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REQUIREMENTS FOR A STANDARD FOR TRACTOR-IMPLEMENT COMMUNICATIONS

by

H. Auernhammer

Institut für Landtechnik, Technische Universität München
Freising-Weihenstephan, Germany

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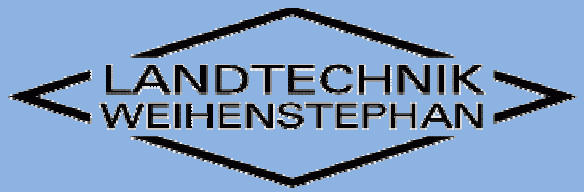

Requirements for a Standard for Tractor-Implement Communications

Hermann Auernhammer

Technische Universität München
85350 Freising-Weihenstephan, Germany

Introduction

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Introduction

By now, tractor development is approaching its third stage.

Mechanics and hydraulics are now able to communicate via electronics.

Communication is possible between vehicles, between tractor and implement and between mobile unit and farm management.

If these new possibilities are to be used to their full potential, the following conditions must be considered:

- Farmers should be ensured independence of the manufacturer by means of interface standardization
- New technology ought to fit into already existing mechanization systems a step-by-step extension on the way to fully atomized processes is desirable.

Mechanization trends

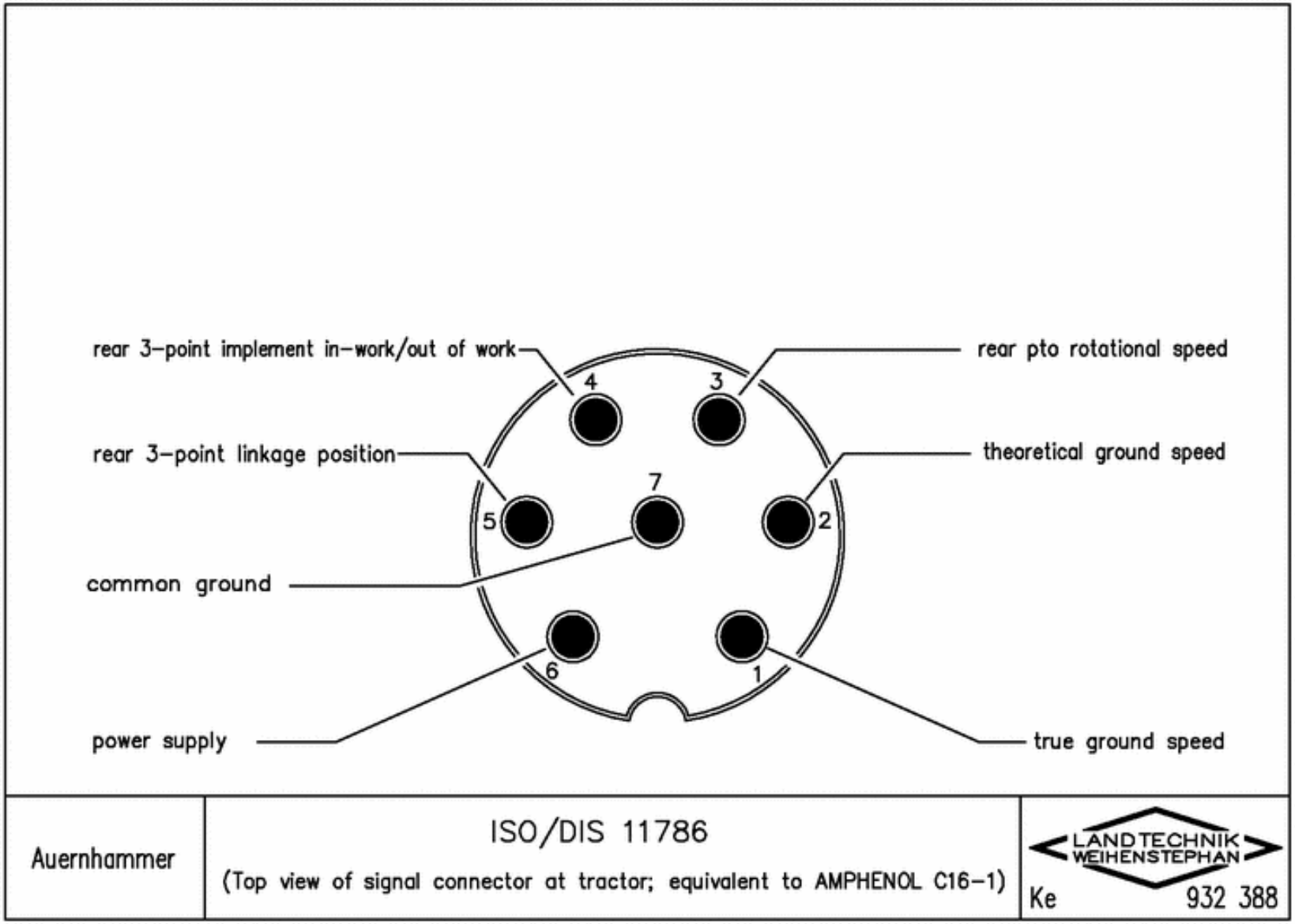
Higher demands regarding technical performance and a reduction in needed manpower led to a more complex use of tractor and implement.

Implement combinations supplemented or even replaced the "tractor-and-one-implement" unit.

Usually with pulled large implements, tractive force constitutes the only connection between tractor and implement. A transfer of motor-power via take-off shaft is the exception. Linked engines and implements may function completely independently from each other.

Modern implements nowadays have own electronic control units with the need of basic signals either gathered with own sensors or taken up from the tractor.

The number of needed sensors can be reduced to a minimum by using the standardization recommendation in ISO/DIS 11786.


rear 3-point implement in-work/out of work
rear pto rotational speed
rear 3-point linkage position
theoretical ground speed
common ground
power supply
true ground speed
4
3
5
7
2
6
1
Auernhammer
ISO/DIS 11786
(Top view of signal connector at tractor; equivalent to AMPHENOL C16-1)
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Multi-implement control

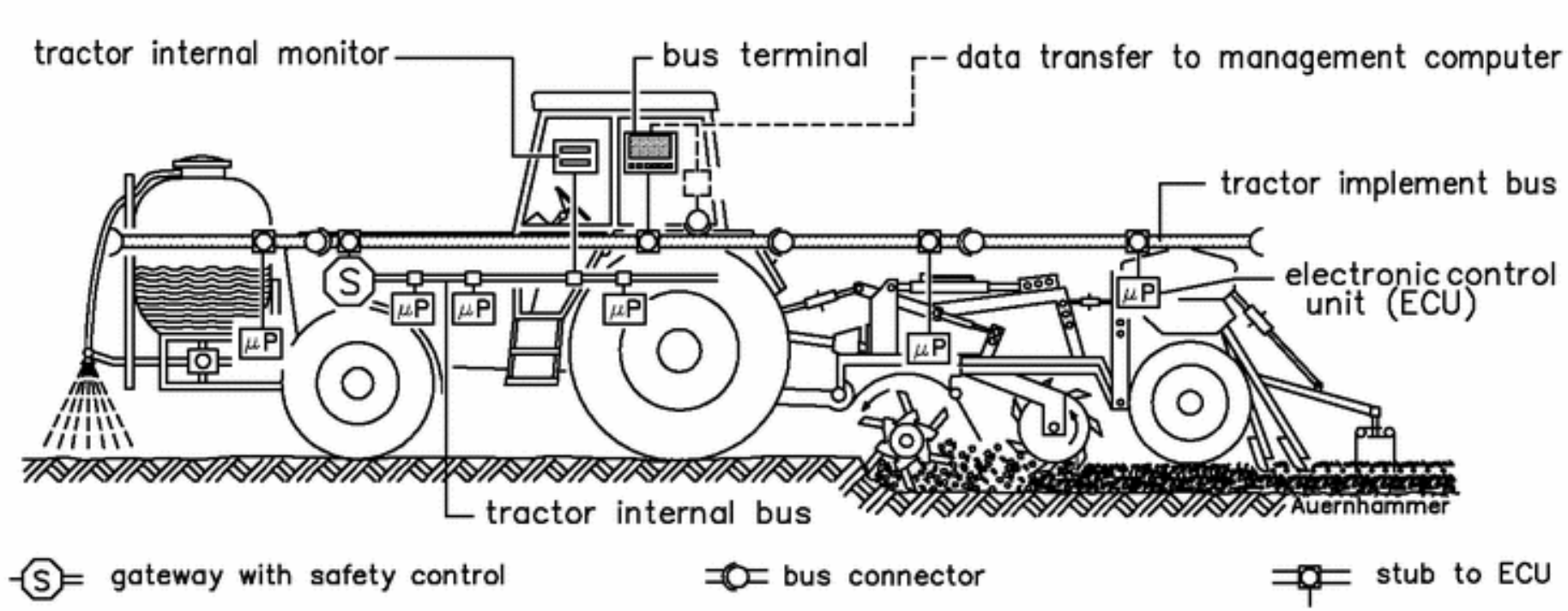
In a system consisting of a tractor and a variety of implements, implement-specific process control computers yield the best results.

They should have the following communication interfaces:

- From and to the driver
- From and to the farm management
- From implement to implement
- Basic data from the tractor for mounted/pulled implements

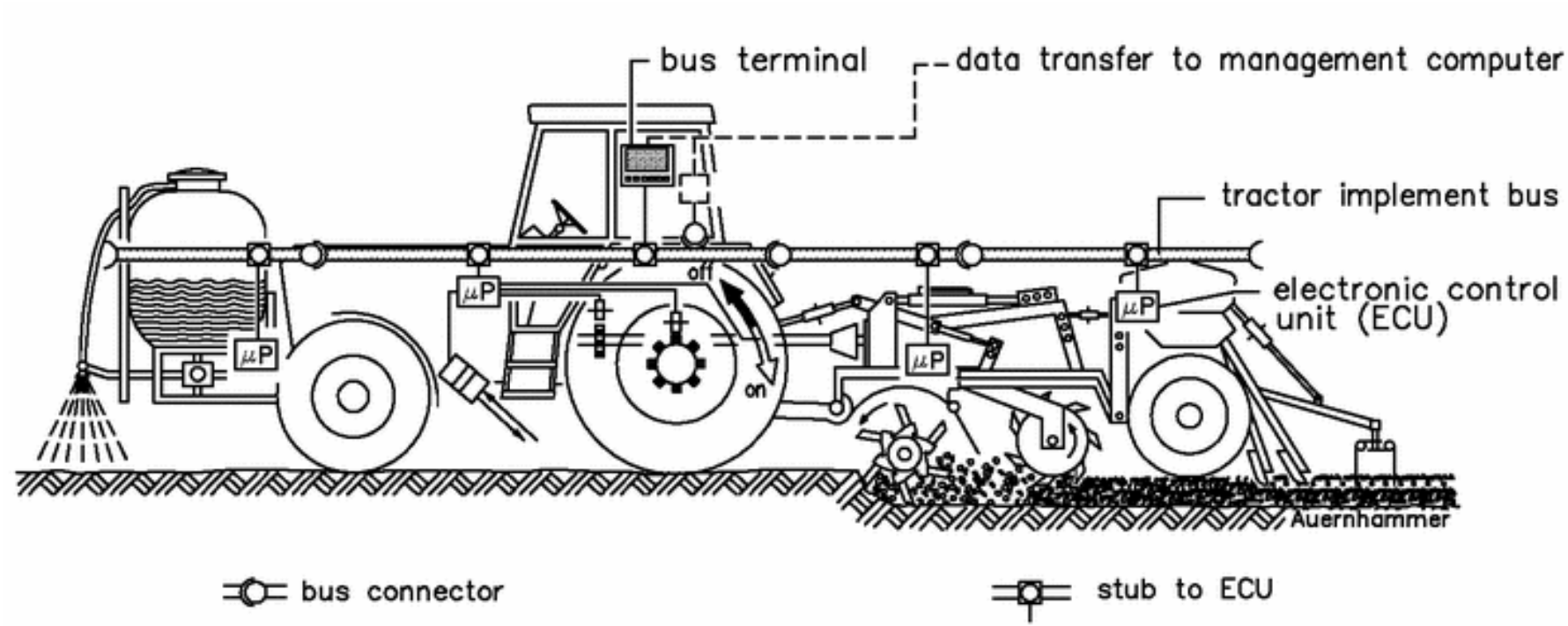
For this, a bus solution is ideal.

Basic draft of a mobile agricultural bus system



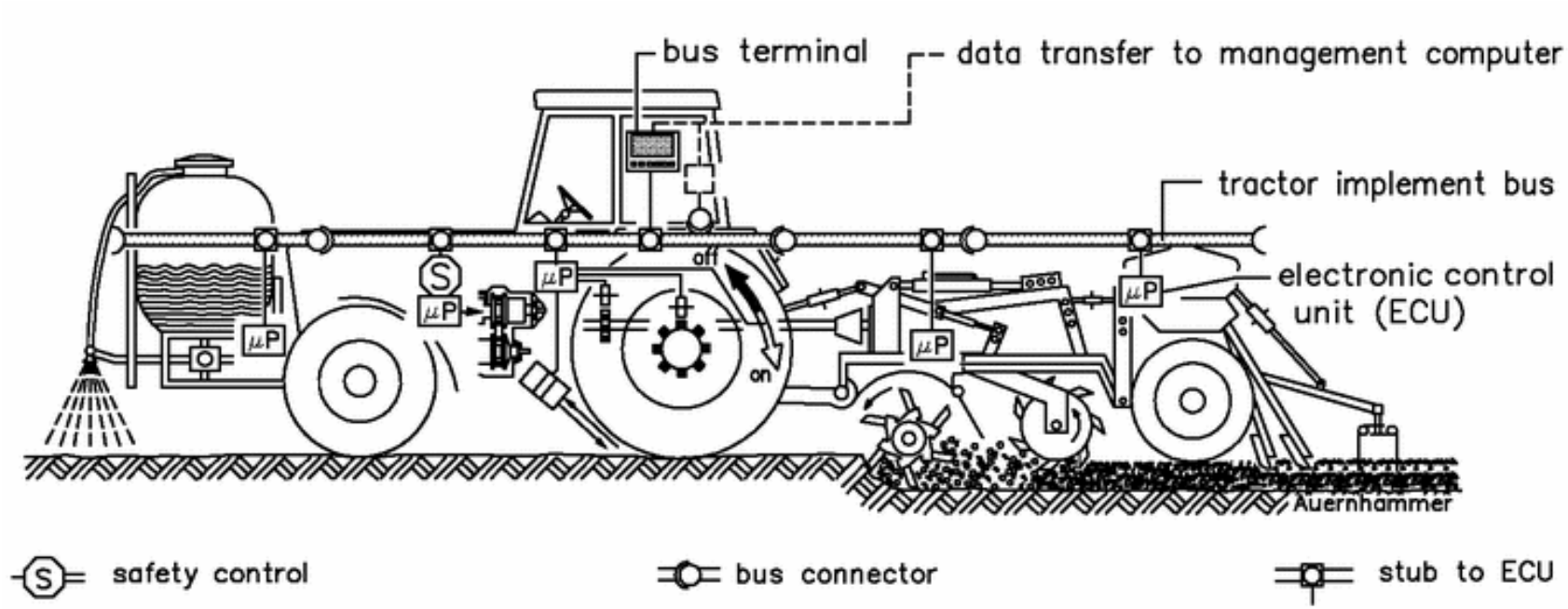
Centralized multi-implement control with connection to the farm management system

(Tractor offers basic signals only)



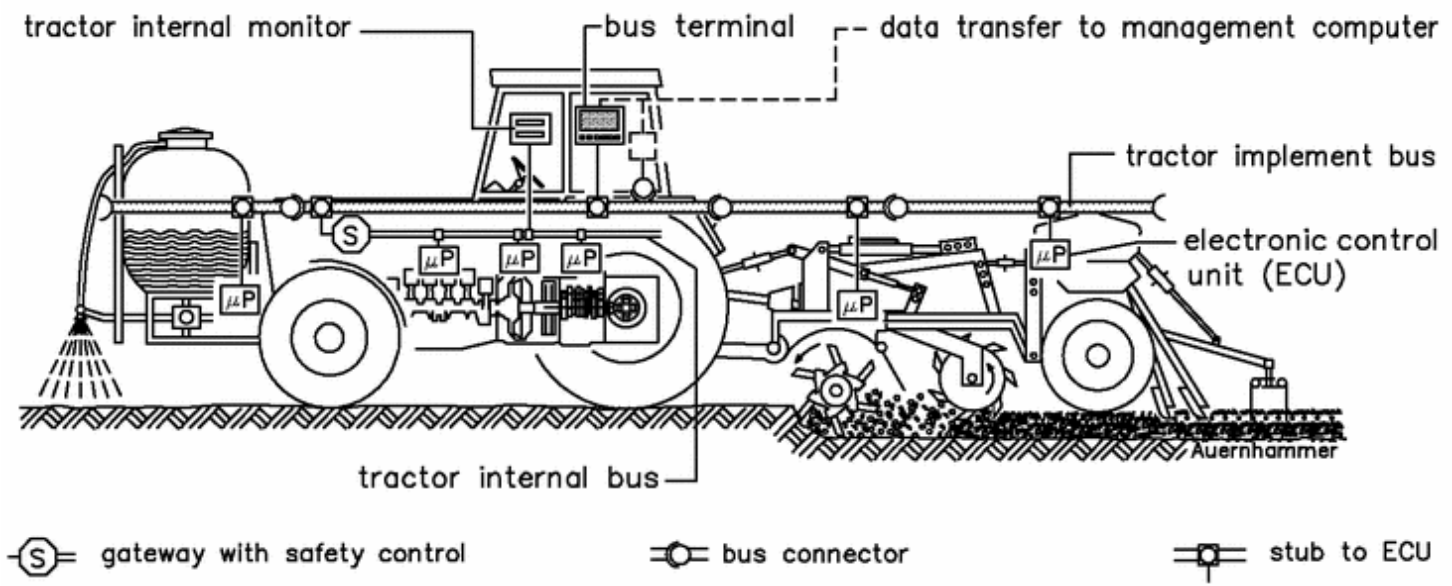
Basic draft for a partially automated tractor-implement bus

(Basic signals from the tractor and e.g. step-less transmission control)



Basic draft for a fully automated tractor-implement bus

(Internal tractor bus with safety control, engine control, transmission control, p.t.o. control and three-point-linkage control)



Multi-implement control and process data acquisition

Generally, with use of electronic devices, an involvement of the operations management is desirable at every stage. Electronic devices rely on sensors which in turn continually process data. It would be irresponsible to use this information solely for process control. Instead, the data should be processed to an appropriate format and made available to the management.

Data content in a unified data format might be a resulting interface. ADIS (Agricultural Data Interchange System) according to ISO/DIS 11787 offers a defined record format. First attempts at an extensive “data dictionary” are available and will guarantee integrity of data in the future.

Conclusions

Intelligent technology within tractor and implements requires communication. Standardized interfaces must ensure this requirement. As a result, the following demands emerge:

- Implements attached to the hydraulic three-point-linkage requiring tractive power only are exclusively served by a tractor-based control loop. No normative standards are required.
- Tractors with single implements in connection with mobile “agricultural computers” need signal connectors with basic signals for speed, r.p.m. figure of the take-off shaft and the working situation (ON/OFF) as a universal and cost-effective solution.
- The use of multi-implement combinations requires an open communication system at driver’s seat for independent control and operation.
- If implements have access to the tractor in a partial automated process, security measures should be introduced.
- Electronics also allows fully automated process operation in tractor-implement combinations. This calls for highest standards with regard to security measures. Identical bus systems in tractors and implements are not required.
- Ultimately, these conditions can only be met by an open system. The system should furthermore be adjustable to local standards and requirements in different countries. Only then, world-wide acceptance is to be expected.