

# AEF: Powering Agricultural Electronics

Agricultural Electronics



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## AEF – Agricultural Industry Electronics Foundation

Seven international agricultural equipment manufacturers and two associations established the Agricultural Electronics Foundation on the 28th of October 2008. The initiative is an independent, international organization. It provides resources and know-how for the increased use of electronic and electrical systems in farming.

Initially, a succession of important tasks associated with ISO 11783 (ISOBUS) formed the main focus of their work. But now the agricultural industry no longer sees the potential of AEF as limited only to ISOBUS. Their work is therefore being expanded to include other important areas such as electric drives, camera systems, farm management information systems, high speed ISOBUS and wireless in-field communication.

The AEF is an international platform that is open for all interested groups from the field of electrical and electronic systems. It is financed through the membership contribution of both founding members and service charges from general members. More than 190 companies, associations and organizations are already members and actively collaborate within the AEF.

The AEF will provide the continuous encouragement and support necessary for introducing guidelines to ISO (International Organization for Standardization) standards in agricultural electrical and electronic systems.

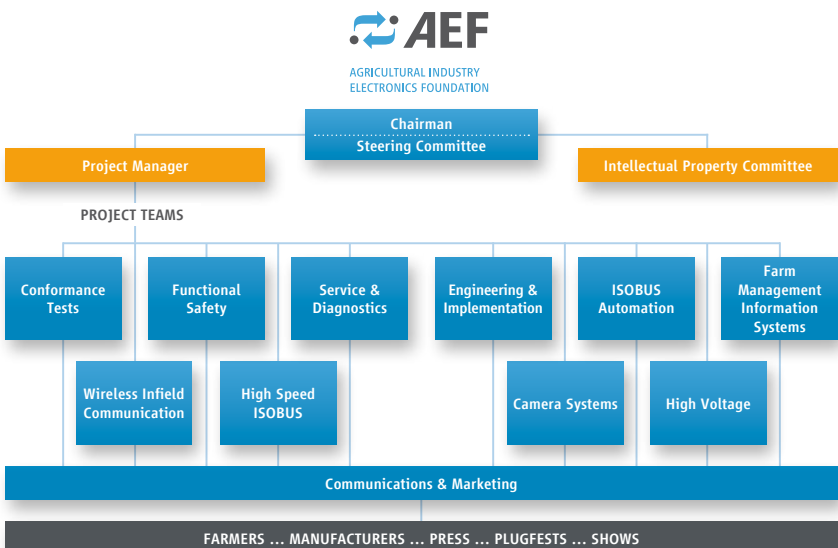


## The AEF Vision

We will be accepted worldwide as the most competent and most relevant organization within the field of agricultural electronics. Future research and development activities, which require an open cooperation between involved parties in the agricultural machinery industry will be within the scope of the AEF.

## The AEF Mission

The development and support for the implementation of generally accepted standards for electric and electronic interfaces as well as standards for data exchange for the agricultural machinery industry. The AEF is providing a framework for the cooperation of all interested parties under the leadership of the core members whilst maintaining competition amongst all members. The AEF supports standardization organizations such as the International Standards Organization (ISO).



## AEF in short

### Customers will benefit

The AEF should establish itself in its own right with mutually beneficial links between various companies. The increased use of electronic and electrical systems is intended to make work easier for our farming customers and provide them with economic benefits. In addition, the AEF also develops and promotes synergistic connections between companies. ISOBUS and other technologies are given the necessary impetus by the AEF.

### ISOBUS as a brand

The AEF would like to establish ISOBUS as a brand and seal of quality. As a central organization, it is ideally placed to be able to reinforce international acceptance of ISOBUS certified products. The intention is for ISOBUS to become accepted as a global communication standard.

### End of confusion

The challenge for the AEF at first was the development of authoritative ISOBUS certification procedures in order to establish compatibility. It is intended to put an end to the confusion surrounding the question of the compatibility of tractors and attached machines. We will achieve compatibility much sooner if all agricultural technology companies are pulling together. This also applies for new tasks the AEF has accepted.

### United approach

The provision of fast and reliable service through cross-manufacturer standards is a significant customer benefit. Eleven internationally manned project teams and numerous subgroups are working on solutions that will help our customers. Together we are more effective than "every man for himself".

## Objectives of the AEF

- Establishment and continuation of the international development and expansion of electronic and electrical technology as well as implementation of electronic standards
- To coordinate international cooperation in ag electronics technology
- To build synergistic partnerships between ag equipment manufacturers for the benefit of equipment users
- To coordinate technical improvements (ISOBUS) including management and enhancement of certification tests
- To organize certification support, training, workshops, marketing activities and consulting relating to any ag electronics international standards.

### Important to know

It is important to know that AEF is not the same as ISO. AEF does not create the international standards. This task remains the domain of the ISO with its affiliated working groups. The AEF replaces the European Implementation Group ISOBUS (IGI) and the North American ISOBUS Implementation Task Force (NAIITF). The AEF is not limited to only ISOBUS. It supports every international agricultural electrical and electronic system standard which has been accepted by the ISO. In addition to the agricultural industry itself, the founding members are the two associations AEM (Association of Equipment Manufacturers) in the USA and VDMA (German Engineering Federation) in Germany.

The organization is based in Frankfurt/Main, Germany.



# First priority was ISOBUS

There are a variety of important subjects relating to ISOBUS that provided the initial focus for AEF's activities. These activities are aimed at providing the resources necessary for addressing important electronics technical subjects on behalf of ag equipment manufacturers and farmers.

### AEF's activities

- Increasing**  
Increased international acceptance and awareness of ISOBUS technology.
- Enhancing**  
Enhanced customer benefits from using the ISOBUS technology.
- Improving**  
Improved compatibility of ISOBUS products with plug and play capability worldwide.
- Collecting**  
Collecting all the information available about ISOBUS products, including their functions , implementation and compatibility, for the service, marketing and sales divisions of manufacturers and suppliers.
- Promoting**  
Promoting the international acceptance of ISOBUS certified products while creating a quality brand and trademark for ISOBUS.

The AEF developed mandatory certification procedures that are continuously advanced. In addition a new label and logo combination has been designed to ensure – in combination with the AEF ISOBUS Database – absolute clarity regarding compatibility between tractors and implements.



## AEF achievements to date

- ✓ About 190 member companies worldwide.
- ✓ Working hierarchic structure.
- ✓ Hundreds of engineers & marketing experts work together in 11 Project Teams to develop guidelines and implement the standard(s).
- ✓ Important “Products” today:
  1. Component certification with AEF Conformance Test covering all major AEF Functionalities.
  2. Five AEF ISOBUS Test Laboratories in Europe and the USA
  3. AEF ISOBUS Database.
  4. Organization and hosting of Plugfests with growing number of participants.
  5. AEF publishes guidelines for its members to use; e. g. Implementation Guidelines or Functional Safety Guidelines.
  6. Furthermore also non-ISOBUS tasks have recently been delegated to the organization:
    - High Voltage on-board networks
    - Camera Systems
    - Farm Management Information Systems (FMIS)
    - Wireless in-field Communication
- ✓ And – no matter whether ISOBUS related or not – there will be a number of new tasks coming up in the future.



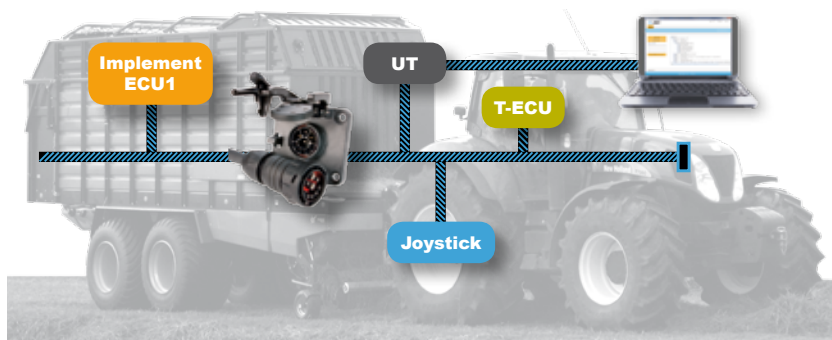
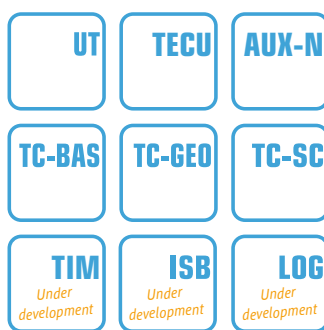
## AEF ISOBUS Functionalities

Ag equipment manufacturers around the world have agreed on ISOBUS as the universal protocol for electronic communication between implements, tractors and computers.

The primary goal of ISOBUS data technology is to standardize the communication which takes place between tractors and implements while ensuring full compatibility of data transfer between the mobile systems and the office software used on the farm. The basis is the international ISO 11783 standard – “Tractors and machinery for agriculture and forestry - Serial control and communications data network”.

This development was triggered by the fact that farmers often use tractors from one brand with implements from another supplier. As long as they are all using different electronic systems, each tractor and each implement combination requires an individual terminal.

A modern ISOBUS system consists of various components, including the tractor, terminal and implement. For system compatibility it is essential what the Universal Terminal and the implement are capable of performing – both separately and together. For increased transparency towards the user the AEF has defined AEF ISOBUS Functionalities that are now also the basis for the certification of ISOBUS products. An ISOBUS functionality can be described as an independent ISOBUS product and the concept is extendable for later additions of functionalities.



# AEF ISOBUS Certification and Label

## AEF Conformance Test

Along with the further development of the ISO 11783 standard and the AEF guidelines new functionalities i.e. Auxiliaries (AUX) and Section Control (TC-SC) were defined in addition to the well known Universal Terminal (UT). Therefore the AEF has developed a new conformance test, which can check these new functionalities. They are also the basis for the certification of ISOBUS products. An ISOBUS functionality can be described as an independent ISOBUS product and the concept is extendable for later additions of functionalities.

## Independent certification

The certification is executed by independent test laboratories selected by the AEF. Further labs will be appointed. For testing they are using the AEF ISOBUS Conformance Test. If the test is positive, the results will be available in the database for registered users as from a manufacturer-scheduled date. Besides the fact that a product complies with the standard ISO 11783 the user can now also see which functionalities it supports.

### Five AEF ISOBUS Test Laboratories



ISOBUS Test Center, Germany

Contact: Torsten Schenzel (torsten.schenzel@isobus-test.com)



Test Center  
Technology and Farm Inputs

DLG Test Center Technology and Farm Inputs, Germany

Contact: Andreas Horn (a.horn@dlg.org)



Reggio Emilia Innovazione (REI), Italy

Contact: Simone Zamboni (zamboni@reinnova.it)



Nebraska Tractor Test Laboratory (NTTL), USA

Contact: Doug Triplett (dtriplett2@unl.edu)



KEREVAL, France

Contact: Yannick Guyomarch (ygh@kereval.com)

For more information about the certification process contact the test lab appropriate for you.

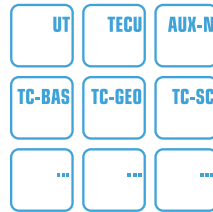
## The AEF ISOBUS Certified Label

The AEF certified label states that the respective ISOBUS components are in compliance with the ISO standard 11783 and moreover, with the additional AEF guidelines. The product has successfully passed the newly developed AEF certification process.

Six abbreviations within small squares symbolize functionalities, three squares containing three dots indicate that the system is open and extendable. Detailed information about the certified product is stored in the AEF database [www.aef-isobus-database.org](http://www.aef-isobus-database.org). Besides the fact that the product conforms to the ISO 11783 standard, the user also knows which functionalities it supports by looking it up in the Database.

AEF Certified

**ISO BUS**



[www.aef-isobus-database.org](http://www.aef-isobus-database.org)



Jetter

KEB



KINZE



Kubota  
For Earth, for Life

LACOS  
Componente Credit



## The AEF ISOBUS Database

Who is responsible when something is incompatible – the tractor manufacturer or the device manufacturer? How can I find an implement for my ISOBUS tractor which is also fully ISOBUS-compatible, and with which I can benefit from significant advantages? Is the implement that I already own ISOBUS-certified and compatible with the new ISOBUS tractor that I want to buy? And if so, which functionalities can I use with both of them?



### ... for farmers and contractors

The AEF database at [www.aef-isobus-database.org](http://www.aef-isobus-database.org) answers these and many other questions. This database contains all relevant information about all machines and devices, which have been ISOBUS-certified so far. With just a few mouse clicks the user can configure his tractor/implement combination and immediately see whether the selected combination is compatible, and with which common functionalities it is equipped. The user can even compare alternatives. If a device cannot be found in the database, it is not certified.



### ... for agricultural machinery dealers

For the dealer, the database makes advising customers easier on the one hand, and on the other, it speeds up troubleshooting through customer service. This can appreciably shorten downtimes.



### ... for agricultural technology manufacturers

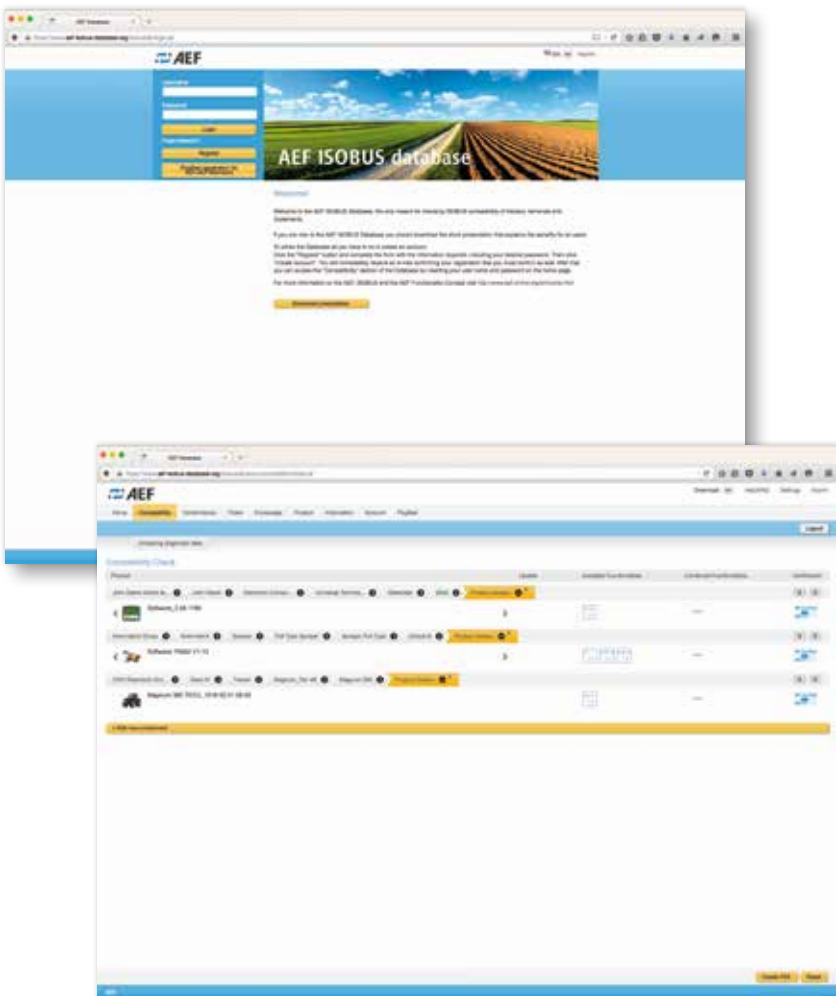
Lastly, the industry (OEMs) collects any reports about problem cases and these remain available in the database as ISOBUS “Knowledge”. These can also be used by the customer service team in the dealership to diagnose and find solutions to problems on-site more quickly. The database is continually and automatically maintained. This is because determining the conformity of machines and implements with the ISOBUS standard, and the related certification, is also carried out via the database by independent, regional ISOBUS Test Laboratories. In addition, a Conformance Test Tool (CT) that is available from the database facilitates and accelerates product development within AEF member companies.

## Conditions of use

Checking compatibility is free of charge for the agricultural public. To upload officially certified products in the database, the manufacturer must purchase a license from AEF. A license must also be purchased in order to use the Conformance Test Tool.

Ultimately the AEF-ISOBUS-Database supports the complete agricultural public (users, dealers and manufacturers) in using the new, worldwide ISOBUS standard.

[www.aef-isobus-database.org](http://www.aef-isobus-database.org)



## The AEF Project Teams

AEF has identified eleven projects that are important to address quickly. For each project a team of international experts, from the member companies, is hard at work to find solutions useful for both the industry members and their customers.



### Project Team 1: Conformance testing

The primary objective is to provide a state-of-the-art testing and certification process which ensures that the ISOBUS components are fully compatible. The formal certification process is designed for execution by independent testing institutes. The tools and protocols for these trials are also available

to the agricultural industry as a whole in order to support the development of ISOBUS compliant components across the board.

### Project Team 2: Functional safety of electronic controls

The mission of this project team is to draw up design and application guidelines for all manufacturers of agricultural equipment when safety related applications using the ISOBUS according to ISO 11783 are to be implemented. In this case all legal directives and standards such as ISO/DIS 25119, ISO 15077 have to be taken into consideration.

### Project Team 3: Engineering and implementation

The task here is to coordinate the market introduction of new ISOBUS features across the ag industry while continuing to monitor the ISOBUS engineering and implementation processes.

## Project Team 4: Service and diagnostics

The main objective is to service combined ISOBUS systems from different OEMs. (The same high quality standards must be met between brands as for individual manufacturers). The result should become tangible with quick and efficient troubleshooting in order to achieve complete customer satisfaction. In addition the issue of technical documentation, exchange of information, FAQs and training are to be tackled here.



## Project Team 5: ISOBUS automation



The market expects automation solutions for ISOBUS systems including Task Controller (TC), Sequence Control (SC) and Tractor Implement Management (TIM). ISOBUS Automation like TIM brings a new level of system complexity with responsibilities and liability aspects shared between the manufacturers involved in the automated systems in the field. The AEF PT 2 Functional Safety identified several

areas of liability risks for companies providing such multi-brand automation systems. This shared liability drives the need for a means to ensure that systems not following the AEF guidelines will be detected and addressed.

## Project Team 6: Communication and marketing

The communications and marketing project group is responsible for aligning the AEF communication to the public across all member companies. It assumes marketing responsibility for ISOBUS technology towards AEF members and the ag equipment industry in general as well as throughout the farming community. The group also collects information about the requirements of the market. Therefore status and results of the ongoing AEF work are published. The focus is placed on promoting ISOBUS in the market and establishing the new ISOBUS certified logo as the unique brand. To achieve their aims, the group coordinates various activities such as participation in industry conferences, shows and exhibitions along with design and public relations programs.

## Project Team 7: High-voltage on-board networks

Electric drives are becoming increasingly important in agricultural technology. The objective of this project team is to develop a proposal for a standard tractor interface that supplies power to attached machines and external components. The idea behind this is that the electric motors on all standard attached machines should be compatible with every model of tractor, and the only limitation should be the output data of the tractor engine. Locally controlled electric motors can overcome the restrictions of mechanical and hydraulic solutions and meet the requirements of a new generation of attached machines, and should also provide considerable benefits at the same time.

Five subgroups are already working on special areas in this direction: Interface connection (physical interface), requirements for attached machines, safety and risk analysis, specification of the interface with regard to the requirements for communication and performance, and for approaches to solving cooling system problems.

## Project Team 8: Camera systems

The camera systems project group will proceed in two phases: In the first phase a solution has been found for harmonizing the connectivity between cameras mounted on an implement and terminals mounted on the towing tractor. The solution focuses on today's needs utilizing camera systems with analogue image transmission. In the second phase the team will address future needs which are anticipated to include complex camera applications requiring digital image transmission.

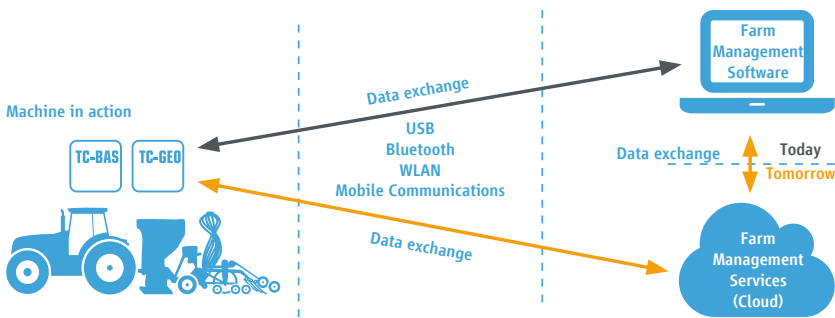


## Project Team 9: Farm Management Information Systems (FMIS)

The AEF project group "FMIS" is the ninth ISOBUS project team of the AEF. As part of consistent further development of the AEF ISOBUS strategy, it will develop common solutions for connecting mobile vehicles and attached machines to central farm computers and similar systems. The main areas of work for this team are the harmonization and expansion of existing standards for interfaces for data transfer, and the development of implementation recommendations (AEF guidelines) for manufacturers of machine electronics and management software.



The process of establishing a uniform and clearly structured certification of ISOBUS functions on mobile machines is already underway and should, in future, also be extended to include the interfaces for information and management systems. European as well as North and South American software and electronics companies are invited to participate in the work.



## Project Team 10: High-Speed ISOBUS

To meet the growing demand for data communication on ag equipment, a new High-Speed ISOBUS project team will explore concepts for increasing bandwidth on the bus.

The team’s work will also pave the way for integration of new features and functions, such as the expansion of diagnostics, the support of electric drives, M2M communications, and connection of real-time video systems.

## Project Team 11: Wireless Infield Communication

The new Wireless Infield Communication project team will focus on selecting suitable radio standards (such as WLAN) for machine-to-machine (M2M) communications. The new team will also examine communications encryption and functional reliability.

M2M communications allow machines to communicate directly while working together. A secure and standardized in-field radio communication system is required so that machines can control each other or simply exchange status information such as position, speed, and fill level. Also the machine-to FMIS-communication is covered by this project group.

## AEF membership

For manufacturers of electronic products for agricultural use the Agricultural Industry Electronics Foundation (AEF) is the “Club” to join. To date about 190 companies worldwide benefit from the advantages the organization offers. For a moderate Service Fee you will get access to the expertise acquired within the foundation. Membership in the AEF helps you to make your products fit for the future. But you are obliged to participate actively and you can then take advantage of a number of benefits.

### Become an AEF member

Every year tens of thousands of new tractors are being purchased with standardized ISOBUS terminals. A main factor behind these purchases is the customer’s expectation that more and more implements can be controlled by these modern tractors. They are – as always – looking for ease of handling, reduced costs and long-term viability.

You will find all necessary information regarding membership and its cost as well as for fees for Database and Conformance Test at the AEF website [www.aef-online.org/membership](http://www.aef-online.org/membership).

As an applicant for AEF membership please download and fill in the application form at [aef-online.org/membership](http://aef-online.org/membership) and send it to the AEF Office [office@aef-online.org](mailto:office@aef-online.org). You will then receive a database account and can handle licenses there.

**For uploading your products to the AEF ISOBUS Database and for application of the AEF ISOBUS Conformance Test Tool Licenses are mandatory.**

To match the growing organization the AEF has developed a billing system to automatically handle invoicing of fees and service charges as well as activating accounts and licenses. Since September 2015 purchasing licenses and further expansion or cancellations of subscriptions can only be executed via login in the AEF Database ([aef-isobus-database.org](http://aef-isobus-database.org)) under your company’s access information.

## Advantages and benefits

### **Participate actively in the AEF Project Teams**

As a member you are actively involved in the project teams and influence their results.

### **ISOBUS knowledge and AEF Guidelines**

Being a member helps your company with its product development by giving you access to the latest ISOBUS knowledge.

### **Use the AEF Diagnostic Tool for free**

Equip your and your dealer's service team with the AEF ISOBUS Check Tool in order to speed up troubleshooting of an ISOBUS combination cross manufacturer, even in the field.

### **Get a 20 % discount ...**

... on licences for database and conformance test. As an AEF member you will benefit from a considerable discount on licenses. This by far exceeds the service fee a General Member has to pay.

### **AEF Testing environment**

AEF Membership helps you to make your systems ISOBUS compatible with products of other manufacturers through semiannual Plugfests. These help to speed up the ISOBUS product development within your company.

### **Take influence on the ISOBUS standard**

You're part of a round table of the industry to share and agree upon AEF Guidelines complementing the ISOBUS standard.

### **Interim conformance tests**

Use the AEF Conformance Test Tool within your company in order to accelerate development of your products towards ISOBUS compatibility and AEF ISOBUS Certification.

### **Compatibility at all levels**

Ensure compatibility of your products at all levels of development.

### **Visibility in the AEF ISOBUS Database**

Your certified ISOBUS products can be seen in the AEF ISOBUS Database allowing not only the dealers but also the public to search for compatible ISOBUS combinations.

### **AEF ISOBUS Certification**

Get your products certified by one of the AEF ISOBUS Test Laboratories.

### **AEF support**

AEF supports the marketing of your ISOBUS products and promotes both development and market penetration.



AGRICULTURAL INDUSTRY  
ELECTRONICS FOUNDATION

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