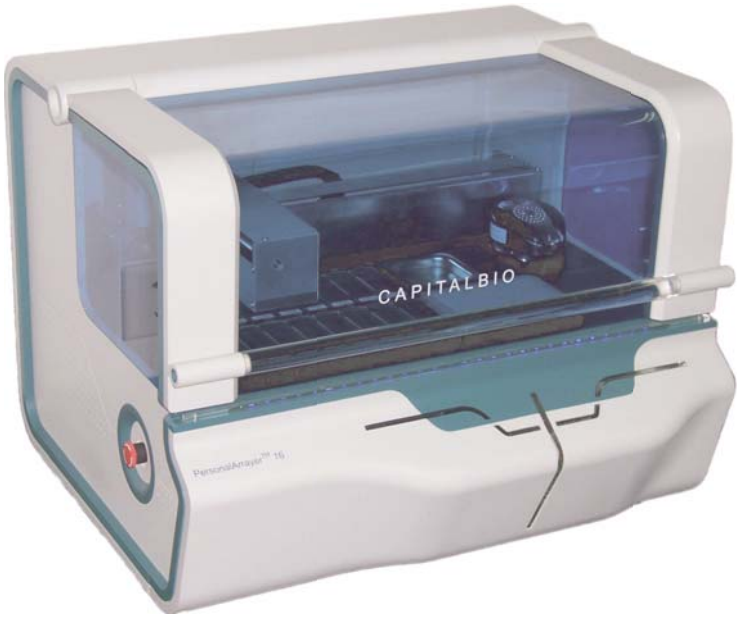
PersonalArrayer™ 16

Microarray Spotter

User Manual

Version 1.0



CapitalBio Corporation

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CapitalBio PersonalArrayer™ 16 Software

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This Agreement shall be governed by the laws of the People's Republic of China.

If you have any question with respect to this Agreement, please contact **CapitalBio**:

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Prologue

Thank you for choosing **CapitalBio**'s **PersonalArrayer™ 16**. The manual provides all of the necessary information required to carry out applications on the instrument. Please read it through, follow the instructions and observe all the cautions and limitations. Before you go on, verify that the instrument you are going to operate is **PersonalArrayer™ 16** manufactured by **CapitalBio Corporation**.

In the prologue, general information about **PersonalArrayer™ 16** is provided. Abbreviations and alternative names are listed as well.

Manual Content

Chapter	Content
Safety Precautions	Provides crucial information to use the system safely. All **PersonalArrayer™ 16** users should read this chapter before installing and using the system.
Hardware Installation	Provides **PersonalArrayer™ 16** hardware specifications and step-by-step instructions for installation of the system.
Software Installation	Provides instructions on how to install the **PersonalArrayer™ 16** application software and the device drivers.
Software Tutorial	Provides brief instructions on basic operations for **Spotting** and **Dispensing**, and instructions on how to run the system for a test immediately after the hardware and software installation.
Configuration	Provides instructions on how to configure the system parameters before **Spotting** or **Dispensing**.
Slide Spotting	Provides detailed instructions on **Slide Spotting** workflow.
Slide Dispensing	Provides detailed instructions on **Slide Dispensing** workflow.
Plate Spotting	Provides detailed instructions on **Plate Spotting** workflow.
Plate Dispensing	Provides detailed instructions on **Plate Dispensing** workflow.
Additional Software Features	Provides descriptions of additional software features such as system self check, maintenance and **Reprinting**.
Routine Maintenance	Provides information on routine maintenance for quality service.
Troubleshooting	Provides answers to frequently asked questions and solutions to frequently encountered problems.

Technology & Working Mode

Technology

PersonalArrayer™ 16 is a high performance microarray spotter. It uses a precision system to distribute a specified quantity of liquid sample to specified position on the microarray substrate.

PersonalArrayer™ 16 uses precise robotic motion control technology to control the movement of X, Y and Z axes and move the **Spotting Pin**s or the **Dispensing Nozzle** to set positions to spot or dispense sample droplets and meet the requirements of high precision and high speed printing of microarrays.

PersonalArrayer™ 16 has both contact printing proprietary non-contact dispensing technology. This flexible technology enables **PersonalArrayer™ 16** users to perform microarraying applications for nucleic acids, proteins and other biomolecules on preformed chip surfaces such as glass slides, plastic slides, silicon slides, plates or membranes.

The combined **Dispenser** or **Pin**s cleaning system consists of sonicating, rinsing and vacuum drying, which decreases or eliminates most cross-contamination among samples. The **Humidifier**, **Plate Chiller** and **HEPA Filter** each contribute to the high fabrication quality of the microarrays.

Working Mode

PersonalArrayer™ 16 can switch between four working modes as listed below.

Working Mode	Substrate	Distribution Technology
Slide Spotting	Slide	Contact Spotting
Slide Dispensing	Slide	Non-contact Dispensing
Plate Spotting	Plate	Contact Spotting
Plate Dispensing	Plate	Non-contact Dispensing

Notes

The path name you specified for a customizable user file should conform to the naming rules of Windows operating systems, without slash, backslash, comma and other characters that are not compatible with Windows systems, etc.

It is recommended that the instrument software is installed by professionals familiar with Windows 2000/XP.

Below are abbreviations and the corresponding full terms.

Instrument	**PersonalArrayer™ 16** Microarray Spotter
Spotting Module	The module consists of **Pin**(s) and **Pin Holder**
Dispensing Module	The module consists of a **Nozzle**, a **Nozzle Holder**, control circuits and air courses
Spotting	Contact Spotting
Dispensing	Non-contact Dispensing
Plate Deck	The platform carrying microplates when printing on plate substrates
Slide Deck	The platform carrying slides when printing on slide substrates
HEPA Filter	The air filter removes at least 99.97% of airborne particles as small as 0.3 microns

Technical Support

The staff at **CapitalBio** is always ready to help with any problems you may encounter with installation, operation, software and any related field for this instrument,. We also appreciate any suggests or comments you may have.

Contact information is as follows.

Address: **CapitalBio Corporation**

18 Life Science Parkway

Changping District

Beijing 102206, China

Tel: +86-10-80725793

Fax: +86-10-80726782

Website: http://www.capitalbio.com

Email: techsupport@capitalbio.com

globalsales@capitalbio.com

To ensure the best technical support, please be prepared to provide the following information:

- The SERIAL NUMBER of your **CapitalBio PersonalArrayer™ 16** (located on the nameplate at the back of the instrument)
- The version number of the application software
- Description of the problem
- Methods you have already tried to solve the problem
- Your phone number, fax number, e-mail address or any other means by which we can contact you

In addition, convenient access to your **CapitalBio PersonalArrayer™ 16** during a technical support phone call will facilitate the process.

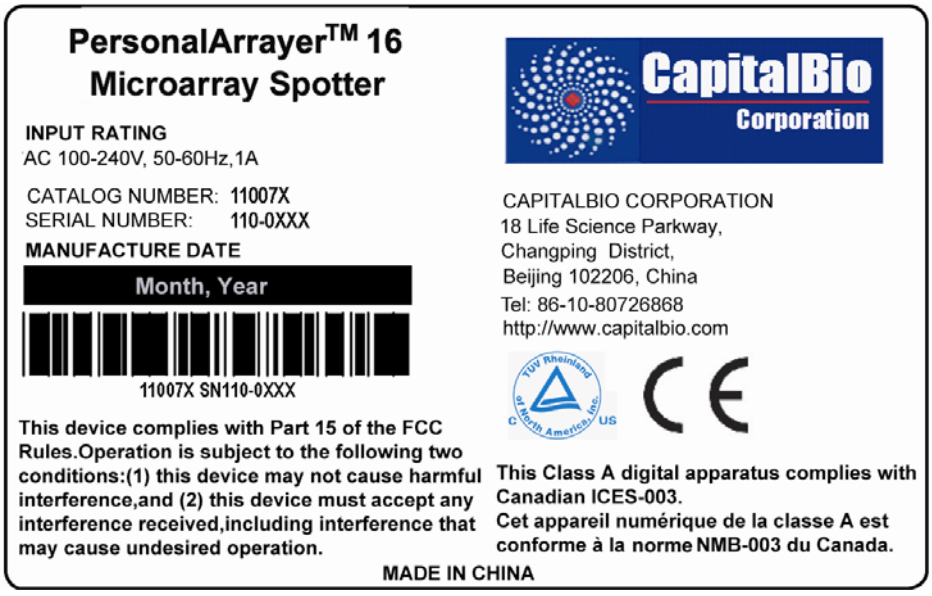
Additional information can be found in the following:

- Documentation provided with the computer workstation and its software.

Safety Precaution

Warning:
Use of controls or adjustments or performance of procedures other than those specified in the installation guide and user manual may result in damage to the instrument, loss of data, invalid data, hazardous voltage, moving parts, or even cause fire. Exposure to hazards may cause severe or fatal injury.

Certification, Identification and Power Supply Label



Product Label

Enclosure

The **Enclosure** is designed to protect users from exposure to hazardous moving parts or electric shock. Users are not supposed to access the interior of the **PersonalArrayer™ 16** during routine operations.

Please do not lift the **Enclosure** open while the instrument is running, in case of unexpected injury. **PersonalArrayer™ 16** is provided with safety interlock, which will halt the system and wait until the **Enclosure** is closed again.

Warning:
If the **Enclosure** is damaged, please do not use the instrument until it has been inspected by a certified technician.

Power Cord

The power cord is packed with the instrument. It has heat insulated PVC material which can apply up to AC450V. It must not be replaced with electric wiring of different rating or electric shock, fire or damage to the spotter may occur.

Warning:
We suggest that users do not replace the power supply cord provided by the manufacturer. If needed, contact the technical support team for the **CapitalBio PersonalArrayer™ 16**.

Fuse

There are 2 fuses of the same rating in **PersonalArrayer™ 16**, with specification of 5mm diameter × 20mm length, F 2.5 A/250 V. Users can replace them with fuses only of the same rating.

Warning:
Please make sure that replacement fuses have the above rating, or electric shock, fire or damage to the spotter may occur.

Fan

The fan in the **CapitalBio PersonalArrayer™ 16** is necessary for ventilation. **Do not** block or cover the fan vent. Blockage will cause the temperature to rise and may result in damage to the spotter; possibly causing electric shock and/or fire.

Warning:
Please do not cover the fan vent on the Backboard of the **CapitalBio PersonalArrayer™ 16**. Otherwise the temperature will rise and result in damage to the spotter; possibly causing electric shock and/or fire.

Moving Parts

Moving parts in the interior of the instrument may also cause physical injury. Under normal operation, the **Enclosure** protects the user from such hazards.

Warning:
Do NOT attempt to access the interior of the instrument while it is running.

Water

The **CapitalBio PersonalArrayer™ 16** has some components, such as the **Sonicator Bath**, **Humidifier**, and the **Wash Buffer Bucket**, which must be filled with some water for daily operations. The **Humidifier** should be filled with deionized water; The **Wash Buffer Bucket** should be filled with deionized water or other buffer; The **Sonicator Bath** should be filled with deionized water or other buffer.

All water or buffers should be replaced daily. There are two syringes in the accessory pack. Always use one of them to fill the **Sonicator Bath**, and use the other to take the fluid out of the **Sonicator Bath**.

Sample Requirements

Fabrication of nucleic acid or protein microarrays may be undertaken on the **CapitalBio PersonalArrayer™ 16** with either the contact **Spotting Module** or the non-

contact **Dispensing Module**.

The properties of the sample are an important factor influencing the production of the microarray and the quality of microarray chips. To fulfill the quality specification, samples should comply with the following requirements:

- All of the samples and buffer must be water-soluble to ensure that they can be rinsed out completely with the distilled water.
- No corrosive components should be present in the sample.
- The pre-treatment procedures, such as filtration and purification, are indispensable to eliminate large particles in the sample and to avoid high viscosity or clotting.
- The viscosity of the sample solution should be at a low or moderate level to avoid undesirable consequence, such as a jammed **Nozzle**, blocked **Pin** and cross-contamination due to incomplete cleaning. A level of viscosity lower than 40% glycerol is recommended.
- For protein, the concentration should not be higher than 5mg/mL.

Note:
Prior to application of a novel sample and buffer system, exploratory tests for the better printing or dispensing conditions are compulsory. The sample buffer system, **Pin** type, slide surface modification process, **Sample aspiration time**, **Delay time**, **Cleaning Protocol**, **Max. spot count per uptake** should all be considered for optimization.

System Cleaning

When a novel sample and buffer system are about to be applied, exploratory tests for the most effective cleaning protocol are compulsory. It is recommended to use fluorescent-labeled reagent in such experiments to evaluate the effectiveness of the cleaning procedures.

When **Dispensing**, the pins should be passed through no less than 2 cleaning cycles prior to switching to printing a new sample source, and the number of washing cycles must be increased more when printing samples of higher viscosity, or higher concentrations are used.

Note:
A stand alone **Cleaning Protocol** should be completed before shutting down the system, to ensure complete cleanliness for subsequent use.

Emergency Stop Button

The **EMS** (**Emergency Stop**) button can be found at the left side of the instrument. It can be useful if the apparatus malfunctions, or when you want to stop the instrument immediately.

Note:
The **EMS** button has to be reset before the microarray workstation can be restarted.

Service

Service should only be conducted by a **CapitalBio Corporation** technician or by their authorized agencies. Consult **CapitalBio Corporation** or authorized agencies for repair

instructions and technical support. See “Technical Support” in the Prologue for more information.

Chapter 1 Hardware Installation

1.1 Overview

Please read the instructions in this manual carefully before you begin the installation and use of the instrument. You should also be fully familiar with the operating procedures and requirements. Please follow the installation guidelines fully and correctly to avoid damage to the instrument.

This chapter will describe hardware installation requirements and installation procedures and inspection details, configuration, switching of **Dispensing Module** and **Spotting Module**, switching of **Slide Deck** and **Plate Deck**, and the overall layout of the instrument.

1.2 Installation Requirements

1.2.1 Environment

The **PersonalArrayer™ 16** should be placed in a clean room that meets the following environmental conditions (**Spotting** or **Dispensing** environmental requirements):

Site Requirement	Indoor Use
Cleanliness degree	10000 class (meets or exceeds GMP requirements)
Temperature Range	5-30 °C
Relative Humidity Range	30% - 50%
Altitude	Up to 2000m

Note:
Because the microarray workstation is a precision instrument, please keep the environment as clean as possible. Install the microarray workstation away from sunlight, ventilation ducts and any other devices that may cause significant change in temperature and humidity.

1.2.2 Space

Length(mm)	Depth(mm)	Height(mm)
560	500	435

1.2.3 Power

Frequency(Hz)	50 - 60
Rated Voltage(V)	AC 100-240
Maximum Input Current(A)	1
Rated Power(W)	250
Fuse	5.0A/125V

1.2.4 Electromagnetic Compatibility (EMC)

A mild EMC environment is desirable for optimal functioning of the instrument. Strong

electromagnetic fields may lead to unpredictable results. The following cautions should be considered:

- Keep the instrument away from devices irradiating large electromagnetic emission such as pacemakers, electric welding equipment, etc.
- Keep the instrument away from power-consuming appliances that frequently start-up or turn-off, such as refrigerators and centrifuges.
- Keep the instrument away from any other strong magnetic fields.
- Do not share the power strip with too many other electrical appliances.
- Do not plug-in or remove any other equipment connected to the same power strip while the instrument is running.

Note:
An EMC environment compliant to CE regulation is required.

1.2.5 Computer Workstation

The computer configuration should meet the following requirements to guarantee the software performance for **PersonalArrayer™ 16**:

CPU	Pentium 4 2.0GHz or higher
Physical Memory	512M or more
Virtual Memory	512M or more
Free Space on Hard disk	40G or more
CD-ROM	40× speed or faster
USB Controller	USB 2.0
Display System	17 inch colored, with resolution of 1024×768 pixels or more
Operating System	Microsoft Windows® 2000 patched with Service Pack 4, or Microsoft Windows® XP patched with Service Pack 2

1.2.6 Pressure Supply requirements

An independent pneumatic pressure source is required for **PersonalArrayer™ 16** in **Dispensing** working mode. The source can be either purified compressed air/nitrogen cylinder or purified air compressor. The compression resistance of the cylinder should be no less than 14 MPa and inner volume of the bottle should be no less that 8L.

A pressure regulator should be connected to the source to output 0.3-0.4 MPa pneumatic pressure. PU tubing with 4mm outer diameter connects the pressure regulator to **PersonalArrayer™ 16**. The tubing should not be too long.

Warning:

- The output pressure range of the regulator should be 0.3-0.4 MPa,but never higher than 0.5 MPa. Please observe these regulations to avoid risk of instrument damage or injury.
- Please recharge the cylinder when its output is lower than 1 MPa
- The storage and operation should comply with all local safety regulations.

1.3 Receiving Inspection

1.3.1 Initial Inspection upon Receipt of Equipment

Please check the package as soon as you receive it. If you find any obvious damage during your visual inspection, describe it on the receipt sheet that comes with the package.

1.3.2 Unpacking

If you find any damage of the instrument itself after you remove all the packaging, please report this immediately to the delivering agent and **CapitalBio Corporation**.

Please avoid violent shaking and collision when you move and place the instrument.

Please check if the components are all present after opening the packing boxes. Please contact **CapitalBio** if you have any questions or concerns.

Please do not connect the instrument to a power supply if you notice any obvious damage.

1.3.3 Packing List

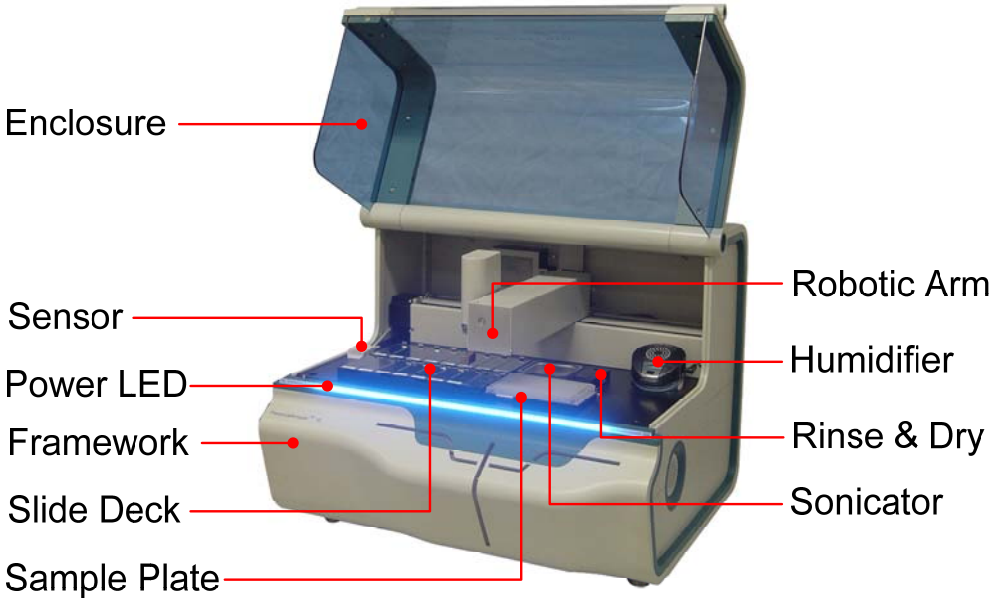
Refer to the Packing List to check for the presence of all components.

1.4 Hardware Installation

1.4.1 Before You Start

Although **PersonalArrayer™ 16** is intentionally designed to be conveniently set up by non-technical end-users, you have to read the instructions in this manual carefully before you begin the installation process and start using the instrument. You should also be completely familiar with the operating procedures and requirements. Please follow the installation guidelines completely and correctly to avoid damage to the instrument.

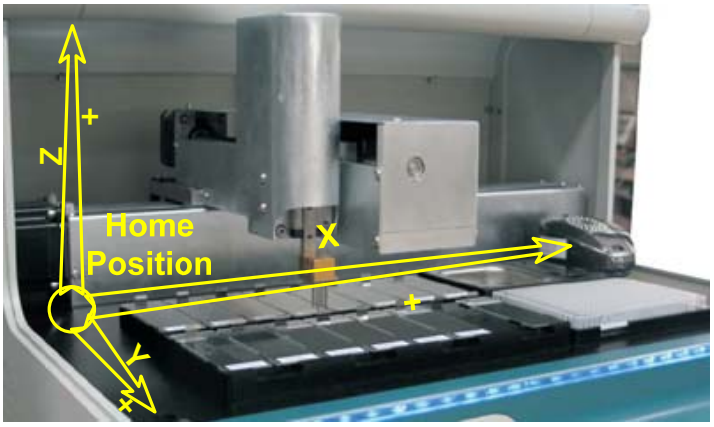
1.4.2 Description and Components



There are 4 functional units: **Framework**, Backboard, **Enclosure** and **Platform**. Important components are the **Humidifier**, vacuum pump, peristaltic pump and **Sonicator**.

The **Framework** holds up the instrument. The peristaltic pump and vacuum pump are mounted onto the **Framework** in the rear. The multi-axis **Robotic Arm** is assembled on the platform, which is the core component of spotting functionality. The **Enclosure** isolates the **Platform** from ambient environment and human accessibility during running. There are interfaces for power, pneumatic pressure and liquid conduits on the Backboard.

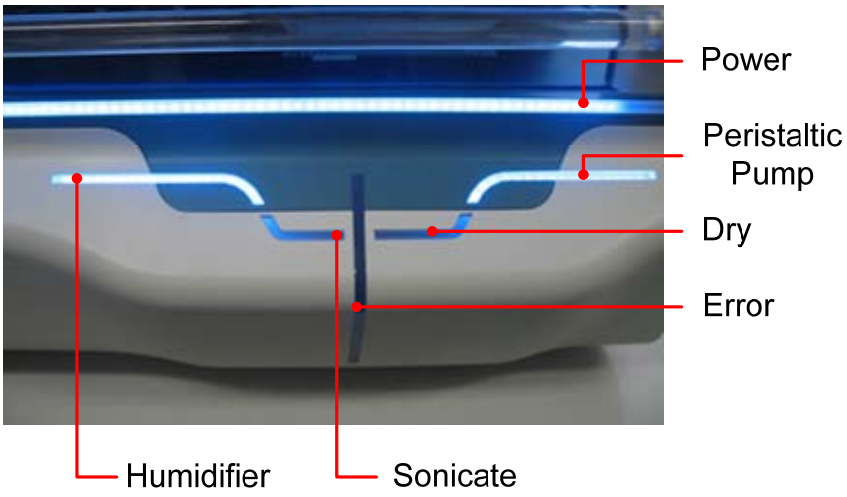
1.4.3 Platform



The core of the instrument, the **Platform** consists of a multi-axis **Robotic Arm**, a platen, a **Humidifier**, **Rinse & Dry** module and **Sonicator**. The **Robotic Arm** is responsible for precise positioning of the pin/nozzle. The X axis refers to left and right; the Y axis refers to forward and backward in the horizontal plane; and the Z axis refers to upward and downward. The platen carries **Plate Deck** or **Slide Deck** to spot on various substrates. The **Rinse & Dry** module is connected to the peristaltic pump and the vacuum pump to rinse and dry the **Pin**s or **Nozzles**. The **Sonicator** implements sonicleaning of the **Pin**s in the **Spotting** mode or is used as a **System Liquid** container in the **Dispensing** mode. The **Sample Plate** accommodates samples for printing and it should be either a monolithic 96-well plate or 384-well plate. The **Humidifier** is used to maintain a constant relative humidity for the working space within the instrument.

1.4.4 Front panel

There are 6 LED indicators on the Front panel as shown below.

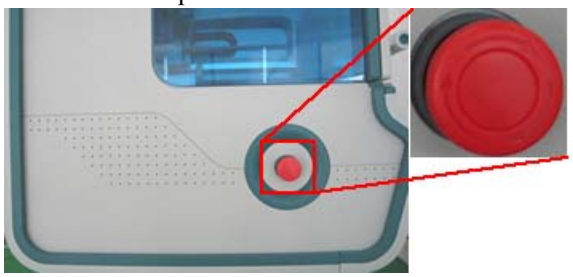


LED status description:

LED	Status	Indication
Power	ON	Instrument is power-on
	OFF	Instrument is power-off
Error	ON	EMS is pressed down, or other errors occurred
	OFF	Other circumstance
Humidifier	ON	**Humidifier** is working
	OFF	**Humidifier** is idle
Sonicator	ON	**Sonicator** is working
	OFF	**Sonicator** is idle
Dry	ON	Vacuum pump is working
	OFF	Vacuum pump is off line
Peristaltic Pump	ON	Peristaltic pump is working, **Rinse Basin** is working
	OFF	Peristaltic pump is off line, **Rinse Basin** is idle

1.4.5 Side View

The **Emergency Stop** button in red is placed on the left hand side of the instrument.



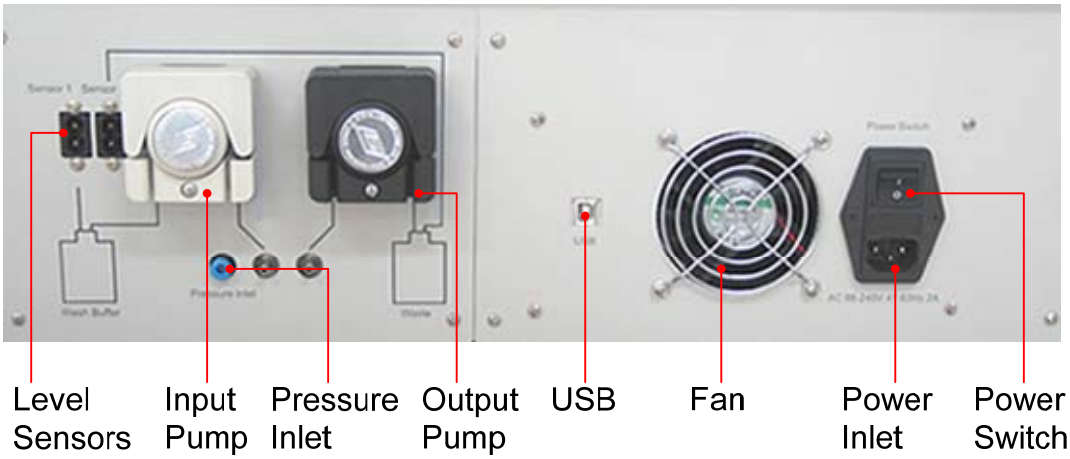
When the **EMS** button is pressed down to halt the instrument immediately, the Error LED will illuminate. Meanwhile, a dialog box will appear on the computer screen to prompt you to turn off the instrument. After responding to the dialog, the user can exit from the program.

If you intend to restart the instrument after you press the **EMS** button, before turning on the instrument and launching the software, you must rotate the button as indicated by the arrows on the button to reset the **EMS** button.

Note:
After you press the **EMS** button, please turn off the instrument as instructed by the software.
Please confirm that the **EMS** button is reset before restarting the instrument.

1.4.6 Backboard

The interfaces for power, pneumatic pressure and liquid conduits are placed on the Backboard.



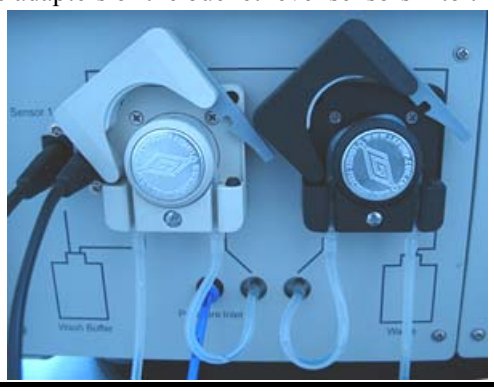
Note:
Do not block the fan vent or insert anything into the vent.

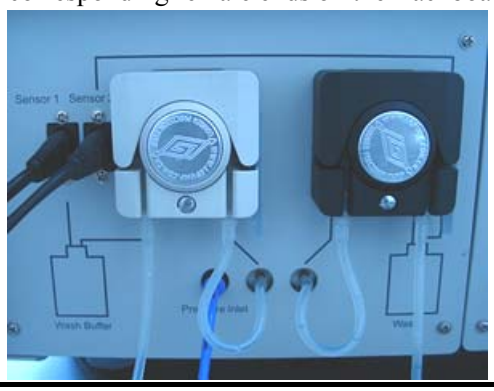
1.5 Hardware Installation

Hardware should be installed by professionals. In order to ensure the correct and efficient operation of the instrument, the user should become familiar with the construction and functionality of the instrument. The user should also be awear of the interchange procedure s from **Spotting Module** to **Dispensing Module** or from **Slide Deck** to **Plate Deck**.

Step 1
Place the instrument on a stable level work bench.

Step 2
Take out the tubing, **Wash Buffer Bucket** and **Waste Bucket** from the package, follow the instructions below to connect the input pump, output pump and two buckets, and then plug the adapters of the bucket level sensors into the corresponding female ends on the Backboard.





Step 3 Please refer to section 1.2.6 to prepare the pressure source, and then connect the pressure source to the inlet on the Backboard with the 4mm outer diameter PU tube.
Step 4 Connect the instrument to the computer with the USB cable.
Step 5 Connect the instrument to the power net with the power cord. The instrument should be grounded via the power cord to avoid electrical shock.

1.6 Installation Check List

Before Installation:

- Make sure the power input is the same as the rated power requirements (Refer to 1.2.3). It is recommended to use a UPS of AC 110 V/220 V, 750 W.
- Inspect the instrument to check:
  - Whether the connectors and terminals are connected, inserted and fastened correctly.
  - Whether there is any liquid spillage or pools.
  - Whether the device is well grounded.
  - Whether the power is shut down.

During Installation:

- Connect the cables and tubing according to the requirements stated in the user manual and printed marks on the equipment.
- Make sure all the connections are securely plugged in.
- Connect the pneumatic tubing, connectors and/or adaptors in clean surroundings and make sure there is no pressure leakage in the pneumatic systems.
- Cover the **Nozzle** with the **Nozzle Mask** to avoid airborne dust particles.

After Installation:

- Clean the **Platform**, **Plate Deck** or **Slide Deck**, **Enclosure** etc., with cotton cloth
- Clean the **Humidifier**, **Sonicator**, **Wash Buffer Bucket** and **Waste Bucket**.

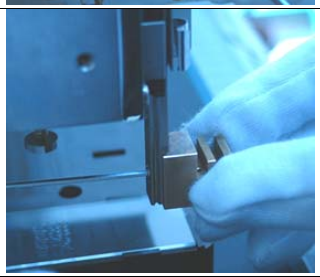
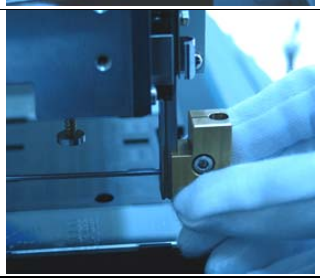
1.7 Test Run

- Check all cable or wiring connection again.
- Check the **Platform** and make sure there are no obstacles to obstruct the movements of the pin/nozzle.
- Clean the **Rinse Basin**, **Wash Buffer Bucket**, **Sonicator** and fill them with deionized water.
- Install the application software.
- Power on the instrument, launch **PersonalArrayer™ 16** software.
- Check if there is any abnormal noise from the motors.
- Conduct functional tests for rinse, sonicate, dry, exhaust and emergency stop, respectively.

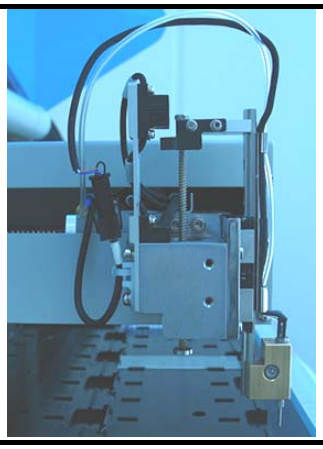
- Carry out **Position Calibration**, then prepare the sample and printing substrates.
- Run a test routine program to print an array.
- Refer to Troubleshooting section if there is anything wrong.

1.8 Switch between Spotting and Dispensing Mode

Users can conveniently change the **Spotting Module** to the **Dispensing Module** on the Z axis in order to switch the instrument between **Spotting** and **Dispensing** mode. The procedure is as follows:

Step 1 Turn to the *Prepare* page, click the *Load Pin* button and the **Robotic Arm** will move to a proper position for following operation. Step 2 Use tweezers to remove **Pin**s from the **Pin Holder**.	
Step 3 Use a screwdriver to unscrew the bolts on the casing and remove the casing.	
Step 4 Unscrew the bolts on the **Pin Holder**, and remove them.	
Step 5 Hold the **Nozzle Holder** to mount and fix it. Step 6 Use a level indicator to make sure the **Nozzle Holder** and **Platform** are parallel.	

Step 7
Plug in control cables and conduits.
Step 8
Assemble the **Nozzle** and fasten the bolt.
Step 9
Mount the casing and fasten it.
Step 10
Exit the application software and launch it again.
Step 11
Check the interface to confirm that the program has identified the hardware configuration and initialized the instrument in the **Dispensing** mode correctly.



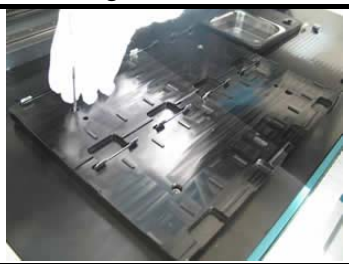
The procedure to replace the **Dispensing Module** for the **Spotting Module** is similar.

Note:
Remove the **Pin**(s) or **Nozzle** before you switch the modules.
Expel any possible dust or particles within the air course before you assemble the **Nozzle** onto the **Nozzle Holder**.
Restart the application software after you switch the module.

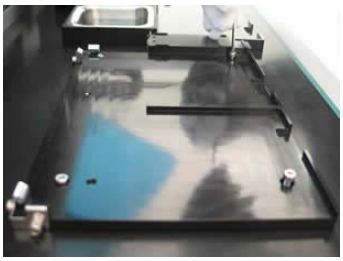
1.9 Switch between Slide and Plate Mode

Users can conveniently replace the **Slide Deck** with the **Plate Deck** or vice versa to switch the instrument between slide and plate mode. The procedure is as following:

Step 1
Turn to the *Prepare* page, click the *Load Slides* or the *Load Plates* button and the **Robotic Arm** will move to a proper position for the following operation.
Step 2
Unscrew the 4 bolts on the corners of the **Slide Deck** and remove the deck.



Step 3
Align the **Plate Deck** to the positioning pin on the **Platform** and place it with care.
Step 4
Screw the 4 bolts at the corners.
Step 5
Exit the program and launch it again.
Step 6
Check the interface to confirm the program has identified the hardware configuration and initialized the instrument in **Plate Spotting** or **Plate Dispensing** mode correctly.

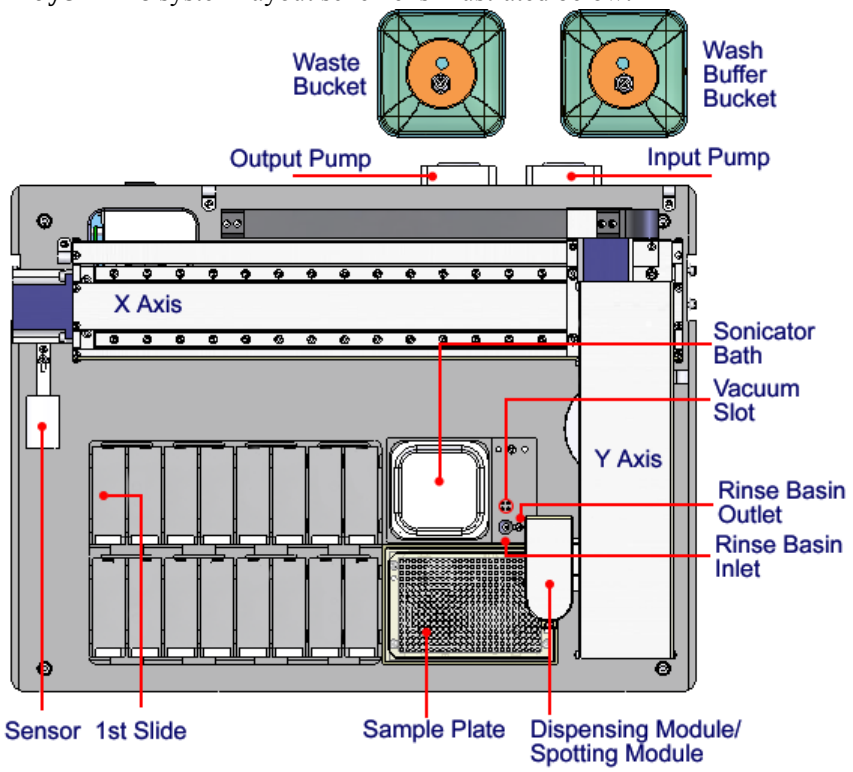


The procedure to replace the **Plate Deck** for the **Slide Deck** is similar.

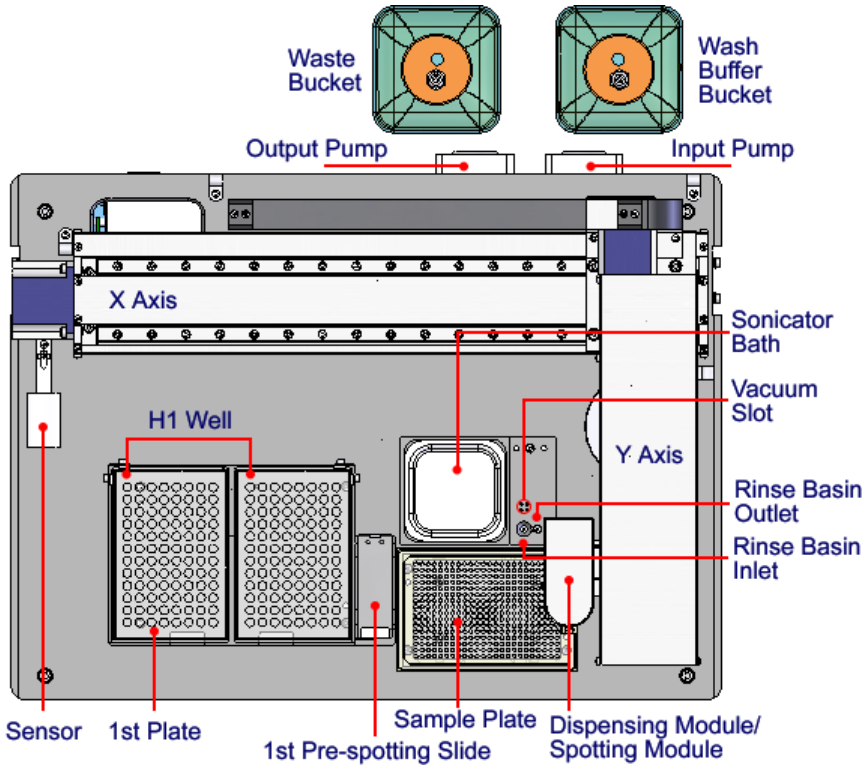
Note:
Please remove all slides or plates from the deck before you switch the decks to avoid potential damage to slides or plates.
Please restart the application software after you switch the decks.

1.10 Layout Scheme

PersonalArrayer™ 16 system layout scheme is illustrated below:



In **Slide Spotting** or **Slide Dispensing** Mode



In **Plate Spotting** or **Plate Dispensing** Mode

Chapter 2 Software Installation

2.1 Overview

Only **PersonalArrayer™ 16** application software should be installed onto the computer to connect and control the instrument. It is recommended that a person familiar with Microsoft Windows® 2000/XP install the software.

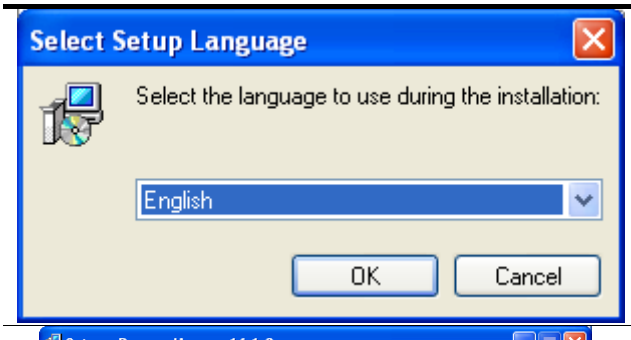
2.2 Installation Requirements

Microsoft Windows XP including Service Pack 2 is recommended. Please refer to 1.2.5 for computer configuration requirements.

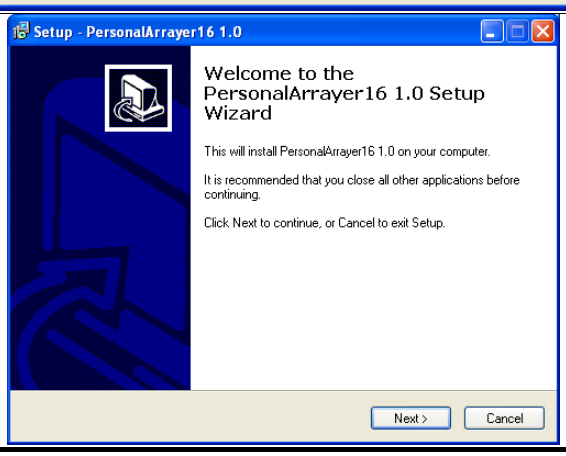
2.3 Prepare to Install

Step 1 Power on the computer. Log on as administrator.
Step 2 Insert the installation CD with **PersonalArrayer™ 16** label into the CD ROM.
Step 3 Browse the CD, find "PersonalArrayer 16 Setup.exe" file and double click it to show the installation wizard.

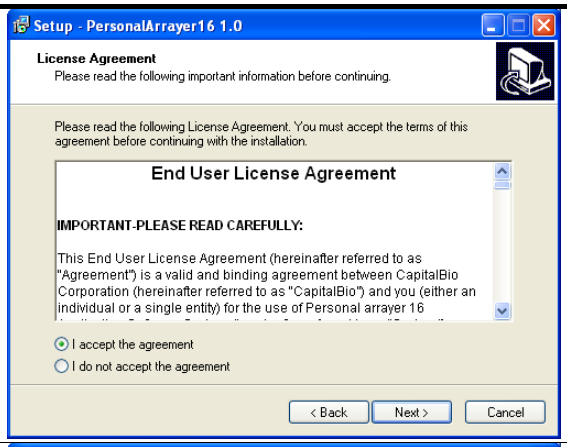
2.4 Setup Wizard



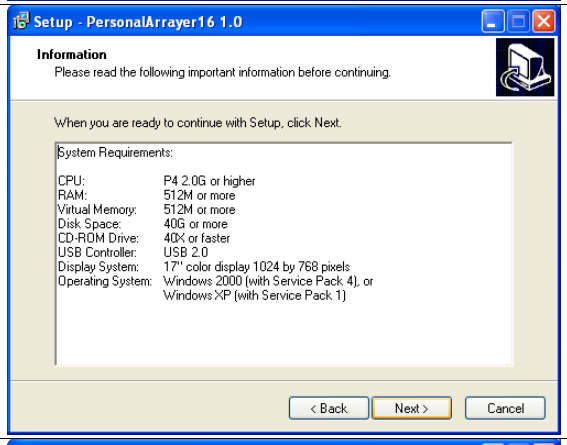
Step 1
Choose language pack during setup and click *OK* button.



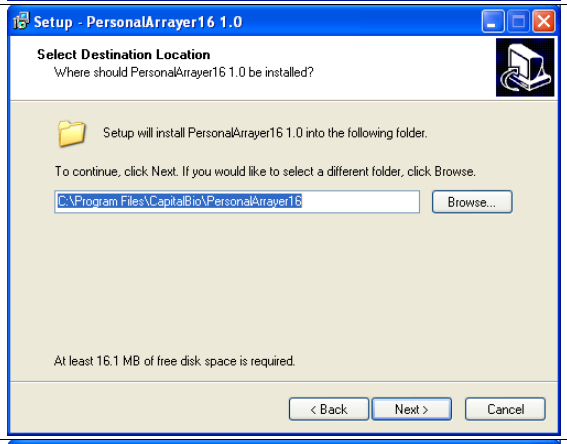
Step 2
Start Screen. Click the *Next* button to proceed.



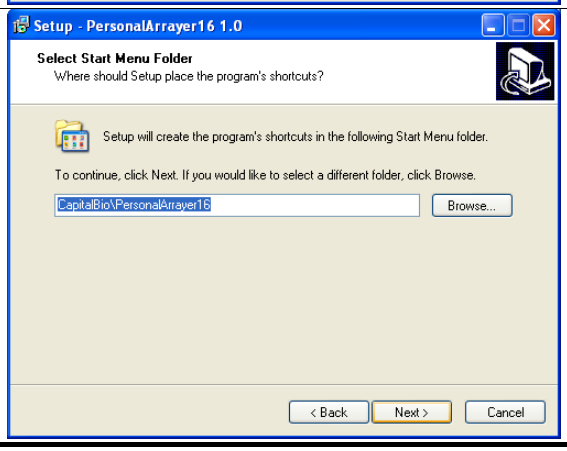
Step 3
End user agreement. Please read it through before you select "I accept" and click the *Next* button to proceed.



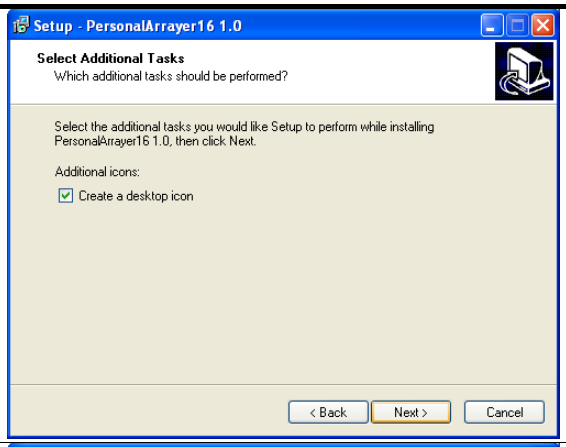
Step 4
System configuration requirements of the computer. Check the list and proceed.



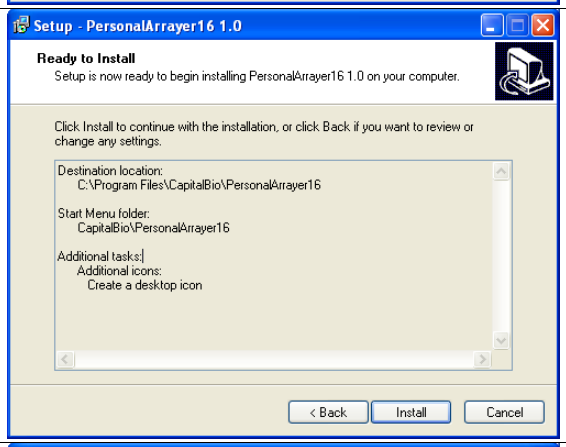
Step 5
Choose a destination directory for the installation.



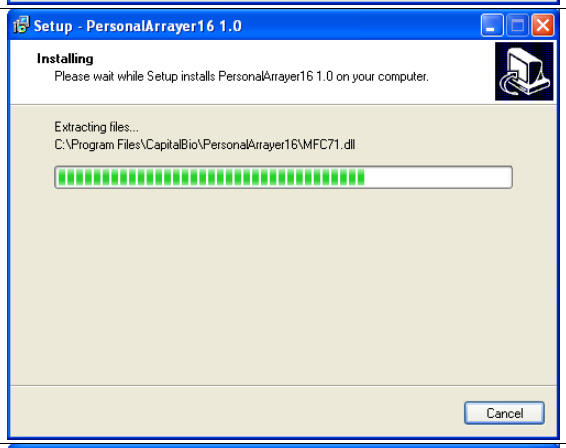
Step 6
Specify a reference name for the program group which is about to be added into the Windows® Start menu.



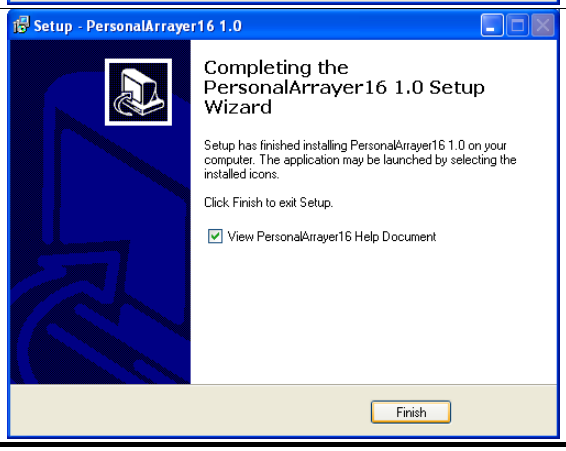
Step 7
Choose whether to create a shortcut on the desktop.



Step 8
Confirm the installation task. Click *Install* button to start.



Step 9
The progress bar for the installation.



Step 10
Installation is complete and click *Finish* to exit the wizard. You can choose to reboot the system immediately or later.

Note:
With the help of setup wizard, you can always click the *Back* button to go back to a previous step and make any necessary changes, or click the *Cancel* button to exit the wizard.

2.5 Uninstall the Software

Like any other Windows application software, the **PersonalArrayer™ 16** application software can be uninstalled from the *Control Panel*. Follow these steps to uninstall: click on the "*Add/Remove Programs*" item, find "PersonalArrayer 16" in the program list, choose *Change/Remove* and confirm when notified. The program should now be removed.

Chapter 3 Software Tutorial

3.1 Overview

In this chapter, we will guide you to spot or dispense a microarray on substrates such as slides. This way, you can quickly grasp the basic skills to use the software and accomplish basic **Spotting**/**Dispensing** tasks.

It is mandatory to check the configuration parameters, particularly to perform **Position Calibration** to ensure the system functions correctly when any of the following occur: a new system is installed, the system is moved, or if changes are made to the hardware or software.

3.2 Getting Started

3.2.1 Launch the System

Step 1
Power on the computer.

Step 2
Use the USB cable to connect the instrument and the computer, power on the instrument.

Step 3
Select Programs > CapitalBio > PersonalArray16> PersonalArray16 from *Start* Menu.

Step 4
Input correct user name and password on the login dialog. The software will detect the instrument, identify the working mode and launch self test.

PersonalArrayer™ 16 can switch between four working modes as **Slide Spotting**, **Slide Dispensing**, **Plate Spotting** and **Plate Dispensing** for 96-well plate. The software will identify which is the current working mode according to hardware configuration of the instrument and initialize the corresponding interfaces.

Note:
If the self test failed, please restart the instrument and software as following:

- Power off the instrument;
- Exit the software;
- Restart the instrument and software.

According to user's interests and familiarity with the system, the software provides two experience styles for running:

Guided Style

New users and those who are not familiar enough with the system can choose the **Guided Style** to run a printing program step by step, by clicking *Next* button to proceed.

Expert Style

Experienced users can click the buttons on the left **Task Panel** to access any particular page directly, with more flexibility.

The two styles are both integrated into the user. Users can employ both styles at will, and at the same time the software provides guided control of new steps until the user is familiar with the process.

3.3 Configuration

It is mandatory to reset the configuration parameters, particularly to perform **Position Calibration** to ensure the system functions correctly whenever any of the following occur: a new system is installed, the system is moved, or changes are made to the hardware or software.

The configuration parameters are set to defaults immediately after installation. Users can check them, with help from technical support if necessary. Please refer to Chapter 4 for more details.

3.4 Position Calibration

Position Calibration defines key positions for the operation of the instrument. It must be performed before any printing job. Please refer to 4.2 for more details.

3.5 Printing Preparation

 Prepare	Click the *Prepare* button on the left **Task Panel** to turn to *Prepare* page.

On the *Prepare* page the user can send commands to the instrument to rinse, dry, sonicate and exhaust the pins or nozzle, to switch decks or modules, and to send the **Robotic Arm** to the home position.

Users can load an existing stand alone **Cleaning Protocol** to simplify the daily routine as follows:

Step 1	Input the path name of the protocol file in the text box, or click the *Open* button to browse and select.
Step 2	Click *Start* button.
Step 3	The progress bar indicates the task is running
Step 4	Wait for the task completion or click the *Stop* button to break it.

You can set up a wash protocol on the *Clean* page and save it for later use. The wash protocol can be complex. Please refer to 5.9, 6.9, 7.9 and 8.9 for detailed operations.

3.6 Program

In order to plan a printing run, the following steps and corresponding command interfaces are involved:

 Pin	Available in the **Spotting** mode. For you to specify the amount of **Pin**s on the **Pin Holder** and the pattern in which the **Pin**s are arranged. Please refer to sections 5.5 and 7.5 for instructions.
 Dispenser	Available in the **Dispensing** mode. Only 1 nozzle can be applied to the **PersonalArrayer™ 16**. Please refer to sections 6.5 and 8.5 for instructions.
 Slide	Available in **Slide Spotting** or **Slide Dispensing** mode. For you to specify the printable area on the slides, the number of slides, the start slide, and the number of pre-spotting slides (in **Slide Spotting** mode). Please refer to sections 5.6 and 6.6 for instructions.

 Plate	Available in **Plate Spotting** or **Plate Dispensing** mode. For you to specify the number of plates and which is the start plate. Please refer to sections 7.6 and 8.6 for instructions.
 Array	For you to specify the arrangement of the microarrays, such as the array parameters and spots on the slides or in the plate well; replication of the spots and arrays, pre-spotting and pre-dispensing settings. Please refer to sections 5.7, 6.7, 7.7, and 8.7 for instructions.
 Sample	For you to specify the number of sample plates, sample distribution among the wells and sampling sequence. In addition, access to the *Advanced Option* related to sample, preview, sample tracking are provided on this page. Please refer to sections 5.8, 6.8, 7.8 and 8.8 for instructions.
 Clean	For you to set up cleaning protocols for the **Pin** or **Nozzle** and save or load them. In the **Spotting** mode, the cleaning protocol can be composed of any combination of *Rinse*, *Sonicate* and *Dry* operation. In the **Dispensing** mode, the protocol can be composed of any combinations of *Rinse*, *Exhaust* and *Dry* operations. Please refer to sections 5.9, 6.9, 7.9 and 8.9 for instructions.

3.7 Run

 Run	Click the *Run* button on the left **Task Panel** to turn to the *Run* page.

The procedure to run a protocol is described below.

Step 1	Check the protocol. It is recommended to save.
Step 2	Click the *Run* button on the left **Task Panel** to turn to run page.
Step 3	Click the *Start* button.
Step 4	The software will check the program settings and prompt users if there is anything wrong.
Step 5	Confirm that the slides, **Pre-spotting** slides or plates are ready.
Step 6	*Start* to run the program. Wash the **Pin**s or **Nozzle** according to the protocol.
Step 7	Uptake samples according to the **Sample Sequence**.
Step 8	**Pre-spotting** or **Pre-dispensing** if the protocol requires.
Step 9	Spot or dispense according to array settings.
Step 10	Repeat steps 6 to 9 until all the slides or plates are finished.

During the procedure a user can click the *Pause* button to pause the current operation. The user can choose to resume, to exit the program, to pause after clean or to go back. Or the user can click the *Stop* button to exit the program immediately.

The program can go back to a previous position to **Reprint** missing spots. Please refer to section 9.4 for details.

3.8 Protocol Backup & Restore

	Click the *Save Protocol* button to save the protocol as an **Array Protocol File** with .sap suffix.

	Click the *Open Protocol* button to deploy a protocol from an **Array Protocol File** with .sap suffix and confirm.
	After you successfully save the current protocol or load an existing one, you can double click the P button on the status bar at the right bottom corner of the window to bring out a dialog to check the path name of the current protocol.

Note:
It is recommended that you save the protocol before running.

3.9 Exit System

Step 1	Exit the running program or wait until it is completed.
Step 2	Exit the application software.
Step 3	Power off the instrument.

Chapter 4 Configuration

4.1 Overview

The system configuration options and guidelines are provided in this chapter.

After the installation of the **PersonalArrayer™ 16** application software, the user should check the system configuration including **Position Calibration** parameters, velocity and acceleration. *Dispense* options will be available in the **Dispensing** mode.

The system configuration parameters are crucial to the performance of the instrument. Improper configuration could lead to damage. It is recommended that only a person familiar with the system can modify the settings.

Click the *Configuration* button on the tool bar in the upper right corner of the main frame to access the **System Configuration** dialog.

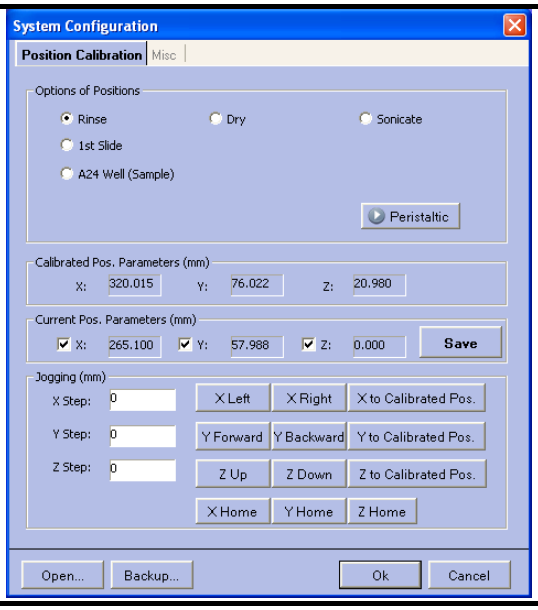
You can modify and reset the following parameters.

Position Calibration	*Rinse* position calibration, please refer to section 4.2.1
	Dry position calibration, please refer to section 4.2.2
	Sonicate (**System Liquid**) position calibration, please refer to section 4.2.3
	Exhaust position calibration, please refer to section 4.2.4
	Slide position calibration, please refer to section 4.2.5
	Target plate well position calibration, please refer to section 4.2.6
	Sample plate well position calibration, please refer to section 4.2.7
	Pre-dispense position calibration, please refer to section 4.2.8
	Pre-spotting slide position calibration, please refer to section 4.2.9
Dispense Setting	Please refer to section 4.3
Miscellaneous	Please refer to section 4.4

4.2 Position Calibration

Position Calibration refers to determining and recording the locations of several components on the microarray spotter, which are critical to different steps during **Spotting** or **Dispensing** operations. **Position Calibration** should also be carried out after any instrumentation changes or maintenance to ensure that the precise location is determined and to avoid any potential problems. The **Position Calibration** page of the **System Configuration** dialog consists of 4 sections: *Positions*, *Calibrated Pos. Parameters*, *Current Pos. Parameters* and *Jogging*. The **Position Calibration** page in the **Slide Spotting** mode is as following.

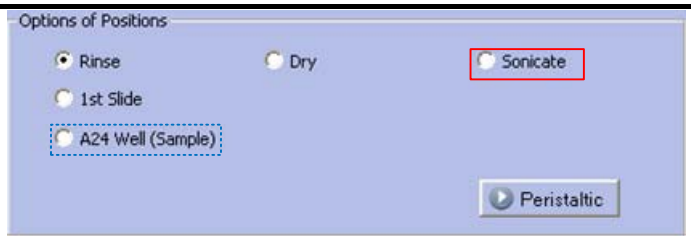
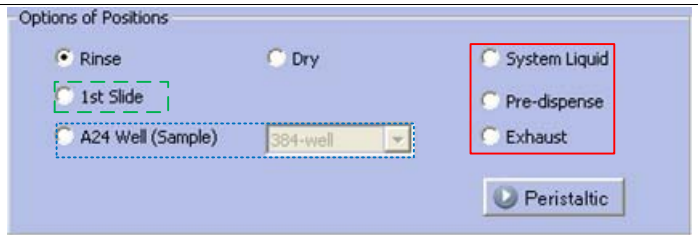
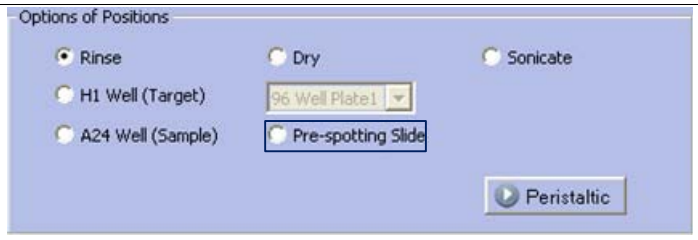
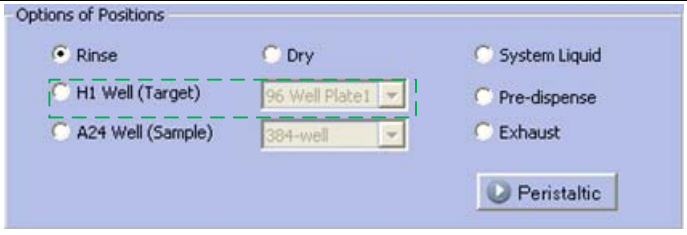
Warning:
Please press the *Z Home* button to lift the **Pin** or **Nozzle** up along the *Z* axis before the **Position Calibration** occurs in order to eliminate the possibility of collision.



Depending on your selection in the *Positions* section, the coordinates will be loaded and shown in *Calibrated Pos. Parameters* section.

The following part of this manual describes the operation for the calibration of posistions for rinse, dry, sonicate, exhaust, target plate, sample plate, pre-dispense and pre-spotting slide.

The Options available in *Positions* depends upon working mode, as illustrated below:

Slide Spotting mode	
Slide Dispensing mode	
Plate Spotting mode	
Plate Dispensing mode	

Jogging section contains the following UI elements:

X Step Y Step	The distance travelled by the **Spotting Module** or **Dispensing Module** along the X, the Y, or the Z axes per step. The maximum

Z Step	step distance is 50mm for the X axis, 40mm for the Y axis, and 10mm for the Z axis.
X Left X Right	Click the button to move the **Spotting Module** or the **Dispensing Module** along the X axis, a step per click.
Y Forward Y Backward	Click the button to move the **Spotting Module** or the **Dispensing Module** along the Y axis, a step per click.
Z Up Z Down	Click the button to move the **Spotting Module** or the **Dispensing Module** along the Z axis, a step per click.
X to Calibrated Pos. Y to Calibrated Pos. Z to Calibrated Pos.	Click the button to move the **Spotting Module** or the **Dispensing Module** along the X/Y/Z axis to the position calibrated for the last time.
X Home *Y Home* *Z Home*	Click the button to move the **Spotting Module** or the **Dispensing Module** along the X/Y/Z axis to home position (0, 0, 0).

Note:
Whenever a new system is installed, or the system is moved to a new place, or some changes are made to the hardware or software, it is mandatory to check the configuration parameters. It is especially important to perform **Position Calibration** to ensure that the system functions correctly and to avoid any potential damage.
Please check and confirm that the step length per jog is not too large. Set it to appropriate values in order to prevent any collision or other damage.

4.2.1 Rinse Position Calibration

The **Rinse Position** is where the inlet of the **Rinse Basin** is located. It is necessary to calibrate the **Rinse Position** to ensure that all 4 pins on the **Pin Holder** or the **Nozzle** can descend into the inlet of the basin.

Please refer to 1.10 to see the basin's location in the instrument.

The procedure is the following:

Step 1 Select the *Rinse*
Select the *Rinse* option in the *Positions* section. The X, Y, Z coordinates that were last calibrated will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** or the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.

Step 2 Confirm initial position of the **Robotic Arm**
The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.

Step 3 Move to the proper position
In the *Jogging* section, set the step to the appropriate value (for example, 5 – 10 mm when the the tip of the **Pin**s or the **Nozzle** is away from the target position, and 1 – 2 mm when it moves more closer), and click the buttons to move the **Spotting Module** or the **Dispensing Module** directly over the basin inlet and submerge the **Pin**s or **Nozzle** below the liquid surface within the inlet of basin at the proper depth.

Step 4 Save the calibrated position
Specify the X, Y, Z coordinates to be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the new current position as the new calibrated position. The **Spotting Module** or the **Dispensing Module** will then move up to the home position along the Z axis.

Warning:
When moving the axes, always be aware of the position of the **Pin**s/**Dispenser**. Make sure that the planned routines of all the moving components are clear of any obstacles before you apply actual movement to avoid potentially disastrous outcomes.

4.2.2 Dry Position Calibration

The **Dry Position** is where the **Vacuum Slot**s are located. It is necessary to calibrate the **Dry Position** to ensure that all 4 **Pin**s on the **Pin Holder** or the **Nozzle** can descend into the inhalant hole(s).

Please refer to 1.10 to see the location of the **Vacuum Slot** on the instrument.

The procedure is as following:

Step 1 Select the *Dry*
Select the *Dry* options in the *Positions* section. The X, Y, Z coordinates that were last calibrated will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** or the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.

Step 2 Confirm initial position of the **Robotic Arm**
The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.

Step 3 Move to the proper position
In the *Jogging* section, set the step to the appropriate value, and click the buttons to move the **Spotting Module** or the **Dispensing Module** directly over the **Vacuum Slot** and insert the **Pin**s or **Nozzle** into the inhalant holes at the proper depth to be dried completely.

Step 4 Save the calibrated position
Specify the X, Y, Z coordinates to be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as the new calibrated position. The **Spotting Module** or the **Dispensing Module** will move up to the home position along the Z axis.

4.2.3 Sonicate Position Calibration

The **Sonicate Position** is where the **Sonicator Bath** is located. It is necessary to calibrate the **Sonicate Position** to ensure that all 4 **Pin**s on the **Pin Holder** or the **Nozzle** can descend into the bath.

Note:
The **Sonicate Position** applies to the **Spotting** mode. In the **Dispensing** mode the dispenser uptakes the **System Liquid** from the bath, but the **Nozzle** does not require sonication, and the bath position is referred as the **System Liquid** (reservoir) position.

Please refer to section 1.10 to see the bath location on the instrument.

The procedure is the following:

Step 1 Select *Sonicate* or **System Liquid** Select the *Sonicate* (in **Spotting** mode) or the **System Liquid** (in **Dispensing** mode) option in the *Positions* section. The X, Y, Z coordinates that were last calibrated will be shown in the *Calibrated Pos. Parameters* section, and the current X, Y, Z coordinates of the **Spotting** module or the **Dispensing** module will be shown in the *Current Pos. Parameters* section.
Step 2 Confirm initial position of the **Robotic Arm** The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.
Step 3 Move to the proper position In the *Jogging* section, set the step to the appropriate value, and click the buttons to move the **Spotting Module** or the **Dispensing Module** directly over the bath and submerge the **Pin**s or the **Nozzle** under the liquid surface at the proper depth to ensure sonicate or uptake performance.
Step 4 Save the calibrated position Specify that the X, Y, Z coordinates will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as the new calibrated position. The **Spotting Module** or the **Dispensing Module** will move up to the home position along the Z axis.

4.2.4 Exhaust Position calibration

The **Exhaust Position** is where the **Rinse Basin** outlet is located and is used during **Dispensing** mode. It is necessary to calibrate the **Exhaust Position** to ensure that the **Nozzle** can hover just above the outlet of basin.

Please refer to 1.10 to see the location of the basin in the instrument.

The procedure is the following:

Step 1 Select *Exhaust* Select the *Exhaust* option in the *Positions* section. The X, Y, Z coordinates that were last calibrated will be shown in the *Calibrated Pos. Parameters* section, and the current X, Y, Z coordinates of the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.
Step 2 Confirm initial position of the **Robotic Arm** The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.
Step 3 Move to the proper position In the *Jogging* section, set the step to the appropriate value, and click the buttons to move the **Dispensing Module** directly over the basin outlet and aim the **Nozzle** toward the centre of the basin outlet.
Step 4 Save the calibrated position Specify that the X, Y coordinates will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as the new calibrated position, and the new coordinates will be shown in the *Calibrated Pos. Parameters*.

4.2.5 Slide Position Calibration

In the **Slide Spotting** or the **Slide Dispensing** mode, it is necessary to calibrate the **1st Slide Position**. The X and Y coordinates represent the upper left corner of the slide, and the Z coordinate represents the position of the **Robotic Arm** when the **Pin** barely makes contact with the slide in the **Spotting** mode or when the **Nozzle** tip is 1mm-1.5mm above the surface of the slide in the **Dispensing** mode.

Please refer to 1.10 to see the slide location on the instrument.

Note:
There should be only one **Pin** on the **Pin Holder** while working in **Slide Spotting** mode.
The Z coordinate should be recorded independently.

The procedure is as follows:

Step 1 Select *1st Slide*
Select *1st Slide* options in the *Positions* section. The X, Y, Z coordinates that were last calibrated will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** or the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.

Step 2 Confirm initial position of the **Robotic Arm**
The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.

Step 3 Move to the proper position along the X, Y axis and save
CAUTION: In the *Jogging* section, set the step to the appropriate value for the X-, Y- axis, and click the buttons to move the **Spotting Module** or the **Dispensing Module** directly over the upper left corner of the first slide.
Specify that the X, Y coordinates, but not the Z coordinate, will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as the new calibrated position.

Step 4 Move to the proper position along the Z axis and save
CAUTION: In the *Jogging* section, set the step to the an appropriate value for the Z- axis, and click the buttons to move the **Spotting Module** to make the **Pin** barely contact with the surface of the slide or move the **Dispensing Module** to hover it over the slide with 1mm-1.5mm distance.
Specify the Z coordinate, but not the X, Y coordinates, to be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as a new calibrated position. The **Spotting Module** or the **Dispensing Module** will move up to the home position along the Z axis.

4.2.6 Target Plate Position Calibration

The **PersonalArrayer™ 16** supports up to two plates, and it is necessary to calibrate the H1 well positions of each target plate position respectively. Calibration is necessary to ensure that the solo **Pin** or the **Nozzle** can aim at the center of the H1 well of the plate, and that the **Pin** should barely contact with the bottom of the well in the **Spotting** mode. In the **Dispensing** mode, the **Nozzle** should be 1-1.5mm above of the bottom of the well in the. The Z axis height can be calibrated once for all plates.

Please refer to section 1.10 to see the plate location on the instrument

Note:
When you are calibrating target plate position, there should be only one **Pin** on the **Pin Holder** if it is in the **Plate Spotting** mode.

The procedure goes as follows:

Step 1 Select Target Plate
Select H1 Well (Target) options in the *Positions* section. The most recent calibrated X,Y,Z coordinates will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** or the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.

Step 2 Confirm initial position of the **Robotic Arm**
The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.

Step 3 Calibrate and save the X axis and the Y axis coordinates
CAUTION: In the *Jogging* section, set the step for the X axis and Y axis to the appropriate values, and click the buttons to move the **Spotting Module** or the **Dispensing Module** to hover over the center of H1 well.
Specify that the X, Y coordinates will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as a new calibrated position.

Step 4 Calibrate and save the Z axis coordinates
CAUTION: In the *Jogging* section, set the step for Z axis to an appropriate value, and click the buttons to move the **Spotting Module** to make the pin barely make contact with the bottom of the well, or move the **Dispensing Module** to make the nozzle is 1-1.5mm above from the bottom of well.
Specify that the Z coordinate will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and confirm to use the current position as a new calibrated value. The **Spotting Module** or the **Dispensing Module** will move up to the home position along the Z axis.

4.2.7 Sample Plate Position Calibration

The **Sample Plate** setting should use a 384-well plate in the **Spotting** mode, while it may use a 96-well plate or a 384-well plate in the **Dispensing** mode. The **Sample Plate Position Calibration** depends on the plate type. For the 384-well plate the position of the A24 well should be calibrated; for the 96-well plate the counter part is the A12 well.

Please refer to 1.10 to see the plate location on the instrument

Note:
When you are calibrating the **Sample Plate** position, there should be only one **Pin** on the **Pin Holder**, and the distance between the bottom of the well on the plate and the **Pin** or **Nozzle** should be a minimum of 1mm.

The procedure is the following:

Step 1 Select the **Sample Plate** Select the A24 Well (Sample) option in the *Positions* section. In the **Dispensing** mode, a combo box will be activated and you can choose to use the 96-well plate or the 384-well plate. If you choose the 96-well plate the calibration position label will change into the A12 Well (Sample). The last calibrated X,Y,Z coordinates will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** or the **Dispensing Module** will be shown in the *Current Pos. Parameters* section.
Step 2 Confirm initial position of the **Robotic Arm** The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.
Step 3 Move to the proper position In the *Jogging* section, select the appropriate value, and click the buttons to move the **Spotting Module** or the **Dispensing Module** directly over the centre of the A12/A24 well and then submerge the **Pin** or **Nozzle** into the sample to a depth that is sufficient to ensure reliable sample uptake.
Step 4 Save the calibrated position Specify that the X, Y, Z coordinates will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and confirm to use the current position as a new calibrated value. The **Spotting Module** or the **Dispensing Module** will move up to the home position along the Z axis.

4.2.8 Pre-dispensing Position Calibration

The **Pre-dispensing Position Calibration** applies to the **Dispensing** mode. It refers to the Z coordinate of the **Dispensing Module** when you carry out **Pre-dispensing** after sample uptake, ensures that the distance from the nozzle to the plate top surface is about 2mm. The **Nozzle** is just above the sample well when **Pre-dispensing**, thus only the Z coordinate is involved in the setting of the **Pre-dispensing Position Calibration**.

Please refer to 1.10 to see the plate location on the instrument.

The procedure is as following:

Step 1 Select *Pre-dispense* Select *Pre-dispense* option in the *Positions* section. The last calibrated Z coordinates will be shown in the *Calibrated Pos. Parameters* section, and the current Z coordinates of the **Dispensing Module** will be shown in the *Current Pos. Parameters* section. If the position has never been calibrated before, the default value will be 0.
Step 2 Confirm initial position of the **Robotic Arm** The initial position on the Z axis will be 0. Please check if the **Robotic Arm** is actually at (x, y, 0). If it is not, click the *Z Home* button to move along the Z axis. It is recommended that you calibrate the **Pre-dispensing** position immediately after the **Sample Plate** position without moving the **Dispensing Module** along the X axis and Y axis to ensure the **Nozzle** is above the plate. If it is not above the plate, you can choose the **Sample Plate Position Calibration** and move it to a calibrated position, which should be above the plate.
Step 3 Move to the proper position **CAUTION:** In the *Jogging* section, set the step to the proper value for the Z axis, and click the buttons to move the **Nozzle** directly over the plate top surface, about 2mm above.

Step 4 Save the calibrated position
CAUTION: Specify that the Z coordinate but not the X, Y coordinates will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as a new calibrated value. The **Dispensing Module** will move up to the home position along the Z axis.

4.2.9 Pre-spotting Slide Position Calibration

In the **Plate Spotting** mode, it is necessary to calibrate the **Pre-spotting Slide** position. The X and Y coordinates represent the upper left corner of the slide, and the Z coordinate represents the position of the **Robotic Arm** when the **Pin** barely makes contact with the slide.

Please refer to 1.10 to see the slide location on the instrument.

Note:
There should be only one **Pin** in the **Pin Holder** while working in the **Slide Spotting** mode.
The Z coordinate should be recorded independently.

The procedure is the following:

Step 1 Select the **Pre-spotting Slide**
Select the **Pre-spotting Slide** options in the *Positions* section. The last calibrated X,Y,Z coordinates will be shown in the *Calibrated Pos. Parameters* section, and the current X,Y,Z coordinates of the **Spotting Module** will be shown in the *Current Pos. Parameters* section.

Step 2 Confirm initial position of the **Robotic Arm**
The initial position will be in the upper left extreme after the instrument is power-on, that is (0, 0, 0) in the *Current Pos. Parameters* section. Please check if the **Robotic Arm** is actually at (0, 0, 0). If it is not, click the *X Home* or *Y Home* or *Z Home* button to move along the corresponding axis.

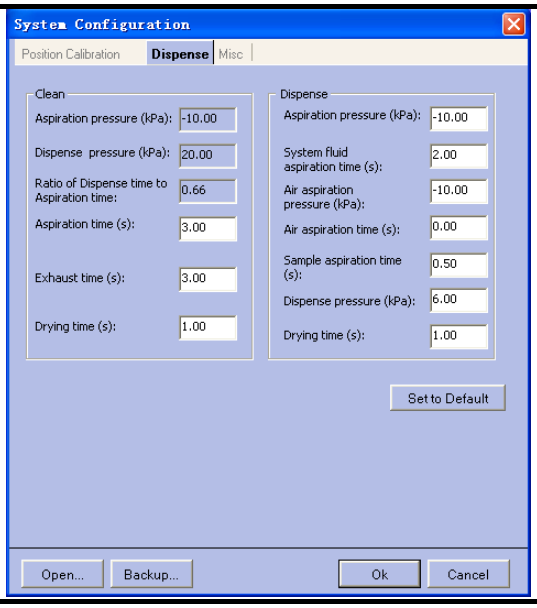
Step 3 Move to the proper position along the X, Y axis and save
In the *Jogging* section, set the step to the appropriate values for the X-, Y- axis, and click the buttons to move the **Spotting Module** directly over the upper left corner of the **Pre-spotting Slide**.
Specify that the X, Y coordinates, but not the Z coordinate, will be saved in the check boxes within the *Current Pos. Parameters* section. Click the *Save* button and then confirm to use the current position as a new calibrated value.

Step 4 Move to the proper position along the Z axis and save
In the *Jogging* section, set the step to the appropriate value for the Z- axis, and click the buttons to move the **Spotting Module** to make the **Pin** barely contact with the surface of the slide.
Specify that the Z coordinate, but not the X and Y coordinates, will be saved in the check boxes within the *Current Pos. Parameters* section. Click *Save* button and then confirm to use the current position as a new calibrated value. The **Spotting Module** will move up to the home position along the Z axis.

4.3 Dispense Parameters Setting

The *Dispense* dialogue page is available in the **Dispensing** mode to control pneumatic components and procedures. These parameters have already been calibrated by the manufacturer.

The dialogue page consists of two sections: *Clean* and *Dispense*, as illustrated below:



The *Clean* section consists of pressure and time specifications for cleaning procedures. The *Dispense* section consists of pressure and time specifications for the dispensing and sample uptake procedures.

The parameters are listed below:

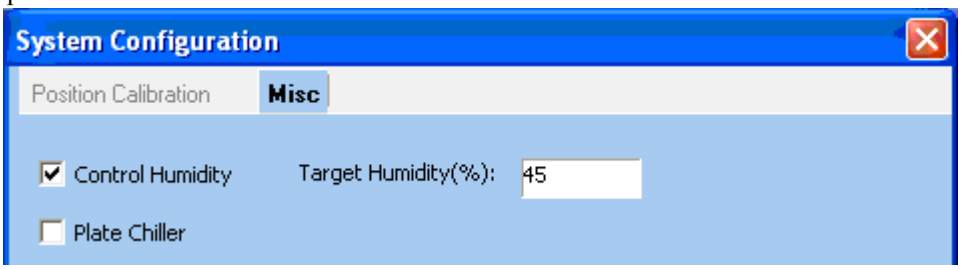
Clean	**Aspiration pressure**	Refers to the pressure applied to take up washing buffer or water, in kPa.
	Dispense pressure	Refers to the pressure applied to exhaust the washing buffer or water through the nozzle, in kPa.
	Ratio of Dispense time to Aspiration time	A fractional number
	Aspiration Time	Refers to the time applied to take up washing buffer or water, in seconds.
	Exhaust time	Refers to the time required to exhaust the washing buffer or water, in seconds.
	Drying time	Refers to the time required for vacuuming after washing, in seconds.
Dispense	**Aspiration pressure**	Refers to the pressure applied to take up the sample or the system liquid preparations, in kPa.
	System liquid aspiration time	Refers to the time required to take up the system liquid, in seconds.
	Air aspiration pressure	Refers to the pressure applied to inhale air to separate sample and **System Liquid**, in kPa.
	Air aspiration time	Refers to the time required to inhale air, in seconds.
	Sample aspiration time	Refers to the time required to take up the sample, in seconds.
	Dispense pressure	Refers to the pressure applied to dispense the sample through the nozzle onto the substrate, in kPa.
	Drying time	Refers to the time required for vacuuming after taking up sample or system liquid, in seconds.

Note:
The **Dispense pressure** should be no less than 3 kPa and the **Dispensing Time** no less than 250μs.
The **Sample aspiration time** and **Dispense pressure** may be modified

according to the viscosity and surface tension characteristics of the sample. Click the *Set to Default* button to load the default settings.

4.4 Miscellaneous

Users can choose whether to apply humidity control and use the plate chiller. The specification of target relative humidity in percentages is described on this page. If you want to apply humidity control, please confirm that there is enough water in the humidifier before you run the experiment.



In the check boxes: Select either plate chiller or humidity control. If humidity control is chosen, enter a relative humidity value in the Target Humidity box.

4.5 Backup and Restore

Confirm that all necessary modifications are put on the **System Configuration** dialog box and click the *OK* button at the bottom of the dialog box to apply the modifications, save them into the **System Configuration** file and then exit the dialog box.

You can click the ***Backup*** button to save the data as a **System Configuration** file (*.sas). Click the ***Open*** button and confirm when notified to restore the settings previously saved by selecting a *.sas file.

Chapter 5 Slide Spotting

5.1 Overview

The work flow and instructions for microarray spotting onto slides with the **PersonalArrayer™ 16** are described in this chapter. After reading the chapter through, the user will have gained essential skills in **Slide Spotting** procedures and for instrument and related software operations.

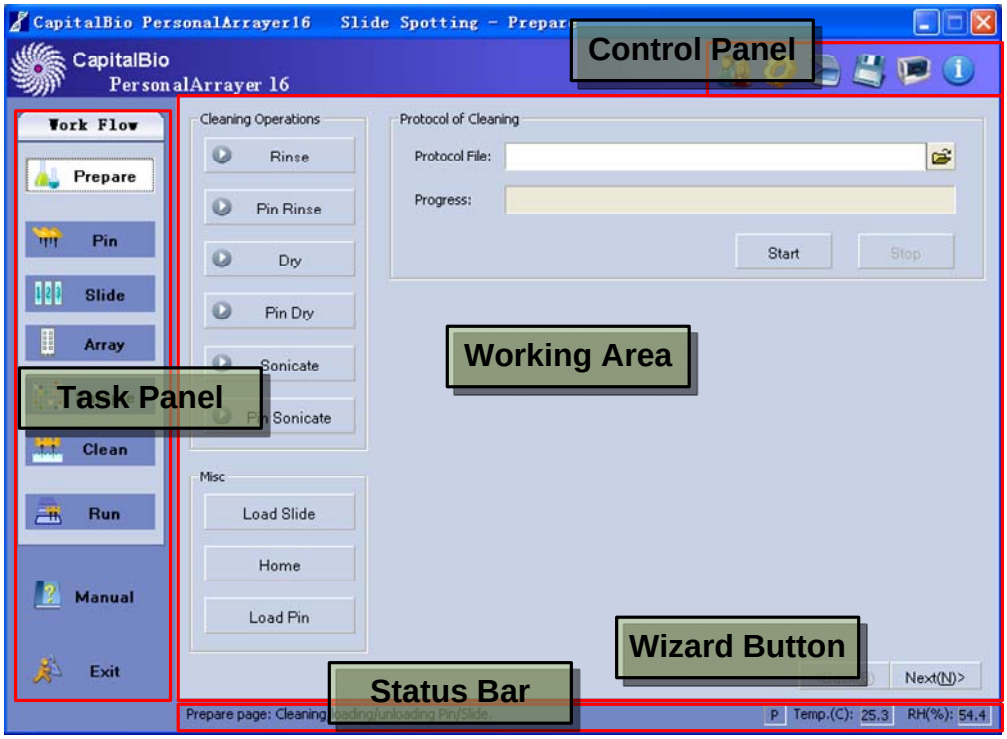
5.2 Hardware Configuration

In the **Slide Spotting** mode, the **Spotting Module** should be fitted on the **Robotic Arm** (please refer to section 1.8 in the manual for instructions on changing between the **Spotting Module** and the **Dispensing Module**), and the **Slide Deck** should be fitted on the platform (please refer to section 1.9 in the manual to switch between the **Slide Deck** and the **Plate Deck**).

5.3 Start the System

Please refer to section 3.2 to start the **PersonalArrayer™ 16** system.

If the hardware is correctly configured as described in section 5.2, the software will identify the current working mode and initialize the interface illustrated as below.



5.4 Prepare

The application software begins with the *Prepare* page automatically after launch. Alternatively, you can click the *Prepare* button on the left **Task Panel** to go to the *Prepare*

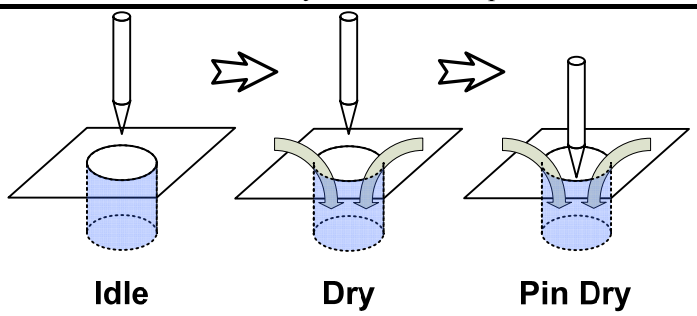
page.

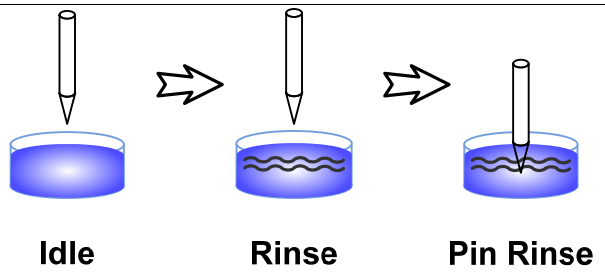
Users can load the **Pin**(s) onto the **Pin Holder**, load slides on the **Slide Deck**, clean the **Pin**(s), and move the **Robotic Arm**s to the home position.

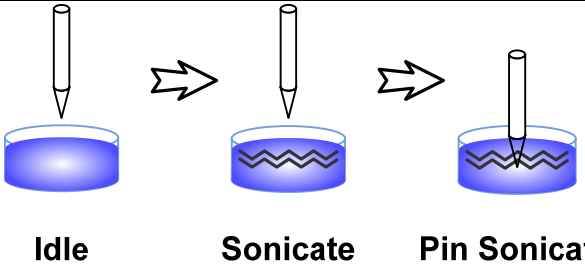
Warning:
Please carry out **Position Calibration** before you proceed.

5.4.1 Cleaning Operations

For the cleaning operations, users can undertake following actions: *Rinse*, *Pin Rinse*, *Dry*, *Pin Dry*, *Sonicate* and *Pin Sonicate*. Users may execute each command independently. The sections below describe the actions necessary to start and stop each command.







5.4.1.1 Rinse

	Rinse	Click the *Rinse* button and the water in the **Rinse Basin** will begin to flow. Meanwhile the **Rinse Indicator** will be illuminated.
	Rinse	Click the *Rinse* button again to exit the current action. The **Rinse Indicator** will turn off.

Please ensure that there is sufficient water in the **Rinse Basin** for the following steps.

5.4.1.2 Pin Rinse

	Pin Rinse	Click the *Pin Rinse* button, the water in the **Rinse Basin** will begin to flow and the **Robotic Arm** will move to dip the **Pin** into the basin. Meanwhile the **Rinse Indicator** will be illuminated.
	Pin Rinse	Click the *Pin Rinse* button again to exit the current action. The **Robotic Arm** will lift up the **Pin** out of the basin. The **Rinse Indicator** will turn off.

5.4.1.3 Dry

	Dry	Click the *Dry* button and the vacuum pump will start to work. Meanwhile the **Dry Indicator** will be illuminated.
	Dry	Click the *Dry* button again to exit the current action. The **Dry Indicator** will turn off.

5.4.1.4 Pin Dry

	Pin Dry	Click the *Pin Dry* button, the vacuum pump will start to work and the **Robotic Arm** will dip the **Pin** into the **Vacuum Slot** to get rid of remaining liquid. Meanwhile the **Dry Indicator** will be illuminated.
	Pin Dry	Click the *Pin Dry* button again to exit the current action. The **Dry Indicator** will turn off.

5.4.1.5 Sonicate

	Sonicate	Click the *Sonicate* button, the **Sonicator** will start to ultrasonically agitate the water bath. The **Sonicate Indicator** will be illuminated.
	Sonicate	Click the *Sonicate* button again to exit the current action. The **Sonicate Indicator** will turn off.

5.4.1.6 Pin Sonicate

	Pin Sonicate	Click the *Pin Sonicate* button, the **Sonicator** will start to ultrasonically agitate the water bath with ultra sound pulse and the **Robotic Arm** will dip the **Pin** into the bath. The **Sonicate Indicator** will be illuminated.
	Pin Sonicate	Click the *Pin Sonicate* button again to exit current action. The **Sonicate Indicator** will turn off.

5.4.2 Cleaning Protocol

Users can load a **Cleaning Protocol** from existing files to run a procedure consisting of a series of actions. Please refer to section 5.9 for details on **Cleaning Protocol** files.

5.4.3 Load Slides

Click the *Load Slides* button and the **Robotic Arm** will move the **Spotting Module** to the extreme right, so you can place the slides onto the **Slide Deck** on the left side.

Warning:
Please make sure that the side with the bar code is up.
Before you lay down the slide, please press the slide clasp away in order to avoid any scratch or damage to the slide.

Hold one narrow end of the slide with your fingers, place the other narrow end onto the **Slide Deck** first, press the slide clasp open, carefully place down the slide into the slot with caution, and release the slide clasp to grisp the slide.

The **Slide Deck** can accommodate up to 16 slides in a 2×8 arrangement.

5.4.4 Home

Click the *Home* button to move the **Robotic Arm** to the home position at the top left corner of the **Platform**. If any of cleaning operations are running, the *Home* command will stop them.

5.4.5 Load Pin

Click the *Load Pin* button and the **Robotic Arm** will move the **Spotting Module** to the front of the instrument for conveniently loading the **Pin**s.

PersonalArrayer™ 16 can be fitted with up to 4 **Pin**s in a 2×2 arrangement. Users can choose 1, 2 or 4 **Pin**s for **Spotting**. Please refer to section 5.5 to check the locations of different combinations of **Pin**s.

Warning:
The actual arrangement of the **Pin**s in the **Pin Holder** should be consistent with the configuration shown in the software. Otherwise it could lead to instrument malfunction, damage, run failure or contamination of the samples.

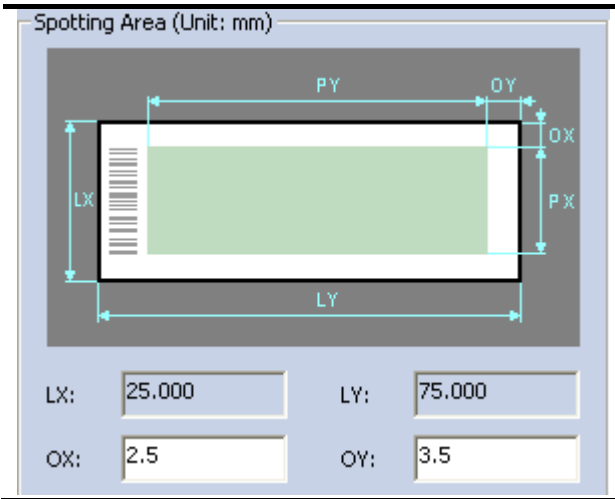
5.5 Pin Configuration

 **Pin**	Click the *Next* button on the Prepare page or click the *Pin* button on the left **Task Panel** to turn to the *Pin Configuration* page.
	**PersonalArrayer™ 16** provides four combinations of **Pin** arrangements in the **Pin Holder**: 1×1, 1×2, 2×1, 2×2. Users can choose the combination in the combo box and preview it in the box below.

Note:
Please confirm that the actual arrangement of the **Pin**s in the **Pin Holder** is consistent with the configuration in the software.
If you change the pin configuration, the array specifications and plate specifications will become invalid, and you will have to check and reset them again.

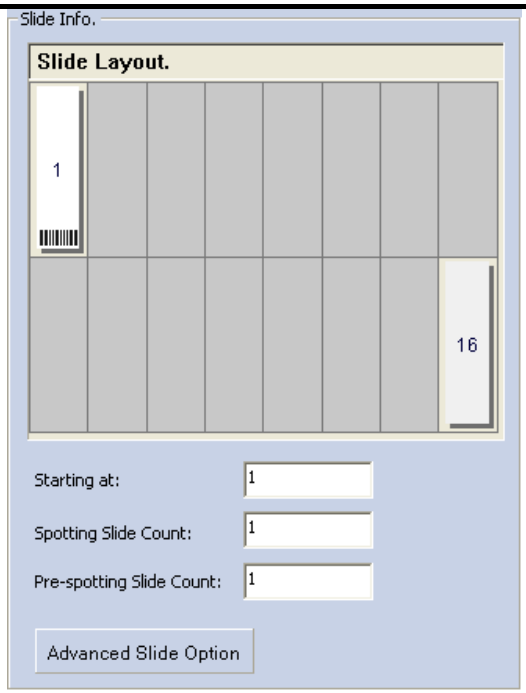
5.6 Slide Configuration

Slide	Click the *Next* button on the *Pin Configuration* page or click on the *Slide* button on the left **Task Panel** to turn to the *Slide* page. This page consists of two sections: the *Spotting Area* section and the *Slides Info* section.



Users can define the dimensions of the printable area of the slides in the *Spotting Area* section.

LX/LY	Width/length of the slide The currently supported dimensions are 25mm×75mm.
OX/OY	Margins between the edges of the printable area and the edges of the slides No less than the *Min Margin*, which could be set on the advanced slide option dialogue (refer to the last part of this section).

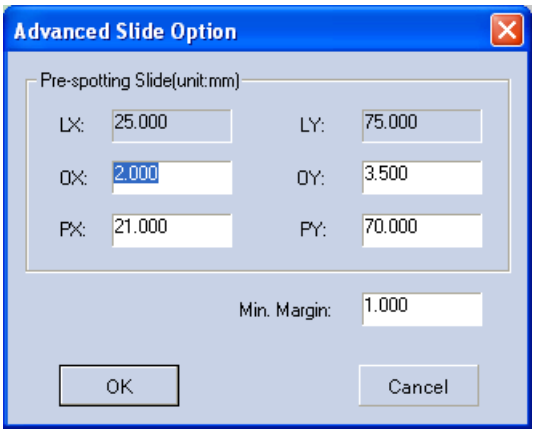


In the *Slides Info* section, the user can specify the number and location of the slides and the **Pre-spotting** Slide. You can decide which slide will be printed first, how many slides will be printed, and how many slides will be used for **Pre-spotting**.

The **Slide Deck** can accommodate up to 16 slides in a 2×8 arrangement.

The slides about to be printed should be placed consecutively (no gaps).

The **Pre-spotting** slide is required in the **Spotting** mode. There should be at least one **Pre-spotting** slide.



Click the *Advanced Slide Option* button on the *Slide* page to show the *Advanced Slide Option* dialog. You can customize the pre-spotting slide here by defining the printable area and the *Min Margin*.

The printable area of the **Pre-spotting** slide(s) is the same with other slides. Please refer to the illustration of the *Spotting Area* section.

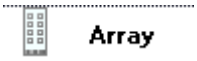
Min Margin refers to the minimum space between the border of the printable area and the edge of **Pre-spotting** slide. It should not be less than 1 mm. OX and OY should not be less than *Min Margin*.

PX/PY refers to width/length of the printable area.

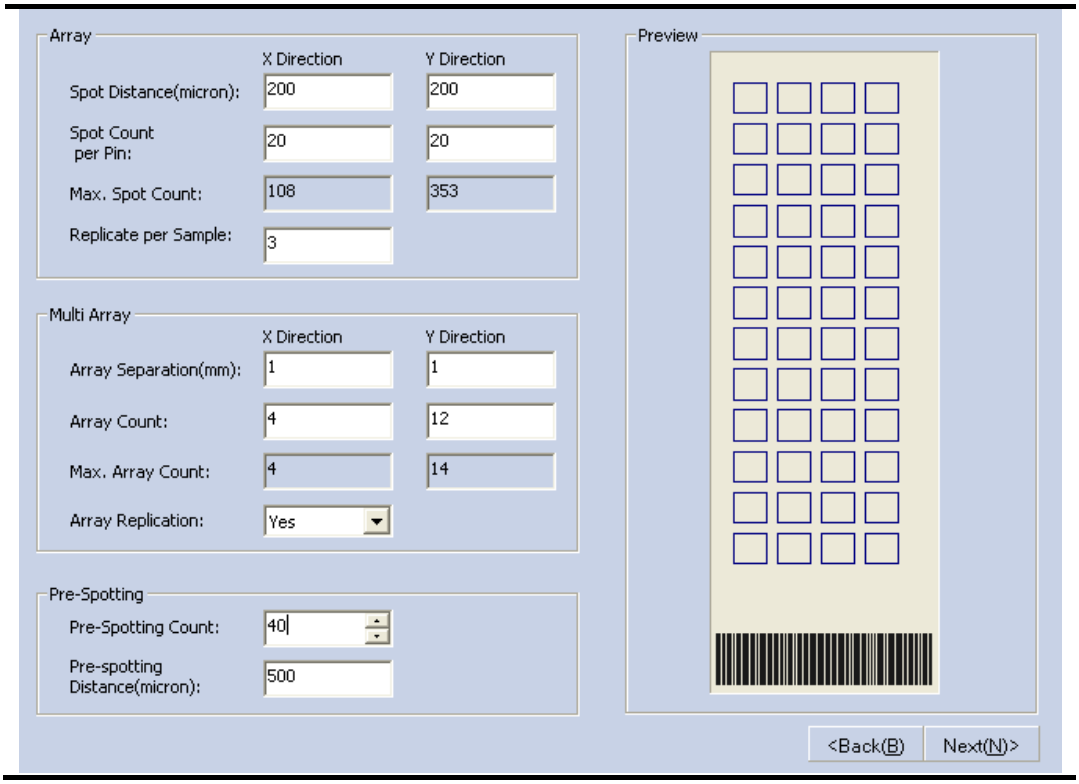
The maximum is restricted by the slide dimensions, and the minimum is related to the *Pin Configuration*. Users will be alerted for an invalid configuration.

Note:
Increasing or decreasing the PX and PY values will increase or decrease **Max. Spot Count** and **Max. Array Count**, respectively.

5.7 Array Definition



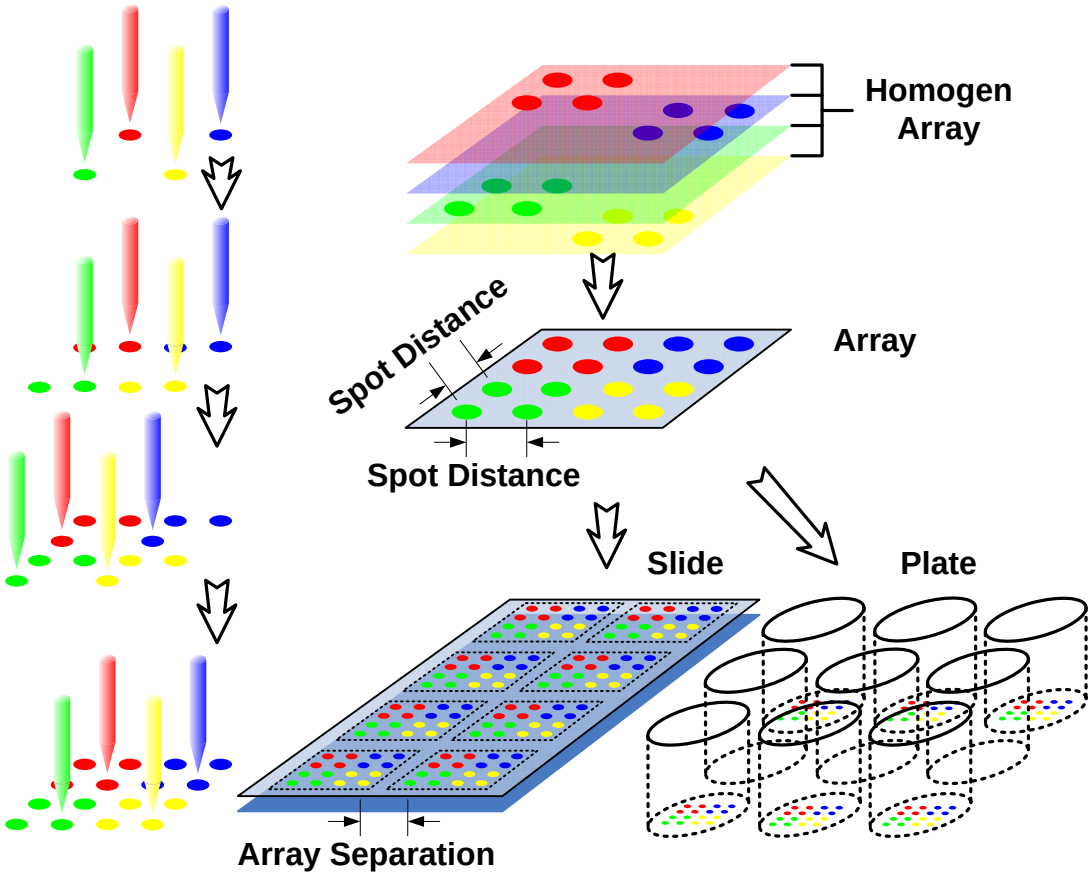
Click the *Next* button on the *Slide* page or click the **Array** button on the left **Task Panel** to turn to the **Array Definition** page.



In this page the user can customize how many **Array**s (sub arrays) will be printed on the slide, how many spots will be in an **Array**, and how the **Array**s and spots are arranged. Users can preview the arrangement on a virtual slide in the box on the right.

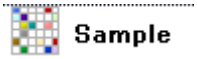
Spot Distance	This is the center-to-center distance in μm between two consecutive spots printed by the same pin within an **Array**. It is dependent upon the diameter of the spots, which are usually 180μm - 400μm.
Spot Count per Pin	The number of deposition actions taken by each pin; Specifically the number of spots printed by the same pin/channel within an **Array**. The count should not be greater than the **Max. Spot Count**.
Max. Spot Count	The maximum number of spots is mainly dependent upon the dimensions of printable area and the **Spot Distance**. The upper limit of the spot count printed by the same **Pin** within an **Array**. If there is only one **Pin** on the **Pin Holder**, the **Max. Spot Count** is determined by the **Spot Distance** by PX/PY. If there is more than one **Pin**, the **Max. Spot Count** is determined by the **Spot Distance** and by the distance between the **Pin**s.
Replicate(s) per Sample	Refers to how many replicates are required for a single sample. It should not be greater than the product of the values of the **Spot Count per Pin** along the X axis and the Y axis.
Array Separation	The distance between the edges of two neighboring **Array**s (sub arrays). It should not be less than the **Spot Distance**.
Array Count	Refers to how many **Array**s (sub arrays) will be arranged on the slide (along each axis). It should not be greater than the **Max. Array Count**.
Max. Array Count	It is determined by **Array Separation**, the size of the array and the printable area.
Array Replication	Indicates whether the arrays share the same sample sequence.
Pre-spotting Count	The number of **Pre-spotting** spots per sample ranges from 0~500. **Pre-spotting** is necessary to ensure the uniformity of spots on the slide by

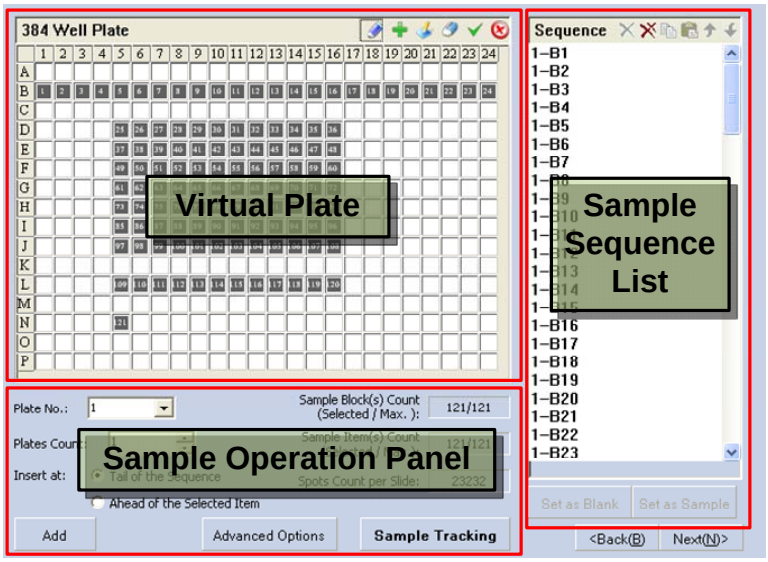
	removing excess liquid.
Pre-spotting Distance	The distance in μm between spots on **Pre-spotting** slides can range from 80μm ~4500μm



The figure illustrates that the spots printed by the same **Pin** constitute a **Homogen Array** within an **Array**. The number of **Homogen Array**s in an **Array** is always the same with the number of **Pin**s on the **Pin Holder**. In the illustration above, there are 4 **Pin**s (2 by 2 configuration) on the **Pin Holder**, the **Array** is 4 by 4. There are 4 **Homogen Array**s in an array, and the **Homogen Array** is 2 by 2. The **Spotting Module** will move up and down for 4 times (alternatively it will take 4 deposition actions of the **Spotting Module**) to complete an **Array**. Thus, the **Spot Count per Pin** is 2 by 2 (X by Y), the **Array Count** is 2 by 4 (X by Y).

5.8 Sample Sequence

	Click the *Next* button on the **Array Definition** page or click the *Sample* button on the left **Task Panel** to turn to the **Sample Sequence** page.



A graphical interface simulating a 384-well plate is presented to aid the setup of the **Sample Sequence** for the uptake of sample. The procedure is described below:

5.8.1 Specify Sample Wells on the Virtual Plate

The software provides a set of tools that allow you to specify the sample wells on the virtual plate.

	Click the *Single Selection* button to select sample well one by one. After you select one sample well, an automatically incremental ordinal number will be assigned to the well, which will be displayed on the center.
	Click the *Row/Column Selection* button to select sample wells row by row or column by column, without changing the assigned ordinal numbers of previously selected wells. If the **Row/Column** is set to Row->Col, the sample wells will be selected row by row. Otherwise, they will be selected column by column. You can find the **Row/Column** options on the *Uptaking Sample* dialog page in the *Advanced Sample Option* dialog box by clicking the *Advanced Option* button at the bottom of the **Sample Sequence** dialog page.
	Click the *Rectangle Selection* button, drag a rectangle on the virtual plate to select a block of sample wells within the border of the rectangle, without changing any assigned ordinal numbers of previously selected wells inside it. The numbering rule will be illustrated later.
	Click the *Clear Out* button, and then click or drag on the virtual plate to deselect the sample well from the sample sequence. The ordinal number will be automatically updated.
	Click the *Select All* button to select all wells into the sample sequence. The numbering rule applies in the same way with rectangle selection.
	Click the *Clear All* button to deselect all the wells from the sample sequence.

Numbering Example				
Row/Column	Row->Col	Col->Row	Row->Col	Col->Row
Row	Left->Right	Left->Right	Right->Left	Right->Left

5.8.2 Plate Sequence

Users can manage the plate sequence as following:

Input an ordinal number for the plate which is about to be added into the plate sequence, in the text box.

Input a copy number for the plates which are about to be added into the plate sequence. The corresponding number of replicates sharing the same sample well arrangement and numbering will be added to the list in a batch.

Select where the current plate design will be added. Select *Append* to add the current plate design to the end of the **Sample Sequence** list represented in the list box on the right hand side. Select *Insert to* add the current plate design in front of the selected items in the **Sample Sequence** list, or to add it to the end if there is no selected item in the list.

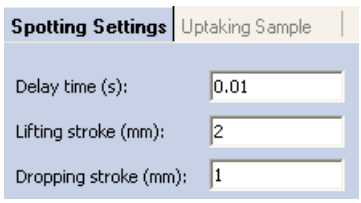
After finishing the plate design, Click the *Add* button to submit and add all the indexed sample wells on the current plate into the **Sample Sequence** list. The selected sample blocks should not exceed the maximum or you will be alerted and the submission will be rejected.

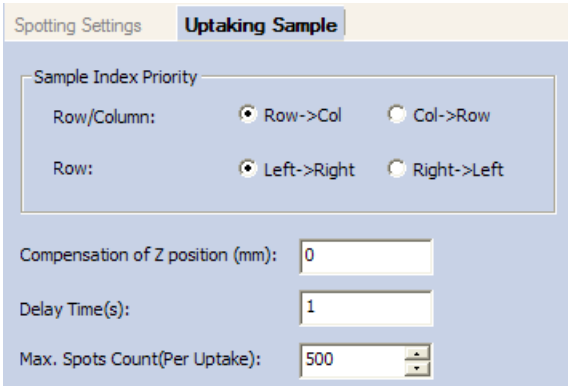
5.8.3 Edit the Sample Sequence List

The user still can modify sample sequence list entries. The following commands are available on the top of the list box: *Delete*, *Delete All*, *Copy*, *Paste*, *Move Up*, and *Move Down*. If for some reason, you did not already pipette any sample into an indexed sample well in the list, you can select the entry and click the *Set as Blank* button and the instrument will skip that well on the sample plate. Click the *Set as Sample* to restore the blank entry.

5.8.4 Advanced Options

Click the *Advanced Slide Option* button to pop up the *Advanced Sample Option* dialog and configure a set of parameters. The parameters are organized into two dialog pages: the *Spotting Settings* dialog page and the *Uptaking Sample* dialog page.





The **Row/Column** option and the **Row** option have been explained in section 5.8.1.

Compensation of Z position	Adjust the Z axis position of the **Spotting Module** to compensate for the difference between the liquid level in the sample well and the calibrated sample plate position. The positive compensation moves the **Pin**(s) further downward and negative compensation moves the **Pin**(s) less downward.
Delay time (for sample uptake)	Customize the length of time the pin is in contact with the sample, dependent upon the nature of the sample.
Max. spots count (per uptake)	Set the maximum number of spots printed per uptake, dependent upon the nature of the sample.

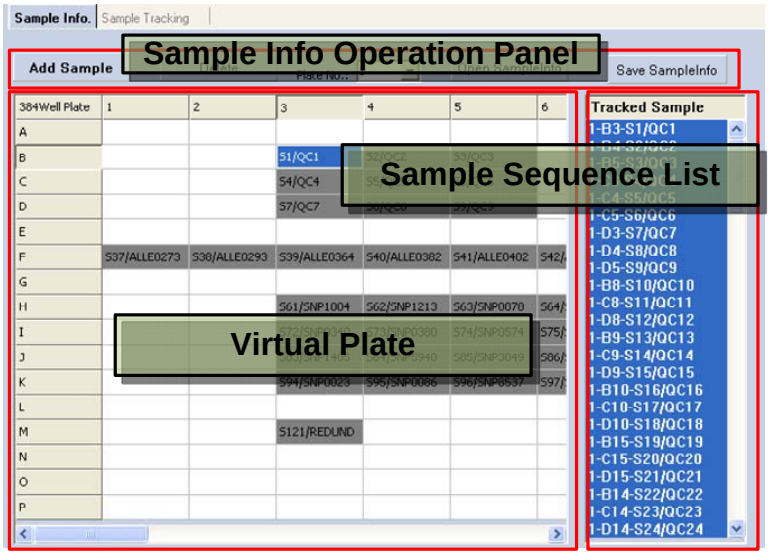
Delay time (for spotting)	Customize the length of time the **Pin** remains in contact with the slide, dependent upon the nature of the sample.
Lifting stroke	The travel distance of the **Spotting Module** along the Z axis from the peak (when it moves upward to the extreme) to the calibrated slide position.
Dropping stroke	The travel distance of the **Spotting Module** along the Z axis from the calibrated slide position to the trough (when it moves downward to the extreme).

5.8.5 Slide Preview

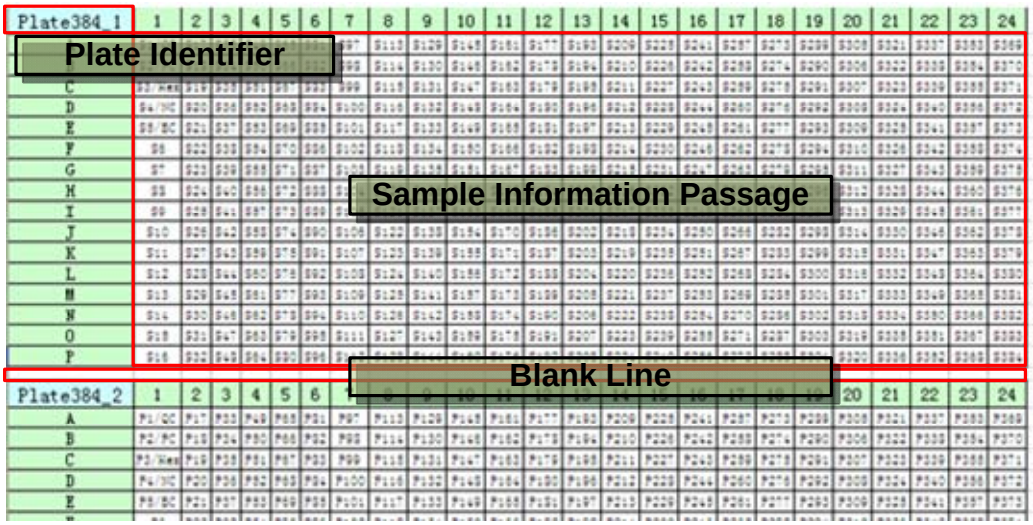
Click the **Sample Tracking** button to preview the distribution of the samples on the slides in the **Sample Tracking** dialog. There are two pages: *Sample Info* page, where a virtual 384-well plate is provided to browse and edit sample information; and *Sample Track* page to provide a preview interface. You can also annotate the samples and export the GAL file.

You should follow the instructions below.

Step 1	Select which plate will be edited in the *Plate No.* combo box.
Step 2	The Sample Info Working Area is a virtual 384-well plate. The wells with a grey background will be used in the printing job; the ones with a white background will not. All the wells can be edited, but only the ones with grey background can be associated with the sample sequence.
Step 3	The text of sample information should be filled into wells with a grey background in a pattern of "Sample ID/Sample Name". Or you can click *Open Sample Info* button to load the existing **Sample Flag File**.
Step 4	Once you complete editing of the sample information, click the *Add Sample* button to associate this information to the sample sequence. Meanwhile the interface of the *Sample Track* page will be updated.
Step 5	Click the Save Sample Info button and then save the sample information on the current plate into a **Sample Flag File** for later use.
Step 6	Click the *Delete* button to clear all the information on the current plate.



The **Sample Flag File** can be an excel document or a simple text file in the specific format as described below.



The **Sample Flag File** is organized in the form of a group of **Sample Information Passage**s.

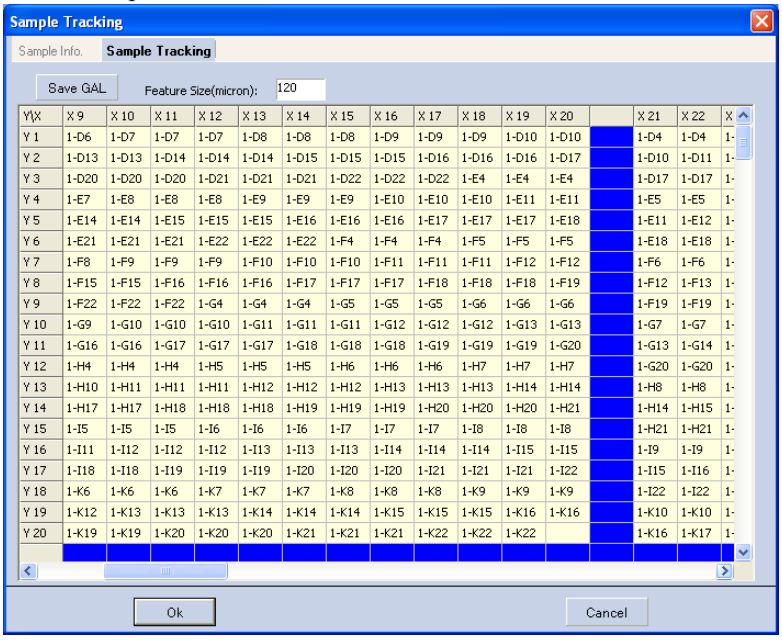
The **Sample Information Passage** should begin with a **Plate Identifier**, which is composed of the "Plate384_" or "Plate96_" followed by the plate index. When the file is loaded, the program will look for a matching plate according to its type and index (No.).

The **Sample Information Passage** is a table of 16 rows and 24 columns referring to the 384-well plate.

Each column of the table in the **Sample Information Passage** should be separated by the tab. Each entry of the sample information should be in a pattern of the "Sample ID/Sample Name". The entry can be blank, but you can not skip rows or columns.

Two neighboring **Sample Information Passage**s are separated by one blank line.

After editing the sample information entries, you can preview the slides to see details of the sample source of each spot, as illustrated below:



Each cell in the grid represents a spot on the slide. The arrays on the slide are separated by rows and columns in dark color. In the demonstration above, the spots are arranged in a 20 ×

20 array and cell (X1, Y1) to cell (X20, Y20) constitutes the first array.

The **Tracking Identifier** of each spot is shown in the cell. For example, "1-A1-S1/QC" refers to the sample in A1 well of plate no. 1, with sample ID of S1 and sample name of QC.

Thus the cells sharing the same **Tracking Identifier** refer to spot replicates of the same sample on the slide.

Users can click the *Save GAL* button to export the sample tracking information into a GAL file, as instructed below.

Step 1	Input **Feature Size** in μm in the text box. **Feature Size** is the expected diameter of the spot on the slides.
Step 2	Click the *Save GAL* button to pop up a dialog to specify the path to save the GAL file.

5.9 Cleaning Protocol

	Click the *Next* button on the **Sample Sequence** page, or click the *Clean* button on the left **Task Panel** to turn to **Cleaning Protocol** page.

A **Cleaning Protocol** can consist of three kinds of operations: *Rinse*, *Sonicate* and *Dry*. A typical **Cleaning Protocol** has four steps: *Rinse-Sonicate-Rinse-Dry*. The number of cycles of this iteration is dependent on the sample characteristics. Samples with high viscosity require more cycles and an elongated time span. It is recommended to optimize the cleaning protocol to save time by conducting a remnant fluorescence test prior to full-state usage.

The procedure to set up a cleaning protocol is described below.

Step 1	Select the operation by checking the box in front of the Rinse label, and click the spin button on the right hand side to specify how long the rinse step will take.
Step 2	Click the Add >> button to append the cleaning operation list in the right list box with the selected operations on the left.
Step 3	Repeat step 1 and 2 to complete the protocol.

After you complete the protocol, you can make use of the tools provided to *Delete*, *Copy*, *Paste*, *Move Up* and *Move Down* a specific entry or delete all entries.

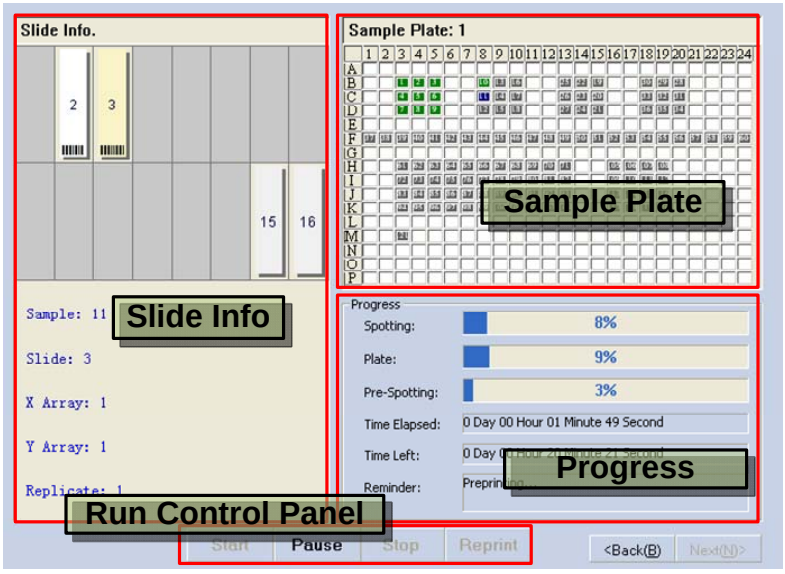
The user can click the *Save* button to backup the current protocol, or click the *Open* button to load an existing protocol.

5.10 Run

Click the *Next* button on the cleaning protocol page, or click the *Run* button on the left **Task Panel** to turn to the run page.

Click the *Start* button to run the protocol.

5.10.1 Run Page Layout



The *Slide Info* section reveals the current status of the slides, including the current sample, current slide, and if the **Array Replication** is true, the row index and the column index of the current array, and the index of current replicate.

The *Plate* section illustrates the status of the current sample plate, including the plate index, which wells have already been sampled, which ones are being sampled right now and which ones have not yet been sampled. The wells at different status levels are differentiated by different colors.

The *Progress* section describes the progress on various levels with bars, including the **Pre-spotting** progress, **Spotting** progress and plate progress. The time statistics and estimation, an information section is also available in this section.

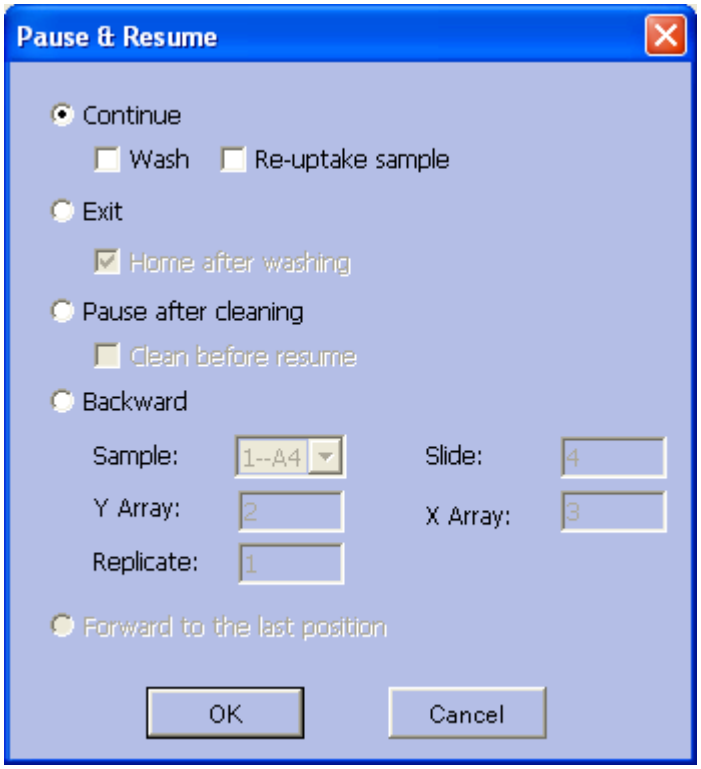
There are control buttons at the bottom of the page, including the *Start* button, *Pause* button, *Stop* button and the **Reprint** button. Please refer to 9.4 to know more about the **Reprint** button.

5.10.2 Pause and Proceed

The pause and the resume functions are provided to handle unexpected emergency events, particularly during **Spotting** applications.

Click the *Pause* button to pop up the **Pause & Resume** dialog. The instrument will enter into halt status after it completes the current basic action.

A basic action refers an action which can not be further subdivided,for example the movement of the **Robotic Arm** along a specific axis.



There are several options you can choose after you access the **Pause & Resume** dialog.

Continue:

Select the actions to execute immediately before the next action in the protocol. For example, check the *Wash* box to insert a wash step into the process just before the next action.

Exit:

Choose to terminate the current running protocol. Check the *Home after washing* box to bring the **Robotic Arm** to the home position and carry out a cleaning operation before termination.

Pause after cleaning:

Choose to carry out a cleaning operation and keep the instrument idle. If the *Clean before resume* box is checked, a cleaning operation will be executed prior to any further action when you want to resume the protocol.

Backward:

Choose to return to a certain prior step and repeat the protocol. You can specify various references to indicate where you want to reprint:

Sample	Specify an index number to determine which sample will be reprinted.
Slide	Specify an index number to determine which slide will be reprinted.
Y Array	Specify an index number to determine which array along the Y axis will be reprinted. If there are no replicate arrays in the protocol, this reference will not be available.
X Array	Specify an index number to determine which array along the X axis will be reprinted. If there are no replicate arrays in the protocol, this reference will not be available.
Replicate	Specify an index number to determine which replicate will be reprinted.

Forward to the last position:

Choose this option to resume from where the user halted the process and returned to the previous step. The option is only available after pause and return.

Click the *OK* button to execute the corresponding operations. If the system is halted, the *Pause* button will appear as the *Continue* button, and the user can click it to resume the current protocol.

5.10.3 Stop

You can either select the *Exit* option on the **Pause & Resume** dialog, or click the ***Stop*** button when the system is halted.

Chapter 6 Slide Dispensing

6.1 Overview

The work flow and instructions for microarray dispensing onto slides with the **PersonalArrayer™ 16** are described in this chapter. After reading this chapter, the user will have gained essential skills in instrument and software operatios for n**Slide Dispensing** procedures.

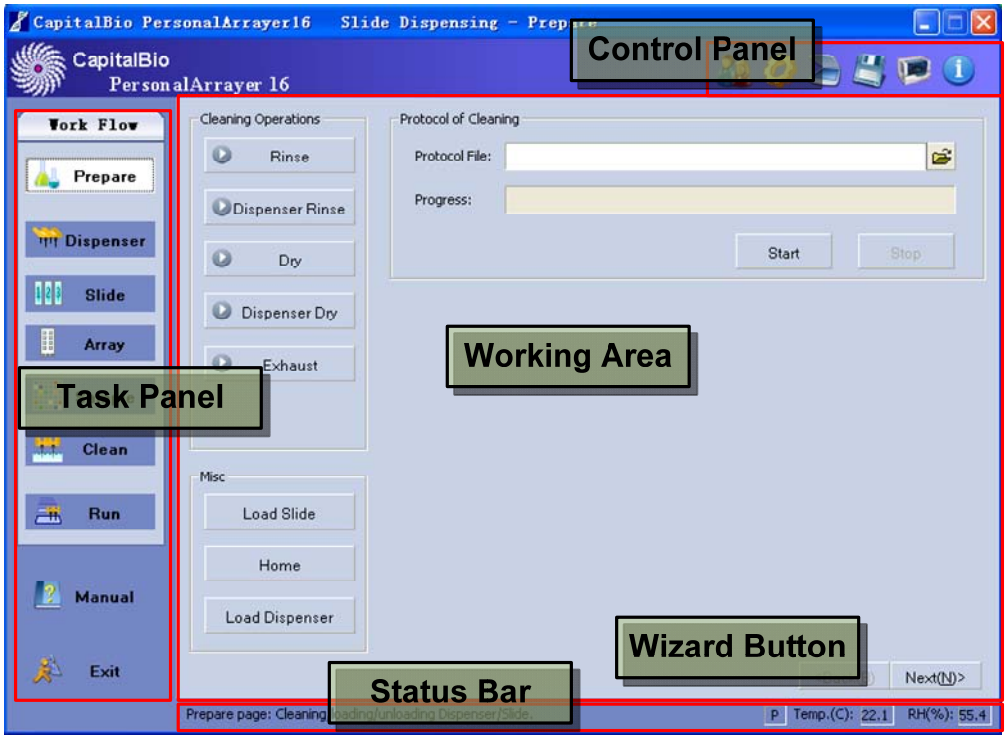
6.2 Hardware Configuration

In the **Slide Dispensing** mode, the instrument should be equipped with the **Dispensing Module** on the **Robotic Arm** (please refer to section 1.8 in the manual to switch between the **Spotting Module** and the **Dispensing Module**), and the **Slide Deck** on the **Platform** (please refer to section 1.9 in the manual to switch between the **Slide Deck** and the **Plate Deck**).

6.3 Start the System

Please refer to section 3.2 to start the **PersonalArrayer™ 16** system.

The software will identify the current working mode and initialize the interface illustrated as below.



6.4 Prepare

The application software automatically begins with the *Prepare* page after launch.

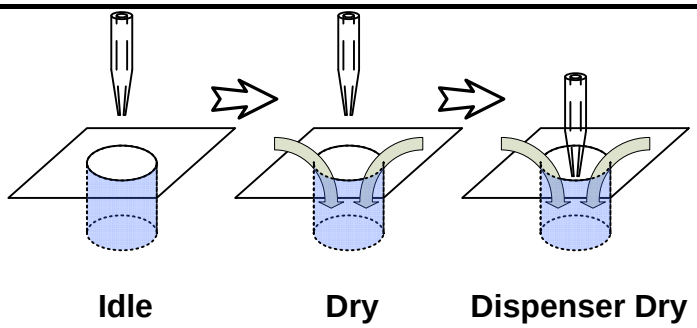
Alternatively, you can click the *Prepare* button on the left **Task Panel** to go to the *Prepare* page.

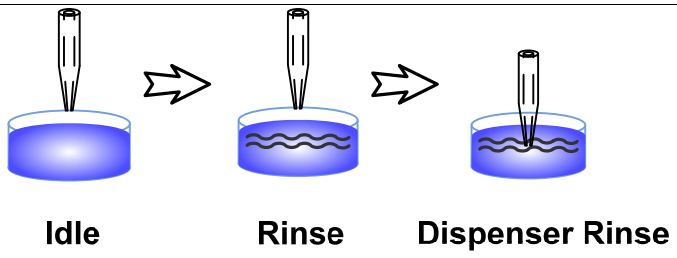
Users can load slides on the **Slide Deck**, clean the nozzle, and move the **Robotic Arm** to the home position.

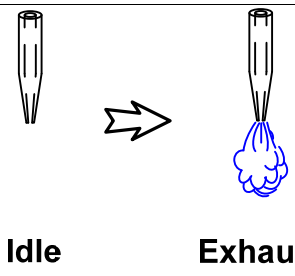
Warning:
Please carry out **Position Calibration** before you proceed.

6.4.1 Cleaning Operations

The following cleaning operations, *Rinse*, *Dispenser Rinse*, *Dry*, *Dispenser Dry*, *Exhaust* are available for use:







Users can always execute these commands independently.

6.4.1.1 Rinse

	Rinse	Click the *Rinse* button and the water in the **Rinse Basin** will begin to flow. Meanwhile the **Rinse Indicator** will be illuminated.
	Rinse	Click the *Rinse* button again to exit current action. The **Rinse Indicator** will turn off.

Please ensure that there is sufficient water in the **Rinse Basin** for the following steps.

6.4.1.2 Dispenser Rinse

	Dispenser Rinse	Click the *Dispenser Rinse* button, the water in the **Rinse Basin** will begin to flow and the **Robotic Arm** will move to dip the **Nozzle** into the basin. Meanwhile the **Rinse Indicator** will be illuminated.
	Dispenser Rinse	Click the *Dispenser Rinse* button again to exit the current action. The **Robotic Arm** will lift up the **Nozzle** out of the basin. The **Rinse Indicator** will turn off.

6.4.1.3 Dry

	Dry	Click the *Dry* button and the vacuum pump will start to work. Meanwhile the **Dry Indicator** will be illuminated.
	Dry	Click the *Dry* button again to exit the current action. The **Dry Indicator** will turn off.

6.4.1.4 Dispenser Dry

	Dispenser Dry	Click the *Dispenser Dry* button, the vacuum pump will start and the **Robotic Arm** will dip the **Nozzle** into the **Vacuum Slot** to get rid of remaining liquid. Meanwhile the **Dry Indicator** will be illuminated.
	Dispenser Dry	Click the *Dispenser Dry* button again to exit the current action. The **Dry Indicator** will turn off.

6.4.1.5 Exhaust

	Exhaust	Click the *Exhaust* button, the **Robotic Arm** will move the **Nozzle** directly over the **Rinse Basin**, turn on the valve in the **Dispensing Module** and *Exhaust* the **Nozzle** and the tubing connected to the **Nozzle**.
	Exhaust	Click the *Exhaust* button again to exit the current action.

6.4.2 Cleaning Protocol

Users can load a **Cleaning Protocol** from existing files to run a procedure consisting of a series of actions. Please refer to section 6.9 for details on **Cleaning Protocol** files.

6.4.3 Load Slides

Click the *Load Slides* button and the **Robotic Arm** will move the **Dispensing Module** to the right extreme, so you can place the slides onto the **Slide Deck** on the left side.

Please refer to section 5.4.3 for more details.

6.4.4 Home

Click the *Home* button to move the **Robotic Arm** to the home position, the top left corner of the **Platform**. If any of the cleaning operations is running, the home command will stop it.

6.5 Dispenser Configuration

	Click the *Next* button on the *Prepare* page or click the **Dispenser** button on the left **Task Panel** to turn to the **Dispenser Configuration** page.

PersonalArrayer™ 16 curently has a single **Dispenser**/**Nozzle**. This combination can not be changed.

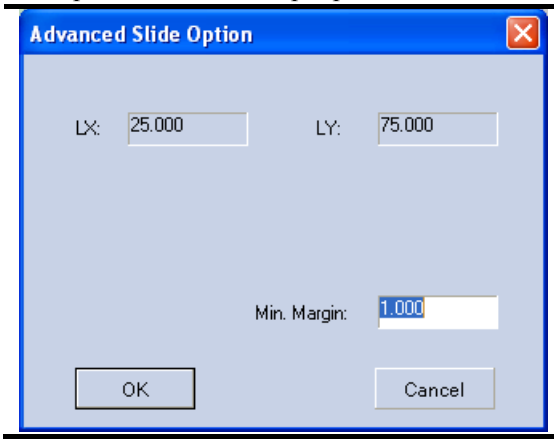
6.6 Slide Configuration

	Click the *Next* button on the **Dispenser Configuration** page or click the *Slide* button on the left **Task Panel** to turn to the *Slide* page. This page consists of two sections: *Dispensing Area* and *Slides Info*.

Please refer to section 5.6 *Spotting Area* to know more about parameters in the *Dispensing Area* section.

In the *Slide Info* section, users can specify the number and location of the slides. You can decide which slide will be printed first, and how many slides will be printed.

In the **Slide Dispensing** mode, the **Pre-dispensing** operation returns excess sample to the sample well on the sample plate, so there is no need to set up **Pre-dispensing** slides.

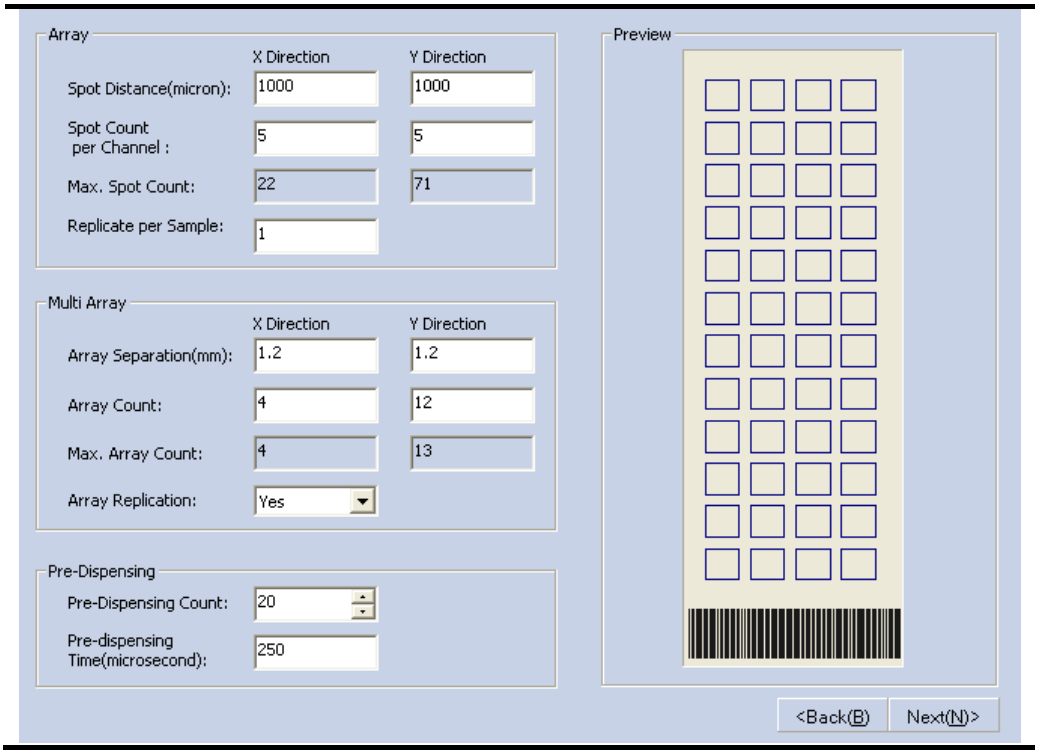


Click the *Advanced Slide Option* button on the *Slide* page to show the *Advanced Slide Option* dialog. You can customize the *Min Margin*.

The *Min Margin* refers to the minimum space between the border of the printable area and the edge of the slide. OX and OY should not be less than the *Min Margin*.

6.7 Array Definition

	Click the *Next* button on the *Slide* page or click the **Array** button on the left **Task Panel** to turn to the **Array Definition** page.



In this page users can customize how many arrays will be printed on the slide, how many spots will be in an array, and how the arrays and spots are arranged. Users can preview the arrangement on a virtual slide in the box on the right.

Spot Distance	Spot-to-spot distance within an array in μm. It is dependent upon the diameter of the spot, usually 800μm - 1500μm.
Spots Count per Channel	The number of deposition action taken by the **Dispenser**; specifically the number of spots printed by the **Dispenser** within an array. It should not be greater than the **Max. Spot Count**.
Max. Spot Count	The maximum number of spots is mainly dependent upon the dimensions of the printable area and the **Spot Distance**. **Max. Spot Count** is determined by the **Spot Distance** and the PX/PY.
Replicate(s) per Sample	Refers to how many replicates are required for a single sample. It should not be greater than the product of the values of the **Spots Count per Channel** along the X axis and the Y axis.
Array Separation	The distance between the edges of two neighboring arrays. It should not be less than the **Spot Distance**.
Array Count	Refers to how many arrays will be arranged on the slide (along each axis). It must not be greater than the **Max. Array Count**.
Max. Array Count	It is determined by **Array Separation**, the size of the array and the printable area.
Array Replication	Indicates whether the arrays share the same sample sequence.
Pre-dispensing Count	Spot count per sample for **Pre-dispensing**, ranging from 0~500. **Pre-dispensing** is necessary to ensure the uniformity of spots on the slide.
Pre-dispensing Time	The duration of the dispensing during the **Pre-dispensing** step will affect the volume delivered. The unit is μs, ranging from 10μs ~2500μs.

6.8 Sample Sequence

	Click the *Next* button on the array definition page or click the *Sample* button on the left **Task Panel** to turn to the **Sample Sequence** page.

A graphical interface simulating a 384-well plate or a 96-well plate (when in **Dispensing** mode) is presented to set up the **Sample Sequence** for sample uptake. Whenever you change the plate type, please refer to section 4.2.7 for instruction on how to calibrate the sample plate position on the **System Configuration** dialog. The procedure is described below:

6.8.1 Step 1: Specify Sample Wells on the Virtual Plate

Please refer to section 5.8.

6.8.2 Step 2: Plate Sequence

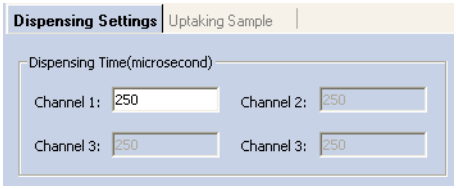
Please refer to section 5.8.

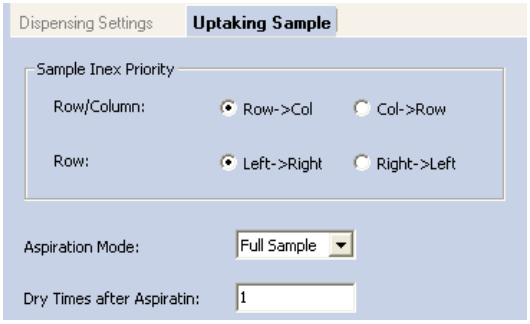
6.8.3 Step 3: Edit the Sample Sequence List

Please refer to section 5.8.

6.8.4 Step 4: Advanced Options

Click the *Advanced Option* button to bring up the *Advanced Sample Option* dialog box and configure a set of parameters. The parameters are organized into two pages: *Dispensing Settings* and *Uptaking Sample*.

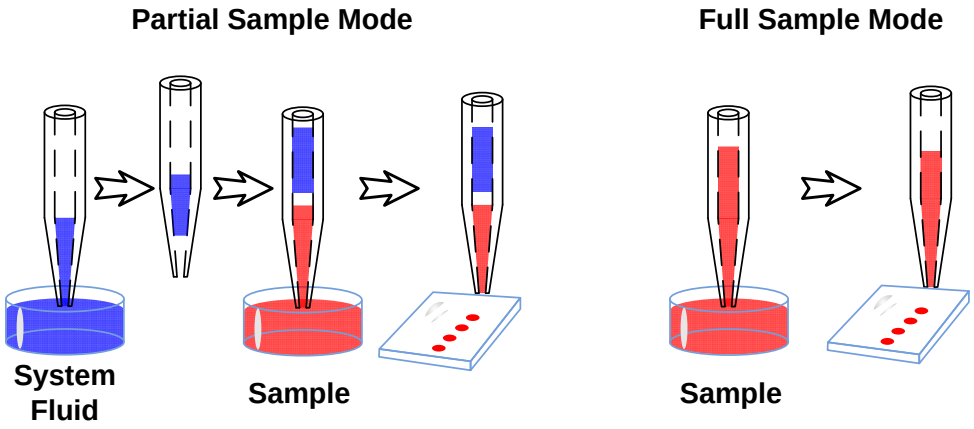




The **Row/Column** option and **Row** option have been explained in section 5.8.1.

Dispensing Time	The **Dispensing Time** for each spot on the substrate, in μs. At present time **PersonalArrayer™ 16** supports only one nozzle so only the first text box is available.
Aspiration Mode	Refers to **Aspiration Mode** for sample and can be selected from two alternatives: **Full Sample** mode and **Partial Sample** mode. In **Full Sample** mode, only the sample is taken into the **Dispenser** channel, so the sample uptake can be returned into the sample plate. In **Partial Sample** mode, **System Liquid** (such as deionized water) is first taken into the **Dispenser** channel, then some air and then the actual sample is taken. Here the sample uptake cannot be returned into the sample plate.

Dry Times after Aspiration	It is necessary to customize the number of times that the vacuum drying of the **Nozzle** is repeated to remove all liquid from the outer surface after aspiration. Each vacuum operation lasts for 1 second. The repeat number is dependent upon the viscosity of the sample.



The respective advantages and disadvantages of the two modes are listed in the table below.

Mode	Full sample	Partial sample
Uptake sequence	Sample only	System liquid-Air-Sample
Sample uptake	>35μL	>5μL
Sample reutilization	Yes	No
Maximum spots per uptake	>5000	>200

6.8.5 Step 5: Slide Preview

Please refer to section 5.8.

6.9 Cleaning Protocol

	Click the *Next* button on the **Sample Sequence** page, or click the *Clean* button on the left **Task Panel** to turn to **Cleaning Protocol** page.

The **Cleaning Protocol** can consist of three kinds of operations: *Rinse*, *Exhaust* and *Dry*. A typical **Cleaning Protocol** has three steps: *Rinse-Exhaust-Dry*. The number of cycles of this iteration is dependent on the sample characteristics. Samples with high viscosity require more cycles and an elongated time span. It is recommended to optimize the **Cleaning Protocol** by conducting a remnant fluorescence test prior to full-state usage.

Please refer to section 5.9 to set up the **Cleaning Protocol**.

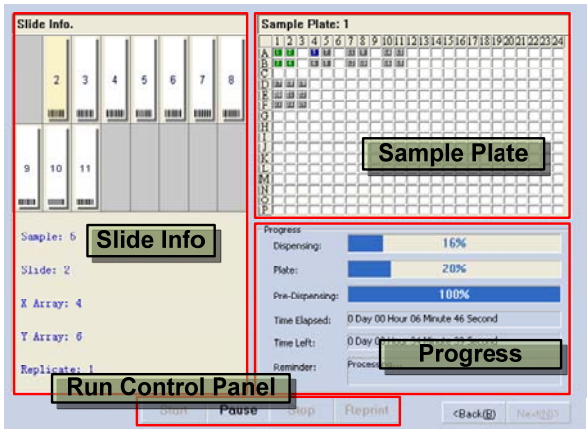
The user can click the *Save* button to backup the current protocol, or click the *Open* button load an existing protocol. Please refer to section 5.4.2 for more details.

6.10 Run

Click the *Next* button on the **Cleaning Protocol** page, or click the *Run* button on the left **Task Panel** to turn to the *Run* page.

Click the *Start* button to run the protocol.

6.10.1 Run Page Layout



The *Slide Info* section reveals the current status of the slides, including the current sample, current slide, and if the **Array Replication** is true, the row index and column index of the current array, and the index of the current replicate.

The **Sample Plate** section illustrates the status of the current sample plate, including the plate index, which wells have already been sampled, which ones are being sampled and which ones have not yet been sampled. The wells at different status levels are differentiated by different colors.

The *Progress* section describes the progress on various levels with bars, including the **Pre-dispensing** progress, **Dispensing** progress and plate progress. The time statistics and estimation and an information section is also available in this section.

There are control buttons at the bottom of the page, including the *Start* button, *Pause* button, *Stop* button and the **Reprint** button. We will continue to discuss the *Pause* button and *Stop* button below. Please refer to section 9.4 to learn more about the **Reprint** button.

6.10.2 Pause and Proceed

The pause and resume functions are provided to handle unexpected emergency events, particularly during **Dispensing** applications.

Click the *Pause* button to bring up the **Pause & Resume** dialog. The instrument will enter into halt status after it completes the current basic action.

The basic action refers an action which cannot be subdivided, for example movement of the **Robotic Arm** along a specific axis.

There are several options available after you access the **Pause & Resume** dialog. Please refer to section 5.10.2 for more details.

Click the *OK* button to execute corresponding operations. If the system is halted, the *Pause* button will appear as the *Continue* button, and users can click it to resume the current protocol.

6.10.3 Stop

You can either select the *Exit* option on the **Pause & Resume** dialog, or click the *Stop* button

when the system is halted.

Chapter 7 Plate Spotting

7.1 Overview

The work flow and instructions for microarray **Spotting** onto plates with the **PersonalArrayer™ 16** are described in this chapter. After reading this chapter, the user will have a basic understanding of **Plate Spotting** procedures and have gained essential skill in instrument and software operations.

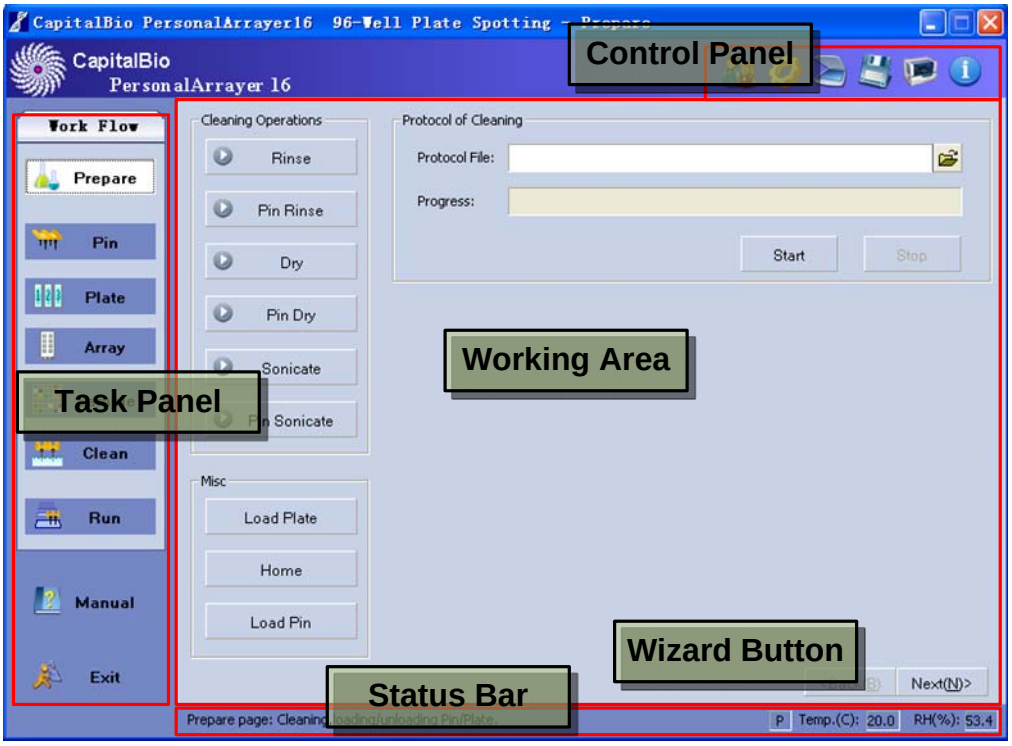
7.2 Hardware Configuration

In the **Plate Spotting** mode, the instrument should be equipped with the **Spotting Module** on the **Robotic Arm** (please refer to section 1.8 in this manual to switch between the **Spotting Module** and the **Dispensing Module**), and the **Plate Deck** on the **Platform** (please refer to section 1.9 in this manual to switch between the **Slide Deck** and the **Plate Deck**).

7.3 Start the System

Please refer to section 3.2 to start the **PersonalArrayer™ 16** system.

If the hardware is correctly configured as described in section 7.2, the software will identify the current working mode and initialize the interface illustrated as below.



7.4 Prepare

The application software begins with the *Prepare* page automatically after launch. Alternatively, you can click the *Prepare* button on the left **Task Panel** to go to the *Prepare*

page.

Users can load the **Pin**(s) onto the **Pin Holder**, load plates on the **Plate Deck**, clean the **Pin**(s), and move the **Robotic Arm**s to the home position.

Warning:
Please carry out **Position Calibration** before you proceed.

7.4.1 Cleaning Operations

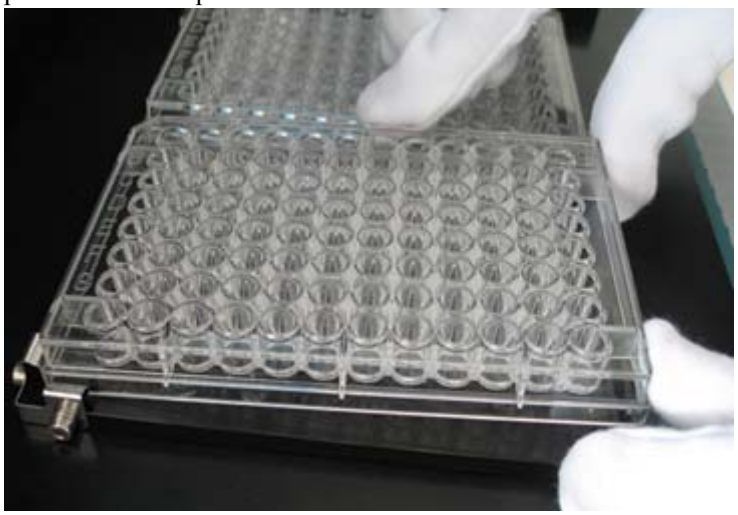
During the cleaning operations, users can take the following actions: *Rinse*, *Pin Rinse*, *Dry*, *Pin Dry*, *Sonicate* and *Pin Sonicate*. The cleaning operations in the **Plate Spotting** mode are the same as ones in the **Slide Spotting** mode. Please refer to section 5.4.1 to learn more.

Users can load a stand alone **Cleaning Protocol** from existing files to run a procedure consisting of a series of actions. Please refer to section 5.9 for details of cleaning protocol files.

7.4.2 Load Plates

Click the *Load Plates* button and the **Robotic Arm** will move the **Spotting Module** to the right extreme, so you can place the slides onto the **Plate Deck** on the left side.

Press the narrow end with the alphabetical index of the plate against the clasp on the **Plate Deck**, and push it into the slot. The Plate Deck provided by the **PersonalArrayer™ 16** can accommodate up to two 96-well plates.



Warning:
Please make sure that the narrow end with the alphabetical index of the plate is pressed against the clasp on the **Plate Deck**.

7.4.3 Home

Click the *Home* button to move the **Robotic Arm** to the home position, at the top left corner of the **Platform**. If any of the cleaning operations is running, the home command will stop it.

7.4.4 Load Pin

Click the *Load Pin* button and the **Robotic Arm** will move the **Spotting Module** to the front

for the convenience of users to load a single pin.

Warning:
In **Plate Spotting** mode, there should be only 1 **Pin** on the **Pin Holder** at the back right corner. Additional pins, or **Pin**s in the incorrect position in the **Pin Holder** may result in malfunction or damage, failure and sample contamination, etc.

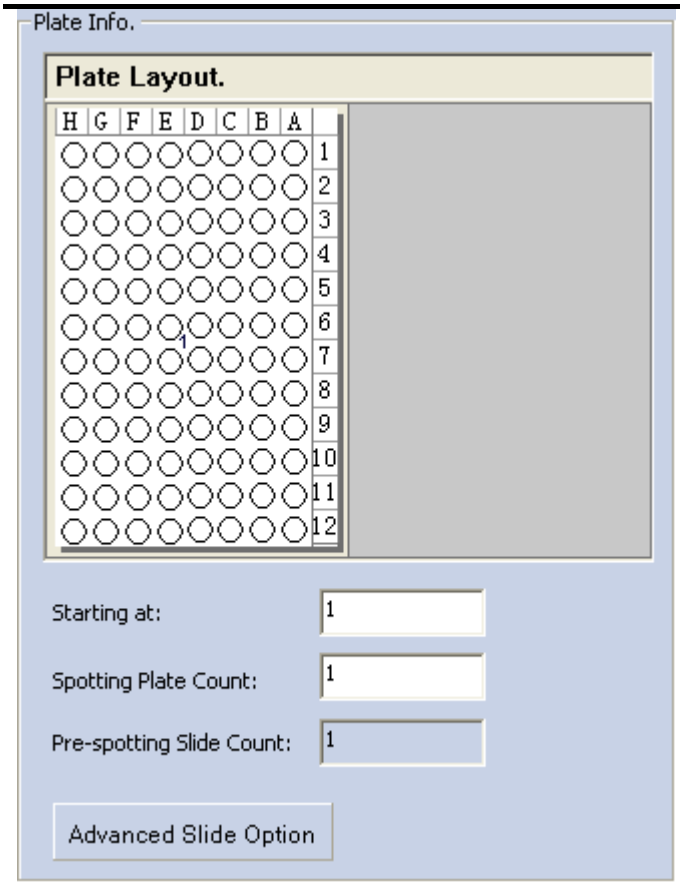
7.5 Pin Configuration

Pin	Click the *Next* button on the *Prepare* page or click the *Pin* button on the left **Task Panel** to turn to the *Pin Configuration* page.

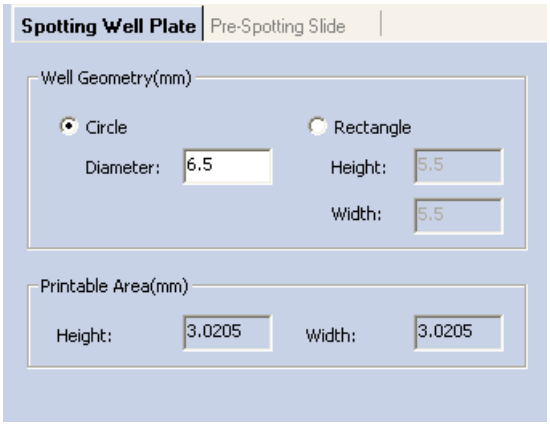
In the **Plate Spotting** mode, there should be only 1 **Pin** in the **Pin Holder**. Thus the combination is fixed.

7.6 Plate Configuration

Plate	Click the *Next* button on the *Pin Configuration* page or click the *Plate* button on the left **Task Panel** to turn to the *Plate* page.



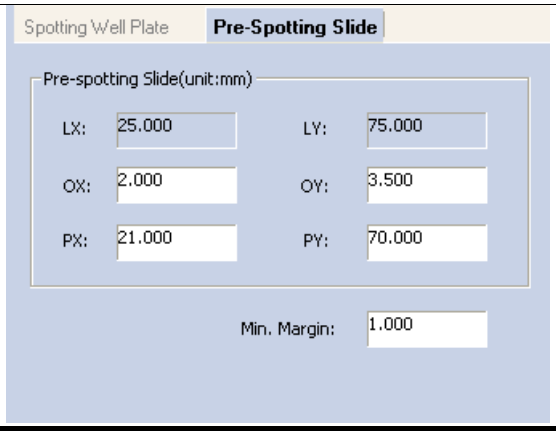
Users can specify the number and location of the plates. You can decide which plate will be printed first and how many plates will be printed. You can also decide how many pre-spotting slides will be needed.
The **Plate Deck** can accommodate up to two 96-well plates and one pre-spotting slide.



Click the *Advanced Option* button on the *Plate* page to bring up the **Plate Advanced Option** dialog. There are two pages: *Spotting Well Plate* page and *Pre-spotting Slide* page.

On the *Spotting Well Plate* page, you can decide the **Well Geometry**, to define whether it is round or square, and the diameter, length or width.

You can also review the **Printable Area** in each well, described by the length and width dimension.

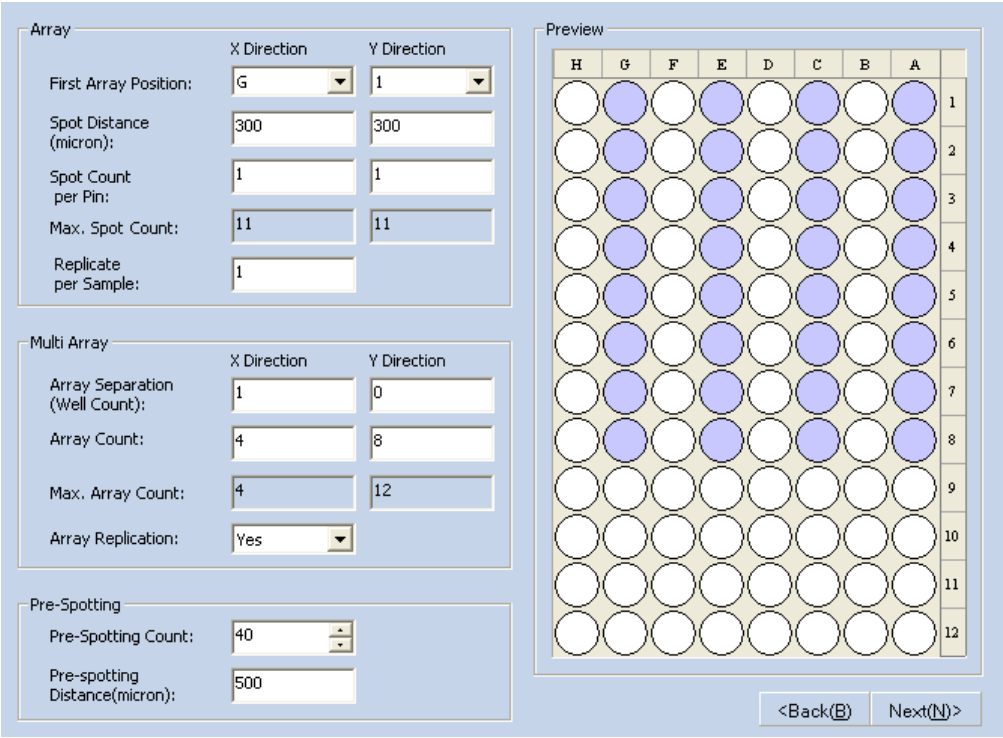


On the *Pre-spotting Slide* page, you can decide the **Printable Area** of the **Pre-spotting** slide. Please refer to section 5.6 to learn more.

7.7 Array Definition

Array

Click the *Next* button on the *Plate* page or click the **Array** button on the left **Task Panel** to turn to the **Array Definition** page.



On this page users can customize the number of arrays that will be printed on the plate, how many spots will be in an array, and how the arrays and spots are arranged. Users can preview the arrangement on a virtual plate in the box on the right. In **Plate Spotting** mode, each array will occupy a well on the plate.

First Array Position	Specify which well on the plate the first array will locate in. The first array in a block of arrays is defined as the top left corner of the block.
Spot Distance	Center-to-center spot distance within an array in μmbetween two consecutive deposition actions taken by the same **Pin**. It usually ranges from 180μm - 400μm, dependent upon the diameter of the spot.
Spot Count per Pin	The number of depositions made by the **Spotting Module**; specifically the number of spots printed by the same **Pin** within an array. It must not exceed the **Max. Spot Count**.
Max. Spot Count	The maximum number of spots is mainly dependent upon the dimensions of **Printable Area** and **Spot Distance**.
Replicate(s) per Sample	Refers to how many replicates are required for a single sample. It is not supposed to be greater than the product of the values of **Spot Count per Pin** along X axis and Y axis.
Array Separation	Define the number of blank wells between two neighboring printed wells.
Array Count	Refers to the number of arrays arranged on the plate (along each axis). It must not exceed the **Max. Array Count**.
Max. Array Count	It is determined by **Array Separation**, **First Array Position** and the number of rows and columns on the plate.
Array Replication	Indicates whether the arrays share the same sample sequence.

Pre-spotting Count, **Pre-spotting Distance** can be set on this page. Please refer to section 5.7 for more details.

7.8 Sample Sequence

Sample	Click the *Next* button on the **Array Definition** page or click the *Sample* button on the left **Task Panel** to turn to **Sample Sequence** page.

A graphical interface simulating a 384-well plate is presented to set up **Sample Sequence** for sample uptake. Please refer to section 5.8 for more details.

7.9 Cleaning Protocol

Clean	Click the *Next* button on the **Sample Sequence** page, or click the *Clean* button on the left **Task Panel** to turn to the **Cleaning Protocol** page.

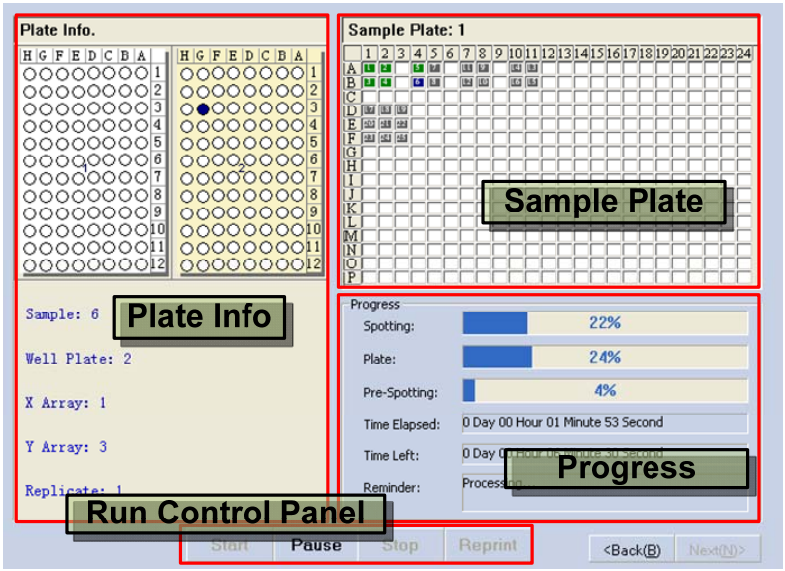
The procedure to set up a **Cleaning Protocol** is the same as in the **Slide Spotting** mode. Please refer to section 5.9 for more details.

7.10 Run

Click the *Next* button on the **Cleaning Protocol** page, or click the *Run* button on the left **Task Panel** to turn to the *Run* page.

Click the *Start* button to run the protocol.

7.10.1 Run Page Layout



The *Plate Info* section reveals the current status of plates, including the current sample, current plate, and if **Array Replication** is applied. It also indicates the row index and column index of the current array, and the index of current replicate.

The *Plate* section illustrates the status of current sample plate, including the plate index, which

wells have already been sampled, which ones are being currently sampled and which ones have not yet been sampled. The wells at different status levels are differentiated by different colors: Green for processed samples, blue for the samples in processing, and grey for samples yet to be processed.

The *Progress* section describes the progress on various levels with bars including the time statistics and an estimation of the **Pre-spotting** progress, **Spotting** progress and plate progress. An information section is also available in this section.

There are control buttons at the bottom of the page, including *Start* button, *Pause* button, *Stop* button and **Reprint** button. We will continue to discuss *Pause* button and *Stop* button below. Please refer to section 9.4 to learn more about **Reprint** button.

7.10.2 Pause and Proceed

The pause and resume functions are provided to handle unexpected emergency events, particularly during **Spotting** applications. Please refer to 5.10.2 for more details.

7.10.3 Stop

You can either select the *Exit* option on the **Pause & Resume** dialog, or click the *Stop* button when the system is halted.

Chapter 8 Plate Dispensing

8.1 Overview

The work flow and instructions for microarray **Dispensing** onto plates with the **PersonalArrayer™ 16** are described in this chapter. After reading this chapter, the user will have gained essential skills in **Plate Dispensing** procedures and for instrument and software operation.

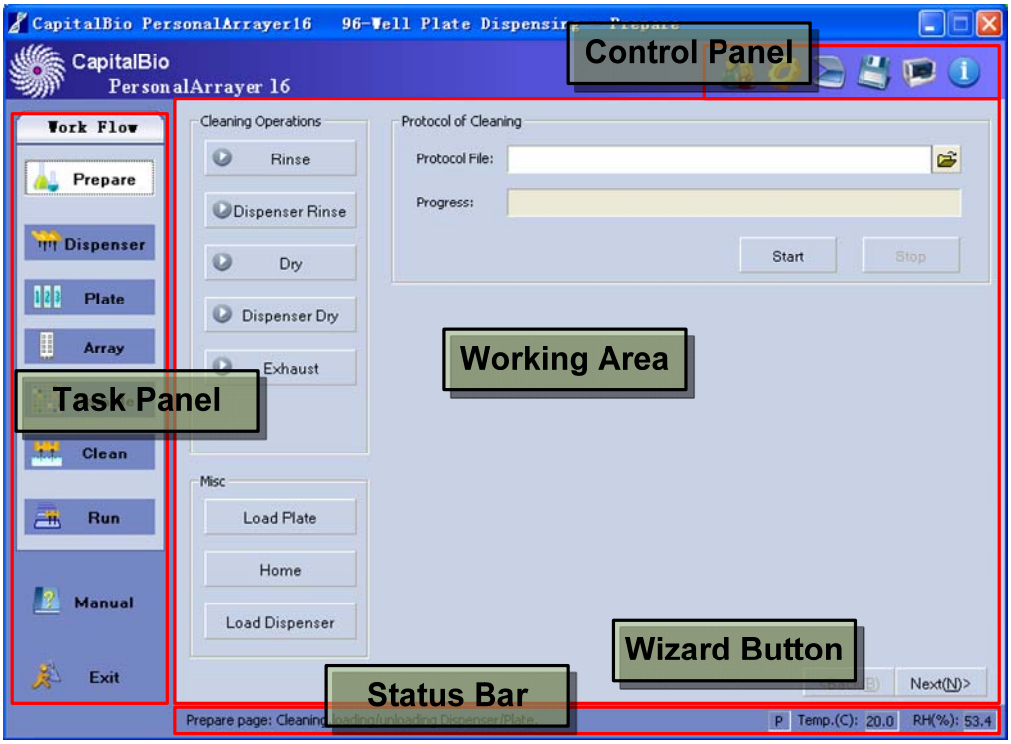
8.2 Hardware Configuration

In the **Plate Dispensing** mode, the instrument should be equipped with the **Dispensing Module** on the **Robotic Arm** (please refer to section 1.8 in this manual to switch between the **Spotting Module** and the **Dispensing Module**), and the **Plate Deck** on the **Platform** (please refer to section 1.9 in this manual to switch between the **Slide Deck** and the **Plate Deck**).

8.3 Start the System

Please refer to section 3.2 to start the **PersonalArrayer™ 16** system.

The software will identify the current working mode and initialize the interface illustrated as below.



8.4 Prepare

The application software begins with the *Prepare* page automatically after launch.

Alternatively, you can click the *Prepare* button on the left **Task Panel** to go to the *Prepare* page.

Users can load plates on the **Plate Deck**, clean the **Nozzle**, and move the **Robotic Arm** to the home position.

Warning:
Please carry out **Position Calibration** before you proceed.

8.4.1 Cleaning Operations

During the cleaning operations, the following actions are available: *Rinse*, *Dispenser Rinse*, *Dry*, *Dispenser Dry*, *Exhaust*. Please refer to section 6.4.1 for more details.

Users can load a stand alone **Cleaning Protocol** from existing files to run a procedure consisting of a series of actions. Please refer to section 5.9 for details of **Cleaning Protocol** files.

8.4.2 Load Plates

Click the *Load Plates* button and the **Robotic Arm** will move the **Dispensing Module** to the right extreme, so you can place the slides onto the **Plate Deck** on the left side.

Please refer to section 7.4.2 for more details.

8.4.3 Home

Click the *Home* button to move the **Robotic Arm** to the home position, the top left corner of the **Platform**. If any of cleaning operations is running, the home command will stop it.

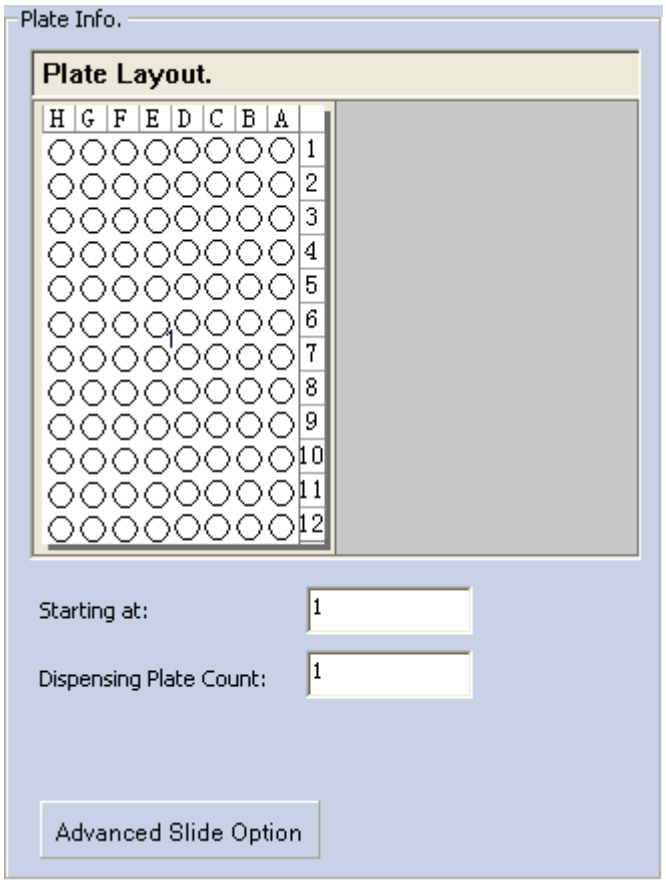
8.5 Dispenser Configuration

Click the *Next* button on the *Prepare* page or click the **Dispenser** button on the left **Task Panel** to turn to the **Dispenser Configuration** page.

PersonalArrayer™ 16 currently has one **Dispenser**/**Nozzle**. Thus the combination cannot be changed.

8.6 Plate Configuration

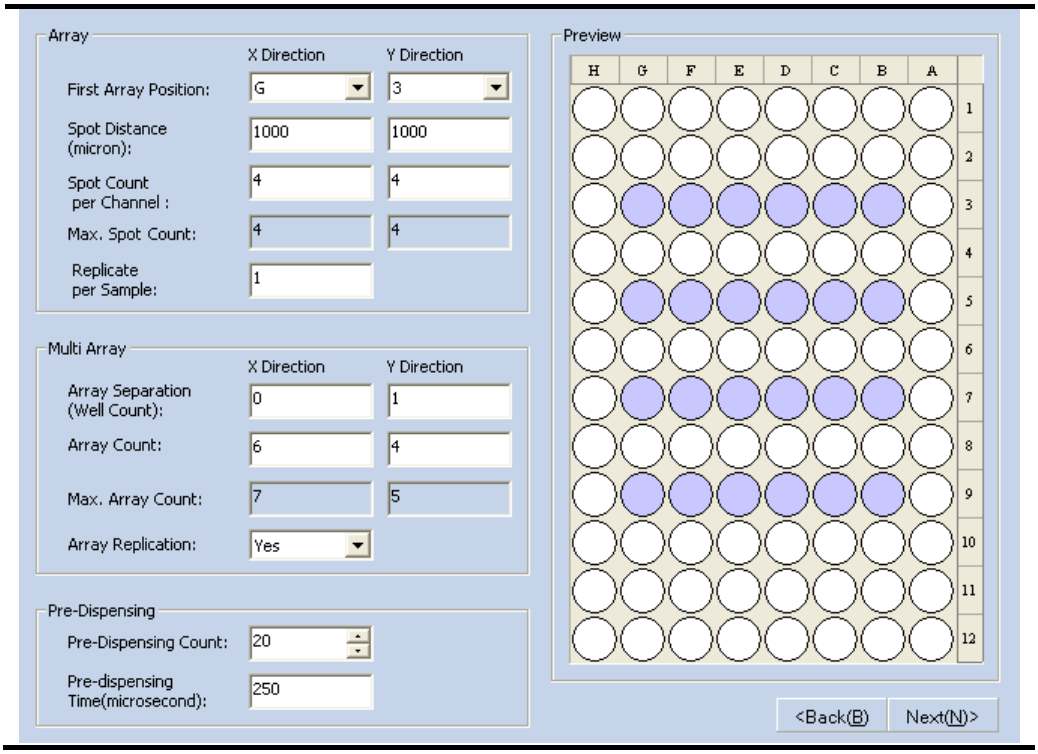
Click the *Next* button on **Dispenser Configuration** page or click the *Plate* button on the left **Task Panel** to turn to the *Plate* page.



Users can specify the number and location of the plates. You can decide which plate will be printed first and how many plates will be printed. In the **Plate Dispensing** mode, **Pre-dispensing** returns excess sample back to the sample well, so there is no need to set up a **Pre-dispensing** slide.
Please refer to section 7.6 to know more about the *Advanced Option*.

8.7 Array Definition

Array	Click the *Next* button on the *Plate* page or click the **Array** button on the left **Task Panel** to turn to the **Array Definition** page.



In this page users can customize the numbers of arrays that will be printed on the plate, how many spots will be in an array, and how the arrays and spots are arranged. Users can preview the arrangement on a virtual plate in the box on the right. In the **Plate Dispensing** mode, each array will occupy a well on the plate.

First Array Position	Specify which well on the plate the first array will be located in. The first array in a block of arrays is defined as the top left corner of the block.
Spot Distance	Center-to-center spot distance within an array in μm between two consecutive depositions by the **Dispenser**. It is usually 800μm - 1500μm, dependent upon the diameter of the spot.
Spots Count per Channel	The number of depositions by the **Dispenser**; namely the number of spots printed by the same **Dispenser** within an array. It is not supposed to be greater than **Max. Spot Count**.
Max. Spot Count	The maximum number of spots is mainly dependent upon the dimensions of the **Printable Area** and the **Spot Distance**.
Replicate(s) per Sample	Refers to how many replicates are required for a single sample. It is not supposed to be greater than the product of the values of **Spots Count per Channel** along X axis and Y axis.
Array Separation	How many blank wells between two neighboring wells which are used for printing.
Array Count	Refers to how many arrays will be arranged on the plate (along each axis). It is not supposed to be greater than the **Max. Array Count**.
Max. Array Count	It is determined by **Array Separation**, **First Array Position** and how many rows/columns there are on the plate.
Array Replication	Indicates whether the arrays share the same sample sequence.

Pre-dispensing Count, **Pre-dispensing Time** can be set on this page. Please refer to 6.7 for more details.

8.8 Sample Sequence

Sample	Click the *Next* button on the **Array Definition** page or click the *Sample* button on the left **Task Panel** to turn to the **Sample Sequence** page.

A graphical interface simulating a 384-well plate or a 96-well plate (when in the **Dispensing** mode) is presented to set up the **Sample Sequence** for sample uptake. Please refer section 6.8 for more details. When the sample plate type changes, please refer to section 4.2.7 to calibrate its position.

8.9 Cleaning Protocol

Clean	Click the *Next* button on **Sample Sequence** page, or click the *Clean* button on the left **Task Panel** to turn to the **Cleaning Protocol** page

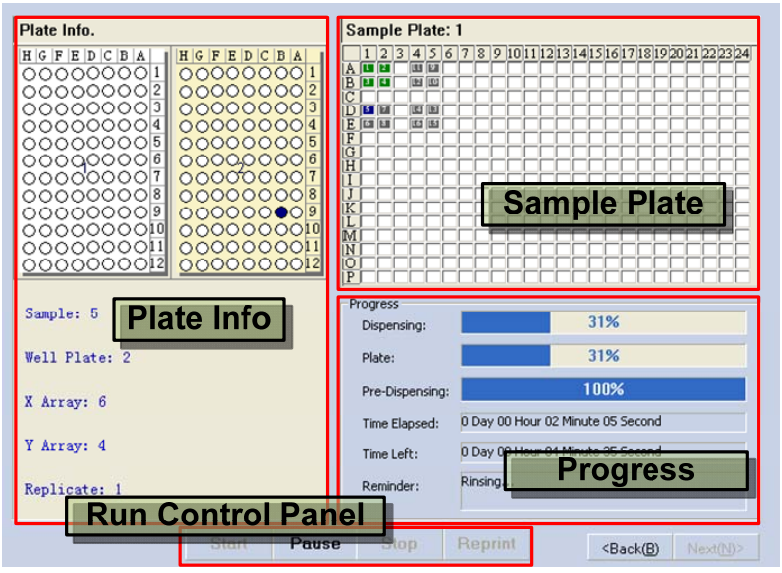
Please refer to 6.9 to set up the **Cleaning Protocol**.

8.10 Run

Click the *Next* button on the **Cleaning Protocol** page, or click the *Run* button on the left **Task Panel** to turn to the *Run* page.

Click the *Start* button to run the protocol.

8.10.1 Run Page Layout



The *Plate Info* section reveals the current status of plates, including the current sample, the current plate, and if **Array Replication** is applied. It also indicates the row index and column index of the current array, and the index of current replicate.

The *Plate* section illustrates the status of current sample plate, including the plate index, which wells have already been sampled, which ones are being sampled right now and which ones have not yet been sampled. The wells at different status levels are differentiated with different

colors: Green for processed samples, blue for the samples in processing, and grey for samples yet to be processed.

The *Progress* section describes the progress on various levels with bars indicating the time statistics and estimation of the **Pre-dispensing** progress, **Dispensing** progress and plate progress. An information section is also available in this section.

There are control buttons at the bottom of the page, including the *Start* button, *Pause* button, *Stop* button and the **Reprint** button. We will continue to discuss *Pause* button and *Stop* button below. Please refer to section 9.4 to learn more about the **Reprint** button.

8.10.2 Pause and Proceed

The pause and resume functions are provided to handle unexpected emergency events, particularly during **Dispensing** applications. Please refer to section 6.10.2 for more details.

8.10.3 Stop

You can either select the *Exit* option on the **Pause & Resume** dialog, or click the *Stop* button when the system is halted.

Chapter 9 Additional Software Features

9.1 Overview

PersonalArrayer™ 16 provides additional functions including: instrument **Self Check**, **Reprint**ing and **User Management**.

The **Self Check** function is used to run tests to check whether the instrument is in normal condition, and reset the instrument to initial status.

Reprinting is actually used to selectively run part of the protocol. You can specify a smaller range of samples, slides or plates, arrays and replicates in the programmed protocol. The user can make use of this function to **Reprint** the missing spots after the running protocol is completed, or just select part of protocol to run (For example, a collection of samples with tag information already filled in).

In the **User Management** dialog, You can control the user entry, including privileges and passwords.

9.2 Self Check

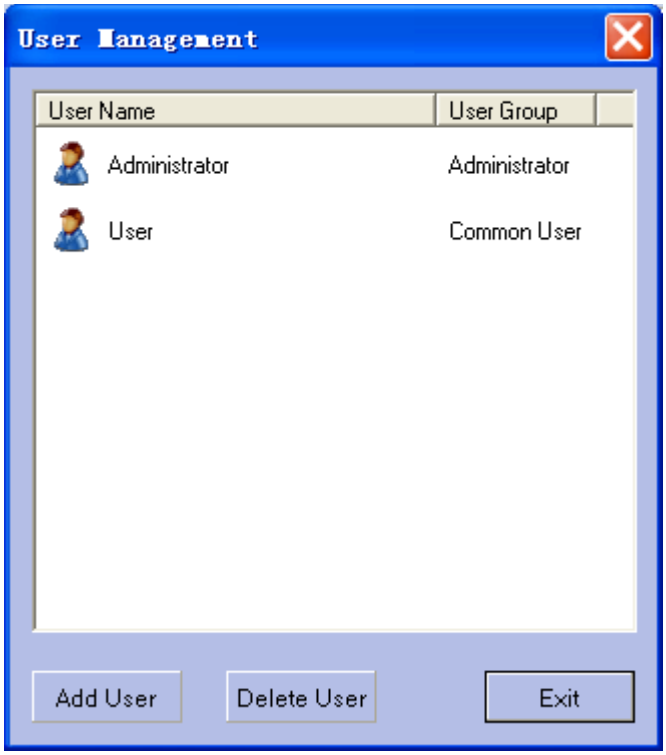
	Click the **Self Check** button on the system panel which is on the right top corner. A dialog will pop up for you to confirm. After **Self Check** is completed, the **Robotic Arm** will be moved to the home position.

9.3 User Management

	Click the **User Management** button on the system panel which is on the right top corner. The **User Management** dialog will pop up.

All registered user entries will be listed in the **User Management** dialog. You can append items to the list or remove items from the list.

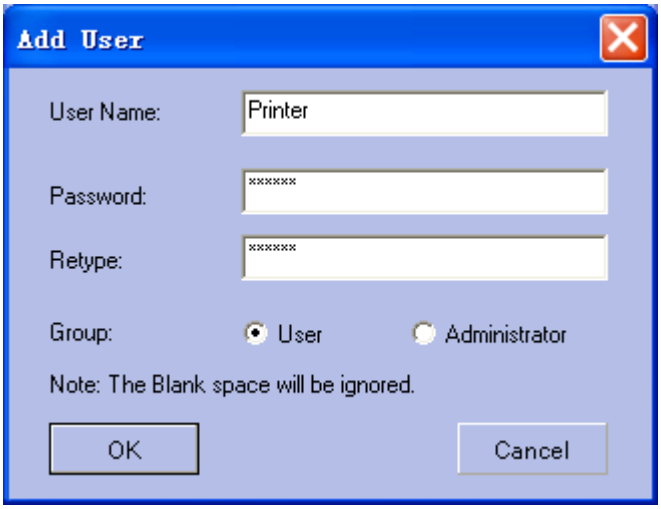
Note:
Only users in the Administrator **User Group** can access the **User Management** dialog.



Note:
There is an intrinsic account Administrator in the user list, and it cannot be deleted.

9.3.1 Add User

Click the *Add User* button on the **User Management** dialog to pop up the *Add User* dialog. Input the user name and password, select a user group, then click *OK* button to confirm it. The new account will be shown in the user list.



Note:
User name and password must be completed.

9.3.2 Delete User

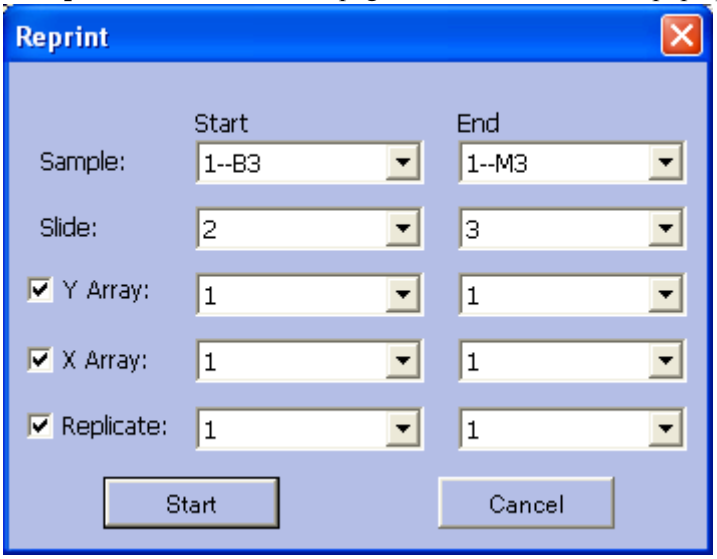
Select an entry in the user list in the **User Management** dialog and click the **Delete User** button to delete it.

9.4 Reprint

The procedure is as following:

9.4.1 Step 1: Launch

Click the **Reprint** button on the *Run* page when it is available to pop up the **Reprinting** dialog.



9.4.2 Step 2: Configure Reprinting Scope

Set parameters to define the scope for reprinting in the dialog, including:

Sample	Define a range of samples by specifying the well to start with, and the well to end at.
Slide/Plate	Define a range of slides/plates for reprinting by specifying the one to start with, and the one to end at.
Y direction X direction	Array position along X/Y axis, with specification of the index to start with and the one to end at. Only available when there are array replicates.
Replicates	Define a range of spot replicates for reprinting by specifying the one to start with and the one to end at.

9.4.3 Step 3: Reprint

Click the *Start* button on the dialog to start the **Reprinting**. The **Reprinting** task is carried out just like a normal printing task.

Chapter 10 Routine Maintenance

10.1 Pre Run and Post Run Cleaning

The stand alone **Cleaning Protocol** should be applied before and after a printing job.

10.2 Pins

Turn to the *Prepare* page, click the *Load Pin* button and the **Robotic Arm** will move to the proper position for the following operation, then you can load or replace **Pin**s on the **Pin Holder**.

Please keep the following in mind when you load or replace pins:

- Wear a pair of gloves to avoid the cross contamination;
- Do not touch the shaft and point end of the pin, in order to protect the **Pin** and avoid contamination;
- Do not strike of contact the point end of the **Pin** with the **Pin Holder**, or it will be damaged.

How to load **Pin**s: Open the **Enclosure** with care. Hold the head end of the **Pin** with your preferred hand, and carefully direct the point end of the pin to the hole on the **Pin Holder** and insert it into the holder. Then take the head end of the **Pin** with tweezers to lift it carefully and avoid deflection or shaking as much as possible. Lower the head end of the **Pin** into the slot on the **Pin Holder** and make sure it can be lifted or dropped smoothly through the slot.

How to unload **Pin**s: Open the **Enclosure** with care. Hold the head end of the **Pin** with your preferred hand carefully, lift it slightly while avoid deflection or shaking as much as possible. Then hold the head end of the **Pin** with your other hand and lift it vertically out the holder. Cover the point end of the **Pin** with the sheath and put away the **Pin** back into the box.

Note:
If the instrument will be not used for a long period of time, please run a stand alone protocol to clean the **Pin**s, then unload the **Pin**s and store them safely.
Lower or raise the pin carefully in straight alignment with the pin hole to avoid bending the pin shaft or contacting the point of the pin with the pin hole.

10.3 Nozzle

Please run a stand alone **Cleaning Protocol** after each run, then cover the **Nozzle** with the nozzle enclosure to protect it from contamination and clogging.

If the instrument will not be used for a long period of time, please unload the **Nozzle** and store it safely in its box.

10.4 Slide Deck

The **Slide Deck** provides a flat surface to carry slides. Please handle it with care when you mount or dismount it from the instrument.

Before printing job, please clean the surface of **Slide Deck** with cotton cloth and alcohol.

After finishing a printing job, please remove all the slides on the deck.

If the deck will not be used for a long period of time, please put it away in its box for storage.

10.5 Plate Deck

The **Plate Deck** provides a flat surface to carry plates. Please handle it with care when you mount or dismount it from the instrument.

Before the printing job, please clean the surface of plate deck with cotton cloth and alcohol.

After the printing job, please remove all the plates on the deck.

If the deck will not be used for a long period of time, please put it away in its box for storage.

10.6 Replenish Buckets

There are 2 water buckets for **PersonalArrayer™ 16**, the **Wash Buffer Bucket** and **Waste Bucket**.

Before each printing job, please check and ensure that the **Wash Buffer Bucket** is full and that the **Waste Bucket** is empty.

If the program will run for a long period of time, please check the status of buckets regularly. If the water runs low or the waste level is high (the application software will alert you), please pause the program, replenish the **Wash Buffer Bucket** and empty the **Waste Bucket**, and then resume.

10.7 Replenish Humidifier

The **Humidifier** is used to maintain a constant relative humidity inside the instrument. Before each printing job, please unplug the **Humidifier**, remove it from the instrument and check the water level. If it is too low, please replenish it with deionized water.

If the program is supposed to run for a long time, please check the **Humidifier** water level at regular intervals.

Please clean the **Humidifier** regularly. Empty the water from the **Humidifier** if it is supposed to be out of use for a long time.

10.8 Replace Pressure Supply

An independent pneumatic pressure source is required for **PersonalArrayer™ 16** under **Dispensing** working mode. The source could be either purified compressed air/nitrogen cylinder or purified air compressor. The compression resistance of the cylinder should be no less than 14 MPa and inner volume of the bottle should be no less that 8L.

Before any printing job, please check if there is sufficient air/nitrogen in the cylinder. If not, please replenish the cylinder.

10.9 Sonicator Bath

If the instrument is out of use for two days or longer, the **Sonicator Bath** should be cleaned and the liquid replaced before reuse:

Step 1	Remove the fluid within the **Sonicator Bath** with the syringe.

Step 2	Clean the **Sonicator Bath** with an alcohol drenched cotton swab.
Step 3	Fill the **Sonicator Bath** again.

10.10 Fluid Lines

The fluid lines should be cleaned before use:

Step 1	Empty the **Wash Buffer Bucket** and **Waste Bucket**.
Step 2	Fill the **Wash Buffer Bucket** with fresh deionized water.
Step 3	Click the Rinse button on the Prepare page to wash the fluid lines.

10.11 Air Course

In **Dispensing** mode, if the instrument is out of use for two days or longer, please click the *Exhaust* button on the *Prepare* page to expel dust or particles from the **Nozzle**.

Please follow the procedure below to switch from the **Spotting** mode to the **Dispensing** mode.

Step 1	Click the *Load Nozzle* button on the *Prepare* page to move the **Robotic Arm** to a convenient position for you to carry out subsequent operations.
Step 2	Romove the cover plate on the *Z* Axis execution module, unplug the control circuit plug and disconnect the **Nozzle**. Remove the **Nozzle** and insert the **Nozzle Head** into the conduit which is connected to the micro valve in the **Nozzle** to keep the **Nozzle** from dust.
Step 3	Click *Exhaust* button on the *Prepare* page and the compressed air will flush the air course to expel any contaminants. After about 1 minute, click the button again to stop.
Step 4	Pull the **Nozzle Head** out of the conduit, and then put the **Nozzle** back into **Nozzle Holder**. Connect the air course and the control circuit plug.
Step 5	Repeat step 3.

Chapter 11 Troubleshooting

11.1 Overview

In this chapter, potential errors and problems with **PersonalArrayer™ 16** are listed. And their remedies are provided If the problem still can not be solved, please contact the technical support at **CapitalBio**.

11.2 Problem and Solution

Type	Index	Description	Cause	Solution
Starting	1.1	X axis no response	Motor power failure	Please contact **CapitalBio**
	1.2	Y axis no response		
	1.3	Z axis no response		
	1.4	Start failed	Bad USB connection	Check USB Connection
			Power absence	Check power supply
			Emergency Stop is pressed or **Enclosure** is open	Check the **Emergency Stop** and close the **Enclosure**
	1.5	Launch failed, configuration file missing	System configuration file is missing or damaged.	Reinstall the software
Running	2.1	**Pin**(s) cannot be raised or dropped smoothly	Dirty environment causing **Pin** or **Pin** hole contamination	Improve the air cleanliness class, clean the pins with **Sonicator**.
	2.2	Bubbles in **Rinse Basin**	Low water level	Replenish the **Wash Buffer Bucket**
			Fluid tube damage near peristaltic pump	Replace the tube
	2.3	**Rinse Basin** overflowing	**Waste Bucket** is full	Empty the **Waste Bucket**
			Outlet conduit is too high	Lower the conduit down
	2.4	Abnormal exit from running job	Bad **Position Calibration**	Check it and rerun **Position Calibration** if necessary
			Motion module exception	Restart the instrument and software program. If it does not work, please contact **CapitalBio**.
			Dispensing module exception	
	2.5	No intake during sample uptake	Contamination or dust inside air course of dispensing module.	Repeat stand alone **Cleaning Protocol**s and refer to Safety Precaution to check available sample
			Insufficient **Sample aspiration time**	Increase **Sample aspiration time**
			Excessive sample viscosity	Decrease sample viscosity
	2.6	Bubble in **Nozzle** and nearby tube	Insufficient sample volume	Increase sample volume
			Excessive **Sample aspiration time**	Decrease **Sample aspiration time**
			Excessive **Air aspiration time**	Decease **Air aspiration time**

	2.7	Droplet suspended under the **Nozzle**	Dust clot in the **Nozzle**	Improve air cleanliness class, repeat stand alone **Cleaning Protocol**s
			Insufficient **Dispense pressure**	Increase **Dispense pressure**
			Insufficient sample uptake	Replenish the sample well
			Nozzle failure	Please contact **CapitalBio**
Spotted arrays	3.1	Missing spot	Insufficient humidity	Increase humidity
			Impaired pin drop	Same as 2.1
	3.2	Irregular feature	Excessive sample viscosity	Decrease sample viscosity
			Excessive velocity	Decrease velocity
			Uneven **Pin Holder**	Adjust the **Pin Holder** to be parallel to the **Platform** with spirit level
	3.3	Overlapping spots	Deficient pre-spotting	Increase **Pre-spotting Count**
	3.4	Disordered array formation	Excessive velocity or loose components	Please contact **CapitalBio**
	3.5	Uneven spot size during the run	Insufficient sample uptake	Increase **Sample aspiration time**
			Excessive sample viscosity	Increase sample uptake frequency
	3.6	Increasing spot intensity as running	Deficient vacuum	Cover and seal the **Vacuum Slot**s that are not in use with plastic membrane to improve vacuum efficiency
	3.7	Poor quality spots	Environment, substrate, sample quality factors	Provide temperature and humidity guarantee, improve air cleanliness class, optimize sample preparation process
Dispensed arrays	4.1	Satellite spots	Deficient humidity	Increase humidity
			Dust clot in the **Nozzle**	Repeat stand alone **Cleaning Protocol**s
			The **Nozzle** is too far away from substrates	Decrease the distance
			Electrostatic charge accumulation	Discharge
			Insufficient **Dispense pressure**	Increase **Dispense pressure**
			Tiny bubbles in the tube	Increase the *Exhaust* frequency and the **Exhaust time**
			Bubbles or foam in sample	Eliminate them (centrifuge)
	4.2	Overlapping spots	Deficient **Pre-dispensing Count**	Increase **Pre-dispensing Count**
			Improper dispense configuration	Decrease **Dispense pressure** and/or **Dispensing Time**
	4.3	Uneven spot size after a while	Insufficient sample uptake	Increase sample uptake
			Insufficient **Dispense pressure**	Increase **Dispense pressure**
			Insufficient **Dispensing Time**	Increase **Dispensing Time** up to 250μs

	4.4	Disordered array formation	Excessive velocity or loose components	Please contact **CapitalBio**
			Incompatible substrates for **Dispensing**	Substitute substrates or apply proper substrate surface modification
File Operation	5.1	Failed to load file when click the *Open Sample Info* button on the **Sample Tracking** dialog.	Incompatible file format	Please refer to section 5.8 to modify the file and retry
	5.2	Failed to open protocol	Incompatible file format	Select a file in a compatible format, or edit the current protocol and save it

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