

# KUKA



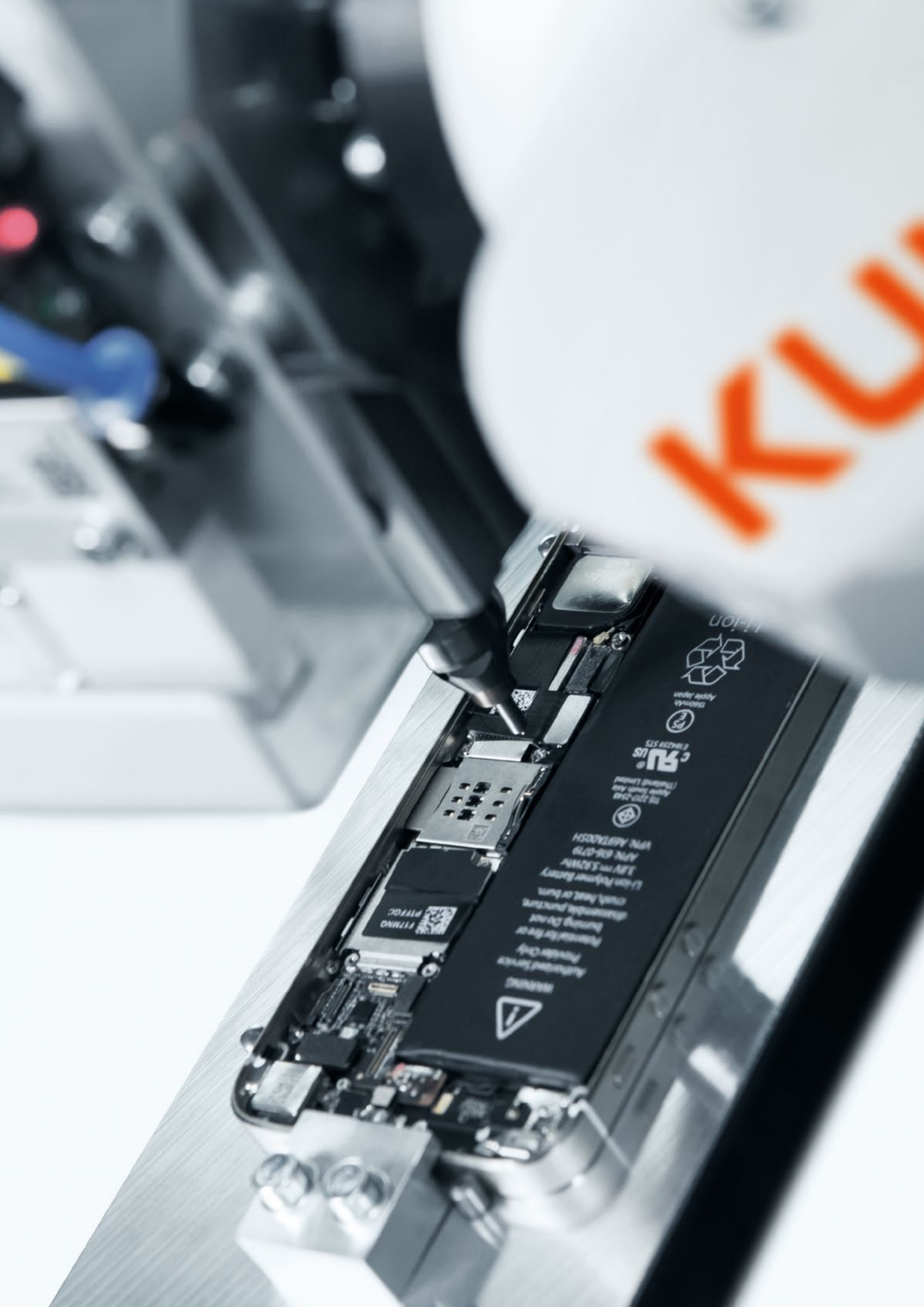
For the world of tomorrow.  
KUKA robots in the electronics industry.





## Perfectly adapted to market requirements. KUKA solutions for the electronics sector.

Dynamic, attractive, promising: the electronics industry is a growth market with great potential – and simultaneously fulfills system-relevant functions for sustainable digitized societies. It is a pioneer and driver of digital transformation. Its innovations constitute the basis for future cloud-based value networks and are already shaping everyday life and working practices worldwide. Successful companies can develop good ideas quickly and produce them flexibly. To this end, KUKA collaboratively develops agile automation solutions together with its partners. The result is individual recipes for success that make it possible to exploit opportunities in an attractive market quickly, optimally and profitably.



## Innovative technology setting the pace. Faster and more efficient with KUKA.

Intelligent displays, high-performance semiconductors, wireless communication – the rapid progress in electronics is making its mark on today's world.

Efficient automation with KUKA robots ensures that the enormous demand for new electronics products can be met quickly. And at the highest level of quality. Because powerful automation is much more than precision, speed and availability. It is the art of transforming ideas into practice.

Extreme speed and efficiency

High flexibility and adaptability

Impressive availability

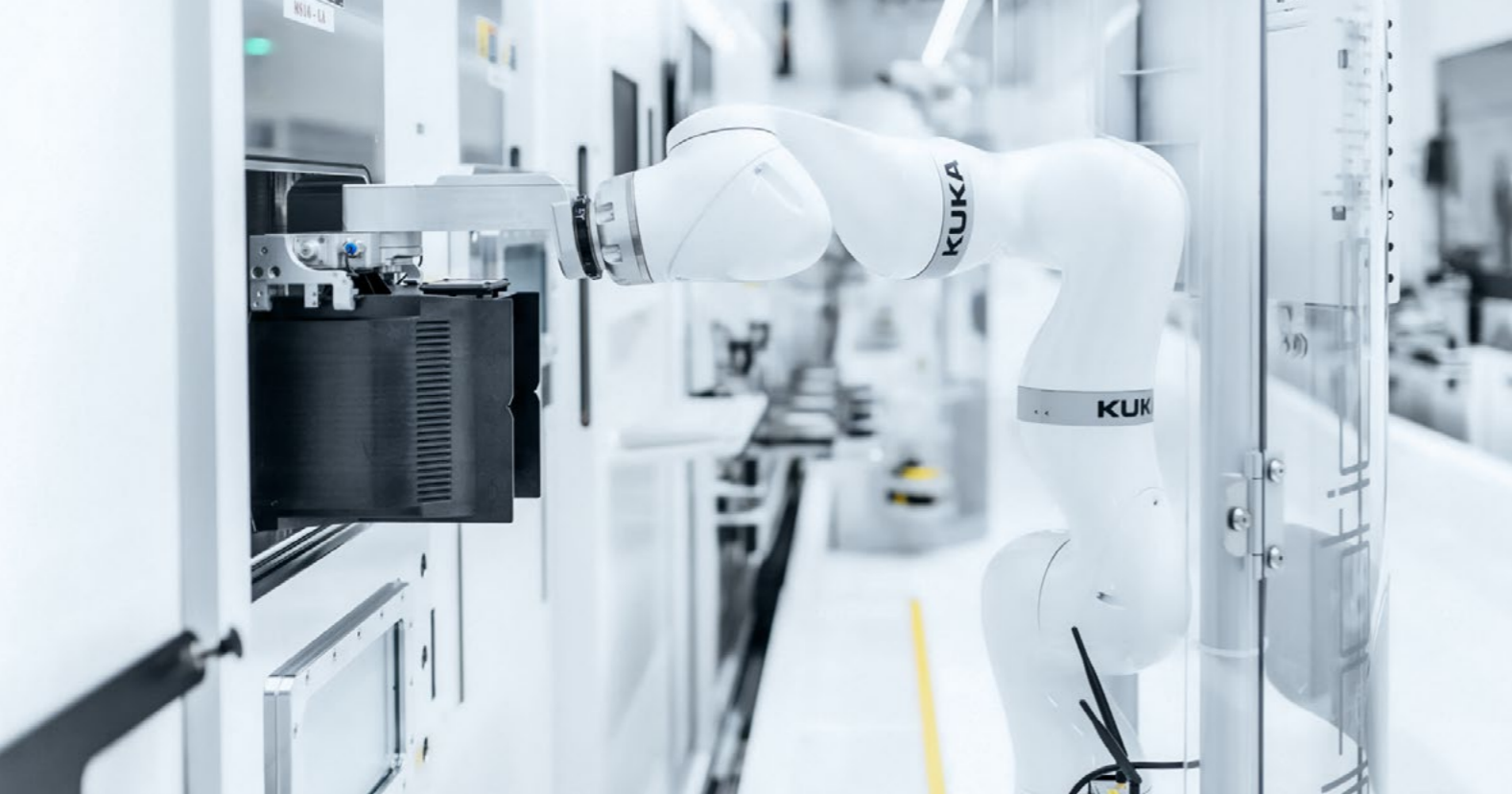
Maximum precision and  
high repeatability

**Greater profitability.** Robotic automation enables faster and more efficient production. Reject rates are sustainably reduced and the availability of 99.995% lies in a very reliable range.

**Supreme product quality.** KUKA automation solutions guarantee extremely precise production with high repeatability. Smart robotic solutions are integrated intelligently into the assembly process. Even the smallest parts can be handled with ease in pick-and-place applications.

**Short time to market.** Short production and innovation cycles demand great flexibility from electronics manufacturers. KUKA robots ensure fast reaction times – with consistently high quality and performance. This means that manufacturers remain efficient and successful.

**More competitive advantages.** With KUKA robotic solutions, every company gains new room for maneuver in the face of fierce price competition. Even small batch sizes can be produced. Ultimately, numerous, valuable competitive advantages can be generated.



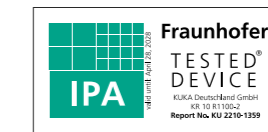
## Semiconductors in the electronics industry. Small chips for a big impact.

KUKA technologies and robots for cleanrooms meet the high requirements for purity, cleanliness and functionality in semiconductor production. At the same time, they combine extreme agility, first-class quality and utmost precision – even in the shortest possible time. Specifically for cleanrooms, KUKA offers low-particle and low-emission robots, cobots and platforms for the manufacture and safe handling of highly sensitive microelectronics such as wafers.

**The Fourth Industrial Revolution is in full swing.** And at the heart of it all: KUKA's many years of expertise in automation and robotics. Tight cycle times, top quality, repeatability, ultra-low particle generation and significant cost reductions are the requirements for intelligent automation in cleanrooms. To meet them, innovative products and individual concepts are needed – for both the construction of new plants as well as for the conversion of existing production facilities. KUKA supplies future-oriented Industrie 4.0 solutions for the semiconductor industry thanks to perfectly coordinated hardware and software. KUKA sensitive robots and mobile cobots can revolutionize demanding production environments. In doing so, they enable human-machine collaboration and pave the way for a new type of cleanroom automation.

**Mobile cobots for cleanrooms: safe handling of sensitive components.** The industrial manufacturing of tomorrow will require production and logistics concepts which are intelligently networked, modular, versatile and mobile. With the KUKA wafer handling solution, KUKA has developed the world's first solution from a single source for the automated transfer and handling of semiconductor cassettes. The application consists of a standardized automated guided vehicle (AGV) and the LBR iiwa lightweight robot as well as KUKA software. Additionally, a sophisticated gripper system has been developed. The mobile cobot navigates in all directions autonomously and without safety fencing. This guarantees safe transport and handling of the sensitive components (wafers, masks, carriers) from one process to the next.

**Precise and fast robots of a cleanroom class.** Cleanroom-relevant criteria are already taken into account during the development of our robots. Our standard robots are thus cleanroom-certified and suitable for many cleanroom applications. They also have easy-to-clean special surfaces as well as primer coatings, paint finishes and seals. As standard, they are also ESD-compatible and are tested and certified by Fraunhofer IPA for cleanroom suitability.



### Advantages for semiconductor production.



**Cleanroom robotics**  
Low-particle and low-emission robots as well as (mobile) cobots with a high cleanroom classification – for example, thanks to internally-located, encapsulated guide mechanisms and cables as well as integrated drive technology.



**Software**  
Because with KUKA the software and the hardware solution come from a single source – fast, flexible and individual integration of the system is ensured.



**Engineering & Customer Service**  
We offer individual, application-specific solutions with a global presence, a worldwide network of system partners, proven best-practice concepts and 24-hour support.



**KUKA TechCenters with global standards**  
KUKA Application & TechCenters are available as test laboratories for our customers at various locations around the world.

# 3C industry – computers, communications and consumer electronics. Faster, shorter, better.

Shortest delivery times, competitive prices – automation in the 3C industry enables cost-efficient production processes. Our powerful small robots and cobots guarantee precision and particularly fast cycle times in the manufacture of computers, cell phones, TVs and the like.

## Automation solutions for competitive electronics production.

No other branch of production is subject to such rapid changes as the manufacture of 3C devices, e.g. cell phones or smart-watches. Extremely short product development and life cycles coincide with maximum requirements in terms of speed and precision. For this reason, many manufacturing steps are still performed manually in the 3C industry.

Our robots for the 3C market provide the answer here: they can be implemented quickly and set standards in terms of accuracy and speed. Both the robots and their controllers require extremely little space in production. The advantageous price ensures that the return on investment is maintained even in the case of short product life cycles. Furthermore, KUKA offers its customers worldwide one of the best service portfolios in the industry with its digital service and local contacts.



### Cut costs

- Increased productivity
- Improved efficiency
- Stable cycle times
- Short cycle times
- On-the-fly operation
- Fast changeover for new production tasks



### Enhance quality

- Low susceptibility to errors
- Automated processes
- Better product quality
- Precision
- Consistent results
- High payloads possible



### Relief of personnel

- Performance of monotonous tasks
- Simple operation of the robot controller
- No programming skills required
- Reduction of ergonomically unfavorable movements
- Human-robot collaboration



### Wide range of robotic solutions

- Production processes from screw fastening to packaging
- Simple reprogramming
- Sensitive assembly
- Cleanroom solutions
- Robots in ESD design

The right solution for the most important processes in the 3C electronics industry.



**Assembly.** From powerful pressing in TV rear panel assembly to the delicate insertion of USIM holders in smartphones – sensitivity plays an important role in the manufacture of computer, communication and consumer electronics. Installing a force-torque sensor on the AGILUS flange makes the robot work almost like a human hand.

**Fasten.** The automation of screw fastening processes with robots eliminates many manual work steps, sustainably reduces error rates and increases the output rate. It makes a major contribution to production efficiency in the 3C market.



**Gluing.** In bonding and 3D bonding applications, various requirements come together: Different gripping positions must be localized, paths must be followed accurately and target positions must be addressed precisely. Automating adhesive bonding processes greatly reduces the error rate.

**Quality control.** Manufacturers of 3C devices are dependent on reliable quality control in order to be able to provide guarantees. Smart robotics concepts ensure automated final inspection of products with torque control, force control and vision inspection.

**Handling.** Manual handling can become a health challenge for employees. Robots provide support, for example, by means of reliable assembly, fast labeling or careful packaging, regardless of whether the components are small, heavy or bulky. Safe human-robot collaboration is also possible with our cobots.

**Loading and unloading.** The loading and unloading of machine tools requires precision. However, automation makes processes not only more accurate, but also faster.

**Palletizing and depalletizing.** Customized automation cells with robots and vacuum grippers can be developed for palletizing tasks.



**Pick and place.** Conveyor belts that do not have to be stopped – automated pick-and-place makes production significantly more efficient. Handling by the robots can be precisely adapted to the speeds. In automated production flows, it is also possible to use multiple robots simultaneously – the so-called KUKA. RoboTeam – for heavy or large parts.



**Polishing.** If the polishing of glass is performed manually, many employees are occupied moving glass panels of diverse sizes into position. In the case of automation with a polishing machine, a robot system tends up to six polishing machines simultaneously and the pick-and-place tasks can also be performed automatically.

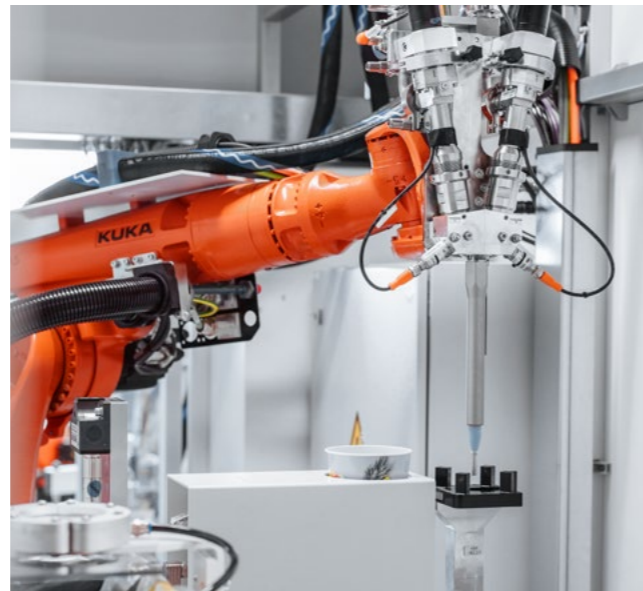


# Automotive electronics from KUKA.

## Mobility reconceived.

Electromobility is on the fast track and demand is growing steadily. As one of the world's leading experts in automation, we understand both the automotive and electronics industries and know what challenges our customers face in the further development of e-mobility. This is why we offer precise, high-performance small robots with special certifications as well as maximum flexibility for the rapidly changing requirements in automotive electronics.

**This is how KUKA contributes to e-mobility.** KUKA supports companies in reaching their goals safely – with the right know-how, robots and software. This is because KUKA industrial robots, cobots and mobile robots impress with their performance, precision and energy efficiency. They allow modular design concepts for production and quickly adapt to new circumstances. They are also specially designed for handling sensitive electronic components.



**Cobots and industrial robots support production, quality inspection, packaging and palletizing.** They have certificates for ESD, cleanrooms and dry rooms. This makes them as safe as possible in electronics sector, low in particles and emissions, as well as extremely robust. The robots are used in areas such as assembly, adhesive bonding processes, component inspection, conventional screw-fastening and handling processes and in the sensitive connection of flexible cables. High voltage is extremely dangerous for humans – but no problem for our KUKA robots.

### Advantages for automotive electronics.



#### KUKA expertise

As an expert with comprehensive know-how in the automotive and electronics sectors over many years, KUKA supplies the necessary robots and software for the electronic components of the vehicles.



#### Certificates

High-quality KUKA robots have ESD, cleanroom and dry room certificates for the manufacture of electronic components for the automotive industry.



#### Equipment

KUKA robots easily take over strenuous and dangerous processes, impressing with their performance, precision and efficiency.



#### Flexible and modular use

KUKA robots carry out a wide range of tasks relating to electronics production for vehicles – from the cleaning of components to palletizing tasks.

**KUKA: intelligent automation solutions for battery production.** The battery cell is the heart of the electric vehicle. KUKA robotics support companies along the road to the pouch cell, the prismatic cell or the cylindrical cell for the battery. Most car battery cells use lithium, which can only be produced in extremely dry

air in order to exploit its full memory capacity. That is why KUKA has developed and certified the KR AGILUS for the dry rooms. The six-axis jointed-arm robot works quickly and precisely in humidity levels below 1 percent. This ensures the production and quality of each individual battery cell.

The **battery management system (BMS)** provides all the necessary functions to operate a battery safely. For example, it records charging/discharging cycles, temperature fluctuations and other relevant data.

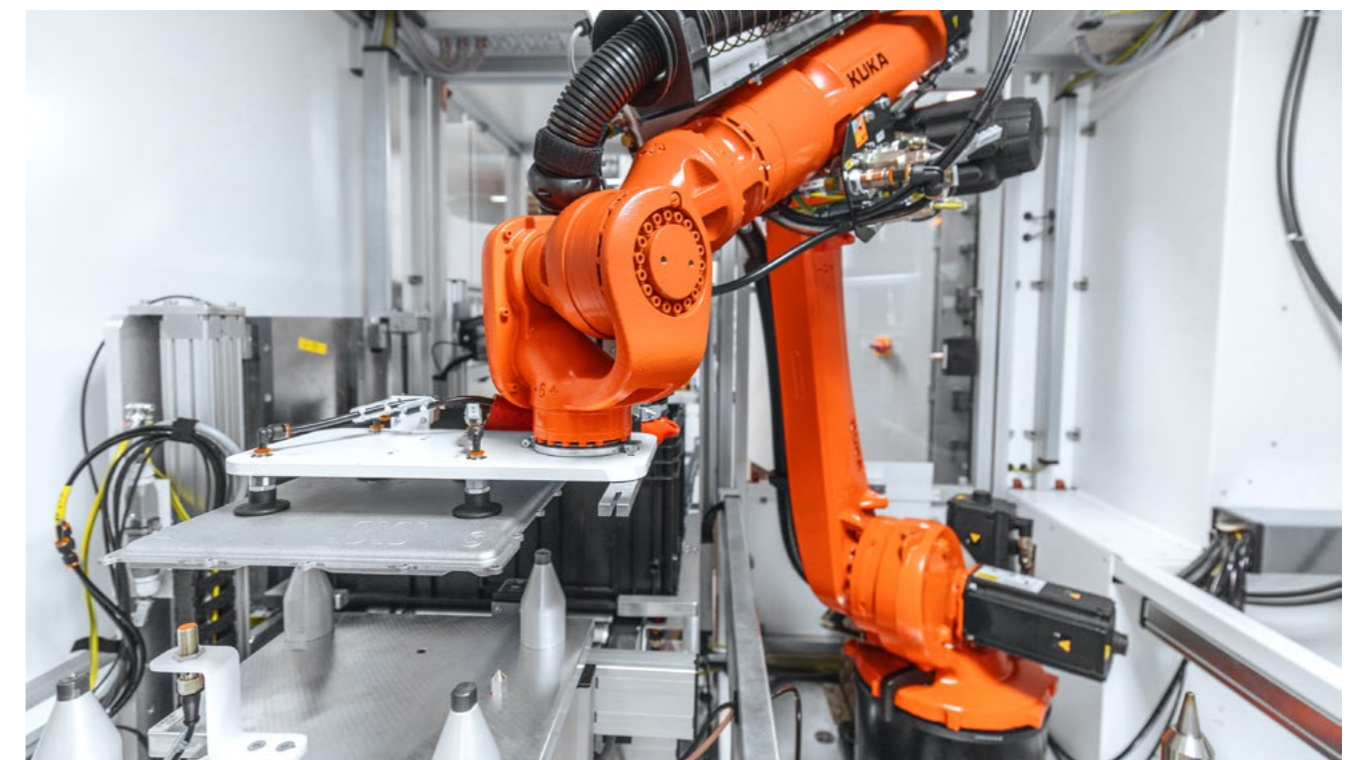
### Electronic components in which KUKA robots are used.

**Thermal management system:** protects the battery from high thermal fluctuations, ensuring a longer battery life.

**Inverter:** converts direct current into alternating current – the 'fuel' that the electric motor can use.

**DC/DC converter:** transforms the voltage of the high-voltage battery into handy 12-volt loads that keep the on-board power supply running.

**Supercomputers:** ensure fast Internet connection, regular security updates and new driving functions. Reliable, extreme precision robots are used for the highly complex technology.





## More efficiency in the white goods industry. Automated production of household appliances.

The use of robots enables flexibility and ensures that the manufacture of household appliances becomes productive and cost-efficient. We have an eye on the challenges posed by the different production processes – and offer simple robot operation.



**Greater efficiency by using robots in the production and final assembly of household appliances.** White goods is the generic term for the wide variety of electronic household appliances – from washing machines and refrigerators to tumble dryers and dishwashers.

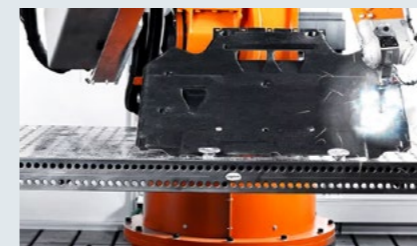
Their production poses a wide variety of challenges: assembly inside appliances, including overhead work and heavy appliance components. At the same time, safety standards and quality guarantees have to be observed. Manufacturers need innovative and simple answers for automation if they want to keep their production efficient and cost-effective despite the many demands.

Automate your production processes in the “white goods” industry.

From the pre-assembly of washing machine drums or the laser cutting of dishwasher parts to final quality assurance – KUKA always has the most efficient automation application for your white goods manufacturing process.



**Handling.** From washing machine floor panels and doors to the loading of conveyor systems for pre-assembly or even preparing finished products for shipping – when it comes to handling, robots not only make light work of heavy-duty tasks – every motion is also collision-proof and can be documented thanks to integrated camera systems.



**Laser cutting.** In many production facilities, laser cutting is often still a manual process that takes a long time and incurs enormous costs. With the world’s first laser cutting offline system, KUKA is bringing laser cutting processes for refrigerators to the production line – and ensuring cost savings for companies.



**Welding.** Different welding technologies are used in the production of electrical appliances, for example for connecting pipes inside refrigerators by means of high-frequency welding. The position of the pipes is detected and the high-frequency welding gun is applied with precision. Spot welding or roller seam welding is also used for joining sheet metal parts in washing machines and tumble dryers.



**Painting.** Painting is often an ergonomic challenge for production workers, for example when overhead working is required. If a painting robot takes over this task, this not only has a positive effect on employee health, but also reduces cycle times. It goes without saying that our robots have explosion protection.

**Assembly.** Assembly is especially challenging with parts that are bulky, heavy or hard to reach. With their payload capacity and reach, robots enable easy handling and can be used, for example, to mount weights in washing machines quickly and precisely.



**Fasten.** Especially in ergonomically unfavorable locations, such as inside electrical appliances, robots play an important role in screw fastening in terms of ensuring employee health and fast cycle times. Material tolerances are compensated with the aid of a vision system.

**Bonding and sealing.** The requirements on bonding and sealing applications are high because the joints have to be stable over a long period and, at the same time, the joining processes must be cost-efficient. Precision is also of decisive importance: this applies to the precise fit of the components to be bonded on the one hand, and to the repeatability of the integrated supply of adhesives on the other.

**Quality control.** Reliable quality assurance has a major impact on the manufacturing costs of white goods. If it is automated and integrated directly into the production process, expenses and risks can be greatly minimized.

# Battery cells. The high demand calls for the automation of battery production.



**Robot-based automation as the key to flexible battery cell production.** The battery industry is currently in turmoil due to evolving cell technologies. This increases the demands on production systems to be ready for future technologies. KUKA robots in battery cell production are ideally suited to changing production requirements. Our simulation tools help to generate digital twins and avoid possible collisions with larger cell geometries. Different tech packages and application software simplify commissioning and enable quick adjustments without extensive programming knowledge.

A decisive advantage is the universal KUKA robot portfolio. KUKA offers all kinematics such as DELTA, SCARA, linear and six-axis kinematics. All are operated with the same controller architecture and can therefore all be programmed with the KUKA KRL programming language. This means that the maintenance personnel in the battery cell production plant only have to learn one programming language, which they master much better than when several languages have to be learned and applied. In addition, this offers advantages in maintenance, servicing, repair and spare parts.

**Different cell architectures/housings are used in battery cell production.** Depending on manufacturer and customer preferences and corresponding production technologies, the respective cell types are used. They have different advantages in terms of energy density, cell chemistry options and production volume.



**Pouch cells**



**Cylindrical cells**



**Prismatic cell**

Energy density at cell level	High (low housing weight, good space utilisation)	High (low housing weight, very good space utilisation)	Medium (increased housing weight, not fully utilised)
Mechanical properties	Low stiffness (force transmission through enclosure limited)	Very high stiffness	High stiffness
Thermal properties	Good surface-to-volume ratio, efficient temperature control	Poor heat dissipation	Good surface-to-volume ratio, efficient temperature control
Solid-state battery suitability	Yes	No	Conditionally
Standardized size	No	Yes	No

Robots are used for loading, unloading and handling (lithium-ion) batteries. They are adapted to the specific environmental requirements and are suitable for both clean room and dry room applications. As the battery material must be protected from moisture, our robots can work in production at a humidity of less than 1 percent. In order to achieve a high level of purity in battery production, our robots have been designed to emit as few particles as possible. In addition to series specially developed for the low ISO cleanroom range, standard series have been measured and certified in the cleanroom. All KUKA robots for battery production are ESD-certified to protect against spontaneous, unwanted discharges.

An important manufacturing process in battery production is the stacking of electrodes, where robots work precisely and efficiently in three-dimensional space. This minimises air pockets and optimises the subsequent evacuation and electrolyte filling. The sealing of the battery cells is carried out according to the cell type, whereby KUKA offers high-quality ultrasonic welding or laser welding based on its experience in robot-guided welding and can flexibly adapt to changes in the cell geometry and welding processes.



## Architecture

Huge range of different cinematics, all with the same controller architecture, same programming language



## Flexibility

Different battery sizes possible to be produced



## Scalability

Increase production volume when necessary



## Quality

High production quality



## Safe

Safe production lines to minimize risks



## Reliable

Stable production with no downtimes and less maintenance



## Global

Rollout and production ramp up possibilities as well as global services



## Sustainability

Environmentally friendly and sustainable



## Cost-Efficient

The production needs to be cost efficient



## KR AGILUS. Custom-tailored for maximum performance in production.

**Little helpers – great help.** Different versions, installation positions, reaches and payloads transform the compact six-axis KR AGILUS robot into a precision artist.

Thanks to the integrated energy supply system and the new KR C5 micro controller, the KR AGILUS achieves the utmost precision in confined spaces. The Safe Robot functionality paves the way for innovative automation concepts. Whether for cleanrooms or potentially explosive environments, or with a particularly hygienic or splash-proof design: every version of the KR AGILUS is always precise and designed for very high working speeds.



## KR SCARA. Geared for maximum efficiency.

**Strong, fast, precise.** From the assembly of small parts to material handling or inspection – the ultra-compact KR SCARA robots immediately deliver maximum efficiency and cost-effectiveness.

The 4-axis KR SCARA robots have an internally-routed media supply for air, power and data – a complete package for the smart integration of peripheral devices and the quick adaptation of the KR SCARA robot to almost any desired application.



## KR C5 micro. Small footprint with big-time performance.

**Maximum performance, connectivity and flexibility in the smallest of spaces.** The KR C5 micro unites robot, PLC, motion and safety control in an ultra-compact housing with a volume of just 16 liters.

The controller can not only be seamlessly integrated into existing automation landscapes, for example, but can also easily take on KR C4 applications as a “functional twin”.

The KR C5 micro is equipped with the necessary hardware resources and flexible I/O ports in order to adapt quickly to future tasks and standards as well. It is the first KUKA controller to run both KUKA.SystemSoftware (KSS) and iiQKA.OS, the next-generation operating system from KUKA.

## LBR iisy. The cobot all-rounder for a new era.

The LBR iisy is flexible, intuitive to operate, quick to implement and safe in collaboration with humans, making the automation of tasks easy. It runs on the iiQKA.OS operating system and is supported by the iiQKA ecosystem.

**Intuitive.** Easy programming with straightforward manual guidance.

**Collaborative.** Enables direct collaboration with humans without fencing.

**Sensor-assisted.** Detects collisions and measures process forces.

**Flexible.** Easy installation of components, quick reuse in new applications.



## KMP 600-S diffDrive. With more movement for a flexible production process.

**The KMP 600 S-2 is a mobile platform that moves flexibly in space.** The autonomously controlled platform, in combination with the latest KUKA.NavigationSolution, integrates seamlessly into the production process. The KMP 600 S-2 provides cost-effective support for your warehouse organization or between manufacturing processes – and is used only as needed.



## KMR iisy. Always on the spot – safely.

**Optimizes your production significantly.** The KMR iisy is a combination of the intelligent and sensitive LBR iisy lightweight robot and a mobile, flexible platform. Maximum mobility and autonomous working methods significantly optimize your production and open up a wide range of potential applications.



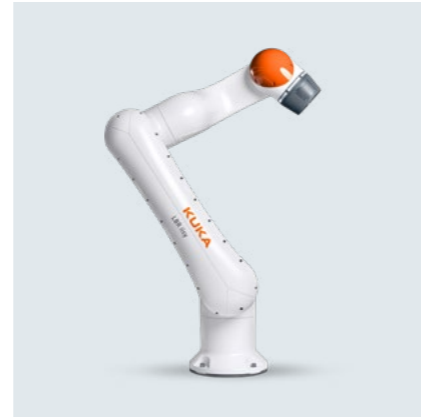
# The spectrum of KUKA robots. Intelligent solutions for your individual requirements.



**KR AGILUS.** The KR AGILUS enables you to tap new fields of application through its versatility. Irrespective of the installation position – whether on the floor, ceiling or wall – it offers the utmost precision in confined spaces (for example, as a WP variant for use within machine tools) thanks to its integrated energy supply system and the new KR C5 micro controller.



**KR SCARA.** The ultra-compact KR SCARA robot delivers maximum efficiency and cost-effectiveness, whether in the assembly of small parts, material handling or inspection. Thanks to an integrated media supply, the robot can be quickly adapted to virtually any application.



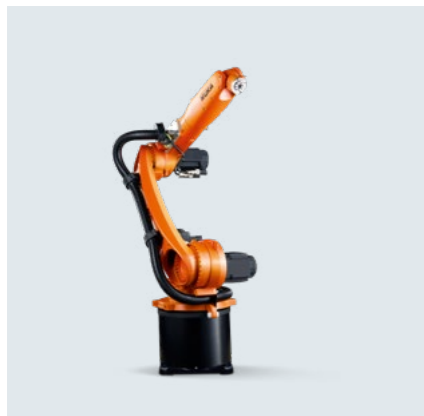
**LBR iisy.** The LBR iisy is flexible, intuitive to operate, quick to implement, safe collaboration with humans and thus a cobot all-rounder for automated production. It combines the ability, precision and reliability of industrial automation with the intuitive flexibility of an intelligent device.



**ESD robots.** ESD robots ideally protect against electrostatic charging or discharging. From assembly to inspection and packaging of electronic consumer goods – KUKA offers various robot series in ESD design with electrically conductive elements and surfaces as standard for electronics production.



**CR robots.** KUKA offers three robot types for use in cleanrooms: the KR AGILUS CR, the KR CYBERTECH CR and the LBR iiwa CR. Airborne particles are avoided and, thanks to special seals, the robot does not generate dust or particles caused by seal abrasion.



**KR CYBERTECH nano.** The robots of the CYBERTECH nano family set new standards in terms of performance, flexibility and precision. Unique in their broad range of abilities, the robots are optimally suited to handle small components, welding, palletizing or adhesive bonding.



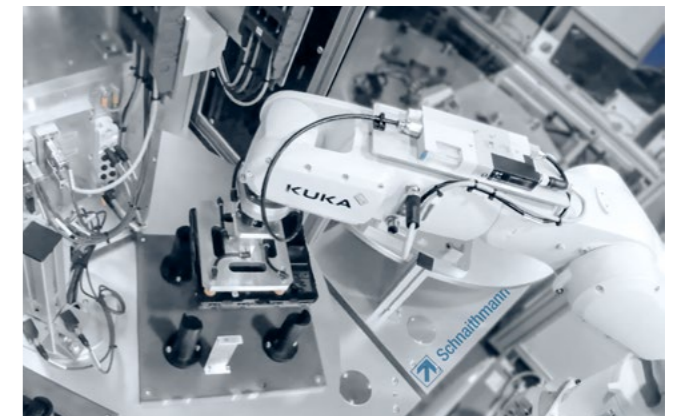
**KMP 600 S-2.** The KMP 600 S-2 is a mobile platform that moves autonomously and flexibly in space, delivering modular, versatile and, above all, mobile manufacturing concepts to the electrical industry. KUKA.NavigationSolution contains all the components for controlling the AMR.



**KMR iisy.** The KMR iisy combines the strengths of the sensitive LBR iiwa lightweight robot with those of a mobile, autonomous platform in a single system. The KMR iisy is location-independent and highly flexible – thus opening up a wide range of potential applications.





**Dry room solutions.** The KUKA KR AGILUS is used for handling at very low humidity or a very low dew point. Thanks to smooth surfaces and internal connection technology, it achieves top performance and maximum productivity – even in dry rooms.



**TechCenter.** Across the globe, KUKA, together with system partners in the Application & TechCenters, offers the opportunity to test automation projects under real conditions with feasibility studies, test setups and simulations – and that on-site or online with the help of professional experts.



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