X2D Introduction

This page introduces the main components and functions of X2D.

This page introduces the main components of the Bambu Lab X2D printer, to help you quickly understand the basic structure and composition of the printer.

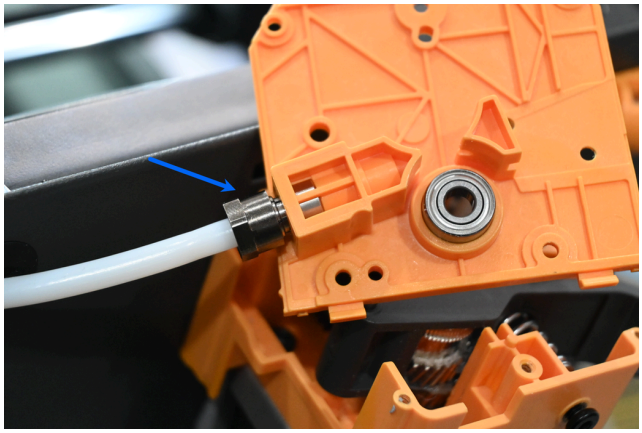
Featured Components: Auxiliary Extruder

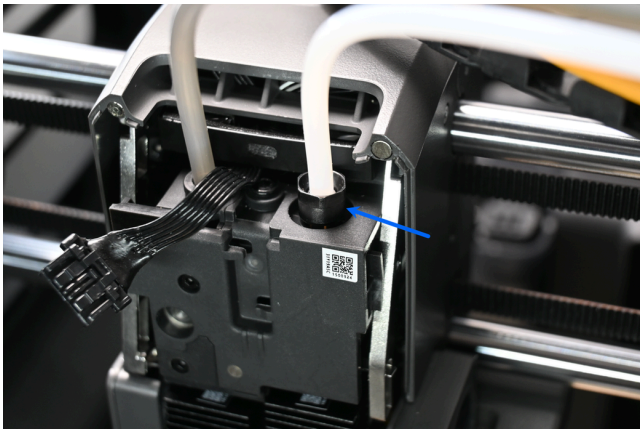
Compared with other dual-nozzle printers from Bambu Lab, the X2D adopts an innovative separate design of main and auxiliary extruders. The core difference lies in the optimized layout of the toolhead and extruder motor: only the main extruder corresponding to the left hotend is integrated inside the toolhead, and the extrusion function of the right hotend is independently undertaken by the auxiliary extruder located at the top of the printer's rear panel.

Compared to the main extruder, the auxiliary extruder features a design where the motor is separated from the toolhead, creating a significant distance between the two. This design effectively saves space within the toolhead, increases the available build volume, and optimizes motion flexibility. **The auxiliary hotend can be connected to either an external spool or the AMS for material feeding, meeting the usage requirements of different printing scenarios.**

The filament outlet of the auxiliary extruder adopts a PTFE tube locking nut, which is consistent with the design of the filament inlet of the auxiliary hotend on the toolhead. As remote extrusion has high requirements for

extrusion force, the service life of ordinary pneumatic connectors cannot meet the demand, while the locking nut can adapt to the use requirements of high-thrust filament feeding, ensuring connection stability and durability.

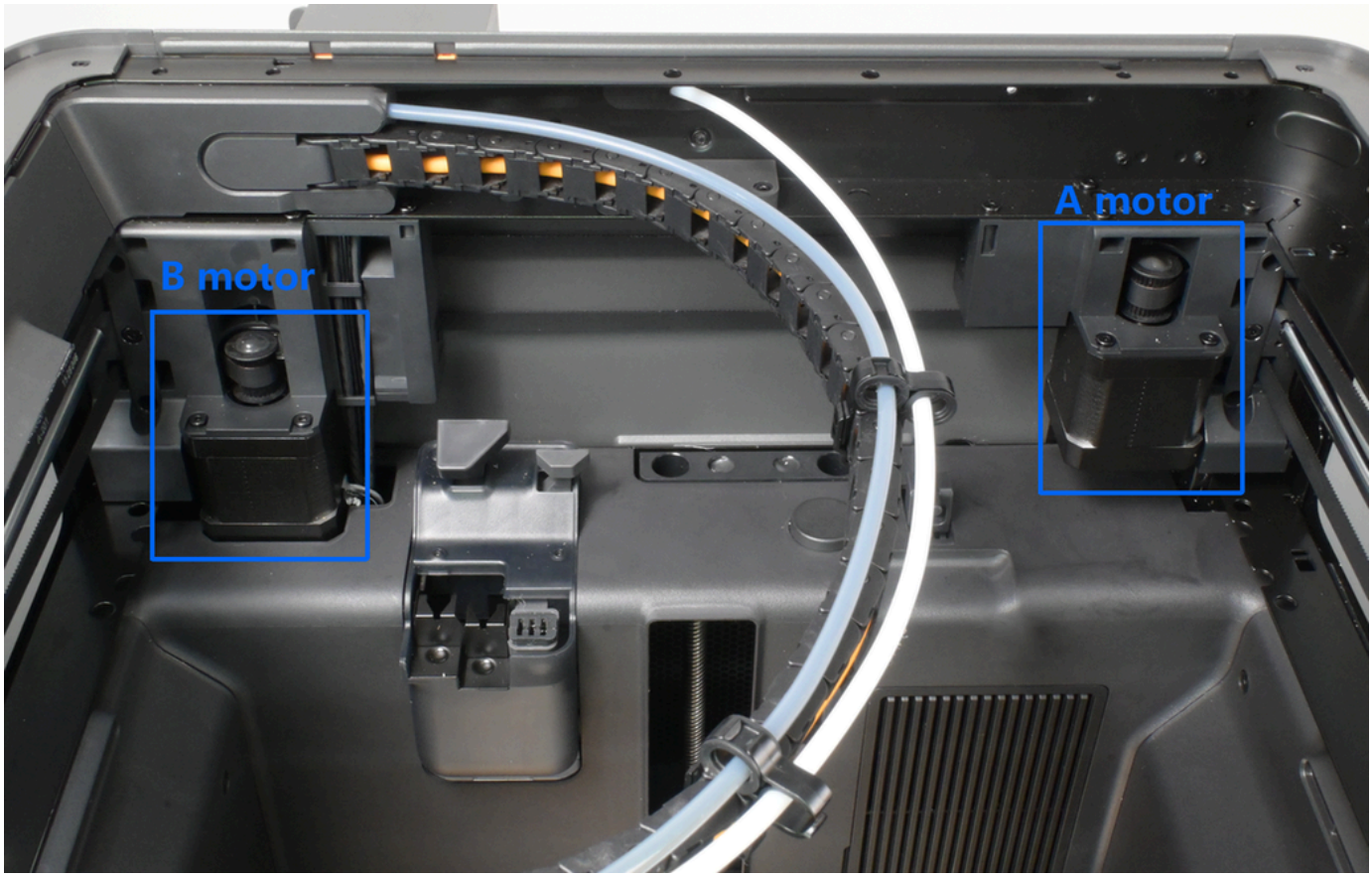




For more information about the auxiliary extruder, please refer to X2D Auxiliary Extrusion.

Core-XY Motion System

X2D is based on the Core-XY architecture, which includes two stepper motors and multiple sets of idler pulleys. Each stepper motor is connected to the toolhead through an independent timing belt, and the motion and position of the toolhead are controlled through the coordinated transmission of the motors and timing belts.

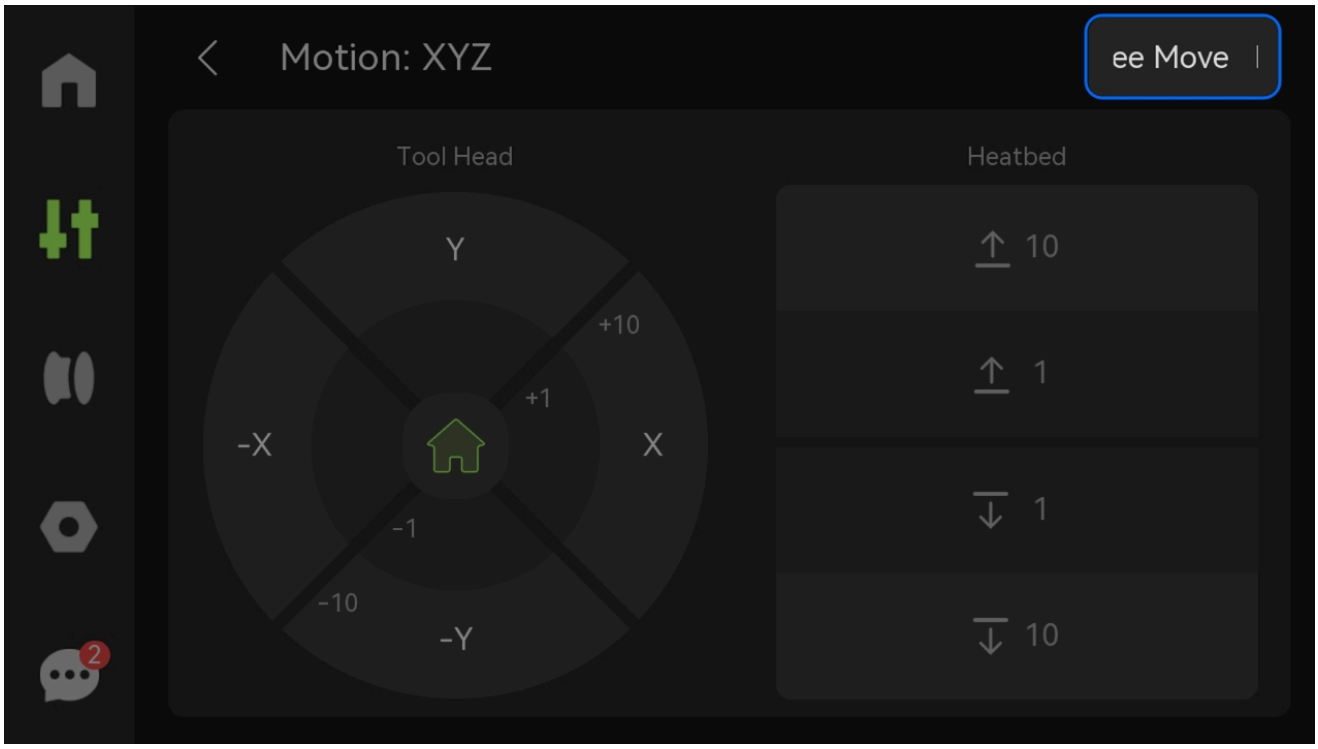


Working principle

In a Core-XY system, Motor A and Motor B independently control two belt loops. As shown below, when the left Motor B operates alone, it drives only the left Y-axis belt, causing the toolhead to move diagonally at a 45° angle.

Similarly, when the right Motor A operates alone, it drives the right Y-axis belt, moving the toolhead diagonally in the opposite 45° direction.

Note: When the motor is not powered, you can manually move the toolhead. After powering on, go to "Control > Motion" to enable free movement mode; once enabled, you can manually move the toohead and heatbed freely while the XYZ motors are idle, facilitating maintenance and inspection.



This structure reduces the weight of moving parts, enabling faster, smoother motion and improved print quality and efficiency.
For more details on the CoreXY motion system, please visit this link .

X-Axis

The X-Axis adopts a linear rod and belt transmission to control the left-right movement of the toolhead, ensuring that the toolhead always remains on a horizontal plane when moving along the X-Axis. The movement in the X direction is driven by stepper motors A and B simultaneously.

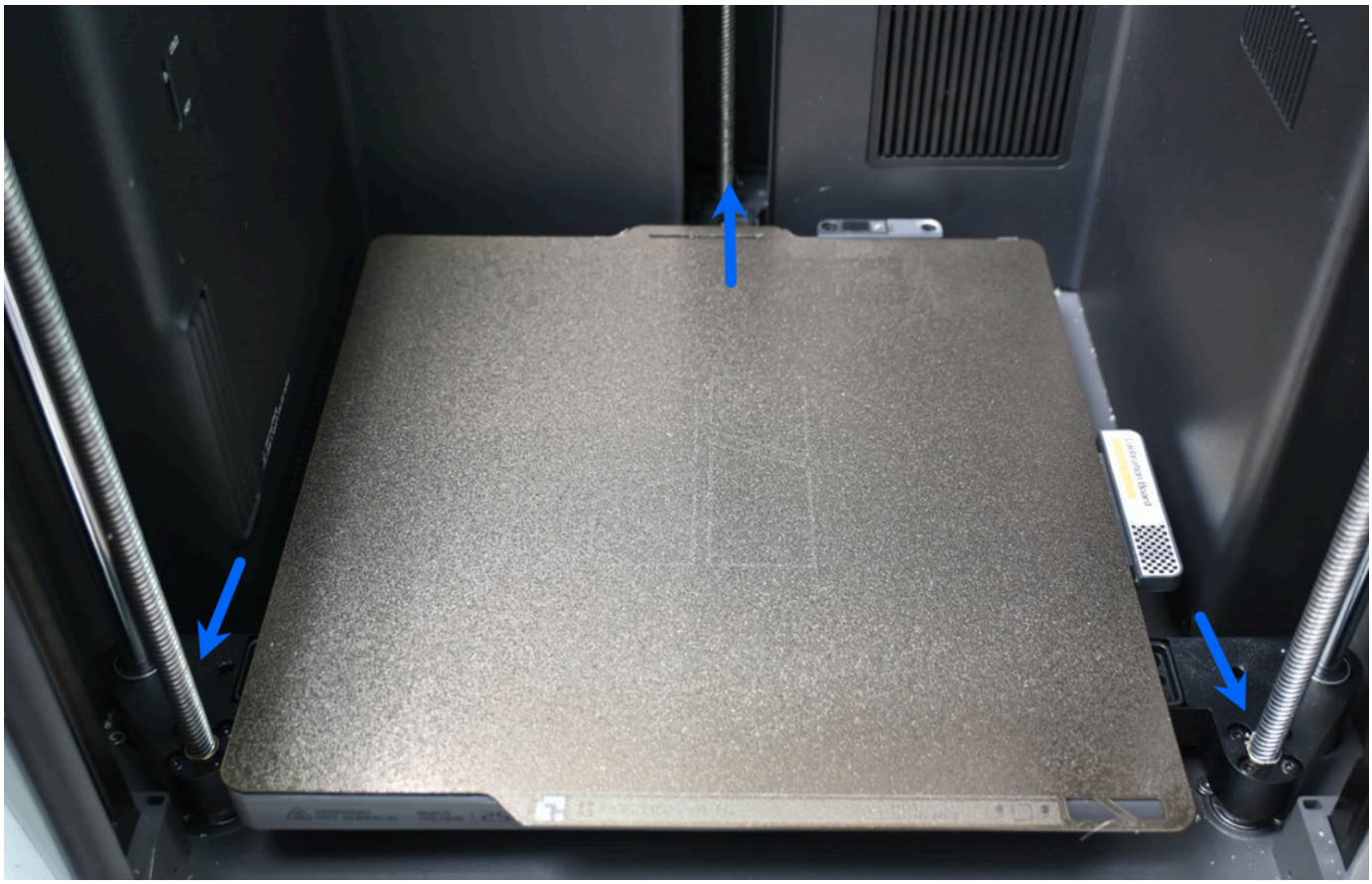
Y-Axis

The Y-Axis controls the front-back movement of the toolhead. The toolhead and the X-Axis move as an integrated unit, sliding back and forth along the Y-Axis linear rods located on both sides of the printer frame. This movement is also driven by stepper motors A and B simultaneously.

Z-Axis

The Z-Axis of the X2D consists of lead screws and linear rods, which are distributed at the front left, front right, and middle rear of the heatbed.

The lead screws are connected to the same Z stepper motor via a belt, and are uniformly driven to rotate by the motor, thereby driving the nuts on the heatbed to rise and fall synchronously, enabling the heatbed to move in the vertical direction. The linear rods provide precise positioning, effectively suppressing the shaking caused by the rotation of the lead screws and ensuring stable operation of the heatbed.



Toolhead

The toolhead is one of the core execution components of a 3D printer, responsible for heating and melting filament, extruding it accurately, and completing layer-by-layer deposition and forming on the printing plane. The main components of the toolhead and their functions are introduced below.

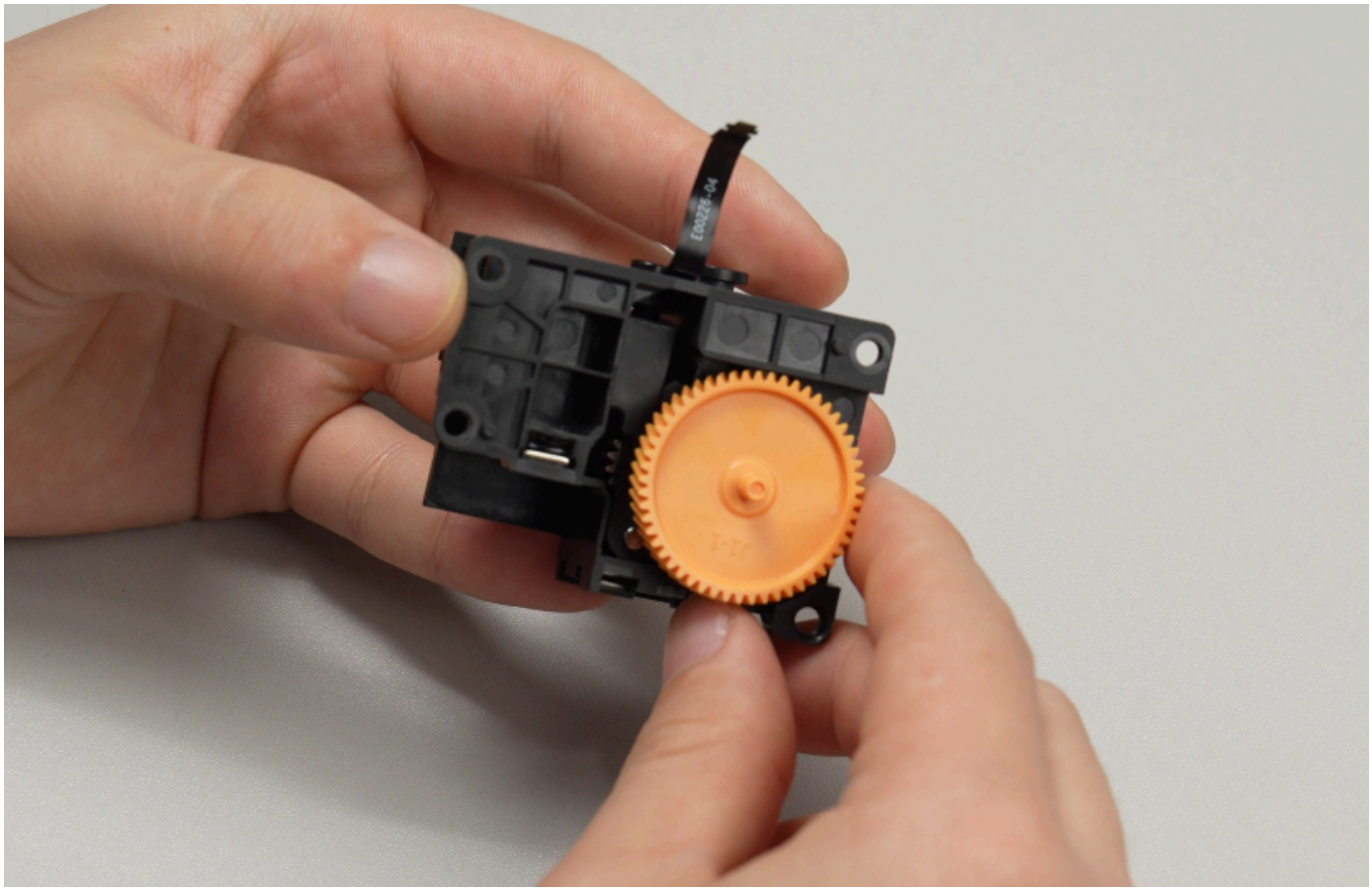
Main Extruder

The main extruder is responsible for gripping and pushing filament into the hotend. After the filament is heated and melted inside the hotend, it is deposited layer by layer into a model through the nozzle. It needs to precisely control the length of filament extrusion and retraction to ensure the dimensional accuracy and appearance quality of the printed model, making it one of the core components of a 3D printer.

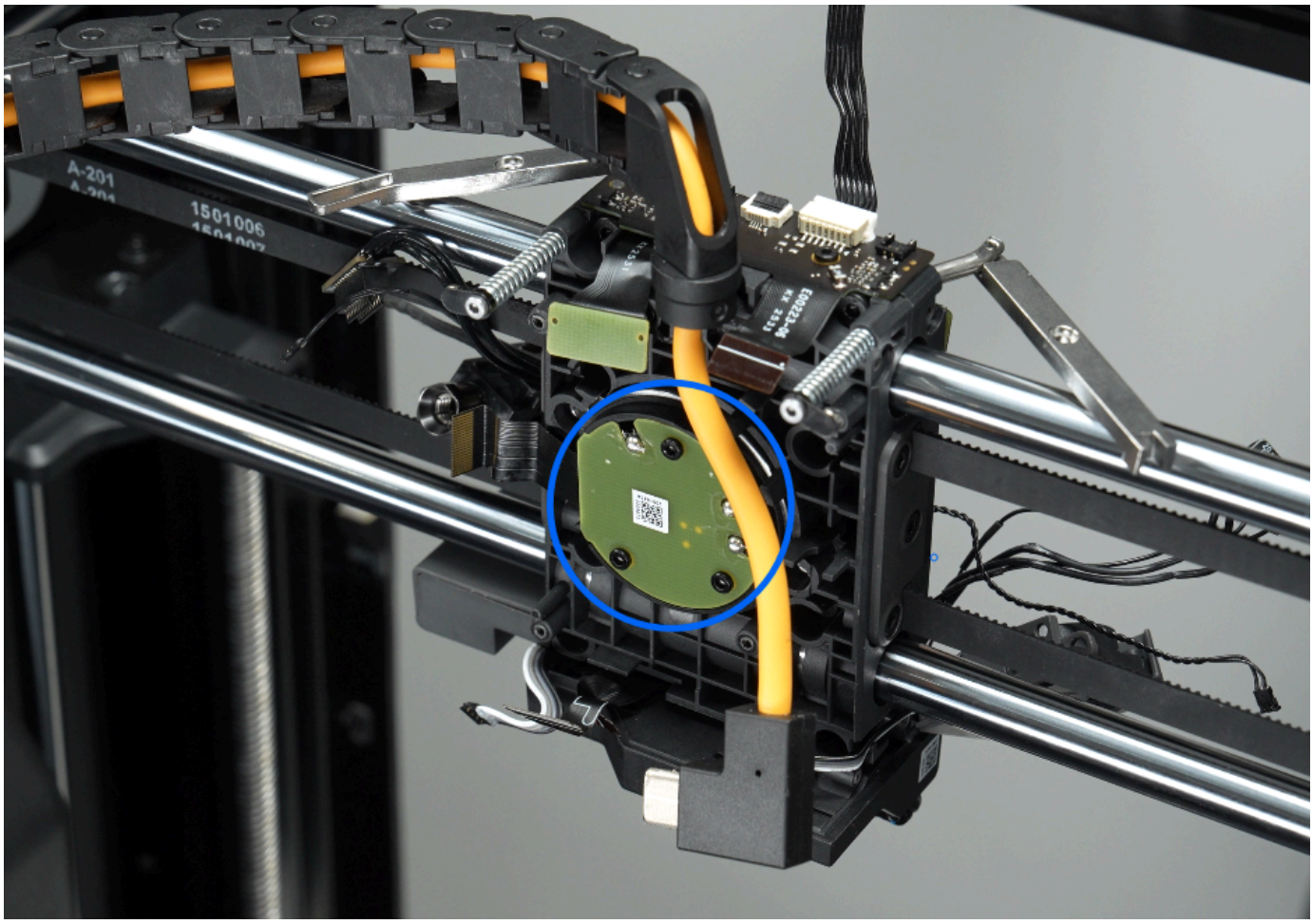
The extruder includes the following important components:

Note: The extruder is a complete and independent product, and no individual small internal accessories are sold separately.

- **Hardened steel extruder gear assembly:** The X2D uses hardened steel extruder gears, which consist of a driving wheel and a driven wheel, and precisely push the filament under the drive of the extruder motor.

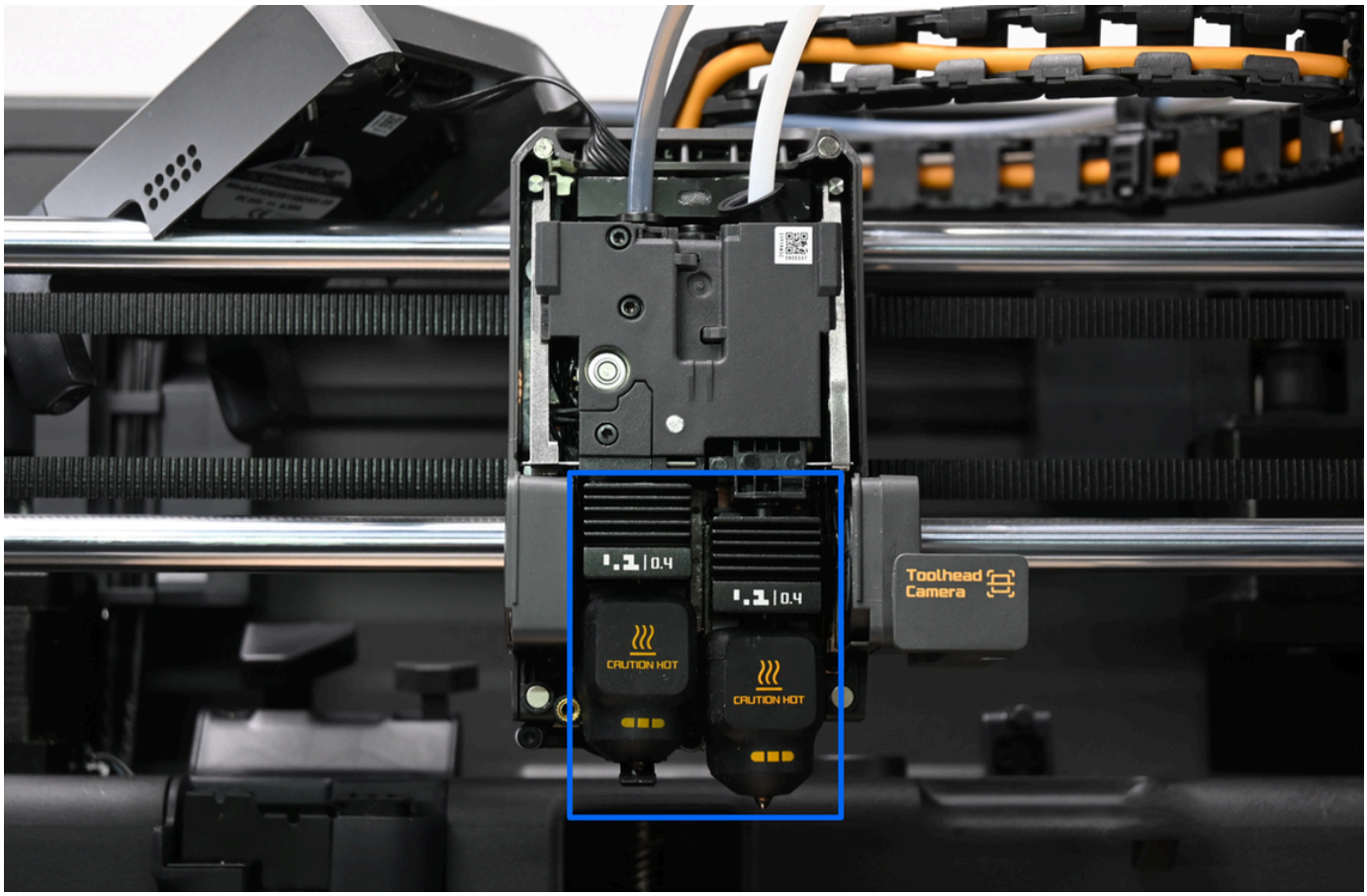


- **Extruder motor:** The extruder motor is installed on the back of the extruder, used to drive the extruder to complete filament extrusion. The X2D uses Bambu Lab's self-developed high-precision permanent magnet synchronous servo motor, which can detect filament entanglement by monitoring resistance changes during operation, further ensuring the smoothness and reliability of the printing process.



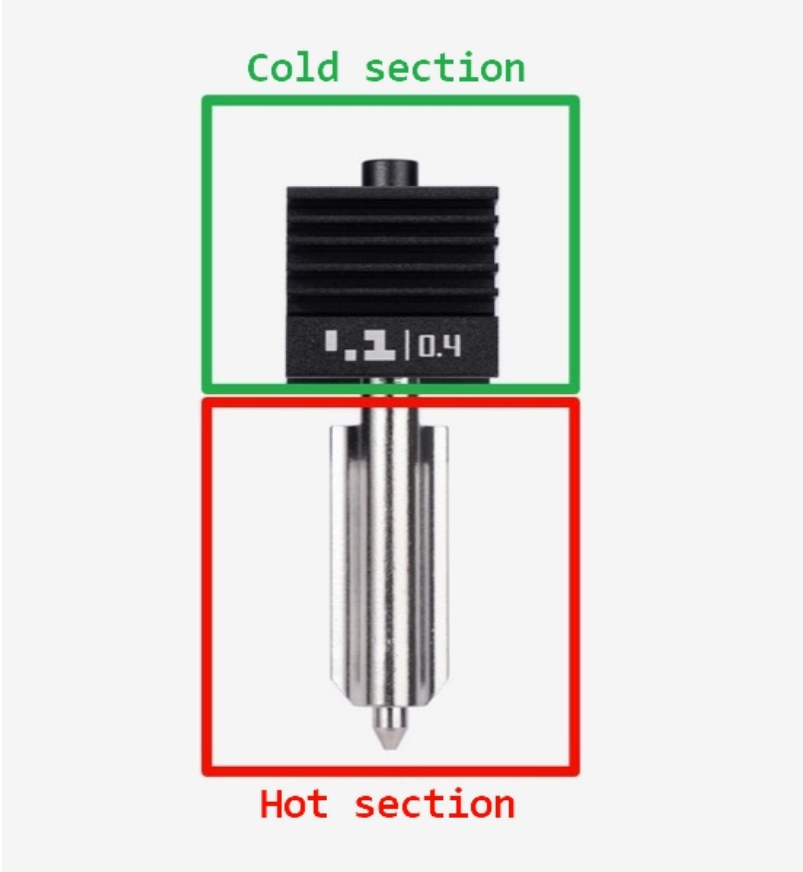
Hotend assembly

The hotend assembly is the core component of the toolhead module, mainly composed of the hotend heating assembly, hotend and silicone sock for hotend, supporting a maximum heating temperature of 300°C. The hotend assembly heats the filament to a specified temperature, and the melted filament is deposited in thin layers to form the model.



Hotend

The hotend integrates the nozzle, heat break and heat sink, and is fixed above the heating assembly via a quick-release lever. After the filament is heated and melted, it is deposited in thin layers through the nozzle.

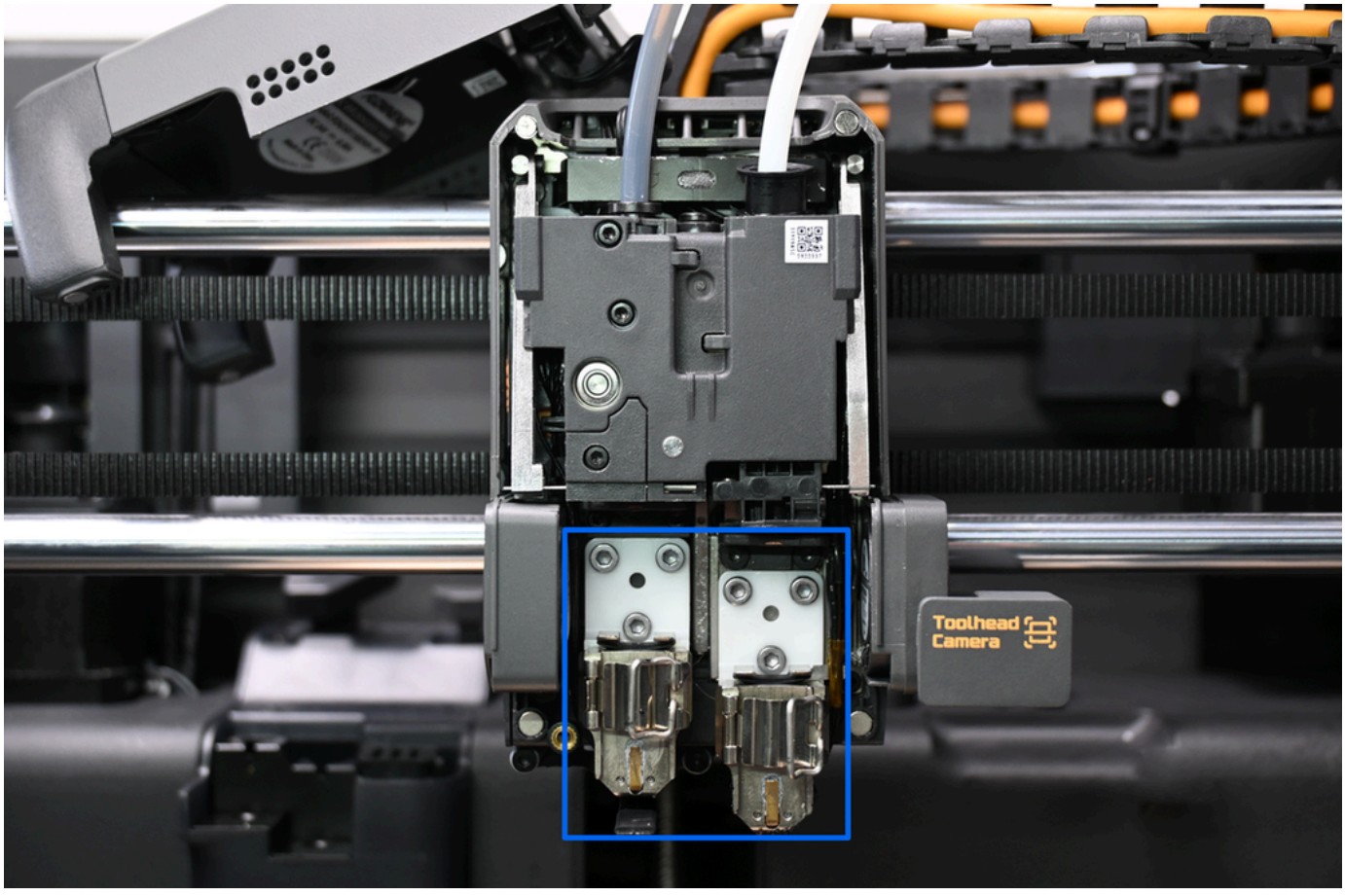


- **Cold section**: Heatsink and heat break maintain a low temperature above the hotend, preventing heat creep and clogs.
- **Hot section**: Melts filament before extrusion through the nozzle.

Hotend Heating Assembly

The hotend heating assembly includes the hotend heater, thermistor for hotend, ceramic base and quick-release lever, which is used to achieve precise heating and temperature monitoring, with a maximum supported heating temperature of 300°C.

The hotend heater and thermistor for hotend are fixed on the heating base, eliminating the need to plug or unplug tiny terminals or use a screwdriver; the quick-release lever is used to fix the hotend, ensuring heat conduction and filament melting.

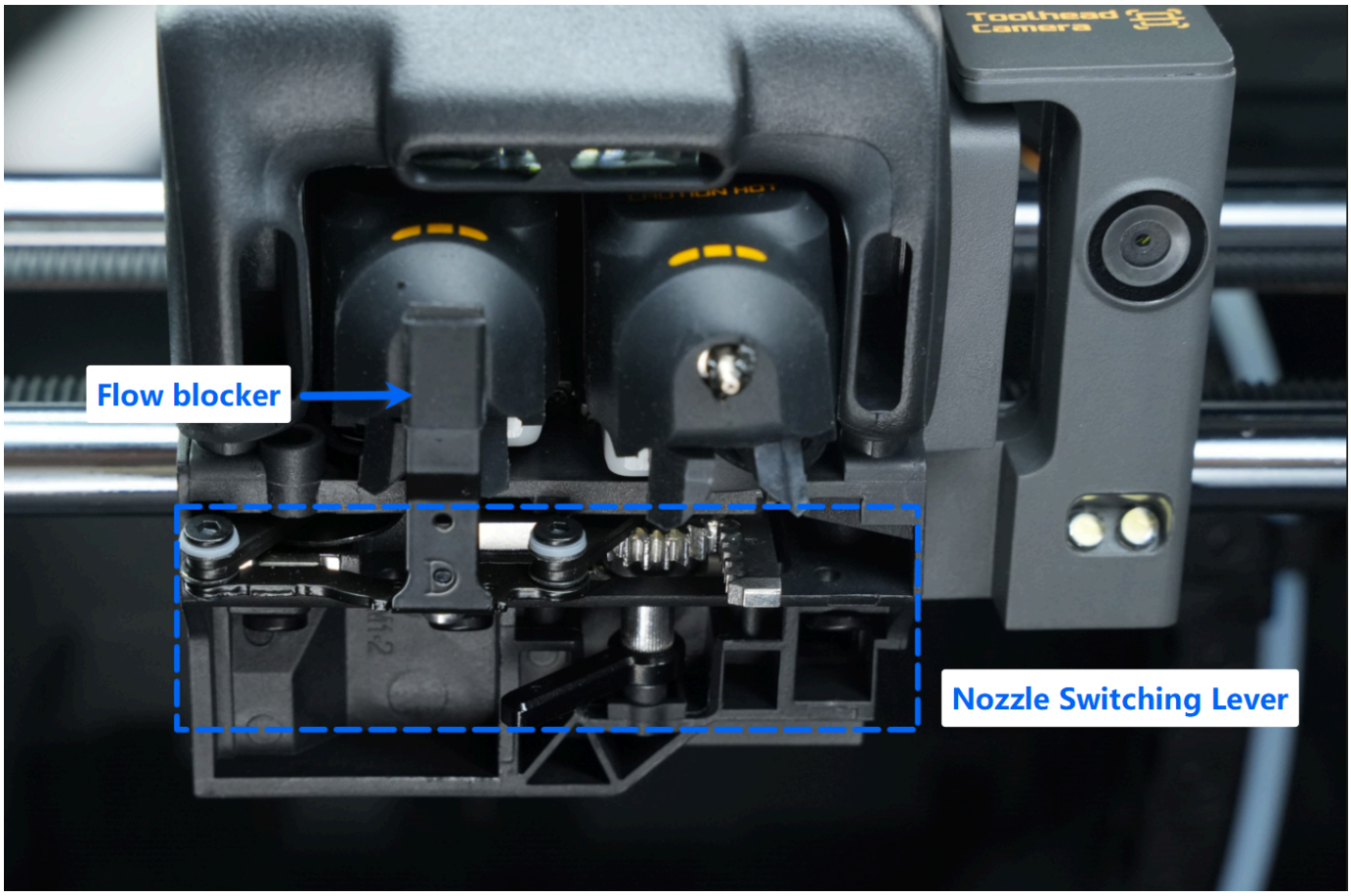


Silicone Sock for Hotend

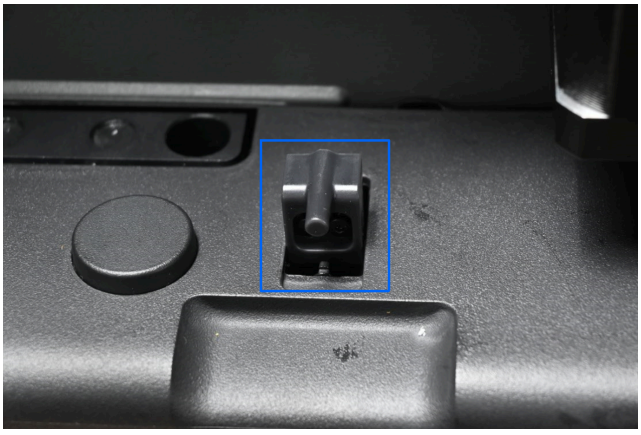
Covers the nozzle to retain heat, stabilize temperature, and prevent plastic buildup. It also has three yellow markers for AI detection of installation status. If missing, the system prompts the user to reinstall it.

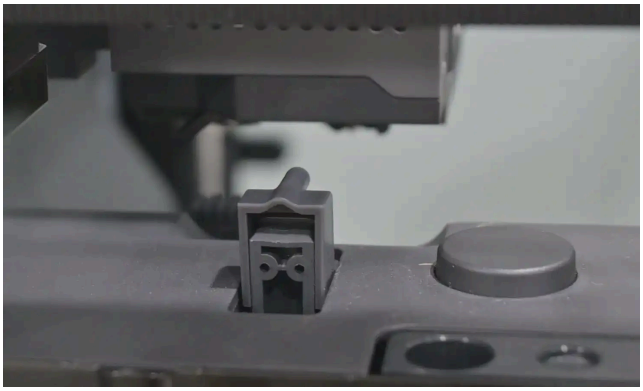
Flow Blocker

A flow blocker is located under the toolhead. It is connected to the nozzle switching lever assembly via a connecting rod and gears, and is used to block the nozzle in a non-operating state to prevent oozing.



Different from other dual-nozzle printers, the X2D does not rely on a lifting motor to rotate and switch nozzles. Instead, it is realized through the contact and cooperation between the nozzle switching lever at the bottom of the toolhead and the nozzle switching push block on the printer lining. After the lever touches the push block assembly, it drives the connecting rod to swing left and right through gear transmission, completing the switching between the main and auxiliary nozzles.

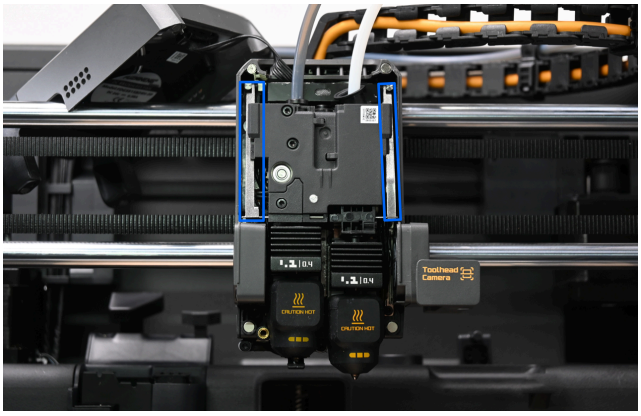


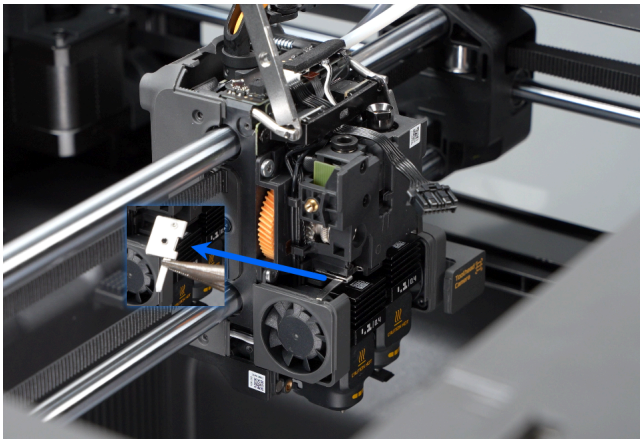


Filament Cutter Lever & Filament Cutter

The X2D is not equipped with an external filament cutter, and the filament cutting function is realized through two filament cutters on the left and right sides of the toolhead.

During the filament cutting process, the toolhead will first move to the designated position in the middle of the chamber, then the filament cutter stopper will extend into the interior from the rear of the toolhead, push the corresponding left/right filament cutter lever forward, and then drive the corresponding filament cutter to complete the filament cutting action.





Part Cooling Fan

A part cooling fan is embedded in the front cover of the X2D toolhead, which can take away the heat from the extruder and the heat sink of the hotend. Through intelligent temperature control, it alleviates the clogging and extrusion obstruction problems that may occur in harsh printing environments, and raises the recommended operating ambient temperature for the printer.

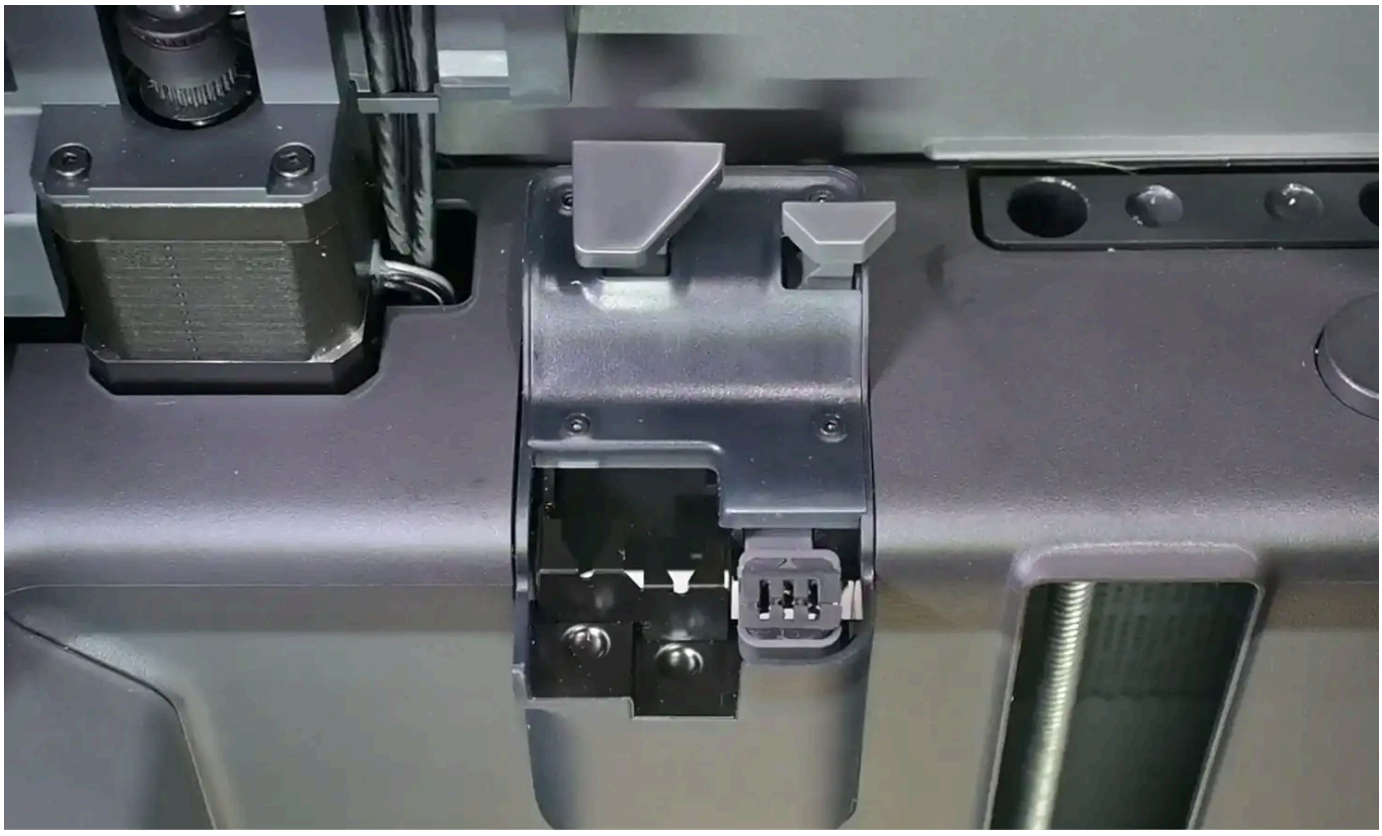
Cooling Fan for Hotend

The X2D is equipped with two cooling fans for the hotend on the left and right. The cold air blown by the fans is guided to the vicinity of the heat sinks of the two left and right hotends through the air duct, to keep the hotend temperature stable and prevent overheating, thereby improving print quality and reducing clogging problems.

Purge Wiper

The purge wiper of X2D includes a purge wiper part and a nozzle wiping pad:

- **Purge wiper part**: Composed of a pushing plate and a receiving plate, it efficiently handles waste filament purged from the nozzle. Its functions include collecting and transporting discarded filament to ensure proper disposal, maintaining continuous and smooth printing operations. This device plays a vital role in multiple printing processes, including printer preparation, pausing/resuming prints, filament loading/unloading, and material changes/purging during multi-color printing.
- **Nozzle wiper part:** Consisting of a pushing rod and a wiping nozzle connecting rod, it cleans the nozzle before starting print tasks. After each print initiation, the cleaning action executes automatically without manual intervention. Note that replacing the silicone nozzle wiper assembly is part of routine maintenance. If damaged, replacement parts are available in the official store.



Nozzle cleaning before printing is divided into two steps:

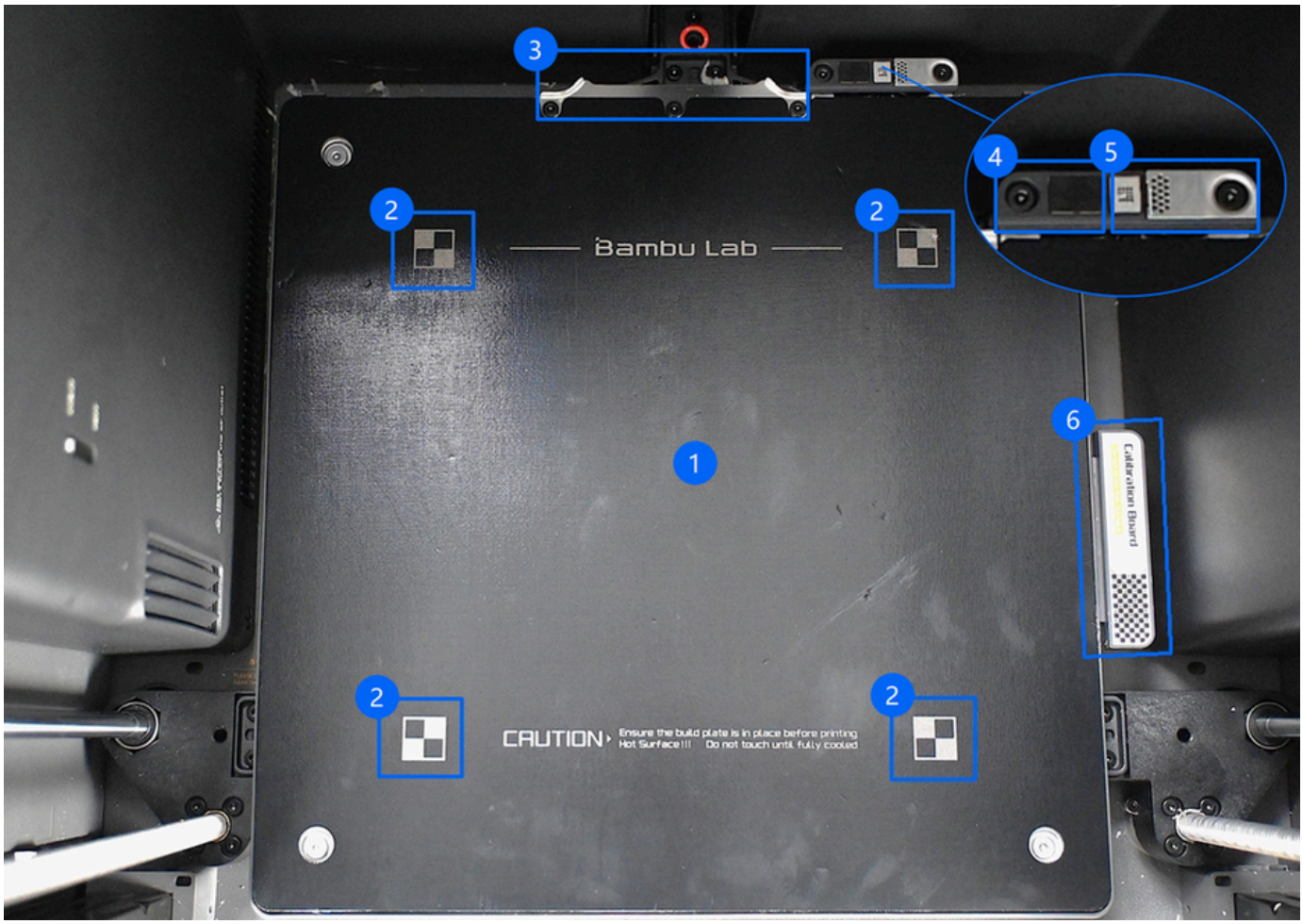
- **Rough wiping**: Removes residual filament attached to the nozzle using the wiping block.
- **Fine wiping**: The nozzle moves to a specific area of the build plate and gently scrapes down 1–2 mm to clean the nozzle tip, ensuring it is smooth and clean.

Heatbed

The heatbed is used to heat the print surface so that prints adhere better to the build plate. Without heating, the deposited filament will cool quickly, generating tension between layers, which can cause warping and affect print quality.

During printing, the X2D printer adjusts the heatbed temperature based on the filament type used, reaching up to 120°C. For example, when printing with PLA on the Bambu Cool Plate, the heatbed temperature is set to 35-45°C to effectively prevent warping. For materials like ABS and PC, the heatbed temperature must be set between 100-110°C to avoid warping.

The heatbed of the X2D printer includes the following components:



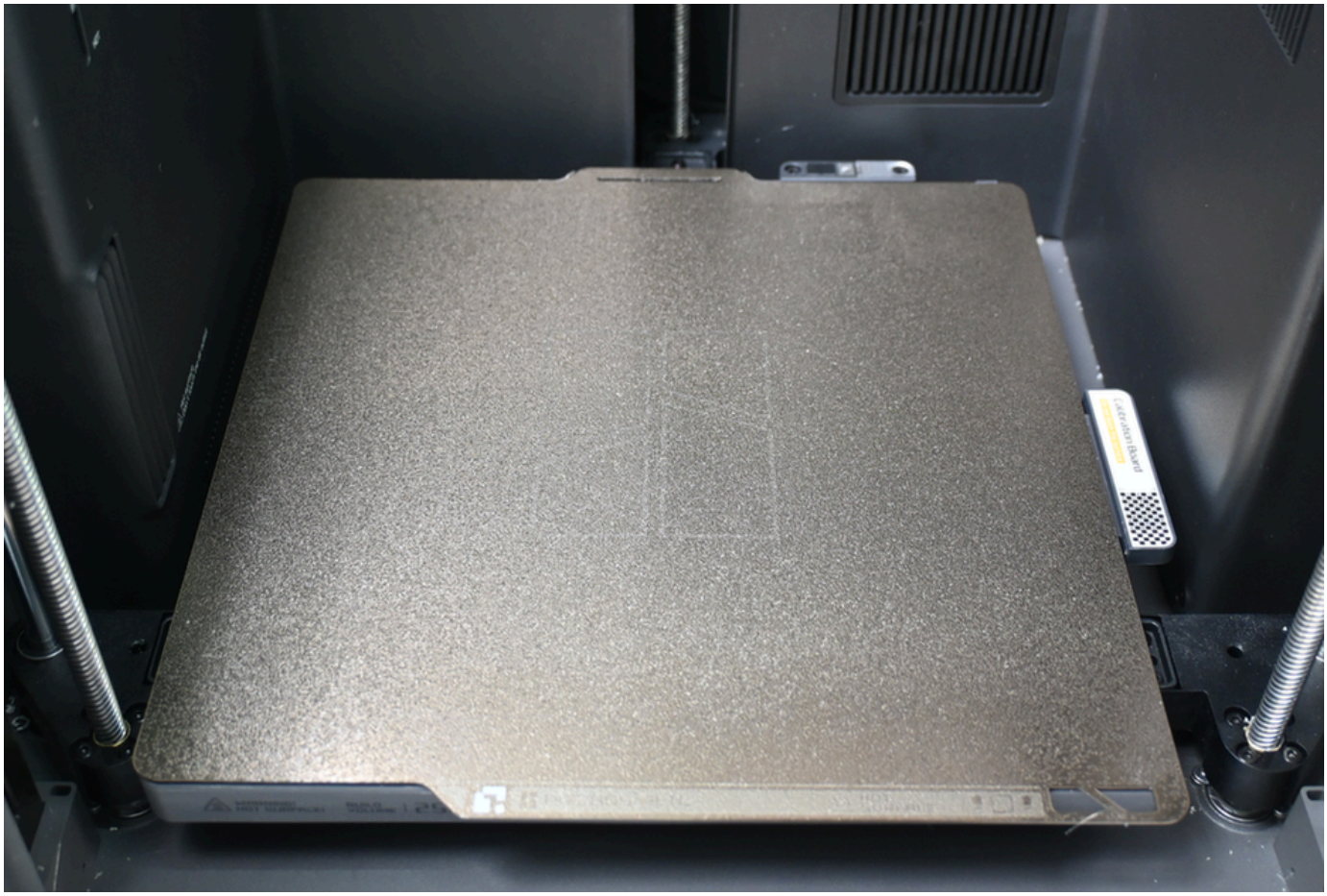
No.	Name	Function	Notes
1	Heating area	Heat the surface	Avoid scratching the soft magnetic sticker with sharp objects.
2	Marker on the magnet surface	Calibrate the live view camera	Avoid scratching the soft magnetic sticker with sharp objects.
3	Build plate positioning parallel block	Easy to place the build plate accurately	When placing the build plate, you can tilt it slightly and slide it inwards, and put it down when it reaches the limit position.
4	Nozzle offset calibration coil	Calibrate the offset of the hotends, ensuring that the positioning of the switched hotends is exactly the same	If you find that the model has an obvious layer shift after switching the nozzle during printing, it is recommended to perform a nozzle offset calibration.
5	Nozzle wiper steel sheet	Clean the nozzle and ensure the nozzle face remains smooth	It can be removed and replaced after severe wear.

No.	Name	Function	Notes
6	Calibration sticker	Calibrate the toolhead camera	Avoid scratching the sticker with sharp objects.

Build Plate

X2D printers come with a Bambu Textured PEI Plate and support all current Bambu 256*256mm² build plates, but cannot recognize first-generation plates. If the device indicates unrecognized plate type, manually select "Ignore" or disable plate detection on the screen.

For more information on build plate, please refer to the Introduction to the Build Plates.



Adaptive Airflow System

The X2D's adaptive airflow system consists of an adaptive airflow switching unit (including the left chamber temperature component and right fan), chamber exhaust fan, and air filter. It automatically switches between **Strong Cooling Mode** and **Heating Mode** based on printing scenarios to regulate chamber temperature.

Adaptive Airflow Switching Unit

Left Auxiliary Part Cooling/Chamber Heating fan

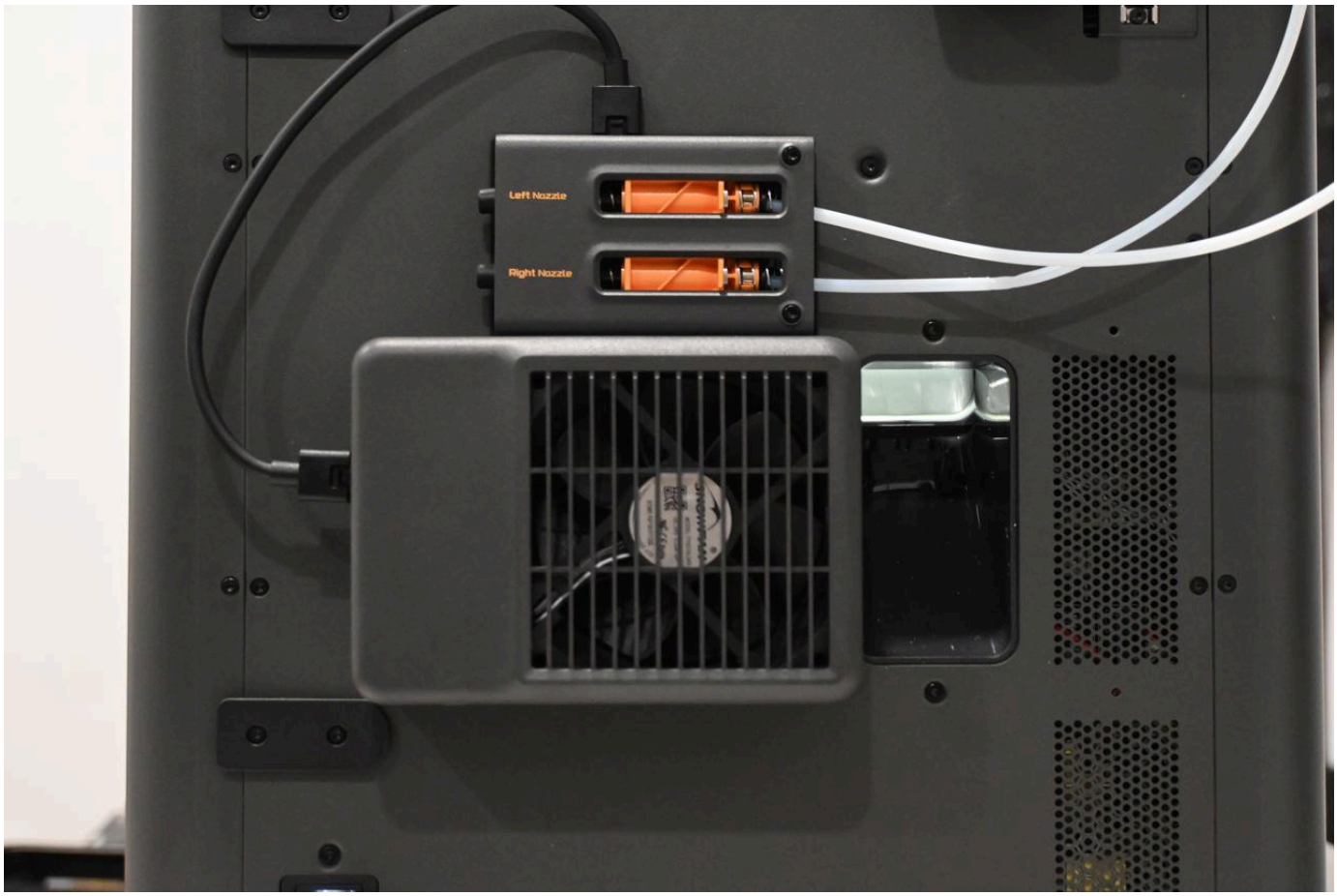
- In **strong-cooling mode**, the left fan serves as an auxiliary part cooling fan, providing enhanced cooling for low-temperature filaments.
- In **heating mode**, the left fan operates as a chamber heating fan. After setting the chamber temperature, the heating wire runs at full power while the fan spins at maximum speed. Post-homing, the heatbed lowers below the air vent (Z-axis height >160mm). The fan then reduces to 40% speed, and the power of heating wire decreases to maintain a stable chamber temperature without direct airflow impacting prints or the heatbed.

Right Auxiliary Part Cooling/Chamber Filtration Fan

- In **strong-cooling mode**, the right fan acts as an auxiliary part cooling fan. When printing low-temperature filaments like PLA, it draws external cool air into the chamber to prevent hotend clogging from excessive heat. The airflow forms a "cooling layer" over prints for rapid solidification and improved quality.
- In **heating mode**, the right fan becomes a chamber filtration fan. For high-temperature filaments, it avoids cold-air intake to stabilize chamber temperature while circulating air through the filter to minimize odors and particles.

Chamber Exhaust Fan

The chamber exhaust fan supports active exhaust functionality. When printing with low-temperature filaments such as PLA, it enables the expulsion of printing gases and synchronizes with the adaptive airflow system to enhance cooling. For high-temperature filaments, activate this feature via "Purify Air at Print End" on the screen. Upon print completion, the device will automatically expel residual gases from the chamber. When used with the ventilation pipe, printing exhaust can be directly directed outdoors or to designated areas.

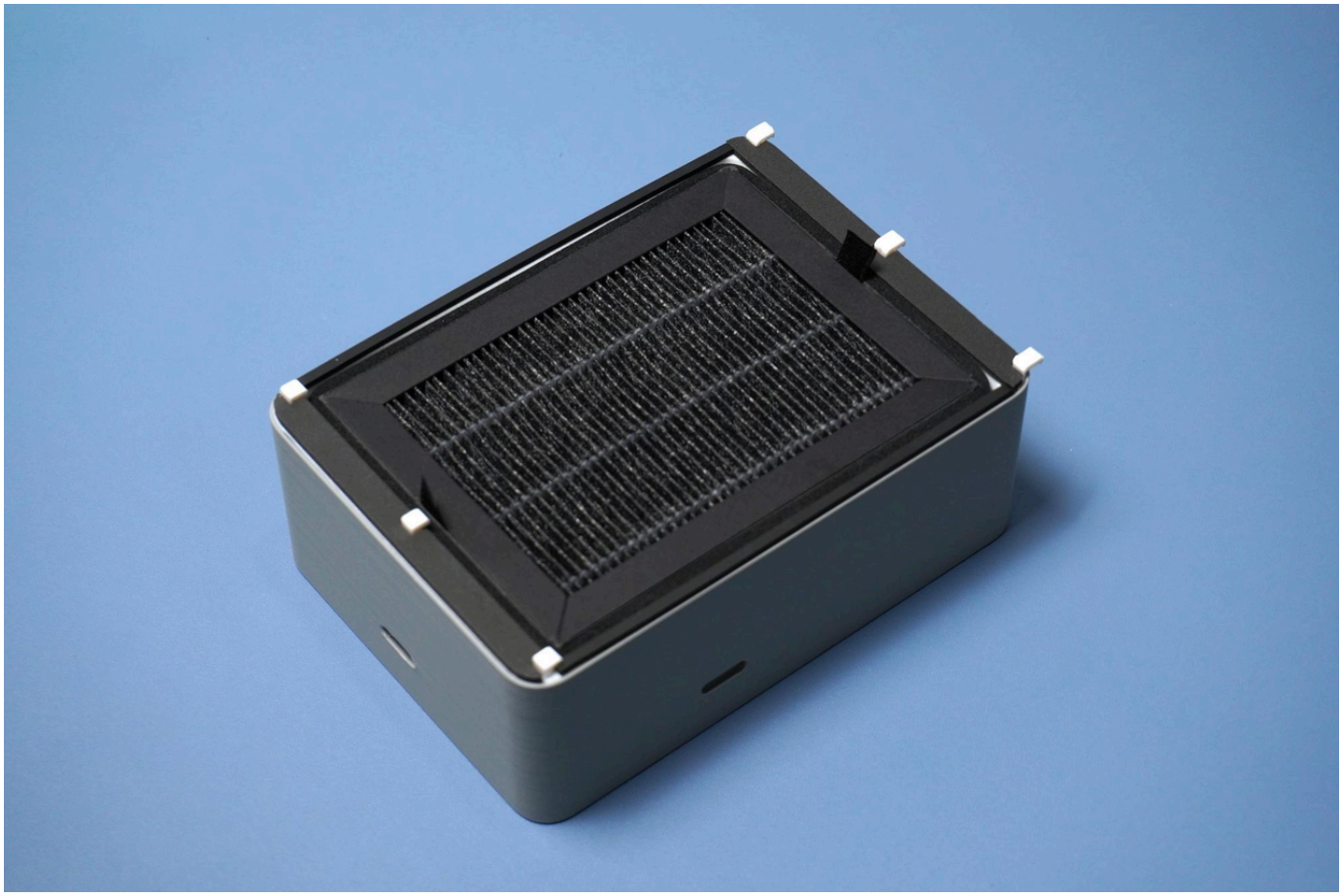


Air Filter

The X2D is equipped with a high-performance air filter that effectively captures VOCs (Volatile Organic Compounds) and particulate matter generated during printing, ensuring a clean working environment.

In Heating Mode, air from the chamber is drawn through the intake behind the filter, where it undergoes filtration and purification, significantly reducing particulate emissions and odors.

The external exhaust fan also supports installing a filter. In cooling mode, hot air inside the chamber flows through the filter, undergoes purification, and is then expelled by the external exhaust fan. This enables internal recirculating exhaust treatment, maintaining fresh indoor air quality.



Filament Buffer

The buffer is installed on the printer's rear panel and contains two filament channels, each corresponding to a hotend:

- Upper path: Leads to the left hotend, connecting to the filament inlet on the printer's rear panel.
- Lower path: Leads to the right hotend, connecting to the auxiliary extruder filament inlet.

When used with the factory-standard length PTFE tubes, it minimizes resistance during filament feeding.

Each channel is divided into a buffer part and a filament detection part.

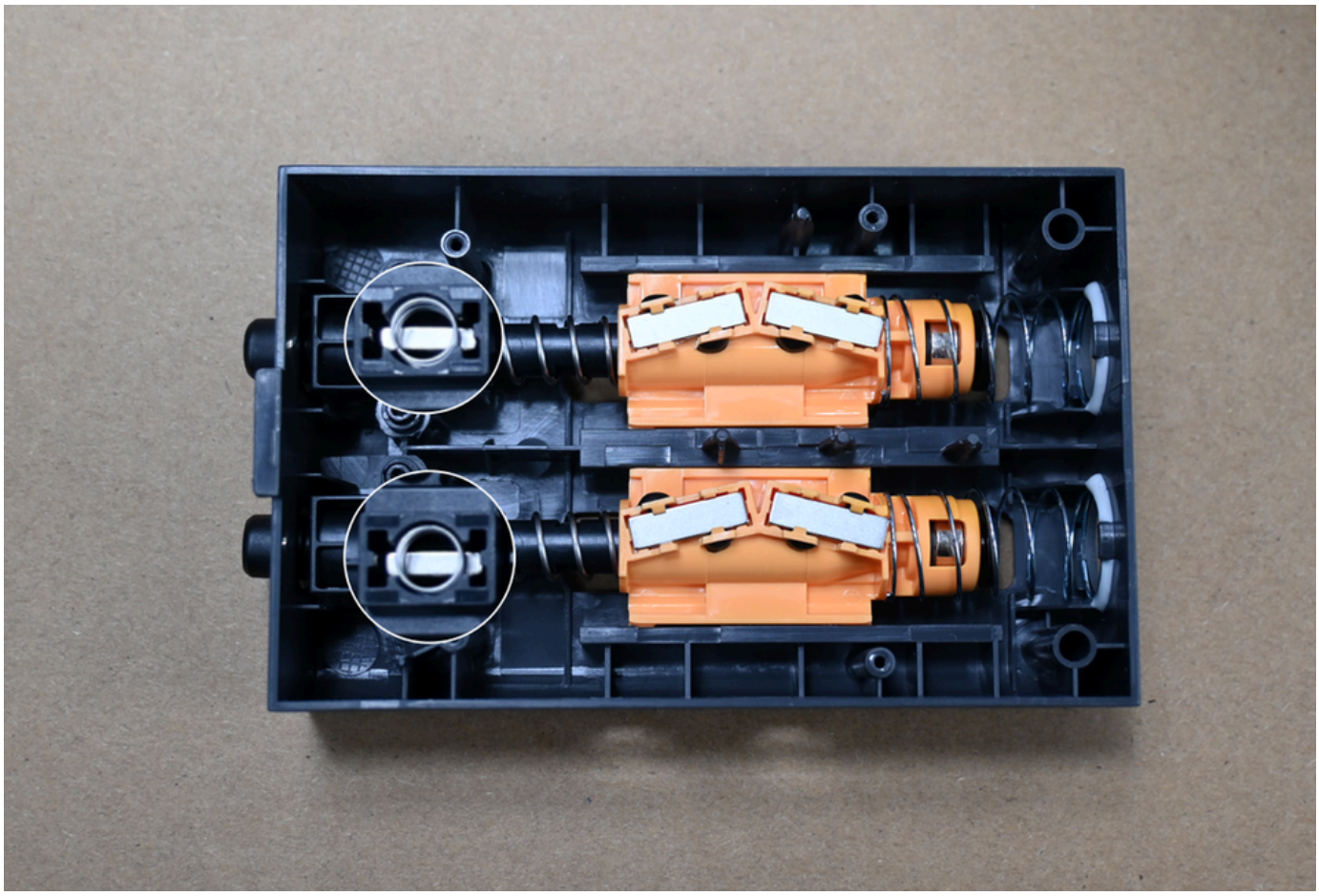
Buffer part

The buffer part mainly includes sliders, magnets, springs, and filament sensors. The basic working principle of the buffer part is that when the AMS pushes the filament into the toolhead extruder, the pressure of the filament pushes the slider to the right and stores a small section of the filament in the buffer. When the extruder consumes the filament in the buffer, the slider returns to the left. The position of the slider is detected by the sensor and fed back to the AMS and the printer to adjust the feeding speed.

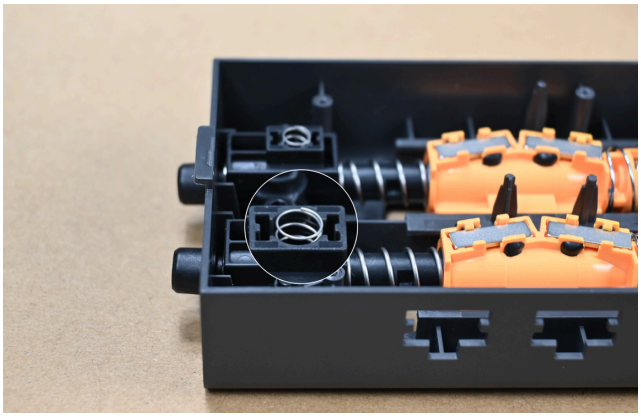
In addition, the buffer part also has a filament entanglement detection function. When filament entanglement or other abnormalities cause increased resistance, the slider will be pushed back to the left. If the slider moves beyond the normal range, the Hall sensor detects the anomaly and triggers a prompt to remind you to handle it.

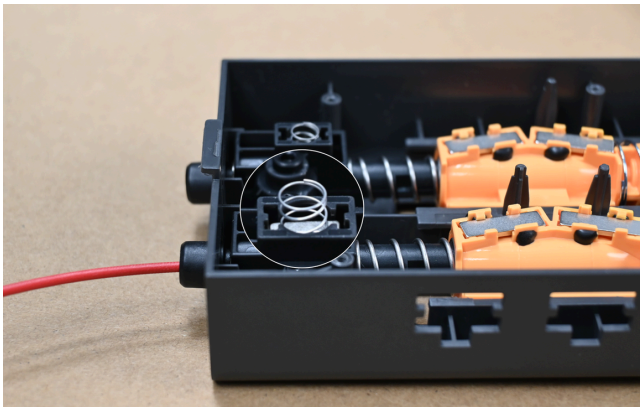
Filament Detection Part

The filament detection part mainly includes magnets, springs, and filament sensors.



When there is no filament in the buffer, the magnet is pressed away from the filament sensor by the spring; when a filament is present, the magnet is pushed toward the Hall sensor by the filament, enabling filament detection functionality.

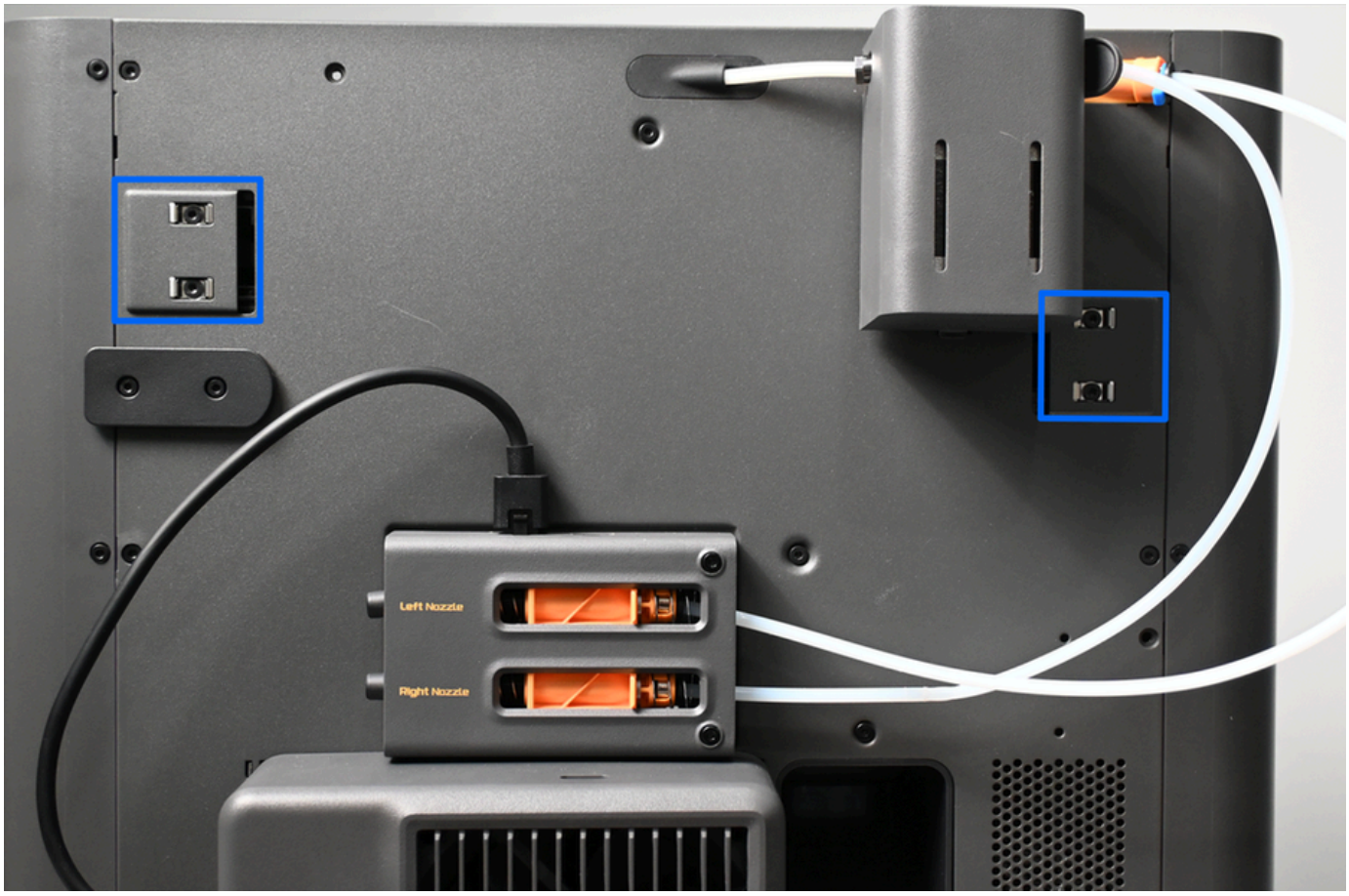




Belt tensioner

The upper rear part of the X2D is equipped with a semi-automatic belt tensioning mechanism. This mechanism utilizes the constant preset tension of the internal spring, and the optimal tension state of the belt can be quickly restored through the simple operations of "loosening the screws and moving the toolhead".

When printed parts appear out-of-round (elliptical) or step loss occurs, or the system prompts "resonance frequency is too low" during the calibration process, it usually indicates insufficient belt tension. In this case, please refer to X2D Belt Tensioning Guide for maintenance to ensure printing accuracy.



Electrical Components

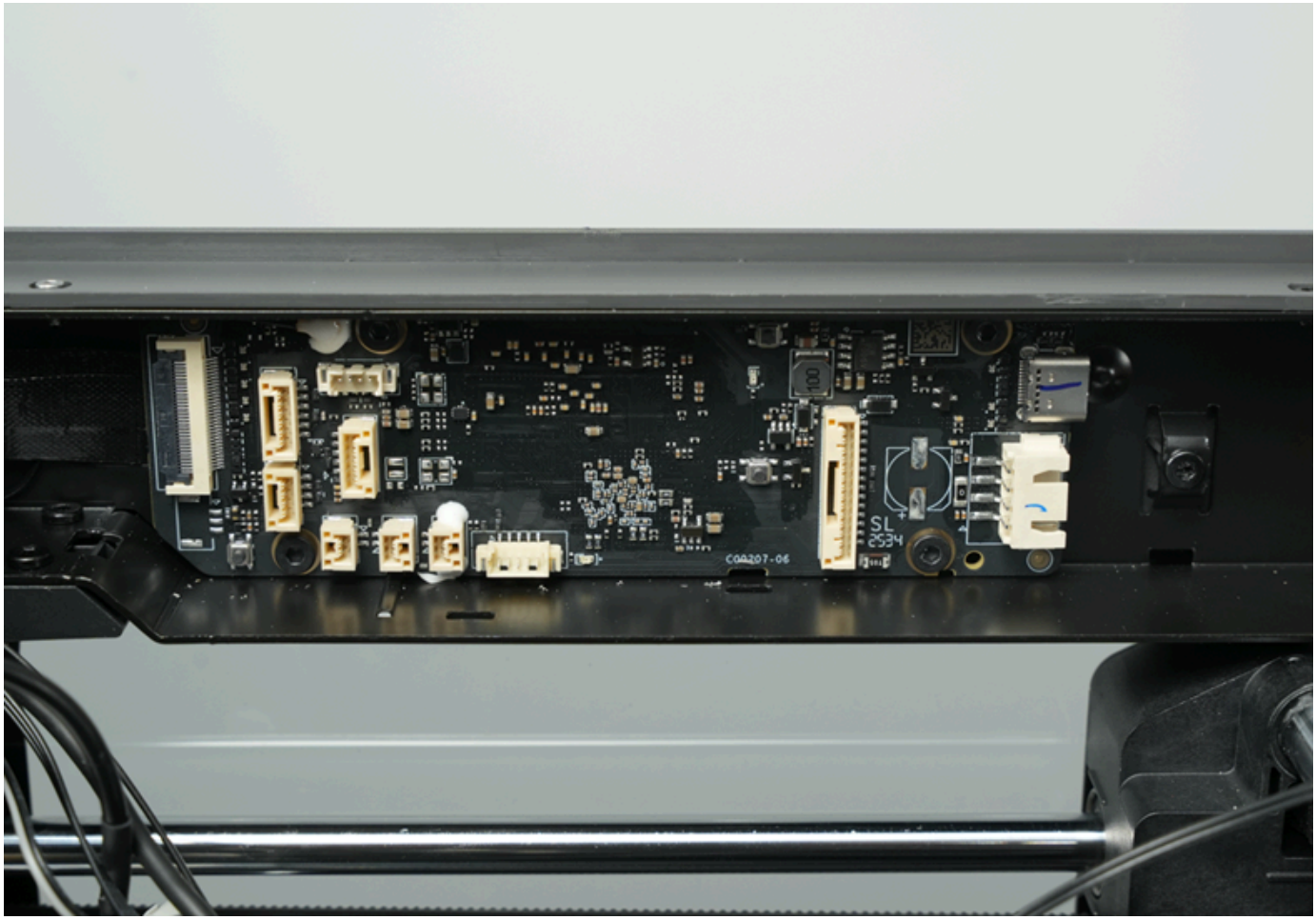
There are many electronic components inside the X2D. Here is an introduction to some of the most important ones:

Main control board

X2D has two types of core main control boards, one is responsible for interactive logic processing (AP), and the other is responsible for the control processing of the whole machine motion unit (MC).

AP Logic mainboard:

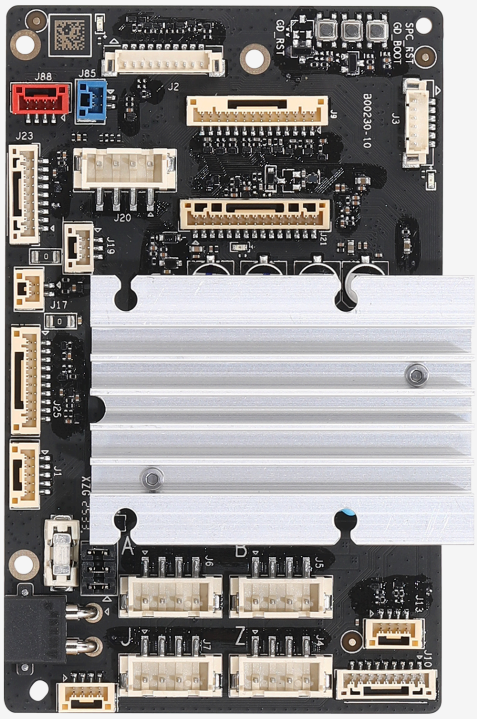
The AP board contains a quad-core CPU as well as the necessary connections to different media electronic devices connected to the printer.
The CPU handles the main media interaction experience and intelligent functions of the X2D (including AI detection, flow calibration, and vibration compensation), as well as connections between the slicer/mobile app and the printer.



MC Motion Control Board:

The MC board contains a dual M4-core MCU and a single M7-core MCU, as well as stepper drivers and the required connections to various motion electronic devices in the printer. It provides: xyz motion control, heated bed temperature control, chamber status detection (front door), circulation system control (air circulation and ventilation channel control).
After receiving G-code streams from the CPU, the MCU controls the actual motion and machine status of the

printer.



USB Storage Port

A USB-A port supporting USB 2.0 protocol, which allows offline printing via a USB drive and storing time-lapse video files.

Screen

The X2D is equipped with a 5-inch 1280*720 touchscreen, combined with a smoother user interface to provide a seamless operating experience.

Camera

Toolhead Camera

The toolhead camera has a resolution of 1600*1200 and a frame rate of 30 fps, enabling high-precision nozzle offset calibration, motion accuracy calibration, and build plate alignment detection.

Live View Camera

The live view camera features a resolution of 1920*1080 and a frame rate of 30 fps, providing live viewing inside the printer chamber, timelapse, and necessary AI detection functions.

End Notes

We hope this guide has provided clear and practical support.

If the issue remains unresolved, please submit a support ticket and include your recent printer logs and additional pictures or other details. Our technical team will review your request and provide detailed assistance.

You can also visit Bambu AI , which can instantly answer common questions and provide you with operational guidance.