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Preface

Purpose

This Document describes the functions, , installation guide of DobotStudio2020, making it easy for users to fully understand and use it.

Intended Audience

This document is intended for:

- Customer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

Change History

Date	Change Description
2020/05/20	The first release

Symbol Conventions

The symbols that may be founded in this document are defined as follows:

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury
	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robotic arm damage
	Indicates a potentially hazardous situation which, if not avoided, can result in robotic arm damage, data loss, or unanticipated result
E NOT	Provides additional information to emphasize or supplement important points in the main text

1. Product Introduction

DobotStudio2020 is a multi-functional control software of robot arm independently developed by our company, which can control various types of robot arms of our company, such as Dobot M1, Dobot Magician, Dobot Magician Lite, Dobot CR5, MG400, etc.. The interface is simple and easy to understand which can help users quickly master the usage of various mechanical arms.

Currently, this version only supports Dobot M1 and MG400. Other types of robotic arms are under development and will be opened later.

2. DobotStudio2020 Installation

The supported OSs are as follows:

- Win7
- Win8
- Win10

The Download path of DobotStudio2020 is : https://cn.dobot.cc/downloadcenter.html

Prerequisites

You have obtained the DobotStudio2020 .

Procedure

Step 1 Decompress the DobotStudio2020 software_o If the directory containing decompressed DobotStudio2020 files is **E:\DobotStudio2020**. Please replace the directory based on site requirements.

Step 2 Double-click DobotStudio2020.exe in the E:\DobotStudio2020directory and click Next.

ObotStudio2020 Setup		[]]	×
Choose Installation Options			
Who should this application be installed for?			0
Please select whether you wish to make this software avail	lable to all users or ju	st yourse	lf
O Anyone who uses this computer (all users)			
Only for me (Administrator)			
There is already a per-user			
installation.(D:\Users\Administrator\AppData\Local\Program Will reinstall/upgrade.	ms\DobotStudio2020)		
DobotStudio2020 1.0.0-rc.202008051520		54	
	Next >	Can	cel



DobotStudio2020 Setup			×
Choose Install Location Choose the folder in which to install DobotStudio2020.			0
Setup will install DobotStudio2020 in the following folder. To instal Browse and select another folder. Click Install to start the installa	l in a different f tion.	folder, clic	k
Destination Folder Users\Administrator\AppData\Local\Programs\DobotStudio20	20 Brow	se	
Dobot5tudio2020 1.0.0-rc.202008051520	Install	Canc	el
Step 4 click Next after finishing installing.	_		V.
Installing Please wait while DobotStudio2020 is being installed.			0
DobotStudio2020 1.0.0-rc.202008051520			
< Back	Next >	Cano	eł

Step 5 Click Finish.

DobotStudio2020 Setup	- (0) >	¢
	Completing DobotStudio2020 Setup	
	DobotStudio2020 has been installed on your computer. Click Finish to close Setup.	
	Run DobotStudio2020	
	< Back Finish Cancel	

3 Dobot M1

3.1 Overview

You can control Dobot M1 through the DobotStudio2020, and perform teaching and playback, Blockly, Script and other operations on the DobotStudio2020.

3.2 DobotStudio2020 Connection

Prerequisites

- You have connected the Dobot M1 to the PC over a serial cable or a network cable.
- You have connected the Dobot M1 to the emergency stop switch.

Procedure

- If the Dobot M1 connects to PC over the serial cable, please select the right serial port and connect it on the DobotStudio2020.
- If the Dobot M1 connects to PC over the network cable (router or directly connection) and they are on the same network segment, please select the right IP address and connect it on the DobotStudio2020. If the device cannot be found, you need to add the device manually. Follow the steps as shown below.

Step 1 Click Manually Add.



Step 2 Click M1 to enter the Overwrite IP Configuration interface.



Step 3 Click **Configure and connect**, The IP address of Dobot M1 will be forced set in the same network segment of the PC before connecting to the PC.



The status is **Connected** on the DobotStudio2020 after connecting successfully.



[!NOTE] If multiple devices are configured at the same time, the system will randomly select a device to connect.

3.3 Function Description

Dobot M1 supports teaching, playback, script control, and Blockly graphics programming. You can use the DobotStudio2020 to control a Dobot M1. The corresponding applications on the M1Studio page is shown below.



Function	Description
Teach&PlayBack	Teach the Dobot M1 how to move and then record the movement to make the Dobot M1 accomplish the recorded movements.
DobotBlockly	Control the Dobot M1 by graphics programming. You can program through a puzzle interface which is intuitive and easy to understand.
Script	Control the Dobot M1 by the scripting language.
Web Management	Execute the saved points lists in the offline mode, and upgrade the firmware.

3.3.1 Teaching and Playback

3.3.1.1 Overview

The teach and Playback function supports tree programming teaching, and users can perform teach and Playback through tree programming. According to different program instructions, the interface displays different parameter settings. The instruction description is shown in the table below.



Instruction	Description	Setting
move to	Motion instructions. Move to a certain point or follow a certain trajectory	Choose different motion mode: movj, movl, jump, arc, circle
speed	Speed instruction. you can set speed and acceleration of the robot arm	Set the robot arm speed acceleration ratio
if/else	Logical instruction. Set Judgment conditions to trigger robot movement	Logical processing based on I/O or variable setting
wait	Waiting instructions. The time can be set to make the robot arm wait	Set the wait time
loop	Loop instruction	Set the number of loop
set out	I/O instruction. You can set the state of I/O	Set the state of the I/O
variable	variable. You can create and set variable values	Create a new variable, and assign an initial value to the variable according to the variable type

3.3.1.2 Alarms Description

If teaching or saving point is incorrect, for example, the Dobot M1 moves to where a point is at a limited position or a singular position, the Dobot M1 will generate an alarm. For details, please see the table as shown below. When an alarm is generated, the red LED indicator on the base will be on.

Alarm Condition	Clear Method
Jogging	
The Joint axis is limited	Jog the limited Joint towards the opposite direction, and the alarm will be automatically cleared
The Cartesian axis is limited	Jog the Joints towards the opposite direction, and the alarm will be automatically cleared
The point is at the singular position when clicking the Cartesian coordinate buttons	Jog joint2, and the alarm will be automatically cleared
Playback	
The starting point or the end point is a singular point in the MOVL mode	Clear the alarm manually and modify the point
A point in the trajectory is a singular point in the MOVL mode	Clear the alarm manually and modify the point
Modify the arm orientation of the saved point in the MOVL mode	Clear the alarm manually and modify the arm orientation
The middle point or the end point is a singular point in ARC mode	Clear the alarm manually and modify the point
A point in the trajectory is a singular point in the ARC mode	Clear the alarm manually and modify the point
Any two of the three points of the arc coincide in the ARC mode	Clear the alarm manually and modify the point
The three points of the arc are in a line in the ARC mode	Clear the alarm manually and modify the point
The trajectory is out of range of the workspace in all modes	Clear the alarm manually and modify the point
The joint is limited in all modes	Clear the alarm manually and modify the point

[!NOTE]

- Singular point: If the directions of the joint1 and joint2 are collinear, the resultant velocity of joint1 and joint2 is not in any direction, but in the direction of joint1 (joint2). Namely, the degrees of freedom of Dobot M1 are degraded. The singular point is at the position where joint2 is located at ±10°. In JUMP and MOVJ mode, the movement of Dobot M1 is joint movement, Dobot M1 will not generate an alarm about singular point.
- Generally, if you save a point where an alarm is generated when implementing jogging, the saved point is unavailable. You need to jog Dobot M1 towards the opposite direction under the Joint coordinate system to clear the alarm, and then save the point. However, if an alarm about singular point is generated when implementing jogging, the saved point is available in JUMP and MOVJ mode.
- In the MOVJ or JUMP mode, if the two points are the same, only different in arm orientations, J1 or J4

may be limited when moving the Dobot M1, resulting in an alarm generated. You need to modify and resave these points and then clear the alarm manually.

The method on how to clear the alarm is shown as follows.

Prerequisites

- The Dobot M1 has been powered on and connected to the DobotStudio2020 successfully.
- The Dobot M1 has been connected to the emergency stop switch.

Procedure

Step 1 Click the alarm tip on the DobotStudio2020 page, as shown below. The Alarm Log is displayed.

Alarm & Log: 12		×
All (1) 🚺 🚺 Info	(0) 🕢 🛕 Warn (0) 🔽 🚫 Error (1)	
Level	Description	Time
8 ERROR	The joint3 is at the positive limited position.	15:26:47
	Reboot Clear Alarm	

Step 2 Click the right alarm, the details on alarm will be displayed.

Step 3 Please clear the alarm with the solution.

If there are no alarm tips on the DobotStudio2020 page, the alarm has been cleared.

3.3.1.3 Motion Mode

The motion modes of Dobot M1 include Jogging, Point to Point (PTP), ARC, and CIRCLE.

• Jogging Mode

Jogging mode is to jog Dobot M1 in the Cartesian coordinate system or Joint coordinate system.

[!NOTE]

This topic describes jogging mode by the GUI operation of DoboStudio2020.

C	ontrol			Se	ettings InitialPose
Use	er Frame	user0	~) To	ool Frame t	ool0 ~
Co	ntrol mode	Jog	Hand-hold		
			ŀ	3	
	é		J (1	22.11.5	
Spe	eed (49%)	0-			
Spo X	381.5		X+	K	Z+
Spe X Y	381.5 -120.24	6	X+	ß	Z+
Spe X Y Z	381.5 -120.24 224.69	Y+	X+ Y-	R+	Z+
Spe X Y Z R	381.5 -120.24 224.69 -17.49	¥+	X+ Y- X-	R+	Z+ R- Z-
Spe X Y Z R	381.5 -120.24 224.69 -17.49	Y+	X+ Y- X-	R+	Z+ R- Z-
Spe X Y Z R	381.5 -120.24 224.69 -17.49 -17.49	Y+	X+ Y- X-	R+	Z+ R- Z-
Spe X Y Z R J1 J2	381.5 -120.24 224.69 -17.49 -17.49 0	Y+ J1+	X+ Y- X- J1-	R+	Z+ R- Z-
Spe X Y Z R J1 J2 J3	381.5 -120.24 224.69 -17.49 -17.49 0 224.69	Y+ J1+	X+ Y- X-	R+ 	Z+ R- Z- J3-

Cartesian coordinate system mode:

- 1. Click X+, X- and Dobot M1 will move along X-axis in the negative or positive direction.
- 2. Click Y+, Y- and Dobot M1 will move along Y-axis in the negative or positive direction.
- 3. Click **Z+**, **Z-** and Dobot M1 will move along Z-axis in the negative or positive direction.
- 4. Click R+, R- and Dobot M1 will rotate along R-axis in the negative or positive direction.

Joint coordinate system mode:

- 1. Click Joint1+, Joint1- and control the Rear Arm to rotate in the negative or positive direction.
- 2. Click Joint2+, Joint2- and control the Forearm to rotate in the negative or positive direction.

- 3. Click **Joint3+**, **Joint3-** and control the Z-axis to move in the negative or positive direction.
- 4. Click Joint4+, Joint4- and control the R-axis to rotate in the negative or positive direction.

• Point to Point Mode (PTP)

PTP mode supports MOVJ, MOVL, and JUMP, which means point to point movement. The trajectory of playback depends on the motion mode.

MOVJ: Joint movement. From point A to point B, each joint will run from the initial angle to its target angle, regardless of the trajectory, as shown below.



MOVL: Rectilinear movement. The joints will perform a straight line trajectory from point A to point B, as shown above.

JUMP: From point A to point B, The joints will move in the MOVJ mode, of which the trajectory looks like a door, as shown below.

- 1. Move up to the lifting Height (Height) in the MOVJ mode.
- 2. Move up to the maximum lifting height (Limit).
- 3. Move horizontally to a point that is above B by height.
- 4. Move down to a point that is above B by height, which the height of the point is that of point B plus Height.
- 5. Move down to Point B.



In the JUMP mode, if the starting point or the end point is higher than or equal to **Limit**, or the height that the end effector lifts upwards is higher than or equal to **Limit**. Assuming that point A is the starting point, point B is the end point, **Limit** is the maximum lifting height, and **Height** is the lifting height.

• Point A and point B are both higher than Limit, but point A is higher than point B.



• Point A and point B are both higher than Limit, but point B is higher than point A.



• Point A is higher than Limit, but point B is lower than Limit.



• The height of point A is the same as that of point B, but both are higher than Limit.



• The height of point A and point B are both the same as Limit.



• Point A and point B are both lower than Limit, but point A plus Height and point B plus Height are higher than Limit.



• ARC

The trajectory of ARC mode is an arc, which is determined by three points (the current point, any point and the end point on the arc), as shown below.



• Circle

The CIRCLE mode is similar to the ARC mode and its trajectory is a circle. In the CIRCLE mode, it is necessary to confirm the starting point with other motion modes.

3.3.1.4 Arc Mode Description

Different from PTP, the trajectory of ARC is an arc, you need to save three points to complete the arc trajectory. The method to save points in CIRCLE is the same as that of ARC.

Prerequisites

- The Dobot M1 has been powered on.
- The Dobot M1 has been connected to the PC successfully.
- The Dobot M1 has been connected to the emergency stop switch.

Procedure

[!WARNING]

You need to use other motion modes to confirm the starting point of the arc trajectory because the middle point and the end point only can be confirmed in ARC mode. When saving points in the ARC mode, please pay attention to the following tips to avoid generating an alarm.

- Any two of the three points of the arc cannot coincide.
- The three points of the arc cannot be in a line.
- The arc trajectory cannot be out range of the workspace
- The arm orientations in ARC and other modes used to confirm the starting point should be the same. Otherwise, the Dobot M1 will not work.

Step 1 Click Teach&PlayBack.





Step 2 Click move to and select movj.



Step 3 Click **Control** to enter the control page, click **Jog**, and then click the Cartesian coordinate system button to jog the robot arm to a point P1.



Step 4 Click Points and ADD to save point P1.

No.	Name	User	Tool	х	Y	z	R	Arm
1	InitialPose	user0	tool0	400	0	200	0	left
2	P1	user0	tool0	297.48	22.52	205.09	-37.44	left



Step 5 Click the drop-down box to select P1 point and click Add on the Parameter Config panel.

movj	movl	jump	arc	circle
	0~	<i></i>	P	
이슈 Param	neter Config			
P Point:	InitialPose	\sim	Customiz	e
	InitialPose			
	P1			
-				

Step 6 Click **Control** to enter the control page, click **Jog**, and then click the Cartesian coordinate system button to jog the robot arm to a point called point A. Click **Points** to enter the saved points list page, click **Add** to save the coordinates of point A. Jog the robot arm again to another point called point B, click **Add** to save the coordinates of point B.

Poir	nts								Control				Setting	a ittifalFizar
hia.	hiame	User	Tael	×	×	z	P	Arm	User Frame	(user)	9	Tool Frame	(10080	
t	InitialPose	user0	teel0	400	0	200	0	lett	Control mod	e ling	Herro-tosk	9		
2	01	usarti	tool0	297.48	22.52	205.09	-37.44	Suft:						
a A	P2	userQ	tool0	398.82	30.68	228.84	4.64	left			1			
4 В	14	user0	toel0	337.68	-205.61	228.61	-38.23	ien .						
									X Sottan V -const Z Sonan R 38.28	-	(* . . X.		2.	
									J1 2135 22 -11		н.	В		11-

Step 7 Select the **arc** motion mode, click the drop-down box on the **Parameter Config** panel and select point A and point B respectively, then click **Add**.

movj	movl	jump	arc	circl
	1	p)	
	E	-	4	
Paran	neter Config	9		
1		-		
A Point:	P2	~	Customize	
A Point: B Point:	P2 P3	~	Customize Customize	
A Point: B Point:	P2 P3 InitialPose	× •	Customize	
A Point: B Point:	P2 P3 InitialPose P1	~	Customize	
A Point: B Point:	P2 P3 InitialPose P1 P2	~	Customize	



Step 8 Click Start, you can see the robot arm moves as an arc.



3.3.1.5 Save Point in Jump Mode

From point A to point B in JUMP mode:

- If point A and point B are only different in Z-axis, and the arm orientations of them are the same, Dobot M1 will not work.
- If point A and point B are the same, only different in arm orientations, for example, the arm orientation of point A is left, and that of point B is right, point A moves to point B as the right hand posture, while the terminal coordinate relative to the origin stays constant.

3.3.1.6 Basic Operation

Application Scenario

If you want to use the Dobot M1 to transport, intelligent sort, write and draw, the teaching and playback function of Dobot M1 can help you to complete. This section uses the suction cup as the end effector to describe how to operate

Prerequisites

- The Dobot M1 has been powered on and connected to the DobotStudio2020 successfully.
- The Dobot M1 has been connected to the emergency stop switch.
- The air pump and the suction cup need to be installed when you suck up objects over the teaching and playback function. For details, please see **Dobot M1 User Guide**.

Procedure

Step 1 Place a small object nearby the Dobot M1, choose one of the following three methods to jog the Dobot M1 to the small object, called point A. The distance from the Dobot M1 to the object should be determined based on site requirements.

- click Jog on the Control page and click the Cartesian coordinate buttons.
- click Jog on the Control page and click the Joint coordinate buttons.
- click Hand-hold on the Control page and and jog the Dobot M1 by hand.



[!NOTE]

- If you want to jog the Dobot M1 by hand when implementing jogging, please click **Hand-hold**to make the motor of Dobot M1 in the disabled state. If you want to move Dobot M1 by clicking the coordinate buttons, please click **Jog** to make the motor in the enabled state.
- If an axis is limited or a point is at the singular position when implementing jogging, an alarm will be

generated. If you save a point after an alarm is generated, the saved point is unavailable. You need to jog the Dobot M1 to clear the alarm, and then save the point again. However, if an alarm about singular point is generated when implementing jogging, the saved point is available in JUMP and MOVJ mode.

New Open Save Save	As Export Start Stop Undo Redo
Directive Type	(50%)
Movement Control V	150 mm/s
	Accelerate(50%)
Speed	15000 mm/s ²
Movement Logic 🗸 🗸	
°∇ <mark>°</mark> if∕else	
C wait	
C loop	
😥 set out	
(x) variable	
	Add

Step 2 Click speed on the Teaching&PlayBack page. Set the speed and acceleration ratio to 50%, click Add.

Step 3 Click the **move to** and select the **jump** motion mode. Click the drop-down box to select point A and set the lifting height (H Param) and the maximum lifting height (zLimit) on the **Parameter Config** page, and click **Add**.

Directive Type	2 Moveme	ent type	
Movement Control 🗸	movj	movl jump	arc circle
move to		zlimit h	
S speed	ž	=0	
Movement Logic 🗸 🗸	† † Paramete	er Config	
°√₀ if/else	P Point:	P1 🗸	Customize
C wait	H Param: 2	20	mm
O loop	zLimit: 2	200	mm
😧 set out			
(x) variable			
		Add	

Step 4 Click wait and set Time to 30ms, and click Add.

Directive Type	Time	30	ms			
Movement Control N	Keep waitir	ng until meet	ing follo	wing cond	ition:	
Movement Control •	O vo	DL01	×)(-++-][[\mathbf{v}
move to	O ADC	AD_01	v)(< ×)		
Speed						
Movement Logic 🔍 🗸						
$^{\circ}C_{\bullet}^{\circ}$ if/else						
🕑 wait						
🔯 set out						
(x) variable						
			100.00			



[!NOTE]

Supposing that we use DOUT17, DOUT18 on the base I/O interface to control the state of the air pump. DOUT17 controls the intake and outtake of the air pump. DOUT18 controls the startup and shutdown. The description in this topic is for reference only, the outputs depend on the I/O interface used. Please replace the outputs based on site requirements.

- 1. Click set out . I/O configuration information will be displayed.
- 2. Click the drop-down list to select **DO_17** and set to **1**.



3. Click + to add I/O, click the drop-down list to select DO_18 and set to 1.



4. Click Add.

Step 7 Click **Z+** to raise the robotic arm, and click other buttons of the Cartesian coordinate system, such as "X+" to move the robotic arm to another point called point B. Click **Add** to save point B.



Step 8 Save Point B. For details, please see Step 3 to Step 4.

Step 9 Release small object over the suction cup.

- 1. Click **set out** . I/O configuration information will be displayed.
- 2. Click the drop-down list to select $\textbf{DO_17}$ and set to 0.



Directive Type	DO_17	v] =	. 0	<u> </u>
Movement Control 🗸	DO_18	×) =	• <u>1</u>	
🔮 move to			- 1	
© speed				
Movement Logic 🛛 🗸				
°\abla if/else				
C) wait				
O loop				
🔅 set out				
(x) variable				
			Add	

4. Click Add.

Step 10 Click Save and Start, the robot arm will teach and playback according to the saved point, and absorb and release the small object.

Main				
(s) speed	50%	50%		
. move to	jump	P1	20mm	-200mm
🕒 wait	time	30ms		
🛞 set out	DO_17	.=	1	
() set out	DO_18	5	1	
9 move to	jump	P2	20mm	200mm
🕒 wait	time	30ms		
💮 set out	DO_17	=	0	
😧 set out	DO_18	-	1	

[!NOTE]

- This topics only describes a trajectory as an example. You can implement multiple trajectories. For details, please see Step 1 to Step 10.
- If you need to operate this file in offline mode, you can click **Export** to save it and then upload it on the Web Management page for running. For details, please see 3.2.4.1 Managing Offline File.

3.3.2 DobotBlockly

Prerequisites

- The Dobot M1 has been connected to DobotStudio2020.
- The Dobot M1 has been connected to an emergency stop switch.

Application Scenario

Blockly is a programming platform based on Google Blockly. You can program through the puzzle format, which is straightforward and easy to understand.

Procedure

Step 1 Click Blockly to enter Blockly interface.

Step 2 Drag the blockly module on the left panel of the Blockly page to program, as shown below.



If robot moves to a point which is user-defined in the motion command, please add the orientation command before this motion command, which indicates the arm orientation of Dobot M1.

Step 3 Click Save and Start to run the program and the robot arm will move as the program.

[!NOTE]

If you need to operate this file in offline mode, you can click **Export** to save it and then upload it on the Web Management page for running. For details, please see 3.2.4.1 Managing Offline File.

3.3.3 Script

Prerequisites

- The Dobot M1 has been connected to DobotStudio2020.
- The Dobot M1 has been connected to an emergency stop switch.

Application Scenario

You can control a Dobot M1 over scripting. Dobot M1 supports various API, such as velocity/acceleration setting, motion mode setting, and I/O configuration, which uses Python language for secondary development. For details about the Dobot M1 API interface and function description, please see *Dobot API Interface Document.

The download path is www.dobot.cc/downloadcenter/dobot-m1.html#most-download.

Procedure

Step 1 Click Script to enter Script interface.

Step 2 Write a script.

You can double-click the interface to add it to program area, the corresponding interface will be displayed on the script programming panel, as shown below.





[!NOTE]

If you need to operate this file in offline mode, you can click **Export** to save it and then upload it on the Web Management page for running. For details, please see 3.2.4.1 Managing Offline File.
3.3.4 Web Management

3.3.4.1 Web Management

The web management of Dobot M1 integrates offline file management, firmware update, and application update, which is used to upload the offline files, make the Dobot M1 in the offline mode, and update the applications. Click **Web Management** to enter the interface as shown below.

🖉 ровот		
# Home File Management	# DobotM1	
1 Uplood Offine Script	Mode Switch Controlling	Web Management
 Offline Scrupt Management Log Management 	Coder Made Gariert Made	The web namager of Dobot MT integrates affine file management, firmware update, application update, and so on.
CP Update A9 Program		
C Update Firmware		

3.3.4.2 Managing Offline File

You can upload the scripts, the blockly programs, or the saved points lists that have been saved on a local PC to Dobot M1 using the web management, to perform offline operation.

After making the Dobot M1 in the offline mode using the web management, the Dobot M1 will be disconnected from the DobotStudio2020.

[!NOTE]

If you need to operate a tray program in the offline mode, please make sure that the tray parameters are set on the network condition. Namely, when setting the tray parameters, you must use the network cable to connect the Dobot M1 and the PC. Otherwise, the tray information cannot be loaded into the Dobot M1 system.

Prerequisites

- The Dobot M1 has been connected to DobotStudio2020 over a network cable.
- You have saved the scripts, the blockly programs, or the saved points lists.
- The Dobot M1 has been connected to an emergency stop switch.

Application Scenario

If the Dobot M1 needs to be running in the offline mode, please use the web management.

Procedure

Step 1 Select the right IP address of Dobot M1 on the DobotStudio2020.

Step 2 Click Web Management >Offline Script Management to enter the Offline Script Management interface .

Step 3 click Add File to enter Upload Offline Script interface.

Offline Script Mar	nagement		
HE ANATTRE DECEMAN	Dene Let		- All
Name	Туре	Whether run as offline mode	Operation
			Coffine Distric A Download
			Cancel Office: Distance

Step 4 Click Select Upload File to select the file to be uploaded.

Only support the files, of which the suffixes are .playback, .blockly, and .script.

Upload Offline Script	
í 	
L	**Step 5**





Step 6 Select the uploaded files that need to be offline executed on the Offline Script Management page, and click Offline to make the files in the offline mode, as shown below.

+sattin EDict.or	å Teles Lis		<u>-</u>
Name	Type	Whether run as offline mode	Operation
			Ø Office
			Courted Officer
			Zotine Diline A Director

Step 7 Select Offline Mode from the drop-down list on the Mode Switch Controlling pane of the Home page, and click Start to make the Dobot M1 in the Offline Mode status, as shown below. The Dobot M1 is disconnected from the M1Studio, and Dobot M1 can be running according to the files that are in the offline mode.



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3.3.4.3 Upgrading Firmware

When the firmware or other applications need to be upgraded, you can use the web management to upgrade the firmware or the application. For example, if you want to use the collision detection or IP address forced configuration function, you can upgrade the Dobot M1 firmware.

[!DANGER]

When updating a firmware, please do not perform any other operation on the Dobot M1 or power off it, to avoid Dobot M1 in an abnormal condition. Otherwise, it will be vulnerable to injury the device or the person.

Prerequisites

- You have connected the Dobot M1 to DobotStudio2020, and the IP addresses of Dobot M1 and the PC must be in the same network segment.
- You have powered on the Dobot M1.
- You have connected the Dobot M1 to an emergency stop switch.
- You have obtained the latest A9 firmware **a9_app-00*xx*.tar**.xx indicates the firmware version, please replace it based on site requirements.

Download path:https://cn.dobot.cc/downloadcenter/dobot-m1.html?sub_cat=119#sub-download.

• You have obtained the latest M1Stuido.

Download path:https://cn.dobot.cc/downloadcenter/dobot-m1.html?sub_cat=119#sub-download.

Procedure

Step 1 Select the right IP address on the DobotStudio2020.

Step 2 Click Web Management > Update A9 Program to enter the interface, as shown below.

Update A9 Program			
Current Version:02008600			
Speed- Statuar- 0%	Details-	Rame.	Since

Step 3 Click Select File to upload the obtained firmware and click Update.

[!WARNING]

If the version of the obtained firmware is **0058** or later, please click **Update** again after **Status** is **100%**, to avoid update failure.

Step 4 Restart Dobot M1 after the update is finished.

Step 5 Click Update Firmware .

Step 6 Select firmware exactly as the order shown below and click One-click Update.

Update Firmware				
Update Type	Properties	IsLastVersion	Slatus	Operation
Dobot Firemanc Stor	Spinist Defails	bfast	Updata Tialah 1004	One-click Sipdate
30 Printing Fermione Size	Spred- Details		Wait for aploading	One-diak Updata
Delwert) Sum	Sprent- Defaile-		Wait for upboaling	One-chick Update
Driver2: Sine	Speed. Details			Oue-dick Update
Drives 3: Star	Spreed: DeSails	blast	Weit for upberfing	One-click Update
Driver 0: Sizzi	Speed: Dettaile		Walt for upboofing	One-dick Update
EndEllanten Stor	Spread. Details			One-click Upstata
All Drivers Sur-	Spreed. Details	Wating	Wait for uploating	One-dick Update

You can view the process of the firmware upgrade. If the progress bar is 100% and the green LED indicator on the base of Dobot M1 is blinking, the update is completed, as shown below. And then the next firmware update can be started.



Step 7 Select Dobot Mode from the drop-down list on the Mode Switch Controlling pane of the Home page and Click Switch.

After upgrading the 3D printing firmware, Dobot M1 will switch to 3D printing mode. You need to switch the **3D Pprinting mode**to **Dobot Mode**, otherwise Dobot M1 cannot be used normally. As shown below.



3.3.5 I/O Assistant

Prerequisites

- Dobot M1 has been connected to DobotStudio2020.
- Dobot M1 has been connected to emergency stop switch.
- The air pump has been installed (If you use an air pump to debug I/O interface).

Application Scenario

The end effectors such as gripper, suction cup need to work with the air pump. The air pump can be controlled by the I/O interface. You can verify the I/O interface and the air pump over **I/O Assistant**.

Procedure

If the air pump is connected to the base I/O interface, the outputs used are DOUT17, DOUT18 respectively. The DOUT18 output controls the startup and shutoff of the air pump.

I/O 1/O Configura DI_02 24V DI_14 24V DI_03 24V DI_15 24V DI_04 24V 24V DI_16 DI 05 24V DI 17 24V DI_06 24V DI_18 24V 24V DI 07 24V DI_19 DI_08 24V DI 20 24V DI_09 24V DI_21 24V DI_10 24V DI_22 24V 24V 24V DI_11 DI_23 DI 12 24V DI 24 24V Output DO_01 DO_12 OV OV DO 02 DO_13 OV VO DO_03 DO_14 0V 24V OV DO 04 DO_15 OV VO 24V DO 05 DO_16 OV 0V 24V DO 06 DO_17 0V 24V 0V 24V

Step 1 Click Teach&PlayBack > I/O to enter I/O interface.

Step 2 Click **24V** of **DO_18** on the **Output** interface, as shown below, The air pump is humming, which indicates that the air pump is enabled. The working state depends on the air pump. Please judge based on site requirements.

				UD Configuration
DI_1	2	24V	DI_24	24V
Ou	tput			
DO	01 (W 24V	DO_12	0V 24V
DO_	02	W 24V	DO_13	OV 24V
DO_	.03 1	W 24V	D0_14	OV 24V
DO_	04	W ZAW	DO_15	OV ZAV
DO	05 (W 24V	DO_16	0V 24V
DO	06 [W 24V	D0_17	0V 24V
DO_	07	W 24V	DO_18	0V 24V
DO	.06 (W 24V	DO_19	0V 24V
DO_	90	W 24V	DO_20	0V 24V
DO_	10 1	N 24V	DO_21	0V 24V
DO_	11	W 24V	DO_22	OV 24V

Step 3 Click 0V of DO_18 on the Output interface. The air pump is not humming, which indicates that the air pump is disabled.



3.3.6 Collision Detection

Collision detection is mainly used for reducing the impact on the robot arm, to avoid damage to the robot arm or external equipment. If the collision detection is activated, the robot arm will stop running automatically when the robot arm hit an obstacle.

Prerequisites

- The Dobot M1 has been powered on and connected to DobotStudio2020 .
- The Dobot M1 has been connected to an emergency stop switch.

Procedure

Step 1 Obtain kinetic parameters of each joint of robot arm, to avoid false collision detection

(1) Remove the fixture on the robot arm and make sure that there are no obstacles within the workspace. If there is no fixture on the robot arm, please skip this step.

(2) Click Menu > Settings > M1 > Collision Detection to enter the collision detection interface.

🌣 Settings	TCP_Payload	
Common	2.5 Kg	
M1	Automatically enable after 55 (5	ōs Restar 🗸
Basic	Security Level Configuration	
Maintenance	Low Middle High	
IP Configuration	TolareteJ1 0 Nm TolareteJ2 0 Nm	VeU1 180 °/s
Firmware Download	TolareteJ3 0 N	VelJ3 200 mm/s
Collision Detection	TolareteJ4 0 Nm	VelJ4 200 °/s
Coordinate System		

(3) Click Auto Calculate to obtain kinetic parameters.

A safety prompt will be shown after clicking Auto Calculate, please read the safety precautions and click Start.

The robot will move in random directions for a while. After the process bar is 100%, the kinetic parameters will be obtained automatically.

Dynamic	Motion Para	meters				
ZZ1	0.0207	FS1	12,1278	FV1	0	
ZZ2	0.1262	MX2	0.5136	MY2	0.0243	
IA2	0.2933	FS2	6.8916	FV2	0	
	Auto Calcula	te			0%	
TCP_Payl	Atten Atten 1.Click Start an 2.Click Start to 3.Please confirm	tion : Id the big fo turn off safe m before yo	rearm of M1 will e mode u click Start	swing randomly		
Recovery	3.1 Ther / M1	e is no load	and fixture insta	lled at the end o	f the	
Au	ite		S	tart Clos	e	
Security	Level Configu	iration				
Lo	w Middle	н	igh			
Tolare	eteJ1 0	Nm	0	VelJ1 (180	°/s	
				1	Apply	

(4) Set Security Level Configuration to Low, Tcp_PayLoad to 0, select EX Force Restart , as shown below.

mmon		
	Recovery Mode	orce Restar 🗸
asic	Security Level Configuration	
laintenance	Low Middle Hi	gh
Configuration	TolareteJ1 0 Nm	VelJ1 180 %s
rmware Download	TolareteJ2 0 Nm TolareteJ3 0 N	VelJ2 180 °/s VelJ3 1000 mm/s
ollision Detection	TolareteJ4 0 Nm	VelJ4 1000 %
oordinate System		

(5) Click **Apply**, The kinetic parameters are saved in the main controller.

[!WARNING]

• When obtaining the kinetic parameters, the robot arm will move in random directions for a while. Please make sure that there are no obstacles within the workspace, to avoid obtaining wrong kinetic parameters because of collision.

- During robot arm running, please do not perform any other operation on the Dobot M1 or power off it, to avoid the Dobot M1 in an abnormal condition
- When the unexpected occurs during robot arm running, please click **Stop** on the **Dynamic Motion Parameters** panel.

Step 2 Mount the fixture on the Dobot M1 based on site requirements.

Step 3 Set the payload based on site requirements. In this topic, we set to 1Kg.

Step 4 Set Recovery Mode to EX Force Restart.

Step 5 Set Security Level Configuration to Middle.

ommon					
11	Recovery Mode	bilision (EX Force	Restar 🗸	1	
Basic	Security Level Conf			-	
Maintenance	Low Mid	dle High			
IP Configuration	TolaneteJ1 [15	Nm	VeU1 (126] */s
irmware Download	TolareteJ2 12 TolareteJ3 200	Nm 0 N	VeU2 (VeU3 (126] */s] mm/s
Collision Detection	Tolarete/4 200	0 Nm	Vell4	700] %s
Coordinate System					

Level	Description
Low	No restrict. Namely, deactivate collision detection
Middle	Activate collision detection and the speed decreases 30%
High	Activate collision detection and the speed decreases 50%

Step 5 Click Apply.

Step 6 Restart the Dobot M1 to make the collision detection parameters effective.

Step 7 Verify whether the collision detection is effective.

When the Dobot M1 hit an obstacle during running, the Dobot M1 stops running automatically. If you touch the Dobot M1, it runs again, indicating that the setting is effective.

3.3.7 Example of Safeguard Stop

The safeguard stop function is used to suspend robot movement in a safe mode. Namely, when the safeguard stop function is enabled and the safeguard input signals are triggered, the robot stops immediately and enters into pause state. In Dobot M1 system, the DI7, DI8 and DI9 interfaces on the DB62 expansion board are safeguard inputs, which can connect to safety doors, light curtains, safety floor mats, etc.

[!WARNING]

- The safeguard input interfaces are available only when the safeguard stop function is enabled. If not enabled, the DI7, DI8 and DI9 on the DB62 expansion board will be used as the common digital input interfaces.
- In normal use of Dobot M1, please DO NOT enable safeguard stop function at will. Otherwise, the scripts cannot be run.

• Immediate Recovery Mode

Only DI7 and DI8 are safety interfaces in the immediate recovery mode. The robot stops moving after disconnecting DI7 and DI8, and the robot resumes its movement after reconnecting DI7 and DI8.

Prerequisites

- The Dobot M1 has been connected to an emergency stop switch.
- The Dobot M1 has been connected to the DB62 expansion board.

Procedure

Step 1 Connect the DB62 expansion board to the door switch, as shown below.



When the safeguard stop function is enabled, either or both of **DI7** and **DI8** interfaces are disconnected from **PGND** interface, the safeguard stop will be triggered and Dobot M1 will stop moving without clearing the queue in the Dobot M1 system. Only when both **DI7** and **DI8** interfaces are connected to **PGND** interface, the Dobot M1 will move again.

Step 2 Power on Dobot M1 and connect it to DobotStudio2020.

Step 3 Click Menu > Settings > M1 > Basic to enter to the basic setting page.

Step 4 Select Immediate Recovery Mode on the DobotStudio2020, and click Apply.



Step 5 Make the Dobot M1 in the running status, and open the door switch. The Dobot M1 will stop immediately and enter into pause state. If you close the door switch, the Dobot M1 resumes movement.

• I/O Trigger Recovery Mode

DI7, DI8, and DI9 are safety interfaces in the I/O trigger recovery mode. The robot stops moving after disconnecting DI7 and DI8. After reconnecting DI7 and DI8, the robot will not resume its movement. Only when DI9 is low level, the robot will resume its movement.

Prerequisites

- The Dobot M1 has been connected to an emergency stop switch.
- The Dobot M1 has been connected to the DB62 expansion board.

Procedure

Step 1 Connect the DB62 expansion board to the door switch, and connect DI9 to a normally open switch, as shown below.



When the safeguard stop function is enabled, either or both of **DI7** and **DI8** interfaces are disconnected from **PGND** interface, the safeguard stop will be triggered and Dobot M1 will stop moving without clearing the queue in the Dobot M1 system. Only when both **DI7** and **DI8** interfaces are connected to **PGND** interface, and DI9 connected to low level, the Dobot M1 will move again.

Step 2 Power on Dobot M1 and connect it to DobotStudio2020.

Step 3 Click Menu > Settings > M1 > Basic to enter to the basic setting page.

Step 4 Select I/O Trigger Recovery Mode on the DobotStudio2020 , and click Apply.

🌣 Settings	Specification		
Common	Device Name t Device SN 14	est1 412080700	Reset Device Name
V1	Initial Position		
Basic	InitialPose 💽 Get P	oint 🛛 😢 Go To	
Maintenance	user0 to	ol0 left	
IP Configuration	X 381.57 Z 176,16	У -120.02 R -17.52	
Firmware Download			
Collision Detection	Security I/O	erv Mode	
Coordinate System	I/O Trigger Record	very Mode	

Step 4 Make the Dobot M1 in the running status, and open the door switch. The Dobot M1 will stop immediately and enter into pause state. If you close the door switch and the normally open switch, the Dobot M1 resumes movement.

3.3.8 Coordinate System

3.3.8.1 User Coordinate System

The User coordinate system is a movable coordinate system which is used for representing equipment like fixtures, workbenches. The origin and the orientations of axes can be defined based on site requirements, to measure point data within the workspace and arrange tasks conveniently. When the position of workpiece is changed or a robot program needs to be reused in multiple processing systems of the same type, you can create coordinate systems on the workpiece to simplify programming.

[!NOTE]

When creating a User coordinate system, please make sure that the reference coordinate system is the base coordinate system. There, User0 is defined as the base coordinate system by default and cannot be changed.

User coordinate system is created by two-point calibration method: Move the robot to two points **p0(x1, y1, z1)** and **p1(x2, y2, z2)**. **p0** is defined as the origin and the line from **p0** to **p1** is defined as the positive direction of X-axis. And then the Y-axis and Z-axis can be defined based on the right-handed rule, as shown below



Take the establishment of User 1 coordinate system as an example.

Prerequisites

- The Dobot M1 has been connected to DobotStudio2020.
- The Dobot M1 has been connected to an emergency stop switch.

Procedure

Step 1 Click Menu > Settings > M1 > Coordinate System on the DobotStudio2020 page.

The coordinate system page is displayed, as shown below.

🔅 Settings	User Fra	me		Tool Fram	ne ×
Common					elete Add
M1	Name	х	Y	Z	R
Basic	user0	0.0000	0.0000	0.0000	0.0000
Maintenance					
IP Configuration					
Firmware Download					
Collision Detection					
Coordinate System					
					Apply

Step 2 Click Add on the User Frame tab to create User coordinate system, as shown below.



Step 3 Input User coordinate system name on the User Frame tab. In this topic, we set to user1.

Step 4 Jog robot to the point P0 and click obtain on the P0: panel of the User Frame tab.

[!NOTE]

When creating a User coordinate system, please make sure that the reference coordinate system is the base coordinate system. Namely ,the User coordinate system is user0 and the Tool coordinate system is tool0 when jogging robot, as shown below.

C	ontrol				Settings In	() itialPose
Use	er Frame	user0	~]	Tool Frame	(tool0	×.
Coi	ntrol mode	Jog	Hand-h	old		
			ງ	******	00	0
			ل			
Spe	eed (50%)	-				-
х	381.57		X+		Z+	
Y	-120.02	1	×			
Z	176.16	Y+	Y-	R+		R-
R	-17.52		х-		Z-	
11	17.45					
12	-17.40	J1+	J1-	J3+	- J3-	
	0					
13	176.16	J2+	J2-	J4	+ J4-	
14	-0.06					

Step 5 Jog robot to the point P1 and click obtain on the P1: panel of the User Frame tab.

Step 6 Click OK.

The created User coordinate system will display on the User Frame tab, as shown below.

💠 Settings	User Fra	ime		Tool Fram	e
Common			сору	modify De	lete Add
M1	Name	Х	Y	Z	R
Basic	user0	0.0000	0.0000	0.0000	0.0000
Dasic	user1	381.0000	-120.0000	176.0000	0.0000
Maintenance					
IP Configuration					
Firmware Download					
Collision Detection					
Coordinate System					
				ļ	Apply

Step 7 Select **user1** and click **Apply**. Now you can use the User 1 coordinate system for teaching and programming.

3.3.8.2 Tool Coordinate System

Tool coordinate system is the coordinate system that defines the distance and rotation angle of the offset, of which the origin and orientations vary with the position and attitude of the workpiece located at the robot flange. When an end effector such as welding gun, gripper is mounted on the robot, the Tool coordinate system is required for programming and operating a robot. For example, you can use multiple grippers to carry multiple workpieces simultaneously to improve the efficiency by setting each gripper to a Tool coordinate system.

[!NOTE]

When creating a Tool coordinate system, please make sure that the reference coordinate system is the base coordinate system. There, Tool0 is defined as the base coordinate system by default and cannot be changed.

Tool coordinate system of SCARA robot is created by two-point calibration method: After an end effector is mounted, please adjust the direction of this end effector to make the TCP (Tool Center Point) align with the same point (reference point) in two different directions, for obtaining the position offset to generate a Tool coordinate system, as shown below.





Take the establishment of Tool 1 coordinate system as an example.

Prerequisites

- The Dobot M1 has been connected to DobotStudio2020.
- The Dobot M1 has been connected to an emergency stop switch.
- The end-effetor has been mounted on the Dobot M1.

Procedure**

Step 1 Click Menu > Settings > M1 > Coordinate System on the DobotStudio2020 page.

The coordinate system page is displayed, as shown below.

🔯 Settings	User Fra	me		Tool Fram	ie ×
Common					elete Add
M1	Name	х	Y	Z	R
Basic	user0	0.0000	0.0000	0.0000	0.0000
Maintenance					
IP Configuration					
Firmware Download					
Collision Detection					
Coordinate System					
					Apply

Step 2 Click Add to create Tool coordinate system on the Tool Frame tab, as shown below.



Step 3 Input Tool coordinate system name on the Tool Frame tab. In this topic, we set to tool1.

Step 4 Jog robot to the point P0 in the first direction and click obtain on the P0: panel of the Tool Frame tab.

[!NOTE]

When creating a Tool coordinate system, please make sure that the reference coordinate system is the base coordinate system. Namely ,the User coordinate system is user0 and the Tool coordinate system is tool0 when jogging robot, as shown below.

C	ontrol				Settings Ir	nitialPose
Use	er Frame	user0	\sim	Tool Frame	(tool0	Ŷ
Coi	ntrol mode	Jog	Hand-ho	bld		
			ו		00	0
		0.115	J.			
Spe	ee <mark>d (50</mark> %)		-			-
х	381.57		X+		Z+	
Y	-120.02	1	×			
z	176.16	Υ+	Y-	R+		R-
R	-17.52		х-		Z-	
11	-17.46					
12	-17.40	J1+	J1-	J3+	J	-
2	0					
13	176.16	J2+	J2-	J4	+ J4-	
J4	-0.06					

Step 5 Jog robot to the point P0 in the second direction and click obtain on the P1: panel of the Tool Frame tab.Step 6 Click OK.

The created Tool coordinate system will display on the Tool Frame tab, as shown below.

🔅 Settings	User Fra	ime		Tool Fram	ne ×
Common			сору	modify D	elete Add
M1	Name	Х	Y	Z	R
Basic	tool0	0.0000	0.0000	0.0000	0.0000
Dasie	tool1	-265.0000	0.0000	0.0000	0.0000
Maintenance					
IP Configuration					
Firmware Download					
Collision Detection					
Coordinate System					
					Apply

Step 7 Select **tool1** and click **Apply**. Now you can use the Tool 1 coordinate system for teaching and programming.

4. Dobot MG400

4.1 Overview

You can control Dobot MG400 through the DobotStudio2020, and perform teaching and playback, Blockly, Script and other operations on the DobotStudio2020.

4.2 DobotStudio2020 Connection

Step 1 Fix the base of robot on a platform with four M5 screws.



Step 3 Set the computer's IP address to communicate with the robot. The robot's IP address is 192. 168.1.6, you need to set the computer's IP address on the same network segment without conflict.

Control Panel > Network and internet > Network Control	ectors >	General	
	Ethernet 1 Unidensited network Realask USB Gate Family Contr	Obtain an IP address automatically Outse the following IP address:	1 40
rnet >Network Connection	Networking sharing This connection uses the following barrs	255.255	255.0
		255.25 OK	5.255. Centre

Step 4 Launch DobotStudio2020, select the right device' IP address and click Connect.



4.3 Function Description

4.3.1 Overview

In this section, we will introduce the basic functions in DobotStudio2020.

		1 2		3	4 5	6	7	
	O Dobot Studio	≘ ଜ		Cafe-LS Online		lobal Speed(42%)	- _	8
	Welcome to Dobot Instant intervent relations Tary to one and a same thereing to one point a same to imply to one popel and another thereing with the same to periphere on the one relations of the same to periphere on the one	Studio2020		Æ	Í	-l		- 9
	Recent Projects	2021 40 OF 123408	Teach & Playback	DebotBleckly		Script		
11 —	dfufef sense stats 4444444 singles stats	2003-00-06-34/2009 2003-07-08-34/2042		10				
	111111 aufiet 171111	2027 20 09 12 21 48	ALCONTROL CONTROL					

No	Description
1	Setting menu, including basic setting, IP setting, Jump parameters setting, etc.
2	Home page
3	Status, including connection status, collision detection level, device status
4	Alarm log. You can click it to check the alarm log.
5	Enable or disable the MG400 motor
6	 Adjust the jogging speed and the running speed before running a program Actual jogging speed = the maximum jogging speed * global speed rate Actual running speed= the maximum running speed * global speed rate * the set velocity rate in the velocity command
7	Software emergency stop button
8	Control page , you can jog MG400 by clicking coordinate system buttons on this page
9	Points page. After jogging the MG400 to a point, you can click Add on this page
10	Main interface. You can select teach&playback, Blockly, or script module to write a program. Also, you can set remote control on the remote control page
11	Recent projects. You can open the recent project directly in this section
4.3.2 Basic Operation

After connecting to the MG400, you can jog robot by clicking coordinate system buttons on the **Control** page.



You can jog MG400 in Cartesian coordinate system after the MG400 is in the enabled status.

- Click X+, X- and MG400 will move along X-axis in a negative or positive direction.
- Click Y+, Y- and MG400 will move along Y-axis in a negative or positive direction.
- Click **Z+**, **Z-** and MG400 will move along Z-axis in a negative or positive direction.
- Click R+, R- and MG400 will rotate along R-axis in a positive or negative direction.

If you control MG400 in different User or Tool Cartesian coordinate system, you need to set them advanced on the **Settings > Coordinate System** page and select the right coordinate system to control MG400.



Also, you can jog MG400 in Joint Coordinate system after the MG400 is in the enabled status. .

- Click J1+, J1- and control the base motor to rotate in the negative or positive direction.
- Click J2+, J2- and control the Rear Arm motor to rotate in the negative or positive direction.
- Click J3+, J3- and control the Forearm motor to rotate in the negative or positive direction.
- Click J4+, J4- and control the end-effector to rotate in the negative or positive direction.

When you want to fine-tune the MG400 by clicking the coordinate system buttons, you can select the right step in the Step mode. The step supports 0.1, 1, 5, and 10. In Cartesian coordinate system, the step unit is mm, and in Joint coordinate system, the step unit is °.

In addition to jogging MG400 on the **Control** page, you can also click to make MG400 move to the initial

pose and click to enter the **Settings** page.

There is another way to make robot jog: Press the hand-teaching button on the forearm and drag the forearm to a point and then press the button again.

4.3.3 Teaching and Playback

The teach and Playback function supports tree programming teaching, and users can perform teach and Playback through tree programming. According to different program instructions, the interface displays different parameter settings. Currently, Teaching and playback only supports single thread. The instruction description is shown in the table below.

)+ File Save 🖓 Un	do 🖉 Bedio 🕲 Debug 💽 Start		> Points	Control 😳 😳 📘
Directive Type	2 Movement type	11 Main	Name User Tool	User Frame 0
Motion	MovJ MavL Jump JointMavJ		PI 0 0	A
g move to	RelMovJ RelMovL Arc Circle			
🖧 cartesian speed		Programming	Points list	Income
oint speed				Mode Jon Step
CP CP	tit Parameter Config			Jog cartension jog
E) sync	Max height z limit 100 mm			Inch 0.1 1 5 10
) DO Commands	Advanced setting			X 230.77 X+ y-
DOInstance	Speed			Y 21.00
¥*	CP •			Z 11:50 Z-
ogic V	Add			R+ R- R 5254 Z-

Instruction	Description	Setting
move to	Motion instructions. Move to a certain point or follow a certain trajectory	Choose different motion mode and set motion parameters. The motion mode supports MovJ, MovL, JointMovJ, Jump, RelMovJ, RelMovL, Arc, Circle All motion modes support advanced settings, including speed, acceleration, CP, indicating that these parameters are valid only in the current mode. In addition, MovJ and MovL motion mode support setting digital output status during moving
cartesian speed	Cartesian speed instruction	Set the Cartesian speed acceleration ratio. This command is valid only when the motion mode is MovL, RelMovL, Jump, Arc, Circle
joint speed	Joint speed instruction	Set the Joint speed acceleration ratio. This command is valid only when the motion mode is MovJ, JointMovJ, RelMovJ
СР	Continuous path instruction	Set Continuous path ratio, the vale range is 0 - 100. This command is invalid when the motion mode is Jump
sync	Synchronization instruction. Whether to stop at this point	None
DO	I/O instruction	Set the status of digital output port (Queue command)
DOInstance	I/O instruction	Set the status of digital output port (Immediate command)
	Logical instruction. Set Judgment	

if/else	conditions to trigger robot movement	Logical processing based on digital input or variable setting
wait	Waiting instructions. The time can be set to make the robot arm wait	Set the wait time
loop	Loop instruction	Set the number of loop
set variable	set variable. You can create and set variable values	Create a new variable, and assign an initial value to the variable according to the variable type

Now, we take an example to describe how to use teach and playback to control MG400 move.

For example, the MG400 moves from point P1 to P2 circularly in MovJ mode under the basic coordinate system.

Step 1 Make MG400 in the enabled status.

r	Dobot Studio 💳 🔿			MG400	Safe-15	FET	Global Speed(42%)
		tetsttt	MDH31		Online	لشا	

Step 2 Click the motion buttons on the Control page to make MG400 jog to P1 point and then click **Add** on the **Points** page.

Step 3 Click the motion buttons on the Control page to make MG400 jog to P2 point and then click **Add** on the **Points** page.





1. Select Loop and select Repeat forever and then click Add.

Directive Type		Repeat forever	II Main
Motion Logic C if/else	> ~	Repeat Times 1 Keep looping until meeting following condition: 1/0 1/0 D_01 Yariable yar name	torever
© wait			
📰 set variable			
		Add	

1. Select **MovJ** mode and select **P1**, then click **Add**.

🧕 Movement type

MovJ	MovL	Jump	JointMovJ						
RelMovJ	RelMovL	Arc	Circle						
P									
Parameter Config									
Advanced sett	ing								
Speed	•								
Accel	•								
СР	•								
Process I / O settings ?									
DO_01	\vee	/ = OF	FV						
Add									

1. Select MovJ mode and select P2, then click Add.

🧕 Movement type

		1	1.1.1.1.1
MovJ	MovL	Jump	JointMovJ
RelMovJ	RelMovL	Arc	Circle
		P	
)		
	~		
Parameter	r Config		
Advanced sett	ing		
Speed	•		
Accel	•		
CP			
Process I /	O settings	?	
DO 01	~	- OF	F V C
00_01			
	Ac	d	

1. Select MovJ mode and select P2, then click Add.

irective Type	2 Movement type	📑 Main		
Action V	MovJ MovL Jump JointMovJ	V loop	forever	
-	RelMovJ RelMovL Arc Circle	9 move to	MovJ P1	
g move to		9 move to	MovJ P2	
cartesian speed	(ar			
🖇 joint speed	~			
CP	11 Parameter Config			
B) sync	Coordinates of P2 V Customize			
2	Advanced setting			
9 00	Speed •			
DOInstance	Accel			

Step 5 Click Save and input project name, then click Start.

The MG400 will moves from P1 to P2 circularly.

In this module, the debug function is not supported.

4.3.4 Blockly

Blockly is a programming platform . You can program through the puzzle format, which is straightforward and easy to understand.

abs - of						Name User Too	User Frame	
Print Hello world!		122.2			1 53 51 5 <mark>1</mark> 153 53	initaTuse 0		
Variables	Blocks	1233	15 80	Programming		Points list		
Make a Variable		- 22 - 21 - 22 - 23					// m	
Make a List							Joggin	g
Move		1.1.1					Made Jog 5	tep
Advanced configuration		1213					Jog Cattension	og
Move in MovJ - mode in	point	14111					Inch 01 1 5	10
Move in RelMovJ - mod	le to point Δx						X (43.12 X+	
Move in Jump mode to point	Raise						¥ -646	
Move in Jump mode to point	Arch (Z 0.96 2	
	We cannot de						R+	R.

Now, we take an example to describe how to use Blockly to control MG400 move.

For example, the MG400 moves from point P1 to P2 circularly in MovJ mode under the basic coordinate system.

Step 1 Make MG400 in the enabled status.

Q	Dobot Studio \equiv	ណិ		tetsttt	3	MG400 (102,156,31) Concertini	 Safe-L5 Online 	٦	Global Speed(42%)	
^	• • • • • • • • • • • • • • • • •		I 11		O M	0400 :-		 1 41		

Step 2 Click the motion buttons on the Control page to make MG400 jog to P1 point and then click **Add** on the **Points** page.

Step 3 Click the motion buttons on the Control page to make MG400 jog to P2 point and then click **Add** on the **Points** page.





There are two methods to generate commands.

- Drag blocks directly.
- Click Advanced configuration to generate block, only support motion blocks.

Advanced configuration						
Move in MovJ - mode to point						
	Settings panel	×				
Move in ReiMovJ · mode to point dx	Motion type					
Move in Jump mode to point Raise	MovJ MovL Jump	JointMovJ	S			
Move in Jump mode to point Arch p	RelMovJ RelMovL Arc	Circle				
	(*P					
Exercise in circle mode: middle point.						
Move in arc mode: middle point en	† Parameter configuration					
Move Arguments	Coordinates of InitialPos	Custom				
set joint acceleration percentage 10 %	Advanced setting	~				
	Speed O					
set joint speed percentage 10 %						

In advanced configuration, you can set the speed and acceleration, CP or digital output status directly in this block.

🧕 Movement type

	Maria	T	In the Adverse I
MovJ	MovL	Jump	JointMovJ
RelMovJ	RelMovL	Arc	Circle
	/	> P	
	~		
Alà Daramata	r Config		
Paramete	r Conlig		
Advanced sett	ting		
Speed	•		
Accel	•		
СР	•		
Process I /	O settings	?	
DO 01	\sim	= OF	FV
	(·
	Ac	ld	

Step 5 Click Save and input project name, then click Start.

The MG400 will moves from P1 to P2 circularly.

In this module, the debug function is not supported.

4.3.5 Script

MG400 supports various API, such as velocity/acceleration commands, motion commands, etc., which uses Lua language for secondary development.

nput search text	src0.lua X globallua X +	Name User Too	User Frame 0 ···································
A. Motion	2	PattalPose 0	
Point to point, the target point is Cartesian point MovJ Commands	3 4 5 6	Points list	
P Linear Movement MovL	Programming		Jogging
Point to point, the target point is Joint point JointMovJ			Mode Jog Step Jog cartension jog Inch 0.1 (\$ 10
Jump Movement, Jump parameters can be set in this command htmp	14 15 16 17		X 34512 X+ y+ y.
P Jump Movement, Jump	18 19		V -4.4
parameters are called by Arch index	20 21		Z 690 Z+ R+ R-

In script, multiple threads are supported. Up to 5 threads can be executed simultaneously. **Scr0.lua** is the main thread, Other threads are sub threads, which run program parallel to the main thread, such as I/O control. You

can click + to add the sub thread. In the sub threads, the motion commands cannot be called. Only the main thread supports motion commands.

In addition, global variable module (global.lua) is only used to define global variables and module functions. The motion commands cannot be called here.

Now, we take an example to describe how to use script to control MG400 move.

For example, the MG400 moves from point P1 to P2 circularly in MovJ mode under the basic coordinate system.

Step 1 Make MG400 in the enabled status.

			n	MG400			0	Global Speed(42%)	
🚺 Dobot Studio 🔚	កែវិ	tetsttt			Safe-L5	12		catching presed (create)	(STOP)
			-1004001-		Online				~

Step 2 Click the motion buttons on the Control page to make MG400 jog to P1 point and then click **Add** on the **Points** page.

Step 3 Click the motion buttons on the Control page to make MG400 jog to P2 point and then click **Add** on the **Points** page.

Jame	Licar	Tool	x	v	7	P		<u> </u>		Toormanie	a:	
vanie	User	1001	~		2	ĸ						
iitialPose	0	0	350	0	0	0			1			
P1	0	0	231.76	21.001	11.900	-52.53		Same I	Ph			
				Cov	er RunTo	Delete						
P2	0	0	295.10	145.35	2.9167	-29.85			~~~			
							20		×			
							Mode	Jog		Step		
							Inch	0.1	1	5	10	
							¥ 295.11	10	- >	1		_
							¥ 14535		X+		Z+	
							Z 292	¥+	٧.	R+	R-	
							and the second second					
							R -29.85	×		1	z-	
							R -29.85	×	\cdot		Z-	
							R -29.85	x	2		z-	
							R -29.85	×			2-	
							 R -29.85 J1 26.22 J2 26.11 	л+	- J1-	J3+	Z- J3-	
							 R -29.85 J1 26.22 J2 26.11 J3 33.95 	л+ J2+	л-		Z- J3-	
							 R -29.85 J1 26.22 J2 26.11 J3 33.95 J4 -56.07 	л+ J2+	л- J2-	33+ 34+	Z- J3- J4-	
							 R -29.85 J1 26.22 J2 26.11 J3 33.95 J4 -56.07 	л+ J2+	- J1- J2-	13+ 	J3- J4-	
							 R -29.85 J1 26.22 J2 26.11 J3 33.95 J4 -56.07 	л+ 	л- 12-	13+ 	J3- J4-	

Step 4 Write a program.

You can double-click the right command to insert it to the programming section or double-click with the optional parameters.



Input search text	Q	1 — Version: Lua 5.4.1
T. Motion		2 while true do
Point to point, the tar is Cartesian point MovJ	get point 🦷	4 Mov_J (P2) 5 end 6
Linear Movement MovL	e	7 8 9
Point to point, the tar is Joint point JointMovJ	get point 👘	10 11 12 13
Jump Movement, Jum parameters can be set command Jump	np t in this	14 15 16 17
Imp Movement, Jum parameters are called index Jump1	np by Arch	19 20 21 22

Point to point, the target point is Cartesian point Movi	(et
2 Elinear Movement	•
Help Document	×
Function:	
MovJ(P)	
Or:	
	20}
<pre>1 local Option={CP=1, Speed]=50, Acc]= 2 MovJ(P, Option)</pre>	10

Step 5 Click Save and input project name, then click Start.

The MG400 will moves from P1 to P2 circularly.

If you want to debug this program, you can set the breakpoints and then click Debug to debug.

4.3.6 Remote Control

4.3.6.1 Overview

External equipment can send commands to MG400 by different remote control modes, such as remote I/O mode and remote Modbus mode. The default mode is online mode when the MG400 is shipped out. When you need to set the remote mode, please set it on the **Remote Control** page with the robot motor in the disabled state.

4.3.6.2 Remote I/O

When the remote mode is remote I/O mode, external equipment can control the MG400 in this mode. You can click **Remote Control** to use this module. The remote control page is shown as follows.

🙆 Dobot Studio 🚊	ନ		3	Mickoo The reaction	Safe-L1		1	Global Speed(51%)	0
			Remote Control					Swe	0
	O Current mode			Remote I/O))	(w)			Ģ
	Remote I/O								
	Ex Script to run		[DobotBlocki v]	demo1		Opim			
	DI configuration								
	Start	DI_15	Pause	DI_13					
	Resume	DI_03	5top	DI_14					
	Emergency stop	DI_16	Clear alarm	DI_T1					
	E DO configuration								
	Ready status	DO_13	Pause status	DO_14					
	Alarm status	DO_15	Running statu	s DO_16					
					M	odily			

In this topic, we only detail how to use remote control mode. The details on how to connect external equipment and use it are not described in this topic.

Prerequisites

- The project to be running in the remote mode has been prepared, supporting script, Blockly and teaching and playback projects.
- The external equipment has been connected to the MG400 by the I/O interface. The specific I/O interface description is shown as follows . You can modify the specified I/O on the **Remote Control** page.

DI configuration			
Start	DI_15	Pause	DI_13
Resume	DI_12	Stop	DI_14
Emergency stop	DI_16	Clear alarm	DI_11
DO configuration	n		
Ready status	DO_13	Pause status	DO_14
Alarm status	DO_15	Running status	DO_16
			Modify

• The MG400 has been powered on.

Procedure

Step 1 Make the MG400 in the disabled status and click Remote Control on the Home page.

The remote control page is displayed.

Step 2 Select Remote I/O on the Current Mode section and select the project with the right program module on the Script to run section.

Step 3 Click Save.

Right now, only the emergency stop button, control page, I/O page are available. The remote status will be displayed on the DobotStudio2020.



Step 4 Trigger the starting signal on the external equipment.

The MG400 will be in the enabled status and move as the selected project. If the stop signal is triggered, the MG400 will be stopped with the disabled status.

4.3.6.3 Remote Modbus

When the remote mode is Remote Modbus mode, external equipment can control the MG400 in this mode. You can click **Remote Control** to use this module. The remote control page is shown as follows.

🙆 Dobot Studio 🚊	ଜ		2	MGROU HELLER	Safe:13	I 0	D Global Speed(5.1%)	- 0
		Ren	note Control				Saw Cancel	٢
	() Current mode		[Remote Modb	us			6
	Remote Modbus							
	(ﷺ Script to run		DobatBlock -	demo3		lpen		
	Coll register address c	onfiguration information	on					
	Start 0		Pause	1				
	Resume 2		Stop	3				
	Emergency stop 4		Clear alarm	5				
	Contact register addre	ss configuration inform	nation					
	Ready status 1		Pause status	2				
	Alarm status 3		Running status	4				

The specific Modbus register descriptions are shown as follows.

Register address (Take a PLC as an example)	Register address (Robot system)	Description
Coil register		
00001	0	Start running in the remote Modbus mode
00002	1	Pause running in the remote Modbus mode
00003	2	Continue to run
00004	3	Stop to run and exit the remote Modbus mode
00005	4	Emergency stop and exit the remote Modbus mode
00006	5	Clear alarm
Discrete input register		
10001	0	Auto-exit
10002	1	Ready status
10003	2	Pause status
10004	3	Running status
10005	4	Alarm status

In this topic, we only detail how to use remote control mode. The details on how to connect external equipment and use it are not described in this topic.

Prerequisites

- The project to be running in the remote mode has been prepared, supporting script, Blockly and teaching and playback projects.
- The MG400 has been connected to the external equipment with the LAN2 interface. You can connect them directly, please select based on site requirements.

The IP address of the MG400 and the external equipment must be in the same network segment without conflict. You can modify the MG400's IP address on the **Settings > IP Configuration** page; the default port is **502** and cannot be modified.

• The MG400 has been powered on.

Procedure

Step 1 Make the MG400 in the disabled status and click Remote Control on the Home page.

The remote control page is displayed.

Step 2 Select **Remote Modbus** on the **Current Mode** section and select the project with the right program module on the **Script to run** section.

Step 3 Click Save.

Right now, only the emergency stop button, control page, I/O page are available. The remote status will be displayed on the DobotStudio2020.



Step 3 Trigger the starting signal on the external equipment.

The MG400 will be in the enabled status and move as the selected project. If the stop signal is triggered, the MG400 will be stopped with the disabled status.

4.3.7 Basic Setting

On the Settings > Basic page, you can modify the MG400's name, view the SN number and hardware info of the MG400, and set the initial pose.

Settings	Specification							>
Common	Device Nan	ne		MG400			Reset Device Name	
MG400	Device SN			NULL				
Basic	Controller H Servo Hard	lardware Ve ware Versio	ersion n	NULL NULL				
IP Configuration Collision Detection Firmware Download	Initial Positic	en Q Maet	n: Delinit (ture 💽	lestor Deball P	ne.	Reset Initial Pose	
Jump Params	×	350.000	Z	0.000	User	0		
Load Params	Y	0.000	R	0.000	Tool	0		
& Home Calibration								
Coordinate System								

4.3.8 IP Configuration

The MG400 can be communicated with external equipment by the LAN2 interface which supports TCP, UDP and Modbus protocols. The default IP address is **192.16.2.6**. In real applications, if the TCP or UDP protocol is used, the robot system can be a client or a server based on site requirements; if the Modbus protocol is used, the robot system only can be the Modbus slave, and the external equipment is the master.

You can modify the IP address on the **Settings > IP Configuration** page, as shown below. The IP address of the MG400 must be in the same network segment of the external equipment without conflict.

Settings	IP Configuration	×
Common MG400 Basic	▲ Only the IP address of LAN2 can be modified to connect external device IP Address 192 - 168 - 2 - 6	es
IP Configuration	Gateway 0 - 0 - 0 - 0	
Firmware Download Jump Params Load Params		
& Home Calibration		

4.3.9 Firmware Download

When the controller firmware needs to be updated, you can import the latest firmware on the **Firmware Download** page. Currently, only controller firmware update is supported.

[!DANGER]

During the updating ,please DO NOT perform any other operation on the MG400 or power off it, to avoid MG400 in an abnormal condition. Otherwise, it will be vulnerable to injury the device or the person.

Step 1 Click Settings > Firmware Download .

The Firmware download page is displayed.

Settings)
Common MG400	Controller Firmware Current Version: 1.4.4.7.2021020	05171053	
Basic	Controller Firmware:	Open	Update
IP Configuration Collision Detection	Servo Firmware Current Version: 1.0.4.0		
Firmware Download	Servo Firmware:	Open	Update
Jump Params	Current Version: 3.4.14		
Load Params	Configuration File:	Open	Update
& Home Calibration			

Step 2 Open the latest controller firmware from the local and click Update.

The MG400's controller will be updated automatically.

Step 3 After the controller is updated, Click Update on the Check for Update window to update the servo firmware.

Curre	ent Version:	1.4.4.7.20210205171053		
Cont	roller Firmware:	MagicianPro_Controller_1.4.4.7.tar.gz	Open	Update
mic	Firmware			
-	minware	1010		
Curre	ent Version:	1.0.4.0		
Curre Serv	ent Version: Check for updat	1.0.4.0 tes ×	Open	Update
Curre Serv Curr	ent Version: Check for updat A new version of the one-click update?	1.0.4.0 tes ×	Open	Update

Step 4 After the servo is updated, Please reboot the MG400.

When rebooting the MG400, the LED indicator on the base delays about 10 seconds before it starts to work.

4.3.10 Collision Detection

Collision detection is mainly used for reducing the impact on the MG400, to avoid damage to the MG400 or external equipment. If the collision detection is activated, the MG400 will suspend running automatically when the MG400 hits an obstacle.

You can enable collision detection function on the **Settings Collision Detection** page and set the collision level. Meanwhile, you can select **Automatically start dragging after collision**, namely, when the robot arm stops running after hitting an obstacle, you can drag robot to a safe position.

Step 1 Click Settings > Collision Detection.

The collision detection page is displayed.

Settings	
Common	Collision Detection
MG400	Collision Detection Sensitivity
Basic	Level1 Level2 FLevel3 Level4 Level5
IP Configuration	Higher level, higher sensitivity
Collision Detection	Recovery Method After Collision Detection
Firmware Download	Method Pause
Jump Params	Collision Signal DO 12 V
Load Params	
& Home Calibration	
Coordinate System	

Step 2 Enable Collision Detection and select the collision detection sensitivity.

There are five levels to select. The higher level, higher sensitivity.

When you select the level, the DobotStudio2020 will display it.



Step 3 Select the recovery mode after the collision is occurred.

There are two ways to recover when the MG400 suspends running because of the collision.



- Automatically resume after 5s: Namely, after 5s, the MG400 will resume the running automatically.
- Pause: Namely, you need to click

Resume to resume the running.

Also, you can trigger the resume I/O on the external equipment to resume the running after set **Collision Signal** and **Continue Signal**. The Continue Signal is the same to the Resume signal on the Remote I/O mode.



4.3.11 Jump Params

If the motion mode is **Jump** when running programs , you need to set **StartHeight**(h1), **EndHeight**(h2), and **zLimit**.

10 sets of Jump parameters are supported. Please select any set of parameters and click **Modify** to set the Jump parameters for calling Jump command with **Arch index** parameter during programming in script or Blockly module, as shown below.

Settings	Jump paramete	er setting		
Common MG400			- z_lant htt	
Basic		1.	<u></u>	
ID Conferentian	Number	h1(mm)	h2(mm)	zLimit(mm)
IP Configuration	0	5	50	- 50
Collision Detection	1	20	50	135
	2	6	24	50
Firmware Download	3	7	50	17
Jump Barans	4	7	50	50
Antip's bitting	5	7	31	49
Load Params	б	7	50	14
	7	7	50	50
Home Calibration	8	7	50	50
	0	-	50	24

4.3.12 Load Params

To ensure optimum robot performance, it is important to make sure the load and eccentric coordinates of the end effector are within the maximum rating for the robot, and that Joint 4 does not become eccentric. Setting load and eccentric coordinates makes the motion of robot optimal, reduces vibration to shorten the operating time. The load is weight of the end effector and work piece, which must not exceed the maximum load(750g). The eccentric coordinates is eccentric coordinates of the end effector and work piece. Please set the right load and eccentric coordinates. Setting a value that is smaller than the actual load may cause errors, excessive shock, insufficient function of the MG400, and shorten the life cycle of parts.

When you launch the DobotStudio2020 and enable the MG400, you need to set the load parameters. At other times, you can set them on the **Settings > Load Params** page.

🏟 Settings	Load Params			×
Common	In order to e	usure the smooth	Aug March	invine of x
MG400	operation of avoid the ph	the manipulator and enomenon of		Y - K
Basic	to set the ec	centric coordinates	1	4
IP Configuration	Id adv engle	Is 0 degrees		
Collision Detection				
Firmware Download	Payload	0	9.	
Jump Params	Offset-x	Q	mm	
Load Params	Offset-y	0	mm	Modify
岛 Home Callbration				
Coordinate System				

If you call the Load API in script or Blockly program and run it, the values will be displayed on the **Settings >** Load Params page synchronously.

4.3.13 Home Calibration

After some parts (motors, reduction gear units) of the MG400 have been replaced or the robot has been hit, the homing point of the robot will be changed. You need to reset the homing point.

Step 1 Put the robot in the homing position in the hand-teaching mode, as shown below.



Step 2 Make the MG400 in the enabled status and click Home.

[!DANGER]

Home calibration is only use to calibrate the homing point. Please operate carefully.

🌣 Settings	Home Calibration	ŝ
Common	Home calibration is only used when the home position changes, please operate carefully,	
MG400	24-37	
Basic	the sec	
IP Configuration	*	
Collision Detection	Ling City	
Firmware Download	Schematic diagram of home position	
Jump Params		
Load Params	Please enable and move the device to the home position and click home calibration.	
Home Calibration		
Coordinate System		

After operating the homing procedure, you can check whether the homing calibration is successful, which view the joint coordinates are (0,0,0,0) on the **Control** page.

4.3.14 Coordinate System

4.3.14.1 User Coordinate System

When the position of workpiece is changed or a robot program needs to be reused in multiple processing systems of the same type, you can create coordinate systems on the workpiece to simplify programming. There are totally 10 groups of User coordinate systems, of which the first one is defined as the Base coordinate system by default and cannot be changed. And the others can be customized by users.

[!NOTE]

When creating a User coordinate system, please make sure that the reference coordinate system is the Base coordinate system.

User coordinate system is created by two-point calibration method. Move the robot to two points **P0(x0, y0, z0)**, **P1(x1, y1, z1)**. Point P0 is defined as the origin and the line from point P0 to Point P1 is defined as the positive direction of X-axis. And then the Y-axis and Z-axis can be defined based on the right-handed rule, as shown below.



Take the establishment of User 1 coordinate system as an example based on two-point calibration method.

Prerequisites

- The MG400 has been powered on and enabled.
- The MG400 is in the Base coordinate system.

Procedure

Step 1 Click Setting > Coordinate system.

The coordinate system page is displayed, as shown below.

Settings	User Frame				Tool Frame		
Common							
NC 400		index	Х	Y	Z	R	
MG400		0	0.000	0.000	0.000	0.000	
Basic		1	224.417	-5.741	164.154	29.666	
		2	72.001	-19.449	10.857	180.000	
IP Configuration		3	357.336	69.970	100.072	109.632	
Collision Detection		4	0.000	0.000	0.000	0.000	
Firmura Davidard		5	350.000	50.000	0.000	-180.000	
Firmware Download		6	0.000	0.000	0.000	0.000	
Jump Params		7	0.000	0.000	0.000	0.000	
Load Params		8	0.000	0.000	0.000	0.000	
		9	0.000	0.000	0.000	0.000	
& Home Calibration							
Coordinate System							

Step 2 Select the right User coordinate system index and click Modify on the User Frame tab.

The Modify User Frame page is displayed.

Settings	User Fra	me	Tool Frame	
Common MG400	Modify User Frame	Æ	*	
Basic IP Configuration Collision Detection Firmware Download				
Jump Params Load Params & Home Calibration Coordinate System	Index 1 P0: X 207.083541 P1: X 207.083541	Y 26.8361892 Y 26.8361892	R -33.515480 R -33.515480	obtain
			Cancel	OK

Step 3 Jog MG400 to the point P0 and click obtain on the P0: panel of the User Frame tab.

[!NOTE]

When creating a User coordinate system, please make sure that the reference coordinate system is the base coordinate system. Namely ,the User coordinate system is 0 and the Tool coordinate system is 0 when jogging robot.

Step 4 Jog MG400 to the point P1 and click obtain on the P1: panel of the User Frame tab.

Step 5 Click OK, the User coordinate system is modified.

Now, you can select the set User coordinate system and jog MG400.


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4.3.14.2 Tool Coordinate System

When an end effector such as welding gun, gripper is mounted on the robot, the Tool coordinate system is required for programming and operating a robot. For example, you can use multiple grippers to carry multiple workpieces simultaneously to improve the efficiency by setting each gripper to a Tool coordinate system.

There are totally 10 groups of Tool coordinate systems. Tool 0 coordinate system is the predefined Tool coordinate system which is located at the robot flange and cannot be changed.

[!NOTE]

When creating a Tool coordinate system, please make sure that the reference coordinate system is the Base coordinate system.

Tool coordinate system of robot is created by two-point calibration method: After an end effector is mounted, please adjust the direction of this end effector to make the TCP (Tool Center Point) align with the same point (reference point) in two different directions, for obtaining the position offset to generate a Tool coordinate system, as shown below.



Take the establishment of Tool 1 coordinate system as an example based on two-point calibration method.

Prerequisites

- The MG400 has been powered on and enabled.
- The MG400 is in the Base coordinate system.

Procedure

Step 1 Mount an eccentric end effector on the robot. The detailed instructions are not described in this topic.

The end effector must be eccentrical. Otherwise, the tool coordinate system cannot be successful.

Step 2 Click Setting > Coordinate system.

The coordinate system page is displayed, as shown below.

Settings	User Frame				Tool Frai	me ×
Common					copy	Modify Add
MG400		index	Х	Y	Z	R
Basic		0	0.000	0.000	0.000	0.000
		1	0.000	0.000	0.000	0.000
IP Configuration		2	-186.609	-121.516	0.000	0.000
		3	0.003	-0.357	0.000	0.000
Collision Detection		4	0.000	0.000	0.000	0.000
Firmware Download		5	0.000	0.000	0.000	0.000
		6	0.000	0.000	0.000	0.000
Jump Params		7	0.000	0.000	0.000	0.000
Load Params		8	0.000	0.000	0.000	0.000
		9	0.000	0.000	0.000	0.000

& Home Calibration

Coordinate System

Step 3 Select the right Tool coordinate system index and click Modify on the Tool Frame tab.

Apply

The Modify Tool Frame page is displayed.

Settings	User Fra	ime	Tool Frame	
Common MG400	Modify Tool Frame	177	17 S	
Basic IP Configuration Collision Detection Firmware Download	Note: Eccentric e	z. x. x. mod-effector is required wh	then calibrating tool coordin	nate system.
Jump Params Load Params	Index 1 P0: X 190.139068	Y -113.81342	R -65.417434	obtain
Coordinate System	P1: X 190.139068	Y -113.81342	R -65.417434	obtain
			Cancel	ОК

Step 4 Jog the MG400 to the reference point in the first direction, and click **obtain** on the **P0**: panel of the Tool Frame tab.

[!NOTE]

When creating a Tool coordinate system, please make sure that the reference coordinate system is the base coordinate system. Namely ,the User coordinate system is 0 and the Tool coordinate system is 0 when jogging robot.

Step 5 Jog the MG400 to the reference point in the second direction, and click **obtain** on the **P1**: panel of the User Frame tab.

Step 6 Click OK, the Tool coordinate system is modified.

Now, you can select the set Tool coordinate system and jog MG400.



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4.3.15 I/O

On the I/O page, there are three features.

- Output: Set the output status.
- Monitor: Monitor the status of the input and output when the MG400 is running.
- Set I/O alias: You can click = to set I/O alias.



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