

GC Auto-sampler

User's Manual



FL1090 Auto-sampler Control Program Version V1.1.1

Statement

Thank you for choosing this product. Before using it, please read the specification carefully to avoid unnecessary damage to the device! We should remind you proper usage can ensure a good using effect will be reached.

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CONVENTIONS

Please read this manual carefully before using the product, and please operate it properly in accordance with this manual.



Warning sign, which warnings matters may result in personal injury or damage of the device, please be cautious about warnings!



Caution sign, pay attention to matters may cause wrong instrument settings, please read the precautions carefully when operate it!

- Before running FL-1090, ensure the sample injector is in ready state.
- The power line is connected properly.
- Sample bottle is placed in correct position on the sample tray.
- Make sure the sample is in the sample bottle.
- Bottle cap is in the middle, and ensure the cushion is flat.
- Sample bottle matches with the operating parameters.
- Sample tray is correctly installed.
- Solvent bottle is placed in correct position.
- There is solvent used to wash the needle in the solvent bottle.
- Liquid waste bottle is empty.
- Liquid waste bottle is placed in correct position.
- The capacity of solvent and liquid waste bottle is sufficient for sample analysis.
- The injector is clean or new.
- The injector specifications matches with the selected system specifications.
- Ensure the injector is unblocked.
- The injector is fastened on the injector frame.
- The push rod of needle core is fastened on the sliding block.
- The heat insulation cushion type on the injection port of the GC is correct.
- The heat insulation cushion nut installed on the injection port of the GC is correct.

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1. Introduction

1.1 Product Overview

Auto-Sampler is designed for the GC pretreatment. It provides users with visual touch interface, allowing users complete the sample pretreatment quickly in accordance with their own sequence and method. It eliminates the complex manual operations, and improves the work efficiency.

1.2 Main Features

- (1) Simple and easy operation and 5" visual man-machine interactive touch interface.
- (2) Intelligentized, user can input orders step by step by following the hint .
- (3) High stability, Real-time comparison fed back by the encoder to makes the operation of the instrument more stable.
- (4) Providing multiple modes of I/O ports to connect with different kinds of GC.
- (5) High degree of automation , 24 hours of uninterrupted work without person.
- (6) Nice appearance, small size, light in weight, easy installation, high universality.
- (7) Syringe handspike use the buffer mechanism to reduce the gas in syringe needle.
- (8) Sample tray use the absolute position to reduce cumulative error.
- (9) The instrument designed by modular design and double lines CAN communication mechanism inside, functional module with strong expansion.
- (10) Drive with precision motor to provide different kinds of powered speed to make the injection speed more stable and the injection volume more accurate.
- (11) The instrument provide universal MODBUS protocol and USB interface to make convenient for the user to programme with computer.
- (12) The system will check the date after user input to make the instrument running safer.
- (13) User can use the computer to control the auto-sampler to improve work efficiency.
- (14) Extend with 150-digit sample tray, supporting double injectors feeding sample into double inlets at the same time.
- (15) Supporting scan bar code and sample temperature control function.

1.3 Work Environment

Temperature

- -20 °C to 50 °C (operation)
- -40 °C to 70 °C (storage)

Humidity

- 10% to 90% (operation)
- 5% to 90% (storage)

1.4 Performance Introduction

Parameters	Range
➤ Injector size	1, 5, 10, 25, 50, 100, 250, 500 (μl)
➤ Digit of sample tray	19-digit sample tray. Extend 150-digit sample tray
➤ Sample injection times of each line	1 to 99 times
➤ Maximum interval	999 min
➤ Minimum sample size	0.1 μl
➤ Maximum sample size	250 μl
➤ Methods	1 to 20
➤ Maximum injection inlet	1
➤ Maximum times of needle cleaning	99 times
➤ Maximum times of sample pumping	99 times
➤ Viscosity delay	0 ~ 60s
➤ Dwell time before and after injection	0 ~ 120s
➤ Needle speed	fast, slow, user-defined
➤ sample extract and injection speed	fast, slow, user-defined
➤ Injection mode	normal mode, continuity mode, sample + L1, sample + L1 + L2, PTV
➤ Control mode	interval automatic control, signal negative control, PC control

2. Introduction of Working Window

Connect the power line properly, turn on the power switch at the bottom of the FL1090. The main page of auto-sampler control program will be entered after the Power on self-test. As shown in Figure 1:

INFO	SEQ	METH	SOLV	ADV
RUN INFO	STOP			
INST INFO	INST ERROR			
ROW NO				1
METH				1
VIAL/TIMES(TIMES)				1
INJ VOL(μ L)				1.0
SYC VOL(μ L)				10
START VIAL NO				1
END VIAL NO				1
CUR VIAL NO				1
VIAL TIMES(TIMES)				1
ANLS TIME(MIN)				10.0
REMN TIME(MIN)				0.0
TRAY				D-150
EQP ADDR				58
RUN INFO	SEQUECE INFO			
START	STOP	RESET	PRIOR	

Figure 1

The operating page consists of five main parts:

- 1) Title information bar: displays the name and running information of instrument.
- 2) Page operation options: switch displays current page to set page.
- 3) Status indicating bar: displays the current operating status and alarm information of the instrument.
- 4) Working area: displaying and setting area of auto-sampler information.
- 5) Command menu: includes command button as run, stop, prior of automatic sequence, and reset of auto-sampler.

3. Function Introduction

3.1 Status Indicating Bar

- △ Operating status: displays the current operating status, including reset, push rod origin, solvent needle washing-before, solvent needle washing-after, sample injection, analysis waiting and other operating information.
- △ Instrument status: displays the instrument hardware's warning info and the warning of setup. User can check the details of the warning data by click the "Run info" button in the "inst info".

3.2 Operation Information

As shown in Figure 1, the operation information include as follow:

- △ SEQ: set the parameter of sequence injection.
- △ SOLV: set the volume of solvent's capacity and waste's capacity.
- △ METH: set the wash syringe method , sampling speed, injection method.
- △ INFO: displays the running information, error data and sequence information.
- △ ADV: set the start mode, signal, syringe type. door status.

3.3 Command Menu

- △ START: start automatic sequence sample injection.
- △ STOP: stop all movement operation of the auto-sampler immediately.
- △ RESET: sample tray ,syringe and injecting mechanism returns to the initial position.
- △ PRIOR: skip to the prior sequence to continue the next injection.

3.4 Instrument Information

Click the option "INFO", As shown in Figure 1.

Each function is described as below:

- △ ROW NO. : displays the system runs to which row of the sample sequence.
- △ METH : displays the serial number of current method used.
- △ VIAL/CYCLE: displays the sample injecting times of each bottle of sample during current operation.
- △ INJ VOL: displays the sample amount extracted when current bottle injects sample.

- △ INJ: displays the type of syringe in this system.
- △ START VIAL NO.: the first vial of current sequences.
- △ END VIAL NO.: the last vial of current sequences.
- △ CUR VIAL: the current vial of this sequences.
- △ VIAL TIME(TIMES) :displays injection times of current bottle.
- △ ANLS TIME(MIN): the time of collecting sample after injection.
- △ REMN TIME(MIN): the remaining time of next injection.
- △ TRAY: displays the type of tray connect with the current auto-sampler.
- △ EQP ADDR: displays the current equipment address and PC control identification number.
- △ RUN INFO: displays the running data of instrument. As shown in Figure 2:



Figure 2

- 1) RECORD: select the days of retention the running data.
 - 2) CLEAR: clear the current log information.
 - 3) BACK: back to the "INFO".
- △ SEQUENCE INFO: the info of each vial in the sequence. As shown in Figure 3:

- 1) RECORD: select the days of retention the sequence data.
- 2) CLEAR: clear the current log information.
- 3) BACK: back to the "INFO".

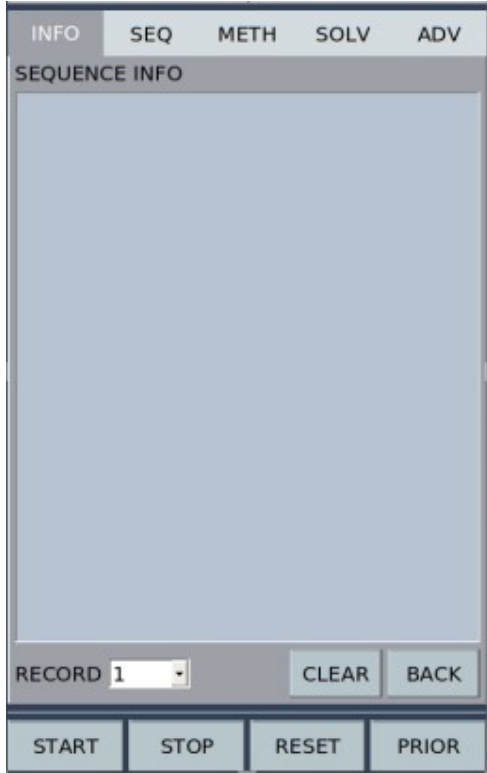


Figure 3

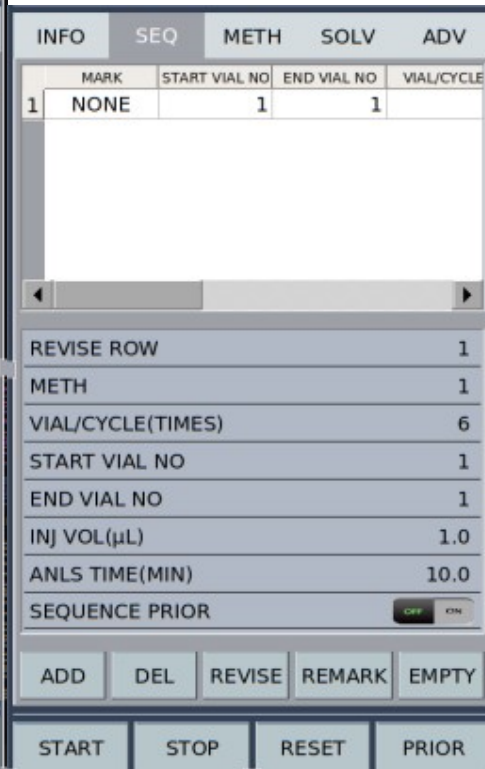


Figure 4

3.5 Sequence Setting

Click the option "SEQ", As shown in Figure 4, Each function is described as below:

△ SEQUENCE : displays all sequences that to be injected. Click the corresponding row NO. to select the right row, the selected sequence will be shown in highlight blue.

- 1) MARK: displays the current injection status.
 - NONE: no operation in current row.
 - DONE: injection done in current row.
 - WAIT: current row stand by, waiting for the next injection.
 - RUN: current row is injecting.
- 2) START VIAL NO.: the first injection vial of current sequences.
- 3) END VIAL NO.: the last injection vial of current sequences.

- 4) VIAL/CYCLE: displays the sample injecting times of each bottle of sample during current operation.
 - 5) METH: displays the serial number of current washing syringe used.
 - 6) INJ VOL: displays the sample amount extracted when current syringe injects sample.
 - 7) ANLS TIME: the time of analysis sample after injection.
 - 8) PRIOR: shows the current row is prior or not.
- △ PARAMETERS: set the info of sequence. Selected sequence row will be shown in highlight blue. The parameters will automatically update the information for the selected row, click the parameter button to set info. When the setting is complete, click the "REVISE" in the command button area to synchronize the information in the current parameter setting area to the sequence display area.
- △ ORDER : Command area for operating sequence information.
- 1) ADD: add a row of sequence information, and displayed to the sequence area.
 - 2) DEL: delete a row of sequence information, and update displayed to the sequence area.
 - 3) REVISE: update the parameter setting and synchronize the info to the sequence area.
 - 4) RESET MARK: clear the selected identification info in sequence area, change it to "NONE".
 - 5) EMPTY SEQUENCE: clear all the info in sequence area and delete every sequence.

3.6 Method setting

Click the option "METH", As shown in Figure 5:

Each function is described as below:

- △ METH SET: select 20 different kinds of methods.
- △ WASH SET: setting the number of times solvent cleaning and the volume of solvent used.(Figure 5)
- 1) SOLV A PRE INJ (TIMES): it is the times for cleaning the injector with Solvent A each time before sample feeding. Unit: time, supporting 99 times at most.
 - 2) SOLV A POST INJ(TIMES): it is the times for cleaning the injector with Solvent A each time after sample feeding. Unit: time, supporting 99 times at most.
 - 3) SOLV A VOL(%): it is the volume of solvent, calculated in the percentage of injector volume, used to clean the injector before and after using the injector. Unit: %,

supporting 60% at most. In terms of the same data, if the selected needle specifications are different, the volume of solvent that used will be different.

- 4) SOLV B PRE INJ (TIMES)/ POST INJ(TIMES)/ VOL(%): the same as SOLV A.
- 5) SAMP PRE INJ(TIMES)& SAMP VOL(%):the same as SOLV A.
- 6) ECONOMICAL: this mode will ignore the volume of solvent A/B used above. This model will automatically calculates the volume of solvent A/B used according to the volume of sample injection. Calculated value = total injection volume + syringe specification *10%.



Figure 5

Figure 6

△ DELAYED & PULL UP: setting the quantity of VISC TIME, PULL UP STROKES, PRE DWELL,POST DWELL(Figure 6).

- 1) VISC TIME(SEC): when extracting the samples, the push rod of the injector walks to specific position at a constant speed, and after the preset delay time the subsequent operations will be carried out. According to different sample viscosity ratios, the settings

of viscosity delay time will be different. Unit: second, supporting 60 seconds at most.

- 2) PULL UP STROKES(TIMES) : it refers to the round trip times of injector push rod from top to bottom positions to eliminate the residual bubbles in the syringe.
- 3) PRE DWELL(SEC): when the injector needle enters into the sample inlet, after the preset delay time the sample feeding operation will be carried out. Unit: second, supporting 120 seconds at most.
- 4) POST DWELL (SEC): after finish injection and waiting the preset delay time, the injector needle will be pulled out from the sample inlet. Unit: second, supporting 120 seconds at most.

△ INJ MODE: setting the current mode of washing and sampling.(Figure7)

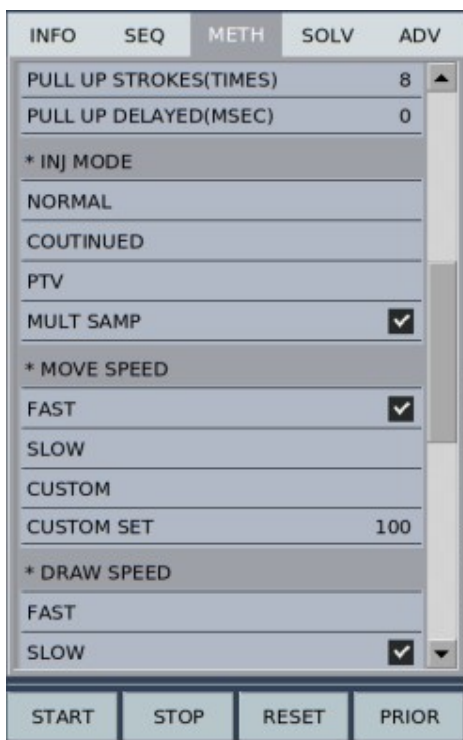



Figure 7

- 1) NORMAL: according to the cleaning times set by users, the cleaning operation of the injector will be carried out each time before and after the injector needle feeding according user's settings.
- 2) COUTINUED: the total injection times of the same bottle, clean the syringe with first injection and last injection, then it will direct sampling without clearing syringe during

the injection.

- 3) PTV: PTV large volume sample feeding.



The difference between PTV model and other modes lays on the time interval and the time for sending START signal after sample feeding.

Non-PTV mode: Each time after sample feeding, it will send a START signal to GC and carry out the wait operation according to the time interval of sequence. PTV mode: each sample will inject without waiting interval, it will send a START signal to GC after the total number of each samples injection finished.

- 4) MULT SAMP: according to the parameters of multilayer sample setting, the sample will be multiple extracted from the special sample tray (L1\L2).

△ MOVE SPEED: when sample feeding, it is the needle feeding speed of injecting mechanism towards sample inlet, including fast , slow speed and user-defined. (Figure 7)

△ DRAW SPEED: the speed of push rod moving upwards to extract the sample, including fast and slow speed and user-defined. (Figure 7)



Figure 8

Figure 9

- △ INJ SPEED: the speed of push rod moving downwards to inject the sample into the inlet, including fast and slow speed and user-defined. (Figure 8)
- △ DISCHARGE GAS SPEED: the speed of syringe moving upwards and downwards to discharge the gas in the needle before sample extraction, including fast and slow speed and user-defined. (Figure 8)
- △ MULT INJ PARM: when select the " MULT INJ PARM", the following parameters are available.(Figure 9)
 - 1) GAP VOL (μ L): it is the volume of air gap that needed between one sample to another .
 - 2) L1 VOL (μ L): the volume of extracted special sample L1.
 - 3) L2 VOL (μ L): the volume of extracted special sample L2.

3.7 Solvent Settings

Click the option "SOLV", the page will show in different way based on which type of sample tray user chosen. If user choose 19-digit sample tray, the page will show as Figure 10. If user choose expend 150-digit sample tray, the page will show as Figure 11.

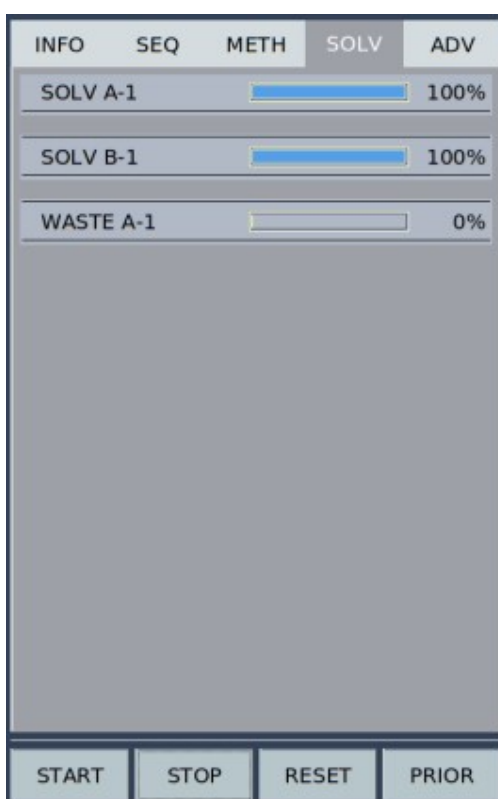


Figure 10

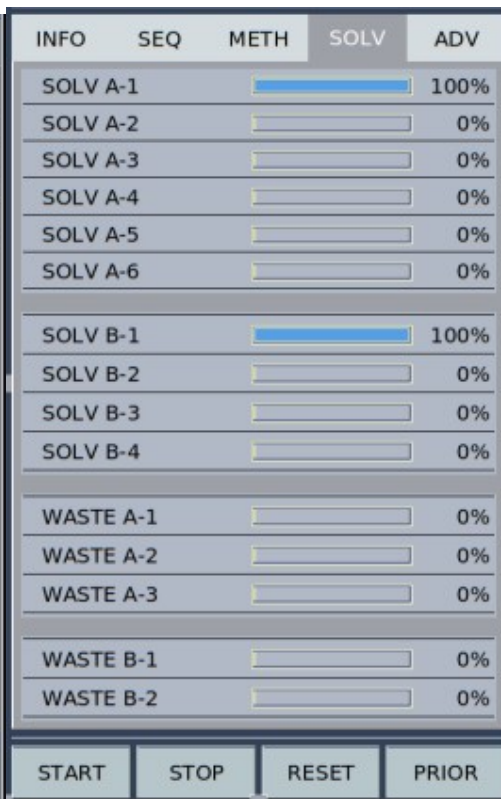


Figure 11

Each function is described as below:

- ◇ In waste liquid state, it lists the current states of the waste liquid bottles A and B. If the bottle is filled up with waste liquid, the corresponding state of the waste liquid bottle will turn red.
- ◇ In solvent condition, it lists the current states of solvent bottles A and B. If the solvent amount in the bottle is extracted below a certain level, the state of the corresponding solvent bottle will turn red.
- ◇ SOLV A(1~6) button: setting the volume of the current solvent A1~A6.
- ◇ SOLV B(1~4) button: setting the volume of the current solvent B1~B4.
- ◇ WASTE A(1~3) button: setting the volume of the current waste A1~A3.
- ◇ WASTE B(1~2) button: setting the volume of the current waste B1~B2.

The setting of solvent & waste is according to the actual capacity of the bottle's volume. The current volume of solvent and waste are calculated automatically during the program running. The instrument will stop automatically and warning if solvent bottle is empty or the waste bottle is full.

3.8 Advanced setting

Click the option "ADV".(Figure12)

Each function is described as below:

- △ LNG: choose the language.
- △ EMPTY WARNING: check the bottle in the expend150-digit sample tray is empty or not.
- △ TWO TOWERS INJ: Supporting double injectors feeding sample into double inlets at the same time.
- △ DOOR STATUS: check the door status when the sequence running, the instrument will warning if the door is opened.
- △ BUZZER ON/OFF: the prompt of buzzer switch.
- △ INJ(μ L): the system support 1, 5,10,25,50,100,250,500 (μ l) kinds of syringes.
- △ RUN MODE
 - 1) Interval automatic control: the next sample feeding is carried out according to the time interval that set by users in sample sequence.
 - 2) GC reverse control: automatic sampler reads a READY signal of GC to start the next sample feeding of automatic injector. (PTV mode does not support GC reverse control mode).



Figure12

△ RUN MODE

- 3) Interval automatic control: the next sample feeding is carried out according to the time interval that set by users in sample sequence.
- 4) GC reverse control: automatic sampler reads a READY signal of GC to start the next sample feeding of automatic injector. (PTV mode does not support GC reverse control mode)

△ SAMP VIAL DEV: the depth of the injector needle entering into the sample bottle, supporting 26 mm at most.

△ SOLV VIAL DEV: the depth of the injector needle entering into the solvent bottle, supporting 28 mm at most.

△ WASTE VIAL DEV: the depth of the injector needle entering into the waste bottle, supporting 10 mm at most.

△ INJ PORT DEV: the depth of the injector needle entering into GC's sample inlet, supporting 28 mm at most.

- △ DEPTH OF INJ PORT: injecting mechanism walks from the original position to the top position of sample inlet. Click on this button, the system will automatically search for the top position of sample inlet and record the distance from the original position to the top position of sample inlet.
- △ DEPTH OF SAMP VIAL: injecting mechanism walks from the original position to the top position of sample bottle. Click on this button, the system will automatically search for the top position of the bottle and record the distance from the original position to the top position of the bottle.
- △ SERIAL NO.: serial number of instrument.

4. Operation Process

4.1 Flow Chart of Operation

FL-1090 liquid auto-sampler process is shown in Figure 13:

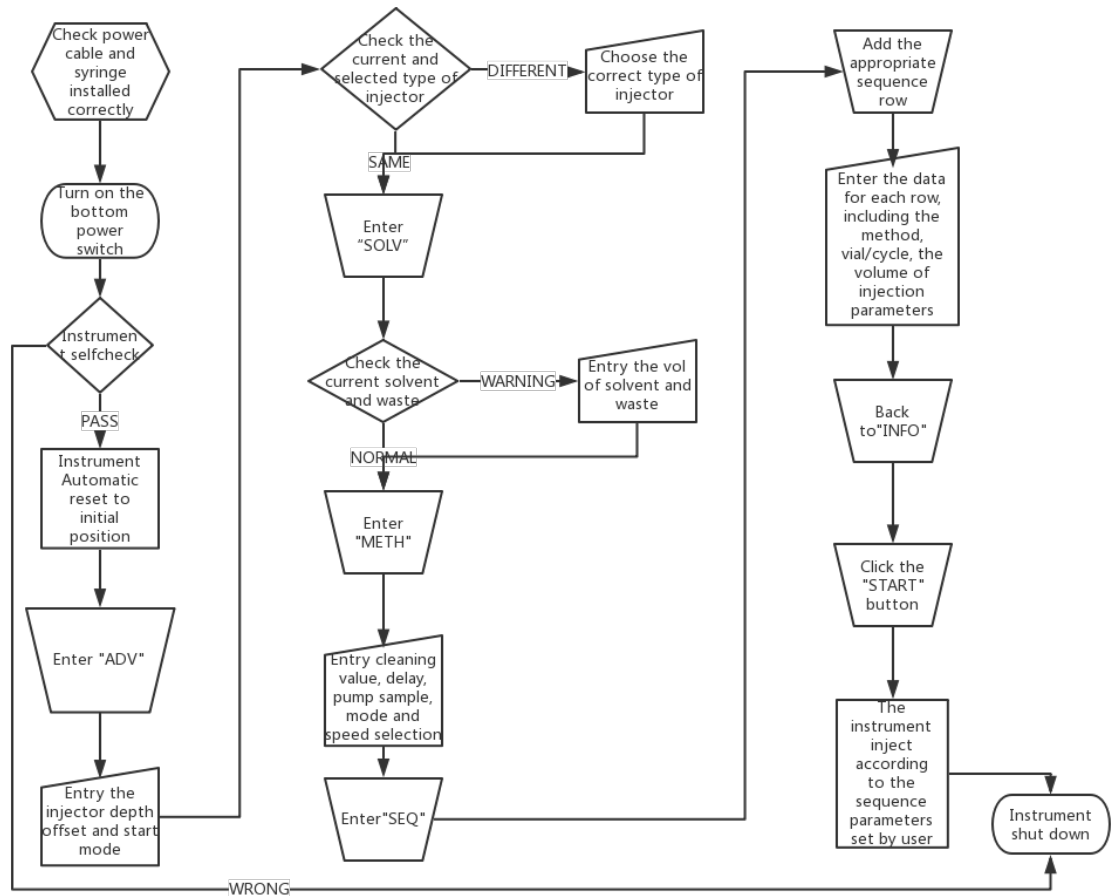


Figure 13

4.2 Operation Example

For example: there are four kinds of samples needed to be analyzed. Load the four kinds of samples into various sample bottles, assigning codes of 1, 2, 3 and 4 for each bottle. For samples 1 and 2, the length of analysis is 5 minutes, wash solvent is A, injection volume is 1 ml, and 3 shots are injected in each bottle of sample. For samples 3 and 4, the length of analysis is 8 minutes, wash solvent is B, injection volume is 1.5 ml, and 5 shots are injected in each bottle of sample.

- 1) Place sample bottles 1, 2, 3 and 4 on the sample plates of No. 1 to No. 4 respectively.
- 2) Ensure that the power line is properly connected and open the power switch at the back of FL-1090 liquid auto-sampler. The machine enters the main page after self-checking, as shown in figure 1.
- 3) Check whether the injector is installed in the injection mechanism. If it is not installed, select one with appropriate specifications. (From the above analysis of example, the maximum amount of each sample needle is not more than 5ml, so a syringe of 10ml can be chosen for sampling. For consideration of the accuracy of sampling, the specification of syringe is best of not more than 10 ml.) Install the syringe on the injection mechanism in accordance with correct procedure.
- 4) Click the "SOLV"(Figure 10/11). Check the waste liquid bottle is full or not. If it is filled with waste liquid, please clear out the waste in the bottle and click on the button of “empty waste liquor bottle”, set the volume to 0.
- 5) As known from the above example, it needs 2 various solvents for the 4 kinds of samples. Fill the two kinds of solvents of A and B into different solvent bottles, with not less than 2ml solvent in each bottle. Place the solvent bottle at the bottle positions A and B. Entry the added solvent volume of “Solvent A” and “Solvent B”.
- 6) Click the "ADV"(Figure12). The analysis time of each sample in the example is known, user can choose “Intervals Auto-control”; if the analysis time of the sample is not known, you should choose “GC Control”. “GC Control” should be selected after setting a series of connections between the injector and the GC then revert control the sample injector.
- 7) Click the "METH"(Figure 6~9). Because the parameters of the wash solvent, amount of use, wash sampling mode and other functions in the two sample groups, it needs two methods of operation.

- Use solvent A for cleaning samples 1 and 2, and set with the method 1
Set as follows: wash 4 times with solvent A before sampling and wash 3 times after sampling, with the amount of 30%. Wash 0 times with solvent B before and after samplings, without setting the amount. Wash the sample twice with the amount of 20%. The viscosity delays for 1 second, the times of pump (the times of air bubble) is 5, the dwell time before sampling is 0 second, and the dwell time after sampling is 0 second. Choose "Normal" for the mode (Figure 7).

- Use solvent B for cleaning samples 3 and 4, and set with the method 2. Click the drop-down button to choose the frame of "Method 2" on the method page, and the current data suggest the page of method 2 settings.

Set as follows: wash 4 times with solvent B before sampling and wash 4 times after sampling, with the amount of 30%. Wash 0 times with solvent A before and after samplings, without setting the amount. Wash the sample 3 times with the amount of 20%. The viscosity delays for 3 seconds, the times of pump (the times of air bubble) is 6, the dwell time before sampling is 0 second, and the dwell time after sampling is 0 second. Choose "Normal".

8) Click the "SEQ" (Figure 4)

- △ Click "ADD" to add new sequence row, the parameter setting as blow:

METH: 1

VIAL/CYCLE(TIMES): 3

START VIAL NO.:1

END VIAL NO.:2

INJ VOL(μ L):1.0

ANLS TIME: 5 min

SEQ PRIOR: OFF

Click "REVISE" to synchronize parameter to the sequence display area.

- △ Click "ADD" to add new sequence row, the parameter setting as blow:

METH: 2

VIAL/CYCLE(TIMES): 5

START VIAL NO.:3

END VIAL NO.:4

INJ VOL(μ L):1.5

ANLS TIME: 8 min

SEQ PRIOR: OFF

Click "REVISE" to synchronize parameter to the sequence display area.

- 9) Click "Start" on the commands menu bar, the sampler starts to run sequential sampling automatically.

5.Interrupt Handling

FL-1090 auto-sampler adopts the semi-closed loop control, the error messages of the various parts will automatically feedback into the system and display in the operating interface.

- △ Power Supply Disconnect
- △ Click "Stop" Button
- △ Entry Wrong Information or Wrong Choice
- △ Abnormal Instrument

If user entry wrong information or wrong choice of functions, system will automatically display the corresponding error messages. Please reset the parameters according to the errors.

When the instrument is interrupted, the system will also automatically display the corresponding error message. Please reset the parameters according to the errors shown on "RUN INFO". If anomaly occurs frequently, please contact with the technical staff or service staff of the company.

When other anomalies occur without warning, please turn off the power switch so as not to damage the instrument components. Please contact with the technical staff of the company immediately.



Non-technical personnel are not allowed to open the casing for repair; otherwise, if there is damage of instrument components or human body hurt occurred, the company shall not be responsible for it!

Restart the sequence sampling:

- 1) Judge and solve the problems caused by interruption.

- 2) Determine the last sample bottle that operates successfully. (Check the line number information on the sample information and check out the final successfully drawn number of GC)
- 3) Take the bottle after the last successfully operating sample bottle as the first one to reset parameters.
- 4) Start the modified sequences from the control equipment.

6. Input / Output Signal

FL1090 's external interface signal through the three row of fifteen pin port on the bottom to complete. (Figure 14)

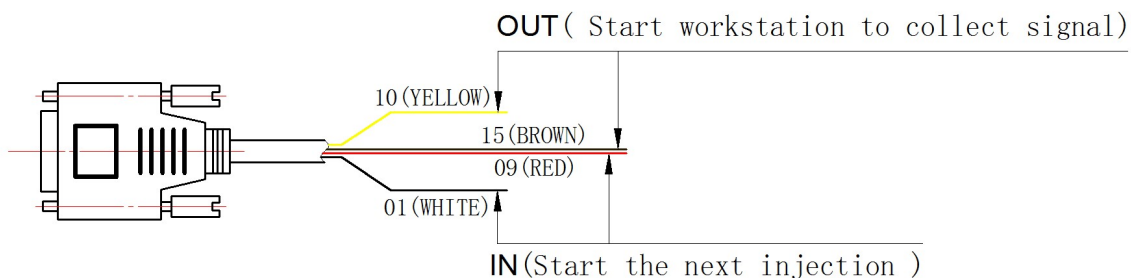


Figure 14

OUT (Output signal group)	The output signal of auto-sampler is working as the input signal of GC to start the GC and Workstation to collect the signal. This signal is a relay signal, the signal will transfers for 3 second at the moment when auto-sample completely injection. The signal is opening circuit state in general.
IN (Input signal group)	The auto-sampler input the signal that received from the GC's output signal to start the next injection in the sequence row. The signal is effective when the white and blue line are in short contact state.

Thanks for choosing FL-1090 Liquid GC Auto-Sampler