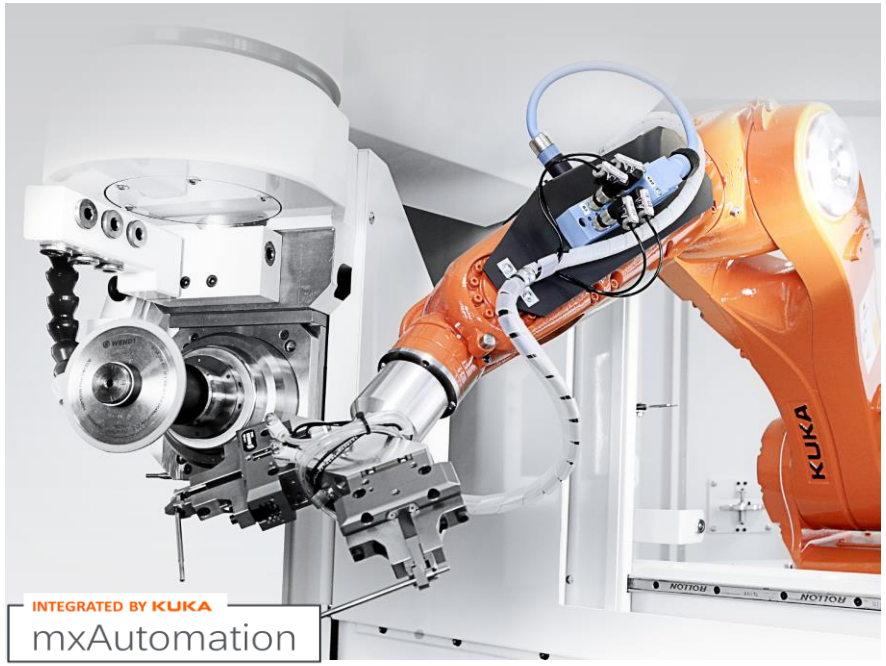

KUKA

KUKA.PLC mxAutomation

Integrated Robot-Based Automation



Status quo without mxAutomation

Current solution of robot-based handling in/at production cells or machines (machine tools, injection molding, die-cast machines, etc.)

- Cell is controlled by a (Soft) PLC
- Robot is controlled by a robot controller

→ **Experts of PLC and robot programming are needed**

- one is depending to the other during commissioning and programming

→ **Longer set-up time**

- Operator knows to manage the cell via machine/cell controller – for Robot actions support from an expert is necessary

→ **High maintenance and life cycle costs**

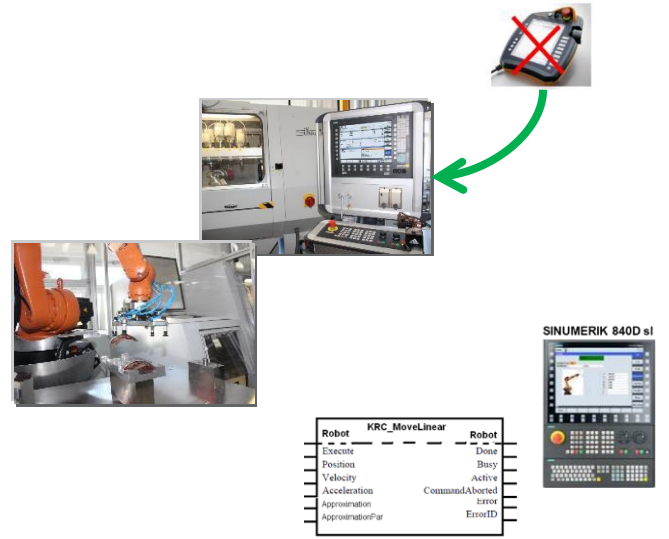
Vision:

- Production cells or machines where all components including the robot are programmed and commanded by its existing machine controller environment
- → easy to program and easy to use for the end-users

mxAutomation – all included in customers cell/machine concept

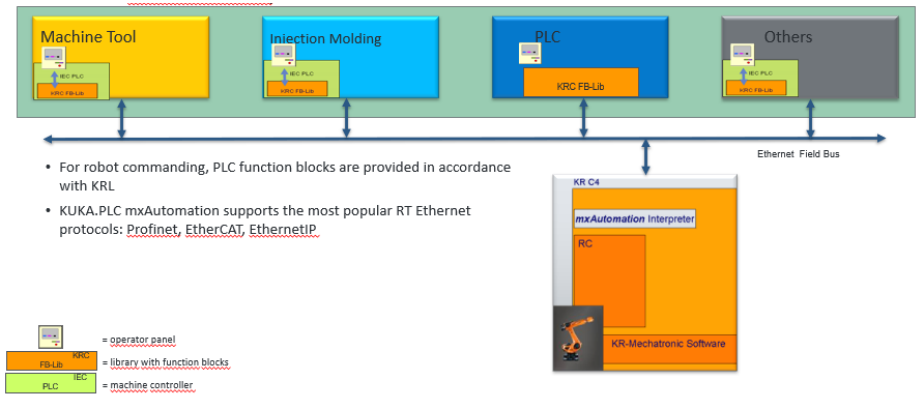
The concept:

- mxAutomation allows programming and commanding a KUKA Robot from a connected PLC
- The programmer/operator can set up, program and diagnosing the robot from the cell- or machine control (PLC), means in the environment he is familiar with
- Nearly all features and functions of KSS are available
- KRC and its mechatronic and safety functions are controlling all movements
- Robot programming skills are not required
- The operator has the same HMI in different applications



How it works:

- Part of mxA is an extensive library, mostly function blocks (FB´s), which will made available on the Engineering suite of the PLC
- FB´s will linked in the PLC language for sequence programming
- In execution mode the parameters are transmitted to the KRC via fieldbus cyclically
- On KRC site they are interpreted, executed, and the results are reported back to the PLC cyclically



mxAutomation – value propositions

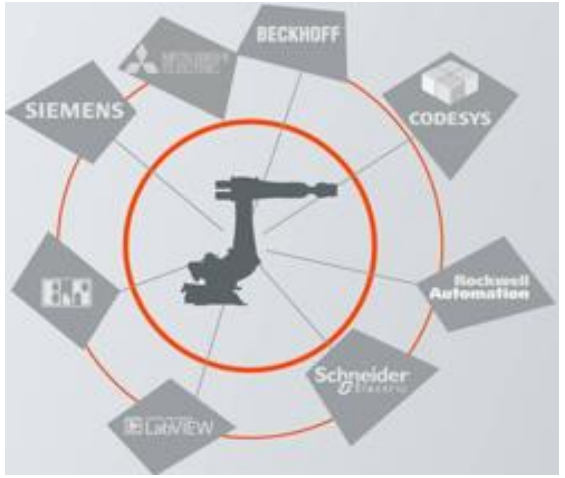
Use KUKA.PLC mxAutomation for commanding KUKA Robots in your language

High integration for user friendly automation solution

- Convincing concept – KUKA Robot is a participant of the PLC controlled cell or CNC machine tool
  - Consistent HMI for different applications
  - Everything can be done by one programmer/operator
  - No specific robot knowledge necessary for commissioning, programming and operating
- Much shorter configuration and set-up time
  - programming and diagnosis over PLC- or machine HMI
  - Simple robot commanding via function blocks
  - Nearly all KSS features can be used (e.g. Conveyor synchronization, vector move etc.)
  - KUKA.LoadDataDetermination callable from mxA
- Many KUKA technology packages are usable
- Lower cost per part – short cycle times and high product quality at minimized production area
  - Fast motion profile and high accuracy path planning of robot controller
  - KUKA.SafeOperation or KUKA.SafeVelocityMonitoring (options)

INTEGRATED BY KUKA

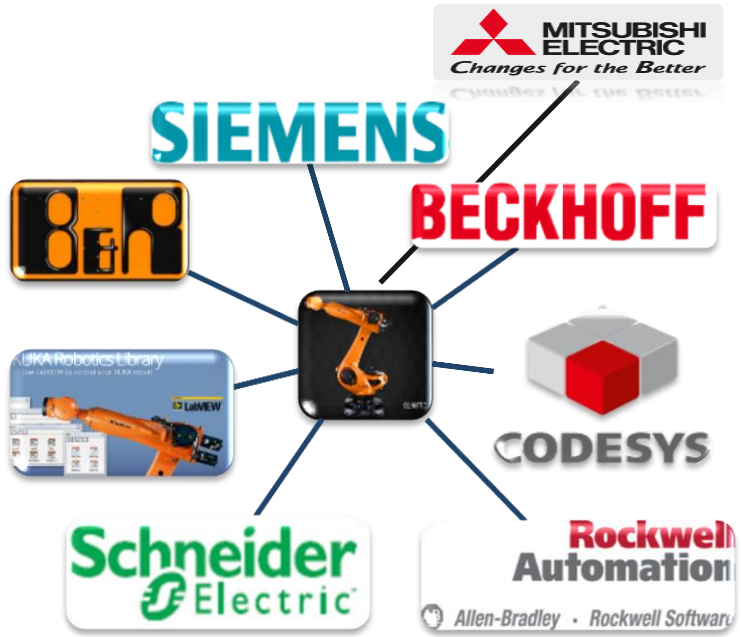
mxAutomation



mxAutomation – supports a wide range of PLCs

- **Siemens**
  - SINUMERIK (Run myRobot)
  - STEP 7 V5.4, S7-300 and S7-400
  - STEP 7 (TIA Portal), S7-300 and S7-400
  - STEP 7 (TIA Portal), S7-1500
  - TIA-Portal (SIMATIC)
  - SIMOTION
- **3S / CoDeSys**
- **AllenBradley / Rockwell**
- **NI / LabView**
- **Robots in Architecture (RIA)**
- **Beckhoff / TwinCat**
- **Schneider-Electric / Modicon**
- **B&R / X…**
- **Lenze / PLC**
- **Mitsubishi / CNC controller**
- **C++ oder C#**

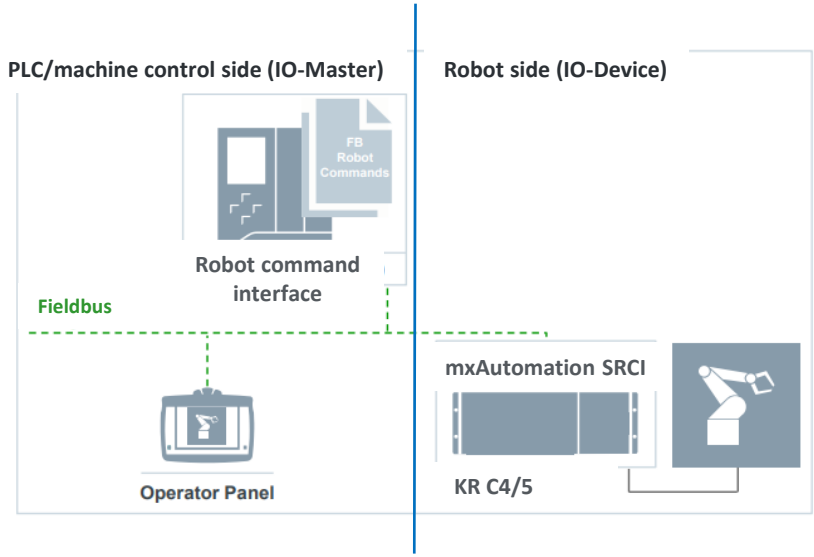
- **Supported by the most popular RT Ethernet protocols**
  - Profinet / ProfiSafe
  - EtherCAT / FSoE
  - EthernetIP / CIPsafety
  - UDP



mxAutomation – KR C4/5 integrated in PLC/machine environment

Project – Configuration – Programming – Diagnose

- Motion programs of the robots are fully integrated in the cell/machine control system and can be archived there
- All operation of the robot can be integrated into the HMI user interface of the system
- Diagnostic messages from the robot are sent to the cell/machine controller for further processed there or displaying on the HMI
- Remote access for service and maintenance (depending on cell/machine controller) extendable to the robot via standard functions



mxAutomation – applications - machine tools

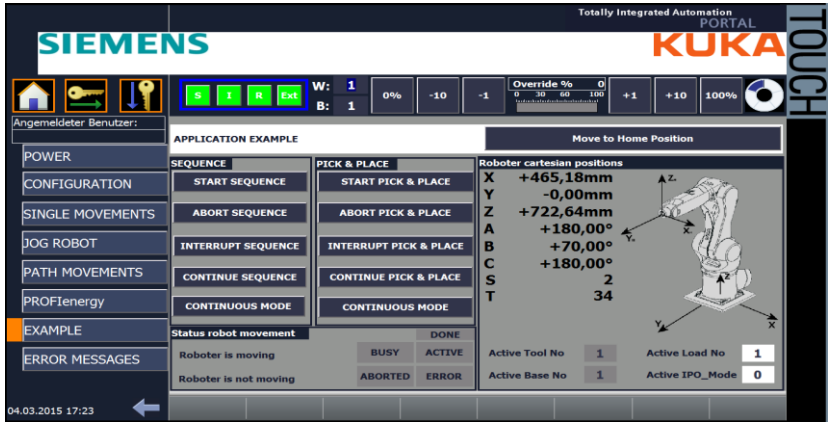
Siemens Sinumerik - Run MyRobot handling

- SINUMERIK commands the robot
- Examples from Siemens are available with complete documentation
- Worldwide support from Siemens and KUKA
- Robot control with a Siemens-Panel

https://www.youtube.com/watch?v=cU3E1R2vRaA&index=1&list=UU6HrPPoLdjNynZCvUrJbmBw

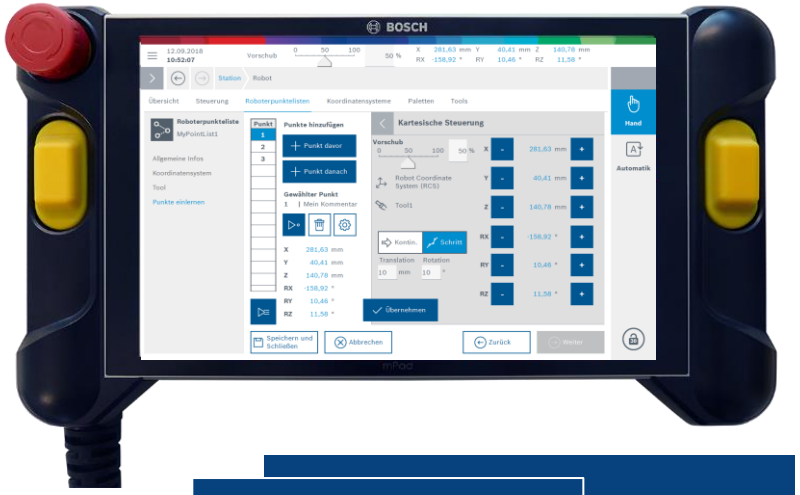
Siemens SIMATIC

- TIA Portal for project configuration, programming & diagnose
- Worldwide support from Siemens and KUKA
- Robot control with a Siemens-Panel
- https://support.industry.siemens.com/cs/document/109482123/controlling-a-kuka-industrial-robot-using-a-simatic-s7-1500?dti=0&lc=en-WW



mxAutomation – applications - machine tools

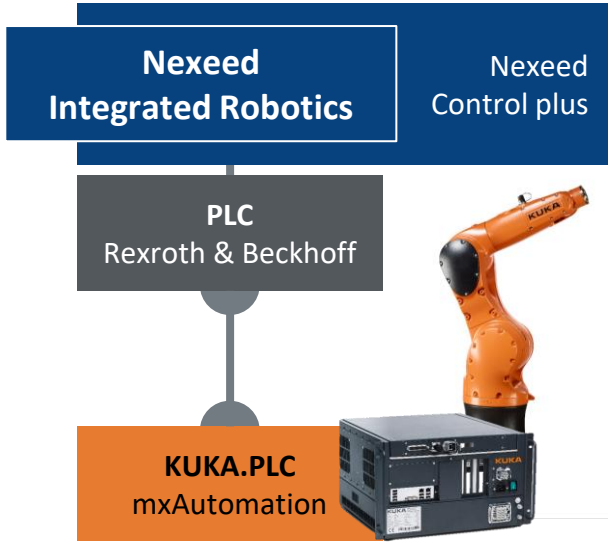
BOSCH
Invented for life



BOSCH Nexeed Integrated Robotics

- Fast commissioning due to standardized robot configuration
- Greatly reduced need for specific KUKA know-how
- Easily adaptable HMI for robot teach-in
- Programming in IEC-61131 programming system
- PLC-side coordinate transformation for vision-guided robot application
- A lot of additional functions: Point list management, pallet handling, space checks, ...
- Simple and fast creation of stable robot applications through provided application template

[Nexeed Automation | Bosch Connected Industry (bosch-connected-industry.com)]



mxAutomation – applications - plastic industry

ENGEL

- Single point of operation
  - using either the 22“ machine panel or the smart mobile robot panel
- Consistent operation for
  - KUKA industrial robots & ENGEL linear viper robots (up to 3 axes)
- Integrated production datasets
  - Parameters for process and products
  - robot sequences (spline), positions, …
- Graphical sequence programming

Features

- EUROMAP67 interface
- Vector move
- Flexible safety control for the entire cell / switchable areas for personal safety

[ENGEL duo 800 – YouTube]

mxAutomation – applications - beverage industry

MEMCO

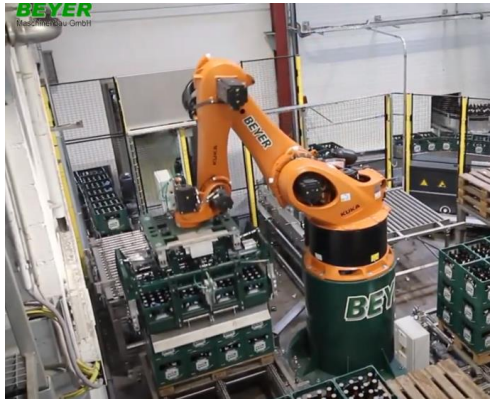
- Layer formation and palletizing by robots
- 4 x KR40pa´s with servo gripper for bushing bottle pack in the right position
- 2 x KR700pa roll grab for palletizing & 1 x KR120pa for intermediate layers
- Drink packages transport, Empty and loaded pallets management

https://www.youtube.com/watch?v=MfQWluIJM2M

BEYER Maschinenbau

- partial renewal of the filling line, capacity 18,000 bottles/hour
- Quantec KR240pa / KR C4 controller
- Combined de-palettizing/palettizing
- Palette handling empties transport, separating, cleaning, inspection, *filling

https://www.youtube.com/watch?v=Kte5NfwJ0j8&t=108s



*separate control system

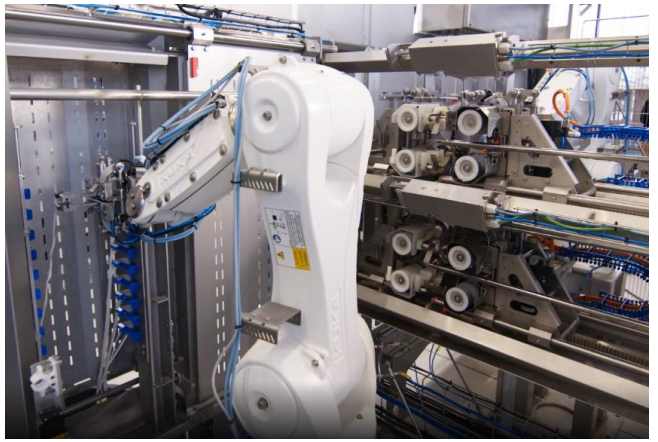
mxAutomation – applications - food industry

Proxima Centauri

- Cleaning, quality check & cutting of pork casings
- 2 x KR Agilus in the world's first complete solution for automated loading, caliber measurement, detection of perforations/holes, cutting and sorting of natural casings
- Optimized cutting accounting for changing diameters, length and holes by an artificial intelligent-powered algorithm
- Intuitive, user-friendly software interface
  - that can be operated by anyone after just a couple of hours of training
  - For rapid modification of operating parameters

→A complete, innovative, efficient and delayable solution for sorting and measurements

- SelectiCa Sorter P1 – Proxima Centauri Aps (proxima-centauri.dk)



mxAutomation – applications - pharma industry

LT Automation, Denmark

- KR3 and KR10 AGILUS are sorting up to 3.000 blood samples a day
- Supports hospital staff and ensures blood sample quality
- Takeing in the transportation box which consist off outer and inner box
- Correct placing is checked by a 3D camara
- Take out the blood samples and sort them for further analysis
- Flexible solution which can be customized

This amazing KUKA robot handles incredible 3,000 blood samples a day! – YouTube

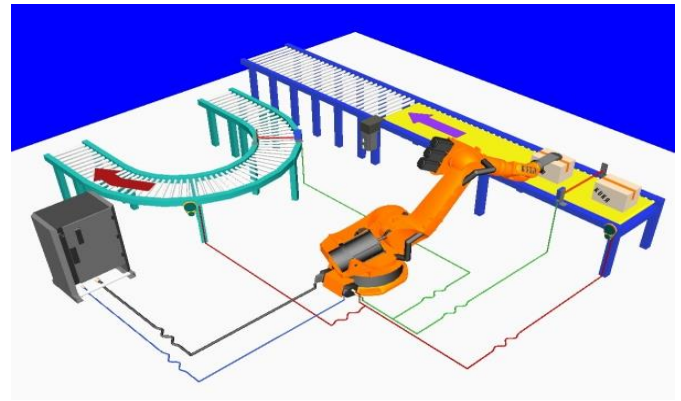
mxAutomation – main functions

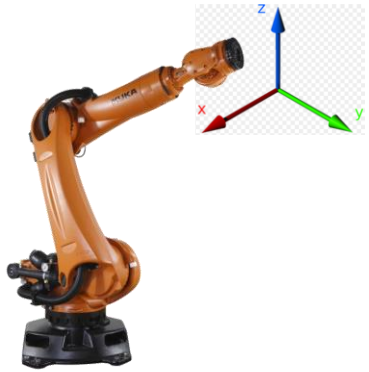
Motion

- Jogging and teaching via custom handheld
- LinearMove, DirectMove (PTP),CircularMove
  - Approximation
  - Triggers: Switch points on trajectories
  - Sequential control – Interrupts, Override, aborts,…
  - Control multiple robots on one PLC (up to 5 Robots)
  - Changing the BASE- and TOOL coordinate systems
- Conveyor synchronisation
- Vector move - allows to push the robot by an external force in cartesian directions

Control

- Reading and write digital and analog robot signals
- Reading and quitting (error) messages





mxAutomation – Improvements

mxA V3.3 for KSS8.6/7 (current architecture)

- Implementation of K customer requirements like ENGEL, 3M etc. in coordination with the stakeholders
  - JogMode → much higher usability (delay between pressing the jog button till move robot is much shorter)
  - Forward / inverse transformation inclusive Tool & Base (one command for calculation and Feedback) → faster result/shorter cycle time
  - Abort Commands – command active signal, brake reaction configurable → advanced applications
  - Tech functions – up to 12 direct return values on call → advanced applications
  - Approaching positions without S&T – fewer transformer calculations required→ less KRC computing power
  - KRC Initialize – detection of an absolute positioning accuracy robot
  - Conveyor tech Features expanded – DLIN usable → shorter cycle times
  - Delete Workpiece – Delete part on conveyor (component out of reach)
  - LoadDataDetermination (**option**) callable from mxAutomation
  - Safe velocity monitoring (**option**) for safe commissioning and jog mode also for SCARA and small robots (new derivate of safe operation technology)

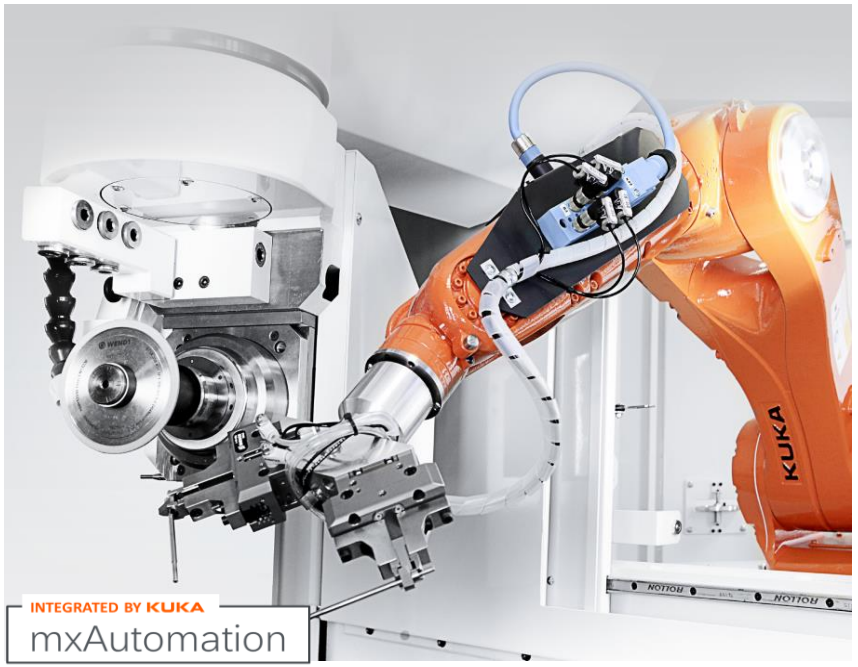
mxAutomation – outlook

Next version – mxAutomation v4.0

- Further developments in feature improvements and performance
- Implementation of **SRCI** core functions
  - SRCI: Standard Robot Command Interface

  ➔Project realization independent of robot brand and plc brand
- New product introduction in Oct 2024

For further information please get in contact with us

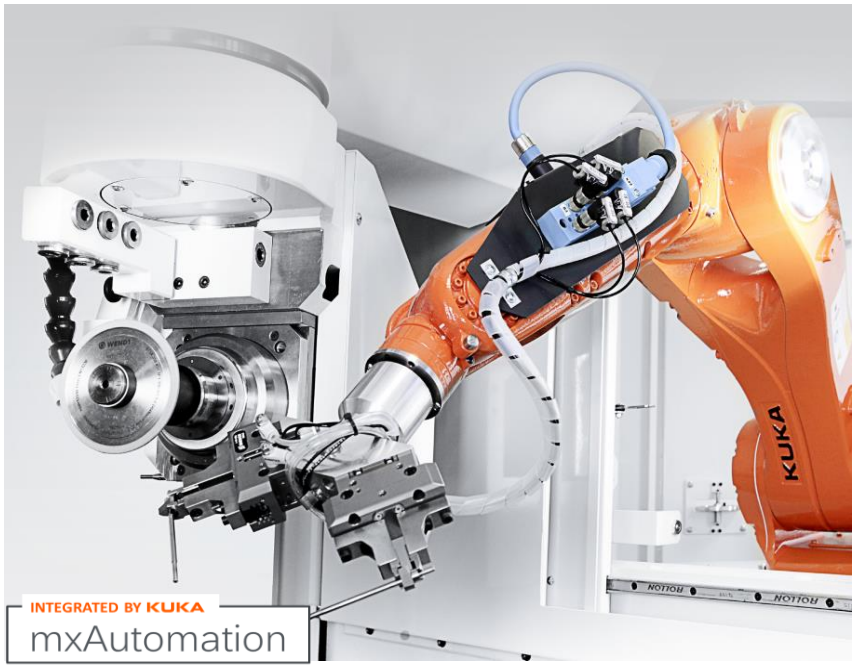


mxAutomation – summary

Summary

- mxAutomation enables external controllers to program and command KUKA Robots on the level of KRL instructions
- Robot programming knowhow is not necessary
- All operation of the robot can be integrated into the HMI user interface of the system
- Final execution, motion profile planning, mechatronic and safety control remains on the KR C4/5

→mxAutomation allows programming and commanding KUKA Robots in your language



mxAutomation – Contact Persons

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