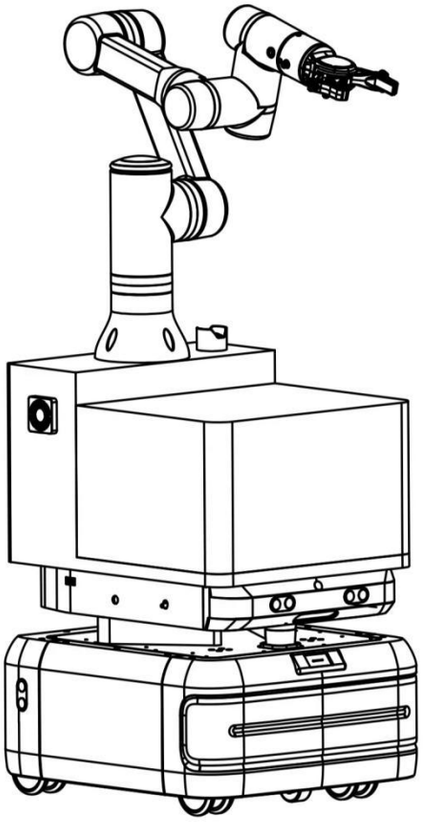
Shanghai Lebai Robotics Co., Ltd.

LM3UP Composite Robot Brief Manual



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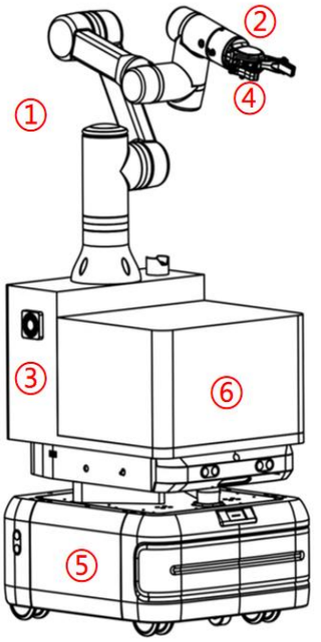
I. Product Overview

The LM3UP Composite Robot is a multifunctional automation solution designed for industrial automation, educational research and development, and service fields. It integrates the flexibility of the Lebai Robot Arm LM3, the mobility of the Yunji UP mobile chassis, the powerful computing capabilities of the RK3588S2 main control module, and the precise vision recognition of the ORBBEC RGBD vision camera. Additionally, it is equipped with a Surface Go programming device, providing wireless programming and control, enhancing the flexibility and safety of on-site programming.

1. System Composition



① Lebai LM3 Collaborative Robot Arm

② Lebai LMG-90 Gripper

③ Composite Robot Control Box (Main Control Module)

④ RGB Camera/Orbbtec RGBD Vision Camera, etc. (Optional)

⑤ Yunji UP Mobile Chassis

⑥ Storage Cabinet

⑦ Surface Go 4 Programming Device (Optional)

2. Product Features

① **Lebai Robot Arm LM3**

- Features: Lightweight design, high load-to-weight ratio, easy programming and deployment.
- Technical Specifications: 6-axis freedom, working radius 638mm, maximum load 3kg.

② **Lebai LMG-90 Gripper**

- Features: Two-finger design, adjustable gripping force, suitable for various grasping tasks.
- Technical Specifications: Stroke 10-90mm, gripping force 10-35N adjustable.

③ **Main Control Module RK3588S2**

- Features: High-performance computing capabilities, rich interfaces, supports a variety of expansion applications.
- Technical Specifications: Octa-core CPU with four A76 + four A55 cores, 6T computing power NPU.

④ **Vision Camera**

- Features: Compact and easy to install, plug-and-play high-performance interface, supports mainstream multi-operating systems including Windows/Linux/Android/Mac-OS.
- Technical Specifications: UVC USB Camera 720P 90-degree distortion-free lens.

Optional Vision Camera

- Features: Provides high-precision 3D vision recognition, supports various vision applications.
- Technical Specifications: RGBD ORBBEC Deeyea / Daibai / Gemini Pro, suitable for vision recognition in complex environments.
- Wireless Vision Module Luban Cat 0wifi

⑤ Yunji UP Mobile Chassis

- Features: Supports SLAM navigation, capable of autonomous movement in complex environments.
- Technical Specifications: Equipped with Luban Cat 4 RK3588S2 main control module, with 4G + SD32G storage.

⑥ Storage Cabinet

- Features: Can be used to store small tools or for module expansion, can also be modified into a mechanical arm transfer work platform.

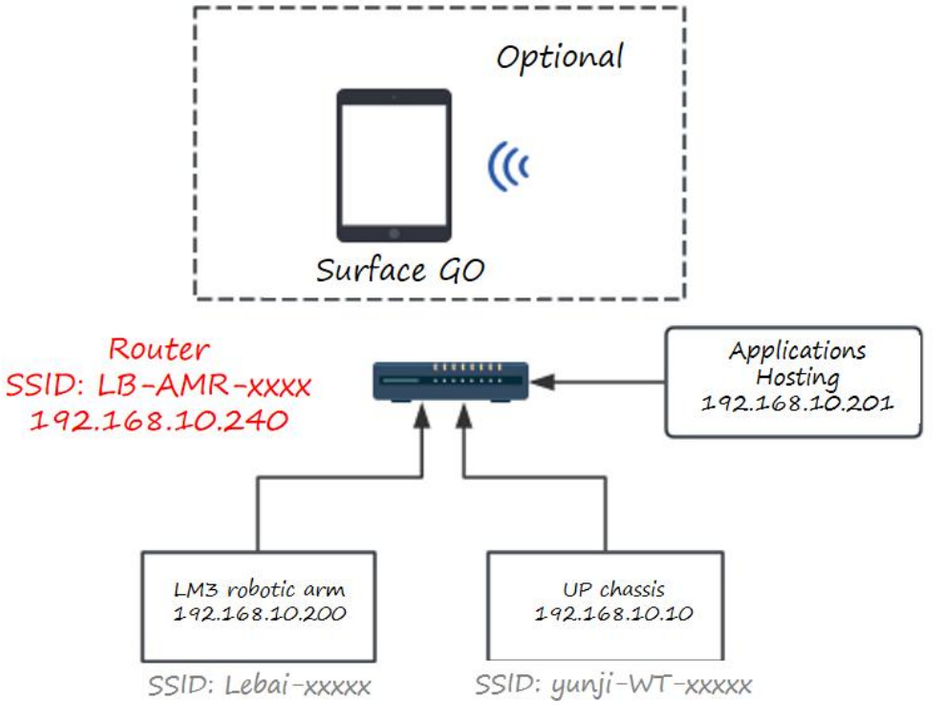
⑦ Optional User Programming Equipment

- Device: Surface Go, equipped with a handheld anti-drop protective case.
- Function: Realizes wireless programming and control of the composite robot, enhancing the flexibility and safety of on-site programming.

3. System Communication Diagram

(Note: For detailed communication settings, please refer to the "Composite Robot Software Installation Guide (Wired Version)" for configuration)

The system communication diagram describes the network connection method between each component, including IP addresses and port configurations.



- Router SSID: LB-AMR-xxxx Default Password: lebairobot
  Router Management Address: 192.168.10.240
- Lebai Robotic Arm: 192.168.10.200
  Wifi Access SSID: Lebai-XXXXX Default Password: 88888888
  Default Access Address: 10.20.17.1
- UP Chassis: 192.168.10.10
  Wifi Access SSID: yunji-WT-xxxxx Default Password: yunjiwater
  Default Access Address: 192.168.10.10:9001
- RK3588S2 & Luban Cat: 192.168.10.201

If the user's computer is connected to the router and wants to access the internet through the router, the computer's gateway should be set to the router's IP (192.168.10.240). If it is only used for internal network debugging, no settings are required.

4. Product Parameters

1) Whole Machine Parameters

Power requirement	AC220V/50Hz (single-phase three wire)
Lithium battery	DC24V 16AH
Lithium battery charging time	About 3.5 hours in shutdown state; Approximately 5.5 hours in standby mode;
Working environment temperature	-10℃~+40℃
Relative humidity of working environment	≤85%（25℃）
Size (standby mode)	535(L)*450(W)*1200(H)mm
Security protection	Laser scanning obstacle avoidance, visual obstacle avoidance, force sensor, emergency stop
External interface	Network port, HDMI, USB port

2) Lebai LM3 Collaborative Robotic Arm

Degrees of freedom	6-axis
Payload	3kg
Working radius	638mm
Arm Weight	9.5kg
Protection level	IP54
End I/O	DI*2/DO*2

3) Yunji UP Mobile Chassis

Basic parameters	Chassis weight	60 kg
Sensor	Overhead camera	1 pcs
	Looking-up camera	1 pcs
	Ultrasound sensor	4 sets
	Laser	20M Laser
	RGB camera	1 set for each front and rear
	Infrared ID	1set
	Infrared ranging	1set
Mobile	The height of the mobile chassis above the ground	40mm
	Maximum through slope (excluding warehouse rack)	Load 20KG : 12°
	Maximum crossing height (excluding warehouse rack)	Load 50KG 20mm
	Maximum clearance distance	40mm
	Minimum passing width	600mm
	Minimum obstacle avoidance height	50mm
	Maximum obstacle avoidance height	1000mm
	Maximum speed	1.5m/s
	Normal speed	(0.8-1.4) m/s
	action	Forward/backward/rotation
	positioning accuracy	5-15cm 8°
	Precision positioning accuracy	2cm 3°
Map	Intelligent mapping	support
	Autonomous positioning	support
	Laser positioning accuracy	2cm
	Map modification and annotation	Support modification and point naming
	Multi map storage and switching	support
	Multi machine obstacle avoidance	support

	Semantic map	Narrow area/Exclusive area/Falling area, etc
Power supply	Battery type	Lithium iron phosphate battery
	Charging voltage	28.4V
	Input voltage of charging station	220VAC
	Charging time	≤ 4 hours
	Battery life	Hard ground>12 hours thick blanket>6 hours
	Rated power	50W
	Maximum power consumption	88W
	Battery capacity	16Ah
	Rated current	3A
Operating environment	Workplace	Indoor halls or lobbies with flat floors
	working temperature	0~50℃
	Working humidity	10~70%
Voice	Horn	Dual channel 3 Ω 5W
	Mobile Music	Support
Communication	4G router	Support mobile
	WiFi 2.4G	Support
Operation method	WeChat Mini Program	
Interface support	Provide cloud based Open API interface	

II. Easy-to-Use Introduction

1. Safety Guide

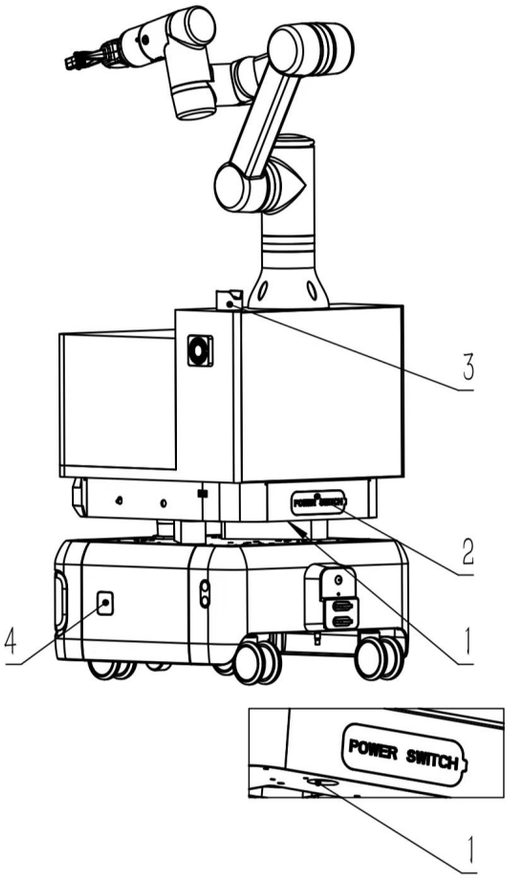


Figure 1: LM3UP robot

- **Emergency Stop Switch**: As shown in the figure, use the emergency stop switch (emergency stop switch as shown in position 3 and 4, The position 3's button stops all movements of the robot during motion, The position 4's button stops only the UP chassis movement during motion).
- **Power Management**: Follow the correct power management procedures during maintenance and operation.
- **Maintenance Operations**: Disconnect the power supply (power supply as shown in figure 1) before maintenance and wait for all movements to stop.

2. Quick Start Guide

(1) Power On/Off Operation

- **Power On**: Turn on the main power switch (The position 2 as shown in figure 1), press the power button (The position 1 as shown in figure 1), and hear two short and one long beep to start the power on.
  (Note: The chassis green light flashing continuously indicates the power-on state, and the chassis indicator light being white and constant, along with the robot arm indicator light being white and constant, completes the power on.)
- **Power Off**: Long press the power button (The position 1 as shown in figure 1) and hear seven short and one long beep for power off, then close the main power switch (The position 2 as shown in figure 1).

(2) End-of-Arm Tool Installation

- Strictly follow the power-off steps to close the main power and disconnect all connections.
- Install the Lebai LMG-90 gripper to the end of the robot arm.
- Check that all connections are secure, then reconnect the power.

(3) Charging Method

- Connect the mobile chassis to the charging pile.
- The white indicator light flashing indicates charging, and the indicator light will remain constant after charging is complete.

Browsers recommended for use are Chrome or Edge.

(4) Mapping

- Enter 192.168.10.10:9001 in the browser to access the chassis tool page.
- Select automatic scanning for mapping and save the map.
- Switch to soft emergency stop mode, push the robot to the desired position, set the current marker position, and enter the point name.
- Enter the charging pile position.
- Test the function to ensure the chassis operates correctly.

(5) Robotic Arm

- Enter 192.168.10.200 in the browser to access the LM3 robot arm page.
- Password: 1111
- Go to the scenario case, modify the marker position name, and run the case.

(6) Hand-Eye Calibration

- Install the gripper camera.
- Prepare the vision calibration board.
- Refer to Lebai hand-eye calibration.

(7) Tag Positioning and Grasping, detailed operations can be found in the "RK Camera User Guide"

- Prepare the tags, pay attention to size and direction.
- Drag the arm to observe the tag.
- Enter the offset calibration program, drag the arm to teach the calibration tag offset value.
- Record the offset value and copy it to the system parameter lua, then rerun the system parameter.
- Enter the grasping program to grasp the object.

III. Software Development Materials

1. Robotic Arm Software API Reference

- **LM3 Help**:
  https://help.lebai.ltd/
- **LM3 Scenario Programming Lua Functions**:
  https://help.lebai.ltd/api/
- **Lebai SDK Programming**:
  https://help.lebai.ltd/program/python.html#lebai-sdk
  https://github.com/lebai-robotics/lebai-sdk

2. Chassis API Documentation:

- **Mobile Platform Manual:**
  http://waterdocs.pages.yunjichina.com.cn/user_manual/
- **Mobile Platform API:**
  http://waterdocs.pages.yunjichina.com.cn/user_manual/exports/water_api.html

IV. Maintenance and Troubleshooting

- **Daily Maintenance**: Clean, check connections, and tighten any loose screws.
- **Troubleshooting**: For detailed troubleshooting, refer to the maintenance manual in the attachment.
- **Installation and Maintenance**: See the composite robot hardware installation steps for details.
- **Roboic arm:** Connects to the mobile chassis through a quick installation interface, regularly check joints and cables.
- **Gripper**: Installed at the end of the robot arm via a standard interface, regularly check gripping force and stroke.
- **Mobile Chassis**: Connected to the robot arm via a standard interface, check tire wear and maintain regularly.
- **Main Control Module**：Installed inside the control box of the mobile chassis, keep the inside of the control box clean.
- **Vision Camera**：Installed on the robot arm or mobile chassis, regularly clean the lens and check the connection cables.

V. Technical Support and After-Sales Service

- **Manufacturer**: Shanghai Lebai Robotics Co., Ltd.
- **Service Support**: Provides online technical support (free of charge) and on-site service (for a fee).
- **Warranty Policy**: Please refer to the product warranty card.