

NTC-E10 for Universal Robots User Manual

Ver. 1.2

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1. Introduction

1.1. Intended use

This document serves as a guide for integrating Nordbo Robotics' NTC-E10 magnetic tool changer in an application using a Universal Robots manipulator.

1.2. Prerequisites

It is recommended that the person executing the instructions of this installation guide has basic knowledge and skill in using Universal Robots' PolyScope and that the user has a basic understanding of the risks related to working with a robot. It is also recommended reader should also have basic knowledge in using a computer and altering its network settings. It is required that the person executing the guide's instructions have made a risk assessment of the application in which the product is integrated before using this manual.

1.3. Safety Warnings

Following instructions must be read thoroughly by anyone intending to use this product.



Warning! This symbol indicates that potentially hazardous, dangerous, or unwanted situations can arise from not following the instructions correctly. If safety instructions are not followed properly it may result in death, personnel injury, or equipment damage.

Before attempting to mount the product on the robot, it is important to ensure that the robot cannot move. The robot must therefore be powered off before attempting to attach the sensor on the robot.

The robot must always be **powered off** before attempting to connect wires to the robot's controller, or when connecting cables between any of Nordbo Robotics' products.

The product may be damaged if dropped on hard surfaces. Be aware that wire connectors of both the sensor and the converter can break if the user overtightens the cables' screw.

The NTC-E10 excluding the NTC-IO-M/F is water and dust resistant according to IP67 test standards.

The sensor can be used within the specified measurement range. Using the sensor outside of its range is considered misuse. Nordbo Robotics is not liable for any damage or injury resulting from misuse.



2. Product information

2.1. NTC-E10 UR Bundle

The UR bundle consists of the items listed below.



2.2. I/O Connector (Optional)



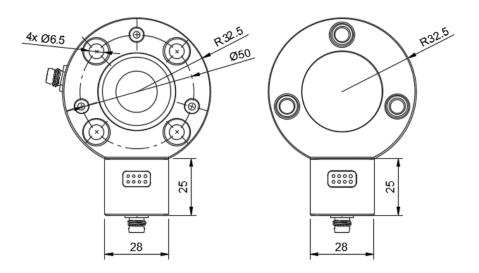


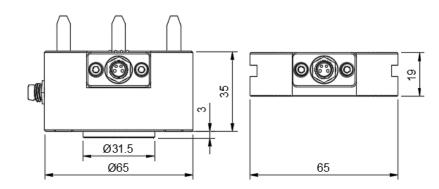


2.3. Technical specifications

	NTC 510
Model	NTC-E10
Dimensions, Assembled	Ø: 65, H: 57 mm
(Diameter x Height)	(When mounted H: 54 mm)
Tool Changer I/O	24V, 1A (ON/OFF)
Weight (excl. NTC-IO)	531 g
Weight (incl. NTC-IO)	602 g
Minimum Clamping Distance	2 mm
Suggested Payload Limit	10 kg
Avg. Max Payload Capacity*	29 kg
Avg. Max Static Moment Capacity X, Y	5 Nm
(Optional) I/O 8-Pin Coupler, signal	24V, 1A
Positional Repeatability, X	0,001 mm
Positional Repeatability, Y	0,020 mm

2.4. Mechanical specifications: NTC-E10







3. Installing the Tool Changer on UR

The following section describes the procedure for installing the tool changer on a UR3, UR5, or UR10 robot, and how to use the software tools created for it.

3.1. Mounting the NTC-E10 on a robot

To mount the sensor to the robot's flange the user will need the supplied bolts and necessary tools.



Warning! The user must make sure that the robot is turned off and unable to move at this step. Unintended robot movement may cause harm to personnel working with the robot.



Step 1

Mount the tool changers robot-sided part on the robot using 4x M6-15 mm bolts.

OBS.! The orientation of the tool changer must be exactly as illustrated.

Step 2

Use the supplied wire to connect the robot's tool end I/O with the tool changer.



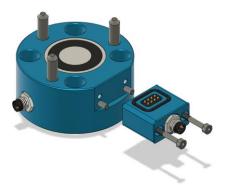


Step 3

Mount the **tool-sided** part on all necessary tools using 4x M6-10 mm bolts per tool.



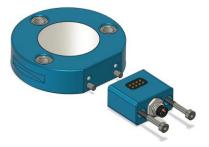
3.2. Mounting IO Quick Connect Add-on (Optional)



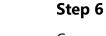
Step 4

Connect the IO on the **robot-sided** part, using 2x metal pins and 2x M3-30 mm bolts





Connect the IO on the **tool-sided** part, using 2x metal pins and 2x M3-30 mm bolts



Connect an 8-pin wire from the robot to the I/O module

attached to the robot-sided part

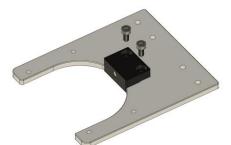


Step 7

Connect an 8-pin wire from the I/O module on the tool-sided part to the I/O of the attached tool.



Mounting tool holders (Optional)



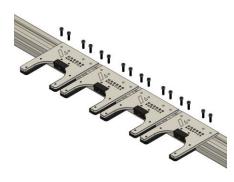
Step 8

Mount the magnet on the underside of the metal plate as illustrated using 2x M4-8 mm bolts. Notice that the Nordbo Robotics logo is not visible on this site.



Step 9

Mount the two square pieces using 4x M4-6 mm bolts.



Step 10 Mount the tool holder(s) with 4x M4 per tool holder.



3.3. Installing the UR Cap

Before installing the URCap, please make sure the Polyscope software version equal to or newer than version 3.14.1 for CB or version 5.9.1 for e-series. The URCap may not function properly if installing on older versions than previously mentioned.

Step 1

Insert the supplied USB flash into the screen's USB slot.

Step 2

In the left menu, click the button URCaps

	Setup Robot	0
Initialize Robot	URCaps Active URCaps	
Language		
Time		
Calibrate Screen	URCap Information	
URCaps		
Network		
Set Password		
Update		
Back		O Restart



Click the button marked with a plus (+)

Step 4

Locate the URCap on the flash drive.

Step 5

Locate and select the latest version of the URCap "**NTC-E.X.X.X.urcap**" on the flash drive and click "Open".

Step 6

Restart the robot to finish installing the URCap. Click the restart button in the lower right corner and wait for the robot to restart.

4. Setting up the Tool Changer

The following section describes how to install the NTC-E tool changer and how to create a program using the tool changing mechanism.

4.1. Setting up the NTC-E

Perform the following steps to install the NTC-E tool changer

Step 1

Open "Program Robot"



Р	olyScope Robot User Interface	?
	Please select	
	Run Program	
ROBOTS		
	Setup Robot	
About		
	Shutdown Robot	

Select the tab "Installation" and open "NTC-E Tool changer" in the left sidebar.

🖉 File		05:24:06 CCCC 🕜)
Program Installati	ion	Move / I/O / Log	
TCP Configuration	-		
Mounting		NTC-e Toolchanger	
I/O Setup		General Tool settings	
🔁 Safety		Setup the IO and release duration used for controlling the NTC-e. The delay and release is the amount of time the toolchanger is activated before	
Variables		and after moving, respectively, when in the holder position and placing the tool.	
MODBUS		Enable NTC-e:	
Features		Release duration: 500 ms	
Base	_	Delay duration: 30 ms	
		Select the digital output used for the toolchanger.	
Smooth Transition		Output: Tool output 0 🔫	
Conveyor Tracking		Hold to release tool	
EtherNet/IP		Hold to release tool	
PROFINET			
NTC-e Toolchanger			
Default Program		Reset general settings to default values.	
	•	Default	

Step 3

Enable control of the tool changer by clicking the checkbox.



<u> </u> File	05:27:18 CCCC 🕜
Program Installation	Move I/O Log
TCP Configuration	NTC-e Toolchanger
I/O Setup	General Tool settings
🔁 Safety	Setup the IO and release duration used for controlling the NTC-e. The delay and release is the amount of time the toolchanger is activated before and after moving, respectively, when in the holder position and placing the tool.
Variables	
MODBUS	Enable NTC-e: 🗹
Features Base Tool Smooth Transition Conveyor Tracking EtherNet/IP	Release duration: 500 ms Delay duration: 30 ms Select the digital output used for the toolchanger. Output: Tool output 0 Hold to release tool
PROFINET	
NTC-e Toolchanger	
Default Program	Reset general settings to default values. Default

The default release and delay can be used in most use cases. If a different cable is used instead of the supplied cable is used, then the output used by the tool changer must be changed.

Optional test of the tool changer:

- Put a tool on the tool changer
- Is the magnet on?
- If yes, you must press the "Hold to release tool" button to pull off the tool.
- If no, verify that the correct outputs are used by the tool changer.

Step 4

Select the tab "Tool settings" and click "Add" to add a new tool.



🕘 File		05:48:20	cccc 🕜
Program Installation	Move I/O Log		
TCP Configuration Mounting	NTC-e Toolchanger		
I/O Setup 🛜 Safety	Toolchanger Add Remove Rename	9	
Variables MODBUS			
Features			
Smooth Transition Conveyor Tracking			
EtherNet/IP PROFINET			
NTC-e Toolchanger			
Default Program 肩 Load/Save			
r			



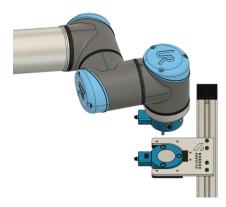
The position of the tool holder is programmed by moving the position where the tool changer is clamped while placed inside the tool holder. This can be achieved using two methods of different methods. One method is to place the tool sided tool in the tool holder and hereafter move the robot to its position until it clamps. Another method is to clamp the tool on the robot and guided it into the holder. The two methods are elaborate below.

OBS.! When dragging or jogging the robot inside the tool holder, align the robot as accurately as possible to reduce torque and friction when picking and placing tools.

Warning! Make sure the tool changer is placed with the correct orientation on the robot. If this is not the case

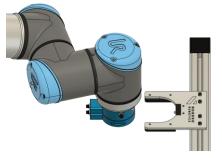
Method 1: Tool in the tool holder

- Put the tool in the tool holder
- Click "Set position"
- Use free drive or jogging to guide the robot into the tool.
- Click "OK"



Method 2: Tool on the robot

- Put the tool on the robot
- Click "Set position"
- Use free drive or jogging to guide the seat the tool in the holder
- Click "OK"

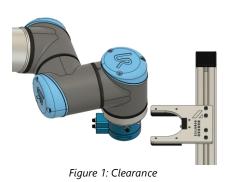


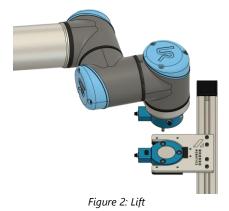


<u> </u> 🛛 File		06:00:35	cccc 🕜				
Program Installat	on Move I/O Log						
TCP Configuration	NTC-e Toolchanger						
Mounting							
I/O Setup	General Tool settings						
🛜 Safety	Screwdriver Add Remove Rename						
Variables	Position Payload						
MODBUS	Set the position for the tool holder. The female flange must be fully inserted in the holder and the robot arm should be aligned as accurately as						
Features	possible to reduce friction and torque when changing						
- Base - Tool	Set position Move here						
Smooth Transition	Set the distance moved out from the holding position						
Conveyor Tracking	when exiting the holder with a tool.						
EtherNet/IP	Clearance: 100.0 mm Move here						
PROFINET	Set the distance moved away from the holding position when switching tools.						
NTC-e Toolchanger	Lift: 50.0 mm Move here						
Default Program	Description:						

When the position of the holder is set, the clearance and lift distances can be changed.

- **Clearance:** The distance the robot is moving in/out when the tool is being picked/placed.
- Lift: The distance the tool changer moves away from the tool after being picked/placed in its holder.







The robot can also move to the *holder position*, *clearance*, and *lift position* by using the "Move here" buttons.

OBS.! The "Move here" buttons do not activate the tool changer automatically. The tool changer must be manually activated by going to the "I/O" tab and activating the correct tool changer output. This is necessary if you want to pick/place tools manually while using "Move here" commands.

🖉 File	06:	07:15 CCCC 🕜				
Program Installation Move I/O Log						
NTC-e Toolchanger						
Mounting I/O Setup	General Tool settings					
🔁 Safety	Screwdriver Add Remove Rename					
Variables	Position Payload					
MODBUS	Set the position for the tool holder. The female flange must be fully inserted in the holder and the robot arm should be aligned as accurately as					
Features	possible to reduce friction and torque when changing					
- Base - Tool	Set position Move here					
Smooth Transition	Set the distance moved out from the holding position					
Conveyor Tracking	when exiting the holder with a tool. Clearance: 100.0 mm Move here					
EtherNet/IP						
PROFINET	Set the distance moved away from the holding position when switching tools.					
NTC-e Toolchanger	Lift: 50.0 mm Move here					
Default Program	Description:					



The center of gravity (COG) and the weight of payloads should be set for each tool to ensure the robot can compensate for the dynamic load. Select the tab "Payload" and input the coordinates for the center of gravity and the weight of the payload.

💦 🥘 File		02:17:10	cccc	\bigcirc	
Program Installation	Move I/O Log				
TCP Configuration					
Mounting	NTC-e Toolchanger				
I/O Setup	General Tool settings				
🙀 Safety	Screwdriver Add Remove Rename	е			
Variables	Position Payload			_	
MODBUS	So the context of gravity and payload of the tool for when it is $COG \ge 0.0$ mm	attached t	o the robot.		
Features	COG X 0.0 mm COG Y 0.0 mm				
Smooth Transition	COG Z 150.0 mm				
Conveyor Tracking	Payload 2000.0 gram				
EtherNet/IP					
PROFINET					
NTC-e Toolchanger					
Default Program					
Load/Save					



Each tool must have a specific Tool Center Point (TCP). Select "TCP Configuration" in the left menu and add a TCP for each tool. This can be done by either using the wizards for "Position" and "Orientation", or by inputting the numbers manually.

Note: It is recommended to use the same names as in step 4 when naming the TCPs.

OBS.! Payload and center of gravity in "TCP Configuration" is not used and should be ignored. Values added in this section will be overwritten by the values defined in the NTC-E URCap.

🕘 File			06:23:23 CCCC 🕜
Program Installation	Move I/O Log		
TCP Configuration		Tool Center	r Point
Mounting	Available TCPs:		
I/O Setup	Screwdriver	-	
🛜 Safety	x 0.0 mm	Rename	• Y •
Variables	Y 0.0 mm	Set as default	X
MODBUS	z 250.0 mm	New	
Features	RX 0.0000 rad	Remove	
Smooth Transition	RY 0.0000 rad	🏏 Position	
Conveyor Tracking	RZ 0.0000 rad	🏏 Orientation	
EtherNet/IP			T
PROFINET	Payload: 0.00 kg		Z
NTC-e Toolchanger	Center of gravity		
Default Program	CX 0.0 mm		The second se
📊 Load/Save	CY 0.0 mm		
	CZ 0.0 mm		



Save the installation when all tools have been added and configured.

🜒 File	06:24:07 CCC	с 🕜				
Program Installation Move I/O Log						
TCP Configuration	Load/Save Robot Installation to File					
Mounting	The Robot Installation covers all aspects of how the robot is placed in its working					
I/O Setup	environment. It includes the mechanical mounting of the robot, electrical connections to other equipment, as well as all options on which the robot program depends. It does no					
🗟 Safety	include the program itself.					
Variables	Save the current installation					
MODBUS	default					
Features	Save As					
Smooth Transition	Load a different installation file					
Conveyor Tracking	Load Create New					
EtherNet/IP						
PROFINET						
NTC-e Toolchanger						
Default Program						
Load/Save						



3.4 Creating a program using tool change

The following section explains how to create a program including the action of tool changing.

OBS.! Always make sure that all tools are already placed in their respective holders and that the robot can move to the holders without collisions when running a program with changing of tools,

Step 1

Create a new program by navigating to the program tab and choose the "Empty Program".

R 🛛 File		00:36:53	cccc 🕜
Program Installation Move	I/O Log		
	New Program		
Load From File			
	Load Program		
Use Template			
	Pick and Place		
	Empty Program		



Create a pick command by performing the following:

- Select the "<empty>" line under "Robot Program" in the tree view to the left
- Select the tab "Structure"
- Select the subtab "URCaps"
- Click on the "Pick tool" to add a tool change operation to the program.

<u> </u> I Sile		00:37:09	cccc 🕜
Program Installation	Move I/O Log		
<pre> <unnamed></unnamed></pre>	Command Graphics Structure Variables		
ar and a second	Program Structure Editor		
	Set placement of node After selected Insert		
	Basic Advanced Wizards URCaps		
	Pick tool		
	Edit		
	Move Copy Paste	e s	Suppress
	Move Cut Delet		
♀ ♠ ≱ ◀ ►	Ve Cut Delet	e	
Simulation	【 ▶ ▶ ■ Speed	🔶 Previous	Next 🔶



Define what tool is being picked by performing the following:

- Select the tab "Command"
- Choose a tool using the dropdown

Note: A tool is picked when the program reaches the "Pick tool: ..." node and automatically put back into its holder when all child nodes have been executed.

🜒 File		00:38:06	cccc 🕜
Program Installation	Move I/O Log		
🕞 <unnamed></unnamed>	Command Graphics Structure Variables		
▼ Robot Program ◆ ▼ Pick tool: Screwdriver └── <empty></empty>	Pick tool		
	Pick a tool from its holder. Screwdriver		
	Payload: 2000.0 gram		
<	Tool description: No description		
Simulation	▲ ▶ ▶ ■ Speed □ ↓ 100%	🔶 Previous	Next 🔿
💽 Real Robot 🛛 🔼			



The following steps explain how to use the active tool and perform movements:

- Select the "<empty>" line under "Pick tool" in the tree view
- Select the tab "Structure"
- Select the subtab "Basic"
- Click on the "Move" button to add a move

🕑 File		00:38:47 CCCC 🕜		
Program Installation	Move I/O Log			
-unnamed	Command Graphics Structure Varial	bles		
Robot Program wdriver	Program Structure Editor			
	Set placement of node After selected 🔻			
	Basic Advanced Wizards URCaps			
	Move	Waypoint		
	Wait	Set		
	Рорир	Halt		
	Comment	Folder		
	Edit			
	A Move Copy	Paste Suppress		
♀ ♠	Move Cut	Delete		
Simulation	↓ ▶ ■ Speed	🔶 Previous 🛛 Next 🌩		



It is important to make sure the robot is using the right TCP before performing actions with a specific tool. This must be checked to make sure the robot moves correctly after picking tools and must be done before any waypoints are set for the move node.

- Select the tab "Command"
- Click the "Set TCP" dropdown and choose the TCP for the tool selected in "Pick tool"

<u> </u>		00:39:19	cccc	?
Program Installation	Move I/O Log			
肩 <unnamed></unnamed>	Command Graphics Structure Variables			
▼ Robot Program • ▼ Pick tool: Screwdriver • ▼ MoveJ • Waypoint_1	Move Specify how the robot will move between waypoints. The values below apply to all child waypoints and depend on the	Movej	vement type.	•
	Set TCP Joint Speed Use active TCP	°/s		
	Use Tool Flange Ic nt Acceleration Use active TCP 80.0			
	Screwdriver TCP NTC-e Toolchanger - Nordbo Robotics A/S			
	Toolchanger Reset			
Simulation	K ► ► Speed □ 100%	🕈 Previous	s Next	•



Add additional waypoints and move nodes as needed.

OBS.! If making new move nodes then repeat Step 5.

<u> I</u> S File		00:40:10 CCCC 🕜
Program Installation	Move I/O Log	
-unnamed>	Command Graphics Structure Vari	ables
Robot Program Pick tool: Screwdriver Over the second	Waypoint	Fixed position
• waypoint_1	Waypoint	_1 0
	Set	Waypoint
	Ed	lit pose
	Move here	
		Advanced Options
	🕥 Stop at this point	Time 2.0 s
	Blend with radius	Joint Speed 60 °/s
	0 mm	Joint Acceleration 80 °/s²
		Use shared parameters
<	Delete Waypoint	용 Add Until
Simulation	► ► ■ Speed □100%	🔶 Previous 🛛 Next 🜩



5. Troubleshooting

The tool does not get signal after connecting

- Test the IO connectors. If not working contact Nordbo Robotics for support.

The tool changer does not clamp properly

- Clean magnet on the male part and the metal plate on the female part.

After picking a tool, the robot does not move as desired.

- Make sure the right tool center point (TCP) is selected in the move program.

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