

# ISOBUS Development

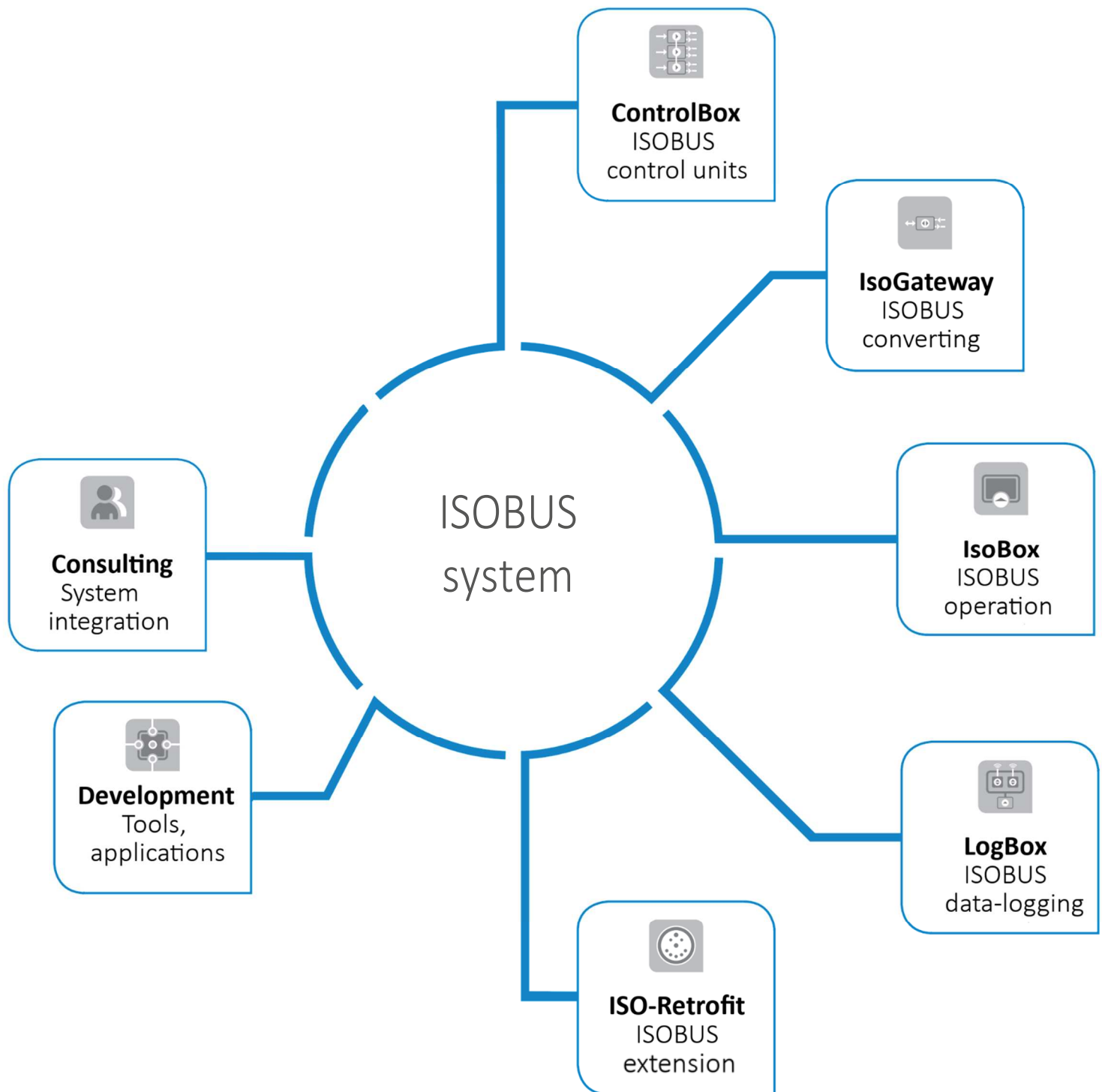
ISOBUS-based agricultural systems

# Connect to ISOBUS!

ISOBUS technology is a milestone in the development of agriculture. In farming, it is often necessary for professionals to use tools and devices from different manufacturers. These non-standardized solutions of different devices make it difficult to share components, but ISOBUS compliant system resolve this problem.

Our company, together with its German partner ANEDO Ltd, develops and distributes ISOBUS-based tools and solutions for manufacturers and service providers. Our goal is to help You to connect with the ISOBUS world, based on your already existing systems and ideas.

# ISOBUS system



## Customizable tools

Our intelligent modular system can map everything from the simplest applications to highly complex control processes reliably and easily. The openness of our system modules allows plenty of scope for individual adaptations.

# ISOBUS control units

## ControlBox

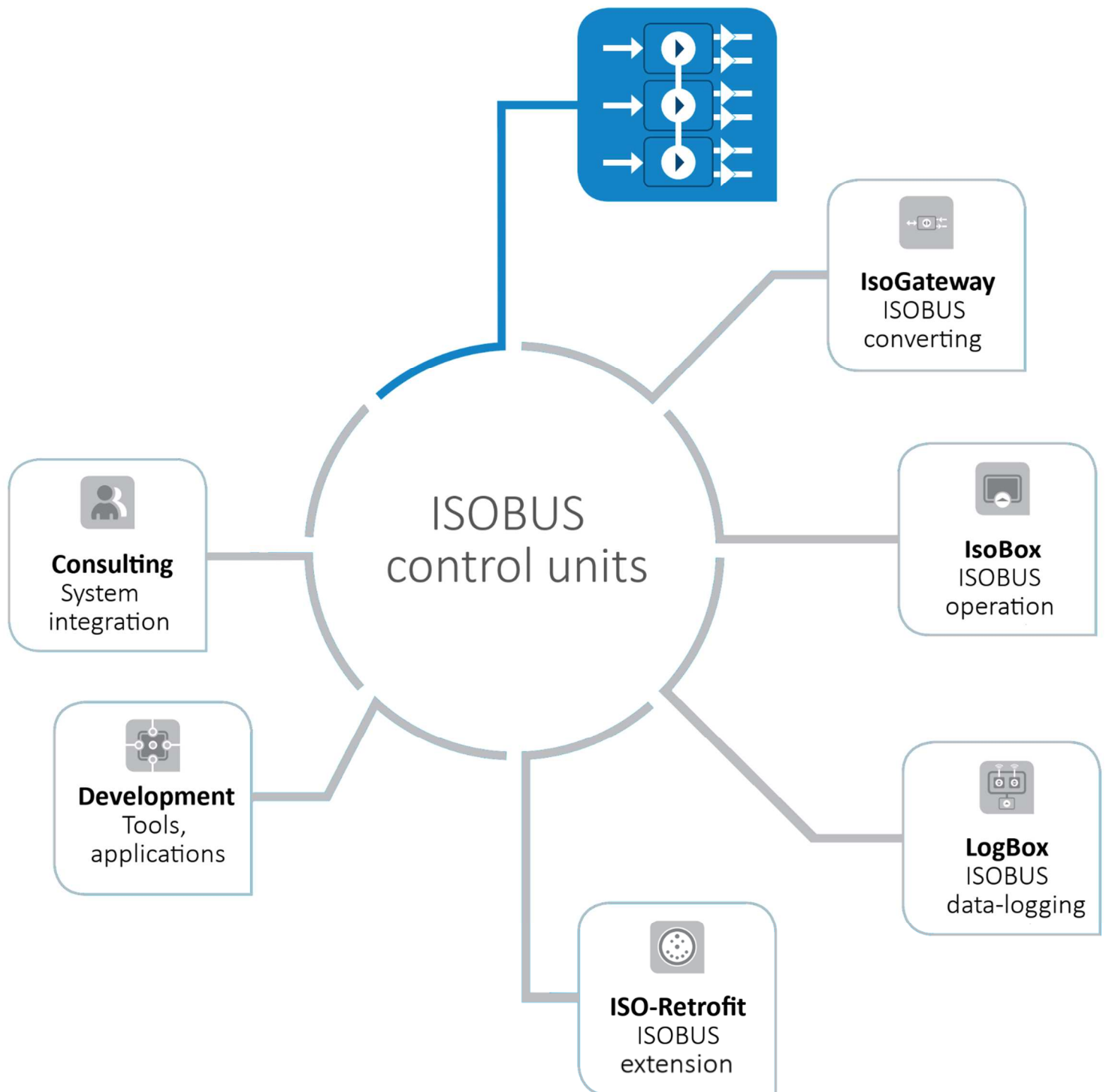




Figure 1: ISOBUS controlling displayed by the tractor's universal terminal

## Here's how it works:

Our ControlBox is based on our partner's, the ANEDO Ltd.'s, open:control family. With the optimal combination of the CODESYS® and EtherCAT® as basic technologies, open:control provides you with an efficient solution for ever faster development cycles in the field of mobile working machines and for the growing complexity of control systems with new integral processes in software development and an innovative architecture for hardware components. open:control can be used easily and securely with everything from the smallest to the most complex machines, all with optimal scalability, of course.

## The advantages:

- Only as much technology as is necessary to provide full functionality
- Made-to-measure electronic suit for every machine/system
- Easily extendible (performance, sensor systems, actuators)
- Grows with the product life-cycle
- Easy to use even for those who are not electronics specialists
- Modular system: extensive use of common parts
- Software that can be reused easily
- CODESYS®: a central development system for all components
- Model-based design: direct integration of Mathlab-Simulink®
- Easy integration of C, C++
- EtherCAT®, CANopen®, SAE J19039, ISOBUS: simply connected

# The components

## Control<sup>1</sup>Box - M10/M15

Powerful mini control unit that are easy to extend via EtherCAT® and CANopen®. Simple connection to the CODESYS® development system via the integrated USB port. With eight outputs and four configurable inputs with status LEDs, many automation tasks can be completed cost-effectively with the M10/M15.

With open:I/O, additional inputs and outputs can be integrated into the system quickly via the EtherCAT® port. With a choice of AMP16 plug connector (M10) for cable harness integration or M12 plug connectors (M15) for direct connection of sensors/actuators.



Figure 2: open:control M10/M15 – Powerful mini control device with I/O

## Control<sup>2</sup>Box - M20/M25

Powerful mini control devices that are easy to extend via EtherCAT® and CANopen®. Simple connection of the CODESYS® development system via the integrated USB port. Flexible application without inputs and outputs, with EtherCAT®, two CAN interfaces, serial interfaces and LIN, also ideal as a gateway, e.g. for retrofitting ISOBUS into existing control systems.

With open:I/O, inputs and outputs can be integrated into the system quickly via the EtherCAT® port. With a choice of AMP16 plug connector (M20) for cable harness integration or M12 plug connectors (M25) for direct connection of interfaces/fieldbuses.



Figure 3: open:control M20/M25 – Powerful mini control device with plenty of interfaces

## Individual I/O modules with fieldbus interface

The open:I/O modules are the optimal complement to distributed sensor/actuator systems in your machines. The I/O connections are wherever they are needed and there is no need for complex and confusing cabling. As a result of the large scalability and configurability of everything from individual sensor/actuator connections through to networks of complex I/O systems, a tailor-made control system can be created for every machine, which can grow with the product life-cycle. Along with a series of standard I/O modules, your module for each I/O pin can be put together quickly and is immediately ready to use; an online product configurator helps you to assemble the individual sensor/actuator connections.

### S10e, S11e, S12e, S13e

The slave modules represent the I/O components of the open:control system. Their modular architecture allows for tailored adaptation to the mobile working machine.

The equipment for the slave modules can be selected from a series of standard slave modules (such as S10e, S11e, S12e, S13e and others) or can be fully customized.

A pool of I/O components for sensors and actuators is available to you for customization. Individual adaptation is completed either using an online product configurator or with the open:control evaluation kit.



Figure 4: I/O modules configured individually

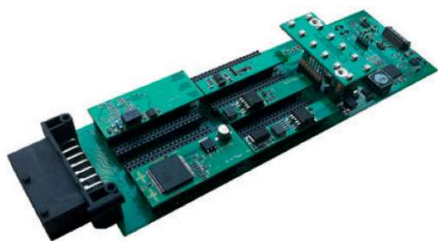


Figure 5: S10dev development kit: simply plug in individual I/O modules



Figure 6: open:control S10dev in a strong housing, ready to use immediately

## S10dev development kit

For fast design of individual machine control systems, almost any number of S10dev development kits can be connected to a master control device via EtherCAT®. Each S10dev can be assembled with an individual array of exchangeable I/O modules. There is a wide choice of different I/O modules available for connecting all standard sensors and actuators on the market and for common communication interfaces. The machine control system can thus be put together as a customized electronic solution, down to the individual I/O pins. With the automatic scan process in CODESYS®, all I/O modules are immediately available and ready to use in the development system. The order code for Rapid EDA can be read directly from the S10dev for a copy of an assembled S10dev that is ready for series production.



# CODESYS®

## The development environment

Using the tried and tested CODESYS® development and programming system, which was developed from automation technology and is now widely used, the application software for the open:control system is created for the entire machine/system, the EtherCAT® network with its I/O modules can be configured easily and all bus systems and ISOBUS functions can be integrated.

Programming of the application software can be carried out in all of the graphics-based and text-based languages of CODESYS® V3.5 (IEC 61131-3). C-components and code-generated, model-based design components (MBSD – model-based software development) can be easily integrated into the application software.

The CODESYS® programming system provides a wide range of debugging and monitoring options without any additional tools. An intuitive representation of all I/Os in the entire network is integrated. The machine software developer restricts themselves exclusively to the implementation of their knowledge of the processes and logic of their machine/system.



Figure 7: Easy approach with modular components and graphical development environment

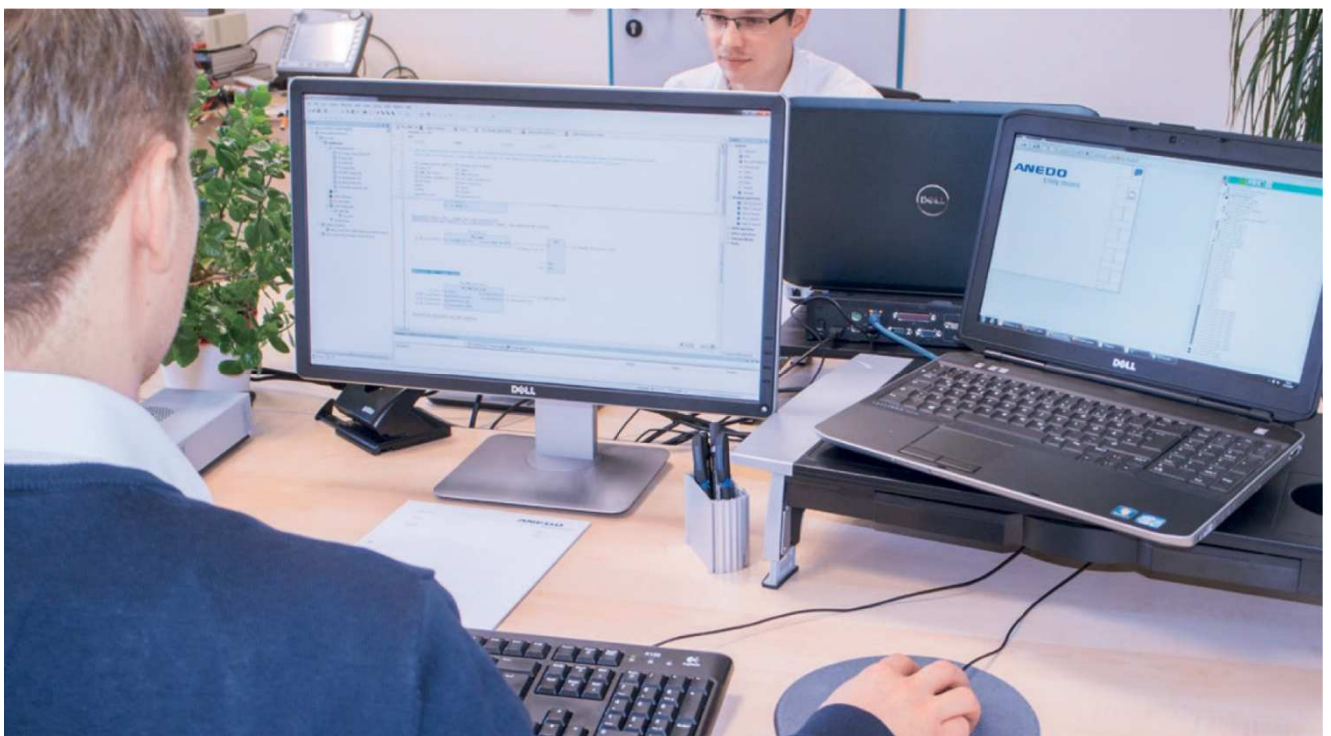


Figure 8: open:control: developing software efficiently and securely





Figure 9: A development environment for the entire development process

CODESYS® is the leading software platform for project development in accordance with IEC 61131-3. The development system combines traditional programming of a control application with the opportunities of professional software development for automation devices.

CODESYS® from 3S-Smart Software Solutions is now the preferred choice of over 350 control system manufacturers and several thousand users from a wide range of industries: factory automation, automation of mobile machines, energy generation and distribution systems, buildings and processes. CODESYS® is therefore the most widely used development environment that is independent of a manufacturer. It is used in millions of machines and systems throughout the world.

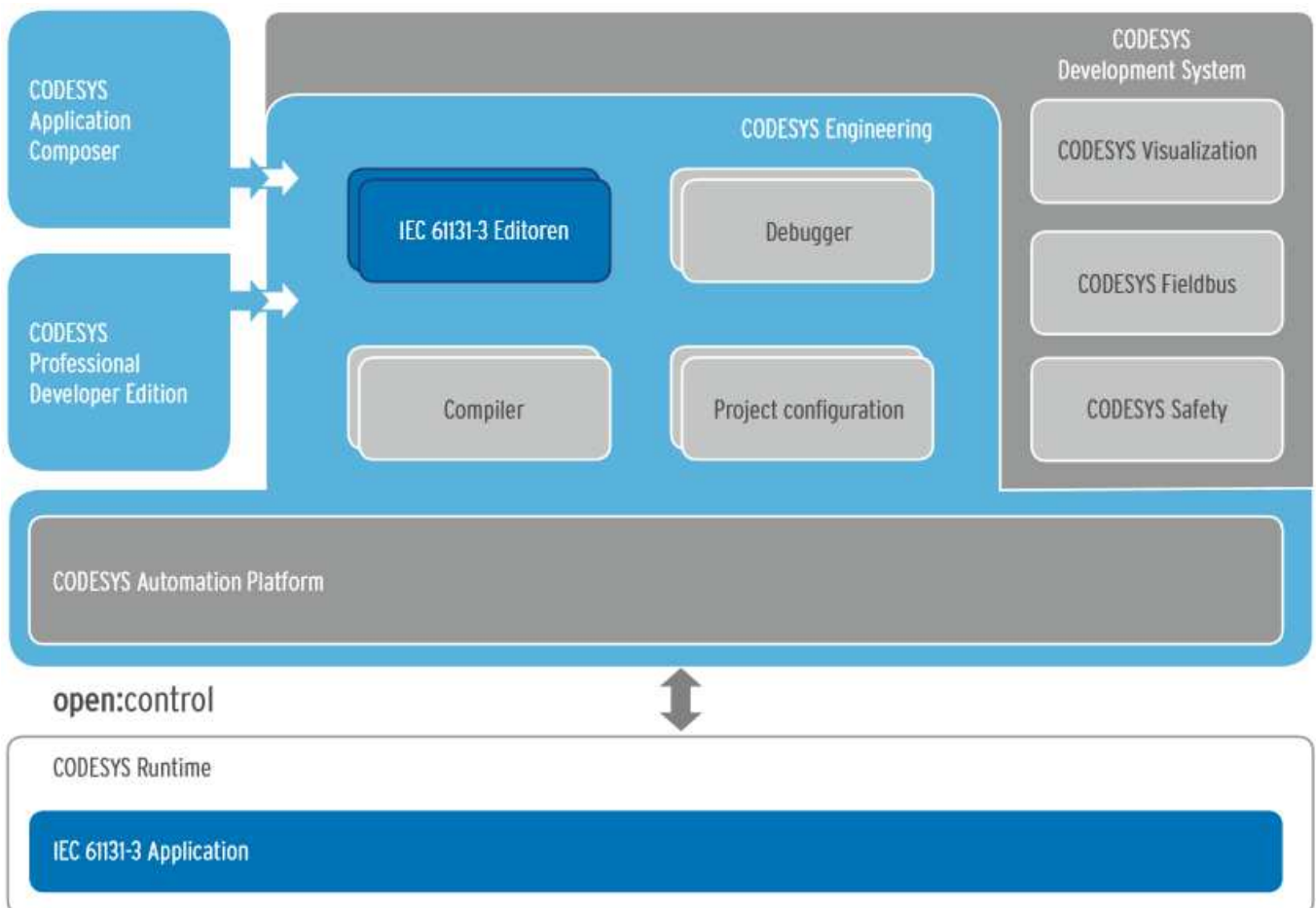


Figure 10: CODESYS® for open:control

# ISOBUS converting

## IsoGateway

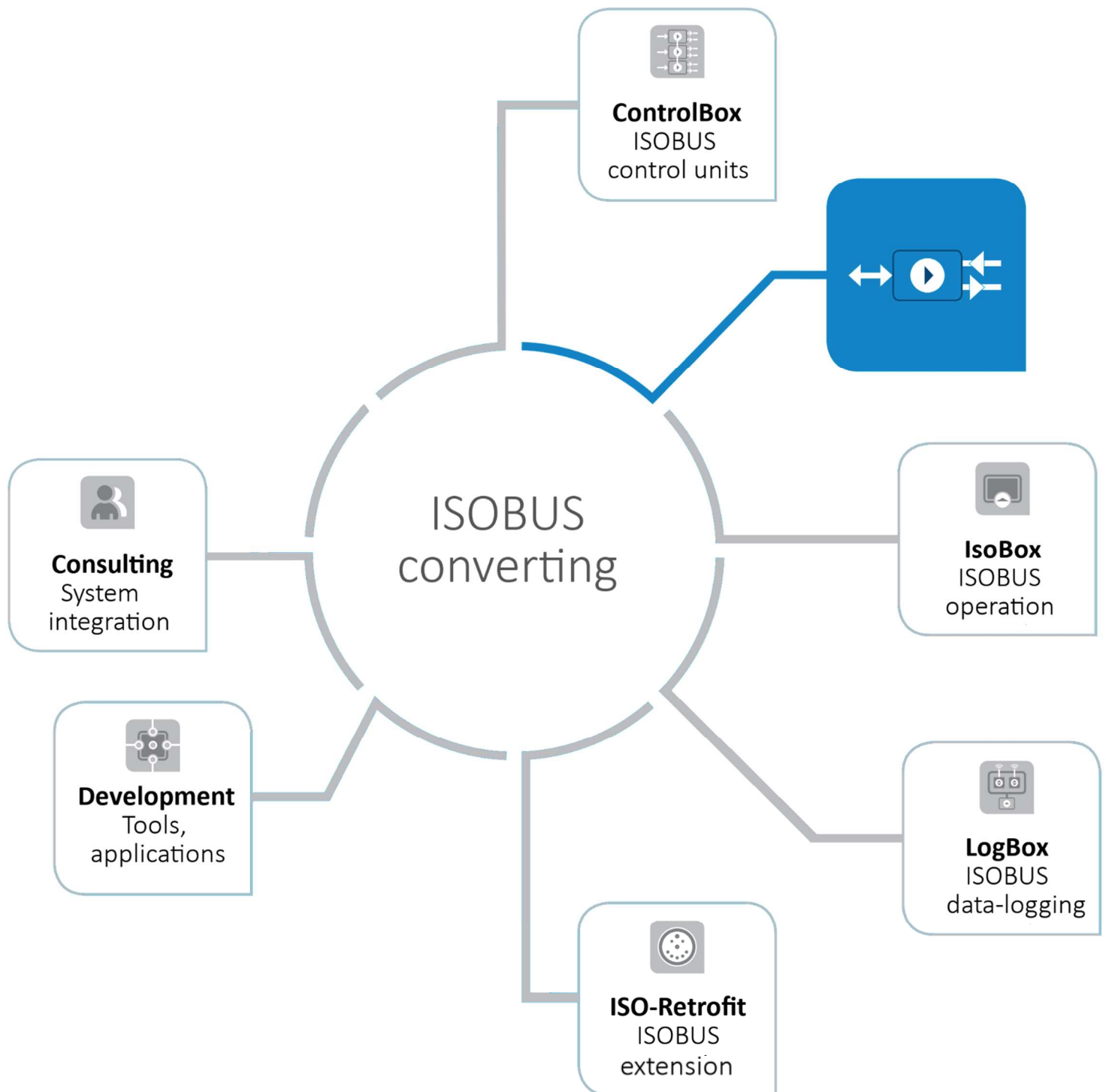




Figure 11: Integrated Ro-Sys Gateway in the XeedGATE module of the Digitroll Kft. (<http://i-xeed.com/>)

## Here's how it works:

Our gateway technology makes ISOBUS an option for your machines. It is possible to keep your existing system with the whole running functionality, however with a software or hardware extension the system communication can be converted to use the ISOBUS.

It does not matter if the actual communication uses a serial or a CAN or a LIN protocol, the gateway can work with it. Our developers can prepare a „dictionary” for your system, can make the ISOBUS visualization, and after it the gateway is ready to use.

## The advantages:

- you can keep your already running system
- the technology can be integrated fast in any kind of controller, with or without a hardware extension board
- if the existing platform makes it possible, the gateway can be implemented only with software
- very fast implementation time
- the integrated ISOBUS Stack makes the deep knowledge of ISOBUS technology unnecessary

# The components

## GatewayBox

A compact and effective device with a proprietary system connector and an ISOBUS connector. It includes all the required hardware components to implement an AEF conform ISOBUS ECU with any kind of ISOBUS functionality.

The integrated Flash drive makes it easy to store different user interfaces, Task-Controller device descriptions or stores the preferred configurations.

The whole device is built into an IP65 device case using AMP Superseal connectors against the ESD and moisture problems



Figure 12: GatewayBox – small device with a proprietary CAN and an ISOBUS connector

## GatewayBoard

If it is required to integrate the gateway hardware into an own case, we can offer an OEM electronic board with the functionality of the GatewayBox. The connection to the system board can be implemented with serial, internal CAN, SPI or with shared memory technology.

The board itself contains every required component for the ISOBUS features as UT, AUX-N, TC-BAS, TC-GEO and TC-SC. Using these components makes the certification process by the AEF an easy work.

## ISOBUS Stack

The main parts of the gateway module are the ISOBUS Stack of ANEDO Ltd.

This software module implements the ISOBUS protocol and hides the protocol-specific know-how. In this way the module itself can be used without any deep knowledge about the ISOBUS technology.

The ISOBUS Stack is a platform-independent software module which can be compiled for any kind of ARM or x86 microprocessor with or without an operating system.

The ISOBUS Stack contains the functionality of:

- ISO 11783-3: Data Link Layer with PGN handling
- ISO 11783-5: Network Management with any amount of working sets
- ISO 11783-6: UT Working Set with AUX-N, Multilanguage and multi-mask support
- ISO 11783-7: Application Layer with the data-handling
- ISO 11783-10: Task controller client (TC-BAS, TC-GEO and TC-SC)
- ISO 11783-12: Diagnostic Services with Level-1 data
- ISO 11783-13: File Server client

## References

In the last years we have already done more successfully AEF certification using our gateway technology. I.

During the project we always extend the existing system with the ISOBUS functionality. Our goal is to be able to provide a very simple data-exchange method between the gateway module and the existing system. Every other ISOBUS-specific function should have made by the gateway module fully automatically.

We have already implemented Gateway software module in the CPU of an existing system, or in a unique CPU integrated by the machine manufacturer. But we have implemented with our own Gateway board and using our GatewayBox as well. It all depends on only the wish and concept of the customer.

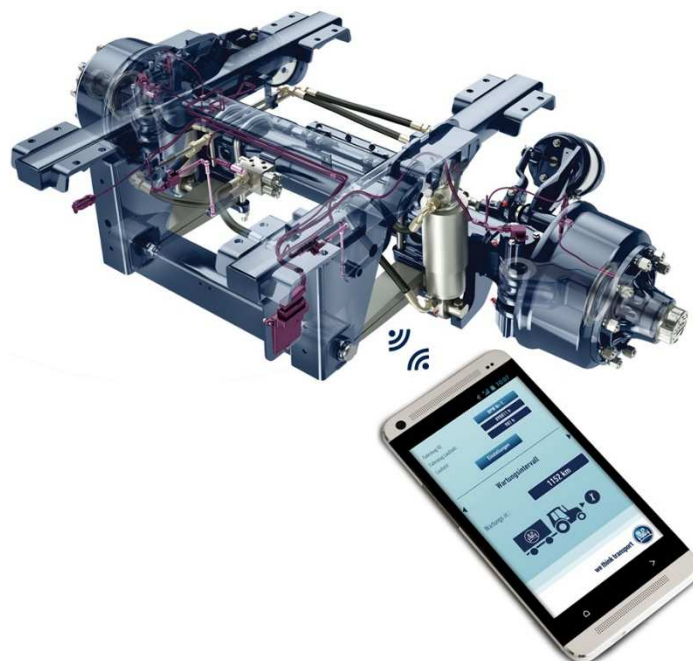
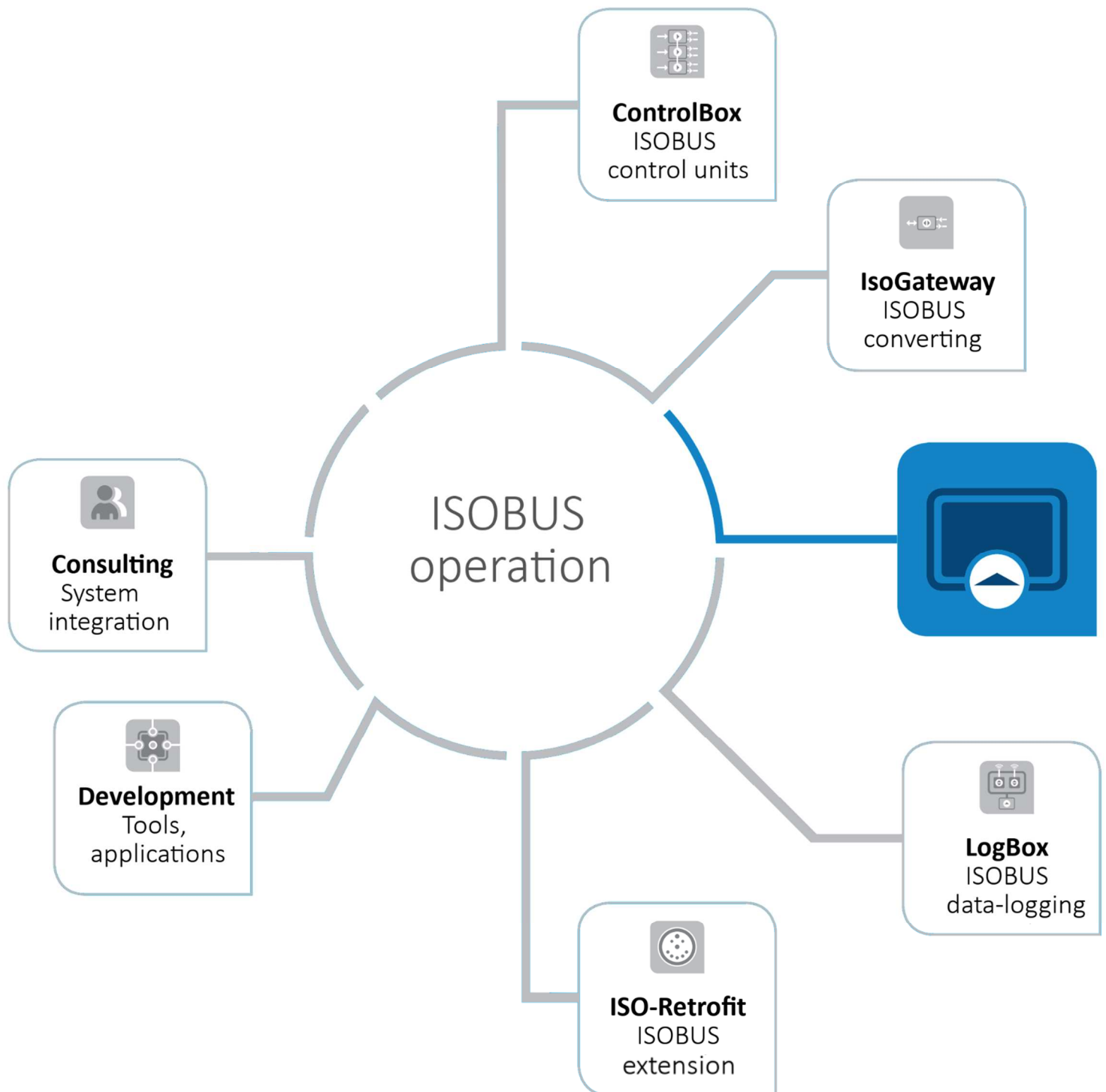


Figure 13: BPW's AgroHUB sensor system with integrated GatewayBoard

# ISOBUS operation

IsoBox





# Here's how it works:

Easy to use and expandable ISOBUS terminal supporting all ISOBUS functionality. Its ultra-bright, visible in sunshine, full-screen 5.6 "or 8.4" screen with the latest touchscreen technology provides fast, easy-to-use and intuitive operation. The weatherproof housing is designed for work and operates in an extended temperature range with moisture and dust resistance.

The ISOBUS visualization platform and the integrated development framework (AGF) enable the creation of professional, integrated operational concepts. With these tools, many of the existing features can be further expanded by custom applications created by the Software Development Kit (SDK).

The open software architecture of the device allows you to customize the user interface (skins) or customize applications to the system. Applied applications have full access to the factory-installed features of the device, so ISOBUS and GPS data are also available. The software system already supports 27 different languages, but it can be expanded just like features and interface.



Figure 14: Iso<sup>1</sup>Box compact operator terminal with full ISOBUS functionality

## The advantages:

- Clear/intuitive operation easily set up
- Optional tactile feedback with SlideStick technology
- Full ISOBUS functionality, even in the smallest device, AEF certifiable
- Future-orientated technologies, modular extendibility
- Easy to extend with integrated and external apps
- Used and tested software thousands of times around the world

# The components

## Iso<sup>1</sup>Box

The compact operating device with 5.6" display and VGA resolution for brilliant colors is suitable for use in sunlight. Under the robust glass front, there is an easy-to-understand, intuitive operator concept that can be set up quickly with or without touch control. Of course, all these options come with the latest AEF-certified version and full ISOBUS functionality. High performance processor suitable for large devices, large-scale language support and simple introduction, these ones provided by the entire IsoBox series.

With an integrated sensor system as standard, brightness and color can be adapted to the surroundings automatically, as can the alignment of the screen with vertical or horizontal fitting. External function keys and proximity sensors ensure that optimal use is made of the screen area. When the touchscreen is activated, a control panel with keys opens up, and then closes again when you take your hand away from the operating area.

Options for even better usability include an even less reflective touchscreen with optical bonding and tactile feedback with SlideStick grooves on the function keys. Known for excellent connectivity: easily accessible USB connection, CAN/ISOBUS and Ethernet as EtherCAT® on the front for direct connection of open:I/O as an interface for optimal process monitoring through the digital video system.



Figure 15: Connectors of the Iso<sup>1</sup>Box



Figure 16: Iso<sup>2</sup>Box: 8,4" touchscreen with SlideStick technology

## Iso<sup>2</sup>Box

Tried and tested operating device with 8.4" touch display suitable for use in sunlight and in VGA resolution. The wide range of features of the Log<sup>1</sup>Box includes optional WiFi and Bluetooth or, with the integrated connectivity slot, additional mobile communications for any wireless technologies such as machine-to-machine (M2M) communication e.g. LoRa®.

## The development environment

Simple development of your own individual apps for all ANEDO operating devices with the widely used AGF development tool that has proven itself over many years, especially among members of the CCI e.V. A representation of all ISOBUS functions and communication interfaces, components for creating the user interface (HMI) as predefined programming interfaces (API) and a range of libraries are all integrated.

The app developer can restrict themselves exclusively to the implementation of their specific functions and the user interface. Access to the ISOBUS and all of the interfaces is straightforward. Good documentation for the AGF makes familiarization easier. The development environment supports the developer with a wide range of debugging and monitoring options. All of the ISOBUS data is available in the apps.

## IsoBox apps

Even in their basic versions, all open:panels are equipped with a wide range of open:panel software components that have been tested and certified over many years throughout the world, allowing fast use of ISOBUS systems and providing a multitude of useful functions for the end user. For even more individuality, the open:panel AGF development environment can be used to develop individual apps quickly for all open:panel devices with the widely used AGF development tool that has proven itself over many years.

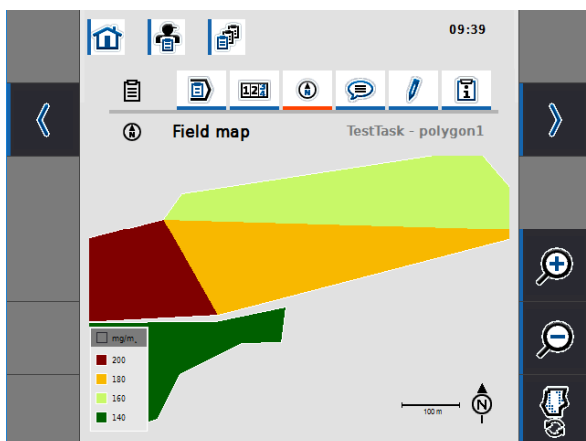
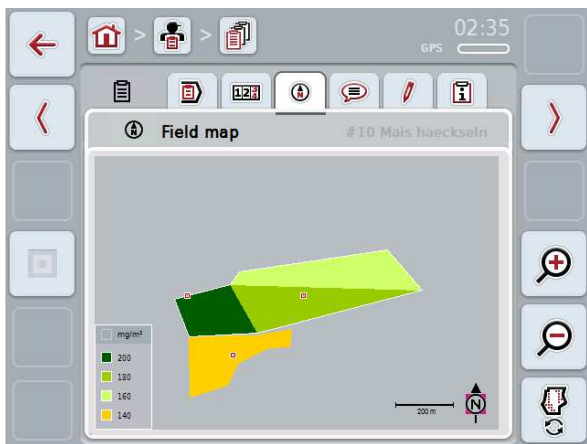


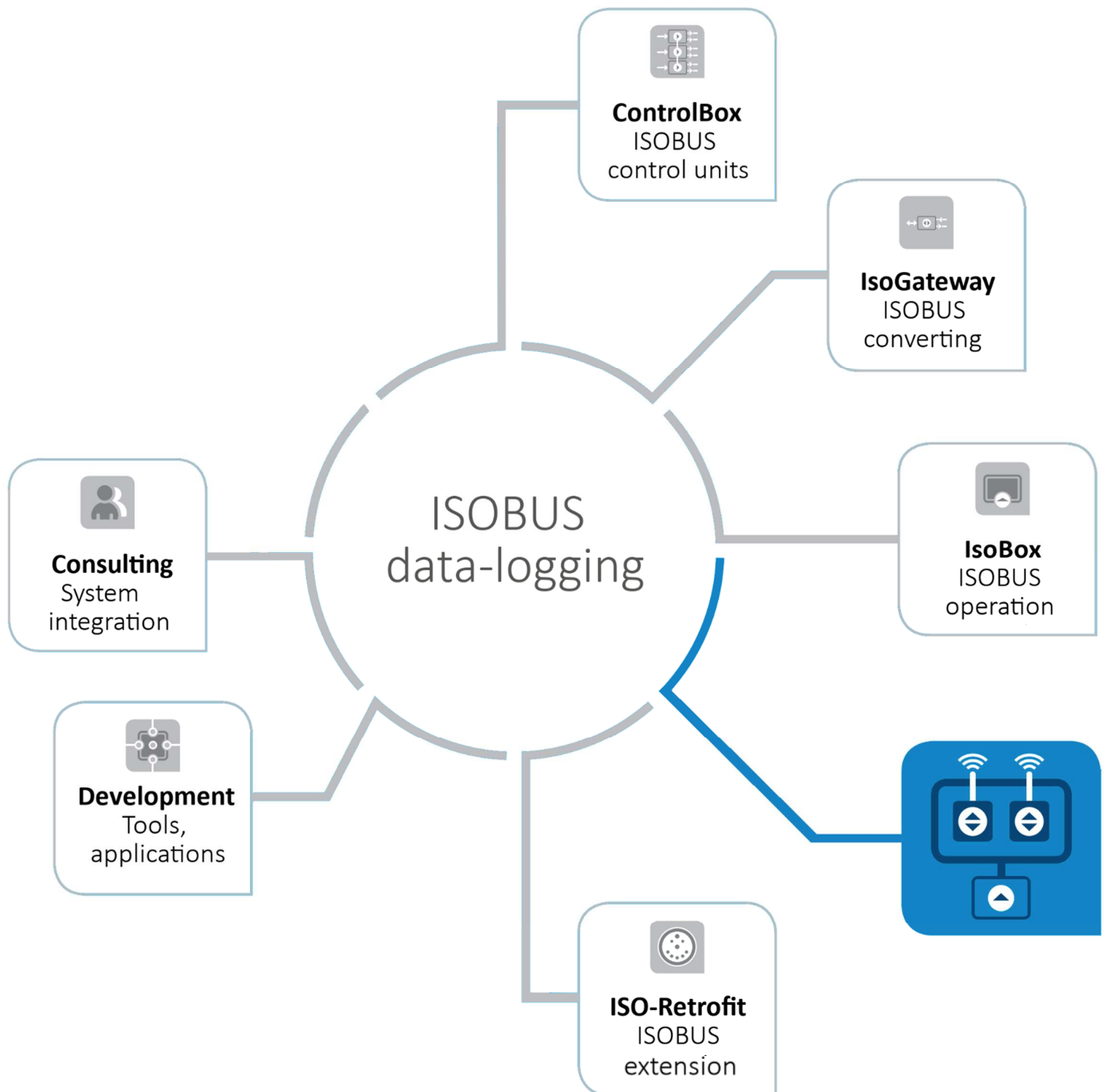
Figure 17: Same apps with different design

## Your company's design

The design of the device, the type of the front-glass and the connectors and all the user interfaces – even the integrated apps and the menu system – could be match to your own design concept. In this way the device can adapt into your own system.

# ISOBUS data-logging

## LogBox



# Here's how it works:

Automatic and general data-logging! The LogBox can read, process and forward the data provided by the tractors and implements' ISOBUS and different CANBUS.

The device can automatically recognize the used CAN protocols as the ISOBUS (ISO11783), SAE J1939 universal CANBUS, ODB or the CANopen protocols.

The device can read the implements' on-work and application information via the ISOBUS and read the diagnostic information as fuel economy, engine usage or work hours of the tractor.

During the processing all the data are combined and extended by the GPS information provided by the integrated GPS receiver and forward the collection data on-the-fly to the servers for further data-processing.

These features are integrated into a very compact outdoor device, which can work without any problem in -20 to +60 °C in dusty or humid environment condition.

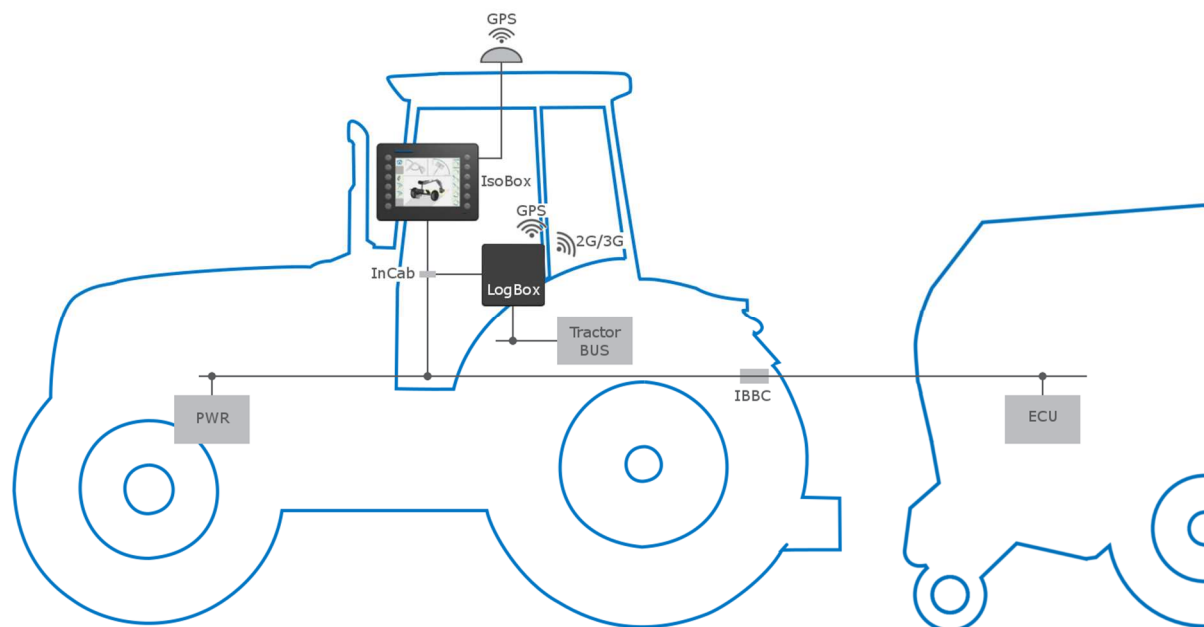


Figure 18: LogBox – data combined from the tractors and from the implements

## The advantages:

- Compact device-case with integrated antennas
- Integrated GPS receiver with optional RTK correction (RTCM 2.0)
- Integrated Bluetooth and optional WiFi and dual-SIM 3G GSM module for the effective data-communication.
- Universal CAN-based data-logging (SEA J1939, ISOBUS, CANopen, ODB, ISO-Diag)

# The components

## Log<sup>1</sup>Box

A basic device with a Bluetooth module. It requires a handy with a proper data-forwarder application. It extends the functionality of the mobile-app. The LogBox communicates with the handy via the Bluetooth connection and forward the collected CANBUS- and the optional connectable extern GPS receiver data to the mobile app. The application can make some processing and can forward the data to the server-systems through the own GSM data-connection.



Figure 19: Log<sup>1</sup>Box – the perfect data-logger extension next to a handy



Figure 20: Log<sup>2</sup>Box: With integrated GPS and GSM module

## Log<sup>2</sup>Box

Device with integrated GPS and GSM module for online data-logging. It requires a SIM card with a proper data-connection service.

The device has a dual CAN connector to be able to get the data parallel from the tractor's diagnostic CANBUS and the ISOBUS used by the implement.

Using the integrated GPS and GSM module the unit can work fully automatic logging and forwarding the data to the cloud-servers.

Using a mobile-app or the ISOBUS UT display in the tractor, the user can make further configuration or diagnostic.

The device has a microSD card which can store the information in case of any GSM communication problem. In this case the collected data are stored on the SD card and can be sent to the server later. So, the data-integrity error can be avoided.



## Log<sup>3</sup>Box

Integrated online and offline data-recorder which supports all the possible communication method and the RTK position-correction. The device can parallel collect data from three different CAN-based bus systems and next to the integrated GPS can read external NMEA 0183 signal as well.

The device has an integrated dual-SIM 3G GSM, WiFi and Bluetooth module, and the RTK supporting GPS module. Using the RTCM protocol for the RTK-correction the map-recorder can store the data with 2-5 cm precision.

Using the 4GB microSD card the device can store the data with high time-frequency and precise position, which could be forwarded to the servers using the WiFi module. In this way the generated information can be used to make some high-precise maps about the working-area.



Figure 21: Log<sup>3</sup>Box: All-in-one data-logger and map-recorder

## Online management

Due our partners it is possible to provide solutions for the whole financial and farm-management system with automatic data-collecting and processing.

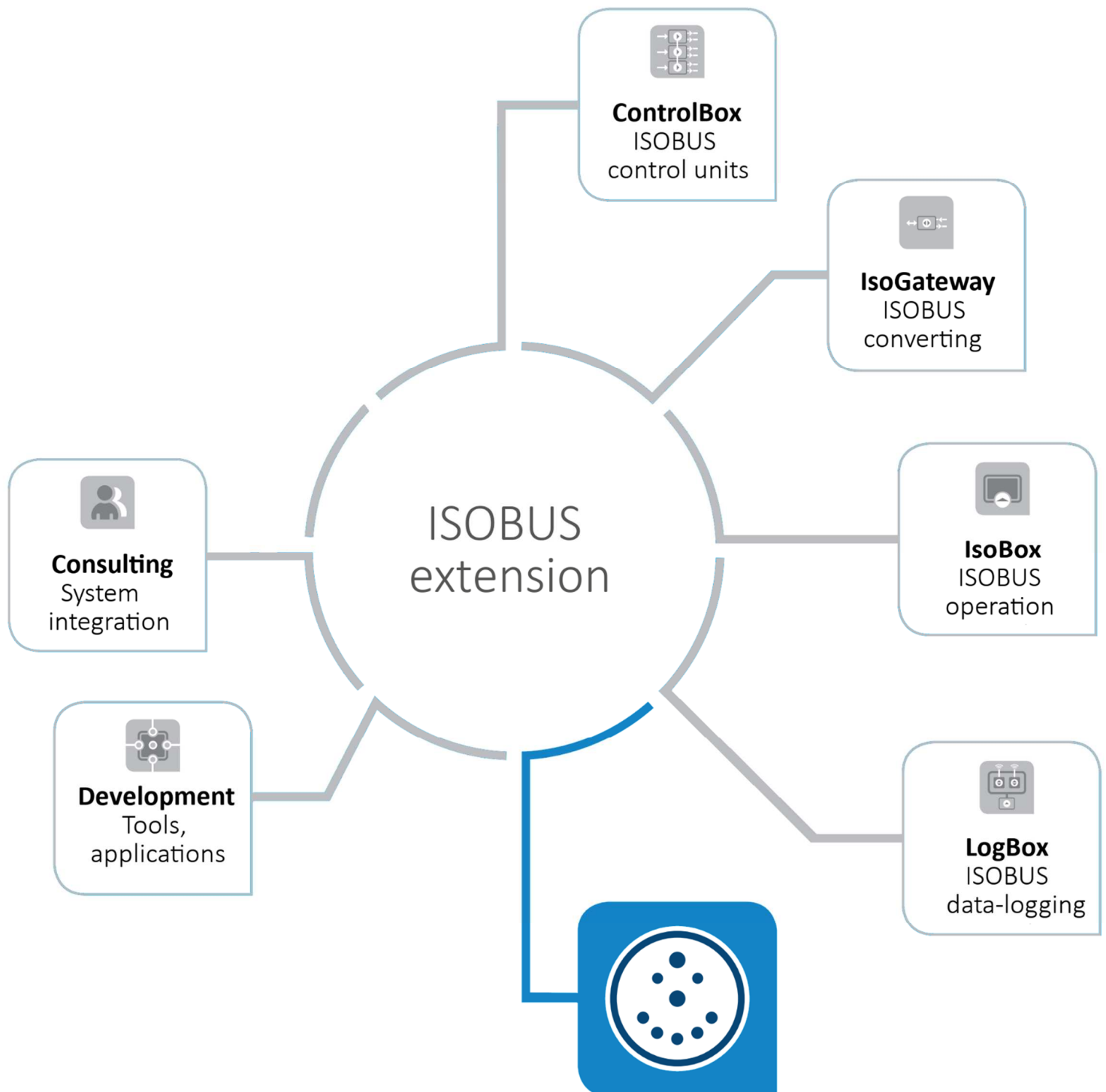
Using the automatic data-handling the systems can provide a better overview about the running works and it is possible to make more suitable planning and controlling.



Figure 22: Decision support system from Agrovir ([www.agrovir.eu](http://www.agrovir.eu))

# ISOBUS operation

## IsoBox



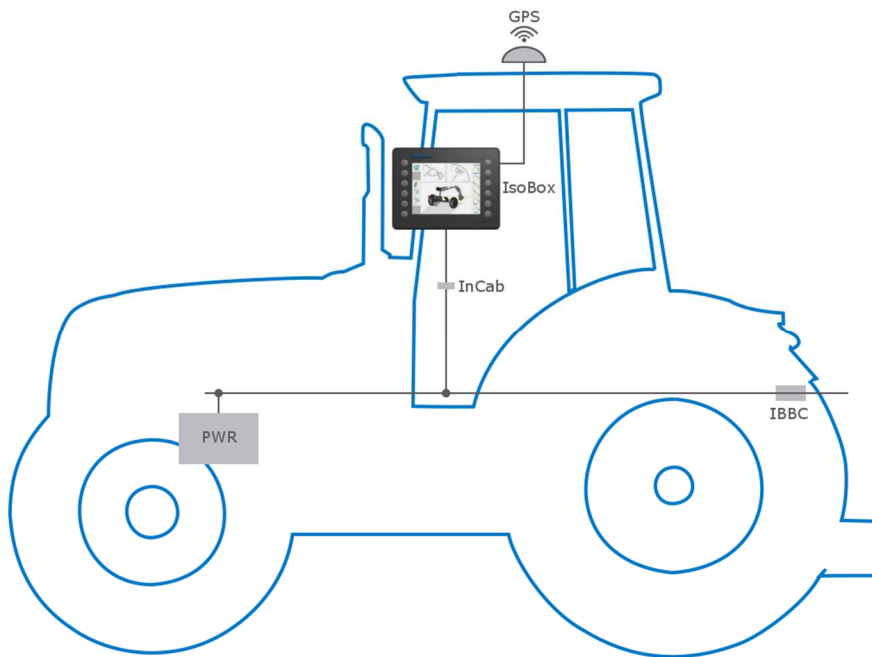


Figure 23: ISOBUS extension for any kind of tractor

## Here's how it works:

In many cases it can be a problem that an ISOBUS implement cannot be used with older types of tractors without any ISOBUS infrastructure. But this problem can be easily solved.

The ISOBUS system can be built afterwards in any kind of tractor. ISOBUS technology is an advantage for any tractor, as it makes possible to use the modern machines and better automatic precision systems.

If it is interesting to provide ISOBUS extension for the tractor without any larger modification, our Iso-retrofit system can be a solution.

We have all the required components to convert a tractor to a Class-1 ISOBUS unit. The kit includes an inCab connector and an IsoBox display in the cabin, and ISOBUS Breakaway connector at the back-side and the battery-connectors. The requirements of the tractorECU can be solved with our software TECU. It can provide the requested minimal ISOBUS information without any additional electronic unit. Using the Iso<sup>2</sup>Box an ISO 11786 (Tractor Signal) connector is possible to use as well to provide the wheel based speed and rpm information. Without this the GPS information can be converted by the software tractorECU into the requested format

The system can be extended with an additional GPS receiver and an additional Breakaway connector at the front-side.

## The advantages:

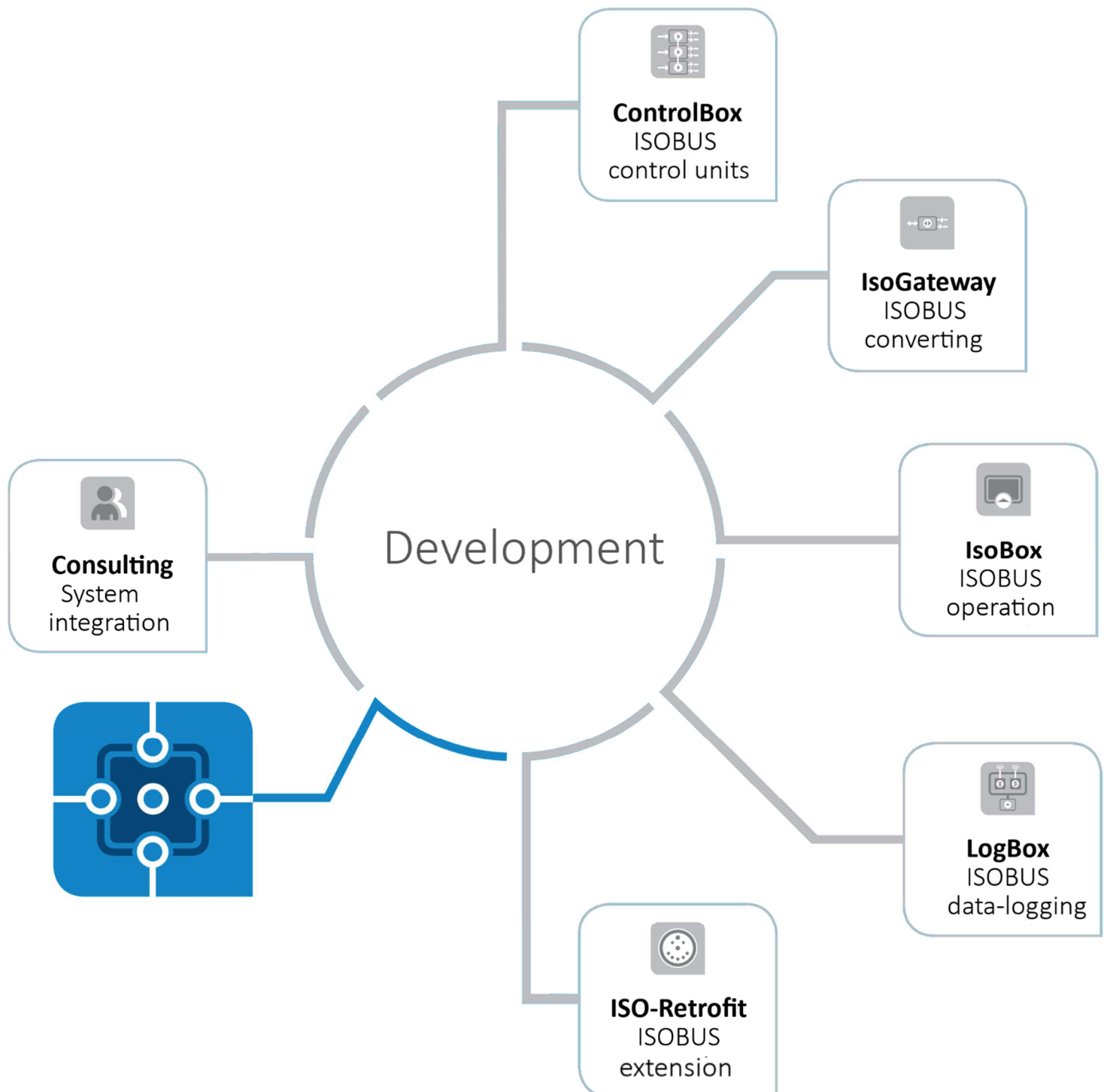
- Universal can be built in fast any kind of tractor
- All components can be get from one source
- Makes possible to work with ISOBUS implements
- Makes possible to use precise automatic farming
- The software TractorECU is easy to configure



Figure 24: ISOBUS Breakaway connector for the tractor – implement connection

# Development

## Tools and applications



# Here's how it works:

If you have a very new idea or an already existing system, we can provide a solution for that. In our office in Debrecen, Hungary, our developers are working on it to make a suitable and flexible solution for Your requirements.

We can provide a full-scale support include the system integration, cables, hardware units and software modules for every module and every function of the ISOBUS ISO 11783.

Fast modernization: we can fast extend your existing control units - implement all the required functionality of ISOBUS – for example with adding the gateway module into your systems. Your machine software can work further as it was, but it can use the ISOBUS as an optional feature.

For our solutions we can provide a development kit as well. Even without the know-how of ISOBUS can it be possible to work further with our modules by your own.



Figure 25: The development is made in our office in Hungary, Debrecen

## The advantages:

- Up-to-date solutions based on the accepted ISO standards
- All the ISOBUS functionalities are ready-to-use
- There is a large amount of different ISOBUS control-units, panels and data-loggers with hardware and software
- Every module is prepared for the AEF certification
- Very flexible devices and applications
- In case of requirement we can provide mobile applications for Android and iOS system as well

# Consulting

Systems integration, AEF certification





# Here's how it works:

Prepare yourself for the future with the ISOBUS. This technology is fully integrated into the systems of Ro-Sys Software. It does not worth any more to develop manufacturer-specific systems if a standardized version is possible to use.

With our hardware and software units it is easy to build a system, fast and effective, even for the smallest machines. With our experts your machines can achieve the AEF certification very fast, which can be a difference in the market.

Due our partner, the ANEDO Ltd, we have a very robust base with several many-years sold and tested devices to create an electronic system for any kind of machine.

The purpose of Ro-Sys is to create and support advanced industrial- and precision agricultural systems in the Central-European region. The professional experience of our German technological partner and our colleagues is the basis that we can provide high-level services to our clients both in the system configurations and in the area of services.



Figure 26: Flexible supporting in the office of in the fields

Our company offers solutions in more areas:

- Development, distributing and support of agricultural precision farming-and ISOBUS products
- Applications and whole system-solutions for mobile and embedded systems

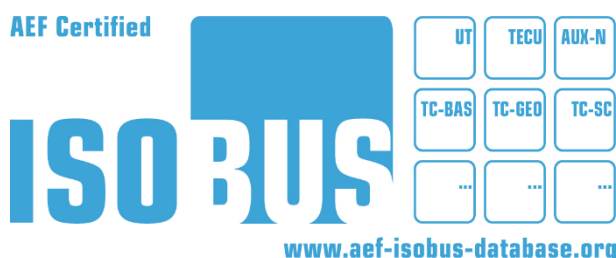


Figure 27: ISOBUS AEF certification

## The advantages:

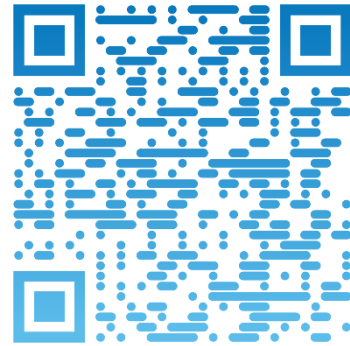
- Lot of experience about the certification and ISOBUS systems
- Personal contact during the development and the certification
- Flexible working methods with consulting about the alternatives
- Cost-effective and fast planning and specification
- We know how the ISOBUS system can be integrated and can work with your machines

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**RO-SYS**

ISOBUS development

**Ro-Sys Software Kft.**

4032 Debrecen

Csapó utca 40

Tel: +36 (52) 212180

Mobil: +36 (70) 635 6460

[info@ro-sys.eu](mailto:info@ro-sys.eu)

[www.ro-sys.eu](http://www.ro-sys.eu)