



Solutions for agriculture

Connectivity, sensors, and data communication



Components that last

High reliability, high flexibility

Products and components used in agriculture and forestry have to “last and work”. They must run reliably under all conceivable weather conditions and environmental influences. This places exacting demands on all the components of mobile machinery. Our products withstand these harsh conditions.



Customizing Future

As a center of excellence for applicative sensors, PULSOTRONIC complements the comprehensive solution portfolio of the Phoenix Contact Group. PULSOTRONIC operates worldwide and works with customers to develop customized

sensor solutions and electronic components in the niche application fields of agricultural machinery, wind turbine generators, industrial trucks, intralogistics, utility vehicles, and standard sensors.



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Our comprehensive portfolio

- Applicative sensors
- Data connectors
- Charging technology for e-mobility
- Heavy-duty connectors
- Sensor/actuator connectors



More information is available here.

Optimum process control with sensors

Sensors measure operating states and loads in real time. This enables manufacturers of mobile machinery to adjust machinery and attachments automatically and efficiently. Sensors help to improve the quality of the work results by providing data to optimize agricultural processes or for further evaluation and processing.



Summary of the solution flow



1. Sensors and devices

Agricultural machinery such as tractors and harvesters are equipped with various sensors that record data such as cutting height, tilling depth, and other machine parameters.



2. Connectivity

These sensors are connected to the vehicle controller via data and signal connectors. Either the information is processed directly or it is forwarded to a cloud for storage or subsequent processing.



3. Data processing and storage

The stored data can be used to perform (real-time) analyses or trigger immediate actions.



4. Data analysis and visualization

With the appropriate analytical software and visualization programs, the data is clearly presented and can be displayed in a dashboard. This means that important parameters such as ground conditions and machine performance can be seen at a glance.



5. Automated decisions

Automated decisions are made based on the analyzed data. For example, automatic adjustment of machine parameters, such as the tilling depth or cutting height. This reduces the operator's workload and ensures consistent work quality. The data

obtained is used to optimize workflows with the aim of conserving resources and achieving higher yields.

This process chain demonstrates how sensors, connectors, gateways, and controllers help increase efficiency and

productivity in agriculture by ensuring a seamless connection from the sensor to the cloud.

Measured value acquisition with sensors

The dynamically growing level of automation in agricultural machinery requires comprehensive monitoring, evaluation, and communication of a wide range of measured variables. Whether within the machine architecture or externally in the cloud – systems and solutions from PULSOTRONIC capture, transport, and control the characteristic values in your application.

Steering column

As part of electronic steering systems, sensors on the steering column supply signals and communicate with the controller.

Flap/pedal angle

Angle sensors enable the detection of opening angles on flaps or even pedal positions.

Deadmen

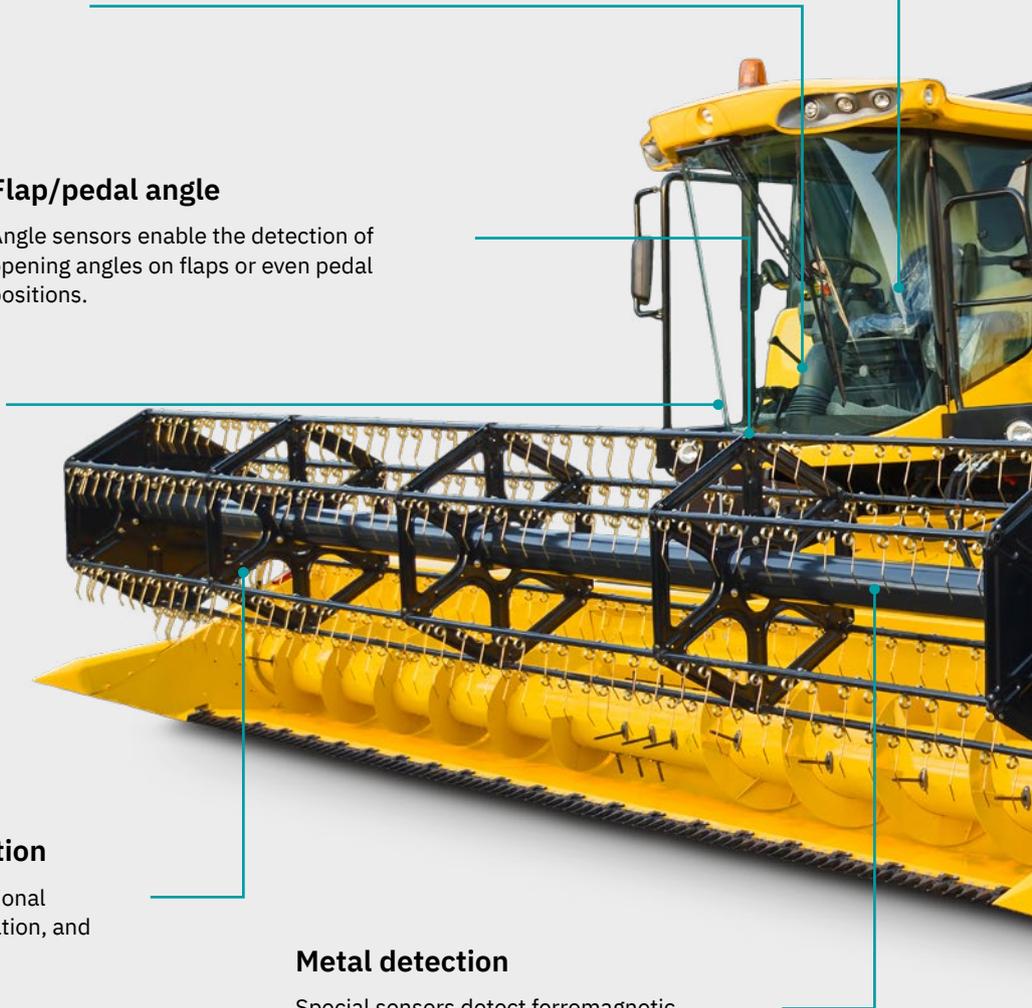
Redundant sensor systems monitor the driver's presence in the seat.

Inclination and acceleration

Sensors based on different functional principles detect position, inclination, and acceleration.

Metal detection

Special sensors detect ferromagnetic materials to protect mobile equipment and to monitor the quality of the crop flow.



Driver presence

Ultrasonic or radar sensors detect the presence and mobility of the driver in the cabin.

Speed/direction

Temperature-stable sensors with high switching frequency measure the direction and speed of rotating objects.

Seed flow

Individually adapted sensors monitor the flow of seeds, fertilizers, or spreading material for reliable application and early detection of blockages.

Single-grain counting

Optical sensors count seeds after separation for precise and controlled spreading.



Position/presence

Depending on the application, ultrasonic sensors as well as optical, inductive, and capacitive sensors reliably detect the position and presence or monitor the level.

Backup warning

Radar sensors monitor the area behind the vehicle when it is in motion and distinguish between moving and stationary objects.

Force/load

Strain gage sensors permanently monitor minute deformations to check for stretching and compression.

Fifth wheel coupling

Sensor bundles increase safety and the degree of automation when coupling the tractor to the trailer.

Steering angle

Angle sensors measure the angular position of mechanical systems.

Ground distance

Ultrasonic or radar sensors detect the distance between equipment, attachments, and attachment parts and the ground.

Applicative sensors

As a center of excellence for applicative sensors, PULSOTRONIC develops customized, innovative sensor solutions for its customers. The key to ensuring smooth processes in subsequent use under high load capacity lies in customized sensors manufactured specifically for the application of the mobile machinery in terms of fit, form, and function.



More information is available here:
www.pulsotronic.de/en/



Technological expertise for customized sensor solutions

Seed flow sensors

Presence monitoring, seed flow and blockage monitoring, or high-resolution counting of individual grains: PULSOTRONIC successfully applies customized systems in terms of function by striking an optimal balance between customer requirements and the associated design effort, especially in the construction of the optical function. The requirements of the agricultural machinery manufacturer with regard to electronics, i.e., power supply, output signal, grain frequency, and protective function, are decisive here.

We design the connection to standard hoses or customized hose systems with inlet and outlet zones and also create an optimal housing design for the application.



FMCW radar sensors

Measurement tasks on mobile machinery require robust yet precise technologies for detecting the surrounding environment or the objects in it. The sensory performance of FMCW radar sensors makes them ideal for use on agricultural machinery, industrial trucks, construction machinery, or as part of fleet management systems. The radar systems detect objects up to 35 m away. PULSOTRONIC provides its customers with a sensor platform from which specific customer application requirements can be verified and implemented. The concept of radar sensors enables manufacturers of agricultural machinery to access the complexity of radar technology more easily. This results in a faster time to market and reliable implementation of the measurement tasks.



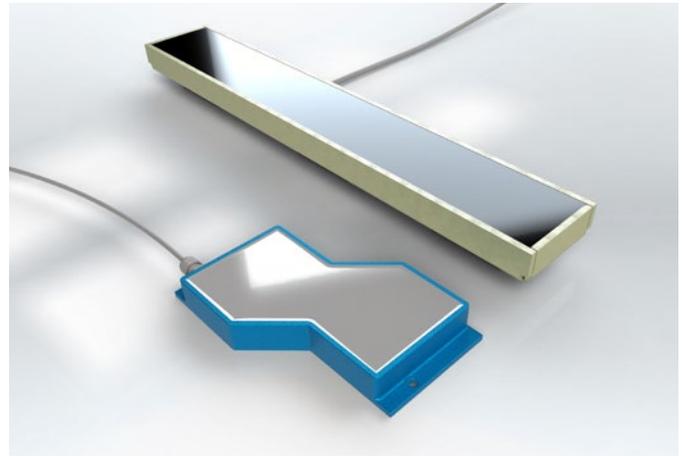
6DoF sensors

6DoF sensors detect movements in all six degrees of freedom of a given space using several sensor principles in one chip. Application-specific adjustments to the measuring ranges can be made via interfaces using firmware. Optional communication via CAN, SPI, IO-Link, or, in the future, SPE round out the universal application profile of the sensors. The variability of the 6DoF sensors enables our agricultural machinery manufacturers to use them on mobile machinery as well as in moving assemblies of stationary agricultural equipment.



Applicative sensors

Inductive sensors



Inductive sensors detect all metals, regardless of whether they are moving or not. The sensors work impact-free and are insensitive to deposits on the active surface, such as metal shavings or dirt, due to their high operating reserves. These sensors offer almost ideal conditions for use in mobile machinery. They are contactless, operate wear-free, have high switching frequencies and switching accuracies as well as a high level of protection against vibrations, dust, and moisture. PULSOTRONIC offers sensors with EMI resistance in accordance with DIN EN ISO 14982 that are designed specifically for use in agricultural machinery.

Balanced inductive systems are a special feature within inductive sensors. Based on several balanced electrical fields, these systems detect the smallest metallic interference in the detection range. PULSOTRONIC metal detectors use this special feature to detect foreign objects in the feed area of forage harvesters or combine harvesters, thus protecting the machinery from damage during the harvesting process.

All inductive sensors can be equipped with IO-Link. This enables improved communication and integration into automation systems, thereby increasing the efficiency and reliability of processes.



More information is available here:
www.pulsotronic.de/en/



Angle sensors

Angle sensors work according to the principle of magnetoresistance or the Hall principle. Depending on the application, these sensors use ferromagnetic metals or polarized permanent magnets as targets and detect angles, angular rotation, or even rotary movements. They excel in robust, mobile applications with their contactless function, high degree of protection up to IP69K, extended temperature and tolerance ranges, and EMI resistance in accordance with DIN EN ISO 14982. PULSOTRONIC takes account of the limited installation space available in moving applications by optimizing the housing design for each customer and by offering a wide range of available connectors.



Capacitive sensors

Capacitive sensors detect metallic and non-metallic objects with different reduction factors. The sensitivity is set via a potentiometer or via teach-in functions. The achievable switching distance depends on the material and shape of the object.

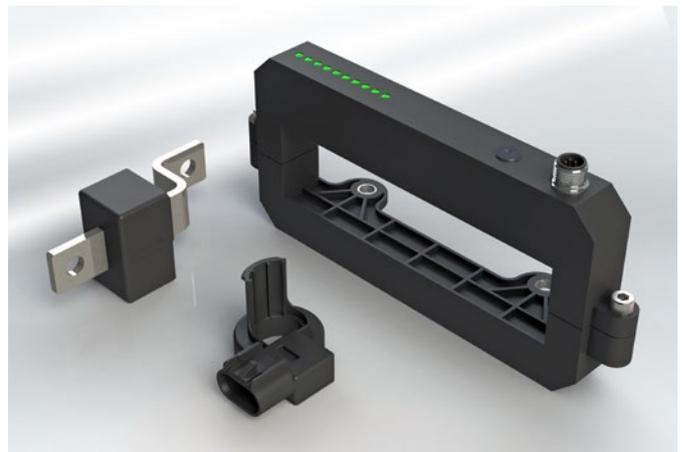
Areas of application include:

- Object detection and metal detection of harvested produce in mobile machinery bunkers
- Level controls without media contact through plastic or glass walls, for example
- Object and position detection or counting of media with a low dielectric constant



Current sensors

Current sensors measure the current in cables or busbars. Based on the Hall or TMR effect, current sensors are used to monitor battery status, charging processes in e-mobility, for overcurrent monitoring, or to detect current peaks (ground fault measurement). Mobile current sensors are characterized by their optimal adaptation to the design of the cable sets, their high robustness against environmental influences, and the variable design of the communication interfaces.



Reliable sensor/actuator connectors

Agricultural and forestry machinery is constantly exposed to extreme environmental influences. To ensure that the machinery is always ready for use, we offer cabling solutions that can withstand any influences such as dirt, vibrations, changes in temperature, moisture, jet water, oil, and UV radiation.



Space-saving and flexible

The compact M12 connector systems enable the space-saving and flexible cabling of sensors and actuators on your machinery. Applications range from the touch panel connection in the driver's cab and inductive position sensors through to radar monitoring of the environment, the detection of foreign objects, and the transmission of video signals.

In addition to preassembled cables, we also offer connectors designed for assembly and distributors for your individual cabling.



Circular connectors



Signal cables and power cables



Distributors, adapters, and conductor connectors



Robust and safe

In practical applications, high demands are placed on valve connectors and valve connector cables due to temperature influences and mechanical influences or contact with oil and grease. Our extensive product range is ideally suited to these harsh operating conditions.

Valve connectors are available in five different designs (A, B, BI, C, CI) as well as for pressure switches (AD). The scope of application ranges from 24 to 230 V AC/DC.



Valve connectors and cables



Quickly ready for use

DEUTSCH and Superseal connectors are often used in work lights and hydraulic valves. The thermoplastic housings provide protection up to IP69K, are temperature- and UV-resistant, and enable fast, vibration-resistant installation with the clip locking function. Customer-specific distributor boxes provide optimum support during cabling. Tailored to specific requirements, they enable easy integration and increase efficiency and reliability.



Molded connectors



Connectors designed for assembly



SKS Kontakttechnik



Heavy-duty connectors

Control cabinet and motor connections to stationary and mobile applications are also subject to extreme requirements. Heavy-duty connectors from the HEAVYCON series protect your interfaces and ensure the reliable transmission of power, data, and signals even under harsh conditions. They are resistant to dirt, water, vibrations, and high mechanical stresses.



Compact interfaces

With the HEAVYCON D7 connectors, you can transmit signals, power, and data easily and extremely reliably, even in confined spaces. The D7 series impresses with its robust yet compact size. With the use of plastic or die-cast aluminum, the D7 connectors are particularly lightweight compared to similar connectors with classic metal housings. Nevertheless, these “lightweights” can withstand extreme environmental influences and can be used outdoors without any problems. The convenient locking latch can be easily operated with one hand and the slimline design enables the tight placement of multiple connectors.



Industrial connectors for all applications



Versatile and flexible connectors

The HEAVYCON complete product range consists of metal and plastic housings, contact inserts, cable glands, and accessories. The sleeve housings, panel-mount bases, surface-mount housings, and coupling housings can be freely combined with one another. They are also mounting and plug-in compatible with aluminum housings from well-known manufacturers. This allows all components to be individually combined and flexibly modified, extended, or replaced.

Our fixed-position and modular contact inserts naturally fit into all housing series. Fast-connection technologies such as Push-in or QUICKON insulation displacement connection make it possible to connect cables in seconds.

With HEAVYCON modular, you can create your own individual connector. By combining various different transmission media in the same housing, you can easily create your highly compact interface.



Industrial connectors for all applications



Innovative e-mobility charging technology

From tractors and combine harvesters to feed machinery – the electrification of the drive train is progressing rapidly. Charging powers of 500 kW and more are needed in the agricultural sector, as are charging powers in lower ranges. We offer the right charging technology.

CHARX 

E-Mobility empowered by Phoenix Contact



Components for charging stations and home chargers

Equip your charging solution for the agricultural sector with CHARX from Phoenix Contact: As a component manufacturer, we supply almost all the equipment for your charging infrastructure – whether an AC home charger or DC fast charging station, whether with PCB, DIN rail, or 19" rack mounting.

From CCS charging cables to load management, our broad portfolio covers all the functional areas of modern charging stations and forms the basis for a strong and networked charging infrastructure that is also increasingly needed in agriculture. Our experts will support you with the design and planning and, if necessary, will also develop customized solutions.



More information is available here:
phoenixcontact.com/charging-infrastructure

Charging inlets for electric vehicles and machinery

With the integrated temperature sensors and high degree of protection of IP67 and IP6K6K and IP6K9K in the contact area, our AC and CCS vehicle charging inlets provide reliable protection against overheating and the ingress of water, dust, and dirt.

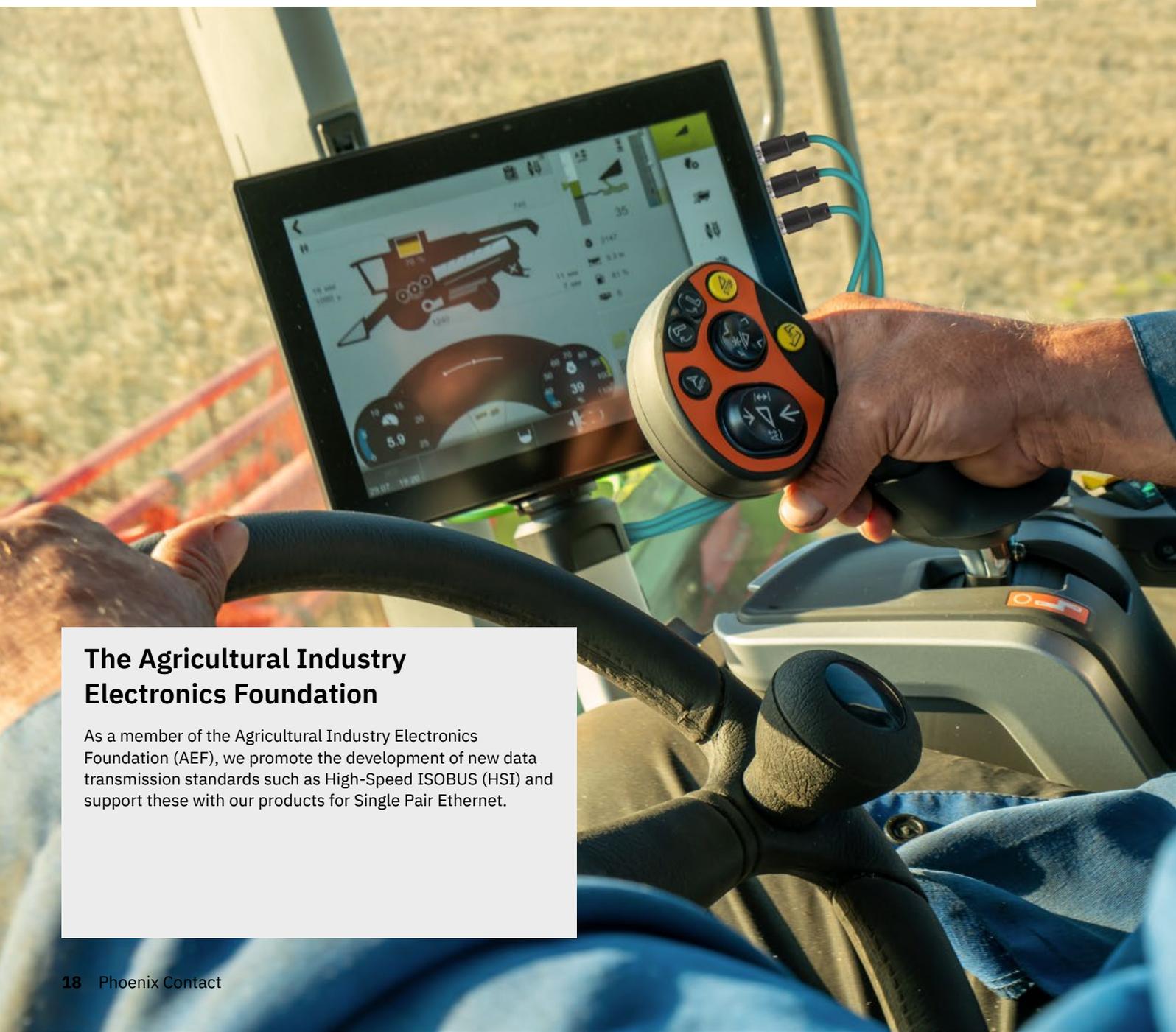
Our CCS charging inlets enable High Power Charging (HPC) with up to 700 kW in Boost Mode with a DC cable cross-section of 120 mm².



More information is available here:
phoenixcontact.com/charx-connect-universal

High-performance data communication

Whether the heat and cold, moisture and dust, or shock and vibrations – we know about the extreme demands placed on data connectors in agricultural machinery. To achieve maximum reliability even under high loads, Phoenix Contact offers robust connectors for long-lasting, stable, and high-performance data transmission.



The Agricultural Industry Electronics Foundation

As a member of the Agricultural Industry Electronics Foundation (AEF), we promote the development of new data transmission standards such as High-Speed ISOBUS (HSI) and support these with our products for Single Pair Ethernet.

Networking in agriculture

Efficient and stable

Connectors for Single Pair Ethernet: compact device and cable connectors from the ONEPAIR series are ideal for efficient data transmission in numerous applications.

The M8 and M12 pin connector patterns

in accordance with IEC 63171-5/-7 and the new M12 hybrid connectors demonstrate their strengths in harsh field environments.



For more information, simply enter the web code into the search field on our website.

 Web code: #2240



High contact density in a compact space

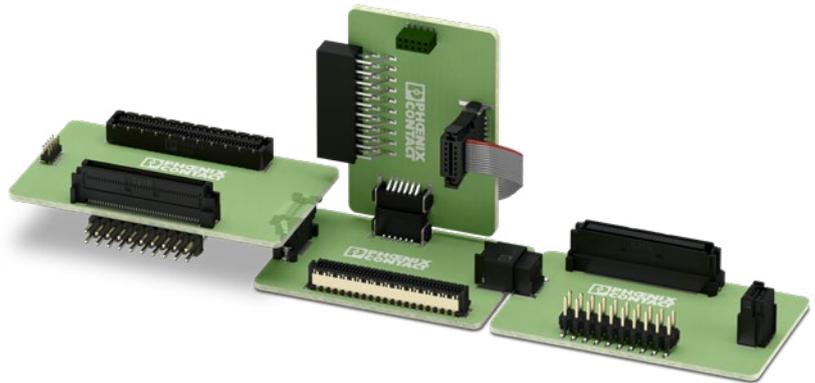
FINEPITCH series board-to-board connectors: Phoenix Contact offers robust shielded and unshielded solutions for power, signal, and data transmission in the device. This allows you to realize individual PCB orientations with different

designs, stack heights, and numbers of positions as a shock-proof and vibration-resistant connection.



For more information, simply enter the web code into the search field on our website.

 Web code: #2492



Reliable and fast with up to 10 Gbps

For reliable and fast data transmission up to 10 Gbps, choose from our portfolio of shielded circular connectors for all common fieldbuses and networks. Molded connectors and connectors designed for assembly offer all degrees of freedom with

regard to cable length and feed-through. Furthermore, our push-pull system enables quick and tool-free mounting.



For more information, simply enter the web code into the search field on our website.

 Web code: #0368



Protection for sensitive measurement technology

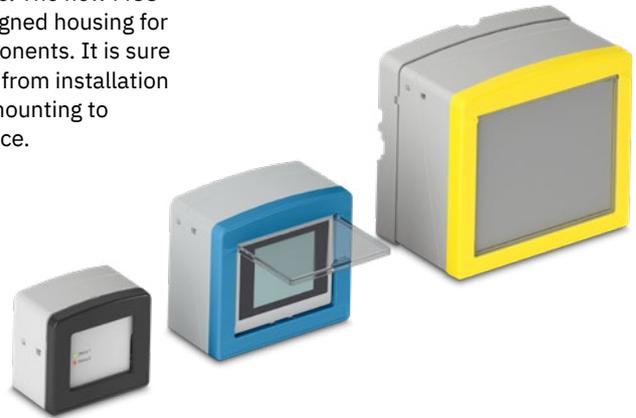
Heat and drought, heavy rainfall, and floods – extreme weather events present an increasing challenge for agriculture. Monitoring and early detection with appropriate measurement technology is becoming increasingly important. Robust outdoor housings ensure the optimum protection of sensitive measuring and evaluation electronics, even under harsh conditions.



MCS monitoring housings

The Monitoring Case System (MCS) is ideal for field devices used in sensor applications. Featuring high IP65/IP67 degree of protection, the housings are suitable for outdoor use. Alternatively, an IP40 version is available. Standard components, optional accessories, and a comprehensive portfolio of connection technology can be combined to create

a wide range of solutions. The new MCS series offers a well-designed housing for diverse electronic components. It is sure to impress at all stages, from installation of the PCB and simple mounting to maintenance of the device.



For more information, simply enter the web code into the search field on our website.

 Web code: #3462

ECS outdoor housings

Robust outdoor housings from the Environmental Case System (ECS) series are the ideal solution for protecting sensitive electronics used in indoor and outdoor applications from dust, dirt, and water. With their IP6X to IP69K degree of

protection and wide temperature range from -40°C to $+100^{\circ}\text{C}$, the housings are ideal for harsh ambient conditions and other challenging environments.



For more information, simply enter the web code into the search field on our website.

 Web code: #0857

Large-volume OCS outdoor housings

The OCS series housings are suitable for device applications under extreme ambient conditions that require larger installation space. They are both lightweight and durable, and protect your valuable contents from heat, UV radiation, and impact stress (IK 10) up to IP69. As a result, they ensure that mobile and location-independent equipment

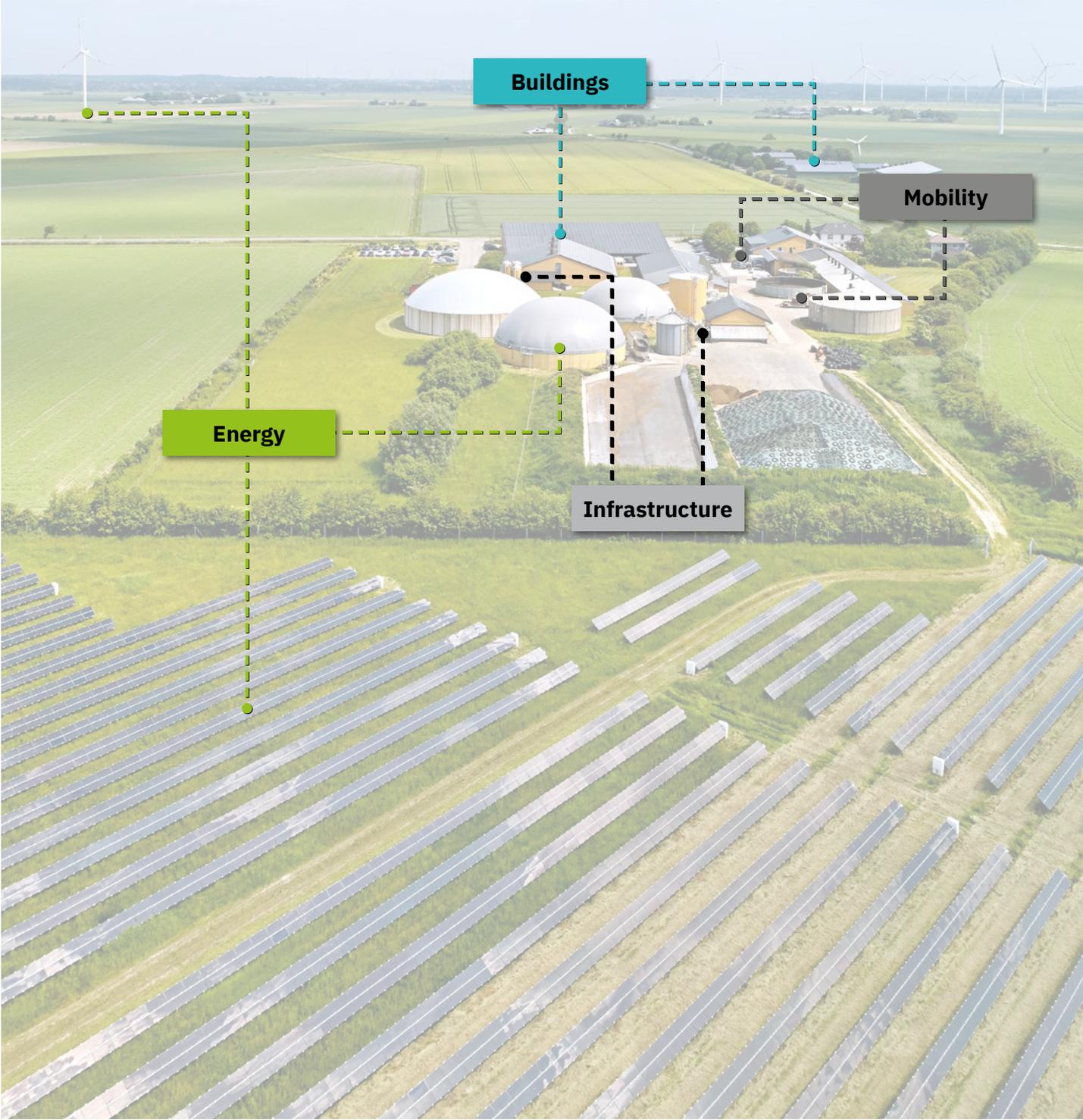
systems can permanently operate with reliability under adverse conditions. The Pico off-grid system (POS) is a PV panel-based solution for the simple setup of energy-self-sufficient systems with multiple performance classes up to 190 watts peak. The solution includes the OCS, a pole bracket, and a solar panel.



For more information, simply enter the web code into the search field on our website.

 Web code: #3249

Electrification, networking, and automation in agriculture



Sector coupling consistently taken further

The farm as a microgrid

Power generation, distribution, storage, and consumption are considered as a holistic system in sector coupling. Individual sectors exchange energy with each other so that it is available in the right form where it is needed. By collecting and evaluating data on energy consumption and generation, the energy flow is optimally controlled.

This means that sectors must be networked not only in terms of performance, but also in terms of communication. Standardized communication protocols within different networks enable the necessary communication, independent of system boundaries. The principle of sector coupling works on a small scale, for example, within a company, as well as across companies. Phoenix Contact provides products, solutions, and services for the electrification, networking, and automation of the energy, industry, infrastructure, and mobility sectors.



As the Phoenix Contact Group, we work on solutions for mobile agricultural and forestry machinery, barn automation, controlled environment agriculture, and farm management.

Sector coupling as the key to the All Electric Society

The All Electric Society vision of the future describes a world in which energy from renewable resources is available in sufficient quantities and at affordable prices. In addition to the consistent generation and use of renewable energy, reducing the demand for primary energy through efficiency measures and creating intelligent and networked systems are the keys to a sustainable future.

To be able to base renewable energy use on demand, solutions and technologies for electrification, networking, and automation for realizing sector coupling are needed.



More information is available here.

Empowering the All Electric Society

Open communication with customers and partners worldwide

Phoenix Contact is a global market leader based in Germany. We are known for producing forward-thinking products and solutions for the comprehensive electrification, networking, and automation of all sectors of the economy and infrastructure. With a global network, we maintain close relationships with our customers, something we believe is essential for our common success.

You can find your local partner at
phoenixcontact.com

