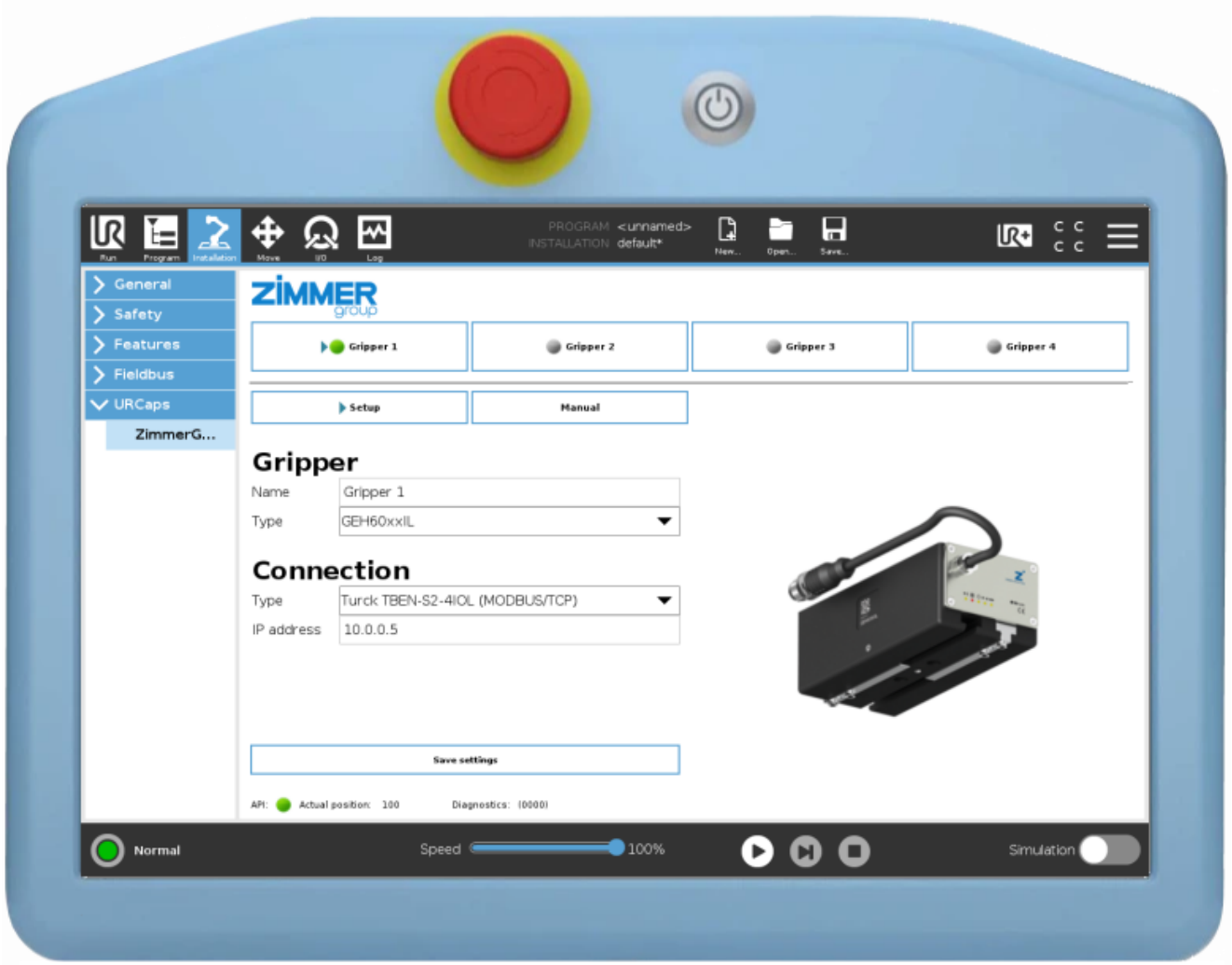
Installation and operating instructions

Zimmer Group Premium URCap



Version 2.0

23.03.2020

Inhalt

1 Supporting documents

The following documents are available for download on our website www.zimmer-group.de. Only the documents currently available on the website are valid.

- Operating instructions for the different devices
- Catalog
- Drawings
- Performance Data
- Information on accessory components

2 Proper use

The Zimmer Group URCaps package is proper used for controlling Zimmer Group grippers directly with the Universal Robot Polyscope. Controlling means the manual use and the embedded use of the gripper in the normal robot sequence.

To ensure an easy operation for the IO-Link-Grippers an Easy-To-Use-Package has been defined, as well as the according accessories (part no ZUB068713).

3 Personnel qualification

Installation, commissioning and maintenance may be undertaken by trained specialists only. They must have read and understood the installation and operating instructions in full.

For understanding this manual, it is important to know and understand the Universal Robot manuals and the manual of the used Zimmer grippers.

4 Description

With the Zimmer Group Premium URCap, the customer can use up to 4 IO-Link grippers with one robot at the same time. In principal most of the grippers out of the Zimmer Group product range can be driven via the Premium URCap Software. This includes all of the IO-Link grippers.
The Zimmer Easy-To-Use-Package (part no ZUB068713) is the perfect link to connect a UR-robot with the grippers of the Zimmer Group portfolio. With this package, the user can connect up to 4 IO-Link grippers to the robot. As shown in the Fig. 1, the grippers will connect to the IO-Link Master and this Master will connect via Modbus to the robot controller.
After installing the enclosed Zimmer Premium URCap software, the user can control each gripper directly from the UR-Polyscope in manual mode and in the robot sequence mode.
The following gripper families are useable with the Zimmer Premium URCap and the Easy-To-Use-Package:
GEH6000IL
GEP5000IL / GED5000IL
GPP5000IL / GPD5000IL
GEP2000IL
HRC-01
HRC-03
HRC-04 / HRC-05

For more and detailed information regarding the different grippers, please look in the gripper operating manual.

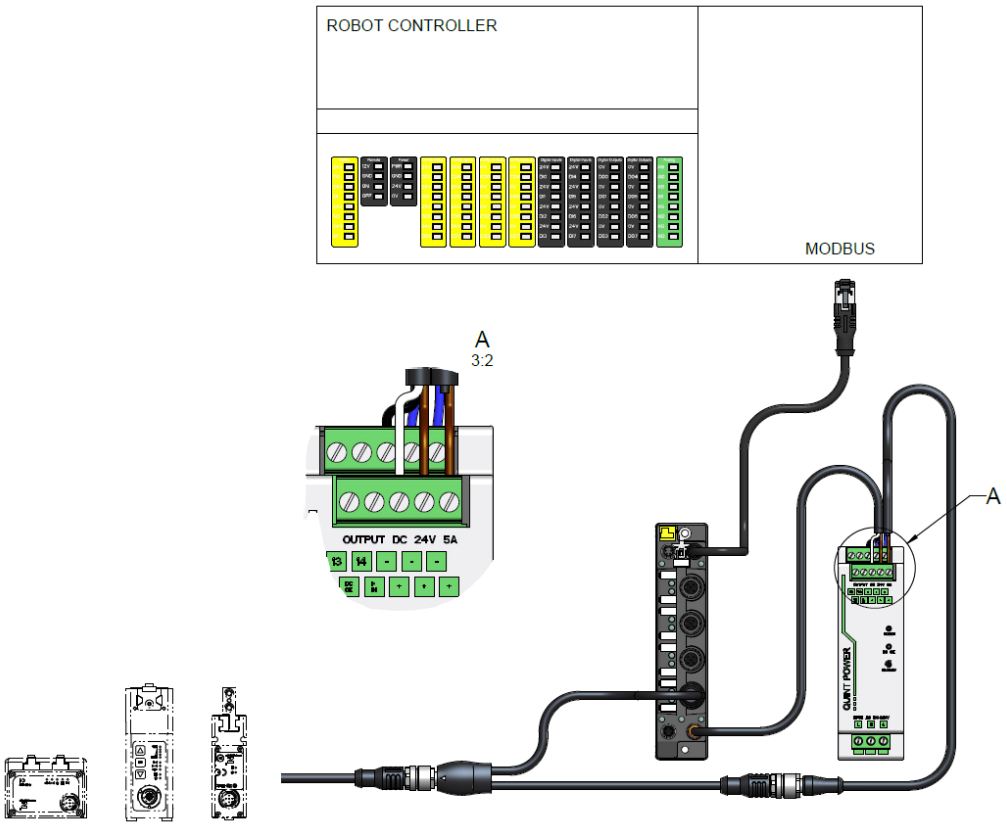


Fig. 1: An example for the wiring between robot and the Zimmer Easy-To-Use-Package

5 Installation

5.1 Safety instructions

- **NOTICE:**
  Switch off the energy supply for the electronics before any assembly, installation or maintenance work.
  ► Electronics may get damaged.

- **CAUTION:**
  Switch off the energy supply for the electronics before any assembly, installation or maintenance work.
  ► Injuries are possible.

- **WARNING:**
  Risk of injury in case of unexpected movement of the machine or system into which the gripper is to be installed.
  ► Switch off the power supply to the machine before all work.
  ► Secure the machine against being switched on unintentionally.
  ► Check the machine for any residual energy.

5.2 Installing the Easy-To-Use-Package

5.2.1 Installing the Hardware

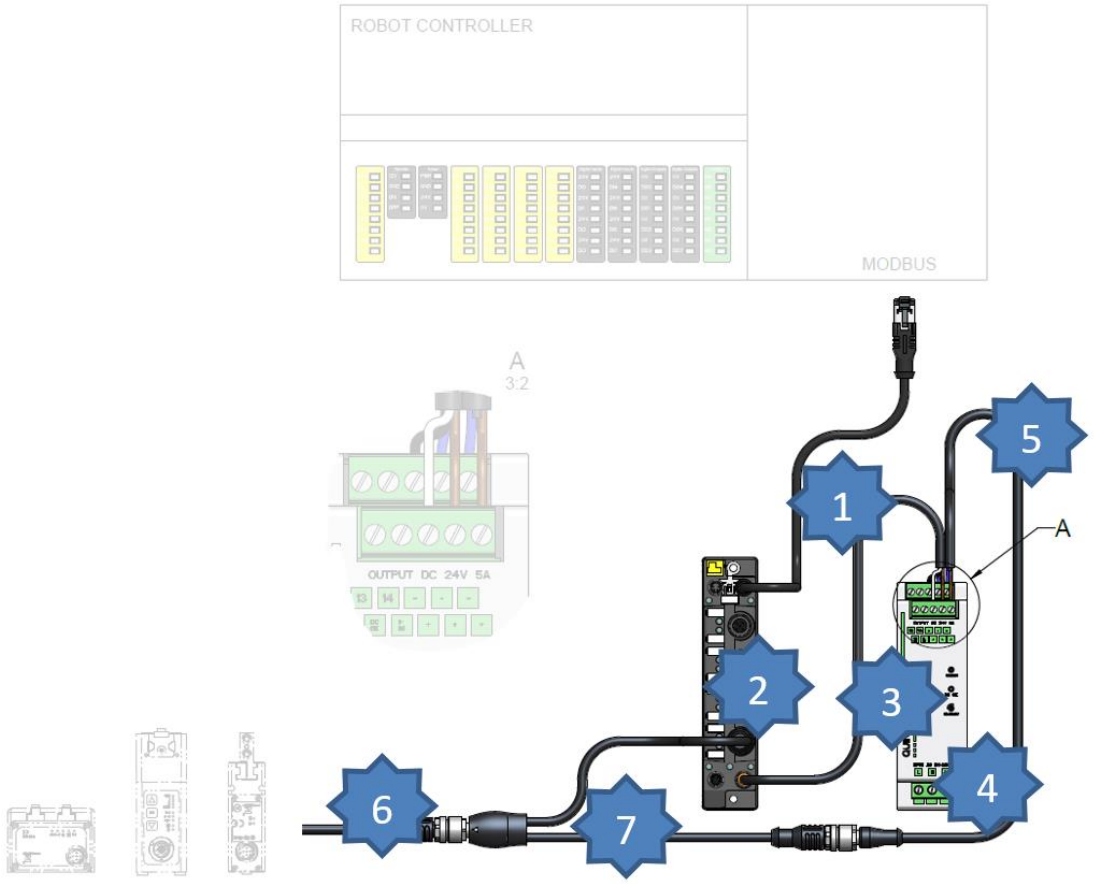


Fig. 2: Parts of the Easy-To-Use-Package

The Easy-To-Use-Package (part no ZUB068713) includes the following parts (Fig. 2):

1. Cable between robot and IO-Link Master
2. IO-Link Master with 4 IO-Link ports
3. Power-supply cable for the IO-Link Master

Additional, the following parts can be ordered according to the gripper-type and the amount of grippers:

4. Power supply unit
5. Cable (Y-adapter to power unit)
6. Connection cable M12 5pol 5m
7. Y-adapter cable (Labeled with “Power” and “IO-Link”)

Please refer the tables below for further information.

Article	Description	Part No.
IO-Link Master	Compact Multiprotocol I/O Module	ZUB068713
Connection cable M8 4pol 5m	Cable for power supply of the IO-Link Master	
Connection cable UR Modbus to Master	Communication cable robot Modbus to IO-Link Master RJ45	
Zimmer Premium URCap	HMI for UR Polyscope	

Tab. 1: Zimmer Easy-To-Use-Package for UR*

Article	Description	Part-No	GEH6000IL GEP5000IL GED5000IL	HRC-01	GEP2000IL HRC-03	GPP5000IL GPD5000IL HRC-04 HRC-05
Connection cable M8 3pol 5m	STO-cable	KAG500	-	X	-	-
Connection cable M12 5pol 5m	Connection Y-adapter to Zimmer gripper	KAG500IL	X	X	X	X
Y-adapter cable	Cable to split power and signal	B12-Y-5IL	X	X	X	X
Cable (Y-adapter to power unit)	Connection cable for power supply unit	KAG500-02	X	X	X	X
Power supply unit	Power supply unit 24/ 10A	CELE00611	X	X	X	X
Energy chain UR3	Energy chain for the robot type UR3	ZUB000009	O	O	O	O
Energy chain UR5	Energy chain for the robot type UR5	ZUB000010	O	O	O	O
Energy chain UR10	Energy chain for the robot type UR10	ZUB000011	O	O	O	O

Tab. 2: Accessory for Easy-To-Use-Package

- not needed for this gripper type
X needed for this gripper type
O optional needed for this gripper type

- **NOTICE:**
  The power supply unit supports 10A (15A peak). Depending on the gripper type and the application, 15A are not enough for supporting four grippers, which moving at the same time.

Install the hardware, as shown in the following figure Fig. *3*:

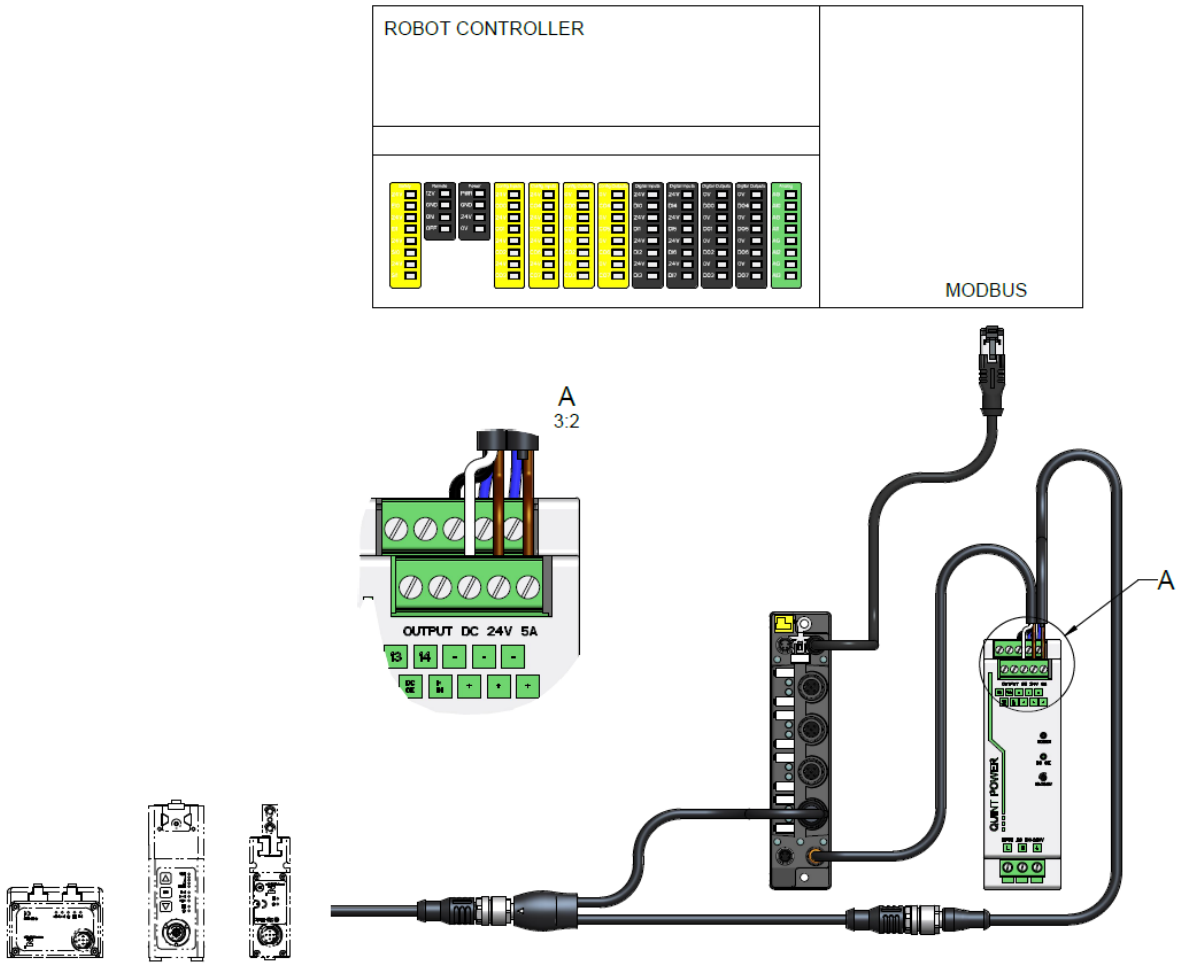
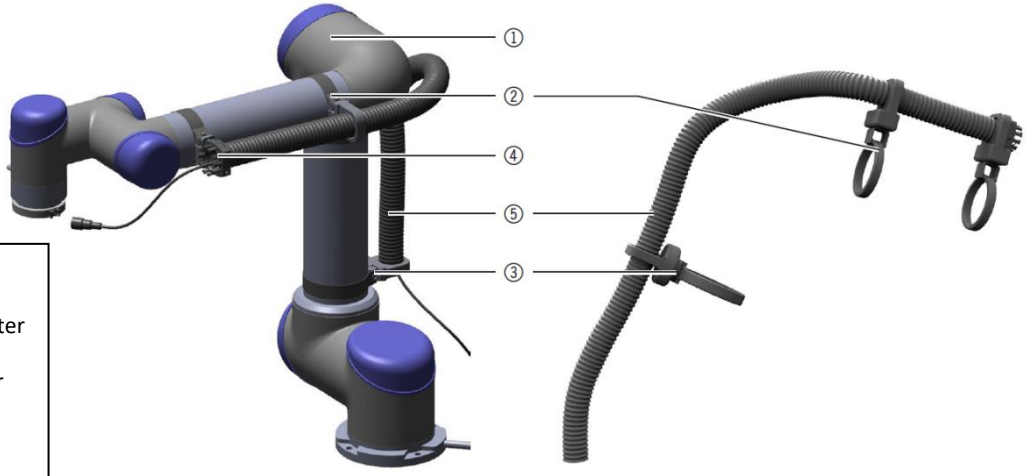


Fig. 3: Wiring between robot and the Zimmer Easy-To-Use-Package

5.2.2 Optional energy chain accessories

It is possible to use optional the accessories below to fit the cable along the robot arm.



1. Robot
2. Hose clamp small diameter
3. Hose clamp big diameter
4. Strain relief
5. Flexible energy chain

Fig. 4: Energy chain accessories

5.2.3 Mechanical dimensions for additional components

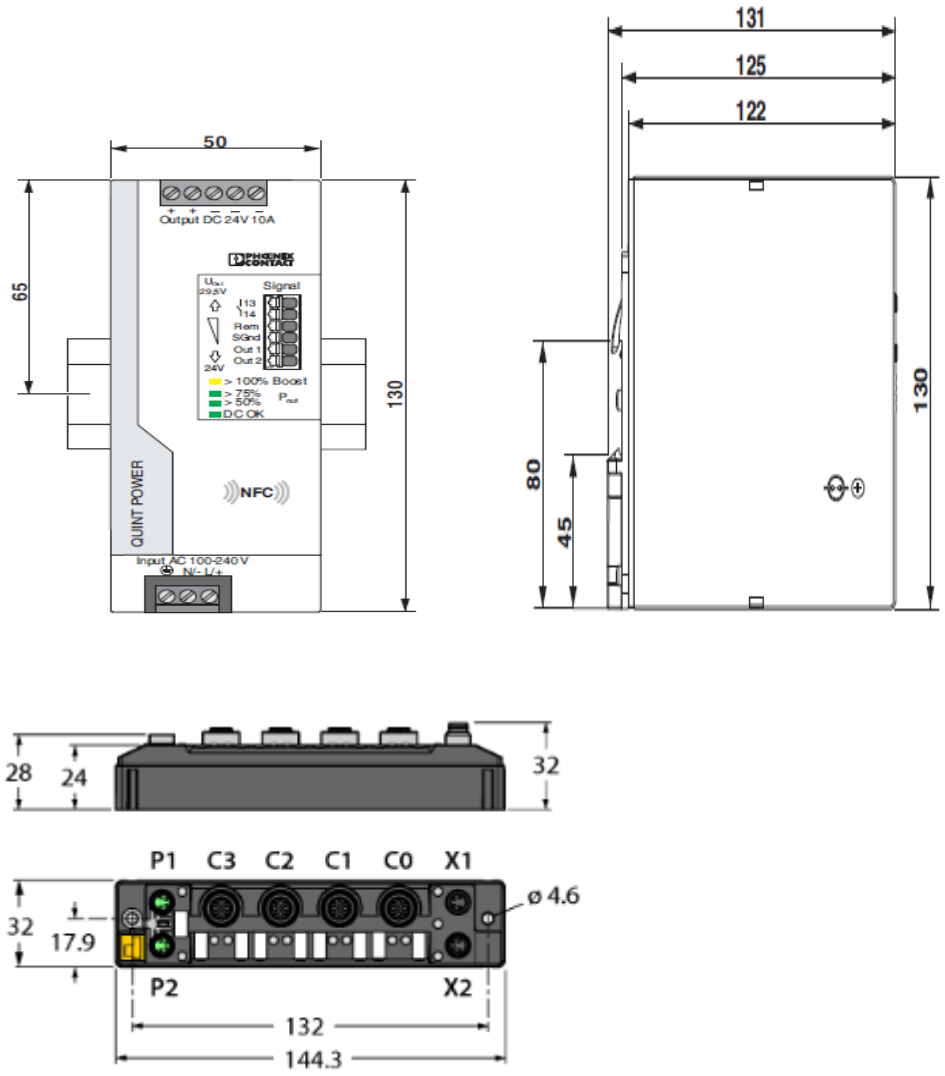
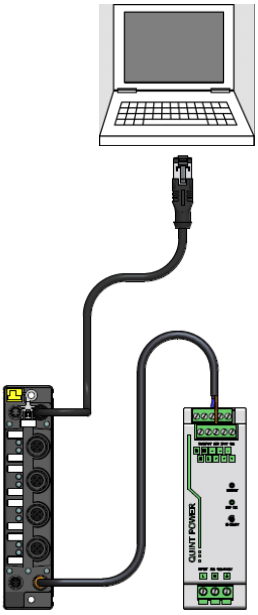


Fig. 5: Mechanical dimensons for additional components

5.3 Configuration of the IO-Link Master

5.3.1 Connecting the Hardware

It is necessary to make some settings in the IO-Link Master, therefore you have to connect your PC or Laptop with the IO-Link Master.



- **NOTICE:**
  In the delivery status or after a factory reset, access the device via web server. The web server can be opened using the IP address 192.168.1.254.
  (Requires the PC to be on the same subnet, e.g. set the PCs IP address to 192.168.1.10 and the Subnet Mask to 255.255.255.0).

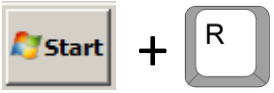
Fig. 6: Connection for configuration of the IO-Link Master

Please follow the steps below to install the IO-Link Master:

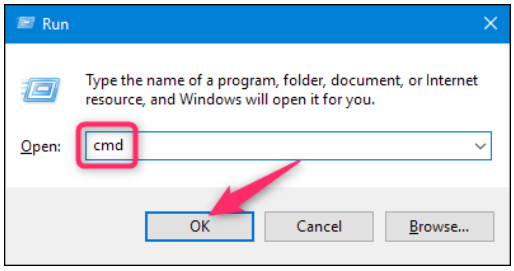
1. Connect an Ethernet cable from a PC to the port ETH-1 on the IO-Link Master TBEN-S2-4IOL (Fig. *6*).
2. Connect the Power cable on Port X1 on the IO-Link Master (Fig. *6*).
3. Test the connection between IO-Link Master and PC (*Ch. 5.3.2*)
4. Open the IO-Link Master configuration page (*Ch. 5.3.3*)
5. Disable the watchdog timer (*Ch. 5.3.4*)
6. Set the correct IP address in the IO-Link Master (*Ch. 5.3.5*)
7. Test the connection with new settings

5.3.2 Test the connection between IO-Link Master and PC

To check the connection on your Windows PC open the **Command Prompt** and execute the **ping** command:

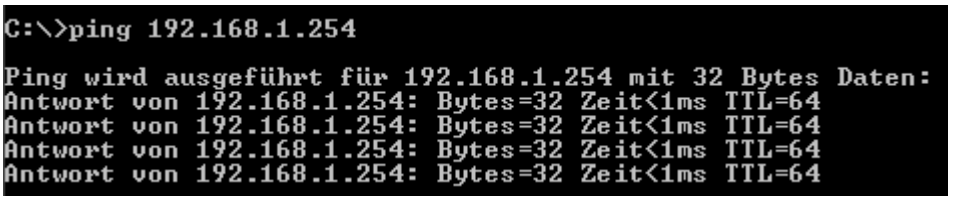
1. Hit the “Windows” +”r”-button. 

2. In the “Run” window, type “cmd” into the Open box, and then hit Enter or click OK.



3. Write the command “ping 192.168.1.254” at the Command Prompt and press Enter (the IO-Link Master has as default the following IP-address: 192.168.1.254)

4. The response shows the IP address you are pinging and the size of the packets being sent on the first line. The next four lines show the replies from each individual packet, including the time (in milliseconds) it took for the response and the time-to-live (TTL) of the packet, which is the amount of time that must pass before the packet is discarded.



When the ping does not get a response from the pinging IP, an error report will be shown. In this case, please check if the IO-Link Master is powered on and connected to the PC correctly (Fig. *6*).

5.3.3 Open the IO-Link Master configuration page

Write the IP-address in your browser:

The page below should now open

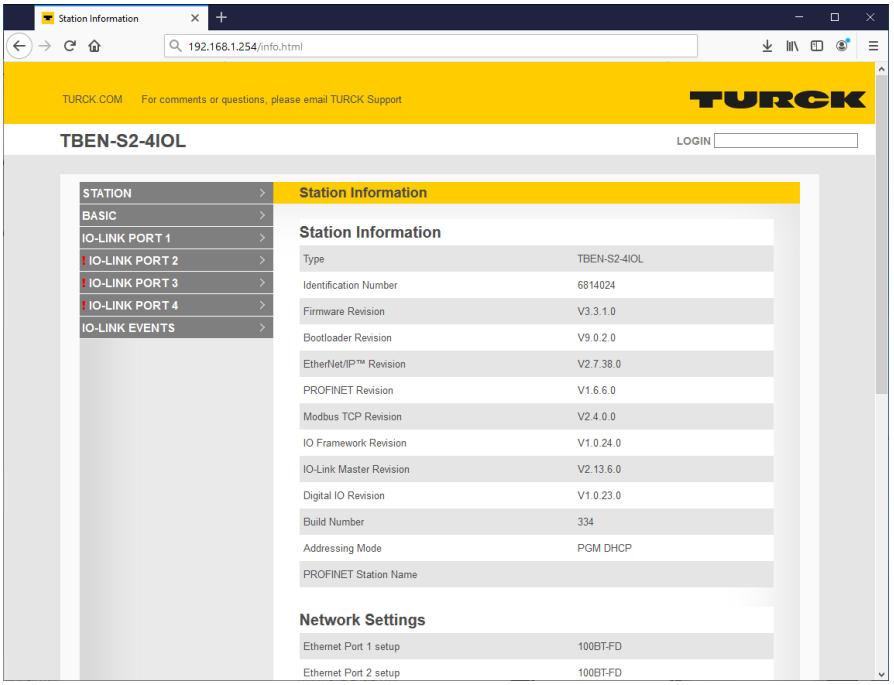


Fig. 7: Start page of the IO-Link Master

Enter the admin password in the top right of the browser. The default password is '**password**'.

5.3.4 Disable the watchdog timer

Please make sure the watchdog is turned off, by setting the value to 0. This setting is found under ‘Station Configuration’.

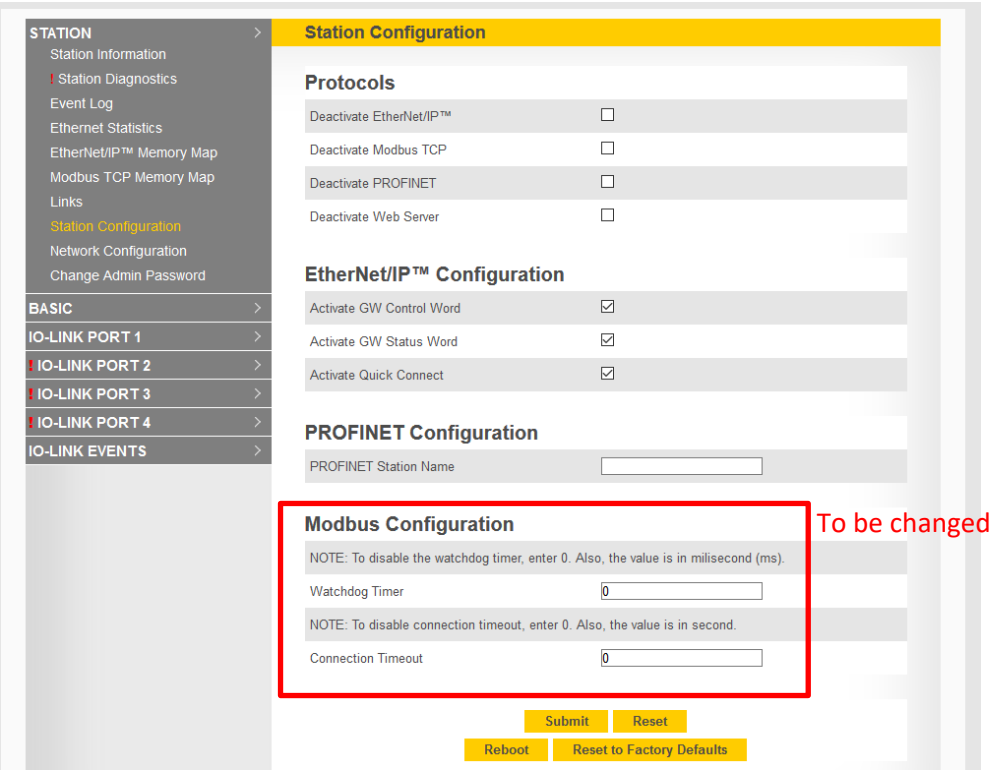


Fig. 8: Station configuration page of the IO-Link Master

5.3.5 Set the working IP address in the IO-Link Master

- **NOTICE:**
  Please contact your system administrator prior to change any network configurations. In the following is a configuration for a standalone robot described.

Under ‘Network Configuration’ (Fig. *9*) change the IP address of the TURCK S2-4IOL to a private address range of the robot.

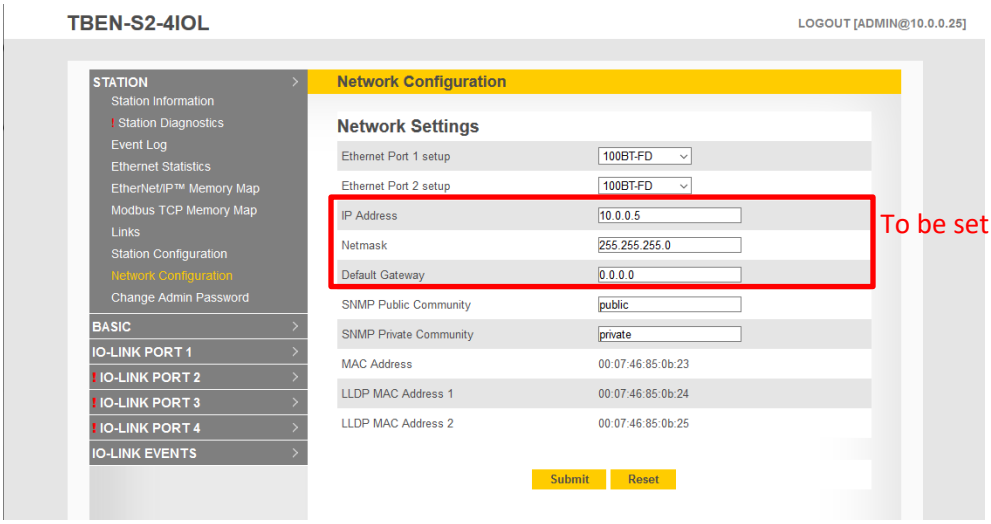


Fig. 9: Network configuration page of the IO-Link Master

We recommend using the IP 10.0.0.5 and the netmask 255.255.0.0, because these settings are the default values in our HMI.
After submitting and rebooting the TURCK TBEN-S2-4IOL, the IP address of the PC needs to be changed to IP 10.0.0.15 and Subnet 255.255.0.0, in order to communicate with the TURCK S2-4IOL in the future.

- **NOTICE:**
  Please make sure, that the UR-robot has an IP-Address e.g. 10.0.0.15 that the robot and the IO-Link-Master are in the same Network.

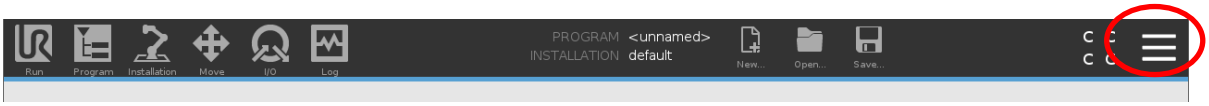
Now repeat test connection (*Ch. 5.3.2*), but now with the IP address 10.0.0.5 and check, if you have connection between your laptop and the IO-Link Master. If you are not able to connect now to the Master, please repeat chapter 5.3 to find the error.

5.4 Network setup on the robot

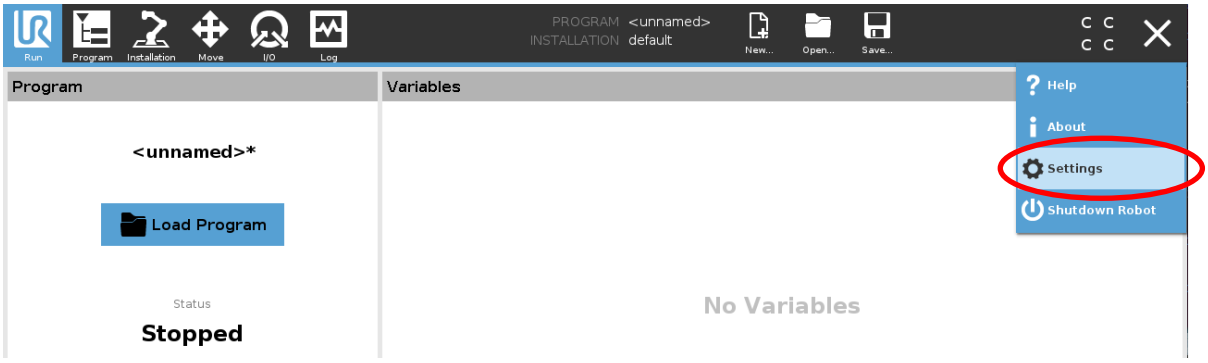
5.4.1 Network settings

Once the IO-Link Master has been successfully configured (*Ch. 5.3*), you will need to setup the network connection on the robot.

1. On the teach pendant, tap the **Hamburger Menu**  in the Header **...**



2. **...** and select **Settings**.



3. In the menu on the left, tap System and select **Network** (Fig. *10*).
4. Select “Static Address” for the network method.
5. Set the IP address and the subnet mask for the robot that the IO-Link Master and the robot are in the same Network.
6. Click “Apply” button to apply the new settings.

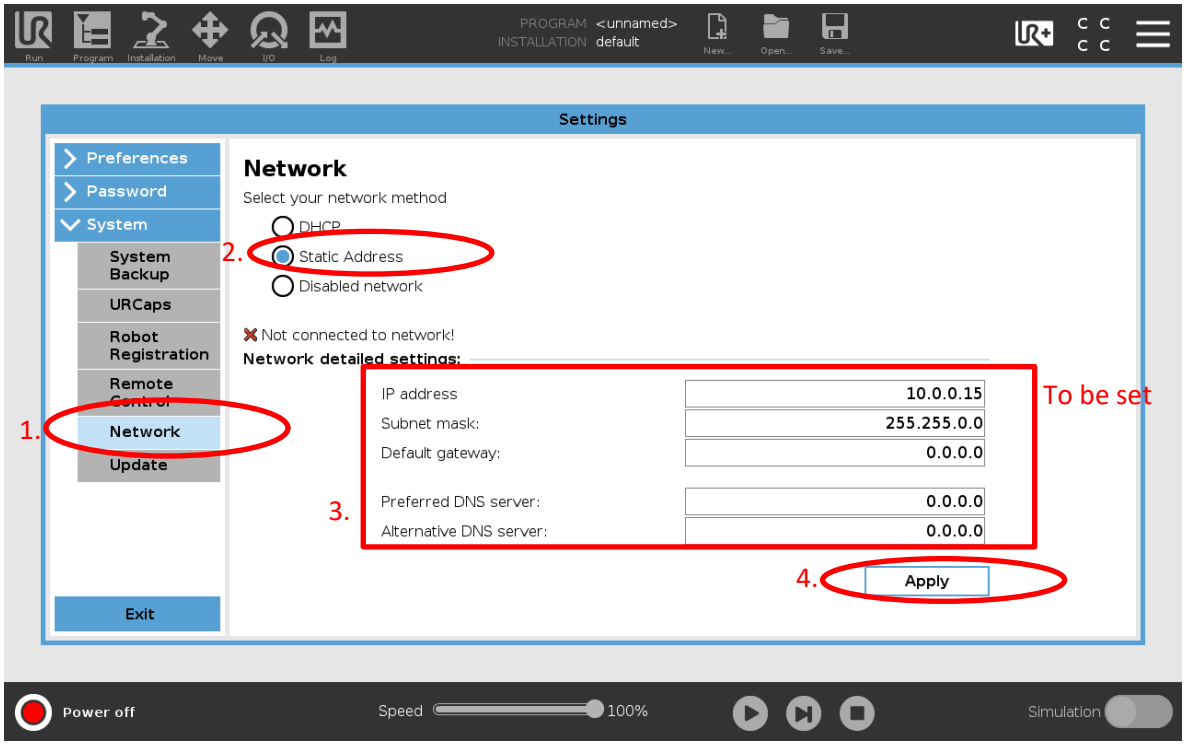
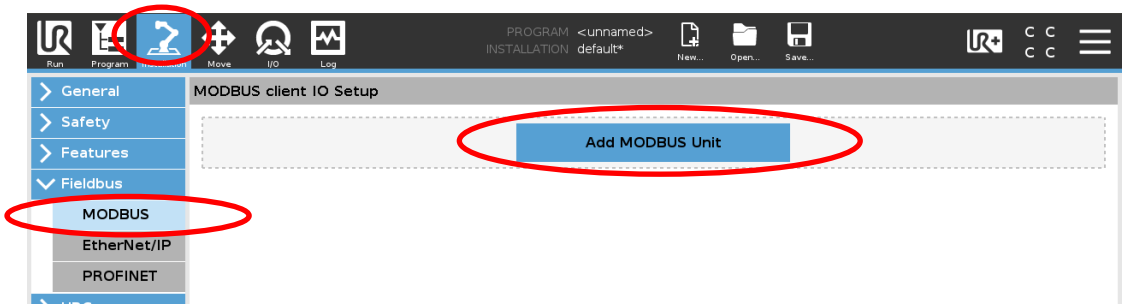


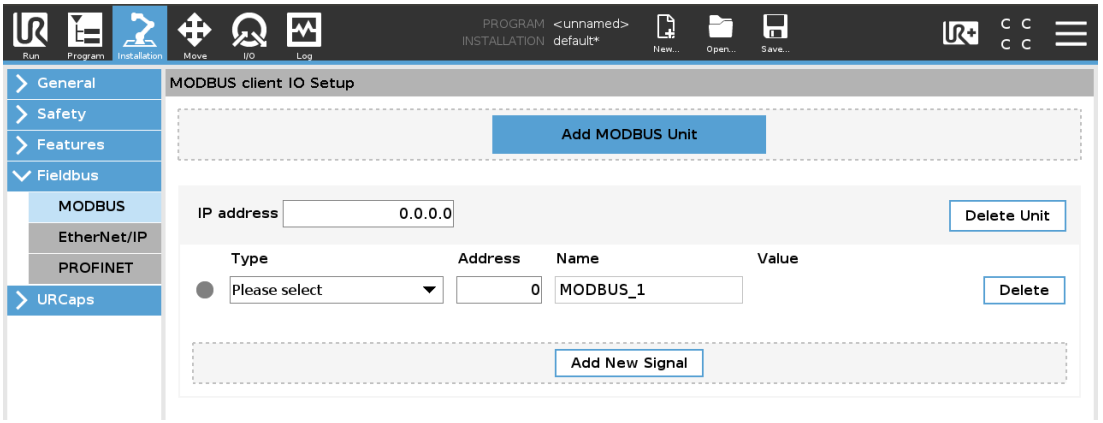
Fig. 10: Network settings on Polyscope

5.4.2 Test Modbus connection

1. Please check if the IO-Link Master and the grippers are connected and powered on. The status LED on the IO-Link Master should be green for: PWR, BUS, ETH1 and IOL (of the connected ports).
2. Go to the **Installation** tab and select **Fieldbus/MODBUS** in the menu on the left.
3. Click „Add MODBUS Unit“ button.



4. A new Modbus communication unit will be created.



5. Please set the IP address of the IO-Link Master (Fig. *11*) and check the „Show advanced options“ on the buttom of the page. Setup the Modbus Signal: select „Register Input“ for Type and type 2 for Address.
6. If the Modbus communication is running the value of the Signal should not be zero and the Connection status of the unit should be „connected“ (Fig. *11*).
7. After the Modbus communication was successfully tested, please delete the fort he test created unit with the „Delete Unit“ button.

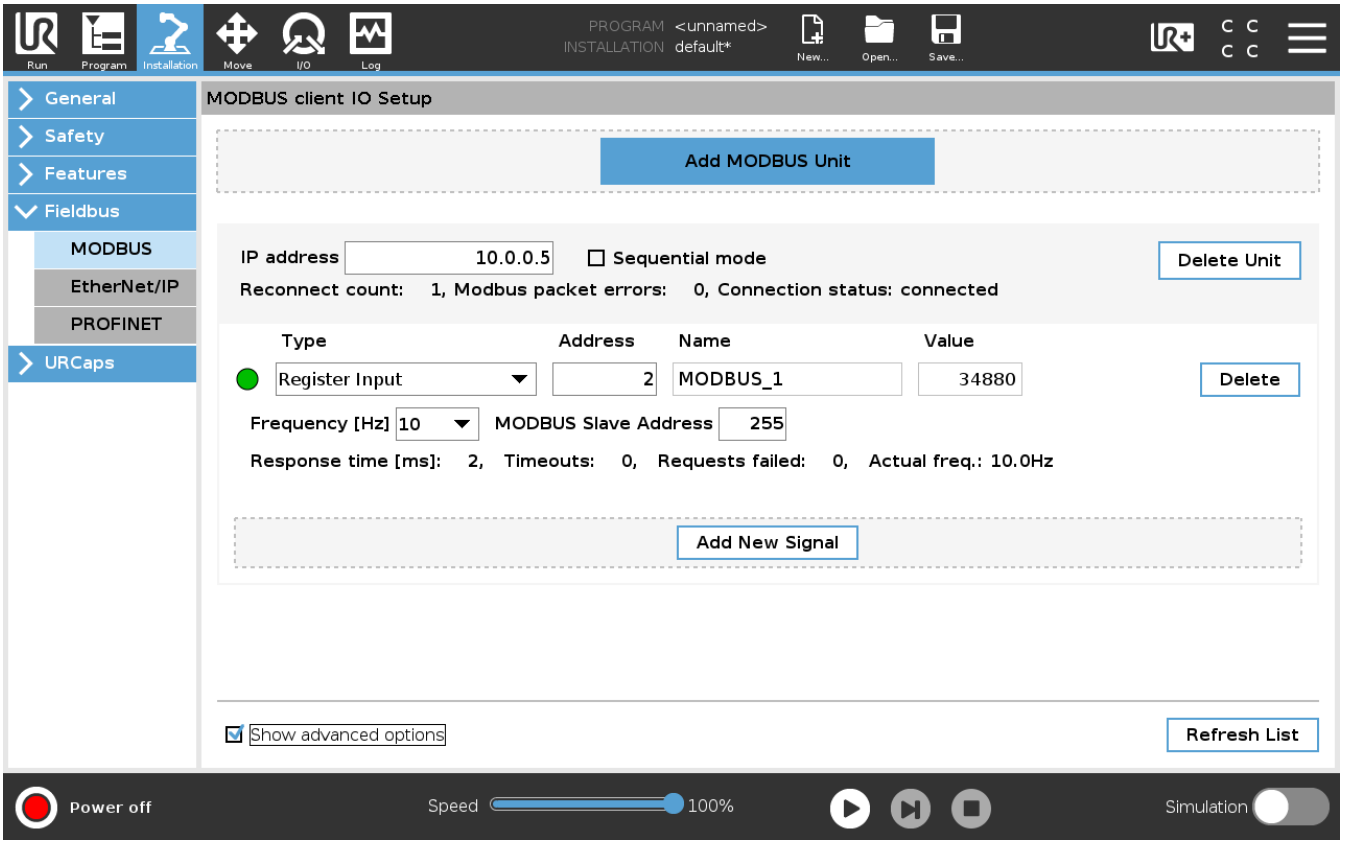


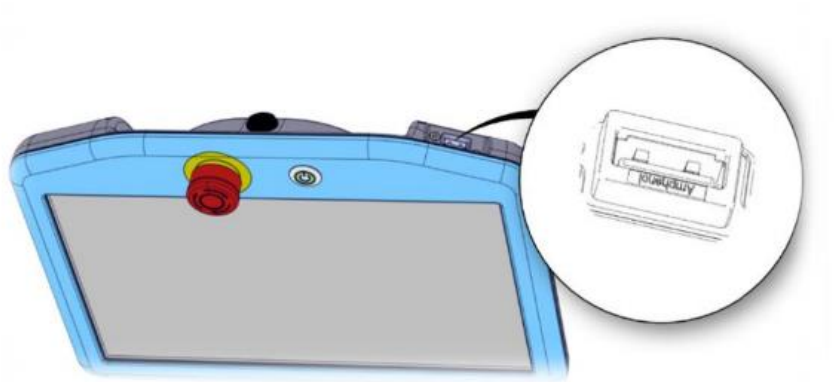
Fig. 11: Polyscope MODBUS client IO Setup page

- **NOTICE:**
  To reduce communication traffic and to increase the throughput rate on the Modbus we highly recommend to delete all unnecessary MODBUS Units and Signals from “MODBUS client IO Setup” page (Fig. *11*) on the robot.

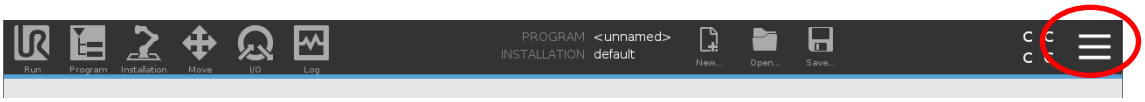
5.5 URCap installation

The UR-Caps Software and the example project is stored on the Zimmer-USB-Stick. Please follow the steps below to install the Zimmer Premium URCap software.

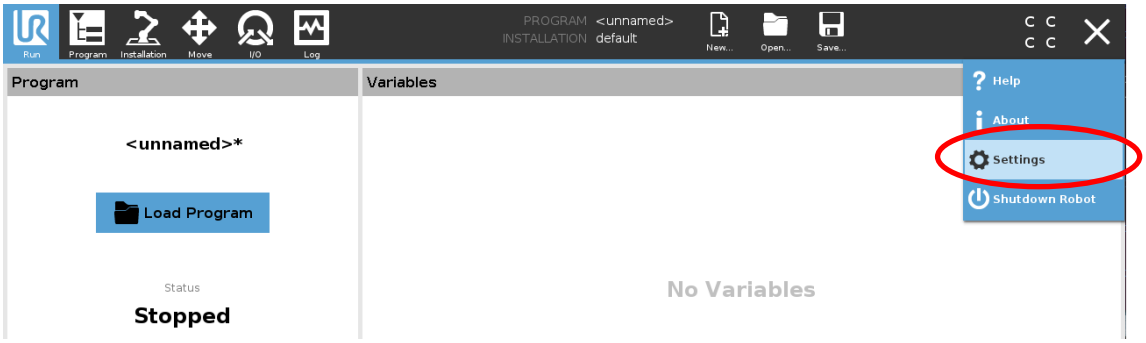
1. Start up the robot and when robot is ready, plug in the Zimmer-USB-Stick.



2. On the teach pendant, tap the **Hamburger Menu** ☰ in the Header **...**

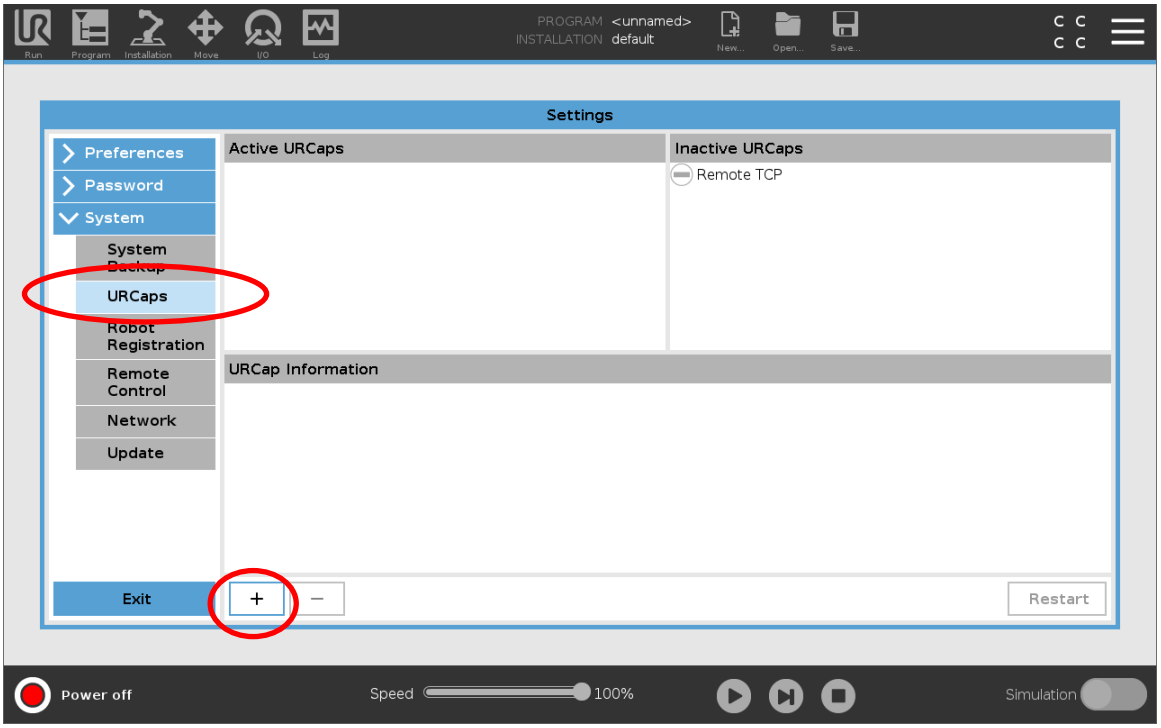


3. **...** and select **Settings**.

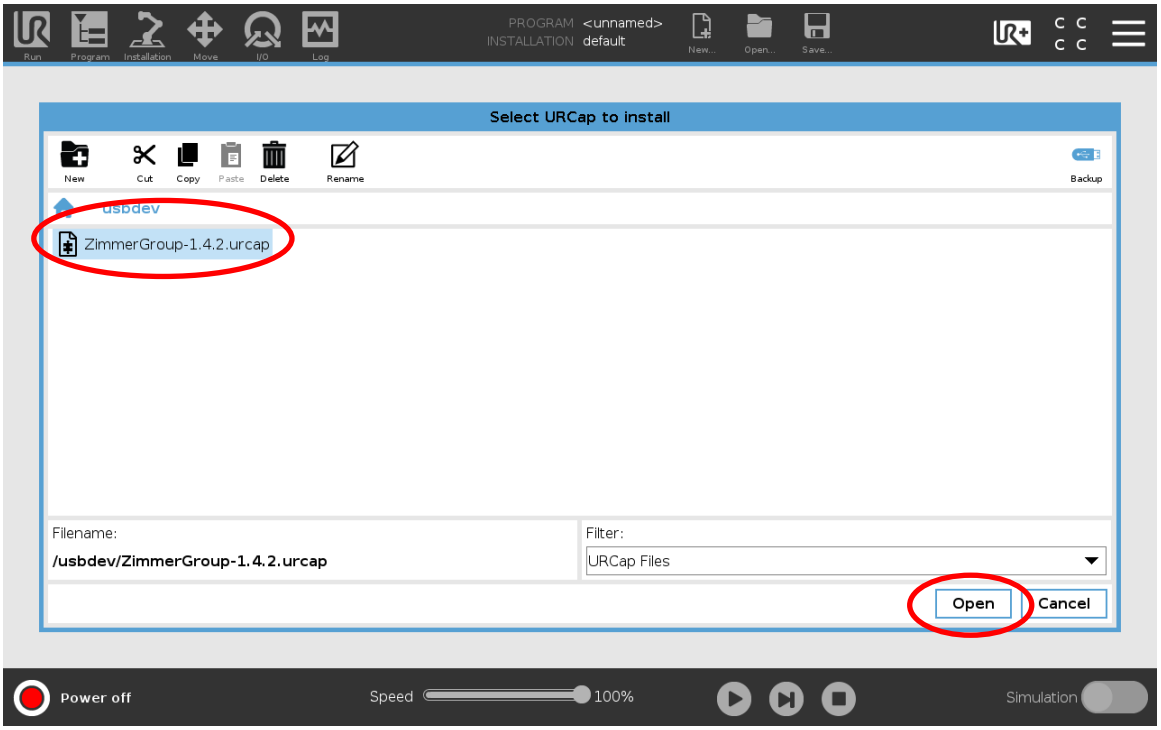


4. In the menu on the left, tap System and select **URCaps**.

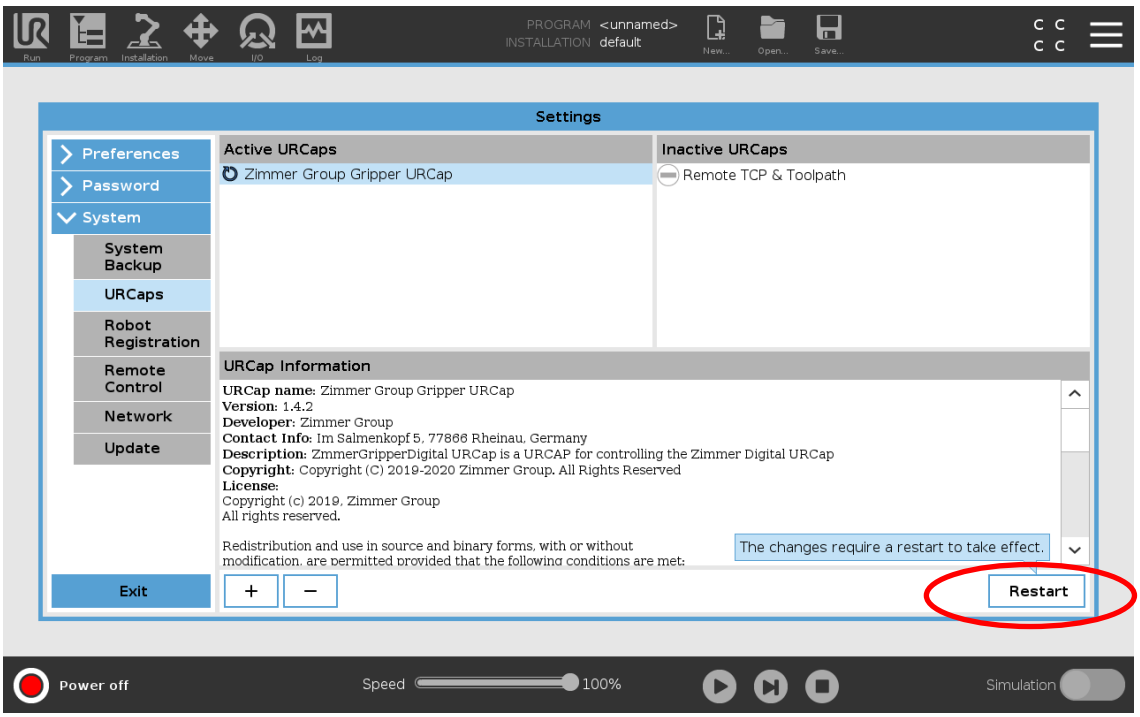
5. Press the + button, select the USB to display content and navigate to the URCap file.



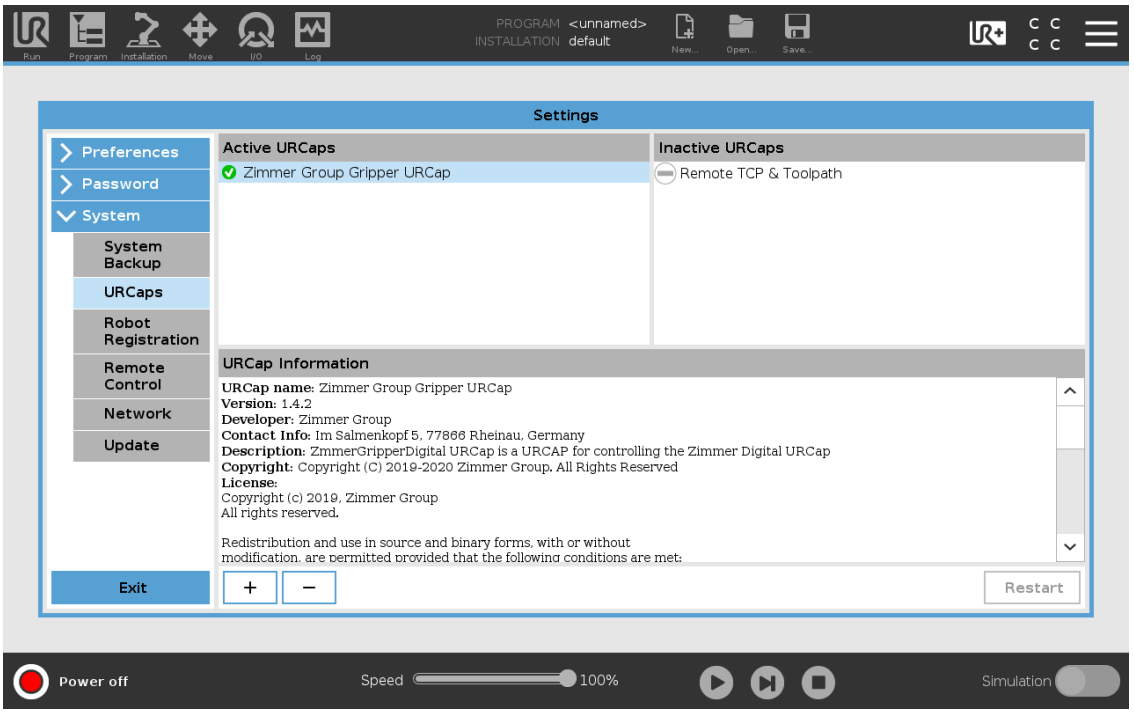
6. Select the **ZimmerGroup-x.x.x.urcap** and press **Open**.



7. Press **Restart** for activating the new firmware. After the restart, the Zimmer Group Software is installed and ready to be used.



8. After the restart, you can check if the Zimmer Group file is installed correctly.



5.6 First setup with the gripper

Once the IO-Link Master has been successfully configured (*Ch. 5.3*), Network on the robot set up (*Ch. 5.4*) and the Zimmer Premium URCap installed (*Ch. 5.5*), you will need to setup the gripper connection to use the gripper in the robot program sequence.

5.6.1 URCap Installation: controls and indicators overview

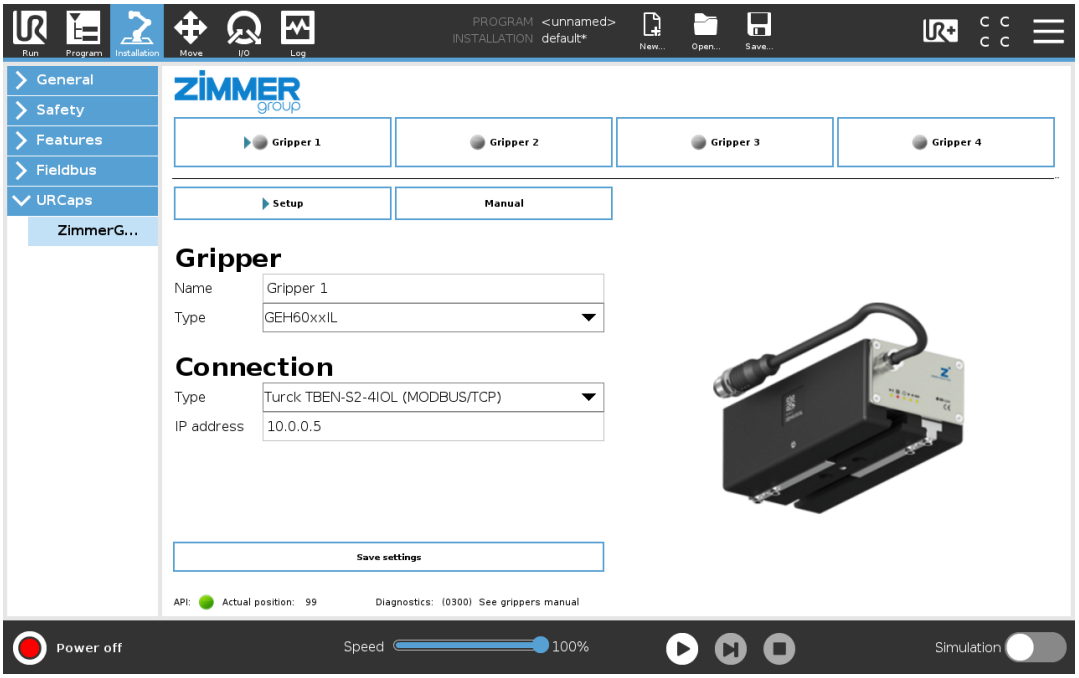
The 

Fig. 12, Fig. 13 shows the elements of the installation setup page of the Zimmer Premium URCap. The table *Tab. 3* contain a short description of these elements.

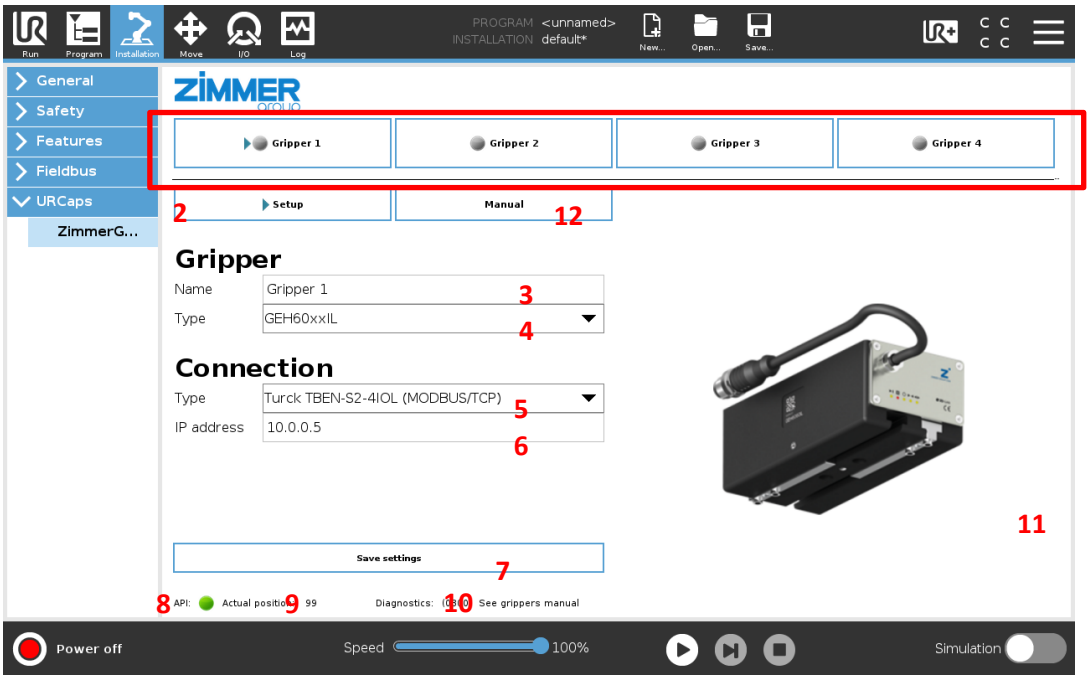


Fig. 12: Zimmer Premium URCap: Installation setup page

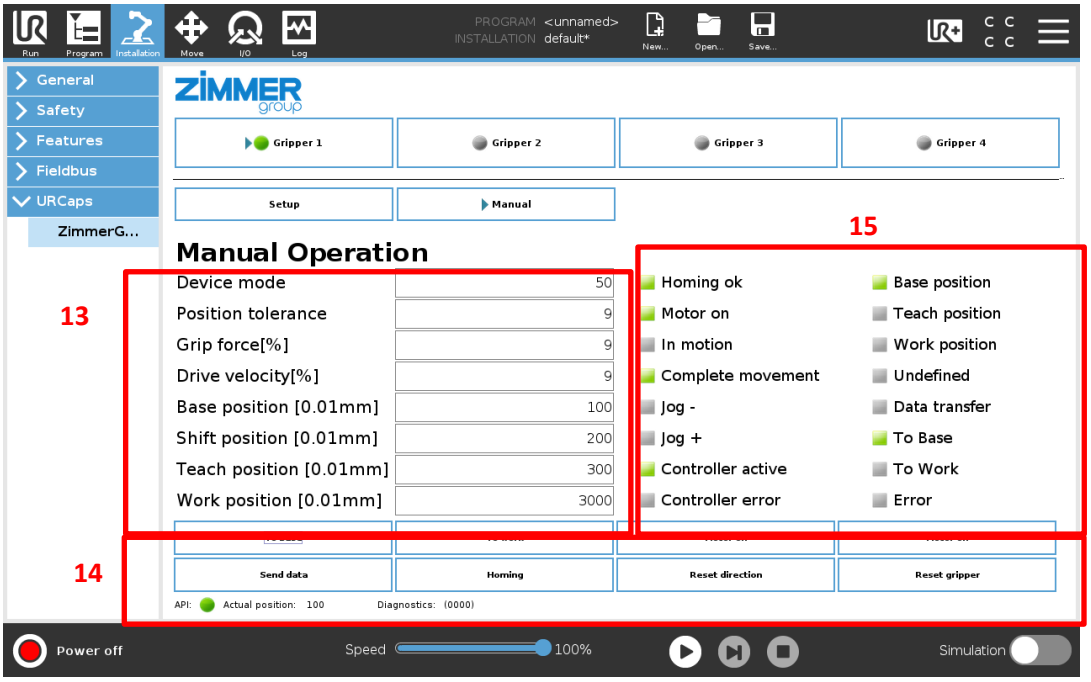


Fig. 13: Zimmer Premium URCap: Installation manual page

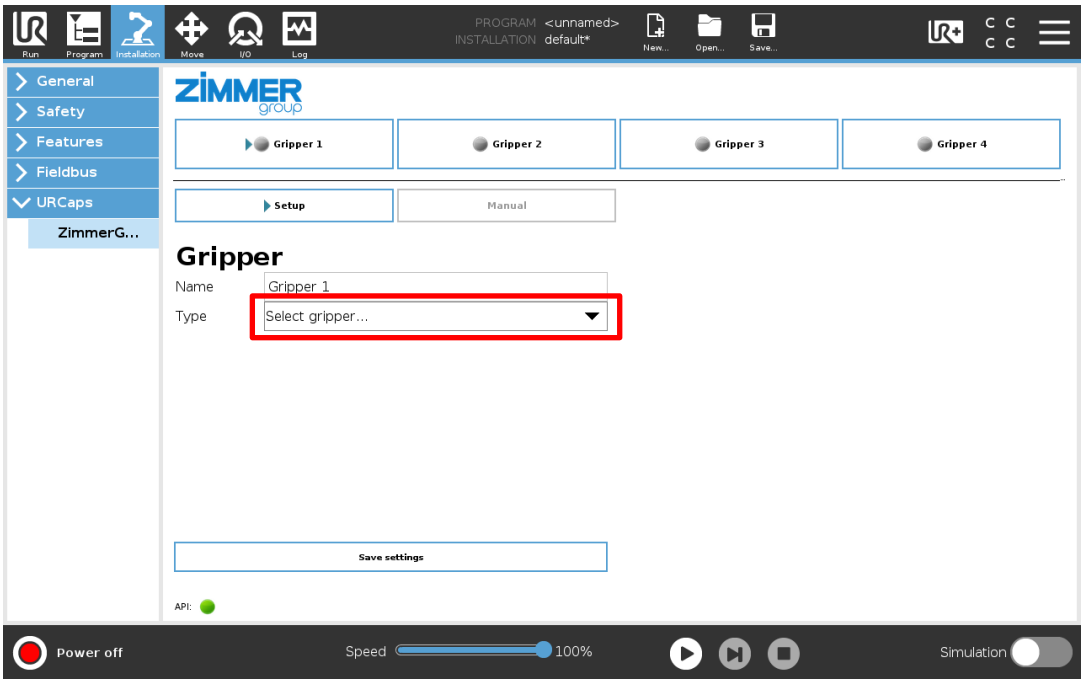
Id	Name	Item type	Description
1	Gripper1 Gripper2 Gripper3 Gripper4	Selection buttons	The buttons to select current active gripper for setup. The gripper order correspond to the IOL-Port order on the IO-Link Master. The blue triangular arrow on the left of caption indicates the current selection. The caption can be changed by edit of the name field (Id3).
2	Setup	Selection button	The button to activate the page for setup the selected gripper type and connection. The blue triangular arrow on the left of caption indicates the current selection.
3	Gripper Name	Edit field	This name will be used for the program node caption in the robot program sequence and for the caption of the gripper button.
4	Gripper Type	Combo box	Selects the type of the gripper connected to the chosen IOL-Port.
5	Connection Type	Combo box	Should be set to IO-Link Master
6	Connection IP address	Edit field	The configured IP address of the IO-Link Master (*Ch. 5.3*)
7	Save settings	Button	Control to save the current setup.
8	API	Indicator	Status indicator of background process, is not green if error.
9	Actual position	Value	The position feedback from gripper, see grippers manual for detailed information.

10	Diagnosis	Value/Text	The diagnosis feedback from gripper, see grippers manual for detailed information.
11	Gripper type image	Image	The common image fo the selected gripper type.
12	Manual	Selection Button	The button to activate the page for manual control the selected gripper. The blue triangular arrow on the left of caption indicates the current selection.
13	PDU fields	Edit fields	The IO-Link PDU data to setup the gripper parameters. See grippers manual for detailed information.
14	Manual control	Buttons	Manual control of the gripper. See grippers manual for detailed information.
15	Status	Indicators	The status feedback bits from gripper, see grippers manual for detailed information.

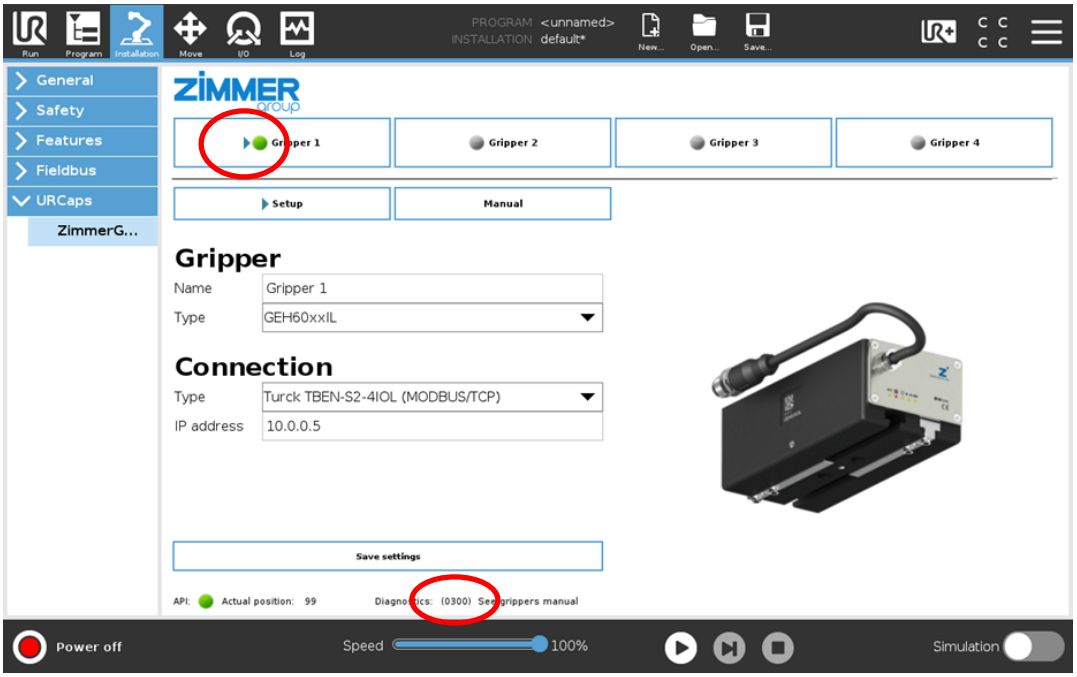
Tab. 3: Elements of URCap Installation page

5.6.2 URCap Installation: setup workflow

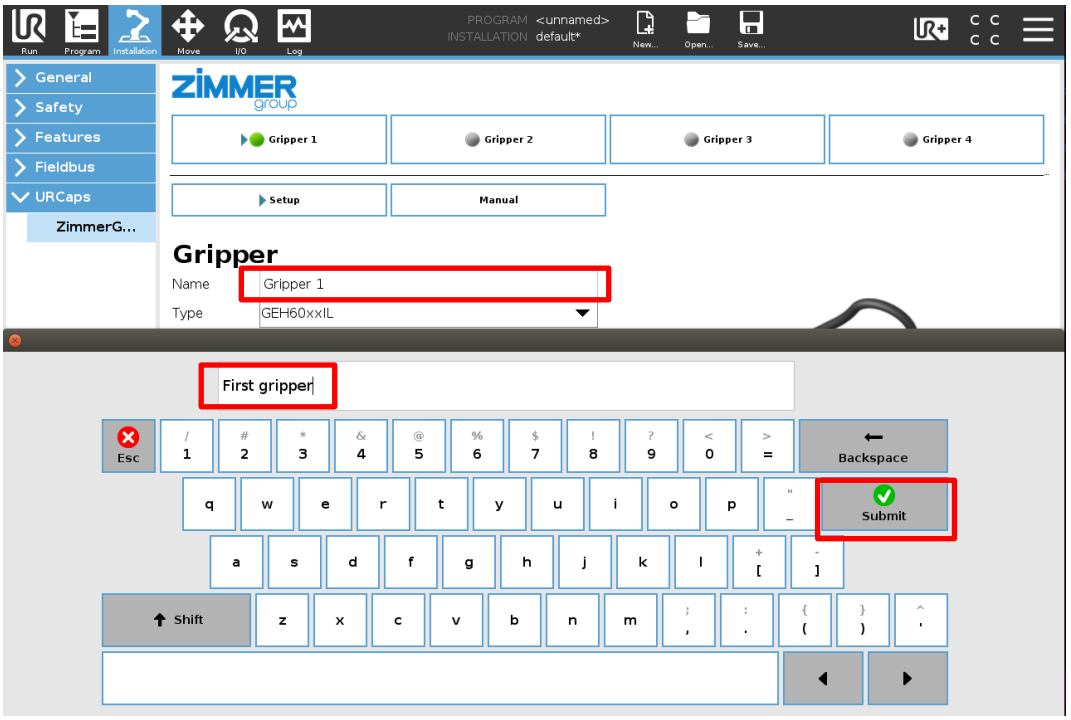
1. power on the IO-Link Master and the grippers.
2. Go to the **Installation** tab and select **URCaps/ZimmerGroup** in the menu on the left.
3. On the setup page select the gripper type from the list.



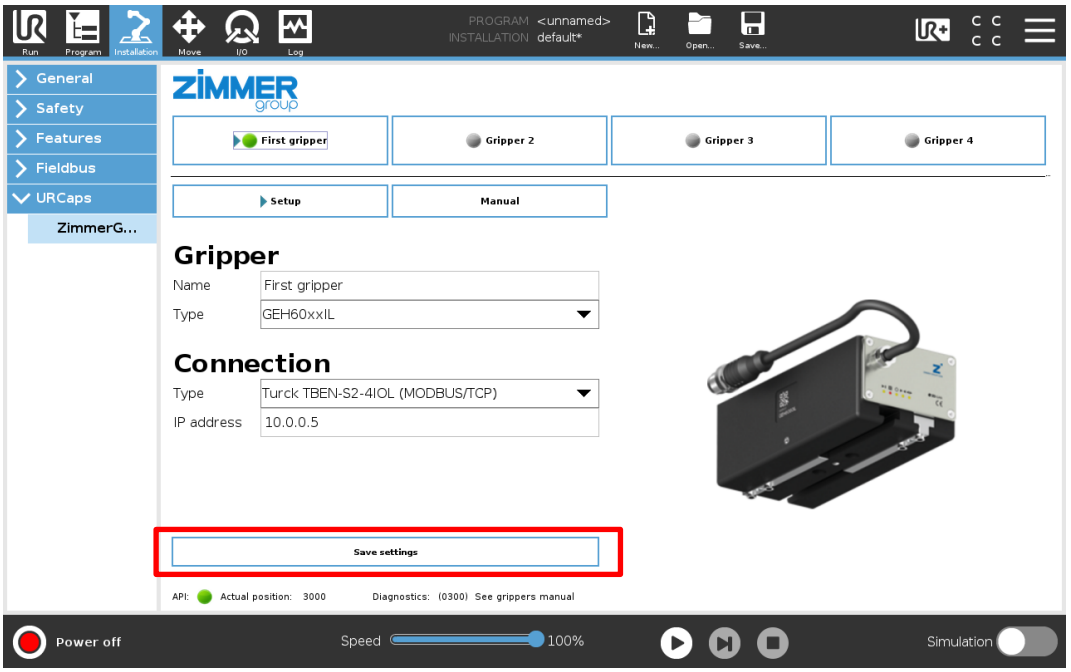
4. Change the IP address if it is not the default. The LED indicator should now be green or orange and Diagnostics have a number value.



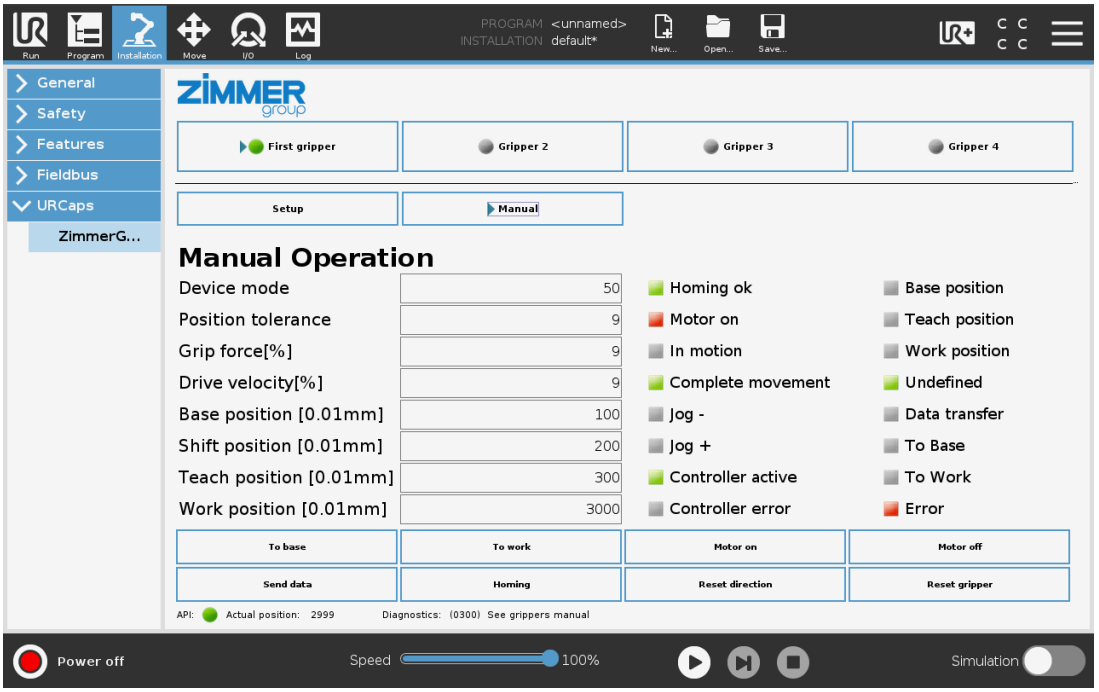
5. You can change the name of the gripper freely. Just tip on the field with the gripeers name, type the new name and submit it.



6. Once you have setup the connection, save the settings with the „Save settings“ button.



7. Now click the „Manual“ and open the manual page. On On the manual page you can control the gripper manually with the buttons on the bottom, send the PDU data to the gripper, see the current status of the gripper (see grippers manual for detailed information).



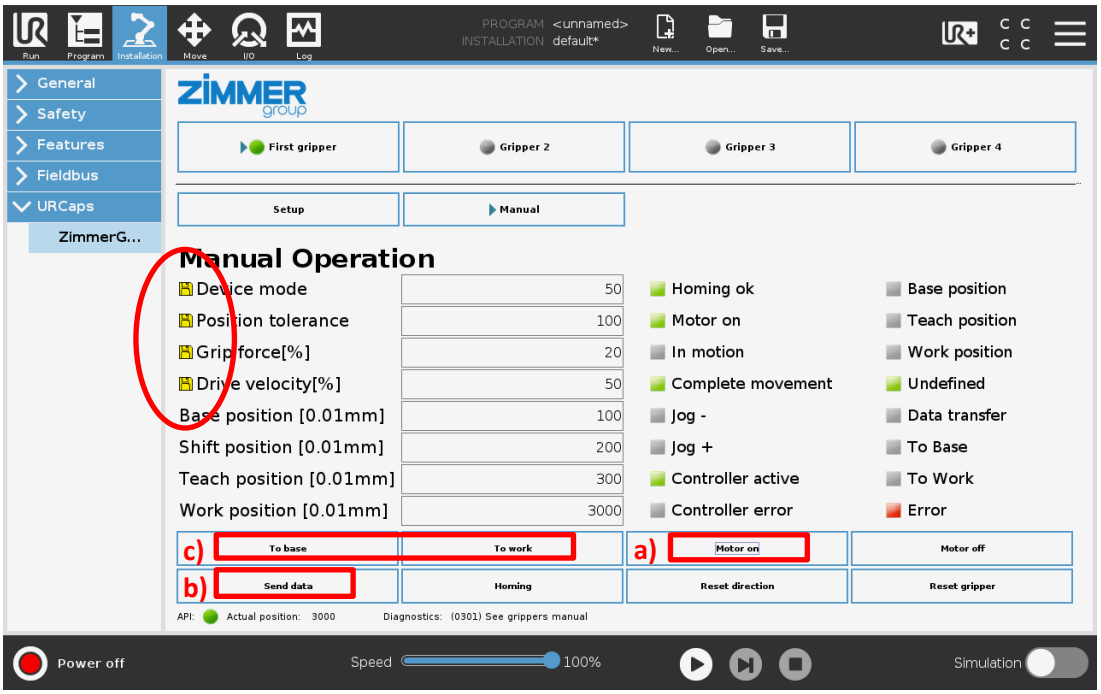
5.7 Manual control

Please read the complete installation and operating instructions of selected gripper first so you are fully familiar with the gripper control.

Here is the small example to control the GEH6000 manually:

a) click „Motor on“ to switch the motor on, the „Motor on“ status indicator is green and „Error“ indicator is red now.
b) cklick „Send data“ to transsmit the valid PDU data, the „Error“ status bit is clear now.
c) move the gripper jaws by clicking on the „To work“ or “To base“ button. After that, please check, if the status indicators.
Note: if you want to move the gripper a second time in the same direction, please change the position parameter and „Send data“, then press the button „Reset direction“. Then you can start your second movement in the same direction. If you toggle all the time between to base and to work, this procedure is not necessary.

- **Notice:** The disk symbol marks not transmitted parameters. With the “Send data” button you can transmit the current data to the gripper.



6 Program the gripper in the robot sequence

You ca find the Zimmer Premium URCap on the left side of Polyscope Program tab under section “URCaps/Z_Gripper”. In the chapter 6.3 is described how to use “Z_Gripper” node in your robot program.

6.1 Command list of the Zimmer Premium URCap

The table below presets all of the gripper commands available in the robot program sequence (automatic mode). The individual commands are executed until they have been successfully executed or the timeout of approximately 20 seconds has expired. You can check if the command was successfully done by check the value of the “Z_CommandFailFlag” variable after the command end. The variable is “False” if the command was successfully done (see *Ch. 6.2*).

Command Name	Description	Gripper Family
Z_Base	Moves the gripper jaws to the base position. Depending on the gripper family is the base-position a free definable position, or fixed set in the gripper	All IO-Link grippers
Z_Work	Moves the gripper jaws to the work position. Depending on the gripper family is the work-position a free definable position, or fixed set in the gripper	All IO-Link grippers
Z_Write_PDU	This command send new PDU (process data unit) to the gripper. You need this command to change the parameters in the gripper, e.g. teach-position or gripforce	All IO-Link grippers
Z_Motor_ON	This command turns on the motor, if all necessary preconditions are fulfilled	GEH6000IL family, HRC-01 family
Z_Motor_OFF	This command turns off the motor	GEH6000IL family, HRC-01 family
Z_Homing	This command moves the gripper to the reference position, if all necessary preconditions are fulfilled	GEH6000IL family, HRC-01 family
Z_Reset_Direction	This command set the direction flag in the gripper to FALSE. This is helpful, if you want to move the gripper 2 times in one direction.	GEH6000IL family, HRC-01 family GEP2000IL family
Z_Get_Status	Reads the status from the gripper into a set of Universal Robots variables once per call. You can use this variables as shown in the example program (*Ch. 6.3.6*)	All IO-Link grippers

Z_Reset_Gripper	This command start the gripper reset function	GEH6000IL family, HRC-01 family
Z_check_status	Reads the status from the gripper into a set of Universal Robots variables and make the user defined check in an endless-loop until the expression goes true or time out (see *Ch. 6.3.5*).	All IO-Link grippers

Tab. 4: Zimmer Premium URCap program sequence commands summary

6.2 Variable list of the Zimmer Premium URCap

The Zimmer Premium URCap creates a list of global variables, which are available for more advanced features. All of these created variables have a “Z_”- prefix (). The variables can be used to check that a calibration has been successful, or to take a special action if the gripper is not in base, teach or work position. Refer the gripper documentation for details about these parameters.

The commands “Z_Get_Status” and “Z_check_status” will update the global variables for the actual gripper. So when you use more than one gripper, the global variables are valid for the last gripper you update the status.

The value of “Z_CommandFailFlag” is set automatically after each command listed in *Tab. 4* and reports the status of last executed command.

The table below shows the summary of the variables used in the Zimmer Premium URCap software.

Variable	Type	Range	Description	available for gripper family
Z_ActualPosition	INTEGER	0 .. 9999	It shows the gripper jaws position sensor data with a factor of 100: e.g. 149 = 1,49mm.	All IO-Link
Z_AtBasePosition	BOOLEAN	True, False	It corresponds 30ot he Bit8 of StatusWord, it is „True“ if the gripper is at the “BasePosition”.	All IO-Link
Z_AtTeachPosition	BOOLEAN	True, False	It corresponds 30ot he Bit9 of StatusWord, it is „True“ if the gripper is at the “TeachPosition”.	All IO-Link
Z_AtWorkPosition	BOOLEAN	True, False	It corresponds 30ot he Bit10 of StatusWord, it is „True“ if the gripper is at the “WorkPosition”.	All IO-Link
Z_CommandFailFlag	BOOLEAN	True, False	It reports the status of last executed command. It is „False“ if the last command was successsfuly done.	All IO-Link
Z_CompleteMovement	BOOLEAN	True, False	It corresponds to the Bit3 of StatusWord, it is „True“ after the movement is complete.	GEH6000IL HRC-01
Z_ControlSystemActive	BOOLEAN	True, False	It corresponds to the Bit6 of StatusWord, it is „True“ as soon as the gripper has booted up after the cold start”.	all IO-Link
Z_ControlWord0x100	BOOLEAN	True, False	It corresponds to the Bit13 of StatusWord. This bit is a direction flag and is active when the last movement order was made in the “BasePosition” direction.	GEH6000IL GEP2000IL HRC-01/03/04/05
Z_ControlWord0x200	BOOLEAN	True, False	It corresponds to the Bit14 of StatusWord. This bit is a direction flag and is active when the last movement order was made in the “WorkPosition” direction.	GEH6000IL GEP2000IL HRC-01/03/04/05
Z_ControllerError	BOOLEAN	True, False	It corresponds to the Bit7 of StatusWord.	GEH6000IL HRC-01

			Error in the controller.	
Z_DataTransferOk	BOOLEAN	True, False	It corresponds to the Bit12 of StatusWord. This bit is used for data transmission, using the “handshake”.	all IO-Link
Z_Diagnostics	INTEGER	0 .. 65535	The value returned in the "Diagnosis" parameter corresponds to the error code.	all IO-Link
Z_Error	BOOLEAN	True, False	It corresponds to the Bit15 of StatusWord. Error in the gripper, if this bit is active, the error message can be determined using the “Diagnosis” parameter.	all IO-Link
Z_HomingOk	BOOLEAN	True, False	It corresponds to the Bit15 of StatusWord. This bit is required as mandatory.	GEH6000IL HRC-01
Z_InMotion	BOOLEAN	True, False	It corresponds to the Bit2 of StatusWord. This bit is active during the run.	GEH6000IL HRC-01
Z_JogMinus	BOOLEAN	True, False	It corresponds to the Bit4 of StatusWord. Confirmation during the “Jog” run in the direction of “BasePosition”.	GEH6000IL HRC-01
Z_JogPlus	BOOLEAN	True, False	It corresponds to the Bit5 of StatusWord. Confirmation during the “Jog” run in the direction of “WorkPosition”.	GEH6000IL HRC-01
Z_MotorOn	BOOLEAN	True, False	It corresponds to the Bit2 of StatusWord. This bit is enabled when the motor is switched on.	GEH6000IL HRC-01
Z_UndefinedPosition	BOOLEAN	True, False	It corresponds to the Bit11 of StatusWord, it is „True“ if the gripper is neither at “TeachPosition”, nor “WorkPosition” and nor “BasePosition”.	all IO-Link
Z_Message	STRING	Text	Feedback from background service, for internal usage only.	-

Tab. 5: “Z_”-variables overview

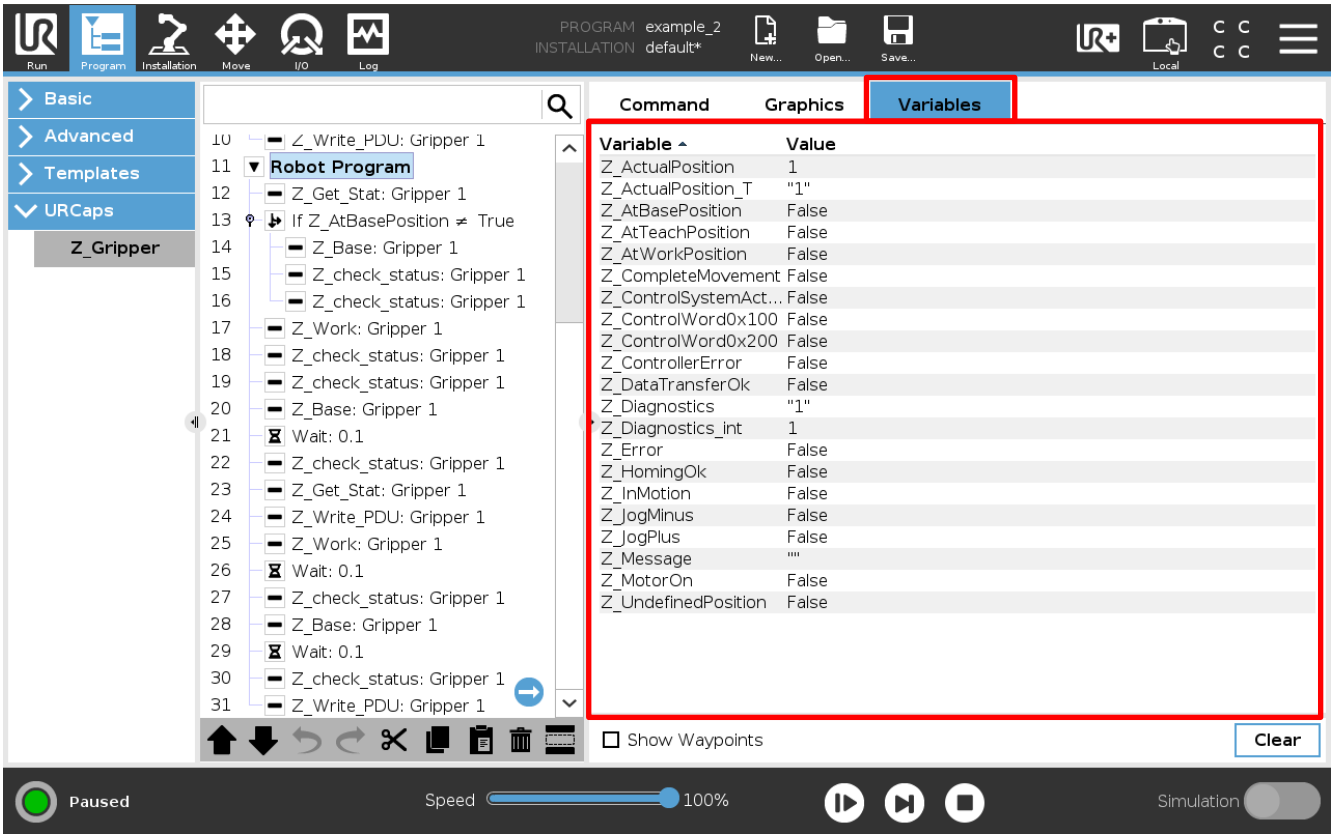


Fig. 14: “Z_”-variables on the Polyscope Variables tab

6.3 How to use Zimmer-Node in Polyscope

6.3.1 Generate a new Zimmer- node in the robot program

To use the Zimmer Premium URCap in your robot program, tap the URCaps on the left side of the Program tab and select the “Z_Gripper” node. A Zimmer node will be added to your robot program.
Now you can select the gripper that should be used from the gripper list and a command to execute.

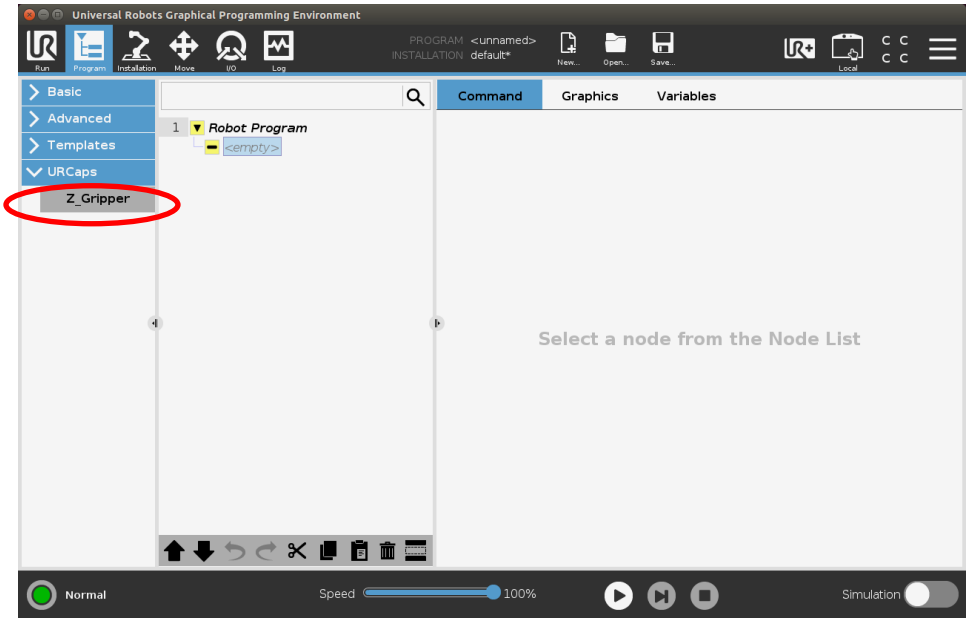


Fig. 15: “Z_Gripper” node on the Polyscope Program tab

6.3.2 Choose the used gripper and add a new command node to the sequence

Once the “Z_Gripper” node was added to your robot program, you can see a yellow colored “ZimmerGripper” node in your Robot Program tree, the Command tab with selection control of the used gripper and command for it on the right side of Polyscope Program tab (*Fig. 16*).

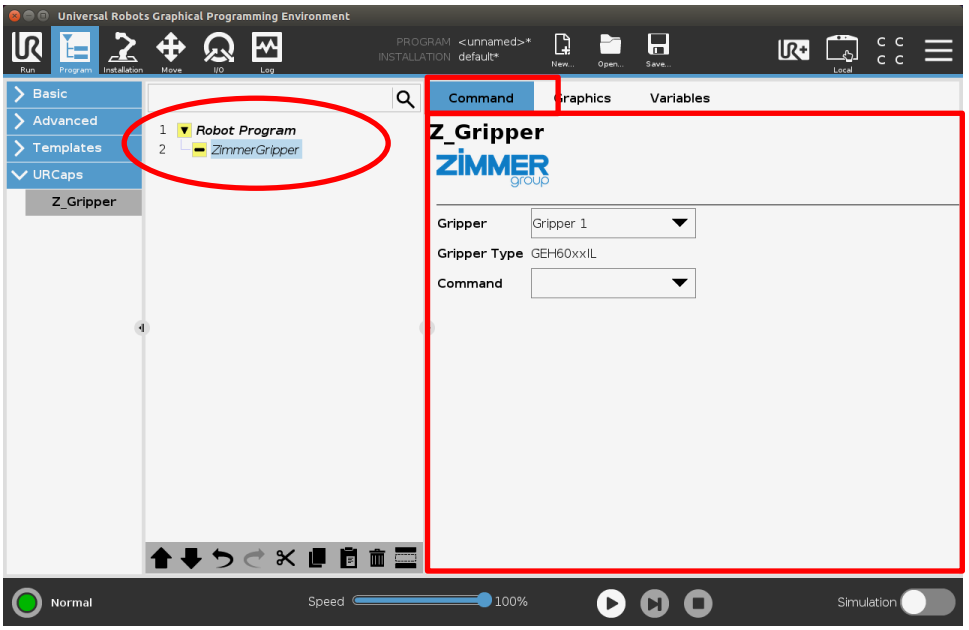


Fig. 16: “Z_Gripper” node, the Polyscope Command tab

6.3.3 Define your node command

In general the yellow color of the node on the Polyscope Robot Program tree marks the nodes it still to be parametrized.
For the “Z_Gripper” node, you should at least select the required command from the command drop-down list on the Polyscope Command tab to parametrize it.

The content of the command drop-down list depends on the gripper family. The summary of all commands is listed in the chapter 6.1.

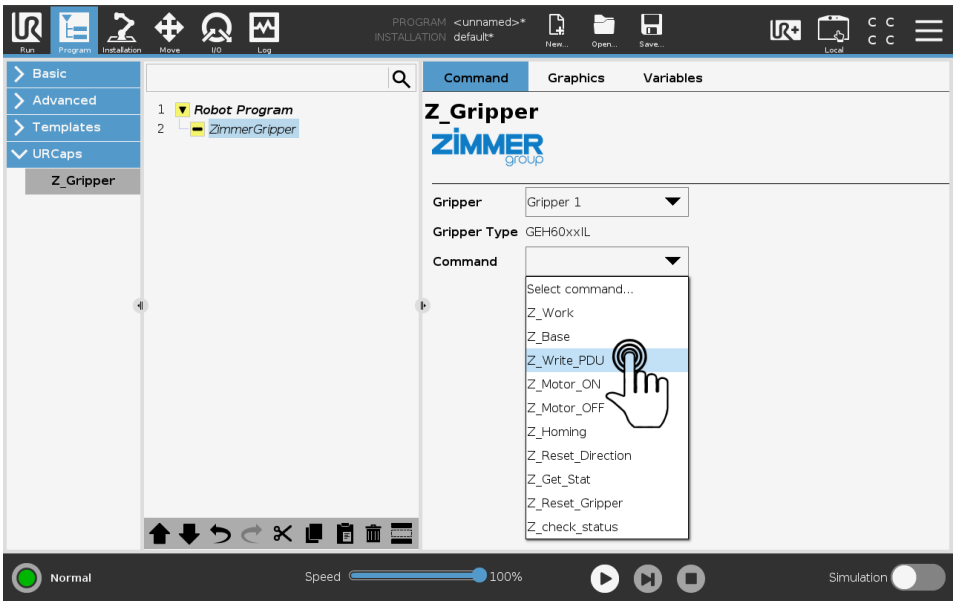


Fig. 17: “Z_Gripper” node, select the command for used gripper

6.3.4 Write new process-data to the gripper (PDU)

You can use the “Z_Write_PDU” command to change the gripper process data within the robot program. Depending on the family of used gripper there are two general types of process data sets.
The first, advanced, type of PDU data set is used in the grippers with extended functionality like the grippers of the 6000 series and HRC-01 grippers (advanced grippers).
The second, basic, type of PDU data set is used in the grippers without extended functionality like the grippers of the 5000 series, 2000 series and HRC-03/04/05 grippers (basic grippers).

You will find the detailed description of the PDU in the gripper manual.

With the manual page descripted in chapter “Manual control 5.7”, you can test all settings before you write your robot sequence.

The figures below show the using of “Z_Write_PDU” command within a robot program (*Fig. 18* for advanced gripper, *Fig. 19* for basic gripper).

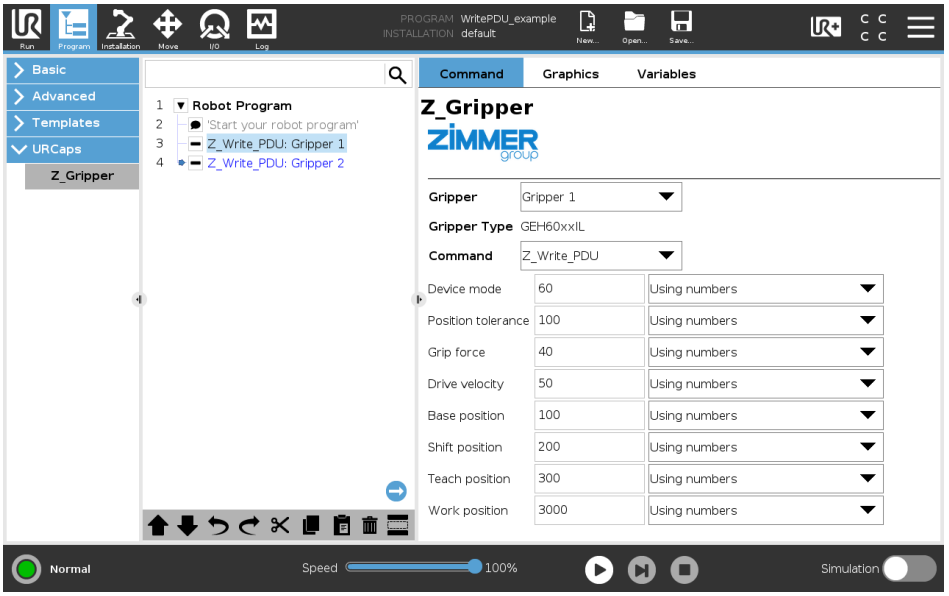


Fig. 18: “Z_Gripper” node, “Z_Write_PDU command for advanced gripper

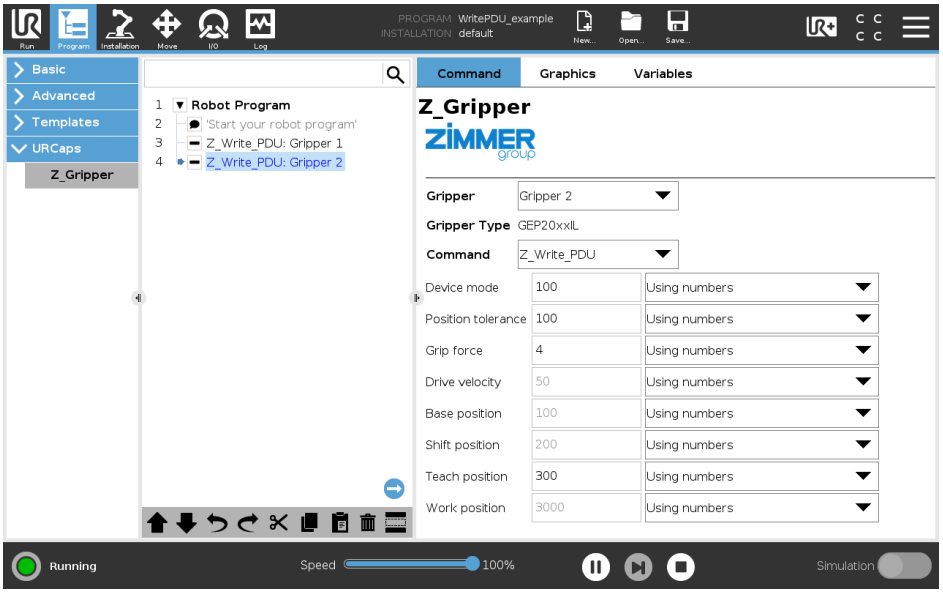


Fig. 19: “Z_Gripper” node, “Z_Write_PDU command for basic gripper

Instead of fixed numbers, you can use the global variables and/or program variables for values in the "Z_Write_PDU" command (or you can combine them). In the following example (*Fig. 20*) is a set of program variables for the first gripper in the "BeforeStart" section defined. These variables are used in the subroutines “SubP_G1_SetPduWorkPiece1” and “SubP_G1_SetPduWorkPiece2”. In the subroutines we change the size of the expected workpiece and send it to the first gripper. In this way, we can define the variables and subroutines for the other grippers and change the parameters as required.

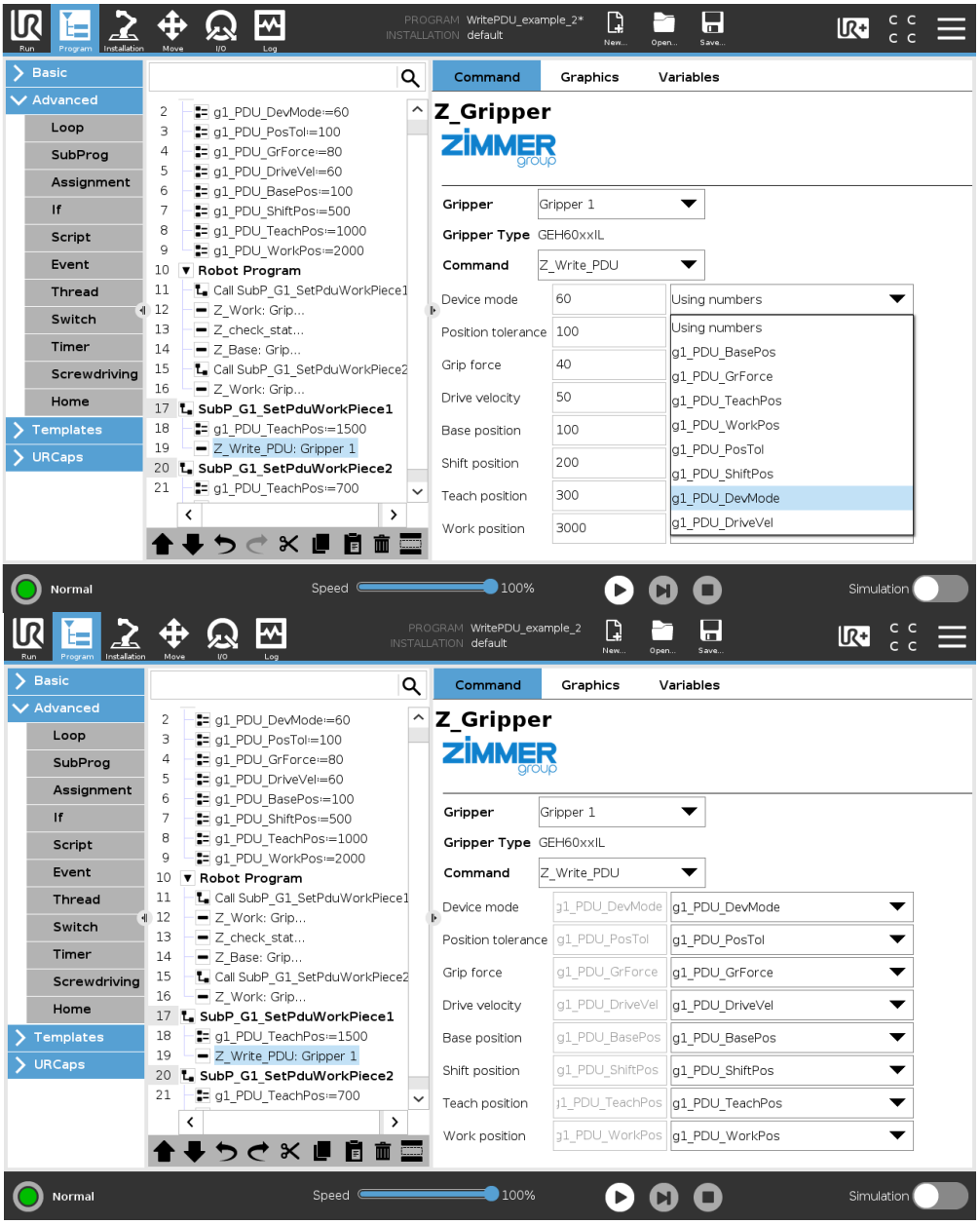


Fig. 20: “Z_Gripper” node, “Z_Write_PDU command with variables

6.3.5 „Z_check_status“ – an advanced loop to check the gripper status

The “Z_check_status” command continuously reads the value of the StatusWord in a loop until the user defined expression becomes true or the timeout occurs (approx. after 20 seconds). The values of global “Z_” variables will be updated while this command (see *Ch. 6.2*).
This command can be useful e.g. to wait and check if the gripper completes the movement in the required position.

In the example below, the loop is active, while the bits “HomingPosition OK”, “TeachPosition”, “MovementComplete” are not set and the bit “InMotion” is clear in the StatusWord.
Read the grippers manual for more information about the StatusWord bits.

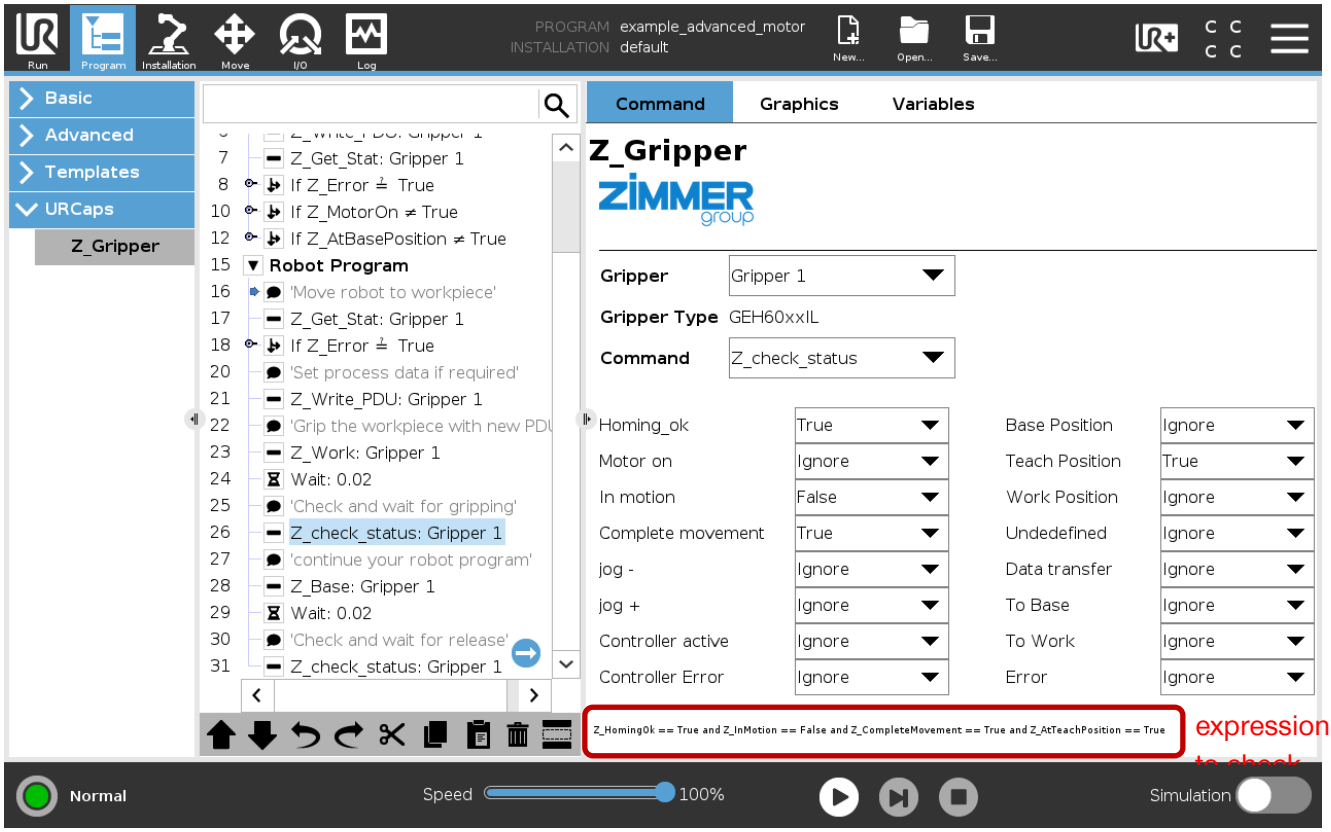


Fig. 21: “Z_Gripper” node, a “Z_check_status example

6.3.6 Loop to check the state of the gripper

If you prefer not to use the “Z_check_status” command in your robot program, you can use the “Z_Get_Stat” command combine with the additional conditional expressions.
The “Z_Get_Stat” command refreshes the values of all global “Z_” variables once per call. You can call the “Z_Get_Stat” command for example in an infinite-loop, check for position flag in an if-condition, with a control structure that control the termination of the loop, and a wait for delay (*Fig. 22*). In this way, you can check a lot of states of the grippers.

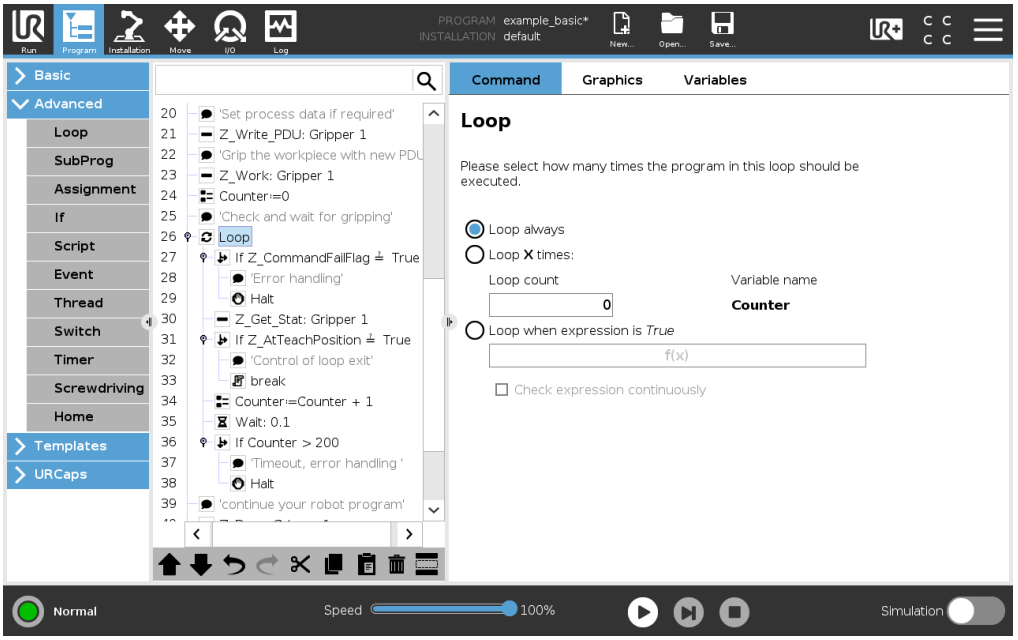


Fig. 22: Example usage of “Z_Get_Stat” for check position bit

6.4 Startup the gripper

After the power on, the grippers must run through the startup sequence once to be able to work properly. Depending on the family of gripper there are two general scenarios to start the gripper. The first scenario is for the grippers with advanced motor management like the grippers of the 6000 series and HRC-01 grippers. The second scenario for the grippers with common motor management like the grippers of the 5000 series, 2000 series and HRC-03/04/05 grippers.

Normally the startup sequence will execute once before the main program loop is started. In UR Polyscope you can add such Before Start Sequence by activate the “Add Before Start Sequence” check box on the Polyscope like showed on the *Fig. 23*.

Now you can select the “*BeforeStart*” element and add the program nodes into this section.

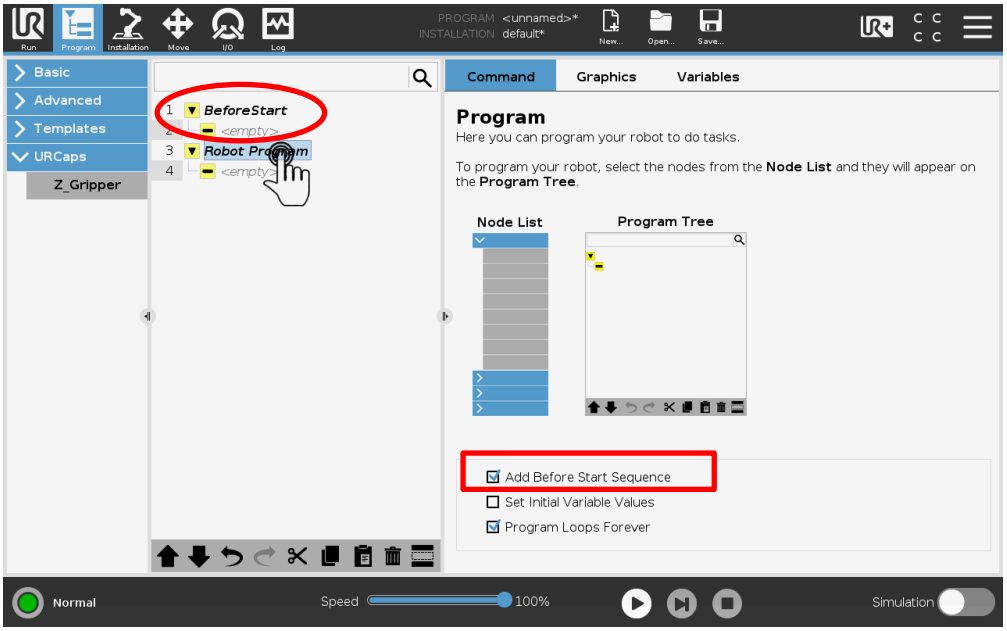


Fig. 23: UR Polyscope, add Before Start sequence

6.4.1 Startup the gripper with advanced motor management

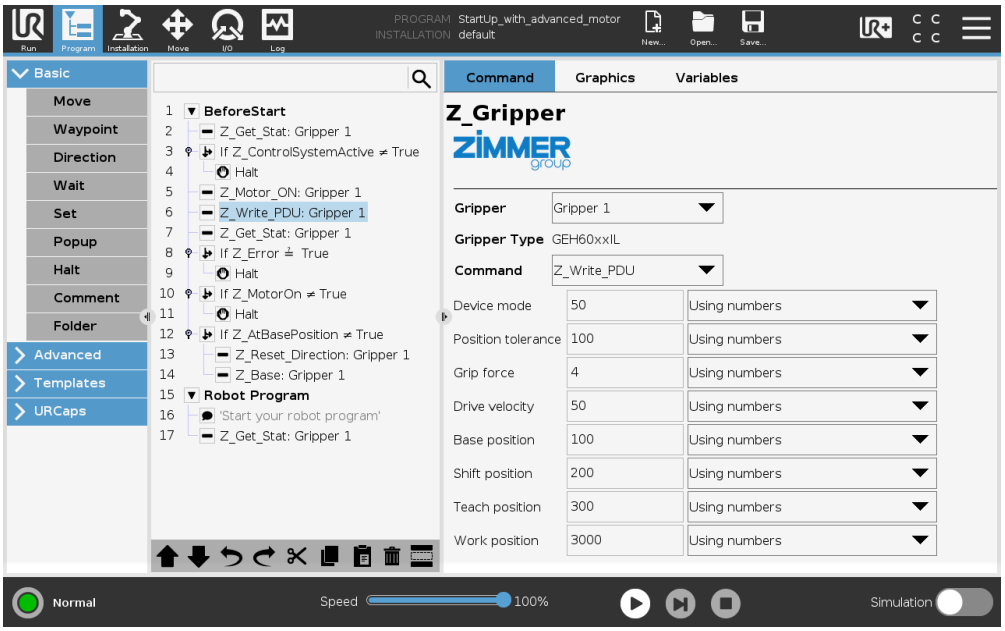


Fig. 24: Example startup sequence for grippers with advanced motor management

The grippers with the advanced motor management need the start the servo motor by separate command. If the gripper family supports the advanced motor management then the commands like “Z_Motor_ON” or “Z_Motor_OFF” are added into command list for selection.

The listing in *Fig. 24* shows an example startup sequence for grippers with advanced motor management. Please refer to the gripper manual for further information.

6.4.2 Startup the gripper with common motor management

The listing in Fig. 25 shows an example startup sequence for grippers with advanced motor management. Please refer to the gripper manual for further information.

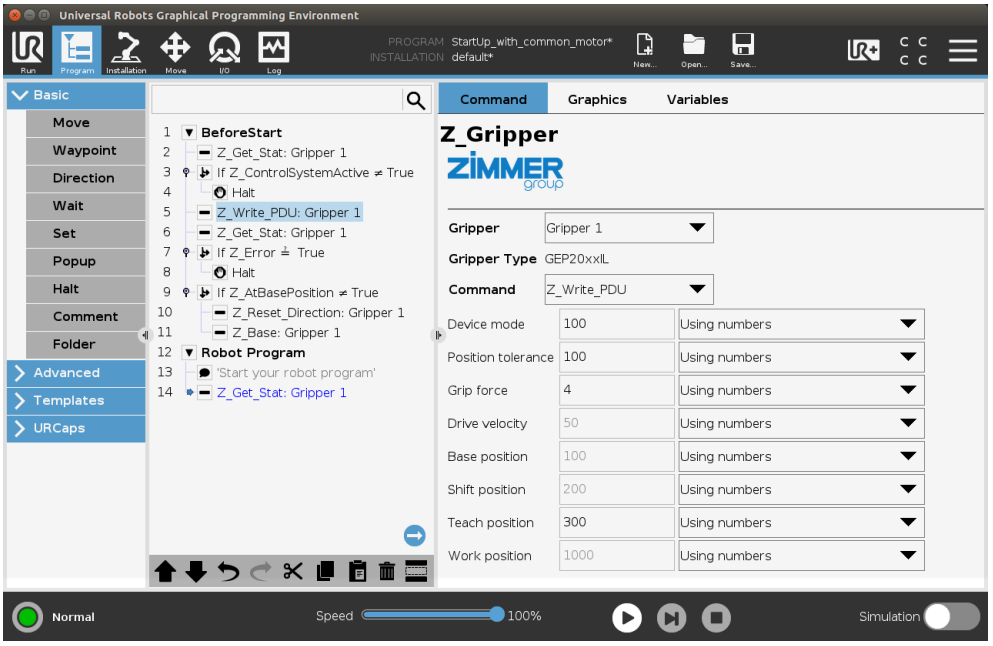


Fig. 25: Example startup sequence for grippers with common motor management

6.5 Write a small sequence to move the gripper

The listing below shows a small example program sequence for advanced gripper, where the gripper

- refreshes the values of the global “Z_” variables (line 17)
- checks if no errors (line 18) with some error handling (line 19)
- loads new PDU data for the current workpiece (line 21)
- starts the gripping (23)
- waits a small delay to be sure that the jaws start the movement and status bits are set (line 24)
- checks in loop for jaws stop in teach position to be sure that the right workpiece is gripped (line 26)
- checks if the command error flag is set (line 27), than error handling (line 28)
- starts the release (line 30)
- waits a small delay to be sure that the jaws start the movement and status bits are set (line 31)
- checks in loop for jaws stop in base position to be sure that the workpiece is released (line 33)
- checks if the command error flag is set (line 34), than error handling (line 35)

The Example assumes that the motor has already been started in the “BeforeStart” sequence (see *Ch. 6.4.1*).

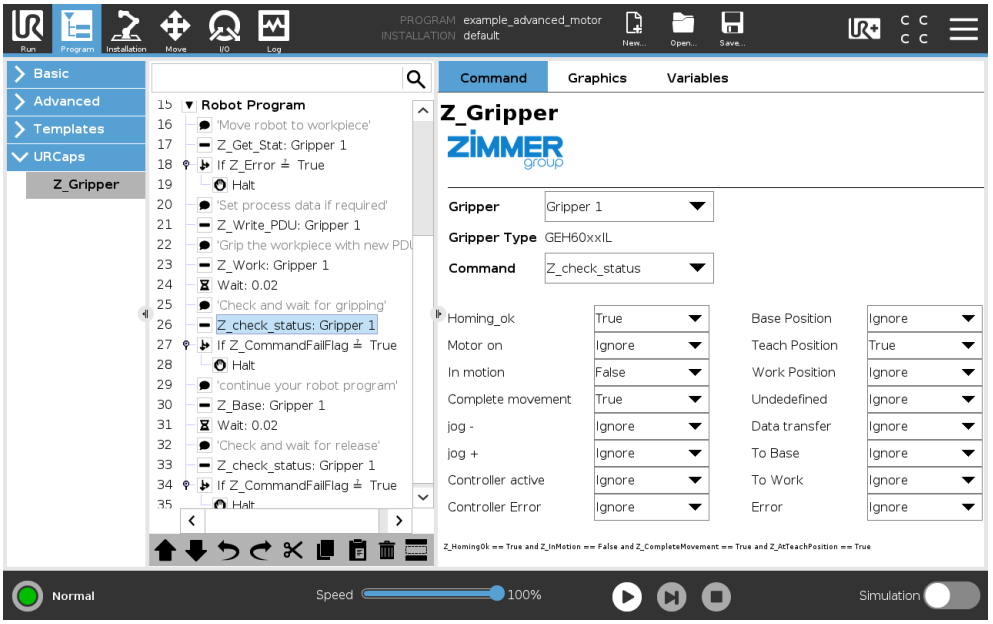


Fig. 26: Example to move advanced gripper

The example can also be used for basic grippers, but in this case the query in the Z_check_status nodes should be adapted, e.g. to check the required position flag only (*Fig. 27*).

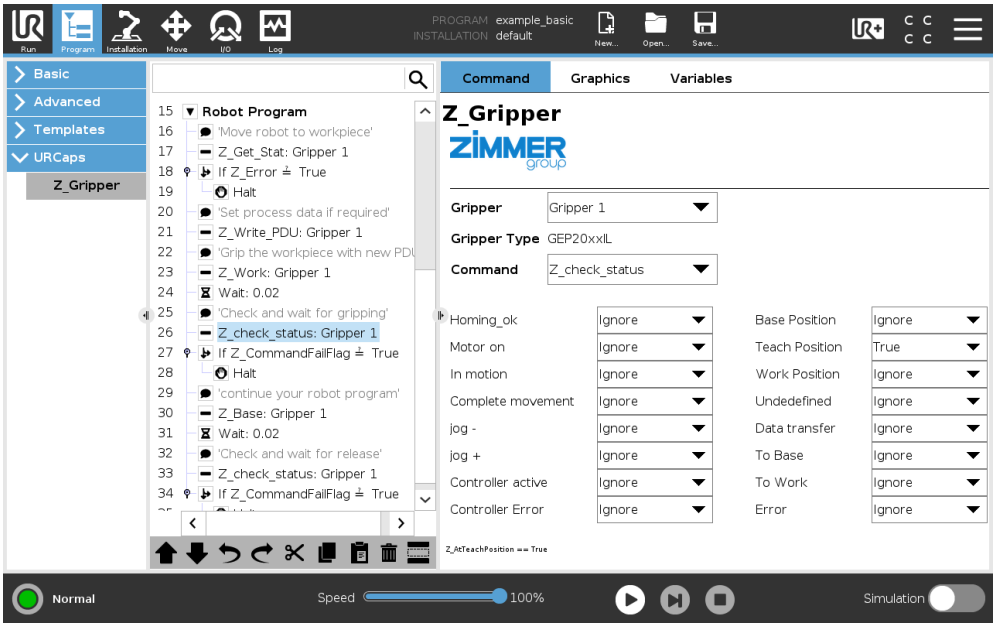


Fig. 27: Example to move basic gripper