BS ISO 11783-12:2014

BSI Standards Publication

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

Part 12: Diagnostics services

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National foreword

This British Standard is the UK implementation of ISO 11783-12:2014. It supersedes BS ISO 11783-12:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AGE/6, Agricultural tractors and forestry machinery.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 75625 2

ICS 35.240.99; 65.060.01

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2014.

Amendments issued since publication

Date	Text affected

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INTERNATIONAL STANDARD

ISO 11783-12

Second edition
2014-09-15

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

Reference number
ISO 11783-12:2014(E)

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

This second edition cancels and replaces the corrected first edition (ISO 11783-12:2009) which has been technically revised.

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*

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— *Part 14: Sequence control*

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Introduction

ISO 11783 specifies a communications system for agricultural equipment, based on the ISO 11898[2] protocol. SAE J1939[4] 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 can 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 ensured 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 can be obtained from:

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INTERNATIONAL STANDARD ISO 11783-12:2014(E)

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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

ISO 14230 (all parts), *Road vehicles — Diagnostic communication over K-Line (DoK-Line)*

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

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

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,[6] and the following, apply.

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3.1
product
device or ECU produced by an 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 provide services to a client

4 Symbols and abbreviated terms

Term	Description
DM	Diagnostic message
DTC	Diagnostic trouble code
FMI	Failure mode indicator
OC	Occurrence count

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 this part of 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

6.1 ISO 11783 diagnostics

This part of ISO 11783 specifies the diagnostics capabilities of control functions. The terms "level 0" and "level 1" diagnostics described in the 1st edition of this part of ISO 11783 are obsolete.

Control function 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 in order 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,

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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 diagnostics 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 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 Control function information

Each control function shall provide additional fault information to the diagnostics 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 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 ISO 11783. A typical screen of the above control function information is presented in Annex D. In addition, the 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 diagnostics user interface. This information includes all the active functionalities and their generations and options. Additional functionalities might be implemented but are inactive. Functionalities which are present, but not currently available in the system, shall be communicated. Functionalities which are present but are not currently enabled in the control function shall not be communicated.

EXAMPLE 1 Functionalities present but not currently available in the system.

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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 still 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 the 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

The terminology "ASCII" is defined as the ASCII subset of the ISO/IEC 8859-1 Latin 1 character set.

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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. This parameter is the same as SPN 2901 as defined in SAE J1939-71.[5]

Data length: Variable, up to 200 characters

Resolution: ASCII (1 byte), 0 offset

Data range: 0 to 255 per byte

Operational range: same as data range

Type: Measured

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. This parameter is the same as SPN 2902 as defined in SAE J1939-71.[5]

Data length: Variable, up to 200 characters

Resolution: ASCII (1 byte), 0 offset

Data range: 0 to 255 per byte

Operational range: same as data range

Type: Measured

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. This parameter is the same as SPN 965 as defined in SAE J1939-71.[5]

Data length: 1 byte

Resolution: 1 step/bit, 0 offset

Data range: 0 to 250 steps

Operational range: 0 to 125

Type: Measured

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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. This parameter is similar to SPN 234 as defined in SAE J1939-71. [5]

Individual software module identifications within an identification field shall be separated by "#" 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: 0 to 255 per byte

Operational range: same as data range

Type: Measured

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: 0 to 255 per byte

Operational range: same as data range

Type: Measured

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

A.6 Diagnostic protocol identification

This parameter indicates the diagnostic protocols in addition to ISO 11783 that are supported by a control function.

Data length: 8 bits

Value	Meaning
00000000	No additional diagnostic protocols supported
00000001	J1939–73
00000010	ISO 14230 (KWP 2000 over K line)
00000100	ISO 15765-3 (UDS on CAN)
00001000	Reserved for ISO assignment
00010000	Reserved for ISO assignment

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