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Railway applications - Energy measurement on board trains - Part 1: General

Bahnanwendungen - Energiemessung auf Bahnfahrzeugen - Teil 1: Allgemeines

Applications ferroviaires - Mesure d'énergie à bord des trains - Partie 1: Généralités

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Railway applications - Energy measurement on board trains - Part 1: General

Applications ferroviaires - Mesure d'énergie à bord des trains - Partie 1: Généralités

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This document (EN 50463-1:2012) has been prepared by CLC/TC9X "Electrical and electronic applications for railways".

The following dates are proposed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-10-15
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2015-10-15

This document (EN 50463-1:2012), together with parts 2, 3, 4 and 5, supersedes EN 50463:2007.

This series of European Standards includes the following significant technical changes with respect to EN 50463:2007:

— the series is based on and supersedes EN 50463:2007;

— the scope is extended, new requirements are introduced and conformity assessment arrangements are added.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive 2008/57/EC amended by Commission Directive 2011/18/EU, see informative Annex ZZ, which is an integral part of this document.

This document is Part 1 of the EN 50463 series which consists of the following parts, under the common title *Railway applications — Energy measurement on board trains*:

Part 1, General;

Part 2, Energy measuring;

Part 3, Data handling;

Part 4, Communication;

Part 5, Conformity assessment.

This series of European Standards follows the functional guidelines description in Annex A, “Principles of conformity assessment”, of EN ISO/IEC 17000 tailored to the Energy Measurement System (EMS).

The requirements for Energy Measurement Systems in the relevant Technical Specifications for Interoperability are supported by this series of European Standards.

Introduction

The Energy Measurement System provides measurement and data suitable for billing and may also be used for energy management, e.g. energy saving.

This series of European Standards uses the functional approach to describe the Energy Measurement System. These functions are implemented in one or more physical devices. The user of this Series of standards is free to choose the physical implementation arrangements.

Structure and main contents of the EN 50463 series

This series of European Standards is divided into five parts. The titles and brief descriptions of each part are given below:

EN 50463-1 – General

The scope of EN 50463-1 is the Energy Measurement System (EMS).

EN 50463-1 provides system level requirements for the complete EMS and common requirements for all devices implementing one or more functions of the EMS.

EN 50463-2 – Energy measuring

The scope of EN 50463-2 is the Energy Measurement Function (EMF).

The EMF provides measurement of the consumed and regenerated active energy of a traction unit. If the traction unit is designed for use on a.c. traction supply systems, the EMF also provides measurement of reactive energy. The EMF provides the measured quantities via an interface to the Data Handling System.

The EMF consists of the three functions: Voltage Measurement Function, Current Measurement Function and Energy Calculation Function. For each of these functions, accuracy classes are specified and associated reference conditions are defined. This part also defines all specific requirements for all functions of the EMF.

The Voltage Measurement Function measures the voltage of the CL system and the Current Measurement Function measures the current taken from and returned to the CL system. These functions provide signal inputs to the Energy Calculation Function.

The Energy Calculation Function inputs the signals from the Current and Voltage Measurement Functions and calculates a set of values representing the consumed and regenerated energies. These values are transferred to the Data Handling System and are used in the creation of Compiled Energy Billing Data.

The standard has been developed taking into account that in some applications, the EMF may be subjected to legal metrological control. All relevant metrological aspects are covered in this part of EN 50463.

EN 50463-2 also defines the conformity assessment of the EMF.

EN 50463-3 – Data handling

The scope of EN 50463-3 is the Data Handling System (DHS).

The on board DHS receives, produces and stores data, ready for transmission to any authorised receiver of data on board or on ground. The main goal of the DHS is to produce Compiled Energy Billing Data and transfer it to an on-ground Data Collection Service (DCS). The DHS can support other functionality on board or on-ground with data, as long as this does not conflict with the main goal.

EN 50463-3 also defines the conformity assessment of the DHS.

EN 50463-4 – Communication

The scope of EN 50463-4 is the communication services.

This part of EN 50463 gives requirements and guidance regarding the data communication between the functions implemented within EMS as well as between such functions and other on board units where data are exchanged using a communications protocol stack over a dedicated physical interface or a shared network.

It includes the on board to ground communication service and covers the requirements necessary to support data transfer between DHS and DCS.

EN 50463-4 also defines the conformity assessment of the communications services.

EN 50463-5 – Conformity assessment

The scope of EN 50463-5 is the conformity assessment procedures for the EMS.

EN 50463-5 also covers re-verification procedures and conformity assessment in the event of the replacement of a device of the EMS.

EMS functional structure and dataflow

Figure 1 illustrates the functional structure of the EMS, the main sub-functions and the structure of the dataflow and is informative only. Only the main interfaces required by this standard are displayed by arrows.

Since the communication function is distributed throughout the EMS, it has been omitted for clarity. Not all interfaces are shown.

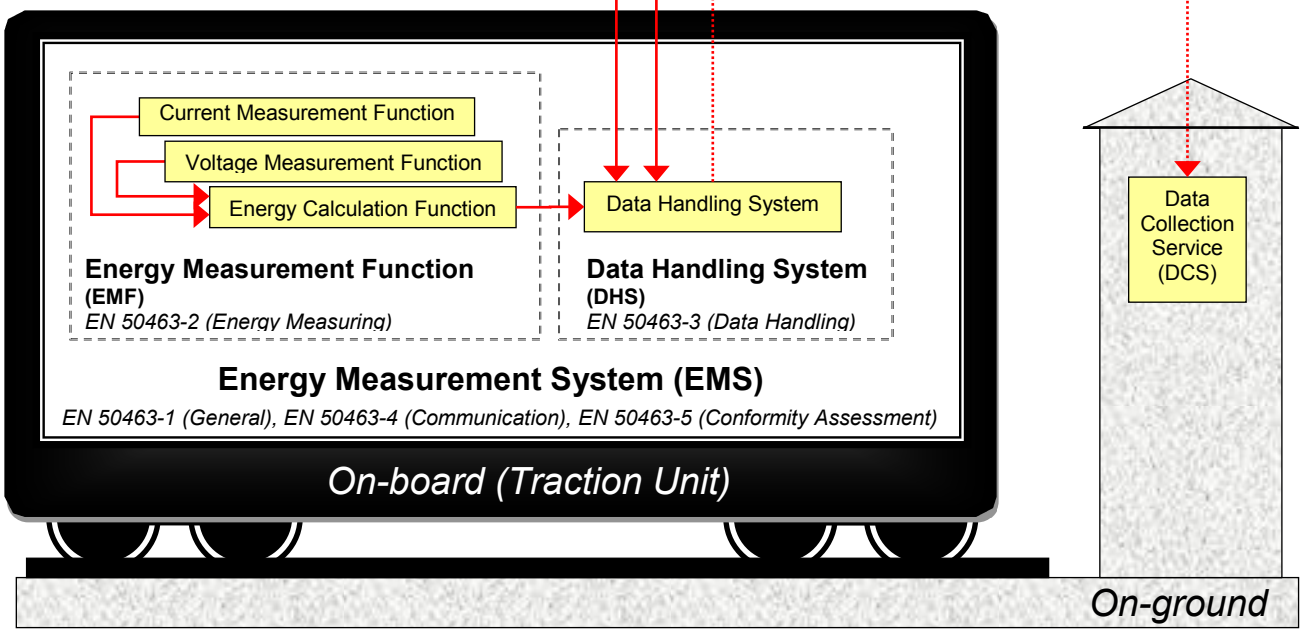

Figure 1 — EMS functional structure and dataflow diagram

1 Scope

This European Standard describes the primary purpose of the EMS, which is to meter energy consumption for billing. The EMS may also be used for other functions such as energy management.

This part of EN 50463:

- gives requirements for the complete Energy Measurement System and also requirements for all devices implementing one or more functions of the Energy Measurement System;
- applies to newly manufactured Energy Measurement Systems for use on board railway traction units, powered by a.c. and/or d.c. supply voltages as listed in the EN 50163;
- does not apply to portable Energy Measurement Systems.

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.

EN 50124-1:2001+A2:2005, *Railway applications — Insulation coordination — Part 1: Basic requirements — Clearances and creepage distances for all electrical and electronic equipment*

EN 50125-1:1999, *Railway applications — Environmental conditions for equipment — Part 1: Equipment on board rolling stock*

EN 50153, *Railway applications — Rolling stock — Protective provisions relating to electrical hazards*

EN 50155:2007, *Railway applications — Electronic equipment used on rolling stock*

EN 50463-2 , *Railway applications — Energy measurement on board trains — Part 2: Energy measuring*

EN 50463-3 , *Railway applications — Energy measurement on board trains — Part 3: Data handling*

EN 50463-4 , *Railway applications — Energy measurement on board trains — Part 4: Communication*

EN 50463-5 , *Railway applications — Energy measurement on board trains — Part 5: Conformity assessment*

EN 60085, *Electrical insulation — Thermal evaluation and designation (IEC 60085)*

EN 60529:1991+A1:2000, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989+A1:1999)*

EN 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements* (IEC 61010-1)

EN ISO 13732-1, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (*ISO 13732-1*)*

CEN/TS 45545-2, *Railway applications — Fire protection on railway vehicles — Part 2: Requirements for fire behaviour of materials and components*

CLC/TS 45545-5, *Railway applications — Fire protection on railway vehicles — Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

NOTE When possible, the following definitions have been taken from the relevant chapters of the International Electrotechnical Vocabulary (IEV), IEC 60050. In such cases, the appropriate IEV reference is given. Certain new definitions or modifications of IEV definitions have been added in this standard in order to facilitate understanding. Expression of the performance of electrical and electronic measuring equipment has been taken from EN 60359.

3.1.1
authenticity
security measures ensuring that the interface only transfers data or signals when the source and destination are correctly matched

3.1.2
CEBD-related data
all data produced by any function of the EMS required for the production of CEBD

Note 1 to entry: This includes voltage data, current data, energy data, time data and location data.

3.1.3
Compiled Energy Billing Data
CEBD
dataset compiled by the DHS suitable for energy billing

3.1.4
Consumption Point ID
CPID
13 digit number (numeric value without dividers or decimals) based on a European Vehicle Number from the traction unit plus one additional digit to uniquely identifying each EMS installed on the traction unit

Note 1 to entry: Where a traction unit has more than one EMS, the 13th digit is used to uniquely identify each EMS on the traction unit.

3.1.5
Contact Line
CL
conductor system for supplying electric energy to a traction unit through current-collecting equipment

[SOURCE: IEV 811-33-01, modified]

3.1.6
Current Measurement Function
CMF
function of an EMF measuring the current taken from and returned to the CL by the traction unit

3.1.7
Data Collection Service
DCS
on ground service collecting the CEBD from an EMS

3.1.8
Data Handling System
DHS
function combining the energy data produced by an EMF with other data, storing and transmitting the data to a DCS and other systems

3.1.9
enclosure
housing affording the type and degree of protection suitable for the intended application

[SOURCE: IEV 195-02-35]

3.1.10
Energy Calculation Function
ECF
function calculating energy data using input signals from the VMF and CMF

3.1.11
energy data
set of measured energy values transferred from EMF to DHS

3.1.12
Energy Measurement Function
EMF
function comprising the voltage measurement function, the current measurement function and the energy calculation function

3.1.13
Energy Measurement System
EMS
on board system comprising the EMF, DHS and associated communications services

3.1.14
equipment type
specific design of device containing one or more functions, produced by one supplier and having similar properties including where applicable metrological properties, the same uniform construction of parts determining these properties and the same functional components

Note 1 to entry: Equipment is designated by the manufacturer by one or more groups of letters or numbers, or a combination of letters and numbers. Each equipment type has one designation only.

Note 2 to entry: The equipment type is represented by the equipment sample as provided for type test.

Note 3 to entry: Functions can be VMF, CMF, ECF, EMF, DHS or EMS or any combination of these functions.

[SOURCE: IEV 314-07-07, modified]

3.1.15
European Vehicle Number
EVN
unique 12 digit identification number defined according to European Legislation

Note 1 to entry: See decision 2011/314/EU.

3.1.16
function
specific purpose or objective to be accomplished that is specified or described without reference to the physical means of achieving it

Note 1 to entry: A function (considered as a black-box) transfers input parameters (material, energy, information) into related output parameters (material, energy, information).

3.1.17
interface
link between two functions of the EMS or between the EMS and other functions

Note 1 to entry: A link can be physical or virtual.

3.1.18
purchaser
entity that is a recipient of the EMS or parts of the EMS provided by a supplier

3.1.19
supplier
entity that supplies EMS or parts of the EMS; may also be the manufacturer

3.1.20
traction unit
vehicle or group of vehicles in fixed formation, for which the energy taken from and/or returned to the CL is to be measured by an EMS

Note 1 to entry: EN 50463 uses the term 'traction unit' to describe the part of a train to which energy metering is applied. The term 'traction unit' is considered to be a more suitable term than 'vehicle' because the latter term is generally used to describe the smallest part of a train i.e. an individual vehicle.

3.1.21
Voltage Measurement Function
VMF
function of an EMF measuring the voltage of the CL

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

All the abbreviations are listed in alphabetical order.

CEBD	Compiled Energy Billing Data
CL	Contact Line
CMF	Current Measurement Function
CPID	Consumption Point ID
DCS	Data Collection Service
DHS	Data Handling System
ECF	Energy Calculation Function