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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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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2: Functional requirements specification

FOREWORD

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International Standard IEC 62290-2 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
9/1529/FDIS	9/1543/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- withdrawn,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 assuring security within the urban guided transit system.

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

This series defines a catalogue of UGTMS functional requirements split into mandatory and optional functions, as well as customisation principles. The functions used are based on the given grade of automation taking into account the grade of line. 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 like track layout and headway requirements. It is in 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.

The application of this series is the responsibility of the transport authority concerned in accordance with the authority having jurisdiction.

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.

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

The safety levels for the functions of each specific application have to be determined by a specific hazard analysis.

This series is a recommendation for those transport authorities, wishing to introduce interoperable, interchangeable and compatible equipment. It is the responsibility of transport authorities, in accordance with authorities having jurisdiction, to take into account their particular needs in the application of the series.

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. The definition of generic interfaces with existing equipment is taken into account in the IEC 62290 series.

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.

Standard series IEC 62290 will 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 main functions of UGTMS (Urban Guided Transport Management and Command/Control Systems).

The three other parts correspond to the three steps 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 4 of Part 1. Safety level allocation can only be done after a hazard and risk analysis has been carried out.

  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 taking into account grade of line: 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.

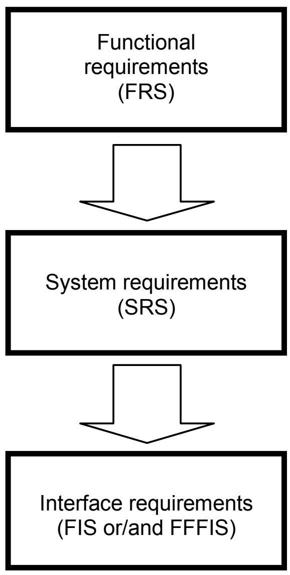
- Part 3 (under consideration) “System specifications” deals with the architecture of the system and the allocation of the requirements and functions identified in part 2 to architecture constituents (SRS).

  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 FIS or several FFFIS will be defined for the same interface.



IEC 891/11

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

Functional requirements are defined as such requirements, which are 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 functional 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.

Functional 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 specification of UGTMS (Urban Guided Transport Management and Command/Control Systems). IEC 62290-2 is applicable for new lines or for upgrading existing signalling and command control systems.

This part of IEC 62290 is applicable to applications using:

- spot or continuous data transmission
- continuous supervision of train movements by train protection profile
- localisation of trains by 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.

Command and control systems which do not use data communications, between wayside equipment and trains, for train protection purposes are outside the scope 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 complete application, either generic or specific.

Because of that, this part of the standard is not intended to be used as a basis for the definition of complete SRS, FIS nor FFFIS.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including 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 following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1
additional non-standard function
function to be adapted to the specific requirements of each transport authority (due to local rules or specific needs of the transport authority); the components affected by this function are not necessarily interchangeable nor interoperable

3.1.2
automatic mode
operation in GOA 2, 3 or 4

3.1.3
emergency brake
brake or combination of brakes which ensures that the train will stop with the brake rate agreed between authority having jurisdiction, transport authority and train manufacturer

3.1.4
mandatory function
function compulsory for any UGTMS application depending of the GOA and has to be developed in compliance with the UGTMS requirements in order to obtain interchangeable and interoperable components

NOTE Requirements of mandatory functions are also mandatory unless they are marked as optional.

3.1.5
mission (of a train)
non-safety related instruction for guiding a train for a journey from one defined location (e.g. terminal station, transfer track) to another defined location including intermediate stops for passenger transfer and possibly needed actions of a train (e.g. turn back) including time constraints

3.1.6
movement authority
permission for a train to run, within the constraints of the infrastructure, up to a specific location

3.1.7
operation control HMI
external central HMI (at OCC) and/or local HMI (if any)

3.1.8
non-operative UGTMS trains
non-UGTMS equipped trains and trains with inoperative UGTMS onboard-equipment

3.1.9
optional function
function not compulsory for a defined GOA – for a specific UGTMS application the transport authority has to decide if it uses it or not; if yes, this function shall be compliant with the UGTMS requirements, in order to obtain interchangeable and interoperable components

3.1.10
reporting train
UGTMS-equipped train able to report its location and other relevant information

3.1.11
safe places
areas within the network of an operator where evacuation of passengers can be performed, depending on current operational conditions, with a minimum of risks to the passengers (e.g. stations, refuges on the line which are not under emergency condition)

3.1.12
service brake
braking applied by the driver or the train UGTMS onboard equipment to control train speed

NOTE This takes into account passengers comfort, economic and environmental considerations.

3.1.13
train integrity
the quality of the train being complete (no car unduly separated from the train)

3.1.14
train stop
a device located adjacent to a running rail which is so positioned that if the signal with which it is associated is displaying danger it actuates the braking system of a train which passes this signal; alternatively, when a line speed restriction exists, it may be used independently of a signal

[IEC 60050-821:1998, 821-08-10]

3.1.15
transfer track
transition area between unequipped part of a network and UGTMS territory

3.1.16
zone of protection
a zone where no train is allowed to run as a response to various kinds of incidents except identified hazardous situations for which trains can leave the zone

3.2 Abbreviations

AC Alternating Current
DC Direct Current
FPA Flank Protection Area
M Mandatory
O Optional
OVL Overlap
RD Route Destination
REQ Requirement
RO Route Origin

4 Operational concept

4.1 Organisation of operation for urban guided transport

The organisation of operation for public transport is structured generally in the following tasks and carried out under use of facilities of 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,
- operation management and supervision (Operation Control Centre) which is described in Clause 6,
- execute train operation (decentralised control and safeguarding level, wayside and onboard) which is 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.

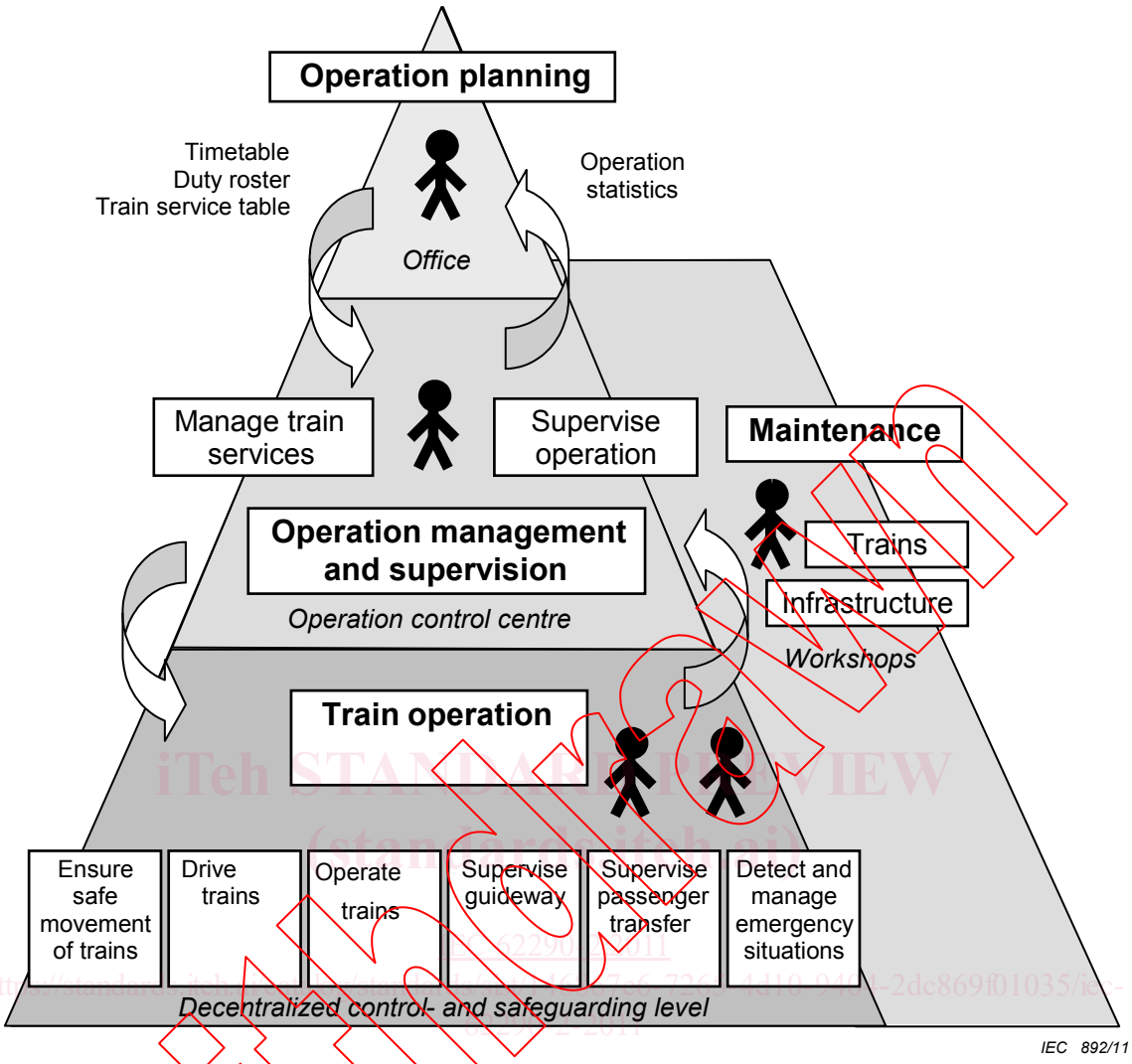


Figure 2 – Organisation of operation

This hierarchy of organisation of operation will contribute to the description of UGTMS functions of this "functional requirements specification" based on IEC 62290-1. It is also a first approach for a system hierarchy to be described in the System Requirement Specification (SRS). As first attempt the whole complex of "Train operation" shall be assigned to a "control and safeguarding level" which will include "UGTMS wayside equipment" and "UGTMS onboard equipment", provided by interfaces with operation control centre equipment. The whole complex of "Operation Management and supervision" will be assigned to the "OCC equipment" which provides also the central operators HMI to operate and display all functions required inside and outside UGTMS. The description of functions will take into account wayside and onboard elements which has to be provided by the system to fulfil orderly and safe transportation in accordance to required GOA.

The task of operation planning contains all necessary measures to prepare operation. The activities are assigned to office working places independent from installations and facilities for operation management, supervision and executing train operation.

Operation planning has to provide at least the operation management and supervision level with all necessary information to execute train operation and will be provided by information from management and supervision level with the goal to adjust the planning process for operational needs.

If required the timetable is defined as a given workflow of train movements to realise the transport offer for a specific “operation day” with details about the required number of vehicles. The timetable will be composed for every line and contains the departure time on every station of the line and timings for junctions where applicable.

During the night break (if there is one), the operation of non-passengers trains is possible.

The tasks of operation management and supervision take place under use of facilities primarily at the Operation Control Centre level. It contains all measures which are necessary to provide operation under normal, perturbed and failure situations. This system level has to be provided with information from planning level.

Additionally this system level expects all required information from the control and safeguarding level for the needs of supervising operation. This data should also be used on the planning level to optimise the operational programme (e.g. practical headway, practical travel time, etc.).

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

The tasks of executing train operation take place under use of facilities on the decentralised control and safeguarding level. It contains all measures which are necessary to control and safeguard train operation. This system level has to be provided with information from the Operation control level with the goal of controlling train operation. It provides the OCC level with information with the goal to supervise the status of infrastructure and trains and providing data for maintenance of trains and wayside equipment.

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 with consideration of the grade of line. 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.