International Standard

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Fifth edition
2026-03

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

Part 3: Application layer, transport layer and network layer

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

Partie 3: Couche d'application, couche transport et couche réseau

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Contents

Page

Foreword

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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 document 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).

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

This fifth edition cancels and replaces the fourth edition (ISO 11783-3:2018), which has been technically revised.

The main changes are as follows:

— term entries have been added in Clause 3;

— former Annex A has been deleted, and subsequent annexes have been relabelled;

— default priority has been replaced by assigned priority;

— transport protocol abort handling has been improved to unambiguously close a transport session;

— proprietary B PG has been added to data page one;

— length limit for Proprietary A and Proprietary A2 PGs have been removed;

— usage of 11-bit CAN IDs has been limited;

— a control function responding with a NACK when receiving unsupported PDU1 type messages has been made possible.

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

The ISO 11783 series specifies a communications system for agricultural equipment based on the ISO 11898-1 CAN protocol. The SAE J1939 series[1)], on which parts of ISO 11783 series are based, were developed jointly for use in truck and bus, construction, and agriculture applications. Joint documents have been 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 the ISO 11783 series can be found in ISO 11783-1.

The purpose of the ISO 11783 series 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.

1) Society of automotive engineers.

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

Part 3:
Application layer, transport layer and network layer

1 Scope

This document specifies the open system interconnections (OSI) application layer, the transport, and the network layer, as well as the mapping to the controller area network (CAN) data link layer protocol as specified in ISO 11898-1. The application layer specifies messages, which are mapped to CAN CC data frames using the classic extended frame format (CEFF). For messages exceeding the length of the CEFF-formatted data frames, this document specifies transport layer and network layer protocols based on the SAE J1939-21 recommended practice.

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 11783-5, *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 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical coding sublayer*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11783-1, ISO 11898-1 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 https://www.electropedia.org/

3.1
multi-packet message
message that does not fit into the data field of a single CAN data frame (i.e. messages with more than eight byte of parameters)

3.2
data transfer packet
packet that contains data which is part of a larger message communicated using either TP.DT or ETP.DT

3.3
request to send
RTS
message used to gain approval to send a block of data

3.4
clear to send
CTS
message used to grant approval to a sender of a block of data

3.5
group function value
GFV
unsigned eight-bit number that identifies a unique parameter or sequence of parameters in a dedicated PG

Note 1 to entry: The values follow the recommendations for one-byte parameter given in ISO 11783-7.

3.6
extended group function value
EGFV
one-, two- or three-byte number that identifies a unique parameter or sequence of parameters in a dedicated PG

Note 1 to entry: The interpretation of the values is proprietary and defined by the manufacturer.

3.7
message
protocol entity of the application layer such as parameter groups (PG)

3.8
controller area network
CAN
serial communication technology covering the data link layer and the physical coding sublayer in accordance with ISO 11898-1 as well as the physical medium attachment (PMA) sublayer in accordance with ISO 11898-2

Note 1 to entry: There are three frame format types specified: CAN CC (classic), CAN FD (flexible data rate) and CAN XL (extended data field length). This document series uses only CAN CC frame formats.

Note 2 to entry: There are five PMA types specified: CAN HS (high-speed), CAN FD, CAN SIC (signal improvement capability), CAN SIC XL, and CAN FT (fault-tolerant). This document series uses only the CAN HS type.

3.9
source address
SA
number identifying the originator CF of a message

3.10
destination address
DA
number identifying the consumer CF of a message

4 Abbreviated terms

ACK	acknowledgement
CAN CC	CAN classic
CAN FD	CAN flexible data rate
CAN XL	CAN extended data field length
CBFF	classic basic frame format
CEFF	classic extended frame format
CF	control function
CRC	cyclic redundancy check
DP	data page
EDP	extended data page
EGFV	extended group function value
EOF	end of frame
PDU	protocol data unit
PF	PDU format
PS	PDU specific
GE	group extension
GFI	group function index
IDE	identifier extension
N/A	not applicable
RTR	remote transmission request
SOF	start of frame
SRR	substitute remote request bit

5 Technical requirements

5.1 Mapping of messages to CAN data frames

5.1.1 General requirements and recommendations

Messages specified in this document shall be mapped to CAN data frames in CEFF using 29-bit identifier fields. CAN data frames in CBFF may be transmitted for proprietary purposes (for details, see 5.1.4). A CF conformant with this document shall not transmit CAN FD data frames and CAN XL data frames as well as CAN remote frames.

NOTE The CAN data link layer entity sends CAN error frames and CAN overload frames as specified in ISO 11898-1.

5.1.2 Mapping of ISO 11783 messages to CAN data frames in CEFF

The CEFF message, illustrated in Figure 1, encompasses a single protocol data unit (PDU). The PDU consists of seven predefined fields, assimilated from information provided by the application layer:

— priority;

— EDP;

— DP;

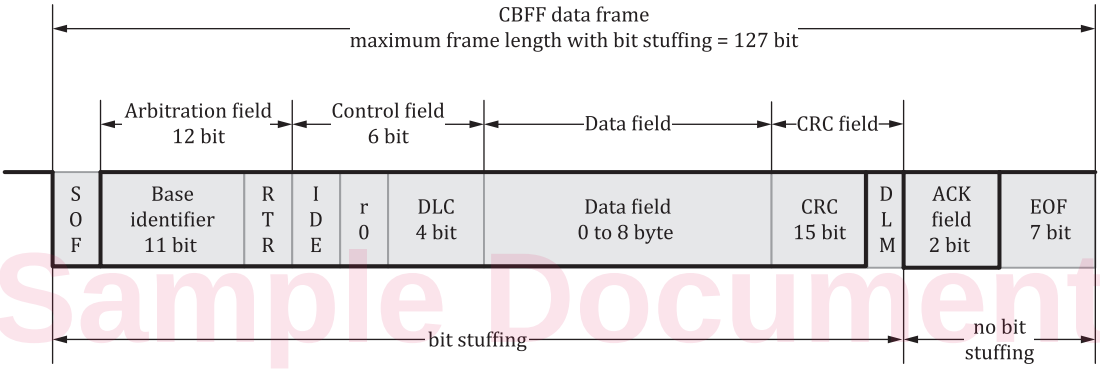
— PF;

— PS, which can be DA, GE;

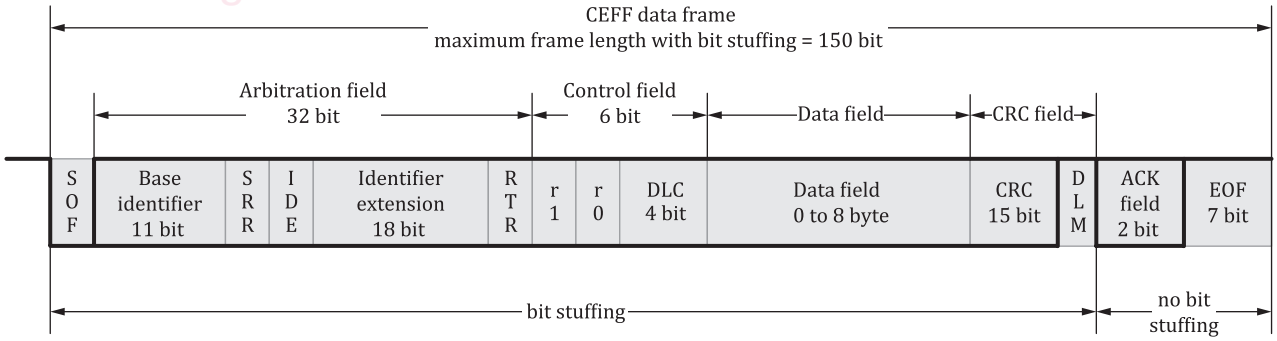
— SA;

— data.

See 5.2 for a detailed description of each field, and 5.3 for PDU formats.



a) CBFF



b) CEFF

Figure 1 — CAN CC data frames

The fields are then packaged into one CAN CC data frame and sent over the physical media to other network controllers. The layers of the OSI model that ISO 11783 series supports are shown in Figure 2. It is possible that some PG definitions require more than one CAN CC data frame in order to send their information.

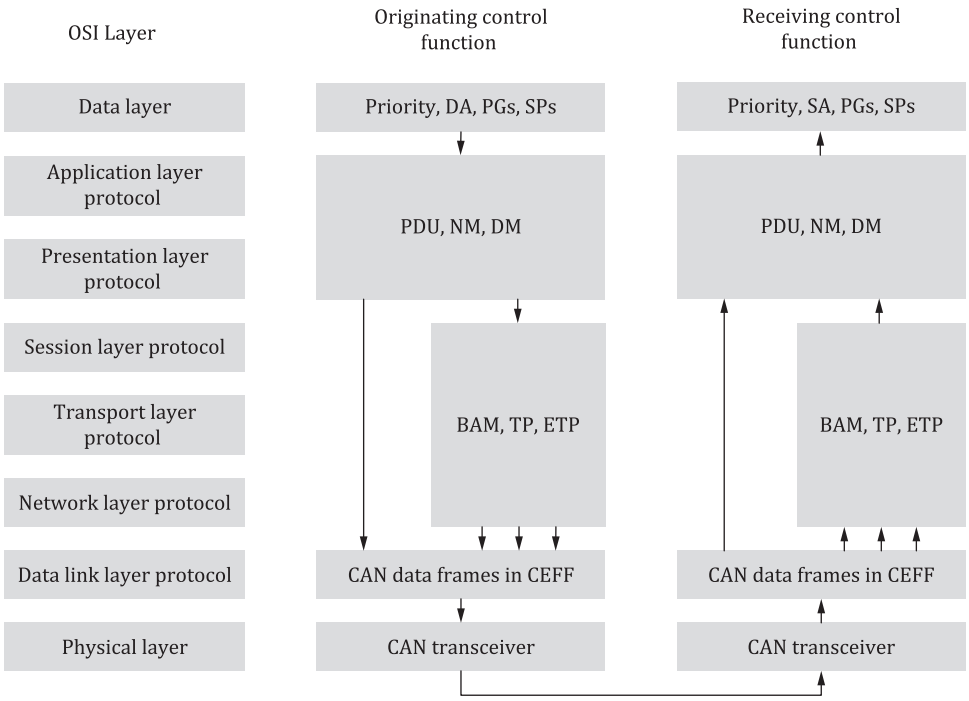


Figure 2 — Application of OSI model according to ISO 11783 series

Table 1 shows the arbitration and control fields of the 29-bit identifier for CAN, 29-bit identifier for the ISO 11783 series and 11-bit identifier for CAN, and the use of the 11-bit identifier on an ISO 11783 series-defined network. A complete definition for each of the bit field assignments according to ISO 11783 series is given in 5.3. In the ISO 11783 series, the CAN data frame data field is described as bytes one to eight. Byte one's most significant bit, bit eight, is the first bit sent closest to the data length code (DLC). Byte eight's least significant bit, bit one, is the last of the data bits to be sent and is closest to the cyclic redundancy check (CRC) field. See Figure 3.

Table 1 — Mapping of ISO 11783 fields into CAN arbitration and control fields

29-bit CAN identifier		11-bit CAN identifier	
CAN	**ISO 11783**	**CAN**	**ISO 11783**
ID28	P3	ID28	P3
ID27	P2	ID27	P2
ID26	P1	ID26	P1
ID25	EDP	ID25	SA8
ID24	DP	ID24	SA7
ID23	PF8	ID23	SA6
ID22	PF7	ID22	SA5
ID21	PF6	ID21	SA4
ID20	PF5	ID20	SA3
ID19	PF4	ID19	SA2
ID18	PF3	ID18	SA1
ID17	PF2	-	-
ID16	PF1	-	-
ID15	PS8	-	-
ID14	PS7	-	-
ID13	PS6	-	-

Table 1 *(continued)*

29-bit CAN identifier		11-bit CAN identifier	
CAN	**ISO 11783**	**CAN**	**ISO 11783**
ID12	PS5	-	-
ID11	PS4	-	-
ID10	PS3	-	-
ID9	PS2	-	-
ID8	PS1	-	-
ID7	SA8	-	-
ID6	SA7	-	-
ID5	SA6	-	-
ID4	SA5	-	-
ID3	SA4	-	-
ID2	SA3	-	-
ID1	SA2	-	-
ID0	SA1	-	-

P#	Priority bit number (#) according to this document
EDP	Extended data page according to this document
SA#	Source address bit number (#) according to this document
DP	Data page according to this document
PF#	PDU format bit number (#) according to this document
PS#	PDU specific bit number (#) according to this document

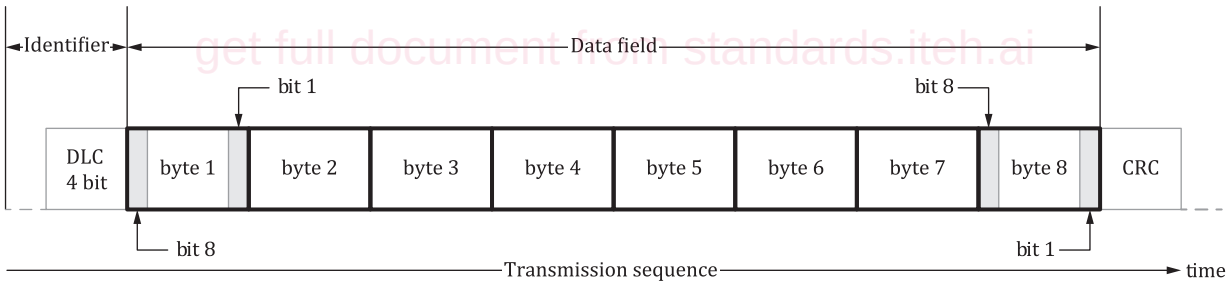


Figure 3 — CAN CC data field

5.1.3 Parameter group numbers (PGN)

Mapping of the 18-bit PGN in the 24-bit PG data field is done as follows.

The 24-bit value shall be sent the least significant byte (LSB) first [see Table 2, also according to which the most significant byte (MSB) is sent third and the middle byte second]. The 24-bit PGN shall be determined from the following constituent components: six bit set to zero, EDP bit, DP bit, PF field (eight bit) and PS field (eight bit).

The procedure for the bit fields to be converted to PGN is as follows.

The six most significant bits of the PGN shall be set to zero. Then the EDP bit, DP bit and PF field shall be copied into the next 10 bit. If the PF value is less than 240 ($F0_{16}$), then the LSB of the PGN shall be set to

zero. Otherwise, it may be set to the value of the PS field. See Table 2 for an illustration of the PGN, their corresponding bits and their conversion to a decimal number.

NOTE Not all 131 072 combinations (2^{17}) are available to be assigned as PGN. Only a total of 8 672 combinations are available for assignment {calculated as: 2 pages × [240 + (16 × 256)] = 8 672}, using the conventions specified in this document. See ISO 11783-1 for the latest PGN assignments.

Table 2 — Parameter group number examples

PGN constituent components					PGN (hex.)	Numbers of assignable PGs	Cumulative numbers of PGs	Assigned by
PGN (MSB) Byte 1 sent third in CAN data field			PGN Byte 2 sent second in CAN data field	PGN (LSB) Byte 3 sent first in CAN data field				
Bit 8 to 3	EDP	DP	PF	PS				
	Bit 2	Bit 1	Bit 8 to 1	Bit 8 to 1				
0	0	0	0 to 238	0	000000 to 00EE00	239	239	ISO
0	0	0	239	0	00EF00	1	240	MF
0	0	0	240 to 254	0 to 255	00F000 to 00FEFF	3 840	4 080	ISO
0	0	0	255	0 to 255	00FF00 to 00FFFF	256	4 336	MF
0	0	1	0 to 238	0	010000 to 01EE00	239	4 575	ISO
0	0	1	239	0	01EF00	1	4 576	MF
0	0	1	240 to 255	0 to 255	01F000 to 01FFFF	4 096	8 672	ISO

Key
MF Manufacturer

5.1.4 ISO 11783 support of ISO 11898-1 data frames in CBFF

Controllers on the network, based on ISO 11783 series may support data frames in CBFF. Though these are not compatible with the ISO 11783 series message structure, to accommodate the co-existence of the two formats, a minimum level of definition is given. This minimum definition allows controllers that use this format to reduce the interference with other controllers. CBFF messages are defined as being proprietary. CBFF messages should not be transmitted, because of real-time and timing-behaviour impacts for the messages standardized in ISO 11783 series. In reference to Table 1, the 11-bit CAN identifier field is parsed as follows: the three most significant bits are used as priority bits; the eight least significant bits identify the SA of the PDU. Priority bits are described in 5.2.2. The SA is described in 5.2.7.

Incorrect bus arbitration can occur when two messages, one base frame and one extended frame, access the bus at the same time. The SA is a higher relative priority in the base frame messages than in the extended frame messages. The message with an 11-bit CAN identifier (base frame) can have an SA indicating a higher priority than that of the EDP bit, DP bit and PF of the 29-bit CAN identifier (extended frame) message. The three priority bits should be used to achieve the correct bus arbitration.

5.2 Protocol data unit (PDU)

5.2.1 General

The protocol data unit (PDU), as specified in this document, shall consist of the seven fields listed in 5.1.2 and those specified below. These fields shall then be packaged into one or more CAN CC data frames and sent over the physical media to other network controllers. There is only one PDU per CAN CC data frame possible.

NOTE Some PG definitions require more than one CAN CC data frame for sending the corresponding data.

Certain bits of the CAN CC data frame fields are left out of the PDU definition because they are controlled entirely by the CAN data link layer. These include the SOF, SRR, IDE, RTR, CRC, ACK and EOF fields, and parts of the control field.

The PDU fields (see Figure 4) are specified in 5.2.2 to 5.2.8.

	Priority	EDP	DP	PF	PS	SA	Data
No. of bits	3	1	1	8	8	8	64

Figure 4 — PDU fields

5.2.2 Priority (P)

5.2.2.1 Priority field

The three bits of the Priority field (P3, P2, P1) shall be mapped into the three highest priority CAN identifier bits (as specified in Table 1). On the receiving CAN nodes, the Priority field shall be ignored.

The Priority field value of 000_2 has the highest priority and the value of 111_2 has the lowest priority according to ISO 11898-1. See Annex B for additional information about on assignment of priority values to messages.

5.2.2.2 Assigned priority

Messages with an assigned priority shall use the assigned priority.

NOTE 1 The assigned priority is intended to achieve the application-required latency for messages.

NOTE 2 Transport protocol messages (see 5.9.4, 5.9.5, 5.10.5.2 and 5.10.6) use their assigned priority and the assigned priority of the transported PG is not used.

5.2.2.3 Default priority

Messages with a default priority should be sent with the priority given in Annex B. Messages with the default priority may be sent with the priority as specified for the message.

5.2.3 Extended data page (EDP)

The EDP bit is used in conjunction with the DP bit to determine the structure of the CAN identifier of the CAN CC data frame. The EDP bit shall be set to zero on transmitted messages. (See Table 3 for the defined uses of the EDP and DP fields.)

5.2.4 Data page (DP)

The DP bit is used in conjunction with the EDP bit to determine the structure of the CAN identifier of the CAN CC data frame. With the EDP bit set to zero, the DP bit selects between page zero and page one of the PG descriptions. See Table 3.

Table 3 — Definition of extended data page (EDP) and data page (DP) use

EDP Bit 25	**DP Bit 24**	**Description**
CAN ID Bit 25	**CAN ID Bit 24**	
0	0	ISO 11783 page 0 PG
0	1	ISO 11783 page 1 PG
1	0	Reserved by SAE J1939 series
1	1	Reserved by SAE J1939 series

NOTE There is no mapping of DP 10_2 and 11_2 to a CAN identifier specified.

5.2.5 PDU format (PF)

PF is an 8-bit field determining the PDU format as specified in Table 4.

Table 4 — Definition of PDU specific (PS) field

PDU format	PF	PS
PDU1	00_{16} to EF_{16}	Destination address (DA)
PDU2	$F0_{16}$ to FF_{16}	Group extension (GE)

5.2.6 PDU specific (PS)

PS is an 8-bit field containing either the DA or GE. See Table 4.

In case of a DA of 00_{16} to FD_{16} (specific address), only the addressed CF shall process the message; other CFs should ignore it. If the DA is FF_{16} (global address), each CF shall process the message.

NOTE 1 DA of FE_{16} (NULL address) is not applicable as DA.

The GE field, in conjunction with the four least significant bits of the PF field, provides 4 096 additional PDU2 PGs per data page.

NOTE 2 When the four most significant bits of the PDU format field are set, it indicates that the PS field is a GE field.

In addition, 240 PGs are provided in each data page for use only in the destination-specific format PDU (PDU1 format). In total, 8 672 PGs are available to be defined using the two data pages available.

This total is calculated using Formula (1):

$$[240 + (16 \times 256)] \times 2 = 8\,672 \quad (1)$$

where

240 is the number of PDU format field values available per data page (i.e. PDU1 format, PS field = DA);

16 is the number of PDU format values per GE value (i.e. PDU2 format only);

256 is the number of possible GE values (i.e. PDU2 format only);

2 is the number of data page states (both PDU formats).

See also 5.3.

5.2.7 Source address (SA)

The SA is an 8-bit field. A CF shall use only one SA. There shall only be one CF on the network with a given SA.

NOTE For address management and allocation, and procedures to prevent duplication of SA, see ISO 11783-5.

5.2.8 PG data field

5.2.8.1 PG data field with fixed length from zero byte to eight byte

When a PG needs eight or less data bytes for transporting parameters, then it can be mapped into a single CAN data frame in CEFF. PGs should allocate eight byte of the CAN data field independent of the size of the mapped parameters. This provides a means of adding parameters and avoiding incompatibility with previous revisions that only define part of the CAN data field. The remaining, not used, CAN data field bytes shall be defined as “not available” (see ISO 11783-7:2022, 5.5.9). When the number of parameter data bytes associated with a PG is specified, it cannot be changed. For example, the Request PG (PGN 59 904), has a PG data length of three byte, so the CAN DLC is set to three.

NOTE A group function (see 5.4.6), for example VT-commands (as specified in ISO 11783-6:2018, C.1), uses the same data field length because the PG is the same.