# WhatsMiner Immersion Cooling

# Miner

# Operation Guide

**V2.0**

Shenzhen MicroBT Electronics Technology Co., Ltd.

# Forward

## About this Document

This Document includes instructions for installing, disassembling, managing, and maintaining an immersion cooling miner. All pictures and other information are merely for illustrative purposes. Read carefully the manual before using the immersion cooling miner.

## Symbol instruction

| Symbol | Instruction |
| --- | --- |
|  | Provides additional information to supplement the main text. |
|  | Indicates a potential risk which, if not avoided, could result in miner damage or unpredictable results. |

## Safeguards instruction

- Please check whether there are obvious physical faults before power-on. Be careful of electric shock.
- The miner should be kept away from the water source and should not be operated in a humid environment.
- Professional maintenance is required for the miner.
- It is forbidden to touch the miner directly by hand under the condition of power-on.
- Please use stable voltage.

## Revision history

| Version | Revision Content | Release Time |
| --- | --- | --- |
| V1.0 | First release | 20200101 |
| V2.0 | Updated content | 20250217 |

## Legal information



Any part of this Document, including text, images, graphics, etc., belongs to Shenzhen MicroBT Electronics Technology Co., Ltd. or its affiliated companies (hereinafter referred to as "MicroBT"). Without written permission, no unit or individual may extract, copy, translate, or modify all or part of this Document in any way. Unless otherwise agreed, MicroBT makes no express or implied representations or warranties with respect to this Document. The information contained in this Document is subject to change, without

notice, due to product updates or other reasons. Please find the latest version of this Document on the MicroBT website.

and other MicroBT’ s trademarks and logos are properties of MicroBT in various jurisdictions.

Other trademarks, logos and company names in this Document are properties of their respective owners.

## Product certification

Our product has been certified as follows

# Contents

# 1. Introduction

## 1.1 Overview

Whatsminer immersion cooling miner includes multiple models, such as M36S+, M36S++, M56, M56S, M56S+, M56S++, M66, M66S, M66S+, and M63S++. Different models of immersion cooling miners merely differ in performance and specification, such as power ratio and hashrate, but they are basically the same in appearance, installation and disassembly methods, operation, and maintenance. Therefore, this Document takes the newest version M66S++ as an example for introduction.

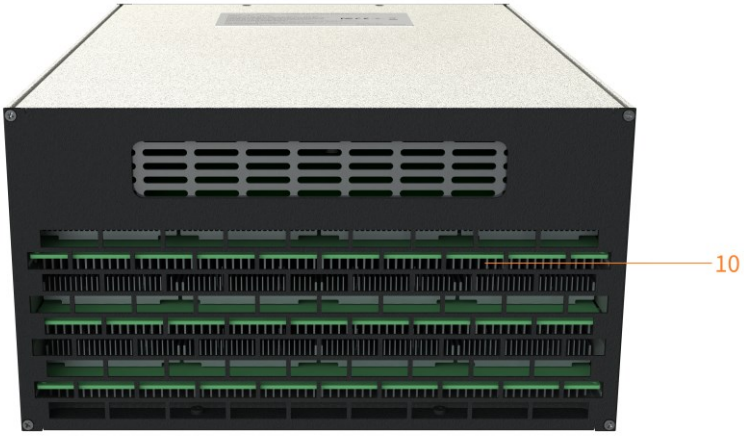
An immersion cooling miner has many advantages. For example, it can maintain lower operating temperatures compared to traditional air cooling solutions, the lower temperature can significantly extend a lifespan of a miner, as it reduces strains imposed from excessive heat, the absence of air cooling fans in an immersion cooling system reduces noise pollution generated by a Bitcoin mining operation, and the immersion cooling system is more energy-efficient than their air-cooled counterparts. With the mining hardware’ s reduced thermal stress, the immersion cooling miner can save on energy consumption and operating costs.

## 1.2 Components

The following figures show a top panel and a bottom panel of an immersion cooling miner, which includes many components, such as a control board, handles, and a liquid outlet.


1. Power supply interface
2. Outlet
3. Handle
4. Control board housing
5. Indicator lights
6. TF card slot
7. IP Found button
8. Reset button
9. Ethernet interface

Figure 1-1




10. Inlet

Figure 1-2

Note:

- The single-phase immersion cooling miner adopts a liquid circulation flow method of bottom-in and top-out for heat dissipation. Its control board, Ethernet interface, and power supply interface are all on an upper panel of the immersion cooling miner, which is convenient for maintenance.
- The figures are merely for an illustrative purpose. The actual miner may differ.

## 1.3 Parameters

Different models of immersion miners have different specifications. For specific parameters, see the corresponding product manual on the official website (WhatsMiner).

In terms of environmental parameters and pressure drop characteristics, these immersion cooling miners are basically the same.

The following table introduces environmental parameters of an immersion cooling miner, in which liquid refers to coolant.

Table 1-1

| | |
|---|---|
| Liquid temperature | ● Working temperature (inlet): 20 °C – 45 °C @ normal mode, 20 °C – 40 °C @ high performance mode<br>  Note:<br>■ For M66S++, M66S+, M66S, M66, M56S++, working temperature (inlet) is 25 °C – 55 °C @ normal mode, and 25 °C – 45 °C @ high performance mode.<br>■ When the price of Bitcoin is low and the electricity cost is higher than the income of Bitcoin, you need to adjust the performance mode to low performance mode. At this time, you can complete this operation through WhatsMinerTool or API without the need for any adjustments to an immersion cooling system.<br>● Inlet liquid temperature control accuracy: ± 2 °C<br>● Storage and transportation temperature: -40 °C – +70 °C |
| Liquid flow | ● Rated flow: ⩾ 24 L/min<br>● Flow control accuracy: ± 10 %<br>  Note: Temperature difference between inlet liquid and outlet liquid corresponds to 24 L/min is close to 7 °C @ normal mode, 10 °C @ high performance mode. |
| Liquid pressure drop | Pressure drop characteristics of different areas inside an immersion cooling miner are different. See Table 1-2 for details. |
| Liquid medium | Special coolant: Insulating liquid (Shell S5X/S3X)<br>  Note:<br>● See 1.4 Properties and Safety Requirements for for liquid properties and |

| | |
|---|---|
| | safety requirements.<br>● The coolant needs to be tested regularly. Refer to Table 1-3 for test indicators and cycles. When test data of the coolant exceeds or is lower than the test indicators, its performance will not meet requirements and the coolant must be replaced.<br>● It is suggested not to use any other coolant other than the recommended Shell S5X/S3X. |
| Humidity | ● Storage humidity: 5 % RH – 95 % RH (non-condensing)<br>● Long-term storage humidity: 30 % RH – 69 % RH (non-condensing) |

Note: Parameters related to liquid flow in Table 1-1 are based on Shell S5X/S3X as a liquid medium. If the liquid medium uses other types of coolant, the parameters related to liquid flow need to be calculated separately. In the case that immersion cooling miners have the same calorific value, a product of liquid specific heat capacity, density, and flow is a fixed value, that is, the flow is inversely proportional to the product of the density and the specific heat. In such a case, you can calculate the flow of a coolant based on its density and specific heat. For example, when Shell S5X/S3X is used as the coolant, its specific heat capacity is 2274 J/(kg • °C), density is 806 kg/m$^3$, and flow is 24 L/min, so when EC110 is used as the coolant, and its specific heat capacity is 2231 J/(kg • °C), density is 778 kg/m$^3$, its flow can be calculated as follows: (2274*806*24) /(2231*778)=25.35.

The following table shows pressure drop characteristics of different areas inside the immersion cooling miner.

Table 1-2

| **Area** | **Flow (m$^3$/h)** | **Sectional average flow velocity (m/s)** | **Pressure drop (pa)** |
|---|---|---|---|
| PCB bottom radiator (Section size: 33.5 x 265 mm) | 0.122 | 0.00381739 | 25.6 |
| | 0.173 | 0.00541319 | 36.4 |
| | 0.226 | 0.00707156 | 47.9 |
| | 0.281 | 0.00879252 | 59.9 |
| | 0.337 | 0.01054476 | 72.8 |
| | 0.396 | 0.01239088 | 86.1 |
| PCB top radiator (Section size: 17.5x265mm) | 0.034 | 0.002036538 | 25.5 |
| | 0.048 | 0.002875112 | 36.5 |
| | 0.064 | 0.003833483 | 47.9 |
| | 0.08 | 0.004791854 | 60 |

| Area | Flow ($m^3/h$) | Sectional average flow velocity (m/s) | Pressure drop (pa) |
|---|---|---|---|
| | 0.096 | 0.005750225 | 73 |
| | 0.114 | 0.006828392 | 86.4 |
| Power supply (Section size: 17.5x265mm) | 0.433 | 0.010555312 | 24.8 |
| | 0.55 | 0.01340744 | 35.2 |
| | 0.661 | 0.016113305 | 46.2 |
| | 0.767 | 0.018697284 | 57.8 |
| | 0.868 | 0.021159378 | 70.2 |
| | 0.965 | 0.023523963 | 82.9 |

## 1.4 Properties and Safety Requirements for Coolant

1. It should have good thermodynamic performance (relatively high thermal conductivity, high liquid specific heat value, and low viscosity among similar substances).
2. It should have good chemical and thermal stability relative to a life cycle of an electronic system and a specified operating temperature.
3. It should be transparent and odorless.
4. Its boiling point should be greater than >150 °C.
5. Its flash point should be 140 °C or it may not have a flash point.
6. Its autoignition point should be greater than or equal to 300 °C.
7. Its pour point should be less than -40 °C.
8. Its purity should be greater than or equal to 99.5 %.
9. Its non-volatile residues should be less than or equal to 10 ppm.
10. Its water content should be less than or equal to 50 ppm.
11. Its acidity should be less than or equal to 0.05 mg/KOH/g.
12. Withstand voltage breakdown: Initial state ⩾ 30 KV/2.5 mm; and saturated water state > 10 KV/2.5 mm.
13. Volume resistivity (40 °C or as per your specified application temperature): ⩾ $1*10^{12}$ Ω・cm; dielectric constant: (40 °C or as per your specified application temperature, 0.1 - 32 GHz) < 2.5; and dielectric loss factor (40 °C or as per your specified application temperature, 0.1 – 32 GHz) < 0.005.
14. Particle size limit in coolant: After the coolant is circulated, the number of particles larger than 5 μm in 100 ml of the coolant is ⩽ 2000, and there are no particles larger than 50 μm.
15. Stability: It should have good antioxidant stability and thermal stability relative to the

life cycle of the electronic system and the specified operating temperature; (for a hydrocarbon single-phase coolant) RPVOT ⩾ 300 (ASTM D2272); and thermal stability: liquid chemical decomposition temperature ⩾ 120 °C.

16. Compatibility: During an operation process, an immersion cooling miner and components related to an immersion cooling system come into direct contact with the coolant for a long time. An impact of the coolant on the immersion cooling miner and component materials, as well as a reverse impact of the immersion cooling miner and component materials on the coolant, should be verified in advance to ensure that availability requirements of the immersion cooling system are met.
17. Physical reactions between the liquid and contact materials, including dissolution, extraction, and the like, should not affect corresponding functions of the liquid and system materials. For example, using the liquid to extract plasticizers from a cable insulation layer can cause hardening and cracking of cables, or dissolution of substances in the immersion cooling system into contact liquid can lead to an increase in liquid viscosity or deterioration of performance.
18. Dissolved substances resulting from convection or driven flow of the liquid shall not affect other materials or devices with which the liquid is in contact. For example, the plasticizers precipitated from the cables will reduce heat exchange efficiency on a surface of a heating device through accumulation.
19. The liquid chemical decomposition temperature should be much higher than operating temperature of the immersion cooling system and potential local overheating temperature.
20. It belongs to a non-toxic category. It is non-irritating to eyes and skin, and does not have mutated cell mutations or heart diseases.
21. During the operation process, it is recommended to regularly monitor changes in typical conventional physical and chemical properties of the coolant to understand its degree of oxidation, moisture absorption and an impact of particulate contaminants, so that quality of the coolant is within an acceptable range of variation to ensure a normal operation of devices such as the immersion cooling miner. When there are abnormalities in test items, the coolant should be maintained or replaced.

Monitoring parameters that may be used and recommended test frequency are shown as follows.

Table 1-3

| **Test Items** | **Unit** | **Detection Indices** | **Suggested Test Cycle** | **Test Method** |
|---|---|---|---|---|
| Appearance | — | Clear liquid without impurities and | Several times a year | Visual inspection |

| | | | | |
|---|---|---|---|---|
| | | suspension | | ASTM D1524 |
| Color | mm | ⩽ 0.5 | Once a year | ASTM D1500 |
| Acidity | mg/KOH/g | ⩽ 0.1 | Once a year | GB/T 264<br>ASTM D2440 |
| Flash Point | ℃ | ⩾ A-8<br>(Suppose original value is A) | Once a year | GB/T 261<br>GB/T 3536<br>ASTM D92 |
| Dielectric Constant (40 ℃ or as per your specified application temperature, 0.1-32 GHz) | — | ⩽ A+0.05<br>(Suppose original value is A) | Once a year | GB/T 1409-2006<br>ASTM D924 |
| Water Content | mg/L | ⩽ Saturated water absorption capacity | Once a year | GB/T 7600<br>ASTM D1533 |
| Dielectric loss factor (40 ℃ or as per your specified application temperature, 0.1 – 32 GHz) | — | ⩽ 0.005 | Once a year | GB/T 5654<br>ASTM D924 |
| Breakdown Voltage (2.5 mm gap) | kV | ⩾ 15 | Once a year | GB/T 507<br>ASTM D1816 |
| Volume resistivity (40 ℃ or as per your specified application temperature) | Ω・cm | ⩾$1*10^{12}$ | Once a year | GB/T 5654 |
| Viscosity | $mm^2/s$ or CST | ⩽ A*（1+5%）<br>(Suppose original value is A) | Once a year | GB/T 10247<br>GB/T 265<br>ASTM D445 |

| | | | | |
|---|---|---|---|---|
| Corrosive Sulfur | — | Not corrosive | Every two years | SH/T0804 ASTM D1275 |

Note:

- In an early stage of the operation, a test cycle of the coolant can be appropriately increased, such as once every three months or half a year. After the operation is stable, the test cycle should be at least once a year.
- Regarding a sampling point, due to different coolant densities, when the density of the liquid is greater than the density of water, the water is in an upper layer, so the sampling point should be biased towards the upper layer, and when the density of the liquid is less than the density of the water, the water is in a lower layer, so the sampling point should be biased towards the lower layer.

## 2. Design Considerations of Immersion Cooling System

Immersion cooling is a technique used in mining to cool down mining equipment, mainly a computer hardware known as ASICs (Application-Specific Integrated Circuits) that are used to mine. Immersion cooling involves submerging electronic components, such as ASIC chips, into an insulating liquid. This liquid has high thermal conductivity and efficiently dissipates the heat generated by an immersion cooling miner away from hardware.

An immersion cooling system is more efficient at moving heat away from the immersion cooling miner than an air cooling system. Managing heat exhaustion from the immersion cooling miner is a key part of miner operations maintenance.

An immersion cooling method enables direct contact between components and the insulating liquid, providing superior heat dissipation. Typically, the immersion cooling system includes dry coolers/cooling towers, tanks, pumps, pipes, heat exchangers, dielectric coolant, and sensors and monitoring/control systems.

Therefore, when you purchase an immersion cooling miner, an immersion cooling system is essential. You can choose our cooperators, such as Fog Hashing and Hash House, to obtain professional support and assistance, thereby helping you save time and energy. If you have any interests, feel free to consult our sales.

For example, Fog Hashing's immersion cooling system for mining uses advanced

immersion type cooling technology. It removes fan coolers from the immersion cooling miner and immerses it fully in dielectric coolant, which has an order of magnitude more heat capacity than air, resulting in effective cooling. This technology improves mining efficiency and thermal management. Specifically, the Fog Hashing BC40 Pro (Customized Version) is an all-in-one solution which consists of an integrated immersion cooling container and 8 independent V-shaped dry cooler sets. The system utilizes a single-phase immersion cooling solution and a single loop implementation. A water spray subsystem is also integrated for the extremely hot regions, providing supplementary heat dissipation capability under high-temperature conditions. The following figure illustrates a general view of the system.

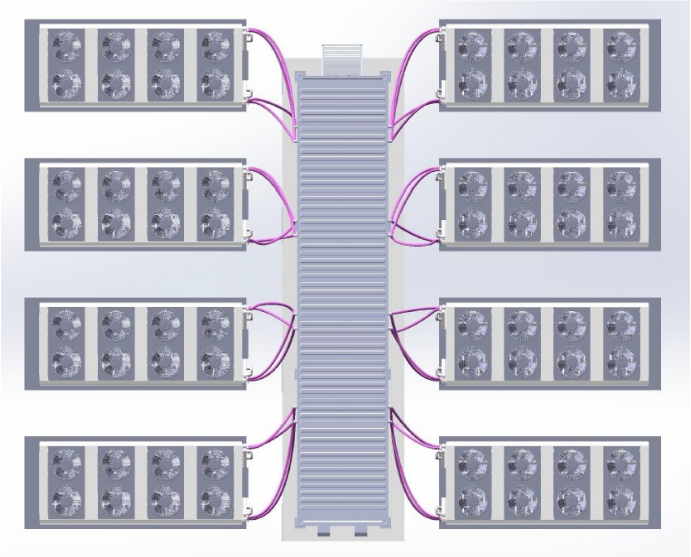


Figure 2-1

For another example, Hash House’ s Trident series are cutting-edge immersion cooling mobile data center designed to enhance computational performance and extend miner lifespan. Specifically, it can offer a cost-effective and plug-n-play solution for the immersion cooling miner, and can maximize profitability and efficiency while minimizing transportation, construction, and maintenance costs with its all-in-one design, rapid deployment capabilities, and scalability.

In addition, you can also build your immersion cooling system as needed. To be more specific, you can choose to build a single cycle immersion cooling system or a double cycle immersion cooling system.

In the single cycle immersion cooling system, an immersion cooling CDU (Cooling Distribution Unit) includes the following components, such as a differential pressure sensor, a flowmeter, a circulating pump, a filter, an automatic exhaust valve, a manual

exhaust valve, a drain valve, and the like. In a double cycle immersion cooling system, the most important component included in the immersion cooling CDU is a heat exchanger, while other components are similar to those in the single cycle immersion cooling system. The benefit of a double cycle mode is less total oil is used. Therefore, when you have necessary components, you can prepare to build a simple immersion cooling system. The following two figures show examples of CDUs in single cycle and double cycle modes.

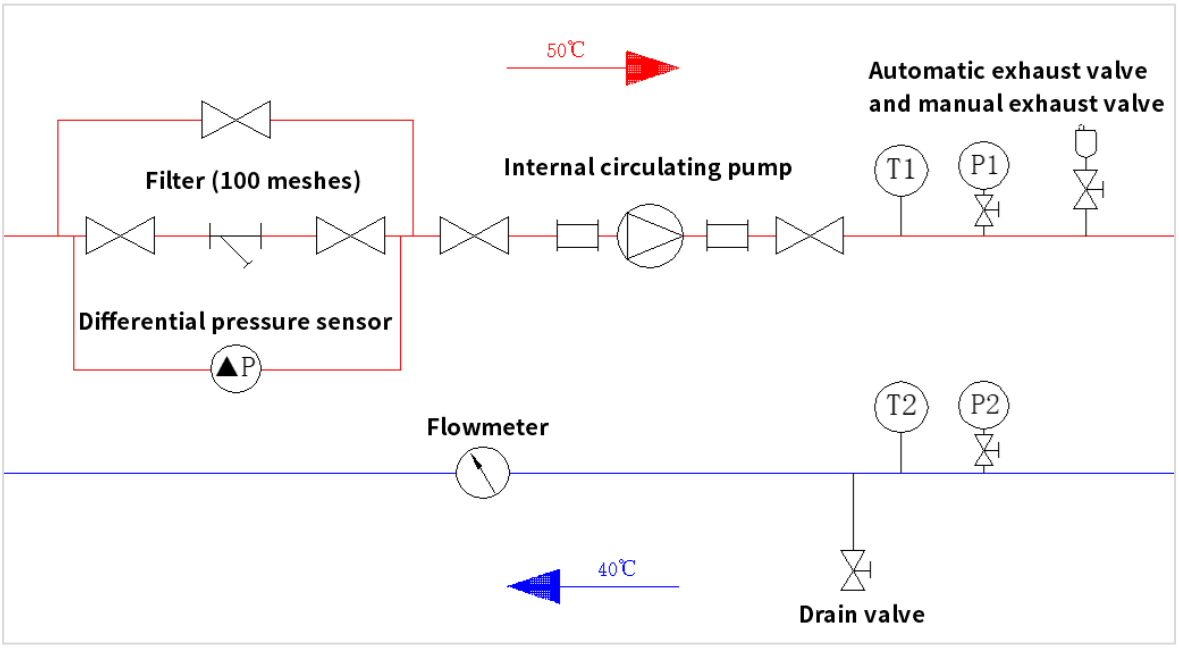



Figure 2-2

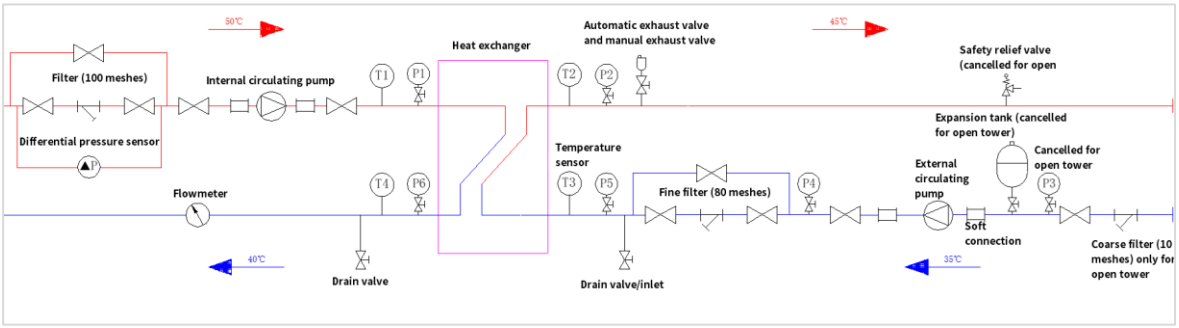



Figure 2-3

Finally, when you design your immersion cooling system, some considerations must be taken into account. The detailed introduction provided below is for reference only.

1. System pipeline: It is recommended that hard pipes in a pipeline in a cycle system be made of sanitary stainless steel and be prefabricated in a factory and then installed on site without cutting, grinding, welding and other processes. Hoses should consider compatibility with a coolant to prevent leakage due to corrosion by the coolant.

Note: To ensure cycle system cleanliness, it is recommended to use easy-to-clean

sanitary stainless steel pipes in the pipeline. Various pipeline components may be prefabricated, and undergo pressure testing, acid pickling and passivation, rinsing, drying, sealing and packaging in the factory to ensure cleanliness. It is not recommended to use carbon steel pipes or galvanized steel pipes since they have poor cleanliness. Large particles of welding slag and oxides are easily occurred at welding positions during a welding process, making it difficult to clean up inside the pipes. Therefore, pipes are prone to rusting before being put into use.

2. Compatibility selection of system components: For different coolants, system components that need to be considered for the corrosion by the coolant mainly include circulating pumps, pipeline sealing components, network cables, power supply cables, and the like.

 Note: Different coolants have different compatibility with materials. Circulating pump shaft seals, pipes, sealing components connecting the pipes, network cables and power supply cables in the cycle system must all be selected and designed for a specific coolant. Otherwise, system components may be damaged or even liquid media may leak or the immersion cooling miner may malfunction. We will shoulder no responsibility for such damage to the miner.

3. Filter: It is recommended to configure a filter with a mesh size of 100 or above in a main road and a 5 μm core filter in a bypass in the cycle system.

 Note: The above two filters need to be connected during a normal operation of the cycle system, and if system impurities cannot be filtered, it may cause the damage to the immersion cooling miner. We will shoulder no responsibility for such damage to the miner.

4. Temperature resistance of system components: It is recommended to use the system components with temperature resistance greater than or equal to 85 °C.

 Note: If the temperature resistance of the system components is lower than 85°C, it is easy to cause the damage to the system components or even the leakage of the coolant, which may cause the damage to the immersion cooling miner. We will shoulder no responsibility for such damage to the miner.

5.Circulating pump: It is recommended to adopt a configuration of one in use and one in standby to improve system reliability.

6.Tank: It is recommended that inner liner be made of stainless steel. In addition, a Tank design with multiple miner positions recommends considering an equalization design of each miner position and different areas of the immersion cooling miner itself to ensure that a coolant flow of each miner position and different areas of the immersion cooling miner

itself is balanced to prevent a local area of the immersion cooling miner from overheating.

a) If the inner liner of Tank is made of the stainless steel, spraying is also recommended to ensure the cleanliness. If the spraying is not performed, it is necessary to perform cleaning treatments such as acid pickling, passivation, cleaning, and drying. If carbon steel is adopted, the spraying must be performed after welding to ensure the cleanliness. Generally, after welding, the inner liner of Tank is first polished to remove burrs, sharp edges, and welding slag. Then, pressure test and leak detection (using water or kerosene for the leak detection) are carried out. After confirming that there is no leakage, the spraying or cleaning treatment is performed. You should pay attention to using a coating that is compatible with the coolant used for the spraying.

b) Since pressure drop from an outlet of a feed pipe of Tank to an inlet of different miner positions is different, different miner positions will obtain different flows of the coolant. Therefore, the Tank design needs to adjust this pressure drop to ensure uniform inlet pressure of the miner positions in different areas, thereby achieving a flow balance between the miner positions.

c) Since pressure drop characteristics of different areas of the immersion cooling miner itself are different (see Table 1-2 for details), when designing openings on a liquid equalization support plate inside Tank, it needs to consider reasonable allocation of the coolant flow based on heat generation of different areas of the immersion cooling miner itself (mainly distinguishing between a PCB area and a power supply area, with 5-10% of flow in the power supply area). The following four types of opening diagrams of the liquid equalization support plate are used as references.

   i. A first type: 8 Φ10 holes face a PCB large radiator area & 8 Φ10 holes face a PCB small radiator area & 5 Φ5 holes face a power supply area.

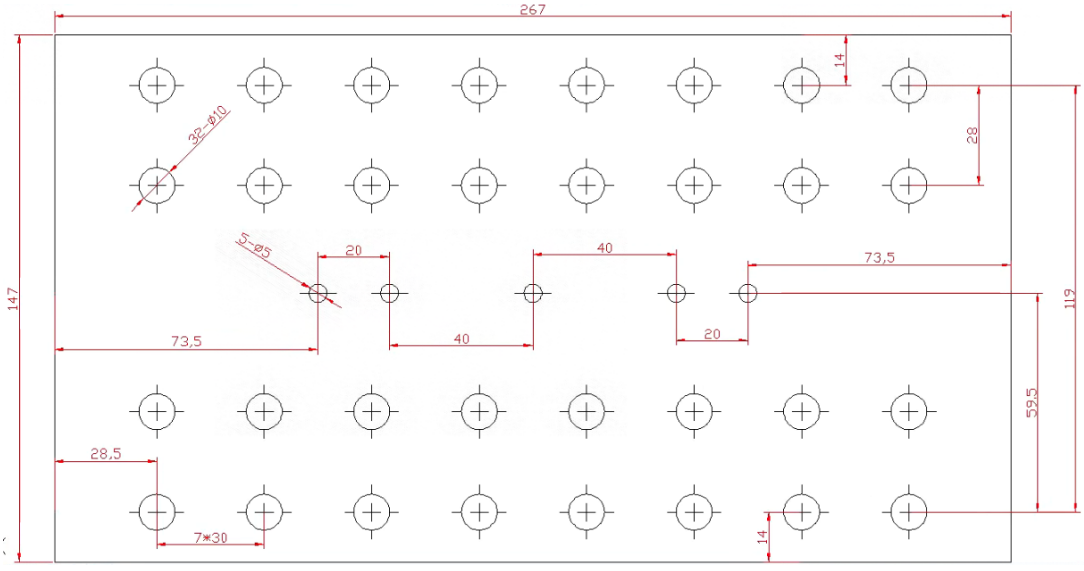



Figure 2-4

   ii. A second type: 18 Φ8 holes face the PCB large radiator area & 19 Φ8 holes face the

PCB small radiator area & 6 Φ6 holes face the power supply area.

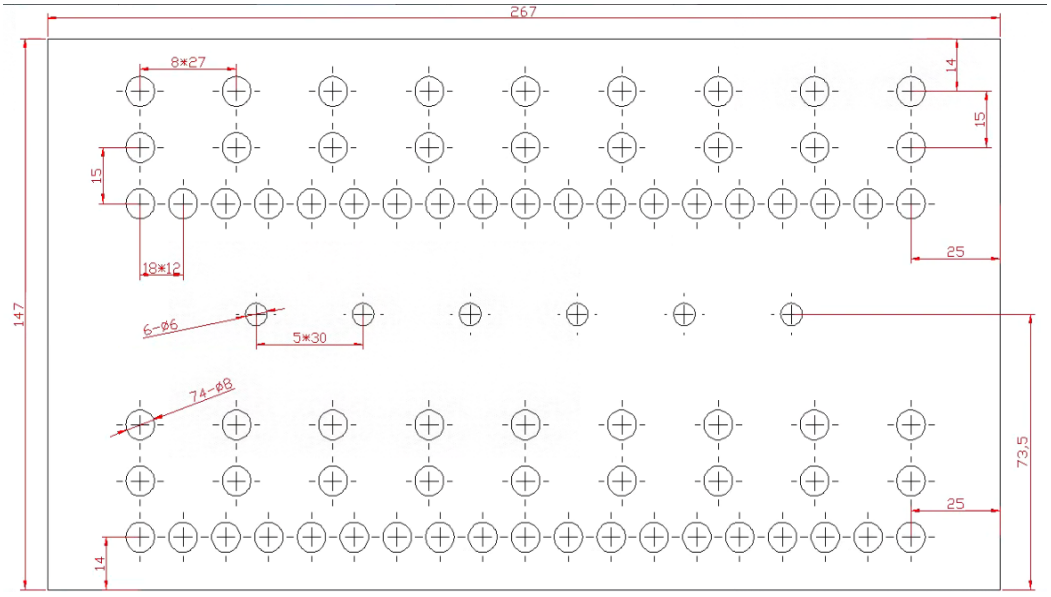



Figure 2-5

iii. A third type: 20 Φ6 holes face the PCB large radiator area & 19 Φ6 holes face the PCB small radiator area & 6 Φ5 holes face the power supply area.

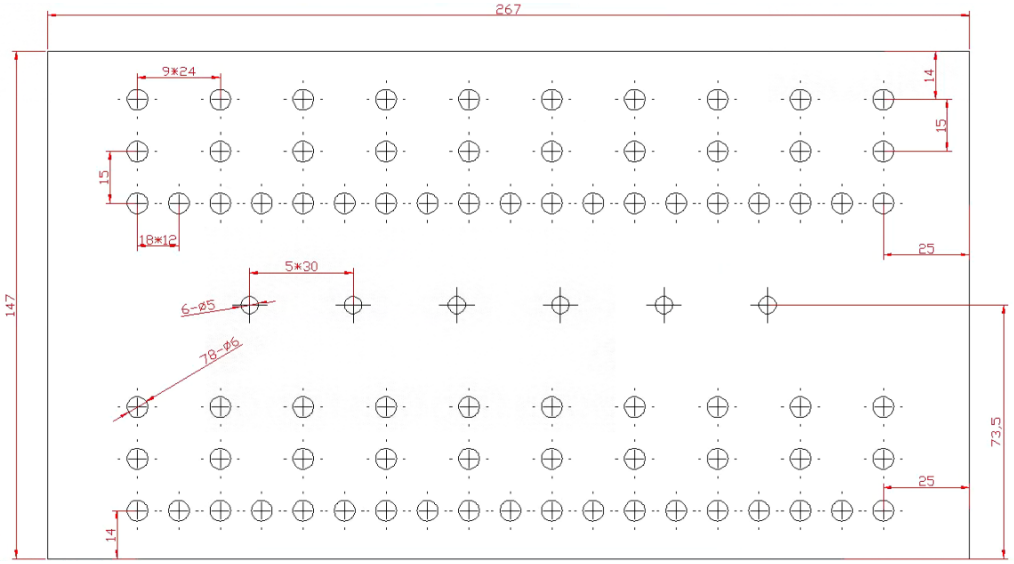



Figure 2-6

iv. A fourth type: 24 Φ4 holes face the PCB large radiator area & 23 Φ4 holes face the PCB small radiator area & 10 Φ3 holes face the power supply area.

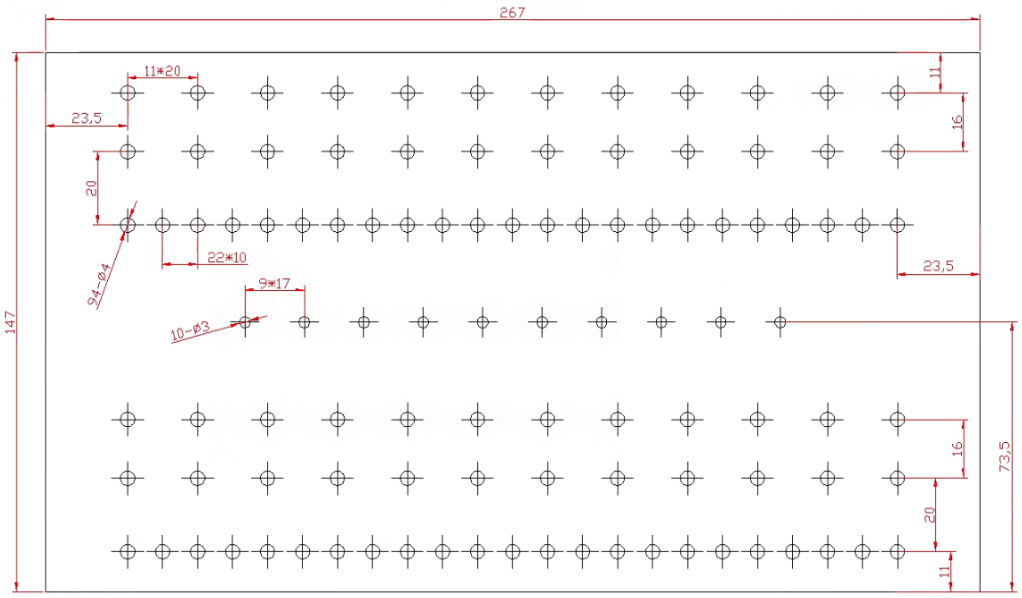



Figure 2-7

7. System cleanliness control: To ensure the cleanliness of the entire cycle system, it is recommended to first ensure the cleanliness of finished products of various key components, including circulating pumps, Tank, radiators, prefabricated pipeline and pipes, and the like. Secondly, when designing the cycle system, it is recommended that a main pipeline system reserve a bypass to connect an additional cycle system cleaning apparatus with a pressure boosting function, which is equipped with a fine filter of 5 μm or more.

Note:

a) A new circulating pump will be tested before leaving the factory, so there will be residual water inside. It is recommended to clean the residual water before leaving the factory or using it.

b) Regarding to processing technologies of the prefabricated pipeline and pipes, Tank and radiators, it is recommended to have a cleaning and drying process to ensure that there are no water stains, dust, metal chips, welding slag impurities, and the like. After cleaning and drying, seal as soon as possible to prevent internal contamination by dust and impurities. Requirements for water washing and drying of finished components refer to Table 2-1. Regarding to packaging and transportation of the prefabricated pipeline and pipes, Tank and radiators, it is recommended to do a good job of internal dust control.

c) The system cycle cleaning apparatus with the pressure booster function herein refers to an independent cleaning apparatus with a booster pump, which is only used when the cycle system needs cyclic cleaning, and does not need to be connected during a normal operation of the cycle system.

Table 2-1

| Procedure | Purpose | Operation | Inspection Standard |
| --- | --- | --- | --- |
| Water flushing | The number of particles meets requirements | Flush with pure water | After taking out 100 ml of flushing water from the immersion cooling miner, if the number of particles larger than or equal to 5 μm shall not exceed 500, and the number of particles larger than or equal to 15 μm shall not exceed 100, cleaning is qualified.<br>  Note: A test method for the number of particles (5 μm) is as follows. Take 100 ml of flushing water sample and let it pass through a filter paper with a diameter of 39 mm, a mesh of 3 mm * 3 mm, and a mesh of 5 μm, then observe the filter paper under a microscope, select 12 grids at random, count the number of particles thereon, and then calculate an average number of particles on each grid δ, where $\delta \leqslant 500*3^2/(\pi*39^2/4) = 4$. |
| Drying | Remove the residual water in the immersion cooling miner | Use a drying oven or a drying fan, control the temperature at 120 ℃ - 140 ℃ , dry inner surfaces of pipes, and continue to dry for 15 minutes after there is no obvious residual water in the immersion cooling miner. | Dry inside the immersion cooling miner is qualified. |

 Note: Due to the unclean cycle system, the coolant may mix with water, metal

shavings, or welding slag impurities, which may cause the damage to the immersion cooling miner. We will shoulder no responsibility for such damage to the miner.

8. Bypass valve: It is recommended to add a bypass valve on a cold source side of the cycle system to prevent the liquid supply temperature from being too low.

 Note: If there is no bypass valve, when the cycle system has a sufficiently large heat dissipation temperature difference (difference between a target inlet temperature and an ambient temperature), even if a fan on the cold source side does not rotate, the target inlet temperature may be too low, and thus cannot rise to a minimum target value (20 °C), and the immersion cooling miner may not meet a hashrate standard. The bypass valve can bypass return liquid with high temperature of the immersion cooling miner and mix it with outlet liquid on the cooling source side with lower temperature to prevent the temperature of supply liquid from being too low.

# 3. Precautions Before Putting Miner into Operation

## 3.1 System Installation

Before assembling a cycle system, all components in the cycle system must be confirmed to be clean. If the components are not clean enough, clean them before installing the cycle system.

During an installation process of each component in the cycle system, cleanliness inside the devices must also be ensured, including pipeline, pipes, Tank and radiators. For example, when installing a certain pipe, only remove packaging of the pipe, and do not remove the packaging of other devices. If foreign particles are accidentally mixed into a certain component during the installation process, clean it with a clean cloth or a vacuum cleaner in time. Moreover, in an installation suspension period, seal and protect the components that have been unpacked but not yet installed or put into use.

 Caution: if impurities in a certain stage are not handled cleanly, it will cause heavy losses, because after the cycle system is put into use, if a certain component is not clean, the components in the entire cycle system and coolant will be contaminated, causing a decrease in insulation performance of the coolant and the damage to the immersion cooling miner, or flow of particles and impurities can wear down the immersion cooling miner. Once the cycle system is contaminated, it is very difficult to clean it.

## 3.2 System Pipeline Pressure Test

After installing all system components, it is recommended to perform pressure tests and leakage tests to ensure that there are no leakages in connections of all system components. It is recommended to use a water test when using the water for the cycle, and ensure that there is no leakage under a water test pressure of 6 bar. It is recommended to use a nitrogen gas test when using the coolant for the cycle and use a soap bubble method to test sealing positions of connectors, and ensure that there is no leakage under a gas test pressure of 4 bar. If an air compressor is used for the gas test, there is a risk of condensation in the air, which may cause the water to mix into the cycle system. There are risks in directly injecting the coolant for the pressure test. Once the leakage occurs, it is difficult to collect the coolant.

## 3.3 System Cleanliness Reconfirmation

Before injecting the coolant into the cycle system, confirm again whether the entire cycle system is clean, including a circulating pump, pipes, Tank, radiators, and the like, and ensure that there are no obvious water stains, dust, metal chips, welding slag impurities, and the like.

## 3.4 System Liquid Injection

If it is a double cycle system, first fill the cycle system with the water and test the pressure, observe whether there is water flowing out from a Tank side, and confirm that hot and cold sides of a heat exchanger are completely isolated and not connected. After the coolant is injected into the cycle system, the circulating pump starts a cycle at a low frequency and in an intermittent manner to evacuate air in the cycle system. After the air in the cycle system is evacuated and the coolant circulates stably for one to two hours, confirm whether a filter is clean. After confirming that the filter is clean, put an immersion cooling miner into Tank, and collect the excess coolant. The coolant level needs to be high enough to ensure that a liquid return port does not inhale the air.

## 3.5 System Demo Verification

Before putting immersion cooling miners into Tank in batches, if it is a newly built cycle system, it is recommended to use a Demo system for a trial operation for more than one week to verify system design to a certain extent before scale application. At the same time, it is recommended to test various indicators of the coolant in the cycle system to ensure

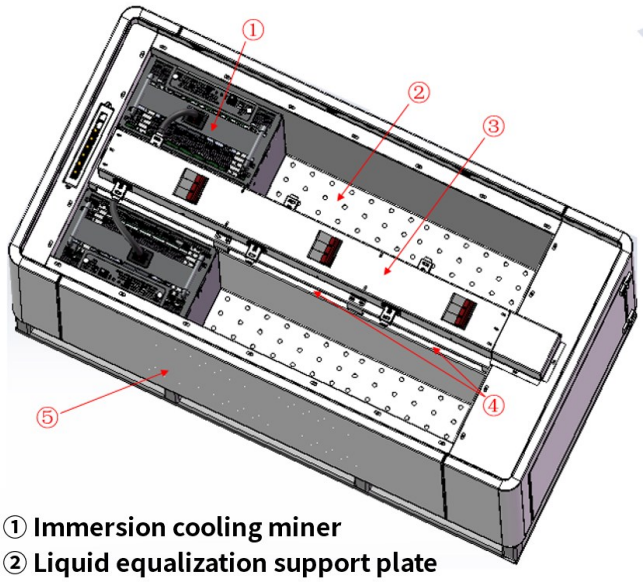
that the indicators of the coolant are qualified (refer to Table 1-3) to avoid failure problems of the immersion cooling miners in batches.

## 3.6 System Deployment

Before deploying the immersion cooling miners, after the cycle system is installed and filled with the coolant, the coolant should be circulated for 1 hour, then 100 ml samples are taken from the liquid return port of Tank, the liquid injection port of Tank, and other areas where impurities may be the most. Among them, the number of particles greater than or equal to 5 μm in the100 ml samples should be less than or equal to 500, the number of particles greater than or equal to 15 μm should be less than or equal to 100, and there are no particles larger than 50 μm (based on a cleanliness level NAS 3 of NAS 1638 standard). If the cleanliness level does not meet the standard, the cycle system is connected to a 5 μm high-precision filter apparatus with an independent booster pump for circulating and filtering the coolant until the cleanliness level meets the standard.

Note: A test method for the number of particles (5 μm) is as follows. Take 100 ml of coolant or flushing water sample and let it pass through a filter paper with a diameter of 39 mm, a mesh of 3 mm * 3 mm, and a mesh of 5 μm, then observe the filter paper under a microscope, select 12 grids at random, count the number of particles thereon, and then calculate an average number of particles on each grid δ, where $\delta \leqslant 500*3^2/(\pi*39^2/4) = 4$.

The immersion cooling miner uses a bottom-in and top-out coolant cycle flow method to dissipate heat. Therefore, the immersion cooling miner needs to be placed in an immersion cooling Tank that allows the coolant to flow in and out from the inside of the immersion cooling miner. A liquid equalization support plate at the bottom of the immersion cooling Tank needs to support the immersion cooling miner. The coolant passes through the liquid equalization support plate and a bottom panel of the immersion cooling miner and directly enters the immersion cooling miner, and flows out from a top side or an upper panel of the immersion cooling miner, as shown in the following figure. The immersion cooling miner can be put into Tank and taken out Tank by one person.




**① Immersion cooling miner**
**② Liquid equalization support plate**
**③ PDU**
**④ Tank overflow**
**⑤ Tank**

Figure 3-1

## 3.7 Other Considerations

1. Check whether the voltage of a PDU is normal before powering it on. If the voltage of the PDU is abnormal, a corresponding tank needs to be powered off for check.
2. During an operation of the double cycle system, pay attention to whether there are water droplets mixed in the coolant in Tank. If there are water droplets, there may be a leakage in a plate heat exchanger, causing water to enter the coolant. At this time, Tank needs to be stopped immediately.
3. When a failure rate of the immersion cooling miners in a single cycle system reaches 10% or more, shut down and check immediately.
4. It is recommended to power on the immersion cooling miners in batches when powering on to prevent the damage from surges.
5. During the operation, check all materials in contact with the coolant from time to time for compatibility, such as sealing rings, network cables, power supply cables, and the like, and replace them in time if there is any abnormality.
6. The immersion cooling miner must be powered on and turned on after the coolant circulates normally.
7. Removing the immersion cooling miner from Tank can cause a liquid level of Tank to decrease. Pay attention to the liquid level to ensure that the liquid return port does not inhale the air.
8. The power supply cables must be original accessories from the factory.
9. Press a shrapnel when unplugging the power supply cable.


Figure 3-2

# 4. Introduction to Optional Accessories

For different demand scenarios, you can contact us to purchase required accessories. A list of optional accessories is detailed as below.

Table 4-1

| No. | Accessory | Specification | Legend | Remarks |
|---|---|---|---|---|
| 1 | Power supply cable | ● L = 1200 mm<br>● Double heads with plugs<br>● 4*2 $mm^2$ |  | The power supply cable is used to connect a power supply of an immersion cooling miner to a PDU of Tank where the immersion cooling miner is located, and plugs at both ends of the power supply cable match a power supply interface (socket) of the immersion cooling miner.<br>Note: An interface of the PDU of Tank needs to be a socket interface matched with a plug of the power supply cable. The power supply cable is suitable for a miner cabinet usage scenario |

| | | | | |
|---|---|---|---|---|
| | | | | provided by Microbt. |
| 2 | Power supply cable | • L = 1000 mm<br>• Single head with socket<br>• 4*2mm² |  | The socket interface of the power supply cable is of the same specification as the socket interface of a power supply of the immersion cooling miner. |
| 3 | Power supply cable | • L = 1000mm<br>• Single head with plug<br>• 4*2mm² |  | A plug of the power supply cable matches a power supply interface (socket) of the immersion cooling miner. |

# 5. Environment Configuration for Miner

## 5.1 Device List for Miner Configuration

Table 5-1

| No. | Name | Quantity | Description |
|---|---|---|---|
| 1 | Computer | 1 | Configuring immersion cooling miner related parameters and operations. |
| 2 | Power Supply | 1 | Powering an immersion cooling miner. |
| 3 | Network Switch | 1 | Enabling communication between the immersion cooling miner and a computer.<br>Note: A network switch can connect to an external network. |
| 4 | DHCP Miner/Router | 1 | Providing a dynamic IP address for the immersion cooling miner when initially powering on it. |
| 5 | NTP Miner/Router | 1 | Providing NTP network time for the immersion cooling miner. |

## 5.2 Network Environment Configuration for Miner

When an immersion cooling miner leaves the factory, it defaults to obtaining a dynamic IP address through DHCP (Dynamic Host Configuration Protocol). Therefore, a DHCP server should be configured in a network of a mining farm, or a router enables DHCP to

dynamically allocate IP addresses. The operating time of the immersion cooling miner and the accuracy of hashrate statistics depend on the network NTP (Network Time Protocol) time. The immersion cooling miner itself is configured by default with multiple public NTP server addresses. In order to accelerate speed of NTP obtaining the network time and improve the time precision, it is recommended to configure a local NTP server in the network of the mining farm.

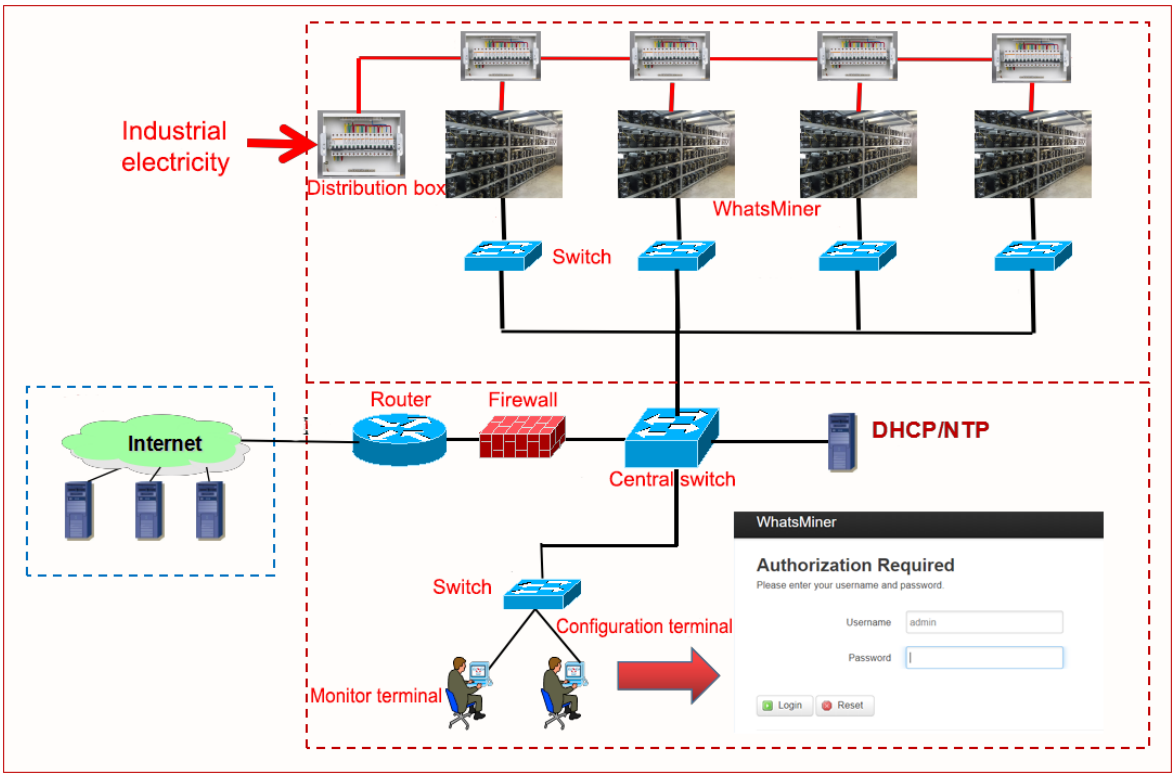



Figure 5-1

## 5.3 Data Configuration for Miner

You can configure data for an immersion cooling miner on the webpage.

### 5.3.1 Querying Dynamic IP Address Obtained by Miner

You can query a dynamic IP address of the immersion cooling miner on WhatsMinerTool. You can download this software on WhatsMiner.

Before configuring miner data, connect your computer to the same network segment as the immersion cooling miner.

Step 1 Double-click WhatsMinerTool to enter a main page.

Note: Before operating WhatsMinerTool, download it first.

Step 2 Click **IP Monitor** tab, configure **Room**, **Shelf**, **Layer**, **Place**, and **Step** as needed, and

then click **Start**.

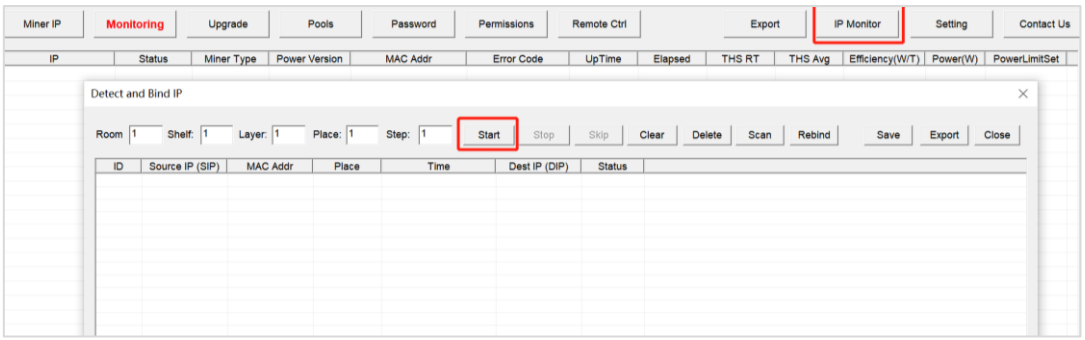



Figure 5-2

### 5.3.1.1 Checking IP Address Reported by Miner

After the immersion cooling miner is powered on for about 30 seconds, under normal circumstances, a yellow light on a network port is always on and a green light is flashing. At this time, press **IP Found** button on a control board of the immersion cooling miner for more than 2 seconds, then two LED lights, **Active** and **Alarm**, will flash a few times, indicating that the immersion cooling miner has broadcast its IP address and MAC address to the network.

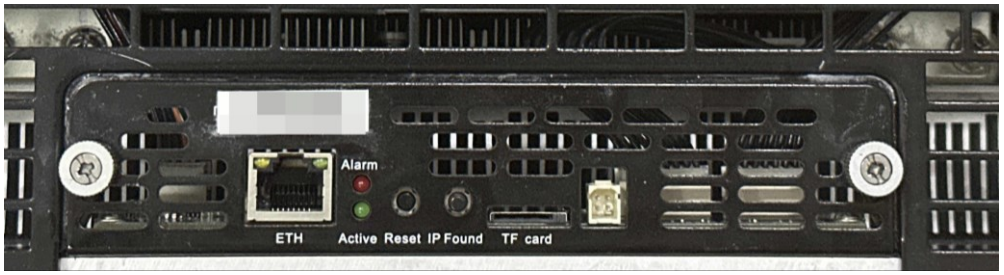



Figure 5-3

You can view the dynamically obtained IP address and MAC address, and miner place reported by the immersion cooling miner in WhatsMinerTool.

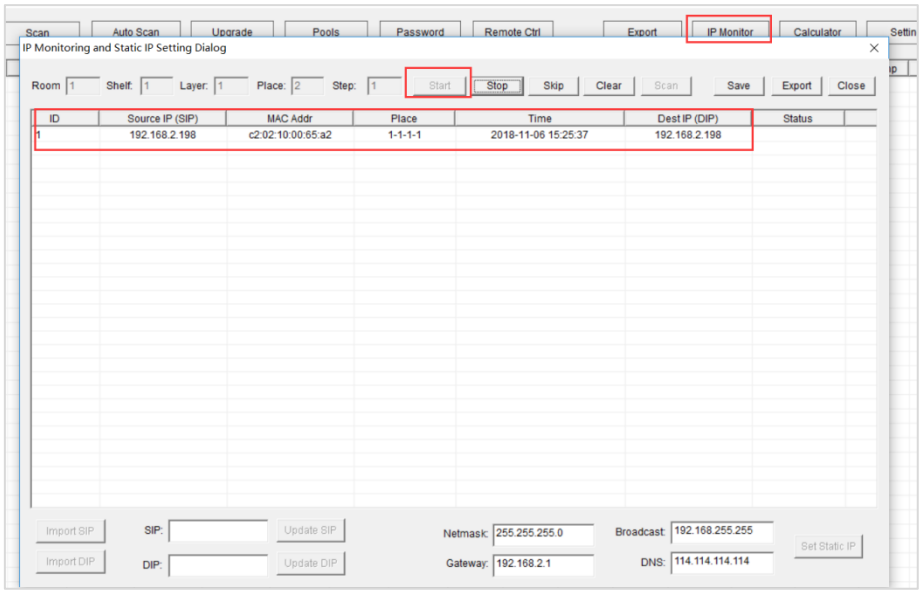


Figure 5-4

Note:

- If all lights on a control board of the immersion cooling miner are not lit up after power-on, check whether a power supply cable is connected reliably and correctly.
- If the two LED lights, **Active** and **Alarm**, on the control board of the immersion cooling miner are lit up, but lights on the network port are not lit up, or the green light is not flashing, check whether a switch is functioning properly, a network cable is connected reliably, and there is a problem with the quality of the network cable.
- The computer operating WhatsMinerTool and the immersion cooling miner must be in the same network segment. Otherwise, WhatsMinerTool may not receive a broadcast message from the immersion cooling miner, so that the IP Address and MAC Address reported by the immersion cooling miner cannot be queried.
- If the computer and the immersion cooling miner are in the same network segment and a DHCP service is enabled in the network, but WhatsMinerTool does not query the IP address of the immersion cooling miner after pressing an **IP Found** button, long press a **Reset** button on the control board for more than 5 seconds to restore factory default configuration, then power off and power on the immersion cooling miner to restart it, and press the **IP Found** button again to detect the IP address of the immersion cooling miner after powering on for 30 seconds.
- If the computer is operating WhatsMinerTool, when you click **Start** but do not manually press the **IP Found** button on the control board, WhatsMinerTool automatically finds the IP address and MAC address of the immersion cooling miner, indicating that the **IP Found** button of the immersion cooling miner may be stuck in the control board, you need to find an immersion cooling miner corresponding to a MAC address(referring to a MAC address barcode stuck on a case of the immersion cooling miner) displayed in WhatsMinerTool, then power off the corresponding immersion cooling miner, and reinstall the control board to ensure that buttons and indicator lights on the control board are exposed and not stuck in the control board.

#### 5.3.1.2 Configuring Pool and Worker

Step 1 Open a browser on a computer, enter the obtained IP address of an immersion cooling miner in an address bar, and then enter a username and a password to enter a main page of a backend of the immersion cooling miner.

Note:

- The computer and the immersion cooling miner should be in the same network segment.
- The username and the password are the same, default is admin.

Step 2 Click **Configuration** -> **Miner Configuration**, enter a pool name and a worker name as needed, and then click **Save & Apply** to save the configuration.

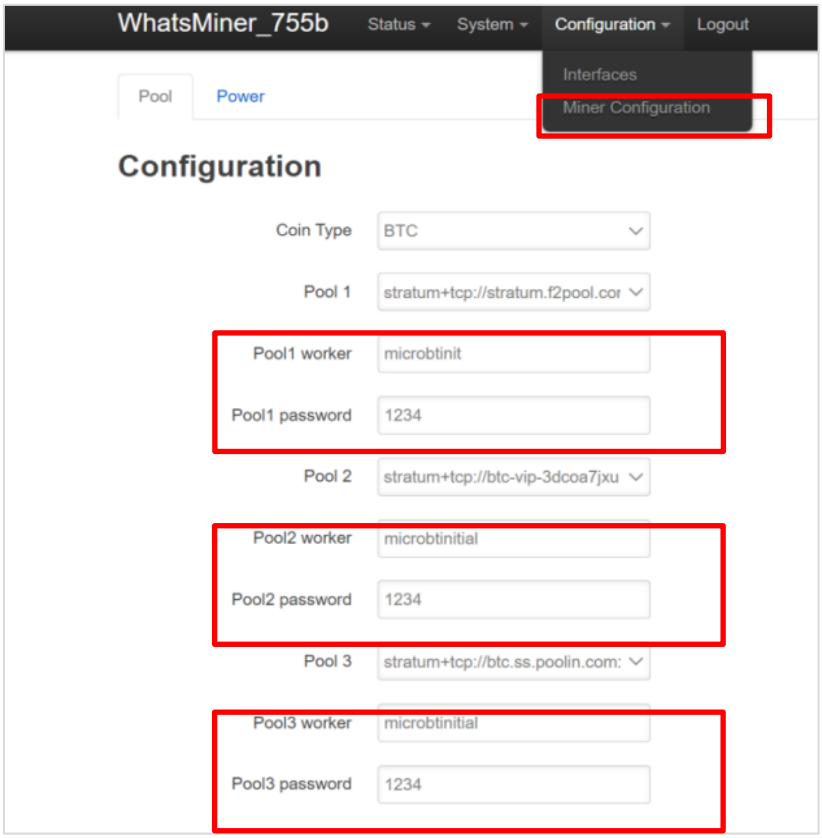



Figure 5-5

Note: After completing the configuration, you need to restart a miner program or a control board to make the configuration effective.

- Restart the miner program: In the main page of the backend of the immersion cooling miner, click **Status** -> **Miner Status**, and then click **Restart Miner** to restart the miner program.

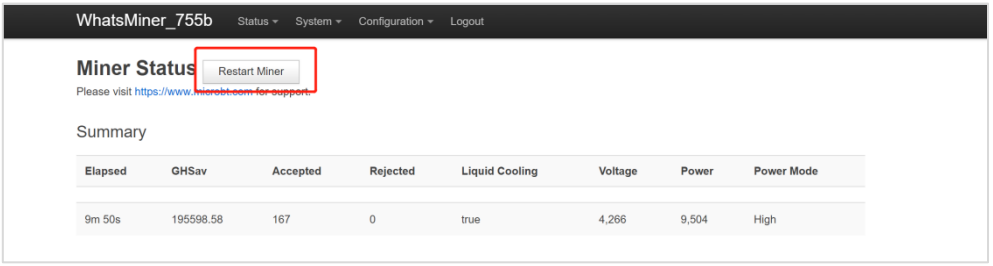



Figure 5-6

- Restart the control board: In the main page of the backend of the immersion cooling miner, click **System** -> **Reboot**, and then click **Perform reboot** to restart the control board.

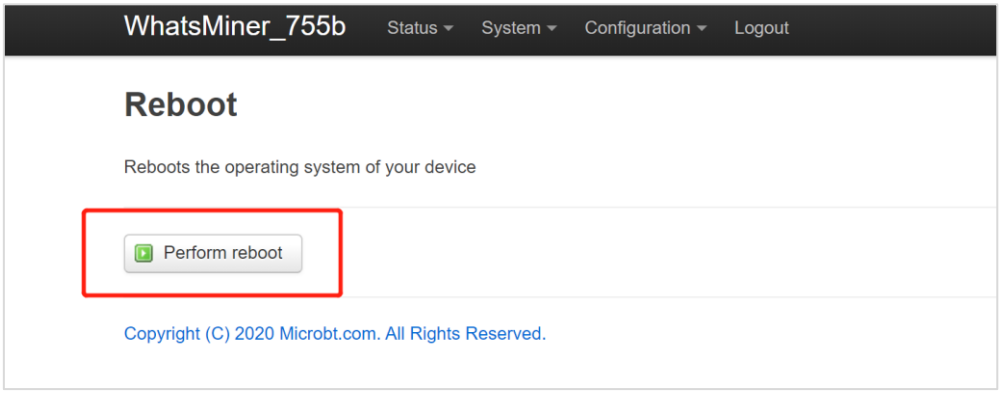



Figure 5-7

After restarting for about half a minute, the page will automatically jump to a login page.

### 5.3.2 Configuring NTP Synchronization Server Address (Optional)

The immersion cooling miner has been configured by default with 4 NTP server addresses. You can modify or add a NTP server address when a default NTP server address cannot be connected or you want to connect your own server address as needed.

Step 1 Open a browser on a computer, enter the obtained IP address of an immersion cooling miner in an address bar, and then enter a username and a password to enter a main page of a backend of the immersion cooling miner.

Note:

- The computer and the immersion cooling miner should be in the same network segment.
- The username and the password are the same, default is admin.

Step 2 Click **System** -> **System**, and then configure a NTP server candidate.

Note: An **Enable NTP client** function is enabled by default.

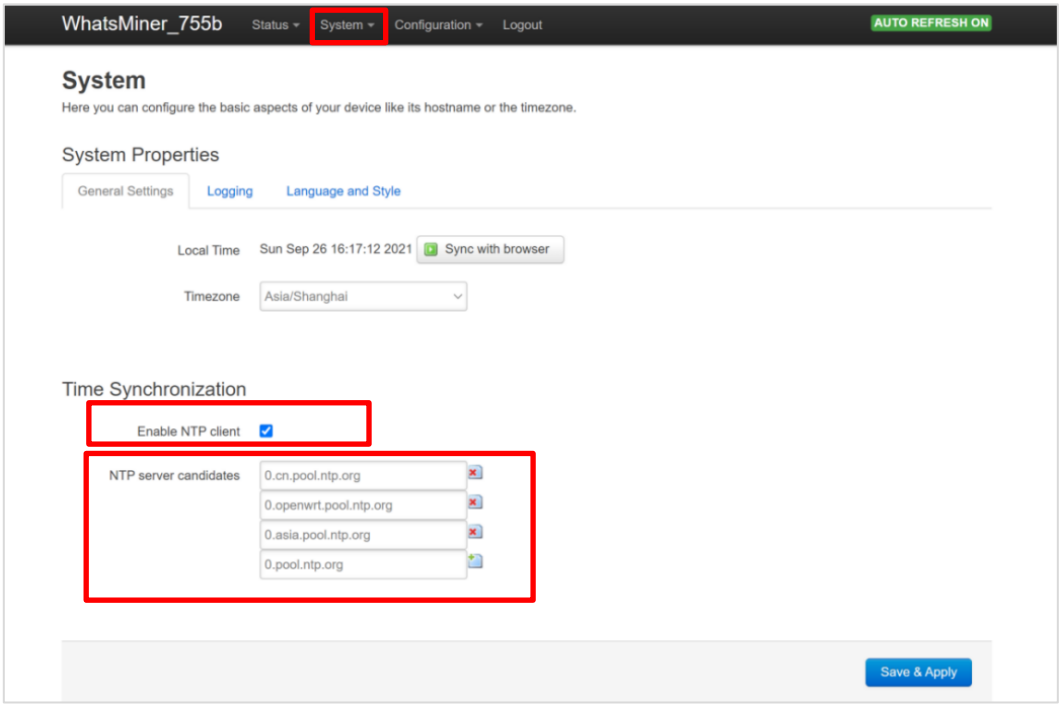



Figure 5-8

Step 3 Click **Save & Apply**.

### 5.3.3 Configuring Static IP Address (Optional)

You can modify an IP address obtained through DHCP to a static IP address for network planning of miner operation. When there is an IP conflict, configuring the static IP address can avoid not being able to search for the IP address of the immersion cooling miner.

Step 1 Open a browser on a computer, enter the obtained IP address of an immersion cooling miner in an address bar, and then enter a username and a password to enter a main page of a backend of the immersion cooling miner.

Note:

- The computer and the immersion cooling miner should be in the same network segment.
- The username and the password are the same, default is admin.

Step 2 Click **Configuration** -> **Interface**, and then click **Edit** under **Actions** tab.

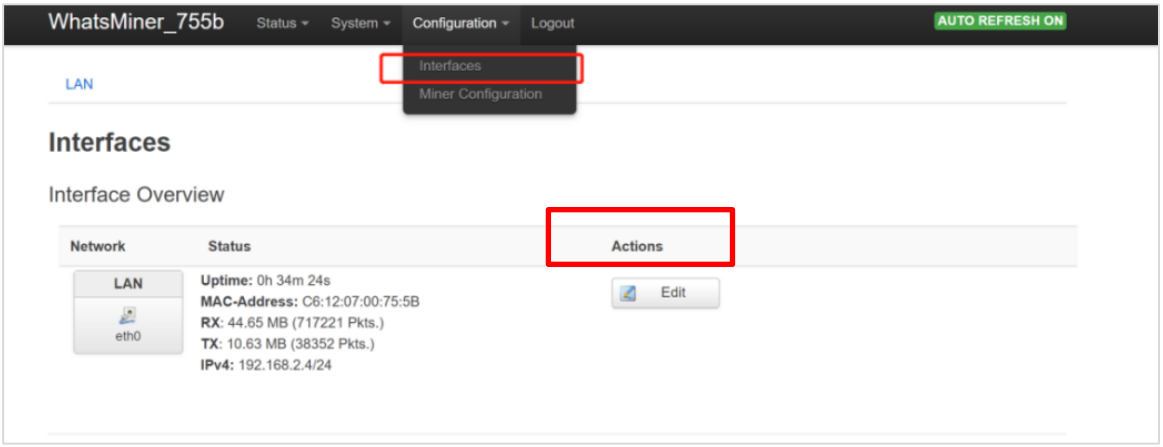



Figure 5-9

Step 3 In an **Edit** page, select **Static address** from **Protocol**, click **Switch protocol**, and then change an IP address, a mask, a gateway, a broadcast address, and a DNS address to an actual planned address of the immersion cooling miner.

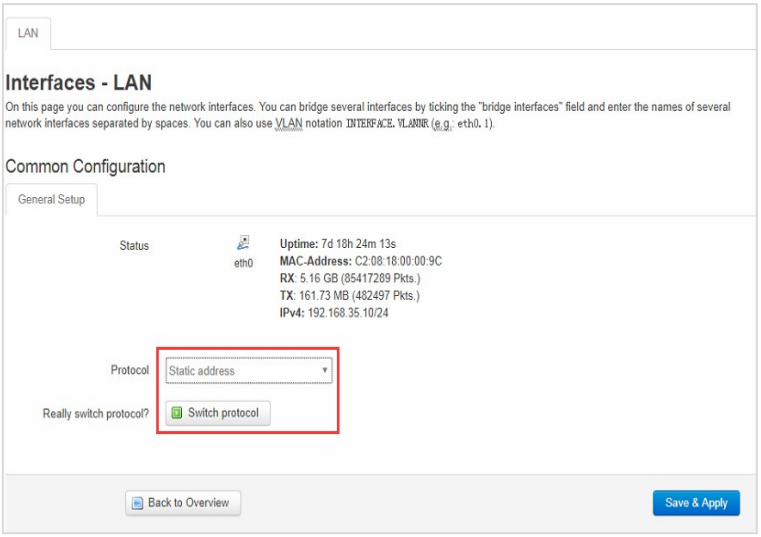



Figure 5-10

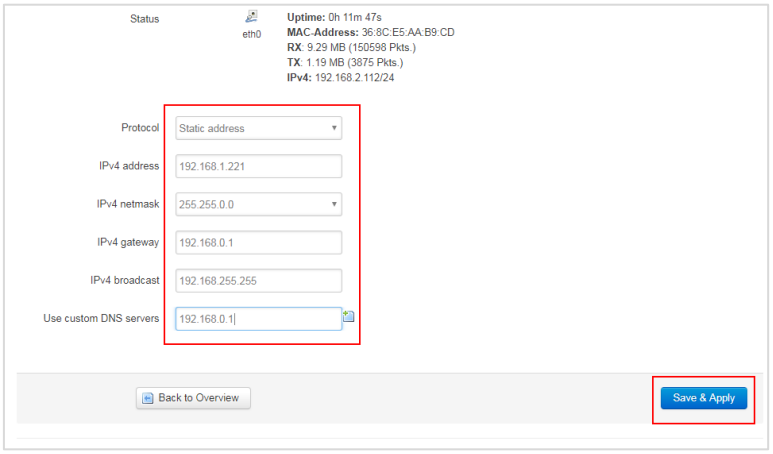



Figure 5-11

Step 4 Click **Save & Apply**.

Note: After saving the configuration, you need to reuse the newly configured static

IP address to log in to the immersion cooling miner, otherwise the page will remain loading until it fails to load.

## 6. Operation Status Check for Miner

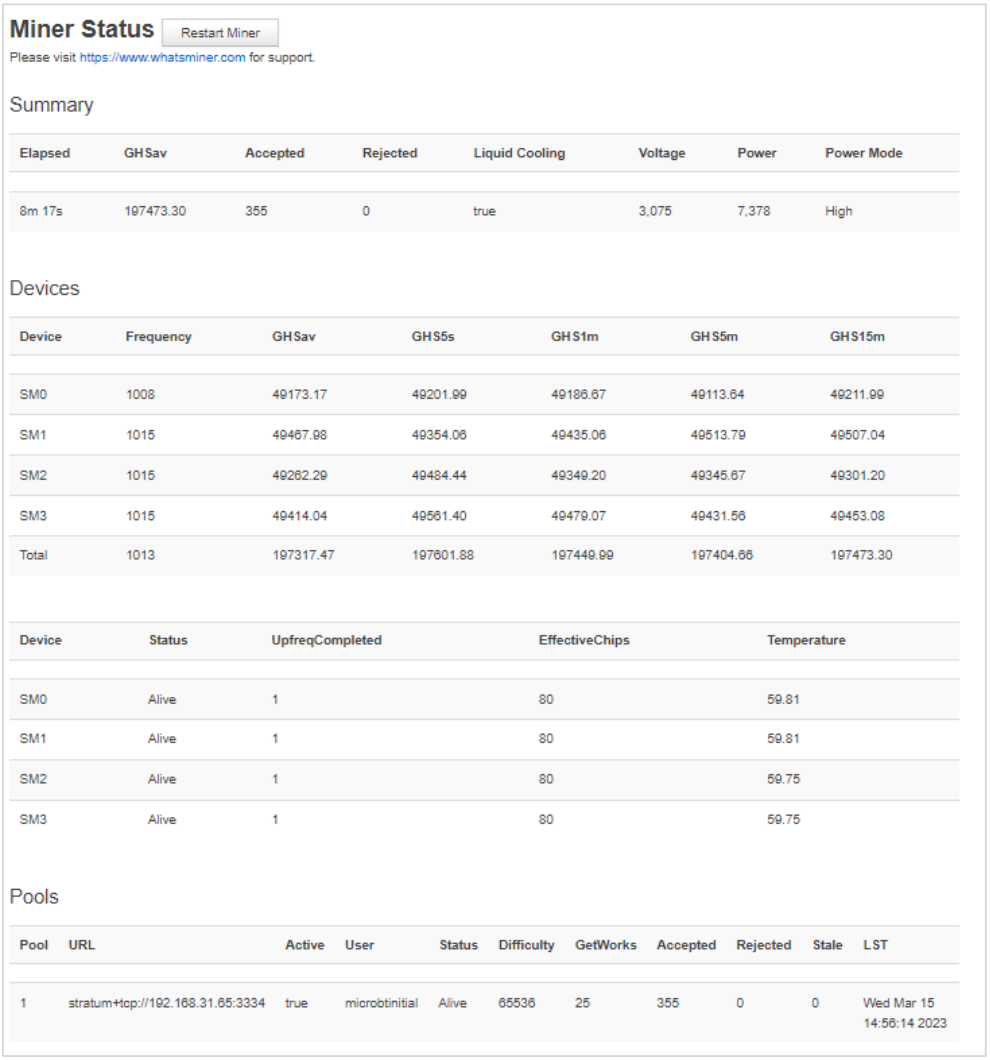
After an immersion cooling miner is connected to a network, you can log in to the immersion cooling miner on a computer connected to the same network segment to check its operation status.

Step 1 Open a browser on a computer, enter the obtained IP address of an immersion cooling miner in an address bar, and then enter a username and a password to enter a main page of a backend of the immersion cooling miner.

 Note:

- The computer and the immersion cooling miner should be in the same network segment.
- The username and the password are the same, default is admin.

Step 2 Click **Status** -> **Miner Status** to enter a status page of the immersion cooling miner. You can view an overall hashrate of the immersion cooling miner (see **GHSav** under **Summary** and **Devices** sections), pool information, hash board temperature, power, power mode, and the like as needed.



**Miner Status** Restart Miner

Please visit https://www.whatsminer.com for support.

Summary

| Elapsed | GHSav | Accepted | Rejected | Liquid Cooling | Voltage | Power | Power Mode |
|---|---|---|---|---|---|---|---|
| 8m 17s | 197473.30 | 355 | 0 | true | 3,075 | 7,378 | High |

Devices

| Device | Frequency | GHSav | GHS5s | GHS1m | GHS5m | GHS15m |
|---|---|---|---|---|---|---|
| SM0 | 1008 | 49173.17 | 49201.99 | 49186.67 | 49113.64 | 49211.99 |
| SM1 | 1015 | 49467.98 | 49354.06 | 49435.06 | 49513.79 | 49507.04 |
| SM2 | 1015 | 49262.29 | 49484.44 | 49349.20 | 49345.67 | 49301.20 |
| SM3 | 1015 | 49414.04 | 49561.40 | 49479.07 | 49431.56 | 49453.08 |
| Total | 1013 | 197317.47 | 197601.88 | 197449.99 | 197404.66 | 197473.30 |

| Device | Status | UpfreqCompleted | EffectiveChips | Temperature |
|---|---|---|---|---|
| SM0 | Alive | 1 | 80 | 59.81 |
| SM1 | Alive | 1 | 80 | 59.81 |
| SM2 | Alive | 1 | 80 | 59.75 |
| SM3 | Alive | 1 | 80 | 59.75 |

Pools

| Pool | URL | Active | User | Status | Difficulty | GetWorks | Accepted | Rejected | Stale | LST |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | stratum+tcp://192.168.31.65:3334 | true | microbtinitial | Alive | 65536 | 25 | 355 | 0 | 0 | Wed Mar 15 14:56:14 2023 |

Figure 6-1

Note: When the immersion cooling miner is connected correctly and the network is normal, the immersion cooling miner will automatically perform a frequency search test after being powered on. The frequency search test takes about 40 minutes, and only after the frequency search is completed will it enter a formal mining phase. At this time, the displayed is a hashrate when the immersion cooling miner is normally operating. If the frequency search has not ended yet, the displayed will be lower than a hashrate when the immersion cooling miner is normally operating.

# 7. Batch Configuration for Miner Data

You can use WhatsMinerTool for batch configuration of immersion cooling miners' data, such as upgrading firmware and collocating pool. For details, see *WhatsMinerTool_Operation Guide_V2.0_20250311*.

# 8. Installation and Disassembly of Components for Miner

When you receive a new immersion cooling miner, you do not need to assemble it, but when the immersion cooling miner encounters problems, you may need to disassemble some components of the immersion cooling miner to resolve the problems. The following will specifically introduce how to disassemble and install these components, including control board and power supply.

## 8.1 Installing and Disassembling Control Board

When indicator lights on a control board are not lit up or when an error code related to the control board is displayed on a main interface of WhatsMinerTool, you can remove the control board and check it. For details about error code and WhatsMinerTool, see ***WhatsMinerTool_Operation Guide_V2.0_20250311***.

### 8.1.1 Installing Control Board

Step 1 Loosen 2 screws that secure a housing of a control board to a case of an immersion cooling miner, and then pull out the housing of the control board slowly until it is no longer pulled out.


Figure 8-1

Step 2 Unplug 3 flat cables, and then pull out the entire housing of the control board.

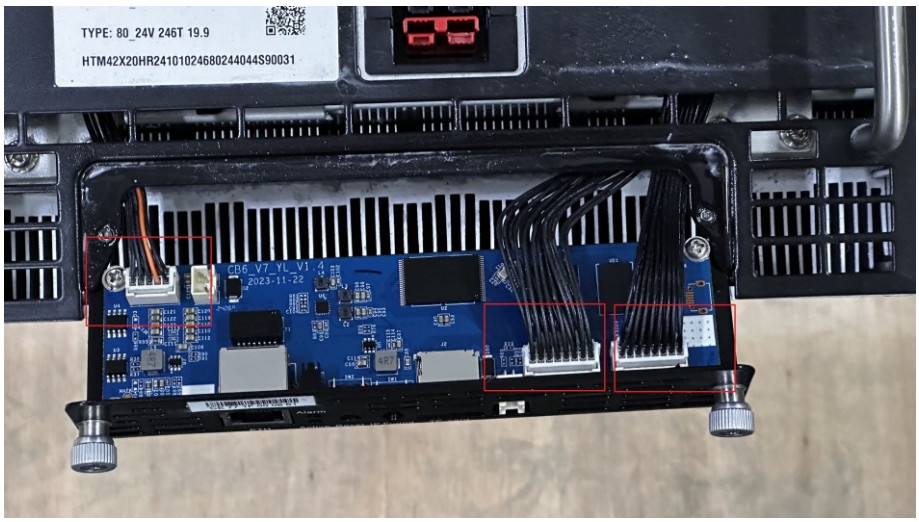



Figure 8-2

Step 3 Remove 4 screws that secure the control board to the housing of the control board, and then remove the control board.

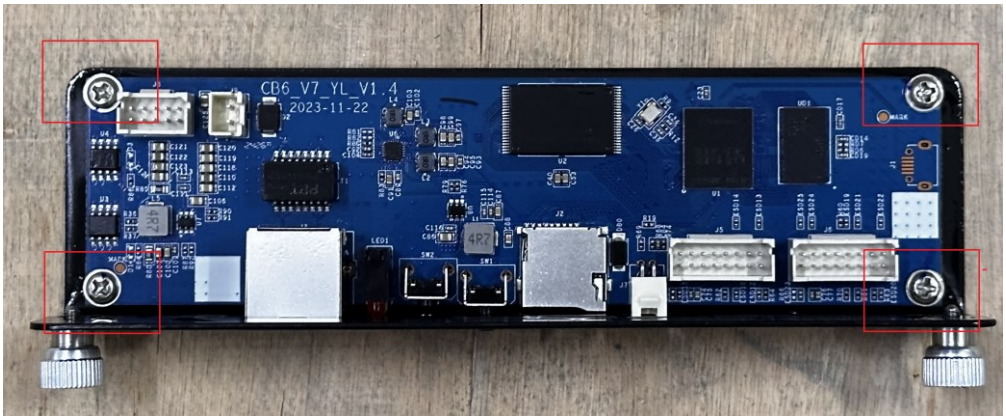



Figure 8-3

### 8.1.2 Installing Control Board

Step 1 Align holes on a control board with holes on a housing of the control board, and then screw in 4 screws and tighten them.

Step 2 Insert 3 flat cables into corresponding slots on the control board.

Step 3 Tighten 4 screws that secure the housing of the control board to a case of an immersion cooling miner.

## 8.2 Installing and Disassembling Power Supply

When a power supply is not working or when an error code related to the power supply is displayed on a main interface of WhatsMinerTool, you can remove the power supply and check it. For details about error code and WhatsMinerTool, see ***WhatsMinerTool_Operation Guide_V2.0_20250311***.

### 8.2.1 Disassembling Power Supply

Step 1 Remove 4 screws on a front panel, and then remove screws on upper and lower panels respectively, 4 in total.

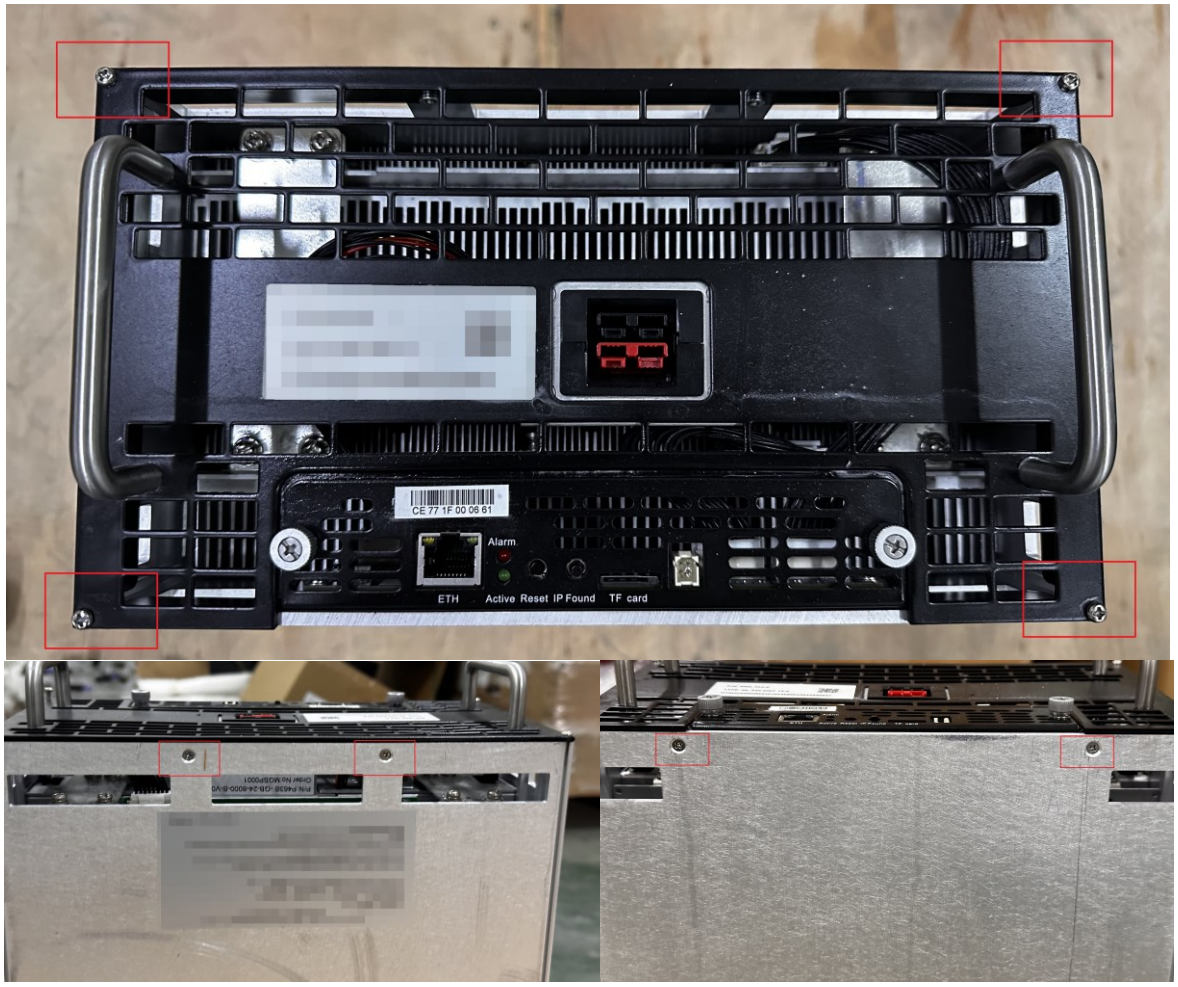



Figure 8-4

Step 2 Open the front panel, and then unplug a power supply flat cable and hash board flat cables.

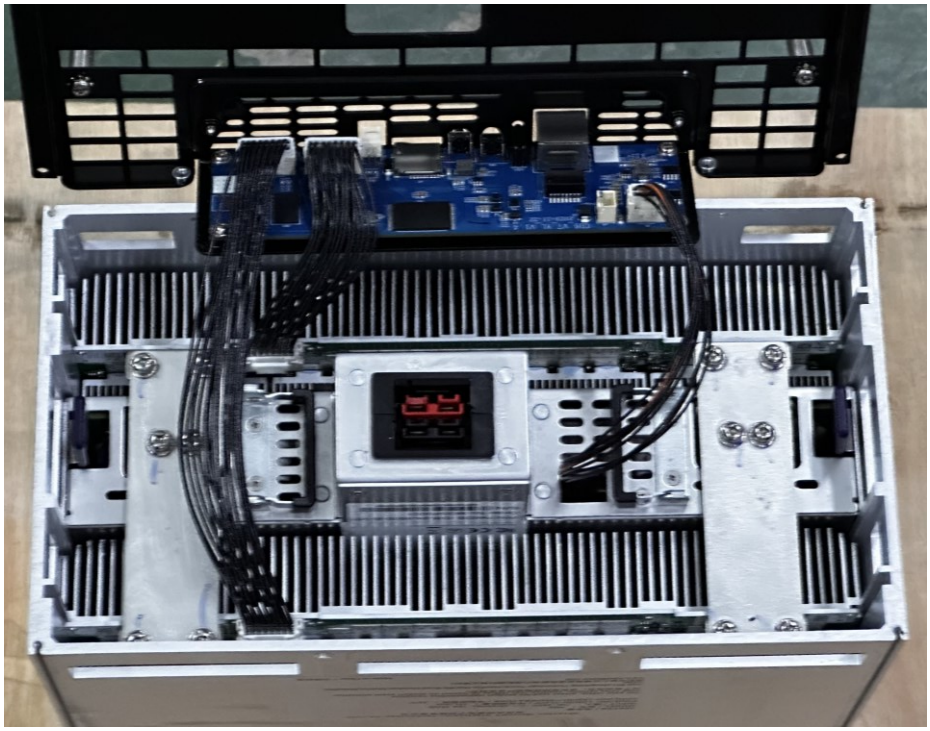


Figure 8-5

Step 3 Remove 12 screws on copper bars.

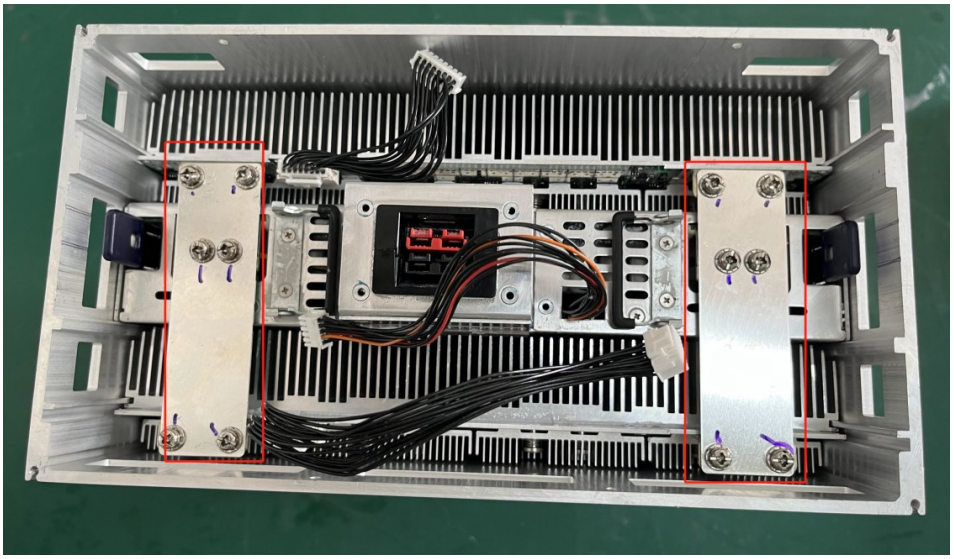


Figure 8-6

Step 4 Pull up handles of a power supply, hold down buckles of the power supply, and then lift the power supply up with both hands to disassemble the power supply.

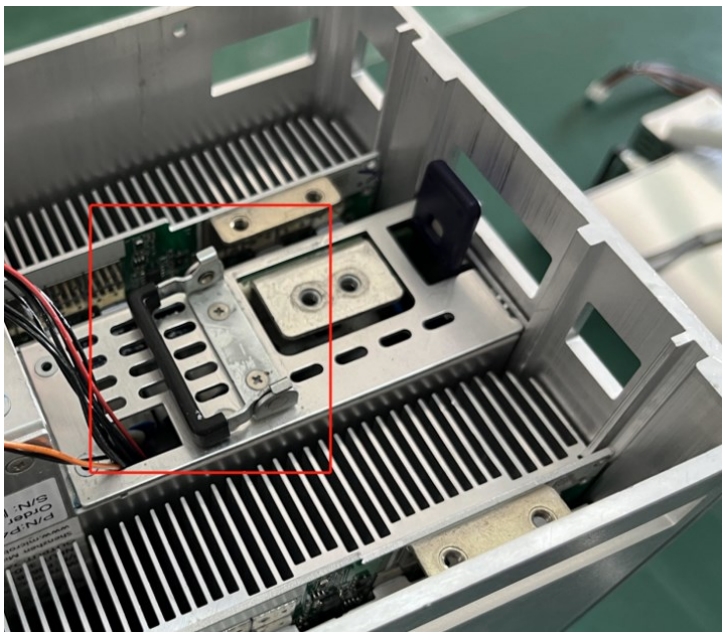


Figure 8-7

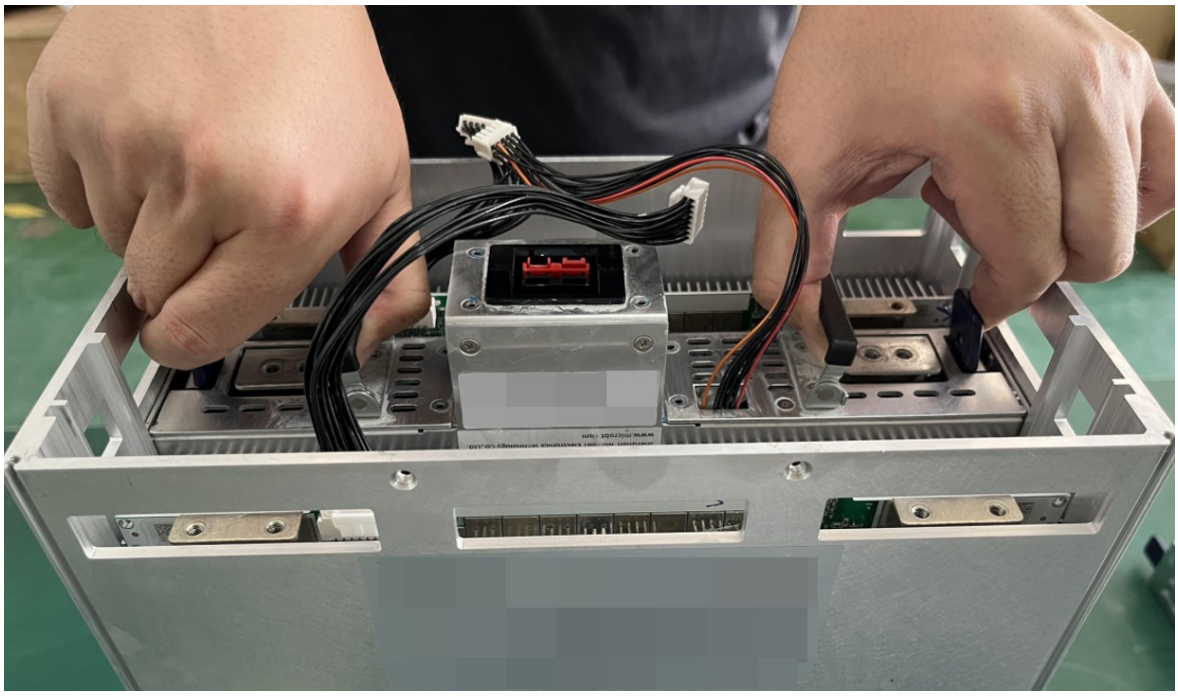


Figure 8-8

### 8.2.2 Installing Power Supply

Step 1 Pull up handles of a power supply, hold down buckles of the power supply, put the power supply into an immersion cooling miner slowly, and then release both hands after the power supply is plugged in properly.

Step 2 Screw in 12 screws that secure copper bars, and then tighten them.

Step 3 Plug in a power supply flat cable and hash board flat cables properly, and then close a front panel.

Step 4 Screw in 4 screws that secure the front panel, screw in 4 screws that secure upper and lower panels respectively, and the tighten them.

# 9. Appendix

## 9.1 Care and Maintenance

After a miner has been in operation or stored for a period of time (3 - 6 months), dust should be regularly cleaned on a hash board, a control board, an adapter board, flat cables and other components to prevent corrosion, dusty, moisture, and the like. For details, see https://www.youtube.com/watch?v=IoM-SRGpslw&t=39s for the video tutorial.

 Note: We will shoulder no warranty responsibility if the miner has serious corrosion, dusty, moisture, and the like.

## 9.2 After-Sales Warranty Policy

Integrity is our commitment to you. MicroBT promises you a one-year warranty period and provides free maintenance service under our warranty coverage. After purchase, it is deemed as an agreement to this policy. Please note that products are not covered under our warranty coverage if the following situations occur.

1. Products are damaged due to improper operation and failure to be properly put into Tank, including but not limited to reverse insertion, insufficient insertion or no insertion of wires.
2. Products are damaged due to failure to use in accordance with product manual or product operation parameter requirements, including but not limited to using incorrect parameters such as voltage, current, environmental temperature and humidity, dust particles, liquid pressure, liquid pH value, and the like.
3. Products are damaged due to failure to use in accordance with operation guide requirements, including but not limited to improperly on and off a shelf, haphazard pulling, scraping, lifting, or hitting leading to component missing, unstable connections, and open circuit on PCB (Printed Circuit Board).
4. Products are damaged due to disassembly, modification, re-assembly, or maintenance without official written or electronic authorization.
5. Products are damaged due to insufficient hashrate or mismatch by using unofficial accessories, including but not limited to PSU (Power Supply Unit), control board, fan, cable, and the like.
6. Products are damaged due to insufficient hashrate, abnormal hashrate, excessive power consumption, or burnout by using unofficial software.
7. Products are damaged directly or their service life is shortened due to self-modification

of operation parameters (such as overclocking).
8. Products are damaged due to on-site environmental issues, including but not limited to humid environments, corrosive environments, high-temperature environments, dust particles, abnormal voltage and current (surges, impacts, instability), low or high AC voltage, and the like.
9. Product labels, serial numbers, and the like, have been modified, defaced, or removed.
10. Products are physically damaged due to deformation, oxidation, corrosion, and the like, including but not limited to extrusion and deformation caused by excessive liquid inlet pressure and non-standard use leading to freezing of cooling plates (immersion cooling products), corrosion caused by excessive or insufficient pH value of liquid media and failure to use specified liquids (immersion-cooling products), damage caused by excessive conductivity of liquid media, and the like.
11. Products are damaged due to force majeure, including but not limited to earthquakes, fires, heavy rain, lightning, sandstorms, and other extreme environmental factors.

This warranty grants you specific legal rights, and you may also have other rights that vary by country/region. The interpretation of this warranty policy belongs to MicroBT.

## 9.3 Terms of After-Sales Warranty Fees

During a warranty period, except for warranty restrictions, we will undertake to repair or, at our sole discretion, replace a defective miner, miner part or component with a qualified miner, miner part or component. You will bear costs associated with returning the miner, miner part, or component to our repair facility. We will bear costs of a part, component, and labor required to perform maintenance and restore the miner to its normal operating status. Upon completion of the repair, we will ship the miner, miner part or component back to you.

You need to return the miner in good condition to our repair facility, and prepay shipping fee, including insurance. If the miner, miner part or component is returned without insurance, you will bear all risks of loss or damage during shipment.

# Striving For Perfection