



ROBOT AND MECHANICAL DESIGN



Again and again, people discover a mechanical principle that is ahead of its time. Like the mechanical design of KUKA robots.



Every day, people think about how they can make their work easier. Here is the state-of-the-art solution.

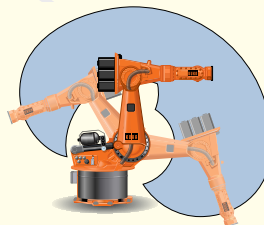


The first cranes were used in the 1st century for building work. They were clumsy to maneuver, however, and their radius of action was small. This did not change until the 15th century, when the slewing crane was invented – with flexible axes for slewing, lifting and lowering.

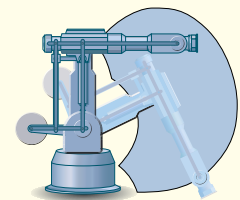
2 GREATER MANEUVERABILITY



The key to greater productivity. KUKA robots are masterful movers with a superior “fist-shaped” work envelope. They can work “overhead” or even reach back “over their shoulder”, thereby giving maximum space utilization and making room for more productive, space-saving system concepts. Here there is practically no alternative to a KUKA robot.



KUKA ROBOT

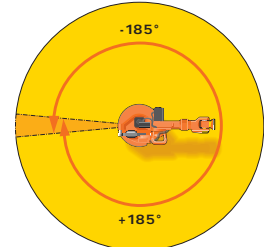


PARALLELOGRAM ROBOT

Many developments in the history of engineering show that the more functional and flexible a system is, the better it will work – and that it will eventually supplant the other systems. The same is true of KUKA robots as against parallelogram robots. The unique maneuverability of KUKA robots allows the arm to swivel up over the robot's "head" or backwards over its "shoulder". At first sight, this extension of the working range may seem small – but a closer look reveals the new potential for rationalization. KUKA robots can realize system concepts that are more compact, more flexible and more efficient. Why not build on these advantages when planning your next project?




KUKA robots move faster. With a rotational range of approx. 370°, the base axis of KUKA robots can execute more than a full turn. The advantage of this is that the robot can operate without a change of configuration in certain applications – and so carry out its work more quickly than conventional robots.



KUKA robots: ideal for realizing space-saving, cost-effective system concepts. The robots work hand in hand, occupying a minimum of space. And on top of such tasks as welding, the robots also carry out the parts feeding. Productivity is increased considerably – the ultimate in rationalization.

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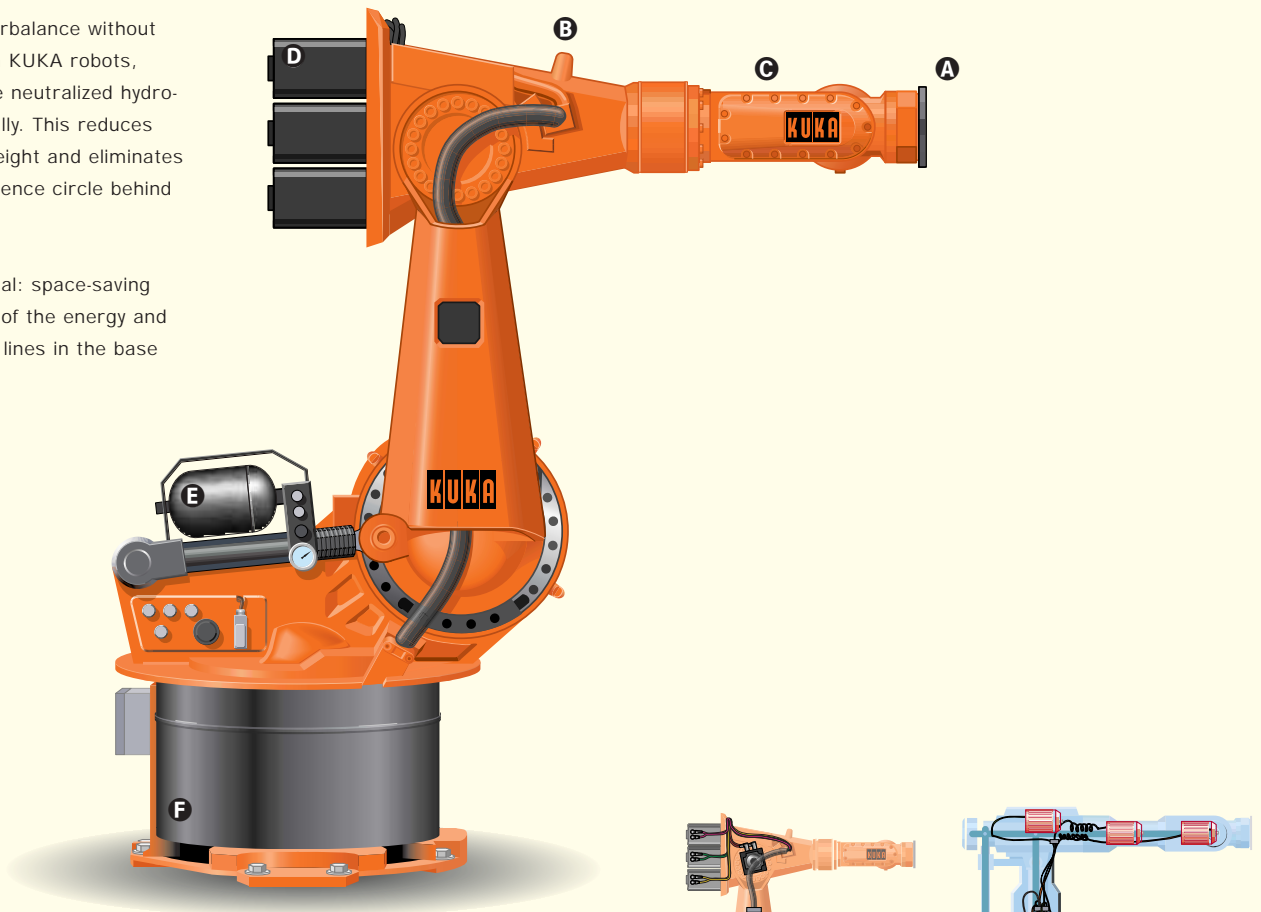
 In 1309, an unknown Milanese inventor was – quite literally – ahead of his time: he designed the first mechanical clock, ringing in a new technological era with his innovative design principle.

THE ORIGINAL ARTICLE: THE KUKA JOINTED-ARM ROBOT AND ITS ADVANTAGES

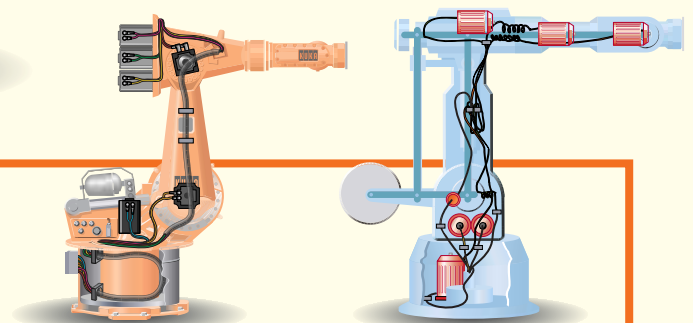
- A** Full payload: the point of application lies beyond the 6th axis.
- B** Irrespective of the payload, KUKA robots can carry a supplementary load of between 10 and 150 kg.
- C** The payload and supplementary load together make up an impressive total load, which can be moved at full speed and with high repeatability.
- D** Optimally positioned: the maintenance-free AC servomotors are easily accessible from the outside.

E Counterbalance without weights: on KUKA robots, masses are neutralized hydro-pneumatically. This reduces the total weight and eliminates the interference circle behind the robot.

F Practical: space-saving integration of the energy and fluid supply lines in the base frame.



In comparison: the internal energy supply system. On a parallelogram robot, if a single cable becomes worn, the whole robot has to be opened up. And the unfavorable weight distribution of the motors affects the dynamics, repeatability and absolute accuracy. Not with KUKA robots: everything is easily accessible, simple to exchange and optimally positioned.



KUKA ROBOT

PARALLELOGRAM ROBOT

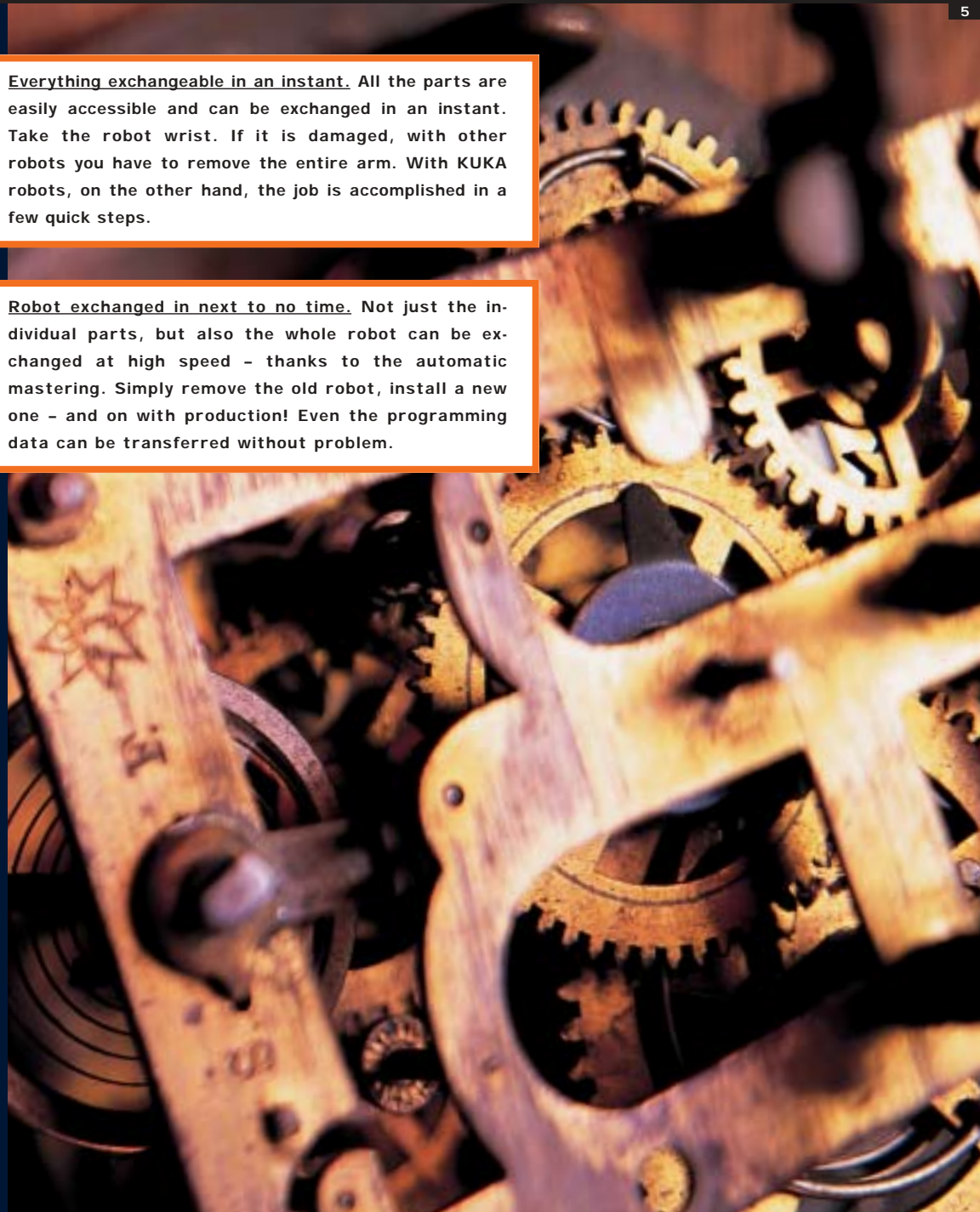
With the invention of the six-axis jointed-arm robot, KUKA has been speeding ahead since 1990, outstripping its competitors by years: this design made it possible to significantly extend the work envelope, reduce the number and weight of assemblies, and eliminate the interference circle inherent in other robots. Another advantage is the highly functional and easily accessible arrangement of the individual components: this provides outstanding load capacity and ease of maintenance. Recently, the KUKA mechanical design has been gaining more and more ground on the market – a confirmation of its superiority.




Everything exchangeable in an instant. All the parts are easily accessible and can be exchanged in an instant. Take the robot wrist. If it is damaged, with other robots you have to remove the entire arm. With KUKA robots, on the other hand, the job is accomplished in a few quick steps.



Robot exchanged in next to no time. Not just the individual parts, but also the whole robot can be exchanged at high speed – thanks to the automatic mastering. Simply remove the old robot, install a new one – and on with production! Even the programming data can be transferred without problem.

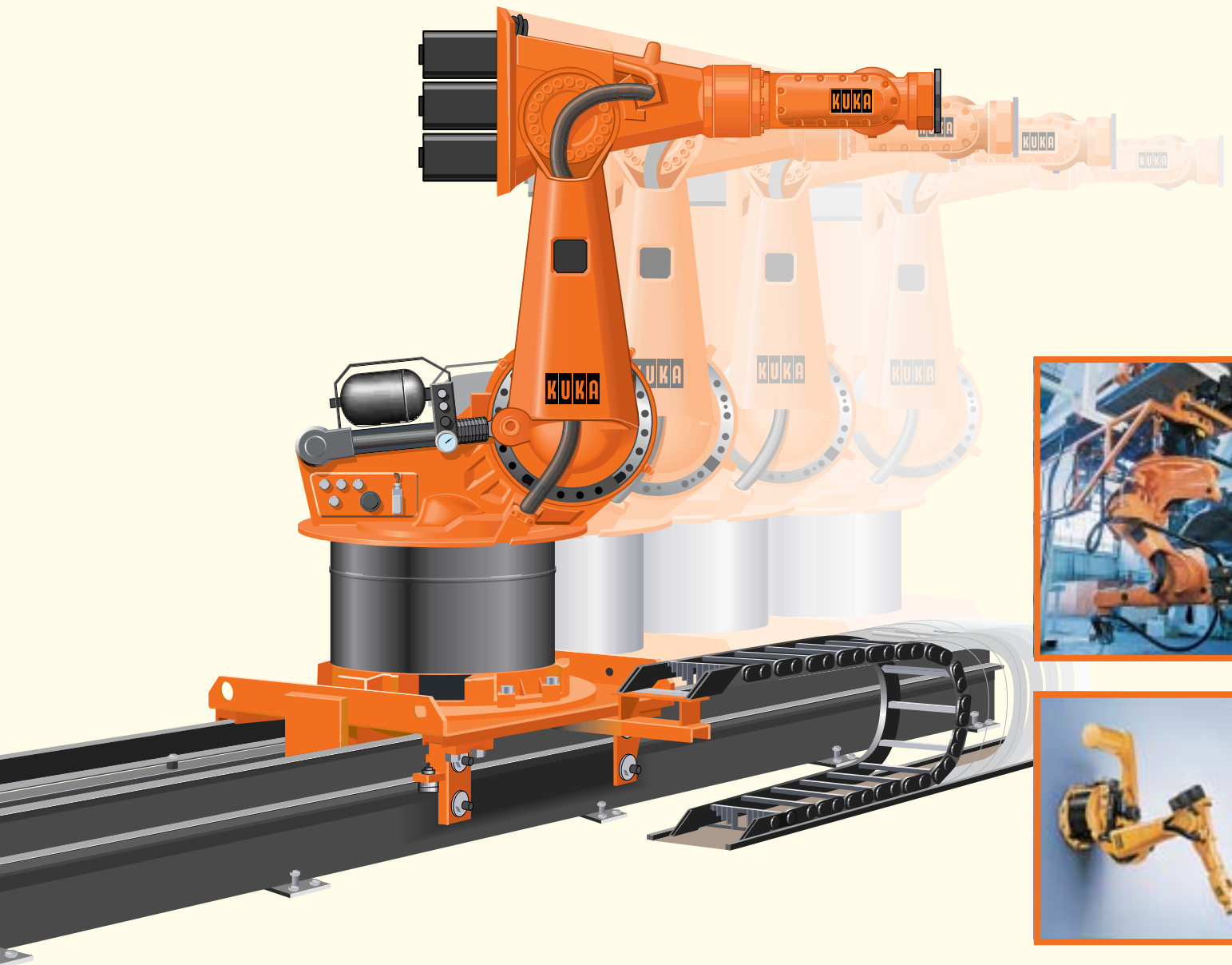


Everything turns on greater flexibility.
That's why we've reinvented the "wheel" for our robots.

 Progress rolls on: to move heavy loads from one place to another, the wagon wheel was invented around 3200 BC - and at the same time the first axle in human history. No other invention has done so much to make people's lives easier.

6 KUKA BUILDS MOBILE ROBOTS

The KUKA linear units KL 250 and KL 1500 make robots mobile. In this way, a single KUKA robot can, for example, serve two machines that are some distance apart - thereby ideally doing away with the need for a second robot. Linear units can be individually configured to the customer's specifications.



Early on, KUKA had the idea of giving its robots additional axes: the linear unit was born. The linear unit allows the robot to move from A to B as if on rails. This extends its operating range, speeds up the work processes, and increases the robot's flexibility and productivity. It's therefore the ideal choice for anyone who wants to get things moving in systems engineering, to make progress and save time, space, money – and even robots. KUKA robots can also be installed on the wall or the ceiling, can be shelf-mounted, or gantry-mounted in inverted position – here too, there are major benefits to be reaped. Once again, KUKA leads the market.



One robot for many jobs.
An expandable tool changing system enables the robot to rapidly change its tooling. This allows a single robot to carry out a variety of different tasks.



Unlimited scope for rationalization. The flexible additional axes are now supported by new software features. For example, axes can be temporarily uncoupled from each other, creating unlimited possibilities for semi-automated production.

The "flying" gantry-mounted robot. KUKA robots can be gantry-mounted in inverted position and traversed on linear axes. In combination with the gantry and the linear unit, the robot can use its speed more effectively and fully utilize the work envelope beneath it. Thus the "gantry robot" is also a "flying" robot in terms of its work pace.

Flexible robots on wall and ceiling. Wall and ceiling-mounted robots, working from above, highlight the advantages of KUKA robots' superior work envelope particularly clearly. The jointed-arm construction opens up endless potential for cost-saving solutions in systems engineering.

The more modular a system is, the more easily it can be tailored to the customer's needs using virtually the same elements.



Movable type, devised by Johannes Gutenberg in 1438, was one of the most significant inventions in human history. It meant that the same letters could now be re-ordered and reset for each new printed page. And a single mold could be used to produce any number of identical letters.

8 MODULAR DESIGN - FOR LOWER PRICES

The success of KUKA robots is founded on a very simple principle: modularity. This is one reason why KUKA has been able to significantly reduce its robot prices since 1989. Because by standardizing the vast majority of components and basic machines, it is possible to manufacture all the parts much more cost-effectively.



Arm extensions – for a better reach. A major factor when choosing a robot is its reach. Here KUKA offers you considerable advantages, with the option of extending the robot arm by 200 mm or 400 mm.

Fewer assemblies – for greater availability. A KUKA jointed-arm robot is made up of fewer components than a conventional robot. And it has only about half as many principal assemblies as a parallelogram robot! With good reason: for the fewer parts a robot has, the less there is that can go wrong.

KUKA too has developed a design system for robots, which allows a huge variety of robot types to be built up from standardized assemblies. As a result, KUKA offers clearly structured robot series, with many possibilities for customization within the modular system. Thanks to the modularity, production costs are reduced and the price falls. A further advantage is that it's not just the individual parts of KUKA robots that are multifunctional, but also the robots themselves. Their performance data are designed to allow you to use the maximum number of robots of the same type – from demanding work to high-precision tasks. This means decisive advantages in maintenance, service and purchasing.



One robot type – for every application. From demanding work such as palletizing to high-precision tasks such as laser welding – every KUKA robot covers an extremely broad spectrum of different applications. So instead of having to order various robot types, with KUKA you can often save money by deploying robots of a single type.

FROM KR 3 TO KR 500: ROBOT SERIES FOR ALL PAYLOADS

Low payloads



KR 3 KR 16

Medium payloads



KR 30 L15 KR 60 K

High payloads



KR 150 KR 210 K

Very high payloads



KR 350 and KR 500

Press-to-press robots



KR 60 P and KR 100 P

Palletizing robots



KR 180 PA KR 500 570 PA

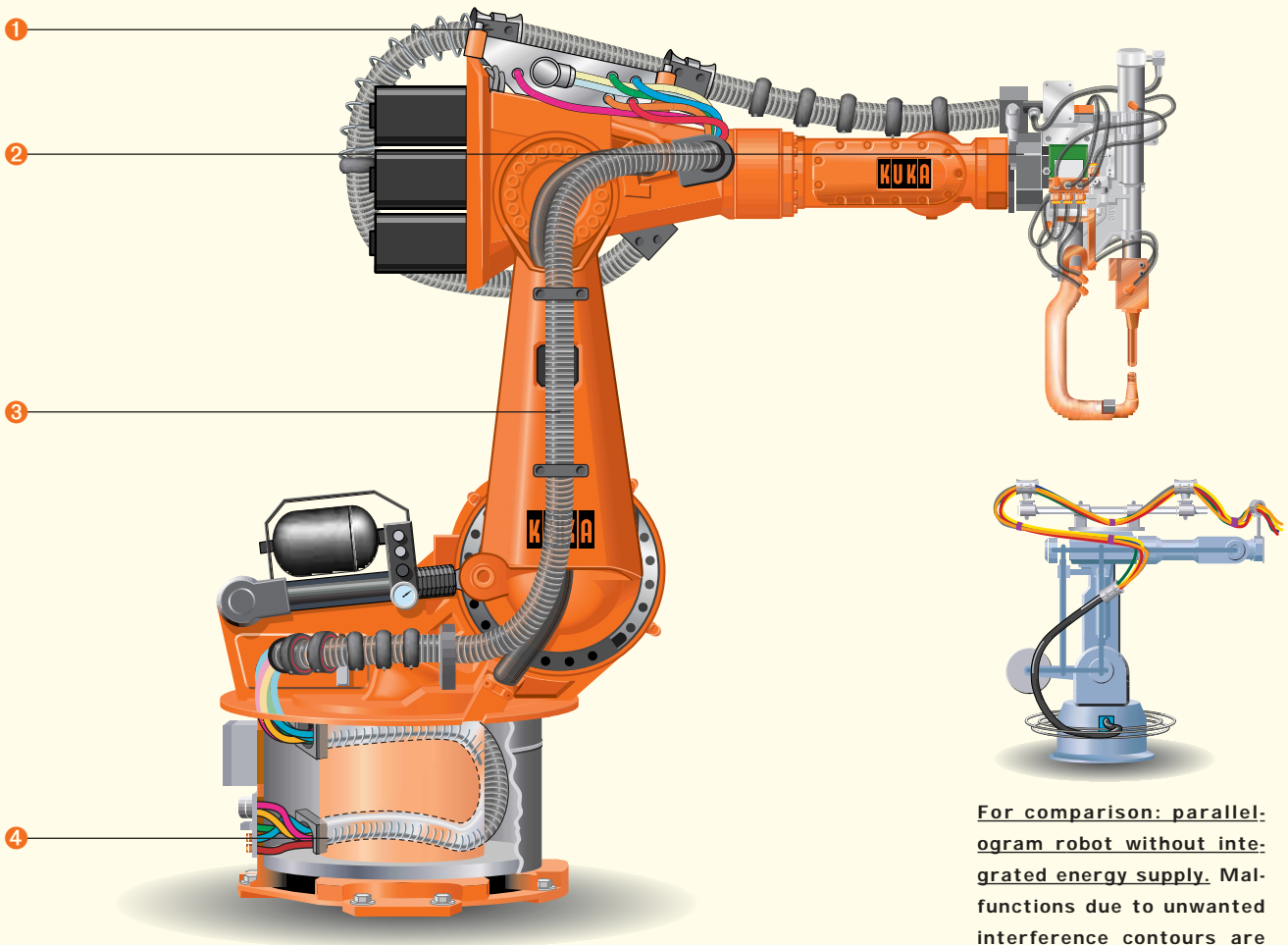
One of the main criteria in determining the “right” choice of robot is the payload. For this reason, KUKA offers four robot series covering all the common payload categories – each series comprising a wide-ranging program with many intermediate steps. Our product range therefore offers you an exceptional variety of individual options, giving you the ideal robot for every situation. Moreover, for special applications such as press linking or palletizing, KUKA has special robot series on offer.

It runs through the whole of human history: only with the right technology is it possible to take the straightest route to one's goal.



In 312 BC, the Romans invented the aqueduct (from Latin aqua "water" and ductus "leading"), a conduit which carried the water without geographical detours across arched bridges right into the city.

INTEGRATED ENERGY SUPPLY SYSTEM



For comparison: parallel-ogram robot without integrated energy supply. Malfunctions due to unwanted interference contours are almost inevitable.

1 Precisely-defined attachment points ensure the reliable routing of the supply tube with minimum interference contours.

2 With the KUKA rotary interface, the supply tube no longer has to follow the movements of axis 6 and can hug the robot wrist.

3 Every supply tube runs close to the robot body – with minimum wear.

4 The integrated energy and fluid supply lines are routed through the base frame for maximum protection and space-efficiency.

In 1990, KUKA invented a special routing system for energy supply lines: the integrated energy supply system runs the supply tube closer to the robot body than with other systems, giving the robot optimum freedom of movement and reducing cable wear to a minimum. Above all, however, this made it possible for the first time to model cable bundles in robot simulations: the one-time interference contours had become an integral part of the robot. This is a real advantage for simulation, planning and offline programming. Thanks to this, shorter conversion times are possible using KUKA offline programs – because there is hardly any need to fine-tune.

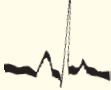


Superior simulation: KUKA Sim. Thanks to the integrated energy supply system, KUKA robots can be simulated much more realistically because the usual interference contours are completely defined. A further advantage lies in the KUKA software: the data are available in real time. This means that with the KUKA simulation program KUKA Sim, robotic cells can be planned and configured with greater true-to-life accuracy than with any other manufacturer. When planning entire production lines, the real-time data can also be transferred from KUKA Sim to other simulation programs such as IGRIP or ROBCAD – saving much time during commissioning and planning.



Superior offline programming: KR C Office. What is true for the simulation programs also has a positive effect on offline programming. The data can be programmed realistically from the very outset, and the usual sources of errors and crashes are reduced to a minimum. KUKA robots are renowned for their short commissioning and conversion times – because there is hardly any need to fine-tune.

Performance and life expectancy have always lain close to the human heart. And choosing a robot is no exception.

 In order to measure the performance of the heart muscle, the Dutch physiologist Willem Einthoven invented the electrocardiograph in 1903. On the basis of an ECG, a heart specialist can determine precisely how efficiently the heart is working.

SHORTER CYCLE TIMES WITH THE DYNAMIC MODEL.



KUKA robots offer a dynamic model in conjunction with the so-called higher motion profile. The dynamic model improves the acceleration capacity of the robot by about 25%, thereby optimizing cycle times. Furthermore, the dynamic model adapts the motion of the robot to suit the load - with a significant effect on the service life of both robot and periphery.

A few central characteristics sum up all there is to say about the performance strengths of KUKA robots. Their accelerations, for example, are 25% faster than traditional systems. The repeatability of up to 0.05 mm in the core working range is the best that is currently available. The availability of 99.99... % is actually achieved in practice. And with proper maintenance, it is possible to achieve a service life of over 15 years. KUKA's tendency to be conservative in specifying data such as these in the past has earned the company an excellent reputation. When we make promises, KUKA robots keep them.

OVER 99,99 %
AVAILABILITY!



LOWER DEAD
WEIGHT FOR
MORE POWER.

The less dead weight you have to carry, the faster you can move and accelerate. Thanks to the CAD and FEM optimized light-weight construction and parts-reduced design, the KUKA robot KR 125 weighs only 0.95 t. Parallelogram robots, on the other hand, are considerably heavier, weighing anything between 1.5 and 2 t.



UP TO 0.05 MM
REPEATABILITY!

With a repeatability rate of up to ± 0.05 mm in the core working range, KUKA robots offer the greatest accuracy that is currently available. That's why there is no better robot for high-precision tasks that must be repeated over and over again: for instance, for contour-cutting plastic parts.



EXTREMELY LONG
SERVICE LIFE.

The KUKA robot shown above has been in operation for over 15 years, making it one of the longest-serving robots. That says a lot about the service life of our robots. And still more about their quality. Even if not all KUKA robots quite reach this ripe old age, with proper maintenance they last longer than most other robots.



KUKA ROBOTS
ABSOLUTELY
ACCURATE

KUKA robots can be gaged with absolute accuracy and calibrated with pin-point precision. Possible bending and deformation of the structure is taken into account in the calibration. KUKA robots are therefore ideal for high-precision tasks such as laser welding or gaging.

People have always striven for things which offer greater performance. Like the KUKA PC-based controller and software.



The microchip, invented in 1971, achieved a technological miracle. With its high storage capacity in the least possible space, computers became smaller, faster, and less expensive. Today the goal is to achieve this miracle anew almost daily. And to constantly increase performance.



Invest in the future and benefit from the worldwide standard: with the open, PC-based controller KR C2. Expansion, and integration of higher-level control structures and lower-level controllers, sensors and actuators, is possible at any time.

ROBOT CONTROLLER KR C 2

People always want help to be within easy reach. KUKA Service is only a phone call away.



In 1876, Alexander Graham Bell built the first telephone that allowed the spoken word to be clearly understandable over long distances. Out of this first simple apparatus arose a worldwide communications system - and a highly efficient tool for customer service.



For production, employee training or as stand-by robots. KUKA Used Robots offers fully-overhauled robots from the KR C1 generation onwards, with up-to-date control software. Alternatively, KUKA robots can also be rented for an agreed period.

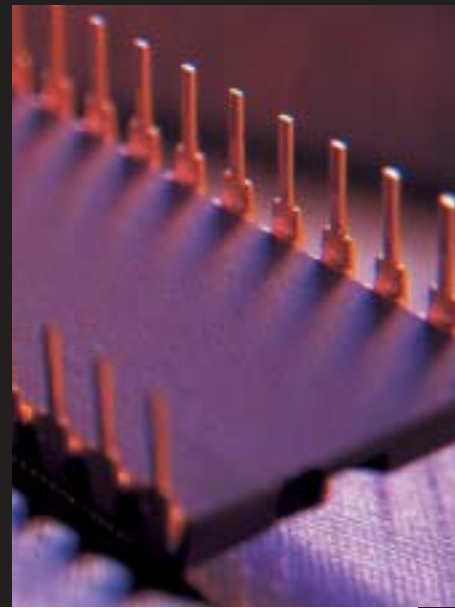
KUKA USED ROBOTS



In the engineering, project planning, and validation phases, KUKA Technical Support will advise you regarding the choice of the right electrical, control, and mechanical systems - and with respect to availability and durability.

KUKA TECHNICAL SUPPORT

With KUKA's open and real-time capable PC-based controller KR C2, you're on the right track for the future. You can take advantage of the worldwide PC standard and participate in future development, and you can integrate KUKA robot systems into subordinate and higher-level control structures (from the sensors up to the management level). Expansion is possible at any time. The KUKA Control Panel (KCP) combines easy operation with rapid programming. The individual robot axes can be moved intuitively with the integrated 6D mouse. Operations are carried out as is usual in Windows – the functions will be familiar from the user's own PC.



Programming can be that easy. The KUKA Control Panel (KCP) combines easy operation with rapid programming. The individual robot axes can be moved intuitively with the 6D mouse. Operations are carried out as is usual in Windows.

KUKA CONTROL PANEL (KCP)



We offer ready-made software packages for common applications. The real-time capable simulation program KUKA Sim and the offline program KR C Office allow rapid systems integration with extremely short downtimes.

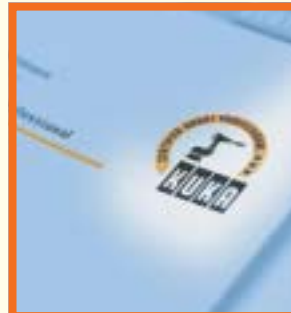
KUKA SOFTWARE PACKAGES

KUKA Customer Support stands by you from initial planning to hand-over of your application: KUKA Technical Support provides help and advice to ensure optimized sequences and cycle times. KUKA Service is geared entirely to the availability of your robots. Besides the Hotline and the usual customer support, KUKA offers you additional service packages: from immediate assistance 24 hours a day, to Internet remote diagnosis and servicing inspections. And KUKA College helps you to help yourself: the KUKA College centers offer practical robot knowledge, from basic introductory courses to applications training.



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KUKA SERVICE



What use would all these system advantages be without good training? That's why KUKA College offers robot knowledge from A to Z – with certified results. Training is geared towards specific target groups: from robot operators to managers.

KUKA COLLEGE

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Products and services

- Jointed-arm robots for payloads from 3 kg to 570 kg
- Linear traversing units for robots
- Special robot designs
- Robot controllers
- Control software
- Technological process software
- Customer support



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KUKA

WORKING IDEAS