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Road vehicles — Tachograph systems —

Part 3: Motion sensor communication interface

Véhicules routiers — Systèmes tachygraphes —

Partie 3: Interface de communication pour capteur de mouvement

Reference number
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 16844-3:2004), which has been technically revised. It also incorporates the Technical Corrigendum ISO 16844-3:2004/Cor. 1:2006.

The main changes are as follows:

— part 5 of this series (ISO 16844-5) has been removed due to its technical irrelevance,

— correction of the typos and mistakes in the text,

— adoption of the content according to the new version of the ISO guidelines,

— adoption of the content according to the new technical requirements,

— alignment of the content regarding to the referred standards.

A list of all parts in the ISO 16844 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.

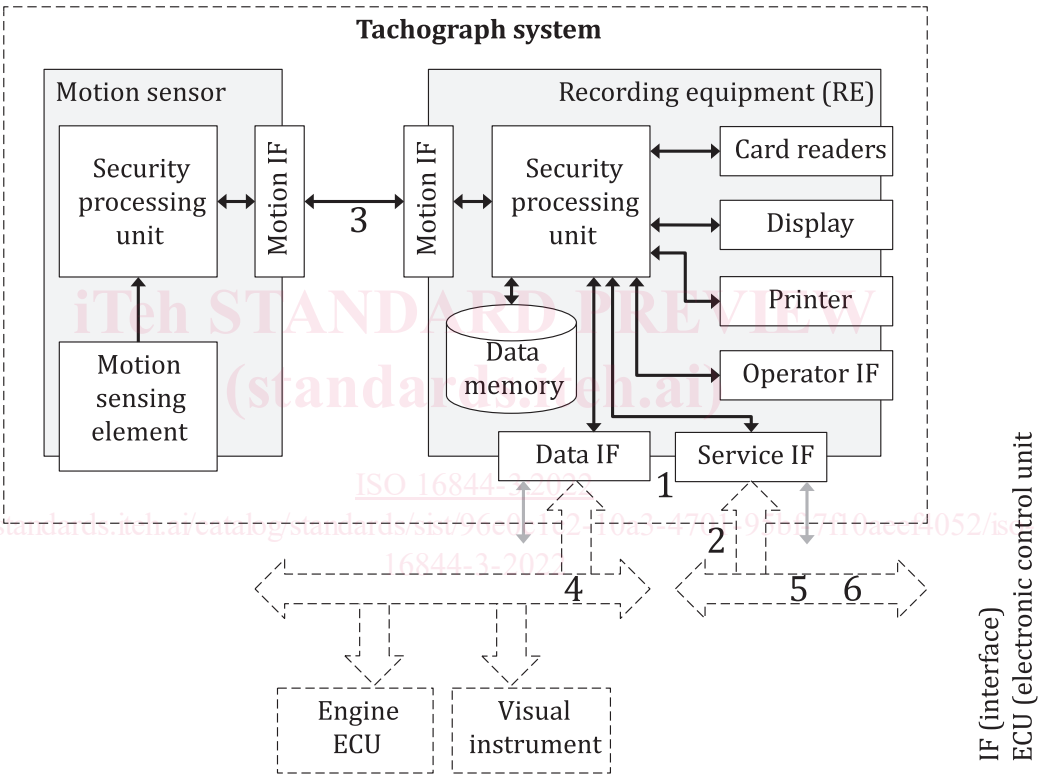
Introduction

This document supports and facilitates the communication between electronic control units (ECUs) and a digital tachograph.

The digital tachograph concept is based upon a recording equipment storing data, related to the activities of the various drivers driving the vehicle, on which it is installed.

During the normal operational status of the recording equipment, data stored in its memory are accessible to different entities (drivers, authorities, workshops, transport companies) in different ways (displayed on a screen, printed by a printing device, downloaded to an external device). Access to stored data is controlled by a smart card inserted in the tachograph.

A typical tachograph system is shown in Figure 1.



Key

1 data and service IF connector standardized in ISO 16844-1

2 electrical data and service IF requirements standardized in ISO 16844-2

3 communication interface between motion sensor and RE standardized in this document

4 CAN-based data IF including parameter groups standardized in ISO 16844-4

5 optional CAN-based service IF standardized in ISO 16884-6

6 data identifier (DID) specification for the optional service IF standardized in ISO 16844-7

Figure 1 — Typical ISO 16844 conformant tachograph system

Road vehicles — Tachograph systems —

Part 3: Motion sensor communication interface

1 Scope

This document specifies the communication interface between motion sensor and recording equipment. This includes the mechanical, electrical and logical requirements.

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 15170-1, *Road vehicles — Four-pole electrical connectors with pins and twist lock — Part 1: Dimensions and classes of application*

ISO 16844-1, *Road vehicles — Tachograph systems — Part 1: Recording equipment data and service connector*

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 16844-1 and the following apply.

ISO and IEC maintain terminology 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
check sum
sum (two byte value) of the bytes pointed out at the corresponding location

3.2
direction of movement
bit 6 of byte MF indicating whether the vehicle moving direction is forward or reverse

3.3
direction of movement On
bit 7 of byte MF indicating whether the additional direction information is available or not

3.4
identification key
key necessary for initialisation of a motion sensor, not stored in the sensor memory

3.5
inter byte timing
possible pause between two bytes of a message

3.6
header
first four bytes of a message containing sync-byte, target, STX and length of the message

3.7
master key
key necessary for initialisation of a motion sensor, not stored in the sensor memory

3.8
pairing key
key only used during the pairing sequence

Note 1 to entry: Every pairing key is unique to the motion sensor to which it belongs. All the cryptography uses the AES-based encryptions.

3.9
reset
restart of the motion sensor processing unit program

3.10
RxD_in
signal within the motion sensor to the RxD input of the processing unit

3.11
session key
key used for messages to be encrypted

Note 1 to entry: Every session key is unique to a special motion sensor and the recording equipment to which it belongs.

3.12
tail
last two bytes of a message containing ETX and LRC

3.13
TxD_out
signal within the motion sensor from the TxD output of the processing unit

3.14
voltage monitor
hardware function that detects a drop of the supply voltage below a defined level

4 Symbols and abbreviated terms

For the purposes of this document, the following the following symbols and abbreviated terms apply:

CAN	controller area network
CS	check sum
CS_{high}	high byte of CS
CS_{low}	low byte of CS
CV	control vector

CVPI	check value previous instruction
D_A	data for authentication
D_{Fs}	data of file selected
DON	direction of movement On
DM	direction of movement
D_S	data of sensor (encrypted, i.e. two-key triple DES)
$e_{K_x}(A)$	encrypted data A using a particular key K_x
EXT	end of text marker
I_S	current power supply
K	master key
K_{ID}	identification key
K_P	pairing key
K'_P	key derived from the pairing used to encrypt the pairing data
K_S	session key
LSB	least significant byte
LRC	longitudinal redundancy check
MF	multi-function byte
MSB	most significant byte
NARA	new audit record available
n	number of bytes
N_S	extended serial number
P_D	pairing data
$R_{type\_approval\_no}$	type approval number of the recording equipment (VU)
R_{serial_no}	serial number of the recording equipment (VU)
STX	start of text
$t_{pairing}$	date of pairing
U_{low}	speed signal voltage low value
$U_{low\ in}$	input signal voltage low value
$U_{low\ out}$	output signal voltage low value
U_{high}	speed signal voltage high value
$U_{high\ in}$	input signal voltage high value

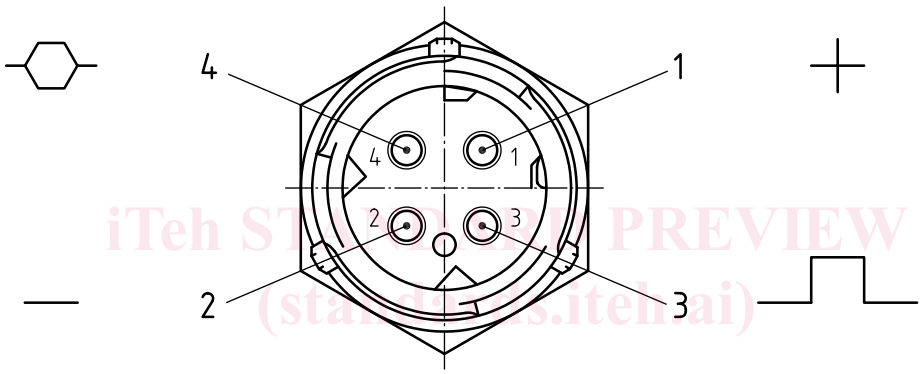
$U_{\text{high out}}$	output signal voltage high value
$U_{\text{pos sply}}$	positive supply voltage
VU	recording equipment
XOR	arithmetical exclusive OR

5 Connector

5.1 Dimensions and pin allocation

The connector used (see Figure 2) shall be according to ISO 15170-1, with coding No. 1, application class K3 (contact temperature range −40 °C to +140 °C, maximum acceleration of vibrations 300 m/s^2).

The pin allocation shall be in accordance with Table 1.



Key

1 to 4 pin numbers

Figure 2 — Marking zone at fixed or free connector — Code 1

Table 1 — Pin allocation

Pin No.	Function
1	Positive supply
2	Battery minus
3	Speed signal, real-time
4	Data signal, in/out

5.2 Electrical specification

5.2.1 Electrical requirements

The allocated connector function shall be in accordance with Table 2 and shall be valid within the temperature range −40 °C to +135 °C.

Table 2 — Electrical requirements of allocated connector function

Pole No.	Function	Parameter	Electrical requirements			Remark
			min.	typical.	max.	
1	Positive supply	Voltage	6,5 V	—	9 V	Reverse voltage protected[b]
		Current I_S	—	—	15 mA	Total unit current without direction signal current, see Clause 8.
2	Battery minus	—	—	—	—	See ISO 16844-2.
3	Speed signal real-time[a]	U_{low}	—	—	0,8 V	I = 250 µA[b]
		U_{high}	$U_{pos\,sply}$ –1,5 V	—	—	I = –150 µA[b]
		Rise time (10 % to 90 %)	—	50 µs	—	Test condition: external pull-up resistor 22 kΩ to positive supply ($U_{pos\,sply}$); $U_{pos\,sply}$ = 6,5 V; external capacitor 2 nF to battery minus.
		Fall time (90 % to 10 %)	—	10 µs	—	
		Frequency	—	—	<1,6 kHz	—
4	Data signal in/out [a]	$U_{low\,in}$	—	—	1,2 V	I = –1 mA[b]
		$U_{high\,in}$	5,2 V	—	—	I = – 0,5 mA[b]
		$U_{low\,out}$	—	—	1 V	I = 1 mA[b]
		$U_{high\,out}$	5,4 V	—	—	I = –20 µA[b]
		Rise time (10 % to 90 %)	—	110 µs	—	Test condition: external pull-up resistor 10 kΩ to positive supply ($U_{pos\,sply}$); $U_{pos\,sply}$ = 6,5 V; external capacitor 5 nF to battery minus.
		Fall time (90 % to 10 %)	—	10 µs	—	
		bit rate	—	1 200 bit/s	—	Accuracy ±3 %

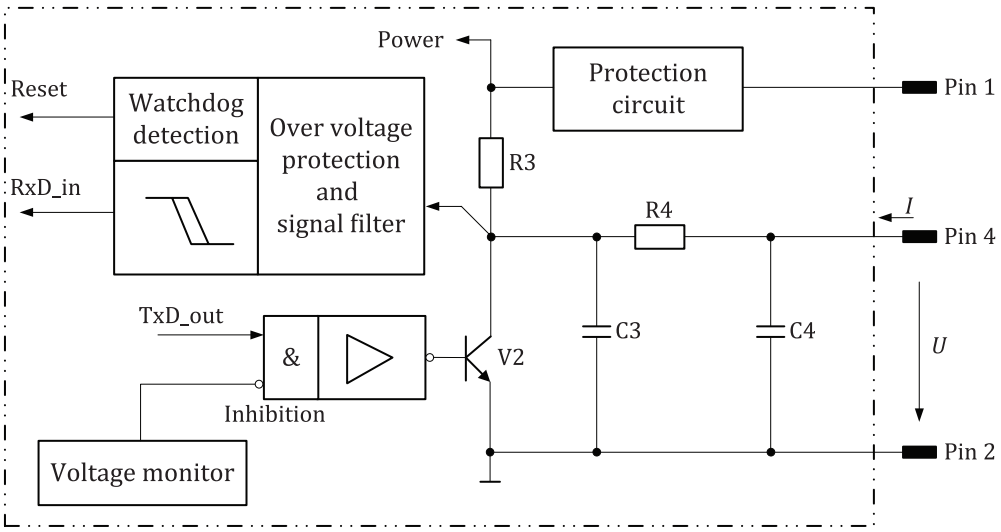
[a] Outputs shall be short-circuit protected up to 28 V for 1 min.

[b] Values are measured relatively to pin 2.

5.2.2 Block diagram data signal, in/out

Figure 3 shows a block diagram of the data interface hardware. If no communication takes place, the state of pin 4 shall be U_{high}. The incoming signal at pin 4 shall be filtered, before it is used as an input signal to the processing unit.

The data TxD_out shall only be transmitted, if the voltage monitor shows that the supply voltage is within the specified range. See also 7.5.3.1.



Key

R3	10 kΩ
R4	330 Ω
C3, C4	2,2 nF
V2	npn transistor

Figure 3 — Interface data signal — Example

5.2.3 Voltage monitoring and watchdog signal

5.2.3.1 Electrical requirements

The electrical requirements of the voltage monitoring of supply voltage over pins 1 and 2, and the watchdog signal, both submitted via pin 4, shall be in accordance with Table 3. If the supply voltage is below 6,5 V, the motion sensor may reply to requests; but if it is below 5,0 V, it shall not reply.

Table 3 — Requirements of the watchdog signal voltage monitor

Parameter		Electrical requirements			Remark
		Min.	Typical	Max.	
Voltage monitor [a]		5,0 V	—	$U_{\text{pos sply}}$ 6,5 V	No remark
Watchdog signal [b]	t_{don}	—	—	1 s	Sensor watchdog reset delay time
	t_{doff}	—	—	1 s	Sensor watchdog recover time
	t_{won}	1 s	—	—	Watchdog on time
	t_{woff}	1 s	—	—	Watchdog off time

[a] See block diagram of data signal in Figure 3.

[b] Voltage level: see data signal in/out (in) $U_{\text{low in}}$, see 5.2.3.2.

5.2.3.2 Timing diagram watchdog signal

If the recording equipment discovers a time-out of an expected response, it shall be possible to start another attempt or send a watchdog signal to the motion sensor in accordance with Figure 4 and, for voltage levels and timing, in accordance with Table 3. If the motion sensor detects a watchdog signal at pin 4, it shall restart its program (see 7.5.3.6).

The reset shall not affect the speed real-time signal of pin 3.