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

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 It supersedes BS ISO 11783-12:2009 which is withdrawn.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.

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This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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INTERNATIONAL STANDARD

ISO 11783-12

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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 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*

— *Part 14: Sequence control*

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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Attention is drawn to the possibility that some of the elements of this part of ISO 11783 can 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.

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.

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,

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.

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.

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

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

Value	Meaning
00100000	Reserved for ISO assignment
01000000	Reserved for ISO assignment
10000000	Reserved for ISO assignment

Type: Measured

A.7 ECU location

The location on a tractor or implement of the physical ECU connected to the ISO 11783 network. This parameter is the same as SPN 2903 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 location because it is used as a parameter delimiter.

A.8 ECU type

The type of the physical ECU connected to the ISO 11783 network. An example of an ECU type is the classification of ECU capabilities such as I/O. This parameter is the same as SPN 2904 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 type because it is used as a parameter delimiter.

A.9 Number of functionalities

This parameter reports the number of functionalities in the control function functionalities message.

Data length: 1 byte

Range: 1 to 255

Resolution: 1 functionality/bit

Type: Measured

A.10 Functionalities

This parameter reports which functionalities are supported by a control function connected to the ISO 11783 network.

Data length: 1 byte

Value	Meaning
0	Minimum control function
1	Universal terminal (server)
2	Universal terminal working set (client)
3	Aux-O inputs
4	Aux-O functions
5	Aux-N inputs
6	Aux-N functions
7	Task controller basic server
8	Task controller basic client
9	Task controller geo server
10	Task controller geo client
11	Task controller section control server
12	Task controller section control client
13	Basic tractor ECU (server)
14	Basic tractor ECU implement set (client)
15 to 255	Reserved for ISO assignment

Type: Measured

A.11 Functionality generation

This parameter reports the generation of the functionality provided by a control function connected to the ISO 11783 network.

Data length: 1 byte

Resolution: 1 generation /bit

Offset: 0

Range: 1 to 255

Unit: Number

Type: Measured

A.12 Number of options bytes

This parameter reports the number of bytes that follow to report which options are supported by a functionality provided by a control function connected to the ISO 11783 network. If a functionality has option bytes, all trailing zero option bytes shall be omitted and not counted in the number of option bytes. In case a functionality has no options, the number of option bytes shall be set to 0.

Data length: 1 byte

Resolution: 1 byte/bit

Offset: 0

Range: 0 to 255

Unit: Number

Type: Measured

A.13 Minimum control function functionality options

This parameter reports which minimum control function functionality options are supported by a control function that is connected to the network.

Data length: 8 bits

Value	Meaning
00000000	No options
00000001 to 10000000	Reserved for ISO assignment

Type: Measured

A.14 Universal terminal functionality options

This parameter reports which UT functionality options are supported by an implement working set master or a VT that is connected to the ISO 11783 network.

Data length: 8 bits

Value	Meaning
00000000	No options
00000001 to 10000000	Reserved for ISO assignment

Type: Measured

A.15 Aux-O functionality options

This parameter reports which auxiliary control type 1 functionality type functions are supported by an implement working set auxiliary function or an auxiliary function input unit that is connected to the ISO 11783 network.

Data length: 8 bits

Value	Meaning
00000000	No options
00000001	Supports type 0 function
00000010	Supports type 1 function
00000100	Supports type 2 function
00001000 to 10000000	Reserved for ISO assignment

Type: Measured

A.16 Aux-N functionality options

This parameter reports which auxiliary control type 2 functionality type functions are supported by an implement working set auxiliary function or an auxiliary function input unit that is connected to the ISO 11783 network. It is possible to have more than 1 bit set in this parameter value.

Data length: 2 bytes

Byte 1-2: 16-bit value

Value	Meaning
00000000 00000000	No options
00000000 00000001	Supports type 0 function
00000000 00000010	Supports type 1 function
00000000 00000100	Supports type 2 function
00000000 00001000	Supports type 3 function
00000000 00010000	Supports type 4 function
00000000 00100000	Supports type 5 function
00000000 01000000	Supports type 6 function
00000000 10000000	Supports type 7 function
00000001 00000000	Supports type 8 function
00000010 00000000	Supports type 9 function
00000100 00000000	Supports type 10 function
00001000 00000000	Supports type 11 function
00010000 00000000	Supports type 12 function
00100000 00000000	Supports type 13 function
01000000 00000000	Supports type 14 function
10000000 00000000	Reserved for ISO assignment

Type: Measured

A.17 Task controller basic functionality options

This parameter reports which basic task controller functionality options are supported by an implement working set master or a task controller that is connected to the ISO 11783 network.

Data length: 8 bits

Value	Meaning
00000000	No options
00000001 to 10000000	Reserved for ISO assignment

Type: Measured

A.18 Task controller geo control channels and functionality options

This is a one-byte or two-byte parameter.

A.18.1 Task controller geo supported control channels

This first option byte reports the number of control channels required by a TC-GEO client or supported by a TC-GEO task controller server that is connected to the ISO 11783 network.

Data length: 1 byte

Resolution: 1 control channel/bit

Offset: 0

Range: 1 to 255

Unit: Number

Type: Measured

A.18.2 Task controller geo functionality options

This second option byte reports which task controller geo functionality options are supported by an implement working set master or a task controller that is connected to the ISO 11783 network. Second byte shall be omitted if zero.

Data length: 8 bits

Value	Meaning
00000000	No options
00000001	Polygon-based prescription maps are supported
00000010 to 10000000	Reserved for ISO assignment

Type: Measured

A.19 Task controller section control options

This is a two-byte option.

A.19.1 Task controller section control number of booms

This first option byte reports how many booms are required by a task controller section control client or supported by a task controller section control that is connected to the ISO 11783 network.

Data length: 1 byte

Resolution: 1 boom/bit

Offset: 0

Range: 1 to 255

Unit: Number

Type: Measured

A.19.2 Task controller section control number of sections

This second option byte reports how many sections are required by a task controller section control client, or supported by a task controller section control that is connected to the ISO 11783 network.

Data length: 1 byte

Resolution: 1 section/bit

Offset: 0

Range: 1 to 255

Unit: Number

Type: Measured

A.20 Basic tractor ECU functionality options

This parameter reports which tractor ECU class and functionality options are supported by an implement working set master or a tractor ECU that is connected to the ISO 11783 network.

Data length: 8 bits

Value	Meaning
00000000	TECU not meeting complete class 1 requirements
00000001	Class 1, no options
00000010	Class 2, no options
00000100	Class required lighting (L)
00001000	Navigation option (N)
00010000	Front hitch option (F)
00100000	Guidance option (G)
01000000	Reserved for ISO assignment
10000000	Reserved for ISO assignment

Type: Measured

A.21 ECU hardware ID

This parameter is used to associate the hardware version of an ECU connected to the ISO 11783 network to a conformance test report of that hardware.

Data length: Variable, up to 200 bytes

Resolution: ASCII (1 byte)

Offset: 0

Range: 0 to 255 per byte

Type: Measured

The ASCII character "*" shall not be used in the ECU hardware ID because it is used as a parameter delimiter. The "#" character shall not be used (reserved for future assignment).

A.22 Product identification code

The product identification code, as assigned by the manufacturer, corresponds with the number on the type plate of a product. For vehicles, this number can be the same as the VIN (vehicle identification number). For stand-alone systems, such as VT's, this number can be the same as the ECU identification

number. The combination of the product identification code and the product identification brand shall make the product globally unique.

Data length: Variable, up to 50 characters ("*" delimited)

Resolution: ASCII, 0 offset

Data Range: 0 to 255 per byte

Operation Range: same as data range.

Type: Measured

SPN: 6699

The ASCII character "*" shall not be used in the product identification code because it is used as a parameter delimiter.

A.23 Product identification brand

The product identification brand specifies the brand of a product. The combination of the product identification code and the product identification brand shall make the product unique in the world.

Data length: Variable, up to 50 characters ("*" delimited)

Resolution: ASCII, 0 offset

Data range: 0 to 255 per byte

Operation range: same as data range.

Type: Measured

SPN: 6700

The ASCII character "*" shall not be used in product identification brand because it is used as a parameter delimiter.

A.24 Product identification model

The product identification model specifies a unique product within a brand.

Data length: Variable, up to 50 characters ("*" delimited)

Resolution: ASCII, 0 offset

Data range: 0 to 255 per byte

Operation range: same as data range.

Type: Measured

SPN: 6701

The ASCII character "*" shall not be used in product identification model because it is used as a parameter delimiter.

Annex B
(normative)

Diagnostic information message definitions

B.1 ECU identification information

The ECU identification information message is based on the same message as defined in SAE J1939-71[5] with the following specified parameters. Each control function in the ECU shall send the same ECU-related identification information.

NOTE The fields in this message are separated by an ASCII "*" delimiter.

Transmission repetition rate:	On request	
Data length:	Variable	
Data page:	0	
PDU format:	253	
PDU specific:	197	
Default priority:	6	
Parameter group number:	64965 ($00FDC5_{16}$)	
Byte 1 … m	ECU part number	(See A.1)
Byte m + 1	Delimiter	
Byte m + 2 … n	ECU serial number	(See A.2)
Byte n + 1	Delimiter	
Byte n + 2 … p	ECU location	(See A.7)
Byte p + 1	Delimiter	
Byte p + 2 … q	ECU type	(See A.8)
Byte q + 1	Delimiter	
Byte q + 2 … r	ECU manufacturer name	(See A.5)
Byte r + 1	Delimiter	
Byte r + 2 … s	ECU hardware ID	(See A.21)
Byte s+ 1	Delimiter	

B.2 Software identification

The software identification message is based on the same message as defined in SAE J1939-71[5] with the following specified parameters. The software identification in the software identification message

is used to communicate the software version (or versions) of a control function and the versions of ECU-related software required by the control function.

Transmission repetition rate:	On request
Data length:	Variable
Data page:	0
PDU format:	254
PDU specific:	218
Default priority:	6
Parameter group number:	65242 ($00FEDA_{16}$)

Byte 1	Number of software identification fields	(See A.3)
Bytes 2 … n	Software identification	(See A.4)

NOTE The examples below have line feeds inserted for presentation purposes only. Line feeds are not part of the actual software identification string.

EXAMPLE 1 Three software identification fields.

Control function with four modules in the first software identification field, two modules in the second software identification field, and one module in the third software identification field.

Byte 1	0x03	Number of software identification fields
Byte 2-n	VT1.5# Module1 3.1# Module2 2.0# Module3 2.0# *OpSys XY MMDDYY2.12# Spooler 2.0# *Bootloader 2.12 *	Software identification

EXAMPLE 2 Four software identification fields.

Control function with three modules in the first software identification field, one module in the second software identification field, two modules in the third software identification field, and one module in the fourth software identification field.

Byte 1	0x04	Number of software identification fields
Byte 2-n	SW-PN654321,01.00# CFPN1234a# LG-MK901243# *SW-456789,050421A# *SW-456789,050436B# LG-LK123-20050421# *LB-LH456 *	Software identification

B.3 ISOBUS certification

The ISOBUS certification message shall be in accordance with ISO 11783-7.

B.4 ISO 11783 NAME

The ISO 11783 NAME shall be in accordance with ISO 11783-5. The industry, device class, and function codes are in the address claim message sent by the specific control function. This information is from the address of the control function that has sent the specific address claim. The code values are specified in ISO 11783-1.

B.5 Diagnostic protocol

Each control function shall send this diagnostic protocol message to identify the supported protocols on the bus where the message is received.

Transmission repetition rate:	On request	
Data length:	8 bytes	
Data page:	0	
PDU format:	253	
PDU specific:	50	
Default priority:	6	
Parameter group number:	64818 ($00FD32_{16}$)	
Byte 1	diagnostic protocol identification	(See A.6)
Bytes 2-8	Reserved for ISO assignment	

B.6 Active diagnostic trouble codes (DM1)

This message is based on the same message as defined in SAE J1939-73[6] with the specified required parameters. The information communicated is limited to the currently active diagnostic trouble codes.

Transmission repetition rate: An active diagnostic trouble code (DM1) message is transmitted whenever a DTC becomes an active fault and at a normal update rate of once per second thereafter. If a fault has been active for 1 s or longer, and then becomes inactive, a DM1 message shall be transmitted to reflect this state change. After that, the DM1 is discontinued for this former error condition. If a different DTC changes state within the 1 s update period, a new DM1 message is transmitted to reflect this new DTC. To prevent a high message rate due to intermittent faults that have a very high frequency, it is recommended that no more than one state change per DTC per second be transmitted.

Thus, a DTC that becomes active/inactive twice within a 1 s interval would have one message identifying the DTC becoming active, and one at the next periodic transmission identifying it being inactive. This message shall be sent every second if possible while one or more error conditions are active or in response to a request. If not possible according to timing constraints of ISO 11783-3, start the next transmission at the next 1 s interval.

Data length:	Variable
Data page:	0
PDU format:	254
PDU specific:	202
Default priority:	6

Parameter group number:	65226 ($00FECA_{16}$)	
Byte: 1		Reserved, set to FF_{16}
Byte: 2		Reserved, set to FF_{16}
Byte: 3	bits 8–1	SPN, 8 least significant bits of SPN (most significant at bit 8)
Byte: 4	bits 8–1	SPN, second byte of SPN (most significant at bit 8)
Byte: 5	bits 8–6	SPN, 3 most significant bits (most significant at bit 8)
	bits 5–1	FMI (most significant at bit 5)
Byte: 6	bit 8	SPN conversion method (set to zero)
	bits 7–1	Occurrence count

When the occurrence count is not available, it shall be set to $7F_{16}$.

Bytes 3 to 6 shall be set to zero for no active faults.

This parameter group requires the use of transport protocol as specified in ISO 11783-3 when more than one active DTC exists.

NOTE Bytes 1 and 2 are not repeated in transport protocol DTC messages. Bytes 3 to 6 are repeated for each additional active DTC.

B.7 Previously active diagnostic trouble codes (DM2)

This message is based on the same message as defined in SAE J1939-73[6] with the specified required parameters. The information communicated is limited to the previously active trouble codes. It is used to notify other components on the network of the diagnostic condition of the transmitting electronic component. The data contains a list of diagnostic codes and occurrence counts for previously active trouble codes. Whenever this message is sent, it shall contain all previously active trouble codes with an occurrence count not equal to zero.

Transmission repetition rate:	On request only
	A NACK is required if PGN is not supported (see ISO 11783-3, PGN 59392)
Data length:	Variable
Data page:	0
PDU format:	254
PDU specific:	203
Default priority:	6
Parameter group number:	65227 ($00FECB_{16}$)

Byte: 1		Reserved, set to FF_{16}
Byte: 2		Reserved, set to FF_{16}
Byte: 3	bits 8–1	SPN, 8 least significant bits of SPN (most significant at bit 8)

Byte: 4	bits 8–1	SPN, second byte of SPN (most significant at bit 8)
Byte: 5	bits 8–6	SPN, 3 most significant bits (most significant at bit 8)
	bits 5–1	FMI (most significant at bit 5)
Byte: 6	bit 8	SPN conversion method (set to zero)
	bits 7–1	Occurrence count

When the occurrence count is not available, it shall be set to $7F_{16}$.

Bytes 3 to 6 shall be set to zero for no active faults.

This parameter group requires the use of transport protocol, as specified in ISO 11783-3, only when the message cannot be transmitted in a single frame.

NOTE Bytes 1 and 2 are not repeated in transport protocol. Bytes 3 to 6 are repeated for each additional active DTC.

B.8 Diagnostic data clear/reset previously active DTCs (DM3)

All of the diagnostic information pertaining to the previously active trouble codes (DM2) shall be erased when this PG is requested. The diagnostic data associated with active trouble codes are not affected. Upon the completion of this operation or if there are no faults to clear, a positive acknowledgement shall be sent as required (see ISO 11783-3, PGN 59392). If a control function cannot perform the requested action, then it is required to send a negative acknowledgement (see ISO 11783-3, PGN 59392). Designers should be aware that no positive or negative acknowledgement is sent when the request was sent to the global address.

All control functions shall clear the DTCs and send a positive acknowledgement to this request message.

Transmission rate: On request only

A NACK to requesting address is required if PGN is not supported and it was a destination-specific request for DM3. (See ISO 11783-3, PGN 59392)

Data length: 0

Extended data page: 0

Data page: 0

PDU format: 254

PDU specific: 204

Default priority: 6

Parameter group number: 65228 ($00FECC_{16}$)

EXAMPLE 1 An operator or service technician desires to clear the diagnostic data of an ECU.

EXAMPLE 2 The ECU is able to perform the requested action.

When initiated by the operator or service technician, the diagnostic user interface or a service tool shall send the Request PGN 59904 specifically to the specific ECU with the PGN 65228 as the requested PGN. The ECU shall respond with the Acknowledgement PGN 59392, indicating that the action was successfully completed for PGN 65228.

B.9 Control function functionalities

This message identifies all the functionalities, functionality, generation, and functionality options, supported by control functions.

With an update of this message, the number of option bytes for functionalities can be increased. A receiver of this message shall be able to parse this new message with the added bytes. To guarantee backwards compatibility, the following rules apply.

— Functionality characteristics values reserved for ISO assignment shall be parsed without generating an error.

— If the number of option bytes is larger than specified in this version of the document for a functionality, the receiving CF shall ignore the undefined functionality option bytes and parse the known option bytes for this functionality only.

Each control function shall respond with byte 1 set to FF_{16}. Receivers of this message shall not process the message if byte 1 is set to a value other than FF_{16}. Byte 2 shall be set to the number of functionalities reported in the message. Byte 3 shall be set to the first listed functionality, followed by byte 4 set to the functionality generation of the functionality in byte 3.

Byte 5 shall be set to the number of the following bytes required for the functionality options of the functionality in byte 3. The bits in byte(s) 6 – *n* are set to the supported functionality options.

If more than one functionality is supported, the bytes following the first group of functionality, functionality generation, number of following option bytes, and options byte(s) shall be repeated for each additional functionality. If more than eight bytes are required for the message, the message shall be sent using transport protocol. If less than eight bytes are required, the unused bytes shall be set to FF16.

Transmission repetition rate:	On request
Data length:	variable, 8 bytes minimum
Data page:	0
PDU format:	252
PDU specific:	142
Default priority:	6
Parameter group number:	64654 ($00FC8E_{16}$)

Byte 1	FF_{16}	
Byte 2	Number of functionalities reported in this message	(See A.9)
Byte 3	First listed functionality	(See A.10)
Byte 4	First listed functionality generation	(See A.11)
Byte 5	Number of following first listed functionalities options byte(s)	(A.12)
Bytes 6 … *n*	First listed functionality options, if provided	(See A.13-A.20)
Byte *n*+1	Second listed functionality (if provided)	(See A.10)
Bytes *n*+2	Second listed functionality generation (if provided)	(See A.11)
Bytes *n*+3	Number of following second listed functionalities options byte(s)	(A.12)

Bytes *n*+4 … *m*	Second listed functionality options, if provided	(See A.13-A.20)
Bytes *m*+1… *p*	Additional functionality, functionality generations and options as listed in bytes 3 – n	

EXAMPLE 1 Diagnostic protocol and functionality message for ISO 11783 version 3 virtual terminal with UT generation 2 and minimum CF generation 1

Byte 1	FF_{16}	Reserved	
Byte 2	0x02	Number of functionalities in message	
Byte 3	0x00	Minimum CF	(See A.10)
Byte 4	0x01	Minimum CF generation 1	(See A.11)
Byte 5	0x00	Number of option bytes	(See A.12)
Byte 6	0x01	UT	(See A.10)
Byte 7	0x02	UT generation 2	(See A.11)
Byte 8	0x00	Number of option bytes	(See A.12)

EXAMPLE 2 ISO 11783 Working Set Master compliant with UT generation 3, AUX-N, TC-GEO generation 1, TECU generation 1, and minimum CF generation 1

Byte 1	FF_{16}	Reserved	(See A.6)
Byte 2	0x06	Number of functionalities in message	
Byte 3	0x02	UT	(See A.10)
Byte 4	0x03	UT generation 3	(See A.11)
Byte 5	0x00	Number of option bytes	(See A.12)
Byte 6	0x06	AUX-N	(See A.10)
Byte 7	0x01	AUX -N generation 1	(See A.11)
Byte 8	0x01	Number of option bytes	(See A.12)
Byte 9	00000101	AUX-N function types 0 and 2	(See A.16)
Byte 10	0x08	TC-BAS	(See A.10)
Byte 11	0x01	TC BAS generation 1	(See A.11)
Byte 12	0x00	Number of option bytes	(See A.12)
Byte 13	0x0A	TC-GEO	(See A.10)
Byte 14	0x01	TC-GEO generation 1	(See A.11)
Byte 15	0x01	Number of option bytes	(See A.12)
Byte 16	0x04	Number of control channels	(See A.18)
Byte 17	0x0E	TECU	(See A.10)
Byte 18	0x01	TECU generation 1	(See A.11)

Byte 19	0x01	Number of option bytes	(See A.12)
Byte 20	00001001	Class 1, Navigation options	(See A.20)
Byte 21	0x00	Minimum CF	(See A.10)
Byte 22	0x01	Minimum CF generation 1	(See A.11)
Byte 23	0x00	Number of option bytes	(See A.12)

EXAMPLE 3 Proprietary CF FF_{16}conforming to minimum control function generation 1.

Byte 1		Reserved	
Byte 2	0x01	Number of functionalities in message	
Byte 3	0x00	Minimum control function	(See A.10)
Byte 4	0x01	Minimum control function generation 1	(See A.11)
Byte 5	0x00	Number of option bytes	(See A.12)
Bytes 6 - 8	$FFFFFF_{16}$		

B.10 Product identification

Each control function shall provide information of the product in which it is used. With this information, a service technician will know which control functions belongs to which product. An operator or service technician can also use this information when contacting a dealer or manufacturer to identify a product.

Each control function of a product shall respond with the same product identification information when it receives the Request PGN message for this PGN.

NOTE 1 The fields in this message are separated by an ASCII "*" delimiter.

NOTE 2 Future versions of the product identification information message can contain additional fields, separated by a "*". Control functions based on the version specified in this part of ISO 11783 shall be able to encode at least the information specified in this document.

Transmission repetition rate: On request

Data length: Variable

Data page: 0

PDU format: 252

PDU specific: 141

Default priority: 6

Parameter group number: 64653 ($00FC8D_{16}$)

Byte 1 … k	product identification code (see A.22)
Byte k + 1	Delimiter
Byte k + 2 … m	product identification brand (see A.23)
Byte m + 1	Delimiter
Byte m + 2 … n	product identification model (see A.24)

Byte n + 1 Delimiter

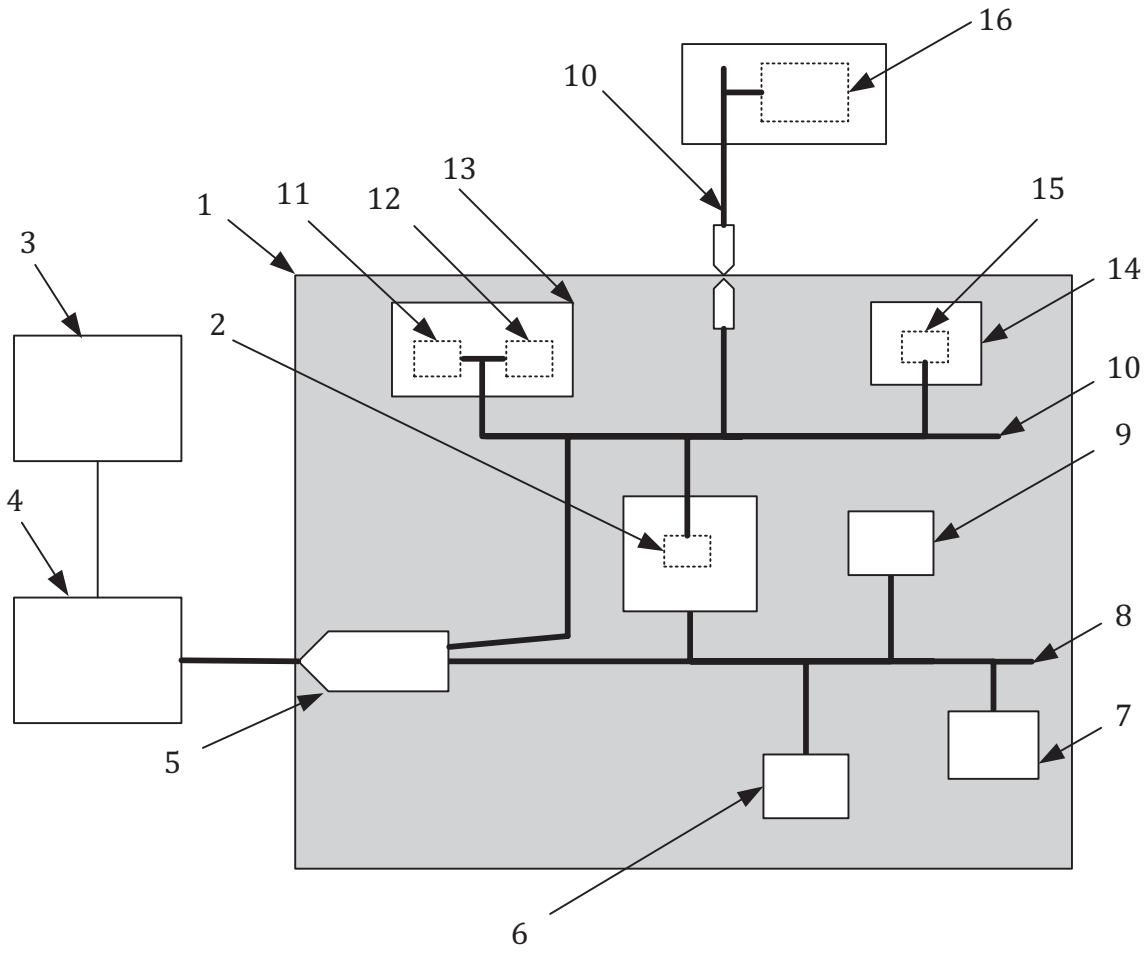
EXAMPLE For product model 1926i from Brand B with identification code 1234567890ABC: 1234567890ABC*Brand B*1962i*

Annex C
(normative)

Network configuration

C.1 Network configuration

Figure C.1 illustrates an example network configuration that shall support the diagnostic system and its connection to the ISO 11783 diagnostic connector.



Key

1	Product1: tractor or self-propelled implement	9	tractor bus ECU n
2	tractor ECU CF	10	ISO 11783 bus
3	diagnostic tool	11	ISO 11783, CF1
4	diagnostic tool interface	12	ISO 11783, CF2
5	ISO 11783 diagnostic connector	13	ISO 11783 OEM-installed ECU
6	tractor bus ECU 1	14	Product 2: ISO 11783 aftermarket ECU
7	tractor bus ECU 2	15	ISO 11783 CF n
8	tractor bus	16	ISO 11783 implement CF

Figure C.1 — Network configuration

C.2 Diagnostic connector

The diagnostic connector and its installation shall be in accordance with ISO 11783-2.

Annex D
(informative)

Network configuration screen examples: Network information screens

D.1 General

Figure D.1 illustrates an example of a typical network information screen (see 6.2).

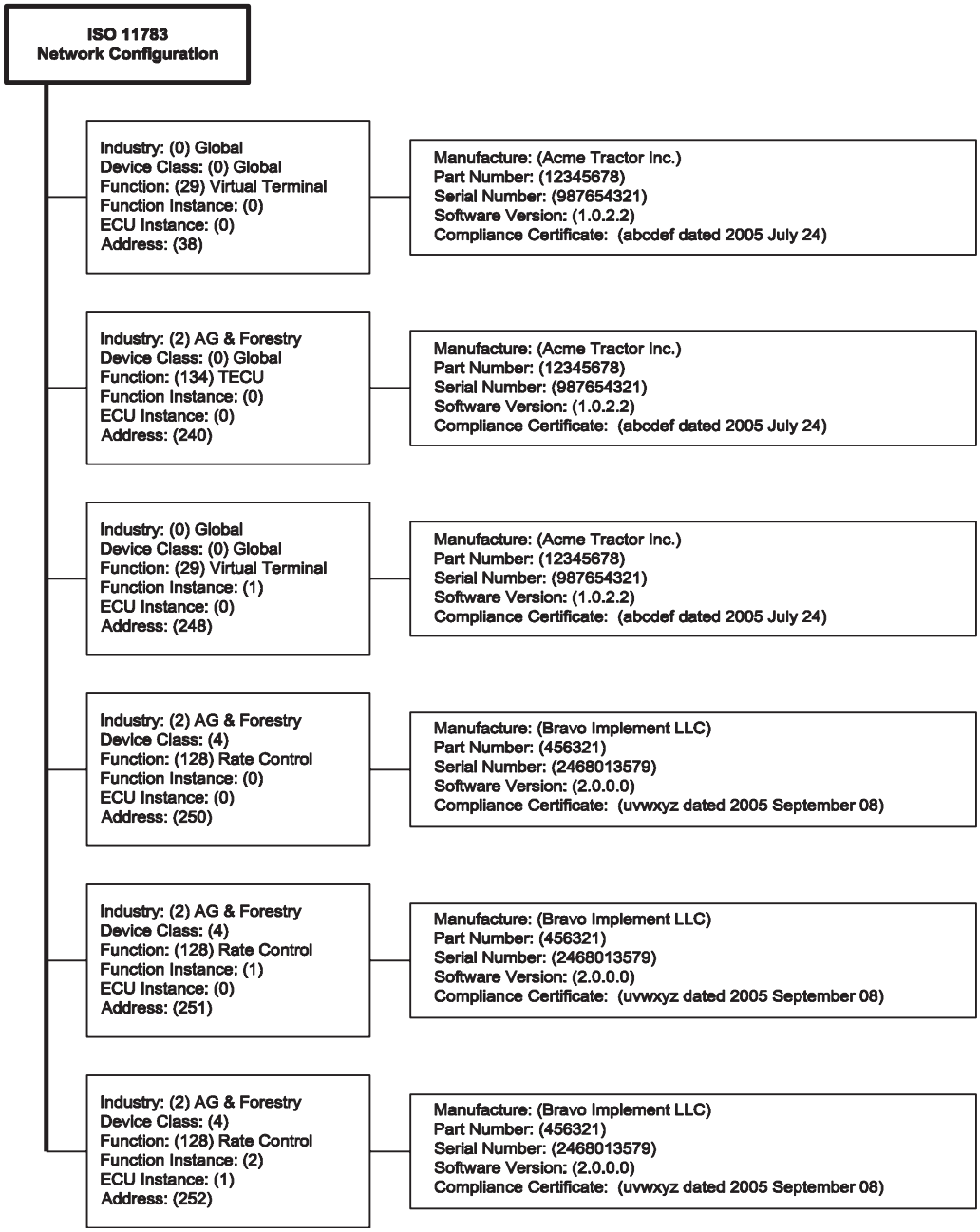


Figure D.1 — Typical network information screen

D.2 Network statistics screen

Figure D.2 illustrates a typical network statistics screen (see 6.3)

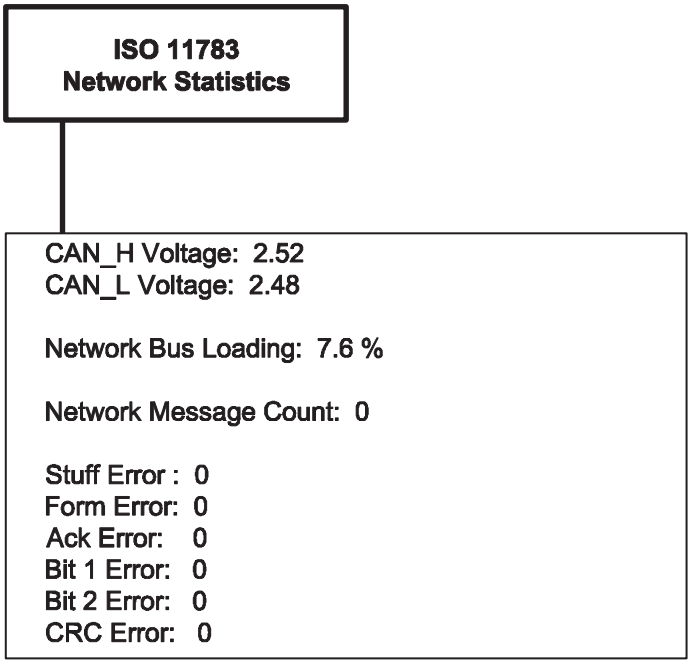


Figure D.2 — Typical network statistics screen

D.3 Network diagnostic screens

Figure D.3 illustrates examples of typical network diagnostic information screens (see 6.4).

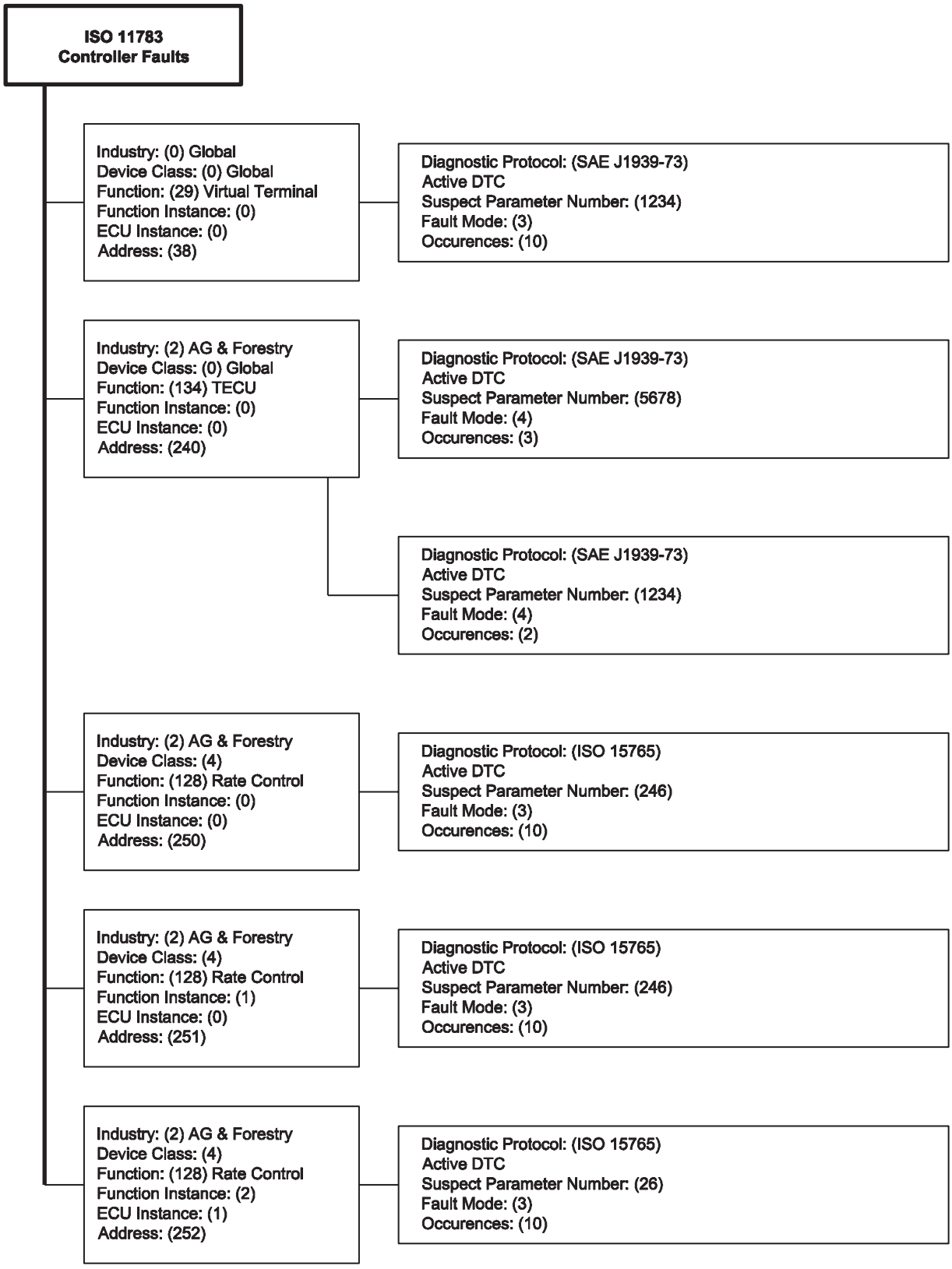


Figure D.3 — Typical network diagnostic information screen

D.4 Connected system functionalities screens

Figure D.4 illustrates examples of a typical connected system functionalities screen (see 6.5).

Functionalities	**System Configured**	System Generation
UT	✓	Gen: 3
AUX -O	X	X
AUX -N	✓	Gen: 2
TC -BAS	✓	G en: 1
TC -GEO	✓	Gen: 1
TC -SC	X	X
TECU	X	X

NOTE 1 X indicates not installed or not available.

NOTE 2 Displayed functionality names are examples only and not specified in this part of ISO 11783.

Figure D.4 — Typical connected system functionalities screen

D.5 Implement functionalities screens

Figure D.5 illustrates examples of a typical implement capable functionalities screen (see **6.5**).

Functionalities	Actual Tractor Functionalities	Actual Implement Functionalities
UT	Gen: 4	Gen: 3
AUX -O	X	X
AUX -N	Gen: 4	Gen: 2
TC -BAS	Gen: 1	Gen: 1
TC -GEO	Gen: 1	Gen: 1
TC -SC	X	X
TECU	X	X

NOTE 1 X indicates not installed or not available.

NOTE 2 Displayed functionality names are examples only and not specified in this part of ISO 11783.

Figure D.5 — Typical implement capable functionalities screen

D.6 Example of a functionality alarm mask

Figure D.6 illustrates an example of a typical functionality alarm mask.

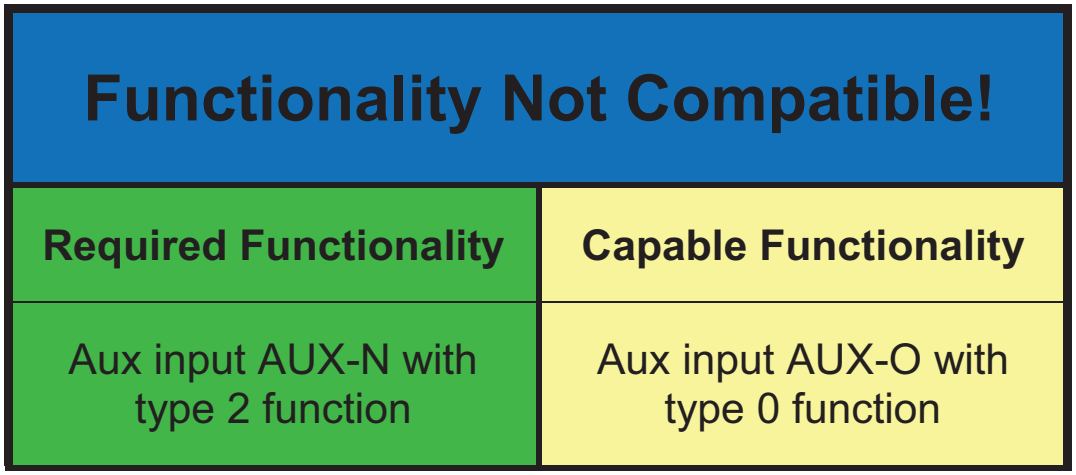


Figure D.6 — Example of a functionality alarm mask

Annex E
(normative)

Failure mode indicator definitions

E.1 Introduction

The following definitions are applicable when using failure mode indicators (FMIs). Examples have been included to help achieve consistent usage of the failure mode indicators. Not all FMIs are applicable to a given SPN. For example, a control function diagnosing a particular input, such as SPN 1873 (rear hitch position), can use FMIs 3 and 4, and therefore, would not use FMIs 5 and 6.

E.2 Definitions used for the FMI descriptions

Data: Any information pertaining to physical conditions that is communicated to an electronic module in the form of voltage, current, PWM signals, or data streams.

Real world: Mechanical parameters or operating conditions that can be measured in the form of voltage, current, PWM signals, and data streams.

Signal range: Definitions are shown in Figure E.1, which also gives the definitions for regions a to k.

Region a	Total signal input range possible that can be measured by an electronic module.
Region b	Total signal range physically possible, as defined by an application.
Region c	Range defined as normal for a given real-world measurement.
Region d	Range defined as below normal, most severe level of what is considered normal for the given real-world measurement.
Region e	Range defined as above normal, most severe level of what is considered normal for the given real-world measurement.
Region f	Range that is low outside the range of what is considered physically possible for a given system, indicating that a short to a low source has occurred.
Region g	Range that is high outside the range of what is considered physically possible for a given system, indicating that a short to a high source has occurred.
Region h	Range defined as below normal, least severe level of what is considered normal for a given real-world measurement.
Region I	Range defined as above normal, least severe level of what is considered normal for a given real-world measurement.
Region j	Range defined as below normal, moderately severe level of what is considered normal for a given real-world measurement.
Region k	Range defined as above normal, moderately severe level of what is considered normal for a given real-world measurement.

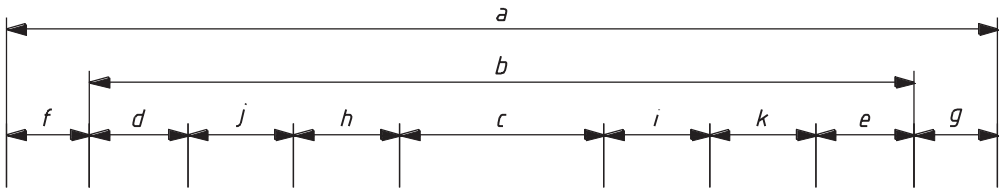


Figure E.1 — Signal ranges

E.3 FMI descriptions

The following are detailed descriptions of each FMI, using the definitions given in E.2.

E.3.1 FMI = 0 (Data valid but above normal operation range — Most severe level)

The signal communicating information is within a defined, acceptable, and valid range, but the real-world condition is above what would be considered normal as determined by the predefined most severe level limits for that particular measure of the real-world condition (Region e of the signal range definition). Broadcast of data values is continued as normal.

E.3.2 FMI = 1 (Data valid but below normal operational range — Most severe level)

The signal communicating information is within a defined, acceptable, and valid range, but the real-world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real-world condition (Region d of signal range definition). Broadcast of data values is continued as normal.

E.3.3 FMI = 2 (Data erratic, intermittent, or incorrect)

Erratic or intermittent data include all measurements that change at a rate not considered possible in real-world conditions, and that must be caused by improper operation of the measuring device or its connection to the module. Broadcast of data value is replaced by the “error indicator” value.

Incorrect data include any data not received and any data that are exclusive of the situations covered by FMIs 3, 4, 5, and 6 as follows, see E.3.4 to E.3.7. Data can also be considered incorrect if they are inconsistent with other information collected or known about the system. This FMI is applicable to rationality-type failures.

E.3.4 FMI = 3 (Voltage above normal, or shorted to high source)

a) A voltage signal, data or otherwise, is above the predefined limits that bound the range (Region g of the signal range definition). Broadcast of data value is replaced by the “error indicator” value.

b) Any signal external to an electronic control module whose voltage remains at a high level when the control function commands it to low. Broadcast of data value is replaced by the “error indicator” value.

E.3.5 FMI = 4 (Voltage below normal, or shorted to low source)

a) A voltage signal, data or otherwise, is below the predefined limits that bound the range (Region f of the signal range definition). Broadcast of data value is replaced by the “error indicator” value.

b) Any signal external to an electronic control module whose voltage remains at a low level when the control function commands it to high. Broadcast of data value is replaced by the “error indicator” value.

E.3.6 FMI = 5 (Current below normal or open circuit)

a) A current signal, data or otherwise, is below the predefined limits that bound the range (Region f of the signal range definition). Broadcast of data value is replaced by the "error indicator" value.

b) Any signal external to an electronic control module whose current remains off when the control function commands it on. Broadcast of data value is replaced by the "error indicator" value.

E.3.7 FMI = 6 (Current above normal or grounded circuit)

a) A current signal, data or otherwise, is above the predefined limits that bound the range (Region g of the signal range definition). Broadcast of data value is replaced by the "error indicator" value.

b) Any signal external to an electronic control module whose current remains on when the control function commands it off. Broadcast of data value is replaced by the "error indicator" value.

E.3.8 FMI = 7 (Mechanical system not responding or improperly adjusted)

Any fault that is detected as the result of an improper mechanical adjustment, an improper response or action of a mechanical system, which, with a reasonable level of confidence, is not caused by an electronic or electrical system failure. This type of fault can or cannot be directly associated with the value of general broadcast information. This FMI is applicable to rationality-type failures.

E.3.9 FMI = 8 (Abnormal frequency or pulse width or period)

To be considered in cases of FMI 4 and FMI 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside Region b or the signal definition). Also, if the signal is a control function output, any signal whose frequency or duty cycle is not consistent with the signal which is emitted. Broadcast of data value is replaced by the "error indicator" value.

E.3.10 FMI = 9 (Abnormal update rate)

Any failure that is detected when receipt of data through the data network, as an input from a smart actuator or smart sensor, is not at the update rate expected or required by the control function (outside Region c of the signal range definition). Also, this fault can be any error that causes the control function not to send information at the rate required by the system. This type of fault can or cannot be directly associated with the value of general broadcast information. This FMI is applicable to rationality-type failures.

E.3.11 FMI = 10 (Abnormal rate of change)

Any data, exclusive of the abnormalities covered by FMI 2, that are considered valid but which are changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside Region c of the signal range definition). Broadcast of data values is continued as normal. This FMI is applicable to rationality-type failures.

E.3.12 FMI = 11 (Root cause not known)

It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known. Broadcast of data value is replaced by the "error indicator" value.

E.3.13 FMI = 12 (Bad intelligent unit or component)

Internal diagnostic procedures have determined that the failure is one which requires the replacement of the ECU, meaning the packaged unit that includes a microprocessor and its associated components and circuits. It can be assumed that the communications subsystem is not the part that has failed, and that the manufacturer has determined that there is no serviceable component smaller than the ECU involved in the failure. Broadcast of data value is replaced by the "error indicator" value if appropriate, as there can or cannot be any broadcast data involved. This error is to include all internal control function trouble codes that cannot be caused by connections or systems external to the control function. This FMI is applicable to rationality-type failures.

E.3.14 FMI = 13 (Out of calibration)

A failure that can be identified as the result of improper calibration. This is the case in which a subsystem can identify that the calibration attempting to be used by the control function is out of date; or it can be the case that the mechanical subsystem is determined to be out of calibration. This failure mode does not relate to the signal range definition as do many of the FMIs. This FMI is applicable to rationality-type failures.

E.3.15 FMI = 14 (Special instructions)

"Special instructions" is the FMI to be used when the on-board system can isolate the failure to a small number of choices but not to a single point of failure. When this FMI is used, there is a clear necessity for the service technician to take some action to complete the specific diagnosis, and normally the manufacturer would have provided instructions for the completion of that diagnosis. There are two cases in which this will be used.

a) for emission-related diagnostics where it cannot be determined whether the particular failure was due to a sensor being out of range or a case of the actual value being at the edge of a diagnostic region;

b) for the older SPN 611 to SPN 615 where the problem is in determining which of two or more circuits (which can interact) is the one that needs to be repaired.

SPN 611 to SPN 615 are defined as "System Diagnostic Codes", and are used to identify failures that cannot be tied to a specific field-replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs allow the manufacturer some flexibility to communicate non-specific component diagnostic information. Since SPN 611 to SPN 615 use the standard SPN/FMI format, they allow for the use of standard diagnostic tools, electronic dashboards, satellite systems, and other advanced devices that scan parameter groups containing the SPN/FMI formats. Because manufacturer-defined codes are not desirable in terms of standardization, the use of these codes can only occur when diagnostic information cannot be communicated as a specific component and failure mode.

Possible reasons for using a System Diagnostic Code include:

— cost of specific component fault isolation is not justified;

— new concepts in total vehicle diagnostics are being developed;

— new diagnostic strategies that are not component-specific are being developed.

Because SPN 611 to SPN 615 are manufacturer-defined and are not component-specific, FMI 0 to FMI 13 and FMI 15 to FMI 31 have little meaning. Therefore, FMI 14, "Special instructions", is usually used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code. This failure mode does not relate to the signal range definition as do many of the FMIs. This type of fault can or cannot be directly associated with the value of general broadcast information. This FMI is applicable to rationality-type failures.

E.3.16 FMI = 15 (Data valid but above normal operating range — Least severe level)

The signal communicating information is within a defined, acceptable, and valid range, but the real-world condition is above what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real-world condition (Region i of signal range definition). Broadcast of data values is continued as normal.

E.3.17 FMI = 16 (Data valid but above normal operating range — Moderately severe level)

The signal communicating information is within a defined, acceptable, and valid range, but the real-world condition is above what would be considered normal as determined by the predefined moderately

severe level limits for that particular measure of the real-world condition (Region k of signal range definition). Broadcast of data values is continued as normal.

E.3.18 FMI = 17 (Data valid but below normal operating range — Least severe level)

The signal communicating information is within a defined, acceptable, and valid range, but the real-world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real-world condition (Region h of signal range definition). Broadcast of data values is continued as normal.

E.3.19 FMI = 18 (Data valid but below normal operating range — Moderately severe level)

The signal communicating information is within a defined acceptable and valid range, but the real-world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real-world condition (Region j of signal range definition). Broadcast of data values is continued as normal.

E.3.20 FMI = 19 (Received network data in error)

Any failure that is detected when the data received through the network are found replaced by the "error indicator" value (i.e. FE_{16}, see ISO 11783-3). This type of failure is associated with received network data. The component used to measure the real-world signal is wired directly to the module sourcing the data to the network and not to the module receiving the data via the network. This FMI is applicable to Regions f and g of the signal range definition. This type of fault can or cannot be directly associated with the value of general broadcast information.

E.3.21 FMI = 20-30 (Reserved for future assignment)

These FMIs are reserved for future assignments.

E.3.22 FMI = 31 (Condition exists)

This FMI is used to indicate that the condition that is identified by the SPN exists when no applicable FMI exists or in cases when the reported SPN name spells out the component and a non-standard failure mode. This type of fault can or cannot be directly associated with the value of general broadcast information. This FMI will mean "not available" when the associated SPN is also "not available", as when the remainder of a packet is filled with binary ones after all data have been transmitted. This FMI is applicable to rationality-type failures.

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