EN

Robotic Arm Quick Start

A Getting Started Guide for Amber Robotic Arm Series

- Amber B1 7-DOF robotic arm
- Amber L1 7-DOF robotic arm
- Amber C1 6-DOF robotic arm

Version：V0.0.11

Date：2024.4.11

Important Notes

- This manual is part of the product.
- Read and follow the instructions in this manual.
- Keep this manual in a safe place.
- Give this manual and any other documents relating to the product to anyone that uses the product.
- Please consult the latest catalogue to find out about the product's technical specifications.
- We reserve the right to make modifications without prior notification.

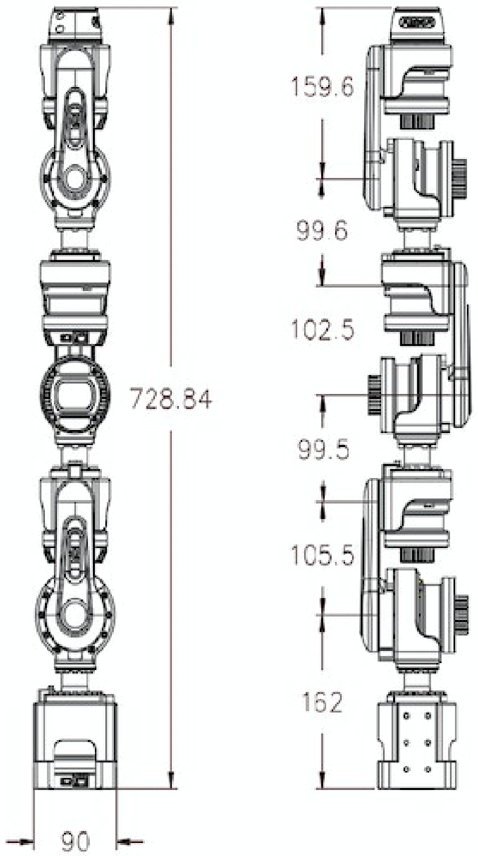
Table of Contents

1. AMBER Hardware Introduction

1.1 Specification & Connection

1.1.1 7-DOF Amber B1 System

Specifications



Model:Bionic-1

Weight:
7.8 kg / 17.2 lbs

Height:
750 mm / 29.5 in

Payload:
3 kg / 6.6 lbs

Reach:
581 mm / 22.9 in

Repeatability:
0.05mm/0.0019 in

Degree of freedom:
7 rotating joints

Actuator:
Brushless servo motor

Working temperature:
0~40°C

Working environment humidity:
≤ 95%

Mounting:
Any

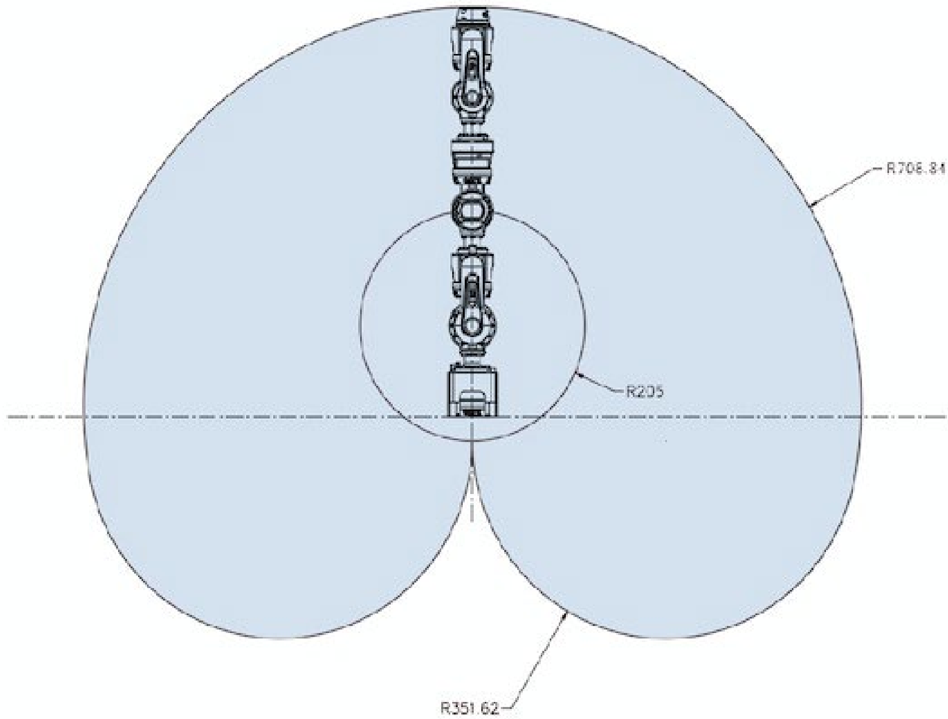
Communication:
Ethernet

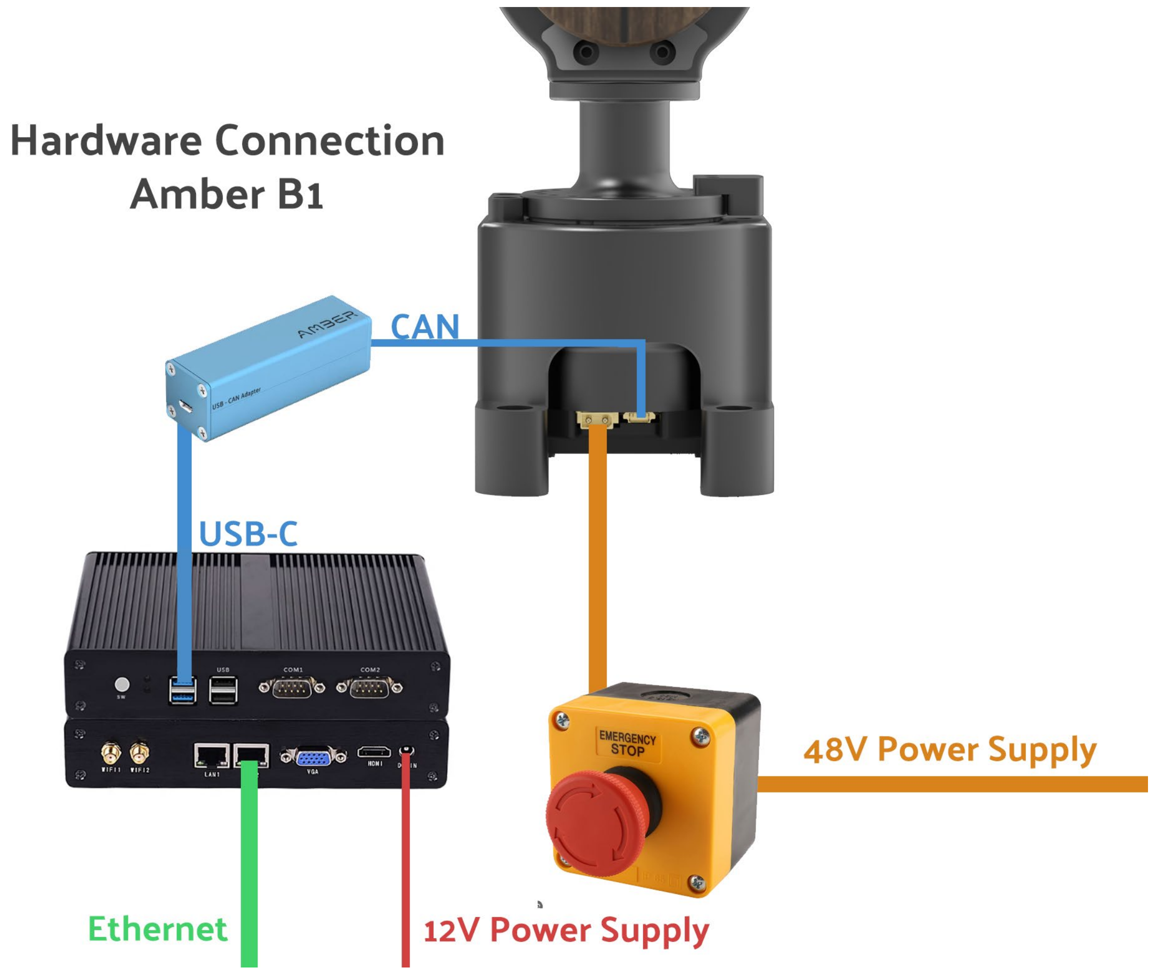
Supply Voltage:
48V

Consumption:
Approx. 200W

Material:
Aluminum alloy & carbon fiber

AIOS Techical	1DOF	2DOF	3DOF	4DOF	5DOF	6DOF	7DOF
Reach:	± 140	± 133	± 131	± 131	± 131	± 131	± 131
Max Speed:	120°/s	120°/s	120°/s	120°/s	120°/s	120°/s	120°/s
Gear Ratio:	50	50	50	50	30	30	30

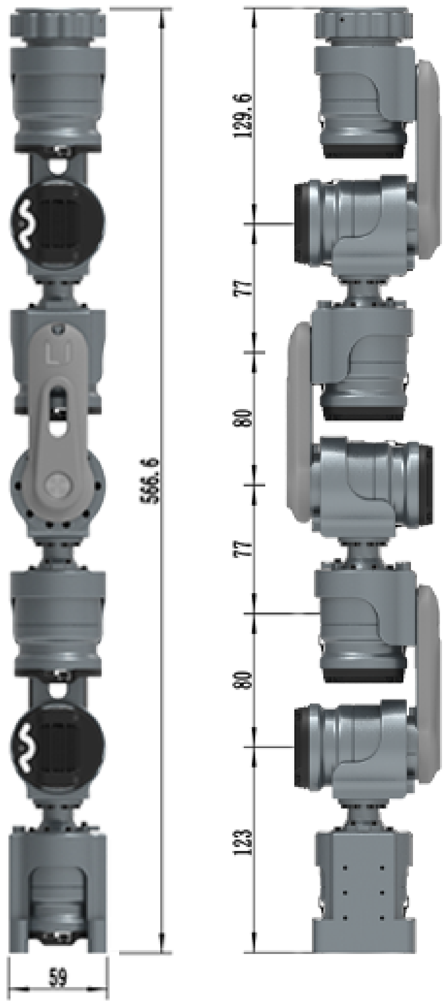

R706.84
R205
R351.62


Hardware Connection
Amber B1
CAN
USB-C
Ethernet
12V Power Supply
48V Power Supply
EMERGENCY STOP

1.1.2 7-DOF Amber L1 System

Specifications

Model: Lucid-1



Weight: 3.2kg/7lbs

Height: 566mm/22.3in

Payload: 1.5kg/3.3lbs

Reach: 443.6mm/17.4in

Repeatability: 0.5mm

DOF: 7

Actuator: AIOS series

Working temperature: 0~40 ℃

Communication: UDP/CAN

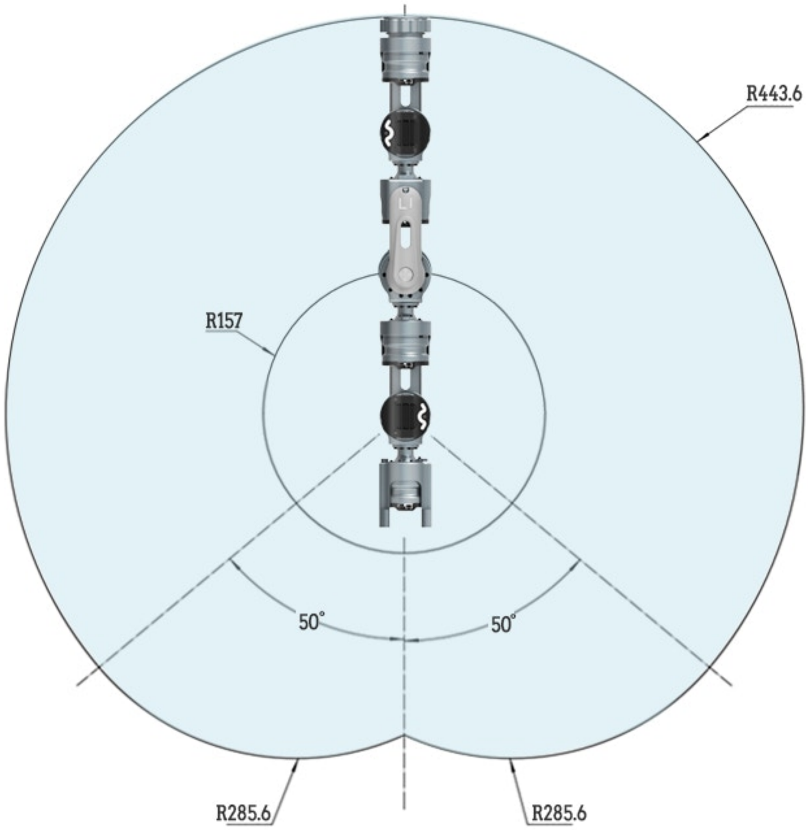
Supply Voltage: 24~36V

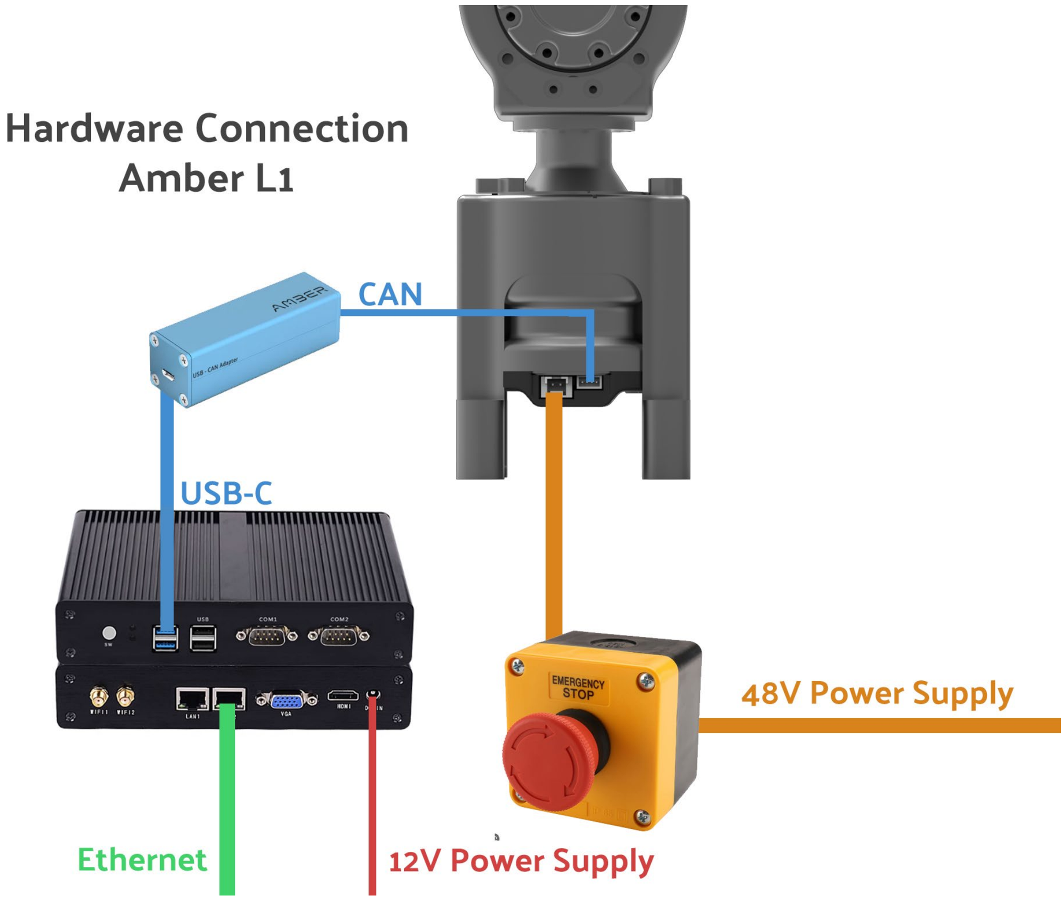
Power: 150W

Material: Aluminum ally & steel

Max TCP Speed: 1.5m/s

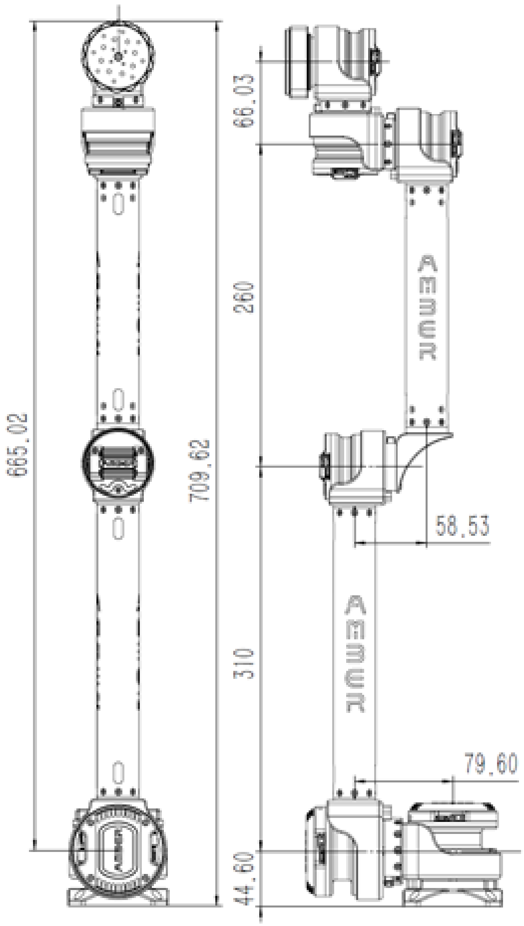
AIOS Technical	1 DOF	2 DOF	3 DOF	4 DOF	5 DOF	6 DOF	7 DOF
Reach	±148°	±130°	±148°	±130°	±148°	±130°	±180°
Max speed	120°/s	120°/s	120°/s	120°/s	120°/s	120°/s	120°/s


R443.6
R157
50°
50°
R285.6
R285.6


Hardware Connection
Amber L1
CAN
USB-C
EMERGENCY STOP
48V Power Supply
Ethernet
12V Power Supply

1.1.3 6-DOF Amber C1 System

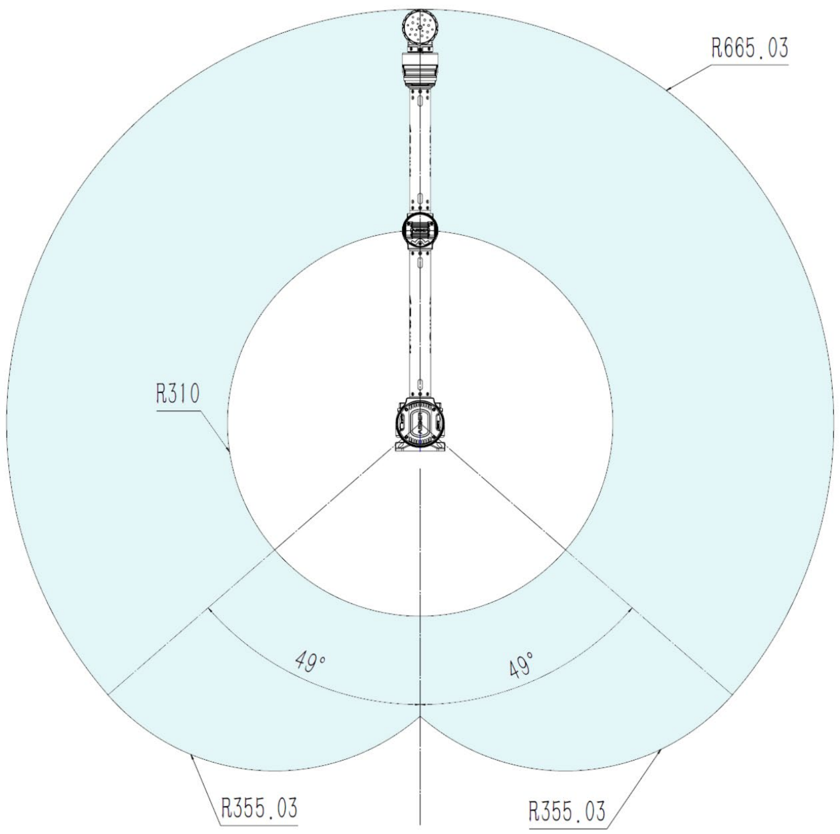
Specifications

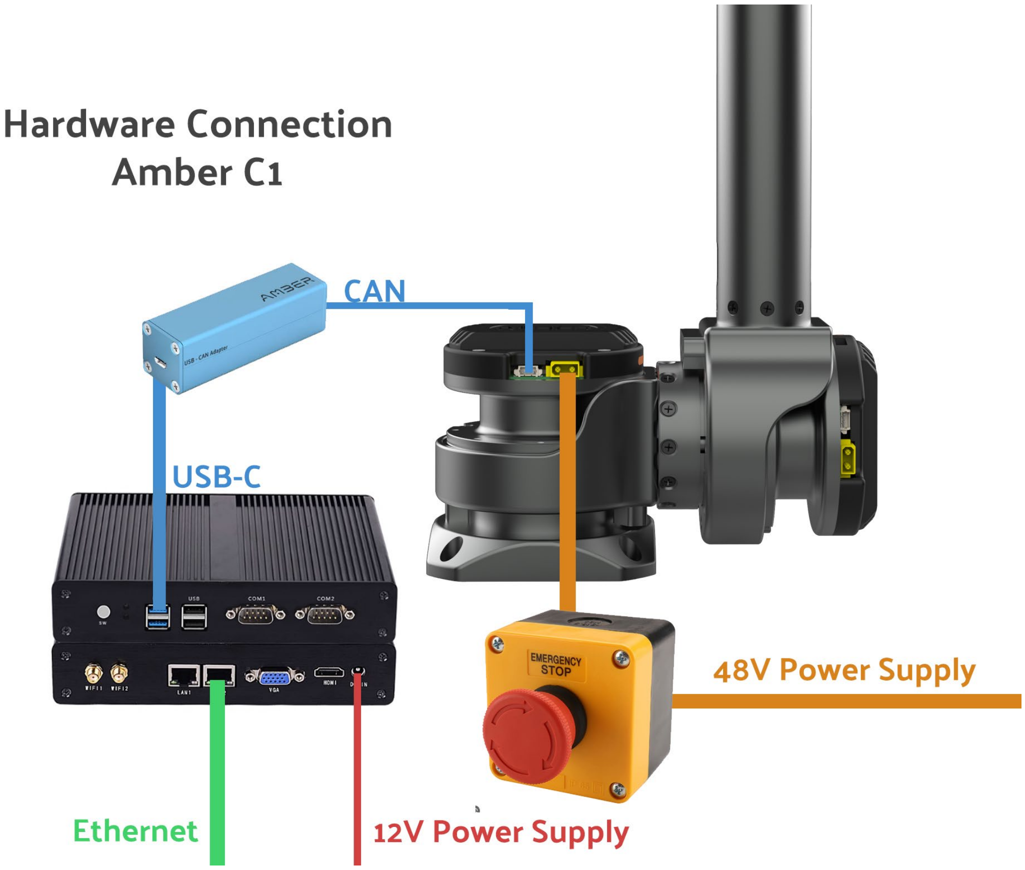


Model： C-1 6DOF

Weight： 3.43kg/7.56lbs	**Height：** 709.6mm/27.9in
Payload： 1.5kg/3.3lbs	**Reach：** 636.0mm/25.0in
Repeatability: 0.01mm	**DOF:** 6
Actuator: AIOS series	
Working temperature: 0~40 ℃	
Communication: UDP/CAN	
Supply Voltage: 24~36V	**Power:** 150W
Maerial: Aluminum ally & steel	**Max TCP Speed:** 1.5m/s

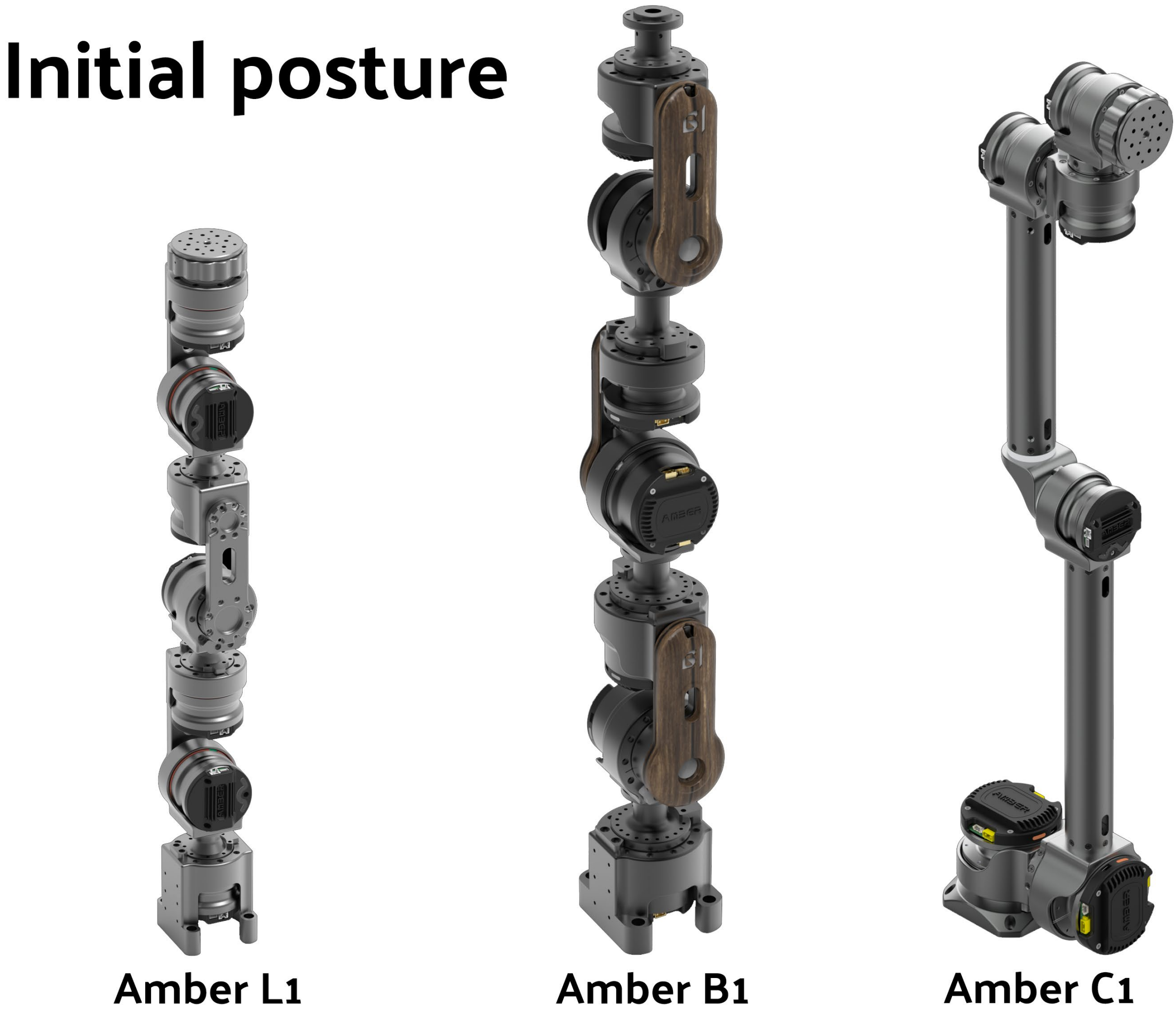
	1DOF	2DOF	3DOF	4DOF	5DOF	6DOF	7DOF
Reach	±131°	±131°	±147°	±147°	±147°	±180°	N/A
Max speed	120°/s	120°/s	120°/s	120°/s	120°/s	120°/s	N/A


R665.03
R310
49°
49°
R355.03
R355.03


Hardware Connection
Amber C1
CAN
USB-C
48V Power Supply
Ethernet
12V Power Supply
EMERGENCY STOP

1.2 Initial position

Make sure to manually position the robot arm in the standard initial position before turning it on.



- After powering on, the robot arm will use this position as the zero point of each joint, so the accuracy of the initial posture is very important.

- The robotic arm will lose its position after each power outage and needs to be manually repositioned to the initial posture.

1.3 Power ON

Voltage selection

Toggle the voltage selection switch on the side of the power supply to match the input voltage of your local electrical code requirements.

Before leaving the factory, we set the switch at 230 to prevent potential injuries.

Switch Gear	115	230
Input Votage Range	100 ~ 120VAC	200 ~ 240VAC
Frequncy Range	50~60Hz	50~60Hz

Turning the switch to 110V when using a 220V power supply standard is very dangerous and may cause serious damage.

Release the emergency stop switch

- Make sure all wiring is connected
- Turn the emergency stop switch clockwise and lift

- When an emergency occurs, please press the emergency switch to cut off the power immediately.
- The emergency switch will cut off the power supply and de-energize the robotic arm, posing a potential risk of falling.

Power On IPC

- Make sure all wiring is connected
- Press power button

Wait for beeps

- 1 beep → Starting the startup process
- (wait about 3 minute)
- 3 short beep + 1 long beep → Started successfully

We currently require at least a LAN connection when the robotic arm is started to ensure you have the ability to handle any situation.

2. Amber Robot Studio V1.5

Ensure your robot with all modules are powered on the initial position and connected to the local network.

Confirm the status of the mini-hub by checking the blue light at the top. A high-speed flashing indicates successful communication between both ends of the mini-hub. If the blue light is flashing at a low speed, it means that only one end of the mini-hub is communicating successfully.

Next, open a web browser (preferably Google Chrome) and enter the following:

```
http://[your IP address]:10101/#page1
```

(Figure 1):

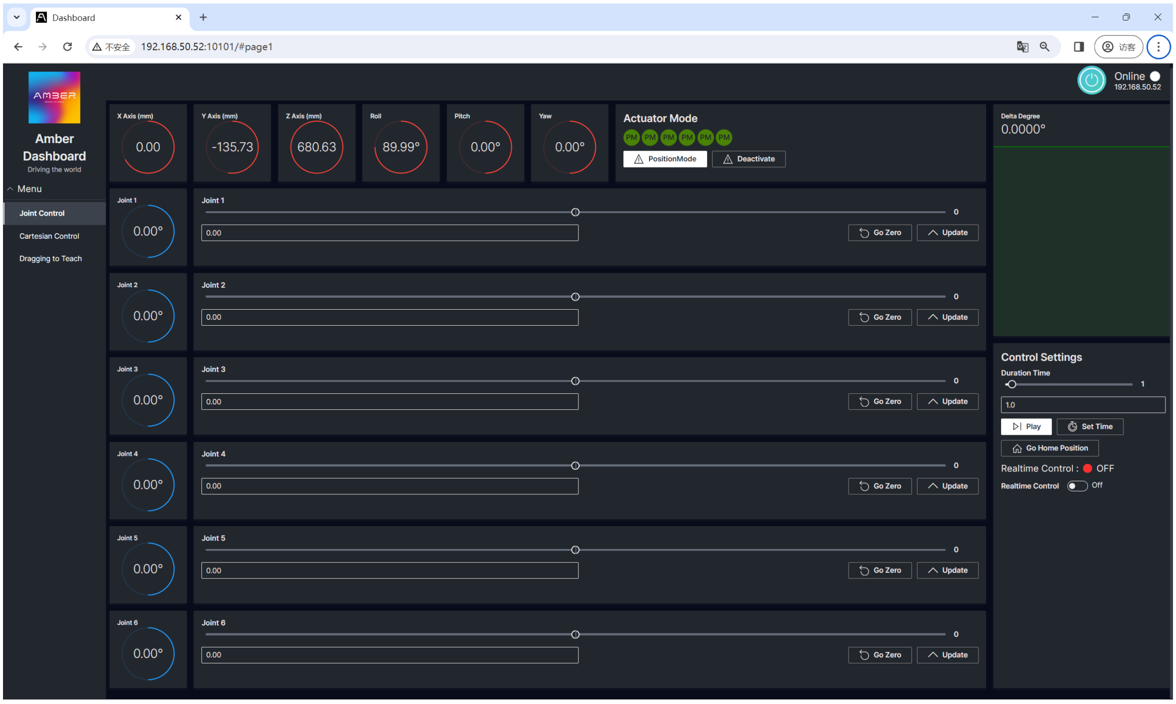


Figure 1

2.1 Planning and Actuator Modes

The options panel on the left showcases the current motion planning modes available for the robotic arm (refer to Figure 2):

- Joint Control
- Cartesian Coordinate System Control
- Drag and Drop Teaching Mode

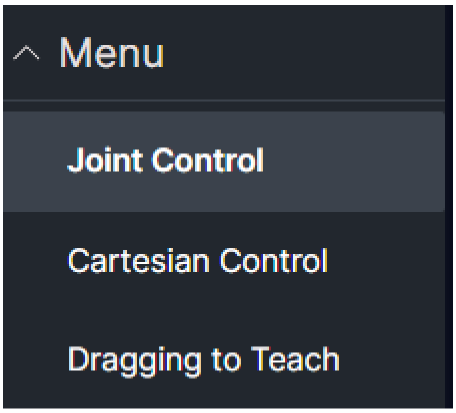


Figure 2

The power button located on the right indicates the connection status of the core driver (refer to Figure 3).

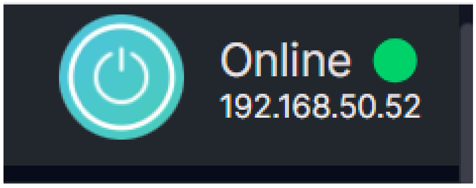


Figure 3

Located at the top of the page (as depicted in Figure 4), upon clicking the Position Mode button, the robot arm will transition into position mode, activating the motion control interface.

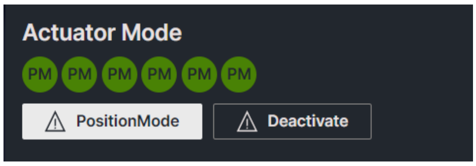


Figure 4

Upon clicking the Deactivate button, the robot arm will enter Deactivate mode, disabling the motion control.

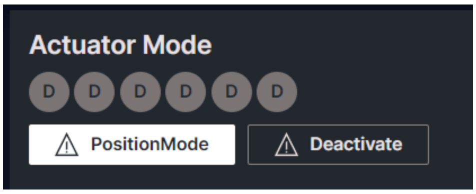


Figure 5

**The 7DOF model will have 7 joint status indicators*

- Prior to entering the position mode, ensure the robot arm is placed in the standard initial posture. The state of the robot arm upon entering the position mode after powering off is crucial.

- Please note that when deactivating the robotic arm, it will immediately relinquish maintaining its current position, potentially leading to a fall and causing injury. Prior to deactivation, ensure that the robotic arm is returned to its standard initial posture.

2.2 Basic control

Begin by selecting the Position Mode as indicated in 2.1 to activate the motion control mode of the robotic arm.

If you wish to return the robot arm to its initial position, simply click on the Go Home Position button located on the right side of the interface. Upon clicking, the robot arm will move back to the specified initial position.

2.2.1 Joint Control

Control Settings allows you set configurations of controlling. (Figure 7):

- Duration Time (s): This setting allows you to specify the target duration time for movements.
    - If the joint performance aligns with the time requirements, the movement will adhere to the specified time. However, if the joint performance falls short of meeting the time requirements, the joint movement will operate at the maximum performance of the joint.

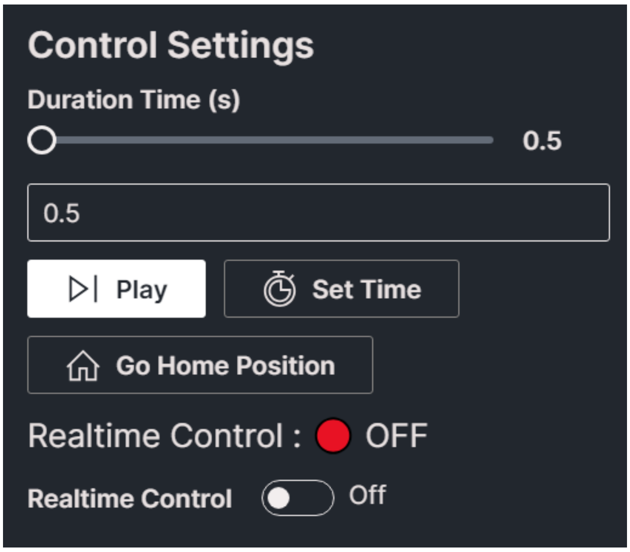


Figure 7

- Set Time button save changes of the input field.
- Play button allows you execute your command combination (multiple joint positions) immediately.
- Go Home Position button rotate every joint to zero degree (Zero Position).

Open the real-time control mode button and click Joint Control to switch to joint control mode (Figure 8):

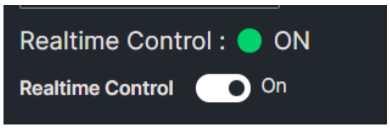
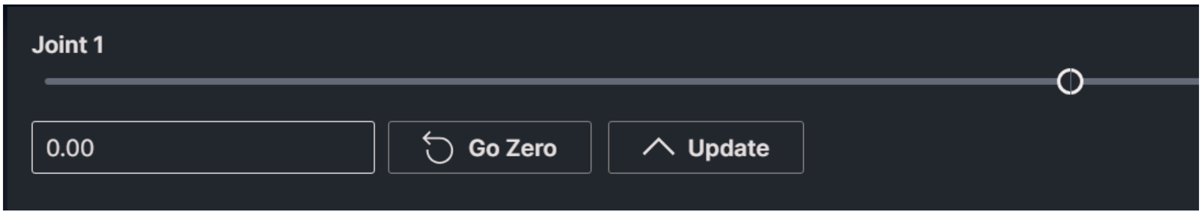
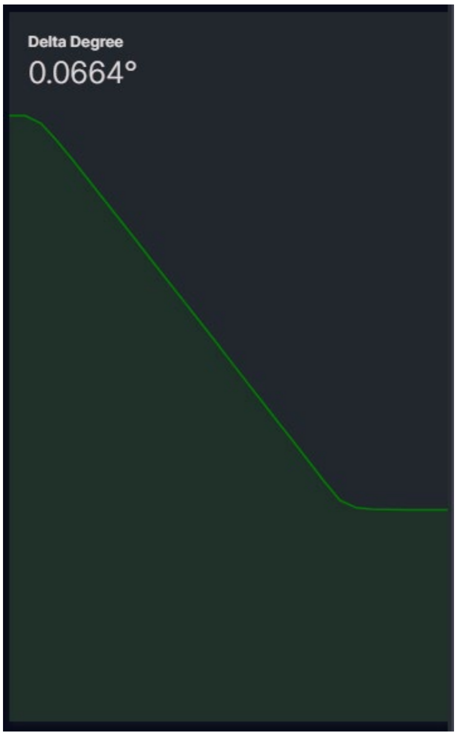


Figure 8

Congratulations! You're now ready to plan your joint movements!
Control joint planning by dragging the progress bar of each joint and inputting the desired angle. Please ensure that the robot arm has ample and safe working space.

Once the real-time control mode is activated, dragging the slider will prompt the specified joint to move according to your adjustments..





Once you've entered the specified joint angle, click the "Update" button to prompt the robot arm to execute the movement.

At the top of the joint control page, the real-time robot arm pose (xyz/rpy) will be displayed. On the left side, real-time joint angles will be shown in degrees.

To reset a specific joint angle to 0 after executing the movement, simply click the "Go Zero" button.

The "Delta Degree" indicates the variance between the actual angle and the target angle.

2.2.2 Cartesian Control

Open the real-time control mode button and click Cartesian Control to switch to Cartesian space control mode (Figure 9):

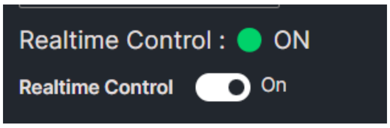


Figure 9

congratulations! Now you can do Cartesian space planning!
Control Cartesian space planning by adjusting the progress bars for x, y, z, and rpy inputs to specify the desired pose. Please ensure that the robot arm has adequate and safe working space available. Refer to Figure 10 for visual guidance.

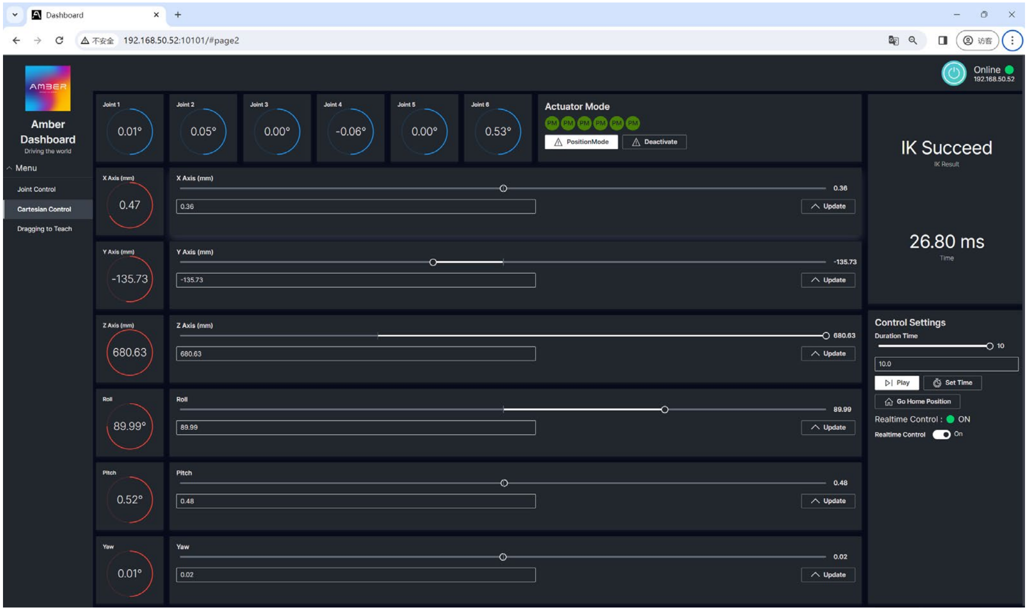


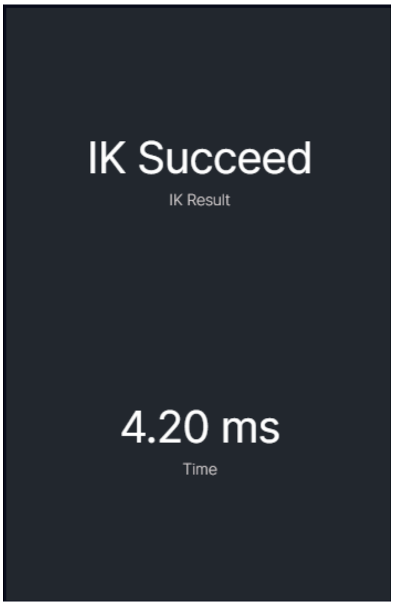
Figure 10

Upon enabling real-time control mode, dragging the progress bar will prompt the robot arm to mimic your adjustments.

After inputting the specified value, click the "Update" button to execute the movement by the robot arm.

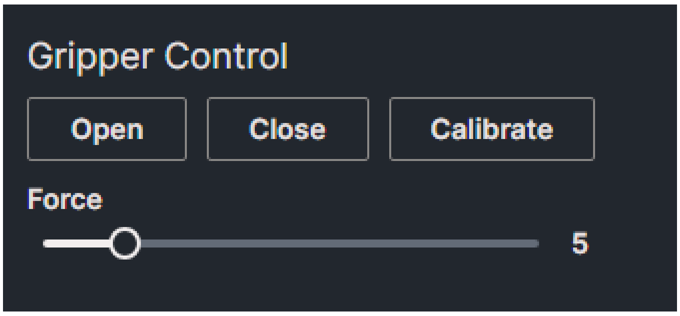
Real-time joint angles (unit: degrees) will be showcased at the top of the Cartesian space control page, while the real-time robot arm pose (xyz/rpy) will be displayed on the left.

The IK (Inverse Kinematics) status indicator showcases the Cartesian coordinates of the last request, signaling whether the target can be successfully reached and the time taken by the IK solver to achieve this.



2.2.3 Gripper Control

Gripper control is accessible through both Joint Control and Cartesian Control pages, conveniently located on the right side of the operator interface.

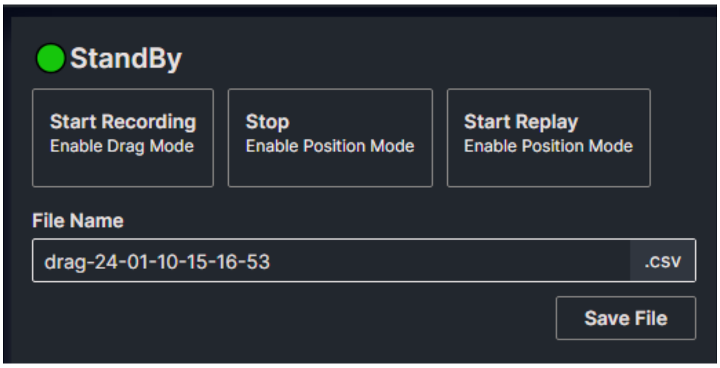


Following a power outage, gripper recalibration is necessary upon system reactivation. To initiate this process, simply click the "Calibrate" button on the right-hand side and patiently await a few seconds for the gripper to undergo calibration. It is crucial to note that if the gripper is in an open state prior to calibration, it will automatically close; therefore, any objects or materials between the jaws must be removed to avoid calibration failure.

Once the calibration is successfully completed, users can utilize the "Open" button to reposition the gripper in an open configuration. Conversely, the "Close" button is available to initiate the gripping action by closing the jaws.

For enhanced control over the gripping force, a force slider is provided. It allows users to adjust the force applied when the clamp jaw is closed. It's important to be aware that the force value is currently a reference without a specified unit.

2.2.4 Dragging to teach (Beta)



Click "Start Recording" to enter the drag-to-teach mode. The indicator above will display "Recording."

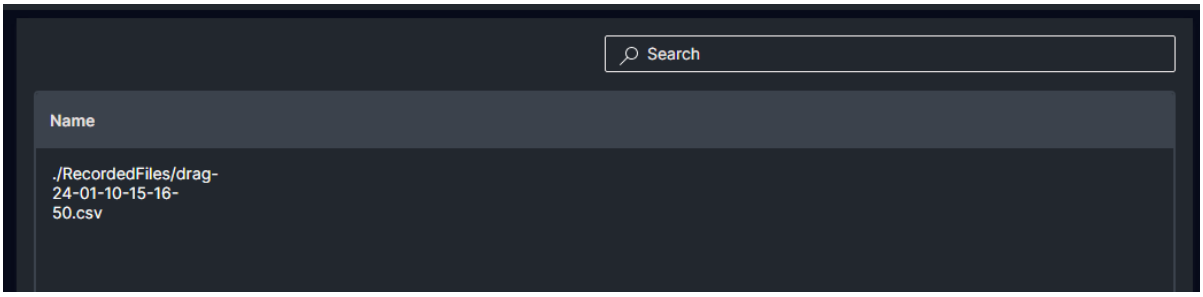
In this mode, the robotic arm can be manually dragged, and the trajectory of the movement will be recorded in real time.

Upon entering drag mode, the robotic arm will promptly relinquish maintaining its current position, potentially leading to a fall and causing injury. Before activating this mode, ensure that the robotic arm is returned to its standard initial posture.

Click the "Stop" button to exit the drag teaching mode, prompting the robot arm to return to its previous position.

Once the trajectory has been recorded, you have the option to save it as a file. Before saving, you can modify the file name as needed.

To replay the trajectory, click the "Start Replaying" button, and the robot arm will execute the recorded trajectory .
Trajectory replay can be interrupted by pressing the stop button



Navigate the file list on the right to select the desired trajectory for playback. You can utilize the search function by name to locate specific trajectories.

3. Trobleshooting

Note if 3 short beep + 1 long beep doesn't work, there may be a malfunction, the most likely of which is that the MiniHub is not connected.

In general, a power off and restart, following correct hardware connection, should resolve most issues.

However, for manual troubleshooting, follow the steps below.

3.1 Log in to the system

openssh-server has been installed on the industrial computer by default, use the following credentials to log in. (Or you can choose to plug in a keyboard, mouse and monitor)

```
Username: amber
Password: a
```

3.2 Kill dashboard

```
killall wave waved
```

(May need sudo)

3.3 Connect MiniHub

Plug out and plug in MiniHub

if using 6-axis Amber C1

```
cd /home/amber/amber_core_6
```

or if using 7-axis Amber L1/B1

```
cd /home/amber/amber_core_7
```

run

```
bash initCAN.sh
```

3.4 Boot Core Control System

```
nohup ./amber_core >core.log 2>&1 &
```

We currently require at least a LAN connection when the robotic arm is started to ensure you have the ability to handle unexpected situations.

3.5 Boot Web Dashboard

```
cd /home/amber/dashboard
source venv/bin/activate
nohup wave run app.py >/dev/null 2>&1 &
```

4. AMBER Robotic Arm application development & integration

4.1 Pre-installed scripts

These scripts will be run before leaving the factory to check the working condition of the robot arm. You can also do this and develop your own applications by referring to the script content.

We provide the following script in the /home/amber/ directory.

- **cmd_10_mode_ctrl.py**

  This feature recently went through a breaking update, and the documentation for it may be incorrect or incomplete, and we're working on fixing it.

  The purpose of this script is to start the robot arm and put it in position mode. Its function is equivalent to pressing the "position" button on the web dashboard.

  You can run it by using the following command.

```
python cmd_10_mode_ctrl.py
```

- **test.py**

  The purpose of this script is to command the robotic arm to cycle to -1 radians or +1 radians to confirm that the robotic arm is working as expected.

  You can run it by using the following command.

```
python test.py
```

4.2 AMBER Robotic arm API based on UDP Protocol

https://github.com/MrAsana/UDP-Protocol-API

4.3 Python examples for UDP Protocol

GitHub - MrAsana/Python_API: Control sample code of Python UDP API

4.4 C++ examples for UDP Protocol

GitHub - MrAsana/C_Plus_API: Control sample code of C++ UDP API

5. AMBER Robotics Github Project

https://github.com/MrAsana