

RCA



Reference CCS Architecture

*An initiative of the ERTMS users group and
the EULYNX consortium*

System feature definition

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1 Preamble

1.1 Release Information

Basic document information:

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1.2 Imprint

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Support and Feedback:

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1.3 Disclaimer

This No disclaimer defined.

1.4 Purpose

The purpose of this document is twofold:

- Showcase how feature definitions for a complex railway system can be managed with a feature tree.
- Show, which features have been considered in RCA 1.0 release in comparison to a future full release of RCA.

This is done for a selected subset of the system capabilities ("85 Provide navigation data of one train unit", "09 Move train unit", "01 Set point to required position"). From this, it can be derived implicitly, which features are not part of the current RCA 1.0 release. For system capabilities not included in this document, there is no formal feature definition yet. As explained in "Methodological background on features used within RCA" the primary use of features is to stage the development of RCA into iterations, each adding more features, until the full scope has been reached. Example: For system capability 85, this release will not consider 3D absolute positioning (as in GNSS), but the full version of RCA will do.

It must be noted that this document is regarded as of preliminary maturity and provides the benefit of showcasing the feature tree based system development. Hence it is emphasised here that this document is not yet consolidated with other previously released RCA documentation e.g. the document "Concept: RCA Effects - Business Case" [1]. This must happen in future developments.

2 Version history

Version	Date	Author	Description
0.1	2022-09-30	Dr. Oliver Lemke	First release.
0.2	2022-10-19	Dr. Oliver Lemke	Minor formal changes.

3 References

Reference ID	Name	Document ID	Version
1	Concept: RCA Effects - Business Case	RCA.Doc.10	Gamma.1
2	RCA Terms and Abstract Concepts	RCA.Doc.14	1.0

4 Methodological background on features used within RCA

Features are an abstraction in the problem space (user view from outside to the system) detached from concrete specification model (the reference architecture model). The feature model and the reference architecture model are orthogonal to each other, one feature can affect different elements of the reference architecture model.

Features are categorised according to different feature categories (refer to column "Category" below) and allocated to different type of feature trees (refer to columns "Feature Tree Type").

Features are linked to model elements for the reference architecture (e.g. system capabilities).

The definition of variants with selected subset of features serves two purposes for RCA:

1. Define persistent variants in the reference architecture, where mutually exclusive aspects of the system must be managed.
2. Stage the development of the reference architecture. For each intermediate release towards the full scope development of the RCA functionality a variant is defined. Each variant defines, which features are already developed and included in this release and which features are to be developed for a later release.

At the current stage of development the second purpose is actually the primary purpose of this feature tree. In the future the first purpose will become effective when such bespoke persistent variants will have been elaborated.

The following tables shows how feature categories and feature tree types are defined.

Category	Definition	Feature Tree Type		
		system capability feature tree	system technology feature tree	operating environment feature tree
PROVIDES feature	<p>PROVIDES feature of a system capability provides a functionality to actors, external systems or other features.</p> <p>This could be (but not limited to):</p> <ul style="list-style-type: none"> • commands: on demand request by an actor, external system or other feature, e.g., door closing request • indications; constantly provided values by the feature, e.g., TU speed • logging data: storage of data for provisioning asynchronously to actors, external system or other features 	X	-	-
CONSIDERS feature	<p>CONSIDER feature defines what a system capability is able to consider during its processing.</p> <p>This could be (but not limited to):</p> <ul style="list-style-type: none"> • operational conditions: e.g., switch conditions for a point • operational constraints: handled failure situations of a system capability 	X	-	-

Category	Definition	Feature Tree Type		
		system capability feature tree	system technology feature tree	operating environment feature tree
IS CONSTRAINED BY TECHNOLOGY feature	IS CONSTRAINED BY TECHNOLOGY feature limits technological solutions in the solution space e.g., reference points ETCS balises	X	X	-
ALLOWS OPERATIONS OF feature	ALLOWS OPERATIONS OF feature defines physical objects needed for operation purposes, e.g., different type of point devices or locateable rolling stocks	X	-	X

5 Feature Trees and Variant Configurations

This section defines the feature tree definition that have been completed so far. Each feature tree is defined by the following information:

- Feature: The information in this column comprises of three parts. An indent, the feature criticality and the name of the feature.
 - Indent: This information is symbolised by zero or more dashes and indicates the level in the hierarchy of the feature tree. E.g. a feature without dash is the most top level feature. A feature with one dash is one level down of that top level feature.
 - Feature criticality: This information indicates, if a feature as to be implemented, if its implementation is purely optional or something in between these two criticality definitions are used:
 - Mandatory: A feature with this criticality has to be implemented.
 - Optional: A feature can be selected independent from any parent or sibling feature criticality definitions.
 - Alternative: Of features grouped under one parent feature, only one and not more features have to be selected, if the parent feature is selected.
 - Or: Of features grouped under one parent feature, at least one feature has to be selected, if the parent feature is selected.
 - Feature name: This information indicates the defined name of the feature in the structure of verb and object.
- Description: The information in this column provides a description of the functionality provided by the respective feature.
- Release versions: The following columns show, which features are selected for the last release and what the full scope of RCA would be:
 - RCA_BL1_0: This column indicates, which features are selected in the Release RCA Baseline 1 Release 0.
 - RCA_Full_Scope: This column indicates, which features are contained in the full scope definition of RCA.

5.1 85 Provide navigation data of one train unit

Feature	Description	RCA_R1_0	RCA_Full_Scope
Mandatory: 85 Provide navigation data of one train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
- Optional: 85 Provide navigation data of one train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Provide features provide navigation data of one train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide train unit front end position	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Or: Provide train unit front end position in distance to reference point	Detect the reference point for a train unit and determining the Train Unit front end position as distance to the reference point.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide train unit front end position by track edge point	Provide the train unit front end position as a track edge point on the topology.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide train unit front end position by absolute position	Provide an absolute position of the Train Unit rear end in a global coordinate system.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide train unit rear end position	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Mandatory: Provide train unit rear end position in distance to reference point	Detect the reference point for a train unit and determining the train unit rear end position as distance to the reference point.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Mandatory: Provide train unit rear end position by track edge point	Provide the train unit rear end position as a track edge point on the topology.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Mandatory: Provide train unit rear end position by absolute position	Provide an absolute position of the Train Unit rear end in a global coordinate system.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide moveable object extent	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide moveable object extent as linear continuous track area	Localize a train unit as a linear contiguous track area, i.e. that the extent of the Train Unit is unambiguously mapped to the topology.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide moveable object extent as track area	Localize a train unit as a track area, i.e. that the extent of the Train Unit is not unambiguously mapped to the topology. On Train Unit might be represented occupying multiple track edge sections at on point in time.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide speed	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide speed along track axis	Provide the train speed as 1 dimensional value along the track axis.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide speed as 3D speed	provide the train speed as 3 dimensional value for each axis in space.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
--- Optional: Provide acceleration	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide acceleration along track axis	Provide the train acceleration as 1 dimensional value along the track axis.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide acceleration as 3D acceleration	Provide the train acceleration as 3 dimensional value for each axis in space.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide train integrity status and train safe length	Provide the train integrity (that means that all coupable train parts are connected as expected) and the safe train length of the whole train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide physical orientation	Provide the physical orientation of a train unit, e.g which Train Unit end is pointing in which direction of the topology.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide movement direction	Provide movement direction of a train unit, i.e. the direction towards which train unit end a train unit is moving.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide cold movement detection	Provide cold movement detection of a train unit. It can detect that the position of a train unit has changed which the localisation functionalities for that train unit were not active.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Consider features for provide navigation data of one train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider information of reference point passing	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider ID of balise group only during reference point passing	Consider only ID information of balise group during passing a reference point, e.g. a balise.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider ID and direction of balise group during reference point passing	Consider ID and passing direction of balise group information while passing a reference point.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider 3D absolute position	Consider 3 dimensional absolute position information for determining navigation data.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
--- Optional: Consider odometry information	Consider odometry information for train unit navigation data.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider track occupancy status	Consider the track occupancy status, e.g. by a train detection system (TDS) using axle counters.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider train integrity status	Consider train integrity status. Train integrity means that all coupable train units are coupled as expected.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider safe train length	Considers the safe train length information for estimating the navigation data.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider cold movement detection	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider cold movement detection by cold movement detector	Consider a cold movement detector unit for determining cold movement.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider cold movement detection always on	Consider that a cold movement detection is done by an always on localisation system.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider cab activation	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider cab activation by driver	Consider cab activation by driver for determining movement direction. Cab activation by driver is not possible for GoA4 trains.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Consider cab activation by system	Consider cab activation by system for determining physical orientation and movement direction, especially for trains without cabs like GoA4 train units.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Is Constrained By Technology Features	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Constrained for 1D localisation	Be constrained by technology for 1 dimensional position determination.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Constrained for 1D localisation by eurobalise	Be constrained by technology for 1 dimensional position determination by eurobalises.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Constrained for 3D localisation	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Optional: Constrained for 3D localisation by GNSS	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Alternative Constrained for 3D localisation by GNSS only	Be constrained by technology for 3 dimensional position determination by GNSS only, that means a train centric localisation system using satellite information.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Alternative Constrained for 3D localisation by GNSS and augmentation data	Be constrained by technology for 3 dimensional position determination by GNSS combined with augmentation data, that means a train centric localisation system using satellite information.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Alternative Constrained for 3D localisation by GNSS with augmentation only in specific area	Be constrained by technology for 3 dimensional position determination by GNSS combined with augmentation data in specific areas, that means a train centric localisation system using satellite information and augmentation data in specific areas.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Constrained for 3D localisation by radar fingerprinting	Be constrained by technology for 3 dimensional position determination by radar fingerprinting.	<input type="checkbox"/>	<input type="checkbox"/>
---- Optional: Constrained for 3D localisation by magnetic fingerprinting	Be constrained by technology for 3 dimensional position determination by magnetic fingerprinting.	<input type="checkbox"/>	<input type="checkbox"/>
---- Optional: Constrained for 3D localisation by digital map and IMU	Be constrained by technology for 3 dimensional position determination by digital map and initial measurement unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Allows operations of feature provide navigation data of one train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Allows operations of locatable rolling stock	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Allows operations of only full qualified train units for localisation	Allow operation of only full qualified train units for localisation.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Optional: Allows operations of single wagons for localisation	Allow operation of single wagons for localisation.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

5.2 09 Move train unit

Feature	Description	RCA_R1_0	RCA_Full_Scope
Mandatory: 09 Move train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
- Optional: Move train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Provide features for move train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide train unit stop	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Correct Inaccurate Stop	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Or: Jog forward automatically	Automatically correct the stopping position of a train unit that has stopped short of the required stopping accuracy.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Or: Jog forward manually	Driver manually corrects the stopping position when an automatically driven train unit has stopped short of the required stopping accuracy.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Or: Jog backward manually	Driver manually corrects the stopping position when an automatically driven train unit has stopped short of the required stopping accuracy.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Or: Jog backward automatically	Automatically correct the stopping position of a train unit that has stopped short of the required stopping accuracy.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Stop train unit accurately at buffer stop or other train unit automatically	Park a train unit accurately at a configurable distance and accuracy next to a buffer stop or another train unit. Notes: The distance and accuracy are typically well below of what safe train localisation can achieve. A typical configuration will be parking at a distance of 1m +/- 0,5 m but configuration might be required	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide brake control	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Provide brake test dynamically on mission	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
----- Or: Provide brake test manually	Test manually the brakes during movement when the train approaches a critical section where a dynamic brake test is required by operational rules.Note: This is not the same as the test of the dynamic brake.In the absence of this feature the system cannot drive a train unit automatically over sections of the network where operational rules require a dynamic test of the brakes for the given train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Or: Provide brake test automatically	Test automatically the brakes during movement when the train approaches a critical section where a dynamic brake test is required by operational rules.Note: This is not the same as the test of the dynamic brake.In the absence of this feature the system cannot drive a train unit automatically over sections of the network where operational rules require a dynamic test of the brakes for the given train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Assure brake capability under winter conditions automatically	Apply automatically measures to assure that the train unit maintains its nominal braking capability under winter conditions. The measures might be specific to the train unit but typically involve to shortly brake the train in regular intervals to de-ice or warm the brakes.In the absence of this feature certain train units must not be driven automatically under winter conditions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
<p>---- Optional: Control brakes on loco-hauled trains automatically</p>	<p>Control brake blending and main brake pipe pressure and eventually other aspects of brake control on loco-hauled trains. In the absence of this feature the system can only drive trains automatically where the brake effort can be controlled by the system by a simple required brake effort value. Note: loco-hauled trains is a slightly inaccurate abbreviation for something more complex. It means trains on which the TCMS of the train unit is not able to receive a simple brake effort requirement value and shield the brake blending and main brake pipe pressure control from the system but on which brake blending and/or main brake pipe pressure control must be controlled by the automation system. Because the trains in question have a very big overlap with the set of loco-hauled trains this term is often used as colloquial abbreviation.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p>---- Optional: Deactivate/activate a brake type automatically when driving through a brake type inhibition area</p>	<p>Command the deactivation and re-activation of specific brake types automatically when the train drives through a brake type inhibition area. In the absence of this feature the deactivation and re-activation of specific brake types must be performed by the driver or - for a driverless train - the train must not drive through an brake type inhibition area.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p>---- Optional: Apply holding brake automatically</p>	<p>Command the holding brake automatically, when the train unit comes to a stop, if appropriate. In the absence of this feature the train unit can only be driven automatically when the train unit itself applies the holding brake when appropriate w/o intervention of the system.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p>--- Optional: Provide traction control</p>	<p>None</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Optional: Restrict traction power on pushed train units automatically	Restrict the traction power on a critical section for train units that have a working traction vehicle at the rear end in order to lower the risk of derailment in the critical section. In the absence of this feature the system is not able to drive a train unit with a working traction vehicle at the rear end automatically through a critical section. Note: The most common type of train for which this feature is relevant are push-pull-trains.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Manage longitudinal forces automatically	Take the longitudinal forces within a train unit into account in the control of traction and brake force when driving a train unit in order to keep the risk of derailment low. This feature applies for instance for trains with an uneven distribution of weight, e.g. mixed freight trains. In the absence of this feature automatic driving is not possible for certain train units (tbd: must be defined better).	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Deactivate/activate the traction system automatically when driving through neutral/powerless section	Command the deactivation of the active traction system and the activation of the right traction system automatically when the train drives through a neutral or powerless section. In the absence of this feature the deactivation and activation of the traction system must be performed by the driver or - for a driverless train - the train must not drive through neutral/powerless sections.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Avoid stop in area where train has insufficient traction force to depart automatically	Assure that a train comes to a stop only at locations where it has sufficient traction force to re-depart. Note: This feature is mostly relevant for heavy trains on uphill sections.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide train status	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Report train status	Export a number of train status values or to use these values for the optimisation of the missions.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Or: Forecast train times	Improve the re-planning of train times and train order using a forecast of the arrival times at the next and optionally subsequent timing points along the mission based on the on-board computation of the mission-critical speed profile. Note: This feature is specifically for the on-board computation because it is assumed that this is more accurate than a trackside computation.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide pantograph control	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Avoid stop in feeder section border zone with raised pantograph automatically	Assure automatically that a train unit equipped with pantographs does not come to a stop with a pantograph is raised in a feeder section border zone where the raised pantograph can short-circuit the feeder sections and cause fire. In the absence of this feature trains must not run driverless through feeder section border zones where a stopped raised pantograph may cause fire.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide different driving modes	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide manual driving of train unit	Support that a train unit is driven manually from one stopping point to the next. In the absence of this feature train units can only be driven automatically.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide automatic driving of train unit	Drive a train unit automatically from one stopping point to the next w/o any of the on-top features listed below. Note: this feature is already realised with GoA2 but is equally valid under GoA3 and 4. In the absence of this feature trains can only be driven manually.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Manage low adhesion	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Manage low adhesion while acceleration automatically	Automatically command the application of sand to improve the adhesion while accelerating, especially when departing.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Or: Manage low adhesion while braking automatically	Automatically command the application of sand to improve adhesion while braking.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Activate / deactivate wheel flank lubrication	Automatically carry out task of the driver in the activation and deactivation of wheel flank lubrication systems.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Consider features for move train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider known extent of train unit	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider known train unit front end and train unit rear end	Move train units, where train unit front end position and train unit rear end position is known.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider known train unit front end	Move train units, where only train unit front end position is known.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider undefined train unit ends	Move train units, where neither train unit front end nor train unit rear end position is known.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider trigger for movement	None	<input type="checkbox"/>	<input type="checkbox"/>
---- Optional: Consider trigger for movement by mission	Move train units, where the movement is required by a provided mission.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
--- Optional: Consider conditions for movement	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider loading gauge	Consider the loading gauge of the train unit, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider other trains	Consider the presence of other train units, when ensuring safety for the movement of a train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider other infrastructure reservations for train units	Consider the granted infrastructure reservations for other train units, when ensuring safety for the movement of a train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider field element states	Consider the state of moveable field elements, when ensuring safety for the movement of a train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider points state	Consider the state of affected points, when ensuring safety for the movement of a train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider level crossings state	Consider the state of affected level crossings, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Optional: Consider derailleurs state	Consider the state of affected derailleurs, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider gauntlet tracks and further allocation sections	Consider gauntlet tracks and further Allocation Sections in the driving path, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider risk paths	Consider risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider limits of risk paths	None	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider limits by points	Consider points to limit risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider limits by derailleurs	Consider derailleurs to limit risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider limits by movement permission	Consider further movement permissions to limit risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider limits by train unit	Consider further train units to limit risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
----- Optional: Consider limits by operational rules	Consider operational rules to limit risk paths, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider Usage Restriction Areas	Consider Usage Restriction Areas, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider non-stopping areas	Consider non-stopping areas as a restriction, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider temporary speed restrictions	Consider temporary speed restrictions as a restriction, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider track closure	Consider track closures as a restriction, when ensuring safety for the movement of a train unit.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: Consider warning areas	Consider warning areas, when ensuring the movement of a train unit.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

5.3 01 Set point to required position

Feature	Description	RCA_R1_0	RCA_Full_Scope
Mandatory: 01 Set point to required position	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
- Optional: Set point to required position	Can set one point to a required position. Multiple points in a train path need to be set individually.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Provide features for set point to required position	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide diagnostic data	Provide diagnostic data that is related to the actual movement of the point.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide diagnostic data of object controller	Provide diagnostic information of the object controller according to Standard Diagnosis Interface Point (SDI-P [EULYNX]).	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide diagnostic data of point switch conditions	Provide diagnostic information if and why one or more point switch conditions have not been fulfilled.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide diagnostic data of technical failure	Provide diagnostic information if and which technical failure prevents successful execution of commands, e.g. interrupted network communication in the end-to-end communication.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Provide log data for set point to required position	Provide log data collected while setting the point to required position.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide logging of diagnostic data of object controller	Log diagnostic information of the object controller according to Standard Diagnosis Interface Point (SDI-P [EULYNX]).	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide logging of diagnostic data of point switch conditions	Provide logging of diagnostic information if and why one or more point switch conditions have not been fulfilled.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Provide logging of diagnostic data of technical failure	Provide logging of diagnostic information if and which technical failure prevents successful execution of commands, e.g. interrupted network communication in the end-to-end communication.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Indicate on HMI	Indicate various aspects of the point state on the HMI for the operations manager.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Indicate time out for point switching	Indicate a time-out for switching a point on the HMI to the operations manager.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
---- Or: Indicate observed point position	Indicate the current, observed position of the point on the HMI to the operations manager.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Indicate usage in authorised movement	Indicate, if a point is used in an authorised movement; that includes the risk buffer of an authorised movement.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Indicate occupation by train unit	Indicate, if the point is occupied by a train unit on the HMI to the operations manager.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Indicate usage in risk buffer	Indicate, how the point is used in a risk buffer of an authorised movement on the HMI to the operations manager.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Consider features for set point to required position	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider trigger point for switching	Handle different triggers for point switching.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Trigger point switching by mission	Trigger point switching as required in a mission.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Trigger point switching by HMI input	Trigger point switching as required by an input on some HMI.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider point switch conditions	Consider multiple conditions before executing a switch request.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check conflict with train unit	Check, if a train unit is on or near the extent of the point.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check current point position	Check, if point is already in requested position.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check non-trailable point has been trailed	Check, if non-trailable point has been trailed.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check status information is up to date	Check, if the status information about the point is available.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check usage in authorised movement	Check, if the point is used in an authorised movement; that includes the risk buffer of an authorised movement and usage as risk path limiting element.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Or: Check intentional point blocking	Check, if the point has been intentionally blocked from changing position.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--- Optional: Consider energy balance while switching of points	Take energy consumption of point machines into account, if multiple points need change position during a short period of time.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-- Optional: Is constrained by technology feature	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Feature	Description	RCA_R1_0	RCA_Full_Scope
--- Optional: Point machine interface	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: 4 Wire Point Machine Interface	None	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
---- Optional: 7 Wire Point Machine Interface	None	<input type="checkbox"/>	<input type="checkbox"/>