INTERNATIONAL STANDARD

ISO 11898-1

Second edition
2015-12-15

Road vehicles — Controller area network (CAN) —

Part 1: Data link layer and physical signalling

Véhicules routiers — Gestionnaire de réseau de communication (CAN) —

Partie 1: Couche liaison de données et signalisation physique

Reference number
ISO 11898-1:2015(E)

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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 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).

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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 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 11898-1:2003), which has been technically revised. It also incorporates the Corrigendum ISO 11898-1:2003/Cor 1:2006.

ISO 11898 consists of the following parts, under the general title *Road vehicles — Controller area network (CAN)*:

— *Part 1: Data link layer and physical signalling*

— *Part 2: High-speed medium access unit* [1)]

— *Part 3: Low-speed, fault-tolerant, medium-dependent interface*

— *Part 4: Time-triggered communication*

— *Part 5: High-speed medium access unit with low-power mode* [1)]

— *Part 6: High-speed medium access unit with selective wake-up functionality* [1)]

1) Parts 2, 5, and 6 are being revised. They will be merged under a new edition of Part 2.

Introduction

ISO 11898 was first published as one document in 1993. It covered the CAN data link layer, as well as the high-speed physical layer.

In the reviewed and restructured ISO 11898 series:

— Part 1 defines the data link layer including the logical link control (LLC) sub-layer and the medium access control (MAC) sub-layer, as well as the physical signalling (PHS) sub-layer;

— Part 2 defines the high-speed physical medium attachment (PMA);

— Part 3 defines the low-speed fault-tolerant physical medium attachment (PMA);

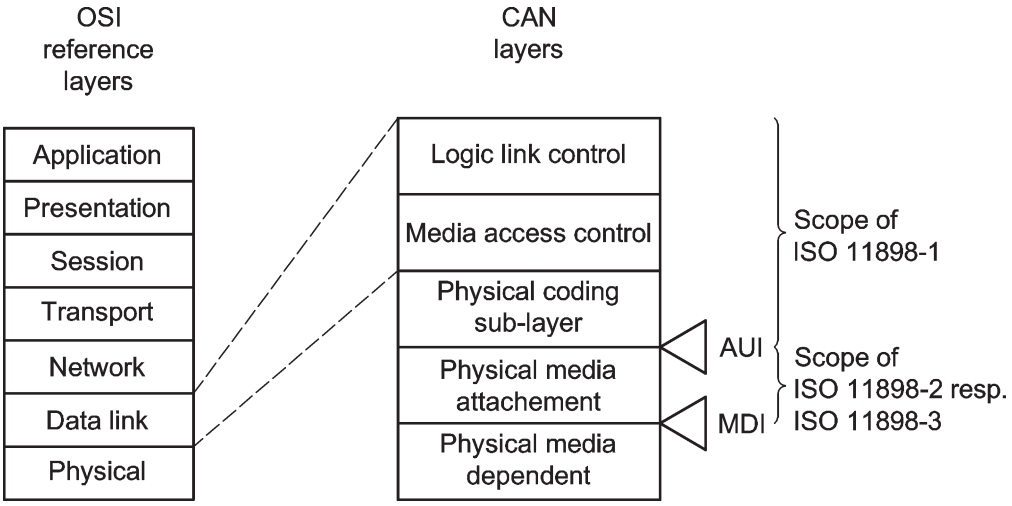
— Part 4 defines the time-triggered communication;

— Part 5 defines the power modes of the high-speed physical medium attachment (PMA);

— Part 6 defines the selective wake-up functionality of the high-speed physical medium attachment (PMA).

NOTE ISO 11898-2 is updated in parallel to the update of this part of ISO 11898 to combine the functions described in ISO 11898-2, ISO 11898-5 and ISO 11898-6. (The future edition of ISO 11898-2 will cancel and replace the current ISO 11898-2:2003, ISO 11898-5:2007 and ISO 11898-6:2013)

Figure 1 shows the relations between the OSI reference layers and the parts of the ISO 11898 series.



NOTE ISO 11898-2 refers to the future edition that will cancel and replace the current ISO 11898-2:2003, ISO 11898-5:2007 and ISO 11898-6:2013.

Figure 1 — CAN data link and physical sub-layers relation to the OSI model

Road vehicles — Controller area network (CAN) —

Part 1:
Data link layer and physical signalling

1 Scope

This part of ISO 11898 specifies the characteristics of setting up an interchange of digital information between modules implementing the CAN data link layer. Controller area network is a serial communication protocol, which supports distributed real-time control and multiplexing for use within road vehicles and other control applications.

This part of ISO 11898 specifies the Classical CAN frame format and the newly introduced CAN Flexible Data Rate Frame format. The Classical CAN frame format allows bit rates up to 1 Mbit/s and payloads up to 8 byte per frame. The Flexible Data Rate frame format allows bit rates higher than 1 Mbit/s and payloads longer than 8 byte per frame.

This part of ISO 11898 describes the general architecture of CAN in terms of hierarchical layers according to the ISO reference model for open systems interconnection (OSI) according to ISO/IEC 7498-1. The CAN data link layer is specified according to ISO/IEC 8802-2 and ISO/IEC 8802-3.

This part of ISO 11898 contains detailed specifications of the following (see Figure 2):

— logical link control sub-layer;

— medium access control sub-layer;

— physical coding sub-layer.

There are three implementation options. They are the following:

— support of the Classical CAN frame format only, not tolerating the Flexible Data Rate frame format;

— support of the Classical CAN frame format and tolerating the Flexible Data Rate frame format;

— support of the Classical CAN frame format and the Flexible Data Rate frame format.

The last option is recommended to be implemented for new designs.

NOTE Implementations of the first option can communicate with implementations of the third option only as long as the Flexible Data Rate frame format is not used; otherwise, Error Frames are generated. There are opportunities to run implementations of the first option also in CAN networks using the Flexible Data Rate frame format, but these are not in the scope of this part of ISO 11898.

2 Conformance

The data link layer conformance test plan is not in the scope of this part of ISO 11898. For an implementation to be compliant with this part of ISO 11898, the logical link control sub-layer and the medium access control sub-layer shall comply with all mandatory specifications and values given in this part of ISO 11898. If optional specifications and values are implemented, they shall comply, too.

3 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/IEC 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model — Part 1*

ISO/IEC/IEEE 8802-3:2014, *Standard for Ethernet — Part 3*

4 Terms and definitions

For the purpose of this part of ISO 11898, the following terms and definitions apply.

4.1
arbitration phase
phase where the nominal bit time is used

4.2
bit stuffing
frame coding method providing bus state changes required for periodic resynchronization when using an NRZ bit representation

Note 1 to entry: Whenever the transmitting logic encounters a certain number (stuff width) of consecutive bits of equal value in the data, it automatically stuffs a bit of complementary value—a stuff bit—into the outgoing bit stream. Receivers de-stuff the Data Frames and the Remote Frames, i.e. the inverse procedure is carried out.

4.3
bus
topology of a communication network, where all nodes are reached by passive links which allow transmission in both directions

4.4
bus comparator
electronic circuit converting physical signals used for transfer across the communication medium back into logical information or data signals

4.5
bus driver
electronic circuit converting information or data signals into physical signals so that these signals can be transferred across the communication medium

4.6
bus state
one of two complementary logical states: dominant or recessive

Note 1 to entry: The dominant state represents the logical 0, and the recessive state represents the logical 1. During simultaneous transmission of dominant and recessive bits, the resulting bus state is dominant. When no transmission is in progress, the bus is idle. During idle time, it is in recessive state

4.7
Classical Base Frame Format
format for Data Frames or Remote Frames using an 11-bit identifier, which are transmitted with one single bit rate and up to and including 8 data bytes

4.8
Classical Extended Frame Format
format for Data Frames or Remote Frames using a 29-bit identifier, which are transmitted with one single bit rate and up to and including 8 data bytes

4.9
Classical Frame
Data Frame or Remote Frame using the Classical Base Frame Format or the Classical Extended Frame Format

4.10
content-based arbitration
CSMA arbitration procedure resolving bus-contention when multiple nodes simultaneously access the bus

4.11
data bit rate
number of bits per time during data phase, independent of bit encoding/decoding

4.12
data bit time
duration of one bit in data phase

4.13
Data Frame
frame containing user data (e.g. one or more signals or one or more suspect parameters of one or more process data)

4.14
data phase
phase where the data bit time is used

4.15
edge
difference in bus-states between two consecutive time quanta

4.16
Error Frame
frame indicating the detection of an error condition

4.17
FD enabled
able to receive and to transmit FD Frames, as well as Classical Frames

4.18
FD Base Frame Format
format for Data Frames using an 11-bit identifier, which are transmitted with a flexible bit rate and up to and including 64 data bytes

4.19
FD Extended Frame Format
format for Data Frames using a 29-bit identifier, which are transmitted with a flexible bit rate and up to and including 64 data bytes

4.20
FD Frame
Data Frame using the FD Base Frame Format or FD Extended Frame Format

4.21
FD intolerant
only able to receive or to transmit Classical Frames, disturbing FD Frames

4.22
FD tolerant
not able to receive or to transmit FD Frames but not disturbing them