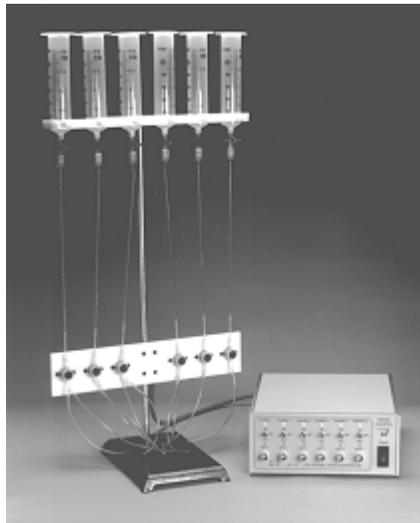


Warner Instruments, Inc.
Perfusion Valve Controller
Model VC-6



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The **VC-6** Valve Control System lies at the heart of a multi-valve perfusion system designed to automate and control the delivery of solutions to Warner Instruments imaging and recording chambers. However, its flexible design allows the system to be used in many applications not using Warner equipment.

The basic system includes the valve controller, a valve bracket with valves, connecting cable, C-Flex[®] tubing and an **MP Series** manifold. The complete system includes all of the above plus a ring stand, six 60 cc syringes, 20 feet of Tygon tubing and an assortment of tubing connectors.

The controller can independently regulate the function of up to six valves. The system can be purchased in a two or four valve configuration and can be easily expanded by simply adding more valves.

Individual valves can be controlled via a manual switch or an external digital (TTL) signal. An event marker pulse, generated each time a valve is switched on, is provided at the rear of the instrument for recording into your acquisition system. Valve transitions (opened or closed) occur at full power to insure rapid response times and are then held in place at less than half power to prevent heat transfer to solutions.

Pinch valves are supplied as standard equipment. They are the simplest from a maintenance standpoint since solutions do not come into contact with the valve and the tubing is easily exchanged. Pinch valves are dual acting with both normally open and normally closed sides.

If the valve input line is split using a Y-connector, solution can flow to waste while the valve is in the off position.

These pinch valves are designed to work with silicone type tubes, C-Flex[®], or other similar type tubes. All systems are supplied with a small quantity of C-Flex[®] tubing. Response times for the valves varies with solution viscosity and tubing, however, typical times are 20-50 ms.

NOTE: Minimizing the length of C-Flex[®] or silicone tubing used will reduce the gas permeability of the system.

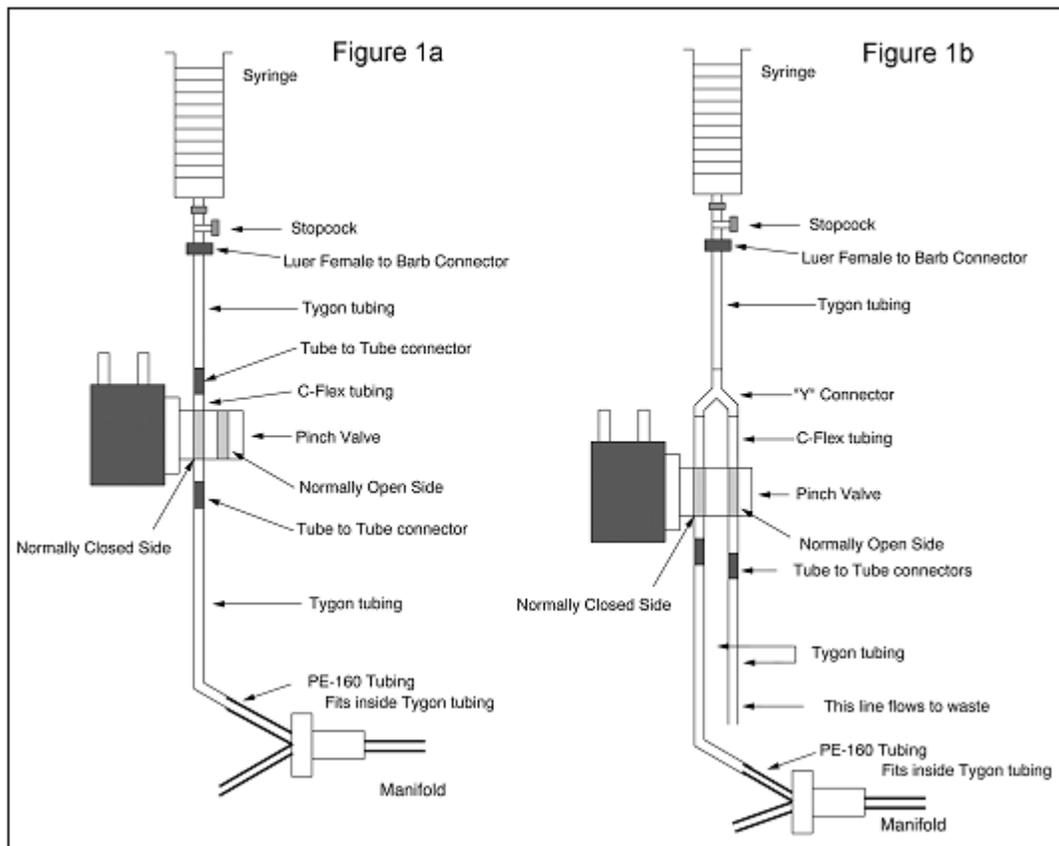
OPERATING DIRECTIONS

Before beginning setup take inventory of the plastic fittings supplied with the complete system. These fittings include six (6) each of 1/16" ID tube-to-tube connectors, 1/16" ID tube-to-tube Y connectors, 1/16" ID Luer-to-female barb connectors, and stopcock-with-Luer connector. Connectors are shown, in order, below. Plastic tubing can be attached to these connectors with little effort. Basic Systems are supplied with a manifold only.



Setup

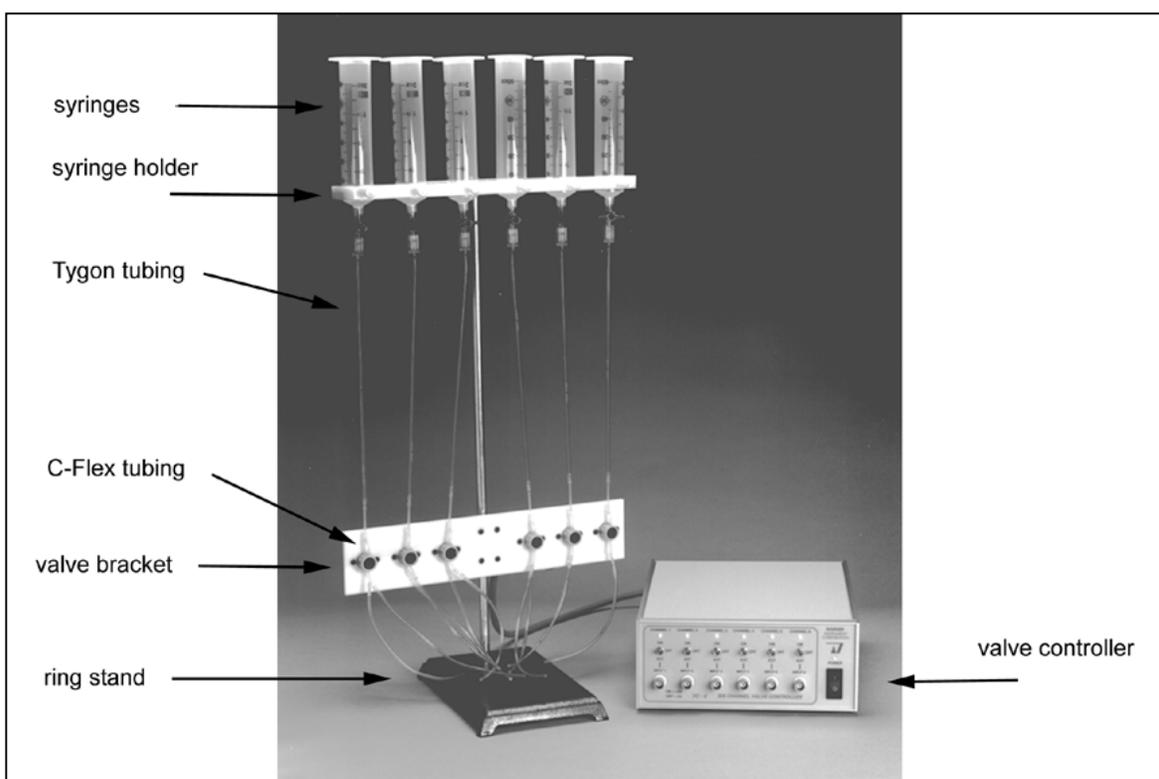
Figures 1a and 1b below illustrate two configurations wherein the perfusion system operates in either a stopped flow or continuous flow-to-waste mode. In general, the shortest response time of the system to selection of a solution will be achieved by keeping the tubing length between the MANIFOLD and sample as short as possible.



The **VC-6 Valve Controller** is initially assembled by first attaching the VALVE BRACKET to the RING STAND as shown in Figure 2 (below).

This is followed by insertion of C-Flex[®] tubing into the pinch valves. Depending on the flow arrangement you're using, cut six (6) or twelve (12) pieces of C-Flex[®] tubing to length. Attach a tube-to-tube connector to *each end* if using the system shown in Figure 1a. Attach a tube-to-tube connector to *only the lower end* if using the system shown in Figure 1b. Mount the tubing to the valves as shown in Figure 1.

NOTES: (1) A slight stretch of the tubing while mounting will facilitate insertion into the valve. Keep the length of C-Flex[®] tubing as short as is feasible. (2) The solenoid valves will not transition between *open* and *closed* states prior to insertion of the C-Flex[®] tubing.



Next attach the SYRINGE HOLDER to the RING STAND. Affix a stopcock-with-Luer connector to each syringe and mount into the SYRINGE HOLDER. Now cut six (6) pieces of Tygon[®] tubing just long enough to run from the stopcock to the C-Flex[®] tubing. Attach a Luer-to-female barb connector to the top end and a tube-to-tube connector to the valve end and make attachments to the syringe and for each channel.

Finally, attach a tube-to tube connector to the C-Flex[®] tubing on the outboard end of the valve and attach a short piece of Tygon[®] tubing. Insert a short length of PE-160 tubing into the Tygon[®] tubing and make a connection to the manifold.

Instructions for use

Flow Adjustment

Flow rates can be adjusted by raising or lowering the reservoir holder, as well as by adjusting the height of each reservoir within the holder.

The table below lists the approximate flow rates for a reservoir at the specified height with the supplied Tygon® tubing.

Reservoir height	Approximate flow rate
61 cm (24 in.)	14 ml/min
30 cm (12 in.)	9 ml/min
20 cm (8 in.)	5 ml/min

REAR PANEL

- The Event Marker output produces a 500 ms logic-level output (+5 V) each time a valve is turned on. At all other times the Event Marker output is low (0 V).
- A 15 pin "D" type female connector is used to connect the VALVE BRACKET (and valves) to the CONTROLLER.
- A polarized, 3-conductor, IEC320/CEE-22 connector is used for line (mains) power input to the instrument. A removable cordset, terminated with a NEMA 5-15P connector, is standard. An alternate cordset may be supplied when local circumstances dictate different mains voltages and connections. Contact our offices for details.
- A fuse holder contains a protective fuse in series with the high side (brown or black wire) of the mains. The holder accepts 1/4 x 1-1/4 inch (6.35 x 31.8 mm) fuses of the type indicated.

MAINTENANCE

Cleaning

Do not use alcohol, aromatic hydrocarbons or chlorinated solvents for cleaning. They may adversely react with the plastic materials used to manufacture the system.

If salt solution spills on the valve assembly it should be cleaned as soon as possible with a soft cloth dampened with a mild solution of detergent and water.

The exterior of this instrument may be cleaned periodically to remove dust, grease and other contamination. It is not necessary to clean the inside. Use a soft cloth dampened with a mild solution of detergent and water and avoid abrasive cleaners.

WARRANTY

The **VC-6** is warranted to be free from defects in materials and workmanship for a period of two years from the date of shipment. If a failure occurs within this period, we will repair or replace the faulty component(s) at our discretion. This warranty does not cover failure or damage caused by physical abuse or electrical stress (e.g., exceeding specified input limits).

Shipping charges to the factory are the customer's responsibility. Return shipping of the repaired unit will be paid by Warner Instruments, Inc.

SPECIFICATIONS

Valves	12 VDC /0.25 A to maintain pinch
Tubing	1/32 ID x 3/32 OD tubing
Valve Bracket	Delrin. Mounts on 3/8" or 1/2" ring stand
Connection Cable	2.4 meter (8 ft.) connecting cable terminated with quick disconnects on valve end and 15 pin male "D" type connector on controller end.
Reservoirs	60 cc capacity syringes
Reservoir Holder	Delrin. Holds six syringes with thumb screws for each reservoir.
Valve Controller	
Switch Selection	<i>Manual, Off or External</i>
External Input	+5 V TTL-compatible (BNC Connector)
Event Marker	Logic level pulse 500 ms nominal (rear panel BNC connector)
Manifold	2/1, 4/1 or 6/1 nominal dead space
Power	110-130 or 200-250 VAC, single-phase, 50/60 Hz, 20 watt
Operating Temperature	10-40° C (50-104° F)
Dimensions (H x W x D)	89 x 203 x 305 mm (3.5 x 8.0 x 12 in.)
Weight / Shipping Weight	3.7 kg (8 lb.) / 4.6 kg (10 lb.)