Full-Automatic Nucleic Acid Extraction System GeneRotex 96

Service Manual

Intellectual Property

Xi'an Tianlong Technology Co., Ltd. (“Tianlong”) owns the copyright of this non-publicly published manual and is entitled to treat it as confidential information. This manual is only used as a reference for maintenance of Tianlong’s products.

This manual and all its intellectual property rights (including copyright) are owned by Tianlong. Without the prior written permission of Tianlong, no one shall use, disclose or allow others by any means to obtain all or part of the information in this manual . Without the prior written permission of Tianlong, no one shall (but not limited to) photograph, copy, reproduce or translate into other languages all or part of contents of this manual.

Tianlong has the final right to interpret the manual

Tianlong reserves the right to modify any content of this manual without prior notice

Tianlong reserves the right to change the technology without prior notice

Tianlong reserves the right to change the product specifications without prior notice

Statement

Tianlong does not make any form of guarantee for this manual, including (but not limited to) the implied guarantee of marketability and suitability for a specific purpose.

Tianlong is only responsible for the safety, reliability and performance of the instrument under the following conditions:

Assembly operation, expansion, re-adjustment, improvement and repair are all carried out by personnel approved by Tianlong;

The relevant electrical equipment complies with national standards;

The instrument is used in accordance with the operating instructions.

In the event of the following situations, Tianlong will not be responsible for the safety, reliability and operating conditions of the products

Components are replaced, stretched and re-commissioned

The product is not used correctly in accordance with the User Manual.

Warranty

Maintenance Service

Free service scope:

All equipment in accordance with Tianlong's specified scope of warranty service can be subject to the free service.

Charged service scope:

For all equipment beyond Tianlong's specified scope of warranty service, Tianlong will implement the charged service;

The product needs to be repaired due to the following causes even in the warranty period: Man-made damage; grid voltage beyond the specific scope of the equipment; acts of god.

Tianlong will not be responsible for the direct, indirect or final damage and delay arising from the following causes (including but not limited to):

Improper use; replacement of accessories unauthorized by Tianlong or repair of equipment by the personnel unauthorized by Tianlong.

After-sales Service Unit

Xi'an Tianlong Technology Co., Ltd.

Address: No. 389, Zhuhong Road, Xi'an National Economic and Technological Development Zone

Postal code: 710018

Service hotline: 400-606-1686 +86-29-82683675

Copyright Information

Version No.: 1.0

Date of issue: Nov., 2020

Contents

Chapter 1 Safety and Precautions

The user uses this product voluntarily, and must strictly abide by the following safety precautions for the operation, maintenance, repair and transportation of this product. This product is designed with full consideration of biological pollution protection, electrical safety protection and mechanical movement protection. Any operation that does not comply with safety precautions or other reminder information in this manual may result in protection failure, or may prejudice he safety standard of design and manufacture and the intended use scope of the instrument.

Xi'an Tianlong Technology Co., Ltd. shall not bear any responsibility for any loss caused by the user not reading this manual or failing to operate the instrument in accordance with the contents of this manual!

⚠ **Caution:** Please read this manual carefully before using the instrument. Incorrect understanding or operation may cause damage to the instrument, harm to the laboratory, injury to the operator, and lower instrument use efficiency.

❗ **Reminder:** Please note that all descriptions indicated with “Caution”, “Reminder” and “Ban” as well as the safety symbols and marks used in the manual and on the instrument.

1.1 General Safety and Precautions

⚠ **Caution:** The operator shall not disassemble the instrument, replace the components or debug the instrument without our authorization. If the above operations are required, they must be approved by us and then completed by professionals.

⚠ **Caution:** Please avoid bumping against and damaging the instrument. Handle with care.

⚠ **Caution:** In the event of following situations, the user shall immediately pull out the power plug of the instrument from the power socket, and contact the supplier or ask our professional maintenance personnel to deal with it:

- The instrument undergoes raining or water logging;
- Abnormal sound or odor appears during the operation of the instrument;
- The instrument is bumped or the enclosure is damaged;
- The instrument function has evident changes.

🚫 **Ban:** Do not move the instrument during its operation.

⚠ **Caution:** The openings on the instrument are provided for ventilation. To avoid excessive temperature, do not block or cover these openings during the operation of the instrument, or cover the surface of the instrument with use a dust guard or any other materials.

Caution: If this instrument needs to be installed or transported, please contact us to request professionals or professional guide. Otherwise, we shall not bear any responsibility for the damage caused to the instrument.

Caution: After the instrument is installed, the transportation lock shall be properly kept in accordance with the technician's requirements.

Caution: During the operation of the instrument, do not forcibly open the sample compartment. Otherwise, the biological safety, electromagnetic radiation and other protective actions of the instrument will be prejudiced.

Caution: Do not forcibly place consumables (96-hole plate/8-tube strip/test tube, etc.) that are not compatible with this instrument into the sample module.

Caution: Failure to use the instrument in accordance with the method as specified by the manufacturer may prejudice the protection provided for the instrument.

1.2 Personal Safety and Precautions

Caution: The actual weight of the instrument is relatively large, so the instrument shall be moved or lifted with appropriate tools, methods or by cooperating with others. Avoid moving the instrument alone without cooperating with others. Lifting the instrument improperly may result in the physical injury, pain or damage to the instrument.

Ban: Do not touch the power plug, power cord or switch with wet hand.

Hot surface: During the operation of the instrument, the sample module in the sample compartment may be hot. During the test and immediately after the test, do not directly touch the sample module with your hand or any body part to avoid burns. Please open the sample compartment and take out the sample after the temperature of the sample module drops to the standby temperature.

1.3 Electrical Safety and Precautions

Ban: This instrument has voltage that is harmful to the human body. Please power off the instrument before opening the casing of the instrument at any time. Do not replace components when the power cord is connected.

Caution: The enclosure of this instrument shall be properly grounded through the power ground wire. Any damage to the internal or external grounding path of the instrument may result in danger.

Caution: If the electric leakage is found, please immediately power off and stop using the instrument.

Caution: Power off the instrument before moving it.

Reminder: Generally, please use the power cord that comes with the instrument. If the original power cord is broken, worn or disconnected, replace it with an equivalent power cord as soon as possible.

Caution: To avoid the risk of electric shock, the power cord of this instrument must be reliably grounded. The power cord of this instrument is a standard three-plug power cord. Please insert the power plug into an appropriate three-wire grounded socket (the external power supply connected to the socket must be grounded reliably) to ensure the safety of the instrument.

Caution: The power grid environment where the instrument is located must be grounded.

Caution: Please carefully check whether the power connection is secure. Always hold the plug when plugging or unplugging the power cord. Do not pull the power cord forcibly. When inserting the plug into the power supply, make sure that the plug is fully inserted into the socket.

Caution: Keep the power plug and power cord away from hot objects such as heater. When using this instrument, do not place anything on the power cord, and do not place the power cord in a place where people often move.

Caution: The fuse model of this instrument is 250V/10A, and the fuse is placed in a spare box at the power socket at the rear of the instrument. Using an inappropriate fuse may damage the wiring system of the instrument and cause a fire. Before turning on the power switch of the instrument, please check to make sure that the fuse has been installed correctly.

Caution: To avoid the risk of fire for a long time, please use the correct type of fuse with the rating as indicated by this instrument when replacing the fuse. Please cut off the power first, unplug the power cord, and pry open the fuse box with a flat-blade screwdriver, and replace the old fuse with an equivalent new one.

1.4 Environmental Safety and Precautions

Caution: This instrument is only applicable to an indoor environment which is well-ventilated and free of corrosive gas.

Ban: Electric sparks may result in explosion hazard. Do not use this instrument in an environment where flammable and explosive gases exist or may exist.

Reminder: The working ambient temperature of this instrument shall be between 10℃ and 30℃, and the relative humidity should be ≤~80%.

Reminder: The working environment of this instrument shall be normal atmospheric pressure (the altitude is lower than 2000 m).

1.5 Bio-safety and Precautions

Biohazard: The sample object of this instrument is nucleic acid. In actual operation, please treat it as a biological sample with potential biological hazards. During the sample handling and operation, generally applicable safety protection actions shall be taken, and appropriate protective goggles, clothing and gloves shall be worn.

Biohazard: The user shall dispose of the discarded sample and contaminated materials in accordance with the relevant local or national applicable regulations.

Biohazard: This instrument shall be treated as a waste with biological contamination risk during disposal. Before reuse, recycling, or disposal, the instrument shall be cleaned (including cleaning, disinfection, and/or sterilization). This instrument shall be disposed of in accordance with relevant local or national regulations.

Biohazard: If the liquid samples overflow during any operation, appropriate disinfectants shall be quickly used for disinfection to avoid the spread of contaminants to laboratory personnel or contamination of instrument.

Chapter 2 System Overview

2.1 Applicable Scope

The full-automatic nucleic acid extraction system can be widely used in scientific research, clinical, disease control, food safety, forensic and other fields. Users only need to add samples and paramagnetic particle method nucleic acid extraction reagents, load reaction consumables, and the full-automatic nucleic acid extraction system will complete all nucleic acid extraction operations in accordance with the experimental procedures.

With different magnetic bead method nucleic acid extraction reagents, the full-automatic nucleic acid extraction system can quickly extract the DNA and RNA in animal and plant tissues, blood, body fluids, and criminal materials.

2.2 Product Composition and Structure

2.2.1 Product Composition

This product is mainly composed of temperature control module, rotating module, magnetic attraction module, circuit control module, power supply module, enclosure, man-machine interaction module and software.

2.2.2 Product Structure

Front

Figure 2-1 Front of Full-automatic Nucleic Acid Extraction System

Introduction to functions:

1.Display

2.Experiment module lifting door

3. Experiment module drop-down door

Back

Figure 2-2 Back of Full-automatic Nucleic Acid Extraction System

Introduction to functions:

1.Heat emission hole on the back

2.Three-in-one switch

3.UV lamp door

4.USB interface

Experiment Module

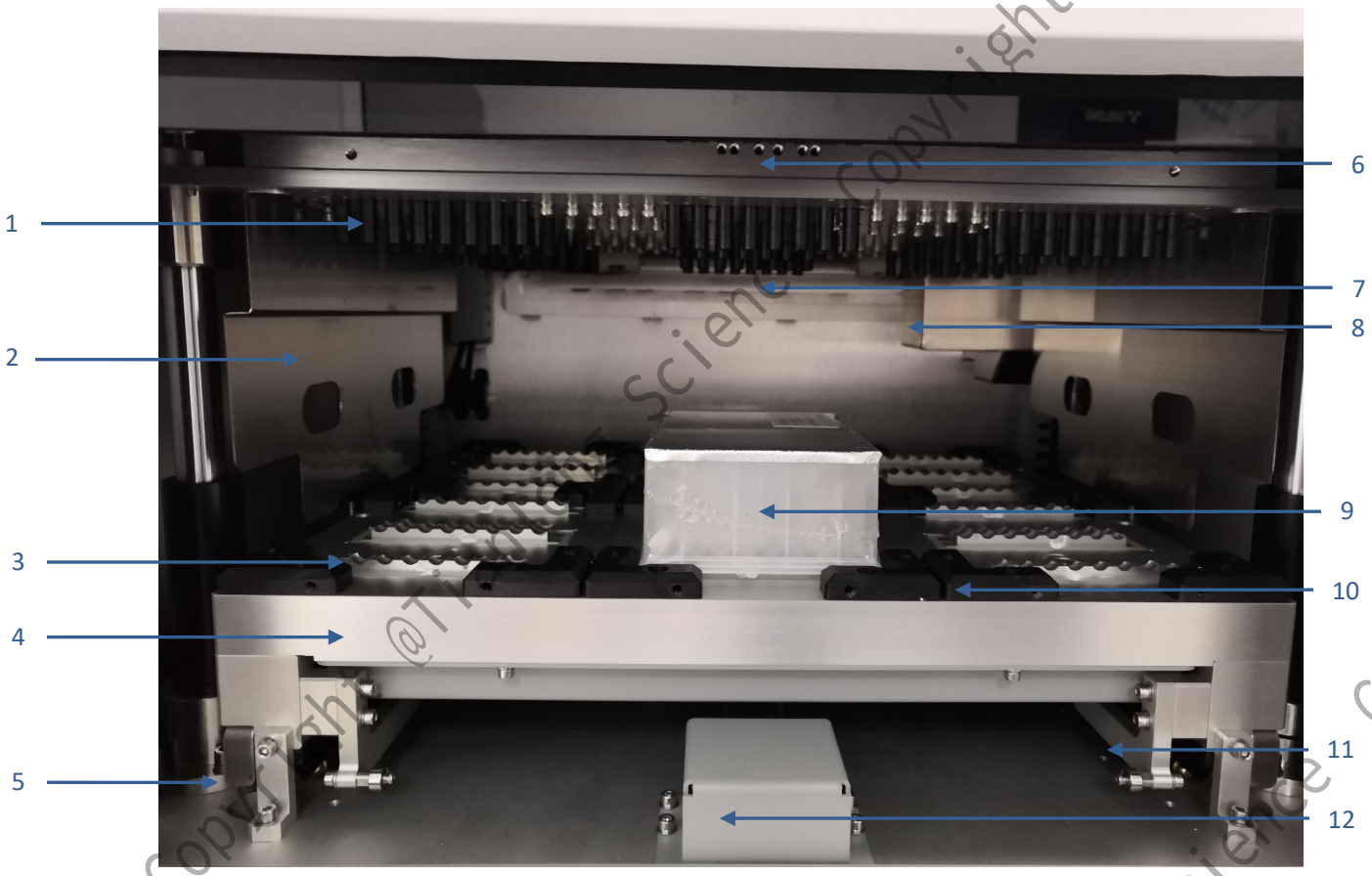


Figure 2-3 Experiment Module

Introduction to functions:	1. Rotary sleeve	2.Lead screw protective shield
	3.Heater strip	4.Heating upper plate
	5.Transportation lock	6.Rotary sleeve frame
	7.UV lamp	8. Power wind shield
	9.Tianlong 96 deep hole plate 2.0 (anti-static)	10.Deep hole plate positioning block
	11.Push rod slide way	12. Horizontal pushing belt wheel cover plate

2.3 Conventional Parameters

1) Product specification: 490mm(L)×510mm(W)×480mm(H) Weight: 45 Kg

2) Packing specification: 700mm(L)×660mm(W)×580mm(H) Weight: 55 Kg

3) Communication interface: USB interface

Chapter 3 Installation Requirements and Procedure

3.1 Installation Requirements

3.1.1 Environmental Requirements

a) Only applicable to an indoor environment with good ventilation, no corrosive gas and no strong magnetic field interference

b) Avoid using it in direct sunlight, keep it away from heaters, stoves and all other heat sources, and away from water sources, such as pools and water pipes.

c) There shall be no electromagnetic field interference and no electrical equipment that generates vibration or high-frequency waves around the instrument

d) When a single instrument is used, the distance between the ventilation hole around the instrument and the nearest object shall not be less than 30cm. When multiple instruments are used at the same time, the distance between instruments shall be no less than 80cm

e) Do not place the instrument on a soft cushion. Otherwise, the base will fall into the soft cushion and block the cooling fan below the instrument

f) Do not place the instrument close to the wall or stack other objects behind the instrument to avoid affecting the heat dissipation of the instrument

g) The instrument shall be placed at a location where the power cord is easily plugged and unplugged and away from people passing by to prevent someone from tripping over the power cord

h) Operating ambient temperature:10℃~30℃;

i) The relative humidity shall be ≤80%;

3.1.2 Power Requirements

a) Working power supply requirements: Three-wire grounding power supply, voltage AC 220±10%, 50Hz/60Hz, 600VA; UPS is recommended

b) The voltage between the neutral wire and the ground wire shall be less than 3V

3.2 Inspection before Installation

3.2.1 Environment and Power Inspection

a) Use a conforming hygrothermograph to measure the temperature and humidity in the operating room of the nucleic acid

instrument

b) Use a conforming multimeter to measure the supply voltage and the voltage between the neutral wire and the ground wire

After the measurement is completed, record the corresponding data in the *Nucleic Acid Extraction System Installation and Acceptance Report*

3.2.2 Appearance and Configuration Inspection

a) Check whether the inner and outer packaging of the instrument is intact, whether it is damaged, bumped, soaked, affected by damp and deformed, etc.

b) Check whether the instrument and accessories are damaged, rusted and bumped, etc. in appearance

c) Check whether the model, specification, configuration and quantity of the instrument and accessories are consistent with the packing list

d) Check if the accompanying documents (user manual and certificate, etc.) of the instrument are complete

After the inspection, record the corresponding conditions in the *Acceptance Report of Installation and Acceptance of Nucleic Acid Extraction System*

3.3 Installation Procedure

3.3.1Unpacking

The transportation package of this product is a whole equipment carton package, lined with protective foam. The instrument body inside the packing container is sealed by a dust guard, and foam is used for support and protection at the corners of the instrument to prevent collision and vibration during transportation, as shown in Figure 3-1.

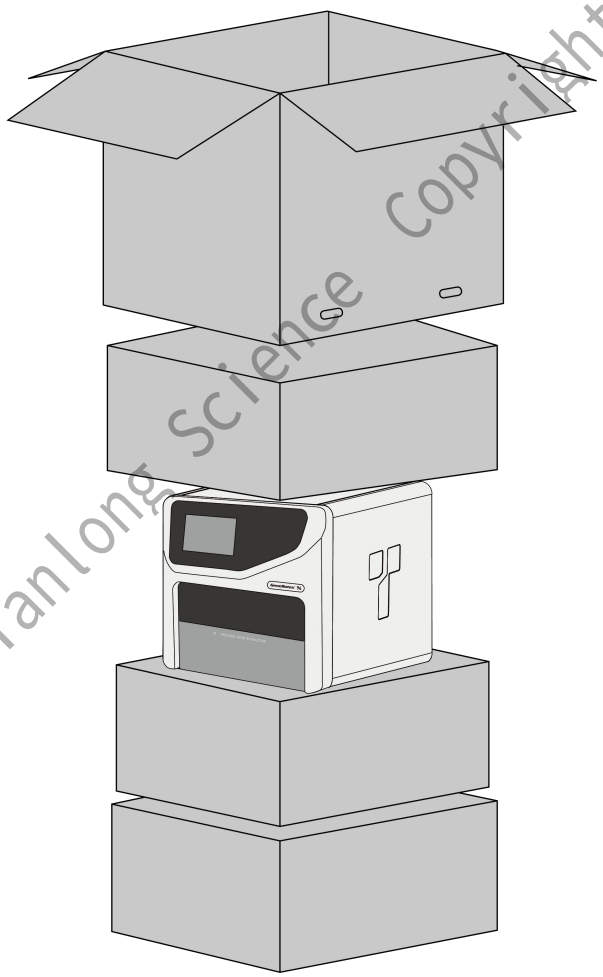


Figure 3-1. Exploded View of Packing Container

Instrument unpacking procedure

Step1: Please transfer the product packing container to the working place and open the sealing strip of the packing container, as shown in Figures a and b.

Step 2: Open the top cover of the packing container and remove the rubber buckles on both sides of the packing container (4 pieces in total); hold the handles on both sides of the instrument packing container, and remove the upper part of the packing container, as shown in Figures c and d.

Step 3: Remove the protective foam at the top of the instrument and take out the instrument of the packing container as shown in Figure e.

Step 4: Remove the dust guard of the instrument body, hold the left and right sides of the instrument and place the instrument on a plane stably.

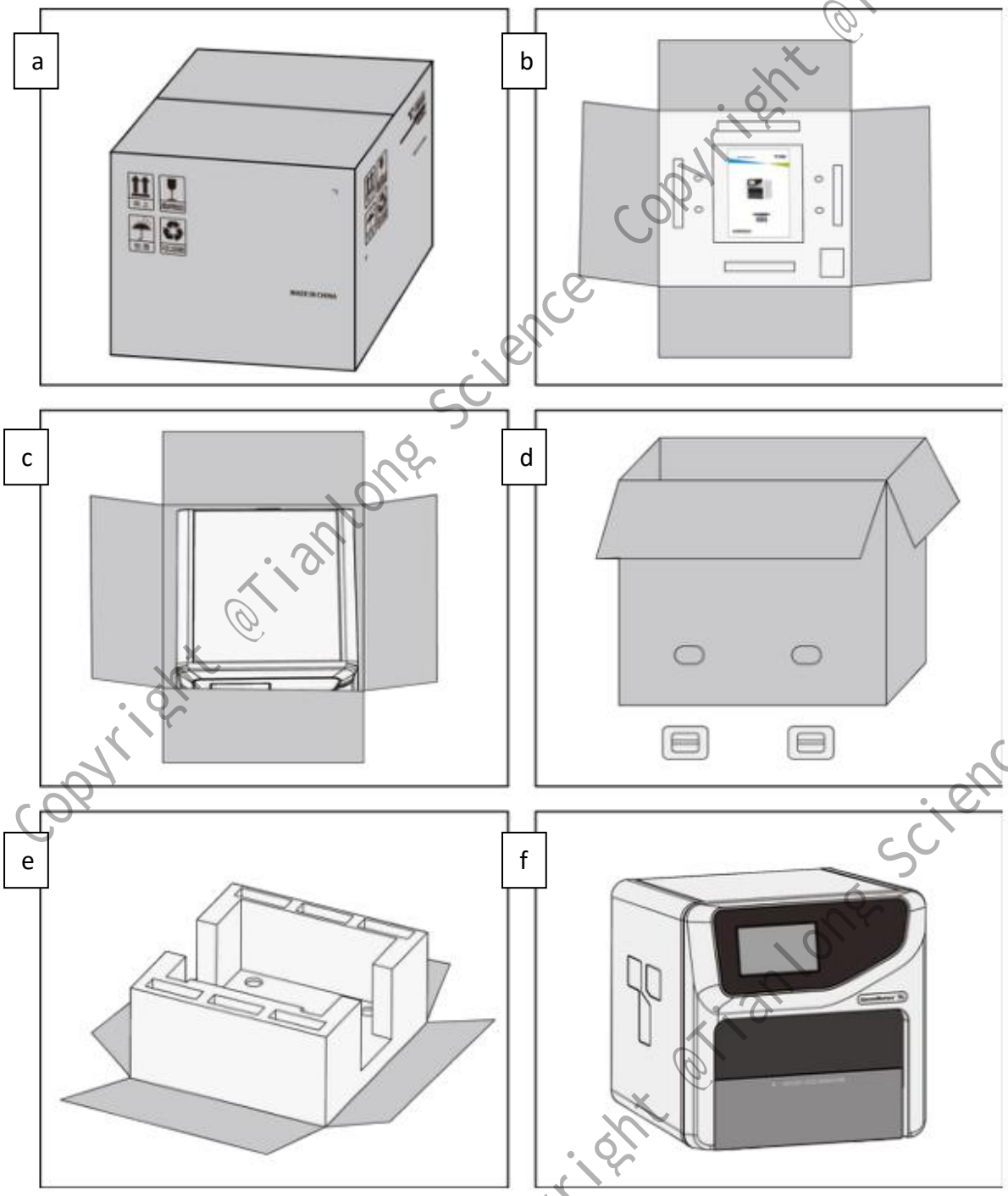


Figure 3-2 Unpacking Procedure

Reminder: To prevent the generation of condensed water, do not unpack the instrument before the container reaches the room temperature.

Reminder: Before unpacking the instrument, please carefully check the integrity of the product packaging. If there are defects, collisions or water logging marks, please contact the Transportation Department or us to solve the specific matters.

Reminder: After unpacking, please check the product and its accessories according to the packing list. In case of any discrepancy, please contact us or our distributor in time for replenishment. After the acceptance inspection passes, please fill in the relevant contents on the installation information feedback form and feed it back to us for filing and warranty.

Caution: Please keep the original packaging materials of this instrument properly for future transportation again. The packaging design of this product can reduce damage during transportation and ensure transportation safety. Selection of other packaging materials will invalidate the warranty. Xi'an Tianlong Technology Co., Ltd. will not be liable for any damage to the instrument due to improper packaging during transportation. Please also keep the instrument related documents provided by us for future use.

Caution: With the net weight of about 45 kg, the instrument must be handled carefully. It is recommended that two persons shall cooperate to move the instrument and some protective actions shall be taken to avoid damage. When lifting the instrument, place your hands on the bottom of both sides to carry it.

3.3.2 Instrument Installation

Removal of Instrument Transportation Lock

After the instrument is properly placed on the laboratory bench, do not directly power on the instrument. Please follow the instructions to remove the transportation lock before running the instrument. The specific operations are as follows:

1) Please open the drop-down door of the experiment module, and remove 4 bolts of transportation lock on the left and right sides of the instrument with M3 hexagonal socket tool, as shown in Figure 3-3.

2) Please release the drop-down door to restore it naturally, and appropriately keep 2 transportation locks and 4 bolts.

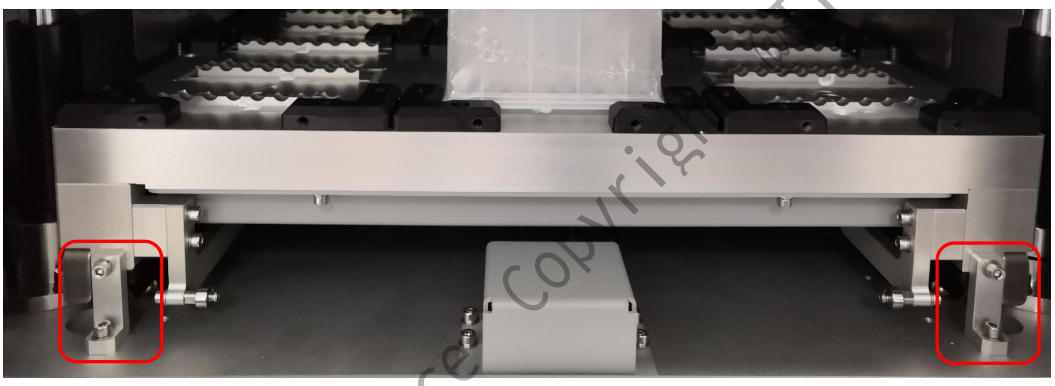


Figure 3-3. Transportation Lock

Caution: Unless specifically indicated in the manual, do not loosen or disassemble the internal, exposed bolts or other parts of the instrument at will. Otherwise, the instrument will be inaccurate and the instrument warranty will be invalidated.

Caution: This instrument must be disassembled by professionals.

Power-on Self-inspection

1) Plug in the power cord of the instrument, and turn on the power switch on the back of the instrument to switch on the instrument. The instrument will be then started and initialized. The system initialization interface is as shown in Figure 3-4.

Figure 3-4 Initialization Interface of Instrument

2) After self-inspection passes, the instrument will enter the standby state.

3) At this time, you can create a new experiment program normally or read the experiment program by scanning the QR code on the reagent.

3.4 Performance Test

The following 3 points need to be checked in the performance test:

1) Whether the instrument will provide the reminder “incorrect placement of stirring sleeve” before running if the stirring sleeve is not placed at the column 2/8

2) Whether the loading and unloading of stirring sleeve are normal and whether the stirring sleeve is damaged

3) Whether the heating strip can reach the set temperature in the set time

3.4.1 Reagents and Tools Preparation

Reagents Preparation

Before using the product, the user shall select the corresponding paramagnetic particle method nucleic acid extraction reagent. In this manual, the "Full-Automatic Nucleic Acid Extraction System GeneRotex 96 Installed Kit" of Tianlong Technology Co.,

Ltd. is used as an example for description.

3.4.2 Test Items and Procedure

Please refer to the “Instructions for Use of Full-Automatic Nucleic Acid Extraction System GeneRotex 96 Installed Kit”

Loading of consumables

1) Place the stirring sleeve correctly at columns 2 and 8 of 96-deep-hole plate.

2) Place the 96-deep-hole plate in the experiment module of the full-automatic nucleic acid extraction system.

Reminder: Please confirm that the notch of the 96-deep-hole plate faces the upper left of the experiment moduleand is placed appropriately (horizontal without floating or inclination), as shown in Figure 3-6.

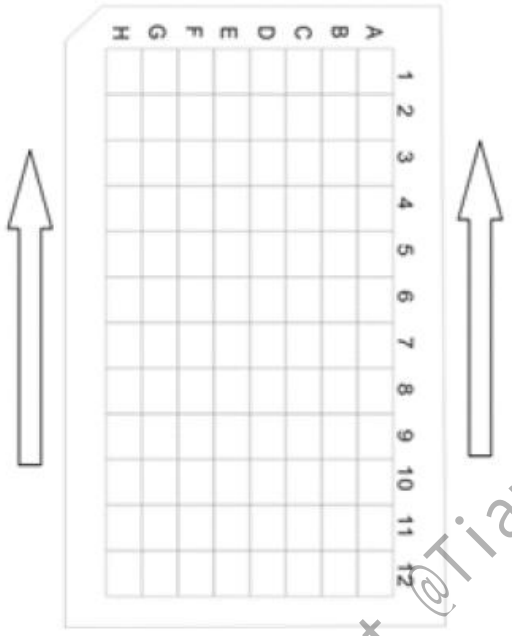


Figure 3-6 Deep-Hole Plate

Reminder: Ensure that columns 2 and 8 of each deep-hole plate are provided with the stirring sleeves and the deep-hole plate is not inclined and does not float. Otherwise, the risks of the instrument such as operation abnormality, stirring sleeve, rotating sleeve damage and magnetic bar rupture may be caused, and the experimental results will be affected.

Running Test

1) Click the “Out” key and place the deep-hole plate provided with the stirring sleeve on the experiment module.

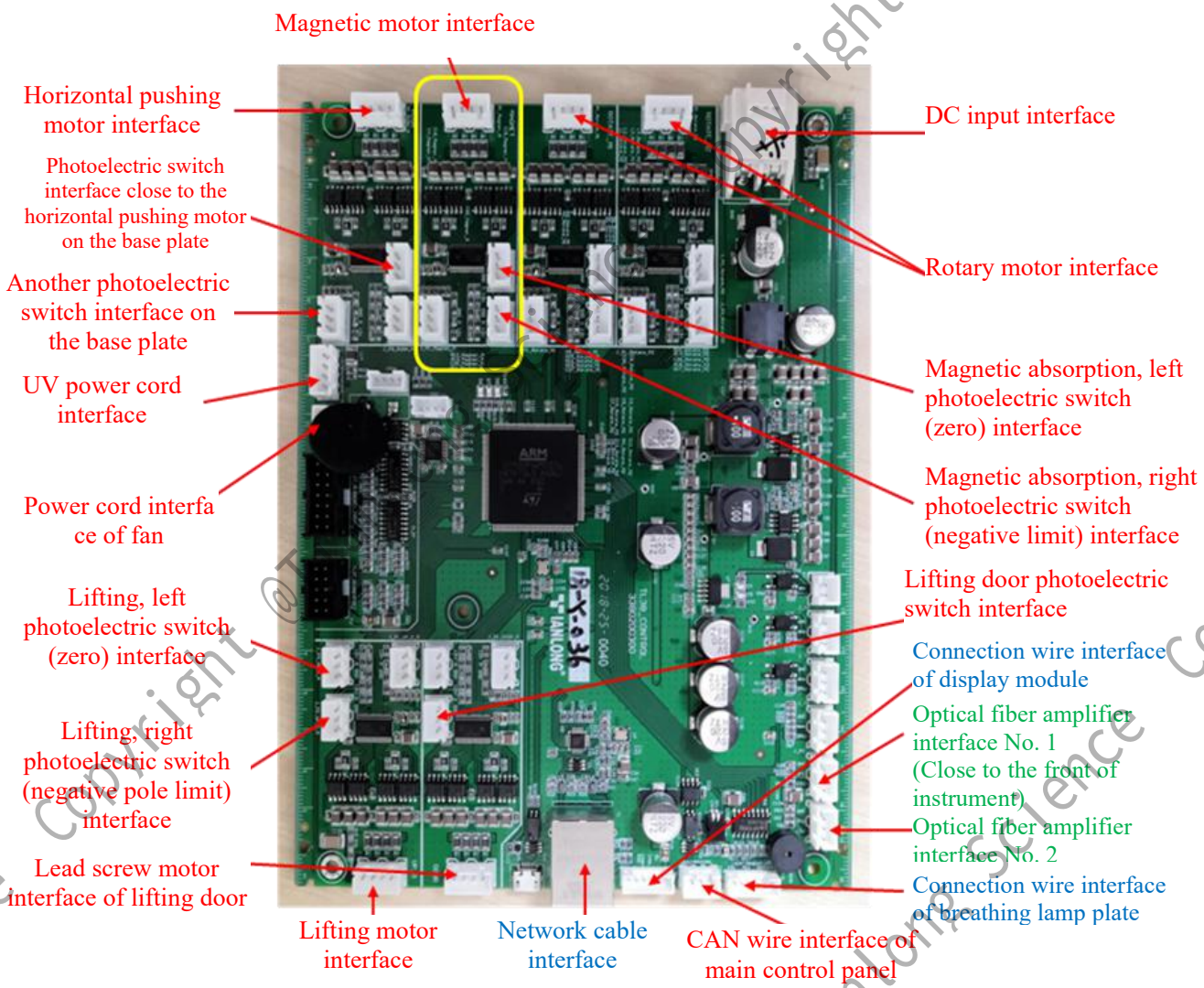
2) Click the “Out” key to return the experiment module into the instrument, and press the “Run” key to start running the test program.

Chapter 4 Troubleshooting

Disassembly:

Remove 2 bolts on the back panel with the M3 hexagonal tool to remove the top shell, remove the 6 bolts on both sides of the back panel and 1 bolt below the left and right side panels to remove the left and right shells.

Connection Description of Main Control Panel Terminals



4.1 LCD Abnormality (Screen Scratch, Screen Reversal and Contact Failure, etc.)

- **Fault Description:**

  The LCD cannot be displayed normally and the experimental operation cannot be normally carried out.

- **Troubleshooting:**

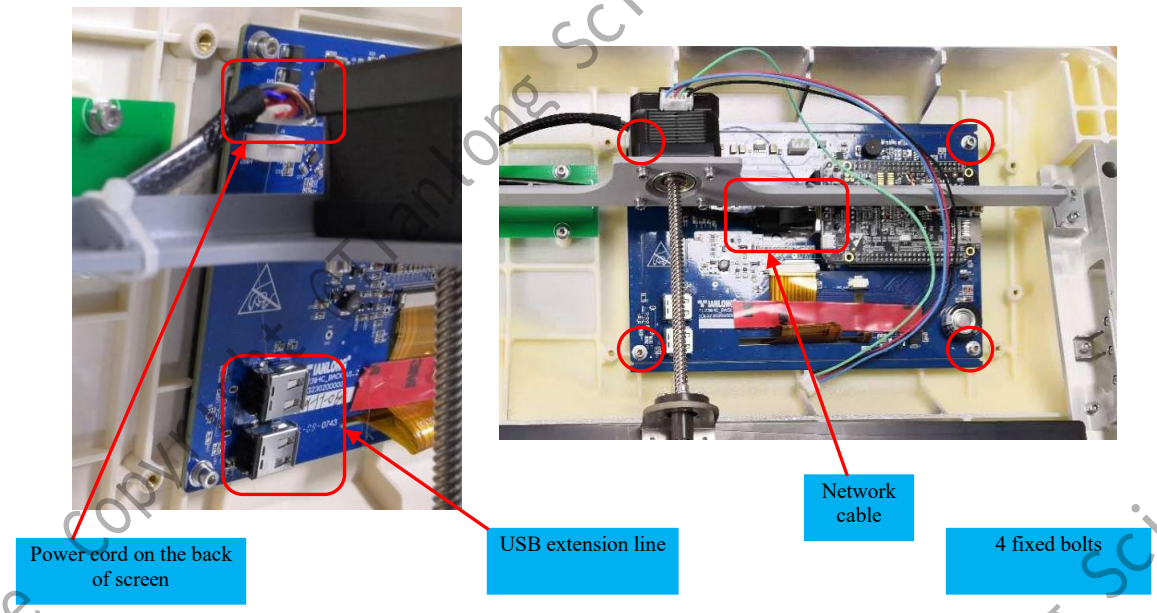
  1. Restart the instrument and observe whether the fault exists.
  2. Check whether the two FPCs between the LCD screen on the back of the screen and the circuit board are connected properly, touch the FPCs with your hand to see if the LCD screen has changed (poor communication will cause the above abnormalities).
  3. Loosen 4 fixed bolts on the back of the screen. Restart the instrument to check whether the fault exists (the welding spot short circuit between the LCD and the electronic components on the back of the

circuit board will result in the above abnormalities).

4. If all above items are normal, replace the display module.

➢ **Maintenance Method:**

Unplug the network cable, 2 USB extension cables, and the power cord on the back of the screen, and then remove the 4 fixed screws on the back of the screen to remove the display module. Re-connect 2 FPCs or replace the display module as shown below.



4.2 Reset Failure and Position Overranging of Horizontal Pushing Motor

➢ **Fault Description:**

The horizontal pushing motor is at the abnormal position and cannot run to the designated position.

➢ **Troubleshooting:**

1. Check whether the horizontal pushing shading plate and horizontal pushing photoelectric switch can sense each other.
2. Insert and extract the power cord of horizontal pushing motor and photoelectric switch wire of horizontal pushing motor again, restart the instrument to check whether the horizontal pushing motor runs (whether the experiment module runs) and check whether 2 red indicators of horizontal pushing photoelectric switch wire are normally on and whether the fault exists.
3. When the instrument is powered on, gently pull the experiment module with your hand to see if there is a small amount of displacement in the experiment module. If so, it proves that the connection between

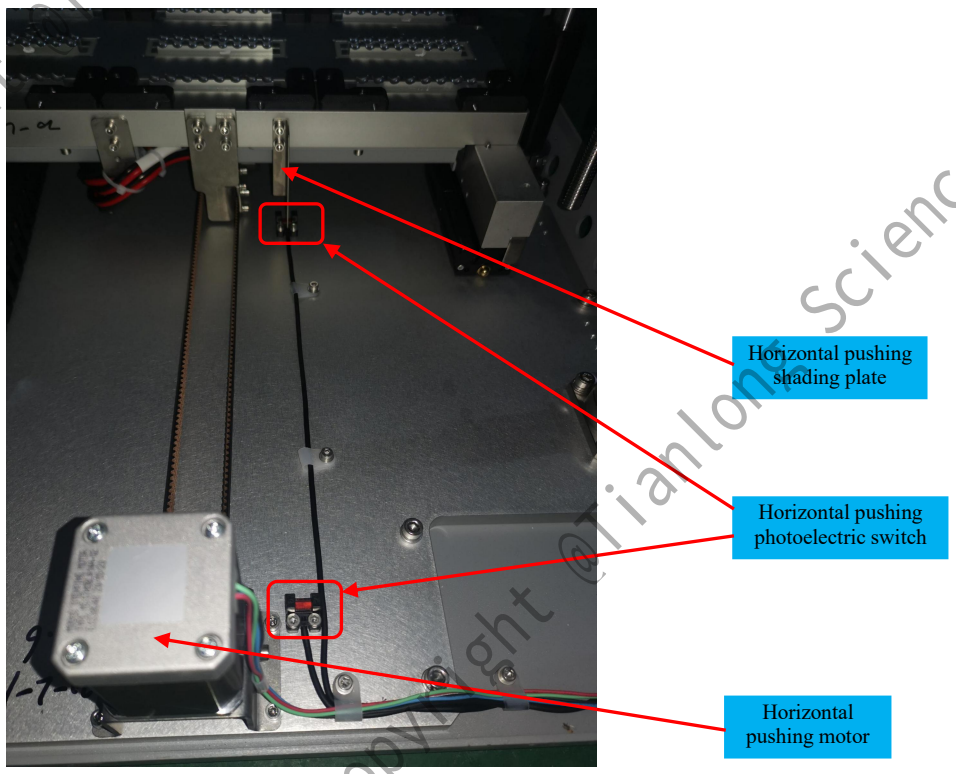
the horizontal pushing motor and the motor synchronous pulley is loose.

4. If all items above are normal, replace the main control panel. You need to enter the commissioning mode before replacing the main control panel to record all motor parameters. After the replacement, manually enter all parameters and check the alignment position of the instrument.

➢ **Maintenance Methods:**

1. If the shading plate and photoelectric switch cannot sense each other, re-adjust the position of the shading plate and place the shading plate at the central position of 2 corners of the photoelectric switch.

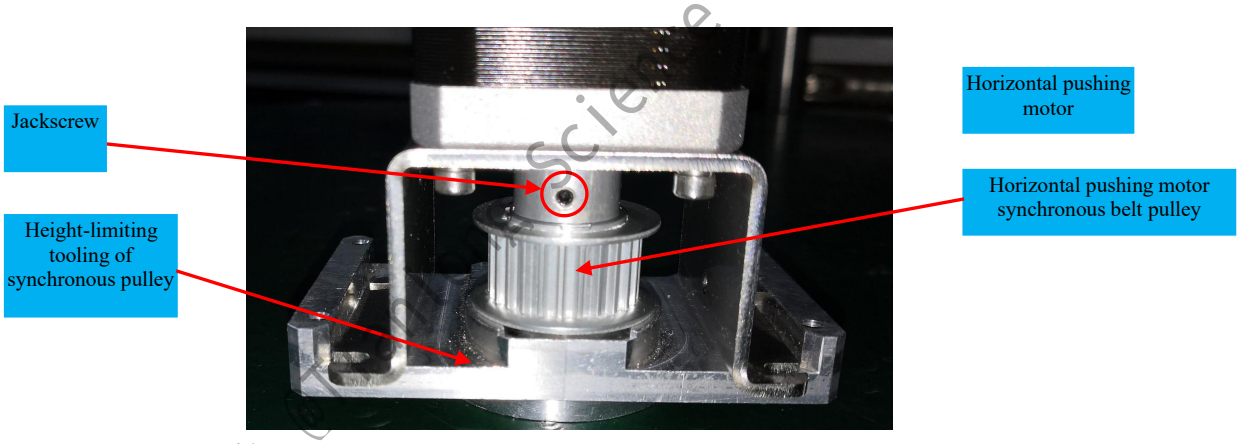
1. If the motor does not run and the red indicator of the photoelectric switch is off, you need to replace with new materials, remove the back panel, replace the faulty components with new ones, and re-route the wires according to the original wiring position, as shown in the figure below.



3. If there is a small amount of displacement in the experiment module, it means that the connection between the horizontal pushing motor and the motor synchronous belt pulley is loose. Remove the motor base from the bottom plate and re-lock the motor synchronous belt pulley as follows:

Install two M4*8 or M3*6 (according to the actual conditions) jackscrews in the fixed holes of the synchronous belt pulley of the horizontal pushing motor. One jackscrew must be pressed against the

axial section of the motor. Install it on the rotating shaft of the 42 motor at the direction as shown in the figure, and then place it on the fixed height-limiting tooling of the synchronous belt pulley according to the method as shown in the figure. Tighten two jackscrews to fix the belt pulley P5 (the jackscrews need to be coated with 243 medium-strength thread glue. After jackscrews are tightened, keep them still for more than 8 hours until they are solidified), as shown in the figure below.



4. If steps 2 or 3 have been carried out, the alignment position of the instrument must be checked as follows:

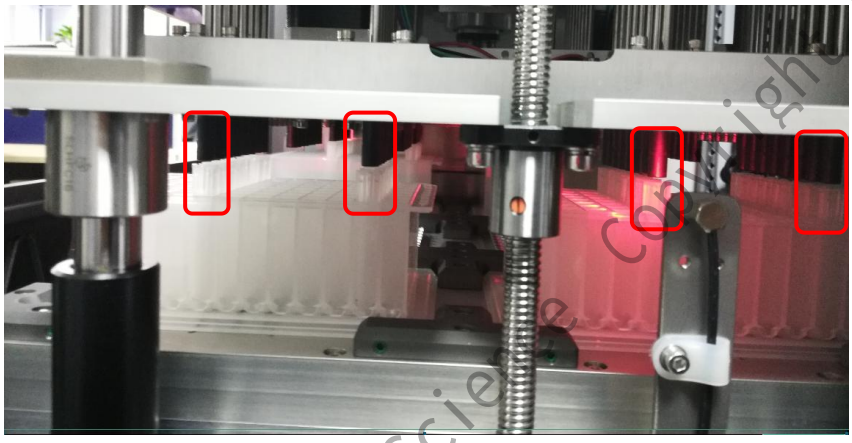
1) Take at least 4 deep-hole plates, place them at positions 1, 3, 4, 6 of the experiment module and correctly place the stirring sleeve at columns 2 and 8;

2) Enter the debugging mode, select the horizontal pushing motor column, click the test button at the hole 2 position, and run the heating module to the corresponding position;

3) Select the lifting motor column, click the test button at the top of the stirring sleeve, and run to the corresponding position;

4) Check whether the stirring sleeve is aligned to the rotating sleeve from both sides of the instrument. If not, slightly adjust the position parameters of the horizontal pushing motor hole 2 until the stirring sleeve is aligned to the rotating sleeve as shown in the figure below;

5) Make a confirmation, click “Save” and “Backup Parameter” (only for new version), restart the instrument and follow up the experiment results.



4.3 Reset Failure and Position Overranging of Lifting Motor

- **Fault description:**

  The lifting motor is at the abnormal position and cannot run to the designated position.

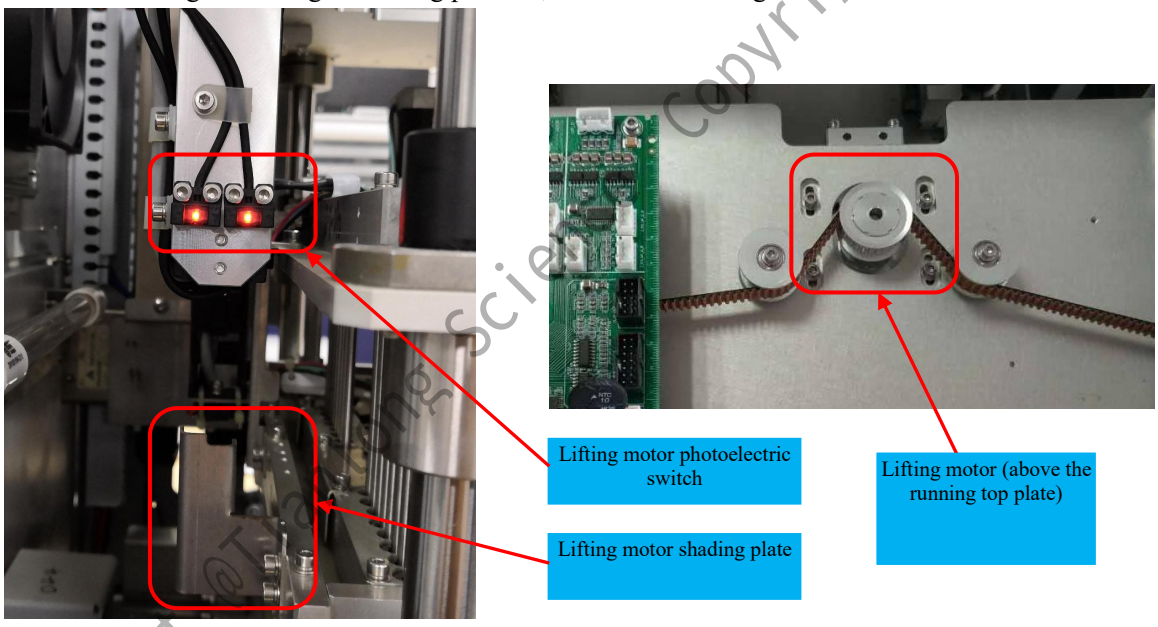
- **Troubleshooting:**

  1. Check whether the motor shading plate and lifting photoelectric switch can sense each other.
  2. Insert and extract the power cord of lifting motor and photoelectric switch wire of lifting motor again, restart the instrument (the shading plate must be lower than the photoelectric switch position before the instrument is restarted) to check whether the lifting motor runs (whether the rotating sleeve frame moves up and down normally) and check whether 2 red indicators of lifting photoelectric switch wire are normally on and whether the fault exists.
  3. When the instrument is powered on, gently pull the belt above the running top plate with the hand and check whether the belt has a small amount of displacement. If so, it proves that the connection between the lifting motor and the motor synchronous belt pulley is loose.
  4. If all above items are normal, replace the main control panel. Before replacing the main control panel, you need to enter the commissioning mode to record all motor parameters. After replacement, enter all parameters manually and check the loading position of the stirring sleeve and the magnetic absorption position.

- **Maintenance Method:**

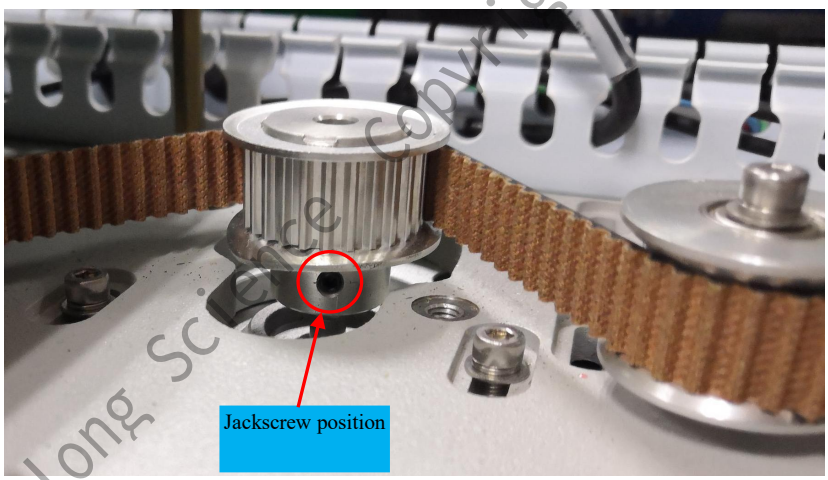
  1. If the shading plate and photoelectric switch cannot sense each other, re-adjust the position of the shading plate, place the shading plate at the central position of 2 corners of the photoelectric switch, and the distance between the shading plate and the photoelectric switch shall be appropriate (it can shield the photoelectric switch signal without contact).

2. If the motor does not run and the red indicator of the photoelectric switch is off, you need to replace with new materials, remove the back panel, replace the faulty components with new ones, and re-route the wires according to the original wiring position, as shown in the figure below.



3. If there is a small amount of displacement in the experiment module, it means that the connection between the lifting motor and the motor synchronous belt pulley is loose. Loosen 1 fixed jackscrew between them, coat medium-strength thread glue and then tighten them. Loosen another 1 fixed jackscrew, coat medium-strength thread glue and then tighten them (Keep it still for more than 8 hours after the jackscrews are tightened until they are solidified).

Note: The height position between the motor shaft and the synchronous belt pulley shall not be changed. One jackscrew must be perpendicular to the axial section of the motor (the axial section of the motor can be seen from the vertical top of the synchronous belt pulley) as shown below:



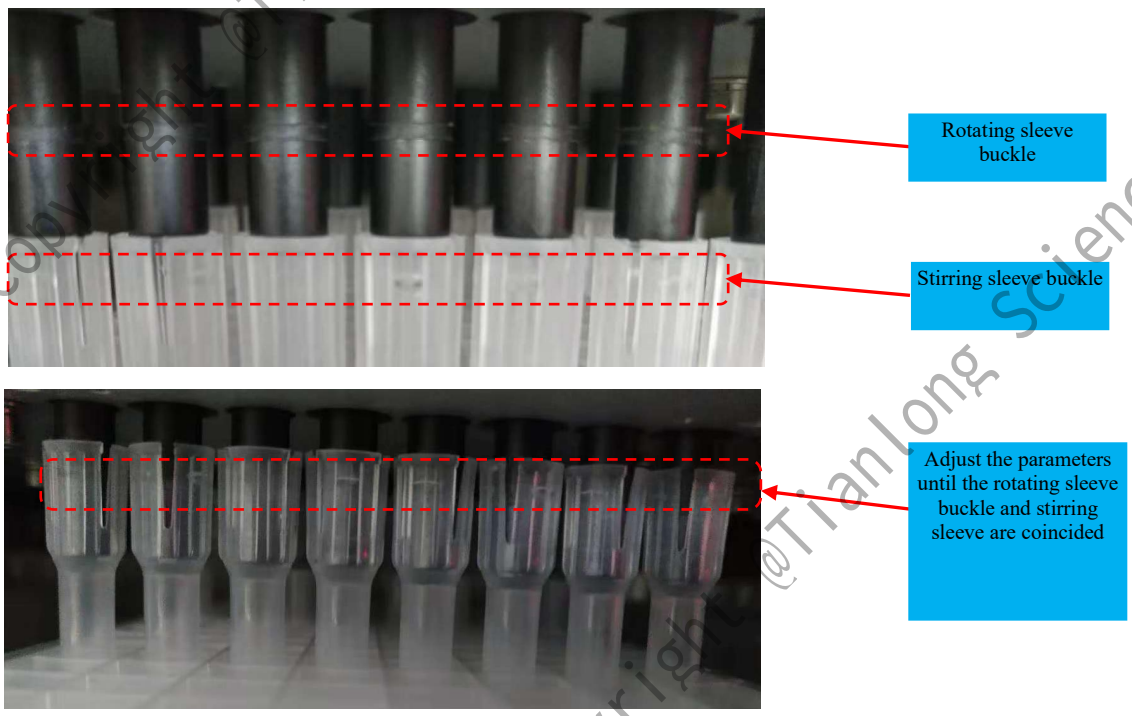
4. If steps 2 or 3 have been carried out, the loading position and magnetic absorption position of the stirring sleeve must be checked as follows:

1) Take at least 4 deep-hole plates, place them at positions 1, 3, 4, 6 of the experiment module and correctly place the stirring sleeve at columns 2 and 8;

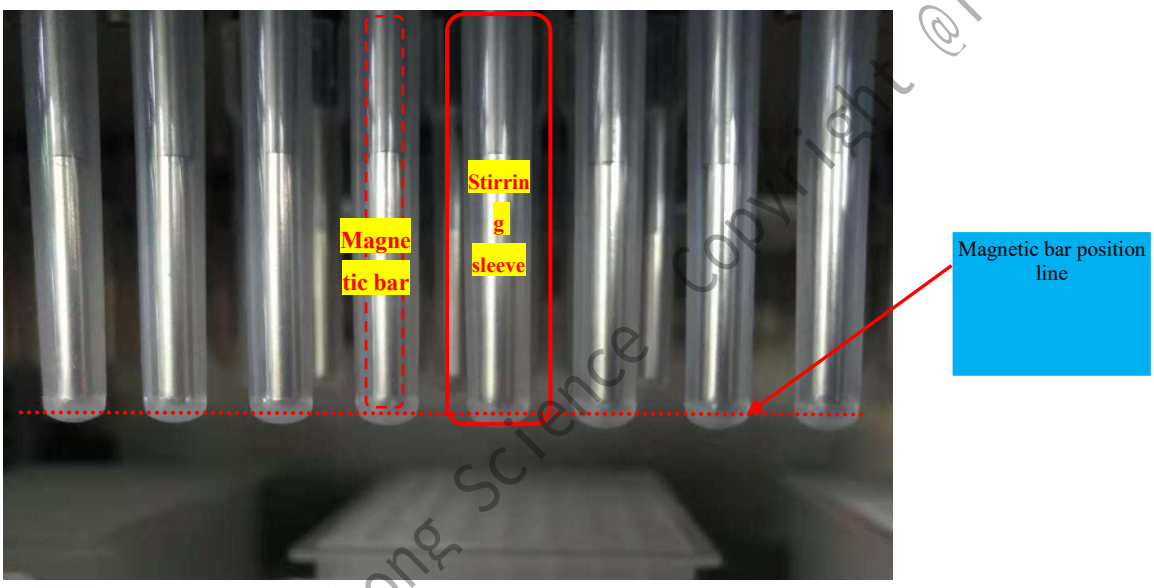
2) Enter the debugging mode, select the horizontal pushing motor column, click the test button at the hole 2 position, and run the heating module to the corresponding position;

3) Select the lifting motor column, click the test button at the top of the stirring sleeve, and run to the corresponding position;

4) Select the lifting motor column, click the test button at the loading stirring sleeve position to load the stirring sleeve and check whether the buckle of the rotating sleeve is coincided with that of the stirring sleeve. If not, slightly adjust the parameters at the loading position until they are coincided.



5) Select the lifting motor column, click “motor reset” at the bottom right corner to reset the rotating sleeve frame. Then, select the magnetic absorption and module door motor column. Click the test button behind the “Magnetic Bar Position during Magnetic Absorption”. Run the magnetic bar to the corresponding position and slightly adjust the values. The magnetic bar shall be at the bottom of the stirring sleeve (The magnetic bar shall be close to the stirring sleeve as far as possible, but they shall not be in contact).



5. Make a confirmation, click “Save” and “Backup Parameter” (only for new version), restart the instrument and follow up the experiment results.

4.4 Reset Failure and Position Overranging of Magnetic Motor

- **Fault Description:**

The magnetic motor is at the abnormal position and cannot run to the designated position.

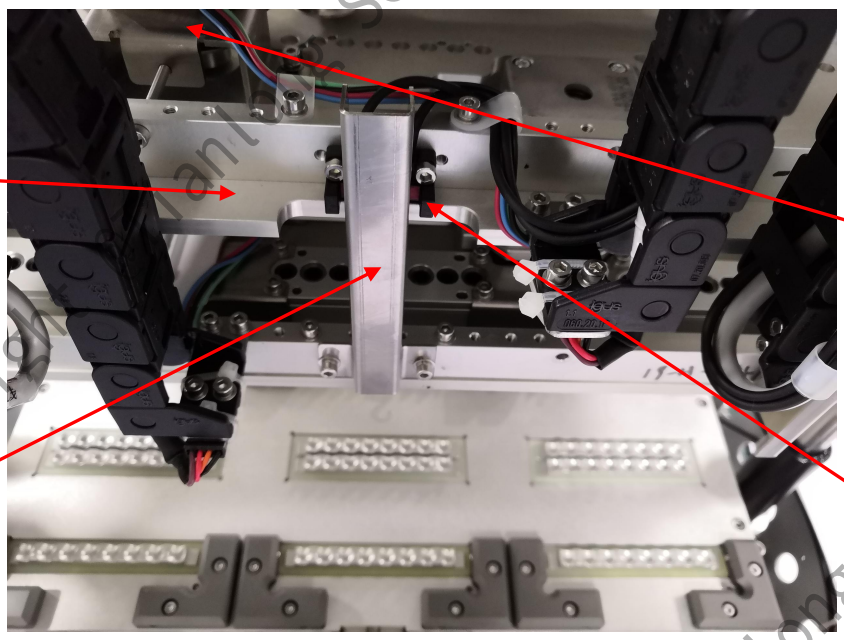
- **Troubleshooting:**

1. Check whether the magnetic motor shading plate and magnetic photoelectric switch can sense each other.
2. Insert and extract the power cord of magnetic motor and photoelectric switch wire of magnetic motor again, restart the instrument (the blocking piece of shading plate must be higher than the photoelectric switch position before the instrument is restarted) to check whether the magnetic motor runs (whether the magnetic bar frame moves up and down normally) and check whether 2 red indicators of magnetic photoelectric switch wire are normally on and whether the fault exists.
3. When the instrument is powered on, gently pull the belt above the magnetic bar frame module with the hand and check whether the belt has a small amount of displacement. If so, it proves that the connection between the magnetic motor and the motor synchronous belt pulley is loose.
4. If all above items are normal, replace the main control panel. Before replacing the main control panel, you need to enter the commissioning mode to record all motor parameters. After replacement, enter all parameters manually and check the magnetic absorption position of the instrument.

➢ **Maintenance Methods:**

1. If the shading plate and photoelectric switch cannot sense each other, re-adjust the position of the shading plate, place the shading plate at the central position of 2 corners of the photoelectric switch, and the distance between the shading plate and the photoelectric switch shall be appropriate (it can shield the photoelectric switch signal without contact).

2. If the motor does not run and the red indicator of the photoelectric switch is off, you need to replace with new materials, remove the back panel, replace the faulty components with new ones, and re-route the wires according to the original wiring position, as shown in the figure below.



3. If there is a small amount of displacement in the experiment module, it means that the connection between the magnetic motor and the motor synchronous belt pulley is loose. Loosen 1 fixed jackscrew between them (The magnetic motor can be seen from the side of the instrument. The tightened jackscrew of synchronous belt pulley can be found), coat medium-strength thread glue and then tighten them. Loosen another 1 fixed jackscrew, coat medium-strength thread glue and then tighten them (Keep it still for more than 8 hours after the jackscrews are tightened until they are solidified).

4 If steps 2 or 3 have been carried out, the magnetic absorption position of the instrument must be checked. Refer to “Step 4 of 5.3 Maintenance Methods”.

5) Make a confirmation, click “Save” and “Backup Parameter” (only for new version), restart the instrument and follow up the experiment results.

4.5 Module Door Motor Reset Failure

- **Fault Description:**

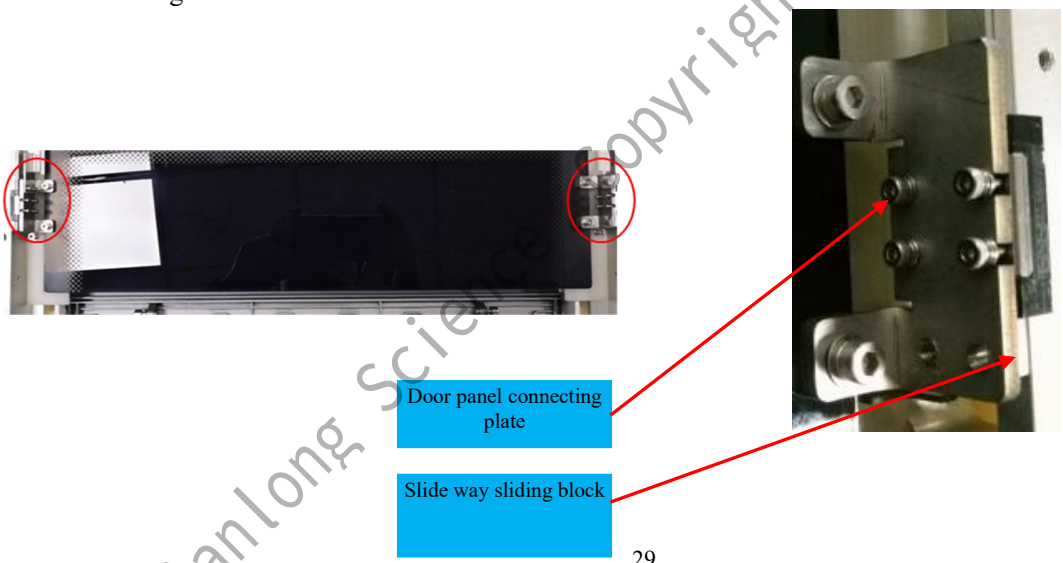
The module door is at the abnormal position and cannot run to the designated position.

- **Troubleshooting:**

1. When the instrument is powered off, slowly pull the module door with hand and repeat this action for 5-10 cycles. Restart the instrument to check whether the fault exists.
2. Check whether the module door motor shading plate and module door photoelectric switch can sense each other.
3. Insert and extract the power cord of module door motor and photoelectric switch wire of module door motor again, restart the instrument (the cabin door is closed before the instrument is restarted) to check whether the module door motor runs (whether the module door moves up and down normally) and check whether 2 red indicators of magnetic photoelectric switch wire are normally on and whether the fault exists.
4. If all items above are normal, replace the main control panel. Before replacing the main control panel, you need to enter the commissioning mode to record all motor parameters. After replacement, enter all parameters manually.

- **Maintenance Methods:**

1. If the sliding between the module door and the linear slide ways on its both sides is not smooth, slightly loosen the fixed screws between the door panel connecting plate and the slide way sliding block on both sides of the module door, move the position of the door panel connecting plate back and forth, and pull the module door up and down. Tighten the screws when the module door slides smoothly, as shown in the figure below.



2. If the shading plate and photoelectric switch cannot sense each other, re-adjust the position of the shading plate, place the shading plate of the module door motor at the central position of 2 corners of the photoelectric switch, and the distance between the shading plate and the photoelectric switch shall be appropriate.
3. If the motor does not run (not taken into account temporarily because it never occurs) and the red indicator of the photoelectric switch is off, you need to replace with new materials, fix the front panel and re-route the wires according to the original wiring position.

Chapter 5 Maintenance

SN	Fault	Troubleshooting	Solution
1	Screen display failure after the instrument is powered on	1: Check whether the power supply is normal 2: Check whether the fuse is normal 3: Check whether the switching power supply is normal	Replace the faulty parts
2	The UV lamp is not on	1: Check whether the UV lamp tube is normal 2: Check whether the UV lamp ballast is normal	Replace the faulty materials
3	The equipment has abnormal sound	Whether the stirring sleeve is inserted in place	Re-insert the stirring sleeve appropriately
4	Magnetic beads remain in all hole positions	1: Power on the instrument, and run the mixing command. When the stirring sleeve drops in the midway, quickly click the interface pause command (the stirring sleeve is at the lowest position at this moment). Check a. whether the stirring sleeve is at the central position of the deep-hole plate square hole b. whether there is gap between the stirring sleeve and the bottom of the deep-hole plate. Run the magnetic absorption command and click the pause command when the magnetic bar drops in the midway (the magnetic bar is at the lowest position). Check c. Ensure that the magnetic bar is at the bottom of the stirring sleeve and is not closely attached to the bottom of the stirring sleeve. 2: Check whether the motor parameters of the instrument are consistent with the motor parameters when the instrument is delivered out of the factory,	Adjust the motor parameters
5	Magnetic beads remain in some hole positions	1: Eliminate other problems such as a: Deep-hole plate position, b. Whether the reagent is correct, c: Whether the stirring sleeve position is correct, d: Whether the heating strip is normal. After a fault appears, record the hole positions where the magnetic bead remains (photos preferably). Carry out multiple experiments and record the hole positions where the magnetic beads remain. Check whether the hole positions are the same; if not, find out the non-instrument problems; if so, proceed the next step. 2: Run the mixing command. When the stirring sleeve	Adjust the motor parameters

		drops in the midway, quickly click the interface pause command (the stirring sleeve is at the lowest position at this moment), a. Check whether the stirring sleeve is at the central position of the deep-hole-plate square hole. If not, adjust the parameters of motor No. 3 in accordance with Section 6.2 of the maintenance manual. b. Check whether there is gap between the stirring sleeve and the bottom of deep-hole plate. If it is not at the specified position, adjust the parameters of motor No. 1 in accordance with Section 6.2 of the maintenance manual. c. Run the magnetic absorption command and click the pause command when the magnetic bar drops in the midway (the magnetic bar is at the lowest position). Ensure that the magnetic bar is at the bottom of the stirring sleeve and is not closely attached to the bottom of the stirring sleeve. If it is not at the specified position, adjust the parameters of motor 35 in accordance with the maintenance manual.	