Technical Article

Greater Flexibility in Industrial Image Processing

Hybrid connector solutions increase integration density and reduce cabling effort

Hybrid connector systems are becoming increasingly important in industrial image processing. By combining power and data transmission in a single interface, they enable more compact systems and significantly higher integration density. This approach opens up new possibilities in system architecture and paves the way for more compact, efficient, and high-performance camera systems.

Reduced size, lower weight, and minimized cabling are particularly important in industrial robotics and dynamic applications. Hybrid single-cable solutions reduce assembly effort and system costs while increasing reliability. Eliminating separate interfaces for power and data reduces the required installation space and simplifies integration. Solutions such as HySpeedVision implement this approach by combining power and data transmission in a compact interface.

Real-Time Capability as a Key Driver

The increasing demand for process dynamics and real-time capability is a key driver of this development. In highly automated production lines, camera-based systems must integrate precisely into specified cycle times. Deterministic, minimal latencies are essential, especially when image data is used to directly control subsequent process steps.

These requirements are even more stringent in applications involving moving systems, such as robotics. For example, when a robotic arm moves to position components for inline inspection, low latencies are critical for precision, cycle time, and process stability.

Traditional transmission concepts with separate power and data lines are reaching their limits. These concepts increase system complexity, require additional installation space, and are only marginally suitable for dynamic applications in terms of mechanical load capacity, integration and installation effort, operational reliability, and failure tolerance.

Openness to Protocol Diversity

Industrial image processing applications are characterized by their diversity. Therefore, interfaces must be flexible and open to various protocols. Hybrid connector systems address this need by supporting a wide range of established transmission standards.

They focus particularly on SerDes (serializer/deserializer) technologies, which convert parallel data streams into high-performance serial signals. Unlike network-based Ethernet solutions, SerDes technologies enable deterministic point-to-point connections with minimal latency, which is a decisive advantage for real-time applications and dynamic motion profiles.

Technical Article

Established standards include GMSL™, FPD-Link™, APIX®, and ASA Motion Link, among others. These standards enable data rates in the double-digit gigabit range over distances of more than ten meters, making them ideal for demanding industrial applications.

Hybrid systems are physically implemented by separating power and data paths within a single cable. Dedicated power conductors supply power to the camera and peripherals, and high-speed differential pairs enable interference-free data rates in the gigabit range.

High Demands in Industrial Robotics

As automation increases, so do the demands placed on connectivity solutions. In addition to electrical parameters, the importance of mechanical properties is becoming clearer. In industrial robotics, for example, cable compatibility with drag chains and torsional strength are particularly important.

Furthermore, connection solutions must reliably function under demanding environmental conditions and meet the corresponding protection ratings, up to IP67.

Therefore, extended temperature ranges, robust housing designs, and high electromagnetic compatibility (EMC) are essential. Industrial applications increasingly benefit from automotive industry technologies, especially with regard to shielding concepts and production readiness.

Hybrid connector systems combine these requirements, enabling robust, compact, high-performance transmission solutions, even under dynamic loads.

Design Support as a Key Success Factor

As data rates increase, the focus on high-frequency technology in system development is growing. Aspects such as controlled impedance, signal integrity, and minimizing reflections and losses must be considered early in the design process.

Consequently, close collaboration between component manufacturers and system developers is becoming increasingly important. Design-in support, simulations, and electromagnetic field analyses help ensure the optimal design of the entire transmission path, from the connector through the cable to the printed circuit board.

This holistic approach is especially important in the context of miniaturization and increasing integration density, as it is a decisive factor for success.

Outlook: Automation as a Catalyst

Industrial image processing will continue to be established as a key technology in automated production environments.

Technical Article

Camera-based applications, such as pick-and-place, are becoming standard and enhancing the flexibility and efficiency of production processes.

At the same time, advancing automation is driving miniaturization in industrial manufacturing and robotics. The need for high-performance, space-saving connection solutions is growing due to more compact systems and limited installation spaces.

Hybrid connector systems play a central role here because they bundle functionality while reducing complexity for users.

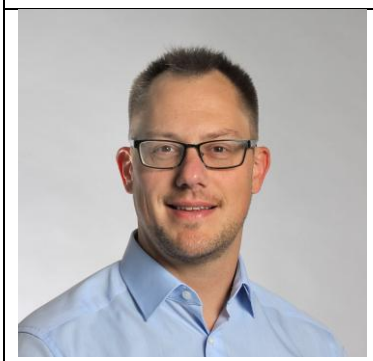
They offer clear advantages in terms of reliability and service life, particularly in dynamic applications with high mechanical stresses, such as tight bending radii and torsional stress. Thus, they are essential to the next generation of industrial image processing systems.

Further information: www.rosenberger.com/de/produkt/hyspeedvision-hyv/

Author: Johannes Baumann, Product Manager at Rosenberger

Technical Article

Images (royalty-free use with credit: “Image: Rosenberger”)

	Rosenberger offers robust RF cable solutions for the reliable integration of industrial camera systems
	HySpeedVision cable assemblies are characterized by high torsional resistance and suitability for tight bend radii
	HySpeedVision connection solution: DC to 3.5 GHz, up to 12 Gbit/s
	Johannes Baumann, Product Manager at Rosenberger

Technical Article

About Rosenberger

Rosenberger is a globally renowned manufacturer of electronic components and systems, recognized for cutting-edge technologies, engineering excellence, and uncompromising quality. Headquartered in Germany, the Rosenberger Group operates worldwide with numerous sales and production locations, offering a broad range of standardized and customized connectivity solutions in RF, high-voltage, and fiber optic technologies.

Rosenberger ensures the reliable transmission of signals, data, and power in the most demanding application areas. Leading high-tech companies across sectors such as mobile communications and telecommunications, industrial measurement technology, automotive electronics, medical and industrial electronics, data centers, and aerospace rely on Rosenberger products for their precision and outstanding reliability.

The company's CNC machining division produces precision parts for various industries, including the automotive and commercial vehicle sectors, shipbuilding, and classic mechanical and plant engineering.

Since its founding in 1958, Rosenberger has been family-owned and currently employs around 15,000 people worldwide. The company's employees are known for their dedication, innovative spirit, and commitment to quality, all firmly rooted in the values of a traditional family business.

For more information, please visit: www.rosenberger.com

Media Contacts

Rosenberger Hochfrequenztechnik GmbH & Co. KG
Aldo Croci Torti
Marketing Services
Hauptstrasse 1
83413 Fridolfing, Germany
Phone: +49 8684 18 1707
aldo.crocitorti@rosenberger.com
www.rosenberger.com

Profil PR oHG
Jan Lauer
Humboldtstrasse 21
38106 Braunschweig, Germany
Phone: +49 531 387 33 18
j.lauer@profil-pr.com
www.profil-pr.com