



# AUTOSAMPLER

## LCS 5040

### User manual

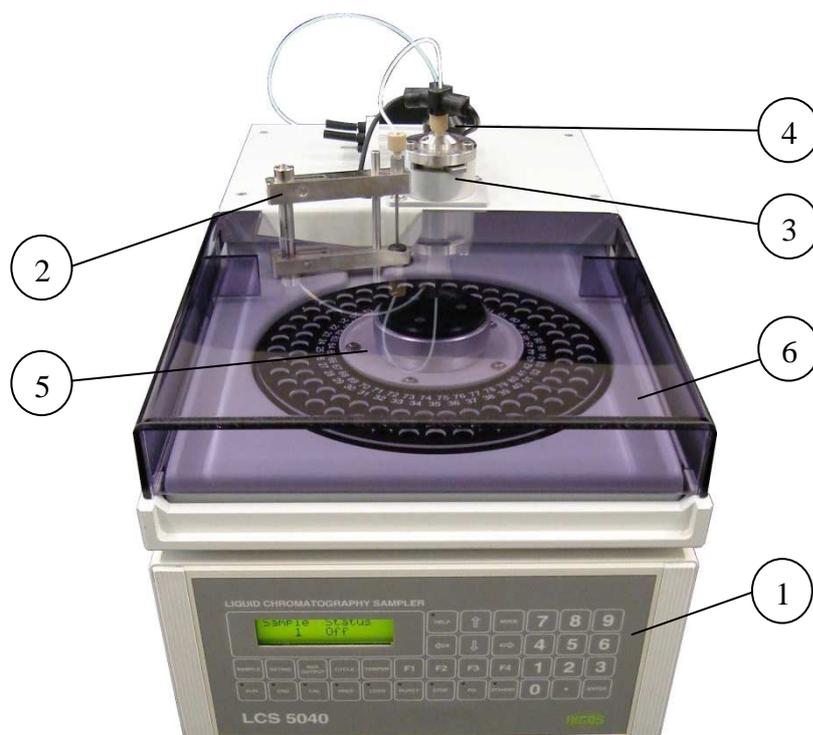


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# 1. INTRODUCTION

Autosampler LCS5040 is designed for automatic dispensing of sample series to the flow of the liquid chromatograph mobile phase. This device can be controlled with the help of the PC data station software.

Autosampler LCS5040 is designed as a standalone device, which can be hyphenated into an assembly of more devices controllable by DataApex software, even those constructed by another producers. Serial communication enables to hyphenate more devices into HPLC assembly or for other purpose, and to control and analyze measurement by master computer. In case there is no intelligent software available, it is possible to control the sample sequence and the start-up of the integrating system by using the timer program of the autosampler. Device also has connector with TTL signals in order to control peripherals without any processor.



- |                         |                     |
|-------------------------|---------------------|
| 1. Keyboard and display | 4. Peristaltic pump |
| 2. Arm with a needle    | 5. Sample disc      |
| 3. Dosing valve         | 6. Cover            |

Fig. 1. Autosampler

## Caution:

Fittings have standard HPLC thread UNF10-32. Beware of replacement with M5 thread!

**It is not allowed to use the apparatus in any manner other than those provided for in the operating instructions, otherwise the protection provided by the system could be interfered.**

## 2. DESCRIPTION AND SPECIFICATION

### 2.1 Description

Autosampler is equipped with disc with sample cooling, peristaltic pump, dosing valve with sensors and arm with needle for sample withdrawal. Precise, efficient and reliable mechanics, together with modern electronics and software, provides universal use.

#### 2.1.1 Disc and sample cooling

Cooling is provided by Peltier cells with precise temperature regulation. Disc holder is turned by an engine and can hold sample discs for various amount of samples. Either 25 and 40 samples, or 25 and 80 samples – depends on execution.

#### 2.1.2 Peristaltic pump, dosing valve with sensors and arm

Peristaltic pump is driven by a motor. Tube of peristaltic pump is changeable. Dosing valve is designed for pressure up to 40 MPa. When valve position is changed to **LOAD** position, autosampler sends the signal for analysis start. There are two optical sensors on the valve, which detects whether there is a sample present inside the capillary.

#### 2.1.3 Memory

All settings, including program, are permanently saved in memory, even after turning-off.

#### 2.1.4 Inputs / Outputs

In order to control additional peripherals, device has inputs and outputs (TTL signals).

## 2.2 Specification

Sample option 1.....	40 plastic 0,5 ml test-tubes closed with seals 25 glass 1,5 ml vials closed with PTFE septum or plastic
Sample option 2.....	80 glass 0,5 ml micro test-tubes closed with septum 25 glass 1,5 ml vials closed with PTFE septum or plastic
Cooling.....	adjustable up to 24 °C below ambient temp.
Sample loop.....	5 µl standard, bigger optional
Sample consumption.....	sample loop volume + 30 µl
Mobile phase pressure.....	max. 35 MPa
Materials in contact with mobile phase.....	stainless steel, PEEK, PTFE
Total length of dosing .....	max. 600 min.
Communication .....	RS485
Control signals	
inputs .....	2 (TTL level)
outputs .....	4 (TTL level)
Dimensions (w x h x d) .....	240 x 260 x 400 mm
Weight .....	15 kg
Power supply .....	230 V, ±10%, 50 Hz
Overvoltage category in installation .....	II.
Power drain .....	max. 80 VA

The apparatus is designed for environments with a temperature within the range from 15 to 30°C; humidity up to 80 % without acid and caustic vapours.

Staff must be properly instructed in safety regulations and work with used liquids.

## 3. PUTTING INTO OPERATION

### 3.1 Unpacking

Carefully unpack the autosampler from the box. Check the enclosure for any transport damages. If there are any, please contact the carrier.

With reference to packing list check presence of all items. Don't forget to check the entire wrapping material. In case of any missing part, please contact Your provider or producer.

Place the autosampler on the table and familiarize yourself with the distribution and function of particular control and connection components. Before the first switch-on, read carefully user manual.

Autosampler must have at least 0,15m beyond the back cover.

Air access is in the lower part of the device, thus the device has to stand on a solid platform and air inlet must not be covered.

#### 3.1.1 What will you need

In order to put the autosampler into operation you will need the following items:

1. Other parts of the liquid chromatograph: pump, column, detector.
2. Bottle with flushing liquids (distilled water). One or more bottles with mobile phase.

It is recommended to use bottle caps with tubing openings. It is suitable to use tubes with

inlet filters. The tubes must be resistant to pumped liquids. Bottles shall not be placed directly on the sampler.

3. Appropriate pipes and connection material serving for the connection of the autosampler and other instruments of the chromatograph.
4. Connect autosampler to other chromatography devices with its communication cable.
5. Mount the waste tube to proper outlet and place the other end to waste tank, labeled according to valid legislation and liquid description.

### 3.1.2 Control and connection components

Power switch is placed on the back panel. After its switch-on, backlight will lit up. On the back panel are also Mains connection lead, fuse, communication connectors and waste outlet.

*Aux. output:* TTL level connector for operating of additional connected devices (4 Output - control , 2 Input – validation). Pin scheme can be seen in figure 3.

*Communication:* Couple of  $\mu$ LAN connectors for double-wire connection of the whole set connected into purpose system.  $\mu$ LAN network is electrically compatible to RS 485 standards.

All connections and interconnections shall be done only by cables delivered by the producer. Connectors are mutually noninterchangeable.



- |                          |                         |
|--------------------------|-------------------------|
| 1. Aux output            | 4. Power switch         |
| 2. Mains connection lead | 5. Communication RS 485 |
| 3. Fuse                  | 6. Waste outlet         |

Fig. 2. Back panel

- Out 1
- GND 2
- Out 3
- Out 4
- Out 5
- In 6
- In 7

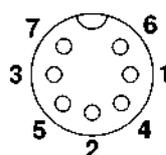


Fig. 3. AUX layout

## 3.2 Keyboard and display

Display, together with membrane keyboard, provides user comfort for both direct and program control. Besides pump including gradient valves, the program can also control such additional devices as sampler or laboratory robot, eventually also secondary pump, needed for realisation of high pressure gradient.

Functions of particular keys are:

<b>HELP</b>	help
<b>SAMPLE</b>	sample switching
<b>SETTING</b>	basic parameter setting
<b>MODE</b>	additional parameter setting
<b>AUX AOUTPUT</b>	in and output setting
<b>CYCLE</b>	cycle setting
<b>TEMPER</b>	sample cooling
<b>CAL</b>	calibration
<b>PREP</b>	prepares a sample to the loop
<b>LOAD</b>	dispenses prepared sample If sample is not present, it is prepared and then dispensed.
<b>INJECT</b>	opens the dispensing valve
<b>STOP</b>	cancels proceeded action If error occurs, error is erased and sampler turned to basic state.
<b>FIX</b>	Fixes sample disc driver. It is used during the disc installation.
<b>STANDBY</b>	Passing from and to standby mode.
<b>RUN</b>	Activates the program control of the cycle, if there is a program in the internal memory.
<b>END</b>	Interrupts the operation of the program.
<b>ENTER</b>	Key for confirmation of the entered number or for a selection from the menu.
⇒	Direction keys for the movement of the cursor under individual positions of the display.

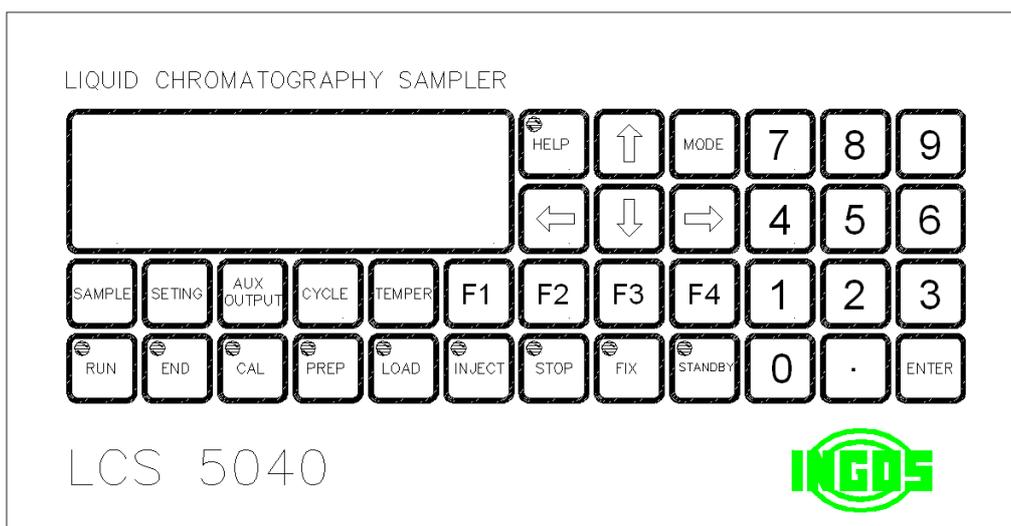


Fig. 4. Keyboard

### 3.3 Device start-up

The following procedure applies to the start-up:

1. Plug the power cable to socket of appropriate voltage.
2. Connect the device with chromatography assembly via communication cable.
3. Connect hydraulics.
4. Turn on the power switch. Now is device in standby mode.
5. By pressing **STANDBY** button pass from standby mode.
6. Mount the disc with samples.
7. Continue according to next chapter.

## 4. OPERATION

All device functions are controllable via keyboard on the front panel.

1. You can move cursor with arrows  $\leftarrow \updownarrow \rightarrow$ . Cursor moves over items, not characters.
2. Use numeric keyboard to input numbers. You can change the item, where is the cursor. To input negative value, use + **MODE**.
3. To choose from **MENU** move cursor over desired item and press **ENTER**. Display shows only two rows, longer options rolls.

### 4.1 Standby

In **STANDBY** mode is active only sample cooling to previously set temperature. Display shows device id and yellow **STANDBY** diode is on.

By pressing **STANDBY** device passes to work mode and automatically starts its calibration.

### 4.2 Direct control

#### 4.2.1 Sample insertion

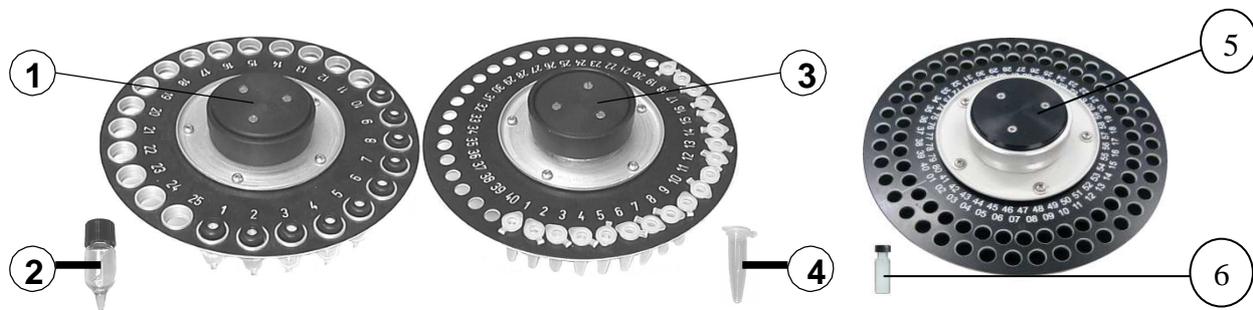
Sample vials are to be inserted into disc dispensers. Disc can be fixed in order to avoid its rotation due mounting to its driver, by pressing **FIX** button. Disc must be mounted to fit as low as possible into five holes of the driver. Then mount the disc to driver by pressing the upper ring with stable pressure.

Device can be equipped with three types of dispensers:

1. 40pcs of 1,5ml microtubes disc
2. 25pcs of 1ml glass vials disc
3. 80pcs of 0,8ml glass microvials disc

It is possible to interchange:

1. 40pcs of 1,5ml microtubes disc with 25pcs of 1ml glass vials disc
2. 80 pcs of 0,8ml glass microvials disc with 25pcs of 1ml glass vials disc



- |                |                     |                     |
|----------------|---------------------|---------------------|
| 1. 25pcs disc  | 3. 40pcs disc       | 5. 80pcs disc       |
| 2. Vials 1,5ml | 4. Microtube 0,5 ml | 6. Microtube 0,5 ml |

Fig. 5 Dispensing discs

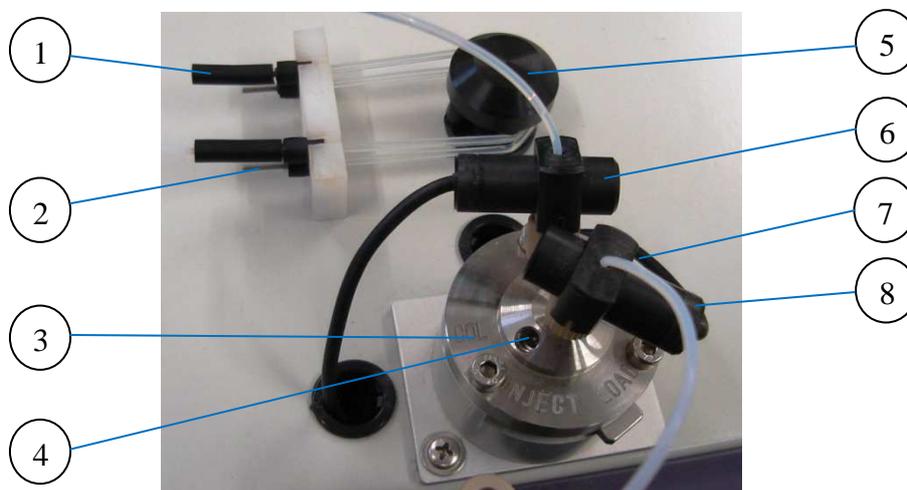
### 4.2.2 Calibration

It is necessary to calibrate optical sensors in order to maintain smooth operation. During this calibration are sample loop, needle and tubes being flushed.

Calibration consists of three steps:

1. Peristaltic pump flushes loop and needle with water and sensor measures value of water.
2. Peristaltic pump reverse mode dries the loop and measures value of air.
3. Loop is once again filled with water and the system is ready for dispensing.

Calibration is automatical when passing from STANDBY mode, or by CAL button. Calibration is being indicated by glowing indicator light. In case of error, indicator light blinks.



- |                                  |                     |
|----------------------------------|---------------------|
| 1. Rinsing liquid in-flow        | 5. Peristaltic pump |
| 2. Loop for pump sealing rinsing | 6. Sensor 2         |
| 3. Dispensing valve              | 7. Pump connector   |
| 4. Column connector              | 8. Sensor 1         |

Fig. 6 Hydraulics

# HYDRAULIC SCHEME OF INGOS LC 5000

## LIQUID CHROMATOGRAPH WITH AUTOSAMPLER

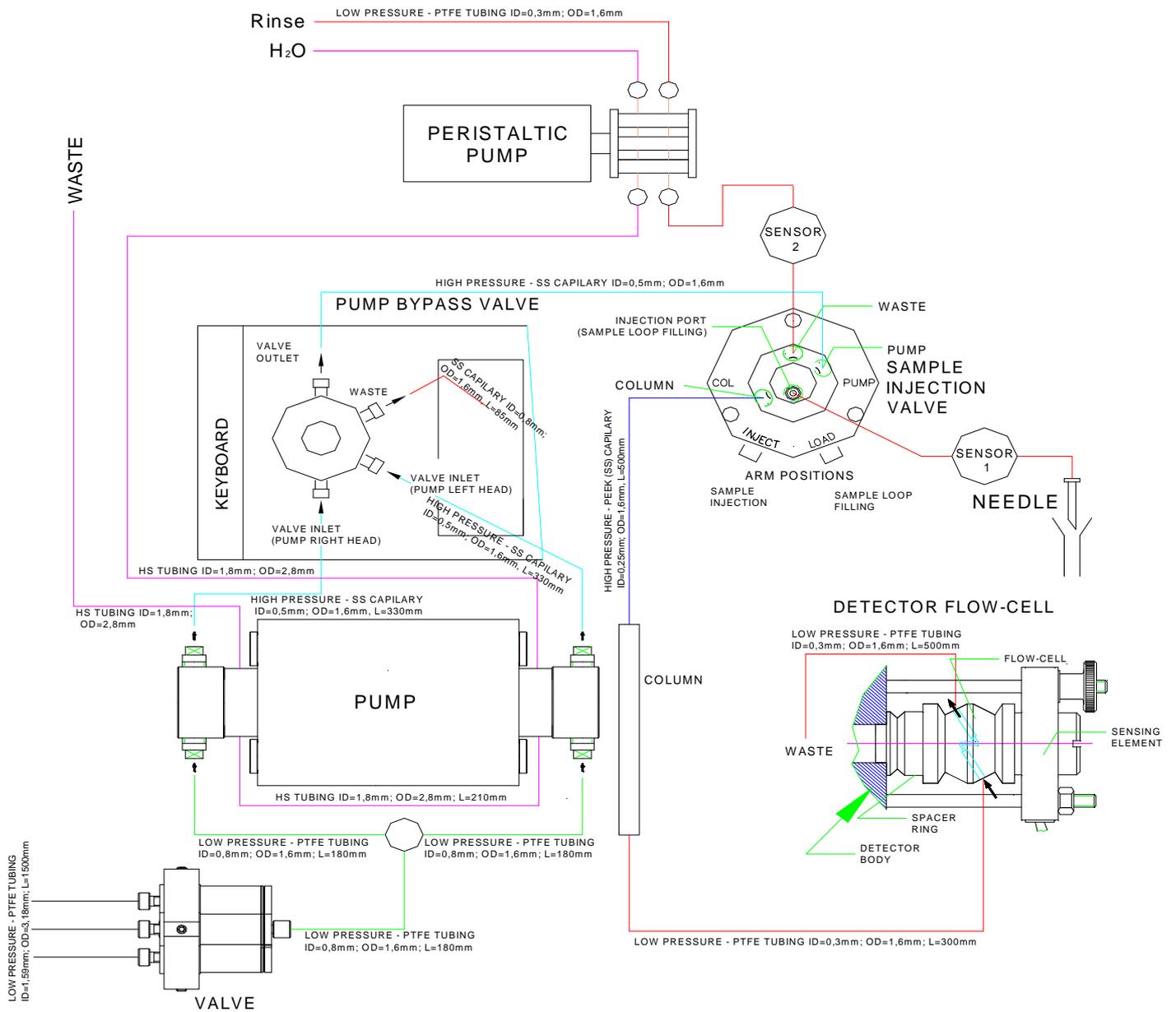


Fig. 7 Hydraulic scheme – application example

### 4.2.3 Dispensing

**SAMPLE** button shows this display:

<b>Sample</b>	<b>Status</b>
<b>1</b>	<b>Off</b>

<b>SAMPLE</b>	position of dispensed sample
<b>STATUS</b>	dispensing system status. shows actual pressure.
<i>Off</i>	system is idle
<i>Prepare</i>	sample is present in loop
<i>Working</i>	system is working
<i>Error</i>	error while dispensing

Dispensing itself consists of two steps. At first sample is being prepared into the loop, then dispensing takes part.

Sample preparation is started by pressing **PREP** button. While the sample is being prepared, the PREP indicator light glows.

**LOAD** button does the dispensing process. In case there is no sample ready, proceed in preparation and then dispensing. After dispensing turns the valve rotor and peristaltic pump washes the loop and the needle. Turning time can be changed in settings (see chapter 4.4.1).

Dispensing and preparation can be aborted any time by pushing **STOP** button. In case of error, PREP or LOAD indicator light blinks. **STOP** button erases the error.

### 4.2.4 Control I/O

**AUX OUTPUT** button shows output command setting and echo display.

<b>AUX</b>	<b>-S-</b>	<b>-R-</b>
<b>OUTPUT</b>	<b>1234</b>	<b>56</b>

Display shows these values.

**-S-** Output commands controllable via numeric keyboard (buttons 1 to 4). First push calls and second one cancels the action.

**-R-** Echoes are read only.

### 4.2.5 Cooling temperature setting

**TEMP** button shows temperature setting display.

<b>Temper</b>	<b>Fin</b>	<b>Act</b>
<b>On</b>	<b>8.0</b>	<b>18.2</b>

Meaning of particular values is stated below:

**Temper** Turns the cooling On or Off. ENTER button switches the value.

**Fin** Place to enter desired temperature.

**Act** Actual temperature. This value is read only.

## 4.3 Program control

### 4.3.1 Cycle quantity setting

**CYCLE** button calls number of cycles.

<b>Sample</b>	<b>Rep</b>	<b>Time</b>
<b>1-3</b>	<b>2</b>	<b>2.00</b>

Meaning of particular values is stated below:

**Sample** Numbers of first and last sample in the sequention.

**Rep** Offtake number.

**Time** Cycle duration.

Entered sequention can be saved and set even after device shutdown. During the sequention can be change only the number of the last sample.

### 4.3.2 Program run

**RUN** button starts sequention set in **CYCLE** menu. This sequention can be interrupted by **END** button. Pressing **SAMPLE** button during the program process shows display below:

<b>Sample</b>	<b>Stat/Tim</b>
<b>5 2</b>	<b>2.35</b>

Meaning of particular values is stated below:

**Sample** Actual sample number and number of repetition.

**Stat/Time** Analysis status or time. During the sample preparing shows **Working**, during analysis progress shows time. If error occurs, shows **Error**.

## 4.4 Parameter setting

### 4.4.1 Menu SETTING

Base parameter setting can be done in setting menu, which is called by pressing **SETTING** button.

Settings	
Inject T	0.20
Fill Vol	300
Aux Off	1234
Aux Next	1234 56
Aux Rdy	1234
Aux Inj	1234
Aux Wait	1234
Aux End	1234
Manual Inj	No
Save settings	

Meaning of particular values is stated below:

**Inject T** Turned valve duration.

**Fill Vol** Volume of withdrawn sample past the first sensor, before the needle is pulled out. In case of too high value, sample consumption rises; in case of too low value dispensing ends in error. The right volume is (when there is sample present in the loop – *preparing* status) approx. 30mm of liquid.

Other values adjusts the communication with other devices vgia logical I/O. Numbers 1 – 4 are logical 1, character „\_“ is logical 0. Input commands are controllable via numeric keyboard, where pushing of number 1 – 4 calls the command and second push of the same number cancels the command.

**Aux Off** Status of control outputs, when device does not work.

**Aux Next** Status of control outputs during sample preparation. Numbers 5 and 6 are logical inputs used for condition definition, which is then expected by the device after sample preparation. Input configuration is controllable via buttons 5 and 6. Number indicates waiting for input value = 1, character „\_“ indicates waiting for input value = 0, character „x“ indicates, that value of particular input is meaningless.

**Aux Rdy** Status of control outputs when is the sample prepared.

**Aux Inj** Status of control outputs while dosing.

**Aux Weit** Status of control outputs while waiting.

**Aux End** Status of control outputs while ending sequection.

**Manual Inj** On or Off defines, if output signals should be set for manual dosing.

**Save setting** Pressing **ENTER** button stores set values into memory, where it is stored even after device shutdown. This option saves also cooling and sequection settings.

## 4.4.2 MODE menu

Other settings can be adjusted via MODE menu called by **MODE** button.

<p style="text-align: center;"><b>Mode menu</b> <b>Save setting</b> <b>Communication</b> <b>Service</b></p>
---

Meaning of particular values is stated below:

**Save setting**      Save of setting – same as in chapter 4.4.1  
**Communication**      Serial communication parameters setting – see chapter 4.4.3  
**Service**              Calls service mode. – **only for trained technician**

## 4.4.3 Communication setting

Communication setting display can be called by MODE menu,

<b>Type</b>	<b>Adr</b>	<b>Psd</b>
<b>uLan</b>	<b>7</b>	<b>9600</b>

Meaning of particular values is stated below:

**Type**              Serial communication type – either  $\mu$ LAN or RS232.  
**Adr**              Device address in  $\mu$ LAN network.  
**Spd**              Serial communication speed.

## 4.5 Clarity control

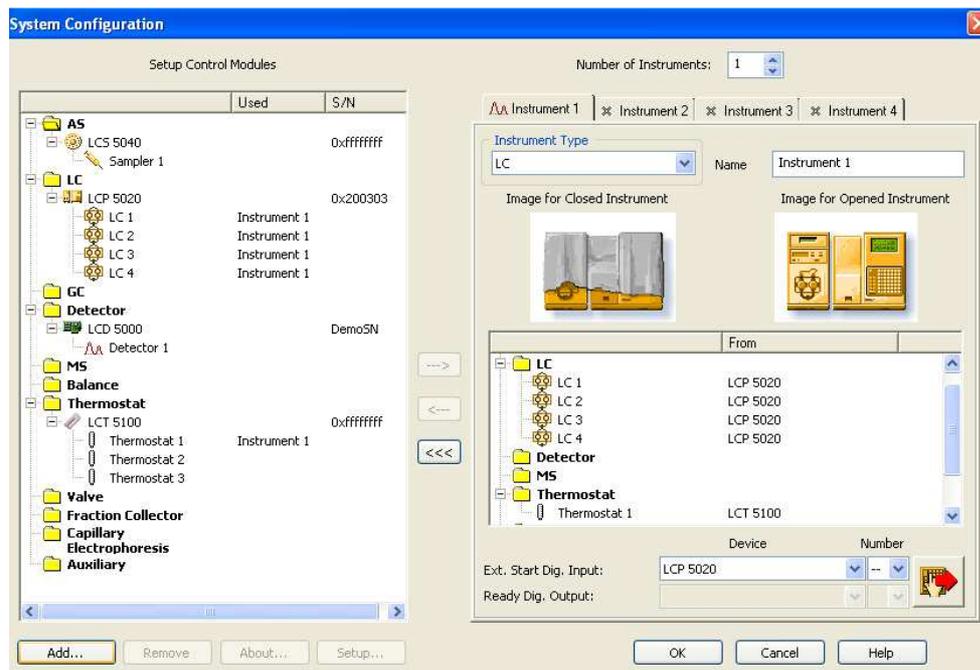


Fig. 8 System configuration

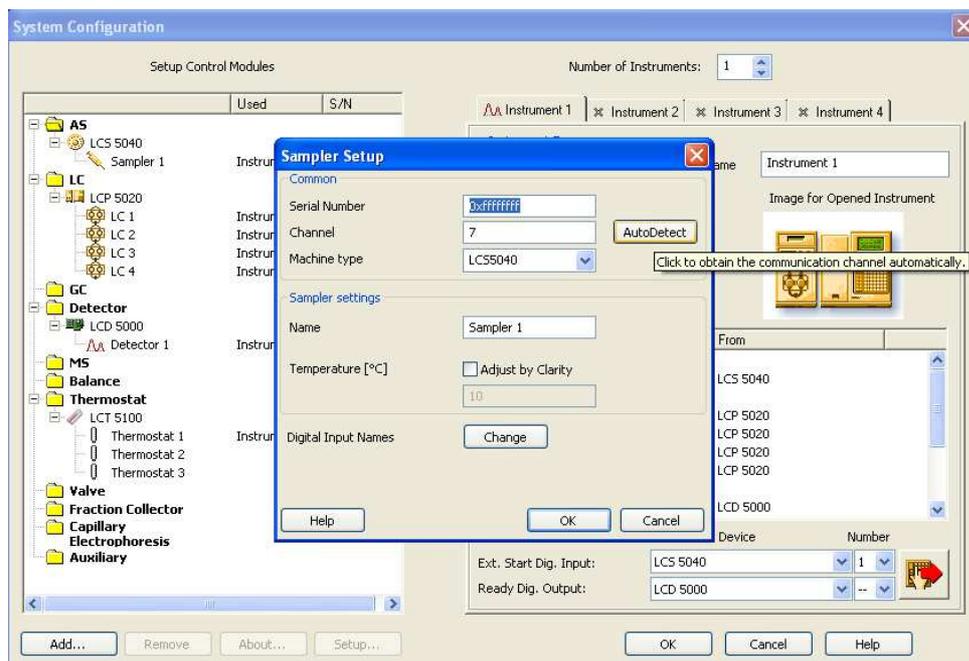


Fig. 9 Autosampler detection



Fig. 10 Assembly

Other processes are described in Clarity user manual.

Chromulan control processes are described in Chromulan user manual.

## 4.5 Regular maintenance and service

Autosampler LCS5040 requires no special maintenance, outer surfaces can be cleaned by moist flannel rag. It is possible to use regular cleansers. It is suitable to wipe up dispenser, after dispenser disc removal.

Only part with decreased durability is peristaltic pump tube. Spare tubes are packed with the device in spare parts. Lifetime of tube is approx. 2 months. Silicon tube has ID 1mm, wall width 0,5mm and length 80mm.

Pump piston sealings durability can be increased by using this tube for piston rinsing by mounting this tube to upper peristaltic pump holder.

## 4.7 Errors and their fixing

Majority of incorrect commands is indicated on the display. In case of other error call service or manufacturer. In case of leak, seal it and properly dry drop away area.

The most common error is worn off peristaltic pump tubes. Simply replace the old ones with the new ones.

## 5. ELECTRONICS

Sampler electronics is a compact unit, powered only by voltage necessary for motor, which is 24V DC, 2.5A. Entire electronics, except for the fused network inlet, network switch and switching power supply, are under safe voltage. All voltages necessary for both analog and digital functions are generated by unit power supply. Unit consists of mainboard interconnected to drive, keyboard, sensors and outputs.

The power supply is suitable for 230V; 110-130V must be mentioned in the order. Device contains T0,63A tube fuse for 230V. **Pay attention to correct tube fuse value!**

## 6. SOFTWARE

Sampler SW controls all functions, mediates contact with user via keyboard and display, communicates by RS485 with other devices of the purpose system including PC. Due to large number of time-consuming operations is SW layered into these layers:

Orders received at the highest level are included into the input queue, decoded and gradually executed.

At time-program execution layer are computed interpolations for gradient and flow rate values. Likewise are generated time orders for cooperation with other devices and peripherals of liquid chromatograph.

Highest priority layer is reserved for communication with other components of assembly and master PC. Master PC can use freeware CHROMULAN or SW Clarity. When using DataApex SW Clarity, it is possible to interconnect assembly to other producers devices, which also cooperates with this SW, and manage these devices by one master PC.

## 7. ACCESSORIES AND SPARE PARTS

### 7.1 Basic accessories

- 1 pc. power cord
- 2 pcs. Tube fuse T 0,63 A
- 4 pcs. stainless screw
- 4 pcs. metal sealing ring
- 4 pcs. PEEK screw
- 2 pcs. peristaltic loop
- 1 pc. silicon tube Ø1/Ø3 length=1 m

### 7.2 Other accessories

It is possible to order connection cables, custom capillaries, various volume sample loops.

## 8. WARRANTY

Manufacturer provides warranty of two years from the date of delivery of the product to the customer. The device can be used only in the manner specified in this user manual. Manufacturer is not liable for damages resulting from non-compliance with the conditions specified in this user manual.

Device is designed for ambient with a temperatures range 15 - 35 °C, humidity up to 80% without acidic and corrosive vapours. Operating staff must be instructed about security regulations and safe work with used liquids.

All warranty and post-warranty repairs are performed by the manufacturer or its authorized organisation.

### 8.1 Waste disposal

After the end of service life dispose device according to applicable regulations on waste, or pass the device vendors or manufacturers for disposal.

**Caution:**

This device contains parts (mounted PCB) that come under hazardous waste.

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