DM lite 4K
User Manual

Revision 2.0 – Oct. 2023

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01.
Introduction

1.1. Manual Version

Revision 2.0 – Oct. 2023

1.2. Copyright

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1.3. Software and System Compatibility

This manual is applicable to hardware: DM lite 4K series, and DM lite plus series.
This manual is applicable to software: DM ctrl v1.1.

1.4. Instrument Manufacturing

acxel™
3F, Building B, Xingzhongchuang Centre, Nanhai, Foshan, China
Made in China

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1.7. Safety Statement

1.7.1. Warnings
A 'warning' statement indicates a danger. Reminding you to pay attention to a certain operation step, operation or similar problem. If you do not follow the prompts or do not follow the instructions properly, personal injury or death may result. Unless you have fully understood and met the conditions indicated, please do not ignore the "Warning" statement and continue.

1.7.2. Cautions
A 'caution' statement indicates a danger. Reminding you to pay attention to a certain operation step, an operation or a similar problem. If you do not follow the prompts or do not follow the instructions properly, the product may be damaged or important data may be lost. Do not ignore the caution prompt until you fully understand and meet the conditions indicated.

02.
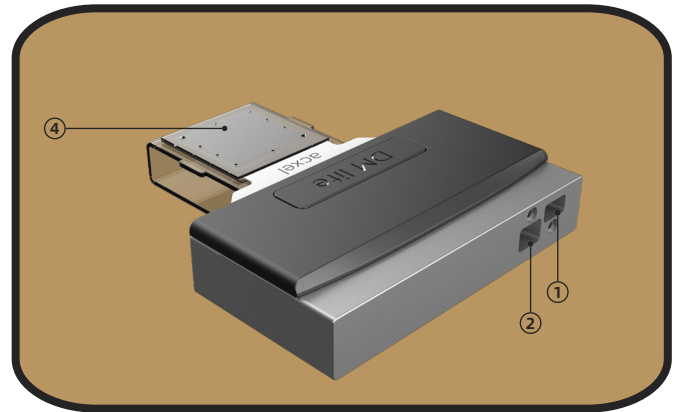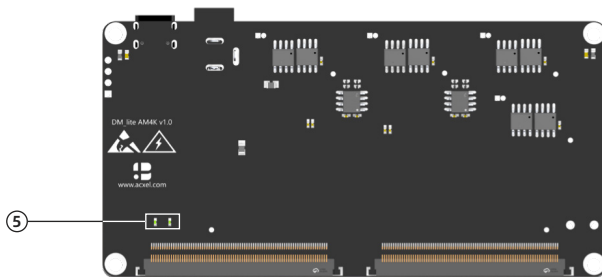# Device

2.1. Overall Components
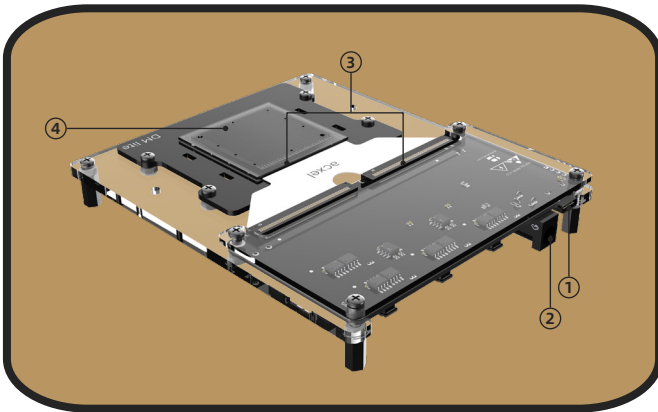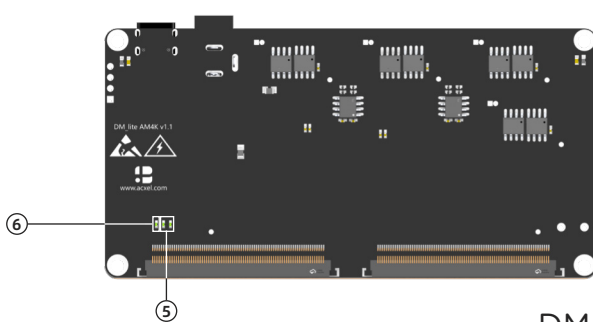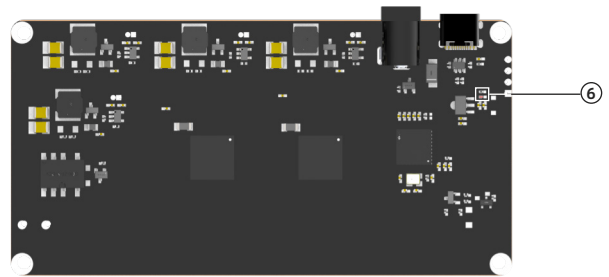

DM lite series

DM lite plus series

DM lite 4K v1.0

DM lite 4K v1.1

① Power socket
② Data cable socket
③ Chip connector

④ Chip (not included in this product)
⑤ Chip status indicators
⑥ Power indicator

2.2. Accessories Checklist

Category	Power Adapter	USB Cable
Quantity	1	1

## 2.3. Parameters

Typical Size	145mm×120mm×26mm (DM lite) 136.5mm×120mm×30mm (DM lite plus)
Typical Weight	104g (DM lite) 261g (DM lite plus)
Power Supply Requirement	5 V, 2 A
Temperature Requirement	10~30 °C
Voltage Setting Range	8~80 V
OS Compatibility	Windows 10, Windows 11

2.4. Safety Precautions

a. This device is intended for professional use only.
b. Please use the consumables recommended by acxel™ for this device.
c. Dropping or strong impacts may result in equipment malfunction or damage.
d. To prevent equipment damage or electric shock, it is important to avoid any liquids from flowing into the device.
e. In case of a malfunction, please discontinue the use of the device, immediately turn off the power, and unplug the power cable.
f. Follow the recommended troubleshooting methods. If you are unable to resolve the issue on your own, please contact acxel™'s after-sales engineer.

03.
Device Usage Instructions

3.1. Connecting Data and Power Cables
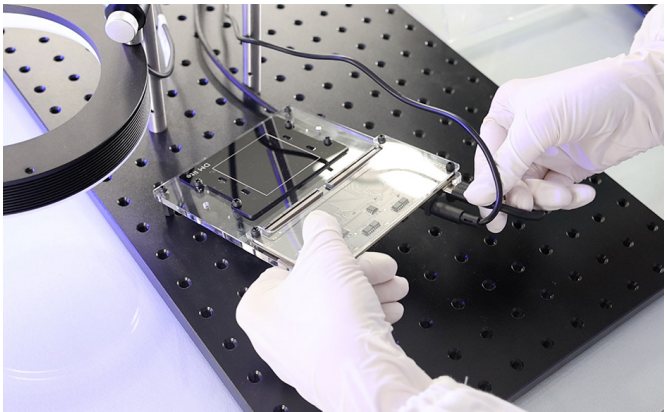
Connect the data and power cables, ensuring that the power supply meets the technical requirements. Once connected, the power indicator light will illuminate, indicating that the device has a proper power supply.

Cautions: Ensure the use of product-compatible power adapters, power cables, and data cables. The use of uncertified power adapters and cables may result in the device not functioning correctly which may cause permanent damage.

3.2. Unpack the chip

Open the chip packaging bag and take out the chip.

Cautions: Be sure to wear anti-static gloves when handling the chip. Static electricity may permanently damage some or all of the electrodes of the chip.

3.3. Connect the Chip

Tilt the chip at a 45° angle, insert the FPC into the chip connector, and then place the chip flat on the instrument. Ensure that the chip's flexible printed circuit (FPC) is inserted into the designated position of the connector, and securely lock the connector cover. Inspect the chip to ensure that the FPC is not skewed, or raised.

Cautions: Incorrect installation of the FPC may lead to issues such as damage to the chip connector, inability to connect the chip, or FPC deformation.

Cautions: Please ensure that the device is in a chip powered off state when installing the chip. Installing chips while powered on may cause chip damage.

Note: Please ensure that both the chip connector and the chip's FPC are clean to prevent a decline in chip connection quality and potential equipment damage.

3.4. Load the Medium Oil

For the chip model without a pipette guide sleeve:
Use a pipette to slowly add the medium oil into the oil inlet, until the chip is entirely filled. Typically, 150-200 µL of medium oil is sufficient to load the AM4K chip.
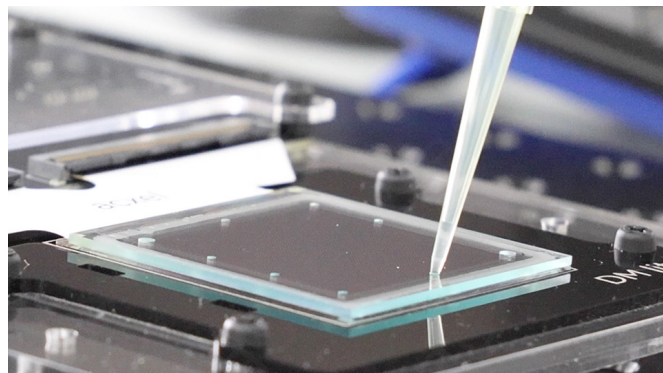
Please be aware that when loading the medium oil, it is essential to prevent the formation of air bubbles within the chip's electrode area, as they can affect droplet manipulation. An effective method for oil loading is to purge any air from the pipette nozzle before loading, and then proceed to fill it through the same inlet until entirely filled.

For the chip model equipped with a pipette guide sleeve:
Unscrew the cap of the oil bottle and position it above the chip's oil inlet. Carefully rupture the sealing film to enable the medium oil to flow into the interior of the chip, completely filling its volume.
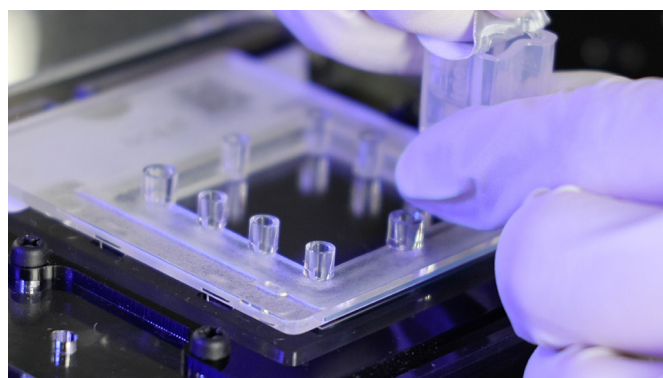
Notice: Always use medium oil certified by acxel™. Improper medium oil may cause a decrease in droplet handling performance and even chip damage.

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3.5. Power on the Chip

Open and log in to the DM ctrl software (refer to 4.1. Opening DM ctrl, and 4.2 Software Login). Click the 'Power' button. The indicator icon within the software will transition from red to green, while both chip status indicators on the device will illuminate, signifying a successful chip connection.
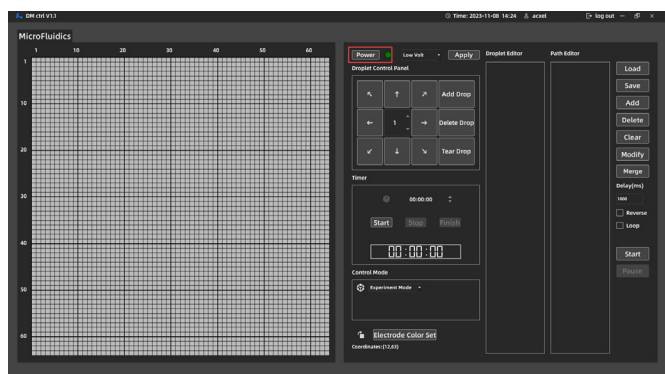

3.6. Set the Voltage

Click 'Apply' in the settings panel to set the voltage (refer to 4.6 Settings Panel).

3.7. Enable the Electrode

To draw a droplet preview for sample loading, hold down the left mouse button and draw an electrode area on the Electrode Map Panel (draw 4×4 area next to the inlet as an example). Click the 'Add Drop' button to add the previewed droplet as an actual droplet area. The corresponding electrode will be actuated when the droplet is added (refer to 4.8.1 Electrode Map Panel and 4.8.2 Droplet Editor Panel).
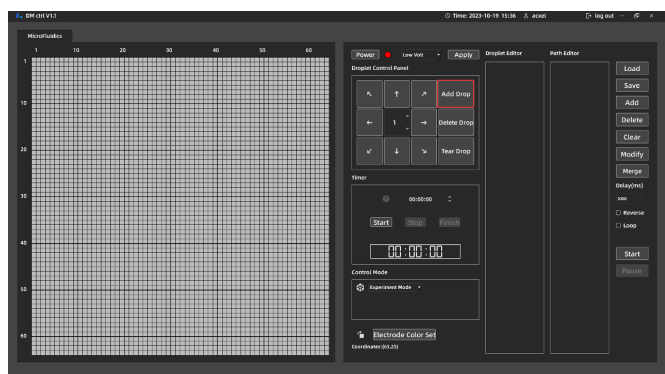
Or, you can import a path script file by clicking 'Load' on the Path Editor panel (refer to 4.9 Path Editor Panel). Double-click on the first step of the path in the Path Editor Panel to create the initial droplet. The 'Droplet Editor' will correspondingly show the added droplet, and the droplet will be activated according to the designated path.

3.8. Load the Sample

Load the sample into the corresponding sample inlet on the chip. Draw up 3 μL of sample (for an electrode area of 4×4 in this example). Using a lower sample volume is not recommended as it may not be properly injected onto the added droplet area.
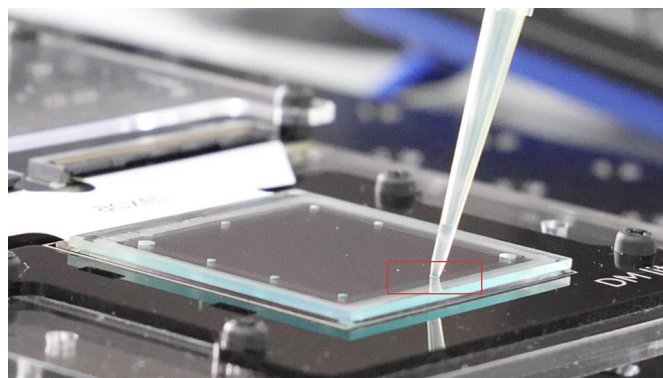
Please be aware that when loading the medium oil, it is essential to prevent the formation of air bubbles within the chip's electrode area, as they can affect droplet manipulation. An effective tip for sample loading is to purge any air from the pipette nozzle before loading, ensure the medium oil inside the chip is full, and ensure tip of the pipette is held vertically at the inlet.

Caution: Avoid any liquids from flowing into the device to prevent equipment damage or electric shock.

Note: At low or high temperatures, there may be differences in the flowability of reagents.

3.9. Start the Auto Path

After import a path script file ,or manually design a path script, the path step will show in the Path Editor panel (refer to 3.7. Enable the Electrode and 4.14. Path Editing Example).

Click 'Start', and the droplet will begin to move according to the designated path, completing the splitting process.
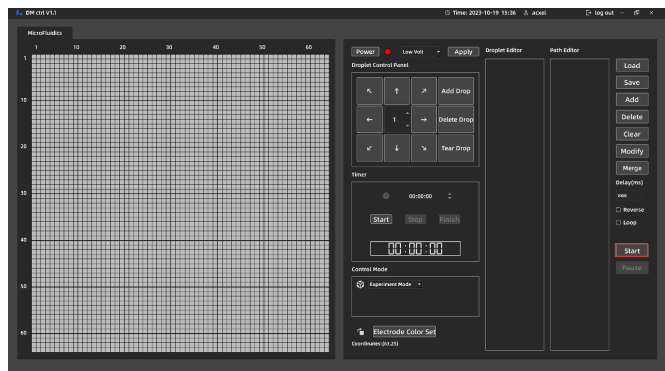
3.10. Power Off and Remove the Chip

Click the 'Power' button in the DM ctrl. The indicator light will transition from green to red, and the chip status indicator on the device will turn off, indicating that the chip's power supply has been disconnected.
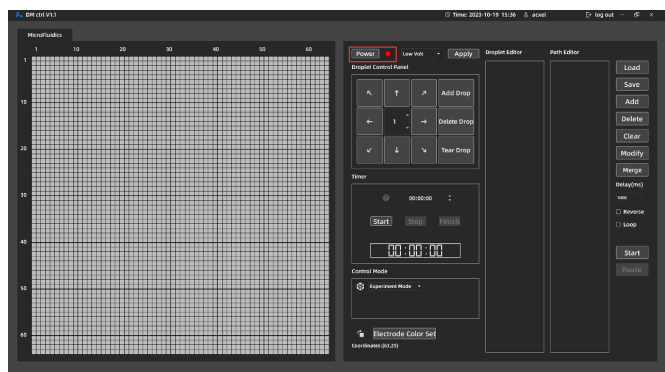
Please verify that the chip status indicator is indeed off. Subsequently, proceed to open the chip connector and carefully remove the chip.

Cautions: Do not attempt to connect or remove the chip while it is powered on, as this may result in hardware malfunctions.
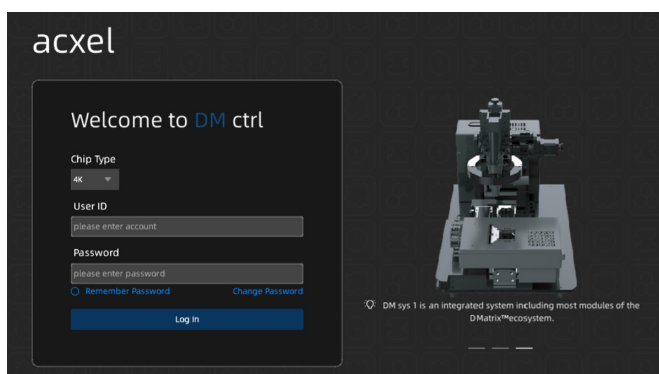
04.

DM ctrl Usage

4.1. Opening DM ctrl

Double-click the 'DM ctrl.exe' file within the software folder to open the software.
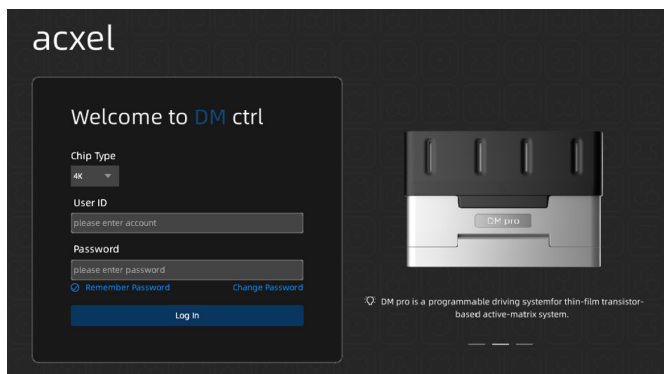

4.2. Software Login

Double-click the 'DM ctrl.exe' file within the software folder to open the software.


Launch the 'DM ctrl' software and log in using the provided username and password.

Note: Please be aware that a single account can only be utilised on a single hardware device. If you attempt to log in to an account currently in use on the other device, you will be unable to do so and will receive the corresponding error message. In such a situation, you will require an additional account or you must log out from the other device first.

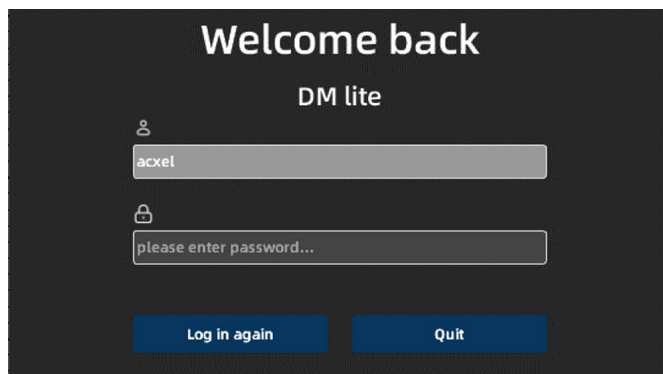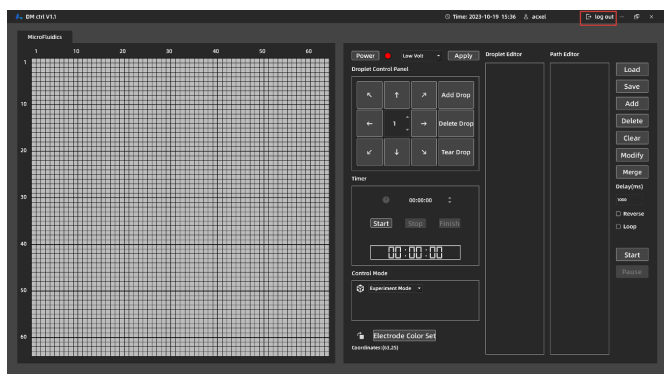Select 'Remember Password' to save your account password, eliminating the need to

When you need to change the password, you can click on 'Change Password' to start.
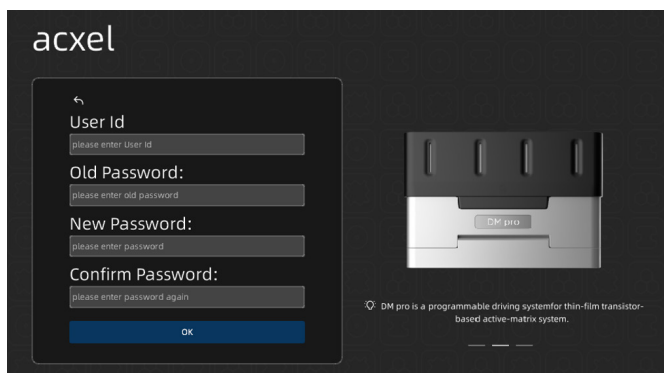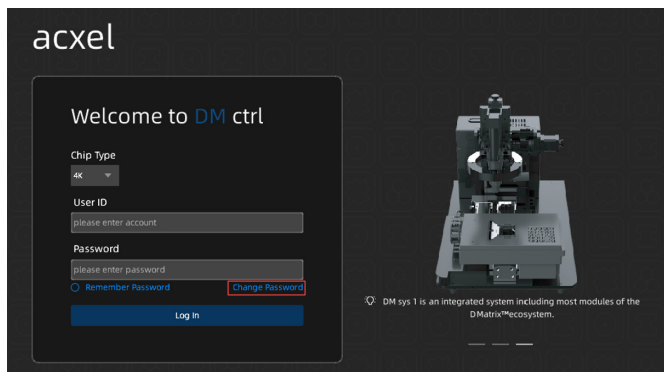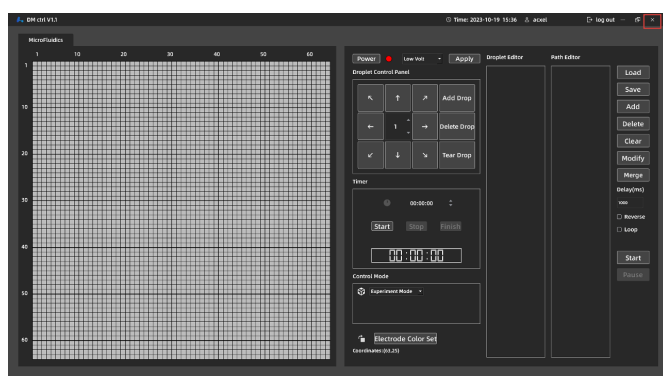

4.3. Software Logout

Click the 'log out' button to log your account out from the online database, allowing you to use this account on another device.
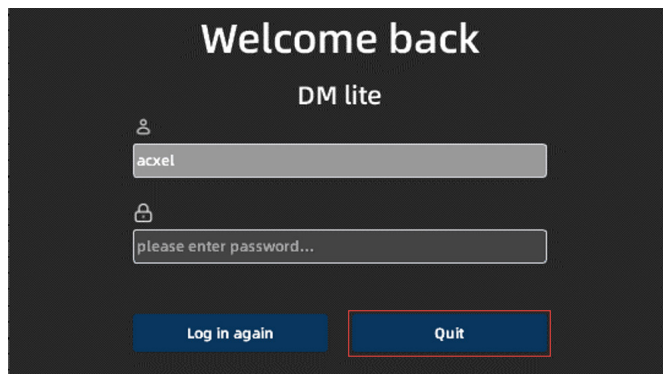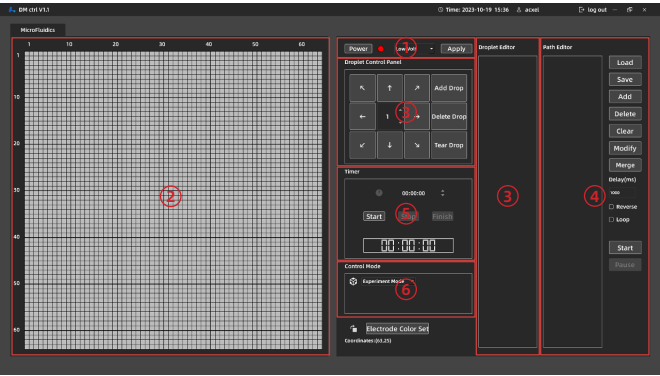

4.4. Closing DM ctrl

Click the '×' button in the upper right-hand corner to close the DM ctrl.

Alternatively, you can logout the DM ctrl first, click the 'Quit' button to close the DM ctrl and also logout of the account from the online database.

4.5. Interface Overview

Index	Component Name
①	Settings Panel
②	Electrode Map Panel
③	Droplet Editor Panel
④	Path Editor Panel
⑤	Timing Panel
⑥	Control Mode Selection Panel

4.6. Settings Panel

4.6.1. 'Power' button and power indicator

Power On/Off and Status Display. When the indicator is green, it indicates that the chip is powered, while red signifies that the chip is powered off.
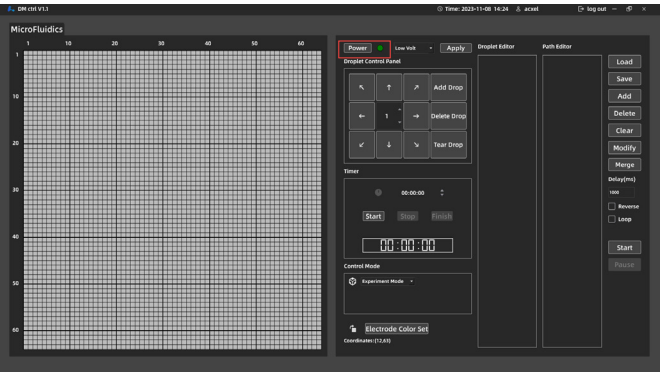

4.6.2. 'Apply' button and voltage selection

Provides three voltage profiles - Low, Medium, and High. Choose the voltage setting according to experimental requirements. It is generally recommended to use Low voltage profile unless there are specific requirements.
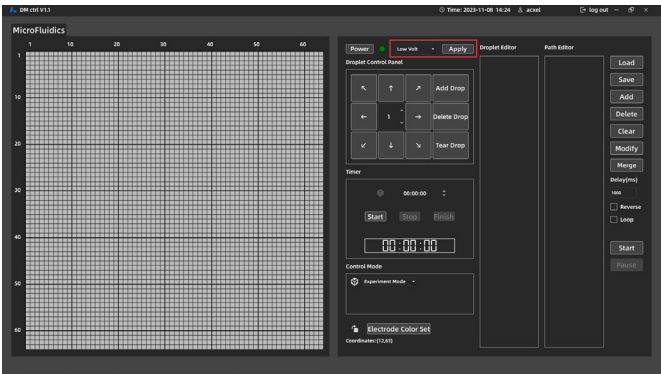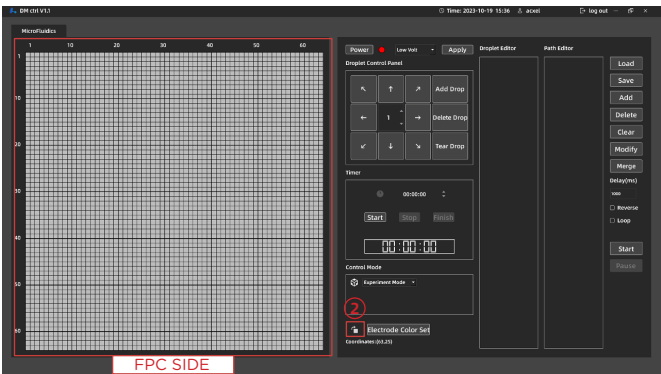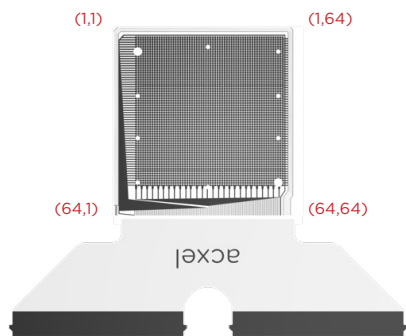
4.7.Electrode Map Panel

Alternatively, you can logout the DM ctrl first, click the 'Quit' button to close the DM ctrl and also logout of the account from the online database.
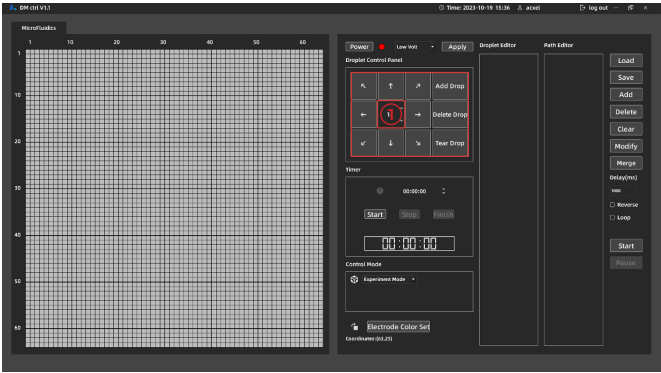

Note: Avoid using diagonal movement when moving droplets of size 1×1 or 1×2, as it may reduce the likelihood of successful droplet movement.

You can rotate the Electrode Map Panel to adapt the device placement using the button at mark ②.
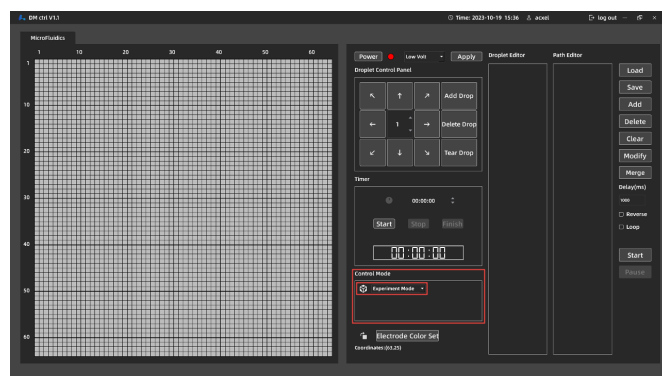
(1,1)   (1,64)

(64,1)   (64,64)

4.8. Droplet Editor Panel

Displays the coordinates and size of the powered area. The coordinates represent the top-left corner pixel of the selected area.

4.9. Path Editor Panel

Provides options for importing, adding, deleting, clearing, modifying, merging, running, looping, and reversing paths. Button functions include 'Load' for importing paths, 'Save' for saving paths, 'Add' for adding paths, 'Delete' for deleting paths, 'Clear' for clearing paths, 'Modify' for modifying paths, 'Merge' for merging paths, 'Reverse' for returning paths, 'Loop' for looping paths, 'Start' for starting paths, 'Pause' for stopping

paths, and 'Delay' for setting the time each step of the path remains. Refer to 4.14. Path Editing Example for detailed using examples.
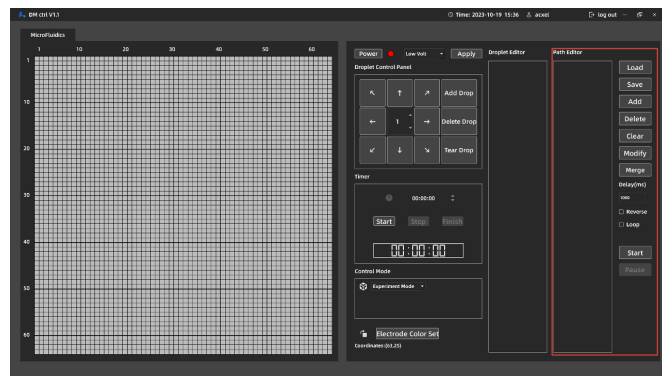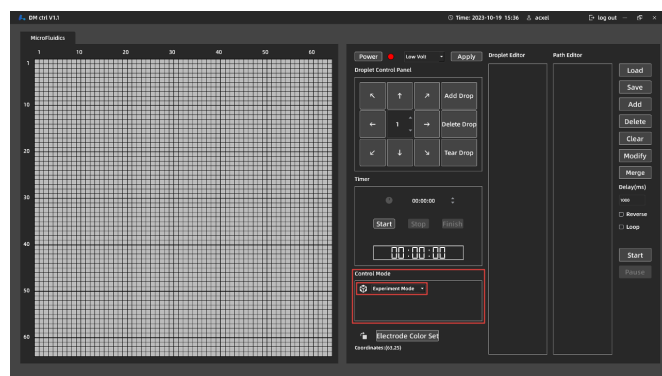

4.10. Control Mode Selection Panel

4.10.1. Experiment Mode
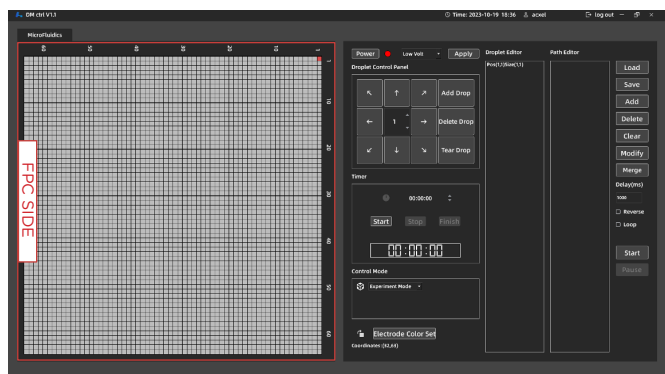Allows actions such as adding, deleting, and moving droplets.

4.10.2. Path Designer Mode
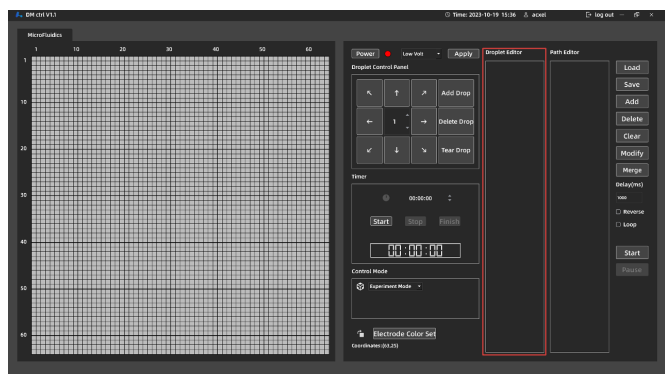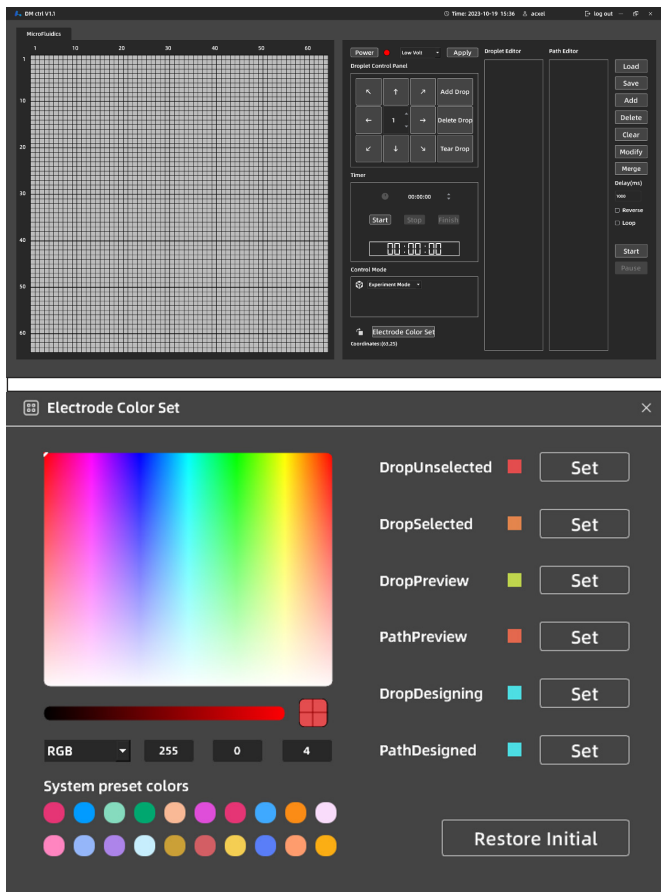Allows actions such as adding, deleting, and moving droplets.

4.11. Electrode Colour Set

You can customise the colour of the droplet in various states:

Droplet Type	Description
Drop Unselected	The added droplets, which can be listed in the Droplet Editor but are not currently selected.
Drop Selected	The presently selected droplet.
Drop Preview	The area that is selected but not yet added in the Electrode Map Panel.
Path Preview	The trail of droplets visited for the selected path in the Path Editor Panel.
Drop Designing	The node through which droplets are moved in Path Designer Mode.
Path Designing	The path trace along which droplets are moved in Path Designer Mode.

4.12. Timer Panel

Set the time, then click 'Start' to start the countdown, 'Stop' to pause, and 'Finish' to end.
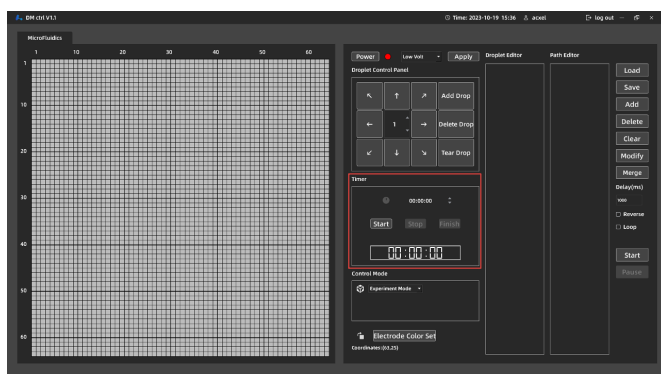

4.13. Shortcuts

| Key	Function
Key Board - Spacebar	Adds droplets when no droplet is selected and adds paths when a droplet is selected.
Key Board - Delete	Deletes droplets.
Key Board – W, A, S, D	Moves selected droplets.
Mouse - Scroll Wheel	Generates automatic splitting paths.

4.14. Path Editing Example

4.14.1. Continuous Movement in Path Designer

a. In the Electrode Map Panel, press and hold the left mouse button to select a 4x4 pixel electrode.
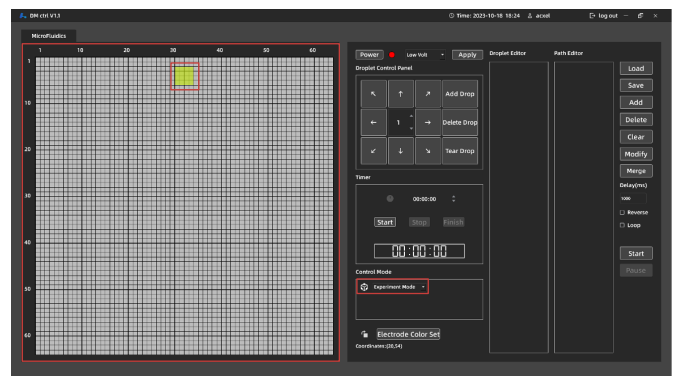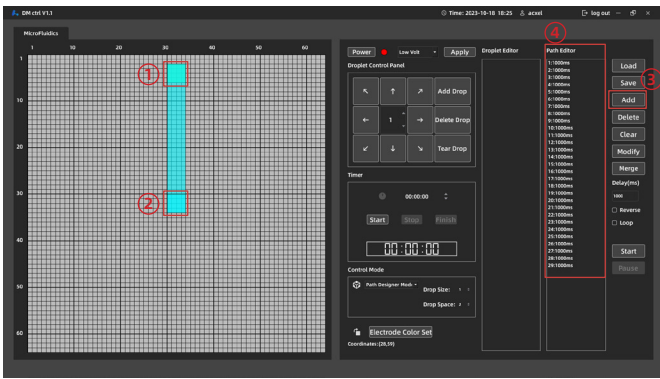

b. In the Control Mode Selection Panel, switch to 'Path Designer Mode' to enter path editing mode.
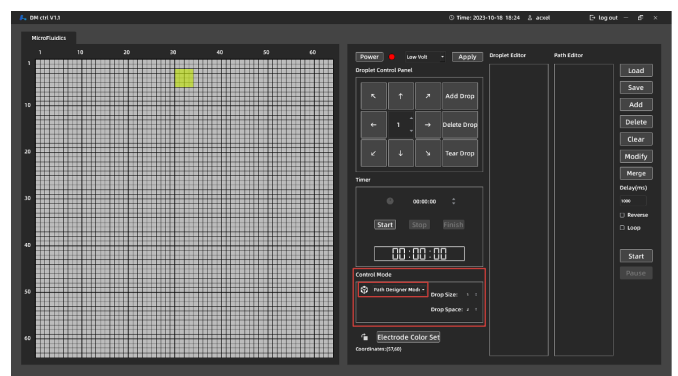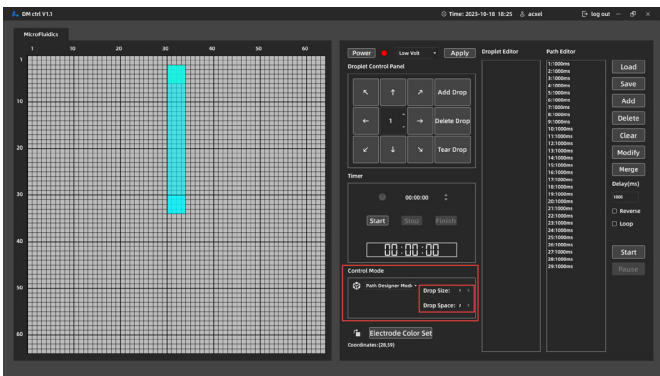

c. In the Electrode Map Panel, left-click on the selected droplet to pick it up. The droplet will follow the mouse and display a simulated path. When the mouse reaches the target location, click the left mouse button to fix it.

d. Click 'Add' in the Path Editor Panel to generate the path. The path for moving the selected droplet will be displayed in 'Droplet Editor'.

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4.14.2. Automatic Splitting in Path Generation

a. Keep the 'Control Mode' in 'Path Designer Mode' and set the splitting parameters. In this example, set 'drop size' to 1 and 'drop space' to 2.

b. In the Electrode Map Panel, right-click to deselect any selected droplets. Double-click on the last step in 'Path Editor' to create a new droplet position. You can see the droplet in the 'Droplet Editor'. Click the 'Tear Drop' button in the Electrode Map Panel to split the 4x4 droplet into 16 individual 1x1 droplets. The splitting path for the selected droplet will be displayed in 'Path Editor'.
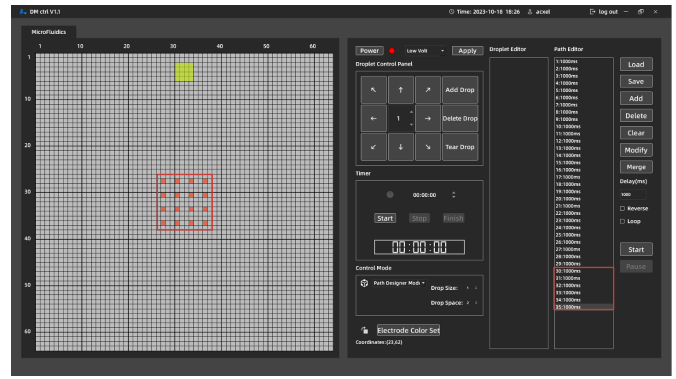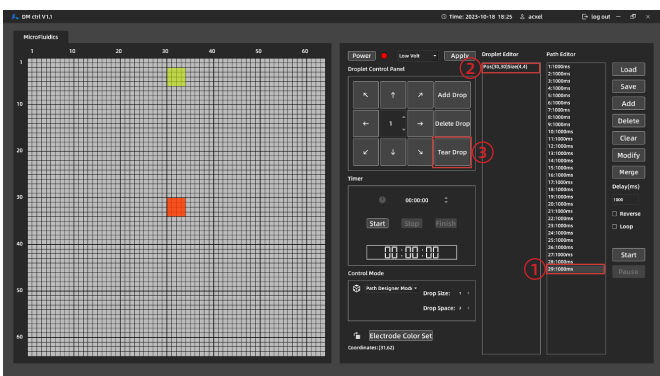
Note: If you need to edit a new path, clear the original path by clicking 'Clear' in Path Editor.

You can also switch to the 'Experiment Mode' in the Control Mode Panel and long-press the left mouse button in the Electrode Map Panel to select pixel electrodes and create new droplets.

4.14.3. Manual Path Design

Switch the operation mode to 'Experiment Mode' in the Control Mode Panel.

In the Droplet Editor Panel, right-click to select an individual droplet you want to move. After selecting, you can use the left mouse button to click the direction keys in the Electrode Map Panel for upward, leftward, downward, and rightward movements.

After completing the movement, click 'Add' in the Path Editor Panel to continue adding a new path.
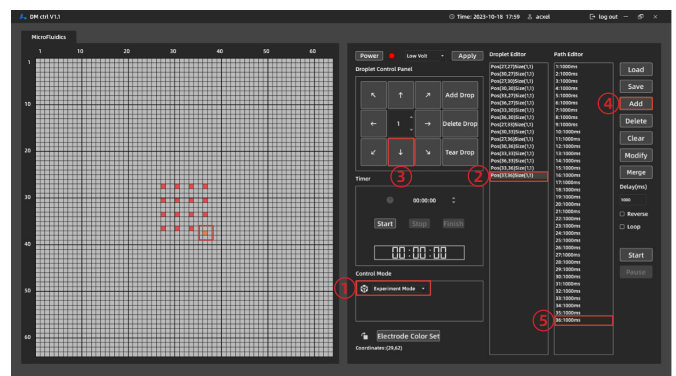
To change the droplet for movement, first deselect the previously selected droplet by right-clicking.

05.
Maintenance

5.1. General Care and Maintenance

Follow these guidelines:
1. Keep the device away from direct sunlight or extreme temperatures to prevent damage.
2. Use a soft cloth to wipe the device's surface and avoid using harsh chemicals or abrasive materials.
3. Avoid exposing the device to liquids or moisture, and immediately cut off the power and dry it if it comes into contact with any liquids.
4. Protect the device from accidental bumps or drops and avoid vibration and shock during use.
5. Obtain and install software updates as recommended to enhance system performance and address any potential bugs.
6. Avoid exposing the microfluidics platform to electromagnetic interference (EMI) sources.
7. Do not attempt to disassemble the device components by the user without help from

5.2. Abnormalities Handling

5.2.1. Handling Equipment Abnormalities
If there is any abnormality with the device, please immediately cut off the power and contact the after-sales service support@acxel.com.

06.
Version History

Date	Description
2023/09	Initial version
2023/10	Update for DM lite plus series, DM lite 4K v1.1, and DM ctrl v1.1.