Dear Customers, Partners, and Friends,

Those who save money in the wrong places end up paying more in the long run. This truth also applies to the automation of production processes. Because even the most precise robot and the most precise machine tool only work with the desired level of flexibility and efficiency when the clamping technology and gripping system components are intelligently attuned to it. Among mid-sized companies alone, up to 15 percent of potential machine capacity remains unutilized. So it's worthwhile to specifically analyze which processes can be automated how, and where users can save on set-up times or eliminate them altogether. Modern clamping devices offer enormous potential for improving economic efficiency, process reliability, and flexibility in the manufacturing process – and all this comes with a comparably low level of effort. Especially in Europe, the trend is therefore heading towards high-tech clamping devices and networked, fully automated solutions. Technologically, there are currently four topics in focus: Making processes more flexible with minimum set-up times, full automation in 24/7 operation, human/robot collaboration, and intelligent process monitoring “closest to the part”, i.e. directly on the workpiece. On the next few pages, we will show you the solutions we are using to shape modern machining. Immerse into the future with us in this issue.

Henrik A. Schunk
Chief Executive Officer

The SCHUNK Booth at the AMB 2018 stands for “Open. Smart Clamping in Smart Factories”. Here, everything is all about our clamping technology components, which are open for all machines and applications as well as higher-level control systems.

“Open” at SCHUNK stands for interfaces that are open to all components in the overall system. It stands for a perfectly coordinated modular system. And it stands for users who are hereby able to select components purely based on their requirements.

With workpiece and tool clamping technology, which suits every machine type and every interface, and a clever modular system with products for every application, SCHUNK is opening up entirely new fields of application. This flexibility creates space for maximum productivity and quality. But that’s not all: Clamping technology components with integrated sensors “closest to the part” enable process monitoring and optimization directly on the workpiece. Meaning all data is recorded and analyzed extremely accurately to ensure maximum process reliability. This allows the components to increase the transparency of processes and results – thereby allowing new strategies.

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Chief Executive Officer

2018 | 2nd. Issue

The Journal

SCHUNK News
Inside: Here’s what the new intelligent iTENDO toolholder can do
Page 4

Equipped by SCHUNK
Automated production with SCHUNK products
Page 8 – 9

Equipped by SCHUNK
Go-act EGP+L for human/robot collaboration
Page 10 – 11

Dates
International shows and events
2018/2019
Page 12

Hot Topics
Digitalization – Possibilities for intelligent production
Page 2 – 3

New Product Innovation
Our innovations for highly efficient production processes
Page 6 – 7

Worldwide
Our Tec-Center in Spain
Page 5

SCHUNK News
Inside: Here’s what the new intelligent iTENDO toolholder can do
Page 4

Equipped by SCHUNK
Automated production with SCHUNK products
Page 8 – 9

Equipped by SCHUNK
Go-act EGP+L for human/robot collaboration
Page 10 – 11

Dates
International shows and events
2018/2019
Page 12

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Maximum flexibility and efficiency in the processes – this is what every production strives for. At AMB, SCHUNK shows this year under the show motto “Open” how you can achieve this with the help of our solutions. “Open” in this context stands for interfaces that are open to all components in the overall system. A perfectly attuned modular system ensures that process owners define their strategy without compromise, regardless of dependencies of individual components. So the user decides purely on the basis of his requirements. Because SCHUNK products are suitable for every machine, every application, and the live recording and analysis of data for process control.

Open. For any Machine.
SCHUNK components always fit – no matter for which machine type and interface which you are searching for a solution. The user can freely choose and combine the workpiece and tool clamping technology. Enabling it to always find the right solution for your requirements. This flexibility creates space for maximum productivity and quality.

Open. For any Application.
Are you looking for a system for prototype construction that facilitates a fast and flexible exchange? Or one that demonstrates its strengths in standard production? SCHUNK has the right solution for every application. With our clever modular system for workpiece clamping and our broad toolholder program – from the simple solution to the high-tech product – we unite flexibility and efficiency.

Open. For any Data.
In the future, intelligent systems will make it possible to intervene in the production process in real time, even when unmanned. To do so, the components “closest to the part” must be intelligent and versatile. Gripping systems and clamping technology components from SCHUNK with integrated sensors facilitate a flexibilization of production processes as well as a process monitoring and optimization directly on the workpiece. Thus they offer the possibility to operate automated systems and value chains at the optimum.
Digital Tools
make it easier

On the way to smart production, high-tech clamping devices and gripping systems as well as digital tools play a central role. These are the technologies that will shape the future of machining.

The number of product and size variants and the cost pressure are rising rapidly. The use of modern clamping devices helps to master these challenges. Because these helpers have a decisive influence on profitability, process reliability, and flexibility in the production process. Since their share in the total investment of a machine tool is usually comparatively low, customers can achieve a lot here with little effort.

Intelligent process monitoring

Automated machine loading makes processes much more efficient today than they were five years ago. Now it’s time for the next stage of acceleration: digitalization and networking. Clamping devices play a special role due to their “closest to the part” position. Intelligent clamping devices can access data directly on the workpiece, analyze them, enrich them with expert knowledge, and pass them on to higher-level systems. In this context, we refer to “Smart Clamping”. It serves to record and analyze process data in real time in order to transparently present the actual situation in production. After processing the data in the integrated electronics, they are sent to the system control unit or higher-level systems for autonomous process control and monitoring.

At AMB, SCHUNK will use the iTENDO to show how such a scenario can be realized: The intelligent toolholder collects data via the built-in sensor system directly at the cutting edge, and transfers it to a control and evaluation unit. This evaluates the data and regulates the machining process as soon as previously defined exact limits are exceeded (read more about the iTENDO in the interview on page 4).

Another intelligent clamping device is the iTENDO. It enables entry into additive manufacturing without having to invest in equipment or expertise. It allows designers and system engineers to quickly and easily commission the 3D printing of clamping technology and gripping system components. The principle is comparable to that of an online photo service: customers upload data, select material, and quantity, and submit the order – and have their machine components delivered in just a few days.

The HTML-based service runs on all web-enabled PCs, smartphones, and tablet computers. Designers can upload all conventional CAD formats and have them displayed in the 3D viewer and checked fully automatically for their printability. In doing so, they can order components for clamping technology and gripping systems that they designed themselves up to maximum dimensions of 150 mm x 120 mm x 100 mm online. SCHUNK then manufactures all parts from polyamide, aluminum or stainless steel within 10 working days in an excellent and precise quality.

Digital Twins

Another tool on the way to digitization is the simulation of production processes or complete production systems. SCHUNK has put together an entry-level package in an OEM partnership with Siemens PLM Software. It consists of Mechatronics Concept Designer™, a component library of digital tools and support during use. This makes it easier than ever before for customers to enter this world. The solution enables users to simulate complete assembly systems in three-dimensional space. They can handle the entire engineering process from concept to mechanics, electrics, and software towards virtual commissioning, digitized in one system. With this in mind, we have created our 24 V mechatronics program for high-performance assembly as digital twins, to enable simple assembly systems to be simulated without comprehensive software expertise. The component library from SCHUNK comprises in the first stage the EGP parallel grippers, the ELP linear modules, the EGS rotary gripping modules, as well as the E65 rotary modules. In the medium term, all gripping system and clamping technology components will be available here as digital twins.
"A Prime Example for Industry 4.0"

The iTENDO is the world’s first intelligent toolholder with real-time process control. In an interview, developers Friedrich Bleicher and Johannes Ketterer explain how the embedded systems solution makes production smart and economical.

Why do companies need intelligent solutions for the machine tool?

Bleicher: In automated production in small batch sizes, you cannot know exactly how long you can use a tool until the end of its life has reached. So companies tend to replace it prematurely. In so doing, they are losing out on 30 to 50 percent of its service life – and in so doing are throwing a lot of money right out of the window! Intelligent solutions based on integrated electronics and sensor technology make it possible to make much better use of the tool, and eliminate such waste. If something unusual happens in the process, the intelligent solution intervenes, makes the process more stable or stops it if needs be. This way, the customer can increase the profitability of their manufacturing processes enormously.

Why did you integrate the sensors into the toolholder?

Bleicher: If the machine is to intervene in the process, we must give it feeling, and bring the sensors as close as possible to the machining process. The logical consequence for us was to integrate sensor technology into the toolholder mountings. Because the closer to the effective working area we record data, the more sensitively the sensors are able to react to it.

Bleicher: The iTENDO goes far beyond what most people currently associate with Industry 4.0. It makes the decisions itself and implements them autonomously. In so doing, it brings intelligence into production and is a prime example of Industry 4.0.

How does the iTENDO implement Industry 4.0 in the company?

Bleicher: The iTENDO measures via the built-in sensors accelerations and vibrations directly on the workpiece and transfers the data to the machine control. This can then react in real time and influence the cutting process. If for instance the smart toolholder detects that the tool is driving at the limit, the machine control system intervenes without the need for any human intervention and adequately adjusts the process. So it can prevent excessive tool wear or a machine crash. The iTENDO is the solution that integrates sensors and logics and thus facilitates autonomous action of an automated system in the manufacturing process. It makes the decisions itself and implements them autonomously. In so doing, it brings intelligence into production and is a prime example of Industry 4.0.

Ketterer: On the market, there are several components equipped with sensors, some of which are also capable of running evaluations or identifying trends with the data. However, the iTENDO is the only component that is capable of autonomously intervening in the process. It goes much further than other systems that only display process information. And it goes far beyond what most people currently associate with Industry 4.0. Compared to other systems and technology providers, it is also considerably cheaper. The “intelligence” of the iTENDO can also be modularly integrated into a large proportion of the existing SCHUNK total tooling toolholder portfolio, and therefore facilitates a wide range of applications in machining regardless of machine type and process. Finally, the iTENDO can be upgraded at any time to all common machine tool control systems.

Ketterer: The data is exclusively stored locally on the machine; it does not leave the plant. With the app provided, customers can view it on all electronic devices – PC, tablet or mobile phone, and use it for parameterization and trend analysis.

Let’s take another look into the future: what’s the next step?

Ketterer: We need to develop the logic so that we can soon autonomously optimize all processes – be they finishing, roughing or deep hole drilling. To do this, we must teach the logic how it should react to certain process specifics. This will allow machines to produce even more autonomously and efficiently in the future and down to batch size 1.

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What advantages does the iTENDO have over other intelligent solutions in the market, for example process monitoring systems or Industry 4.0-enabled machine tools?

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Where can the iTENDO be used?

Bleicher: In general, companies can use the iTENDO on all machine tools. However, it really demonstrates its strengths in processes with strong fluctuations due to the material or ambient conditions, the production of very expensive components or in processes with high tool wear. Examples of this are the production of very thin-walled components, very expensive components for the aerospace sector, where you have to make sure that there are no rejects, and rough machining of high-strength or hardened materials.
The application developed by graduate Roger Marfà in the Tec-Center writes “SCHUNK” and “PGN+” alternately.

Tangible Technology

In our Tec-Center in Spain, customers and students experience gripping systems and clamping technology in action.

Roger Marfà looks contentedly at the rotating cubes. After they stop, he can read “SCHUNK”. The graduate of the University of Mataró has developed this application for his thesis in the Tec-Center of the Intec Spain. It is made up of the parallel gripper PGN-plus 80, a swiveling SRU-plus 20 with fluidic and electric feed-throughs, as well as fast acting control valves. The application writes “PGN+” and “SCHUNK” alternately in the right form and branding. “We work closely with the university on the Technology campus as well other students and pupils from technical schools”, says Javier Garcia, General Manager, SCHUNK Intec Spain. This enriches both sides: “The Students benefit from the insight into the practice and the possibility to use our products. And we are very close to the current state of knowledge and research.”

The Tec-Center exists since the beginning of 2016. It is located on the ground floor of the subsidiary on the Techno Campus of Mataró University, about 25 kilometers away from Barcelona. Here, SCHUNK Intec Spain is exhibiting a cross-section of its product portfolio and showing applications in use. These include swivel and gripping modules, Pick & Place units and magnetic clamping technology, all of which can be observed by the visitors in motion at the machine. Just like at a trade show, you can pick up the products, try them out and run a machining test on the machine. “Thanks to the Tec-Center, we can demonstrate our products to customers and better explain solutions.”

Javier Garcia, General Manager, SCHUNK Intec Spain

Training on the latest market trends

In addition, SCHUNK offers training to inform customers or interested parties of the latest market trends, and to provide support in the implementation of gripping system and clamping technology solutions. In so doing, the subsidiary works in close collaboration with other market players in the industry. For instance in the past there were joint workshops with FANUC for customers in the field of machining, for whom the company provided a robodrill machine. SCHUNK Intec Spain is currently cooperating with TRUMPF, whose 3D printing machine for metal components TruPrint 1000 is the latest addition to the machinery fleet. It specifically melts metal in powder form by laser and this way assembles components in virtually any geometrical shape layer by layer. This allows it to produce workpieces in many different contours and shapes. This is particularly interesting when it comes to prototype construction. “Where they see the need for it, our area sales managers invite customers into the Tec-Center,” says Garcia. “Customers are keen to accept such invitations, even if they are several hundred miles away.” Besides joint events with machine or robot manufacturers, there are also special seminars tailored specifically for customers.

Further education for customers, employees, and students

These are not the only thing that will expand your technical expertise. Employees, students from vocational schools and other students can also receive further training at the SCHUNK Tec-Center. At Mataró University, field trips are a regular fixture on the lesson plan. Using clamping and gripping solutions on site, professors systematically convey foundation knowledge. Students from the years above can use the applications in the Tec-Center to build and test solutions for their final papers. Every now and then, a young talent even joins the team: Since graduating, Roger Marfà works for SCHUNK in Spain and now passes his knowledge onto students, candidates, and customers.

“Thanks to the Tec-Center, we can demonstrate our products to customers and better explain solutions.”

Javier Garcia, General Manager, SCHUNK Intec Spain

Pupils from vocational schools and students from the University of Mataró continue to learn about clamping and gripping solutions in the Tec-Center.

In our Tec-Center in Spain, customers and students experience gripping systems and clamping technology in action.
Smarter Metal Cutting

iTENDO, the world’s first intelligent toolholder, monitors the machining process directly on the tool and controls the cutting parameters in real time.

Oscillations, chatter marks, tool failure – all these problems in machining could soon be a thing of the past. This is all made possible by the smart iTENDO hydraulic expansion toolholder. This intelligent toolholder permanently analyzes the machining process during machining. It is equipped with a sensor, battery, and transmitter unit. It records data directly on the tool, transmits it wirelessly to a receiving unit in the machine room, and passes it from there by cable to a control and evaluation unit, where based on a specific algorithm, a key figure for the process stability is continuously calculated. If the process becomes unstable, it can either be stopped in real time and without the intervention of the operator, reduced to previously defined basic parameters, or regulated until the cut returns to a stable range. Users can define both the exact limits and the corresponding reactions when they are exceeded via a web service. The system is extremely easy to retrofit, meaning a modification or replacement of machine components is not required. SCHUNK developed the iTENDO in cooperation with the TU Vienna and TOOL IT GmbH Vienna. From 2019, the intelligent toolholder mountings will initially be provided in combination with TENDO hydraulic expansion toolholders. ■

Product information: schunk.com/itendo

Small is beautiful

The VERO-S NSL mini 100-25 clamping stations generate high clamping forces in a compact space.

The VERO-S NSL mini 100-25 are the new ones in the mini modular system. Permanently mounted on the machine table, they precisely pick up a wide variety of clamping devices from the NSE mini range, and enable quick set-up procedures. The powerful clamping stations are available as 1-way, 2-way, or 4-way clamping stations. A reworked drive increases the pull-down forces: each clamping module achieves a pull-down force of 6,000 N due to a patented dual stroke system with activated turbo function. Depending on the thread used, the holding force is 15 kN (M6) or 25 kN (M8). The 4-way clamping station, at a dimension of 199 x 199 x 40 mm, achieved pull-down forces of 24 and holding forces of 60 or 100 kN. A spring assembly locks the mini clamping stations self-retaining and form-fit. They do not consume any energy when actuated. In addition, they have a very long service life, as all the functional parts of the clamping modules, such as the base body, clamping pin, and clamping slide, are made of stainless steel. The other components of the clamping stations are chemically nickel-plated or hard-anodized, and are therefore also stainless. ■

Product information: schunk.com/vero-s-nsl-mini
Light and strong

The “TANDEM plus 140” clamping force blocks assist automated machine loading.

High clamping force, compact design, low weight: the “TANDEM plus 140” clamping force blocks are ideal for pallet loading of machine tools where robots are in use. With a compact base area of 140 x 140 mm, they also ensure – even in confined spaces – process-reliable workpiece clamping on all common machine tools. In addition, the vises are extremely insusceptible to dirt: Chips, dust and dirt nests have no chance with them, and cooling lubricant is discharged to the outside. The user decides where the control and lubrication system is to be installed. An alignment edge is helpful when attaching the vise itself. The new blocks also feature excellent clamping repeat accuracy with deviations of under 0.015 mm. With the TANDEM plus 140, users have the choice between pneumatic, hydraulic, or spring operated: As a centric clamping vise with a stroke of 3 mm per chuck jaw, as a long-stroke centric vise with 7 mm per chuck jaw, or as a vise with fixed chuck jaw and 6 mm stroke. Depending on the version, the clamping force is between 15,000 and 30,000 N. This makes every imaginable application possible. Its users can simply switch between the variants as required.

Product information:

schunk.com/tandem

Process-reliable exchanging

The VERO-S NSE-A3 138 clamping module enables fast and process-reliable workpiece and clamping device exchange during automated machine loading.

The SCHUNK VERO-S modular system offers over 1,000 possible combinations for efficient workpiece clamping, and now the clamping module VERO-S NSE-A3 138 is added to this. The module is particularly well-suited for automated machine tool loading, as well as for applications in handling, assembly and automation technology. For a reliable exchange of workpiece and clamping device, the automation component is equipped with a powerful blow-off function, which carefully cleans the bearing surface during the changing process. In addition, a spring-actuated cone seal prevents chips or dirt from penetrating the interface. The pull-down force is 8,000 N – with activated turbo function, it is even as high as 28 kN. And because the module body has a high dimensional stability, a particularly high rigidity and high tilting moments can be achieved, allowing lateral forces to be reliably absorbed. Depending on the application, any number of automation components are combineable.

Product information:

schunk.com/vero-s-nse-a3

Being well-prepared for all Eventualities

The high-precision TRIBOS polygonal clamping technology is now also available for lathes and automatic revolving transfer machines with driven tools.

Special polygon toolholders with ER cone make it possible: A system that can be combined with all conventional mountings for ER collet chucks – even with driven tools. Instead of a collet chuck, users simply insert the TRIBOS mounting into the toolholder, fix it with the ER clamping nut and get started – with an accuracy of 0.01 mm in length. This enables fast set-up times and high repeat accuracy, even for tools with the smallest of shank diameters. The clamping system is resistant to dirt, and has high radial rigidity. Users can choose between two designs: The particularly slim TRIBOS-Mini ER is an expert in the field of micro-machining. Small shank diameters, filigree machining and hard to reach areas are no problem for it. The TRIBOS RM ER with its enormous clamping force is specialized for precise volume machining in high speed ranges. The anchor structure and high stability dampen vibrations and ensure that the tool has a long service life. TRIBOS enables the highest speeds, demanding form and position tolerances and knows no material fatigue. So it is used in a wide array of industries.

Product information:

schunk.com/tribos-er

Process-reliable design

Direct clamping of smallest shanks.

Slim interfering contour

for machining hard-to-reach areas.

Rotationally symmetrical design

for maximum speed of rotation and more precise shape and position tolerances for delicate machining operations.

Maximum stability

for increased service life of the turning tools.

Chip-repellent design

prevents permanent settling of chips.

The ideal “clamping force to weight” ratio

for use on “20 kg robots”.

Coolant drain holes

make sure that any penetrating cooling lubricant is conducted outwards.

Tried-and-tested lubrication system

either manual lubrication or central lubrication via connections at the bottom side.

Integrated media transfer

for transfer of fluids of up to 300 bar.

High-precision anti-twist protection V4

for easy positioning in automated solutions and the possibility to always keep the pallet 90° out of cycle.

Cone seal integrated in the standard version

for a fully protected clamping pin interface.

Stepped flat surfaces with integrated cleaning function

in order to prevent chips from accumulating and to ensure a clean environment around the clamping pallet or clamping device.
Self-supporter in the Production Chain

For the production of our chuck jaws, we rely on automated systems with SCHUNK products. Taking the example of two systems, we will show you why.

Station 1

Autonomous production of chuck jaws

Lauffen am Neckar: In the system we produce standard chuck jaws completely automatically using two robots. For this purpose, the first robot grips several raw parts simultaneously using a magnetic gripper and puts them down. Then the second robot comes onto the scene: It picks up the placed raw parts and takes them to the laser measuring station, which measures them and then places them in the vises of the machine. Once all parts are inserted, the machining table rotates in the machine and starts working. The already processed parts are rotated with the table by 180 degrees, so that the machine can devote its efforts to the second side. The robot grips the finished parts and places them onto the engraving machine. Then it puts them in a box, where a special gripper oils them in layers.

1 A SCHUNK employee programs the process in order that the unmanned production will later run smoothly. Due to autonomous production, we are able to significantly increase the degree of utilization of the automated system significantly.

2 Exchange please: The robot grips a new gripper to complete its next task. Due to the magnetic gripper and parallel gripper PGN-plus, we can handle raw and finished parts with great versatility. In so doing, we can handle over 200 different workpiece types in one automated system.
Safe control of large part variances

Lauffen am Neckar: Standard chuck jaws, claw jaws, stepped top jaws, base jaws and segment jaws made of steel, as well as PRONTO and BWSW quick-change systems – we make all this on our automated manufacturing system in hall 3. Such a large parts variance poses enormous challenges to systems in series production and requires a high degree of flexibility of the clamping systems used. We tackle this challenge when producing our chuck jaws using an automated production system with a highly flexible clamping system. It combines efficiency with flexibility and consists of tombstones with VERO-S quick-change clamping technology, the clamping systems KONTEC and TANDEM, as well as our precision toolholders.

Unmanned finishing in the production system: Unmanned production increases the utilization factor of the machine to over 90 percent. With 500 CNC programs, it enables up to 300 different product variants to be generated.

Whether they are base jaws or BWSW quick-change systems – due to the highly flexible clamping system, we can efficiently produce a large parts variance.
The Robots are “breaking free”

Robots are increasingly able to work outside of protective fences. This is made possible by the integration of high-tech sensor technology and innovative control technology. These technologies pave the way for so-called collaborative robot applications, which enable a physically safe collaboration between humans and their electromechanical assistants. Such sensitive robots are used either at a stationary location at the workstation or on the move – on a mobile platform.

Comprehensive handling tasks

Robotic systems coming from a mobile platform and a robot arm, so-called mobile manipulators, have been researched for some time and used to varying degrees. The variant of this system suitable for operation alongside and with people is referred to as a sensitive mobile manipulator and has the crucial characteristic of being able to detect external influences by means of sensor technology. This will facilitate an adequate response to static and dynamic obstacles as well as to forces acting from the outside. The practical use of sensitive mobile manipulators is comprehensive. Even in an industrial context, they take on all kinds of handling tasks. In manufacturing areas, there are mostly tasks in intralogistics or in-house product handling. Box transport, component removal, and insertion from and into machines or shelves, simple placement manipulations that serve work preparation, are all part of the main tasks. Secure gripping technologies that are suitable for use in human/robot collaboration are essential here. A monitored gripping force limit and a rounded design distinguish such systems.

Safe hold

The robot system works at normal speed, provided that there is free access in the machining area. When a human enters the machining area this is monitored i.e. by a laser scanner, and the robot system enters into a safety-monitored stop.

The closer human and robot work together, the higher the safety requirements of the technology and components become. At the same time, the standard ISO/TS 15066 differentiates between four methods here:
Flexible automation tool

CHIMERA is a sensitive mobile manipulator and was developed by ROBOTICS, the Institute for Robotics and Mechatronics at JOANNEUM RESEARCH. The hybrid system, which is also among the collaborative robotic systems, is made up of a sensitive robot (UR10), an autonomously navigating mobile robot (MiR100), a secure gripping system (SCHUNK Co-act EGP-C) and an additional image sensor. It unites the respective advantages of robotic systems, making it a flexible automation tool. Numerous handling tasks can be completed with such a system. In addition to simple logistical tasks right up to feeding, collaborative tasks with humans will also be possible in the future. Similar to a “human assistant”, CHIMERA also helps people with various activities, responds to spoken commands and provides information using digital connectivity.

Hand guiding

The robot system is guided by a human. In order to do so, the system must be able to detect the force of the human e.g. using a force/torque sensor. The robot system only moves when this movement is enabled by the human using a safety switch. Otherwise the robot system is in a safety-monitored stop.

Speed and separation monitoring

The machining area of the robot system is divided up into successive zones. If the entry of a human into one of the first zones is detected for instance by a laser scanner, the robot system goes into a lower speed. When the zone directly next to the robot is entered, the robot system goes into a safety-monitored stop.

Power and force limiting

The robot system works with limited force and power when collaborating directly with humans. The maximum forces and pressures applied to humans may not exceed the values specified in the technical specifications. This is ensured by an inherently safe design or safety features.

Find out more in the video on HRC applications in production at SCHUNK. 
schunk.com/hrc-application
## Shows and Events At a Glance

### September
- **AMB**
  - 18.09. – 22.09.2018
  - Stuttgart, Germany
- **CIIF - Robotics Show**
  - 19.09. – 23.09.2018
  - Shanghai, China
- **SEPEM Sud-Est Avignon**
  - 25.09. – 27.09.2018
  - Avignon, France
- **Micronora**
  - 25.09. – 28.09.2018
  - Besançon, France
- **Metalmadrid**
  - 26.09. - 27.09.2018
  - Madrid, Spain
- **Robo Business**
  - 26.09. – 27.09.2018
  - San Francisco, CA, USA
- **SWTAL**
  - 27.09. – 29.09.2018
  - Lüdenscheid, Germany
- **MSV**
  - 01.10. – 05.10.2018
  - Brünn, Czechia
- **TOOLEX**
  - 02.10. – 04.10.2018
  - Sosnowiec, Poland
- **Maktek**
  - 26.09. - 27.09.2018
  - Istanbul, Turkey
- **Motek**
  - 18.09. – 22.09.2018
  - Stuttgart, Germany
- **BMIU**
  - 25.09. – 28.09.2018
  - Indianapolis, IN, USA
- **SEPEM Sud-Est Avignon**
  - 25.09. – 27.09.2018
  - Avignon, France
- **Robotics and Automation**
  - 10.10. – 11.10.2018
  - Milan, Italy
- **GFMC**
  - 10.10. – 12.10.2018
  - Indiananapolis, IN, USA
- **Metalex Vietnam**
  - 11.10. – 13.10.2018
  - Ho Chi Min City, Vietnam
- **ITAP**
  - 16.10. – 18.10.2018
  - Singapore, Singapore
- **IZB**
  - 16.10. – 18.10.2018
  - Wolfsburg, Germany
- **Assembly Show**
  - 23.10. – 25.10.2018
  - Rosemont, IL, USA
- **SIANE**
  - 25.10.2018
  - Toulouse, France

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### October
- **BIMU**
  - 09.10. – 13.10.2018
  - Milan, Italy
- **Motek**
  - 26.09. – 27.09.2018
  - San Francisco, CA, USA
- **SWTAL**
  - 01.10. – 05.10.2018
  - Brünn, Czechia
- **MSV**
  - 01.10. – 05.10.2018
  - Brünn, Czechia
- **TOOLEX**
  - 02.10. – 04.10.2018
  - Sosnowiec, Poland
- **FMB**
  - 07.11 - 09.11.2018
  - Bad Salzuflen, Germany
- **TMTS**
  - 07.11. – 11.11.2018
  - Taichung, Taiwan
- **ATX Montreal**
  - 14.11. – 15.11.2018
  - Montreal, Canada
- **BE 4.0**
  - 20.11. – 21.11.2018
  - Mulhouse, France
- **Machuneeering**
  - 27.03. – 29.03.2019
  - Brussels, Belgium
- **Hannover Messe**
  - 01.04. – 05.04.2019
  - Hanover, Germany

### November
- **JIMTOF**
  - 01.11. – 06.11.2018
  - Tokyo, Japan
- **FMB**
  - 07.11 - 09.11.2018
  - Bad Salzuflen, Germany
- **TMTS**
  - 07.11. – 11.11.2018
  - Taichung, Taiwan
- **FMB**
  - 07.11 - 09.11.2018
  - Bad Salzuflen, Germany
- **TMTS**
  - 07.11. – 11.11.2018
  - Taichung, Taiwan
- **ATX Montreal**
  - 14.11. – 15.11.2018
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- **BE 4.0**
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  - Mulhouse, France
- **Machuneeering**
  - 27.03. – 29.03.2019
  - Brussels, Belgium
- **Hannover Messe**
  - 01.04. – 05.04.2019
  - Hanover, Germany

### December
- **JIMTOF**
  - 01.11. – 06.11.2018
  - Tokyo, Japan
- **FMB**
  - 07.11 - 09.11.2018
  - Bad Salzuflen, Germany
- **TMTS**
  - 07.11. – 11.11.2018
  - Taichung, Taiwan
- **ATX Montreal**
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  - 27.03. – 29.03.2019
  - Brussels, Belgium
- **Hannover Messe**
  - 01.04. – 05.04.2019
  - Hanover, Germany

### 2019
- **February
  - intec**
  - 05.02. – 08.02.2019
  - Leipzig, Germany
- **LogiMat**
  - 19.02. – 21.02.2019
  - Stuttgart, Germany
- **TMTS**
  - 07.11. – 11.11.2019
  - Taichung, Taiwan
- **5th Expert Days Service Robotics**
  - 27.02. – 28.02.2019
  - Odense, Denmark
- **March
  - Machuneeering**
  - 20.03. – 29.03.2019
  - Brussels, Belgium
- **Hannover Messe**
  - 01.04. – 05.04.2019
  - Hanover, Germany
- **April
  - 4. Competence Day Hausen/Mengen**
  - 01.04. – 05.04.2019
  - Hausen/Mengen, Germany
- **May
  - ICRA**
  - 20.05. – 24.05.2019
  - Montreal, Canada
- **MEDTEC**
  - 21.05. – 23.05.2019
  - Nuremberg, Germany
- **Moulding Expo**
  - 21.05. – 24.05.2019
  - Nuremberg, Germany

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