SMART ROBOTICS
Masters in Flexible Automation

SMART PALLETIZER
SMART, SAFE & SIMPLE THROUGH SOFTWARE

Total waiting time: 12.4 hour
Number of picked products: 11846
Total pallets: 46
Errors: 5
Availability: 99.7%

www.smart-robotics.nl
CONTENT

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Smart, Safe &amp; Simple</td>
<td>5</td>
</tr>
<tr>
<td>Smart Software</td>
<td>6-10</td>
</tr>
<tr>
<td>Service</td>
<td>11-13</td>
</tr>
<tr>
<td>Smart Palletizer</td>
<td>14-16</td>
</tr>
<tr>
<td>Technical specifications</td>
<td>17-18</td>
</tr>
</tbody>
</table>

SMART ROBOTICS
MASTERS IN FLEXIBLE AUTOMATION
SMART ROBOTICS

INTRODUCTION

Smart Robotics aims to develop smart, flexible, safe and user-friendly robot solutions to help customers automate in an innovative way.

CORE BUSINESS: SMART SOFTWARE
Intelligent software for fast and flexible cobot deployment is our core business. Our software platform is the most sophisticated cobot operating system on the market and brings valuable benefits to our customers. We take pride in solving mechanical challenges through software.

We develop software that enables you to operate the cobots just as easily as your smartphone or tablet. With our smart software, cobots do not require any application dependent programming or teach-in.

Additionally, through frequent software updates uploaded to our solutions in the field, we do not only keep them up-to-date, but also let them benefit from the latest features developed by our software engineers.

THE SMART PALLETIZER
Through Smart Software we can help lift your production process to the next level with our Smart Palletizer, a compact end-of-line solution for the ultra-flexible palletization of products. With our 3D-printed grippers the Smart Palletizer can handle many types of boxes, both open and closed. Working together with your employees, the Smart Palletizer requires minimum space and is accessible from all sides. It is Smart, Safe & Simple.
SMART, SAFE & SIMPLE
THROUGH SOFTWARE

SMART
Thanks to our Smart Software, our robots can easily adjust themselves to a new assignment, changes in the environment or product variations. They are quickly up-and-running with a new installation or product change.

The Application Decision Engine enables the robot to start or continue its operation from any state, without the need for time-consuming recovery procedures.

SAFE
Cobots are inherently safe. The special force sensors in all joints are used to restrict the forces at impact. As cobots work among people, it is inevitable that they will come into contact with people.

This is laid down in the safety standard ISO/TS 15066:
“If contact between robots and humans is allowed, and incidental contact does occur, then that contact shall not result in injury. Reduce risk by limiting mechanical impact force to human body parts by moving parts of robot, end-effector or work piece”.

Cobot safety is at the forefront of all our developments. They comply with the appropriate regulations specifically developed and implemented for cobots in ISO norms and CE, including the European Machine Directive 2006/42/EC. The UR10 is also TÜV certified for safe deployment.

In addition, Heico Sandee, Managing Director at Smart Robotics, chairs the Dutch norm commission (NEN) on robotics which is part of ISO TC 299 Robotics.

Our software automatically sets the safety settings based on the box weight.

SIMPLE
Because of their user-friendly interface and their self-correcting abilities, Smart Robotics’ robots are easy to use, even by non-technically educated employees. Our robots are independent and reliable. They can adjust themselves to changes in the environment or production process, needing only minimal instructions of an employee. Anyone can work with our solutions.

Just enter box size, box weight and choose the stacking pattern when adding a new product.
Our software is what makes the Smart Palletizer a Smart, Safe & Simple solution. The software generates 3D virtual box positions based on the stacking pattern. We call this a world model.

To be able to handle a large variety of box formats and stacking patterns for both the Vacuum and Fork Gripper, an advanced planning and sorting algorithm has been developed. For each box in a pattern layer, this algorithm computes all possible ways to pick and place a box. We call this a box transfer strategy. In addition, the robot computes the order in which the boxes are placed on the pallet.

Subsequently, the transfer strategies for each box are evaluated until a strategy is selected that meets the following requirements:

• Collision check: the pick and place approach motion does not collide with components such as the Smart Palletizer frame, the SFU, previously placed boxes or the other pallet.
• Reachability check: The pick and place positions are within reach.
• The motion planner is able to compute a collision-free trajectory from pick- to place position.

Once a box transfer strategy is selected, the robot can go to work. All actions of the Smart Palletizer are coordinated by the Application Decision Engine (ADE). Based on the internal state and external sensor inputs, the ADE decides when to move the robot, when to use the actuator to move the robot up and down, when to switch the gripper on and off and when to ask the SFU for the next box.

The ADE allows for more flexibility than traditional scripting or state machine approaches. The ADE enables the robot to start or continue its operation from any state, without the need for time-consuming recovery procedures.

Together, these software modules enable the Smart Palletizer to work without being told how to. This is what our R&D team works on daily: improving the algorithms that power our Smart Software to gain even smoother and faster movements for our solutions.
SMART SOFTWARE
HOW DOES IT WORK?

REACHABILITY CHECK

MOTION PLANNING
WHAT DOES OUR SOFTWARE DO FOR YOU?
For palletizing in general, whether you palletize by hand or automatically, you need to know three things:

- The box size (length x width x height)
- The box weight
- The stacking pattern

The stacking pattern shows the number of boxes in a layer, the configuration of those boxes in the layer, the number of layers, the arrangement of these layers and whether or not slip sheets are needed in between layers.

Typically, this is already decided by your logistical department and available to you in either a central system, graphically or in text.

If you have used a palletizer before, you probably needed to program the palletizer for every exact motion of the palletizer, per product, per layer and per specific box.

FROM TODAY ON, YOU DON’T!
Our Smart Palletizer only needs the same instructions as you would provide to your human co-worker to start palletizing. That is what our software does for you!
SMART SOFTWARE
DATA LOGGING

STATISTICS
Our data logging produces statistics that teach us how the Smart Palletizers are performing. This includes performance visualization on a day-to-day, weekly or monthly timeframe, for one or multiple Smart Palletizers for us and our customers.

ENHANCEMENT
With this data we enhance our hardware and software, pinpoint development needs and share experiences with our after sales team. We are not only product leaders with Smart products, but also with Smart Service.
SMART SOFTWARE

BENEFITS

CORE BUSINESS
Developing Smart Software is the core business of Smart Robotics. It allows for fast, flexible and safe use of our cobots. Instead of solving challenges with mechanical adjustments, which is common, we adjust the software. This brings valuable benefits to our customers:

<table>
<thead>
<tr>
<th>TASK</th>
<th>TIME NEEDED</th>
<th>SMART SOFTWARE</th>
<th>CUSTOMER BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery time</td>
<td>Short</td>
<td>No need for custom programming. Robot movements are automatically generated based on customer product list.</td>
<td>Quick realization of benefits, no project work involved.</td>
</tr>
<tr>
<td>Installation time</td>
<td>Short</td>
<td>Just connect the cobot to external (power) sources and place the cobot in line with production.</td>
<td>Quick realization of benefits. No need for long production stop.</td>
</tr>
<tr>
<td>Changing box dimensions</td>
<td>On the spot</td>
<td>Simple dimension input.</td>
<td>Independence from supplier or trained technician.</td>
</tr>
<tr>
<td>Changing stacking patterns</td>
<td>On the spot and/or through connected systems</td>
<td>Simple input in UI or fully automated with connected external logistical software (PalOPTI, Multipack or others).</td>
<td>Independence from supplier or specialized programmer.</td>
</tr>
<tr>
<td>Service</td>
<td>Online</td>
<td>Online service and online software updates. Replacement of parts is easy.</td>
<td>Direct help, avoid travel time or availability issues of service personnel.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Predictable</td>
<td>Through data collection the maintenance is based on real-time use.</td>
<td>Higher equipment availability and lower costs of ownership.</td>
</tr>
</tbody>
</table>
HELPING OUR CUSTOMERS

For our cobots we have developed unique logging capabilities which enables us to provide online service and to remotely warn for or solve errors.

Besides the online data logging, video footage from the integrated camera (optional) helps our team to be the best in class. Once an error occurs, the system can review what happened 30 seconds prior to the error. In addition, the camera has recorded a 30-second video prior to the error. This information allows us to see what happened in the moments before the error occurred.

By replaying the Smart Palletizer movements in a 3D simulation, we can trace its movements step-by-step and identify any errors that occurred.

We can monitor all Smart Palletizers 24/7, which allows us to optimize the OEE for our customers. This way, we can make sure that our Smart Palletizers around the world perform problem free, night and day.
SMART SERVICE
SOFTWARE UPDATES

Our software updates are uploaded to your Smart Palletizer(s) as soon as they are available and relevant for your system. We strive for all Smart Palletizers to be on the same software releases to enable a high-end service.

Your Smart Palletizer(s) receive their update after notification and your permission; we will not update your system during production and without your consent. Nevertheless, the updates will be uploaded and tested remotely without the need for an operator to be present at the Smart Palletizer.
SERVICE

AFTER SALES SERVICE
We feel confident that any problem with the Smart Palletizer can be either solved remotely through our online service or by the hardware replacement service. Small wear parts can be replaced by your employees with help of our manuals.

ONLINE HELPDESK
With the Remote Service subscription, you have access to our helpdesk where you will find a competent team member who can remotely help you to solve any issues with your Smart Palletizer. With the mandatory internet connection, we back-up your software before and after we make changes during the online help.

SOFTWARE UPDATE
With the Software Update subscription, we update the software of your Smart Palletizer as soon as we develop new releases. For this, we require an internet connection, which will log in to our system via a secured VPN connection. You will receive a request for the moment of update.

HARDWARE REPLACEMENT SERVICE
We deliver the Smart Palletizer and the hardware peripherals with a comprehensive spare part catalogue that states the manufacturer, the manufacturer’s type number and any other information that you may require when ordering spare parts directly from the manufacturer. You save time and money for hardware components that are easy to replace by your employees.

In the unlikely event that the cobot fails due to a hardware failure that cannot be resolved, even with help from our online helpdesk, we will replace the complete unit (Smart Palletizer) with an exchange module. You can easily install this unit yourself. Once the replacement unit is installed, you return your defect unit to us for repair. Once repaired, we ship the unit back to you. Finally, we have the exchange module collected at your address. A Hardware Replacement subscription is mandatory for this service.
SMART PALLETIZER
SMART, SAFE & SIMPLE

PALLETIZING
With our Smart Software we have developed the Smart Palletizer to help your organization with the ultra-flexible palletization of products.

The Smart Palletizer allows you to palletize on a small footprint. It fits on 3m², including pallets. In combination with our Smart Formation Unit you are still well under 9m². Not only a small footprint, but also easily accessible.

The Smart Palletizer cooperates with people and is generally used at the end of a production line. It is a valuable addition to your workforce. It is Smart, Safe & Simple.

QUICK START
Talk to us about your needs. Send us a copy of your product list and we will run a quick scan with our simulation software and recommend a configuration. From thereon, it is simply a question of ordering the Smart Palletizer and installing it in your factory.

Please find the technical specifications at the end of this brochure.
SMART PALLETTIZER
GRIPPERS

3D PRINTED
Our specialized lightweight grippers are 3D printed in polyamide (nylon) material which is strong and durable. After printing, the grippers are spray coated to smoothen the surface.

3D printing allows for rounded edges - following the safety rules for cobots - as well as integrated pneumatic channels and components to minimize cables. A standardized quick-change system makes changing grippers an easy task that only takes seconds.

VACUUM GRIPPER
For boxes, cases and products that can be picked from the top we use the Vacuum Gripper. The gripper has double vacuum chambers to pick single or multiple products. Also, the gripper has integrated venturi vacuum generators.

FORK GRIPPER
For trays, open boxes and boxes with a lid that cannot be picked from the top with a Vacuum Gripper, but have to be carried, we have developed the Fork Gripper.

Retractable forks and a vacuum pad on the side carry the box. The venturi vacuum generator is integrated in the Fork Gripper as well.
SMART PALLETIZER
SMART FORMATION UNIT

PRODUCT INFORMATION
The Smart Formation Unit (SFU) is an integrated motor roller-based system that allows for the accumulation, buffering and precise formation of boxes to aid the automation process in collaboration with the Smart Palletizer. The SFU is beneficial for packaging applications that require flexibility in terms of the number and size of boxes to be picked and placed. Due to the smart alignment, no mechanical changes are required when handling different package dimensions. The SFU is configured to align these box formations at the pick-up location and has a standard buffering section for improved control and time management.

GENERAL USE
The SFU is generally used as the pre-formation station for the Smart Palletizer. Based on the configuration, a number of boxes can be buffered in order to enable and maintain autonomous production without the intervention of an operator.

The precise pick-up location allows for a seamless integration with existing production facilities and prevents anomalies in pick-up formations, which improves operation speed.

The SFU is compatible with the Vacuum Gripper and Fork Gripper. When using the Fork Gripper, the SFU allows for 4-sided picking, therewith catering for a larger number of stacking patterns. It is available in a right- and left-handed side configuration and by default equipped with one buffer segment. The number of buffer segments can be increased if required.

Please note that the cycle time performance of the Smart Palletizer can be doubled by using a multiple-pick strategy. To execute this function, a SFU is recommended.

Other buffering and infeed possibilities can be discussed in cooperation with our team.
# TECHNICAL SPECIFICATIONS

## SMART PALLETIZER (SP2 SERIES)

### GENERAL SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Frame</td>
<td>Stainless steel frame with 2 pallet seats and automatic sliding mounting pillar for raising and lowering the robot position during pallet loading. Integrated stainless steel control cabinet with two push buttons for registration of empty pallets. Separate pneumatic box with air filtering unit and optional pneumatic valves.</td>
</tr>
<tr>
<td>Controls</td>
<td>UR Controller and Smart Robotics Processor (PC) in the stainless steel frame, including 5m power cable for external power connection. Detached light pillar with a 2-color lamp (green and red) and mounted stainless steel touchscreen (rated IP54).</td>
</tr>
<tr>
<td>Software</td>
<td>Smart Robotics robot AI-software for easy (re)configuration of the cobot.</td>
</tr>
</tbody>
</table>

### CAPABILITIES

<table>
<thead>
<tr>
<th>Payload</th>
<th>The maximum payload for the UR10 cobot is 10kg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting weight</td>
<td>Depending on the gripper design, the maximum lifting weight is 8kg per pick.</td>
</tr>
<tr>
<td>Pallets</td>
<td>1200 x 800mm, 1200 x 1000mm (compatible with Vacuum and Fork Gripper) 1165 x 1165 mm (compatible with Vacuum Gripper)</td>
</tr>
<tr>
<td>Stack height</td>
<td>Pallet height up to approximately 2100mm, depending on the stacking pattern and box size.</td>
</tr>
<tr>
<td>Cycle time</td>
<td>Vacuum Gripper: approximately 8-9 seconds to pick and place a box. This is 7 boxes/min or 14 for double picks. Fork Gripper: approximately 9-10 seconds or 6 boxes/min.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>The repeatability of the UR10 cobot is ±0.1 mm.</td>
</tr>
<tr>
<td>Safety</td>
<td>15 advanced safety features tested according to EN ISO 13849: 2008 PL d and EN ISO 10218-1: 2011, Clause 5.4.3.</td>
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</tbody>
</table>

### ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>100-240 VAC 50-60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>System operation</td>
<td>24 and 48 VDC</td>
</tr>
<tr>
<td>Operation power</td>
<td>app. 400W for a standard program</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>0-40°C (non-condensing)</td>
</tr>
<tr>
<td>Classification</td>
<td>IP54 with the stainless steel touchscreen</td>
</tr>
</tbody>
</table>
## TECHNICAL SPECIFICATIONS

### SMART FORMATION UNIT (SFU600 SERIES)

<table>
<thead>
<tr>
<th>GENERAL SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
</tr>
<tr>
<td>IP Classification</td>
</tr>
<tr>
<td>Frame material</td>
</tr>
<tr>
<td>Minimum closed box size</td>
</tr>
<tr>
<td>Minimum open box size</td>
</tr>
<tr>
<td>Maximum box size</td>
</tr>
<tr>
<td>Execution</td>
</tr>
<tr>
<td>Accessories</td>
</tr>
</tbody>
</table>

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<thead>
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</tr>
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<td>Input voltage</td>
</tr>
<tr>
<td>System Operation</td>
</tr>
<tr>
<td>Operation Power</td>
</tr>
<tr>
<td>Synchronization</td>
</tr>
</tbody>
</table>