

Time for heroes

The world of industrial production is faced with major upheaval. New problems and risks – but also challenges and great opportunities – must be managed and utilised. In uncertain times, we need orientation points and role models. Sometimes even little heroes. HARTING's Captain ix is a pioneer and a symbolic figure for a new generation of Ethernet interfaces and for a cooperation establishing the new ix Industrial® connector as a new global standard.

Text: Matthias Fritsche, Jonas Diekmann – HARTING Electronics **Bilder:** HARTING Electronics

Communication and networks are in flux. The development of I4.0 and IoT is ensuring the continuous spread and connection of ever more components and participants in the industrial environment around Ethernet networks. Ethernet is capturing more and more areas of our lives and will penetrate every company structure in the future. The path is going away from co-existent Ethernet and bus systems for data and sensor technology, and towards a complete Ethernet system – from the cloud through to the smallest recesses of industrial production. In addition to uniform protocols, this also includes the corresponding infrastructure, which must itself shrink as a result of ever smaller terminals and sensor/actuator systems.

The demands being placed on the "nerves" and "synapses" of future industry are clear. The device interfaces and system cables must be smaller and more powerful, yet at the same time more robust. Plenty of challenges and opportunities await users and manufacturers. HARTING's new ix Industrial® connector is a clear commitment towards miniaturisation and sets a new standard in terms of robustness and performance for IP20 Ethernet connections.



The story so far?

To date, the Ethernet interface in the IP20 environment has been embodied by the RJ45 connector. This connector, which is the most widely used in the world, is omnipresent and therefore loved by users. However, due to its lack of robustness through broken locking tabs and occasional contact problems, many users experience more of a love-hate relationship with the RJ45. In view of ever smaller devices, such as flat mobile devices, displays, smaller automation devices, cameras and sensors, the size of the RJ45 puts a limit on the miniaturisation possible. Thus, a smaller and more robust plug-in connection is on the wish list of many users and developers, though one which can still produce Cat. 6A performance for 1/10Gbit/s Ethernet at a control level.

And looking forward?

HARTING presents the HARTING ix Industrial® – a system which meets all of these requirements.

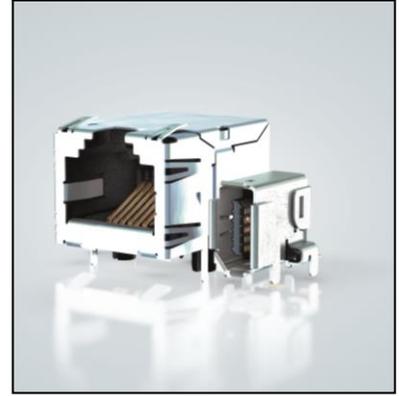
The sockets, which



Mating face with 360° shielding and the separated data contacts for a secure data transmission.



Five robust THR shielding contacts



In size comparison: ix Industrial and RJ45

are 70% smaller than for the RJ45, allow device manufacturers to use them with considerably smaller devices, which can thus be more easily adapted to the needs of miniaturisation. This is the case with ever-shrinking camera systems, for example, where a conventional RJ45 socket already occupies most of the space in the housing, as well as with control units and small industrial computers. This also requires fast Ethernet over a small interface, as well as for switches, WLAN access points, routers and other network components.

This little superhero can also play its strengths in other industrial sectors, however. On public trains and buses, the displays and passenger information systems can also be supplied with power via PoE/PoE+ and with data via the ix interface. Vibrations and other mechanical stresses are not an issue.

For device integration, a small yet robust connector with five THR shield contacts gives maximum stability on the PCB. The data contacts are SMD contacts. As a result, the PCB sockets can be processed using normal reflow soldering along with all other conventional components, and no separate manual or wave-soldering step is necessary. As a result, the developer and device manufacturer can easily integrate the new ix Industrial® system into new devices, and can also be sure that this interface is firmly anchored on the PCB and can reliably withstand even rough handling.

In overall terms, the end devices can be made slightly smaller by reducing the physical space required for the socket, as miniaturised sockets and plugs enable a

significantly higher packing density. For the upright and angled sockets (illustrated), the spacing between the sockets is just 10 millimetres. In the foreseeable future, the socket will also be available in a flat, angled design for very flat devices. Wall ducts too, which complete the application spectrum, also form part of the ix range in terms of their perspective, and complete the new ix "ecosystem". HARTING provides the next evolutionary stage, HARTING ix Industrial®, with everything that was missing from its predecessor.

As both the components and the housings of the systems are constantly reducing in size, the space for the cabling is also limited. By way of device cabling, HARTING offers the user flexible and thin system cables with a small bending radius, which also makes installation in miniaturised housings a possibility. They can have the ix connector face on both ends, or mixed ix and RJ45 connectors. The third option has an X-coded M12 on one end.

At an initial stage, the HARTING ix Industrial® connector is available in straight form. Angled connector variants will follow in the future so that more space-critical applications can also be achieved using angled cable outlets. All in the name of maximum flexibility. Thanks to the mixed system cables from ix to RJ45 connector faces in particular, the step-by-step devices can be easily integrated into existing cabling systems with the new ix connector face. A perfectly interfaced system consisting of a socket and a plug connector as well as finished system cables guarantee a process-safe solution from a single source.

Smaller, yet more rugged

"Small" is generally equated with "delicate", "fine", and "sensitive". However, since it is these negative characteristics (in the industrial environment) which have often led to problems with the RJ45, the ix Industrial® has been designed to be considerably more robust.



Two snap-in metal clips for safe connection

The ix connectors have a stable locking mechanism using two metal hooks, which engage with a clearly audible click when plugged in, thus providing the user with acoustic and haptic feedback as to correct interlocking. This guarantees an absolutely safe and vibration-proof connection from the cable through to the PCB. This makes them suitable for industrial applications as well as for applications in the railway, robotics and automation sectors, and indeed everywhere else where there are high mechanical loads. In order to intercept the forces acting on the cable too, the new ix Industrial has robust strain relief which connects the cable firmly to the connector shielding via a robust shield crimp. This ensures a completely robust connection – from the 5 THR shield contacts connected by means of 2 snap-hooks in the plug area, through to the cable itself.



HARTING ix Industrial mated

As a result of increasingly modular thinking and planning, higher contact durability is an issue that manufacturers must consider carefully. Modules such as production units, tools and other system components, are no longer simply rigidly wired, but are also re-arranged and frequently reconnected. In a connector's life, it may be plugged in and taken out several hundred to a thousand times. In order to offer absolute safety to users, the HARTING ix Industrial® is designed and tested for at least 5,000 cycles. Even after this high number of (dis-) connections, all relevant parameters, such as transition and insulation resistance, voltage resistance and the connection and pulling forces, remain within the permissible limits. Quality and reliability are a top priority at HARTING. To meet these requirements, all connectors are subjected to various tests at our in-house, state-of-the-art test

laboratory and are examined using state-of-the-art equipment. This applies to all environmental simulations, such as various storage situations involving climatic extremes and corrosive gases, as well as a variety of mechanical tests, such as shock and vibration tests, contact durability and connection and pulling forces, as well as various other test methods. It's no problem for our little superhero. He easily passes even the most demanding of shock and vibration tests according to the railway standard EN 50155. But Captain ix is not merely a rugged type. He is fast too.

For more performance

Transmission bandwidth also plays a role at a time of ever more data suppliers. This is also the case under difficult operating conditions, where EMC is an issue. High-frequency transmission is always subject to the problem of interference. HARTING offers continuous 360° shielding in this respect. There are no longer any unprotected wires from the cable to the connection point, which can affect a fault-free high-frequency signal. The cable shield is crimped directly to the connector housing with the crimped ring and thus has strain relief and continuous shield transition. A particular challenge is to effectively minimise the interrelation between the individual data pairs with this small design with very close contacts. For this purpose, a shield case is concealed between the two contact rows in the socket, which effectively prevents interrelation between the two opposing contact rows.

Furthermore, the new ix Industrial® has not 8, but 10 contacts. In each row of contacts, the central contact serves as a shield between the two pairs of wires. For this purpose, this central contact on the PCB is connected to the earth potential. Due to the shield case and the earthed contacts, the arrangement of the signal-carrying contacts results in a similar arrangement to that of an X-coded M12 round connector. Each pair of wires are shielded well from their neighbours in a separate cable or connector quadrant. This measure effectively

protects against crosstalk and ensures perfect data transmission.

Cooperation

In response to the challenging and growing demand for global digitisation technology, the HARTING Technology Group from Espelkamp has entered into cooperation with the Japanese company HIROSE Electric C. Ltd., Tokyo, in which both partners have agreed to bundle their strengths together. In the course of global digitisation through the Internet of things and services, the miniaturisation of components and interfaces in connection technology is a decisive factor which must be promoted globally.

"Industry 4.0 as an expression of the Internet of things needs one thing above all: an Ethernet connection to any Industry 4.0 component," explained Philip Harting, Chairman of the HARTING Technology Group. "The international standardisation of new high-performance components and infrastructures is an essential



prerequisite for market success, and provides security in terms of planning."

The Japanese partner HIROSE Electric offers miniaturised connection solutions for small portable devices such as mobile phones, tablets and cameras. HIROSE Electric has thus contributed to the miniaturisation of and high-speed transmission by electronic devices. The result of this cooperation is

the development of a new miniaturised and robust Ethernet interface for high data rates. The ix Industrial®!

Dimensions, robustness and Cat. 6A performance in combination with the possibility of Power-over Ethernet (PoE) are examples of successful miniaturisation, and more of the same is sought. They give the HARTING ix Industrial® the potential to assume the great legacy of the RJ45. A new standard for Industry 4.0 and IoT applications. For this vision to become a reality, both partners have jointly launched a new standard and have disclosed and standardised this new Ethernet interface in the published IEC /PAS 61076-3-124.