<table>
<tr><th colspan="3" align="center"><b>ERTMS/ETCS</b></th></tr>
</table>

| | |
|---|---|
| **Train Interface FFFIS** | |

| | |
|---|---|
| REF : SUBSET-119 | |
| ISSUE : 4.0.0 | |
| DATE : 2023-07-05 | |

| Company | Technical Approval | Management approval |
|---|---|---|
| ALSTOM | | |
| AZD | | |
| CAF | | |
| FAIVELEY TRANSPORT | | |
| HITACHI RAIL STS | | |
| KNORR-BREMSE | | |
| MERMEC | | |
| SIEMENS | | |
| THALES | | |
| TÜV | | |
| VOITH TURBO | | |
| VOSSLOH | | |

# MODIFICATION HISTORY

| Version | Date | Modification / Description | Editor |
|---|---|---|---|
| 0.1.0 | 05-09-2013 | Submission to sector for review | Armin Weiss |
| 0.1.1 | 08-10-2013 | Review according open SG comments<br><br>3.2.1.3.4 added acc. Telco<br><br>4.3.2.1 deleted acc. Telco<br><br>Table 4-1 Missing references added<br><br>5.2.6.2 Names corrected (T_...)<br><br>5.3.2.2.2 Reference added<br><br>5.3.3.7 Reference added<br><br>5.3.8.7 Reference added<br><br>5.3.13 added<br><br>5.5.2.4.1.5 extended due to specific signals for special brake status<br><br>5.5.2.4.3.2f adapted due to specific signals for special brake status | Armin Weiss |
| 0.1.2 | 11.10.2013 | changes see review sheet Subset-119v010_review sheet_ERA_091013_SG v2.doc | Armin Weiss |
| 0.1.3 | 24.10.2013 | changes see review sheet Subset-119v010_review sheet_ERA_091013_SG v2.doc | Armin Weiss |
| 0.1.4 | 29.10.2013 | changes see review sheet Subset-119v010_review sheet_ERA_091013_SG v3.doc | JP Gilbert |
| 0.1.5 | 12.11.2013 | changes see review sheet Subset-119v010_review sheet_ERA_091013_SG v3.doc<br><br>5.1.1.2.1. Explanation for invalid signal values adapted. | Armin Weiss |
| 0.1.6 | 9.12.2013 | BT Review | Armin Weiss |
| 0.1.7 | 10.01.2014 | TI acronym added | JP Gilbert |
| 0.1.8 | 17.01.2014 | Review meeting in Berlin | Armin Weiss |
| 0.1.9 | 11.02.2014 | Review of Live meeting<br><br>main brake pipe, main pipe -> brake pipe<br><br>STM order chapters referring to related trackside order chapters | Jean-Pierre Gilbert, Armin Weiss |
| 0.1.9.1 | 12.02.2014 | Changes after agreement with SG:<br><br>HMI pictograms removed from pictures | Armin Weiss |

| | | Area signals in variant 2 removed | |
| | | Variant 1 for special brake inhibition introduced | |
| 0.1.10 | 27.02.2014 | Changes acc. Review meeting in Munich | Armin Weiss |
| 0.1.11 | 04.03.2014 | Changes acc. Review confcall March, 4th | Armin Weiss |
| 0.1.12 | 25.09.2014 | Changes according review Unisig_SG_COM_SS-119v0 1 11_1 0 | J.P. Gilbert |
| 0.1.13 | 16.10.2014 | For consistency with Subset-034 and Subset-026 removed Test in progress, Emergency Brake Command Status, EB Command Feedback, and the clause 5.4.1.2.2. Replaced the contents of the following with "to be harmonized" (because the solutions are not part of MR1): Management of Track Conditions including Open MCB and Traction Current Cut-Off, and train data information. Added specifications for STM orders. Deleted TCO Solution 1. | F. Bitsch |
| 1.0.1 | 20.06.2016 | Reworked the document due to solution of the relevant B3R2 CRs CR0239, CR0539, and CR1163 and consideration of SG comments with agreed corrections. | F. Bitsch |
| 1.0.2 | 27.07.2016 | Correction that change marks are only related to the last official version 0.1.13 and not to pre-versions of 1.0.1. Change mark authors harmonised to "UNISIG". Consideration of SG comments with agreed corrections. | F. Bitsch |
| 1.0.3 | 25.10.2017 | Reworked according to the agreements achieved for CR0539 and CR1163 in 10/2016. Consideration of agreed review comments. | F. Bitsch |
| 1.0.4 | 20.01.2018 | Incorporation of the answers for review comments | F. Bitsch |
| 1.0.5 | 07.05.2018 | Incorporation of the answers for review comments and decisions from the phone conferences 06.03.2018 and 13.4.2018 | F. Bitsch |
| 1.0.6 | 26.05.2018 | Incorporation of the decisions from the phone conferences 23. And 24.05.2018 | F. Bitsch |
| 1.0.7 | 14.06.2018 | Changes according to discussed review comments received for versions 1.0.4-1.0.6 | F. Bitsch |

| 1.0.8 | 07.09.2018 | Rework of train data topic (especially chapter 5.5) based on the discussion on purpose of train data and principles of train data entry from external source | F. Bitsch |
|---|---|---|---|
| 1.0.9 | 21.10.2018 | Changes for the train data topic (especially chapter 5.5) due to the discussed review comments. Added new clause 3.3.1.1. | F. Bitsch |
| 1.0.10 | 11.01.2019 | Further changes for chapter 5.5 due to the discussed review comments. 1.1.1.3 re-stored to the formulation of version 1.0.5 due to discussions with UNISIG SC. | F. Bitsch |
| 1.0.11 | 12.04.2019 | Changes according to discussed review comments received for versions 1.0.10 | F. Bitsch |
| 1.0.12 | 04.06.2019 | Changes according to decisions of the telco 24.05.2019 for Special Brake Status, Brake Position, §3.3.1.1, and §5.3.11.1.2.1 | F. Bitsch |
| 1.0.13 | 06.06.2019 | Changes according to decisions of the telco 06.06.2019 in 4.3.1.7, 4.3.7, 5.3.1.12, and 5.3.7 | F. Bitsch |
| 1.0.14 | 07.06.2019 | Editorial changes. Changes in the name of OBU_TR_SP_Height(K)_BitX for indication of bit0 – bit 4 | F. Bitsch |
| 1.0.15 | 25.06.2019 | Editorial changes. | F. Bitsch |
| 1.1.0 | 29.09.2020 | Baseline 3 2nd release version | F. Bitsch |
| 1.1.1 | 19.07.2020 | Deletion of parts to be moved to SS-143 and additions for consistency with SS-143 | F. Bitsch |
| 1.1.2 | 21.09.2020 | Changes according to the review meeting 09.09.2020 | F. Bitsch |
| 1.1.3 | 28.09.2020 | Introduction of Train Integrity according to CR940 solution | F. Bitsch |
| 1.1.4 | 31.10.2020 | Changes according to the received comments for changes related to Train Integrity | F. Bitsch |
| 1.1.5 | 02.11.2020 | Changes according to the review meeting in the UNIFE MG On-board Architecture at 02.11.2020 | F. Bitsch |
| 1.1.6 | 09.11.2020 | Changes according to new comments. | F. Bitsch |
| 1.1.7 | 16.11.2020 | Changes according to the review meeting in the UNIFE MG On-board Architecture at 16.11.2020 | F. Bitsch |
| 1.1.8 | 23.11.2020 | Changes according to the review meeting in the UNIFE MG On-board Architecture at 23.11.2020 | F. Bitsch |

| 1.2.0 | 24.11.2020 | Draft version for distribution in the ERA TWG ARCHI | F. Bitsch |
|-------|------------|-----------------------------------------------------|-----------|
| 1.2.1 | 14.12.2020 | Introduction of the AD output signal compliant with CR1238 solution | F. Bitsch |
| 1.2.2 | 05.05.2021 | Changes according to the discussed review comments in the ERA TWG ARCHI 18.02.2021 and the follow-up meeting at 05.05.2021 | F. Bitsch |
| 1.2.3 | 26.07.2021 | Changes according to further received comments in the UNIFE MG On-board Architecture and ERA comment no. 9 | F. Bitsch |
| 1.2.4 | 06.09.2021 | Changes according to further received comments in the UNIFE MG On-board Architecture | F. Bitsch |
| 1.2.5 | 02.11.2021 | Added Appendix A; changes based on safety analysis; consideration of CR solutions for CR1374, CR1383, CR1290, and CR1346 | F. Bitsch |
| 1.2.6 | 15.11.2021 | Changes due to review comments in the UNIFE MG On-board Architecture. | F. Bitsch |
| 1.2.7 | 11.01.2022 | Changes due to comments from OCORA. | F. Bitsch |
| 1.2.8 | 18.01.2022 | Changes due to follow-up comments from OCORA. | F. Bitsch |
| 1.2.9 | 22.01.2022 | Editorial changes for the submission to EECT | F. Bitsch |
| 1.2.10 | 25.04.2022 | Changes due to comments from OCORA and EECT and due to alignment of terms with TSI Loc&Pas | F. Bitsch |
| 1.2.11 | 27.05.2022 | Changes due to EECT 05/05/22; deletion of "Train Type" signal according to the proposed changes to Subset-034; §5.3.11.1.1 extended for STM | F. Bitsch |
| 1.2.12 | 28.06.2022 | Changes due to EECT 09/06/22; deletion of "Tilting Status" signal; references to S-120 are aligned with its update; clarification for SDTv2 parameters; Remote Shunting due to changed safety analysis | F. Bitsch |
| 1.2.13 | 09.11.2022 | Alignment with the CR solution for CR1367 | F. Bitsch |
| 1.2.14 | 07.01.2023 | Changes due to comments from EUG/OCORA and ERA and update of the CR1367 solution. | F. Bitsch |
| 3.9.2 | 15.02.2023 | Formal update for the B4R1 pre-release version | F. Bitsch |
| 4.0.0 | 05.07.2023 | Baseline 4 1st release version | F. Bitsch |

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# 1. INTRODUCTION

## 1.1 Scope and Purpose

1.1.1.1 This interface specification defines the form fit functional interface between the ERTMS/ETCS on-board equipment and the vehicle. It is the physical implementation of the interface that is functionally specified in [6]. The references for each function specified in [6] are shown in Table 1-1. The safety requirements for each signal is specified in [13], chapter 2 shall be considered along with this subset.

| Section of Subset-119 | Name | Section of Subset-034 |
|---|---|---|
| 5.1.1 | Sleeping | 2.2.1 |
| 5.1.2 | Passive Shunting | 2.2.2 |
| 5.1.3 | Non Leading | 2.2.3 |
| 5.1.4 | Isolation | 2.2.4 |
| 5.1.5 | Automatic Driving | 2.2.5 |
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| Section of Subset-119 | Name | Section of Subset-034 |
|---|---|---|
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| 5.5.2 | Type of Train Data Entry | 2.6.1 |
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| 5.5.4.9 | Train Fitted with Airtight System | 2.6.3 |
| 5.6.1 | Train Running Number | 2.7.1 |
| 7 | National System Isolation | 2.8 |

**Table 1-1 Cross references between Subset-034 and Subset-119**

1.1.1.2    This interface specification aims at minimising the number of interfaces/components needed for the integration of ERTMS/ETCS on-board equipment into a vehicle.

1.1.1.3    In order to cover different applications, any Rolling Stock having an ERTMS/ETCS on-board from basic diesel locomotives to high tech train sets, and from 'newly developed vehicle designs' to 'all other vehicle types and rolling stock in operation', several solutions are specified and all shall be supported by the ERTMS/ETCS on-board.

## 1.2 Document Structure

1.2.1.1 Chapter 1 describes the scope and purpose of the document, the terms and abbreviations and the references

1.2.1.2 Chapter 2 describes the architecture of the interface and the naming conventions.

1.2.1.3 Chapter 3 describes the general requirements for the hard-wired interface.

1.2.1.4 Chapter 4 describes the general requirements for the serial interface as well as the specific requirements for the MVB, the CAN and the ECN.

1.2.1.5 Chapter 5 describes the requirements for the signals to be exchanged via the TI.

## 1.3 References

1.3.1.1 The following references, part of TSI CCS Annex A, are used in this document:

    [1]    SUBSET-026 ERTMS/ETCS System Requirements Specification

    [2]    ETCS Driver Machine Interface-ERA_ERTMS_015560

    [3]    SUBSET-035 Specific Transmission Module (FFFIS)

    [4]    SUBSET-091 Safety Requirements for the Technical Interoperability of ETCS in Levels 1 & 2

    [5]    TSI LOC&PAS, 1302/2014/EU

    [6]    SUBSET-034 FIS for the Train Interface

    [7]    SUBSET-023 Glossary of Terms and Abbreviations

    [8]    SUBSET-059 Performance Requirements for STMs

    [9]    EN50159 Safety related communication in transmission systems

    [10]    SUBSET-040 Dimensioning and Engineering rules

    [11]    ERA_ERTMS_040001 Assignment of values to ETCS variables

    [12]    SUBSET-125 ATO over ETCS – System Requirements Specification

    [13]    SUBSET-120 FFFIS TI – Safety Analysis

    [14]    SUBSET-147 FFFIS part: CCS Consist Network Communication Layers

1.3.1.2 The following documents, not part of TSI CCS Annex A, are used in this document:

| | | Version |
|---|---|---|
| [15] | IEC61375-1 TCN – Train Communication Network – General Architecture | 2012 |

| [16] | IEC61375-2-1 TCN – Train Communication Network – WTB | 2012 |
| [17] | IEC61375-2-3 TCN – Train Communication Network – Communication Profile | 2015 |
| [18] | IEC61375-3-1 TCN – Train Communication Network – MVB | 2012 |
| [19] | IEC61375-3-3 TCN – Train Communication Network – CAN | 2012 |
| [20] | IEC61375-3-4 TCN – Train Communication Network – ECN | 2014 |
| [21] | IEC61158-Serie Profinet | 2019 |
| [22] | IEC61784-3-3 Profisafe | 2016 |
| [23] | CIP Networks Library from ODVA | 2009 |

## 1.4 Terms and Abbreviations

1.4.1.1 Only those terms are listed, which are not defined in the ETCS glossary [7]

| Option | Option refers to the case in which the hard-wired interface is used instead of the mandatory serial interface. |
|---|---|
| Hard-wired Interface | An interface where each signal is transmitted by a separate pair of wires. |
| Serial Interface | An interface where multiple signals are transmitted via a bus/network or a point-to-point connection. Three types of busses are considered in section 4. |
| Solution | Solution refers to a mandatory implementation. |
| Traction Cut Off | Inhibit positive traction effort (i.e. driving effort). |
| Brake actuator | Device that physically brakes the train. |
| Pressure switch | Device that measures pressure in a brake pipe, main pipe or brake cylinder. It is actuated by a change in pressure at a level threshold. |
| Train integrator | The one responsible for integration of ERTMS/ETCS on-board in the vehicle |
| Cycle time on the serial bus | Time between two successive frames or ports which are cyclically transmitted on the serial bus, see [20]. |

**Table 1-2 Terms**

## 1.4.1.2 Only those abbreviations are listed, which are not defined in [7].

| | |
|---|---|
| ATO-OB | ATO On-Board Unit |
| BW | Backward |
| CAN | Controller Area Network |
| CCS | Control-Command and Signalling |
| CR | Change Request |
| cstUUID | unique consist identifier |
| ECN | Ethernet Consist Network |
| EC | Eddy Current Brake |
| ECS | Eddy Current Brake for Service Brake |
| ECE | Eddy Current Brake for Emergency Brake |
| EP | Electro Pneumatic Brake |
| FDT | Fault Detection Time as used in [13] |
| FW | Forward |
| MG | Magnetic Shoe Brake |
| MPU | Main Processor Unit |
| MVB | Multifunction Vehicle Bus |
| MSFE | Maximum Safe Front End |
| mSRE | Minimum Safe Rear End |
| NID | National Identification |
| OBU | ERTMS/ETCS On-Board Unit |
| PG | Pantograph |
| RIO | Remote Input Output |
| RB | Regenerative Brake |
| RST | Rolling Stock |
| SDT | Safe Data Transmission like defined in [17], Appendix B |
| SID | Safety Identifier |
| SSC | Safe Sequence Counter |
| TCMS | Train Control and Monitoring System |

| | |
|---|---|
| TFR | Tolerable Failure Rate |
| THR | Tolerable Hazard Rate |
| TI | Train Interface |
| TR | Train |

**Table 1-3 Abbreviations**

# 2. TRAIN INTERFACE

## 2.1 Architecture

2.1.1.1 The Train Interface specified in this document consists of serial interface and hard-wired interface.

2.1.1.2 Some signals are only supported over serial interface due to the type of data.

2.1.1.3 ERTMS/ETCS on-board equipment shall support the serial interface as defined in this specification and the following four signals on the hard-wired interface: O_EB1_C, O_EB2_C, O_TC1_C, O_IS_S.

2.1.1.4 ERTMS/ETCS on-board equipment might also support the signals defined in this specification via the hard-wired interface. In this case, these signals shall be compliant with this specification.

2.1.1.5 Serial data defined in this document shall not be distributed over more than one type of BUS in one specific application.

2.1.1.6 Figure 2-1 shows the OBU (green colour) interfaced to the vehicle (blue colour) via hard-wired and serial Interface. The interface itself is drawn in red colour.
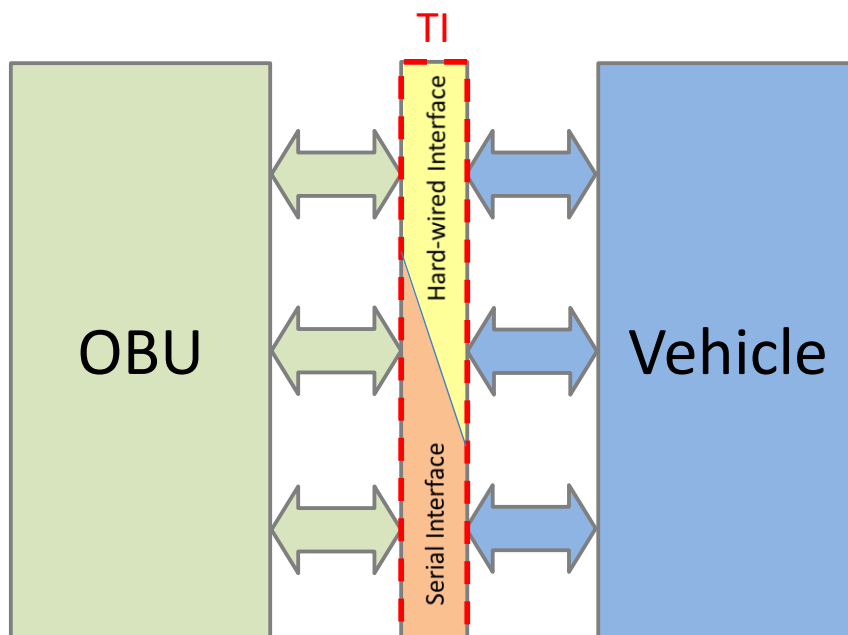


**Figure 2-1 Hard-wired and serial links between vehicle and ERTMS/ETCS on-board equipment**

2.1.1.7    Hard-wired interfaces are defined according to the standardized Reference Input and Output Architecture (RIO) circuits defined in Chapter 3.2.

2.1.1.8    The ERTMS/ETCS on-board equipment shall support as serial interface one or several of the following types of bus: CAN, MVB and ECN as defined in chapter 4.

2.1.1.9    Table 2-1 gives an overview of the functional I/O with the requirements for which ways of transmission shall be provided mandatorily or optionally. Which information shall be transmitted via the serial or hard-wired interface is marked with "M" for mandatory and which can be transmitted via the hard-wired interface is marked with 'O' for optional. On the other hand '-' refers to a case where it is not supported by the interface. Technical requirements for the implementation are described in Chapters 4 and 5.

2.1.1.10   Subset-034 [6] contains the mandatory and optional requirements for the application of the I/O functions by the rolling stock subsystem. All I/O functions shall be implemented in the ERTMS/ETCS on-board with the exception of the acquisition of train data information from the train interface which is an optional feature for the ERTMS/ETCS on-board equipment according to [6], 2.6.2.2.

2.1.1.10.1 The simultaneous use of both hard-wired and serial interface for the same functionality is only allowed if required to achieve a safety level as defined in [13], chapter 2 (e.g. EB command, solution 3). Otherwise, either serial or hard-wired interface shall be used for the same function.

2.1.1.10.2 If for a given functionality, optionally the hard-wired interface is used, the corresponding signal on the serial interface shall be provided but shall not be evaluated at the receiving end (either train or ERTMS/ETCS on-board unit according to the source of information).

2.1.1.10.3 Exception 1: EB command as described in solution 3 shall use both hard-wired and serial interface.

2.1.1.10.4 Exception 2: TCO command shall use both hard-wired and serial interface.

| No | Functional I/O as per [6] | Source | Hard-wired interface | Serial interface |
|---|---|---|---|---|
| 1 | Sleeping | TR | O | M |
| 2 | Passive Shunting | TR | O | M |
| 3 | Non-Leading | TR | O | M |
| 4 | Isolation (of ETCS) | OBU | M | - |
| 5 | Automatic Driving | OBU | O | M |
| 6 | Remote Shunting | OBU | O | M |
| 7 | Service Brake Command | OBU | O | M |
| 8 | Brake Pressure | TR | - | M |
| 9 | Emergency Brake Command | OBU | M | M |
| 10 | Regenerative Brake Inhibit | OBU | - | M[1] |
| 11 | Magnetic Shoe Brake Inhibit | OBU | - | M[1] |
| 12 | Eddy Current Brakes for Service Brake Inhibit | OBU | - | M[1] |
| 13 | Eddy Current Brakes for Emergency Brake Inhibit | OBU | - | M[1] |
| 14 | Special Brake Inhibit – STM Orders | OBU | O | M |
| 15 | Special Brake Status | TR | O | M |
| 16 | Additional Brake Status | TR | O | M |
| 17 | Change of Traction System | OBU | - | M[1] |
| 18 | Powerless Section with Pantograph to be Lowered – Trackside Orders | OBU | - | M[1] |
| 19 | Pantograph – STM Orders | OBU | O | M |
| 20 | Air Tightness – Trackside Orders | OBU | - | M[1] |
| 21 | Air Tightness – STM Orders | OBU | O | M |
| 22 | Station Platform | OBU | - | M[1] |
| 23 | Powerless Section with Main Power Switch to be Switched Off – Trackside Orders | OBU | - | M[1] |
| 24 | Main Power Switch – STM Orders | OBU | O | M |
| 25 | Change of Allowed Current Consumption | OBU | - | M[1] |
| 26 | Engine Orientation in Supervised Manoeuvre | OBU | O | M |
| 27 | Traction Cut-Off | OBU | M | M |
| 28 | Cab Status | TR | O | M |
| 29 | Direction Controller | TR | O | M |
| 30 | Train Integrity | TR | O | M |

| 31 | Traction Status (only for STM) | TR | O | M |
|----|-------------------------------|----|----|----|
| 32 | Set Speed (for DMI indication) | TR | - | M |
| 33 | Type of Train Data Entry | TR | O | M |
| 34 | Overall Consist Length Information | TR | - | M |
| 35 | Train Data Information | TR | O[2] | O |
| 36 | Train Running Number | TR | - | M |
| 37 | National System Isolation | TR | O | M |

**Table 2-1 Reference to all functional I/O**

## 2.2 Naming Conventions

### 2.2.1 Signals on the Hard-wired Interface

2.2.1.1 The naming conventions are used to ensure identification of each single signal inside of this specification and the safety requirements in the associated [13], chapter 2.

2.2.1.2 The name of each signal has the following character structure, where each digit indicates the position of a character: 1_23(4)_5_(6)

2.2.1.3 Character 1: Signal source

T = Train

O = ERTMS/ETCS on-board equipment

2.2.1.4 Character 2+3(+4): Function or signal short name

| AD | Automatic Driving |
|-----|-------------------|
| AT | Air Tightness |
| BW | Backward |
| BP | Brake Position |
| CS | Cab Status |
| CT | Change of Traction System |
| EB1 | Emergency Brake 1 |

---

[1] For vehicles in which the communication of ERTMS Track Conditions via serial interface is not supported a project specific adaptation is necessary which allows to command the ETCS Track Condition orders via hard-wired interface, see §5.3.1.15.

[2] Only optional for train fitted with airtight system and brake position. Other signals are available only via serial interface.

| EB2 | Emergency Brake 2 |
|---|---|
| ECS | Eddy Current Brake for Service Brake |
| ECE | Eddy Current Brake for Emergency Brake |
| FAT | Fitted with Airtight System |
| FW | Forward |
| IS | Isolation (of ETCS) |
| MG | Magnetic Shoe Brake |
| NL | Non Leading |
| PG | Pantograph |
| PS | Passive Shunting |
| RB | Regenerative Brake |
| RS | Remote Shunting |
| SB | Service Brake |
| SL | Sleeping |
| TC1 | Traction Cut-off |
| TR | Traction Status (only for STM) |
| TRI | Train Integrity |
| TT1, TT2 | Type of Train Data Entry |

2.2.1.5    Character 5: Signal class

| A | Status Cab A |
|---|---|
| B | Status Cab B |
| C | Command |
| E | Enable |
| F | Feedback of a command |
| I | Inhibition |
| S | Status |

2.2.1.6    Character 6 (optional): Contact index or number of relay (1 to m) or type of logic for the signal (non-inverted or inverted):

| 1 .. m | Contact index related to the same signal. |
|---|---|
| N | The non-inverted signal of an antivalent pair. |
| I | The inverted signal of an antivalent pair. |

2.2.1.7    Examples:

O_EB1_C_1 means "Emergency brake 1 command signal contact number 1".

O_EB1_C_3 means "Emergency brake 1 command signal contact number 3".

T_SL_E_N means "Sleeping enable not inverted signal".

## 2.2.2    Signals on the Serial Interface

2.2.2.1    The naming conventions are used to ensure identification of the signals on the serial interface inside of this specification and the safety requirements in the associated [13], chapter 2.

2.2.2.2    The name of each signal has the following structure, where each digit indicates the position: 1_2_3(_4_5)

2.2.2.3    1: Signal source

TR = Train side

OBU = ERTMS/ETCS on-board equipment

2.2.2.4    2: Signal sink

TR = Train

OBU = ERTMS/ETCS on-board equipment

2.2.2.5    3: signal name in a readable form, giving information about the corresponding function

| AirTightFitted | Train Fitted with Airtight System |
|---|---|
| ACC | Allowed Current Consumption |
| AD | Automatic Driving |
| AT | Air Tightness |
| AxleLoadCat | Axle Load Category |
| BrakePercentage | Brake percentage |
| BrakePosition | Brake Position |
| BrakePressure | Brake Pressure |
| Brake_Status | Brake Status |
| CabStatus | Cab Status |
| CTS | Change of Traction System |
| DirectionFW | Direction Controller Forward |
| DirectionBW | Direction Controller Backward |
| EB3 | Emergency Brake 3 |

| | |
|---|---|
| ECE / ECEInhibit | Eddy Current Brake for Emergency Brake inhibition |
| ECS / ECSInhibit | Eddy Current Brake for Service Brake Inhibition |
| L_CONSISTFRONTCABAMAX | Max Consist Length on the side of the engine corresponding to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| L_CONSISTFRONTCABAMIN | Min Consist Length on the side of the engine corresponding to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| L_CONSISTFRONTCABANOM | Nominal Consist Length on the side of the engine corresponding to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| L_CONSISTREARCABAMAX | Max Consist Length on the side of the engine opposite to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| L_CONSISTREARCABAMIN | Min Consist Length on the side of the engine opposite to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| L_CONSISTREARCABANOM | Nominal Consist Length on the side of the engine opposite to Cab A and counted from the end of the engine corresponding to the orientation of this cab A |
| LoadingGauge | Loading Gauge |
| MGI / MGInhibit | Magnetic Shoe Brake Inhibition |
| MPS | Main Power Switch |
| NLEnabled | Non Leading |
| NTCIsolated | National System Isolation |
| PassiveShunting | Passive Shunting |
| PG | Pantograph |
| RBI / RBInhibit | Regenerative Brake Inhibition |
| RS | Remote Shunting |
| ServiceBrake | Service Brake |
| SetSpeed | Set Speed (for DMI indication) |
| SP | Station Platform |
| SupTractionSys | Supported Traction Systems |
| TCO | Traction Cut-Off |
| Traction_Status | Traction Status (only for STM) |

| TrainCatCantDef | Train Category Cant Deficiency |
|---|---|
| TypeTrainConfiguration | Type of Train Configuration |
| TrainIntegrity | Train Integrity |
| TrainLength | Train Length |
| TrainSleep | Sleeping |
| TypeTrainData | Type of Train Data Entry |

2.2.2.6    4_5: if necessary, more detailed information about the signal/function (Status, Feedback, information about possible iterations, additional names, explanation if signal is inverted)

# 3. GENERAL REQUIREMENTS FOR THE HARD-WIRED INTERFACE

## 3.1 General Requirements

3.1.1.1 For the ERTMS/ETCS on-board the hard-wired interface for the signals specified in clause 2.1.1.3 is mandatory. It shall comply with the requirements in this section 3.

3.1.1.2 The cabling between the vehicle and the ERTMS/ETCS on-board is within the responsibility of the vehicle.

## 3.2 Reference Input and Output Architecture (RIO)

3.2.1.1 Output refers to the information from the OBU to the vehicle.

3.2.1.2 Input refers to the information from the vehicle to the OBU.

3.2.1.3 For binary inputs and outputs the following architecture is defined:
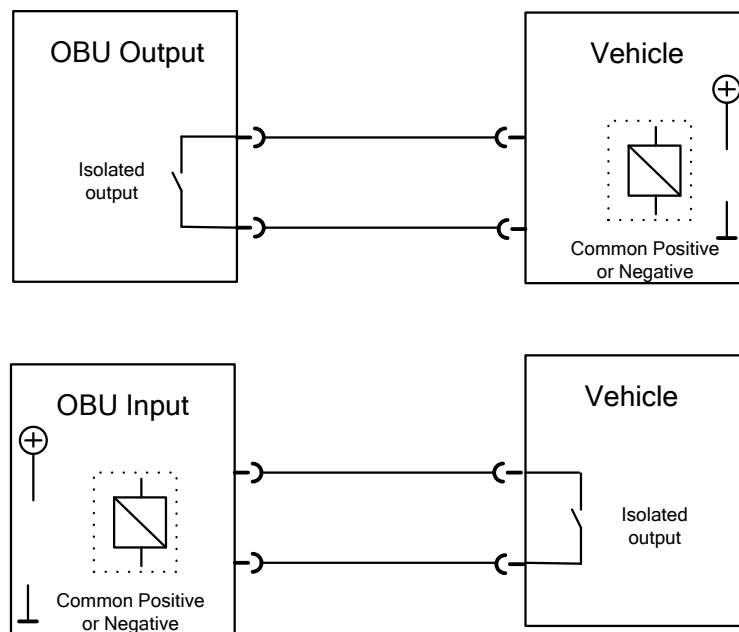


**Figure 3-1 Reference I/O pair**

3.2.1.3.1 Note1: Figure represents the functionality of an isolated output, but it is not restricted to a specific design.

3.2.1.3.2 Characteristics for input signals are specified by the ERTMS/ETCS on-board power supply, whereas the characteristics for the output signals are specified by the vehicle power supply.

3.2.1.3.3 Characteristics for input and output signals are listed in the Table 3-2 and Table 3-3.

3.2.1.4 Definition of signal states:

| Signal | Output | Level |
|--------|--------|-------|
| 0 | Open (high impedance) | Low |
| 1 | Closed (low impedance) | High |

**Table 3-1 Definition of signal states**

## 3.3 Boolean OBU Inputs

3.3.1.1 For input signals, the input information shall be considered as stable whenever the values of the signal remains unchanged for a period greater than the time t_transient_period_inputs which is configurable. During the transient time, the state of the input information has to be considered as unchanged.

3.3.1.2    Inputs shall have the following characteristics:

| Characteristic | Value |
|---|---|
| Max. voltage between pins | • 24 V + overvoltage according EN 50155<br>• 48 V + overvoltage according EN 50155<br>• 72 V + overvoltage according EN 50155<br>• 96 V + overvoltage according EN 50155<br>• 110 V + overvoltage according EN 50155 |
| Max. input current in High level[1] | • 200 mA for 24 V nominal voltage<br>• 100 mA for 48 V nominal voltage<br>• 60 mA for 72 V nominal voltage<br>• 50 mA for 96 V and 110 V nominal voltage |
| Max. L/R[2] | • 40ms |
| Min. input current in High level[1] | • 4 mA for 24 V nominal voltage<br>• 4 mA for 48V nominal voltage<br>• 3 mA for 72V nominal voltage<br>• 2 mA for 96V nominal voltage<br>• 2 mA for 110V nominal voltage<br>• Otherwise: 1 mA and transient peak |
| Max. input current that has to be detected as Low level[3][1] | • 250μA |

**Table 3-2 Characteristics for OBU Boolean Inputs**

3.3.1.2.1    [1]: Input current is the current that flows through the input pin.

3.3.1.2.2    [2]: L/R is the fraction of inductance over the resistance of the load.

3.3.1.2.3    [3]: Higher currents could also be detected as Low level, but should be avoided by the vehicle output.

## 3.4    Boolean OBU Outputs

3.4.1.1    In case of two (or more) independent output signals composing a single output, the output information shall be considered as stable whenever the values of the two (or more) signals remain unchanged for a period greater than the time t_transient_period_outputs which is configurable.

### 3.4.1.2 Outputs shall comply with the following characteristics:

| Characteristic | Value |
|---|---|
| Max. voltage between output pins in "Open" state | • 24 V + over-voltage according EN 50155<br>• 48 V + over-voltage according EN 50155<br>• 72 V + over-voltage according EN 50155<br>• 96 V + over-voltage according EN 50155<br>• 110 V + over-voltage according EN 50155 |
| Max. continuous current through output in "Closed" state | • 1 A for 24 V nominal voltage<br>• 0.5 A for 48 V nominal voltage<br>• 0.3 A for 72 V nominal voltage<br>• 0.2 A for 96 V and 110 V nominal voltage |
| Lowest possible output current in Closed status | High Power Outputs<br>• 15 mA for 24 V nominal voltage<br>• 15 mA for 48 V nominal voltage<br>• 13 mA for 72 V nominal voltage<br>• 10 mA for 96 V nominal voltage<br>• 10 mA for 110 V nominal voltage<br>Low Power Outputs<br>• 4 mA for 24 V nominal voltage<br>• 4 mA for 48 V nominal voltage<br>• 3 mA for 72 V nominal voltage<br>• 2 mA for 96 V nominal voltage<br>• 2 mA for 110 V nominal voltage |
| Max. leakage current in Open status at any voltage | 250µA |
| Max. L/R[1] | 40 ms |
| Max. allowed time for a signal with two independent outputs to be invalid in transition phase | 100 ms (this time covers switching time between independent outputs and contact bouncing time) |
| Output durability (in operating cycles) | ≥ 100.000 electrically at 20 VA load and 40 ms L/R |

**Table 3-3 Characteristics for OBU Boolean outputs**

3.4.1.2.1    *1 L/R is the fraction of inductance over the resistance of the load.

# 4. GENERAL REQUIREMENTS FOR THE SERIAL INTERFACE

## 4.1 General Requirements

4.1.1.1 For the ERTMS/ETCS on-board the serial interface is mandatory. It shall comply with the requirements in this section and specified in [14].

4.1.1.2 This chapter includes the solutions regarding the ECN, MVB and CAN based on [17], [18], [19], [20], [21], [22], and [23].

4.1.1.2.1 Note: The application communication protocols, e.g. PROFINET, CIP, and TRDP are supplementary protocols for the application of ECN.

4.1.1.3 All data is transmitted cyclically as process data (see [15] for process data definition).

4.1.1.4 Transmission cycle time for the process data on the serial bus shall be the one defined in Table 4-1.

## 4.2 Serial Architectures

### 4.2.1 General

4.2.1.1 There are two possible architectures for the transmission of information via a serial bus – architecture a) and b). Both architectures are fit for the transmission of safety related and non-safety related information as defined [13], chapter 2. It is up to the train integrator to choose the adequate architecture.

### 4.2.2 Architecture a)

4.2.2.1 Note: This architecture allows the use of hardware which is not able to implement requirements defined in [9] necessary for safety related communication.

4.2.2.2 Note: The interface on the serial bus regarding port and packet structure depends on the used I/O module hardware. As the frames on the serial bus of an I/O module hardware depends of its design and is not standardised the interface cannot be standardised. In case of architecture a) the realisation could deviate from the packets defined in chapter 4.3.

**4.2.2.3** The following figure describes architecture a).
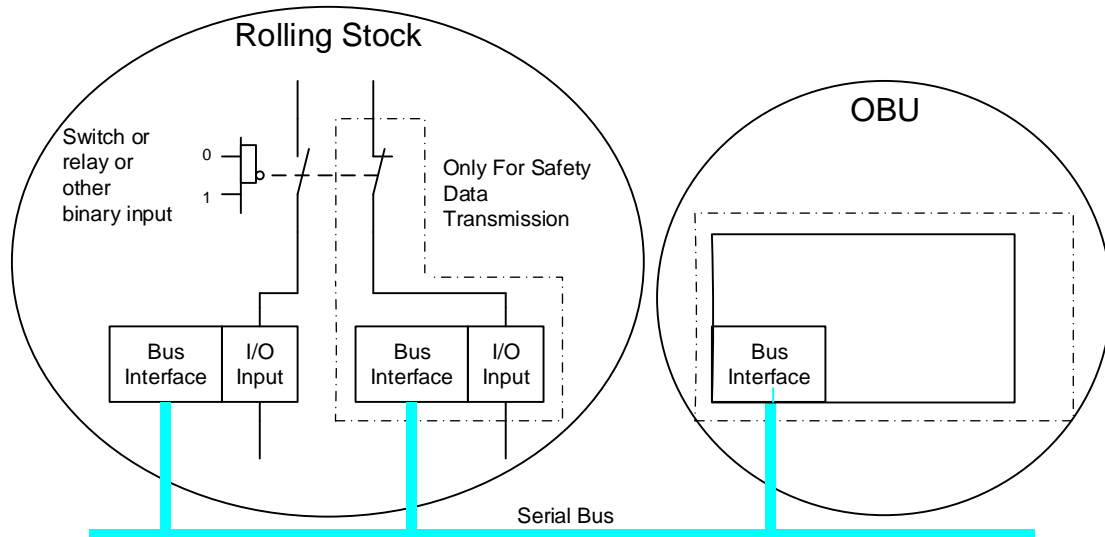


**Figure 4-1 Architecture a)**

**4.2.2.4** The architecture can define information signals using either single contact or antivalent contacts.

**4.2.2.5** When using Architecture a), the following principles shall be used for safety related information:

**4.2.2.5.1** Information shall be derived using antivalent contacts.

**4.2.2.5.2** In case of antivalent/redundant input/output information is required separate I/O hardware shall be used.

### 4.2.3 Architecture b)

4.2.3.1 Note: This architecture allows the use of hardware which is able to implement requirements defined in [9] necessary for safety related communication.

4.2.3.2 The architecture allows the transmission of both non-safety related and safety related information.

4.2.3.3 Using safety devices the TFR achievable depends on the Rolling Stock (e.g. TCMS) design (Hardware and software).
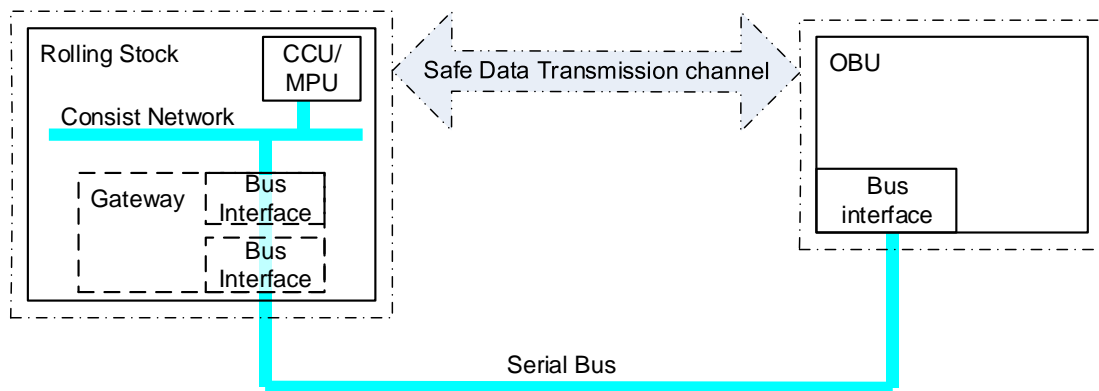


**Figure 4-2 Architecture b)**

| 4.2.3.4 | When using Architecture b) safe data transmission shall be applied according to [17], Appendix B when the required safety integrity level of certain functionality cannot be fulfilled with safety integrity level provided by the serial bus transmission. |
|---|---|
| 4.2.3.5 | Exception: In case the safety protocol ProfiSafe according to IEC 61784-3-3 [22] is applied, the SDT trailer is replaced by the ProfiSafe trailer. |
| 4.2.3.6 | Optionally the Rolling Stock (e.g. TCMS) can integrate a gateway to adapt to the bus type defined by the ERTMS/ETCS on-board. The additional transfer delay introduced due the implementation of the gateway shall be below 200ms (worst case). |

## 4.3 Coding

### 4.3.1 General

| 4.3.1.1 | This chapter presents the definition of the data to be transmitted via Bus. |
|---|---|
| 4.3.1.2 | The structure of the packets defined below is identical for both safety and non-safety related information. |
| 4.3.1.3 | The packets on the serial bus shall provide for each signal a specific validity bit to be set at source side. |
| 4.3.1.3.1 | A signal has its validity bit set to false if it is not used on the source side i.e. the signal is spare (the part of a packet is not used) or the signal is not trustable due to a problem on the source side. |
| 4.3.1.3.2 | Note: The validity bit is set to TRUE independently on whether the signal is used by the receiver or not. |
| 4.3.1.4 | Signals not provided from the defined source shall be marked as not used by setting the related validity bit to FALSE at source side. |
| 4.3.1.4.1 | In case EB command is performed as described in Solution 1 (see §5.2.3.2.7) or Solution 2 (see §5.2.3.2.8), the signal OBU_TR_EB3_Cmd shall not be used. |
| 4.3.1.5 | The Serial Interface Table 4-1, provided in section 4.3.2, describes for each function the maximum cycle time, signal size in bit, data type for transmission, name on hard-wired interface, name on serial interface and a comment. |
| 4.3.1.6 | The tables in chapter 4.3.3 to 4.3.13 describing the coding of the different packets sent from OBU and TR are derived from Table 4-1. The packets for MVB, CAN and ECN differ |

only in the additional trailer necessary for safe data transmission (in case of architecture b), see 4.2.3).

4.3.1.7    The packets are defined in big endian byte order. The data ordering in packets shall be according to [16].

4.3.1.8    Spare bits and bytes in the packets shall be set to 0.

4.3.1.9    If the validity bit is set to 0 a spare value check of this data field shall not take place.

### 4.3.2 Serial Interface Signals

4.3.2.1 Note: The signal types used in the following table are defined in [16], table 19.

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Sleeping | 128 / 100 | 2 | 2*BOOLEAN1 | TR_OBU_TrainSleep, TR_OBU_TrainSleep_Not | **Enable sleeping function** <u>Coding:</u> see Table 5-1 |
| Passive Shunting | 128 / 100 | 1 | BOOLEAN1 | TR_OBU_PassiveShunting | **Passive shunting** <u>Coding:</u> see Table 5-2 |
| Service Brake | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_ServiceBrake | **Service brake command** <u>Coding:</u> see Table 5-7 |
| Emergency Brake | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_EB3_Cmd | **EB 3 command** <u>Coding:</u> see Table 5-9. Note: the EB command via the serial interface refers to Figure 5-6 |
| Traction Cut Off | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_TCO_Cmd | **Traction cut-off** <u>Coding:</u> see Table 5-35 |
| Non Leading | 128 / 100 | 1 | BOOLEAN1 | TR_OBU_NLEnabled | **Non Leading** <u>Coding:</u> see Table 5-3 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Automatic Driving | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_AD_StatusStatus | **Status for Automatic Driving** <br> <u>Coding:</u> <br> see Table 5-5 |
| Remote Shunting | 128 / 100 | 1 | 2*BOOLEAN1 | OBU_TR_RS_Status | **Status for Remote Shunting** <br> <u>Coding:</u> <br> see Table 5-6 |
| Direction Controller | 128 / 100 | 2 | 2*BOOLEAN1 | TR_OBU_DirectionFW, TR_OBU_DirectionBW | **Status of Direction controller relative to occupied cab** <br> <u>Coding:</u> <br> see Table 5-37 |
| Cab Status | 128 / 100 | 2 | 2*BOOLEAN1 | TR_OBU_CabStatusA, TR_OBU_CabStatusB | **Status of Cabs** <br> <u>Coding:</u> <br> see Table 5-36 |
| Brake Pressure | 128 / 100 | 8 | UNSIGNED8 | TR_OBU_BrakePressure | **Brake Pressure** <br> <u>Coding:</u> <br> see Table 5-8 |
| Special Brake Inhibition Area – Trackside Orders (Regenerative Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_RBI_D_Entry | **Remaining distance from the max safe front end to the start location of the regenerative brake inhibition area** <br> <u>Coding:</u> <br> see Table 5-23 |
| Special Brake Inhibition Area – Trackside Orders (Regenerative Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_RBI_D_Exit | **Remaining distance from the min safe rear end to the end location of the regenerative brake inhibition area** <br> <u>Coding:</u> <br> see Table 5-24 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Special Brake Inhibit – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_RBInhibit_Cmd | **Regenerative brake inhibit command**<br>Coding:<br>see Table 5-15 |
| Special Brake Inhibition Area – Trackside Orders (Magnetic Shoe Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_MGI_D_Entry | **Remaining distance from the max safe front end to the start location of the magnetic shoe brake inhibition area**<br>Coding:<br>see Table 5-23 |
| Special Brake Inhibition Area – Trackside Orders (Magnetic Shoe Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_MGI_D_Exit | **Remaining distance from the min safe rear end to the end location of the magnetic shoe brake inhibition area**<br>Coding:<br>see Table 5-24 |
| Special Brake Inhibit – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_MGInhibit_Cmd | **Magnetic shoe brake inhibit command**<br>Coding:<br>see Table 5-16 |
| Special Brake Inhibition Area – Trackside Orders (Eddy Current Brakes for Service Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_ECS_D_Entry | **Remaining distance from the max safe front end to the start location of the inhibition area of the eddy current brake for service brake**<br>Coding:<br>see Table 5-23 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Special Brake Inhibition Area – Trackside Orders (Eddy Current Brakes for Service Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_ECS_D_Exit | **Remaining distance from the min safe rear end to the end location of the inhibition area of the eddy current brake for service brake** <u>Coding:</u> see Table 5-24 |
| Special Brake Inhibit – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_ECSInhibit_Cmd | **Eddy current brake inhibit command for service brake** <u>Coding:</u> see Table 5-17 |
| Special Brake Inhibition Area – Trackside Orders (Eddy Current Brakes for Emergency Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_ECE_D_Entry | **Remaining distance from the max safe front end to the start location of the inhibition area of the eddy current brake for emergency brake** <u>Coding:</u> see Table 5-23 |
| Special Brake Inhibition Area – Trackside Orders (Eddy Current Brakes for Emergency Brake Inhibit) | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_ECE_D_Exit | **Remaining distance from the min safe rear end to the end location of the inhibition area of the eddy current brake for emergency brake** <u>Coding:</u> see Table 5-24 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Special Brake Inhibit – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_ECEInhibit_Cmd | **Eddy current brakes inhibit command for emergency brake**<br>Coding:<br>see Table 5-18 |
| Brake Status | 128 / 100 | 8 | BITSET8 | TR_OBU_Brake_Status | **Brake status**<br>Coding for each bit:<br>Bit0: Electro Pneumatic Brake Status (EP_S), see Table 5-19<br>Bit1: Electro Pneumatic Brake Status (EP_S_Not), see Table 5-19<br>Bit2: Eddy Current Brake Status (EC_S), see Table 5-20<br>Bit3: Eddy Current Brake Status (EC_S_Not), see Table 5-20<br>Bit4: Regenerative Brake Status (RB_S), see Table 5-21<br>Bit5: Regenerative Brake Status (RB_S_Not), see Table 5-21<br>Bit6: Magnetic Shoe Brake Status (MG_S), see Table 5-22<br>Bit7: Magnetic Shoe Brake Status (MG_S_Not), see Table 5-22 |
| Type of Train Data Entry | 256 / 200 | 2 | 2*BOOLEAN1 | TR_OBU_TypeTrainData_S1, TR_OBU_TypeTrainData_S2 | **Type of train data entry.**<br>Coding:<br>see Table 5-43 |
| Type of Train Configuration | 256 / 200 | 8 | UNSIGNED8 | TR_OBU_TypeTrainConfiguration | **Type of Train Configuration.**<br>Coding:<br>bit 0..4 see Table 5-42<br>bit 5..7 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTFRONTCABAMAX | **Max consist length on the side of the Engine corresponding to Cab A**<br>Coding:<br>bit 0..11 see Table 5-44<br>bit 12..15 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTFRONTCABAMIN | **Min consist length on the side of the Engine corresponding to Cab A**<br>Coding:<br>bit 0..11 see Table 5-44<br>bit 12..15 set to 0 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTFRONTCABANOM | **Nominal consist length on the side of the Engine corresponding to Cab A** <br> Coding: <br> bit 0..11 see Table 5-44 <br> bit 12..15 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTREARCABAMAX | **Max consist length on the side of the Engine opposite to Cab A** <br> Coding: <br> bit 0..11 see Table 5-44 <br> bit 12..15 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTREARCABAMIN | **Min consist length on the side of the Engine opposite to Cab A** <br> Coding: <br> bit 0..11 see Table 5-44 <br> bit 12..15 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_L_ CONSISTREARCABANOM | **Nominal consist length on the side of the Engine opposite to Cab A** <br> Coding: <br> bit 0..11 see Table 5-44 <br> bit 12..15 set to 0 |
| Train Data | 256 / 200 | 4 | UNSIGNED8 | TR_OBU_TrainCatCantDef | **Train data: train category cant deficiency** <br> Coding: <br> bit 0..3 see 5.5.4.2.3.1 <br> bit 4..7 set to 0 |
| Train Data | 256 / 200 | 12 | UNSIGNED16 | TR_OBU_TrainLength | **Train data: train length** <br> Coding: <br> bit 0..11 see 5.5.4.3.3.1 <br> bit 12..15 set to 0 |
| Train Data | 256 / 200 | 8 | UNSIGNED8 | TR_OBU_BrakePercentage | **Train data: brake percentage** <br> Coding: <br> bit 0..8 see 5.5.4.4.4.3 |
| Train Data | 256 / 200 | 4 | 4*BOOLEAN1 | TR_OBU_BrakePosition1, TR_OBU_BrakePosition1_Not, TR_OBU_BrakePosition2, TR_OBU_BrakePosition2_Not | **Train data: Brake Position** <br> Coding: <br> see Table 5-46 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Train Data | 256 / 200 | 8 | UNSIGNED8 | TR_OBU_LoadingGauge | **Train data: loading gauge** <br> Coding: <br> see 5.5.4.6.3.1 |
| Train Data | 256 / 200 | 7 | UNSIGNED8 | TR_OBU_AxleLoadCat | **Train data: axle load category** <br> Coding: <br> bit 0..6 see 5.5.4.7.3.1 <br> bit 7 set to 0 |
| Train Data | 256 / 200 | 10 | UNSIGNED32 | TR_OBU_SupTractionSys | **Train data: list of supported available traction systems i** <br> Coding: <br> bit 0 set o 0 <br> bit 1..31 see 5.5.4.8.3 |
| Train Data | 256 / 200 | 1 | BOOLEAN1 | TR_OBU_AirTightFitted | **Train data: train fitted with airtight system** <br> Coding: <br> see Table 5-48 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| National System Isolation | 128 / 100 | 16 | UNSIGNED16 | TR_OBU_NTCIsolated | **National System Isolation**<br>Coding:<br><br>Coding for each bit (see Table 5-50):<br>Bit0: NTC system 1 (T_IS_S_N1 / ISS1)<br>Bit1: NTC system 2 (T_IS_S_N2 / ISS2)<br>Bit2: NTC system 3 (T_IS_S_N3 / ISS3)<br>Bit3: NTC system 4 (T_IS_S_N4 / ISS4)<br>Bit4: NTC system 5 (T_IS_S_N5 / ISS5)<br>Bit5: NTC system 6 (T_IS_S_N6 / ISS6)<br>Bit6: NTC system 7 (T_IS_S_N7 / ISS7)<br>Bit7: NTC system 8 (T_IS_S_N8 / ISS8)<br>Bit8: NTC system 9 (T_IS_S_N9 / ISS9)<br>Bit9: NTC system 10 (T_IS_S_N10 / ISS10)<br>Bit10: NTC system 11 (T_IS_S_N11 / ISS11)<br>Bit11: NTC system 12 (T_IS_S_N12 / ISS12)<br>Bit12: NTC system 13 (T_IS_S_N13 / ISS13)<br>Bit13: NTC system 14 (T_IS_S_N14 / ISS14)<br>Bit14: NTC system 15 (T_IS_S_N15 / ISS15)<br>Bit15: NTC system 16 (T_IS_S_N16 / ISS16) |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| National System Isolation | 128 / 100 | 16 | UNSIGNED16 | TR_OBU_NTCIsolated_Not | **National System Isolation Inverted (in case the NTCx safety level requires a second signal)**<br>Coding:<br><br>Coding for each bit (see Table 5-50):<br>Bit0: NTC system 1 (T_IS_S_I1 / ISS_Not1)<br>Bit1: NTC system 2 (T_IS_S_I2 / ISS_Not2)<br>Bit2: NTC system 3 (T_IS_S_I3 / ISS_Not3)<br>Bit3: NTC system 4 (T_IS_S_I4 / ISS_Not4)<br>Bit4: NTC system 5 (T_IS_S_I5 / ISS_Not5)<br>Bit5: NTC system 6 (T_IS_S_I6 / ISS_Not6)<br>Bit6: NTC system 7 (T_IS_S_I7 / ISS_Not7)<br>Bit7: NTC system 8 (T_IS_S_I8 / ISS_Not8)<br>Bit8: NTC system 9 (T_IS_S_I9 / ISS_Not9)<br>Bit9: NTC system 10 (T_IS_S_I10 / ISS_Not10)<br>Bit10: NTC system 11 (T_IS_S_I11 / ISS_Not11)<br>Bit11: NTC system 12 (T_IS_S_I12 / ISS_Not12)<br>Bit12: NTC system 13 (T_IS_S_I13 / ISS_Not13)<br>Bit13: NTC system 14 (T_IS_S_I14 / ISS_Not14)<br>Bit14: NTC system 15 (T_IS_S_I15 / ISS_Not15)<br>Bit15: NTC system 16 (T_IS_S_I16 / ISS_Not16) |
| Change of Traction System | 128 / 100 | 16 | INTEGER16, 2's complement | OBU_TR_CTS_D_Change | **Remaining distance from the max safe front end to the location of change of traction system**<br>Coding:<br>see Table 5-23 |
| Change of Traction System | 128 / 100 | 10 | UNSIGNED16 | OBU_TR_CTS_NewId | **Country identifier of the new traction system**<br>Coding:<br>bits 0..9: see Table 5-25<br>bits 10..15: spare bits |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Change of Traction System | 128 / 100 | 4 | UNSIGNED8 | OBU_TR_CTS_NewVoltage | **Voltage of the new traction system** <u>Coding:</u> bits 0..3: see Table 5-25 bits 4..7: spare bits |
| Powerless Section with Pantograph to be Lowered – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_PG_D_Entry | **Remaining distance from the max safe front end to the start location of the powerless section with pantograph to be lowered** <u>Coding:</u> see Table 5-23 |
| Powerless Section with Pantograph to be Lowered – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_PG_D_Exit | **Remaining distance from the min safe front end to the end location of the powerless section with pantograph to be lowered** <u>Coding:</u> see Table 5-24 |
| Pantograph – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_PG_Cmd | **Pantograph command** <u>Coding:</u> see Table 5-27 |
| Air Tightness Area – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_AT_D_Entry | **Remaining distance from the max safe front end to the start location of the air tightness area** <u>Coding:</u> see Table 5-23 |
| Air Tightness Area – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_AT_D_Exit | **Remaining distance from the min safe rear end to the end location of the air tightness area** <u>Coding:</u> see Table 5-24 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Air Tightness – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_AT_Cmd | **Command air tightness command**<br>Coding:<br>see Table 5-29 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Entry1 | **Remaining distance from the max safe front end to the start location of the platform 1**<br>Coding:<br>see Table 5-23 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Exit1 | **Remaining distance from the min safe front end to the end location of the platform 1**<br>Coding:<br>see Table 5-24 |
| Station Platform | 256 / 200 | 4 | 4*BOOLEAN1 | OBU_TR_SP_Height1_Bit0,<br>OBU_TR_SP_Height1_Bit1,<br>OBU_TR_SP_Height1_Bit2,<br>OBU_TR_SP_Height1_Bit3 | **Height of the platform 1**<br>Coding:<br>see Table 5-30 |
| Station Platform | 256 / 200 | 2 | 2*BOOLEAN1 | OBU_TR_SP_Right1,<br>OBU_TR_SP_Left1 | **Side the platform 1 is on**.<br>Coding (OBU_TR_SP_Left, OBU_TR_SP_Right):<br>see Table 5-30 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Entry2 | **Remaining distance from the max safe front end to the start location of the platform 2**<br>Coding:<br>see Table 5-23 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Exit2 | **Remaining distance from the min safe front end to the end location of the platform 2**<br>Coding:<br>see Table 5-24 |
| Station Platform | 256 / 200 | 4 | 4*BOOLEAN1 | OBU_TR_SP_Height2_Bit0,<br>OBU_TR_SP_Height2_Bit1,<br>OBU_TR_SP_Height2_Bit2,<br>OBU_TR_SP_Height2_Bit3 | **Height of the platform 2**<br>Coding:<br>see Table 5-30 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Station Platform | 256 / 200 | 2 | 2*BOOLEAN1 | OBU_TR_SP_Right2, OBU_TR_SP_Left2 | **Side the platform 2 is on**. <u>Coding (OBU_TR_SP_Left, OBU_TR_SP_Right)</u>: see Table 5-30 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Entry3 | **Remaining distance from the max safe front end to the start location of the platform 3** <u>Coding:</u> see Table 5-23 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Exit3 | **Remaining distance from the min safe front end to the end location of the platform 3** <u>Coding:</u> see Table 5-24 |
| Station Platform | 256 / 200 | 4 | 4*BOOLEAN1 | OBU_TR_SP_Height3_Bit0, OBU_TR_SP_Height3_Bit1, OBU_TR_SP_Height3_Bit2, OBU_TR_SP_Height3_Bit3 | **Height of the platform 3** <u>Coding:</u> see Table 5-30 |
| Station Platform | 256 / 200 | 2 | 2*BOOLEAN1 | OBU_TR_SP_Right3, OBU_TR_SP_Left3 | **Side the platform 3 is on**. <u>Coding (OBU_TR_SP_Left, OBU_TR_SP_Right)</u>: see Table 5-30 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Entry4 | **Remaining distance from the max safe front end to the start location of the platform 4** <u>Coding:</u> see Table 5-23 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Exit4 | **Remaining distance from the min safe front end to the end location of the platform 4** <u>Coding:</u> see Table 5-24 |
| Station Platform | 256 / 200 | 4 | 4*BOOLEAN1 | OBU_TR_SP_Height4_Bit0 , OBU_TR_SP_Height4_Bit1, OBU_TR_SP_Height4_Bit2, OBU_TR_SP_Height4_Bit3 | **Height of the platform 4** <u>Coding:</u> see Table 5-30 |

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| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Station Platform | 256 / 200 | 2 | 2*BOOLEAN1 | OBU_TR_SP_Right4, OBU_TR_SP_Left4 | **Side the platform 4 is on**. Coding (OBU_TR_SP_Left, OBU_TR_SP_Right): see Table 5-30 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Entry5 | **Remaining distance from the max safe front end to the start location of the platform 5** Coding: see Table 5-23 |
| Station Platform | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_SP_D_Exit5 | **Remaining distance from the min safe front end to the end location of the platform 5** Coding: see Table 5-24 |
| Station Platform | 256 / 200 | 4 | 4*BOOLEAN1 | OBU_TR_SP_Height5_Bit0, OBU_TR_SP_Height5_Bit1, OBU_TR_SP_Height5_Bit2, OBU_TR_SP_Height5_Bit3 | **Height of the platform 5** Coding: see Table 5-30 |
| Station Platform | 256 / 200 | 2 | 2*BOOLEAN1 | OBU_TR_SP_Right5, OBU_TR_SP_Left5 | **Side the platform 5 is on**. Coding (OBU_TR_SP_Left, OBU_TR_SP_Right): see Table 5-30 |
| Powerless Section with Main Power Switch to be Switched Off – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_MPS_D_Entry | **Remaining distance from the max safe front end to the start location of the powerless section with main power switch to be switched off** Coding: see Table 5-23 |
| Powerless Section with Main Power Switch to be Switched Off – Trackside Orders | 256 / 200 | 16 | INTEGER16, 2's complement | OBU_TR_MPS_D_Exit | **Remaining distance from the min safe front end to the end location of the powerless section with main power switch to be switched off** Coding: see Table 5-24 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Main Power Switch – STM Orders | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_MPS_Cmd | **MPS open command**<br>Coding:<br>see Table 5-32 |
| Change of Allowed Current Consumption | 128 / 100 | 16 | INTEGER16, 2's complement | OBU_TR_ACC_D_Change | **Remaining distance from the max safe front end to the location of change of allowed current consumption**<br>Coding:<br>see Table 5-23 |
| Change of Allowed Current Consumption | 128 / 100 | 10 | UNSIGNED16 | OBU_TR_ACC_Limit | **New allowed current consumption**<br>Coding:<br>Bit 0..9: see Table 5-33<br>Bit 10..15: spare |
| Engine Orientation in Supervised Manoeuvre | 128 / 100 | 1 | BOOLEAN1 | OBU_TR_EngOrientSM | **Engine Orientation in Supervised Manoeuvre**<br>Coding:<br>see Table 5-34 |
| Traction Status (only for STM) | 128 / 100 | 1 | BOOLEAN1 | TR_OBU_Traction_Status | **Traction status**<br>Coding:<br>see Table 5-39 |
| Set Speed value | 128 / 100 | 16 | UNSIGNED16 | TR_OBU_SetSpeedValue | **Set speed value**<br>Coding:<br>see Table 5-40 |
| Set Speed display | 128 / 100 | 1 | BOOLEAN1 | TR_OBU_SetSpeedDisplay | **Set speed display**<br>Coding:<br>see Table 5-41 |

| Function | maximum cycle time for MVB and CAN / ECN [ms] | signal size[Bit] | signal type for transmission | name on serial interface | Comment |
|---|---|---|---|---|---|
| Train Integrity | 256 / 200 | 4 | 4*BOOLEAN1 | TR_OBU_TrainIntegrity_S1, TR_OBU_TrainIntegrity_S1_Not, TR_OBU_TrainIntegrity_S2, TR_OBU_TrainIntegrity_S2_Not | **Train integrity** <br> Coding: <br> see Table 5-38 |
| Train Running Number | 256 / 200 | 32 | UNSIGNED32 | TR_OBU_NID_OPERATIONAL | **Train running number** <br> Coding: <br> see Table 5-49 |

**Table 4-1 Generic Serial Interface Table**

4.3.2.2    All signals are transmitted over the networks in packets according to reference [15]. The list of the various packets is given hereafter in the following paragraphs.

4.3.2.3    The safety protocol ProfiSafe according to IEC 61784-3-3 [22] requires the use of a limited range of data types and a specific order of signals in a packet depending on their data types. In order to fulfil IEC 61784-3-3 [23], the data structures (codings and packets) defined in the following chapters need to be re-arranged. The data structures applicable in this case are defined in Appendix A – Profinet Signal and Packet Definitions.

### 4.3.3 TR Packet 1

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| TR_OBU_TrainSleep | BOOLEAN1 | | 0.0 |
| TR_OBU_TrainSleep_Not | BOOLEAN1 | | 0.1 |
| TR_OBU_PassiveShunting | BOOLEAN1 | | 0.2 |
| TR_OBU_NLEnabled | BOOLEAN1 | | 0.3 |
| TR_OBU_DirectionFW | BOOLEAN1 | | 0.4 |
| TR_OBU_DirectionBW | BOOLEAN1 | | 0.5 |
| TR_OBU_CabStatusA | BOOLEAN1 | | 0.6 |
| TR_OBU_CabStatusB | BOOLEAN1 | | 0.7 |
| TR_OBU_TypeTrainData_S1 | BOOLEAN1 | | 1.0 |
| TR_OBU_TypeTrainData_S2 | BOOLEAN1 | | 1.1 |
| Spare1 | BOOLEAN1 | | 1.2 |
| Spare2 | BOOLEAN1 | | 1.3 |
| TR_OBU_Traction_Status | BOOLEAN1 | | 1.4 |
| Spare3 | BOOLEAN1 | | 1.5 |
| TR_OBU_SetSpeedDisplay | BOOLEAN1 | | 1.6 |

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Spare4 | BOOLEAN1 | | 1.7 |
| TR_OBU_BrakePressure | UNSIGNED8 | | 2.0 |
| TR_OBU_Brake_Status | BITSET8 | | 3.0 |
| TR_OBU_NTCIsolated | UNSIGNED16 | | 4.0 |
| TR_OBU_SetSpeedValue | UNSIGNED16 | | 6.0 |
| TR_OBU_NTCIsolated_Not | UNSIGNED16 | | 8.0 |
| Spare5 | UNSIGNED16 | | 10.0 |
| Spare6 | UNSIGNED16 | | 12.0 |
| Spare7 | UNSIGNED16 | | 14.0 |
| Spare8 | UNSIGNED16 | | 16.0 |
| Spare9 | UNSIGNED16 | | 18.0 |
| Spare10 | UNSIGNED16 | | 20.0 |
| Validity1 | UNSIGNED16 | Validity of value of variables contained in the first two bytes of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 1.0 is in bit 8. The validity of the signal with offset 1.7 is in bit 15. | 22.0 |
| Validity2 | UNSIGNED16 | Validity of value of variables contained in bytes 2 to 21 of the packet. The validity of the signal with offset 2.0 is in bit 0. The validity of the signal with offset 20.0 is in bit 11. | 24.0 |

## 4.3.4 TR Packet 2

| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Spare1 | BOOLEAN1 | | 0.0 |
| Spare2 | BOOLEAN1 | | 0.1 |
| TR_OBU_BrakePosition1 | BOOLEAN1 | | 0.2 |
| TR_OBU_BrakePosition1_Not | BOOLEAN1 | | 0.3 |
| TR_OBU_BrakePosition2 | BOOLEAN1 | | 0.4 |
| TR_OBU_BrakePosition2_Not | BOOLEAN1 | | 0.5 |
| TR_OBU_AirTightFitted | BOOLEAN1 | | 0.6 |
| Spare3 | BOOLEAN1 | | 0.7 |
| Spare4 | UNSIGNED8 | | 1.0 |
| TR_OBU_TypeTrainConfiguration | UNSIGNED8 | | 2.0 |
| TR_OBU_BrakePercentage | UNSIGNED8 | | 3.0 |
| Spare5 | UNSIGNED16 | | 4.0 |
| TR_OBU_TrainLength | UNSIGNED16 | | 6.0 |
| TR_OBU_LoadingGauge | UNSIGNED8 | | 8.0 |
| TR_OBU_AxleLoadCat | UNSIGNED8 | | 9.0 |
| TR_OBU_TrainCatCantDef | UNSIGNED8 | | 10.0 |

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| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| TR_OBU_TrainIntegrity_S1 | BOOLEAN1 | | 11.0 |
| TR_OBU_TrainIntegrity_S1_Not | BOOLEAN1 | | 11.1 |
| TR_OBU_TrainIntegrity_S2 | BOOLEAN1 | | 11.2 |
| TR_OBU_TrainIntegrity_S2_Not | BOOLEAN1 | | 11.3 |
| Spare6 | BOOLEAN1 | | 11.4 |
| Spare7 | BOOLEAN1 | | 11.5 |
| Spare8 | BOOLEAN1 | | 11.6 |
| Spare9 | BOOLEAN1 | | 11.7 |
| TR_OBU_SupTractionSys | UNSIGNED32 | | 12.0 |
| TR_OBU_NID_OPERATIONAL | UNSIGNED32 | | 16.0 |
| Spare10 | UNSIGNED16 | | 20.0 |
| Validity1 | UNSIGNED16 | Validity of value of variables contained in bytes 0 to 10 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 1.0 is in bit 8. The validity of the signal with offset 10.0 is in bit 15. | 22.0 |
| Validity2 | UNSIGNED16 | Validity of value of variables contained in bytes 11 to 20 of the packet. The validity of the signal with offset 11.0 is in bit 0. The validity of the signal with offset 20.0 is in bit 10. | 24.0 |

### 4.3.5 TR Packet 3

| TR Packet 3 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| TR_OBU_ L_CONSISTFRONTCABAMAX | UNSIGNED16 | | 0.0 |
| TR_OBU_ L_CONSISTFRONTCABAMIN | UNSIGNED16 | | 2.0 |
| TR_OBU_ L_CONSISTFRONTCABANOM | UNSIGNED16 | | 4.0 |
| TR_OBU_ L_CONSISTREARCABAMAX | UNSIGNED16 | | 6.0 |
| TR_OBU_ L_CONSISTREARCABAMIN | UNSIGNED16 | | 8.0 |
| TR_OBU_ L_CONSISTREARCABANOM | UNSIGNED16 | | 10.0 |
| Spare1 | UNSIGNED16 | | 12.0 |
| Spare2 | UNSIGNED16 | | 14.0 |
| Spare3 | UNSIGNED16 | | 16.0 |
| Spare4 | UNSIGNED16 | | 18.0 |
| Spare5 | UNSIGNED16 | | 20.0 |
| Spare6 | UNSIGNED16 | | 22.0 |

| TR Packet 3 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Validity | UNSIGNED16 | Validity of value of variables contained in bytes 0 to 11 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 11. | 24.0 |

### 4.3.6 Variables for Generic Packet Structures

4.3.6.1 The OBU packets 1 to 2 shall have a static packet structure, see clause 5.3.1.2. The OBU packets 3 to 7 shall have a generic packet structure, see clause 5.3.1.2.

4.3.6.2 The track conditions which shall be transmitted with generic packet structure (see clause 5.3.1.2) have the same data structure.

4.3.6.3 Coding for variables used for generic packet structures

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_TC_ID1, OBU_TR_TC_ID2, OBU_TR_TC_ID3, OBU_TR_TC_ID4, OBU_TR_TC_ID5, OBU_TR_TC_ID6, OBU_TR_TC_ID7, OBU_TR_TC_ID8, OBU_TR_TC_ID9, | 8 bits | Track condition ID. The purpose of the track condition ID is to be able to distinguish more easily the track conditions to be transmitted among themselves. 0x00 to 0xFF are set for track conditions which are transmitted. For the next track condition to be transmitted the next value |

| | | |
|---|---|---|
| OBU_TR_TC_ID10,<br>OBU_TR_TC_ID11,<br>OBU_TR_TC_ID12,<br>OBU_TR_TC_ID13,<br>OBU_TR_TC_ID14,<br>OBU_TR_TC_ID15,<br>OBU_TR_TC_ID16,<br>OBU_TR_TC_ID17,<br>OBU_TR_TC_ID18,<br>OBU_TR_TC_ID19,<br>OBU_TR_TC_ID20 | | shall be set. The Track condition ID of one track condition shall not change as long as this track condition is transmitted. Note: this means that if, while the OBU is transmitting a track condition and a track condition ID becomes free (this ID was used for the transmission of another track condition which transmission is now terminated), the OBU will continue the transmission of this track condition keeping the same ID, even if the new free ID has a lower value than the currently used one. |
| OBU_TR_TC_TYPE1,<br>OBU_TR_TC_TYPE2,<br>OBU_TR_TC_TYPE3,<br>OBU_TR_TC_TYPE4,<br>OBU_TR_TC_TYPE5,<br>OBU_TR_TC_TYPE6,<br>OBU_TR_TC_TYPE7,<br>OBU_TR_TC_TYPE8,<br>OBU_TR_TC_TYPE9,<br>OBU_TR_TC_TYPE10,<br>OBU_TR_TC_TYPE11,<br>OBU_TR_TC_TYPE12,<br>OBU_TR_TC_TYPE13,<br>OBU_TR_TC_TYPE14,<br>OBU_TR_TC_TYPE15, | 8 bits | Track Condition Type.<br>For each type of track condition there is an unambiguous value. The used value indicates which type of track condition is transmitted.<br>The values are defined in Table 4-3. |

| | | |
|---|---|---|
| OBU_TR_TC_TYPE16,<br>OBU_TR_TC_TYPE17,<br>OBU_TR_TC_TYPE18,<br>OBU_TR_TC_TYPE19,<br>OBU_TR_TC_TYPE20 | | |
| OBU_TR_D_ENTRY1,<br>OBU_TR_D_ENTRY2,<br>OBU_TR_D_ENTRY3,<br>OBU_TR_D_ENTRY4,<br>OBU_TR_D_ENTRY5,<br>OBU_TR_D_ENTRY6,<br>OBU_TR_D_ENTRY7,<br>OBU_TR_D_ENTRY8,<br>OBU_TR_D_ENTRY9,<br>OBU_TR_D_ENTRY10,<br>OBU_TR_D_ENTRY11,<br>OBU_TR_D_ENTRY12,<br>OBU_TR_D_ENTRY13,<br>OBU_TR_D_ENTRY14,<br>OBU_TR_D_ENTRY15,<br>OBU_TR_D_ENTRY16,<br>OBU_TR_D_ENTRY17,<br>OBU_TR_D_ENTRY18,<br>OBU_TR_D_ENTRY19,<br>OBU_TR_D_ENTRY20 | 16 bits | Remaining distance to the start location point D (OBU_TR_XXX_D_Entry)  for the respective Track Condition Type, see Table 5-23. |
| OBU_TR_D_EXIT1,<br>OBU_TR_D_EXIT2, | 16 bits | Remaining distance to the end location point E (OBU_TR_XXX_D_Exit)  for the |

| | | | |
|---|---|---|---|
| OBU_TR_D_EXIT3,<br>OBU_TR_D_EXIT4,<br>OBU_TR_D_EXIT5,<br>OBU_TR_D_EXIT6,<br>OBU_TR_D_EXIT7,<br>OBU_TR_D_EXIT8,<br>OBU_TR_D_EXIT9,<br>OBU_TR_D_EXIT10,<br>OBU_TR_D_EXIT11,<br>OBU_TR_D_EXIT12,<br>OBU_TR_D_EXIT13,<br>OBU_TR_D_EXIT14,<br>OBU_TR_D_EXIT15,<br>OBU_TR_D_EXIT16,<br>OBU_TR_D_EXIT17,<br>OBU_TR_D_EXIT18,<br>OBU_TR_D_EXIT19,<br>OBU_TR_D_EXIT20 | | respective Track Condition Type, see Table 5-24. | |

**Table 4-2 Coding for Variables used for Generic Packet Structures**

4.3.6.4    If with track condition variables no track condition information is transmitted the respective validity bit shall be set to "0".

4.3.6.5    Meaning of the Track Condition Type Values and the relation to Track Condition Distance Variables

| Value of OBU_TR_TC_TYPExx | Type of Track Condition / Meaning | Variable to be allocated to OBU_TR_D_ENTRYxx | Variable to be allocated to OBU_TR_D_EXITxx |
|---|---|---|---|
| | | | |

| 0x00 | Regenerative Brake Inhibition | OBU_TR_RBI_D_Entry | OBU_TR_RBI_D_Exit |
|---|---|---|---|
| 0x01 | Magnetic Shoe Brake Inhibition | OBU_TR_MGI_D_Entry | OBU_TR_MGI_D_Exit |
| 0x02 | Eddy Current Brake for SB Inhibition | OBU_TR_ECS_D_Entry | OBU_TR_ECS_D_Exit |
| 0x03 | Eddy Current Brake for EB Inhibition | OBU_TR_ECE_D_Entry | OBU_TR_ECE_D_Exit |
| 0x04 | Air Tightness Section | OBU_TR_AT_D_Entry | OBU_TR_AT_D_Exit |
| 0x05 | Powerless Section with Pantograph to be Lowered | OBU_TR_PG_D_Entry | OBU_TR_PG_D_Exit |
| 0x06 | Powerless Section with Main Power switch to be Switched Off | OBU_TR_MPS_D_Entry | OBU_TR_MPS_D_Exit |
| 0x07 to 0xFF | Spare values | - | - |

**Table 4-3 Meaning of Track Condition Type Values**

4.3.6.6     Note: There is a simple  indication of going back to initial state or keep the current setting for the track conditions  which consists in stopping to provide information for this track condition, which means sending the special value "8000h" for the remaining distance to

the start and end location or to the location of change according to §5.3.1.12. This applies for the transmission with the static packet structure and also with the generic packet structure.

### 4.3.7 OBU Packet 1

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table 4-1)** | **Byte.Bit Offset** |
| OBU_TR_ServiceBrake | BOOLEAN1 | | 0.0 |
| OBU_TR_EB3_Cmd | BOOLEAN1 | | 0.1 |
| OBU_TR_TCO_Cmd | BOOLEAN1 | | 0.2 |
| OBU_TR_RBInhibit_Cmd | BOOLEAN1 | | 0.3 |
| OBU_TR_MGInhibit_Cmd | BOOLEAN1 | | 0.4 |
| OBU_TR_ECSInhibit_Cmd | BOOLEAN1 | | 0.5 |
| OBU_TR_ECEInhibit_Cmd | BOOLEAN1 | | 0.6 |
| OBU_TR_AT_Cmd | BOOLEAN1 | | 0.7 |
| OBU_TR_MPS_Cmd | BOOLEAN1 | | 1.0 |
| OBU_TR_PG_Cmd | BOOLEAN1 | | 1.1 |
| OBU_TR_AD_Status | BOOLEAN1 | | 1.2 |
| OBU_TR_RS_Status | BOOLEAN1 | | 1.3 |
| Spare1 | BOOLEAN1 | | 1.4 |

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| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Spare2 | BOOLEAN1 | | 1.5 |
| Spare3 | BOOLEAN1 | | 1.6 |
| OBU_TR_EngOrientSM | BOOLEAN1 | | 1.7 |
| Spare4 | UNSIGNED16 | | 2.0 |
| OBU_TR_CTS_D_Change | INTEGER16 | Change of Traction System | 4.0 |
| OBU_TR_CTS_NewId | UNSIGNED16 | | 6.0 |
| OBU_TR_CTS_NewVoltage | UNSIGNED8 | | 8.0 |
| Spare5 | UNSIGNED8 | | 9.0 |
| OBU_TR_ACC_D_Change | INTEGER16 | Change of Allowed Current Consumption | 10.0 |
| OBU_TR_ACC_Limit | UNSIGNED16 | | 12.0 |
| Spare6 | UNSIGNED16 | | 14.0 |
| Spare7 | UNSIGNED16 | | 16.0 |
| Spare8 | UNSIGNED16 | | 18.0 |
| Spare9 | UNSIGNED16 | | 20.0 |
| Validity1 | UNSIGNED16 | Validity of value of variables contained in the first two bytes of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 1.0 is in bit 8. The validity of the signal with offset 1.7 is in bit 15. | 22.0 |

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Validity2 | UNSIGNED16 | Validity of value of variables contained in bytes 2 to 19 of the packet. The validity of the 1st signal with offset 2.0 is in bit 0. The validity of the signal with offset 20.0 is in bit 10. | 24.0 |

### 4.3.8 OBU Station Platform (OBU Packet 2)

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Validity1 | BOOLEAN1 | Variables for element 1 are used | 0.0 |
| Validity2 | BOOLEAN1 | Variables for element 2 are used | 0.1 |
| Validity3 | BOOLEAN1 | Variables for element 3 are used | 0.2 |
| Validity4 | BOOLEAN1 | Variables for element 4 are used | 0.3 |
| Validity5 | BOOLEAN1 | Variables for element 5 are used | 0.4 |
| Spare1 | BOOLEAN1 | - | 0.5 |
| Spare2 | BOOLEAN1 | - | 0.6 |
| Spare3 | BOOLEAN1 | - | 0.7 |
| OBU_TR_SP_Left1 | BOOLEAN1 | | 1.0 |
| OBU_TR_SP_Right1 | BOOLEAN1 | | 1.1 |
| Spare4 | BOOLEAN1 | | 1.2 |
| Spare5 | BOOLEAN1 | | 1.3 |
| OBU_TR_SP_Height1_Bit0 | BOOLEAN1 | | 1.4 |
| OBU_TR_SP_Height1_Bit1 | BOOLEAN1 | | 1.5 |
| OBU_TR_SP_Height1_Bit2 | BOOLEAN1 | | 1.6 |
| OBU_TR_SP_Height1_Bit3 | BOOLEAN1 | | 1.7 |

**OBU Station Platform**

| Data name | Type | Description (as a complement to Table 4-1) | Byte.Bit Offset |
|---|---|---|---|
| OBU_TR_SP_Left2 | BOOLEAN1 | | 2.0 |
| OBU_TR_SP_Right2 | BOOLEAN1 | | 2.1 |
| Spare6 | BOOLEAN1 | | 2.2 |
| Spare7 | BOOLEAN1 | | 2.3 |
| OBU_TR_SP_Height2_Bit0 | BOOLEAN1 | | 2.4 |
| OBU_TR_SP_Height2_Bit1 | BOOLEAN1 | | 2.5 |
| OBU_TR_SP_Height2_Bit2 | BOOLEAN1 | | 2.6 |
| OBU_TR_SP_Height2_Bit3 | BOOLEAN1 | | 2.7 |
| OBU_TR_SP_Left3 | BOOLEAN1 | | 3.0 |
| OBU_TR_SP_Right3 | BOOLEAN1 | | 3.1 |
| Spare8 | BOOLEAN1 | | 3.2 |
| Spare9 | BOOLEAN1 | | 3.3 |
| OBU_TR_SP_Height3_Bit0 | BOOLEAN1 | | 3.4 |
| OBU_TR_SP_Height3_Bit1 | BOOLEAN1 | | 3.5 |
| OBU_TR_SP_Height3_Bit2 | BOOLEAN1 | | 3.6 |
| OBU_TR_SP_Height3_Bit3 | BOOLEAN1 | | 3.7 |
| OBU_TR_SP_Left4 | BOOLEAN1 | | 4.0 |
| OBU_TR_SP_Right4 | BOOLEAN1 | | 4.1 |

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description (as a complement to Table** 4-1**)** | **Byte.Bit Offset** |
| Spare10 | BOOLEAN1 | | 4.2 |
| Spare11 | BOOLEAN1 | | 4.3 |
| OBU_TR_SP_Height4_Bit0 | BOOLEAN1 | | 4.4 |
| OBU_TR_SP_Height4_Bit1 | BOOLEAN1 | | 4.5 |
| OBU_TR_SP_Height4_Bit2 | BOOLEAN1 | | 4.6 |
| OBU_TR_SP_Height4_Bit3 | BOOLEAN1 | | 4.7 |
| OBU_TR_SP_Left5 | BOOLEAN1 | | 5.0 |
| OBU_TR_SP_Right5 | BOOLEAN1 | | 5.1 |
| Spare12 | BOOLEAN1 | | 5.2 |
| Spare13 | BOOLEAN1 | | 5.3 |
| OBU_TR_SP_Height5_Bit0 | BOOLEAN1 | | 5.4 |
| OBU_TR_SP_Height5_Bit1 | BOOLEAN1 | | 5.5 |
| OBU_TR_SP_Height5_Bit2 | BOOLEAN1 | | 5.6 |
| OBU_TR_SP_Height5_Bit3 | BOOLEAN1 | | 5.7 |
| OBU_TR_SP_D_Entry1 | INTEGER16 | | 6.0 |
| OBU_TR_SP_D_Exit1 | INTEGER 16 | | 8.0 |
| OBU_TR_SP_D_Entry2 | INTEGER16 | | 10.0 |
| OBU_TR_SP_D_Exit2 | INTEGER 16 | | 12.0 |

**OBU Station Platform**

| Data name | Type | Description (as a complement to Table 4-1) | Byte.Bit Offset |
|---|---|---|---|
| OBU_TR_SP_D_Entry3 | INTEGER16 | | 14.0 |
| OBU_TR_SP_D_Exit3 | INTEGER 16 | | 16.0 |
| OBU_TR_SP_D_Entry4 | INTEGER16 | | 18.0 |
| OBU_TR_SP_D_Exit4 | INTEGER 16 | | 20.0 |
| OBU_TR_SP_D_Entry5 | INTEGER16 | | 22.0 |
| OBU_TR_SP_D_Exit5 | INTEGER 16 | | 24.0 |

### 4.3.9 OBU Packet 3

**OBU Packet 3**

| Data name (structure and fixed generic content) | Type | Default values | Values per type of track condition | Byte.Bit Offset |
|---|---|---|---|---|
| **OBU_TR_TC_ID1** | UNSIGNED8 | - | 0x00 to 0xff | 0.0 |
| OBU_TR_TC_TYPE1 | UNSIGNED8 | - | 0x00 to 0x06 | 1.0 |
| OBU_TR_D_ENTRY1 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 2.0 |
| OBU_TR_D_EXIT1 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 4.0 |
| **OBU_TR_TC_ID2** | UNSIGNED8 | - | 0x00 to 0xff | 6.0 |
| OBU_TR_TC_TYPE2 | UNSIGNED8 | - | 0x00 to 0x06 | 7.0 |

| OBU Packet 3 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| OBU_TR_D_ENTRY2 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 8.0 |
| OBU_TR_D_EXIT2 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 10.0 |
| **OBU_TR_TC_ID3** | UNSIGNED8 | - | 0x00 to 0xff | 12.0 |
| OBU_TR_TC_TYPE3 | UNSIGNED8 | - | 0x00 to 0x06 | 13.0 |
| OBU_TR_D_ENTRY3 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 14.0 |
| OBU_TR_D_EXIT3 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 16.0 |
| **OBU_TR_TC_ID4** | UNSIGNED8 | - | 0x00 to 0xff | 18.0 |
| OBU_TR_TC_TYPE4 | UNSIGNED8 | - | 0x00 to 0x06 | 19.0 |
| OBU_TR_D_ENTRY4 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 20.0 |
| OBU_TR_D_EXIT4 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 22.0 |
| Validity | UNSIGNED16 | - | Validity of value of variables contained in bytes 0 to 22 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 15. | 24.0 |

### 4.3.10 OBU Packet 4

| Data name (structure and fixed generic content) | Type | Default values | Values per type of track condition | Byte.Bit Offset |
|---|---|---|---|---|
| **OBU Packet 4** | | | | |
| **OBU_TR_TC_ID5** | UNSIGNED8 | - | 0x00 to 0xff | 0.0 |
| OBU_TR_TC_TYPE5 | UNSIGNED8 | - | 0x00 to 0x06 | 1.0 |
| OBU_TR_D_ENTRY5 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 2.0 |
| OBU_TR_D_EXIT5 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 4.0 |
| **OBU_TR_TC_ID6** | UNSIGNED8 | - | 0x00 to 0xff | 6.0 |
| OBU_TR_TC_TYPE6 | UNSIGNED8 | - | 0x00 to 0x06 | 7.0 |
| OBU_TR_D_ENTRY6 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 8.0 |
| OBU_TR_D_EXIT6 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 10.0 |
| **OBU_TR_TC_ID7** | UNSIGNED8 | - | 0x00 to 0xff | 12.0 |
| OBU_TR_TC_TYPE7 | UNSIGNED8 | - | 0x00 to 0x06 | 13.0 |
| OBU_TR_D_ENTRY7 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 14.0 |
| OBU_TR_D_EXIT7 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 16.0 |
| **OBU_TR_TC_ID8** | UNSIGNED8 | | 0x00 to 0xff | 18.0 |
| OBU_TR_TC_TYPE8 | UNSIGNED8 | - | 0x00 to 0x06 | 19.0 |
| OBU_TR_D_ENTRY8 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 20.0 |
| OBU_TR_D_EXIT8 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 22.0 |

| OBU Packet 4 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| Validity | UNSIGNED16 | - | Validity of value of variables contained in bytes 0 to 22 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 16. | 24.0 |

### 4.3.11　OBU Packet 5

| OBU Packet 5 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| **OBU_TR_TC_ID9** | UNSIGNED8 | - | 0x00 to 0xff | 0.0 |
| OBU_TR_TC_TYPE9 | UNSIGNED8 | - | 0x00 to 0x06 | 1.0 |
| OBU_TR_D_ENTRY9 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 2.0 |
| OBU_TR_D_EXIT9 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 4.0 |
| **OBU_TR_TC_ID10** | UNSIGNED8 | - | 0x00 to 0xff | 6.0 |
| OBU_TR_TC_TYPE10 | UNSIGNED8 | - | 0x00 to 0x06 | 7.0 |
| OBU_TR_D_ENTRY10 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 8.0 |
| OBU_TR_D_EXIT10 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 10.0 |

| OBU Packet 5 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| **OBU_TR_TC_ID11** | UNSIGNED8 | - | 0x00 to 0xff | 12.0 |
| OBU_TR_TC_TYPE11 | UNSIGNED8 | - | 0x00 to 0x06 | 13.0 |
| OBU_TR_D_ENTRY11 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 14.0 |
| OBU_TR_D_EXIT11 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 16.0 |
| **OBU_TR_TC_ID12** | UNSIGNED8 | - | 0x00 to 0xff | 18.0 |
| OBU_TR_TC_TYPE12 | UNSIGNED8 | - | 0x00 to 0x06 | 19.0 |
| OBU_TR_D_ENTRY12 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 20.0 |
| OBU_TR_D_EXIT12 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 22.0 |
| Validity | UNSIGNED16 | - | Validity of value of variables contained in bytes 0 to 22 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 15. | 24.0 |

### 4.3.12 OBU Packet 6

| Data name (structure and fixed generic content) | Type | Default values | Values per type of track condition | Byte.Bit Offset |
|---|---|---|---|---|
| **OBU Packet 6** | | | | |
| **OBU_TR_TC_ID13** | UNSIGNED8 | - | 0x00 to 0xff | 0.0 |
| OBU_TR_TC_TYPE13 | UNSIGNED8 | - | 0x00 to 0x06 | 1.0 |
| OBU_TR_D_ENTRY13 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 2.0 |
| OBU_TR_D_EXIT13 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 4.0 |
| **OBU_TR_TC_ID14** | UNSIGNED8 | - | 0x00 to 0xff | 6.0 |
| OBU_TR_TC_TYPE14 | UNSIGNED8 | - | 0x00 to 0x06 | 7.0 |
| OBU_TR_D_ENTRY14 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 8.0 |
| OBU_TR_D_EXIT14 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 10.0 |
| **OBU_TR_TC_ID15** | UNSIGNED8 | - | 0x00 to 0xff | 12.0 |
| OBU_TR_TC_TYPE15 | UNSIGNED8 | - | 0x00 to 0x06 | 13.0 |
| OBU_TR_D_ENTRY15 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 14.0 |
| OBU_TR_D_EXIT15 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 16.0 |
| **OBU_TR_TC_ID16** | UNSIGNED8 | - | 0x00 to 0xff | 18.0 |
| OBU_TR_TC_TYPE16 | UNSIGNED8 | - | 0x00 to 0x06 | 19.0 |
| OBU_TR_D_ENTRY16 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 20.0 |
| OBU_TR_D_EXIT16 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 22.0 |

| OBU Packet 6 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| Validity | UNSIGNED16 | - | Validity of value of variables contained in bytes 0 to 22 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 15. | 24.0 |

### 4.3.13    OBU Packet 7

| OBU Packet 7 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| **OBU_TR_TC_ID17** | UNSIGNED8 | - | 0x00 to 0xff | 0.0 |
| OBU_TR_TC_TYPE17 | UNSIGNED8 | - | 0x00 to 0x06 | 1.0 |
| OBU_TR_D_ENTRY17 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 2.0 |
| OBU_TR_D_EXIT17 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 4.0 |
| **OBU_TR_TC_ID18** | UNSIGNED8 | - | 0x00 to 0xff | 6.0 |
| OBU_TR_TC_TYPE18 | UNSIGNED8 | - | 0x00 to 0x06 | 7.0 |
| OBU_TR_D_ENTRY18 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 8.0 |
| OBU_TR_D_EXIT18 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 10.0 |

| OBU Packet 7 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **Values per type of track condition** | **Byte.Bit Offset** |
| **OBU_TR_TC_ID19** | UNSIGNED8 | - | 0x00 to 0xff | 12.0 |
| OBU_TR_TC_TYPE19 | UNSIGNED8 | - | 0x00 to 0x06 | 13.0 |
| OBU_TR_D_ENTRY19 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 14.0 |
| OBU_TR_D_EXIT19 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 16.0 |
| **OBU_TR_TC_ID20** | UNSIGNED8 | - | 0x00 to 0xff | 18.0 |
| OBU_TR_TC_TYPE20 | UNSIGNED8 | - | 0x00 to 0x06 | 19.0 |
| OBU_TR_D_ENTRY20 | INTEGER16 | - | OBU_TR_xxx_D_Entry | 20.0 |
| OBU_TR_D_EXIT20 | INTEGER16 | - | OBU_TR_xxx_D_Exit | 22.0 |
| Validity | UNSIGNED16 | - | Validity of value of variables contained in bytes 0 to 22 of the packet. The validity of the signal with offset 0.0 is in bit 0. The validity of the signal with offset 22.0 is in bit 15. | 24.0 |

## 4.4 MVB

### 4.4.1 General

4.4.1.1    The lower communication layers are specified in [14].

4.4.1.2    In case of architecture b) (see 4.2.3) the safe data transmission shall be implemented in accordance with [17], Appendix B. Note: Only the packet part which is termed as "send telegram" in [17], figure B.13 "MVB-VDP" is defined in this Subset.

### 4.4.2 Data Properties and Application of the Safety Protocol

4.4.2.1    TR Packet 1

Properties:

    Port address: configurable

    Source device: TR

    Sink device: OBU

    Data class: Process data, 32 bytes

    Maximum cycle time: 128 ms

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 1 (see chapter 4.3.3) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

### 4.4.2.2 TR Packet 2

Properties:

Port address: configurable

Source device: TR

Sink device: OBU

Data class: Process data, 32 bytes

Maximum cycle time: 256 ms

| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 2 (see chapter 4.3.4) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

### 4.4.2.3 TR Packet 3

Properties:

Port address: configurable

Source device: TR

Sink device: OBU

Data class: Process data, 32 bytes

Maximum cycle time: 256 ms

| TR Packet 3 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 3 (see chapter 4.3.5) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

### 4.4.2.4 OBU Packet 1

Properties:

    Port address: configurable

    Source device: OBU

    Sink device: TR

    Data class: Process data, 32 bytes

    Maximum cycle time: 128 ms

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Packet 1 (see chapter 4.3.7) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

### 4.4.2.5 OBU Station Platform Packet (OBU Packet 2)

Properties:

    Port address: configurable

    Source device: OBU

    Sink device: TR

    Data class: Process data, 32 bytes

    Maximum cycle time: 256 ms

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Station Platform (see chapter 4.3.8) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

### 4.4.2.6　OBU Packet 3 to OBU Packet 7

Properties:

　　Port address: configurable

　　Source device: OBU

　　Sink device: TR

　　Data class: Process data, 32 bytes

　　Maximum cycle time: 256 ms

| OBU Packet 3 … OBU Packet 7 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Packet 3 to OBU Packet 7 (see chapters 4.3.9 to 4.3.13) | | | 0.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 26.0 |

## 4.5　CAN

### 4.5.1　General

4.5.1.1　The lower communications layers are specified in [14].

4.5.1.2　In case of architecture b) (see 4.2.3) the safe data transmission shall be implemented in accordance with [17], Appendix B (MVB).

4.5.1.2.1　An MVB packet shall be constructed at sender side to calculate the CRC and shall be split for transmission in 5 CAN packets, each with a different CAN packet identifier, see Figure 4-3.

4.5.1.2.2　At receiver side the CAN packets shall be merged again to an MVB packet to check the CRC.

4.5.1.2.3　All packets (CAN and MVB) of the same sequence shall use the same SSC value taken over from the MVB packet.
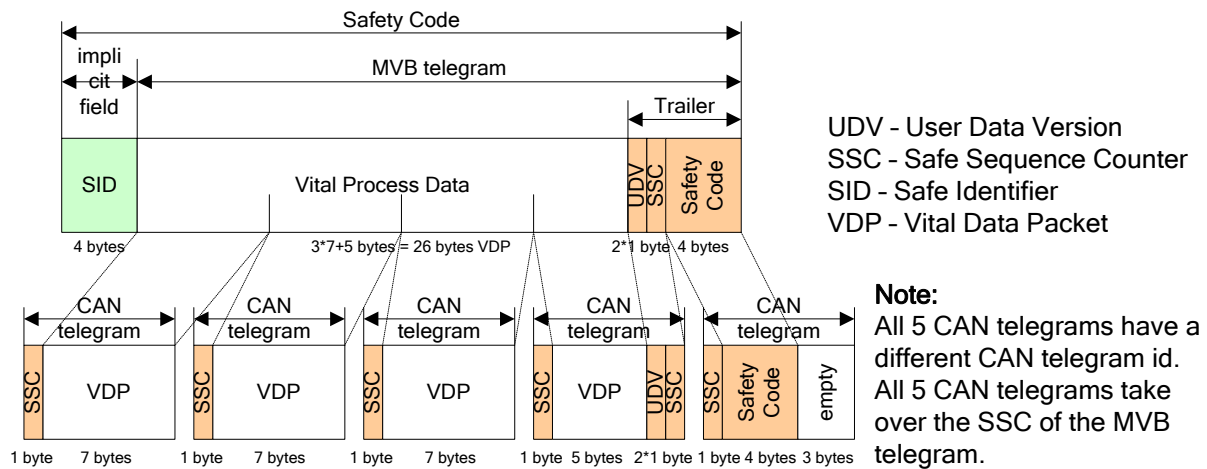
**Figure 4-3 Safe Data Transmission via CAN**

4.5.1.3    Note: Only the packet part which is termed as "send telegram" in [17], figure B.13 "MVB-VDP" is defined in this Subset.

## 4.5.2    Data Properties and Application of the Safety Protocol

4.5.2.1    CAN is using MVB coding, see chapter 4.4.2.

4.5.2.2    CAN packet numbers are configurable according to [19].

# 4.6    ECN

## 4.6.1    General

4.6.1.1    The lower communications layers are specified in [14].

4.6.1.2    In case of architecture b) (see 4.2.3) the safe data transmission shall be implemented in accordance with [17], Appendix B.

4.6.1.3    Note: The reference to SDTv2 covers only the safety protocol but it does not mean that embedding into TRDP is required.

4.6.1.4    Note: Only the packet part which is termed as "send telegram" in [17], figure B.6 "ETB-VDP" is defined in this Subset.

4.6.1.5    Note: SafeTopoCount is set to 0 as the network is only a Consist local communication network.

4.6.1.6    The value of cstUUID (unique consist identifier) shall be configured as a fixed value.

4.6.1.7    Exception: In case the optional safety protocol ProfiSafe according to IEC 61784-3-3 [22] is applied, the SDT trailer is replaced by the ProfiSafe trailer and appended directly to the data structures as defined in Appendix A, without any padding bytes.

## 4.6.2    Data Properties and Application of the Safety Protocol

4.6.2.1    TR Packet 1

Properties:

   ComId: configurable

   Source device: TR

   Sink device: OBU

   Data class: Process data

   Maximum cycle time of source device: 100 ms

   Dataset ID: configurable

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 1 (see chapter 4.3.3) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

4.6.2.2    TR Packet 2

Properties:

   ComId: configurable

   Source device: TR

   Sink device: OBU

   Data class: Process data

   Maximum cycle time of source device: 200 ms

   Dataset ID: configurable

| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 2 (see chapter 4.3.4) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

4.6.2.3    TR Packet 3

Properties:

ComId: configurable

Source device: TR

Sink device: OBU

Data class: Process data

Maximum cycle time of source device: 200 ms

Dataset ID: configurable

| TR Packet 3 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Description** | **Byte.Bit Offset** |
| Content according to TR Packet 3 (see chapter 4.3.5) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

### 4.6.2.4 OBU Packet 1

Properties:

    ComId: configurable

    Source device: OBU

    Sink device: TR

    Data class: Process data

    Maximum cycle time of source device: 100 ms

    Dataset ID: configurable

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Packet 1 (see chapter 4.3.7) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

### 4.6.2.5 OBU Station Platform Packet (OBU Packet 2)

Properties:

    ComId: configurable

    Source device: OBU

    Sink device: TR

    Data class: Process data

    Maximum cycle time of source device: 200 ms

    Dataset ID: configurable

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Packet 2 (see chapter 4.3.8) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

### 4.6.2.6    OBU Packet 3 to OBU Packet 7

Properties:

ComId: configurable

Source device: OBU

Sink device: TR

Data class: Process data

Maximum cycle time of source device: 200 ms

Dataset ID: configurable

| OBU Packet 3 … OBU Packet 7 | | | |
|---|---|---|---|
| **Data name** | **Type** | **Value Interpretation** | **Byte.Bit Offset** |
| Content according to OBU Packet 3 to OBU Packet 7 (see chapters 4.3.9to 4.3.13) | | | 0.0 |
| Padding | UNSIGNED16 | SDT trailer needs to start at 4 byte alignment | 26.0 |
| Safe data transmission trailer according to [17], Appendix B (in case of architecture b), see 4.2.3) | | | 28.0 |

# 5. REQUIREMENTS FOR THE SIGNALS TO BE EXCHANGED AT THE TRAIN INTERFACE

## 5.1 Mode Control

### 5.1.1 Sleeping

5.1.1.1 Architecture

5.1.1.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.1.1.2 Coding

| T_SL_E_N / TR_OBU_TrainSleep | T_SL_E_I / TR_OBU_TrainSleep_Not | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | Sleeping not requested |
| 1 | 0 | Sleeping requested |
| 1 | 1 | Invalid |

**Table 5-1 Coding for enable Sleeping function**

5.1.1.3 Safety Requirements

5.1.1.3.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.1.2 Passive Shunting

5.1.2.1 Architecture

5.1.2.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.1.2.2 Coding

| T_PS_E / TR_OBU_PassiveShunting | Meaning |
|---|---|
| 0 | Passive shunting not permitted |
| 1 | Passive shunting permitted |

**Table 5-2 Coding for Passive Shunting**

### 5.1.2.3 Safety Requirements

5.1.2.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.1.3 Non Leading

### 5.1.3.1 Architecture

5.1.3.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

### 5.1.3.2 Coding

| T_NL_E / TR_OBU_NLEnabled | Meaning |
|---|---|
| 0 | Non-leading not permitted |
| 1 | Non-leading permitted |

**Table 5-3 Coding for Non Leading**

### 5.1.3.3 Safety Requirements

5.1.3.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.1.4 Isolation

### 5.1.4.1 Architecture

5.1.4.1.1 Reference architecture as defined in Chapter 3 is allowed.

5.1.4.1.2 The signal shall be generated directly by the ERTMS/ETCS isolation device.

### 5.1.4.2 Coding

| O_IS_S | Meaning |
|---|---|
| 0 | ERTMS/ETCS on-board not isolated |
| 1 | ERTMS/ETCS on-board isolated |

**Table 5-4 Coding for Isolation (of ETCS)**

### 5.1.4.3 Safety Requirements

5.1.4.3.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.1.5 Automatic Driving

5.1.5.1 Architecture

5.1.5.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.1.5.2 Coding

| O_AD_S / OBU_TR_AD_Status | Meaning |
|---|---|
| 0 | ERTMS/ETCS on-board is not in AD mode |
| 1 | ERTMS/ETCS on-board is in AD mode |

**Table 5-5 Coding for Automatic Driving**

5.1.5.2.1 Note: It is assumed that this output information is used for GOA2.

5.1.5.3 Safety Requirements

5.1.5.3.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.1.6 Remote Shunting

5.1.6.1 Architecture

5.1.6.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

| O_RS_S / OBU_TR_RS_Status | Meaning |
|---|---|
| 0 | ERTMS/ETCS on-board is not in a mode permitting remote shunting |
| 1 | ERTMS/ETCS on-board is in a mode permitting remote shunting |

**Table 5-6 Coding for Remote Shunting**

5.1.6.2 Safety Requirements

5.1.6.2.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.2 Signals for the Control of Brakes

### 5.2.1 Service Brake Command

5.2.1.1 Architecture

5.2.1.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.2.1.2 Coding

| O_SB_C / OBU_TR_ServiceBrake | Meaning |
|---|---|
| 0 | Service brake not commanded |
| 1 | Service brake commanded |

**Table 5-7 Coding for Service Brake command**

5.2.1.3 Safety Requirements

5.2.1.3.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.2.2 Brake Pressure

5.2.2.1 General

5.2.2.1.1 Note: The value of air pressure input represents either the pressure in the brake cylinders or in the UIC brake pipe, see [6], 2.3.2.3.1.

5.2.2.2 Architecture

5.2.2.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

5.2.2.3 Coding

| Name | Size | Meaning | |
|---|---|---|---|
| TR_OBU_BrakePressure | 8 bits | 0 | 0.0 bar |
| | | 1 … 60 | Steps of 0.1 bar up to 6 bar |
| | | 61 … 255 | Spare values |

**Table 5-8 Coding for Brake Pressure**

5.2.2.4 Safety Requirements

5.2.2.4.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.2.3 Emergency Brake Interface

5.2.3.1 General

5.2.3.1.1 Two standard ways of transfer of the emergency brake command within the vehicle and train consist exist according to [5]:

- Electrical safety line (Figure 5-1)
- Pneumatic brake pipe according to (Figure 5-2)

5.2.3.2 Emergency Brake Command

5.2.3.2.1 Figure 5-1 shows a possible integration of an ERTMS/ETCS on-board on each end vehicle of a consist into an emergency brake architecture based on an electric safety line, where the emergency brake command is transmitted by de-energizing electric actors. Relays K1 and K2 are the transfer components.

5.2.3.2.1.1 Note: This is only a principle drawing not showing all details of the safety loop.

5.2.3.2.2 EB lines are redundant for safety reasons. The contacts of the ERTMS/ETCS on-board in each line shall be controlled separately in order to be able to test each line independently.

5.2.3.2.3 Notes to all figures: All contacts are drawn in position "no power" which corresponds to "EB commanded". Actors 1, m and n are devices (valves, relays, electronic inputs of brake control etc.) either on one vehicle or distributed over the consist or distributed over the train. In addition, "ETCS" refers to ERTMS/ETCS on-board equipment.
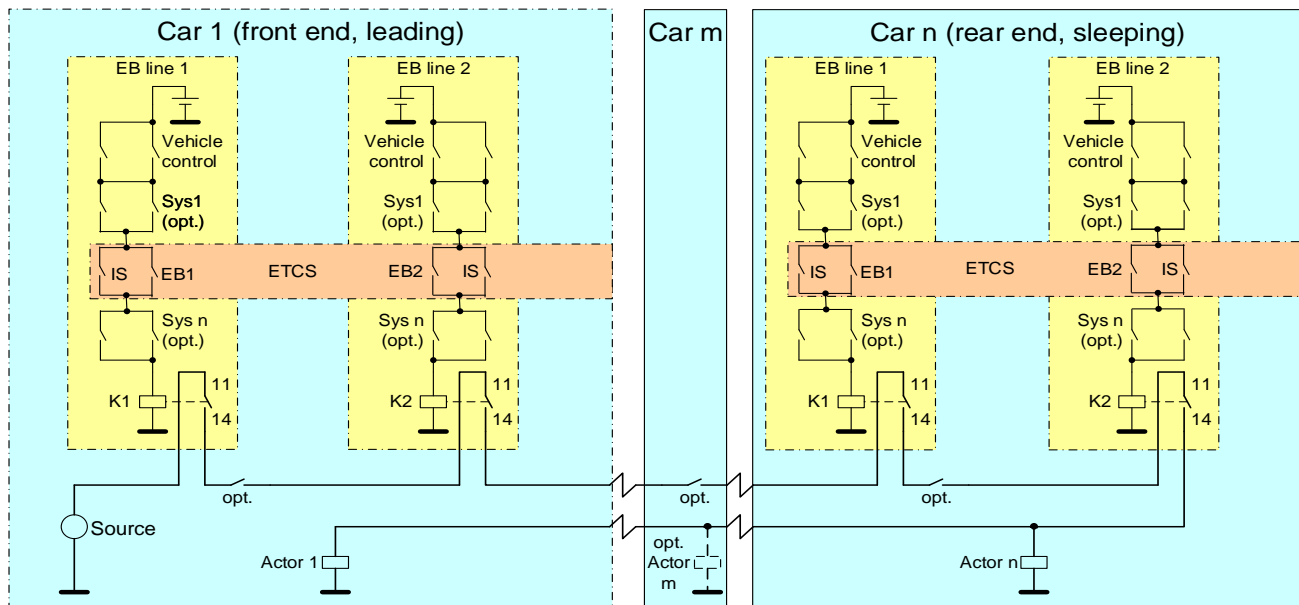


**Figure 5-1 EB architecture example with electric safety loop**

5.2.3.2.4 The following figure shows a possible integration of an ERTMS/ETCS on-board on each end vehicle into an emergency brake architecture based on a brake pipe where the emergency brake command is transmitted by venting a pneumatic pipe. In this architecture the transfer components are the valves controlled by the EB lines and venting the brake pipe.
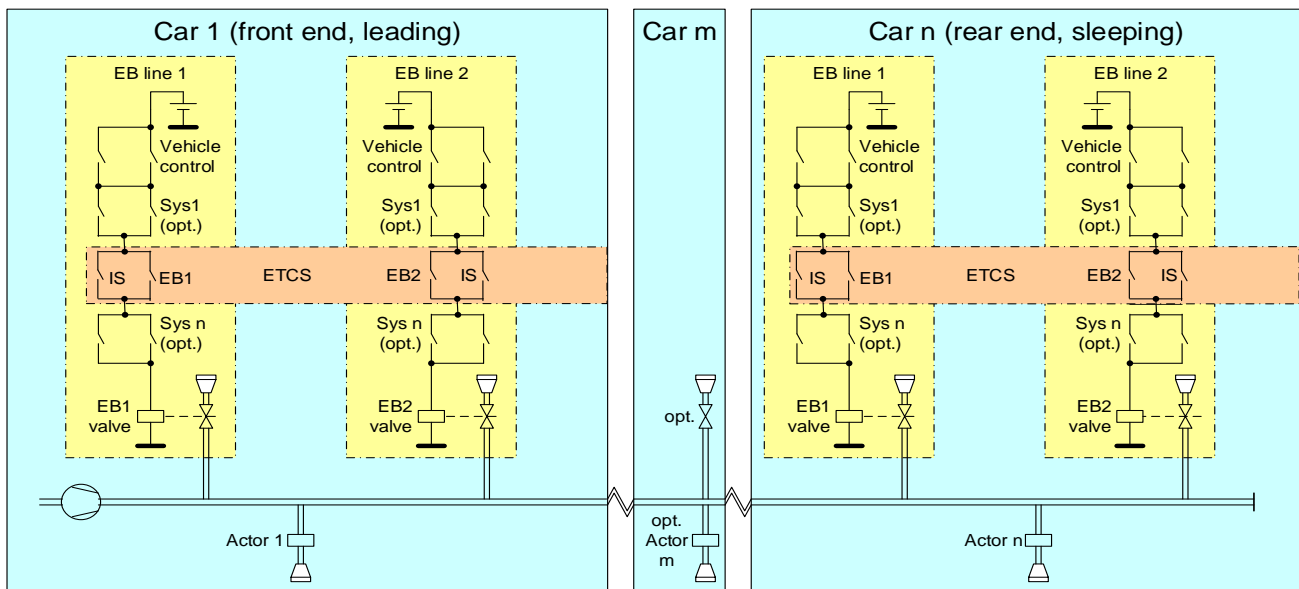


**Figure 5-2 EB architecture example with brake pipe**

5.2.3.2.5 The following figure shows another possible integration of an ERTMS/ETCS on-board on each end vehicle. The second EB line is implemented by using the serial interface to the Rolling Stock (e.g. TCMS). The further transmission from the Rolling Stock to the brake system is out of scope, but needs to be considered in the safety case (see safety requirements referenced in section 5.2.3.2.13)
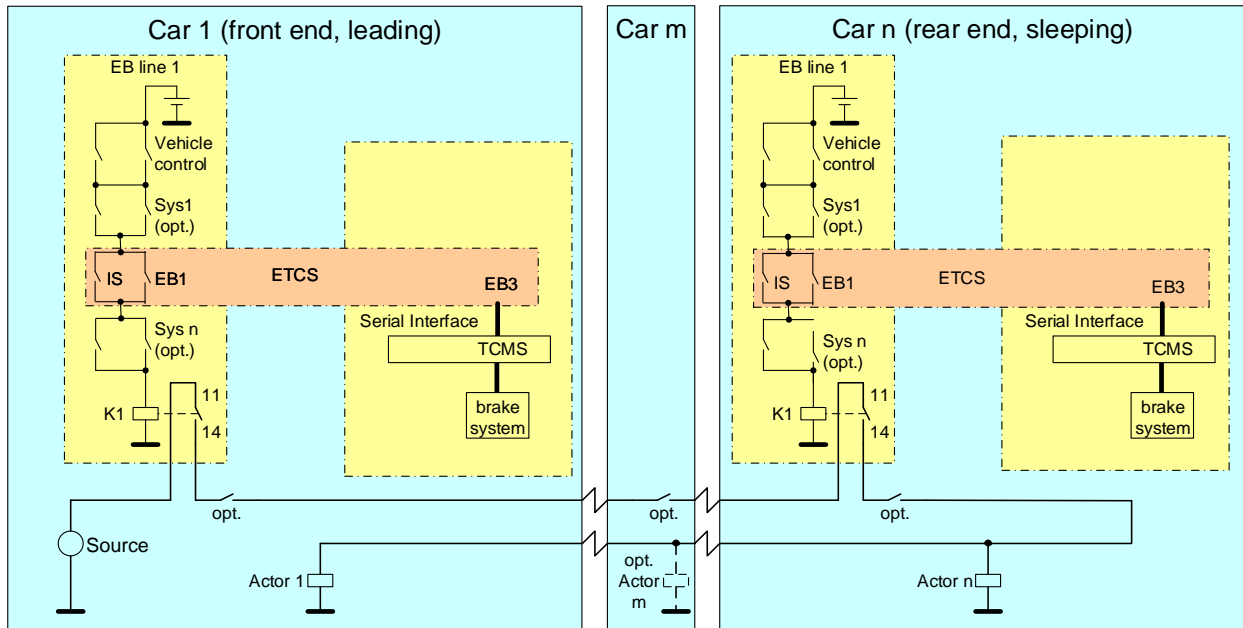
**Figure 5-3 EB architecture example with one EB line and a serial link**

5.2.3.2.6    In sections 5.2.3.2.7, 5.2.3.2.8 and 5.2.3.2.9 harmonized solutions for the EB command interface are defined.

5.2.3.2.7    Architecture Solution 1: Four NO contacts for two EB lines (see figure 5-4).

5.2.3.2.7.1    Architecture Solution 1 can be used for the architecture examples of Figure 5-1 and Figure 5-2.

**Figure 5-4 EB function, Solution 1: 2 EB lines**

5.2.3.2.7.2   The contacts O_EB1_C_1 and O_EB1_C_2 are part of the same relay and form only one signal named O_EB1_C. O_EB2_C_1 and O_EB2_C_2 are part of another single relay and form another signal named O_EB2_C.

5.2.3.2.8   Architecture Solution 2: Two NO contacts for two EB lines (see figure 5-5).

5.2.3.2.8.1   Architecture Solution 2 can be used for the architecture examples of Figure 5-1 and Figure 5-2.

**Figure 5-5 EB function, Solution 2: 2 EB lines**

5.2.3.2.9 Architecture Solution 3: One NO contact for one EB line and serial interface (see figure 5-6).

5.2.3.2.9.1 Architecture Solution 3 can be used for the architecture examples of Figure 5-3.



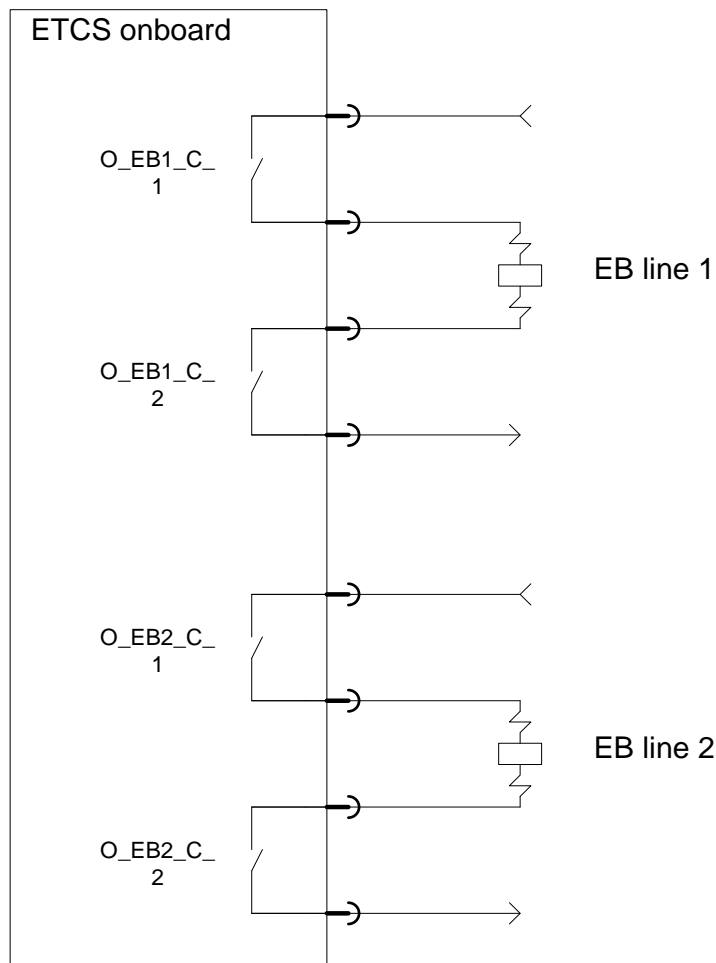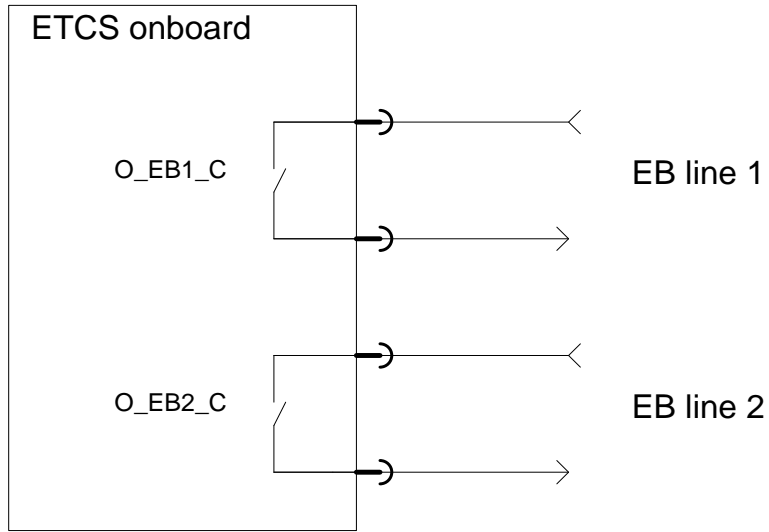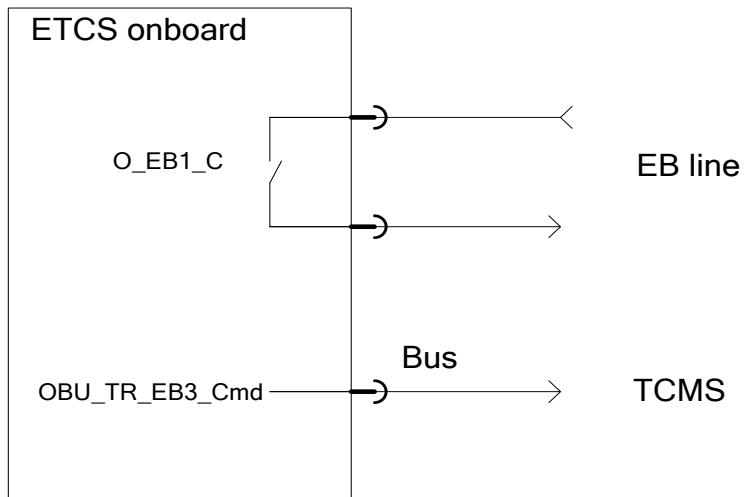**Figure 5-6 EB function, Solution 3: 1 EB line, serial interface**

### 5.2.3.2.10 General Architecture

5.2.3.2.10.1 For O_EB1_C and O_EB2_C only reference architecture as defined in Chapter 3 is allowed.

5.2.3.2.11 For OBU_TR_EB3_Cmd only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.2.3.2.12 Coding

| O_EB1_C | O_EB2_C | Meaning |
|---------|---------|---------|
| 0 | 0 | EB commanded |
| 0 | 1 | Fault in normal operation |
| 1 | 0 | Fault in normal operation |
| 1 | 1 | EB not commanded from ERTMS/ETCS on-board |

**Table 5-9 Coding for EB1 and EB2 command (solutions 1 and 2)**

| O_EB1_C | OBU_TR_EB3_Cmd | Meaning |
|---------|----------------|---------|
| 0 | 0 | EB commanded |
| 0 | 1 | Fault in normal operation |
| 1 | 0 | Fault in normal operation |
| 1 | 1 | EB not commanded from ERTMS/ETCS on-board |

**Table 5-10 Coding for EB1 and EB3 command (solution 3)**

5.2.3.2.12.1 Vehicle shall apply EB in any cases in which the coding for "EB command" is different from O_EB1_C = 1 and O_EB2_C = 1 / OBU_TR_EB3_Cmd = 1.

5.2.3.2.12.2 Fault in normal operation is considered whenever the values of O_EB1_C and O_EB2_C / OBU_TR_EB3_Cmd remain different for a period greater than 2s. The failure has to be detected by the vehicle.

### 5.2.3.2.13 Safety Requirements

5.2.3.2.13.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.2.4 Special Brake Inhibition Area – Trackside Orders



**Figure 5-7 Passing a Special Brake Inhibition Area**

5.2.4.1 This is a track condition to be handled although not included in chapter 5.3. Chapter 5.3.1 also applies for Special Brake Inhibition Area.

5.2.4.2 Note: In [1], 5.20.5 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide the remaining distance to the start location point D (OBU_TR_XXX_D_Entry) and the remaining distance to the end location point E (OBU_TR_XXX_D_Exit) to the ERTMS/ETCS external function (e.g. TCMS).

### 5.2.4.3 Architecture

5.2.4.4 Only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.2.4.5 Coding

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_RBI_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_RBI_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-11 Coding for Regenerative Brake Inhibit**

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_MGI_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_MGI_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-12 Coding for Magnetic Shoe Brake Inhibit**

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_ECS_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_ECS_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-13 Coding for Eddy Current Brake for Service Brake Inhibit**

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_ECE_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_ECE_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-14 Coding for Eddy Current Brake for Emergency Brake Inhibit**

### 5.2.4.6 Safety Requirements

5.2.4.6.1 Safety requirements shall apply as defined in [13], chapter 2.
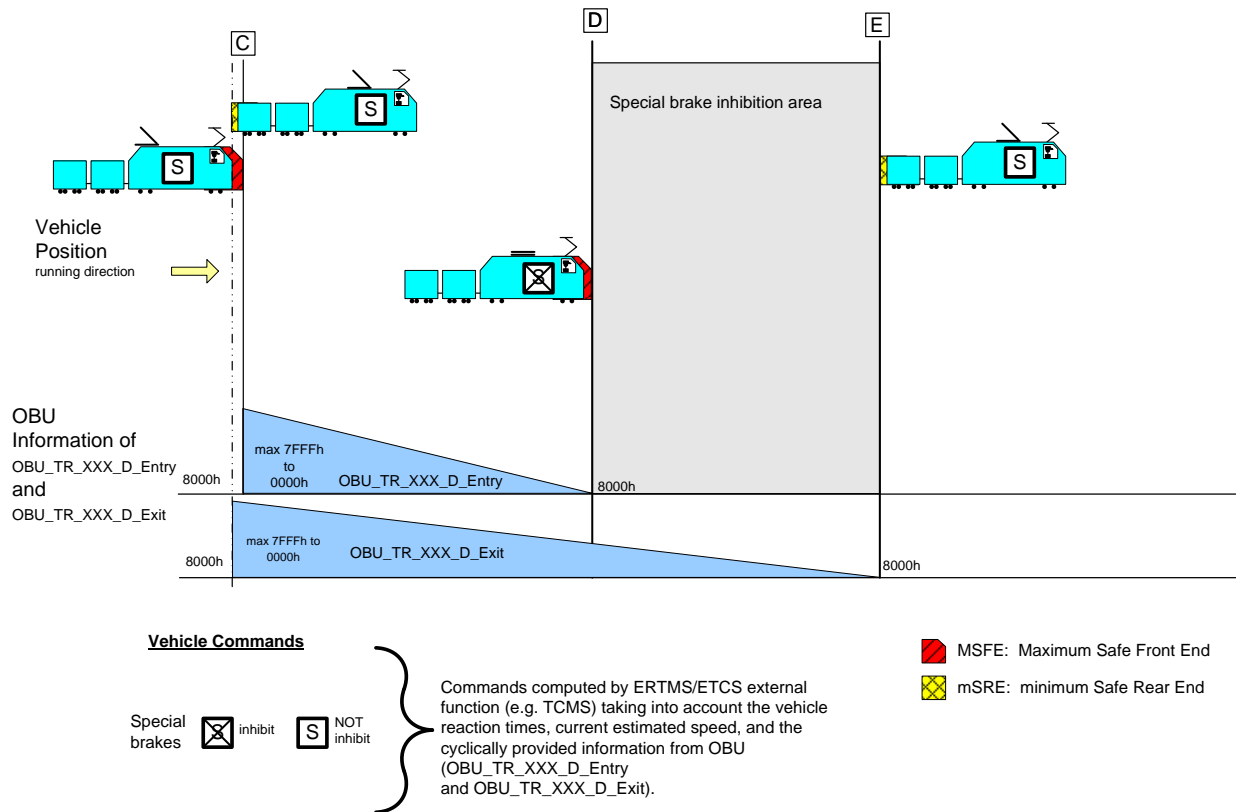
## 5.2.5 Special Brake Inhibition Area – STM Orders

### 5.2.5.1 Architecture

5.2.5.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

### 5.2.5.2 Coding

5.2.5.2.1 Regenerative brake inhibition command

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_RBInhibit_Cmd<br>O_RB_I | Binary output or<br>(1 bit on bus) | 0: Regenerative Brake is not to be inhibited<br>1: Regenerative Brake is to be inhibited |

**Table 5-15 Coding for Regenerative Brakes Inhibition command – STM Orders**

5.2.5.2.2 Magnetic shoes brakes inhibition command

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_MGInhibit_Cmd<br>O_MG_I | Binary output or<br>(1 bit on bus) | 0: Magnetic Shoe Brake is not to be inhibited<br>1: Magnetic Shoe Brake is to be inhibited |

**Table 5-16 Coding for Magnetic Shoe Brake Inhibition command – STM Orders**

5.2.5.2.3 Eddy current brakes for service brake inhibition command

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_ECSInhibit_Cmd<br>O_ECS_I | Binary output or<br>(1 bit on bus) | 0: Eddy Current Brake for Service Brake is not to be inhibited<br>1: Eddy Current Brake for Service Brake is to be inhibited |

**Table 5-17 Coding for Eddy Current Brake for Service Brake Inhibition command – STM Orders**

5.2.5.2.4 Eddy current brakes for emergency brake inhibition command

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_ECEInhibit_Cmd<br>O_ECE_I | Binary output or<br>(1 bit on bus) | 0: Eddy Current Brake for Emergency Brake is not to be inhibited<br>1: Eddy Current Brake for Emergency Brake is to be inhibited |

**Table 5-18 Coding for Eddy Current Brake for Emergency Brake Inhibition command – STM Orders**

5.2.5.3 Safety Requirements

5.2.5.3.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.2.6 Special Brake Status

5.2.6.1 General

5.2.6.1.1 The inhibition of a special brake results in a different model to be used by the ERTMS/ETCS on-board internally. Hence informing the ERTMS/ETCS on-board about the status of a specific special brake can be relevant to calculate the brake model that has to be used.

5.2.6.2 Architecture

5.2.6.2.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.2.6.3 Coding

5.2.6.3.1 Electro Pneumatic Brake Status

| T_EP_S_N / EP_S | T_EP_S_I / EP_S_Not | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | Brake not active, see definition in [6], §2.3.6.5. |
| 1 | 0 | Brake active, see definition in [6], §2.3.6.5. |
| 1 | 1 | Invalid |

**Table 5-19 Coding for Electro Pneumatic Brake Status**

5.2.6.3.2 Eddy Current Brake Status

| T_EC_S_N / EC_S | T_EC_S_I / EC_S_Not | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | Brake not active, see definition in [6], §2.3.6.5. |
| 1 | 0 | Brake active, see definition in [6], §2.3.6.5. |
| 1 | 1 | Invalid |

**Table 5-20 Coding for Eddy Current Brake Status**

5.2.6.3.3 Regenerative Brake Status

| T_RB_S_N / RB_S | T_RB_S_I / RB_S_Not | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | Brake not active, see definition in [6], §2.3.6.5. |
| 1 | 0 | Brake active, see definition in [6], §2.3.6.5. |
| 1 | 1 | Invalid |

**Table 5-21 Coding for Regenerative Brake Status**

5.2.6.3.4   Magnetic Shoe Brake Status

| T_MG_S_N / MG_S | T_MG_S_I / MG_S_Not | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | Brake not active, see definition in [6], §2.3.6.5. |
| 1 | 0 | Brake active, see definition in [6], §2.3.6.5. |
| 1 | 1 | Invalid |

**Table 5-22 Coding for Magnetic Shoe Brake Status**

5.2.6.4      Safety Requirements

5.2.6.4.1   Safety requirements shall apply as defined in [13], chapter 2.

### 5.2.7 Additional Brake Status

5.2.7.1 Additional brakes shall be handled in the same manner like special brakes.

5.2.7.2 Currently no brakes which would qualify for "additional brakes" in the meaning of [1] are known.

## 5.3 Control of Train Functions

### 5.3.1 General

5.3.1.1 Note: The structure of the packets is defined in 4.3.6 to 4.3.13.

5.3.1.2 Note: A fixed data structure is used for track conditions with a specific structure and for which specific rules are foreseen in SS-040:

- 5 track conditions Station Platform

- 1 track condition Change of Traction System

- 1 track condition Change of Allowed Current Consumption

Note: A generic data structure is used for transmitting track conditions that have the same data structure. Up to 20 track conditions can be transmitted by using the generic data structure. 20 has been selected in order to fulfill the rule of Subset-040, 4.3.2 l) for these track conditions:

- track condition Regenerative Brake Inhibition

- track condition Magnetic Shoe Brake Inhibition

- track condition Eddy Current Brake for SB Inhibition

- track condition Eddy Current Brake for EB Inhibition

- track condition Air Tightness Section

- track condition Powerless Section with Pantograph to be Lowered

- track condition Powerless Section with Main Power switch to be Switched Off

5.3.1.3 For the generic data structure part the track conditions shall be dynamically allocated to the generic packet data structure.

5.3.1.4 Note: The final content of a packet is determined dynamically and depends on the track conditions information needed to be transmitted at the moment the message is created.

---

5.3.1.5    Note: The Track Conditions themselves are specified in [1].

5.3.1.6    Note: The specifications on how to perform the functions on the vehicle side are outside the scope of ERTMS/ETCS. Therefore, they are not part of this document and are not part of any other UNISIG document. This includes also a possibly needed merging of track condition of the same type in case the Rolling Stock (e.g. TCMS) receives several track conditions of the same type.

5.3.1.7    Due to trackside topology two track conditions of the same type can be encountered within a short period of time or short distance. It is the responsibility of the Rolling Stock (e.g. TCMS) to act in accordance with the characteristics of the vehicle. Example: The TCMS could decide to keep the flaps closed between two adjacent tunnels.

5.3.1.8    The ERTMS/ETCS on-board shall receive the information related to the Track Conditions from the trackside, process it and forward it to the ERTMS/ETCS external function (e.g. TCMS) via the TI. In this application data of Numerical signal type is used and therefore this information can be transmitted to the ERTMS/ETCS external function (e.g. TCMS) only via the serial interface. The information from ERTMS/ETCS on-board shall be used by the ERTMS/ETCS external function (e.g. TCMS) to perform all necessary actions at the right time (e.g. to change the traction system at the given location). This means that the ERTMS/ETCS external function (e.g. TCMS) has to take into account relevant delay times (e.g. for opening the main power switch). This offers the flexibility for the ERTMS/ETCS external function (e.g. TCMS) to take into account the physical positions of the actuators of the train with respect to the front end of the train (e.g. for opening the main power switch, the distance between the front end and the pantographs) when reacting on these outputs.

5.3.1.9    The generation of the information forwarded to the ERTMS/ETCS external function (e.g. TCMS) shall start as specified in chapter 5.20 of [1].

5.3.1.10    If the Track Condition data refer to a single location (reference point) and not to a track section, then only the start location has to be considered which in this case is equal to the exit point. Example: Change of allowed current consumption.

5.3.1.11    The cycle time for the Track Condition variables on the serial interface shall be according to Table 4-1.

5.3.1.12    Data type used for the remaining distances is an INTEGER16 (2's complement) with a resolution of 1 meter (see Table 5-23 and Table 5-24).

| Value range | Meaning |
|---|---|
| 8000h (special value) | No remaining distance to the start location of a track condition of the considered type or to the location of a change of traction system is provided to the train. |
| 7FFFh (special value) | The value to be transmitted is higher than the highest value of the transmittable range. This special value is a flag indicating that the remaining distance value to be transmitted is higher than the max value of the range, i.e. > 32766 m. |
| 8001h (special value) | The value to be transmitted is lower than the lowest value of the transmittable range. This special value is a flag indicating that the remaining distance value to be transmitted is lower than the min value of the range, i.e. < -32766 m. |
| 7FFEh to 0000h (32766 m to 0 m) 8002h to FFFFh (-32766 m to -1 m) | This value represents the remaining distance to the start location of the track section. |

**Table 5-23 Coding of variables "OBU_TR_XXX_D_Entry" and "OBU_TR_XXX_D_Change"**

| Value range | Meaning |
|---|---|
| 8000h (special value) | No remaining distance to end location of a track condition of the considered type is provided to the train. The initial state is required for the track condition. In case of ACC and CTS the current settings of the track condition shall be kept. |
| 7FFFh (special value) | The value to be transmitted is higher than the highest value of the transmittable range. This special value is a flag indicating that the remaining distance value to be transmitted is higher than the max value of the range, i.e. > 32766 m. |
| 8001h (special value) | The value to be transmitted is lower than the lowest value of the transmittable range. This special value is a flag indicating that the remaining distance value to be transmitted is lower than the min value of the range, i.e. < -32766 m. |
| 7FFEh to 0000h (32766 m to 0 m) 8002h to FFFFh (-32766 m to -1 m) | This value represents the remaining distance to the end location of the track section. |

**Table 5-24 Coding of variables "OBU_TR_XXX_D_Exit"**

5.3.1.13    Note: It is possible that the distance provided jumps (backwards or forwards) e.g. due to ETCS internal reset of odometry inaccuracy.

5.3.1.14    Note: The vehicle side has to consider the impact if a driver overrules commands for a track condition.

5.3.1.15    Note: For vehicles without serial interface a project specific adaptation is necessary which allows to command the ETCS Track Condition orders via hard-wired interface by computing all individual commands required to manage the Track Condition functions. Whether the function to transform the remaining distances into elementary commands is implemented inside the EVC or in any other device in the vehicle is a project specific matter.

## 5.3.2    Change of Traction System

5.3.2.1    Note: In [1], 5.20.6 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide

- the remaining distance (OBU_TR_CTS_D_Change) to the location of change of traction system (point F),

- the new traction system (OBU_TR_CTS_NewId) and

- the new voltage (OBU_TR_CTS_NewVoltage)

to the ERTMS/ETCS external function (e.g. TCMS).

5.3.2.2    Architecture

5.3.2.2.1    Only serial connection (bus) as defined in Chapter 4 is allowed.
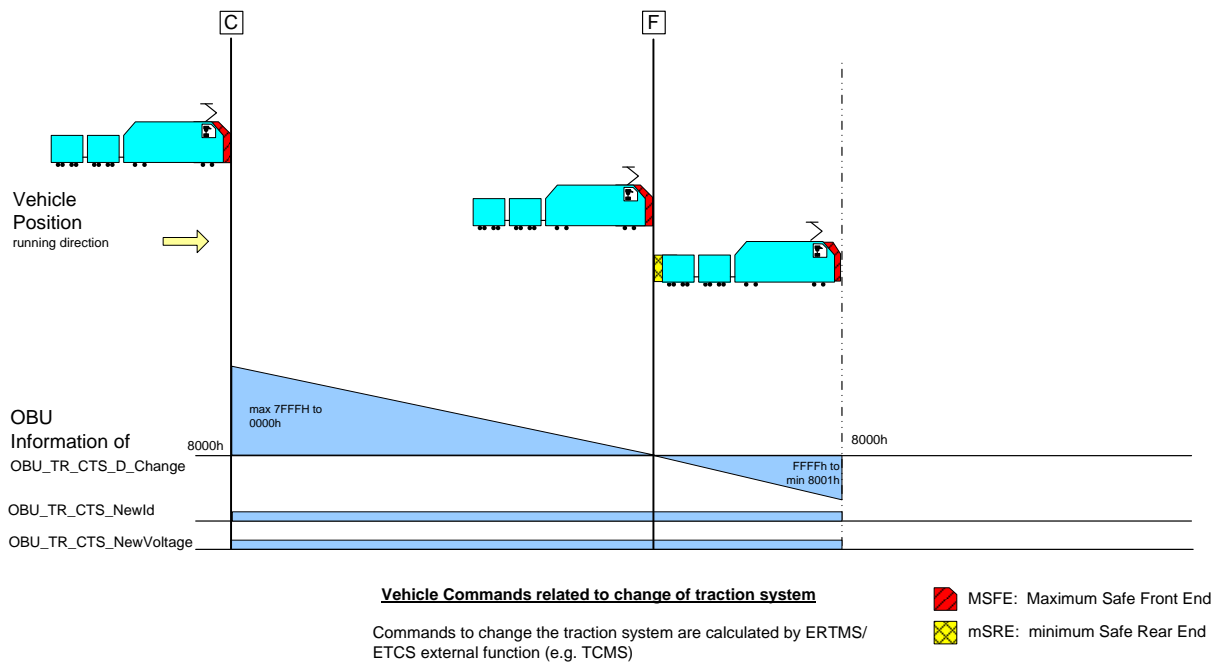
**Figure 5-8 Changing the traction system**

### 5.3.2.3 Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_CTS_D_Change | 16 bits | See Table 5-23, resolution: 1 ≡ 1 m. |
| OBU_TR_CTS_NewId | 10 bits | The new traction system (NID_CTRACTION). For coding refer to NID_CTRACTION as defined in [1], 7.5.1.86.1. If M_VOLTAGE is 0 the value shall not be considered. Only 10 bits are used. The values from 1024 to 65535 are spare values. |
| OBU_TR_CTS_NewVoltage | 4 bits | The new voltage (M_VOLTAGE). For coding refer to M_VOLTAGE as defined in [1], 7.5.1.78. Only 4 bits are used. The values from 16 to 255 are spare values. |

**Table 5-25 Coding for Change of Traction System**

5.3.2.3.1 Note: In practice the change of traction system Track Condition may be used combined with another Track Condition e.g. a powerless section with pantograph to be lowered.

5.3.2.3.2 When receiving "change of traction system" information in which the variable OBU_TR_CTS_D_Change is set to the special value 8000h (see Table 5-23), the vehicle shall not consider the variables OBU_TR_CTS_NewId and OBU_TR_CTS_NewVoltage contained in this information.

5.3.2.4 Safety Requirements

5.3.2.4.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.3.3 Powerless Section with Pantograph to be Lowered – Trackside orders
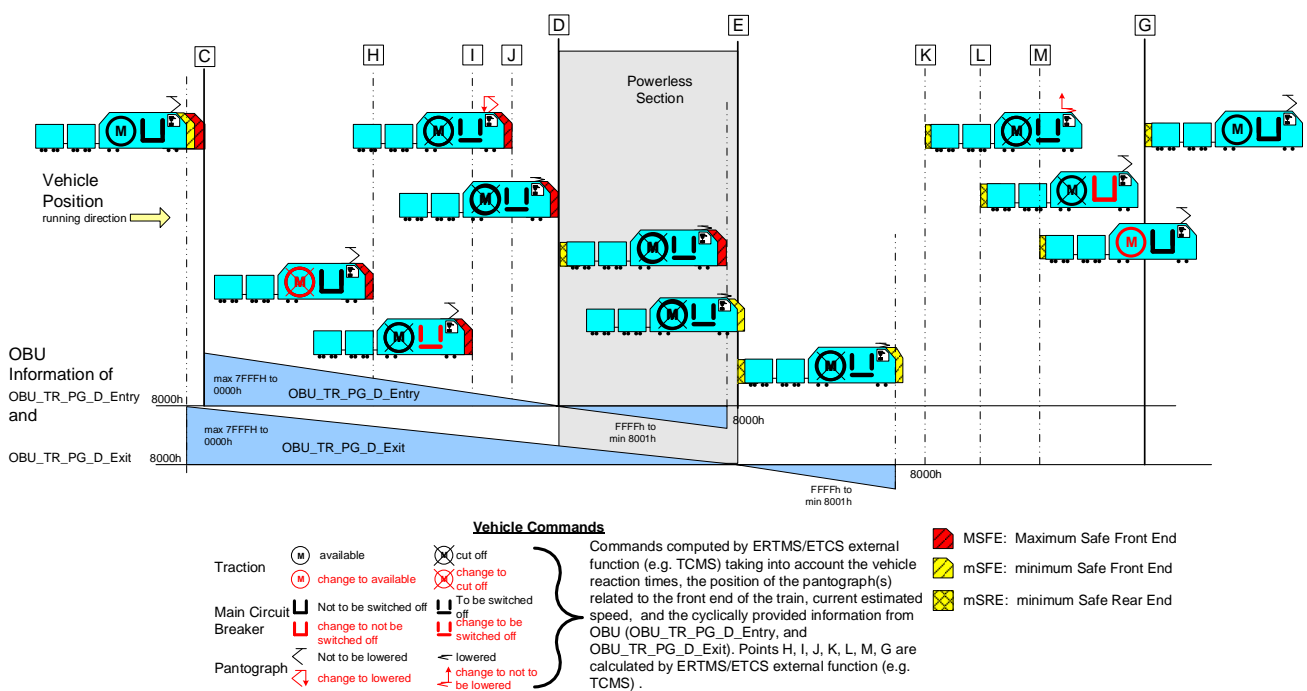


**Figure 5-9 Passing a Powerless Section with Pantograph to be Lowered**

5.3.3.1 Note: In [1], 5.20.2 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide the remaining distance to the start location point D (OBU_TR_PG_D_Entry) and the remaining distance to the end location point E (OBU_TR_PG_D_Exit) to the ERTMS/ETCS external function (e.g. TCMS).

5.3.3.2 Note: The ERTMS/ETCS external function (e.g. TCMS) commands to cut off the traction when the max safe front end of the train reaches the point H.

5.3.3.3 Note: The ERTMS/ETCS external function (e.g. TCMS) commands to switch off the main circuit breaker when the max safe front end of the train reaches the point I.

5.3.3.4    Note: The ERTMS/ETCS external function (e.g. TCMS) commands to lower the pantograph when the max safe front end of the train reaches the point J.

5.3.3.5    Note: The ERTMS/ETCS external function (e.g. TCMS) commands the pantograph not to be lowered the when the min safe rear end of the train reaches the point K.

5.3.3.6    Note: The ERTMS/ETCS external function (e.g. TCMS) commands the main circuit not to be switched off when the min safe rear end of the train reaches the point L.

5.3.3.7    Note: The ERTMS/ETCS external function (e.g. TCMS) commands to change the traction to be available when the min safe rear end of the train reaches the point M.

5.3.3.8    Note: When the min safe rear end of the train reaches the point G the traction is available.

5.3.3.9    Note: The points H, I, J, K, L, M, and G are only for illustration for the sequence of the actions. The train could also control each pantograph separately and therefore react according to the location of the various pantographs, not according to the location of the train front/rear end as assumed in the figure.

5.3.3.10    Architecture

5.3.3.10.1   Only serial connection (bus) as defined in Chapter 4 is allowed.

5.3.3.11    Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_PG_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_PG_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-26 Coding for Lower Pantograph Command**

5.3.3.12    Safety Requirements

5.3.3.12.1   Safety requirements shall apply as defined in [13], chapter 2.


## 5.3.4    Pantograph – STM Orders

5.3.4.1    Architecture

5.3.4.1.1   Reference architecture as defined in Chapter 3 or serial interface is allowed.

### 5.3.4.2    Coding

| Name | Size | Meaning |
|------|------|---------|
| O_PG_C / OBU_TR_PG_Cmd | Binary output or (1 bit on bus) | 0: Lower Pantograph 1: Raise pantograph |

**Table 5-27 Coding for Pantograph Command – STM Orders**

### 5.3.4.3    Safety requirements

5.3.4.3.1    Safety requirements shall apply as defined in [13], chapter 2.

## 5.3.5    Air Tightness Area – Trackside orders
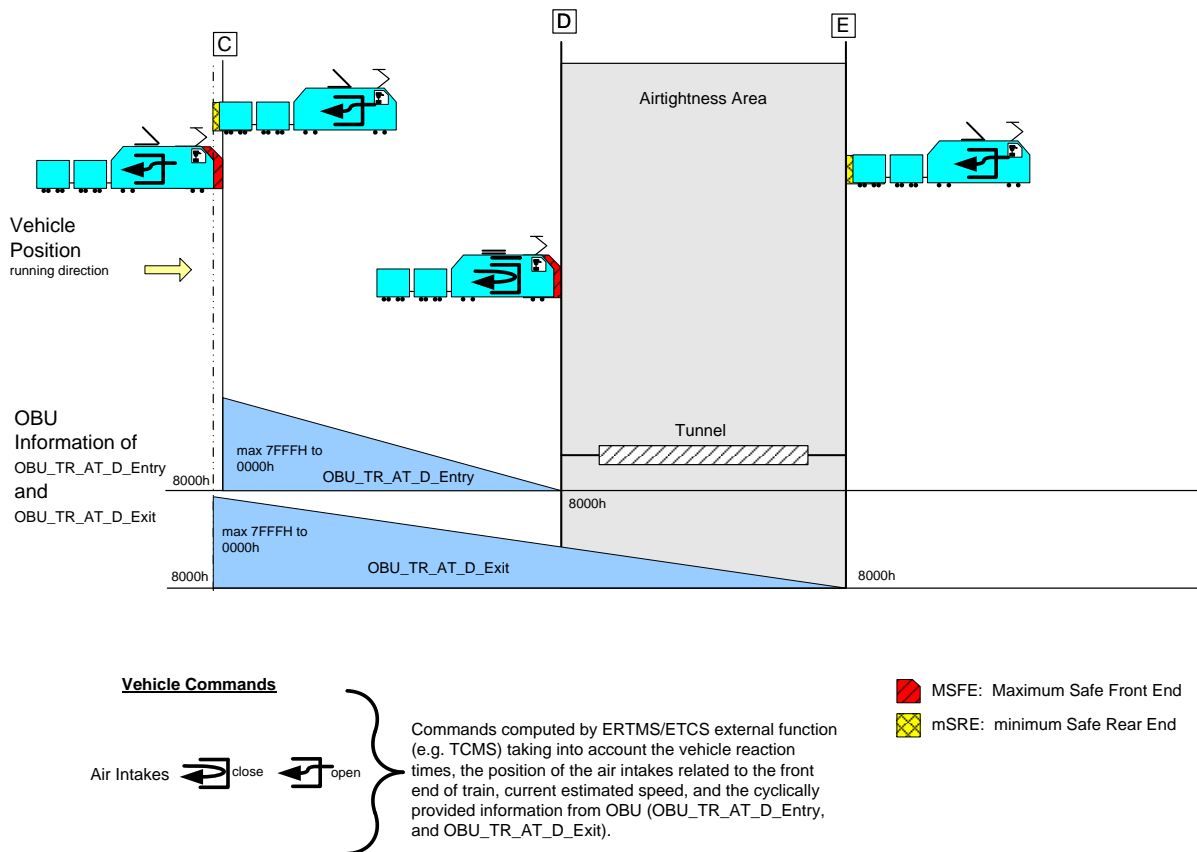


**Figure 5-10 Passing an Air Tightness Area**

5.3.5.1    Note: In [1], 5.20.4 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide the remaining distance to the start location point D

(OBU_TR_AT_D_Entry) and the remaining distance to the end location point E (OBU_TR_AT_D_Exit) to the ERTMS/ETCS external function (e.g. TCMS).

5.3.5.2    Architecture

5.3.5.3    Only serial connection (bus) as defined in Chapter 4 is allowed.

5.3.5.4    Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_AT_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_AT_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-28 Coding for Air Tightness Area Command**

5.3.5.5    Safety Requirements

5.3.5.5.1    Safety requirements shall apply as defined in [13], chapter 2.


## 5.3.6    Air Tightness – STM Orders

5.3.6.1    Architecture

5.3.6.1.1    Reference architecture as defined in Chapter 3 or serial interface is allowed.

5.3.6.2    Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_AT_Cmd<br>O_AT_C | Binary output or<br>(1 bits on bus) | 0: Open air conditioning intake<br>1: Close air conditioning intake |

**Table 5-29 Coding for Air Tightness – STM Orders**

5.3.6.3    Safety requirements

5.3.6.3.1    Safety requirements shall apply as defined in [13], chapter 2.

### 5.3.7 Station Platform

5.3.7.1  Note: In [1], 5.20.8 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide

- the remaining distance to the start location point D (OBU_TR_SP_D_Entry(K)),

- the remaining distance to the end location point E (OBU_TR_SP_D_Exit(K)),

- the height of the platform above rail level (OBU_TR_SP_Height(K)),

- and the position of the platform (OBU_TR_SP_Left(K) and OBU_TR_SP_Right(K))

to the ERTMS/ETCS external function (e.g. TCMS).

5.3.7.2  Architecture

5.3.7.2.1  Only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.3.7.3 Coding

| Name | Size | Meaning |
|---|---|---|
| OBU_TR_SP_D_Entry(K) | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_SP_D_Exit(K) | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |
| OBU_TR_SP_Height(K)_Bit0, OBU_TR_SP_Height(K)_Bit1, OBU_TR_SP_Height(K)_Bit2, OBU_TR_SP_Height(K)_Bit3 | 4 bits | The height of the platform above rail level (derived from M_PLATFORM [1], 7.5.1.75.5). Coding (Bit 3 / Bit 2 / Bit 1 / Bit 0): 0000: 200 mm 0001: 300-380 mm 0010: 550 mm 0011: 580 mm 0100: 680 mm 0101: 685 mm 0110: 730 mm 0111: 760 mm 1000: 840 mm 1001: 900 mm 1010: 915 mm 1011: 920 mm 1100: 960 mm 1101: 1100 mm 1110 – 1111: Spare |
| OBU_TR_SP_Right(K), OBU_TR_SP_Left(K) | 2 bits | The position of the platform (derived from Q_PLATFORM [1], 7.5.1.126.2). Coding (OBU_TR_SP_Left(K) (Bit 1) / OBU_TR_SP_Right(K) (Bit 0)): 00: no platform (default value) 01: right 10: left 11: both sides |

**Table 5-30 Coding for Station Platform**

#### 5.3.7.3.1 Note:

K= number of stored information in the on-board (see [10], 4.3.2.1.1 t))

.

K= 0 no valid information

K= 1 first station platform

K= 2 second station platform

…

K= 5 fifth station platform

5.3.7.3.2 When receiving "station platform" information in which, for a value of index K, both the variables OBU_TR_SP_D_Entry(K) and OBU_TR_SP_D_Exit(K) are set to the special value 8000h (see Table 5-23 and Table 5-24 respectively), the vehicle shall not consider the variables OBU_TR_SP_Height(K)_Bit0, OBU_TR_SP_Height(K)_Bit1, OBU_TR_SP_Height(K)_Bit2, OBU_TR_SP_Height(K)_Bit3, OBU_TR_SP_Left(K) and OBU_TR_SP_Right(K) contained in this information.

5.3.7.4 Safety Requirements

5.3.7.4.1 Safety requirements shall apply as defined in [13], chapter 2.

**Figure 5-11 Station Platform**

### 5.3.8 Powerless Section with Main Power Switch to be Switched Off – Trackside Orders

5.3.8.1 Note: In [1], 5.20.3 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide the remaining distance to the start location point D

(OBU_TR_MPS_D_Entry) and the remaining distance to the end location point E (OBU_TR_MPS_D_Exit) to the ERTMS/ETCS external function (e.g. TCMS).

5.3.8.2     Note: The ERTMS/ETCS external function (e.g. TCMS) commands to cut off the traction before the max safe front end of the train reaches the point H.

5.3.8.3     Note: The ERTMS/ETCS external function (e.g. TCMS) commands to switch off the main circuit breaker before the max safe front end of the train reaches the point I.

5.3.8.4     Note: The ERTMS/ETCS external function (e.g. TCMS) commands the main circuit not to be switched off when the min safe rear end of the train reaches the point L.

5.3.8.5     Note: The ERTMS/ETCS external function (e.g. TCMS) commands to change the traction to be available when the min safe rear end of the train reaches the point M.

5.3.8.6     Note:  When the min safe rear end of the train reaches the point G the traction is available.

5.3.8.7     Note: The points H, I, L, M, and G are only for illustration for the sequence of the actions.

5.3.8.8     Architecture

5.3.8.8.1   Only serial connection (bus) as defined in Chapter 4 is allowed.
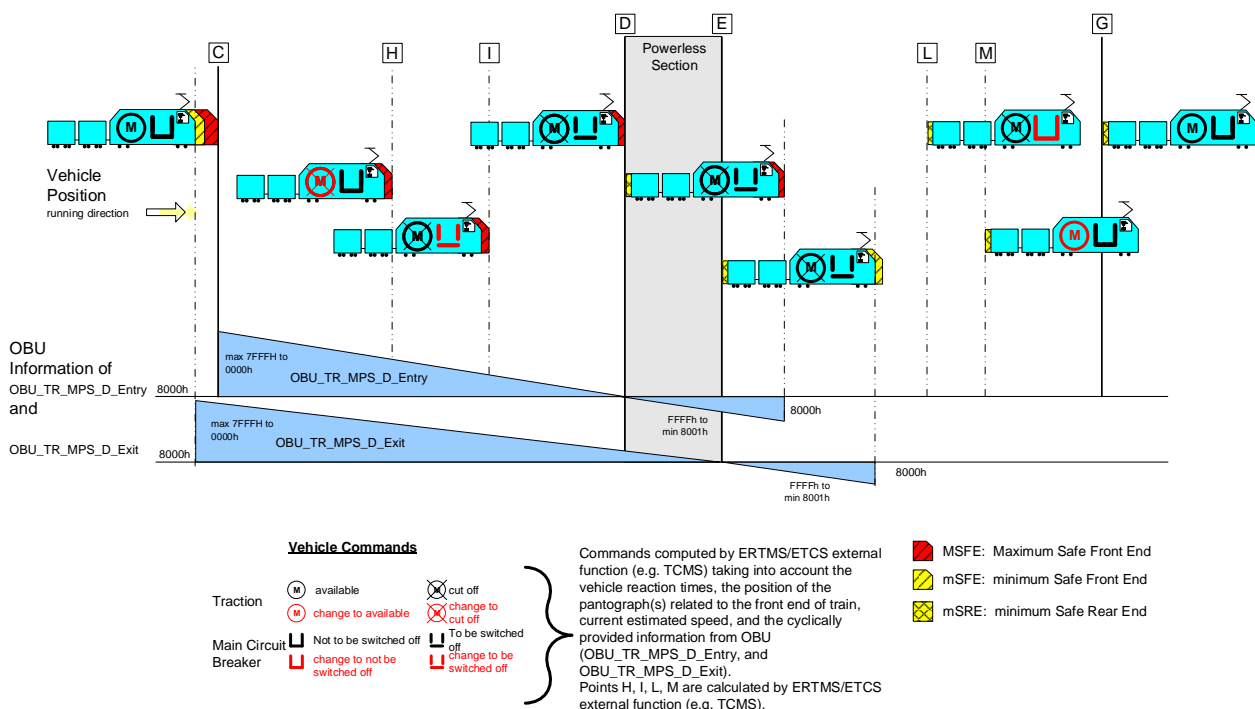


**Figure 5-12 Passing a Powerless Section with Main Power Switch to be Switched Off**

### 5.3.8.9 Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_MPS_D_Entry | 16 bits | See Table 5-23 Resolution: 1 ≡ 1 m. |
| OBU_TR_MPS_D_Exit | 16 bits | See Table 5-24 Resolution: 1 ≡ 1 m. |

**Table 5-31 Coding for passing a Powerless Section with Main Power Switch to be Switched Off**

### 5.3.8.10 Safety Requirements

5.3.8.11 Safety requirements shall apply as defined in [13], chapter 2.


## 5.3.9 Main Power Switch – STM Orders

### 5.3.9.1 Architecture

5.3.9.1.1 Reference architecture as defined in Chapter 3 or serial interface is allowed.

### 5.3.9.2 Coding

| Name | Size | Meaning |
|------|------|---------|
| O_MPS_C / OBU_TR_MPS_Cmd | Binary output or (1 bit on bus) | 0: Main Power Switch to be switched off 1: Main Power Switch NOT to be switched off |

**Table 5-32 Coding for Main Power Switch – STM Orders**

### 5.3.9.3 Safety requirements

5.3.9.3.1 Safety requirements shall apply as defined in [13], chapter 2.


## 5.3.10 Change of Allowed Current Consumption

5.3.10.1 Note: In [1], 5.20.7 it is specified between which locations the ERTMS/ETCS on-board equipment shall provide the remaining distance (OBU_TR_ACC_D_Change) to the location of change of allowed current consumption (point F) and the new current limit (OBU_TR_ACC_Limit) to the ERTMS/ETCS external function (e.g. TCMS).

### 5.3.10.2 Architecture

5.3.10.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.
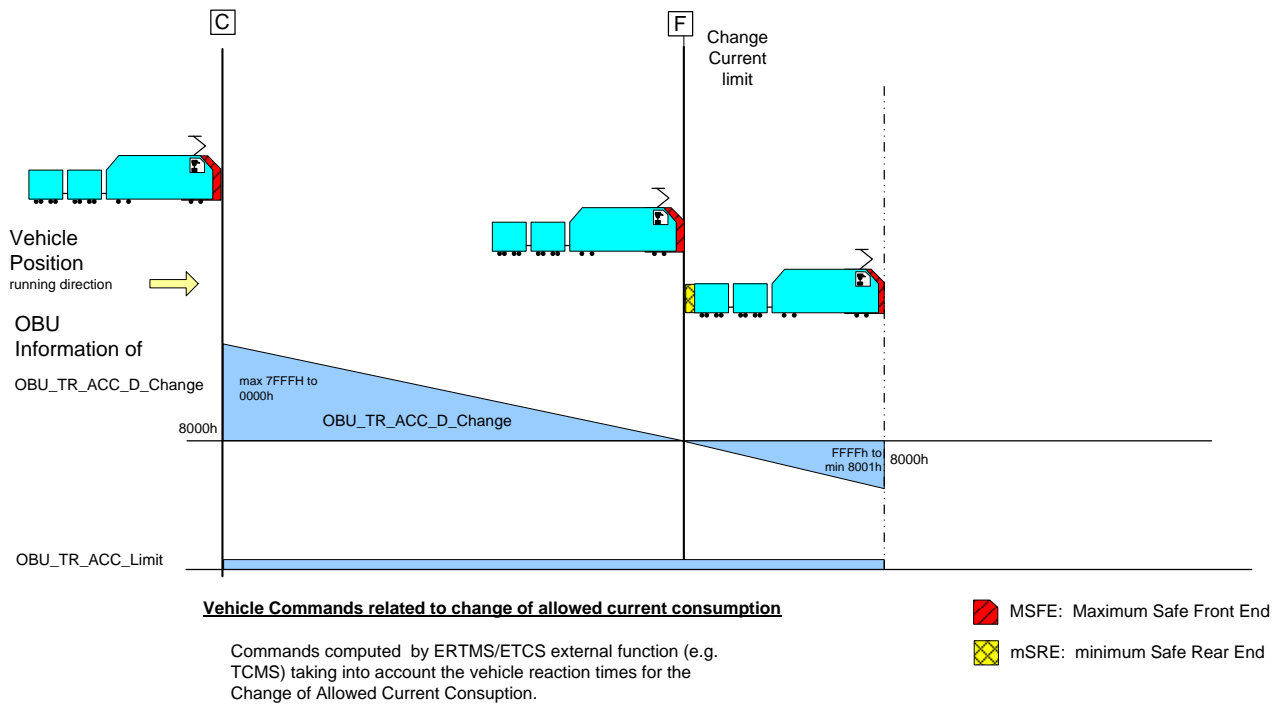
**Figure 5-13 Change of Allowed Current Consumption**

### 5.3.10.3 Coding

| Name | Size | Meaning |
|------|------|---------|
| OBU_TR_ACC_D_Change | 16 bits | See Table 5-23, resolution: 1 ≡ 1 m. |
| OBU_TR_ACC_Limit | 10 bits | New current limit (M_CURRENT). (For coding, Min value and Max value refer to M_CURRENT as defined in [1], 7.5.1.62.1). Only 10 bits are used. The values from 1024 to 65535 are spare values. |

**Table 5-33 Coding for Change of Allowed Current Consumption**

5.3.10.3.1 When receiving "change of allowed current consumption" information in which the variable OBU_TR_ACC_D_Change is set to the special value 8000h (see Table 5-23), the vehicle shall not consider the variable OBU_TR_ACC_Limit contained in this information.

5.3.10.4    Safety Requirements

5.3.10.5    Safety requirements shall apply as defined in [13], chapter 2.

## 5.3.11    Engine Orientation in Supervised Manoeuvre

5.3.11.1    General

5.3.11.1.1  This output is generated by the ERTMS/ETCS on-board in Supervised Manoeuvre mode to indicate to the train how to interpret the relevant track condition outputs, see illustration in Figure 5-14.
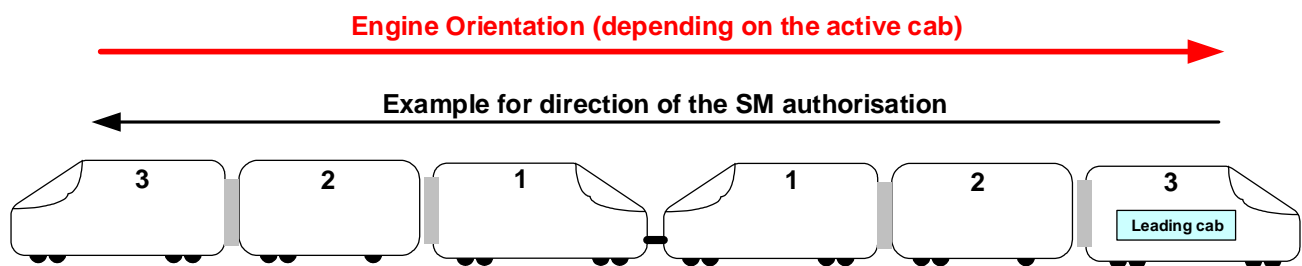


**Figure 5-14 Illustration of the term Engine Orientation**

5.3.11.2    Architecture

5.3.11.2.1  Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.3.11.3    Coding

| O_EO_S / OBU_TR_EngOrientSM | Meaning |
|---|---|
| 0 | The engine orientation is the same as the one of the SM authorisation |
| 1 | The engine orientation is opposite to the one of the SM authorisation |

**Table 5-34 Coding for Engine Orientation in Supervised Manoeuvre**

5.3.11.4    Safety Requirements

5.3.11.4.1  Safety requirements shall apply as defined in [13], chapter 2.

### 5.3.12 Traction Cut-Off

5.3.12.1 General

5.3.12.1.1 The following signal is defined as the traction cut off as soon as the train passes the warning limit of the braking curve model as defined in [1] or as a consequence of an STM command (see Table 1-2).

5.3.12.1.2 Note: With traction cut-off the driving force is cut. Electrical traction could still be used for braking, depending on the specific vehicle implementation.

5.3.12.1.2.1 The Traction Cut-Off command is used as defined in [1] 3.13.9.3.2.3 a) and 3.13.2.2.8.1.

5.3.12.1.2.2 Architecture
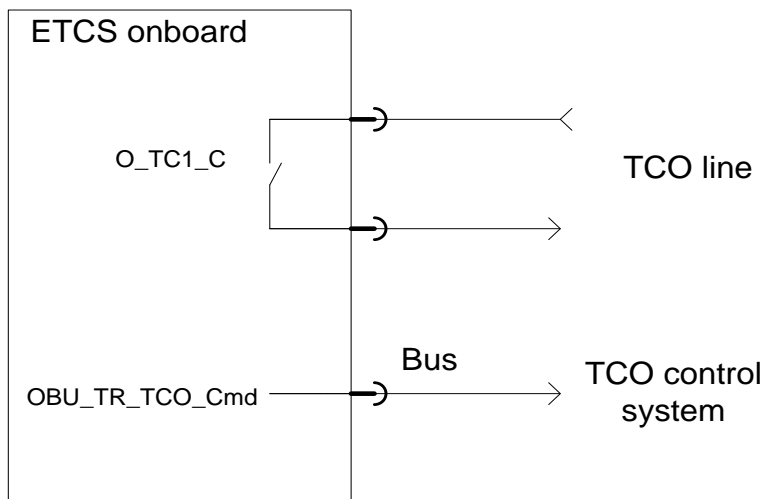


**Figure 5-15 TCO function: 1 TCO line and a serial interface**

5.3.12.2 Coding

| O_TC1_C | OBU_TR_TCO_Cmd | Meaning |
|---------|----------------|---------|
| 1 | 1 | Traction cut-off not commanded |
| 0 | 1 | Traction cut-off commanded. |
| 1 | 0 | Traction cut-off commanded. |
| 0 | 0 | Traction cut-off commanded. |

**Table 5-35 Coding for Traction Cut Off**

5.3.12.3 Safety Requirements

5.3.12.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.4 Signals for Train Status Information

### 5.4.1 Cab Status

5.4.1.1 Architecture

5.4.1.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.4.1.2 Coding

| T_CS_A / TR_OBU_CabStatusA | T_CS_B / TR_OBU_CabStatusB | Meaning |
|---|---|---|
| 0 | 0 | no cab active |
| 1 | 0 | Cab A active |
| 0 | 1 | Cab B active |
| 1 | 1 | Invalid |

**Table 5-36 Coding for Cab Status**

5.4.1.2.1 In case the ETCS on-board unit receives the status of two cabs (Cab A and Cab B), the status of Cab A shall be connected to the "Cab Status A" input and the status of Cab B shall be connected to the "Cab Status B" input.

5.4.1.2.2 Note: In case the train is fitted with two ETCS on-board units (one on each end of the train), it is sufficient to provide only the cab status signal related to the local cab.

5.4.1.3 Safety Requirements

5.4.1.3.1 Safety requirements shall apply as defined in [13], chapter 2.

### 5.4.2 Direction Controller

5.4.2.1 Architecture

5.4.2.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

### 5.4.2.2 Coding

| T_FW_S /<br>TR_OBU_DirectionFW | T_BW_S /<br>TR_OBU_DirectionBW | Meaning |
|---|---|---|
| 0 | 0 | Neutral (no direction selected) |
| 1 | 0 | Forward (relative to active cab) |
| 0 | 1 | Backward (relative to active cab) |
| 1 | 1 | Invalid |

**Table 5-37 Coding for Direction Controller**

### 5.4.2.3 Safety requirements

5.4.2.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.4.3 Train Integrity

### 5.4.3.1 Architecture

5.4.3.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.4.3.1.2 Note: The train length as acquired as train data from an external source (see section 5.5.4.3) may be also relevant for train integrity.

### 5.4.3.2 Coding

| T_TRI_S1_N / TR_OBU_ TrainIntegrity_ S1 | T_TRI_S1_I / TR_OBU_ TrainIntegrity_ S1_Not | T_TRI_S2_N / TR_OBU_ TrainIntegrity_ S2 | T_TRI_S2_I / TR_OBU_ TrainIntegrity_ S2_Not | Meaning |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Invalid |
| 0 | 0 | 0 | 1 | Invalid |
| 0 | 0 | 1 | 0 | Invalid |
| 0 | 0 | 1 | 1 | Invalid |
| 0 | 1 | 0 | 0 | Invalid |
| 0 | 1 | 0 | 1 | Train Integrity Lost |
| 0 | 1 | 1 | 0 | Train integrity status unknown |
| 0 | 1 | 1 | 1 | Invalid |
| 1 | 0 | 0 | 0 | Invalid |
| 1 | 0 | 0 | 1 | Invalid |
| 1 | 0 | 1 | 0 | Train integrity confirmed |
| 1 | 0 | 1 | 1 | Invalid |
| 1 | 1 | 0 | 0 | Invalid |
| 1 | 1 | 0 | 1 | Invalid |
| 1 | 1 | 1 | 0 | Invalid |
| 1 | 1 | 1 | 1 | Invalid |

**Table 5-38 Coding for Train Integrity**

### 5.4.3.3 Safety Requirements

5.4.3.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.4.4 Traction Status

### 5.4.4.1 Architecture

5.4.4.1.1 Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

### 5.4.4.2 Coding

| T_TR_S / TR_OBU_Traction_Status | Meaning |
|---|---|
| 0 | Traction is Off |
| 1 | Traction is On |

**Table 5-39 Coding for Traction Status (only for STM)**

5.4.4.2.1 Note: "Traction off" refers to traction zero or negative (electro-dynamic brake) whereas "traction on" refers when traction is positive.

### 5.4.4.3 Safety Requirements

5.4.4.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.4.5 Set Speed

### 5.4.5.1 Architecture

5.4.5.1.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.4.5.2 Coding

| Name | Size | Meaning | |
|---|---|---|---|
| TR_OBU_SetSpeedValue | 16 bits | 0 … 600 | Set speed in steps of 1 km/h up to 600 km/h |
| | | 601… 65535 | Spare values |

**Table 5-40 Coding for Set Speed value**

| Name | Size | Meaning |
|---|---|---|
| TR_OBU_SetSpeedDisplay | Binary output (1 bits on bus) | 1: set speed to be displayed<br>0: set speed not to be displayed |

**Table 5-41 Coding for Set Speed display**

### 5.4.5.3 Safety Requirements

5.4.5.3.1 Safety requirements shall apply as defined in [13], chapter 2.

## 5.5 Train Data

### 5.5.1 General

5.5.1.1.1 This section specifies two ways of providing train data to ETCS on-board via the Train Interface:

- The train data themselves.

- The train data are derived from type of train configuration information. The identifier is used by the ETCS on-board to select the appropriate train data set among the pre-configured ones.

5.5.1.1.2 The following sections specify which of these two ways applies for each train data element.

5.5.1.1.3 A "train data set" represents a set of train data consisting of all the data that are specified in 6.1.1.1 item 6.

5.5.1.1.4 The train data can be derived from type of train configuration input. This input is specified in 5.5.1.2. Which train data shall be derived from this input is configured on-board.

5.5.1.1.5 When the train does not provide a train data element the corresponding validity bit is set to 0, see 4.3.1.3.1. This might be a degraded situation, which has to be handled project specific (e.g. by using existing pre-defined values or train data have to be entered manually).

5.5.1.2 Type of Train Configuration

5.5.1.2.1 The type of train configuration input can be used to deduce the values of the train data (see list of the data in section 6.1.1.1, Table 6-1, no. 6).

5.5.1.2.2 The number of values of the "type of train configuration" to use and their meaning is configured on-board.

5.5.1.2.3 If no type of train configuration value is provided the validity bit shall be set to FALSE.

5.5.1.2.4 Architecture

5.5.1.2.4.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

## 5.5.1.2.5  Coding

| Name | Size | Meaning | |
|------|------|---------|--|
| TR_OBU_TypeTrainConfiguration | 5 bits | 0 … 31 | A train data set is selected among pre-configured train data sets input. |

**Table 5-42 Coding of variable Type of Train Configuration**

5.5.1.3  For ERTMS/ETCS on-board equipment principle regarding the consideration of the train data inputs received from the train interface see [6] §2.6.4.

## 5.5.2  Type of Train Data Entry

### 5.5.2.1  General

5.5.2.1.1  This input indicates the type of train data entry configuration to be applied (see clause 11.3.9.6 of [2] (DMI spec)).

### 5.5.2.2  Architecture

5.5.2.2.1  Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

### 5.5.2.3  Coding

| T_TT_S1 / TR_OBU_TypeTrainData_S1 | T_TT_S2 / TR_OBU_TypeTrainData_S2 | Meaning |
|-----------------------------------|-----------------------------------|---------|
| 0 | 0 | Invalid |
| 1 | 0 | Fixed |
| 0 | 1 | Flexible |
| 1 | 1 | Switchable |

**Table 5-43 Coding for Type of Train Data Entry**

### 5.5.2.4  Safety Requirements

5.5.2.4.1  Safety requirements shall apply as defined in [13], chapter 2.

### 5.5.3 Overall Consist Length Information

5.5.3.1.1 The train interface allows the ETCS on-board to determine the overall consist length values as follows:

- By selecting/calculating the adequate overall consist length value based on the "type of train configuration" input.

- By receiving the values of the overall consist length from the train interface.

5.5.3.2 Architecture

5.5.3.2.1 For the six overall consist lengths values the serial connection (bus) as defined in Chapter 4 is allowed.

| Name | Size | Meaning |
|---|---|---|
| TR_OBU_L_ CONSISTFRONTCABAMAX | 16 bits | The max consist length on the side of the engine corresponding to Cab A, counted from the end of the engine corresponding to the orientation of this cab A, and considering the coupling play and/or any other uncertainties in the consist length information, transmitted to the ERTMS/ETCS on-board in [m]. <br><br> For the coding refer to the definition in [1], 7.5.1.42.1. <br><br> Only 12 bits are used. The values from 4096 to 65535 are spare values. |
| TR_OBU_L_ CONSISTFRONTCABAMIN | 16 bits | The min consist length on the side of the engine corresponding to Cab A, counted from the end of the engine corresponding to the orientation of this cab A, and considering the coupling play and/or any other uncertainties in the consist length information, transmitted to the ERTMS/ETCS on-board in [m]. <br><br> For the coding refer to the definition in [1], 7.5.1.42.2. <br> Only 12 bits are used. The values from 4096 to 65535 are spare values. |

| TR_OBU_L_ CONSISTFRONTENGINENOM | 16 bits | The nominal consist length on the side of the engine corresponding to Cab A without any coupling play, counted from the end of the engine corresponding to the orientation of this cab A, transmitted to the ERTMS/ETCS on-board in [m]. |
|---|---|---|
| | | For the coding refer to the definition in [1], 7.5.1.42.3. |
| | | Only 12 bits are used. The values from 4096 to 65535 are spare values. |
| TR_OBU_L_ CONSISTREARCABAMAX | 16 bits | The max consist length on the side of the engine opposite to Cab A, counted from the end of the engine corresponding to the orientation of this cab A, and considering the coupling play and/or any other uncertainties in the consist length information, transmitted to the ERTMS/ETCS on-board in [m]. |
| | | For the coding refer to the definition in [1], 7.5.1.42.4. |
| | | Only 12 bits are used. The values from 4096 to 65535 are spare values. |
| TR_OBU_L_ CONSISTREARCABAMIN | 16 bits | The min consist length on the side of the engine opposite to Cab A, counted from the end of the engine corresponding to the orientation of this cab A, and considering the coupling play and/or any other uncertainties in the consist length information, transmitted to the ERTMS/ETCS on-board in [m]. |
| | | For the coding refer to the definition in [1], 7.5.1.42.5. |
| | | Only 12 bits are used. The values from 4096 to 65535 are spare values. |

| TR_OBU_L_ CONSISTREARCABANOM | 16 bits | The nominal consist length on the side of the engine opposite to Cab A without any coupling play, counted from the end of the engine corresponding to the orientation of this cab A, transmitted to the ERTMS/ETCS on-board in [m]. |
|---|---|---|
| | | For the coding refer to the definition in [1], 7.5.1.42.6. |
| | | Only 12 bits are used. The values from 4096 to 65535 are spare values. |

**Table 5-44 Coding for Overall Consist Length**

5.5.3.3     Safety Requirements

5.5.3.3.1   Safety requirements shall apply as defined in [13], chapter 2.

## 5.5.4      Other Train Data Information

5.5.4.1     General

5.5.4.1.1   The following solutions require a serial bus system connection between ERTMS/ETCS on-board equipment and train control system. Only some train data can be implemented on hard-wired interface. Such an implementation is an option (see Table 2-1 with footnote 1).

5.5.4.1.2   Note: The procedure "Changing Train Data from sources different from the driver" only starts if a change of input information, which affects train data, is detected on an ERTMS/ETCS on-board external interface (see [1], 5.17.2.2, S0). Therefore, the train data validated by the driver are not changed as long as inputs on the Train Interface, which affects these train data, do not change.

5.5.4.1.3   Note: Axle Number is a purely static data element and is set only by configuration in the ETCS on-board. These data are not part of train data by external sources in Subset 119.

5.5.4.1.4   Note: Also the List of National Systems Available On-board is out of scope of the standardized train interface. In [6] National System Isolation is related only to STMs.

5.5.4.1.5   Note: "Other international train category" is not transferred via Train Interface since "brake position" input is transferred.

### 5.5.4.2 Train Category  Cant Deficiency

5.5.4.2.1 The train interface allows the ETCS on-board to determine the cant deficiency value as follows:

- By selecting/calculating the adequate cant deficiency value based on the "type of train configuration" input.

- By receiving the value of the cant deficiency from the train interface.

5.5.4.2.2 Architecture for transferring the variable via TI

5.5.4.2.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

5.5.4.2.3 Coding

5.5.4.2.3.1 It is a 4 bit variable with a specific meaning as defined in [1], 7.5.1.82.2.

5.5.4.2.4 Safety Requirements

5.5.4.2.4.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.5.4.3 Train Length

5.5.4.3.1 The train interface allows the ETCS on-board to determine the train length value as follows:

- By selecting/calculating the adequate train length value based on the "type of train configuration" input.

- By receiving the value of the train length from the train interface.

5.5.4.3.2 Architecture for transferring the variable via TI

5.5.4.3.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

5.5.4.3.3 Coding

5.5.4.3.3.1 The train length is transmitted to the ERTMS/ETCS on-board as 12 bit variable in [m] according to [1], 7.5.1.56.

5.5.4.3.4 Safety Requirements

5.5.4.3.4.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.5.4.4 Traction / Brake Parameters

5.5.4.4.1 General

5.5.4.4.1.1 The traction / brake parameters consist of the time for traction cut-off (T_traction_cut_off) (traction model) and several brake models.

5.5.4.4.1.2 A brake model parameter set corresponding to each different train configuration or different actual states of the brake system (e. g. brakes defective) shall be predefined (by the train integrator) and stored in the ERTMS/ETCS on-board.

5.5.4.4.1.3 Note: Correction factors for the emergency deceleration are not transmitted via TI. This data is pre-configured in the ETCS on-board (linked to each EB speed dependent deceleration model, see [1] 3.13.2.2.9.1.2).

5.5.4.4.1.4 Note: Correction factor for gradient on normal service deceleration is not transmitted via TI. This data is pre-configured in the ETCS on-board.

5.5.4.4.1.5 Note: Taking into account the last two clauses the following parameters have to be considered as traction / brake parameters from the parameters listed in [1], 3.18.3.2 :

- Traction model

- Brake build up time model and speed dependent deceleration model

- Brake percentage

- Brake position

- Nominal rotating mass


5.5.4.4.2 Traction Model

5.5.4.4.2.1 The train interface allows the ETCS on-board to determine the traction model value (value of time delay T_traction_cut_off as per [1] 3.13.2.2.2.1) as follows:

- By selecting/calculating the adequate traction model value based on the "type of train configuration" input.

5.5.4.4.2.2 Note: the traction model value can depend on the train length value and the selection of the adequate traction model value can therefore be based on the "type of train configuration" input.


5.5.4.4.3 Brake build up time model and speed dependent deceleration model:

5.5.4.4.3.1 The train interface allows the ETCS on-board to determine the brake build up time model values (T_brake_emergency values and T_brake_service values, see [1] 3.13.2.2.3.2) and speed dependent deceleration model values (A_brake_emergency(V) and A_brake_service(V), see [1] 3.13.2.2.3.1) as follows:

- By selecting the train data set including the adequate brake build up time model values and the speed dependent deceleration model values based on the "type of train configuration" input plus the status of special brakes (see [1] 3.13.2.2.6.2).

- By calculating the adequate brake build up time value in a project specific way using the conversion models based on 'brake position' and 'train length' and by calculating the adequate speed dependent deceleration model values by applying the conversion model to the brake percentage value.

5.5.4.4.3.2   The speed dependent deceleration models related to the normal service brake are pre-configured in the ETCS on-board and the selection of the appropriate model is based on the service brake deceleration at zero speed, A_brake_service(V=0), deduced from the full service brake model and the brake position (see 5.5.4.4.5).

### 5.5.4.4.4   Brake percentage

5.5.4.4.4.1   The train interface allows the ETCS on-board to determine the brake percentage value as follows:

- By selecting/calculating the adequate brake percentage value based on the "type of train configuration" input.

- By receiving the value of the brake percentage from the train interface based on a "brake percentage" input, which is acquired by other means than ETCS train data entry.

5.5.4.4.4.2   Architecture for transferring the variable via TI

5.5.4.4.4.2.1   Only serial connection (bus) as defined in Chapter 4 is allowed.

5.5.4.4.4.3   Coding

| Name | Size | Meaning | |
|------|------|---------|--|
| TR_OBU_BrakePercentage | 8 bits | 0 … 9 | Spare values |
| | | 10 … 250 | See [1], A.3.11, resolution: 1 % |
| | | 251 … 255 | Spare values |

**Table 5-45 Coding of variable Brake Percentage**

### 5.5.4.4.5   Brake position

5.5.4.4.5.1   The train interface allows the ETCS on-board to determine the brake position value as follows:

- By selecting/calculating the adequate brake position value based on the "type of train configuration" input.

- By receiving the value of the brake position from the train interface which is read e.g. from a switch installed at vehicle level.

5.5.4.4.5.2   Architecture for transferring the variable via TI

5.5.4.4.5.2.1   Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.5.4.4.5.3   Coding

| T_BP_S1_N / TR_OBU_ BrakePosition1 | T_BP_S1_I / TR_OBU_Brake Position1_Not | T_BP_S2_N / TR_OBU_ BrakePosition2 | T_BP_S2_I / TR_OBU_Brake Position2_Not | Meaning (see [1], 3.13.2.2.4.1) |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Invalid |
| 0 | 0 | 0 | 1 | Invalid |
| 0 | 0 | 1 | 0 | Invalid |
| 0 | 0 | 1 | 1 | Invalid |
| 0 | 1 | 0 | 0 | Invalid |
| 0 | 1 | 0 | 1 | Invalid |
| 0 | 1 | 1 | 0 | Passenger train in P |
| 0 | 1 | 1 | 1 | Invalid |
| 1 | 0 | 0 | 0 | Invalid |
| 1 | 0 | 0 | 1 | Freight train in P |
| 1 | 0 | 1 | 0 | Freight train in G |
| 1 | 0 | 1 | 1 | Invalid |
| 1 | 1 | 0 | 0 | Invalid |
| 1 | 1 | 0 | 1 | Invalid |
| 1 | 1 | 1 | 0 | Invalid |
| 1 | 1 | 1 | 1 | Invalid |

**Table 5-46 Coding for Brake Position**

**5.5.4.4.6　Nominal rotating mass**

5.5.4.4.6.1　The train interface allows the ETCS on-board to determine the nominal rotating mass value as follows:

- By selecting/calculating the adequate nominal rotating mass value based on the "type of train configuration" input.

**5.5.4.4.7　Safety Requirements**

5.5.4.4.7.1　Safety requirements shall apply as defined in [13], chapter 2.

**5.5.4.5　Maximum Train Speed**

5.5.4.5.1　The train interface allows the ETCS on-board to determine the maximum train speed value as follows:

- By selecting/calculating the adequate maximum train speed value based on the "type of train configuration" input.

5.5.4.5.2　The maximum train speed is a 7 bit variable with values in steps of 5 km/h according to [1], 7.5.1.160.

**5.5.4.5.3　Safety Requirements**

5.5.4.5.3.1　Safety requirements shall apply as defined in [13], chapter 2.

**5.5.4.6　Loading Gauge**

5.5.4.6.1　The train interface allows the ETCS on-board to determine the loading gauge value as follows:

- By selecting/calculating the adequate loading gauge value based on the "type of train configuration" input.

- By receiving the value of the loading gauge from the train interface.

5.5.4.6.2　Architecture for transferring the variable via TI

5.5.4.6.2.1　Only serial connection (bus) as defined in Chapter 4 is allowed

5.5.4.6.3　Coding

5.5.4.6.3.1　The loading gauge is transmitted as 8 bit variable with values according to [1], 7.5.1.68.

### 5.5.4.6.4 Safety Requirements

5.5.4.6.4.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.5.4.7 Axle Load Category

5.5.4.7.1 The train interface allows the ETCS on-board to determine the axle load category value as follows:

- By selecting/calculating the adequate axle load category value based on the "type of train configuration" input.

- By receiving the value of the axle load category from the train interface.

### 5.5.4.7.2 Architecture for transferring the variable via TI

5.5.4.7.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.5.4.7.3 Coding

5.5.4.7.3.1 The axle load category is transmitted as 7 bit variable with values according to [1], 7.5.1.62.

### 5.5.4.7.4 Safety Requirements

5.5.4.7.4.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.5.4.8 Traction system(s) accepted by the engine

5.5.4.8.1 The train interface allows the ETCS on-board to determine the traction system(s) accepted by the engine value as follows:

- By selecting/calculating the adequate traction system(s) accepted by the engine values based on the "type of train configuration" input.

- By receiving the list of available traction systems accepted by the engine from the train interface.

### 5.5.4.8.2 Architecture for transferring the variable via TI

5.5.4.8.2.1 Only serial connection (bus) as defined in Chapter 4 is allowed.

### 5.5.4.8.3 Coding

| Name | Size | Meaning | |
|---|---|---|---|
| TR_OBU_SupTractionSys | 32 bits | 0 | Spare value |
| | | 1 … 31 | A list of available traction systems is provided. This list is transmitted as a binary mask, indicating which traction systems configured in the on-board shall be considered as available (1 is available, 0 is not available). The assignment shall be defined according to chapter 6 "Configuration Management". |

**Table 5-47 Coding of Traction System(s) Accepted by the Engine**

5.5.4.8.3.1 The configured list of available traction systems shall contain 31 combinations of NID_CTRACTION with values according to Subset-026 [1], 7.5.1.86.1 and M_VOLTAGE with values according to Subset-026 [1], 7.5.1.78

5.5.4.8.3.2 Note: It has to be considered that new value definitions of NID_CTRACTION are possible due to updates of [11].

5.5.4.8.3.3 Note: The maximum number of traction systems managed by a train is intrinsically limited to 31. This limit comes from the N_ITER variable in train data messages sent to RBC in Subset-026 [1].

### 5.5.4.8.4 Safety Requirements

5.5.4.8.4.1 Safety requirements shall apply as defined in [13], chapter 2.


### 5.5.4.9 Train Fitted with Airtight System

5.5.4.9.1 The train interface allows the ETCS on-board to determine the train fitted with airtight system value as follows:

- By selecting/calculating the adequate train fitted with airtight system value based on the "type of train configuration" input.

- By receiving the value of the train fitted with airtight system from the train interface.

5.5.4.9.2    Architecture for transferring the variable via TI

5.5.4.9.2.1    Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.5.4.9.3    Coding

| T_FAT_S / TR_OBU_AirTightFitted | Meaning |
|---|---|
| 0 | Train not fitted with airtight system. |
| 1 | Train fitted with airtight system. |

**Table 5-48 Coding for Train Fitted with Airtight System**

5.5.4.9.4    Safety Requirements

5.5.4.9.4.1    Safety requirements shall apply as defined in [13], chapter 2.

# 5.6      Additional Data

## 5.6.1      Train Running Number

5.6.1.1    Architecture

5.6.1.1.1    Only serial connection (bus) as defined in Chapter 4 is allowed.

5.6.1.2    Coding

| Name | Size | Meaning |
|---|---|---|
| TR_OBU_NID_OPERATIONAL | 32 bits | For coding refer to NID_OPERATIONAL as defined in [1], 7.5.1.92. The NID_OPERATIONAL consists of up to 8 digits which are entered left adjusted into the data field, the leftmost digit is the digit to be entered first (Binary Coded Decimal). In case the NID_OPERATIONAL is shorter than 8 digits, the remaining space is to be filled with special character "F". For each digit the values from A to E are spare values. "FFFF FFFF" is spare value. |

**Table 5-49 Coding for Train Running Number**

5.6.1.3    Safety Requirements

5.6.1.3.1    Safety requirements shall apply as defined in [13], chapter 2.


# 5.7    National System Isolation

5.7.1.1    Architecture

5.7.1.1.1    Reference architecture as defined in Chapter 3 or serial connection (bus) as defined in Chapter 4 is allowed.

5.7.1.2    Coding

5.7.1.2.1    Due to the fact that there are multiple existing NTC systems, it shall be possible to configure up to at least 16 (see [3]) signals referring to different national systems.

5.7.1.2.2    Depending on the safety level of the NTC system one signal or two signals are needed.

| T_IS_S_Nx / ISSx | Meaning |
|---|---|
| 0 | NTCx not isolated |
| 1 | NTCx isolated |

**Table 5-50 Coding for National System Isolated (in case the NTCx safety level requires only one signal)**

| T_IS_S_Nx / ISSx | T_IS_S_Ix / ISS_Notx | Meaning |
|---|---|---|
| 0 | 0 | Invalid |
| 0 | 1 | NTCx not isolated |
| 1 | 0 | NTCx isolated |
| 1 | 1 | Invalid |

**Table 5-51 Coding for National System Isolated (in case the NTCx safety level requires two signals)**


5.7.1.3    Safety Requirements

5.7.1.3.1    Safety requirements shall apply as defined in [13], chapter 2.

# 6. CONFIGURATION MANAGEMENT

6.1.1.1 The following table lists the configuration data related to the Train Interface, which shall be considered for offline agreement.

| No. | Configuration Items | Description |
|---|---|---|
| 1. | cstUUID | Unique consist identifier, UUID of the consist<br><br>ARRAY[16] OF UNSIGNED8 |
| 2. | Train Interface version X applicable for the interface | The applicable Train Interface version X is the version implemented by both the vehicle and the ERTMS/ETCS on-board equipment.<br><br>X=1: SS-119 ed. 0.0.13 is implemented<br><br>X=2: SS-119 ed. 1.1.0 is implemented<br><br>X=3: SS-119 ed. 1.3.0 is implemented |
| 3. | Transient period time t_transient_period_inputs for Boolean OBU Inputs | Unit: ms<br><br>Range: 0-1000<br><br>Resolution: 1 ms |
| 4. | Transient period time t_transient_period_outputs for Boolean OBU Outputs | Unit: ms<br><br>Range: 0-1000<br><br>Resolution: 1 ms |
| 5. | List of traction systems supported by the train | The list shall contain 31 combinations of {M_VOLTAGE; NID_CTRACTION}<br><br>Coding of NID_CTRACTION: 10 bit variable with values according to Subset-026 [1], 7.5.1.86.1<br><br>Coding of M_VOLTAGE: 4 bit variable with values according to Subset-026 [1], 7.5.1.78 |

| | | | |
|---|---|---|---|
| 6. | Train Data Set based on the "type of train configuration" input. | The following lines of no. 6. describe the elements corresponding to a certain train data set; see coding in 5.5.1.2.5. | |
| | Overall Consist Length | See Table 5-44 | |
| | Cant Deficiency | See [1] 7.5.1.82.2. | |
| | Train length | See [1] A.3.11 | |
| | Brake model parameter set<br>• Traction model<br><br>• Brake build up time model values based in addition also on the status of special brakes<br>• Speed dependent deceleration model values based in addition also on the status of special brakes<br>• Brake percentage<br>• Brake position<br>• Nominal rotating mass | • T_traction_cut_off as per [1] 3.13.2.2.2.1<br><br>• T_brake_emergency values and T_brake_service values, see [1] 3.13.2.2.3.2<br><br>• A_brake_emergency(V) and A_brake_service(V), see [1] 3.13.2.2.3.1<br><br>• See [1] A.3.11<br>• See coding in 5.5.4.4.5.3<br>• Unit: %; resolution: 1% | |
| | Maximum train speed | See [1] A.3.11 | |
| | Loading gauge | See [1] A.3.11 | |
| | Axle load category | See [1] A.3.11 | |
| | Traction system(s) accepted by the engine | See coding in 5.5.4.8.3 | |
| | Train fitted with airtight system | See [1] A.3.11 and coding in 5.5.4.9.3 | |
| 7. | Way of providing Train Data | See [6], clause 2.6.4 with the possibilities to be configured for all the train data in the following lines | |
| | Overall Consist Length | | |
| | Cant Deficiency | | |
| | Train length | | |

| | | Brake model parameter set <br> • Traction model <br> • Brake build up time model values <br> • Speed dependent deceleration model values <br> • Brake percentage <br> • Brake position <br> • Nominal rotating mass | |
| --- | --- | --- | --- |
| | | Maximum train speed | |
| | | Loading gauge | |
| | | Axle load category | |
| | | Traction system(s) accepted by the engine | |
| | | Train fitted with airtight system | |
| 8. | | National System Isolation | Configuration which of the available national systems corresponds to which NTC variables NTC1 – NTC16 for NTC Isolation input. |

**Table 6-1 Configuration data related to the Train Interface**

6.1.1.2   Note: For serial bus the user data version (udv) in the SDT trailer (see [17]) is set according to the selected interface version X.

# 7. APPENDIX A – PROFINET SIGNAL AND PACKET DEFINITIONS

### 7.1.1 TR Packet 1

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity1 (part 1) | UNSIGNED8 | Q_P1_Valid1_1 | 0.0 |
| Validity1 (part 2) | UNSIGNED8 | Q_P1_Valid1_2 | 1.0 |
| Validity2 (part 1) | UNSIGNED8 | Q_P1_Valid2_1 | 2.0 |
| Validity2 (part 2) | UNSIGNED8 | Q_Spare1 | 3.0 |
| TR_OBU_TrainSleep | BOOLEAN1 | Q_TrainSleep | 4.0 |
| TR_OBU_TrainSleep_Not | BOOLEAN1 | Q_TrainSleep_N | 4.1 |
| TR_OBU_PassiveShunting | BOOLEAN1 | Q_PassiveShunt | 4.2 |
| TR_OBU_NLEnabled | BOOLEAN1 | Q_NLEnabled | 4.3 |
| TR_OBU_DirectionFW | BOOLEAN1 | Q_DirectionFW | 4.4 |
| TR_OBU_DirectionBW | BOOLEAN1 | Q_DirectionBW | 4.5 |
| TR_OBU_CabStatusA | BOOLEAN1 | Q_CabStatusA | 4.6 |
| TR_OBU_CabStatusB | BOOLEAN1 | Q_CabStatusB | 4.7 |
| TR_OBU_TypeTrainData_S1 | BOOLEAN1 | Q_TypeTrainData1 | 5.0 |

| TR Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| TR_OBU_TypeTrainData_S2 | BOOLEAN1 | Q_TypeTrainData2 | 5.1 |
| Spare1 | BOOLEAN1 | Q_Spare2 | 5.2 |
| Spare2 | BOOLEAN1 | Q_Spare3 | 5.3 |
| TR_OBU_Traction_Status | BOOLEAN1 | Q_TractionStatus | 5.4 |
| Spare3 | BOOLEAN1 | Q_Spare4 | 5.5 |
| TR_OBU_SetSpeedDisplay | BOOLEAN1 | Q_SetSpeedDisp | 5.6 |
| Spare4 | BOOLEAN1 | Q_Spare5 | 5.7 |
| TR_OBU_BrakePressure | UNSIGNED8 | Q_BrkPressure | 6.0 |
| TR_OBU_Brake_Status | UNSIGNED8 | Q_BrakeStatus | 7.0 |
| TR_OBU_NTCIsolated | UNSIGNED16 | Q_NTCIsol | 8.0 |
| TR_OBU_SetSpeedValue | UNSIGNED16 | Q_SetSpeedVal | 10.0 |
| TR_OBU_NTCIsolated_Not | UNSIGNED16 | Q_NTCIsol_N | 12.0 |

### 7.1.2 TR Packet 2

| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity1 (part 1) | UNSIGNED8 | Q_P2_Valid1_1 | 0.0 |
| Validity1 (part 2) | UNSIGNED8 | Q_P2_Valid1_2 | 1.0 |
| Validity2 (part 1) | UNSIGNED8 | Q_P2_Valid2_1 | 2.0 |
| Validity2 (part 2) | UNSIGNED8 | Q_P2_Valid2_2 | 3.0 |
| Spare1 | BOOLEAN1 | Q_Spare1 | 4.0 |
| Spare2 | BOOLEAN1 | Q_Spare2 | 4.1 |
| TR_OBU_BrakePosition1 | BOOLEAN1 | Q_BrakePos1 | 4.2 |
| TR_OBU_BrakePosition1_Not | BOOLEAN1 | Q_BrakePos1_N | 4.3 |
| TR_OBU_BrakePosition2 | BOOLEAN1 | Q_BrakePos2 | 4.4 |
| TR_OBU_BrakePosition2_Not | BOOLEAN1 | Q_BrakePos2_N | 4.5 |
| TR_OBU_AirTightFitted | BOOLEAN1 | Q_AirTightFitted | 4.6 |
| Spare3 | BOOLEAN1 | Q_Spare3 | 4.7 |
| TR_OBU_TrainIntegrity_S1 | BOOLEAN1 | Q_TrainInt_S1 | 5.0 |
| TR_OBU_TrainIntegrity_S1_Not | BOOLEAN1 | Q_TrainInt_S1_N | 5.1 |
| TR_OBU_TrainIntegrity_S2 | BOOLEAN1 | Q_TrainInt_S2 | 5.2 |

| TR Packet 2 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| TR_OBU_TrainIntegrity_S2_Not | BOOLEAN1 | Q_TrainInt_S2_N | 5.3 |
| Spare5 | BOOLEAN1 | Q_Spare4 | 5.4 |
| Spare6 | BOOLEAN1 | Q_Spare5 | 5.5 |
| Spare8 | BOOLEAN1 | Q_Spare6 | 5.6 |
| Spare9 | BOOLEAN1 | Q_Spare7 | 5.7 |
| Spare4 | UNSIGNED8 | Q_Spare8 | 6.0 |
| TR_OBU_TypeTrainConfiguration | UNSIGNED8 | Q_TrainComp | 7.0 |
| TR_OBU_BrakePercentage | UNSIGNED8 | Q_BrakePerc | 8.0 |
| TR_OBU_LoadingGauge | UNSIGNED8 | Q_LoadGauge | 9.0 |
| TR_OBU_AxleLoadCat | UNSIGNED8 | Q_AxleLoadCat | 10.0 |
| TR_OBU_TrainCatCantDef | UNSIGNED8 | Q_TrainCatCD | 11.0 |
| TR_OBU_TrainLength | UNSIGNED16 | Q_TrainLength | 12.0 |
| Spare10 | UNSIGNED16 | Q_Spare9 | 14.0 |
| TR_OBU_SupTractionSys | UNSIGNED32 | Q_SupTracSys | 16.0 |
| TR_OBU_NID_OPERATIONAL | UNSIGNED32 | Q_NidOp | 20.0 |

### 7.1.3    TR Packet 3

| TR Packet 3 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity1 (part 1) | UNSIGNED8 | Q_P3_Valid1_1 | 0.0 |
| Validity1 (part 2) | UNSIGNED8 | Q_Spare1 | 1.0 |
| Validity2 (part 1) | UNSIGNED8 | Q_Spare2 | 2.0 |
| Validity2 (part 2) | UNSIGNED8 | Q_Spare3 | 3.0 |
| TR_OBU_ L_CONSISTFRONTCABAMAX | UNSIGNED16 | Q_L_CFrontCAMax | 4.0 |
| TR_OBU_ L_CONSISTFRONTCABAMIN | UNSIGNED16 | Q_L_CFrontCAMin | 6.0 |
| TR_OBU_ L_CONSISTFRONTCABANOM | UNSIGNED16 | Q_L_CFrontCANom | 8.0 |
| TR_OBU_ L_CONSISTREARCABAMAX | UNSIGNED16 | Q_L_CRearCAMax | 10.0 |
| TR_OBU_ L_CONSISTREARCABAMIN | UNSIGNED16 | Q_L_CRearCAMin | 12.0 |
| TR_OBU_ L_CONSISTREARCABANOM | UNSIGNED16 | Q_L_CRearCANom | 14.0 |

### 7.1.4    OBU Packet 1

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity1 (part 1) | UNSIGNED8 | I_P1_Valid1_1 | 0.0 |
| Validity1 (part 2) | UNSIGNED8 | I_P1_Valid1_2 | 1.0 |
| Validity2 (part 1) | UNSIGNED8 | I_P1_Valid2_1 | 2.0 |
| Validity2 (part 2) | UNSIGNED8 | I_Spare1 | 3.0 |
| OBU_TR_ServiceBrake | BOOLEAN1 | I_ServiceBrake | 4.0 |
| OBU_TR_EB3_Cmd | BOOLEAN1 | I_EB3_Cmd | 4.1 |
| OBU_TR_TCO_Cmd | BOOLEAN1 | I_TCO_Cmd | 4.2 |
| OBU_TR_RBInhibit_Cmd | BOOLEAN1 | I_RBInhibit_Cmd | 4.3 |
| OBU_TR_MGInhibit_Cmd | BOOLEAN1 | I_MGInhibit_Cmd | 4.4 |
| OBU_TR_ECSInhibit_Cmd | BOOLEAN1 | I_ECSInhibit_Cmd | 4.5 |
| OBU_TR_ECEInhibit_Cmd | BOOLEAN1 | I_ECEInhibit_Cmd | 4.6 |
| OBU_TR_AT_Cmd | BOOLEAN1 | I_AT_Cmd | 4.7 |
| OBU_TR_MPS_Cmd | BOOLEAN1 | I_MPS_Cmd | 5.0 |
| OBU_TR_PG_Cmd | BOOLEAN1 | I_PG_Cmd | 5.1 |
| OBU_TR_AD_Status | BOOLEAN1 | I_AD_Status | 5.2 |

| OBU Packet 1 | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_RS_Status | BOOLEAN1 | I_RS_Status | 5.3 |
| Spare1 | BOOLEAN1 | I_Spare2 | 5.4 |
| Spare2 | BOOLEAN1 | I_Spare3 | 5.5 |
| Spare3 | BOOLEAN1 | I_Spare4 | 5.6 |
| OBU_TR_EngOrientSM | BOOLEAN1 | I_EngOrientSM | 5.7 |
| Spare4 (part 1) | UNSIGNED8 | I_Spare5 | 6.0 |
| Spare4 (part 2) | UNSIGNED8 | I_Spare6 | 7.0 |
| OBU_TR_CTS_NewVoltage | UNSIGNED8 | I_CTS_NewVolt | 8.0 |
| Spare5 | UNSIGNED8 | I_Spare7 | 9.0 |
| OBU_TR_CTS_NewId | UNSIGNED16 | I_CTS_NewId | 10.0 |
| OBU_TR_ACC_Limit | UNSIGNED16 | I_ACC_Limit | 12.0 |
| OBU_TR_CTS_D_Change | INTEGER16 | I_CTS_D_Change | 14.0 |
| OBU_TR_ACC_D_Change | INTEGER16 | I_ACC_D_Change | 16.0 |

### 7.1.5 OBU Station Platform (OBU Packet 2)

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity1 | BOOLEAN1 | I_P2_Valid1 | 0.0 |
| Validity2 | BOOLEAN1 | I_P2_Valid2 | 0.1 |
| Validity3 | BOOLEAN1 | I_P2_Valid3 | 0.2 |
| Validity4 | BOOLEAN1 | I_P2_Valid4 | 0.3 |
| Validity5 | BOOLEAN1 | I_P2_Valid5 | 0.4 |
| Spare1 | BOOLEAN1 | I_Spare1 | 0.5 |
| Spare2 | BOOLEAN1 | I_Spare2 | 0.6 |
| Spare3 | BOOLEAN1 | I_Spare3 | 0.7 |
| OBU_TR_SP_Left1 | BOOLEAN1 | I_SP_Left1 | 1.0 |
| OBU_TR_SP_Right1 | BOOLEAN1 | I_SP_Right1 | 1.1 |
| Spare4 | BOOLEAN1 | I_Spare4 | 1.2 |
| Spare5 | BOOLEAN1 | I_Spare5 | 1.3 |
| OBU_TR_SP_Height1_Bit0 | BOOLEAN1 | I_SP_Height1_B0 | 1.4 |
| OBU_TR_SP_Height1_Bit1 | BOOLEAN1 | I_SP_Height1_B1 | 1.5 |

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_SP_Height1_Bit2 | BOOLEAN1 | I_SP_Height1_B2 | 1.6 |
| OBU_TR_SP_Height1_Bit3 | BOOLEAN1 | I_SP_Height1_B3 | 1.7 |
| OBU_TR_SP_Left2 | BOOLEAN1 | I_SP_Left2 | 2.0 |
| OBU_TR_SP_Right2 | BOOLEAN1 | I_SP_Right2 | 2.1 |
| Spare6 | BOOLEAN1 | I_Spare6 | 2.2 |
| Spare7 | BOOLEAN1 | I_Spare7 | 2.3 |
| OBU_TR_SP_Height2_Bit0 | BOOLEAN1 | I_SP_Height2_B0 | 2.4 |
| OBU_TR_SP_Height2_Bit1 | BOOLEAN1 | I_SP_Height2_B1 | 2.5 |
| OBU_TR_SP_Height2_Bit2 | BOOLEAN1 | I_SP_Height2_B2 | 2.6 |
| OBU_TR_SP_Height2_Bit3 | BOOLEAN1 | I_SP_Height2_B3 | 2.7 |
| OBU_TR_SP_Left3 | BOOLEAN1 | I_SP_Left3 | 3.0 |
| OBU_TR_SP_Right3 | BOOLEAN1 | I_SP_Right3 | 3.1 |
| Spare8 | BOOLEAN1 | I_Spare8 | 3.2 |
| Spare9 | BOOLEAN1 | I_Spare9 | 3.3 |
| OBU_TR_SP_Height3_Bit0 | BOOLEAN1 | I_SP_Height3_B0 | 3.4 |
| OBU_TR_SP_Height3_Bit1 | BOOLEAN1 | I_SP_Height3_B1 | 3.5 |

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_SP_Height3_Bit2 | BOOLEAN1 | I_SP_Height3_B2 | 3.6 |
| OBU_TR_SP_Height3_Bit3 | BOOLEAN1 | I_SP_Height3_B3 | 3.7 |
| OBU_TR_SP_Left4 | BOOLEAN1 | I_SP_Left4 | 4.0 |
| OBU_TR_SP_Right4 | BOOLEAN1 | I_SP_Right4 | 4.1 |
| Spare10 | BOOLEAN1 | I_Spare10 | 4.2 |
| Spare11 | BOOLEAN1 | I_Spare11 | 4.3 |
| OBU_TR_SP_Height4_Bit0 | BOOLEAN1 | I_SP_Height4_B0 | 4.4 |
| OBU_TR_SP_Height4_Bit1 | BOOLEAN1 | I_SP_Height4_B1 | 4.5 |
| OBU_TR_SP_Height4_Bit2 | BOOLEAN1 | I_SP_Height4_B2 | 4.6 |
| OBU_TR_SP_Height4_Bit3 | BOOLEAN1 | I_SP_Height4_B3 | 4.7 |
| OBU_TR_SP_Left5 | BOOLEAN1 | I_SP_Left5 | 5.0 |
| OBU_TR_SP_Right5 | BOOLEAN1 | I_SP_Right5 | 5.1 |
| Spare12 | BOOLEAN1 | I_Spare12 | 5.2 |
| Spare13 | BOOLEAN1 | I_Spare13 | 5.3 |
| OBU_TR_SP_Height5_Bit0 | BOOLEAN1 | I_SP_Height5_B0 | 5.4 |
| OBU_TR_SP_Height5_Bit1 | BOOLEAN1 | I_SP_Height5_B1 | 5.5 |

| OBU Station Platform | | | |
|---|---|---|---|
| **Data name** | **Type** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_SP_Height5_Bit2 | BOOLEAN1 | I_SP_Height5_B2 | 5.6 |
| OBU_TR_SP_Height5_Bit3 | BOOLEAN1 | I_SP_Height5_B3 | 5.7 |
| OBU_TR_SP_D_Entry1 | INTEGER16 | I_SP_D_Entry1 | 6.0 |
| OBU_TR_SP_D_Exit1 | INTEGER16 | I_SP_D_Exit1 | 8.0 |
| OBU_TR_SP_D_Entry2 | INTEGER16 | I_SP_D_Entry2 | 10.0 |
| OBU_TR_SP_D_Exit2 | INTEGER16 | I_SP_D_Exit2 | 12.0 |
| OBU_TR_SP_D_Entry3 | INTEGER16 | I_SP_D_Entry3 | 14.0 |
| OBU_TR_SP_D_Exit3 | INTEGER16 | I_SP_D_Exit3 | 16.0 |
| OBU_TR_SP_D_Entry4 | INTEGER16 | I_SP_D_Entry4 | 18.0 |
| OBU_TR_SP_D_Exit4 | INTEGER16 | I_SP_D_Exit4 | 20.0 |
| OBU_TR_SP_D_Entry5 | INTEGER16 | I_SP_D_Entry5 | 22.0 |
| OBU_TR_SP_D_Exit5 | INTEGER16 | I_SP_D_Exit5 | 24.0 |

### 7.1.6    OBU Packet 3

| OBU Packet 3 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| Validity (part 1) | UNSIGNED8 | - | I_P3_Valid_1 | 0.0 |
| Validity (part 2) | UNSIGNED8 | - | I_P3_Valid_2 | 1.0 |
| OBU_TR_TC_ID1 | UNSIGNED8 | - | I_TC_ID1 | 2.0 |
| OBU_TR_TC_ID2 | UNSIGNED8 | - | I_TC_ID2 | 3.0 |
| OBU_TR_TC_ID3 | UNSIGNED8 | - | I_TC_ID3 | 4.0 |
| OBU_TR_TC_ID4 | UNSIGNED8 | - | I_TC_ID4 | 5.0 |
| OBU_TR_TC_TYPE1 | UNSIGNED8 | - | I_TC_TYPE1 | 6.0 |
| OBU_TR_TC_TYPE2 | UNSIGNED8 | - | I_TC_TYPE2 | 7.0 |
| OBU_TR_TC_TYPE3 | UNSIGNED8 | - | I_TC_TYPE3 | 8.0 |
| OBU_TR_TC_TYPE4 | UNSIGNED8 | - | I_TC_TYPE4 | 9.0 |
| OBU_TR_D_ENTRY1 | INTEGER16 | - | I_D_ENTRY1 | 10.0 |
| OBU_TR_D_ENTRY2 | INTEGER16 | - | I_D_ENTRY2 | 12.0 |
| OBU_TR_D_ENTRY3 | INTEGER16 | - | I_D_ENTRY3 | 14.0 |
| OBU_TR_D_ENTRY4 | INTEGER16 | - | I_D_ENTRY4 | 16.0 |
| OBU_TR_D_EXIT1 | INTEGER16 | - | I_D_EXIT1 | 18.0 |

| OBU Packet 3 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| OBU_TR_D_EXIT2 | INTEGER16 | - | I_D_EXIT2 | 20.0 |
| OBU_TR_D_EXIT3 | INTEGER16 | - | I_D_EXIT3 | 22.0 |
| OBU_TR_D_EXIT4 | INTEGER16 | - | I_D_EXIT4 | 24.0 |

### 7.1.7 OBU Packet 4

| OBU Packet 4 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| Validity (part 1) | UNSIGNED8 | - | I_P4_Valid_1 | 0.0 |
| Validity (part 2) | UNSIGNED8 | - | I_P4_Valid_2 | 1.0 |
| OBU_TR_TC_ID5 | UNSIGNED8 | - | I_TC_ID5 | 2.0 |
| OBU_TR_TC_ID6 | UNSIGNED8 | - | I_TC_ID6 | 3.0 |
| OBU_TR_TC_ID7 | UNSIGNED8 | - | I_TC_ID7 | 4.0 |
| OBU_TR_TC_ID8 | UNSIGNED8 | | I_TC_ID8 | 5.0 |
| OBU_TR_TC_TYPE5 | UNSIGNED8 | - | I_TC_TYPE5 | 6.0 |
| OBU_TR_TC_TYPE6 | UNSIGNED8 | - | I_TC_TYPE6 | 7.0 |

| OBU Packet 4 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_TC_TYPE7 | UNSIGNED8 | - | I_TC_TYPE7 | 8.0 |
| OBU_TR_TC_TYPE8 | UNSIGNED8 | - | I_TC_TYPE8 | 9.0 |
| OBU_TR_D_ENTRY5 | INTEGER16 | - | I_D_ENTRY5 | 10.0 |
| OBU_TR_D_ENTRY6 | INTEGER16 | - | I_D_ENTRY6 | 12.0 |
| OBU_TR_D_ENTRY7 | INTEGER16 | - | I_D_ENTRY7 | 14.0 |
| OBU_TR_D_ENTRY8 | INTEGER16 | - | I_D_ENTRY8 | 16.0 |
| OBU_TR_D_EXIT5 | INTEGER16 | - | I_D_EXIT5 | 18.0 |
| OBU_TR_D_EXIT6 | INTEGER16 | - | I_D_EXIT6 | 20.0 |
| OBU_TR_D_EXIT7 | INTEGER16 | - | I_D_EXIT7 | 22.0 |
| OBU_TR_D_EXIT8 | INTEGER16 | - | I_D_EXIT8 | 24.0 |

### 7.1.8 OBU Packet 5

| OBU Packet 5 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity (part 1) | UNSIGNED8 | - | I_P5_Valid_1 | 0.0 |

**OBU Packet 5**

| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
|---|---|---|---|---|
| Validity (part 2) | UNSIGNED8 | - | I_P5_Valid_2 | 1.0 |
| OBU_TR_TC_ID9 | UNSIGNED8 | - | I_TC_ID9 | 2.0 |
| OBU_TR_TC_ID10 | UNSIGNED8 | - | I_TC_ID10 | 3.0 |
| OBU_TR_TC_ID11 | UNSIGNED8 | - | I_TC_ID11 | 4.0 |
| OBU_TR_TC_ID12 | UNSIGNED8 | - | I_TC_ID12 | 5.0 |
| OBU_TR_TC_TYPE9 | UNSIGNED8 | - | I_TC_TYPE9 | 6.0 |
| OBU_TR_TC_TYPE10 | UNSIGNED8 | - | I_TC_TYPE10 | 7.0 |
| OBU_TR_TC_TYPE11 | UNSIGNED8 | - | I_TC_TYPE11 | 8.0 |
| OBU_TR_TC_TYPE12 | UNSIGNED8 | - | I_TC_TYPE12 | 9.0 |
| OBU_TR_D_ENTRY9 | INTEGER16 | - | I_D_ENTRY9 | 10.0 |
| OBU_TR_D_ENTRY10 | INTEGER16 | - | I_D_ENTRY10 | 12.0 |
| OBU_TR_D_ENTRY11 | INTEGER16 | - | I_D_ENTRY11 | 14.0 |
| OBU_TR_D_ENTRY12 | INTEGER16 | - | I_D_ENTRY12 | 16.0 |
| OBU_TR_D_EXIT9 | INTEGER16 | - | I_D_EXIT9 | 18.0 |
| OBU_TR_D_EXIT10 | INTEGER16 | - | I_D_EXIT10 | 20.0 |
| OBU_TR_D_EXIT11 | INTEGER16 | - | I_D_EXIT11 | 22.0 |

| OBU Packet 5 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| OBU_TR_D_EXIT12 | INTEGER16 | - | I_D_EXIT12 | 24.0 |

### 7.1.9 OBU Packet 6

| OBU Packet 6 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| Validity (part 1) | UNSIGNED8 | - | I_P6_Valid_1 | 0.0 |
| Validity (part 2) | UNSIGNED8 | - | I_P6_Valid_2 | 1.0 |
| OBU_TR_TC_ID13 | UNSIGNED8 | - | I_TC_ID13 | 2.0 |
| OBU_TR_TC_ID14 | UNSIGNED8 | - | I_TC_ID14 | 3.0 |
| OBU_TR_TC_ID15 | UNSIGNED8 | - | I_TC_ID15 | 4.0 |
| OBU_TR_TC_ID16 | UNSIGNED8 | - | I_TC_ID16 | 5.0 |
| OBU_TR_TC_TYPE13 | UNSIGNED8 | - | I_TC_TYPE13 | 6.0 |
| OBU_TR_TC_TYPE14 | UNSIGNED8 | - | I_TC_TYPE14 | 7.0 |
| OBU_TR_TC_TYPE15 | UNSIGNED8 | - | I_TC_TYPE15 | 8.0 |
| OBU_TR_TC_TYPE16 | UNSIGNED8 | - | I_TC_TYPE16 | 9.0 |

| OBU Packet 6 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **PROFINET signal name** | **Byte.Bit Offset** |
| OBU_TR_D_ENTRY13 | INTEGER16 | - | I_D_ENTRY13 | 10.0 |
| OBU_TR_D_ENTRY14 | INTEGER16 | - | I_D_ENTRY14 | 12.0 |
| OBU_TR_D_ENTRY15 | INTEGER16 | - | I_D_ENTRY15 | 14.0 |
| OBU_TR_D_ENTRY16 | INTEGER16 | - | I_D_ENTRY16 | 16.0 |
| OBU_TR_D_EXIT13 | INTEGER16 | - | I_D_EXIT13 | 18.0 |
| OBU_TR_D_EXIT14 | INTEGER16 | - | I_D_EXIT14 | 20.0 |
| OBU_TR_D_EXIT15 | INTEGER16 | - | I_D_EXIT15 | 22.0 |
| OBU_TR_D_EXIT16 | INTEGER16 | - | I_D_EXIT16 | 24.0 |

### 7.1.10    OBU Packet 7

| OBU Packet 7 | | | | |
|---|---|---|---|---|
| **Data name (structure and fixed generic content)** | **Type** | **Default values** | **PROFINET signal name** | **Byte.Bit Offset** |
| Validity (part 1) | UNSIGNED8 | - | I_P7_Valid_1 | 0.0 |
| Validity (part 2) | UNSIGNED8 | - | I_P7_Valid_2 | 1.0 |
| OBU_TR_TC_ID17 | UNSIGNED8 | - | I_TC_ID17 | 2.0 |

| OBU Packet 7 | | | | |
|---|---|---|---|---|
| Data name (structure and fixed generic content) | Type | Default values | PROFINET signal name | Byte.Bit Offset |
| OBU_TR_TC_ID18 | UNSIGNED8 | - | I_TC_ID18 | 3.0 |
| OBU_TR_TC_ID19 | UNSIGNED8 | - | I_TC_ID19 | 4.0 |
| OBU_TR_TC_ID20 | UNSIGNED8 | - | I_TC_ID20 | 5.0 |
| OBU_TR_TC_TYPE17 | UNSIGNED8 | - | I_TC_TYPE17 | 6.0 |
| OBU_TR_TC_TYPE18 | UNSIGNED8 | - | I_TC_TYPE18 | 7.0 |
| OBU_TR_TC_TYPE19 | UNSIGNED8 | - | I_TC_TYPE19 | 8.0 |
| OBU_TR_TC_TYPE20 | UNSIGNED8 | - | I_TC_TYPE20 | 9.0 |
| OBU_TR_D_ENTRY17 | INTEGER16 | - | I_D_ENTRY17 | 10.0 |
| OBU_TR_D_ENTRY18 | INTEGER16 | - | I_D_ENTRY18 | 12.0 |
| OBU_TR_D_ENTRY19 | INTEGER16 | - | I_D_ENTRY19 | 14.0 |
| OBU_TR_D_ENTRY20 | INTEGER16 | - | I_D_ENTRY20 | 16.0 |
| OBU_TR_D_EXIT17 | INTEGER16 | - | I_D_EXIT17 | 18.0 |
| OBU_TR_D_EXIT18 | INTEGER16 | - | I_D_EXIT18 | 20.0 |
| OBU_TR_D_EXIT19 | INTEGER16 | - | I_D_EXIT19 | 22.0 |
| OBU_TR_D_EXIT20 | INTEGER16 | - | I_D_EXIT20 | 24.0 |