

PreciGenome Perfusion System

Introduction

Perfusion system for cell culture is a system with the passage of fluid through the circulatory system or lymphatic system to a bioreactor for cell culture. There are different types of cell perfusion systems, including microfluidic perfusion systems, gravity or pressure-driven perfusion systems, bioreactor perfusion systems, and small-mammal organ perfusion systems. These perfusion systems are convenient tools for a variety of applications, such as multi-reagent delivery, culturing cells at microscales, etc.

Choices of Perfusion Systems

The choice of a perfusion system depends on the type of experiment. For simple live cell imaging experiments, pressure-driven flow controller, syringe or peristaltic pumps can be used. For experiments requiring more control over cells environment, injection at precise low flow rates or switch between different media, pressure-driven is preferred for the applications.

PreciGenome offers a variety of perfusion systems for different requirements of your applications. Our system offers pulse-free flow perfusion with our microfluidic and pressure-driven technology. It allows control over microenvironmental cues, such as cell-cell and cell-matrix interactions, the potential to scale experiments, the use of small culture volumes, and the ability to integrate with microsystem technologies for on-chip experimentation. It also allows precise and on-demand delivery and removal of biochemical reagent in the extracellular microenvironment, and controlled application of mechanical forces exerted via fluid flow.

Microfluidic Perfusion Chambers

A wide range of commercial perfusion and imaging chambers are now available. It includes conventional perfusion chambers, i.e. glass bottom Petri dishes, multi-well chambers mounted on microscope slides, heating stages with a variety of interchangeable perfusion adapters, or microfluidic chips. Depending on your experiments, some chambers will be more suited to your needs. PreciGenome offers a variety of microfluidic chips in different materials to meet most of our customers' application requirements. Three types of materials, including polymers, glass and silicon, are commonly used to fabricate microfluidic chips. Material of chips is selected depending on the application requirements, including chip design, types of solvent or reagent used in experiments, needs of applications, budget, and fabrication time, etc.



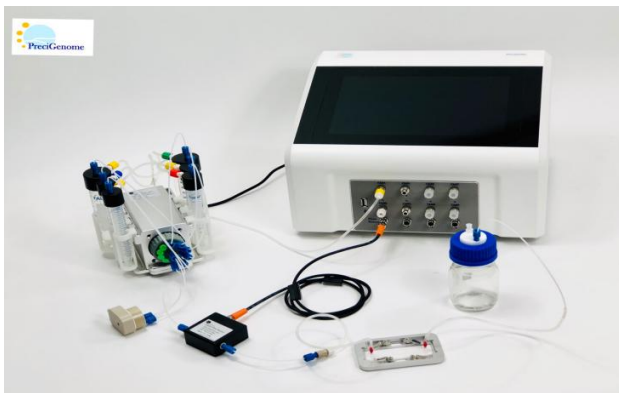
Applications

- Cell culture, cell response to medium change
- Live cell imaging, 3D cell culture, stem cells assays
- Drug screening
- Calcium imaging, bioreactor research, toxicity tests

Multi-Reagents Perfusion System

Introduction

Many microfluidic applications, such as cell culture, Organ-on-a-Chip, and DNA/RNA sequencing, etc., require multiple reagents switching. PreciGenome offers a complete and ready-to-use perfusion system with consistent liquid delivery. With our software and SDK libraries, users can implement complicated process control easily. Our perfusion system has been designed to meet most common cell biology researchers' needs.



A multi-reagents perfusion system setup with PG-MFC controller

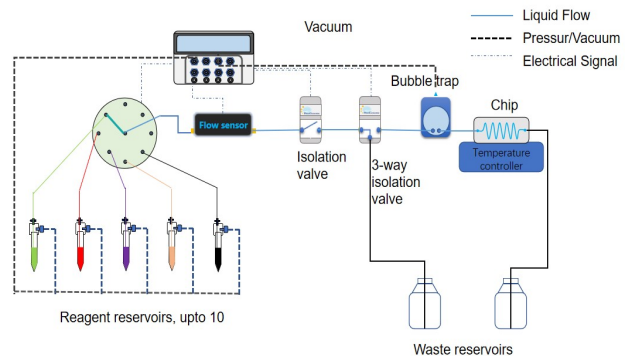
System Benefits

- User configurable complex process
- Automation
- Minimal cross-contamination between reagents
- Precise pressure control
- Liquid flow rate control with an external flow sensor
- Easy for setup and optimization
- Low cost
- Controlled volume injection (optional)

System Configuration and Description

The system is comprised of a pressure/flow controller, a rotary valve, several microfluidic reservoirs (the number depending on the number reagents used), a liquid flow sensor (optional), a bubble trap (optional) and other necessary accessories such as tubing, fittings, and connectors. A precisely controlled pressure is applied to the multiple reagent reservoirs and pushes reagents from the reservoirs to the downstream fluidic line. The rotary

valve is used to select which reagent is pushed to the downstream fluidic line. A liquid flow sensor is optionally connected to measure the flow rate in the flow path for precise flow rate control and controlled volume delivery. A bubble trap can also be connected in the fluidic path to remove bubbles. Isolation valve can be added in the fluidic path to direct reagents to waste or the device users are interested.



Schematic of multi-reagents perfusion system

System Specifications

- 4 independent pressure channels (2 for the light version controller)
- Max 4 sets of perfusion units running simultaneously
- Reservoir volume: 15mL/50mL/1.5mL, larger volume options also available
- Liquid flow rate up to 5 ml/min

System Components

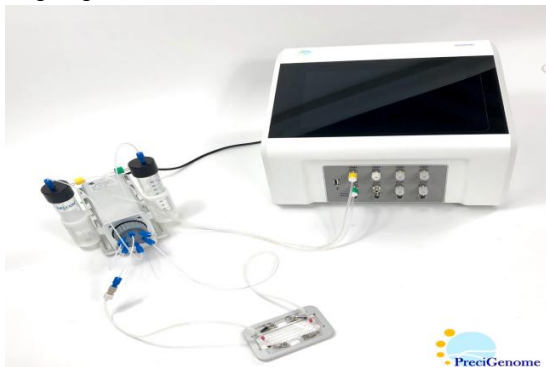
Catalogue number	Part description	Quantity
PG-MFC-8CH (or PG-MFC-LT2 light version)	Microfluidic pressure/flow controller	1
PG-ROT-10	Rotary valve (10 to 1)	1
PG-LFS-0430 (other models are available for different flow rate ranges)	Liquid flow sensor (0-80uL/min)	1
PG-MRK-15ML (other models are available for different volumes)	Microfluidic reservoir kit (15mL)	N(depends on number of reagents)
PG-FIT-Kit	Fingertight Flangeless Fittings	1
TUB1-16-L50I	PTFE Tubing, 1/16"OD x 1/32"ID, 50inch/pack	1

Recirculating Perfusion System

Introduction

Recirculating perfusion system is a cell culture device with a bioreactor connected to a recirculation pathway, where the exchange of spent media occurs.

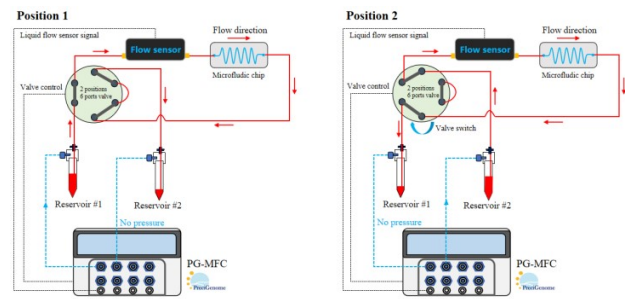
PreciGenome recirculating perfusion system offers the ability of simulation of various physiological flow conditions, such as continuous unidirectional, oscillating, and pulsatile flow. It allows control over microenvironmental cues, such as cell-cell and cell-matrix interactions, the potential to scale experiments, the use of small culture volumes, and the ability to integrate with microsystem technologies for on-chip experimentation.



A reagent circulation setup with PG-MFC-8CH controller

Working Principle

As shown in the schematics, in position 1, reagent flows out from reservoir 1, through the 6-port switching valve (3-ways 2-positions valve), enters the microfluidic chip with a perfusion chamber from its left side, and flows into reservoir 2. In this position, the pressure is applied to reservoir 1, and reservoir 2 connects to the atmosphere. In position 2, reagent flows out from reservoir 2, enters the microfluidic chip from its left side, and flows into reservoir 1 by changing the connection position of the switching valve. In this position, the pressure is applied to reservoir 2, and reservoir 1 connects to the atmosphere.



Schematic of reagent circulation system

System Benefits

- Controlled shear stress
- Long duration experiments
- Automation
- Precise pressure and flow rate control (optional)
- Ready to connect with the incubator
- Temperature control module is also available to be integrated into the system (optional)

Work Modes

- Unidirectional flow mode
- Bidirectional flow mode
- Pulse flow mode

System Components

Catalogue #	Part description	QTY
PG-MFC-8CH (or PG-MFC-LT2 light version)	Microfluidic pressure/flow controller	1
PG-ROT-6P-3W2P	6-port switching valve (3-ways 2-positions)	1
PG-LFS-0430 (other models are available for different flow rate ranges)	Liquid flow sensor (0-80uL/min)	1
PG-MRK-15ML (other volumes options are available)	Microfluidic reservoir kit (15mL)	2
PG-FIT-Kit	Fingertight Flangeless Fittings	1
TUB1-16-L50I	PTFE Tubing, 1/16"OD x 1/32"ID, 50inch/pack	1