# MSC-200
# Manual Solution Changer
# User's Manual

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The MSC-200 system is constituted of the following items :

1. **MEV-9 electrovalve controller** (see chapter MEV-9 Electrovalve controller)
2. **EVH-9 electrovalve array** (see chapter EVH-9 electrovalve module )
3. **Manifold 9 to 1** (see chapter Manifold for details)
4. **Tubing** (see chapter Tubing installation for details)
5. **Power supply** : external converter AC/DC, 85ac-260ac/12V
6. **15 pins cable** (see chapter Automatic control))
7. **luer locks** (9 units) for connection of tubing and reservoir syringes

Optional parts are : (see corresponding chapter for details)
1. Linear head
2. Syringe rack
3. Syringe rack holder
4. Heated manifold

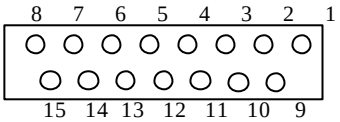
## 1. MEV-9 Electrovalve controller

The MEV-9 module controls 9 electrovalves of the EVH-9 module.

Power supply : external converter AC/DC, 85ac-260ac/12V. 5 pin DIN plug to connect power supply.

Connection to the EVH-9 module : 15 pin female connector « Electro Valves$_{1...9}$ » (see drawing below )

### Electro Valves $_{1...9}$



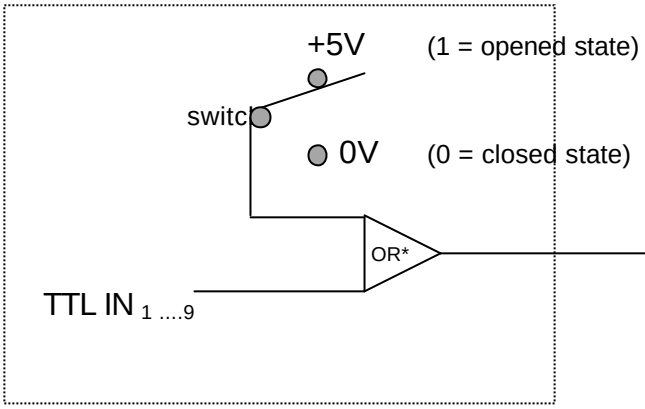

| pin No | function |
|---|---|
| 8 | EV 1 |
| 7 | EV 2 |
| 6 | EV 3 |
| 5 | EV 4 |
| 4 | EV 5 |
| 3 | EV 6 |
| 2 | EV 7 |
| 1 | EV 8 |
| 9 | EV 9 |
| 10 | 0 V |
| 11 | 0 V |
| 12 | 0 V |
| 13 | +12 V |
| 14 | +12 V |
| 15 | +12 V |

## Control of electrovalves :

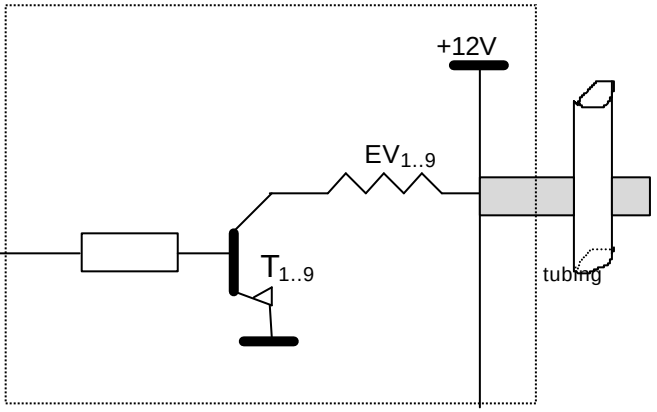
1) manual control, using 9 (on/off) switches on the front panel
2) automatic control, using external TTL pulses connected to 9 BNC inputs.

**1) Manual control :** changing the switch position sends a logic TTL pulse ( 0V or +5V), this corresponds to closed or opened valve state respectively), following a logical function as on the drawing below :

**MEV-9** simplified diagram




**EVH-9** simplified diagram




(*) Logical function

| manual switch | TTL IN | Electro Valve state |
|---|---|---|
| 0 | 0 | 0= closed |
| 0 | 1 | 1= opened |
| 1 | 0 | 1= opened |
| 1 | 1 | 1= opened |

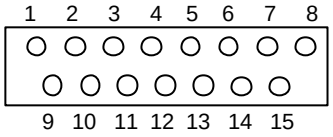
## 2) Automatic control :

In this mode the user can open and close the valves using TTL pulses coming from different sources, like RSC-200, digital I/O PC board, etc.

Two types of connectors for the TTL pulses are available :

1) On the rear panel of the MEV-9 a 15 pin male connector « TTL IN $_{1...9}$ ».
The connection cable MEV-9 / RSC-200 is delivered with the MEV-9 controller. It can be connected to the TTL in 1-9 connector on the rear panel of MEV-9, and to the Electro Valve connector on the rear panel of the RSC160/200. The manual control of valves, via MEV-9 might be useful for an RSC system.
In case the RSC is not used, this cable permits to use a TTL control via a 15 pin connector and any other connector than BNC (the BNC connectors are present on the side wall of the MEV-9, see point 2 below). To adapt this cable to your source of TTL commands may need a replacement of the connector. A diagram with connection references is shown below.

**TTL-IN$_{1 ....9}$**




| pin No | function |
|---|---|
| 8 | TTL in 1 |
| 7 | TTL in 2 |
| 6 | TTL in 3 |
| 5 | TTL in 4 |
| 4 | TTL in 5 |
| 3 | TTL in 6 |
| 2 | TTL in 7 |
| 1 | TTL in 8 |
| 9 | TTL in 9 |
| 10 | 0 V |
| 11 | 0 V |
| 12 | 0 V |
| 13 | +12 V |
| 14 | +12 V |
| 15 | +12 V |

2) on the side of the MEV-9 box, nine BNC connectors are available for easy connection to any trigger source. The input numbers corresponds to manual switches numbers.
Example of Digidata board with P-clamp : connect the output digital BNCs from your board and define the TTL patterns in your stimulation.

## 2. EVH-9 electrovalve module

The EVH-9 has 9 normally closed pinch electrovalves. The valves are powered by 12V (2A). The cable should be connected to the Electro Valves port on the rear panel of the MEV-9 controller.

The module can be fixed on the rack holder (see optional parts list) or on any other stable support.

## 3.Tubing

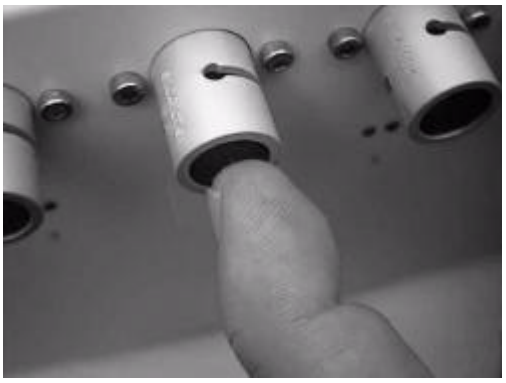
The EVH-9 electrovalve array can work with tubing of different types, like silicone, tygon or C-Flex. The outside diameter should not exceed 2.5mm. Our preference is C-Flex tubing (ID: 0.5mm, OD: 2.1mm, Reference: COLE PARMER #6424-59 or BIOBLOCK SCIENTIFIC #M71195). C-Flex tubing is well adapted to our electrovalves and is much less permeable to air than, for example, silicon tubing. This tubing also gives a best compromise between high flexibility (squeezing factor) and low permeability to air. This tubing is connected by simple insertion into the output tubing of the manifold.

### 3.1 Installation of tubing

After the syringe rack is installed with syringes and luer locks are inserted into one end of the tubing, the tubing can be fit into the electrovalve grooves. It is important to check if the tubing is well inserted in the valves, by checking the flow. To help a correct tubing insertion a procedure is described below.

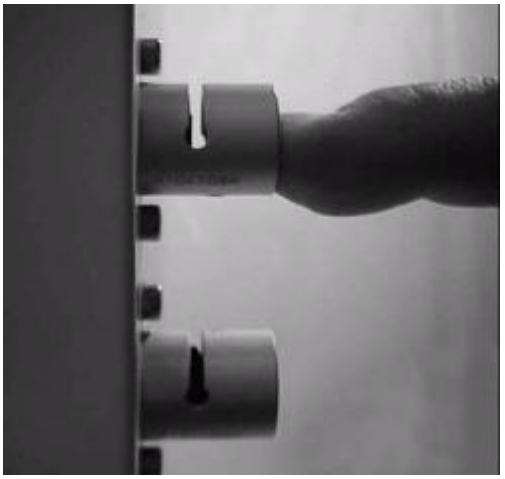
Picture 1

Pressing the central part of the valve opens the valve



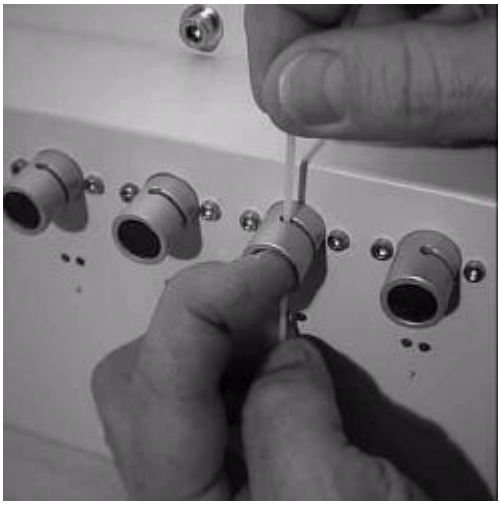
Picture 2

The upper valve is in open state, the space where the tubing should be inserted is well seen. The valve below is in closed state.



Picture 3

With the valve opened with one finger, insert the tubing, holding it vertical and slightly stretched. When the tubing is inserted in the valve's groove, make sure it is well vertical and in the groove axis. Do not stretch the valve excessively.



Make sure that the tubing is not stretched between the syringe and the valve, what may block the flow or cause the leakage.

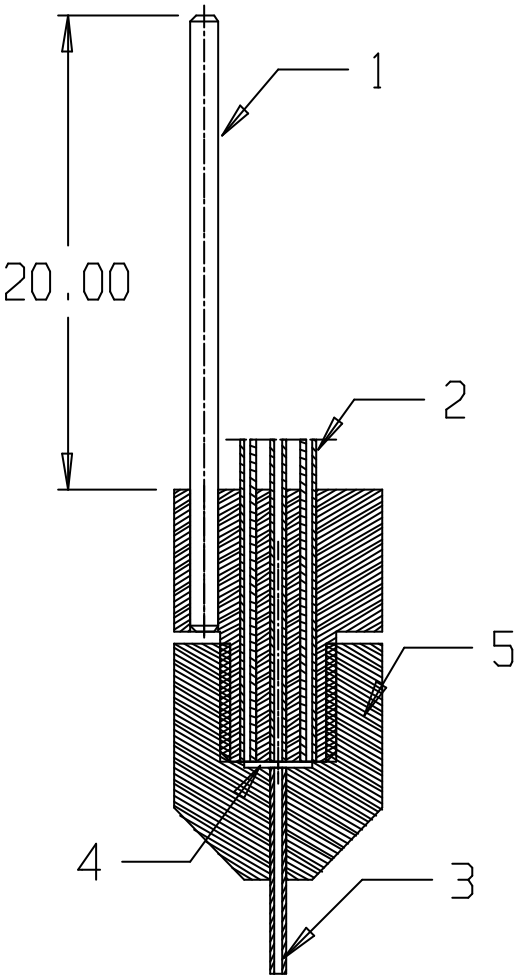
### 3.2 Flow test

Having installed all tubing in the valves, fill the syringes with water and check all valves one by one. Open the valve by control unit or by hand and see if the water is flowing correctly, and stops when the valve is closed. In case of any problem check :

- the tubing is not blocked on the level of luer lock,
- the tubing is not under tension between the syringe and the valve,
- the tubing is well in the valve groove
- the tubing is not blocked inside (use a syringe piston to push the solution)

## 4. Standard manifold

The standard manifold was designed to be easy to handle, easy to clean and robust. The output and input tubing are made of standard, easily available materials, and can easily be exchanged. The user can access the common chamber by unscrewing the body of the manifold. See drawing for details.




1) The manifold is equipped with a metal pin which permits the fixation to any micromanipulator electrode holder.

2) Input tubing: 9 input lines made of polyethylene. Polyethylene tubing (ID: 0.3, OD: 0.70mm, Reference: MERCK CLEVENOT BIE-03401-0001

3) Output tubing: one output line made of fused silica tubing. Length: 5cm, inside diameter: 320 µ (standard) or 530 µ . If different output diameter should be used, it is possible to buy only the lower part of the manifold (5).

4) Dead volume: 2.1 µl

## 5. Optional parts

### 5.1 Linear head

Like in RSC-160 & RSC-200 systems, this head permits to separate all the tubing from the reservoir syringe to the very output. Application of this head is alternative to a manifold, and gives the possibility to avoid it's major drawbacks, like dead volume, cross-contamination and necessity of washing (using the linear head, all parts which are in contact with drugs can easily be replaced) The linear head must be fixed on a manipulator and the position changes are done manually. The head is positioned in the Petri dish with one tubing outlet set precisely in front of the patch pipette or the cell. The internal diameter of the tubes is large enough to perfuse most cell sizes at very slow flow rates (10-50 µl/min typical).

### 5.2 Syringe Rack and Rack Holder

The most convenient way to hold the reservoir syringes is to use the syringe rack that has been especially designed for this use.
The syringe rack can be installed or hanged at the most convenient location in the Faraday cage or set on its holder.

### 5.3 Heated manifold MPRE8

In case a temperature control system is used for bath heating, a perfused solution need to have the same temperature as the bath. To obtain this a MPRE8 heated manifold and temperature control system can be used.
The input tubing of the heated manifold has to be connected (be insertion) into the C-flex tubing.
For other details concerning MPRE8 manifold see the technical description delivered with the manifold.