Deep | Link

V 1.0.5

Smart Teach Tool URCap Manual

Deep | Link
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Copyright

Version:	V 1.0.4-Build006
Date:	2022-June-15
Language:	English and Chinese

******English Documentation **********

1. Brief Introduction

This URCap provides an add-in software to facilitate teaching with UR robot, it provides **ergonomic mechanical design** which makes the product very comfortable to use with, it implements a **freedrive button** on cobot tool flange, so the field user will feel convenient to drag cobot arm to desired position, it also has implemented extra two button for inserting taught waypoint in **MoveL, MoveJ, Move P, as well as MoveC**. In addition, it provides a **programmable LED band** for indicating program state. We believe this feature would be much useful when single operator is occupying several cobots and he can identify each cobot task progress with help of the LED signalization. To follow with Deep-Link's design DNA, it is a lean design to **re-using maximumly native Polyscope functions** and can help you quickly build your own decent application.

The compatibility minimum requirement is:

Universal Robots
e-series: 5.19 or newer.

2. Installation

1st step: click hamburger menu on top right of Polyscope.

Figure 1 Installation 1st step.

2nd step: Select Settings / System / URCaps, then click "+" button on button area.

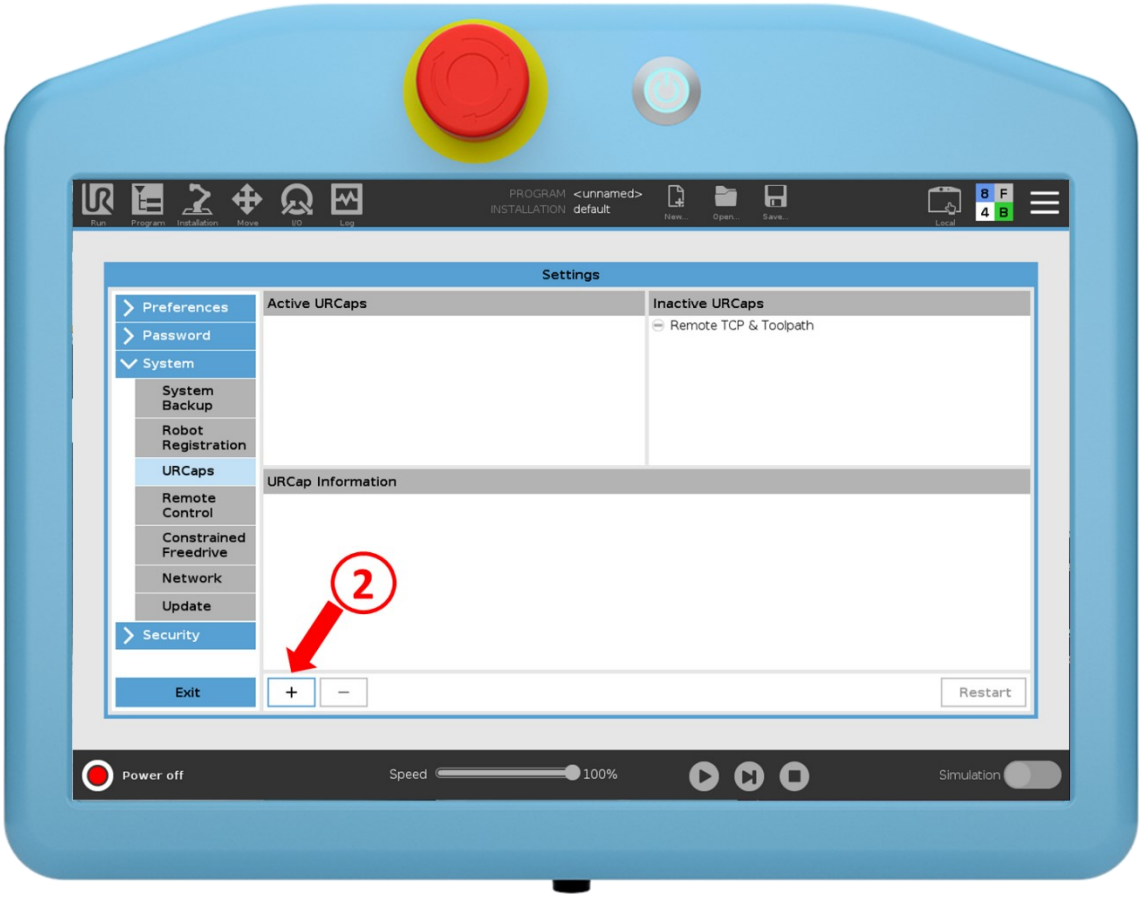

Figure 2 Installation 2nd step

3rd step: select the <SmartTool-1.0.x .urcap> file in the folder browser and click **Open** button, then click **Restart**. After restart Polyscope, it will display as below figure.

Figure 3 Installation 3rd step.

4th step: Click **Installation** and click License Import button showed in Figure 4 to navigate in directory for the corresponding license file, subsequently click Activate button until it will get Figure 5 message box which means license activation is completed. The <Enable Freedrive> checkbox is also needed to check.

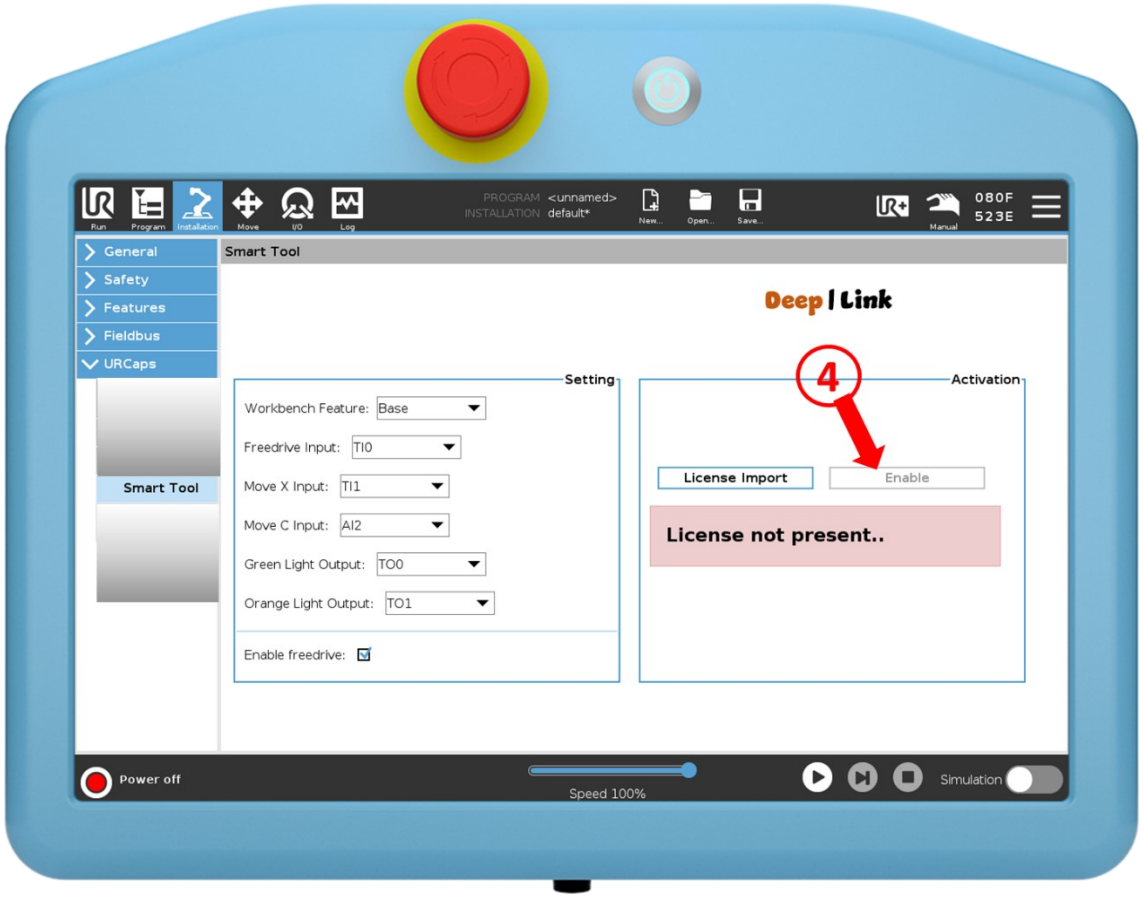

Figure 4 Installation 4th step.

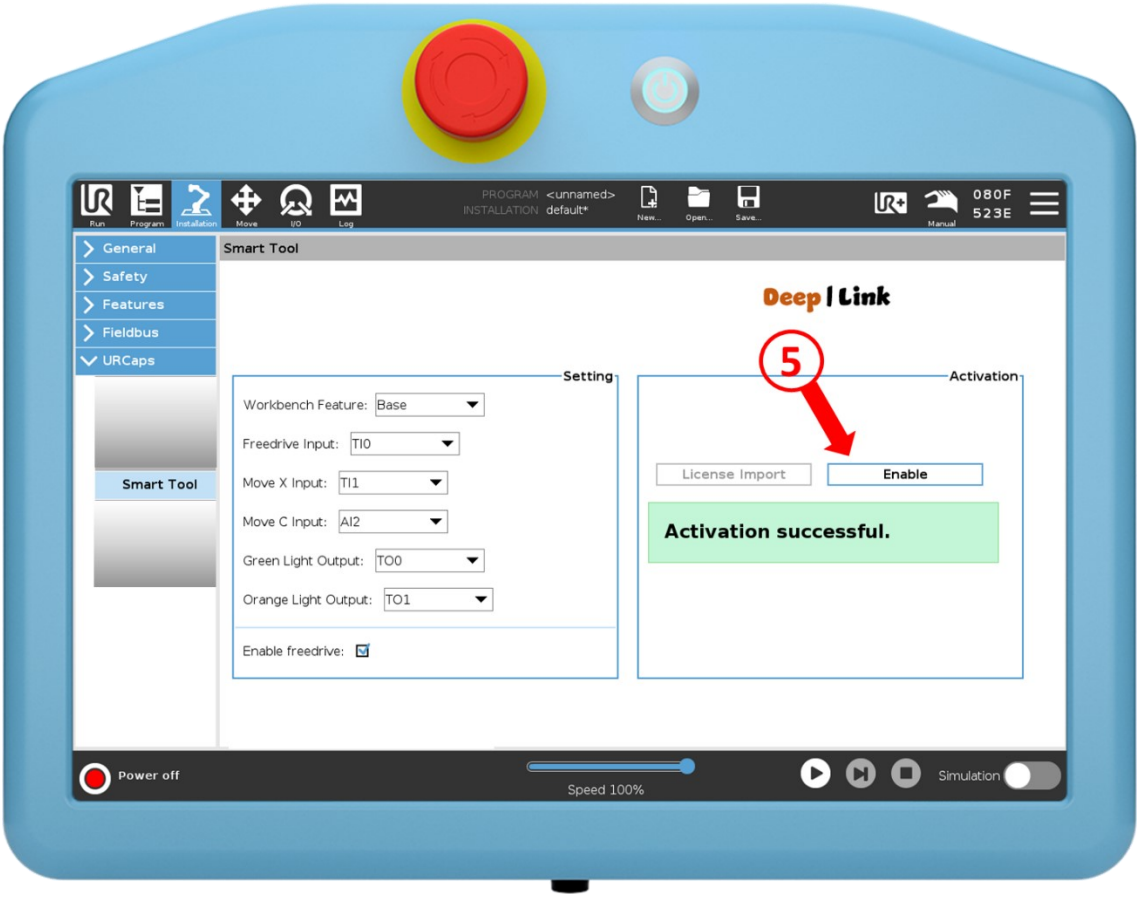

Figure 5 Installation activation view.

5th step: The next step is to take care of tool I/O configuration, it can be as simple as going to Installation -> General -> Tool I/O and select SmartTool from the menu as being shown in Figure 6.

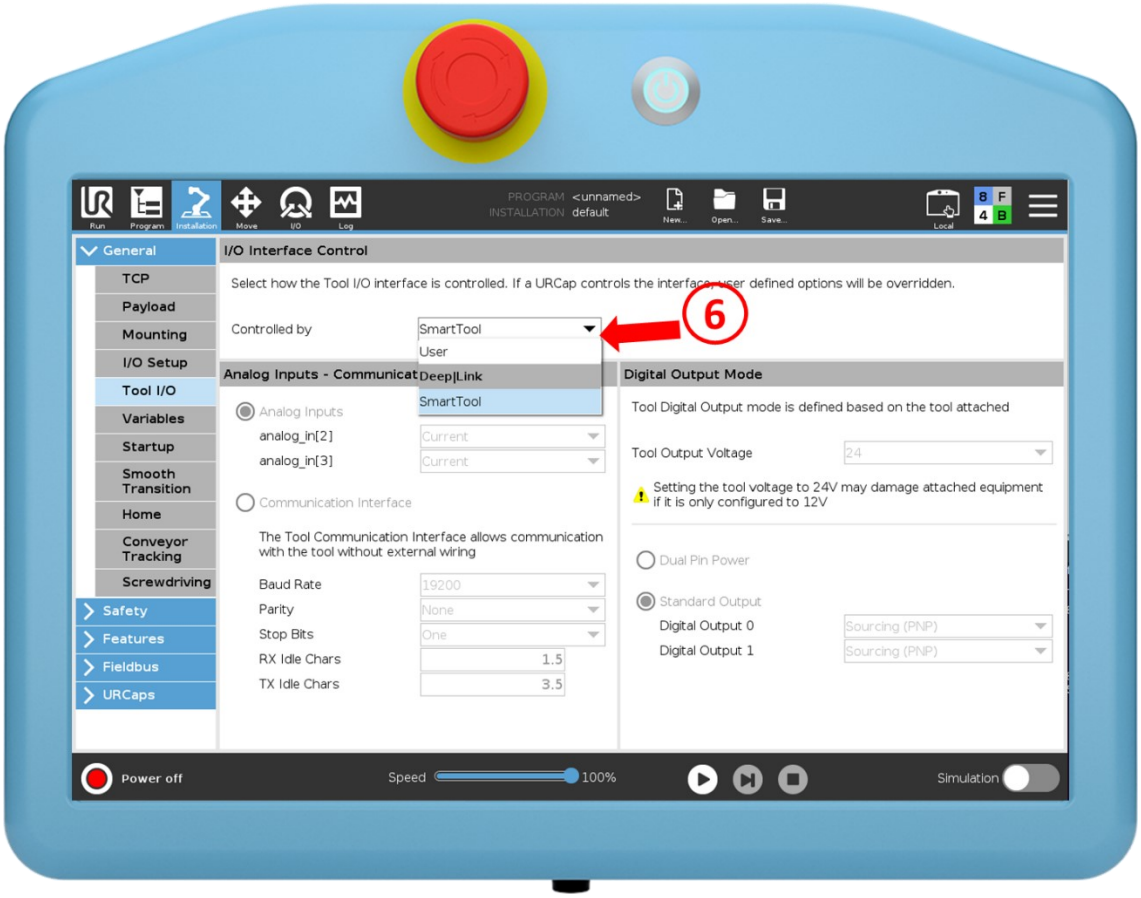

Figure 6 Installation Tool-IO configuration.

For UR20 case:

For Universal Robots UR20
To comply with UR20 unique safety design, the Smart Tool IO signal will be wired to robot controller cabinet, below is a workaround procedure:

1. ***in the Tool I/O setting please make sure it selects "Controlled by - Smart Tool",***
2. ***Installation->URCap-> Smart Tool page, make the IO configuration that reflects real connection,***
3. ***in I/O tab page , make the corresponding analog_in configured as Current, shown in*** Figure 7 ***and*** Figure 8***.***
4. ***Installation -> Safety -> I/O, select the corresponding Configure_input as Freedrive.***

Figure 7 UR20/UR30/UR15/UR18/UR8L cobot IO setting procedure.

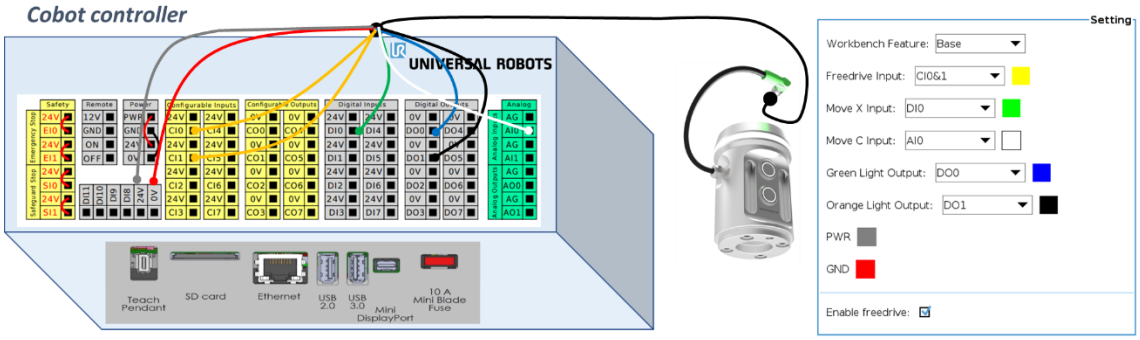

Figure 8 UR20/UR30/UR15/UR18/UR8L cobot IO wiring reference (legacy system).

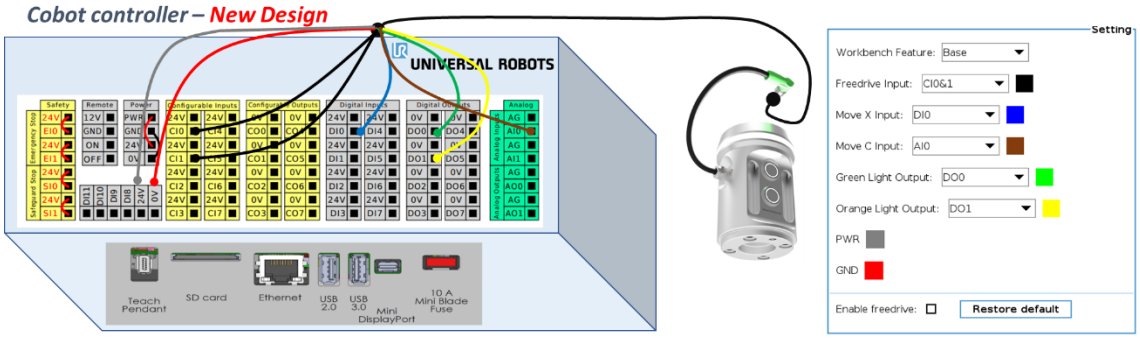

Figure 9 UR20/UR30/UR15/UR18/UR8L cobot IO wiring (new system production since 2023 September)

6th step: Eventually click tool bar button on Polyscope top **Save / Save Installation As...** to save current license so user won't have to configure Installation every time reboot. And now all installation is completed.

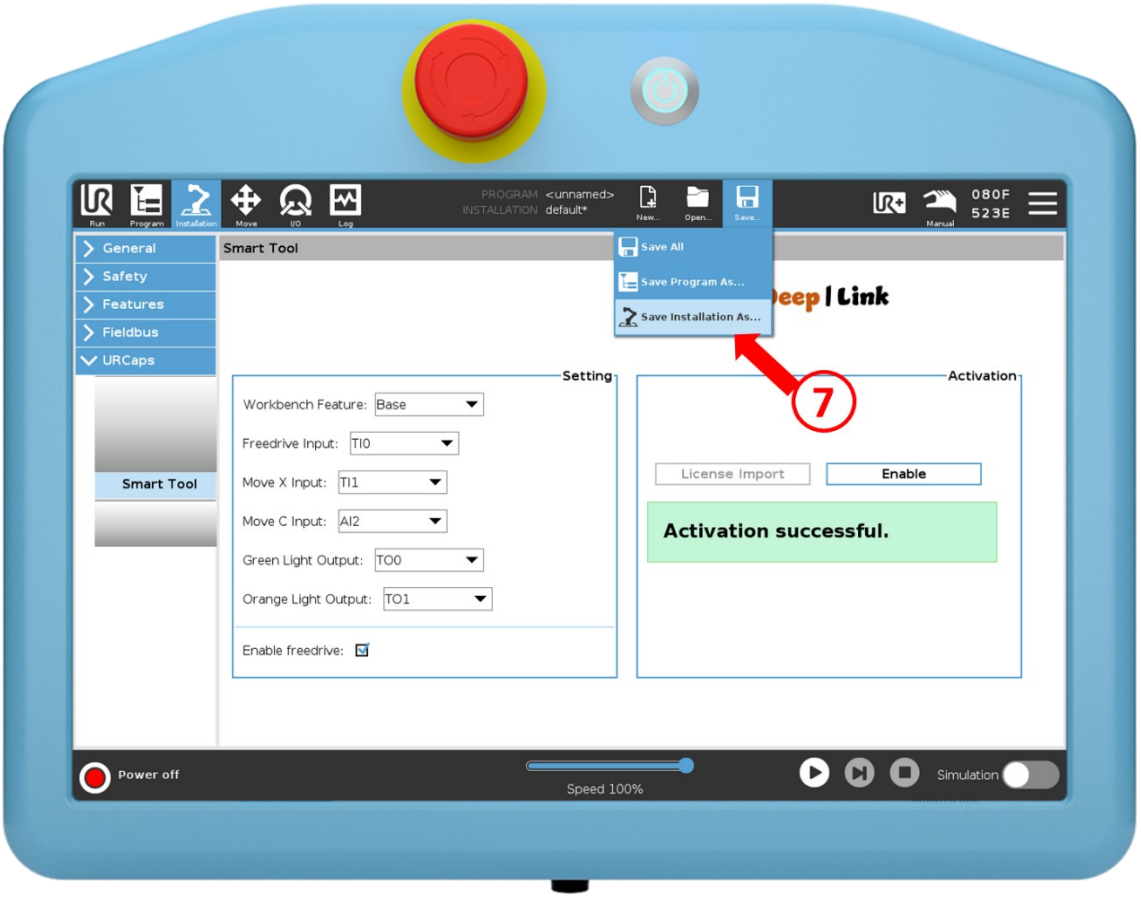

Figure 10 Save installation configuration.

3. Electrical Drawing

	Color	Signal	Description
8	Red	GND	Ground
5	Gray	POWER	0V/12V/24V
7	Blue	TO0/PWR	Digital Outputs 0 or 0V/12V/24V
6	Pink	TO1/GND	Digital Outputs 1 or Ground
4	Yellow	TI0	Digital Inputs 0
3	Green	TI1	Digital Inputs 1
1	White	AI2 / RS485+	Analog in 2 or RS485+
2	Brown	AI3 / RS485-	Analog in 3 or RS485-

Figure 11 Tool I/O signal mapping (legacy design)

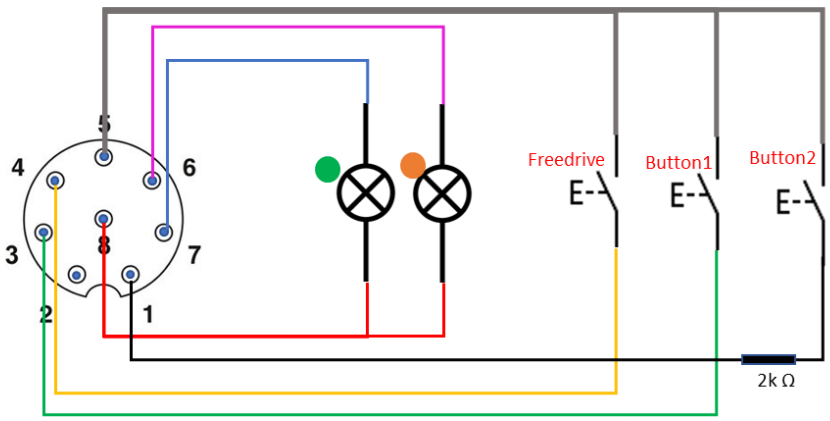

Figure 12 Electrical wiring drawing (legacy design)

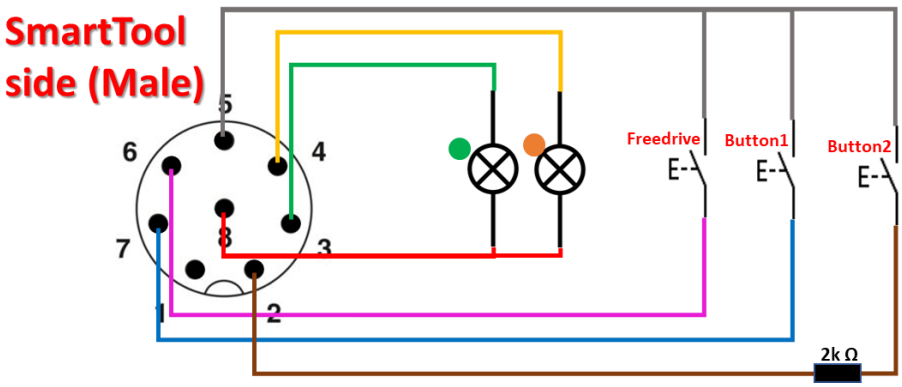

Figure 13 Electrical wiring drawing (new design)

4. Product Specification & Mechanics

ITEMS	VALUE
Weight	745 g
Material	Aluminum, PP plastic
Working temperature	5 ~ 50℃
Store temperature	-25 ~ 55℃
IP protection level	IP54
LED color type	Green, Orange
LED maximum blink frequency	10 Hz
Packing list	Smart Teach Tool x1 Screw M6x35, A2-70 x4 Pin D6x16 x1

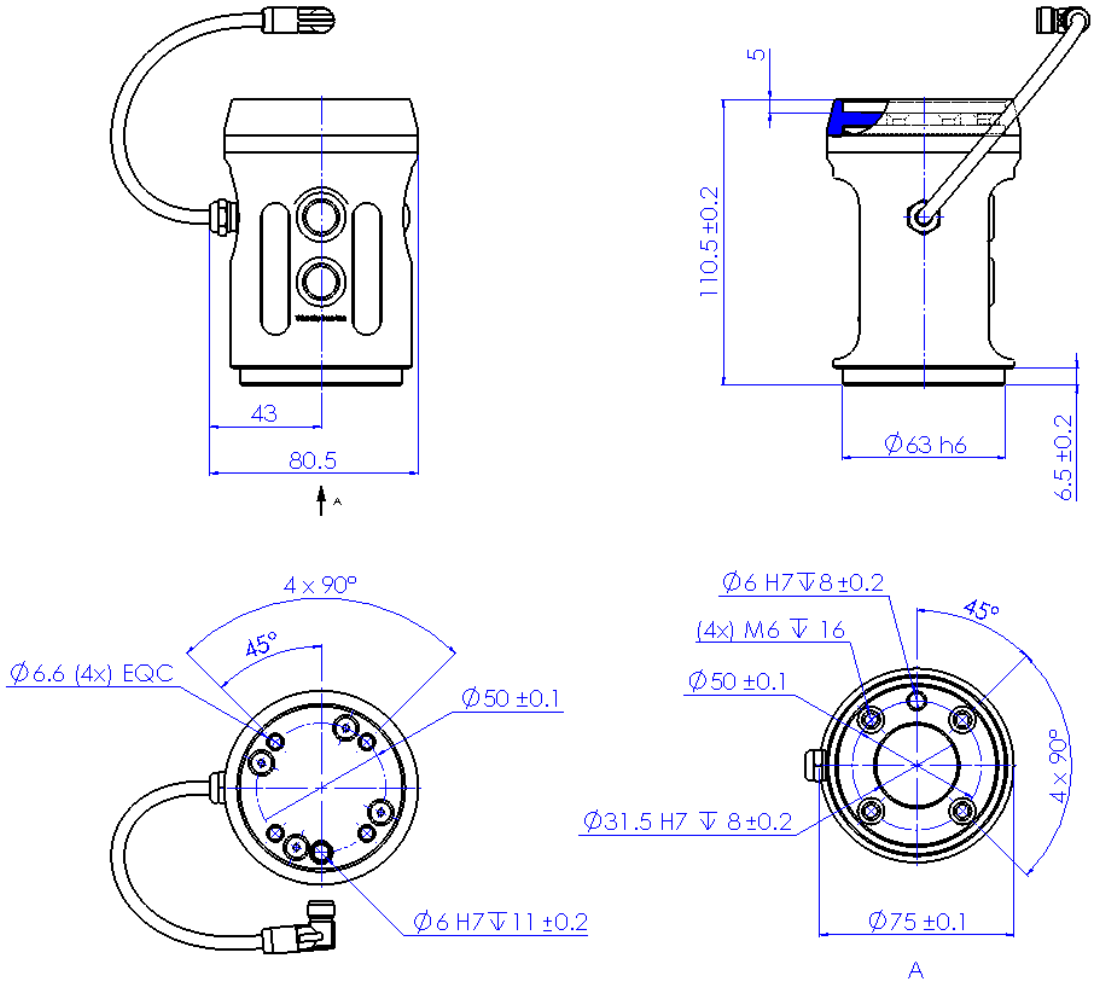

Figure 14 Product's Mechanic Dimensions

5. Activation

Send your question or request at mailbox: info@deep-link.cn

6. Context configuration

6.1 Tool Teach ProgramNode

This section demonstrates the 2 URCapProgramNode.

Figure 15 Tool Teach program node interface, the Motion Parameter area permits linear/angular motion parameter specification, and these data will be effective in further inserting waypoint/Cirwaypoint nodes, if you want to rewrite previous nodes motion parameters, then the Update button can be used to realize this function.

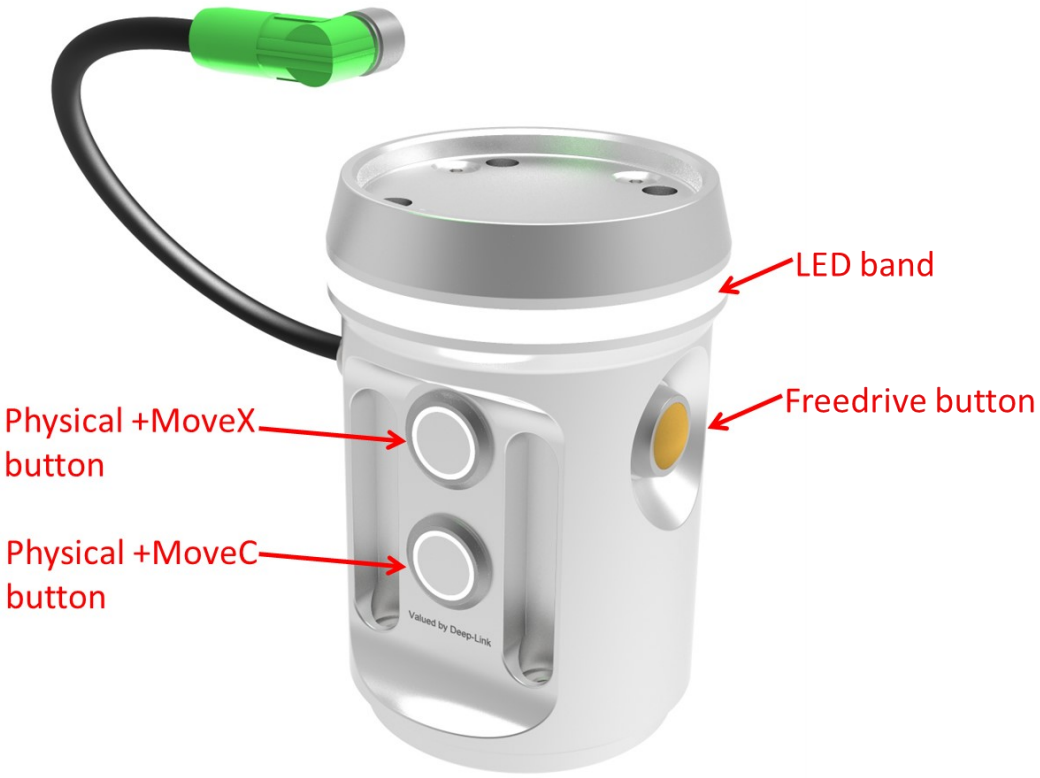

Figure 16 Physical product button & illumination function.

6.2 Tool Light ProgramNode

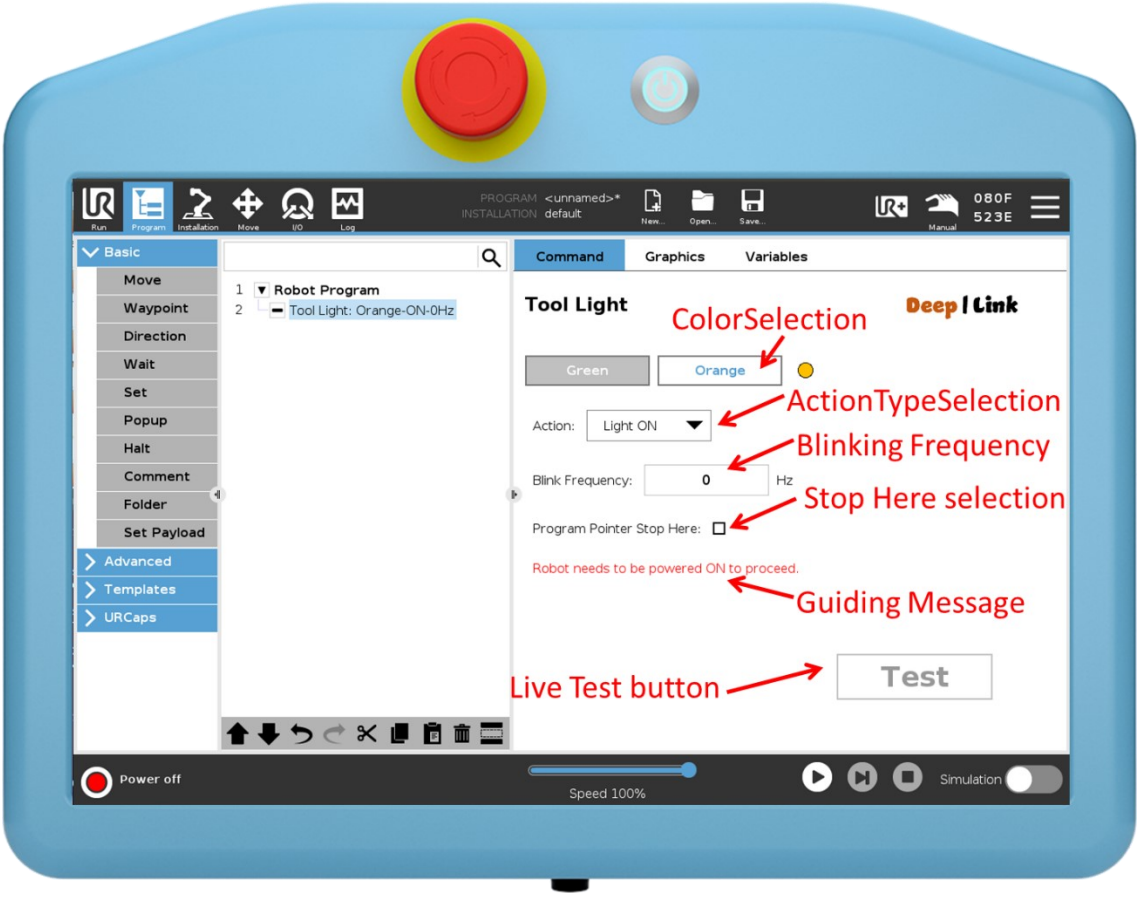

Figure 17 Tool Light program node interface, Blink frequency 0 Hz means the LED will light up constantly, currently there are 2 colors available as Green & Orange, and the Action options are Light ON and Light OFF.

6.3 Trajectory offsetting

In a context of user desires to offset current robot trajectory without modifying waypoint, it is suitable to consider a Trajectory offsetting within Smart Tool URCap. It is possible to create the workbench plane by Polyscope default function in Installation -> Features -> Planes as Figure 19, subsequently, you can select this workbench feature in Installation -> URCaps -> Smart Tool combobox as Figure 20. The robot will be able to run same relative trajectory in the taught plane into new target plane.

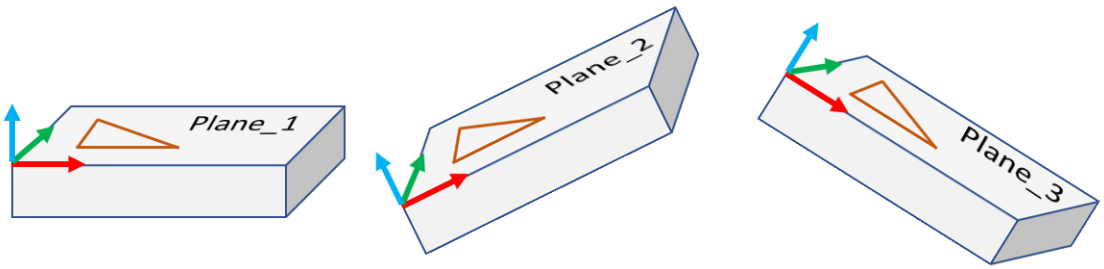

Figure 18 Trajectory offsetting context.

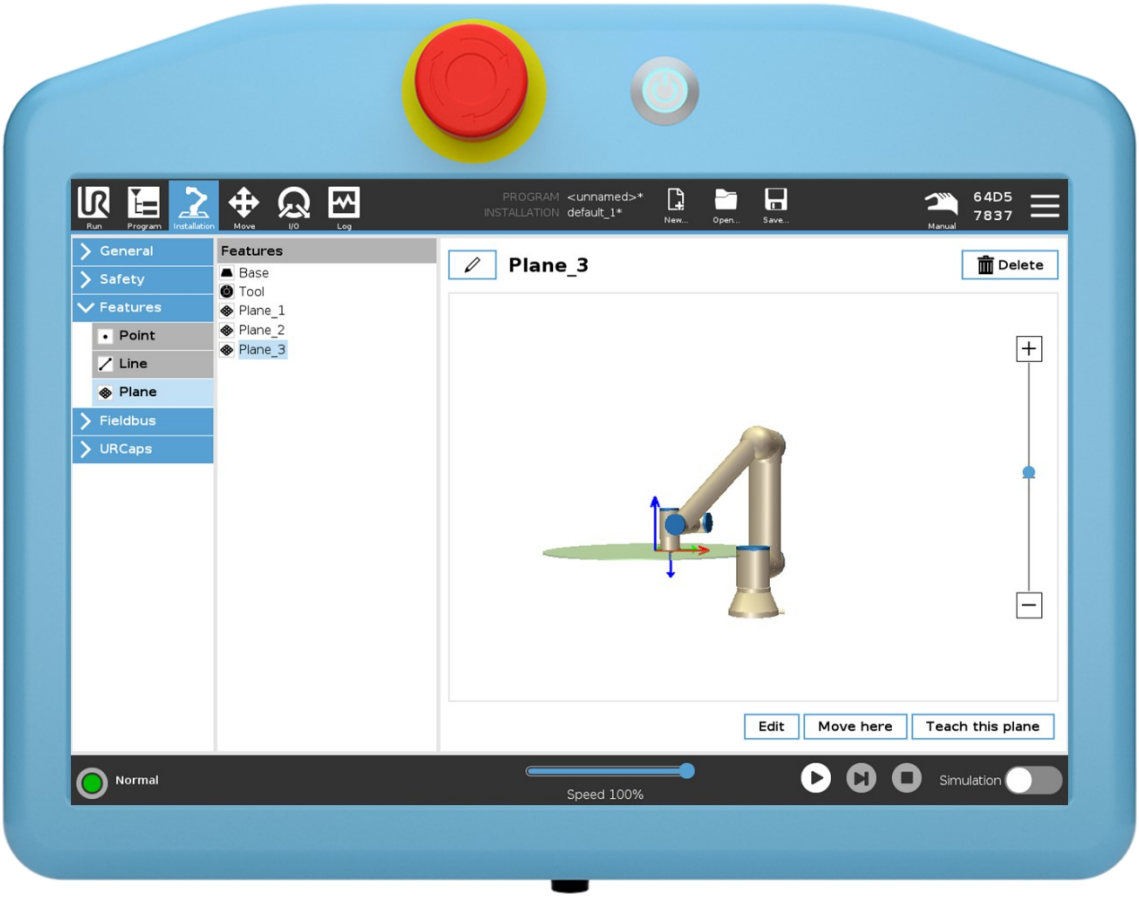

Figure 19 Create feature Plane in Installation -> Features -> Planes.

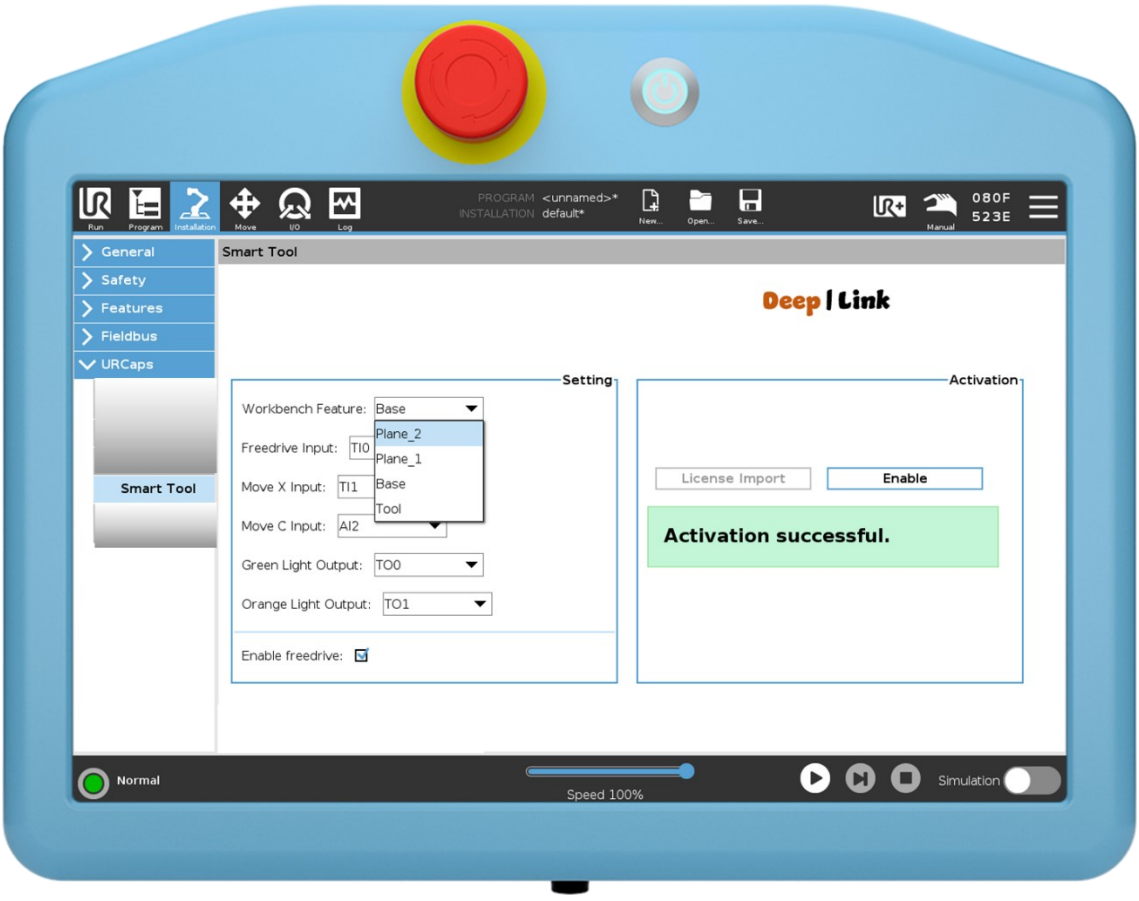

Figure 20 Selecting target offsetting feature in the combobox of Installation.

6 Error instruction

CATEGORY	NUMBER	DESCRIPTION
Warning	001	Robot needs to be powered ON to proceed. -> Please power on cobot
Warning	002	Please make a move type selection. -> So here user will need to make a move type selection in Tool Teach interface
Warning	003	Tool-IO needs to configure. -> please follow 2-Installation / 5th step to setup the tool-IO configuration.
Warning	004	Reached trial limit. -> This will happen when license is not activated and urcap is in trial mode, and the maximum moveX waypoint quantity is 4 and MoveC is 2 waypoints maximum to formulate 1 curve complete.
Warning	005	Please enable Freedrive at InstallationNode. -> This warn suggest checking the checkbox in Installation Node as being explained in 2-Installation / 4th step.

7 Revision notes

Version	Description	Time [YYYY-MM-DD]
1.0.2-Build017	Initial release	2023-May-10
1.0.4-Build005	Add manual QR code, Add CN translation.	2023-June-05
1.0.4-Build006	Improve live test button performance, Improve CN translation in URCapProgramNode, Add Copyright section	2023-July-15
1.0.4-Build010	Add Program Pointer stop here function in Tool Light node.	2023-August-20
1.0.4-Build011	Add Tool-DO runstate dependency	2023-August-21
1.0.4-Build012	Add Feature offsetting function. Add waypoint Move Here, Set Point button. Optimize shared motion parameter function. Fix Tool Light issue on runstate.	2023-September-23
1.0.4-Build015	Adjust Tool Light UI for easier programming.	2023-October-16
1.0.4-Build017	Build for UR+ compliance retrofitting. Adjust Chinese translation	2023-December-18
1.0.4-Build019	Optimize activation approach.	2023-December-27
1.0.4-Build020	General update.	2024-April-07
1.0.4-Build021	Add StartFromNode and BreakPointOnNode capability. Add MAC info in Installation node.	2024-May-07
1.0.4-Build023	Make DI/O configurable in InstallationNode to support Universal-Robot UR20 cobot. **Switch to ursim-5.15.0.126572*	2024-July-12
1.0.4-Build032	Fix installation icon deformation. Rectify manual electrical wiring diagram. Fix UR20 IO setting error, and teaching miss.	2024-October-24

1.0.5-Build008	Improve Tool-Teach responsiveness by 300%. Update activation experience. Fix feature switching bug. Add simulator variant. Update activation configuration. Point node & Circular Point node interface simplified. Simplify Digital Output runstate dependency.	2025-April-30
1.0.5-Build010	Upgrade URSIM base to 5.19.0+ Adjust Linear acceleration minimum to 0.5 mm/s2.	2025-August-12
1.0.5-Build012	Add full check of Tool-IO setting. Add Jog Tool - v1.0.3. Streamline non-activation behavior. Retrofit electrical connection according to UR's TCI design change, see Notification detail.	2025-December-22

******Chinese Documentation / 中文文档 **********

V 1.0.5

Smart Teach Tool URCap Manual

示教工具 产品手册

Deep | Link
发布于 2023 年 5 月，中国杭州

1. 摘要

此产品为 Universal-Robots 机器人定制开发的机器人示教工具产品，它包括一个十分**容易上手且使用舒适**的机械拓展工具法兰，为机器人增加了 **freedrive 按钮** 使现场操作的用户非常轻松的拖动机器人手臂，同时还装备了两个额外的按钮用于增加程序中的**线性轨迹，关节运动轨迹，和弧线轨迹**。此外，它还包括一个**可编程指示 LED 灯带**，结合 URCap 软件可以方便在程序中插入控制等待的程序。我们相信这个功能对**提高用户操作机器人效率**有显著效果，尤其在一人照看多台机器人时，指示灯对他将有很大帮助，因为通过灯带信号，他可以很轻松了解每台机器人执行任务的情况。本产品设计延续了 Deep-Link 一贯的设计理念：**简易、高效**，同时最大限度使用示教器原生指令以保证用户**一致的体验**和最大的**灵活性**。

URCap 软件对机器人软件要求：

Universal Robots
e-series: 5.19 或 更新版本.

2. 安装

第 1 步：点击右上角的汉堡菜单

Figure 21 安装第 1 步

第 2 步：选择 **设置 / 系统 / URCaps**，随后点击屏幕下方的 “+”按钮。

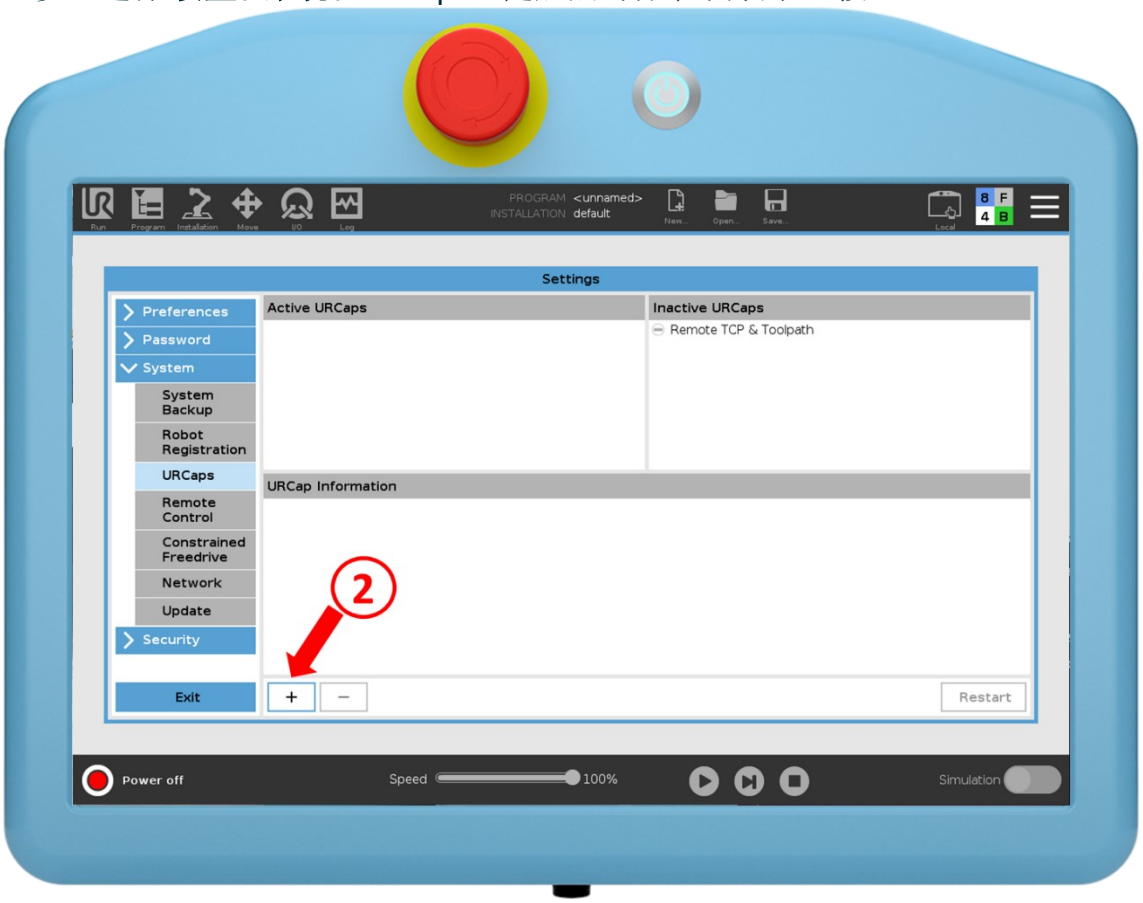

Figure 22　安装第 2 步

第 3 步：从文件浏览器中选择 <SmartTool-1.0.x .urcap> 文件并点击 **打开** 按钮，随后点击 **重启**。如图所示 Figure 23。

Figure 23　安装第 3 步

第 4 步：点击 **安装设置**，如图 Figure 24 所示，随后点击授权导入按钮，在文件夹中对话框中选择相应的激活文件，随后点击激活按钮，直到出现如 Figure 25 所示的激活成功页面。
<激活 Freedrive> 的选项框同样需要勾选。

Figure 24　安装第 4 步

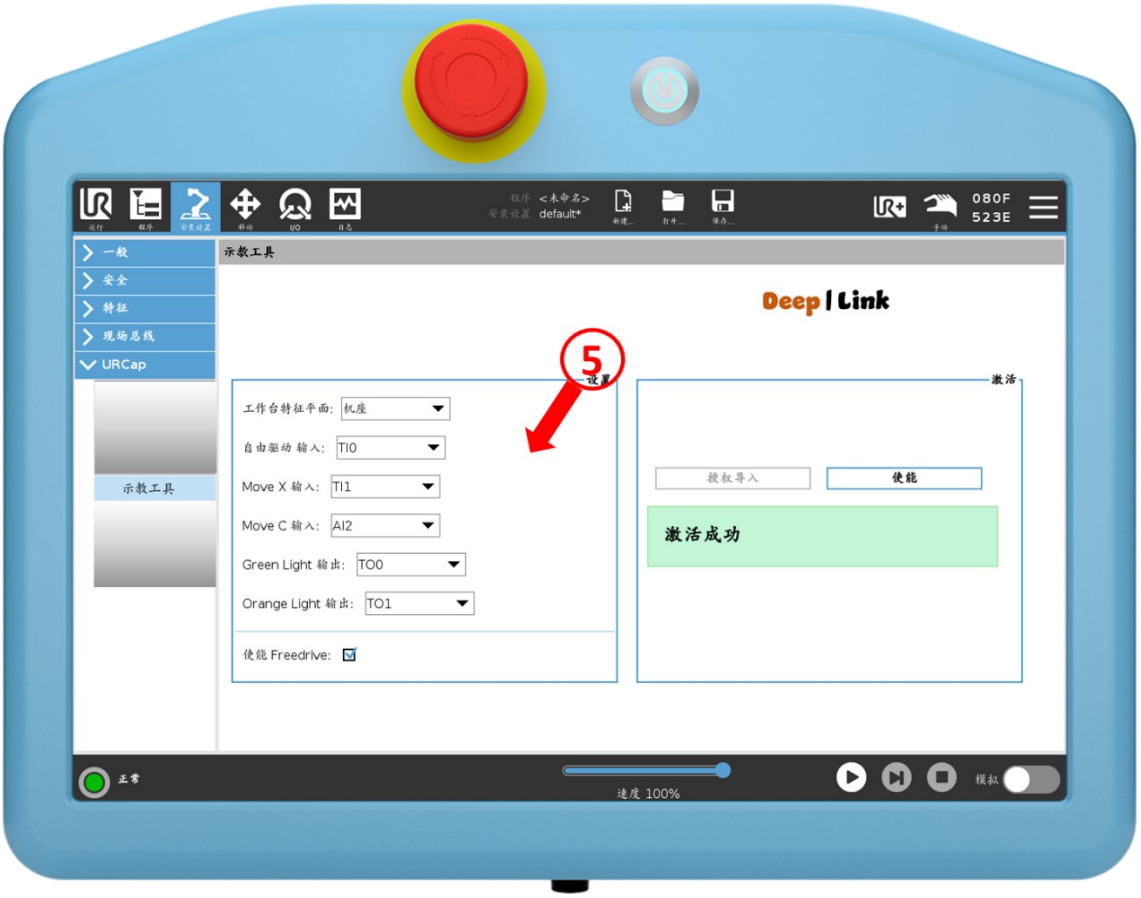

Figure 25　安装激活成功页面

第 5 步：接着一步是设置工具 I/O，请选择 **安装设置 -> 一般 -> 工具 I/O** 并在下拉菜单中选择 SmartTool，如图所示 Figure 26。

Figure 26 安装第 5 步：工具 IO 设置。

对于 UR20 情况:

对于 Universal Robots UR20 机器人说明：
为适配 UR20 独特安全设计，示教工具线缆直连机器人控制柜, 以下是操作步骤，如图所示，Figure 27，Figure 28***：***

1. ***在工具 I/O 界面请选择“控制者 - Smart Tool”,***
2. ***移步 安装设置->URCap-> 示教工具界面, 根据实际接线配置 IO 通道,***
3. ***移步 I/O 界面***  ***, 确保对应的 模拟输入通道被配置为“电流”。***
4. ***安装设置 -> 安全 -> I/O, 选择对应的 Configure_input 为 自由拖动.***

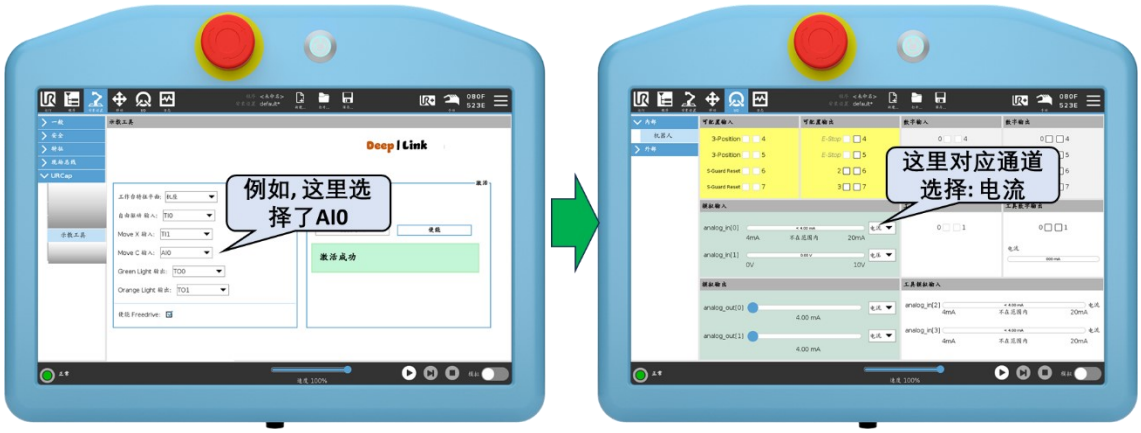

Figure 27 UR20/UR30/UR15/UR18/UR8L IO 配置操作步骤示意

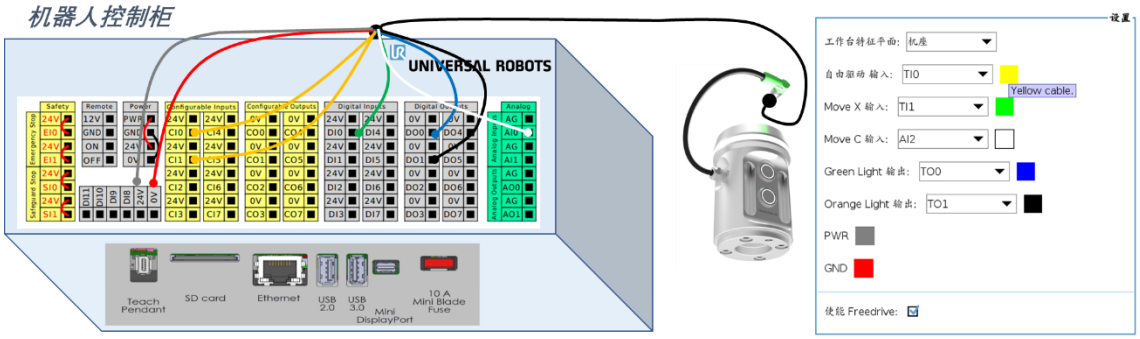

Figure 28 UR20/UR30/UR15/UR18/UR8L 控制柜连线示例(UR 旧设计系统)

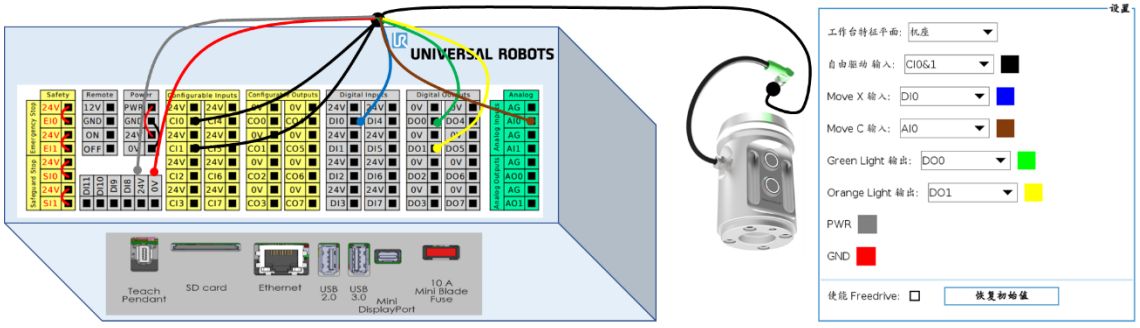

Figure 29 UR20/UR30/UR15/UR18/UR8L 控制柜连线示例(UR 新设计系统， 切换时间--2023 September—供参考)

第 6 步：点击屏幕上方的 **保存/ 安装设置另存为**... 已保存当前做过的设置，这样下次开机时您就不需要再进行以上配置步骤。至此，安装完毕。

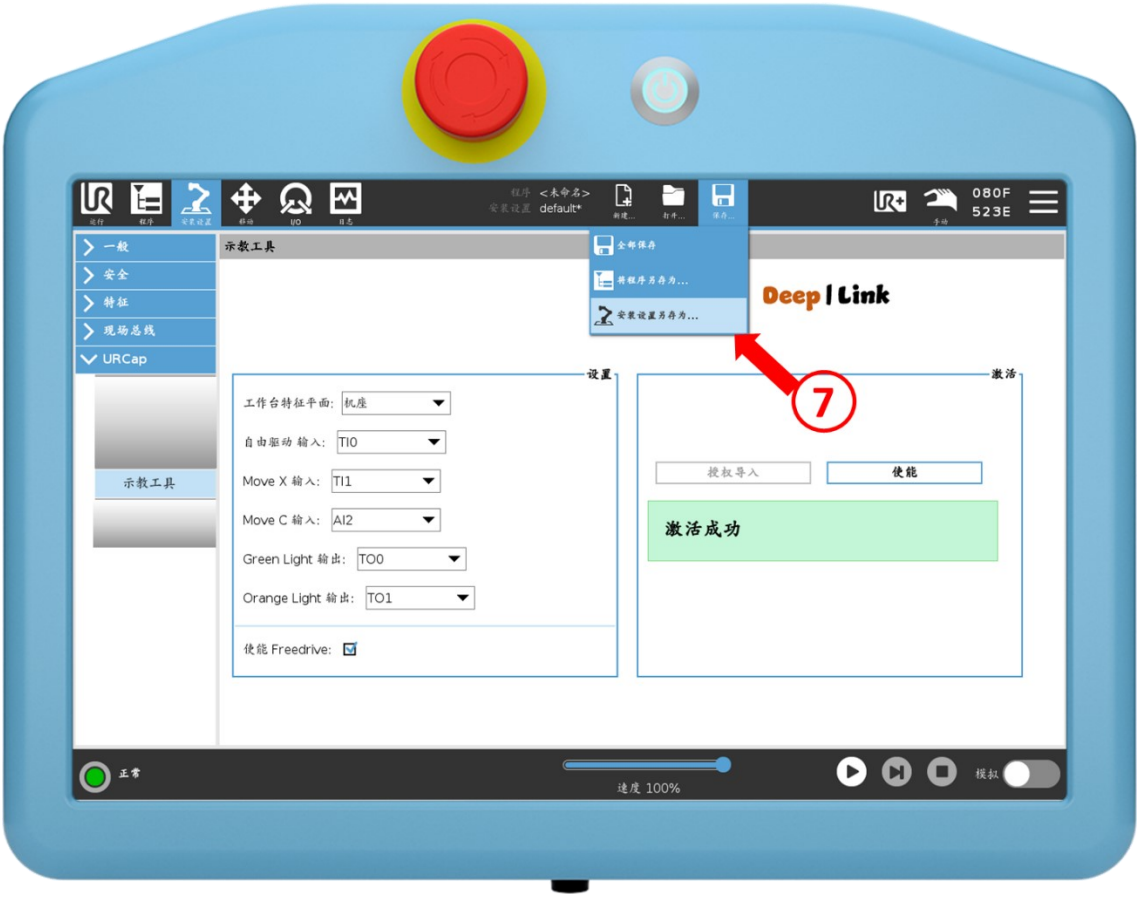

Figure 30 Save installation configuration.

3. 电路图纸

	Color	Signal	Description
8	Red	GND	Ground
5	Gray	POWER	0V/12V/24V
7	Blue	TO0/PWR	Digital Outputs 0 or 0V/12V/24V
6	Pink	TO1/GND	Digital Outputs 1 or Ground
4	Yellow	TI0	Digital Inputs 0
3	Green	TI1	Digital Inputs 1
1	White	AI2 / RS485+	Analog in 2 or RS485+
2	Brown	AI3 / RS485-	Analog in 3 or RS485-

Figure 31 Tool I/O 信号映射表(旧设计)

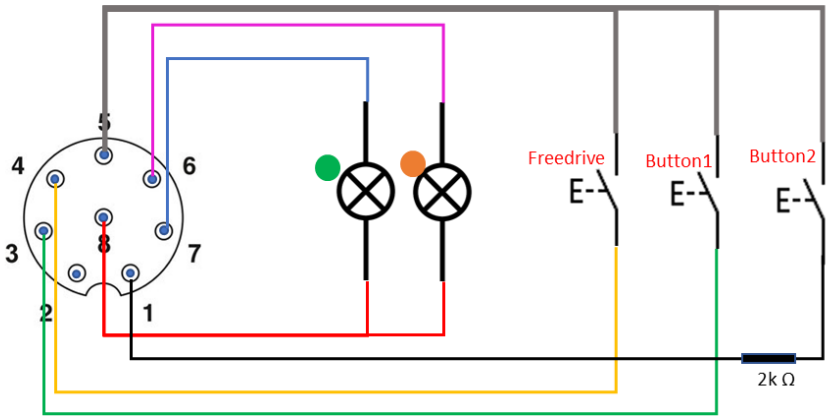

Figure 32 信号连接图(旧设计)

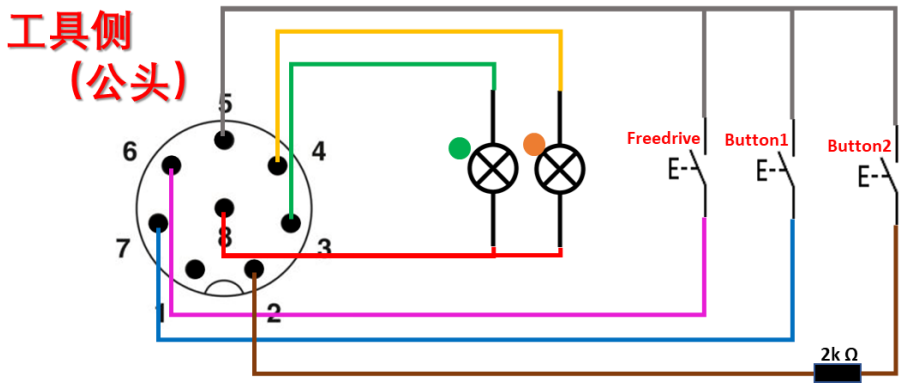

Figure 33 信号连接图(新设计)

4. 产品参数表 和 机械设计

类别	内容
重量	745 克
材质	铝，PP 塑料
工作温度	5 ~ 50℃
储存温度	-25 ~ 55℃
IP 防护等级	IP54
LED 颜色种类	绿色，橙色
LED 最大闪烁频率	10 Hz
包装清单	示教工具产品　x1 螺丝 M6x35, A2-70　x4 销 D6x16　x1

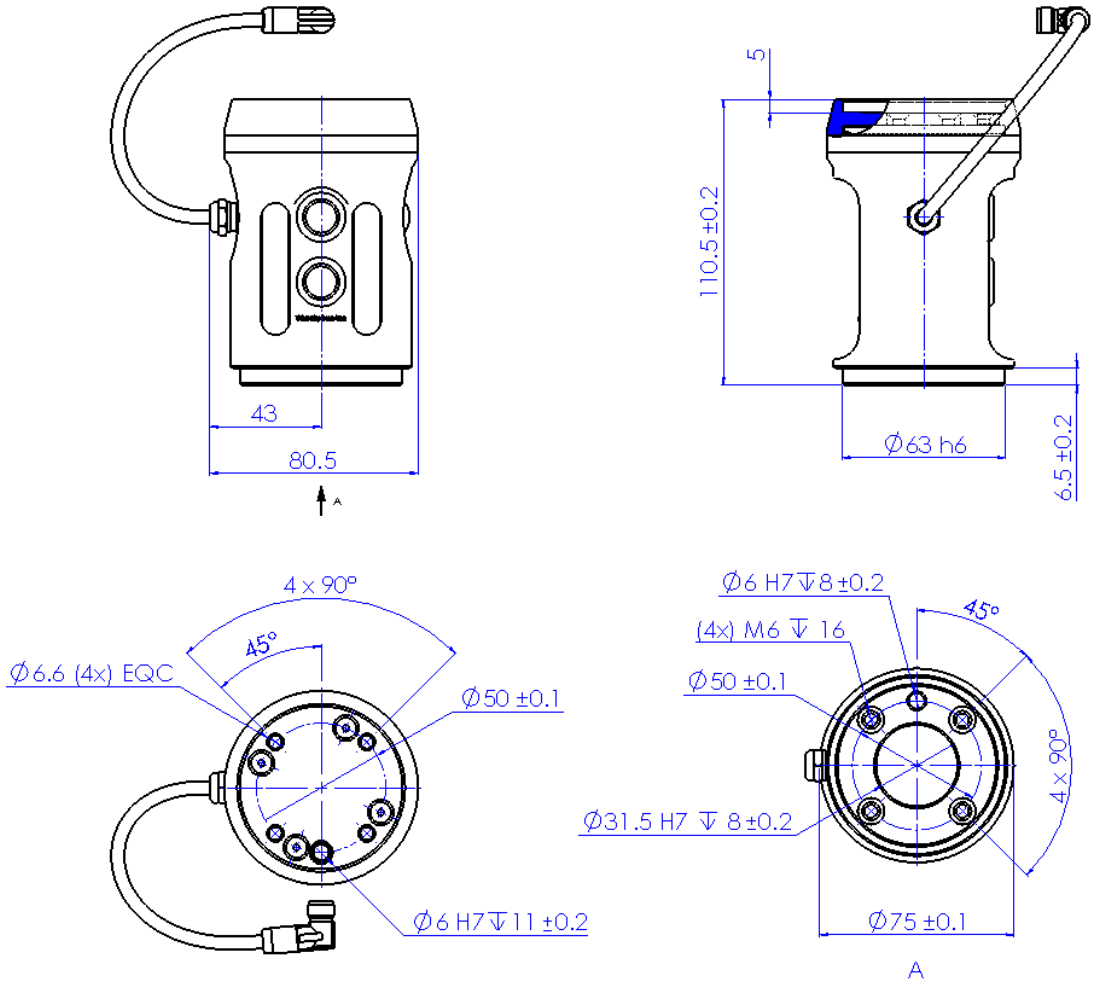

Figure 34 Product's Mechanic Dimensions

5. 激活

请将您的激活需求或问题发送至邮箱：info@deep-link.cn

6. 场景配置

6.1 Tool Teach 工具示教

Figure 35 工具示教程序页面

Figure 36 产品功能展示图

6.2 Tool Light 工具信号灯

Figure 37 工具信号灯编程页面，闪烁频率 0Hz 意味着 LED 灯常亮，当前有 2 中颜色可选【绿色、橙色】，有 2 中动作命令可选【开灯、熄灯】。

6.3 路径整体偏移

在工作台发生变化，而工件相对工作台不变时，可以考虑使用路径整体偏移功能以实现快速编程，如 Figure 38。

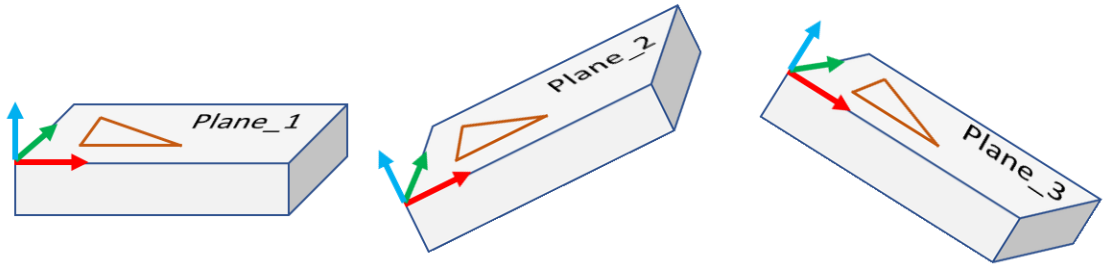

Figure 38 路径整体偏移示意图

首先，可以在安装设置->特征->平面 中创建新的工作台平面，如 Figure 39。
随后，可以在安装设置->URCap->示教工具 中选择对应的工作台特征平面，这样机器人的轨迹可以整体偏移到新的屏幕中，如 Figure 40。

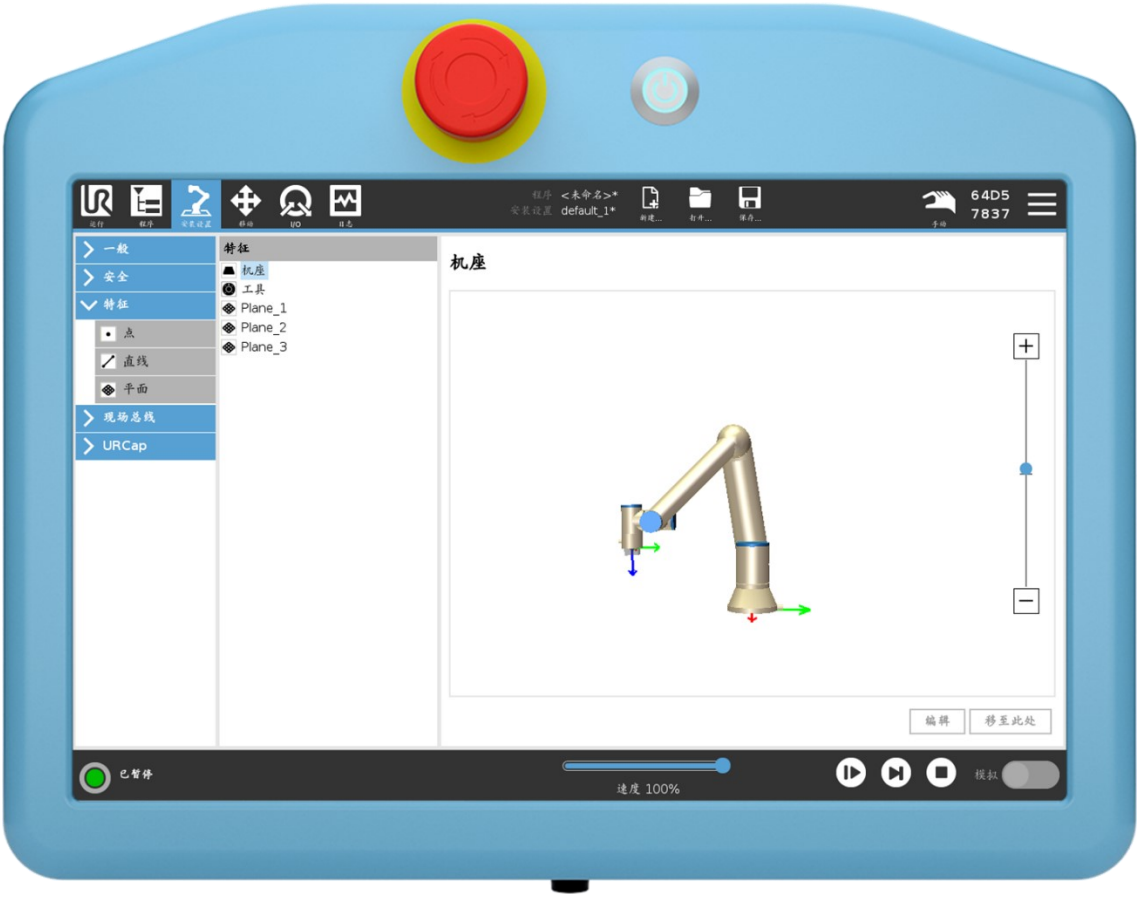

Figure 39 创建平面

Figure 40 选择目标工作台特征平面

7. 错误信息

种类	编号	描述
警告	001	机器人需要先上电. -> 请给机器人上电
警告	002	请选择移动类型. -> 用户需要先定义要添加路点的类型【MoveJ, MoveL, MoveP】再操作物理按钮。
警告	003	请先进行 Tool-IO 设置. -> 请参照第 2-安装 / 第 5 步章节设置工具 I/O 设置。
警告	004	达到试用限值. -> 当 URCap 未激活时会出现这种情况，在试用状态下 moveX 最多可添加 4 个路点，MoveC 最多可添加 2 个路点。
警告	005	请在安装界面使能 Freedrive. -> 这个警告提示用户需要在安装设置页面软件使能 Freedrive 才可以操作 Freedrive 按钮。参见 2-安装 / 第 4 步。