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THE VALUE-ADDED NETWORK.

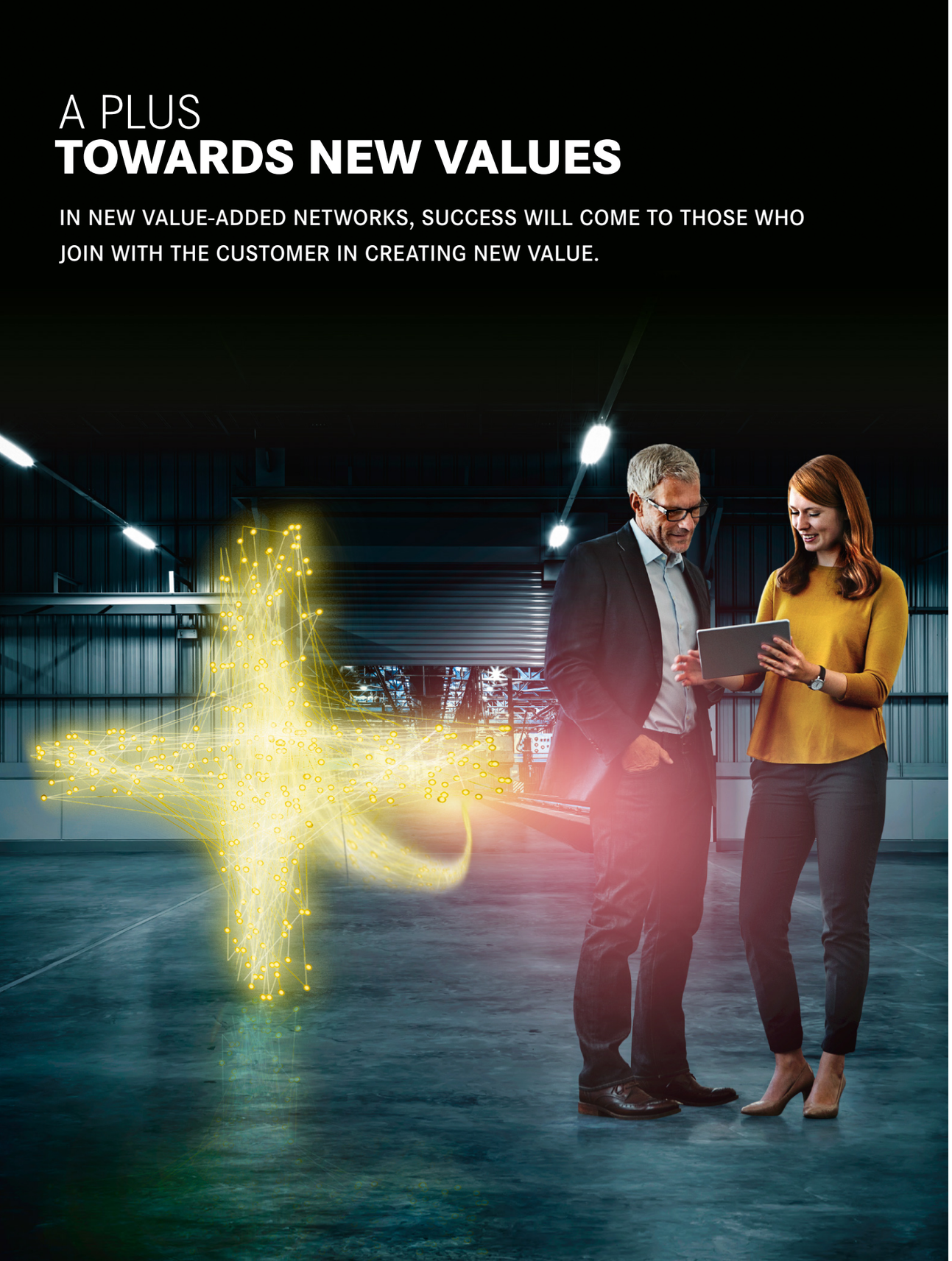
HOW INTEGRATED INDUSTRY CREATES ADDED VALUE.

HARTING®

Pushing Performance

A PLUS
TOWARDS NEW VALUES

IN NEW VALUE-ADDED NETWORKS, SUCCESS WILL COME TO THOSE WHO JOIN WITH THE CUSTOMER IN CREATING NEW VALUE.



DELIVERING CUSTOMER SOLUTIONS WITH **HIGH CUSTOMER VALUE** IS WHAT WE DO

Dear customers and business partners,

If you ask companies what their goal is, the answer is first and foremost: creating value for customers – naturally, while being as profitable as possible for the company. In many cases, however, this is merely given lip service, as the opposite is usually more correct: being profitable and thereby creating value for customers. In any case, this statement is actually not so bad.

But the central question remains: What is the cause here, and what is the effect?

Can a company be sustainably profitable and, as a result, create value for the customer? Decades ago, everyone talked only about "shareholder value" – and for many companies this was the yardstick of all action.

Here, I'd like to make the assertion that actions which are customer-oriented and geared towards creating value for people are ultimately worthwhile because they generate success, which is then rewarded with growth and profitability. **We already manifested this action back in 1996 in our vision.** At that time we already expressed our customer focus by our mission statement **"We want to create values for people"**. Values have changed since then, courtesy of the fourth industrial revolution. In value creation, value-added networks in which jointly customised solutions are created are moving ever closer to customers.

I am firmly convinced of the following: whoever creates value together with customers in new value-added networks will be successful. But how can customers recognise whether values are being created for them, and thereby represent the foundation of success?

Not by words, but only by action and by deeds. And these are the focus of our new issue of tec.news. Our actions and deeds are jointly developed solutions delivering high value for our customers.

Wishing you enjoyable reading.

Yours sincerely,

Philip Harting,
Chairman of the Board

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PushPull V4 Industrial**

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DIGITALISATION AND NEW FORMS OF VALUE CO-CREATION IN ECOSYSTEMS

EXPLOITING POTENTIALS AND COPING WITH THE CHALLENGES OF TRANSFORMATION

Prof. Dr. Uta Wilkens

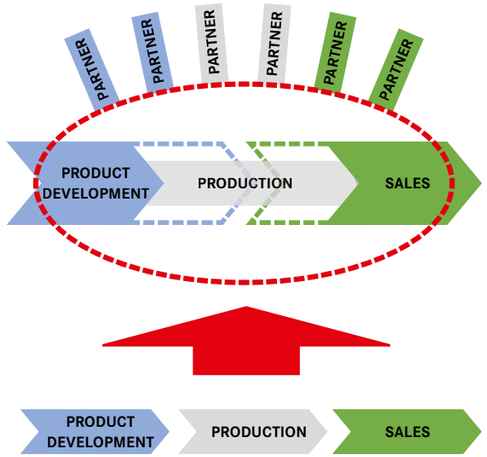

Fig. 1: Transformation towards value-creation systems

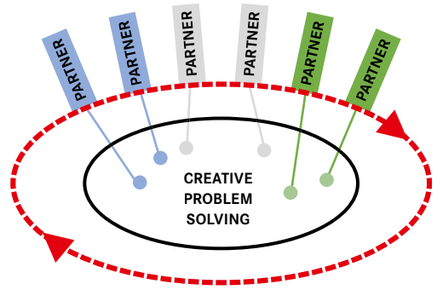

Fig. 2: Cooperation in the Ecosystem

Digitalisation allows running new business models but also implies a broader socio-technical systems change. Particularly well-known examples result from the platform economy such as Car2Go or Airbnb: customers don't receive a product, but rather a solution tailored to one's individual needs, e.g. mobility. The solution provider adds value by digitally coordinating the offer – he provides availability without ownership of the means of production.

New potentials for value creation resulting from digitalisation can also be exploited by manufacturing industries. By using data from own domains, as well as from other contexts there are new possibilities to identify trends and customer needs much earlier and more precisely with the help of data analytics. Service components can also be expanded on a digital basis. That is the reason why there is a strong belief in highly-developed Western economies to gain competitive advantages from so-called product service systems (PSS). PSS describe an integrated customer solution of products and services. For example, customers receive, instead of agricultural machinery, a complete harvest logistic integrating geo-data, or a constant room climate instead of an air-conditioner. These examples from business-to-business illustrate that solution providers can gain high margins as they absorb risk components of the customer in their business models.

For realizing new business models, the product development process has to change considerably. This concerns sensor technology, which is of central importance for integrated service components. It also concerns the cooperation with the customer during the entire development process. Due to value co-creation with

> ***For realizing new business models, the product development process has to change considerably.***

the customer the boundaries between development and sales are becoming increasingly blurred. Moreover, product development anticipates the whole production process in the virtual twin. This also means that the focus of adding value shifts from production to the development of the integrated solution (see Baars/Lasi, 2016). Operational sub-processes cannot be optimised separately; rather they merge into the value-creation systems (see Fig. 1).

Value co-creation means that customers and other external stakeholders participate with their expertise as members of

the ecosystem. Solution development is of mutual interest and leads to new forms of co-working and organizing. Product development teams work in cross-organizational settings (see Figure 2). These new forms of work organization go hand in hand with increasing job demands for all members involved. They need to cooperate for creative problem solving activities but remain subordinated in different formal management systems. They need to combine their knowledge with external partners and at the same time have to protect it as the cooperation partner can also be a competitor. The parties need to achieve mutual understanding but at the same time keep their own company interests in mind. This requires high competencies to act in virtual, networked cross-organizational settings. Faced with novel problems, project employees must be able to competently convey their expertise in heterogeneous teams, deal with high complexity, and need to be open for team-based learning and development processes (Wilkens et al., 2017).

Looking at the results of the IAO Fraunhofer Institute in Stuttgart (2016), it becomes obvious that companies sited in Germany are preparing for Industrie 4.0 when it comes to manufacturing, assembly, production planning and logistics. To date, only a small proportion of the 498 companies surveyed is looking into the transformation of product development (18%) and services (17%). One-third of the surveyed companies are preparing for change with regard to organizational structures and employees skills. In most cases, however, exploratory processes are still taking place.

The question arises as to which transformation process companies or network partners have to face?

The question arises as to which transformation process companies or network partners have to face in order to be able to act successfully as a partner in a value co-creation community. Is there a need for disruptive transformation or are there gentler forms of change? In the discourse on digitalisation, the mainstream proposes disruptive forms of change. For companies, this would mean pursuing new spin-offs and start-ups, greenfield experimentation in small enterprises with altered forms of organizing and cooperation. At the end of the day this could imply that only parts of the workforce are involved in firm development and that the participation of employees' representatives is reduced. A possible alternative is the gentle slope approach (Herrmann/Wilkens, 2017), which explores the forms of change that lead over a gentle hill with only mild steepness. This is to say, the transformation will not proceed effortlessly and entirely evolutionarily, but that firms can take accompanying measures in order to gain experience and confidence in dealing with new forms of organizing and participation. This requires new project-oriented areas of experimentation with changes in governance and new forms of partnership between companies, including those that compete in other areas. Employees' participation from the very beginning is another crucial point. New techniques can only be learned if one intentionally unlearns other techniques and is willing to accept that these are mastered only imperfectly at the first attempt. The gentle slope approach can especially be pursued if one starts early with new forms of organizing and value co-creation.

Is there a need for disruptive transformation or are there gentler forms of change?

The HARTING Technology Group provides excellent conditions for the gentle slope approach. Here, corporate and personnel strategy are interconnected. In-company training and personnel development are oriented towards new forms of cooperation in competence-based learning scenarios. This approach can also be further developed with network partners. New project formats, e.g. for market communication, are already pursued in an ecosystem across language borders consisting of local subsidiaries with alternating lead functions. These are the most valuable experiences enhancing the further development of the HARTING Technology Group. ■

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FUTURE PROSPECTS

How are production environments changed by Integrated Industry? What new solutions are resulting from it in order to create value and benefits for the customer? tec.news posed these questions to leading HARTING managers, who – in line with their respective areas of work within the Technology Group – voiced their various standpoints.

What do we need to do to implement production in a future-proof manner using the existing machinery on hand?

A. Conrad

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Andreas Conrad, Chief Operations Officer, HARTING Technology Group, Andreas.Conrad@HARTING.com
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tec.news: The age of Integrated Industry and Industrie 4.0 is significantly influencing and changing our society. In this context, we would like to shed more light on industrial production environments. Mr. Conrad, you're responsible for Operations at HARTING – what are the requirements that do you see with respect to industrial production?

Conrad: First, we need to distinguish between two different approaches. Of course, on the one hand, it's possible to follow the greenfield approach: if we have total freedom and can install a completely new factory, you can completely integrate all the value-added production processes and use new services in an all-encompassing manner. This entails significant investment, but we also do it.

On the other hand, we're working on a brownfield approach, which is based on the existing circumstances: what do we need to do to implement production in a future-proof manner using the existing machinery on hand? Ultimately, the results of both approaches need to be compared in order to be able to draw conclusions about the range of objectives and the effort that's required.

Thiem: And yet, the question arises: isn't it the case that we need the brownfield approach to enable the greenfield approach in the first place? We need the requirements that we generate from those experiences to define how the new machines should look.

Conrad: Of course, irrespective of the brownfield or greenfield approach, we have an ideal conception of the importance of collecting and processing data. Naturally, it goes without saying that both sides have the goal of shortening the lead times in production, to make them more flexible, and to become significantly faster overall. Of course, we also want to gain stability while doing so and achieve more robust processes, which increases efficiency. In order to ensure this, we've got to increase the communication capability of machines and plants and integrate them into end-to-end IT, i.e. leverage the full spectrum of ICT, which is the backbone of an Integrated Industry.

Franke: This has an impact on mechanical engineering, because, unlike in the past, in today's mechanical engineering we can make information available that's generated from systems and that couldn't be obtained in the past, or was very difficult to obtain, information which didn't correlate amongst itself. Today, it's easier for us to link information – for example, the maintenance engineer can recognise earlier the cause of an error, then the installer can optimally prepare his next steps for the next tool preparation task, etc.

tec.news: The HAII4YOU system exhibited at the Hannover Messe trade fair is based on a modularised system which HARTING

A. Conrad, Chief Operations Officer, HARTING Technology Group

It goes without saying that both sides have the goal of shortening the lead times in production, to make them more flexible, and to become significantly faster overall.

A. Conrad

> ***Our services can easily be set up on data collected in the standardised manner.***
>
> U. Gräff

is using to illustrate basic principles intended to be used in future: end-to-end integration, coordination and the derivation of development requirements, which is done so that this can be carried over to other product areas. What are your other objectives for Operations over the next five years?

Conrad: It's quite clear that our goal is to cover our production processes with a digital layer – the Enterprise Integration Layer (EIL) – within the next few years, in order to obtain a digital representation of it, as well as to digitally depict the logistics within companies and corporate networks. Regarding the implementation of this, right now we're in the definition phase: how must this EIL be structured? What must it be able to do? What information is forwarded to the plants, then back from there, and is needed how and where? What basic design should the architecture have?

Gräff: On the functional side there's also a service system that provides us with support to make processes more robust. And, with regard to machine engineering, this is where our MICA® steps in: it's positioned exactly between the machine and the digital layer. Here, I'd also like to come back to the brownfield approach once again. Its modular design – both hardware and software – enables the MICA® to generate data from existing machines. Since today we're dealing with a fundamentally heterogeneous world of plant engineering and mechanical engineering, the standards in place are manifold and vary in different characteristics, depending on the characteristics of the machine builder.

U. Gräff, Managing Director HARTING Electric and HARTING Electronics, HARTING Technology Group

Franke: In principle, the services are independent of the brownfield or greenfield approach and help increase availability and effectiveness. With regard to the standards, it's necessary to define them precisely so that we don't end up with some proprietary solutions that make it complex to collect data in the machine. In this context, the machine provides the key data for services. However, these services are generally not part of the machine's functionality.

Gräff: Uniform standards for the collection of data are important, since these have to be suitable for mapping meaningful services using the described situation. Our services can easily be set up on data collected in the standardised manner. MICA®, on the other hand, should be viewed as connectivity for these services, i.e. as a tool that captures, preprocesses and maps the services. Thus, a data reference is generated. With regard to condition monitoring, the MICA® maps for instance the host to read out the machine status in terms of energy data. This integrated service approach is implemented in conjunction with the corresponding software.

Thiem: I'd like to stress this. The MICA® is the connecting element between the real layer in production and the Cloud layer, i.e. between the machines and the possible services. Even though we, as an enabler for Integrated Industry, primarily make it possible to offer these services, we also implement selected services such as energy metering ourselves and offer our customers solutions packages for services.

Conrad: The MICA® is currently in use in various applications within our production. In injection molding, information which pertains to operating conditions is captured. In Han® packaging, the MICA® serves as a node for several systems, etc.

Next, we will equip individual pilot areas with sensors and MICA® for each machine group in order to implement "predictive maintenance", i.e. to minimise machine downtimes.

For us, the MICA® is an important building block in numerous areas intended to convey machinery into the digital future! ■

L.-P. Thiem, Systems Architect HARTING Electric, HARTING Technology Group

Dr. V. Franke, Managing Director HARTING Applied Technologies GmbH & Co. KG

> ***The MICA® is the connecting element between the real layer in production and the Cloud layer, i.e. between the machines and the possible services.***
>
> Dr. V. Franke

CONCRETE IMPLEMENTATION OF **RAMI 4.0 WITH MICA®**

The future of production is showing itself to be more modular and simpler. The origin of this future lies in the fruition of Integrated Industry and Industrie 4.0. Compact and robust solutions will have to be developed to implement distributed task assignment in the field. These tasks include e.g. the acquisition of sensor data or data from communication with central IT systems. This is precisely where the HARTING MICA® (Modular Industry Computing Architecture) comes into play – a modular and open platform for the fast and cost-efficient implementation of individual Integrated Industry projects.

Lars Hohmuth,
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For the MICA®, the Hannover Messe trade show is of very notable importance: in 2016, the event saw Deutsche Messe AG confer the MICA® with the Hermes Award, the world's most important innovation award for engineers. The MICA® platform, which consists of a toolbox for hardware modules and software apps, convinced the jurors both on the basis of its open approach and its ability to provide rapid prototyping, as well as with regard to application development.

MICA® makes devices usable which formerly were not even networked or which possess outdated communication capabilities.

In contrast to single-board computers, e.g. Beaglebone or Raspberry Pi, the MICA® features a three-part board, one part of which can be freely loaded. Another advantage is its suitability for industrial use, down to the smallest of details: the MICA® is robust and comes in a compact aluminium housing, including industry-standard connectors. Even with hardware adaptations, the form factor and the degree of protection remain constant.

The modular concept has served as the basis on which different MICA® versions have already been implemented by HARTING and within the HARTING partner network (MICA.network). These include:

- The MICA® Energy for capturing energy data via Modbus interface
- MICA® as an RFID reader with integrated data processing
- MICA® variants with fieldbus connectivity for EtherCAT, Profinet and Ethernet / IP applications
- MICA® as a gateway to LoRaWAN (Long Range Wide Area Network) networks

The MICA® assumes a key function when the initial step is taken on the way to Industrie 4.0 – the digitalisation of production equipment. First, this move means that the MICA® is linked to the Reference Architecture Model of Industrie 4.0, or RAMI 4.0 for short, which was jointly defined by the German business associations BITKOM, VDMA, ZVEI and other partners. Essential elements of Industrie 4.0 are brought together by RAMI 4.0 in a three-dimensional coordinate system which features a layered structure. The goal is to use a service-oriented architecture to aid in abiding by a common understanding of standards, Industrie 4.0 technology and different user perspectives. RAMI 4.0 recommends using the concept of a so-called management shell to create the virtual image of a device or a machine in the digital world. The MICA® represents the ideal hardware basis for this: it makes devices usable which previously were not even networked, or which possess outdated communication capabilities. In the virtual world, MICA® helps to transform old machines into new, modern devices. In the following, tec.news presents two user examples which can be found in HARTING production plants and which illustrate how the RAMI 4.0 model works. ■

For more information please visit www.HARTING-MICA.com

EXISTING PRODUCTION EQUIPMENT **RETROFITTED WITH MICA®**

Centralised machine monitoring and process optimisation are two of the fastest ways to operate production systems and machines more efficiently and cost-effectively. Still, with machinery lifetimes of between 15 and 30 years, a large part of the existing machine stock usually possesses neither the computing power nor the memory capacity to capture, store, or communicate relevant data. In many cases, these machines also use data formats and protocols from the 1980s and 1990s – meaning they've long since stopped being supported by PLCs and industrial PCs.

A retrofit example can be found in an injection moulding machine used in HARTING's connector manufacturing line which communicates via the EUROMAP 15 protocol. The protocol is no longer state-of-the-art. Virtualisation in the MES system is neither economically viable nor desirable in terms of operational safety. Here, the MICA® bridges the gap between the injection moulding machine and the ERP/MES by implementing the RAMI 4.0 management shell. Next is the deployment of the EUROMAP 15 interface, which while it is present in the machine has nevertheless not been used due to the lack of a suitable communication partner.

EUROMAP 15 is a rather simple protocol that specifies the exchange of information between a machine and a host computer. Various telegrams are defined to achieve this, such as the interrogation of the production status or the transmission of settings data, etc., which are exchanged as coded byte sequences. The specification of the protocol comprises a total of eight documents, among others the elementary communication protocol,

Here, the MICA® bridges the gap between the injection moulding machine and the ERP/MES system.

the monitoring and control of production, the transfer of data records or the transfer of variables. The MICA® implements the entire protocol and performs the encoding and decoding of the telegrams. The machine's telegrams received as byte sequences are transformed into natural-language JSON objects and thus made available for modern communication systems such as MQTT or OPC UA. In the other direction, the MICA® handles the conversion back to byte sequences and communicates with the machine in accordance with the protocol.

Thanks to the modular open-source design of the MICA®, existing MICA® containers and open source code were able to be accessed and development time was substantially reduced. The modularity and the use of an intermediate JSON format also makes it possible to integrate other legacy systems with minimal effort. On the server side, the approach also offers extreme flexibility and connectivity: other protocols and data sinks can be supported by incorporating an appropriate container such as e.g. the Cloud connectors for IBM Bluemix, SAP Hana, Microsoft Azure or Amazon Web Services. ■

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EUROMAP 15

In 1992 the EUROMAP Association published the EUROMAP 15 protocol for the communication of injection moulding machines and host computers. It enables the exchange of production and settings data as well as status and statistical information, and defines the telegrams to be used for this purpose. Originally designed for use on the basis of serial interfaces (RS 485), Ethernet connections are now also supported

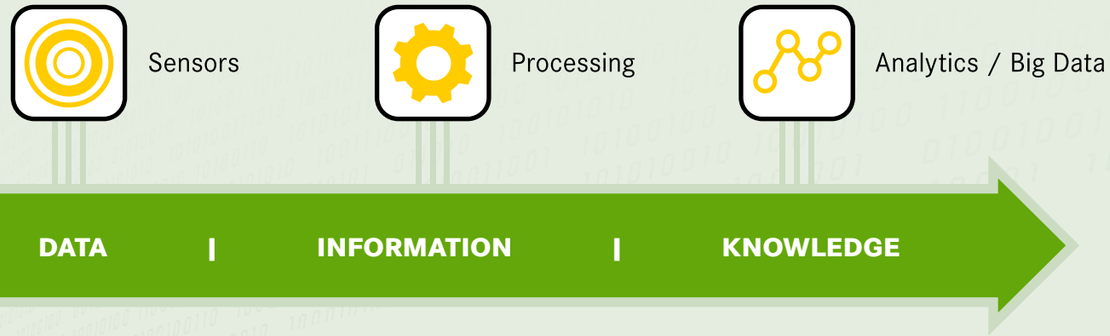
IN BRIEF

- Read operating parameters online
- Loading production plans to the machine and from the machine online
- Continuous capture and storage of all data, which are then available for various uses

LOCAL? GLOBAL? DOESN'T MATTER!

OPEN SOURCE ENERGY CAPTURE FROM THE MICA® TO THE CLOUD.

With the MICA® (Modular Industry Computing Architecture), HARTING offers a solution to cache, analyse and process data directly at machines and plants. But thanks to the modular and open MICA® architecture, it's also easy to link machines directly to powerful Cloud and AI solutions. As a result, the MICA® can quickly create local solutions to capture particularly important KPIs. On the other hand, an entire factory can also be migrated to Industrie 4.0, and conversion times can be drastically shortened.



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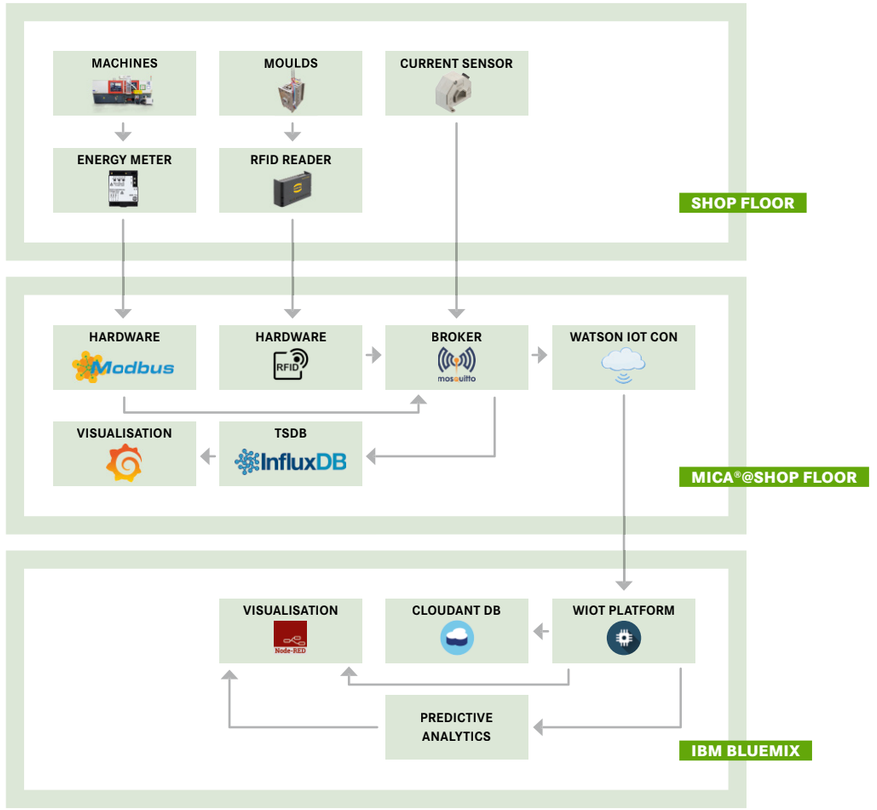
ENERGY MEASUREMENT AND PREDICTIVE MAINTENANCE WITH IBM BLUEMIX



In the following application example, which was first presented at SPS IPC Drives in November 2016, injection moulding machines of various manufacturers and ages at a HARTING factory are connected to IBM Bluemix and Watson IoT using the MICA®. The MICA® acts as a administration shell, i.e. it creates a digital representation of a device in the digital world, thereby transforming it into an I4.0 component. The MICAs® were equipped with a modular function board which provides a Modbus RTU and 8 S0 connections for current transformers and current meters. At the same time, the MICA® records the RFID tags of the installed injection moulding tools via Ethernet.

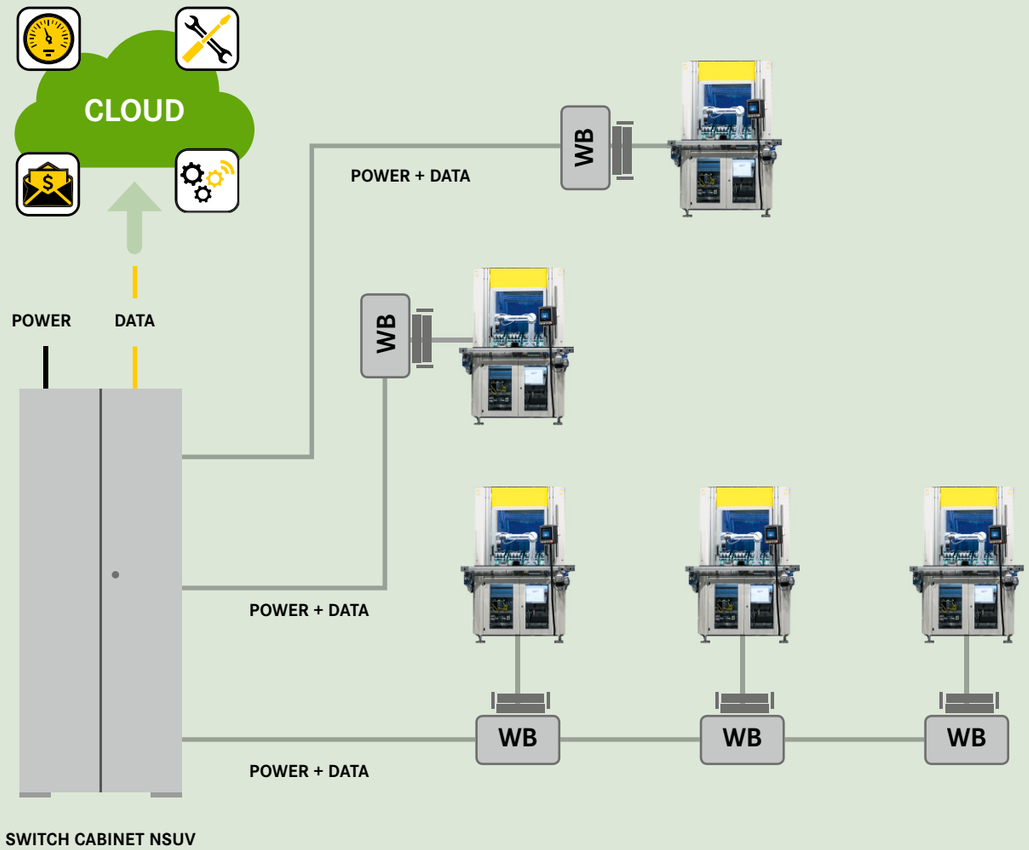
All data are then optionally stored locally on the MICA® in Influx DB – an Open Source database optimised for time series – using the freely available MICA® MQTT container and evaluated using the Open Source tool Grafana, or transferred to an IBM Data Center in London for storage and evaluation via a Watson IoT connector installed on the MICA®. This seamless transition between local and global data processing means that a user can start with a local PoC or an application for a few machines and then, without new hardware and with minimal software changes, migrate to a company-wide solution.

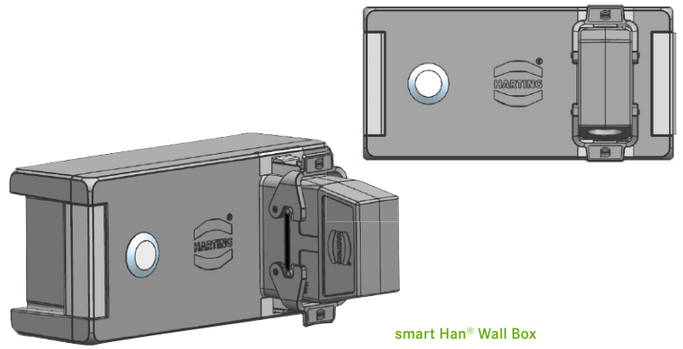
The MICA® acts as a administration shell, i.e. it creates a digital representation of a device in the digital world.

During the three days during which measurements were taken, several gigabytes of data were collected and visualised for analysis. The application has also been available for viewing at the IBM Watson IoT Center in Munich since 16 February. ■

smart Han® WALL BOX: LEARNING FROM E-MOBILITY

The use of connectors in Integrated Industry is associated with the objective of enabling plants and their supply infrastructure to meld into a flexible unit. From the point of view of the operator, the re-configurability of a plant for new products is crucial: the smoother the change takes place, the more efficient the facility. Here, the uniform integration via standardised interfaces in plant-wide energy and communications networks is an important step towards digitalisation.





smart Han® Wall Box

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What does a connector that allows reconfiguration and provides additional value look like? The answer is provided by the smart Han® Wall Box. HARTING modeled its development on the charging process for electric vehicles. Typically, no electrician is present when recharging batteries, as is also the case during manufacturing. To enable non-specialists to perform charging, it must be ensured that the connector cannot be pulled out during charging. Such a scenario would expose the vehicle, operator and infrastructure to considerable hazards.

In principle, three prerequisites for charging electric vehicles can also be applied to manufacturing facilities:

1. Personal protection: Unintentionally unplugging a connector during charging can produce an arc, which puts the operator at risk. In an industrial environment, the risk may be even greater, e.g. when using DC voltage networks.
2. Protecting connectors: Unplugging under load is not permissible according to EN 61 984 since it poses risks for the user and damages the contact surface. Alternatively, plug-in devices could be used which can be plugged in under load, but their size would preclude their use in miniaturisation.
3. Facility protection: Unplugging under load leads to an undefined plant standstill, which can destroy workpieces, machine and/or an entire system.

Protecting persons and plant facilities can only be achieved by actively locking the connector, which also prevents unintended and/or improper pulling. The solution employs sensory data on the operating state and largely rules out human failure. The advantage is that even non-specialist personnel can plug in plant/system modules. Appropriate precautions ensure that plugging and unplugging pose no problems for operator and plant.

The system module is protected from being disconnected under load.

The smart Han® Wall Box meets all these requirements. It is a universal interface for power, compressed air, Ethernet and other signals. In addition, it integrates measures to protect the operator and system. The modularised interface thus becomes a smart I4.0 component. In the basic version, the box features sensor-based evaluation of whether the requirements in IEC 61984 are fulfilled. The connector is only released if the contacts are free of voltage and current. Otherwise, it remains locked.

In the “Enhanced” variant, the Wall Box offers an integrated sensor function which, as part of predictive maintenance, continuously monitors machine condition and reduces standstill time. A further option is energy measurement: as part of comprehensive monitoring, the Box helps to reduce consumption, and prevents expensive failures by employing continuous network analysis. Data from the Box are available for the Smart Factory and in the “Cloud”. ■

RFID AND SENSORS – A STRONG TEAM

Anyone exchanging information today – no matter whether privately, professionally, from person to person, man to machine or machine to machine – has long known the following: if the parties exchanging information are not identified, nothing works.

The typical question asked when meeting someone – "How are you?" – is just as natural. What is normal between individuals is also indispensable in the development of automation technology.

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Every day, thousands of people are transported up to the mountains with the help of state-of-the-art gondola and chair lift systems. It goes without saying that the doors of the gondola lift are automatically closed upon leaving the valley and mountain stations. But how is this monitored?

Thanks to the latest UHF RFID sensor technology from HARTING, this is now even simpler and more reliable. Each gondola receives a passive, i.e. maintenance-free Ha-VIS ETB sensor transponder. The HARTING UHF Reader is then used to read this in the valley or mountain station. The reading zone, which is local yet nevertheless within the stations along the gondola route, is generated using the flexible UHF LOCFIELD® antenna. This permits the gondolas to be safely identified. In addition, the sensor transponder transmits the current state of the gondola door: open or closed. The sensor transponder is connected to the gondola door via a cable with corresponding switching contacts. The system is completely battery-free and uses the Class1Gen2 standard of the highly rated GS1©.

The same reliable technique is also used in railway applications. Here, however, the sensor data are different. Again, the requirement is to have a reliable and maintenance-free system which wirelessly transmits temperature values from the wheel set into the lock. This reliably detects overheating, and subsequent maintenance intervals can be planned accordingly. Wireless communication facilitates the replacement of a wheel set and thereby saves money on complex cabling under the train.

> ***RFID technology from HARTING can do far more than simply identify components.***

These are two examples which show that RFID technology from HARTING can do far more than simply identify components. ■

For more information please visit:
www.HARTING-RFID.com

POWER ON PCB

Power distribution connections within cabinets and 19” rack systems are typically hard wired. There is obviously a trend to reduce assembly time and increase modularisation and customisation with PCB (Printed Circuit Board) solutions. However, the challenge is to achieve the same current carrying capacity and meet the same industrial and safety standards with a PCB assembly. Cross sections of copper traces are smaller, compared to these of cables, but with thick copper technology, the PCB itself is capable for higher current applications.

Markus Witte,
Corporate Signal Integrity,
HARTING Technology Group,
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POWER DISTRIBUTION

The wiring with cables for power distribution is one solution, but it takes some time for installation and testing. Another approach is a PCB assembly that connects circuits and components with the embedded traces on each layer.

Advantages of PCB solutions are:

- Reduction of failures caused by to wrong wiring during installation and the resulting assembly and test time
- Additional components like relays or circuit breakers and further electrical functionality on the PCB.
- Modularisation with adding various connector interface for additional modules.
- Customisation with versatile assembly variants
- Possibility of adding identification areas, i.e. RFID or chips to store inventory data.

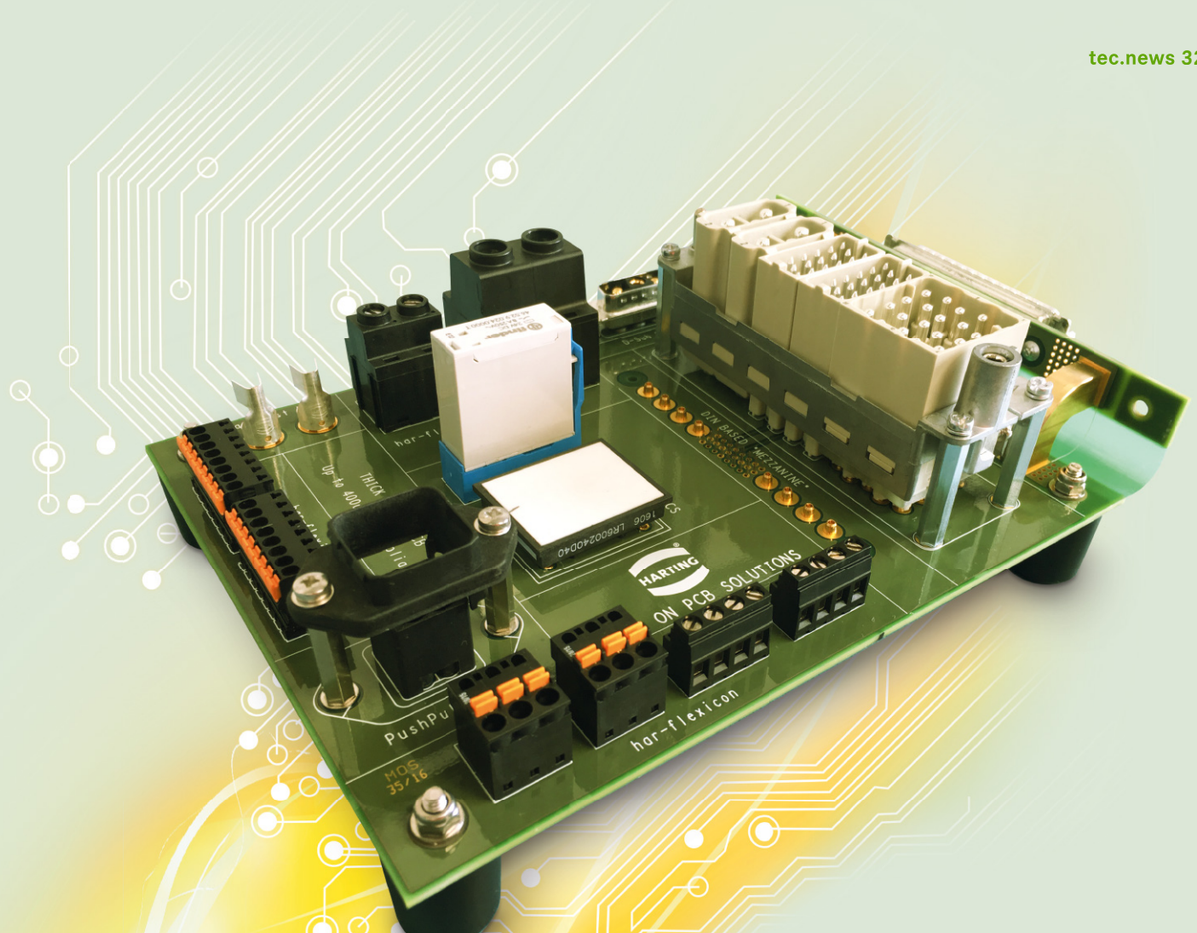
The design of PCB’s requires some good knowledge and understanding about industry and safety standards to set up design rules and constraint for each net. The requirements are depending on the normative references for distribution boxes, laboratory environments, rolling stock applications, etc. It requires wide traces to achieve the same cross-section of a cable wire. The different layers of multi-layer board, stitched together with plated thru holes, allows the distribution of the cross-section on several layers.

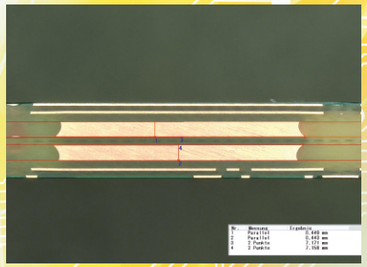
The design of PCB’s requires some good knowledge and understanding about industry and safety standards to set up design rules and constraint for each net.

The copper thickness is a limiting factor for current carrying capacity. Some PCB manufactures in the market enable technologies to increase the copper thickness in the inner layers. One solution is thick copper technology.

The PCB has some areas for power input and output and shows a typical example for a panel mounted applications with a 90° semi-flex area and power to connect the high current between the rigid PCB’s.

HARTING has the in-house capabilities to evaluate the current rating and integrity based on analytical calculations, simulations or measurements. ■





Cross section of a thick copper track

Power on PCB Evaluation Board

IN BRIEF

- Trends towards panel mounted Printed Circuit Boards for various markets are recognized.
- It requires good PCB design know how including the applicable industry and safety standards.
- Thick copper technology offers a good routing density while meeting the clearances to adjacent traces and copper planes.
- Simulation tools are very important to analyze current carrying capacity and impact of transient signals.
- HARTING offers products and services for Power On PCB solutions.

MODULAR PRODUCTION REQUIRES AIR PRESSURE

Han-Modular® PNEUMATIC METAL MODULE

In order to supply their systems with power, modern modular production uses compressed air in addition to electricity. Pneumatics can be an efficient solution for drives, control systems, brake systems, holding and unloading devices. HARTING has re-analysed the requirements for pneumatic interfaces in the industrial sector, with the result that a new pneumatic module has been unveiled which uses metal contacts and can be plugged/unplugged ten thousand times.

Finn Timmermann, Product Manager,
HARTING Technology Group,
Finn.Timmermann@HARTING.com

Compressed air technology offers numerous advantages for industrial applications, including very high availability and storability of compressed air as well as easy assembly of the components involved. Pneumatic systems are typically low-maintenance, overload-proof and infinitely adjustable. In the case of longer holding operations, compressed air drives are more energy-efficient and therefore more advantageous than electrical drives.

HARTING has developed two- and three-pole plug-in connector modules for compressed air transmission so that users can construct their distribution systems in space-saving manner. These modules employ plastic contacts specified for at least 500 mating cycles. For machines whose tools are switched out a maximum of two or three dozen times per year, this number of reliable mating cycles is entirely sufficient. However, modern production plants often need to cope with higher demands. Tool switchouts and conversions are becoming increasingly frequent and take place automatically to an extent.

Consequently, HARTING has opted to use metal as the contact material of the new pneumatic module. This component is thus suitable for use in harsh industrial environments – and can handle 10,000 mating cycles. Thanks to its robustness, the module provides support for flexible manufacturing systems, which are characterised by daily tool switchouts, actuator switchouts and/or system add-ons.

The maximum operating pressure was increased from 8 bar – for the pneumatic module with plastic contacts – to 10 bar. The new module thus covers the entire so-called low-pressure range. The application possibilities for plug-in compressed air distribution systems in Integrated Industry are multiplying.

A key advantage for the user is that “hybrid” configurations of pneumatic and other high mating cycles modules are now possible. The users saves space and time during installation and maintenance by combining electrical contacts, contacts for fibre optics and contacts for the transmission of compressed-air in one single housing.

Thanks to its robustness, the module provides support for flexible manufacturing systems.

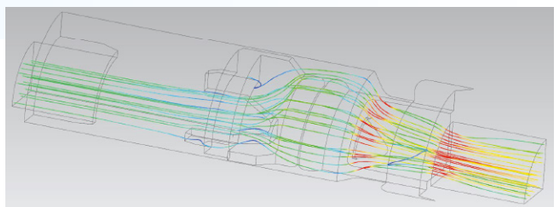
Due to the longevity of the module and the contacts, the tools and other machine elements in the systems can be switched out – the interface remains the same over the entire life cycle.

With the integration of the widely used plug-in connection technology based on the Push-Pull principle, HARTING is also reacting to changes in the industrial standards for the connection of pneumatic components. Like the plastic variant, the blue colour of the Han® Pneumatic Metal Module distinguishes it from the electrical modules. Tubes with diameters 3 mm, 4 mm and 6 mm fit on contact pins and sockets. Optionally, shut-off valves in the sockets ensure that air pressure is maintained in an application even when the connector is unplugged.

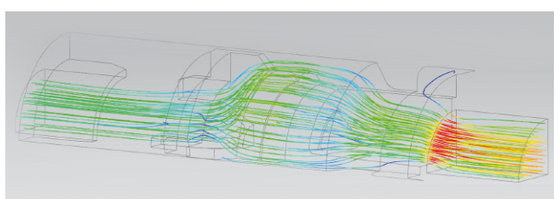
Since the Han-Modular® Pneumatic Metal Module does not require any guide pins and sockets, it can be combined with all Han-Modular® compatible housings without limitation, including the Han-Eco®, Han-Yellock® and standard housings. ■

Minimal pressure drop thanks to flow simulation:
HARTING has minimised the pressure loss in the Han® Pneumatic Metal Module with the aid of flow simulations (Computational Fluid Dynamics – CFD). The coloured lines in the diagrams demonstrate how compressed air flows through the contacts of the Han® Pneumatic Metal Module. Red shows regions with very high flow velocity, blue regions with very slow flow velocity of the air. By altering the valve piston, high speeds were successfully avoided and pressure drop was cut by half.

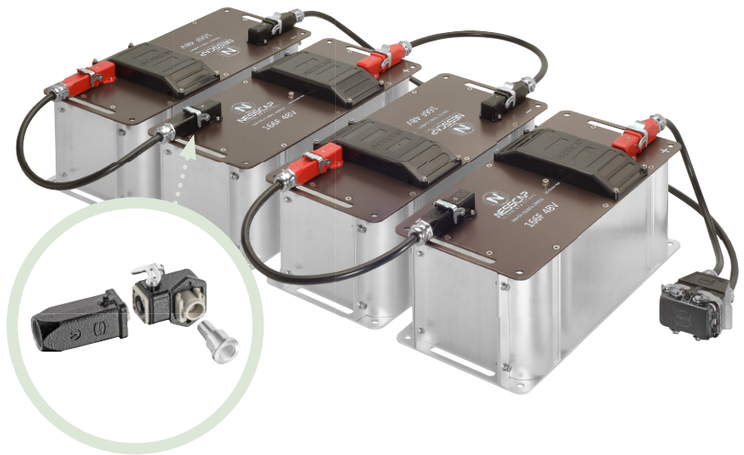
Fluid speeds in conventional pneumatic contact:



Fluid speeds in the optimised Han® pneumatic contact:



COMPACT CONNECTOR FOR ENERGY STORAGE DEVICES



Energy storage devices composed of batteries and/or capacitors are available for a wide range of applications, from the smallest boat to the large industrial plant. The systems are easily scalable and can be located almost everywhere.

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Andras Meszaros, Industry Segment Manager, HARTING Technology Group, Andras.Meszaros@HARTING.com

Whether as a back-up power supply for pitch systems of wind turbines or as energy storage for regenerative brakes of trains, the connections between storage units and consumers must be powerful, flexible and reliable. Otherwise, there is the risk that the capacitors and batteries in use are no longer maintenance-free.

In the past, back-up units were usually hard-wired. This connection technique is common practice but also has its drawbacks, for example, when units need to be exchanged quickly. Disconnecting wires in small spaces can be very time-consuming. Under these conditions, connectors can reduce maintenance time and costs.

For a reliable connection and operation of electrical storage devices, connectors must fulfil certain requirements: they must be able to transmit high currents within a small footprint and provide reliable compensation of power fluctuations. For such applications, HARTING has developed the Han® Q 1/0. This single-pole connector is robust, can transmit currents of more than 100 A – and only needs the space of a Han® 3A housing.

A key feature of the Han® Q 1/0 is the use of an angled male contact, which is fed out of the application at a right angle and forms a relatively flat structure with the storage unit. Finger-protected contact inserts ensure that users do not come into contact with live parts (according to IEC 60 529).

HARTING pre-assembles the angled male-male variant in a Han® 3M housing, so that no other assembling work is needed to be performed by the customers, thus saving installation time. On the cable side, straight hoods using female inserts with the axial screw termination technique enable connecting wires without the use of special tools. The connection to the storage unit is realised by a female bushing. This can be customised and make the solution even more compact. ■

MISS M8TY

AND THE POWER OF MINIATURISATION

She has come to unite thousands of sensors and actuators, and leads them to the furthermost reaches at the field level. Wherever she appears, she shows her true face and proves that even the small among us can accomplish great things. Her rough housing defies water and dust, while her strong core spreads the message of digitalisation at the speed of light. Miss M8ty is more than a phenomenon. She has come to stay.

Matthias Domberg,
Product Manager,
HARTING Technology Group,
Matthias.Domberg@HARTING.com

What at first sounds like pathos is nothing but the plan to connect the furthest reaches of industrial production to a united Ethernet network. This bold plan requires the right connection technology. Devices and applications of all kinds are becoming ever smaller and are begging to be supplied with data and power via a single miniaturised interface. In many cases, long-established connectors are just too big for this task.

Miss M8ty, HARTING's little heroine, has now come to the rescue of users and equipment manufacturers, and features a miniaturised, powerful and robust solution. With overmoulded cables and device-side sockets, right up to the circuit board, HARTING – just in time for this year's Hannover Messe trade fair – will be showing not only individual components, but a complete M8 D-encoded solution for Ethernet from the Cloud down to every sensor. With 100Mbit and PoE, Miss M8ty carries power and data down to the furthest corners at the field level. Here, her tough shell overcomes any and all opponents who dare put themselves in the way of the secure transmission of bits and bytes. With an IP67 degree of protection, water and dust are powerless to affect her, and she is shielded against EMC from other field devices according to ISO 11801 – the prerequisite for fast Ethernet transmission. For our little heroine, no problem. Featuring Ethernet according to IEEE 802.3, she speaks the future language of all subscribers and, thanks to being standardised according to PAS IEC 61076-2-114, also gives users the certainty that she works well with M8 connections which are currently in place.

Miss M8ty delivers a miniaturised, powerful and robust solution.

The tiny heroine for big networks brings Ethernet to the smallest conceivable application and demonstrates the power of miniaturisation. Here, she is more than a phenomenon. She has come to stay. ■

IN SHORT

- space-saving
- small, robust and IP65/67 protected

M12

WITH TRANSFORMER – MINIATURISATION IN A DEMANDING ENVIRONMENT

Standard M12 with external transformer unit.

M12 D-coded, significant space savings due to the transformer unit in the connector.

Matthias Domberg, Product Manager,
HARTING Technology Group,
Matthias.Domberg@HARTING.com

The footprint needed for components of an Ethernet interface must be reduced in size in order to meet the requirements imposed by miniaturisation. While the transmitters required for Ethernet have long been familiar in RJ45 jacks, HARTING presents a world-first innovation with an integrated transformer in the M12 format.

RJ45 sockets with integrated transformer have long been in existence. However, till now an IP65/67 class circuit board connector with transformer has been sought in vain. With the M12 Magnetics, HARTING is now the sole manufacturer to offer this world-first innovation, and HARTING has the central requirements in mind of the markets and customers in the areas of transportation and automation. The interfaces for Ethernet networks must become smaller and, at the same time, more robust.

Interfaces for Ethernet networks must become smaller and, at the same time, more robust.

A solution must be found if there is the prospect of moisture, dust or strong vibrations during operation. M12 Magnetics combines the functions of the connector and the transformer required for Ethernet with no increase in size. This component is installed wherever Ethernet-capable components are connected to networks. It protects the chips in devices by means of galvanic separation and at the same time ensures the decoupling of the ground potential between the cabling and the terminal. Till now, the standard has been to partition the individual components on the board. Consequently, connectors, transformers and PHY chips always sit side-by-side. In addition to dispensing with the transformer, the M12 Magnetics does away with additional components such as capacitors and resistors, with the result that up to 30% space is saved in the circuit board layout compared to the area employing the M12 without transformer. This allows customers to reduce housing size while also enabling them to eliminate additional part numbers. In return, the customer obtains power transfer via POE+ as well as better signal integrity, since connectors and transformers work in a coordinated manner. Also, the design and design-in of circuit cards is simplified. Reduced space requirements and fewer components also make routing conducting paths easier. ■

IN SHORT

- Space saving of up to 30%
- Simplification of design and design-in of circuit cards

FAMILIAR DESIGN WITH NEW FEATURES – **THE PUSHPULL V4 INDUSTRIAL**

The PushPull V4 has been developed for cabling Ethernet in industrial buildings and consequently become the IEC standard. Since Ethernet has now penetrated into the field, it was time to set a standard for industrial device cabling with the new version of this proven interface. Among other things, it now offers a new housing material which also withstands very aggressive chemicals, a lock, and more flexible cable entry. This provides even more process reliability, thus offering the user even more potential uses and making the PushPull all the more versatile. The PushPull V4 Industrial – for Power, Signal and Data in the modular building-block concept.

Which properties are particularly important for a connector in the area of modularisation and I4.0? If users are asked, simple and fast handling is just as important as robustness and the resulting usage spectrum.

Industrial production processes are becoming ever more modular and more flexible, and cabling and connection technology must take this into account. Downtime during conversion work costs a system operator money, and naturally must be kept as brief as possible.

Mathias Ohsiek,
Product Manager, HARTING Technology Group,
Mathias.Ohsiek@HARTING.com

If production is relocated or switched over, HARTING's PushPull system can also be used to disconnect and reconnect the industrial lifelines in seconds. To further optimise this process, HARTING gave the PushPull V4 a facelift and will now present the second generation at the HM 2017 and highlight its new strengths.

The PushPull now also meets the toughest requirements.

Thus, the PushPull V4 Industrial has a new housing material, which additionally protects it against extremely aggressive chemicals such as cutting oils in turning and milling centers. These and other aggressive operating materials present increased challenges for the connectors used in the application. Optimised for future applications, the PushPull now also meets the toughest requirements.

In order to make locking the connector even more secure, the new version has an additional anti-rotation device which secures the PushPull locking element in the plugged state and ensures more process reliability against unintentional pulling.

Process reliability is also guaranteed by the connector's simple and intuitive operation. Consequently, the second generation of the PushPull has only one cable clamp instead of three, with a larger cable diameter of 4.5-10mm diameter. This relegates loose fit and poor strain relief to the past.

To increase the speed of the Plug & Play principle, the second generation PushPull has been fitted out with two different colour markings. The first is used to provide a quick overview of whether the connector and the socket are correctly aligned with one another and that plugging can be done without problems. The second colour coding serves to ensure the correct arrangement of plug and socket. If an application features numerous PushPull connectors installed side-by-side, the installer will have an easier time keeping an overview – a simple, yet tried-and-tested means to eliminate incorrect wiring and save time during assembly.

Naturally, in keeping with the lines of the building-block principle, old and new PushPull components are compatible with each other. The PushPull V4 Industrial increases process reliability in industrial device cabling and saves assembly time – ensuring simplified and safe handling even for demanding applications.

The proven solution - optimised for our customers. ■

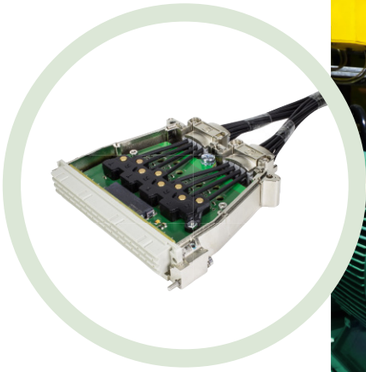
IN SHORT

- Better protection by a new housing material
- Additional anti-rotation device provides more process reliability
- Simple and intuitive operation

An additional anti-rotation device protects against unintentional pulling.

THE SMALL SOLUTION FOR BIG **POWER**

Electric motors are the backbone of industrial drive technology. Without them, automated production processes are inconceivable. Powerful electrical drives are controlled via IGBT semiconductor elements connected to necessary insulation via Polymer Optical Fibre. This represents a sensitive and space-intensive solution. HARTING offers users the ability to go down new paths in IGBT control. Connect electrically – transmit optically. Miniaturised, of course.



Electric motors from the widest range of performance classes are part and parcel of modern society, like smartphones, the internet and electrically-assisted movement in rail settings. Motors are used that range from a few watts to several MW. The control technology for these motors is quite simple when they run at a constant speed or have low power consumption. However, it's a different story if their speed needs to be controlled or they consume high amounts of power.

Speed control in the larger performance classes of several hundred kW, e.g. for traction control in trains, propulsion motors on ships or e-buses, is done using IGBT semiconductors, which can switch large loads with very low control power. The signals for controlling the IGBTs are transmitted by means of Polymer Optical Fibre (POF) due to the high insulation and voltage requirements.

Till now, the connection technology for the optical fibers has required a relatively significant amount of space and is not particularly service-friendly. For a three-phase motor alone, six connections are required. If even one of them fails, till now the entire control module has had to be replaced. To do so, all the fibers must be individually separated and reconnected. Consequently, the attendant risk of damage or incorrect connection of the fibres is quite high.

> ***Our focus is on easier installation and saving time if service is required.***

HARTING now shows how the POF transmission path can be redesigned much more compactly and modularly. Here, the focus is on simpler installation, faster, time-saving servicing, and the use of Active Optical Cables (AOC), which make optical plug-in unnecessary. The advantages of "electrical connection and optical transmission" are especially beneficial in industrial environments.

In AOC, the individual fibres are bundled in a robust DIN housing which also contains the transceiver for converting the optical signals into electrical signals. The housing meets the enhanced railway and industrial requirements for robustness and EMC. The cable can be laid straight or angled and features optimised kink protection and strain relief for the fibres. Taking e.g. a board with 16 connections, the AOC offers a space saving of 40% and one need only connect one plug to ensure a secure connection. The optical fibres are not opened and cannot be mixed up. In the event of a defective cable, however, the DIN housing can be opened and the defective cable can be individually replaced. If a connection for an optical fibre is defective, one can simply replace the inexpensive cable assembly – one no longer need expend significant effort to replace the entire costly module, as has previously been the case. In contrast to the previous solution, the optical connections on the AOC board are reflow-soldering-capable and can thus be loaded in automated fashion. The value-added proposition for the customer is self-evident - the HARTING solution is smaller, more robust, more secure during handling, and significantly faster and cheaper in the event of servicing. Seen in an overall context, the customer receives a solution that is not only more reliable, but also significantly more cost-effective overall over the service life. HARTING Active Optic Cabling is bringing movement to the future. ■

Rainer Bussmann,
Product Manager,
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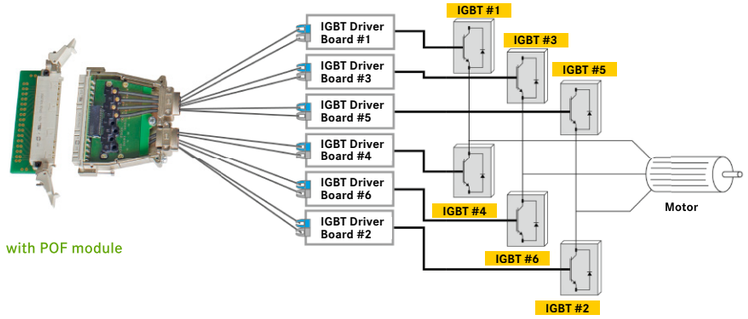
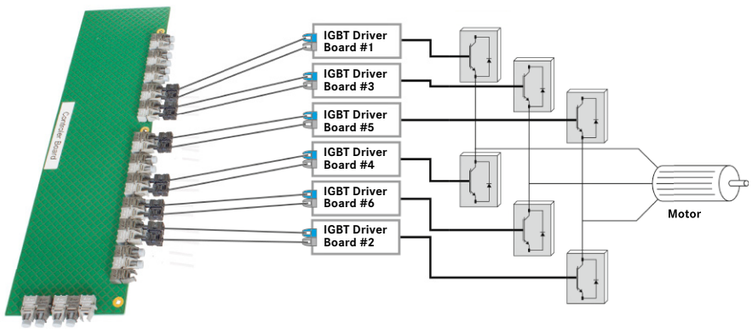
COMPARISON OF IGBT CONNECTION



with POF module



standard solution

COMPACT LIGHTS FOR HARSH ENVIRONMENT

HARTING has a longstanding relationship with all market leading manufacturers in the transportation market. In the rolling stock market HPR connectors are used in a wide range of outdoor railway applications. The outstanding performance and reliability of the connectors are the key elements of the success.

Danny Maijinckx,
Business Development Director EMEA HARTING Customised Solutions,
HARTING Technology Group,
Danny.Maijinckx@HARTING.com

All LED lights have been equipped with cables, flexible protective tubing and 3A HPR connectors.

Positioning lights for signalling function

Through the years' the already comprehensive connector range was, on customer request, completed by a variety of customised solutions and services. The profound market application knowledge was fundamental to support the market demand and to build up a range of customised solutions. Special die casted part and junction boxes are some examples of customer specific solutions HARTING offers to the market. Jumper cables and cable sets for underfloor and bogie applications have become an increscent part of the product portfolio.

Based on the outstanding references and the good experience with us as solution provider, HARTING received the request to create a new solution. A miniature lighting structure for an existing locomotive series, to improve the safety around. At first sight, this kind of application was not in the scope of the HARTING range. However, the more we learned about the project the more common ground was detected and it became obvious that this was a typical HARTING Customised Solution project. HCS started to create a new solution based on LED technology to achieve the primary target: "a compact lighting structure solution". It was a fundamental request to have a compact solution because the locomotive was already existing. The additional lighting structure had to be integrated with a minimum of effort and structural changes. HARTING developed a LED solution and packed this into a protective metal housing to achieve another important demand "a solution for a harsh environment". Outdoor use, IP rating, shock, vibrations, low temperatures and high light output were all elements that had to be matched with the specific railway requirements and norms.

The customer wanted to have additional lights to ensure the safety of the operators around the locomotive. The LED lights have been supplied in two variants. White lights were requested for the working areas, the front and the back of the locomotive in the coupling zones to increase the visibility during the coupling and uncoupling of trains. Also the access stairs of the locomotive were equipped with white lights. For signalling function, the locomotive was equipped with additional positioning lights, therefor orange coloured lights were placed on both sides of the locomotive. For the mounting of the LED lights customised brackets have been designed.

HCS started to create a new solution based on LED technology to achieve the primary target: a compact lighting structure solution.

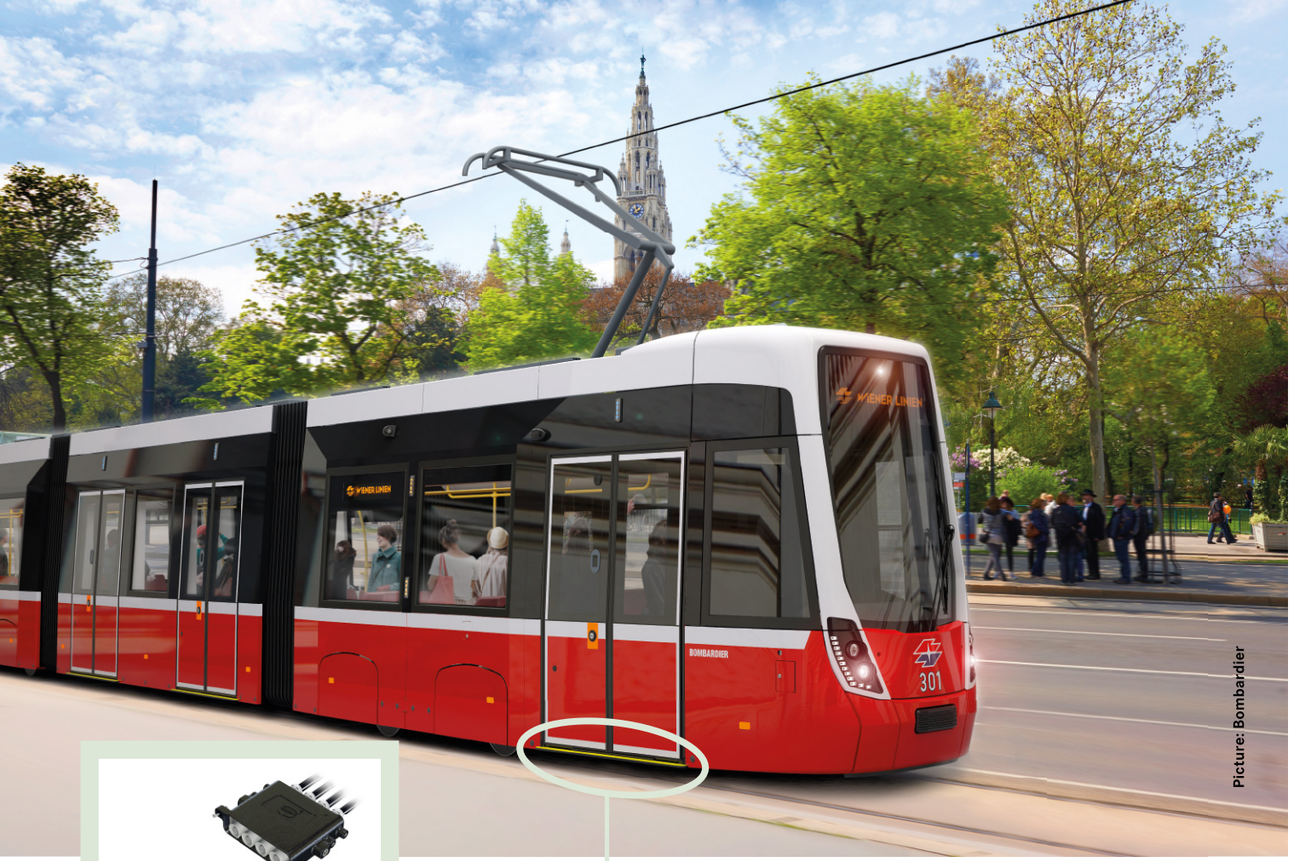
LED lights also needed to be connected and operated, therefor HCS created in close cooperation with the customer the best possible routing for the cables. All LED lights have been equipped with cables, flexible protective tubing and 3A HPR connectors. The cables are all connected to a, specially for the application designed, junction box. To operate the lights from the outside a special piezo electric switch has been developed and integrated into a 3A HPR HARTING connector housing. In this way the proven HARTING connector technology was be combined with the very solid Piezo technology to achieve a robust and reliable solution to operate the compact LED locomotive solution.

Apart from the LED lights the HPR connection technology is the core of this solution. The robustness and the compact format of this HCS solution opens doors to other applications with similar requirements in different markets. ■

IN SHORT

- HCS offers solutions for individual customer challenges
- Development of a LED solution to improve the all-around safety of a locomotive series.

For more information about HARTING Customised Solutions visit:



Picture: Bombardier

Han® 22 HPR Slim makes world's lowest entry height possible.

LOW-FLOOR TECHNOLOGY ON ULTRA-FLAT Han® 22 HPR Slim

Frank Quast, Head of Product Management Installation Technology, HARTING Technology Group, Frank.Quast@HARTING.com
Andreas Mehringer, Global Account Manager, HARTING Technology Group, Andreas.Mehringer@HARTING.com

One of the central requirements when designing modern Light Rail Vehicles (trams) is barrier-free accessibility. Low-floor technology makes boarding and exiting considerably easier, in particular for elderly persons, passengers with baby carriages, as well as wheelchair users. The new low-floor tram "FLEXITY Wien" in Vienna will realise the world's lowest entry height of 215 mm – and is embedded in an overall concept. Ramps and lifts have ensured handicap-friendly access to all subway stations and over 95% of tram and bus stops.

CHALLENGES

Low-floor technology has great advantages, but also presents challenges. These include e.g. that the top edge of the platform and entrance doors be at the same height, as well as the need to wholly avoid forming any steps in the passenger compartment, thereby providing accessibility to all passengers. Systems vendors have developed various solutions to implement rail vehicles with low floor technology. In addition to chassis in gantry design, similar to a harbour crane, bogies are also used in a modern axle-integrated design and all have one thing in common: extremely tight space conditions.

Despite the small dimensions, the resulting interface is a real power package.

SOLUTIONS

In low-floor technology, train builders have little space between chassis and car body floor. As a result, designers are always looking for solutions that offer the same power and/or line density in a smaller installation space or a higher power and/or line density in the currently used space. The HARTING Technology Group, in close cooperation with the customer, has optimised the housing dimensions of the required connectors in such a way that the space requirement is reduced by some 40% compared to conventional solutions. The result fits optimally into a gap of 8 cm between car body and bogie.

Despite the small dimensions, the resulting interface is a real power package. The Han® 22 HPR Slim is ultra-flat, yet still easily offers space for four 250A high-current contacts. Equipped with a robust HPR housing made of die-cast aluminium, this connector particularly satisfies the need for transmission of high power in the under-floor area of rail vehicles, e.g. for the engine connection.

SUMMARY

For extreme space requirements such as low-floor concepts, ultra-flat interfaces are called for. The growing high-current connector portfolio from HARTING always provides the right solutions when it comes to ensuring compact and efficient motor drives. Users can design their rail vehicles in a modular segment manner, resulting in faster and more efficient maintenance and repair work. ■

IN SHORT

- Han® 22 HPR Slim: ultra-flat, offers space for four 250A high-current contacts
- robust HPR housing made of die-cast aluminium

PARTICIPANT FROM THE VERY START:
MAJOR HANNOVER MESSE ANNIVERSARY FOR HARTING

70 YEARS

Long since the world's biggest industry trade show, Hannover Messe will be exactly 70 years old this year. And the HARTING Technology Group has good reason to join the celebrations, too: this family owned and family managed company is among the handful of exhibitors who have made the journey to the capital of Lower Saxony every single year since 1947. Hanover is highly significant to HARTING for many different reasons.

Lars Kühme,
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When "Wilhelm Harting Mechanische Werkstätten" opened 1945 its doors in Minden, Wilhelm Harting was on the lookout for customers for his new business – initially successful for its electric fences, hotplates, energy-saving lights and irons. The first fair in the summer of 1947 lasted 21 days and was open exclusively to German exhibitors. Some 1,300 companies were represented in Hanover, and 736,000 visitors attended. Export contracts worth nearly 32 million dollars were signed. Since only 180 hotel rooms were available, more than 10,000 visitors had to stay in private quarters. Hanover had won out over Düsseldorf, Cologne and Hamburg as the location for the trade fair not least because of the nearby military airfields Wunstorf and Bückeburg.

The Han® connector patented in 1956 and the new types of connector that followed marked the beginning of a huge success story.

As it attended more fairs over the next few years, HARTING demonstrated its entrepreneurial vision and feel for technology trends and the needs of customers and markets. The following decade was marked by the production of medical apparatus, tape recorders and jukeboxes.

The Han® connector patented in 1956 and the new types of connector that followed marked the beginning of a huge success story, attracting lots of attention to HARTING at the fair and confirming its market position. The production of modern cigarette vending machines also made a significant contribution to constantly rising sales. The end of the 1970s marked a new era, with the introduction of internationalisation - the first step towards becoming a global company.

Coming in April, Hannover Messe has been the most important date in the HARTING trade fair diary for seven decades now. With a main stand covering 1,600m² and as a partner on several shared stands – as ever – HARTING continues to stake its claim as a highly innovative technology company. With complete hardware and software solutions for all applications in the field of industrial connection technology, the company has also developed into a solution provider for Integrated Industry (Industrie 4.0).

HARTING's commitment to the fair is not limited to its physical presence in the line-up, however. Its strong sense of belonging is also evidenced by Dietmar Harting's long-term role as Chairman of the Advisory Committee of Hannover Messe and the Construction and Investment Committee of Deutsche Messe AG Hannover, his work with the Supervisory Board of Deutsche Messe AG and, since 2002, his role as its Vice Chairman. Dietmar Harting was awarded the Lower Saxony Service Medal (2004) and the Trade Fair Honorary Gold Medal (2006) for his far-reaching commitment. ■

Our booth evolves

1949

1962

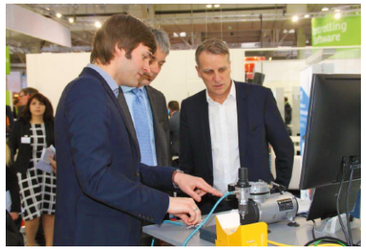
1993

2014

MICA.network AT THE HANNOVER MESSE TRADE FAIR

MICA.network is the user community for all things MICA®. The MICA.network is just as diverse and open as the Open Computing platform from HARTING: from start-ups to internationally established companies, this is the meeting ground for experts who use the MICA® for their own applications or business models.

MICA.network partners will be using the Hannover Messe trade fair to present their IIoT and I4.0 applications. Proven concepts and use cases will be front and centre and, among others, will be used to demonstrate solutions in the fields of Status Monitoring and/or Preventive Maintenance for machines, Fog Computing, Human Machine Interface and Remote Services. Additionally, in the area of applications, energy management will also play an important role. More than 20 partners are expected to attend the get-together.



For more information please visit: www.MICA.network

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HARTING **TRADE SHOW CALENDAR**

24.04. – 28.04.2017	Germany, Hanover, Hannover Messe 2017
16.05. – 18.05.2017	Austria, Linz, Smart Automation
16.05. – 19.05.2017	USA, Las Vegas, EDS Connects
17.05. – 19.05.2017	Japan, Tokyo, Electrical Construction Equipment and Materials (JECA) Fair 2017
14.06. – 17.06.2017	Korea, Busan, RailLog 2017
21.06. – 24.06.2017	Thailand, Bangkok, Manufacturing Expo 2017
05.07. – 08.07.2017	China, Shanghai, CIROS 2017
05.09. – 08.09.2017	China, Shanghai, AMTS 2017
12.09. – 15.09.2017	Germany, Husum, Wind Trade Fair Husum 2017
26.09. – 29.09.2017	Poland, Gdańsk, Trako 2017
09.10. – 13.10.2017	Czech Republic, Brno, MSV Brno 2017
10.10. – 12.10.2017	Finland, Helsinki, Elkom / Automation 2017
17.10. – 19.10.2017	China, Peking, China Wind Power (Wind Power Asia) 2017
07.11. – 11.11.2017	China, Shanghai, IAS - Industrial Automation Show Shanghai 2017
13.11. – 19.11.2017	USA, Las Vegas, LDI 2017
28.11. – 30.11.2017	Germany, Nuremberg, SPS IPC Drives 2017

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THE ADVENTURES
OF THE THREE LITTLE GIANTS

CAPTAIN IX **MISS M8TY** **TW1STER**

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