IEEE STANDARDS ASSOCIATION

IEEE Standard for the Functioning of Interfaces Among Propulsion, Friction Brake, and Train-Borne Master Control on Rail Rapid Transit Vehicles

IEEE Vehicular Technology Society

Sponsored by the
Rail Transportation Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

4 March 2013

IEEE Std 1475™-2012
(Revision of
IEEE Std 1475-1999)

IEEE Std 1475™-2012
(Revision of
IEEE Std 1475-1999)

IEEE Standard for the Functioning of Interfaces Among Propulsion, Friction Brake, and Train-Borne Master Control on Rail Rapid Transit Vehicles

Sponsor

Rail Transportation Standards Committee
of the
IEEE Vehicular Technology Society

Approved 5 December 2012

IEEE-SA Standards Board

Abstract: The interfaces between and among functional systems on rail rapid transit vehicles are prescribed. The systems themselves are treated as “black boxes”; requirements for the input signals and the output response are given. For each category of interface, three types are listed in increasing technical sophistication.

Keywords: friction brake, IEEE 1475™, interfaces, master control, propulsion, rail vehicles, rapid transit

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-0-7381-8254-4 STD98156
Print: ISBN 978-0-7381-8255-1 STDPD98156

Notice and Disclaimer of Liability Concerning the Use of IEEE Documents: IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

Use of an IEEE Standard is wholly voluntary. IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon any IEEE Standard document.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained in its standards is free from patent infringement. IEEE Standards documents are supplied "**AS IS**."

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

Translations: The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official Statements: A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered the official position of IEEE or any of its committees and shall not be considered to be, nor be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on Standards: Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important to ensure that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. Any person who would like to participate in evaluating comments or revisions to an IEEE standard is welcome to join the relevant IEEE working group at http://standards.ieee.org/develop/wg/.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

Notice to users

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

Updating of IEEE documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at http://standards.ieee.org/index.html or contact the IEEE at the address listed previously. For more information about the IEEE Standards Association or the IEEE standards development process, visit IEEE-SA Website at http://standards.ieee.org/index.html.

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this IEEE standard was completed, the P1475 Working Group had the following membership:

David R. Phelps, *Chair*
Lowell Goudge, *Vice Chair*

Timothy Cramond
David Gregson
Kenneth Karg
Walter Keevil
Richard Mazur
Raymond Strittmatter
David Turner

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Steven Bezner
Bill Brown
Keith Chow
Timothy Cramond
Michael Crispo
Ray Davis
H. Glickenstein
Lowell Goudge
David Gregson
Randall Groves
Werner Hoelzl
Paul Jamieson
Andrew Jones
Kenneth Karg
Piotr Karocki
Walter Keevil
Yuri Khersonsky
Thomas Kurihara
Greg Luri
Arturo Maldonado
Richard Mazur
Michael S. Newman
Charles Ngethe
David R. Phelps
Alan Rumsey
Bartien Sayogo
Suresh Shrimavle
Gil Shultz
Alexander Sinyak
Jeffrey Sisson
David Thurston
David Turner
John Vergis
Jian Yu

When the IEEE-SA Standards Board approved this standard on 5 December 2012, it had the following membership:

Richard H. Hulett, *Chair*
John Kulick, *Vice Chair*
Robert M. Grow, *Past Chair*
Konstantinos Karachalios, *Secretary*

Satish Aggarwal
Masayuki Ariyoshi
Peter Balma
William Bartley
Ted Burse
Clint Chaplin
Wael Diab
Jean-Phillippe Faure
Alexander Gelman
Paul Houzé
Jim Hughes
Young Kyun Kim
Joseph L. Koepfinger*
John Kulick
David J. Law
Thomas Lee
Hung Ling
Oleg Logvinov
Ted Olsen
Gary Robinson
Jon Walter Rosdahl
Mike Seavey
Yatin Trivedi
Phil Winston
Yu Yuan

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Richard DeBlasio, *DOE Representative*
Michael Janezic, *NIST Representative*

Michelle D. Turner
IEEE Standards Program Manager, Document Development

Michael Kipness
IEEE Standards Program Manager, Technical Program Development

Introduction

This introduction is not part of IEEE Std 1475-2012, IEEE Standard for the Functioning of Interfaces Among Propulsion, Friction Brake, and Train-Borne Master Control on Rail Rapid Transit Vehicles.

This introduction provides background on the rationale used to develop this standard, which may aid in the understanding, usage, and applicability of this standard.

Rail transit vehicles have been notable for their lack of standardization. Some real-life factors have contributed to this, primarily because of historic differences in the civil infrastructure and electrical power supply. This standard sets forth a framework for the interfaces among the propulsion system, friction brake system, and master control, but does not attempt to standardize the individual systems themselves and does not dictate that all vehicles must use the most advanced technology available.

This standard applies to rail transit vehicles, which are usually, but not exclusively, electrically powered. These vehicles include railway electric multiple unit (EMU) cars, Heavy rail vehicles (HRVs) (subway or elevated cars), Light rail vehicles (LRVs) (streetcars), including units that combine powered and unpowered trucks or axles. All of these vehicles can be operated under the control of a driver or varying levels of complexity of train control computer, which are lumped together for this purpose as vehicle on-board (master) control (VOBC). In general, the type of train operation does not normally affect the propulsion/brake interface, and this standard can be applied irrespective of the presence or absence of a human driver. Fully automated, driverless implementations of the above vehicle types are sometimes included in the mode of transit referred to as automated guideway transit (AGT) and, to the extent that the vehicle does not have other unique requirements, this standard can be applied. It is not intended that this standard be universally required for all AGT systems, and neither is it intended that this standard apply to locomotives hauling trains nor to locomotive-hauled (including “push-pull”) cars.

The classes of railway vehicles (such as those termed diesel multiple unit [DMU]), which use a diesel engine or other nonelectric prime mover, have features of the propulsion and braking systems used in these vehicles that are similar to those used in conventional electrically powered vehicles. To the extent that these systems are similar to those used in electrically powered vehicles, this standard can be applied.

This specification applies specifically to newly designed or newly modified systems. It is understood that for the necessity of backwards compatibility to older vehicles, which may employ what would be considered non-standard trainline systems, that the specific interface requirements of this standard do not strictly apply. It should be noted, however, that some of the concepts of redundancy and checking are still applicable.

NOTE 1—Self-propelled railway vehicles operating on common carrier railroad trackage are subject to regulations issued by governmental bodies (e.g., federal, state, and local bodies). In selected jurisdictions, this is also true for rail transit vehicles. The user should recognize that such regulations always take precedence over a consensus standard.

NOTE 2—Master control, as defined in 3.1 and utilized herein, is a term selected to apply broadly to any VOBC from manual control, as historically understood, to all forms of automatic train control (including, but not limited to, automatic train protection, automatic train stop, automatic train operation, and cab signals and all combinations thereof).

Contents

IEEE Standard for the Functioning of Interfaces Among Propulsion, Friction Brake, and Train-Borne Master Control on Rail Rapid Transit Vehicles

1. Overview

1.1 Scope

This standard specifies the interface functionality among propulsion, friction brake, and train-borne master control. The standard encompasses performance parameters, communication methods and the means for measurement and verification of performance. Third party systems performing functions traditionally carried out in one of the above systems are also covered.

1.2 Purpose

IEEE Std 1475 contains specifications leading to standardization, compatibility and interchangeability of functional protocols for interfaces among train-borne master control, propulsion, friction brake, spin-slide control, etc., reducing first cost and recurrent integration problems. This standard, in use by car-builders and system suppliers, has lowered costs, reduced vehicle introduction problems, improved reliability, and facilitated upgrades. It further helps prioritize safety functionality.