# UC-8 Injector

# Programmable Systems for Solutions Application & Switching

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- Up to 16-Channels
- Programmable timing and sequencing up to 32 steps
- Compatible with Imaging & Data Acquisition systems
- No electrical noise during switching
- Automatic switch to WASH solutions for easy manual operation
- Bath Perfusion & Local Application
- Built-in Pressure Controller or External Pressure Source



User's Guide



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#### **Specifications**

**Remote Control** wireless control for easy manual operation **TTL Signals** +5 Volts activates valves, individual BNC connector for each valve, DB-9 connector **Analog Voltage Input Decoder** Input analog voltage at rear panel BNC is decoded at 0.5V intervals per channel **Pressure Controller** 0-15PSI (or external source up to 300PSI) **Programmable Timers** 1 ms accuracy, stored in controller memory AUTO memory mode automatically switches channels, and activates "wash" solution between channels in sequence Software control through RS232 port (or USB adapter)

#### Output

x8, #10-32 threaded ports for 1/8in O.D. tubing (pressure switch), 15PSI max. (or 100PSI max. with an external source)

Size (Controller): 12Wx6Hx9D in. **Power Supply** 

100 to 240 V AC, 50/60 Hz

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#### Introduction

The controller comes with power cable, tubing, and all necessary fitting. If the built-in pressure controller (1.5 PSI) was not ordered, a source of pressurized gas is required to operate the system. The pressure sources needs to be regulated, since the maximum input pressure should not exceed 300 PSI. The controller ships adjusted for input pressure 40 PSI.

#### Installation Guide

Insert pieces of 1/8in. O.D. BLACK tubing inside OUTPUT ports on the back of the controller. Simply push the tubing inside the ports all way, and slightly pull back to clamp. In order to disconnect, push YELLOW rim inside the connector, and pull the tubing out. Connect the other end of tubing to your setup to provide pressure. Usually luer connectors are used for this purpose.

Connect power cable.



2 Turn the controller ON using ON/OFF switch on the BACK panel. Initially, the output is open to the air. Touch SET button and then, PRESSURE button. Set/adjust required pressure using the key-pad: touch CLEAR button first, key in a new value, and touch ENTER key to save the new value. Push button START to start the pressure controller.

step1	step9	channe delay: time:	əl:	1 0ms 120ms		16channe	S
step2	step10	12	20	ms			
step3	step11	1	2	3	ms		
step4	step12	4	5	6	sec		
step5	step13	7	8	9	min		
step6	step14			NEXT	DELAY		
step7	step15						
step8	step16					PRESSURE	EXIT

**The output pressure will regulate solution flow rates in your liquid delivery setup.** 

IMPORTANT: in case of open (not-sealed) systems, it is normal pressure reading being low. This, however, should be avoided since the controller is designed to provide pressure to closed systems in order to regulate flow rates in small volume delivery setups. Touch EXIT button.

4 Initially the controller will keep outputs closed, which is shown by OPEN button. Touching the button OPEN, or clicking on any channel on the provided remote control, will open the valves - the button will show CLOSE word.

1	CLOSED	time Oms	14.5PSI	9	OPEN
2	CLOSED	100sec		10	AUTO
3	CLOSED	0ms		11	CODE
4	CLOSED	0ms		12	16->8
5	CLOSED	0ms		13	A1
6	CLOSED	0ms		14	A2
7	CLOSED	0ms		15	A3
8	CLOSED	0ms		16	SET

#### Output Control

Each output channel can be activated by one of four ways:

**Manual Switch** positioned on the front display, or using remote control; manual control can be used to OVERRIDE external input;

**External Input TTL signal** activates an individual channel. Rear panel BNC connectors provide access to all 16 channels. Rear panel DB-9 connectors provides a convenient access through an optional DB-9 cable to activate the channel using digital signals (parallel to the BNC connectors);

**Analog Signal Decoder** allows you to activate each output channel by applying a voltage signal in the range 0 - 10V to Analog Discriminator input BNC, located on the rear panel; using this input, one analog output channel from a data acquisition system can control 16 output channels;

**Binary Decoder** allows using four digital output channels from a data acquisition system to control 15 output channels; the 16th channel is activated when no input signal is present.

**Software Commands** sent through RS232/USB interface allow you to program solution application and exchange protocols, which make the system extremely flexible.

#### Using Wireless Remote Control PC-16-RC

1. The remote control unit requires three AAA type batteries (included).

2. Eight push-buttons will activate/de-activate the first eight channels of PC-16 controller directly: push once to activate, push again to de-activate.

3. The grey unlabeled, CONTROL, button will activate/de-activate channels from 9 to 16, when used in conjunction with buttons 1 to 8. Pushing the control button will make the remote unit's LED turn red. Pushing the numerical button, while LED is red, will activate/de-activate the corresponding channel of PC-16 controller.

The remote control is programmed to activate only PC-16 controller with certain address (and will not work with other controllers). To put the remote into the correct mode, press GREY (CONTROL) button until the remote starts flashing (blinking) and then press button "1" - to program to the address 1 (or 2 for address 2; and 3 for address 3). To program the controller for the correct address, touch button A1 for address 1, or A2 for address 2, A3 for address 3.

	PC-16 CHANNEL	PC-16 CHANNEL
BUTTON		CONTROL
1	1	9
2	2	10
3	3	11
4	4	12
5	5	13
6	6	14
7	7	15
8	8	16

#### Troubleshooting

If the remote unit stops activating some channels, press the control button until the unit's LED starts blinking and push button 1 to restore the settings.

#### Front Panel Controls

1	CLOSED	time 14.5PSI Oms	9	OPEN
2	CLOSED	100sec	10	AUTO
3	CLOSED	0ms	11	CODE
4	CLOSED	0ms	12	16->8
5	CLOSED	0ms	13	A1
6	CLOSED	0ms	14	A2
7	CLOSED	0ms	15	A3
8	CLOSED	0ms	16	SET

Front Panel Controls	
1,2, 8 Switches	Touching the channel NUMBER button manually switches valves ON/OFF. This will override external software, TTL and ANALOG signals.
AUTO	Switches the controller into Automatic Memory Mode. Activating any chan- nel manually (or using remote control) while in AUTO memory mode - will ini- tiate previously set timer for this channel, and starts switching next channels in sequence if programmed. Pressing AUTO button while a channel is OPEN - will designate this channel as a "WASH" solution, This channel will turn ON automatically when no channels are open. This can be used to activate "WASH" between channels in AUTO sequence.
CLOSE	or power supplied to the valves - valves are CLOSED . This is used if turning all the valves OFF at once is required during the experiment, or during the initial setup and filling the lines.
CODE	CODE is used to switch the controller into CODE mode;.
A1, 2, 3	Switches the address for the controller, this should correspond to the address set on the remote control;
SET	Displays SET screen to adjust timers and sequence parameter;

### Output and Back Panel

analog 💿 🕒	TTL 000000 00000	RS232 ●	
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Outputs	
DB-9 Connectors	Two DB-9 connectors on the rear of the controller are used to connect to
VALVES I	the valves. Valves I to valves 1-8, and Valves II to valves 9-16.
VALVES II	

Back Panel	
OUTPUT	Output ports provide pressure to deliver liquid.
TTL 1 8, and DB-9 connector	BNC connectors for TTL input signal (+5V). Applying the TTL signal will activate an individual channel. Multiple parallel connections are possible.
Analog	IN: BNC connector to apply an analog signal to switch individual channels using Analog Discriminator.
RS232	DB-9 connector for the provided null-modem cable to link to your computer and use software control (during imaging applications, for example). Can be used with optional USB adapter.

## Using Analog Input Controls

The table below shows recommended values for analog input to activate the channels. The analog discriminator uses windows 0.5V wide.

Input Voltage	Channel Activated
0 - 0.5 V	None
0.5 - 1 V	Channel 1
1 - 1.5 V	Channel 2
1.5 - 2 V	Channel 3
2 - 2.5 V	Channel 4
2.5 - 3 V	Channel 5
3 - 3.5 V	Channel 6
3.5 - 4 V	Channel 7
4 - 4.5 V	Channel 8
4.5 - 5 V	Channel 9
5 - 5.5 V	Channel 10
5.5 - 6 V	Channel 11
6 - 6.5 V	Channel 12
6.5 - 7 V	Channel 13
7 - 7.5 V	Channel 14
7.5 - 8 V	Channel 15
8 - 8.5 V	Channel 16

## Using TTL Input in CODE Mode

TTL Inputs			Channel	
TTL 1	TTL 2	TTL 3	TTL 4	Activated
0	0	0	0	Channel 16
1	0	0	0	Channel 1
0	1	0	0	Channel 2
1	1	0	0	Channel 3
0	0	1	0	Channel 4
1	0	1	0	Channel 5
0	1	1	0	Channel 6
1	1	1	0	Channel 7
0	0	0	1	Channel 8
1	0	0	1	Channel 9
0	1	0	1	Channel 10
1	1	0	1	Channel 11
0	0	1	1	Channel 12
1	0	1	1	Channel 13
0	1	1	1	Channel 14
1	1	1	1	Channel 15

#### Programming timers and channel sequences

If you touch button SET on the front panel, the display will show SET screen, which will allow you to program timers for individual channels, and delays between channels in sequence.



The touch pad on the right is used to enter time values in ms, sec or min. To switch between time and delay, touch "Delay"/"Time" button. To edit the values, use "Clear" button. Touch button "Enter" to put the new value into the controller memory. In order to mover between different channels values, touch buttons NEXT/PREV.

In order to make all 16 channels available for use, select box "16 channels". After finishing programming, touch EXIT button.

ONCE PROGRAMMED THE TIMERS SETTINGS ARE STORED in THE CONTROLLER MEMORY and WILL BE AVAILABLE EVERY TIME PC-16 CONTROLLER IS USED. IN ORDER TO CHANGE TIMING OF ERASE SETTINGS - THE CONTROLLER NEEDS TO BE RE-PROGRAMMED USING SET SCREEN

Each channel can be programmed for TIME to be active, and DELAY time before it becomes active after the previous STEP in the sequence. If the channel has TIME programmed more than 0ms, it will make STEP (with the same number as the channel number) in the sequence.

Sequence will go from lower STEP number to the higher number STEP, if activated. For sequence to continue to the next STEP, DELAY for this STEP (channel) should be more than 0ms. DELAY of 1ms makes sequence go "without" a delay (with almost no delay). If either TIME or DELAY for a STEP are equal 0ms – sequence will stop before this "not activated" STEP. If DELAY for channel 1 is more than 0ms – sequence will continue as a "loop", starting again with STEP 1. Up to 16 STEPs can be activated, even if only 8-channels are physically present in the system. If automatic WASH is used between steps while in delay, the maximum number of "steps" will be 32.

To initiate sequence, the controller should be put into AUTOmatic mode, by touching AUTO button on the screen, and then pressing (on the screen or remote) any button (STEP) in the sequence. Removing AUTOmatic mode by pressing the button again, will stop the sequence.

After STEPs in the sequence are activated using SET screen, multiple channels can be added to the STEP, by going

through the channels (touching NEXT/PREV buttons) and selecting STEPs where the channel should be active. This can be used to overlap multiple channels at the same time, combine different channels in the same volume/sample, or activate multiple channels to apply solutions in parallel to different samples/volumes.

For more flexibility, the channel can be excluded from the same number STEP by un-selecting the same number STEP on the screen (for the same number channel). This means that although the channel was used to activate the STEP in the sequence, it does not have to be actually OPEN during this step. This can be used to make sequences of channels in random order.

#### Software control using RS232 port.

After connecting the controller to your computer through provided RS232 null-modem cable (or an optional USB adapter **CFPS-USB**), you can switch valves by sending ASCII codes from your application software. This is used to program automatic perfusion control during your experiment.

RS232 port (COM1, for example) should be set at 115,200 baud, 8 bits, Parity none, 1 Stop bit. The following is the list of commands:

Command	
!Sn	Set channel n ON (where n is 0 for channel 1, F for channel 15)
!Cn	Set channel n OFF
!A0	Set first 8 channels (1 8) OFF
!BO	Set second 8 channels (9 16) OFF
!A1	Set first 8 channels ON
!B1	Set second 8 channels ON
!SG	Set all channels ON
!CG	Set all channels OFF
!Rn	Read status of channel n, returns 0 if OFF, and 1 if ON
!RG	Read status of all channels, returns 16 bits nnnnnnnnnnnnnnn, the first bit is channel 16, the last is for channel 1

#### Warranty

This product is warranted to be free from defects in material and workmanship for the duration of one year. Normal wear, or damage resulting from abuse, accident, alteration, misuse, service by an unauthorized party or shipping damage, are excluded from this warranty and are not covered. Bioscience Tools will repair or replace the defective product covered by this warranty free of charge if it is returned, postage prepaid, to Bioscience Tools, ph: 1-877-853-9755.

#### Pressurized Cylinders, PC



#### Small Volume Delivery System, SVDS1/2



SVDS1 system can be used with a pressure source, or solutions can be withdrawn by a negative pressure supplied by CFPS-1U units. The output solution tubing can be connected to valves of a PS solution switch, and then to a MM, PM or ZMM micro-manifolds. The pressure input should be connected to a regulated pressure source using 1/16" I.D. tubing and T/Y-connectors – one pressure input to all eight (or less) pressure input luer ports positioned on the top. The solutions will be switched by turning ON/ OFF the appropriate valves by the controller of the perfusion system. The applied pressure will push the solution through the opened line.

The system ships fully assembled. Below are the instructions on connecting the replacement tubing.







- Measure and cut eight (or fewer) pieces of polyethylene tubing, 1/16" O.D. fitting sleeves. Put a short piece of the fitting sleeve over delivery tubing (the system is shipped with 2' of Teflon tubing per each channel). Insert the sleeve into the ferrule.
- 2. Secure the tubing inside the plastic block by tightening the threaded nut (do not tighten completely yet).
- 3. Screw in conical plastic tube (included), and pull the delivery tubing so that the end of it still touches the conical bottom. Tighten the threaded ferrule fitting.

ALTHOUGH PROVIDED FITTING WILL ENSURE AIRTIGHT SEAL, THREADED PORTS AND TUBES MIGHT REQUIRE SOME GREASE TO MAKE AIR-TIGHT SEAL INSIDE THREAD.

4. The system can be mounted on a custom 6 mm O.D. rod or on 1' long threaded aluminum rod, which can be mounted on a standard 0.5" O.D. stand through X-block (X-block and a threaded rod are included). This allows

positioning the solutions near your samples, to minimize the dead volume.

If valves used to open solution lines, connect Teflon tubing to valve's inlet using sleeves of soft tubing. The valve's outlet should be connected to a micropipette, a micro-manifold or a chamber using another tubing.





#### Zero-Dead Volume Manifolds, ZMM



In case when even a slight contamination of different solutions is undesirable, a zero-dead volume manifold can be used instead of regular Teflon manifolds. The zero-dead volume manifolds offer the additional advantage of facilitating perfusion and accelerating solution exchange rate around your samples. This manifold can be also used for solution outflow/suction, by connecting one of the channels to CFPS-1U unit.

ZMM manifolds come with 2 feet tubing with luer connectors, to connect to a computerized perfusion systems, PS. Use fitting from PS-KIT to attach connecting tubing to either 1/16" soft tubing or polyethylene tubing, included with perfusion systems.



- 1. Position the manifold on a microscope adapter.
- 2. Place the tip of the manifold inside a chamber. The stainless tubing can be moved inside black holder to obtain desired configuration and to fit inside perfusion chambers.
- 3. The inside polyimide tubing can be adjusted to provide non-contaminating flow of different solutions by positioning the outputs at different heights. The polyimide tubing can be cut to required length using a surgical grade

sharp blade or a scalpel. Polyimide tubing is washable.

Note: Selected channels of the manifold can be also used to provide suction or outflow of solution from the chamber to keep the volume inside the chamber constant. The height of the suction tubing will determine the level of solution (volume) inside the chamber.

4. Position outflow or suction tubing inside the chamber before using the perfusion system.

Note: The polyimide 360/250 micron I.D. tubing inside the manifolds will provide adequate solution flow with regular gravity driven perfusion system PS. If higher solution flow rate through the manifold are required, the solutions can be pressurized or elevated. SVDS1/2 systems, for example, requires external pressure application to drive the solutions from the reservoirs. Controlled flow systems CFPS can also provide enough pressure to drive the solutions through the manifold.

Note: Always wash the manifold with DISTILLED water after use.

