BPR holder outlet and running the pump at 1.0 ml/min. Similarly, the outlet BPR cartridge holder is supplied with a 10 bar chemically inert BPR cartridge fitted. This can also be adjusted slightly if required in the same way.

4. Controlling the Binary Pump Module

- In standalone mode, the BPM is controlled by the laptop computer supplied. Connect the computer to the BPM using the ethernet cable supplied or connect wirelessly using the Wi-Fi router supplied

- When connected to a FlowSyn, connect the BPM via the side panel serial port to the FlowSyn 'Pump C' port that it is located on the FlowSyn rear panel using the black serial cable (supplied). Change the configuration setting in the FlowSyn 'hidden' menu to 'BPM'. [Nb: this screen is accessed by pressing the <Up> and <Down> arrows simultaneously.]

4.1 Connecting the Binary Pump Module to a Reactor Module (Standalone Mode)

(Please see the diagrams over the page)

Connect a suitable reactor (coil, chip, or column) between the mixer block and the outlet valve assembly of the BPM.

Up to 4 external reactor modules may be connected and controlled simultaneously.

Modules approved by Uniqsis can be controlled directly using the BPM control software. The reactor temperature can be set, and pumps started and stopped by the software. Pump and reactor pressures and temperatures are monitored in real-time. Reactor modules currently approved are:

1. **Polar Bear *Plus* Flow** (compatible with Uniqsis coil and chip reactors; range -40°C – 150°C).

Connect the Polar Bear *Plus* Flow and the BPM to the Wi-Fi router supplied using the ethernet cables supplied. The control laptop can be connected either over Wi-Fi or using a 3rd LAN cable. The Polar Bear *Plus* Flow will be recognised by the control app.

2. **Polar Bear *Plus* GSM** (compatible with Asynt chip reactors; range -30°C – 150°C).

Connect the Polar Bear *Plus* GSM and the BPM to the Wi-Fi router supplied using the ethernet cables supplied. The control laptop can be connected either over Wi-Fi or using a 3rd LAN cable. The Polar Bear *Plus* Flow will be recognised by the control software.

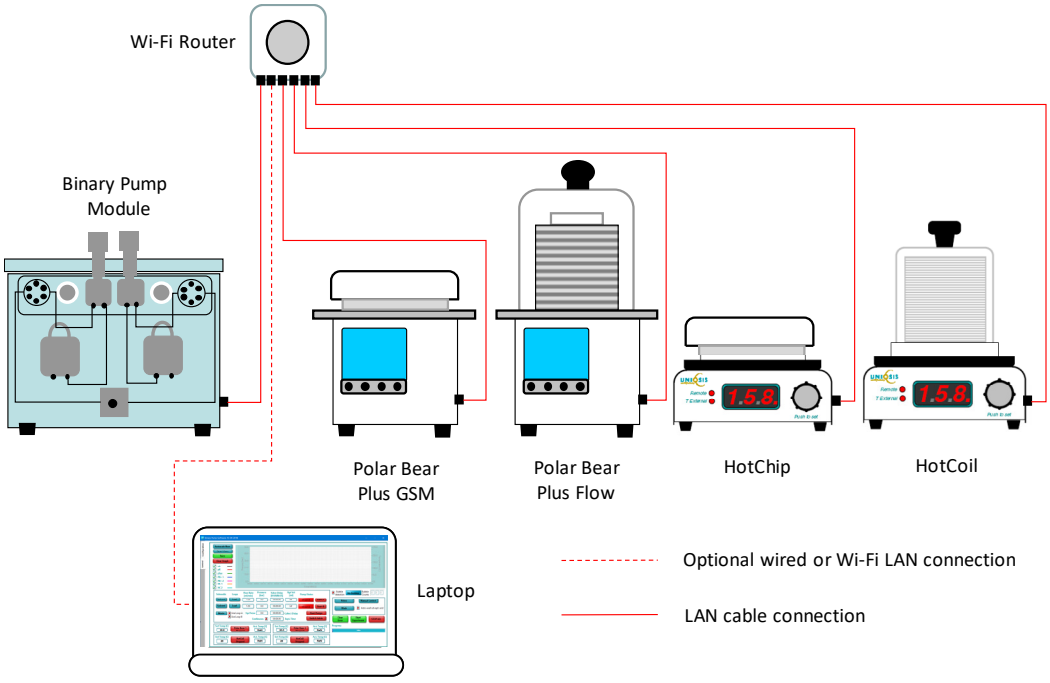
3. **HotCoil** (compatible with all Asynt coil reactors: ambient – 260°C).

Connect the HotCoil to the computer used to control the BPM as for the PB+ above.

4. **HotChip** (compatible with all Asynt chip reactors: ambient – 230°C).

Connect the HotCoil to the computer used to control the BPM as for the PB+ above.

Fig. 4.1. Connecting the BPM to reactor modules: Wi-Fi/LAN connection.



4.2 Operating the Binary Pump Module (Standalone Mode)

Priming the pump heads.

1. Working alternately on each channel, set the Inlet Valves to <Rgt>, then:
2. Attach a syringe to each priming port stem and unscrew the stem about 1 turn to open the port.
3. Slowly draw up liquid until no air bubbles are visible in the tubing between the Inlet Valve and the reagent stock bottle.
4. Switch the Inlet Valves over to <Solv> and repeat this process. However, this time continue to draw up liquid until no air bubbles are drawn into the syringe. Typically, this requires 2-3 ml of liquid.
5. Close the Priming Ports by screwing the stems back in until finger tight.
6. Start each pump in turn, and look to see if a stable pressure builds and is maintained by each pump head. If it continues to oscillate significantly (greater than 0.5 – 1 bar), then it is likely that there is still air in the system. Repeat the priming procedure.
7. If a reactor is connected, and this needs to be primed also, then it is often convenient to use the <Prime> function, which runs both pumps continuously at the currently displayed flow rate for 5 minutes and then stops.

Hint: If this procedure fails to produce a stable pressure reading, then it is possible that either a pump check valve is contaminated or faulty, or that the back pressure regulator cartridge in the respective pump manifold is not working properly. In either case, the check valve or BPR cartridge should be removed and cleaned or replaced.

4.2.1 Cleaning a pump check valve

Check valves are retained by the upper and lower bushings to the right hand side of each pump head. The left hand bushings contain spacers only. Tubing connections to the bushings should be removed before unscrewing the bushing with a 10 mm spanner. The check valve can be dissembled and cleaned out. However, this is NOT recommended. Generally flushing the check valve through with a suitable cleaning solvent is adequate.

Uniqsis can supply a useful tool designed for this purpose (Part # UQ7035).
Note: take care to replace the check valve the correct way around and do not over tighten the bushing (refer to the Knauer Azura Pump User Manual).

4.2.3 Cleaning a BPR cartridge

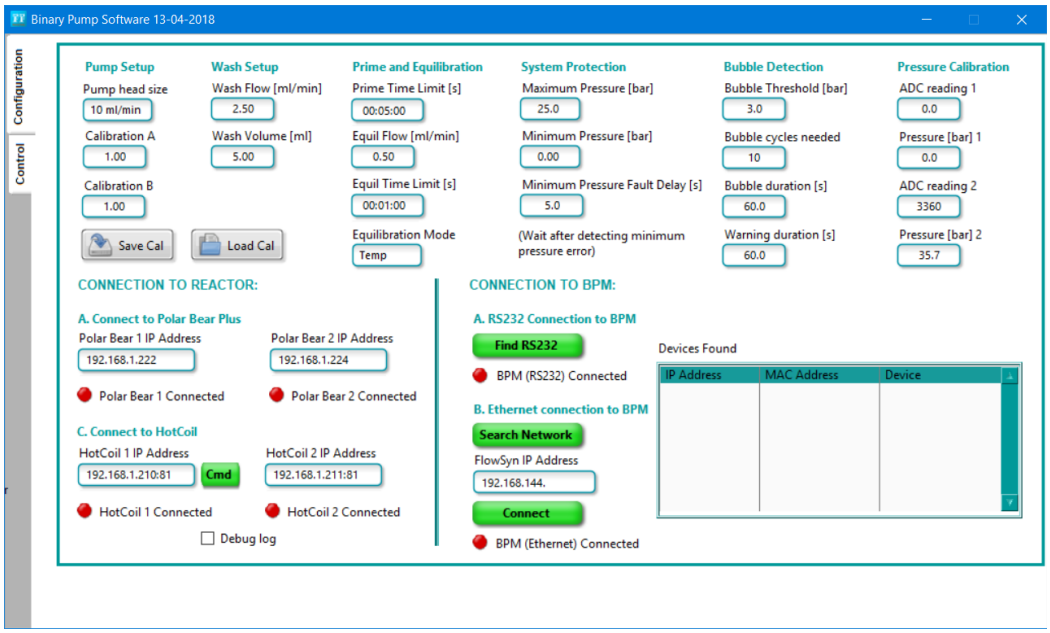
Although a back pressure regulator cartridge can be dissembled and cleaned by 'popping off' the large white end cap, any damage or deposits to the 'O'-ring or piston seat will cause the BPR cartridge to either perform unreliably or fail. In these instances, replacement is the best option.
High quality chemically resistant BPR cartridges constructed of perfluoropolymer and Hastelloy® are available from Uniqsis in various pressure ratings (e.g. 10 bar P-763U), please enquire.

P/N	Description
P-762U	Back Pressure Regulator Cartridge (5 bar Blue) CHEMICALLY RESISTANT
P-763U	Back Pressure Regulator Cartridge (10 bar Red) CHEMICALLY RESISTANT
P-766U	Back Pressure Regulator Cartridge (20 bar White) CHEMICALLY RESISTANT
P-765U	Back Pressure Regulator Cartridge (30 bar Green) CHEMICALLY RESISTANT
P-795U	Back Pressure Regulator Cartridge (40 bar Black) CHEMICALLY RESISTANT
P-700U-KIT	Set of 5 chemically inert BPR cartridges 5, 10, 20, 30 and 40 bar

4.3 Binary Pump Module PC Control Software

The BPM control software has 2 control screens.

4.3.1 Configuration Tab



The <Configuration> tab displays and permits system parameters to be edited. Once set, most of these do not need to change frequently.

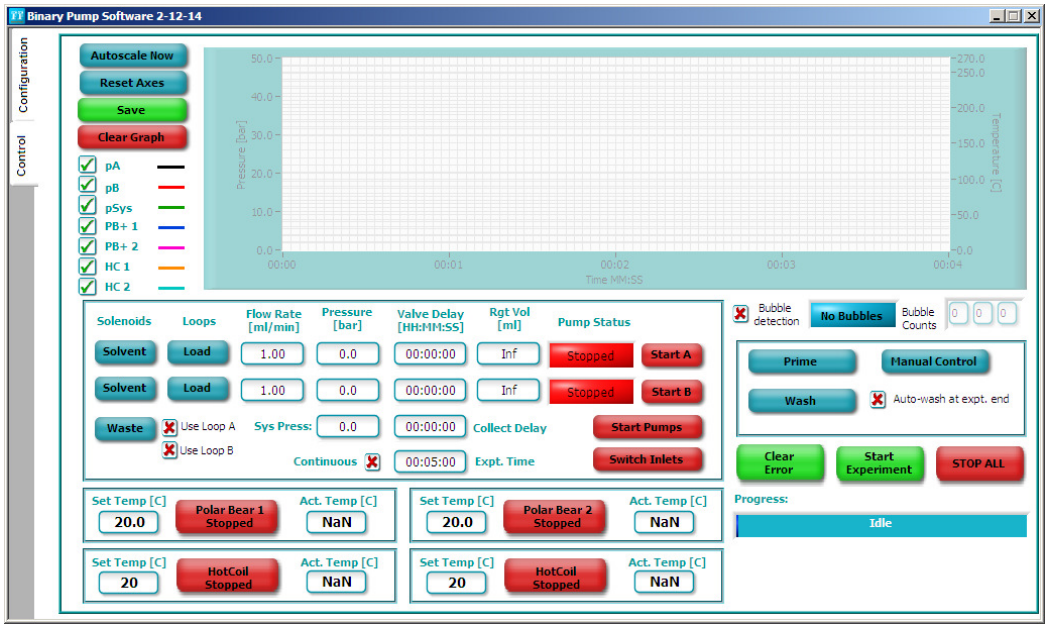
Function	Description
Pump Setup:	
<Pump Head Size>	Selects 10 ml/min or 50 ml/min pump head size options.
<Calibration A>	Calibration factor for pump A.
<Calibration B>	Calibration factor for pump B.
[Save Cal]	Save pump calibration factors
[Load Cal]	Load saved pump calibration factors
Wash Setup:	
<Wash Flow>	Wash flow rate (ml/min).
<Wash Volume>	Wash volume (ml).
Prime and Equilibration:	
<Prime Time Limit>	Run time for the prime cycle. Default = 05:00 min
<Equil. Time Limit>	Equilibration time limit. When <Equil. Mode> is set to

	'Time', a programmed experiment will commence after this equilibration period.
<Equil. Mode>	Equilibration mode may be set to 'Time' or 'Temp'. When in 'Temp' mode, a programmed experiment will not start until the setpoint temperature has been reached first.
System Protection:	
<Maximum Pressure>	If the pressure detected at **any** pressure transducer exceeds this value at any point, the pumps will stop.
<Minimum Pressure>	If the pressure detected at **any** pressure transducer falls below this value, the pumps will stop after the Minimum Pressure Fault Delay period. Default = 00:05 seconds.
<Minimum Pressure Fault Delay>	See 'Minimum Pressure' above.
Bubble Detection:	
<Bubble Threshold>	Amplitude of pressure oscillation (in bar) that, if exceeded, is recognised by the bubble detection algorithm as an air bubble at an individual fluidic circuit.
<Bubble Cycles Needed>	Number of complete bubble cycles that exceed the permissible threshold needed to trigger the bubble detection alarm.
<Bubble Duration>	Time period before resetting the bubble detection cycle.
<Warning Duration>	Period for which the 'bubbles detected' warning is displayed after the bubble detection alarm is triggered prior to system shutdown. During this period the BPM may be re-primed. In which case the 'Bubble Detection' tick box should be un-ticked and then reset.
Pressure Calibration:	
<ADC Reading 1>	Please do not change. Engineer only.
<Pressure 1>	Please do not change. Engineer only.
<ADC Reading 2>	Please do not change. Engineer only.
<Pressure 2>	Please do not change. Engineer only.
Connecting to RS232 BPMs:	
[Find RS232]	Use to confirm that the RS232 serial interface connection is in place. Green 'Serial Connected' indicator confirms that communication is working.
Connecting to Ethernet BPMs:	

[Search Network]	Searches active network for IP address of connected devices.
[Connect]	Attempts to connect to device with the IP address shown. Green light 'TCP Connected' indicates that the connection is active.
<BPM IP address>	Default BPM IP is: 192.168.1.202.
Connecting to external reactors:	
<Polar Bear 1 IP address>	Default PB+ 1 IP is: 192.168.1.222. Connects automatically.
<Polar Bear 2 IP address>	Default PB+ 1 IP is: 192.168.1.224. Connects automatically.
<HotCoil 1 IP address>	Default PB+ 1 IP is: 192.168.1.211. Connects automatically.
<HotCoil 2 IP address>	Default PB+ 1 IP is: 192.168.1.212. Connects automatically.

4.3.2 Control Tab

The <Control> tab permits manual control of all pump functions, and can also be used to programme and run a simple single automated experiment which can be optionally followed by a wash sequence. This is the control screen that also shows real time graphs of pressure readouts (and temperature where applicable).



Function	Description
Graphing Controls:	
<Auto scale Now>	Scales the plot axes to best fit the data displayed.
<Reset Axes>	Resets the plot axes to the default ranges.
<Save>	Dispenses the specified volume at the flow rate shown using the syringe pump. Destination is determined using the tick/cross button on the syringe valve.
<Clear Graph>	Clears the graph plot.
Tick Boxes:	
<P_B>	Toggles graphing of the pressure measured at the pump head of channel A On/Off.
<P_A>	Toggles graphing of the pressure measured at the pump head of channel A On/Off.
< P_{Sys}>	Toggles graphing of the BPM System pressure measured at the mixer unit On/Off
<PB+ 1>	Toggles graphing of the Polar Bear Plus Flow reactor #1 temperature On/Off.
<PB+ 2>	Toggles graphing of the Polar Bear Plus Flow reactor #2 temperature On/Off.
<HC 1>	Toggles graphing of the HotCoil reactor #1 temperature On/Off.
<HC 2>	Toggles graphing of the HotCoil reactor #2 temperature On/Off.
<Continuous>	If checked, pumps will run indefinitely.
<Auto Wash>	If selected, runs a solvent wash sequence at the end of the experiment according to the parameters specified in the <Configuration> tab.
<Bubble Detection>	If selected, counts gas bubbles detected by each pressure transducer. Note the sensitivity of this algorithm can be adjusted in the <Configuration> tab. If the permitted number of bubbles per detection period is exceeded, a warning will be displayed and if the pumps are not re-primed within the warning period, the pumps will stop.
Control Functions:	
<Polar Bear 1 Stopped/Started >	Switches the Polar Bear Plus Flow 1 On/Off.
<Polar Bear 2 Stopped/Started>	Switches the Polar Bear Plus Flow 2 On/Off.
<HotCoil 1 Stopped/Started >	Switches the HotCoil 1 On/Off.
<HotCoil 2 Stopped/Started >	Switches the HotCoil 2 On/Off.
<Solvent><Reagent>	Switches the low pressure inlet valve between the solvent and reagent inlets respectively. This operation can be performed manually at any time – even during

	an automated experiment.
<Load ><Inject>	Switches the high pressure Rheodyne injection valves between the fill (<Load>) and in-line (<Inject>) positions. This operation can be performed manually at any time – even during an automated experiment.
<Start><Stop>	Starts and Stops the pump running.
<Clear Error>	Clears any current error messages which appear as the parameter in error flashing red.
<Waste><Collect>	Switches the low pressure outlet valve between the waste and collect positions.
<Use Loop>	Tick box function that allows reagents to be introduced using sample loops instead of reagent stock bottles.
<Collect Delay>	After starting an experiment, the Outlet Valve remains switched to 'Waste' until the <Collect Delay> time period is exceeded and then switches to 'Collect'.
<Expt. Time>	Total experiment run time. Default = 05:00 mins.
Variables:	
<Flow Rate> (ml/min)	Specified the pump flow rate for the respective channel.
<Valve Delay> (hh:mm:ss)	Specifies the time from the beginning of an experiment at which an injection valve or an inlet valve is switched from 'Load' to 'Inject', or 'Solvent' to 'Reagent' respectively.
<Reagent Volume> (ml)	Specifies the volume of reagent solution to be drawn from a particular stock bottle or loop before switching back to 'Solvent' or 'Load' respectively. Default value is 'infinite'.
<Collect Delay>	Specifies the time from the start of a programmed experiment at which the output selection valve is switched from 'Waste' to 'Collect'.
Indicators:	
<Pressure> (bar)	Indicates the pressure measured by an individual pressure transducer (channel A, channel B, system/mixer).
<Pump Status>	Indicates whether a pump is On or Off.
<Bubble Counts>	Displays number of 'air bubbles' detected at each pressure transducer within the designated detection window.
Macro Functions:	
<Prime>	Runs a solvent prime sequence on both pump channels. Solvent is pumped by both pumps at the <Wash Flow> rate and <Wash Volume> as specified in the <Configuration> tab for 05:00 mins.

<Manual Control>	Reverts from an automated experiment to continuous running under the conditions displayed when the control button is clicked.
<Wash>	Runs an automated solvent wash sequence according to the parameters specified in the <Configuration> tab.
<Clear Error>	Clears a displayed pressure error (displayed pressure reading flashing red).
<Start Expt>	Begins the programmed experiment.
<Stop All>	Stops all pumps.

5. Error conditions:

1. High pressure error. Indicated by red flashing pressure reading display.

2. Low pressure error. Indicated by red flashing pressure reading display.

3. 'No serial ports found'. Ethernet or serial connection between BPM and control computer is broken. Check cable and connections.

3. 'Could not connect to IP address. Error code 42'. Ethernet connection is broken or the control computer is trying to connect to the wrong IP address.' Try <Search Network> to check the IP address.

6. Specification:

6.1 Binary Pump Module Specification

Width x Depth x Height	360 mm x 270 mm x 300 mm
Weight	19 kg
HPLC pump minimum flow rate	10 µl/min (0.05 ml/min)
HPLC pump maximum flow rate	10 ml/min (50.0 ml/min)
Resolution	0.005 ml/min (0.01 ml/min)
Fixed back pressure regulator	Up to 100 bar (200 bar option)
Pressure sensor	100 bar (200 bar option)

(Options are shown in parentheses).

6.2 BPM Power Specification

100-240V, 50-60Hz, <0.9A

Mains supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.

6.3 Electrical Supply

The device is intended for use with AC power networks of 120–240 V and 50-60Hz.

Check that the supply voltage marked on the serial number label, and the type of mains plug, are correct for your mains supply outlet, which must have a ground connection.

6.4 Conditions of Use

Operating environment:	Indoor use only
Pollution degree:	2
Installation category:	II
Temperature	5 to 40°C
Maximum relative humidity	80 % r.h. in room temperatures up to 31°C decreasing linearly to 50 % r.h. at 40 °C
Altitude	Up to 6,500 feet (2,000 m) above sea level
Operating Environment:	Indoor use only

The unit should be protected from exposure to direct sunlight.

7. Warranty

The Binary Pump Module is covered by a warranty for 12 months from the date of delivery.

The warranty does not include:

Accidental or wilful damage
Fair wear and tear.
Damage caused by incompatible solvents or substrates
Blockages caused by precipitation in the system (See user maintenance)
Use outside of the parameters of the conditions of use (see conditions of use)

Warranty includes:

Protection against faulty materials or workmanship
Labour and travel costs for a qualified Uniqsis approved engineer
Shipment costs if unit is required to go back to base for repair

All warranty claims shall be invalid if any unauthorised changes are made to the unit.

8. Cleaning & Care

Risk of electrical shock or short circuit if cleaning solutions enter the inside of the Binary Pump Module. Do not over-moisten the cleaning cloth.

All external surfaces of the instrument can be cleaned using a cloth moistened either with a dilute aqueous soap solution or isopropanol.

Corrosive reagents and solvents should not be left in contact with any painted or anodised external surfaces for extended periods of time.

9. Service and Support

If the fuses blow during operation, a competent person should check whether the unit has developed a fault needing rectification before the fuses are replaced. To replace the mains fuses, remove the mains lead from the unit, release the fuse drawer catches using a small screwdriver and extract the drawer. Replace the fuses with the correct type and rating: **2 off, 1AT (250Vac) slow blow 5 x 20mm**. Replace the fuse drawer in the unit.

Note: if a main fuse blows, it is likely to be indicative of a problem with the unit that simply replacing the fuse will not resolve.

10. Controlling the Asynt Binary Pump Module by Wi-Fi

The Asynt Binary Pump Module can be controlled wirelessly from a PC. If this is required then it is necessary to fit the **BPM Wi-Fi Control Kit**. This needs to be done by an Asynt engineer.

10.1 Configuring the Wi-Fi Comms.

1. The BPM is supplied with a high quality Wi-Fi enabled router that has a fixed IP address set to 192.168.1.100.

2. Check that the Wi-Fi adaptor on your laptop (not the LAN adaptor) has an IP address in the same range by accessing the TCP/IP4 protocol – say 192.168.1.210. Do not set the IP address to the same as that for the BPM.

8. The BPM has the IP address: 192.168.1.202

9. With Wi-Fi enabled, when you <search network> in the BPM 'Configuration' screen, it should see the router and you will be able to connect by selecting <connect>. In fact, it will probably connect automatically.

NB: when changing LAN settings like this, it may be necessary to reboot from time to time to ensure that the new settings take effect.

For service and support please call Asynt:

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