

FlowSyn™ – The Continuous Flow Reactor from Uniqsis
Designed by chemists for chemists



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FlowSyn™ – range overview

At the forefront of flow reactor design, FlowSyn is the platform of choice within major pharmaceutical companies and academic research laboratories around the world.

The FlowSyn continuous flow reactor has been designed by chemists, for chemists. Whether you are new to flow chemistry or an advanced user, Uniqsis offers a range of accessible modules with outstanding chemical compatibility and proven reliability.

FlowSyn™

For single reactions

- Superheated reactions up to +260°C, 100 bar (option 300°C)
- Small scale cooled reactions down to -85°C
- Run seamless scale up reactions
- Continuous or plug flow
- Segmented flow



FlowSyn Multi-X™

For multiple reactions

- Automatically run sequential experiments
- Reagent scanning, reaction profiling and optimisation
- Explore a range of reaction conditions: temperature, residence time and stoichiometry



FlowSyn Auto-LF™

For multiple experiments with multiple reagents

- The ultimate tool for combinatorial experiments
- Compound library synthesis
- Reagent scanning and reaction optimisation
- Concentration studies



FlowSyn Maxi™

For High throughput applications

- Total flow rate 0.0 to 100 ml/min at 100 bar
- Up to 4 reagent channels
- Temperature range -85°C to 260°C (option 300°C)
- Takes all coil reactors up to 60 ml – put several in series to increase capacity
- Flow path stainless, PTFE or Hastelloy



High Performance

- Accurate, uniform temperature control from -85°C to +300°C
- Pressure up to 200 bar: Perform superheated reactions routinely
- Automated reactions: Allows unattended operation
- Chemical compatibility: Choose stainless steel, Hastelloy or PTFE flow path

Flexible

- Perform an extensive range of chemistries from mg to kg
- Choose from modules for reaction profiling and optimisation, and library synthesis
- Add up to 4 reactors in series for homogeneous and heterogeneous reactions
- Expand system to 4 reagent channels for multi-stage chemistry

Safe

- All pressurised parts contained within a Plexiglass safety cover
- Automatic shutdown in the event of a leak or blockage
- Pressure and temperature limits automatically determined depending on system configuration
- High performance connections and tubing prevent tubing blow-outs

We offer a range of upgrades that further enhance the FlowSyn range, which means that your system grows with your needs.

Software

Display and data logging or full FlowControl™ software suite

- Graphically build reaction configuration
- Program 4 channels and 4 reactors
- Program 100 independent experiments
- Analyse saved experiments
- Reporting – export data into Excel
- Wi-Fi or LAN interface



Reactors – heaters

HotCoil™ for heated experiment to add capacity for scale up

- Add up to 4 reactors independently controlled
- Temperature range ambient to 260°C (optional upgrade 300°C)
- Takes all Uniqsis coil reactors up to 60 ml
- Can be used with HotColumn™ multi position five column reactor



Reactors – sub ambient

PolarBear™ and PolarBear Plus™ range for sub ambient reactors

- State of art cooling range from -88°C and 150°C
- Add up to 4 reactors
- Takes all coil and chip mixer/reactors
- Full remote control from FlowSyn and FlowControl



Pumps

Up to 4 reagent channels and 4 loops

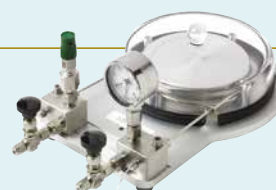
- Stand-alone single channel or binary pump reagent delivery system
- Flow rate maximum 20 ml/min or 100 ml/min (Maxi) 100 bar or 200 bar option
- Connects to FlowSyn and FlowControl Wi-Fi network



Gas-liquid chemistry

For reactions under continuous flow conditions

- Tube-in-tube gas-liquid reactors provide a safe and efficient means of performing gas-liquid reactions
- Gas-permeable fluoropolymer inner tubing allows a wide range of gases to rapidly diffuse into the liquid phase



In-line detection

In-line UV-Vis spectrophotometer for detecting steady state

- 190 to 900 nm NIR option available
- 4 user selectable wavelengths
- Short path length high pressure cell – can work at high concentrations
- Optical fibre connections – position flow cell anywhere in the flow path



FlowSyn – your flexible research tool

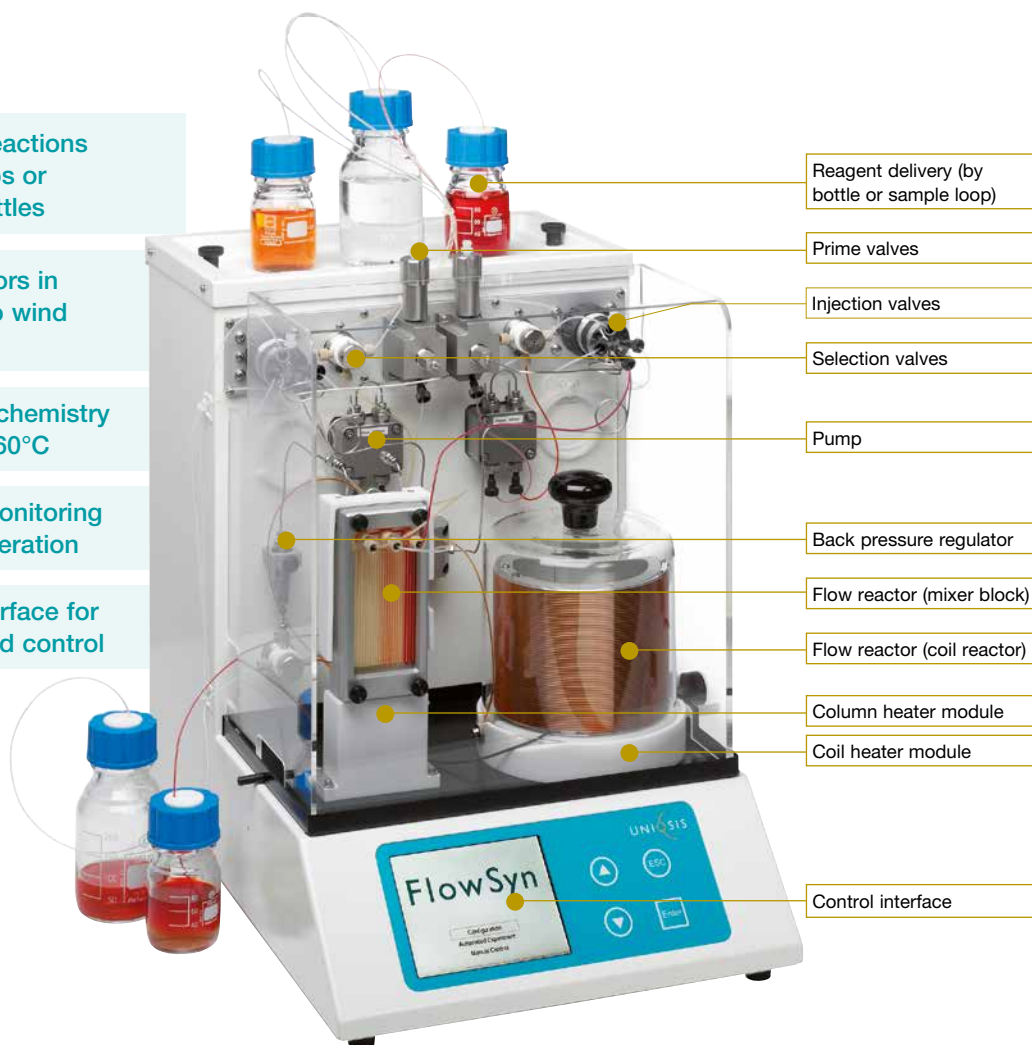
Run small scale reactions using sample loops or scale up using bottles

Interchange reactors in minutes. Option to wind your own coils

Run superheated chemistry routinely up to +260°C

Active pressure monitoring for unattended operation

Easy, intuitive interface for reaction set and control



Reagent delivery (by bottle or sample loop)

Prime valves

Injection valves

Selection valves

Pump

Back pressure regulator

Flow reactor (mixer block)

Flow reactor (coil reactor)

Column heater module

Coil heater module

Control interface

Chemical compatibility options

	FlowSyn PTFE	FlowSyn Steel	FlowSyn Hastelloy®
Flow Path	All PTFE	PTFE* and 316 Stainless Steel	PTFE* and Hastelloy®
Pmax / bar	40	100	100
Tmax / °C Coil / Column (chip)	+150**	+260 / +150**	+260 / +150**
Chemical Resistance	Excellent	Very Good	Excellent

* Note PTFE is only used for low pressure components in the flow path in these configurations.

** 300°C Coil heater option and 200°C Column/Chip options available.



FlowSyn PTFE



FlowSyn Steel

FlowSyn in detail

A fully integrated, easy to use one-box continuous flow reactor system.

Reagent delivery

Choose your method of reagent/solvent delivery – bottles or loops

Reagent solutions can be delivered from bottles (for continuous processing) or sample loops (for small scale, plug flow reactions).

Selection valves

For switching between reagent solutions and cleaning solvent.

Chemically resistant sample injection valves

The bespoke sample injection valves offer high chemical resistance to concentrated mineral acids such as nitric and sulfuric acids. The valve has been specifically designed with 1.0 mm internal channel diameter to minimise the risk of blockages.

Pumps, priming and pressure

Two independent flow channels driven by chemically resistant high-pressure pumps

FlowSyn pumps have been specially modified to improve chemical resistance. These chemically inert high-pressure pumps deliver total flow rates adjustable from 0.01 to 20.0 ml/min. FlowSyn automatically monitors each high-pressure reagent channel and will alert the user if there is an air bubble or inconsistent pumping during an experiment.

Convenient dedicated priming ports

FlowSyn pumps can be easily primed without disconnecting any fittings, and the system itself purged of air using the dedicated 'Prime' function.

Back pressure regulator

FlowSyn uses interchangeable chemically resistant, back pressure regulators to maintain constant pressure during an experiment.

Reactor modules

Coil heater

The electronically controlled coil heater module has been designed for fast heat up. Reactor temperature is calibrated for accurate temperature control that is consistently maintained throughout the whole reaction.

- Glass insulated cover
- Allows use of different sized reactors
- Maximum temperature +260°C (+300°C option)

Column heater

- Adapts for columns of different sizes.
- Maximum temperature +150°C (+200°C option)
- Also houses glass mixing blocks
- Can be liquid or gas cooled

Gas-cooled heat exchanger

Allows you to pre-heat reagents prior to entering column.

Allows you to cool product solutions below the solvent boiling point before exiting the pressurised reaction – essential when performing reactions above the boiling point of the solvent (superheating).

FlowSyn control interface

FlowSyn has an in-built graphical control interface making it very easy and quick to set up reactions.

Configuration

– FlowSyn will automatically set pressure and temperature limits based upon the materials the reactors are made from.

System Configuration	
RH REACTOR	LH REACTOR
Type: Coil	Type: Column
Material: HT PTFE	Material: Peek
Volume: 5.0 ml	Volume: 2.5 ml
Max Temp: 150 C	Max Temp: 150 C
Sys Dead Vol: 0.6 ml	Heat Exch: Yes
Min Pressure: 0 psi	Delay: 5 s
Max Pressure: 300 psi	Press. Unit: psi
Threshold: ±10 psi	Equil Flow: 0.5 ml/min
Wash Flow: 2.0 ml/min	

Save Permanently Calibration Main Menu (Esc)

All components (pumps, reactors and valves) can be independently controlled from within the Manual Control screen.

FlowSyn Manual Control

Inlet A: Solvent Inlet B: Solvent Outlet: Waste

Loop A: Load Loop B: Load

Pump A: 1.00 ml/min 88 psi Stopped

Pump B: 1.00 ml/min 93 psi Stopped

Pump C: 0.00 ml/min Stopped

Coil: 29°C ACTUAL SET 0°C

Column: 30°C 0°C

Pressure: 59 psi

ELAPSED TIME: 00:00:00

<< Main Menu RUN TIME Continuous Prime Run

Automated Control

– Set up a reaction in minutes. Input the reaction time and FlowSyn will work out the flow rate.

FlowSyn Auto Set Up

Inlet A: Bottle Coil Res Time: 00:10:00

Inlet B: Bottle Col. Res Time: 00:10:00

Volume A: 1.0 ml Tot. Flow Rate: 1.0 ml/min

Volume B: 1.0 ml Pre Collect: 0.0 ml

A:B Ratio: 1:1 Post Collect: 0.0 ml

Coil Temp: 13 C Final Wash: 0.0 ml

Col. Temp: 17 C Intermed Wash: 0.0 ml

Inlet A. Choose between "Bottle" and "Loop" inlets

<< Main Menu (Esc) Start Experiment >>

To ensure consistent and reproducible results, FlowSyn equilibrates to reaction temperature using system solvent.

FlowSyn Equilibration

Priming: 0.039 ml

Coil Temp: 18.4°C

Col. Temp: 22.2°C

Pressure: 79 psi

The experiment will start automatically when all parameters are within limits for 10 seconds, or you can start the experiment manually using the button below.

<< Settings (Esc) Auto-Start in 5.2 s >>

When up to the desired temperature, FlowSyn introduces the reagents, and the reaction begins. Throughout the reaction you can see the progress. At the end of the reaction FlowSyn will automatically wash the whole flow path with clean solvent.

FlowSyn Experiment Status

Inlet A: Reagent Inlet B: Reagent Outlet: Waste

Loop A: Load Loop B: Load

Pump A: 0.50 ml/min Pump B: 0.50 ml/min

Coil C: 13°C SET

Coil C: 17°C

p (psi): 115

Waiting for reagents to reach reactor

Current Expt: 0% 00:22:48

Series Status: 1/1

Manual Control 00:22:48 remaining Abort (Esc)

FlowSyn Multi-X

Multiple experiment package for multiple reactions



Run experiments with varying reaction temperature, time and stoichiometry

Perform sequential reaction profiling and optimisation

FlowSyn controls the fraction collector – no PC required!

Unattended operation – allows overnight optimisation

Flow chemistry is an excellent method for reaction profiling and optimisation, particularly prior to scale up. High reproducibility of results, coupled with short processing times, allows rapid exploration of a range of reaction conditions.

The FlowSyn Multi-experiment package (FlowSyn Multi-X) consists of either a Gilson FC203B or FC204 fraction collector and an enhanced FlowSyn control interface.

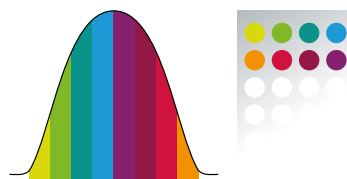
The FlowSyn can be programmed to perform up to 10 sequential experiments (100 with FlowControl software) and will then run unattended and collect the output of each experiment according to the collection protocol selected ('fractionate' or 'optimise').

Reaction outputs can be either simply 'fractionated' or collected using a dedicated optimisation rack whereby each reaction plug is collected into a single vial and an aliquot is directly sampled into a 2 ml LCMS vial for subsequent analysis.

Sample collection options

'Fractionate'

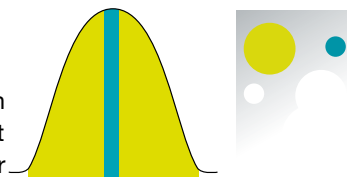
Select the arrangement and number of vials to be collected for each experiment. This is a useful method to model the dispersion curve.



'Optimise'

Each reaction is collected into a 20 ml vial and an aliquot taken at the steady state point into a 2 ml LCMS vial for subsequent analysis.

A 40 ml vial option is also available.



Why should I collect the steady state?

Generally, only the material at the steady state has a product distribution that is truly representative of a scale up result.

Use the Flow-UV in line UV/VIS detector to detect steady state.



FlowSyn Multi-X: FC203B option

- Small footprint
- 1 rack position
- Takes both Fractionate and Optimise racks



FlowSyn Multi-X: FC204 option

- High throughput – run up to 100 experiments
- 4 rack positions
- Takes both Fractionate and Optimise racks

Rack options

Fractionate:	4 x 11 ml vials
Optimise:	10 x 20 ml vials
	10 x 40 ml vials

Set up

Setting up the FlowSyn Multi-X is a very straightforward process:

Step 1

– Set up a single 'template' reaction

FlowSyn Auto Set Up

Inlet A: Bottle	Coil Res Time: 00:10:00
Inlet B: Bottle	Col. Res Time: 00:10:00
Volume A: 1.0 ml	Tot. Flow Rate: 1.0 ml/min
Volume B: 1.0 ml	Pre Collect: 0.0 ml
A:B Ratio: 1 : 1	Post Collect: 0.0 ml
Coil Temp: 13 C	Final Wash: 0.0 ml
Col. Temp: 17 C	Intermed Wash: 0.0 ml

Inlet A: Choose between 'Bottle' and 'Loop' inlets

<< Main Menu (Esc) Start Experiment >>

Step 2

Choose collection mode: fractionate or optimise

FlowSyn Setup Fraction Collector

Collect mode: Fr 4x4ml Fraction size: 0.4 ml

Collect direction: Right Wait: 0.6 ml

Protocol: New Row Aliquot size: 0.07 ml

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

No of Expts: 10

Back (Esc) Table View

FlowSyn Setup Fraction Collector

Collect mode: Optimise Fraction size: 4.0 ml

Collect direction: Down Wait: 1.0 ml

Protocol: None Aliquot size: 0.05 ml

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

No of Expts: 10

Back (Esc) Table View

Step 3

Edit individual experiments in 'Table View'

Multiple Experiment Table

Expt	Vol A (ml)	Vol B (ml)	Ratio	Coil Temp (°C)	Coil Res Time	Flow Rate (ml/min)
1	0.5	0.5	1:1	20	23	00:00:20 3.00
2	0.6	0.4	1.5:1	20	23	00:00:20 3.00
3	0.4	0.6	1:1.5	20	23	00:00:20 3.00
4	0.5	0.5	1:1	60	23	00:00:24 2.50
5	0.6	0.4	1.5:1	60	23	00:00:24 2.50
6	0.4	0.6	1:1.5	60	23	00:00:24 2.50
7	0.5	0.5	1:1	120	23	00:00:30 2.00
8	0.6	0.4	1.5:1	120	23	00:00:30 2.00
9	0.4	0.6	1:1.5	120	23	00:00:30 2.00
10	0.5	0.5	1:1	160	23	00:00:48 1.25
Total:	5.0	5.0				

Back Sort Start >>

Check reaction progress in 'Experiment Running'

FlowSyn Experiment Status

Inlet A: Reagent Inlet B: Reagent Outlet: Waste

Loop A: Load Loop B: Load

Pump A: 0.50 ml/min Pump B: 0.50 ml/min

ACTUAL	SET	
Coil°C: 13	13	Waiting for reagents to reach reactor
Coil°C: 17	17	
p (psi): 115	115	

Current Expt: 0% 00:22:48

Series Status: 1/1

Manual Control 00:22:48 remaining Abort (Esc)

FlowSyn Auto-LF

For automated combinatorial experiments



Run up to 100 experiments with multiple reagent inputs*

Powerful, intuitive PC interface

Efficiently loads and collects reactions simultaneously

FlowSyn Automated Loop Filling (FlowSyn Auto-LF) is an optional module which enables you to perform automated combinatorial experiments, i.e. to run multiple experiments with multiple reagent inputs.

- Automatically prepare focussed combinatorial compound libraries in flow
- Optimise reactions and perform reagent screening using multiple starting materials (e.g. base or coupling reagent screen)
- Integrated wash steps to prevent cross-contamination
- Simultaneous loop filling and fraction collection to save processing time
- Electrically operated selection valve – no injection ports to block!
- Continuously monitor flow reactor progress and performance in real time – interactive displays of pressure and temperature
- Save experiment log files
- Up to 4 reagent channels and 4 reactors when used with FlowControl software.

With its many capabilities FlowSyn Auto-LF is a powerful and versatile research tool enabling you to harness the power of flow chemistry to deliver more compounds faster.

- **Flexible:** Each reaction can have a different set of conditions
- **Efficient:** Separate Sampler and Fraction Collector enables loop filling for the next experiment to begin before the current experiment has finished, significantly reducing series run times
- **Reliable:** No injection port to leak or block; fully integrated robust wash protocols minimise the risk of cross-contamination
- **Versatile:** Partial, full or over-filling of sample loops possible
- **Accurate:** Sampler can be calibrated to position samples precisely within sample loops
- **Powerful:** Independent control of Sampler, real-time reaction monitoring and data logging
- **Easy to set up:** Multiple experiments quickly programmed via familiar user interface
- **Compact:** Stacked small format XYZ Sampler and Fraction Collector minimises valuable fume cupboard space.

* With Flow Control software

Programming FlowSyn Auto-LF

FlowSyn Auto-LF is programmed with dedicated Auto-LF or FlowControl software supplied on a laptop computer. The user interface is organised in a similar way to the standard FlowSyn graphical interface and is very straightforward to use. All the control screens (Configuration, Manual Control, Experiment Setup and Logging) are conveniently accessed by selecting the relevant 'tab'.

Setting up experiments

FlowSyn Auto-LF has been designed by chemists for chemists, so setting up experiments is straightforward and intuitive:

- Enter a series of combinatorial experiments into the spreadsheet style user interface running on the FlowSyn notebook.
- Place the reagent solutions into the sample rack (these may be septum capped to minimise evaporation).
The compact XYZ sampler then automatically selects and loads the solutions into the FlowSyn sample loops.
- Solutions are initially loaded into an intermediate holding coil. Air bubbles can be incorporated to prevent sample dispersion and dilution during the sample loop loading process.
- Each reagent solution is then transferred directly to the appropriate sample loop. An electrically operated selection valve is utilised to avoid the need for unreliable injection ports
- All transfer lines are rigorously washed between operations to eliminate any possibility of cross contamination.

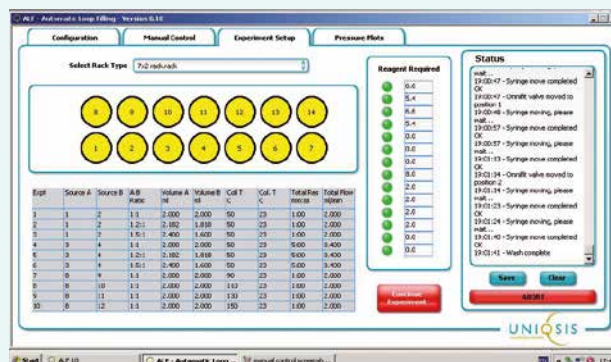
FlowSyn control from Auto-LF

Experiment Setup

Use the 'Experiment Setup' screen to build the set of combinatorial reactions you plan to run. Simply select your desired reagent rack layout and associate the different solutions.

Your plan is displayed as a spreadsheet that summarises all the reaction conditions, each of which can be completely different.

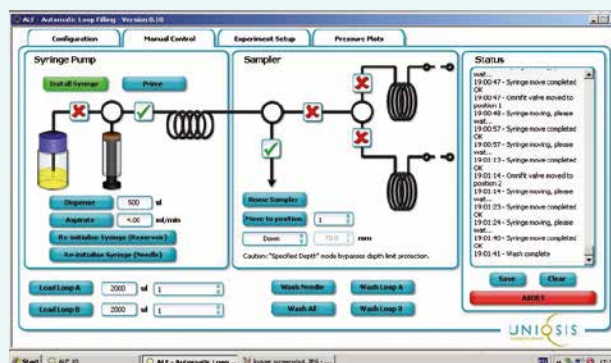
The volumes of reagent solutions are automatically accumulated, and an error message is displayed if any of these inadvertently exceeds the maximum permissible vial volume.



Manual Control

You can control the Sampler and associated syringe pump independently via the Manual Control screen. Simply select the desired flow path by clicking on the check boxes on the schematic. This feature is particularly useful when assembling or calibrating a new hardware configuration.

A number of macros are included to simplify some common operations.



FlowSyn Maxi

For High throughput experiments for multiple Kg quantities per day



Temperature range -85°C to 260°C
(300°C option)

Up to 4 reagent lines 0.1 to 50 ml/min 100 bar

Up to 4 x 60 ml reactors in series, or larger
scale reactor

Safe – setup and walk away operation



The Uniqsis FlowSyn Maxi combines all the benefits of the FlowSyn system with greatly enhanced flow capacity (up to 100 ml/min) and reactors up to 60 ml to deliver a versatile and highly productive continuous flow system for high throughput single reactions.

The high resolution user interface quickly guides the operator through the process for setting up a flow chemistry reaction with 2 reagents or 4 with additional reagent channels. Once set up, FlowSyn Maxi automatically runs the experiment unattended, ensuring that critical parameters remain within defined limits.

Reactor capacity can be further increased to give higher throughput by adding up to an additional 4 reactors*, either HotCoil or Polar Bear Plus reactor stations. By placing coil reactors in series reactor sizes can be increased to 240 ml.

Reagents can be delivered from large bottles or loop up to 50 ml. The FlowSyn Maxi can be operated manually as a standalone instrument or automatically with one of the Fraction collectors such as the FC204 capable of holding 4 racks, ideal for reaction profiling to determine steady-state or optimisation experiments.

The FlowSyn Maxi also combines with the Uniqsis static mixer devices to ensure excellent mixing to allow high reproducibility and facilitate scale up. This is particularly important for higher flow rate applications where diffusion is slow. Custom designed large mixer and residence time chips are also available.

For large scale exothermic applications the FlowSyn can be used with the ColdCoil coupled to an external chiller that can operate down to -85°C or with the Polar Bear Plus. Although not much bigger than a shoe box, this compact and portable unit can maintain reactor temperatures anywhere between -40°C and +150°C.

Polar Bear Plus Flow reactor is easy to use and is completely self-contained, requiring only an electricity supply for operation – no cardice, refrigerants or messy heat transfer fluids! An ideal companion for larger scale exothermic chemistry.



* With FlowControl software

FlowControl™

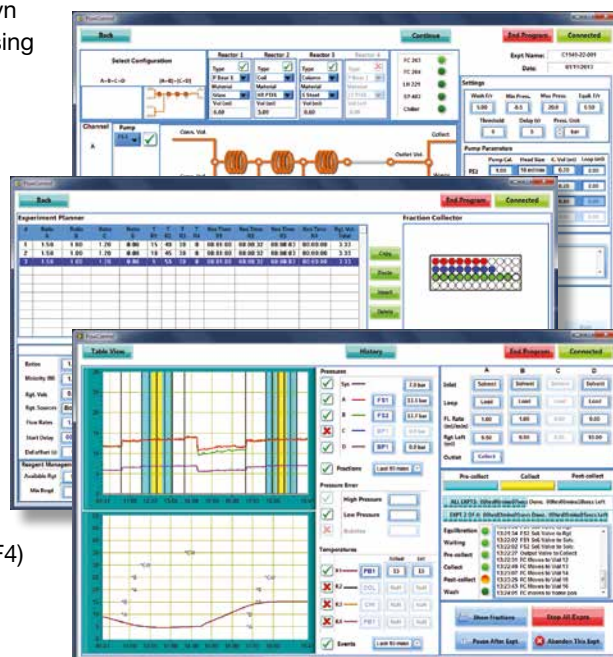
Multi-channel automated flow chemistry

FlowControl is a powerful application that allows the FlowSyn and all add-on modules to be programmed and operated using a single user interface.

Based upon the existing FlowSyn control interface, FlowControl is both intuitive and straightforward to use, but adds a more versatile experiment planner, a data-logging module, a data analysis facility and a reporting function.

Key features include:

- Create new experiments or reload and/or modify existing saved methods
- Control up to 4 flow channels (FlowSyn + BPM or standalone pumps)
- Control up to 4 reactors (coils, chips, columns, sub-ambient reactors)
- Program up to 100 independent experiments with individual fraction collection protocols
- Automated robotic filling of up to 4 sample loops (Auto-LF4)
- Real time data logging, archiving and data export into Excel etc.
- Edit experiments 'on-the-fly', skip or pause the current experiment
- Analyse and manipulate saved data whilst simultaneously running other experiments
- Remote Wi-Fi control and data logging from your office using a dedicated wireless router.



Data logging

A simple real-time data logging package

The real-time data-logging package is intended for users who do not need the sophistication of FlowControl. You can view pressure and temperature plots in real time during an experiment by switching to the 'Pressure Plots' screen. This data allows you to quickly survey the performance of the flow reactor and confirm that all is well.

You can subsequently save and download the pressure and temperature profiles for archiving.

In addition, all the control screens have a 'Status' window summarising the individual automated operations performed in a run. These can also be saved as a record of the experiment.



Coil reactors

For homogeneous reactions (up to +300°C)



Wide range of coil reactors for mg – kg reactions

Excellent reaction visibility in perfluoropolymer coil reactors

Specifically designed for fast heat up and accurate temperature control

Change coils in seconds with our patented reactor design control

FlowSyn coil reactors consist of 1mm id tubing wound around an aluminium 'mandrel'. They have been designed to allow rapid switching between different sizes and materials for different reactions, making FlowSyn an ideal research tool.

Coil reactors heat up rapidly and retain a uniform temperature throughout the whole reaction, guaranteeing reproducibility of reactions.

Smaller volume coils can be used for small scale reactions, allowing the minimal amount of material to be used.

Larger scale reactors up to 60 ml are suitable for scale up experiments or when a longer residence time is required.

Reaction size is not limited to coil volume! Several coils can be placed in series to increase the volume and scale.

Scale up

Maximising throughput (g/hr) is of key importance for scale up. Large scale coils (identified with * in table) have 2.1 mm id channels to increase overall volume. To ensure optimum mixing and heating performance, we recommend using a mixer block to pre-heat and pre-mix reagents.

Can the coils be used for sub-ambient reactions?

Yes – all coils can be used with FlowSyn Cold to -70°C

	PTFE	PFA	Stainless Steel	Hastelloy®
Size / ml	2, 5, 10, 14, 20, 25*	2, 5, 10, 14, 20, 52*	2.5, 5, 10, 20, 40*, 60*	2.5, 5, 10, 20
Pmax psi / bar	300 / 20	300 / 20	2800 / 200	2800 / 200
Tmax / °C	+150	+150	+300	+300
Chemical Resistance	Excellent	Excellent	Very Good	Excellent

Column reactors

For heterogeneous reactions (+150°C and 40 bar)



Adjustable column for varying reaction scale

Pack your own reagents, catalysts & scavengers

Using solid supported reagents, catalysts and scavengers in a flow reactor offers significant benefits.

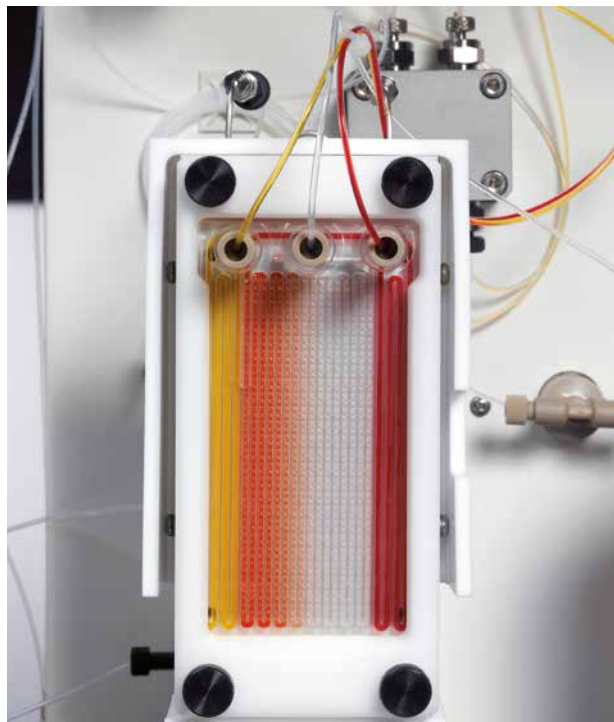
- Convenient for 'Catch and release' reaction protocols
- Scavengers used for in-line purification
- Using immobilised reagents and catalysts can often avoid the need for subsequent product purification.

Uniqsis column heater will accept 10mm id x 100mm OMNIFIT® glass columns with enhanced PEEK adjustable end fittings. The column length can be easily adjusted to allow for varying amounts of material.

6.6mm id columns can also be used with column adaptor inserts. For multiple column use the HotColumn 6 column holder accessory. Optional stainless steel columns are available for use up to 200°C.

Mixer reactor blocks

For efficient mixing



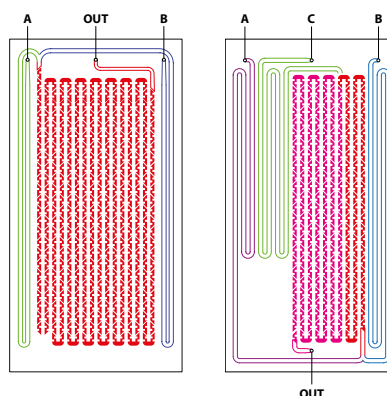
Rapid mixing in 1 mm id channels

Temperature control of rapid exothermic reactions

Manufactured from borosilicate glass

Operates up to 200°C and 40 bar

A + B or (A+B) + C static mixer geometries



To achieve high reproducibility and facilitate scale up, it is important to control both mixing and temperature, particularly for highly exothermic or fast mixing-dependent reactions.

On a small scale, the narrow channels of the FlowSyn system provide good control of mixing by diffusion, and in these cases the standard mixer is adequate.

For higher throughput applications or where diffusion is slow, Uniqsis has designed a range of ingenious glass static mixer blocks (also known as 'chips') to provide efficient turbulent mixing throughout the block.

Precision machined from borosilicate glass and chemically inert, these blocks incorporate narrow channels with active mixing geometries that promote both diffusional and turbulent mixing, as well as functioning as very efficient heat exchangers. Uniqsis offers 2 input A + B and 3 input (A + B) + C static mixer geometries. The 1 mm id channels are wider than most glass 'chips' to minimise blockages.

Mixer blocks can be attached to the FlowSyn column module or to FlowSyn Cold and Polar Bear Plus. Longer residence time chips are available and can be custom made on request. Both positions can be heated and cooled. Reagents are tempered prior to mixing.

Larger residence time mixer/reactor chips up to 20 ml are available for larger scale applications.

Applications

- Fast, exothermic reactions
- Precise temperature controlled mixing
- Pre-mix for high flow rate (scale up) experiments
- Small scale reaction optimisation
- Bi-phasic reaction / quench



Channels are designed and precision machined to promote turbulent mixing and minimise blockages

2 ml	2 way
270 µl	2 way
1 ml	3 way
15 ml	2 way

What pressure and temperature can the mixer block withstand?

Each individual block is pressure tested to 40 bar and can be used at -80°C to +260°C

HotCoil™

Standalone Coil Heater (300°C)



Temperature range: ambient – 260°C
(300°C option)

Use with FlowSyn, Binary Pump Module and FlowControl

Perfect for adding additional reactor capacity to FlowSyn for scale up

Large bright display with visual heat-up and cool-down indication

The Uniqsis HotCoil is an independent heated reactor station that can be linked to the FlowSyn and Binary pump (up to 2). It will work with all the Uniqsis coil reactors from 1 – 60 ml and the HotColumn for catalyst and immobilized reagents.

The HotCoil can be remotely controlled by the FlowSyn and this constitutes an excellent route to scale up by adding additional reactor capacity and therefore throughput to an existing FlowSyn flow chemistry system.

Add up to 2 HotCoil reactors in series to the FlowSyn and Binary Pump reagent addition module using the LAN or RS232 interface.

HotColumn™ adaptor

Coil-to-column reactor convertor



Fits 10, 15 and 20 mm OD columns

Accommodates up to six column holders

Insulated column holders with glass viewing window

Optional external temperature sensor

The HotColumn Adaptor converts any Uniqsis coil reactor module into a multi-position column reactor.

The HotCoil will work on the FlowSyn directly or the HotCoil. This will allow extended bed length to increase the amount of catalyst or immobilised reagent present in a reaction.

The columns can be filled with scavengers to aid with product clean-up.

There are insulated holders for 10, 15 and 20 mm OD columns can hold an external temperature probe. Each holder has a glass viewing window.

FlowSyn ColdCoil™

-70°C to 150°C (requires external chiller and/or heating re-circulator)



Integral probe for precise temperature monitoring

Compatible with FlowSyn coil and chip reactors

Patented coil reactor clamping mechanism

Low cost coil heater module that may be controlled using the FlowSyn or Binary Pump Module or used in standalone mode in combination with your own pumps.

The ColdCoil requires a compatible chiller with an external temperature probe and RS232 interface.

Polar Bear™

High Performance Chiller Unit (ambient to -88°C)



Dedicated cryogenic reactor module for flow chemistry applications

Fast, precise cooling without the need for cardice, liquid nitrogen or heat transfer fluids

Compatible with all Uniqsis coil & chip reactors

Reactor accommodates multiple coils to allow pre-cooling of reagent solutions prior to mixing

Maximum coil reactor volume 60 ml

Developed in a collaboration between Cambridge University, UK and Cambridge Reactor Design the Polar Bear standalone chiller unit delivers efficient cooling down to -88°C without the need for solid CO₂, or liquid nitrogen.

Polar Bear Plus Flow™

(-40°C to +150°C)



Compact and portable – can easily be relocated in and out of fume cupboards

A nitrogen purge can be connected to prevent 'icing-up'

Compatible with all Uniqsis FlowSyn coil and chip reactors

A state-of-the-art heating and cooling reactor module for flow chemistry applications, the Polar Bear *Plus* Flow is completely self-contained and very easy to use. No need for cardice, refrigerants or heat transfer fluids. Takes all Uniqsis coil reactors and has an optional mixer / reactor holder.

Reagent delivery and pump options

Adding extra pump channels is useful for multi-stage (telescope) chemistry or simply for running in a quench

The FlowSyn, FlowSyn Multi X and the FlowSyn ALF system can be upgraded to 3 or 4 channels by either adding the Binary Pump (BPM) or standalone pumps

These are connected to the FlowSyn and can be controlled directly from the FlowSyn interface however for optimal automatic operation the FlowControl software suite is essential.

Binary pump

(Reagent delivery) module



Upgrades any FlowSyn continuous flow chemistry system to four-channel operation

Up to 2800 psi 200 bar maximum pressure and 0.9 – 10 ml or 0.1 – 50 ml per channel

Introduce reagent from bottles or loop injectors

Three Hastelloy/ceramic pressure transducers as standard

Use in combination with individual flow reactor units as the core of a modular flow reactor system



The new Binary Pump Module (BPM) has been designed to offer the flow chemist maximum flexibility. It may be used either as a **2-channel upgrade** in combination with any FlowSyn system (to give 4 identical reagent channels in total), **or** completely independently as a **stand-alone dual reagent delivery module**.

The BPM is solidly engineered and uses latest generation HPLC pump heads modified to offer broad general chemical compatibility.

Three Hastelloy pressure transducers constantly monitor pressure and system performance to ensure safe operation.

The chemical flow path can be stainless steel, PTFE or Hastelloy for optimal chemical compatibility

10P / 20P

Extra channels with standalone pumps



Pump with 10 ml/min or 50 ml/min heads

P max 200 bar

20 P model has built-in pressure transducer and priming port

RS232 and LAN interface

Compatible with FlowSyn and FlowControl

Add extra pump channels to the FlowSyn for multi-stage chemistry or when more than two reagents are used, or to quench a reaction. The pump is plumbed in-line, either to a T piece or mixer.

The pump is automatically recognised and can be controlled by the FlowSyn or FlowControl.

Pumps can have an optional manual 4 way inlet switching valve.

Stand

For pumps or fraction collector



Useful for Binary pump or fraction collector

Plate for Wi-Fi router on side

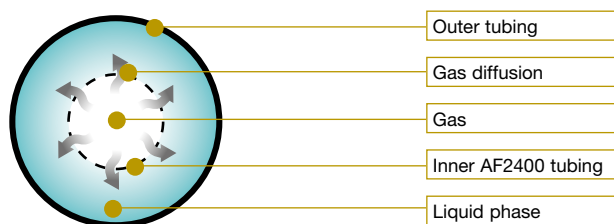
Available in 350 mm or 450 mm wide

The custom designed stand is a useful accessory for placing extra pump channels or fraction collectors to make more space available in the fume hood.

The Wi-Fi router easily attaches to the side plate.

The stand is robust and can easily hold 25 kg.

Tube-in-tube gas-liquid reactors provide a safe and efficient means of performing gas-liquid reactions under continuous flow conditions. They utilise a gas-permeable fluoropolymer inner tubing through which a wide range of gases can rapidly diffuse into the surrounding liquid phase.



GAM I Pre-saturation module

Tube-in-tube Gas Addition Module



Rapidly generate continuous gas-saturated solvent stream

Perform heterogeneous and homogeneous gas liquid reactions

Optional portable gas reservoir

Although designed primarily as a module to provide a solvent feed that is pre-saturated with gas, the GAM I can be used at ambient temperature as a flow reactor. It has an integrated gas management manifold.

GAM II Coil reactor

Tube-in-tube Gas Addition Module



Safely and reproducibly perform gas-liquid reactions in flow

Perform gas-liquid reactions at elevated or sub-ambient temperatures

Economical use of expensive gases

Compatible with FlowSyn, Cold Coil and Polar Bear *Plus* Flow

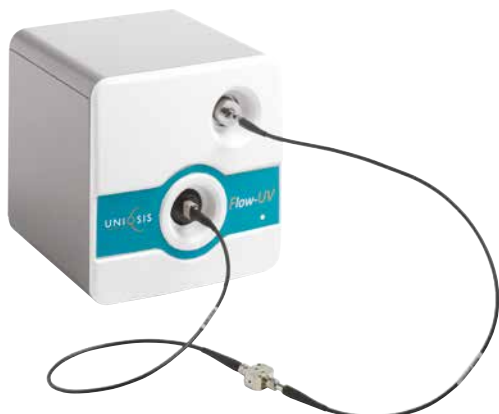
In the GAM II, the tube-in-tube concept is incorporated into a standard Uniqsis coil reactor. This can be either heated or cooled, and gas is now supplied 'on-demand' directly to the reaction mixture to improve throughput.

The outer tubing is stainless steel for safety and to ensure optimal heat transfer.

To facilitate gas management, an optional gas manifold is also available.

Flow-UV

In-line UV-Vis spectrophotometer



Range 190 – 900nm, NIR option available

Short path length, in-line high pressure flow cell may be positioned anywhere in the flow path

Use up to 5 wavelengths

Long life Xenon lamp

The Uniqsis Flow-UV is a compact in-line UV-Vis specially developed for flow chemistry applications that enables real-time monitoring of dispersion and is therefore particularly useful for small scale reactions that are typically not completely under steady state conditions.

Back pressure

Chemically resistant back pressure cartridges



Uniqsis have a proprietary range of BPR cartridges 5,10,20, 30 50 bar together with holders in stainless, PTFE and Hastelloy.

All perfluoropolymer and Hastelloy HC-276 construction

Colour-coded to denote pressure rating (RED, BLUE, GREEN, WHITE, BLACK)

Adjustable (+/- 5-10 bar using a 1.5 mm Allen key)

Place several BPR's in series to increase back pressure

Fit existing BPR cartridge holders

Fabricated entirely from custom-made components

Interchangeable with existing BPR cartridges

Uniqsis

Located in Cambridge, England, Uniqsis has a team of flow chemists and engineers developing innovative technology for the flow chemistry market.

At the forefront of flow reactor design, FlowSyn is the platform of choice within major pharmaceutical companies and academic research laboratories around the world.

Contact us for:

- Assistance in choosing your FlowSyn configuration
- Application support and training
- After sales service and preventative maintenance options.



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