openETCS / UNISIG Subset-026-3.6

Calculate balise group locations and the current train position

Summary:
This model serves to determine the train location information as specified in Subset026-3.6 "Location principles, train position and train orientation".

Company: Siemens AG
Authors: Uwe Steinke
Reference: UNISIG Subset026-3.6 "Location principles, train position and train orientation"
Index: Version No 01.00.00
Date: 2015-08-17

Distribution List: <distribution list>

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1.   General Project Description

This model serves to determine the train location information as specified in Subset026-3.6 "Location principles, train position and train orientation".
It receives the information from passed balise groups including linking information and location references and makes up a list of balise groups in front of the train, calculates the current train position and assigs the "Last relevant balise group" LRBG.
During a train trip, it receives odometry data, keeps on track with passed balise groups and determines the current position.

The idea of the chosen solution is based on a "nominal location" starting with value 0 when the OBU is switched on. All distances announced by linking information are mapped to their appropriate nominal location by signed additions of the distances.

The top level of this model is represented by the node "calculateTrainPosition" (see 3.1.6 in this document) .

D3.6 Location Principles, Train Position and Train Orientation.

- Name: CalculateTrainPosition.etp
- Description: SUBSET-026-3, ISSUE : 3.3.0, 3.6 "Determine Train Location Information"
- Copyright Siemens AG, 2015
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http://joinup.ec.europa.eu/software/page/eupl/licence-eupl)
- Gist URL: ---
- Cryptography: No
- Author(s): Uwe Steinke

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.

2. Software Architecture

2.1. Project Architecture

This section displays the package hierarchy of projects.

Project CalculateTrainPosition
      CalculateTrainPosition_Pkg
           BG_relocation_Pkg
           BG_utilities_Pkg
           gp_functions_Pkg
           Linking_Pkg
           msgAdapter_Pkg
           Pos_Pkg

Project Library BasicLocationFunctions
      BasicLocationFunctions_Pkg

Project Library BG_Types
      BG_Types_Pkg
      Common_Types_Pkg
      Id_Pkg
      Packet_TrainTypes_Pkg
      Packet_Types_Pkg
      Radio_Types_Pkg

Project Library Obu_BasicTypes
      Obu_BasicTypes_Pkg

Project Library TrainPosition_Types
      TrainPosition_Types_Pck

2.2. Call Graph

This Call Graph displays the dependency tree of model operators.

1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::deleteBGs_fromIndex
      1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::deleteBGs_fromIndex_itr
2. CalculateTrainPosition_Pkg::BG_utilities_Pkg::mergeBGs_by_id
      2.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::mergeBGs_by_id_itr
         2.1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::mergeBG_by_id
            2.1.1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfBG_by_id
               2.1.1.1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfBG_by_id_itr
                  2.1.1.1.1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::positionedBGs_ids_equal
                    2.1.1.1.1.1.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::nidBG_nidc_equal
3. CalculateTrainPosition_Pkg::BG_utilities_Pkg::passedBGs_ids_equal
      3.1. CalculateTrainPosition_Pkg::BG_utilities_Pkg::nidBG_nidc_equal
4. CalculateTrainPosition_Pkg::calculateTrainPosition
      4.1. CalculateTrainPosition_Pkg::addAnnouncedBGs

CalculateTrainPosition_Pkg::BG_utilities_Pkg::trimSeqNoOnTrack_itr

CalculateTrainPosition_Pkg::BG_utilities_Pkg::positionedBGs_ids_equal
4.2.1.2.1.7.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::nidBG_nidc_equal
4.2.1.3.
CalculateTrainPosition_Pkg::BG_relocation_Pkg::recalculate_BG_locations_astern
4.2.1.3.1.
CalculateTrainPosition_Pkg::BG_relocation_Pkg::recalculate_BG_locations_astern_itr
4.2.1.3.1.1.
BasicLocationFunctions_Pkg::sub_2_distances [3]
4.2.1.3.1.2.
BasicLocationFunctions_Pkg::sub_2_odoDistances [2]
4.2.1.3.1.3.
CalculateTrainPosition_Pkg::BG_relocation_Pkg::recalculate_BG_location_astern
4.2.1.3.1.3.1.
BasicLocationFunctions_Pkg::add_2_Distances [2]
4.2.1.3.1.3.2.
BasicLocationFunctions_Pkg::overlapOf_2_Locations
4.2.1.3.1.3.3.
BasicLocationFunctions_Pkg::sub_2_distances [2]
4.2.1.3.1.3.4.
BasicLocationFunctions_Pkg::sub_2_odoDistances
4.2.1.3.1.3.5.
CalculateTrainPosition_Pkg::BG_relocation_Pkg::calculateLocalBGInaccuracies
4.2.1.3.1.3.5.1.
BasicLocationFunctions_Pkg::add_2_Distances
4.2.1.3.1.3.5.2.
BasicLocationFunctions_Pkg::scaledDLINK_2_dlink [2]
4.2.1.3.1.4.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::positionedBGs_ids_equal
4.2.1.3.1.4.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::nidBG_nidc_equal
4.2.2. CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfBG_by_id
4.2.2.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfBG_by_id_itr
4.2.2.1.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::positionedBGs_ids_equal
4.2.2.1.1.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::nidBG_nidc_equal
4.2.3. CalculateTrainPosition_Pkg::genPassedBG_SeqNo
4.2.3.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfPassedBG_by_id
4.2.3.1.1.
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4.2.3.1.1.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::indexOfBG_by_id_itr
4.2.3.1.1.1.1.
CalculateTrainPosition_Pkg::BG_utilities_Pkg::positionedBGs_ids_equal
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4.2.3.2. CalculateTrainPosition_Pkg::gp_functions_Pkg::countUp
4.2.4. CalculateTrainPosition_Pkg::passing_a_BG

3. CalculateTrainPosition Project

3.1. CalculateTrainPosition_Pkg Package

3.1.1.   Comments and Information

CalculateTrainPosition_Pkg Comments:
Incorporates the functions to calculate the balise group locations and the actual train position.

Table 1: CalculateTrainPosition_Pkg Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2015-08-17
	Version	01.00.00
	to_c	True
Remark_1	Description	CalculateTrainPosition - Description: Calculates the actual train position based on passed balise groups - Copyright Siemens AG, 2015 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.2.   Types

Table 2: Public Types of CalculateTrainPosition_Pkg

Name	Definition	Comments and Information
positionedBGs_w_overrun_T	{BGs : TrainPosition_Types_Pck::positionedBGs_T, overrun : bool}	

3.1.3.   Constants

Table 3: Public Constants of CalculateTrainPosition_Pkg

Name	Type	Value	Comments and Information
cNoInfoFromLinking	TrainPosition_Types_Pck::infoFromLinking_T	{valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}	
cNoOfAtLeast_8_LRBGs	int	3	Comments: Covers 3.6.2.2 c): ??? The on-board equipment shall be able to accept information referring to one of at least eight LRBGONB last reported to the RBC.
cNoOfAtLeast_x_unlinkedBGs	int	2	Comments: Covers ???: Min no of unlinked BGs to be memorized

Name	Type	Value	Comments and Information
		{valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetectionInaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, noCoordinateSystemHasBeenAssigned : false, trainOrientationToBG : Q_DIRLRBG_Reverse, trainRunningDirectionToBG : Q_DIRTRAIN_Reverse}, linkedBGs : [{valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0 q_linkorientation : Q_LINKORIENTATION_The_balise_grou	

Name	Type	Value	Comments and Information
		{valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0,	

Name	Type	Value	Comments and Information
		[{valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0,	

Name	Type	Value	Comments and Information
		{outOfMemSpace : false, passedBG_foundNotWhereExpected : false, positionCalculation_inconsistent : false, linkedBGMissed : false, BGpassedInUnexpectedDirection : false, BG_LinkingConsistencyError : false, twoConsecutiveLinkedBGs_missed : false, doubleRepositioningError : false, bg : {valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version :	

Name	Type	Value	Comments and Information
cNoValidIndex	int	-1	Comments: An invalid index.

Name	Type	Value	Comments and Information
		{valid : false, timestamp : 0, trainPositionIsUnknown : false, noCoordinateSystemHasBeenAssigned : false, trainPosition : {nominal : 0, d_min : 0, d_max : 0}, estimatedFrontEndPosition : 0, minSafeFrontEndPosition : 0, maxSafeFrontEndPostion : 0, LRBG : {valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_S	

3.1.4.   addAnnouncedBGs Operator

Declared as **`private function`**

3.1.4.1.   Interface

Table 4: Inputs of addAnnouncedBGs

Name	Type	Properties	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T		Comments: Input event reporting a balise group during its passage, if there is one.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T		Comments: The last collection of currently known BGs.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 5: Outputs of addAnnouncedBGs

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The collection of BGs as known when passedBG was passed.
overrun	bool	Comments: Indicates, that not all of the elements of BGs_2 could be merged into BGs_out, due to not enough space in BGs_out.

3.1.4.2.   Locals

Table 6: Locals of addAnnouncedBGs

Name	Type	Comments and Information
lrbg	TrainPosition_Types_Pck::positionedBG_T	

3.1.4.3.   Operator Hierarchy

diagram : diagram_addAnnouncedBGs_1

3.1.4.4. Graphical and Textual Diagrams

3.1.4.4.1. View of diagram_addAnnouncedBGs_1 (addAnnouncedBGs)
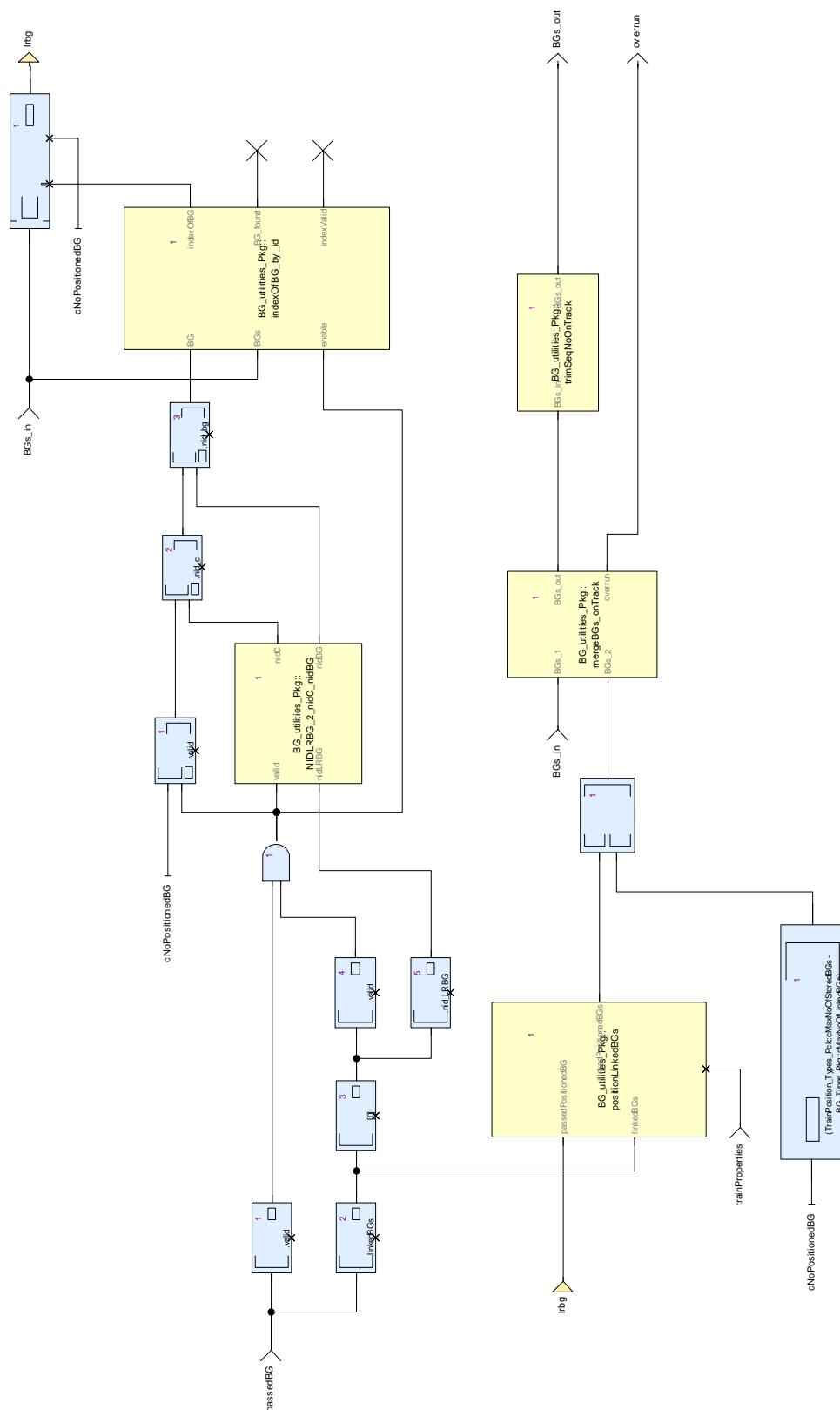
Figure 1: View of diagram_addAnnouncedBGs_1 (addAnnouncedBGs)

Table 7: positionLinkedBGs (#1) hidden inputs assignment of diagram_addAnnouncedBGs_1

Rank	Name	Value
1	trainProperties	*wired (_L25)*

3.1.5.   calculateBGLocations Operator

Declared as **private node**

3.1.5.1.   Comments and Information

calculateBGLocations Comments:
Calculation of the locations of passed and announced BGs

Table 8: calculateBGLocations Annotations

Note Name	Attribute	Value
GdC_1	Author	Author : Uwe Steinke
	DateC	Created : 2014-15-22
	DateM	Modified : 2014-06-03
	Version	No 00.03.00
	to_c	True
Remark_1	Description	The main function calculating the actual train position. - Description: Calculates the actual train position based on passed balise groups - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.5.2.   Interface

Table 9: Inputs of calculateBGLocations

Name	Type	Properties	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T		Comments: Input event reporting a balise group during its passage, if there is one.

Name	Type	Properties	Comments and Information
lastBGs	TrainPosition_Types_Pck::positionedBGs_T		Comments: The last collection of currently known BGs.
reset	bool		Comments: Resets all to an initials state and deletes all stored BGs.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 10: Outputs of calculateBGLocations

Name	Type	Comments and Information
BGs	TrainPosition_Types_Pck::positionedBGs_T	Comments: The collection of currently known BGs.
errors	TrainPosition_Types_Pck::positionErrors_T	
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The most recently passed positioned balise group.

3.1.5.3.   Locals

Table 11: Locals of calculateBGLocations

Name	Type	Comments and Information
BGpassedInUnexpectedDirection	bool	
outOfMemSpace	bool	
passedBG_foundNotWhereExpected	bool	
passedPositionedBG_loc	TrainPosition_Types_Pck::positionedBG_T	

3.1.5.4.   Operator Hierarchy

<u>diagram</u> : diagram_errorReporting
<u>diagram</u> : diagram_passing_a_BG

3.1.5.5.   Graphical and Textual Diagrams

3.1.5.5.1.   View of diagram_errorReporting (calculateBGLocations)
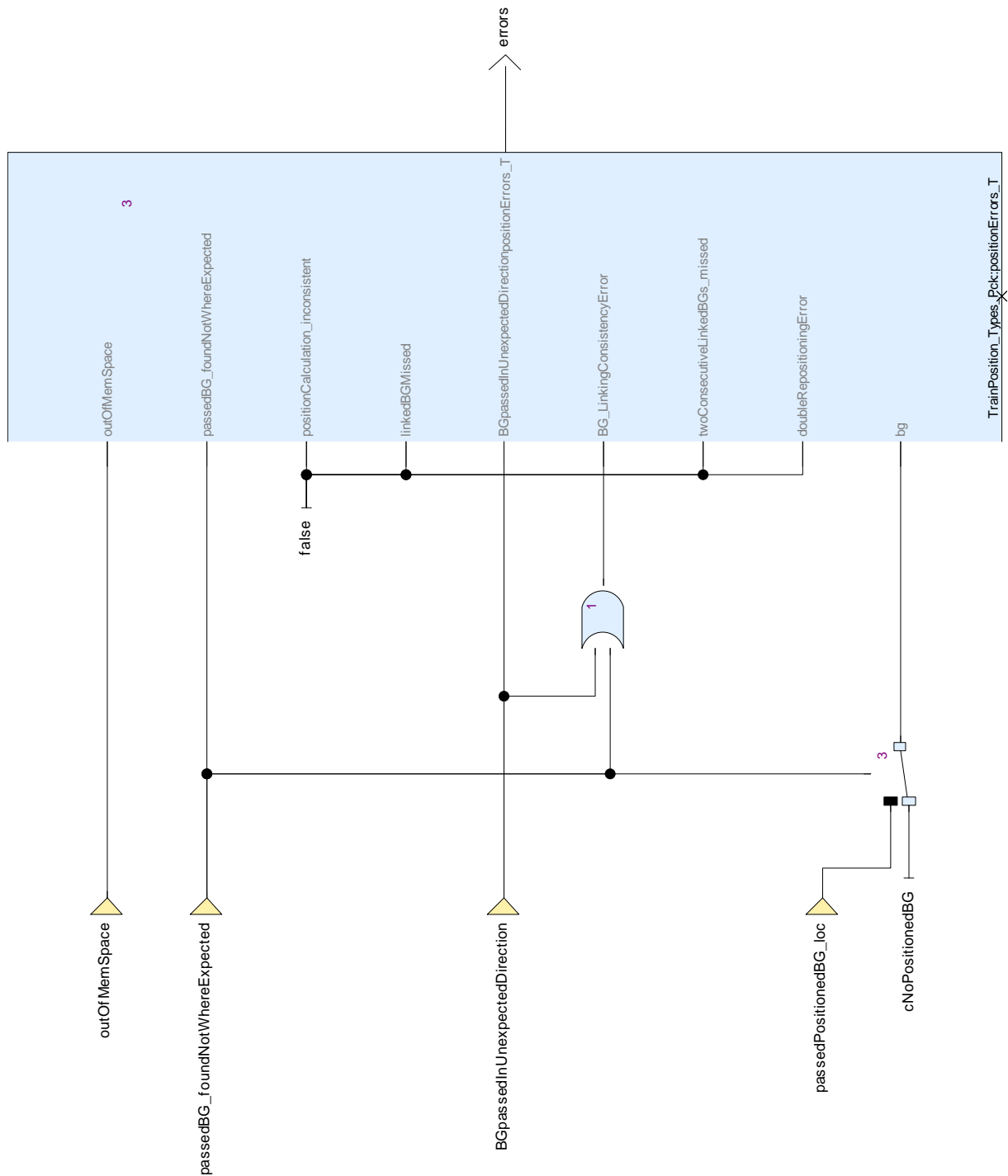
Figure 2: View of diagram_errorReporting (calculateBGLocations)

3.1.5.5.2.   View of diagram_passing_a_BG (calculateBGLocations)
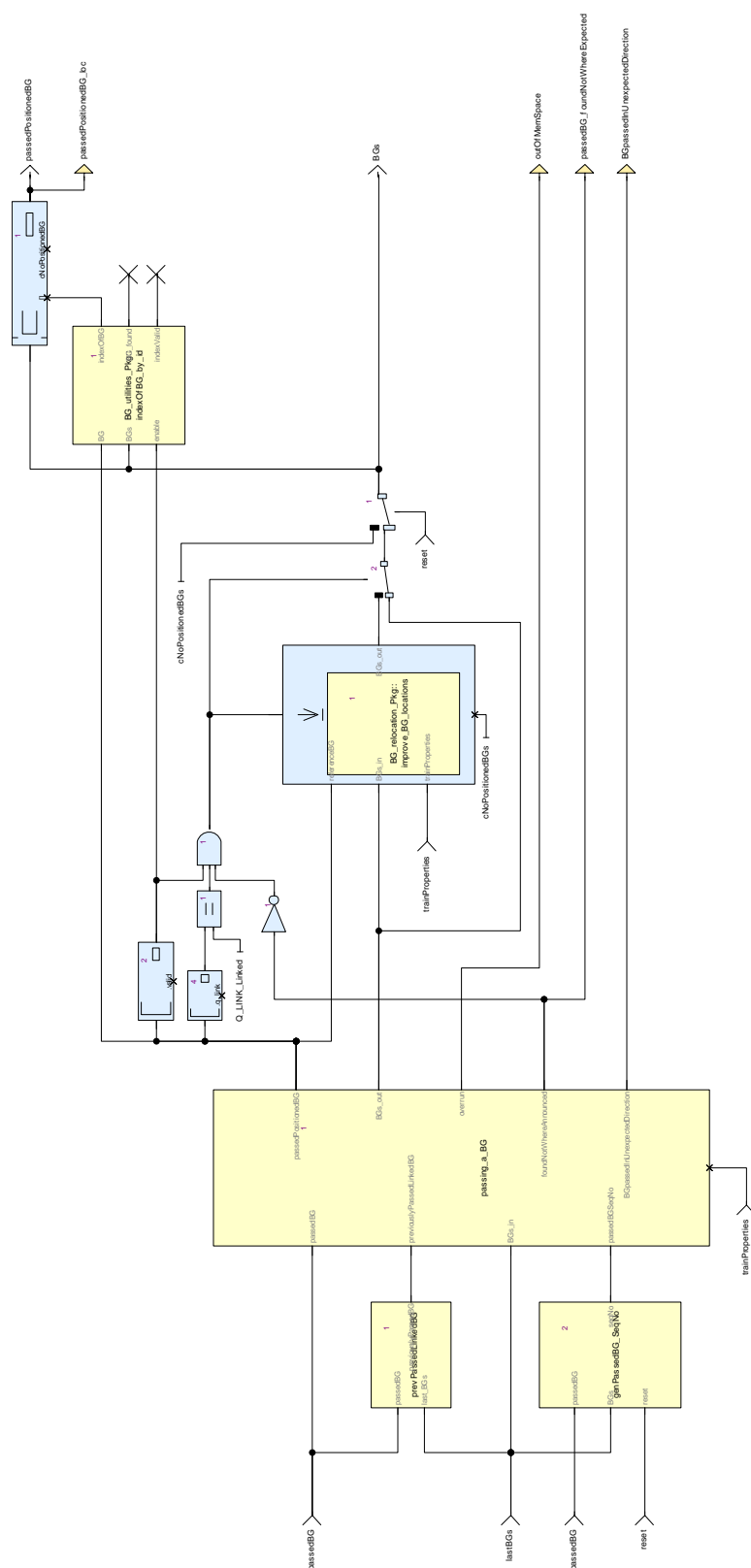
Figure 3: View of diagram_passing_a_BG (calculateBGLocations)

Table 12: improve_BG_locations (#1) hidden inputs assignment of diagram_passing_a_BG

Rank	Name	Value
1	trainProperties	*wired (_L355)*

Table 13: passing_a_BG (#1) hidden inputs assignment of diagram_passing_a_BG

Rank	Name	Value
1	trainProperties	*wired (_L356)*

3.1.6.   calculateTrainPosition Operator

Declared as **public node**

3.1.6.1.   Comments and Information

calculateTrainPosition Comments:
The main function calculating the locations of balise groups and the current train position.

Table 14: calculateTrainPosition Annotations

Note Name	Attribute	Value
GdC_1	Author	Author : Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2015-08-17
	Version	No 01.00.00
	to_c	True
Remark_1	Description	The main function calculating the actual train position. - Description: Calculates the current train position based on passed balise groups - Copyright Siemens AG, 2015 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.6.2.   Interface

Table 15: Inputs of calculateTrainPosition

Name	Type	Properties	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg:: odometry_T		Comments: The current odometry values
passedBG	BG_Types_Pkg::passe dBG_T		Comments: Input event reporting a balise group during its passage, if there is one. (Deprecated input, will be removed in future releases)
msgFromTrack	Common_Types_Pkg:: ReceivedMessage_T		Comments: Input event reporting a balise group during its passage or announcing linked balise groups ahead via radio.
trainProperties	TrainPosition_Types_Pc k::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.
reset	bool	hidden (#2)	Comments: Resets all to an initials state and deletes all stored BGs.

Table 16: Outputs of calculateTrainPosition

Name	Type	Comments and Information
trainPosition	TrainPosition_Types_Pc k::trainPosition_T	Comments: The resulting train position with reference to the LRBG
BGs	TrainPosition_Types_Pc k::positionedBGs_T	Comments: The collection of currently known BGs.
errors	TrainPosition_Types_Pc k::positionErrors_T	Comments: Errors and inconsistencies detected by the calculation.

3.1.6.3.   Locals

Table 17: Locals of calculateTrainPosition

Name	Type	Properties		Comments and Information
BG_passed	bool			
BGs_loc	TrainPosition_Types_Pc k::positionedBGs_T	last	cNoPositioned BGs	
errors_loc	TrainPosition_Types_Pc k::positionErrors_T			
linkedBGMissed	bool			
missedLinkedBG	TrainPosition_Types_Pc k::positionedBG_T			
onlyBGsAnnouncedVia Radio	bool			
passedBG_asPositioned BG	TrainPosition_Types_Pc k::positionedBG_T	default	cNoPositioned BG	Comments: The least recently passed BG (linked or unlinked)
passedBG_loc	BG_Types_Pkg::passe dBG_T			

Name	Type	Properties	Comments and Information
positionCalculationNotConsistent	bool		
trainPositionInfo	TrainPosition_Types_Pck::trainPositionInfo_T		
twoConsecutiveLinkedBGsMissed	bool		

3.1.6.4.   Operator Hierarchy

<u>diagram</u> : diagram_calculateBGs
      activate if : if_BGpassed_or_onlyAnnounced
          branch : then
          branch : else
               branch : then
               branch : else
<u>diagram</u> : diagram_calculateDecoration
<u>diagram</u> : diagram_detectMissingBGs
<u>diagram</u> : diagram_provideErrorFlags

3.1.6.5.   Graphical and Textual Diagrams

3.1.6.5.1.   View of diagram_calculateBGs (calculateTrainPosition)
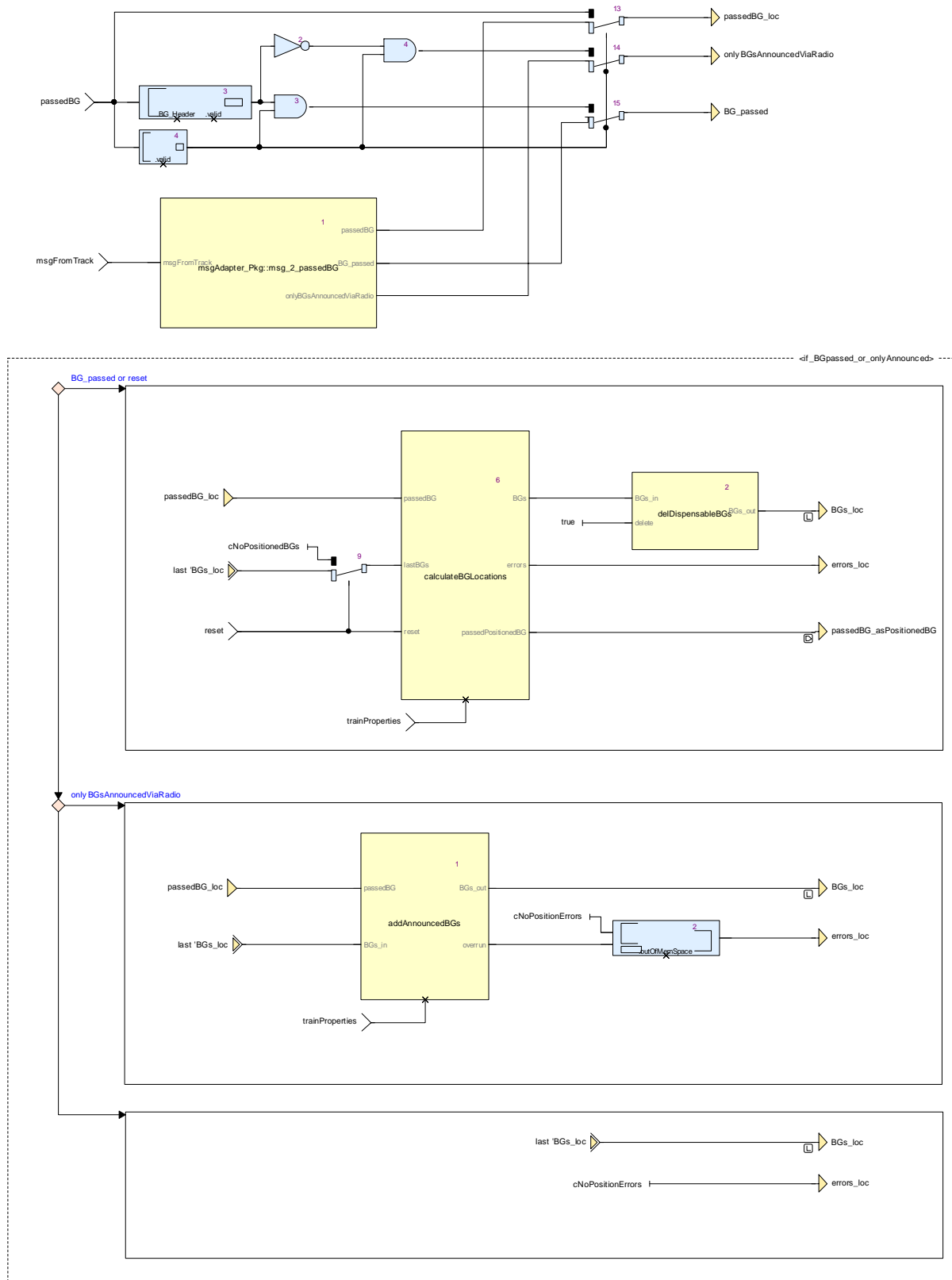
Figure 4: View of diagram_calculateBGs (calculateTrainPosition)

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Table 18: addAnnouncedBGs (#1) hidden inputs assignment of diagram_calculateBGs

Rank	Name	Value
1	trainProperties	*wired (_L16)*

Table 19: calculateBGLocations (#6) hidden inputs assignment of diagram_calculateBGs

Rank	Name	Value
1	trainProperties	*wired (_L21)*

Table 20: Conditional Blocks of diagram_calculateBGs

Conditional Block	Comments and Information
if_BGpassed_or_onlyAnnounced	

Table 21: Actions of diagram_calculateBGs

Conditional Block Action	Comments and Information
if_BGpassed_or_onlyAnnounced:then	
if_BGpassed_or_onlyAnnounced:else:then	
if_BGpassed_or_onlyAnnounced:else:else	

3.1.6.5.2.   View of diagram_calculateDecoration (calculateTrainPosition)
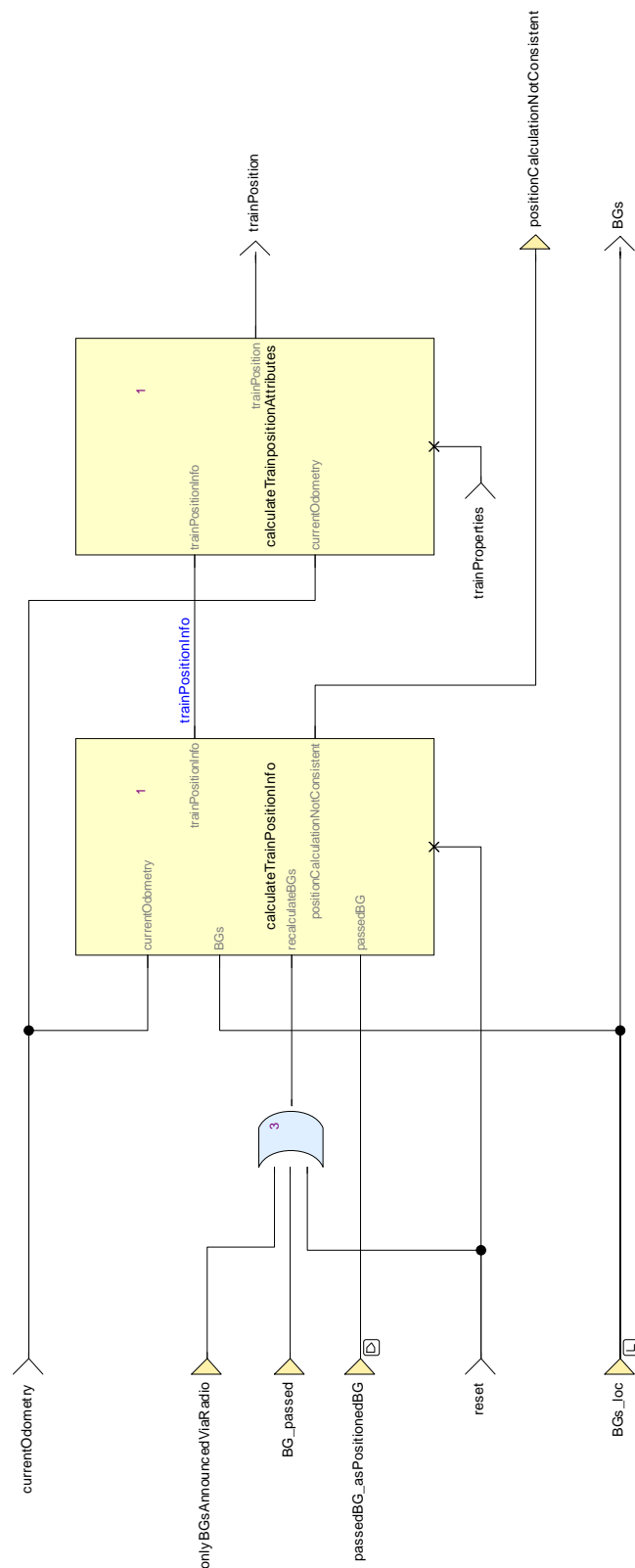
Figure 5: View of diagram_calculateDecoration (calculateTrainPosition)

Table 22: calculateTrainPositionInfo (#1) hidden inputs assignment of diagram_calculateDecoration

Rank	Name	Value
1	reset	*wired (_L238)*

Table 23: calculateTrainpositionAttributes (#1) hidden inputs assignment of diagram_calculateDecoration

Rank	Name	Value
1	trainProperties	*wired (_L207)*

3.1.6.5.3.   View of diagram_detectMissingBGs (calculateTrainPosition)
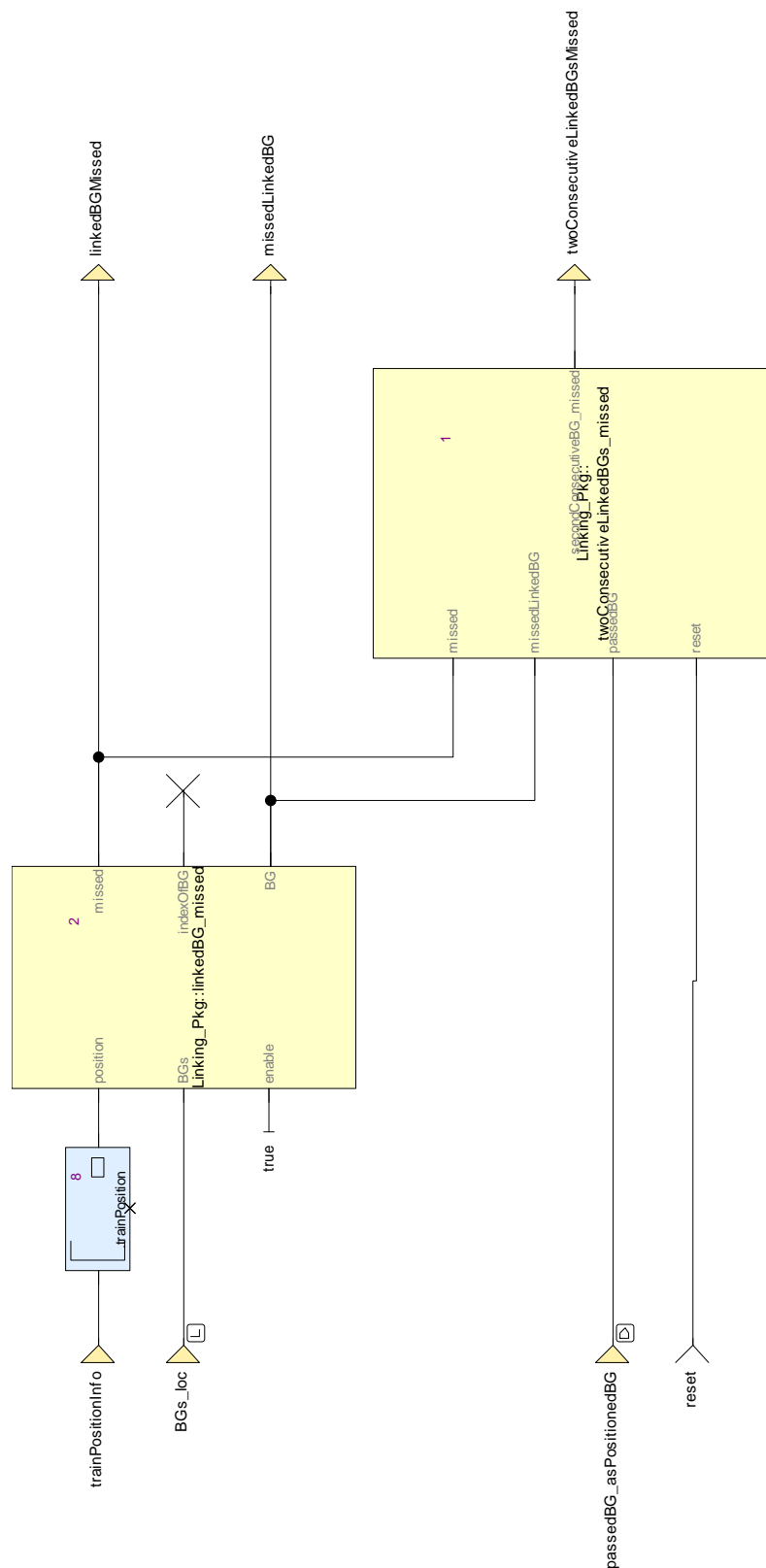
Figure 6: View of diagram_detectMissingBGs (calculateTrainPosition)

3.1.6.5.4. View of diagram_provideErrorFlags (calculateTrainPosition)
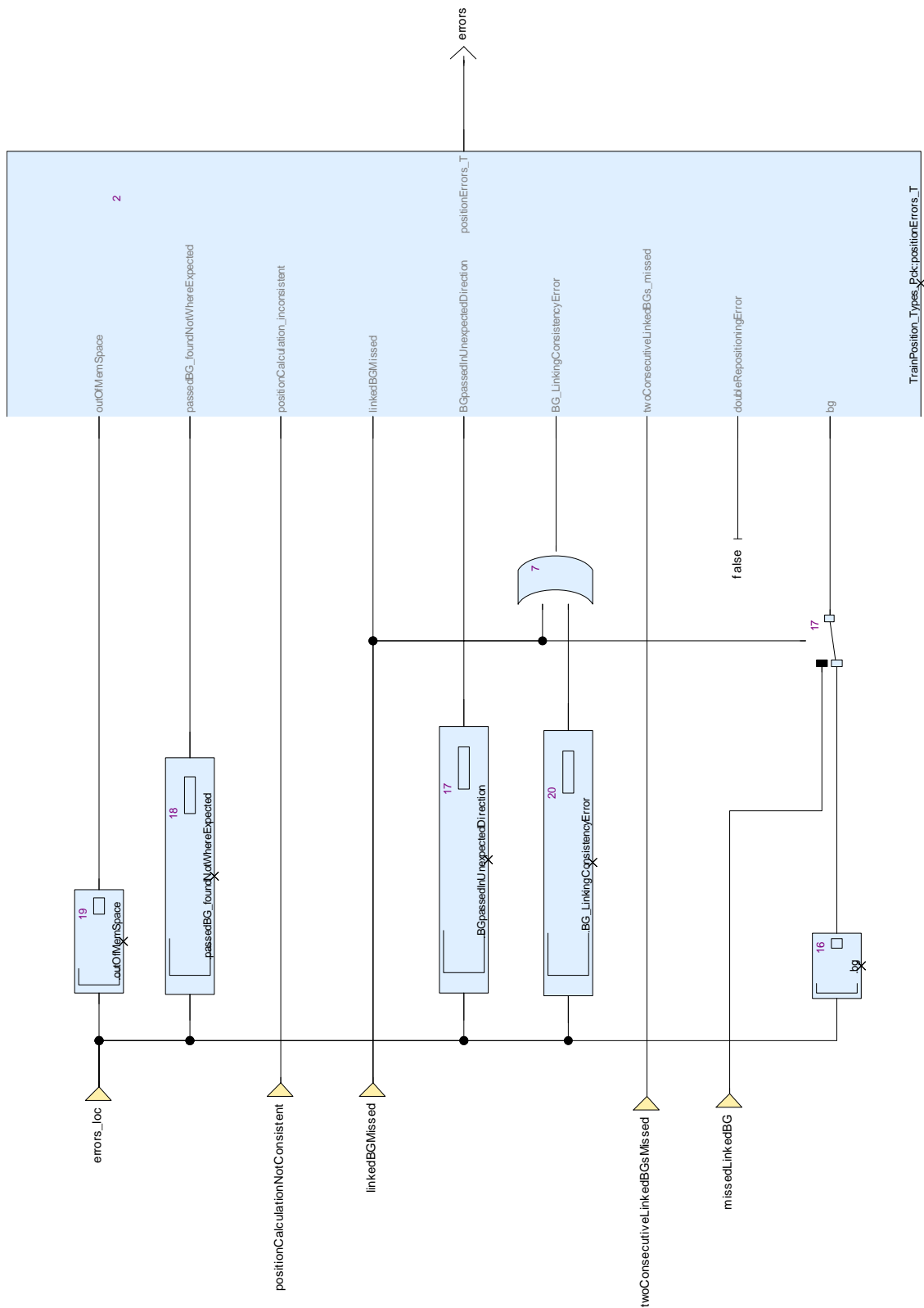
Figure 7: View of diagram_provideErrorFlags (calculateTrainPosition)

3.1.7. calculateTrainpositionAttributes Operator

Declared as **private function**

3.1.7.1.   Comments and Information

calculateTrainpositionAttributes Comments:
Figures out the attributes of the current train position with reference to a given LRBG.

Table 24: calculateTrainpositionAttributes Annotations

Note Name	Attribute	Value
GdC_1	Author	Author : Uwe Steinke
	DateC	Created : 2014-15-22
	DateM	Modified : 2014-06-03
	Version	No 00.03.00
	to_c	True
Remark_1	Description	The main function calculating the actual train position. - Description: Calculates the actual train position based on passed balise groups - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.7.2.   Interface

Table 25: Inputs of calculateTrainpositionAttributes

Name	Type	Properties	Comments and Information
trainPositionInfo	TrainPosition_Types_Pck::trainPositionInfo_T		Comments: The resulting train position with reference to the known list of balise groups.
currentOdometry	Obu_BasicTypes_Pkg::odometry_T		Comments: The current odometry values
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 26: Outputs of calculateTrainpositionAttributes

Name	Type	Comments and Information
trainPosition	TrainPosition_Types_Pck::trainPosition_T	Comments: The resulting train position with reference to the LRBG

3.1.7.3.   Operator Hierarchy

<u>diagram</u> : diagram_calculateTrainpositionAttributes

3.1.7.4.   Graphical and Textual Diagrams

3.1.7.4.1.   View of diagram_calculateTrainpositionAttributes (calculateTrainpositionAttributes)

Figure 8: View of diagram_calculateTrainpositionAttributes (calculateTrainpositionAttributes)

Table 27: frontendToLRBG (#1) hidden inputs assignment of diagram_calculateTrainpositionAttributes

Rank	Name	Value
1	trainProperties	*wired (_L307)*

3.1.8.   calculateTrainPositionInfo Operator

Declared as **private node**

3.1.8.1.   Comments and Information

calculateTrainPositionInfo Comments:
Provides the train position information.

3.1.8.2.   Interface

Table 28: Inputs of calculateTrainPositionInfo

Name	Type	Properties	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg:: odometry_T		Comments: The current odometry values
BGs	TrainPosition_Types_Pck::positionedBGs_T		
recalculateBGs	bool		Comments: Triggers the recalculation of the last linked and unlinked BGs.
passedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The least recently passed BG (linked or unlinked).
reset	bool	hidden (#1)	

Table 29: Outputs of calculateTrainPositionInfo

Name	Type	Comments and Information
trainPositionInfo	TrainPosition_Types_Pck::trainPositionInfo_T	Comments: The resulting train position with reference to the known list of balise groups.
positionCalculationNot Consistent	bool	

3.1.8.3.   Operator Hierarchy

<u>diagram</u> : diagram_calculateTrainPositionInfo_1

3.1.8.4.   Graphical and Textual Diagrams

3.1.8.4.1.   View of diagram_calculateTrainPositionInfo_1 (calculateTrainPositionInfo)
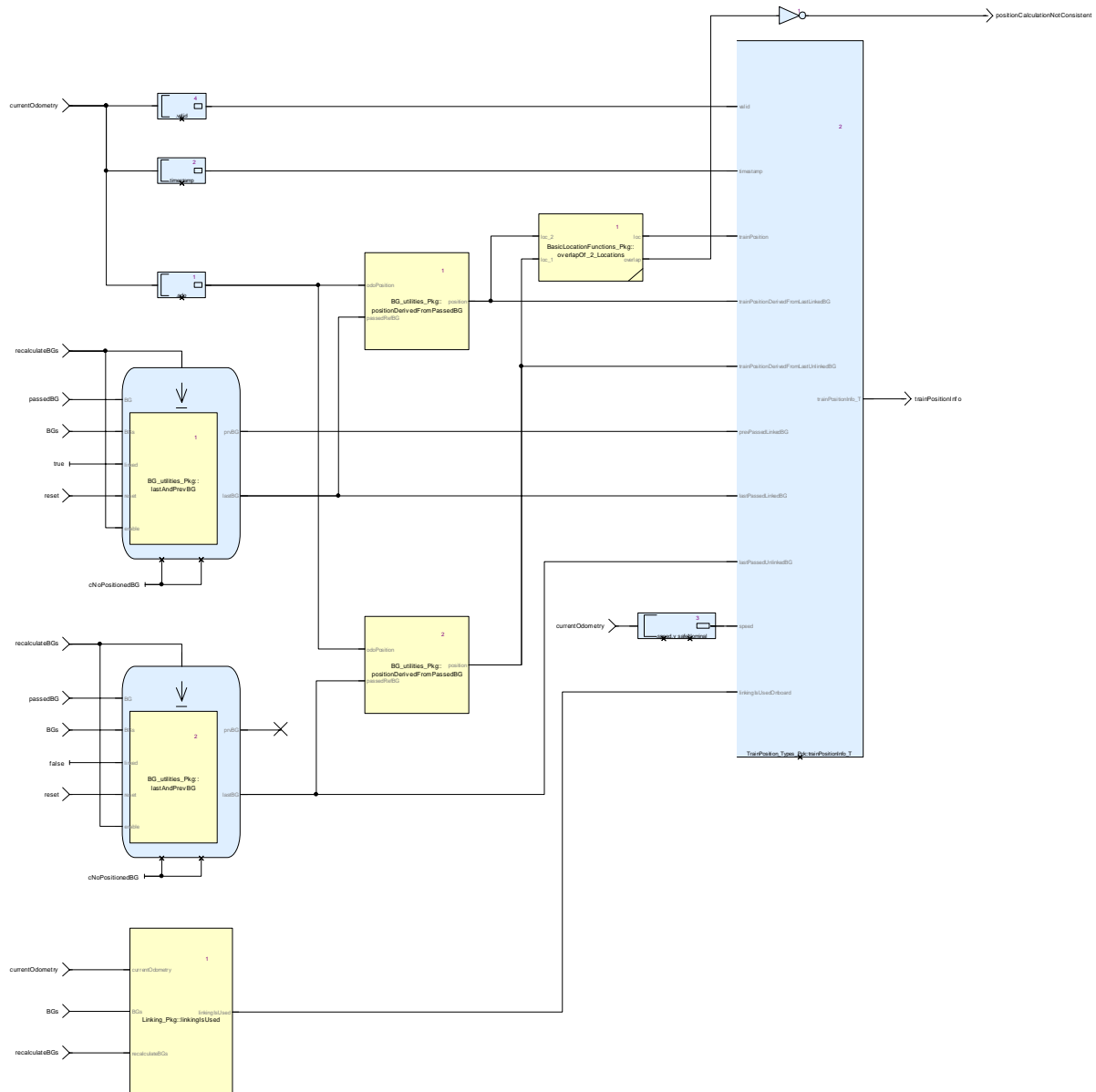
Figure 9: View of diagram_calculateTrainPositionInfo_1 (calculateTrainPositionInfo)

3.1.9.   delDispensableBGs Operator

Declared as **private function**

3.1.9.1.   Comments and Information

delDispensableBGs Comments:
Deletes dispensable BGs.
As dispensable are seen
- if at least on passed linked BGs exist: all BGs prior to the last
cNoOfAtLeast_8_LRBGs linked BGs (covers   3.6.2.2 c)).
- if no passed linked BGs exist: all BGs prior to the last
cNoOfAtLeast_2_unlinkedBGs unlinked BGs.

3.1.9.2.   Interface

Table 30: Inputs of delDispensableBGs

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	Comments: The collection of BGs as known before passedBG was passed.
delete	bool	

Table 31: Outputs of delDispensableBGs

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The collection of BGs as known when passedBG was passed.

3.1.9.3.   Locals

Table 32: Locals of delDispensableBGs

Name	Type	Comments and Information
passedLinkedBGsCount	int	
passedUnlinkedBGsCount	int	

3.1.9.4.   Operator Hierarchy

diagram : diagram_delDispensableBGs_1
        activate if : IfBlock1
                branch : then
                branch : else

3.1.9.5.   Graphical and Textual Diagrams

3.1.9.5.1.   View of diagram_delDispensableBGs_1 (delDispensableBGs)
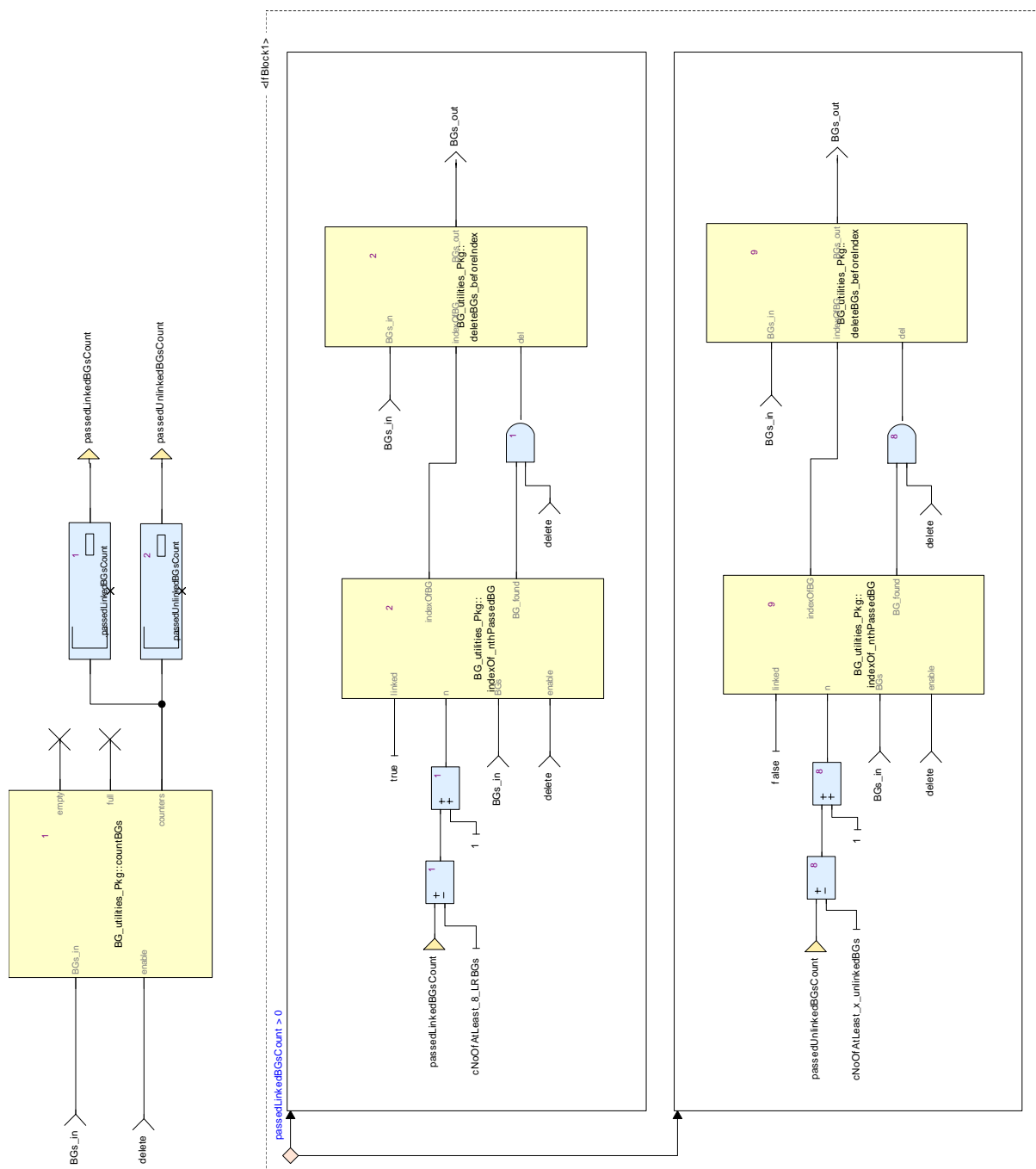
Figure 10: View of diagram_delDispensableBGs_1 (delDispensableBGs)

Table 33: Conditional Blocks of diagram_delDispensableBGs_1

Conditional Block	Comments and Information
IfBlock1	

Table 34: Actions of diagram_delDispensableBGs_1

Conditional Block Action	Comments and Information
IfBlock1:then	

Conditional Block Action	Comments and Information
IfBlock1:else	

3.1.10.   genPassedBG_SeqNo Operator

Declared as **private node**

3.1.10.1.   Comments and Information

genPassedBG_SeqNo Comments:
Generates a sequence number for every passed BG. The sequence no is intended to be an order criterion for the BGs on the track.
If a BG was already passed before, it's sequence no is preserved.

3.1.10.2.   Interface

Table 35: Inputs of genPassedBG_SeqNo

Name	Type	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T	Comments: Input event reporting a balise group during its passage, if there is one.
BGs	TrainPosition_Types_Pck::positionedBGs_T	
reset	bool	Comments: Resets all to an initials state and deletes all stored BGs.

Table 36: Outputs of genPassedBG_SeqNo

Name	Type	Comments and Information
seqNo	int	

3.1.10.3.   Locals

Table 37: Locals of genPassedBG_SeqNo

Name	Type	Comments and Information
incrPassedBGSeqNo	bool	
keepPassedBGSeqNo	bool	

3.1.10.4.   Operator Hierarchy

<u>diagram</u> : diagram_genPassedBG_SeqNo_1

3.1.10.5.   Graphical and Textual Diagrams

3.1.10.5.1.   View of diagram_genPassedBG_SeqNo_1 (genPassedBG_SeqNo)
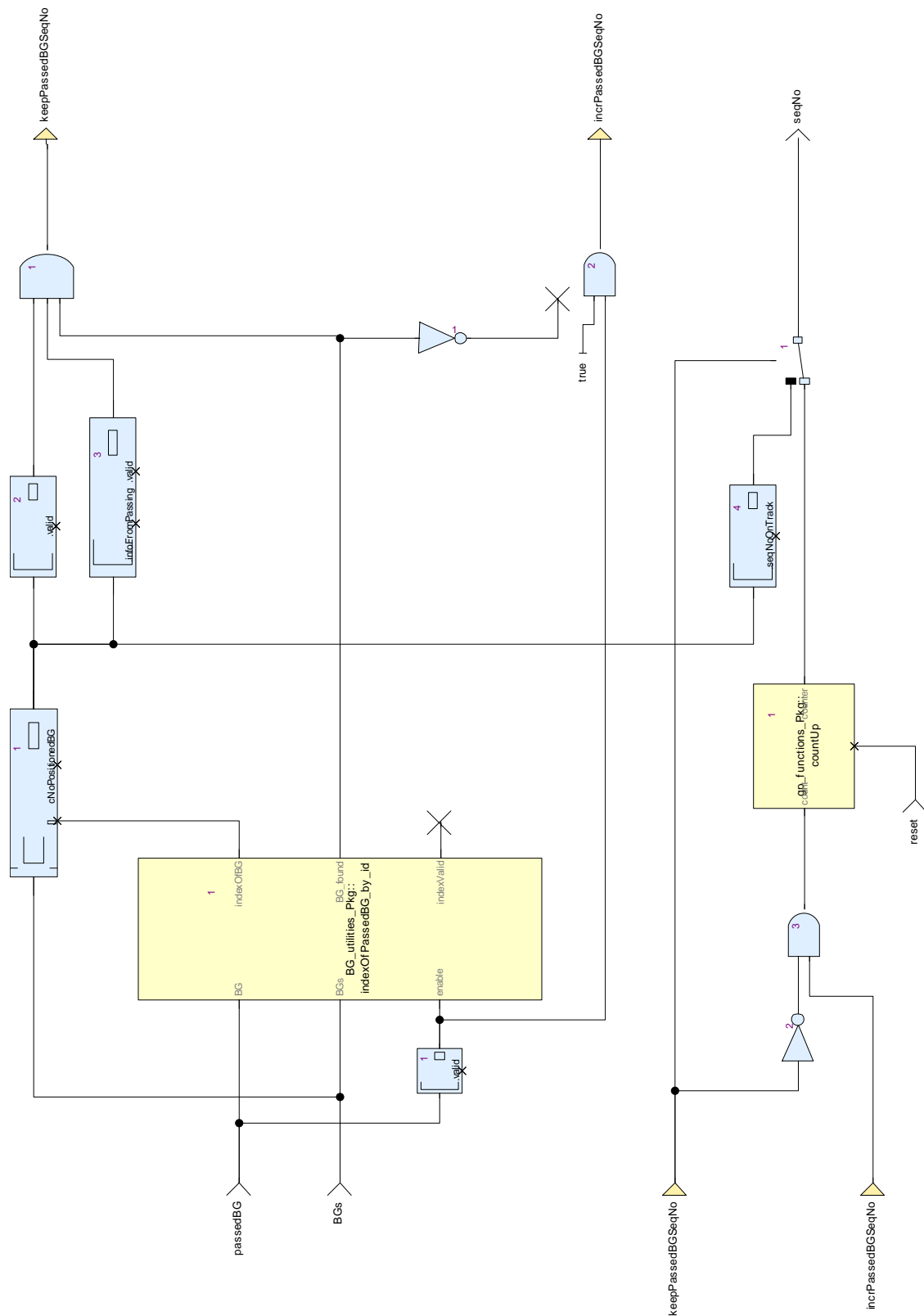
Figure 11: View of diagram_genPassedBG_SeqNo_1 (genPassedBG_SeqNo)

Table 38: countUp (#1) hidden inputs assignment of diagram_genPassedBG_SeqNo_1

Rank	Name	Value
1	reset	*wired (_L3)*

3.1.11.   memPassedBG Operator

Declared as **private node**

3.1.11.1.   Comments and Information

memPassedBG Comments:
Memorizes the passed linked and unlinked BG

Table 39: memPassedBG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Memorizes the passed linked and unlinked BG - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.11.2.   Interface

Table 40: Inputs of memPassedBG

Name	Type	Comments and Information
passedBG	TrainPosition_Types_Pck::positionedBG_T	
prevPassedLinkedBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The previously passed linked BG as a reference location for improvement of an unlinked BG location.
reset	bool	

Table 41: Outputs of memPassedBG

Name	Type	Comments and Information
passedLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
passedUnlinkedBG	TrainPosition_Types_Pck::positionedBG_T	

3.1.11.3. Locals

Table 42: Locals of memPassedBG

Name	Type	Properties		Comments and Information
passedUnlinkedBG_loc	TrainPosition_Types_Pck::positionedBG_T	last	cNoPositionedBG	

3.1.11.4. Operator Hierarchy

<u>diagram</u> : diagram_memPassedBG_1

3.1.11.5.   Graphical and Textual Diagrams

3.1.11.5.1.   View of diagram_memPassedBG_1 (memPassedBG)
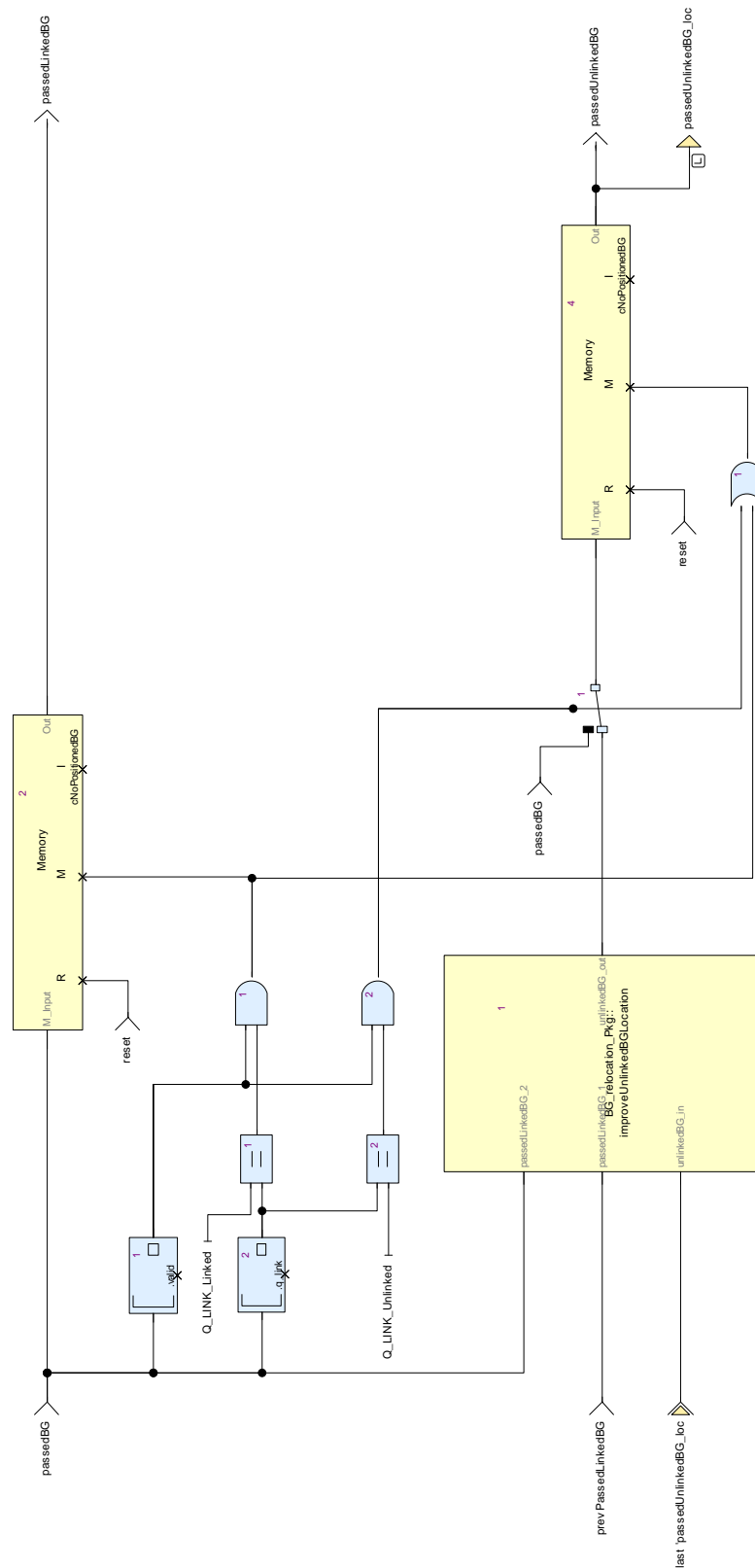
Figure 12: View of diagram_memPassedBG_1 (memPassedBG)

Table 43: Memory (#2) hidden inputs assignment of diagram_memPassedBG_1

Rank	Name	Value
1	Reset	*wired (_L17)*
2	MemCond	*wired (_L8)*
3	InitVal	cNoPositionedBG

Table 44: Memory (#4) hidden inputs assignment of diagram_memPassedBG_1

Rank	Name	Value
1	Reset	*wired (_L16)*
2	MemCond	*wired (_L25)*
3	InitVal	cNoPositionedBG

3.1.12.   passedBG_2_positionedBG Operator

Declared as **private function**

3.1.12.1.   Comments and Information

passedBG_2_positionedBG Comments:
Converts a passed balise group information to a positioned balise group information and calculates the location of the passed BG.

Table 45: passedBG_2_positionedBG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Converts a passed balise group to a positioned balise group information - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.12.2. Interface

Table 46: Inputs of passedBG_2_positionedBG

Name	Type	Properties	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T		Comments: The balise group as actually passed.
passedBG_asAnnounced	TrainPosition_Types_Pck::positionedBG_T		Comments: If the passed balise group was previously announced, this is the passed BG as known before passing. If the passed balise group was not announced, this input has to be set invalid.
previouslyPassedLinkedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The previously passed linked BG, if there is one. Serves a reference point for location calculation.
passedBGSeqNo	int		Comments: Sequence no of the just passed BG
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 47: Outputs of passedBG_2_positionedBG

Name	Type	Properties		Comments and Information
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T			Comments: The passed and positioned balise group. If the BG was announced by linking information previously, the linking and the passing information are merged together. If the BG was not announced before, only the passing information is evaluated.
foundNotWhereAnnounced	bool	default	false	Comments: Indicates that the location of the passed BG does not fit into the window, where it was expected by the linking information.
BGpassedInUnexpectedDirection	bool			Comments: 3.16.2.3.2: BG is passed in an unexpected direction
linkedBGs	TrainPosition_Types_Pck::linkedBGs_asPositionedBGs_T			Comments: The balise groups linked with the passed BG.

3.1.12.3.   Locals

Table 48: Locals of passedBG_2_positionedBG

Name	Type	Properties		Comments and Information
BG_wasAnnounced	bool			Comments: Indicates, that the BG was previously announced with linking information and the signature is consistent.
BGpassedInUnexpectedDirection_loc	bool			
foundNotWhereAnnounced_loc	bool	default	false	
location	Obu_BasicTypes_Pkg::LocWithInAcc_T			
passedPositionedBG_loc	TrainPosition_Types_Pck::positionedBG_T			

3.1.12.4.   Operator Hierarchy

diagram : diagram_calculateDistance
        activate if : ifAnnouncedOrABGWasPreviouslyPassed
                branch : then
                branch : else
                        branch : then
                        branch : else
                                branch : then
                                branch : else
diagram : diagram_checkAnnouncedInfo
diagram : diagram_checkBGorientation
diagram : diagram_passedBG_2_positionedBG
diagram : diagram_positionLinkedBGs

3.1.12.5.   Graphical and Textual Diagrams

3.1.12.5.1.   View of diagram_calculateDistance (passedBG_2_positionedBG)
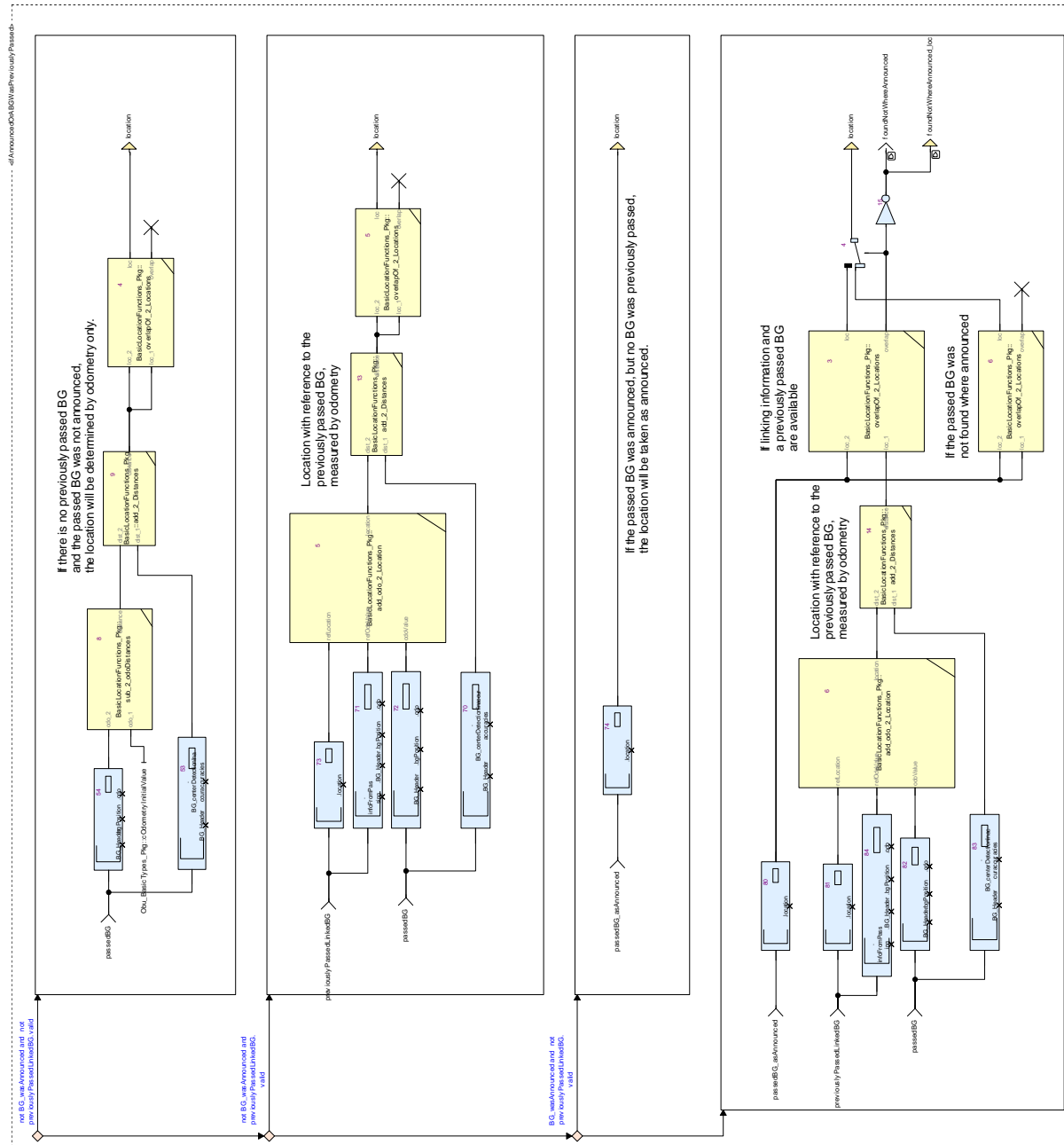
Figure 13: View of diagram_calculateDistance (passedBG_2_positionedBG)

diagram_calculateDistance Comments:
Calculates the location of the passed balise group, dependant on if it was announced by linking or not and if another BG was previously passed or not.

Table 49: Conditional Blocks of diagram_calculateDistance

Conditional Block	Comments and Information
ifAnnouncedOrABGWasPreviouslyPassed	

Table 50: Actions of diagram_calculateDistance

Conditional Block Action	Comments and Information
ifAnnouncedOrABGWasPreviouslyPassed:then	
ifAnnouncedOrABGWasPreviouslyPassed:else:then	
ifAnnouncedOrABGWasPreviouslyPassed:else:else:then	
ifAnnouncedOrABGWasPreviouslyPassed:else:else:else	

3.1.12.5.2.   View of diagram_checkAnnouncedInfo (passedBG_2_positionedBG)
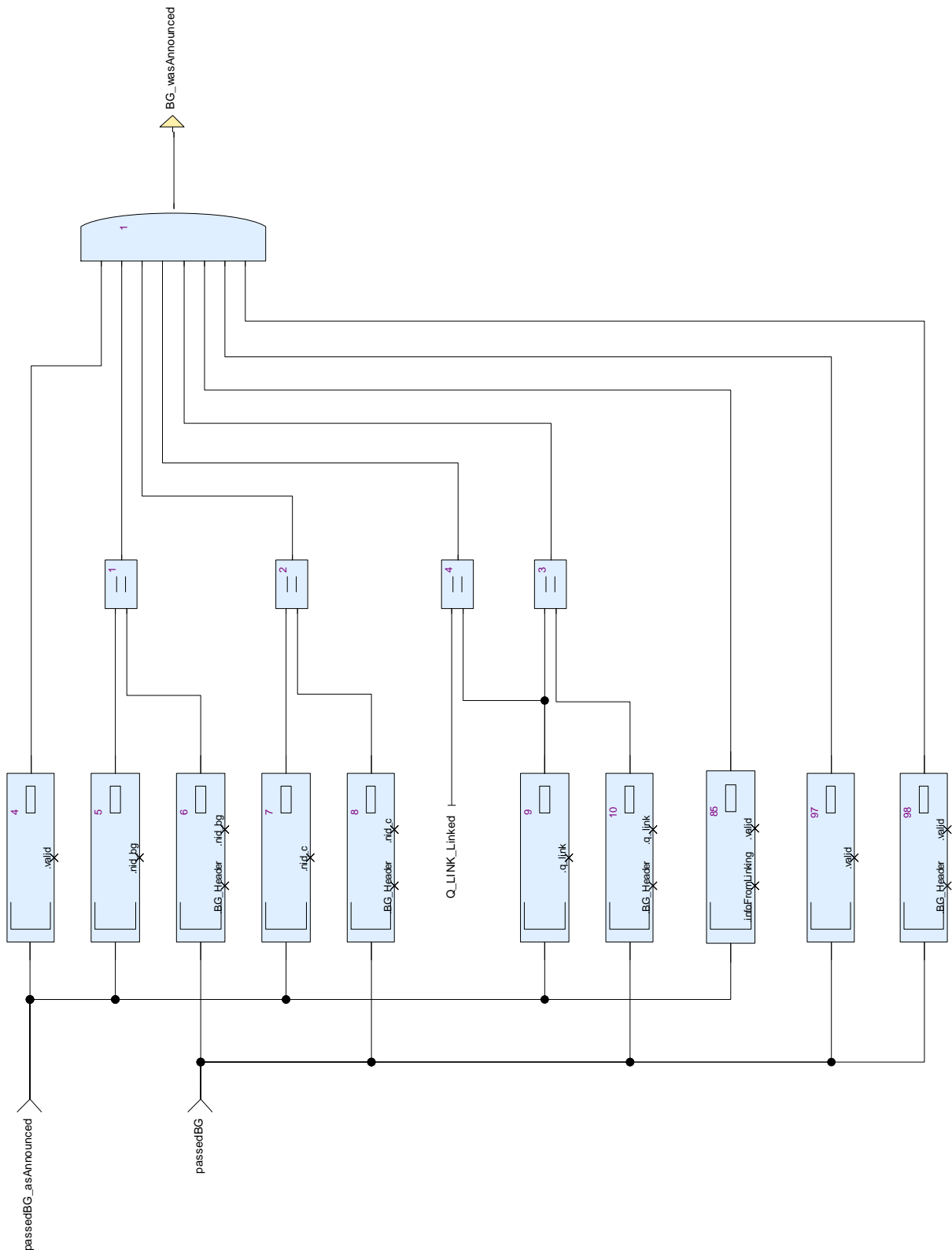
Figure 14: View of diagram_checkAnnouncedInfo (passedBG_2_positionedBG)

diagram_checkAnnouncedInfo Comments:
Checks if the passed BG was announced with linking information.

3.1.12.5.3. View of diagram_checkBGorientation (passedBG_2_positionedBG)
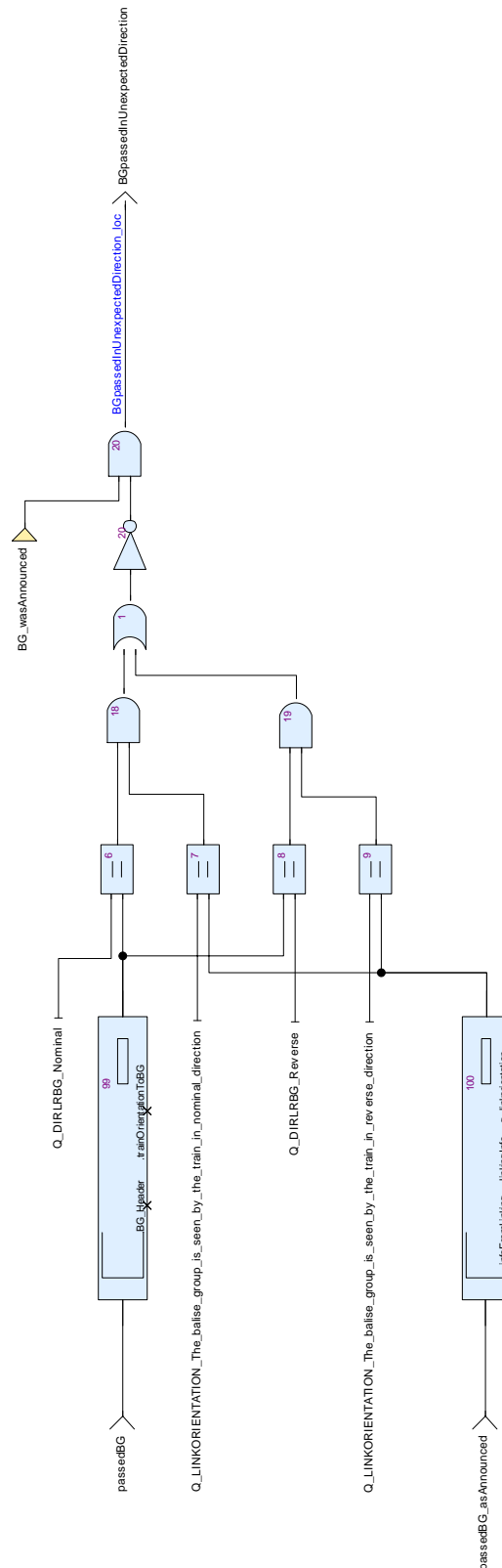
Figure 15: View of diagram_checkBGorientation (passedBG_2_positionedBG)

3.1.12.5.4.   View of diagram_passedBG_2_positionedBG (passedBG_2_positionedBG)
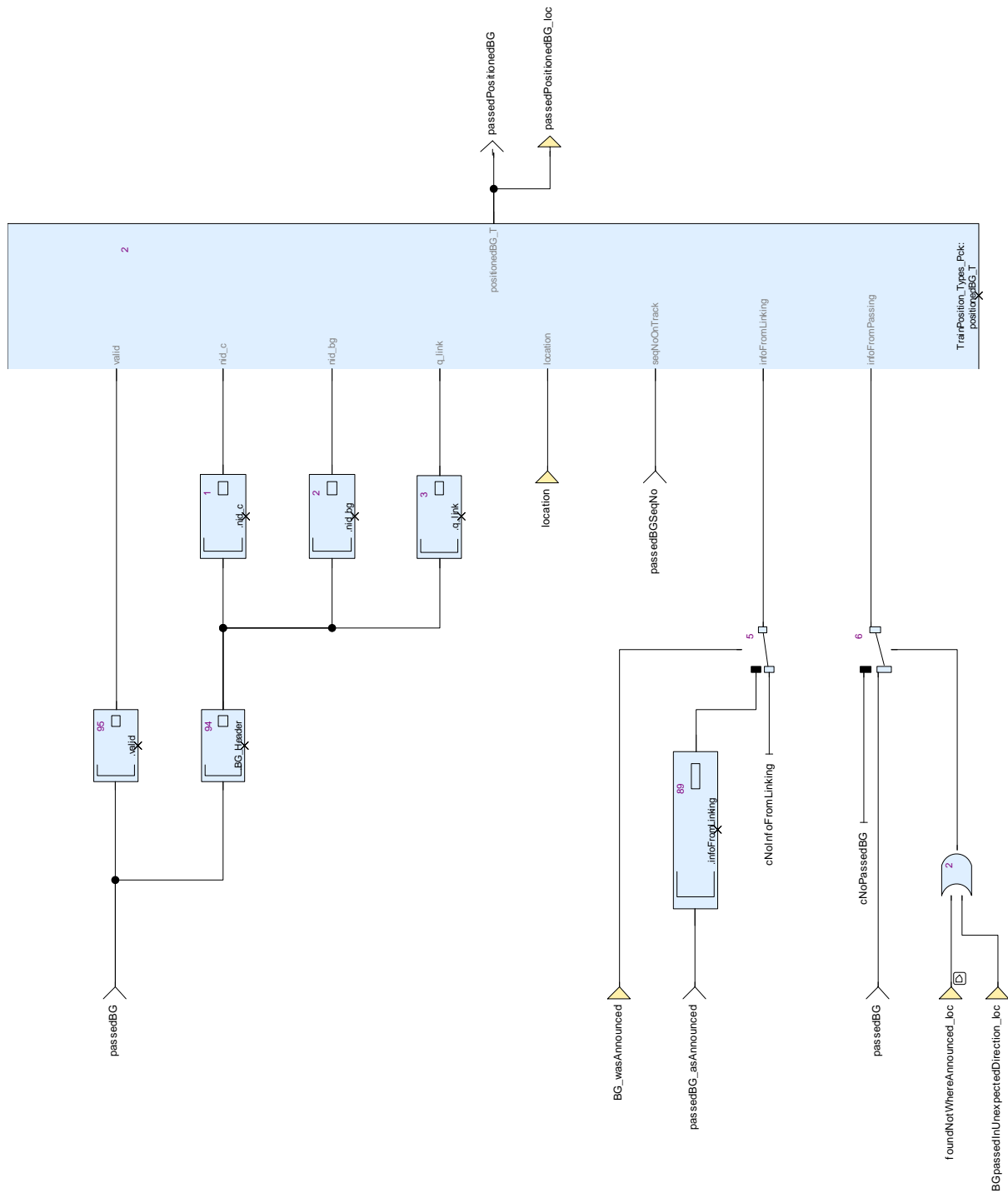
Figure 16: View of diagram_passedBG_2_positionedBG (passedBG_2_positionedBG)

3.1.12.5.5.   View of diagram_positionLinkedBGs (passedBG_2_positionedBG)
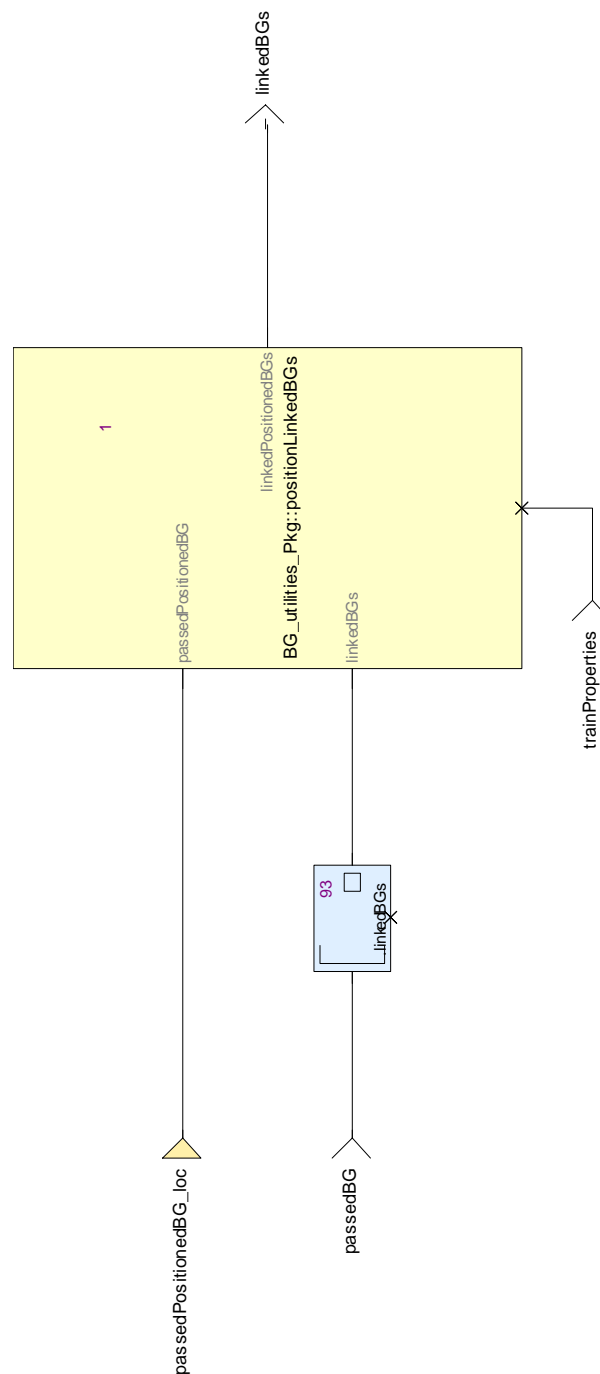
Figure 17: View of diagram_positionLinkedBGs (passedBG_2_positionedBG)

Table 51: positionLinkedBGs (#1) hidden inputs assignment of diagram_positionLinkedBGs

Rank	Name	Value
1	trainProperties	*wired (_L282)*

3.1.13.   passing_a_BG Operator

Declared as **private function**

3.1.13.1.   Comments and Information

passing_a_BG Comments:

Provides the location calculations while passing a BG

Table 52: passing_a_BG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Provides the location calculations while passing a BG - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.13.2.   Interface

Table 53: Inputs of passing_a_BG

Name	Type	Properties	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T		
previouslyPassedLinkedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The previously passed linked BG, if there is one. Serves a reference point for location calculation.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T		Comments: The collection of BGs as known before passedBG was passed.
passedBGSeqNo	int		Comments: Sequence no of the just passed BG
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 54: Outputs of passing_a_BG

Name	Type	Comments and Information
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The passed and positioned balise group. If the BG was announced by linking information previously, the linking and the passing information are merged together. If the BG was not announced before, only the passing information is evaluated.
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The collection of BGs as known when passedBG was passed.
overrun	bool	Comments: Indicates, that not all of the elements of BGs_2 could be merged into BGs_out, due to not enough space in BGs_out.
foundNotWhereAnnounced	bool	Comments: Indicates that the location of the passed BG does not fit into the range, where it was expected by the linking information.
BGpassedInUnexpectedDirection	bool	Comments: 3.16.2.3.2: BG is passed in an unexpected direction

3.1.13.3.   Operator Hierarchy

<u>diagram</u> : diagram_passing_a_BG_1

3.1.13.4.   Graphical and Textual Diagrams

3.1.13.4.1.   View of diagram_passing_a_BG_1 (passing_a_BG)
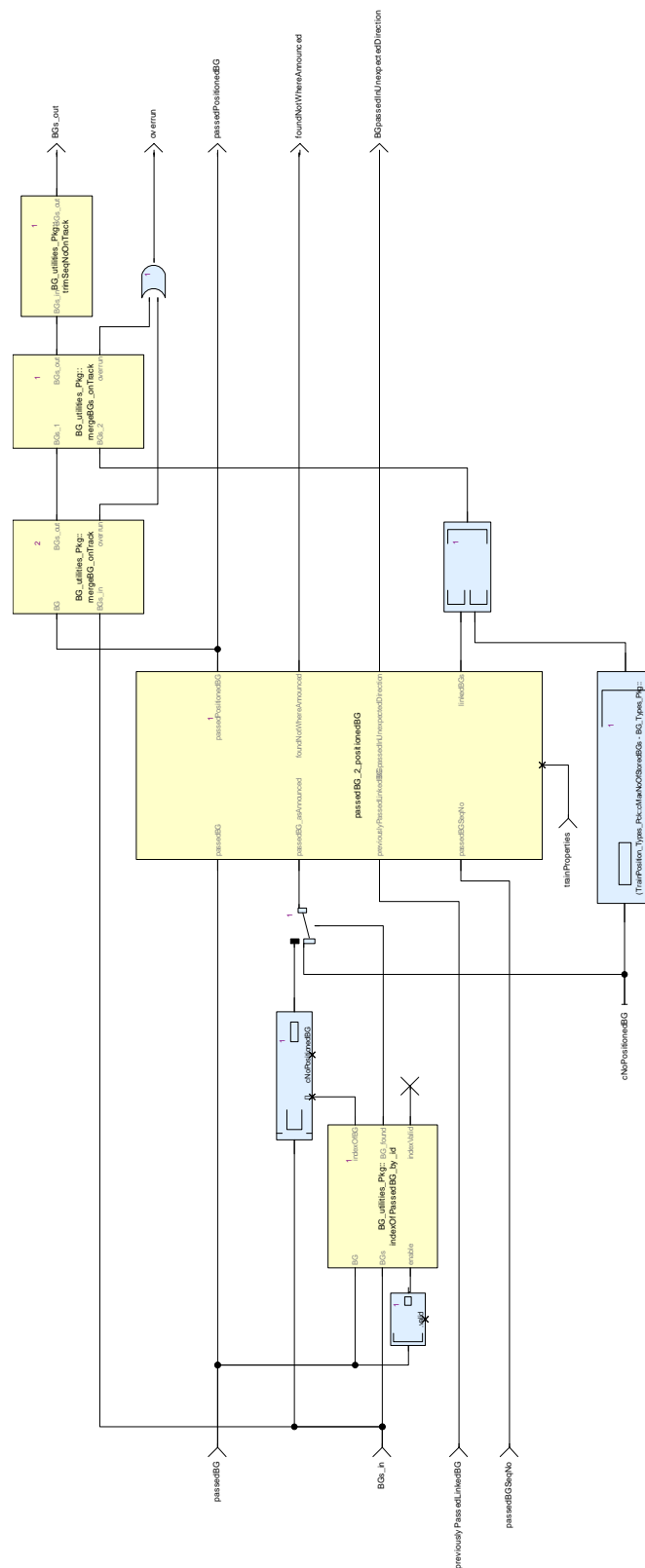
Figure 18: View of diagram_passing_a_BG_1 (passing_a_BG)

Table 55: passedBG_2_positionedBG (#1) hidden inputs assignment of diagram_passing_a_BG_1

Rank	Name	Value
1	trainProperties	*wired (_L31)*

3.1.14.   prevPassedLinkedBG Operator

Declared as **private function**

3.1.14.1.   Comments and Information

prevPassedLinkedBG Comments:
Memorizes the previously passed BG when a new BG is passed and the IDs are different

Table 56: prevPassedLinkedBG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Memorizes the previously passed BG when a new BG is passed and the IDs are different. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.1.14.2.   Interface

Table 57: Inputs of prevPassedLinkedBG

Name	Type	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T	Comments: The currently passed BG
last_BGs	TrainPosition_Types_Pck::positionedBGs_T	Comments: The current collection of BGs before the passed BG was found.

Table 58: Outputs of prevPassedLinkedBG

Name	Type	Comments and Information
previouslyPassedBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The previously passed linked BG

3.1.14.3.   Operator Hierarchy

<u>diagram</u> : diagram_prevPassedLinkedBG_1

3.1.14.4.   Graphical and Textual Diagrams

3.1.14.4.1.   View of diagram_prevPassedLinkedBG_1 (prevPassedLinkedBG)
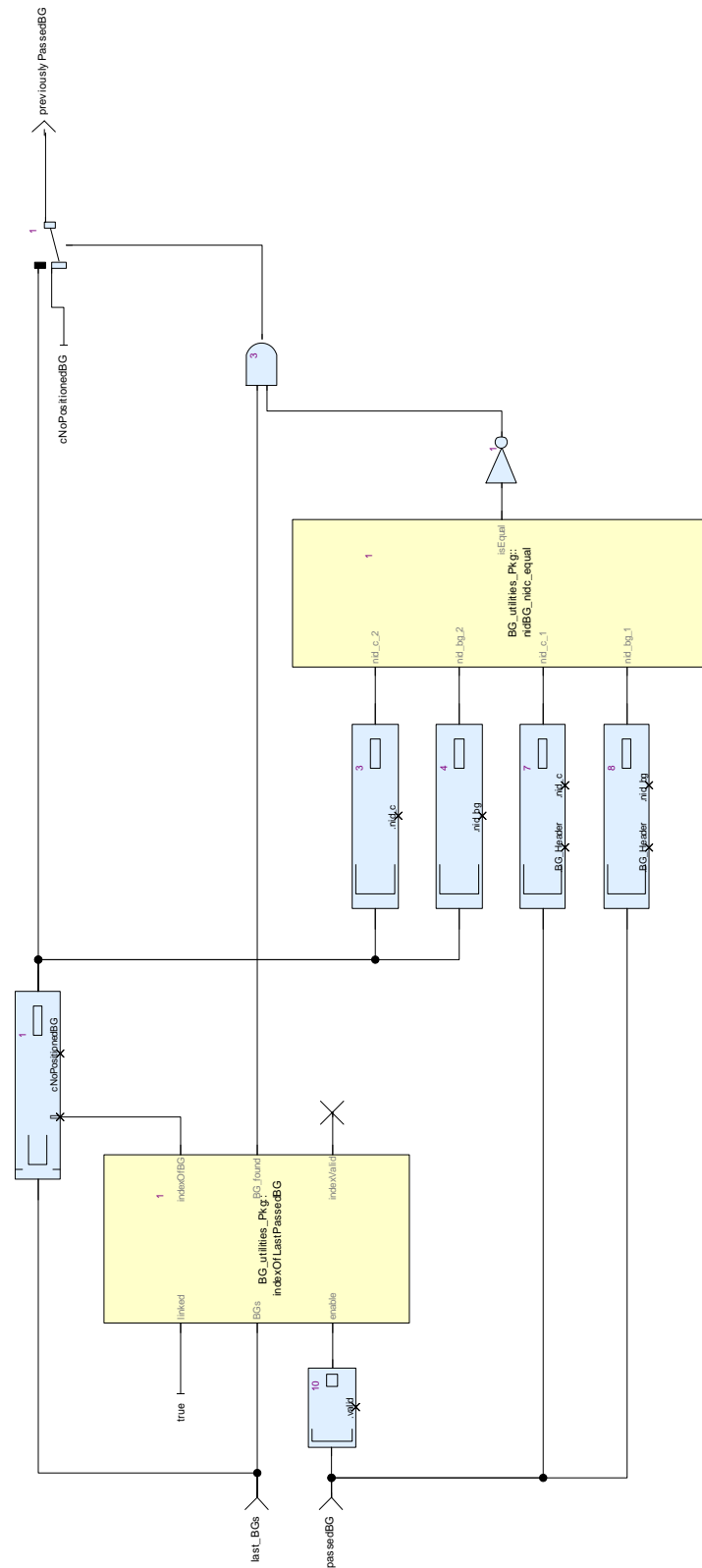
Figure 19: View of diagram_prevPassedLinkedBG_1 (prevPassedLinkedBG)

3.2. CalculateTrainPosition_Pkg::BG_relocation_Pkg Package

3.2.1.   Types

Table 59: Public Types of BG_relocation_Pkg

Name	Definition	Comments and Information
BGs_forImprovement_T	{prevLinkedBG : TrainPosition_Types_Pck::positionedBG_T, unlinkedBG : TrainPosition_Types_Pck::positionedBG_T, indexOfUnlinkedBG : int}	Comments: Serves to map and fold through the BGs prevLinkedBG Comments: The previous linked BG in the map and fold chain unlinkedBG Comments: The previous unlinked BG in the map and fold chain indexOfUnlinkedBG Comments: Enables the location recalculation for all BGs subsequent to refBG
linkedBG_index_T	{previousLinkedBG_idx : int, currentIndex : int, subsequentLinkedBG_idx : int}	previousLinkedBG_idx Comments: Index of the BG before currentIndex Comments: The current index subsequentLinkedBG_idx Comments: Index of the BG behind
linkedBGs_indices_T	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T ^TrainPosition_Types_Pck::cMaxNoOfStoredBGs	
refBGs_T	{refBG : TrainPosition_Types_Pck::positionedBG_T, prevLinkedBG : TrainPosition_Types_Pck::positionedBG_T, prevUnlinkedBG : TrainPosition_Types_Pck::positionedBG_T, recalculate : bool, sumOfBestDistances : Obu_BasicTypes_Pkg::LocWithInAcc_T}	Comments: Serves to map and fold through the BGs refBG Comments: The reference BG for the location recalculation. prevLinkedBG Comments: The previous linked BG in the map and fold chain; the linked BG, where sumOfPrevLinkingDistances refer to. prevUnlinkedBG Comments: The previous unlinked BG in the map and fold chain recalculate Comments: Enables the location recalculation for all BGs subsequent to refBG sumOfBestDistances Comments: The sum of the linking distances and odometry (for linking holes) from the chain of previous linked BGs since refBG.

3.2.2.   Constants

Table 60: Public Constants of BG_relocation_Pkg

Name	Type	Value	Comments and Information
cNoLinkedBG_index	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	{previousLinkedBG_idx : gp_functions_Pkg::noValidIndex, currentIndex : (-1), subsequentLinkedBG_idx : gp_functions_Pkg::noValidIndex}	

Name	Type	Value	Comments and Information
		{refBG : {valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0,	

3.2.3.   calculateLocalBGInaccuracies Operator

Declared as **private function**

3.2.3.1.   Comments and Information

calculateLocalBGInaccuracies Comments:
Calculates the inaccuracies of a BG caused by local effects:
- centerDetectionInaccuracy
- linking inaccuracy
- Q_NVLOCACC (National Value)
- Default value

3.2.3.2.   Interface

Table 61: Inputs of calculateLocalBGInaccuracies

Name	Type	Properties	Comments and Information
BG_in	TrainPosition_Types_Pck::positionedBG_T		Comments: The BG that's location has to be recalculated
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 62: Outputs of calculateLocalBGInaccuracies

Name	Type	Comments and Information
localInaccuracies	Obu_BasicTypes_Pkg::LocWithInAcc_T	

3.2.3.3.   Operator Hierarchy

diagram : diagram_calculateLocalBGInaccuracies_1

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3.2.3.4.   Graphical and Textual Diagrams

3.2.3.4.1.   View of diagram_calculateLocalBGInaccuracies_1 (calculateLocalBGInaccuracies)
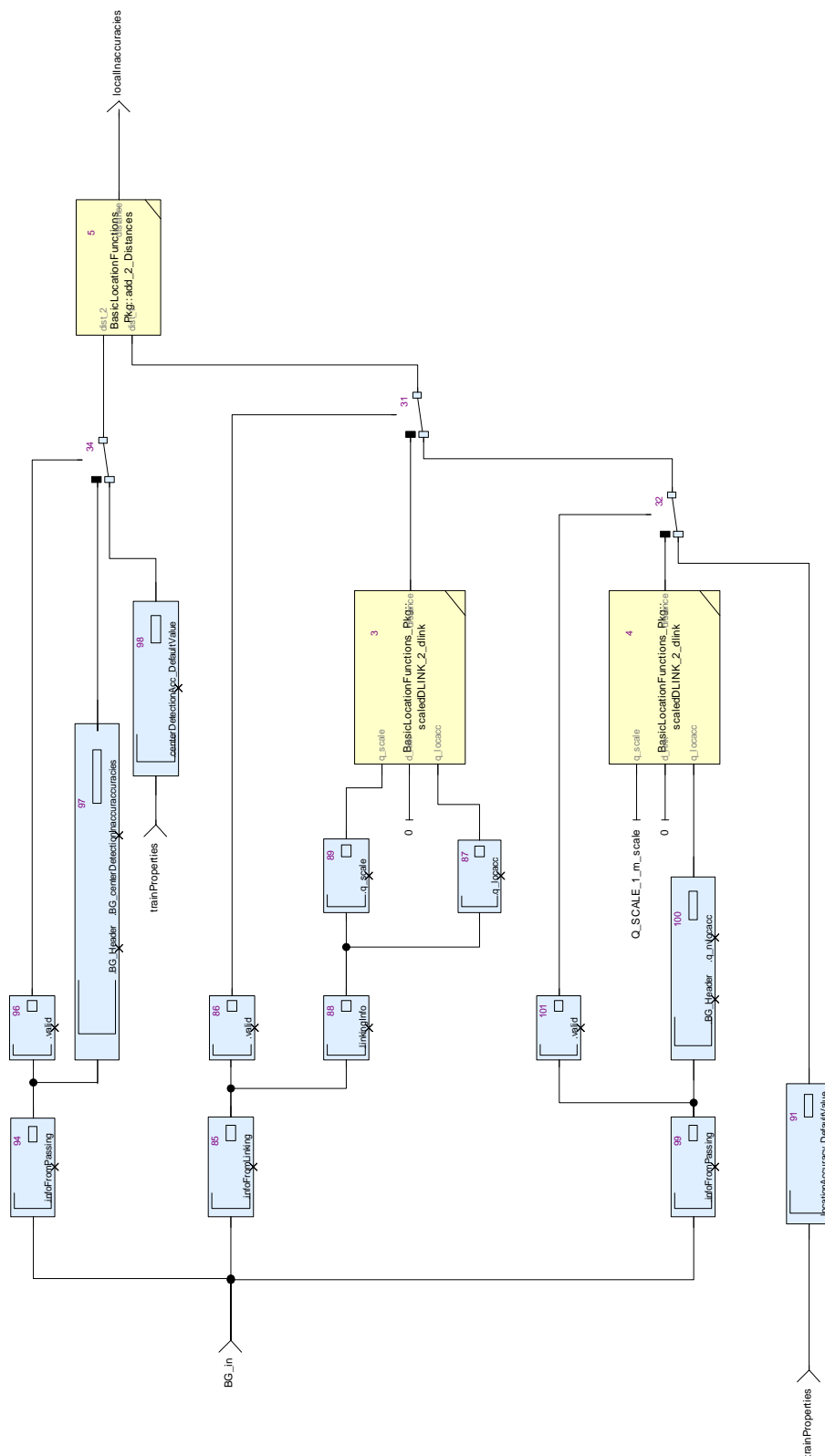
Figure 20: View of diagram_calculateLocalBGInaccuracies_1 (calculateLocalBGInaccuracies)

3.2.4. findLinkedBG_bckwd_itr Operator

Declared as **private function**

3.2.4.1. Comments and Information

findLinkedBG_bckwd_itr Comments:
Function for iterating through all BGs in backward direction.
If BG_in is a linked BG, index_out.subsequentLinkedIndex is set to the current index.
If not,   index_out.subsequentLinkedIndex is taken from the previous iteration.
index_out.currentIndex is taken from index_in without change.
index_out.previousLinkedIndex is taken unchanged from index_in.

3.2.4.2. Interface

Table 63: Inputs of findLinkedBG_bckwd_itr

Name	Type	Comments and Information
index_acc_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	
index_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	
BG_in	TrainPosition_Types_Pck::positionedBG_T	Comments: The unlinked BG that's location shall be improved

Table 64: Outputs of findLinkedBG_bckwd_itr

Name	Type	Comments and Information
index_acc_out	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	
index_out	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	

3.2.4.3. Operator Hierarchy

diagram : diagram_findLinkedBG_bckwd_itr_1

3.2.4.4.   Graphical and Textual Diagrams

3.2.4.4.1.   View of diagram_findLinkedBG_bckwd_itr_1 (findLinkedBG_bckwd_itr)
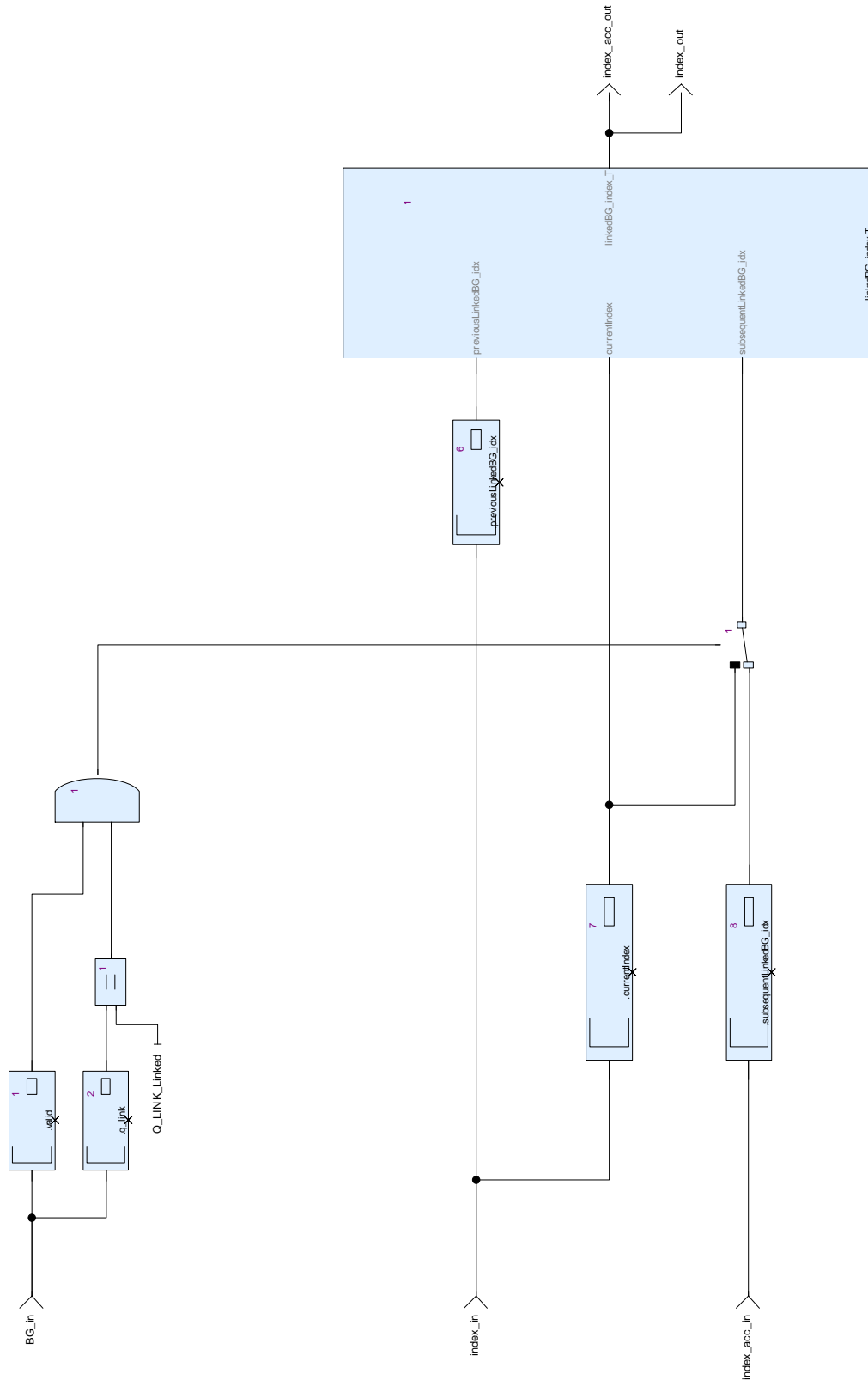
Figure 21: View of diagram_findLinkedBG_bckwd_itr_1 (findLinkedBG_bckwd_itr)

3.2.5.   findLinkedBG_fwd_itr Operator

Declared as **private function**

3.2.5.1.   Comments and Information

findLinkedBG_fwd_itr Comments:
Function for iterating through all BGs in forward direction.
If BG_in is a linked BG, index_out.previousLinked_BG_idx is set to the current index.
If not,   index_out.previousLinked_BG_idx is taken from the previous iteration.
index_out.currentIndex is generated be incrementing the index from the previous iteration.
 index_out.subsequentLinkedIndex taken unchanged from index_in.

3.2.5.2.   Interface

Table 65: Inputs of findLinkedBG_fwd_itr

Name	Type	Comments and Information
index_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	Comments: Indices for the iteration
BG_in	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be searched for.

Table 66: Outputs of findLinkedBG_fwd_itr

Name	Type	Comments and Information
index_acc	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	Comments: The results to be tranferred to the next iteration.
index_out	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	Comments: The resulting indices

3.2.5.3.   Operator Hierarchy

diagram : diagram_findLinkedBG_fwd_itr_1

3.2.5.4.   Graphical and Textual Diagrams

3.2.5.4.1.   View of diagram_findLinkedBG_fwd_itr_1 (findLinkedBG_fwd_itr)
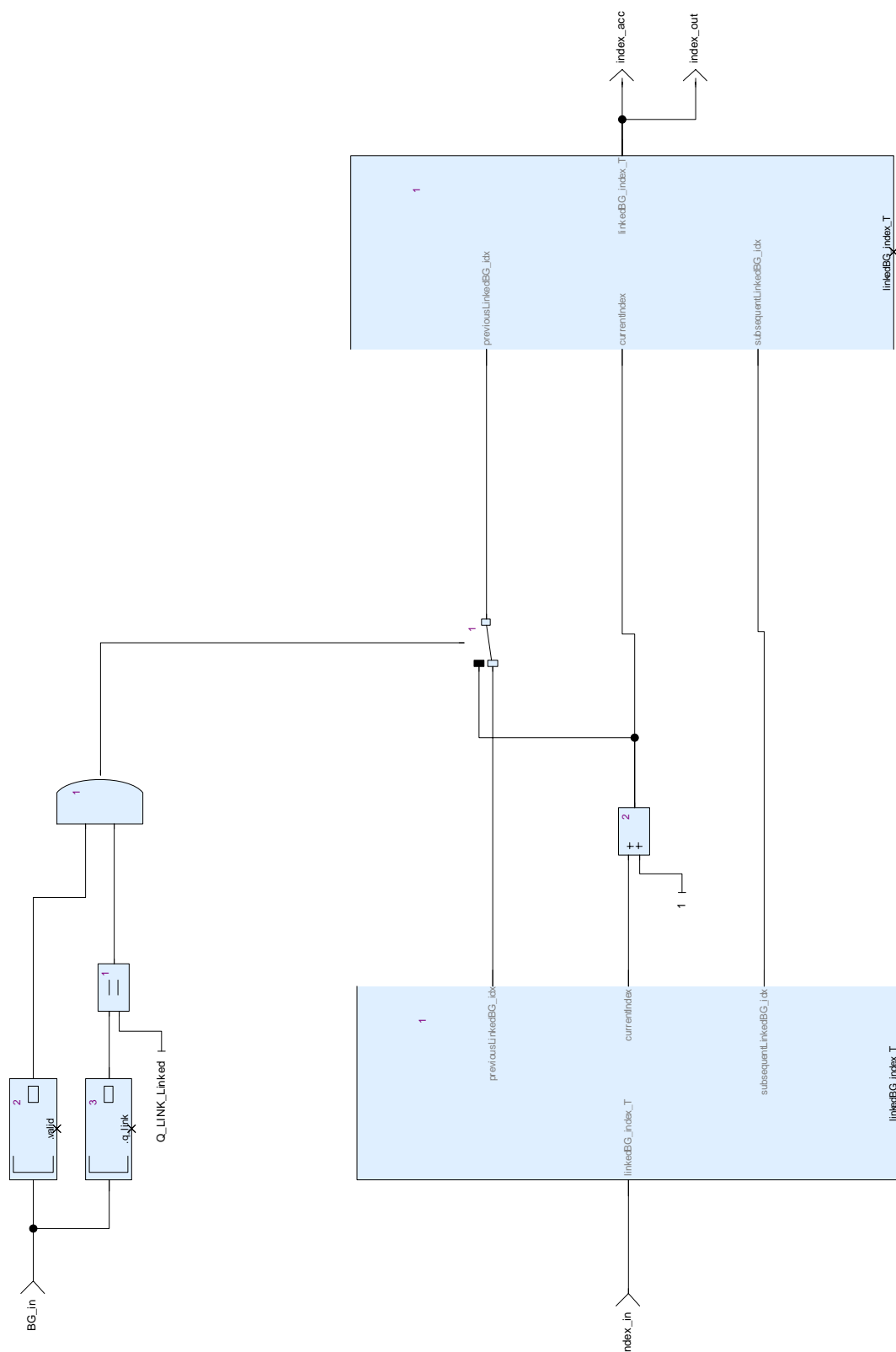
Figure 22: View of diagram_findLinkedBG_fwd_itr_1 (findLinkedBG_fwd_itr)

3.2.6. findLinkedBGs Operator

Declared as **private function**

3.2.6.1. Comments and Information

findLinkedBGs Comments:
Iterates through BGs_in forward and backward direction and looks for linked BGs.
The result is an array of indices, where each cell related to an unlinked BG provides
the indices of the linked BG before and behind the unlinked BG.

3.2.6.2. Interface

Table 67: Inputs of findLinkedBGs

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	Comments: The BGs to be analyzed.

Table 68: Outputs of findLinkedBGs

Name	Type	Comments and Information
BGs_indices	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBGs_indices_T	Comments: The resulting array of indices.

3.2.6.3. Operator Hierarchy

diagram : diagram_findLinkedBGs_1

3.2.6.4.   Graphical and Textual Diagrams

3.2.6.4.1.   View of diagram_findLinkedBGs_1 (findLinkedBGs)
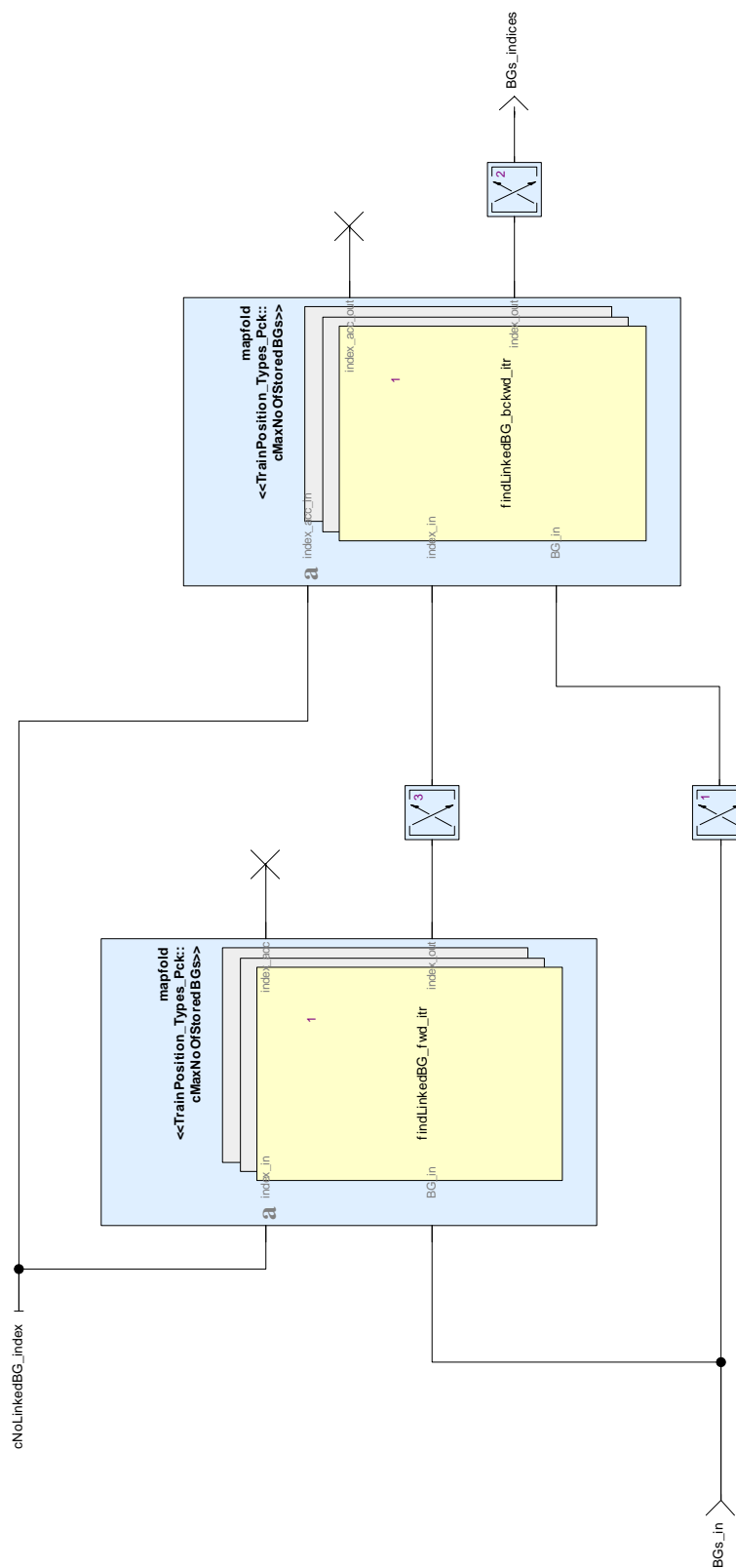
Figure 23: View of diagram_findLinkedBGs_1 (findLinkedBGs)

3.2.7.   improve_BG_locations Operator

Declared as **public function**

3.2.7.1.   Interface

Table 69: Inputs of improve_BG_locations

Name	Type	Properties	Comments and Information
referenceBG	TrainPosition_Types_Pck::positionedBG_T		Comments: Recalculates the locations of all BGs with reference to referenceBG. Reduces the inaccuracy of referenceBG to a minimum, while the inaccuries of all BGs in front and behind are growing in both directions.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T		
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 70: Outputs of improve_BG_locations

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.2.7.2.   Operator Hierarchy

<u>diagram</u> : diagram_improve_BG_locations

3.2.7.3.   Graphical and Textual Diagrams

3.2.7.3.1.   View of diagram_improve_BG_locations (improve_BG_locations)
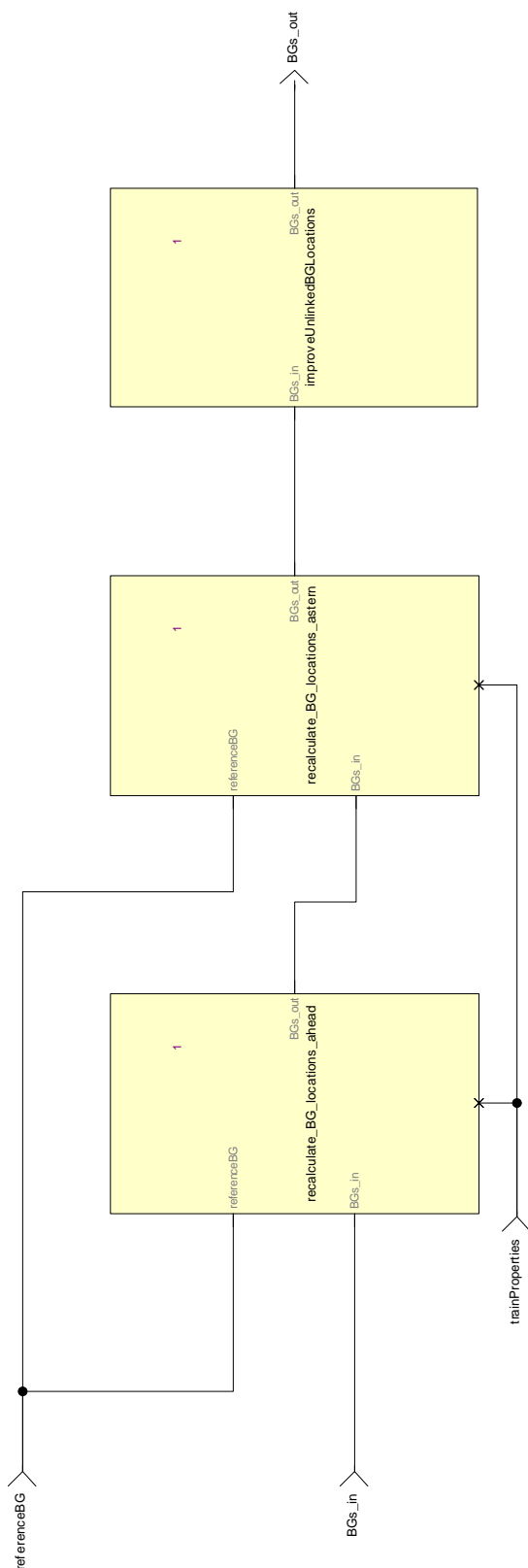
Figure 24: View of diagram_improve_BG_locations (improve_BG_locations)

Table 71: recalculate_BG_locations_ahead (#1) hidden inputs assignment of diagram_improve_BG_locations

Rank	Name	Value
1	trainProperties	*wired (_L39)*

Table 72: recalculate_BG_locations_astern (#1) hidden inputs assignment of diagram_improve_BG_locations

Rank	Name	Value
1	trainProperties	*wired (_L39)*

3.2.8.   improveUnlinkedBGLocation Operator

Declared as **public function**

3.2.8.1.   Comments and Information

improveUnlinkedBGLocation Comments:
Tries to improve the location of an unlinked BG with reference to two different passed linked BGs.
If the improvement fails, the location of the unlinked BG will be left unchanged.

3.2.8.2.   Interface

Table 73: Inputs of improveUnlinkedBGLocation

Name	Type	Comments and Information
passedLinkedBG_2	TrainPosition_Types_Pck::positionedBG_T	Comments: The second passed linked BG as the second reference location.
passedLinkedBG_1	TrainPosition_Types_Pck::positionedBG_T	Comments: The first passed linked BG as the first reference location.
unlinkedBG_in	TrainPosition_Types_Pck::positionedBG_T	Comments: The unlinked BG that's location shall be improved

Table 74: Outputs of improveUnlinkedBGLocation

Name	Type	Comments and Information
unlinkedBG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The unlinked BG that's location might have been improved

3.2.8.3.   Operator Hierarchy

<u>diagram</u> : diagram_improveUnlinkedBGLocation_1

3.2.8.4.   Graphical and Textual Diagrams

3.2.8.4.1.   View of diagram_improveUnlinkedBGLocation_1 (improveUnlinkedBGLocation)
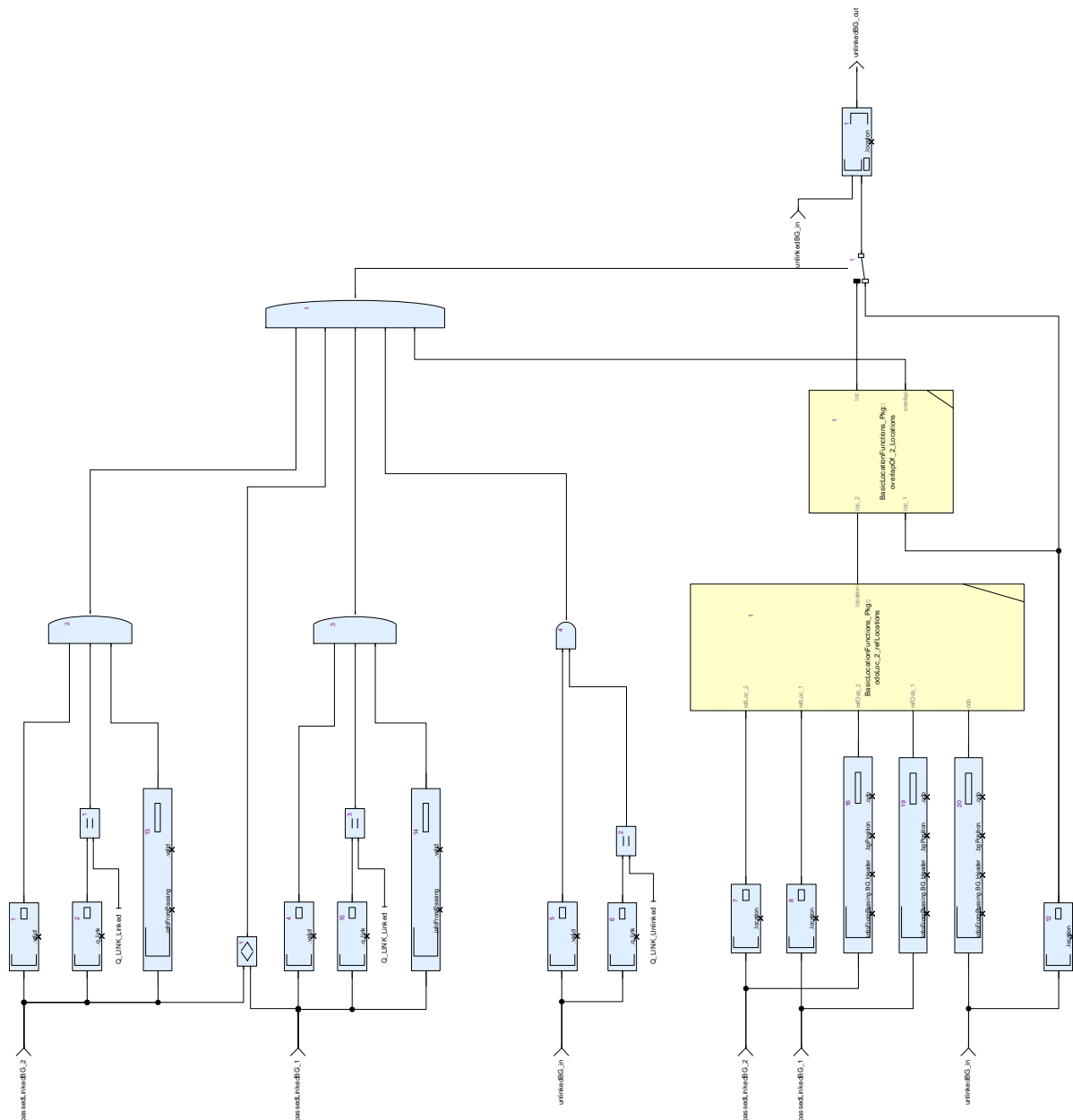
Figure 25: View of diagram_improveUnlinkedBGLocation_1 (improveUnlinkedBGLocation)

3.2.9.   improveUnlinkedBGLocations Operator

Declared as **private function**

3.2.9.1.   Interface

Table 75: Inputs of improveUnlinkedBGLocations

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	

Table 76: Outputs of improveUnlinkedBGLocations

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.2.9.2.   Operator Hierarchy

diagram : diagram_improveUnlinkedBGLocations_1

3.2.9.3.   Graphical and Textual Diagrams

3.2.9.3.1.   View of diagram_improveUnlinkedBGLocations_1 (improveUnlinkedBGLocations)
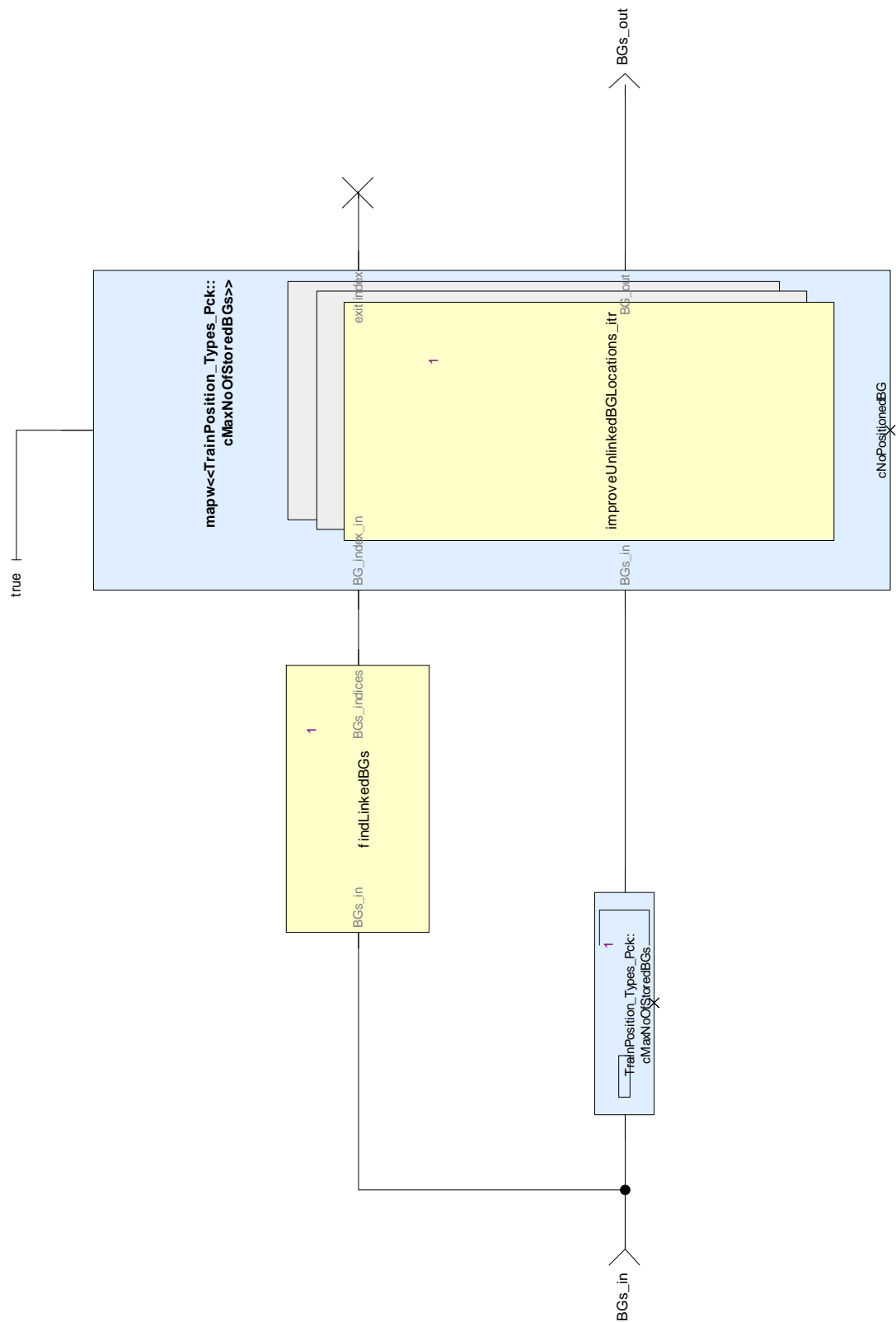
Figure 26: View of diagram_improveUnlinkedBGLocations_1 (improveUnlinkedBGLocations)

3.2.10.   improveUnlinkedBGLocations_itr Operator

Declared as **private function**

3.2.10.1.   Interface

Table 77: Inputs of improveUnlinkedBGLocations_itr

Name	Type	Comments and Information
BG_index_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::linkedBG_index_T	Comments: Indices for the iteration
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	

Table 78: Outputs of improveUnlinkedBGLocations_itr

Name	Type	Comments and Information
cont	bool	
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be searched for.

3.2.10.2.   Operator Hierarchy

diagram : diagram_improveUnlinkedBGLocations_itr_1

3.2.10.3.   Graphical and Textual Diagrams

3.2.10.3.1.   View of diagram_improveUnlinkedBGLocations_itr_1
(improveUnlinkedBGLocations_itr)
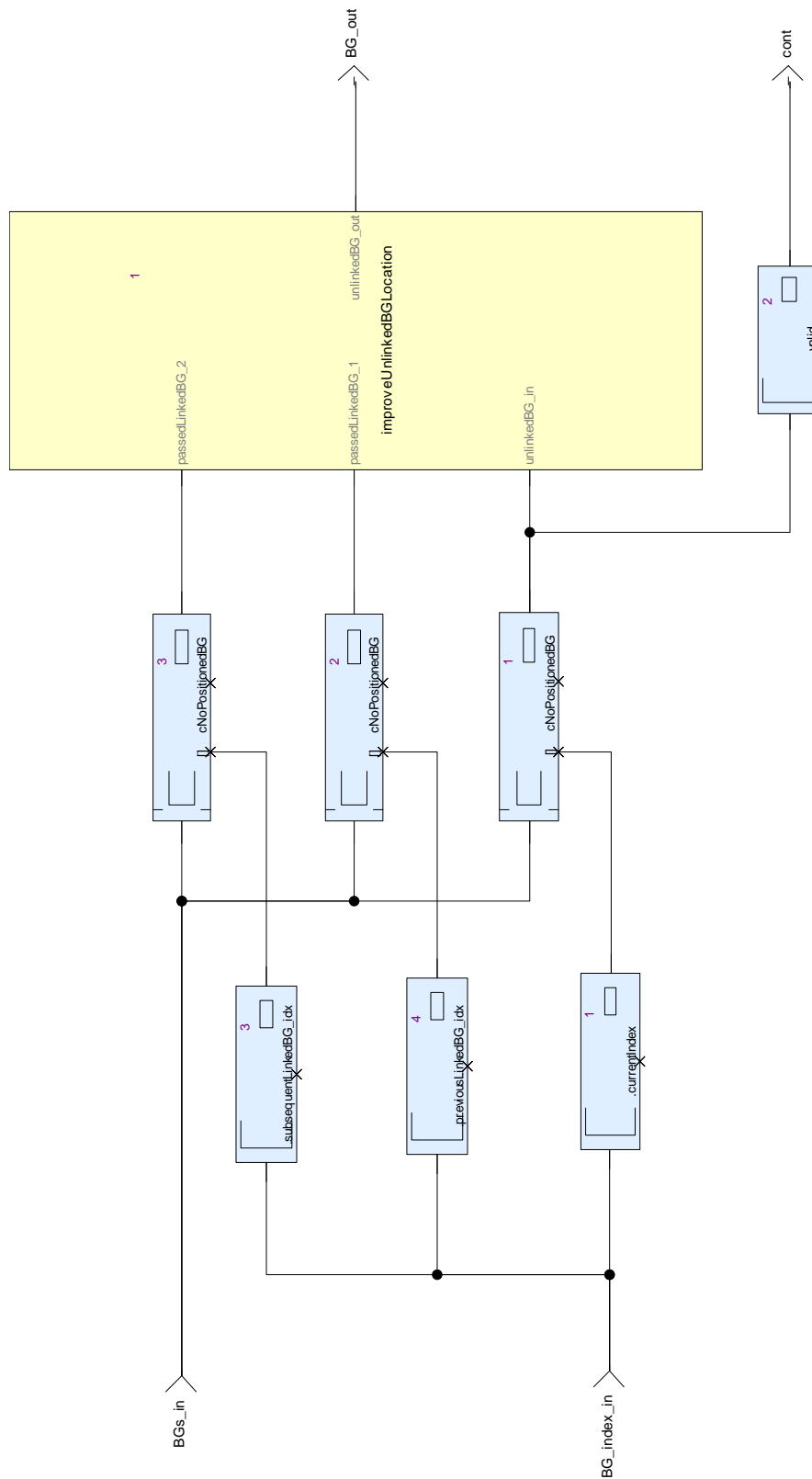
Figure 27: View of diagram_improveUnlinkedBGLocations_itr_1 (improveUnlinkedBGLocations_itr)

3.2.11.   recalculate_BG_location_ahead Operator

Declared as **private function**

3.2.11.1.   Comments and Information

recalculate_BG_location_ahead Comments:
Recalculates the location of a BG based on the location of a previous BG.
If prevBG and BG_in are linked BGs, the linking information will be evaluated for location calculation.
If prevBG is not a linked BG, the BG location will be calculated from odometry only.
if prevBG is not valid, the location will remain unchanged.
Preconditions:
- prevBG must have a location assigned.
- BG_in and prevBG should have linking and passing information, if appropriate.

3.2.11.2.   Interface

Table 79: Inputs of recalculate_BG_location_ahead

Name	Type	Properties	Comments and Information
BG_in	TrainPosition_Types_Pck::positionedBG_T		Comments: The BG that's location has to be recalculated
prevLinkedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The previous linked BG.
refBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The referende BG.
sumOfBestDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T		Comments: The distances with between refBG and prevLinkedBG.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 80: Outputs of recalculate_BG_location_ahead

Name	Type	Comments and Information
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG that's location has been recalculated.

3.2.11.3.   Operator Hierarchy

diagram : diagram_recalculate_BG_location

3.2.11.4.   Graphical and Textual Diagrams

3.2.11.4.1.   View of diagram_recalculate_BG_location (recalculate_BG_location_ahead)
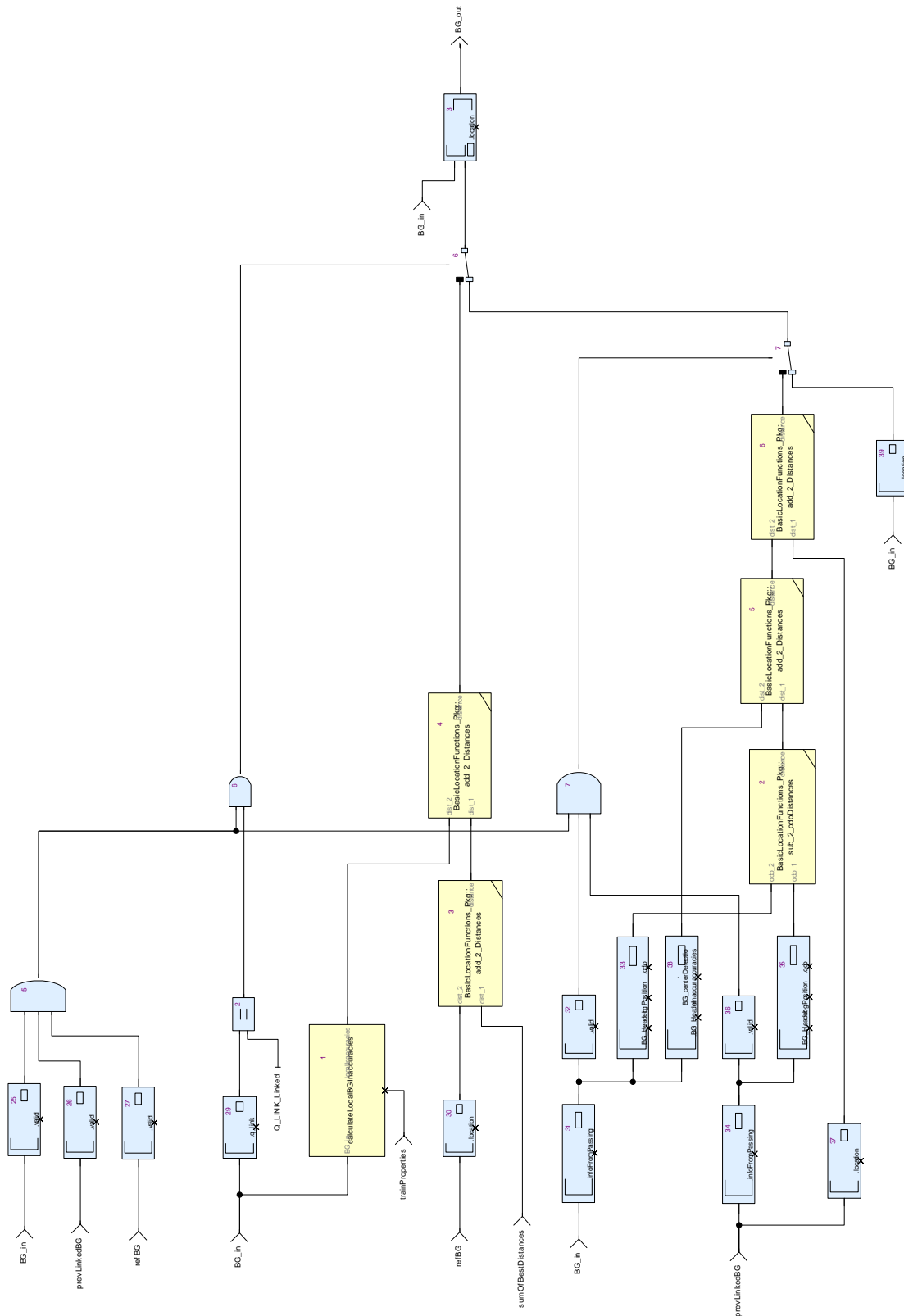
Figure 28: View of diagram_recalculate_BG_location (recalculate_BG_location_ahead)

Table 81: calculateLocalBGInaccuracies (#1) hidden inputs assignment of diagram_recalculate_BG_location

Rank	Name	Value
1	trainProperties	*wired (_L184)*

3.2.12.   recalculate_BG_location_astern Operator

Declared as **private function**

3.2.12.1.   Comments and Information

recalculate_BG_location_astern Comments:
Recalculates the location of a BG based on the location of a BG ahead (prevBG).
if BG_in is a linked BG, it's location is given by the sumOfBestDistances plus it's local mounting inaccuracies.
if BG_in is unlinked, it's location is calculated from the location of the previous linked BG and the distance measured by odometry.
Otherwise, the BG_in location is left unchanged.
Preconditions:
- prevLinkedBG must have a location assigned.
- BG_in and prevLinkedfBG should have linking and passing information, if appropriate.

3.2.12.2.   Interface

Table 82: Inputs of recalculate_BG_location_astern

Name	Type	Properties	Comments and Information
BG_in	TrainPosition_Types_Pck::positionedBG_T		Comments: The BG that's location has to be recalculated
prevLinkedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The previous linked BG.
refBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The referende BG.
sumOfBestDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T		Comments: The distances with between refBG and prevLinkedBG.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 83: Outputs of recalculate_BG_location_astern

Name	Type	Comments and Information
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG that's location has been recalculated.

3.2.12.3.   Operator Hierarchy

diagram : diagram_recalculate_BG_location

3.2.12.4.   Graphical and Textual Diagrams

3.2.12.4.1.   View of diagram_recalculate_BG_location (recalculate_BG_location_astern)
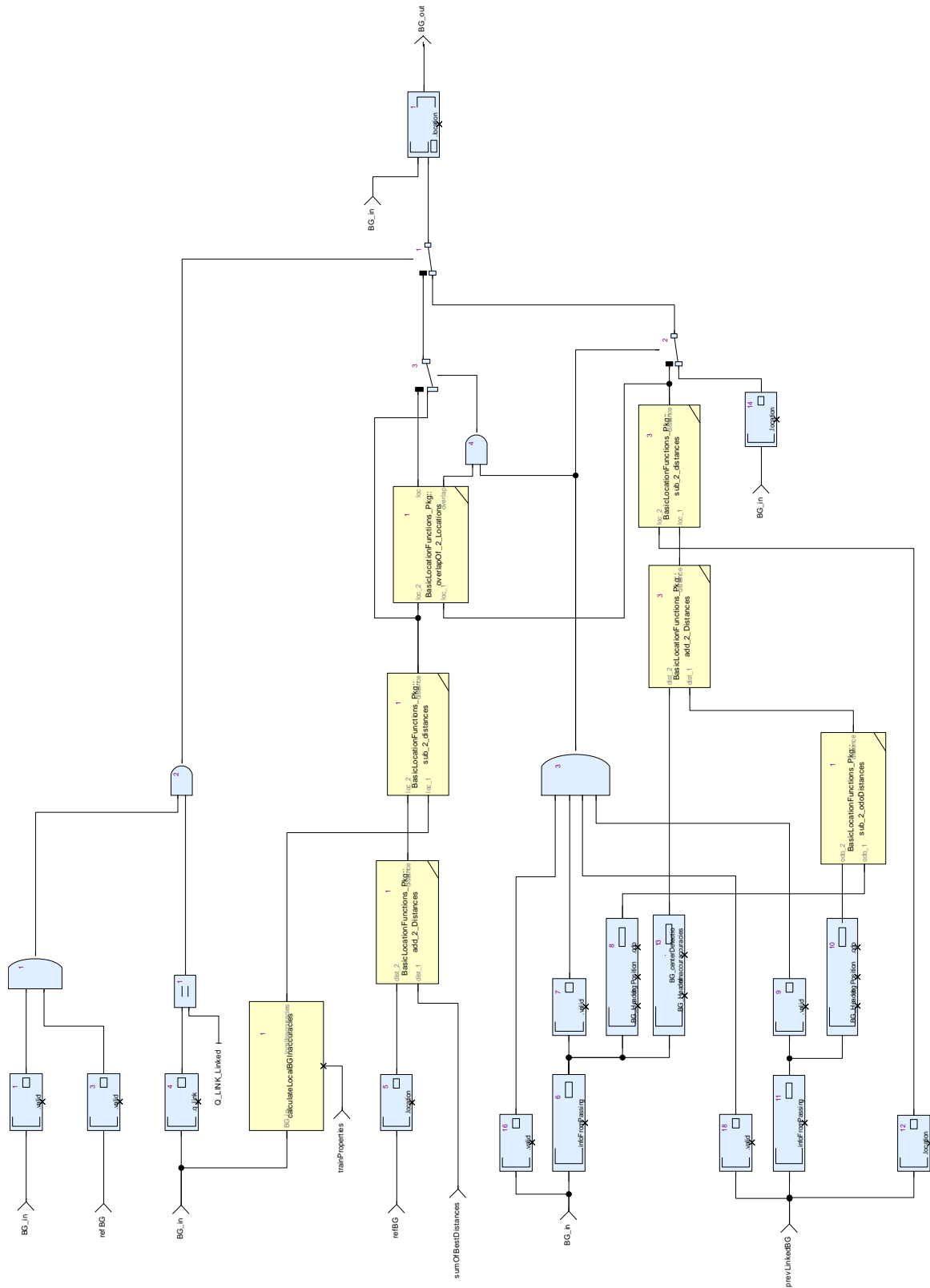
Figure 29: View of diagram_recalculate_BG_location (recalculate_BG_location_astern)

Table 84: calculateLocalBGInaccuracies (#1) hidden inputs assignment of
diagram_recalculate_BG_location

Rank	Name	Value
1	trainProperties	*wired (_L184)*

3.2.13.   recalculate_BG_locations_ahead Operator

Declared as **private function**

3.2.13.1.   Comments and Information

recalculate_BG_locations_ahead Comments:
Recalculates the BG locations in forward direction, starting from referenceBG to all
BGs ahead.
The location accuracy of referenceBG in BGs is minimized while leaving its nominal
location unchanged.
The locations of all BGs ahead of referenceBG are adjusted relatively to
referenceBG.
The locations of all BGs astern of referenceBG are left unchanged.
BGs_in should have locations assigned and arranged in increasing order of
locations.

3.2.13.2.   Interface

Table 85: Inputs of recalculate_BG_locations_ahead

Name	Type	Properties	Comments and Information
referenceBG	TrainPosition_Types_Pck::positionedBG_T		Comments: Recalculates the locations of all BGs with reference to referenceBG, beginning with the referenceBG and all BGs afterwards. Reduces the inaccuracy of referenceBG to a minimum, while the inaccuries of all BGs before and after are growing in both directions.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T		
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 86: Outputs of recalculate_BG_locations_ahead

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.2.13.3.   Operator Hierarchy

<u>diagram</u> : diagram_recalculate_BG_locations_ahead_1

3.2.13.4.   Graphical and Textual Diagrams

3.2.13.4.1.   View of diagram_recalculate_BG_locations_ahead_1 (recalculate_BG_locations_ahead)
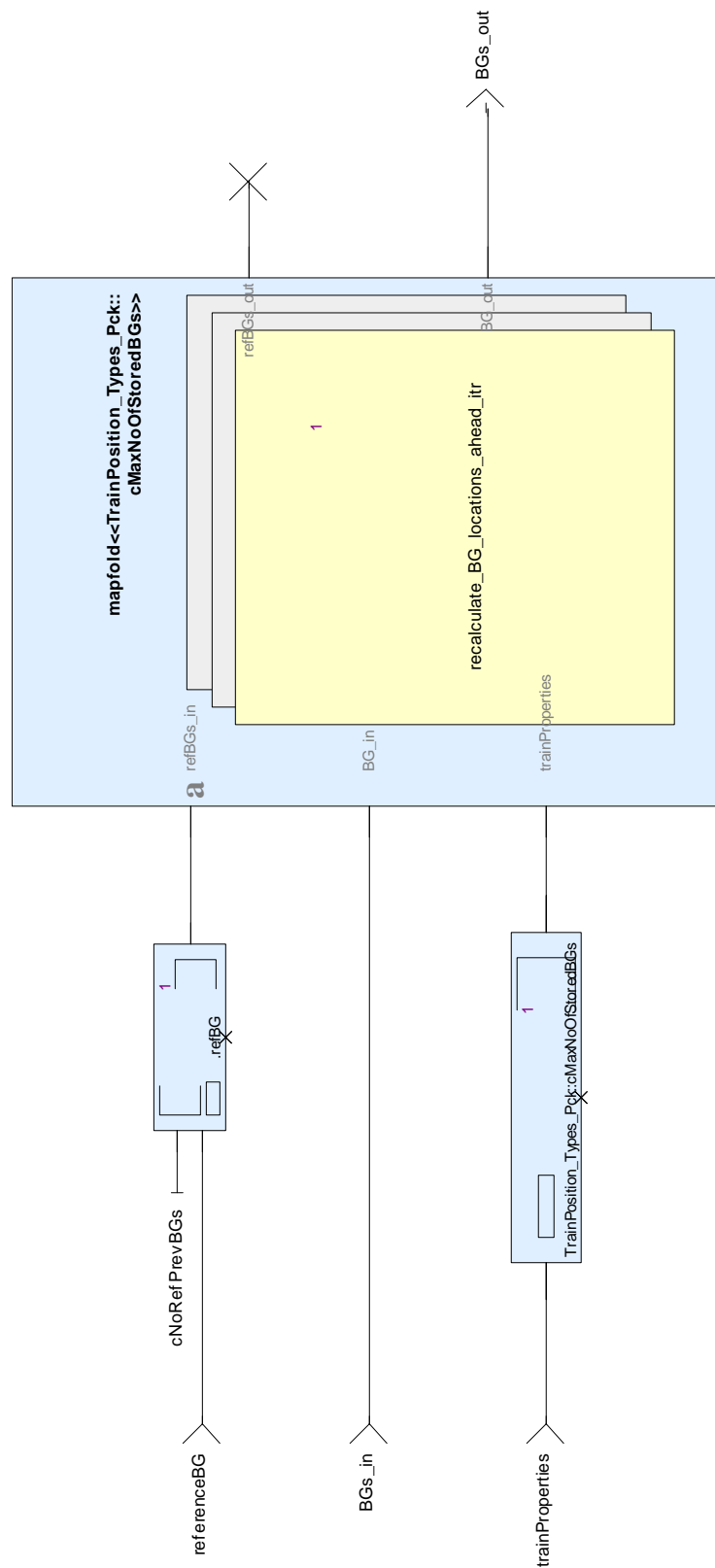
Figure 30: View of diagram_recalculate_BG_locations_ahead_1 (recalculate_BG_locations_ahead)

Table 87: recalculate_BG_locations_ahead_itr (#1) hidden inputs assignment of
diagram_recalculate_BG_locations_ahead_1

Rank	Name	Value
1	trainProperties	*wired (_L10)*

3.2.14.   recalculate_BG_locations_ahead_itr Operator

Declared as **`private function`**

3.2.14.1.   Comments and Information

recalculate_BG_locations_ahead_itr Comments:
Iterated function for recalculating the locations of all BGs in forward direction,
starting from refBGs_in.refBG with all BGs ahead.
The location accuracy of refBGs_in.refBG is minimized while leaving its nominal
location unchanged.
The location of a BG_in ahead of refBGs_in.refBG is adjusted relatively to
refBGs_in.
The locations of a BG_in astern of refBGs_in.refBG is left unchanged.
See diagram descriptions for more details.

3.2.14.2.   Interface

Table 88: Inputs of recalculate_BG_locations_ahead_itr

Name	Type	Properties	Comments and Information
refBGs_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::refBGs_T		
BG_in	TrainPosition_Types_Pck::positionedBG_T		Comments: The BG that's location has to be recalculated
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 89: Outputs of recalculate_BG_locations_ahead_itr

Name	Type	Comments and Information
refBGs_out	CalculateTrainPosition_Pkg::BG_relocation_Pkg::refBGs_T	
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG that's location has been recalculated.

3.2.14.3.   Locals

Table 90: Locals of recalculate_BG_locations_ahead_itr

Name	Type	Comments and Information
BG_loc_inacc	Obu_BasicTypes_Pkg::LocWithInAcc_T	
BGin_is_refBG	bool	

Name	Type	Comments and Information
d_prevLinkedBG_refBG	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: Distance from the previous linked BG to the refBG, if refBG is an unlinked BG.
prevLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
prevUnlinkedBG	TrainPosition_Types_Pck::positionedBG_T	
recalculateSubsequentBGs	bool	
refBG	TrainPosition_Types_Pck::positionedBG_T	
refLocation	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: The recalculated location of the reference BG.
relocatedBG	TrainPosition_Types_Pck::positionedBG_T	
sumOfBestDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: Accumulates the distances with between refBG and a linked BG_in.

3.2.14.4. Operator Hierarchy

diagram : diagram_assembleResults
diagram : diagram_assign_refBG
diagram : diagram_calculate_BGin_inaccuracies
diagram : diagram_determinePreviousLinkedBG
diagram : diagram_determinePreviousUnlinkedBG
diagram : diagram_recalculate_BG_location
diagram : diagram_recalculate_refBG_location
diagram : diagram_sumOfPrevBestDistances

3.2.14.5.   Graphical and Textual Diagrams

3.2.14.5.1.   View of diagram_assembleResults (recalculate_BG_locations_ahead_itr)
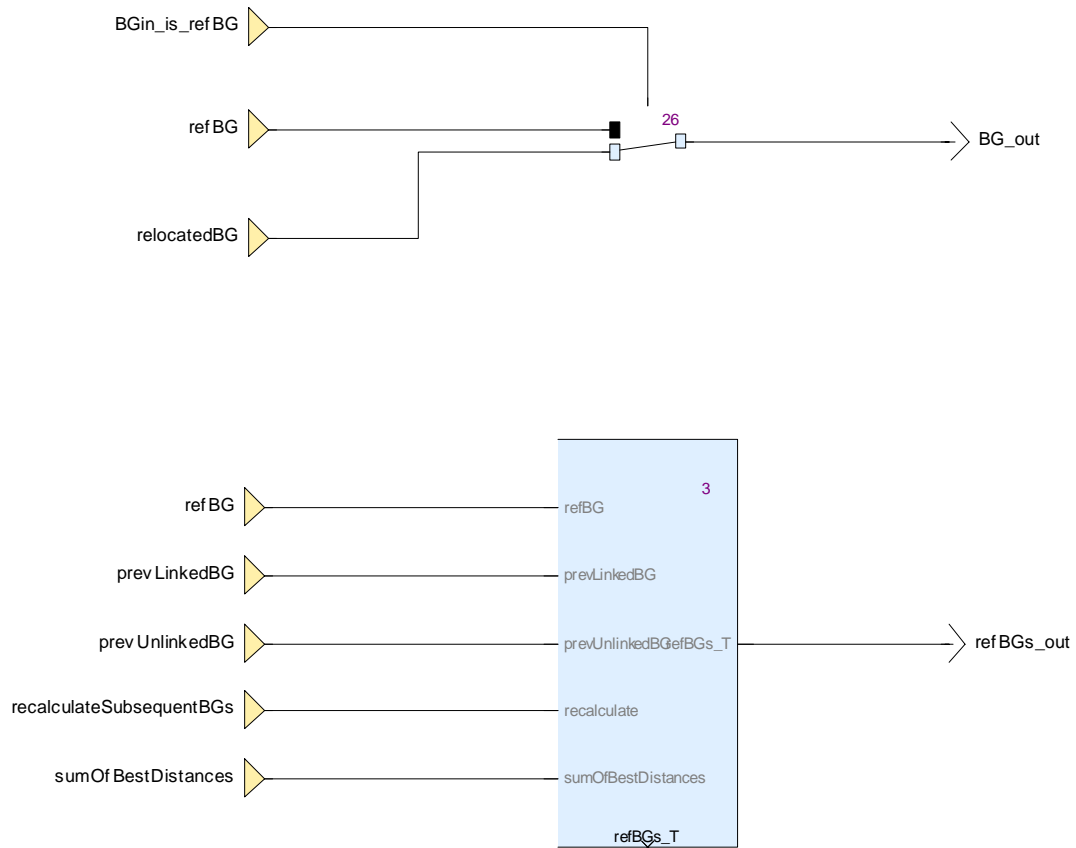
Figure 31: View of diagram_assembleResults (recalculate_BG_locations_ahead_itr)

diagram_assembleResults Comments:
Assembles the outputs.

3.2.14.5.2.   View of diagram_assign_refBG (recalculate_BG_locations_ahead_itr)
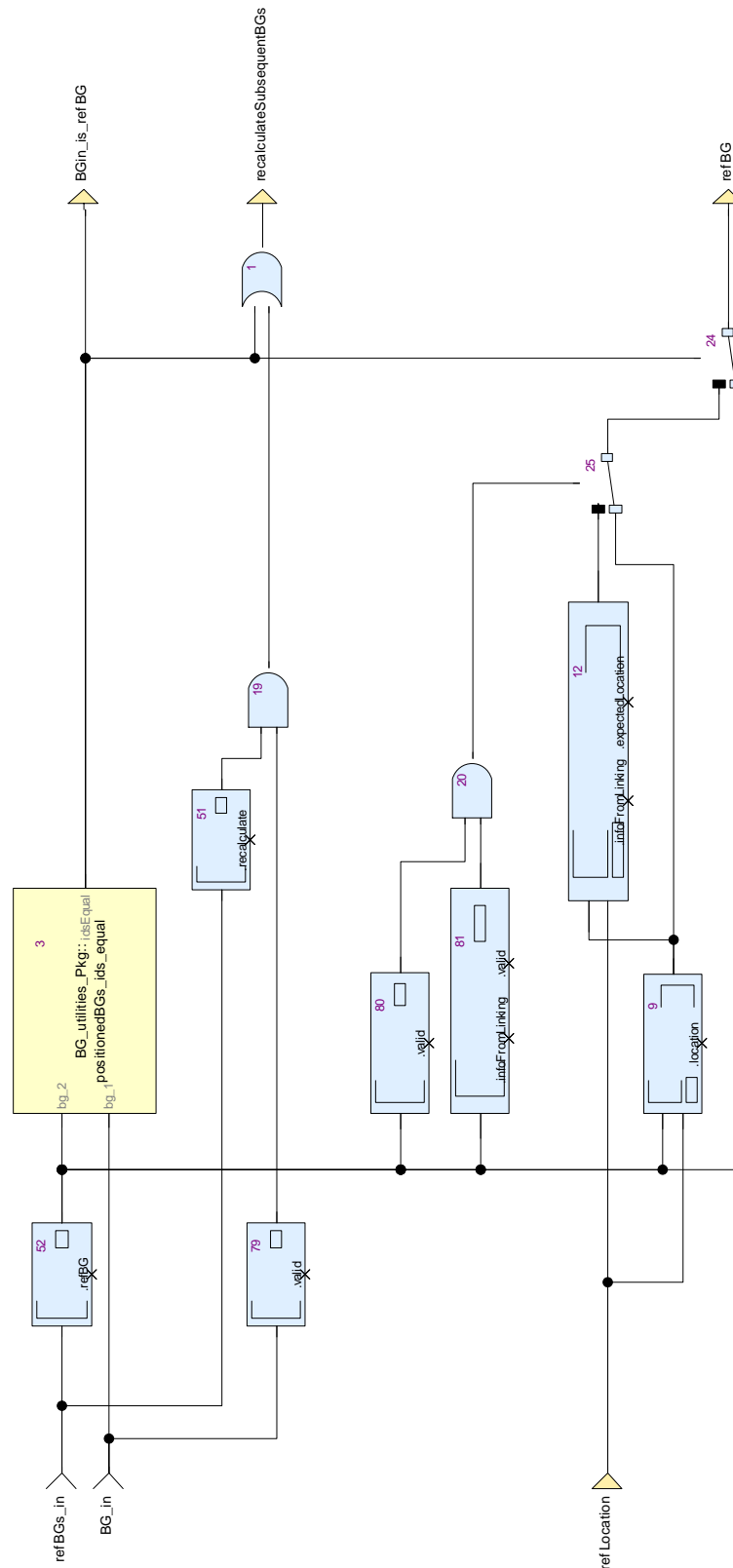
Figure 32: View of diagram_assign_refBG (recalculate_BG_locations_ahead_itr)

diagram_assign_refBG Comments:
Determines if BG_in is the reference BG.
If yes, the location of the reference BG has to be recalculated.

For all subsequent BGs in the iteration, the locations have to recalculated.
For all BGs in the iteration before the reference BGs, the locations are kept
unchanged.

3.2.14.5.3.   View of diagram_calculate_BGin_inaccuracies (recalculate_BG_locations_ahead_itr)
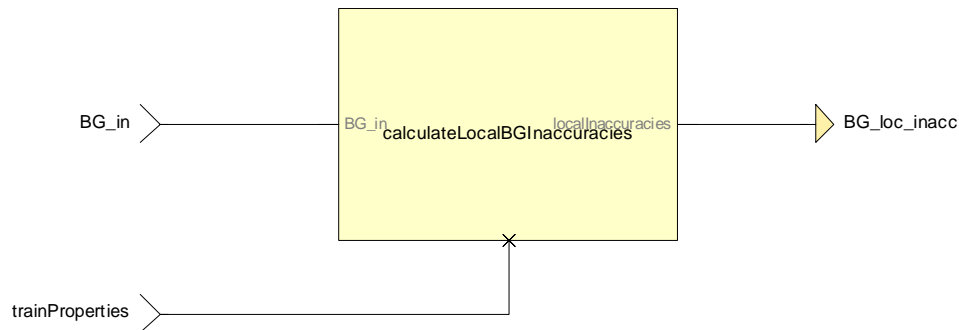
Figure 33: View of diagram_calculate_BGin_inaccuracies (recalculate_BG_locations_ahead_itr)

Table 91: calculateLocalBGInaccuracies (#) hidden inputs assignment of
diagram_calculate_BGin_inaccuracies

Rank	Name	Value
1	trainProperties	*wired (_L197)*

diagram_calculate_BGin_inaccuracies Comments:
Calculates the local inaccuraccies of BG_in, i. e. the inaccuracies caused
- by linking Q_LOCACC or
- by the national value Q_NVLOCACC or
- by the default location inaccuracy
and the centerDetectionInaccuracies.

3.2.14.5.4.   View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_ahead_itr)
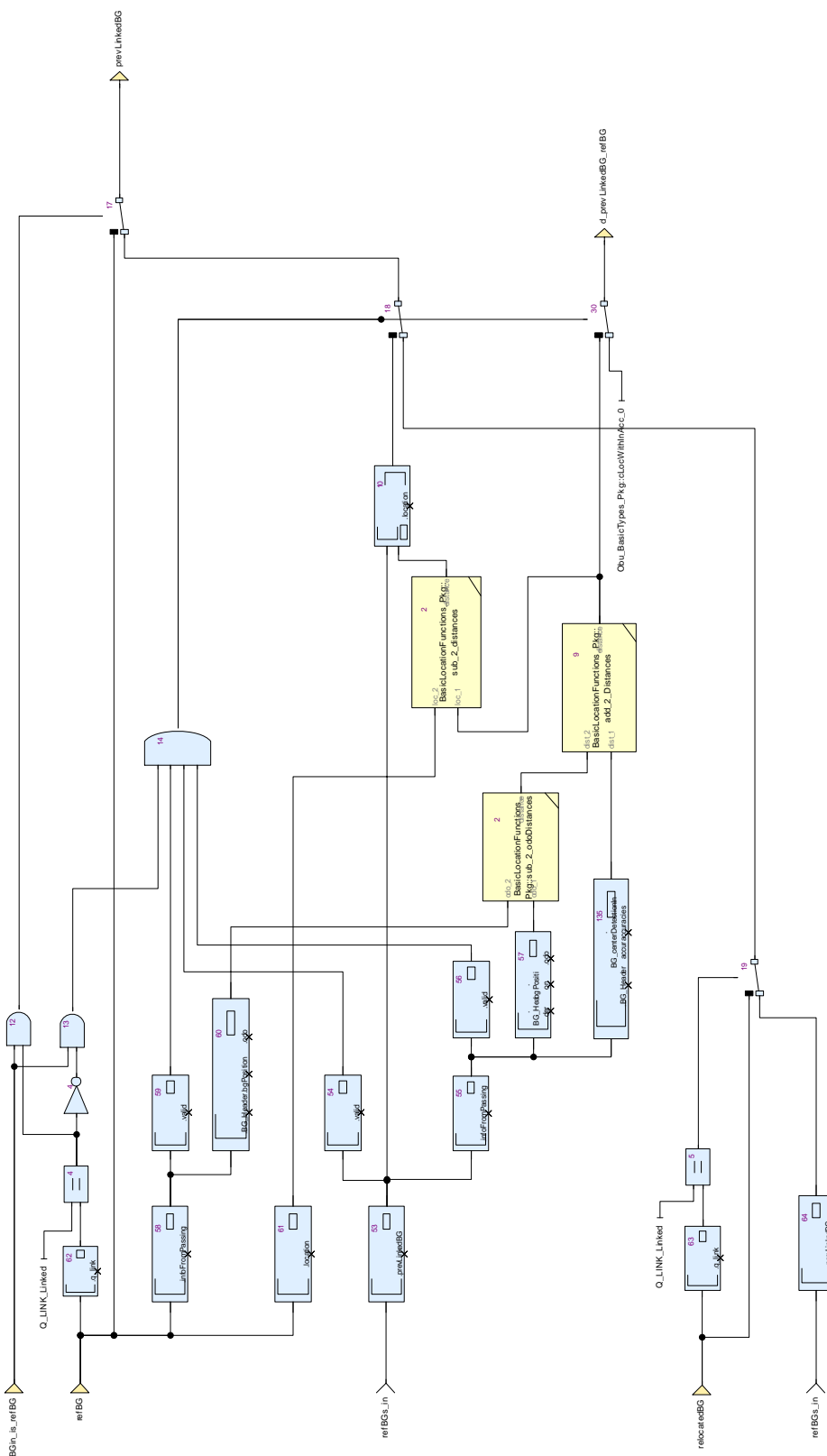
Figure 34: View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_ahead_itr)

diagram_determinePreviousLinkedBG Comments:

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Determines the previous linked BG.

If BG_in is the reference BG and the reference BG is a linked BG, prevLinkedBG is set to refBG.

If BG_in is the reference BG and is an unlinked BG, the location of prevLinkedBG is recalculated from refBG based upon odometry values.

This is possible, because refBG must have been passed, and therefore prevLinkedBG too.

If BG_in is not the reference BG and is a linked BG, prevLinkedBG is set to BG_in.

If BG_in is not the reference BG and is an unlinked BG, prevLinkedBG is taken from refBGs_in.prevLinkedBG.

3.2.14.5.5.   View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_ahead_itr)
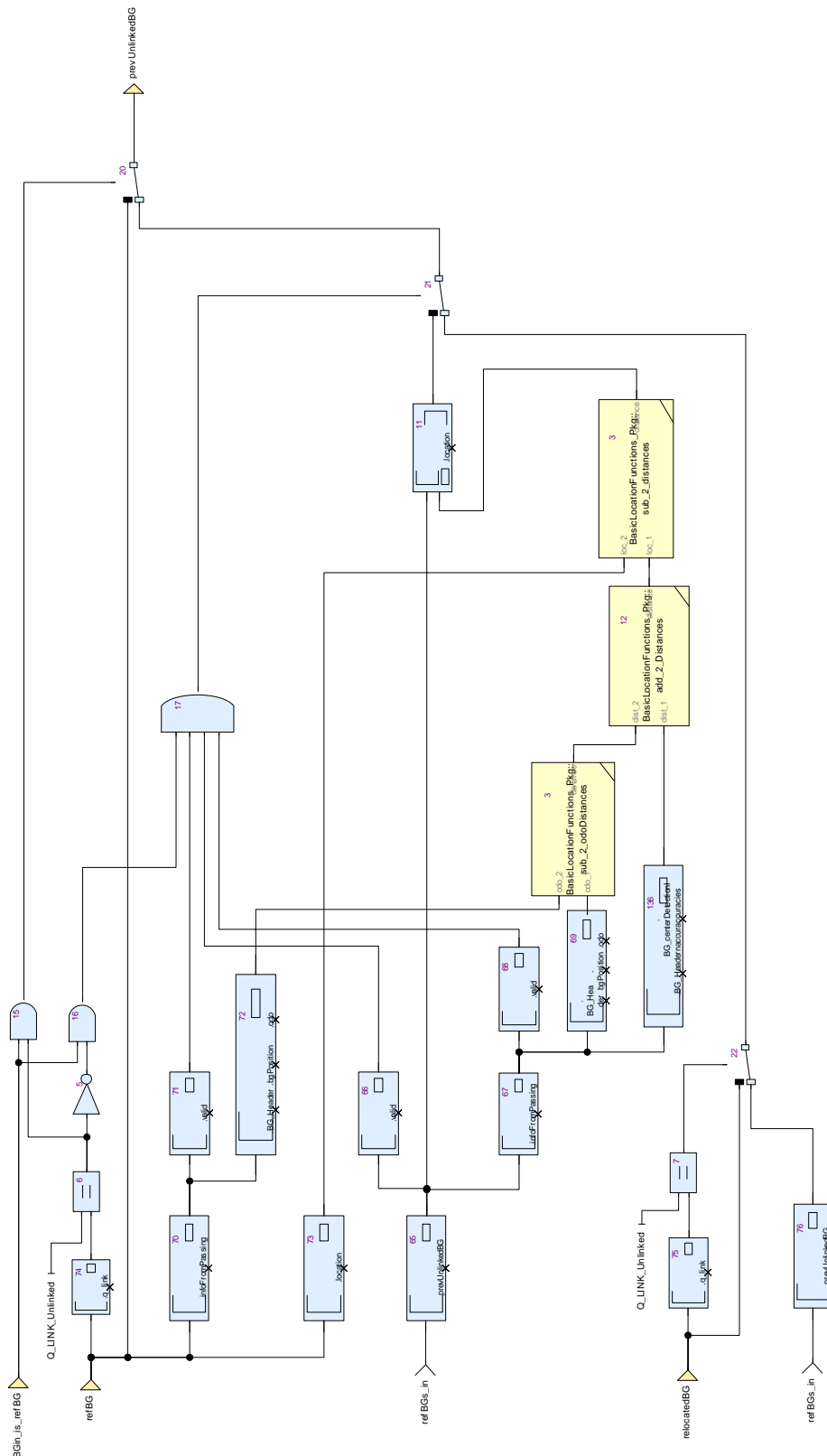
Figure 35: View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_ahead_itr)

diagram_determinePreviousUnlinkedBG Comments:

Determines the previous unlinked BG.

If BG_in is the reference BG and the reference BG is an unlinked BG, prevUnlinkedBG is set to refBG.

If BG_in is the reference BG and a linked BG with or without linking information, the location of prevUnlinkedBG is recalculated from refBG based upon odometry values.

This is possible, because refBG must have been passed, and therefore prevUnlinkedBG too.

If BG_in is not the reference BG and is an unlinked BG, prevLinkedBG is set to the relocated BG_in.

If BG_in is not the reference BG and is not an unlinked BG, prevLinkedBG is taken from refBGs_in.prevUnlinkedBG.

3.2.14.5.6. View of diagram_recalculate_BG_location (recalculate_BG_locations_ahead_itr)
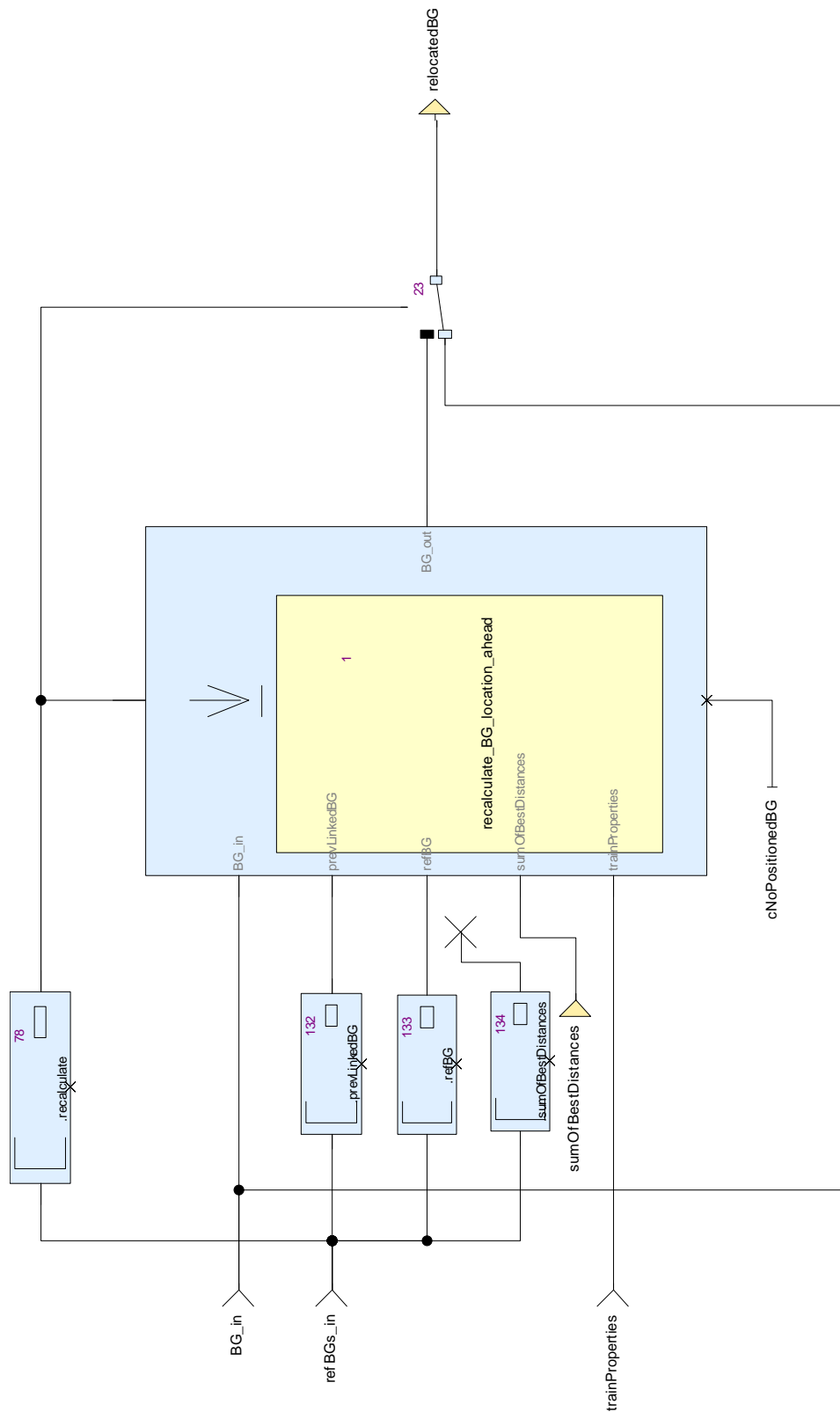
Figure 36: View of diagram_recalculate_BG_location (recalculate_BG_locations_ahead_itr)

Table 92: recalculate_BG_location_ahead (#1) hidden inputs assignment of
diagram_recalculate_BG_location

Rank	Name	Value
1	trainProperties	*wired (_L293)*

3.2.14.5.7. View of diagram_recalculate_refBG_location (recalculate_BG_locations_ahead_itr)
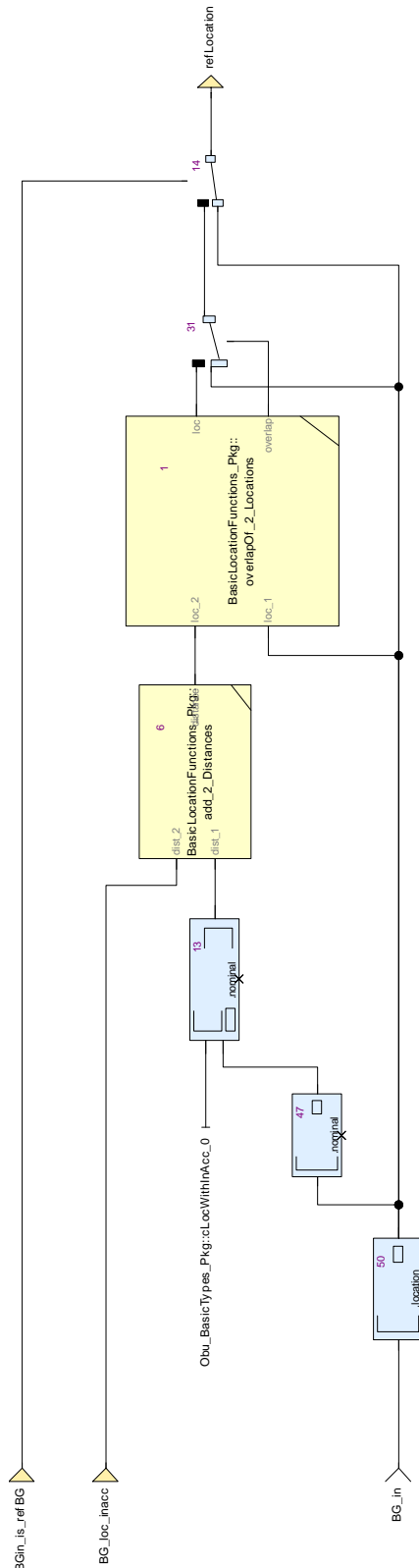
Figure 37: View of diagram_recalculate_refBG_location (recalculate_BG_locations_ahead_itr)

diagram_recalculate_refBG_location Comments:
Recalculate the location of the reference BG.
The location of the reference BG will be the origin, from where all other locations

have to be recalculated.
If the refBG is
- a linked BG with linking information available or
- an unlinked BG or
- a linked BG without linking information
its nominal location is kept unchanged with only the local inaccuracies applied.

3.2.14.5.8.   View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_ahead_itr)
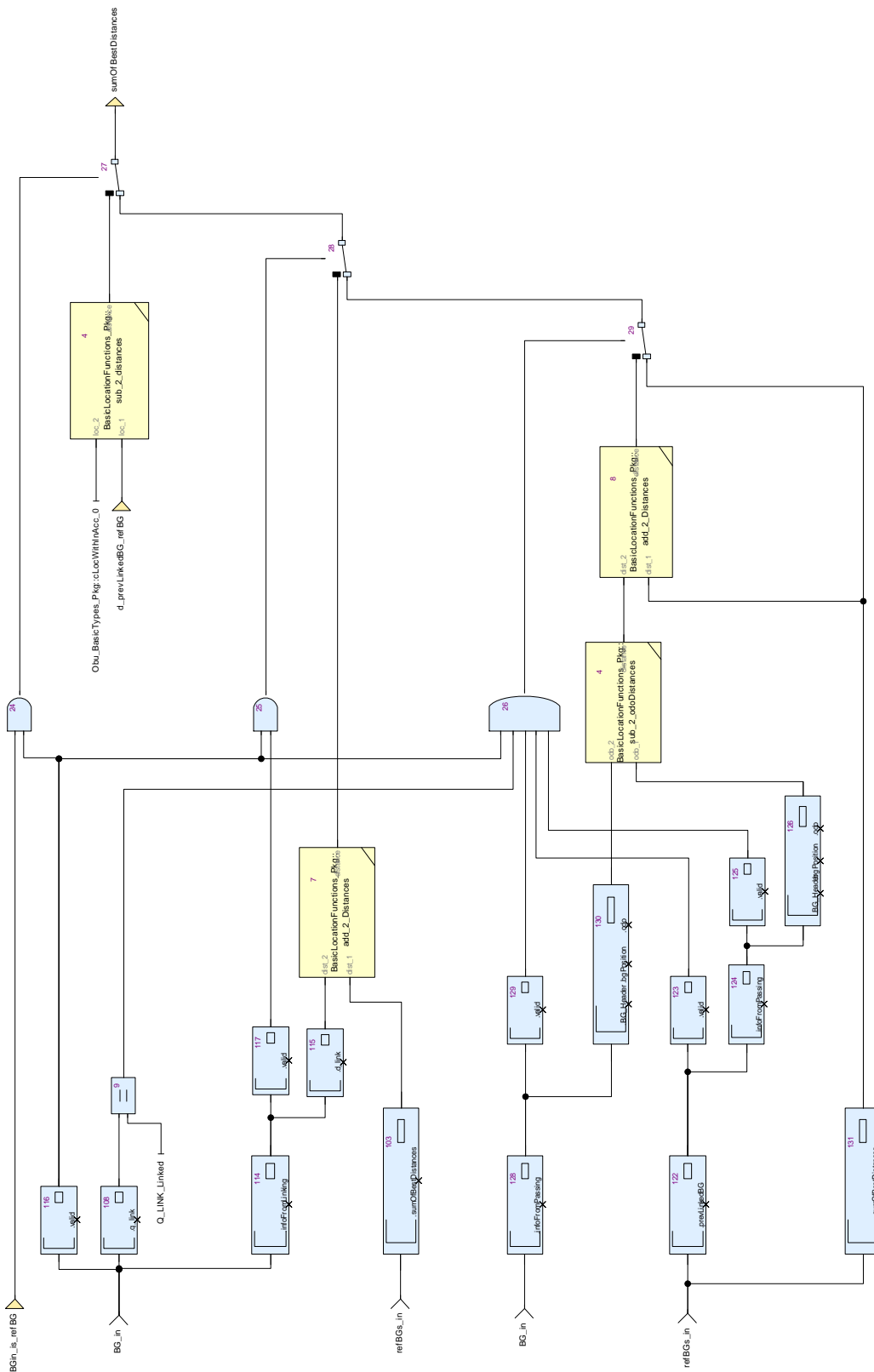
Figure 38: View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_ahead_itr)

diagram_sumOfPrevBestDistances Comments:

Accumulates the sum of linking distances and - in case of linking holes - odometry distances.
The sum is reset to 0, if BGin is the refBG and a linked BG.
If BGin is the refBG and an unlinked BG, sumOfBestDistances is set to the negative distance of the previous linked BG to refBG.
This assures, that sumOfBestDistances will be calculated correctly for all BGs ahead of refBG.

3.2.15.   recalculate_BG_locations_astern Operator

Declared as **private function**

3.2.15.1.   Comments and Information

recalculate_BG_locations_astern Comments:
Recalculates the BG locations in backward direction, starting from referenceBG to all previous BGs.
The location of referenceBG in BGs stays unchanged.
The locations of all BGs before referenceBG are adjusted relatively to referenceBG.
The locations of all BGs ahead of referenceBG are left unchanged.
BGs_in should have locations assigned and arranged in increasing order of locations.

3.2.15.2.   Interface

Table 93: Inputs of recalculate_BG_locations_astern

Name	Type	Properties	Comments and Information
referenceBG	TrainPosition_Types_Pck::positionedBG_T		Comments: Recalculates the locations of all BGs with reference to referenceBG, beginning with the BG before the referenceBG and then all BGs backwards.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T		
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 94: Outputs of recalculate_BG_locations_astern

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.2.15.3.   Operator Hierarchy

diagram : diagram_recalculate_BG_locations_astern_1

3.2.15.4.   Graphical and Textual Diagrams

3.2.15.4.1.   View of diagram_recalculate_BG_locations_astern_1
(recalculate_BG_locations_astern)
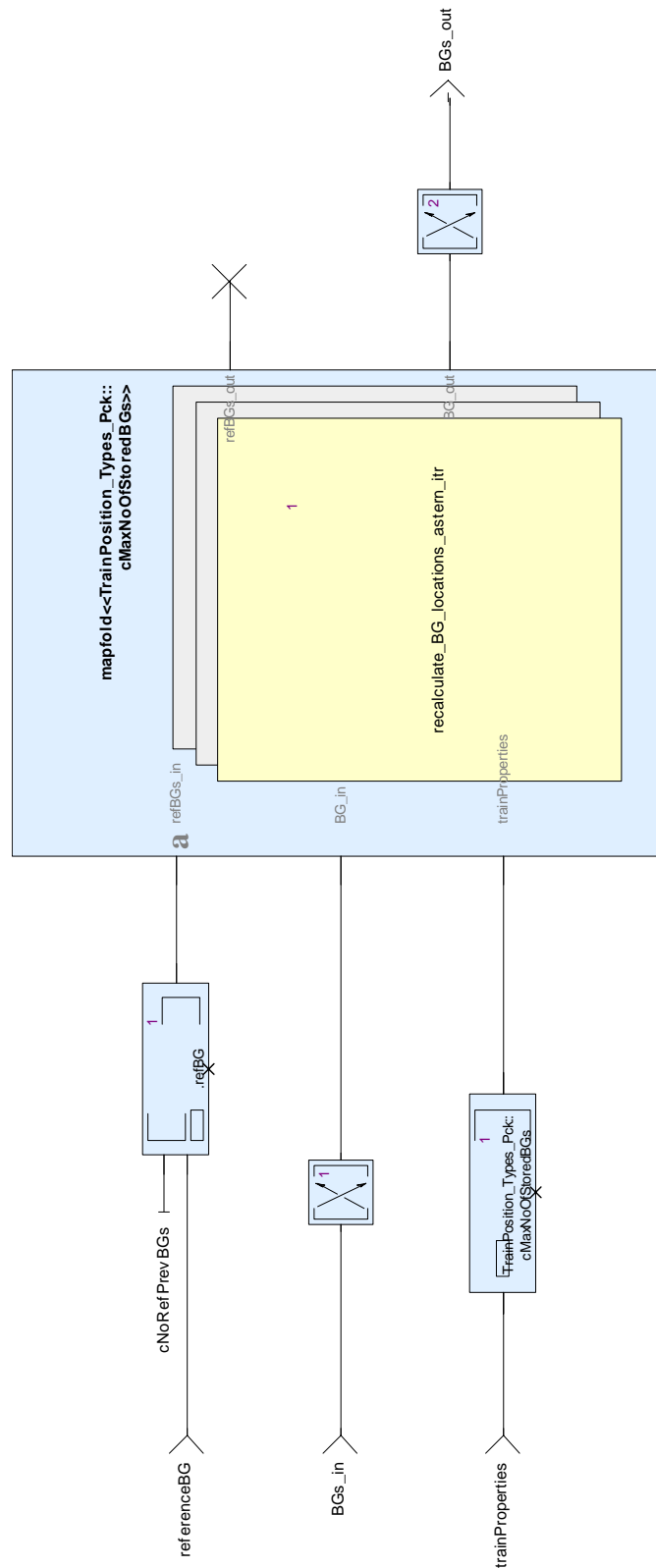
Figure 39: View of diagram_recalculate_BG_locations_astern_1 (recalculate_BG_locations_astern)

Table 95: recalculate_BG_locations_astern_itr (#1) hidden inputs assignment of diagram_recalculate_BG_locations_astern_1

Rank	Name	Value
1	trainProperties	*wired (_L12)*

3.2.16.   recalculate_BG_locations_astern_itr Operator

Declared as **private function**

3.2.16.1.   Comments and Information

recalculate_BG_locations_astern_itr Comments:
Iterated function for recalculating the locations of all BGs in backward direction, starting from refBGs_in.refBG with all BGs astern.
The location of refBGs_in.refBG is left unchanged.
The location of a BG_in astern of refBGs_in.refBG is adjusted relatively to refBGs_in.
The location of a BG_in ahead of refBGs_in.refBG is left unchanged.
This function is for iterating through the BGs from tail to head, i. e. in backwards direction.
Therefore, refBGs_in.prevLinkedBG and refBGs_in.prevUnlinkedBG refer to BGs previously in the iteration, i. e. ahead of BG_in.
See diagram description for more details.

3.2.16.2.   Interface

Table 96: Inputs of recalculate_BG_locations_astern_itr

Name	Type	Properties	Comments and Information
refBGs_in	CalculateTrainPosition_Pkg::BG_relocation_Pkg::refBGs_T		Comments: Note: prevUnlinkedBG and prevLinkedBG are previous for the backward iteration.
BG_in	TrainPosition_Types_Pck::positionedBG_T		Comments: The BG that's location has to be recalculated
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 97: Outputs of recalculate_BG_locations_astern_itr

Name	Type	Comments and Information
refBGs_out	CalculateTrainPosition_Pkg::BG_relocation_Pkg::refBGs_T	
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG that's location has been recalculated.

3.2.16.3.   Locals

Table 98: Locals of recalculate_BG_locations_astern_itr

Name	Type	Comments and Information
BGin_is_refBG	bool	

Name	Type	Comments and Information
prevLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
prevUnlinkedBG	TrainPosition_Types_Pck::positionedBG_T	
recalculateSubsequentBGs	bool	
refBG	TrainPosition_Types_Pck::positionedBG_T	
relocatedBG	TrainPosition_Types_Pck::positionedBG_T	
sumOfBestDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: Accumulates the distances with between refBG and a linked BG_in.

3.2.16.4.   Operator Hierarchy

diagram : diagram_assembleResults
diagram : diagram_assign_refBG
diagram : diagram_determinePreviousLinkedBG
diagram : diagram_determinePreviousUnlinkedBG
diagram : diagram_recalculate_BG_location
diagram : diagram_sumOfPrevBestDistances

3.2.16.5.   Graphical and Textual Diagrams

3.2.16.5.1.   View of diagram_assembleResults (recalculate_BG_locations_astern_itr)
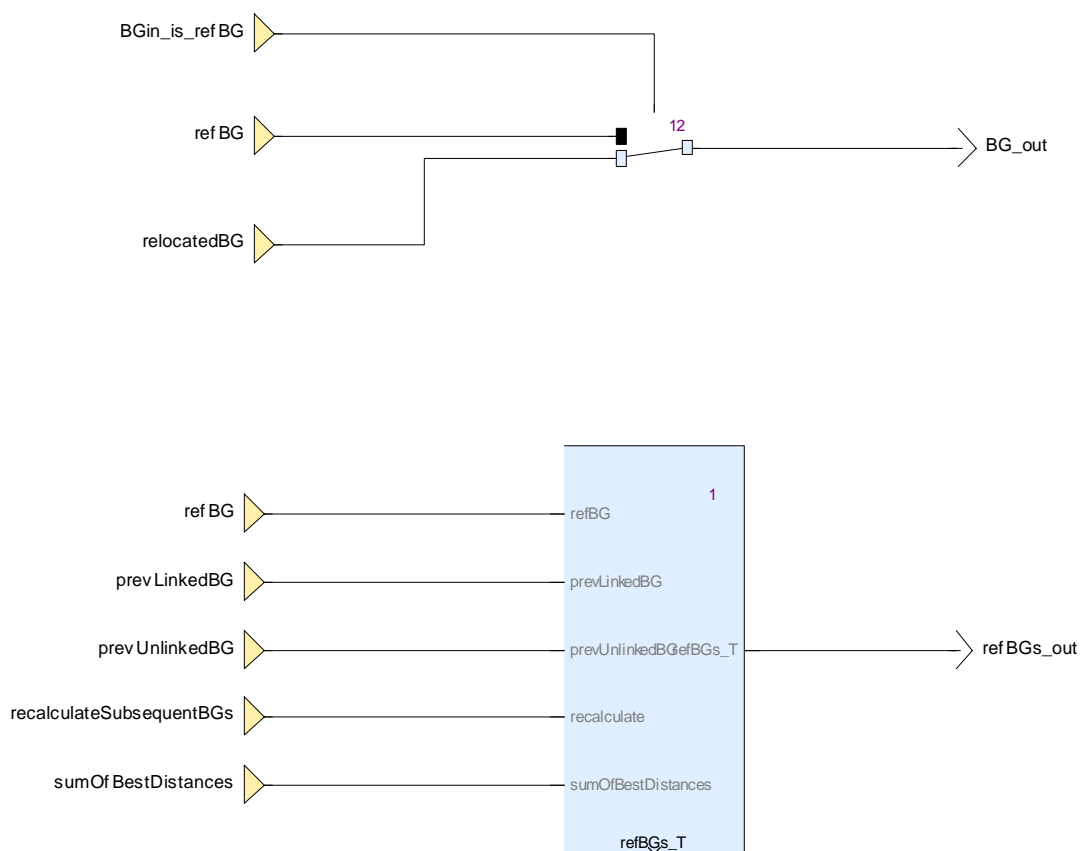
Figure 40: View of diagram_assembleResults (recalculate_BG_locations_astern_itr)

diagram_assembleResults Comments:

Siemens AG

Assembles the outputs.

3.2.16.5.2.   View of diagram_assign_refBG (recalculate_BG_locations_astern_itr)
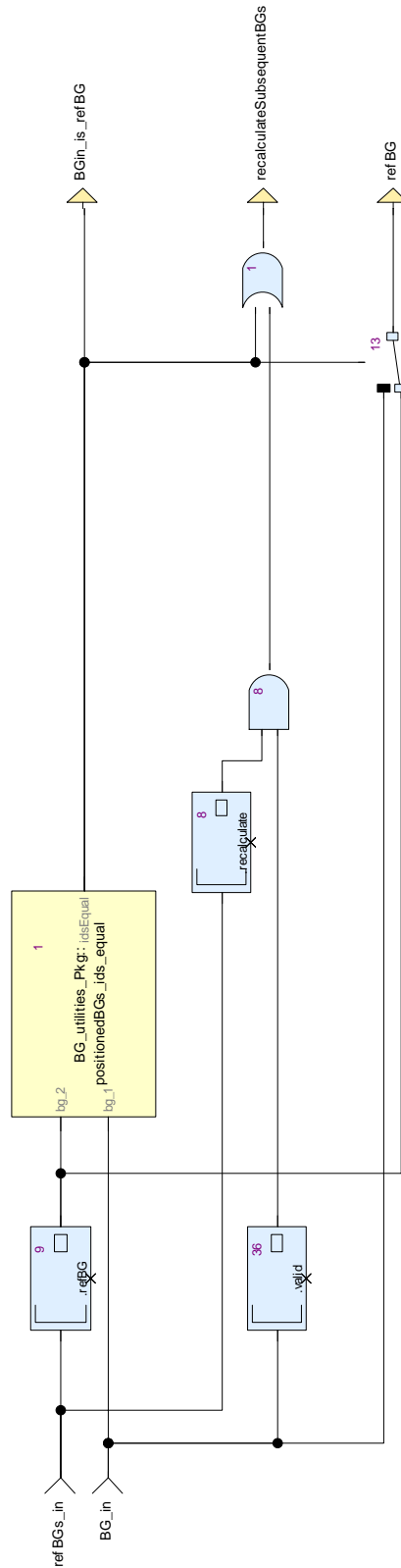
Figure 41: View of diagram_assign_refBG (recalculate_BG_locations_astern_itr)

diagram_assign_refBG Comments:

Determines if BG_in is the reference BG.

If yes, the location of the reference BG has to be taken from BG_in instead of refBGs_in, since the location of the reference BG was recalculated in the previous "recalculate_BG_locations_ahead" function.

For all subsequent BGs in the iteration, the locations have to recalculated.

For all BGs in the iteration before the reference BGs, the locations are kept unchanged.

3.2.16.5.3.   View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_astern_itr)
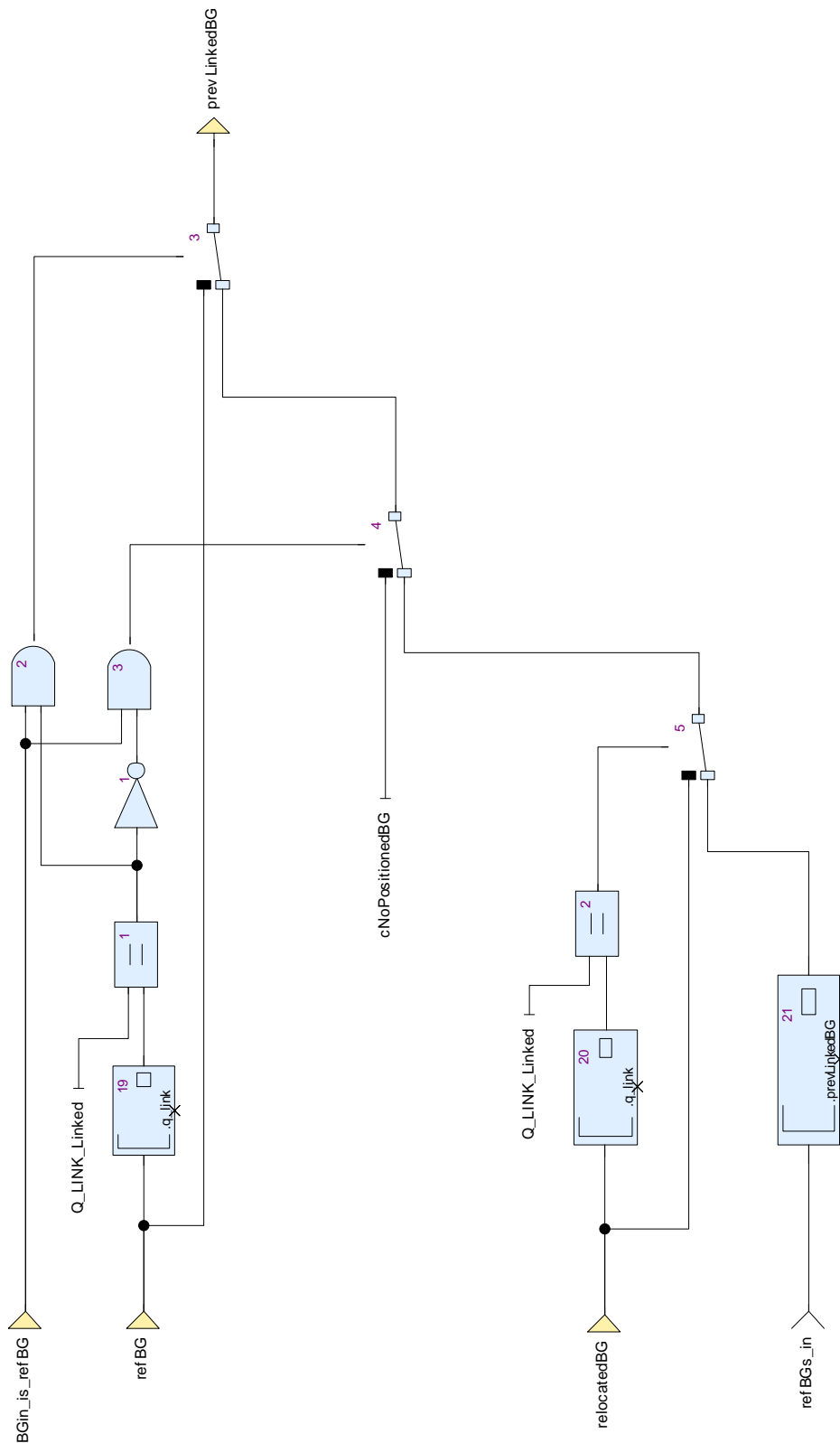
Figure 42: View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_astern_itr)

diagram_determinePreviousLinkedBG Comments:

Determines the previous linked BG.

If BG_in is the reference BG and the reference BG is a linked BG, prevLinkedBG is

set to refBG.

If BG_in is the reference BG and is an unlinked BG, prevLinkedBG is set to no BG (cNoPositionedBG).

If BG_in is not the reference BG and is a linked BG, prevLinkedBG is set to the relocated BG_in.

If BG_in is not the reference BG and is an unlinked BG, prevLinkedBG is taken from refBGs_in.prevLinkedBG.

3.2.16.5.4.   View of diagram_determinePreviousUnlinkedBG
(recalculate_BG_locations_astern_itr)
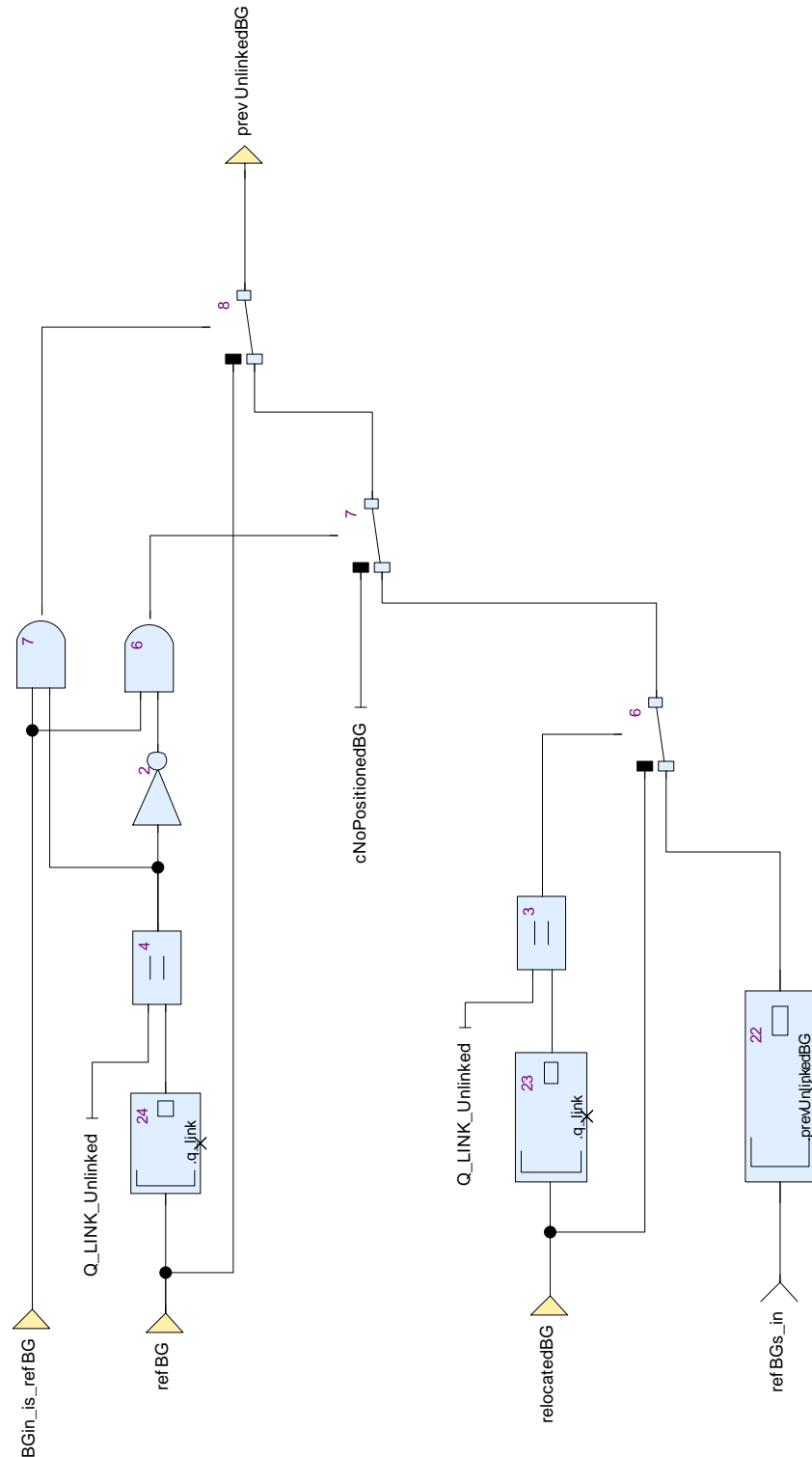
Figure 43: View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_astern_itr)

diagram_determinePreviousUnlinkedBG Comments:
Determines the previous unlinked BG.
If BG_in is the reference BG and the reference BG is an unlinked BG,
prevUnlinkedBG is set to refBG.
If BG_in is the reference BG and a linked BG with or without linking information,

prevUnlinkedBG is set to no BG (cNoPositionedBG).
If BG_in is not the reference BG and is an unlinked BG, prevLinkedBG is set to the relocated BG_in.
If BG_in is not the reference BG and is not an unlinked BG, prevUnlinkedBG is taken from refBGs_in.prevUnlinkedBG.

3.2.16.5.5.   View of diagram_recalculate_BG_location (recalculate_BG_locations_astern_itr)
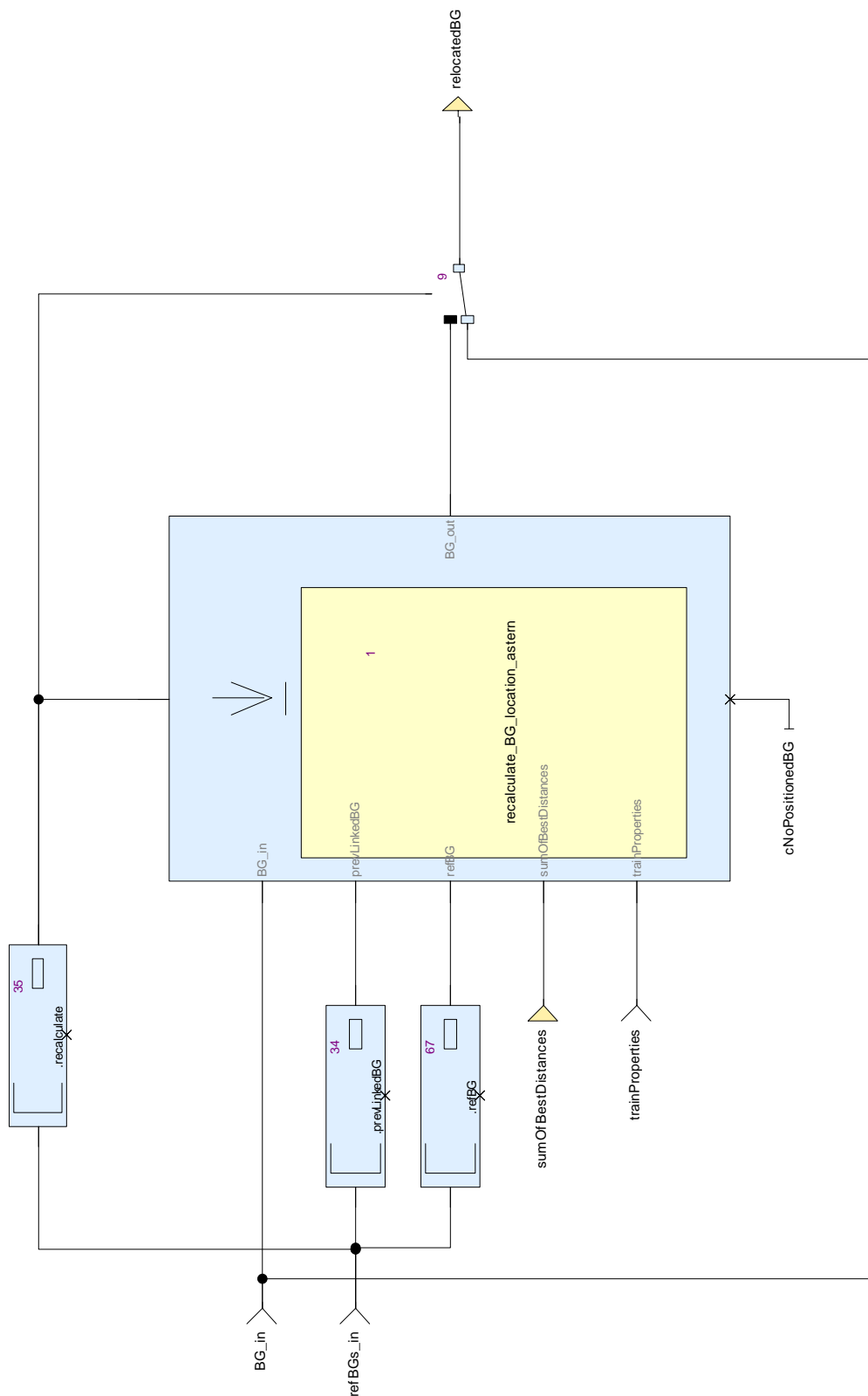
Figure 44: View of diagram_recalculate_BG_location (recalculate_BG_locations_astern_itr)

Table 99: recalculate_BG_location_astern (#1) hidden inputs assignment of
diagram_recalculate_BG_location

Rank	Name	Value
1	trainProperties	*wired (_L250)*

diagram_recalculate_BG_location Comments:
Recalculates the location of BG_in.

3.2.16.5.6.   View of diagram_sumOfPrevBestDistances
(recalculate_BG_locations_astern_itr)
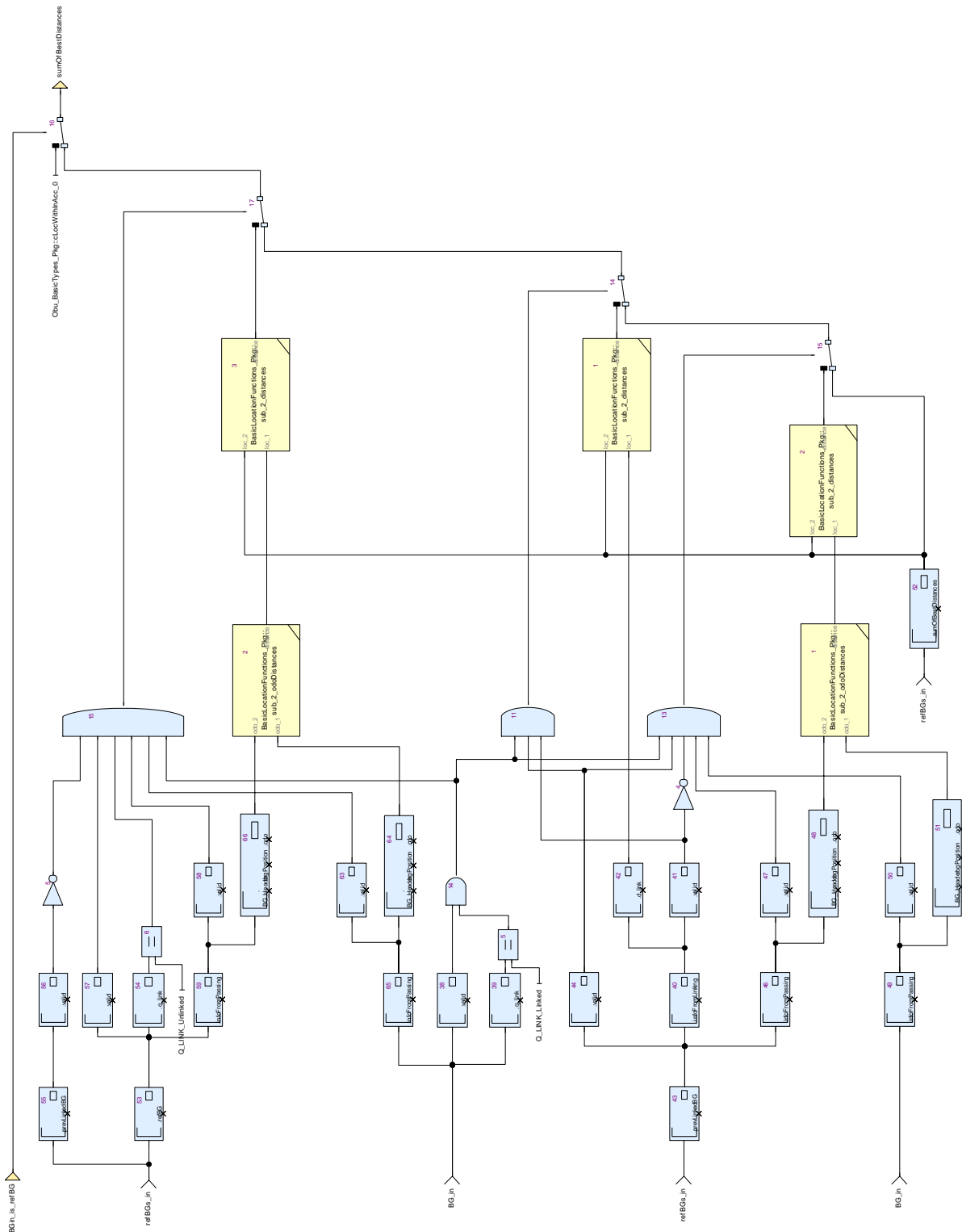
Figure 45: View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_astern_itr)

diagram_sumOfPrevBestDistances Comments:
Accumulates the sum of linking distances and - in case of linking holes - odometry distances.
The sum is reset to 0, if BGin is the refBG and a linked BG.

3.3. CalculateTrainPosition_Pkg::BG_utilities_Pkg Package

3.3.1. Types

Table 100: Public Types of BG_utilities_Pkg

Name	Definition	Comments and Information
BG_counters_T	{unlinkedBGsCount : int, linkedBGsCount : int, totalBGsCount : int, passedUnlinkedBGsCount : int, passedLinkedBGsCount : int, passedTotalBGsCount : int}	Comments: Serves to count the BGs
BG_find_T	{index : int, noOfFoundBGs : int, BGFound : bool}	Comments: Serves to search throug the BGs

3.3.2. Constants

Table 101: Public Constants of BG_utilities_Pkg

Name	Type	Value	Comments and Information
cBG_find_0	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_find_T	{index : cNoValidIndex, noOfFoundBGs : 0, BGFound : false}	
cBGCounters_0	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_counters_T	{unlinkedBGsCount : 0, linkedBGsCount : 0, totalBGsCount : 0, passedUnlinkedBGsCount : 0, passedLinkedBGsCount : 0, passedTotalBGsCount : 0}	

Name	Type	Value	Comments and Information
		{valid : false, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, location : {nominal : 0, d_min : 0, d_max : 0}, seqNoOnTrack : 0, infoFromLinking : {valid : false, nid_bg_fromLinkingBG : 0, nid_c_fromLinkingBG : 0, expectedLocation : {nominal : 0, d_min : 0, d_max : 0}, d_link : {nominal : 0, d_min : 0, d_max : 0}, linkingInfo : {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}}, infoFromPassing : {valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0,	

3.3.3.   countBGs Operator

Declared as **public function**

3.3.3.1.   Comments and Information

countBGs Comments:
Determines the linked, unlinked and total number of BGs in BG_in.

3.3.3.2.   Interface

Table 102: Inputs of countBGs

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 103: Outputs of countBGs

Name	Type	Comments and Information
empty	bool	Comments: No BG in BGs_in.
full	bool	Comments: BGs_in filled completely with BGs.
counters	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_counters_T	

3.3.3.3.   Operator Hierarchy

<u>diagram</u> : diagram_countBGs_1

3.3.3.4.   Graphical and Textual Diagrams

3.3.3.4.1.   View of diagram_countBGs_1 (countBGs)
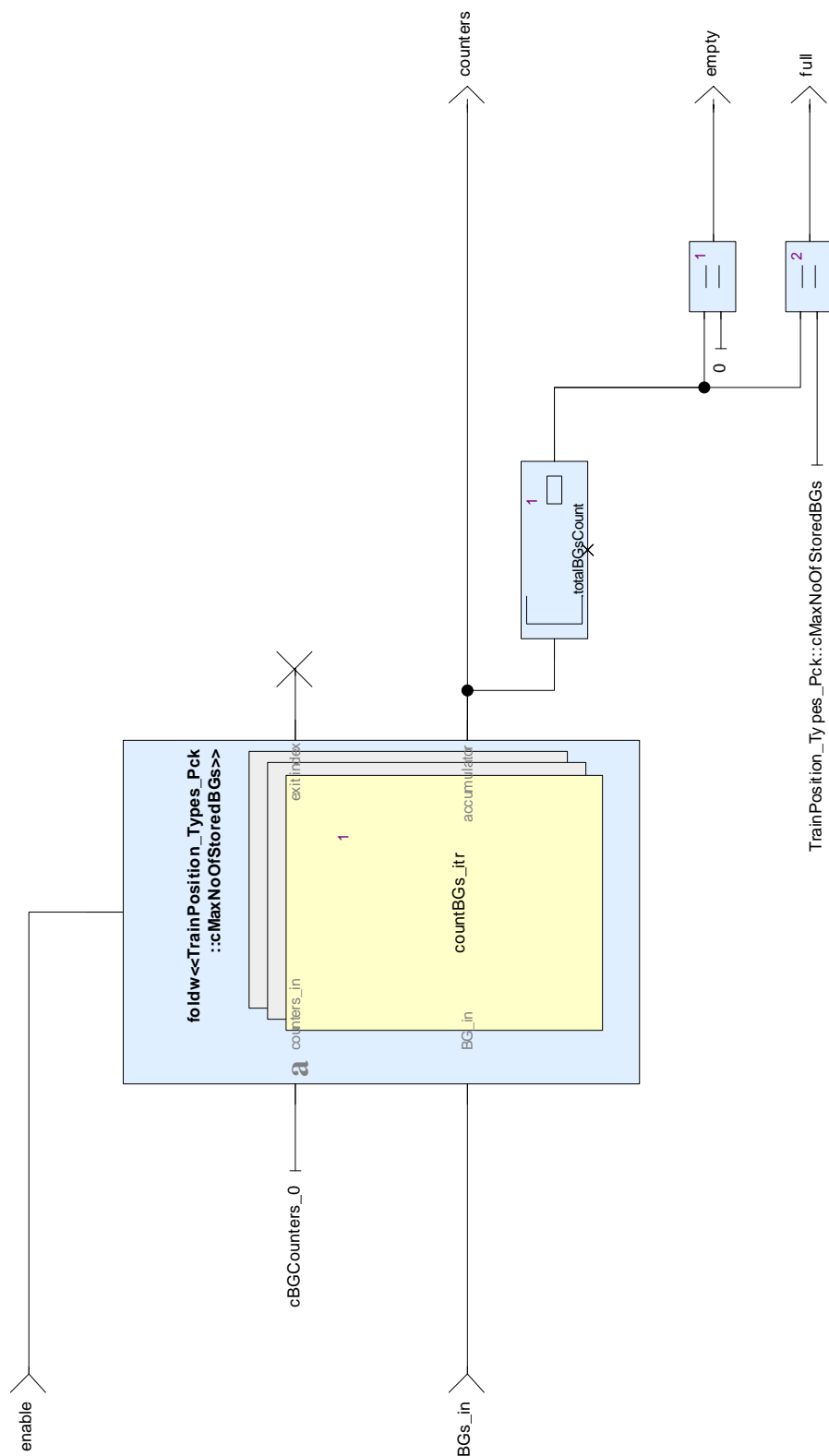
Figure 46: View of diagram_countBGs_1 (countBGs)

3.3.4.   countBGs_itr Operator

Declared as **private function**

3.3.4.1.   Comments and Information

countBGs_itr Comments:
Iterated function for countBGs

3.3.4.2.   Interface

Table 104: Inputs of countBGs_itr

Name	Type	Comments and Information
counters_in	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_counters_T	
BG_in	TrainPosition_Types_Pck::positionedBG_T	

Table 105: Outputs of countBGs_itr

Name	Type	Comments and Information
cont	bool	
counters_out	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_counters_T	

3.3.4.3.   Operator Hierarchy

<u>diagram</u> : diagram_countBGs_itr_1

3.3.4.4.   Graphical and Textual Diagrams

3.3.4.4.1.   View of diagram_countBGs_itr_1 (countBGs_itr)
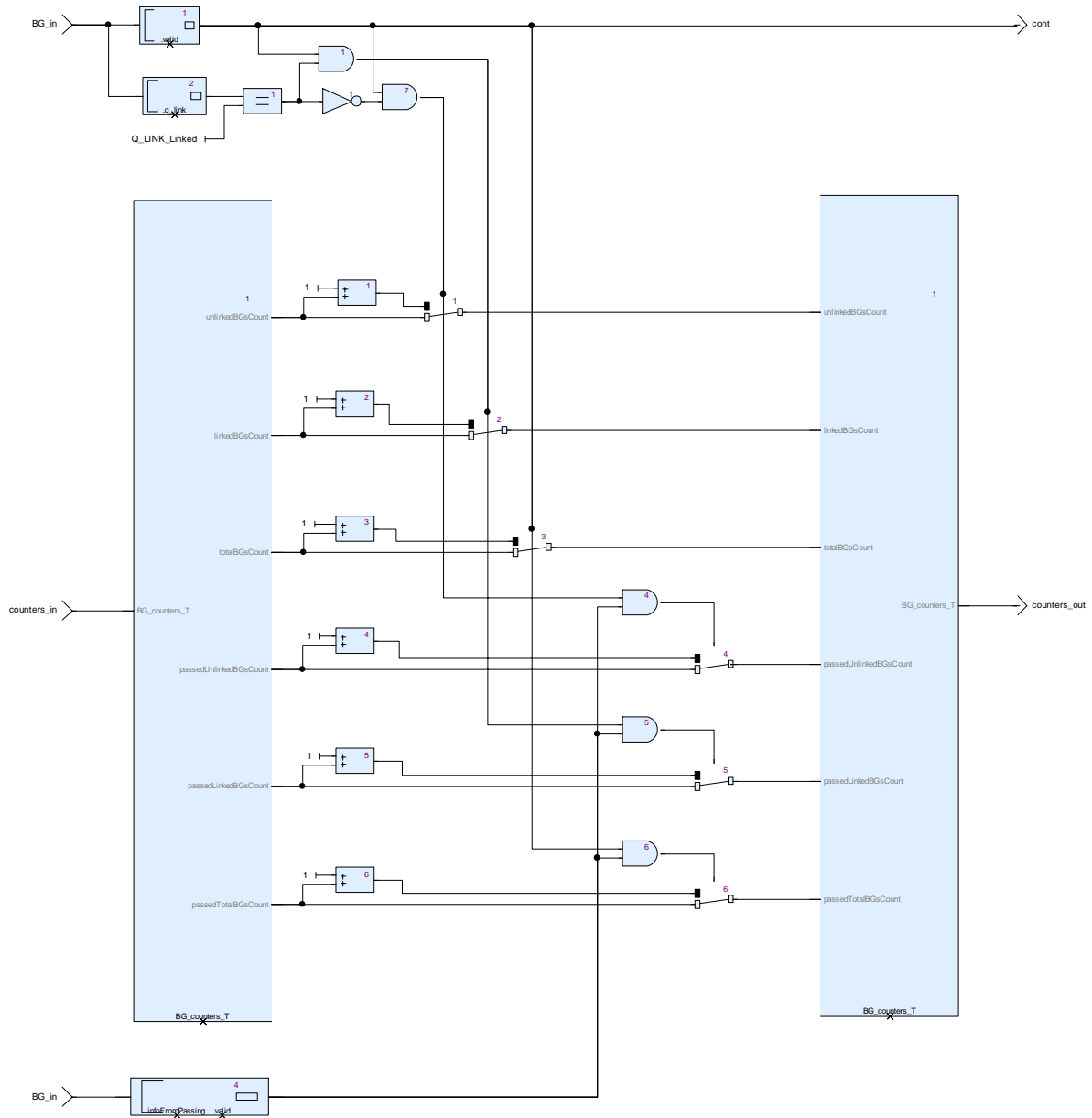
Figure 47: View of diagram_countBGs_itr_1 (countBGs_itr)

3.3.5.   deleteBG_atIndex Operator

Declared as **public function**

3.3.5.1.   Comments and Information

deleteBG_atIndex Comments:
Deletes a BG in BGs, designated by indexOfBG.
The hole caused by the deletion is filled afterwards by shifting the higher part of
BGs down by 1, so that no hole is left in BGs_out afterwards.

3.3.5.2.   Interface

Table 106: Inputs of deleteBG_atIndex

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	
indexOfBG	int	
del	bool	Comments: Delete command. Deletion takes place if del = true.

Table 107: Outputs of deleteBG_atIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.3.5.3.   Operator Hierarchy

<u>diagram</u> : diagram_deleteBG_atIndex_1

3.3.5.4.   Graphical and Textual Diagrams

3.3.5.4.1.   View of diagram_deleteBG_atIndex_1 (deleteBG_atIndex)
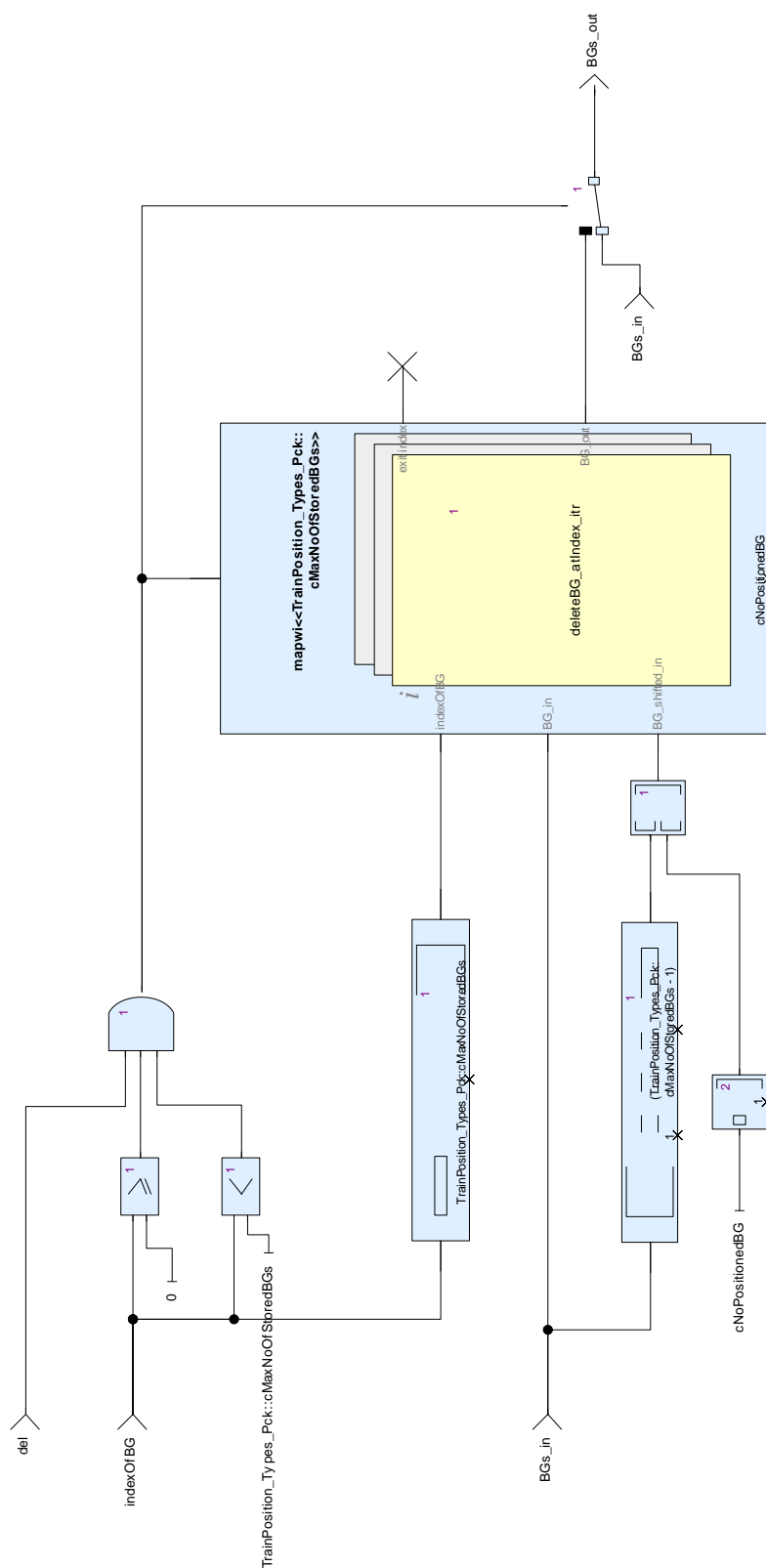
Figure 48: View of diagram_deleteBG_atIndex_1 (deleteBG_atIndex)

3.3.6.   deleteBG_atIndex_itr Operator

Declared as **private function**

3.3.6.1.   Comments and Information

deleteBG_atIndex_itr Comments:
Iterated function used by deleteBG_atIndex

3.3.6.2.   Interface

Table 108: Inputs of deleteBG_atIndex_itr

Name	Type	Comments and Information
iteratorIndex	int	
indexOfBG	int	
BG_in	TrainPosition_Types_Pck::positionedBG_T	
BG_shifted_in	TrainPosition_Types_Pck::positionedBG_T	

Table 109: Outputs of deleteBG_atIndex_itr

Name	Type	Comments and Information
cont	bool	
BG_out	TrainPosition_Types_Pck::positionedBG_T	

3.3.6.3.   Operator Hierarchy

diagram : diagram_deleteBG_atIndex_itr_1
        activate if : IfBlock1
                branch : then
                branch : else
                        branch : then
                        branch : else

3.3.6.4. Graphical and Textual Diagrams

3.3.6.4.1. View of diagram_deleteBG_atIndex_itr_1 (deleteBG_atIndex_itr)
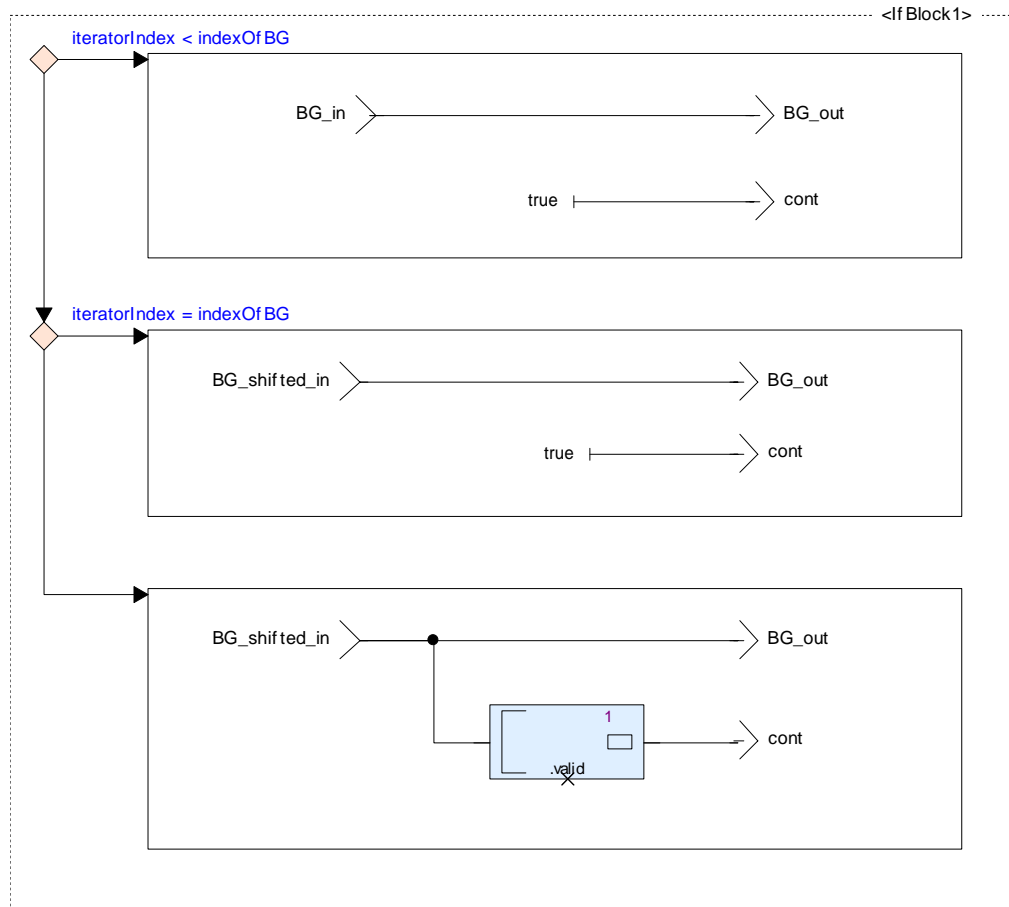
Figure 49: View of diagram_deleteBG_atIndex_itr_1 (deleteBG_atIndex_itr)

Table 110: Conditional Blocks of diagram_deleteBG_atIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 111: Actions of diagram_deleteBG_atIndex_itr_1

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

3.3.7. deleteBGs_beforeIndex Operator

Declared as **public function**

3.3.7.1. Comments and Information

deleteBGs_beforeIndex Comments:
Deletes all BGs in BGs, starting with index 0 until (indexOfBG - 1).

3.3.7.2.   Interface

Table 112: Inputs of deleteBGs_beforeIndex

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	
indexOfBG	int	
del	bool	Comments: Delete command. Deletion takes place if del = true.

Table 113: Outputs of deleteBGs_beforeIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.3.7.3.   Operator Hierarchy

<u>diagram</u> : diagram_deleteBGs_beforeIndex_1

3.3.7.4.   Graphical and Textual Diagrams

3.3.7.4.1.   View of diagram_deleteBGs_beforeIndex_1 (deleteBGs_beforeIndex)
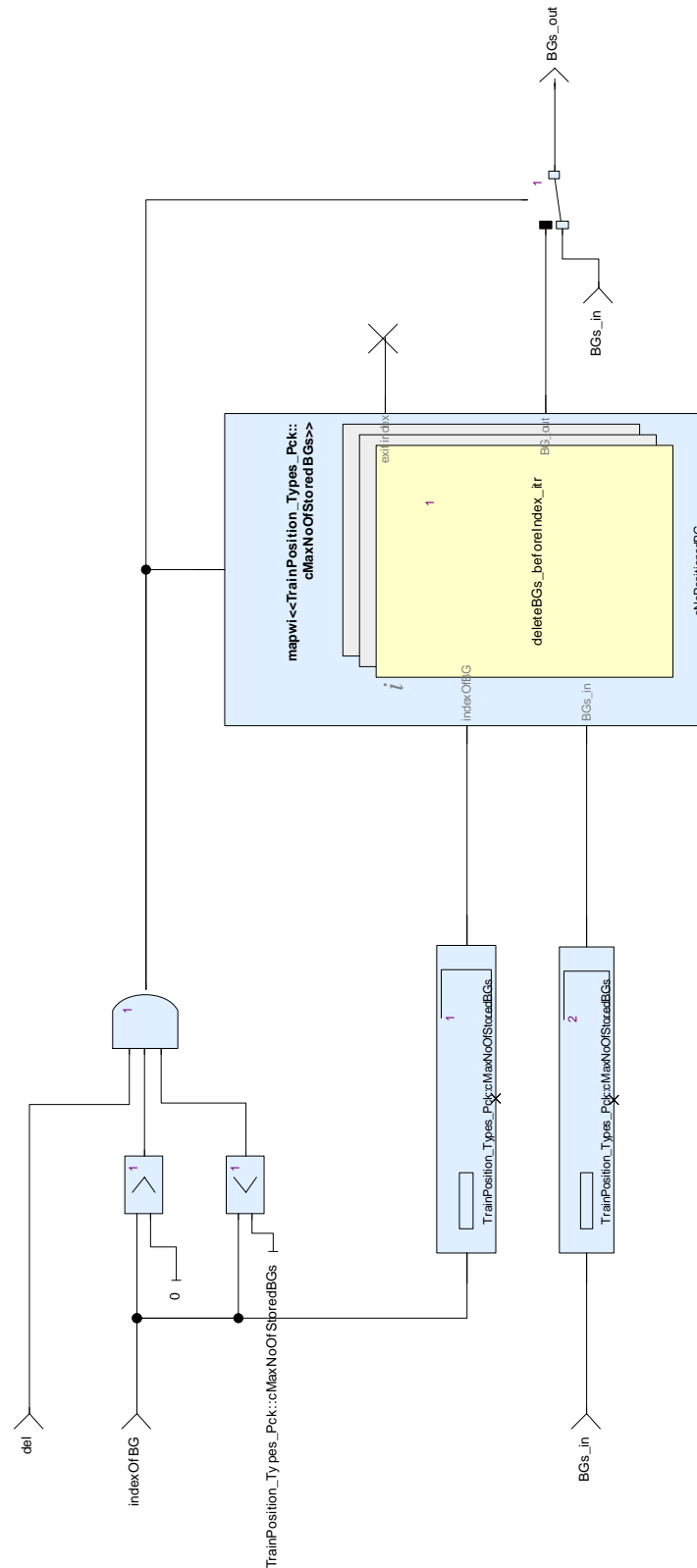
Figure 50: View of diagram_deleteBGs_beforeIndex_1 (deleteBGs_beforeIndex)

3.3.8.   deleteBGs_beforeIndex_itr Operator

Declared as **private function**

3.3.8.1.   Comments and Information

deleteBGs_beforeIndex_itr Comments:
Iterated function used by deleteBGs_beforeIndex

3.3.8.2.   Interface

Table 114: Inputs of deleteBGs_beforeIndex_itr

Name	Type	Comments and Information
iteratorIndex	int	
indexOfBG	int	
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	

Table 115: Outputs of deleteBGs_beforeIndex_itr

Name	Type	Comments and Information
cont	bool	
BG_out	TrainPosition_Types_Pck::positionedBG_T	

3.3.8.3.   Operator Hierarchy

<u>diagram</u> : diagram_deleteBGs_beforeIndex_itr_1

3.3.8.4.   Graphical and Textual Diagrams

3.3.8.4.1.   View of diagram_deleteBGs_beforeIndex_itr_1 (deleteBGs_beforeIndex_itr)
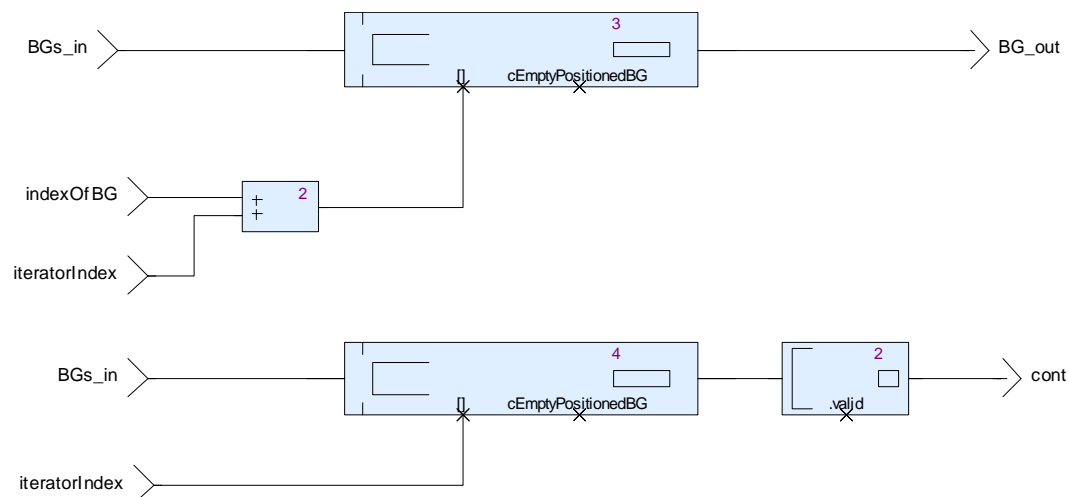
Figure 51: View of diagram_deleteBGs_beforeIndex_itr_1 (deleteBGs_beforeIndex_itr)

3.3.9.   deleteBGs_fromIndex Operator

Declared as **public function**

3.3.9.1.   Comments and Information

deleteBGs_fromIndex Comments:
Deletes all BGs in BGs, starting with indexOfBG until the end of the list.

3.3.9.2.   Interface

Table 116: Inputs of deleteBGs_fromIndex

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	
indexOfBG	int	
del	bool	Comments: Delete command. Deletion takes place if del = true.

Table 117: Outputs of deleteBGs_fromIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

3.3.9.3.   Operator Hierarchy

diagram : diagram_deleteBGs_fromIndex_1

3.3.9.4.   Graphical and Textual Diagrams

3.3.9.4.1.   View of diagram_deleteBGs_fromIndex_1 (deleteBGs_fromIndex)
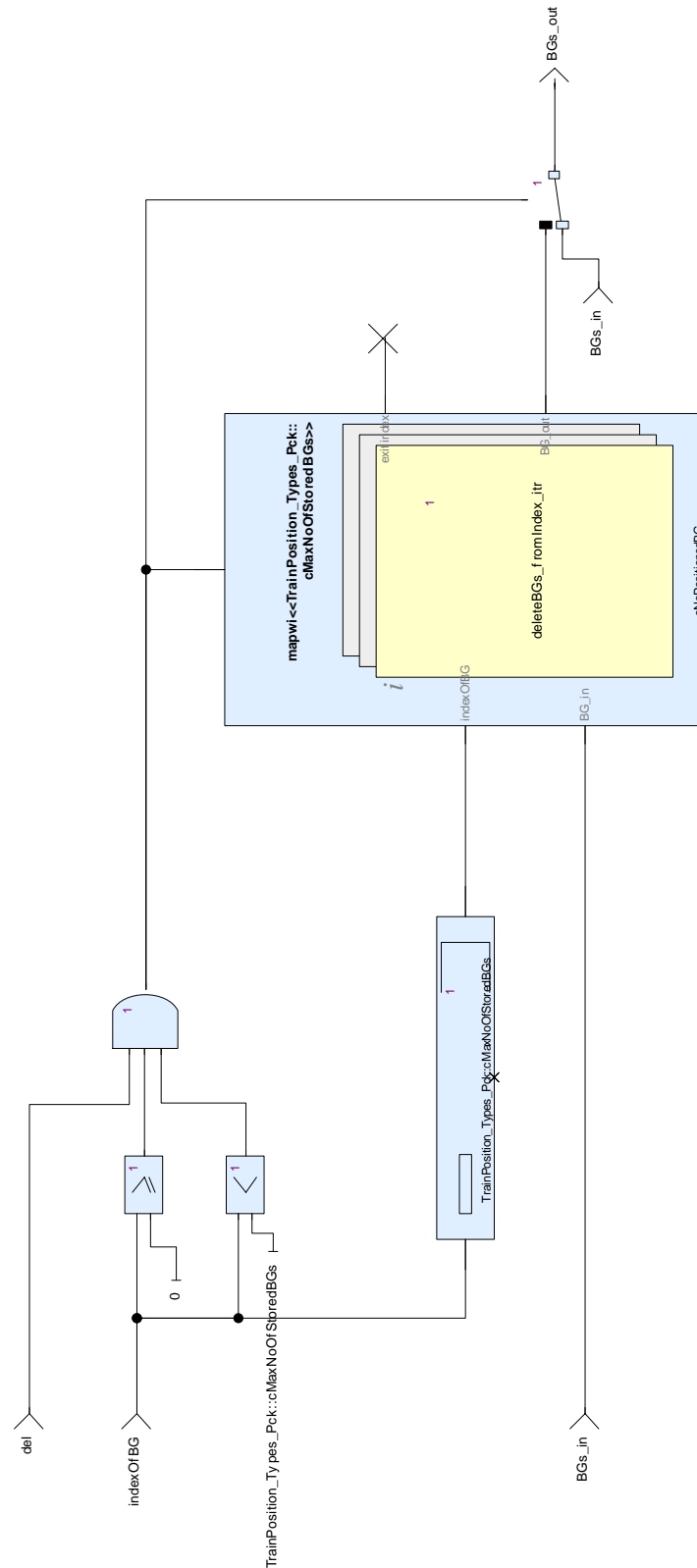
Figure 52: View of diagram_deleteBGs_fromIndex_1 (deleteBGs_fromIndex)

3.3.10.   deleteBGs_fromIndex_itr Operator

Declared as **private function**

3.3.10.1.   Comments and Information

deleteBGs_fromIndex_itr Comments:
Iterated function used by deleteBGs_fromIndex

3.3.10.2.   Interface

Table 118: Inputs of deleteBGs_fromIndex_itr

Name	Type	Comments and Information
iteratorIndex	int	
indexOfBG	int	
BG_in	TrainPosition_Types_Pck::positionedBG_T	

Table 119: Outputs of deleteBGs_fromIndex_itr

Name	Type	Comments and Information
cont	bool	
BG_out	TrainPosition_Types_Pck::positionedBG_T	

3.3.10.3.   Operator Hierarchy

<u>diagram</u> : diagram_deleteBGs_fromIndex_itr_1
      activate if : IfBlock1
           branch : then
           branch : else
                 branch : then
                 branch : else

3.3.10.4.   Graphical and Textual Diagrams

3.3.10.4.1.   View of diagram_deleteBGs_fromIndex_itr_1 (deleteBGs_fromIndex_itr)
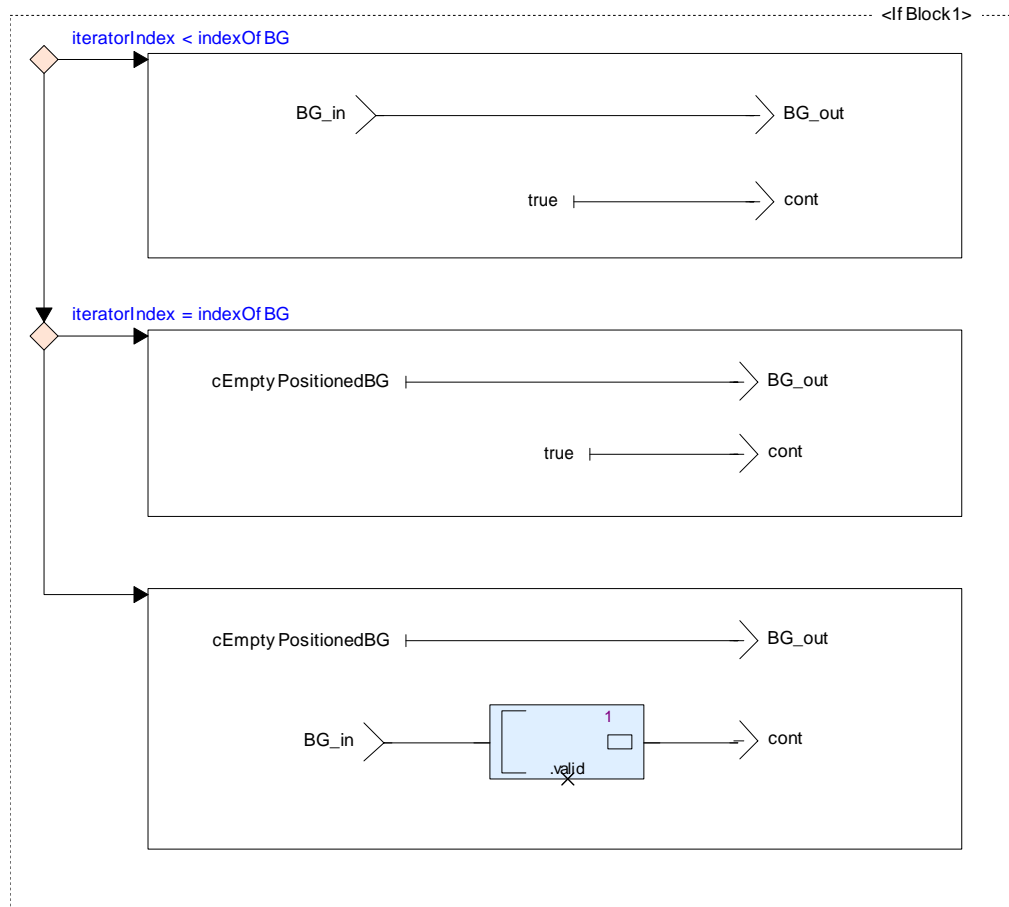
Figure 53: View of diagram_deleteBGs_fromIndex_itr_1 (deleteBGs_fromIndex_itr)

Table 120: Conditional Blocks of diagram_deleteBGs_fromIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 121: Actions of diagram_deleteBGs_fromIndex_itr_1

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

3.3.11.   indexOf_nthPassedBG Operator

Declared as **public function**

3.3.11.1.   Comments and Information

indexOf_nthPassedBG Comments:
Determines the index of the n-th linked or unlinked passed BG in BGs.

3.3.11.2.   Interface

Table 122: Inputs of indexOf_nthPassedBG

Name	Type	Comments and Information
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
n	int	Comments: The n-th BGs will be searched. This is the related number "n".
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 123: Outputs of indexOf_nthPassedBG

Name	Type	Comments and Information
indexOfBG	int	
BG_found	bool	Comments: Indicates, that BG exists in BGs.

3.3.11.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOf_nthPassedBG_1

3.3.11.4.   Graphical and Textual Diagrams

3.3.11.4.1.   View of diagram_indexOf_nthPassedBG_1 (indexOf_nthPassedBG)

Figure 54: View of diagram_indexOf_nthPassedBG_1 (indexOf_nthPassedBG)
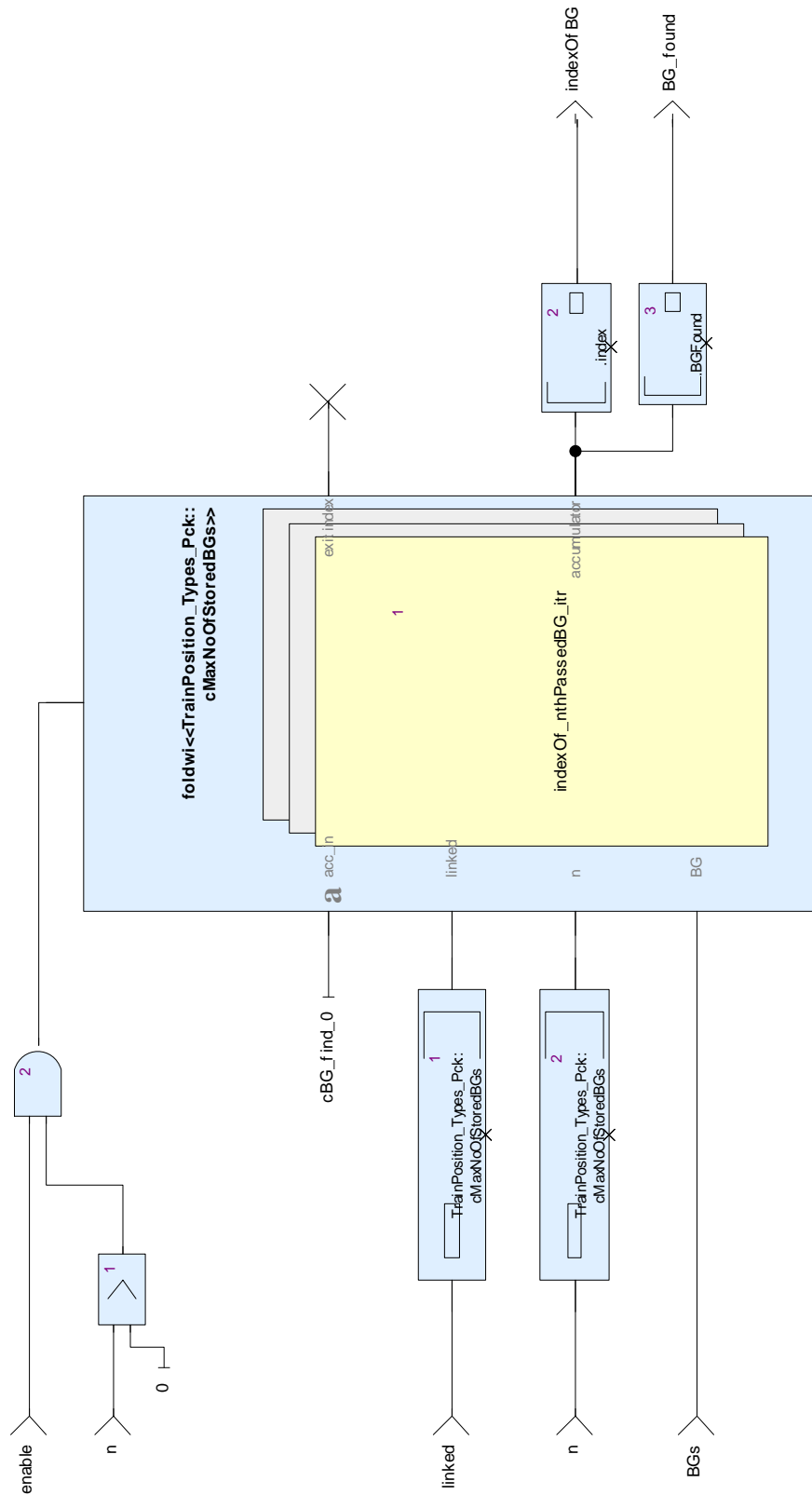
3.3.12.   indexOf_nthPassedBG_itr Operator

Declared as **private function**

3.3.12.1.   Comments and Information

indexOf_nthPassedBG_itr Comments:
Iterated function for indexOf_nthPassedBG

Table 124: indexOf_nthPassedBG_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.12.2.   Interface

Table 125: Inputs of indexOf_nthPassedBG_itr

Name	Type	Comments and Information
iteratorIndex	int	
acc_in	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_find_T	
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
n	int	
BG	TrainPosition_Types_Pck::positionedBG_T	

Table 126: Outputs of indexOf_nthPassedBG_itr

Name	Type	Comments and Information
cont	bool	
acc_out	CalculateTrainPosition_Pkg::BG_utilities_Pkg::BG_find_T	

3.3.12.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOf_nthPassedBG_itr_1

3.3.12.4.   Graphical and Textual Diagrams

3.3.12.4.1.   View of diagram_indexOf_nthPassedBG_itr_1 (indexOf_nthPassedBG_itr)
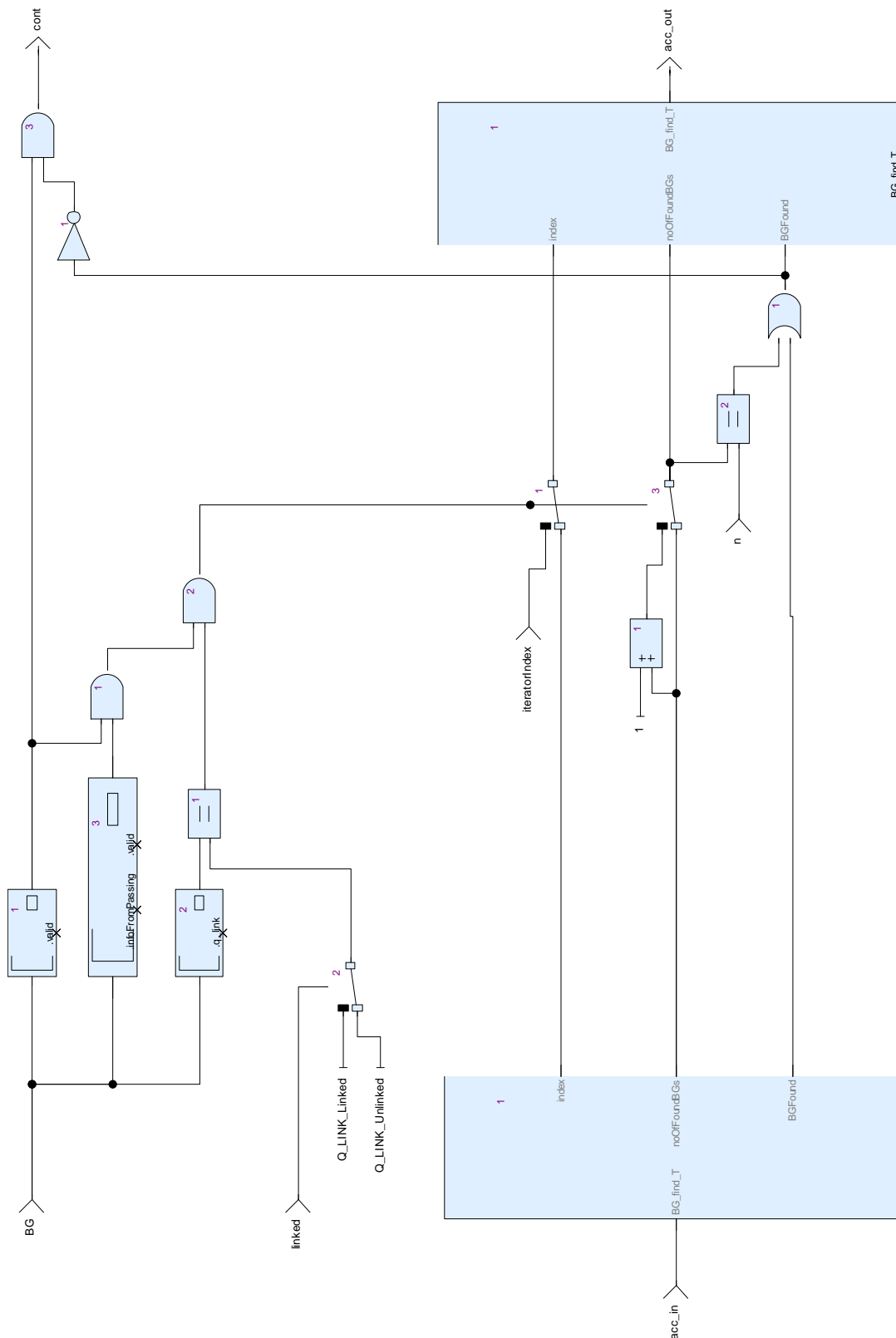
Figure 55: View of diagram_indexOf_nthPassedBG_itr_1 (indexOf_nthPassedBG_itr)

3.3.13. indexOfBG_by_id Operator

Declared as **public function**

3.3.13.1. Comments and Information

indexOfBG_by_id Comments:
Determines the index of BG in BGs by comparing NID_BG and NID_C.
If BG is found, the output BG_found is set, otherwise unset.
If BG is not found, the output indexOfBG is set to a free cell in BGs.
If BG is not found and no free cell is available in BGs, indexValid is unset.

Table 127: indexOfBG_by_id Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Determines the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.13.2. Interface

Table 128: Inputs of indexOfBG_by_id

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 129: Outputs of indexOfBG_by_id

Name	Type	Comments and Information
indexOfBG	int	

Name	Type	Comments and Information
BG_found	bool	Comments: Indicates, that BG exists in BGs.
indexValid	bool	Comments: Indicates, that no valid index could be assigned to BG. Practically, this means that there could no place be assigned to BG in BGs.

3.3.13.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOfBG_by_id_1

3.3.13.4.   Graphical and Textual Diagrams

3.3.13.4.1.   View of diagram_indexOfBG_by_id_1 (indexOfBG_by_id)
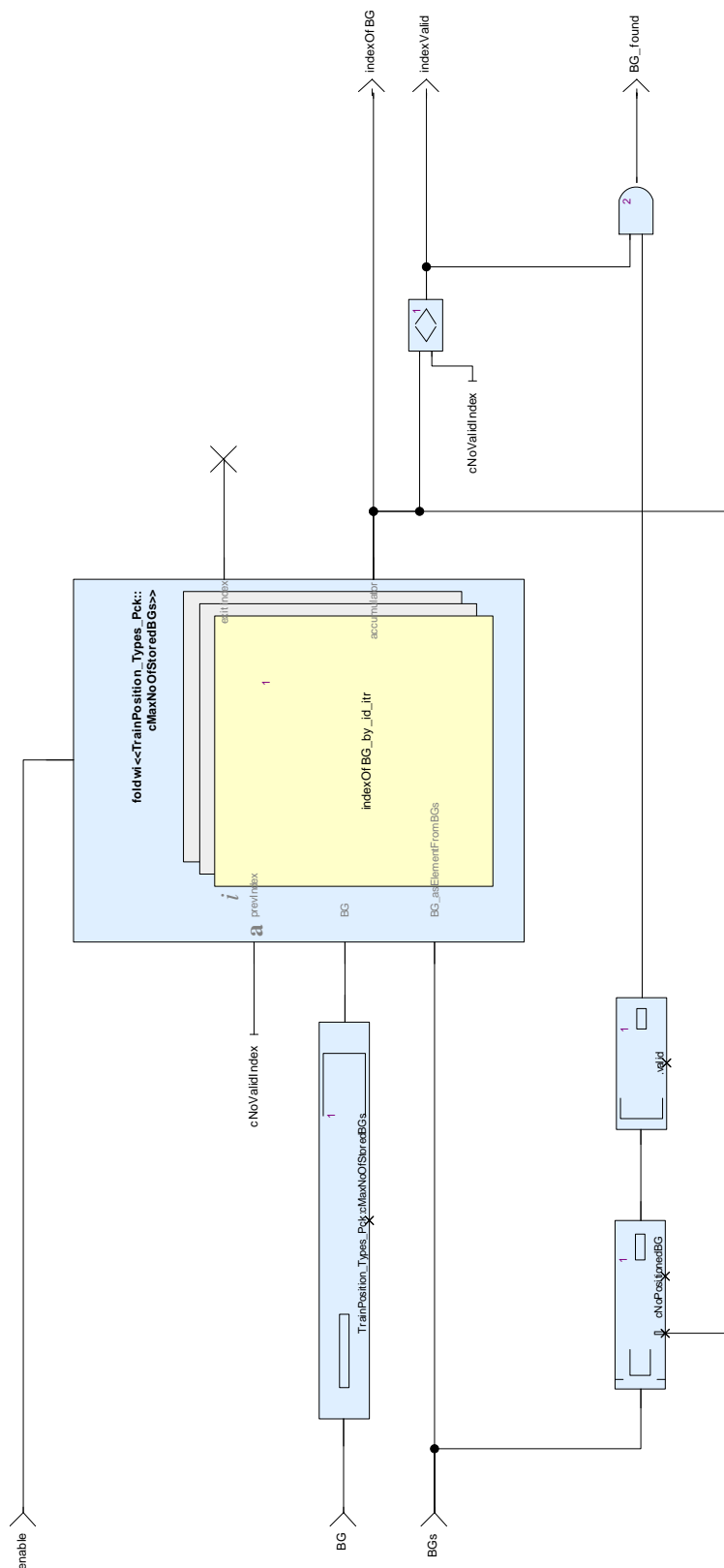
Figure 56: View of diagram_indexOfBG_by_id_1 (indexOfBG_by_id)

3.3.14.   indexOfBG_by_id_itr Operator

Declared as **private function**

3.3.14.1.   Comments and Information

indexOfBG_by_id_itr Comments:
Iterated function for determing the index of BG in BGs

Table 130: indexOfBG_by_id_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.14.2.   Interface

Table 131: Inputs of indexOfBG_by_id_itr

Name	Type	Comments and Information
iteratorIndex	int	
prevIndex	int	
BG	TrainPosition_Types_Pck::positionedBG_T	
BG_asElementFromBGs	TrainPosition_Types_Pck::positionedBG_T	

Table 132: Outputs of indexOfBG_by_id_itr

Name	Type	Comments and Information
cont	bool	
indexOfBG	int	

3.3.14.3.   Operator Hierarchy

diagram : diagram_indexOfBG_by_id_itr_1

3.3.14.4.   Graphical and Textual Diagrams

3.3.14.4.1.   View of diagram_indexOfBG_by_id_itr_1 (indexOfBG_by_id_itr)
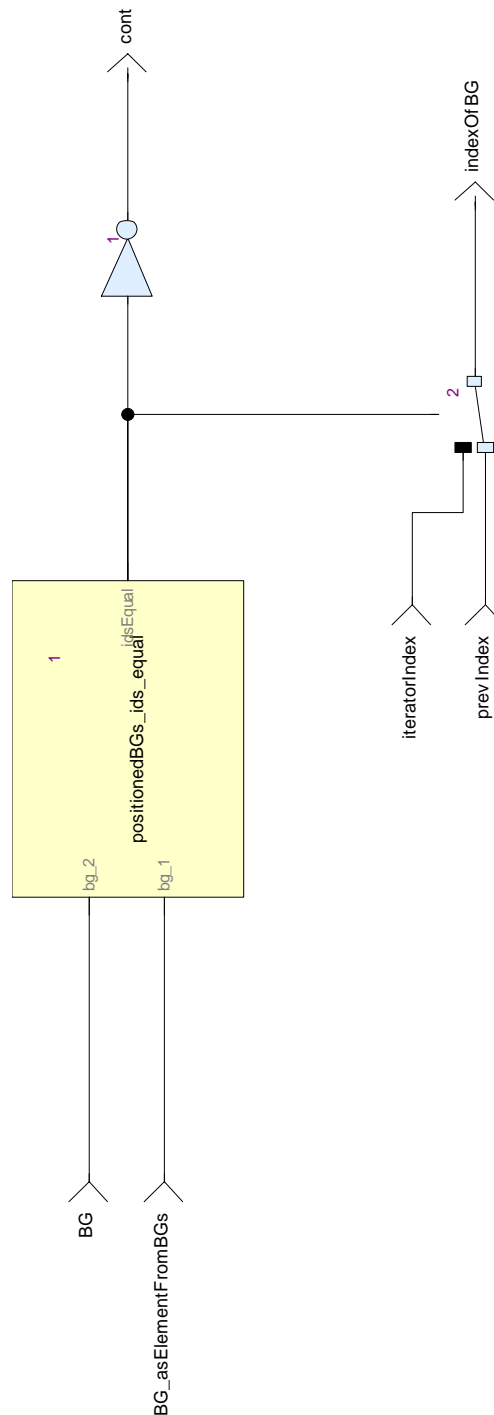
Figure 57: View of diagram_indexOfBG_by_id_itr_1 (indexOfBG_by_id_itr)

3.3.15.   indexOfBG_onTrack Operator

Declared as **public function**

3.3.15.1.   Comments and Information

indexOfBG_onTrack Comments:
Determines the must index of BG in BGs.
If BG is a passed BG, the index is determined by the order of the sequence no (seqNoOnTrack).
If BG is an announced (linked) BG (not yet passed), the index is determined by the expected nominal location.
If BG already exists in BGs at that index, BG_found is set, otherwise unset.
If no index can be assigned, indexValid is unset.
Note:
indexOfBG may point to a cell in BGs already occupied by a different BG.
It is not checked, if BG is already stored in BGs at a different index.

Table 133: indexOfBG_onTrack Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Determines the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.15.2.   Interface

Table 134: Inputs of indexOfBG_onTrack

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 135: Outputs of indexOfBG_onTrack

Name	Type	Comments and Information
indexOfBG	int	
BG_found	bool	Comments: Indicates, that BG exists in BGs.
indexValid	bool	Comments: Indicates, that no valid index could be assigned to BG. Practically, this means that no cell could be assigned to BG in BGs.

3.3.15.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOfBG_onTrack_1

3.3.15.4. Graphical and Textual Diagrams

3.3.15.4.1. View of diagram_indexOfBG_onTrack_1 (indexOfBG_onTrack)
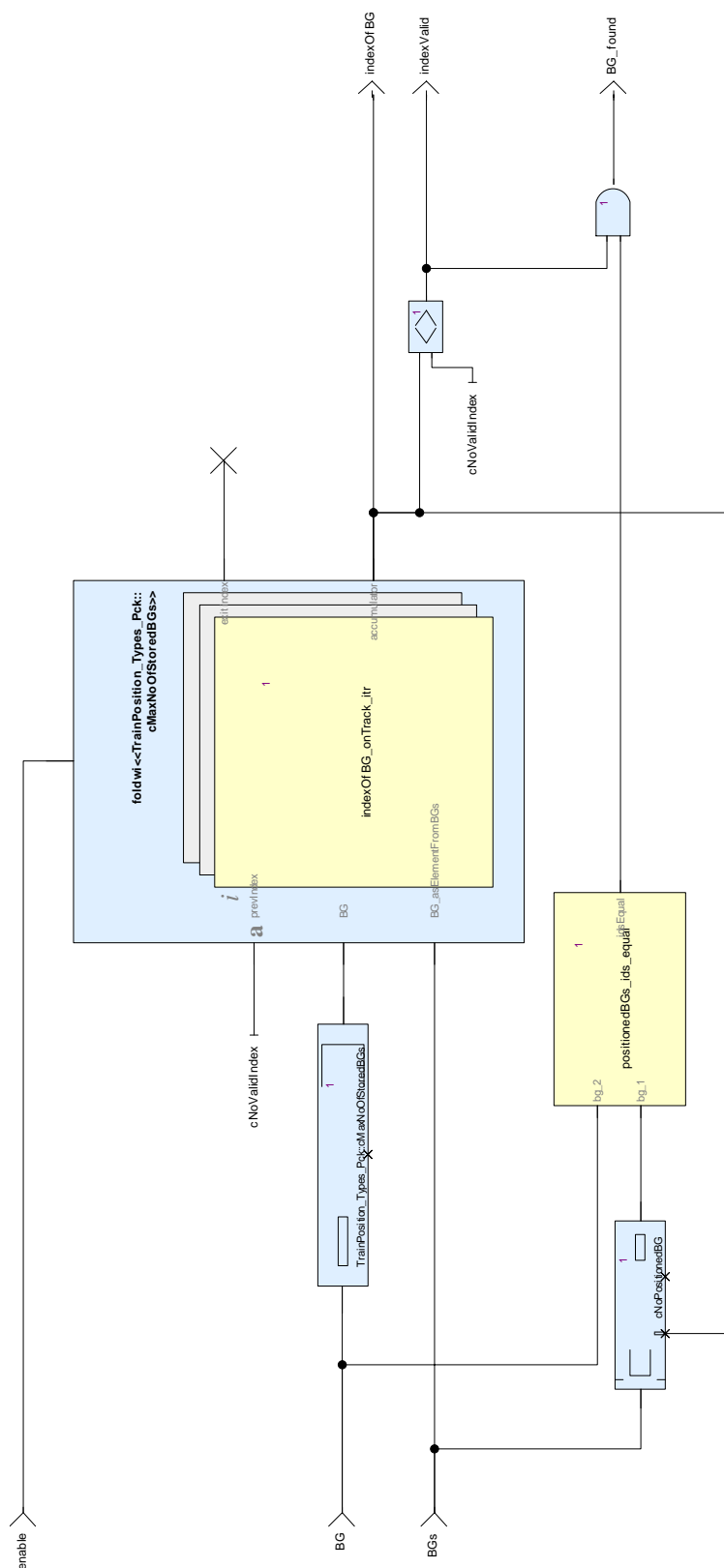
Figure 58: View of diagram_indexOfBG_onTrack_1 (indexOfBG_onTrack)

3.3.16.   indexOfBG_onTrack_itr Operator

Declared as **private function**

3.3.16.1.   Comments and Information

indexOfBG_onTrack_itr Comments:
Iterated function for determing the index of BG in BGs

Table 136: indexOfBG_onTrack_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.16.2.   Interface

Table 137: Inputs of indexOfBG_onTrack_itr

Name	Type	Comments and Information
iteratorIndex	int	
prevIndex	int	
BG	TrainPosition_Types_Pck::positionedBG_T	
BG_asElementFromBGs	TrainPosition_Types_Pck::positionedBG_T	

Table 138: Outputs of indexOfBG_onTrack_itr

Name	Type	Comments and Information
cont	bool	
indexOfBG	int	

3.3.16.3.   Locals

Table 139: Locals of indexOfBG_onTrack_itr

Name	Type	Comments and Information
invalidateIndex	bool	
stopIteration	bool	

3.3.16.4.   Operator Hierarchy

diagram : diagram_setIndex
diagram : diagram_stopIteration

3.3.16.5.   Graphical and Textual Diagrams

3.3.16.5.1.   View of diagram_setIndex (indexOfBG_onTrack_itr)
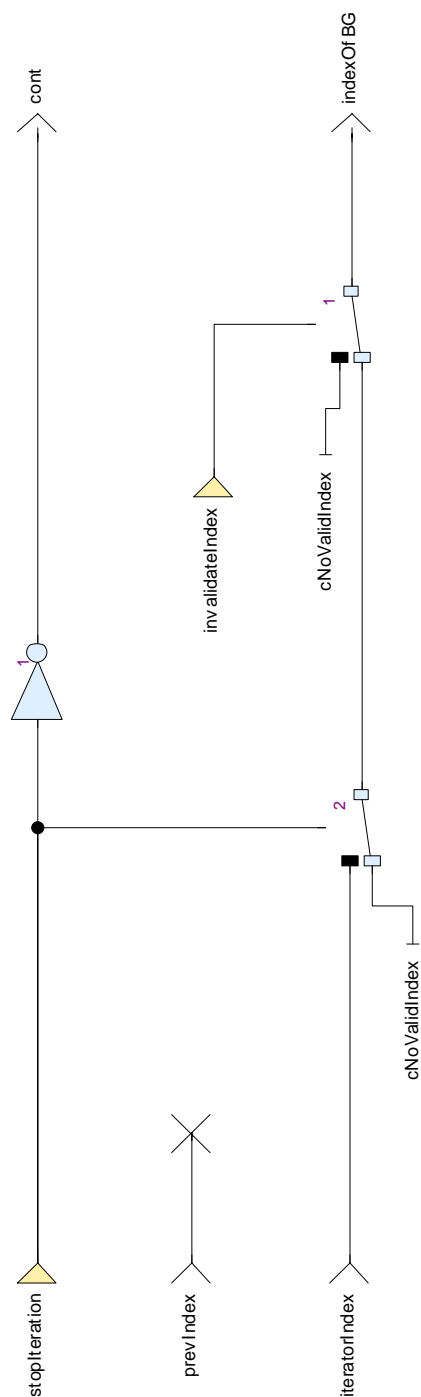
Figure 59: View of diagram_setIndex (indexOfBG_onTrack_itr)

3.3.16.5.2.   View of diagram_stopIteration (indexOfBG_onTrack_itr)

Figure 60: View of diagram_stopIteration (indexOfBG_onTrack_itr)

3.3.17.   indexOfLastBG Operator

Declared as **public function**

3.3.17.1.   Comments and Information

indexOfLastBG Comments:
Determines the index of the last (most ahead) linked or unlinked BG in BGs.

3.3.17.2.   Interface

Table 140: Inputs of indexOfLastBG

Name	Type	Comments and Information
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 141: Outputs of indexOfLastBG

Name	Type	Comments and Information
indexOfBG	int	
BG_found	bool	Comments: Indicates, that BG exists in BGs.
indexValid	bool	Comments: Indicates, that a valid index was found.

3.3.17.3.   Operator Hierarchy

diagram : diagram_indexOfLastBG_1

3.3.17.4.   Graphical and Textual Diagrams

3.3.17.4.1.   View of diagram_indexOfLastBG_1 (indexOfLastBG)
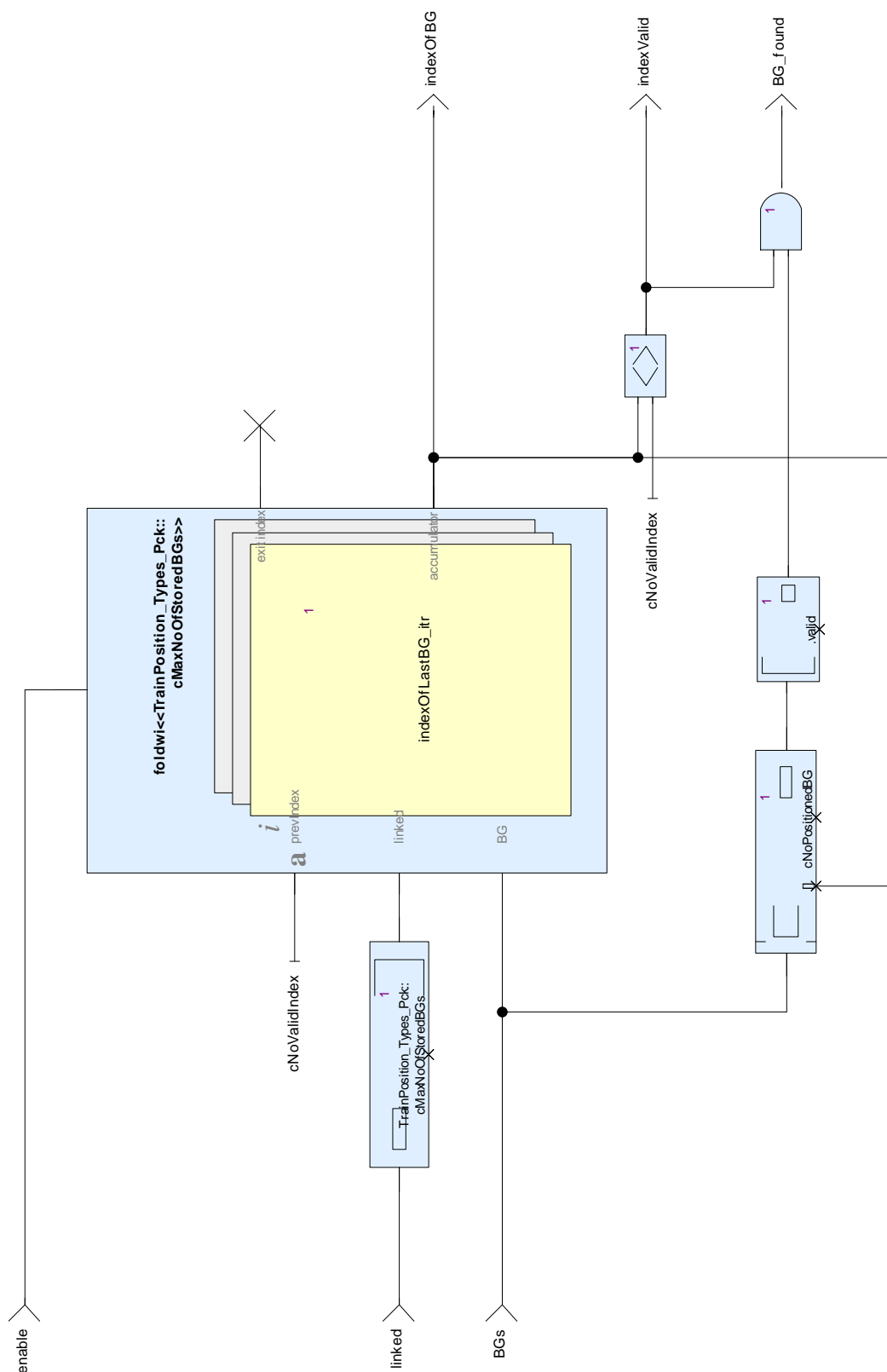
Figure 61: View of diagram_indexOfLastBG_1 (indexOfLastBG)

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3.3.18.   indexOfLastBG_itr Operator

Declared as **private function**

3.3.18.1.   Comments and Information

indexOfLastBG_itr Comments:
Iterated function for indexOfLastBG

Table 142: indexOfLastBG_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.18.2.   Interface

Table 143: Inputs of indexOfLastBG_itr

Name	Type	Comments and Information
iteratorIndex	int	
prevIndex	int	
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
BG	TrainPosition_Types_Pck::positionedBG_T	

Table 144: Outputs of indexOfLastBG_itr

Name	Type	Comments and Information
cont	bool	

Name	Type	Comments and Information
indexOfBG	int	

3.3.18.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOfLastBG_itr_1

3.3.18.4. Graphical and Textual Diagrams

3.3.18.4.1. View of diagram_indexOfLastBG_itr_1 (indexOfLastBG_itr)
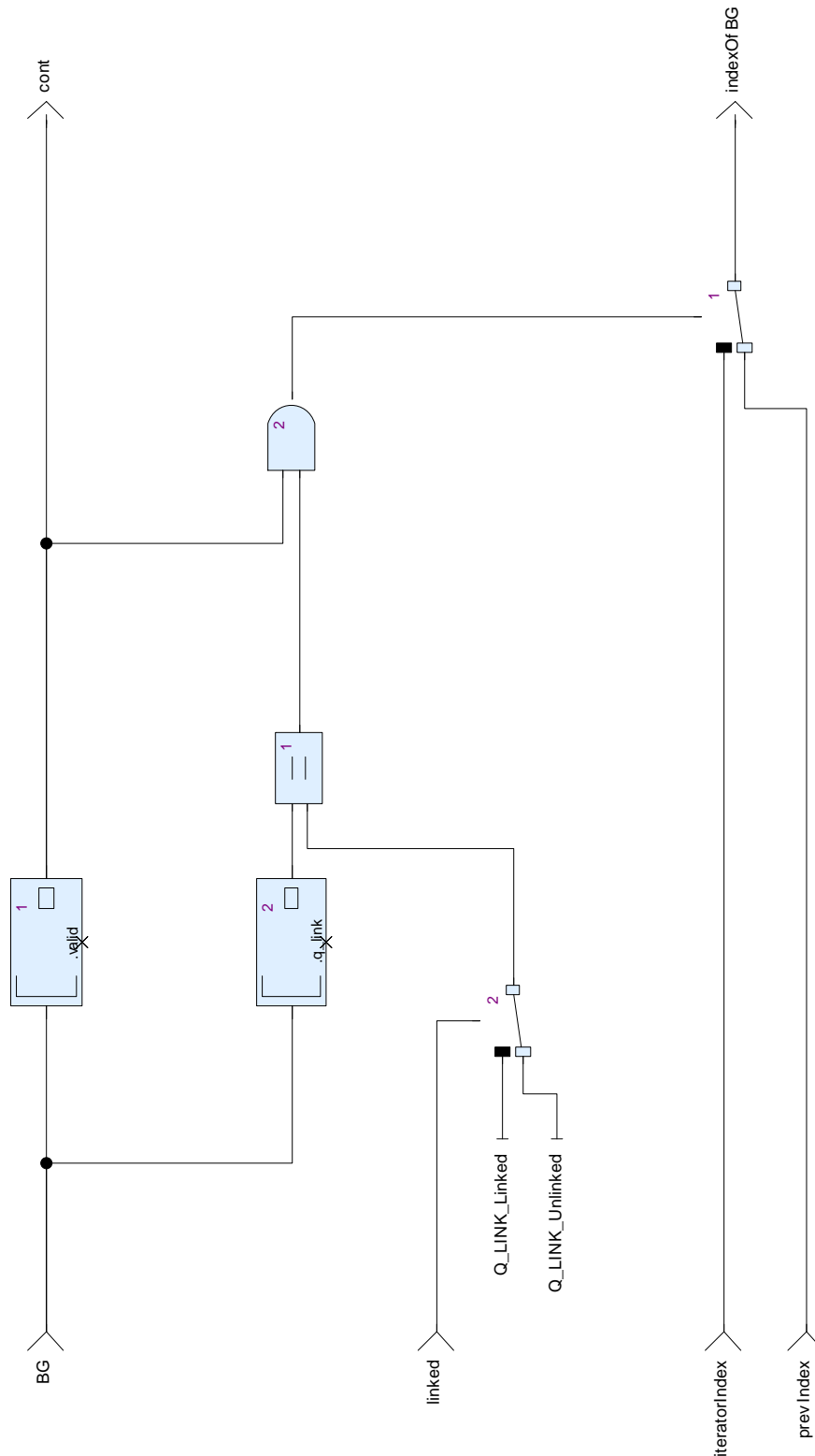
Figure 62: View of diagram_indexOfLastBG_itr_1 (indexOfLastBG_itr)

3.3.19. indexOfLastPassedBG Operator

Declared as **public function**

3.3.19.1.   Comments and Information

indexOfLastPassedBG Comments:
Determines the index of the last (most ahead) linked or unlinked passed BG in BGs.

3.3.19.2.   Interface

Table 145: Inputs of indexOfLastPassedBG

Name	Type	Comments and Information
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 146: Outputs of indexOfLastPassedBG

Name	Type	Comments and Information
indexOfBG	int	
BG_found	bool	Comments: Indicates, that BG exists in BGs.
indexValid	bool	Comments: Indicates, that a valid index was found.

3.3.19.3.   Operator Hierarchy

diagram : diagram_indexOfLastPassedBG_1

3.3.19.4.   Graphical and Textual Diagrams

3.3.19.4.1.   View of diagram_indexOfLastPassedBG_1 (indexOfLastPassedBG)
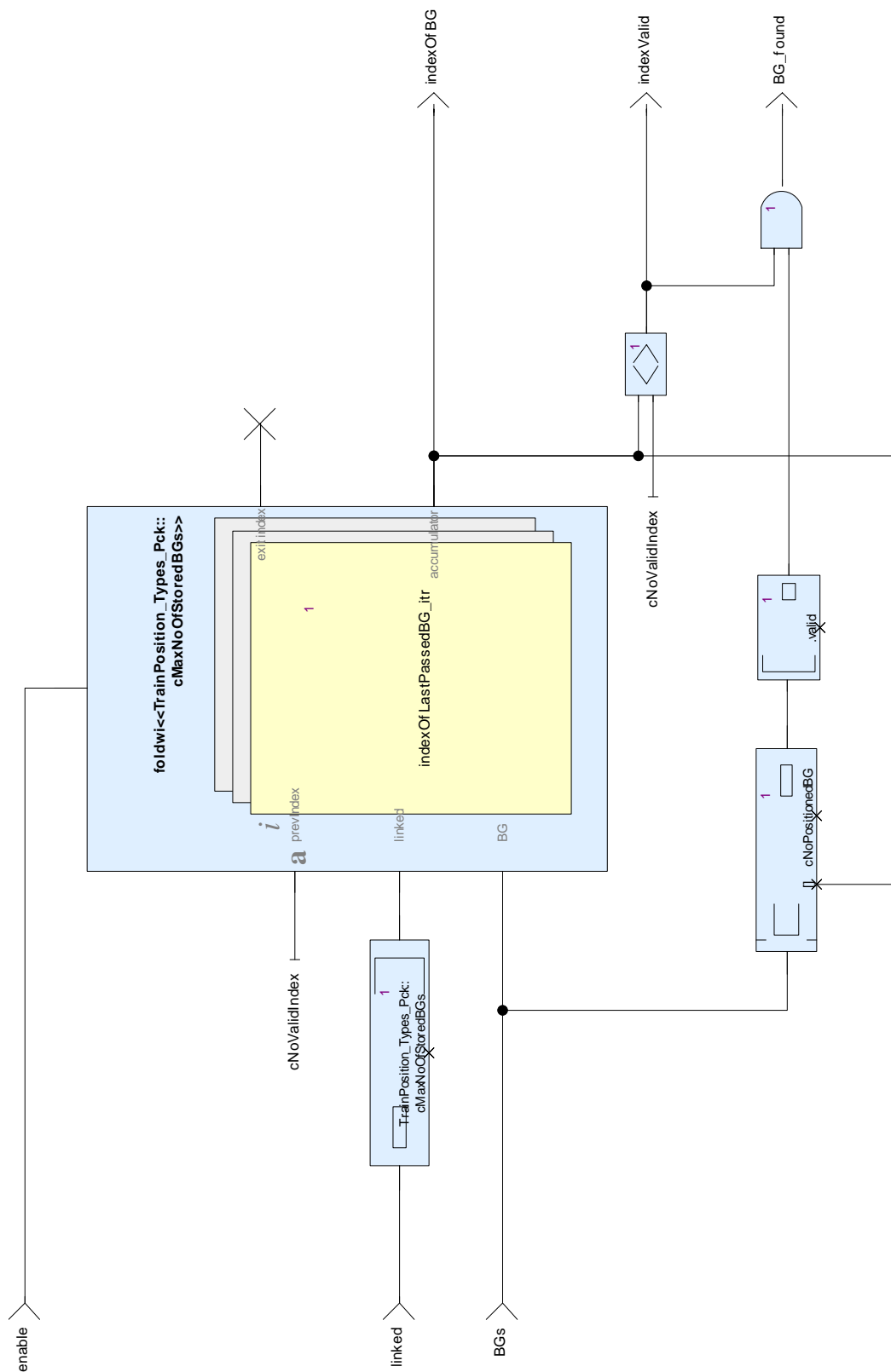
Figure 63: View of diagram_indexOfLastPassedBG_1 (indexOfLastPassedBG)

3.3.20.   indexOfLastPassedBG_itr Operator

Declared as **private function**

3.3.20.1.   Comments and Information

indexOfLastPassedBG_itr Comments:
Iterated function for indexOfLastPassedBG

Table 147: indexOfLastPassedBG_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.20.2.   Interface

Table 148: Inputs of indexOfLastPassedBG_itr

Name	Type	Comments and Information
iteratorIndex	int	
prevIndex	int	
linked	bool	Comments: Condition if the seach is for a linked or unlinked BG.
BG	TrainPosition_Types_Pc k::positionedBG_T	

Table 149: Outputs of indexOfLastPassedBG_itr

Name	Type	Comments and Information
cont	bool	

Name	Type	Comments and Information
indexOfBG	int	

3.3.20.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOfLastPassedBG_itr_1

3.3.20.4.   Graphical and Textual Diagrams

3.3.20.4.1.   View of diagram_indexOfLastPassedBG_itr_1 (indexOfLastPassedBG_itr)
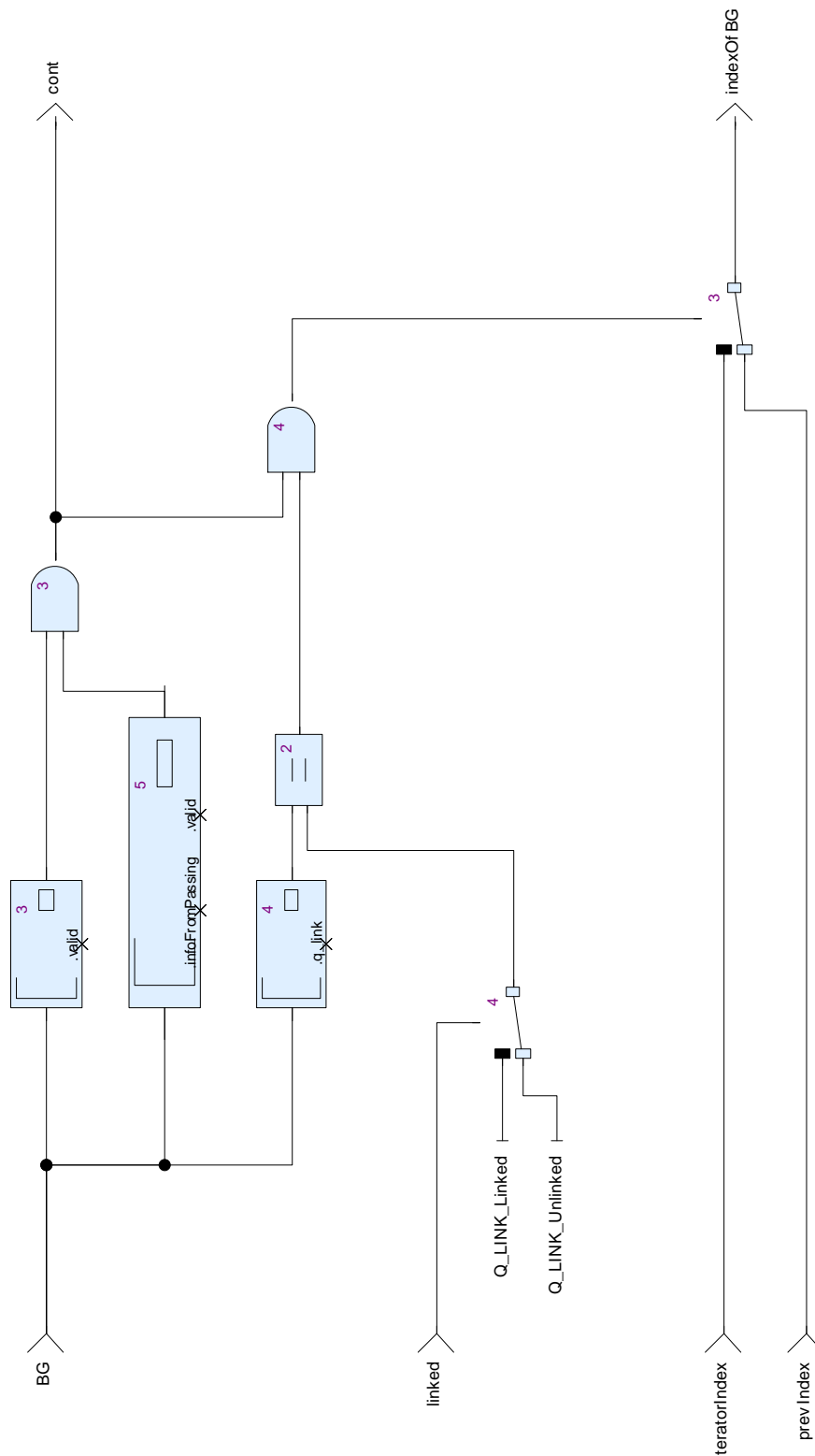
Figure 64: View of diagram_indexOfLastPassedBG_itr_1 (indexOfLastPassedBG_itr)

3.3.21.   indexOfPassedBG_by_id Operator

Declared as **public function**

3.3.21.1. Comments and Information

indexOfPassedBG_by_id Comments:

Determines the index of a passed BG in BGs by comparing NID_BG and NID_C.

Table 150: indexOfPassedBG_by_id Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Determines the index of a passed BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.21.2. Interface

Table 151: Inputs of indexOfPassedBG_by_id

Name	Type	Comments and Information
BG	BG_Types_Pkg::passedBG_T	
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 152: Outputs of indexOfPassedBG_by_id

Name	Type	Comments and Information
indexOfBG	int	
BG_found	bool	Comments: Indicates, that BG exists in BGs.
indexValid	bool	Comments: Indicates, that no valid index could be assigned to BG. Practically, this means that there could no place be assigned to BG in BGs.

3.3.21.3.   Operator Hierarchy

<u>diagram</u> : diagram_indexOfPassedBG_by_id_1

3.3.21.4.   Graphical and Textual Diagrams

3.3.21.4.1.   View of diagram_indexOfPassedBG_by_id_1 (indexOfPassedBG_by_id)
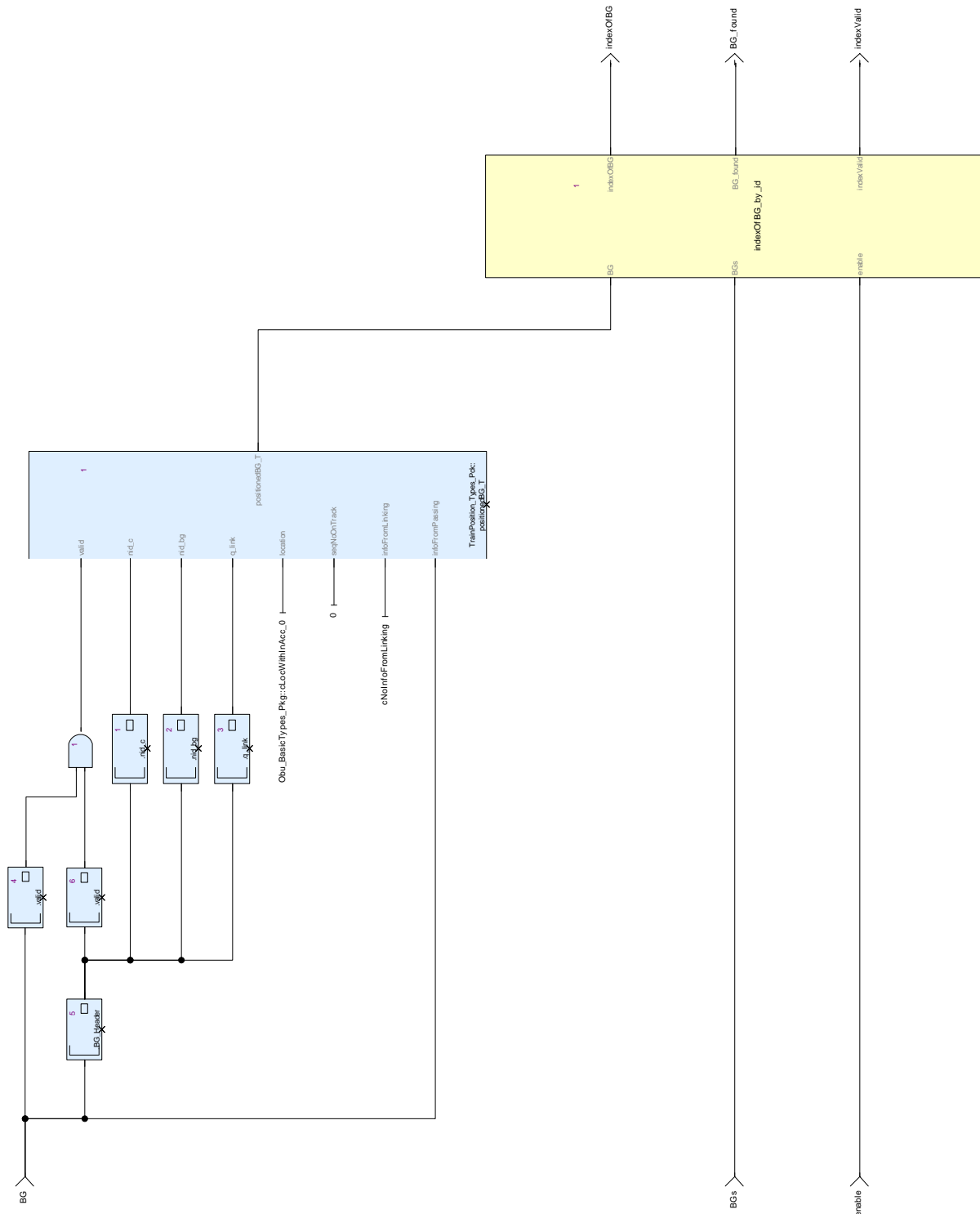
Figure 65: View of diagram_indexOfPassedBG_by_id_1 (indexOfPassedBG_by_id)

3.3.22.   insertBG_atIndex Operator

Declared as **public function**

3.3.22.1.   Comments and Information

insertBG_atIndex Comments:
Inserts BG in BGs_in at the cell given by indexOfBG.
The BGs above BG are shifted upwards by 1.
If a BG with the same ID already exists in BGs at the same cell, BG will replace it.
If there is no space in BGs_in for the insertion, overrun will be set and no insertion performed.

3.3.22.2.   Interface

Table 153: Inputs of insertBG_atIndex

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	
indexOfBG	int	
insert	bool	Comments: insert comannd. Must be true to execute the insertion.

Table 154: Outputs of insertBG_atIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	
overrun	bool	Comments: Indicates, that no merge took place due to no space in BGs_in.

3.3.22.3.   Operator Hierarchy

diagram : diagram_insertBG_atIndex_1

3.3.22.4.   Graphical and Textual Diagrams

3.3.22.4.1.   View of diagram_insertBG_atIndex_1 (insertBG_atIndex)
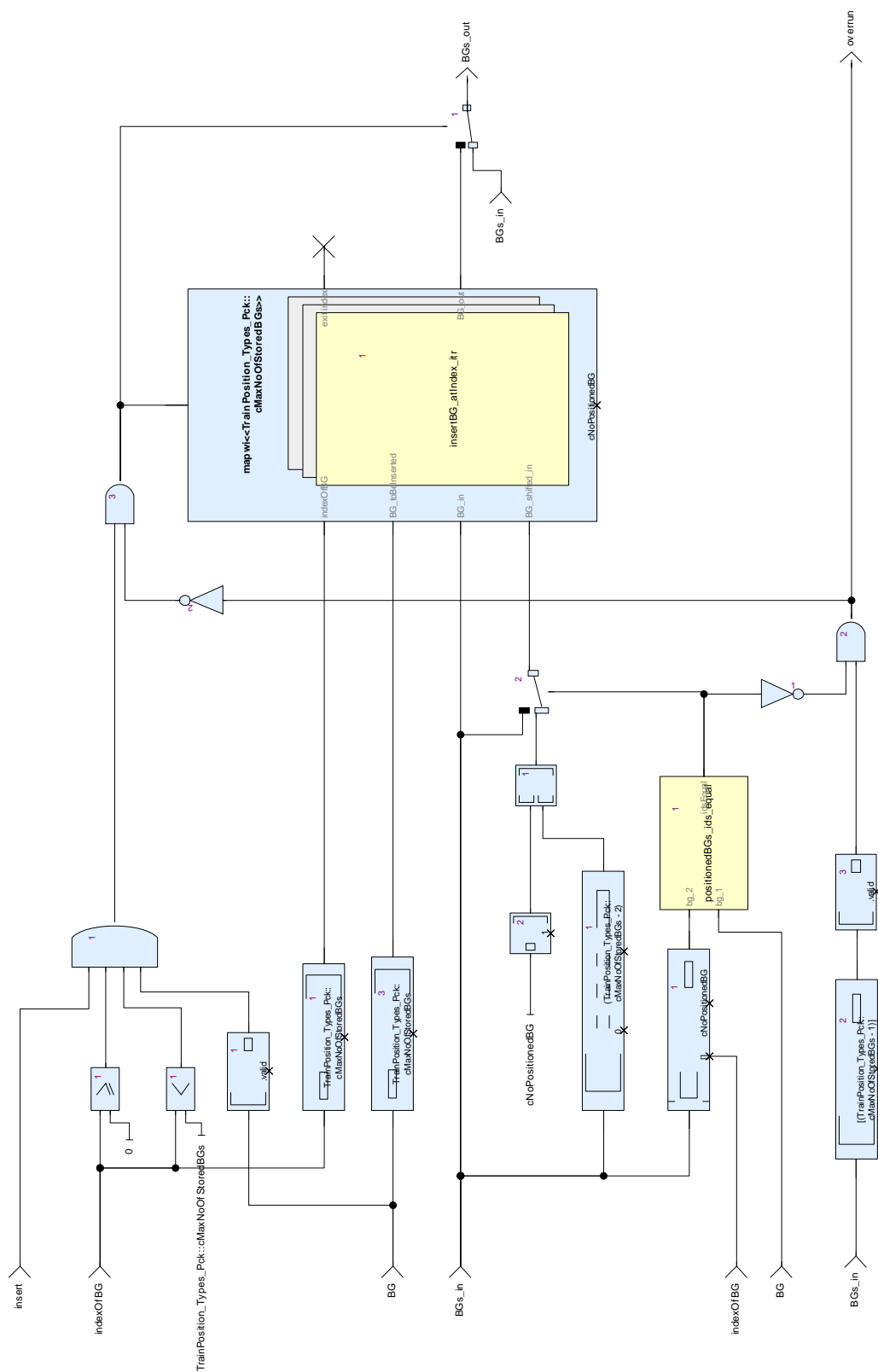
Figure 66: View of diagram_insertBG_atIndex_1 (insertBG_atIndex)

3.3.23.   insertBG_atIndex_itr Operator

Declared as **private function**

3.3.23.1.   Comments and Information

insertBG_atIndex_itr Comments:
Iterated function for insertBG_atIndex.

3.3.23.2.   Interface

Table 155: Inputs of insertBG_atIndex_itr

Name	Type	Comments and Information
iteratorIndex	int	
indexOfBG	int	
BG_toBeInserted	TrainPosition_Types_Pck::positionedBG_T	
BG_in	TrainPosition_Types_Pck::positionedBG_T	
BG_shifted_in	TrainPosition_Types_Pck::positionedBG_T	

Table 156: Outputs of insertBG_atIndex_itr

Name	Type	Comments and Information
cont	bool	
BG_out	TrainPosition_Types_Pck::positionedBG_T	

3.3.23.3.   Operator Hierarchy

diagram : diagram_insertBG_atIndex_itr_1
        activate if : IfBlock1
                branch : then
                branch : else
                        branch : then
                        branch : else

3.3.23.4.   Graphical and Textual Diagrams

3.3.23.4.1.   View of diagram_insertBG_atIndex_itr_1 (insertBG_atIndex_itr)
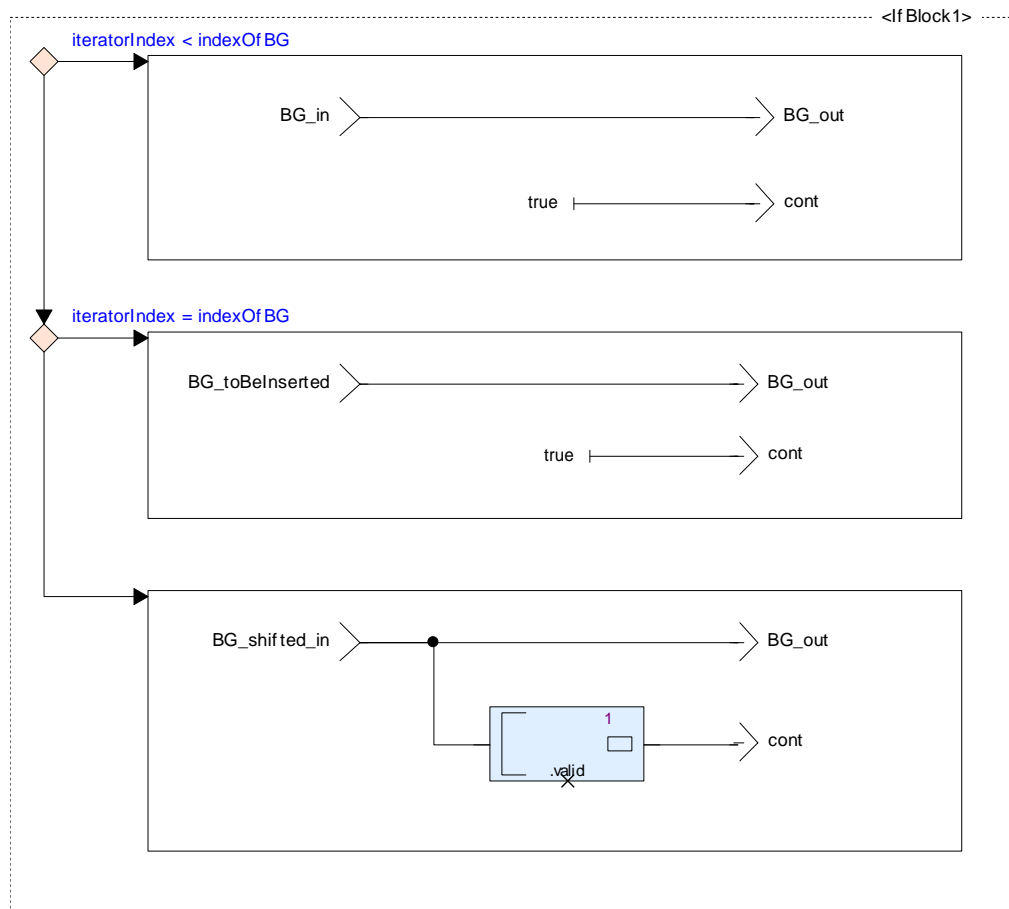
Figure 67: View of diagram_insertBG_atIndex_itr_1 (insertBG_atIndex_itr)

Table 157: Conditional Blocks of diagram_insertBG_atIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 158: Actions of diagram_insertBG_atIndex_itr_1

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

3.3.24.   lastAndPrevBG Operator

Declared as **public node**

3.3.24.1.   Comments and Information

lastAndPrevBG Comments:
Memorizes the last and the previously passed BG.

3.3.24.2.   Interface

Table 159: Inputs of lastAndPrevBG

Name	Type	Properties		Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	last	cNoPositionedBG	Comments: The current BG as input.
BGs	TrainPosition_Types_Pck::positionedBGs_T			Comments: The list of stored BGs.
linked	bool			Comments: Determines, if linked or unlinked BGs shall be stored.
reset	bool			
enable	bool			

Table 160: Outputs of lastAndPrevBG

Name	Type	Comments and Information
prvBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The previous BG, memorized and updated with its actual value from BGs
lastBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The last BG, memorized

3.3.24.3.   Locals

Table 161: Locals of lastAndPrevBG

Name	Type	Properties		Comments and Information
prvBG_loc	TrainPosition_Types_Pck::positionedBG_T	last	cNoPositionedBG	
storedBG_loc	TrainPosition_Types_Pck::positionedBG_T	last	cNoPositionedBG	

3.3.24.4.   Operator Hierarchy

diagram : diagram_lastAndPrevBG_1

3.3.24.5.   Graphical and Textual Diagrams

3.3.24.5.1.   View of diagram_lastAndPrevBG_1 (lastAndPrevBG)
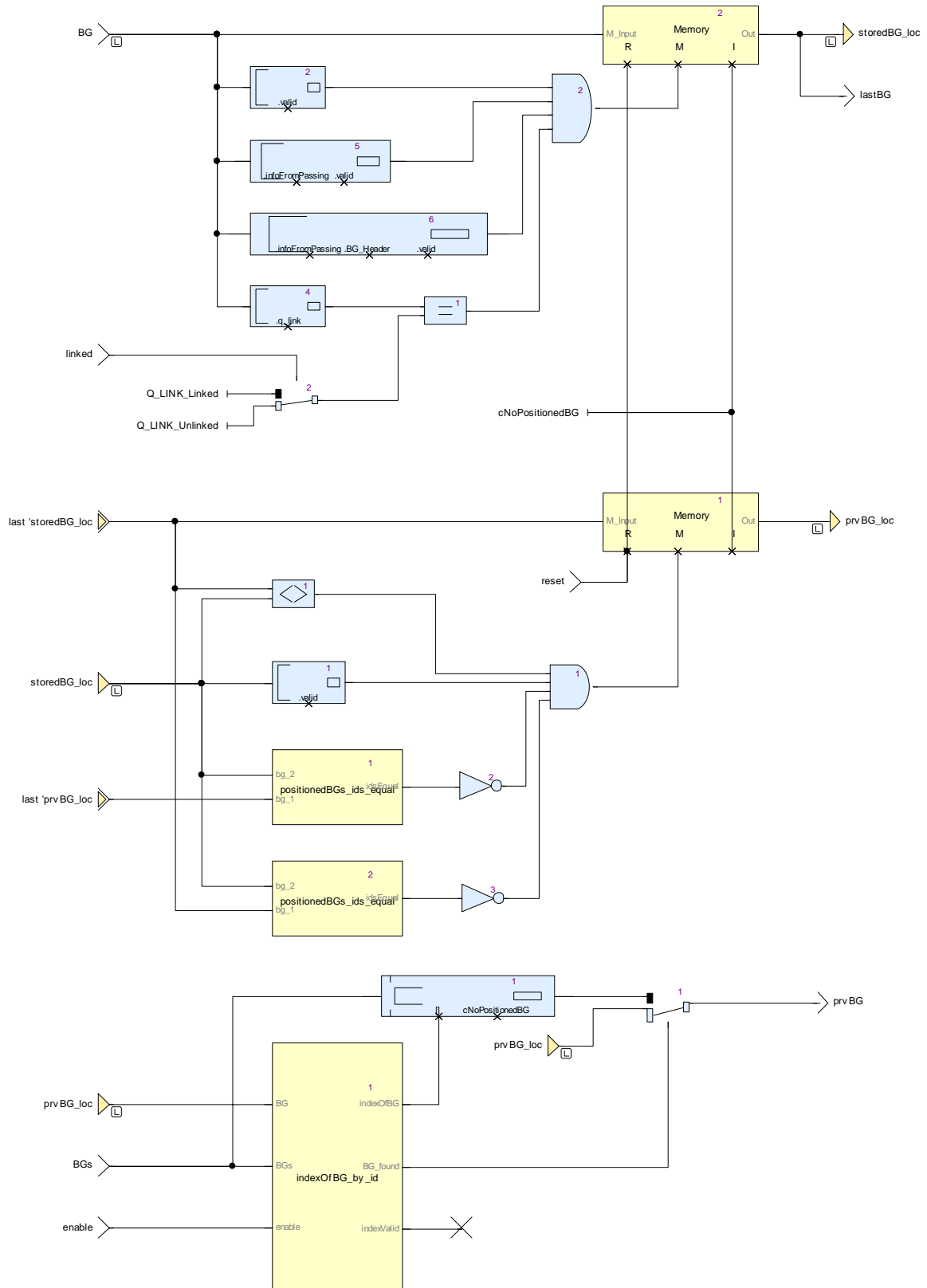
Figure 68: View of diagram_lastAndPrevBG_1 (lastAndPrevBG)

Table 162: Memory (#1) hidden inputs assignment of diagram_lastAndPrevBG_1

Rank	Name	Value
1	Reset	*wired (_L12)*
2	MemCond	*wired (_L8)*
3	InitVal	*wired (_L6)*

Table 163: Memory (#2) hidden inputs assignment of diagram_lastAndPrevBG_1

Rank	Name	Value
1	Reset	*wired (_L12)*
2	MemCond	*wired (_L38)*
3	InitVal	*wired (_L6)*

3.3.25.   mergeBG_by_id Operator

Declared as **private function**

3.3.25.1.   Comments and Information

mergeBG_by_id Comments:
Merges a BG into an array of BGs.
If an element in BGs exists in BGs with the same ID as BG, the element in BGs will be replaced by BG.

Table 164: mergeBG_by_id Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Merges a BG into an array of BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.25.2. Interface

Table 165: Inputs of mergeBG_by_id

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	Comments: The BGs where BG is to be merged with.

Table 166: Outputs of mergeBG_by_id

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The resulting array of merged BGs.
overrun	bool	Comments: Indicates, that no merge took place due to no space in BGs_in.

3.3.25.3. Operator Hierarchy

diagram : diagram_mergeBG_by_id_1

3.3.25.4.   Graphical and Textual Diagrams

3.3.25.4.1.   View of diagram_mergeBG_by_id_1 (mergeBG_by_id)
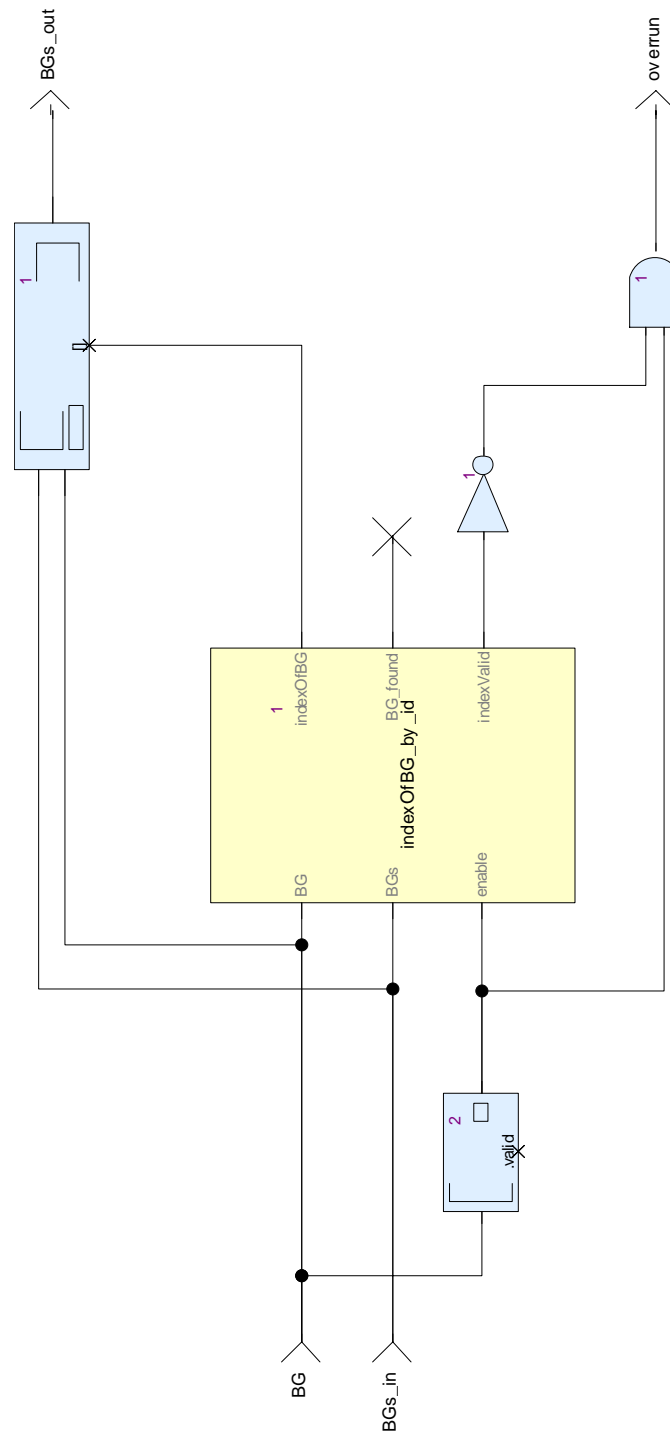
Figure 69: View of diagram_mergeBG_by_id_1 (mergeBG_by_id)

3.3.26.   mergeBG_onTrack Operator

Declared as **public function**

3.3.26.1.   Comments and Information

mergeBG_onTrack Comments:

Inserts BG into the collection of BGs.

If BG has been passed already, it will be sorted by its seqNoOnTrack within all other passed BGs.

If the passed BG was an announced BG in BGs before, it will replace this announced BG, if necessary on a different position in BGs.

If BG is an announced BG, it will be sorted by its nominal location within all other announced BGs.

BGs_in and BGs_out comprise all passed BGs followed by all announced BGs.

3.3.26.2.   Interface

Table 167: Inputs of mergeBG_onTrack

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	Comments: The BGs where BG is to be merged with.

Table 168: Outputs of mergeBG_onTrack

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The resulting array of merged BGs.
overrun	bool	Comments: Indicates, that no merge took place due to no space in BGs_in.

3.3.26.3.   Operator Hierarchy

<u>diagram</u> : diagram_mergeBG_onTrack_1

3.3.26.4.   Graphical and Textual Diagrams

3.3.26.4.1.   View of diagram_mergeBG_onTrack_1 (mergeBG_onTrack)
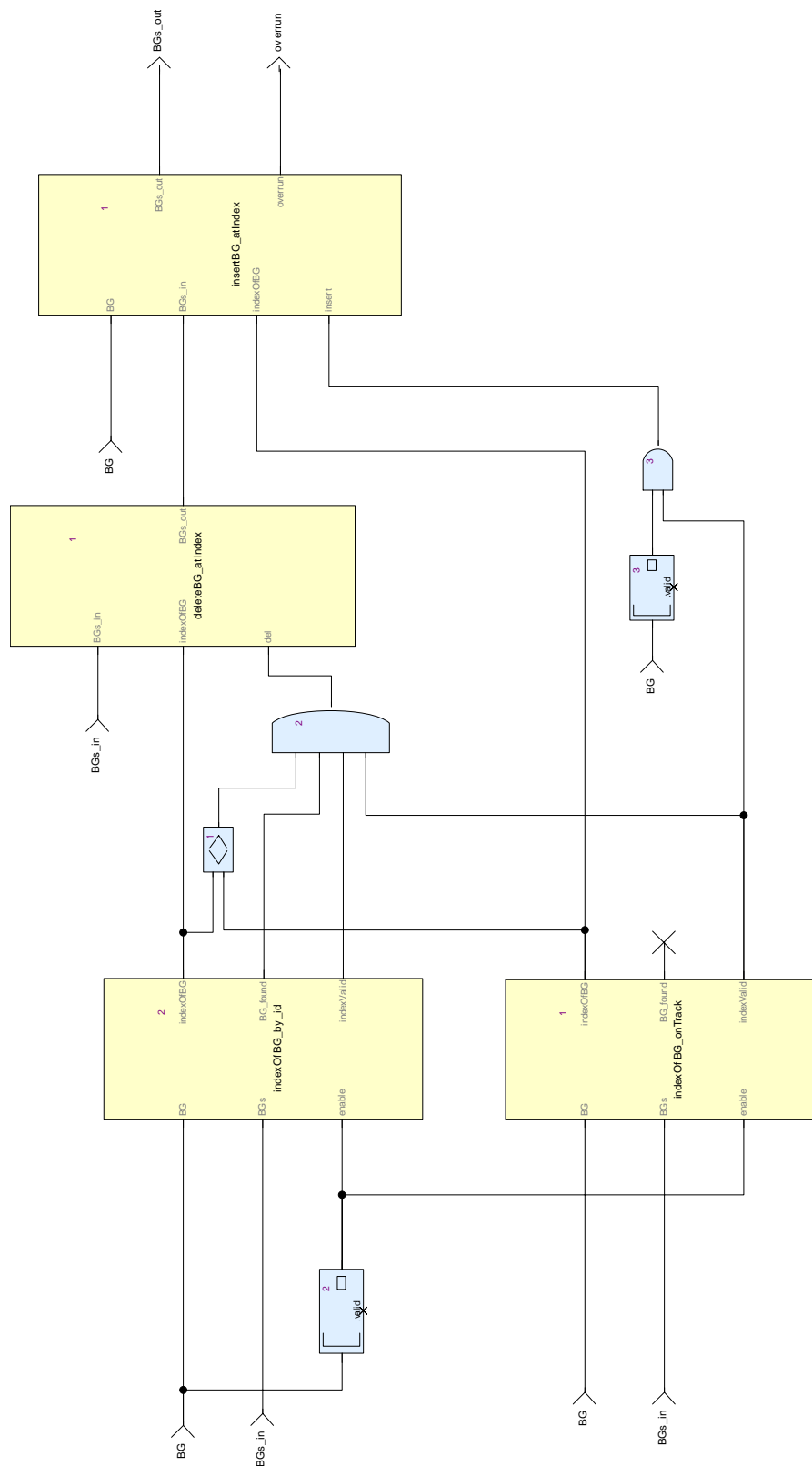
Figure 70: View of diagram_mergeBG_onTrack_1 (mergeBG_onTrack)

3.3.27.   mergeBGs_by_id Operator

Declared as **public function**

3.3.27.1.   Comments and Information

mergeBGs_by_id Comments:
Merges two arrays of BGs by id.
If a BG with the same id exists in BGs_1 and BGs_2, the BG from BGs_2 will
override the element in BGs_1.
Otherwise, the valid elements of BGs_2 will be stored in empty slices of BGs_1.
Overrun indicates not enough space for merging.

Table 169: mergeBGs_by_id Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Merges two arrays of BGs by id. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.27.2.   Interface

Table 170: Inputs of mergeBGs_by_id

Name	Type	Comments and Information
BGs_1	TrainPosition_Types_Pck::positionedBGs_T	Comments: The first array of BGs to be merged.
BGs_2	TrainPosition_Types_Pck::positionedBGs_T	Comments: The second array of BGs to be merged.

Table 171: Outputs of mergeBGs_by_id

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The resulting array of merged BGs.

Name	Type	Comments and Information
overrun	bool	Comments: Indicates, that not all of the elements of BGs_2 could be merged into BGs_out, due to not enough space in BGs_out.

3.3.27.3.   Operator Hierarchy

<u>diagram</u> : diagram_mergeBGs_by_id_1

3.3.27.4.   Graphical and Textual Diagrams

3.3.27.4.1.   View of diagram_mergeBGs_by_id_1 (mergeBGs_by_id)
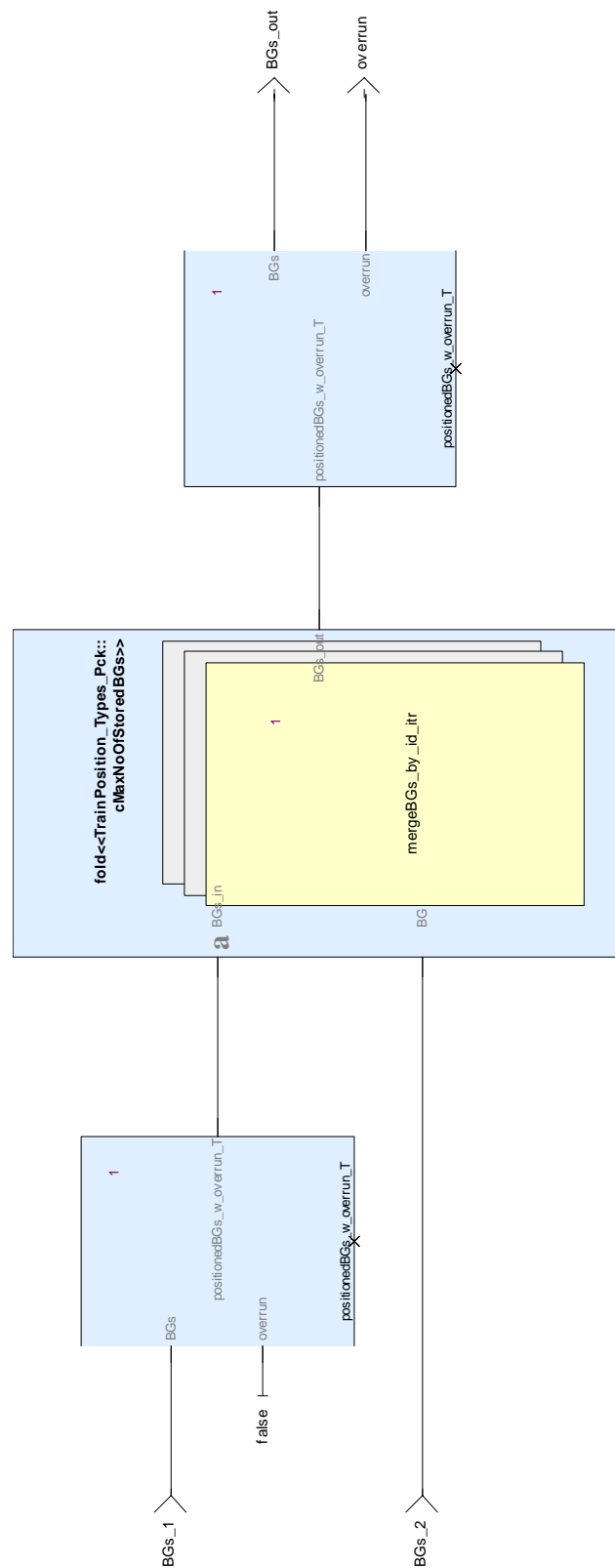
Figure 71: View of diagram_mergeBGs_by_id_1 (mergeBGs_by_id)

3.3.28.   mergeBGs_by_id_itr Operator

Declared as **private function**

3.3.28.1.   Comments and Information

mergeBGs_by_id_itr Comments:
Iterated function for the merge of a BG into an array of BGs.

Table 172: mergeBGs_by_id_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Iterated function for the merge of a BG into an array of BGs. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.28.2.   Interface

Table 173: Inputs of mergeBGs_by_id_itr

Name	Type	Comments and Information
BGs_in	CalculateTrainPosition_Pkg::positionedBGs_w_overrun_T	Comments: The BGs where BG is to be merged with.
BG	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.

Table 174: Outputs of mergeBGs_by_id_itr

Name	Type	Comments and Information
BGs_out	CalculateTrainPosition_Pkg::positionedBGs_w_overrun_T	Comments: The resulting array of merged BGs.

3.3.28.3.   Operator Hierarchy

<u>diagram</u> : diagram_mergeBGs_by_id_itr_1

3.3.28.4.   Graphical and Textual Diagrams

3.3.28.4.1.   View of diagram_mergeBGs_by_id_itr_1 (mergeBGs_by_id_itr)
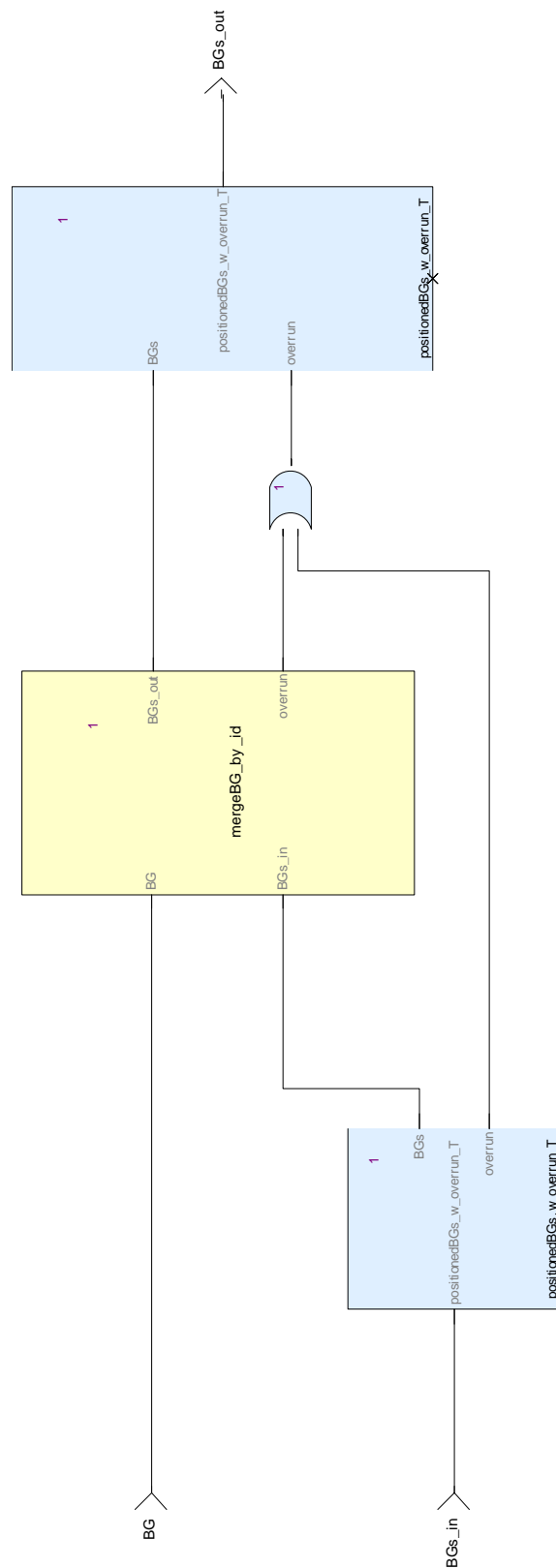
Figure 72: View of diagram_mergeBGs_by_id_itr_1 (mergeBGs_by_id_itr)

3.3.29.   mergeBGs_onTrack Operator

Declared as **public function**

3.3.29.1.   Comments and Information

mergeBGs_onTrack Comments:
Merges two arrays of BGs and sorting their sequence by seqNoOnTrack (passed BGs) and nominal location announced BGs)
If a BG with the same id exists in BGs_1 and BGs_2, the BG from BGs_2 will override the element in BGs_1.
Otherwise, the valid elements of BGs_2 will be stored in empty slices of BGs_1.
Overrun indicates not enough space for merging.

Table 175: mergeBGs_onTrack Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Merges two arrays of BGs by id. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.29.2.   Interface

Table 176: Inputs of mergeBGs_onTrack

Name	Type	Comments and Information
BGs_1	TrainPosition_Types_Pck::positionedBGs_T	Comments: The first array of BGs to be merged.
BGs_2	TrainPosition_Types_Pck::positionedBGs_T	Comments: The second array of BGs to be merged.

Table 177: Outputs of mergeBGs_onTrack

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The resulting array of merged BGs.
overrun	bool	Comments: Indicates, that not all of the elements of BGs_2 could be merged into BGs_out, due to not enough space in BGs_out.

3.3.29.3.   Operator Hierarchy

diagram : diagram_mergeBGs_onTrack_1

3.3.29.4.   Graphical and Textual Diagrams

3.3.29.4.1.   View of diagram_mergeBGs_onTrack_1 (mergeBGs_onTrack)
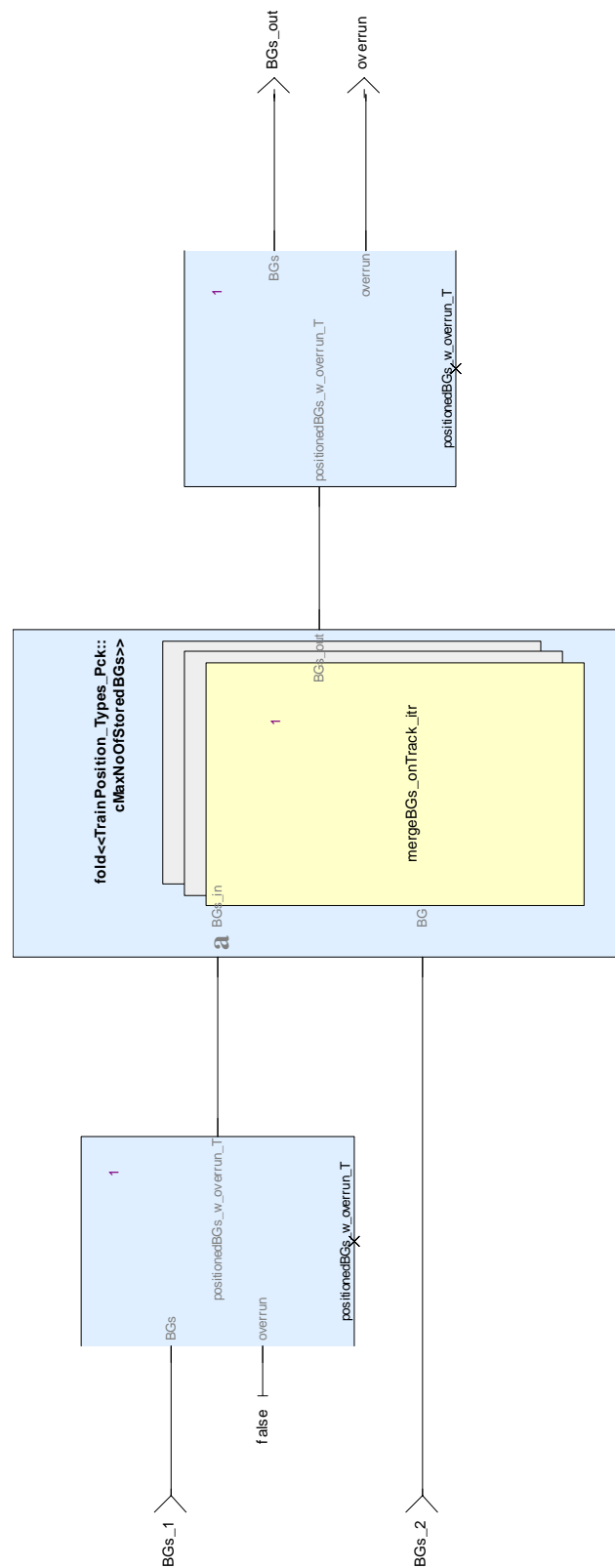
Figure 73: View of diagram_mergeBGs_onTrack_1 (mergeBGs_onTrack)

3.3.30.   mergeBGs_onTrack_itr Operator

Declared as **private function**

3.3.30.1.   Comments and Information

mergeBGs_onTrack_itr Comments:
Iterated function for the merge of a BG into a sorted array of BGs.

Table 178: mergeBGs_onTrack_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Iterated function for the merge of a BG into an array of BGs. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.30.2.   Interface

Table 179: Inputs of mergeBGs_onTrack_itr

Name	Type	Comments and Information
BGs_in	CalculateTrainPosition_Pkg::positionedBGs_w_overrun_T	Comments: The BGs where BG is to be merged with.
BG	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.

Table 180: Outputs of mergeBGs_onTrack_itr

Name	Type	Comments and Information
BGs_out	CalculateTrainPosition_Pkg::positionedBGs_w_overrun_T	Comments: The resulting array of merged BGs.

3.3.30.3.   Operator Hierarchy

<u>diagram</u> : diagram_mergeBGs_onTrack_itr_1

3.3.30.4.   Graphical and Textual Diagrams

3.3.30.4.1.   View of diagram_mergeBGs_onTrack_itr_1 (mergeBGs_onTrack_itr)
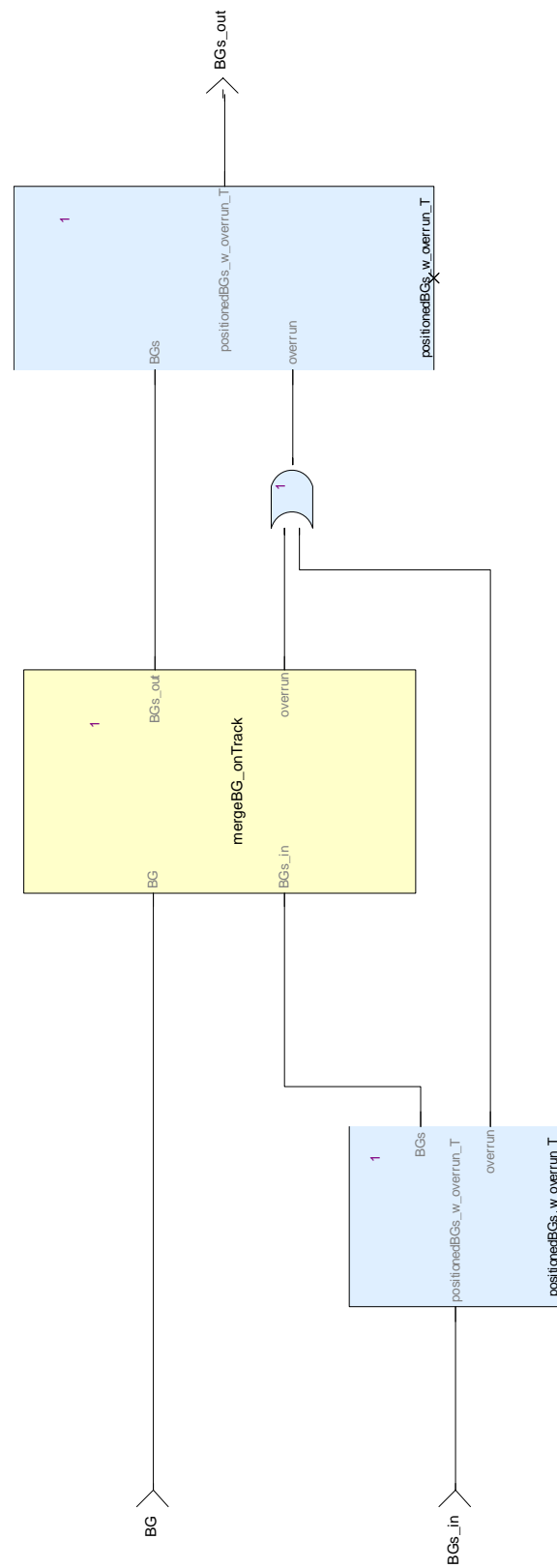
Figure 74: View of diagram_mergeBGs_onTrack_itr_1 (mergeBGs_onTrack_itr)

3.3.31.   nidBG_nidc_equal Operator

Declared as **public function**

3.3.31.1.   Comments and Information

nidBG_nidc_equal Comments:
Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values.

Table 181: nidBG_nidc_equal Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.31.2.   Interface

Table 182: Inputs of nidBG_nidc_equal

Name	Type	Comments and Information
nid_c_2	NID_C	
nid_bg_2	NID_BG	
nid_c_1	NID_C	
nid_bg_1	NID_BG	

Table 183: Outputs of nidBG_nidc_equal

Name	Type	Comments and Information
isEqual	bool	

3.3.31.3.   Operator Hierarchy

diagram : diagram_nidBG_nidc_equal_1

3.3.31.4.   Graphical and Textual Diagrams

3.3.31.4.1.   View of diagram_nidBG_nidc_equal_1 (nidBG_nidc_equal)
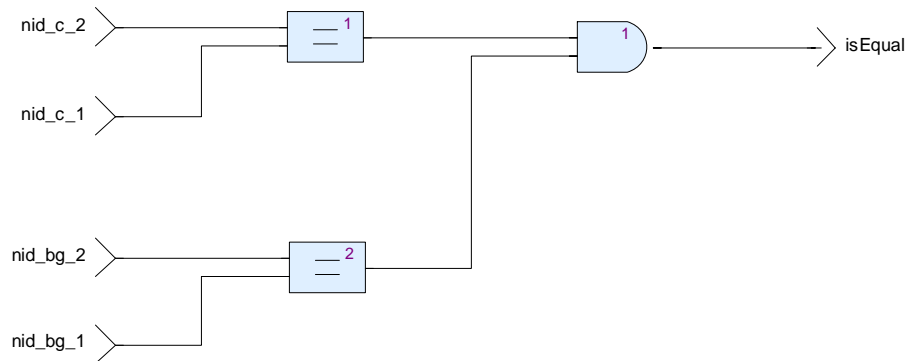
Figure 75: View of diagram_nidBG_nidc_equal_1 (nidBG_nidc_equal)

3.3.32.   nidC_nidBG_2_NIDLRBG Operator

Declared as **public function**

3.3.32.1.   Comments and Information

nidC_nidBG_2_NIDLRBG Comments:
Constructs an NID_LRBG value from NID_C and NID_BG

3.3.32.2.   Interface

Table 184: Inputs of nidC_nidBG_2_NIDLRBG

Name	Type	Comments and Information
valid	bool	
nidC	NID_C	
nidBG	NID_BG	

Table 185: Outputs of nidC_nidBG_2_NIDLRBG

Name	Type	Comments and Information
nidLRBG	NID_LRBG	

3.3.32.3.   Operator Hierarchy

diagram : diagram_nidC_nidBG_2_NIDLRBG_1

3.3.32.4.   Graphical and Textual Diagrams

3.3.32.4.1.   View of diagram_nidC_nidBG_2_NIDLRBG_1 (nidC_nidBG_2_NIDLRBG)
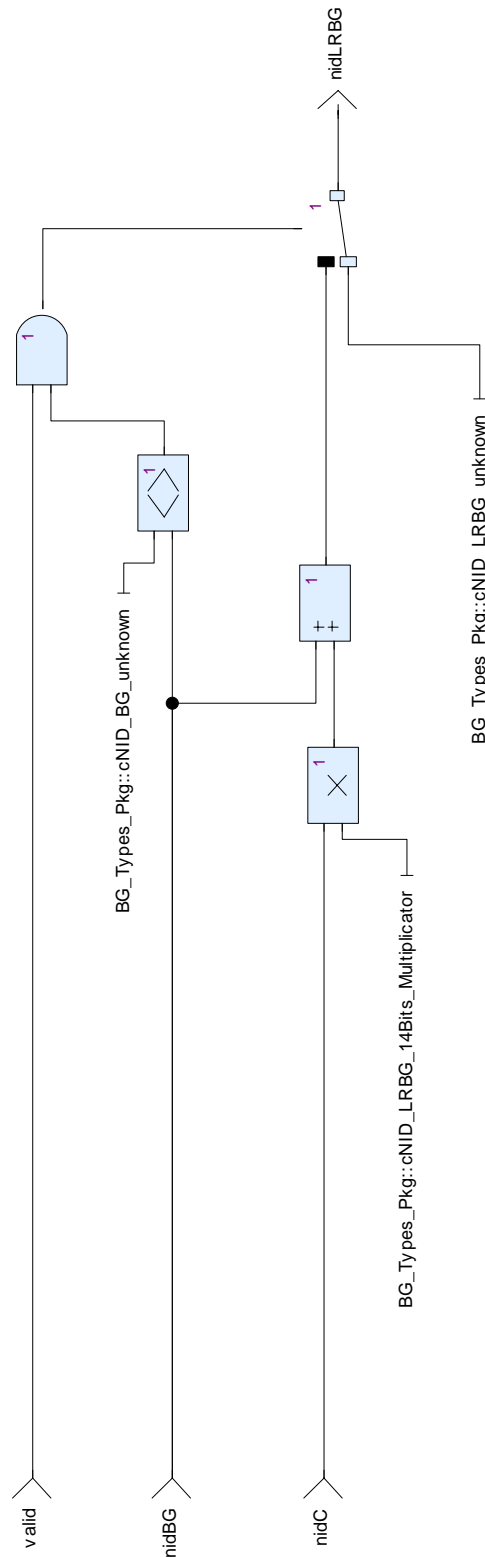
Figure 76: View of diagram_nidC_nidBG_2_NIDLRBG_1 (nidC_nidBG_2_NIDLRBG)

3.3.33.   NIDLRBG_2_nidC_nidBG Operator

Declared as **public function**

3.3.33.1.   Comments and Information

NIDLRBG_2_nidC_nidBG Comments:
Constructs   NID_C and NID_BG from NID_LRBG

3.3.33.2.   Interface

Table 186: Inputs of NIDLRBG_2_nidC_nidBG

Name	Type	Comments and Information
valid	bool	
nidLRBG	NID_LRBG	

Table 187: Outputs of NIDLRBG_2_nidC_nidBG

Name	Type	Comments and Information
nidC	NID_C	
nidBG	NID_BG	

3.3.33.3.   Operator Hierarchy

<u>diagram</u> : diagram_NIDLRBG_2_nidC_nidBG_1

3.3.33.4.   Graphical and Textual Diagrams

3.3.33.4.1.   View of diagram_NIDLRBG_2_nidC_nidBG_1 (NIDLRBG_2_nidC_nidBG)
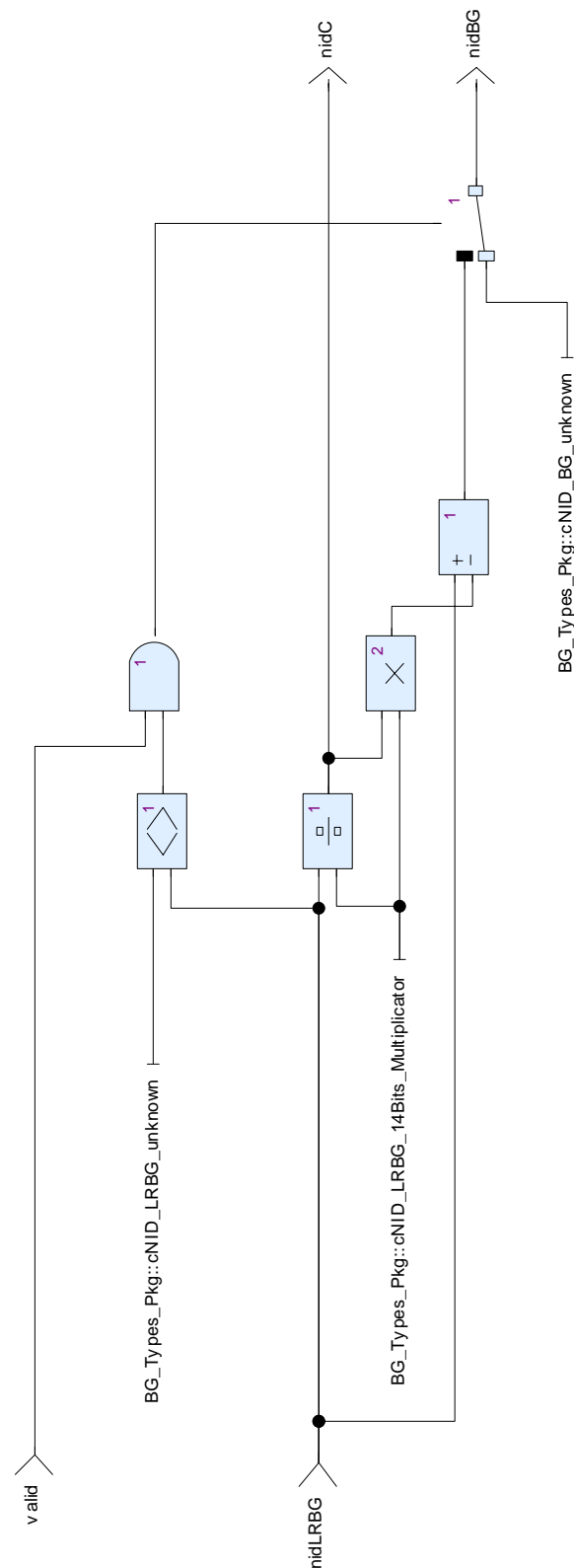
Figure 77: View of diagram_NIDLRBG_2_nidC_nidBG_1 (NIDLRBG_2_nidC_nidBG)

3.3.34.   passedBGs_ids_equal Operator

Declared as **public function**

3.3.34.1.   Comments and Information

passedBGs_ids_equal Comments:
Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values.

Table 188: passedBGs_ids_equal Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.34.2.   Interface

Table 189: Inputs of passedBGs_ids_equal

Name	Type	Comments and Information
bg_2	BG_Types_Pkg::passedBG_T	
bg_1	BG_Types_Pkg::passedBG_T	

Table 190: Outputs of passedBGs_ids_equal

Name	Type	Comments and Information
idsEqual	bool	
idsDifferent	bool	

3.3.34.3. Operator Hierarchy

<u>diagram</u> : diagram_passedBGs_ids_equal_1

3.3.34.4. Graphical and Textual Diagrams

3.3.34.4.1. View of diagram_passedBGs_ids_equal_1 (passedBGs_ids_equal)
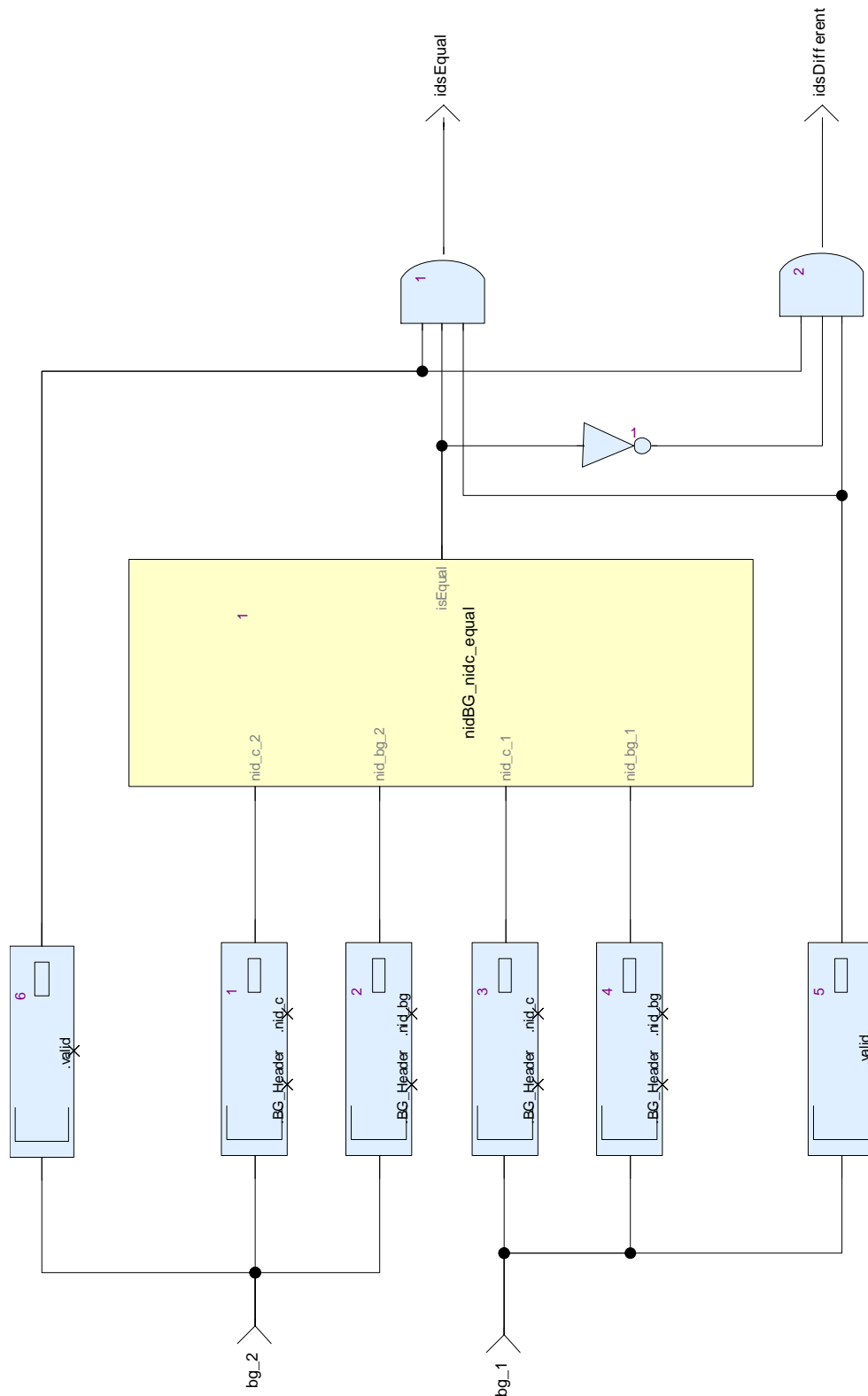
Figure 78: View of diagram_passedBGs_ids_equal_1 (passedBGs_ids_equal)

3.3.35.   posInRangeOfBG Operator

Declared as **public function**

3.3.35.1.   Comments and Information

posInRangeOfBG Comments:
Determines, it the position meets the range of a known BG

3.3.35.2.   Interface

Table 191: Inputs of posInRangeOfBG

Name	Type	Comments and Information
position	Obu_BasicTypes_Pkg::LocWithInAcc_T	
BGs	TrainPosition_Types_Pck::positionedBGs_T	
enable	bool	

Table 192: Outputs of posInRangeOfBG

Name	Type	Comments and Information
isInRange	bool	
indexOfBG	int	
BG	TrainPosition_Types_Pck::positionedBG_T	

3.3.35.3.   Operator Hierarchy

diagram : diagram_posInRangeOfBG_1

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3.3.35.4.   Graphical and Textual Diagrams

3.3.35.4.1.   View of diagram_posInRangeOfBG_1 (posInRangeOfBG)
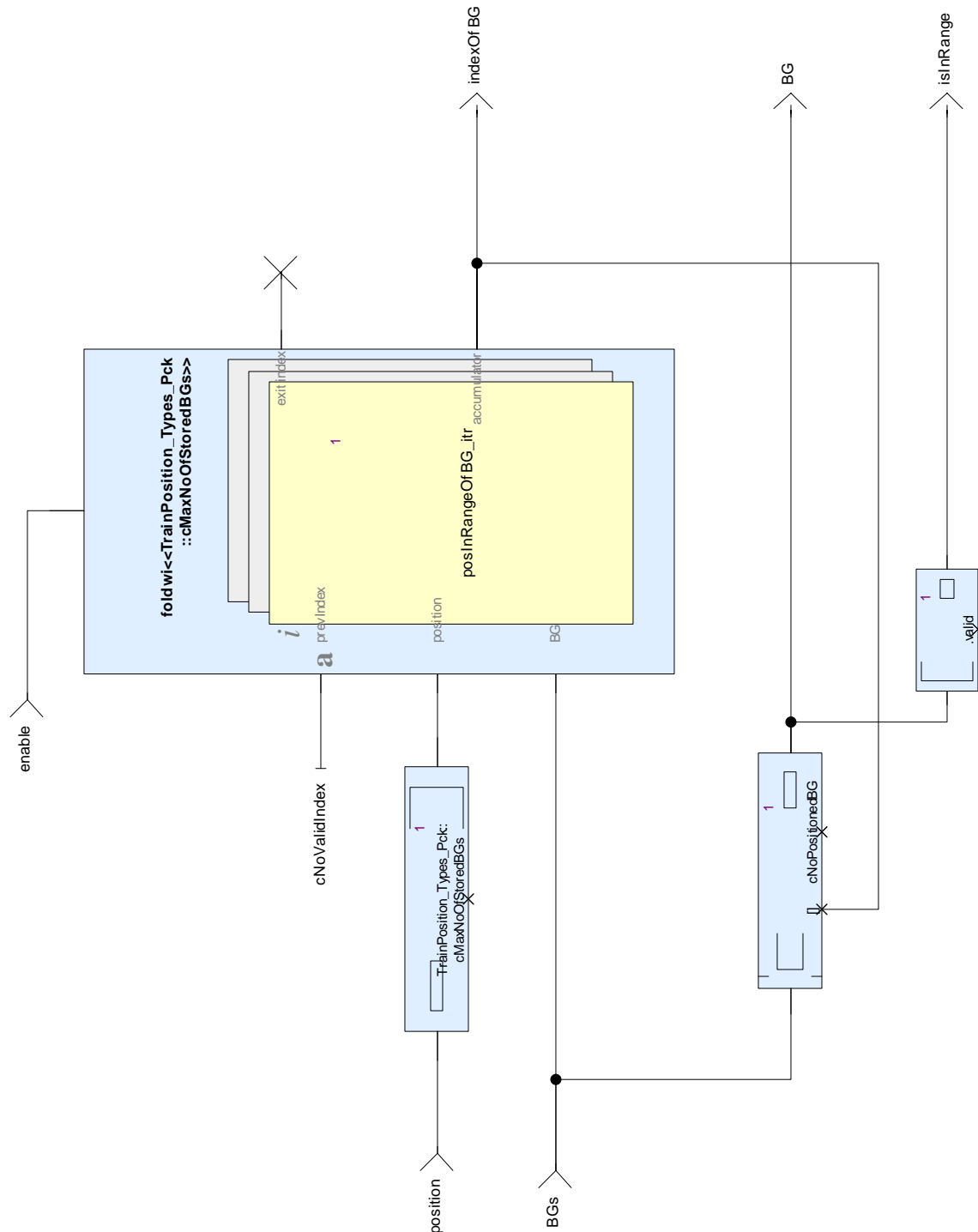
Figure 79: View of diagram_posInRangeOfBG_1 (posInRangeOfBG)

3.3.36.   posInRangeOfBG_itr Operator

Declared as **private function**

3.3.36.1.   Comments and Information

posInRangeOfBG_itr Comments:

Iterated function for indexOfLastPassedBG

Table 193: posInRangeOfBG_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	Version : 00.02.00
	to_c	True
Remark_1	Description	Iterated function for determing the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.36.2.   Interface

Table 194: Inputs of posInRangeOfBG_itr

Name	Type	Comments and Information
iteratorIndex	int	
prevIndex	int	
position	Obu_BasicTypes_Pkg:: LocWithInAcc_T	
BG	TrainPosition_Types_Pck::positionedBG_T	

Table 195: Outputs of posInRangeOfBG_itr

Name	Type	Comments and Information
cont	bool	
indexOfBG	int	

3.3.36.3.   Locals

Table 196: Locals of posInRangeOfBG_itr

Name	Type	Comments and Information
BG_isAhead	bool	
inRange	bool	

3.3.36.4.   Operator Hierarchy

diagram : diagram_posInRangeOfBG_itr_1

3.3.36.5.   Graphical and Textual Diagrams

3.3.36.5.1.   View of diagram_posInRangeOfBG_itr_1 (posInRangeOfBG_itr)
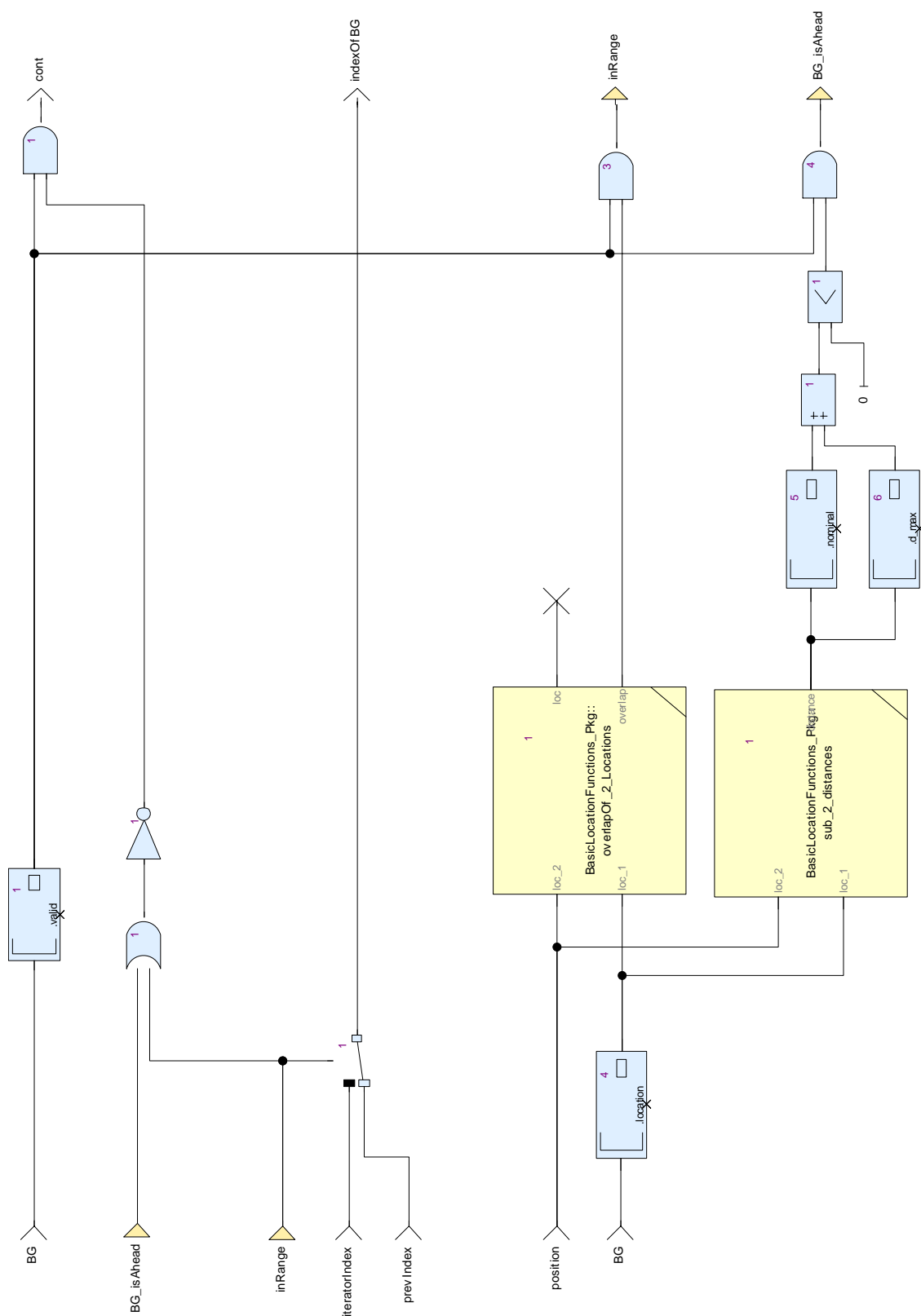
Figure 80: View of diagram_posInRangeOfBG_itr_1 (posInRangeOfBG_itr)

3.3.37.   positionDerivedFromPassedBG Operator

Declared as **public function**

3.3.37.1.   Comments and Information

positionDerivedFromPassedBG Comments:
Calculates the train position on the base of the odometry and a passed reference BG.
If there is no reference BG or the reference BG had not been passed, the odoPosition will simply be converted into a position.

Table 197: positionDerivedFromPassedBG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the train position on the base of the odometry and a passed reference BG. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.37.2.   Interface

Table 198: Inputs of positionDerivedFromPassedBG

Name	Type	Comments and Information
odoPosition	Obu_BasicTypes_Pkg::OdometryLocations_T	Comments: The position measured by odometry
passedRefBG	TrainPosition_Types_Pck::positionedBG_T	Comments: The passed reference BG. Important: this BG must have been passed already, since its odometry values must be known.

Table 199: Outputs of positionDerivedFromPassedBG

Name	Type	Comments and Information
position	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: The resulting position.

3.3.37.3.   Operator Hierarchy

<u>diagram</u> : diagram_positionDerivedFromPassedBG_1
      activate if : IfBlock1
           branch : then
           branch : else

3.3.37.4.   Graphical and Textual Diagrams

3.3.37.4.1.   View of diagram_positionDerivedFromPassedBG_1 (positionDerivedFromPassedBG)

Figure 81: View of diagram_positionDerivedFromPassedBG_1 (positionDerivedFromPassedBG)
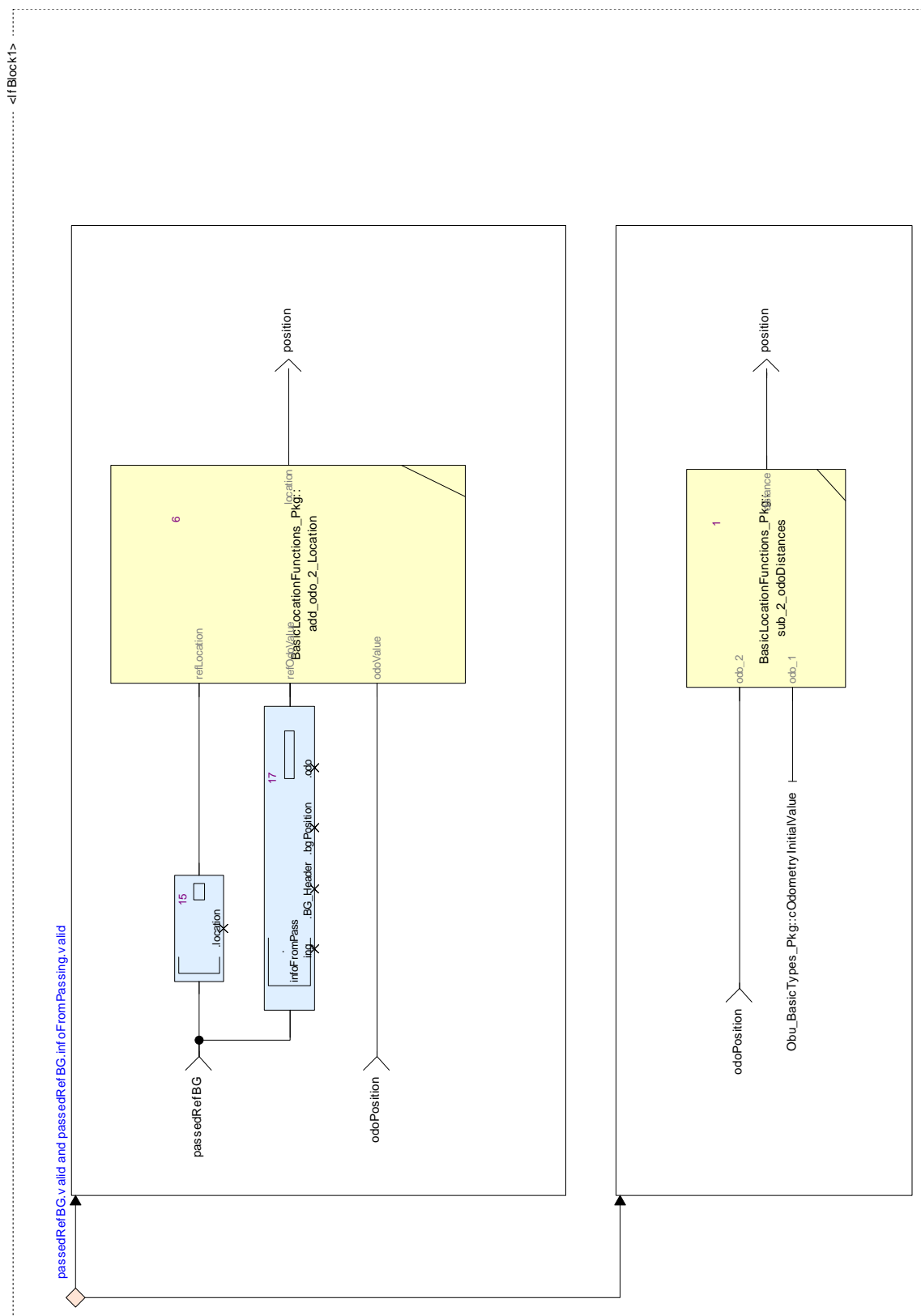
Table 200: Conditional Blocks of diagram_positionDerivedFromPassedBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 201: Actions of diagram_positionDerivedFromPassedBG_1

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

3.3.38.   positionedBGs_ids_equal Operator

Declared as **public function**

3.3.38.1.   Comments and Information

positionedBGs_ids_equal Comments:
Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values.

Table 202: positionedBGs_ids_equal Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.38.2.   Interface

Table 203: Inputs of positionedBGs_ids_equal

Name	Type	Comments and Information
bg_2	TrainPosition_Types_Pck::positionedBG_T	
bg_1	TrainPosition_Types_Pck::positionedBG_T	

Table 204: Outputs of positionedBGs_ids_equal

Name	Type	Comments and Information
idsEqual	bool	

3.3.38.3.   Operator Hierarchy

diagram : diagram_positionedBGs_ids_equal_1

3.3.38.4.　Graphical and Textual Diagrams

3.3.38.4.1.　View of diagram_positionedBGs_ids_equal_1 (positionedBGs_ids_equal)
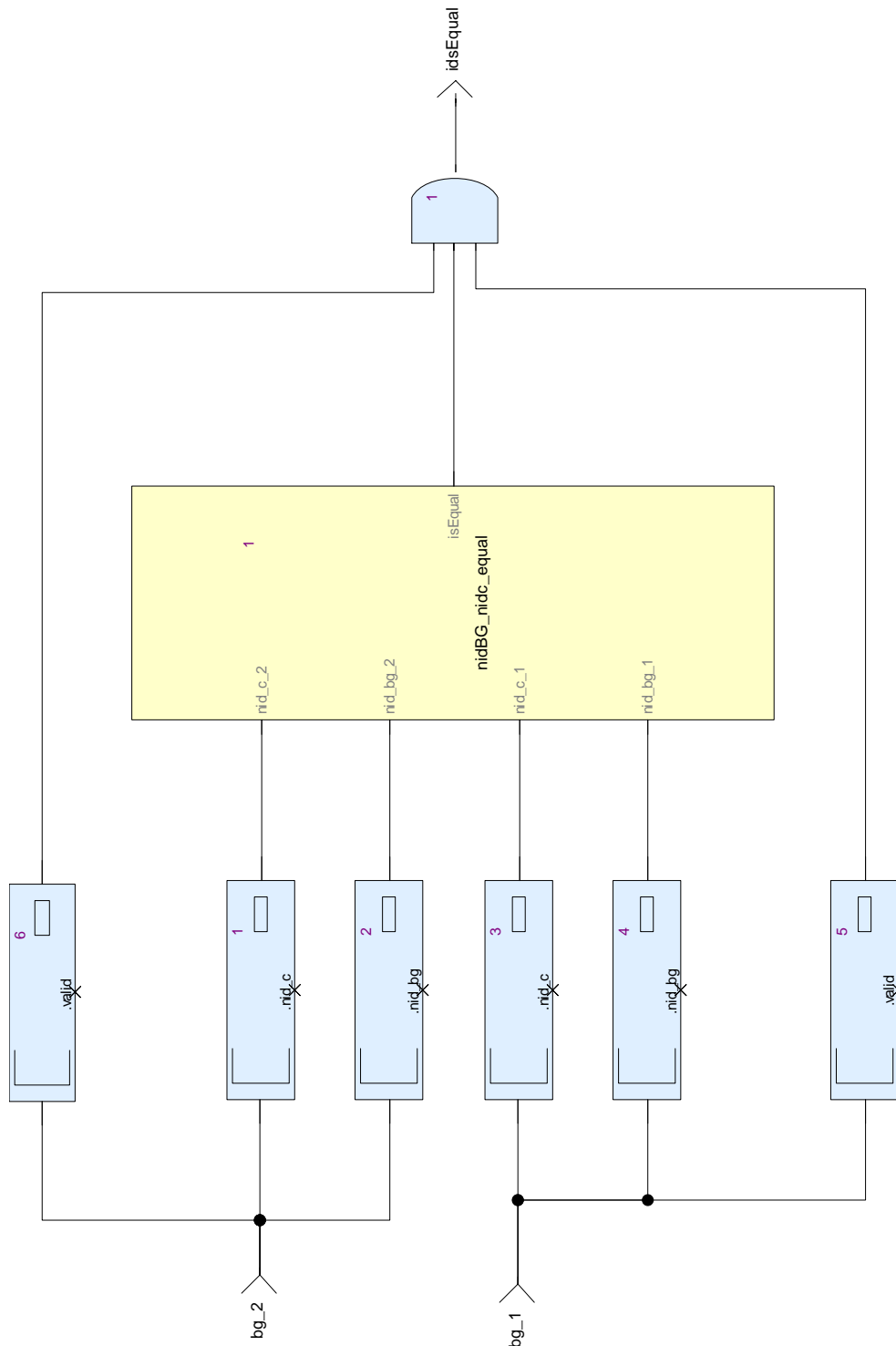
Figure 82: View of diagram_positionedBGs_ids_equal_1 (positionedBGs_ids_equal)

3.3.39.　positionedBGs_ids_notEqual Operator

Declared as **public function**

3.3.39.1.   Comments and Information

positionedBGs_ids_notEqual Comments:

Checks if the ids of 2 BG are not equal by comparing their NID_BG and NID_C values.

Table 205: positionedBGs_ids_notEqual Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Checks if the ids of 2 BG are equal by comparing their NID_BG and NID_C values. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.39.2.   Interface

Table 206: Inputs of positionedBGs_ids_notEqual

Name	Type	Comments and Information
bg_2	TrainPosition_Types_Pck::positionedBG_T	
bg_1	TrainPosition_Types_Pck::positionedBG_T	

Table 207: Outputs of positionedBGs_ids_notEqual

Name	Type	Comments and Information
idsNotEqual	bool	

3.3.39.3.   Operator Hierarchy

diagram : diagram_positionedBGs_ids_notEqual_1

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3.3.39.4.   Graphical and Textual Diagrams

3.3.39.4.1.   View of diagram_positionedBGs_ids_notEqual_1
(positionedBGs_ids_notEqual)
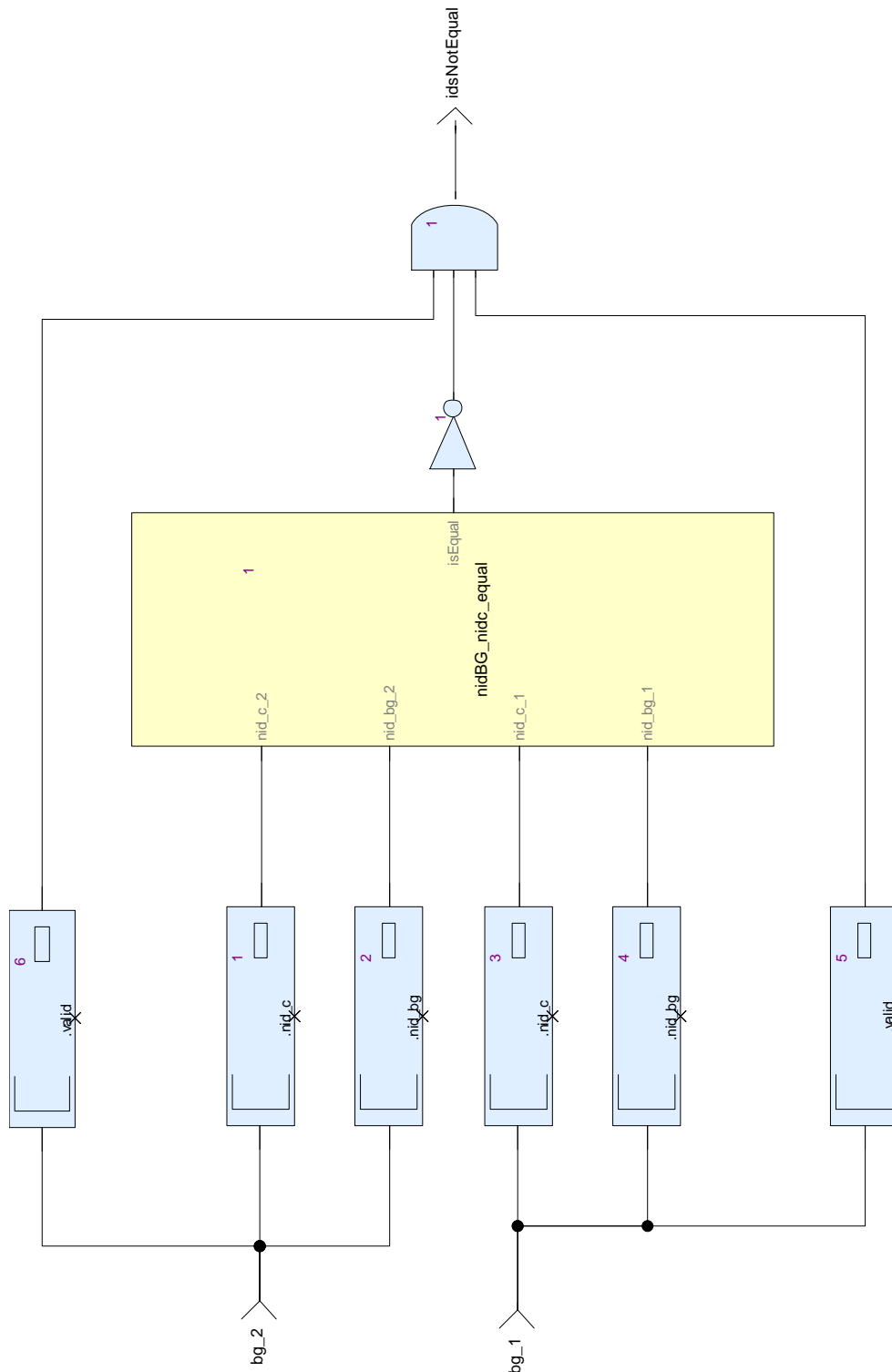
Figure 83: View of diagram_positionedBGs_ids_notEqual_1 (positionedBGs_ids_notEqual)

3.3.40.   positionLinkedBGs Operator

Declared as **public function**

3.3.40.1.   Comments and Information

positionLinkedBGs Comments:
Converts the linking information - received while passing a BG - into announced (= linked positioned) BGs.

Table 208: positionLinkedBGs Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Converts the linking information, received while passing a BG into an announced (= linked positioned) BG. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.40.2.   Interface

Table 209: Inputs of positionLinkedBGs

Name	Type	Properties	Comments and Information
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The actually passed BG, where the linking information originates from.
linkedBGs	BG_Types_Pkg::LinkedBGs_T		
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 210: Outputs of positionLinkedBGs

Name	Type	Comments and Information
linkedPositionedBGs	TrainPosition_Types_Pck::linkedBGs_asPositionedBGs_T	

3.3.40.3.   Operator Hierarchy

diagram : diagram_positionLinkedBGs_1

3.3.40.4.   Graphical and Textual Diagrams

3.3.40.4.1.   View of diagram_positionLinkedBGs_1 (positionLinkedBGs)
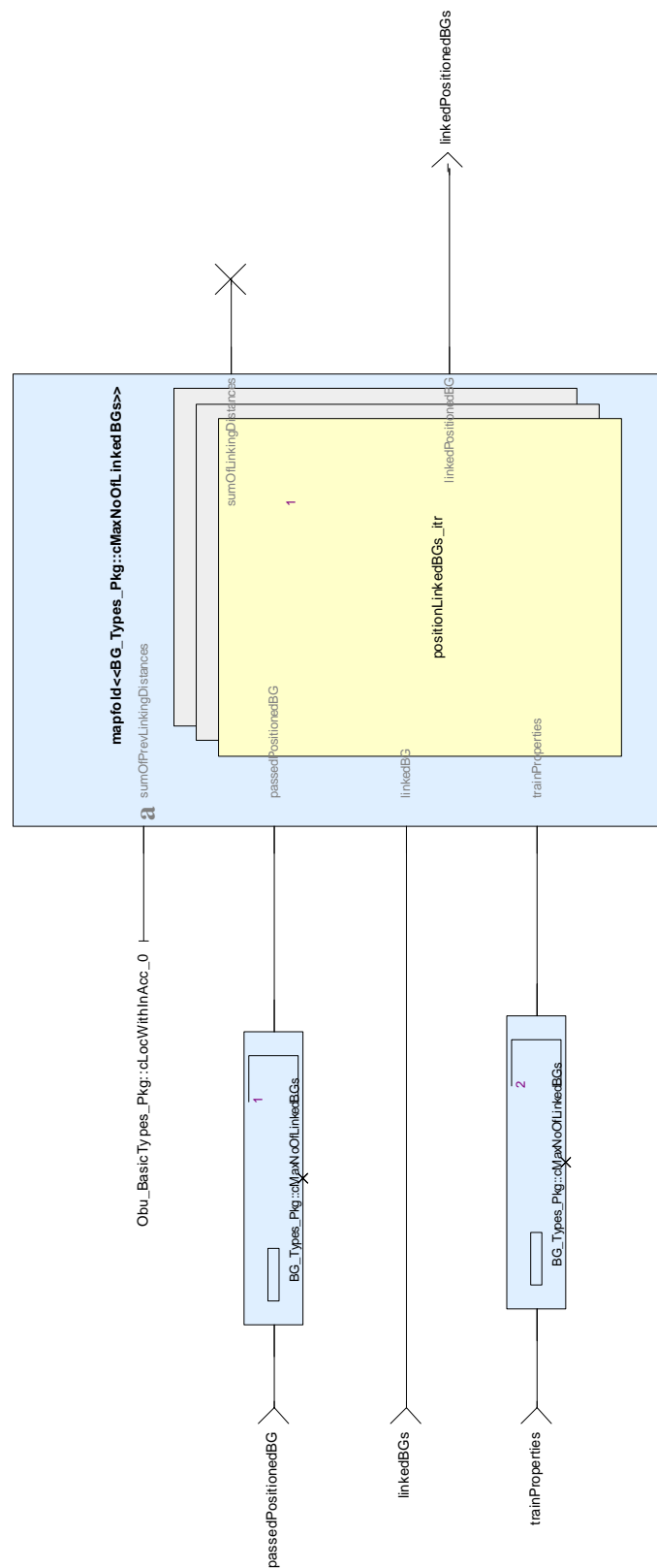
Figure 84: View of diagram_positionLinkedBGs_1 (positionLinkedBGs)

Table 211: positionLinkedBGs_itr (#1) hidden inputs assignment of diagram_positionLinkedBGs_1

Rank	Name	Value
1	trainProperties	*wired (_L9)*

3.3.41.   positionLinkedBGs_itr Operator

Declared as **private function**

3.3.41.1.   Comments and Information

positionLinkedBGs_itr Comments:
Iterated function for the conversion of the linking information - received while passing a BG - into an announced (= linked positioned) BG.

Table 212: positionLinkedBGs_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Iterated function for the conversion of the linking information, received while passing a BG into an announced (= linked positioned) BG. - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

3.3.41.2.   Interface

Table 213: Inputs of positionLinkedBGs_itr

Name	Type	Properties	Comments and Information
sumOfPrevLinkingDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T		Comments: The sum of the linking distances from the chain of previous linked BGs since the passedPositionedBG.

Name	Type	Properties	Comments and Information
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The actually passed BG, where the linking information originates from.
linkedBG	BG_Types_Pkg::LinkedBG_T		Comments: One of the linked BG, announced by the passed BG.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 214: Outputs of positionLinkedBGs_itr

Name	Type	Comments and Information
sumOfLinkingDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T	Comments: Sum of linking distances from the passedPositionedBG until this BG.
linkedPositionedBG	TrainPosition_Types_Pck::positionedBG_T	

3.3.41.3.   Operator Hierarchy

<u>diagram</u> : diagram_positionLinkedBGs_itr_1

3.3.41.4.   Graphical and Textual Diagrams

3.3.41.4.1.   View of diagram_positionLinkedBGs_itr_1 (positionLinkedBGs_itr)
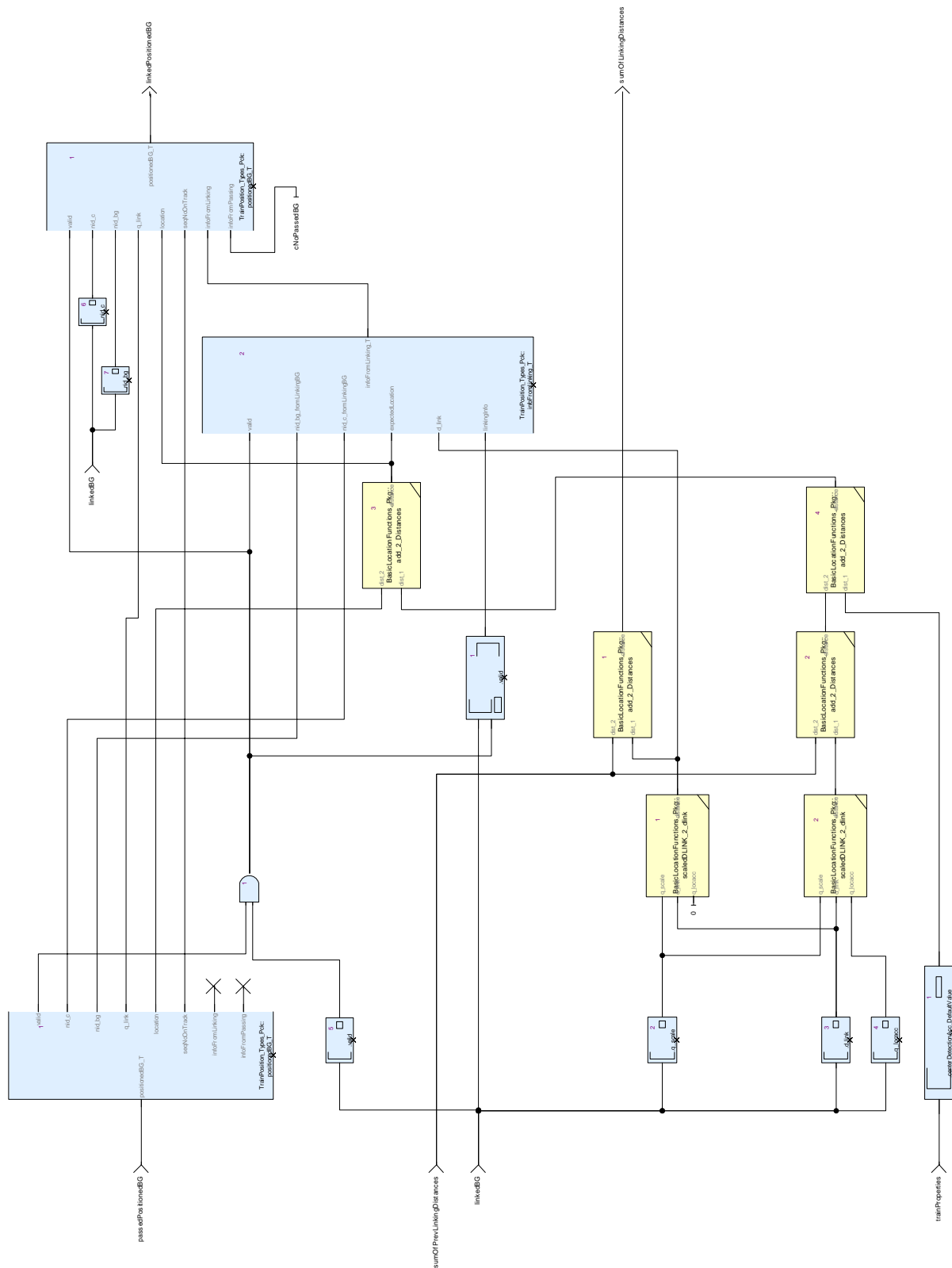
Figure 85: View of diagram_positionLinkedBGs_itr_1 (positionLinkedBGs_itr)

3.3.42.   trimSeqNoOnTrack Operator

Declared as **public function**

3.3.42.1.   Comments and Information

trimSeqNoOnTrack Comments:
Adjusts the sequence number (seqNoOnTrack) of announced (not yet passed BGs).

3.3.42.2.   Interface

Table 215: Inputs of trimSeqNoOnTrack

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	Comments: The BGs where BG is to be merged with.

Table 216: Outputs of trimSeqNoOnTrack

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	Comments: The resulting array of merged BGs.

3.3.42.3.   Operator Hierarchy

diagram : diagram_trimSeqNoOnTrack_1

3.3.42.4.   Graphical and Textual Diagrams

3.3.42.4.1.   View of diagram_trimSeqNoOnTrack_1 (trimSeqNoOnTrack)
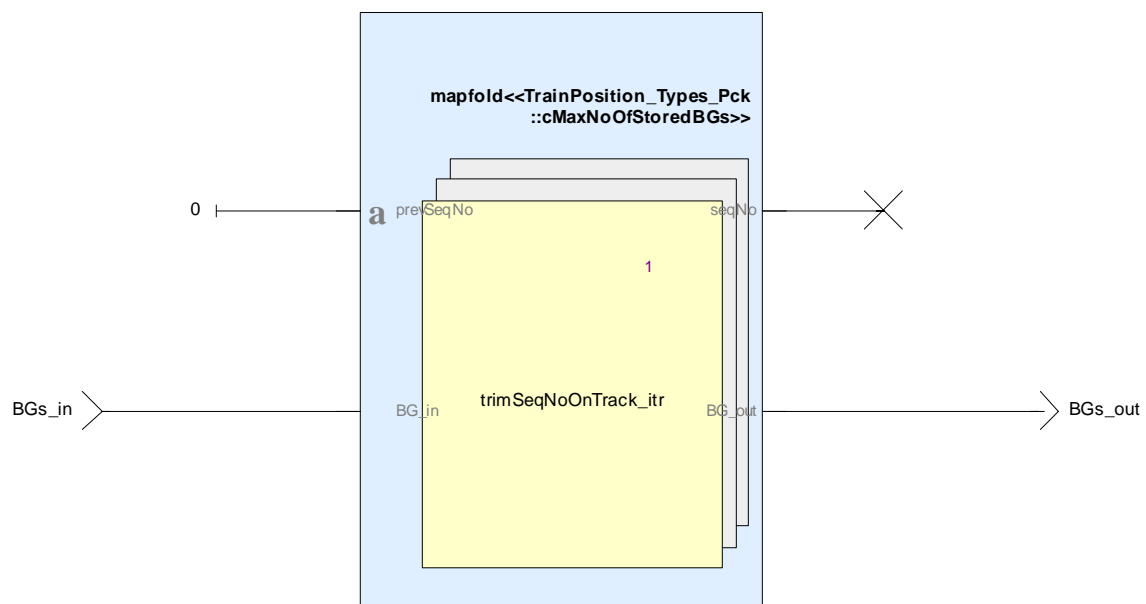
Figure 86: View of diagram_trimSeqNoOnTrack_1 (trimSeqNoOnTrack)

3.3.43.   trimSeqNoOnTrack_itr Operator

Declared as **private function**

3.3.43.1.   Comments and Information

trimSeqNoOnTrack_itr Comments:

Adjusts the sequence number (seqNoOnTrack) of announced (not yet passed BGs).

3.3.43.2.   Interface

Table 217: Inputs of trimSeqNoOnTrack_itr

Name	Type	Comments and Information
prevSeqNo	int	
BG_in	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.

Table 218: Outputs of trimSeqNoOnTrack_itr

Name	Type	Comments and Information
seqNo	int	
BG_out	TrainPosition_Types_Pck::positionedBG_T	Comments: The BG to be merged.

3.3.43.3.   Operator Hierarchy

<u>diagram</u> : diagram_trimSeqNoOnTrack_itr_1

3.3.43.4.   Graphical and Textual Diagrams

3.3.43.4.1.   View of diagram_trimSeqNoOnTrack_itr_1 (trimSeqNoOnTrack_itr)
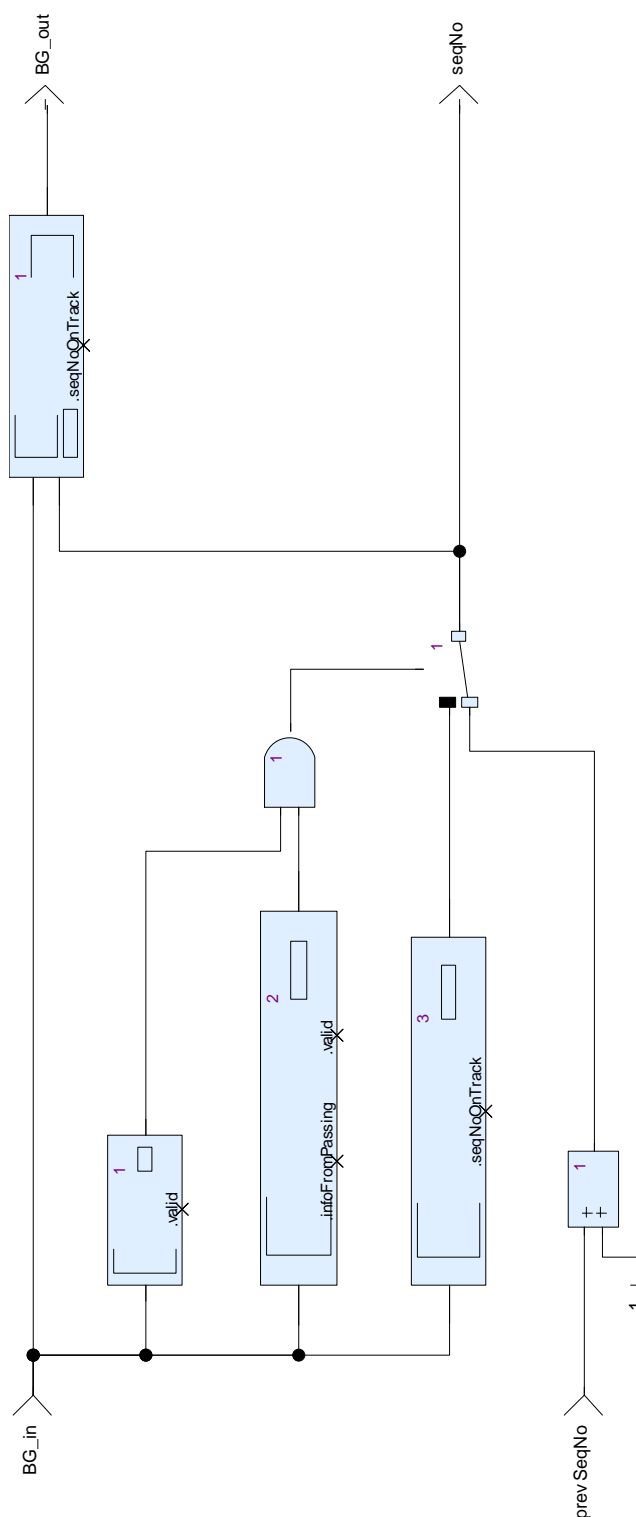
Figure 87: View of diagram_trimSeqNoOnTrack_itr_1 (trimSeqNoOnTrack_itr)

3.4. CalculateTrainPosition_Pkg::gp_functions_Pkg Package

3.4.1. Constants

Table 219: Public Constants of gp_functions_Pkg

Name	Type	Value	Comments and Information
noValidIndex	int	-1	

3.4.2. countUp Operator

Declared as **public node**

3.4.2.1. Comments and Information

countUp Comments:
Counter counting upwards by one.

3.4.2.2. Interface

Table 220: Inputs of countUp

Name	Type	Properties	Comments and Information
count	bool		Comments: Enables counting.
reset	bool	hidden (#1)	Comments: Resets the counter value to 0.

Table 221: Outputs of countUp

Name	Type	Comments and Information
counter	int	Comments: The counter value.

3.4.2.3. Operator Hierarchy

diagram : diagram_countUp_1

3.4.2.4.   Graphical and Textual Diagrams

3.4.2.4.1.   View of diagram_countUp_1 (countUp)
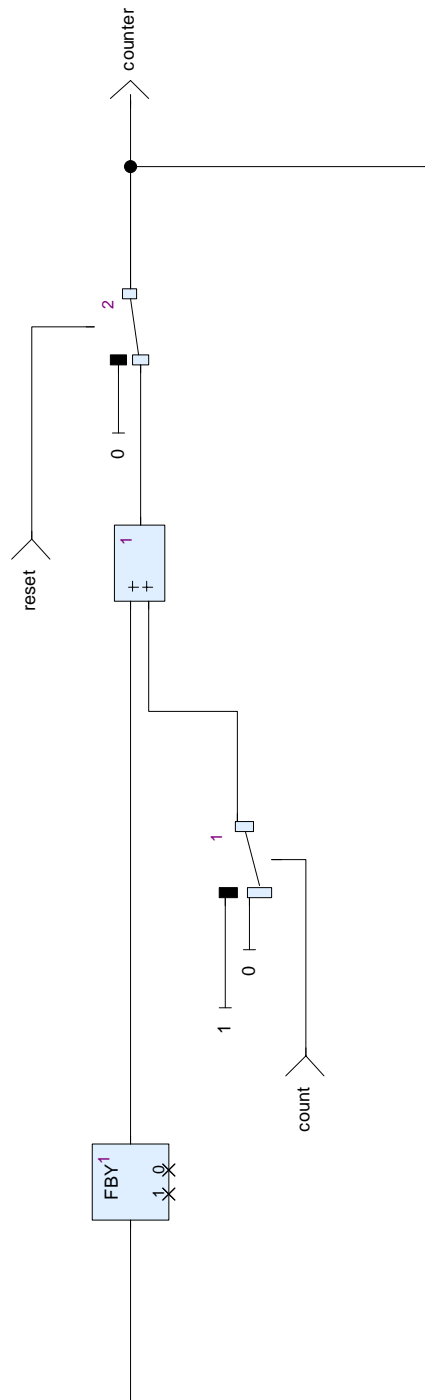
Figure 88: View of diagram_countUp_1 (countUp)

3.5. CalculateTrainPosition_Pkg::Linking_Pkg Package

3.5.1.   linkedBG_missed Operator

Declared as **public node**

3.5.1.1.   Comments and Information

linkedBG_missed Comments:

Detects, when the range of a linked BG (where it is expected to be found) is left and the BG has not been passed yet (infoFromPassing.valid is false).
Steadily observes the current train posittion and detects, when the train leaves the expectation window of any BG. When this happens, checks wether it is a linked BG and has been marked as passed.
If not, it was not found within its expectation window.

3.5.1.2.   Interface

Table 222: Inputs of linkedBG_missed

Name	Type	Properties		Comments and Information
position	Obu_BasicTypes_Pkg::LocWithInAcc_T	last	Obu_BasicTypes_Pkg::cLocWithInAcc_0	
BGs	TrainPosition_Types_Pck::positionedBGs_T			
enable	bool			

Table 223: Outputs of linkedBG_missed

Name	Type	Comments and Information
missed	bool	
indexOfBG	int	
BG	TrainPosition_Types_Pck::positionedBG_T	

3.5.1.3.   Locals

Table 224: Locals of linkedBG_missed

Name	Type	Comments and Information
movedAhead	bool	
weakenedPosition	Obu_BasicTypes_Pkg::LocWithInAcc_T	

3.5.1.4.   Operator Hierarchy

diagram : diagram_linkedBG_missed_1
diagram : diagram_linkedBG_missed_2
         activate if : IfBlock1
                 branch : then
                 branch : else

3.5.1.5.   Graphical and Textual Diagrams

3.5.1.5.1.   View of diagram_linkedBG_missed_1 (linkedBG_missed)
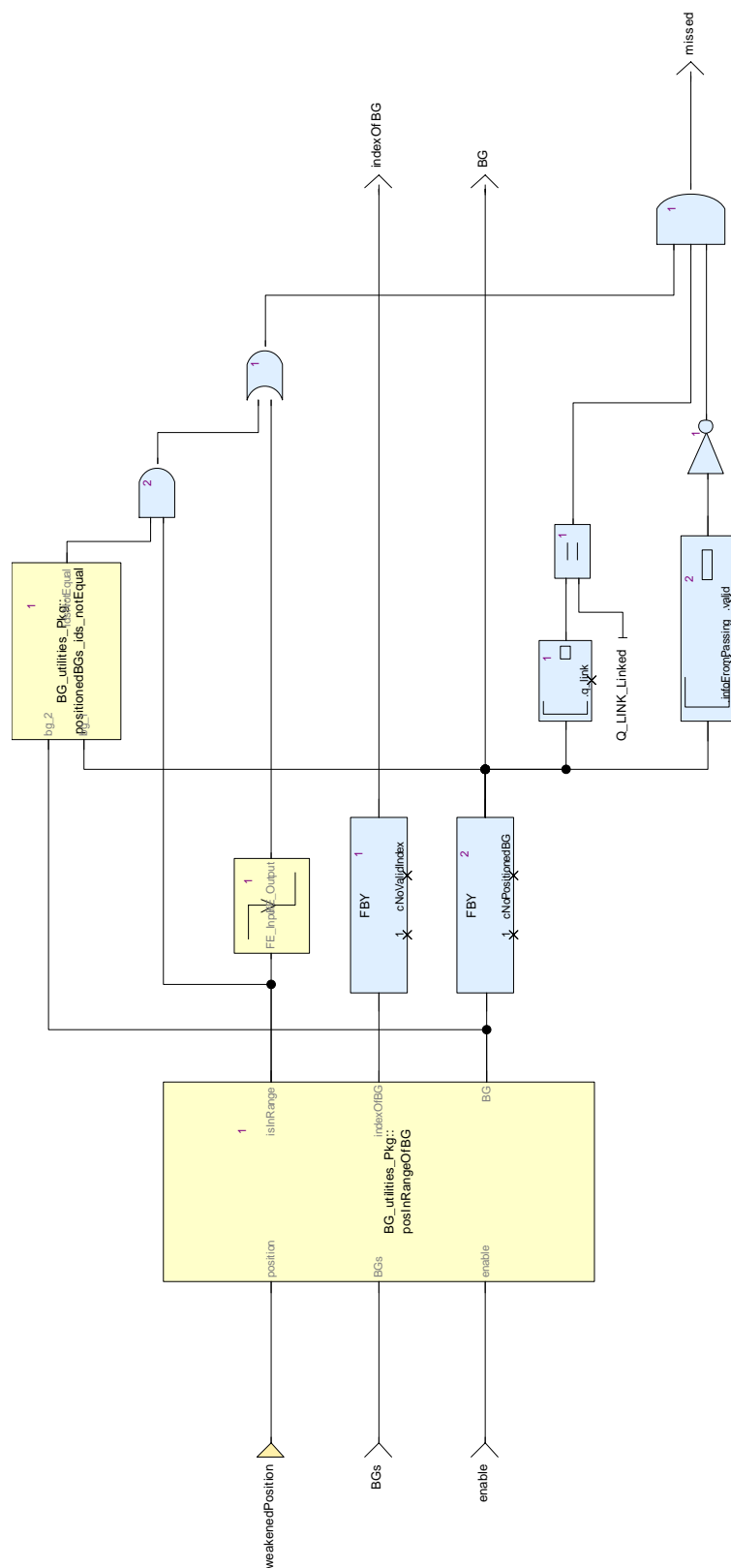
Figure 89: View of diagram_linkedBG_missed_1 (linkedBG_missed)

3.5.1.5.2. View of diagram_linkedBG_missed_2 (linkedBG_missed)
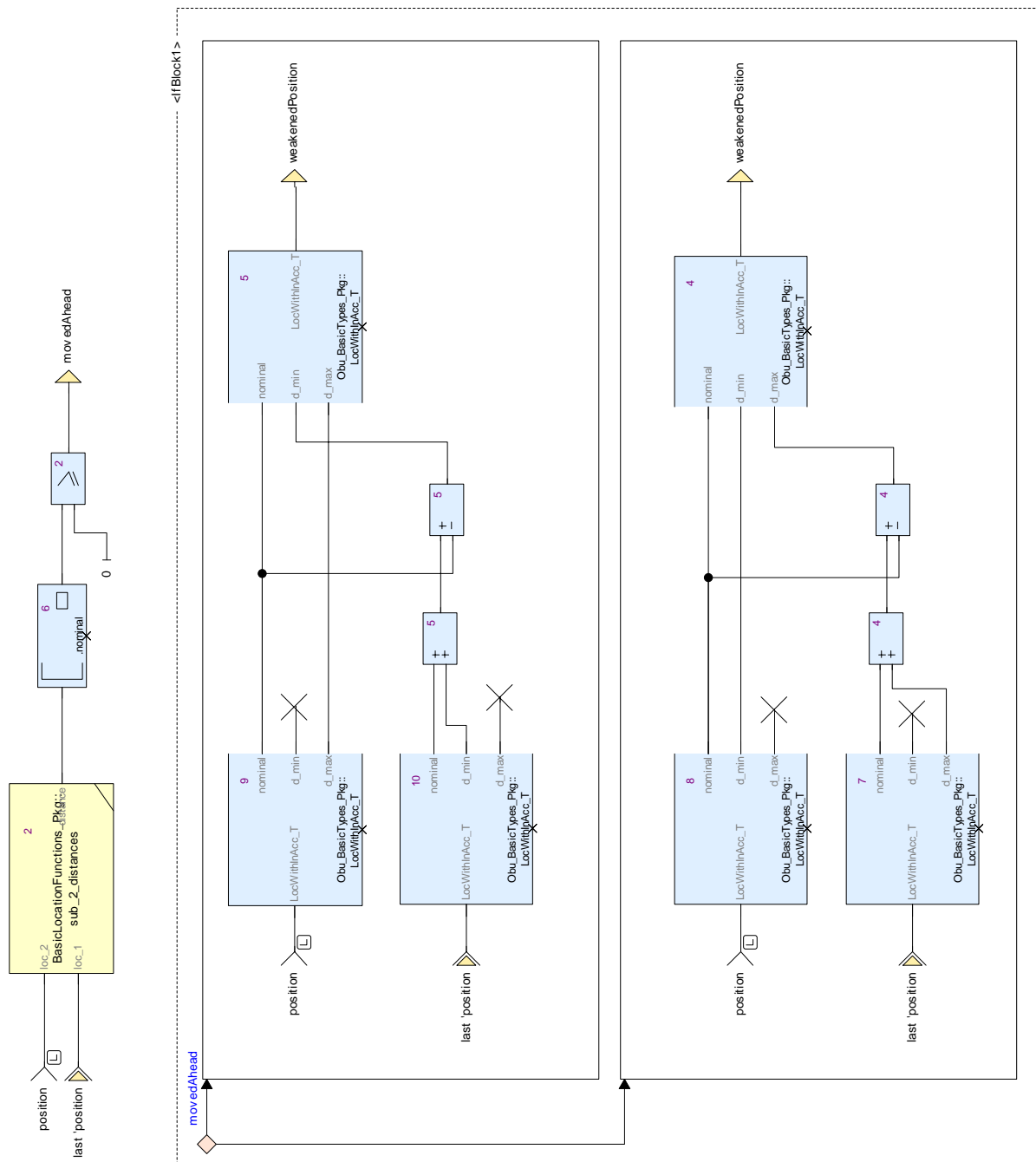
Figure 90: View of diagram_linkedBG_missed_2 (linkedBG_missed)

Table 225: Conditional Blocks of diagram_linkedBG_missed_2

Conditional Block	Comments and Information
IfBlock1	

Table 226: Actions of diagram_linkedBG_missed_2

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

3.5.2.   linkingIsUsed Operator

Declared as **public node**

3.5.2.1.   Comments and Information

linkingIsUsed Comments:
3.4.4.2.1.1:
Provides the "Linking information is used" information

3.5.2.2.   Interface

Table 227: Inputs of linkingIsUsed

Name	Type	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	Comments: The current odometry values
BGs	TrainPosition_Types_Pck::positionedBGs_T	
recalculateBGs	bool	Comments: Triggers the recalculation of the last linked and unlinked BGs.

Table 228: Outputs of linkingIsUsed

Name	Type	Comments and Information
linkingIsUsed	bool	

3.5.2.3.   Locals

Table 229: Locals of linkingIsUsed

Name	Type	Comments and Information
lastLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
lastPassedLinkedBG	TrainPosition_Types_Pck::positionedBG_T	

3.5.2.4.   Operator Hierarchy

diagram : diagram_linkingIsUsed_1

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3.5.2.5.   Graphical and Textual Diagrams

3.5.2.5.1.   View of diagram_linkingIsUsed_1 (linkingIsUsed)

Figure 91: View of diagram_linkingIsUsed_1 (linkingIsUsed)
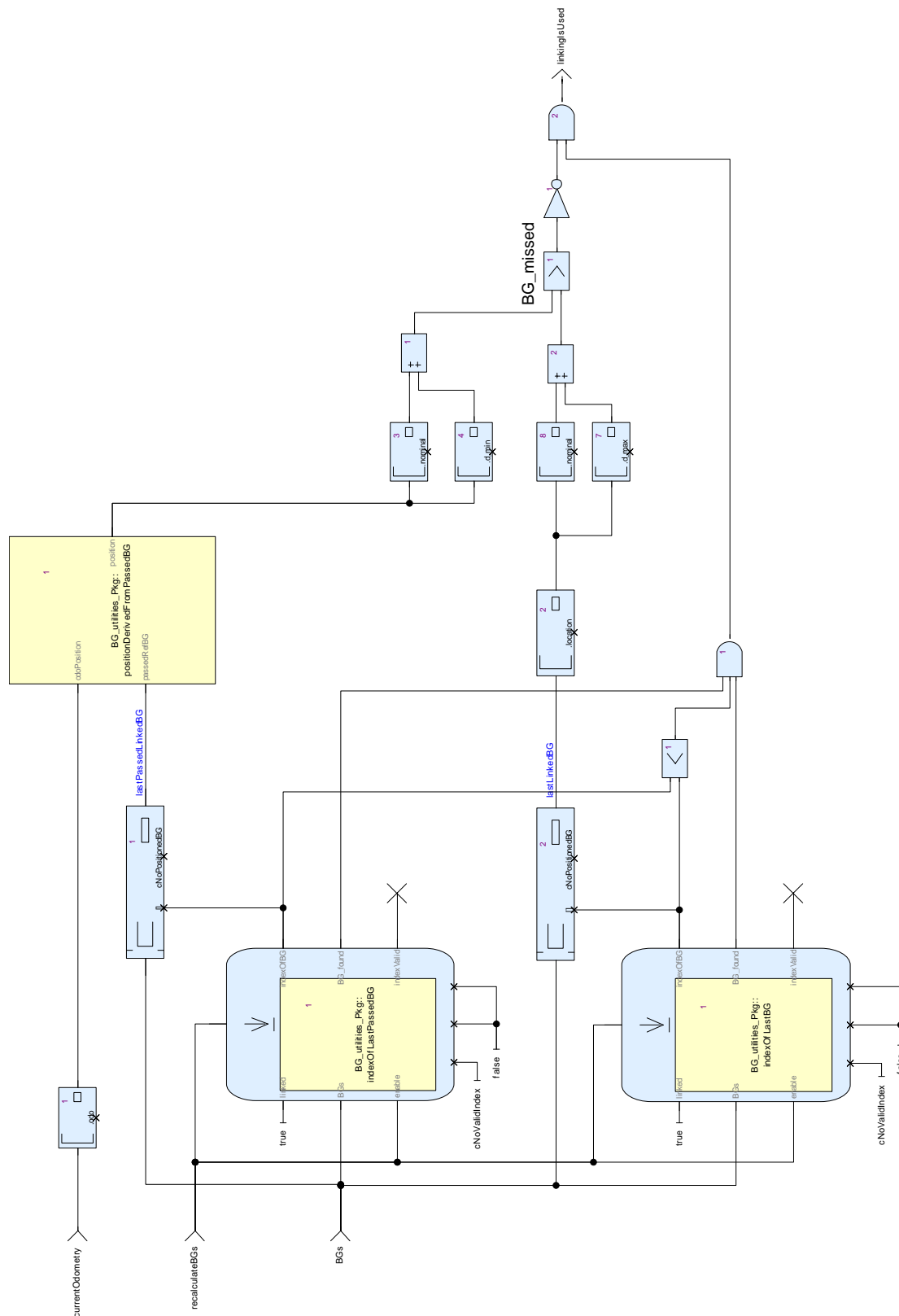
3.5.3.   twoConsecutiveLinkedBGs_missed Operator

Declared as **public node**

3.5.3.1.   Comments and Information

twoConsecutiveLinkedBGs_missed Comments:
Detects, if 2 subsequent linked BGs are missed.
Criterium: If 2 consecutive linked balise groups announced by linking are not detected and the end of the expectation window of the second balise group has been passed.

3.5.3.2.   Interface

Table 230: Inputs of twoConsecutiveLinkedBGs_missed

Name	Type	Comments and Information
missed	bool	
missedLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
passedBG	TrainPosition_Types_Pck::positionedBG_T	
reset	bool	

Table 231: Outputs of twoConsecutiveLinkedBGs_missed

Name	Type	Comments and Information
secondConsecutiveBG_missed	bool	

3.5.3.3.   Locals

Table 232: Locals of twoConsecutiveLinkedBGs_missed

Name	Type	Properties		Comments and Information
linkedAnnouncedBG_passed	bool			
storedMissedBG	TrainPosition_Types_Pck::positionedBG_T	last	cNoPositionedBG	

3.5.3.4.   Operator Hierarchy

diagram : diagram_twoConsecutiveLinkedBGs_missed_1

3.5.3.5.   Graphical and Textual Diagrams

3.5.3.5.1.   View of diagram_twoConsecutiveLinkedBGs_missed_1 (twoConsecutiveLinkedBGs_missed)
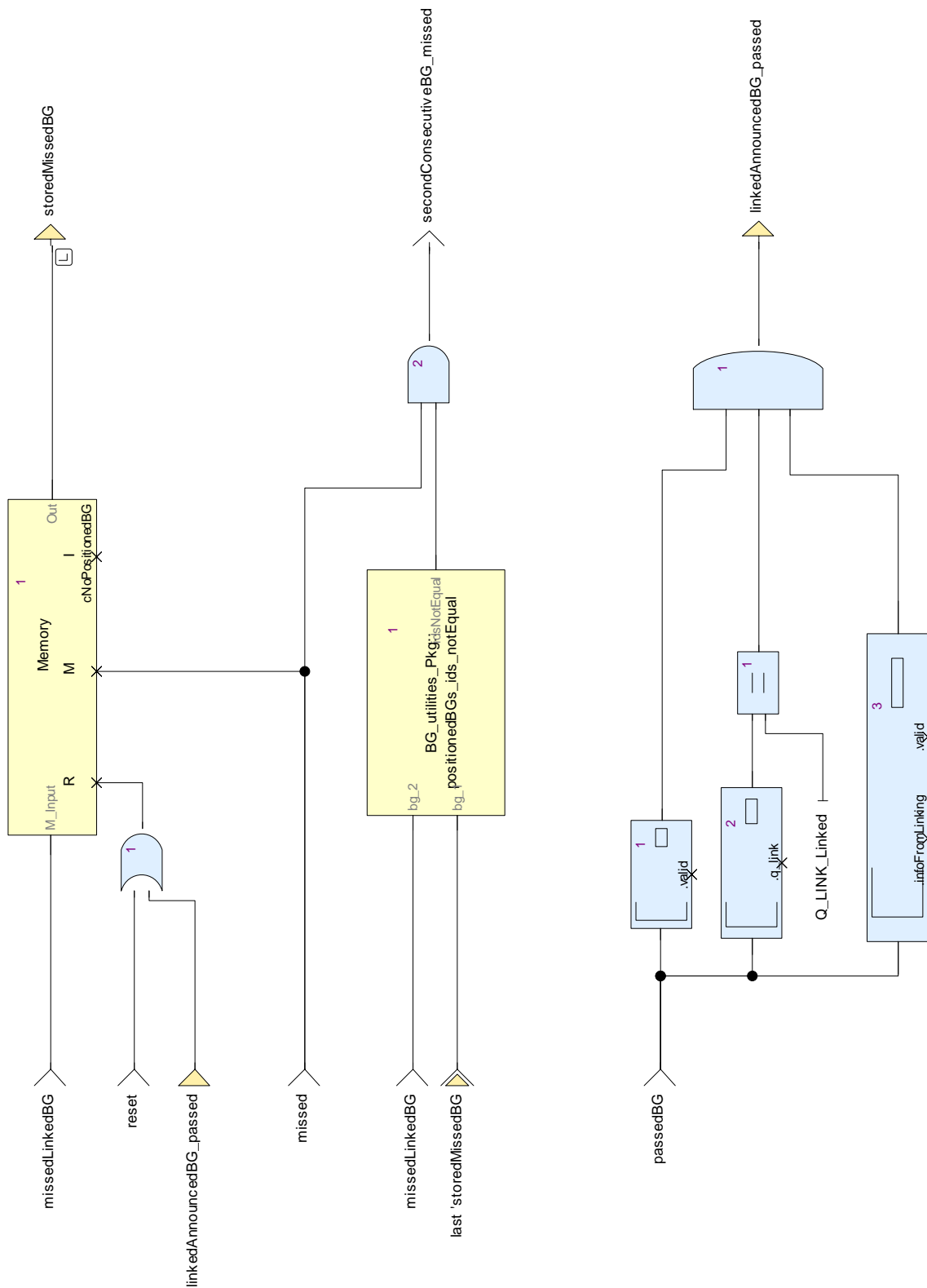
Figure 92: View of diagram_twoConsecutiveLinkedBGs_missed_1
(twoConsecutiveLinkedBGs_missed)

Table 233: Memory (#1) hidden inputs assignment of diagram_twoConsecutiveLinkedBGs_missed_1

Rank	Name	Value
1	Reset	*wired (_L29)*
2	MemCond	*wired (_L24)*
3	InitVal	cNoPositionedBG

3.6. CalculateTrainPosition_Pkg::msgAdapter_Pkg Package

3.6.1. Constants

Table 234: Public Constants of msgAdapter_Pkg

Name	Type	Value	Comments and Information
cTM_Radio_TrackTrain _Header_Default	TM::Radio_TrackTrain_Header_T	{radioDevice : 0, receivedSystemTime : 0, nid_message : 0, t_train : 0, m_ack : 0, nid_lrbg : 0, t_train_reference : 0, nid_em : 0, q_scale : 0, d_sr : 0, t_sh_rqst : 0, d_ref : 0, q_dir : 0, d_emergencystop : 0, m_version : 0}	

3.6.2. msg_2_passedBG Operator

Declared as **public function**

3.6.2.1. Interface

Table 235: Inputs of msg_2_passedBG

Name	Type	Comments and Information
msgFromTrack	Common_Types_Pkg:: ReceivedMessage_T	

Table 236: Outputs of msg_2_passedBG

Name	Type	Comments and Information
passedBG	BG_Types_Pkg::passedBG_T	
BG_passed	bool	
onlyBGsAnnouncedVia Radio	bool	

3.6.2.2. Operator Hierarchy

diagram : diagram_msg_2_passedBG_1

3.6.2.3.   Graphical and Textual Diagrams

3.6.2.3.1.   View of diagram_msg_2_passedBG_1 (msg_2_passedBG)

Figure 93: View of diagram_msg_2_passedBG_1 (msg_2_passedBG)
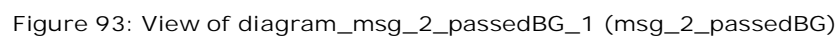
3.7. CalculateTrainPosition_Pkg::Pos_Pkg Package

3.7.1. Types

Table 237: Public Types of Pos_Pkg

Name	Definition	Comments and Information
trainMovementDir_T	enum {trm_unknown, trm_standstill, trm_increasing, trm_decreasing}	Comments: Train direction related to the OBU coordinate system trm_unknown Comments: Direction unknown trm_standstill Comments: No movement: train stands still trm_increasing Comments: Train moves towards increasing locations of the OBU coordinate system trm_decreasing Comments: Train moves towards decreasing locations of the OBU coordinate system
trainRelMovementDirection_T	enum {trrlm_unknown, trrlm_forward, trrlm_backward}	Comments: Train movement direction relative to train orientation

3.7.2. Constants

Table 238: Public Constants of Pos_Pkg

Name	Type	Value	Comments and Information
cOdometryStartVal	Obu_BasicTypes_Pkg::odometry_T	{valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}	
cSpeed_0	Obu_BasicTypes_Pkg::Speed_T	0	

3.7.3. frontendToLRBG Operator

Declared as **public function**

3.7.3.1. Comments and Information

frontendToLRBG Comments:
Calculates on which side of the LRBG the estimated front end is

3.7.3.2.   Interface

Table 239: Inputs of frontendToLRBG

Name	Type	Properties	Comments and Information
LRBG	TrainPosition_Types_Pck::positionedBG_T		Comments: The LRBG
trainPositionInfo	TrainPosition_Types_Pck::trainPositionInfo_T		Comments: The resulting train position with reference to the known list of balise groups.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden (#1)	Comments: The trains properties required for train position calculation.

Table 240: Outputs of frontendToLRBG

Name	Type	Comments and Information
nominalOrReverseToLRBG	Q_DLRBG	

3.7.3.3.   Locals

Table 241: Locals of frontendToLRBG

Name	Type	Comments and Information
estimated_d_LRBGToFrontend	Obu_BasicTypes_Pkg::L_internal_Type	Comments: Estimated (nominal) distance from train front end to LRBG (typically astern to the front end)
trainOrientationToLRBG	Q_DIRLRBG	

3.7.3.4.   Operator Hierarchy

<u>diagram</u> : diagram_frontendToLRBG_1
      activate if : IfBlock1
          branch : then
          branch : else
               branch : then
               branch : else

3.7.3.5. Graphical and Textual Diagrams

3.7.3.5.1. View of diagram_frontendToLRBG_1 (frontendToLRBG)
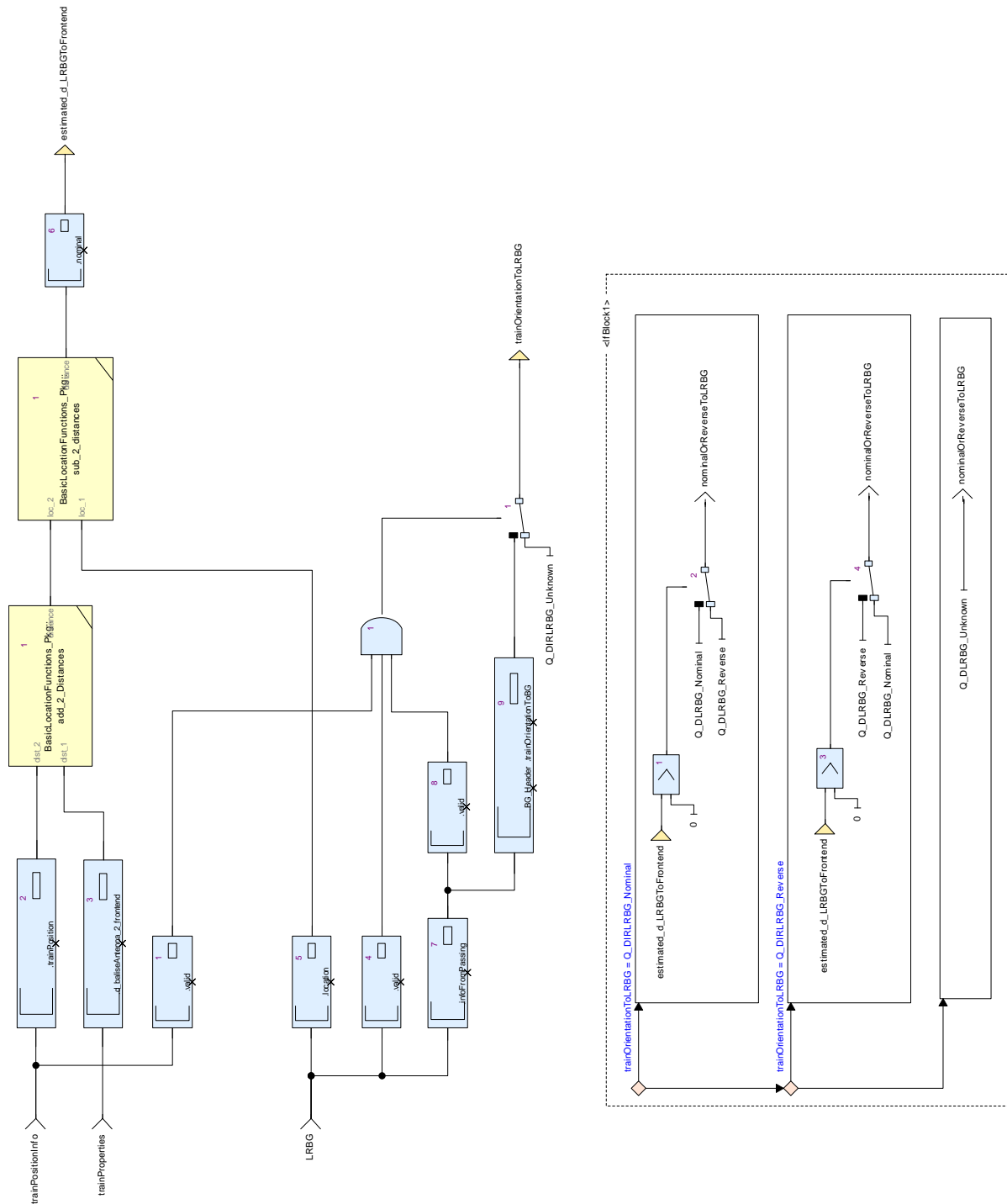
Figure 94: View of diagram_frontendToLRBG_1 (frontendToLRBG)

Table 242: Conditional Blocks of diagram_frontendToLRBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 243: Actions of diagram_frontendToLRBG_1

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

3.7.4. invert_Q_DIRTRAIN Operator

Declared as **private function**

3.7.4.1. Interface

Table 244: Inputs of invert_Q_DIRTRAIN

Name	Type	Comments and Information
in	Q_DIRTRAIN	

Table 245: Outputs of invert_Q_DIRTRAIN

Name	Type	Comments and Information
out	Q_DIRTRAIN	

3.7.4.2. Operator Hierarchy

diagram : diagram_invert_Q_DIRTRAIN_1

3.7.4.3. Graphical and Textual Diagrams

3.7.4.3.1. View of diagram_invert_Q_DIRTRAIN_1 (invert_Q_DIRTRAIN)
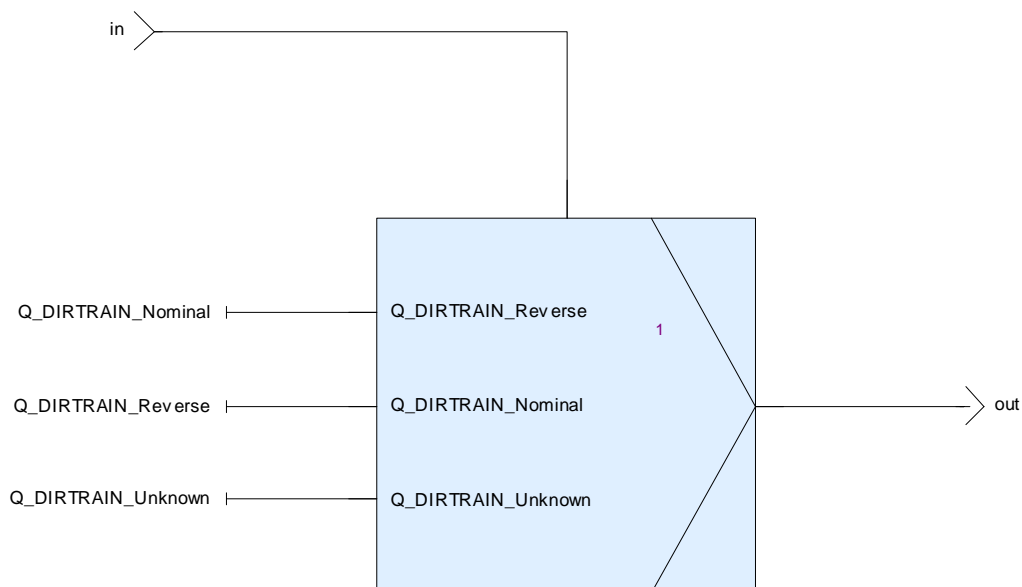
Figure 95: View of diagram_invert_Q_DIRTRAIN_1 (invert_Q_DIRTRAIN)

3.7.5. movementDir Operator

Declared as **private node**

3.7.5.1. Comments and Information

movementDir Comments:

Determines the onboard relative movement direction (forward / backward) dependant on odometry and cab activation.

3.7.5.2.   Interface

Table 246: Inputs of movementDir

Name	Type	Properties		Comments and Information
odo	Obu_BasicTypes_Pkg::odometry_T	last	cOdometryStartVal	Comments: The current odometry values
activeCab	TIU_Types_Pkg::cab_ID_T			

Table 247: Outputs of movementDir

Name	Type	Comments and Information
direction	CalculateTrainPosition_Pkg::Pos_Pkg::trainRelMovementDirection_T	Comments: The movement related to the OBU coordination system.

3.7.5.3.   Operator Hierarchy

<u>diagram</u> : diagram_movementDir

3.7.5.4.   Graphical and Textual Diagrams

3.7.5.4.1.   View of diagram_movementDir (movementDir)
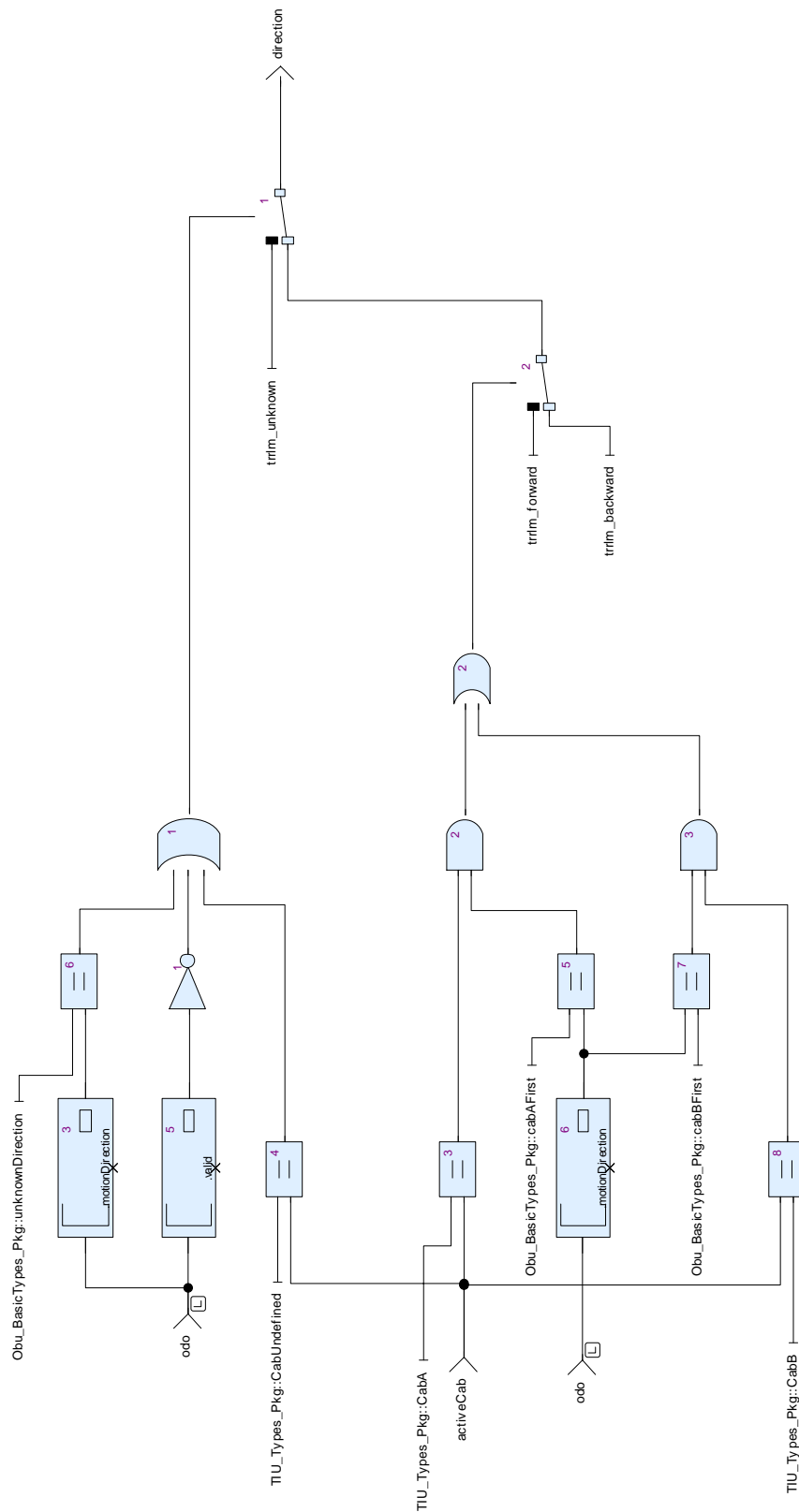
Figure 96: View of diagram_movementDir (movementDir)

3.7.6.   runningDirectionVsRef_obsolete Operator

Declared as **public node**

3.7.6.1.   Comments and Information

runningDirectionVsRef_obsolete Comments:
Determines the current train running direction compared to a known reference running direction and speed.

3.7.6.2.   Interface

Table 248: Inputs of runningDirectionVsRef_obsolete

Name	Type	Comments and Information
refTrainRunningDirection	Q_DIRTRAIN	Comments: Train running direction at the reference location
refSpeed	Obu_BasicTypes_Pkg::Speed_T	Comments: Speed at the reference location
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	Comments: The current odometry with the current speed

Table 249: Outputs of runningDirectionVsRef_obsolete

Name	Type	Comments and Information
trainRunningDirection	Q_DIRTRAIN	Comments: The current train running direction

3.7.6.3.   Locals

Table 250: Locals of runningDirectionVsRef_obsolete

Name	Type	Comments and Information
currentDir	CalculateTrainPosition_Pkg::Pos_Pkg::trainMovementDir_T	
refDir	CalculateTrainPosition_Pkg::Pos_Pkg::trainMovementDir_T	

3.7.6.4.   Operator Hierarchy

diagram : diagram_runningDirectionVsRef_obsolete_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else
    activate if : IfBlock2
        branch : then
        branch : else
            branch : then
            branch : else

3.7.6.5. Graphical and Textual Diagrams

3.7.6.5.1. View of diagram_runningDirectionVsRef_obsolete_1 (runningDirectionVsRef_obsolete)
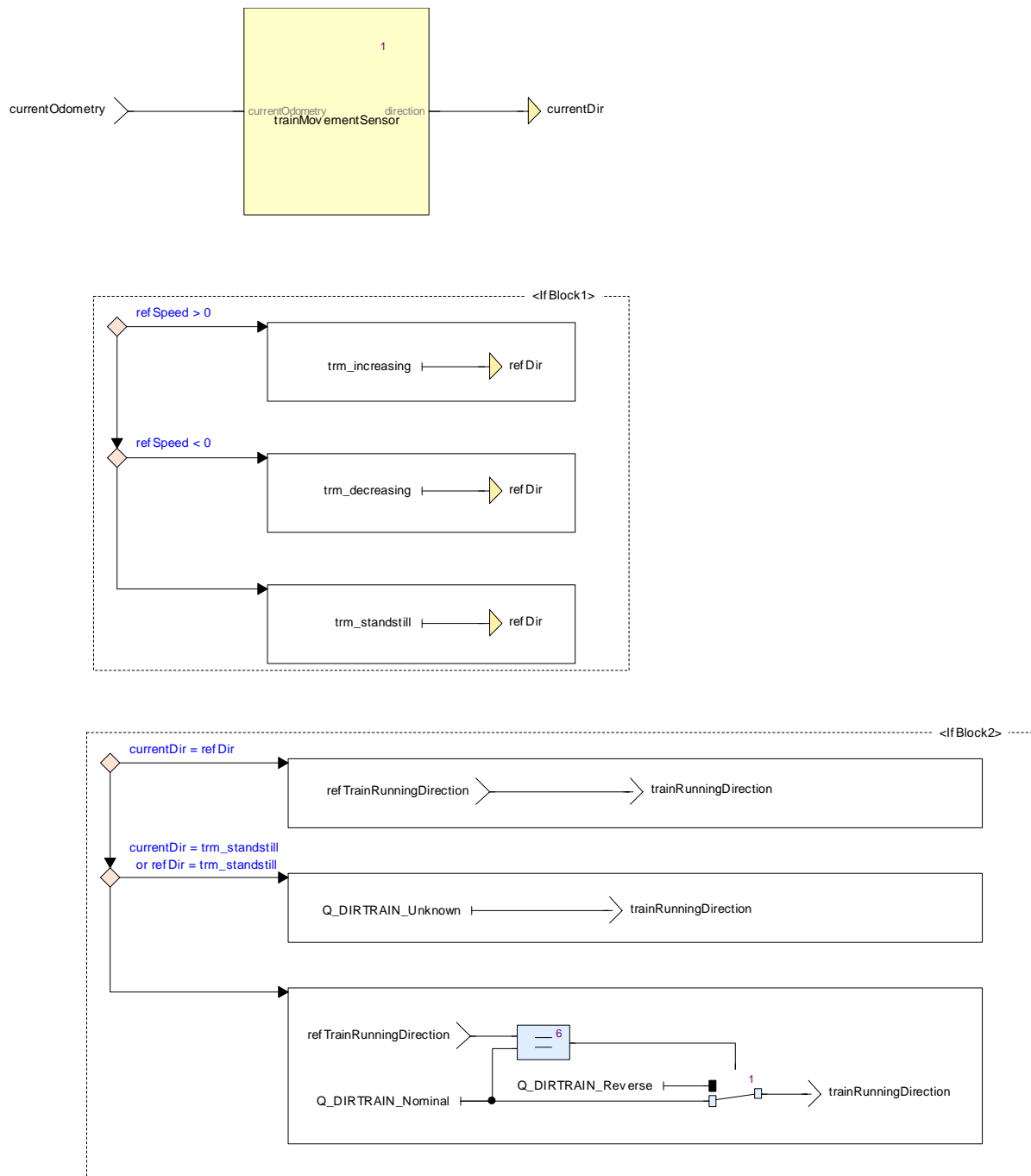
Figure 97: View of diagram_runningDirectionVsRef_obsolete_1 (runningDirectionVsRef_obsolete)

Table 251: Conditional Blocks of diagram_runningDirectionVsRef_obsolete_1

Conditional Block	Comments and Information
IfBlock1	
IfBlock2	

Table 252: Actions of diagram_runningDirectionVsRef_obsolete_1

Conditional Block Action	Comments and Information
IfBlock1:then	
IfBlock1:else:then	
IfBlock1:else:else	
IfBlock2:then	
IfBlock2:else:then	
IfBlock2:else:else	

3.7.7.   trainMoveDir_vs_refBG Operator

Declared as **public function**

3.7.7.1.   Comments and Information

trainMoveDir_vs_refBG Comments:
Determines the current train running direction compared to a known reference running direction and speed.

3.7.7.2.   Interface

Table 253: Inputs of trainMoveDir_vs_refBG

Name	Type	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	Comments: The current odometry with the current speed
refBG	TrainPosition_Types_Pck::positionedBG_T	

Table 254: Outputs of trainMoveDir_vs_refBG

Name	Type	Comments and Information
direction	Q_DIRTRAIN	Comments: The current train running direction

3.7.7.3.   Locals

Table 255: Locals of trainMoveDir_vs_refBG

Name	Type	Comments and Information
currMotionDir	Obu_BasicTypes_Pkg::odoMotionDirection_T	
refMotionDir	Obu_BasicTypes_Pkg::odoMotionDirection_T	
refRunningDirectionToBG	Q_DIRTRAIN	

3.7.7.4.   Operator Hierarchy

<u>diagram</u> : diagram_trainMoveDir_vs_refBG_2

3.7.7.5.   Graphical and Textual Diagrams

3.7.7.5.1.   View of diagram_trainMoveDir_vs_refBG_2 (trainMoveDir_vs_refBG)
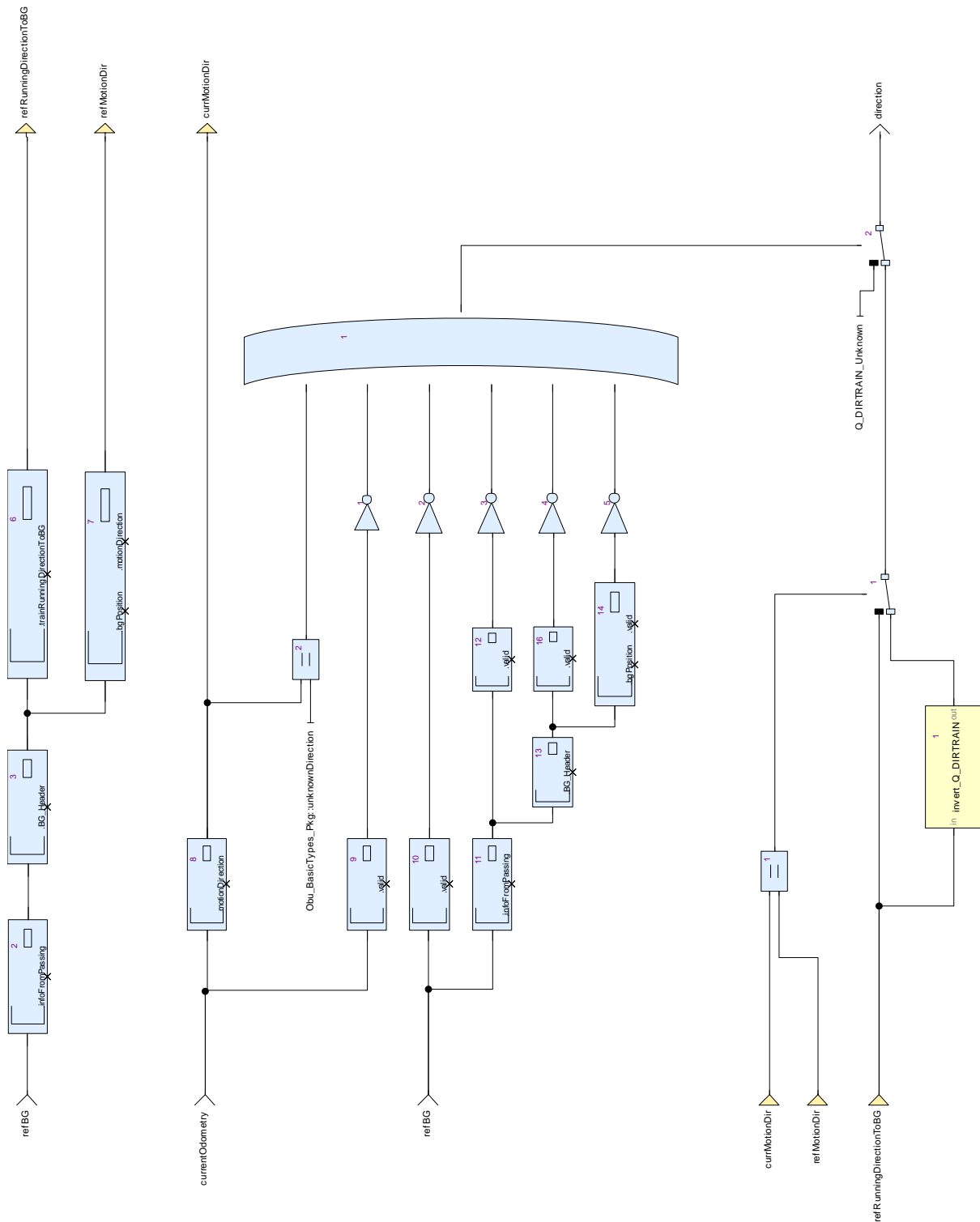
Figure 98: View of diagram_trainMoveDir_vs_refBG_2 (trainMoveDir_vs_refBG)

3.7.8.   trainMovementSensor Operator

Declared as **private node**

3.7.8.1.   Comments and Information

trainMovementSensor Comments:
Determines the movement direction of the train based on odometry.

3.7.8.2.   Interface

Table 256: Inputs of trainMovementSensor

Name	Type	Properties		Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	last	cOdometryStartVal	Comments: The current odometry values

Table 257: Outputs of trainMovementSensor

Name	Type	Comments and Information
direction	CalculateTrainPosition_Pkg::Pos_Pkg::trainMovementDir_T	Comments: The movement related to the OBU coordination system.

3.7.8.3.   Locals

Table 258: Locals of trainMovementSensor

Name	Type	Properties		Comments and Information
direction_loc	CalculateTrainPosition_Pkg::Pos_Pkg::trainMovementDir_T			
speed_loc	Obu_BasicTypes_Pkg::V_internal_Type	last	cSpeed_0	
standstillDetected	bool			

3.7.8.4.   Operator Hierarchy

diagram : diagram_trainMovementSensor_1
    state-machine : SM1
        state : Decreasing
        state : Increasing
        state : Standstill
        state : Unknown

3.7.8.5.   Graphical and Textual Diagrams

3.7.8.5.1.   View of diagram_trainMovementSensor_1 (trainMovementSensor)
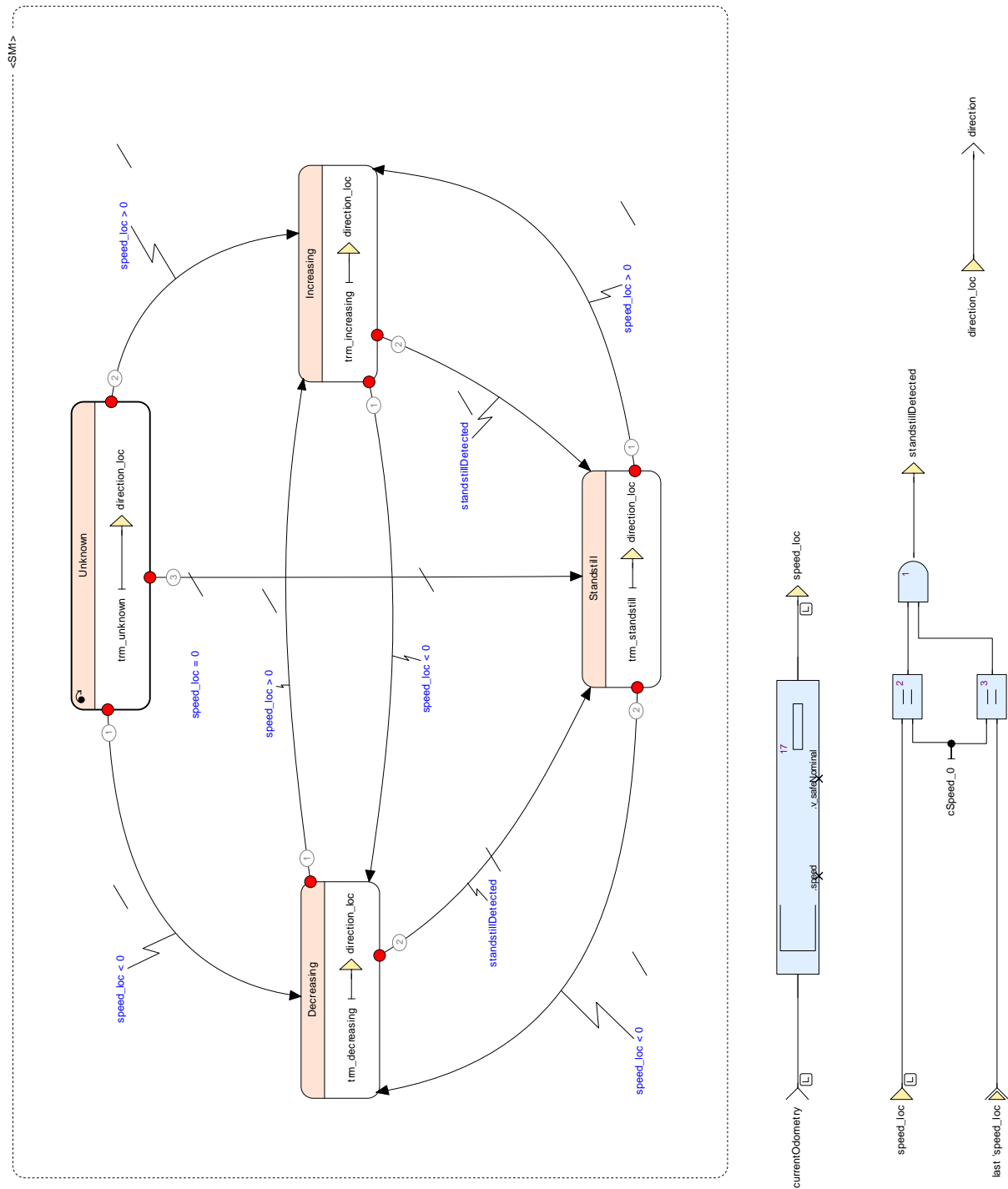
Figure 99: View of diagram_trainMovementSensor_1 (trainMovementSensor)

Table 259: State Machines of diagram_trainMovementSensor_1

State Machine	Comments and Information
SM1	

Table 260: States of diagram_trainMovementSensor_1

State	Comments and Information
SM1:Decreasing	
SM1:Increasing	
SM1:Standstill	
SM1:Unknown	

Table 261: Transitions of diagram_trainMovementSensor_1

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Decreasing Target: SM1:Increasing	1	Condition: speed_loc > 0	
Source: SM1:Decreasing Target: SM1:Standstill	2	Condition: standstillDetected	
Source: SM1:Increasing Target: SM1:Decreasing	1	Condition: speed_loc < 0	
Source: SM1:Increasing Target: SM1:Standstill	2	Condition: standstillDetected	
Source: SM1:Standstill Target: SM1:Increasing	1	Condition: speed_loc > 0	
Source: SM1:Standstill Target: SM1:Decreasing	2	Condition: speed_loc < 0	
Source: SM1:Unknown Target: SM1:Decreasing	1	Condition: speed_loc < 0	
Source: SM1:Unknown Target: SM1:Increasing	2	Condition: speed_loc > 0	
Source: SM1:Unknown Target: SM1:Standstill	3	Condition: speed_loc = 0	

4. Project Library: Obu_BasicTypes

4.1. Obu_BasicTypes_Pkg Package

4.1.1. Comments and Information

Obu_BasicTypes_Pkg Comments:
Standardized basic type definitions to be used within all internal OBU functions

4.1.2. Types

Table 262: Public Types of Obu_BasicTypes_Pkg

Name	Definition	Comments and Information
A_internal_Type	int	Comments: Standardized acceleration type for all internal calculations: in 0.01 m/s2
BCD_T	int	Comments: Binary Coded Decimal (Range 0:9, A - F). Use value F for digit to indicate no digit (if number shorter than 6 digits)
G_internal_Type	int	Comments: Standardized gradient type for all internal gradient calculations: in per 0.1 mill
L_internal_Type	int	Comments: Standardized length type for all internal length, distance and location calculations: in cm
Location_T	Obu_BasicTypes_Pkg::L_internal_Type	Comments: Generic for all length, distance and location calculation: in cm
LocWithInAcc_T	{nominal : Obu_BasicTypes_Pkg::L_internal_Type, d_min : Obu_BasicTypes_Pkg::L_internal_Type, d_max : Obu_BasicTypes_Pkg::L_internal_Type}	Comments: Location with +/- tolerance nominal Comments: Nominal location d_min Comments: Min Location = nominal + d_min (typically < 0) d_max Comments: Max Location = nominal + d_max
odometry_T	{valid : bool, timestamp : Obu_BasicTypes_Pkg::T_internal_Type, odo : Obu_BasicTypes_Pkg::OdometryLocations_T, speed : Obu_BasicTypes_Pkg::OdometrySpeeds_T, acceleration : Obu_BasicTypes_Pkg::A_internal_Type, motionState : Obu_BasicTypes_Pkg::odoMotionState_T, motionDirection : Obu_BasicTypes_Pkg::odoMotionDirection_T}	Comments: Odometry values with time stamp timestamp Comments: time of the odometry stamp [ms] odo Comments: Odometry values speed Comments: speed given by the sensors of the odometer [km/h] acceleration Comments: acceleration provided by the odometer [0.01m/s2] motionState Comments: "Train is in Motion" State motionDirection Comments: "Direction the train is moving"

Name	Definition	Comments and Information
OdometryLocations_T	{o_nominal : Obu_BasicTypes_Pkg::L_internal_Type, o_min : Obu_BasicTypes_Pkg::L_internal_Type, o_max : Obu_BasicTypes_Pkg::L_internal_Type}	Comments: Location information provided by odometry o_nominal Comments: Nominal odometry value o_min Comments: Min. distance = o_min2 - o_min1 o_max Comments: Max distance = o_max2 - o_max1
OdometrySpeeds_T	{v_safeNominal : Obu_BasicTypes_Pkg::V_internal_Type, v_rawNominal : Obu_BasicTypes_Pkg::V_internal_Type, v_lower : Obu_BasicTypes_Pkg::V_internal_Type, v_upper : Obu_BasicTypes_Pkg::V_internal_Type}	Comments: Speed information provided by odometry. The current speed of the train, bounded by the Upper and Lower values. In more details - The upper estimation of the speed - The lower estimation of the speed - The safe nominal estimation of the speed which will be bounded between 98% and 100% of the upper estimation - The raw nominal estimation of the speed which will be bounded between the lower and the upper estimations The speed is always positive, ranging from 0 to 600 km/h [m/s] v_safeNominal Comments: The safe nominal estimation of the speed which will be bounded between 98% and 100% of the upper estimation v_rawNominal Comments: The raw nominal estimation of the speed which will be bounded between the lower and the upper estimations v_lower Comments: The lower estimation of the speed v_upper Comments: The upper estimation of the speed
odoMotionDirection_T	enum {unknownDirection, cabAFirst, cabBFirst}	Comments: Indicates the direction the train is moving. Based on the sensors of the Odometer.
odoMotionState_T	enum {noMotion, Motion}	Comments: Indicates whether from a Train point of View the train is in motion. Based on the sensors of the Odometer.
Speed_T	Obu_BasicTypes_Pkg::V_internal_Type	Comments: General speed type: in km/h.

Name	Definition	Comments and Information
T_internal_Type	int	Comments: Standardized system time type used for all internal time calculations: in ms
V_internal_Type	int	Comments: Standardized speed type used for all internal speed calculations: in km/h

4.1.3.   Constants

Table 263: Public Constants of Obu_BasicTypes_Pkg

Name	Type	Value	Comments and Information
cLocWithInAcc_0	Obu_BasicTypes_Pkg::LocWithInAcc_T	{nominal : 0, d_min : 0, d_max : 0}	
cOdometryInitialValue	Obu_BasicTypes_Pkg::OdometryLocations_T	{o_nominal : 0, o_min : 0, o_max : 0}	Comments: Initial odometry values

5. Project Library: TrainPosition_Types

5.1. TrainPosition_Types_Pck Package

5.1.1.   Comments and Information

TrainPosition_Types_Pck Comments:
This library provides the data type definitions used in train position calculations

Table 264: TrainPosition_Types_Pck Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-06-03
	Version	00.03.00
	to_c	True
Remark_1	Description	Description : Determines the index of BG in BGs - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

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5.1.2.   Types

Table 265: Public Types of TrainPosition_Types_Pck

Name	Definition	Comments and Information
infoFromLinking_T	{valid : bool, nid_bg_fromLinkingBG : NID_BG, nid_c_fromLinkingBG : NID_C, expectedLocation : Obu_BasicTypes_Pkg::LocWithInAcc_T, d_link : Obu_BasicTypes_Pkg::LocWithInAcc_T, linkingInfo : BG_Types_Pkg::LinkedBG_T}	Comments: Describes a linked BG as announced from the linking BG. Mainly, this information is taken from the linking packet. nid_bg_fromLinkingBG Comments: ID of the BG, where the linking information originates from expectedLocation Comments: Location, where the BG is expected to be found, calculated from announced linking distance. d_link Comments: Linking distance with inaccuracies, converted from Q_SCALE, D_LINK, Q_LOCACC of the linking packet. linkingInfo Comments: Linking info as announced from the linking BG, where this BG.
linkedBGs_asPositionedBGs_T	TrainPosition_Types_Pck::positionedBG_T ^BG_Types_Pkg::cMaxNoOfLinkedBGs	Comments: Array of linked balises groups in the format of positioned BGs
positionedBG_T	{valid : bool, nid_c : NID_C, nid_bg : NID_BG, q_link : Q_LINK, location : Obu_BasicTypes_Pkg::LocWithInAcc_T, seqNoOnTrack : int, infoFromLinking : TrainPosition_Types_Pck::infoFromLinking_T, infoFromPassing : BG_Types_Pkg::passedBG_T}	location Comments: The best known location calculated from linking and from passing information seqNoOnTrack Comments: Sequence number: specifies the order of the BG passed or expected to be passed infoFromLinking Comments: If linked, this is the BG info as announced from a linked BG. Most of the data is taken from the linking information. infoFromPassing Comments: If the balise group was passed, this is the relevant information received from the BG.
positionedBGs_T	TrainPosition_Types_Pck::positionedBG_T ^cMaxNoOfStoredBGs	Comments: All balise groups stored for train position calculation

Name	Definition	Comments and Information
positionErrors_T	{outOfMemSpace : bool, passedBG_foundNotWhereExpected : bool, positionCalculation_inconsistent : bool, linkedBGMissed : bool, BGpassedInUnexpectedDirection : bool, BG_LinkingConsistencyError : bool, twoConsecutiveLinkedBGs_missed : bool, doubleRepositioningError : bool, bg : TrainPosition_Types_Pck::positionedBG_T}	outOfMemSpace Comments: Memory overrun: a passed or announced BG could not be stored passedBG_foundNotWhereExpected Comments: The currently passed linked BG location does not match the expectation window positionCalculation_inconsistent Comments: A consistency problem arised during position calculation linkedBGMissed Comments: The expectation window for an announced BG was passed without detecting the BG. BGpassedInUnexpectedDirection Comments: The BG was passed in a different orientation than announced via linking BG_LinkingConsistencyError Comments: Balise group: linking consistency error (ref. 3.16.2.3) twoConsecutiveLinkedBGs_missed Comments: 2 consecutive linked balise groups announced by linking are not detected and the end of the expectation window of the second balise group has been passed (3.16.2.7.1) doubleRepositioningError Comments: Double repositioning error (3.16.2.7.2) bg Comments: The corresponding BG in the case of an error

Name	Definition	Comments and Information
trainPosition_T	{valid : bool, timestamp : Obu_BasicTypes_Pkg::T_internal_Type, trainPositionIsUnknown : bool, noCoordinateSystemHasBeenAssigned : bool, trainPosition : Obu_BasicTypes_Pkg::LocWithInAcc_T, estimatedFrontEndPosition : Obu_BasicTypes_Pkg::Location_T, minSafeFrontEndPosition : Obu_BasicTypes_Pkg::Location_T, maxSafeFrontEndPostion : Obu_BasicTypes_Pkg::Location_T, LRBG : TrainPosition_Types_Pck::positionedBG_T, prvLRBG : TrainPosition_Types_Pck::positionedBG_T, nominalOrReverseToLRBG : Q_DLRBG, trainOrientationToLRBG : Q_DIRLRBG, trainRunningDirectionToLRBG : Q_DIRTRAIN, linkingIsUsedOnboard : bool}	Comments: 3.6.1.3 trainPositionIsUnknown Comments: 3.6.3.1.3.1 noCoordinateSystemHasBeen Assigned Comments: 3.4.2, 3.6.3.1.4: Every balise group has its own co-ordinate system trainPosition Comments: The calculated train position with inaccuracies.# estimatedFrontEndPosition Comments: 3.6.4.4 a): Absolute train front end position since system start minSafeFrontEndPosition Comments: 3.6.4.4 c) :Minimum safe front end position maxSafeFrontEndPostion Comments: 3.6.4.4.b) :Maximum safe front end position LRBG Comments: LRBG = last passed linked balise group prvLRBG Comments: BG passed previously to LRBG nominalOrReverseToLRBG Comments: 7.5.1.106: Q_DLRBG: Qualifier telling on which side of the LRBG the estimated front end is trainOrientationToLRBG Comments: 3.6.1.3: Orientation of the train in relation to the direction of the LRBG trainRunningDirectionToLRBG Comments: 3.6.1.3: Direction of train movement in relation to the LRBG orientation linkingIsUsedOnboard Comments: Designates, if at least one announced linked BG is ahead

Name	Definition	Comments and Information
trainPositionInfo_T	{valid : bool, timestamp : Obu_BasicTypes_Pkg::T_internal_Type, trainPosition : Obu_BasicTypes_Pkg::LocWithInAcc_T, trainPositionDerivedFromLastLinkedBG : Obu_BasicTypes_Pkg::LocWithInAcc_T, trainPositionDerivedFromLastUnlinkedBG : Obu_BasicTypes_Pkg::LocWithInAcc_T, prevPassedLinkedBG : TrainPosition_Types_Pck::positionedBG_T, lastPassedLinkedBG : TrainPosition_Types_Pck::positionedBG_T, lastPassedUnlinkedBG : TrainPosition_Types_Pck::positionedBG_T, speed : Obu_BasicTypes_Pkg::Speed_T, linkingIsUsedOnboard : bool}	trainPosition Comments: The best known train position trainPositionDerivedFromLastLinkedBG Comments: The train position measured by odometry behind the positon of the last passed linked BG trainPositionDerivedFromLastUnlinkedBG Comments: The train position measured by odometry behind the positon of the last passed unlinked BG prevPassedLinkedBG Comments: The previously (before the last passed linked) passed BG lastPassedLinkedBG Comments: The last recently passed linked BG lastPassedUnlinkedBG Comments: The last recently passed unlinked BG speed Comments: Current train speed linkingIsUsedOnboard Comments: 3.4.4.2.1.1: "Linking information is used"
trainProperties_T	{nid_engine : NID_ENGINE, nid_operational : NID_OPERATIONAL, l_train : L_TRAIN, d_baliseAntenna_2_frontend : Obu_BasicTypes_Pkg::LocWithInAcc_T, d_frontend_2_rearend : Obu_BasicTypes_Pkg::LocWithInAcc_T, locationAccuracy_DefaultValue : Obu_BasicTypes_Pkg::LocWithInAcc_T, centerDetectionAcc_DefaultValue : Obu_BasicTypes_Pkg::LocWithInAcc_T}	Comments: Static train properties necessary for train position calculation. nid_engine Comments: 7.5.1.88, Onboard ETCS identity. nid_operational Comments: 7.5.1.92, Train Running Number l_train Comments: 7.5.1.56, train length d_baliseAntenna_2_frontend Comments: Distance from the trains balise antenna to the trains front end. d_frontend_2_rearend Comments: Distance from the trains front end to rear end locationAccuracy_DefaultValue Comments: 3.6.4.3.2 centerDetectionAcc_DefaultValue Comments: Will be applied, if centerDetectionInaccuracy from BTM is not available, especially for announced and not yet passed BGs

5.1.3.   Constants

Table 266: Public Constants of TrainPosition_Types_Pck

Name	Type	Value	Comments and Information
cMaxNoOfStoredBGs	int	2 * BG_Types_Pkg::cMaxNoOfLinkedBGs	Comments: Max. number of balise groups stored for position calculation
cQ_SCALE_10_cm_resolution	Obu_BasicTypes_Pkg::Location_T	10	Comments: 7.5.1.129: Resolution of Q_SCALE::10cm: = 10 cm (Location_Type in cm)
cQ_SCALE_10_m_resolution	Obu_BasicTypes_Pkg::Location_T	1000	Comments: 7.5.1.129: Resolution of Q_SCALE::10 m: = 1000 cm (Location_Type in cm)
cQ_SCALE_1_m_resolution	Obu_BasicTypes_Pkg::Location_T	100	Comments: 7.5.1.129: Resolution of Q_SCALE::1 m: = 100 cm (Location_Type in cm)
cQLOCACC_resolution	Obu_BasicTypes_Pkg::Location_T	100	Comments: 7.5.1.115: Resolution of Q_LOCACC is in m = 100 cm (Location_Type in cm)

6. Project Library: BG_Types

6.1. BG_Types_Pkg Package

6.1.1.   Types

Table 267: Public Types of BG_Types_Pkg

Name	Definition	Comments and Information
BG_Header_T	{valid : bool, q_updown : Q_UPDOWN, m_version : M_VERSION, q_media : Q_MEDIA, n_total : N_TOTAL, m_mcount : M_MCOUNT, nid_c : NID_C, nid_bg : NID_BG, q_link : Q_LINK, bgPosition : Obu_BasicTypes_Pkg::odometry_T, BG_centerDetectionInaccuraccuracies : Obu_BasicTypes_Pkg::LocWithInAcc_T, q_nvlocacc : Q_NVLOCACC, noCoordinateSystemHasBeenAssigned : bool, trainOrientationToBG : Q_DIRLRBG, trainRunningDirectionToBG : Q_DIRTRAIN}	Comments: Common header of the balise group datagram BG_centerDetectionInaccuraccuracies Comments: Location inaccuries caused by the balise group center detection q_nvlocacc Comments: 3.6.4.3.2: Default accuracy of the balise location, specific to each balise and taken from the national values noCoordinateSystemHasBeen Assigned Comments: 3.4.2, 3.6.3.1.4: Every balise group has its own co-ordinate system trainOrientationToBG Comments: 3.6.1.3: Orientation of the train in relation to the direction of the BG trainRunningDirectionToBG Comments: 3.6.1.3: Direction of train movement in relation to the BG orientation
BG_Message_T	{present : bool, Telegrams : BG_Types_Pkg::TelegramArray_T, numberBalises : int, centerOfBalisePosition : BG_Types_Pkg::centerOfBalisePosition_T}	present Comments: indicates whether the bg-message present is. Telegrams Comments: headers of all received telegrams filled up from the start of the array numberBalises Comments: additional packets received with the balises centerOfBalisePosition Comments: position of the balise group as given by the Odometer
BG_Orientation_T	enum {BG_Orientation_Reverse, BG_Orientation_Nominal, BG_Orientation_Unknown}	Comments: gives the orientation of a balise group
centerOfBalisePosition_T	{odometerOfBaliseDetection : Obu_BasicTypes_Pkg::odometry_T, BG_centerDetectionInaccuraccuracies : Obu_BasicTypes_Pkg::LocWithInAcc_T}	Comments: Gives the information for location and accuracy of measurements odometerOfBaliseDetection Comments: Location BG_centerDetectionInaccuraccuracies Comments: Location inaccuries caused by the balise group center detection

Name	Definition	Comments and Information
LinkedBG_T	{valid : bool, nid_LRBG : NID_LRBG, q_dir : Q_DIR, q_scale : Q_SCALE, d_link : D_LINK, q_newcountry : Q_NEWCOUNTRY, nid_c : NID_C, nid_bg : NID_BG, q_linkorientation : Q_LINKORIENTATION, q_linkreaction : Q_LINKREACTION, q_locacc : Q_LOCACC}	Comments: 7.4.2.2: Single, but complete, element from LinkingPacket_Type valid Comments: This element has valid data nid_LRBG Comments: 8.4.4.6.1: ID of the reference LRBG (refers to radio message) q_dir Comments: Validity direction of transmitted data with reference to directionality of the balise group sending the information or to directionality of the LRBG q_scale Comments: 7.5.1.129: Qualifier for the distance scale: 10 cm, 1 m, 10 m d_link Comments: 7.5.1.10: Incremental linking distance to next linked balise group q_newcountry Comments: 7.5.1.121: New Country Qualifier nid_c Comments: 7.5.1.86: Identity number of the country or region nid_bg Comments: 7.5.1.85: Identity number of the balise group Identity number of a balise group or loop within the country or region defined by NID_C q_linkorientation Comments: 7.5.1.116: Qualifier for the direction of the linked balise group: Indicates whether the linked balise group will be overpassed by the train in nominal or reverse direction. q_linkreaction Comments: 7.5.1.117: Qualifier for the reaction to be performed if a linking or a balise group message consistency problem occurs with the balise group linked to q_locacc Comments: 7.5.1.115: defines the absolute value of the accuracy of the Balise location (max +/- 63 m)
LinkedBGs_T	BG_Types_Pkg::LinkedBG_T ^cMaxNoOfLinkedBGs	Comments: Array of linked balise groups. This array replaces the linking packet (TrackToTrain::Linking)

Name	Definition	Comments and Information
ModeAndLevelStatus_T	{m_mode : M_MODE, m_level : M_LEVEL, m_leveltr : M_LEVELTR}	Comments: !! Change Name and Type name (Christian)--> This type is only temporary. Proper solution needs split and new definition. m_mode Comments: Mode of train m_level Comments: Level of train m_leveltr Comments: level transition
NID_ERRORBG	int	Comments: Id if an balise group which was passed with errors (for JRU, subset 27 section 4.2.4.12) Special Value: 16383 (unknown balise group)
passedBG_T	{valid : bool, BG_Header : BG_Types_Pkg::BG_Header_T, linkedBGs : BG_Types_Pkg::LinkedBGs_T}	Comments: Information reveived from a BG passede BG_Header Comments: Common header of the balise group datagram linkedBGs Comments: The linked balise groups announced from this BG.
RBCOrientationReport_T	{assignment_of_coordinate_system : Radio_TrackToTrain::Assignment_of_coordinate_system}	Comments: !! Check: Usecase
RBCReport_T	{train_position_report : Radio_TrainToTrack::Train_Position_Report}	Comments: !! Check: Usecase
Telegram_T	{valid : bool, checkResult : bool, telegramheader : BG_Types_Pkg::TelegramHeader_T, packets : Common_Types_Pkg::CompressedPackets_T}	Comments: 8.4.2: Structure of a telegram in the balise group channel. valid Comments: The element has valid data checkResult Comments: Result generated by the API on the success of the decoding of the telegram. True: teegram decoded without errors False errors recognised when decoding the telegram. The decoding routine performs checks on bit level on all relevant parameters. telegramheader Comments: Information received from the balise packets Comments: Packets received via the balises
TelegramArray_T	BG_Types_Pkg::Telegram_T ^cMaxNoBalises	Comments: Array of Telegrams making a Balise Group (for check)

Name	Definition	Comments and Information

TelegramHeader_T	{q_updown : Q_UPDOWN, m_version : M_VERSION, q_media : Q_MEDIA, n_pig : N_PIG, n_total : N_TOTAL, m_dup : M_DUP, m_mcount : M_MCOUNT, nid_c : NID_C, nid_bg : NID_BG, q_link : Q_LINK}	Comments:
		8.4.2.1: The Balise Telegram Header
		This structure is not "packed" to bit boundaries
		q_updown Comments:
		7.5.1.142: Balise telegram transmission direction
		m_version Comments:
		7.5.1.79: Version of ETCS system
		q_media Comments:
		7.5.1.119: Qualifier to indicate the type of media, i.e.,
		   0 Balise
		   1 Loop
		n_pig Comments:
		7.5.1.81: Defines the relative position in a balise group
		n_total Comments:
		7.5.1.82: Total number of balise(s) in the group, i.e.,
		   0 --> 1 balise in the group
		   7 --> 8 balises in the group
		m_dup Comments:
		7.5.1.63: Duplicate balise, Flags to tell whether the balise is a duplicate of one of the adjacent balises.
		m_mcount Comments:
		7.5.1.71: Message counter, The purpose of this counter is to make it possible for the ERTMS/ETCS on-board to detect which balise group message the telegram belongs to.
		nid_c Comments:
		7.5.1.86: Identity number of the country or region
		nid_bg Comments:
		7.5.1.85: Identity number of the balise group
		Identity number of a balise group or loop within the country or region defined by NID_C
		q_link Comments:
		7.5.1.114: Link Qualifier
		This qualifier is used to mark a balise group as linked or unlinked.

TrainToTrackStatus_T	{nid_ntc : NID_NTC, q_length : Q_LENGTH}	Comments: !! Change Name and Type name (Christian)--> This type is only temporary. Proper solution needs split and new definition. nid_ntc Comments: national system id : where does the type result from q_length Comments: qualifier for train integrity status: woher?

6.1.2.   Constants

Table 268: Public Constants of BG_Types_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
		{valid : false, checkResult : false, telegramheader : {q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_pig : N_PIG_I_am_the_1st, n_total : N_TOTAL_1_balise_in_the_group, m_dup : M_DUP_No_duplicates, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked}, packets : {PacketHeaders : [{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0},	

Name	Type	Value	Comments and Information
cEmptyBG_Header	BG_Types_Pkg::BG_Header_T	{valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetectionInaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, noCoordinateSystemHasBeenAssigned : false, trainOrientationToBG : Q_DIRLRBG_Reverse, trainRunningDirectionToBG : Q_DIRTRAIN_Reverse}	

Name	Type	Value	Comments and Information
		{present : false, Telegrams : [{valid : false, checkResult : false, telegramheader : {q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_pig : N_PIG_I_am_the_1st, n_total : N_TOTAL_1_balise_in_the_group, m_dup : M_DUP_No_duplicates, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked}, packets : {PacketHeaders : [{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false,	

Name	Type	Value	Comments and Information
cEmptyHeader	BG_Types_Pkg::TelegramHeader_T	{q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_pig : N_PIG_I_am_the_1st, n_total : N_TOTAL_1_balise_in_the_group, m_dup : M_DUP_No_duplicates, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked}	Comments: empty telegram header
cEmptyLinking	BG_Types_Pkg::LinkedBG_T	{valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}	

Name	Type	Value	Comments and Information
cEmptyLinkings	BG_Types_Pkg::LinkedBGs_T	[{valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}, {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}, {valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg : 0, q_linkorientation : Q_LINKORIENTATION_The_balise_group_is_seen_by_the_train_in_reverse_direction, q_linkreaction : Q_LINKREACTION_Train_trip, q_locacc : 0}, {valid : false, nid_LRBG : 0, q_dir	

Name	Type	Value	Comments and Information
		{valid : false, BG_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetectionInaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, noCoordinateSystemHasBeenAssigned : false, trainOrientationToBG : Q_DIRLRBG_Reverse, trainRunningDirectionToBG : Q_DIRTRAIN_Reverse}, linkedBGs : [{valid : false, nid_LRBG : 0, q_dir : Q_DIR_Reverse, q_scale : Q_SCALE_10_cm_scale, d_link : 0, q_newcountry : Q_NEWCOUNTRY_Same_country__or__railway_administration_no_NID_C_follows, nid_c : 0, nid_bg q_linkorientation : Q_LINKORIENTATION_The_balise_grou	

Name	Type	Value	Comments and Information
cemptyPosition	BG_Types_Pkg::centerOfBalisePosition_T	{odometerOfBalise Detection : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}}	Comments: empty Balise Position

Name	Type	Value	Comments and Information
		[{valid : false, checkResult : false, telegramheader : {q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_pig : N_PIG_I_am_the_1st, n_total : N_TOTAL_1_balise_in_the_group, m_dup : M_DUP_No_duplicates, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked}, packets : {PacketHeaders : [{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0},	

Name	Type	Value	Comments and Information
cInitOrientation	Q_DIRTRAIN	Q_DIRTRAIN_Unknown	Comments: Default Orientation
cInvalidIndex	int	-1	
cMaxDistanceBalisesInGroup	Obu_BasicTypes_Pkg::OdometryLocations_T	{o_nominal : 1200, o_min : 1200, o_max : 1200}	Comments: Maximum distance between balises within a group: Subset 40 section 4.1.1.2
cMaxListBGs	int	20	Comments: Maximum Number of Balises
cMaxNoBalises	int	8	Comments: Max. number of balises in a balise group
cMaxNoOfLevelTransitionOrders	int	4	Comments: Max. number = 31
cMaxNoOfLinkedBGs	int	4	Comments: Max. number of linked balise groups announced by a BG (arbitrary value); Must be 33, but set to 4 to ease debugging !!!
cNID_BG_unknown	NID_BG	16383	Comments: type NID_BG = int /* MinVal = 0, MaxVal = 16382 */ -- 16383 = Identity_is_unknown_(only_to_be_used_for_Linking_information)
cNID_LRBG_14Bits_Multiplicator	int	16384	Comments: 16384: Serves to calculate NID_LRBG = 16384 * NID_C + NID_BG
cNID_LRBG_unknown	NID_LRBG	16777215	Comments: type NID_LRBG = int -- 16777215 = Unknown
cUnknownBG	int	16383	Comments: The balise is unknown

6.2. Common_Types_Pkg Package

6.2.1.   Types

Table 269: Public Types of Common_Types_Pkg

Name	Definition	Comments and Information
CompressedHeaders_T	int ^cDIM_MaxRMessages	Comments: Array of metadata for the messages
CompressedPacketData_T	int ^cDIM_MaxDataElementsInRMessage	Comments: packets received. If packets for "bothdirections" are processed both variables for the packets are in use. The packet-selection is limited to the Utrecht-Amsterdam-scenario

Name	Definition	Comments and Information
CompressedPackets_T	{PacketHeaders : Common_Types_Pkg::Metadata_T, PacketData : Common_Types_Pkg::CompressedPacketData_T}	Comments: Definition for handling generic data interfaces
filterRelatedEvents_T	{pendingL1Transition : bool, pendingL12L3Transition : bool, pendingAckOfTrainDataFromRBC : bool, emergencyStopAccepted : bool, lastAckTextMessageId : int, pendingNTCTransition : bool, SPPAndGradientOnBoard : bool, MACoverNotFullLength : bool}	Comments: In this type a set of track related states of the system. The types are mainly related to Information Filter Conditions. pendingL1Transition Comments: Indication if an announced LEVEL 1 transition is present. Used for Level Filter exception [1]. pendingL12L3Transition Comments: Indication if an announced LEVEL 2 or LEVEL 3 transition is present. Used for Level Filter exception [2] pendingAckOfTrainDataFrom RBC Comments: Indicate if the acknowledgement of train data is pending. Used for Level Filter exception [3]. emergencyStopAccepted Comments: Indicate if the train performs an emergency brake. Used for Level Filter exception [5]. lastAckTextMessageId Comments: The ID of the last acknowleged text message ID. Used for Level Filter exception [12]. pendingNTCTransition Comments: Indication if an announced LEVEL NTC transition is present. Used for Level Filter exception [6,7]. SPPAndGradientOnBoard Comments: Speed Profile and Gradient Profile received and available on board MACoverNotFullLength Comments: MA does not cover full length of the trip
Metadata_T	Common_Types_Pkg::MetadataElement_T ^cMetadataArraySize	Comments: Stores the metadata about packets. 26 = 2*13 = max packet number in scenario * 2 directions

Name	Definition	Comments and Information
MetadataElement_T	{nid_packet : NID_PACKET, q_dir : Q_DIR, valid : bool, startAddress : int, endAddress : int}	Comments: Used to store generic metadata about a packet nid_packet Comments: Packet number q_dir Comments: Direction valid Comments: True, if the data of this packet is valid. startAddress Comments: Start address of packet in generic packet array endAddress Comments: End address of packet in generic packet array
MSG_Errors_T	{linkedBGError : bool, unlinkedBGError : bool, BG_versionIncompatible : bool, radioSequenceError : bool, tNvContactError : bool, otherTimingError : bool, radioMessageConsistencyError : bool, nid_c : NID_C, nid_errorbg : BG_Types_Pkg::NID_ERRORBG}	Comments: Error flags for errors reported at the check procedures at messages linkedBGError Comments: Error in a linked BGH - Message has been detected. unlinkedBGError Comments: Error in an Unlinked Balise Group has been detected. BG_versionIncompatible Comments: Version of received Balises is not compliant with the train. Balises cannot be used radioSequenceError Comments: The sequence of messages in the input channel is not correct radioMessageConsistencyError Comments: An incomplete mesage has been received (missing packets or information). nid_c Comments: Country code of the balise group with errors. nid_errorbg Comments: Balise group id of the balise group with errors.
MsgSource_T	enum {msrc_undefined, msrc_Euroradio, msrc_Eurobalise, msrc_RadioInfillUnit, msrc_OBU}	Comments: Source of the message msrc_Euroradio Comments: The message is a Euroradio-message msrc_Eurobalise Comments: The message is a Eurobalise-message

Name	Definition	Comments and Information
outPackets_T	{p0 : Packet_TrainTypes_Pkg::PT0_Position Report_T, p1 : Packet_TrainTypes_Pkg::PT1_Position Report_2BG_T, p3 : Packet_TrainTypes_Pkg::PT3_Onboar dTelephoneNumbers_T, p4 : Packet_TrainTypes_Pkg::PT4_ErrorRe porting_T, p5 : Packet_TrainTypes_Pkg::PT5_TrainRu nningNumber, p9 : Packet_TrainTypes_Pkg::PT9_Level23 _TransitionInformation_T, p11 : Packet_TrainTypes_Pkg::PT11_Validat edTrainData_T}	
PositionReportParamet er_T	{present : bool, nidBG : NID_BG, bgLocation : Obu_BasicTypes_Pkg::Location_T, packet58 : Packet_Types_Pkg::P58_PositionRepo rtParameters_T, sendingRBC : Common_Types_Pkg::RBC_Id_T}	nidBG Comments: BG that has been sent Packet58 or, in case Packet58 has been sent by the RBC, the reference BG bgLocation Comments: location of the BG sendingRBC Comments: Information defing the RBC which was sending the information
radioManagementMess age_T	{valid : bool, messageSource : Common_Types_Pkg::MsgSource_T, Radio_Common_Header : Radio_Types_Pkg::Radio_TrackTrain_ Header_T, p42 : Packet_Types_Pkg::P42_SessionMana gement_T, p45 : Packet_Types_Pkg::P45_RadioNetwor kRegistration_T, sendingRBC : Common_Types_Pkg::RBC_Id_T}	Comments: This type collects packets and messages dedicated for sesto Radio Management Inputs. valid Comments: Valid Indicator messageSource Comments: Source of this message Radio_Common_Header Comments: Header of Euroradio message p42 Comments: Radio Session Mangement Packet p45 Comments: Radio Network Registration Packet sendingRBC Comments: Information defing the RBC which was sending the information
RadioMetadata_T	{t_train_reference : bool, nid_em : bool, q_scale : bool, d_sr : bool, t_sh_rqst : bool, d_ref : bool, q_dir : bool, d_emergencystop : bool, m_version : bool}	Comments: In Radiomessages some variables are mandatory. This structure states if the variable is present (set in the bitstream). If the variable is present, the respective entry is set to true. t_train_reference Comments: T_TRAIN reference in message no 8

Name	Definition	Comments and Information
RBC_Id_T	{valid : bool, nid_c : NID_C, rbc_id : NID_RBC, device_id : int}	Comments: Identifies the RBC valid Comments: Valid Indicator nid_c Comments: Country Code of the RBC rbc_id Comments: Id of the RBC device_id Comments: Id of the device connected to the radio interface
ReceivedMessage_T	{valid : bool, source : Common_Types_Pkg::MsgSource_T, radioMetadata : Common_Types_Pkg::RadioMetadata_T, BG_Common_Header : BG_Types_Pkg::BG_Header_T, Radio_Common_Header : Radio_Types_Pkg::Radio_TrackTrain_Header_T, packets : Common_Types_Pkg::CompressedPackets_T, sendingRBC : Common_Types_Pkg::RBC_Id_T}	Comments: Common message type, which supports both Eurobalise and Euroradio-messages valid Comments: True, if all data in the message is valid source Comments: Source of the message: Euroradio or Eurobalise radioMetadata Comments: Only to be set in radio-messages: Which mandatory variables are set to a value? BG_Common_Header Comments: Header of Eurobalise message Radio_Common_Header Comments: Header of Euroradio message packets Comments: Packet Information. To access functions of the TrackMessages package are mandatory. sendingRBC Comments: Information defing the RBC which was sending the information
TrackSide_Errors_T	{applyServiceBrake : bool, badBaliseMessageToDMI : bool, errorLinkedBG : bool, errorUnlinkedBG : bool, radioSequenceError : bool, radioMessageConsistencyError : bool, nid_c : NID_C, nid_errorbg : BG_Types_Pkg::NID_ERRORBG}	Comments: Errors resulting from Trackside message checks nid_c Comments: Code of the balise group where the error has been recognised nid_errorbg Comments: id of the balise group where the error has been recognised
TrackSide_ForCheck_T	{valid : bool, systemTime : Obu_BasicTypes_Pkg::T_internal_Type, msg_type : Common_Types_Pkg::MsgSource_T, telegramHeaders : BG_Types_Pkg::BG_Message_T, radio_Msg : Radio_Types_Pkg::RadioMessage_T}	Comments: This type is used for the interface between buildBG and check systemTime Comments: Indicates the time the message had been received in the train.

6.2.2.   Constants

Table 270: Public Constants of Common_Types_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
		{valid : false, source : msrc_undefined, radioMetadata : {t_train_reference : false, nid_em : false, q_scale : false, d_sr : false, t_sh_rqst : false, d_ref : false, q_dir : false, d_emergencystop : false, m_version : false}, BG_Common_Header : {valid : false, q_updown : Q_UPDOWN_Down_link_telegram, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS, q_media : Q_MEDIA_Balise, n_total : N_TOTAL_1_balise_in_the_group, m_mcount : 0, nid_c : 0, nid_bg : 0, q_link : Q_LINK_Unlinked, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : {v_safeNominal : 0, v_rawNominal : 0, v_lower : 0, v_upper : 0}, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetectionInaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, noCoordinateSystemHasBeenAssigned : false, trainOrientationToBG : Q_DIRLRBG_Reverse, trainRunningDirectionToBG : Q_DIRTRAIN_Reverse}, Radio_Common_Header : {radioDevice : 0,	

Name	Type	Value	Comments and Information
cDIM_MaxDataElementsInRMessage	int	500	
cDIM_MaxRMessages	int	30	

Name	Type	Value	Comments and Information
		[{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir :	

Name	Type	Value	Comments and Information
cemptyMT	Common_Types_Pkg::MetadataElement_T	{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}	

Name	Type	Value	Comments and Information
cEmptyPackets	Common_Types_Pkg::CompressedPacketData_T	[0, 0]	

Name	Type	Value	Comments and Information
cMetadataArraySize	int	cDIM_MaxRMessages	
cNidPacketInvalid	NID_PACKET	-1	
cNoErrors	Common_Types_Pkg::MSG_Errors_T	{linkedBGError : false, unlinkedBGError : false, BG_versionIncompatible : false, radioSequenceError : false, tNvContactError : false, otherTimingError : false, radioMessageConsistencyError : false, nid_c : 0, nid_errorbg : 0}	
cNoFilterEvents	Common_Types_Pkg::filterRelatedEvents_T	{pendingL1Transition : false, pendingL12L3Transition : false, pendingAckOfTrainDataFromRBC : false, emergencyStopAccepted : false, lastAckTextMessageId : 0, pendingNTCTransition : false, SPPAndGradientOnBoard : false, MACoverNotFullLength : false}	
cNoMetaDataElement	Common_Types_Pkg::MetadataElement_T	{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}	

6.3. Id_Pkg Package

6.3.1.   Constants

Table 271: Public Constants of Id_Pkg

Name	Type	Value	Comments and Information
cm02_SR_Authorization	NID_MESSAGE	2	
cm03_Movement_Authority	NID_MESSAGE	3	
cm06_Recognition_Of_Exit_From_Trip_Mode	NID_MESSAGE	6	
cm08_Acknowledgement_of_Train_Data	NID_MESSAGE	8	

Name	Type	Value	Comments and Information
cm09_Request_To_Shorten_MA	NID_MESSAGE	9	
cm15_Conditional_Emergency_Stop	NID_MESSAGE	15	
cm16_Unconditional_Emergency_Stop	NID_MESSAGE	16	
cm18_Revocation_of_Emergency_Stop	NID_MESSAGE	18	
cm24_General_Message	NID_MESSAGE	24	
cm27_SH_Refused	NID_MESSAGE	27	
cm28_SH_Authorised	NID_MESSAGE	28	
cm32_RBC_RIU_System_Version	NID_MESSAGE	32	
cm33_MA_with_Shifted_Location_Reference	NID_MESSAGE	33	
cm38_Initiation_of_a_Communication_Session	NID_MESSAGE	38	
cm39_Acknowledgement_of_termination_of_a_communication_session	NID_MESSAGE	39	
cm41_Train_Accepted	NID_MESSAGE	41	
co129_Validated_Train_Data	NID_MESSAGE	129	
co132_MA_Request	NID_MESSAGE	132	
co136_Train_Position_Report	NID_MESSAGE	136	
co146_Acknowledgement	NID_MESSAGE	146	
co147_Acknowledgement_of_Emergency_Stop	NID_MESSAGE	147	
co150_End_of_Mission	NID_MESSAGE	150	
co154_No_Compatible_Version_Support	NID_MESSAGE	154	
co155_Initiation_of_a_communication_session	NID_MESSAGE	155	
co156_Termination_of_a_communication_session	NID_MESSAGE	156	
co159_Session_established	NID_MESSAGE	159	
cp003_NationalValues	NID_PACKET	3	
cp005_linking	NID_PACKET	5	
cp042_Session_Management	NID_PACKET	42	
cp045_Radio_Network_registration	NID_PACKET	45	
cp058_Position_Report_Parameters	NID_PACKET	58	

6.4. Packet_TrainTypes_Pkg Package

6.4.1.   Types

Table 272: Public Types of Packet_TrainTypes_Pkg

Name	Definition	Comments and Information
aNID_NTC_T	NID_NTC ^cMaxNationalSystem	
aNID_RADIO_T	Packet_TrainTypes_Pkg::sNID_RADIO_T ^cmaxNumberTelephoneNumbers	
aTractionIdentity_T	Packet_TrainTypes_Pkg::sTractionIdentity_T ^cMaxTractionIdentity	
PT0_PositionReport_T	{valid : bool, packet0 : TrainToTrack::Position_Report}	Comments: Adding a valid flag to Packet 0
PT11_ValidatedTrainData_T	{valid : bool, NC_CDTRAIN : NC_CDTRAIN, NC_TRAIN : NC_TRAIN, l_train : Obu_BasicTypes_Pkg::L_internal_Type, v_maxtrain : Obu_BasicTypes_Pkg::V_internal_Type, m_loadinggoage : M_LOADINGGAUGE, m_axleloadcat : M_AXLELOADCAT, m_airtight : M_AIRTIGHT, n_axle : N_AXLE, nIter_tractionIdentity : int, tractionIdentity : Packet_TrainTypes_Pkg::aTractionIdentity_T, nIter_ntc : int, nid_ntc : Packet_TrainTypes_Pkg::aNID_NTC_T}	valid Comments: packet is present
PT1_PositionReport_2BG_T	{valid : bool, packet1 : TrainToTrack::Position_Report_based_on_two_balise_groups}	Comments: Adding a valid flag to packet 1.
PT3_OnboardTelephoneNumbers_T	{valid : bool, number : int, aNID_RADIO : Packet_TrainTypes_Pkg::aNID_RADIO_T}	valid Comments: packet is present number Comments: givs the number of telephone numbers in the onboard telefone number list aNID_RADIO Comments: List of telephone numbers
PT4_ErrorReporting_T	{valid : bool, M_ERROR : M_ERROR}	Comments: Adding a valid flag to packet 4.
PT5_TrainRunningNumber	{valid : bool, TrainRunningNumber : NID_OPERATIONAL}	Comments: Adding a valid flag to packet 5.
PT9_Level23_TransitionInformation_T	{valid : bool, transitionInformation : NID_LTRBG}	Comments: Adding a valid flag to Packet 0 transitionInformation Comments: 7.4.3.4.2 Packet Number 9: Level 2/3 transition information
sNID_RADIO_T	{valid : bool, telephoneNumber : Packet_TrainTypes_Pkg::telephoneNumber_T}	
sTractionIdentity_T	{m_voltage : M_VOLTAGE, nid_ctraction : NID_CTRACTION}	

Name	Definition	Comments and Information
telephoneNumber_T	Obu_BasicTypes_Pkg::BCD_T ^cDigitsInTelephoneNumber	Comments: 7.5.1.95: Radio subscriber number. The number is to be entered "left adjusted" starting with the first digit to be dialled. Padding by the special value F shall be added after the least significant digit of the number.

6.4.2.   Constants

Table 273: Public Constants of Packet_TrainTypes_Pkg

Name	Type	Value	Comments and Information
cDigitsInTelephoneNumber	int	15	
cIterPacket58	int	2	Comments: value is bound to 32
cMaxNationalSystem	int	3	
cmaxNumberTelephoneNumbers	int	1	Comments: Size needs verification
cMaxTractionIdentity	int	3	Comments: Size reduced for testing
cNoNTC	Packet_TrainTypes_Pkg::aNID_NTC_T	[0, 0, 0]	Comments: empty ntc list
cNoTractionSystems	Packet_TrainTypes_Pkg::aTractionIdentity_T	[{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}]	Comments: empty list of traction systems

6.5. Packet_Types_Pkg Package

6.5.1.   Types

Table 274: Public Types of Packet_Types_Pkg

Name	Definition	Comments and Information
axleload_T	{valid : bool, m_axleloadcat : M_AXLELOADCAT, v_axleload : V_AXLELOAD}	Comments: N_ITER-helper-type
axleloadArray_T	Packet_Types_Pkg::axleload_T ^3	Comments: Subset 040 4.3.2.1.1 p)
Diff_T	{valid : bool, q_diff : Q_DIFF, nc_cddiff : NC_CDDIFF, nc_diff : NC_DIFF, v_diff : V_DIFF}	Comments: N_ITER-helper-type

Name	Definition	Comments and Information
DiffArray_T	Packet_Types_Pkg::Diff_T ^cNIterMax	Comments: N_ITER-helper-type
IterPacket58_T	{d_loc : D_LOC, q_lgtloc : Q_LGTLOC}	d_loc Comments: Incremental distance between locations where the train has to report its position (7.5.1.11) q_lgtloc Comments: Qualifier for the specified report location (7.5.1.113)
IterPacket58List_T	Packet_Types_Pkg::IterPacket58_T ^cIterPacket58	
nidC_T	{valid : bool, nid_c : NID_C}	Comments: N_ITER-helper-type
nidCArray_T	Packet_Types_Pkg::nidC_T ^cNIterMax	Comments: N_ITER-helper-type
nvkrint_T	{valid : bool, l_nvkrint : L_NVKRINT, m_nvkrint : M_NVKRINT}	Comments: N_ITER-helper-type
nvkrintArray_T	Packet_Types_Pkg::nvkrint_T ^cNIterMax	Comments: N_ITER-helper-type
nvkvint_T	{valid : bool, v_nvkvint : V_NVKVINT, m_nvkvint12 : M_NVKVINT, m_nvkvint23 : M_NVKVINT}	Comments: N_ITER-helper-type m_nvkvint12 Comments: Valid between V_NVKVINT(n) and V_NVKVINT(n+1) If Q_NVKVINTSET = 1, gives the correction factor if maximum emergency brake deceleration is lower than A_NVP12 m_nvkvint23 Comments: Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT(n) and V_NVKVINT(n+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23
nvkvintArray_T	Packet_Types_Pkg::nvkvint_T ^cNIterMax	Comments: N_ITER-helper-type
nvkvintset_T	{valid : bool, q_nvkvintset : Q_NVKVINTSET, a_nvp12 : A_NVP12, a_nvp23 : A_NVP23, nvkintArray : Packet_Types_Pkg::nvkvintArray_T}	Comments: N_ITER-helper-type nvkintArray Comments: Only if Q_NVKVINTSET = 1 Valid between V_NVKVINT(n) and V_NVKVINT(n+1) Gives the correction factor if maximum emergency brake deceleration is higher than A_NVP23 / N_ITER(k) variable: m
nvkvintsetArray_T	Packet_Types_Pkg::nvkvintset_T ^cNIterMax	Comments: N_ITER-helper-type
P12_Level1MovementAuthorities_T	Packet_Types_Pkg::P12_Level1MovementAuthority_T ^cNIterMaxMA	Comments: Packet number 12 iterations / Dimensioning: Subset 040 4.3.2.1.1 a)

Name	Definition	Comments and Information
P12_Level1MovementAuthority_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, v_main : V_MAIN, v_loa : V_LOA, t_loa : T_LOA, l_section : L_SECTION, q_sectiontimer_k : Q_SECTIONTIMER, t_sectiontimer_k : T_SECTIONTIMER, d_sectiontimerstoploc_k : D_SECTIONTIMERSTOPLOC, l_endsection : L_ENDSECTION, q_sectiontimer : Q_SECTIONTIMER, t_sectiontimer : T_SECTIONTIMER, d_sectiontimerstoploc : D_SECTIONTIMERSTOPLOC, q_endtimer : Q_ENDTIMER, t_endtimer : T_ENDTIMER, d_endtimerstartloc : D_ENDTIMERSTARTLOC, q_dangerpoint : Q_DANGERPOINT, d_dp : D_DP, v_releasedp : V_RELEASEDP, q_overlap : Q_OVERLAP, d_startol : D_STARTOL, t_ol : T_OL, d_ol : D_OL, v_releaseol : V_RELEASEOL}	Comments: Packet number 12: 7.4.2.3
P131_RBCTransitionOrder_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_rbctr : D_RBCTR, nid_c : NID_C, nid_rbc : NID_RBC, nid_radio : NID_RADIO, q_sleepsession : Q_SLEEPSESSION}	Comments: Packet number 131: 7.4.2.27
P135_StopShuntingOnDeskOpening_T	{valid : bool, q_dir : Q_DIR}	Comments: Packet number 135 7.4.2.32
P137_StopIfInStaffResponsible_T	{valid : bool, q_dir : Q_DIR, q_srstop : Q_SRSTOP}	Comments: Packet number 137: 7.4.2.33
P138_ReversingAreaInformation_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_startreverse : D_STARTREVERSE, l_reversearea : L_REVERSEAREA}	Comments: Packet number 138: 7.4.2.34
P139_ReversingSupervisionInformation_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_reverse : D_REVERSE, v_reverse : V_REVERSE}	Comments: Packet number 139: 7.4.2.35
P140_TrainRunningNumberFromRBC_T	{valid : bool, q_dir : Q_DIR, nid_operational : NID_OPERATIONAL}	Comments: Packet number 140: 7.4.2.36
P15_Level23MovementAuthorities_T	Packet_Types_Pkg::P15_Level23MovementAuthority_T ^cNIterMaxMA	Comments: Packet number 15 iterations / Dimensioning: Subset 040 4.3.2.1.1 a)

Name	Definition	Comments and Information
P15_Level23Movement Authority_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, v_loa : V_LOA, t_loa : T_LOA, l_section : L_SECTION, q_sectiontimer_k : Q_SECTIONTIMER, t_sectiontimer_k : T_SECTIONTIMER, d_sectiontimerstoploc_k : D_SECTIONTIMERSTOPLOC, l_endsection : L_ENDSECTION, q_sectiontimer : Q_SECTIONTIMER, t_sectiontimer : T_SECTIONTIMER, d_sectiontimerstoploc : D_SECTIONTIMERSTOPLOC, q_endtimer : Q_ENDTIMER, t_endtimer : T_ENDTIMER, d_endtimerstartloc : D_ENDTIMERSTARTLOC, q_dangerpoint : Q_DANGERPOINT, d_dp : D_DP, v_releasedp : V_RELEASEDP, q_overlap : Q_OVERLAP, d_startol : D_STARTOL, t_ol : T_OL, d_ol : D_OL, v_releaseol : V_RELEASEOL}	Comments: Packet number 15: 7.4.2.4
P21_GradientProfile_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_gradient : D_GRADIENT, q_gdir : Q_GDIR, g_a : G_A}	Comments: Packet number 21: 7.4.2.6
P21_GradientProfiles_T	Packet_Types_Pkg::P21_GradientProfile_T ^cNIterMax	Comments: Packet number 21 iterations
P255_EndOfInformation_T	{valid : bool, nid_packet : NID_PACKET}	Comments: Packet number 255: 7.4.4.1
P27_InternationalStatic SpeedProfile_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_static : D_STATIC, v_static : V_STATIC, q_front : Q_FRONT, diffArray : Packet_Types_Pkg::DiffArray_T, SSPArray : Packet_Types_Pkg::SSPArray_T}	Comments: Packet number 27: 7.4.2.7 / Special implementation, see comments diffArray Comments: Iterations are stored inline in arrays. N_ITER variable n SSPArray Comments: Iterations are stored inline in arrays. N_ITER variable k
P39_TrackConditionCh angeOfTractionSystem _T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_traction : D_TRACTION, m_voltage : M_VOLTAGE, nid_ctraction : NID_CTRACTION}	Comments: Packet number 39: 7.4.2.8

Name	Definition	Comments and Information
P3_NationalValues_T	{valid : bool, q_dir : Q_DIR, d_validnv : D_VALIDNV, nid_cArray : Packet_Types_Pkg::nidCArray_T, v_nvshunt : V_NVSHUNT, v_nvstff : V_NVSTFF, v_nvonsight : V_NVONSIGHT, v_nvlimsuperv : V_NVLIMSUPERV, v_nvunfit : V_NVUNFIT, v_nvrel : V_NVREL, d_nvroll : D_NVROLL, q_nvsbtsmperm : Q_NVSBTSMPERM, q_nvemrrls : Q_NVEMRRLS, q_nvguiperm : Q_NVGUIPERM, q_nvsbfbperm : Q_NVSBFBPERM, q_nvinhsmicperm : Q_NVINHSMICPERM, v_nvallowovtrp : V_NVALLOWOVTRP, v_nvsupovtrp : V_NVSUPOVTRP, d_nvovtrp : D_NVOVTRP, t_nvovtrp : T_NVOVTRP, d_nvpotrp : D_NVPOTRP, m_nvcontact : M_NVCONTACT, t_nvcontact : T_NVCONTACT, m_nvderun : M_NVDERUN, d_nvstff : D_NVSTFF, q_nvdriver_adhes : Q_NVDRIVER_ADHES, a_nvmaxredadh1 : A_NVMAXREDADH1, a_nvmaxredadh2 : A_NVMAXREDADH2, a_nvmaxredadh3 : A_NVMAXREDADH3, q_nvlocacc : Q_NVLOCACC, m_nvavadh : M_NVAVADH, m_nvebcl : M_NVEBCL, q_nvkint : Q_NVKINT, nvkvintsetArray : Packet_Types_Pkg::nvkvintsetArray_T, nvkrintArray : Packet_Types_Pkg::nvkrintArray_T, m_nvktint : M_NVKTINT}	Comments: Packet number 3: 7.4.2.1.1 / Special implementation, see comments nid_cArray Comments: Inline-Array of N_ITER-iteration, N_ITER variable k nvkvintsetArray Comments: Inline-Array of N_ITER-iteration, N_ITER variable n nvkrintArray Comments: Inline-Array of N_ITER-iteration, N_ITER variable l
P40_TrackConditionChangeOfAllowedCurrentConsumption_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_current : D_CURRENT, m_current : M_CURRENT}	Comments: Packet number 40: 7.4.2.8.1
P41_LevelTransistionOrders_T	Packet_Types_Pkg::P41_LevelTransitionOrder_T ^cNIterMax	Comments: Packet number 41 iterations
P41_LevelTransitionOrder_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_leveltr : D_LEVELTR, m_leveltr : M_LEVELTR, nid_ntc : NID_NTC, l_ackleveltr : L_ACKLEVELTR}	Comments: Packet number 41: 7.4.2.9
P42_SessionManagement_T	{valid : bool, q_dir : Q_DIR, q_rbc : Q_RBC, nid_c : NID_C, nid_rbc : NID_RBC, nid_radio : NID_RADIO, q_sleepsession : Q_SLEEPSESSION}	Comments: Packet number 42: 7.4.2.10
P44_DataUsedByApplicationsOutsideTheERTMSETCSSystem_T	{valid : bool, q_dir : Q_DIR, nid_xuser : NID_XUSER, nid_ntc : NID_NTC, Other_data_depending_on__NID_XUSER : int}	Comments: Packet number 44: 7.4.2.11 Other_data_depending_on__NID_XUSER Comments: TODO
P45_RadioNetworkRegistration_T	{valid : bool, q_dir : Q_DIR, nid_mn : NID_MN}	Comments: Packet number 45: 7.4.2.11.1
P46_ConditionalLevelTransitionOrder_T	{valid : bool, q_dir : Q_DIR, m_leveltr : M_LEVELTR, nid_ntc : NID_NTC}	Comments: Packet number 46: 7.4.2.11.2

Name	Definition	Comments and Information
P46_ConditionalLevelTransitionOrders_T	Packet_Types_Pkg::P46_ConditionalLevelTransitionOrder_T ^cNIterMax	Comments: Packet number 46 iterations
P49_ListOfBalisesForSHArea_T	{valid : bool, q_dir : Q_DIR, q_newcountry : Q_NEWCOUNTRY, nid_c : NID_C, nid_bg : NID_BG}	Comments: Packet number 49: 7.4.2.12
P49_ListOfBalisesForSHAreas_T	Packet_Types_Pkg::P49_ListOfBalisesForSHArea_T ^cNIterMax	Comments: Packet number 49 iterations
P51_AxleLoadSpeedProfile_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_trackinit : Q_TRACKINIT, d_trackinit : D_TRACKINIT, d_axleload : D_AXLELOAD, l_axleload : L_AXLELOAD, q_front : Q_FRONT, axleloadArray : Packet_Types_Pkg::axleloadArray_T}	Comments: Packet number 51: 7.4.2.13 / Special implementation, see comments axleloadArray Comments: Inline-array for N_ITER / variable N_ITER (k) = m
P51_AxleLoadSpeedProfiles_T	Packet_Types_Pkg::P51_AxleLoadSpeedProfile_T ^cNIterMaxAxleloadSpeedProfile	Comments: Packet number 51 iterations / Dimensioning: Subset 040 4.3.2.1.1 o)
P52_PermittedBrakingDistanceInformation_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_trackinit : Q_TRACKINIT, d_trackinit : D_TRACKINIT, d_pbd : D_PBD, q_gdir : Q_GDIR, g_pbdsr : G_PBDSR, q_pbdsr : Q_PBDSR, d_pbdsr : D_PBDSR, l_pbdsr : L_PBDSR}	Comments: Packet number 52: 7.4.2.13.1
P52_PermittedBrakingDistanceInformations_T	Packet_Types_Pkg::P52_PermittedBrakingDistanceInformation_T ^cNIterMaxPermittedBrakingDistanceInformation	Comments: Packet number 52 iterations / Dimensioning: Subset 040 4.3.2.1.1 s)
P57_MovementAuthorityRequestParameters_T	{valid : bool, q_dir : Q_DIR, t_mar : T_MAR, t_timeoutrqst : T_TIMEOUTRQST, t_cycrqst : T_CYCRQST}	Comments: Packet number 57: 7.4.2.14

Name	Definition	Comments and Information
P58_PositionReportParameters_T	{valid : bool, nid_packet : NID_PACKET, q_dir : Q_DIR, l_packet : L_PACKET, q_scale : Q_SCALE, t_cycloc : T_CYCLOC, d_cycloc : D_CYCLOC, m_loc : M_LOC, n_iter : N_ITER, iterPacket58List : Packet_Types_Pkg::IterPacket58List_T}	Comments: Position Report Parameters valid Comments: the packet is valid nid_packet Comments: Packet ID q_dir Comments: Validity direction of transmitted data l_packet Comments: Packet length q_scale Comments: Qualifier for the distance scale t_cycloc Comments: Time Interval between two position reports sent by the train d_cycloc Comments: Distance between two position reports from the train m_loc Comments: Special location/moment where the train has to report its position n_iter Comments: Number of iterations of a data set following this variable in a packet iterPacket58List Comments: List of pairs of distances and locations
P63_BaliseInSRAuthority_T	{valid : bool, q_dir : Q_DIR, q_newcountry : Q_NEWCOUNTRY, nid_c : NID_C, nid_bg : NID_BG}	Comments: Packet number 63: 7.4.2.16
P63_ListofBalisesinSRAuthority_T	Packet_Types_Pkg::P63_BaliseInSRAuthority_T ^cNIterMax	
P64_InhibitionOfRevocableTSRsFromBalisesInL23_T	{q_dir : Q_DIR}	Comments: Packet number 64: 7.4.2.16.1
P65_TemporarySpeedRestriction_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, nid_tsr : NID_TSR, d_tsr : D_TSR, l_tsr : L_TSR, q_front : Q_FRONT, v_tsr : V_TSR}	Comments: Packet number 65: 7.4.2.17
P65_TemporarySpeedRestrictions_T	Packet_Types_Pkg::P65_TemporarySpeedRestriction_T ^cNIterMaxTSR	Comments: Packet number 65 iterations / Dimensioning: 10 = maximal number of packets in one message according to Subset 040 4.3.2.1.1 e)
P66_TemporarySpeedRestrictionRevocation_T	{valid : bool, q_dir : Q_DIR, nid_tsr : NID_TSR}	Comments: Packet number 66: 7.4.2.18
P66_TemporarySpeedRestrictionRevocations_T	Packet_Types_Pkg::P66_TemporarySpeedRestrictionRevocation_T ^cNIterMaxTSR	
P68_TrackCondition_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_trackinit : Q_TRACKINIT, d_trackinit : D_TRACKINIT, d_trackcond : D_TRACKCOND, l_trackcond : L_TRACKCOND, m_trackcond : M_TRACKCOND}	Comments: Packet number 68: 7.4.2.20

Name	Definition	Comments and Information
P68_TrackConditions_T	Packet_Types_Pkg::P68_TrackCondition_T ^cNIterMaxTrackConditions	Comments: Packet number 68 iterations / Dimensioning: Subset 040 4.3.2.1.1 l)
P69_TrackConditionStationPlatform_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_trackinit : Q_TRACKINIT, d_trackinit : D_TRACKINIT, d_trackcond : D_TRACKCOND, l_trackcond : L_TRACKCOND, m_platform : M_PLATFORM, q_platform : Q_PLATFORM}	Comments: Packet number 69: 7.4.2.20.1
P69_TrackConditionStationPlatforms_T	Packet_Types_Pkg::P69_TrackConditionStationPlatform_T ^cNIterMaxTrackConditionStationPlatform	Comments: Packet number 69 / Dimensioning: Subset 040 4.3.2.1.1 t)
P70_RouteSuitabilityData_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_trackinit : Q_TRACKINIT, d_trackinit : D_TRACKINIT, d_suitability : D_SUITABILITY, q_suitability : Q_SUITABILITY, m_linegauge : M_LINEGAUGE, m_axleloadcat : M_AXLELOADCAT, m_voltage : M_VOLTAGE, nid_ctraction : NID_CTRACTION}	Comments: Packet number 70: 7.4.2.21
P70_RouteSuitabilityDatas_T	Packet_Types_Pkg::P70_RouteSuitabilityData_T ^2	Comments: Packet number 70 / Dimensioning: Subset 040 4.3.2.1.1 m)
P71_AdhesionFactor_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_adhesion : D_ADHESION, l_adhesion : L_ADHESION, m_adhesion : M_ADHESION}	Comments: Packet number 71: 7.4.2.22
P72_PacketForSendingPlainTextMessages_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_textclass : Q_TEXTCLASS, q_textdisplay : Q_TEXTDISPLAY, d_textdisplay : D_TEXTDISPLAY, m_modetextdisplay_start : M_MODETEXTDISPLAY, m_leveltextdisplay_start : M_LEVELTEXTDISPLAY, nid_ntc_start : NID_NTC, l_textdisplay : L_TEXTDISPLAY, t_textdisplay : T_TEXTDISPLAY, m_modetextdisplay_end : M_MODETEXTDISPLAY, m_leveltextdisplay_end : M_LEVELTEXTDISPLAY, nid_ntc_end : NID_NTC, q_textconfirm : Q_TEXTCONFIRM, q_conftextdisplay : Q_CONFTEXTDISPLAY, q_textreport : Q_TEXTREPORT, nid_textmessage : NID_TEXTMESSAGE, nid_c : NID_C, nid_rbc : NID_RBC, l_text : L_TEXT, x_text : Packet_Types_Pkg::xTextArray_T}	Comments: Packet number 72: 7.4.2.23 / Special implementation, see comments x_text Comments: Array of type X_TEXT

Name	Definition	Comments and Information
P76_PacketForSendingFixedTextMessages_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_textclass : Q_TEXTCLASS, q_textdisplay : Q_TEXTDISPLAY, d_textdisplay : D_TEXTDISPLAY, m_modetextdisplay_start : M_MODETEXTDISPLAY, m_leveltextdisplay_start : M_LEVELTEXTDISPLAY, nid_ntc_start : NID_NTC, l_textdisplay : L_TEXTDISPLAY, t_textdisplay : T_TEXTDISPLAY, m_modetextdisplay_end : M_MODETEXTDISPLAY, m_leveltextdisplay_end : M_LEVELTEXTDISPLAY, nid_ntc_end : NID_NTC, q_textconfirm : Q_TEXTCONFIRM, q_conftextdisplay : Q_CONFTEXTDISPLAY, q_textreport : Q_TEXTREPORT, nid_textmessage : NID_TEXTMESSAGE, nid_c : NID_C, nid_rbc : NID_RBC, q_text : Q_TEXT}	Comments: Packet number 76: 7.4.2.24
P79_GeographicalPositionInformation_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, q_newcountry : Q_NEWCOUNTRY, nid_c : NID_C, nid_bg : NID_BG, d_posoff : D_POSOFF, q_mposition : Q_MPOSITION, m_position : M_POSITION}	Comments: Packet number 79: 7.4.2.25
P79_GeographicalPositionInformations_T	Packet_Types_Pkg::P79_GeographicalPositionInformation_T ^cNIterMax	Comments: Packet number 79 iterations
P80_ModeProfile_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, d_mamode : D_MAMODE, m_mamode : M_MAMODE, v_mamode : V_MAMODE, l_mamode : L_MAMODE, l_ackmamode : L_ACKMAMODE, q_mamode : Q_MAMODE}	Comments: Packet number 80: 7.4.2.26
P80_ModeProfiles_T	Packet_Types_Pkg::P80_ModeProfile_T ^cNIterMaxModeProfiles	Comments: Packet number 80 iterations / Dimensioning: Subset 040 4.3.2.1.1 c)
P88_LevelCrossingInformation_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, nid_lx : NID_LX, d_lx : D_LX, l_lx : L_LX, q_lxstatus : Q_LXSTATUS, v_lx : V_LX, q_stoplx : Q_STOPLX, l_stoplx : L_STOPLX}	Comments: Packet number 88: 7.4.2.26.1
SSP_T	{valid : bool, d_static : D_STATIC, v_static : V_STATIC, q_front : Q_FRONT, diffArray : Packet_Types_Pkg::DiffArray_T}	Comments: N_ITER-helper-type diffArray Comments: Iterations are stored inline in arrays. Variable N_ITER(k) = m
SSPArray_T	Packet_Types_Pkg::SSP_T ^cNIterMax	Comments: N_ITER-helper-type
xText_T	{valid : bool, x_text : X_TEXT}	Comments: N_ITER helper type
xTextArray_T	Packet_Types_Pkg::xText_T ^255	Comments: Iterations of X_TEXT

6.5.2.   Constants

Table 275: Public Constants of Packet_Types_Pkg

Name	Type	Value	Comments and Information
cIterPacket58	int	2	Comments: value is bound to 32
cNIterMax	int	7	Comments: Max number of iterations in packets is 31 according to SRS. Set to 7 for scenario Utrecht-Amsterdam
cNIterMaxAxleloadSpeedProfile	int	7	Comments: Max number of iterations in 1 packet 14(+1 default iteration) according to Subset 040 4.3.2.1.1 o). Set to 7 for Utrecht-Amsterdam scenario
cNIterMaxMA	int	5	Comments: Subset 040 4.3.2.1.1 a)
cNIterMaxModeProfiles	int	3	Comments: Subset 040 4.3.2.1.1 c)
cNIterMaxPermittedBrakingDistanceInformation	int	3	Comments: Subset 040 4.3.2.1.1 s)
cNIterMaxRouteSuitabilityData	int	3	Comments: Subset 040 4.3.2.1.1 m)
cNIterMaxTrackConditions	int	7	Comments: Max number of iterations in 1 packet = 19 (+1 default iteration) according to Subset 040 4.3.2.1.1 l). Set to 7 for scenario Utrecht-Amsterdam
cNIterMaxTrackConditionStationPlatform	int	5	Comments: Subset 040 4.3.2.1.1 l)
cNIterMaxTSR	int	10	Comments: 10 = maximal number of packets in one message according to Subset 040 4.3.2.1.1 e)

6.6. Radio_Types_Pkg Package

6.6.1. Types

Table 276: Public Types of Radio_Types_Pkg

Name	Definition	Comments and Information
Radio_TrackTrain_Header_T	{radioDevice : int, receivedSystemTime : Obu_BasicTypes_Pkg::T_internal_Type, nid_message : NID_MESSAGE, t_train : T_TRAIN, m_ack : M_ACK, nid_lrbg : NID_LRBG, t_train_reference : T_TRAIN, nid_em : NID_EM, q_scale : Q_SCALE, d_sr : D_SR, t_sh_rqst : T_TRAIN, d_ref : D_REF, q_dir : Q_DIR, d_emergencystop : D_EMERGENCYSTOP, m_version : M_VERSION}	radioDevice Comments: Identifier of the radio device (assuming 2 devices are installed for RBC-RBC-Handover) receivedSystemTime Comments: Timestamp when the message has been received in the system nid_message Comments: Message Identifier / From: General header t_train Comments: Time, according to trainborne clock, at which message is sent / From: General header m_ack Comments: Indicates whether the telegram must be acknowledged or not / From: General header nid_lrbg Comments: Identity of last relevant balise group / From: General header t_train_reference Comments: 8.7.4: Reference to received train data message nid_em Comments: 8.7.6: Message 15: Conditional Emergency Stop q_scale Comments: Qualifier for the distance scale / From: Message 33: MA with Shifted Location Reference d_emergencystop Comments: 8.7.6: Distance between LRBG and the position reference to the emergency stop. m_version Comments: 8.7.12: Version of the ERTMS/ETCS system.

Name	Definition	Comments and Information
Radio_TrainTrack_Header_T	{present : bool, nid_message : NID_MESSAGE, t_train : T_TRAIN, nid_engine : NID_ENGINE, xQ_MARQSTREASON : Q_MARQSTREASON, xT_TRAIN : T_TRAIN, xNID_EM : NID_EM, xQ_EMERGENCYSTOP : Q_EMERGENCYSTOP, xNID_TEXTMESSAGE : NID_TEXTMESSAGE}	Comments: 8.4.4.7: Standard format of rdio message train to track present Comments: Indicates whether the header is present in the interface. nid_message Comments: Message Identifier / From: General header t_train Comments: Time, according to trainborne clock, at which message is sent / From: General header nid_engine Comments: Identity of the train xQ_MARQSTREASON Comments: Only relevant for some messages xT_TRAIN Comments: Only relevant for some messages: Time stamp contained in the message that is acknowledged xNID_EM Comments: Only relevant for some messages: Emergency message identity xQ_EMERGENCYSTOP Comments: Only relevant for some messages: Qualifier for emergency stop management xNID_TEXTMESSAGE Comments: Only relevant for some messages: Text message identifier
Radio_TrainTrack_Message_T	{present : bool, header : Radio_Types_Pkg::Radio_TrainTrack_Header_T, packets : Common_Types_Pkg::outPackets_T}	
RadioMessage_T	{present : bool, consistencyError : bool, header : Radio_Types_Pkg::Radio_TrackTrain_Header_T, radioMetadata : Common_Types_Pkg::RadioMetadata_T, packets : Common_Types_Pkg::CompressedPackets_T, sendingRBC : Common_Types_Pkg::RBC_Id_T}	present Comments: True if new data is available. consistencyError Comments: A consistency error was detected. header Comments: Radio message header radioMetadata Comments: Metadata for radio interface specific variables. For radio messages some variables are mandatory per nid_message. packets Comments: Packets of the radio message sendingRBC Comments: Information defing the RBC which was sending the information
sessionStatus_Type	enum {morc_st_inactive, morc_st_establishing, morc_st_maintaining, morc_st_terminating}	Comments: Designates the MoRC session status

6.6.2.   Constants

Table 277: Public Constants of Radio_Types_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
		{present : false, consistencyError : false, header : {radioDevice : 0, receivedSystemTime : 0, nid_message : 0, t_train : 0.0, m_ack : M_ACK_No_acknowledgement_required, nid_lrbg : 0, t_train_reference : 0.0, nid_em : 0, q_scale : Q_SCALE_10_cm_scale, d_sr : 0, t_sh_rqst : 0.0, d_ref : 0, q_dir : Q_DIR_Reverse, d_emergencystop : 0, m_version : M_VERSION_Previous_versions_according_to_e_g_EEIG_SRS_and_UIC_A200_SRS}, radioMetadata : {t_train_reference : false, nid_em : false, q_scale : false, d_sr : false, t_sh_rqst : false, d_ref : false, q_dir : false, d_emergencystop : false, m_version : false}, packets : {PacketHeaders : [{nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0}, {nid_packet : 0, q_dir : Q_DIR_Reverse, valid : false, startAddress : 0, endAddress : 0},	

7.   Project Library: BasicLocationFunctions

7.1. BasicLocationFunctions_Pkg Package

7.1.1.   Comments and Information

BasicLocationFunctions_Pkg Comments:
This component provides basic position calculation functions as specified in
https://github.com/openETCS/SRS-Analysis/blob/master/System%20Analysis/WorkingRepository/Group4/SUBSET_26_3-6/DetermineTrainLocationProcedures.docx while taking inaccuracies into account.

Basic calculation functions for position determination of train and track elements
- Name: BasicLocationFunctions.etp
- Description: Basic calculation functions for position determination of train and track elements
- Copyright Siemens AG, 2014
- Licensed under the EUPL V.1.1 (
http://joinup.ec.europa.eu/software/page/eupl/licence-eupl)
- Gist URL: ---
- Cryptography: No
- Author(s): Uwe Steinke
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.

Table 278: BasicLocationFunctions_Pkg Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True

Note Name	Attribute	Value
Remark_1	Description	Basic calculation functions for position determination of train and track elements - Name: BasicLocationFunctions.etp - Description: Basic calculation functions for position determination of train and track elements - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.2.   add_2_Distances Operator

Declared as **public function**

7.1.2.1.   Comments and Information

add_2_Distances Comments:
Calculates the sum of 2 distances dist_2 + dist_1

Table 279: add_2_Distances Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True

Note Name	Attribute	Value
Remark_1	Description	Calculates the sum of 2 distances - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.2.2. Interface

Table 280: Inputs of add_2_Distances

Name	Type	Comments and Information
dist_2	Obu_BasicTypes_Pkg:: LocWithInAcc_T	
dist_1	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

Table 281: Outputs of add_2_Distances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

7.1.2.3. Operator Hierarchy

diagram : diagram_add_2_Distances_1

7.1.2.4. Graphical and Textual Diagrams

7.1.2.4.1. View of diagram_add_2_Distances_1 (add_2_Distances)
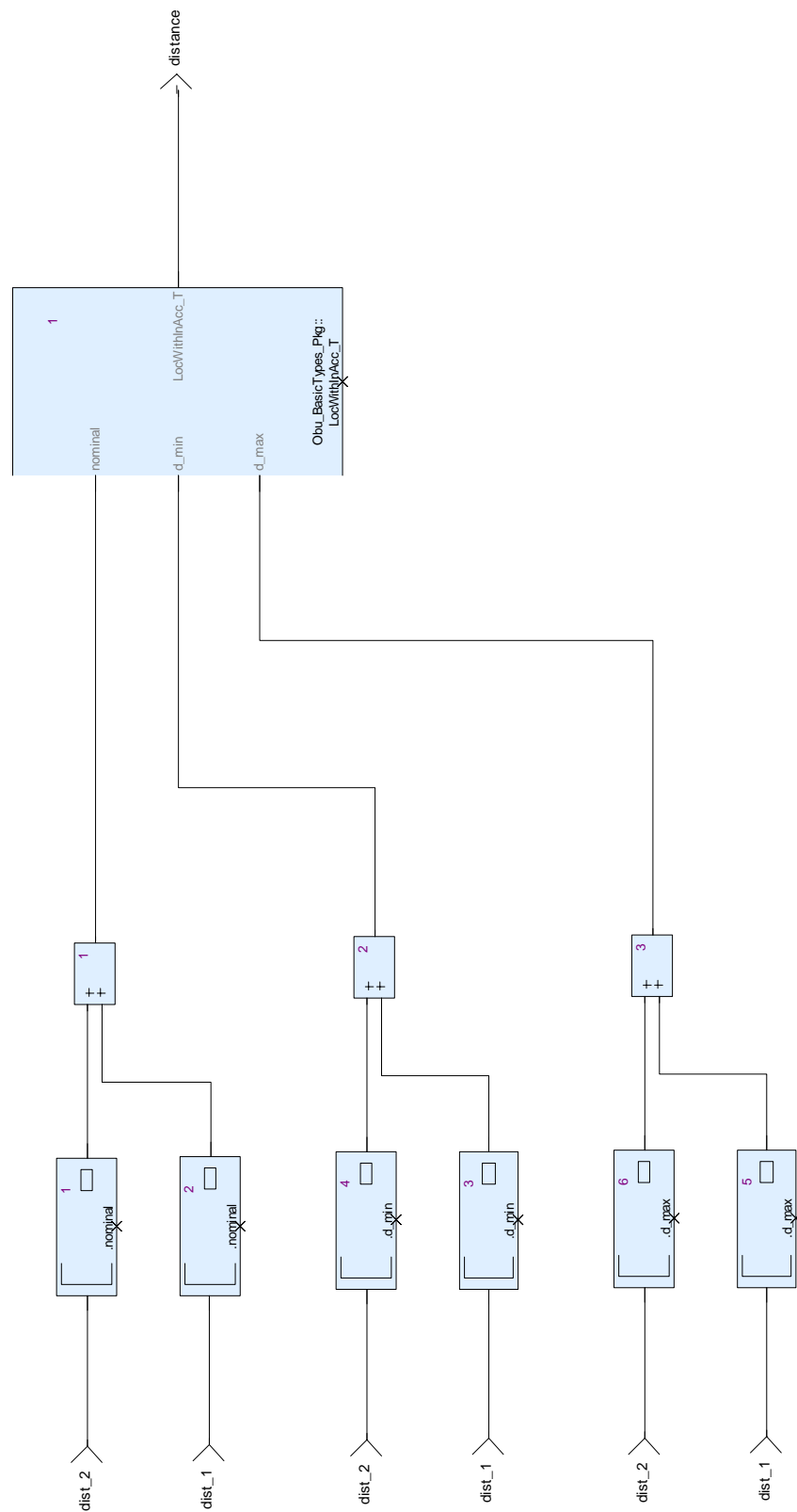
Figure 100: View of diagram_add_2_Distances_1 (add_2_Distances)

7.1.3.   add_odo_2_Location Operator

Declared as **public function**

7.1.3.1.   Comments and Information

add_odo_2_Location Comments:
Calculates the target location after a reference location measured by the odometry:
location = refLocation + (odoValue - refOdoValue).
Applicable, if a reference location is given and a tracel distance behind it is
measured with the odometry.

Table 282: add_odo_2_Location Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the target location after a reference location measured by the odometry - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.3.2.   Interface

Table 283: Inputs of add_odo_2_Location

Name	Type	Comments and Information
refLocation	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: The reference location
refOdoValue	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: The odometry value at refLocation
odoValue	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: The odometry value at the target location "location"

Table 284: Outputs of add_odo_2_Location

Name	Type	Comments and Information
location	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: The target location

7.1.3.3.   Operator Hierarchy

diagram : diagram_add_odo_2_Location_1

7.1.3.4.   Graphical and Textual Diagrams

7.1.3.4.1.   View of diagram_add_odo_2_Location_1 (add_odo_2_Location)
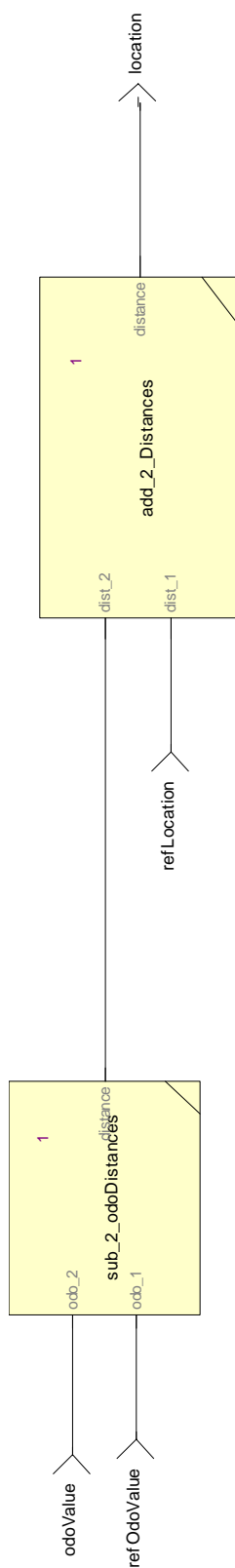
Figure 101: View of diagram_add_odo_2_Location_1 (add_odo_2_Location)

7.1.4.   addDistances Operator

Declared as **public function**

7.1.4.1.   Comments and Information

addDistances Comments:
Calculates the sum of an array of distances

Table 285: addDistances Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the sum of an array of distances - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.4.2.   Interface

Table 286: Inputs of addDistances

Name	Type	Comments and Information
distances	Obu_BasicTypes_Pkg::LocWithInAcc_T^noOfSummands	

Table 287: Outputs of addDistances

Name	Type	Comments and Information
sum	Obu_BasicTypes_Pkg::LocWithInAcc_T	

Table 288: Size Parameters of addDistances

Name	Comments and Information
noOfSummands	Comments: Number of summands

7.1.4.3.   Operator Hierarchy

<u>diagram</u> : diagram_sumOfDistances_1

7.1.4.4.   Graphical and Textual Diagrams

### 7.1.4.4.1.   View of diagram_sumOfDistances_1 (addDistances)
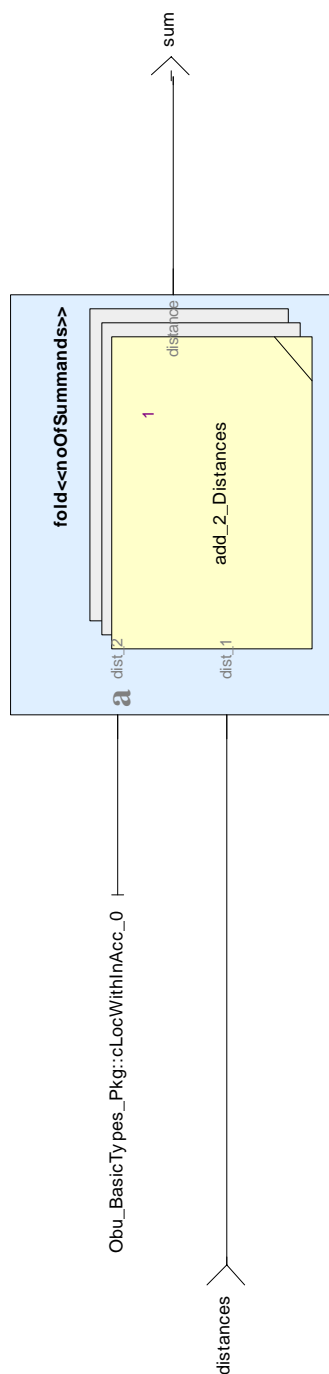
Figure 102: View of diagram_sumOfDistances_1 (addDistances)

7.1.5.   addDistancesBetwLinkedElements Operator

Declared as **public function**

7.1.5.1.   Comments and Information

addDistancesBetwLinkedElements Comments:
Calculates the distance between linked elements like linked balise groups by adding their distances,
Linked elements like balises are – as specified in Subset 026-3.6 – thought to be positioned on an absolutely correct nominal position with a known min/max accuracy around the nominal position.
The distances of elements not needed in the calculation must be set to 0.

Table 289: addDistancesBetwLinkedElements Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the distance between linked elements - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.5.2.   Interface

Table 290: Inputs of addDistancesBetwLinkedElements

Name	Type	Comments and Information
distances	Obu_BasicTypes_Pkg:: LocWithInAcc_T ^noOfLinkedElements	

Table 291: Outputs of addDistancesBetwLinkedElements

Name	Type	Comments and Information
sumOfDistances	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

Table 292: Size Parameters of addDistancesBetwLinkedElements

Name	Comments and Information
noOfLinkedElements	

7.1.5.3.   Operator Hierarchy

diagram : diagram_distanceBetweenLinkedElements_1

7.1.5.4.   Graphical and Textual Diagrams

7.1.5.4.1.   View of diagram_distanceBetweenLinkedElements_1 (addDistancesBetwLinkedElements)

Figure 103: View of diagram_distanceBetweenLinkedElements_1
(addDistancesBetwLinkedElements)
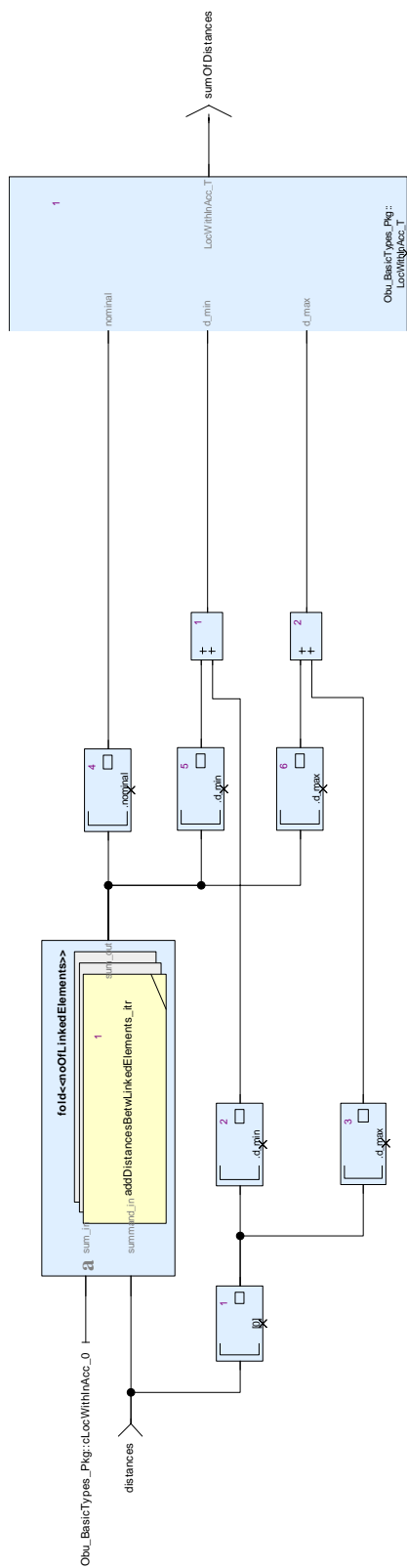
7.1.6.   addDistancesBetwLinkedElements_itr Operator

Declared as **private function**

7.1.6.1.   Comments and Information

addDistancesBetwLinkedElements_itr Comments:
distanceBetweenLinkedElements_itr is the íterated function for the distance calculation between linked elements.
The nominal distances are added.
d_min and d_max are taken from the summand, if it is <> 0 and from the previous sum_in, if == 0.
This assures that the inaccuracies from the last element in the iteration <> 0 are forward even if not all iterations are filled with valid data.

Table 293: addDistancesBetwLinkedElements_itr Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	íterated function for the distance calculation between linked elements - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.6.2.   Interface

Table 294: Inputs of addDistancesBetwLinkedElements_itr

Name	Type	Comments and Information
sum_in	Obu_BasicTypes_Pkg::LocWithInAcc_T	
summand_in	Obu_BasicTypes_Pkg::LocWithInAcc_T	

Table 295: Outputs of addDistancesBetwLinkedElements_itr

Name	Type	Comments and Information
sum_out	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

7.1.6.3.   Operator Hierarchy

<u>diagram</u> : diagram_addDistancesBetwLinkedElements_itr_1

7.1.6.4.   Graphical and Textual Diagrams

7.1.6.4.1.   View of diagram_addDistancesBetwLinkedElements_itr_1 (addDistancesBetwLinkedElements_itr)
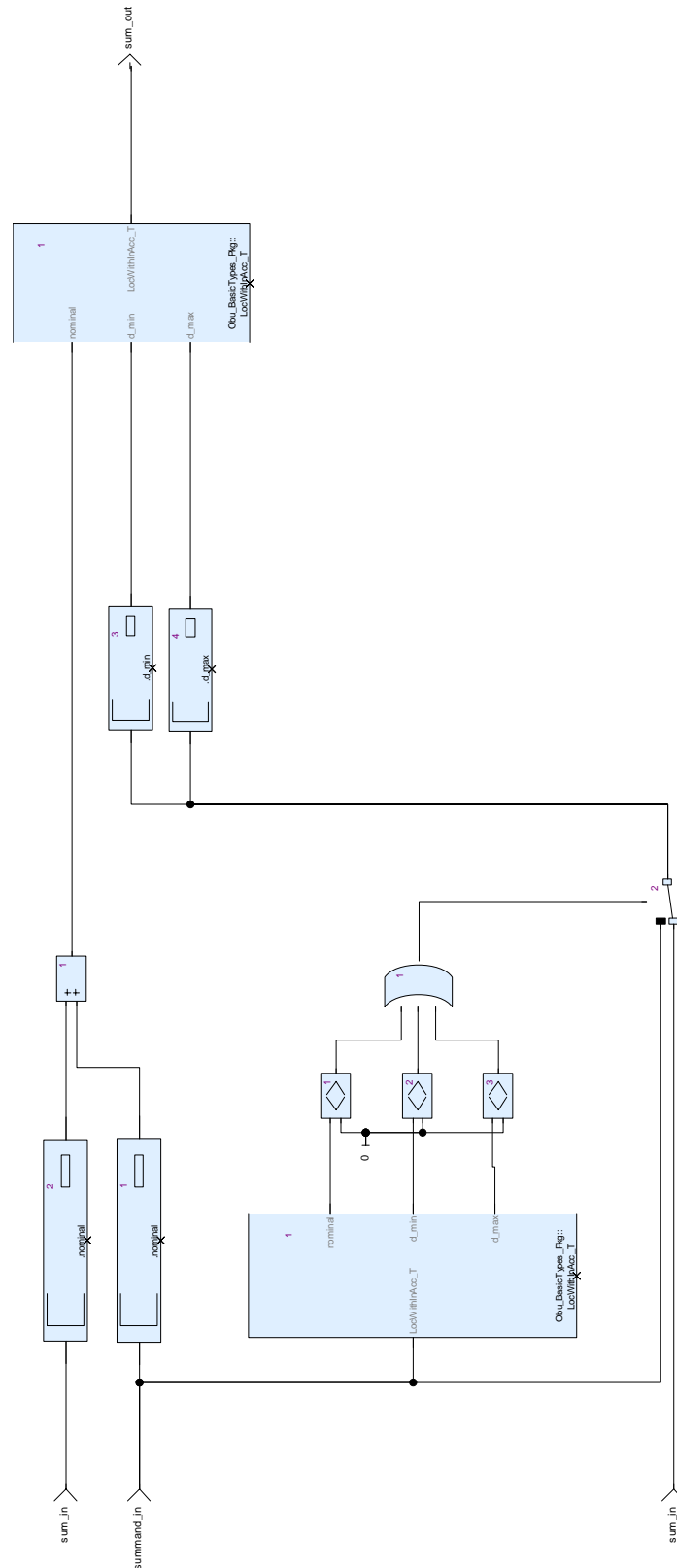
Figure 104: View of diagram_addDistancesBetwLinkedElements_itr_1
(addDistancesBetwLinkedElements_itr)

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7.1.7.   checkMaxAbsOdoDistance Operator

Declared as **public function**

7.1.7.1.   Comments and Information

checkMaxAbsOdoDistance Comments:
Determines, if the distance between odometry positions odo_2 and odo_1 is less than or equal maxDelta.
Please consider the applicable rules for odometry value calculations!

7.1.7.2.   Interface

Table 296: Inputs of checkMaxAbsOdoDistance

Name	Type	Comments and Information
odo_2	Obu_BasicTypes_Pkg:: OdometryLocations_T	
odo_1	Obu_BasicTypes_Pkg:: OdometryLocations_T	
maxDelta	Obu_BasicTypes_Pkg:: OdometryLocations_T	

Table 297: Outputs of checkMaxAbsOdoDistance

Name	Type	Comments and Information
isLessThanOrEqual	bool	

7.1.7.3.   Operator Hierarchy

diagram : diagram_checkMaxAbsOdoDistance_1

7.1.7.4.   Graphical and Textual Diagrams

7.1.7.4.1.   View of diagram_checkMaxAbsOdoDistance_1 (checkMaxAbsOdoDistance)
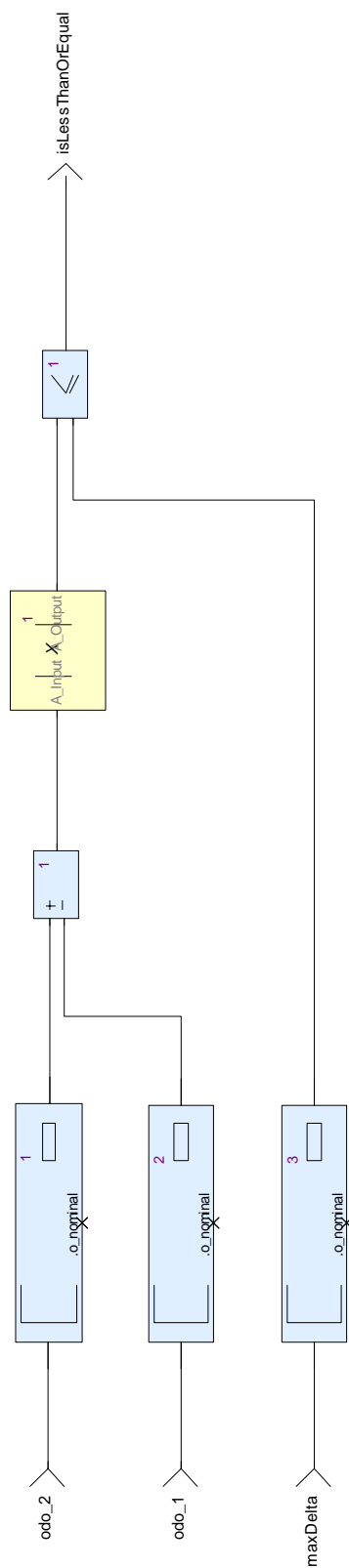
Figure 105: View of diagram_checkMaxAbsOdoDistance_1 (checkMaxAbsOdoDistance)

7.1.8.   dTrain2Trackelem_unlinkedBG Operator

Declared as **public function**

7.1.8.1.   Comments and Information

dTrain2Trackelem_unlinkedBG Comments:
Calculates the distance from the actual train position to a track element, that is linked with a previously passed unlinked BG.
Remark:
There is no need to determine the distance via a second calculation with reference to the following linked balise group.
Instead, the input loc_unlinkedBG should be fed via the odoLoc_2_refLocations function, based on two different reference calculations.

Table 298: dTrain2Trackelem_unlinkedBG Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Distance from the actual train position to a track element - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.8.2.   Interface

Table 299: Inputs of dTrain2Trackelem_unlinkedBG

Name	Type	Comments and Information
dLink_unlinkedBG2Trackelem	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: Linking distance from a previously passed unlinked balise group to the track element
loc_unlinkedBG	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: Location of a previously passed unlinked balise group

Name	Type	Comments and Information
odo_unlinkedBG	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: Odometry value at the previously passed unlinked balise group
actOdo_train	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: Odometry value at the actual train position

Table 300: Outputs of dTrain2Trackelem_unlinkedBG

Name	Type	Comments and Information
dTrain2Trackelem	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: Distance from the actual train position to the track element in front

7.1.8.3.   Operator Hierarchy

diagram : diagram_dTrain2Trackelem_unlinkedBG_1

7.1.8.4.   Graphical and Textual Diagrams

7.1.8.4.1.   View of diagram_dTrain2Trackelem_unlinkedBG_1 (dTrain2Trackelem_unlinkedBG)
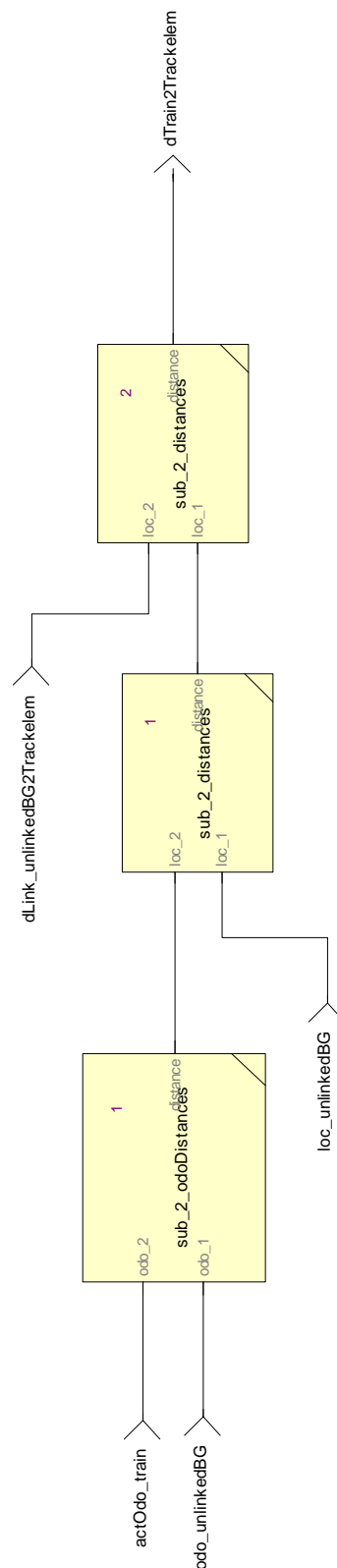
Figure 106: View of diagram_dTrain2Trackelem_unlinkedBG_1 (dTrain2Trackelem_unlinkedBG)

7.1.9.   locReachedOrPassed Operator

Declared as **public node**

7.1.9.1.   Comments and Information

locReachedOrPassed Comments:
Detects, if
loc_2 reaches loc_1 or
loc_2 must have passed loc_1.
Precisely:
Detects, if loc_2 and loc_1 overlap, or - if not - the orientation from loc_2 to loc_1
changed its sign from the previous to the current cycle.
The latter ensures robustness against no overlapping due to limited sampling rates.

Table 301: locReachedOrPassed Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Determines the overlapping section of 2 locations - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.9.2.   Interface

Table 302: Inputs of locReachedOrPassed

Name	Type	Comments and Information
loc_2	Obu_BasicTypes_Pkg:: LocWithInAcc_T	
loc_1	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

Table 303: Outputs of locReachedOrPassed

Name	Type	Comments and Information
hit	bool	

7.1.9.3. Operator Hierarchy

diagram : diagram_locReachedOrPassed_1

7.1.9.4.   Graphical and Textual Diagrams

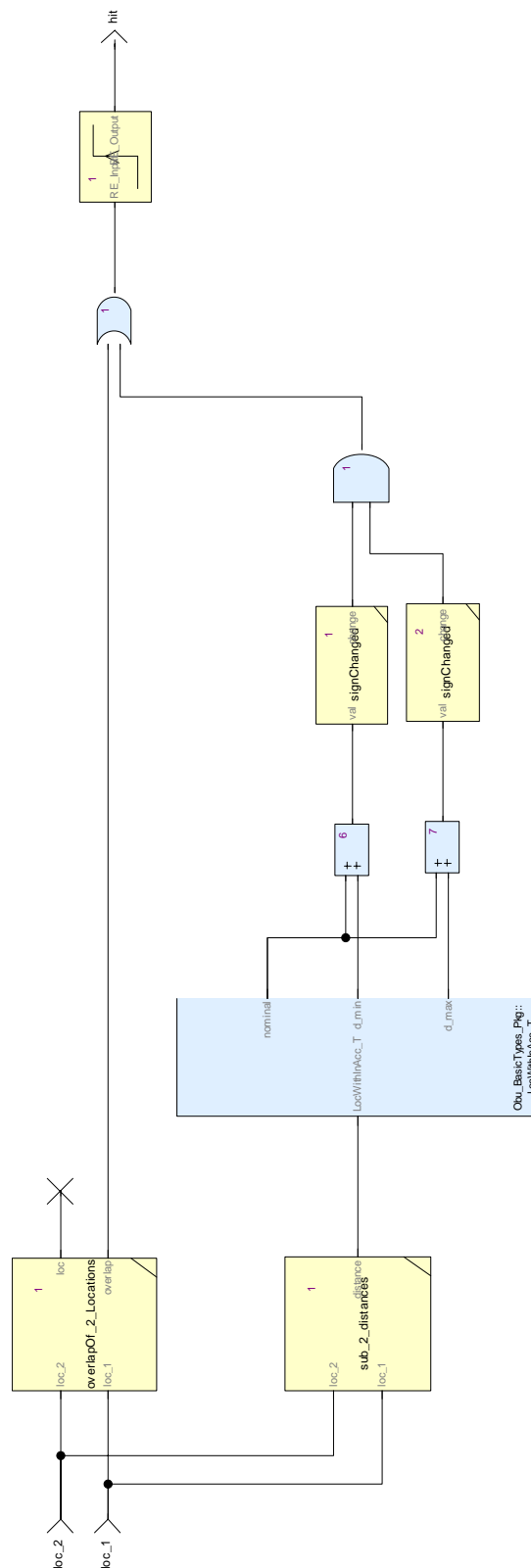### 7.1.9.4.1.   View of diagram_locReachedOrPassed_1 (locReachedOrPassed)

Figure 107: View of diagram_locReachedOrPassed_1 (locReachedOrPassed)

7.1.10.   odoLoc_2_refLocations Operator

Declared as **public function**

7.1.10.1.   Comments and Information

odoLoc_2_refLocations Comments:
Determines the location of an element, measured by odometry, with reference to 2 different known reference locations.
The location of the element can, but must not be necessarily between the two reference locations.
If the locations, calculated internally from refLoc2 and refLoc1 don't overlap, the resulting location will be selected from refLoc1 alone.
This function can be used to calculate the location of an unlinked balise group between 2 linked balise groups.

Table 304: odoLoc_2_refLocations Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Determines the location of an element, measured by odometry, with reference to 2 different known reference locations - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.10.2.   Interface

Table 305: Inputs of odoLoc_2_refLocations

Name	Type	Comments and Information
refLoc_2	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: Reference location 2
refLoc_1	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: Reference location 1

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Name	Type	Comments and Information
refOdo_2	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: Odometry value at reference location 2
refOdo_1	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: Odometry value at reference location 1
odo	Obu_BasicTypes_Pkg:: OdometryLocations_T	Comments: Odometry value at the location to be determined

Table 306: Outputs of odoLoc_2_refLocations

Name	Type	Comments and Information
location	Obu_BasicTypes_Pkg:: LocWithInAcc_T	Comments: The resulting location to be determined

7.1.10.3.   Operator Hierarchy

diagram : diagram_odoLoc_2_refLocations_1

7.1.10.4.   Graphical and Textual Diagrams

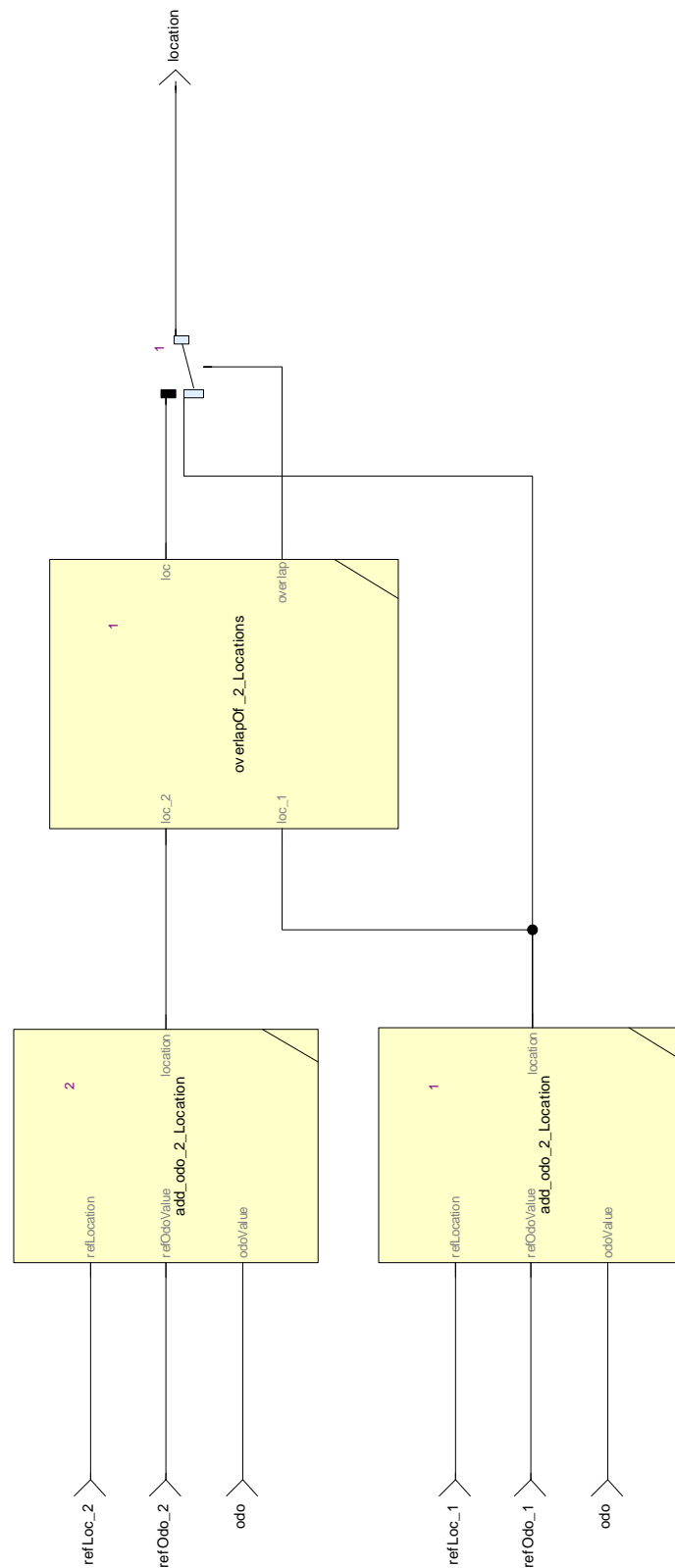### 7.1.10.4.1.   View of diagram_odoLoc_2_refLocations_1 (odoLoc_2_refLocations)

Figure 108: View of diagram_odoLoc_2_refLocations_1 (odoLoc_2_refLocations)

7.1.11.   overlapOf_2_Locations Operator

Declared as **public function**

7.1.11.1.   Comments and Information

overlapOf_2_Locations Comments:
Determines the overlapping section of 2 locations, i. e. a more precise location ("best of")   than each of the 2 input locations.
The nominal value of the resulting location is set to the middle of the overlaping section.
The overlap output is set to true, if an overlapping part exits.
The overlapping section is seen as the mostAccurateValueOf both locations.

Table 307: overlapOf_2_Locations Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Determines the overlapping section of 2 locations - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/l icence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.11.2.   Interface

Table 308: Inputs of overlapOf_2_Locations

Name	Type	Comments and Information
loc_2	Obu_BasicTypes_Pkg:: LocWithInAcc_T	
loc_1	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

Table 309: Outputs of overlapOf_2_Locations

Name	Type	Comments and Information
loc	Obu_BasicTypes_Pkg::LocWithInAcc_T	
overlap	bool	

7.1.11.3. Operator Hierarchy

<u>diagram</u> : diagram_overlapOf_2_Locations_1

7.1.11.4.   Graphical and Textual Diagrams

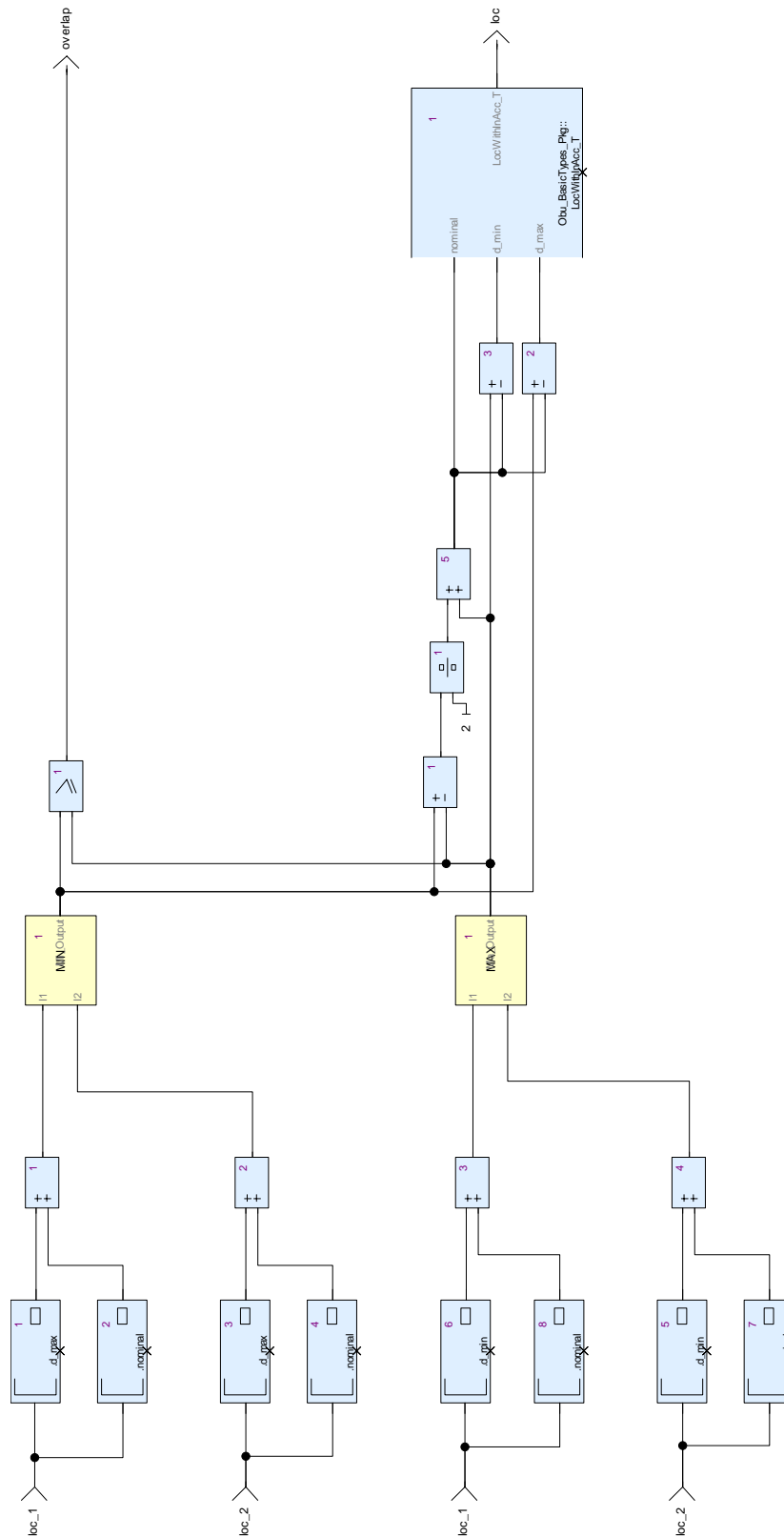### 7.1.11.4.1.   View of diagram_overlapOf_2_Locations_1 (overlapOf_2_Locations)

Figure 109: View of diagram_overlapOf_2_Locations_1 (overlapOf_2_Locations)

7.1.12.   scaledDLINK_2_dlink Operator

Declared as **public function**

7.1.12.1.   Comments and Information

scaledDLINK_2_dlink Comments:
Converts the linking distance variables into the uniform distance type.

Table 310: scaledDLINK_2_dlink Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Converts the linking distance variables into the uniform distance type - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.12.2.   Interface

Table 311: Inputs of scaledDLINK_2_dlink

Name	Type	Comments and Information
q_scale	Q_SCALE	
d_link	D_LINK	
q_locacc	Q_LOCACC	

Table 312: Outputs of scaledDLINK_2_dlink

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

7.1.12.3.   Operator Hierarchy

diagram : diagram_scaledDLINK_2_dlink_1

7.1.12.4.   Graphical and Textual Diagrams

7.1.12.4.1.   View of diagram_scaledDLINK_2_dlink_1 (scaledDLINK_2_dlink)
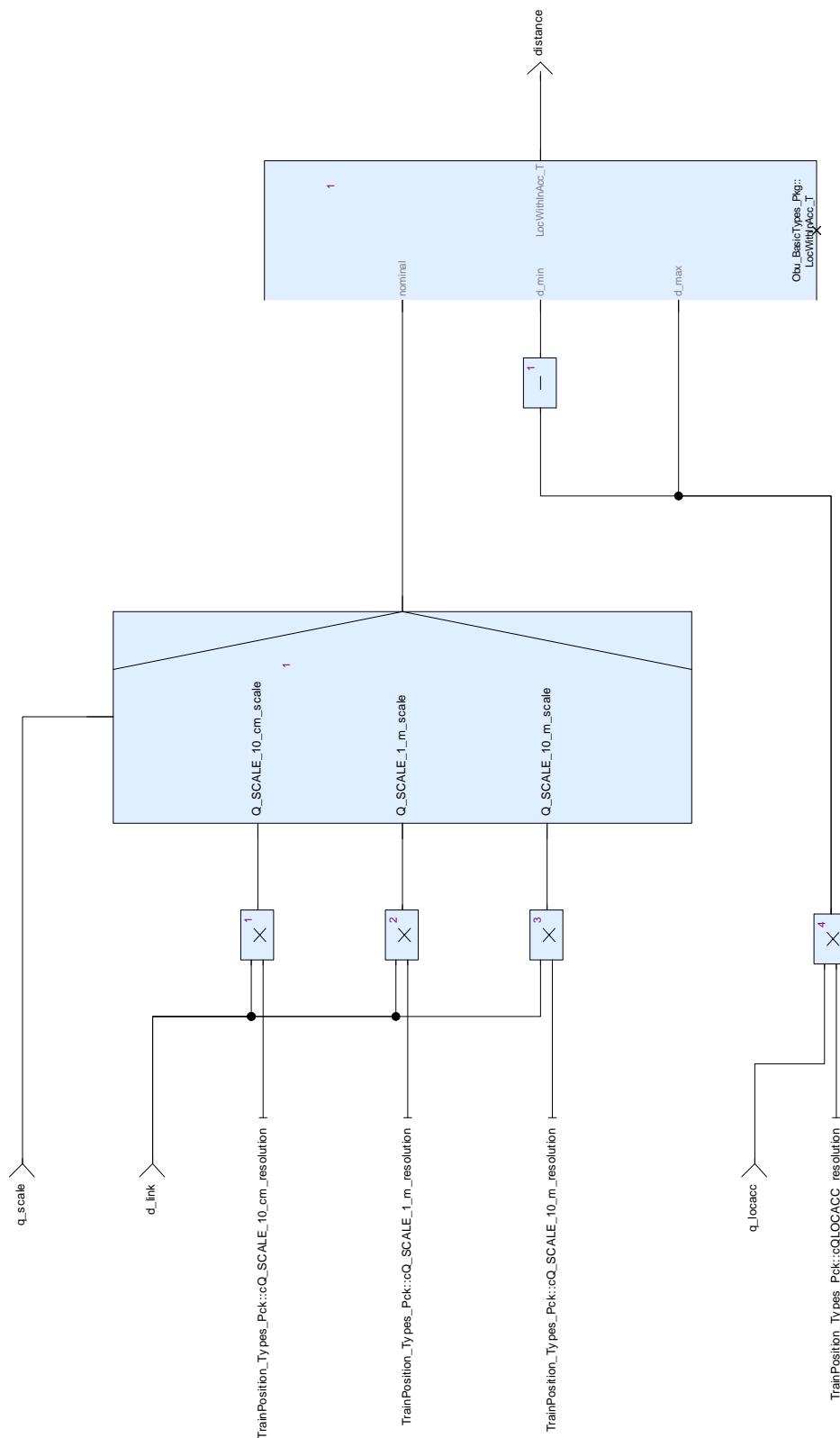

Figure 110: View of diagram_scaledDLINK_2_dlink_1 (scaledDLINK_2_dlink)

7.1.13.   signChanged Operator

Declared as **public node**

7.1.13.1.   Comments and Information

signChanged Comments:
Detects, when the input value changes it's sign.

7.1.13.2.   Interface

Table 313: Inputs of signChanged

Name	Type	Properties		Comments and Information
val	int	last	0	

Table 314: Outputs of signChanged

Name	Type	Comments and Information
change	bool	

7.1.13.3.   Operator Hierarchy

diagram : diagram_signChanged_1

7.1.13.4.   Graphical and Textual Diagrams

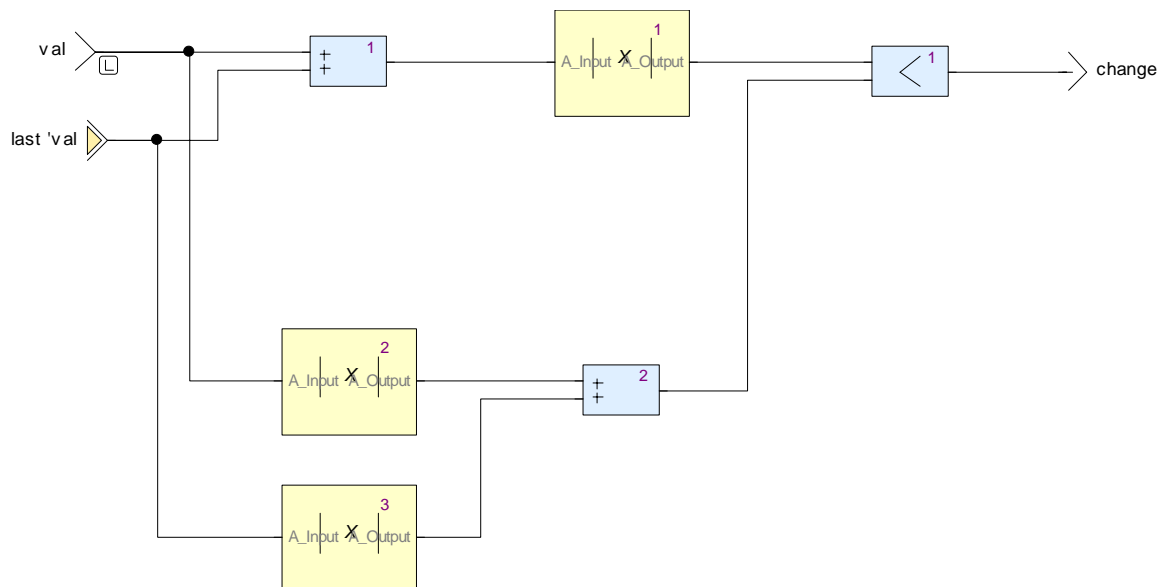#### 7.1.13.4.1.   View of diagram_signChanged_1 (signChanged)

Figure 111: View of diagram_signChanged_1 (signChanged)

7.1.14.   sub_2_distances Operator

Declared as **public function**

7.1.14.1.   Comments and Information

sub_2_distances Comments:
Calculates the distance loc_2 - loc_1 between two locations

Table 315: sub_2_distances Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the distance loc_2 - loc_1 between two locations - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.14.2.   Interface

Table 316: Inputs of sub_2_distances

Name	Type	Comments and Information
loc_2	Obu_BasicTypes_Pkg:: LocWithInAcc_T	
loc_1	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

Table 317: Outputs of sub_2_distances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg:: LocWithInAcc_T	

7.1.14.3.   Operator Hierarchy

diagram : diagram_sub_2_distances_1

7.1.14.4.   Graphical and Textual Diagrams

7.1.14.4.1.   View of diagram_sub_2_distances_1 (sub_2_distances)
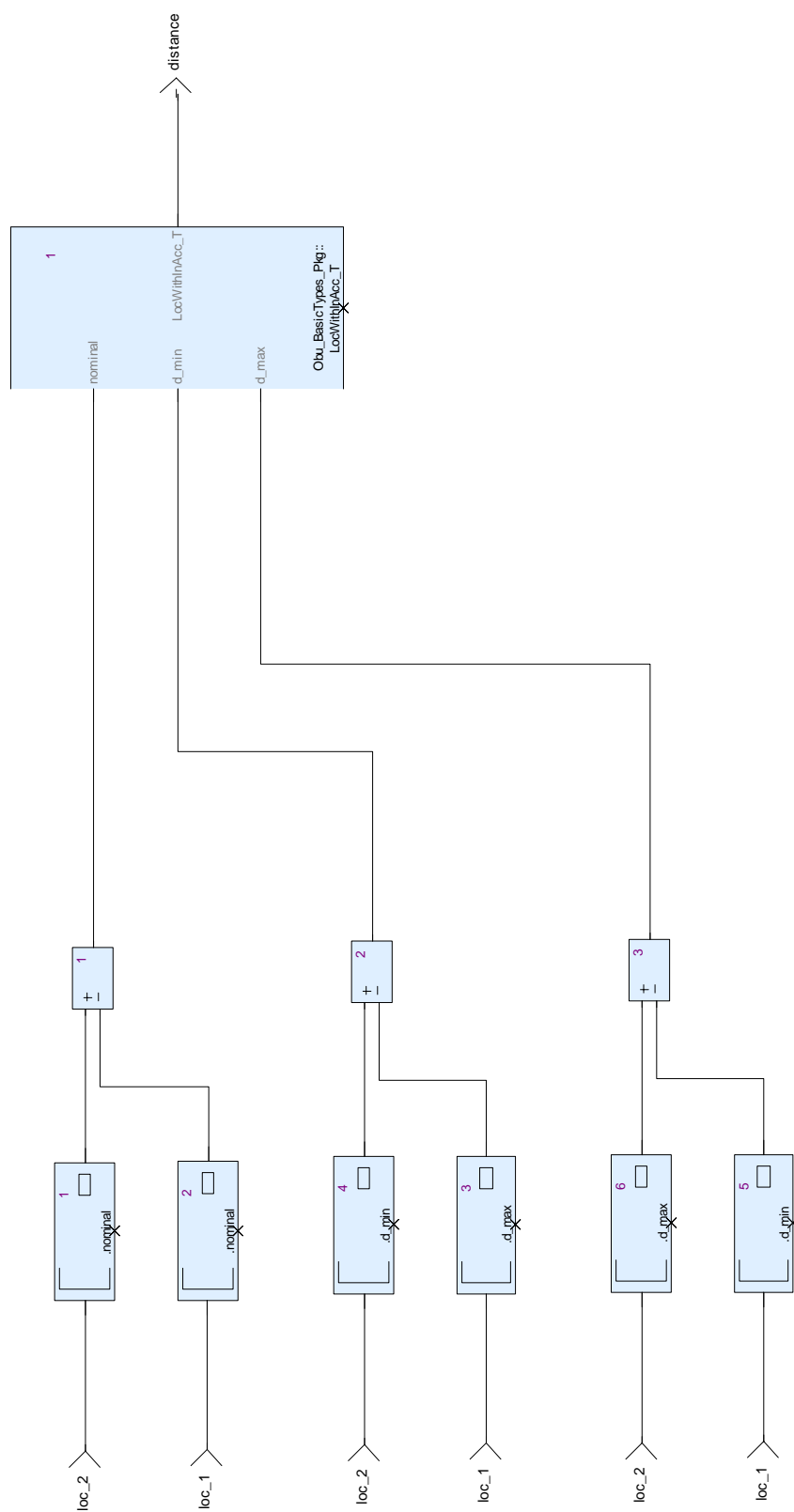

Figure 112: View of diagram_sub_2_distances_1 (sub_2_distances)

7.1.15.   sub_2_odoDistances Operator

Declared as **public function**

7.1.15.1.   Comments and Information

sub_2_odoDistances Comments:
Calculates the distance o2 - o1 based on odometry data

Table 318: sub_2_odoDistances Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-05-22
	Version	00.02.00
	to_c	True
Remark_1	Description	Calculates the distance o2 - o1 based on odometry data - Copyright Siemens AG, 2014 - Licensed under the EUPL V.1.1 (http://joinup.ec.europa.eu/software/page/eupl/licence-eupl) - Gist URL: --- - Cryptography: No - Author(s): Uwe Steinke 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.
	to_c	True

7.1.15.2.   Interface

Table 319: Inputs of sub_2_odoDistances

Name	Type	Comments and Information
odo_2	Obu_BasicTypes_Pkg::OdometryLocations_T	
odo_1	Obu_BasicTypes_Pkg::OdometryLocations_T	

Table 320: Outputs of sub_2_odoDistances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg::LocWithInAcc_T	

7.1.15.3.   Operator Hierarchy

diagram : diagram_sub_2_odoDistances_1

7.1.15.4.   Graphical and Textual Diagrams

7.1.15.4.1.   View of diagram_sub_2_odoDistances_1 (sub_2_odoDistances)
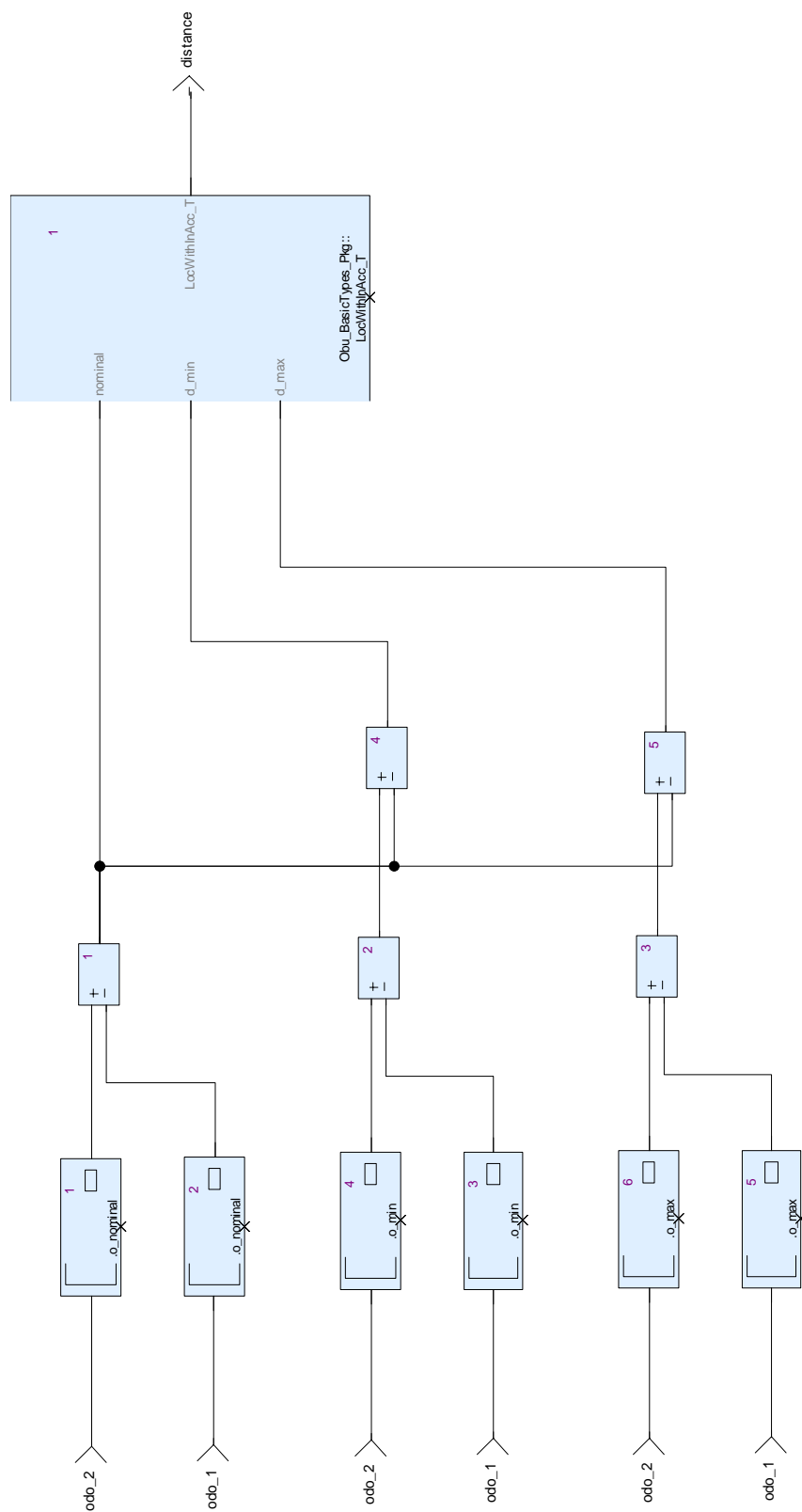

Figure 113: View of diagram_sub_2_odoDistances_1 (sub_2_odoDistances)

End of document.