

# BPS-4: 4 Channel Solution Exchange Systems

Perfusion is critical in most biological applications, both for maintaining the viability of preparations and establishing experimental conditions. Electronic control of solution exchange improves fluid delivery and enhances reproducibility over manual methods. With the **BPS-4** systems, you can configure systems for the basic requirements of the student lab or you can optimize them for the most demanding applications of patch-clamp recording and / or imaging.

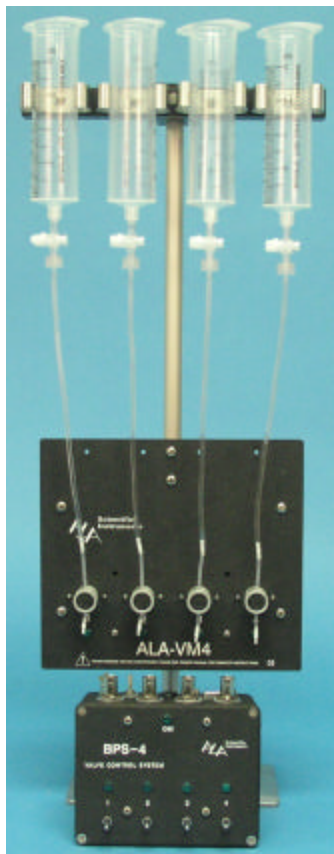
## BPS-4 System Highlights

- \*Fast and easy setup
- \*Low noise electronics suitable for single-channel recording
- \*Switchbox or software control
- \*Pressure or gravity driven
- \*Manifolds for bath exchange or focal application
- \*Low maintenance pinch valves or high speed solenoid valves
- \*Range of reservoir sizes

The **BPS-4** are modular systems that allow for fast and easy setup. All systems are designed to minimize electronic noise, therefore it is suited for electrophysiological recordings. You can control your valve openings from the **BPS-4C** valve controller, manually, or from your data acquisition software using the convenient TTL inputs on the controller housing. Gravity-driven systems (**BPS-4PG** or **BPS-4SG**) are affordable and easily adjusted by positioning the reservoir manifold; more expensive pressure driven systems (**BPS-4PP** or **BPS-4SP**) make precise adjustment of flow rates even easier. ALA has two valve options: three-way pinch valves or solenoid valves made exclusively for ALA by the Lee Co. The pinch valves allow selection of default-open or default-closed positions to reduce heat dissipation to solutions. The pinch tubing is cleaned by rinsing the tubing; because there are no internal wettable surfaces, maintenance consists of periodically changing pinch tubing. ALA's solenoid valves are optimized for high-speed solution exchange. These valves feature a biologically inert internal wettable surface and give valve opening times of less than two msec. All ALA systems can be configured with 5, 10 or 60 ml reservoirs. **As with all ALA instruments, custom configurations are also available.**

All gravity systems consist of a magnetic stand that hold the valve and the reservoir manifolds, an electronic valve controller, tubing, and a standard Minimanifold™ outlet. The standard reservoirs are 60ml luer lock syringes and include 3 way stop cock luer valves. The entire reservoir assembly as well as individual reservoirs can be moved up/down in order to balance fluid flow. The fluid is directed into the standard 4 to 1 inlet (**MMF-4**, Minimanifold™) and then flows out a single output tube. Options include different reservoir sizes and other 4 to 1 perfusion outlets (**MLF-4**, Millimanifold™).

All pressure systems consist of a magnetic stand that hold the valve and pressure reservoir manifolds, an electronic controller, and tubing. Each pressurized system comes standard with the Minimanifold™ outlet in case the user wants to switch to gravity for a particular study. Other outlets can be via an optional Millimanifold™ for large area focal perfusion. For the ultimate in fast focal drug application the system can be used with ALA's Micromanifold® (**QMM-4**). Pinch or solenoid valves are available. To pressurize the system, the optional **PR-10**, Pressure Regulator is suggested.



**BPS-4PG (Pinch Gravity)** system shown as a standard system with pinch valves and Minimanifold™ outlet



**BPS-4SG (Solenoid Gravity)** valve section shown with Lee Co. Solenoid valves.



**BPS-4SP (Solenoid Pressure)** system shown. This is a pressurized system with Lee Co. solenoid valves.



**BPS-4PP (Pinch Pressure)** valve section shown with pinch valves and compression fittings.

# BPS-4: 4 Channel Solution Exchange Systems

## PR-10 Pressure Regulator:

The **PR-10** uses a dual regulator system that completely removes pressure fluctuations at the output. It also employs a pressure switch and when used in the bleed mode completely depressurizes the reservoirs to prevent in-gassing when not in use. The **PR-10** includes a dual scale pressure gauge (PSI / KPa) and luer fittings for the inlet and outlets.



## QMM-4 Quartz Micromanifold:



The QMM-4 consists of 4 x 100  $\mu$ m ID (other sizes are available) quartz coated polyimide tubing that is glued together at one end. The other end is flared out with small silicone connectors attached. These connectors make it easy to attach other tubing to the QMM. At the other end a small single 100  $\mu$ m quartz coated polyimide tube is attached also with a silicone connector. This is the output port. Since the tubing is so small rapid exchange rates are possible and the dead volume is less than 90nl.

## BPS-4C 4 Channel Valve Controller



The **BPS-4C** valve controller can control up to 4 12V valves. It was designed for low output noise so as not to interfere with critical patch clamp experiments. The controller is simple to use. It has 4 toggle switches for manual operation. These switches have 3 positions; on, off, and momentary on. Control from a

users data acquisition system is possible through the 4 TTL compatible input BNC's that are provided. The output is a DB15 type that directly connects to the ALA **VM-4** series of valve manifolds. The controllers also include a remote power supply.

## MMF-4 Minimanifold:

This is the standard 4 to 1 output that comes with all BPS-4 systems. It consists of 4 1/16" barb fittings and 1 1/16" barb fitting output. The dead volume is about 50  $\mu$ l. The material is ABS plastic. It is meant to be used in gravity fed systems to perfuse whole cell baths.



## Ordering Information:

BPS-4PP	4 channel pinch valve bath perfusion system w/ pressurized 5ml reservoirs, controller, power supply, and MiniManifold™ outlet - to miniaturize output use 4 x CF-1 and QMM-4wt or use MLF-4
BPS-4PG	4 Channel Bath Perfusion System - incl. 4 pinch valves, 4 x 60ml reservoirs, controller, power supply, 4 luer valves, magnetic stand, and MMF-4
BPS-4SP	4 channel Lee solenoid valve bath perfusion system w/ pressurized 5ml reservoirs, controller, power supply, and MiniManifold™ outlet - to miniaturize output use 4 x CF-1 and QMM-4wt or use MLF-4
BPS-4SG	4 Channel Bath Perfusion System - incl. 4 Lee solenoid valves, 4 x 60ml reservoirs, controller, power supply, 4 luer valves, magnetic stand, and MMF-4
BPS-4C	4 Channel Valve Controller including power supply, breakout board, & cable
BPS-PV	3 way NC/NO replacement pinch valve
L2V	2 way OEM Lee Co. solenoid valve
BPS-PS	BPS controller power supply
PR-10	0 - 10 PSI Pressure Controller
VM-STAND	Magnetic base stand for BPS valve manifolds - 2 rods and magnetic base
RESBRACK-4	4 Reservoir bracket for 60ml reservoirs w/mounting block - other sizes available
BPS-BREAK	Breakout board to BPS controller for up to 8 12V valves
QMM-4	Quartz Micromanifold® for BPS-4 systems - to miniaturize the outlet - standard 4 to 1 @ - 100 $\mu$ m ID tubes w/100 mm ID tip (custom ID versions available, please specify)
QMM-4WT	Quartz Micromanifold® for BPS-4 system - to miniaturize the outlet - standard 4 to 1 @ - 100 $\mu$ m ID tubes w/100 mm ID tip (custom ID versions available, please specify) with FEP tubing installed

MLF-4	MilliManifold™ 4 to 1 polyimide tubing 500 $\mu$ m ID w/1/16" barb fittings
MMF-4	MiniManifold™ 4 to 1 for 1/16" ID tubing
TUBING-1	1/8" ID x 1/4" OD tygon tubing - 10'
TUBING-2	1/16" ID x 1/8" OD tygon tubing 10'
TUBING-3	BPS silicone pinch valve tubing 2' - gravity flow
TUBING-4	Silicone pinch valve tubing 2' - pressure flow
FEP-1	Clear Teflon Tubing - 230 mm ID/600mm OD - 4 meters
FEP-2	Clear Teflon Tubing - 380 mm ID/760 mm OD - 4 meters
PET-10	Polyethylene Tubing PE-10 - 4 meters
PET-20	Polyethylene Tubing PE-20 - 4 meters
BPS-4TUBE	BPS-4 tubing kit - tygon/silicone tubing & connectors w/o MMF-4
BPS4AIRMAN	BPS-4 Pressurized air manifold tubing set
CF-1	Compression Fitting for PE-10/FEP-1 tubing to 1/16" ID tubing
CF-2	Compression Fitting for PE-20/FEP-2 tubing to 1/16" ID tubing
5mlRES	5ml pressurized reservoir assembly w/3way luer valve
5mlRESCLP	5ml reservoir mounting clips - set of 4 with screws
10mlRES	10ml pressurized reservoir assembly w/3way luer valve
10mlRESCLP	10ml reservoir mounting clips - set of 4 with screws
60mlRES	60ml pressurized reservoir assembly w/3way luer valve
60mlRESCLP	60ml reservoir mounting clips - set of 4 with screws
PPLG10ml	10ml pressurized reservoir plug only - for HSW Norm-Ject all plastic luer lock tip
PPLG5ml	5ml pressurized reservoir plug only - for HSW Norm-Ject all plastic luer lock tip
PPLG60ml	60ml pressurized reservoir plug only - for Terumo SS-60L luer lock tip
3WL	3 way stop cock luer valve
DB9-CABLE	BPS controller to valve manifold replacement cable
PV-2	Flow control manually adjusted pinch valve

## Specifications

### Valve Controller:

Dimension.....	4.7" (L) x 4.25" (W) x 3.1" (H) Wt: 14.7 oz.
Power.....	110/220VAC external/15VDC@2.7A CE compliant
Computer Control.....	4 x TTL high BNC inputs 1 for each valve
Manual Control.....	4 x Toggle Switch - on/off/mom.

### Valve Manifolds:

Pinch Valves.....	4 x 12VDC/0.25A ea.- Sirai 3 way Pinch Valve
Pinch Valve Opening Speed.....	15 ms
Pinch Valve Tubing O.D.....	.062 (or .032 with QMM)
Solenoid Valves.....	4 x 9-12VDC/0.25A ea.- Lee OEM Inert Solenoid Valve
Solenoid Valve Opening Speed.....	1-2 ms
Reservoirs.....	4 x 5ml (pressure), 10ml, or 60ml syringe (gravity)

## Gravity flow rate specifications assuming 60ml reservoirs are full

Height (cm)	w/ MLF-4 ml/min	w / MMF-4 ml/min
90	11	37
80	10	31
70	9	29
60	8	25
50	7	22

Sample pressurized flow rate: 1ml in 9 minutes  
@ 10 PSI / 70kPa through QMM-4 100  $\mu$ m tubes

