FlowSyn™ – The Continuous Flow Reactor

Designed by chemists for chemists

UNIQSIS

Asynt

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)
- Add the Cold Coil or Cold Chip and an external chiller for sub-ambient reactions
- 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 in 316L stainless steel, PTFE or Hastelloy C

High Performance

- Accurate, uniform temperature control
- Pressure up to 100 bar: perform superheated reactions routinely
- Automated reactions: allows unattended operation
- Chemical compatibility: Choose stainless steel, Hastelloy C 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
- 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 a blockage
- Pressure and temperature limits determined by system configuration and automatically managed
- High performance connections

UPGRADES

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 flow reactor system configuration
- Integrate and automatically control up to 4 pumps and 4 reactors
- Program up to 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 additional standalone reactor modules to FlowSyn
- Temperature range available: ambient to 260ºC
- Compatible with Uniqsis coil or glass chip reactors
- HotCoil can accommodate 6 column reactors using HotColumn Adaptor

Reactors – sub ambient

PolarBear Plus™ range for sub ambient reactions

- State of the art micro-compressor technology: -40ºC to 150ºC
- Full remote control using FlowSyn or FlowControl software
- Compatible with all Uniqsis coil reactors and glass static mixer chip reactors

Pumps

Up to 4 reagent channels and 4 loops

- Stand-alone single channel HPLC or dual pump reagent delivery system (BPM)
- Interchangeable 10 or 50ml/min chemically resistant pump heads
- Control using the FlowSyn of FlowControl software

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

- Solid state technology requires no ongoing maintenance or calibration
- 200 to 1050 nm Xe strobe lamp source
- Either 4 user-selectable wavelengths or full spectrum
- Short path, length high pressure cell – can work at high concentrations
- Optical fibre waveguides allow flow cell to be positioned anywhere in the flow path

FlowSyn – your flexible research tool

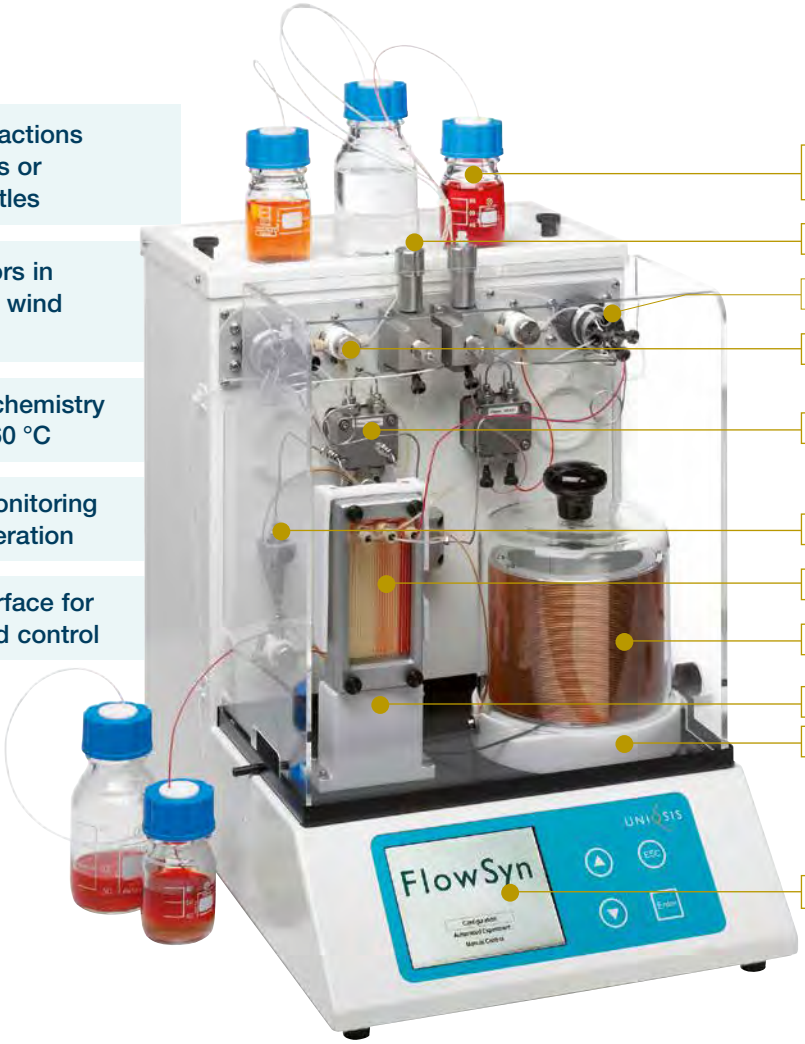
Run small scale reactions using sample loops or scale up using bottles

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 up and control



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 uses the latest generation Knauer AZURA high pressure pumps that have been specially modified with perfluoropolymer and Ti internals to improve chemical resistance. These chemically inert. pumps deliver total flow rates adjustable from 0.01 to 20.0 ml/min at up to a user defined limit of 100bar. 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

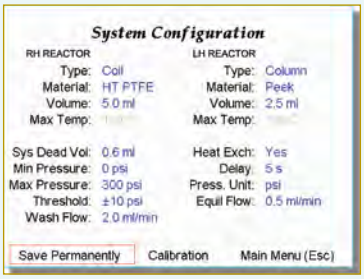
Allows you to pre-heat reagents prior to entering column.

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).

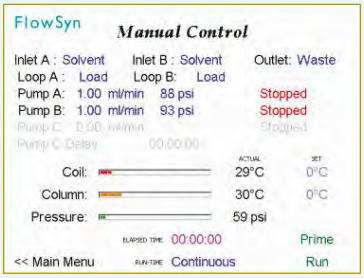
FlowSyn control interface

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

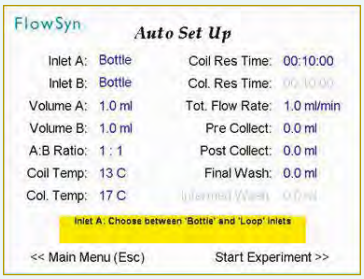
Configuration – FlowSyn will automatically set pressure and temperature limits based upon the materials the reactors are made from.



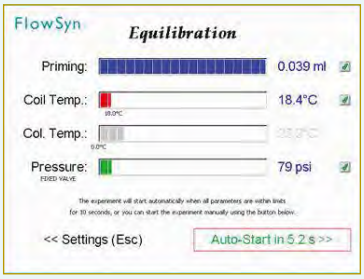
All components (pumps, reactors and valves) can be independently controlled from within the Manual Control screen.



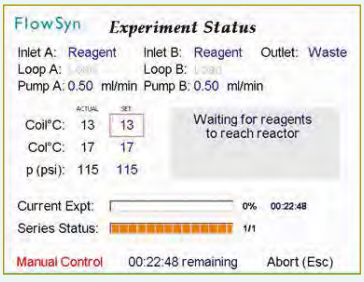
Automated Control – Set up a reaction in minutes. Input the reaction time and FlowSyn will work out the flow rate.



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



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 Multi-X

Multiple experiment package for performing reactions in series

- Automate a sequence of reactions
- Vary reaction temperature, time and stoichiometry
- Perform 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.

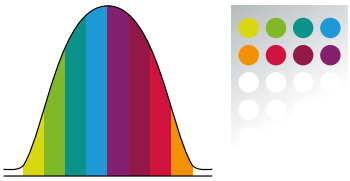
The FlowSyn Multi-experiment package (FlowSyn Multi-X) consists of either a Gilson FC203B or FC204 fraction collector and an enhanced FlowSyn control interface.

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).

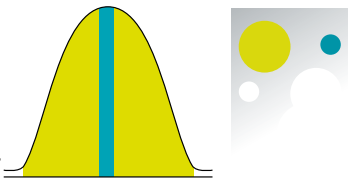
Reaction outputs can be either simply fractionated or collected using a dedicated optimisation rack whereby each reaction plug is collected into a single vial and an aliquot is directly sampled into a 2 ml LCMS vial for subsequent analysis.

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

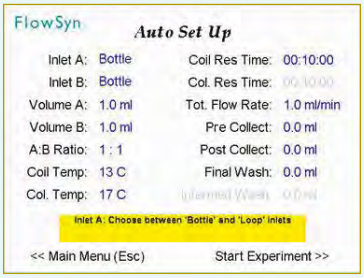
Rack options

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

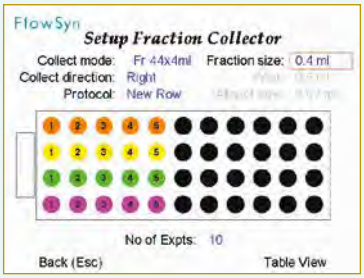
Set up

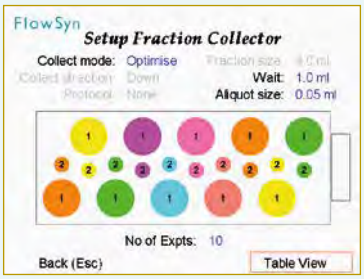
Setting up the FlowSyn Multi-X is a very straightforward process:

Step 1
– Set up a single 'template' reaction

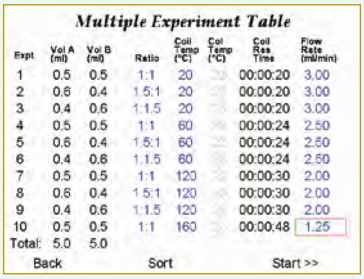


Step 2
Choose collection mode: fractionate or optimise

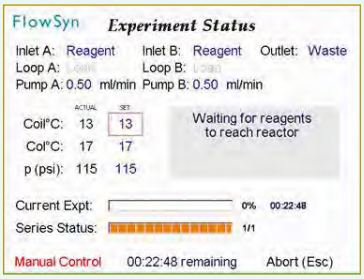




Step 3
Edit individual experiments in 'Table View'



Check reaction progress in 'Experiment Running'



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
- Integrate up to 4 reagent channels (as shown above) and up to 4 reactor modules 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 controlled using FlowControl II software running on a separate computer. This can be connected over dedicated Wi-Fi, if required.

The user interface is organised in a similar way to the standard FlowSyn graphical interface and is very straightforward to use.

Setting up experiments

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

- After selecting the 'Start New Experiment' screen, you will be prompted to enter details of your system configuration. Whilst individual modules will be automatically detected, reactor volumes and materials and the fluidic connections between them should be entered using the graphical interface - similar to the standard FlowSyn.
- Move to the 'Experiment Planner' screen and enter the details of individual experiments into the spreadsheet. Define the way in which you want the reaction products to be collected/fractionated.
- Place the reagent solutions into the sample rack (these may be septum capped to minimise evaporation) and start the experiment.
  The compact XYZ sampler then automatically selects and begins to load reagent solutions into the FlowSyn sample loops, as required.
- 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
- Finally, the pumps adjust to the desired flow rate and the experiment begins.
- All transfer lines are rigorously washed between operations to eliminate any possibility of cross contamination.
- Finally, the system is flushed through with clean solvent and a report is produced to accompany the saved reaction data.

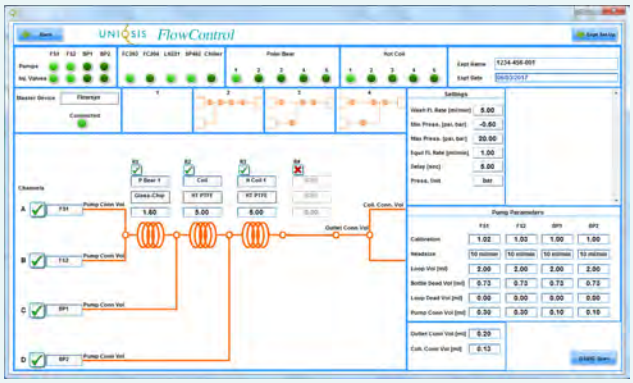
FlowSyn control from Auto-LF

Home Screen

This is the initialisation and navigation control screen.

Start Experiment

Enter the details of your system configuration.



Experiment Planner

Enter the reaction conditions and collection protocol for each experiment.

Real-time Logging

Real-time logging of all the experiments: pressure and temperature traces, UV/Vis plot , flow rates and valve positions

FlowSyn Maxi

For High throughput experiments for multiple Kg quantities per day

- Temperature range up to 260°C (300°C option)
- Flow rates up to 2x 50ml/min; P_{max} = 100bar
- Add Uniqsis standalone reactor modules to increase capacity
- Compatible with Polar Bear modules and Cold Coil and Cold Chip to extend temperature range into sub-ambient
- Add additional standalone pumps or the Binary Pump Module to increase the number of dosing channels
- Program and automate scale-up experiments: fully compatible with Multi-X multi-experiment upgrade

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 Maxi builds on the standard FlowSyn design by adding, in addition to larger capacity pump heads, upgraded chemically inert inlet and outlet selection valves and larger bore tubing.

The high resolution user interface quickly guides the operator through the process for setting up a flow chemistry reaction. 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.

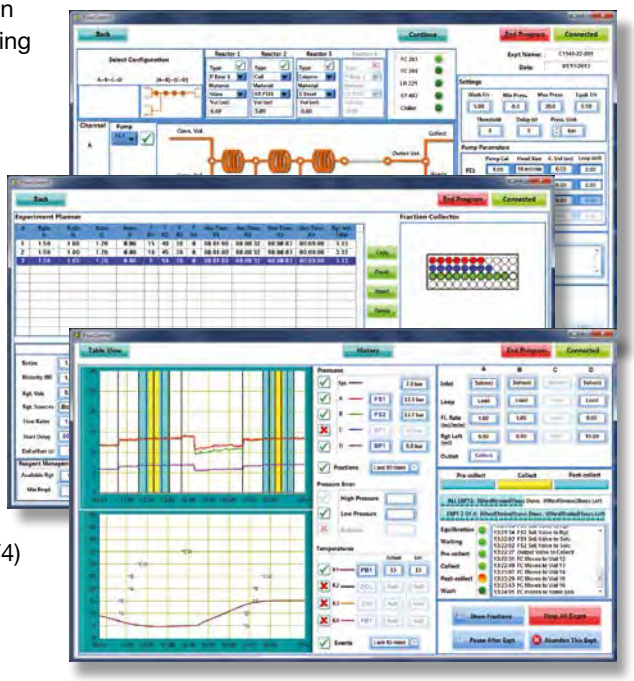
For large scale exothermic applications the FlowSyn can be used with the Cold Coil or Cold Chip coupled to an external chiller that can operate down to -78°C.

The GAM II tube-in-tube gas addition module may also be fitted to provide reactions with 'gas on demand'.

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.

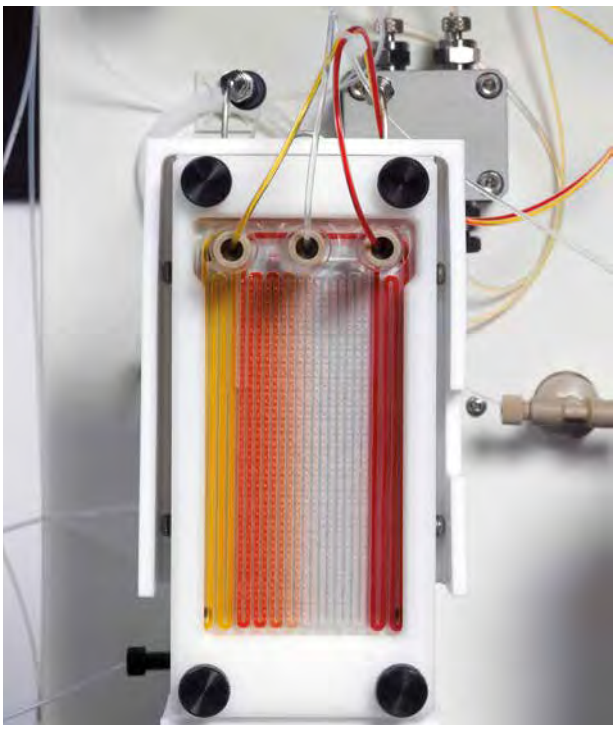
- Convenient for 'Catch and release' reaction protocols
- Scavengers used for in-line purification
- Using immobilised reagents and catalysts can often avoid the need for subsequent product purification.

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

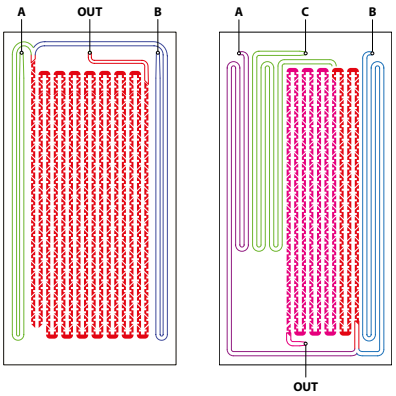
6.6 mm id columns can also be used with column adaptor inserts. For multiple column use the HotColumn 6 column holder accessory. Optional stainless steel columns are available for use up to 200°C.

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 ('GSMs') that ensure 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 are very versatile and can be attached to the FlowSyn column module the Cold Chip, the Polar Bear GSM or, with suitable adaptors, to the Cold Coil and Polar Bear Plus. Larger longer residence time chips (up to 20ml) are also available and can be custom made on request. The GSMs incorporate tempering channels prior to the mixing point.

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

What sizes are available?

From 0.27ml up to 20ml in either a COMPACT or LARGE format

What pressure and temperature can the mixer block withstand?

Each COMPACT block is pressure tested to 40 bar and can be used at -80°C to +260°C. LARGE GSMs with wider channels have a lower P_{max}

HotCoil™

Standalone Coil Heater (260°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 applications

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

Optional external temperature probe for use with HotColumn Adaptor

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

The HotCoil can be remotely controlled by the FlowSyn or FlowControl software 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 embedded LAN or RS232 interface.

HotChip™

Standalone Heater for GSMs (230°C)

Temperature range: ambient - 230°C

Accommodates 1x LARGE or 2x COMPACT format GSMs ('chips')

Insulated cover with large glass view window

Use with FlowSyn, Binary Pump Module and FlowControl

The Uniqsis HotChip is a standalone heated reactor station that can either be used independently or be connected to the FlowSyn and Binary pump. It is compatible with all sizes of Uniqsis glass static mixer chips ('GSMs').

The HotChip is very flexible and has both RS232 serial and TCP/IP ethernet connectivity which allows it to be controlled remotely using either Uniqsis's FlowControl software - or permits integration into other flow chemistry reactor systems.

The unit is compact and portable and a gas cooling option can be fitted to speed up cool-down times, if required.

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 HotColumn Adaptor can be fitted to either the FlowSyn, the HotCoil, the Cold Coil or the Polar Bear Plus Flow. All column reactors are 10cm long, and are available in either glass (with an adjustable endpiece to vary bed length), or stainless steel. A range of different diameters are available.

Columns can be easily linked in series to extend bed length for scale-up applications.

Separate insulated holders fit 10, 15 and 20mm OD glass columns and also 3/8" and 1/2" OD stainless steel column reactors.

For more accurate temperature control, each holder can accommodate an external temperature sensor. 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. Optional COMPACT GSM holder.

Polar Bear Plus GSM™

(-40°C to +150°C)

- -30°C - 150°C temperature range
- Fast, precise cooling without the need for cardice, liquid nitrogen or heat transfer fluids
- Compatible with all Uniqsis GSM reactors
- Maximum GSM reactor volume 20 ml

A versatile self-contained heating and cooling module for Uniqsis GSMs, the Polar Bear Plus GSM can accommodate 2x COMPACT GSMs or 1x LARGE format GSM. The mixer/reactors can be conveniently maintained between -30°C and 150°C without the need to periodically add refridgerants, simply by connecting to an electricity supply.

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'
- -40°C - 150°C temperature range
- Compatible with all Uniqsis coil 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.

Additionally, since the BPM is essentially a FlowSyn without the integrated reactor modules, by adding standalone reactor modules it is possible to build a custom flow reactor system that is controlled through the BPM software. Again, automated control is further enhanced by additional of the FlowControl software package. Uniqsis offer a variety of such 'FlowLab Plus' systems off-the-shelf.

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

Chemically resistant HPLC pump fitted with interchangeable 10 ml/min or 50 ml/min heads

P_{max} = 100/200bar

Available with integrated pressure transducer and priming port

Remote control via RS232 serial or TCP/IP ethernet

Compatible with FlowSyn & FlowControl software

Add extra pump channels to the FlowSyn for multi-stage chemistry, 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 II software.

Pumps can optionally be fitted with a useful manual 4 way inlet switching valve or an integrated in-line back pressure regulator.

Standalone HPLC pumps are available both with and without a pressure sensor.

Equipment stand

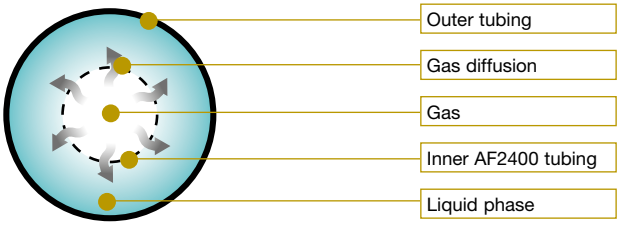
For pumps or fraction collector

Useful to maximise the use of fume hood space

Available in 3 different sizes

These custom-designed stands are very useful for building a modular (FlowLab) flow reactor system and allow for the optimal placement of pumps, reactor modules and fraction collectors within limited fume hood space.
The stands are constructed of epoxy-coated steel and are very strong.

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 a 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

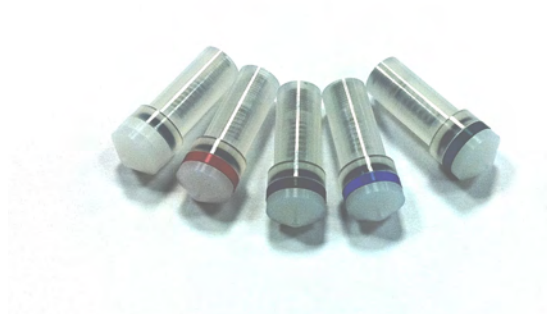
- Range 190 – 900nm, NIR option available
- Short path length, in-line high pressure flow cell may be positioned anywhere in the flow path
- Use up to 5 wavelengths or full diode array
- Long life Xenon lamp

The Uniqsis Flow-UV is a compact in-line solid-state UV-Vis specially developed for flow chemistry applications.

It 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 available in 5,10, 20, 30, 40 bar ratings together with holders in stainless steel, PTFE and Hastelloy.

They are constructed from Hastelloy, EDFE, Kel-F and Perlast to afford maximum chemical resistance.

- 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

PhotoSyn

High power continuous flow Photoreactor

- 365nm (UV-A), 455nm (BLUE), 525nm (GREEN) and custom wavelength options
- 700W Variable output programmable PSU
- Independent temperature control of coil reactor
- Ethernet (TCP/IP), RS232 and USB connectivity

The Uniqsis PhotoSyn is a high power photoreactor for both small-scale and scale-up applications. It can accommodate coil reactors up to 50ml in volume. The high-power LEDs encircle the coil reactor for optimal illumination. The constant current, digital power supply has ports for remote control over bethernet and serial.

Borealis Flow

Compact flow reactor for continuous flow chemistry

- 365, 385, 405, 420, 455, 525nm LED options
- 15ml FEP coil reactor
- Liquid-cooled Borealis 120/180W LED lamp unit
- Internal temp. sensor to accurately measure reactor temperature
- Independent control of reactor temperature

The addition of a high-power Borealis LED lamp unit and an internal FEP coil reactor to the Cold Coil converts it into the Borealis photoflow reactor. Borealis Flow delivers high intensity narrow-bandwidth irradiation and accurate temperature control of the coil reactor in a compact package.

Borealis PhotoChip

Compact format plate reactor for continuous flow chemistry using GSMs

- 365, 385, 405, 420, 455, 525nm LED options
- Maximum input power 180W
- Compatible with all Uniqsis GSM and TIP reactors

Photochip is a compact, high power LED photoreactor module for GSMs and tube-in-plate reactors.

Accurate temp. control of the GSM is achieved by connection to either a tap or recirculator.

Asynt is a global provider of world-leading technologies and services for scientific research. Developed by chemists for chemists, our laboratory equipment responds to the real demands of industry and academia worldwide, providing solutions from benchtop to kilo lab scale and beyond.

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.

Headquarters:
Asynt Ltd, 29 Hall Barn Road, Isleham, Ely, Cambridge CB7 5RJ, United Kingdom
+44 (0) 1638 781 709
www.asynt.com