



**SLOVENSKI STANDARD**  
**SIST EN 61375-2-1:2012**

**01-oktober-2012**

---

**Železniške elektronske naprave - Komunikacijsko omrežje vlaka - 2-1. del: Ožičeno podatkovno vodilo WTB (IEC 61375-2-1:2012)**

Electronic railway equipment - Train communication network - Part 2-1: WTB - Wire Train Bus (IEC 61375-2-1:2012)

Elektronische Betriebsmittel für Bahnen - Zug-Kommunikations-Netzwerk - Teil 2-1: WTB - Wire Train Bus Konformitätsprüfung (IEC 61375-2-1:2012)

Matériel électronique ferroviaire - Réseau embarqué de train (TCN) - Partie 2-1: Bus de train filaire (WTB) (CEI 61375-2-1:2012)

<https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012>

**Ta slovenski standard je istoveten z: EN 61375-2-1:2012**

---

**ICS:**

45.020

Železniška tehnika na splošno

Railway engineering in general

**SIST EN 61375-2-1:2012**

**en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 61375-2-1:2012](https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 61375-2-1**

August 2012

ICS 45.060

English version

**Electronic railway equipment -  
Train communication network (TCN) -  
Part 2-1: Wire Train Bus (WTB)  
(IEC 61375-2-1:2012)**

Matériel électronique ferroviaire -  
Réseau embarqué de train (TCN) -  
Partie 2-1: Bus de Train Filaire (WTB)  
(CEI 61375-2-1:2012)

Elektronische Betriebsmittel für Bahnen -  
Zug-Kommunikations-Netzwerk -  
Teil 2-1: WTB - Wire Train Bus  
Konformitätsprüfung  
(IEC 61375-2-1:2012)

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

This European Standard was approved by CENELEC on 2012-07-26. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 9/1642/FDIS, future edition 1 of IEC 61375-2-1, prepared by IEC/TC 9 "Electrical equipment and systems for railways" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61375-2-1:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-04-26
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-07-26

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 the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

**(standards.iteh.ai)**

## Endorsement notice

The text of the International Standard IEC 61375-2-1:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60870-5-1      NOTE Harmonized as EN 60870-5-1.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60571	-	Electronic equipment used on rail vehicles	-	-
IEC 60807	Series	Rectangular connectors for frequencies below 3 MHz	-	-
IEC 61375-1	-	Electronic railway equipment - Train communication network - Part 1: TCN - Train Communication Network general architecture	EN 61375-1	-
IEC 61375-2-2	2012	Electronic railway equipment - Train communication network (TCN) - Part 2-2: Wire Train Bus conformance testing	EN 61375-2-2	2012
IEC 61375-3-1	-	Electronic railway equipment - Train communication network (TCN) - Part 3-1: Multifunction Vehicle Bus (MVB)	EN 61375-3-1	-
ISO/IEC 8802-2	-	Information technology - Telecommunications - and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 2: Logical link control	-	-
ISO/IEC 8824	Series	Information technology - Abstract Syntax Notation One (ASN.1)	-	-
ISO/IEC 8825	Series	Information technology - ASN.1 encoding rules	-	-
ISO/IEC 8859-1	-	Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No.1	-	-
ISO/IEC 9646	Series	Information technology - Open Systems Interconnection - Conformance testing methodology and framework	-	-
ISO/IEC 10646	-	Information technology - Universal multiple-octet coded character set (UCS)	-	-
ISO/IEC 13239	-	Information technology - Telecommunications - and information exchange between systems - High-level data link control (HDLC) procedures	-	-
ITU-T Recommendation V.24	-	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)	-	-
ITU-T Recommendation Z.100	-	Specification and Description Language (SDL)-	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEEE 754	-	Binary floating-point arithmetic	-	-
UIC CODE 556	-	Information transmission in the train (train-bus)	-	-
UIC CODE 557	-	Diagnostics on passenger rolling stock	-	-

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 61375-2-1:2012](https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012>

## **Annex ZZ** (informative)

### **Coverage of Essential Requirements of EU Directives**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Annex III of the EU Directive 2008/57/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

**WARNING:** Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 61375-2-1:2012](https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 61375-2-1:2012](https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/bc3ac37f-e85b-4ceb-bafd-858ed8c7b726/sist-en-61375-2-1-2012>





IEC 61375-2-1

Edition 1.0 2012-06

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Electronic railway equipment – Train communication network (TCN) –  
Part 2-1: Wire Train Bus (WTB)**

**Matériel électronique ferroviaire – Réseau embarqué de train (TCN) –  
Partie 2-1: Bus de Train Filaire (WTB)**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

**XP**

ICS 45.060

ISBN 978-2-88912-067-3

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	11
INTRODUCTION.....	13
1 Scope.....	15
2 Normative references.....	15
3 Terms and definitions, abbreviations, conventions.....	16
3.1 Terms and definitions .....	16
3.2 Abbreviations.....	32
3.3 Conventions .....	34
3.3.1 Base of numeric values.....	34
3.3.2 Naming conventions.....	34
3.3.3 Time naming conventions .....	34
3.3.4 Procedural interface conventions .....	35
3.3.5 Specification of transmitted data .....	37
3.3.6 State diagram conventions.....	39
3.4 General considerations .....	40
3.4.1 Interface between equipment .....	40
3.4.2 Interface between consists.....	40
3.4.3 Real-Time Protocols .....	40
3.4.4 Network Management .....	41
3.4.5 Configurations .....	41
3.4.6 Structure of a standard device.....	42
3.5 Conformance test .....	45
4 Physical layer .....	46
4.1 Topology .....	46
4.1.1 Bus sections .....	46
4.1.2 Couplers.....	46
4.1.3 Nodes.....	46
4.1.4 Consist orientation .....	46
4.1.5 Consist specification (informal) .....	47
4.2 Medium specifications .....	48
4.2.1 Topology.....	48
4.2.2 Duplicated medium (option) .....	48
4.2.3 Bus Configuration rules.....	49
4.2.4 Cable specification.....	50
4.2.5 Shielding concept .....	51
4.2.6 Terminator.....	52
4.3 Medium attachment .....	53
4.3.1 Node connection points identification .....	53
4.3.2 Direct node attachment.....	53
4.3.3 Indirect node attachment.....	54
4.3.4 Connector (optional) .....	54
4.4 Node specifications .....	55
4.4.1 Node elements.....	55
4.4.2 Node and switch settings .....	57
4.4.3 Duplicated Line Units (option) .....	57
4.5 Line Unit specifications .....	58

4.5.1	Galvanic separation .....	58
4.5.2	Insertion losses of a Line Unit .....	58
4.5.3	Switches specifications .....	59
4.5.4	Shield connection to a Line Unit .....	59
4.5.5	Fritting (option) .....	60
4.6	Transceiver specifications.....	61
4.6.1	Conventions.....	61
4.6.2	Transmitter .....	61
4.6.3	Receiver specifications .....	64
4.7	Medium-dependent signalling.....	66
4.7.1	Frame encoding and decoding .....	66
4.7.2	Duplicated line handling (option) .....	69
4.7.3	Line Unit interface.....	71
5	Link Layer Control.....	72
5.1	Addressing .....	72
5.2	Frames and telegrams .....	73
5.2.1	Frame_Data format.....	73
5.2.2	Telegram timing.....	74
5.2.3	Elements of the HDLC Frame.....	76
5.2.4	Link Control Field.....	77
5.2.5	Handling of 'Attention', 'Change' and 'Inhibit' .....	80
5.2.6	Size, FCS and protocol errors.....	80
5.3	Telegram formats and protocols.....	80
5.3.1	Link Data field.....	80
5.3.2	Process Data.....	81
5.3.3	Message Data.....	83
5.3.4	Supervisory Data .....	84
5.3.5	Detection telegram.....	85
5.3.6	Presence telegram.....	87
5.3.7	Status telegram .....	88
5.3.8	Set to Intermediate telegram .....	90
5.3.9	Naming telegram .....	91
5.3.10	Unname telegram .....	93
5.3.11	Set to End telegram .....	93
5.3.12	Topography telegram .....	95
5.4	Medium allocation.....	97
5.4.1	Organisation .....	97
5.4.2	Periodic Phase .....	98
5.4.3	Sporadic phase .....	99
5.5	Inauguration .....	99
5.5.1	General .....	99
5.5.2	Descriptors .....	101
5.5.3	Detection of other compositions (informal) .....	105
5.5.4	State diagrams of the inauguration.....	108
5.6	Link layer interface .....	148
5.6.1	Link layer layering .....	148
5.6.2	Link Process_Data_Interface .....	149
5.6.3	Link Message_Data_Interface .....	150
5.6.4	Link management interface .....	150

6	Real-Time protocols.....	161
6.1	General .....	161
6.1.1	Contents of this clause.....	161
6.1.2	Structure of this clause .....	162
6.2	Variables – Services and Protocols .....	163
6.2.1	General .....	163
6.2.2	Link layer Interface for Process_Data.....	163
6.2.3	Application interface for Process_Variables .....	169
6.3	Messages Services and Protocols.....	184
6.3.1	General .....	184
6.3.2	Reference station.....	184
6.3.3	Message packets handling.....	187
6.3.4	Message Link layer .....	189
6.3.5	Message Network Layer.....	199
6.3.6	Message transport layer.....	211
6.3.7	Multicast Transport Protocol (option).....	242
6.3.8	Message session layer.....	258
6.3.9	Message Presentation Layer .....	260
6.3.10	Message Application layer.....	260
6.4	Presentation and encoding of transmitted and stored data.....	281
6.4.1	Purpose.....	281
6.4.2	Data ordering.....	282
6.4.3	Notation for the primitive types.....	283
6.4.4	Structured types.....	290
6.4.5	Alignment.....	299
6.4.6	Notation for special types.....	299
7	Application Layer .....	301
7.1	Process Data Marshalling .....	301
7.1.1	Marshalling Types.....	301
7.1.2	Marshalling Modes .....	301
7.1.3	Data Paths in PDM .....	302
7.1.4	PDM Operation .....	303
7.1.5	PDM Functions .....	304
7.2	WTB Line Fault Location Detection .....	306
7.2.1	Architecture .....	307
7.2.2	Protocol Overview.....	308
7.2.3	LFLD Sequence .....	309
7.2.4	End Node State Machine (Testing Node).....	311
7.2.5	Intermediate Node State Machine (Segmenting Node).....	311
7.2.6	Disturbed Line selection.....	311
7.2.7	Location Detection .....	311
8	Train Network Management .....	313
8.1	General .....	313
8.1.1	Contents of this clause.....	313
8.1.2	Structure of this clause .....	314
8.2	Manager, Agents and interfaces.....	314
8.2.1	Manager and Agent.....	314
8.2.2	Management messages protocol.....	314
8.2.3	Interfaces .....	315

8.3	Managed objects .....	317
8.3.1	Object Attributes .....	317
8.3.2	Station objects .....	317
8.3.3	WTB link objects .....	320
8.3.4	Variable objects .....	321
8.3.5	Messenger objects .....	323
8.3.6	Domain objects .....	324
8.3.7	Task objects .....	324
8.3.8	Clock object .....	325
8.3.9	Journal object .....	325
8.3.10	Equipment object .....	326
8.4	Services and management messages .....	326
8.4.1	Notation for all management messages .....	326
8.4.2	Station services .....	331
8.4.3	WTB link services .....	338
8.4.4	Variables services .....	350
8.4.5	Messages services .....	360
8.4.6	Domain services .....	369
8.4.7	Task services .....	374
8.4.8	Clock services .....	376
8.4.9	Journal Service .....	377
8.4.10	Equipment Service .....	379
8.5	Interface Procedures .....	380
8.5.1	Manager interface (MGI) .....	380
8.5.2	Agent interface .....	381
Bibliography	.....	384
Figure 1	– Wire Train Bus .....	13
Figure 2	– Layering of the TCN .....	14
Figure 3	– State transition example .....	39
Figure 4	– Interfaces between equipment .....	40
Figure 5	– Interfaces between consists .....	40
Figure 6	– Train Bus and Consist network .....	41
Figure 7	– TCN configurations .....	42
Figure 8	– TCN WTB device configuration options .....	43
Figure 9	– Train Composition (two Intermediate Nodes shown) .....	46
Figure 10	– Vehicle measurement .....	47
Figure 11	– Connected nodes in regular operation .....	48
Figure 12	– Double-line attachment .....	49
Figure 13	– Grounded shield concept .....	52
Figure 14	– Floating shield concept .....	52
Figure 15	– Terminator .....	53
Figure 16	– Direct node attachment (optional double-line) .....	53
Figure 17	– Indirect attachment .....	54
Figure 18	– WTB connector, front view .....	55
Figure 19	– Example of MAU Structure .....	56

Figure 20 – Node with redundant Line Units.....	58
Figure 21 – Attenuation measurement .....	59
Figure 22 – Shield grounding in the Line Unit.....	60
Figure 23 – Fritting source and load .....	60
Figure 24 – Transmitter fixtures.....	62
Figure 25 – Pulse wave form at transmitter.....	63
Figure 26 – Signal and idling at transmitter .....	64
Figure 27 – Receiver signal envelope .....	65
Figure 28 – Receiver edge distortion .....	66
Figure 29 – Idealised frame on the line (16 bit Preamble shown).....	67
Figure 30 – Bit encoding.....	67
Figure 31 – Preamble.....	67
Figure 32 – End Delimiter.....	68
Figure 33 – Valid frame, RxS, CS and SQE signals .....	69
Figure 34 – Garbled frame, RxS, CS, SQE signals.....	69
Figure 35 – Redundant Lines (as seen at a receiver) .....	70
Figure 36 – Line_Disturbance signals .....	71
Figure 37 – HDLC Frame structure.....	73
Figure 38 – Telegram timing.....	74
Figure 39 – Example of Interframe spacing.....	75
Figure 40 – Frame spacing measured at the master side.....	76
Figure 41 – Frame spacing at the slave.....	76
Figure 42 – HDLC Data format .....	77
Figure 43 – Format of HDLC Data .....	77
Figure 44 – Process Data telegram .....	81
Figure 45 – Format of Process Data Request .....	82
Figure 46 – Format of Process Data Response.....	83
Figure 47 – Message Data telegram .....	83
Figure 48 – Format of Message Data Request.....	83
Figure 49 – Format of Message Data Response .....	84
Figure 50 – Supervisory telegram .....	84
Figure 51 – Detection telegram.....	85
Figure 52 – Format of Detect Request.....	86
Figure 53 – Format of Detect Response .....	86
Figure 54 – Presence telegram.....	87
Figure 55 – Format of Presence Request .....	87
Figure 56 – Format of Presence Response.....	88
Figure 57 – Status telegram .....	88
Figure 58 – Format of Status Request .....	89
Figure 59 – Format of Status Response.....	90
Figure 60 – Set-to-Intermediate telegram .....	90
Figure 61 – Format of SetInt Request.....	90
Figure 62 – Format of SetInt Response .....	91

Figure 63 – Naming telegram .....	91
Figure 64 – Format of Naming Request .....	92
Figure 65 – Format of Naming Response.....	92
Figure 66 – Unnaming telegram.....	93
Figure 67 – Format of Unname Request .....	93
Figure 68 – Set to End telegram .....	93
Figure 69 – Format of SetEnd Request.....	94
Figure 70 – Format of SetEnd Response .....	94
Figure 71 – Topography telegram .....	95
Figure 72 – Format of Topography Request.....	95
Figure 73 – Format of Topography Response .....	96
Figure 74 – Structure of the Basic Period .....	97
Figure 75 – Node position numbering .....	100
Figure 76 – Format of Node Descriptor .....	101
Figure 77 – Format of Node Report .....	102
Figure 78 – Format of User Report .....	102
Figure 79 – Format of Composition Strength.....	103
Figure 80 – Master_Report.....	104
Figure 81 – Format of Topo Counter.....	104
Figure 82 – Format of Master Topo.....	105
Figure 83 – Timing Diagram of detection protocol .....	107
Figure 84 – Major node states and application settings.....	108
Figure 85 – Node processes (End Setting).....	109
Figure 86 – AUXILIARY_PROCESS states .....	115
Figure 87 – NAMING_RESPONSE macro.....	116
Figure 88 – States of MAIN PROCESS.....	117
Figure 89 – Macro ‘START_NODE’ .....	120
Figure 90 – Procedure REQUEST_RESPONSE .....	122
Figure 91 – Procedures ‘SET_TO_INT’ and ‘SET_TO_END’ .....	123
Figure 92 – Macro ‘INIT_MASTER’ .....	124
Figure 93 – Macro ‘NAMING_MASTER’ .....	125
Figure 94 – Macro ASK_END .....	126
Figure 95 – Procedure NAME_ONE .....	129
Figure 96 – Macro TEACHING_MASTER.....	131
Figure 97 – Macro ‘UNNAMING_MASTER’ .....	132
Figure 98 – Macro ‘REGULAR_MASTER’ .....	134
Figure 99 – Macro CHECK_DESC .....	135
Figure 100 – Macro PERIODIC_POLL .....	137
Figure 101 – Macro MESSAGE_POLL .....	138
Figure 102 – States ‘UNNAMED_SLAVE’ .....	140
Figure 103 – States ‘NAMED_SLAVE’ .....	142
Figure 104 – Macro ‘LEARNING_SLAVE’.....	144
Figure 105 – Macro ‘REGULAR_SLAVE’.....	146