INTERNATIONAL STANDARD

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Tractors and machinery for agriculture and forestry — Serial control and communications data network —

Part 5: Network management

Tracteurs et matériels agricoles et forestiers — Réseaux de commande et de communication de données en série —

Partie 5: Gestion du réseau

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11783-5 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

ISO 11783 consists of the following parts, under the general title *Tractors and machinery for agriculture and forestry — Serial control and communications data network*:

— *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 application layer*

— *Part 8: Power train messages*

— *Part 9: Tractor ECU*

— *Part 10: Task controller and management information system data interchange*

— *Part 11: Data dictionary*

Annex A of this part of ISO 11783 is for information only.

Introduction

Parts 1 to 11 of ISO 11783 specify a communications system for agricultural equipment based on the CAN 2.0 B [1] protocol. SAE J 1939 documents, on which parts of ISO 11783 are based, were developed jointly for use in truck and bus applications and for construction and agricultural applications. Joint documents were completed to allow electronic units that meet the truck and bus SAE J 1939 specifications to be used by agricultural and forestry equipment with minimal changes. This part of ISO 11783 is harmonized with SAE J 1939/81 [2]. General information on ISO 11783 is to be found in ISO 11783-1.

The purpose of ISO 11783 is to provide an open, interconnected system for on-board electronic systems. It is intended to enable electronic control units (ECUs) to communicate with each other, providing a standardized system.

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this part of ISO 11783 may involve the use of a patent concerning the controller area network (CAN) protocol referred to throughout the document.

ISO takes no position concerning the evidence, validity and scope of this patent.

The holder of this patent right has assured ISO that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from:

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Germany

Attention is drawn to the possibility that some of the elements of this part of ISO 11783 may be the subject of patent rights other than those identified above. ISO shall not be held responsible for identifying any or all such patent rights.

Tractors and machinery for agriculture and forestry — Serial control and communications data network —

Part 5: Network management

1 Scope

This part of ISO 11783 specifies a serial data network for control and communications on forestry or agricultural tractors and mounted, semi-mounted, towed or self-propelled implements. Its purpose is to standardize the method and format of transfer of data between sensor, actuators, control elements, and information-storage and -display units, whether mounted on, or part of, the tractor or implement. This part of ISO 11783 describes the management of source addresses (SAs) for electronic control units (ECUs), the association of addresses with the functional identification of a device and the detection and reporting of network-related errors. It also specifies procedures for initialization and response to brief power outages, and minimum requirements, for network-connected ECUs.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 11783. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 11783 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3339-0:1986, *Tractors and machinery for agriculture and forestry — Classification and terminology — Part 0: Classification system and classification*

ISO 11783-1:—[1)], *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 1: General standard for mobile data communication*

ISO 11783-2:—[1)], *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 2: Physical layer*

ISO 11783-3:1998, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 3: Data link layer*

ISO 11783-4, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 4: Network layer*

1) To be published.

3 Terms and definitions

For the purposes of this part of ISO 11783, the terms and definitions given in ISO 11783-1 and the following apply.

3.1
non-configurable-address ECU
ECU having an SA set by its manufacturer in accordance with the preferred addresses of this part of ISO 11783 and not able to be changed (for example, a service tool)

3.2
service-configurable-address ECU
ECU having an SA that can be changed in operational service mode, normally using a service tool and any of a number of proprietary techniques, or using the commanded-address message

3.3
command-configurable-address ECU
ECU having an SA that can be changed using the commanded-address message during normal operation

3.4
self-configurable-address ECU
ECU having an SA that, based on internal calculations, determines and then claims its own source address or, if unsuccessful in that claim, can recalculate and claim another address

4 General description

4.1 Address configuration

Address configuration is the obtainment by an ECU of a source address that identifies it on an ISO 11783 network. The ECU can be a non-configurable-address, service-configurable-address, command-configurable-address or self-configurable-address ECU, with the address configuration describing the manner in which the ECU obtains its SA. Address configuration is distinct from address claiming, the process whereby the ECU broadcasts its intent to use a particular address (4.3.3).

NOTE It is not the aim of this part of ISO 11783 to require that an ECU possess a particular address-configuration capability. Support for self-configurable addressing in this part of ISO 11783 does not imply that a given ECU should support self-configurable addressing. ISO 11783 ECUs are not required to possess a self-configurable addressing capability.

4.2 Types of ECU

4.2.1 Standard ECU

The standard ECU is one whose primary function neither involves network communication, programming nor diagnosis, and whose role is other than that of a tool or network interconnection unit. The standard ECU is used in engines, transmissions, virtual terminals, application-rate-control and traction-control systems. Data loggers and recorders fall into the same category; however, where these assume diagnostic tool functions, they will need to conform to the requirements pertaining to diagnostic tools (4.2.2). The standard ECU lacks the ability to modify the source address of another ECU, except as a result of address claiming. Standard ECUs may or may not be capable of self-configurable addressing.

4.2.2 Diagnostic/development tool

Diagnostic and development tool ECUs are those connected to an ISO 11783 subnetwork for the purpose of analysing, debugging, developing or monitoring any ECU on the subnetwork or the operation of the subnetwork itself. Although these tools are not expected to be permanently attached to a subnetwork, such a tool may well be a permanent part of a particular machine or implement. In either case, the capabilities of these tools are more extensive than those of standard ECUs because they are primarily designed to interact with other ECUs on the network and have no other external functionality (a diagnostic tool, for example, is not expected to provide torque, plant beans or brake an implement).

Such a tool can be proprietary, to be used on a particular manufacturer's ECU, or general-purpose, for application on ECUs made by several manufacturers. It can also be designed primarily for work on the network itself, providing network integration services for the system integrator or original equipment manufacturer (OEM).

4.2.3 Network interconnection unit

Network interconnection units are ECUs such as repeaters, bridges and gateways that enable communication between different networks or subnetworks, forwarding messages from one subnetwork to another (see also ISO 11783-4). Subnetworks linked by network interconnection units can have the same protocol, as in the case of two ISO 11783-specified subnetworks in the same machine, or different ones, as in the case of ISO 11783 and SAE J 1708 or J 1587 subnetworks. They can also communicate with other, off-machine subnetworks, such as satellite links, token rings or cellular modems.

NOTE Network interconnection units serving as gateways translate from ISO 11783 subnetworks to various other networks. This part of ISO 11783 deals only with the ISO 11783 portions of those ECUs.

4.3 NAME and address

4.3.1 In the context of ISO 11783, a NAME[2)] is a 64-bit entity composed of fields (5.1.2) assigned by ISO. An ECU's NAME describes its function and place in the network, and any function on a network can be designated by a NAME. Every ECU transmitting messages on an ISO 11783 network shall have a NAME, in order to have a functional description and numerical value that can be used in address arbitration (see annex A for examples of NAMEs). NAMEs are normally established during initial network configuration, or when an ECU is added to the network.

4.3.2 An address is used on an ISO 11783 network to make a message identifier unique, and to determine a message source, when it is known as a source address. The procedures for address management in the ISO 11783-network-management protocol enable individual SAs to be associated with particular ECU functions (6.2). In the case of the ECU that implements several functions, a different address capability can exist for each of the functions, even if each has only one node.

4.3.3 An address-claim message containing both a NAME and an SA is used to associate the two on the network. The association of a unique NAME and address also associates the address with the corresponding function. However, regardless of the SA with which it is associated, a NAME will retain a consistent definition.

5 Specifications

5.1 NAME

5.1.1 General

Each ECU on a network shall have at least one NAME, identifying the ECU by its primary function.

Network integrators and ECU manufacturers shall ensure that each ECU on a particular network has a unique NAME not possessed by another ECU on that network.

5.1.2 NAME fields

5.1.2.1 Table 1 defines and specifies the fields that comprise a NAME, listing them in order of priority, from the self-configurable-address bit to the identity number's least significant byte.

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2) Software label for the 8 byte number that contains fields for identifying a function performed by a unit or subunit connected to the ISO 11783 network.

Table 1 — NAME fields

Field	Definition	No. of bits	Byte no.	Byte ordering [a]
Self-configurable address	Indicates whether an ECU is self-configurable (1) or not (0); needs always to be known and set to the appropriate value	1	8	Bit 8: Self-configurable address
Industry group	Defined and assigned by ISO, identifies NAMEs associated with industries (e.g. agricultural equipment)	3		Bit 7 to bit 5: Industry group (most significant at bit 7)
Device class instance	Indicates occurrence of a particular device class in a connected network; definition depends on industry group field contents (see Figure 1)	4		Bit 4 to bit 1: Device class instance (most significant at bit 4) [b]
Device class	Defined and assigned by ISO, provides a common NAME for a group of functions within a connected network; when combined with an industry group can be correlated to a common NAME, e.g. “planter” with “agricultural equipment”	7	7	Bit 8 to bit 2: Device class (most significant at bit 8)
Reserved	Reserved for future definition by ISO	1		Bit 1: Reserved
Function	Defined and assigned by ISO: when value between 0 and 127, independent of any other field for definition; when > 127 and < 254, definition depends on device class; when combined with industry group and device class, can be correlated to a common NAME for specific hardware, though not implying any specific capabilities	8	6	Bit 8 to bit 1: Function (most significant at bit 8)
Function instance	Indicates specific occurrence of a function on a particular device system of a network [a]	5	5	Bit 8 to bit 4: Function instance (most significant at bit 8)
ECU instance	Indicates which of a group of ECUs associated with a given function is referenced [c]	3		Bit 3 to bit 1: ECU (most significant at bit 3)
Manufacturer code	Assigned by committee (see ISO 11783-1), indicates manufacturer of ECU for which the NAME is being referenced; independent of any other NAME field	11	4	Bit 8 to bit 1: Most significant 8 bits of manufacturer code (most significant at bit 8)
			3	Bit 8 to bit 6: Least significant 3 bits of manufacturer code (most significant at bit 8)
Identity number	Assigned by the ECU manufacturer, necessary where the NAME is not unique (i.e. two identical NAMEs on the same network)	21		Bit 5 to bit 1: Most significant 5 bits of identity number (most significant at bit 5)
			2	Bit 8 to bit 1: Second byte of identity number code (most significant at bit 8)
			1	Bit 8 to bit 1: Least significant byte of identity number (most significant at bit 8) [c]

NOTE See 11783-1 for numerical values of industry groups, device classes, functions and manufacturer codes.

[a] The byte ordering of the NAME fields is arranged so that the NAME can be treated as a number, consistent with ISO 11783-7 [3].

[b] Bit 1 is the last of the data bits sent and closest to the cyclic redundancy code (CRC) in the message.

[c] Bit 8 is the bit closest to the data link control (DLC) in the message.

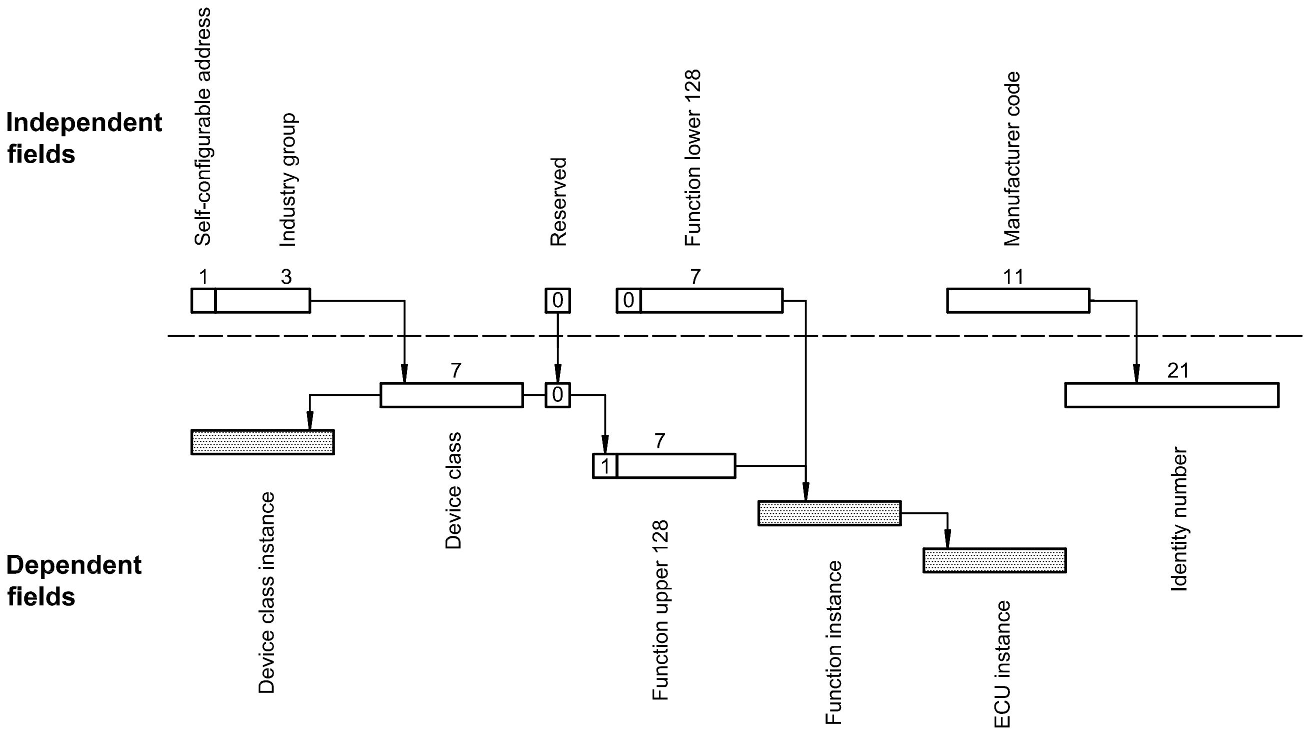

Figure 1 — NAME-field relationships and dependencies

5.1.2.2 It shall be possible to program all the fields that comprise a NAME.

5.1.2.3 If the data for any NAME field (except the self-configurable address) is unknown or unavailable, it should be set to binary "1" to indicate this.

5.1.2.4 The reserved bit should be set to zero.

5.1.2.5 Any instance field in the NAME should be able to be changed and reconfigured when an ECU is installed, or where there are multiple instances, on the network. In the case of a single, or first, device class, function or ECU, the corresponding instance field should be set to zero to indicate this.

An agreement can be reached, where appropriate, between the manufacturer and the system integrator on the interpretation and use of function instances.

EXAMPLE In the case of two engines and transmissions, agreement is reached that engine instance 0 be physically connected to transmission instance 0, and engine instance 1 to transmission instance 1.

5.1.2.6 Where a single engine is managed by two separate control units, each attached to the same ISO 11783 network, the ECU instance field should be set to 0 for the first ECU and to 1 for the second.

5.1.2.7 The ECU manufacturer shall ensure that the identity number is unique (ensured by the manufacturer using an identity number, a serial number or a data/time code on the product), and non-varying when power is removed.

5.1.2.8 Figure 1 shows the relationships between the fields, as well as the dependence of the upper 128 functions on device class and industry group, the dependence of identity number on manufacturer code, and the independence of function 0 to function 127 from either industry group or device class. The number of bits that each field comprises is noted above each field.