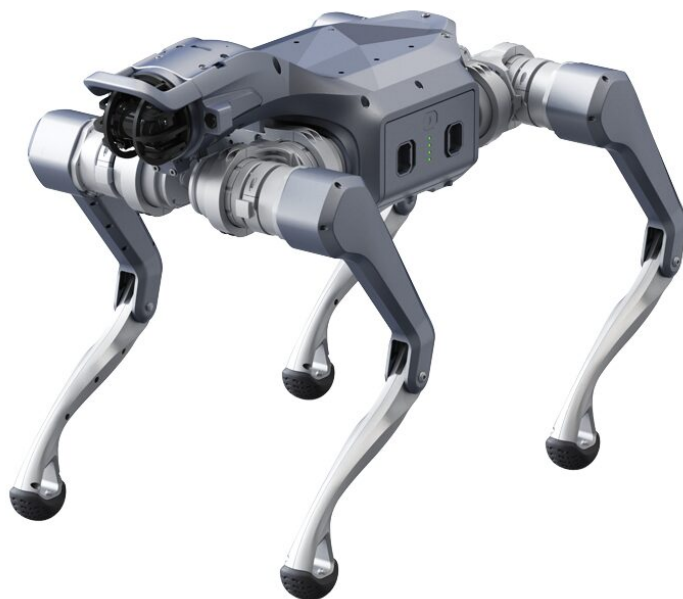


MYBOTSHOP

QUADRUPEd ROBOTICS

Unitree A2

User Manual



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1 Attention

Attention: Read this document carefully. In case of doubt, it is essential to consult specialists, experts, or the manufacturer (Unitree Robotics) or distributor (MYBOTSHOP / QUADRUPED Robotics) of the assemblies used. The robot must not be put into operation before clarification. Contact information is available in the Getting Help & RMA chapter.

Do not allow persons who are not familiar with robotics or these instructions to operate the robot. Robots are dangerous in the hands of untrained users.

Do not operate the robot if you are intoxicated, under the influence of drugs, or unable to concentrate. Familiarize yourself with the startup procedure and the emergency stop method (Quick Start chapter) before powering the robot on.

Caution: The A2 is a high-power industrial quadruped capable of rapid, forceful motion at up to 5 m/s. Maintain adequate clearance during operation, keep the emergency stop accessible at all times, and never allow untrained personnel to operate the robot.

2 Disclaimer

The A2 robot documented here is sold and supported by *MYBOTSHOP / QUADRUPED Robotics* as the German distributor for Unitree Robotics. Basic familiarity with Unitree's DDS-based control stack (and ROS 2, if using the ROS 2 bridge) is required to develop against the software covered in this manual.

The client acknowledges and agrees that any information or materials provided by MYBOTSHOP / QUADRUPED Robotics are for R&D and development purposes only. Any services are provided "AS IS" and without any representation or warranty of any kind, express or implied, including but not limited to any warranty of merchantability, fitness for a particular purpose, non-infringement, or any other warranty.

This product is intended for civilian use only. Users should avoid making dangerous modifications or using the robot in hazardous ways. Specification values summarised in this manual are drawn from Unitree's published material and may vary by firmware version, configuration, and operating conditions — always cross-reference the official Unitree A2 SDK Development Guide before development or deployment. For terms, policies and compliance with local laws and regulations, refer to the Unitree Robotics website and the RMA/support process in the Getting Help & RMA chapter.

MYBOTSHOP / QUADRUPED Robotics shall not be liable for any damages, including but not limited to direct, indirect, special, incidental, or consequential damages, arising out of or in connection with the use or inability to use the information or materials in this document. This limitation on liability shall apply regardless of the form of action, whether in contract, tort, or otherwise.

3 About the A2

Unitree A2



Unitree A2 Industrial Quadruped Robot

The Unitree A2 is an industrial-grade quadruped robot engineered for demanding field operations such as inspection, security patrol, mapping, and logistics. Built around twelve high-torque joint actuators, dual industrial LiDAR, and hot-swappable batteries for 24/7 duty cycles, the A2 combines rugged durability with the open control interfaces required for research, autonomy development, and commercial deployment.

Rugged Industrial Mobility

The A2 is built for the field. Twelve high-performance electric joint actuators deliver up to 180 N·m of torque, enabling a top speed of up to 5 m/s , a maximum step height of 300 mm , and slope traversal of up to $\pm 45^\circ$. An ingress-protected chassis (IP56 outer body, IP67 internal compartments) allows operation across an ambient range of -20°C to $+55^\circ\text{C}$, in dust, rain, and uneven terrain.

Continuous Operation and Heavy Payloads

Two 9,000 mAh hot-swappable batteries support uninterrupted, around-the-clock operation by allowing battery exchange without powering down. The A2 carries a 25 kg payload while walking and supports up to 100 kg in a stationary stance, providing ample capacity for sensor packages, manipulators, and mission equipment.



Unitree A2 autonomous inspection deployment

Autonomous inspection deployment

360° Perception

Dual industrial LiDAR units (front and rear) provide full 360° spatial awareness for mapping, obstacle avoidance, and autonomous navigation. An HD camera with an integrated front LED enables low-light operation, while proprioceptive sensors (joint encoders and an IMU) support stable closed-loop locomotion and state estimation.

Open Control and Developer-Friendly Design

The A2 exposes fully open, low-latency control interfaces over the official `unitree_sdk2` (C++) and `unitree_ros2` packages, communicating via DDS. It is suitable for:

- Autonomous inspection and security patrol
- SLAM, mapping, and outdoor navigation research
- Whole-body and locomotion control development
- Multi-robot and fleet coordination



Unitree A2 operating in the field

Note: For SDK setup, network configuration, and example commands, see the SDK Development section. The official developer reference is maintained by Unitree at the A2 SDK Development Guide .

4 Quick Start – Startup, E-Stop & Shutdown

Quick Start

Startup Procedure

Step 1: Pre-start Checks

Before powering on, place the A2 on a flat, stable surface with adequate clearance on all sides. Ensure the surrounding area is free of people and obstacles, and that the legs are arranged in a natural, untangled posture.

Warning: Keep all personnel clear of the robot during startup. The A2 is a high-power machine and may make sudden movements as it transitions between control states.

Step 2: Install the Batteries

Insert both battery packs into their compartments until each latch engages with a clear click. Confirm both packs are fully seated and secured. Do not force a pack — if it does not seat smoothly, remove it and check the orientation.

Step 3: Power On

Power on each battery using the standard Unitree sequence:

1. Briefly press the battery power button once.
2. Press and hold the button for more than 2 seconds to turn the battery on.

Wait approximately one minute for the robot to complete initialization and enter its idle/damping state.

Step 4: Stand and Operate

Once initialization completes, use the remote controller to bring the A2 to a standing posture, then switch into locomotion (walking) mode. Verify the robot is balancing stably before issuing movement commands or releasing any support.

Note: Exact controller key combinations depend on the firmware build shipped with your unit. Refer to the controller reference supplied with the robot and the official Unitree A2 documentation for the current key map.

Emergency Stop

If the A2 enters an abnormal or unsafe state, trigger the emergency stop — either via the physical E-stop button or the controller stop combination. The robot will enter a damping/protective mode

and lower itself toward the ground in a controlled manner.

Important: Always know the location of the emergency stop before operating the robot. Keep the external E-stop accessible throughout any field deployment.

Shutdown Procedure

1. Move the A2 to an open, level area with clearance behind it.
2. Command the robot into its resting/crouched posture using the controller.
3. Engage damping mode so the joints relax safely.
4. Briefly press each battery power button, then press and hold for more than 2 seconds to power down.

After shutdown, if the robot will be unused for an extended period, remove both battery packs for safe storage.

Attention: Keep hands and clothing clear of the leg joints during all posture transitions to avoid pinch injuries.

5 SDK Development – Network & Software Access

SDK Development

This section summarises how to set up and develop applications for the Unitree A2 using the official SDKs. It is based on Unitree's A2 SDK Development Guide and the public Unitree repositories. Always treat the official guide as the authoritative reference for your firmware version.

Overview

The A2 is controlled through Unitree's DDS-based communication stack. Two primary SDKs are available:

- `unitree_sdk2` — the C++ SDK for high- and low-level control, state subscription, and sensor access. Repository: `unitree_sdk2`.
- `unitree_ros2` — ROS 2 packages that bridge the same DDS interface into ROS 2 topics and messages. Repository: `unitree_ros2`.

All Unitree open-source SDKs are published under the Unitree Robotics GitHub organisation .

Requirements

Item	Requirement
Operating System	Ubuntu 20.04 LTS
Compiler	GCC 9.4.0 (C++17)
Build System	CMake 3.10+
Architecture	x86_64 or aarch64
Transport	DDS (CycloneDDS)

Installing Dependencies

Install the build toolchain and required libraries:

```
sudo apt update
sudo apt install -y cmake g++ build-essential \
    libyaml-cpp-dev libeigen3-dev libboost-all-dev \
    libspdlog-dev libfmt-dev
```

Building and Installing `unitree_sdk2`

Clone and build the C++ SDK:

```
git clone https://github.com/unitreerobotics/unitree_sdk2.git
cd unitree_sdk2
mkdir build && cd build
cmake ..
make
```

To install the SDK system-wide (recommended for use in your own CMake projects):

```
cd unitree_sdk2/build
cmake .. -DCMAKE_INSTALL_PREFIX=/opt/unitree_robotics
sudo make install
```

Network Configuration

The A2 communicates with a development PC over Gigabit Ethernet using DDS. Unitree robots use the 192.168.123.x subnet by convention. Configure your PC's wired interface to a static address on the same subnet (for example 192.168.123.222) and verify connectivity before running any example.

```
# Example: set a static IP on the wired interface (replace eth0 with your NIC)
sudo ip addr add 192.168.123.222/24 dev eth0
sudo ip link set eth0 up

# Confirm the robot is reachable
ping 192.168.123.<robot>
```

Important: The exact robot IP address and network setup are documented in the official A2 SDK Development Guide . Confirm the address for your unit before configuring your PC.

Specifying the Network Interface

unitree_sdk2 examples and applications must be told which network interface is connected to the robot. The interface name (for example eth0) is passed as a command-line argument when launching an example:

```
# Run a built example, passing the network interface name
./example_program eth0
```

In your own code, the interface is supplied when initialising the DDS channel factory:

```
#include <unitree/robot/channel/channel_factory.hpp>

int main(int argc, char** argv)
{
    // argv[1] is the network interface connected to the A2 (e.g. "eth0")
    unitree::robot::ChannelFactory::Instance()->Init(0, argv[1]);
    // ... create publishers / subscribers and control the robot ...
}
```

```
    return 0;  
}
```

ROS 2 Driver (unitree_ros2)

For ROS 2 integration, use `unitree_ros2`, which exposes the A2's DDS interface as ROS 2 topics. The package relies on a CycloneDDS RMW configured to bind to the network interface connected to the robot. After sourcing the workspace, set the DDS configuration and interface as described in the repository README, then launch the bridge.

```
git clone https://github.com/unitreerobotics/unitree_ros2.git  
# Build and source per the repository instructions, then configure  
# CYCLONEDDS_URI to bind the RMW to the robot-facing interface.
```

Note: ROS 2 distribution support and exact build steps are version-dependent. Follow the `unitree_ros2` README for the supported distribution and the current CycloneDDS configuration.

Safety When Developing

Warning: Custom control code can command the robot into unsafe states. Always test new control software with the robot safely supported or in a clear, open area, keep the emergency stop within reach, and validate joint commands against the documented limits before deployment.

Further Resources

- A2 SDK Development Guide (official)
- `unitree_sdk2` (C++ SDK)
- `unitree_ros2` (ROS 2 packages)
- Unitree Robotics on GitHub
- Unitree Document Center

6 Hardware Overview & Full Specification

Hardware



Unitree A2 Industrial Quadruped Robot

Component Overview

The Unitree A2 is a four-legged industrial robot composed of a sealed central body and four identical legs. Each leg provides three degrees of freedom — hip abduction/adduction, hip flexion/extension, and knee flexion — for a total of twelve actuated joints . The legs use high-torque electric joint actuators with integrated reduction and dual-encoder feedback for precise, dynamic locomotion across rough terrain.

The body houses the onboard compute, dual hot-swappable batteries, the IMU, and the perception payload (LiDAR and camera). External panels are sealed to IP56 , while internal compartments reach IP67 , allowing the robot to operate in dust, rain, and extreme temperatures.

Degrees of Freedom

Category	Specification
Total DOF	12
Per Leg DOF	3 (Hip Roll, Hip Pitch, Knee)
Legs	4

Joint Actuators

The A2 uses Unitree’s self-developed electric joint actuators, engineered for high torque density, thermal robustness, and precise closed-loop control. Each actuator integrates dual encoders, providing high-resolution position and velocity feedback required for dynamic gaits, balance recovery, and accurate state estimation.

Parameter	Specification
Actuator Type	High-performance electric (PMSM)
Peak Joint Torque	Up to 180 N·m
Feedback	Dual encoder (position + velocity)
Count	12 (3 × 4 legs)

Note: Joint ordering, limits, and reference frames used by the control SDK are defined in the official A2 SDK Development Guide . Always confirm joint indices against the SDK header definitions before sending low-level commands.

Perception



Unitree A2 dual LiDAR 360-degree perception

Dual LiDAR providing 360° spatial coverage

LiDAR

The A2 integrates dual industrial LiDAR units — one forward-facing and one rear-facing — providing combined 360° horizontal coverage . This configuration supports real-time point-cloud generation for SLAM, mapping, obstacle detection, and autonomous navigation in unstructured environments.

Camera

An HD camera with an integrated front LED light delivers visual perception for teleoperation, inspection imaging, and low-light navigation. The illuminator enables operation in dark indoor areas, tunnels, and night patrols.

Proprioception

An onboard IMU combined with the per-joint dual encoders provides the proprioceptive sensing required for balance, contact estimation, and stable locomotion control.

Onboard Computer

The A2 ships with an embedded octa-core CPU for motion control and standard autonomy workloads. For perception-heavy or AI inference tasks, an optional Intel Core i7 computing module can be fitted to provide additional processing headroom.

Parameter	Specification
Base Compute	Embedded octa-core CPU
Optional Compute	Intel Core i7 module
Networking	Gigabit Ethernet, USB-C, Wi-Fi 6, Bluetooth 5.2
Optional Networking	4G LTE, GPS

Important: For security reasons, change any default login credentials after first access and follow proper shutdown procedures before performing hardware or software modifications.

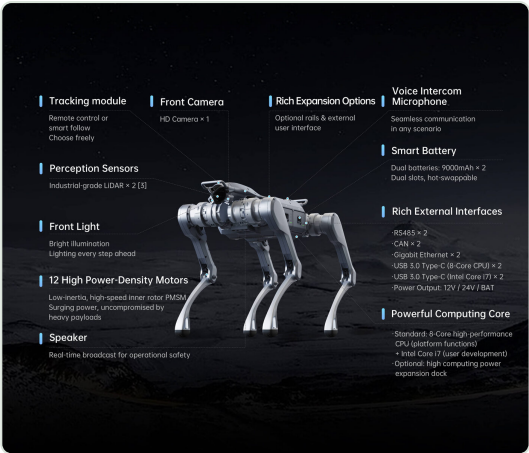
Power System

The A2 is powered by two 9,000 mAh batteries that support hot swapping , allowing one pack to be replaced while the other sustains the robot. This enables continuous, 24/7 operation in inspection and security deployments without a full power-down cycle.

Parameter	Specification
Battery Configuration	Dual 9,000 mAh packs
Hot Swap	Supported
Runtime (unloaded)	~5 hours
Runtime (full load)	~3 hours

Warning: Always verify that each battery is fully latched before operation. If the A2 will be stored for an extended period, remove the battery packs. Handle batteries according to lithium-battery safety guidelines.

Specifications



Unitree A2 parameter specification diagram

Official Unitree A2 parameter diagram

Physical & Mechanical

Parameter	Specification
Dimensions (L × W × H, standing)	720 × 550 × 820 mm
Weight (with battery)	~37 kg
Weight (without battery)	~31 kg
Total Degrees of Freedom	12 (3 per leg)
Joint Actuators	12 high-performance electric joints
Peak Joint Torque	Up to 180 N·m
Ingress Protection	IP56 (outer body) / IP67 (internal)
Operating Temperature	-20 °C to +55 °C

Mobility & Performance

Parameter	Specification
Maximum Speed	Up to 5 m/s
Maximum Step Height	300 mm
Maximum Slope	±45°
Payload (walking)	25 kg
Payload (stationary)	Up to 100 kg
Operational Range (unloaded)	~20 km
Operational Range (loaded)	~12.5 km

Power & Endurance

Parameter	Specification
Battery	Dual 9,000 mAh hot-swappable packs
Runtime (unloaded)	~5 hours
Runtime (full load)	~3 hours
Hot Swap	Yes (24/7 operation supported)

Sensing & Compute

Parameter	Specification
LiDAR	Dual industrial LiDAR (front + rear, 360°)
Camera	HD camera with front LED illumination
Proprioception	Joint encoders + IMU
Onboard Compute	Embedded octa-core CPU
Optional Compute	Intel Core i7 module

Connectivity

Interface	Specification
Wireless	Wi-Fi 6 + Bluetooth 5.2
Wired	Gigabit Ethernet (RJ45) + USB-C
Optional	4G LTE + GPS

Warning: Safety Notice: The A2 is a high-power industrial robot capable of rapid, forceful motion. Maintain adequate clearance during operation, keep the emergency stop accessible, and never allow untrained personnel to operate the robot. Civilian Use Only: This product is intended exclusively for lawful civilian applications. Hazardous modifications and deployment in dangerous contexts are strictly prohibited.

Note: Specification Source: Values summarised here are drawn from Unitree's published material and may vary by firmware version, configuration, and operating conditions. Always cross-reference the official Unitree A2 SDK Development Guide before development or deployment.



Unitree A2 in operation

7 Getting Help & RMA

RMA / Support

How to Raise a Return Merchandise Authorization (RMA) Case

At QUADRUPED Robotics, we are committed to providing excellent support to ensure your issues are resolved promptly. If you encounter any problems with our products, please follow the steps below to raise a Return Merchandise Authorization (RMA) case:

Step 1: Open a Topic in Our Forum

1. Visit MYBOTSHOP Forum .
2. Open a new topic describing your issue in detail. Our support team and community members will attempt to assist you in resolving the problem remotely.

Step 2: Contact Support for RMA Number

If the issue cannot be resolved remotely through our forum:

1. Email us at support @ quadruped . de .
2. Provide a detailed description of the issue and include any troubleshooting steps already taken.
3. Our support team will evaluate your case and, if necessary, issue a RMA number along with a return address or a shipping label.

Important Shipping Information

Note: Please note: All goods must be sent back to the following address: QUADRUPED Robotics GmbH c / o MYBOTSHOP GmbH Willy - Messerschmitt - Strasse 12 50126 Bergheim Germany Do not ship goods without obtaining a RMA number. Parcels sent without a RMA number will be declined and returned to the sender. Do not ship goods to QUADRUPED Robotics GmbH Office in Leverkusen!

Help Resources

In case of any issues, help can be taken from any of the following forums/resources:

1. MYBOTSHOP Forum : The forum is actively monitored by support teams at MYBOTSHOP GmbH .
2. Github Issues : Issues can be reported in the repository.
3. Online QA Sites: Questions can be asked on any of the QA sites like StackOverflow and Answers ROS .

8 Getting Involved & FAQ

Getting Involved

The software provided are Opensource, so contributions from community are welcome on our Github repository

Frequently Asked Questions

(Coming Soon)