

# AI-Starter

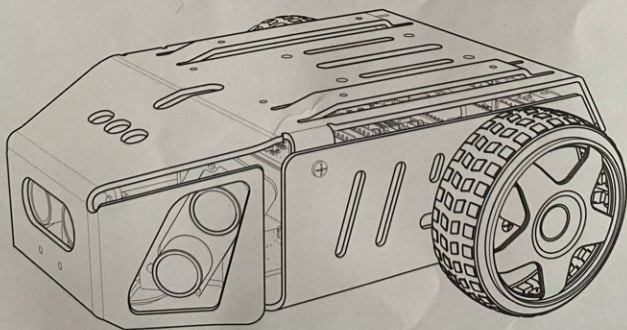
## User Guide

### 用户手册




AI-Starter是专为学习人工智能而打造的入门级教育机器人平台。AI-Starter兼容Arduino主板, 具备丰富的传感器模块, 可实现巡线、避障等趣味性十足的功能, 寓教于乐, 增强孩子学习机器人的兴趣。AI-Starter支持图形化编程, 通过简单的拖拽就能轻松学习编程知识, 锻炼逻辑思维能力, 培养孩子成为人工智能时代的原住民。

*AI-Starter is an entry-level educational platform for students to learn robotics and AI. Compatible with Arduino, AI-Starter has several sensors to realize functions such as following lines, avoiding obstacles autonomously and more, which is attractive for kids to learn about robotics. Featured with visual programming language, AI-Starter can help kids learn programming easily and quickly, and improve their understanding of artificial intelligence, creativity, innovation, and more.*

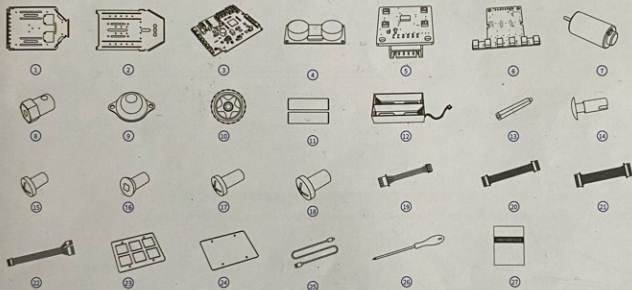
- 图形化编程, 轻松直观学习编程  
*Learn Programming Intuitively and Simply by Drag and Drop*
- 兼容Arduino, 丰富的课程资源  
*Compatible with Arduino, Share Abundant Curriculum Resources*
- 不同传感器模块, 实现多种趣味玩法  
*Different Sensors Give More Fun Functions*
- 多种通信方式, 自由丰富拓展  
*Multiple Connection Ways, Develop More Applications Freely*
- 可充电电池, 轻松使用管理  
*Rechargeable Battery Make Your Robot Easy to Use*



# 1. 注意事项 Safety Precautions

-  请务必按照电池盒正负极提示安装电池; 仅支持18650型号的可充电锂电池。  
When putting the batteries inside, please make sure the polarity is not reversed. Only the Li-ion rechargeable battery of 18650 type is supported.
-  用户需自行组装AI- Starter; 组装时请勿用力拧紧螺丝, 以防滑丝。  
Users need to assemble the AI- Starter by themselves. Please do not tighten screws hard when assembling it, to avoid the threads stripping.
-  AI- Starter使用过程中需时刻监控其运行状态, 以防电机长时间堵转, 导致AI- Starter主控板和电机损坏。  
Please keep an eye on the AI- Starter when it works, to avoid motor stalling for a long time, which could damage the control board and motor of the AI- Starter.

# 2. 零件清单 Parts List



- |  |  |
|--|--|
| ① 底盘 / Chassis X 1                                       | ⑮ M3*5 圆头十字螺丝 / M3*5 Cross Round Head Screw x 30 |
| ② 外壳 / Shell X 1   | ⑯ M3*5 沉头十字螺丝 / M3*5 Cross Countersunk Screw x 4 |
| ③ DoDuo Mega 2560 X 1                                    | ⑰ M3*6 圆头十字螺丝 / M3*6 Cross Round Head Screw x 6  |
| ④ 超声波传感器 / Ultrasonic Sensor X 3                         | ⑱ M4*6 圆头十字螺丝 / M4*6 Cross Round Head Screw x 3  |
| ⑤ 颜色传感器 / Color Sensor X 2                               | ⑲ 4PIN超声波连接线 / 4PIN Ultrasonic Sensor Cable x 3  |
| ⑥ 红外巡线传感器 / Infrared Sensor X 1                          | ⑳ 6PIN颜色传感器连接线 / 6PIN Color Sensor Cable x 2     |
| ⑦ 直流减速电机 (带编码器) / DC Gear Motor (with Encoder) X 2       | ㉑ 8PIN追踪模块连接线 / 8PIN Tracking Module Cable x 1   |
| ⑧ 联轴器 / Coupling X 2                                     | ㉒ 6PIN电机连接线 / 6PIN Motor Cable x 2               |
| ⑨ 万向轮 / Universal Wheel X 1                              | ㉓ 亚克力板A / Acrylic Plate A X 1                    |
| ⑩ 轮胎 / Tire X 2  | ㉔ 亚克力板B / Acrylic Plate B X 1                    |
| ⑪ 18650 可充电锂电池 / 18650 Li-ion Battery x 2 (Not included) | ㉕ USB连接线 / USB Cable X 1                         |
| ⑫ 18650 电池盒 / Battery Holder x 1                         | ㉖ 十字螺丝刀 / Cross Screwdriver X 1                  |
| ⑬ 铜螺栓 / Brass Stud M3*32 x 3 x 4                         | ㉗ 用户手册 / User Guide X 1                          |
| ⑭ R2048 尼龙铆钉 / Nylon Rivet x 10                          |  |

- 超声波传感器: 通过超声波测量前方 30mm~1000mm 范围内障碍物的距离。  
Ultrasonic Sensor: Detect the obstacle ranging from 30mm to 1000mm via ultrasound.
- 颜色传感器: 通过颜色滤波器识别场地中的颜色, 使AI- Starter根据不同的颜色执行不同的任务。  
Color Sensor: Identify the color in the field via color filter to execute different tasks.
- 红外巡线传感器: 通过红外对管来识别黑线, 以实现自动巡线行驶。  
Infrared Sensor: Identify the black line via infrared photomultiplier tube to realize auto-tracking.

### 3. 技术参数

#### Technical Parameters

工作电压: 7.4V  
Operating Voltage: 7.4V

主控板: DuDuino Mega2560 (兼容 Arduino Mega2560)  
Control Board: DuDuino Mega2560 (Compatible with Arduino Mega2560)

最大负载: 500g  
Maximum Load: 500g

轮胎直径: 67mm  
Tire Diameter: 67mm

工作环境: 0°C~40°C  
Operating Environment: 0°C~40°C

编程软件: Arduino IDE or Mixly, DobotBlock  
Programming Software: Arduino IDE or Mixly, DobotBlock

通信方式: USB 通信 / 串口通信  
Communication Interface: USB communication / Serial communication

拓展接口: 4Pin通用I/O接口 x 2  
Expansion Interface: 4Pin general I/O interface x 2

传感器: 超声波传感器 x 3 / 颜色传感器 x 2 / 红外巡线传感器 /  
地磁传感器 x 1 / 光敏传感器 x 1  
Sensor: Ultrasonic Sensor X 3 / Color Sensor X 2 / Infrared  
Sensor / Geomagnetic Sensor X 1 / Light Sensor X 1

减速比: 48:1  
Reduction ratio: 48:1

电压: 7V  
Voltage: 7V

空载电流: 150mA  
No-load current: 150mA

编码器分辨率: 585pulse/r  
Encoder resolution ratio: 585pulse/r

堵转电流: 700mA  
Stall current: 700mA

最大转速: 200r/m  
Maximum rotate speed: 200r/m

微处理器: ATmega2560  
MPU: ATmega2560

电池: 18650可充电锂电池  
Battery: 18650Li-ion rechargeable battery

超声波可测范围: 30mm-1000mm  
Ultrasonic Measurement Range: 30mm-1000mm

AI-Starter尺寸: 195mmx172mmx79mm  
Size: 195mmx172mmx79mm

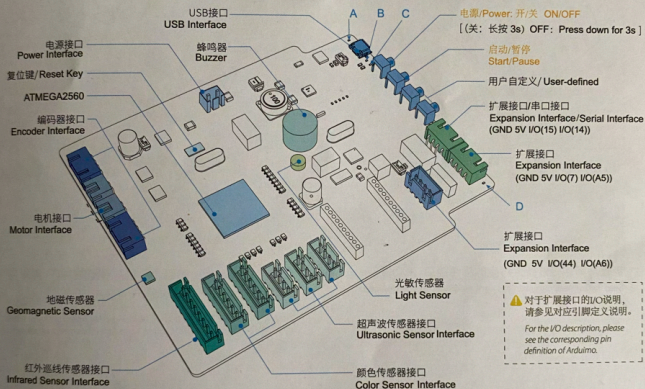
AI-Starter重量: 810g  
Weight: 810g



## 4. 接口说明 Interface Description

LED 指示灯 / LED Indicators: A、B、C、D

序号/NO.	A	B	C	D
颜色/Color	蓝色/Blue	红色/Red	红色/Red	蓝色/Blue
状态/Status	用户自定义 User-defined	开: 充电中 关: 未充电 ON: Charging OFF: Uncharged	开: 低电量 关: 正常 ON: Low Battery OFF: Normal	用户自定义 User-defined



## 5. 快速装配

### Quick Assembly

步骤1: 分别采用两个R2048尼龙铆钉将三个超声波传感器固定在小车前方(只在对角固定), 如图1和图2所示。

Step 1. Fix the three ultrasonic sensors on the AI-Starter with two R2048 nylon rivets respectively (fix diagonally), as shown in Figure 1 and Figure 2.

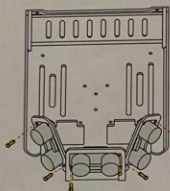


图1 超声波传感器安装位置  
Figure1 The Location of Ultrasonic Sensors



固定时请将正前方的超声波传感器连接器朝上其余两个超声波传感器的连接器朝下。  
Please make the connector of the ultrasonic sensor in the front of the AI-Starter upward and the other two beside downward when fixing.

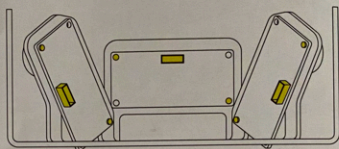


图2 螺丝固定位置  
Figure 2 The Fixed Position with Screws

步骤2: 采用M3\*5 圆头十字螺丝将颜色传感器和红外巡线传感器固定在小车底盘, 如图3所示。

Step 2. Fix sensors on the chassis of the AI-Starter with M3\*5 crossround head screws, as shown in Figure 3.

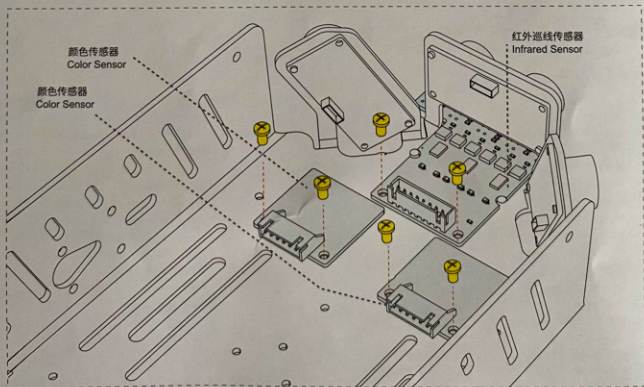


图3 传感器安装  
Figure 3 Sensor Installation

步骤3: 采用两个M3\*5沉头十字螺丝将电池盒固定在小车底盘, 并将电池装入电池盒, 如图4和图5所示。

Step 3. Mount the battery holder with M3\*5 cross countersunk screws and put the batteries inside, as shown in Figure 4 and Figure 5.

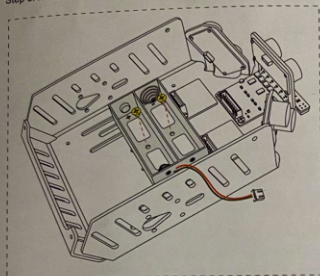


图4 电池盒安装  
Figure 4 Battery Holder Installation

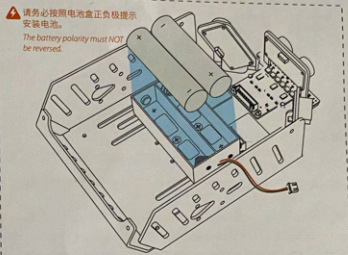


图5 电池极性提示  
Figure 5 The Polarity of Battery

步骤4: 采用M3\*5和M4\*6圆头十字螺丝将电机、联轴器和轮胎顺序固定在小车两侧, 如图6所示。

Step 4. Fix a motor, coupling, and tire at each side of the AI-Starter in sequence with M3\*5 and M4\*6 cross round head screws, as shown in Figure 6.

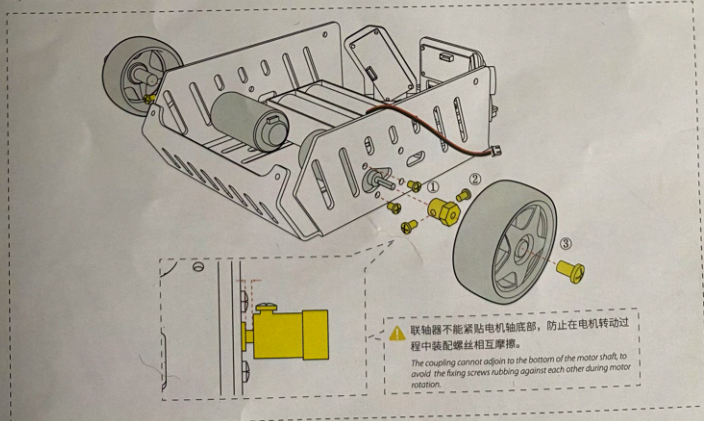


图6 电机, 联轴器和轮胎安装  
Figure 6 Motor, Coupling and Tire Installation



步骤5: 采用两个M3\*5圆头十字螺丝将万向轮固定在底盘背部, 如图7所示。

Step 5. Fix the universal wheel on the back of the chassis with two M3\*5 cross round head screws, as shown in Figure 7.

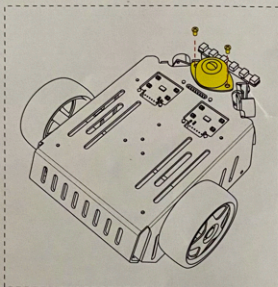


图7 万向轮安装  
Figure 7 Universal Wheel Installation

步骤6: 将四个M3\*32+4的铜螺栓柱固定在小车底盘, 如图8所示。

Step 6. Fix the four M3\*32+4 brass studs on the chassis of the AI-Starter, as shown in Figure 8.

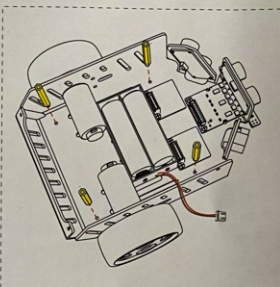


图8 铜螺栓柱安装  
Figure 8 Brass Stud Installation

步骤7: 将连接线接入对应的组件接口, 如图9所示。

Step 7. Connect cables to the right interfaces in the sub-units, as shown in Figure 9.

▲ 接入连接线后将连接线并拢向车头一侧, 以便安装主控板。  
Please arrange the connecting cables in the front of the AI-Starter after connecting.

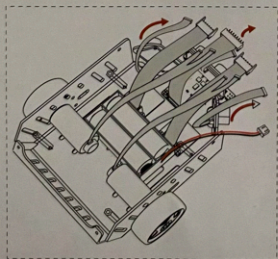


图9 线缆连接  
Figure 9 Connect Cables

步骤8: 将主控板上的四个孔位与铜螺栓柱对齐, 并采用四个M3\*5圆头十字螺丝固定, 如图10所示。

Step 8. Align the four hole sites of the control board with the brass studs and fix with four M3\*5 cross round head screws, as shown in Figure 10.

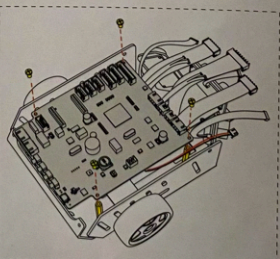


图10 主控板安装  
Figure 10 Control Board Installation

步骤9: 将连接线连接至主控板上对应的接口上, 如图11所示。

Step 9. Connect cables to the right interfaces on the control board, as shown in Figure 11.

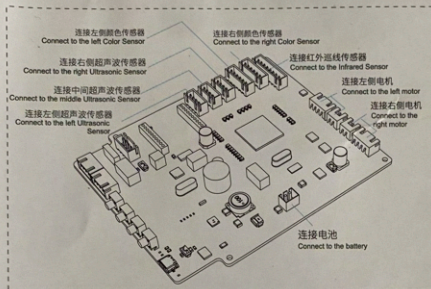


图11 主控板连接  
Figure11 Connect to the Control Board

步骤10: 采用四个M3\*5圆头十字螺丝将外壳固定, 如图12所示。

Step 10. Fix the AI-Starter shell with four M3\*5 cross round head screws, as shown in Figure 12.

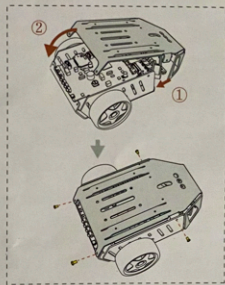


图12 外壳安装  
Figure12 Fix the AI-Starter Shell

步骤11: (可选) 采用四个M3\*6圆头十字螺丝将两个亚克力板固定在小车顶部, 如图13所示。

Step 11. (Optional) Fix the two acrylic plates at the top of the AI-Starter with four M3\*6 cross round head screws, as shown in Figure 13.

配合Dobot 魔术师机械臂使用时, 需安装亚克力板, 用于物流运输。安装前请撕下亚克力板上的保护膜。

Please fix the acrylic plates on AI-Starter for logistics transportation when used with Dobot Magician. Before fixing, please remove the protection films.

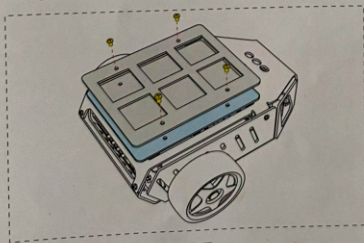


图13 螺丝固定位置  
Figure 13 The Fixed Position with Screws

步骤12: 完成安装。

Step 12. Done.

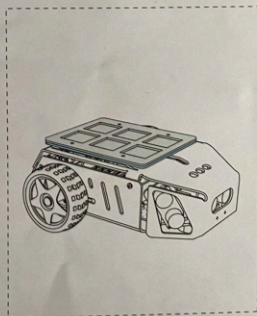


图14 整机模型  
Figure 14 Integral Model