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

Part 12: Diagnostics services

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

Partie 12: Services de diagnostic

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Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Symbols and abbreviated terms	2
5 General description	2
6 Requirements	3
6.1 Diagnostics capability level.....	3
6.2 Network information	3
6.3 Network statistics	3
6.4 Controller information.....	4
6.5 Controller diagnostics.....	4
Annex A (normative) Diagnostic information parameter definitions.....	5
Annex B (normative) Diagnostic information message definitions.....	8
Annex C (normative) Network configuration.....	12
Annex D (informative) Network configuration screen examples.....	14
Bibliography	18

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 2.

The main task of technical committees is to prepare International Standards. 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.

ISO 11783-12 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: Mobile data element dictionary*
- *Part 12: Diagnostics services*
- *Part 13: File server*

Automated functions is to form the subject of a future part 14.

Introduction

ISO 11783 specifies a communications system for agricultural equipment based on the CAN 2.0 B ^[4] protocol. SAE J1939 ^[5] documents, on which parts of ISO 11783 are based, were developed jointly for use in truck and bus applications and for construction and agriculture applications. Joint documents were completed to allow electronic units that meet the truck and bus SAE J1939 specifications to be used by agricultural and forestry equipment with minimal changes.

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

Part 12: Diagnostics services

1 Scope

ISO 11783 as a whole 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 sensors, 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 network's diagnostic system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

ISO 11783-3:2007, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 3: Data link layer*

ISO 11783-5, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 5: Network management*

ISO 11783-7:—¹⁾, *Tractors and machinery for agriculture and forestry — Serial control and communications data network — Part 7: Implement messages application layer*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 14230 (all parts), *Road vehicles — Diagnostic systems — Keyword Protocol 2000*

ISO 15765-3, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 3: Implementation of unified diagnostic services (UDS on CAN)*

SAE J1939/73, *Application Layer — Diagnostics*

1) To be published. (Revision of ISO 11783-7:2002)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11783-1, ISO 14229-1 and SAE J1939-73, and the following, apply.

- 3.1 non-compliant diagnostics**
level 0 diagnostics, not completely meeting the requirements of level 1 diagnostics
- 3.2 basic diagnostics**
level 1 diagnostics as specified in this part of ISO 11783
- 3.3 enhanced diagnostics**
level 2 diagnostics, based on level 1 diagnostics and specifying a limited level of diagnostics interoperability between the vendor unique protocols and/or applications

NOTE This level of diagnostics is additional to ISO 15765-3 and SAE J1939-73 diagnostics and is intended to be defined in an amendment to this part of ISO 11783.

- 3.4 suspect parameter number SPN**
19 bit number used to identify the item for which diagnostics are being reported

NOTE Suspect parameter numbers are assigned to each individual parameter in a parameter group and to items that are relevant to diagnostics, but are not a parameter in a parameter group.

4 Symbols and abbreviated terms

- DM1 Active trouble code message
- DM2 Previously active trouble code message
- DTC Diagnostic trouble code
- ECU Electronic control unit
- FMI Fault mode identifier
- OC Occurrence count
- PGN Parameter group number
- SPN Suspect parameter number

5 General description

The standard diagnostic system specified in this part of ISO 11783 requires that all units connected to an ISO 11783 network provide the information specified in ISO 11783 to enable the operator and/or service technician to complete network diagnostics and identify which unit has failed or is operating in a faulty state.

6 Requirements

An interface is required for an operator or service technician in order to diagnose problems and faults on an ISO 11783 network. This diagnostic user interface may be provided by the virtual terminal or another type of user interface connected to the network. The information specified in the following subclauses shall be provided to the operator or service technician by this user interface for diagnosing problems and faults of the suspect connected ECU, sensor or actuator.

6.1 Diagnostics capability level

This part of ISO 11783 specifies the different levels of diagnostics capability of a function controller. These capability levels should be applied to new designs as well as existing or legacy ISO 11783-compliant controllers:

- a) level 0 diagnostics (non-compliant diagnostics);
- b) level 1 diagnostics (basic diagnostics);
- c) level 2 diagnostics (enhanced diagnostics).

Function controllers capable of level 1 diagnostics may use single-frame messages to provide the requested diagnostic information.

6.2 Network information

All function controllers connected to the ISO 11783 network shall provide level 1 diagnostics information to the diagnostic user interface. This information provides an overview of the status of all communicating function controllers connected to the operating network. It shall include:

- a) the part number, serial number and manufacturer's name of the connected function controller;
- b) the NAME of each function controller as defined in ISO 11783-5;
- c) the version of the software for the controller;
- d) the compliance test data, including the laboratory that performed the test, certificate data and year tested.

All function controllers shall use the messages defined in Annex B to provide the above information when requested by the diagnostic interface. The diagnostic user interface shall also monitor the messages on the network to obtain information from the address claim process and shall request the additional information using the messages specified in Annex B. Parameters for these messages are defined in Annex A. A typical network status screen is shown in Annex D. Either the virtual terminal or diagnostic user interface shall provide an equivalent screen of the network status.

6.3 Network statistics

The user interface that displays the network status shall also use its network connection to measure the network bus statistics. These network statistics shall include the bus load and any of the CAN errors detected while sending or receiving messages. It is recommended that the average bus voltages be included in these network statistics. Typically, the voltages can be averaged over a time period of 250 ms to 5 s.

A typical screen of the network statistics is presented in Annex D.

6.4 Controller information

Each function controller shall provide additional fault information to the level 1 diagnostics user interface when requested. This information provides additional data to enable the operator or service technician to isolate the problem or fault to a specific ECU. It includes:

- a) the ECU-required diagnostic protocol, the specific protocol of an ECU required for non-ISO 11783 or ISO 11783 level 2 diagnostics;
- b) active diagnostic trouble codes (suspect parameter numbers and failure mode indicators);
- c) previously active diagnostic trouble codes (suspect parameter numbers and failure mode identifiers);
- d) fault occurrences (if available);
- e) members of working set (if any).

All function controllers shall use the messages defined in Annex B to provide the above information when requested by the diagnostic user interface. The diagnostic user interface shall request the function controller's suspect parameter number and fault mode indicator information using the messages specified in Annex B. Parameters for these messages are defined in Annex A or in the appropriate part of the ISO 11783. A typical screen of the above function controller information is presented in Annex D. In addition, the user interface shall provide an equivalent screen of the network status.

6.5 Controller diagnostics

Once a problem or fault has been isolated to a particular function controller, as displayed in the controller information screen, a service tool that uses the identified protocol of that particular function controller can be connected to the network via the diagnostic connector specified in ISO 11783-2. The tool can then be used to troubleshoot the problem identified by the displayed diagnostic trouble code.