

ATOM Series Teleoperation User Guide

Original Instructions

Issue: V1.3

Date: 2026-08-13

Copyright © SHENZHEN DOBOT CORP LTD 2025-2026. All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without the prior written consent of SHENZHEN DOBOT CORP LTD (hereinafter referred to as "DOBOT").

Disclaimer

To the maximum extent permitted by applicable law, the products described (including its hardware, software and firmware, etc.) in this document are provided **AS IS**, which may have flaws, errors or faults. DOBOT makes no warranties of any kind, express or implied, including but not limited to, merchantability, satisfaction of quality, fitness for a particular purpose and non-infringement of third party rights. In no event will DOBOT be liable for any special, incidental, consequential or indirect damages resulting from the use of our products and documents.

Before using our product, please thoroughly read and understand the contents of this document and related technical documents that are published online, to ensure that the robot is used on the premise of fully understanding the robot and related knowledge. Please use this document with technical guidance from professionals. Even if follow this document or any other related instructions, damages or losses may happen in the using process DOBOT shall not be considered as a guarantee regarding all security information contained in this document.

The user has the responsibility to make sure following the relevant practical laws and regulations of the country, in order that there is no significant danger in the use of the robot.

SHENZHEN DOBOT CORP LTD

Address: Room 1003, Building 2, Chongwen Garden, Nanshan iPark, Liuxian Blvd, Nanshan District, Shenzhen, Guangdong Province, China

Website: www.dobot-robots.com

Preface

Purpose

This manual describes how to use teleoperation for the DOBOT ATOM series robots.

Intended audience

This document is intended for:

- Customer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

Revision history

Date	Version	Revision history
2026/08/13	V1.3	Added content such as Controller Teleoperation , VR Neck-Hanging Operation , and App Teleoperation
2025/12/25	V1.2	Separate the teleoperation section into a standalone manual
2025/10/15	V1.1	Optimized Connecting to the robot WiFi section
2025/09/26	V1.0	The first release

Symbol conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury.
 WARNING	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robot damage.
 NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in robot damage, data loss, or unanticipated result.
 NOTE	Provides additional information to emphasize or supplement important points in the main text.

Contents

Preface	ii
1. Overview	1
2. Gesture Teleoperation	2
2.1 Start the teleoperation program	2
2.1.1 Switch robot modes	2
2.1.2 Access the onboard PC2	3
2.1.3 Start the teleoperation program on PC2.....	3
2.2 Start teleoperation.....	6
2.2.1 Enter teleoperation via the VR interface.....	6
2.2.2 Human-robot synchronization.....	7
2.2.3 Start data recording (Optional)	8
2.2.4 Stop data recording (Optional)	9
2.2.5 Stop human-robot synchronization.....	10
2.2.6 Exit VR browser interface	10
2.3 Stop the teleoperation program	10
3. Remote Controller Teleoperation	11
3.1 Settings	11
3.2 Operating instructions.....	11
3.3 Data collection instructions	12
4. VR Neck-Hanging Operation	13
5. App Teleoperation	14
6. Trajectory Payback	16
7. Operation Precautions	17
8. FAQ	19
8.1 Program error 1	19
8.2 Program error 2	19
8.3 Signal latency or stuttering.....	19

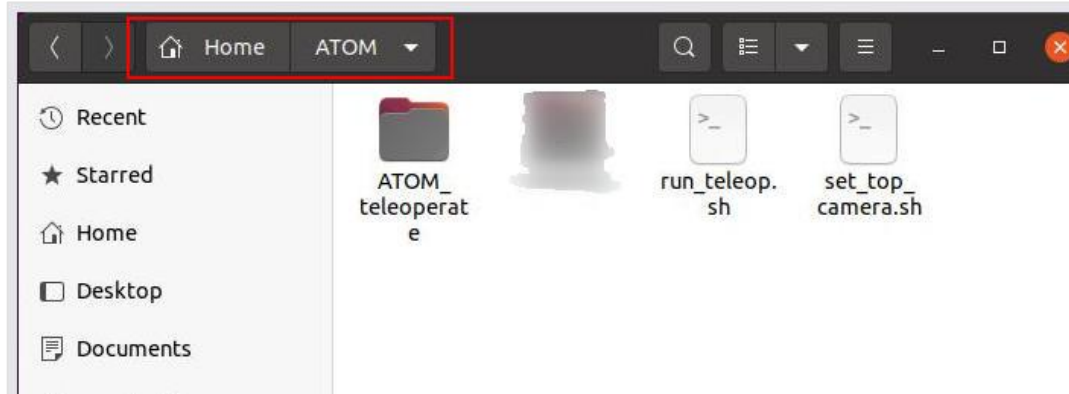
1. Overview

When you wear a VR headset (such as Quest 3 or Apple Vision Pro), your gestures or VR controller inputs are captured and mapped via algorithms to the upper body of the DOBOT ATOM robot in real time, including the head, both arms, and dexterous hands or grippers. At the same time, you can view the robot's first-person perspective through the VR headset, enabling teleoperation and data collection.

2. Gesture Teleoperation

2.1 Start the teleoperation program

Copy, extract, and save the teleoperation program firmware into the ATOM folder under the Home directory of the onboard PC2 (create the folder manually if it does not exist). After extraction, the file directory path should be as follows:



NOTICE

- When extracting, ensure the directory structure does not include an extra folder level from the archive name. The correct path is `/home/ATOM/ATOM_teleoperate` (not `/home/ATOM/ATOM_teleoperate_1.1.../ATOM_teleoperate`). This is because the `.sh` script is configured to launch the program from `/home/ATOM/ATOM_teleoperate` by default.
- The teleoperation firmware and the PC1 controller firmware versions must match; otherwise, DDS communication will fail and teleoperation cannot be started. The suffix of the package name, such as "pc1v1120", indicates that it is compatible with the PC1 controller version V1.1.2.0.

2.1.1 Switch robot modes

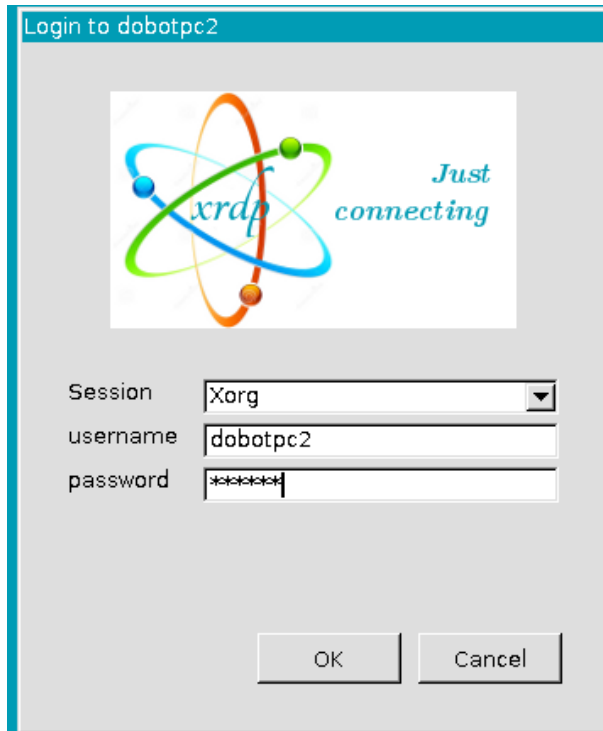
After the robot is powered on and enabled via the App, press the buttons on the remote controller to enter teleoperation mode.

The modes that support upper limb teleoperation include: Debugging, Position Control, and Main Motion Control Walking Mode.

- When the robot is supported by a stand, it can enter debug mode.
- When the robot is not fixed by a stand, you can enter the main motion control walking mode and enable the motion control model to help maintain balance.

2.1.2 Access the onboard PC2

1. Connect a laptop to the robot via wireless or wired connection.
 - **Wireless connection:** Connect to the WiFi corresponding to the target robot, such as "ATOMMX-4521-0731" (MX indicates that the target robot is the Max version, and the following number is the robot's serial number).
 - **Wired connection:** Connect to the robot's switch Ethernet port via a wired connection, and configure the local machine's network to the 192.168.8.x subnet (the same subnet as the robot's PC2).
2. Open Remote Desktop, enter IP "192.168.8.13:3390", username "dobotpc2", and password "123456".



2.1.3 Start the teleoperation program on PC2

1. Ensure that there are no obstacles around the robot before starting teleoperation, to avoid arm collisions at the initial position.
2. Set the following parameters:
 - a. **Configure the index for the head stereo camera:** The USB index for the head stereo camera might change each time the robot is powered on or if a USB device is plugged in or out from PC2.

Automatic setting method: Navigate to the ATOM directory and right-click to open a terminal (all subsequent command operations on PC2 should be performed in this directory). Enter the command `./set_top_camera.sh`.

If the setting is successful, the following information will be displayed:

```
(base) SHENZHEN DOBOT CORP LTD:~/ATOM$ ./set_top_camera.sh
/home/b476/ATOM/ATOM_teleoperate/robot/robot_control_dds_P1
test video_index: 0
frame (720, 2560, 3)
[Successful]:Found the top camera index: 0
Setting successful
```

b. Configure other parameters

Open the configuration file

/home/ATOM/ATOM_teleoperate/teleop/teleop_config.ini and configure the following parameters. Leave all other parameters at their default values.

Parameter name	Default values	Type	Description	Range/Unit
save_data_fps	20	int	Frame rate for data saving (this value can be set to a maximum of 50 when the head stereo camera resolution is 720P, and a maximum of 30 when the resolution is 1080P)	1 – 50
save_data_path	/home/dobotpc2/ATOM/datasets/	str	Dataset saving path (for all tasks)	-
project_name	new_dataset	str	Task dataset folder name	-
top_camera_id	0	int	The index of the head stereo camera, which corresponds to the video index of the camera under /home/dev/ in the Linux system. It can be configured through auto-detection.	-
top_camera_resolution	(720,1280)	Tuple	Resolution of the head stereo camera (width, height)	Optional: (1080,1920), (720,1280), (480,640), (240,320)
top_camera_fps	60	int	Head stereo camera frame rate	30 or 60
use_hand_camera	False	bool	Whether to use the wrist camera	True / False
left_hand_camera_sn	230322270903	str	Serial number of the left-hand camera	-
right_hand_camera_sn	230322273859	str	Serial number of the right-hand camera	-
human_arm_length	0.60	float	Operator arm length, used to adjust the scaling mapping for robot arm extension	0.5 ~ 1(m)
pinching_threshold	0.015	float	Thumb-index finger pinch	0 – 0.040(m)

Parameter name	Default values	Type	Description	Range/Unit
d			adhesion threshold	
thumb_rotation_threshold	150	int	Robot thumb rotation value (used to adjust the pinch between the thumb and index finger)	0 – 300
thumb_bending_threshold	490	int	Robot thumb bending value (used to adjust the pinch between the thumb and index finger)	300 – 600
indexfinger_bending_threshold	410	int	Robot index bending value (used to adjust the pinch between the thumb and index finger)	300 – 600
two_hand_distance_offset	0.05	float	Two-hand convergence distance offset (used to adjust the robot's hand proximity distance when the operator brings both hands together)	0 – 0.2(m)

3. Run the teleoperation program

Enter the command `./run__teleop.sh` to start the teleoperation program. Wait for a moment for the arm to automatically move to the initial position.

NOTE

- For the first run, enter the command `chmod +x run_upper_teleop.sh` to grant execution permission, then execute `./run__teleop.sh`.
- If prompted that the ATOM environment cannot be activated, first run `source ~/.bashrc`, then enter the command again.

2.2 Start teleoperation

The text display in VR is as follows:

- **Control:** Whether human-robot synchronization is active. **On** (activated) / **Off** (deactivated)
- **Record:** Whether the status of data collection is active. **On** (activated) / **Off** (deactivated)
- **Trigger:** Posture trigger status.

Fingers open: **Fok/Fno**

Arm joint 2 exceeds 30°: **Aok / Ano,c**

Wrist horizontal: **W1ok / Wno**

Wrist vertical, palm inward: **W2ok / Wno**

When the conditions for triggering human-robot synchronization posture are met: **Control pose...**

When the conditions for triggering data collection posture are met: **Record pose...**

2.2.1 Enter teleoperation via the VR interface

Connecting to the robot WiFi

Set up a wireless connection to the robot's WiFi network, such as "ATOMMX-4521-0731" and password "12345678".

Enter the VR browser interface

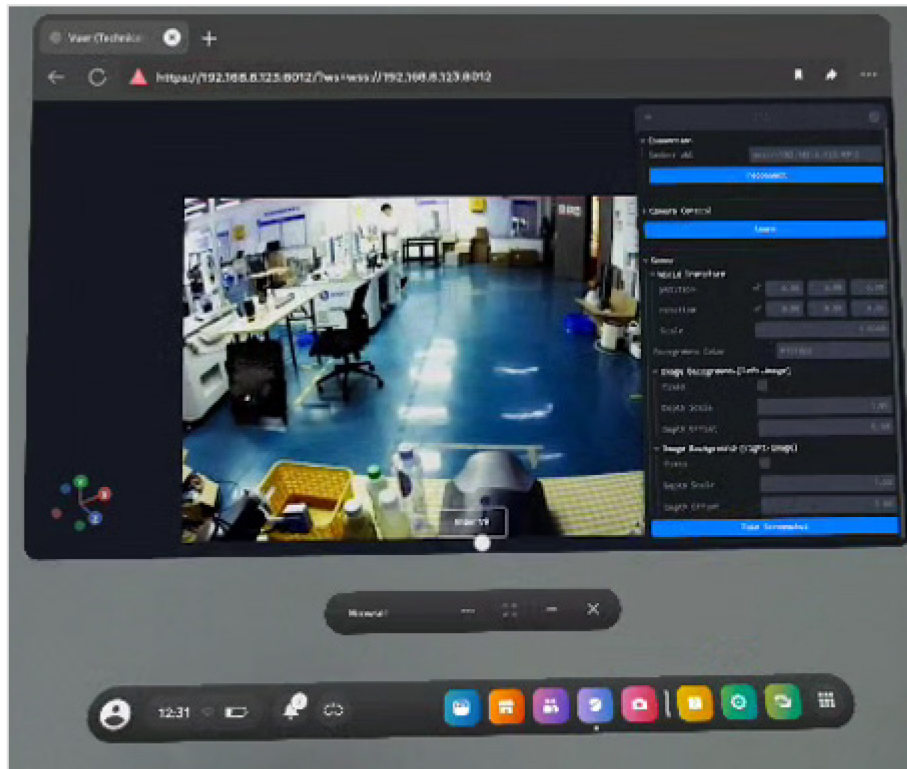
Go to the [DOBOT ATOM VR website](#). If you can see the live camera view, the system is running normally.

NOTICE

Please ensure the browser window is placed directly in front of the operator, and do not open multiple teleoperation browser windows simultaneously.

Enter teleoperation immersive mode

Click **Enter** at the bottom of the screen to enter immersive mode (or Virtual Reality). If a pop-up prompt appears, click "Allow".



2.2.2 Human-robot synchronization

1. Open both hands and match the robot's posture. The following three conditions must be met simultaneously (the interface will display "Trigger: Control pose...") and held for 3 seconds:
 - a. Fingers open
 - b. Arm joint 2 exceeds 30°
 - c. Wrist horizontal
2. When the **Control** status in the upper-left corner of the screen turns red and shows **On**, it indicates that synchronization is active.

NOTICE

During synchronization, keep your arms still first, and wait for the robot's posture to sync with yours before proceeding to the next action.

3. Keep both hands in a fist to avoid triggering the stop-sync posture.



2.2.3 Start data recording (Optional)

1. Open both hands and match the robot posture. The following three conditions must be met at the same time (the interface will show "Trigger: Record pose...") and maintained for 3 seconds:
 - a. Fingers open
 - b. Arm joint 2 exceeds 30°
 - c. Wrist vertical, palm facing inward
2. When the **Record** status in the upper-left corner of the screen turns **red** and shows "On", it indicates that data collection recording is active.
3. Control the robot to perform operation tasks. Throughout the process, image data from all cameras (head stereo camera, left and right wrist cameras) and robot upper body data (including 2×7 joint angles for both arms, 2×6 degrees of freedom for the dexterous hands, and 2 degrees of freedom for the head, all in radians) are saved to the configured **data file save path**. The automatically generated directory structure is as follows:

```

|-----
|--Data file storage path xxxxx #configured data file storage path
|-----collect_data #all episode data
|-----2025xxxxxxx #folder named with data collection timestamp, one episode of
task data
|-----observation #robot upper body data
|-----0.pkl #first frame body data, internal data structure: obs (28-dim
array), action (28-dim array). For the 28 data indices, see Table 1 below.
|-----1.pkl
|-----xx.pkl
|-----top_left #head stereo left camera images
|-----0.jpg #first frame image
|-----1.jpg
|-----xx.jpg
|-----top_right #head stereo right camera image data

```

```

|-----wrist_left  #left wrist camera image data
|-----wrist_left  #right wrist camera image data
|-----trajectory.txt #robot upper body trajectory data for one episode task
|-----

```

Table 2.1 Degrees of freedom corresponding to each dimension data index

Index		Corresponding DOF	Index		Corresponding DOF
0–6 Left arm		1–7 Joint	13–19 Right arm		1–7 Joint
7 – 12 Left fingers	7	Little finger	20 – 25 Right fingers	20	Little finger
	8	Ring finger		21	Ring finger
	9	Middle finger		22	Middle finger
	10	Index finger		23	Index finger
	11	Thumb bend		24	Thumb bend
	12	Thumb rotation		25	Thumb rotation
26		Head left-right movement	27		Head pitch

2.2.4 Stop data recording (Optional)

- Open both hands and match the robot posture. The following three conditions must be met at the same time (the interface will show "Trigger: Record pose...") and maintained for 3 seconds:
 - Fingers open
 - Arm joint 2 exceeds 30°
 - Wrist vertical, palm inward
- When the **Record** status in the upper-left corner of the screen shows a **red "Off"**, it indicates that data collection recording has stopped.

2.2.5 Stop human-robot synchronization

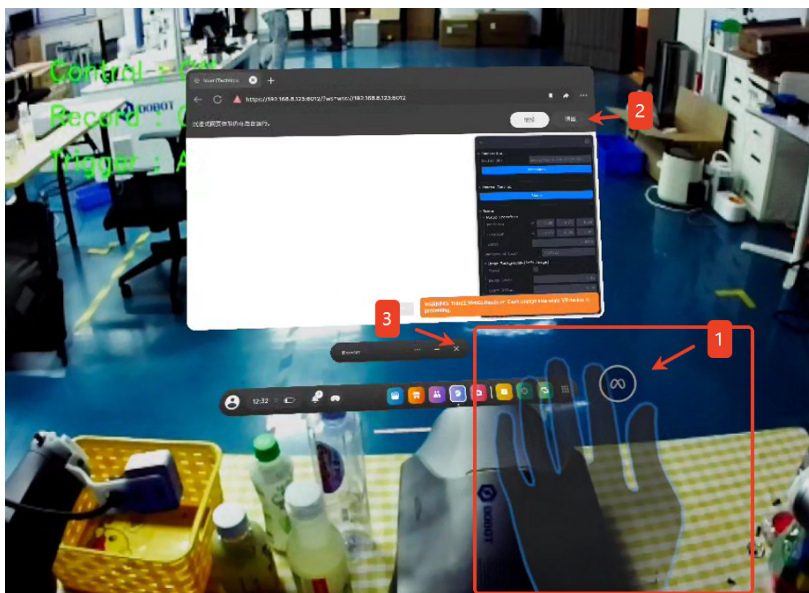
1. Open both hands and match the robot's posture. The following three conditions must be met simultaneously (the interface will display "Trigger: Control pose...") and held for 3 seconds:
 - a. Fingers open
 - b. Arm joint 2 exceeds 30°
 - c. Wrist horizontal
2. When the **Control** status in the upper-left corner shows a **green "Off"**, synchronization is no longer active.

NOTE

If the required posture for exiting synchronization cannot be achieved, ask an assistant (not the teleoperator) to stop the teleoperation program on the remote desktop PC2 to exit.

2.2.6 Exit VR browser interface

1. Exit the immersive mode interface by pinching your thumb and index finger together with the right palm facing your eyes.
2. Click "Exit" in the top right corner of the browser, and then click the "**x**" at the bottom of the browser window to close it (this may need to be done twice until the browser window is completely closed).



2.3 Stop the teleoperation program

On the PC2 terminal page where the teleoperation program is running, press **Ctrl+C** once to stop the teleoperation program, allowing the arm to automatically move to the waist position. Press **Ctrl+C** again to complete stopping the teleoperation program.

3. Controller Teleoperation

3.1 Settings

If the robot's end effector is equipped with a DH gripper, the VR controllers can be used to teleoperate the robot's upper limbs, arms, head, and end gripper. If using the ATOM-W wheeled humanoid robot, the chassis movement can also be controlled.

Operation mode settings

1. Log in to the DobotEX App, go to Device > Dexterous Hand and Accessories > Dexterous Hand Settings, and set the robot's end dexterous hand to "DH Adaptive Gripper AG-160-95".
2. After completing the settings, restart the robot for the changes to take effect.
3. When the teleoperation firmware starts, it automatically enters controller teleoperation mode and receives data from the VR controllers (gesture data is not received).

VR settings

Disable gesture tracking in VR to prevent occasional automatic switching between controller and gesture modes during teleoperation, which may cause black screens or other issues. The setting method is as follows:

1. Open the VR "Settings > Motion Tracking" interface and disable "Gesture and Body Tracking".
2. When gesture teleoperation mode is needed, enable "Gesture and Body Tracking".

3.2 Operating instructions

Controller-based teleoperation is similar to gesture-based teleoperation in terms of usage. The differences are: the controller's spatial posture is used instead of hand gestures to control the arms; controller buttons replace gestures for starting/stopping synchronization and recording; and additional controls are provided via the trigger for the gripper and the joystick for chassis movement.

Button instructions

- Left controller Y button: Press and hold for 2 seconds to start human-robot synchronization; press and hold again for 2 seconds to stop
- Left controller X button: Press and hold for 2 seconds to start data recording; press and hold again for 2 seconds to stop
- Left controller joystick: Move up/down to control the wheeled chassis forward or backward
- Right controller joystick: Move left/right to steer the chassis left or right
- Index finger trigger: Control the gripper open/close position



NOTICE

Both controllers must be held during operation. If only one controller is held while entering VR and starting synchronization, the robot may assume an abnormal posture.

3.3 Data collection instructions

When the robot is controlled via controller-based teleoperation for gripper and chassis operation, the recorded upper-body data (obs and action) is 18-dimensional, consisting of 2×7 joint angles (in radians) for both arms, 2×1 degrees of freedom for the grippers, and 2 degrees of freedom for the head. When using the ATOM-W wheeled humanoid robot, the body data (obs and action) is 20-dimensional, meaning that 2 additional degrees of freedom are added for the chassis (linear velocity and angular velocity), as shown in the table below.

Table 3.1 Degrees of Freedom Corresponding to Each of the 20-Dimensional Data Indices

Index	Corresponding DOF	Index	Corresponding DOF
0–6	Left arm 1–7 joint	8 – 14	Right arm 1–7 joint
7	Left gripper	15	Right gripper
16	Head left-right movement	17	Head pitch
18	Chassis linear velocity	19	Chassis angular velocity

4. VR Neck-Hanging Operation

When network congestion or interference causes significant image latency, or when you prefer to observe the robot directly rather than through the VR view, you can hang the VR headset around your neck and operate in that position.

VR settings

Make sure to disable the VR headset's auto-sleep feature; otherwise, it will go into sleep mode when hung around your neck.

Navigate to "Settings -> General -> Power -> Sleep Mode" on the VR headset and set the sleep timeout to 4 hours.

How to use

1. After entering teleoperation immersive mode, position the browser window in front of your neck.
2. Place the VR headset around the front of your neck and adjust it so that the camera faces directly forward. (If the camera does not face forward, it will not be able to see your hands when raised, and hand gestures will not be recognized.)
3. Start human-robot synchronization normally using gestures, the controller, or the toolchain platform.



NOTICE

If you are using the VR headset in neck-mounted mode to control the wheeled robot and plan to follow it within a small workspace:

- Shift your body only. Do not turn around, except for slight head adjustments. Turning may change the VR headset orientation and cause abnormal arm postures.
- If a safety boundary is set in the VR environment, do not move beyond it. Otherwise, arm or gesture recognition may fail, which could cause the robot to assume an unexpected posture.

5. App Teleoperation

If you are using the App for teleoperation, make sure the teleoperation service is set to launch at startup. You only need to do this once.

NOTICE

- When updating the teleoperation firmware or toolchain version, you will also need to reconfigure this setting. Otherwise, the actual teleoperation service running in the background will still be the old version. Once configured, the teleoperation service will automatically start at boot and run in the background, ready to receive teleoperation on/off signals from the App or the PC toolchain platform.
- How the teleoperation service is launched depends on whether auto-start has been configured. If it has, the toolchain will call the service directly. If not, starting the toolchain will automatically launch the teleoperation service in the background. However, closing the toolchain will not stop the service. It will continue running until the robot is shut down.

Configure auto-start

- If using the ATOM_teleoperate teleoperation firmware, right-click to open a terminal in the ATOM_teleoperate/teleoperate_server directory. If using the toolchain platform, right-click to open a terminal in the EmbodyLink/usr/bin/tool/teleoperateapp/_internal/teleoperate_server directory, and run the following commands. A successful configuration is shown in the figure below:

```
chmod +x ./setup_service.sh
./setup_service.sh
```

```
dobotpc2@ubuntu: ~/ATOM/ATOM_teleoperate/teleoperate_server
(base) dobotpc2@ubuntu:~/ATOM/ATOM_teleoperate/teleoperate_server$ chmod +x ./setup_service.sh
(base) dobotpc2@ubuntu:~/ATOM/ATOM_teleoperate/teleoperate_server$ ./setup_service.sh
正在验证 sudo 权限...
默认密码验证成功。
当前工作目录: /home/dobotpc2/ATOM/ATOM_teleoperate/teleoperate_server
开始配置 teleoperate.service 服务...
服务 teleoperate.service 正在运行, 正在停止...
服务已停止。
父目录路径: /home/dobotpc2/ATOM/ATOM_teleoperate
父目录名称: ATOM teleoperate
检测到父目录为 ATOM teleoperate, 设置 ExecStart 为: /home/dobotpc2/ATOM/ATOM_teleoperate/teleoperate_server/start_teleoperate_server.sh
当前用户名: dobotpc2
服务文件修改完成。
复制服务文件到 /etc/systemd/system/ ...
重新加载 systemd 配置...
启用服务 (开机自启) ...
启动服务...
检查服务状态...
服务 teleoperate.service 已成功启动。
● teleoperate.service - TeleoperateServer
   Loaded: loaded (/etc/systemd/system/teleoperate.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2026-02-26 18:27:20 CST; 2s ago
   Process: 89586 ExecStartPre=/bin/sleep 10 (code=exited, status=0/SUCCESS)
   Main PID: 89822 (python3)
   Tasks: 2 (Limit: 76793)
   Memory: 165.4M
   CGroup: /system.slice/teleoperate.service
           └─89822 python3 main.py
             └─89872 /home/dobotpc2/miniforge3/envs/Atom/bin/python3 -c from multiprocessing.resource_tr...

2月 26 18:27:20 ubuntu systemd[1]: Started TeleoperateServer.
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: =====
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: ATOM 遥操作系统启动脚本
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: =====
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: [1/3] 初始化 conda 环境...
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: [2/3] 激活 conda 环境 Atom...
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: =====
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: 启动主程序 main.py (包含 DDS 子线程) ...
2月 26 18:27:20 ubuntu start_teleoperate_server.sh[89822]: =====
2月 26 18:27:21 ubuntu start_teleoperate_server.sh[89822]: 2026-02-26 18:27:21.941[teleop_atom_serv...
Hint: Some lines were ellipsized, use -l to show in full.
可运行以下命令查看服务详细日志:
    journalctl -u teleoperate.service -f
配置完成。
(base) dobotpc2@ubuntu:~/ATOM/ATOM_teleoperate/teleoperate_server$
```

NOTICE

The teleoperation service auto-start can be configured using either the firmware or the toolchain, but you should use only one method. The last configuration will overwrite any previous settings.

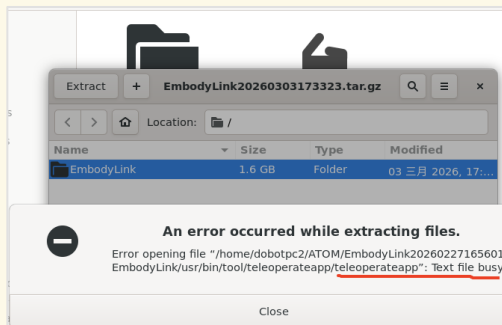
2. (Optional) View the real-time service running log output.

```
journalctl -u teleoperate.service -f
```

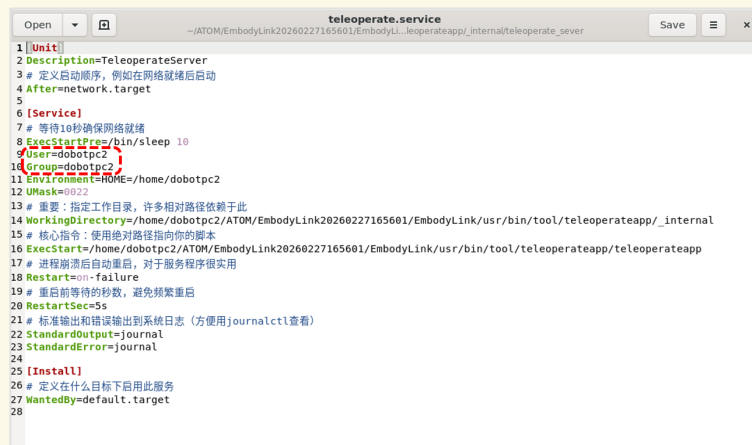
NOTICE

1. When updating the EmbodyLink toolchain platform, if you extract and replace the original files directly, you may encounter a message indicating that teleoperateapp is in use and cannot be updated (as shown below). In this case, you should stop the teleoperation background service first, then extract and replace the files.

Run the following command in the terminal to stop the service: `sudo systemctl stop teleoperate.service`.



2. If you are not using the PC2 that comes with the ATOM system by default, you will need to manually modify the Group and User fields in the teleoperate_server/teleoperate.service file to match the actual username.



6. Trajectory Payback

In certain scenarios, such as when requiring a robot to repeatedly perform a specific motion trajectory or to execute actions via voice trigger, the trajectory recording and playback function can be used to obtain the desired motion path. That is, first record the trajectory, then have the robot replay the offline trajectory.

NOTE

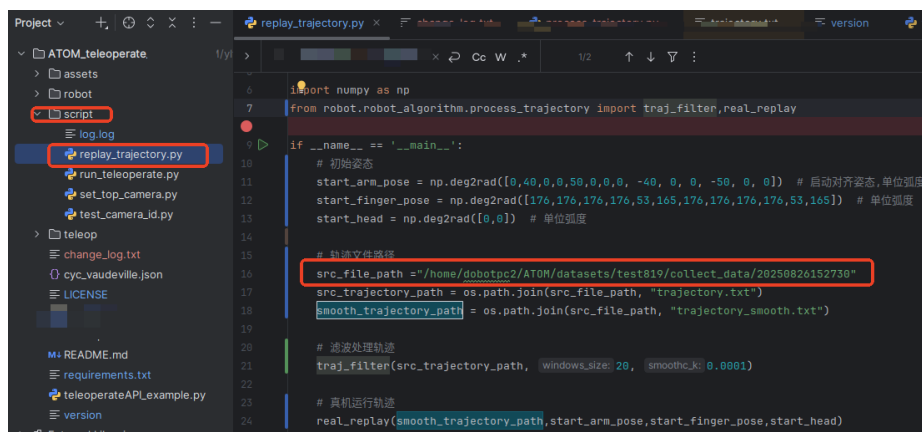
Data recorded using the wheeled controller for gripper teleoperation is currently not supported (18-dimensional or 20-dimensional data).

Operation method

1. **Teleoperation trajectory recording:** Use the teleoperation methods described earlier to record the trajectory. Save the recorded trajectory file as `trajectory.txt` (refer to [Start data recording \(Optional\)](#) for specific path details).
2. **Executing trajectory on the robot:** Open the `ATOM_teleoperate > script > replay_trajectory.py` file, enter the absolute path of the directory containing the trajectory file, and then run the `replay_trajectory.py` program.

NOTE

- To run the `replay_trajectory.py` program: right-click to open a terminal window in the `ATOM_teleoperate/script` directory, run `conda activate ATOM` to activate the environment, then run `python replay_trajectory.py` to start the program.
- If an error occurs indicating the `csaps` library is not found, you can install it by entering the command `pip install csaps` online.



Enter the path where the trajectory file is located



Trajectory playback on the robot

7. Operation Precautions

VR usage precautions

Due to the automatic switching between the Quest's gesture control mode and controller control mode, the system will immediately switch to controller mode upon detecting any controller movement. This will cause the gesture control mode to deactivate.

Therefore, please remove the batteries from the controllers before entering VR immersive mode. This prevents an automatic switch to controller mode during teleoperation, which would cause the teleoperation interface to freeze.

Operator postures

In VR, drag the browser to the forward-facing view and refresh the browser page. At this point, the body and head orientation of the person will be set as the reference posture. The operator should not adjust posture or move position, as misalignment with the robot's front may lead to unsafe postures.

If the operator needs to adjust posture, adjustments should be made while in the stopped teleoperation sync state. Once posture adjustments are complete, drag the browser to the forward-facing view again, refresh the browser page, and enter the teleoperation sync state once more.

Operator's hand position

The operator's hands should be positioned in front and below the VR headset, at least 20cm away from the headset. Avoid retracting hands to the waist or behind the body, as this may lead to unrecognized positioning and cause the robot to assume an unsafe posture.

When both hands obscure each other, visual gesture recognition is affected, which may result in finger posture jitter.

Notice during head movement

Hand posture recognition is referenced to the orientation of the VR headset. When the operator moves head, the robot's hands will move accordingly. Therefore, you should be careful to avoid collisions between the robot's hands and surrounding objects.

Notice when removing VR headset

Ensure to exit the teleoperation sync state or stop the teleoperation program before removing the VR headset. Otherwise, the robot may assume an abnormal posture or causing collisions.

Impact of network environment

Teleoperation uses local WiFi to connect the VR headset and the robot, but WiFi signals are easily affected by network interference. In environments with multiple WiFi networks, video latency or robot motion jitter may occur. For solutions to latency or stuttering issues, refer to the [Signal latency or stuttering](#) section.

Number of operators

It is recommended to have two operators: one wearing the VR headset to perform teleoperation and another to assist with the following tasks:

- Monitor the robot's surroundings for safety, and inform the teleoperator if any abnormal or unsafe posture is observed so that it can be adjusted.
- If any error occurs, run the stop script on the computer to force exit from teleoperation sync, or press the emergency stop button on the robot to halt motion immediately.

8. FAQ

8.1 Program error 1

Issue

When running the teleoperation program, the error 'NoneType' object has no attribute 'hands' is reported.

```
Traceback (most recent call last):
  File "run_teleoperate.py", line 8, in <module>
    TeleoperateAPI.teleop_main()
  File "teleoperate_API.py", line 196, in teleoperate_API.TeleoperateAPI.teleop_
main
  File "teleop_real.py", line 501, in teleop_real.TeleopMain
  File "robot_upper_control.py", line 97, in robot_upper_control.UpperControl.dy
namic_approach
  File "robot_upper_control.py", line 42, in robot_upper_control.UpperControl.ge
t_joint_state
AttributeError: 'NoneType' object has no attribute 'hands'
^CError in atexit._run_exitfuncs:
Traceback (most recent call last):
```

Solution

The error may be due to the dexterous hand configuration not being enabled (disabled by default). Please enable the dexterous hand configuration.

8.2 Program error 2

Issue

When running the teleoperation program, the error 'NoneType' object has no attribute 'id' or 'left arm' is reported.

Solution

Version mismatch between controller and teleoperation software, or LAN2 port connected to a network (causing DDS communication errors). Use matching versions and unplug the LAN2 cable.

```
2026-07-08 20:15:32.411[Atom:write:1125][pid:26563][tid:140053030611840]INFO--> [Info]:vr process init success...
2026-07-08 20:15:38.630[Atom:write:1125][pid:26563][tid:140053030611840]INFO--> Start dds
2026-07-08 20:15:41.633[Atom:write:1125][pid:26563][tid:140053030611840]INFO--> [Info]:robot_type:
2026-07-08 20:15:41.633[Atom:write:1125][pid:26563][tid:140053030611840]INFO--> ATOM W
2026-07-08 20:15:41.633[Atom:write:1125][pid:26563][tid:140053030611840]INFO--> [Error]: 'NoneType' object has no attribute 'id'
```

8.3 Signal latency or stuttering

Issue

In complex network environments such as exhibition halls or areas with walls that block signals, the robot's onboard WiFi is prone to interference. This can delay wireless transmission between the robot and the VR headset, resulting in choppy teleoperation performance.

Solution

The following three methods can be used together or separately.

Method 1: Operate at close range

- Keep the VR headset as close to the robot as possible.

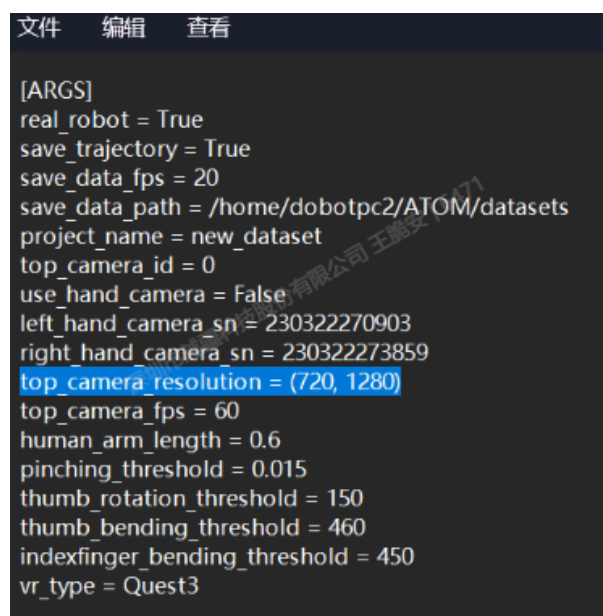
In environments without network interference, the maximum recommended operating distance between the VR headset and the robot is generally up to 15 meters. In complex network environments, it is advisable to stay within 1 to 2 meters.

- Hang the VR headset around the neck and operate without viewing the image

Since the transmission delay is mainly caused by video streaming, you can simply hang the VR headset around your neck and operate the robot by watching it directly, rather than viewing the image in the VR headset. Refer to [VR Neck-Hanging Operation](#) for operating instructions.

Method 2: Reduce the stereo camera resolution

In the teleoperation configuration file (teleop/teleop_config.ini), reduce the head camera resolution from the default (720×1280) to (480×640) or (240×320). This reduces the amount of image data transmitted over the network and helps lower latency.



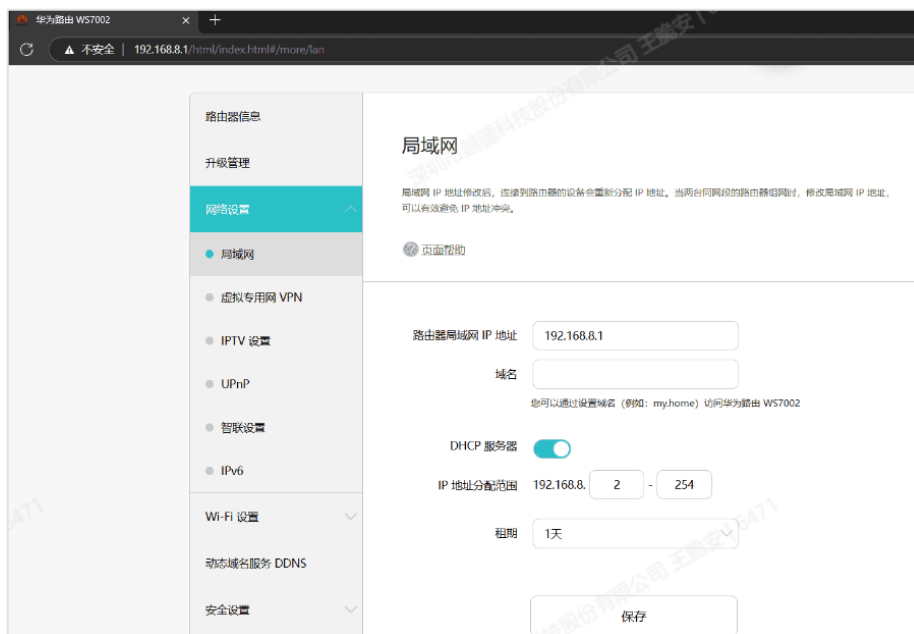
Method 3: Use an external router

Replace the onboard router with an external router.

1. Disconnect the robot's onboard router, then connect an external high-signal router (such as a gigabit router) to the first Ethernet port on the upper back of the robot body (which connects to the internal switch). Place this external router close to the VR operating area to ensure a short-range, stable connection between the VR headset and the router.
2. To set up the external router: plug the cable from the robot's rear panel into a LAN port on the router. Some routers have auto-sensing WAN/LAN ports, so make sure the port is set to LAN mode. Otherwise, the local network may not work properly. For example, to set up a Huawei router:
 - a. set the first port as a fixed WAN port and the rest as LAN ports.



- b. Set the router IP to 192.168.8.1, which is on the same subnet as PC1 and PC2 (192.168.8.x).



3. Connect to the external router, access the remote desktop, and launch the teleoperation program normally.