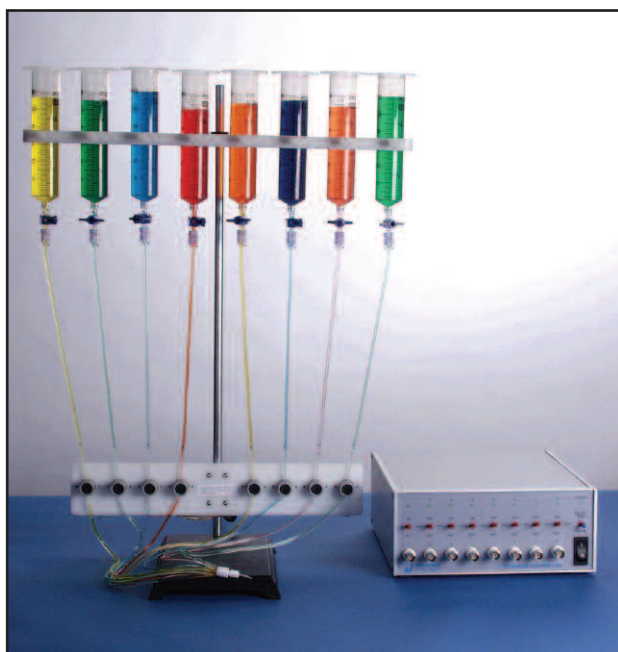


Perfusion Valve Controller

Model VC-8



WARNER
INSTRUMENTS

A Harvard Apparatus Company



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WEEE/RoHS Compliance Statement

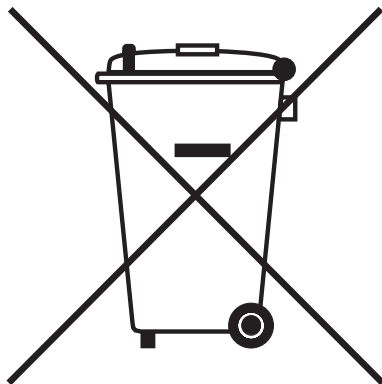
EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive - Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.



- **Do Not Dispose Product with Municipal Waste**
 - **Special Collection/Disposal Required**

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Warner Instruments Perfusion Valve Controller Model VC-8

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Introduction

The **VC-8** 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 complete system includes the valve controller, a valve bracket with valves, connecting cable, C-Flex® tubing, an **MP Series** manifold, a ring stand, eight 60 cc syringes, 25 feet of Tygon tubing and an assortment of tubing connectors.

A new and exciting feature to the **VC-8** system is the **Spill Sensor Probe**. This probe is used to detect the presence of an overflow condition and, when activated, it will automatically shut off all valves protecting your microscope optics.

The controller can independently regulate the function of up to eight valves. Individual valves can be controlled via a manual switch, an external analog signal 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.

Valve options are pinch, Teflon, and Lee miniature types. 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 body 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.

Pinch valves are designed to work with silicone, C-Flex®, or other similar type tubing. All systems are supplied with a small quantity of C-Flex® tubing. Response times for these valves varies with solution viscosity and tubing. However, typical times are 20 to 50 ms.

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

Features

- Choice of 3 valve types
- 8 channel system
- Spill sensor
- Manual and computer control

Operating Directions

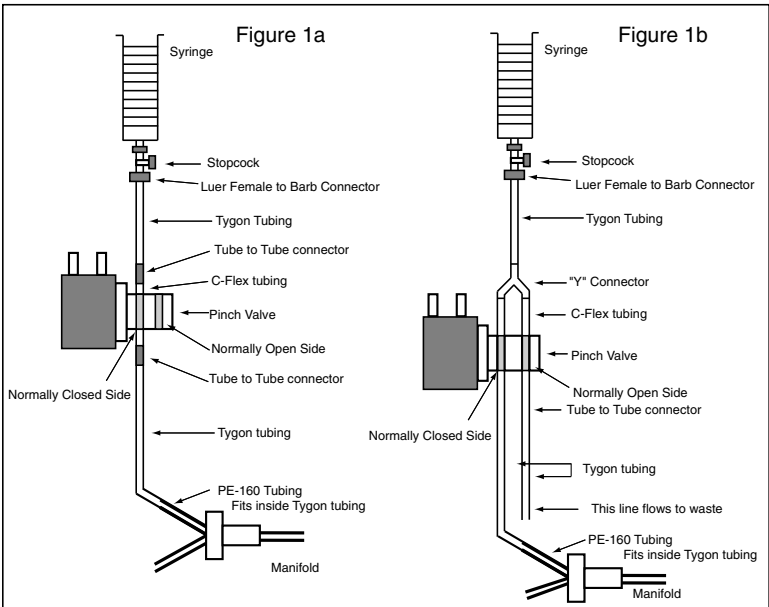
Setup

Before beginning setup take inventory of the plastic fittings supplied with the complete system. These fittings include eight (8) 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.



Valve System

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 MAN-IFOLD and sample as short as possible.

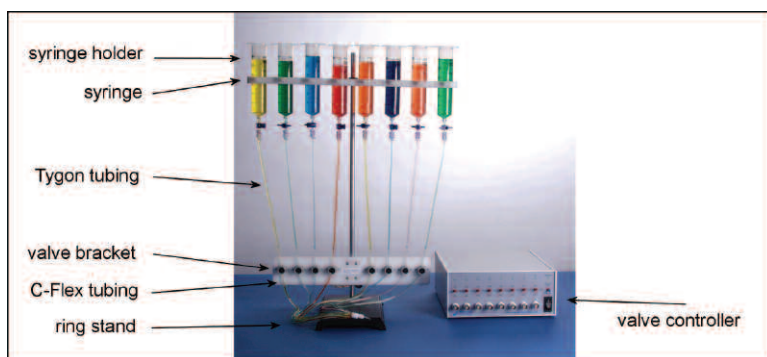


Operating Directions (Cont'd)

The **VC-8 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 eight (8) or sixteen (16) 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 pinch valve. Keep the length of C-Flex® tubing as short as is feasible. (2) The solenoid (pinch) 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 (8) 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 out-board 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.

Overflow Sensor

An overflow or spill sensor is has been provided to assist you in providing a level of protection to your microscope while using the **VC-8 Valve Control System**. The overflow sensor itself is a Ag/AgCl probe which grounds through the chamber bath. A resistance of 10 MΩ or less between the probe and bath will trigger the overflow circuitry. Place the probe adjacent your

Operating Directions (Cont'd)

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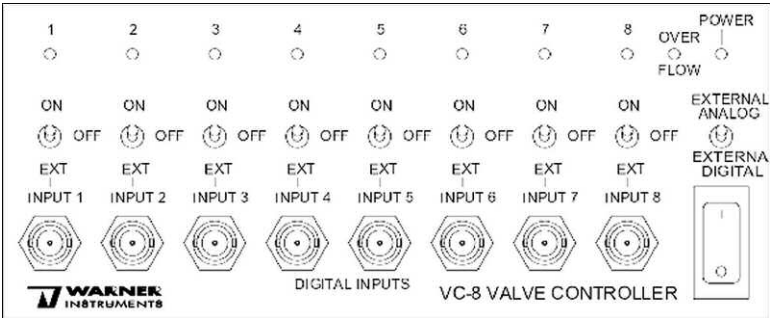
Warner Instruments

perfusion chamber such that the maximum solution height (say, just prior to an actual overflow) is achieved when the solution contacts the tip of the probe. Contact between the probe and your solution will activate the overflow circuitry and close all the valves. The OVERFLOW SENSOR plugs into the OVERFLOW IN BNC on the rear of the controller.

Control Description

Front Panel

The front panel contains TTL inputs for each valve, a 3-position toggle switch for manually setting the state of each valve and an LED displaying the active status for each valve. There is also a 2-position toggle switch for selecting the *command input mode*, a SPILL SENSOR indicator, and a power switch with power on LED.



TTL Inputs

TTL inputs (front panel BNC's and ON/OFF TOGGLE SWITCHES) are provided for all 8 channels of the VC-8 controller. Operation of the front panel TTL inputs is selected by placing the 2 position COMMAND INPUT TOGGLE into *external digital mode*. Use of these inputs can allow the opening of more than one valve at the same time from a digital source such as your computer.

Placing the ON/OFF TOGGLE SWITCH into the *on* position places the associated valve into its open state. A lit LED indicates the open state of the valve. This setting is overridden by the overflow sensor.

Placing the ON/OFF TOGGLE SWITCH into the *off* position places the valve into its closed state. An unlit LED indicates the closed state of the valve.

Placing the ON/OFF TOGGLE SWITCH into the *ext* position activates the associated BNC inputs. A logic level *low* (0V) applied to the BNC places the associated valve into the *closed* state. Correspondingly, a logic level *high* (3 to 5 V) places the associated valve into the *open* state. A lit and an unlit LED indicates the open and closed states of the valve, respectively. These settings can be overridden by the overflow sensor.

Command Input Toggle

The COMMAND INPUT TOGGLE is used to select between the front panel *external digital* controls and the rear panel *external analog* controls.

Control Description (Cont'd)

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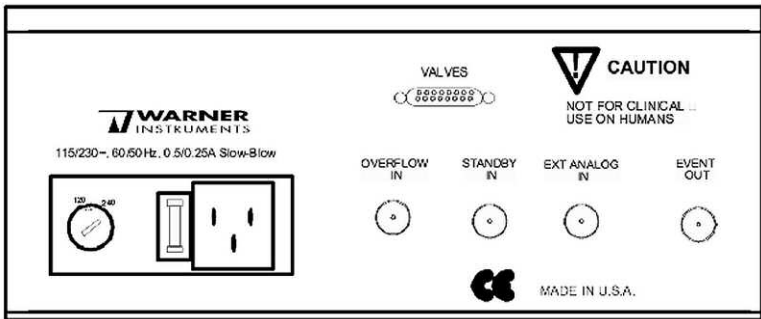
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Overflow

The OVERFLOW LED indicates an overflow condition sensed by the OVERFLOW SENSOR. Activation of this circuit by an overflow condition immediately overrides all other settings and closes all valves.

Rear Panel

The rear panel contains the power input module with fuse, a 15 pin D-connector for the VALVE SET, and 4 BNC connections for OVERFLOW IN, STANDBY IN, EXTERNAL ANALOG IN and EVENT OUT.



D Connector

A 15 pin "D" type female connector is used to connect the VALVE BRACKET (and valves) to the CONTROLLER.

Overflow In

This BNC is used to connect the OVERFLOW SENSOR to the controller. Place the sensor into position and plug it into this BNC.

Standby In

This BNC is provided to allow the placing of the VALVE CONTROLLER into *standby mode*. *Standby mode* disables EXT ANALOG IN inputs and closes all valves.

Activation of this input is selected by placing the FRONT PANEL COMMAND input toggle into *external* analog mode and a TTL level *high* (3 to 5 V) places the instrument in standby.

Control Description (Cont'd)

Ext Analog In

This BNC is used to operate valves using analog voltage settings. The voltage applied to this input selects the valve to open. All other valves are closed. Switching voltages closes the open valve and open the other. Valve selections are overridden by the OVERFLOW SENSOR and the STANDBY BNC.

The table below indicates the selection scheme.

| Applied Voltage (V) | Valve Selection |
|---------------------|-----------------|
| 0 | standby |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |

Event Out

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).

Power Input Module

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. A fuse holder contains a protective fuse in series with the high side (brown or black wire) of the mains. The holder accepts 5 x 20 mm fuses of the type indicated.

Control Description (Cont'd)

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AC Conversion

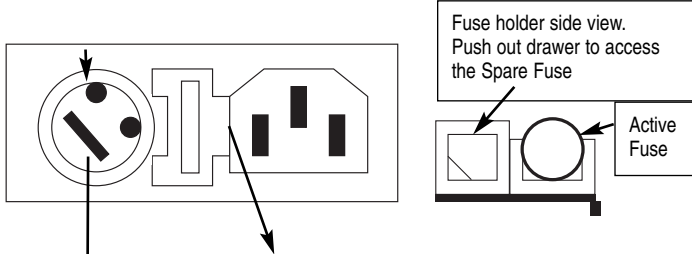
ATTENTION

PLEASE READ BEFORE APPLYING POWER TO YOUR UNIT!!

The unit uses only one fuse; the second one is sent as spare.

Follow these instructions to change the unit(s) from 120 VAC or 220 VAC:

Power Entry Module



Step 1

Depending on AC Voltage being used, turn VAC selector switch to 110 VAC or 220 VAC

Step 2

Carefully pry open the fuse holder from the inside by using a small flat screwdriver. Replace fuse according to voltage being used.

For 120 VAC: 0.50 Amp - 5 x 20 mm Slow Blow
For 220 VAC: 0.25 Amp - 5 x 20 mm Slow Blow

Fuse holder side view. Push out drawer to access the Spare Fuse

Active Fuse

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 Teflon® 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 |

Flow rates as a function of reservoir height.

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.

NOTE: Teflon and Lee Mini Valves must be completely flushed with distilled water after each use. Permanent damage will result if saline solution is allowed to crystallize inside the valve.

The exterior of the CONTROLLER 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. Avoid abrasive cleaners.

Warranty

The VC-8 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.

Appendix

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 eight syringes with thumb screws for each reservoir. |
| Valve Controller (front panel): | |
| Power | Two position on/off with power-on LED |
| Input Select | Two position selecting analog or digital inputs |
| Switch Selection | <i>On (manual), Off or External</i> |
| External Input | +5 V TTL-compatible (BNC Connector) |
| Overflow | LED indicating overflow condition |
| Valve Controller (rear panel): | |
| Overflow In | BNC connection to OVERFLOW SENSOR. Triggered when sensed resistance falls below 10 MΩ. |
| Standby In | BNC connection to activate standby mode. TTL high closes all valves. |
| Ext Analog In | In BNC connection for valve selection. Active valve opened by analog voltage. |
| 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 to 130 or 200 to 250 VAC, single-phase, 50/60 Hz, 20 W |
| Operating Temperature | 10° to 40°C (50° to 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) |
| Operating Conditions: | Equipment is intended to be operated in a controlled laboratory environment. |
| Temperature | 0 to 40°C |
| Altitude | Sea level to 2000 m |
| Relative Humidity | 0 to 95% |

Declaration of Conformity

CE MARKING (LVD & EMC)

Application of Council Directive: 73/23/EEC
89/336/EEC

Standard(s) to which
conformity is declared:

EN61010-1:1993
EN55022 Class A
EN61000-3-2
EN61000-3-3
EN50082-1:1992
EN61000-4-2
EN61000-4-3
ENV50204
EN610000-4-4
EN610000-4-8
EN610000-4-11

Manufacturer's Name:

Warner Instruments, LLC

Manufacturer's Address:

1125 Dixwell Avenue
Hamden, CT 06514
T: (203) 776-0664

Equipment Description:

Valve Controller

Equipment Class:

Class I, ITE-Class A

Model Numbers:

VC-8 Controller

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place: Hamden, Connecticut U.S.A.

Signature: *Ralph Abate*

Full Name: Ralph Abate

Position: Business Manager

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