

# **h**ai

# April 5, 2024 MAD Controller User Manual

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#### Overview



- 1 Introduction
- 2 Requirements
- 3 Installation
- 4 Functionalities
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#### Introduction

#### **?** What is MAD Controller?

Multi Axis Drive (MAD) Controller is a URCap software that allows you to control multiple axis from your UR robot using Festo CMMT-AS/ST and CMMP-AS motor controllers.

With this software you can move up to 4 axis to points or positions easily and code-free, without the need for other external components such as PLC/HMI.

#### Suitable applications:

- Palletizing
- Material handling
- Machine tending

- Material removal
- Quality inspection
- Dispensing

**Warning**: we are not responsible for any damage caused by misuse of this product.





### Introduction

#### ⊱ Clarifications

MAD Controller is compatible with Festo CMMT-AS/ST and CMMP-AS motor controllers depending on the URCap software version:

- 2.x.x: compatible with CMMT-AS/ST (new controller)
- 1.x.x: compatible with CMMP-AS (previous controller)

Some of the functionalities described in this user manual are only available for one controller model, indicated in the footer.



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# Requirements



**Requirements needed to use this URCap satisfactorily:** 

- Universal Robots e-Series<sup>1</sup> (PolyScope 5.3.0<sup>2</sup> or higher<sup>3</sup>)
- Festo CMMT-AS/ST or CMMP-AS motor controller(s)
- Ethernet connection between the robot and motor controller(s)
- USB device (only for installation)

<sup>1</sup> From PolyScope 5.10, for correct operation, check that the *RTDE* service is enabled in *Settings -> Security -> Services*.

<sup>2</sup> Download and instructions for upgrading PolyScope: https://www.universal-robots.com/download





#### Requirements



#### **RTDE** connection

This software makes use of the Universal Robots *Real-Time Data Exchange* (RTDE) protocol to synchronize information necessary for the operation of the URCap.

Below is a table with the registers in use (default range). You can modify its offset from the <u>advanced configuration</u> panel of the URCap.

Туре	Quantity	Range
Integer	12	2435
Boolean	8	6471

**Warning:** check that no other program or URCap uses the configured RTDE registers to avoid possible interference that may cause the software to function incorrectly.



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This section explains everything related to the installation process at the hardware and software level. It is divided into the following subsections:

#### 1. Mounting

General assembly diagram of the mechanical components.

#### 2. Safety connections

Safety connections between the robot and the axis.

#### 3. Motor controller configuration

Configuration of the motor controller using Festo software.

#### 4. URCap Installation

Installation and licensing of the URCap software on the robot.

#### 5. First steps

First steps to take to proceed with the use of the product.











General assembly diagram<sup>1</sup>:



#### <sup>1</sup>See all mounting details in the manufacturer's manual:

https://www.festo.com











- 1 Connect a robot controller double safety output to the STO Safe Torque Off function of the motor controller/s<sup>1</sup>.
- 2 Configure that output as *System Emergency Stopped*<sup>2</sup> from the robot installation panel.

Safety	Input Signal	Function Assignment	
Bobot Limits			
loint Limite	config in[0], config in[1]	Safeguard Reset	
Disess	config_in[2], config_in[3]	Unassigned 🗸 🗸	
Planes	config_in[4], config_in[5]	Unassigned 🗸 👻	
Tool Position	config in[6], config in[7]	Unassigned 🗸	
Tool Direction			
1/0	Output Signal	Function Assignment	OSSD
Hardware			
Three	config_out[0], config_out[1]	System Emergency Stopped	
Position	config_out[2], config_out[3]	Unassigned	
Safe Home	config_out[4], config_out[5]	Unassigned	
eatures	config_out[6], config_out[7]	Unassigned 🗸 🗸	
leidhue			
JRCaps			

<sup>1</sup> In case of using multiple axis, you must use a safety relay to connect them all. <sup>2</sup> This will cause the axis to stop upon collisions, failures or safety stops of the robot.





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We advise you to select a restrictive safety<sup>1</sup> setting on the robot from the robot installation panel.

		PROGRAM <unname INSTALLATION default</unname 	:d>		Save		
🖒 General	! DANGER						
✓ Safety	Use of Safety Configuration param	neters different from those of	defined	by the risk ass	essment ca	n result in hazards that are not	
Robot Limits	reasonably eliminated or risks that are not sufficiently reduced.						
Joint Limits	•						
Planes	Factory Presets	•			1		
Tool Position		Most Restricted				Least Restricted	
Tool Direction	OCustom						
I/O							
Hardware	Limit	Normal		Reduced			
Safe Home	Power	80			<b>80</b> V		
Three	Momentum	5.0			5.0 k	g m/s	
Position	Stopping Time	200			<b>200</b> m	ns	
> Features	Stopping Distance	200			<b>200</b> m		
> Fieldbus	Tool Speed	250			<b>250</b> m	nm/s	
VRCaps	Tool Force	100.0			100.0		
	Elbow Speed	250			<b>250</b> m	nm/s	
	Elbow Force	100.0			100.0		
	Safety	/ password		Unlock L	ock.	Apply	
Power off	Speed	<b></b> 10	0%	D		Simulation	

<sup>1</sup>See the robot user manual for more details.











Once the mounting has been completed and the safety connections between the robot controller and the motor controller/s are connected, it is necessary to configure the latter/s.

If you have purchased the equipment directly from NUTAI, the motor controller/s will already be preconfigured to work correctly with the selected components.

If not, or if reconfiguration is required, it is necessary to connect to the motor controller/s via the Festo parametrization software and configure<sup>1</sup> the necessary components and parameters to function properly with the URCap.

<sup>1</sup> Please refer to NUTAI's document *CMMT-AS/ST* and *CMMP-AS Configuration Manual* and follow the indicated steps to configure the motor controller/s.









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- 1 Copy the installation file madcontroller-{version}.urcap into a USB device and plug the USB into your robot's teach pendant.
- 2 Go to *Settings* in the upper right menu, then *System* -> *URCaps* and click on the install button (+).







- 3 Navigate through your USB device, select the URCap and click on the *Open* button.
  - Click on *Restart* button to apply installation.





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Once restarted, if it has been successfully installed you should see the URCap along with the 🗸 mark.

			Settings			
Νр	references	Active URCaps	Inactive URCaps			
		CobotVNC	Remote TCP & Toolpath			
<u> </u>	assword	🕑 MAD Controller	<u> </u>			
Ƴ s'	ystem					
	System Backup					
	URCaps					
	Robot Registration					
	Remote	URCap Information				
	Control	URCap name: MAD Controller				
	Constrained Freedrive	Constanti 6.1.0 Developer: NUTAI S.L. Contact Info: Pol. Ind. L'Alteró, Av. del Palmar. 9, 46460 Silla, Valencia, Spain Description: Multi Axis Drive Controller for FESTO. Copyright: Copyright: Copy				
	Network					
	Update	License Type: All rights reserved				
		Conversion (c) 2021 NUMALS I				
		All rights reserved.		•		
	Exit	+ -		Restart		





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The next step is to license the URCap. To do this, insert the USB with the license installer<sup>1</sup> into the robot's teach pendant. Wait until the green confirmation message is displayed and restart the robot.



<sup>1</sup> You can also license the product manually by entering your license key.

<sup>2</sup> Make sure to always keep the robot's system date up-to-date to avoid licensing issues.







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#### How do I request my license key?

Check the serial number<sup>1</sup> of your robot and send it to us by email<sup>2</sup>.



<sup>1</sup>We need the serial number of the robot controller, which can be seen following the steps above. Usually, it is the same as the one shown on the robot arm, but you should check it.

<sup>2</sup> Contact us at sales@nutai.com







<sup>1</sup>For a better understanding, we advise you to complete the reading of this user manual before carrying out the actions indicated in this section.





Once the URCap is installed, you must perform the following configuration from the URCap for each of your axis:

- 1. <u>Connect</u> to your axis
- 2. Perform a <u>Home</u><sup>1</sup>
- 3. Configure the new <u>software position limits</u><sup>2</sup>

<sup>1</sup> It is possible that you cannot move the axis due to the software position limits configured by default, so in this case you must previously configure them from the <u>Parameters</u> tab, setting large values temporarily.

<sup>2</sup> From the <u>Parameters</u> tab, select the *Software position limits* option and configure the lower and upper limit, respectively.



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This section explains everything related to the functionalities of the URCap software. It is divided into the following subsections:

#### 1. Installation panel

Configuration of axis parameters and saving of points.

#### 2. Program panel

Axis movement instructions using program nodes and URScript code.

#### 3. Toolbar panel

Diagnosis of the axis and Jog manual movement.











You can configure all the features of the URCap from the installation panel. This window has 3 tabs (
): Axis, Parameters and Points:

		PROGRAM <b><unnamed></unnamed></b> 📑 📑 🖬 INSTALLATION default* New Open Save	📃 🕄 🔊 אש
🖒 General	MAD Controller		
> Safety			
> Features	Multi Axis Drive	Axis 1 Axis 2	
> Fieldbus		mm N/A Axis	Parameters Points
✔ URCaps			
CobotVNC			
MAD Controller		Select the number of axis	
		2 💌	
		Axis 1 Axis 2	
		IP address: 192.168.0.10 192.168.0.11	
		Port: 502 502	
		Units: mm 🔻 r 🔻	
		🕢 Apply 🥼 Scan	
Power off	Spe	ed 🕖 100% 🕞 🖸 🔘	Simulation

□ The information of the configured axis is also displayed: their status and their current position.





From the Axis tab you can select the number of axis you want to work with, assigning each one its IP address, port and position units.

		PROGRAM <b><unnar< b=""> INSTALLATION <b>default</b></unnar<></b>	med> 📮 📑 * New Open	Save		
🔪 General	MAD Controller					
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>		Axis 1 143.05 mm N/A		Axis	Parameters	Points
✔ URCaps						
CobotVNC						
MAD Controller		Selec	t the number of a	xis		
			2 🔻			
		ID address.	Axis 1	Axis 2		
		IP address:	192.108.0.10	192.108.0.11		
		Port:	502	502		
		Units:	mm 🔻	r 🔻		
			y (((q)	)) Scan		
		L'				
Power off	Spe	ed	100%		Sim	iulation

Once the axis have been specified, press the *Apply* button to connect<sup>1</sup> or reconnect to them.

<sup>1</sup> In case of error, check that there are no other active connections to your axis via PLC or FAS/FCT.





Select the number of axis					
	2	•			
	Axis 1	Axis 2			
IP address:	192.168.0.10	192.168.0.11			
Port:	502	502			
Units:	mm 🔻	r 🔻			

- Number of axis: enable the number of selected axis up to 4 axes, limited according to the license purchased.
- **IP address and port**: connection parameters with the motor controller.
- **Units**: position units, as configured in the motor controller.





The *Scan* button<sup>1</sup> (□) will perform a device search and will list them with their main data —IP address, MAC, firmware version, and configuration status.

		PROGRAM <b><unname< b=""> INSTALLATION <b>default*</b></unname<></b>	ed>	Save		F 8 6
🔪 General	MAD Controller					
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>	Multi Axis Drive Controller & FESTD	Axis 1 143.05 mm N/A		Axis	Parameters	Points
VURCaps CobotVNC		Select	the number of avi	-		
MAD Controller		Select		5		
		IP address: 1	Axis 1	<b>Axis 2</b> 92.168.0.11		
		Port: Units:	502 mm 🔻	502 r 👻		
			((rp))	Scan		
Power off	Speec	100	0%	00	Simu	Ilation

<sup>1</sup>This functionality is only available for CMMP-AS motor controllers.





The *Flash* button (**D**) allows you to identify the motor controller. When pressed, the letters HELLO will be displayed on the screen of the selected controller.



□ It is possible to edit the motor controller network configuration by clicking on it.





UNIVERSAL ROBOTS

### **Functionalities**

In this window you can configure the name, IP address, subnet mask, gateway and DNS server of the selected motor controller (□).

	PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	* 📮 📑 🗖	
General     MAD Controller			
> Safety			
> Features	Name	Axis	
> Fieldbus	Current network settings		
V URCaps	IP Addr.	192.168.0.10	
CobotVNC	Subnet	255.255.255.0	
MAD Controller	Standard gateway	192.168.0.10	
	DNS Server	192.168.0.10	
	Use the following network se	ettings	
	IP Addr.	192.168.0.10	
	Subnet	255.255.255.0	
	Standard gateway	192.168.0.10	
	DNS Ser∨er	192.168.0.10	
	Apply	Back	
Normal S	Speed		Simulation

□ Press the *Apply* button to save the changes and restart the controller.

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From the *Parameters* tab you can consult —*Read* button— and configure —*Write* button— (□) the most common parameters of the controller.

		PROGRAM <unnamed></unnamed>	Open Save	📃 🛃 🚛	
<ul> <li>&gt; General</li> <li>&gt; Safety</li> </ul>	MAD Controller				
<ul><li>&gt; Features</li><li>&gt; Fieldbus</li></ul>	Multi Axis Drive Controller № FESTO	Axis 2 N/A	Axis	Parameters Points	Select a parameter
✔ URCaps					Positioning Velocity 🔹
CobotVNC				Other params	Positioning Velocity
Controller		Select a parameter			Jog Velocity (Phase 1)
	Positioning Ve	elocity	<b>~</b>	Particul Made	Jog Velocity (Phase 2)
					Software End Positions
	Velocity (mm/s):	500.0		Speed (%): 20	Positioning Acceleration
					Positioning Deceleration
				Home	Positioning Torque Limit
				Set Home here	Maximum motor current
	Re Re	ead 🕞 Write		Move to Home	
O Normal	Speed 🥌	100%		Simulation	

Warning: modifying the parameters will affect the operation of its components. All the parameters located in this tab (except *Reduced Mode*) are stored in the motor controller and not in the installation file.





Description of the main configuration parameters:

- 1. Positioning speed: base speed for direct —that is, moving to value or point (not Jog).
- 2. Jog speed (phase 1)<sup>1</sup>: maximum speed in manual mode (Jog) during initial phase.
- **3.** Jog speed (phase 2)<sup>2</sup>: maximum speed in manual mode (Jog) during final phase.
- Software position limits: minimum and maximum software end position (not limited). Plausibility rule: Lower limit ≤ Upper limit.

<sup>12</sup> Parameter only available for CMMP-AS motor controllers.




Description of the main configuration parameters:

- 5. Positioning acceleration: acceleration for direct mode positioning tasks.
- 6. Positioning deceleration: deceleration for direct mode positioning tasks.
- **7. Positioning torque limit**<sup>1</sup>: torque limit in *mNm* (not limited). If the axis exceeds this limit, the fault is activated. The value 0 disables the torque limitation.
- **8. Maximum motor current**: maximum current in % or Arms of the nominal current of the motor.

<sup>1</sup> Parameter only available for CMMP-AS motor controllers.





If it is required to read or modify any other parameter<sup>1</sup> of the controller<sup>2</sup>, it is possible to do<sup>3</sup> so knowing its *PNU* and its *Index* by means of the *Other params* button.



<sup>1</sup>This functionality is only available for CMMP-AS motor controllers.

<sup>2</sup> See the motor controller manual for the full list of parameters.

<sup>3</sup> In case of reading or writing position, speed or acceleration parameters, you will have to consider the exponents previously configured in the motor controller via FCT.





It is possible to enable and configure the axis speed in *Reduced mode* ( $\Box$ ). By enabling this option, if the robot is in Reduced Mode, the maximum positioning velocity of the selected axis will be limited to the configured percentage.

		PROGRAM <unnamed> INSTALLATION default*</unnamed>	New Oper Save	<b>IR•</b> <mark>5</mark>			
> General	MAD Controller						
> Safety > Features > Fieldbus	Multi Axis Drive Controller & FESTO	Axis 2 N/A	Axis	Parameters Points			
🗸 URCaps							
CobotVNC							
MAD Controller		Select a parameter		Other params			
	Positioning V	Positioning Velocity					
				Reduced Mode			
	Velocity (mm/s):		500.0	Enable: 🗹			
				Speed (%): 20			
				Home			
				Set Home here			
	R	.ead 🛛 🕞 Wr	ite	Move to Home			
Normal	Speed 🥌	100%		Simulation			

Warning: this software functionality does not replace the SLS (*Safe Limited Speed*, EN 61800-5-2) motor controller safety function, which would require the additional safety hardware module.





You can define the current position as *Home* (□) using the set home button. The Homing<sup>1</sup> procedure is detailed on the next slide.

			<unnamed> 🔒 default* New</unnamed>	Open Save	📰 🚼 🔛
> General	MAD Controller				
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>	Multi Axis Drive Controller & FESTO	Axis 1 143.05 mm N/A		Axis	Parameters Points
VRCaps CobotVNC MAD Controller		Select a para	meter		Other params
	Pos	sitioning Velocity	500.0		Reduced Mode 0
	velocity (mi		500.0		Speed (%): 20
		Read	<b>W</b> rite	]	Set Home here Move to Home
Normal	Speed		100%		Simulation

Clicking on *Move to Home* will move the axis to the current zero position.

<sup>1</sup>We recommend using multi-turn absolute encoders to avoid having to perform Homing every time the motor controller is restarted.



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## **Functionalities**



### What is Homing?

The Homing procedure consists of defining what the zero point of the axis will, that is, the physical position where the axis will indicate zero position. Once the Home is defined, you can move the axis and memorize points based on this reference<sup>1</sup>.

#### **?** How do I perform a Homing?

- 1. Move the axis by manual movement (Jog<sup>2</sup>) to the position you want to set as the zero point<sup>3</sup>
- 2. Press the set home button and wait for the motor controller to restart

<sup>1</sup> It is advisable to physically mark this point on the axis in case it is necessary to perform another Home later, and thus not lose the reference of the memorized points. <sup>2</sup> You can move in Jog from the *Points* tab or from the Toolbar.

<sup>3</sup> This operation will set the axis zero point and the project zero point internally in the motor controller as zero at the position where the axis is when homing.





From the *Points* tab you can save —*Teach Pi* button— and move —*Move to Pi*<sup>1</sup> button— to positions to use them during the program, as well as move the selected axis in manual mode with the Jog buttons ( $\Box$ ).

			INSTALLATION	default* New	Open Save		C D		
Safety     Features		Ilti Axis Drive	Axis 1 143.04 N/	<b>5 2</b> A					
<ul> <li>Fieldbus</li> <li>URCaps</li> </ul>		Point No	Description	Position (mm)	Axis Teach	Parameters Move	Points		
CobotVNC	â	P1	P1	143.04	Teach P1	Move to P1	• ^		Not memorized
Controller	â	P2	P2	480.02	Teach P2	Move to P2	0	l õ	Memorized
	â	РЗ	Р3	1056.96	Teach P3	Move to P3	0		Memorized in current position
	â	P4	P4	1633.73	Teach P4	Move to P4	0		Memorized out of SW limits
	Î	P5		] - [	Teach P5	Move to P5			Axis controller N/A or not enable
	Î	P6		] - [	Teach P6	Move to P6	•		
	Ê	P7		٦ - [	Teach P7	Move to P7	• ~		
		•	jog -	og +	۲ Page -	> Page +			
Normal		Sp	beed	100%		Sin	nulation		

<sup>1</sup>The axis must be stopped the button is pressed, otherwise it will not move and will display *Wait*.





You can also memorize the position of your points manually by clicking on the current position value and entering the new value (□).







Clicking on the upper left logo opens a product information window with the status of the license, the version, possible updates, etc.









From the URCap information popup you can also access the advanced configuration panel by keeping the NUTAI logo pressed for 3s.

From here you can make additional settings such as the offset of the RTDE registers.













The URCap has three program nodes:

- 1
- MAD MOVE: move the axis to the desired position
- 2 MAD CPOS: wait for the axis to reach a position
- **3** MAD HOME: perform homing on the axis



Furthermore, it is possible to make use of URScript functions to interact with the axis through program code, as explained in subsequent slides.





From any of the program nodes, you can move to the configured position using the button in the lower right corner.

		PROG INSTALLA	RAM <b><unnamed>*</unnamed></b> TION default*	New Open	Save	
> Basic		۹	Command	Graphics	Variables	
<ul> <li>&gt; Advanced</li> <li>&gt; Templates</li> </ul>	1 <b>Robot Program</b> 2 MAD MOVE - Axis 1 - P1 - 100%	6 - Sync	MAD MOV	E		
VIRCaps MAD CPOS MAD MOVE			Movement configu Type: To point	uration.		Multi Axis Drive Controller & FESTO
	0	ũ		Axis: Point: Speed (%): Mode:	1 P1 <b>100</b> Synchronous	▼ ▼ ▼
Normal	く 全 ま う ご 米 連 首 前 Speed (二)	>	Preview Type: To point   Speed: 100%   N	Axis: 1   Point: F Aode: Synchrond		Move here

<sup>1</sup> For the button to be enabled, you must complete the configuration of the program node, as well as ensure that the axis is available.





MAD MOVE: move the axis to the desired position

In type To point the robot will move to positions defined in the installation panel, while in type To value it will move to the position indicated manually.

Run Program Instalation		PROGRAM <unr< th=""><th>named&gt;* <b>[]</b> ult* <sub>New</sub> Open</th><th>Save</th><th></th></unr<>	named>* <b>[]</b> ult* <sub>New</sub> Open	Save	
> Basic		Q Comm	nand Graphics	Variables	
> Advanced	1 Robot Program	MAD	MOVE		
> Templates	2 MAD MOVE - Axis 1 - P1	- 100% - Sync	MOVE		
		Moyopp	unt configuration		
MAD CPOS		Type:	To point		Multi Axis Drive Controller to FESTO
MAD MOVE					•
			Axis:	1	•
	0	Þ	Point	P1	
			i on c.		
			Speed (%):	100	
			Mode:	Synchronous	▼
		Duras das			
	1	Preview	N		
		Speed:	To point   Axis: 1   Point: 100%   Mode: Synchroi	P1 nous	Move here
Normal	Speed		100%	$\mathbf{O}$ $\mathbf{O}$	Simulation





**MAD MOVE**: move the axis to the desired position.

- Selection of the axis on which to carry out the movement
- □ Value or destination point to which you want to move the axis
- Percentage of speed over the set positioning speed







**MAD MOVE**: move the axis to the desired position.

- □ In *Synchronous* mode the instruction waits for the completion of the movement, while in *Asynchronous* mode the execution starts the movement and continues.
- □ The movement can be *Absolute* referenced to *Home* or *Relative* referenced to the position in which it is at the moment of execution.



Warning: when using asynchronous mode, be sure to avoid any possible collisions. Note that when resuming a program paused during an asynchronous movement, it can be completed in a different duration.





**2** MAD CPOS: wait for the axis to reach<sup>1</sup> a position to continue execution.

In type To point it will wait in a point defined in the <u>Points</u> tab, while in type To value it will wait in the position indicated manually.

		PROG INSTALLA	RAM <b><unnamed>*</unnamed></b> TION <b>default*</b>	Nex Open	Save	
> Basic		۹	Command	Graphics	Variables	
> Advanced	1 V Robot Program		MAD CPO	5		
> Templates	2 MAD CPOS - Axis 1 - 50 m	m		-		
MAD CPOS			Position control o	onfiguration.		
MAD MOVE			Type: To value	-		
			Þ			
				Axis:	1	▼
				Value (mm):	50	
			Preview			
	<b>▲ ♥ ゔ ♂ X ■ </b> Ē	<b>İ</b>	Type: <b>To value</b>	Axis: 1   Value:	50 mm	Move here
O Normal	Speed 🧲		100%	D	00	Simulation

<sup>1</sup>This command is especially useful for waiting at a point or value after an asynchronous move.





2 MAD CPOS: wait for the axis to reach a position to continue execution.

- Selecting the axis to wait on
- Value or destination point where to wait

Run Program Installation		PROC INSTALLA	GRAM <b><unnamed>*</unnamed></b> TION default*	New Open	Save	
> Basic		۹	Command	Graphics	Variables	
> Advanced	1 🔻 Robot Program					
<b>&gt;</b> Templates	2 - MAD CPOS - Axis 1 - P1		MAD CPUS	•		
✔ URCaps						
MAD CPOS			Position control co	onfiguration.		Multi Axis Drive
MAD MOVE			Type: To point	•		
	0		II+			
				Axis:	1	▼
				Point:	P1	<b>T</b>
			Dreview			
			FIEVIEW			
	<b>▲ ╄ ゔ ♂ ₭ ₫ ₫</b>	<b>İ</b>	Type: <b>To point</b>	Axis: 1   Point:	P1	Move here
O Normal	Speed 🥌		100%	D	00	Simulation





3 MAD HOME: perform homing on the axis

Selecting the axis on which to perform homing

		PROG INSTALLA	GRAM <b><unnamed>*</unnamed></b> TION default*	New Open	Save	
<b>&gt;</b> Basic		۹	Command	Graphics	Variables	
<ul> <li>&gt; Advanced</li> <li>&gt; Templates</li> </ul>	1 V Robot Program 2 MAD HOME - Axis 1		MAD HOM	E		
✔ URCaps						
MAD CPOS			Homing configura	tion.		Multi Axis Drive
MAD MOVE						
ન		()	Þ			
				Axis:	1	▼
			Preview			
			Axis: 1			Move to Home
Normal	Speed	a 🦲 🔤	100%	D	00	Simulation

<sup>1</sup>This functionality is only available for CMMT-AS/ST motor controllers.





Comparison between synchronous and asynchronous movements:







In addition to the program nodes, it is possible to use **URScript functions** to interact with the axis from the robot code and even integrate them into other URCaps.



These functions allow the user to move the axis, check positions, perform homing or get the current position. The following slides detail each of the available functions.





- Name of the function: mad\_move()
- Description: move the axis (equivalent to <u>MAD MOVE</u> node)
- Arguments:
  - axis: axis to move [1..LICENSED\_AXIS]
  - pos: target position or increment (depending on mov argument)
  - speed: relative speed[1..100]
  - mode: synchronous or asynchronous mode [0 | 1]
  - mov: absolute or relative movement [0 | 1]
- **Return**: True if the execution is successful, False if the execution failed
- Example: mad\_move(2, 1565.50, 80, 1, 0) --> True





- Name of the function: mad\_cpos()
- Description: check the axis position(equivalent to <u>MAD CPOS</u> node)
- Arguments:
  - axis: axis to move [1..LICENSED\_AXIS]
  - pos: target position to check
- **Return**: True if the execution is successful, False if the execution failed
- Note: this function is especially useful for waiting at a position value after launching an asynchronous move
- Example: mad\_cpos(2, 1565.50) --> True





- Name of the function: mad\_home()<sup>1</sup>
- Description: perform a homing on the axis (equivalent to <u>MAD HOME</u> node)
- Arguments:
  - axis: axis to move [1..LICENSED\_AXIS]
- **Return**: True if the execution is successful, False if the execution failed
- Note: The homing method to be executed will be the one configured in the controller
- Example: mad\_home(1) --> True

<sup>1</sup>This functionality is only available for CMMT-AS/ST motor controllers.





- Name of the function: mad\_get\_pos()
- **Description**: get current axis position
- Arguments:
  - axis: axis to get position[1..LICENSED\_AXIS]
- Return: current axis position, -1,000,000 in case of axis N/A or any other type of error
- Note: this function can be useful to execute other actions in parallel when verifying that an axis exceeds a certain position, for example
- Example: mad\_get\_pos(2) --> 1565.50









# mutai

## Functionalities

You can access the URCap toolbar from any window ( $\Box$ ) to check the status of the controller and move the axis manually using *Jog* ( $\Box$ ).

Run Program Installation		PROGRAM <u Installation def</u 	nnamed>* 😭 ault* New	Open Save	
🔰 General	MAD Controller		CobotVNC	Multi Axis Drive	
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>	Multi Axis Drive Controller & FESTO	Axis 1 143.04 mm N/A		Axis 1	Axis 2
V URCaps	Point No	Description F	Position (mm)	Enable	
CobotVNC MAD	💼 Р1 Р	21	143.04	Stop Ready	
Controller	<b>m</b> P2 P	22	480.02	O Mov. completed	
	💼 РЗ Р	23	1056.96	() Warning	
	<b>أ</b> P4 P	94	1633.73	Position: 143.04 mm Speed: 0%	
	💼 Р5				
	<u>р</u> е Р6		-	Status: Connected IP Addr.: 192.168.0.10   Po Ready FSM: S4   Position FS	rt: 502 5M: SA1
	р7				
	Jog	g - Jog -		Jog -	Jog +
O Normal	Speed	d	100%	$\mathbf{b}$ <b>O O</b>	Simulation





In case of displaying<sup>1</sup> an error or warning message, you can check the complete message by clicking on it<sup>2</sup>.



<sup>1</sup> The error and warning messages disappear after a few seconds.

<sup>1</sup> For more information on the error or warning and its possible solutions, see the motor controller manual.



## Overview



- 1 Introduction
- 2 Requirements
- 3 Installation
- 4 Functionalities
- 5 Safety
- 6 Uninstallation
- 7 Best practices
- 8 Support







This section explains everything related to safety aspects. It is divided into the following subsections:

#### 1. Essential recommendations

Basic aspects of the connection and configuration of the axis.

#### 2. Integration recommendations

Advanced aspects on the integration of the product in the final solution.













- **Connect the safety** between the robot and the motor controller/s as indicated in <u>Installation</u> section
- Correctly configure your motor controller/s software position limits from the <u>Parameters</u> tab
- In an emergency, press the robot **emergency push button** to immediately stop the robot and axis
- When moving an axis to any point or value, the **relative speed of the robot** (slider) will be applied over the configured positioning speed











Here are some recommended integration schemes according to the level of safety required in the final integration of the product:

- **1. Basic level**: the robot and the axis are in a fenced area. Both stop if the operator enters the fence.
- 2. Medium level: the robot and the axis are NOT in a fenced area. The robot stops/ reduces, and the axis stops if the operator enters the operating area.
- **3.** Advanced level: the robot and the axis are NOT in a fenced area. The robot and the axis reduce their speed if the operator enters the operating area.

The following slides detail each of these safety levels.

Warning: these slides are only safety tips. We are not responsible for damages caused by misuse or incorrect integration of this product in the customer's final solution.





**1. Basic level**: the robot and the axis are in a fenced area. Both stop if the operator enters the fence.



Connection diagram

**Warning:** these slides are only safety tips. We are not responsible for damages caused by misuse or incorrect integration of this product in the customer's final solution.





**1. Basic level**: the robot and the axis are in a fenced area. Both stop if the operator enters the fence.



Integration diagram

Warning: these slides are only safety tips. We are not responsible for damages caused by misuse or incorrect integration of this product in the customer's final solution.





2. Medium level: the robot and the axis are NOT in a fenced area. The robot stops/ reduces, and the axis stops if the operator enters the operating area.



1) robot and axis stop; 2) robot reduces and axis stops

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## Safety

2. Medium level: the robot and the axis are NOT in a fenced area. The robot stops/ reduces, and the axis stops if the operator enters the operating area.



Integration diagram

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**3.** Advanced level: the robot and the axis are NOT in a fenced area. The robot and the axis s reduce their speed if the operator enters the operating area.



Connection diagram

**Warning:** these slides are only safety tips. We are not responsible for damages caused by misuse or incorrect integration of this product in the customer's final solution.







**3.** Advanced level: the robot and the axis are NOT in a fenced area. The robot and the axis s reduce their speed if the operator enters the operating area.



Integration diagram

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# Uninstallation



Go to Settings in the upper right menu, then System -> URCaps

Select MAD Controller and click the uninstall button (-)





# Uninstallation



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Finally, click on the *Restart* button to apply the uninstall

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		Settings					_
> Preferences	Active URCaps						
> Password							_
Ƴ System							_
URCaps							_
Remote Control							
Network							_
Update	URCap Information						
				The chang	es require a restart to	take effect.	
Exit	+ –					Restart	
Power off	Speed 🥽	100%		0	00	Simulation	



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### **Best practices**

#### $\bigwedge$ We advise you to follow the following recommendations:

- Before making any movement, check that there are no risks of collision
- The components must only be manipulated by qualified technical personnel
- If you replace any components, perform a *Home* and check the saved points
- Perform proper periodic maintenance of your mechanical components<sup>1</sup>
- If you mount your robot on one or more axis, use flexible cabling (*High-Flex*)

<sup>1</sup>See all the information on the manufacturer's website: <u>https://www.festo.com</u>



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#### Support



For further information, please contact:



#### NUTAI S.L.

Pol. Ind. L'Alteró, Av. del Palmar, 9 46460 Silla (Valencia) Spain

> Phone: +34 961 76 70 85 Email: support@nutai.com

> > www.nutai.com

