Product Instruction Manual

Exo Std

Exoskeleton Teleoperation System

Contents

1、Disclaimer

The operator confirms that they are familiar
with the safety instructions and equipment operation specifications, and voluntarily use the exoskeleton teleoperation system. If the operator violates the safety instructions and there are intentional or gross negligence behaviors such as being distracted during the operation process, which in turn causes misoperation, out-of-control or other abnormal operations of the exoskeleton operation robot, and thus results in personal injury or property loss to themselves or a third party, the relevant liability shall be borne by the operator himself or his affiliated unit, and the equipment provider shall not bear any compensation and related joint liability.

2、Safety Instructions

1. The operator must be familiar with the functions and operation specifications of the exoskeleton body and the remote operation terminal before operating.
2. Before operation, the obstacles in the operation area need to be cleared, ensure that the ground is flat, without wet or slippery conditions, without sharp debris, reserve sufficient space for the movement of the equipment and emergency avoidance, and stay away from dangerous areas such as high-voltage electricity, flammable and explosive substances, and strong magnetic fields.
3. The operator needs to dress properly, coil up long hair, and it is prohibited to wear loose clothes and ornaments to avoid being caught in the joints of the equipment.
4. When operating remotely, one must stay focused, strictly prohibit distraction, operate the joystick at a uniform speed, avoid violent operations such as sudden stops, sudden turns, and sudden ascents, and prevent the equipment from losing balance or component damage.
5. During operation, closely observe the status of the equipment. If abnormal noises, jams, loose joints, signal abnormalities or alarms occur, immediately cut off the power supply, troubleshoot the problems and then restart the equipment.
6. If someone is injured, immediately take first aid measures; when the equipment has serious faults, it is strictly prohibited to repair it without authorization, and professional technical personnel need to be contacted for handling.
7. Those who violate the operations of these instructions and cause losses shall bear corresponding responsibilities.

3、Product Overview

3.1 Product Introduction

The Exoskeleton Remote Operation System is a lightweight wearable device for high-precision remote control and human-robot collaboration scenarios. The system takes the independently developed high-precision encoder joint module as the core, supports a data sampling frequency of up to 1000Hz and a 14-bit attitude resolution, can accurately capture every subtle movement of the operator, and achieve millisecond-level low-latency human-machine mapping.

The whole machine adopts a carbon fiber telescopic link structure and a human-machine engineering back system design. The single machine weight is about 3kg (excluding the back device), and a comfortable and natural operation experience can be maintained even during long-term wearing.

The system has 10 free joints and 4 lockable spin joints, covering the full range of anthropomorphic configuration movements, supports the back IMU to collect the torso posture, and expands the head IMU wearing device to collect the head posture. The two-handle control unit provides multi-channel analog and digital inputs, supports linear trigger, TMR magnetoresistive dual-axis joystick and custom button operations, and realizes smooth input feedback at an effective rate of 200Hz/500Hz. The device is connected through Type-C PD power supply and high-speed data interface, and can achieve attitude mapping and isomorphic control with a variety of robot platforms.

With its comprehensive performance of high frequency, high precision and high stability, this system can be widely applied to scenarios such as fine operation, remote operation, motion imitation and data acquisition. Whether it is using a remote control robotic arm to complete complex operations or providing real-time action teaching for intelligent robots, the exoskeleton can achieve a natural control experience of" what you see is what you do", providing a solid foundation for human-robot collaboration and intelligent training.

3.2 Parameter Table

parameter	specifications
joint quality	About 60 grams
typical mass of a single machine	3kg (excluding ergonomic back support)
configuration support	anthropomorphic configuration
mechanical limit configuration	J1:270°; J2:240°; J3,J5:300°; J4,J6,J7: 180°
Joint configuration	10 free joints, 4 lockable articulations
connecting rod configuration	carbon fiber telescopic adjustable connecting rod
Back fixation	Parallel Shoulder Braces + Ergonomic Back-Pass System
power supply interface	Type-C PD 5V
data interface	Type-C
joint data accuracy	14 bit
maximal rate of joint data theory	1000Hz
Handle count	2
handle control analog channel	Linear Trigger, TMR (Thermoresistive Magnetic Resistor) Dual-Axis Remote Control
digital channel of handle control	Remote lever press state, 4 custom buttons, side toggle switch
Maximum effective rate of joystick and trigger data	200Hz (filtered)
Back sensor (optional)	IMU inertial sensor *1
Additional external sensors (optional)	IMU inertial sensor *1
DOR	benchmark200Hz/500Hz

4、Instructions for Use

4.1 Unpacking and Inspection

Check whether the packing box is damaged or deformed. Confirm that the working area is flat and free of obstacles, and reserve space for the robotic arm to unfold and be transported. Open the packing box layer by layer, and take out the soft package, the certificate of compliance, the robotic arm, the head and each accessory in turn. Slowly lower the robotic arm onto the installation base that has been pre-adjusted to be horizontal to avoid collision.

4.2 Pre - startup Inspection

1. Check the overall appearance of the exoskeleton and confirm that there are no damages, deformations, or cracks on the back load-bearing soft bag, limb joints, and cover plates, and that there is no looseness or detachment at the connection parts.

2. Check the wearing and fixing parts. The straps such as shoulder straps, waist belts, and leg straps are not worn or broken and can effectively fix the exoskeleton.

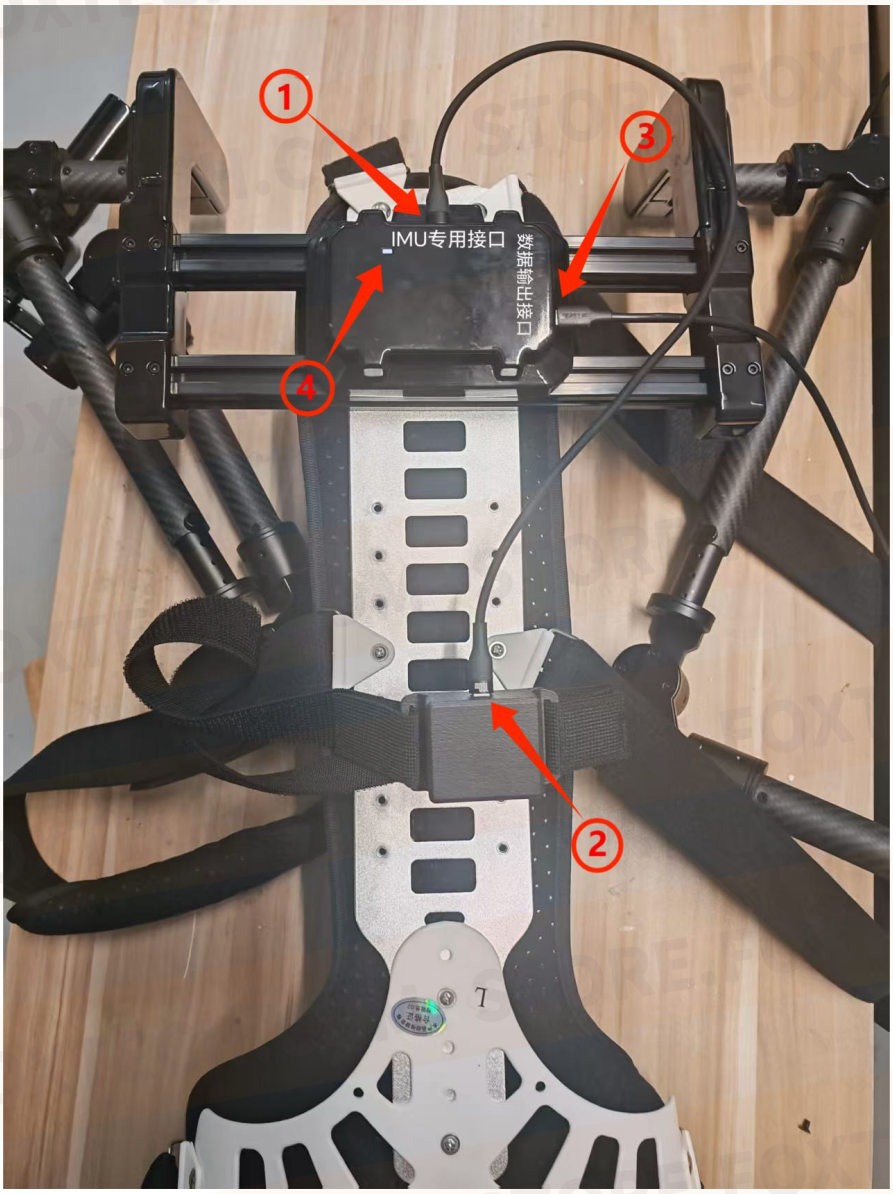
3. Check that all the buttons on the handle can be pressed normally, the joystick is sensitive to move, and the surface of the handle is not damaged.

4. Check the joint movement. Manually move the joints to confirm smooth movement, no jamming, no abnormal noise, and normal limit function.

4.3 Power Connection

（1） Connect the data port

Connect the dedicated interface of the IMU to the head (as shown in Figure 1), and connect the data output interface to the computer (as shown in Figure 1). If the indicator lights on both the left and right handles and the central control board flash blue and white (as shown in Figures 1, 2, and 3), the connection is successful.



①Head-IMU dedicated interface connection

②head connection

③PC connection

④The blue and white indicator lights on the control panel are flashing.

Picture 1 Line connection and central control board indicator light

⑤The left handle indicator light flashes blue and white

⑥The right-hand indicator light flashes blue and white

Figure 2 Left handle indicator light Figure 3 right handle indicator light

（2）Software access to exoskeleton

At this time, click on the exoskeleton device on the host computer, click on "Add Exoskeleton Device" in the upper right corner (as shown in Figure 4), select the serial port and then create a connection (as shown in Figure 5). If the device status shown in the pop-up window is "Connected", it proves that the exoskeleton device has been successfully added (as shown in Figure 6).

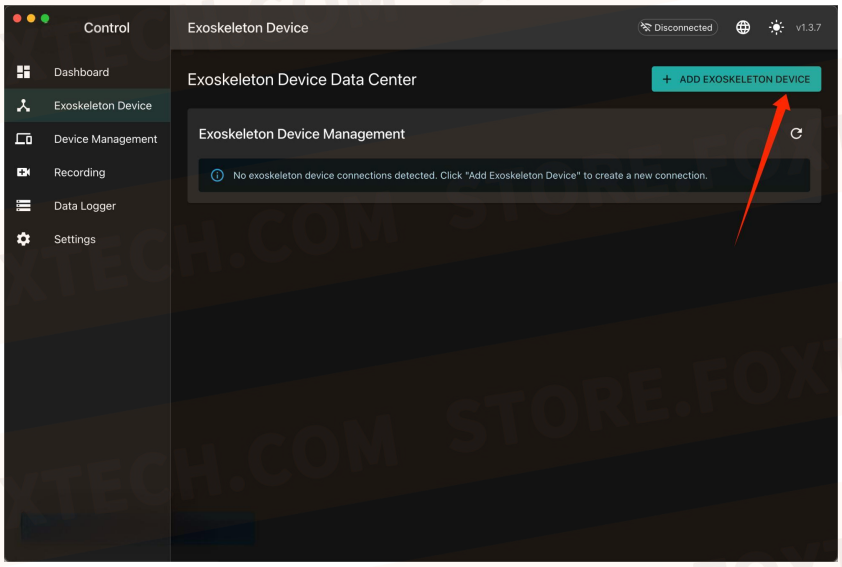


Figure 4 Add exoskeleton

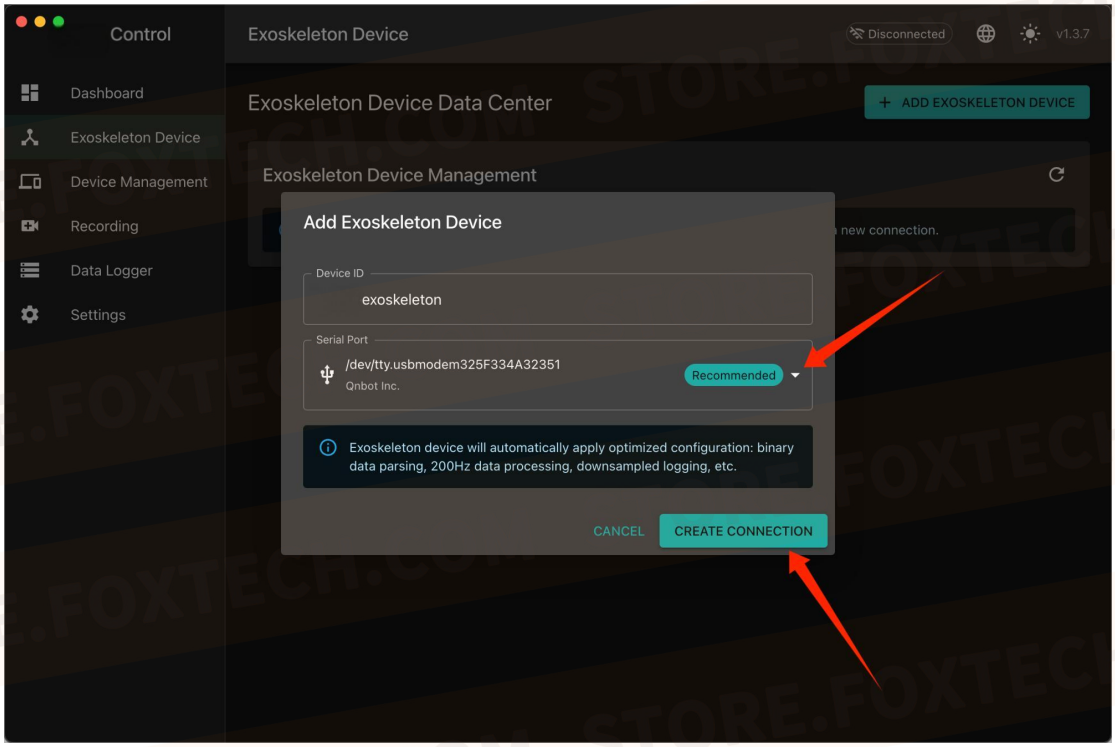


Figure 5 Select a serial port and create a connection

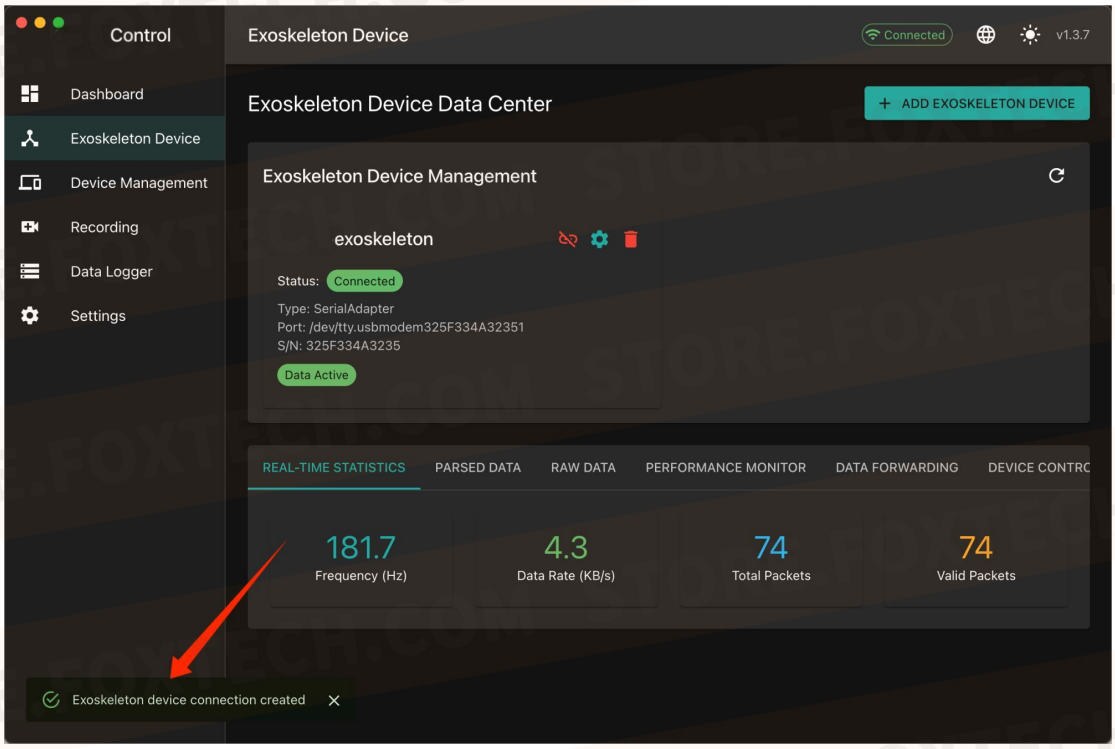


Figure 6 Exoskeleton added successfully

4.4 Wearing Method

Fix the soft package on the exoskeleton main body, tighten the waist strap, wear the exoskeleton according to the method shown in the figure (as shown in Figures 7 and 8), rotate each joint to the correct position (note the red arrows in Figures 9 and 10), and ensure that the robotic arm can move normally.

Figure 7 Front Wearing

Figure 8 Back Wearing

Figure 9 Left Side Wearing

Figure 10 Right Side Wearing

4.5 Configuration Forwarding

In the performance monitoring of the exoskeleton device in the host computer software, click on "Configuration Forwarding" (as shown in Figure 11), enter the control link of the robot to be controlled in the WebSocket URL, click on "Add Forwarding Target" and then click on "Apply Configuration" (as shown in Figure 12). If there is no response when clicking on "Apply Configuration", the configuration is not successful and you can communicate with our staff for handling; if after clicking on "Apply Configuration" and then clicking on "Real-time Statistics", the data below are all displayed normally, then the configuration is successful (as shown in Figure 13).

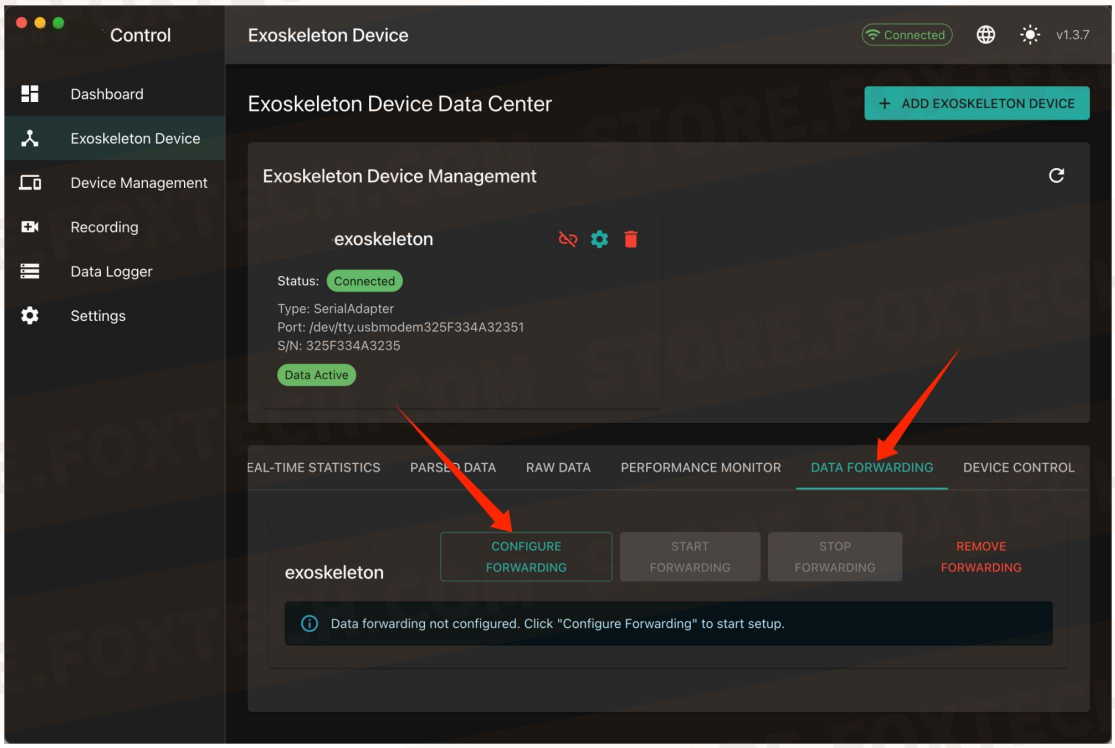
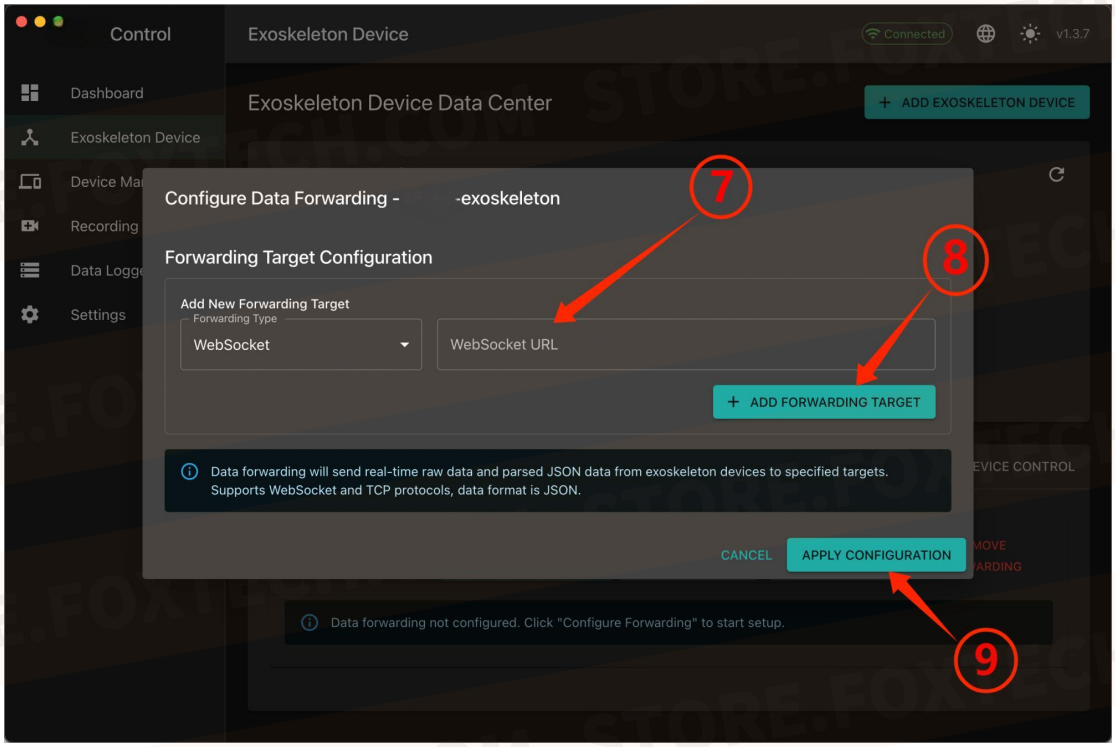


Figure 11 Performance Monitoring



⑦Enter the corresponding link of the robot

⑧Add a forwarding target after entering the link

⑨Application configuration after successfully forwarding the link to the target

Figure 12　Add a forwarding target and apply the configuration

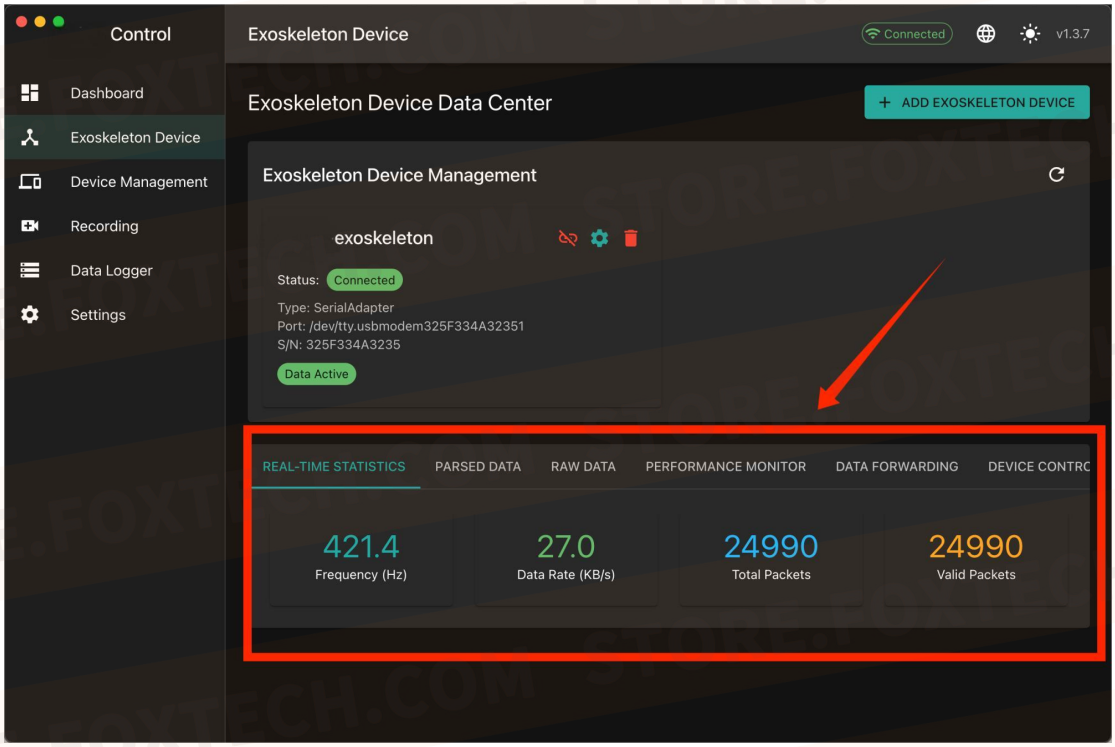


Figure 13　Check the data to confirm the successful configuration

4.6 Manipulation process

After configuring the forwarding, activate the exoskeleton arm and head and use the handle to control the robot. The joystick and buttons of the handle can be customized by the user (as shown in Figure 14). It is recommended that the user set the joystick of the handle to control the movement of the robot and the trigger of the handle to the end controller.

Figure 14 Customize the edit buttons and joystick of the right-hand handle

5、Firmware update

5.1 Software download

For software download, contact the pre-sales / after-sales personnel. We will explain the relevant specific operation process to you and provide detailed download guidance.

5.2 Host computer language switching

Click the spherical icon in the upper right corner of the host computer to switch between Chinese and English modes.

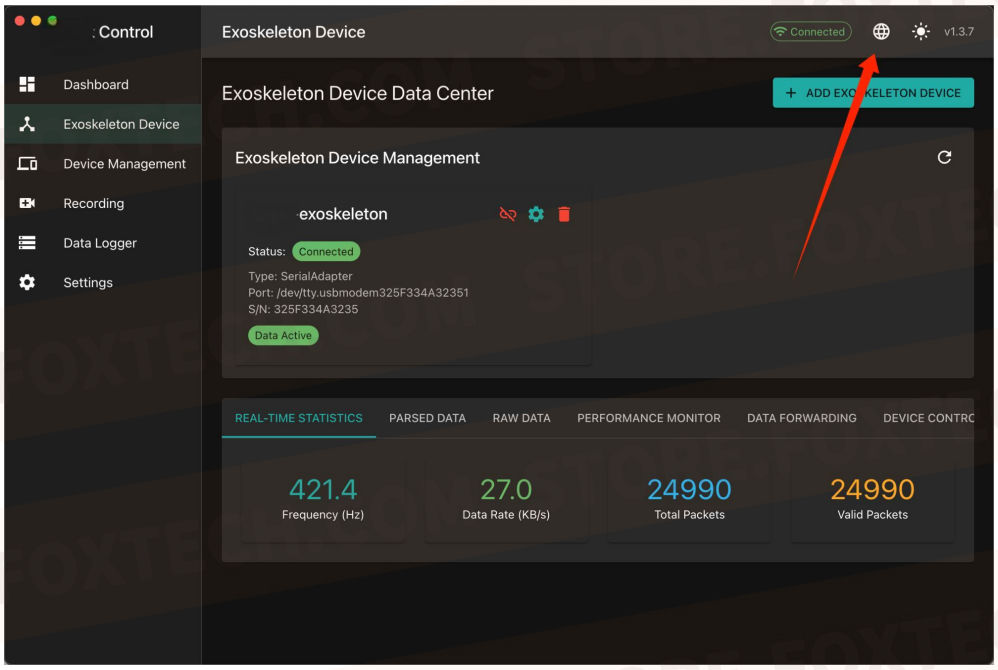


Figure 15 Chinese-English switching of the host computer

5.3 Device detection

1. Push the push rod to close the exoskeleton device (see Figure 17).
2. Click Settings in the host computer software, and then click Firmware flashing (see Figure 16).
3. Then use a screwdriver (or other sharp object) to hold down the side upgrade button without releasing (see Figure 17).

4. Push the push rod to open the device (see Figure 17).

5. Release the screwdriver when the indicator light on the central control board shows a constant white light (see Figure 17).

6. Click to detect the device and end the operation when the device has been detected (see Figure 16).

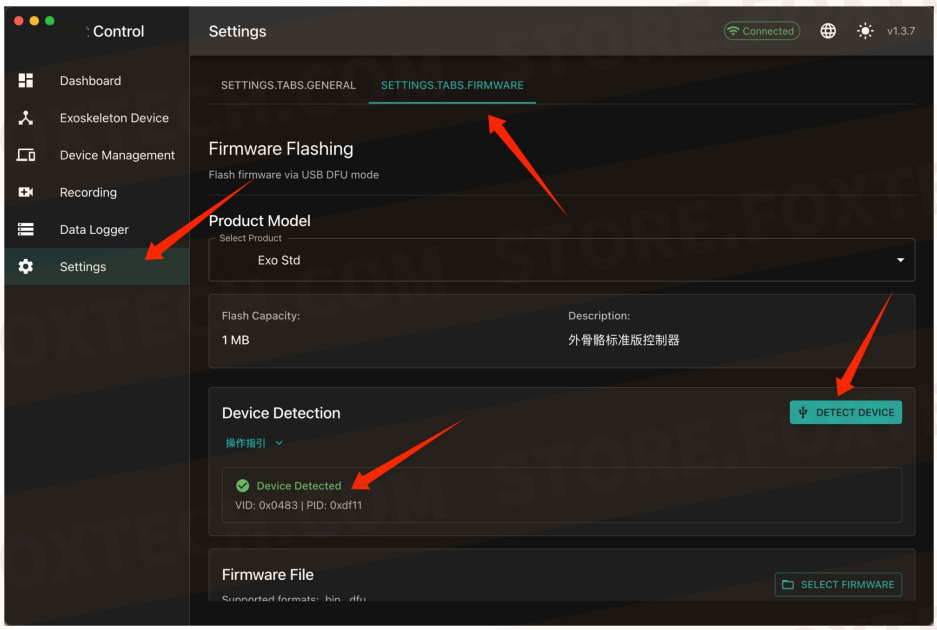


Figure 16 Host computer detecting the device

⑩Push rod (controls the switch of the exoskeleton device)

⑪Side upgrade button

⑫Central control board indicator light

Figure 17 Operation of the main control board detecting the device

5.4 Burning files

In the host computer software, click Select Firmware in the firmware file (as shown in Figure 18), select the required file (as shown in Figure 19), click Open, return to the settings interface and select Start Burning (as shown in Figure 20). When the burning progress reaches 100% and it shows that the burning is successful, all steps are completed (as shown in Figure 21).

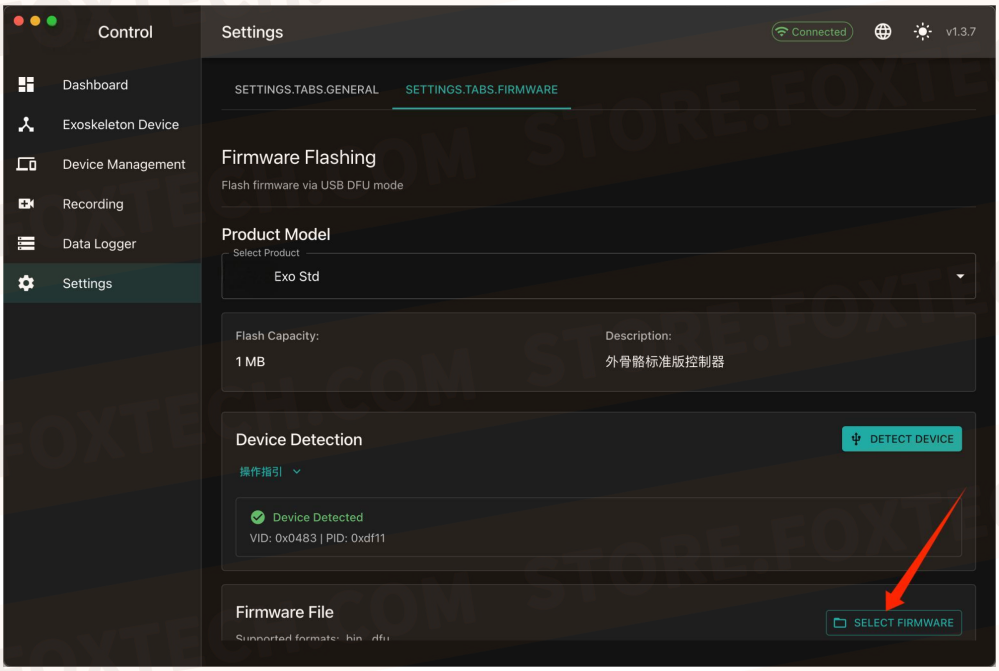


Figure 18 Selecting firmware

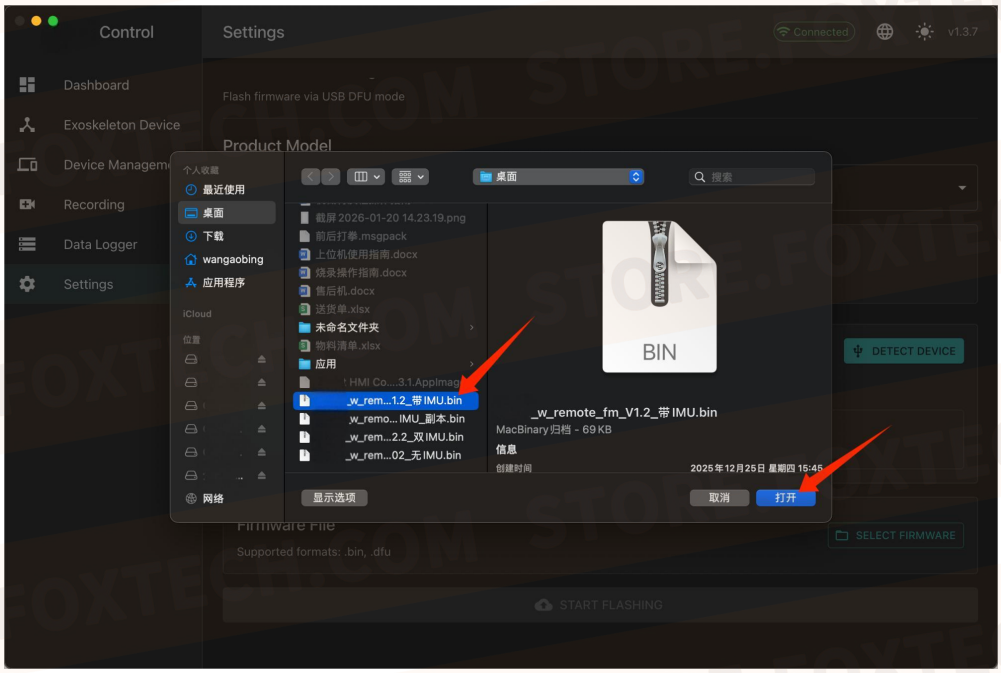


Figure 19 Selecting a file

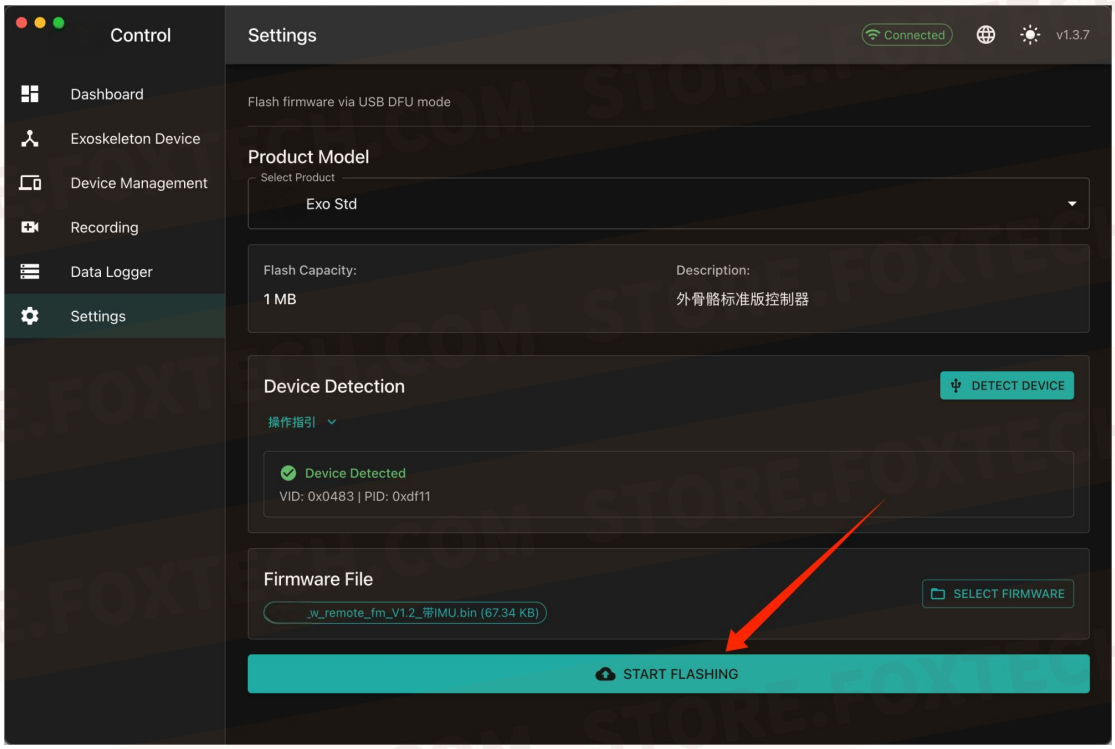


Figure 20 Starting to burn

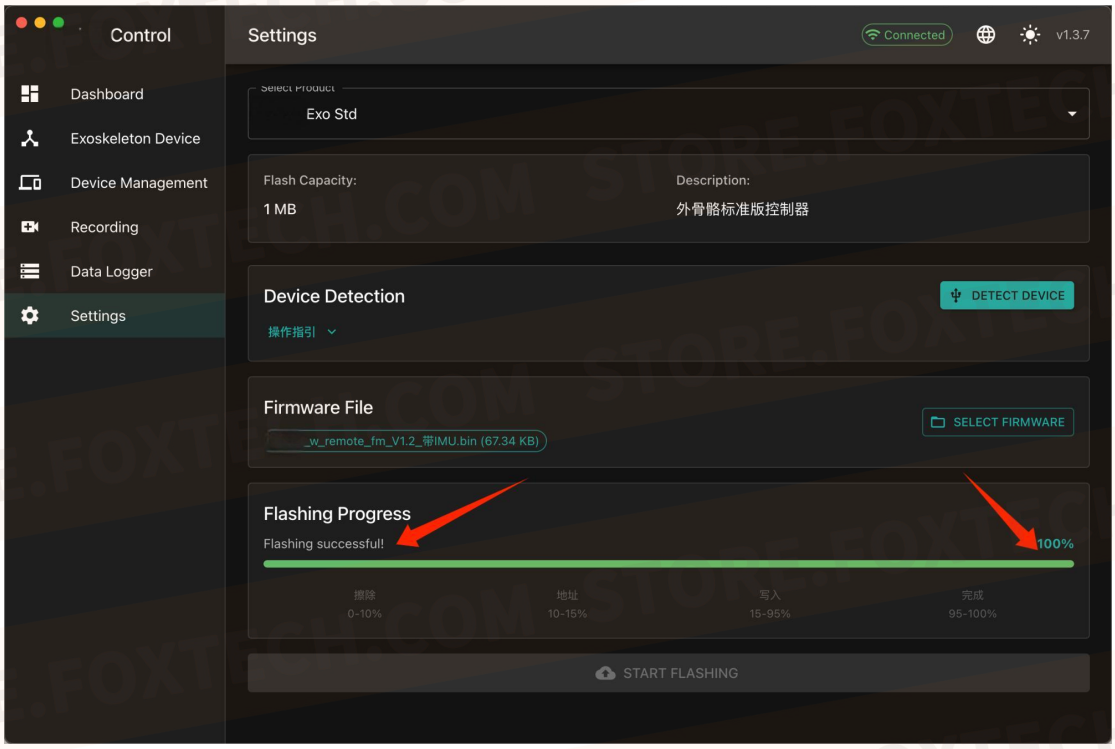


Figure 21 Burning completed

6、Maintenance and servicing

6.1 Body Cleaning

Before cleaning, disconnect the power supply of the exoskeleton to avoid moisture contacting the power interface and circuits. Wipe the dust and stains on the surface of the fuselage with an alcohol wet wipe, focusing on cleaning the back bearing frame, joint gaps and the surface of the handle to avoid dust accumulation. After cleaning the surface, dry it with a dry cloth. Do not turn on the device until all components are dry.

6.2 Product Maintenance

1、 Regularly check the joints of the exoskeleton to ensure smooth joint movement.

2、 Regularly check the straps and the surface of the exoskeleton. Tighten or replace them in time if any wear or looseness is found to avoid affecting the use effect of the exoskeleton.

3、 Avoid exposing the exoskeleton to humid, high-temperature and corrosive environments for a long time. When storing, place it on a flat and dry place to avoid extrusion and collision.

4、 After using the exoskeleton for a period of time, comprehensively check the basic functions of the exoskeleton device, detect potential faults and handle problems in time if any are found.

5、 It is prohibited to disassemble and modify the device components without permission. If you have any questions during the maintenance process, contact the company's professional staff for assistance.