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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electronic railway equipment – On board driving data recording system – Part 1: System specification

Matériel électronique ferroviaire – Système embarqué d'enregistrement de données de conduite – Partie 1: Spécification du système

IEC 62625-1:2013

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ELECTRONIC RAILWAY EQUIPMENT – ON BOARD DRIVING DATA RECORDING SYSTEM –

Part 1: System specification

FOREWORD

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International Standard IEC 62625-1 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/1820/FDIS	9/1844/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62625 series, published under the general title *Electronic railway equipment – On board driving data recording system*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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The contents of the corrigendum of October 2016 have been included in this copy.

INTRODUCTION

In the railway market over the last decade, the demand for event recorders onboard of trains, metros and trams, has continuously increased. The operators are asking for more and more recorders beyond the simple recording of speed, distance and elapsed time. Consequently, many national safety authorities in many countries around the world require the installation of on board event recording system. Herein some examples are listed:

- In Japan, the Ministry of Land, Infrastructure and Transport revised "Shorei (The Ministerial regulation of Japan)" in 2006 for implementing juridical recorder. This regulation requires the railway authorities having constant operational requirements to install juridical recorders.
- In the USA, the Federal Railroad Administration issued in 2005 the “Final Rule 49 CFR Part 229”. The rule requires that the leading locomotives of all the USA trains are equipped with compliant event recorders.
- In the UK, the regulation GM/RT 2472 requires that the majority of trains operating on the network rail controlled by infrastructure are fitted with a compliant on train data recorder.
- In Europe, the technical specifications for interoperability for the control-command system and for Operation require the implementation of a Juridical Recording Unit when running on the trans european network (TEN) (Directive 2008/57/EC of the European parliament and of the council).

Today, it is necessary to set a common specification that can be referred to by the regulations issued by each national safety authority to harmonize these requirements, to simplify the rolling stock design and to ensure a cost effective implementation. The aim of this standard is to fulfil this target.

In addition to the usual benefits of standardization for the railway stakeholders (e.g. cost reduction), this standard has the following benefit:

- Achievement of a specification of a worldwide juridical event recorder that respects the minimum requirements necessary for the interoperability of trains crossing the borders of countries around the world (e.g. Europe, Asia, USA/Canada).
- The goals of the on board driving data recording system are to enable the checking of train operation according to the driving rules through recording the events of train operation. According to national laws, this checking can be used for enquiry after an accident or incident or for the regular monitoring of the driver’s ability and qualification to operate the train.

ELECTRONIC RAILWAY EQUIPMENT – ON BOARD DRIVING DATA RECORDING SYSTEM –

Part 1: System specification

1 Scope

This part of IEC 62625 covers the specification of an on board driving data recording system for the purpose of recording data about the operation of the train. The data refers both to the driver behaviour and the on board systems behaviour to support systematic safety monitoring as a means of preventing incidents and accidents.

The data is recorded in a way that is suitable for identifying cause and where possible consequence, such that the data is suitable:

- for investigative use in case of accidents and incidents;
- to monitor the appropriate actions of drivers.

The conformance test procedure will be covered by a future standard in the IEC 62625 series.

This standard specifies the requirements for a universal recording system that is applicable to all types of rail vehicles.

Requirements and responsibilities for the management and retention of the data to ensure that its integrity is maintained once it has been extracted from the recording device lie outside the scope of this standard.

Application of this standard is subsidiary to the responsibility of the transport authority and the safety regulatory authority and to the specific laws and decrees where the ODDRS (on board driving data recording system) is deployed.

2 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.

IEC 60571, *Railway applications – Electronic equipment used on rolling stock*

IEC 61375 (all parts), *Electronic railway equipment – Train communication network (TCN)*

IEC 62498-1, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

ISO/IEC 8824 (all parts), *Information technology – Abstract Syntax Notation One (ASN.1)*

3 Terms, definitions, abbreviations, acronyms, and conventions

3.1 Terms and definitions

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

3.1.1
accident
an unintended event or series of events that results in death, injury, loss of a system or service, or environmental damage

Note 1 to entry: Accidents are divided into the following categories: collisions, derailments, level crossing accidents, accidents to persons caused by rolling stock in motion, fires and others.

3.1.2
consist
single vehicle or a group of vehicles which are not separated during normal operation

Note 1 to entry: Train set and rake of coaches are synonyms.

Note 2 to entry: A consist may contain one or more traction units.

EXAMPLE The vehicles of a consist are steadily connected in a workshop, and automatic couplers are mounted at both ends of the consist to facilitate the coupling and de-coupling of complete consists in the workshop or during operation.

3.1.3
incidents
any occurrence, other than accident or serious accident, associated with the operation of trains and which may affect the safety of operation

3.1.4
monitoring data
data related to the monitoring of the driver competence

3.1.5
non-volatile storage medium
memory and the relevant interface circuitry, which store the data for investigative use in case of accidents and incidents

Note 1 to entry: The non-volatile storage medium may be protected.

3.1.6
ODDR unit
physical unit which implements the ODDRS

Note 1 to entry: ODDRS may be implemented by one or more ODDR units.

3.1.7
resolution
smallest change in the measurand, or stored quantity, which causes a perceptible change in the indication

[SOURCE: IEC 60050-311:2001, 311-03-10, modified]

3.1.8
train safety functions
technical barrier to prevent a hazard to become an accident during the train operation

3.2 Abbreviations and acronyms

ATO: Automatic Train Operation
ATS: Automatic Train Supervision
ATP: Automatic Train Protection
AWS: Automatic Warning System
CSV: Comma Separated Values
DIS: Driver Information System
DSD: Driver's Safety Device
EBA: Eisenbahn-Bundesamt
EMU: Electric Multiple Unit
ERTMS: European Rail Traffic Management System
ETCS: European Train Control System
FBS: Functional Breakdown Structure
GPS: Global Positioning System
GSM-R: Global System for Mobile Communications - Railway
HMI: Human-Machine Interface
I/O: Input/Output
IT: Information Technology
JRU: Juridical Recording Unit
LKJ: Lieche Yunxing Jiankong JiluZhuangzhi
LSB: Least Significant Bit
LZB: Linienzugbeeinflussung
MVB: Multifunction Vehicle Bus
ODDR: On Board Driving Data Recording
ODDRS: On Board Driving Data Recording System
PBS: Product Breakdown Structure
PZB: Punktförmige Zugbeeinflussung
RAL: Reichsausschuss für Lieferbedingungen
SCMT: Sistema Controllo Marcia Treno
TCMS: Train Control and Monitoring System
TCN: Train Communication Network
TPWS: Train Protection and Warning System
TSI: Technical Specifications for Interoperability
USB: Universal Serial Bus
UTC: Universal Time, Coordinated
VDV: Verband Deutscher Verkehrsunternehmen
WSP: Wheel Slip/Slide Protection
XML: eXtensible Markup Language

3.3 Conventions

3.3.1 Base of numeric values

This part of IEC 62625 uses a decimal representation for all numeric values unless otherwise noted.

Analog and fractional values include a comma.

EXAMPLE The voltage is 20,0 V.

Binary and hexadecimal values are represented using the ASN.1 (ISO/IEC 8824) convention.

EXAMPLE Decimal 20 coded on 8 bits = '0001 0100'B = '14'H.

3.3.2 Naming conventions

The naming conventions applied in this standard are specified by ISO/IEC Directives, Part 2, sixth edition (2011).

4 Requirements

4.1 General

The requirements are delivered and listed for each relevant function of ODDRS from the Functional Breakdown Structure illustrated by Annex E.

4.2 Functional requirements

4.2.1 Record train data

During train operation, data relevant to train operation according to Clause 1 shall be recorded on board by the on board driving data recording system. The records shall be done in such a way that it is possible to determine the driving relevant events that occurred.

The recording system shall record continuously whenever it is in recording mode (see Figure 1 and Figure 2).

The system shall localize, date and time-stamp all events that it records.

The system shall not overwrite data until at least 8 days have elapsed after it was recorded.

The last 24 h recorded data shall be held available in the ODDRS, except after controlled and authorised retrieving of recorded data. Retrieving includes also the removing and replacing of storage medium.

The data recorded shall be such that the actions of the train driver and the actions of the train safety functions can be determined directly or indirectly (i.e. from analysing more than one item of data).

The ODDRS shall monitor and record at least following data:

- Time of day and date
- Train speed
- Train location
- Driver's commands relevant to safe operation
- Actions of safety functions related to train operation (see Clause 1)

Annex F contains a check list of monitored and recorded data.

4.2.2 Ensure on board protection of recorded data

ODDRS shall have a means of protecting against loss or damage of the recorded data.

The data integrity shall be maintained under predefined worst case accident scenario (see 4.3.1.7).

Disconnection or loss of external power to the device shall not affect the integrity of data which has already been recorded.

The ODDRS shall be provided with a means of safeguarding against unauthorised access (e.g. extraction or download) to recorded data.

The ODDRS shall be provided with a means of preventing writing, modifying and deleting the recorded data. Nevertheless the date and time entry for synchronization is accepted based on a record of the synchronization process and a procedure to ensure that this synchronization is done by an authorized personnel (this procedure is outside the scope of this standard).

After loss of power, ODDRS shall maintain data contents for at least one month.

4.2.3 Ensure retrieval of recorded data

ODDRS shall allow recorded data to be extracted for analysis and retention on an external device. There are two types of data extraction means. One is the remove and convey of the storage medium from ODDRS to the ground facility and extract data in the ground facility. The second is the data transmission through a communication interface.

Errors during data extraction shall result in re-transmission until an error free transmission is completed.

If the data is not allowed to be overwritten (for instance by national regulations) a visible indication output shall be provided to show if more than 80 % of the storage medium contains recorded data which has not yet been extracted or downloaded.

The retrieval of data shall be done securely by authorized personnel or authorized systems. The ODDRS shall be provided with the means to check the success of the retrieval of the recorded data and after the success the data can be overwritten. Execution of the extraction or the download shall not affect the integrity of the source data; that is, it shall not modify, delete or overwrite it. Multiple successive downloads of the recorded data shall be possible.

If the ODDRS is capable of downloading whilst it is recording, for instance in the context of a train moving, the recording train data function specified in 4.2.1 and the protection function specified in 4.2.2 shall not be affected.

For the last 24 h of recorded data, a storage medium incorporated within ODDRS named “protected storage medium” shall:

- be removable in order that it can be removed from the ODDRS unit by means of tools if necessary,
- have protection level according to 4.3.1.7,
- be non-volatile for at least 2 years,
- be easily identifiable to achieve quick recovery following an accident.

and shall allow the stored data to be extracted.

4.2.4 Enable recorded data analysis

Extracted data shall be submitted to a software tool, provided by the manufacturer, that converts them into a standard format for data exchange (e.g. CSV, XML).

4.2.5 Optional functions

4.2.5.1 Display ODDRS status to the driver

It is recommended to have the operational status of the ODDRS and the non-volatile storage medium presence indication visible in the driver's cab.

4.2.5.2 Make easy the recognition of the non-volatile storage medium

The non-volatile storage medium shall be orange as defined in RAL 2003.

4.2.5.3 Provide on-board and on-board to ground communication

If an on-board network is provided on a train then the ODDRS shall interface with TCMS system and obtain data from it.

In case that ODDRS is interfaced to the on-board network, the preferred consist network specified by IEC 61375 series shall be used.

In case the communication between the ODDRS and ground is requested, a communication gateway could be integrated or interfaced to ODDRS. The preferred solution for the mobile communication gateway is according to the requirements specified IEC 61375 series.

4.2.5.4 Provide low power management

ODDRS could enter into power saving mode when the train has been stopped, without a driver present, for more than a pre-determined time. Power consumption in power saving mode is much lower than the in normal mode. The full functional mode shall be resumed as soon as the train is in operation mode.

4.2.5.5 Support digital signature and driver identification

The recorded data shall be digitally signed.

Digital signature and train driver identification may be realised by using smart card or encryption with asymmetrical key or by equivalent means, e.g. biometric.

The driver identification function shall be used to enable management functions (e.g. train operation enabling function).

4.2.5.6 Provide on-board diagnostics and enable remote maintenance

The ODDRS should provide on-board diagnostics and enable remote maintenance such as follows:

- Function to provide status information monitored from the operator control center, of the train which is ODDRS equipped.
- System remote initialization function
- Function to upload new software, function to download diagnostic logging files
- Download tool for recorded data

4.3 System requirements

4.3.1 On board driving data recording system

4.3.1.1 General

The ODDRS shall include for one train consist at least one on board driving data recording unit.

The ODDRS has at least three modes as listed below:

- Power off mode
- Initialization mode
- Recording mode

Additional modes may be provided.

The ODDRS shall enter recording mode in less than 60 s when it is powered on from power off mode (see Figure 1).

When the ODDRS is in recording mode, the ODDRS shall continuously monitor the incoming data and record the data according to 4.2.1.

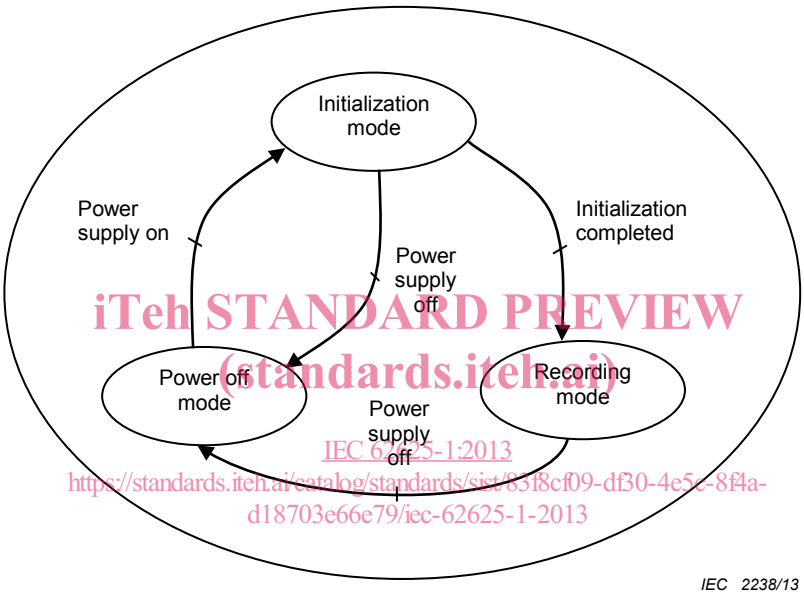

Figure 1 – ODDRS modes

4.3.1.2 Performance and capacity

4.3.1.2.1 Storage capacity

The data shall be recorded on a non-volatile storage medium.

The ODDRS physical storage medium(s) shall have the storage capacity to record according to 4.2.1.

The protected storage medium of ODDRS shall meet the requirements specified in 4.2.3.

4.3.1.2.2 Recording performance

With reference to the recording performance of ODDRS, in terms of latency time from the occurring of the incoming event (i.e. the signal input change that generates recording data) to the recording into the non-volatile storage medium, two classes are defined:

Class R1: The ODDRS shall record incoming event data within 500 ms.

Class R2: The ODDRS shall record incoming event data within 3 s, thereby providing increased life of non-volatile storage medium.

In both cases the assumed incoming data flow is 10 incoming events per second.

The resolution of the time stamping of the recorded data shall be less or equal to 1 s.

The ODDRS shall ensure that incoming data spaced out by 250 ms are recorded in a sequential order (i.e. it may happen that data spaced out by less than 250 ms are not recorded in a correct order).

4.3.1.3 Environment

The ODDRS shall be compliant to IEC 60571.

The ODDRS should satisfy the condition defined by IEC 62498-1 for electric device environmental conditions on train.

The ODDRS ambient temperature class will be the same or better than that specified for the train on which the ODDRS is installed.

4.3.1.4 ODDRS unit availability and reliability

The ODDRS unit shall have a mean time between failures greater than 50 000 h. The ODDRS unit shall be removed, replaced and made operational in less than 1 h.

The mean failure rate of recording a different data than the incoming one shall be less than 10^{-5} per hour during train operation.

The mean failure rate of retrieving data different than the recorded one shall be less than 10^{-5} per hour.

4.3.1.5 Non-tampering, non-alteration and security of records

The recorded data shall be completed with the measures to safeguard data integrity (e.g. checksum).

The integrity of the data shall be ensured by an error detecting code applied on the recorded data and on the out coming recorded data. The type of error detecting code and its length shall be chosen considering the length of the protected record. The software tool (see 4.2.4) enabling out coming recorded data analysis shall use the error detecting code to detect any altered data.

Countermeasures shall be taken in order to ensure that the recorded data is equal to the incoming data.

Stored data shall be protected by authorization against misuse e.g. by a login process before establishing a connection to the ODDRS by its interfaces.

4.3.1.6 Maintainability and diagnostic

The ODDRS shall execute a self-test during the initialization mode. If the ODDRS detects self-malfunction or loss of the power source, it shall have a method of tracing such events.

An output shall be provided by the recording system to indicate periodically its running status. The output serves to indicate that the device is receiving power and that it is functioning correctly; it does not imply that the device's inputs are connected and delivering data.

The ODDRS should provide a service interface for authorized access to the parameterisation (i.e. set of parameter values used by a function) of functional capabilities and performance.