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# LC-08 Column Selector

## User Manual



PromoChrom Technologies Ltd

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## 1. Introduction

LC-08 column selector can make column change with a button press or using built-in method. It eliminates troubles in manually changing HPLC columns and improves efficiency and reliability in analysis. It can be controlled using the keypad on the front panel or using a computer with the LC-04SP software.

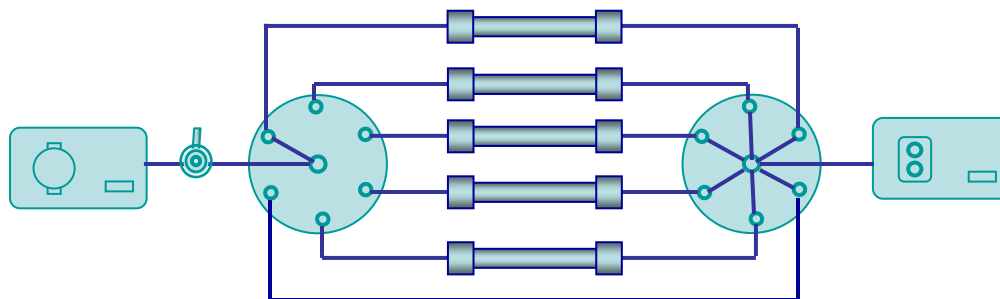
When working as standalone, users can program the column selector using only 6 buttons. The method and sequence are stored for repeated use. The built in method and sequence enable automatic column switching within a run or between the runs. Computer is not necessary for many applications.

For more complex applications, LC-08 column selector can be controlled using the LC-04SP software and work together with other LC-04SP valve modules.

The column selector is compatible with most HPLC instruments. It can synchronize with an HPLC according to its start/stop signals. It can also work as a control master to control the start and stop of an HPLC. The later function is very useful when the HPLC do not have automatic start capability.

LC-08 column selector uses a stream selection valve and a 7-port adapter to connect up to 6 columns.

The following picture shows a typical connection diagram of the column selector. One channel is connected using just a tubing. This channel can be used as bypass channel for fast priming of pump or for direct injection of samples without separation. This can be useful in tuning of a LC-MSD.



Connection diagram of column selector

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## 2. Installation

### 2.1 Hardware connection

LC-08 column selector has two versions: the standalone version and a version with both keypad control and PC control. The standalone version includes fittings for the 12 ports, a remote cable, and a 24 VDC power supply. In addition to the components in the standalone version, the PC control version comes with a RS232 cable, a USB/RS232 converter, a remote cable, and a CD carrying the control software. The two versions use different firmware. An upgrade is possible by changing the micro controller in the device.

Depending on selection of options, a tubing kit is also included. The kit includes twelve 200-mm stainless steel tubing for connecting columns on the selector, one bypass tubing, tubings for connecting to sampler and detector, and twelve fittings and ferrules for 6 columns. The ID of tubing can be 0.12 mm (flow rate < 3 mL/min), 0.25 mm (flow rate < 10 mL/min) or 0.5 mm (flow rate < 30 mL/min).

Below are the procedures for the connection:

- 1) Connect the central port of the stream selection valve with outlet of auto sampler or manual injector. The tubing may be the one from the HPLC or use a long tubing in the tubing kit.
- 2) Connect the central port of the 7-port adapter with the inlet of the detector.
- 3) Connect port 6 of the stream selection valve with one port of the 7-port adapter (for bypassing channel). This can be done using the bypass tubing in the tubing kit.
- 4) Connect inlets of 5 columns to the stream selection valve and connect the outlet of the columns to the 7-port adapter.

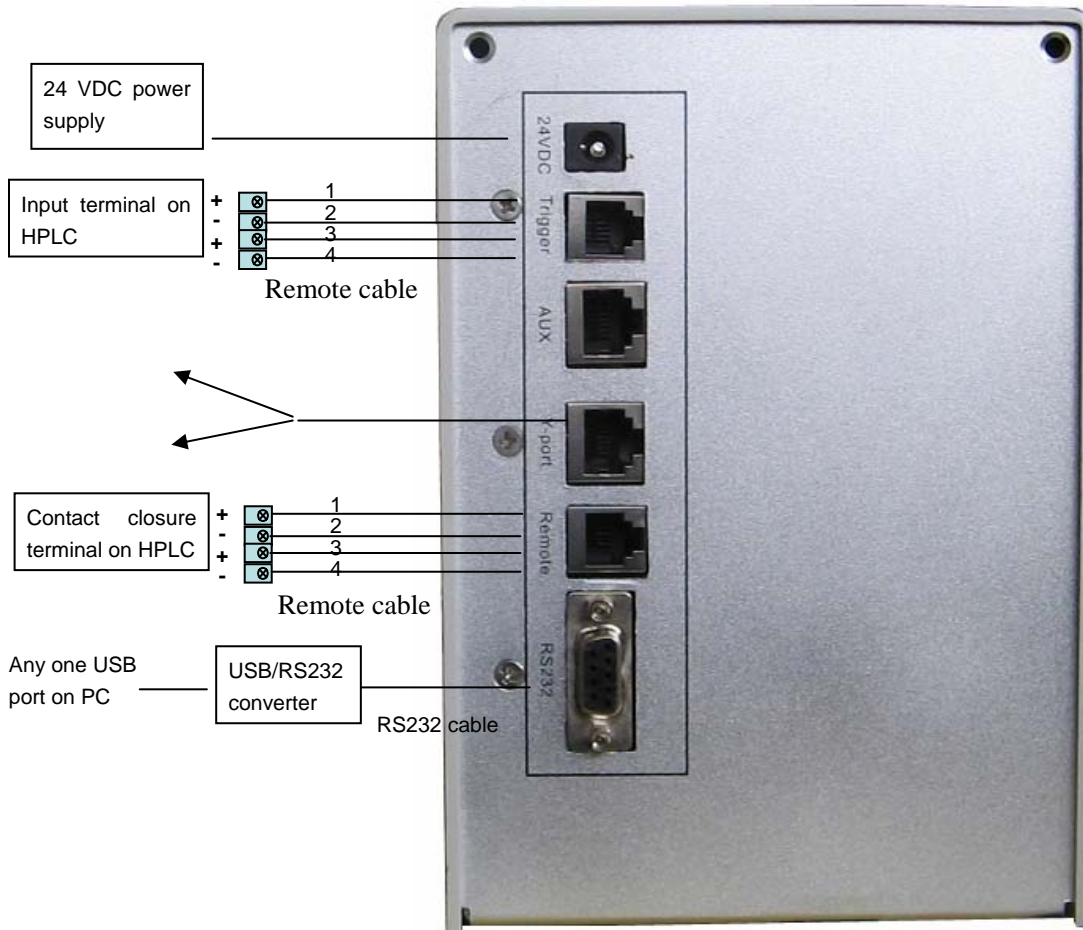
**Since all the 6 ports of the 7-port adapter are connected with the central ports, any unused ports must be blocked or connected to a port on the stream selection valve. Otherwise liquid will leak out from that port, instead of flowing to the detector.**

The diameter of tubing must match the flow rate. For flow rate below 5 mL/min, use 0.12-0.17 mm tubing to connect columns between the ports and use 0.17-0.25 mm tubing to connect the selector with the sampler and the detector. In case of preparative HPLC, 0.25-0.5 mm tubing should be used. If both analytical column and preparative columns are used, use 0.12-0.17 mm tubing to connect the analytical columns with the ports and use 0.5-mm tubing for other connections.

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## 2.2 Electric connection

Follow the following diagram to make electric connection. Make sure the power switch is at off position during the connection. Plug the power supply cable to 110/240 AC source only after all the components are properly connected.



Procedures:

- 1) Install USB/RS232 converter (For PC controlled version only)  
LC-04SP uses RS232 to communicate with the control software in PC. If the PC does not have RS232 port, USB ports on PC can be converted using a USB/RS232 converter. Plug a USB/RS232 converter to a USB port on PC. When asked for driver, insert the driver CD included with the converter.

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Follow the instructions to complete the driver installation.

- 2) Connect the selector to PC (For PC controlled version only)  
Use RS232 cable to connect the valve box to a RS232 port on the PC. In case of using USB/RS232 converter, connect the RS232 cable to the convert and then connect the converter to any USB ports on the PC.
- 3) Connect the column selector with HPLC  
LC-08 has two ports for integration with HPLC. The remote port is used when the selector need to follow the start and stop of the HPLC. In case the HPLC does not have automatic start/stop function, the LC-08 can work as a control master and automatically trigger start and stop of the HPLC. In this case the trigger port should be used.

The remote cable can be used for both situations. It has 4 wires. Wires 2 and 4 are signal ground. When plugged into the remote port, wire 1 is for start signal and wire 3 is for stop signal. When plugged into the trigger port, wire 1 is for trigger 1 and wire 3 is for trigger 2.

If the HPLC is an Agilent 1100 or 1200, use the remote cable for 1100/1200 to connect the remote port of the selector with the remote port on any of the HPLC module. For other brand HPLC, use the general purpose remote cable to connect the valve box with contact closures on the HPLC. If the terminals of the contact closure have “+” and “-” marks, connect the start and stop wires of remote cable with the “+” terminal and the ground wire with the “-” terminal.

- 4) Plug in the power supply for the valve box.
- 5) Plug the cable of power supply to the AC power source.

### **2.3 Install software (for the version with PC control)**

The control software is written using Visual Basic and can only be used with PC run under Windows operation system. It works well with PCs installed with Windows 2000, Windows XP, and Windows Vista.

There are two ways of using the software. One is to install the software to the PC using a setup program and the other is to use without installation.

To install the software to PC, first close all the applications and then insert the CD carrying the software. Open folder “Control software” and click at setup.exe. Follow the instructions given on the screen to complete the installation.

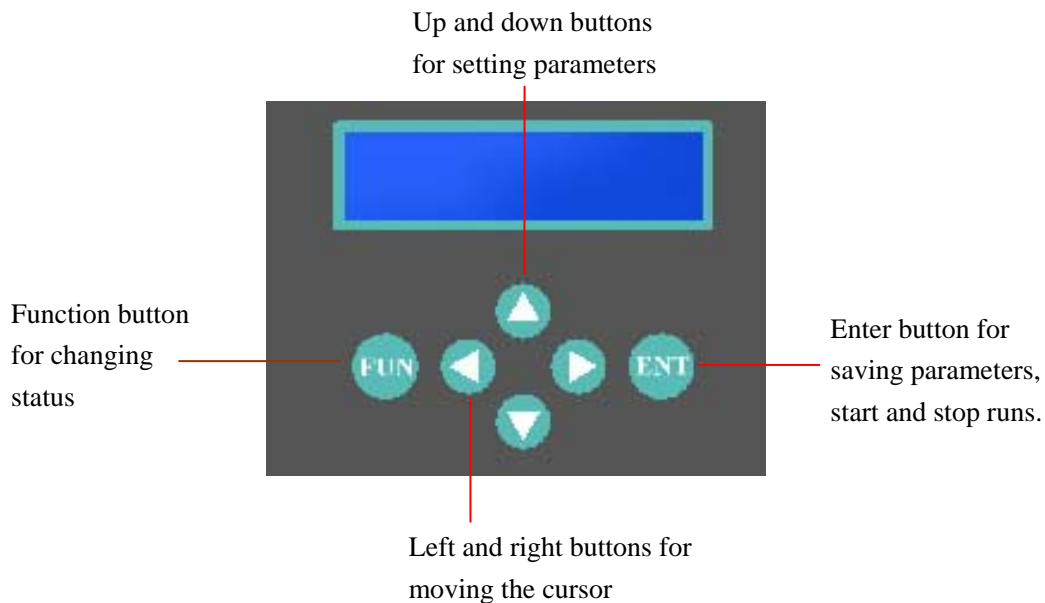
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For most PCs, the control software for LC-04SP can be used without installation. It can be lunched by simply clicking at the software file LC04SP.exe on the CD. For the convenience of use, file LC04SP.exe may be copied to the hard drive of PC. When the PC has been installed with very complicate software (such as a LC-CE-MS), this direct approach may be used to avoid disturbance on the existing software.

### 3. Operation

#### 3.1 Summary of the button operations

LC-08 keypad has 6 buttons. The FUN button is used for changing the status. There are 7 statuses. Each press of the FUN button will cause change to next status. When the status reached seventh status, the next press of FUN button will bring it back to the original status. The four buttons with arrows are for handling parameters. The ENT button is used to save parameters and to trigger start and stop of a run. **Whenever a parameter is changed using the four arrowed buttons, ENT button should be pressed to save the parameter.**



The following table summarizes the function of the 7 status:

Status Explanation	LCD Screen Display								
<p><b>1. Original status.</b> LC-08 is in this status when the device is powered on. It must be set at this status if PC control is used.</p>	<p>Status: Ready Current port: 1</p>								
<p><b>2. Method status.</b> Stored method is loaded. User can use cursor and up and down buttons to modify method parameters. First press of ENT button will save the method. Second press of ENT button will start a run. The third press of ENT button will stop a run. The method run can also be started and stopped by the remote signals at this status.</p>	<table border="0"> <tr> <td>n</td> <td>Time</td> <td>Port</td> <td>Rdy</td> </tr> <tr> <td>1</td> <td>023.0</td> <td>3</td> <td>0</td> </tr> </table> <p><i>(see following section for more details about method)</i></p>	n	Time	Port	Rdy	1	023.0	3	0
n	Time	Port	Rdy						
1	023.0	3	0						
<p><b>3. Sequence status.</b> Stored sequence is loaded. User can use cursor and up and down buttons to modify sequence parameters. First press of ENT button will save the sequence. Second press of ENT button will start running of the sequence. The third press of ENT button will stop the sequence. The sequence can also be started and stopped by the remote signals at this status.</p>	<table border="0"> <tr> <td>n</td> <td>Run#</td> <td>Port</td> <td>Rdy</td> </tr> <tr> <td>1</td> <td>1</td> <td>3</td> <td>0</td> </tr> </table> <p><i>(see following section for more details about sequence)</i></p>	n	Run#	Port	Rdy	1	1	3	0
n	Run#	Port	Rdy						
1	1	3	0						
<p><b>4. Direct switch status.</b> The stream selection valve can be directly switched using up and down buttons. The target port and the actual port number (or column) is displayed.</p>	<p>Direct switch</p> <table border="0"> <tr> <td>2</td> <td>2</td> </tr> <tr> <td><i>(target)</i></td> <td><i>(actual)</i></td> </tr> </table>	2	2	<i>(target)</i>	<i>(actual)</i>				
2	2								
<i>(target)</i>	<i>(actual)</i>								
<p><b>5. Module setting status.</b> A module number is used as device ID for PC control of multiple modules. The default setting is 1. LC-04SP software is used to control LC-08 together with a LC-04SP; the module number of the two must be different. Users can either set the LC-04SP as 2 using the control software or set the LC-08 as 2 from this function.</p>	<p>Set Module #</p> <p>1</p>								
<p><b>6. Repeat number setting status.</b> The default value is 0. When LC-08 is used as control master, the value needs to be above 0. A method or sequence will repeat automatically when the repeat number is set above 0.</p>	<p>Repeat #</p> <p>2</p>								
<p><b>7. Waite time setting status.</b> Waite time is the interval between runs when LC-08 is used as control master.</p>	<p>Waite time (min)</p> <p>3</p>								

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### 3.2 Use built-in method and sequence

A method and a sequence are stored with the LC-08 selector for standalone operation. A method can be used to change columns within a run (at the method status). A sequence is for changing columns between the runs. For more complex control, such as each run use more than one column and different run use different columns, the LC-04SP control software should be used for the control.

LC-08 column selector can store the last setting of the method and sequence even when it is powered off. It saves trouble for repeated setting of the parameters.

A method decides the timing for port (or column) change. It has 10 lines. The LCD shows the line number (0-9), switching time (0.1 to 999.9 min) and the target port number (1-6).

n	Time	Port	Rdy	Status (Rdy or RUN)
1	023.0	3	0	Run elapsed time in minute

To change the parameter, move the cursor to the beginning of the line and use up and down buttons to reach the line that needs to be changed. Then move the cursor to the parameter and use up and down buttons to change the settings. After finishing the modification, ENT button must be pressed to save the new settings. If the port number is set as 7, it will be treated as a stop command. A run will stop even without a stop signal from the HPLC. All the lines are discarded afterwards. It is useful when not all the lines in a method are needed.

A method can be started and stopped by the ENT button or by remote signals. When wire 1 of the remote cable is connected to ground or set to TTL 0, the method will start. When wire 3 of the remote cable is connected to ground or set to TTL 0, the run will stop. If the repeat number is set above 0, the run will repeat automatically when it is stopped.

A sequence decides at which run the column switch should occur. It has 10 lines also. The LCD shows the line number (0-9), number of runs for switching (1 to 255 runs) and the target port number (1-6). The following LCD display means column (or port) 3 is connected when the HPLC was making 15<sup>th</sup> run and currently the HPLC is making the 16<sup>th</sup> run.

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n	Run#	Port	RUN	Status (Rdy or RUN)
2	15	3	16	Number of runs done by HPLC

LC-08 uses the remote signal to count the run number. When wire 1 of the remote cable is connected to ground or set to TTL 0, LC-08 will recognize it as a start of a run. When wire 3 of the remote cable is connected to ground or set to TTL 0, LC-08 will recognize it as a stop of a run. The run will stop.

If the repeat number is set above 0, the run will repeat automatically when it is stopped. Waite time is used to decide the interval of automatic start in a method run.

### 3.3 Directly switch the valve

When the status is set to “Direct switch”, valve can be switched stepwise using the up button. It is useful for simple column change. When the device is switched off, the connected port number will be stored and maintained when the selector is powered on again.

### 3.4 Use LC-04SP control software

When LC-08 column selector is set at the original status, it can be controlled by LC-04SP software. The communication is through a RS232 port or a USB port with a USB/RS232 converter.

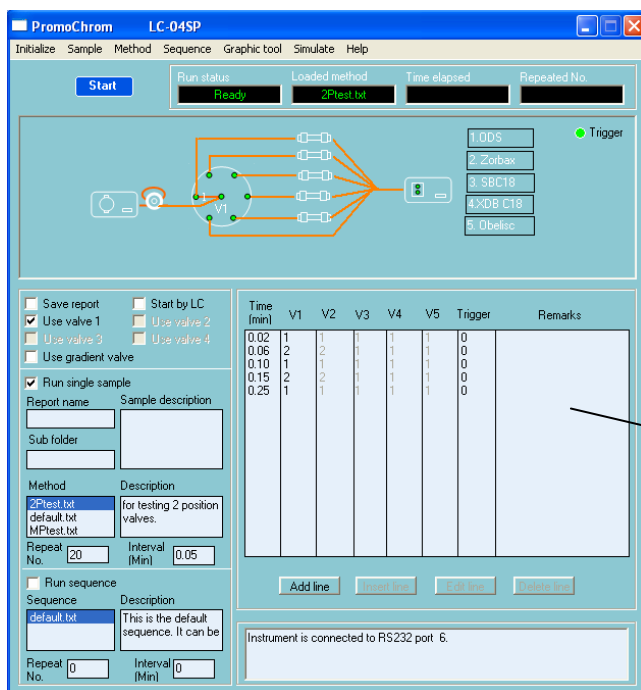
Below are the general procedures for operating the selector with LC-04SP software:

- 1) Switch on all the modules in the system
- 2) Lunch the software for HPLC
- 3) Lunch the software for LC-04SP
- 4) Draw valve diagram according to the instrument connection
- 5) Set up method for LC-04SP and save the method
- 6) Set up method for the HPLC and save the method
- 7) Start run from HPLC (LC-04SP will start also)

Although users can draw the valve diagram within the control software, a ready drawing is provided in the software CD. Copy file configGui from the CD to the folder C:\LC04SV. It will replace the original configGui file. Close the LC-04SP software and launch it again. A drawing as follows will be displayed in the control software.

A method may be built using the default method as template or may be obtained by modifying an existing method. Below are the procedures for setting up a method:

- 1) Load method default.txt or load a method that is similar to your new method
- 2) Click button “Add line”, “Insert line”, or “Edit line” to bring out the parameter entry panel
- 3) Enter parameters for each step
- 4) Click at menu bar “Method” at the top to save the method
- 5) Use “simulation” function to find out the flow path for each procedure



When setting up a method for a non-Agilent HPLC, make sure the contact closure is closed when a run starts and make the contact closure open when a run is completed.

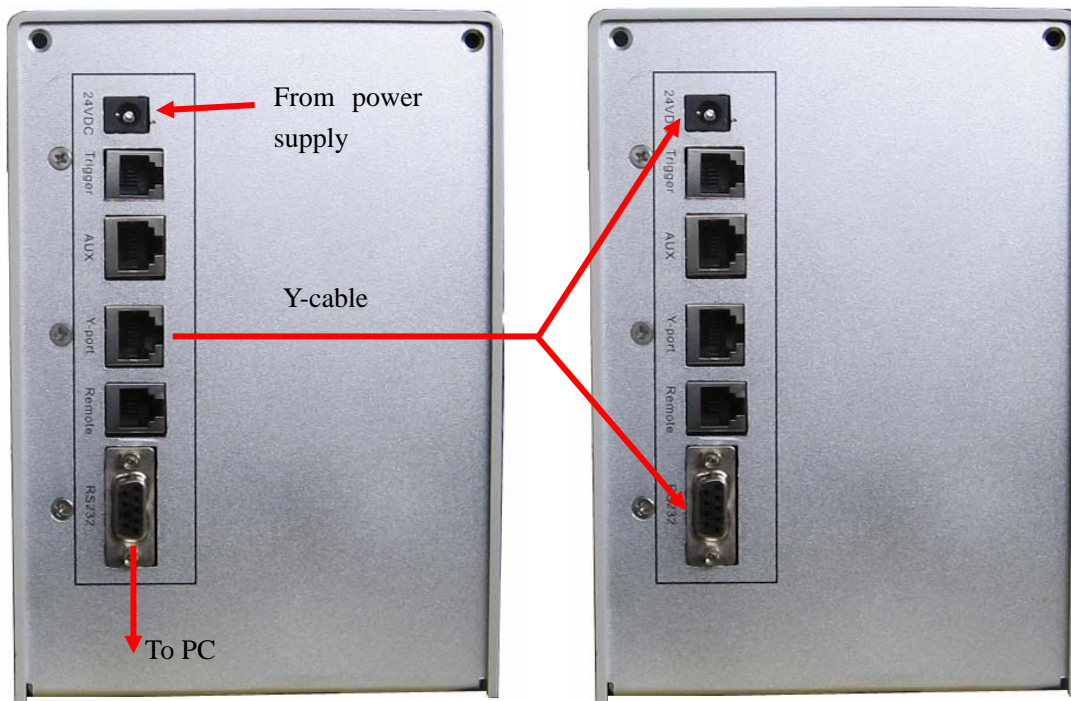
**Since the column switch can interrupt the liquid flow, pump flow should be stopped before making a column switch if the flow rate is above 5 mL/min.**

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#### 4. Use two modules together

The LC-04SP control software can treat one LC-08 as one LC-04SP module and control two modules. The two devices need to have different module number to enable the software to differentiate them. The default setting of the module number is 1. When two modules are to be used together, one needs to be changed to 2. The module number of LC-08 column selector can be set from the keypad. The module number of LC-04SP device can be changed from the control software. Please refer to the LC-04SP user manual for details.

The following diagram shows the wiring for using two modules together:



## 5. Troubleshooting

When the device is switched on, if the LCD screen is not on or is not steady, the cause could be an inappropriate connected cable, a malfunctioning power supply, or the power is not switched on. If these factors are verified not the cause, the control board may have been damaged. In this case, the device should be disconnected immediately from the power source and send to the supplier for repairing.

The control software of LC-04SP can detect instrument errors and provide on-line helps for trouble shooting. Below is an example when the device is not switched on or is not properly connected:

The screenshot shows the PromoChrom LC-04SP software interface. The 'Run status' field displays 'Error'. The 'Loaded method' is '2Ptest.txt'. The 'Time elapsed' and 'Repeated No.' fields are empty. A schematic diagram of the instrument is shown in the center, with a 'Trigger' indicator light. Below the diagram are several control buttons: 1. DDS, 2. Zorbax, 3. SBC18, 4. XDB C18, and 5. Ubelisc. The interface includes a table with columns for Time (min), V1, V2, V3, V4, V5, Trigger, and Remarks. The table contains five rows of data. At the bottom, a message box states: 'No communication with the instrument. Please check power and cable connection. Then click at Initialize to try again.'

Time (min)	V1	V2	V3	V4	V5	Trigger	Remarks
0.02	1	1	1	1	1	0	
0.06	2	2	1	1	1	0	
0.10	1	1	1	1	1	0	
0.15	2	2	1	1	1	0	
0.25	1	1	1	1	1	0	

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Below are some troubleshooting tips:

- 1) **The software cannot communicate with the device.** The cause could be inappropriately connected RS232 cable or a jam on the communication port. First check the cable connection and click at “Initialize” menu bar to make a reconnection. If the problem still exists, power cycle the device and restart computer.
- 2) **Valve fails to reach position.** This could be caused by stick of valve or disturbance in communication. The procedure for solving the problem is the same as point 1.
- 3) **The HPLC cannot synchronize with LC-04SP.** When a remote cable is used, make sure the start wire and the ground wire are correctly connected to the terminals of the contact closure on the HPLC. In the method or instrument control, make sure the contact closure will close when it start a run and will open when a run is finished.
- 4) **Other problems.** An effective way of solving problem is to switch off the device and put on again and restart computer.

## 6. Specifications

### High pressure switching valve

Liquid contact material: stainless steel and Valcon H (carbon fiber reinforced PTFE)

Port thread: 1/16” ZDV

Pressure limit: 5,000 PSI (liquid)

Temperature limit: 75 °C

Port diameter: 0.4 mm

Switch time: < 150 ms per step

### System

Communication with PC: RS232

Power supply: 24 VDC

Power consumption: < 0.5 A

Integration with other instruments: two input triggered by TTL signal or contact closure;  
two TTL output for triggering other device