Software manual
2D Grasping Kit

SCHUNK software module for URCap

Hand in hand for tomorrow

Imprint

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Technical changes:

We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

Thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

Customer Management

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Please read the operating manual in full and keep it close to the product.

Table of Contents

1 General

1.1 About this manual

This manual contains information about the SCHUNK software module "URCap" and its use in the robot control interface UR Polyscope.

The software is used to easily integrate and control the following products in Universal Robots applications:

- 2D Grasping-Kit

NOTE: The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

This manual describes the software environment on an e-Series UR robot. Compatibility with the CB series is not provided.

Validity These instructions apply for the following software versions:

SVC Firmware Version	UR Cap Version
>=3.0.0	4.0.0

In addition to these instructions, the documents listed under ▶ 1.7 [🗋 6] are applicable.

1.2 Target group

This manual is intended for robot integrators who have basic mechanical and electrical training skills and who are also familiar with elementary programming concepts.

Commissioning and troubleshooting may only be performed by qualified personnel with appropriate training.

The following knowledge is required:

- Basic knowledge of robotics
- Knowledge in handling UR robots

Electrical installations may only be carried out by a suitably trained electrician.

1.3 Symbol definition

The following symbols are used in this manual:

- ■ Prerequisite for an action
1. Action 1
2. Action 2
     - ⇨ Intermediate results
- ⇨ Final results
- ▸ 1.3 [🗅 5]: chapter number and [page number] in hyperlinks

1.4 Abbreviations

SVC   SCHUNK Vision Controller (Industrial PC)

AI   Artificial Intelligence

1.5 Brands

- • UR is a registered trademark of Universal Robots A/S (Denmark).

1.6 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Dangers for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.7 Applicable documents

- Commissioning instructions for 2D Grasping-Kit *
- Operating manual for the UR robot e-Series

The documents labeled with an asterisk (*) can be downloaded from **schunk.com/downloads**.

2 Functional description of "URCap"

The "URCap" software module facilitates operation and application creation for SCHUNK products on a collaborative robot from Universal Robots.

All necessary controls are installed via the software module. After the installation is complete, the programming elements are deployed within the Polyscope graphical user interface (GUI). The GUI supports the entire configuration of SCHUNK products as well as the necessary control and programming options.

The following functions are available in the software module and can be used in a robot program:

- **Vision**: Main window for selecting and documenting sample programs, program functions and script functions.
- **DoGrasp**: Sample program for the execution of a grasping routine.
- **GetGrasp**: Starts object detection and receives the grasping pose for an object.
- **SetOffset Waypoint**: Adds an offset orthogonal to a waypoint.
- **ApplyOffset**: Applies an offset to a waypoint, e.g. to correct the deposit position after an automatic grip.
- **SetProject**: Requests a project change based on the project ID.
- **SetTool**: Requests a tool change based on the tool ID.
- GetObjectCount: This function allows you to analyze the scene. The number of all objects and the number of instances of a specified object class are determined.
- GetState: This function queries the status of the SVC.
- GraspFeedback: Sends feedback to SVC regarding the performed gripping action.
- **Viewer**: Displays the camera image showing object detection and grasping planning for the last "GetGrasp" command.

Further Information on the functions ▶ 6 [🗋 14].

The "URCap" software module has been tested under the Polyscope version 5.11 of Universal Robots. SCHUNK recommends installation of the latest Polyscope version (at least Version 5.11) on the robot used.

To avoid compatibility problems, check the operating software of the UR control unit before using "URCap" and update it if necessary.

3 Connecting the product to the robot control system

Before connecting or commissioning the product, read the operating manual of the robot and observe the instructions in this manual!

⚠ WARNING

Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

⚠ CAUTION

Risk of injury from electric shock due to contact with live parts!

- Follow the operating manual for the robot.
- Before starting any work on the product: Switch off the energy supply and secure against re-connection.

NOTE

Safety-relevant signals (e.g. emergency stop) must be wired externally, e.g. via safety relays, thus completely disconnecting the product from the power supply.

- Perform a risk assessment for the entire robotic application based on legal requirements to evaluate all safety-related aspects of the application.

- SVC (industrial PC) is connected to the robot via a network cable.
- IP address of the SVC is known (factory settings 192.168.1.76)
- IP address of the robot is in the same subnet (example 192.168.1.100)
- For information on connecting the product, see the commissioning instructions.

4 Installing the software module

CAUTION	SCHUNK

Possible damage to product!

The product or the robot may get damaged if electrical cables are connected or disconnected during operation.

- Connect or disconnect electrical connections only when the device is switched off.

NOTE

To install the software, SCHUNK recommends using a USB stick.

Prepare the USB stick

The USB stick must meet the following requirements:

- Formatted in FAT32 format
- Designation of the removable drive: "SCHUNK_VISION"

Installing the software module

NOTE

To avoid malfunctions, SCHUNK recommends installing the current version of the software module.

1. Download the current version of the software module from **schunk.com/downloads-software** and copy it to the USB stick.
2. Connect the USB stick to the robot control system. The USB interface is located at the back.
3. Switch on the robot control system.
   ⇨ The robot control system is started.
4. Select the "System" button in the left menu.
   ⇨ A sub-menu opens.
5. Select the "URCaps" button.
6. Select the "+" button.
7. Select URCaps software module.
8. Select the "Open" button.
   ⇨ The software module is added and displayed in the Explorer window.
9. Select the "Restart" button to complete the installation.
   ⇨ The system restarts.
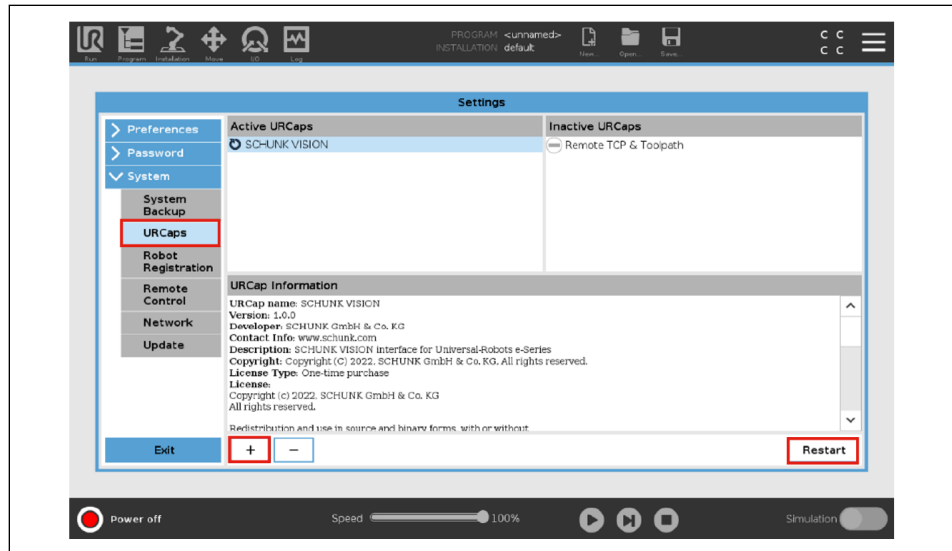
4.1 Uninstalling the software module

1. Switch on the robot control system.
   ⇨ The robot control system is started.
2. Open the menu at the top right and choose "Settings".
3. Select the "System" button in the left menu.
   ⇨ A sub-menu opens.
4. Select the "URCaps" button.
5. Select URCaps software module.
6. Select the "-" button.
7. Select the "Restart" button to complete the deinstallation.
   ⇨ The system restarts.

5 Configuring the software module

> ⚠️ **WARNING**
>
> **Risk of injury due to sudden movements!**
>
> Components could move unexpectedly and result in serious injuries.
>
> - During commissioning, observe all warnings displayed on the software interface.
> - Keep a safe distance and wear suitable protective equipment.

- ■ Robot and SVC are switched on and connected with a network cable.
- ■ Robot and SVC are in the same network.

1. Select the "Installation" button in the header line.
2. Select the "URCaps" button.
3. Select the "SCHUNK VISION" button.
   ⇨ The explorer window shows the configurable parameters.
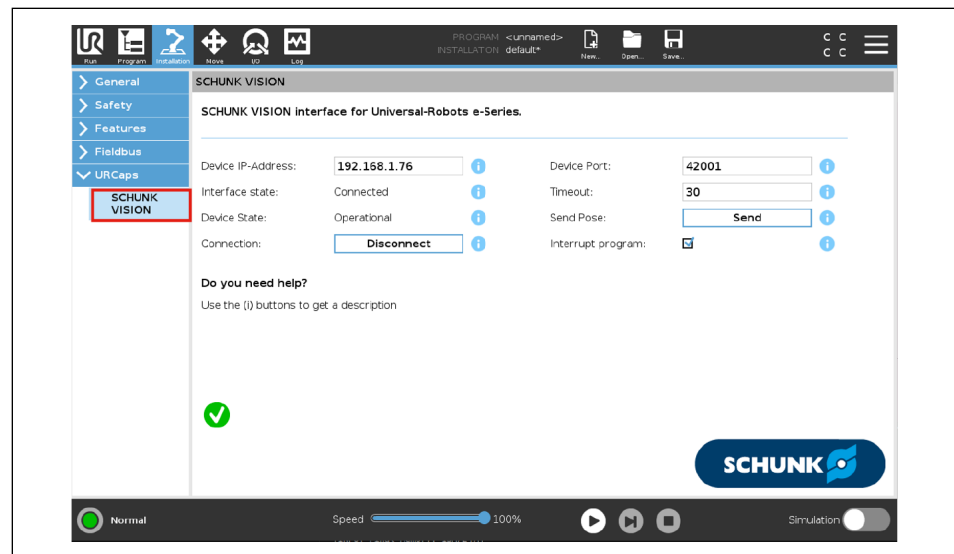
The following settings can be made in the menu item "SCHUNK VISION":

- Selection of the IP address SVC
  Factory setting: 192.168.1.76

- Selection of the port SVC
  Factory setting: 42001

- Connect: A connection is established to the SVC

- Disconnect: The connection to the SVC is disconnected

- Timeout: Exact limit for a timeout in seconds between the robot's request and the vision system's response.

- Sending the robot position: The current position (TCP) in the robot's base coordinate system is transmitted to the Vision system.
- Program interruption: By activating this option, the main program is interrupted as soon as a function of this URCap detects an error.

Connecting robot and SVC

1. Select IP address or use factory setting. This depends on the settings of the SVC.
2. Select the "Connect" button.
   - ⇨ Connection is established.

Possible messages

The following messages may appear in the installation area:

Message	Action
Info: A new version of the SCHUNK URCap is available.	• Update of the URCap. Download from the SVC user interface at *Robots > Plugins > Universal Robots*.
Info: Version check…	• No action required.
Warning: Device not connected! Please enter parameters and connect.	• Set IP address and port. • Select the "Connect" button in the installation window.
Error: Connection cannot be established!	• Check connection cable. • Check the network settings of the robot. • Check network settings on SVC *Settings > Network > Robot*.

Message	Action
Error: Device version incompatible! Please update the device.	• SVC Update. Request new version from SCHUNK. • OR: Downgrade the URCap. Download from the SVC user interface at *Robots > Plugins > Universal Robots*.
Error: Check network parameters and connection cable!	• Check connection cable. • Check the network settings of the robot. • Check network settings on SVC *Settings > Network > Robot*.

6 Creating robot program

After installing the "SCHUNK VISION" software module, the following functions can be inserted into a robot program.

Function	Description
▶ Vision [🗋 16]	Main window for selection of sample programs, program functions and script functions. Contains the documentation for all functions. When a function is selected, they are created in the program window.
▶ DoGrasp [🗋 17]	Sample program for the execution of a grasping routine. Comments mark the places where application-dependent commands are missing.
▶ GetGrasp [🗋 18]	Starts object detection and receives the grasping pose for an object. All necessary information is provided to handle a grasping task. The function is parameterized by specifying the gripping mode, selection criterion and object ID.
▶ SetOffsetWaypoint [🗋 19]	Adds an offset orthogonal to a waypoint. The offset is specified in millimeters.
▶ ApplyOffset [🗋 20]	Applies an offset to a waypoint, e.g. to correct the deposit position after an automatic grip.
▶ GraspFeedback [🗋 21]	Sends a feedback signal to the SVC in relation to the grasping action performed.
▶ SetProject [🗋 22]	Requests a project change based on the project ID.
▶ SetTool [🗋 23]	Requests a tool change based on the tool ID.
▶ GetObjectCount [🗋 24]	This function allows you to analyze the scene. The number of all objects and the number of instances of a specified object class are determined.
▶ GetState [🗋 25]	This function queries the status of the SVC.
▶ Viewer [🗋 26]	Displays the camera image showing object detection and grasping planning for the last "GetGrasp" command.

Add function to robot program

1. Select the "Program" button in the header line.
   ⇨ The robot program and a short description for creating the program are displayed in the Explorer window.
2. In the robot program, select the position where the function is to be inserted.
3. Press the "URCaps" button.
   ⇨ All available functions are displayed in the menu.
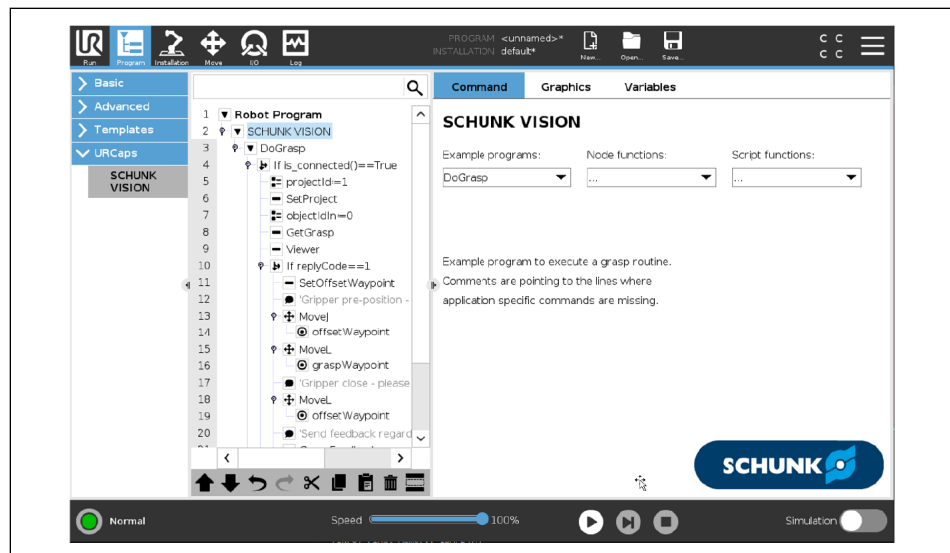4. For further information on the functions, see the following sections.

6.1 Vision

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.
  ⇨ "Command" tab is displayed in the Explorer window.

2. Select the desired function.
  ⇨ Documentation is displayed in the "Command" tab.
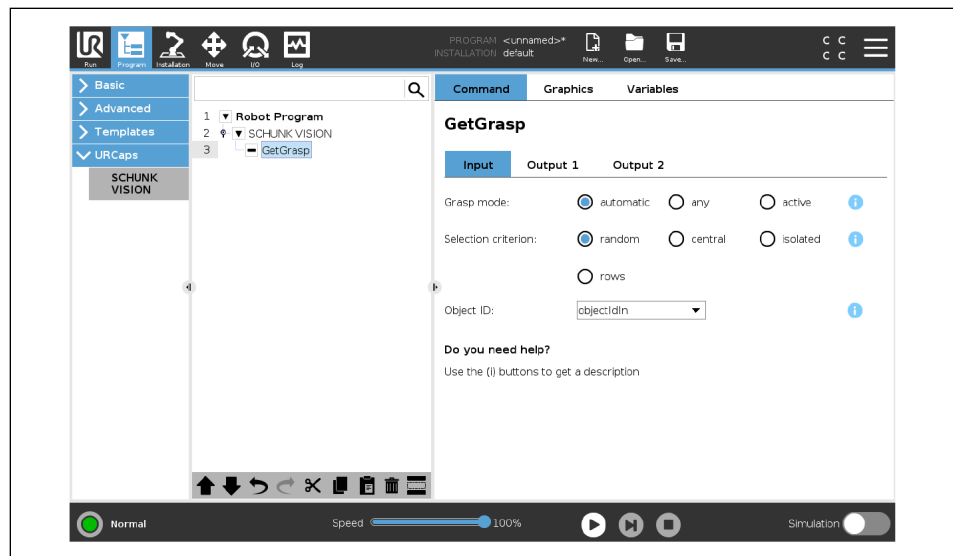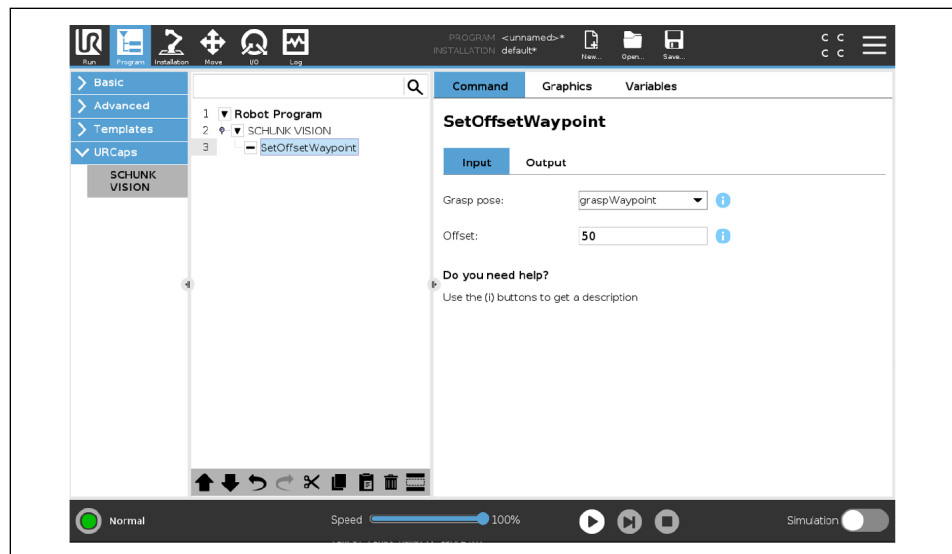 ⇨ The selected function has been added to the program code.
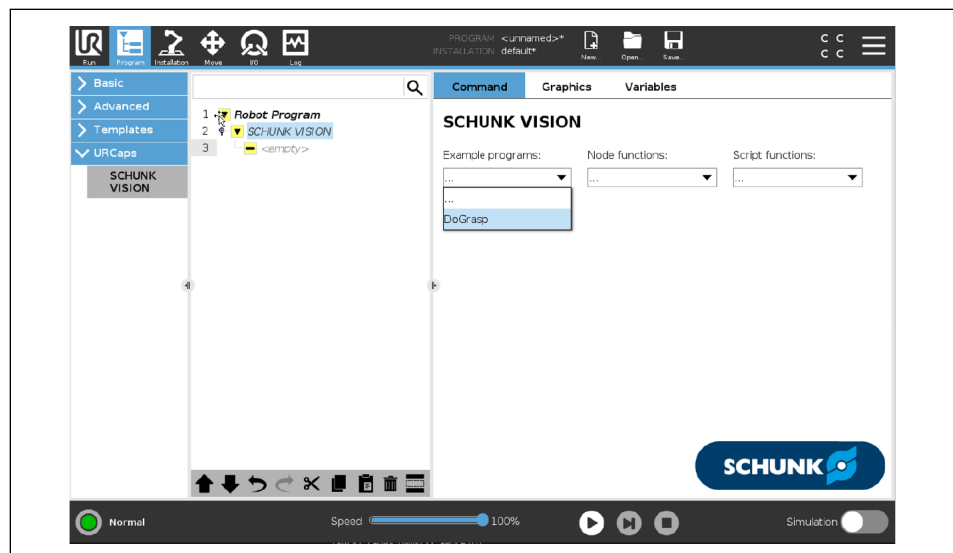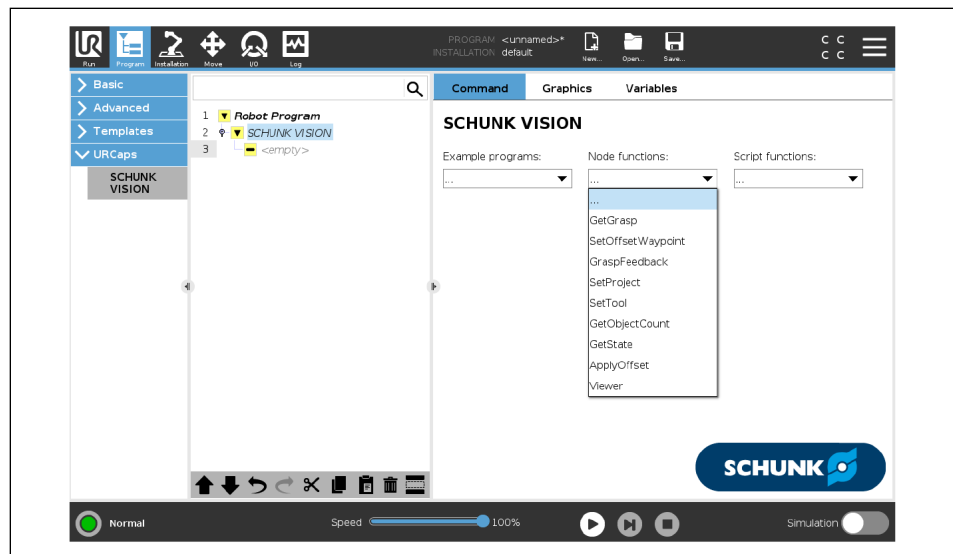
6.2 DoGrasp

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "DoGrasp" sample program.

⇨ The selected function has been added to the program code.

3. Set the ID of the project.

4. Set the ID of the tool.

5. Set the ID of the object (0 for any).

6. Replace comments with commands.

6.3 GetGrasp

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "GetGrasp" sample program.

⇨ The selected function has been added to the program code.

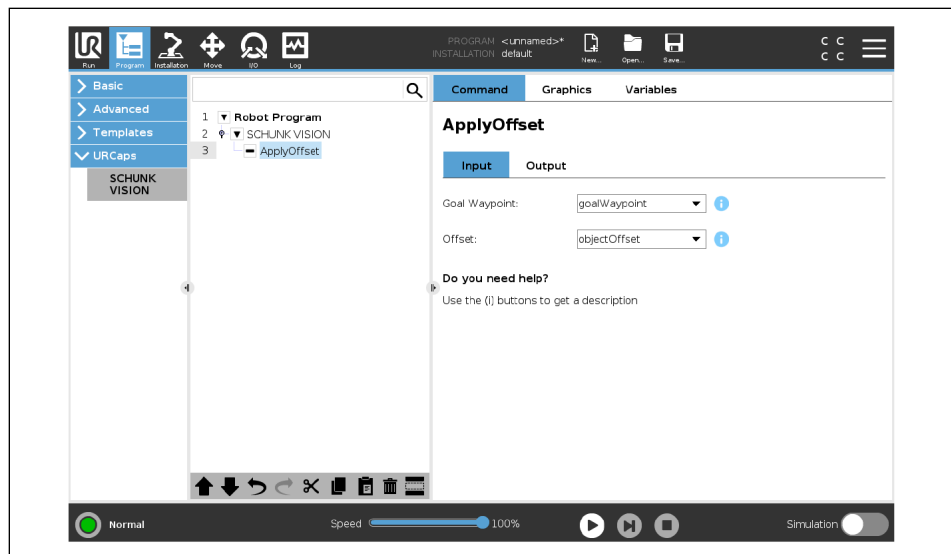**3.** Select the gripping mode, selection criterion and object ID.

6.4 SetOffsetWaypoint

- ■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.
   - ⇨ "Command" tab is displayed in the Explorer window.

2. Select the example program "SetOffsetWaypoint".
   - ⇨ The selected function has been added to the program code.
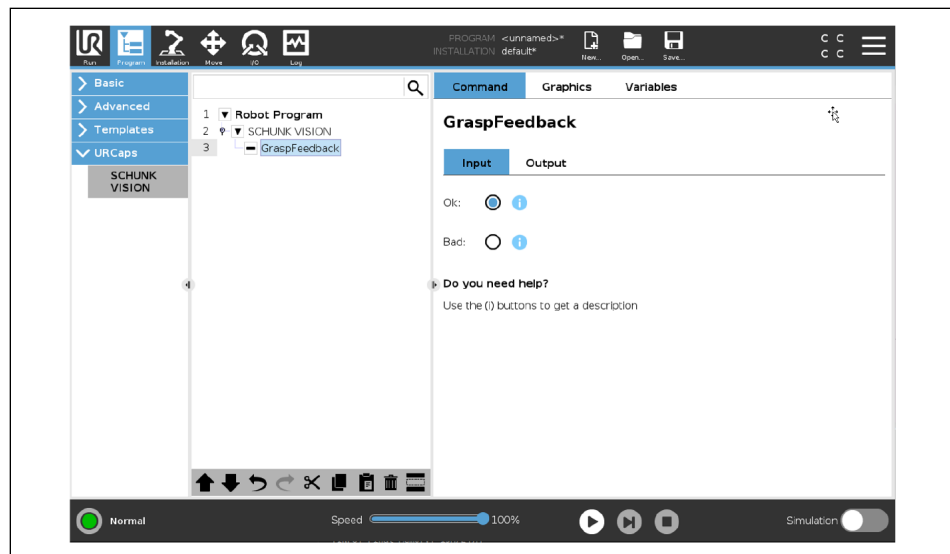
3. Enter offset in millimeters.

6.5 ApplyOffset

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "ApplyOffset" sample program.

⇨ The selected function has been added to the program code.

**3.** Define the robot's target pose and assign it to the variable for the target waypoint.

6.6 GraspFeedback

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select "GraspFeedback" sample program

⇨ The selected function has been added to the program code.

3. Depending on the quality of the gripping action performed, select "OK" or "Bad" as feedback.
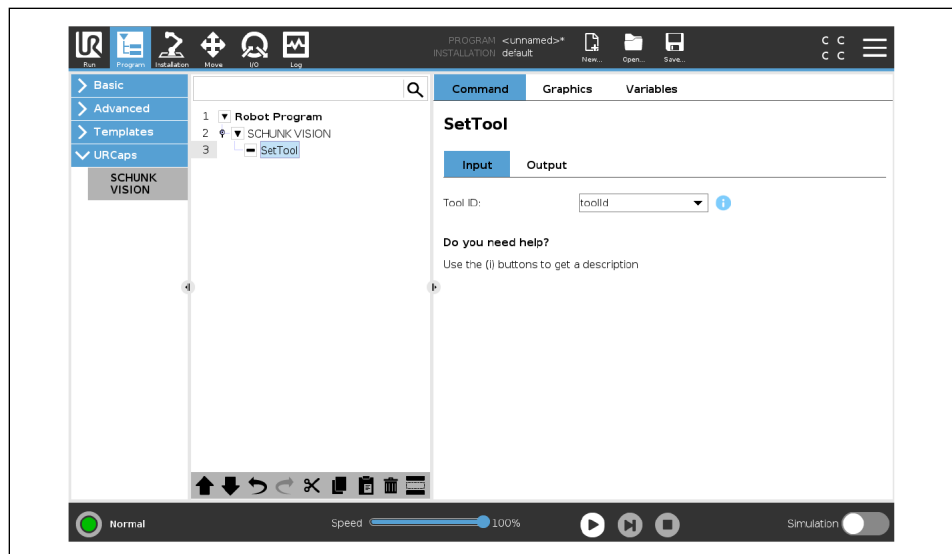
6.7 SetProject

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "SetProject" sample program.

⇨ The selected function has been added to the program code.

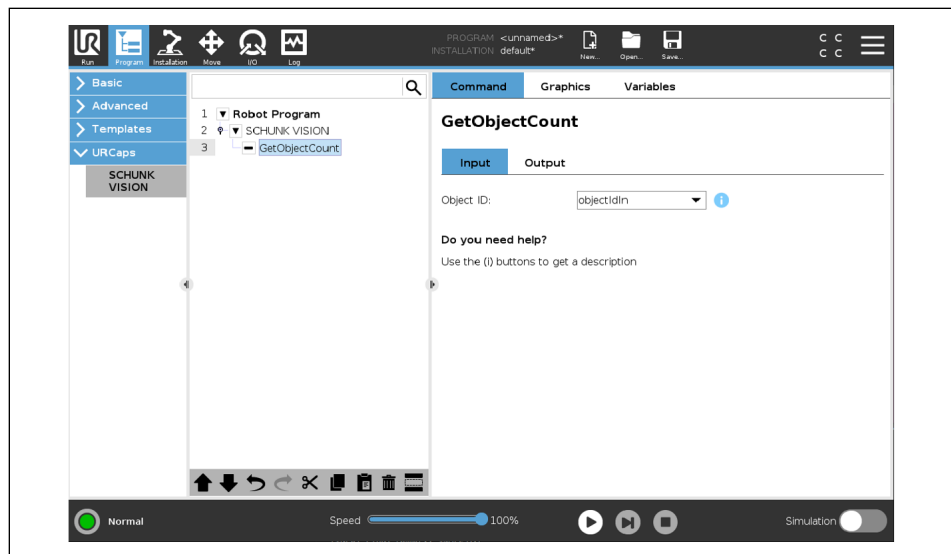**3.** Variable for the project ID with the ID of the project to be activated.
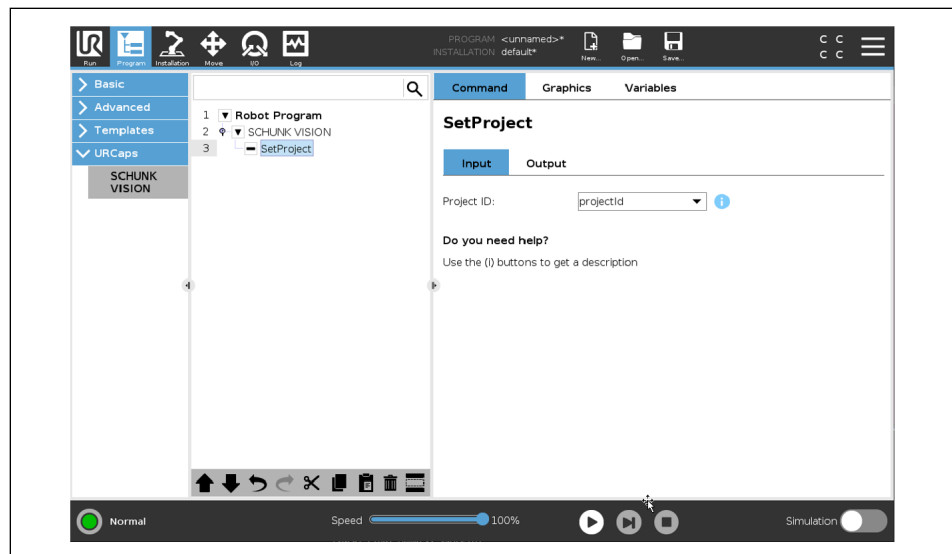
6.8 SetTool

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "SetTool" sample program.

⇨ The selected function has been added to the program code.

3. Variable for the tool ID with the ID of the project to be activated.
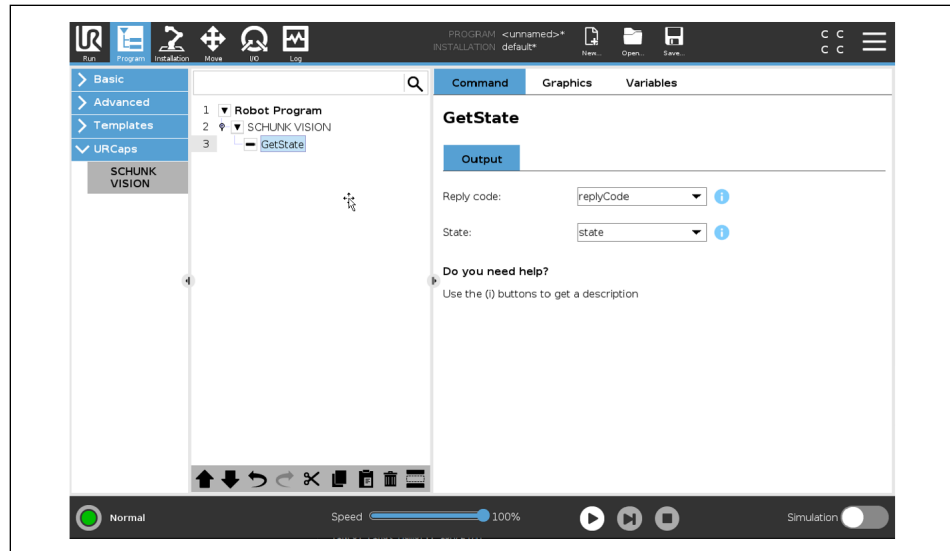
6.9 GetObjectCount

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "GetObjectCount" sample program.

⇨ The selected function has been added to the program code.

**3.** Write the variable for the object ID using the ID of the target object or select "0" for all objects.

6.10 GetState

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "GetState" sample program.

⇨ The selected function has been added to the program code.

6.11 Viewer

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK VISION" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the "Viewer" sample program.

⇨ The selected function has been added to the program code.
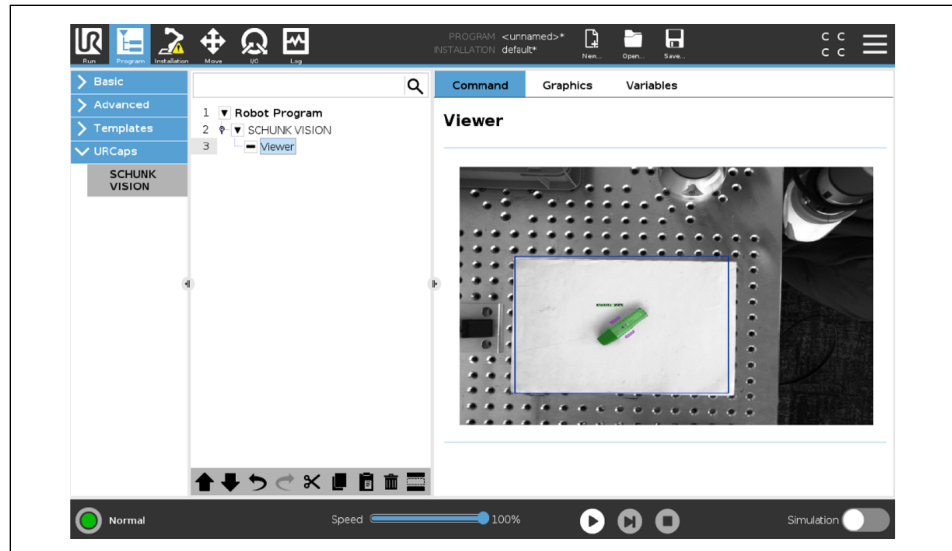
7 Script functions

Following the installation of the "SCHUNK VISION" software module, the following functions can be added to a robot program:

| Function	Description
connect	Creates a TCP/IP connection to the SVC. "Port" and "Address" parameters are obtained from the installation node. Return value "True" if a connection can be established, otherwise "False".
connect_ip	Creates a TCP/IP connection to the SVC. The "Port" and "Address" parameters must be transferred to the function. Return value "True" if a connection can be established, otherwise "False".
is_connected	Checks an existing TCP/IP connection to the SVC. Return value "True" if a connection exists, otherwise "False".
disconnect	Closes an existing TCP/IP connection to the SVC. Return value "True" if a connection can be closed, otherwise "False".
get_timeout_state	Status of the timeout. If the set exact limit (installation window) for time monitoring is exceeded, this function returns "True", otherwise "False". If the value is "True", all values from the previous function are invalid.
send_tool_pose	This function transfers the current tool position (TCP) in the base coordinate system to the Vision system. This function can be used, for sample, to transfer the tool position during robot calibration.

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Add function to robot program

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "Program" button in the header line.

2. Select the button "Advanced" > "Script" > Box "f(x)"

⇨ A sub-menu opens.

3. Select drop-down menu <Function> at the bottom left.

4. Select the desired function. For further information on the functions, see the previous table.

5. Select the "Submit" button.

⇨ The command is displayed in the robot program.

Add function with the "SCHUNK Vision" main window

■ In the robot program, the position where the function is to be inserted is marked.

1. Select the "URCaps" > "SCHUNK Vision" button.

⇨ "Command" tab is displayed in the Explorer window.

2. Select the desired function.

⇨ Documentation is displayed in the "Command" tab.

⇨ Function is created in the program window.
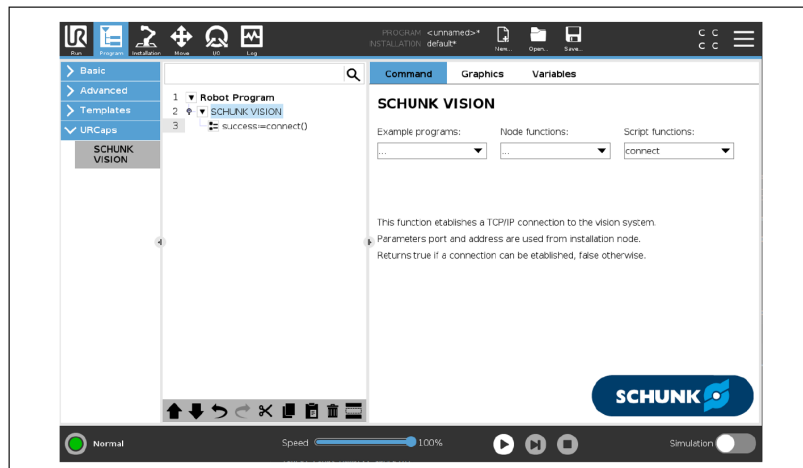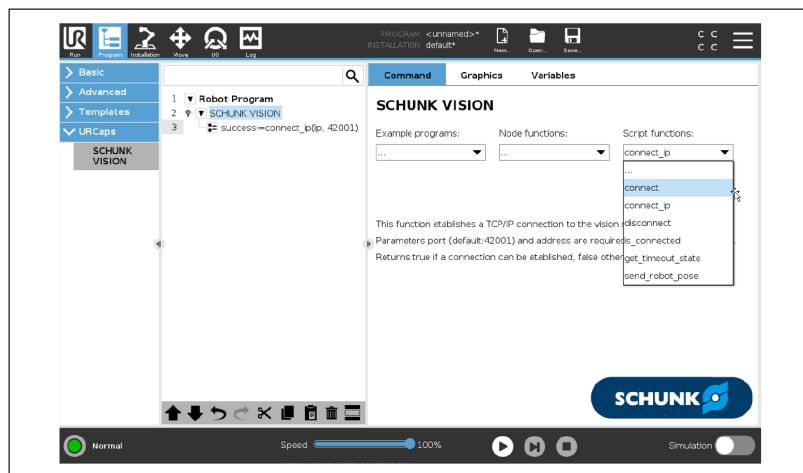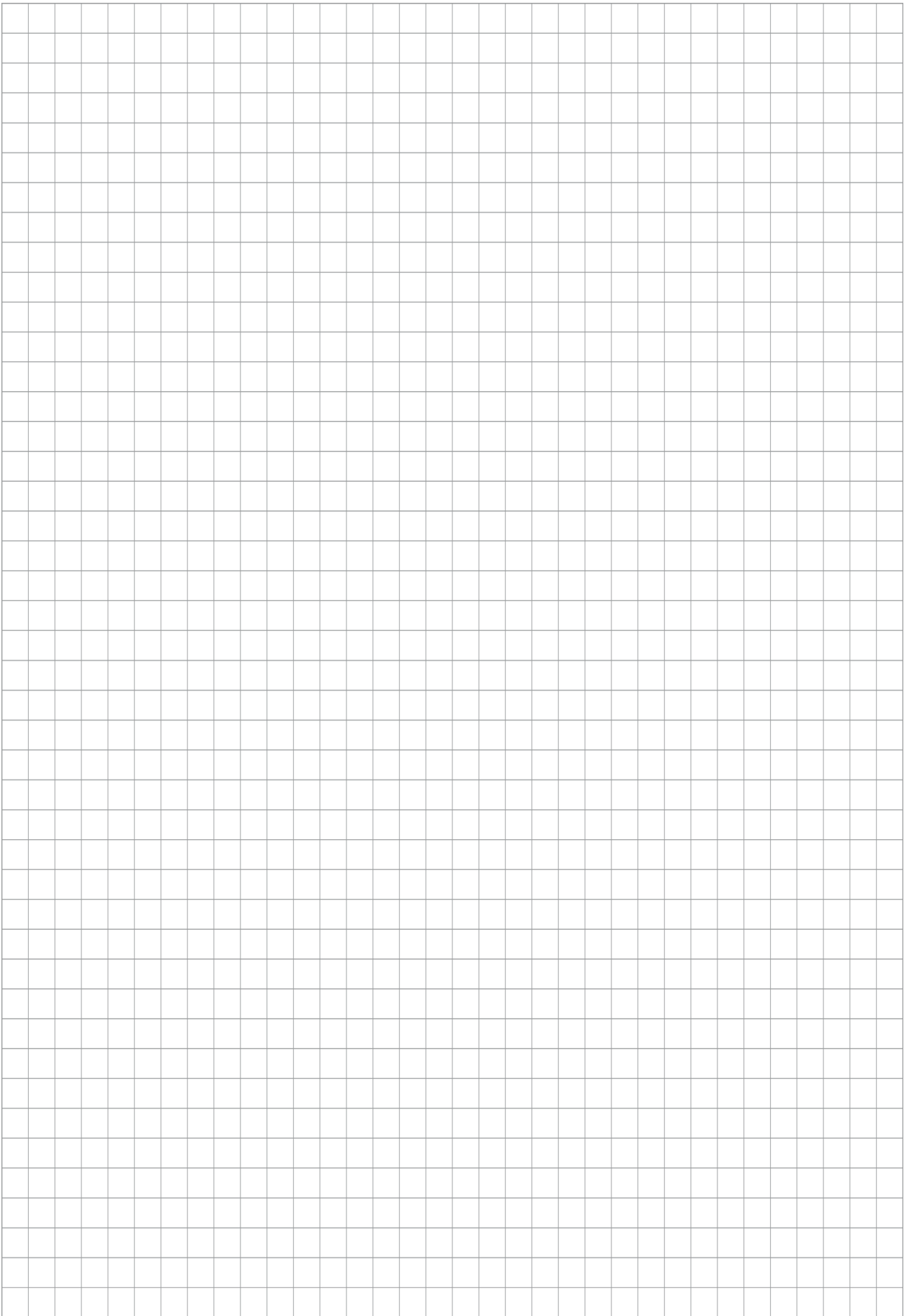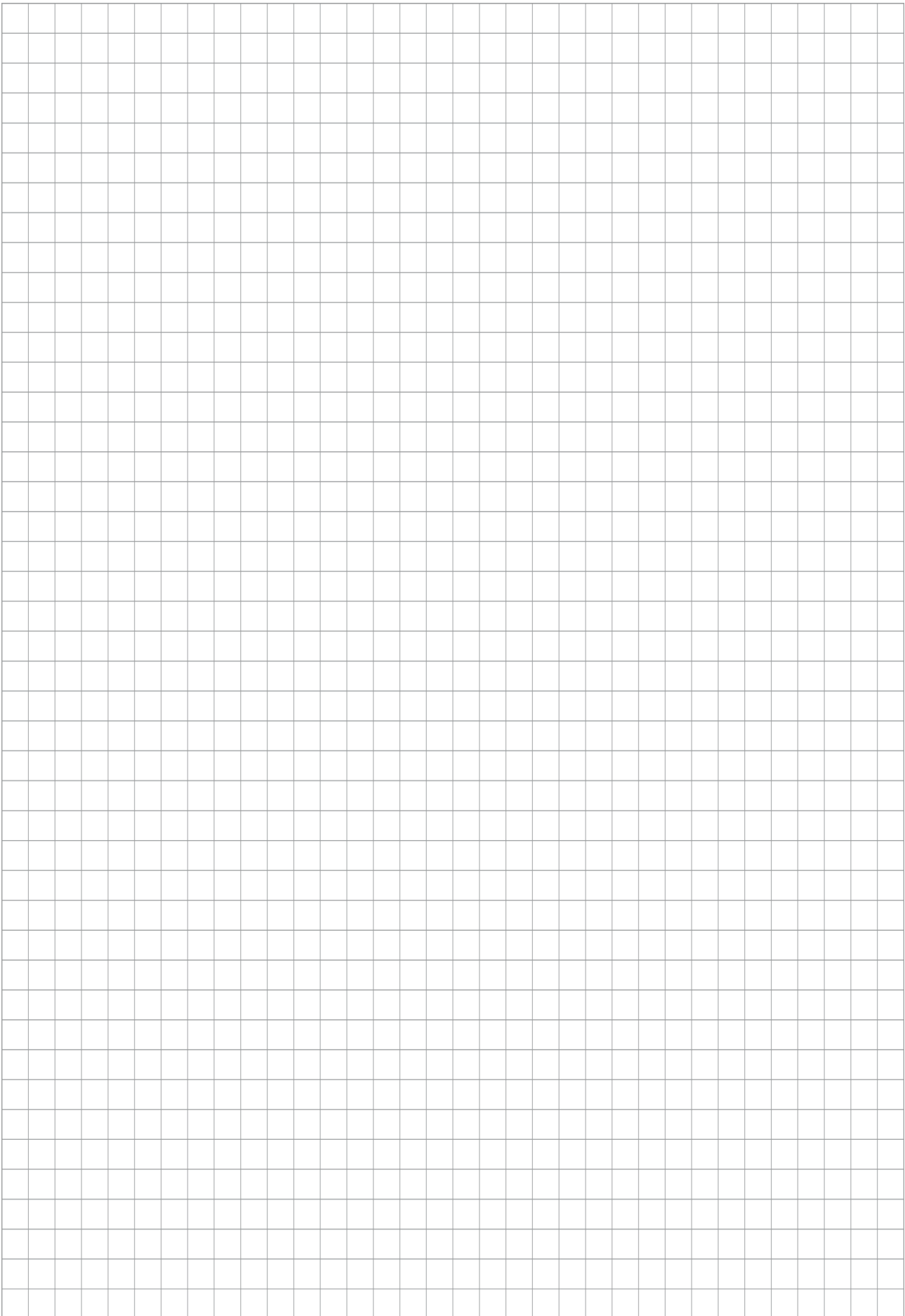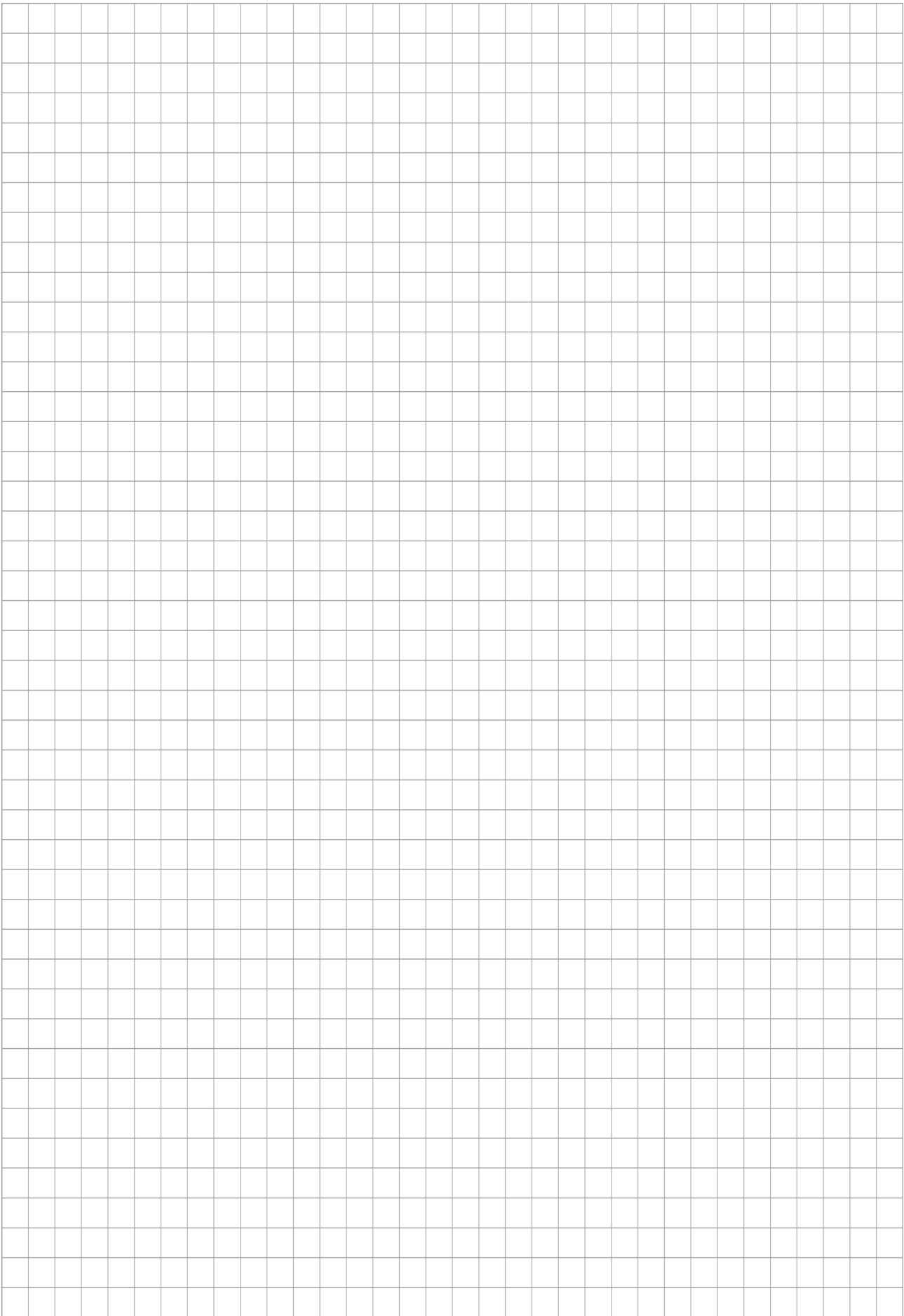
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