Collaborative Applications
Masters of Robotics, Motion and Control
## Content

Introduction .................................................................................. 4

What a Collaborative Workstation is and how it differs from a Collaborative Robot ............... 5

Possible Modes of Collaboration ............................... 6

Benefits of Force-limited Robots ............................... 7

Forms of Collaboration ......................................................... 8

Functions:

- PFL Function ................................................................. 10
- Robot Avoidance Motion Function ........................................ 10
- Lead Through Function ......................................................... 11
- FSU Functions – Functions also valid for HC10 ................. 11

Accessories:

- Smart Pendant ...................................................................... 12
- Zimmer HRC Gripper ............................................................ 15
- SCHUNK Co-act EGP ........................................................... 16
- SCHMALZ Electrical Vacuum Generator – CobotPump ECBPi ......................................................... 17
- PILZ pressure-sensitive safety mat PSENmat .................. 18
- STÖGER Automation Screwdriver CSX ................................. 19

Training:

- Collaborative Programming ................................................... 20
- SMART Pendant Programming .............................................. 20

Case Study MOTOMAN HC10:

- YASKAWA and PILZ .......................................................... 21
Introduction

Collaborative applications have become widely discussed in the past few years. The idea behind this new concept is to create a flexible workplace in order to keep up with recent market trends and customer demands for more customized products in smaller batches.

YASKAWA offers a complete portfolio of products that meet customer requirements.
What a Collaborative Workstation is and how it differs from a Collaborative Robot

In a collaborative workplace, not only the actual robot interacting with a human worker is considered, but the entire concept of the workstation, equipment and application, as well as the extent and type of human-machine interaction. The result is a complex cell within the production facility that must comply with the standards defined for the given territory. In Europe, the applicable standard is Machinery Directive MD2006/42/EC and derived standards of ISO 10218-2.

A collaborative robot, on the other hand, is a device that automatically performs complicated, often repetitive tasks; it is designed with smooth edges and surfaces to eliminate pinch points and is often equipped with additional sensors for detecting the human or other obstacles on collision. Collaborative robots comply with ISO 10218-1 and TS 15066 and achieve a minimum performance level of PLd, Cat. 3 according to ISO 13849-1.
Possible Modes of Collaboration

There are four modes of collaboration as defined by ISO TS 15066:

1. Safety Monitored Stop
2. Hand Guiding
3. Speed and Separation Monitoring
4. Power and Force Limiting

1. Safety Monitored Stop

- **Application type:**
  - Used when robot is working mostly alone
  - Human interaction with robot is occasional

- **Operation procedure:**
  - Human steps into the pre-defined restricted area and the robot stops all movements (servo is on but brakes are applied)
  - Robot restarts motion when safety parameters are reset (i.e. human presses the reset button, human leaves red zone of a safety scanner, etc.)

- **Robot type:**
  - Standard industrial robot

- **Example:**
  - Human performs a secondary operation on a workpiece while robot is holding it

2. Hand Guiding

- **Application type:**
  - Used for path teaching or hand guiding of the robot
  - Pick and place applications

- **Operation procedure:**
  - Human switches the robot to TEACH mode
  - Robot runs with safety guards in PLAY or REMOTE mode

- **Robot type:**
  - Standard industrial robot with additional sensing device (i.e. Kinetiq sensor)

- **Example:**
  - Quick and easy path teaching
  - Robot guiding during seat assembly in the car body
3. Speed and Separation Monitoring

- **Application type:**
  - Uses laser scanners, light curtains or vision systems to track the worker

- **Operation procedure:**
  - Robot works within pre-defined safety zones and acts accordingly when human is detected within the zones (e.g. slows down to 50% speed, slows down to 20% speed, stops)

- **Robot type:**
  - Standard industrial robot with additional sensing device for safety zone monitoring (e.g. safety eye from PILZ, safety scanner or light curtain from SICK, etc.)

- **Example:**
  - Loading jigs, removing finished products

4. Power and Force Limiting

- **Application type:**
  - Robot works alongside a human without additional safety devices

- **Operation procedure:**
  - Robot monitors external forces applied to its body and performs action (e.g. stop, retreat)

- **Robot type:**
  - Not a standard industrial robot, but robot with special force-limited features
  - Robot has rounded shapes for dissipation of forces in case of impact
  - Depending on the results of a risk assessment, it may not require additional safety devices

- **Example:**
  - Machine tending, picking and packing, assembly, etc.

Benefits of Force-limited Robots

- **Easy programming:**
  - Hand guiding
  - User-friendly software interface (e.g. buttons, arrows, animation and visualization, etc.)

- **Easy operation:**
  - Easy start-up procedures

- **Easy installation into the environment:**
  - Lightweight arm
  - Fenceless cell (depending on Risk Assessment result)

- **Cheaper cell:**
  - No fence or no additional safety devices (depending on Risk Assessment result)

- **Cheaper operation:**
  - No special training of operators or workers is necessary
Forms of Collaboration

Coexistence
- Robot and human have separated working areas and do not interfere frequently
- Human can occasionally enter working zone of the robot

Cooperation
- Robot and human have shared working area
- Human can enter working zone of the robot regularly
- Both of them work on separate tasks

Collaboration
- Robot and human have shared working area
- Human enters working zone of the robot frequently or constantly
- Human closely interfere with the robot
PFL Function (Power and Force-limiting)

- Safety function based on information from 6 built-in torque sensors in the robot arm
- When the external force acting on a robot exceeds a limit level (each axis, TCP), the robot stops
- When the restart switch of the robot is pushed, the robot withdraws a protection stop and restarts movement

Robot Avoidance Motion Function

- Application function based on the value of an external force applied to the robot
- Decision based on the value of an external force applied to the robot arm
- Robot can be pushed away from the user in a vector of the applied external force
- When external force disappears, robot returns to the push-away point and resumes operation
Lead Through Function

- Application function allowing an operator to hand-guide the robot
- A robot moves in a chosen coordinate system (link motion, rectangular and joint coordinate system)

FSU Functions – Functions also valid for HC10

- Application function based on a value of an external force applied to the robot
- Decision based on the value of an external force applied to the robot arm
- Robot can be pushed away from the user in a vector of applied external force
- When external force disappears, robot returns to the push away point and continues its operation

Individual Axis Range Limitation
- Safety Speed Limitation

Individual Axis Speed Monitoring
- with standstill monitoring

Safety Range Limitation

Tool Angle Monitoring

Tool Change Monitoring

PFL Function (Power and Force-limiting)
- setting and limitation of forces

Teaching of the robot is performed without using a programming pendant

Extra function for HC10
Smart Pendant

- Smart Pendant reduces what the user needs to remember in order to enter instructions and values, and the procedures for doing so.

- The main menu makes switching between screens more user-friendly, as all menus are listed in a sequence that requires minimal memorization.

- Easy access to all functions: The user can remember the location of each item in the navigation menu and safely return to the home menu in case of confusion.
• Smart Pendant allows a user to quickly:
  – Trigger an action
  – Select an option
  – Adapt parameter options
  – Obtain assistance

• Smart Pendant introduces a new type of coordinate frame: SMART FRAME

• Traditional teach pendant programming requires the operator to select the appropriate coordinate frame (joint, world, tool or user), which defines the direction in which the robot will move when a button is pressed. If the frame is not set correctly, moving the robot in the wrong direction or with the wrong trajectory can lead to problems and require time-consuming corrections.

• Hand Guiding is a collaborative feature that allows an operator to hand-guide the robot to a desired position.

• This task can be achieved by utilizing additional external hardware mounted directly on the robot or by a robot specifically designed to support this feature, e.g. HC10.

• Smart Pendant is YASKAWA’s next generation programming pendant that makes no compromise between ease of use and capability.

• Its key features are:
  – Easy-to-understand operation and user interface designed with customer participation
  – Simplified INFORM programming without loss of functionality
  – Command Builder for automatic INFORM generation
  – SMART FRAME jogging eliminates coordinate frames
  – Direct teaching with hand guiding for HC10
  – Built in Help function and “How-To” guides
Zimmer HRC Grippers

Zimmer HRC grippers meet the requirements of protection principles in accordance with ISO/TS 15066, including patented and BG-certified safety gripper jaws. The mechanical self-locking mechanism of the safety gripper fingers ensures safety even in the event of an emergency stop or loss of power. Integrated state monitoring thanks to a wrap-around LED display enables straightforward state monitoring. Process and service data can be exchanged bidirectionally between the gripper and higher-level control system; optional connections to robot-specific human-machine interfaces (HMI) round out the range of products. Zimmer HRC grippers can be adapted directly to the HC10, both mechanically and electrically. As a result, MOTOMAN robots can be commissioned quickly and easily in combination with Zimmer grippers and the jointly developed “Plug & Play” HMI.

### 2-JAW PARALLEL GRIPPERS

<table>
<thead>
<tr>
<th>COOPERATIVE</th>
<th>COLLABORATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRIC</td>
<td>ELECTRIC</td>
</tr>
<tr>
<td><strong>HRC-01-072797</strong></td>
<td><strong>HRC-01-072794</strong></td>
</tr>
<tr>
<td><strong>Stroke per jaw:</strong></td>
<td><strong>Stroke per jaw:</strong></td>
</tr>
<tr>
<td>60 mm</td>
<td>60 mm</td>
</tr>
<tr>
<td><strong>Gripping force:</strong></td>
<td><strong>Gripping force:</strong></td>
</tr>
<tr>
<td>820 N</td>
<td>120 N</td>
</tr>
<tr>
<td><strong>Weight:</strong></td>
<td><strong>Weight:</strong></td>
</tr>
<tr>
<td>1.8 kg</td>
<td>2.0 kg</td>
</tr>
<tr>
<td><strong>IP class:</strong></td>
<td><strong>IP class:</strong></td>
</tr>
<tr>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Maintenance free (max.):</strong></td>
<td><strong>Maintenance free (max.):</strong></td>
</tr>
<tr>
<td>5 mio. cycles</td>
<td>5 mio. cycles</td>
</tr>
</tbody>
</table>

STO safety functions + mechanical self-locking mechanism in the event of a power drop + safety gripper jaws prevent 140 N from being exceeded

**KEY BENEFITS**

- DGUV-certified
- Mechanical safe-locking
- Integrated state monitoring
- Optional connections to robot-specific human-machine interface (HMI)

*Value based on the parameters described in the ISO/TS 15066, determined with a force measuring device certified by the DGUV (German Social Accident Insurance).*

---

**Zimmer HRC Grippers**

**KEy Benefits**

- DGUV-certified
- Mechanical safe-locking
- Integrated state monitoring
- Optional connections to robot-specific human-machine interface (HMI)

**Zimmer Group**

Phone +49 7844 9139-0
Telefax +49 7844 9139-1199
E-Mail kontakt@zimmer-group.de
www.zimmer-group.de
SCHUNK Co-act EGP

Customer specific gripping unit for
YASKAWA MOTOMAN HC10 (PNP, NPN)

The Co-act EGP gripping unit is suitable for collaborating robots with the specific connection to YASKAWA MOTOMAN HC10 (PNP, NPN) robot.

**KEY BENEFITS**
- Gripping unit for collaborative robot
- Plug & Work with MOTOMAN HC10 (PNP, NPN)
- Control via digital I/O

**Technical data**

<table>
<thead>
<tr>
<th>ID-Nr.</th>
<th>1325126 (PNP) or 1334003 (NPN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>40</td>
</tr>
<tr>
<td>Stroke per jaw</td>
<td>6 mm</td>
</tr>
<tr>
<td>Min. / max. gripping force</td>
<td>35 / 140 N</td>
</tr>
<tr>
<td>Max. admissible finger length</td>
<td>50 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.69 kg</td>
</tr>
<tr>
<td>Mechanical interface</td>
<td>Robot specific</td>
</tr>
<tr>
<td>Nominal voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Electrical interface</td>
<td>Internal plug (switching principle PNP or NPN)</td>
</tr>
<tr>
<td>Sensors</td>
<td>Inductive proximity switches</td>
</tr>
</tbody>
</table>

Please contact us with your individual requirement.
You can reach the Co-act Team at:
Hotline Co-act Team +49 7133 103 3444
E-Mail co-act-team@de.schunk.com
SCHMALZ Electrical Vacuum Generator – ECBPi

Intelligent, autonomous and flexible

Vacuum Generation – for Collaborative Robots

SCHMALZ presents the CobotPump ECBPi – a new generation of intelligent vacuum generators that do not need compressed air. Their areas of application include mobile robotics, for example in autonomous warehouses or stationary handling tasks with collaborative robots (cobots).

APPLICATION

- Intelligent electrical vacuum generator for handling, airtight and slightly porous workpieces
- Integrated interface for controlling and monitoring the handling process
- For use in mobile robotics, fully automated small parts handling and stationary handling tasks

KEY BENEFITS

- Connection via IO-Link allows process monitoring and predictive maintenance from the machine to the cloud
- Condition monitoring reduces errors and downtime – this ensures the availability of the system
- NFC interface features direct access to processes and the device via smartphone
- Energy efficient thanks to integrated automatic adaptation of the performance to the handling process
- Individual flange plate for YASKAWA robot enables fast and effortless connection to robot

<table>
<thead>
<tr>
<th>Ordering data</th>
<th>Type</th>
<th>Part no.</th>
<th>Further information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum generator ECBPi</td>
<td>ECBPi 12 24V-DC M12-8 with M12, 8-pin plug</td>
<td>10.03.01.00314</td>
<td><a href="https://www.schmalz.com/en/10.03.01.00314">https://www.schmalz.com/en/10.03.01.00314</a></td>
</tr>
<tr>
<td></td>
<td>ECBPi 12 24V-DC TB-8 with terminal strip</td>
<td>10.03.01.00364</td>
<td><a href="https://www.schmalz.com/en/10.03.01.00364">https://www.schmalz.com/en/10.03.01.00364</a></td>
</tr>
</tbody>
</table>

The electrical vacuum generator ECBPi is delivered as a ready-to-connect product. Available accessories: flange plate, connection cable, connection distributor

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum generator ECBPi</td>
<td>12</td>
<td>13</td>
<td>24 – DC</td>
<td>0.6</td>
<td>5 ... 45</td>
<td>775</td>
</tr>
</tbody>
</table>

J. Schmalz GmbH
Johannes-Schmalz-Str. 1, 72293 Glatten, Germany, T. +49 7443 2403-0
HYPERLINK “mailto:schmalz@schmalz.de”
schmalz@schmalz.de
HYPERLINK “http://WWW.SCHMALZ.COM/ECBPI”
WWW.SCHMALZ.COM/ECBPI
PILZ pressure-sensitive safety mat
PSENmat

Key benefits
- Pressure-sensitive safety mat (failsafe) and position detection (standard) in a single product; the first ever combination of area monitoring and virtual switch function
- Ergonomic workplace: thanks to the integrated switch functionality, PSENmat supports new machine concepts, hands-free working and an obstruction-free workspace
- Compliant with standard EN ISO 13856-1
- Integrated OSSD outputs for high flexibility and reduced cabling
- Series connection of up to 22 mats possible
- Extremely fast reaction time: ≤ 25 ms
- Robust safety mat designed for large mechanical loads: protection type IP67
- SIL 2 in accordance with EN ISO 61508, safety level Pi d in accordance with EN 13849
- Can be used at ambient temperatures from 0 to +50°C

Safe monitoring and individual operation
The world-first PSENmat is a pressure-sensitive mat (failsafe) with integrated switch functionality (standard): It means you can now benefit from safe area monitoring and an operating function based on integrated virtual switches. PSENmat slows or stops the machine when personnel enter the hazardous area (access protection) and/or step behind.

Order numbers
- Pressure-sensitive safety mat, black
  - PSENmat 1000 600 32 PUR bk
    - 6U000001
- Pressure-sensitive safety mat, light grey
  - PSENmat 1000 600 32 PUR gr
    - 6U000002
- Ramps
  - PSENmat ramp ec PUR
    - 6U000003
  - PSENmat ramp ic PUR
    - 6U000004
  - PSENmat ramp PUR 1000
    - 6U000005
  - PSENmat ramp PUR 862
    - 6U000006
  - PSENmat ramp PUR 724
    - 6U000007
  - PSENmat ramp PUR 600
    - 6U000008
  - PSENmat ramp PUR 462
    - 6U000009
  - PSENmat ramp PUR 324
    - 6U000010
- Terminator
  - PSENmat Terminator
    - 560 100
  - SDD ES ETH mat
    - 540 140

Prospective introduction: June 2018

We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.

Headquarters:
Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone +49 711 3409-0, Telefax +49 711 3409-133
E-Mail info@pilz.de, www.pilz.com
STÖGER Automation Screwdriver CSX

Automatic Screwdriver for Human-Robot-Interaction with automatic Feeding

With its CSX STÖGER AUTOMATION has developed the first screwdriving unit specially designed for human-robot-interaction. As in all screwdriving units, the fasteners are automatically fed to the CSX. When this screwdriver was designed, special care was taken to eliminate possible risks for the operator.

**KEY BENEFITS**
- Rounded edges
- Automatic switch-off when protection sleeve is touched
- Short design
- Low weight
- Automatic feeding of fasteners
- Open interfaces for drives (electric/pneumatic), free choice of type and manufacturer
- Interfaces for signal and data exchange
- Analogue displacement-measuring system
- High availability
- Quick bit change without special tools
- Controlled by the robot controller
- Suitable for robots with load-bearing capacity > 5 kg

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw size</td>
<td>M2 – M8 *</td>
</tr>
<tr>
<td>Nuts</td>
<td>Upon request</td>
</tr>
<tr>
<td>Weight (without drive)</td>
<td>Approx. 2.0 kg</td>
</tr>
<tr>
<td>Torque</td>
<td>Up to 16 Nm</td>
</tr>
<tr>
<td>Pressing force tool stroke</td>
<td>10 to 70 N</td>
</tr>
<tr>
<td>Noise level measurement</td>
<td>Approx. 50 dBa</td>
</tr>
<tr>
<td>Cycle time</td>
<td>From 0.8 sec.*</td>
</tr>
<tr>
<td>Vacuum version</td>
<td>Yes</td>
</tr>
<tr>
<td>Bit change</td>
<td>Downward, &lt; 10 sec.</td>
</tr>
<tr>
<td>Length (without drive)</td>
<td>Approx. 450 mm (depending on fastener)</td>
</tr>
</tbody>
</table>

* Standard, weitere Größen auf Anfrage


STÖGER AUTOMATION GmbH
Gewerbering am Brand 1, 82549 Königsdorf, Germany
Phone +49 8179 997 67-0, E-Mail info@stoeger.com, www.stoeger.com
Collaborative Programming
Hand in Hand

HRC-Applications

Trainings for Collaborative Programming cover all robotics applications which are collaborative or co-existent.

The industrial robots special kinematics and Human-Robot applications will be specially trained. The specific hand guided or conventional programmed applications will be taught in compliance with safety regulations. Special working commands which activate the tools are being considered as far as possible.

- Collaborative Operator Training – RB1CY  
- Collaborative Basic Training – RB2CY  
- Collaborative Crossover Training – RB3CY  
- Collaborative Upgrade Training – HC RB4CY

SMART Pendant Programming
Pretty well SMART

Smart Pendant programming training differs from others due to using the Smart Pendant.

Programming itself and the programming language is quite easy and very user-friendly.

With this training you will reach an easy and fast success. This application will be taught using various examples.

- Smart Pendant Operator Training – RB1S  
- Smart Pendant Basic Training – RB2S  
- Smart Pendant Crossover Training – RB3S  
- Upgrade Smart Pendant Training – RB4S

For detailed information see page 22 and 23 brochure “Training overview”.
Collaborative Applications

YASKAWA and PILZ – Case Study with MOTOMAN HC10

PILZ GmbH & Co. KG is a technology company in the area of safe automation with the head office in Ostfildern (Stuttgart Area). In this use case, functional testing of various circuit board types has to be executed.

Challenge
- Automated Pick & Place application for in-circuit testing of conductor boards
- Manual adapter change for different product types

Solution
- Use of the collaborative MOTOMAN HC10 robot to combine automated and manual tasks without spatial separation
- Safety zone monitoring with PILZ “Safety Eye”
- Robot switches from full-speed to collaborative speed when a worker approaches
- Redesigned FIFO material provision for defined material in-feed and withdrawal
- Camera vision system (Cognex) mounted on a linear axis for component identification
- MOTOMAN HC10 robot picks components from small loading carrier and places them into the testing device
- Depending on testing results, component is positioned in respective small load carrier
- Robot pushes finished small load carriers down the flow rack lane
- Worker changes adapter manually, when product type changes

Results
- Flexible solution which combines the abilities of human and robot
- Direct Human-Robot Cooperation without spatial separation
- Maintaining high operation speed and productivity with safe area monitoring
- Smooth and secure speed change during adapter change, maintenance or error fixing
- Autonomous part detection and handling
- Minimally invasive conceptual changes at the manual work station decrease setup effort and maintain the previous logistic concept

Stammhaus:
Pilz GmbH & Co. KG
Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telefon +49 711 3409-0, Telefax +49 711 3409-133
E-Mail info@pilz.de, www.pilz.com

We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.
YASKAWA GROUP
AT YASKAWA Austria
Schwechat/Wien
+43(0)1-707-9324-15
CZ YASKAWA Czech s.r.o.
Rudná u Prahy
+420-257-941-718
ES YASKAWA Ibérica, S.L.
Gavà/Barcelona
+34-93-6303478
FR YASKAWA France SARL
Saint-Aignan-de-Grand-Lieu
+33-2-40131919
FI YASKAWA Finland Oy
Turku +358-(0)-40300600
GB YASKAWA UK Ltd.
Banbury +44-1295-272755
IT YASKAWA Italia s.r.l.
Torino +39-011-9005833
IL YASKAWA Europe Technology Ltd.
Roth Hâ‘ayin +972-3-9004114
NL YASKAWA Bénelux B.V.
Son +31-40-2895500
PL YASKAWA Polska Sp. z o.o.
Wrocław +48-71-7928670
RU YASKAWA Nordic AB
Moskva +46-480-417-800
SE YASKAWA Nordic AB
Torsås +46-480-417-800
SI YASKAWA Slovenia
Ritnica +386-1-8372-410
TR YASKAWA Turkey Elektrik
Ticaret Ltd. Sti.
İstanbul +90-216-5273450
ZA YASKAWA Southern Africa (PTY) Ltd
Johannesburg +27-11-6083182

DISTRIBUTORS
BG ARAMET ROBOTICS Ltd.
Yambol +359-885 317 294
Kammarton Bulgária Ltd.
Sofia +359-02-926-6060
DK Robotcenter Danmark
Læsøning +45 7022 2477
EE RK R Seadmed OÜ
Tallinn/Estonia +372-68-35-235
GR Gizeis Robotics
Nea Kifissia +30-2106251455
HU Flexman Robotics Kft
Budapest +36-30-9510065
LT Profibus UAB
Panevėžys +370-45-518575
NO Skala Robotech AS
Lierstranda +47-32240600
PT ROBOPLAN Lda
Aveiro +351-234 943 900
RO Sam Robotics srl
Timisoara +40-720-279-866
MPL Automation S.R.L.
Satu Mare +40 (0) 261 750 741

YASKAWA Headquarters
YASKAWA Europe GmbH
Robotics Division
Yaskawastraße 1
85391 Allershausen, Germany
Tel. +49 (0) 8166/90-0
Fax +49 (0) 8166/90-103
robotics@yaskawa.eu.com
www.yaskawa.eu.com

YASKAWA ACADEMY
and sales office Frankfurt
YASKAWA Europe GmbH
Robotics Division
Hauptstraße 185
65760 Eschborn, Germany
Tel. +49 (0) 6196/77725-0
Fax +49 (0) 6196/77725-39

All dimensions in mm.
Technical data may be subject to change without previous notice.
Please request detailed drawings at robotics@yaskawa.eu.com.
Collaborative Applications
A-09-2018, A-No. 195961

robotics@yaskawa.eu.com
www.yaskawa.eu.com