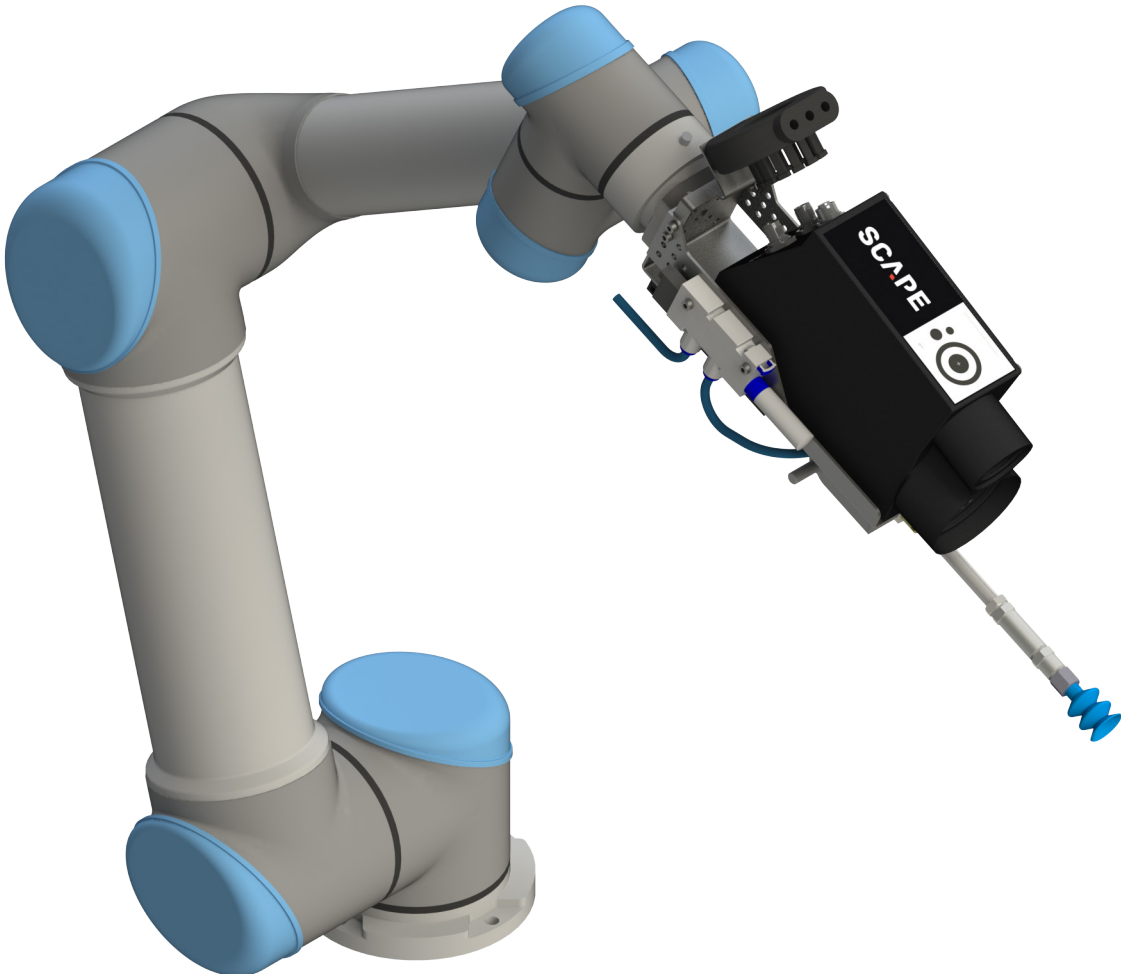


QUICK GUIDE

# SCAPE Easy-Picker



## 1 INTRODUCTION

The SCAPE Easy-Picker is the easy way to bin-picking. The package includes a complete "Tool Unit" and all the necessary software to perform bin-picking. The Tool Unit includes a suction cup gripper and a 3D sensor and is ready to be mounted directly on the robot!. PC and all necessary software to get started are included.

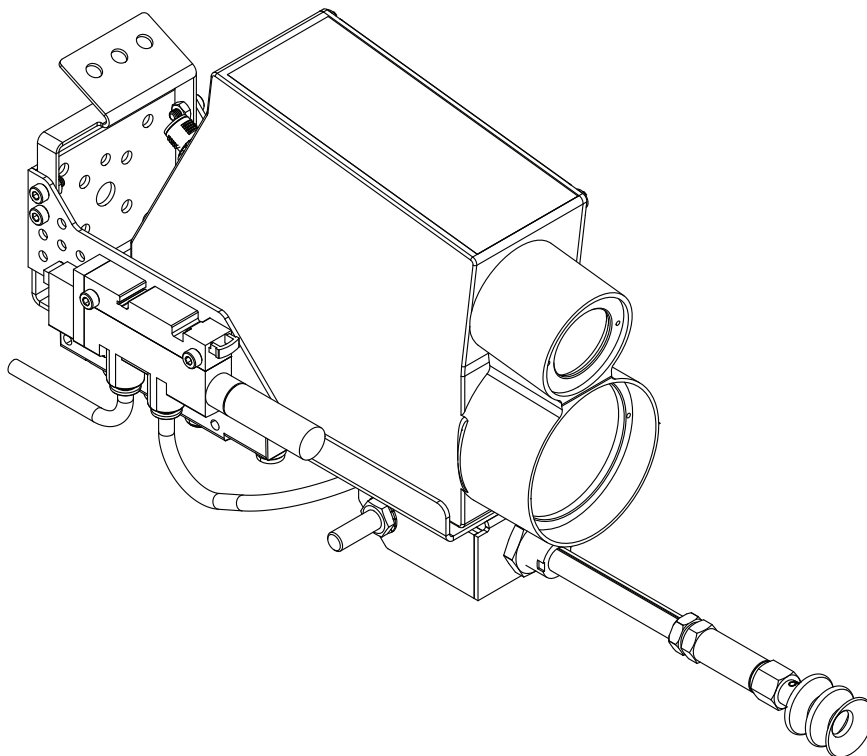
The SCAPE Easy-Picker can be upgraded with different product options. When upgrading to a Tool Unit with two grippers, it is called SCAPE Mini-Picker. All upgrades are included in this manual and it will be noted when we are talking about an upgrade.

This manual will guide you through the steps needed to get the system up and running. The manual is divided into the following main topics:

- Content of package
- Installation of hardware
- Installation and setting up SCAPE URCap
- Calibrating and Measuring the Workcell
- Running bin-picking and teaching place movements with included example parts
- Training of new parts
- Upgrades

Much of the documentation is done by video clips. It is recommended to read this document as a PDF on a PC with internet access. In this way it is possible to click directly on the links to the videos.

Note, the SCAPE Easy-Picker has various options, so the package differs depending on the chosen options. When upgrading to a Tool Unit with two grippers, it is called SCAPE Mini-Picker. Documentation of upgrades are included in this manual and will be noted at the relevant places throughout the document. Also, please refer to the section "Upgrades" for some of the additional options.



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## 2 PREREQUISITE

The following things are needed to get started:

- Robot: UR5, UR10 or UR16.
- 2 Inputs (Modbus used if upgraded to SCAPE Mini-Picker)
- 4 Outputs (Modbus used if upgraded to SCAPE Mini-Picker)
- Compressed air: Min. 3 bar, 25 liter/minute
- Connector between compressed air and Ø6 tube on SCAPE Easy-Picker.

A PC is included with the SCAPE Mini-Picker system. The following must be available:

- Monitor
- Keyboard
- Mouse

Recommended: Brackets to mount the included energy chain along the robot arm.

## 3 CONTENT OF THE SCAPE EASY-PICKER PACKAGE

The content of the package is shown below.

Below is a complete detailed overview of all included hardware and software.

### SOFTWARE

The following SCAPE software is installed on the SCAPE Controller PC but also included on the supplied USB stick:

- SW10-23 SCAPE Easy-Picker Software Suite™ (part of SCAPE Bin-Picking Suite (x64)...exe)
- OP11-03 SCAPE 3D Orientation Control™ (part of SCAPE Bin-Picking Suite (x64)...exe)
- OP13-08 SCAPE Grid Scanner Recognition™ - Compact (part of SCAPE Bin-Picking Suite (x64)...exe)
- OP17-01 SCAPE Automatic Self Test™ (part of SCAPE Bin-Picking Suite (x64)...exe)
- TC10-01 SCAPE Part Training Studio™ (part of SCAPE Bin-Picking Suite (x64)...exe)
- Drivers (in folder "Drivers")
- SCAPE Robot Program (in folder "SCAPE URCap")
- Example Product Files (in folder "Product")
- Splashtop (enables remote support)



## HARDWARE

### PC10-20 SCAPE Controller PC:

- Intel Core i5-10400 Six Core processor
- 16 GB DDR4 2666 MHz RAM
- 250 GB NVMe SSD Hard disk
- Gigabit LAN
- HDMI, DVI and VGA
- 3 USB 3.1 Gen. 1 ports and 5 USB 2.0 ports,
- Software protection dongle is included (needed to run the SCAPE software).

Note, the PC specifications may change without notice. The above specifications are the minimum regarding processing power, memory, and storage space.

### TU05-20 Tool Unit with SCAPE Grid Scanner and Suction Cup Gripper

- Grid Scanner – Compact
- Suction Cup mounted on a suspension unit including a vacuum sensor and a collision sensor.
- Ejector to create suction from compressed air.
- A valve to turn on/off the suction.
- Energy chain holder with energy chain (IGUS PMAFLEX PC, igus i-pclt-36b)
- Interface plate for mounting on the UR robot.
- I/O module (passive)
- TCP Pointer
- All needed cables.
- Suction Cups (round) included (2 of each):

Diameters [mm]							
Ø5	Ø 7	Ø 9	Ø12	Ø 14	Ø 17.5	Ø 20	Ø 25

### OP17-02 SCAPE AUTOMATIC SELF TEST

- CAST Station plate (comes in a separate package)

### Example parts

- 20 pieces of "Angle Tube" example parts. Pretrained product included for testing.

## 4 HARDWARE INSTALLATION

The video

Assembling (coming soon)

Demonstrates how to mount the hardware. In the following sections we will describe the assembly details that may be difficult to see from the video.

### 4.1 TOOL UNIT - INSTALLATION AND MOUNTING

The Tool Unit is supplied with an interface fitting the flange on the UR robot. The interface plate includes a precision pin which means the Tool Unit can only be mounted with one specific orientation.

An energy chain is mounted on the Tool Unit. It is an IGUS PMAFLEX PC chain, configuration "igus i-pclt-36b". Energy chain bracket to mount the chain along the robot arm are not included. The energy chain can be mounted with cable ties; however it is recommended to use some kind of brackets to minimize the wear and tear of the energy chain. When mounting the energy chain, make sure there is enough slag right before the point where it is mounted on the Tool Unit so the Tool Unit can be rotated 180 degrees without pulling the energy chain. Correct mounting can be seen in figure 1 and 2.

### 4.2 MOUNT THE CAST STATION

Mount the CAST Station plate (OP17-02) vertically near the robot in a place where the robot has a good work envelope in front of the plate. A simpler alternative is to have a well-defined position on the table (plate placed horizontally) where the plate is placed temporarily during calibration.

This can typically be under the bins. But do not leave the plate there, it will most likely get dirty and scratched. The drawback with this simple solution is that you cannot run automatic or semi-automatic self-test of the system.

### 4.3 CONNECTING THE CABLES

Cables and tubes to connect are:

- Ethernet cable for the SCAPE Grid Scanner (going to the SCAPE Controller PC).
- Cable for I/O module with an open end (flying leads). These leads must be connected to the robots I/O's.
- Power cable for the SCAPE Controller PC.
- Ethernet cable between the SCAPE Controller PC and the UR robot.
- Tube (Ø6 mm) for compressed air (min. 3 bar, 25 l/min)
- Ethernet cable for internet connection (optional, needed for remote support)



Fig. 1 - Energy Chain with 0 degrees rotation of the 6th axis.



Fig. 2 - Energy Chain with 180 degrees rotation of the 6th axis.

Connecting the flying leads at the end of the cable for the I/O module is done as follows:

Port on I/O block	Wire color	Function	UR I/O Terminal
1	White	Vacuum Sensor	CI2
3	Yellow	Collision Sensor	CI1
2	Green	Ring Light	CO1
4	Grey	Air Valve	CO2
5	Pink	Projector	CO0
+24VDC	Brown	Supply voltage (+)	Any of the 24V terminals in the "Configurable Inputs" blocks.
0VDC	Blue	Supply voltage (-)	Any of the 0V terminals in the "Configurable Inputs" blocks.

## 5 INSTALLING AND SETTING UP THE SCAPE ROBOT PROGRAM

The SCAPE robot program is provided as a “URCap” implementation. Files can be found on the USB key with the software in the folder “SCAPE URCap”.

The video

[Installing and setting up SCAPE URCap](#)

Contains complete instructions on how to:

- Install the program
- Initialize robot
- Configure and test I/O's



Scan the QR Code or click the image to see the video!

Link: [www.youtube.com/watch?v=fXHD4vBX5S8](http://www.youtube.com/watch?v=fXHD4vBX5S8)



## 6 SOFTWARE ON THE SCAPE CONTROLLER PC

The supplied SCAPE Controller PC is installed with the following software:

- Windows 10 (64 bit)
- SCAPE software and drivers
- Splashtop for remote access in case support is needed
- Quick Guide documentation (this document) and the videos

All applications and documentation are placed directly on the desktop.

### 6.1 SCAPE BIN-PICKING SUITE™

The installed SCAPE applications found on the desktop are:



**SCAPE**  
Bin-Picking Manager™



**SCAPE**  
Calibration Manager™



**SCAPE**  
Part Training Studio™



**SCAPE**  
Communication Server™

**SCAPE Calibration Manager™:** For configuring all the units in a Workcell, such as the robot, cameras, grippers, light sources, and sensors. This is already done when you open the application. It is also in this application that measuring the locations of units in the cell and calibrating sensors take place.

**SCAPE Bin-Picking Manager™:** Run-time unit during bin-picking. It controls the starting and stopping of bin-picking system and changing of products.

**SCAPE Part Training Studio™:** For training new parts based on a CAD files or by scanning the parts. It includes the recognition and gripping of the parts.

In addition, there is a service running in the background (started automatically):

**SCAPE Communication Server™:** For communication between SCAPE and the UR robot. Connection to the UR robot has already been configured.

If the applications need to be re-installed or updated, please refer to the documentation "SCAPE Software Installation & Maintenance Manual".

### 6.2 DRIVERS FOR SCAPE GRID SCANNER RECOGNITION™

Necessary drivers are installed:

- FlyCapture\_2.11.3.121\_x64.exe

For re-installing please refer to "SCAPE Software Installation & Maintenance Manual". They are available on the supplied USB stick.

## 7 CALIBRATING AND MEASURING THE WORK CELL

The video:

[Calibrating and measuring the Workcell](#)

Shows what needs to be calibrated and measured and guides you through the process.

Open the SCAPE Calibration Manager. It is already installed with a Workcell configuration containing all the items in the SCAPE Easy-Picker product.

Now follow the video guide.

Just to give a short overview, here are the topics:

- Measuring the TCP (also refer to the UR documentation section "Installation → TCP Configuration")
- Calibrating the Kinematics of the robot
- Measuring the bin (adding more bins is explained in the Appendix)
- Measuring the Handling Station (Upgrade option. Adding a Handling Station is explained in "11.1 3D Orientation Control")
- Defining Workspace (optional)
- Calibrating the Grid Scanner
- Measuring the Suction Cup

Although the suction cups are already measured in the delivered Workcell it is highly recommended to measure them again. They may not be in the exact same position.



Scan the QR Code or click the image to see the video!

Link: [www.youtube.com/watch?v=IM\\_D0xOcvLg](http://www.youtube.com/watch?v=IM_D0xOcvLg)

## 8 TEACHING ROBOT MOVEMENTS

A few fixed robot movements must be taught. They cover the movements between

The video

[Teaching Waypoints for fixed movements](#)

Shows which waypoints to teach and how to do it.

The points to be taught are:

- Waypoints for bin-picking movements and Handling Station movements (optional).
- Teach waypoints for place movements.



Scan the QR Code or click the image to see the video!

Link: [www.youtube.com/watch?v=bKQDsRAXioc](http://www.youtube.com/watch?v=bKQDsRAXioc)

## 9 RUNNING BIN-PICKING AND TEACHING PLACE MOVEMENTS

Close the SCAPE Calibration Manager and open the SCAPE Bin-Picking Manager. The program is set up to load the example product for the parts (named Angle-Tubes) included with SCAPE Easy-Picker. This example product is included just to make sure that you can check that the full system is working.

Caution: Ensure that the TCP pointer on the robot is dismantled before start-up!

The video

[Running bin-picking and teaching place movements](#)

Shows how to:

- Run the bin-picking.
- Teach waypoints for place movements (with and without Orientation Control)



**Scan the QR Code or click the image to see the video!**

Link: [www.youtube.com/watch?v=xqYcOrzhZdk](http://www.youtube.com/watch?v=xqYcOrzhZdk)

## 10 TRAINING A NEW PART FOR BIN-PICKING

Close the SCAPE Bin-Picking Manager and open the SCAPE Part Training Studio.

The video

[Training a new part for bin-picking](#)

Will guide you through how to teach a new part.



Scan the QR Code or click the image to see the video!

Link: [www.youtube.com/watch?v=hFhI5\\_gM2LA](http://www.youtube.com/watch?v=hFhI5_gM2LA)

## 11 UPGRADES

All upgrades must be ordered separately. They are not part of the standard SCAPE Easy-Picker product.

### 11.1 3D ORIENTATION CONTROL

The Easy-Picker and Mini-Picker can be upgraded with "3D Orientation Control" (OP11-03). With this option it is possible to guarantee a precision grip before final delivery which again can guarantee precision delivery.

Physically this option consists of a white plate called a "Handling Station". By default, it has the dimensions 400x800 mm. Can be different size per agreement.

The plate is typically be installed next to the bin. If SCAPE is not 100% sure about the recognition of the part on the table, SCAPE will not attempt to grip it but will instead "reject" it, this can be done in two ways:

1. System stops and waits for operator to remove the part.
2. Handling Station plate is tipped automatically (typically the part then slides back into the bin but it can also be into a "reject"-bin).

For the second solution (which is recommended), Scape can deliver the table with this functionality. Please contact Scape for more information.

### HOW TO ADD AND MEASURE HANDLING STATION IN SCAPE CALIBRATION MANAGER

1. Right click [Handling station] and select [Add Handling Station].

The Handling Station Properties dialog will be displayed.

2. Type name and description of the Handling Station.
3. [No Camera] is default in [Stationary Camera Used at this Handling Station].

### 11.2 UPGRADE TO SCAPE MINI-PICKER: TWO GRIPPERS

The Easy-Picker can be upgraded to a Tool Unit with two grippers. For that upgrade we call the product a SCAPE Mini-Picker.

In many bin-picking scenarios it is necessary to have two grippers. Reasons are:

- One part in a bin may require two different grippers depending on which side is facing upwards.
- Precision grip may require a finger gripper instead of a suction cup to achieve sub-millimeter precision.
- If more parts (from different bins) need to be picked in the same cycle.

When upgrading to a Mini-Picker system, i.e. two grippers, a Tool Unit controller is included. This controller takes care of handling the significant increased number of signals (both inputs and output) and valves. Mounting that directly on the Tool Unit would increase the size and weight too much.

The Tool Unit controller includes a Modbus bus system to handle the communication between the UR controller and the signals and valves in the Tool Unit controller.

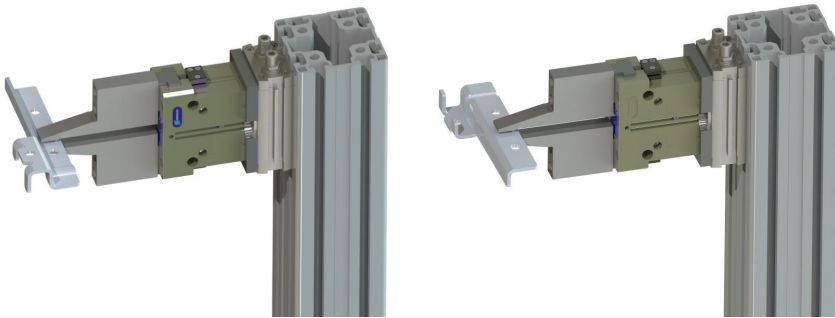
Installation documentation coming soon.

### 11.3 PART TURNER

The Mini-Picker can be upgraded with a "Part Turner" (PT10-01). Requires 3D Orientation Control.

When a part is placed on the Handling Station it is often in an orientation (support mode) which makes it impossible to grip and place the part into for instance a fixture or a machine. The only solution is to somehow turn the part and grip it from another side before final delivery.

This is the purpose of the Part Turner. The Part turner consists of a parallel gripper mounted on a rotary stage. To turn the part to robot delivers the part into the fingers of the Part Turner which then rotates the part 180 degrees and the robot regrips it from the opposite side. Example:



The pole is not included but can be ordered per request.

A passive I/O module (same as the ones on the Tool Unit) is included. Sensors for checking open/close fingers and end-rotation position of the turning unit are included.

Installation documentation coming soon.

### 11.4 CAMERA AND LAMPS FOR 3D ORIENTATION CONTROL (only available for SCAPE Mini-Picker)

The Mini-Picker (see section 12.3 for upgrading from Easy-Picker to Mini-Picker) can be upgraded with Stationary Camera and Lights (SL13-01) for the Orientation Control (see section 12.1). This will result in faster cycle times because the robot is no longer involved in the image acquisition using the Grid Scanner.

This option includes:

- Camera with lens and a blue filter
- Two LED lamps emitting blue light
- Ethernet cable (20 m) to connect the camera to the SCAPE Controller PC)

A tower for mounting the camera and lamps can be ordered per request but is not included per default.

Installation documentation coming soon.

## APPENDIX

### A HOW TO ADD AND MEASURE BINS

1. Right click [Bins] and select [Add Bin].

The [Bin properties] dialog with two tabs [General] and [Bin surfaces] will be displayed.

#### The [Bin properties] Tab [General].

2. Type in name and description in the fields [Name of the Bin] and [Description of the bin].
3. Select [Bin Type]:
  - Bin: Standard bin.
  - Pallet Box: Variable height box built from wooden frames around pallet.
  - Gripping Area Without Sides: No actual bin, but an area in which to pick objects.
4. Select [Inner Height of the Bin] depending on the [Bin Type] chosen:
  - Bin: Type in Inner Height of the Bin.
  - Pallet Box: Type in Number of Pallet Box Frames in use and height of each frame.
  - Gripping Area Without Sides: Type in Maximum Object Height.

#### The [Bin properties] - Tab [Bin surfaces]

11. The tab [Bin surfaces] dialog can be used to add extra details to the bin model if needed. Features such as rounded corners should be added to the model to avoid collisions.  
Click Save to save changes and exit the dialog.

## **B ACQUIRING A POINT CLOUD WITH THE GRID SCANNER**

The Grid Scanner may be used as an independent 3D data acquisition sensor. Thus, it includes a functionality that allows the user to acquire point clouds aside from the main bin-picking program.

The point clouds may be visualized in the SCAPE software and saved to disk in a format supported by the Point Cloud Library.

The widespread use of the PCL format allows the user to import the data collected with the SCAPE Grid Scanner in third party software or employ the data for custom made applications.

### **Individual Point Cloud Acquisition with SCAPE Calibration Manager**

SCAPE Calibration Manager allows to acquire, visualize, and save point clouds individually, one at a time.

It also provides the settings that the user needs to tune for a correct operation of the Grid Scanner, both for the individual as well as the automated point cloud Acquisition.

The point cloud acquisition functionality may be found under the menu options of the Grid Scanner. This section assumes that the Grid Scanner has already been calibrated. In the tree panel on the right side of the main SCAPE Calibration Manager window, right click on Grid Scanner and select "Acquire Point Cloud" (Fig 1).

The point cloud acquisition requires that the calibration robot program is running. If the calibration program is not running a small dialog will be shown asking the user to run the program.

In this case SCAPE requests to run the program to send a command to the robot to turn on the pattern projector embedded in the Grid Scanner.

As a general note, consider that several of the instructions in this section require the robot calibration program to be running and similar message boxes will be shown asking the user to run it.

Once the robot calibration program is run, the main menu for point cloud acquisition will be shown (Fig 3).

The main items to take into consideration in this menu are the following:

#### **[Camera Live View]**

Shows a live feedback from the Grid Scanner camera. As it may be appreciated the pattern is projected over the content of the bin.

#### **[Sensor Settings]**

Group-Box: contains the adjustment tools for the acquisition settings.

##### **[Shutter]**

adjusts the shutter speed, which regulates the exposition time of the camera to the incoming light. The shutter needs to be adjusted such that the content of the bin is visible while avoiding blooming in bright regions.

##### **[Sensor to Part Distance]**

Defines the distance at which the Grid Scanner expects the content of the bin to be. This setting needs not be accurate.

It is recommended that the parts lie somewhat within the center of the interval shown in "Range". Having parts outside the range will result in false interpretation of the distance, i.e. the point cloud will not be correct.

#### **[Save Path]**

Disk location to save the point clouds.

#### **[Point Cloud Name]**

Name to be given to the point cloud file name. The name is automatically updated to avoid overwriting existing point cloud files. However, if the user manually alters this name, overwriting an existing point cloud, this behaviour will be suspended.



## **[Acquire Point Cloud]**

Click this button to transform the image shown in the [Camera Live View] into a point cloud.

## **[Save Settings Button]**

Click the button to save the current settings (Shutter, Sensor to Part Distance and Save Path). Next time the dialog in Fig 3 is opened, the saved settings will be loaded.

Clicking on [Acquire Point Cloud] shows a new dialog containing the point cloud view (Fig 4).

This 3D view allows rotating, translation and zooming of the perspective. The point cloud may be saved in the previously defined location by clicking on [Save Point Cloud to Disk] or discarded if this dialog is simply closed.

The point cloud acquisition general procedure is as follows:

Jog the robot to the desired position and ensure that  
the projected pattern covers the scene.

Adjust the settings.

Save the settings if they were not saved before or they needed to be modified.

Click on [Acquire Point Cloud].

Click [Save Point Cloud to Disk] to save or [Close] to discard the point cloud.

Repeat from Step 1 if desired.

**Note:** *Settings are saved in the Workcell file*

## Support & Contact

Opening Hours: 08:00-15:00 CET/CEST  
Telephone: +45 65 25 66 00  
E-mail: [support@scapetechnologies.com](mailto:support@scapetechnologies.com)

### **Support Terms:**

Scape Technologies A/S normally only provide support during regular business hours.  
Scape Technologies A/S will provide support for initial configuration and setup of SCAPE Easy-Picker via Splashtop Remote Access.

## Scape Technologies A/S

Østerbro 5C  
5000 Odense  
Denmark  
CVR: 27 58 78 87  
Phone: +45 70 25 31 13  
[info@scapetechnologies.com](mailto:info@scapetechnologies.com)

# SCAPE

THE BIN-PICKING COMPANY