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Third edition
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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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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

This third edition cancels and replaces the second edition (ISO 11783-12:2014), which has been technically revised. The main changes compared to the previous edition are as follows:

— addition of SPNs to all parameters;

— removal of the Control Function Functionality parameters to an online database;

— updated document references.

A list of all parts in the ISO 11783 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 11783 specifies a communications system for agricultural equipment, based on the ISO 11898[4] protocol. SAE J1939[7] 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.

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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 document describes the network's diagnostic system.

NOTE   The name and contact information of the Maintenance Agency for this document can be found at http://www.iso.org/mara.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *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, *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*

SAE J1939-73, *Application layer — Diagnostics*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
product
device or ECU produced by an original equipment manufacturer (OEM)

Note 1 to entry: When an ECU is installed by a device OEM, the device is a product. When an ECU is offered in the market, independent from a device (e.g. "aftermarket" installations), the ECU is a product.

3.2
basic tractor ECU
functionality characteristics which are specific to an ISO 11783-9 TECU

3.3
server
control function on the mobile implement bus that provides services to a client

4 Symbols and abbreviated terms

AUX-N   functionality – AUX new

CF   control function

DM   diagnostic message

DTC   diagnostic trouble code

ECU   electronic control unit

FMI   failure mode indicator

OC   occurrence count

PG   parameter group

PGN   parameter group number

TC-BAS   functionality – task controller basic

TC-GEO   functionality – task controller geo

TC-SC   functionality – task controller section control

TECU   functionality – tractor ECU

UT   functionality – universal terminal

VT   virtual terminal

5 General description

The standard diagnostic system specified in this document requires that all units connected to an ISO 11783 network provide the information specified in this document 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

6.1 ISO 11783 diagnostics

This document specifies the diagnostics capabilities of control functions. The terms "level 0" and "level 1" diagnostics described in the 1st edition of this document are obsolete.

Control functions shall support all ISO 11783 diagnostic information messages defined in Annex B and their derived requirements. Parameters for these messages are defined in Annex A.

An interface is required for an operator or service technician to diagnose problems and faults on an ISO 11783 network. This diagnostic user interface can 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.

6.2 Network information

All control functions connected to the ISO 11783 network shall provide network information to the diagnostic user interface. This information provides an overview of the status of all communicating control functions connected to the operating network. It shall include

a) the part number, serial number and manufacturer's name of the connected ECU containing control functions,

b) the NAME of each control function as defined in ISO 11783-5,

c) the version (or versions) of software and the versions of ECU-related software required by each control function,

d) the compliance test data, including the laboratory that performed the test, certificate data and year tested as provided by the test lab prior to the test, and

e) the product identification message.

The diagnostic user interface shall monitor the messages on the network to obtain information from the address claim process and shall request additional information from control functions. All CFs within the same ECU shall send the same ECU identification information. A typical network status screen is shown in Annex D.

6.3 Network statistics

The diagnostic user interface that displays the network status shall also use its network connection to measure the network bus statistics. At a minimum, the diagnostic user interface shall include the following network statistics if supported by hardware: bus load, CAN errors detected while sending or receiving messages and network message count. If enabled by hardware, network statistics should also include average bus voltages over a time period of 250 ms to 5 s.

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

6.4 Control function information

Each control function shall provide additional fault information to the diagnostic user interface. This information provides additional data to enable the operator or service technician to determine the problem or fault on a specific ECU. It includes

a) the specific protocol of a control function required for non-ISO 11783 or ISO 11783 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 indicators), and

d) fault occurrences (if available).

Control functions shall also support clearing previously active diagnostic trouble codes (if required).

The diagnostic user interface shall request the control function's suspect parameter number and failure 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 ISO 11783. A typical screen of the above control function information is presented in Annex D. In addition, the diagnostic user interface shall provide an equivalent screen of the network status. Annex E provides the definition of each failure mode indicator.

6.5 Functionalities

Each control function shall provide its active functionality information to the diagnostic user interface. This information includes all the active functionalities and their generations and options. Additional functionalities can be implemented but are inactive. Functionalities which are present, but not currently available in the system shall be communicated. Functionalities which are present but not currently enabled in the control function shall not be communicated.

EXAMPLE 1   Functionalities present but not currently available in the system: An implement has an ECU with a CF1 control function that has minimum CF, TC-GEO, and TC-SC functionality. The implement is connected to a tractor without a TC-SC server functionality. The TC-SC functionality is present but not currently available within the ECU. CF1 reports minimum CF, TC-GEO, and TC-SC functionality within the functionality information messages.

EXAMPLE 2   Functionalities present but not currently enabled in the control function: An implement has an ECU with a CF1 control function that has minimum CF, TC-GEO, and TC-SC functionality. The customer has purchased only the TC-GEO functionality. The TC-SC functionality is disabled within the ECU. CF1 reports only minimum CF and TC-GEO functionality within the functionality information messages.

The diagnostic user interface shall request a control function's functionality, generation and option information using the control function functionalities message specified in Annex B. Parameters for this message are defined in Annex A. An example of a network diagnostic screen showing a connected system's functionalities and their generation is illustrated in Annex D. Another typical screen is also shown in Annex D of the capable generation for each service type control function functionality and the capable functionality generation of each operating implement Working Set Master functionality.

The diagnostic protocol message is for diagnostic purposes only and shall not be used by CFs to configure run-time operation.

6.6 Control function diagnostics

Once a problem or fault has been isolated to a particular control function of an ECU, as displayed on the diagnostic information screen, a service tool that uses the identified protocol of that particular control function can be connected to the network through 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.

6.7 ISO Latin 1 character set

There are 191 graphic character values and 65 control function character values (0 through 31 and 127 through 159) in the ISO/IEC 8859-1 Latin 1 character set. The terminology "ASCII" and "printable ASCII" are used in this document to refer to the set of 191 graphic character values. Unless otherwise specified, only these 191 character values are permitted for ASCII parameters.

Annex A
(normative)

Diagnostic information parameter definitions

A.1   ECU part number

This is the part number of the physical ECU connected to the ISO 11783 network.

Data length:	Variable, up to 200 characters
Resolution:	ASCII (1 byte), 0 offset
Data range:	32 to 126 and 160 to 255 per byte (excluding non-printable characters)
Operational range:	same as data range
Type:	Measured
SPN:	2901

The ASCII character "*" shall not be used in the ECU part number because it is used as a parameter delimiter.

A.2   ECU serial number

This is the serial number of the physical ECU connected to the ISO 11783 network.

Data length:	Variable, up to 200 characters
Resolution:	ASCII (1 byte), 0 offset
Data range:	32 to 126 and 160 to 255 per byte (excluding non-printable characters)
Operational range:	same as data range
Type:	Measured
SPN:	2902

The ASCII character "*" shall not be used in the ECU serial number because it is used as a parameter delimiter.

A.3   Number of software identification fields

This is the number of software identification designators represented in the software identification parameter group.

Data length:	1 byte
Resolution:	1 step/bit, 0 offset
Data range:	0 to 250 steps

Operational range:	0 to 125
Type:	Measured
SPN:	965

A.4 Software identification

This is the identification of the software of a control function and any required ECU-related software versions. Software identification fields in the software identification shall be separated by an ASCII "*" as a delimiter. An ASCII "*" is required at the end of the last software identification field, even if there is only one software identification field.

Individual software module identifications within an identification field shall be separated by a "#" delimiter. The last module within a software identification field can be terminated by a "#" delimiter.

Data length:	Variable, up to 200 characters
Resolution:	ASCII (1 byte), 0 offset
Data range:	32 to 126 and 160 to 255 per byte (excluding non-printable characters)
Operational range:	same as data range
Type:	Measured
SPN:	234

The ASCII characters "*" and "#" shall not be used in the software identification parameters because they are used as parameter delimiters.

A.5 ECU manufacturer name

The manufacturer name is a human-readable string that can be interpreted by a service technician. The same text as registered with the manufacturer code can be used and can contain branding information as well. It can contain the manufacturer's name as well as the OEM integrator. This information aids the service technician to acquire service help.

Data length:	Variable, up to 200 characters
Resolution:	ASCII (1 byte), 0 offset
Data range:	32 to 126 and 160 to 255 per byte (excluding non-printable characters)
Operational range:	same as data range
Type:	Measured
SPN:	4304

The ASCII character "*" shall not be used in the ECU manufacturer name because it is used as a parameter delimiter.