

Rail Industry Standard

RIS-2747-RST

Issue: One

Date: March 2017

Functioning and Control of Exterior Doors on Passenger Vehicles

Synopsis

This document sets out requirements for the standardisation of door systems and their operation within the GB rail industry and should be used in conjunction with the LOC & PAS TSI.

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Issue Record

Issue	Date	Comments
One	04/03/2017	This RIS has been developed to provide updated requirements and guidance on the per-vehicle control for automatic selection door operation (ASDO) systems of releasing the trains doors when entering a platform.

This document will be updated when necessary by distribution of a complete replacement.

Superseded Documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GMRT2473 issue two Power Operated External Doors on Passenger Carrying Vehicles	All	04/03/2017
GEGN8577 issue three Guidance on the Application of Selective Door Operating Systems	All	04/02/2017

Supply

The authoritative version of this document is available at www.rssb.co.uk/railway-group-standards. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Purpose and Introduction

1.1 Purpose and introduction

1.1.1 This document is a rail industry standard (RIS) on the functioning and control of exterior doors on passenger vehicles.

1.1.2 This document should be read in conjunction with the Locomotive and Passenger Rolling Stock Technical Specification for Interoperability (LOC & PAS TSI) 2014 (commission regulation (EU) 1302/2014), the Accessibility for Persons with Reduced Mobility (PRM) TSI 2014 (commission regulation (EU) 1300/2014) and BS EN 13272:2012, as there are requirements for doors within these documents that are not duplicated. This RIS sets out additional requirements for the standardisation of door systems and their operation within the Great Britain (GB) rail industry.

1.1.3 The LOC & PAS TSI sets out mandatory requirements for the door system and mandates compliance with specific clauses of BS EN 14752:2015.

1.1.4 The PRM TSI sets out additional mandatory requirements for doors, particularly relating to accessibility for all passengers.

1.1.5 BS EN 14752:2015 sets out additional requirements relating to the construction, operation and testing of doors.

1.1.6 This RIS sets out requirements to address silent points, that is points not addressed, in the TSIs and addresses points in BS EN 14752:2015 which are permitted to be specified in the technical specification. The silent points addressed in this document have been agreed by the Rolling Stock Standards Committee (RST SC).

1.1.7 Appendix [B](#) provides an explanation of the different states during the opening of the doors.

1.1.8 Appendix [E](#) gives guidance on the scenarios and operating conditions that could be included in a risk assessment for the introduction of a Selective Door Operation (SDO) system. This may form part of the analysis for an assessment under the requirements of the Common Safety Method for Risk Evaluation and Assessment (CSM RA).

1.2 Scope

1.2.1 The scope of the exterior door system is restricted to power operated doors.

1.2.2 The scope includes requirements for the infrastructure manager (IM) and railway undertaking (RU) relating to SDO systems.

1.2.3 The SDO system includes requirements for passenger information systems (PIS) for the provision of information to passengers as part of the operation of the SDO system.

1.3 Application of this document

1.3.1 Compliance requirements and dates have not been specified since these will be the subject of internal procedures or contract conditions.

1.3.2 The Standards Manual and Railway Group Standards (RGS) Code does not currently provide a formal process for deviating from a Rail Industry Standard (RIS). However, a member of RSSB, having adopted a RIS and wishing to deviate from its requirements, may request a Standards Committee to provide opinions

and comments on their proposed alternative to the requirement in the RIS. Requests for opinions and comments should be submitted to RSSB by e-mail to proposals.deviation@rssb.co.uk. When formulating a request, consideration should be given to the advice set out in the 'Guidance to applicants and members of Standards Committee on deviation applications', available from RSSB's website.

1.4 Health and safety responsibilities

1.4.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

1.5 Structure of this document

1.5.1 This document sets out a series of requirements that are sequentially numbered.

1.5.2 This document also sets out the rationale for the requirement. The rationale explains why the requirement is needed and its purpose. Rationale clauses are prefixed by the letter 'G'.

1.5.3 Where relevant, guidance supporting the requirement is also set out in this document by a series of sequentially numbered clauses and is identified by the letter 'G'.

1.6 Approval and Authorisation

1.6.1 The content of this document was approved by Rolling Stock Standards Committee (RST SC) on 28 October 2016.

1.6.2 This document was authorised by RSSB on 03 February 2017.

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Part 2 Requirements for Doors

2.1 Constructional and operational requirements

2.1.1 Door systems shall conform to the requirements of BS EN 14752:2015.

Rationale

G 2.1.2 As stated in the introduction to BS EN 14752:2015 'This European Standard specifies the minimum requirements for construction and operation of railway passenger access systems to ensure: safe access and egress from passenger trains through body side doors and steps; usability for persons with reduced mobility; a minimum risk of injury to persons as a result of door and step operation; that the doors and moveable steps, ramps, bridging plates remain closed when the vehicle is in motion and safe maintenance of the entrance systems'.

Guidance

G 2.1.3 In BS EN 14752:2015 there are many instances where precise requirements or alternative provisions are permitted to be defined in the technical specification.

G 2.1.4 The affected clauses are listed in BS EN 14752:2015 Annex G. Where appropriate, requirements are set out in this document to address these points to make the application of BS EN 14752:2015 conform to operational requirements in GB and be consistent with accepted practice.

G 2.1.5 The affected clauses are set out in Appendix A of this document, including a commentary or whether they are addressed in this document.

2.2 Aerodynamic stresses

2.2.1 Instead of BS EN 14752:2015 clause 4.2.1.2, door systems shall be assessed for the aerodynamic loads set out in clause 5.4.2 of GMRT2100 issue 5.

2.2.2 Door systems shall be assessed for the optional vehicle overturning load case set out in BS EN 14752:2015 clause 4.2.1.4.

Rationale

G 2.2.3 The structural loads specified represent accepted GB practice and ensure that for aerodynamic loads consistent methods and load magnitudes are used for all external parts of a vehicle.

G 2.2.4 The load cases specified in BS EN 14752:2015 (which are the loads in UIC 566) have uncertain origin but are probably due to open air passing with other trains, plus a component for wind loading. The aerodynamic load due to passing trains depends on the passing train aerodynamic design and track spacing. For this case continental track spacing would have been used, which reduces aerodynamic pressures compared with GB track spacing. The values specified in GMRT2100 have been developed specifically for the GB track spacing.

Guidance

G 2.2.5 The loads specified in GMRT2100 for units operating at 100 mile/h or less are equivalent to the UIC derived loads referenced by BS EN 14752:2015 and represent established GB practice. For higher speed operation the methods specified by GMRT2100 are compatible with the requirements of the LOC & PAS TSI.

G 2.2.6 For direct access, external doors exclusively for use by train crew or personnel for access and egress and only accessible by them in normal operation, a load of 3 kPa may be applied instead of the specified 6 kPa.

2.3 Ability to withstand shock and vibration

2.3.1 Door systems shall be assessed for shock and vibration according to BS EN 61373:2010 for Category 1 Class A equipment.

Rationale

G 2.3.2 This clarifies an ambiguity in BS EN 14752:2015 between the requirement in clause 4.2.1.5 and the type test plan in Annex E.

Guidance

G 2.3.3 The mechanical installation of the door system to the vehicle is assessed for proof and fatigue loading according to the requirements for equipment attached to the bodyshell set out in BS EN 12663-1:2010 as stated in clause 4.2.1.5 of BS EN 14752:2015.

G 2.3.4 The mechanical installation is assessed for the integrity of its attachment to the vehicle carbody and also to determine the effect of shock and vibration on the door system itself.

2.4 Labels and warning signs

2.4.1 Labels and warning signs shall conform to the requirements set out in GMRT2130.

Rationale

G 2.4.2 Door labels and warning signs are part of a wider set of labels and warning signs and are therefore required to be consistent with all other labels and warning signs on a vehicle.

G 2.4.3 This sets out the GB example in place of those set out in clause 4.4 of BS EN 14752:2015.

Guidance

G 2.4.4 None.

2.5 Locking and interlocking of doors

2.5.1 Door and step

2.5.1.1 It shall be possible to lock a door out of service from the interior of the vehicle.

2.5.1.2 The device to lock a door out of service shall also lock out of service associated movable steps, where fitted.

Rationale

G 2.5.1.3 The ability to lock a defective door out of service inside the vehicle gives staff the ability to lock the door and step out of use irrespective of where the train is located. If a door is defective, any associated movable step is redundant and if an associated step is defective the door cannot be safely used, as safe stepping distances cannot be guaranteed.

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Guidance

G 2.5.1.4 These requirements apply in conjunction with the requirements set out in BS EN 14752:2015 clauses 5.1.6.1 and 5.1.6.2, which treat doors and steps as independent entities. The requirements in this document treat a door and a powered step as linked entities even when there is no mechanical linkage between the door and its step.

G 2.5.1.5 When a movable step is locked out of service this is always in the fully retracted or closed position. This will lead to the door being disabled under this requirement.

2.5.2 Safety bypass switches

2.5.2.1 The devices specified in clauses 5.1.6.1 and 5.2.2.1 of BS EN 14752:2015 shall be unable to be held in the isolated position while the door is open.

Rationale

G 2.5.2.2 This requirement reduces the risk of the interlock circuit being bypassed.

Guidance

G 2.5.2.3 This can be achieved by making the bypass device inaccessible when the door is open.

2.5.3 Systems included in interlock

2.5.3.1 The following door systems shall be included in the interlock circuit:

- a) Systems specified in clauses 5.2.2.1 and 5.2.2.2 of BS EN 14752:2015.
- b) Non-passenger doors on passenger carrying vehicles that infringe kinematic gauge restrictions when open.
- c) Bodyside doors on all vehicles to which passengers may have access for through passage.

Rationale

G 2.5.3.2 These requirements reduce the risk from any of these doors opening and potentially causing injuries.

G 2.5.3.3 This removes the ambiguity over whether the systems in clause 4.2.2.8(2) of the LOC & PAS TSI form part of the interlock circuit.

Guidance

G 2.5.3.4 The door system consists of all doors, and door equipment, not just those normally used by passengers.

G 2.5.3.5 It is permissible to indicate that the door is closed and locked to the train crew via diagnostic or train management systems. This is in addition to the external door indicator lights set out in 2.6.

G 2.5.3.6 A convention has been to indicate interlock with a single blue light at each door control position and / or in the cab.

2.5.4 Reaction to loss of interlock

2.5.4.1 When the door locked proving circuit is lost while the train is moving:

- a) The train shall be brought to a standstill by an immediate and automatic application of the train emergency brake unless overridden by the driver.
- b) The driver shall be notified of the reason for the emergency brake application.

Rationale

G 2.5.4.2 This requirement reduces the potential for an incident occurring following a door becoming open when the train is in motion.

Guidance

G 2.5.4.3 Door interlock is defined in the LOC & PAS TSI, BS EN 14752:2015 and [2.5.3.1](#).

G 2.5.4.4 Interlock emergency brake override, as set out in [2.5.5.1](#).

G 2.5.4.5 The requirements for an emergency brake are set out in GMRT2045.

G 2.5.4.6 This is an additional functionality to the LOC & PAS TSI, which only specifies what happens if interlock cannot be gained.

G 2.5.4.7 This functionality has historically been provided on GB units to reduce the potential for a passenger falling out of an open doorway when the train is moving (another relay contact in the feed to the emergency brake release relay).

G 2.5.4.8 Provision for this is set out in GMRT2045.

2.5.5 Interlock override

2.5.5.1 An automatic brake application override shall be provided that shall:

- a) Be operable only by the driver.
- b) Provide time for the driver to respond to the emergency brake application notification.
- c) Not prevent the driver operating other driving controls.
- d) Provide an indicator that the brake application has been overridden.

2.5.5.2 If the interlock is lost when departing a platform, operation of the override shall meet the requirements of clause 4.2.5.3.3 of the LOC & PAS TSI for activation of the brake by the passenger alarm.

Rationale

G 2.5.5.3 This requirement allows the train to reach a safe position before being stopped in the event that a door is not locked while the train is in motion.

G 2.5.5.4 Loss of interlock at a platform may be an indication of an issue at the platform train interface and therefore it is safest to remain stopped at the platform and not override the brake application.

Guidance

G 2.5.5.5 Indication may be provided by the operation of the system; for example, if the override system requires the button to be held to silence the alarm, then an indication is provided.

G 2.5.5.6 The time provided for the driver to respond to an emergency brake application is typically 30 seconds based on current GB practice.

G 2.5.5.7 Other driving controls are those that are required to allow the driver to move the train to a position of safety before bringing it to a halt.

2.6 Door status indicators

2.6.1 External door status indicators shall be provided on both sides of a vehicle and shall:

- a) Be amber in colour according to either:
 - i) Signal yellow as set out in BS 1376:1974, or

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- ii) Match existing door status indicator lights.
- b) Only extinguish when the doors that they are indicating are in the closed position and are proved locked.
- c) Be positioned such that the top of the indicator is no lower than the top of the window line.

2.6.2 Where more than one indicator is provided on each side of the vehicle, the indicator shall be directly associated with the door it is indicating.

Rationale

G 2.6.3 These requirements provide a means for the staff involved in the dispatch process to check the status of the doors even on a crowded platform.

G 2.6.4 This addresses the discretionary aspect of clause 5.6.2 of BS EN 14752:2015.

Guidance

G 2.6.5 Convention is to provide a single amber light for each side of the vehicle.

G 2.6.6 Where a single indicator is provided, convention is to place the indicator midway between the two sets of doors so that it is not directly associated with a single set of doors.

G 2.6.7 It is permissible to use the door status indicators to convey other information; for example, operation of passenger emergency alarms or the door being under local control provided the requirements in 2.6.1 are met.

2.7 Internal emergency egress device

2.7.1 For operation in GB, emergency egress handles shall be green according to BS ISO 3864-4:2011.

2.7.2 Visual proof of operation shall be provided at each door.

2.7.3 When an egress device is operated, it shall alert the train crew that the device has been operated and at which door on which vehicle.

Rationale

G 2.7.4 These requirements ensure that the operation of these devices minimises the risks to passengers of opening the doors at speed and that use and performance is consistent between different types of vehicle.

Guidance

G 2.7.5 These requirements address the discretionary aspects of BS EN 14752:2015 clause 5.5.1.8 and the LOC & PAS TSI clause 4.2.5.5.9.

G 2.7.6 Emergency egress devices may require a preliminary action to allow the device to be used; for example, removing or breaking a transparent cover to reduce the chance of misuse of the device.

G 2.7.7 It is GB practice to use green for access and egress devices in common with accepted signposting for emergency routes and exits. Red is reserved for marking passenger alarms and communication devices and fire alarms. This is allowed for in BS EN 14752:2015 clause 4.3.2.3.

G 2.7.8 Proof of an activation of a door egress device may be by:

- a) Latched position of the handle.
- b) Alarm to the driver.
- c) Local indicator light or buzzer.

G 2.7.9 Activation of the door egress device may be recorded on the On Train Data Recorder (OTDR).

2.8 External emergency access device

2.8.1 For operation in GB, emergency access handles shall be the same colour as the bodyside that they are mounted in.

Rationale

G 2.8.2 This reduces the chance of misuse of the handle by disguising the handle.

Guidance

G 2.8.3 It is GB practice to paint the handles to match the bodyside. BS EN 14752:2015 clause 4.3.3.3 only sets out a recommendation for the colour.

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Part 3 Control of Doors

3.1 Crew controls

3.1.1 Controls for the operation of the doors shall be either:

- a) Located in a driver's cab or prevented from being used by unauthorised persons when not in use, or
- b) Positioned relative to the side of the train that the doors they are controlling are on.

3.1.2 The controls on the desk related to doors shall be grouped together or be integrated into one combined element. The position of these elements shall reflect the associated side of the unit.

3.1.3 Where controls are provided for operation by a member of the train crew other than the driver, they shall be located adjacent to the doorway on the side of the train that the doors they are controlling are on.

3.1.4 The design of door release command when under the control of the train crew shall reduce as far as reasonably practicable the risk of accidentally releasing the doors.

3.1.5 To close and lock all doors prior to departure a single identifiable control shall be provided at each door control position.

Rationale

G 3.1.6 These requirements reduce the likelihood of unauthorised or unintentional release of doors and provide consistent operation between vehicles.

Guidance

G 3.1.7 The convention is to use a key switch to prevent unauthorised operation when in an area accessible to passengers but other devices are permitted.

G 3.1.8 Where the controls are provided on a Human Machine Interface (HMI):

- a) Separating the buttons for left and right reduces the risk of inadvertently selecting the wrong side doors.
- b) It is good practice to consider the plane of the HMI screen in relation to the direction of travel of the train to ensure that the buttons are placed unambiguously.

G 3.1.9 The requirement set out in 3.1.2 for the driver's controls is taken from the draft prEN 16186-2:201X.

G 3.1.10 A review using Human Factor (HF) methods can verify that the controls can be operated from the required positions without discomfort or injury. The review could include:

- a) Reach to the controls.
- b) View of doors.
- c) View through the side window (from the driver's seated position, if the controls are in the driver's cab).
- d) Risk from inadvertent operation due to a confusing layout.
- e) Ease of operation.

G 3.1.11 Existing solutions to achieve the open command requirement include:

- a) Two red push buttons that are pressed simultaneously.
- b) Latch released rotary switches.

G 3.1.12 For HMI systems a sequence of button presses could meet the requirements where it is not possible to simultaneously press two buttons.

G 3.1.13 The convention is to use a blue push button for closing the doors, but other methods of meeting this requirement are permitted.

G 3.1.14 A single button on an HMI could achieve the close command requirement.

G 3.1.15 Providing a button with a textured surface or tactile surround is often a method of making the control identifiable by touch.

3.2 Ready to start communication

3.2.1 Where the train is designed for operation with a guard, a ready to start communication channel between the driver and guard shall be provided, with the following features:

- a) Be located at each driving position and at each control panel not in a driving cab.
- b) Have controls which are distinguishable from other controls in the vicinity.
- c) Only be active at the positions in use by the train crew.
- d) Activate only when all doors, except those controlled by the guard during dispatch, are closed and locked.

Rationale

G 3.2.2 This requirement provides the method of communication between the driver and the guard, as part of the dispatch process.

Guidance

G 3.2.3 The convention is for a green push button to be used.

G 3.2.4 Other methods of providing a ready-to-start signal are permitted, for example:

- a) Mobile remote control device.
- b) HMI control.

G 3.2.5 If a push button is used, fitting one with a textured surface or surround aids identification so that it can be operated by touch.

G 3.2.6 The convention is to label the buttons with a text label or a pictogram.

G 3.2.7 Linking the control signal for the communication channel to the door interlock signal prevents the ready-to-start signal being given when interlock is not achieved.

G 3.2.8 The device may be used for additional communications between the driver and the guard.

3.3 Auto closing

3.3.1 Where auto-closing is used, the time before doors are automatically closed shall be:

- a) Determined by risk assessment.
- b) Configurable during maintenance.

3.3.2 The door open buttons shall remain active when the doors are auto-closing.

Rationale

G 3.3.3 Auto-closing provides a method of improving the efficiency of systems such as heating, ventilation and air conditioning (HVAC).

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G 3.3.4 Making the timing configurable permits the time to be changed when operational requirements change.

Guidance

G 3.3.5 Auto-closing will only occur when there has been nobody in the door portal for the specified time.

G 3.3.6 Configuration range is normally 10 - 120 seconds in 5 second intervals.

G 3.3.7 Many fleets currently use 15 seconds.

G 3.3.8 Selection of the time before closure includes consideration of:

- a) Safety of users.
- b) Efficiency of other systems.

G 3.3.9 It is permissible to locally disable auto-closing at a doorway when, for example, using wheelchair ramps or loading catering supplies.

G 3.3.10 Obstacle detection remains active during auto-closing.

3.4 Deactivation of local opening control

3.4.1 The passenger door open buttons shall:

- a) Be deactivated when a train door close command is initiated by a member of the train crew.
- b) Remain deactivated throughout the door closing process.

Rationale

G 3.4.2 This reduces the risk from the doors being opened when the close command has been given and therefore the potential for door trapping incidents when the door starts to open and then closes before the door is fully open.

G 3.4.3 This requirement is included as a result of learning point 4 in the RAIB report on West Wickham.

Guidance

G 3.4.4 Train door close command is initiated by a member of the train crew that is authorised to perform this operation. It does not relate to a local command given by a passenger or train doors closing due to an auto-close function.

G 3.4.5 This is separate from the obstacle detection functionality.

Part 4 Requirements for SDO Design

4.1 Use of selective door operation

4.1.1 An SDO system shall be used that prevents doors being released when there is no platform available.

Rationale

G 4.1.2 Where there are no alternative means to accommodate all doors on a train within the length of platform, an SDO system reduces the risk from passengers opening a door where there is no platform available.

G 4.1.3 This requirement addresses an option in clause 5.1.3 of BS EN 14752:2015.

Guidance

G 4.1.4 The SDO system application is a supervisory application; that is, it is not controlling the train to a stopping point (as in automatic train operation). It is a system that, if defined conditions are fulfilled, enables certain doors for opening.

G 4.1.5 The four basic requirements for effective implementation of SDO are:

- a) Inhibiting those doors which do not give safe access to / from the platform.
- b) Enabling those doors which give safe access to / from the platform.
- c) Providing appropriate visual passenger information.
- d) Providing appropriate audible passenger information.

G 4.1.6 Guidance on the information to passengers is set out in [D.8.3](#).

G 4.1.7 Some systems require confirmation of the doors to be released by the train crew and PIS announcements to be made by the train crew.

G 4.1.8 The most sophisticated systems carry out all of the SDO functions automatically.

G 4.1.9 The selection of the type of SDO system is subject to a range of technical, operational and cost benefit criteria.

G 4.1.10 The way in which these functions are met depends on the technology chosen.

G 4.1.11 It is not recommended that manual SDO systems are used, as these have a higher risk factor due to relying solely on human actions and judgement.

G 4.1.12 Appendix [C](#) sets out more information on the different SDO systems.

G 4.1.13 Appendix [H](#) sets out information on existing SDO systems.

4.2 Selection of system

4.2.1 The system of SDO shall use:

- a) Track based equipment, and / or
- b) A location based system using an onboard Global Navigation Satellite System (GNSS) type system to identify the location.

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Rationale

G 4.2.2 These options are proven systems that provide the information about which doors are to be enabled / released to the member of staff / system responsible for controlling the doors.

Guidance

G 4.2.3 Track based equipment is typically beacons (also known as balises and Eurobalises) as set out in [C.3](#), [C.4](#), [C.5](#) and [C.6](#).

G 4.2.4 The SDO assessment tool developed in T769 'Criteria for the application of selective door operation' may be used to support the selection of an SDO system.

G 4.2.5 Design criteria for the train crew's role in SDO system activities include consideration of:

- a) Ensuring that the train crew are not overloaded.
- b) The potential for distraction due to secondary workload, such as having to make passenger announcements.

G 4.2.6 GNSS([C.2](#)) or European Train Control System (ETCS)([C.5](#)) are the systems with the most automatic functionality. The selection of these systems is dependent on the design functionality of the train.

G 4.2.7 Although permission can be given automatically to enable / release the doors, the designer may choose to require verification by train crew.

G 4.2.8 Information may be provided to the person operating the doors by an HMI or control panel.

G 4.2.9 Alternatively, the information may be provided directly to the individual door controllers and the person operating the doors will open the doors as normal.

G 4.2.10 More detailed guidance on the selection of an SDO system is given in [Appendix D](#).

4.3 Controls

4.3.1 The SDO HMI controls shall:

- a) Only be displayed when the SDO operation is required or when the SDO system has failed.
- b) Display details of the failure mode when reporting failures.
- c) Indicate the action required when in normal operating mode.

Rationale

G 4.3.2 This reduces the risk of distracting the driver with unnecessary information.

Guidance

G 4.3.3 Failure modes may include:

- a) Loss of train positioning information.
- b) Incorrect train positioning information.
- c) Malfunction of the SDO system controller.
- d) Data in the train is out of date or has become corrupted.

4.4 SDO manual override

4.4.1 A manual override facility shall be included in the SDO system design.

Rationale

G 4.4.2 This requirement provides a method of responding to a failure of the SDO system.

Guidance

G 4.4.3 The potential failures of SDO systems that would lead to degraded mode working are set out in [G4.3.3](#).

G 4.4.4 See [D.6](#) for detailed information.

G 4.4.5 Functionality may be included in a Fully Automatic Selective Door Opening (FASDO) system to enable only those doors adjacent to a platform in the event that the stopping point is incorrect.

G 4.4.6 There will be a need to make additional manual announcements when the automatic PIS system fails, in accordance with the RU's operating procedures.

G 4.4.7 Arrangements for managing defective on-train equipment are set out in RIS-3437-TOM.

G 4.4.8 Guidance for managing defective on-train equipment is set out in GOGN3637.

4.5 SDO requirements for the PIS system

4.5.1 The PIS system shall be capable of providing information regarding SDO, including:

- a) Direction to the nearest released door.
- b) Status of doors: released / not released shall be clearly indicated.

4.5.2 Information on those doors being inhibited and those to be released shall be provided on the approach to the station before the train has come to a halt at the platform.

4.5.3 On trains with no corridor connections, the PIS system shall provide information regarding which part of the train will be available for passengers to alight at a short platform as the train approaches the last station with a full length platform before that with a short platform.

4.5.4 The PIS system shall be capable of being adjusted, either automatically or by the train crew, when there is a change to the next station stop. Announcements shall only be changed when the crew have acknowledged the change to the route.

Rationale

G 4.5.5 These requirements provide passengers with the correct information at a time which allows them to alight safely at their desired station.

Guidance

G 4.5.6 The following methods can be used to aid clarity in the information provided to passengers:

- a) Use a standardised format defined by the RU.
- b) Use the same information at each station regarding names, context and content.
- c) Use standard terms rather than railway specific terminology.
- d) Test the messages on a small group of users to check for understanding.

G 4.5.7 The naming convention used to identify each vehicle shall be consistent with the design or designation by the operator.

G 4.5.8 Information is standardised by the operator, as the information will be dependent on the system used, for example, the naming of vehicles.

G 4.5.9 Example messages for SDO are:

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- a) 'The doors at the rear of this coach do not open at the next station, please use the doors towards the front of the train. This is due to a short platform.'
- b) 'The doors in coaches E, F and G do not open at the next station, please move forward to coach D. This is due to the train being longer than the platform.'
- c) 'The doors in the rear coaches do not open at station x, this is due to a short platform. If you are travelling in the rear coaches and wish to alight at station x, please alight at station y and move to the front coaches.'
- d) 'The doors in coach A do not open at the next station, please move towards the rear of the train. This is due to the train being longer than the platform.'

G 4.5.10 Human factors good practice could be used to define the information.

G 4.5.11 The PIS, when working with Automatic Selective Door Opening (ASDO) systems, requires the identity and location of the next scheduled station as an input to allow it to display / announce the correct information.

G 4.5.12 The potential sources of SDO system information to the public include:

- a) Customer information when booking and at stations.
- b) Passenger announcements over the public address system, and visually on the train.
- c) On indicators at the doors.

G 4.5.13 Indicators at doors could be that the door buttons do not illuminate in accordance with clause 4.3.1.7.1 of BS EN 14752:2015.

G 4.5.14 The PIS could emphasise where SDO systems affect a journey.

G 4.5.15 Where appropriate, inside the train, information may be provided to advise passengers that:

- a) They are in the correct part of the train for particular station(s) that have short platforms, and
- b) Where relevant, they are not in the correct part of the train.

G 4.5.16 Announcements may be made several times during a journey where passengers could be in a section of a train which prevents them alighting at certain stations.

G 4.5.17 Change in PIS announcements may be achieved manually.

4.6 SDO outputs

4.6.1 Door system

4.6.1.1 The SDO system shall provide the following signals to the door system when the train is stopped at a valid SDO location:

- a) Door enable.
- b) Appropriate door release.

Rationale

G 4.6.1.2 The primary function of SDO is to enable the appropriate doors.

Guidance

G 4.6.1.3 This interface may be provided by the Train Control Management System (TCMS).

4.6.2 Information to crew

4.6.2.1 Information shall be made available to the train crew so that they can:

- a) Confirm the correct number of doors are selected, where required, as a function of the system.
- b) Manage a failure of the system.
- c) Be aware of the stations at which SDO is used.

Rationale

G 4.6.2.2 This provides the train crew with information so that they can operate the doors correctly and manage system failures.

Guidance

G 4.6.2.3 Information made available to the train crew may contain:

- a) Train length.
- b) Platform length.
- c) Stopping points.
- d) Locations where SDO is used.

G 4.6.2.4 A handbook may be produced explaining the system and the operation at each station.

G 4.6.2.5 The stopping information, to the extent known to the SDO system logic, may be displayed to the train crew as follows:

- a) Name of the station and the train length in an ASDO system.
- b) Include the platform identity in a FASDO system.

G 4.6.2.6 The train crew are informed of the details of the failure, as set out in [4.3](#).

G 4.6.2.7 It may be appropriate to provide an SDO reminder on platform stop markers at locations where SDO systems are required to be used.

G 4.6.2.8 The design requirements of platform stop markers are set out in GIRT7033.

G 4.6.2.9 The existing designs of platform stop markers are shown in Sign AK104 (available from the RSSB standards catalogue).

4.6.3 HMI

4.6.3.1 The door status shall be displayed on the HMI. The following status should be identified:

- a) Door prevented from being enabled by SDO system.
- b) Normal (door closed and locked).
- c) Door released, or open.
- d) Door locked or out of use.
- e) Door fault.

Rationale

G 4.6.3.2 The train crew in control of the doors need to be able to identify door status to take the appropriate actions.

Guidance

G 4.6.3.3 Figure [1](#) is an example of an HMI display for SDO where the colours have the following meanings:

- a) Black = door disabled from being released by SDO system.
- b) Blue = normal (door closed and locked).
- c) Red = door released, or open.

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- d) White = door locked or out of use.
- e) Yellow = door fault.

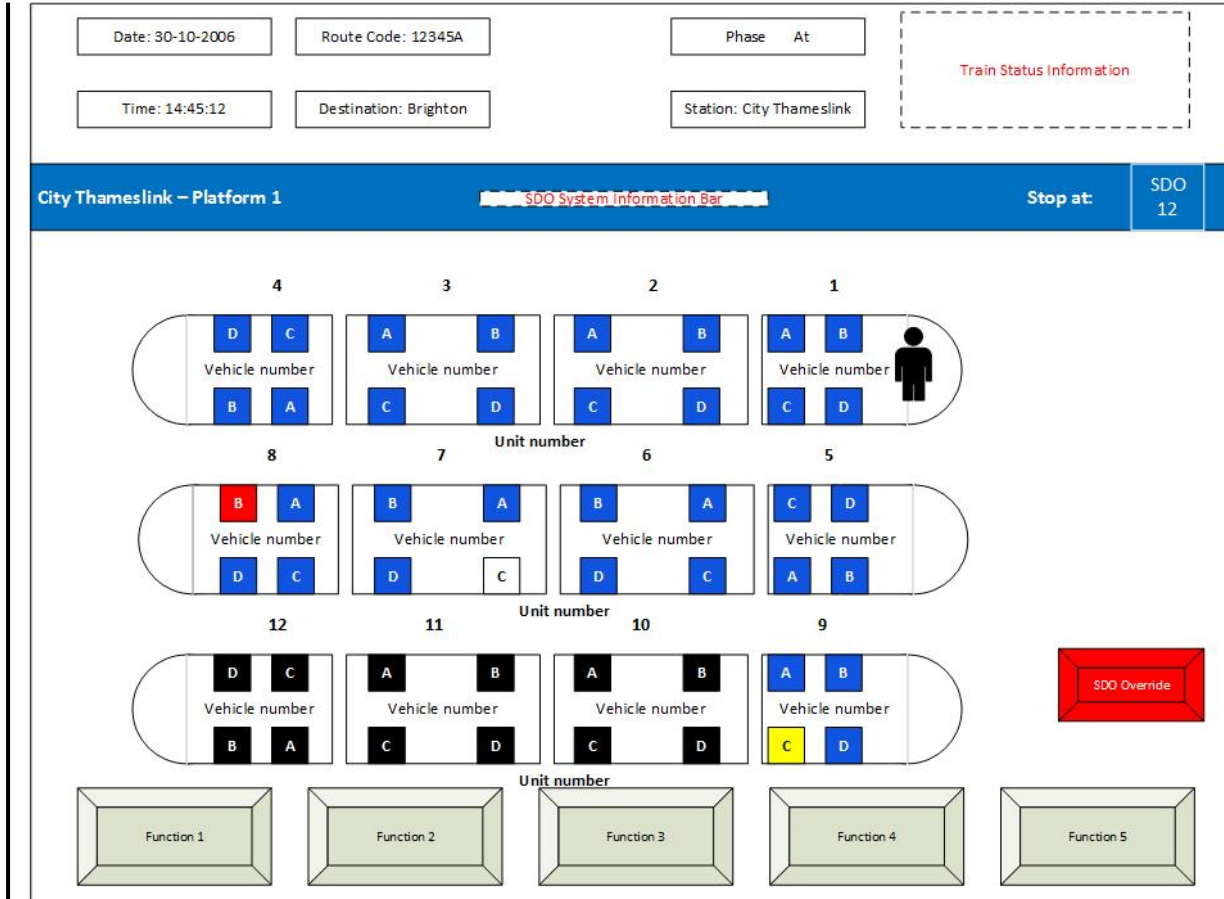


Figure 1: HMI display for SDO

G 4.6.3.4 The colour used for a door that is locked SDO or out of use may also be used as an indicator for a door that has been manually deselected by the operator due to, for example, a station overrun.

G 4.6.3.5 Standardisation of the display information allows crew to swap easily between train types, providing the HMI display is also mounted in a similar location and orientation relative to the train crew.

4.7 SDO inputs

4.7.1 Information required

4.7.1.1 The information in Table 1 shall be provided to the SDO onboard system.

Information	Per Train SDO	Per Vehicle SDO	Location Based SDO	
Stopping points	Location in relation to platform end	As required by system design	Not required	Yes

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Information		Per Train SDO	Per Vehicle SDO	Location Based SDO
	Tolerances of stopping position for FASDO system	Yes		Yes
Train length		Yes	Yes	Yes

Table 1: SDO - Inputs to the onboard system

4.7.1.2 An input shall be provided to the onboard SDO system to activate it when either:

- a) The train approaches a station where SDO is required, or
- b) The train approaches any station if the SDO system requires a valid read at all stations to enable the doors.

Rationale

G 4.7.1.3 This provides the SDO onboard system with the information necessary to perform its functions.

Guidance

G 4.7.1.4 Stopping point information may be presented either directly to the onboard SDO system from the beacon or via a database.

G 4.7.1.5 Train length information may be presented:

- a) Directly to the onboard SDO system from the message received by the system at each location.
- b) Via TCMS.
- c) Via an onboard database that forms part of the SDO system.

G 4.7.1.6 This input may be from the infrastructure equipment or via location recognition in a GNSS system.

G 4.7.1.7 Location recognition could be via a match between the GNSS signal and a location in an on-board database.

4.7.2 Validity of location

4.7.2.1 Once the train location has been determined as being in a valid station location, the information shall be valid within a defined range.

4.7.2.2 The SDO system, when using beacons on the infrastructure, shall ignore application codes or data formats that do not comply with the format for the SDO system selected.

Rationale

G 4.7.2.3 These requirements check that the data being given to the system is valid for the application being used.

Guidance

G 4.7.2.4 Defined range means that the system retains the SDO settings for x metres, where x is determined by the requirements of the system.

G 4.7.2.5 An SDO off signal may be provided to reset the doors between locations where the next defined location is within the validity limit. The SDO On signal may be considered as the input to recognise an SDO location as set out in [4.7.1.2](#).

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G 4.7.2.6 The format for SDO systems using track beacons for Per Vehicle or Per Train control is set out in [6.3.1a\(i\)](#).

G 4.7.2.7 The format for SDO systems using Tilt Authorisation and Speed Supervision (TASS) or ETCS beacons is set out in [6.3.1a\(ii\)](#).

G 4.7.2.8 Other application codes, for example 02, may be used in the future on Radio Frequency Identification (RFID) beacons. The process for defining these codes is set out in RIS-2795-RST.

G 4.7.2.9 ETCS, TASS and other systems, already use the beacons known as Eurobalises.

4.8 Correct Side Door Enable (CSDE)

4.8.1 Integration with SDO

4.8.1.1 Where a correct side door enable system is to be used it shall be part of the SDO system.

4.8.1.2 The CSDE system shall identify the doors that are adjacent to the platform and allow them to be released.

4.8.1.3 The system shall prevent the release of the doors when the wrong side doors are selected.

Rationale

G 4.8.1.4 These requirements reduce the potential for human error in releasing the doors and ensure that there is not a conflict with the SDO system resulting in a wrong side failure of the doors.

Guidance

G 4.8.1.5 CSDE is normally inherent in a FASDO system.

G 4.8.1.6 The correct side door information may be provided by the beacon or via an onboard database.

G 4.8.1.7 The doors may be released automatically by the SDO / CSDE system or manually by the train crew.

G 4.8.1.8 CSDE is likely to be implemented via TCMS.

4.8.2 Warnings to train crew

4.8.2.1 The system shall:

- a) Warn the train crew when the wrong side doors are selected.
- b) Provide instructions on what to do to enable the correct doors.

4.8.2.2 In the event of a CSDE system failure, the system shall inform the train crew that it has failed.

Rationale

G 4.8.2.3 This requirement provides assistance to the train crew allowing them to minimise disruption to the service.

Guidance

G 4.8.2.4 The warning can include:

- a) An audible alarm.
- b) Written information on why a warning is being given, for example 'there is the potential for wrong side door release'.

- c) Written information on the steps to be undertaken, for example 'confirm you are at a platform, release the doors on the correct side'.
- d) Written information on who to inform, for example 'advise the signaller or operations controller'.

G 4.8.2.5 The record of the wrong side doors being selected could also be made in a remote condition monitoring system to help improve the design of the system or identify potential system failures.

G 4.8.2.6 Failures of the system can include:

- a) Failure to identify location.
- b) Failure to read platform side information.

4.8.3 Manual override

4.8.3.1 It shall be possible to override the CSDE system in order to:

- a) Correct a system failure.
- b) Allow doors to be opened in an emergency.

4.8.3.2 System override shall be recorded on the train.

Rationale

G 4.8.3.3 There will be occasions when either the wrong side doors need to be released or the system recognises the incorrect location. This requirement provides the capability for passengers to alight in these conditions.

Guidance

G 4.8.3.4 A method of providing a manual override would include the need to make repeated selections of the doors, and acknowledgements of the warning, to reduce the human error risk.

G 4.8.3.5 An alternative method would be for the train crew to select the doors to be opened through the TMS with a minimum of stages to prevent inadvertent operation.

G 4.8.3.6 Operational rules may be written to define the circumstances where override may be used.

G 4.8.3.7 The system may identify a failure; for example, missing information from a beacon and request an override.

4.9 Onboard location systems for SDO

4.9.1 For SDO systems that do not rely on infrastructure components, the location shall be provided to the SDO system from an onboard GNSS receiver.

4.9.2 The SDO system shall include a method of verifying the location identified by the GNSS system signal.

4.9.3 Station locations shall be recorded in a database which is available for reference on board the train.

Rationale

G 4.9.4 This provides an accurate location with a back-up in case of loss of the GNSS signal.

Guidance

G 4.9.5 The GNSS receiver may be used for multiple purposes on the train. Guidance on GNSS receivers for use on trains is given in GEGN8578.

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G 4.9.6 The accuracy required for the location identification will be defined based on the requirements of the SDO system in use. The accuracy required depends on the margin available for train stopping and still being in the platform. If platform edge doors are used, then the accuracy required will be very high.

G 4.9.7 Verification of the location may be done automatically by cross-referencing the location with one or more systems, for example, an on-track beacon.

G 4.9.8 A majority decision on the location would provide a method of managing locations when multiple sources of the location information are available.

G 4.9.9 Verification of the location may be achieved by asking the train crew to confirm their location.

G 4.9.10 To provide an easy search for the train crew, stations could be recorded by name.

G 4.9.11 The RU is responsible for providing the station location data, but this may be from a centrally managed database.

Part 5 Requirements for Doors and SDO Maintenance

5.1 Doors

5.1.1 The functional limits of the door system shall be specified and recorded in the maintenance plan.

Rationale

G 5.1.2 Safe operation of doors is supported by undertaking the correct maintenance. Good practice is to develop the maintenance as an integral part of the design process.

Guidance

G 5.1.3 The maintenance plan would typically include:

- a) Maintainability of critical tolerances for safe door operation.
- b) Accessibility for facilitating installation of replacement components, maintenance and testing.
- c) Arrangements for validating any software used and verifying its correct installation and operation.
- d) Testing procedures and door fault diagnostic procedures.

5.2 SDO

5.2.1 The design of the system shall include the maintenance plan, including testing and diagnostics for all parts of the system.

5.2.2 System maintenance shall also include maintenance of the SDO beacon database set out in [6.2.2](#).

Rationale

G 5.2.3 SDO is an important part of the operational functionality of the train and therefore needs maintaining to ensure continued operation.

G 5.2.4 The SDO beacon database provides a common source of information for the IM and the RU.

Guidance

G 5.2.5 The maintenance plan can include:

- a) Self-tests.
- b) Autodiagnosics.
- c) Depot test facilities.
- d) Special tools.

G 5.2.6 Further guidance is given in [Appendix F](#).

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Part 6 SDO Requirements for Railway Undertakings and Infrastructure Managers

6.1 Calculation of platform length

6.1.1 The operational platform length recorded on the beacon shall be determined taking into account the following factors:

- a) Physical length of the platform (top of ramp to top of ramp).
Note: The useable operational length of the platform may be shorter than this physical length.
- b) Distance from stop mark to approach end top of ramp.
- c) Operational length of platform between signals, where trains reverse.
- d) Whether or not all platforms in a station are the same length.
- e) Standardising the number of doors opening on a line of route.
- f) Standardising the numbers of doors opening on a mix of train classes.

Rationale

G 6.1.2 Platform length is a required input to the design of the SDO systems as it allows the number of doors to be opened and, if appropriate, the position of the beacon to be calculated.

Guidance

G 6.1.3 On a single direction platform, the operational distance is generally considered to be the distance between the furthest stop mark and the approach end top of ramp.

G 6.1.4 On a bi-directional platform, the operational length is either the same as that for a single direction platform or the distance between the furthest up and down direction stop marks.

G 6.1.5 Trains usually need to stand back slightly from signals to enable them to be viewed by drivers, so the useable length of a platform may be less than its actual length.

6.2 Beacon identification and management

6.2.1 Each beacon shall be given a unique reference.

6.2.2 A database for the SDO beacons shall be made which:

- a) Records the unique reference.
- b) Records the information stored on each beacon as described in [6.3.1b](#) against the unique reference.
- c) Is version controlled.
- d) Is updated when changes are made or new locations added.

Rationale

G 6.2.3 This identifies the beacon for fault identification and rectification.

Guidance

G 6.2.4 A unique reference may be created by using the location and individually numbering the beacons used at this location.

G 6.2.5 The unique reference may be ensured by checking the database set out in [6.2.2](#) for duplicates.

G 6.2.6 The database may be maintained by each RU or by the IM.

6.3 Data and format for SDO beacons

6.3.1 Where track based equipment using beacon technology is used for SDO purposes the data on the beacons shall:

- a) Be formatted:
 - i) As set out in RIS-2795-RST for RFID beacons.
 - ii) According to a defined structure, as set out in RIS-0784-CCS for ETCS balises.
- b) Record the following:
 - i) Unique reference.
 - ii) Location information as required by the application.
 - iii) Direction information as required by the application.
 - iv) Platform length.

Rationale

G 6.3.2 This allows for multiple system suppliers by standardising the data format.

Guidance

G 6.3.3 This is a standard format that:

- a) Provides all the required information for the SDO RFID (Per Train (see [C.3](#)), Per Vehicle (see [C.4](#))) system and permits compatibility between different suppliers' SDO equipment.
- b) Identifies the beacon as an SDO system that can be read by the onboard system reader appropriate to the system being used.

G 6.3.4 This data provides:

- a) All the information required by the onboard SDO system to control the doors.
- b) Information so that the system can be maintained and modified.

G 6.3.5 The information stored on an SDO RFID beacon is typically:

- a) Unique reference of the beacon.
- b) Station location code.
- c) Platform number and direction.
- d) Operational length of the platform.
- e) Any duplicate beacons (duplicate beacons could be given a suffix on their code, for identification purposes).

G 6.3.6 The information stored on a TASS SDO Eurobalise when the SDO system is as set out in [C.6](#) is typically:

- a) Track direction.
- b) Identification of the Eurobalise in the approach to the station.
- c) Eurobalise identity.
- d) Eurobalise type.
- e) Distance to platform start.
- f) Platform length.

G 6.3.7 The information stored on an ETCS balise when the SDO system is as set out in [C.5](#) may include:

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- a) Information to identify stopping points.
- b) Station identity.
- c) CSDE information.
- d) Information to select the correct number of doors for ASDO.
- e) Command to enable doors in the stopping window for FASDO.

6.4 Calculation of SDO beacon position

6.4.1 Per vehicle control

6.4.1.1 The position of the beacon relative to the end of the useable platform shall be calculated using the following variables:

- a) Distance between the longitudinal centre line of the vehicle and the reader on each vehicle.
- b) Distance between the longitudinal centre line of the vehicle and the trailing edge of the door.
- c) Pre-read distance of the beacon.
- d) The maximum distance that the beacon can be placed from the end of the platform without reducing the number of doors that will be opened.

Rationale

G 6.4.1.2 Doors will open on every vehicle that passes over the beacon, so the correct location of the beacon has an effect on safety.

Guidance

G 6.4.1.3 The end of the platform is normally determined as the top of the ramp at the approach end of the platform. Where steps are provided the platform end gate is used as the reference point.

G 6.4.1.4 The distance between the reader and the longitudinal centre line of the vehicle is required to calculate the distance so that the calculations take into account that the reader position may change and the vehicle may approach the platform from either direction.

G 6.4.1.5 The distance between the trailing edge of the door and the longitudinal centre line of the vehicle is required to address the fact that the reader may be forward of the centre line when approaching the platform.

G 6.4.1.6 The pre-read measurement is the distance in advance of the beacon that the reader may be able to read the information on the beacon. Using this reduces the likelihood of the doors not being next to the platform when the beacon is read.

G 6.4.1.7

Note: The distance to the end of the body may be used instead of the trailing edge of the door if the whole vehicle is required to be on the platform.

G 6.4.1.8 The calculation that may be used is: beacon position = maximum reader to longitudinal centre + reader to trailing edge of door + pre-read distance.

G 6.4.1.9 Using the sum of all the distances allows for approaching the platform in either direction and the different reader mounting positions.

G 6.4.1.10 Per vehicle SDO control operates as set out in [C.4](#).

G 6.4.1.11 Beacons are mounted on each approach for a bi-directional platform.

6.4.2 Per train control

6.4.2.1 The position of the beacon relative to the end of the useable platform shall be calculated using the following variables / conditions:

- a) Position of reader on train.
- b) At each approach for bi-directional platforms.
- c) Maximum signal progressing time.
- d) Distance from reader to cab.
- e) Shortest possible stopping time.
- f) With co-operation of the IM.

Rationale

G 6.4.2.2 The beacon needs to be positioned so that the train can read the data from the beacon each time it arrives at a platform to enable the correct number of doors to be opened.

Guidance

G 6.4.2.3 The train may approach a platform from either direction.

G 6.4.2.4 The train may have either cab leading so the reader position relative to the leading cab will vary.

G 6.4.2.5 The maximum signal processing time is the maximum time to read and interpret the data from the beacon.

G 6.4.2.6 The shortest possible stopping time is the minimum time from reading the beacon to the train being stopped at the platform.

6.4.3 Tilt Authorisation and Speed Supervision (TASS) controlled SDO system

6.4.3.1 The position of the Eurobalises shall be determined according to the factors set out in Table 2.

Eurobalise	Factors included in the calculation / installation location	Selection of installation distance when multiple distances have been calculated
First	Distance from stopping point	The Eurobalise is installed at furthest calculated distance plus the length of the longest train stopping in the station
	Minimum required SDO announcement times	
	Calculated for each approach to each short platform or group of short platforms	
Second	Shall be located close to each platform or group of short platforms	
	Shall be between 10 m and 100 m from the rear of the longest train stopping at the platform	

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Eurobalise	Factors included in the calculation / installation location	Selection of installation distance when multiple distances have been calculated
	Shall include the defined tolerance of the train stopping position	
Cancel	On the approach to full length platforms with a first SDO Eurobalise on the approach	
	Apply the minimum separation distance to the first SDO Eurobalise	

Table 2: TASS beacon position installation

6.4.3.2 All Eurobalises shall be installed according to the installation rules set out in 6.5.

Rationale

G 6.4.3.3 This requirement reduces the risk of the SDO Eurobalises affecting the operation of other systems. It also provides the onboard system with the required information in time to inform the passengers and release the doors safely.

G 6.4.3.4 Reporting the location to the RBC supports fault detection of balises installed for packet 44 applications.

Guidance

G 6.4.3.5 Each train may only pass over one 'first SDO' Eurobalise on the approach to a station.

G 6.4.3.6 The SDO Eurobalises are read by the rear car in a train.

G 6.4.3.7 The maximum service braking rate is as set out in .

G 6.4.3.8 Distances are calculated for each approach track at their permissible speed limit for the track.

G 6.4.3.9 Times are calculated at line speed with clear signals and no speed restrictions.

G 6.4.3.10 Announcement time used on existing services is four minutes.

G 6.4.3.11 If short platforms all have the same length, they may be grouped together as a group of short platforms.

G 6.4.3.12 TASS SDO system is set out in C.6.

6.4.4 Packet 44 ETCS systems

6.4.4.1 The balise position shall be determined according to the following constraints:

- a) Use existing ETCS balises wherever possible.
- b) Provide sufficient time for the onboard SDO system to process the information and carry out the required functions.
- c) Provide sufficient time for appropriate PIS announcements to be made.
- d) The balise shall be able to be associated with a specific platform or group of platforms.
- e) According to the installation rules set out in 6.5.

6.4.4.2 The location of the Eurobalises shall be reported to the RBC in accordance with the ETCS National Trackside Sub-System Requirements.

Rationale

G 6.4.4.3 This minimises the amount of equipment to be mounted on the infrastructure and reduces the risk of the SDO system not having time to process the information before the system is required.

G 6.4.4.4 Reporting the location to the RBC supports fault detection of balises installed for packet 44 applications.

Guidance

G 6.4.4.5 The factors determining whether an existing balise can be used are as follows:

- a) Space on the balise — there are only 830 or 210 user bits available per balise, depending on what type of balise is used (standard or reduced size).
- b) The velocity at which the balises are expected to be read (see UNISIG Subset-036), and
- c) If multiple Eurobalises are required, the maximum number of Eurobalises in a group is eight (also UNISIG Subset-036).
- d) Formatting the data correctly, as set out in [6.3.1a\(ii\)](#), to avoid the ETCS onboard equipment initiating a service brake application.
- e) Is the trackside location correct for the SDO function?
- f) Does the balise installation have suitable installation tolerance and maintenance regime for the SDO function?

G 6.4.4.6 The European Rail Traffic Management System (ERTMS) reference design recommends that packet 44 information should be included in balises required for ETCS to minimise the number of balises. It also requires that all of these balises are linked and included in linking information to avoid the service brake application set out above, and to facilitate identification of failed balises.

G 6.4.4.7 The time to process the information will depend on the information being received, the functions being carried out and the onboard processing required.

G 6.4.4.8 Announcement times and grouping of platforms are as set out for the TASS controlled SDO system in [6.4.3](#).

G 6.4.4.9 Platform identification is critical where CSDE is being used so that the correct side is identified.

G 6.4.4.10 The ETCS SDO system is set out in [C.5](#).

6.5 Installation of SDO beacons

6.5.1 The beacon shall be installed on a sleeper in between the rails according to the following constraints:

- a) At least one sleeper's distance from any adjacent equipment, for example, Automatic Warning System (AWS) / Train Protection & Warning System (TPWS), track securing spike, cables, expansion joints.
- b) At a minimum data processing distance from other RFID tags.
- c) Not within a set of points.
- d) At a location that covers all approaches to the platform under consideration.
- e) Not within an area of limited clearance.
- f) Not on steel sleepers.

6.5.2 In addition, for beacons used for TASS and ETCS solutions, the following constraints apply:

- a) Not within the TASS minimum separation distance of 20 m.
- b) According to the rules in UNISIG Subset-040.

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Rationale

G 6.5.3 This requirement reduces the risk of the SDO system affecting the operation of other systems.

Guidance

G 6.5.4 Separation distance of at least one sleeper's distance, for RFID solutions, has been used in operation and found not to cause interference.

G 6.5.5 Track spikes may be moved to allow installation of the SDO beacon.

G 6.5.6 Access is required by maintenance and installation staff.

6.6 Definition of station locations

6.6.1 The station location shall be defined by latitude and longitude co-ordinates at the centre of the station and enclosed within a virtual geographic barrier (geofence).

Rationale

G 6.6.2 This requirement allows compatibility between different SDO systems.

Guidance

G 6.6.3 Historically, the geofence has been 300 m in diameter.

G 6.6.4 The geofence diameter may be reduced where more accurate systems are available.

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Appendices

Appendix A EN 14752:2015 Annex G and Requirements Captured in the Doors RIS

Note: The content of this appendix is provided for guidance only.

Clause/ Subclause	Title	Included	Comment/Reference
4.1.2.5	Manual operation	No	Requirement is clear in the standard, does not need adding in this RIS.
4.1.3	Track level access	No	Out of scope - applies to staff access doors.
4.1.4	Relative position of the step edge	No	Covered by PRM TSI.
4.2.1.2	Aerodynamic stresses	Yes	2.2
4.2.1.3	Relation to vehicle gauge	No	Out of scope - covered by gauging standards.
4.2.1.4	Vehicle overturning case	Yes	2.2
4.2.1.5	Ability to withstand vibration and shock	Yes	2.3
4.3.1	Door buttons	No	Requirements covered by PRM TSI.
4.3.1.4	Passenger door button location	No	Requirement is clear in the standard, does not need adding in this RIS.
4.3.2.3	Colour of emergency egress device	No	GB can comply with the main requirement and does not need the option.
4.3.3.1	Quantity and location of access device	No	Requirement covered in the LOC & PAS TSI.
4.5.2	Mechanical interface with the vehicle	No	Single duty holder as it will vary with vehicle design.
4.6.1	Fire protection	No	Requirements covered in GMRT2130.
4.6.2.1	Sound insulation	No	Single duty holder as it will vary with vehicle design.
4.6.2.2	Thermal insulation	No	Single duty holder as it will vary with vehicle design.
4.9	Protection against electrical hazards	No	Requirements covered in GMRT2111 and GMRT2113.
4.10.1	Weather	No	No need to specify requirements above the standard requirements.
4.10.3	Air pressure tightness	No	Single duty holder as it will vary with vehicle design.

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Clause/ Subclause	Title	Included	Comment/Reference
5.1.2	Release doors and steps	No	This RIS applies to TSI compliant trains.
5.1.3	Interlocking of released doors	Yes	4.1
5.1.6	Out-of-service devices	Yes	2.5.1
5.2.1.3.2.2	Door closing alert sequence	No	Requirement is clear in the standard, does not need adding in this RIS.
5.2.1.4.2.2	Closing force	No	Single duty holder as this is a function of the expected operation of the train.
5.2.1.4.2.4	Non-contact obstacle detection	No	Single duty holder as this is a function of the expected operation of the train.
5.2.1.5	Anti-drag	No	Requirement is clear in the standard, does not need adding in this RIS. Single duty holder will decide if this is required on the train.
5.3.1	Safety during opening	No	Single duty holder as the details will vary with vehicle design and operation.
5.5.1.2	Emergency egress conditions	No	LOC & PAS TSI addresses the option specified in this requirement.
5.5.1.6	Emergency egress device operation	Yes	2.7
5.5.1.8	Protection against accidental operation	No	LOC & PAS TSI addresses the option specified in this requirement.
5.5.2	Emergency windows in access doors	No	This is an option that may be specified by an RU. The requirements are clear in the standard.
5.6.2	Status indication	Yes	2.6
6.2	Type tests	No	Specification of endurance tests is at the discretion of the RU.
6.3	Routine tests	No	Specification of routine tests will be dependent on the design of the doors.
7	Documentation related to installation and maintenance of the entrance system	Yes	5.1

Table 3: Inclusion of requirements in Annex G of BS EN 14752:2015 in this RIS

Appendix B Door states

B.1 Enabling and releasing of doors

B.1.1 To open the doors, the doors need to be enabled and then released as shown in Figure 2.

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B.1.2 When the doors are enabled, the individual door control units are set up such that they can receive a release command from the train.

B.1.3 When the release command is received the doors are able to be opened either by local control by the passenger or a command at train level which opens all doors which are adjacent to a platform.

B.1.4 In some door control systems, doors may be enabled and released in a single train level command if all doors are to be opened. Where only some doors are opened, the process is in two stages.

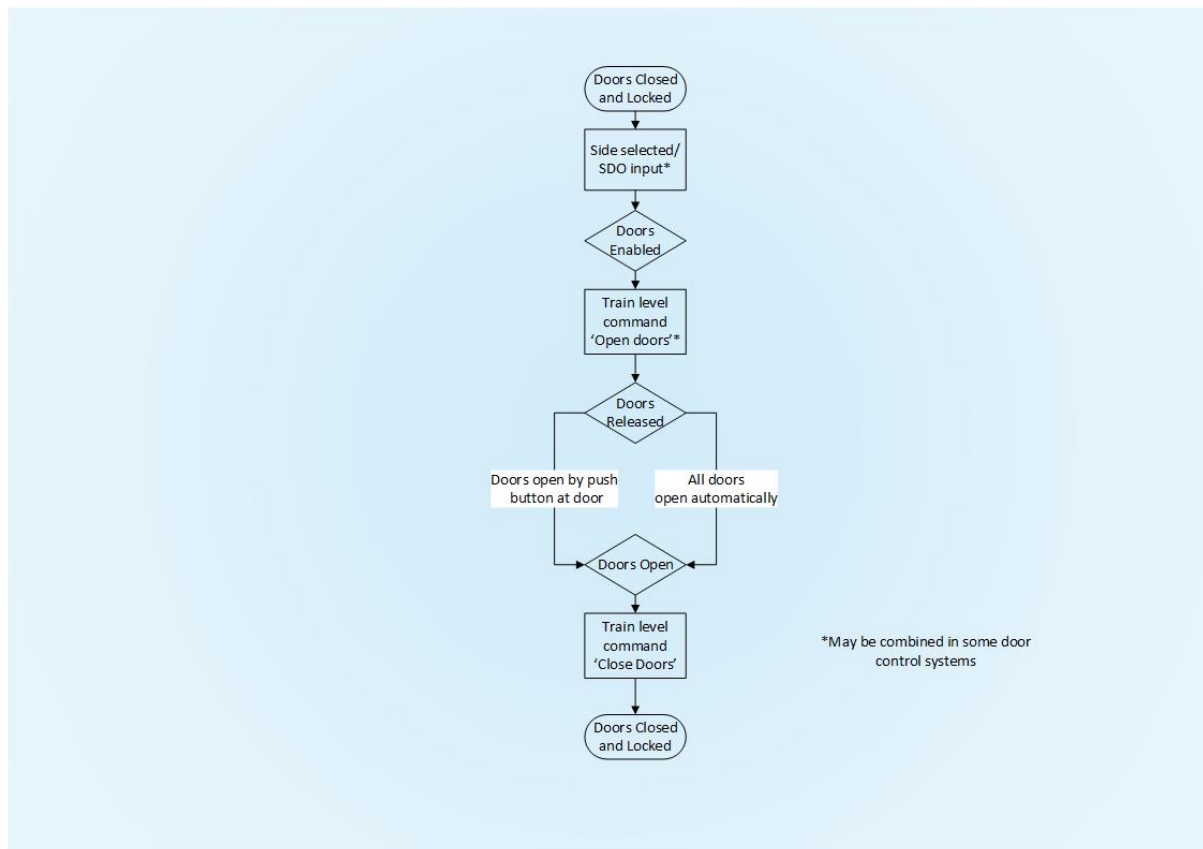


Figure 2: Doors open and close cycle

Appendix C SDO Technologies

Note: The content of this appendix is provided for guidance only.

C.1 History of SDO

C.1.1 SDO systems have been introduced and continue to be used for the following reasons:

- It is not uncommon for passenger trains to stop at platforms shorter than the trains; a practice that has occurred for many years.
- When slam doors were in use the passenger alone was responsible for deciding when to open the door and there was no indication given to help in the decision.
- The introduction of power operated doors has given the impetus to provide a means of controlling safe access for passengers to / from the platform. This can be achieved by use of an SDO system.
- SDO systems have been in use in GB for several years, but to-date no single system has emerged as the 'ideal' solution. The level of automation and technology utilised has varied considerably.

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- e) Demands on the passenger-carrying capacity of the railway are predicted to increase in the future. SDO systems allow improved utilisation of stations, trains and pathways to be achieved within a relatively short timescale, without waiting for expensive and time-consuming projects to extend platforms or increase the number of train movements.

C.2 Location system

C.2.1 This is the original system used for ASDO where the train's GNSS (GPS) system gives a location and from this the train uses a look-up table to obtain the permitted number of doors that can be released at that station (location).

C.2.2 Where GNSS (GPS) coverage is poor or not accurate enough (two adjacent platforms of different lengths) this is augmented by a track system (for example, Tracklink 2) providing an update of the location in terms of station and platform length.

C.2.3 With location based SDO systems the train knows where it is and, based on this information, selects the correct side and number of doors. As this information could be incorrect or not present, it requires confirmation from the train crew before releasing doors. The train crew has the ability to select a different station (override) where incorrect or no station / platform information is provided. The location is provided by GPS augmented by a track beacon or just a track beacon.

C.2.4 When a RFID beacon is available this system can use:

- a) Station identity.
- b) Platform number.
- c) Platform length.

C.2.5 Guidance on GNSS is given in GEGN8578.

C.3 Per train

C.3.1 In per train control, every platform at which the train stops is equipped with an RFID beacon and at least the front vehicle of the train is equipped with a reader.

C.3.2 The train is pre-programmed to open no more than the minimum number of doors that can be accommodated by all the platforms on the route, so where no beacon is present it fails safe.

C.3.3 When the train passes over the beacon the usable platform length is read by the train and the number of doors associated with that length will be released.

C.3.4 For SDO the RFID beacon provides platform length.

C.3.5 For associated correct side door enable the RFID beacon provides:

- a) Correct side door enable.
- b) Approach direction *.

Note: * Used for bi-directional working only.

C.3.6 As this fails safe, a check by train crew is not required and so can be used by driver or guard release of doors. Additionally, the following information may be used when required:

- a) Station identity.
- b) Platform number.

C.3.7 This system fails safe in that, when a beacon is not read, then either no doors are enabled / released, or the minimum number of doors that can be accommodated at every station at which that train stops are released. The system is reset by the train detecting it has left a station and so all doors are set to SDO OFF.

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C.4 Per vehicle

C.4.1 In per vehicle control each platform is fitted with a beacon at entry and each vehicle is fitted with a reader. When a vehicle passes over a beacon (programmed SDO ON) then the doors are enabled on that vehicle (release only occurs after the train crew operate the release push buttons).

C.4.2 The system is reset by the train detecting it has left a station and so all doors are set to SDO OFF.

C.4.3 For SDO the RFID beacon provides:

- a) SDO ON.
- b) A cyclic redundancy check to confirm that the beacon data is valid.

C.4.4 For associated correct side door enable the RFID beacon provides:

- a) Correct side door enable.
- b) Approach direction.

C.4.5 A feature, not used at present by the per vehicle system but available, is for an SDO OFF beacon to be placed at the end of a platform to address the situation where the front of the train is not in the platform. This would not fail safe if the SDO OFF beacon was not read.

C.4.6 The system fails safe in that, where no beacon is present or detected, then no doors on the train or the minimum number of doors that can be accommodated in every platform, are enabled.

C.5 Packet 44

C.5.1 The packet 44 SDO system uses the ETCS system to transmit the information required for SDO on the train.

C.5.2 The transmission can be by on-track beacon or by RBC, which is then referenced to a beacon.

C.5.3 Packet 44 is read by the Specific Transmission Module (STM) and interpreted as door control information and passed to the door control system.

C.5.4 Packet 44 data structures are managed by RSSB, as set out in RIS-0784-CCS.

C.5.5 A specific application of packet 44 is set out in [C.6](#).

C.5.6 Existing uses of packet 44 are set out in [H.17](#).

C.6 TASS

C.6.1 TASS SDO systems are a specific application of the ETCS Packet 44 structure using the same Eurobalises as the TASS system.

C.6.2 The system requires two Eurobalises to verify the information read from the first Eurobalise.

C.6.3 The information from these Eurobalises is read by the existing TASS equipment on tilting trains.

C.6.4 Data is structured according to NID_UKSYS value 6, as set out in the Packet 44 register maintained by RSSB in accordance with RIS-0784-CCS.

C.7 Manual SDO

C.7.1 Manual SDO systems are not recommended in new applications, as set out in [G.4.1.11](#). They are also not recommended in services where high passenger densities occur, such that a guard is unable to make their way to the appropriate door control panel (for example see [H.1](#)). This section describes how the existing manual systems work.

C.7.2 In manual operation, a member of the train crew enables the operation of doors according to the station and platform length. The driver is responsible for stopping at the platform location that corresponds

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to the train formation. In the event of an excessive error, the train crew take appropriate action through the public address and the SDO system to enable passengers to disembark safely.

C.7.3 Possible appropriate scenarios applicable to manual SDO systems include limiting door operation:

- a) To one vehicle only. (It is possible in the most restrictive operation to only release one door on a train rather than a vehicle.)
- b) To doors forward of a control point manned by the train guard.
- c) To one or more units within a multiple unit train.

C.7.4 It is generally recommended that manual SDO systems are not used for trains utilising Driver Only Operation (Passenger) (DOO (P)).

C.7.5 It is recommended that a consistent method of operation is adopted within fleets to avoid risk from error caused by confusion of staff or customers. For example, it would generally be undesirable for passengers to be expected to alight from the front part of a train at some stations, but to alight from the rear on other stations on the same route or network.

C.8 Comparison of systems

C.8.1 Table 4 sets out the extent to which the SDO functions are able to be automated in normal modes of operation to provide systems corresponding to basic ASDO and FASDO classifications. These classifications are not absolute and are used to give a conceptual view of the extent of the automation that can be employed.

Function	Manual	ASDO	FASDO
Recognising the next station	Manual	Automatic	Automatic
Recognising the platform	Manual	Automatic	Automatic
Recognising the train length	Manual	Automatic	Automatic
Detecting where doors are permitted to be enabled	Manual	Automatic	Automatic
Detecting when doors are permitted to be released	Manual	Manual	Automatic
Providing information to passengers	Manual and/or Automatic	Automatic	Automatic
Verifying the operational state of the equipment	Automatic	Automatic	Automatic

Table 4: Degree of automation of SDO systems



Appendix D SDO Detailed Design Considerations

Note: The content of this appendix is provided for guidance only.

D.1 System interfaces

D.1.1 The system boundary and interfaces of SDO systems are shown in Figure 3. The door control system may be part of the TCMS system.

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 Addressed by this document and other standards
 Addressed by this document

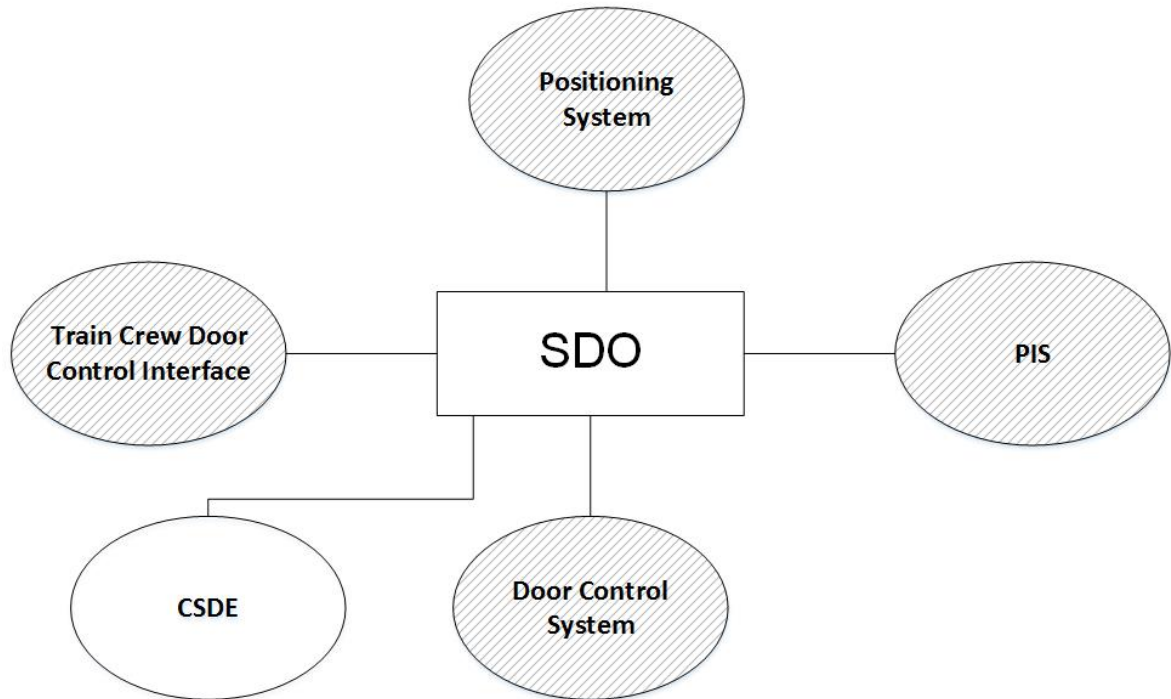


Figure 3: SDO system interfaces

D.2 Stakeholders

D.2.1 There are many stakeholders in the design of the SDO system as shown in Table 5.

Stakeholder	Role in relation to SDO Systems
Infrastructure manager	To co-operate with RUs to agree the interface between the trainborne and infrastructure parts of the SDO system
	To provide and maintain the infrastructure part of the SDO system where fitted trackside
	To co-operate with the RUs in order to jointly accept the SDO system in accordance with the ROGS*
	To specify SDO systems
Station manager (this includes train operators when responsible for this IM's role)	To provide the infrastructure to support SDO systems, for example RFID tags
	To maintain the infrastructure associated with SDO systems
	To assist with determining operational platform length

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Stakeholder	Role in relation to SDO Systems
RUs	To co-operate with the IM and station managers in agreeing which stations will be provided with SDO systems
	To provide and maintain trainborne SDO system equipment
	To co-operate with the IM in order to jointly accept the SDO system in accordance with the ROGS
	To specify SDO systems
Rolling stock owners	To carry out some of the above activities for which RUs are responsible, as established by contract
	To specify SDO systems
Suppliers	To provide SDO systems in accordance with legislation, standards and IM's and RU's requirements
	To carry out some of the activities for which IMs and RUs are responsible, as established by contract
ORR	To provide guidance to IMs and RUs to assist with the acceptance of the system through the ROGS to SDO systems
Passengers	To follow guidance instructions generated for their information as a result of the application of SDO systems
Major railway projects, for example HS2, Crossrail	To specify SDO systems

Table 5: Stakeholders role in developing SDO systems

Note: *ROGS - Railways and Other Guided Transport Systems (Safety) Regulations 2006

D.3 Impact on dwell time

D.3.1 The response time of any door control system affects the dwell time at a station platform. Dwell time depends upon the typical sequential events set out in Table 6 and the introduction of automation to an SDO system changes the timing of one of these events.

D.3.2 The volume of passengers alighting or joining also affects dwell time where a limited number of doors are available for use under an SDO system.

D.3.3 Including these effects on dwell time can help the assessment of the appropriateness of the system selected and can influence automatic system design.

Event
Train stopped
Train crew checks SDO system interface
Train crew presses door release buttons on the correct side
Door release lights illuminated

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Event
Door release system command and control
Doors begin opening, time to fully open
Passengers alight
Passengers boarding
Train dispatch - identify when it is safe to close doors
Operate door close
Communicate door close through train and response time of door system
Hustle warning
Door close phase
Door interlock communication
Driver response time to interlock, or two bells. Driver checks the dispatch corridor and if safe to do so, takes traction and starts to drive away from platform

Table 6: Dwell time events

D.4 Radio Frequency (RF) environment

D.4.1 The SDO system may involve large numbers of readers transmitting and receiving RF on the same frequencies at the same time. The design of the system will include a consideration of this RF environment and the effect on the infrastructure and the operation of the SDO system.

D.5 Reliability of location data

D.5.1 The design will consider the method of ensuring the reliability of the location information.

D.5.2 On location based systems this may be achieved by reading the beacon multiple times and not enabling the doors until at least two sets of valid beacon data that match have been read.

D.5.3 On position based systems this may be achieved by using an alternative location identifying system, as set out in [4.9.2](#).

D.6 Manual override

D.6.1 Manual override is required in the following situations:

- Emergency evacuation.
- SDO system failure.
- Normal stopping point not available.

D.6.2 The manual override arrangements may provide for:

- The train crew to select for release individual doors / vehicles in any combination.
- The use of override to be logged either in the SDO system, a train data management system and / or Train Data Recorder (TDR). Other data, such as the system state and train location, could be recorded at the same time. Requirements for TDR are set out in GMRT2472.
- The process to be simple and achievable in a timely manner, limiting the opportunities for error. The process could be subjected to human factors analysis.

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d) Passengers to be advised of the location of the doors released by the override process. This could be achieved manually.

D.6.3 It is good practice to consider strategies to maintain competence, such as periodic refresher training, to manage potential skill fade resulting from drivers rarely using the manual override function.

D.7 HMI display in the event of SDO system failure

D.7.1 The following provides guidance on how failures of the SDO system to correctly identify the location could be displayed on the HMI.

D.7.2 The screen, as shown in Figure 1, is modified as follows:

- a) The SDO system information bar is made red in colour (background).
- b) Text is provided relating to the system's best estimate of the location, for example, the system may have determined the macro / station location – 'City Thameslink?', or 'City Thameslink - Platform 1'.
- c) Beneath the SDO system information bar, the system may offer three options in red background – 'Confirm', 'Change' or 'Emergency Release'.
- d) Operation of 'Confirm', 'Change' or 'Emergency Release' to be logged to the TDR, as this is an indication of potential failure within the SDO system.
- e) Where the station (macro) location is confirmed, the system then offers the choice of platform available for that station, or the platform may already have been automatically offered.
- f) When the button 'Change' is operated, the system initially triggers the same audio / visual announcement over PIS, as if 'SDO System Override' had been selected.
- g) When 'Change' has been selected, a new screen, or screen window, offers nearby stations. The SDO system controller, independent of the GNSS navigation unit, estimates its whereabouts; that is, where the last station is known, then the current station is from a limited list, particularly where distance travelled is factored into the decision. The train crew is offered a list of stations to choose from. In case the actual station is not in the list, an alphabet selection of all stations that the train may call at is offered.
- h) When a member of the train crew selects a 'Change' station, they are then offered the selection of platforms.
- i) When the station / platform is selected, the train crew confirms the selection.
- j) When finally selected, the SDO system information bar becomes blue in colour and the arrangement of doors for release is displayed.
- k) The train crew is now required to release the train doors.

D.8 PIS system

D.8.1 SDO PIS sources

D.8.1.1 The potential sources of SDO system information to the public include:

- a) Customer information when booking and at stations.
- b) Passenger announcements over the public address system, and visually on both trains and platforms.
- c) On indicators at the doors.

D.8.2 Locations where SDO is used

D.8.2.1 It is normally required that existing PISs provide information concerning station calling patterns.

D.8.2.2 The PIS can emphasise where SDO systems affect a journey.

D.8.3 Information given to passengers

D.8.3.1 Potential pitfalls for the SDO information given to passengers are:

- a) The sequential (series) PIS addressing method proving too time consuming for the normal approach time to stations where SDO systems are in use, in order to give passengers adequate information in a timely manner.
- b) Inconsistency in the use of coach letters and numbers.

D.8.3.2 The SDO PIS system design can consider and mitigate these.

Appendix E Guidance for Operating an SDO System

Note: The content of this appendix is provided for guidance only.

Note: Many details of the operation of the train are unknown to the system supplier and need to be controlled by the RU. This section sets out details of some of the conditions that may be considered when introducing an SDO system.

E.1 Risk analysis of SDO system design and functionality

E.1.1 As part of the introduction of the SDO system, a full risk assessment may be required according to the CSM RA, as the change is likely to be 'significant'. Full guidance on the CSM RA process can be found at <http://www.rssb.co.uk/improving-industry-performance/management-of-change>. Where the change is not considered significant, the supplier and / or RU may perform a risk assessment, including the scenarios in this appendix, according to their own safety management system.

E.1.2 In introducing the SDO system, particular elements to be included in the risk assessment are to define the conditions of use of the system, including the potential for human error when operating in these conditions.

E.1.3 The reason for completing the risk assessment is to demonstrate that the introduction of SDO operation is sufficiently safe and the risk is as low as reasonably practicable. The risk assessment will result in a number of safety requirements that will form part of the safety justification.

E.1.4 Expected operational scenarios could include:

- a) Stopping short at a platform.
- b) Stopping incorrectly.
- c) Overrunning the platform.
- d) Stopping additionally or unexpectedly.
- e) A change in direction of travel.
- f) A change in train length.
- g) An unplanned train configuration.
- h) Fouling of road crossings adjacent to the station platform.
- i) Transfer into empty coaching stock.
- j) Being required to draw forward to clear starting signal.

E.1.5 The functional / safety requirements may be met by operational rules, by technical means or a combination of both. The method of meeting the requirements is determined by the system operator in discussion with the system supplier.

E.1.6 Stopping short and stopping incorrectly at a platform are considered particularly as, in some SDO systems, more doors may have been enabled than are actually next to a platform.

E.1.7 In this context the SDO system comprises both equipment and the train crew.

E.1.8 These operating scenarios are derived from a safety analysis carried out as part of the research project set out in [4.2](#).

E.1.9 However, safety analysis specific to each SDO system project will show full design justification.

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E.2 Multiple units without gangways

E.2.1 The use of SDO on multiple unit trains not fitted with inter-unit gangways might lead to a situation where passengers in one section of the train were unable to move to a part of the train where doors were available for egress to the platform. This is likely to be unacceptable both in respect of customer service, and safety, since the response of passengers in such a situation cannot be ensured.

E.2.2 Where the decision is made to use SDO on these trains it may be done where:

- a) The platforms are always at least the length of the unit plus one vehicle (or one door) long.
- b) Announcements are made to allow passengers to move to a different unit at the previous station.
- c) A seat reservation system can help to assign passengers to the correct part of the train.

E.2.3 All of these methods would require safety justification.

E.3 Persons with reduced mobility (PRM)

E.3.1 Operators have a statutory obligation to take into account the needs of those with reduced mobility; this applies to boarding and alighting the train.

E.3.2 It is therefore important to ensure that PRM customers do not find themselves unable to egress the train at their destination because they are either unable to move through the train to a safe alighting point or, due to sensory impairment or learning disabilities, are unaware that an SDO system is utilised on their train or are unable to recognise instructions relating to an SDO system.

E.4 Joining services

E.4.1 Good practice is for a joining service to take account of a train already berthed at the platform, in particular, when the combined trains have a length longer than the platform.

E.5 Splitting services

E.5.1 Good practice is for functional or operational procedures to manage splitting; that is, where two units that were operating in multiple, split to form two new services, as the newly formed train in the rear needs to operate an SDO system to ensure that doors not adjacent to the platform continue to be inhibited.

E.6 Reversing from a station

E.6.1 A further difficulty arises at stations where trains reverse their direction of travel (due to termination or to take an onward route at certain junction stations). This affects the selection of the doors to be enabled / inhibited. Good practice is for the information given to passengers to be clear and given prior to arrival so that the direction of travel is clear.

E.7 Different platform lengths

E.7.1 In most cases, all of the platforms in regular use at a particular station will be of similar length. However, where this is not the case, it may be desirable for the SDO system to vary the numbers of doors enabled according to the individual platform used.

Appendix F Guidance on the Maintenance of SDO Systems

Note: The content of this appendix is provided for guidance only.

F.1 Onboard systems

F.1.1 Auto diagnosis

F.1.1.1 For automated systems, well-designed SDO system facilities include fault autodiagnoses. When a fault is detected, the unit concerned is identified and a fault code assigned. This information can be made available to the staff responsible as part of the train's standard maintenance facilities. This guidance extends to on-train detection of failures of any infrastructure equipment used for the SDO system function, such that a report is logged by the on-train system where it is possible to detect any infrastructure equipment that is missing or failed.

F.1.2 Component lifetime

F.1.2.1 A well-designed electronic system does not require routine overhaul. However, some components may have limited life and require replacement.

F.1.3 Component overhaul

F.1.3.1 On ASDO systems that are not fully electronic, and on manual SDO systems, overhaul of additional SDO system components can be undertaken at appropriate frequencies.

F.2 Location based systems

F.2.1 Analysis

F.2.1.1 The navigation unit can have a management interface, allowing a computer to be connected and thereby perform detailed analysis. Analysis can include a method of observing satellite signal strength and average signal strength, averaged over a period of time. This analysis facilitates the checking of the performance of the antenna.

F.2.2 Journey simulation

F.2.2.1 It is good practice for depot staff (and development / project engineers) to have the capability to simulate GNSS through the maintenance computer. This makes it possible to take the train 'on a journey' from within the depot. This test facility can then be used to validate databases whenever they have been changed. However, this does not control the risk of entering the wrong latitude and longitude coordinates, as there is a strong chance that both the simulator and on-train database will match, sharing the same data source. RFID testing at each station along the route will validate the on-train database.

F.2.3 Verification of data

F.2.3.1 A well-designed ASDO system will incorporate self-testing. GNSS can be verified by regular cross-checking specific tag locations where beacons are used as back-up. Alternatively, the GNSS system can be monitored by tracking the number of times drivers have to change the location, or errors identified during station stops.

F.3 Infrastructure systems

F.3.1 Cleaning

F.3.1.1 Routine cleaning, as a maintenance task, can be considered to manage the risk from, for example, brake dust affecting the performance of train antennas.

F.3.1.2 A previous problem with some train antennas has been the application of conductive paint treatment over the antenna domes. This risk can be managed by giving a warning in the maintenance procedures.

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F.3.2 Ability of maintainer to read a beacon

F.3.2.1 To facilitate the testing of beacons, infrastructure installation and maintenance teams can be provided with a method of confirming the output of a beacon locally, if only to confirm they have installed the correct beacon at the correct location and that signal strength is as expected.

F.3.3 Diagnostic reports

F.3.3.1 A well-designed ASDO system automatically provides reports from the assistance server or, alternatively, reports available by analysis of Train Management System (TMS) data. The reports typically provide the following information for action by the IM:

- a) Beacon reference number.
- b) Station / platform identifier.
- c) Beacon location on platform.
- d) Problem.
- e) Action; that is, replace, investigate etc.
- f) Date / time.

F.3.4 Depot test location

F.3.4.1 Where appropriate, SDO locations can be installed at depots. These are then included in the on-train database as additional stations.

F.3.4.2 The test location can provide the facility to test the manual override function.

F.3.5 Cleaning

F.3.5.1 Routine cleaning of infrastructure components is not currently envisaged, although a report of poor performance may be corrected by cleaning.

Appendix H Selection of Existing SDO Systems

Note: The content of this appendix is provided for guidance only.

H.1 Class 158 and 159 Super Sprinter

H.1.1 The guard is required to use the vestibule controls adjacent to a driving cab in the portion of the train being released (in direction of travel) and the system works on a 'per unit' basis.

H.1.2 The guard goes to the required door control panel, and on releasing the doors uses the 'SDO' option.

H.1.3 When the doors are released, the door control panel sends a 'door closed' signal to the unit(s) to the rear of where the guard is positioned (for example, on a train formed of 2x159 units, the guard will go to the controls adjacent to cab 3 to release only the front three coaches).

H.2 Class 17X Turbostar

H.2.1 Class 17X units have a manual SDO system that is controlled by the guard / train manager. The guard / train manager may choose to open all doors on the train or all the doors between their current position and the active cab. The selection is from the door control panel operated by the guard / train manager by means of a switch.

H.2.2 Depending on the subclass of Turbostar, the door selection may be made either from any door or from any cab.

H.3 Class 180 Adelante

H.3.1 Class 180s have a manual SDO system.

H.3.2 The driver operates a rotary switch within the cab to select one to five vehicles (counting from the rear) for which the doors are prevented from opening.

H.3.3 Automatic announcements are made which can be supplemented by driver announcements.

H.3.4 The driver communicates that the train is at the correct stopping place via a bell code and the guard confirms this via a bell code before the doors are opened.

H.4 Class 185 Desiro

H.4.1 Class 185 use a fully manual system where the conductor locks the doors that will not be platformed immediately after leaving the previous station.

H.4.2 The door out-of-use lock is used and a maximum of three sets of doors are locked.

H.4.3 Passengers are informed that these doors are unavailable by announcements on the PA and, furthermore, by verbal communication to passengers by the conductor when in the rear carriage(s) locking the doors.

H.5 Class 220/221 Voyagers

H.5.1 SDO system functionality is built into the train's TMS using the Class 375 principle of GNSS, as set out in [H.7](#), to identify the station; however, to ascertain which platform the train is on, the driver is required to make a manual selection.

H.5.2 Once at the station the TMS interrogates an inbuilt database that contains a list of platform lengths, platform numbers and station names. Since the system knows which station it is at, it is able to provide the driver with a list of platform options. The driver then selects the platform which they have stopped at. The system can then look up the allowable number of vehicle doors to open by cross-referencing door release codes with its internal database.

H.5.3 While Class 220/221 is equipped with a Rail Vehicle Accessibility Regulations 1998 (RVAR) compliant PIS, the train operator has chosen to provide audio announcement through the train crew. The system therefore depends on the train crew making appropriate announcements concerning SDO.

H.5.4 The system on Class 220/221 is not considered to be a fully ASDO system, sitting between manual SDO and ASDO systems.

H.5.5 The SDO system on Class 220/221 is currently not used in service.

H.6 Class 222 Meridian SDO system

H.6.1 The SDO system is operated on the principle of a manual system, in that it relies on the driver to decide how many doors are permitted to be released at each station.

H.6.2 This is achieved by the provision of buttons by which the driver controls the number of doors to be released.

H.6.3 The SDO system has no awareness of train location or the number of doors that are permitted to be released. Instead, the driver selects the number of doors to be released at every station.

H.6.4 The SDO relays are part of the door control unit relay panel.

H.7 Class 375 Electrostar

H.7.1 Class 375 was the first GB mainline railway train to be equipped with an ASDO system acceptable to Her Majesty's Rail Inspectorate (HMRI).

H.7.2 The 'navigation unit' relies solely on a GNSS receiver housed in the PIS destination indicator, although there is a back-up using the GNSS receiver in the second cab of the leading unit. This is linked to a database to provide door opening and PIS functionality.

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H.7.3 The location of every station is defined by a central point (at the centre of the station) through latitude and longitude co-ordinates.

H.7.4 This location is programmed in the ASDO system database within the Intelligent Display Unit. The ASDO system generates a geofence of 300 m from the station centre, and the software calculates this as an approximation to a square by setting a 'delta' on the latitude and longitude. The delta is a value of decimal degrees latitude / longitude approximating to ± 300 m.

H.7.5 Subsequent software updates have modified this arrangement to approximate to a circle, due to difficulties in discriminating between stations on lines with NW / SE or NE / SW orientation.

H.7.6 An ASDO 'tracking system' uses a network map of connected stations such that, working from a previous known station, a limited number of options are available for the next station. The system tracks the journey through stopping and 'pass through' stations.

H.7.7 This tracking system allows the ASDO system to predict and offer possible solutions to the train driver if GNSS fails to recognise the next station, due to it having no GNSS reception.

H.7.8 Where two successive stations have no GNSS reception, drivers are required to make a manual selection. Alternatively, where GNSS can be received between the stations, then a correcting waypoint between the stations can be defined.

H.7.9 This system allows a driver to manually confirm or alter the chosen location, or manually release doors in individual vehicles when a GNSS fix is not available.

H.7.10 Class 375 is equipped with an audio / visual PIS, compliant with the RVAR. The PIS also deals with splitting and joining services, describing which vehicles (by number) proceed to each individual destination on splitting services.

H.8 Class 376 Electrostar

H.8.1 The system operates in the same way as Class 375, as set out in [H.7](#).

H.9 Class 377 Electrostar

H.9.1 Class 377 is similar to Class 375, as set out in [H.7](#), but with the addition of a Hima-Sella Tracklink 2 reader and antenna fitted to the underframe of driving vehicles.

H.9.2 The readers and associated antennas decode transmissions from a Tracklink 2 transmitter loop installed in the 4-foot at selected stations. The routes that these units serve include some stations that have platforms of different lengths.

H.9.3 Where Class 375 simply identifies the general area of a station (± 300 m from the centre) and treats all platforms as equal, Class 377 does likewise at the majority of stations, but a small number are treated as a special case.

H.9.4 The special cases are those stations with different platform lengths or stations where GNSS reception is not possible or reliable.

H.9.5 The number of vehicles allowing door release is only increased following positive detection of a Tracklink 2 loop identifying that a longer platform has been approached.

H.9.6 The system uses the GNSS-based system to ascertain which station it is at, and attains a default configuration for door release based upon the shortest platform at that station.

H.9.7 However, when the train is routed onto a longer platform, it passes over a Tracklink 2 loop, and data is received regarding the station Universal Location Identifier (ULI) number and platform length.

H.9.8 The train then amends the door selection for the ASDO system and the audio/visual announcement accordingly.

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H.9.9 Every platform approached is equipped with a Tracklink 2 transmitter / antenna, for consistency. GNSS identifies the station at a global level, and the Tracklink 2 loop identifies the platform.

H.9.10 In some cases, a number of Tracklink 2 transmitters / antennas are installed along a particular platform.

H.9.11 CSDE has been enabled on the Tracklink 2 system.

H.9.12 Since the system uses a hybrid of GNSS and loop, failures of loop can therefore be identified by the train; the SDO system is substantially failsafe and depends on the driver stopping at the correct point.

H.10 Class 378 Capitalstar Electrostar

H.10.1 The SDO system is a per train system using Hima-Sella Tracklink III track beacons to broadcast the platform length. Tag data is formatted according to RIS-2795-RST.

H.10.2 This information is read by the reader on the pantograph vehicle and the location compared with that retrieved from the GPS system and SDO database linked to the Wheel Slide Protection (WSP) counters.

H.10.3 The location is selected based on two out of three location systems matching and provided to the TCMS.

H.10.4 The system includes CSDE. This warns the driver when the wrong doors are selected.

H.10.5 The system can be overridden by enabling the doors three times on the side that is actually adjacent to the platform.

H.11 Class 387 Electrostar

H.11.1 The Class 387 SDO system is the same as for the Class 377 as set out in [H.9](#).

H.12 Class 390 Pendolino

H.12.1 The ASDO uses two track mounted Eurobalises similar to those used for TASS.

H.12.2 These provide duplicate information to the rear cab TASS system on the train as it is approaching a short platform.

H.12.3 As the train passes the first beacon, the ASDO system is activated and the correct number of doors inhibited.

H.12.4 This triggers audio and visual messages to the passengers about the number of doors that are inhibited.

H.12.5 A pictogram appears on the driver's TMS screen indicating that SDO has been activated. The selection is reconfirmed when the train passes the second beacon.

H.12.6 The doors remain inhibited until the train has moved a train length away from the platform.

Note: The step does not deploy if a passenger operates the emergency egress handle.

H.13 Class 444 and 450 Desiro

H.13.1 The SDO system is a per train system using Hima-Sella track beacons to broadcast the platform length.

H.13.2 This information is read by the reader on the leading vehicle and transmitted to the TCMS. The train then calculates the number of doors that can be opened based on the platform length.

H.13.3 The SDO system interfaces with the PIS. The PIS automatically notifies passengers to move forward to the appropriate vehicle in stations with short platforms once the data has been read from the beacon.

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H.13.4 The system calculates the number of doors to be opened with all configurations of 444 / 444, 444 / 450 and 450 / 450 based on the different vehicle lengths.

H.13.5 The default condition is to open the doors of the front three coaches on a Class 444 and the front four coaches on a Class 450.

H.13.6 The Class 444 and Class 450 also have a manual system which is overridden by the ASDO system. The manual switches have no effect on door release but could be used if the ASDO system is temporarily or permanently isolated by the driver.

H.13.7 On a risk based approach, following the introduction of ASDO, guards are no longer permitted to use the manual SDO option following any isolation.

H.13.8 In the event of a default door release, at platforms where the train is not fully accommodated, passengers join or alight via the coaches released in default.

H.13.9 Where the train is fully accommodated, all doors are released following a temporary override of the ASDO system initiated by the driver.

H.14 Class 458/5 Juniper

H.14.1 The SDO system is a per vehicle system using Hima-Sella track beacons to enable the doors on each vehicle.

H.14.2 The beacon is read by a reader on each vehicle and the interface is directly with the door control relays.

H.14.3 There is a default condition of the doors on the front four vehicles being released.

H.14.4 The readers are reset by pulses provided the WSP system based on distance travelled.

H.14.5 Each driving cab is fitted with override switches which can temporarily or permanently override the output from the readers in every car.

H.14.6 The health of each reader is reported to the driver through the Train Management System (TMS).

H.14.7 In order to assist guards at platforms, bodyside indicator lights are only illuminated on those cars which are ASDO-enabled.

H.14.8 There is also a manual SDO system fitted to these trains.

H.14.9 The manual system is live at all times and can also act in the capacity of a temporary override of the ASDO system to release the front five coaches of a 10-car train (or all five coaches of a five-car train).

H.14.10 A risk assessment was undertaken when the system was introduced and, as a result of this, guards are not permitted to use the manual SDO option.

H.14.11 In the event of a default door release, at platforms where the train is not fully accommodated, passengers board or alight via the coaches released as the default condition.

H.14.12 Where the train is fully accommodated all doors are released following a temporary override of the ASDO system initiated by the driver.

H.15 Class 465 and 466 Networker

H.15.1 The Networker fleet consists of a family of similar designs:

- a) Class 465, including variants.
- b) Class 466.

H.15.2 A semi-automatic SDO system is incorporated using an early form of the Hima-Sella Tracklink system.

H.15.3 Control is provided on this system while the vehicle receiver is above the loop, and depends on accuracy in the stopping position.

H.15.4 The SDO system can disable doors in the front and rear vehicles only, and manual control by the driver is still available.

H.15.5 This is not in everyday use because it is inherently not failsafe, as there is no way of detecting a failed track loop.

H.16 Mark III coaches

H.16.1 On Great Western Railway, the SDO system is manual and is controlled by the guard. The guard operates the doors from the furthest forward control panel on UP services and the rearmost control panel on DOWN services.

H.16.2 On Chiltern Power Door Mk3 vehicles, the SDO system is manual and is controlled by the guard. The guard operates the doors from the rearmost coach on the platform, in both directions.

H.17 Packet 44 Codes

H.17.1 At the time of publication, NID_UKSYS codes have been allocated for use in SDO systems, as set out in Appendix A.1 of RIS-0784-CCS.

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Definitions

Access Device	An access device is a device to open the doors in an emergency from the exterior of the train.
Alighting	The act of getting off a train.
Beacon	A means of providing digital information, comprised of a tag embedded in a mechanical housing, known as balises or Eurobalises for certain applications.
Boarding	The act of getting on a train.
Door	A door available for passenger use, including its components e.g. windows and controls, irrespective of the number of door leaves used.
Driver Machine Interface (DMI)	A HMI for the driver.
Egress Device	An egress device is a device to permit evacuation from inside the train to the outside.
Enable	Allow a door to be released. Note: Doors are only released after the train crew or system activates the release command.
Human Machine Interface (HMI)	HMI is the graphical interface device which indicates information to the operator (user) and which is used by the operator for the purpose of operating the associated system(s).
Infrastructure Manager (IM)	Any 'body' or undertaking that is responsible in particular for establishing and maintaining railway infrastructure, or part thereof, as defined in article 3 of Directive 91/440/EEC, which may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings. <i>Article 3 (b) of Directive 2004/49/EC.</i>
Inhibit	Prevent a door from being released.
Locked	When a door is positively held in the closed position such that it cannot be opened without operation of train crew operated controls or devices, and/or emergency access/egress devices.
Locked out of use	When a door is manually locked by a mechanism other than the normal operational door controls and unavailable for passenger use following a defect or for operational requirements.
Passenger Carrying Rail Vehicle	Rail vehicle designed and used to convey fare-paying persons.

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Public Address (PA)	An audio system for providing passengers and/or people on platforms with information.
Ready to Start	A communication signal used to advise the driver that it is permissible to start the train.
Release	Allow those power doors which are enabled to be opened.
Specific Transmission Module (STM)	Device allowing the ERTMS/ETCS onboard equipment to be interfaced with the onboard part of an existing National Train Control system. It allows smooth transitions from/to the National System and gives access to some ERTMS/ETCS on-board resources (e.g. DMI). <i>ERTMS_and_ETCS Glossary of Terms UNISIG Subset-023 v3.1.0 dated 12/05/2014 :UNISIG Subset-023 v3.1.0 dated 12/05/2014</i>
Tilt authorisation and speed supervision system (TASS)	The system that authorises the use of tilt mode by sending messages from on-track beacons to an on-board reader. The onboard system also supervises the speed of the train.
Train	A train is defined as (a) traction unit(s) with or without coupled railway vehicles, including light locomotive and self-propelled rail vehicle operating in rail mode, with train data available operating between two or more defined points.
Train crew	Members of the onboard staff of a train who perform designated safety related tasks on the train, for example the driver or guard.
Unit	A permanently coupled group of vehicles. A unit may also be a single vehicle.
Vehicle	An individual vehicle or car of any train formation.
Wrong side door release	A failure when the doors are released on the side opposite to that intended, normally the side not adjacent to a platform.

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Abbreviations

ASDO	Automatic Selective Door Operation.
AWS	Automatic Warning System.
CSDE	Correct Side Door Enable.
DMI	Driver Machine Interface.
DOO(P)	Driver Only Operation (Passenger).
ERTMS	European Rail Traffic Management System.
ETCS	European Train Control System.
FASDO	Fully Automatic Selective Door Operation.
GB	Great Britain.
GNSS	Global Navigation Satellite System.
GPS	Global Positioning System.
HMI	Human Machine Interface.
HVAC	Heating, Ventilation and Air Conditioning.
IM	Infrastructure Manager.
ORR	Office of Rail and Road.
OTDR	On Train Data Recorder.
PA	Public Address.
PIS	Passenger Information System.
PRM	Persons with Reduced Mobility.
RAIB	Rail Accident Investigation Branch.
RBC	Radio Block Centre.
RFID	Radio Frequency Identification.
RIS	Rail Industry Standard.
RST	Rolling Stock.
RU	Railway Undertaking.
RVAR	Rail Vehicle Accessibility Regulations.
SDO	Selective Door Operation.
STM	Specific Transmission Module.
TASS	Tilt Authorisation and Speed Supervision system.
TCMS	Train Control and Management System.
OTDR	On Train Data Recorder.
TMS	Train Management System.
TPWS	Train Protection and Warning System.

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TSI	Technical Specification for Interoperability.
UIC	Union Internationale des Chemins de Fer.
ULI	Universal Location Identifier.
WSP	Wheel Slide Protection.

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References

The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from <http://www.rsb.co.uk/railway-group-standards>.

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Documents referenced in the text

Railway Group Standards

GIRT7033	Lineside Signs
GMRT2045	Compatibility Requirements for Braking Systems of Rail Vehicles
GMRT2100	Requirements for Rail Vehicle Structures
GMRT2111	Rolling Stock Subsystem and Interface to AC Energy Subsystem
GMRT2113	Rolling Stock Subsystem and Interfaces to DC Conductor Rail Energy Subsystem
GMRT2130	Vehicle Fire, Safety and Evacuation
GMRT2472	Requirements for Data Recorders on Trains
GMRT2473	Power Operated External Doors on Passenger Carrying Rail Vehicles (superseded by RIS-2747-RST)

RSSB documents

AK104	Sign AK104 Platform Stop Markers
GEGN8577	Guidance on the Application of Selective Door Operating Systems
GEGN8578	Guidance on the Use of On-Train Satellite Positioning Technology Based Locator for Railway Applications
GOGN3637	Guidance on Defective on-Train Equipment
RIS-0784-CCS	Rail Industry Standard on Management of Packet 44 of the ETCS Data Protocol
RIS-2795-RST	Rail Industry Standard for Track to Train RFID Compatibility
RIS-3437-TOM	Defective On-Train Equipment
T769	Criteria for the application of selective door operation http://www.sparkrail.org/Lists/Records/DispForm.aspx?ID=612

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Other references

BS 1376:1974	Specification for colours of light signals
BS EN 12663-1:2010	Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)
BS EN 13272:2012	Electrical lighting for rolling stock in public transport systems
BS EN 14752:2015	Bodyside entrance systems for rolling stock
BS EN 61373:2010	Railway applications - Rolling stock equipment - Shock and vibration tests
BS ISO 3684-4:2011	Graphical symbols - Safety colours and safety signs - Part 4: Colorimetric and photometric properties of safety sign materials
CSM RA	CSM RA : Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009 (as amended) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02013R0402-20150803&qid=1458140632045&from=EN
Interoperability Directive	DIRECTIVE 2008/57/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 on the interoperability of the rail system within the Community
LOC & PAS TSI	Locomotives & Passenger Rolling Stock TSI regulation number 1302/2014
prEN 16186-2:201X	Railway applications - Driver's cab Part 2: Integration of displays, controls and indicators
PRM TSI	Passengers with Reduced Mobility TSI regulation number 1300/2014
RAIB Report on West Wickham	Rail Accident Investigation Report into a serious incident at West Wickham station on 10 April 2015 https://www.gov.uk/government/news/raib-report-032016-serious-accident-at-west-wickham-station
Railway Safety Directive	DIRECTIVE 2004/49/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2004 on safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive)

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ROGS	Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS)
RVAR	The Rail Vehicle Accessibility Regulations 1998
UIC 566	Loadings of coach bodies and their components.
UNISIG Subset-036	ERTMS/ETCS FFFIS for Eurobalise http://www.era.europa.eu/Pages/Home.aspx
UNISIG Subset-040	ERTMS/ETCS Dimensioning and Engineering Rules http://www.era.europa.eu/Pages/Home.aspx