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HARTING's Technology Newsletter | 35

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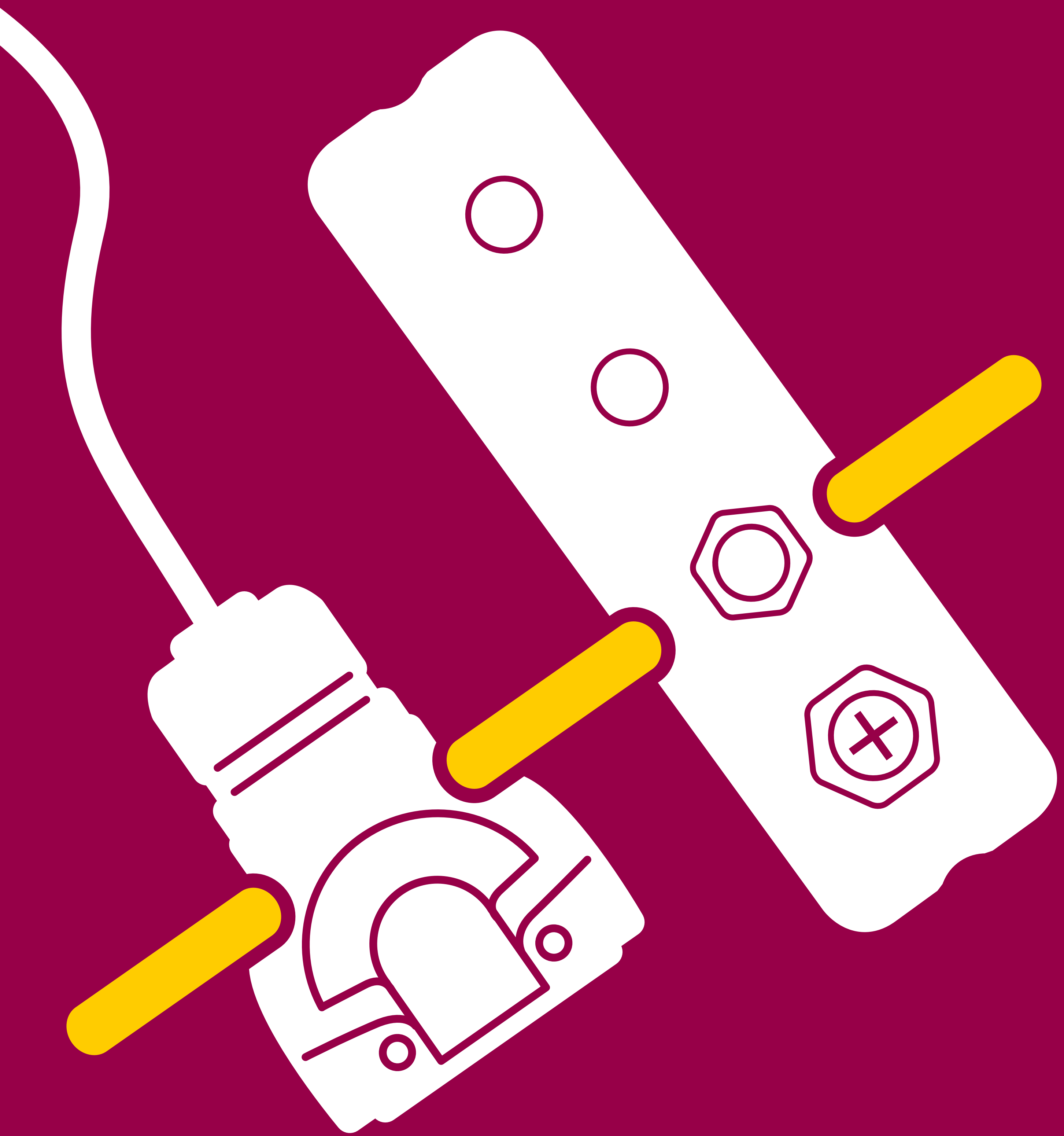
DYNAMIC DUO: MICA TEAMS WITH
AIS HOST COMPUTER

Now is the time for
**strong
connections...**

HARTING

Pushing Performance

… with **connectivity solutions** between Edge and Cloud.



Connection technology 4.0 in the Industrial Internet of Things

Dear readers,

HARTING produces connection technology - nothing new about this. The Han® connector combines the expectation of unrestricted robustness with the long lifecycles in the industrial sector.

Industrie 4.0 does everything differently.

Production is becoming flexible and changeable. This is happening because everything is migrating to the internet – which means that the Internet of Things (IoT) is taking shape. This influence is also determining our connectors as well. But things need a connection to the internet in the first place. Here, I see our MICA as the connection concept. With the MICA, the OT is brought to the internet and to the Cloud, based on IT software concepts. Here, this connection technology must be as solid as the Han® connector. Yes, our Han® connectors are also Things. So now we've come full circle, when the classic connection functions – that will continue to be in demand in the future – are supplemented by internet and Cloud connectivity.

For me, all this is connection technology, connection technology 4.0 in the industrial Internet of Things. More than ever, the connection solution is important – and we offer it.

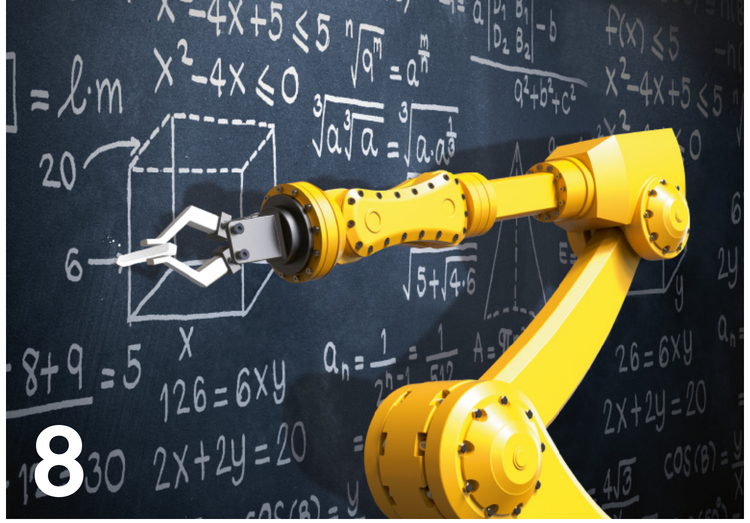
I hope you enjoy reading our latest issue of tec.news!

Yours sincerely

Philip Harting

Philip Harting,
Vorstandsvorsitzender

Connector2Cloud
The new industrial infrastructures



Edge Devices as the I40 key
to "life-long learning" by a machine

Digital integration of
machinery – practical implementation

Lightweight modular
connectors for Big Data

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CONNECTOR2CLOUD – THE NEW INDUSTRIAL INFRASTRUCTURES

The transition from physical connections to a hybrid world of physical and digital networking is beginning to take shape. In response, more and more system solutions based on the Plug & Work principle are in the spotlight. HARTING is actively supporting this approach with system-compatible products and application-specific solution packages, which will above all shape the new industrial infrastructures.

THE NEW EDGE (HAN® AND MICA ARE SQUARE!)

The Edge of the new digital industrial (network) infrastructure is currently the focus of numerous activities and discussions, also among larger user organisations and committees. Not least the Industrial Internet Consortium (IIC), which has published a white paper on "Edge Computing in IIot" in order to assort and describe the variety of possibilities. These potentials are already supported by the HARTING MICA, as the open platform allows any combination of sensors and Clouds to be integrated. In addition, HARTING already supplies application-specific solutions for specific problems via its pre-assembled solution packages.

Digital connection of the physical world

The IIC White Paper also demonstrates that the Edge, depending on the application, can be on different layers and devices. There will also be applications where a connection to a Cloud is not mandatory, but in which the Cloud can generate additional value – as in the central orchestration of devices and applications, for example.

EDGE CONNECTED

Edge analytics gateways, e.g. the MICA, have a fundamental contribution to make to new infrastructures. The MICA connects the physical world – for example via sensors or smart connectors – with the Cloud. Examples could include an autarkic sensor, a sensor in a machine or future connectors with sensor technology. Intelligent connectors will also be characterised by the functional integration of electronic sensor circuits with embedded computing power. This new class of devices is augmented by wireless sensors, which offers advantages over wired solutions – especially with regard to retrofit applications. In this way, the boundaries between IIoT connectivity and the electromechanical connectivity of connectors will continue to merge.

The computing power on the Edge means that initial calculations and analyses of the collected data can now be carried out. Depending on the application and customer benefits, it is possible to make decisions on the spot without having to resort to additional systems. These decisions can be made by simply displaying states, or going all the way through to intervention in the ongoing, running process. The hidden added value of the metric results by way of comparison with other context data, e.g. manufacturing data. Among others, this will be demonstrated in the first version by way of system-compatible connectors and sensor systems, which will bring the paradigm of Edge computing even closer to the machine. ■

IIoT connectivity and the electro-mechanical connectivity of connectors will merge even further

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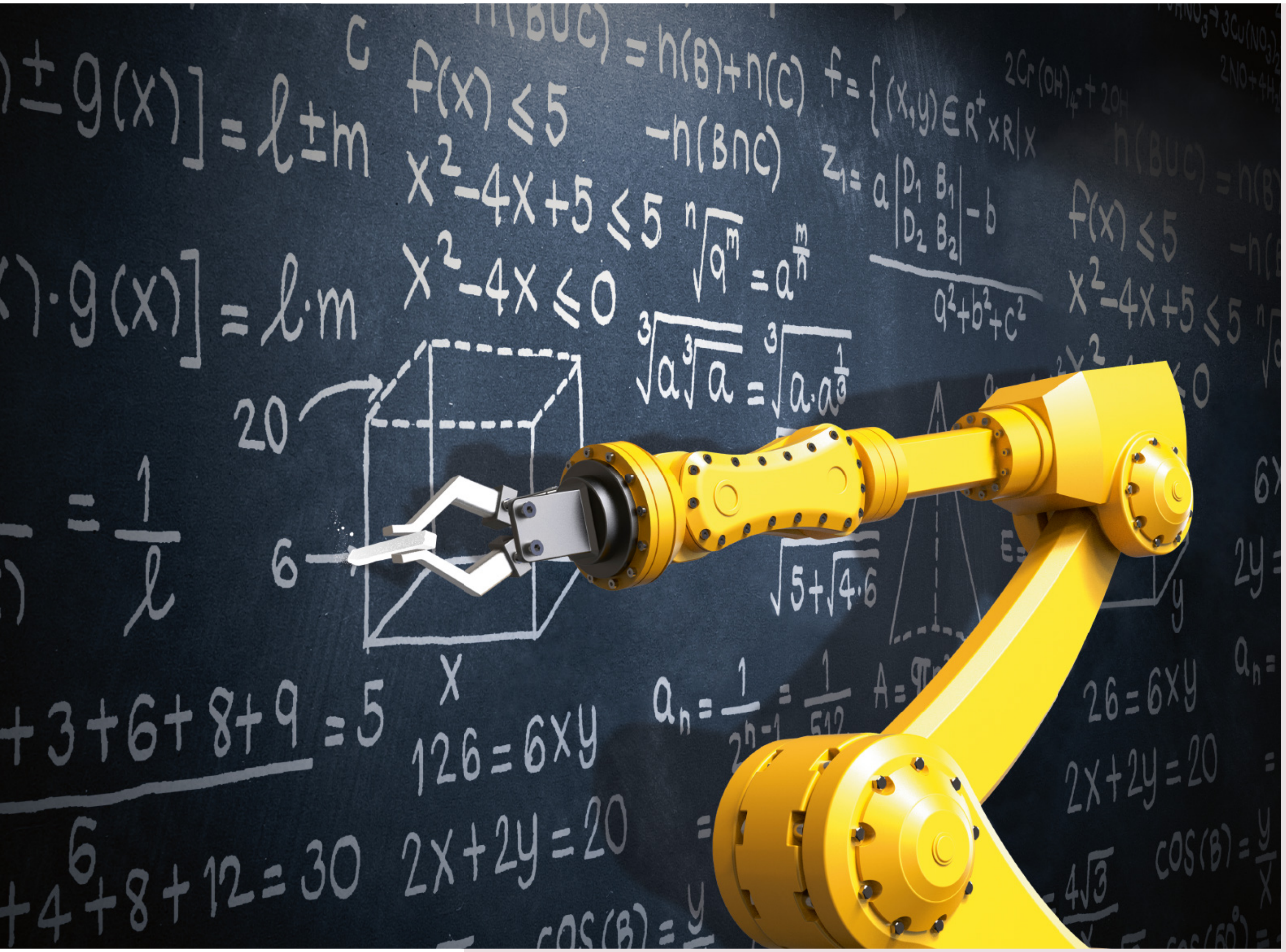
IN SHORT

- MICA as a core element of the digital connection
- Functional integration in the connector → digital Han®
- Digital connectors as the new Edge of the industrial network?

EDGE DEVICES AS THE I40 KEY …TO "LIFE-LONG LEARNING" BY A MACHINE



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The implementation of the 4th Industrial Revolution continues to focus on the linking of industrial production to the internet and the Cloud. This aspect has parallels with the Internet of Things (IoT) and can be seen as its industrial expression, i.e. as an industrial IoT (IIoT).

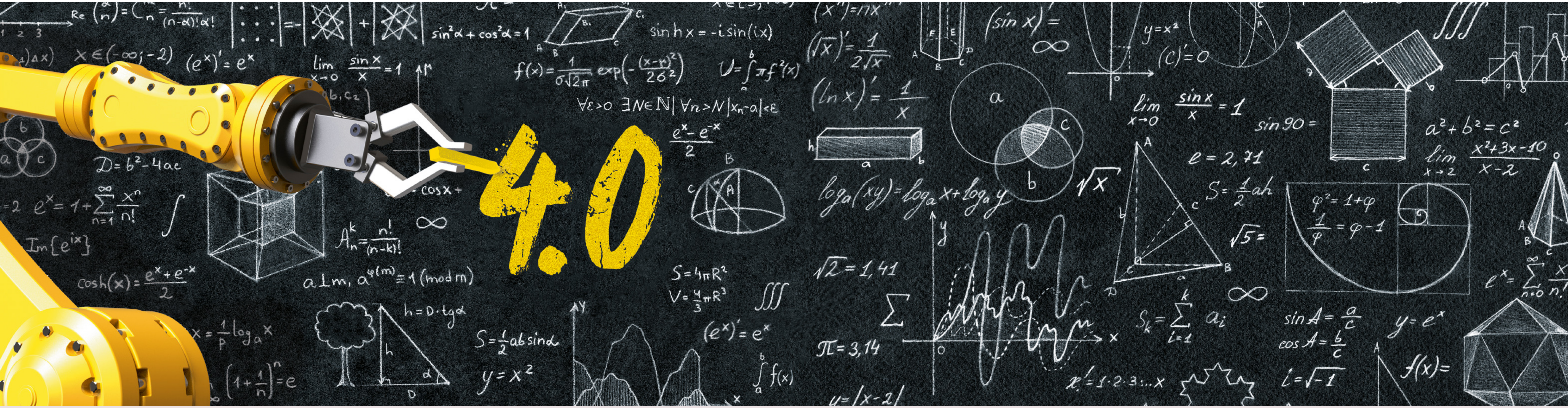
The revolutionary approach of I40 should not be seen as a one-time fundamental change, but as openness to permanent change. Connecting to the internet boosts the functionality and performance of an industrial plant and machinery – thereby permanently adjusting and improving seamless integration and in the form of digital, value-added networks.

A key role is played by Edge Devices that are used directly in the production module.

A key role is played by Edge Devices that are used directly in the production module, i.e. in the area of the plant and machine. Edge devices are tasked with lifecycle services such as predictive maintenance, performance management, asset management or spare part management. But they can also be more general in nature by enabling process optimisation through Cloud-based services. Important here are the open interfaces of the edge devices that are used, along with extensive standardisation of the integration. This way, these intelligent systems can be used uniformly by different software systems as well as also uniformly integrated into the manufacturing environment. The SmartFactory^{KL} has created a concept here and has already shown the first implementation steps on the demonstrator at HM 2018.

Certainly, IT edge devices are all-rounders, since they can be used universally for all services. But there is one exception: automation. On the face of it, this appears to be a contradiction since the 4th Industrial Revolution is often seen as being the assumption by IT of all functions in the industrial sector. Also, converged Ethernet networks have been implemented for years now. A decisive step in this is TSN (Time Sensitive Networks). Now, the Ethernet network can be universally integrated into hard real-time areas. Why shouldn't the IT edge device be used universally, including for automation? Or, vice versa: Why shouldn't the PLC also be used universally as an IT edge device?

If one analyses the requirements for an industrial control and an IT edge device, there are clear differences. The programming



of the PLC is adapted to the machine, strongly function-oriented, and uses well-established hardware and software that has already proven itself within the application. The basic function of a machine or of a machine module – for example, a module of the Smart Factory demonstrator – only changes if there are significant changes in the production process. Of course, parameters of the actual sequence can be accessed in order to enable flexible production within the scope of a mass customisation. However, these changes do not affect the modules to such an extent as to require a new commissioning in each and every instance. As a rule, the basic control structure with the deployed control system remains unchanged over many years, something which is necessary not least in light of safety aspects. It is absolutely atypical for a completely new PLC to be installed during the life cycle to increase performance. This is usually only customary after several years, in the course of refurbishment.

By contrast, the installation of an IT edge device usually constitutes an expandable platform which is constantly adapted and built out during the life cycle of a machine via the use of additional services. Software updates in short intervals are also common here. However, no new commissioning of the machine takes place, since e.g. safety-relevant aspects are not affected. The software used also meets the necessary standards in the IT environment. OPC UA constitutes an intersection in communication with industrial devices, even if signs are already on the horizon that this communication standard is not the only one that will be used by IT in the industrial environment. IoT standards such as MQTT are also finding inroads here. Consequently, the IT edge device turns out to be a device that is completely built and operated according to IT paradigms. Most of all, it is not rigid and unchanged in the life cycle of a machine or plant. It will continuously evolve with lifecycles far below those of automation devices. This is necessary to keep up with IT. But that would mean that even a PLC – an intelligent drive in a machine – will be replaced in a machine at the latest after five years in order to be up to date with the latest IT standards. This is neither economically viable nor technically feasible.

The decoupling of IT edge devices and automation devices provides further advantages in plant operation.

The decoupling of IT edge devices and automation devices provides further advantages in plant operation. For example, since another jurisdiction exists within companies as well, the devices can be accessed independently.

But one thing is also evident – and this has been shown very clearly in the SmartFactory^{KL}: besides the hardware and software decoupling, a communication connection still remains. The different devices access the same sensors. And if the production process is to be optimised by new services, access to the automation devices is absolutely necessary. This requires suitable interfaces, including a semantic description of the devices. Creating these is the urgent task of the future, because in most of today's applications the automation device and the edge device operate completely separately, mostly with their own, dedicated sensors. This is not optimal either, as both devices have their justification. But their sensible use is not only based on co-existence – their cooperation is crucial. Otherwise, it comes down to a fight that only an edge device with integrated automation control – meaning an all-rounder – can win. But those jacks of all trades have proven more often than not to be lame ducks.

Therefore the preference for reliance on fast edge devices, which provide the requisite ability for the system or machine to learn over its entire life cycle. ■

EDGE COMPUTING IN PRODUCTION?

The Industrie 4.0 production plant of the SmartFactory^{KL} partner consortium 2018. HARTING is also contributing to the project with a production module for manufacturing the business card holder in lot size 1. Photo: SmartFactory^{KL}/ Alexander Sell

The “Edge” concept has been swirling around production for several years now. What’s really behind it? The “Edge” terminus originates from mobile network technology. There it became clear some time ago that the available data rates not sufficient to relay data intensive computing tasks to centralised computer centres. This in turn means that IT technology must be provided at the edge of the network, in radio cell base stations.

Built-in MICA as Edge Device at the Industrie 4.0 production facility of the SmartFactory^{KL} partner consortium. Photo: SmartFactory^{KL}/Alexander Sell

The concept was transferred in the production sector without second thoughts. Here, however, we find a completely different architecture. Production control traditionally features a decentralised structure. Powerful controllers perform process control in real time, while on-site industrial PCs provide databases, interfaces, and evaluation functions.

Frankly speaking, we've always been performing edge computing in the production sector. However, there are two other new things besides just the terminus itself: the increasing use of open and standardised protocols, as well as today’s availability of small and inexpensive computers, the so called edge devices. There is yet another new aspect at hand: increasing vertical integration is leading to a convergence of central IT functions and decentralised plant control since modern production must adapt to requirements and requires timely production data in a flexible way. This necessitates new, and above all standardised, interface protocols like OPC UA.

In principle the PC-based controllers available today offer the option of running virtually any soft-ware on a computer. From high-level language programming in IEC61131 to virtual machines and hypervisor technology, the door is wide open here. However, in reality controllers in machines and plants do not usually have the internal software architecture needed to perform edge computing in the sense of decentralised preprocessing as per IT standards. A line controller of an automation application is not networked with the surrounding IT. In addition, for safety and availability reasons it should be as autonomous as possible, i.e. decoupled from IT processes.

Also, upgrading an existing system by adding even small functions already requires intervention in the controller. Often, just to enable new communication interfaces even the control computer would need to be exchanged.

At this point, dedicated edge devices for new I4.0 services can be easily deployed to upgrade existing equipment of all ages. An upgrade involving new functions is thereby possible without interference with a tested and certified system. Consequently, edge devices can, among other things, act as a kind of data gateway to bridge protocols and implement security functionality. ■

Prof. Dr.-Ing. Martin Ruskowski
Prof. Dr.-Ing. Martin Ruskowski holds the Chair of “Machine Tools and Controls” at the Technical University of Kaiserslautern and is the Head of the Innovative Factory Systems research depart-ment at the German Research Center for Artificial Intelligence. His research interests include industrial robots as machine tools, artificial intelligence in automation technology and novel control concepts for automation. Previously, he held several executive positions in industry, most recently as Head of Research & Development at the KUKA Industries Group

INDUSTRIE 4.0 – RETROFIT WITH MICA

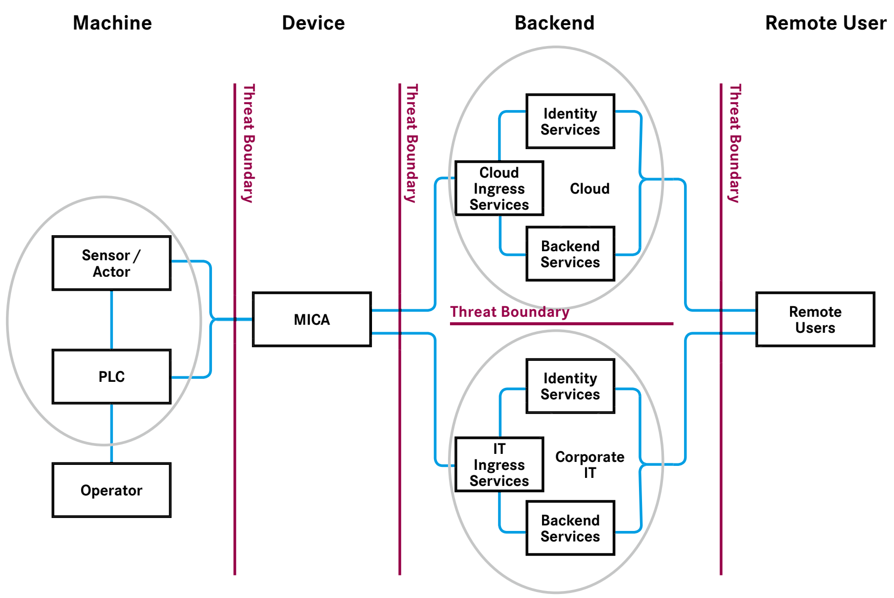
Whether you call it IoT, IIoT, or Industrie 4.0, in recent years the biggest technical revolution since the introduction of the SPS has been playing out in the industrial sector. Especially in the retrofit area – i.e. in more than 90% of all industrial facilities – the question now arises as to how manufacturing IT can be connected to company IT, and possibly the Cloud, without having to change the production network or creating new, unforeseeable security problems.

Where does the MICA enter the picture in production?
HARTING MICA makes it possible to set up an intermediate layer between the machine and the rest of the world with minimal effort and thereby isolate production from company IT, while at the same time collecting, evaluating and, if necessary, forwarding KPIs and other relevant data.

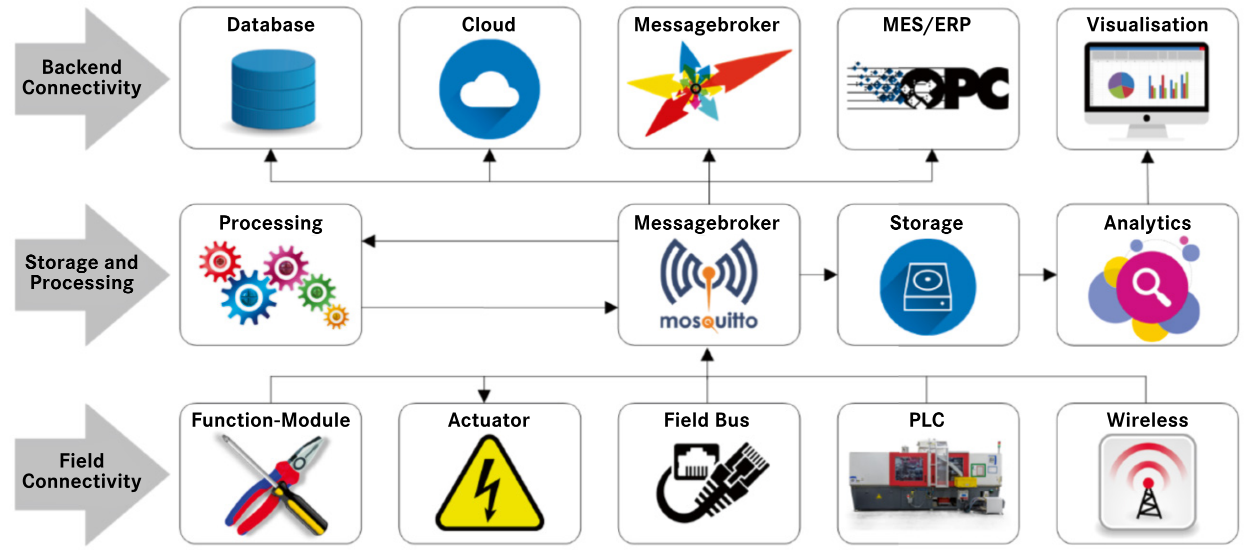
In this model, the MICA has three tasks:

a. Communication with the machine, either via the PLC or separate sensors and actuators
b. Preprocessing and conversion of data
c. Communication with the backend, e.g. with corporate IT or Cloud services

MICA AS A BRIDGE BETWEEN MACHINE AND BACKEND.



SOFTWARE ARCHITECTURE OF THE MICA



How is this role reflected in the MICA software architecture?
The role of MICA within production is directly reflected in its software architecture, which provides for three levels:
The "Field Connectivity" layer is used to connect to data sources, e.g. control and sensors and data sinks such as actuators in production. In the "storage and processing" level, local processing of the data takes place to e.g. perform edge analytics or remote data storage. The "backend connectivity" level connects to higher systems such as databases, Cloud services, as well as ERP and MES systems. Within the various levels, LXC containers are used to implement required functions as microservices. The microservices communicate with each other by way of a local message broker and the MQTT communication protocol. Due to the container architecture and the event-based approach, the individual services are clearly decoupled from each other, which enables high reusability of individual services in different projects. This directly reduces the development effort and thereby enables a much faster project implementation compared to traditional approaches. ■

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DIGITAL INTEGRATION OF MACHINERY

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PRACTICAL IMPLEMENTATION

How do you succeed in digitising the machine inventory at HARTING? What are the challenges that need to be mastered when you go down this path, and what goals has the Technology Group set itself for digital integration? tec.news spoke with Markus Obermeier, Team Manager Industrie 4.0, Dr. Stefan Berlik, Team Leader Cognitive Systems, and Thomas Kämper, Specialist Condition Monitoring & Maintenance Services, who are spearheading the project.

The digital integration of the machinery is being implemented by Thomas Kämper, Markus Obermeier and Dr. Stefan Berlik (f.l.t.r.)

tec.news: What does the practical implementation of the digitisation of machinery at HARTING look like? Are edge devices and/or the Cloud used?

T. Kämper: With regard to the digital integration of our machinery we rely on both the MICA as an edge device, as well as on the cloud. Here, the goal of data acquisition and sensor technology is to fully exploit a machine's potential for improvement and to try to predict unplanned events. Starting from here, we can additionally derive forecasting ability, adaptability, and self-optimisation.

M. Obermeier: The first step is to collect and record large amounts of data. When this results in patterns, models can be derived which we then transmit to an edge device. Ultimately, the question of data storage in the cloud, data centre or edge is application-specific. It depends on the amount of data generated at the measuring point or sensor. With a large amount of data, the cloud is certainly attractive for cost reasons. With small amounts we can stay in the edge area. If an analytics model can be made known to edge devices, it's possible to run edge analytics.

Dr. S. Berlik: The combination of different data sources also plays an important role. Many times, not only are the measurement data of a single machine necessary – other data sources also have to be incorporated to get the overall picture. In such cases, it makes sense to transfer the data from the MICA to the cloud to perform the aggregation and correlation there and eventually bring the model down again.

tec.news: What are the short and long-term goals for the digitisation process?

M. Obermeier: We're pursuing short-term and long-terms goals in the digital integration of our machinery. On the one hand, we are achieving quick-wins, on the other hand we're also taking a structured look at the entire machine inventory, analysing it with respect to our project goals and creating a concept for the processes in this area. We're looking to harness this method to create a robust architecture that can be used in many places. Of course, it's hugely important here to hand over the process and the IT architecture based on training and documentation and to ensure the qualification of the operating and technical personnel. After all, they'll then be able to perform the roll-out to all other relevant positions themselves.

T. Kämper: In the past, we only stored in structured formats, in order to perform classic business analytics. This brings us up against our limits, because in addition to the structured data we also have, for example, time series for sensors, JPEGs, and text files stored locally on hard drives, etc. We have to assign all of these, and we make use of the associated sophisticated technologies to do so.

tec.news: What role does MICA play in this undertaking?

M. Obermeier: The MICA forms the gateway between the machine and the cloud. As indicated at the start of the interview, it collects data, evaluates them and helps to detect irregularities. In order to view data from a machine, you don't need a local application: the software containers are on the MICA, their user interface is accessible in a web-based manner. This is one of its strengths over other systems, which, for example, only collect data in one place and require a server for data storage. With the MICA, everything is bundled – it's one single device with various software containers that you can connect to each other in order to achieve complete, initial quick results, e.g. a LIVE visualisation of process data.

Dr. S. Berlik: It also offers the possibility to merge different data and to obtain a highly meaningful overall picture through the extremely simple integration of external sensors, for example. Especially with regard to cloud data acquisition over a longer period of time, it can be very interesting to obtain precise insight into the production conditions of different machines. How can I produce cost-efficiently and energy-efficiently? And what can one machine learn from another?

T. Kämper: At the moment, we are using three different MICA models. We have opted for the basic model in plastic injection moulding and are thereby gaining access to the process data of the machine. Cycle and dosing times, the temperatures – we can even draw on built-in sensors to access compressed air data for example. Moreover, we are also relying on our RFID MICA with regard to plastic injection moulding machines. The tools are equipped with RFID tags so that we can also view the tool's data. Consequently, a plausibility check will be performed in the near future, to see if the tool and e.g. the gripper fit for the corresponding order. When it comes to recording the energy of plants and machines, we draw on our MICA Energy, which communicates with the respective electricity meters by way of an extra interface, displays values and collects and evaluates the desired data. This is based on the Modbus protocol. With regard to our orientation going forward, we want to use additional MICA variants in production in the future, for example when remote maintenance is involved. Furthermore, the MICA is on the job locally to preprocess data in order to keep data traffic in our IT network low and to reduce latency in data analysis.

tec.news: What advantages does the MICA offer in comparison to other gateways?

At the moment, we are using three different MICA models

T. Kämper: The MICA models we are relying on feature crucial strengths compared to other systems. On the one hand, there is industrial suitability with IP67 protection and the compactness of direct installations in machines. On the other hand, we benefit from various interfaces that conventional industrial PCs do not have, such as RFID interfaces. Furthermore, the MICA scores points with its flexible, Linux based open-source software. Thanks to the open platform, the MICA can be configured with freely available software. The resulting openness allows the installation of different containers on a single system, so you don't have to resort to different island solutions. Also, only one-time investment costs are incurred with the MICA, so there are no license or leasing fees compared to full-fledged PCs. ■

MICA on the job: Injection moulding system at HARTING plant II

MICA VARIANTS NOW ON THE JOB AT HARTING

Lars Hohmuth,
Product Manager Embedded Systems, HARTING IT Software Development,
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In order to rapidly and conveniently implement digitisation projects directly on systems and machines, the HARTING Technology Group opts for a modular, industrial-strength mini-computer: the HARTING MICA (Modular Industry Computing Architecture). Available in several variants, it can be deployed in a variety of application scenarios.

Modular hardware, flexible open-source software based on a Linux operating system and robust mechanics do the rest, in order to ensure that a creative, individual solution approach can perform even in the harshest industrial environments. With protection class IP67, it is perfectly protected against temperature fluctuations, dirt, dust, moisture or vibrations.

All MICA variants are characterised by cost and space savings as well as by easy handling. The HARTING Technology Group is harnessing the following models for the digital integration of its machinery:

MICA Basic:

- 1 GHz Single-Core processor, 1GB RAM, 4GB eMMC, USB 2.0
- Linux-based
- IP67
- Fanless
- High EMC
- Communication via Ethernet

MICA Energy:

- 1 GHz Single-Core processor, 1GB RAM, 4GB eMMC, USB 2.0
- Linux-based
- IP67
- Fanless
- High EMC
- Current sensors connect via Modbus RTU / TCP, S0 Interfaces and evaluate data directly

Ha-VIS RFID Reader:

- 1 GHz Single-Core processor, 1GB RAM, 4GB eMMC, USB 2.0
- Linux-based
- IP67
- Fanless
- High EMC
- Contactless tools recognise or read out sensor data via RFID

DYNAMIC DUO: MICA TEAMS WITH AIS HOST COMPUTER

LINE CONTROL IN A HETEROGENEOUS PLANT FACILITY

The Dresden-based AIS Automation team is comprised of software experts in the field of factory automation and IT solutions. As an internationally oriented company, AIS specialises in development and integration services. The company's targeted software solutions are deployed in process automation and machine control, as well as in factory-wide production IT.

When it comes to the production environments of automotive suppliers, the traceability (Track & Trace) of individual parts as they make their way through processes – e.g. in CNC machining – plays an increasingly important role. Collected data must be thoroughly analysed to effect process optimisation and quality control. On the one hand, this is required by the customer. On the other, this type of traceability generates a not insignificant competitive advantage for the supplier.

The payoff is particularly offered by the industrial suitability, modular design and the expandability of the MICA.

This is where the HARTING MICA comes into play in conjunction with the AIS line controller "FabEagle® Line Control" and forms the core component for production control within this constellation. The MICA integrates additional hardware components such as Data Matrix Code (DMC) scanners, operator pushbuttons and signal lamps needed to implement material tracking on the CNC machine. In addition, as an Edge Computing device the HARTING MICA establishes communication with the host computer. To support material interlock, it also ensures that a corresponding relay is controlled in the CNC machine. This prevents e.g. multiple processing of material and/or NOK material. In future, MICA will perform the analysis and evaluation of the torque from the CNC spindle. These results will then be passed on to the AIS master computer.

The payoff is particularly offered by the industrial suitability, modular design and expandability of the MICA, which teams with the master computer such that the integrated systems behave like a modern I4.0-capable system. Other bonuses include the low installation effort and the fact that no adjustments to the system software are required. ■

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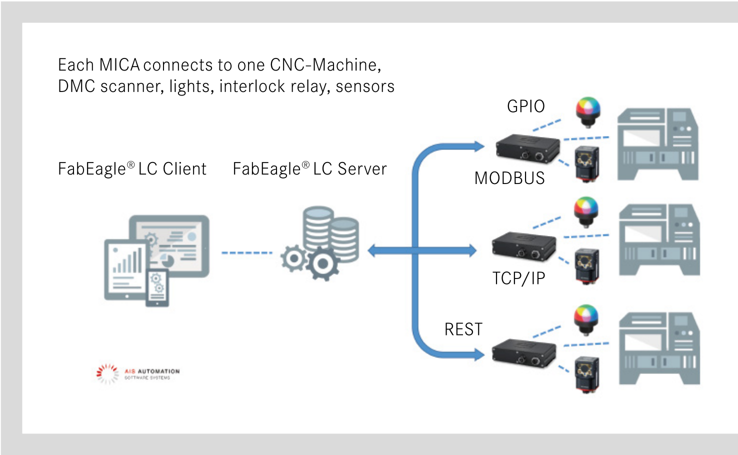

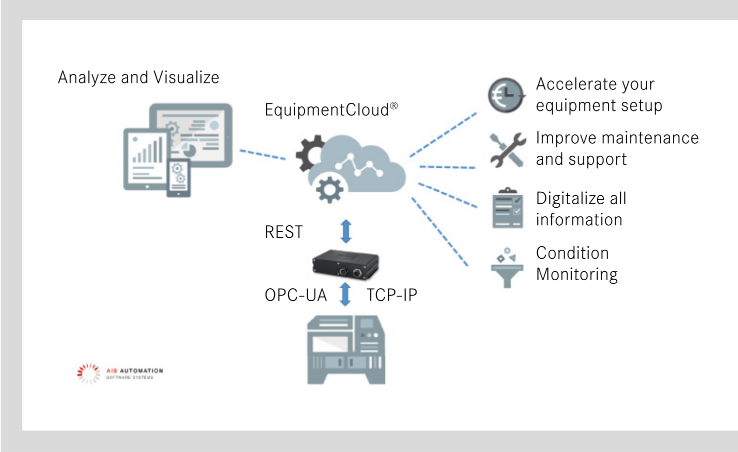

IN SHORT

- Acquisition of process data, alarms and messages via the existing equipment interface
- Material tracing
- No changes to existing system software

SLIMMING THE WAY TO **INTEGRATED INDUSTRY**

HARTING is driving forward the standardisation effort of the new Single Pair Ethernet (SPE) technology. Now, in a multi-stage selection process, international standardisation committees have decided in favour of the Technology Group's SPE mating face. This also gives planning security to designers of new devices or sensor/actuator technology and they can actively start with the implementation of SPE in the respective device technology. This is the final step to IP-based network connectivity from the Cloud to the sensor.

Single Pair connector portfolio in IP20 and IP65/67 in M8 external dimensions from HARTING (PCB socket and cable plug).

Single Pair Ethernet is a new Ethernet technology that requires only one pair of wires to transfer data and power. This technology, which is driven by the automotive industry, is also gaining increasing importance in automation technology, where its development is advancing in targeted manner. Due to its simplicity and an associated reduction in weight, space requirements and installation effort, a great future is seen for the technology within the industrial sector, automation technology and the rail industry, among others.

SPE now makes it also possible to implement digitisation down to the field level, i.e. end-to-end IP-based communication. Equipping simple sensors via cameras, reader and identification devices etc. with Ethernet interfaces supports the implementation of Integrated Industry and IIoT.

END-TO-END COMPATIBILITY OF DEVICES, CABLES AND CONNECTORS

The end-to-end compatibility of devices, cables and connectors is a prerequisite for the widespread use and hence the successful marketing of SPE technology. The international standardisation selection has seen two mating faces prevail:

- For building wiring, the mating face according to IEC 63171-1: this mating face is based on the proposal from CommScope and is known under the synonym variant 1 (LC style) for M1I1C1E1 environments
- For industrial and industry-related applications, the mating face according to IEC 61076-3-125: this mating face is based on the proposal of HARTING and is specially designed for use in up to M3I3C3E3 ambient conditions, and is known as variant 2 (industrial style)

MICE describes environmental conditions for installations and provides planners and users with valuable information on the specification of technical equipment and cabling. As part of this, the requirements for mechanical robustness (M), IPxx degree (I), chemical and climatic resistance (C) and electromagnetic safety (E) are described.

In the broadest sense, M1I1C1E1 describes an environment such as the one found e.g. in an office building, while $M_3I_3C_3E_3$ describes an extreme environment such as e.g. in an industrial setting or outdoors.

ADEQUATE POWER – EVEN OVER 1 PAIR

The already available Ethernet technology according to IEEE 802.3bp 1000Base-T1 delivers 1GBit/s transmission speed over only a single pair of copper cabling. At the same time, devices can be remotely powered via IEEE 802.3bu power over Ethernet – here PoDL = power over data line.

However, requirements from Integrated Industries or IIoT go even further. In order to develop simple, secure and efficient industrial communication of the future, the continuous connection of all participants of a comprehensive network from the Cloud to the sensor via IP-based Ethernet services is required. Here, SPE delivers the decisive difference to bus systems or power interfaces.

TOGETHER TO THE GOAL

HARTING offer a comprehensive product portfolio for the industrial sector based on the mating face defined in the standard. Prototypes of this new connector were first introduced two years ago at SPS 2016 in tandem with the two other connectors, the ix Industrial® and M8 d-coded. Following the standardisation of the HARTING ix Industrial®, the second connector now becomes the industry standard. ■

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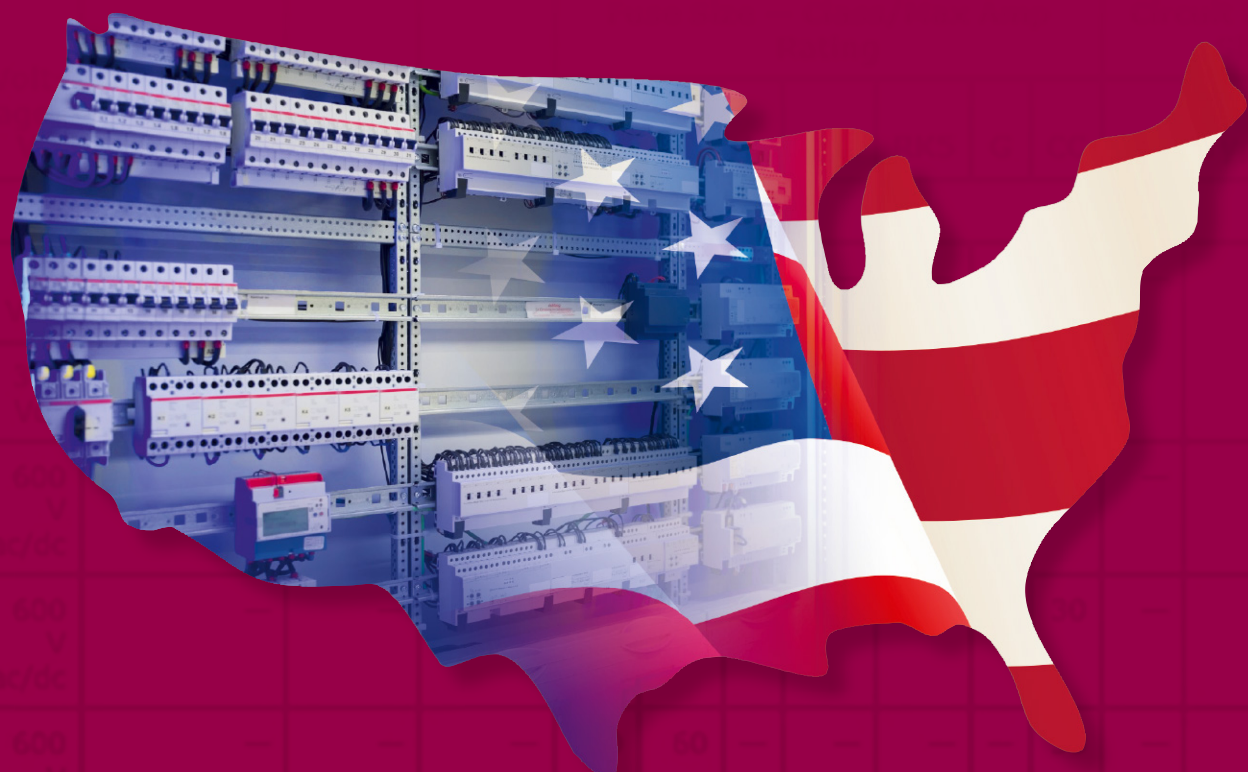
FASTER ACCESS TO APPROVAL REQUIREMENTS



for pluggable interfaces for industrial control panels

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The trend towards modularity in plants and production facilities also extends to industrial control panels and control units. In response to these developments, HARTING has been cooperating with U.S. product certifier, Underwriters Laboratories, UL. This cooperation has led to faster access through the approval process for pluggable interfaces for industrial control panels and delivers a greater efficiency for the North American market.

UL 508 A – U.S. BASIS FOR INDUSTRIAL PANEL SHOPS

Industrial control panels for the North American market are to comply with the UL 508A standard. This standard defines the requirements for electrical safety and fire protection, with the aim of avoiding personal injury and property damage. Failure to do so may result in non-acceptance and thereby additional expense in installing equipment in the United States and Canada.

New trends also entail the need for adaptation. Industrial control panel construction have seen modular assemblies as well as fast and simple connection technology make inroads into all "modern" solutions as essential elements. The standards group has also responded to this trend and has taken the essential innovations into account in standard UL 508A, Edition 2018.
HARTING was one of the leading driving forces behind the update of the standard. Particular attention was placed on standards UL 2237 and UL 2238, which are relevant for interfaces installation, performance, and operation. Another update concerns the table SA1.1, requirements for components. Now available on UL.com/ UL508A- Supplement SA, gives manufacturers more flexibility in selecting and using UL-certified components. Changes are currently being entered so that adjustments can be made quickly. The requirements continue to be part of the certification.

UL CERTIFICATIONS DIRECTORY
https://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html
Please enter the following information:
Company Name: HARTING Electric
UL File Number: e318390
...and this will give you a complete overview!

UL 2237/2238 – BASIS FOR INTERFACES WITHIN UL 508A

UL 2237/2238 contain specifications for cable assemblies and connectors in control cabinets. To date, developers who wanted to work with the electrical characteristics relevant to the design of a control panel for the North American market have needed to possess a thorough and detailed knowledge of UL product categories (Category Code Numbers –CYJV, PVVA) – and most often had to contact individual component manufacturers in obtaining performance parameters.

The joint efforts of UL, HARTING and panel shops have succeeded in defining these parameters relevant to interface design in every detail. The result is a table in the UL Certification Directory, which is freely accessible and available to anyone at anytime, anywhere, with fingertip access via the UL homepage (**https://iq.ulprospector.com/info**). All-important specifications such as cable cross-section, the maximum current carrying capacity, environmental rating or overcurrent protection, including short-circuit rating. In the updated version, the values are recognisable at a glance and can be quickly compared for different products.

DATA ACCEPTANCE PROGRAM

UL has accredited the HARTING Technology Group for the Data Acceptance Program (DAP). Since acceptance in the DAP, HARTING has been permitted to conduct testing in its own laboratory according to the UL standards defined in the accreditation certificate. This testing ability can reduce the safety certification process. This program provides a coordinated and integrated effort in reducing in-house product development time. As a result, products can attain certification faster for the North American market, while customer-specific solutions can be developed more efficiently – together with customers. ■

LIGHTWEIGHT MODULAR CONNECTORS **FOR BIG DATA**

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In linking computing units to data centers, modular connectors in the Han-Eco® Modular plastic housing have proved their worth as a standard solution for the fast and cost-efficient design of the power supply.

When it comes to supplying data centre computing units with power and data, and networking devices with as little effort as possible, from an operator's point of view there are two things that are key to successful operation:

- The computing units must be installed quickly and therefore in a cost-optimised manner
- Computing capacity losses resulting from faulty computers need to be able to be resolved quickly and smoothly so that the available capacity and/or memory remain as large as possible and no data loss results

In view of these requirements, the structure of modern data centres is highly standardised. Mutually harmonised, ready-made solutions for architecture, infrastructure and computing units are the rule. The demand for prefabricated units in total installed computing capacity is constantly on the rise. Data centre developers have responded to challenges by employing a high degree of modularity – without losing sight of the overarching goal of optimal installation. It is important to install as much computing capacity as possible, with the infrastructure around the storage units being required to meet the same requirements. In many projects, there is a three-stage power and distribution level for the uninterruptible power supply. In the system, which is built like a family tree, the maximum currents to be transmitted are 100A, 70A and finally 40A at the lowest distribution level. Up to 20 units are suspended at each end of a tree – in addition to memory, there are also e.g. fans, in order to reduce heat. Data centre planners are faced with the question of how to tie together and connect the different levels of power distribution as quickly as possible. The means of choice has often been hardwired prefabricated units in the field, not only in North America, where the largest data centres are. This method places high demands on the expertise of personnel in the field and also prevents a smooth build-up of systems at the installation site.

Data centre planners are faced with the question of how to tie together and connect the different levels of power distribution as quickly as possible.

As with many infrastructure-based requirements for connection technology, the HARTING Technology Group has also implemented just the right solution here for users, and has used this approach in numerous projects with the Han-Eco® plastic connector together with well-known storage operators. Han-Eco® series connectors win points above all thanks to their low weight, good handling and extremely robust design – factors which are absolutely essential for use on construction sites. As a contact insert, the Han Modular® system offers an extremely flexible option for power, signal and data transmission that meets all the specific requirements of the user. Not only do the required 40A, 70A or 100A current carrying capacities present no problem, the customer can also select different connection types and housing shapes.

In addition to connection technology, many of our customers also have the option of purchasing entire cable assemblies from HARTING. The end-to-end tested and optionally coded cables optimise the build-out of IT infrastructure and also reduce the risk of incorrect wiring to zero. Thus, in the event of malfunction, faults in the cabling can largely be ruled out, and individual memory elements can be exchanged quickly without special knowledge. ■

IN SHORT

- Storage operators rely on Han-Eco® plastic connectors and cable assemblies
- Han-Eco® series: low weight, good handling and extremely robust design
- End-to-end tested and optionally coded cables optimise the build-out of IT infrastructure

JOINING FORCES TO SUCCESS

Activity is heating up in the field of M12 circular connectors. Connection technology providers are taking great strides in the direction of tool-less PushPull locking. As part of the standardisation effort, which HARTING is actively furthering, the appropriate universal standards for M12 PushPull interlocks are now slated to be established. These standards create investment security for the customer and meet the requirements of the M12 as a familiar, standardised interface. While previous solutions lock on the outside on upright sockets with a characteristic “CLICK”, the first steps on the way to retractable M12 PushPull inverse sockets are now audible.

The history of PushPull locking in the M12 connector range reads like a book with two plots. First, there is HARTING. The tradition-bound company from East Westphalia has long been established on the market with the well-known M12 PushPull solution, nowadays a veritable standard. Right from the start, the focus of the HARTING protagonist M12 PushPull was on robustness. Consequently, fast and tool-free locking was needed that is suitable for every imaginable target market. The HARTING M12 is a tough guy: protected according to IP65/67, shock and vibration-proof to IEC 61373, EMC problems done away with thanks to a full-metal housing, and fire protection compliance via DIN EN 45545-2.

But other industry representatives in the field of connection technology have also recognised the added value of the PushPull locking system for M12 and have developed and brought to market their own PushPull concepts.

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A DIFFERENT GOAL

Unlike the HARTING solution, however, these concepts tend to target the automation market. Here, the focus is on other requirements than those in the transportation sector, which is why the solutions must ultimately turn out different. While the focus in rail transport is on absolute robustness and reliability in the face of very tough ambient demands, in automation it is space and costs which play an overriding role. Thus, the sockets resulting from these two development efforts are different, and not readily compatible with each other. The result is the market-specific co-existence of both systems. So equal and yet so different.

Thus, the industrial sector and the committees which are active on the path to standardisation and a uniform solution found themselves facing a dilemma: how to meld two solutions into one standard? At first glance, the solutions seem similar, nevertheless they are designed for a widely different range of applications and cannot arbitrarily be swapped for one another. Ultimately, the only viable standard would be the one that combines both solutions into a common PushPull theme and matches them to their specific applications.

The HARTING M12 PushPull version has become a common standard in rail transport, and the same applies to the solution in factory automation, which HARTING has helped promote. The end result is an IEC 61076-2-010 that provides one solution for transportation and one for factory automation, thus creating investment security and second sources for users.

> ***Going down the path to a solution like that, one with such enormous potential, can only be done jointly.***

CHAPTER 3. TOGETHER TO SUCCESS

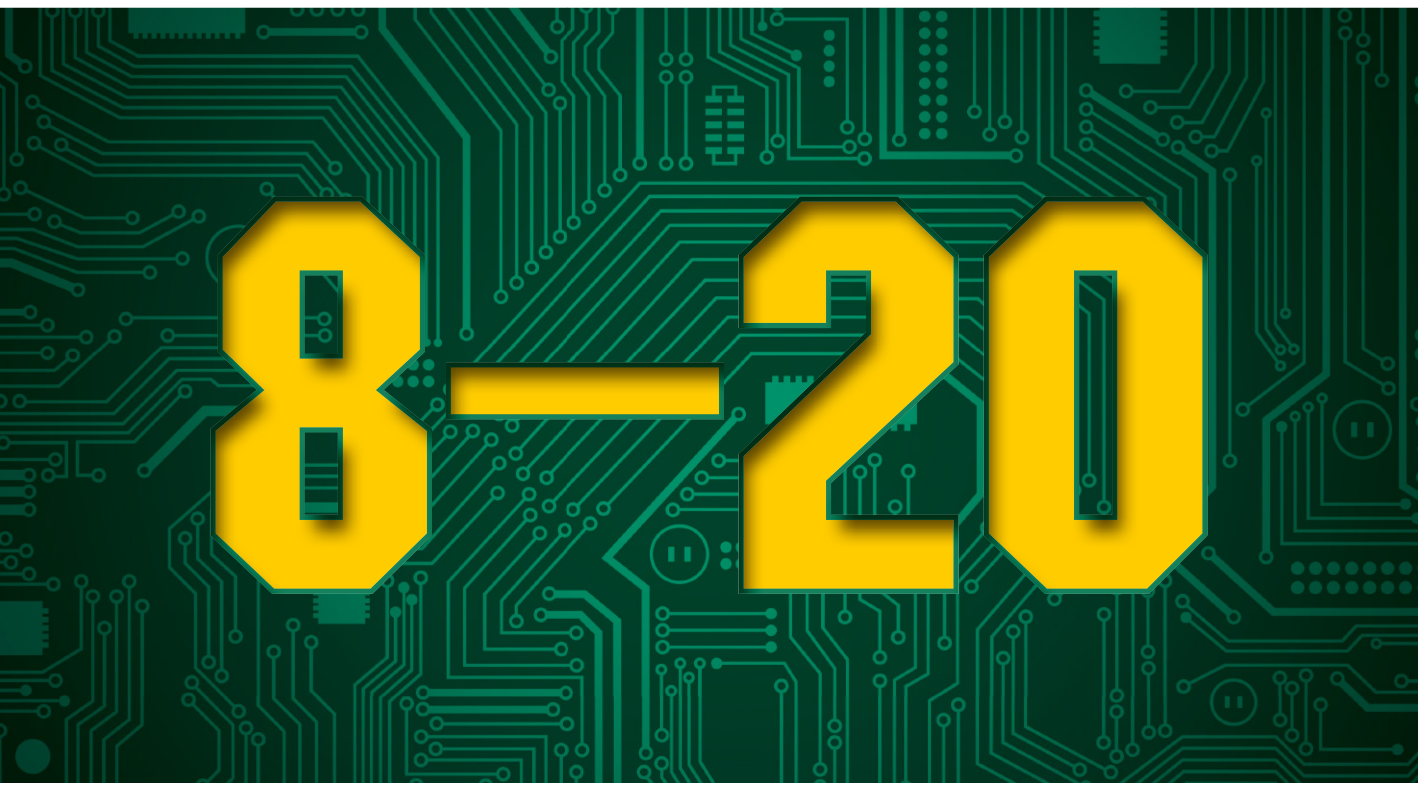
But that's not the end of the story. Since the previous M12 PushPull can only be plugged onto upright sockets that protrude from a single device, an additional solution is required for space-saving sockets that are recessed and flush with device housings. This solution in turn requires an M12 that is insertable INTO the socket with a completely new interlock. At the same time, these new sockets must also be able to accept normal screw connectors in M12, i.e. be backward compatible. Constructively speaking, a whole new chapter.

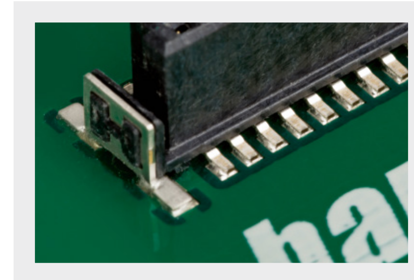
Since the topics of cooperation, partnering and mutual success are becoming ever more important, one thing that has been recognised and learned from previous history: going down the path to a solution like that, one with such enormous potential, can only be done jointly. In response to the wishes of automation users and the subsequent joint initiative of numerous industry representatives, the ball got rolling on the subject of the M12 PushPull in ‘inverse’ fashion. HARTING has actively been involved in pushing the topic of standardisation on the way to a recessed PushPull connector. The result is an M12 PushPull inverse connector that clearly focuses on the automation market. Here, factors such as costs - and above all size - play a greater role than absolute robustness for every conceivable purpose. This requires an approach that is ‘as good and robust as necessary, and as inexpensive as possible’.

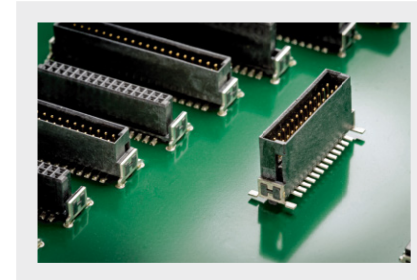
The planned codings already demonstrate the relevance for a retractable PushPull inverse. Thus, the proposed standard includes codings A, B, D, H, K, L, M, S, T and X. ■

TO NEW HEIGHTS

Every device and application is unique. The unending miniaturisation trend means device manufacturers are redesigning their products in ever shorter cycles. All required components must also continuously become more compact, yet offer robust design and be easy to work with at the same time. Since the printed circuit boards in the interior of the associated devices must constantly be adapted to new spatial conditions, HARTING has added another two heights to its har-flex® range which bridge the last remaining gap in the har-flex® family for PCB distances of 8-20mm. With a unique variance in pin numbers, fixtures, heights and reliable parameters for soldering, the 1.27 millimeter interface is always the right choice for your device.







When constructing industrial equipment, every case is unique. Each housing must accommodate different sizes, shapes and requirements. Consequently, the circuit boards inside the device must always compensate for other spatial arrangements. Each board must have a defined position for interfaces to the housing wall or for other electronic components. These vary depending on the device and use. In order to have the necessary flexibility, HARTING's har-flex® offers a particularly small interface with a pitch of 1.27 millimeters. har-flex® thus fits in almost every small application and yet is very robust at the same time.

Depending on which type of application is needed, the user can select pin numbers of 6-100 pins, can choose whether attachment should be SMT or via additional THR hold-downs. In order to be able to offer the correct distance to one or more printed circuit boards in the device, HARTING's har-flex® family also features male connectors (stacking height 4.85 mm) and female connectors (stacking height 13.65 mm). These complete the product assortment and, beginning in the first quarter of 2019, will enable board distances of 8-20mm. For even larger board distances, IDC ribbon cable assemblies are available.

har-flex® pick&place is also suitable for use in increasingly automated production and can be soldered using the reflow soldering process. In order to support users with their processing, HARTING attaches great importance to absolute precision in its components.

Coplanarity should be mentioned in this context. Coplanarity describes how parallel and also signal contacts and holding pins in an SMD connector are aligned with each other, which is crucial for the subsequent quality of the solder joint. If connection pins deviate too much from each other, the connection can be of poor quality or faulty. To ensure good solderability, the coplanarity of all contacts is checked thoroughly during the production process. This ensures high quality and that we meet our own demands on our interfaces. In addition to optical inspection to IPC-A-610 Class 3 standards, which rely on externally visible criteria such as wetting angle and filling level, HARTING laboratories also use sanding and X-ray technology to test the quality of solder joints.

To ensure good solderability, the coplanarity of all contacts is checked thoroughly during the production process.

In addition to the correct position of the contact pins, their coating is also relevant for a good connection. har-flex® contacts are provided with a tin coating, which also melts in the reflow oven and consequently forms a reliable connection with the solder pad. Their large variance, new installation heights and the constant monitoring of our high quality standards position har-flex® as the ideal interface for in-device PCBs. ■

IN SHORT

- Flexibility thanks to har-flex®: small interface with a pitch of 1.27 millimeters
- har-flex® family also features male connectors (stacking height 4.85 mm) and female connectors (stacking height 13.65 mm)
- board distances of 8-20mm

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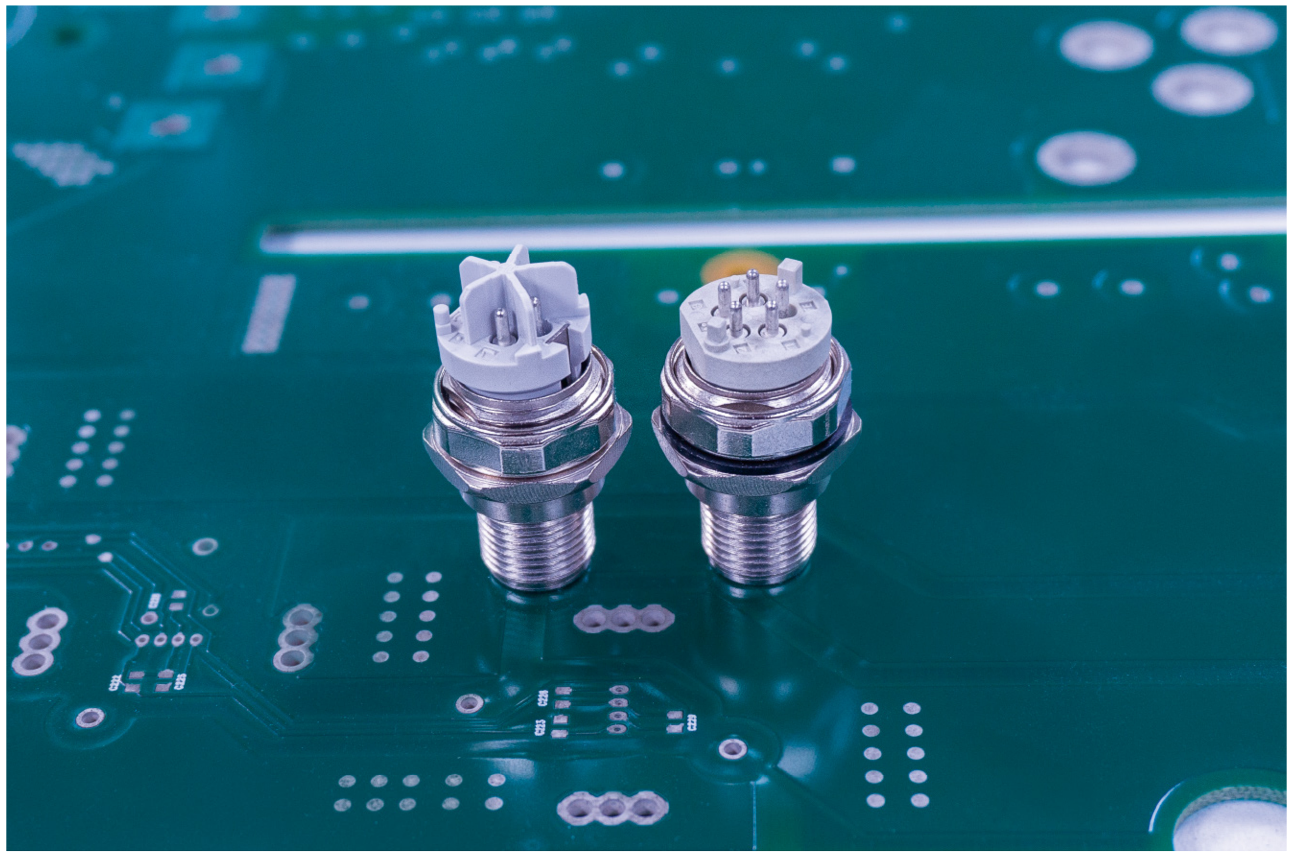
GOING BEYOND LIMITS.

The pursuit of miniaturisation and space savings extends to the gamut of components used in device construction. Housing, computer systems, network connectivity – everything is reduced in size while simultaneously ramping up in terms of power, speed or stability. Consequently, drive technology must also shrink. For electric drives with high power consumption, the 7/8" solution was the previous standard. With M12 in K-coding, the gap between low-voltage L-coding and the large 7/8" interface has been filled and the power density limit pushed far upwards.



In addition to impacting data and network technology, the constant miniaturisation of whole devices increasingly affects required drive technology. Here, the same principle applies as in data transmission: components must simultaneously become smaller, lighter and more powerful. In the area of circular connectors, which have been widely used internationally, power has so far been supplied via M12 A codings. But these quickly reach their performance limits. For more energy-hungry applications, the 7/8" interface has been installed. Everything in between had to be covered by other interfaces. To close this gap in the area of metric circular connectors, new codes and standards had to be added.

From a planning and technical point of view, with K-coding the last black spot on the energy supply map can now be removed.

In the area of PNO, the L-coded M12 is available in the low-voltage range. With voltages of 63V at 16A, the L-coded M12 is the standard solution for I/O boxes in a Profinet environment. These are preferably used in the field of automobile production. But if drives with higher power consumption are intended to be supplied via a space-saving interface, the basic parameters of the L-coding are insufficient, and are given a boost by K-coding. From a planning and technical point of view, with K-coding the last black spot on the energy supply map can now be removed.

With 630V at 16A AC, some 7kW are available, which is more than enough power. For performance figures of this size in a compact M12 housing, special attention had to be paid to clearances and creepage distances as well as the adequate protection of users. This is done by a PE contact directly attached to the housing which is designed in the mating face as a pre-leader in order to dissipate any voltages and to drain off a spark-over on the housing or between contacts in the event of uncertainty. The printed circuit board socket also had to be protected contact-side against voltage flashovers. For this purpose, all hold-downs are mutually separated by an insulator star which must be factored into PCB design.

The cable side features K-coding as a crimp version. Locking is effected via the well-known and M12-typical screw connection as well as the new PushPull locking, which locks quickly and provides acoustic feedback when successfully locked.

In addition to K-coding, which is at the forefront in terms of performance, the M12 codes S, M, T and L meet the more stringent requirements imposed on small interfaces with respect to power supply. ■

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FIBRE OPTIC AS A LINKING ELEMENT

ROTARY JOINT LINKS STATIC AND ROTATING PARTS OF A FACILITY

The need for efficient and secure networking in the industrial environment is growing continuously. The sector is increasingly relying on fibre-optic cabling in order to be able to transmit higher data rates securely and without disruption, even over long distances.

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HARTING's fibre-optic, bi-directional rotary transmitter offers the ability to connect the static and rotating parts of a system via glass fibre with all the advantages of fibre-optic technology. The need for a connection of this type is evident in wind turbines, but is now conceivable as well in many other areas of industry and in mechanical and plant engineering – wherever it's necessary to transmit from a fixed to a perpetually rotating area.

Here, HARTING has developed and successfully tested an holistic system solution for bi-directional Ethernet data transmission. This means that the advantages offered by fibre-optic networking can be exploited throughout a facility, e.g. in wind power generation, deployed from the tower base via the nacelle to the rotating blade tips. This enables the optical transmission of sensor, control and communication data from out of the hub. It also permits the monitoring of the blades by means of HD video transmission. However, the areas of application can be extended to numerous other uses as well, e.g. in robotics, in the crane industry, or in mining.

The suitability of the rotary transmitter for use in harsh outdoor environments is defined by its rugged, salt-water-resistant stainless-steel housing. It also supports a wide operating temperature range of -40° C to +85° C. Robust ST connectors ensure reliable linking of the fibre into and out of the rotary transmitter.

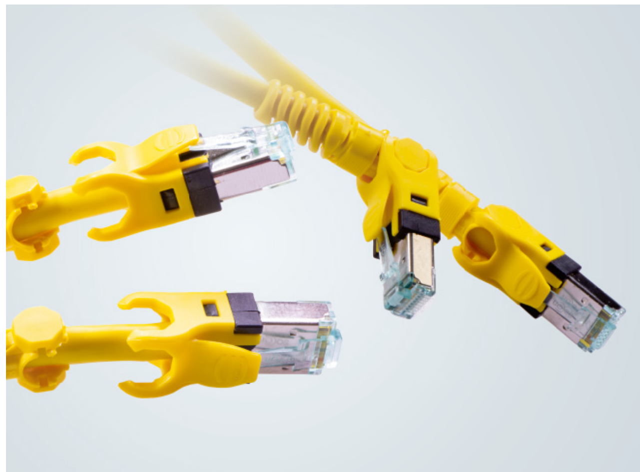
If required by the application, special cable glands can improve the degree of protection from IP20 to IP56.

In addition to the rotary transmitter as a central element, HARTING also offers the complete range of connectivity solutions required for error-free and end-to-end installation – if necessary a custom built complete solution for the simplest of handling based on the "plug-and-play" principle. For error-free cabling, HARTING provides prefabricated and tested fibre-optic cables. These ensure trouble-free signal transmission and additional transfer routing can be provided via the HARTING switch portfolio. The connection from the switch to the controller can also be achieved by using HARTING's proven PushPull quick connection technology. Finally robust Han® housings reliably protect sensitive fibre-optic connectors even in harsh environments. ■

Robust Han® housings reliably protect sensitive fibre-optic connectors even in harsh environments.

COMPACT, AGILE AND COST-OPTIMISED

Made-to-measure problem-solving with standard components – the new overmoulded VarioBoot RJ45 Cat. 6_A cable assemblies for 1/10GBit/s transmission harmonise customer needs with a tailor-made standard. The application dictates the direction. No matter what the cable routing needs to look like in the end, the HARTING VarioBoot RJ45 goes with you in all directions – without interference or transmission loss. The path that the Cat. 6_A line ends up taking, e.g. through the control cabinet, can be decided at the very end. A short pull on the anti-kink sleeve and a click in the desired direction is all it takes for the line to search out another path. Rounded off by its low height, the HARTING VarioBoot RJ45 offers the perfect solution. ■



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Cabeling paradigm						U	G	&		O		K
Modification of existing production equipment			T	R		F						
US standard for industrial control panels							-		0	8		
Device				E			E					

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HARTING TRADE SHOW CALENDER

27.11. – 29.11.18	Germany, Nuremberg, SPS/IPC Drives 2018
27.11. – 30.11.18	China, Shanghai, bauma
04.12. – 07.12.18	Russia, Moscow, Electrical Networks 2018
23.01. – 25.01.19	Korea, Seoul, SEMICON Korea 2019
24.01. – 30.01.19	India, Bangalore, IMTEX - Indian Metal-Cutting Machine Tool Show
05.02. – 07.02.19	Mexico, Monterrey, Expo Manufactura 2019
05.02. – 07.02.18	USA, New Orleans, DistribuTECH Conference
04.03. – 09.03.19	Taiwan, Taipei, TIMTOS - Taipei International Machine Tools Show
10.03. – 12.03.19	China, Guangzhou, SIAF - SPS Industrial Automation Fair Guangzhou 2019
19.03. – 22.03.19	Czech Republic, Brno, AMPER
26.03. – 29.03.19	Poland, Warsaw, Automaticon
27.03. – 29.03.19	Korea, Seoul, AIMEX - Automation World 2019
28.03. – 30.03.19	Italy, Parma, SPS/IPC Drives Italia
01.04. – 05.04.19	Germany, Hanover, Hannover Messe 2019

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Pushing Performance

HARTING Technology Group

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