WARNER INSTRUMENTS
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Perfusion Fast-Step

VCS-77CSP, VCS-77CSPL, VCS-77CSP8 and VCS-77CSP8L

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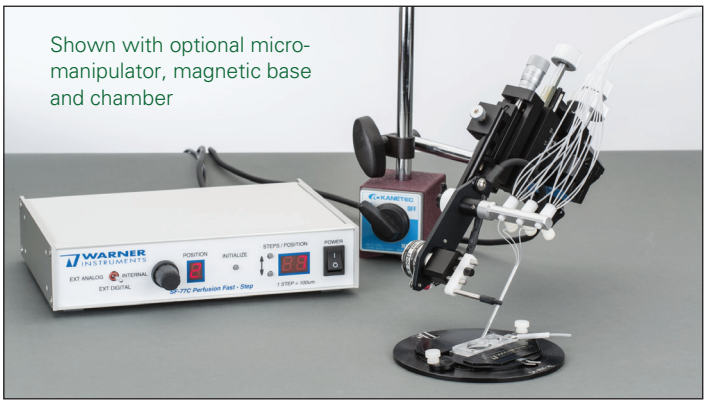
SF-77C, SF-77CLT and SF-77CST

Perfusion Fast-Step

Highly effective stimulus solution delivery device



- Solution delivery for patch clamp and other electrophysiology studies
- Solution changes in milliseconds
- Minimal flow turbulence
- No switching through intervening solutions
- Manual or automatic step control (digital or analog)
- Modest cost and easy maintenance

The **SF-77C** is a fast solution delivery device for use in patch clamp and electrophysiology studies. Control and test solutions flow continuously through adjacent delivery tubes and a stepper mechanism selects which tube is directed at the preparation. The rapid response and nominal hysteresis of the stepper allows for very short switching times. Complete solution changes are typically achieved within 20 msec for a large, 700 µm step and times are significantly shortened as the step size is decreased.

Multiple Solution Studies

In the standard configuration, up to six different solutions are connected to a single input manifold, which in turn is connected to one of three square glass stimulus tubes. The three tube design is superior to a two-tube design in that complex solution exchange protocols can be brought to bear on the sample under study. Since the complete system is designed to accommodate three manifolds (one for each tube), and since each manifold can accommodate up to 6 feed lines, it is possible to immediately select between 18 different input solutions.

Manual or External Control

The stepper mechanism can be manually controlled via the front panel or externally directed from your data acquisition program. Manually, the system can be stepped to 8 positions in 7 equally spaced steps. These same 8 positions can also be directly selected by applying an analog signal to the external analog input BNC or by passing a 3 Bit word to the TTL inputs on the instrument rear panel.

Square Glass Ports

The square glass tubes used for solution delivery significantly reduces mixing turbulence, allowing the SF-77C to be used for studies with both membrane patches and whole cells, even when the cells are not fixed to a substrate.

System Versatility

The design of the SF-77C permits the use of various size glass tubing for perfusion delivery.

SF-77C: Standard System (0.7 mm ID tubes)

The standard system is shipped with 3SG700-5 single-walled 3-barrel glass tubing which eliminates the need to glue individual barrels together. Spacing between barrels is 0.7 mm and step speed between adjacent barrels is typically 20 msec. Single barrel SG800-5 tubes (up to 5) can be used with the same holder.

SF-77CLT: Large Tube System (1.0 mm ID tubes)

Larger ports are required when using the SF-77C with larger cell structures such as the Xenopus oocyte. Solutions are delivered through 1.0 mm ID square tubes (SG1000-5) with barrel-to-barrel spacing of 1.4 mm.

SF-77C/5M: Standard System with Five Manifolds

The SF-77C/5M is the same system as the SF-77C except that it is provided with five perfusion manifolds.

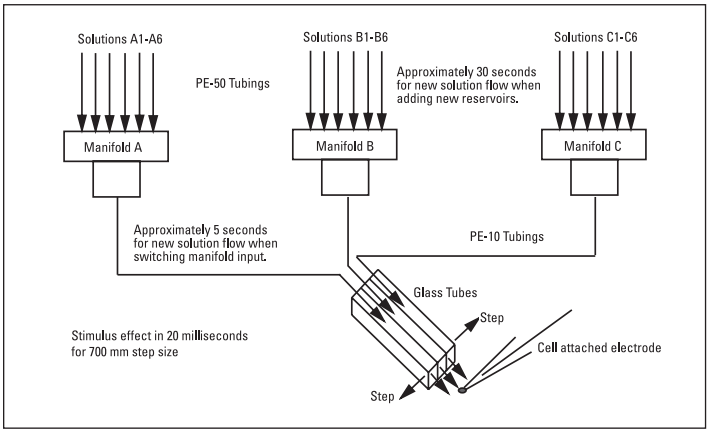
SF-77CST: Fast Stepping with Theta Tubing

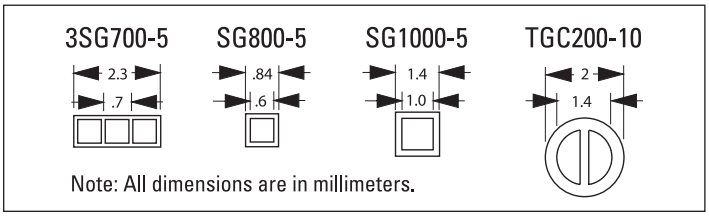
Very fast perfusion stepping is possible using 2-barrel Theta tubing. The technique requires close attention to detail with careful placing of the pipes and the excised patch. The tubing is pulled on a standard puller for a tip diameter of approximately 300 µm and a barrel spacing of approximately 100 µm. When using 100 µm steps, it is important to minimize any vibration produced by the stepper motor. This is accomplished by reducing the motor voltage via the control located on the instrument rear panel. The voltage is lowered until the vibration artifact is minimized. Any residual artifact may be removed by subtracting averaged null traces.*

Easy Set-Up

The stepper mechanism is compact, lightweight, and free of either mechanical or electrical noise. The mechanism connects to the control box with a 2 meter shielded cable and is provided with a mounting rod for attachment to a manipulator. Manifolds can support 2, 4 or 6 inputs depending on the experiment. Solutions flow from reservoirs to the manifold through PE-50 tubing and PE-10 tubing is used to connect the manifold outputs to the glass tubes.

* Reference: Jie Zheng and Fred Sigworth, Selecting Changes during Activation of Mutant Shaker Potassium Channels, J. General Physiology, vol. 10 August 1997, 101-117, Rockefeller Univ. Press





- Solution changes between tubes occur within milliseconds.
- Changes between solutions connected to individual ports occur within 5 seconds.
- Entirely new solutions can be added into any port with a waiting time of no more than 30 seconds.
- The cell is never required to pass through an intervening solution to get from control to test solution.

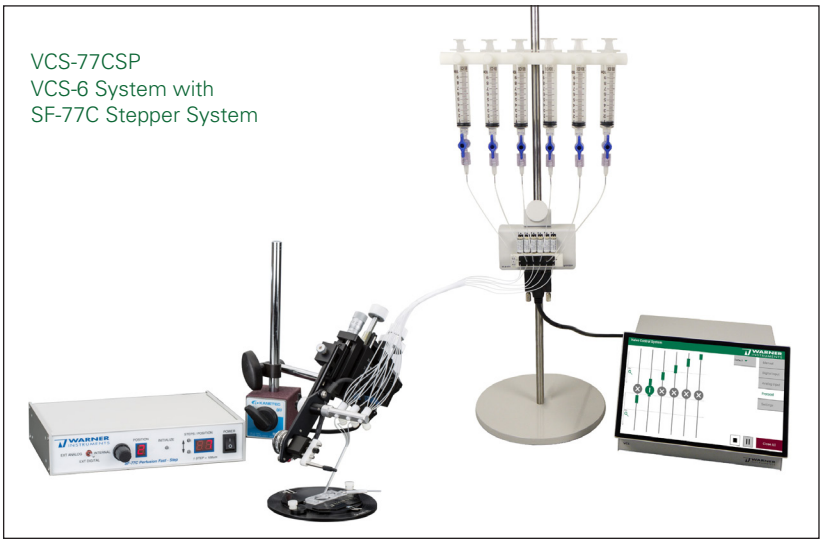
SPECIFICATIONS	
Number of Steps	1 to 7
Step Size	Adjustable from 100 µm to 1.5 mm steps in 100 µm increments
Step Speed	Typically 20 msec for 700 µm step
Step Control:	
Manual	8 positions with POSITION selector
Analog Signal	8 positions with voltage levels 0-7 V, 1V/step
Digital Signal	8 positions with 3 Bit TTL signal
Max. Stepper Range	12.0 mm
Mounting Handle	6.3 mm X 10 cm (D x L)
Stepper Weight	110.5 g (including handle)
Solution Manifolds	Three manifolds supplied with each system; MM series for SF-77C and SF-77CST and ML series with SF-77 CLT
MM Series	MM-2, MM-4 and MM-6 manifolds use PE-50 tubing at input and PE-10 tubing at output
ML Series	ML-2, ML-4 and ML-6 manifolds use PE-50 tubing at both input and output
Solution Flow Rates	Rates measured with solution reservoir height of approx. 60 cm (24 in)
With MM Series	100 µl/min
With ML Series	1 ml/min
Control Box:	
Size (H x W x D)	5.0 x 21.2 x 19 cm
Power Requirements	120 – 240 VAC, 50/60 Hz, 10 VA
System Shipping Wt.	2.7 kg
Warranty	Two years, parts and labor

Order #	Model	Product
64-3020	SF-77C	Standard System with MM Series Manifolds, 1 pkg. 3SG700-5 Glass, GH-1 Glass Holder, and 1 pkg. each PE-10 and PE-50 Tubing
64-3023	SF-77C/5M	Perfusion System with 5 manifolds
64-3022	SF-77CLT	Large Tube System with ML Series Manifolds, 1 pkg. SG1000-5 Glass, GH-10 Glass Holder, and 2 pkg. of PE-50 Tubing
64-3021	SF-77CST	Theta Glass System with MM Series Manifolds, 1 pkg. TGC-200-10 Glass, GH-2T Glass Holder, and 1 pkg. each PE-10 and PE-50 Tubing
ACCESSORIES AND REPLACEMENT PARTS		
64-0119	3SG700-5	3-Barrel Square Glass Tubes, 0.6 mm x 5 cm (ID x L), pkg. of 10
64-0120	3SG700-10	3-Barrel Square Glass Tubes, 0.6 mm x 10 cm (ID x L), pkg. of 10
64-0121	SG-800-5	Single Barrel Square Glass Tubes, 0.6 mm x 5 cm (ID x L), pkg. of 25
64-0122	SG-1000-5	Single Barrel Square Glass Tubes, 1 mm x 5 cm (ID x L), pkg. of 25
64-0124	GH-1	Glass Holder for 3SG700-5, 3SG700-10 and SG800-5 Glass
64-0125	GH-2T	Glass Holder for Theta Glass
64-0126	GH-10	Glass Holder for SG1000-5 Glass
64-0750	PE-10/10	Polyethylene Tubing 10 ft.
64-0752	PE-50/10	Polyethylene Tubing 10 ft.
64-0811	TG200-4	Theta Glass Tubes, 2.0 mm x 10 cm (OD x L), pkg. of 100

VCS-77CSP and VCS-77CSP8

Perfusion Fast-Step

Mini-valve controller and fast stepper combo



VCS-77CSP
VCS-6 System with
SF-77C Stepper System

- Allows computer control of multiple perfusion lines
- Six and eight channel systems available
- Solution changes in milliseconds

The **VCS-77CSP** perfusion system combines the VC-6M Perfusion Valve Control System and the SF-77C Fast Step Perfusion System into a single package. It allows computer control of multiple perfusion setups, saving time and effort.

The VCS-77CSPL system includes:

64-3020	SF-77C	Perfusion Fast-Step System
64-3086	VCS-6 MINI	Valve Control System/6 Mini Valves
64-0055	MM-33L	Micromanipulator, Left Handed
64-0060	MB-B	Magnetic Base

The **VC-77CSP8** perfusion system combines the VC-8M Perfusion Valve Control Systems and the SF-77C Fast Step Perfusion System.

The VC-77CSP8 system includes:

64-3020	SF-77C	Perfusion Fast-Step System
64-3082	VCS-8-MINI	Valve Control System/8 Mini Valves
64-0056	MM-33R	Micromanipulator, Right Handed
64-0060	MB-B	Magnetic Base

Order #	Model	Product
64-3109	VCS-77CSP	Complete VCS-6 Fast-Step Perfusion System with right-handed micromanipulator
64-3110	VCS-77CSPL	Complete VCS-6 Fast-Step Perfusion System with left-handed micromanipulator
64-3111	VCS-77CSP8	Complete VCS-8 Fast-Step Perfusion System with right-handed micromanipulation
64-3112	VCS-77CSP8L	Complete VCS-8 Fast-Step Perfusion System with left-handed micromanipulation

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