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# 1. Safety Instruction



**Users must read the safety instruction carefully before running the EX3600 instrument!**

## 1.1 Symbol Definition

The following symbols will be printed in “EX3600 Automated Nucleic Acid Extraction Instrument User Manual”.

Symbol	Explanation	Description
	Warning	Risk of physical injury or instrument damage for any irregular operation
	Biohazard	Precaution of touching substances with potential infection risk
	Important	Important information for the proper use of the instrument

## 1.2 Operation Requirements



Read the user manual carefully before running the EX3600 Automated Nucleic Acid Extraction Instrument for the first time, and only operate according to manual instructions.



This instrument is an electromechanical equipment. There will be a risk of electric



shock or physical injury if the instrument is not operated under the guidelines listed in the “EX3600 Automated Nucleic Acid Extraction Instrument User Manual”.

- ▶ Users can replace the fuse by themselves. But do not disassemble the instrument or replace the other components without authorization, which may lead to the damage of instrument and is not covered by warranty;
- ▶ Only certified technicians from Liferiver can maintain the equipment;
  - ▶ Do not open the instrument when it is in use;
  - ▶ Ensure no obstacle could interfere with the movement of the magnetic bar frame and magnetic cap frame;
  - ▶ Install the instrument in a clean and ventilated room, avoid corrosive gas and strong magnetic field interference and avoid direct sunlight and heat;
  - ▶ According to the technical standard, the working condition of the instrument is at room temperature (10°C-40°C), and relative humidity under 85%.



- ▶ Must wear safety goggles and gloves when handling toxic, corrosive or infectious substances;
- ▶ Take precautions to all the potential biohazard, must comply with the local safety regulations when handling and disposal of wastes. If splashing or leaks occur, immediately use an appropriate disinfectant to disinfect areas and follow appropriate Safe Lab Practice to ensure the safety of the workers and eliminate any cross contamination;
- ▶ Damaged instrument must be returned to the manufacturer for maintenance if under warranty; the instrument must be thoroughly disinfected before shipment.



## 1.3 Electrical Safety



s EX3600 Automated Nucleic Acid Extraction Instrument is designed according to electrical safety protection grade Class I (IEC);

- ▶ To prevent electrical shock hazard, EX3600 Automated Nucleic Acid Extraction Instrument must be connected to the three prong grounded outlet which meets the safety standard, voltage ~220V (50Hz);
- ▶ Before connecting the power cord, make sure that the AC power voltage and frequency are consistent with the instrument requirements. Verify that the power is switched off before plugging the power cord into the outlet;
- ▶ When connecting the communication cable, ensure that the system is turned off to avoid accidental damage to the instrument;
- ▶ Do not touch the power switch and power cord with wet hands;
- ▶ Do not unplug the power cord before turning off the instrument;
- ▶ Do not clean the instrument before disconnecting the power;
- ▶ Do not change the fuse before disconnecting the power;
- ▶ Turn off the power when the instrument is not in use.



**To avoid electrical shock hazard, the instrument must be connected to the power with safety grounding device.**



## 2. Overview

### 2.1 Intended Use

Combined with the corresponding magnetic beads isolation kits, EX3600 Automated Nucleic Acid Extraction Instrument can extract high purity DNA, RNA, miRNA and viral nucleic acid from various samples, such as whole blood, serum, plasma, feces, milk and cells. It is suitable for the nucleic acid extraction in genome research, molecular biology research and clinical genetic testing.

### 2.2 Fundamental Principle

Using a stepper motor controlled by microcomputer, EX3600 Automated Nucleic Acid Extraction Instrument can achieve up to 0.1mm precision transmission. Magnetic field strength on the magnetic bar surface is greater than 2500Gs, which can complete the pre-established beads move and transfer function through the interaction of magnetic bars with ferromagnetic or ferrous magnetic beads ( $0.03\mu\text{m} \leq D \leq 10\mu\text{m}$ , D: diameter of particles). With the corresponding magnetic beads extraction kits, the instrument can extract nucleic acids from samples by controlling the movement of the magnetic bar and magnetic cap to collect, release and transfer the magnetic beads. The extraction of the nucleic acids mainly includes the following steps:

- (1) Adsorption: Add magnetic beads into sample binding solution, vibrate and blend thoroughly, the released nucleic acid will be adsorbed to the surface of the magnetic beads.
- (2) Washing: Collect and transfer the magnetic beads from the absorption step into washing buffer, wash repeatedly to remove impurities.



- (3) Elution: Transfer the magnetic beads into elution buffer. After vibrating and blending thoroughly, target nucleic acid will drop from the surface of the magnetic bead and dissolve into the elution buffer.

## 2.3 Main performance parameters and specifications

Product Model	EX3600
Sample Volume	20-200 $\mu$ l
Throughput	36units/run
Sample Handling Time	3-5 min
Instrument Running Time	20-40min
CMOD (control module)	1
Magnetic Beads Collection Efficiency	$\geq 99\%$
96 Well Plate	3 pieces
Magnetic Cap (disposable)	3 strips (12 wells/strip)
Keypad / Display Screen	Start/ Stop/ Direction Keys/ LCD
Boundary Dimension (L×W×H)	53×50×45cm
Net Weight	30 kg
Operation Condition	10-40 $^{\circ}$ C, relative humidity < 85%

## 2.4 Key Components

This instrument is mainly composed of control module, dynamical system, work part, transmissions, and power supply.



## 2.5 Main Structure



1. Magnetic bar
2. Magnetic cap
3. 96 well plate
4. Well plate transport platform

## 2.6 Instrument Panel Identification and Function

### Front Panel



Function key: "START", "STOP"

"START": Start to run the selected program.





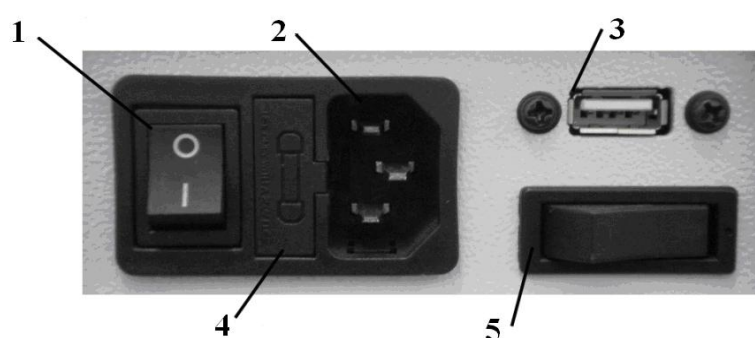
“STOP”: Press one time to pause the program, continuously press twice to stop the program.

Direction key: “▲”、“▼”

Forward or backward bottom, press to choose a preset program.

LCD screen: Display the name of the selected program, the running steps (absorption, washing or elution), and run time.

### Rear Panel



1. On/off switch (power switch)
2. Power cord receptacle
3. USB port
4. Fuse
5. UV lamp switch

## 2.7 96 Well Plate Indication



**Important.** When placing the 96 well plate, please note that Well A must be at the lower left corner!



	A	B	C	D	E	F	G	H
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								



## 3. Instrument Installation

### 3.1 Transportation and Storage

In transit, the instrument must be in the original packing to avoid damage. Only store the equipment in room temperature(20°C-40°C), with a relative humidity less than 90%. For more information on the transit requirement, please refer to the signed purchasing agreement.

### 3.2 Unpacking

Upon receiving the instrument, please inspect the package carefully to make sure all accessories are present and that the instrument has not been damaged in shipping.



**Warning.** Do not run the instrument if there is any damage.

### 3.3 Packing List

No.	Description	Amount
1	EX3600 Automated Nucleic Acid Extraction Instrument	1
2	Power Cord	1
3	“EX3600 Automated Nucleic Acid Extraction Instrument User Manual”	1
4	Inspection Report	1
5	Fuse (Φ5×20mm, 10A, 250V)	2
6	Magnetic Cap	2



7	96 Well Plate	2
8	Certificate of Approval	1
9	Warranty Card	1
10	Packing List	1

**If any item is missing or damaged, please contact the distributor immediately!**

### 3.4 Installation Requirements

- (1) Locate a dry, sturdy, leveled surface with no direct sunlight;
- (2) In order to ensure the stability of the instrument, please use the 220V  $\pm$  22V AC power voltage stabilizer where there is large voltage fluctuation;
- (3) Working temperature: 10-40°C, relative air humidity under 85%;
- (4) Do not place the instrument next to or near a heat source;
- (5) To avoid electrical shock hazard, the instrument must be connected to the three prong grounded outlet, which meets safety standards.



**Users must read the user manual carefully and operate the instrument only according to the manual.**

### 3.5 Installation Steps

- (1) Take out the instrument from the packing box, and put it on a dry, sturdy, leveled surface;
- (2) Open the instrument and take out the filling materials inside;
- (3) Plug in the power cord to the power receptacle of the instrument, then connect the power cord to the outlet.



- (4) Turn on the power switch at the back of the instrument. The instrument has the POST (Power On Self Test) function. After it passes the self test, the instrument is in standby mode.



**Warning.** If the instrument can't pass the self-test, please contact the manufacturer or distributor!



## 4. Instrument Operation

### 4.1 Sample Pretreatment

The pretreatment of different types of samples should be strictly according to the instruction manual in the nucleic acid isolation kit.

### 4.2 Operation Steps

- (1) Prepare the reagents and the samples according to the instruction manual in the corresponding kit.
- (2) Turn on the instrument. After the magnetic bar frame and magnetic cap frame rise up, pull out the 96 well plate transport platform.
- (3) Put the 96 well plate on the transport platform carefully (well A should be on the left side), and then put the transport platform back to its original place.
- (4) Insert the magnetic caps into the groove, push slightly till a “click” sound, which means the caps are completely inserted.
- (5) Close the instrument.
- (6) Choose a program and press “START” to begin the isolation process.
- (7) After the program is finished, take out the 96 well plate and the magnetic caps, collect the eluted nucleic acid solutions, and transfer them into EP tubes. The nucleic acids can be used immediately for experiments or store temporarily at 4°C or -20°C for longer preservation.
- (8) Turn on the UV lamp for 30 minutes to disinfect.



## 4.3 Power Off

Shut down the instrument by switching the On/Off switch at the rear lower right corner of the instrument. Dispose the 96 well plate and magnetic cap as biologic hazard wastes. Use some soft clothes or paper towels soaked with deionized water, detergent or soap to clean the transport platform and the instrument surface. If there are any spills on the transport platform or on the instrument, sterilize with 75% alcohol or other disinfectants.

## 4.4 Application Examples

### 4.4.1 Viral RNA Purification

This EX3600 Automated Nucleic Acid Extraction Instrument can extract and purify viral RNA by using the corresponding reagents:

Ribonucleic Acid (RNA) Isolation Kit (Preloaded for Auto Extraction)	Cat.No. Z-ME-0014/0018
Viral DNA/RNA Isolation Kit (Preloaded for Auto Extraction)	Cat.No. Z-ME-0016/0019

Operation steps: see 4.2 operation steps → choose “RNA Isolation” program → press “START” to begin. After the program is finished, transfer the solution in Row E of the 96 well plate to RNase-free EP tubes. The purified RNA can be used immediately for experiments or store at -20°C for long preservation.

**Note: For specific operation steps please see the kit instruction manual.**

### 4.4.2 Whole Blood Genomic DNA Purification

This EX3600 Automated Nucleic Acid Extraction Instrument can extract and purify



genomic DNA (gDNA) from whole blood samples by using the corresponding reagents “Whole Blood Genomic DNA Isolation Kit, Cat.No. Z-ME-0038”.

Operation steps: see 4.2 operation steps → choose “ZJ Blood gDNA” program → press “START” to begin. After the program is finished, transfer the solution in Row E of the 96 well plate to DNase-free EP tubes. The purified gDNA can be used immediately for experiment or store at -20°C for long preservation.

**Note: For specific operation steps please see the kit’s instruction manual.**

#### 4.4.3 Viral DNA Purification

This EX3600 Automated Nucleic Acid Extraction Instrument can extract and purified viral DNA from samples by using the corresponding reagents

Viral DNA/RNA Isolation Kit (Preloaded for Auto Extraction)	Cat.No. Z-ME-0016/0019
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Operation steps: see 4.2 operation steps → choose “DNA Isolation” program → press “START” to begin. After the program is finished, transfer the solution in Row E of the 96 well plate to DNase-free EP tubes. The purified DNA can be used immediately for experiment or store at -20°C for long preservation.

**Note: For specific operation steps please see the kit instruction manual.**





## 5. Consumables and Reagents

### 5.1 Related Consumables and Reagents

Product	Specification	Cat.#
Whole Blood Genomic DNA Isolation Kit	60 tests/kit	Z-ME-0038
Ribonucleic Acid (RNA) Isolation Kit (Preloaded for Auto-Extraction)	240 tests/kit (20 plates/kit*12 tests/plate)	Z-ME-0014
Ribonucleic Acid (RNA) Isolation Kit (Preloaded for Auto-Extraction)	60 tests/kit (5 plates/kit*12 tests/plate)	Z-ME-0018
Viral DNA/RNA Isolation Kit (Preloaded for Auto-Extraction)	240 tests/kit (20 plates/kit*12 tests/plate)	Z-ME-0016
Viral DNA/RNA Isolation Kit (Preloaded for Auto-Extraction)	60 tests/kit (5 plates/kit*12 tests/plate)	Z-ME-0019
Magnetic cap	20 strips/box	OHC0131
96 well plate & magnetic cap	20 sets/box (each set: 1 plate & 1 cap)	OHC0132
Silicone cover	10 pieces/box	OHC0143



## **6.Maintenance, Troubleshooting and Considerations**

### **6.1 Periodical Preventative Maintenance**

6.1.1 Keep the instrument clean from dusts and liquids. After each run, turn on the built-in UV lamp for sterilization.

6.1.2 Clean and sterilize instrument regularly. Use a mild detergent, like 75% ethanol, to clean the screen, keyboard and plastic cover. Do not use the corrosive cleanser, as it will destroy the surface paint.

6.1.3 If the instrument is contaminated, first use a dry cloth to wipe it clean and then disinfect it with UV light. If it is contaminated by bio-hazardous materials, clean the instrument thoroughly with a mild sterilizing solution, like Pasteurized liquid.

6.1.4 Do not use autoclave to sterilize any instrument parts or the instrument.

### **6.2 How to Clean the Well Plate Transport Platform**

Keep the well plate transport platform clean, and avoid accumulating excessive amount of dust or dirt on it. Clean the surface of the platform by using a soft cloth with cleanser or ethanol at least once a week.



## 6.3 How to Clean the Magnetic Bars

Use a soft cloth dipped with cleanser or ethanol to clean the magnetic bars.

## 6.4 Sterilization

If the samples are bio-hazardous materials, the following sterilization procedures or other alternative methods are essential.

- ① Prepare the disinfectant.
- ② Take out the 96 well plate and magnetic cap, discard after sterilization. Clean the well plate transport platform.
- ③ Wipe the surface of the instrument by using a soft cloth soaked with 75% ethanol.
- ④ Pack the instrument into a big plastic bag with the door open.
- ⑤ Put a soft cloth soaked with disinfectant into the same bag. Make sure that the cloth does not touch the instrument.
- ⑥ Seal off the plastic bag, lay aside for at least 24 hours.
- ⑦ Take the instrument out, and clean again with a mild disinfectant.

**Note: disinfectant—10% formaldehyde or 75% ethanol or 4% glutaraldehyde.**

## 6.5 Troubleshooting Guide

6.5.1 After the instrument is turned on, the system will automatically start self-check. When self-check is passed, the magnetic bar frame and magnetic cap frame will stay standby and the LCD screen will show the current program. If the self-check fails to pass, the instrument will buzz with a sound like “didi...”.

### 6.5.2 Solution for the Possible Fault

Fault	Possible Cause	Solution
The lead rail can	The magnetic cap doesn't rise	Press the “STOP” button. If the



not move.	up.	problem persists, restart the machine.
The magnetic cap is in the wrong position.	The position of the magnetic cap is not consistent with the signal of the internal sensor.	Check whether there is any block to prevent the up-and-down movement of the magnetic cap. Check whether the cap is totally inserted into the groove.
The magnetic cap moves overtime.	Internal sensor could not detect the cap within a designated timeframe.	Check whether there is any block to prevent the cap movement.
The lead rail is at the wrong position.	The position of the lead rail is not consistent with the internal sensor signal.	Check whether there is any block to prevent the left-and-right movement of the lead rail.
The lead rail moves overtime.	Internal sensor could not detect the lead rail within a designated timeframe	Check whether there is any block to prevent the left-and-right movement of the lead rail.
The magnetic bar is at the wrong position.	The position of the magnetic bar place is not consistent with the signal of the internal sensor.	Check whether there is any block to prevent the up-and-down movement of the magnetic bar.
The magnetic bar moves overtime.	Internal sensor could not detect the cap within a designated timeframe	Check whether there is any block to prevent the up-and-down movement of the magnetic bar.
The machine makes “kada” noise.	The well plate is not fixed well.	Make sure the plate is completely inserted into the groove.
The fixed parameters are lost.	The fixed parameters of the instrument are missing.	Please contact our technical service department for help.



## 6.6 Considerations

6.6.1 Be cautious and gentle when putting the 96 well plate on the transport platform to avoid accidental spills.

6.6.2 When placing the 96 well plate on the transport platform, make sure that the letter “A→H” on the plate are facing the outside of the platform from left to right “A→H”. Place the 96 well plate tightly on the platform. If skewed, it could lower the magnetic beads transfer efficiency.

6.6.3 When inserting the magnetic cap, push the cap gently until hearing a “click” sound to assure that the cap is completely inserted into the groove.

6.6.4 Every time before inserting or taking out the magnetic cap and the 96 well plate, make sure that the magnetic caps and magnetic bars are raised all the way to the top and are completely separated from the 96 well plate.

6.6.5 Before operating this instrument, please read the user manual thoroughly and carefully. Only operate under the guidelines in this user manual.



## Appendix A. FAQ Solution

Q1. Will the magnetism of the magnetic bars die down? If so, how long will the bar last? Are they replaceable?

A1. The magnetic bars of EX3600 system are made from durable materials and the magnetism is everlasting. However, if necessary, the bars can be replaced. For example, if the bars are mechanically damaged, it needs to be replaced, and the replacement should be done by a certified maintenance technician.

Q2. How strong is the magnetic field of the bars? Will the magnetism affect highly sensitive equipment in the surroundings?

A2. The magnetic field is mainly around the tip of the magnetic bars. It is partial, so it will not affect any surrounding equipment.

Q3. What should I do if I forget to insert the magnetic caps and the magnetic beads are absorbed to the surface of the bars?

A3. Use a soft cloth dipped with mild detergent or soap to wipe the magnetic bars and to remove as much magnetic beads as possible.



## Appendix B. Example for Viral RNA Extraction

**B.1** Use “RNA Isolation Kit, Cat. No. ME-0012” to extract viral RNA from feces samples of FMDV suspected case dissolved in PBS.

(1) Add the reagents into the 96 well plate according to the instruction manual in the kit.

Row/ Plate	Reagent(s) and Volume
A	Binding Buffer 500μl
	RNA Binding Beads B 20μl
	Carrier RNA 6μl
	Sample 200μl
B	Washing Buffer A 500μl
C	Washing Buffer W 500μl
D	Washing Buffer W 500μl
E	Elution Buffer 100μl

(2) Turn on the instrument, after the magnetic bar frame and magnetic cap frame rise up, pull out the 96 well plate transport platform.

(3) Carefully put the 96 well plate preloaded with reagents and samples on the transport platform in its proper place (well A should be on the left side), and then gently push to insert the transport platform.

(4) Gently push to insert the magnetic cap into the groove until hearing a “click”



sound.

- (5) Close the instrument.
- (6) Choose “RNA Isolation” program, press “START” to begin the isolation.
- (7) After the program is finished, take out the 96 well plate and magnetic cap, collect the solution in Row E immediately, and transfer it into RNase-free EP tubes. It can be used for immediate experiment or store at 4°C temporarily or -20°C for long preservation.

**B.2** Use “Ribonucleic Acid (RNA) Isolation Kit (Preloaded for Auto-Extraction), Cat.No. ME-0014” to extract viral RNA from throat swabs samples of Influenza suspected case.

### **B.2.1** Full Plate Operation

- (1) Tear the aluminum foil according to the kit instruction manual.
- (2) Add 6µl Carrier RNA and 200µl samples into the well A1-A12 of the 96 well plate.
- (3) Turn on the instrument, after the magnetic bar frame and magnetic cap frame rise up, pull out the 96 well plate transport platform.
- (4) Carefully put the 96 well plate preloaded with reagents and samples on the transport platform in its proper place (well A should be on the left side), and then gently push to insert the transport platform.
- (5) Gently push to insert the magnetic cap into the groove till hearing a “click” sound.
- (6) Close the instrument.
- (7) Choose “RNA Isolation” program, press “START” to begin the isolation.
- (8) After the program is finished, take out the 96 well plate and magnetic cap, collect the solution in Row E immediately, and transfer into RNase-free EP tubes. It can be used for immediate experiment or store at 4°C temporarily or -20°C for long preservation.

### **B.2.2** Operation with less than 12 samples





- (1) Tear the aluminum foil according to the kit instruction manual.
- (2) Add 6 $\mu$ l Carrier RNA and 200 $\mu$ l samples into the corresponding well of the 96 well plate. For example, if there are 5 samples in total, add 6 $\mu$ l Carrier RNA and 200 $\mu$ l samples into the well A1-A5 of the 96 well plate.
- (3) Turn on the instrument, after the magnetic bar frame and magnetic cap frame rise up, pull out the 96 well plate transport platform.
- (4) Carefully put the 96 well plate preloaded with reagents and samples on the transport platform in its proper place (well A should be on the left side), and then gently push to insert the transport platform.
- (5) Gently push to insert the magnetic cap into the groove till hearing a “click” sound.
- (6) Close the instrument.
- (7) Choose “RNA Isolation” program, press “START” to begin the isolation.
- (8) After the program finishing, take out the 96 well plate and magnetic cap, collect the solution in the corresponding well E immediately, and transfer into RNase-free EP tubes. It can be used for immediate experiment or store at 4 $^{\circ}$ C temporarily or -20 $^{\circ}$ C for long preservation. For example, samples are added to well A1-A5, then the solution is collected in well E1-E5.
- (9) Cover the 96 well plate tightly with the silicone cover (Cat.No. OHC0143).
- (10) The rows, which have not been added samples, can be used for next time. For example, well A1-A5 has been added samples in the first run, but well A6-A12 has not and are can be used for the next run. See B.2.2 step (2) – (8) for operation.

**Note: Do not use the same 96 well plate with preloaded reagents for more than 4 times.**



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