IEC 62290-2

Edition 2.0 2014-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Urban guided transport management and command/control systems –
Part 2: Functional requirements specification

Applications ferroviaires – Systèmes de contrôle/commande et de gestion des transports guidés urbains –
Partie 2: Spécification des exigences fonctionnelles

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FOREWORD

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International Standard IEC 62290-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This second edition cancels and replaces the first edition issued in 2011. It constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

– all terms and definitions have been moved to Part 1.

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

FDIS	Report on voting
9/1914/FDIS	9/1942/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 of IEC 62290 series, under the general title *Railway applications – Urban guided transport management and command/control systems*, 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- withdrawn,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.

INTRODUCTION

IEC 62290 standard series specifies the functional, system and interface requirements for the command, control, and management systems intended to be used on urban, guided passenger transport lines and networks. This series does not apply to lines that are operated under specific railway regulations, unless otherwise specified by the authority having jurisdiction.

These systems are designated here as Urban Guided Transport Management and Command/Control Systems (UGTMS). UGTMS cover a wide range of operations needs from non-automated (GOA1) to unattended (GOA4) operation. A line may be equipped with UGTMS on its full length or only partly equipped.

This series does not specifically address security issues. However, aspects of safety requirements may apply to ensuring security within the urban guided transit system.

The main objective of this series is to achieve interoperability, interchangeability and compatibility.

This series is a recommendation for those transport authorities wishing to introduce interoperable, interchangeable and compatible equipment.

It is the responsibility of the transport authority concerned in accordance with the authority having jurisdiction to decide on how to apply this series and to take into account their particular needs.

IEC 62290 series is also intended to support applications for upgrading existing signalling and command control systems. In this case, interchangeability and compatibility could be ensured only for the additional UGTMS equipment. Checking the possibility for upgrading existing equipment and the level of interoperability is the responsibility of the transport authority concerned.

Application of the series should take into account the differences between the various networks operated in different nations. Those differences include operational and regulatory requirements as well as different safety cultures.

This series defines a catalogue of UGTMS requirements split into mandatory and optional functions. The functions used are based on the given grade of automation. By fulfilling the requirements, a supplier can create one or more generic applications including all mandatory functions and all or a subset of optional functions. A generic application will achieve interoperability within the defined specific application conditions. Customising a generic application will create a specific application taking into account of local conditions such as track layout and headway requirements. It is the choice of supplier and transport authority to add additional functions to a generic or specific application. These additional functions are not described in this series.

According to IEC 62278, it is the responsibility of the transport authority, in agreement with the authority having jurisdiction, to decide, taking into account their risk acceptance principles to conduct specific hazard and risk analysis for each specific application. The safety levels for the functions of each specific application have to be determined by a specific risk analysis.

Terms like "safety related command", "safety conditions", "safe station departure" are mentioned without having performed any hazard analysis.

Standard series IEC 62290 is intended to consist of four parts:

- Part 1 “System principles and fundamental concepts” provides an introduction to the standard and deals with the main concepts, the system definition, the principles and

the basic functions of UGTMS (Urban Guided Transport Management and Command/Control Systems).

The three other parts correspond to the three steps (see Figure 1) required in the process of specifying UGTMS and are to be used accordingly.

- Part 2 “Functional requirements specification” specifies the functional requirements associated to the basic functions provided by Part 1, within the system boundaries and interfaces as defined in Figure 3 of Part 1.

  The FRS (Functional Requirements Specification) identifies and defines the functions that are necessary to operate an urban guided transport system. Two types of functions are distinguished for a given grade of automation: mandatory functions (e.g. train detection) and optional functions (e.g. interfaces to passenger information and passenger surveillance systems). Requirements of functions have the same allocation, unless they are marked otherwise.

- Part 3 (under consideration) “System requirements specifications” deals with the architecture of the system and the allocation of the requirements and functions identified in Part 2 to architecture constituents.

  The SRS (System Requirement Specification) specifies the architecture of a UGTMS system, with mandatory and optional constituents.

- Part 4 (under consideration) “Interface specifications” deals with the definition of the interfaces, as well as the data exchanged by them (FIS and FFFIS), for the interoperable and interchangeable constituents identified in Part 3.

  For interfaces between UGTMS constituents, the logical interface or FIS (Functional Interface Specification) and/or the physical and logical interface or FFFIS (Form Fit Functional Interface Specification) will be considered.

NOTE The specific structures of Part 3 and Part 4 will be established following completion of Part 2 to accommodate optional and mandatory constituents, and to reflect local conditions. In principle, only one FIS or/and FFFIS will be defined for the same interface. However, when justified in some cases, several FISs or several FFFISs will be defined for the same interface.

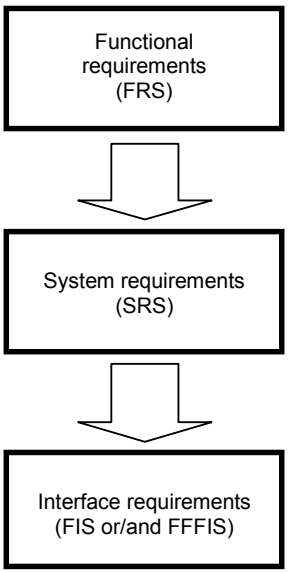

Figure 1 – The three-step process followed by the UGTMS standard

Requirements are those necessary to fulfil all operational needs for safe and orderly operation requested by transport authorities without regard to technical solutions.

The chosen level of detail in describing requirements enables customers as well as authorities having jurisdiction to be assured that generic applications delivered by different suppliers will cover at least the same functionality as specified in this part of IEC 62290.

Requirements which are established by this series are indicated clearly with a requirement identification number related to the function to be covered.

RAILWAY APPLICATIONS – URBAN GUIDED TRANSPORT MANAGEMENT AND COMMAND/CONTROL SYSTEMS –

Part 2: Functional requirements specification

1 Scope

This part of IEC 62290 specifies the functional requirements of UGTMSs (Urban Guided Transport Management and Command/Control Systems) for use in urban guided passenger transport lines and networks. This part of IEC 62290 is applicable for new lines or for upgrading existing signalling and command control systems.

This part of IEC 62290 is applicable to applications using:

- continuous data transmission
- continuous supervision of train movements by train protection profile
- localisation of trains by external wayside equipment or reporting trains.

This standard is not applicable to existing command and control systems or projects in progress prior to the effective date of this standard.

In this Part 2 of the standard, the functional requirements set the framework to which detailed functions should be added to define any generic or specific application.

Because of that, although this part of the standard is applicable as a basis to define SRS, FIS and FFFIS, elements may be added for a generic or specific application.

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 62290-1, *Railway applications – Urban guided transport management and command/control systems – Part 1: System principles and fundamental concepts*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in IEC 62290-1 apply.

4 Operational concept

4.1 Organisation of operation for urban guided transport

The organisation of operation for public transport is structured generally into the following tasks and carried out by using infrastructure (guideway and its elements) and trains (see Figure 2):

- planning operation (Offices for planning operation including timetable, train- and staff resources), which is out of the scope of this standard,
- operations management and supervision (Operations Control Centre) as described in Clause 6,
- execute train operations, as described in Clause 5,
- maintenance for all facilities and equipment of the transport system, especially infrastructure, trains, UGTMS equipment. Maintenance is out of the scope of this standard but UGTMS supports maintenance as described in 6.9.

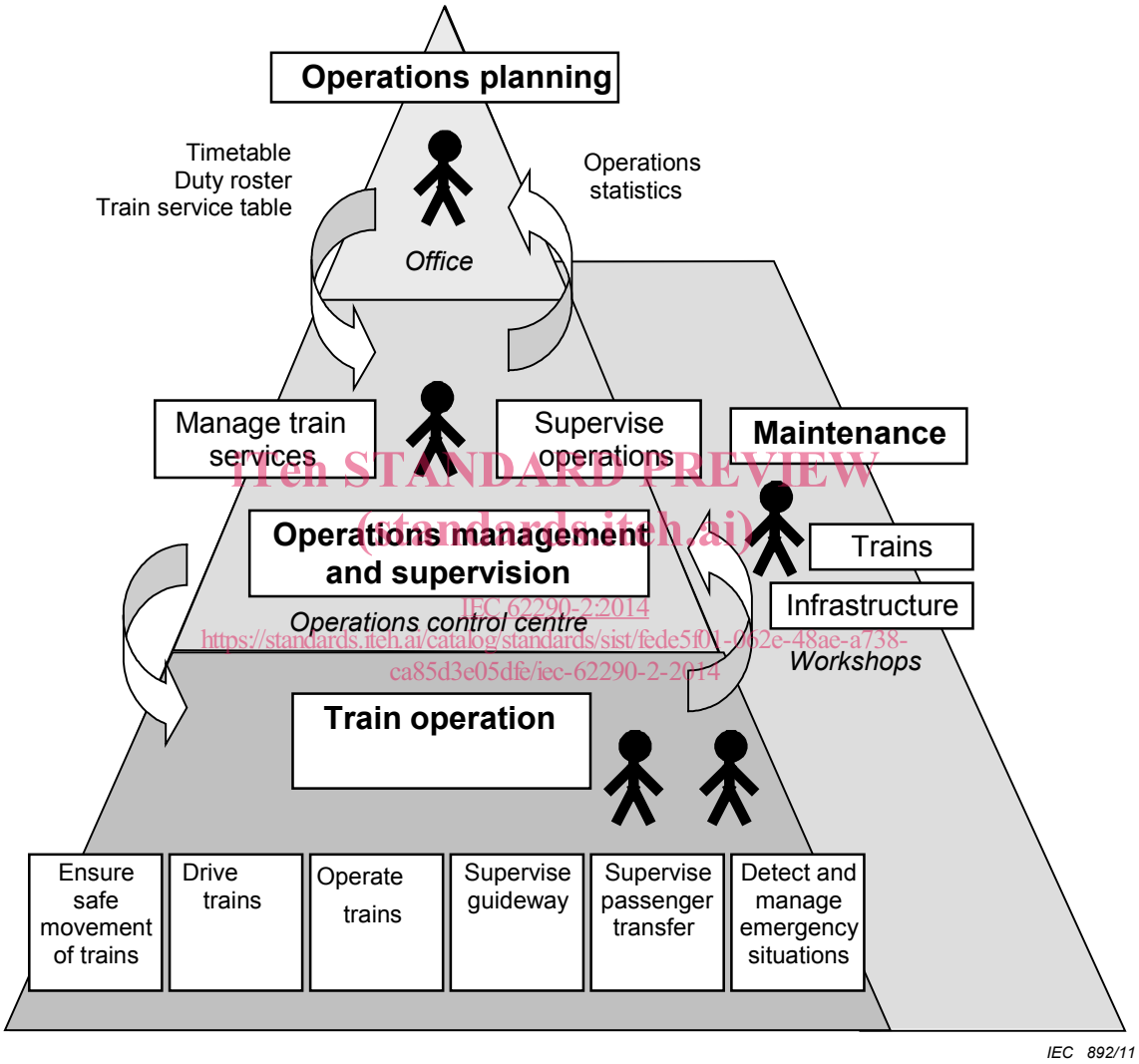

Figure 2 – Organisation of operation

This operations organisation hierarchy provides an overview of UGTMS functions of this functional requirements specification. It is also a first approach for a system hierarchy to be described in the System Requirement Specification (SRS). Train operations are enabled by command-control equipment situated both at the wayside and onboard, which interfaces to the OCC equipment. Operation management and supervision is carried out from the OCC which provides also the interface to operations control HMI to operate and display all functions required by UGTMS.

The task of operations planning contains all necessary measures to prepare operation.

Operation planning has to provide the operation management and supervision level with all necessary information to execute train operation and will be provided with information from

management and supervision level to enable adjustment of the planning process for operational needs.

Operations management and supervision include all measures which are necessary to ensure operations in normal, perturbed and failure situations.

The functions to be realised on this level are described in Clause 6.

4.2 Basic operational principles

UGTMS can be applied to a wide range of urban guided transport systems and the specific UGTMS operational requirements for a given application will depend on the required grade of automation. The following basic operational principles will however apply for all UGTMS applications.

UGTMS will have precise knowledge of the limits of UGTMS territory which can include both mainline and yard tracks.

UGTMS will include the capability to perform verification checks of the UGTMS onboard equipment prior to entering UGTMS territory. The checks should be performed sufficiently in advance of entry into UGTMS territory to verify the proper operation of the UGTMS onboard equipment, including any UGTMS wayside equipment dependencies.

Under normal circumstances, it should not be necessary for a train to come to a stop when entering or exiting UGTMS territory, unless required for other safety or operational reasons.

UGTMS-equipped trains can include passenger trains, non-passenger trains and maintenance trains and different functional requirements may apply to the different types of train. For example, non-passenger trains and maintenance trains will normally not be required to stop at passenger stations on the mainline.

UGTMS-equipped trains will be capable of operating in various driving modes, depending on the grade of automation and on the operational status of the UGTMS onboard and/or wayside equipment.

UGTMS will ensure a safe route, safe train separation, and the safe speed of all UGTMS-equipped trains operating in UGTMS territory. Trains can be operated manually by a train driver, or automatically by UGTMS depending on the grade of automation. When operating automatically, some functions (such as door operation) may continue to be the responsibility of the train staff.

Trains not equipped with UGTMS onboard equipment, and/or trains with inoperative UGTMS onboard equipment, that are operating in UGTMS territory will operate under the protection of either a separate fall-back wayside signal system or operating procedures, or a combination of both, as specified by the transport authority. (See also 4.6 below).

Commands from staff shall be provided via the interface with the operations control HMI.

Systems are run either with or without a timetable, for example by using headway regulation only.

4.3 Principles to ensure safe route

The operational purpose of setting routes is to allow trains to travel to different destinations in the network.

UGTMS permits trains to be manually or automatically routed between any defined origin and destination in accordance with the train service requirements for the line, predefined routing

rules, and any UGTMS user-directed service strategy. Where applicable to the specific track configuration, automatic routing will support the proper merging and diverging of trains at junctions, the turnback of trains, the movement of trains from/to yards and train storage areas, and the rerouting of trains in response to service disruptions and/or planned outages.

UGTMS will ensure a safe route for all UGTMS trains in all grades of automation.

To prevent train collisions and derailments, train movement will not be authorized until the route is set and locked. The route will be locked prior to the train entering the route and route locking will be maintained while the train is within the route. Routes will be released by manual commands or by movement of trains.

Ensuring a safe route is either a UGTMS function or an external function, in the latter case appropriate interface shall be provided.

4.4 Principles to ensure safe separation of trains

The required design and operating headways for the line will be as specified by the transport authority. The design headway for a line involves many factors that are outside of UGTMS (e.g. track alignment, gradients, track speed limits, train acceleration and braking rates, station dwell times, terminal track configurations, driver reaction times, etc.). These factors shall be specified by the transport authority. UGTMS factors contributing to achievable headways include accuracy of train location and train speed determination, resolution of movement authority limits for a given train, frequency at which location reports and movement authorities are updated, data communication delays, and UGTMS equipment reaction times for both UGTMS wayside and UGTMS onboard equipment.

UGTMS will provide safe train separation assurance in all grades of automation based on the principle of an instantaneous stop of a preceding train. Safe train separation may be achieved using either fixed block or moving block principles.

To ensure safe train separation, UGTMS establishes an absolute movement authority limit for each train based on the determined location of the train ahead. This absolute movement authority limit represents the limit of movement protection for a following train, with appropriate consideration of the location margin inaccuracy of the preceding train (including any rollback tolerance).

4.5 Principles to ensure safe speed

UGTMS will provide overspeed protection in all grades of automation to ensure that the train's actual speed will not exceed its safe speed. The safe speed will be derived with consideration of both permanent and temporary speed limits within the train's movement authority as well as any permanent or temporary speed restrictions applicable to the train.

UGTMS ensures that a train does not travel beyond the train protection profile by supervising train movement along the authorized route to a defined target point (see Figure 3). The distance between the target point and movement authority limit is a variable safety distance, as determined by the safe braking model, to ensure that the limit of movement protection will not be exceeded. The safe braking model includes consideration of factors such as location margin inaccuracy of following train, train length, allowable overspeed permitted by the UGTMS system, maximum speed measurement error, UGTMS reaction times and latencies, maximum train acceleration rate possible at the time an overspeed condition is detected by UGTMS, worst-case reaction times to disable the propulsion system and apply the emergency brakes following detection of an overspeed condition, and emergency brake rate, etc.

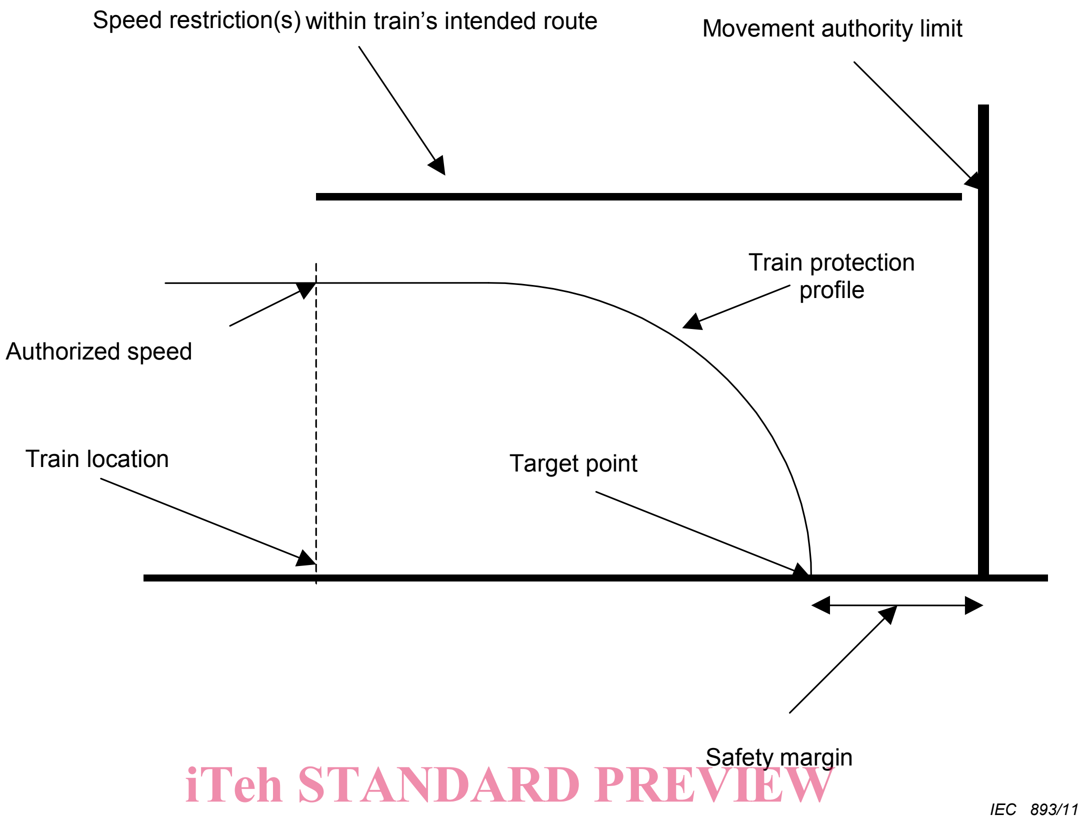

Figure 3 – Train protection profile and speed supervision

According to the safe braking model, any violation of the train protection profile will not result in the train being beyond the movement authority limit.

4.6 Degraded modes of train operation

It is a basic operational principle to continue to move trains with a level of safety potentially degraded in the event of UGTMS equipment failures, possibly at reduced operating speeds and/or increased operating headways when compared to normal train operations. As a consequence, UGTMS will support degraded modes of operation in the event of failure, and will continue to provide train protection with minimum reliance on adherence to operating procedures. This will be achieved through functional elements of UGTMS itself, through a separate non-UGTMS fall-back wayside signal system (if specified by the transport authority), or through strict adherence to operating procedures, or through a combination of any or all of the above.

Degraded modes of train operation should take advantage of the functional capabilities of UGTMS in order to eliminate hazards to passengers and staff while continuing to provide passenger train service. Specifically, degraded modes of train operations in UGTMS territory should address those UGTMS equipment failures that affect all trains operating within a particular area of control or a particular train operating within any area of control.

For all functions of UGTMS a non-communicating train or a train with inoperative onboard equipment shall be handled in the same way as a non-equipped train.

5 Functions for train operation

This clause contains all functions which are necessary for train operation to be provided by UGTMS.