Taiwan
Advanced
Nanotech

Maelstrom 9610 LH

User Manual

TAN Bead Nucleic Acid Extractor (Non-Sterile)

039.L1601.X01Rev V1.2

Contents

ENGLISH

About Manual

The label on the instrument, the User Manual, and other packaging material may contain following symbols:

REF — Catalog number	 Temp Limit (Operating)
SN — Serial number	 Keep Dry
 Specification of fuse	 Keep Away From Sunlight
 Manufacturer	
 The date of manufacture	EC REP — EU authorized representative
 The CE mark	IVD — In Vitro Diagnostic Medical Device
 Instructions for Use	 Humidity limit
 Non-Sterile	 Caution
 Biologic Risks	 Biologic risks
 Hot surface, risk of burns	
 Watch your fingers and hands	
 The WEEE symbol, indicating separate collection for WEEE-Waste of electrical and electronic equipment	

About Instrument

Warning

- Use a power cord that meets your country's standard. In case of any questions, contact your local distributor for assistance.
- Maelstrom 9610 LH operates within the voltage range of 100 Volts and 240 Volts.
- Do not use the instrument with damaged power cord or a loose socket.
- To disconnect the power plug from the AC outlet, hold the power plug itself instead of pulling the power cord.
- Prior to performing the maintenance, make sure to disconnect the power plug from the outlet.
- Do not pour any liquid on the instrument.
- Do not place any containers with liquid on the instrument. Doing so may cause a fire, an electric shock or malfunctions of the instrument.
- Do not touch the power plug or cord if there is a chance of lightning. Failure to observe this may cause electric shocks.
- If you hear a thunder or suspect an approaching lightning when in use, turn off the power switch and disconnect the power plug from the AC outlet immediately. Failure to observe this may cause a fire or malfunctions.

About Instrument

Caution

- Never attempt to remodel the instrument without the permission from the manufacturer. Doing so may lead to a fire or an electric shock.

- Do not subject the instruments to any impacts and do not knock it. Doing so may cause malfunctions.

- Any repairs to the instrument must be performed by agencies authorized by Taiwan Advanced Nanotech Inc.

- Only use the original spare parts supplied by Taiwan Advanced Nanotech Inc on the instrument.

- If the equipment is used in a manner not specified by the manufacturer, the protection given by the instrument may be impaired or invalid.

1. Introduction

About

Maelstrom 9610 LH is easily integrated into Liquid Handling Workstation, introducing a new tip sensor which automatically reminds user that the instrument is failure picking up or leaving tips.

Principle

Maelstrom 9610 LH uses patented magnetic beads, spin tips and reagent kits technologies , consisting of three major process: isolation, purification and concentration.

Intended Purpose/ Intended Use

The Maelstrom 9610 LH is intended for medical laboratory use by trained personnel in automation environments. The instrument is intended for automated transfer and processing of magnetic particles in a microplate format, to extract and purified nucleic acids from human samples. The purified nucleic acid can be used with any downstream application employing PCR-based qualitative, semi-quantitative and quantitative assays.

1. Introduction

Environmental Requirements

To avoid shortening the lifespan of the instrument, use Maelstrom 9610 LH in a location that meets the following criteria:

- Choose a location with good air circulation.
- Place Maelstrom 9610 LH on the table that can bear at least 30 kg
- Do not use Maelstrom 9610 LH in a location where is with huge temperature and humidity variability.
- Operate condition:
  Temperature: 10-40℃
  Relative humidity: 40-80%
- Storage and transport condition:
  Temperature: 5-50℃
  Relative humidity: 20-85%
- Maximum operate altitude:
  2000m

1. Introduction

Safety Instructions and Guidelines

- This device can be used with potentially biohazardous materials. Use appropriate personal protective equipment (gloves, safety goggles, lab coat, etc.) for handling and disposing of biohazardous materials.

- Under a normal condition, sound pressure level from Maelstrom 9610LH does not exceed 80dB and does not cause a hazard. Please contact technical support for assistance in case of a higher sound pressure level.

- This device can be hazardous due to the use of chemical and biohazardous substances.

- Users should adhere to their institutional guidelines for the handling and disposal of all infectious substances used with this device.

- It is important to clean the device after every use. If samples or reagents have been spilled, clean the instrument immediately to avoid damage or contamination of samples.

- This device is to use with the compatible spin tips. Using incompatible spin tips may cause poor extraction performance.

- Read this user manual completely prior to operating the device. Failure to read, understand, and follow the instructions in the manual may result in damage to the device, injury to laboratory and operating personnel or poor performance.

- If any serious incident occurs, please report to the manufacturer and the competent authority of the member state in which the user and/or the patient is established.

1. Introduction

Safety Requirements

- The device has passed the tests and conformed to the standards of IEC 61010-1:2010+A1:2016 (Edition 3.1) and/ or EN 6010-1:2010+A1:2019, "Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements".

- The device has passed the tests and conformed to the standards of IEC 61010-2-101:2018 with IEC 61010-1:2010 + A1:2016 and/ or EN 61010-2-101:2017 with EN 61010-1:2010 + A1:2019, "Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-101: Particular requirements for in vitro diagnostic (IVD) medical equipment".

EMC Requirements

- The device has passed the tests and conformed to the standards of IEC 61326-1:2020 / EN IEC 61326-1:2021 & IEC 61326-2-6:2020 / EN IEC 61326-2-6:2021, "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-6: Particular requirements - In vitro diagnostic (IVD) medical equipment".

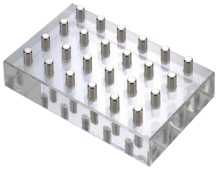
1. Introduction

Accessory

Following accessories may vary region-to-region.

Power cord

Transmission cable



Magnetic Base

Consumables

Maelstrom Switch 8 uses specially designed for optimal processing. Use of other types of pates may damage the instrument and compromise the warranty

96 deep well Plate

96 spin tip holder

96 spin tip

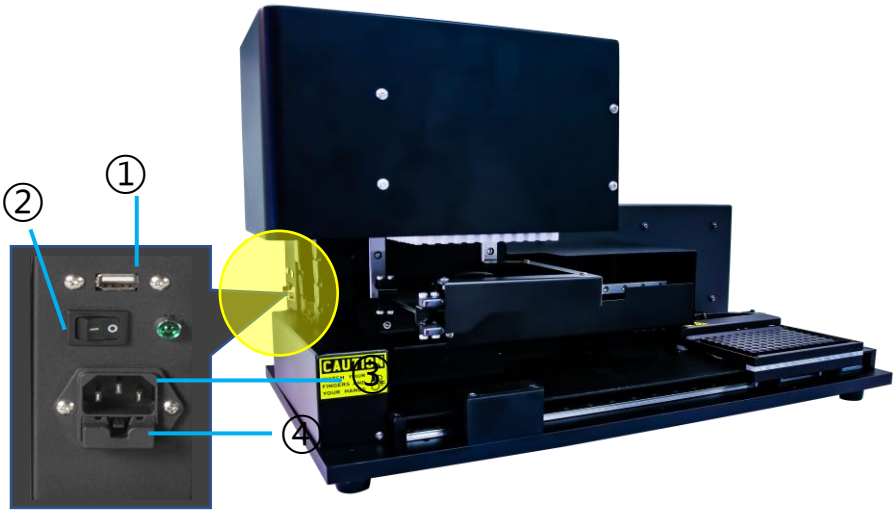
16 base B

16 auto tube

2. Instrument Overview

ITEM	SPECIFICATION
Model	Maelstrom 9610 LH
Weight	Approx.25kg
Dimensions	542(W) x 285(D) x 305(H)mm (Hamilton) 542(W) x 285(D) x 285(H)mm (Tecan)
Power rating	100~240Vac, 3.0A, 50/60Hz
Fuse	250V, 5.0A
Max. Throughput	96samples/run
Process volume	50~1,600µL
Spin speed	500~3,000rpm
Heater	1 independent heating plate
Temperate Range	RT to 130°C
Magnetic rod	>3,900 gauss
Collection Efficiency of Magnetic Particles	>95% Depending on sample and reagent kits. CV<3%.

2. Instrument Overview



① USB type A for connecting with PC

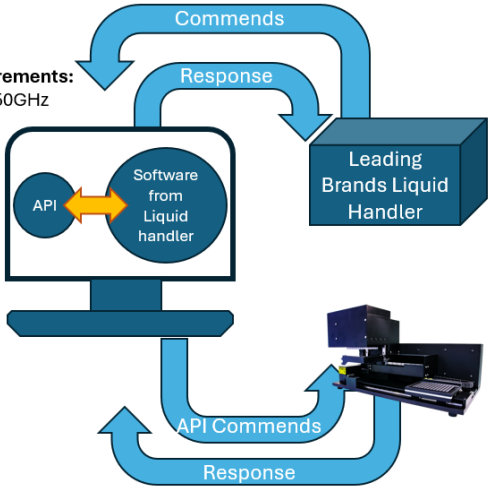
② Power switch

③ Power inlet

④ Fuse

Connections :

Computer minimum requirements:
Processor: Intel Core i5, 2.50GHz
RAM: 8 GB
OS: Windows 10



3. Installation & Get Started

Please note that this instrument weight is around 30kg, it is highly recommended to have 2 individuals or above to handle when taking it out from the box and be sure to work safety.

Step 1:
Take out the instrument from the box, 2 or more individuals is highly recommended.

Step 2:
Remove the cushions around the instrument.

Step 3:
Place the instrument on a flat table that bears over 30 kilograms.

Step 4:
Connect the power. Please note that this instrument is compatible with AC 100-240V power only. Using wrong power source will lead to malfunction or damage.

Step 5:
Connect the system to the computer (Window 10 OS, RAM >8G, Intel core i5 or above) through USB port.

Step 6:
Power on the instrument and it will perform initialization.

Step 7:
Operation protocols may vary between reagents. Please follow the protocols listed in the introduction manual for each reagent kit. General procedures will include:

a. Place the "Spin Tips Assembled Box" onto the heating block.
b. Mount the "Spin Tips" and replace it with the "Deep Well Plate" containing corresponding reagent.
c. Perform the following extraction procedure using the magnetic beads in the "Deep Well Plate" for transfer.
d. Replace the "Deep Well Plate" with other plates as needed to proceed.

4. Command List

Link Control Protocol

USB COM Port = STM32 Virtual COM Port
Baud Rate = 115200
Data Bit = 8
Stop Bit = 1
Parity Bit = None
By using \n – It prints a new line

WELL

	Plate Position	Volume	Action	Placehol der	Placehol der
WELL	2	{Volume}	{Action}	0	0

WELL function : Set up the volume and action

{Volume} : Specified as microliter range from 50 to 1600
{Action Type} : {0} Forward
{1} Reverse
{2} Forward U/D
{3} Reverse U/D

For example :
Send to M9610LH :
"WELL 2 800 0 0 0\n" {Volume=800µL}、{Action=0}

M9610LH Response
"WELL ACK\n" To respond after command received
"WELL OK\n" To respond after command accomplished

Any optional field for which there is no meaningful data contains a zero (0) or a space as a placeholder.

4. Command List

PMOV

	Plate Position
PMOV	{Plate Position}

PMOV function : Set up the plate position

{Plate Position} : {1} Move to left position (only using for 48 series)
{2} Move to right position
{3} Move to exchange position
{4} Distance from initial point 2 mm

For example :
Send to M9610LH :
"PMOV 2\n" {Plate Position = 2}

M9610LH Response :
"PMOV ACK\n" To respond after command received.
"GO_FRONT OK\r\n" To respond after shield plate moving to front limit position.
"PMOV OK\n" To respond after command accomplished.

4. Command List

PMIX

	Plate Position	Spin Time	Spin Speed
PMIX	2	{Spin Time}	{Spin Speed}

PMIX function : Set up spin time and speed

{Spin Time} : Specified as minutes from 0.1 to 60
{Spin Speed} : Specified as RPM from 500 to 3,000

For example :
Send to M9610LH :
"PMIX 2 0.5 3000\n" {Spin Time = 0.5(min)}
{Spin Speed = 3000(rpm)}

M9610LH Response :
"PMIX ACK\n" To respond after command received.
"GO_REAR OK\r\n" To respond after shield plate moving to rear limit position.
"PMIX GO\n" To respond after moving to the position and start the real mix action. The mix time would start to count down.
"PMIX OK\n" To respond after command accomplished.

4. Command List

PCOL

	Plate Position	Beads Collection
PCOL	2	{Collect Time}

PCOL function : Set up the collective time

{Collect Time} : Specified as minutes from 0.1 to 60

For example :
Send to M9610LH :
"PCOL 2 0.5\n" {Collect time = 0.5(min)}

M9610LH Response :
"PCOL ACK\n" To respond after command received.
"GO_REAR OK\r\n" To respond after shield plate moving to rear limit position
"PCOL POS1\n" To respond after moving to the position 1 and start the real collect action. The collect time would start to count down.
"PCOL POS2\n" To respond after moving to the position 2 and start the real collect action. The collect time would start to count down.
"PCOL POS3\n" To respond after moving to the position 3 and start the real collect action. The collect time would start to count down.
"PCOL POS4\n" To respond after moving to the position 4 and start the real collect action. The collect time would start to count down.
"PCOL POS5\n" To respond after moving to the position 5 and start the real collect action. The collect time would start to count down.
"PCOL OK\n" To respond after command accomplished.

4. Command List

PVAPOR

	Plate Position	Vapor time
PVAPOR	2	{Vapor Time}

PVAPOR Function : Set up the vapor time

{Vapor Time} : Specified as minutes from 0.1 to 60

For example :
Send to M9610LH :
"PVAPOR 2 0.5\n" {Vapor time=0.5(min)}

M9610LH Response:
"PVAPOR ACK\n" To respond after command received.
"GO_FRONT OK\r\n" To respond after shield plate moving to front limit position and start the real vapor action. The vapor time would start to count down.
"PVAPOR OK\n" To respond after command accomplished.

4. Command List

TMNT

	Plate Position
TMNT	2

TMNT function : Pick up tips
For example:

Send to M9610LH :
"TMNT 2\n"

M9610LH Response :

"TMNT ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position.
"TMNT OK\n"	To respond after command accomplished.

4. Command List

TEJT

	Plate Position
TEJT	2

TEJT function : Leave tips

For example :
Send to M9610LH :
"TEJT 2\n"

M9610LH Response :

"TEJT ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position.
"TEJT OK\n"	To respond after command accomplished.

4. Command List

TMPE

	Placeholder	Temperature
TMPE	0	{Temperature}

TMPE function : Set up the temperature

{Temperature} : Specified as degrees Celsius from RT to 130

For example :
Send to M9610LH :
"TMPE 0 40\n" {Temperature=40 (deg C)}

M9610LH Response :
"TMPE ACK\n" To respond after receiving command and start the heating process if necessary.
"TMPE OK\n" To respond after temperature reaches the target or after turning off the heating process.

Caution: Please turn off TMPE after heating process.

Send to M9610LH :
"TMPE 0 0\n" {Temperature = 0 (turn Off)}

M9610LH Response :
"TMPE ACK\n" To respond after receiving command and start the heating process if necessary.
"TMPE OK\n" To respond after temperature reaches the target or after turning off the heating process.

4. Command List

PAUSE

	Pause or Resume
PAUSE	{Pause or Resume}

PAUSE function : PAUSE is only using during spinning period

{Pause or Resume} : {0} Resume
{1} Pause

For example :
Send to M9610LH :
"PMIX 2 0.5 3000\n"

M9610LH Response :

"PMIX ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position
"PMIX GO\n"	To respond after moving to the position and start the real mix action. The mix time would start to count down.

Send to M9610LH :

"PAUS 1\n"	pause mix command

M9610LH Response :

"PAUS ACK\n"	To respond after command received. The mix time would pause to count down.
"PAUS OK\n"	To respond after command accomplished.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position

4. Command List

PAUSE

Send to M9610LH :

"PAUS 0\n"	resume mix command

M9610LH Response :

"PAUS ACK\n"	To respond after command received.
"PAUS OK\n"	To respond after command accomplished.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"PMIX GO\n"	To respond after moving to the position and start the real mix action. The mix time would resume to count down.
"PMIX OK\n"	To respond after command accomplished.

STOP

STOP function: The instrument will be reset and disconnected. And this function is only used for spinning period and idle.

For example :
Send to M9610LH :
"STOP\n"

M9610LH Response :

"STOP ACK\n"	To respond after command received.
"STOP OK\n"	To respond after command accomplished.

p.s. When the instrument is executing a STOP order, the stop process needs to be accomplished. Otherwise, the operator can't give a command.

ORIGIN

ORIGIN function: Three axis (X, Y and Z) moving to basis point

For example :
Send to M9610LH :
"ORIGIN\n"

M9610LH Response :

"ORIGIN ACK\n"	To respond after command received.
"ORIGIN OK\n"	To respond after command accomplished.

4. Command List

Read Temp

ReadTemp function : Reading temperature

For example :
Send to M9610LH :
"ReadTemp\n"

M9610LH Response :
“ReadTemp 0.00 19.79\n”

To respond after command received.
"ReadTemp {Placeholder (48LH only)} {Temperature}"

GetFWVer

GetFWVer function: Getting firmware version

For example :
Send to M9610LH :
"GetFWVer\n"

M9610LH Response :
“GetFWVer V1.0.0.2T1_9610LH\n”
To respond after command received.
"GetFWVer {FW Version}"

4. Command List

TMPR

	Switch Temperature Sensor
TMPR	{Temperature Sensor Type}

TMPR function: Control the temperature sensor

{Switch Temperature Sensor} : {0} Close
{1} Open

For example :
Send to M9610LH :
"TMPR 1\n" Open TMPR

M9610LH Response :
"TMPR ACK\n" To respond after command received.

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.54 48.18\n”
To respond after command received.
{Temperature = 48.18}

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.55 48.18\n”
To respond after command received.
{Temperature = 48.18}

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.55 44.47\n”
To respond after command received.
{Temperature = 44.47}

4. Command List

TMPR

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
"ReadTemp 478.55 44.40\n"
To respond after command received.
{Temperature= 44.40}

Send to M9610LH :
"TMPR 0\n" Close TMPR

M9610LH Response :
"TMPR ACK\n" To respond after command received.
"TMPR OK\n" To respond after command accomplished.

GetErrorCode

GetErrorCode function: Getting error code

For example :
Send to M9610LH :
"GetErrorCode\n"

M9610LH Response :
“GetErrorCode 1111111 00000030\n“
To respond after command received.
"GetErrorCode {state code(7 ASCII)} {error code(8 ASCII)}"

5. Parse “GetErrorCode” Response

1st argument: State code (7 ASCII)

1	2	3	4	5	6	7

Func 1 Plate state

1) Basis point
2) Remove position
3) Left position
4) Right position
5) Moving
6) Abnormal

Func 2 Mixing state

1) Normal
2) Spinning
3) Pause
4) Abnormal

Func 3 Collection state

1) Normal
2) Elution
3) Collection
4) Abnormal

Func 4 Heater state A (position2)

1) Stop heating
2) Reach setting temperature
3) Heating up
4) Cooling down
5) Abnormal

Func 5 Heater state B (position1)

1) Stop heating
2) Reach setting temperature
3) Heating up
4) Cooling down
5) Abnormal

Func 6 Tip state

1) Normal
2) Mounting
3) Ejecting
4) Abnormal

5. Parse “GetErrorCode” Response

1st argument: State code (7 ASCII)

1	2	3	4	5	6	7

Func 7 Vapor state

1) Normal
2) Vapor
3) Abnormal

5. Parse “GetErrorCode” Response

2nd argument: Error code (8 ASCII)

A	B	C	D	E	F	G	H

Func A X-axis motor

0) Normal
1) Unusual position
2) Limit deviate
3) Calibration failed

Func B Y-axis motor

0) Normal
1) Unusual position
2) Placeholder
3) Calibration failed

Func C Z-axis motor

0) Normal
1) Unusual position
2) Placeholder
3) Calibration failed

Func D Slew drive motor

0) Normal
1) Unusual rotational speed

Func E Drip-proof motor

0) Normal
1) Unusual front position
2) Unusual rear position

Func F Heater A (position2)

0) Normal
1) Over heating
2) Unusual heating time
3) Temperature issue

5. Parse “GetErrorCode” Response

2nd argument: Error code (8 ASCII)

A	B	C	D	E	F	G	H

Func G Heater B (position1)

0) Normal
1) Over heating
2) Unusual heating time
3) Not available
4) Temperature issue

Func H Tip

0) Normal
1) Unusual mounting
2) Unusual ejecting

6. Response Error Code

Error Code	Description
Motor X reset failed	X-axis motor reset failed
Motor X reset overtime	X-axis motor reset is overtime
Motor X move failed	X-axis motor move is failed
Motor Y reset failed	Y-axis motor reset is failed
Motor Y reset overtime	Y-axis motor reset is overtime
Motor Y move failed	Y-axis motor move is failed
Motor Z reset failed	Z-axis motor reset is failed
Motor Z reset overtime	Z-axis motor reset is overtime
Motor Z move failed	Z-axis motor move is failed
HeaterBoardA InValid Temp	Input invalid temperature value
Heater 2 heating up overtime	Heating plate heats up overtime
Heater 2 overheated	Heating plate is overheated
DC motor1 not reach target speed	Spin-DC motor do not reach target speed

6. Response Error Code

Error Code	Description
DC motor not reach target speed	Baffle-DC motor do not reach target speed
GO_BAFFLE TimeOut	Baffle moves to limited position overtime
GO_FRONT TimeOut	Baffle moves to front position overtime
GO_REAR TimeOut	Baffle moves to rear position overtime
Motor_GO_BAFFLE_err	Baffle motor is malfunction
PARAM Err	Input invalid parameter value
WELL_PARAM_Err	Input invalid WELL-parameter value
<CMD> BUSY	Instrument is busy
TMNT FAIL	Picking up tips is failed
TEJT FAIL	Leaving tips is failed
TMPE TempErr	Input invalid temperature value
Motor_GO_REMOVE_err	Plate moves to right position is failed
Motor_GO_REMOVE_SaveDataFail	Save position data to EEPROM is failed

7. Technical Support

In case of any questions, please try to contact our authorized distributor nearest to you. Taiwan Advance Nanotech Inc. provides post-sale services call number at +886-3-3167568 or via email: service@tanbead.com for assistance.

Please provide this instrument serial number when you talk to our technician, that will solve the problems efficiently and answer your questions more precisely.

8. Cleaning and Maintenance

- Clean the device after every use. When users detect samples or reagents have been spilled, clean the device immediately to avoid damage or contamination.
- Wear gloves and appropriate personal protective equipment. If the device is used with biohazardous materials, dispose of any cleaning materials used in accordance with your institutional guidelines.
- The device may go through a run with the magnetic rods unprotected. If this happens, the magnetic rod needs to be cleaned immediately.
- To clean the magnetic rods, wipe with a soft cloth dampened with pure water. Do not use alcohol solvent.
- If the magnetic rods cannot be cleaned, please contact TANBead (service@tanbead.com) for technical assistance.

9. Disposal

The decision whether to dispose of a potentially contaminated medical device is usually made by the owner in consultation with appropriate federal, state, and local authorities. In determining which medical devices should be discarded, the owner must assess each product's current condition and potential safety risks.

10. Patent

Patent List	
USA	US09616398B2
EU	EP2937136
Canada	CA2862946
Japan	JP6151735B2
Korea	KR101696517B1
China	CN104971638B
Taiwan	TWI526245B
WIPO	WO2016127292

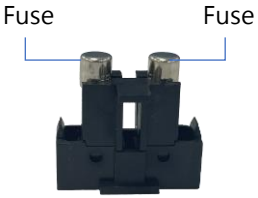
11. About Manufacturer

- **Manufacturer**：Taiwan Advanced Nanotech Inc.
- **Manufacturer Address**：6F, No. 188, Wenhe Rd. Guishan Dist., Taoyuan City 333, Taiwan
- **Manufacturer Tel**： +886-3-3167568

12. Appendix

Specification of Fuse:

- UL recognized component
- 5A, 250Vac x2pcs
- Size 5.2Φ x 20mm



Precautions

The following safety precautions will prevent injury to personnel and damage to equipment. There are the MINIMUM safety precautions for replacing fuse(s).

1. Turn the power off and discharge the circuit before removing a blown fuse.
2. Use a fuse puller (an insulated tool) when you remove a fuse from a clip-type fuseholder.
3. Please always replace the faulty fuse(s) with one equal in size, amperage, rating and type.
4. Turn the main power switch back on and see if electricity is restored.

Taiwan Advanced Nanotech

Maelstrom 9610 LH

使用手冊

台灣圓點奈米技術股份有限公司
台灣圓點核酸自動萃取儀(未滅菌)

039.L1601.X01Rev V1.2

目錄

About Manual

The label on the instrument, the User Manual, and other packaging material may contain following symbols:

型號

序號

保險絲規格

製造商

製造日期

CE標誌

使用說明書

注意未滅菌

注意生物危害

注意高溫

注意機械夾手

廢棄物電子電機設備指令

操作溫度限制

保持乾燥

遠離陽光

關於儀器

警告

- 請使用符合銷售國家標準指定電壓、電源線。
- 請勿使用損壞電源線或鬆動電源插座。
- 請勿放置液體於儀器上方，避免傾倒導致儀器損壞或故障。
- 斷開插座時請握緊儀器插頭，請勿拉扯電源線。
- 儀器清潔保養時，請關閉電源並斷開插座。
- 疑似雷擊時，請立即關閉電源並斷開插座

關於儀器

繁體中文

注意事項

- 請勿撞擊、敲打儀器，造成儀器故障損壞
- 未經製售商許可，請勿嘗試維修、改裝，造成儀器故障損壞。
- 儀器維修須經由台灣圓點奈米技術股份有限公司、授權製售商工程師操作進行。
- 儀器維修須經由台灣圓點奈米技術股份有限公司、授權製售商提供原廠零組件。
- 請依照台灣圓點奈米技術股份有限公司、授權製售商提供指示使用儀器。

1. 簡介

Maelstrom 9610 LH 可以整合到移液系統工作站，提高分子診斷實驗室的生產力，提供常規性操作流程轉變為無人化核酸萃取的最佳解決方案。

運作原理

使用磁棒收集和轉移磁珠，並使用旋轉套混合檢體及緩衝液。提昇混合效率，延伸的磁棒可以有效地收集磁珠。在細胞裂解，吸附核酸，洗滌和洗脫後獲得純化的核酸。

預期用途

Maelstrom 9610 LH為純化及分離核酸之自動化操作平台，藉由磁珠從檢體中萃取、純化核酸。建議搭配使用台灣圓點奈米技術股份有限公司核酸萃取試劑相關套組，以獲得最佳的萃取純化效能。

1. 簡介

環境要求

避免減少儀器的使用壽命，請滿足以下條件使用本產品:

- 室內使用，避免溫差或濕度較大的空間
- 儀器須放置在可承載至少30公斤的平台桌面或平台上
- 操作環境要求:
  溫度: 10-40℃
  相對溼度: 40-80%
- 儲存和運輸環境要求:
  溫度: 5-50℃
  相對溼度: 20-85%
- 使用高度要求:
  低於海拔2000米

1. 簡介

安全說明及指南

- 此儀器使用在具有潛在生物危害物質實驗時，需做好個人防護措施(手套、護目鏡、實驗服等)

- 在正常情況下，本產品運作時聲音不超過80分貝並造成危害，如果產生較高的分貝，請聯繫技術支援。

- 由於使用化學及生物危害物質，本設備可能存在危險。

- 使用者應遵守其所屬機構規範，處理和棄置本設備使用的所有感染性物質。

- 每次使用後需清潔儀器，若樣品或試劑打翻沾染至儀器上，請立即清潔，避免損壞或污染其他實驗樣品。

- 此儀器需與台灣圓點奈米提供之特定旋轉套一起使用，否則可能導致萃取效果不佳。

- 操作儀器前，請完整閱讀此操作說明手冊，未能閱讀、理解並遵循手冊之說明，可能導致設備損壞、操作人員受傷或實驗結果不佳。

1. 簡介

安全規範

- Maelstrom 9610 LH 設備已通過測試並符合 IEC 61010-1:2010+A1:2016 (Edition 3.1) and EN 6010-1:2010+A1:2019 《測量、控制和實驗室用電氣設備的安全要求 - 第 1 部分：一般要求》的標準。

- Maelstrom 9610 LH 設備已通過測試並符合 IEC 61010-2-101:2018 with IEC 61010-1:2010 + A1:2016 and EN 61010-2-101:2017 with EN 61010-1:2010 + A1:2019標準《測量、控制和實驗室用電氣設備的安全要求 - 第 2-101 部分：體外診斷 (IVD) 的特殊要求》 醫用器材”。

電磁相容

- Maelstrom 9610 LH 設備已通過測試並符合 IEC 61326-1:2020 / EN IEC 61326-1:2021 & IEC 61326-2-6:2020 / EN IEC 61326-2-6:2021 標準，“測量、控制和實驗室用電氣設備 - EMC 要求 - 第 2-6 部分：特殊要求 - 體外診斷 (IVD) 醫療設備”。

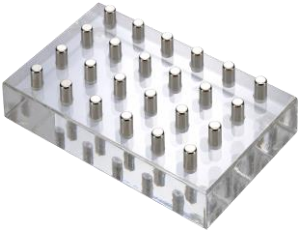
1. 簡介

配件清單

儀器所檢附之配件，會依各國家而有所不同。

電源線

傳輸線



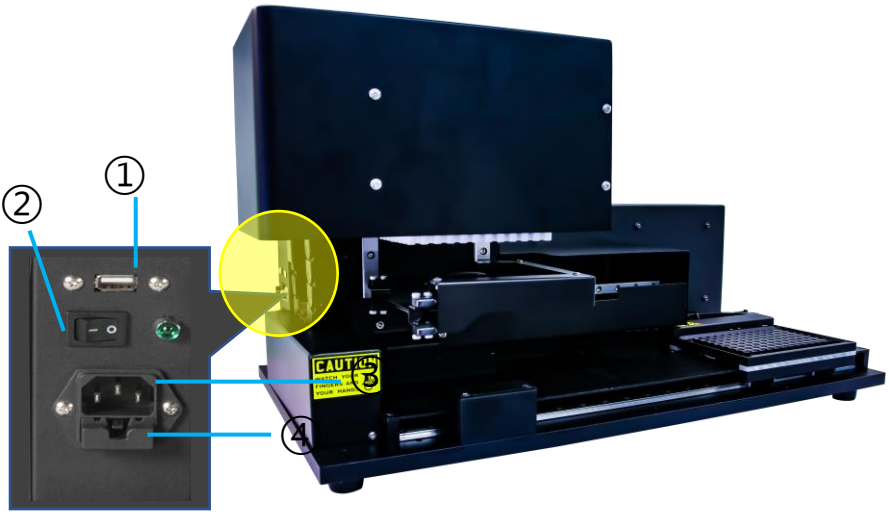
磁座

旋轉套組合包

儀器概述

項目	規格
型號	Maelstrom 9610 LH
Weight	約25公斤
材積	542(寬) x 285(深) x 305(高)毫米 (Hamilton) 542(寬) x 285(深) x 285(高)毫米 (Tecan)
電器規格	100-240伏特, 50/60赫茲, 3.0安培 (Class I)
保險絲規格	250伏特, 5.0安培
最大通量	96樣品/次
試劑體積	50~1,600毫升
攪拌速度	500~3,000轉
加熱模組	1組獨立加熱盤
磁棒規格	>3,900高斯

儀器概述



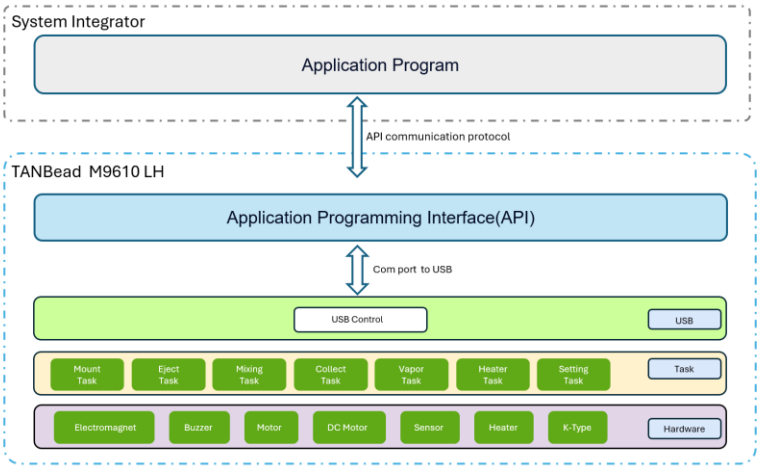
① 傳輸線接口

② 電源開關

③ 電源接口

④ 保險絲

通訊示意圖：



3. 安裝注意事項

請注意本產品的重量約30公斤，從包裝箱中取出本產品進行安裝時，建議2人以上一起搬運並請特別注意安全。

步驟 1:
自包裝箱中取出儀器。

步驟 2:
移除緩衝材。

步驟 3:
將儀器搬運至可承載30公斤以上的桌面或是平台。

步驟 4:
接上電源線，請注意本產品僅適用電壓100-240伏特，錯誤的電源會導致運作異常或對儀器造成損壞。

步驟 5:
連接機器上USB通訊線到電腦上。

步驟 6:
打開電源，儀器將自動進行復位動作。

步驟 7:
操作流程會依照試劑不同而不同，請遵循試劑的使用說明書進行設定程式，一般操作流程包括：

a. 放置旋轉套組合包到移動平台上
b. 插取旋轉套，置換成反應盤
c. 混合並吸取磁珠進行轉移到其他反應盤
d. 依序置換不同的反應盤以完成萃取試驗

4. 指令列表

Link Control Protocol

USB COM Port = STM32 Virtual COM Port
Baud Rate = 115200
Data Bit = 8
Stop Bit = 1
Parity Bit = None
By using \n – It prints a new line

WELL

	Plate Position	Volume	Action	Placehol der	Placehol der
WELL	2	{Volume}	{Action}	0	0

WELL function : Set up the volume and action

{Volume} : Specified as microliter range from 50 to 1600
{Action Type} : {0} Forward
{1} Reverse
{2} Forward U/D
{3} Reverse U/D

For example :
Send to M9610LH :
"WELL 2 800 0 0 0\n" {Volume=800µL}、{Action=0}

M9610LH Response
"WELL ACK\n" To respond after command received
"WELL OK\n" To respond after command accomplished

Any optional field for which there is no meaningful data contains a zero (0) or a space as a placeholder.

4.指令列表

PMOV

	Plate Position
PMOV	{Plate Position}

PMOV function : Set up the plate position

{Plate Position} : {1} Move to left position (only using for 48 series)
{2} Move to right position
{3} Move to exchange position
{4} Distance from initial point 2 mm

For example :
Send to M9610LH :
"PMOV 2\n" {Plate Position = 2}

M9610LH Response :
"PMOV ACK\n" To respond after command received.
"GO_FRONT OK\r\n" To respond after shield plate moving to front limit position.
"PMOV OK\n" To respond after command accomplished.

4.指令列表

PMIX

	Plate Position	Spin Time	Spin Speed
PMIX	2	{Spin Time}	{Spin Speed}

PMIX function : Set up spin time and speed

{Spin Time} : Specified as minutes from 0.1 to 60
{Spin Speed} : Specified as RPM from 500 to 3,000

For example :
Send to M9610LH :
"PMIX 2 0.5 3000\n" {Spin Time = 0.5(min)}
{Spin Speed = 3000(rpm)}

M9610LH Response :
"PMIX ACK\n" To respond after command received.
"GO_REAR OK\r\n" To respond after shield plate moving to rear limit position.
"PMIX GO\n" To respond after moving to the position and start the real mix action. The mix time would start to count down.
"PMIX OK\n" To respond after command accomplished.

4.指令列表

繁體中文

PCOL

	Plate Position	Beads Collection
PCOL	2	{Collect Time}

PCOL function : Set up the collective time

{Collect Time} : Specified as minutes from 0.1 to 60

For example :
Send to M9610LH :
"PCOL 2 0.5\n" {Collect time = 0.5(min)}

M9610LH Response :
"PCOL ACK\n" To respond after command received.
"GO_REAR OK\r\n" To respond after shield plate moving to rear limit position
"PCOL POS1\n" To respond after moving to the position 1 and start the real collect action. The collect time would start to count down.
"PCOL POS2\n" To respond after moving to the position 2 and start the real collect action. The collect time would start to count down.
"PCOL POS3\n" To respond after moving to the position 3 and start the real collect action. The collect time would start to count down.
"PCOL POS4\n" To respond after moving to the position 4 and start the real collect action. The collect time would start to count down.
"PCOL POS5\n" To respond after moving to the position 5 and start the real collect action. The collect time would start to count down.
"PCOL OK\n" To respond after command accomplished.

4.指令列表

PVAPOR

	Plate Position	Vapor time
PVAPOR	2	{Vapor Time}

PVAPOR Function : Set up the vapor time

{Vapor Time} : Specified as minutes from 0.1 to 60

For example :
Send to M9610LH :
"PVAPOR 2 0.5\n" {Vapor time=0.5(min)}

M9610LH Response:
"PVAPOR ACK\n" To respond after command received.
"GO_FRONT OK\r\n" To respond after shield plate moving to front limit position and start the real vapor action. The vapor time would start to count down.
"PVAPOR OK\n" To respond after command accomplished.

繁體中文

4.指令列表

繁體中文

TMNT

	Plate Position
TMNT	2

TMNT function : Pick up tips
For example:

Send to M9610LH :
"TMNT 2\n"

M9610LH Response :

"TMNT ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position.
"TMNT OK\n"	To respond after command accomplished.

4.指令列表

TEJT

	Plate Position
TEJT	2

TEJT function : Leave tips

For example :
Send to M9610LH :
"TEJT 2\n"

M9610LH Response :

"TEJT ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position.
"TEJT OK\n"	To respond after command accomplished.

4.指令列表

TMPE

	Placeholder	Temperature
TMPE	0	{Temperature}

TMPE function : Set up the temperature

{Temperature} : Specified as degrees Celsius from RT to 130

For example :
Send to M9610LH :
"TMPE 0 40\n" {Temperature=40 (deg C)}

M9610LH Response :
"TMPE ACK\n" To respond after receiving command and start the heating process if necessary.
"TMPE OK\n" To respond after temperature reaches the target or after turning off the heating process.

Caution: Please turn off TMPE after heating process.

Send to M9610LH :
"TMPE 0 0\n" {Temperature = 0 (turn Off)}

M9610LH Response :
"TMPE ACK\n" To respond after receiving command and start the heating process if necessary.
"TMPE OK\n" To respond after temperature reaches the target or after turning off the heating process.

4.指令列表

PAUSE

	Pause or Resume
PAUSE	{Pause or Resume}

PAUSE function : PAUSE is only using during spinning period

{Pause or Resume} : {0} Resume
{1} Pause

For example :
Send to M9610LH :
"PMIX 2 0.5 3000\n"

M9610LH Response :

"PMIX ACK\n"	To respond after command received.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position
"PMIX GO\n"	To respond after moving to the position and start the real mix action. The mix time would start to count down.

Send to M9610LH :

"PAUS 1\n"	pause mix command

M9610LH Response :

"PAUS ACK\n"	To respond after command received. The mix time would pause to count down.
"PAUS OK\n"	To respond after command accomplished.
"GO_FRONT OK\r\n"	To respond after shield plate moving to front limit position

繁體中文

4.指令列表

PAUSE

Send to M9610LH :

"PAUS 0\n"	resume mix command

M9610LH Response :

"PAUS ACK\n"	To respond after command received.
"PAUS OK\n"	To respond after command accomplished.
"GO_REAR OK\r\n"	To respond after shield plate moving to rear limit position.
"PMIX GO\n"	To respond after moving to the position and start the real mix action. The mix time would resume to count down.
"PMIX OK\n"	To respond after command accomplished.

STOP

STOP function: The instrument will be reset and disconnected. And this function is only used for spinning period and idle.

For example :
Send to M9610LH :
"STOP\n"

M9610LH Response :

"STOP ACK\n"	To respond after command received.
"STOP OK\n"	To respond after command accomplished.

p.s. When the instrument is executing a STOP order, the stop process needs to be accomplished. Otherwise, the operator can't give a command.

ORIGIN

ORIGIN function: Three axis (X, Y and Z) moving to basis point

For example :
Send to M9610LH :
"ORIGIN\n"

M9610LH Response :

"ORIGIN ACK\n"	To respond after command received.
"ORIGIN OK\n"	To respond after command accomplished.

4.指令列表

Read Temp

ReadTemp function : Reading temperature

For example :
Send to M9610LH :
"ReadTemp\n"

M9610LH Response :
“ReadTemp 0.00 19.79\n”

To respond after command received.
"ReadTemp {Placeholder (48LH only)} {Temperature}"

GetFWVer

GetFWVer function: Getting firmware version

For example :
Send to M9610LH :
"GetFWVer\n"

M9610LH Response :
“GetFWVer V1.0.0.2T1_9610LH\n”
To respond after command received.
"GetFWVer {FW Version}"

4.指令列表

TMPR

	Switch Temperature Sensor
TMPR	{Temperature Sensor Type}

TMPR function: Control the temperature sensor

{Switch Temperature Sensor} : {0} Close
{1} Open

For example :
Send to M9610LH :
"TMPR 1\n" Open TMPR

M9610LH Response :
"TMPR ACK\n" To respond after command received.

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.54 48.18\n”
To respond after command received.
{Temperature = 48.18}

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.55 48.18\n”
To respond after command received.
{Temperature = 48.18}

Send to M9610LH :
"ReadTemp\n" Read temperature command

M9610LH Response :
“ReadTemp 478.55 44.47\n”
To respond after command received.
{Temperature = 44.47}

4.指令列表

TMPR

Send to M9610LH :
"ReadTemp\n"　　Read temperature command

M9610LH Response :
"ReadTemp 478.55 44.40\n"
　　To respond after command received.
　　{Temperature= 44.40}

Send to M9610LH :
"TMPR 0\n"　　Close TMPR

M9610LH Response :
"TMPR ACK\n"　　To respond after command received.
"TMPR OK\n"　　To respond after command accomplished.

GetErrorCode

GetErrorCode function: Getting error code

For example :
Send to M9610LH :
"GetErrorCode\n"

M9610LH Response :
“GetErrorCode 1111111 00000030\n“
　　To respond after command received.
　　"GetErrorCode {state code(7 ASCII)} {error code(8 ASCII)}"

5. “GetErrorCode” 指令回傳對照表

1st argument: State code (7 ASCII)

1	2	3	4	5	6	7

Func 1 Plate state

1) Basis point
2) Remove position
3) Left position
4) Right position
5) Moving
6) Abnormal

Func 2 Mixing state

1) Normal
2) Spinning
3) Pause
4) Abnormal

Func 3 Collection state

1) Normal
2) Elution
3) Collection
4) Abnormal

Func 4 Heater state A (position2)

1) Stop heating
2) Reach setting temperature
3) Heating up
4) Cooling down
5) Abnormal

Func 5 Heater state B (position1)

1) Stop heating
2) Reach setting temperature
3) Heating up
4) Cooling down
5) Abnormal

Func 6 Tip state

1) Normal
2) Mounting
3) Ejecting
4) Abnormal

5. “GetErrorCode” 指令回傳對照表

1st argument: State code (7 ASCll)

1	2	3	4	5	6	7

Func 7 Vapor state

1) Normal
2) Vapor
3) Abnormal

5. “GetErrorCode” 指令回傳對照表

2nd argument: Error code (8 ASCII)

A	B	C	D	E	F	G	H

Func A X-axis motor

0) Normal
1) Unusual position
2) Limit deviate
3) Calibration failed

Func B Y-axis motor

0) Normal
1) Unusual position
2) Placeholder
3) Calibration failed

Func C Z-axis motor

0) Normal
1) Unusual position
2) Placeholder
3) Calibration failed

Func D Slew drive motor

0) Normal
1) Unusual rotational speed

Func E Drip-proof motor

0) Normal
1) Unusual front position
2) Unusual rear position

Func F Heater A (position2)

0) Normal
1) Over heating
2) Unusual heating time
3) Temperature issue

5. “GetErrorCode” 指令回傳對照表

2nd argument: Error code (8 ASCII)

A	B	C	D	E	F	G	H

Func G Heater B (position1)

0) Normal
1) Over heating
2) Unusual heating time
3) Not available
4) Temperature issue

Func H Tip

0) Normal
1) Unusual mounting
2) Unusual ejecting

6.錯誤訊息對照表

錯誤代碼	解析
Motor X reset failed	X軸馬達復位失敗
Motor X reset overtime	X軸馬達復位逾時
Motor X move failed	X軸馬達移動失敗
Motor Y reset failed	Y軸馬達復位失敗
Motor Y reset overtime	Y軸馬達復位逾時
Motor Y move failed	Y軸馬達移動失敗
Motor Z reset failed	Z軸馬達復位失敗
Motor Z reset overtime	Z軸馬達復位逾時
Motor Z move failed	Z軸馬達移動失敗
HeaterBoardA InValid Temp	加熱盤A輸入溫度無效
Heater 2 heating up overtime	加熱盤A加熱超時
Heater 2 overheated	加熱盤A過熱
DC motor1 not reach target speed	攪拌DC馬達轉速未達目標值

6. 錯誤訊息對照表

錯誤代碼	解析
DC motor not reach target speed	擋板DC馬達轉速未達目標值
GO_BAFFLE TimeOut	擋板到達極限位置超時
GO_FRONT TimeOut	擋板移動至前極限超時
GO_REAR TimeOut	擋板移動至後極限超時
Motor_GO_BAFFLE_err	擋板馬達異常
PARAM Err	指令參數錯誤
WELL_PARAM_Err	WELL指令參數錯誤
<CMD> BUSY	儀器忙碌
TMNT FAIL	插套異常
TEJT FAIL	退套異常
TMPE TempErr	輸入錯誤溫度範圍
Motor_GO_REMOVE_err	孔盤移動至右極限超時
Motor_GO_REMOVE_SaveDataFail	儲存右極限位置至EEPROM異常

7. 技術支援

本產品提供完整的售後服務及技術支援，若使用上有任何問題，請嘗試聯繫離您最近的授權經銷商或原廠製售商。

電話: +886-3-3167568

信箱: service@tanbead.com

請在與我們的技術人員交談時提供此儀器序列號，將更有效地解決、回答問題。

8. 清潔保養須知

- 每次實驗後，當用戶檢測到樣品或試劑溢出時和請立即清潔設備，以免損壞或污染。
- 請戴上手套和適當的個人防護設備清潔儀器，並按照您的機構指南處理使用後的清潔用品。
- 儀器可能會在磁棒不受保護的情況下運行，發生這種情況，請立即清潔磁棒。
- 請使用純淨水和軟布擦拭清潔磁棒， 請勿使用酒精溶劑。
- 磁棒無法清潔時，請聯繫TANBead（電話：+886-3-3167568）尋求技術支援。

9. 儀器回收

適當處置可能受污染的醫療器械的決定通常由所有者與適當的聯邦、州和地方當局協商後做出。 在確定應丟棄哪些醫療設備時，所有者必須評估每個產品的當前狀況和潛在的安全風險。

10. 專利資訊

專利列表	
美國	US09616398B2
歐洲	EP2937136
加拿大	CA2862946
日本	JP6151735B2
韓國	KR101696517B1
中國	CN104971638B
台灣	TWI526245B
世界智慧財產權組織	WO2016127292

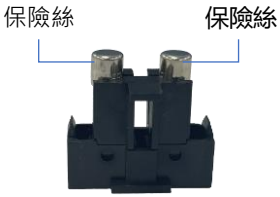
11. 製售商資訊

- 製售商名稱：台灣圓點奈米技術股份有限公司
- 製售商地址：333桃園市龜山區文禾路188號6樓
- 製售商電話：+886-3-3167568

12. 附錄

保險絲規格

- UL 認證元件
- 5A, 250Vac x 2
- 尺寸5.2Φ x 20mm



注意事項

1. 請關閉電源並使電路放電，再更換保險絲。
2. 請使用保險絲拉拔器拆卸保險絲。
3. 請使用尺寸、電流強度、額定值和類型相同的保險絲更換故障保險絲。
4. 請重新打開主電源開關，確認是否恢復供電。

MEMO

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Advanced
Nanotech

User Manual

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