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openETCS Train Data

Draft

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Table Of Contents

[1. General Project Description ToUpdate](#_TOC0)

[2. Software Architecture ToUpdate](#_TOC1)

[2.1. Project Architecture ToUpdate](#_TOC2)

[2.2. Call Graph ToUpdate](#_TOC3)

[3. trainData Project ToUpdate](#_TOC4)

[3.1. trainData\_pkg Package ToUpdate](#_TOC5)

[3.1.1. Constants ToUpdate](#_TOC6)

[3.1.2. checkAcknowledgmentGeneral Operator ToUpdate](#_TOC7)

[3.1.2.1. Comments and Information ToUpdate](#_TOC8)

[3.1.2.2. Interface ToUpdate](#_TOC9)

[3.1.2.3. Operator Hierarchy ToUpdate](#_TOC10)

[3.1.2.4. Graphical and Textual Diagrams ToUpdate](#_TOC11)

[3.1.3. checkGeneralMessage Operator ToUpdate](#_TOC13)

[3.1.3.1. Interface ToUpdate](#_TOC14)

[3.1.3.2. Locals ToUpdate](#_TOC15)

[3.1.3.3. Operator Hierarchy ToUpdate](#_TOC16)

[3.1.3.4. Graphical and Textual Diagrams ToUpdate](#_TOC17)

[3.1.4. checkRadioMessages Operator ToUpdate](#_TOC19)

[3.1.4.1. Interface ToUpdate](#_TOC20)

[3.1.4.2. Operator Hierarchy ToUpdate](#_TOC21)

[3.1.4.3. Graphical and Textual Diagrams ToUpdate](#_TOC22)

[3.1.5. headerMsg129 Operator ToUpdate](#_TOC24)

[3.1.5.1. Comments and Information ToUpdate](#_TOC25)

[3.1.5.2. Interface ToUpdate](#_TOC26)

[3.1.5.3. Operator Hierarchy ToUpdate](#_TOC27)

[3.1.5.4. Graphical and Textual Diagrams ToUpdate](#_TOC28)

[3.1.6. headerMsg146 Operator ToUpdate](#_TOC30)

[3.1.6.1. Comments and Information ToUpdate](#_TOC31)

[3.1.6.2. Interface ToUpdate](#_TOC32)

[3.1.6.3. Operator Hierarchy ToUpdate](#_TOC33)

[3.1.6.4. Graphical and Textual Diagrams ToUpdate](#_TOC34)

[3.1.7. manageTrainData Operator ToUpdate](#_TOC36)

[3.1.7.1. Comments and Information ToUpdate](#_TOC37)

[3.1.7.2. Interface ToUpdate](#_TOC38)

[3.1.7.3. Locals ToUpdate](#_TOC39)

[3.1.7.4. Operator Hierarchy ToUpdate](#_TOC40)

[3.1.7.5. Graphical and Textual Diagrams ToUpdate](#_TOC41)

[3.1.8. packetsFor129 Operator ToUpdate](#_TOC44)

[3.1.8.1. Comments and Information ToUpdate](#_TOC45)

[3.1.8.2. Interface ToUpdate](#_TOC46)

[3.1.8.3. Operator Hierarchy ToUpdate](#_TOC47)

[3.1.8.4. Graphical and Textual Diagrams ToUpdate](#_TOC48)

[3.1.9. sendAcknowledgementRBC Operator ToUpdate](#_TOC50)

[3.1.9.1. Comments and Information ToUpdate](#_TOC51)

[3.1.9.2. Interface ToUpdate](#_TOC52)

[3.1.9.3. Operator Hierarchy ToUpdate](#_TOC53)

[3.1.9.4. Graphical and Textual Diagrams ToUpdate](#_TOC54)

[3.1.10. sendValidTrainDataRBC Operator ToUpdate](#_TOC56)

[3.1.10.1. Comments and Information ToUpdate](#_TOC57)

[3.1.10.2. Interface ToUpdate](#_TOC58)

[3.1.10.3. Operator Hierarchy ToUpdate](#_TOC59)

[3.1.10.4. Graphical and Textual Diagrams ToUpdate](#_TOC60)

[3.1.11. storeDriverInput Operator ToUpdate](#_TOC62)

[3.1.11.1. Interface ToUpdate](#_TOC63)

[3.1.11.2. Locals ToUpdate](#_TOC64)

[3.1.11.3. Operator Hierarchy ToUpdate](#_TOC65)

[3.1.11.4. Graphical and Textual Diagrams ToUpdate](#_TOC66)

[3.1.12. storeTIUData Operator ToUpdate](#_TOC68)

[3.1.12.1. Comments and Information ToUpdate](#_TOC69)

[3.1.12.2. Interface ToUpdate](#_TOC70)

[3.1.12.3. Operator Hierarchy ToUpdate](#_TOC71)

[3.1.12.4. Graphical and Textual Diagrams ToUpdate](#_TOC72)

[3.1.13. trainDataStorage Operator ToUpdate](#_TOC74)

[3.1.13.1. Comments and Information ToUpdate](#_TOC75)

[3.1.13.2. Interface ToUpdate](#_TOC76)

[3.1.13.3. Locals ToUpdate](#_TOC77)

[3.1.13.4. Operator Hierarchy ToUpdate](#_TOC78)

[3.1.13.5. Graphical and Textual Diagrams ToUpdate](#_TOC79)

[3.2. trainData\_Types\_pkg Package ToUpdate](#_TOC81)

[3.2.1. Types ToUpdate](#_TOC82)

[3.2.2. Constants ToUpdate](#_TOC83)

List Of Figures

[Figure 1: View of diagram\_checkAcknowledgmentGeneral\_1 (checkAcknowledgmentGeneral) ToUpdate](#_TocFigure1)

[Figure 2: View of diagram\_checkGeneralMessage\_1 (checkGeneralMessage) ToUpdate](#_TocFigure2)

[Figure 3: View of diagram\_checkRadioMessages\_1 (checkRadioMessages) ToUpdate](#_TocFigure3)

[Figure 4: View of diagram\_headerMsg129\_1 (headerMsg129) ToUpdate](#_TocFigure4)

[Figure 5: View of diagram\_headerMsg146\_1 (headerMsg146) ToUpdate](#_TocFigure5)

[Figure 6: View of diagram\_manageTrainData\_Logic (manageTrainData) ToUpdate](#_TocFigure6)

[Figure 7: View of diagram\_manageTrainData\_Output (manageTrainData) ToUpdate](#_TocFigure7)

[Figure 8: View of diagram\_packetsFor129\_1 (packetsFor129) ToUpdate](#_TocFigure8)

[Figure 9: View of diagram\_sendAcknowledgementRBC\_1 (sendAcknowledgementRBC) ToUpdate](#_TocFigure9)

[Figure 10: View of diagram\_sendValidTrainDataRBC\_1 (sendValidTrainDataRBC) ToUpdate](#_TocFigure10)

[Figure 11: View of diagram\_storeDriverInput\_1 (storeDriverInput) ToUpdate](#_TocFigure11)

[Figure 12: View of diagram\_storeTIUData\_1 (storeTIUData) ToUpdate](#_TocFigure12)

[Figure 13: View of diagram\_trainDataStorage\_1 (trainDataStorage) ToUpdate](#_TocFigure13)

List Of Tables

[Table 1: Public Constants of trainData\_pkg ToUpdate](#_TocTable1)

[Table 2: Inputs of checkAcknowledgmentGeneral ToUpdate](#_TocTable2)

[Table 3: Outputs of checkAcknowledgmentGeneral ToUpdate](#_TocTable3)

[Table 4: Inputs of checkGeneralMessage ToUpdate](#_TocTable4)

[Table 5: Outputs of checkGeneralMessage ToUpdate](#_TocTable5)

[Table 6: Locals of checkGeneralMessage ToUpdate](#_TocTable6)

[Table 7: Inputs of checkRadioMessages ToUpdate](#_TocTable7)

[Table 8: Outputs of checkRadioMessages ToUpdate](#_TocTable8)

[Table 9: Inputs of headerMsg129 ToUpdate](#_TocTable9)

[Table 10: Outputs of headerMsg129 ToUpdate](#_TocTable10)

[Table 11: Inputs of headerMsg146 ToUpdate](#_TocTable11)

[Table 12: Outputs of headerMsg146 ToUpdate](#_TocTable12)

[Table 13: Inputs of manageTrainData ToUpdate](#_TocTable13)

[Table 14: Outputs of manageTrainData ToUpdate](#_TocTable14)

[Table 15: Locals of manageTrainData ToUpdate](#_TocTable15)

[Table 16: Conditional Blocks of diagram\_manageTrainData\_Output ToUpdate](#_TocTable16)

[Table 17: Actions of diagram\_manageTrainData\_Output ToUpdate](#_TocTable17)

[Table 18: Inputs of packetsFor129 ToUpdate](#_TocTable18)

[Table 19: Outputs of packetsFor129 ToUpdate](#_TocTable19)

[Table 20: Inputs of sendAcknowledgementRBC ToUpdate](#_TocTable20)

[Table 21: Outputs of sendAcknowledgementRBC ToUpdate](#_TocTable21)

[Table 22: Inputs of sendValidTrainDataRBC ToUpdate](#_TocTable22)

[Table 23: Outputs of sendValidTrainDataRBC ToUpdate](#_TocTable23)

[Table 24: Inputs of storeDriverInput ToUpdate](#_TocTable24)

[Table 25: Outputs of storeDriverInput ToUpdate](#_TocTable25)

[Table 26: Locals of storeDriverInput ToUpdate](#_TocTable26)

[Table 27: Conditional Blocks of diagram\_storeDriverInput\_1 ToUpdate](#_TocTable27)

[Table 28: Actions of diagram\_storeDriverInput\_1 ToUpdate](#_TocTable28)

[Table 29: Inputs of storeTIUData ToUpdate](#_TocTable29)

[Table 30: Outputs of storeTIUData ToUpdate](#_TocTable30)

[Table 31: Inputs of trainDataStorage ToUpdate](#_TocTable31)

[Table 32: Outputs of trainDataStorage ToUpdate](#_TocTable32)

[Table 33: Locals of trainDataStorage ToUpdate](#_TocTable33)

[Table 34: Conditional Blocks of diagram\_trainDataStorage\_1 ToUpdate](#_TocTable34)

[Table 35: Actions of diagram\_trainDataStorage\_1 ToUpdate](#_TocTable35)

[Table 36: Public Types of trainData\_Types\_pkg ToUpdate](#_TocTable36)

[Table 37: Public Constants of trainData\_Types\_pkg ToUpdate](#_TocTable37)

# General Project Description

This function implements the ETCS train data.  
  
This function refers to sections subset 26 section 3.18.3. and attachment A3.4  
Procedures for changing stat as described in section 5.7 of the SRS are not implemented.  
  
- Name: trainData.etp  
- Description: openETCS Architecture and Desing Document  
- Copyright DB Netz AG, 2015  
- Licensed under the EUPL V.1.1 ( http://joinup.ec.europa.eu/software/page/eupl/licence-eupl )  
- Gist URL: ---  
- Cryptography: No  
- Athor(s): Bernd Hekele  
  
The use of this software is limited to non-vital applications.   
It has not been developed for vital operation purposes and must not be used for applications which may cause harm to people, physical accidents or financial loss.   
  
THEREFORE, NO LIABILITY WILL BE GIVEN FOR SUCH AND ANY OTHER KIND OF USE.

# Software Architecture

## Project Architecture

This section displays the package hierarchy of projects.

Project [trainData](#LinkM-trainData)  
 [trainData\_pkg](#LinkS-!ed/1ecbf/22F4/EA8/55a22585419b)  
 [trainData\_Types\_pkg](#LinkS-!ed/1ecc3/22F4/EA8/55a2259e230f)

## Call Graph

This Call Graph displays the dependency tree of model operators.

1. [trainData\_pkg::checkGeneralMessage](#LinkS-!ed/1f8d8/3997/1190/55b8cfcd901)  
2. [trainData\_pkg::manageTrainData](#LinkS-!ed/1ecc7/22F4/EA8/55a2283a7287)  
 2.1. [trainData\_pkg::checkAcknowledgmentGeneral](#LinkS-!ed/1f959/741D/1138/55c0996212b6)  
 2.2. [trainData\_pkg::checkRadioMessages](#LinkS-!ed/1f862/4021/12AC/55b1de8416bb)  
 2.3. [trainData\_pkg::sendAcknowledgementRBC](#LinkS-!ed/1f31c/54D3/1728/55a3912345c)  
 2.3.1. [trainData\_pkg::headerMsg146](#LinkS-!ed/1f381/54D3/1728/55a3926e354e)  
 2.4. [trainData\_pkg::sendValidTrainDataRBC](#LinkS-!ed/1f02a/7C88/538/55a35e25561d)  
 2.4.1. [trainData\_pkg::headerMsg129](#LinkS-!ed/1f077/7C88/538/55a35fcb48f5)  
 2.4.2. [trainData\_pkg::packetsFor129](#LinkS-!ed/1f17b/7C88/538/55a36b7c2f07)  
 2.5. [trainData\_pkg::trainDataStorage](#LinkS-!ed/1f527/7478/1448/55a5f15636cb)  
 2.5.1. [trainData\_pkg::storeDriverInput](#LinkS-!ed/1f7fe/2937/75C/55a89ab55b5f)  
 2.5.2. [trainData\_pkg::storeTIUData](#LinkS-!ed/1f754/7478/1448/55a6000b43a3)

# trainData Project

## trainData\_pkg Package

### Constants

Table 1: Public Constants of trainData\_pkg

| Name | Type | Value | Comments and Information |
| --- | --- | --- | --- |
| cMsgBasicHeader | Radio\_Types\_Pkg::Radio\_TrainTrack\_Header\_T | {present : true, nid\_message : 0, t\_train : 0.0, nid\_engine : 0, xQ\_MARQSTREASON : Q\_MARQSTREASON\_Start\_selected\_by\_driver, xT\_TRAIN : 0.0, xNID\_EM : 0, xQ\_EMERGENCYSTOP : Q\_EMERGENCYSTOP\_Conditional\_Emergency\_Stop\_accepted\_with\_update\_of\_EOA, xNID\_TEXTMESSAGE : 0} |  |
| cNoMessage | Radio\_Types\_Pkg::Radio\_TrainTrack\_Message\_T | {present : false, header : {present : false, nid\_message : 0, t\_train : 0.0, nid\_engine : 0, xQ\_MARQSTREASON : Q\_MARQSTREASON\_Start\_selected\_by\_driver, xT\_TRAIN : 0.0, xNID\_EM : 0, xQ\_EMERGENCYSTOP : Q\_EMERGENCYSTOP\_Conditional\_Emergency\_Stop\_accepted\_with\_update\_of\_EOA, xNID\_TEXTMESSAGE : 0}, packets : {p0 : {valid : false, packet0 : {NID\_PACKET : 0, L\_PACKET : 0, qscale : Q\_SCALE\_10\_cm\_scale, NID\_LRBG : 0, D\_LRBG : 0, dirlrbg : Q\_DIRLRBG\_Reverse, dlrbg : Q\_DLRBG\_Reverse, L\_DOUBTOVER : 0, L\_DOUBTUNDER : 0, length : Q\_LENGTH\_No\_train\_integrity\_information\_available, L\_TRAININT : 0, V\_TRAIN : 0, dirtrain : Q\_DIRTRAIN\_Reverse, mode : M\_MODE\_Full\_Supervision, level : M\_LEVEL\_Level\_0, NID\_NTC : 0}}, p1 : {valid : false, packet1 : {NID\_PACKET : 0, L\_PACKET : 0, qscale : Q\_SCALE\_10\_cm\_scale, NID\_LRBG : 0, NID\_PRVLRBG : 0, D\_LRBG : 0, dirlrbg : Q\_DIRLRBG\_Reverse, dlrbg : Q\_DLRBG\_Reverse, L\_DOUBTOVER : 0, L\_DOUBTUNDER : 0, length : Q\_LENGTH\_No\_train\_integrity\_information\_available, L\_TRAININT : 0, V\_TRAIN : 0, dirtrain : Q\_DIRTRAIN\_Reverse, mode : M\_MODE\_Full\_Supervision, level : M\_LEVEL\_Level\_0, NID\_NTC : 0}}, p3 : {valid : false, number : 0, aNID\_RADIO : [{valid : false, telephoneNumber : [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]}]}, p4 : {valid : false, M\_ERROR : M\_ERROR\_Balise\_group\_linking\_consistency\_error}, p5 : {valid : false, TrainRunningNumber : 0}, p9 : {valid : false, transitionInformation : 0}, p11 : {valid : false, NC\_CDTRAIN : NC\_CDTRAIN\_Cant\_Deficiency\_80\_mm, NC\_TRAIN : NC\_TRAIN\_Train\_does\_not\_belong\_to\_any\_of\_the\_Other\_International\_Train\_Category, l\_train : 0, v\_maxtrain : 0, m\_loadinggoage : M\_LOADINGGAUGE\_The\_train\_does\_not\_fit\_to\_any\_of\_the\_interoperable\_loading\_gauge\_profiles, m\_axleloadcat : M\_AXLELOADCAT\_A, m\_airtight : M\_AIRTIGHT\_Not\_fitted, n\_axle : 0, nIter\_tractionIdentity : 0, tractionIdentity : [{m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}], nIter\_ntc : 0, nid\_ntc : [0, 0, 0]}}} |  |
| cNoPackets | Common\_Types\_Pkg::outPackets\_T | {p0 : {valid : false, packet0 : {NID\_PACKET : 0, L\_PACKET : 0, qscale : Q\_SCALE\_10\_cm\_scale, NID\_LRBG : 0, D\_LRBG : 0, dirlrbg : Q\_DIRLRBG\_Reverse, dlrbg : Q\_DLRBG\_Reverse, L\_DOUBTOVER : 0, L\_DOUBTUNDER : 0, length : Q\_LENGTH\_No\_train\_integrity\_information\_available, L\_TRAININT : 0, V\_TRAIN : 0, dirtrain : Q\_DIRTRAIN\_Reverse, mode : M\_MODE\_Full\_Supervision, level : M\_LEVEL\_Level\_0, NID\_NTC : 0}}, p1 : {valid : false, packet1 : {NID\_PACKET : 0, L\_PACKET : 0, qscale : Q\_SCALE\_10\_cm\_scale, NID\_LRBG : 0, NID\_PRVLRBG : 0, D\_LRBG : 0, dirlrbg : Q\_DIRLRBG\_Reverse, dlrbg : Q\_DLRBG\_Reverse, L\_DOUBTOVER : 0, L\_DOUBTUNDER : 0, length : Q\_LENGTH\_No\_train\_integrity\_information\_available, L\_TRAININT : 0, V\_TRAIN : 0, dirtrain : Q\_DIRTRAIN\_Reverse, mode : M\_MODE\_Full\_Supervision, level : M\_LEVEL\_Level\_0, NID\_NTC : 0}}, p3 : {valid : false, number : 0, aNID\_RADIO : [{valid : false, telephoneNumber : [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]}]}, p4 : {valid : false, M\_ERROR : M\_ERROR\_Balise\_group\_linking\_consistency\_error}, p5 : {valid : false, TrainRunningNumber : 0}, p9 : {valid : false, transitionInformation : 0}, p11 : {valid : false, NC\_CDTRAIN : NC\_CDTRAIN\_Cant\_Deficiency\_80\_mm, NC\_TRAIN : NC\_TRAIN\_Train\_does\_not\_belong\_to\_any\_of\_the\_Other\_International\_Train\_Category, l\_train : 0, v\_maxtrain : 0, m\_loadinggoage : M\_LOADINGGAUGE\_The\_train\_does\_not\_fit\_to\_any\_of\_the\_interoperable\_loading\_gauge\_profiles, m\_axleloadcat : M\_AXLELOADCAT\_A, m\_airtight : M\_AIRTIGHT\_Not\_fitted, n\_axle : 0, nIter\_tractionIdentity : 0, tractionIdentity : [{m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}], nIter\_ntc : 0, nid\_ntc : [0, 0, 0]}} |  |

### checkAcknowledgmentGeneral Operator

Declared as **public function**

#### Comments and Information

**checkAcknowledgmentGeneral Comments:**

This function implements the acknowledment to ma request and general message.

#### Interface

Table 2: Inputs of checkAcknowledgmentGeneral

| Name | Type | Comments and Information |
| --- | --- | --- |
| trackMessages | Common\_Types\_Pkg::ReceivedMessage\_T |  |

Table 3: Outputs of checkAcknowledgmentGeneral

| Name | Type | Comments and Information |
| --- | --- | --- |
| ackReceived | bool |  |
| ackRequested | bool |  |

#### Operator Hierarchy

diagram : [diagram\_checkAcknowledgmentGeneral\_1](#LinkS-!ed/1f974/741D/1138/55c099626ca3)

#### Graphical and Textual Diagrams

##### View of diagram\_checkAcknowledgmentGeneral\_1 (checkAcknowledgmentGeneral)



Figure 1: View of diagram\_checkAcknowledgmentGeneral\_1 (checkAcknowledgmentGeneral)

### checkGeneralMessage Operator

Declared as **public node**

#### Interface

Table 4: Inputs of checkGeneralMessage

| Name | Type | Comments and Information |
| --- | --- | --- |
| trackMessages | Common\_Types\_Pkg::ReceivedMessage\_T |  |

Table 5: Outputs of checkGeneralMessage

| Name | Type | Comments and Information |
| --- | --- | --- |
| genMessageReceived | bool |  |
| ackRequested | bool |  |

#### Locals

Table 6: Locals of checkGeneralMessage

| Name | Type | Properties | | Comments and Information |
| --- | --- | --- | --- | --- |
| GeneralMsgReceived | bool | last | false |  |

#### Operator Hierarchy

diagram : [diagram\_checkGeneralMessage\_1](#LinkS-!ed/1f8f3/3997/1190/55b8cfcd592c)

#### Graphical and Textual Diagrams

##### View of diagram\_checkGeneralMessage\_1 (checkGeneralMessage)



Figure 2: View of diagram\_checkGeneralMessage\_1 (checkGeneralMessage)

### checkRadioMessages Operator

Declared as **public function**

#### Interface

Table 7: Inputs of checkRadioMessages

| Name | Type | Comments and Information |
| --- | --- | --- |
| trackMessages | Common\_Types\_Pkg::ReceivedMessage\_T |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |

Table 8: Outputs of checkRadioMessages

| Name | Type | Comments and Information |
| --- | --- | --- |
| ackReceived | bool |  |
| ackRequested | bool |  |

#### Operator Hierarchy

diagram : [diagram\_checkRadioMessages\_1](#LinkS-!ed/1f863/4021/12AC/55b1de847400)

#### Graphical and Textual Diagrams

##### View of diagram\_checkRadioMessages\_1 (checkRadioMessages)



Figure 3: View of diagram\_checkRadioMessages\_1 (checkRadioMessages)

### headerMsg129 Operator

Declared as **public function**

#### Comments and Information

**headerMsg129 Comments:**

THis function prepares the Information for validate train data message .  
It is assumed it used with an boolean activator.

#### Interface

Table 9: Inputs of headerMsg129

| Name | Type | Comments and Information |
| --- | --- | --- |
| nidEngine | NID\_ENGINE |  |
| timeStamp | T\_TRAIN |  |

Table 10: Outputs of headerMsg129

| Name | Type | Comments and Information |
| --- | --- | --- |
| header | Radio\_Types\_Pkg::Radio\_TrainTrack\_Header\_T |  |

#### Operator Hierarchy

diagram : [diagram\_headerMsg129\_1](#LinkS-!ed/1f07f/7C88/538/55a35fcb4e78)

#### Graphical and Textual Diagrams

##### View of diagram\_headerMsg129\_1 (headerMsg129)



Figure 4: View of diagram\_headerMsg129\_1 (headerMsg129)

### headerMsg146 Operator

Declared as **public function**

#### Comments and Information

**headerMsg146 Comments:**

THis function prepares the Information for validate train data message .  
It is assumed it used with an boolean activator.

#### Interface

Table 11: Inputs of headerMsg146

| Name | Type | Comments and Information |
| --- | --- | --- |
| nidEngine | NID\_ENGINE |  |
| timeStamp | T\_TRAIN |  |
| RBC\_timeStamp | T\_TRAIN |  |

Table 12: Outputs of headerMsg146

| Name | Type | Comments and Information |
| --- | --- | --- |
| header | Radio\_Types\_Pkg::Radio\_TrainTrack\_Header\_T |  |

#### Operator Hierarchy

diagram : [diagram\_headerMsg146\_1](#LinkS-!ed/1f38b/54D3/1728/55a3926e3bc2)

#### Graphical and Textual Diagrams

##### View of diagram\_headerMsg146\_1 (headerMsg146)



Figure 5: View of diagram\_headerMsg146\_1 (headerMsg146)

### manageTrainData Operator

Declared as **public node**

#### Comments and Information

**manageTrainData Comments:**

Main Model of this project.  
This model implements train data according to section 3.18.3.  
Data may be entered by the train (TIU) before starting the missin or by the driver during start of mission.  
Functional Restrictions to the SRS:  
3.18.3.3 (Entering of data by the driver during standstill) is not implemented.  
Sections 3.18.3.66 3.18.3.7, 3.18.3.8 and 5.17 (Changing of train data from sources different from the driver) is not implemented.  
Data-Flow:  
Data first is received from the train (TIU).  
Second step: train data is sent to the driver (DMI).  
The part relevant for driver interface is confirmed by the driver and sent back to the evc.  
Data received via this interface is merged with the data received via tiu.  
Message Flow:  
Message 129 (Validated Train Data)   
Message 8 (Acknowledment) is processed as apart of the validation procedure with the RBC.  
Message 146 (Acknolwedement)  
Messages from RBC:   
Message 8 (Acknowledment) is processed as apart of the validation procedure with the RBC.

**manageTrainData Traceability:**

1.  3.18.3
2.  3.18.3.1
3.  3.18.3.2
4.  3.18.3.2.a
5.  3.18.3.2.b
6.  3.18.3.2.c
7.  3.18.3.2.d
8.  3.18.3.2.e
9.  3.18.3.2.f
10.  3.18.3.2.g
11.  3.18.3.2.h
12.  3.18.3.2.i
13.  3.18.3.2.j
14.  3.18.3.2.k
15.  3.18.3.2.1
16.  3.18.3.2.2
17.  3.18.3.4
18.  3.18.3.4.a
19.  3.18.3.4.b
20.  3.18.3.4.c
21.  3.18.3.4.d
22.  3.18.3.4.e
23.  3.18.3.4.f
24.  3.18.3.4.g
25.  3.18.3.4.h
26.  3.18.3.4.i
27.  3.18.3.4.1
28.  3.18.3.4.2

#### Interface

Table 13: Inputs of manageTrainData

| Name | Type | Comments and Information |
| --- | --- | --- |
| reset | bool | **Comments:**  bool: reset of train data and related states. |
| trainDatafromTIU | TIU\_Types\_Pkg::trainData\_T | **Comments:**  TIU\_Types\_Pkg::trainData\_T: train data received via TIU. |
| trainDatafromDriver | DMI\_Messages\_Bothways\_Pkg::DMI\_Train\_Data\_T | **Comments:**  DMI\_Messages\_Bothways\_Pkg::DMI\_Train\_Data\_T: Train data received via dmi from the driver. |
| trainDataAckfromDriver | DMI\_Messages\_DMI\_to\_EVC\_Pkg::DMI\_Train\_Data\_Ack\_T | **Comments:**  DMI\_Messages\_DMI\_to\_EVC\_Pkg::DMI\_Train\_Data\_Ack\_T Acknowledgment od data by the driver. This option is relevant for the start of mission procedure of the EVC. |
| trackMessages | Common\_Types\_Pkg::ReceivedMessage\_T | **Comments:**  Common\_Types\_Pkg::ReceivedMessage\_T Messages from RBC:  Message 8 (Acknowledment) is processed as apart of the validation procedure with the RBC. |
| timeStamp | T\_TRAIN | **Comments:**  timestamp of the evc. Used as input to the train parameters of the communication to the RBC |
| eventsForTrainData | trainData\_Types\_pkg::trainData\_Events\_T | **Comments:**  trainData\_Types\_pkg::trainData\_Events\_T Information of the EVC relevant for train data handling according to section 3.18.3 In the current state of the iomplementation the following events are evaluated: - train stand-still - communication Session established The MoRC ready input is used to indicae the evc:morc function is ready with acknolwdgment odf the communication session. |
| nidEngine | NID\_ENGINE | **Comments:**  NID\_ENGINE Id of the engine (for identifing the train to the RBC. |
| p0\_positionReport | Packet\_TrainTypes\_Pkg::PT0\_PositionReport\_T | **Comments:**  Packet\_TrainTypes\_Pkg::PT0\_PositionReport\_T Packet 0 from Position Report for RBC communication |
| p1\_positionReport | Packet\_TrainTypes\_Pkg::PT1\_PositionReport\_2BG\_T | **Comments:**  Packet\_TrainTypes\_Pkg::PT0\_PositionReport\_T Packet 1 from Position Report for RBC communication |

Table 14: Outputs of manageTrainData

| Name | Type | Comments and Information |
| --- | --- | --- |
| actualTrainData | TIU\_Types\_Pkg::trainData\_T | **Comments:**  TIU\_Types\_Pkg::trainData\_T Actual train data values |
| trainDataToRBC | Radio\_Types\_Pkg::Radio\_TrainTrack\_Message\_T | **Comments:**  Radio\_Types\_Pkg::Radio\_TrainTrack\_Message\_T Messages sent to the RBC by this function: Message 129 (Validated Train Data)  Message 146 (Acknolwedement) |
| triggerFromTrainData | trainData\_Types\_pkg::trainData\_Trigger\_T | **Comments:**  trainData\_Types\_pkg::trainData\_Trigger\_T Train Data may trigger some actions in the EVC In the current implementation of train data none of this triggers are relevant. |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  trainData\_Types\_pkg::trainDataStatus\_T Indicates the validation status of train data. For further information see comments to the definition of this type. |

#### Locals

Table 15: Locals of manageTrainData

| Name | Type | Properties | | Comments and Information |
| --- | --- | --- | --- | --- |
| ackReceived | bool |  | |  |
| ackRequested | bool |  | |  |
| sendValidateToRBC | bool |  | |  |
| statusForOutput | trainData\_Types\_pkg::trainDataStatus\_T |  | |  |
| trainData | TIU\_Types\_Pkg::trainData\_T |  | |  |
| trainDataStatus | trainData\_Types\_pkg::trainDataStatus\_T | default | trainData\_Types\_pkg::cNoStates |  |
| last | trainData\_Types\_pkg::cNoStates |

#### Operator Hierarchy

diagram : [diagram\_manageTrainData\_Logic](#LinkS-!ed/1ecc8/22F4/EA8/55a2283a7cff)  
diagram : [diagram\_manageTrainData\_Output](#LinkS-!ed/1f429/4DF5/CF4/55a4aba6408b)  
 *activate if* : [IfBlock1](#LinkS-!ed/1f429/4DF5/CF4/55a4aba6408b)  
 branch : then  
 branch : else  
 branch : then  
 branch : else  
 branch : then  
 branch : else

#### Graphical and Textual Diagrams

##### View of diagram\_manageTrainData\_Logic (manageTrainData)



Figure 6: View of diagram\_manageTrainData\_Logic (manageTrainData)

##### View of diagram\_manageTrainData\_Output (manageTrainData)



Figure 7: View of diagram\_manageTrainData\_Output (manageTrainData)

Table 16: Conditional Blocks of diagram\_manageTrainData\_Output

| Conditional Block | Comments and Information |
| --- | --- |
| IfBlock1 |  |

Table 17: Actions of diagram\_manageTrainData\_Output

| Conditional Block Action | Comments and Information |
| --- | --- |
| IfBlock1:then |  |
| IfBlock1:else:then |  |
| IfBlock1:else:else:then |  |
| IfBlock1:else:else:else |  |

### packetsFor129 Operator

Declared as **public function**

#### Comments and Information

**packetsFor129 Comments:**

THis function prepares the Information for validate train data message .  
It is assumed it used with an boolean activator.

#### Interface

Table 18: Inputs of packetsFor129

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainData | TIU\_Types\_Pkg::trainData\_T |  |
| p0\_positionReport | Packet\_TrainTypes\_Pkg::PT0\_PositionReport\_T |  |
| p1\_positionReport | Packet\_TrainTypes\_Pkg::PT1\_PositionReport\_2BG\_T |  |

Table 19: Outputs of packetsFor129

| Name | Type | Comments and Information |
| --- | --- | --- |
| packetsForRBC | Common\_Types\_Pkg::outPackets\_T |  |

#### Operator Hierarchy

diagram : [diagram\_packetsFor129\_1](#LinkS-!ed/1f186/7C88/538/55a36b7c3d12)

#### Graphical and Textual Diagrams

##### View of diagram\_packetsFor129\_1 (packetsFor129)



Figure 8: View of diagram\_packetsFor129\_1 (packetsFor129)

### sendAcknowledgementRBC Operator

Declared as **public function**

#### Comments and Information

**sendAcknowledgementRBC Comments:**

THis function prepares the Information for validate train data message .  
It is assumed it used with an boolean activator.

#### Interface

Table 20: Inputs of sendAcknowledgementRBC

| Name | Type | Comments and Information |
| --- | --- | --- |
| EVC\_timeStamp | T\_TRAIN |  |
| nidEngine | NID\_ENGINE |  |
| RBC\_timeStamp | T\_TRAIN |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |

Table 21: Outputs of sendAcknowledgementRBC

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainDataToRBC | Radio\_Types\_Pkg::Radio\_TrainTrack\_Message\_T |  |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T |  |

#### Operator Hierarchy

diagram : [diagram\_sendAcknowledgementRBC\_1](#LinkS-!ed/1f326/54D3/1728/55a391237fb4)

#### Graphical and Textual Diagrams

##### View of diagram\_sendAcknowledgementRBC\_1 (sendAcknowledgementRBC)



Figure 9: View of diagram\_sendAcknowledgementRBC\_1 (sendAcknowledgementRBC)

### sendValidTrainDataRBC Operator

Declared as **public function**

#### Comments and Information

**sendValidTrainDataRBC Comments:**

THis function prepares the Information for validate train data message .  
It is assumed it used with an boolean activator.

#### Interface

Table 22: Inputs of sendValidTrainDataRBC

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainData | TIU\_Types\_Pkg::trainData\_T |  |
| evc\_timeStamp | T\_TRAIN |  |
| nidEngine | NID\_ENGINE |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |
| p0\_positionReport | Packet\_TrainTypes\_Pkg::PT0\_PositionReport\_T |  |
| p1\_positionReport | Packet\_TrainTypes\_Pkg::PT1\_PositionReport\_2BG\_T |  |

Table 23: Outputs of sendValidTrainDataRBC

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainDataToRBC | Radio\_Types\_Pkg::Radio\_TrainTrack\_Message\_T |  |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T |  |

#### Operator Hierarchy

diagram : [diagram\_sendValidTrainDataRBC\_1](#LinkS-!ed/1f031/7C88/538/55a35e251428)

#### Graphical and Textual Diagrams

##### View of diagram\_sendValidTrainDataRBC\_1 (sendValidTrainDataRBC)



Figure 10: View of diagram\_sendValidTrainDataRBC\_1 (sendValidTrainDataRBC)

### storeDriverInput Operator

Declared as **public function**

#### Interface

Table 24: Inputs of storeDriverInput

| Name | Type | Comments and Information |
| --- | --- | --- |
| fromDMI\_TrainData | DMI\_Messages\_Bothways\_Pkg::DMI\_Train\_Data\_T |  |
| trainDataAckfromDriver | DMI\_Messages\_DMI\_to\_EVC\_Pkg::DMI\_Train\_Data\_Ack\_T |  |
| originalTrainData | TIU\_Types\_Pkg::trainData\_T |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |

Table 25: Outputs of storeDriverInput

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainDataForEVC | TIU\_Types\_Pkg::trainData\_T |  |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T |  |

#### Locals

Table 26: Locals of storeDriverInput

| Name | Type | Comments and Information |
| --- | --- | --- |
| newState | bool |  |
| updateTrainData | bool |  |

#### Operator Hierarchy

diagram : [diagram\_storeDriverInput\_1](#LinkS-!ed/1f816/2937/75C/55a89ab57c66)  
 *activate if* : [IfBlock1](#LinkS-!ed/1f816/2937/75C/55a89ab57c66)  
 branch : then  
 branch : else

#### Graphical and Textual Diagrams

##### View of diagram\_storeDriverInput\_1 (storeDriverInput)



Figure 11: View of diagram\_storeDriverInput\_1 (storeDriverInput)

Table 27: Conditional Blocks of diagram\_storeDriverInput\_1

| Conditional Block | Comments and Information |
| --- | --- |
| IfBlock1 |  |

Table 28: Actions of diagram\_storeDriverInput\_1

| Conditional Block Action | Comments and Information |
| --- | --- |
| IfBlock1:then |  |
| IfBlock1:else |  |

### storeTIUData Operator

Declared as **public function**

#### Comments and Information

**storeTIUData Comments:**

TIU Data are only updated at the beginning of the initialisation procedure.  
In later phases changing the data is not allowed.

#### Interface

Table 29: Inputs of storeTIUData

| Name | Type | Comments and Information |
| --- | --- | --- |
| trainDatafromTIU | TIU\_Types\_Pkg::trainData\_T |  |
| originalTrainData | TIU\_Types\_Pkg::trainData\_T |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |

Table 30: Outputs of storeTIUData

| Name | Type | Comments and Information |
| --- | --- | --- |
| actualTrainData | TIU\_Types\_Pkg::trainData\_T |  |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T |  |

#### Operator Hierarchy

diagram : [diagram\_storeTIUData\_1](#LinkS-!ed/1f755/7478/1448/55a6000b20f)

#### Graphical and Textual Diagrams

##### View of diagram\_storeTIUData\_1 (storeTIUData)



Figure 12: View of diagram\_storeTIUData\_1 (storeTIUData)

### trainDataStorage Operator

Declared as **public node**

#### Comments and Information

**trainDataStorage Comments:**

Depending on source of data and state of the evc in respect of train data the data are updated according to the rules of section 3.18.3  
The current implementation does not support change of train data after start of missin.

#### Interface

Table 31: Inputs of trainDataStorage

| Name | Type | Comments and Information |
| --- | --- | --- |
| reset | bool |  |
| trainDatafromTIU | TIU\_Types\_Pkg::trainData\_T |  |
| trainDatafromDriver | DMI\_Messages\_Bothways\_Pkg::DMI\_Train\_Data\_T |  |
| trainDataAckfromDriver | DMI\_Messages\_DMI\_to\_EVC\_Pkg::DMI\_Train\_Data\_Ack\_T |  |
| actualStatus | trainData\_Types\_pkg::trainDataStatus\_T | **Comments:**  This item |
| eventsForTrainData | trainData\_Types\_pkg::trainData\_Events\_T |  |

Table 32: Outputs of trainDataStorage

| Name | Type | Comments and Information |
| --- | --- | --- |
| actualTrainData | TIU\_Types\_Pkg::trainData\_T |  |
| updatedStatus | trainData\_Types\_pkg::trainDataStatus\_T |  |

#### Locals

Table 33: Locals of trainDataStorage

| Name | Type | Properties | | Comments and Information |
| --- | --- | --- | --- | --- |
| dataFromDMI | bool |  | |  |
| dataFromTIU | bool |  | |  |
| modifyData | bool |  | |  |
| systemFailure | bool |  | |  |
| trainData | TIU\_Types\_Pkg::trainData\_T | last | trainData\_Types\_pkg::cEmptyTrainData |  |

#### Operator Hierarchy

diagram : [diagram\_trainDataStorage\_1](#LinkS-!ed/1f528/7478/1448/55a5f1561c4a)  
 *activate if* : [IfBlock1](#LinkS-!ed/1f528/7478/1448/55a5f1561c4a)  
 branch : then  
 branch : else  
 branch : then  
 branch : else  
 branch : then  
 branch : else

#### Graphical and Textual Diagrams

##### View of diagram\_trainDataStorage\_1 (trainDataStorage)



Figure 13: View of diagram\_trainDataStorage\_1 (trainDataStorage)

Table 34: Conditional Blocks of diagram\_trainDataStorage\_1

| Conditional Block | Comments and Information |
| --- | --- |
| IfBlock1 |  |

Table 35: Actions of diagram\_trainDataStorage\_1

| Conditional Block Action | Comments and Information |
| --- | --- |
| IfBlock1:then |  |
| IfBlock1:else:then |  |
| IfBlock1:else:else:then |  |
| IfBlock1:else:else:else |  |

## trainData\_Types\_pkg Package

### Types

Table 36: Public Types of trainData\_Types\_pkg

| Name | Definition | Comments and Information |
| --- | --- | --- |
| rbc\_info\_T | {valid : bool, rbc\_version : M\_VERSION, supervisingRBCid : int} | **Comments:**  Information about the RBC neeed for communication **valid Comments:**  Indicated the Information is valid **rbc\_version Comments:**  Version of the RBC **supervisingRBCid Comments:**  Identification of the supervising RBC in the interface to the RTM |
| trainData\_Events\_T | {trainStandStill : bool, driverRequestModify : bool, communicationSessionEstablished : bool, safeRadioConnectionLost : bool, approachingRBCarea : bool, MoRCreadyFlag : bool} | **Comments:**  Events of the EVC with impact on Train Data **trainStandStill Comments:**  3.18.3.3 Train is at standsill - modification of data is possible **driverRequestModify Comments:**  3.18.3.3.1 **communicationSessionEstablished Comments:**  3.18.3.4 **safeRadioConnectionLost Comments:**  3.18.3.4.2 **approachingRBCarea Comments:**  3.18.3.4 **MoRCreadyFlag Comments:**  Needed to make sure the Radio Management confirmation is done |
| trainData\_Trigger\_T | {brakeTrigger : bool, driverRequestModify : bool, shortenLocationBasedInformation : bool, deleteMA : bool, trainLengthIncreased : bool} | **Comments:**  Trigger of the EVC with resulting from Train Data Actions **brakeTrigger Comments:**  3.18.3.3.1 **driverRequestModify Comments:**  3.18.3.3 **shortenLocationBasedInformation Comments:**  3.18.3.7a) the location based information stored on-board shall be shortened to the current position of the train. Refer to appendix A.3.4 for the exhaustive list of information, which shall be shortened. **deleteMA Comments:**  3.18.3.7b) the stored MA, linking and track description, which have been received from the RBC after a level 2/3 transition or a RBC transition for a further location has been ordered, shall be deleted. **trainLengthIncreased Comments:**  3.18.3.8 In case the Train Data regarding train length has been increased, the currently used track description, if any, shall be considered as unknown in rear of the former min safe rear end of the train. |
| trainDataStatus\_T | {valid : bool, validatedByDriver : bool, validatedbyRBC : bool, watingForRBCResponse : bool, driverIsModificationTrainData : bool, timeStampValidateToRBC : T\_TRAIN} | **Comments:**  3.18.3 Train Data definition **valid Comments:**  Data is initialised based on data received from the TIU **validatedByDriver Comments:**  Data has been validated by the Driver **validatedbyRBC Comments:**  Data has been validated by the RBC **watingForRBCResponse Comments:**  3.18.3.4.1 Train is waiting for ackk to validation command **driverIsModificationTrainData Comments:**  3.18.3.3.1 Driver is Modifiing / Revalidating train data  **timeStampValidateToRBC Comments:**  8.7.4 Train data is acknowledged. |

### Constants

Table 37: Public Constants of trainData\_Types\_pkg

| Name | Type | Value | Comments and Information |
| --- | --- | --- | --- |
| cEmptyTrainData | TIU\_Types\_Pkg::trainData\_T | {valid : false, acknowledgedByDriver : false, trainCategory : NC\_TRAIN\_Train\_does\_not\_belong\_to\_any\_of\_the\_Other\_International\_Train\_Category, cantDeficientcy : NC\_CDTRAIN\_Cant\_Deficiency\_80\_mm, trainLength : 0, brakePerctage : 0, maxTrainSpeed : 0, loadingGauge : M\_LOADINGGAUGE\_The\_train\_does\_not\_fit\_to\_any\_of\_the\_interoperable\_loading\_gauge\_profiles, axleLoadCategory : M\_AXLELOADCAT\_A, airtightSystem : M\_AIRTIGHT\_Not\_fitted, axleNumber : 0, numberNationalSystems : 0, nationSystems : [0, 0, 0], numberTractionSystems : 0, tractionSystem : [{m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}, {m\_voltage : M\_VOLTAGE\_Line\_not\_fitted\_with\_any\_traction\_system, nid\_ctraction : 0}]} |  |
| cNoEvents | trainData\_Types\_pkg::trainData\_Events\_T | {trainStandStill : false, driverRequestModify : false, communicationSessionEstablished : false, safeRadioConnectionLost : false, approachingRBCarea : false, MoRCreadyFlag : false} |  |
| cNoStates | trainData\_Types\_pkg::trainDataStatus\_T | {valid : false, validatedByDriver : false, validatedbyRBC : false, watingForRBCResponse : false, driverIsModificationTrainData : false, timeStampValidateToRBC : 0.0} |  |
| cNoTrigger | trainData\_Types\_pkg::trainData\_Trigger\_T | {brakeTrigger : false, driverRequestModify : false, shortenLocationBasedInformation : false, deleteMA : false, trainLengthIncreased : false} |  |

End of document.