BECKHOFF

ATRO Update

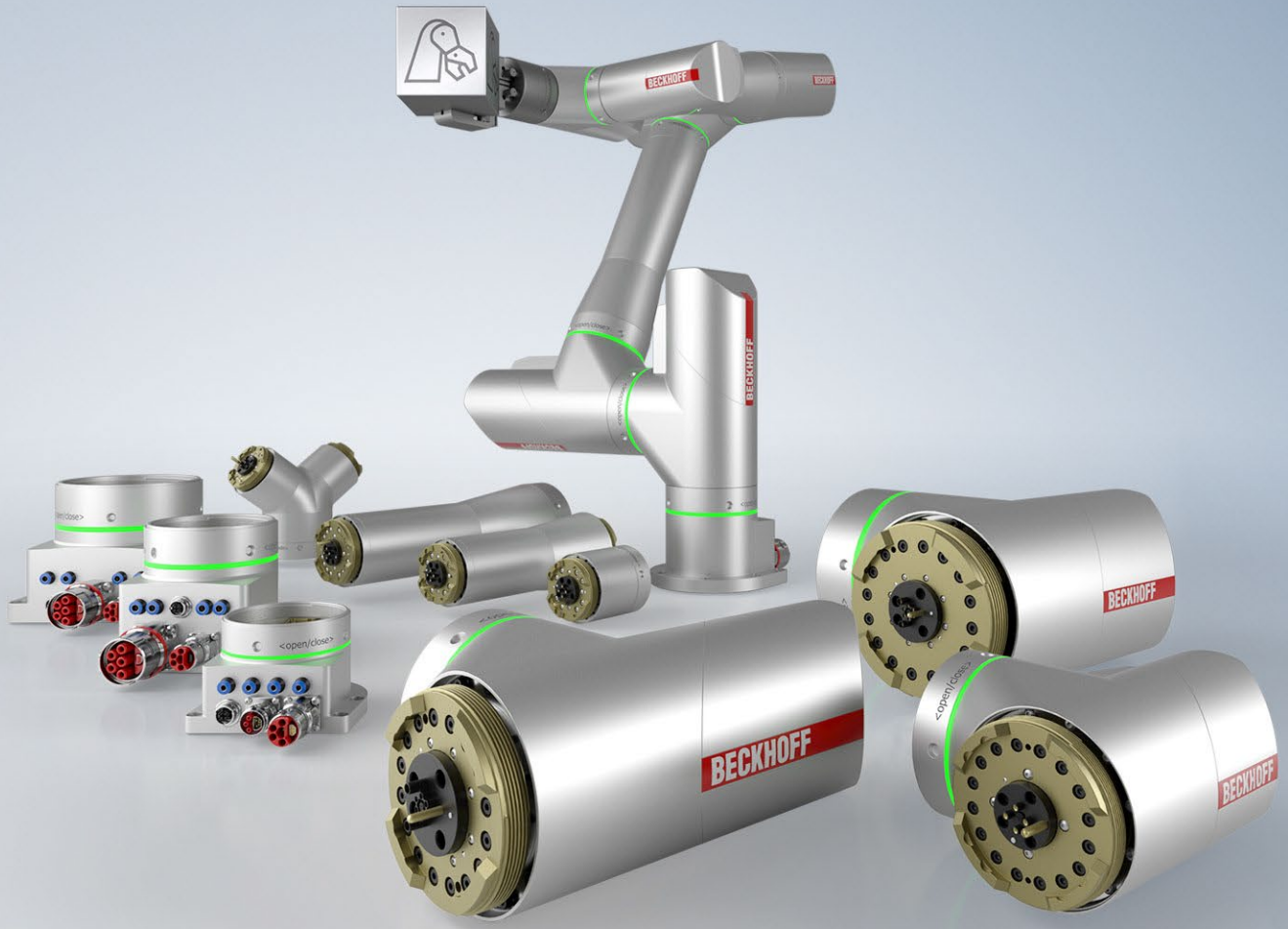
Harri Leppänen
Aluemyyntipäällikkö - Kuopio
Beckhoff Automation Oy

ATRO: Automation Technology for Robotics

BECKHOFF

ATRO system

- offers a unique, modular, and flexible industrial robot system
- fully integrated into the Beckhoff automation system

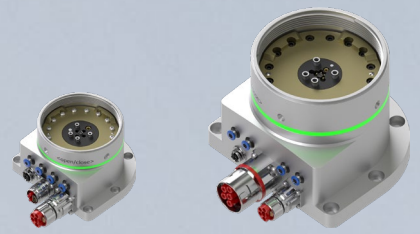


ATRO

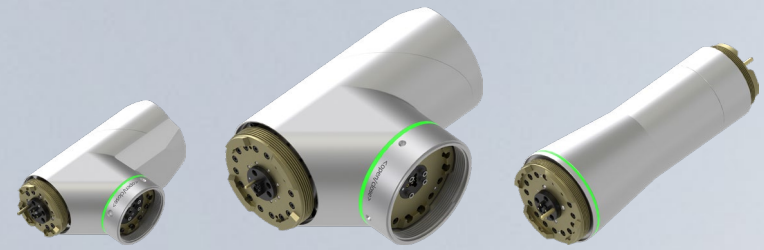
Individual robot configurations from standardized modules

BECKHOFF

ATRO base modules



ATRO motor modules



ATRO link modules

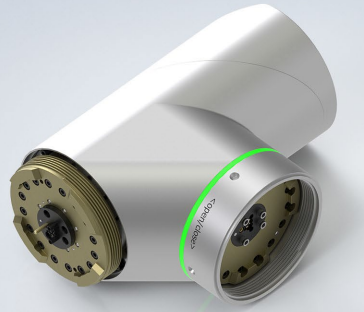
ATRO kinematics

ATRO: The modular and flexible industrial robot system

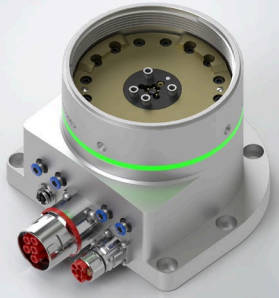
BECKHOFF

- standardized modules are turned into **individual robot configurations**
- **The combination of modules is determined on an application-specific basis.**
  - The size and number of axes vary depending on the required reach and payload, as well as on the required degree of freedom.
  - this cuts down on weight and also reduces cost
- For pick-and-place applications, 4 degrees of freedom are often sufficient
  → only 4 motor modules are required.

ATRO motor module



ATRO base module

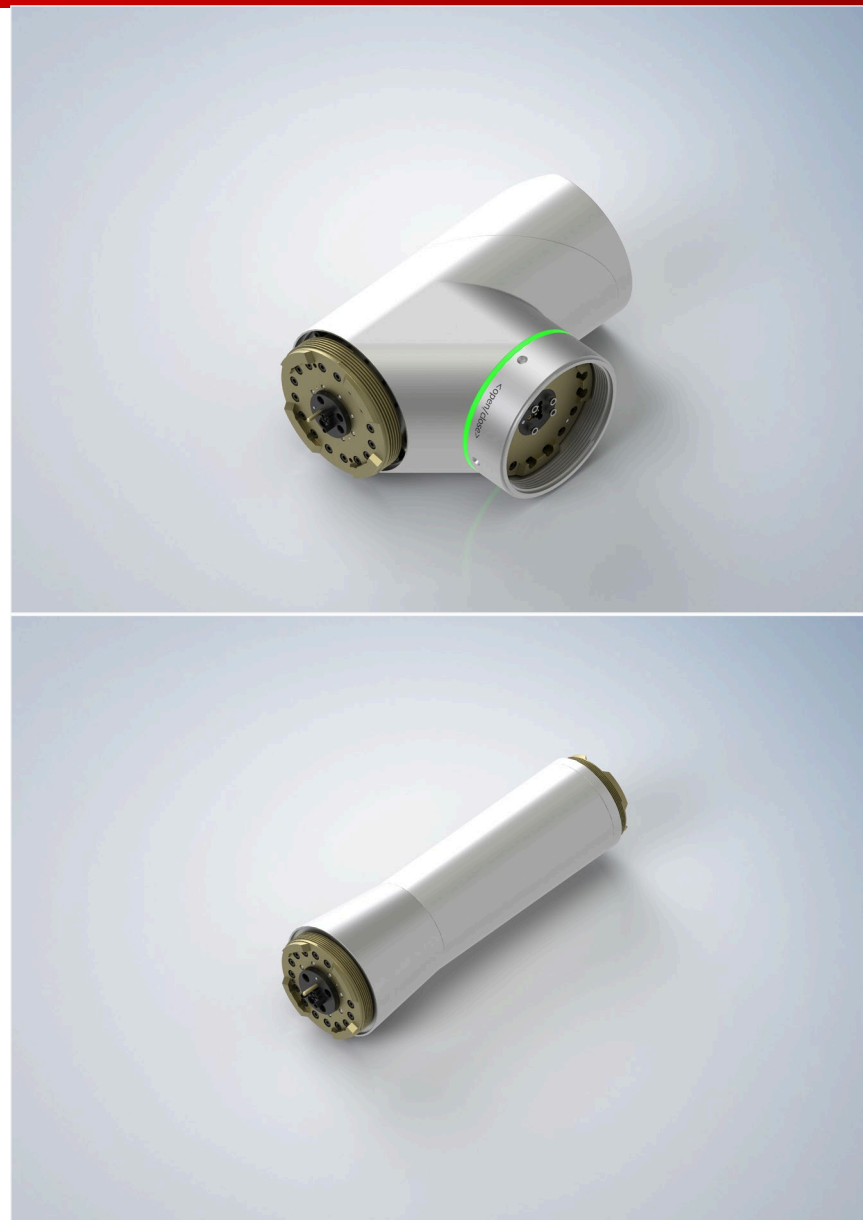


ATRO link module

Modular industrial robot system

BECKHOFF

- **integrated servo drives in the motor modules**
  - free up space in the control cabinet and minimize wiring effort
- straightforward possibility of control cabinet-free operation
  - The control IPC can be integrated into the base.
- modular design **reduces stocking costs for** the customer
  - Different robot configurations use the same modules.
  - Existing modules can be reassembled for future applications.

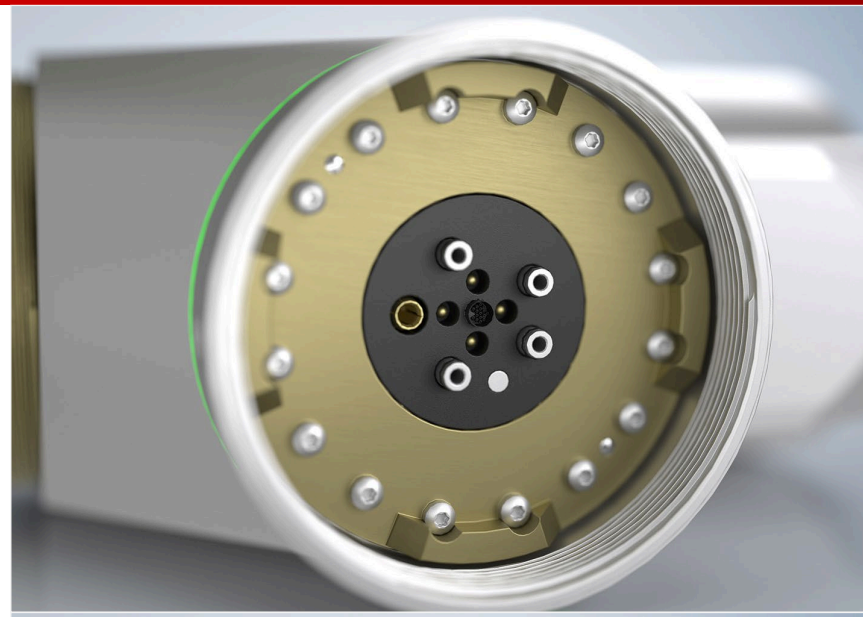


ATRO interface: Standardized interface

BECKHOFF

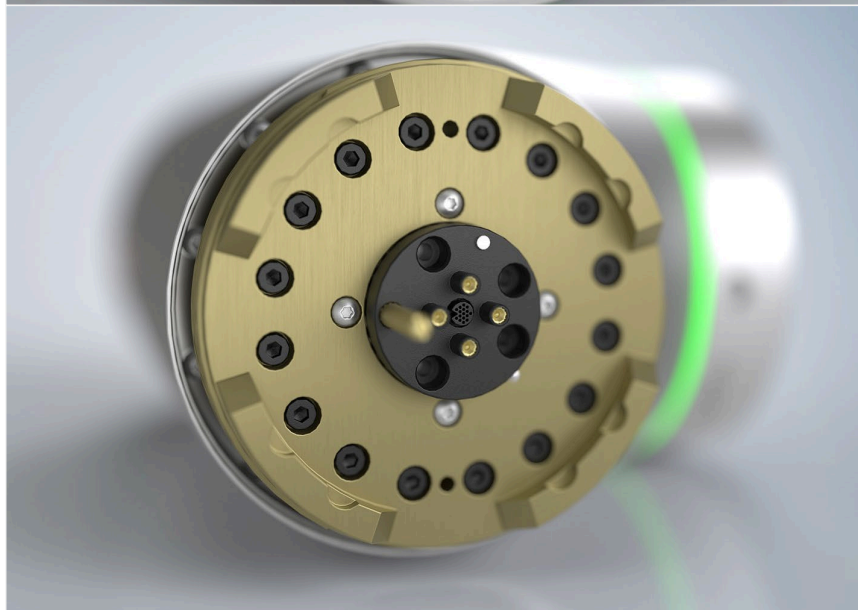
Assembly of the modules is extremely simple

- The ATRO interface is self-centering thanks to the Hirth coupling.
- The self-locking screw connection makes for a stable bond.



One tool is sufficient for the complete assembly of the kinematics.

- The robot can be assembled by just one person.
  - This is especially helpful when mounting/dismounting overhead

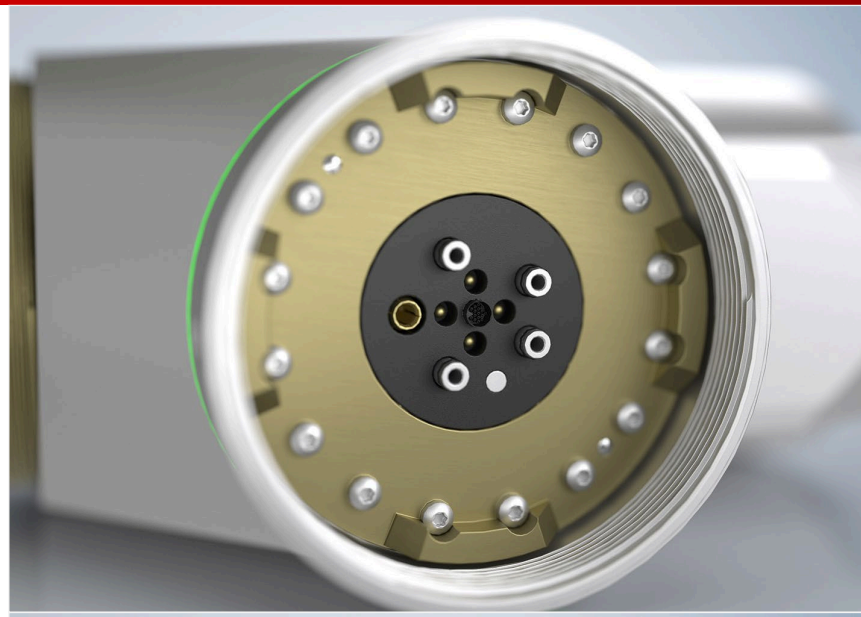


ATRO interface: Standardized interface

BECKHOFF

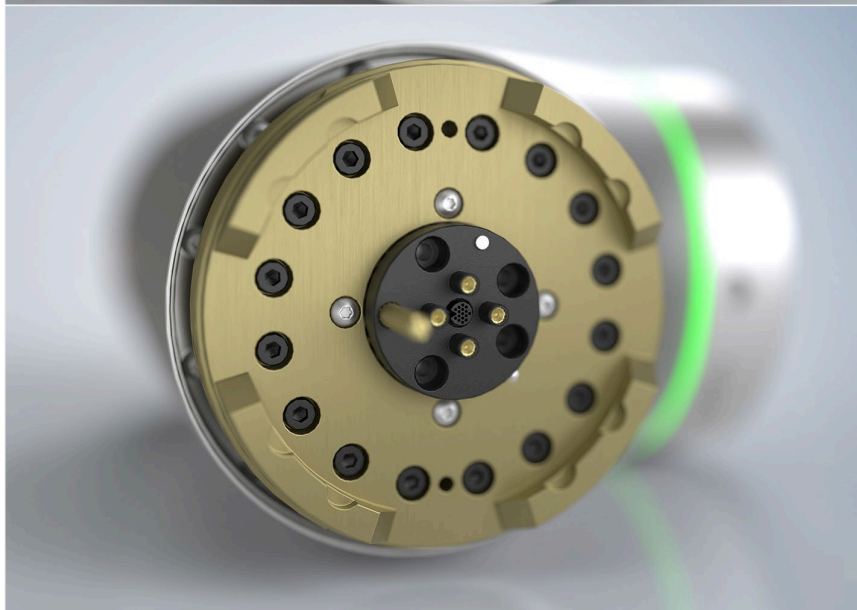
ATRO interface on all motor, link, and base modules

- data, power and fluid interface



ATRO interface also serves as an interface to the tool on the end effector.

- straightforward adaptation to existing grippers
- endless rotation of the tools is maintained thanks to the internal media feed



Assembly

BECKHOFF

- The assembled modules form the complete mechanical construction of the robot.
  - only the motor, link, and base modules are required
- Individual modules can be replaced for maintenance
  - this **minimizes the MTTR*** compared to a complete robot exchange.

*MTTR: Mean Time To Repair

Internal media supply

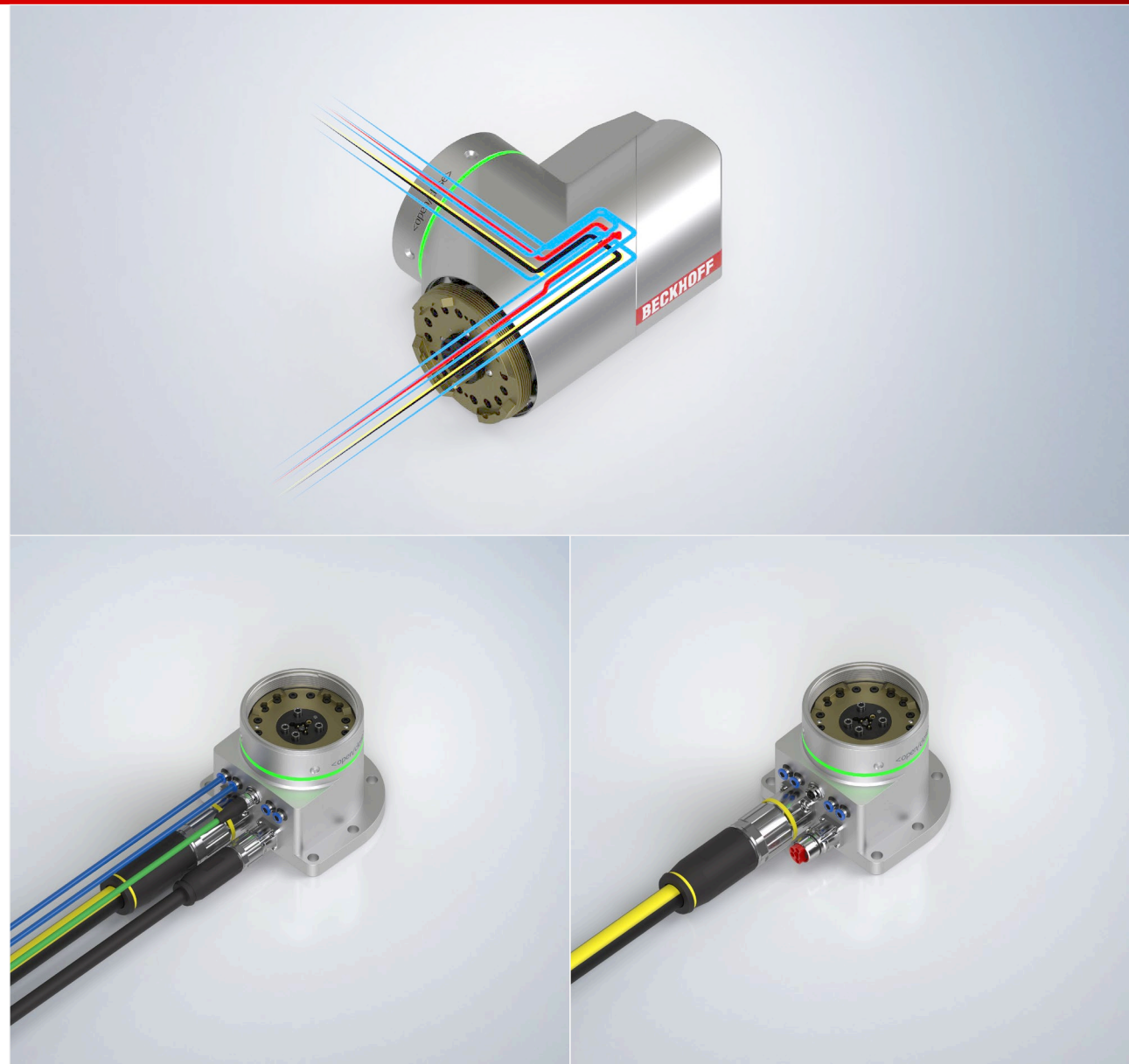
BECKHOFF

- All modules have an **integrated media supply**
  - for data, power and fluid feedthrough e.g., **compressed air, vacuum or water**
  - **from the base to the end effector**
- two media strands
  - robot supply and data interface
  - additional media chanel for the customer application at the end effector

Internal media feed

BECKHOFF

- media for robot supply
  - EtherCAT communication
  - 24/48 V supply for internal electronics and motors
- independent media channel for the customer application
  - power:
    4-pin, e.g., 230 V and
    5-pin, e.g., 400 V AC, or 600 V DC
    (depending on module size)
  - Gigabit Ethernet communication
  - 4x fluids



All axes are endlessly rotating

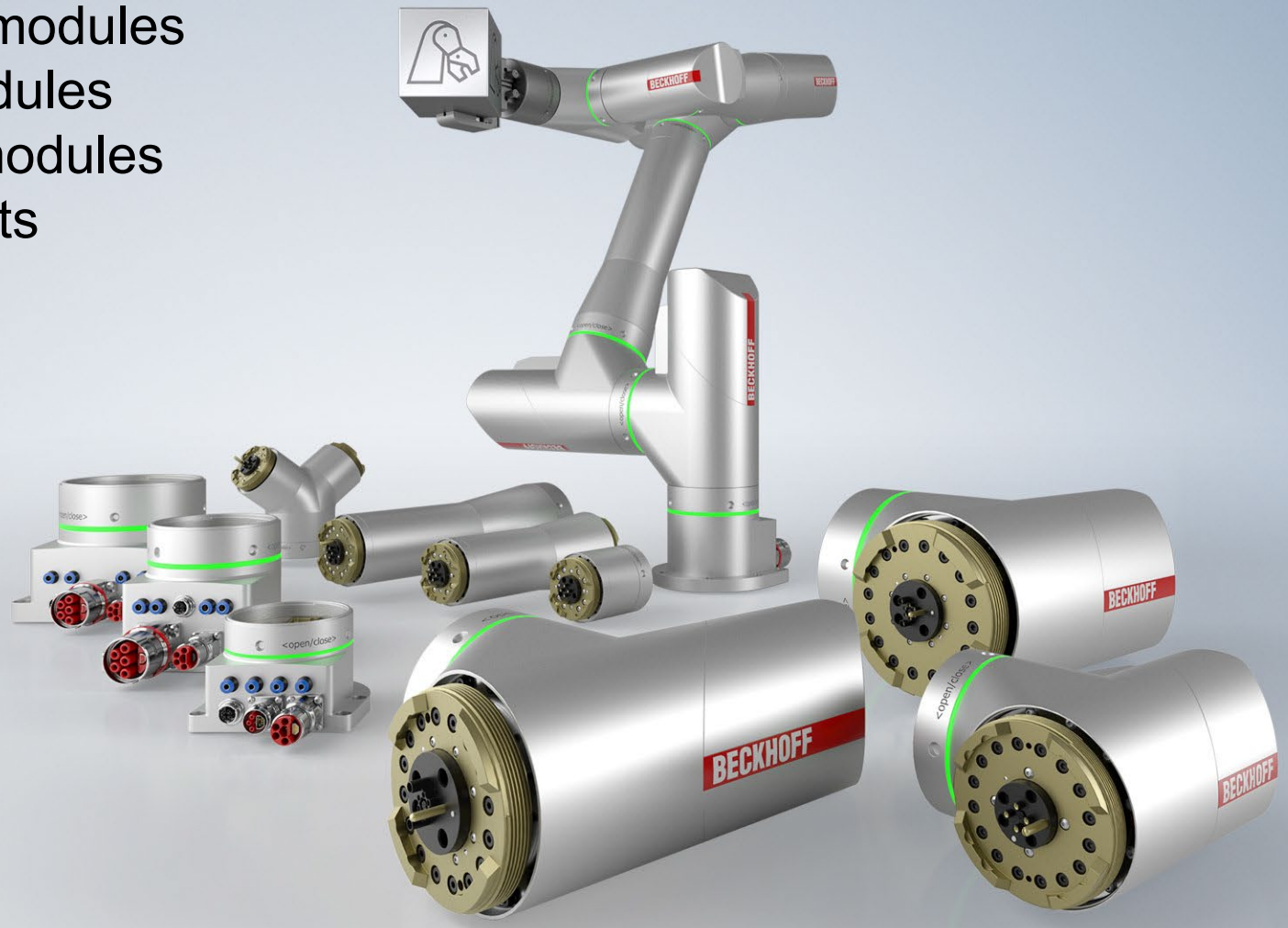
BECKHOFF

- All axes are designed for **endless rotation.**
  - This also applies to the main axes.
- The internal media feed avoids the need for an external hose and cable guide up to the gripper.
  - Interfering cables that prevent endless rotation of the entire structure are thus obsolete.
- The absence of axis limitations simplifies the programming of Cartesian movements.
  - **The shortest paths can always be taken.**

Product overview

BECKHOFF

- RMxxxx motor modules
- RLxxxx link modules
- RBxxxx basic modules
- RKxxxx robot kits



ATRO

RMxxxx motor modules

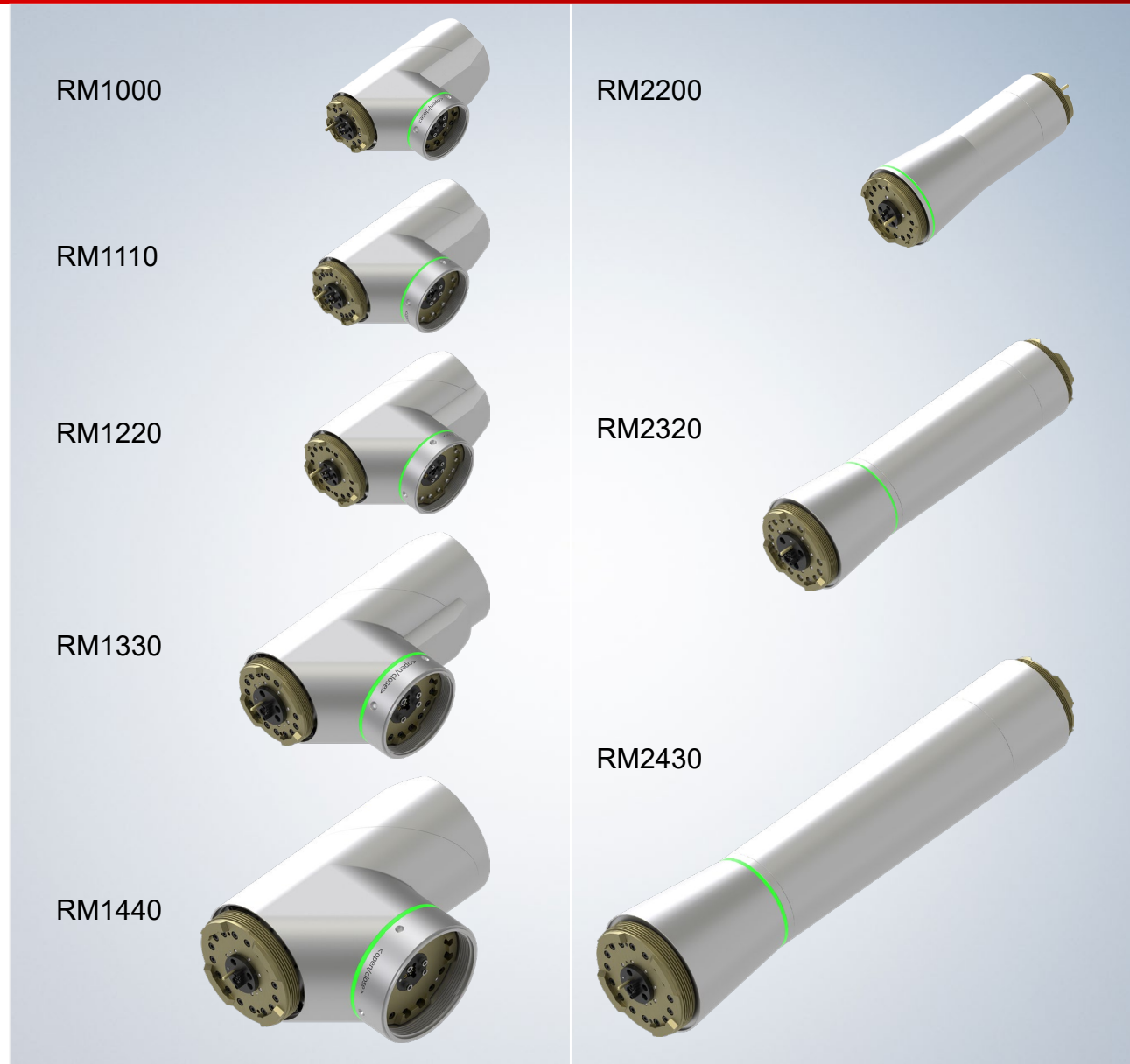
BECKHOFF

different sizes

- 14, 17, 20, 25, 32 modules

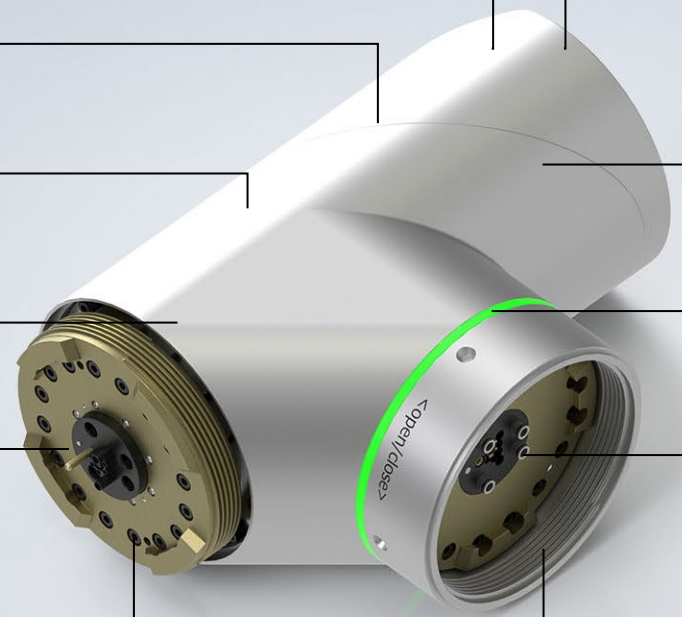
different designs

- L-motor
  - as joints for robot configurations
- I-motor
  - flange size reduction
  - additional axis for extended mobility, e.g., 7-axis kinematics



L-type RM1xxx motor module

BECKHOFF



electronic identification plate

dual encoder

highly compact servomotor

high-performance gearbox

internal media feed for data, energy, and fluids

endless rotation

EtherCAT servo drive

backlash-free holding brake

visual status indicator

standardized mechanical interface

simple mounting thanks to Hirth joint and union thread

RLxxxx link modules

BECKHOFF

- connection modules to create individual robot configurations
- variable shape and length
  - I-shape
  - L-shape
  - Y-shape

RLxxxx link modules

BECKHOFF

passive connection module

reduction of flange sizes possible

standardized mechanical interface

internal media feed energy, communication, fluids

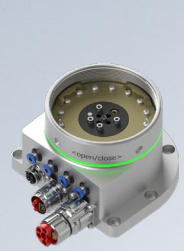
electronic identification plate

variable shape and length for individual robot configurations

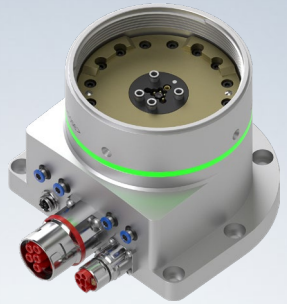
RBxxxx basic modules

BECKHOFF

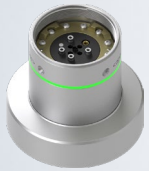
- robust mounting of the robot in all orientations – on a base plate, on the wall, or on the ceiling
- connection level to the internal media supply
  - connected sideways or downwards



RB1000

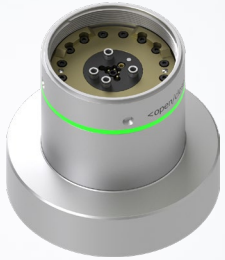


RB1300

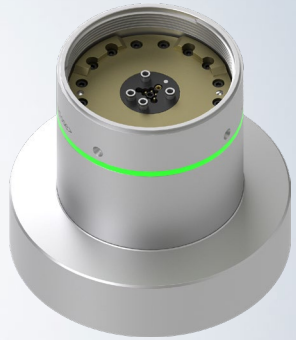


RB2000

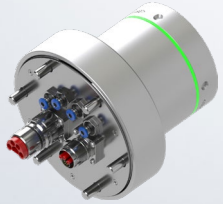
RB2200

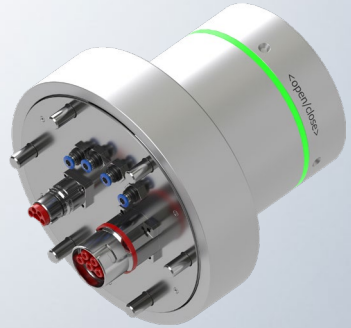


RB2300



RB2400

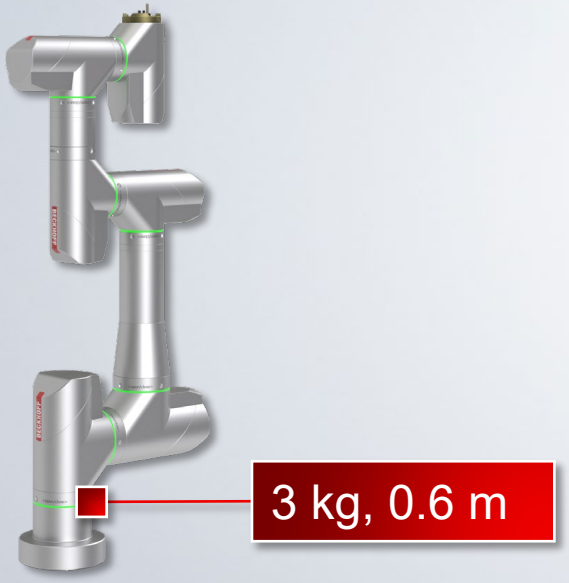




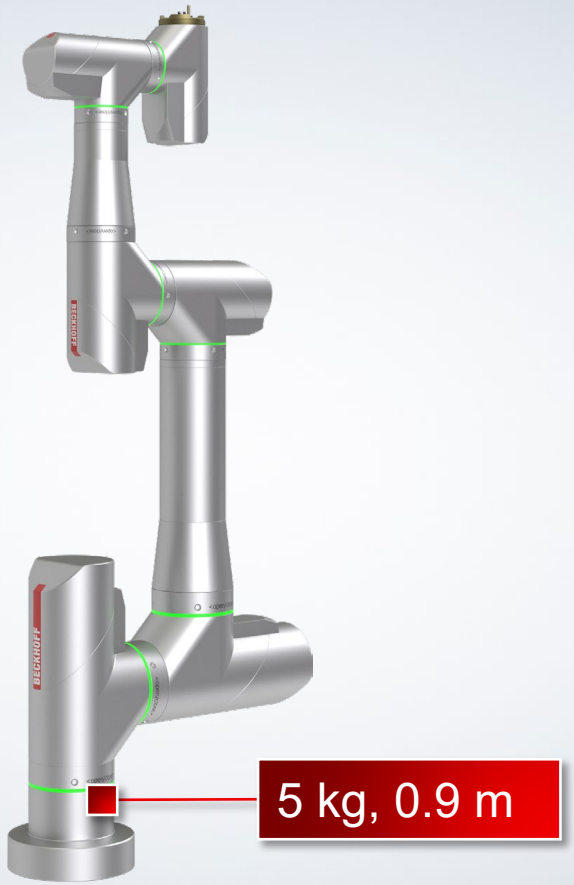
RKxxxx robot kits

BECKHOFF

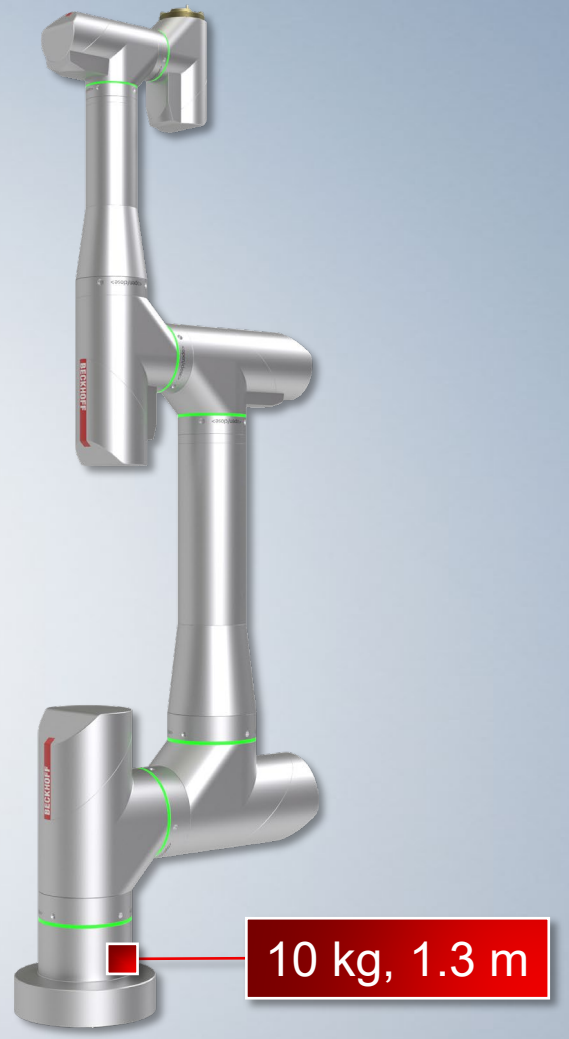
- defined module sets
- starter kits



RK1606-0300



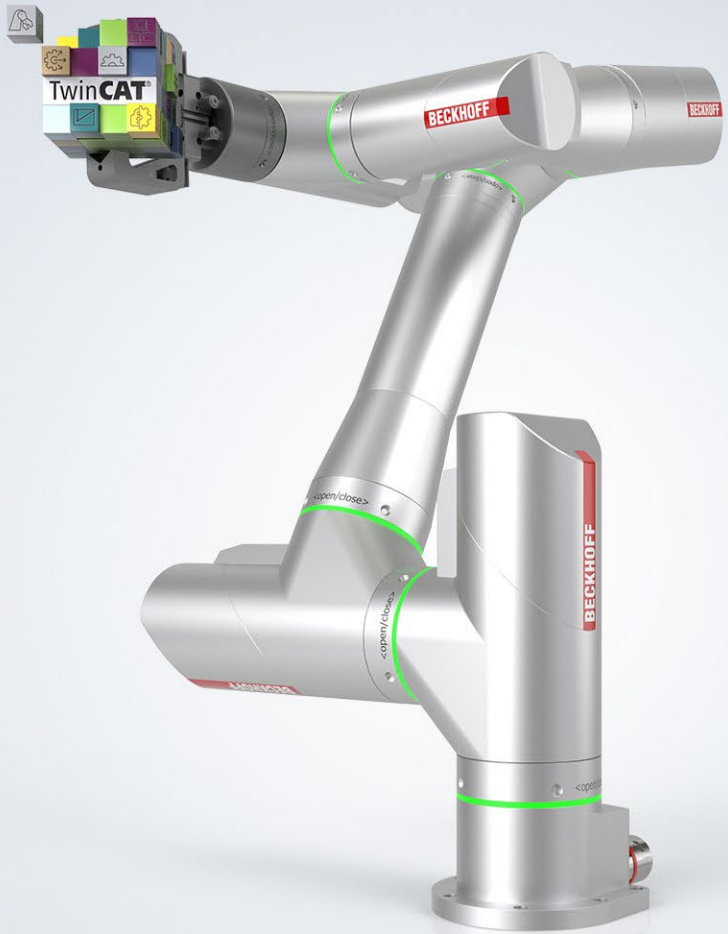
RK1609-0500



RK1613-1000

PC-based control – robot controller fully integrated into TwinCAT

BECKHOFF

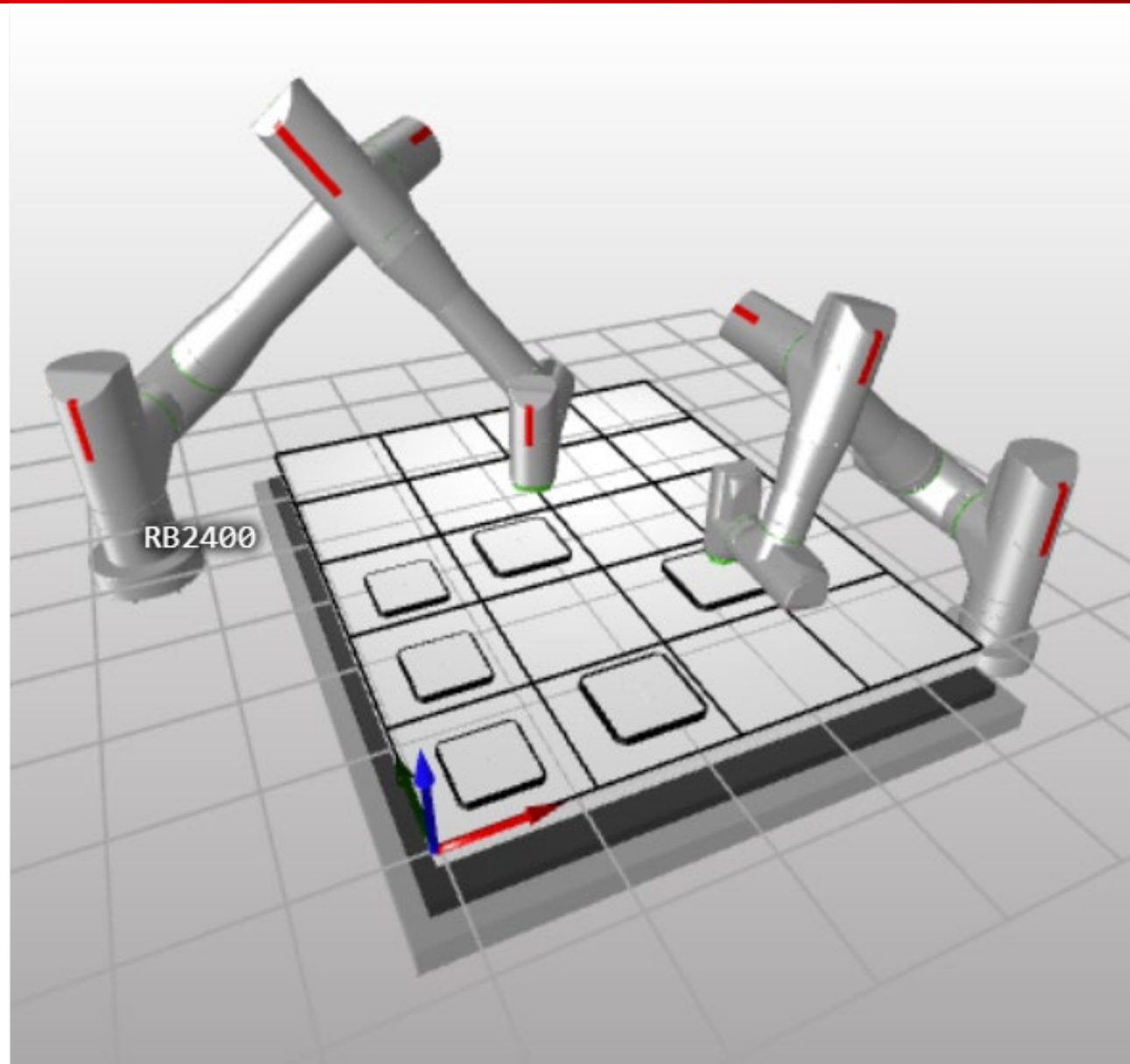


ATRO

High-performance robot controller

BECKHOFF

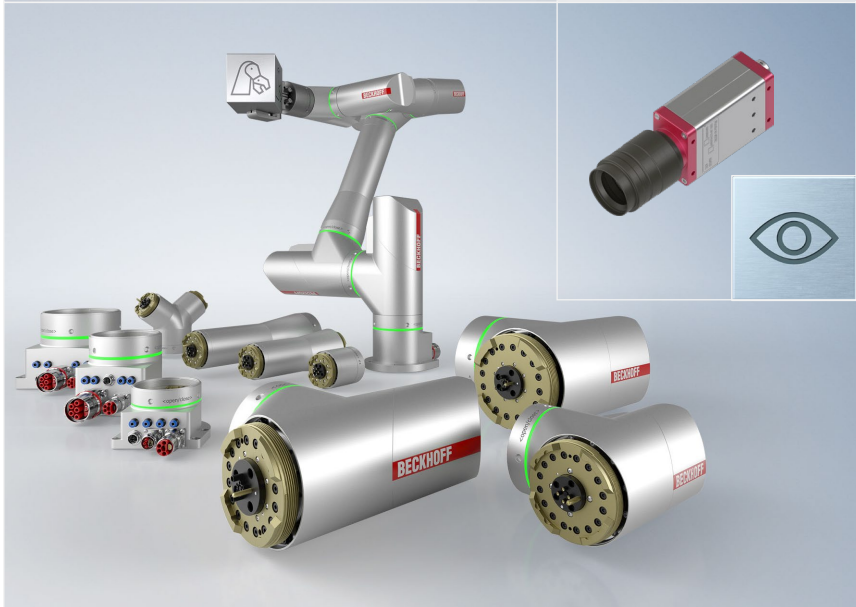
- With active support of multi-core CPUs, TwinCAT offers clear performance advantages compared to conventional robot controllers.
- integrated functionality
  - **one control IPC** for PLC, robot controller, and additional automation functions
    - tthis eliminates time delays for data exchange between tasks
    - the complete system is synchronized
- **Multiple robot kinematics can be operated with one control.**



Extensible through TwinCAT functions

BECKHOFF

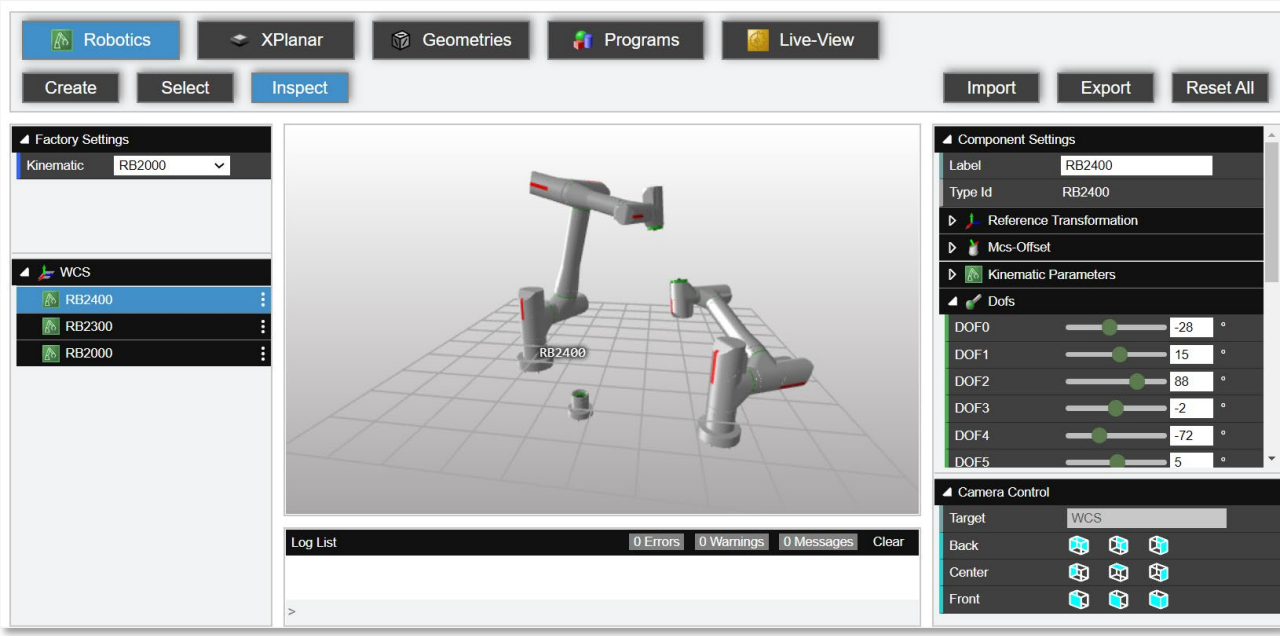
- The robot controller can be combined with all TwinCAT function extensions.
  - The use of **TwinCAT Vision** enable sophisticated applications (e.g., automated bin picking).
  - **Machine Learning** solutions can be used to improve motion performance.
  - **Coordinated motion** between the robot, XPlanar and XTS, and other motion components works seamlessly.
  - **Analytics functions** for predictive maintenance (including operating time, load cycles, and overload) are available.



Configuration and programming

BECKHOFF

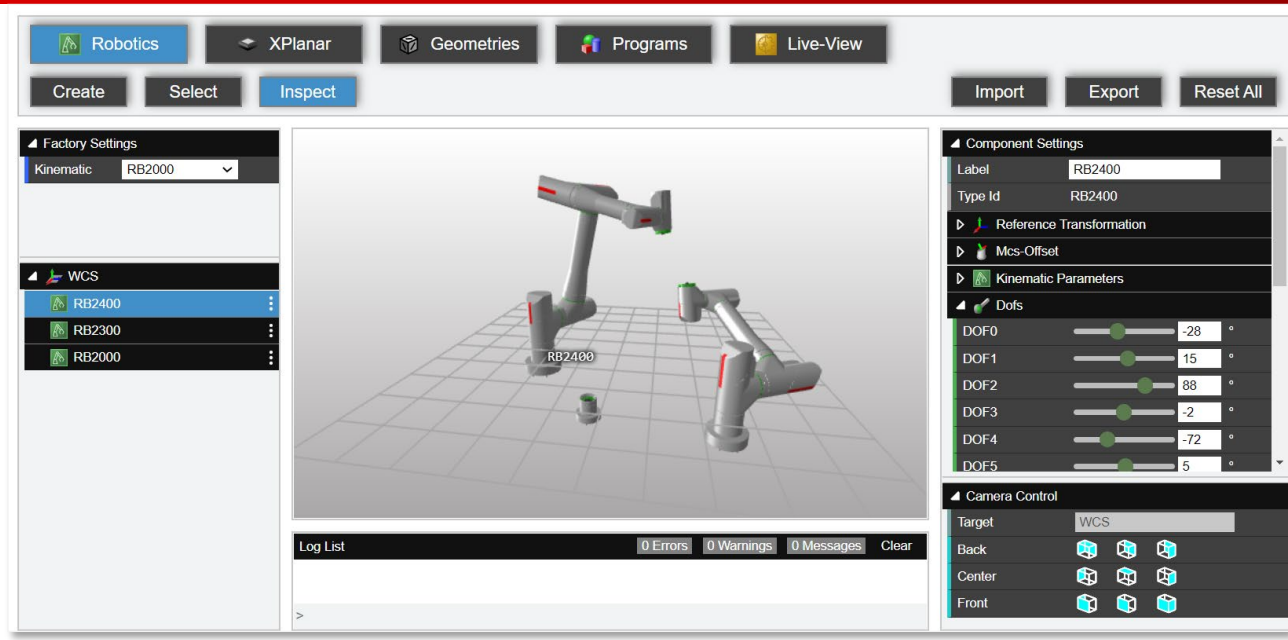
- automatic set-up and checking of the kinematics by EtherCAT bus scan
  - All ATRO modules contain an electronic identification plate that contains the dynamic properties.



Configuration and programming

BECKHOFF

- The kinematics are configured and visualized in a **graphical 3D representation**
  - In **live view**, motion sequences can be displayed online or in a simulation environment.
  - The HTML5-based display can also be embedded in the user's interface.
- The robotics functionalities of TwinCAT are extended.



Robot programming

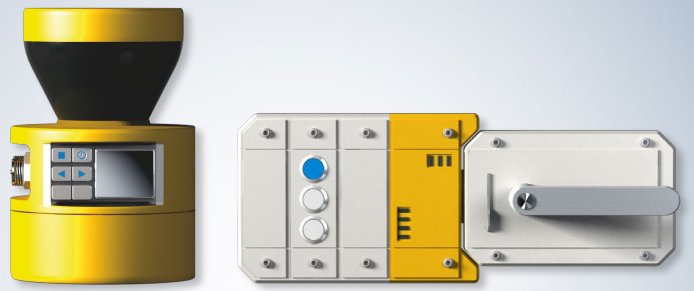
BECKHOFF

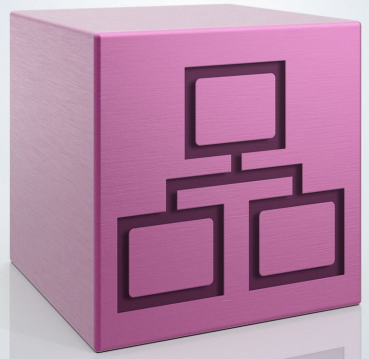
- application programming
  - **Easy Mode**
    for simple applications and all users
  - **Advanced Mode**
    for standard robot-based automation
  - **Technical Mode**
    for TwinCAT experts to handle sophisticated tasks
- motion programming
  - positioning of the robot via **hand guiding**
  - **teaching of** positions via system module or
    external operating buttons

PC-based control – Connectivity

BECKHOFF

- TwinCAT connectivity solutions are also available for robotics through TwinCAT integration.
  - EtherCAT, PROFINET, EtherNet/IP, OPC UA, Modbus, etc.
- Safe sensors and actuators can also be easily integrated into the robot application.
  - All devices with Safety over EtherCAT, PROFIsafe, or safe I/O can be integrated.
- data transport from the production level right through to the production planning and ERP system or cloud





ATRO: Modular, flexible, and integrated.
The perfect robot for every application

BECKHOFF