# SMART SOLUTIONS FOR HUMAN AND MACHINE

## INDUSTRY 4.0

INTELLIGENTE
PERIPHERIEN FÜR ROBOTER

# The Key to Success.

## Here's to a bright future of cooperation for team "human-robot" – all thanks to intelligent peripherals.

### IPR – the smart interface between human and machine.

Industry 4.0 stands for the integration of industrial production with the latest information and communication technology. The trigger for this development has been the continual demand on companies to operate profitably, despite demand for smaller batch sizes and increasingly individualized production.

One development caused by this change, which already seems to be earning profits, is the cooperation of humans and robots. But this is no longer a cooperation separated by a fence, but rather, a cooperation as colleagues working together. However, what the human has inherited naturally – his tactile sensibility – must first be learned by the robot, before humans and robots can truly become a team.

This requires not only new robot concepts, but just as importantly, intelligent peripheral equipment, such as that offered by IPR. These intelligent peripheral devices boost performance even for existing generations of robots and models. And the best thing: this peripheral equipment not only makes the human-machine interaction more secure, but also increases the efficiency of your production, thus strengthening your economic competitiveness.

### IPR makes Industry 4.0 possible

The intelligent, comprehensive product platform of IPR, with its numerous sizes for different load ranges, ensures that production assembly and handling, are Industry 4.0 ready. Our grippers, tool changers, compensation devices, load limiter, 7th axes for industrial robots, force-and-torque sensors, and customized solutions, are ideal for your production of the future.

**Grippers**

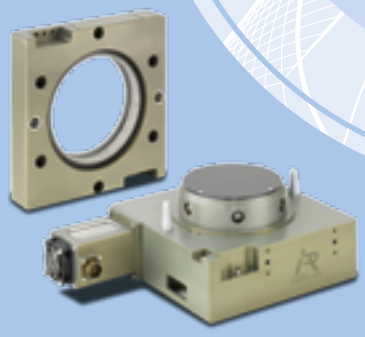
**Force-and-torque-sensors**

**Compensation devices**

Human

4.0

Machine



**Intelligent peripheral equipment integrated into robot systems, facilitates not only a safer human-machine cooperation, but also makes your production more efficient.**

## ON THE WAY TO THE DREAM TEAM

The robot of the future actively cooperates with humans. As well as the customary large units, small assistance robots have also begun to appear. Both types of robots – thanks to intelligent peripheral components – create a risk free working space with humans and which relieves human workers of high ergonomic load tasks, as well as tasks that often lead to errors.

# Welcome at Work: Colleague Robot.
## Adaptiv and simple.

### Top priority: safety for staff members

Industry 4.0 robots of the future will work directly with and beside humans, requiring no seperating security fences or barriers. In these situations, IPR's highly sensitive grippers offer both the necessary security for your staff, as well as the required precision for the manufacturing of your products. For these reasons, IPR's grippers are being constantly optimized so as to guarantee continuous maximum safety and reliability.

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### THE INDUSTRY 4.0 FACTOR

**SECURITY AS A BASIC REQUIREMENT.** Intelligent grippers ensure not only safe handling of components and workpieces, but also the safety of your staff. For this reason, the powerful gripper is important to the efficient realization of Industry 4.0.

## EVERYTHING UNDER CONTROL: WITH IPR'S TECHNOLOGY

### Roller beared gripper RP

The roller-beared gripper is pneumatically driven and functions with extreme sensitivity. The gripping function happens in two steps. In the first step, the object is grasped gently, as if it were made of glass – so for human workers in the vicinity, there is no possibility of harm. In the second step, the robot grips only as hard as is absolutely necessary for safe transport to the next processing stage. In addition, this system is easily upgradeable to an intelligent gripper system, which optimises your production of the future.

### Hybrid gripper

The hybrid gripper acts electro-pneumatically, effectively as a 7th axis for industrial robots, i.e. the robot can communicate with it. This ensures a quick, simple, and above all perfect interaction, exactly as Industry 4.0 demands. The gripper can grasp a wide range of different object sizes with freely programmable gripping force, thus providing the flexibility needed for your future production. The combination of servo control, and pneumatics, ensures a secure grip and handling even of the most sensitive components and workpieces. In this setting, the advantages of both drive systems – fast servo motor positioning and safe powerful pneumatic gripping – are combined.

# Increased fine-motor Sensation for the Robot Arm.

## Increases flexibility and security.

### The production environment in “view”

The robot for Industry 4.0 must not only be safe for staff and products, it must also be capable of flexibly interacting with your production environment. This requires a correspondingly powerful sensor technology, and a safe connection to in-house data communication, to ensure optimal integration within the company’s information exchange. The newly developed force-and-torque sensor – an innovation of IPR and Doll Engineering – impresses greatly in this area, owing to its its ability to reliably and accurately determine forces and momentums within the workspace.

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### THE INDUSTRY 4.0 FACTOR

**FLEXIBILITY** of programming.
The force-and-torque sensor-enables robots to be taught quickly and easily, without the need for advanced pro-gramming knowledge. This guarantees the necessary flexibility for Industry 4.0.

## EVERYTHING IN VIEW: WITH IPR'S TECHNOLOGY

### Force-and-torque-sensor

The development of a new, communication-capable, force-and-torque-sensor is a milestone in the industry. The sensor is located between the robot and the gripper and measures the forces acting on the gripper. Consequently, obstacles, whether human or object, can be directly detected . At the same time, your staff can easily teach the robot, thanks to the force-and-torque-sensor. This allows fast and simple programming, without operator intensive knowledge, thus offering the flexibility needed for Industry 4.0.

### Multi-functions interface

The powerful multi-function interface provides a new standard in the integration of force-torque sensors within control systems. This guarantees a wide variety of connection options for current field bus systems or robots, and enables easy implementation of Industry 4.0 applications. Thanks to the possibility of active force control, this sensor can even be used in measurement technology and in quality assurance procedures.

# The starting Position is not always ideal. The Result however, can be so much more.

## Flexible interaction in the production environment.

### Things are sometimes not what you expected ...

The combination of Z-axis compliance device, lateral alignment device and rotation angle compensation, allows the performance of complex assembly tasks in the easiest of ways. Position errors are compensated for by arbitrarily disengageable and switchable degrees of freedom.

Thanks to the function blocks, the gripper can take parts with offset pitch and angular misalignment, and then align them to the coordinate system of the robot. This prevents parts being tilted or jammed and protects robots and assembly machines from premature wear. In addition, this attribute facilitates and speeds up commissioning.


### THE INDUSTRY 4.0 FACTOR

**TRAILBLAZER.** The function modules release the user from the enormous effort usually required for the balancing of position inaccuracies. This clears the way for Industry 4.0.

## EVERYTHING OK: WITH IPR'S TECHNOLOGY

### Z-Axis Compliance Device ZN

This function allows for the compensation of different height positions and detects impending collisions in the Z-direction. The Z-axis-compliances can be easily combined with joint mechanisms, and in this way, offers a protective mechanism via monitoring of insertion forces during assembly parts and workpieces.

### Lateral Alignment Device KA

The position compensation occurs vertically and can be carried out with high precision in both the tension and compression directions. This allows objects to be handled flexibly, in whatever orientation they arrive at the robot, and thus compensates for the lack of precision of human colleagues. Consequently, two robots, or robots and humans, are able to work safely together, without any additional conversion work, creating an ideal team for Industry 4.0.

### Rotation angle compensation RT

This function module can compensate for the rotation angle around the Z-axis, thus promoting a safe working cooperation between humans and robots.

# Robots with Freedom of Movement.

## Industry 4.0-compatible use of robots.

### Success along the line

In order for robots to work just where they are needed, Industry 4.0 demands, both functionally and spatially, the highest flexibility from assistance robots. To achieve this, not only are the appropriate driving axles required, but the set-up must also ensure that the power supply does not hinder the robot's freedom of movement; a problem that IPR has resolved to the complete satisfaction of its customers. Additionally, a powerful tool changer further increases the robot's flexibility of performance.

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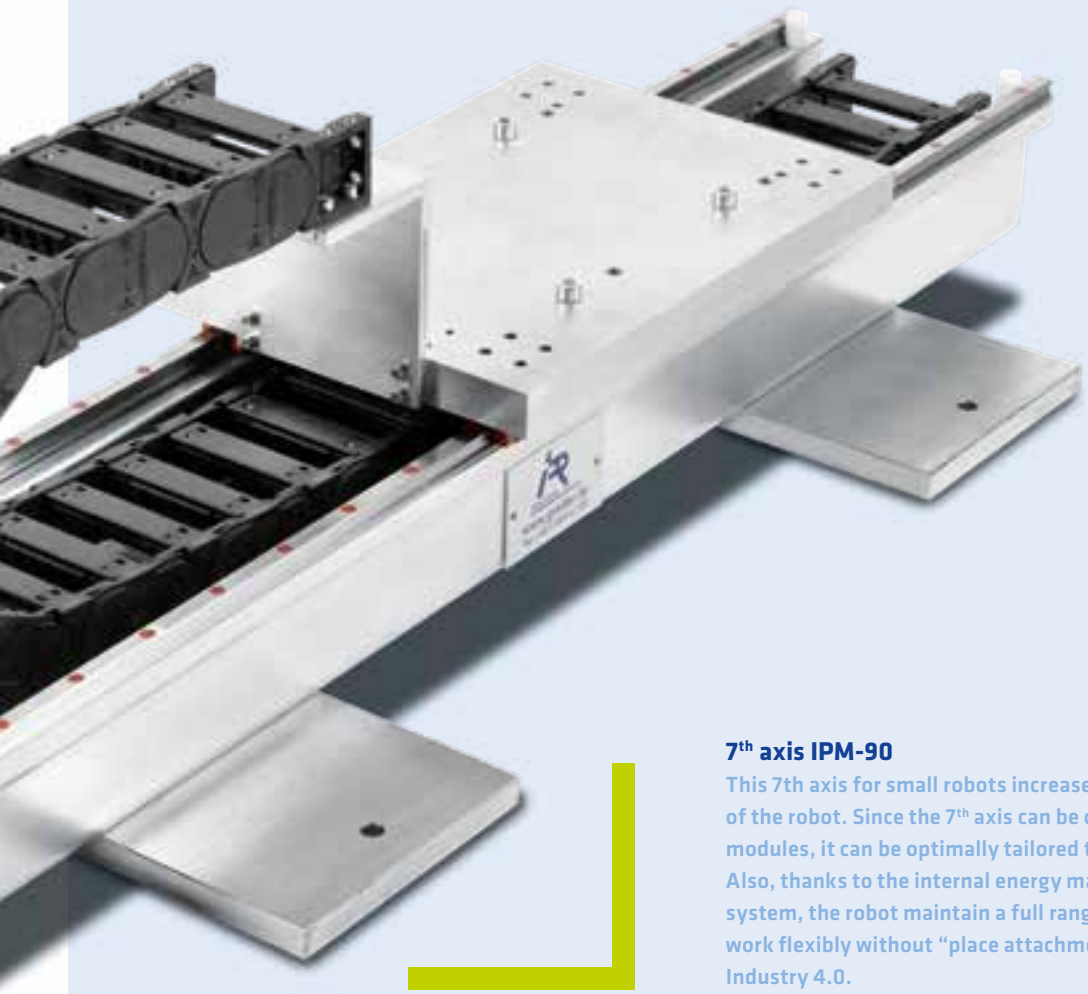
### THE INDUSTRY 4.0 FACTOR

**INFRASTRUCTURE.** Industry 4.0 demands high degrees of automation, cost efficiency and flexibility. The required solutions should therefore be compatible with flexible infrastructures, and this is made possible through the free arrangement of driving axes for robot use.



### 7th axis IPM-90

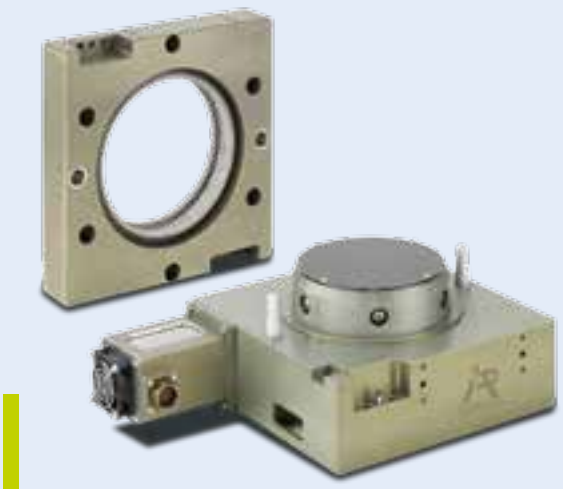
This 7th axis for small robots increases the workspace of the robot. Since the 7th axis can be ordered in modules, it can be optimally tailored to your needs. Also, thanks to the internal energy management system, the robot maintain a full range of motion and work flexibly without "place attachment" – ideal for Industry 4.0.

## EVERYTHING WITHIN REACH: WITH IPR'S TECHNOLOGY

### Electric power tool changer

In order to guarantee a high level of automation with minimal cycle times, the robots are able to perform tool changes. For pneumatic tool changers, a compressed air infrastructure must be provided.

For cases in which the gripper, or other peripheral equipment, requires no compressed air, then this feature represents an unnecessary cost. In addition, compressed air, owing to the necessity of a fixed, installation infrastructure, reduces overall flexibility. IPR's servo motor-driven tool changer is, thanks to its cost-efficiency, fully Industry 4.0 compliant.



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