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Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 3: Application layer for equipment other than brakes and running gear

Véhicules routiers — Échange d'informations numériques sur les connexions électriques entre véhicules tracteurs et véhicules tractés —

Partie 3: Couche d'application pour les équipements autres que les équipements de freinage et les organes de roulement

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 11992-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 11992-3:1998), reviewed in the light of changing legislative requirements and which has been technically revised.

ISO 11992 consists of the following parts, under the general title *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles*:

— *Part 1: Physical layer and data-link layer*

— *Part 2: Application layer for brakes and running gear*

— *Part 3: Application layer for equipment other than brakes and running gear*

Part 4, *Diagnostics*, is under preparation.

Introduction

This part of ISO 11992 is subject to additions which will become necessary in order to keep pace with experience and technical advances. Care has been taken to ensure that these additions can be introduced in a compatible way, and care will have to be taken in the future so that such additions remain compatible with previous versions. In particular, it may become necessary to standardize new parameters and parameter groups. ISO members may request that such new parameters and parameter groups be included in future editions of ISO 11992 by completing the *Parameter identification form* in Annex A and submitting it to ISO/TC 22/SC 3.

Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 3: Application layer for equipment other than brakes and running gear

1 Scope

This part of ISO 11992 specifies the parameters and messages for electronically controlled braking systems other than systems for braking and running gear (i.e. steering, suspension and tyres), to ensure the interchange of digital information between road vehicles with a maximum authorized total mass greater than 3 500 kg and their towed vehicles, including communication between towed vehicles.

The objective of the data structure is to optimize the use of the interface, while preserving a sufficient reserve capacity for future expansion.

2 Normative references

The following referenced documents are indispensable for the application 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 11898:1993[1)], *Road vehicles — Interchange of digital information — Controller area network (CAN) for high-speed communication*

ISO 11992-1, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 1: Physical layer and data-link layer*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11992-1 apply.

4 Abbreviations

ABS Anti-lock Braking System

ASR Anti Spin Regulation (traction control system)

CAN Controller Area Network

1) Amended in 1995. Under revision.

DA	Destination Address
DP	Data Page
ECU	Electronic Control Unit
GE	Group Extension
GPM	General Purpose Message
MSB	Most Significant Byte
ODD	Obstacle Detection Device
P	Priority
PDU	Protocol Data Unit
PF	PDU Format
PGN	Parameter Group Number
PS	PDU-Specific
PTO	Power Take-Off
R	Reserved
SA	Source Address

5 General specifications

The data link and the physical layer shall be in accordance with ISO 11992-1.

To minimize bus loading on the towing/towed vehicle interface, appropriate messages are specified. These messages may be filtered by a device (node) on each vehicle that shall also provide address assignment and electrical isolation from the in-vehicle subnetwork.

The architecture was chosen to allow any combination of new and old towing and towed vehicles. Multiple towed vehicles can be connected in any combination; the network shall be capable of addressing any towed vehicle, including dollies. The truck operator can disconnect and connect towed vehicles at any time and in any order and the network shall adjust and respond accordingly.

6 Application layer

6.1 Message frame format

6.1.1 General

The application layer provides a string of information that is assimilated into a protocol data unit (PDU). The PDU provides a framework for organizing the information which will be sent by the CAN data frame.

The 29 bit identifier shall be in accordance with ISO 11898.

The PDU shall consist of seven fields in addition to the specific CAN fields (see Figure 1).

The PDU fields are Priority (P), Reserved (R), Data Page (DP), PDU Format (PF), PDU Specific (PS) — which can be a Destination Address (DA) or a Group Extension (GE) — Source Address (SA) and data field.

	P	R	DP	PF	PS	SA		Data field
Bits	3	1	1	8	8	8		0 to 64

Figure 1 — 29-bit CAN identifier

6.1.2 Priority

The three priority bits are used to optimize message latency for transmission onto the bus only. They shall be globally masked off by the receiver (ignored). The priority of any message may be set from highest, 0 (000_2), to lowest, 7 (111_2). The default for all control oriented messages is 3 (011_2). The default of all other informational messages is 6 (110_2).

6.1.3 Reserved bit (R)

The reserved bit is reserved for future expansion. This bit shall be set to zero for transmitted messages.

6.1.4 Data page (DP)

The DP bit selects an auxiliary page of parameter group descriptions.

6.1.5 PDU format (PF)

The PF field is an eight-bit field that determines the PDU format and is one of the fields used to determine the parameter group number assigned to the data field. Parameter group numbers shall be used to identify or label a set of commands and data.

6.1.6 PDU-specific (PS)

6.1.6.1 General

The PDU-specific field is an eight-bit field and depends on the PDU format. Depending on the PDU format, it can be a destination address or a group extension. If the value of the PDU format (PF) field is below 240, then the PDU-specific field is a destination address. If the value of the PF field is 240 to 255, then the PDU-specific field contains a group extension (GE) value (see Table 1).

Table 1 — PDU-specific field

	PDU format (PF) field	PDU-specific (PS) field
PDU 1 field	0 to 239	Destination address
PDU 2 field	240 to 255	Group extension

6.1.6.2 Destination address (DA)

The DA field contains the specific address of the towing or towed vehicle to which the message is being sent. The global destination address (255) requires all devices to listen.

6.1.6.3 Group extension (GE)

The GE field, in conjunction with the four least significant bits of the PDU format field, provides for 4 096 parameter groups per data page.

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

6.1.7 Source address (SA)

The SA field is eight bits long. There shall only be one device on the network with a given SA. Therefore, the SA field assures that the CAN identifier will be unique, as required by CAN.

6.1.8 Data field

A single CAN data frame provides a maximum of eight data bytes. All eight bytes shall be used, even if fewer than eight bytes are required for expressing a given parameter group number. This provides a means to easily add parameters, while remaining compatible with previous revisions which only specify part of the data field.

6.1.9 Parameter group number (PGN)

The PGN is a 24-bit number which contains: Reserved bit, Data page bit, PDU Format field (eight bits) and PDU-specific field (eight bits) (see Table 2).

If the PF value is less than 240 ($F0_{16}$; PDU 1 type message), then the lowest byte of the PGN is set to zero.

Table 2 — Content of the parameter group number

Byte 1 (MSB)			Byte 2	Byte 3
Bits 8...3	Bit 2	Bit 1		
000000_2	Reserved	Data Page	PDU format	PDU-specific

6.1.10 PDU 1 format

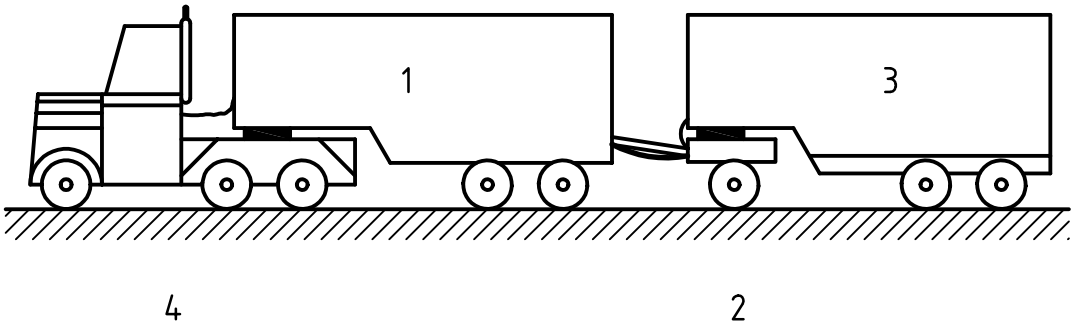
The PDU 1 format allows for applicable messages to be sent to either a specific or global destination. PDU 1 format messages are determined by the PF field. When the message's PF field value is 0 to 239, the message is a PDU 1 format.

6.1.11 PDU 2 format

The PDU 2 format may only be used to communicate global messages. PDU 2 format messages are those where the PF value is equal to 240 to 255.

6.2 Address assignment

A road train consists of one commercial vehicle and one or more towed vehicles. Dolly axles within the road train are treated as additional towed vehicles (see Figure 2).



Key

1 towed vehicle: position #1
2 towed vehicle: position #2
3 towed vehicle: position #3
4 commercial vehicle

Figure 2 — Example of possible road train configuration

The commercial vehicle is the towing vehicle of towed vehicle #1, towed vehicle #1 is the towing vehicle of towed vehicle #2 and so on.

The address of the commercial vehicle is fixed.

The respective address of a towed vehicle corresponds to its position within the road train and has to be newly assigned each time

— communication starts, or

— a towed vehicle has been connected.

For towing vehicle/towed vehicle communication, the addresses shown in Table 3 shall be used as SAs and DAs. To avoid any transmission conflict during the dynamic address assignment phase (power-up), the PDU 2 type message shall have even PS (GE) in the predecessor transmission direction and odd PS (GE) in the successor transmission direction. If the same message has to be sent in both transmission directions, two PSs (GE) are necessary.

The dynamic address assignment shall be handled by the respective towing vehicle/towed vehicle node and concerns the determination of the individual position within the road train. The global destination address shall only be used by the commercial vehicle to broadcast information to all towed vehicles simultaneously.

The dynamic address assignment is based on the transmission of the standard initialization message (see 6.4.2.4) by the respective predecessor within the road train.

Within a road train, the address assignment procedure shall be initiated by the commercial vehicle, using its standard address for the standard initialization message (see Table 3). A powered-up towed vehicle node shall use the towed vehicle #1 address as the default address for transmitting available information, until the standard initialization has been received and a valid address can be assigned.

Table 3 — Commercial vehicle/towed vehicle addresses

Name	Address	Predecessor	Successor
Commercial vehicle (position #0)	235 = EB_{16}	Not applicable	Towed vehicle position #1
Towed vehicle position #1	201 = $C9_{16}$	Commercial vehicle (position #0)	Towed vehicle position #2
Towed vehicle position #2	193 = $C1_{16}$	Towed vehicle position #1	Towed vehicle position #3
Towed vehicle position #3	185 = $B9_{16}$	Towed vehicle position #2	Towed vehicle position #4
Towed vehicle position #4	177 = $B1_{16}$	Towed vehicle position #3	Towed vehicle position #5
Towed vehicle position #5	169 = $A9_{16}$	Towed vehicle position #4	Undefined
Global destination address	255 = FF_{16}	Undefined	Undefined

This allows the towed vehicle node to communicate and to identify its presence to its predecessor immediately after power-up. This means that several towed vehicles can use the same address, until the address assignment procedure has been completed.

An assigned address based on a received predecessor address shall be valid as long as the towed vehicle is powered and no message from the predecessor with a different SA is received.

To provide address assignment for itself and for possible successors, a node shall be capable of continuously sending the standard initialization message with its own SA (see Figure 3).

Continuous sending of the initialization message is necessary to allow immediate towed vehicle address assignment any time a towed vehicle might be connected.

In addition, a towed vehicle node shall be capable of

— identifying its predecessor by the SA of the standard initialization message,

— assigning its own address based on the predecessors address, and

— identifying potential receiver(s) by the destination address and by the message type.

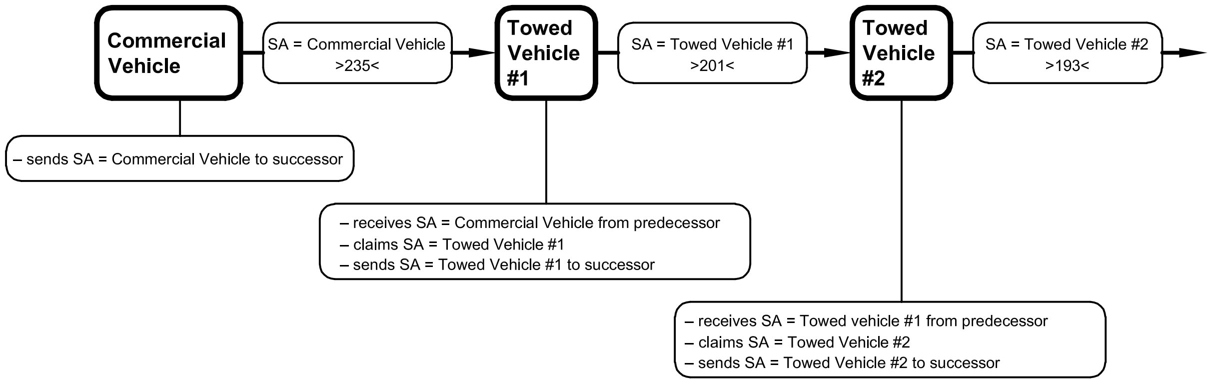

Commercial Vehicle
SA = Commercial Vehicle >235<
Towed Vehicle #1
SA = Towed Vehicle #1 >201<
Towed Vehicle #2
SA = Towed Vehicle #2 >193<
– sends SA = Commercial Vehicle to successor
– receives SA = Commercial Vehicle from predecessor
– claims SA = Towed Vehicle #1
– sends SA = Towed Vehicle #1 to successor
– receives SA = Towed vehicle #1 from predecessor
– claims SA = Towed Vehicle #2
– sends SA = Towed Vehicle #2 to successor

Figure 3 — Address assignment

6.3 Message routing

If there is no provision for a successor, the message routing function is not required.

To allow communication between towing and towed vehicles, a node shall be capable of

— receiving messages from its predecessor and successor within the road train,

— identifying receiver(s) by the destination address (PDU 1 type messages) or the PDU format (PDU 2 type messages),

— routing all messages from its predecessor(s) to its successor(s) within the road train by sending them with the unchanged SA and DA to its successor within a maximal delay time of t_d = 13 ms,

— routing all messages from its successor(s) to its predecessor(s) within the road train by sending them with the unchanged SA and DA to its predecessor within a maximal delay time of t_d = 13 ms.

A towed vehicle node shall not route messages to its successor or predecessor within the road train if the SA of a message received from its *predecessor* corresponds to a road train position higher or equal to its own or if the SA of a message received from its *successor* corresponds to a road train position lower or equal to its own.

Figures 4 to 9 illustrate the PDU type message sent in different directions.

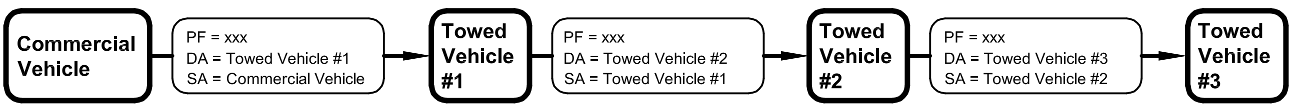


Figure 4 — Example of PDU 1 type messages from towing vehicles to succeeding towed vehicles

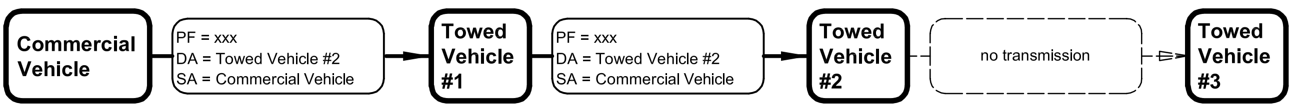


Figure 5 — Example of PDU 1 type message from commercial vehicle to towed vehicle #2

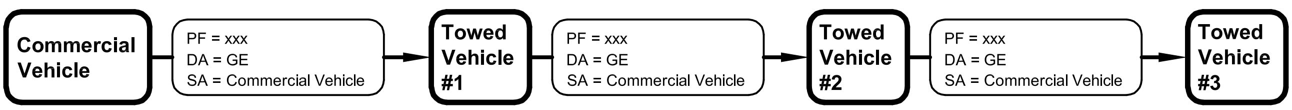


Figure 6 — Example of PDU 2 type message from commercial vehicle to all towed vehicles

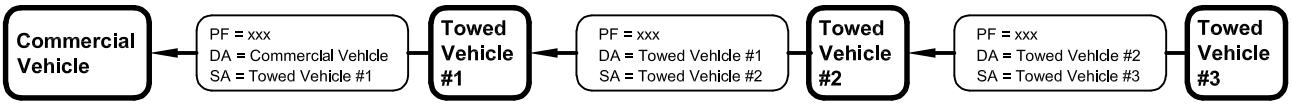


Figure 7 — Example of PDU 1 type messages from towed vehicles to preceding towing vehicles

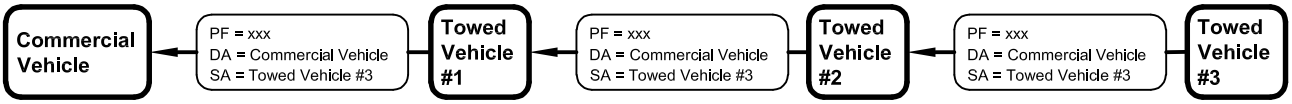


Figure 8 — Example of PDU 1 type message from towed vehicle #3 to commercial vehicle

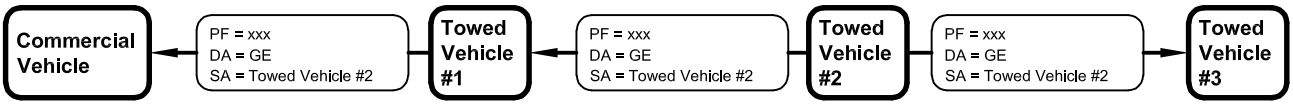


Figure 9 — Example of PDU 2 type message from towed vehicle #2

6.4 Parameters

6.4.1 Parameter ranges

Table 4 specifies the ranges used to determine the validity of transmitted signals.

Table 5 specifies the ranges used to denote the state of a discrete parameter and Table 6 the ranges used to denote the state of a control mode command.

The values in the range “error indicator” provide a means for a module to immediately indicate that valid parameter data is not currently available, owing to some type of error in the sensor, subsystem or module. Additional information about the failure may be available using diagnostic requests.

The values in the range “not available” provide a means for a module to transmit a parameter that is not available or not supported in that module. This value does not replace the “error indicator”.

The values in the range “not requested” provide a means for a device to transmit a command message and identify those parameters where no response is expected from the receiving device.

After power-on, a node shall internally set the “availability bits” of received parameters as not available and operate with default values until valid data is received. When transmitting, undefined bytes shall be sent as 255 (FF_{16}) and undefined bits shall be sent as “1”.

If a component failure prevents the transmission of valid data for a parameter, the error indicator, as specified in Tables 4 and 5, shall be used in place of that parameter data. However, if the measured or calculated data has yielded a value that is valid yet exceeds the defined parameter range, the error indicator shall not be used. The data shall be transmitted using the appropriate minimum or maximum parameter value.

A word (16 bit) parameter shall be sent least significant byte first, most significant byte second.