It is a long time ago that some professors and far-looking engineers in the agriculture machine business started to think about standardized control network. In those days (mid of the 80ties), the basic ideas of the CAN-based LBS (agriculture bus system) were born. The LBS was published as DIN 9684 standard in Germany beginning of the 90ties. Maybe it was too early and not that well specified, but this standard did not become a big commercial success. But the LBS idea of a virtual terminal was taken, combined with the CAN-based J1939 protocols, and internationally standardized as ISO 11783 series. There were also contributions from the North American Agricultural and Construction Industries (CON/AG), which published a framework for adding agriculture-specific messages, which was included in the ISO 11783 standardization activities. The virtual terminal specification within the ISO 11783 standard was pre-developed in Germany by the LAV non-profit organization (part of VDMA, a German Engineering Federation). The bus system specified in the ISO 11783 series is also known as Isobus.

This series of standards specify a serial data network for control and communications on forestry or agricultural tractors and implements. It consists of several parts: General standard for mobile data communication, Physical layer, Data link layer, Network layer, Network management, Virtual terminal, Implement messages applications layer, Power train messages, Tractor ECU, Task controller and management information system data interchange, Mobile data element dictionary, Diagnostic, File Server. The communication services and protocols define communication between tractor electronics and implement electronics through CAN. This results in the implement and the tractor electronics working together, where the implement may use tractor information (like speed and hitch position), and the tractor can control the implement by a single tractor-mounted device, the virtual terminal.

The serial data network controls communication on forestry or agricultural tractors, mounted, semi-mounted, towed or self-propelled implements (implements are for example harvesting machines, sprayers, etc.). Its purpose is to standardize the method and format of transfer of data between sensor, actuators, control elements, information storage and display units whether mounted or part of the tractor, or any implements.

ISO 11783 consists of the following parts:

- Part 1: General standard for mobile data communication
- Part 2: Physical layer
- Part 3: Data link layer
- Part 4: Network layer
- Part 5: Network management
- Part 6: Virtual terminal
- Part 7: Implement messages applications layer
- Part 8: Power train messages
- Part 9: Tractor ECU
- Part 10: Task controller and management information system data interchange
- Part 11: Mobile data element dictionary
- Part 12: Diagnostic
- Part 13: File server

The Isobus is based on CAN running at 250 kbits/s. It uses twisted non-shielded quad cable and high-speed transceivers compliant to ISO 11898-2. The development of the ISO 11783 has resulted in a standard that allows for the seamless communication between tractors and implements, improving efficiency and productivity in agriculture and forestry operations.
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standard is not yet finalized, although it has been started more than 15 years ago. Some parts are under review or in maintenance cycle, and further parts are under development or even not yet started.

The Isobus tractor provides several devices and components. The virtual terminal is mounted in the tractor to allow the operator to control connected implements. This makes any separate implement control box unnecessary; one terminal allows control of all implements. The Task Controller is a piece of software in the terminal that records task data and handles site specific operation, based on input from the farm management system. The 9-pin connector on the tractor allows connecting of the implement cable to the tractor. The tractor battery provides power to the implement. An Isobus-compliant implement provides the power and CAN cable. Connecting of this single cable to the implement connection is enough to operate the implement. An ECU (or job computer), mounted on the implement, controls the implement, which may use an additional embedded CAN network. The ECU reads the implement sensors, and sends the sensor data to the tractor for display on the terminal. It receives operator input for implement control, and activates implement actuators.

**Marketing of the ISO 11783 standard**

In the year 2000, VDMA formed the Implementation Group Isobus in order to promote the Isobus. In the last years at both sides of the Atlantic Ocean, tractor and implement manufacturers have designed devices compliant to the ISO 11783 standard. The VDMA promoted these interfaces under the name Isobus. The German DLG association has established a conformance testing procedure for Isobus-compatible devices. The attempt to export this USA has failed. That is why there is still just one test house, the DLG, which is able to perform the Isobus conformance test and to certify devices. Under development is new conformance test tool, which is intended to be used by different qualified test houses.

Last year, the AEF non-profit organization was established by several companies (Agco, Claas, CNH, Grimme, John Deere, Kverneland Group and Pottinger) and the two associations AEM (Association of Equipment Manufacturers) as well as VDMA. The association has established different working groups and task forces.

Several implement manufacturers have formed the non-profit Competence Center Isobus headquartered in Wallenhorst (Germany). Nowadays, also Isobus device manufacturers have joined the organization. The association will support and influence the international standardization from the viewpoint of the implement manufacturers. The members are also active in the AEF. The association develops hardware (e.g. CC100 and CC200 virtual terminals) and software (e.g. driver program for job controller) for its members.

CiA is going to establish a task force or interest group, which supports and reviews so-to-say in background the ISO 11783 specifications. CiA representatives will submit the comments and proposals to the international standardization body. In addition, the CiA group will develop implementation guidelines and application notes in order to improve interoperability of Isobus-compatible devices.

The group is dedicated for device designers and protocol stack vendors. Nowadays, the above-mentioned conformance test tool is and will be used for certification of Isobus products by DLG on behalf of the AEF. Nevertheless, conformance testing needs to be accompanied by plug-fests, in which the interoperability of devices is tested and proofed. In Europe and USA, several Isobus plug-fest have been already organized by VDMA and AEM. In March 2010, the AEF scheduled an Isobus plug-fest in North America, which is hosted by Nebraska Tractor Test laboratory at the University of Nebraska.

**Confusion on “Isobus stop” button**

The AEF association has reported about some confusion regarding virtual terminals with an additional switch, sometimes referred to as “Isobus stop”. Due to its design, it created the erroneous impression to represent some kind of “emergency stop”. AEF pointed out that this is not the case. To prevent any kind of misleading interpretation, AEF asks all manufacturers not to use the Term “Isobus stop button” any more. Actually the AEF project teams are working on completing the overall set of tasks to be performed by the switch within the Isobus environment.

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**Job computer and tractor ECU**

TeeJet Technologies has developed a range of Isobus task controller. The general-purpose LH IC24 computer is designed to work in conjunction with Isobus virtual terminals (VT). The IC34 computer connects directly to the Isobus and contains a complete collection of input and output capabilities. Further expandability is easily added through the proprietary Powerlink+ CAN expansion bus. These I/O modules ensure design flexibility. The IC34 can be customized to meet design requirements. The company also offers the PowerLink 640 device to upgrade tractors to Isobus compatibility. The data the tractor ECU can be displayed on the PowerLink 640 terminal, which complies with the Isobus VT specification. (hz)

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www.aef-online.org

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At Agritechnica 2009 in Hanover, Kverneland Group has launched its Isomatch Tellus virtual terminal (VT) compliant with ISO 11783 series. The VT is able to displays two different implements simultaneously. This means the operator can observe two Isobus machines through one terminal without the need to constantly toggle between screens, e.g. a fertilizer front hopper and a precision drill at the rear.

Due to the increasing number of functionalities that can be added to a machine such as cameras, task controller, internet browser, operator manuals or tractor ECU, the need for simultaneous controlling of those functionalities is a must for operators. Some of the examples of multi-screen combinations:

- The use of an Isobus implement in the top screen and a camera display in the bottom screen, e.g. to see the machine interface screen of the loader wagon to monitor the trailer content with a camera in one terminal.
- The use of an Isobus implement in the top screen and a Tractor interface screen in the bottom.
- The use of an Isobus implement in the top screen and a Task Controller screen in the bottom.
- The use of an Isobus implement and its operator’s manual in the bottom, helping the operator configure the machine without the need for separate manual.

The presented VT comes in a robust aluminum housing and ergonomic rubber grip. The rugged tire profile of the rubber grip bar relates the terminal with the agricultural industry. The grip bar in combination with easily accessible digital touch screen soft keys, make physical soft key buttons on existing terminals out of date. By moving all soft keys to the right hand side of the display, all soft keys are easy accessible using your thumb.

The VT provides a 15-pin Isobus and power connector and an additional 9-pin Isobus extension connector for a joystick for example. The device features four USB interfaces, which can be used to connect the VT to Bluetooth, WLAN, memory sticks, Internet dongle. The EIA-232 port is suitable for GPS receivers or sensors, and the audio input/output jacks are usable for microphone and headphones.

The VT includes an Isobus task controller (TC) in order to document fuel consumption (if provided by the tractor), total of hectares and other machine-specific totals (e.g.: total amount of bales or total amount of fertilizer spread).

In Hanover, the Kverneland Group demonstrated an add-on software package, which can upgrade the Isobus TC. For example, it gives the operator the possibility to use site specific operations, by uploading and downloading field maps via an ISO-XML file, which is compatible with most farm management systems. With the development and availability of 29 Isobus machine types over the last years and more then 16 000 Isobus implements running worldwide, the company is one of the most experienced in the Isobus business. (hz)

www.kvernelandgroup.com

### Terminal for two Isobus implements

<table>
<thead>
<tr>
<th>Isobus Terminal</th>
<th>Description</th>
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<tbody>
<tr>
<td>VT as central HMI</td>
<td>With the farm computer and a D-GPS receiver for site location can be connected. The implement ECU sends the machine-specific information to the terminal and carries out the drivers’ commands. Several machines (e.g. tractors, field sprayers, drills) can be controlled simultaneously. Besides a broad range of virtual terminals (VT), the company develops, produces and sells electronic solutions for agricultural machinery with the emphasis on combine harvesters, field sprayers, drill machines, beet harvesters and Isobus equipment for tractors. Mueller Elektronik, located in Salzkotten (Germany) was founded in 1984. (hz) <a href="http://www.mueller-elektronik.de">www.mueller-elektronik.de</a></td>
</tr>
</tbody>
</table>
**Application: CAN Network Technology**

![Diagram of CAN network technology]

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