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Road vehicles — Tachograph systems —

Part 6:
Diagnostic communication interfaces

Véhicules routiers — Systèmes tachygraphes —

Partie 6: Interfaces de communication de diagnostic

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Contents

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).

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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 third edition cancels and replaces the second edition (ISO 16844-6:2015), which has been technically revised.

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.
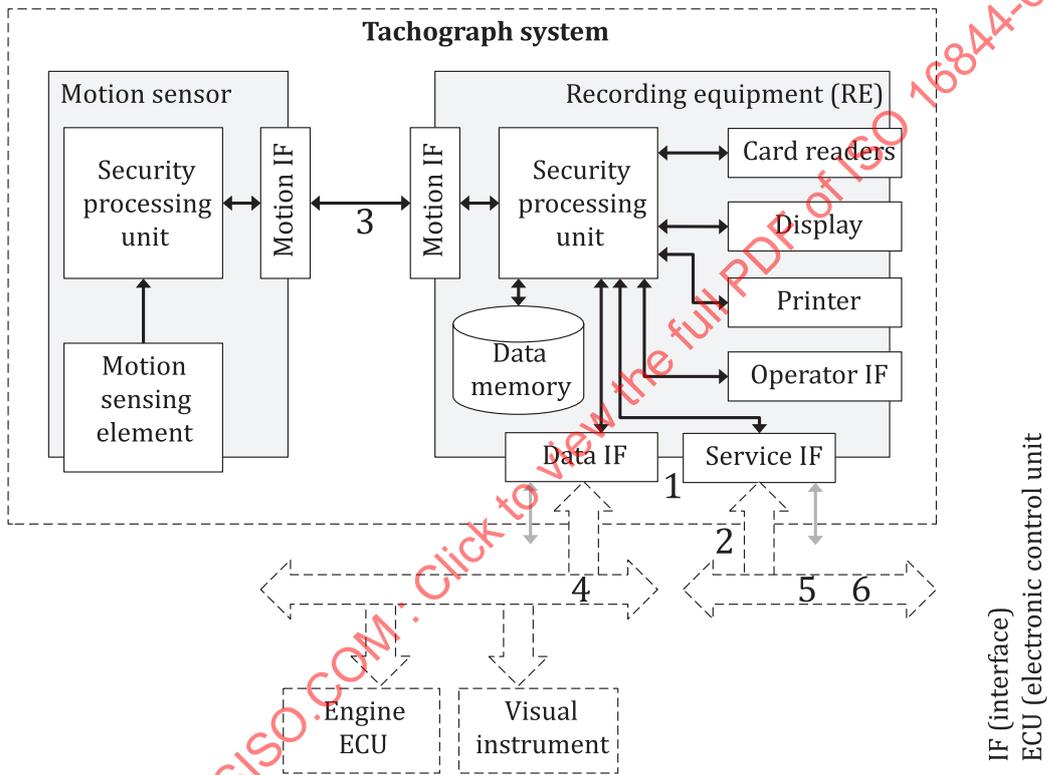
Key

1	data and service IF connector standardized in ISO 16844-1	4	CAN-based data IF including parameter groups standardized in ISO 16844-4
2	electrical data and service IF requirements standardized in ISO 16844-2	5	optional CAN-based service IF standardized in ISO 16884-6
3	communication interface between motion sensor and RE standardized in ISO 16844-3	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 6:
Diagnostic communication interfaces

1   Scope

This document specifies the CAN-based and the K-Line communication between the recording equipment and service tools for software download and calibrating purposes. The provided requirements and recommendations cover physical, data link, network, session, and application layers according to the OSI reference model as well as the unified diagnostics services.

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 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

ISO 14229-2, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 14229-3, *Road vehicles — Unified diagnostic services (UDS) — Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)*

ISO 14229-6, *Road vehicles — Unified diagnostic services (UDS) — Part 6: Unified diagnostic services on K-Line implementation (UDSonK-Line)*

ISO 14230-1, *Road vehicles — Diagnostic communication over K-Line (DoK-Line) — Part 1: Physical layer*

ISO 14230-2, *Road vehicles — Diagnostic communication over K-Line (DoK-Line) — Part 2: Data link layer*

ISO 15765-2, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 2: Transport protocol and network layer services*

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

ISO 16844-4, *Road vehicles — Tachograph systems — Part 4: Display unit communication interface*

ISO 16844-7, *Road vehicles — Tachograph systems — Part 7: Data identifier for the CAN-based service interface*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16844-1 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/

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4 Abbreviated terms

For the purposes of this document, the following the following abbreviated terms apply.

C	conditional
Cvt.	convention
DID	data identifier
DS	default session
DSRC	dedicated short range communication
ECU	electronic control unit
EXTDS	extended diagnostic session
M	mandatory
N	not allowed
O	optional
RS	remote session
SID	service identifier
SSS	system supplier specific session
VMS	vehicle manufacturer specific session

5 Overview and conventions

5.1 General

To enable the implementation of unified diagnostic services on CAN and on K-Line this document is based on the Open Systems Interconnection (OSI) Basic Reference Model specified in ISO/IEC 7498-1[1] and ISO/IEC 10731[2], which structures communication systems into seven layers. When mapped on this model, the services specified by the ISO 16844 series are divided as given in Table 1.

Table 1 — Diagnostics implementation reference applicable to the OSI layers

Applicability	OSI seven layer	Diagnostics according to document	
		On CAN	**On K-Line**
Seven layer according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1/ISO 16844-6	
		ISO 14229-3	ISO 14229-6
	Presentation (layer 6)	Vehicle manufacturer specific	
	Session (layer 5)	ISO 14229-2	
	Transport (layer 4)	ISO 15765-2	—
	Network (layer 3)		
	Data link (layer 2)	ISO 16844-4	ISO 14230-2/ ISO 14230-1
	Physical (layer 1)		

5.2 Service description conventions

The service description conventions according to ISO 14229-1 are used.

5.3 Addresses

5.3.1 Functional addresses

The recording equipment shall respond to the functional address 238_{10} as the recording equipment address and the functional address 255_{10} for broadcasting purposes.

5.3.2 Physical addresses

The recording equipment shall have a physical address of 238_{10}.

5.4 Parameters

If a parameter value or a record value consists of more than one byte, the most significant byte shall always be transmitted first, followed by bytes of decreasing significance.

6 Diagnostic services implementation

6.1 General and overview

The diagnostic services shall be implemented in accordance with ISO 14229-1 and the restrictions given Clause 6. Table 2 specifies tachograph diagnostic services.

Table 2 — Diagnostic service usage and identifier value summary and overview

Diagnostic service name (according to ISO 14229-1)	SID value [a]	Diagnostic session						Subclause
		DS [b]	DPRS [c]	EXTDS [d]	VMS [e]	SSS [f]	RS [g]	
Diagnostic and communication management functional unit								
DiagnosticSessionControl	10_{16}	M	M	M	M	M	M	6.2.1
ECUReset	11_{16}	O	O	O	O	O	O	6.2.2
SecurityAccess	27_{16}	N	M	O	M	M	N	6.2.3
CommunicationControl	28_{16}	N	M	O	O	O	N	6.2.4
TesterPresent	$3E_{16}$	M	M	M	M	M	M	—
AccessTimingParameters	83_{16}	N	O	O	O	O	N	—
SecuredDataTransmission	84_{16}	N	O	O	O	O	N	—
ControlDTCSetting	85_{16}	N	O	O	O	O	N	—
ResponseOnEvent	86_{16}	O	O	O	O	O	U	6.2.5
LinkControl	87_{16}	N	O	O	O	O	N	6.2.6
Data transmission functional unit								
ReadDataByIdentifer	22_{16}	M	M	M	O	O	M	6.3.1
ReadMemoryByAddress	23_{16}	N	N	N	O	O	N	—
ReadScalingDataByIdentifier	24_{16}	M	M	M	O	O	M	—
ReadDataByPeriodicIdentifier	$2A_{16}$	N	O	O	O	O	N	6.3.2
DynamicallyDefineDataIdentifier	$2C_{16}$	O	O	O	O	O	O	6.3.3
WriteDataByIdentifier	$2E_{16}$	N	M	O	O	O	N	6.3.4
WriteMemoryByAddress	$3D_{16}$	N	N	N	O	O	N	—
Stored data transmission functional unit								
ReadDTCInformation	19_{16}	M	M	M	O	O	M	6.4.2
ClearDiagnosticInformation	14_{16}	M	M	O	O	O	M	6.4.1
Input/Output control functional unit								
InputOutputControlByIdentifier	$2F_{16}$	N	N	M	O	O	N	6.5.1
Remote activation of routine functional unit								
RoutineControl	31_{16}	N	O	M	O	O	M	6.6.1
Upload/Download functional unit								
RequestDownload	34_{16}	N	O	N	O	O	N	—
RequestUpload	35_{16}	N	O	O	O	O	M	—
TransferData	36_{16}	N	O	O	O	O	M	—
RequestTransferExit	37_{16}	N	O	O	O	O	M	—

[a] Assigns the service identifier values for the request message.

[b] This session shall be implemented. These services of the defaultSession (DS) may be implemented in each server (ECU), if the electronic system supports the functionality of these services.

[c] This session shall be implemented. These services of the ProgrammingSession (PRGS) may be implemented to allow for programming of memory (e.g. flash), variant coding, parameters, etc. in the server (ECU).

[d] This session shall be implemented. These services of the ExtendedDiagnosticSession (EXTDS) may be implemented to allow for adjustment of input/output signals of the server (ECU).

[e] This session may be implemented. These services of the vehicleManufacturerSpecificSession (VMS) are specified by the vehicle manufacturer.

[f] This session may be implemented. These services of the systemSupplierSpecificSession (SSS) are specified by the system supplier.

[g] This session may be implemented. These services of the remoteSession (RS) are implemented to allow for remote company card authentication and data download.

6.2 Diagnostic and communication management functional unit

6.2.1 DiagnosticSessionControl service

The convention of the DiagnosticSessionControl subfunction parameter, DiagnosticSessionType, shall be in accordance with Table 3.

Table 3 — DiagnosticSessionControl subfunction parameter DiagnosticSessionType

bit 6−0	Description	Cvt.	Mnemonic
01_{16}	defaultSession	M	DS
02_{16}	programmingSession	M	PRGS
03_{16}	extendedDiagnosticSession	O	EXTDS
YY^a	remoteSession This diagnostic session enables all diagnostic services required to allow for remote company card authentication and data download.	M	RS
a The value used for remoteSession shall be determined by using DID $F900_{16}$ (see ISO 16844-7).			

6.2.2 ECUReset service

The convention of the ECUReset subfunction parameter, ResetType, shall be in accordance with Table 4.

Table 4 — ECUReset subfunction parameter ResetType

Value	Description	Cvt.
01_{16}	hardReset	O
02_{16}	keyOffOnReset	M
03_{16}	softReset	O

6.2.3 SecurityAccess service

The convention of the SecurityAccess subfunction parameter, AccessType, shall be in accordance with Table 5. The maximum delay time for the positive response shall be 10 s.

Table 5 — SecurityAccess subfunction parameter AccessType

Value	Description	Cvt.
01_{16}	requestSeed	M
02_{16}	sendKey	M
03_{16}, 05_{16}, 07_{16} to 41_{16}	requestSeed	O
04_{16}, 06_{16}, 08_{16} to 42_{16}	sendKey	O
61_{16} to $7E_{16}$	system supplier specific range	O

6.2.4 CommunicationControl service

The convention of the CommunicationControl subfunction parameter, ControlType, shall be in accordance with Table 6. The convention of the CommunicationControl CommunicationType, parameter shall be in accordance with Table 7.

Table 6 — CommunicationControl subfunction parameter ControlType

Value	Description	Cvt.
00_{16}	enableRxAndTx	M

Table 6 *(continued)*

Value	Description	Cvt.
01_{16}	enableRxAndDisableTx	M
02_{16}	disableRxAndEnableTx	O
03_{16}	disableRxAndTx	O

Table 7 — CommunicationControl CommunicationType parameter

Value	Description	Cvt.
001_2	normalCommunicationMessages	M
010_2	networkManagementCommunication-Messages	O
100_2	diagnosticCommunicationMessages	O

6.2.5 ResponseOnEvent service

The convention of the ResponseOnEvent subfunction parameter, EventType, shall be in accordance with Table 8. The convention of the ResponseOnEvent EventWindowTime parameter shall be in accordance with Table 9. The convention of the ResponseOnEvent serviceToRespondToRecord parameter shall be in accordance with Table 10.

Table 8 — ResponseOnEvent subfunction parameter EventType

Value	Description	Cvt.
00_{16}	stopResponseOnEvent	M
01_{16}	onDTCStatusChange	M
02_{16}	onTimerInterrupt	M
03_{16}	onChangeOfDataIdentifier	M
04_{16}	reportActivatedEvents	O
05_{16}	startResponsOnEvent	M
06_{16}	clearResponseOnEvent	M
07_{16}	OnComparisonOfValues	M

Table 9 — ResponseOnEvent EventWindowTime parameter

Value	Description	Cvt.
02_{16}	infiniteTimeToResponse	M

Table 10 — ResponseOnEvent ServiceToRespondToRecord parameter

Value	Description	Cvt.
22_{16}	readDataByIdentifier	O
19_{16}	readDTCInformation	M
31_{16}	routineControl	O
$2F_{16}$	inputOutputControlByIdentifier	O

6.2.6 LinkControl service

The convention of the LinkControl subfunction parameter, LinkControlType, shall be in accordance with Table 11. The convention of the LinkControl BaudrateIdentifier parameter shall be in accordance with Table 12.

Table 11 — LinkControl subfunction parameter LinkControlType

Value	Description	Cvt.
01_{16}	verifyBaudrateTransitionWithFixedBaudrate	O
02_{16}	verifyBaudrateTransitionWithSpecificBaudrate	O
03_{16}	transitionBaudrate	O

Table 12 — LinkControl BaudrateIdentifier parameter

Value	Description	Cvt.
01_{16}	PC9600Baud	O
02_{16}	PC19200Baud	O
03_{16}	PC38400Baud	O
04_{16}	PC57600Baud	O
05_{16}	PC115200Baud	O

6.3 Data transmission functional unit

6.3.1 ReadDataByIdentifier service

The convention of ReadDataByIdentifier parameter shall be according to ISO 14229-1, with the DIDs specified in ISO 16844-7. The implementation on this service shall support at least eight DIDs with one request/response.

6.3.2 ReadDataByPeriodicIdentifier service

The convention of the ReadDataByPeriodicIdentifier TransmissionMode parameter shall be according to Table 13.

Table 13 — ReadDataByPeriodicIdentifier TransmissionMode parameter

Value	Description	Cvt.
01_{16}	sendAtSlowRate	O
02_{16}	sendAtMediumRate	O
03_{16}	sendAtFastRate	O
04_{16}	stopSending	C[a]
[a] This parameter shall be supported if sendAtSlowRate, sendAtMediumRate, and/or sendAtFastRate are supported.		

6.3.3 DynamicallyDefineDataIdentifier service

The convention of the DynamicallyDefineDataIdentifier subfunctions shall be in accordance with Table 14.

Table 14 — DynamicallyDefineDataIdentifier subfunctions

Value	Description	Cvt.
01_{16}	defineByIdentifier	O
02_{16}	defineByMemoryAddress	C[a]
03_{16}	clearDynamicallyDefinedDataIdentifier	O
[a] DefineByMemoryAddress shall not be used in defaultSession, programmingSession, and extendedDiagnosticSession.		

6.3.4 WriteDataByIdentifier service

The convention of the WriteDataByIdentifier service shall be in accordance with ISO 14229-1, with the DIDs specified in ISO 16844-7.

6.4 Stored data transmission functional unit

6.4.1 ClearDiagnosticInformation service

The convention of the ClearDiagnosticInformation GroupOfDTC parameter shall be in accordance with Table 15.

Table 15 — ClearDiagnosticInformation GroupOfDTC parameter

Value	Description	Cvt.
000000_{16} to $FFFFFE_{16}$	Individual DTC	M
$FFFFFF_{16}$	allDTCs	M

6.4.2 ReadDTCInformation service

The convention of the ReadDTCInformation subfunctions shall be in accordance with Table 16. The convention of the ReadDTCInformation DTC status bits shall be in accordance with Table 17.

Table 16 — ReadDTCInformation subfunctions

Value	Description	Cvt.
01_{16}	reportNumberOfDTCByStatusMask	M
02_{16}	reportDTCByStatusMask	M
03_{16}	reportDTCSnapshotIdentification	O
04_{16}	reportDTCSnapshotRecordByDTCNumber	O
05_{16}	reportDTCSnapshotRecordByRecordNumber	O
06_{16}	reportDTCExtendedDataRecordByDTCNumber	M
07_{16}	reportNumberOfDTCBySeverityMaskRecord	M
08_{16}	reportDTCBySeverityMaskRecord	M
09_{16}	reportSeverityInformationOfDTC	O
$0A_{16}$	reportSupportedDTC	O
$0B_{16}$	reportFirstTestFailedDTC	O
$0C_{16}$	reportFirstConfirmedDTC	O
$0D_{16}$	reportMostRecentTestFailedDTC	O
$0E_{16}$	reportMostRecentConfirmedDTC	O
$0F_{16}$	reportMirrorMemoryDTCByStatusMask	O
10_{16}	reportMirrorMemoryDTCExtDataRecordByDTCNumber	O
11_{16}	reportNumberOfMirrorMemoryDTCByStatusMask	O

Table 17 — ReadDTCInformation DTC status bits

Bit	Description	Cvt.
0	testFailed	M
[a] Bit 1 (testFailedThisMonitoringCycle) is: — mandatory, if bit 2 (pendingDTC) is supported, or — user optional, if bit 2 (pendingDTC) is not supported.		

Table 17 *(continued)*

Bit	Description	Cvt.
1	testFailedThisOperationCycle	C[a]
2	pendingDTC	O
3	confirmedDTC	M
4	testNotCompletedSinceLastClear	M
5	testFailedSinceLastClear	M
6	testNotCompletedThisOperationCycle	M
7	warningIndicatorRequested	M

[a] Bit 1 (testFailedThisMonitoringCycle) is:

— mandatory, if bit 2 (pendingDTC) is supported, or

— user optional, if bit 2 (pendingDTC) is not supported.

6.5 Input/Output control functional unit

6.5.1 InputOutputControlByIdentifier service

The convention of the InputOutputControlByIdentifier InputOutputControlParameter shall be in accordance with Table 18.

The ControlState parameter shall be present only when the InputOutputControlParameter is set to ShortTermAdjustment in the InputOutputControl service.

The setting may be read by the service ReadDataByIdentifier. The DataRecord in the response shall be equal to the parameter ControlState.

Table 18 — InputOutputControlByIdentifier InputOutputControlParameter

Value	Description	Cvt.
00_{16}	returnControlToECU	M
01_{16}	resetToDefault	O
02_{16}	freezeCurrentState	O
03_{16}	shortTermAdjustment[a]	M

[a] ShortTermAdjustment shall not be used in defaultSession.

6.6 Remote activation of routine functional unit

6.6.1 RoutineControl service

The convention of the RoutineControl subfunctions shall be in accordance with Table 19. The convention of the RoutineControl parameter RoutineStatusRecord shall be in accordance with Table 20 when used for exiting status.

Table 19 — RoutineControl subfunctions

Value	Description	Cvt.
01_{16}	startRoutine	M
02_{16}	stopRoutine	O
03_{16}	requestRoutineResults	O

Table 20 — RoutineControl RoutineStatusRecord parameter

Value	Description	Cvt.
61_{16}	normalExitWithResultsAvailable	O
62_{16}	normalExitWithoutResultsAvailable	O
63_{16}	abnormalExitWithResultsAvailable	O
64_{16}	abnormalExitWithoutResultsAvailable	O

7 Application layer requirements

7.1 General

The application layer services shall be implemented according to ISO 14229-1.

7.2 Application layer protocol

7.2.1 General

The application layer protocol shall be implemented according to ISO 14229-3 or ISO 14229-6, or both, as well as according to the additional requirements in Clause 7.

7.2.2 Application layer timing

7.2.2.1 Timing parameters for CAN-based communication

The timing parameter for CAN-based communication shall be according to ISO 14229-3. The ECU(s) shall respond to a request message within $t_{P2\_CAN\_Server}$. The application timing parameter values shall be in accordance with Table 21.

Table 21 — Application layer timing parameters for CAN

Parameter	Values [ms]		Description/requirement
	Min	Max	
$t_{P2\_CAN\_Server}$	0	100	Performance requirement for the server to start with the response message after the reception of a request message (see ISO 14229-2).
$t_{P2*\_CAN\_Server}$	0	5 000	Performance requirement for the server to start with the response message after the transmission of a negative response message with negative response code 7816 (see ISO 14229-2).

7.2.2.2 Timing parameters for K-Line communication

The normal timing parameter, set in accordance with ISO 14230-2 (K-Line), shall apply, using the data link layer according to 11.2.

8 Presentation layer requirements

The presentation layer shall be implemented according to ISO 14229-2.