

MENSCH und AUTOMATION

The magazine for customers of Pilz GmbH & Co. KG Issue 2/2018

PILZ
THE SPIRIT OF SAFETY



“Exploring new avenues in robotics”

An interview with Thomas Pilz about the Pilz Service Robotics Modules and the new Robotics business area.

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Pilz advocates Functional Safety Management (FSM) to implement safety-related engineering projects.

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CE marking for robot assistant systems at the BMW Group.

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Better service

Not all robots are the same – when it comes to standardisation, at least, there is a difference between service and industrial robots. But those two worlds are now converging.

Until recently, permanently installed, huge robots which carried out tasks such as welding on very heavy body parts defined the image of robotics on the factory floor. Such industrial robots were designed for tasks that are too strenuous for humans. But the image of robotics on the factory floor is changing. Nowadays, increasing numbers of smaller, adaptable robot arms – also known as “manipulators” – are being used. They are intended to “give humans a hand” with physically burdensome or monotonous tasks and therefore make their lives easier.

The purpose of these service robots is to assist humans by providing at most a human level of force.

Typical industrial uses of service robots such as these are pick & place applications, handling operations between different production stages or follow-the-line applications where the robot arm has to accurately maintain a prescribed movement path, including retracing a contour or bonding work, for example. Compared to the “robot giants”, service robot arms such as these are not only meant to offer greater flexibility, but also greater autonomy.

Science fiction becoming a reality

This trend is underpinned by humans’ desire to be assisted and unburdened during everyday tasks in the way that C3PO and R2D2 work in the Star Wars saga. Service robotics has its origins in Asia, where for many years robots have been in use not just on the factory floor but also in homes and in public, for example for service tasks in catering and trade.

Safety is and remains crucial

One crucial aspect of robotics, whether in industry or beyond, is safety! The key issue is:

how can safety for humans and machinery be guaranteed when they are working together closely?

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Editorial



Dear Readers,

Human-robot collaboration:
on the cusp of production maturity

When I published the study “Lightweight robots in manual assembly – best to start simply” in 2016, we had problems finding HRC applications in regular assembly tasks. The number of applications has now mushroomed and a realistic assessment of HRC has replaced industry's initial euphoria.

Development has been rapid. A steady stream of new robots and new peripherals is reaching the market, cutting the integration and development outlay and opening up new horizons in work structuring, including in economic terms.

I expect that price and technology developments, coupled with the pressure of demographic change, will prompt a new wave of automation in areas with previously low levels of automation, such as assembly. The robots will physically and mentally relieve workers of heavy and monotonous tasks; this will benefit young, old and disabled employees, and maintain productivity.

We need to minimise the risks of poor work structuring – which I have seen in practice – by involving workers in the planning side and evaluating tasks from an employee perspective.

Best regards,

Prof. Dr.-Ing. Prof. e.h. Wilhelm Bauer
Executive Director of Fraunhofer IAO
Technology Commissioner for the state of Baden-Württemberg

► 360° Continued from page 1

Parallel to the series of standards EN ISO 10218-1/-2, in which the safety requirements for industrial robots are described, another branch of standards for service robotics has taken shape in the Far East since the middle of the last decade. As a consequence, two different standpoints on robot safety have taken shape. That, in turn, has meant that a service robot is not necessarily fit for use in industry, while conversely a robot that is entirely capable of collaborative tasks in industry cannot act as a service robot in society. Quite independently of each other, the relevant standardisation bodies at the IEC and ISO have now set up working groups. This should hold any further uncontrolled proliferation of standards in check. The dream is to return to a uniform structure. This could simplify the development and use of robots for service tasks – both on and away from the factory floor.

Ease of handling determines acceptance

Alongside safety, ease of programming and operation are key to how readily service robots are accepted. The following generally applies:

Modular toolkit for service robotics

The Pilz Service Robotics Modules initially include the manipulator module, the control module, the operator module and the software modules. The latter are based on the open source framework ROS (Robot Operating System), which offers ample scope for functional expansions. The modules together form a package certified by the German statutory accident insurance association (DGUV) in accordance with EN ISO 10218-1 and they provide everything required for the implementation of safe robot applications. This simplifies the path to the obligatory CE marking.

Since every modular component is equipped with open interfaces, users can combine the Pilz modules with modules from third-party providers, including grippers, for example. The new Pilz Service Robotics Modules are also characterised by rapid commissioning: users can connect the modules and use them immediately according to the plug & play principle. Thanks to the 24 V DC power supply, they are suitable for battery operation, bringing benefits



Toolkit for service robotics: Pilz Service Robotics Modules enable users to configure their individual service robotics application.

the easier, the better. At home or in the public realm, robots react to gestures or can be controlled by voice or touch-screen. That trend is now finding its way onto the factory floor: for example with hand guiding or easy-to-operate graphical user interfaces. More and more robots are now capable of performing new tasks even if the operator has no programming skills. One important technical development concerns deep learning and artificial intelligence. They enable humans to interact intuitively with the machine (in this instance a humanoid), develop relationships and draw on its knowledge database. Combining the scope of service robotics with the dictates of industry: that is the fundamental idea behind Pilz's new service robotics offering. The Service Robotics Modules are based on high-performance motion control and safe control technology from Pilz. With these new modules, users can create their very own individual service robot applications both in the industrial environment and in classic service robotics.

for mobile applications – for example in combination with an automated guided vehicle (AGV). These types of Service Robotics Modules therefore do more than just open up new application ranges beyond their classic area of use; incidentally they also provide operators with pragmatic support, enabling them to now perform their daily work in a safer, more ergonomic and more productive way.

Robotics – the safe way!



As a provider of safe automation solutions, Pilz has quite literally “helped to shape” robotics for years now: on countless robot applications with or without a safety fence, sensors provide protection for both the operator and the machine, i.e. the robot.

As a member of the ISO/TC 184 SC2 WG 3 working group, Pilz also plays a key role in helping to shape necessary international norms

and standards – such as ISO/TS 15066 for Human-Robot Collaboration (HRC) – to foster a common understanding of safety. Based on their many years of experience in CE marking in industry, Pilz's safety experts can support robotics users right through to the CE marking stage and accept responsibility for the safety of robot applications.

“Exploring new avenues in robotics”

Pilz presented its new Service Robotics Modules at Automatica. This prompted Mathis Bayerdörfer, Editor-in-chief of “Robotik und Produktion”, to interview Thomas Pilz on the modules and the new Robotics business area.

► **Mr Pilz, how does the new toolkit for robot modules fit into the Pilz product portfolio?**

Thomas Pilz: Robotics has long been a business area in which Pilz, as a safety expert, feels at home. Because traditionally every industrial robot needs not just a safety fence to guard it, but also appropriate safety and automation technology. That's why we've long been active in this segment with safety sensors and control technology and have also gradually been branching out into the areas of consultancy and service – specifically with an eye to HRC and the paradigm shifts it is prompting in the industry.

► **So is Pilz likely to become a robot supplier in the medium term?**

No, we are quite clear about that: we are not a classic robot manufacturer. The actual manufacturer is the one who builds a robot using the modules in our toolkit. We are a supplier of modular building blocks for modern robot applications. Our focus is on service robotics and load-bearing capacities of up to 6 kg. Not that the term service robotics in any way excludes industrial applications. Our solutions for service robotics are universally usable, entirely independently of the market segment. Whether in industry or beyond. What's more, the toolkit is not limited to our kinematics or HRC applications. Classic six-axis manipulators can also be fitted and protected with our modules – whatever their payload and area of use.



► **There's more to a toolkit than kinematics. What other components does your new robotics offering include?**

Our toolkit is very comprehensive. The spectrum of components starts with kinematics and drive technology, encompasses 2D and 3D sensor technology and operating units and extends all the way to proprietary programming software with the matching control modules. We already demonstrated years ago that you can control

kinematics perfectly well with our motion control systems and the automation system PSS 4000. But our concept goes beyond hardware and software. The elements of the new toolkit also include our consultancy and certification services for robotics. That even includes the Pilz collision measuring set for HRC applications. Our ambition is to see that the user can use all these components to configure a robot solution that precisely reflects their individual requirements.

► **Why are you offering the toolkit under the umbrella term service robotics?**

That suitably emphasises our special approach: Because on the one hand it aims to serve as broad a spectrum of uses as possible – from industry to retail or the medical sector. On the other hand we're aiming to explore new avenues in robotics. And that approach fits perfectly with the service robotics market, which is very dynamic and highly innovative because of the large number of start-ups.

► **In the open-source software ROS (Robot Operating System), you are offering a manufacturer-independent programming interface. Have you created your entire toolkit in ROS?**

In the future it should be possible to realise all applications with ROS. After all, this standard is the benchmark for innovative engineering and a degree of openness that is rarely found in classic

industry solutions, as I mentioned earlier. Ultimately we plan to provide all our control programs in the form of ROS nodes, along with the sensor technology. But we won't achieve that goal at a stroke, given the dimensions of the toolkit. That's why we started with the most important modules and are now working down the list.

► **So the robotics toolkit is more than just a test venture?**

Indeed it is. We take the topic of service robotics very seriously. But if you had asked us at Pilz where exactly we were heading when we unveiled the safety relay PNOZ in 1982, nobody would have been able to predict its future. Back then, all we knew was this: technology has the potential to change the market. It's the same with our modular robotics range. I firmly believe we are onto something big here. ◀

The full interview between Mathis Bayerdörfer and Thomas Pilz appeared in “Robotik und Produktion”, issue 3/2018.

► Inside Functional Safety Management

Implementing engineering projects safely

The motto “deliver best quality” pervades all areas of the company and is also reflected in the engineering team, which is responsible for implementing all applications including system integration at Customer Support. To achieve a high standard of quality and avoid errors when implementing safety-related engineering projects, Pilz practises Functional Safety Management (FSM). This is a certified management system for functional safety.

To execute projects successfully in keeping with FSM standards, all relevant phases of the safety life cycle need to interlock like clockwork. That encompasses everything from careful noting of the customer's requirements, through to the specifications in which the requirements are set out in detail, right up to preparing circuit diagrams or software. For optimum project support, the right project members are selected on the basis of their abilities according to a skills matrix. They have access to the supplementary hardware and software tools to implement the project. Finally, the customer requirement is compared with the selected application to identify and rectify possible errors in good time. In the final stage, joint project acceptance can take place with the customer or certification body.

The requirements for the management of safety-related systems are set forth in the standard IEC 61508, for example. ISO 13849-1 defines what needs to be taken into account when creating safety-related application software.

Pilz has adopted the process steps that it stipulates in its engineering. The approach in these engineering projects is captured in detail in the project safety plan, which describes which activities need to be performed in each individual project phase.

Pilz has obtained certification of its own FSM process by TÜV SÜD. The Pilz subsidiaries are either certified directly by TÜV SÜD or they operate according to these standards. Internal audits guarantee an internationally uniform approach. Pilz bears responsibility for the functionality and reliability of the safety and automation functions it designs and installs, and guarantees that all requirements of the relevant standards are met, for maximum customer reassurance. Customers also benefit from the clear process structures, which also bring cost savings in the long term. ◀



Webcode:
web7771

Online information
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In brief ...

Brexit: effects on standards and certificates

Brexit is coming. The effects on the accreditation of the nominated or notified bodies in the UK and the validity of British EC/EU type examination certificates have not yet been clarified conclusively – but those effects could also be significant for plant and machine builders.

At the moment, the transition period is scheduled to end on 30 March 2019. However it is likely that this period will be extended until 31 December 2020.

Until then, the United Kingdom will remain part of the European Single Market and will therefore be obliged to adopt and implement nationally all European rules along with European regulations, guidelines and relevant harmonised standards. Plant and machine builders who fit components, assemblies or even complete machines on the basis of British EC/EU type examination certificates should pay increased attention to how Brexit negotiations develop. Pilz safety components are not affected by Brexit because Pilz does not hold any EC/EU type examination certificates issued by the UK.

Pilz has compiled detailed information on what you will need to bear in mind in the event of a hard Brexit with no trade agreement at: www.pilz.com, webcode: web195930

Further information from the EU is available in English at: <https://ec.europa.eu/docsroom/documents/27401>

► Inside International range of training courses from Pilz

Safe HRC from Sweden to Singapore

Thanks to having implemented a large number of applications and its participation in international standards committees, Pilz possesses extensive knowledge of human-robot collaboration (HRC). That is reflected in its range of services. These also include a worldwide range of training courses.

Pilz adopts a holistic approach to the topic of safe robotics: building on Pilz's many years of experience in the field of CE marking in industry, its experts have acquired extensive expertise. Pilz shares that practical knowledge through the training courses it holds worldwide.


In the seminar entitled "Requirements for the Safe Use of Robots", Pilz provides an understanding of the basic requirements of robot safety. The training course covers, amongst other things, the assessment of risks in connection with the use of robot systems, as the risks here are different from those on conventional machines. Trainers with practical experience explain the typical measures for risk reduction to participants.

What conditions need to be met to ensure injury-free interaction between man and machine? How is the CE marking conformity assessment procedure carried out? In the "Safe Human-Robot Collaboration" seminar, Pilz's experts explain everything that users need to take into account when considering an HRC application and what measures they need to take. ◀



The seminar on safe implementation of HRC applications is generating high interest worldwide. The photo shows Christoph Pratter (centre), Manager for Robot Safety at Customer Support, with training participants in Singapore.

On request, the Pilz Academy can also hold in-house training courses on safe robotics at the client's premises.

 Webcode:
web150535

Online information
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► Inside International workshop for Pilz training officers

Ready for take-off: new qualification as "CECE – Certified Expert in CE Marking"

Pilz is extending its training package and from autumn will be offering the qualification as "CECE – Certified Expert in CE Marking". The international qualification certified by TÜV NORD will provide in-depth expert knowledge on all the necessary steps of the CE marking process.

To prepare for the international launch of the qualification, the training officers of Pilz subsidiaries recently met for a three-day workshop in Cork, Ireland. The event was also an occasion for the over 30 participants to obtain their train-the-trainer licences. It means these experts can now provide the "CECE – Certified Expert in CE Marking" qualification in their respective countries. With their specialist expertise on the local specifics of the market and standards, the training professionals helped tailor the qualification content to international criteria.


As the head office of the Pilz International Services Group (ISG), Cork was the ideal venue for this meeting. The ISG team based there develops innovative, very high-calibre services and training courses for machinery safety that are then offered by the subsidiaries worldwide.

The qualification "CECE – Certified Expert in CE Marking" provides design engineers and safety



The participants of the CECE Rollout Event together with Arne Schiereck, TÜV NORD CERT GmbH (2nd row, fifth from left).

officers on the manufacturer side as well as individuals involved in the CE process on the operator side the necessary knowledge for performing CE marking on new, existing or modified machinery in accordance with established case law and standards. Interested parties should consult the international Pilz Newsletter for further information and details on when the qualification will be offered in which country. ◀

 Webcode:
web153156

Online information
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HRC in automotive manufacturing

The BMW Group is making systematic progress in modernising the work environment in production. Innovative automation and ultramodern assistance systems offer immense opportunities for the workplace. Ergonomically burdensome, strenuous tasks continue to be scaled back, giving workers the chance to make optimum use of their unique cognitive skills.

While human and machine were separated from one another by safety fences in the past, things have changed in recent years: modern lightweight robots, smart devices and exoskeletons reduce the employee's workload and create a direct partnership with them in production. That makes the production system leaner and more adaptable.

Targeted use of assistance systems and lightweight robots

The way roles are divided up here between the employee and the tools available is clear: thanks to their high level of professional skills, creativity and cognitive skills, the employee is predestined for tasks that focus on actual value added, individual precision work and quality management. Assistance systems help with tasks that are strenuous and involve the strain of repetitive, stereotypical activities. Lightweight robots in production do not require any additional fixed points and are relatively mobile to use. They can interact directly with the employee.

Human and machine working to their respective strengths

As far back as 2013, the BMW Group set up the first lightweight robots alongside the line workers at the BMW Group plant in Spartanburg, in the USA. Today, lightweight robots are in operation at BMW Group plants internationally. They take over from the worker for physically strenuous tasks that are often a particular challenge when high precision and repeat accuracy are thrown into the mix. But lightweight robots are also moving into areas where large-scale robot systems are in action behind safety fences. Their flexibility, compact space requirements and the high degree of safety mean employees can once again gain access to zones that used to be off limits. With their flexible range of applications, lightweight robots open up new horizons in classic automation and restore the employees' freedom to make improvements. Obviously safety is the top priority: if a human comes dangerously close to the robot while the latter is moving into position, modern safety technology brakes the robot arm's movement right down to a standstill if need be.

For safety when working with robot assistants, the BMW Group works together with Pilz: the automation company carries out the conformity assessment including final CE marking. That enables Pilz to ensure safe human-robot collaboration (HRC) at multiple production sites of the BMW Group.

Contact, but no injuries

While collisions between human and machine are possible and permissible, they must never represent a hazard to the human. That's why the validation of HRC applications takes on particular importance: the experts from Pilz use a safe and reliable measuring process to determine whether the possible collisions are acceptable in terms of safety. With the BMW Group, as with other customers, Pilz uses a collision measuring set it has developed in-house.

Workplaces where humans and robots work alongside each other without guards are fundamentally a particular challenge in safety terms. Here the BMW Group both in Europe and in the USA is trusting in the expertise of Pilz: the automation company is conducting the conformity assessment procedures required by law at a variety of production sites of the BMW Group in Germany, England and the USA, from risk assessment, through to the safety concept and validation, to the CE marking of multiple applications.

Pilz assumes responsibility worldwide

As an authorised representative, Pilz signs the final declaration of conformity and in doing so assures that every application meets the requirements of the individual market in question. ◀

Webcode:
web182200

Online information
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Human-robot collaboration in axle drive assembly, BMW Group Dingolfing plant: BMW Group is working together with Pilz on safety.

Three minutes with ...

... Daniel Baković

Advanced Development, Senior Manager Control Technology and Mechatronic Systems

► Mr Baković, what are you currently working on?

Now that Pilz presented the Service Robotics Modules at Automatica in June, here in Advanced Development we are now looking to the future. At the moment we are working on new control and operating concepts and the innovative technologies they will require, such as machine learning for robotics. We are also working on implementing new functions and concepts hand in hand with Product Development.

► The Pilz Service Robotics Modules are now on the market. Does that mean your work is done?

No, quite the opposite: the launch of the robotics modules means our work is really only just starting. Obviously we get feedback from the tests and pilot applications. Now customers are telling us about their requirements in practice, which we are examining and implementing. Then there's the task of refining the modules, of course. Our product roadmap is rich in detail.

► So what role does software play in robotics? I believe software is at the very core of robotics modules. I like to draw the analogy with a smartphone: the user expects ease of operation that will help them achieve what they want to do – even if the technology behind it is complex. So we offer customers two options: classic robotics or motion control programming with teach-in program-

ming and PLC programming languages, as well as ROS (Robot Operating System) to take advantage of the benefits of modern programming languages, open source and a large community.



► Open source and exacting industry requirements – how are they compatible?

You can find anything in the open-source world, from simple, undocumented blocks to professional, high-quality projects. When developing our open-source ROS packages, we set ourselves the goal of meeting the customary Pilz quality requirements. Through our membership of the ROS-Industrial Consortium, our partnership with research institutes and our membership of the EU research project "ROSin", we set standards for use in the industrial sphere.



The collision measuring set is used in the process of validating human-robot collaborations and is used to record the force and pressure arising from a potential collision.

In brief ...

Functional safety on modular systems

No Industrie 4.0 without safety: safety and security are what enable the factory of the future. But how can you guarantee safety in modern systems when the situation or configuration keeps changing? Those are the challenges that the white paper "Safety on modular machines" by the Smart Factory KL technology initiative addresses. With the involvement of Pilz and TÜV SÜD, it explores how intrinsically safe, certified production modules can be put together using a cross-module information model to create a flexible but safe plant structure. The white paper is available online:

www.smartfactory.de/en/downloads-whitepaper/

New functions for the web-based visualisation software PASvisu



The software version PASvisu 1.6 now offers the "Advanced Trend Tile". It enables improved analysis of logged data and addition of dynamic trend lines to the PASvisu Runtime. The filter function according to past time profiles is new. Machine data can now be evaluated easily and manageably – the basis for an optimised production process. Further updates – such as font adaptation, file export or protection against accidental changes – facilitate the handling of PASvisu. The software is pre-installed on the Pilz Human Machine Interface PMI v7e and licensed.

Webcode: web150430

Communication concept for the future

"Safe communication for industry of the future" – new solutions for flexible and scalable machine-to-machine communication in real time are being drawn up for this topic as part of the "Taktilus" project. In January, Pilz embarked on this three-year project with other industry partners and research institutes, with the support of the German Federal Ministry for Education and Research. The technology is intended to enable direct human-robot collaboration or the use of wireless emergency stop switches.

► Panorama Revision of "robot standards" EN ISO 10218-1/-2

HRC standards: the next steps

Update for the standards for the field of safe robotics: a new version of the "robot standards" EN ISO 10218-1/-2 is due to be published in May 2021. As a member of the relevant standards committee, Pilz is involved in revising the many topics.

The safety requirements specifically on collaborative robot systems in accordance with EN ISO 10218-1 and EN ISO 10218-2 have still not yet been described comprehensively. The safety requirements have already been developed further as part of the Technical Specification ISO/TS 15066. These contents are partly included in the planned revision of the two standards and/or they are supplemented there. The plan is to publish a new version of EN ISO 10218-1 and EN ISO 10218-2 by May 2021.

Pilz experts are among the members of the international technical committee ISO/TC 299 Robotics, working group WG 3 industrial safety, which met for a working session this summer in Kyoto, Japan. The list of topics to be discussed by the completion of the revision in 2021 is long. It includes preparation of a summary with all

relevant safety functions (e.g. safe stop, safe reduced speed etc.) and the defined minimum requirements according to EN ISO 13849/IEC 62061 for the respective safety functions, the elaboration of more precise safety requirements with regard to brakes, as well as more exact requirements for applications in the types of collaboration according to ISO/TS 15066. Other items on the to-do list are elaborating safety requirements for mobile robots, and adopting and detailing the safety requirements for grippers/gripper systems, based on Technical Report ISO/TR 20218-1. And last but not least: adopting and revising the biomechanical limit values for power and force limiting as well as for quasi-static and transient contacts from ISO/TS 15066.



Webcode:
web10980

Online information
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► Profile Portrait of Pilz Australia subsidiary

Versatility the order of the day Down Under

"We are Number One for safety matters," emphasises Twain Drewett, Managing Director of Pilz Australia since this January.



20 years ago, Pilz decided to establish a subsidiary in Australia and a short time later opened a representative office in New Zealand. The long-term presence is paying dividends: with varied and unique projects to handle Down Under, the team of 23 is not short of work.

The primary demand is for solutions for logistics, packaging, drinks and food industries. There are also plenty of one-off projects, for instance in mining, the healthcare sector or power generation. Pilz Australia's customers appreciate its competent advice on safety matters, and of course the system solutions themselves. Pilz Australia advises them over the entire life cycle, drawing on a comprehensive range of products and services. To provide optimum customer support, Pilz has locations in Melbourne, Sydney and Brisbane as well as repre-

sentative offices in Perth and Adelaide. There is also an office in Auckland, New Zealand.

Coal, iron ore and gold are among Australia's main export goods. So mining, with around 230,000 employees, is one of Australia's major employers. Pilz Australia has been able to land an exceptional project in that sector. An uncompromisingly safe solution was sought for the customer "Winder Controls Australia", a system supplier of conveyor technology for mining. Elevator cars are used to transport mineworkers down to the various levels in the mining gallery and back. Previously, the travel speed was monitored by a simple mechanical control. That solution was considered too unsafe because the elevator car could not be braked in the event of difficulties or if the electronics were to fail. In some cases that

had dramatic consequences and led to serious accidents.

So to make the application safe, Winder Controls Australia was on the lookout for a reliable controller. In the guise of the automation system PSS 4000 from Pilz, the company finally found a solution that satisfied every aspect of the requirements. The controller monitors the elevator car throughout its entire trip. As soon as the drive ceases to meet the rigorous parameters, the elevator car is safely halted. The web-based visualisation solution PASvisu visualises errors and facilitates diagnostics.

Because this was a venture into uncharted territory, Pilz Australia needed to coordinate matters very thoroughly with the customers. Several test runs confirmed the technology's reliability. Pilz's Customer Support in Ostfildern was also consulted for the fine-tuning. The application confirms the impressions of Operations Manager Don Gherashe: he believes the importance of Pilz services has grown in recent years.

Twain Drewett looks to the future: "After many years of preparations, we will soon see a number of major mechanical engineering projects go live. We're always on the lookout for new projects – even beyond our customary hunting grounds." ◀

Solutions like these make sense

Interview with Dr Martina Mironovova, Manager Product Management Robotics Division at Yaskawa, on the use of the dynamic pressure sensitive mat PSENmat in robot applications.



► Mrs Mironovova, what safety functions do modern collaborative robots such as the Motoman HC10 need to offer today?

Martina Mironovova: Collaborative robots are intended to enable close cooperation between humans and machines.

The safety of our Motoman HC10 is guaranteed by force and torque monitoring in all six axes as well as by means of power and force limiting. By monitoring and evaluating external forces you can guide the robot arm directly with your hand and program it. An arm geometry with no pinch points also affords further protection, e.g. for the fingers.

► The safety functions in the robot itself are supplemented by safety technology around the application. Why is that?

Obviously the requirements of the Machinery Directive need to be met. A risk analysis needs to

be performed for each application. Depending on the findings, additional safety devices may then be needed.

► Yaskawa is testing the use of the dynamic safety mat PSENmat from Pilz for this application. What were the reasons?

Various sensor technologies are available for safe robotics. They all have their strengths.

The pressure-sensitive safety mat is especially suitable for use in cluttered applications where there are numerous obstructions – including if visibility is impaired by dust, for example.

► What are the tasks of the PSENmat in the application?

First of all, it provides safe area monitoring:

the pressure-sensitive safety mat identifies when there is someone on it. Should anyone enter the danger zone, the machine slows down or stops. The dynamic pressure sensitive mat PSENmat also offers position detection and enables new machine operating concepts. In other words, the worker can operate the machine by foot. We really liked that aspect.



► Can you summarise the experiences so far?

The sensors in the PSENmat are highly responsive and detect even slight movements, but the mat is also very strong and rugged – even withstanding high mechanical loads. And thanks to the OSSD outputs, the mat is easy to commission.

► How do you rate the prospects for such sensor technology?

Hybrid solutions like these, comprising safety functions integrated into the robot, plus additional safety technologies around the robot, will help increase the speed and therefore productivity of robot applications. We believe such solutions really make sense.

► Inside InnoTrans and Motek: Autumn exhibitions for Pilz

Apropos ...

With Mat P. on his automation tour

Whether he is dealing with applications from the fields of packaging, automotive, traffic engineering, metal processing – as an expert, Mathias P. travels the world with automation solutions by and for Pilz. He often talks to his wife about his experiences...



**PSS 4000
APPLICATIONS**

► Do you know what I noticed on our last city break to Antwerp? The metro is really reliable even though the trains are so tightly scheduled.

That's no coincidence! The transport company De Lijn just recently modernised its control technology without interrupting operations. Bearing in mind it handles over 500 million passengers a year in the Antwerp region. Everything really has to run like clockwork.

► But how on earth do you modernise like that without shutting down?

Here's how: to avoid interfering with passenger traffic for months on end, the modernisation in Antwerp was implemented step by step without encroaching on the complex electrical peripherals. The final changeover was then virtually performed overnight.

► I always wondered how they coordinate railways.

It's really clever how they do it in Antwerp, because three different metro lines meet at what is dubbed the Triangle. Our control technology makes sure only one train at a time can enter the station.

► That sounds like complex technology ...

... but it's still easy to handle. Our automation system PSS 4000 controls and monitors not just point settings and light signals, but also the distances between the trains. In an emergency it can also brake a train. PSS 4000 works more reliably and efficiently than the previous technology, making Antwerp's metro even more punctual.

Tracking down the future

Pilz is showcasing digital control technology for railway systems 4.0 at InnoTrans, the leading trade fair for the rail industry. Motek is the lead exhibition for the assembly and handling technology sector. There, Pilz is presenting its solutions for the smart factory of the future.



"The Future of Mobility" is the motto of this year's InnoTrans 2018 from 18 to 21 September 2018. In Berlin, Pilz is presenting its range of solutions for the digitalisation of trains and tracks.

lisation of trains and tracks.



The smart factory becoming a reality. Motek international trade fair, taking place in Stuttgart from 8 to 11 October 2018, is the world's leading event in the fields of production and assembly automation.

assembly automation.

To contribute to the modernisation and expansion of railway infrastructure, Pilz is investing in open, industry-proven automation technology. At InnoTrans, Pilz is presenting its automation system PSS 4000-R. On the one hand it consists of universally applicable control systems that are robust with regard to electromagnetic faults, extreme temperatures and mechanical stress. On the other hand, the automation system provides the software platform PAS4000 for the purposes of design, configuration and parametrisation. Various editors reduce the configuration work, improve diagnostic options and simplify maintenance and repair. Solutions from Pilz can be used in applications up to the highest safety integrity level – SIL 4, meet CENELEC's normative requirements, and support the open RaSTA protocol. Pilz is exhibiting in Hall 6.2, Stand 214.

Coinciding with the InnoTrans Convention, Pilz is presenting its future solutions in the dialogue forum "Innovation Paths 4.0 – VDB Future Workshop" on September 21.

The Pilz smart factory at the exhibition will show how individualised products can be manufactured under mass production conditions, in a way that's fast, flexible and cost-efficient. All the components involved come from Pilz, from the sensor to the drive and the controller. The new Pilz Service Robotics Modules are also part of the Pilz smart factory. These enable users in the industrial environment to assemble their individual service robot applications. Pilz is exhibiting in Hall 8, Stand 8116.


On 8 October, the first day of the exhibition at Motek 2018, the "Safety + Automation" Specialist Forum will be taking place in Hall 8. In eight individual presentations, renowned experts will give talks on the hot topics of safe automation. In additional presentations, experts will provide practical tips for the implementation of the German Ordinance on Industrial Health and Safety and the CE process. All presentations can be visited individually and without previous registration and are free of charge for the visitors to the exhibition. The detailed programme can be called up at www.sicherheitundautomation.de.

Flexibility for industrial service robotics



The manipulator module PRBT is a robot arm developed by Pilz with a weight of 19 kg. It is equipped with six axes, has a reach of 741 mm and a load bearing capacity of 6 kg. The manipulator module is especially flexible for use in industrial service applications because its compact design means it can be set up in any assembly direction. That makes it ideal for a wide range of tasks such as pick-and-place applications or mobile applications, such as automated guided vehicles (AGV). The battery drive needed for AGVs can be very

easily realised with the manipulator's 24 V technology. The manipulator communicates with the PRCM control module over a CANopen interface. Safe operation is assured by the two integrated safety functions Safe Torque Off (STO) for safe shutdown to EN 61800-5-2 and Safe Brake Control (SBC).


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web182197
Online information
at www.pilz.com

Intuitive and safe robot control



The PRCM control module enables rapid commissioning and intuitive control of the Pilz Service Robotics Modules. Users interconnect the modules according to the plug-and-play principle and can use them immediately. The manipulator's movement is governed by the PMCprimo MC robot control. Meanwhile the PLC controller PSSuniversal PLC monitors the modules' safety functions. The PRCM control module supports open industry communication protocols such as CANopen, EtherCAT and

PROFIBUS. PRCM can not only be programmed with the PLC languages to IEC 61131-3, but the open-source framework ROS (Robot Operating System, see below) is also available, offering the user ample scope for functional expansions.


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Operation and teaching made easy



The operator module PRTM enables user-friendly operation of the robot thanks to operating and visualisation software developed by Pilz. The functions operating mode selection, emergency stop and diagnostics can be selected via a graphical user interface. The panel permits simple setup and teaching of the robot arm via a sensitive touch display. All functions such as manual program processing, motion commands, program control and execution are easy to select and program. The user controls the manipula-

tor via touch functions and hardware buttons. All six axes of the manipulator module can be activated and taught individually or with Cartesian coordinates. For diagnostics, data on error messages and guidance can be exported. Remote maintenance of the Service Robotics Modules can be performed via the remote desktop.


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Open for software programming



The open-source software ROS (Robot Operating System) offers manufacturer-independent programming interfaces. The software is encountered mainly in the world of research and development, and offers considerable programming freedom. With the ROS modules, Pilz offers users high-quality, user-friendly ROS packages directly from the manipulator manufacturer. These meet industrial quality requirements and are ready for immediate use in industrial as well as service robotics environments.

The openness of the ROS modules also enables the user to incorporate other-make modules, providing the opportunity for individually tailored service robotics solutions in industrial environments. There are initially modules for configuring the robot, path planning with important movements for use in industry, as well as an interface for ease of programming in Python.

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Pilz Ireland, Pilz Singapore, Pilz Australia,
BMW Group, ©Andrey-Popov/Shutterstock,
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Reproduction:
SZ Repro, Esslingen, Christine Huebbe, Stuttgart

Printing:
Druckhaus Waiblingen Remstal-Bote GmbH,
Waiblingen

Circulation: 18 800 copies

Paper:

Printed on 100 % recycled paper for the good of the environment.

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8-8-en-3-128, 2018-09 Printed in Germany
© Pilz GmbH & Co. KG, 2018



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