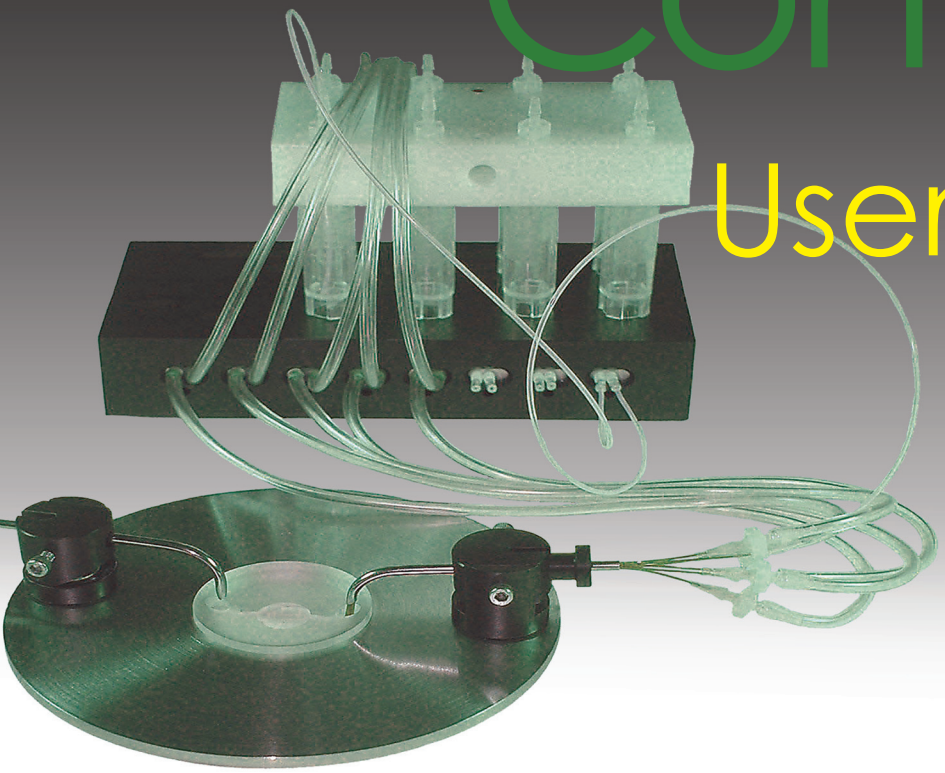
Flow Control

User's Guide



Pressure Controller for liquid delivery systems

- **Precise Pressure Control throughout the experiment**
- **Flow control**
- **Compatible with any perfusion system**
- **Ideal for Small Volume Delivery systems**
- **Compatible with Imaging setups**

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Specifications

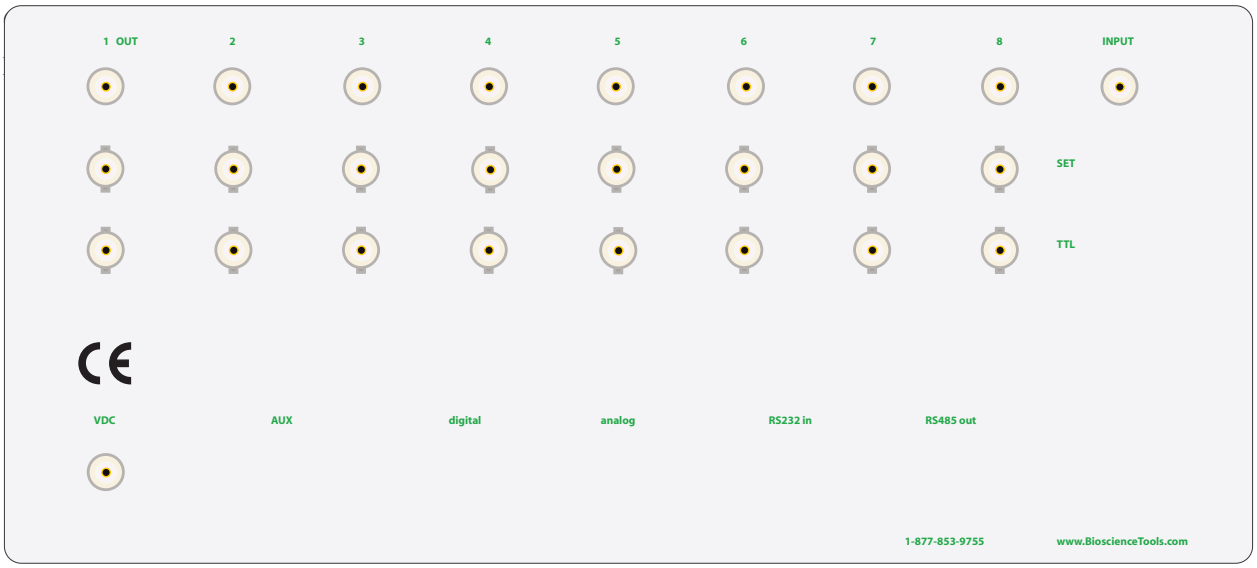
Output Range
0 to 15 PSI
Ports
easy-connect 4mm tubing;
Digital control
BNC connectors;
DB-9 connector;
Analog Output
To monitor output pressure;
Analog Input
To set output pressure;
Analog Discriminating Input
To trigger output pulses;
RS232 Input
To trigger output pulses using software, DB-9;
Size (Controller) : 15.5Wx12Hx12D in.
Power Supply
94 to 234 V AC, 50/60 Hz, External 15VDC adapter

Introduction

The complete pressure control system comes with a controller, power cord, and external power adapter. No pressurized source of gas is required to operate the system. During operation, the controller is continuously monitoring the output pressure level in each channel to provide consistent and defined flow of solution.

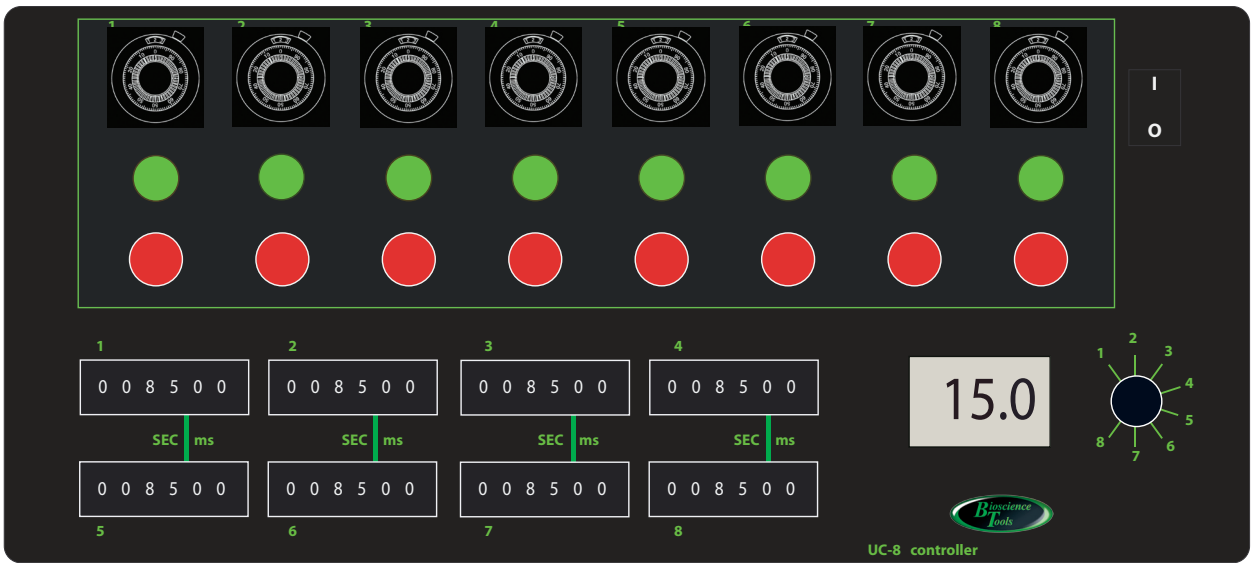
Installation Guide

1 Using provided fitting connect tubing to your setup: gas mixture adapter SH-A, pressure cylinders PC or a small volume delivery system SVDS1. Some additional tubing and fitting might be required. Usually luer-lock fitting or other easy-connect adapters are used to splice different diameter tubing while connecting to 4mm O.D. translucent tubing provided, which fits inside OUT ports on the back of the controller. After splicing provided tubing to your setup, simply push the tubing inside OUT port all way, and slightly pull back to clamp. In order to disconnect the tubing, push YELLOW rim inside the connector, and pull the tubing out.



2 Turn the controller ON. Initially, you can plug the output tubing, so that the controller can regulate output pressure. IMPORTANT: if output tubing is open into the air, the controller might not be able to provide enough pressure. For high pressure requirements and high solution flow, we manufacture a different model that uses a pressurized external source of pressure (gas cylinder for example).

3 Use a switch on the front panel to select a channel to display output pressure on LCD monitor. The LCD monitor on the front panel will show pressure readings in PSI. Rotate the corresponding dial on the front panel to SET required pressure level.



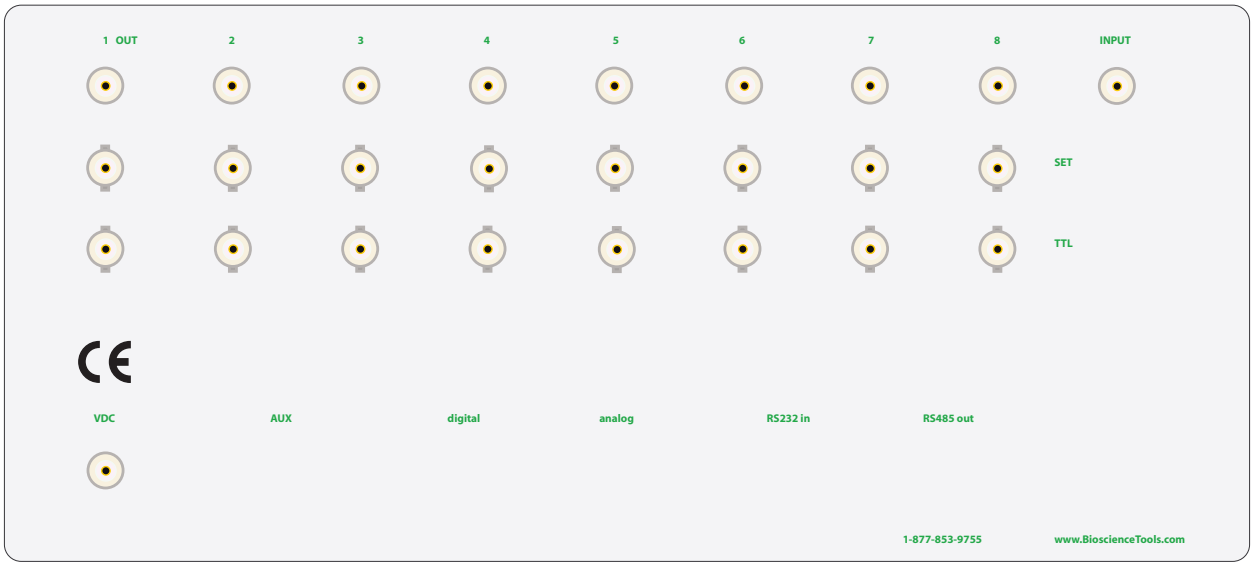
4a Set required pressure pulse length using a corresponding timer dial. Push the corresponding GREEN button. It will turn ON indicating that the output pressure is provided to the channel. The light will turn OFF automatically. However, you can always turn it OFF by pushing the button again.

4b If the timer is set to 000000, the pulse length is controlled manually and by TTL input on the back of the controller. Even if the channel is turned ON electronically by TTL input, it can be always turned OFF by pushing the corresponding GREEN button. NOTE: during switching the timer it is possible to put the dial into 000000 position for a moment, which might result to triggering the output. To prevent this accidental switching, the dial can be set to at least 10ms while switching other digits (if it is questionable to have this extra 10ms during the pulse, simply adjust the last position to 0ms before operating the controller).

Front Panel Controls

Front Panel Controls	
POWER switch	Turns the controller ON.
GREEN LED BUTTONs	Turns the channel ON, and indicates that controller is providing output pressure to the channel.
DIALs	Set output pressure.
TIMERs	Set the duration of the pressure pulse.
SWITCH	Selects channel to display on LCD monitor.
LCD monitor	Indicates output pressure, PSI.

Inputs, Outputs and Back Panel controls



Inputs & Outputs	
OUT ports	Connects to SVDS1, PC cylinders or SH-A adapter to pressurize solutions.
SET BNCs	Used to set output pressure by an external signal 5 V/ 100 PSI
TTL BNC	Digital (TTL) input to turn channels ON/OFF electronically
RS232 DB-9	Software control to trigger output pulses
Aux DB-15	Additional controls, pin 1 is to use with an analog signal to trigger output pulses
VDC power jack	Connects to an external power supply, 15VDC..

Using Analog Input Controls

The table below shows recommended values for analog input (pin 1 in DB-15 Aux connector, pin 8 is ground) to activate the channels. The analog discriminator uses windows 0.5V wide, so other values can be used as well.

Input Voltage	Activates Channel
0-0.5 V	None
1 V	Channel 1
1.5 V	Channel 2
2 V	Channel 3
2.5 V	Channel 4
3 V	Channel 5
3.5 V	Channel 6
4 V	Channel 7
4.5 V	Channel 8

Output Control Using Software

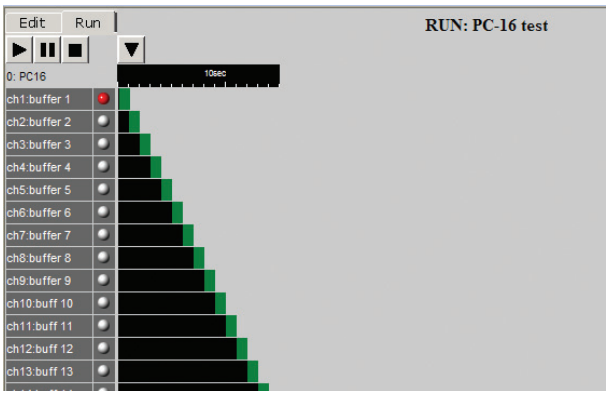
After connecting the controller to your computer through provided RS232 null-modem cable (or an optional USB adapter **CFPS-USB**), you can switch valves by sending ASCI codes from your application software. This is used to program automatic perfusion control during imaging, for example.
RS232 port (COM1, for example) should be set at 9600 baud, 8 bits, Parity none, 1 Stop bit. The following is the list of commands (all letters are **capital**):

Command	
!Sn	Set channel n ON (where n is 0 for channel 1, F for channel 15)
!Cn	Set channel n OFF
!A0	Set first 8 channels (1 … 8) OFF
!B0	Set second 8 channels (9 … 16) OFF
!A1	Set first 8 channels ON
!B1	Set second 8 channels ON
!SG	Set all channels ON
!CG	Set all channels OFF
!Rn	Read status of channel n, returns 0 if OFF, and 1 if ON
!RG	Read status of all channels, returns 16 bits nnnnnnnnnnnnnnn, the first bit is channel 16, the last is for channel 1
!RH	Returns the value of analog input in Volts
!RI	Returns the value of analog input as a 16 bit binary number 000000nnnnnnnnnn. The analog signal discriminator is a 10 bit ADC, so the first 6 bits are zeros. To convert the binary result to voltage, divide the result by 1023, then multiply by 5, and then multiply by 2.5.

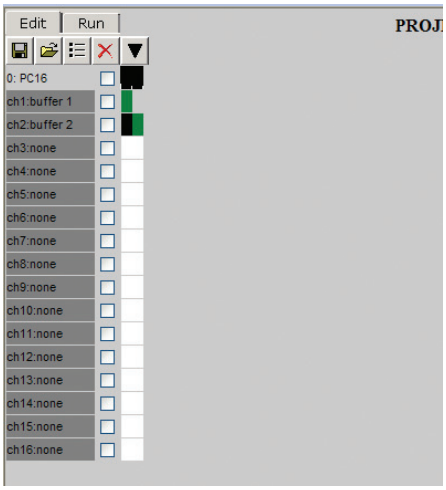
Using Protocol Automation Software

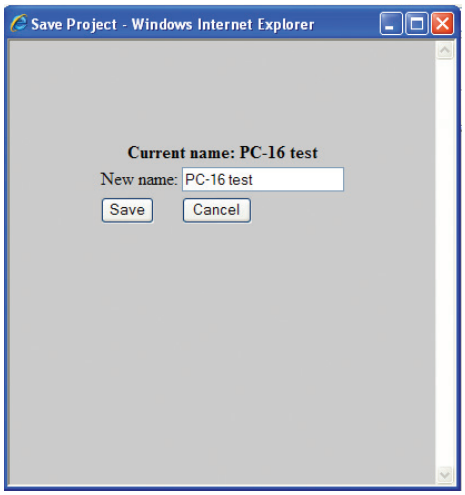
The Protocol Automation software package ships installed on a laptop computer. Connect the computer to the controller using provided NULL MODEM cable. Turn the computer ON. Find and double-click BIOSCIENCE TOOLS icon, which is located in the middle of the Desktop. What you will see on the monitor is a sample protocol to activate all 8 channels of the controller. Click the button PLAY (black triangle) to start the protocol. The controller's channels will be activated for 1sec in sequence. The RED indicators on the controller's front panel and manual buttons on the computer's monitor will be ON for 1sec. After the fifteen's channel is OFF, pop-up window will notify you that the protocol is completed.

Manual channel control can be achieved by clicking small round button located next to the name of the channel. This can be used during initial setup of your experiment.

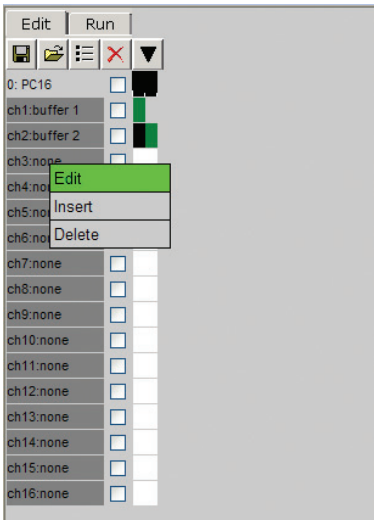


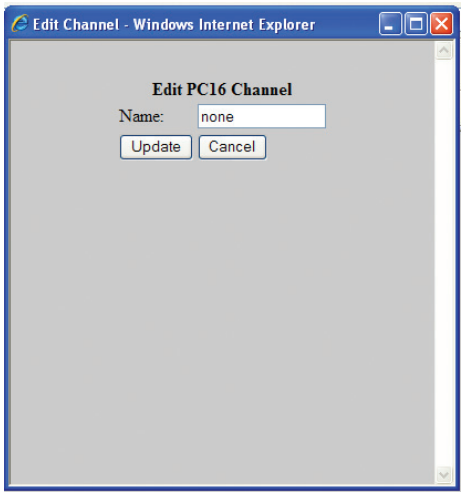
In order to edit or create a new protocol, click the tab EDIT. On the following screen click the button SAVE AS. The window pop-up will let you to create another protocol under different name. After typing a new protocol name, click button SAVE.



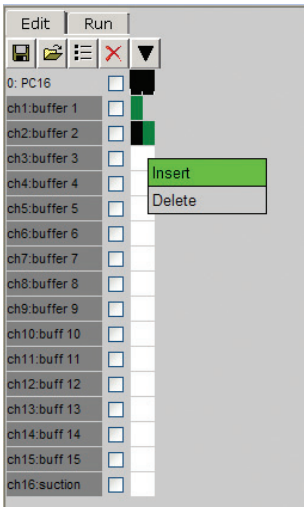


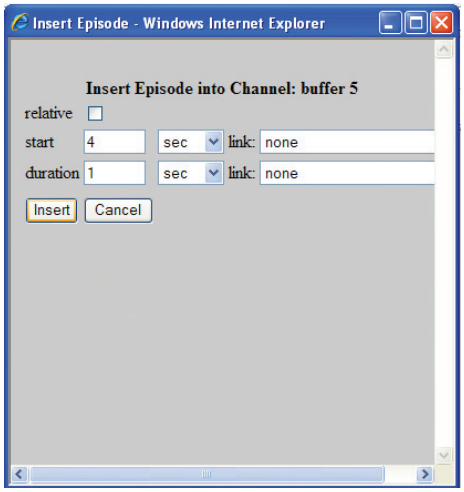
Each channel can be renamed to reflect different settings used during the protocol. In order to rename the channel, click on the channel name, and on the pop-up window select EDIT. On the following pop-up, type in a new name, and click button UPDATE.



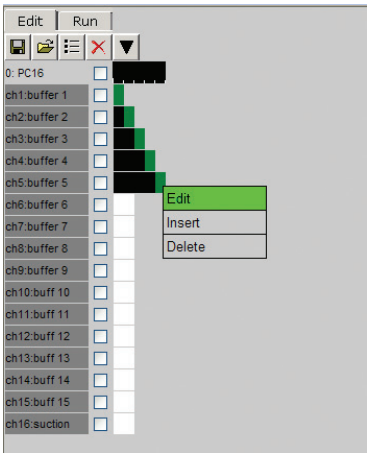


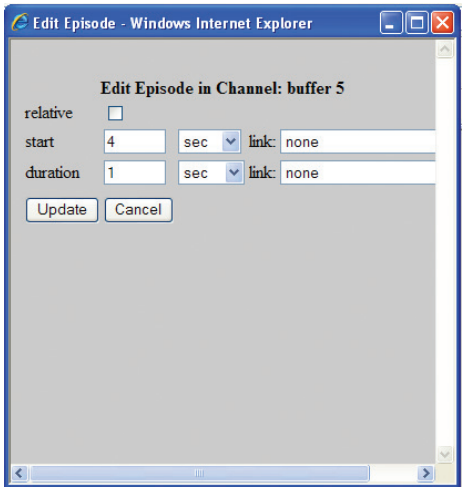
Each channel can have an unlimited number of time episodes, during which it is OPEN. If the channel does not have active episodes, it will be represented an white square. In order to created an OPEN episode, click on the white square and select INSERT on the pop-up widow. The following window will let you to specify time setting for the episode. Type in start time and duration. and click button INSERT. Start time is calculated from the beginning of the protocol. The OPEN episode will be represented by a GREEN area.



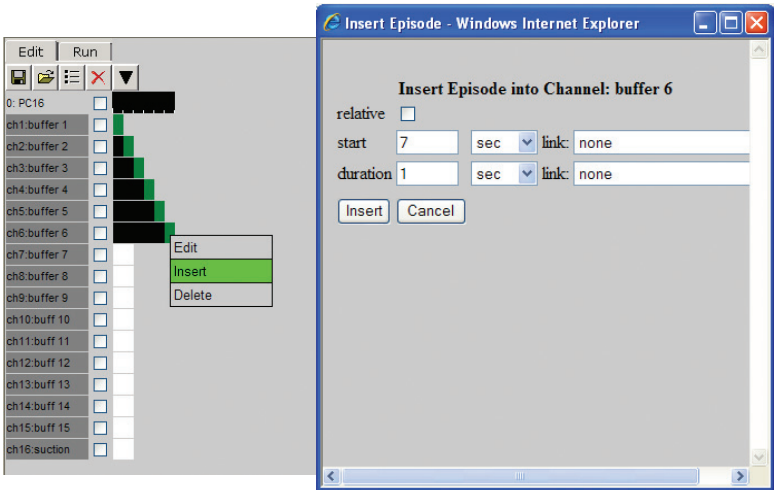


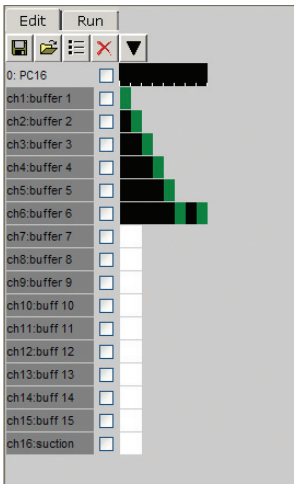
In order to change time settings for an OPEN episode, click on the episode and select EDIT on the pop-up. On the following pop-up window, type in new time parameters and click button UPDATE.





An additional OPEN episode can be added after an existing episode for the same channel. Click on GREEN episode and select INSERT on the pop-up window. On the following pop-up, type in time parameters required and click button INSERT.



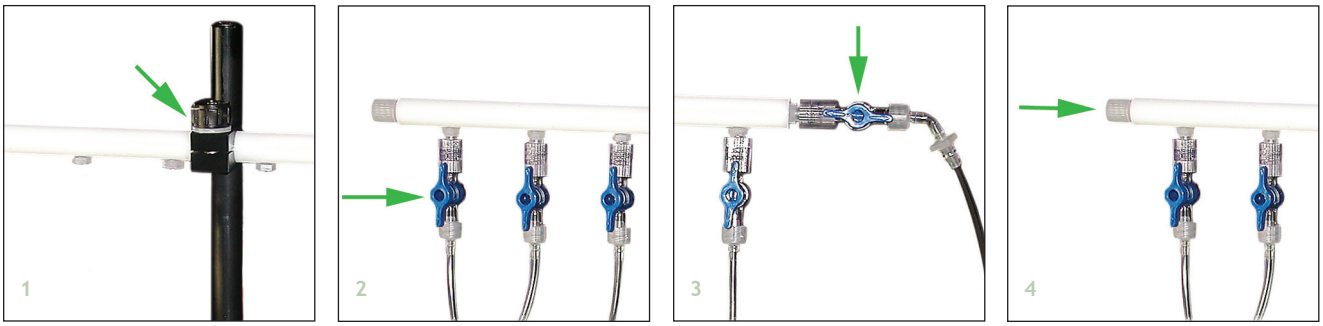


Warranty

This product is warranted to be free from defects in material and workmanship for the duration of one year. Normal wear, or damage resulting from abuse, accident, alteration, misuse, service by an unauthorized party or shipping damage, are excluded from this warranty and are not covered. Bioscience Tools will repair or replace the defective product covered by this warranty free of charge if it is returned, postage prepaid, to Bioscience Tools, 4527 52nd Street San Diego, CA 92115, ph: 1-877-853-9755.

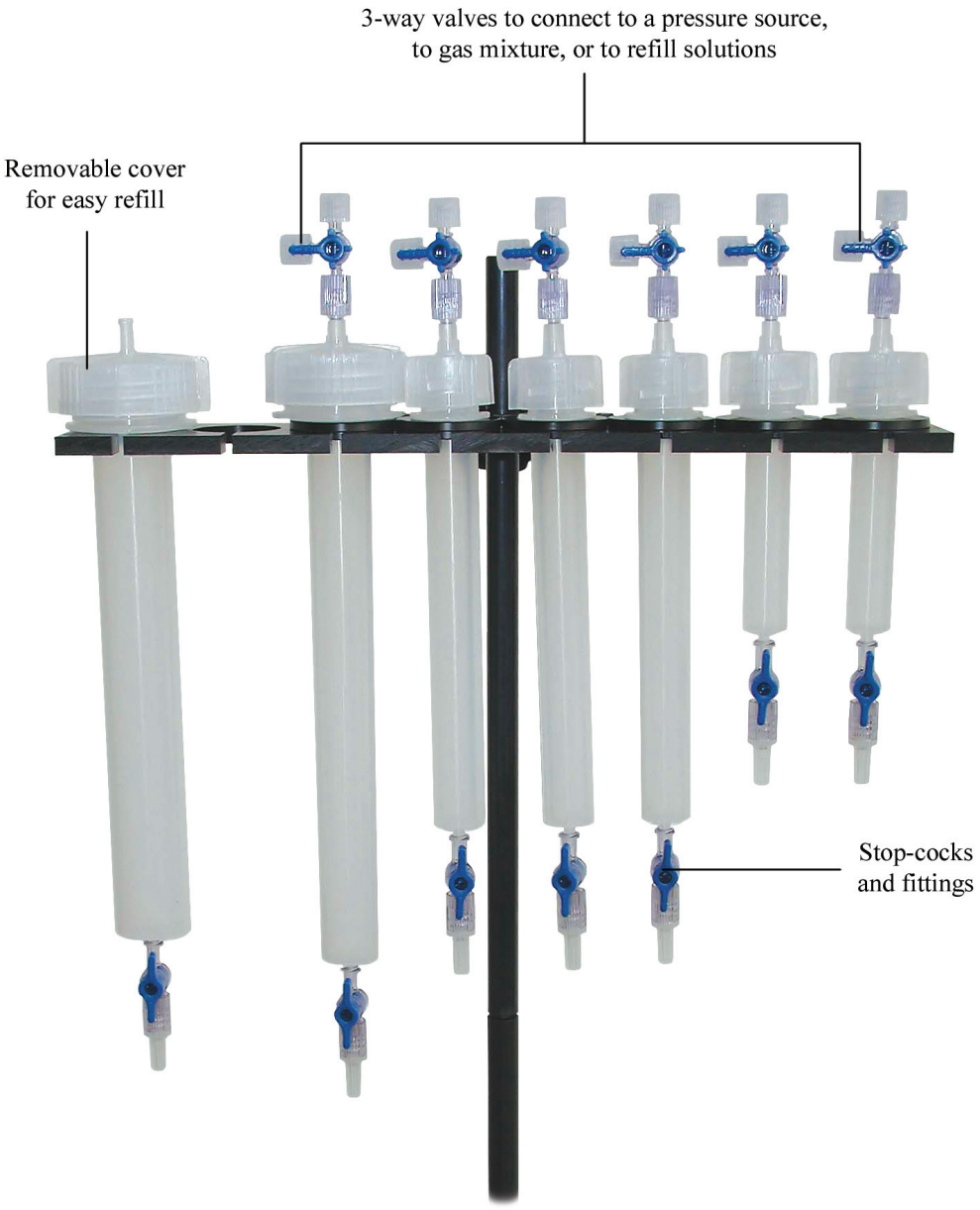
Gas Mixture Adapter, SH-A

This adapter is used to pressurize or to deliver gases, CO2/O2 for example, to experimental solutions in syringe barrels or other containers. Continuous bubbling of the experimental solutions ensures gas saturation inside the solutions. The adapter can be also used to pressurize the solutions by connecting to optional pressure cylinders, PC, available in different sizes - volumes.



1. Mount the adapter on a 0.5in. post (included with SH-1A syringe holder) using provided X-block.
2. Eight luer connectors positioned along the adapter deliver gases to eight separate solutions through 2-way valves (stop-cocks) and thin Teflon or polyethylene tubing. The tubing can be replaced with any custom tubing and other means to dissipate gases inside solutions (aquarium stones, for example). If less then 8 solutions are used, the extra outlets can be closed.
3. Use soft tubing with luer-lock to connect to a source of gas mixture through a 3-way valve attached to the end.
4. Another end can be plugged, or connected to the second adapter (several adapters can be connected in sequence to use the same gas mixture).

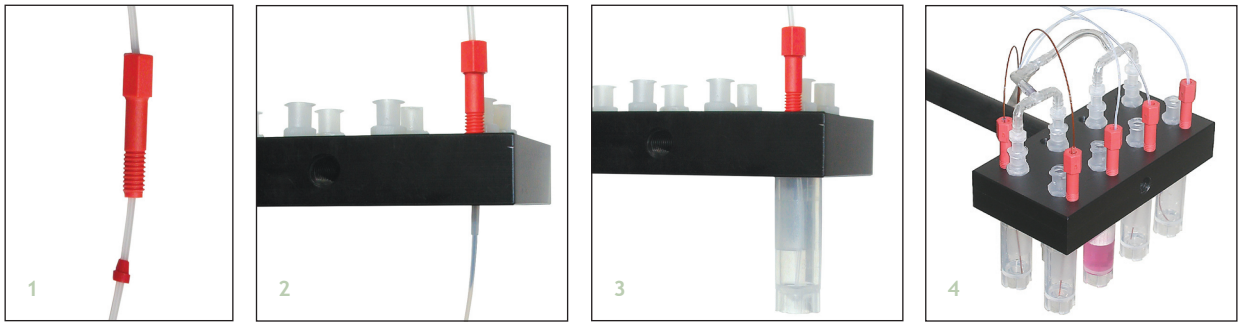
Pressurized Cylinders, PC



Small Volume Delivery System, SVDS1

SVDS1 system can be used with a pressure source, or solutions can be withdrawn by a negative pressure supplied by CFPS-1U units. The output solution tubing can be connected to valves of a PS15-8 solution switch, and then to a MM, PM or ZMM micro-manifolds. The pressure input should be connected to a regulated pressure source using 1/16" I.D. tubing and T/Y-connectors – one pressure input to all eight (or less) pressure input luer ports positioned on the top. The solutions will be switched by turning ON/OFF the appropriate valves by the controller of the perfusion system. The applied pressure will push the solution through the opened line.

The system ships fully assembled. Below are the instructions on connecting the replacement tubing.



1. Measure and cut eight (or fewer) pieces of polyethylene tubing, 1/16" O.D. - fitting sleeves. Put a short piece of the fitting sleeve over delivery tubing (the system is shipped with 2' of Teflon tubing per each channel). Insert the sleeve into the ferrule.

2. Secure the tubing inside the plastic block by tightening the threaded nut (do not tighten completely yet).

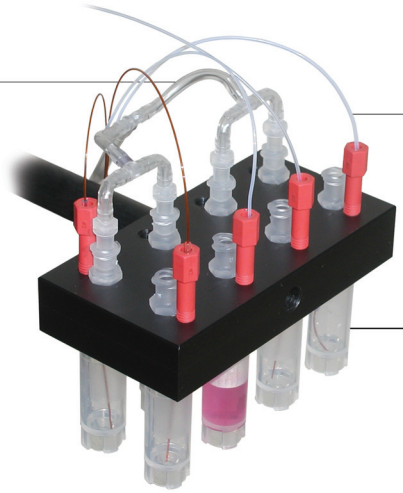
3. Screw in conical plastic tube (included), and pull the delivery tubing so that the end of it still touches the conical bottom. Tighten the threaded ferrule fitting.

ALTHOUGH PROVIDED FITTING WILL ENSURE AIRTIGHT SEAL, THREADED PORTS AND TUBES MIGHT REQUIRE SOME GREASE TO MAKE AIR-TIGHT SEAL INSIDE THREAD.

4. The system can be mounted on a custom 6 mm O.D. rod or on 1' long threaded aluminum rod, which can be mounted on a standard 0.5" O.D. stand through X-block (X-block and a threaded rod are included). This allows positioning the solutions near your samples, to minimize the dead volume.

If valves used to open solution lines, connect Teflon tubing to valve's inlet using sleeves of soft tubing. The valve's outlet should be connected to a micro pipette, a micro-manifold or a chamber using another tubing.

Connecting tubing to
a source of pressure



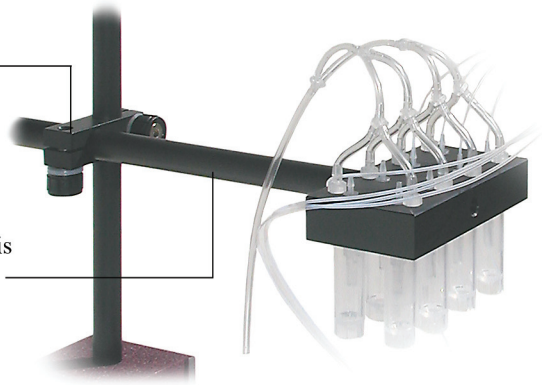
Connecting tubing goes inside small reservoirs. (NOTE: This tubing should be sealed using ferrule-type fitting.) The other end of this tubing should be connected to the valves of PS15 System using ferrule fitting provided.

Small reservoirs attached to the bottom of SVDS1 System. The reservoirs can be sealed air-tight using grease.

4a

Mounting Rod is attached to
a 1/2" post through X-Block

The other end of Mounting Rod is
threaded inside SVDS1 System



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