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Road vehicles — Tachograph systems —

Part 4: CAN interface

Véhicules routiers — Systèmes tachygraphes —

Partie 4: Interface CAN

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Foreword

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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 16844-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 16844 consists of the following parts, under the general title *Road vehicles — Tachograph systems*:

— *Part 1: Electrical connector*

— *Part 2: Recording unit, electrical interface*

— *Part 3: Motion sensor interface*

— *Part 4: CAN interface*

— *Part 5: Secured CAN interface*

— *Part 6: Diagnostics*

— *Part 7: Parameters*

Introduction

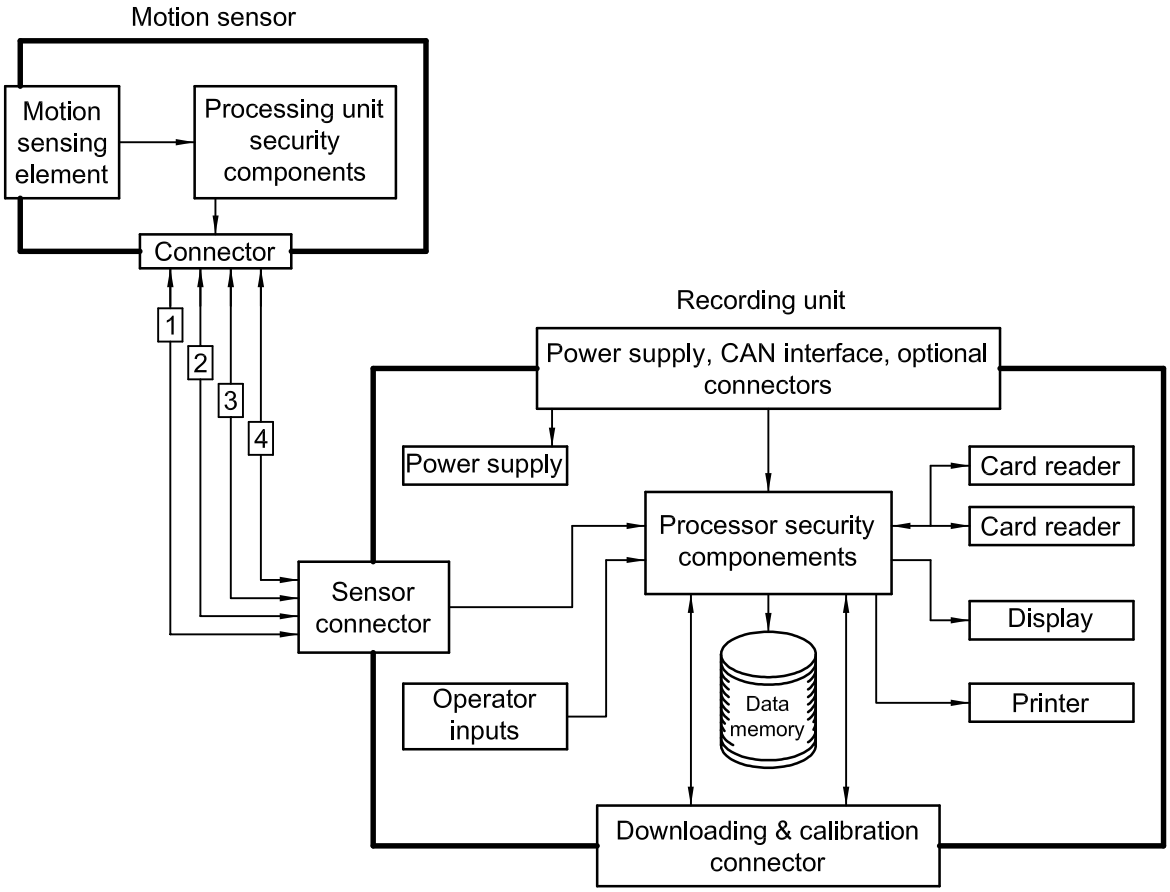
ISO 16844 supports and facilitates the communication between electronic units and a tachograph; the tachograph being based upon Council Regulations (EEC) No. 3820/85 [1] and (EEC) No. 3821/85 [2] and their amendments Council Regulation (EEC) No. 2135/98 [3] and Commission Regulation (EC) No. 1360/2002 [4].

Its purpose is to ensure the compatibility of tachographs from various tachograph manufacturers.

The basis of the digital tachograph concept is a recording unit (RU) that stores data related to the activities of the drivers of a vehicle on which it is installed. When the RU is in normal operational status, the data stored in its memory are made accessible to various entities such as drivers, authorities, workshops and transport companies in a variety of ways: they may be displayed on a screen, printed by a printing device or downloaded to an external device. Access to stored data is controlled by a smart card inserted in the tachograph.

In order to prevent manipulation of the tachograph system, the speed signal sender (motion sensor) is provided with an encrypted data link.

A typical tachograph system is shown in Figure 1.



Key

1 positive supply
2 battery minus
3 speed signal, real time
4 data signal in/out

Figure 1 — Typical tachograph system

Road vehicles — Tachograph systems —

Part 4: CAN interface

1 Scope

This part of ISO 16844 specifies the CAN (controller area network) interface for the interchange — performed in accordance ISO 16844-6 — of digital information between a road vehicle's tachograph system and vehicle units, and within the tachograph system itself. It specifies parameters of, and requirements for, the physical and data link layers of the electrical connection used in the electronic systems.

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 (all parts), *Road vehicles — Controller area network (CAN)*

ISO 16844-6, *Road vehicles — Tachograph systems — Part 6: Diagnostics*

ISO 16844-7, *Road vehicles — Tachograph systems — Part 7: Parameters*

SAE J1939, *Recommended Practice for a Serial Control and Communications Vehicle Network*

SAE J1939/11, *Physical Layer — 250 kbits/s, Twisted Shielded Pair*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
recording unit
part of the tachograph system that acquires and stores data concerning the vehicle and its driver(s) and their activities

3.2
visual instrument
speedometer and display(s) for odometer and trip meter data

4 Abbreviated terms

ACK	positive acknowledgement	Phase_Seg1	phase segment 1
BAM	broadcast announce message	Phase_Seg2	phase segment 2
CAN	controller area network	PS	PDU specific
DA	destination address	R	reserved
DP	data page	RU	recording unit
ECU	electronic control unit	SA	source address
EEC1	electronic engine controller No. 1	Sync_Seg	synchronization segment
EOL	end of line	TBD	to be defined
GE	group extension	TP.DT	transport protocol data transfer
LSB	least significant bit	t_B	bit time
MSB	most significant bit	t_Q	time quanta
NACK	negative acknowledgement	t_{SEG1}	timing segment 1
P	priority	t_{SEG2}	timing segment 2
PDU	protocol data unit	t_{SJW}	synchronization jump width
PF	PDU format	t_{SYNC_SEG}	synchronization segment
PGN	parameter group number	VIN	vehicle identification number

5 Physical layer

5.1 General

The physical layer shall be in accordance with SAE J1939/11, except where otherwise specified in this part of ISO 16844.

5.2 Bit timing requirements

The following parameters of CAN bit timing values shall be used for the settings of the tachograph ECUs (see Figure 2), which shall be in accordance with Table 1.

t_{SJW}

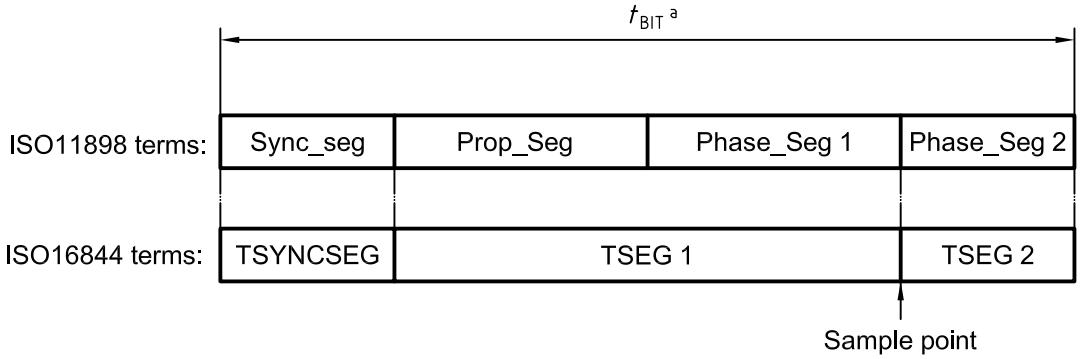
t_B

t_Q

$t_{SYNCSEG}$ = Sync_Seg = $1t_Q$

t_{SEG1} = Prop_Seg + Phase_Seg1

t_{SEG2} = Phase_Seg2



a Nominal bit time.

Figure 2 — Partition of bit time

Table 1 — CAN bit timing parameter values — Single data sampling mode

Parameter	Timing setting		
	min.	nominal	max.
t_B	3 980 ns	4 000 ns	4 020 ns
t_Q	—	—	400 ns
t_{SEG1}	$t_{SEG1} = t_B - 1t_Q - t_{SEG2}$	$t_{SEG1} = t_B - 1t_Q - t_{SEG2}$	$t_{SEG1} = t_B - 1t_Q - t_{SEG2}$

The CAN bit timing values shall also be in accordance with the following conditions:

— nominal bit rate of 250 kBit/s ± 0,5 %;

— sample point at between 80 % and 88 % of nominal bit time, single data sampling mode.

Values for the bit timing shall be in accordance with Table 2, which base on time quanta t_Q.

Table 2 — CAN bit timing parameter values for standard time quanta

t_Q	t_{SJW}	t_{SEG2}
200 ns	600 ns	600 ns
250 ns	500 ns	750 ns
334 ns	668 ns	668 ns
400 ns	800 ns	800 ns

6 Data link layer

6.1 Message frame format

6.1.1 General

For the data link layer, the application layer provides a string of information that is assimilated into a PDU. The PDU provides a framework for organizing the information, which shall be sent in 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 specified in Figure 3.

The PDU fields shall contain P, R, DP, PF, PS, which may be a DA or a GE, SA and data field.

	P	R	DP	PF	PS	SA		Data field
Number of bits	3	1	1	8	8	8		0 to 64

Figure 3 — 29 bit CAN identifier and data field

6.1.2 P bits

Three priority bits shall be used to optimize message latency for transmission onto the bus only. They shall be globally masked off by the receiver. The priority of any message may be set from highest, 0 (000_2), to lowest priority, 7 (111_2). The default values shall be as given in the PGN specifications.

6.1.3 R bit

The R bit is reserved for future expansion. This bit shall be set to logic “0” within transmitted messages.

6.1.4 DP bit

The DP bit selects the page of PGNs.

6.1.5 PF field

The PF field shall contain eight bits that determine the PDU format. It is one of the fields used to determine the PGN assigned to the data field.

6.1.6 PS field

6.1.6.1 General

The PS field shall contain eight bits that depend on the PF. If the PF is below 240, the PS is a destination address; if the PF is 240 to 255, the PS shall contain a GE value.

6.1.6.2 DA

The DA addresses the ECU intended to receive and act upon the message. The global DA of 255dec requires all devices to listen.

6.1.6.3 GE field

The GE field extends the four least significant bits of the PF field, and provides 4 096 parameter groups per data package. It indicates that the PS field is a group extension when the four most significant bits of the PF field are set.

6.1.7 SA field

The SA field shall be eight bits long. There shall be only one device on the network with a given SA, i.e. the SA assures that the CAN identifier is unique.

6.1.8 Data field

A single CAN frame shall provide a maximum of eight data bytes within the data field. All eight bytes shall be used, even if fewer are required. This provides a means to easily add parameters, while retaining compatibility with previous revisions, which only specified part of the data field.

6.2 PGN

6.2.1 General

The parameter group number shall be a 24 bit number, which contains R bit, DP bit, PF field and PS field, (see Figure 4).

Byte 1 (Most significant byte)			Byte 2	Byte 3
Bits 8 ... 3	Bit 2	Bit 1		
000000b	R	DP	PF	PS

Figure 4 — Contents of PGN

6.2.2 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. This message is PDU 1 format when the PDU format field is 0 to 239.

6.2.3 PDU 2 format

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

6.3 Communication modes

6.3.1 Request and acknowledge

6.3.1.1 General

The RU shall respond to following request PGNs.

a) PGN directed to the RU with addresses according to Table 4:

   1) the RU shall transmit the PGN if the PGN requested is supported;

   2) the RU shall send a NACK if the PGN is not supported.

b) Global destination:

   1) the RU shall transmit the PGN if the PGN requested is supported.

   2) the RU shall not respond, if the PGN is not supported.

If a response, NACK or broadcast of the requested PGN is required, the RU shall transmit it within 0,20 s. The receiving device shall not issue another request within 1,25 s of the first request.

6.3.1.2 Request

The request message, identified by the PGN, shall be used to request information from a specific device or globally. Only information that is not broadcast periodically shall be requested.

The request parameter shall be as follows.

Transmission repetition rate:	when needed
Data length:	3 bytes according to Table 3
DP:	0
PF:	234
PS:	DA
Default priority:	6
PGN:	59904 ($00EA00_{16}$)

Table 3 — Request parameter

Bytes	Parameter
1 to 3	PGN being requested (Byte 1 is the least significant byte, and byte 3 is the most significant byte)

6.3.1.3 Acknowledgement

Acknowledgement shall provide a handshake between transmitting and receiving devices.

The acknowledgement parameters shall be as follows.

Transmission repetition rate:	—
Data length:	8 bytes, according to Tables 4 and 5
DP:	0
PF:	232
PS:	DA = Global (255)
Default priority:	6
PGN:	59392 ($00E800_{16}$)

Table 4 — Acknowledge parameters

Byte	Parameter	Remark
1	Control byte	See Table 5
2	Group function Value	Not used (send 255)
3 to 5	Not defined	—
6 to 8	PGN of requested information / PGN that required the acknowledgement (Byte 6 is the least significant byte, and byte 8 the most significant byte)	—

The control byte may take the values according to Table 5.

Table 5 — Control byte values

Control byte	Interpretation	Use
0	ACK	When the local time adjustment was successful (see 7.9). When the trip distance was reset (see 7.6).
1	NACK	When a non-supported PGN was requested with a specific request. When the local time adjustment was not successful (see 7.9).

6.4 Transport protocol

6.4.1 General

The transport protocol is invoked when PGNs containing more than 8 bytes are transmitted. The first frame to be transmitted shall be the BAM, followed by required number of TP.DT containing the segmented data. The interframe space shall be 50 to 200 ms. The PGNs that require multi-packet transfer are driver identification (see 7.8) and vehicle identification (see 7.3).

6.4.2 BAM

The BAM parameters shall be as follows.

Transmission repetition rate: per parameter group to be transferred

Data length: 8 bytes as in Table 6

DP: 0

PF: 236

PS: DA = Global (255)

Default priority: 6

PGN: 60416 ($00EC00_{16}$)

Table 6 — BAM parameters

Byte(s)	Parameter	Remark
1	Control byte	$= 32_{10}$
2 to 3	Total message size in number of bytes	9 to 1785
4	Total number of packets	2 to 255
5	Reserved	—
6 to 8	PGN of packed message (Byte 6 is the least significant byte, and Byte 8 the most significant byte)	—

6.4.3 TP.DT

TP.DT shall be used to transmit the segmented data of a parameter group. The TP.DT message is an individual packet of a multi-packet transfer.

TP.DT parameters shall be as follows.

Transmission repetition rate: Per parameter group to be transferred

Data length: 8 bytes as in Table 7

DP: 0

PF: 235

PS: DA = Global (255)

Default priority: 6

PGN: 60160 ($00EB00_{16}$)

Table 7 — TP.DT Parameters

Byte	Parameter	Note
1	Sequence number	1 to 255
2 to 8	Packed data If the last packet contains less than 8 defined data bytes. It shall then be padded with FF_{16} to fill 8 bytes.	

7 Application layer

7.1 General

Each application parameter shall be according to ISO 16844-7.

7.2 Time/Date

The parameter group containing time and date shall be transmitted from the RU. All parameters shall be supported.

The time/date parameters shall be as follows.

Transmission repetition rate: 1 s

Data length: 8 bytes as in Table 8

DP: 0

PF: 254

PS: 230

Default priority: 6

PGN: 65254 ($00FEE6_{16}$)

Table 8 — Time/date parameters

Byte	Parameter
1	Seconds
2	Minutes
3	Hours
4	Month
5	Day
6	Year
7	Local minute offset
8	Local hour offset

7.3 Vehicle identification

Vehicle identification parameter group shall be transmitted by the RU on a specific or global request from any device on the network.

The vehicle identification parameters shall be as follows.

Transmission repetition rate: on request

Data length: variable as in Table 9

DP: 0

PF: 254

PS: 236

Default priority: 6

PGN: 65260 ($00FEEC_{16}$)

Table 9 — Vehicle identification parameters

Byte	Parameter
1 to 17	VIN
18	Delimiter (ASCII "*")

NOTE For details on how to transmit messages longer than 8 bytes, see 6.4.

7.4 High resolution vehicle distance

The high resolution vehicle distance parameter group shall be transmitted by the RU. All parameters shall be supported. It shall be used for trip and odometer in the visual instrument.

The high resolution vehicle distance parameters shall be as follows.

Transmission repetition rate: 1 s

Data length: 8 bytes as in Table 10

DP: 0

PF: 254

PS: 193

Default priority: 6

Parameter group number: 65217 (00FEC116)

Table 10 — High resolution vehicle parameters

Byte	Parameter
1 to 4	High resolution total vehicle distance
5 to 8	High resolution trip distance

7.5 Service

Service parameters shall be transmitted with the service component identification that has the nearest time until the next service inspection. The RU shall transmit it on specific or global request from any device on the network. The service components that shall be supported are the tachograph (periodic inspection due) and the two driver cards (card expiring).

The service parameters shall be as follows, where only Bytes 4 and 5 are used, and Bytes 1 to 3 and 6 to 8 shall be sent as “Not Available” of the value of FF_{16}.

Transmission repetition rate: on request

Data length: 8 bytes as in Table 11

DP: 0

PF: 254

PS: 192

Default priority: 6

PGN: 65216 ($00FEC0_{16}$)

Table 11 — Service parameters

Byte	Parameter
1 to 3	Not used
4	Service component identification
5	Service delay/calendar time based
6 to 8	Not used

7.6 Reset

The RU shall accept reset from at least the visual instrument. The RU shall upon reception of a correct reset message reset the high resolution trip distance and then send an ACK. A correct reset contains 01_2 in bits 1 and 2 of byte 1, and 252_{10} in byte 2. The tachograph may use the reset message as a heartbeat from the visual instrument. The heartbeat function of the reset message shall be EOL-programmable. Messages that are only used as heartbeat, i.e. do not request a reset, shall contain FF_{16} in all data bytes.

The reset parameters shall be as follows.

Transmission repetition rate: 1 s

Data length: 8 bytes as in Table 12

DP: 0

PF: 222

PS: DA

Default priority: 7

PGN: 56832 ($00DE00_{16}$)

Table 12 — Reset parameters

Byte	Parameter group	Bit	Parameter
1	Trip reset	8 to 5	Not defined
		4, 3 [a]	Ignored
		2, 1	Trip group 1
2	Service component identification	—	—
3 to 8	Not defined	—	—

[a] Bit 3 not defined in this document (defined by SAE).

7.7 TCO1

The TCO1 parameter group shall be transmitted by the RU. All parameters except “Direction” are mandatory.

The TCO1 parameters shall be as follows.

Transmission repetition rate: 50 ms (default), EOL programmable according to ISO 16844-7

Data length: 8 bytes as in Table 13

DP: 0

PF: 254

PS: 108

Default priority: 3

PGN: 65132 ($00FE6C_{16}$)

Table 13 — TCO1 parameters

Byte	Parameter group	Bit	Parameter
1	Work states	8 to 7	Drive recognize
		6 to 4	Driver 2 working state
		3 to 1	Driver 1 working state
2	Driver 1 states	8 to 7	Over speed
		6 to 5	Driver card, driver 1
		4 to 1	Driver 1 time related states
3	Driver 2 states	8 to 7	Not specified
		6 to 5	Driver card, driver 2
		4 to 1	Driver 2 time related states
4	Tachograph status	8 to 7	Direction indicator
		6 to 5	Tachograph performance
		4 to 3	Handling information
		2 to 1	System event
5 to 6	Tachograph output shaft speed	—	—
7 to 8	Tachograph vehicle speed	—	—

7.8 Driver identification

The RU shall transmit driver identification on specific or global request from any device on the network:

a) if only driver Card 1 is present, only the parameter Driver 1 identification and two delimiters shall be transmitted;

b) if only driver Card 2 is present, a delimiter followed by parameter Driver 2 identification and the second delimiter shall be transmitted;

c) if both driver cards are present, the message is sent as stated below;

d) if no driver cards are present, only the two delimiters shall be sent.

The driver identification parameters shall be as follows.

Transmission repetition rate: on request

Data length: variable, as in Table 14

DP: 0

PF: 254

PS: 107

Default priority: 6

PGN: 65.131 ($00FE6B_{16}$)

Table 14 — Driver identification parameters

Byte	Parameter
1 to 19	Driver 1 Identification
20	Delimiter (ASCII "*")
21 to 39	Driver 2 Identification
40	Delimiter (ASCII "*")

NOTE This message can be longer than 8 bytes, depending on the number of driver cards present. For details on how to transmit messages longer than 8 bytes, see 6.4.

7.9 Time/date adjust

The RU shall accept time/date adjust from any device on the network. Upon reception of the message, the RU shall respond as follows:

a) if the message was correct and the local offset time was adjusted correctly, the RU shall transmit an ACK;

b) if the message was not correct or the local offset time was not adjusted, the RU shall transmit a NACK.

A correct time/date adjust message contains valid data in bytes 7 and 8 only. If anything other than FF16 is detected in bytes 1 to 6, the message shall be considered incorrect.

The time/date adjust parameters shall be as follows.

Transmission repetition rate: when required

Data length: 8 bytes as in Table 15

DP 0

PF 213

PS DA

Default priority: 6

PGN: 54528 ($00D500_{16}$)

Table 15 — Time/date adjust parameters

Byte	Parameter	Note
1	Adjust seconds	Not used
2	Adjust minutes	Not used
3	Adjust hours	Not used
4	Adjust month	Not used
5	Adjust day	Not used
6	Adjust year	Not used
7	Adjust local minute offset	—
8	Adjust local hour offset	—

7.10 EEC1

The RU shall accept the EEC1 message when engine speed recording via CAN is implemented.

The EEC1 parameters shall be as follows.

Transmission repetition rate: manufacturer specific

Data length: 8 bytes as in Table 16

DP: 0

PF: 240

PS: 4

Default priority: 3

PGN: 61444 ($00F004_{16}$)

Table 16 — EEC1 parameters

Byte	Parameter
1 … 3	Ignored
4 … 5	Engine speed
6 … 8	Ignored

7.11 Illumination

When illumination via CAN is implemented, the RU shall accept the message from any source address, and with destination address RU or Global.

The illumination parameters shall be as follows.

Transmission repetition rate: 5 s and on change of state

Data length: 8 bytes as in Table 17

DP: 0

PF: 208

PS: DA

Default priority: 6

PGN: 53248 ($00D000_{16}$)

Table 17 — Parameters

Byte	Parameter
1	Requested illumination percentage
2 to 8	Not specified

8 Addresses

Listed ECUs shall have addresses according to Table 18.

Table 18 — Address space for tachograph system

Device name	Address
Engine	0
Visual instrument	23
RU	238
Global	255

Bibliography

[1] Council Regulation (EEC) No. 3820/85 of 20 December 1985 on the harmonization of certain social legislation relating to road transport

[2] Council Regulation (EEC) No. 3821/85 of 20 December 1985 on recording equipment in road transport

[3] Council Regulation (EEC) No. 2135/98 of 24 September 1998 amending Regulation (EEC) No. 3821/85 on recording equipment in road transport and Directive 88/599/EEC concerning the application of Regulations (EEC) No. 3820/85 and (EEC) No. 3821/85

[4] Commission Regulation (EC) No. 1360/2002 of 13 June 2002 adapting for the seventh time to technical progress Council Regulation (EEC) No. 3821/85 on recording equipment in road transport

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