openETCS: WP3-Initial-Architecture

Balise Channel Reception and Train Positioning

Summary:
ETCS OBU Kernel Function Implementation

The train moves on a track equipped with balises and determines its position

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Index: Version No 00.02.00
Date: 2014-09-04

Distribution List: WP3@openetcs.org; wp4@openetcs.org

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1. General Project Description

Minimum OBU Kernel Function Implementation:

The train moves on a track equipped with balises and determines its position

Implemented functions:

Receive and manage balise information
Determine train position
ETCS language data types

References:
- https://github.com/openETCS/SRS-Analysis/issues/9
- https://github.com/openETCS/SRS-Analysis/issues/36
- https://github.com/openETCS/SRS-Analysis/issues
-
https://github.com/openETCS/modeling/blob/master/openETCS%20ArchitectureAndDesign/FirstIteration/openETCSArchitectureAndDesignSpecification.pdf
- https://github.com/openETCS/validation/issues/227
-
https://github.com/openETCS/modeling/tree/master/model/Scade/System/ObuFunctions/ManageLocationRelatedInformation/MLRI_Integration

This document reflects the current implementation status.

- Name: MLRI_Integration.etp
- Description: SUBSET-026, ISSUE : 3.3.0
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http://joinup.ec.europa.eu/software/page/eupl/licence-eupl)
- Gist URL: ---
- Cryptography: No
- Author(s): Uwe Steinke

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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 MLRI_Integration
    MLRI_Integration_Pkg

Project Library BasicLocationFunctions
    BasicLocationFunctions_Pkg

Project Library BG_Types
    BG_Types_Pkg
    Common_Types_Pkg
    Packet_Types_Pkg
    Radio_Types_Pkg

Project Library BuildBGMessage
    BuildBGMessage_Pkg
        BaliseSupport

Project Library CalculateTrainPosition
    CalculateTrainPosition_Pkg
        BG_relocation_Pkg
        BG_utilities_Pkg
        gp_functions_Pkg
        Pos_Pkg

Project Library CheckBGConsistency
    CheckBGConsistency_Pkg
        SubFunction
            DuplicationCheck

Project Library ManageBaliseInfomation_Integration
    ManageBaliseInfomation_Integration_Pkg

Project Library Obu_BasicTypes
    Obu_BasicTypes_Pkg

Project Library ProvidePositionReport
    ProvidePositionReport_Pkg
        PositionReportErrorManager_Pkg

Project Library ReceiveEuroBaliseFromAPI
    btmSupportPkg
    ReceiveEuroBaliseFromAPI_Pkg

Project Library SelectUsableInfo
    SelectUsableInfo_Pkg

Project Library TrainPosition_Integration
    TrainPosition_Integration_Pkg

Project Library TrainPosition_Types
    TrainPosition_Types_Pck

Project Library ValidateDataDirection
    ValidateDataDirection_Pkg
        DetermineBG_Orientation_Pkg

2.2. Call Graph

This Call Graph displays the dependency tree of model operators.

1. MLRI_Integration_Pkg::LocationRelatedInformation
    1.1. ManageBaliseInfomation_Integration_Pkg::ManageBaliseInfomation
    1.2. TrainPosition_Integration_Pkg::ManageTrainPosition

3. MLRI_Integration Project

3.1. MLRI_Integration_Pkg Package

3.1.1. LocationRelatedInformation Operator

Declared as **`public node`**

3.1.1.1. Comments and Information

LocationRelatedInformation Comments:

- Integrates all subfunctions of the Block "ManageLocationRelatedInformation"

3.1.1.2. Interface

Table 1: Inputs of LocationRelatedInformation

Name	Type	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	**Comments:** The current odometry values
reset	bool	**Comments:** Resets all to an initials state and deletes all stored BGs.
systemTime	ProvidePositionReport_Pkg::SystemTime_T	**Comments:** System time of the ETCS EVC
posRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	**Comments:** Information needed to generate the position report (Parts wich are generated outside our model)
trainProps	TrainPosition_Types_Pck::trainProperties_T	**Comments:** Properties of the train Needed as additional information to the radio report.
rcbComm	ProvidePositionReport_Pkg::RBC_Communication_T	**Comments:** Information needed for setting up the radio communication
API_balise	API_Msg_Pkg::API_Telegram_T	**Comments:** Balise Telegram
Train2TrackStatus	BG_Types_Pkg::TrainToTrackStatus_T	**Comments:** Track Status as it is visible in the train
Train_Data	TIU_Types_Pkg::trainData_T	**Comments:** Train data generated by other functions of the system
directionLRBG	ProvidePositionReport_Pkg::BG_Orientation_T	**Comments:** Direction reported from the LRBG
prvDirTrain	Q_DIRTRAIN	**Comments:** Direction of the train
LRBG	TrainPosition_Types_Pck::positionedBG_T	**Comments:** The LRBG used for RBC communication.
locationbasedEvents	ProvidePositionReport_Pkg::LocationBasedEvents_T	**Comments:** Location based events needed for the radio report.

Table 2: Outputs of LocationRelatedInformation

Name	Type	Comments and Information
trainPosition	TrainPosition_Types_Pck::trainPosition_T	**Comments:** Position of the train calculated by the function
trainPosErrors	TrainPosition_Types_Pck::positionErrors_T	**Comments:** Errors and inconsistencies detected by the calculation.
BGs	TrainPosition_Types_Pck::positionedBGs_T	**Comments:** The collection of currently known BGs.
ApplyServiceBrake	bool	**Comments:** Indicator to the EVC: check asks for Service Brake The decision on whether to apply actualy the break is not done by this unit.
BadBaliseMessageToDMI1	bool	**Comments:** Indicator to the EVC: check results in a bad balise group. Please, inform the driver via DMI.
posRep	ProvidePositionReport_Pkg::PositionReport_T	**Comments:** Position Report to be sent to the RBC.

3.1.1.3. Locals

Table 3: Locals of LocationRelatedInformation

Name	Type	Properties		Comments and Information
locBGs	TrainPosition_Types_Pck::positionedBGs_T	last	CalculateTrainPosition_Pkg::cNoPositionedBGs	
locTrainPosition	TrainPosition_Types_Pck::trainPosition_T	last	CalculateTrainPosition_Pkg::cTrainPosition_0	

3.1.1.4. Operator Hierarchy

diagram : diagram_LocationRelatedInformation_1

3.1.1.5. Graphical and Textual Diagrams

3.1.1.5.1. View of diagram_LocationRelatedInformation_1 (LocationRelatedInformation)

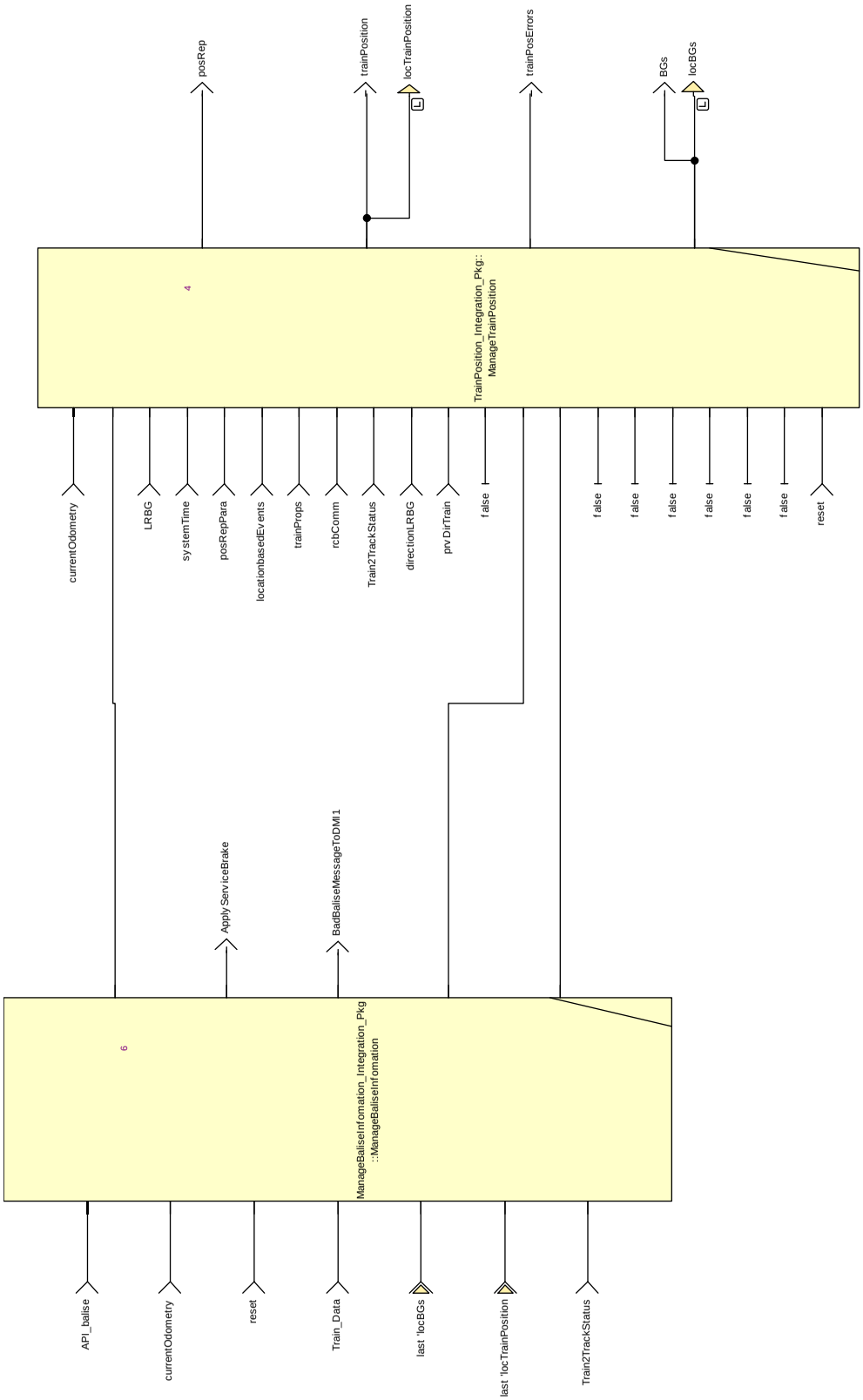


Figure 1: View of diagram_LocationRelatedInformation_1 (LocationRelatedInformation)

4. Project Library: BG_Types

4.1. BG_Types_Pkg Package

4.1.1. Types

Table 4: Public Types of BG_Types_Pkg

Name	Definition	Comments and Information
AdditionalInformation_T	{linkingPackets : BG_Types_Pkg::LinkedBGs_T}	**Comments:** Packets received from balises
BG_Header_T	{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}	**Comments:** Common header of the balise group datagram
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
passedBG_T	{valid : bool, bgPosition : Obu_BasicTypes_Pkg::odometry_T, BG_centerDetectionInaccuraccuracies : Obu_BasicTypes_Pkg::LocWithInAcc_T, q_nvlocacc : Q_NVLOCACC, BG_Header : BG_Types_Pkg::BG_Header_T, linkedBGs : BG_Types_Pkg::LinkedBGs_T, noCoordinateSystemHasBeenAssigned : bool, trainOrientationToBG : Q_DIRLRBG, trainRunningDirectionToBG : Q_DIRTRAIN}	**Comments:** Information reveived from a BG passede **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 **BG_Header Comments:** Common header of the balise group datagram **linkedBGs Comments:** The linked balise groups announced from this BG. **noCoordinateSystemHasBeenAssigned 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
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 : BG_Types_Pkg::AdditionalInformation_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

Name	Definition	Comments and Information
TelegramArray_T	BG_Types_Pkg::Telegram_T ^cMaxNoBalises	**Comments:** Array of Telegrams making a Balise Group (for check)
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.

Name	Definition	Comments and Information
TrainToTrackStatus_T	{m_mode : M_MODE, m_level : M_LEVEL, m_leveltr : M_LEVELTR, nid_ntc : NID_NTC, q_length : Q_LENGTH}	**Comments:** !! Change Name and Type name (Christian) **m_mode Comments:** Mode of train **m_level Comments:** Level of train **m_leveltr Comments:** level transition **nid_ntc Comments:** national system id : where does the type result from **q_length Comments:** qualifier for train integrity status: woher?

4.1.2. Constants

Table 5: Public Constants of BG_Types_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
cAddInfo	BG_Types_Pkg::AdditionalInformation_T	{linkingPackets : [{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,	**Comments:** empty structure for additional information

Name	Type	Value	Comments and Information
cEmpty_BaliseTlg	BG_Types_Pkg::Telegram_T	{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 : {linkingPackets : [{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 :	**Comments:** empty telegram

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 : {linkingPackets : [{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_dir	

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

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 : {linkingPackets : [{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 :	

Name	Type	Value	Comments and Information
		{valid : false, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, BG_Header : {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}, 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_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_S	

Name	Type	Value	Comments and Information
cemptyPosition	BG_Types_Pkg::centerOfBalisePosition_T	{odometerOfBaliseDetection : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetectionInaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}}	**Comments:** empty Balise Position
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

4.2. Common_Types_Pkg Package

4.2.1. Types

Table 6: Public Types of Common_Types_Pkg

Name	Definition	Comments and Information
MsgSource_T	enum {Euroradio, Eurobalise}	
ReceivedMessage_T	{source : Common_Types_Pkg::MsgSource_T, BG_Common_Header : BG_Types_Pkg::BG_Header_T, Radio_Common_Header : Radio_Types_Pkg::Radio_TrackTrain_ Header_T}	

4.3. Packet_Types_Pkg Package

4.3.1. Types

Table 7: Public Types of Packet_Types_Pkg

Name	Definition	Comments and Information
axleload_T	{valid : bool, m_axleloadcat : M_AXLELOADCAT, v_axleload : V_AXLELOAD}	
axleloadArray_T	Packet_Types_Pkg::axleload_T ^cNIterMax	
Diff_T	{valid : bool, q_diff : Q_DIFF, nc_cddiff : NC_CDDIFF, nc_diff : NC_DIFF, v_diff : V_DIFF}	
DiffArray_T	Packet_Types_Pkg::Diff_T ^cNIterMax	
nidC_T	{valid : bool, nid_c : NID_C}	
nidCArray_T	Packet_Types_Pkg::nidC_T ^cNIterMax	
nvkrint_T	{valid : bool, l_nvkrint : L_NVKRINT, m_nvkrint : M_NVKRINT}	
nvkrintArray_T	Packet_Types_Pkg::nvkrint_T ^cNIterMax	
nvkvint_T	{valid : bool, v_nvkvint : V_NVKVINT, m_nvkvint12 : M_NVKVINT, m_nvkvint23 : M_NVKVINT}	**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	

Name	Definition	Comments and Information
nvkvintset_T	{valid : bool, q_nvkvintset : Q_NVKVINTSET, a_nvp12 : A_NVP12, a_nvp23 : A_NVP23, nvkintArray : Packet_Types_Pkg::nvkvintArray_T}	**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
nvkvintsetArray_T	Packet_Types_Pkg::nvkvintset_T ^cNIterMax	
P131_RBCTransitionOrder_T	{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}	
P137_StopIfInStaffResponsible_T	{q_dir : Q_DIR, q_srstop : Q_SRSTOP}	
P138_ReversingAreaInformation_T	{q_dir : Q_DIR, q_scale : Q_SCALE, d_startreverse : D_STARTREVERSE, l_reversearea : L_REVERSEAREA}	
P139_ReversingSupervisionInformation_T	{q_dir : Q_DIR, q_scale : Q_SCALE, d_reverse : D_REVERSE, v_reverse : V_REVERSE}	
P140_TrainRunningNumberFromRBC_T	{q_dir : Q_DIR, nid_operational : NID_OPERATIONAL}	
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}	
P21_GradientProfiles_T	Packet_Types_Pkg::P21_GradientProfile_T ^cNIterMax	
P255_EndOfInformation_T	{nid_packet : NID_PACKET}	
P27_InternationalStaticSpeedProfile_T	{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}	
P39_TrackConditionChangeOfTractionSystem_T	{q_dir : Q_DIR, q_scale : Q_SCALE, d_traction : D_TRACTION, m_voltage : M_VOLTAGE, nid_ctraction : NID_CTRACTION}	

Name	Definition	Comments and Information
P3_NationalValues_T	{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}	
P40_TrackConditionChangeOfAllowedCurrentConsumption_T	{q_dir : Q_DIR, q_scale : Q_SCALE, d_current : D_CURRENT, m_current : M_CURRENT}	
P41_LevelTransistionOrders_T	Packet_Types_Pkg::P41_LevelTransitionOrder_T ^cNIterMax	
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}	
P42_SessionManagement_T	{q_dir : Q_DIR, q_rbc : Q_RBC, nid_c : NID_C, nid_rbc : NID_RBC, nid_radio : NID_RADIO, q_sleepsession : Q_SLEEPSESSION}	
P44_DataUsedByApplicationsOutsideTheERTMSETCSSystem_T	{q_dir : Q_DIR, nid_xuser : NID_XUSER, nid_ntc : NID_NTC, Other_data_depending_on__NID_XUSER : int}	**Other_data_depending_on__NID_XUSER Comments:** TODO
P45_RadioNetworkRegistration_T	{q_dir : Q_DIR, nid_mn : NID_MN}	
P46_ConditionalLevelTransitionOrder_T	{q_dir : Q_DIR, m_leveltr : M_LEVELTR, nid_ntc : NID_NTC}	

Name	Definition	Comments and Information
P46_ConditionalLevelTransitionOrders_T	Packet_Types_Pkg::P46_ConditionalLevelTransitionOrder_T ^cNIterMax	
P49_ListOfBalisesForSHArea_T	{valid : bool, q_dir : Q_DIR, q_newcountry : Q_NEWCOUNTRY, nid_c : NID_C, nid_bg : NID_BG}	
P49_ListOfBalisesForSHAreas_T	Packet_Types_Pkg::P49_ListOfBalisesForSHArea_T ^cNIterMax	
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}	
P51_AxleLoadSpeedProfiles_T	Packet_Types_Pkg::P51_AxleLoadSpeedProfile_T ^cNIterMax	
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}	
P52_PermittedBrakingDistanceInformations_T	Packet_Types_Pkg::P52_PermittedBrakingDistanceInformation_T ^cNIterMax	
P57_MovementAuthorityRequestParameters_T	{q_dir : Q_DIR, t_mar : T_MAR, t_timeoutrqst : T_TIMEOUTRQST, t_cycrqst : T_CYCRQST}	
P58_PositionReportParameter_T	{valid : bool, q_dir : Q_DIR, q_scale : Q_SCALE, t_cycloc : T_CYCLOC, d_cycloc : D_CYCLOC, m_loc : M_LOC, d_loc : D_LOC, q_lgtloc : Q_LGTLOC}	
P58_PositionReportParameters_T	Packet_Types_Pkg::P58_PositionReportParameter_T ^cNIterMax	
P64_InhibitionOfRevocableTSRsFromBalisesInL23_T	{q_dir : Q_DIR}	
P65_TemporarySpeedRestriction_T	{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}	
P66_TemporarySpeedRestrictionRevocation_T	{q_dir : Q_DIR, nid_tsr : NID_TSR}	
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}	
P68_TrackConditions_T	Packet_Types_Pkg::P68_TrackCondition_T ^cNIterMax	

Name	Definition	Comments and Information
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}	
P69_TrackConditionStationPlatforms_T	Packet_Types_Pkg::P69_TrackConditionStationPlatform_T ^cNIterMax	
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}	
P70_RouteSuitabilityDatas_T	Packet_Types_Pkg::P70_RouteSuitabilityData_T ^cNIterMax	
P71_AdhesionFactor_T	{q_dir : Q_DIR, q_scale : Q_SCALE, d_adhesion : D_ADHESION, l_adhesion : L_ADHESION, m_adhesion : M_ADHESION}	
P72_PacketForSendingPlainTextMessages_T	{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}	

Name	Definition	Comments and Information
P76_PacketForSendingFixedTextMessages_T	{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}	
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}	
P79_GeographicalPositionInformations_T	Packet_Types_Pkg::P79_GeographicalPositionInformation_T ^cNIterMax	
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}	
P80_ModeProfiles_T	Packet_Types_Pkg::P80_ModeProfile_T ^cNIterMax	
P88_LevelCrossingInformation_T	{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}	
SSP_T	{valid : bool, d_static : D_STATIC, v_static : V_STATIC, q_front : Q_FRONT, diffArray : Packet_Types_Pkg::DiffArray_T}	
SSPArray_T	Packet_Types_Pkg::SSP_T ^cNIterMax	
xText_T	{valid : bool, x_text : X_TEXT}	
xTextArray_T	Packet_Types_Pkg::xText_T ^255	

4.3.2. Constants

Table 8: Public Constants of Packet_Types_Pkg

Name	Type	Value	Comments and Information
cNIterMax	int	31	

4.4. Radio_Types_Pkg Package

4.4.1. Types

Table 9: Public Types of Radio_Types_Pkg

Name	Definition	Comments and Information
Radio_TrackTrain_Header_T	{nid_message : NID_MESSAGE, t_train : T_TRAIN, m_ack : M_ACK, nid_lrbg : NID_LRBG, q_scale : Q_SCALE, d_sr : D_SR, t_sh_rqst : T_TRAIN, d_ref : D_REF}	**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 **q_scale Comments:** Qualifier for the distance scale / From: Message 33: MA with Shifted Location Reference

5. Project Library: Obu_BasicTypes

5.1. Obu_BasicTypes_Pkg Package

5.1.1. Comments and Information

Obu_BasicTypes_Pkg Comments:

- Standardized basic type definitions to be used within all internal OBU functions

5.1.2. Types

Table 10: 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
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::Speed_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
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.
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

5.1.3. Constants

Table 11: 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

6. Project Library: ManageBaliseInfomation_Integration

6.1. ManageBaliseInfomation_Integration_Pkg Package

6.1.1. ManageBaliseInfomation Operator

Declared as **`public node`**

6.1.1.1. Interface

Table 12: Inputs of ManageBaliseInfomation

Name	Type	Comments and Information
API_balise	API_Msg_Pkg::API_Telegram_T	
ActualOdometry	Obu_BasicTypes_Pkg::odometry_T	
reset	bool	
Train_Data	TIU_Types_Pkg::trainData_T	
storedBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPosition	TrainPosition_Types_Pck::trainPosition_T	
trainStatus	BG_Types_Pkg::TrainToTrackStatus_T	

Table 13: Outputs of ManageBaliseInfomation

Name	Type	Comments and Information
BG_Message	BG_Types_Pkg::passedBG_T	
ApplyServiceBrake	bool	
BadBaliseMessageToDMI	bool	
errorLinkedBG	bool	
errorUnlinkedBG	bool	

6.1.1.2. Operator Hierarchy

diagram : diagram_ManageBaliseInfomation_1

6.1.1.3. Graphical and Textual Diagrams

6.1.1.3.1. View of diagram_ManageBaliseInfomation_1 (ManageBaliseInfomation)

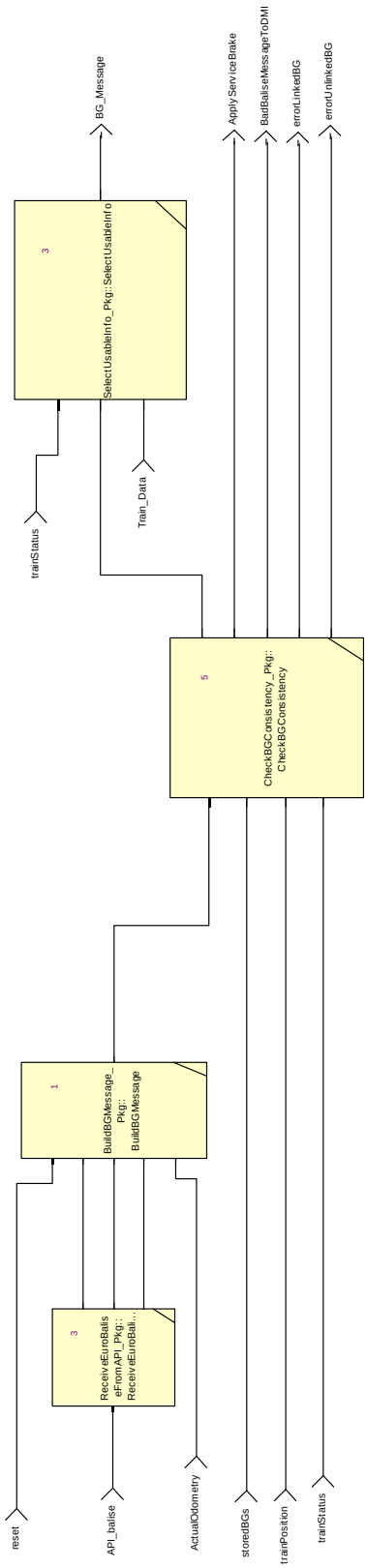


Figure 2: View of diagram_ManageBaliseInfomation_1 (ManageBaliseInfomation)

7. Project Library: BuildBGMessage

7.1. BuildBGMessage_Pkg Package

7.1.1. Open Packages

- BuildBGMessage_Pkg::BaliseSupport

7.1.2. Types

Table 14: Public Types of BuildBGMessage_Pkg

Name	Definition	Comments and Information
BGCollector_T	{badBaliseFlag : bool, BGMessageSent : bool, C_ID : NID_C, BG_ID : NID_BG, balisePosition : BG_Types_Pkg::centerOfBalisePosition_T, positionFirstContact : BG_Types_Pkg::centerOfBalisePosition_T, collectedTelegrams : int, totalTelegrams : int}	**Comments:** This data structure is used internally to collect balise telegrams **badBaliseFlag Comments:** indicates an transmission error on the btm interface between track and train. **BGMessageSent Comments:** If true balise message has been sent already. **C_ID Comments:** 7.5.1.86: Identity number of the country or region Code used to identify the country or region in which the balise group, the RBC or the RIU is situated. These need not necessarily follow administrative or political boundaries. **BG_ID 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. **balisePosition Comments:** Information where the coordinate system of the bg is anchored. The position is given with pig = 1st or pig = 2nd and balises are duplicates The information will be used for calculating thepoistion of the bg-coordinate system. **positionFirstContact Comments:** Information where the first information of the balise group has been received. - can be reletad to a read error (bad balise) - is the information related to the first telegram involved, irregardless of the pig-identifier **collectedTelegrams Comments:** Gives the nuimber of telegrams collected in the bg-message **totalTelegrams Comments:** Counter for the different telegrams collected for the balise group

Name	Definition	Comments and Information
TelegramStore_T	{valid : bool, telegram : BG_Types_Pkg::Telegram_T, position : BG_Types_Pkg::centerOfBalisePosition_T}	**Comments:** The telegram store. In this data structure telegrams are stored if they have to be kept for the next cycle. **valid Comments:** data is valid (i.e., stored by purpose) **position Comments:** Information on where the balise was positioned

7.1.3. Constants

Table 15: Public Constants of BuildBGMessage_Pkg

Name	Type	Value	Comments and Information
cCollectorInit	BuildBGMessage_Pkg::BGCollector_T	{badBaliseFlag : false, BGMessageSent : false, C_ID : 0, BG_ID : 0, balisePosition : {odometerOfBalise Detection : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}}, positionFirstContact : {odometerOfBalise Detection : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}}, collectedTelegrams : 0, totalTelegrams : 0}	**Comments:** Init value for the data structureBG CollectorInit_T

Name	Type	Value	Comments and Information
		{valid : false, telegram : {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 : {linkingPackets : [{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_dir	
cemptyStore	BuildBGMessage_Pkg::TelegramStore_T		**Comments:** Init Value for the empty

7.1.4. addTelegram Operator

Declared as **`public function`**

7.1.4.1. Comments and Information

addTelegram Comments:

- This function adds the received telegram to the balise group data.
- Precondition: all relevant checks are done beforehand.

7.1.4.2. Interface

Table 16: Inputs of addTelegram

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** The telegram to be added to the bg message. The telegram is checked prior to adding it to the grou.
inCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** The actual collector block.
inoldTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** Input: The actual telegram header array.
doUpdate	bool	**Comments:** bool:only if true the telegram needs changing.
inPosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** the actual position information

Table 17: Outputs of addTelegram

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** updated collector
outTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** updated telegram array.
outBGisComplete	bool	**Comments:** out: indicates: the bg is completed, i.e., all telegrams have been collected.

7.1.4.3. Operator Hierarchy

diagram : diagram_addTelegram_1
    activate if : IfBlock1
        branch : then
        branch : else

7.1.4.4. Graphical and Textual Diagrams

7.1.4.4.1. View of diagram_addTelegram_1 (addTelegram)

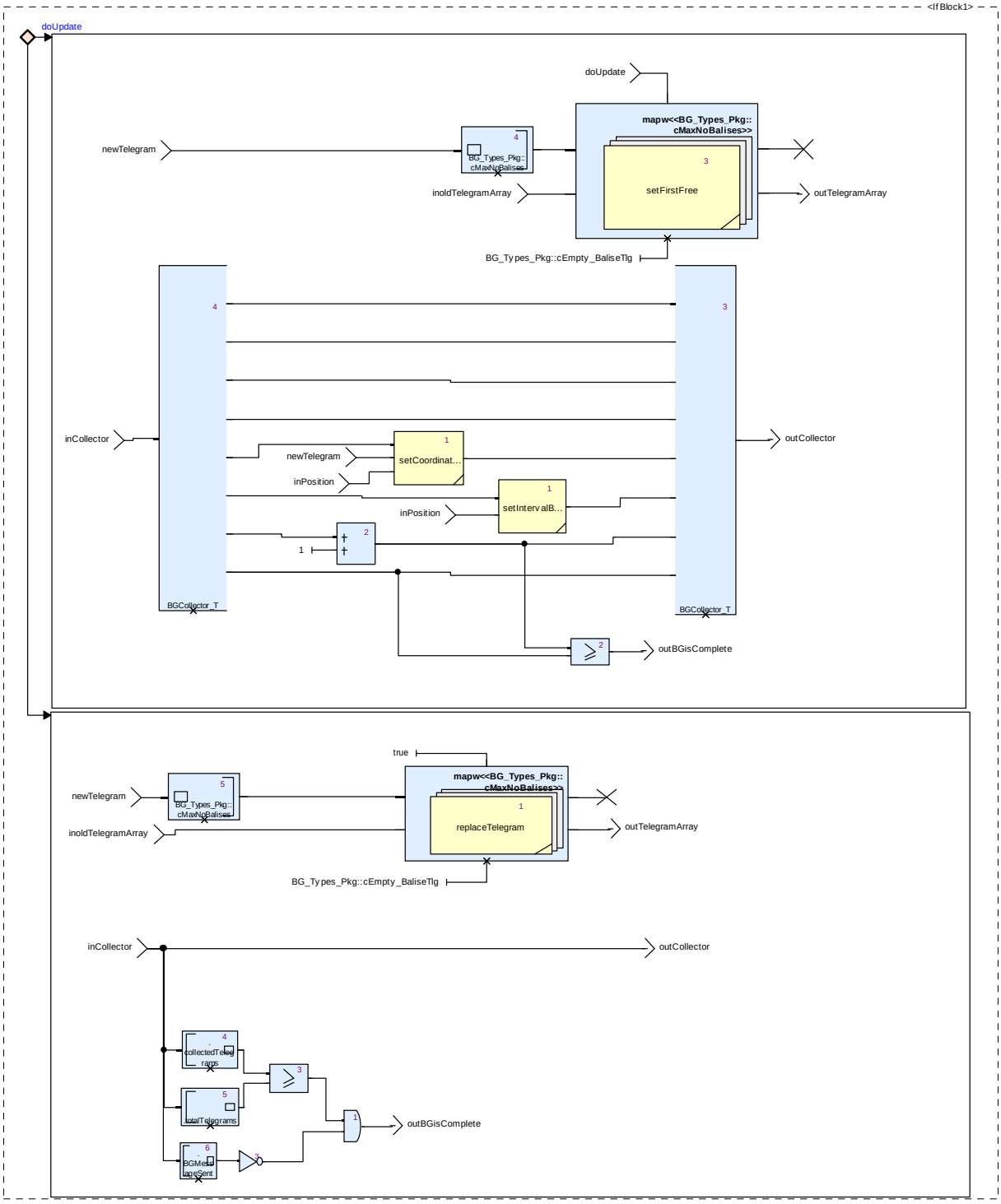


Figure 3: View of diagram_addTelegram_1 (addTelegram)

Table 18: Conditional Blocks of diagram_addTelegram_1

Conditional Block	Comments and Information
IfBlock1	

Table 19: Actions of diagram_addTelegram_1

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

7.1.5. BuildBGMessage Operator

Declared as **`public node`**

7.1.5.1. Comments and Information

BuildBGMessage Comments:

- Main function of this block: build the balise message.
- Refers to 3.4.1, 3.4.2 and other sections.
- According to the specification, the balise group is defined to be complete, based on the following rules:
- The last balise of the balise group has been received.
- In build bg message, this is recognised based on number of balises announced in the first received balise.
- [3.16.2.1.3] A balise within a balise group shall be regarded as missed if
- a) No balise is found within the maximum distance between balises from the previous
- balise in the group.
- or
- b) A following balise within the group has been passed.
- This is indicated by passing a balise with a different balise group identity (bg_id + c_id)
- Special Case for "bad balise" situation:
- in the case of a read error (e.g., CRC check failure) on the balise interface a bad balise information is fed into the balise channel.
- If the bad balise has been recognised while a balises of a balise group are being collceted the telegram will be missing in the balise group message (number of expected balises < number received balises).
- If the bad balise has been recognised outside a balise group location interval, the bad balise will indicated to the check bg block (CRC Failure).
- In this scenario, the output bg-message is "not present" and the output CRC_Failure = true.
- In practice, this means: setting the CRC_Failure output will wait until the train has moved out of the interval.
- The function makes use of data which is maintained over lifetime of a balise.:
- - store collector represents the working data like ids, numbers and position data
- - store BG Header collects the telegrams of a balise group
- - store BG Add Info collects the packets coming with the telegrams of a balise group
- - store Additional Telegram keeps data of an telegram if it could not be processed immediatly after receiving the telegram

- All stores are to be reset when the obu is reset.

7.1.5.2. Interface

Table 20: Inputs of BuildBGMessage

Name	Type	Comments and Information
reset	bool	**Comments:** Input: Request a reset of the data in the function. If reset=true no other input is valid.
inTelegramPresent	bool	**Comments:** Indicates the input inDecodedTelegram is "present", i.e., the input has been updated in this cycle. Only if the telegram is present the position information (incenterOfBalise) is to be used.
inDecodedTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input:Balise Telegram. The parameter is only to be used if the inTelegramPresent parameter is set to true. The data in the telegram may be "valid=true" (telegram has been received without faults) or "valid=false". This indicates an error in transmission.
incenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** Input:Balise Telegram. The parameter is only to be used if the inTelegramPresent parameter is set to true. The parameter passes the position of the balise evaluated by the btm.
inActualOdometry	Obu_BasicTypes_Pkg::odometry_T	**Comments:** Actual Information from the Odometry.

Table 21: Outputs of BuildBGMessage

Name	Type	Comments and Information
outBGMessage	BG_Types_Pkg::BG_Message_T	**Comments:** Output: the balise group message. The element present (bool) indicates whther the information in the telegram is updated. The message passes all telegrams received, the number of balises received with a valid content and the position,where the balise group coordinate system is positioned. The direction parameter is not known at this step.It will be determined later in the flow. The numberBalises element indicates the number of different valid telegrams received for the group. It may differ from the expected number, e.g., after trasnmission errors. In this context different means each telegram is valid and has a unique nid_pig (position in group) parameter. All telegrams in the group have to have the same nid_bg parameter.

7.1.5.3. Locals

Table 22: Locals of BuildBGMessage

Name	Type	Properties		Comments and Information
BGisChangedEarly	bool	default	false	**Comments:** Bool: indicates a balise group has changed before all expected telegrams have been received.
BGisComplete	bool			**Comments:** Bool: indicates the BG-Message is complete
needTelegramStore	bool	default	false	**Comments:** This flag is used for showing if the data in the telegram store is stil to be used.
positionToUse	BG_Types_Pkg::centerOfBalisePosition_T	default	BG_Types_Pkg::cemptyPosition	**Comments:** Temporary store fot the telegram position information. Information is determined by the manageAdditionalTelegram function.
storeAdditionalTelegra	BuildBGMessage_Pkg::	default	cemptyStore	**Comments:**

Name	Type	Properties		Comments and Information
m	TelegramStore_T	last	cemptyStore	This memory is used to store an additional telegram. The store is needed when: - the end of the previous BG is indicated by a new bg In this situation, first the new telegram is stored but not immediatly processed. In the same cycle the BG-Message of the now complete balise group is processed. This implies, there might be a balise telegram left over from the prevous run o the procedure which needs to be taken care of before being able to handle the next one. Practically, this means: - if no (or new odometry info) is present: first empty the store. - if a new telegram is received, swap the telegrams in the store and proceed with the elder telegram.
storeBGTelegramArray	BG_Types_Pkg::TelegramArray_T	last	BG_Types_Pkg::cemptyHeaderArray	**Comments:** This variable is used to collect the telegrams of the balise group. The store has to be initialised when a reset command has been requested.
storeCollector	BuildBGMessage_Pkg::BGCollector_T	last	cCollectorInit	**Comments:** Keeps the control data for the collection procedure. The variable is to be reset when a reset command has been indicate with the input reset set to true.
storeIsChanged	bool	default	false	**Comments:** Bool, Indicates the stores for the collector and for the telegram array have to be updated.

Name	Type	Properties		Comments and Information
telegramPresent	bool			**Comments:** Temporary store fot the telegram presence information. Information is determined by the manageAdditionalTelegram function.
telegramToUse	BG_Types_Pkg::Telegram_T	default	BG_Types_Pkg::cEmpty_BaliseTlg	**Comments:** Temporary store for the telegram information. Information is determined by the manageAdditionalTelegram function.
tempBGTelegramArray	BG_Types_Pkg::TelegramArray_T	default	BG_Types_Pkg::cemptyHeaderArray	**Comments:** Temporary variable for keeping the telegram array. The variable results from problems in scade to link information between different if then else branches.
tempCollectorStore	BuildBGMessage_Pkg::BGCollector_T	default	cCollectorInit	**Comments:** Temporary variable for keeping thecollector information.. The variable results from problems in scade to link information between different if then else branches.

7.1.5.4. Operator Hierarchy

diagram : diagram_BuildBGMessage_1
- *activate if* : IfBlock1
  - branch : then
  - branch : else
    - *activate if* : IfBlock3
      - branch : then
      - branch : else
- *activate if* : IfBlock2
  - branch : then
  - branch : else
    - *activate if* : IfBlock3
      - branch : then
      - branch : else
- *activate if* : IfBlock4
  - branch : then
  - branch : else

7.1.5.5. Graphical and Textual Diagrams

7.1.5.5.1. View of diagram_BuildBGMessage_1 (BuildBGMessage)

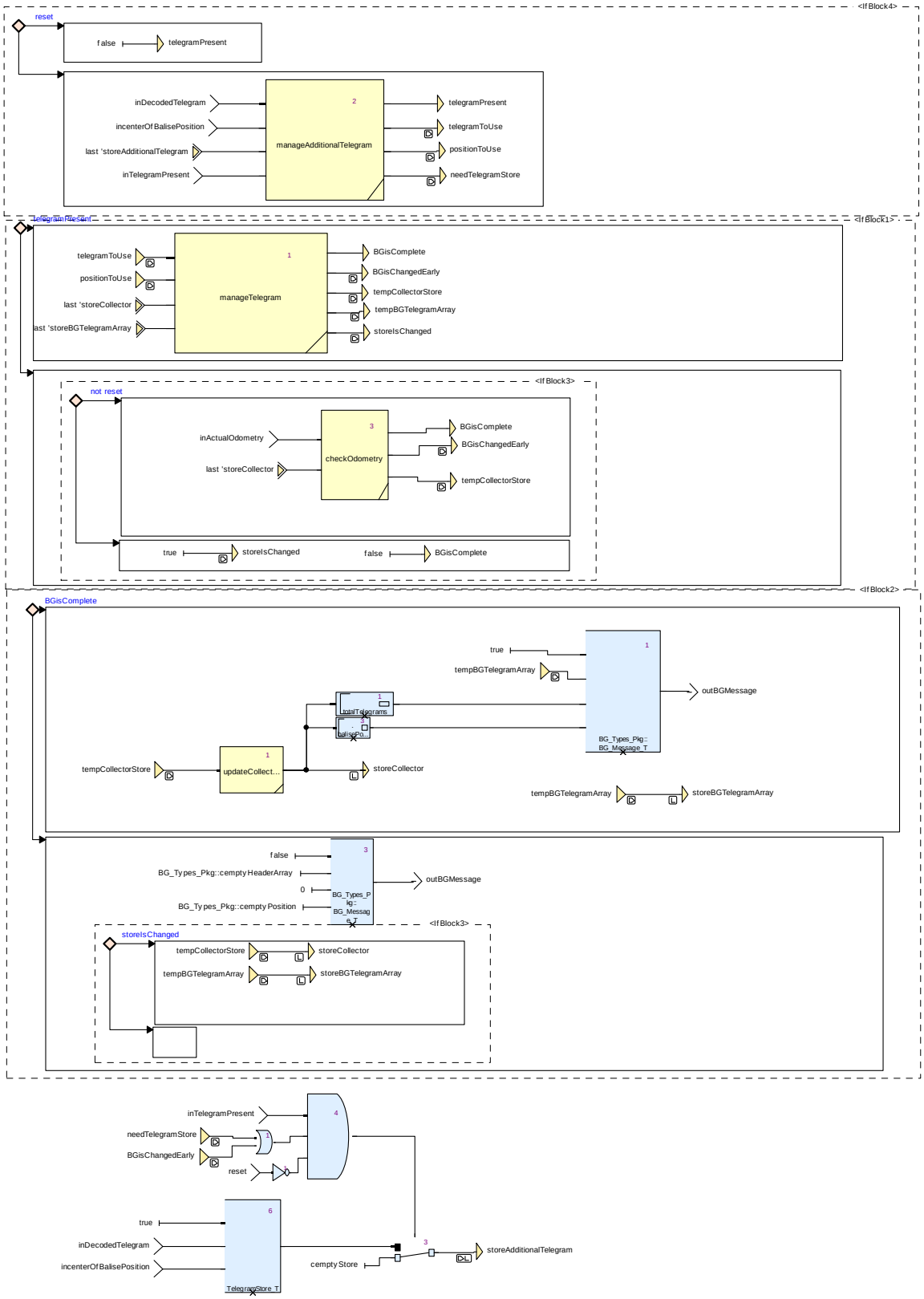


Figure 4: View of diagram_BuildBGMessage_1 (BuildBGMessage)

Table 23: Conditional Blocks of diagram_BuildBGMessage_1

Conditional Block	Comments and Information
IfBlock1	
IfBlock1:else:IfBlock3	
IfBlock2	
IfBlock2:else:IfBlock3	
IfBlock4	

Table 24: Actions of diagram_BuildBGMessage_1

Conditional Block Action	Comments and Information
IfBlock1:then	
IfBlock1:else	
IfBlock1:else:IfBlock3:then	
IfBlock1:else:IfBlock3:else	
IfBlock2:then	
IfBlock2:else	
IfBlock2:else:IfBlock3:then	
IfBlock2:else:IfBlock3:else	
IfBlock4:then	
IfBlock4:else	

7.1.6. checkInit Operator

Declared as **`public function`**

7.1.6.1. Comments and Information

checkInit Comments:

- This block checks on valid data in the collector. If data has init values collector is set to information from new balise.

7.1.6.2. Interface

Table 25: Inputs of checkInit

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: the actual telegram which is being processed.
inCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** Input: the actual collector

Table 26: Outputs of checkInit

Name	Type	Properties		Comments and Information
outCollector	BuildBGMessage_Pkg::BGCollector_T	default	cCollectorInit	**Comments:** out: updated collector

7.1.6.3. Locals

Table 27: Locals of checkInit

Name	Type	Comments and Information
isDefined	bool	**Comments:** bool: the collector is already in use for a balise group.

7.1.6.4. Operator Hierarchy

diagram : diagram_checkInit_1
activate if : IfBlock1
branch : then
branch : else

7.1.6.5. Graphical and Textual Diagrams

7.1.6.5.1. View of diagram_checkInit_1 (checkInit)

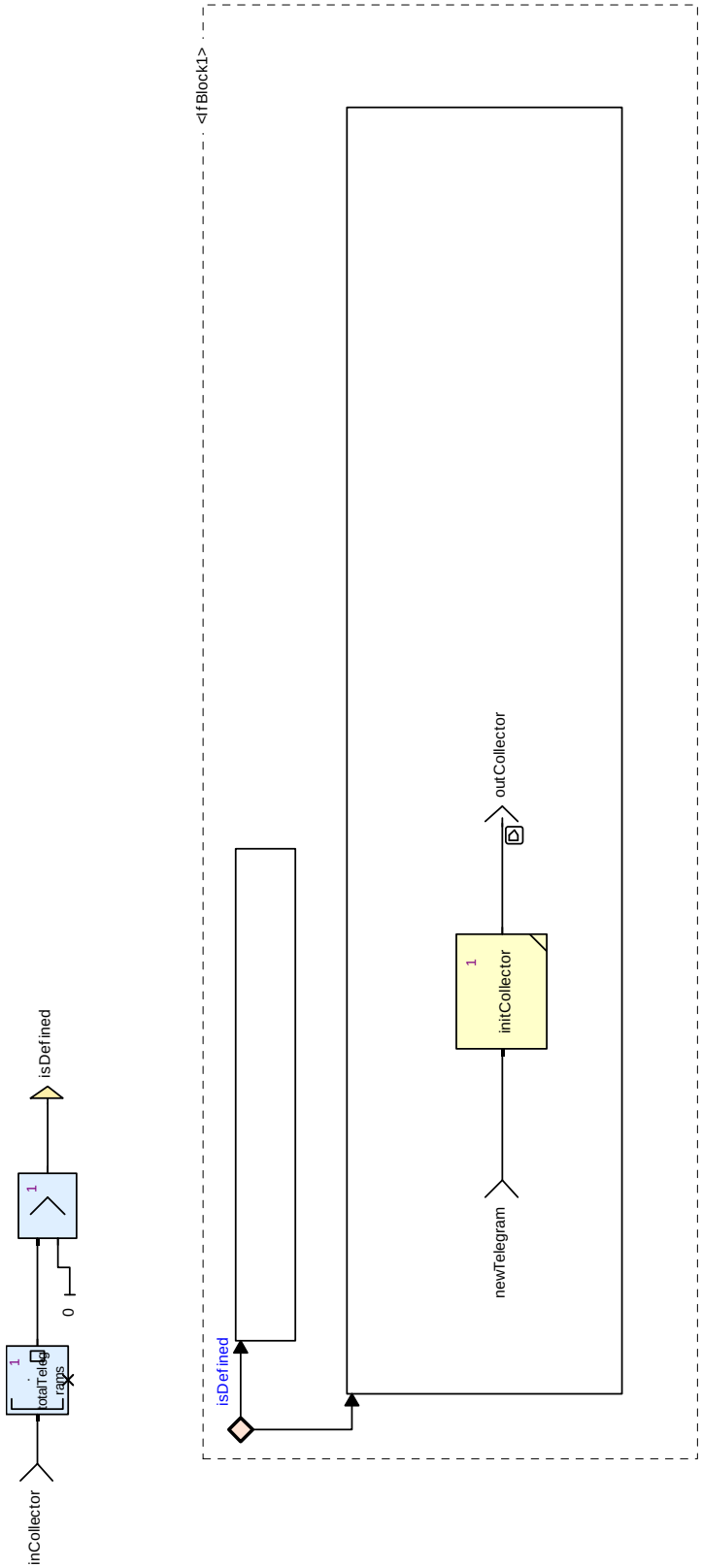


Figure 5: View of diagram_checkInit_1 (checkInit)

Table 28: Conditional Blocks of diagram_checkInit_1

Conditional Block	Comments and Information
IfBlock1	

Table 29: Actions of diagram_checkInit_1

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

7.1.7. checkOdometry Operator

Declared as **`public function`**

7.1.7.1. Comments and Information

checkOdometry Comments:

- The operator checks wehther the absolute distance between two odometry values is less then cMaxDistance.
- The check is needed to determine whether the antenna of the train is still in the allowed range for collecting balises in a balise group.
- The check is requested in section 3.16.2 . Details are defoned in subset 40 section 4.1.1.2.

7.1.7.2. Interface

Table 30: Inputs of checkOdometry

Name	Type	Comments and Information
actualOdometry	Obu_BasicTypes_Pkg::odometry_T	**Comments:** Input: the actual Odometry of the train. The odometry is taken for comparing the actual value with the known position of the balise group.
inCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** input: the actual collector

Table 31: Outputs of checkOdometry

Name	Type	Comments and Information
outMessageComplete	bool	**Comments:** Out: The bg-message is being complted. true indicates the odometry data imply the train has left the location of the balise group.
outBGIsChangedEarly	bool	**Comments:** out: the odometry indicates the train has left the range of the balise group and the bg telegrams are not fully received.
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** output: updated collector

7.1.7.3. Locals

Table 32: Locals of checkOdometry

Name	Type	Comments and Information
isValid	bool	**Comments:** bool: both input parameters are valid.

7.1.7.4. Operator Hierarchy

diagram : diagram_checkOdometry_1
activate if : IfBlock1
branch : then
branch : else

7.1.7.5. Graphical and Textual Diagrams

7.1.7.5.1. View of diagram_checkOdometry_1 (checkOdometry)

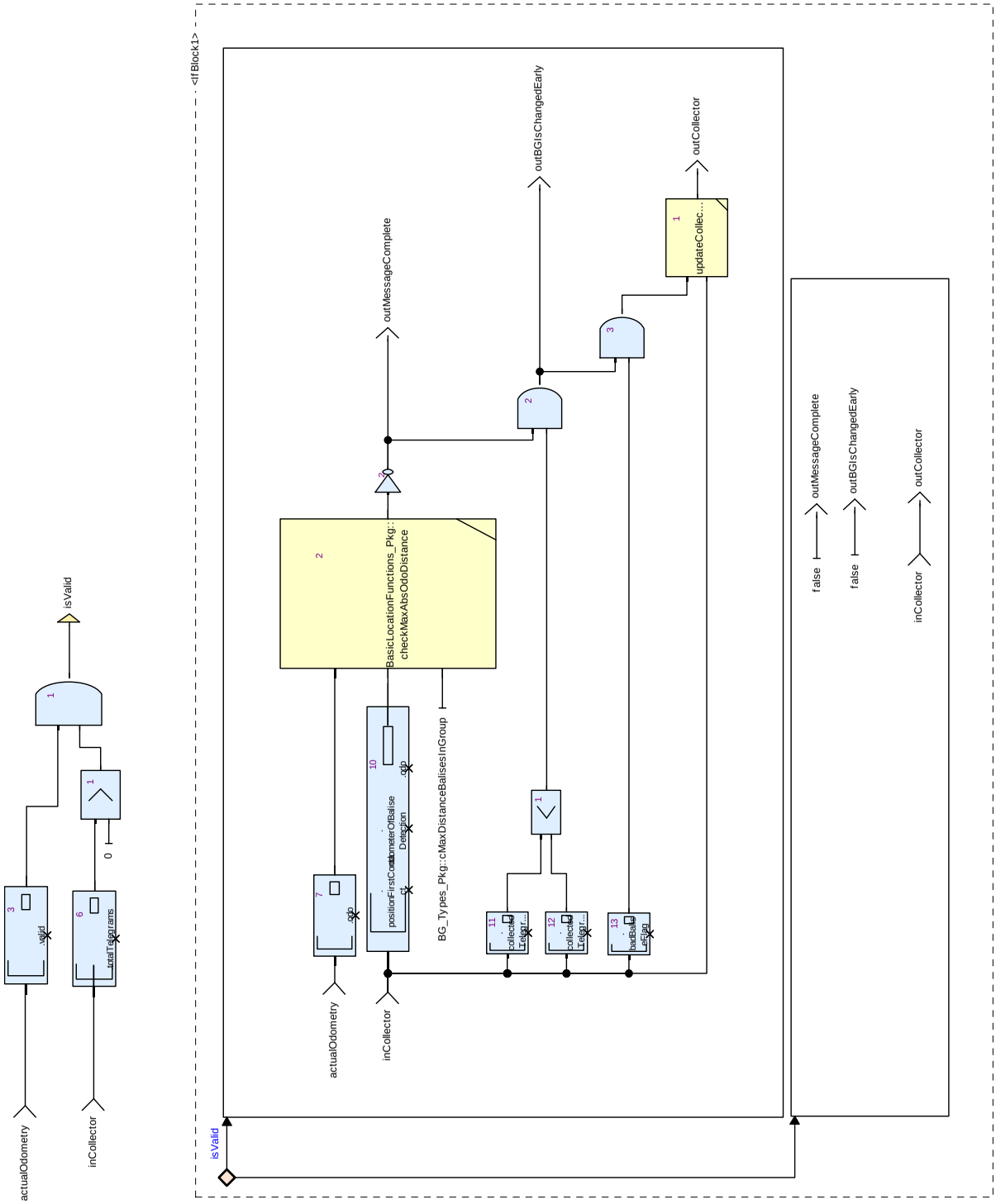


Figure 6: View of diagram_checkOdometry_1 (checkOdometry)

Table 33: Conditional Blocks of diagram_checkOdometry_1

Conditional Block	Comments and Information
IfBlock1	

Table 34: Actions of diagram_checkOdometry_1

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

7.1.8. checkTelegram Operator

Declared as **`public function`**

7.1.8.1. Comments and Information

checkTelegram Comments:

- Procedure checks for consistency of the input data (valid) and looks for the telegram in the balise group.
- If the switch of an balise group is detected which already has been sent as a balise group message the stores are being initialised prior to use.

7.1.8.2. Interface

Table 35: Inputs of checkTelegram

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** The telegram to be checked
inTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** the already collected telegrams of the balise group.
BGCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** input: the actual collector information

Table 36: Outputs of checkTelegram

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** the updated collector information
outTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** output: the updated array of telegrams
outTelegramNotInGroup	bool	**Comments:** out: bool the telegram is valid, but it does not belong to the actually collected group.
outBGchangedEarly	bool	**Comments:** out: the bg in the telegram indicates the train has left the range of the balise group and the bg telegrams are not fully received.

7.1.8.3. Locals

Table 37: Locals of checkTelegram

Name	Type	Comments and Information
newBGInitNeeded	bool	**Comments:** bool: the collector store needs initialisation with the balise groups data.

7.1.8.4. Operator Hierarchy

diagram : diagram_checkTelegram_1

7.1.8.5. Graphical and Textual Diagrams

7.1.8.5.1. View of diagram_checkTelegram_1 (checkTelegram)

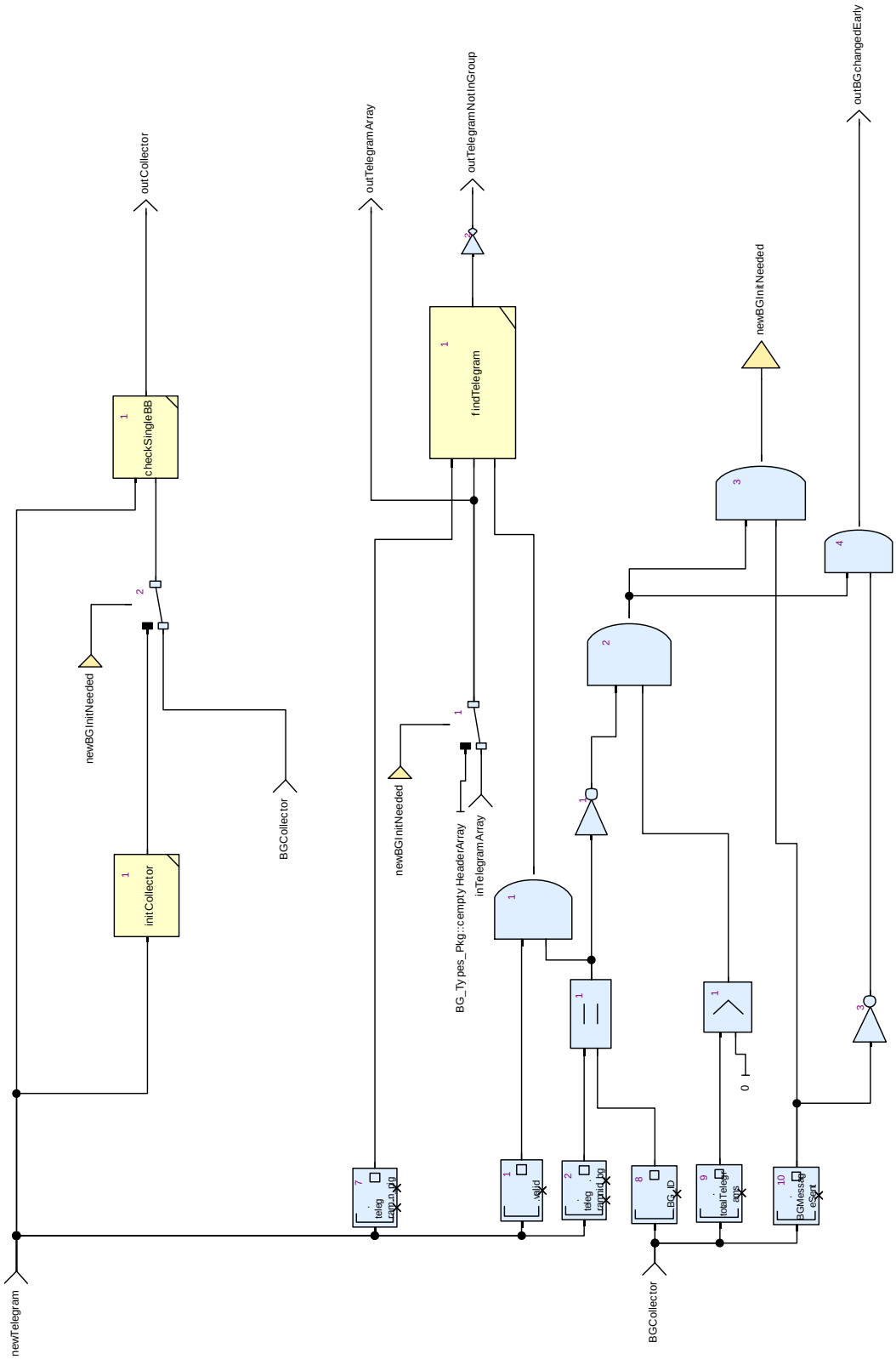


Figure 7: View of diagram_checkTelegram_1 (checkTelegram)

diagram_checkTelegram_1 Comments:

- Provides control data for the balise group collection.

7.1.9. manageAdditionalTelegram Operator

Declared as **`public function`**

7.1.9.1. Comments and Information

manageAdditionalTelegram Comments:

- When a balise of another balise group has been received before sending of the balise message the additional telegram has to be kept on hold.
- First the balise group will be completed.
- In the next call of the message, the additional telegram will be tasken from the hold before processing another balise telegram.

7.1.9.2. Interface

Table 38: Inputs of manageAdditionalTelegram

Name	Type	Comments and Information
inDecodedTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: the newly received telegram.
incenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** Input: the position data corresponding to the telegram.
inTelegramStore	BuildBGMessage_Pkg::TelegramStore_T	**Comments:** Input: the telegram store with the information from the previous run
inputTelegramPresent	bool	**Comments:** input: presence indicator related to the freshly received telegram.

Table 39: Outputs of manageAdditionalTelegram

Name	Type	Comments and Information
outputPresent	bool	**Comments:** output: new presence indicator. The telegrem is present if either a telegram is kept in the store or if the new telegram is present.
outDecodedTelegram	BG_Types_Pkg::Telegram_T	**Comments:** output: new telegram. The telegrem is either taken from the store (first choice) or from the new telegram.
outcenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** Output: the telegram position information.
outNeedStore	bool	**Comments:** Out: bool, indicates the store is still needed after the procedure is executed.

7.1.9.3. Locals

Table 40: Locals of manageAdditionalTelegram

Name	Type	Comments and Information
storeValid	bool	**Comments:** bool: the telegramStore is valid

7.1.9.4. Operator Hierarchy

diagram : diagram_manageAdditionalTelegram_1

7.1.9.5. Graphical and Textual Diagrams

7.1.9.5.1. View of diagram_manageAdditionalTelegram_1 (manageAdditionalTelegram)

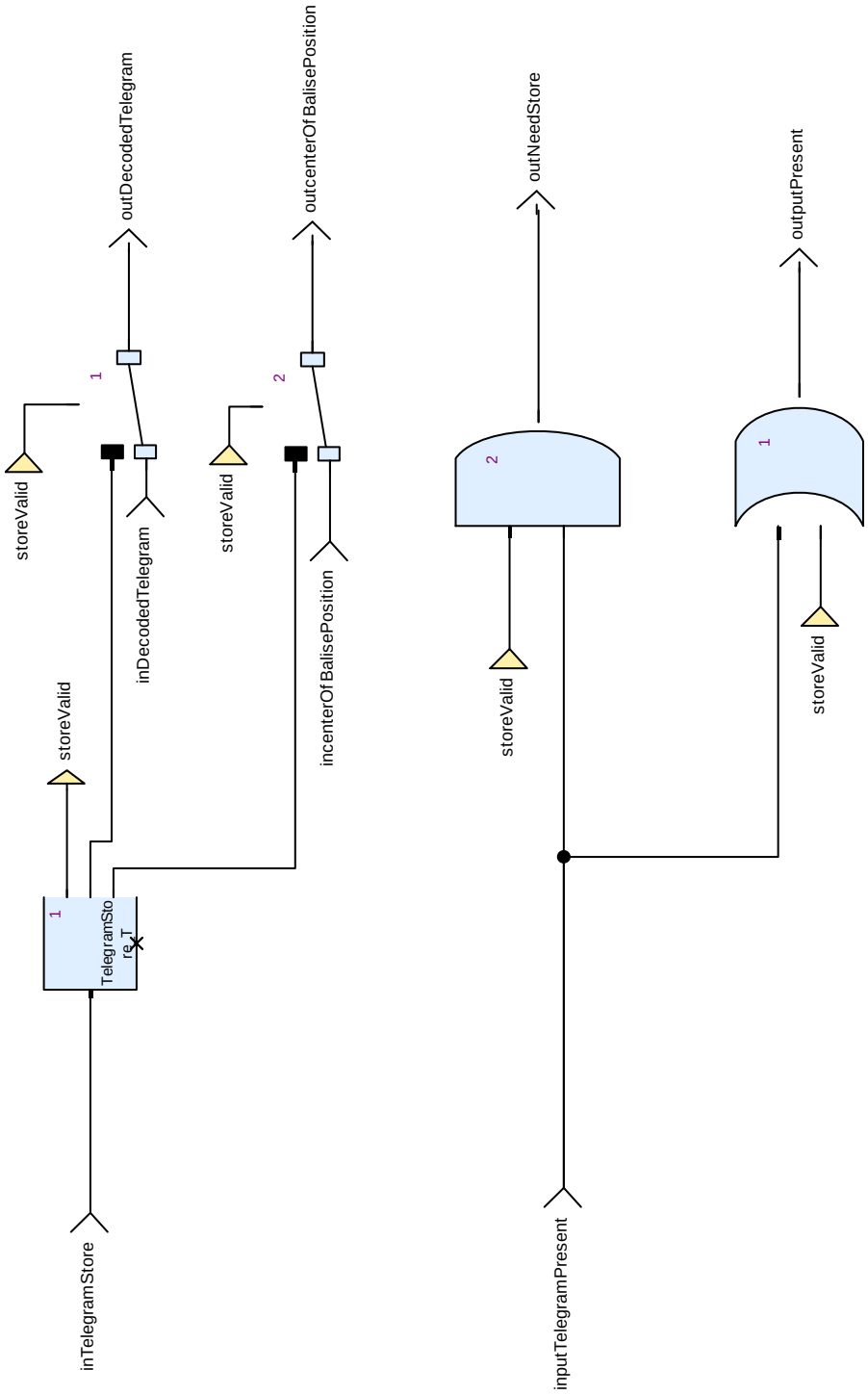


Figure 8: View of diagram_manageAdditionalTelegram_1 (manageAdditionalTelegram)

7.1.10. manageTelegram Operator

Declared as **`public function`**

7.1.10.1. Comments and Information

manageTelegram Comments:

- A valid telegram has been received. This blockperforms necessary checks and causes updates of the stores.

7.1.10.2. Interface

Table 41: Inputs of manageTelegram

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: the actual telegram to be managed
incenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** Input: the poistion information to the actual telegram to be managed
inCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** Input: the actual collector information
inoldTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** Input: the actual balise group array with the collected telegrams.

Table 42: Outputs of manageTelegram

Name	Type	Comments and Information
outBGisComplete	bool	**Comments:** out: indicates: the bg is completed, i.e., all telegrams have been collected.
outBGisChangedEarly	bool	**Comments:** out: the bg in the telegram indicates the train has left the range of the balise group and the bg telegrams are not fully received.
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** out: updated collector
outTelegramArray	BG_Types_Pkg::TelegramArray_T	**Comments:** out: updated bg-array.
outStoresChanged	bool	**Comments:** out: the stores are changed and need updating.

7.1.10.3. Operator Hierarchy

diagram : diagram_manageTelegram_1

7.1.10.4. Graphical and Textual Diagrams

7.1.10.4.1. View of diagram_manageTelegram_1 (manageTelegram)

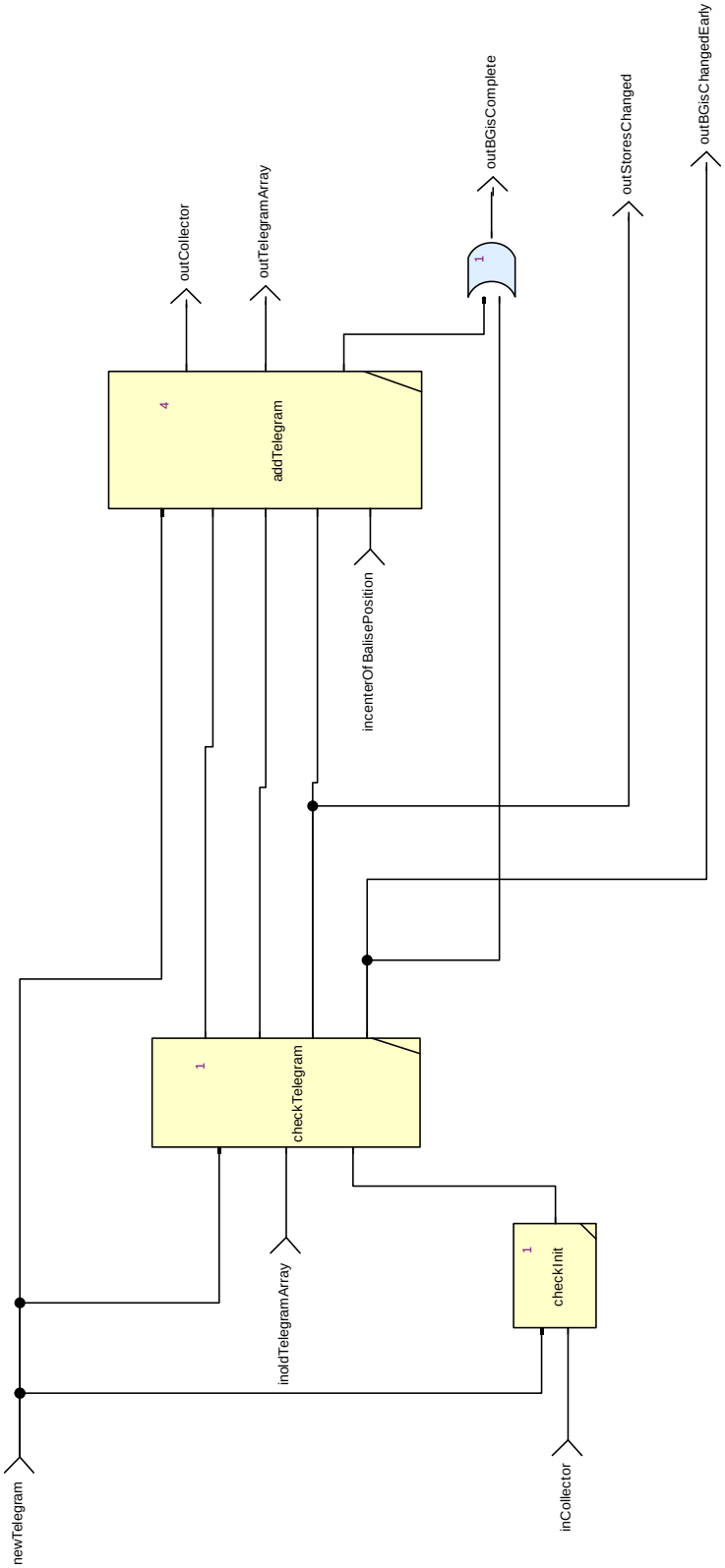


Figure 9: View of diagram_manageTelegram_1 (manageTelegram)

7.1.11. setCoordinateSystemPosition Operator

Declared as **`public function`**

7.1.11.1. Comments and Information

setCoordinateSystemPosition Comments:

- This function is repsonsible for setting the position of the balise coordinate system.
- In general the position is determined with the position of the 1st balise in the group (3.4.2.2).
- In the exceptional case of a duplicated balise the position can be taken from the

7.1.11.2. Interface

Table 43: Inputs of setCoordinateSystemPosition

Name	Type	Comments and Information
inOldPosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** input: position known
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** input actual telegram
incenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** input: position information of the actual telegram

Table 44: Outputs of setCoordinateSystemPosition

Name	Type	Comments and Information
outUpdateBGPosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** out<. updated poition information for the balise group

7.1.11.3. Operator Hierarchy

diagram : diagram_setCoordinateSystemPosition_1

7.1.11.4. Graphical and Textual Diagrams

7.1.11.4.1. View of diagram_setCoordinateSystemPosition_1 (setCoordinateSystemPosition)

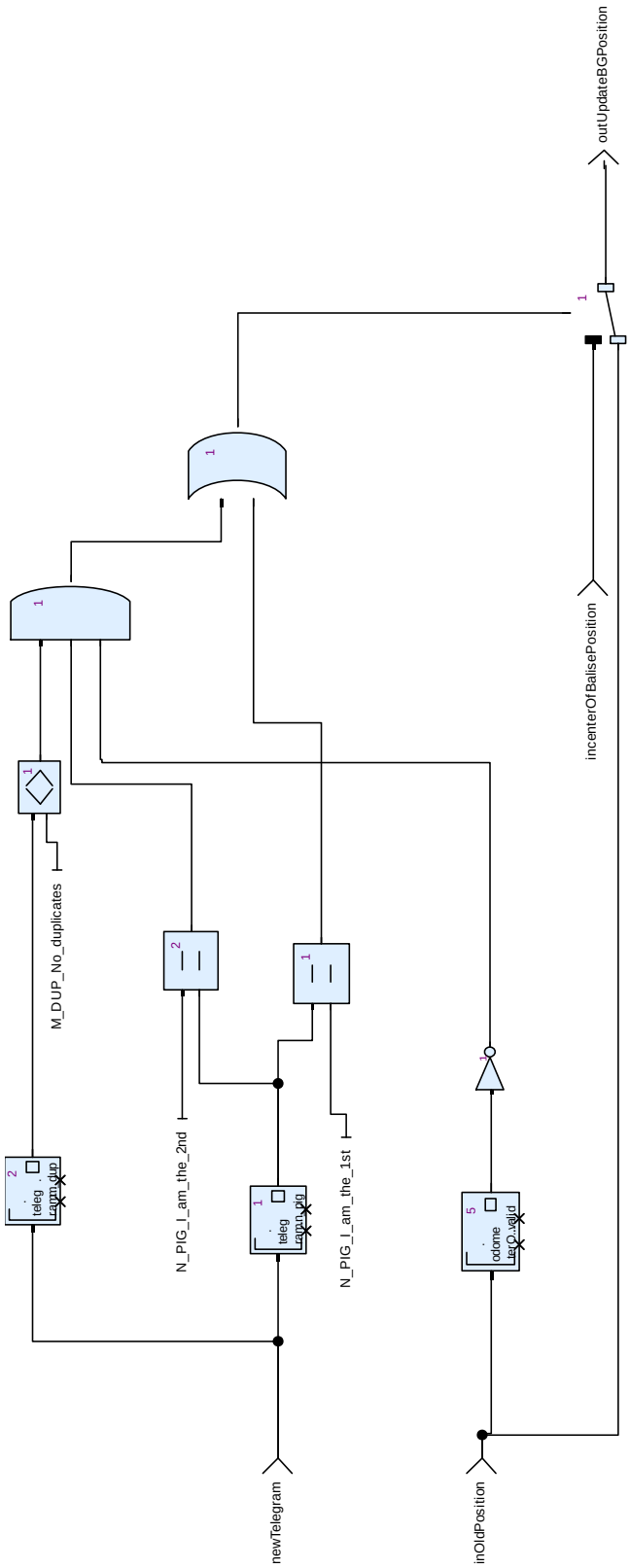


Figure 10: View of diagram_setCoordinateSystemPosition_1 (setCoordinateSystemPosition)

7.1.12. setIntervalBGPosition Operator

Declared as **`public function`**

7.1.12.1. Comments and Information

setIntervalBGPosition Comments:

- This function is repsonsible for setting the positionof the first balise of the balise group.

7.1.12.2. Interface

Table 45: Inputs of setIntervalBGPosition

Name	Type	Comments and Information
inOldPosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** input: position known
incenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** input: position information of the actual telegram

Table 46: Outputs of setIntervalBGPosition

Name	Type	Comments and Information
outUpdateBGPosition	BG_Types_Pkg::centerOfBalisePosition_T	**Comments:** out<. updated poition information for the balise group

7.1.12.3. Operator Hierarchy

diagram : diagram_setIntervalBGPosition_1

7.1.12.4. Graphical and Textual Diagrams

7.1.12.4.1. View of diagram_setIntervalBGPosition_1 (setIntervalBGPosition)

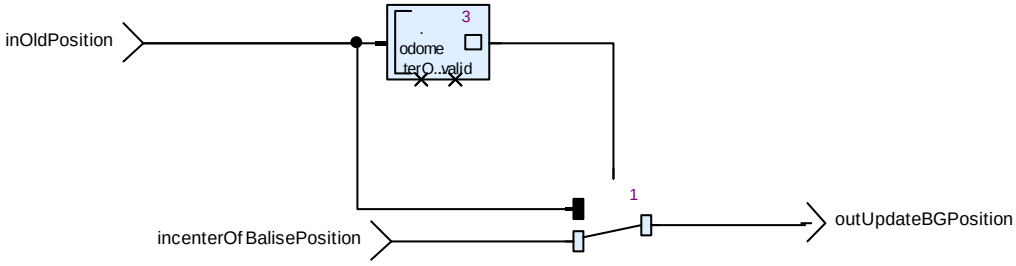


Figure 11: View of diagram_setIntervalBGPosition_1 (setIntervalBGPosition)

7.2. BuildBGMessage_Pkg::BaliseSupport Package

7.2.1. checkSingleBB Operator

Declared as **`public function`**

7.2.1.1. Comments and Information

checkSingleBB Comments:

- This function checks whthe the condition for a single bad balise has to be set respp. reset.
- Set condition:
- either no bg known and bg message sent
- and badbalise received
- Reset Condition:
- singlebb set and
- valid telegram received

7.2.1.2. Interface

Table 47: Inputs of checkSingleBB

Name	Type	Comments and Information
inTelegram	BG_Types_Pkg::Telegram_T	**Comments:** input: actual telegram. Only the valid flag is needed to calculate the badBalise flag.
inCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** input: the actual collector

Table 48: Outputs of checkSingleBB

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** output: updated collector

7.2.1.3. Operator Hierarchy

diagram : diagram_checkSingleBB_1

7.2.1.4. Graphical and Textual Diagrams

7.2.1.4.1. View of diagram_checkSingleBB_1 (checkSingleBB)

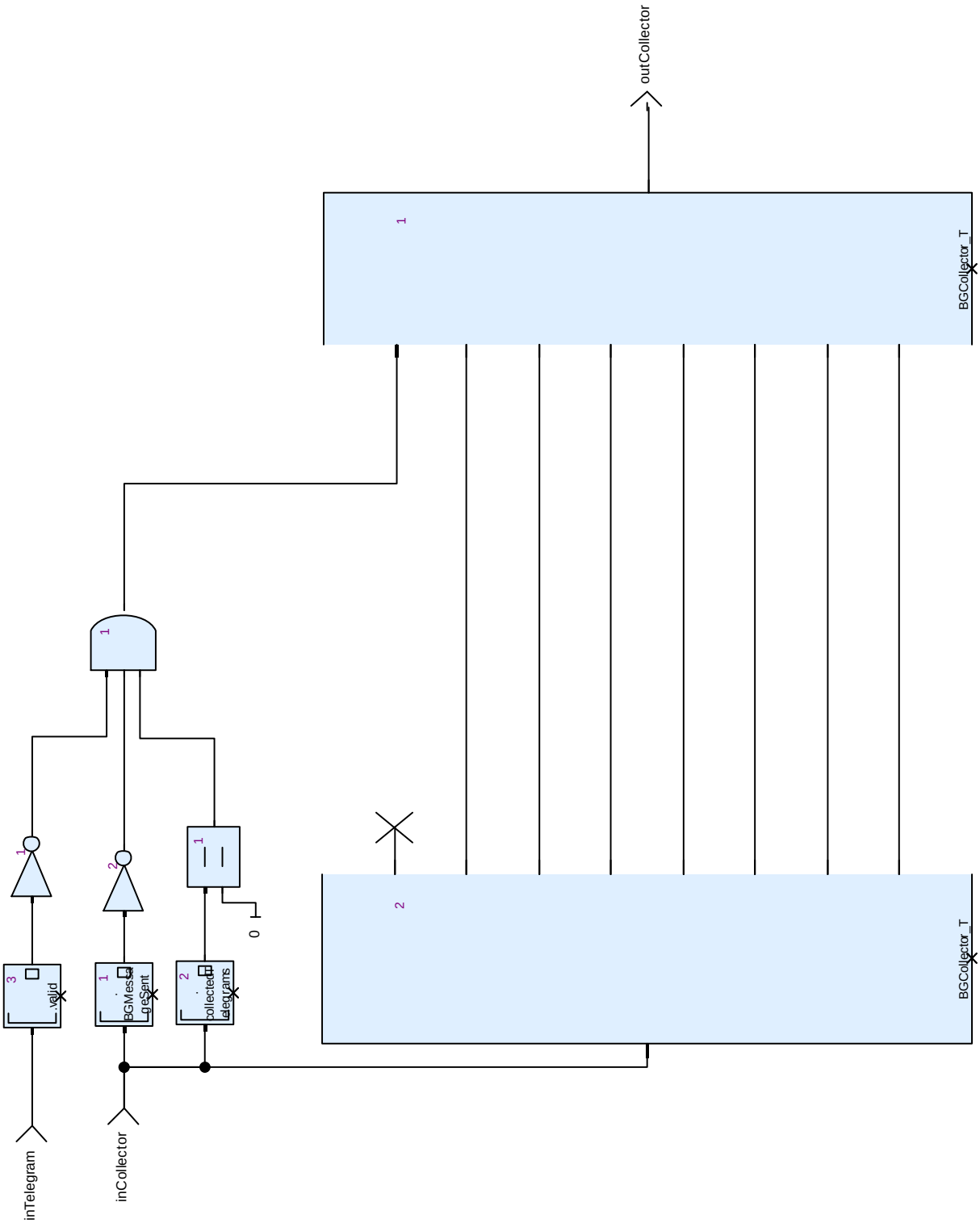


Figure 12: View of diagram_checkSingleBB_1 (checkSingleBB)

7.2.2. convNTotal Operator

Declared as **`public function`**

7.2.2.1. Comments and Information

convNTotal Comments:

- Supporting Function: Converts N_Total (enumerative type) into integer according to the meaning of the values.

7.2.2.2. Interface

Table 49: Inputs of convNTotal

Name	Type	Comments and Information
inNTotal	N_TOTAL	**Comments:** Input: NTotal as enumartion (ETCS Language)

Table 50: Outputs of convNTotal

Name	Type	Comments and Information

outTotal	int	**Comments:**
		Output: nTotal as integer.
		The mapping is according to the meanin, e.g.,
		#pragma kcg enum_val 0 #end
		N_TOTAL_1_balise_in_the_group = 1
		An undefined / unexpected value is mapped to 0.

7.2.2.3. Operator Hierarchy

diagram : diagram_convNTotal_1
- *activate if* : IfBlock1
  - branch : then
  - branch : else
    - branch : then
    - branch : else
      - branch : then
      - branch : else
        - branch : then
        - branch : else
          - branch : then
          - branch : else
            - branch : then
            - branch : else
              - branch : then
              - branch : else
                - branch : then
                - branch : else

7.2.2.4. Graphical and Textual Diagrams

7.2.2.4.1. View of diagram_convNTotal_1 (convNTotal)

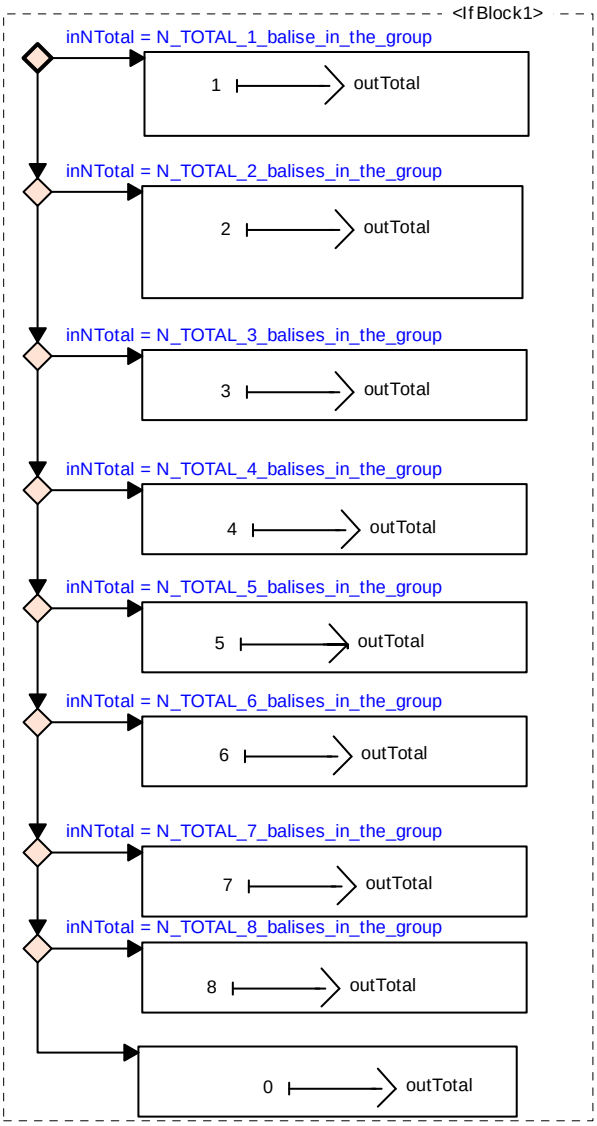


Figure 13: View of diagram_convNTotal_1 (convNTotal)

Table 51: Conditional Blocks of diagram_convNTotal_1

Conditional Block	Comments and Information
IfBlock1	

Table 52: Actions of diagram_convNTotal_1

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

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

7.2.3. findTelegram Operator

Declared as **`public function`**

7.2.3.1. Comments and Information

findTelegram Comments:

- Supportive Function: searches for a telegram in the header array.
- The search is stopped with result true when a telegram could be identified in the array which has the same pig and is valid.

7.2.3.2. Interface

Table 53: Inputs of findTelegram

Name	Type	Comments and Information
which_pig	N_PIG	**Comments:** Input: position in Group (ETCS language)
HeaderArray	BG_Types_Pkg::TelegramArray_T	**Comments:** Input: the actual balise group array. Each telegram in this array is to be checked for the pig. Search is done if at least one element in the array is valid.
doSearch	bool	**Comments:** Input: the search may be skipped with this parameter. Option for e.g., a not-valid telegram.

Table 54: Outputs of findTelegram

Name	Type	Properties		Comments and Information
telegramAlreadyInGroup	bool	default	false	**Comments:** Output: Result of the Search. The falue is set to false, if the array was empty, or if the search was actually skipped by means of the doSearch input parameter.

7.2.3.3. Locals

Table 55: Locals of findTelegram

Name	Type	Comments and Information
valid	bool	**Comments:** bool: the parameter is true if the first element of the input array is valid.

7.2.3.4. Operator Hierarchy

diagram : diagram_findTelegram_1
    activate if : IfBlock1
        branch : then
        branch : else

7.2.3.5. Graphical and Textual Diagrams

7.2.3.5.1. View of diagram_findTelegram_1 (findTelegram)

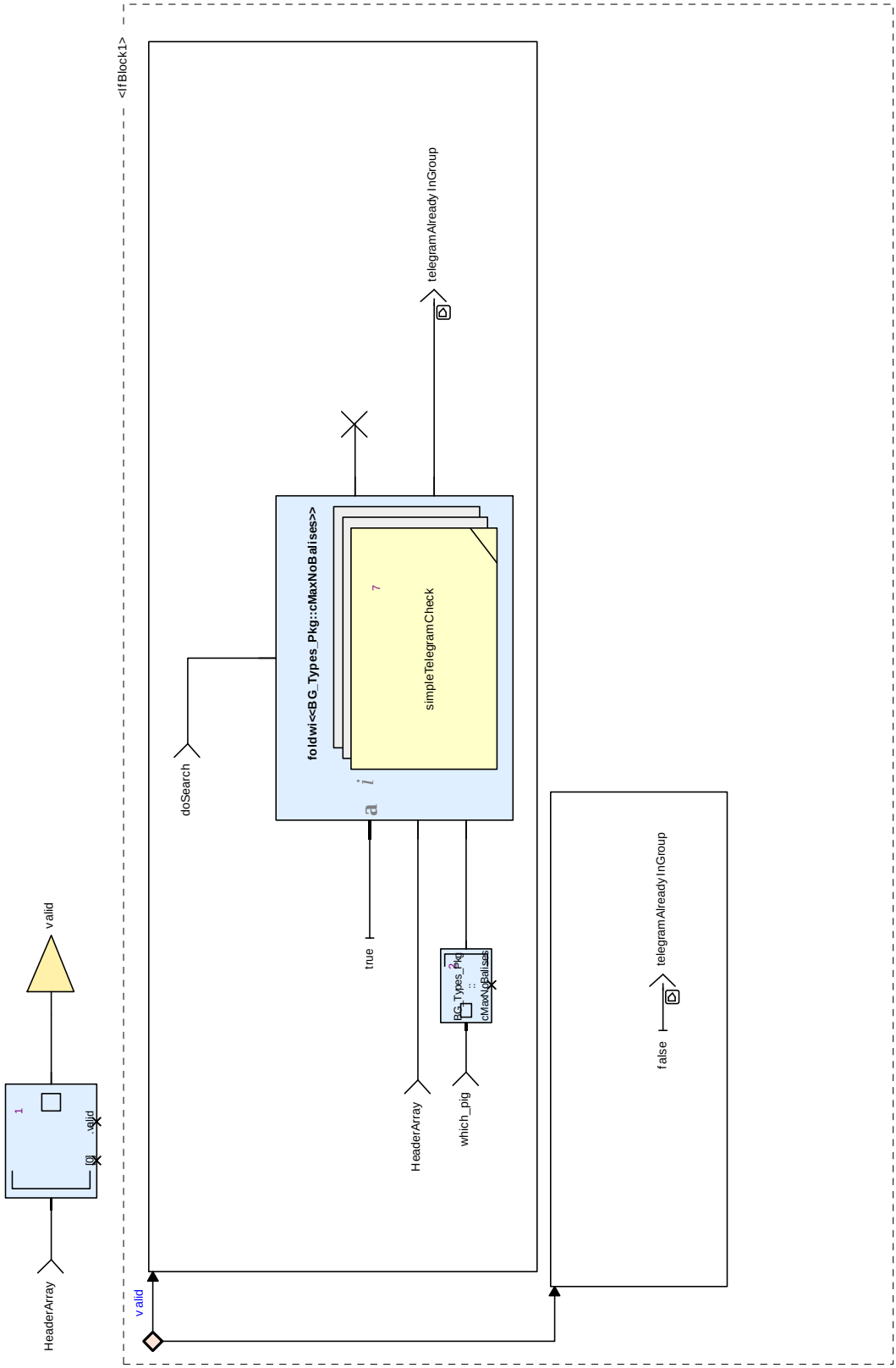


Figure 14: View of diagram_findTelegram_1 (findTelegram)

Table 56: Conditional Blocks of diagram_findTelegram_1

Conditional Block	Comments and Information
IfBlock1	

Table 57: Actions of diagram_findTelegram_1

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

7.2.4. initCollector Operator

Declared as **`public function`**

7.2.4.1. Interface

Table 58: Inputs of initCollector

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: the actual telegram which is being processed.

Table 59: Outputs of initCollector

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg::BGCollector_T	**Comments:** out: updated collector

7.2.4.2. Operator Hierarchy

diagram : diagram_initCollector_1

7.2.4.3. Graphical and Textual Diagrams

7.2.4.3.1. View of diagram_initCollector_1 (initCollector)

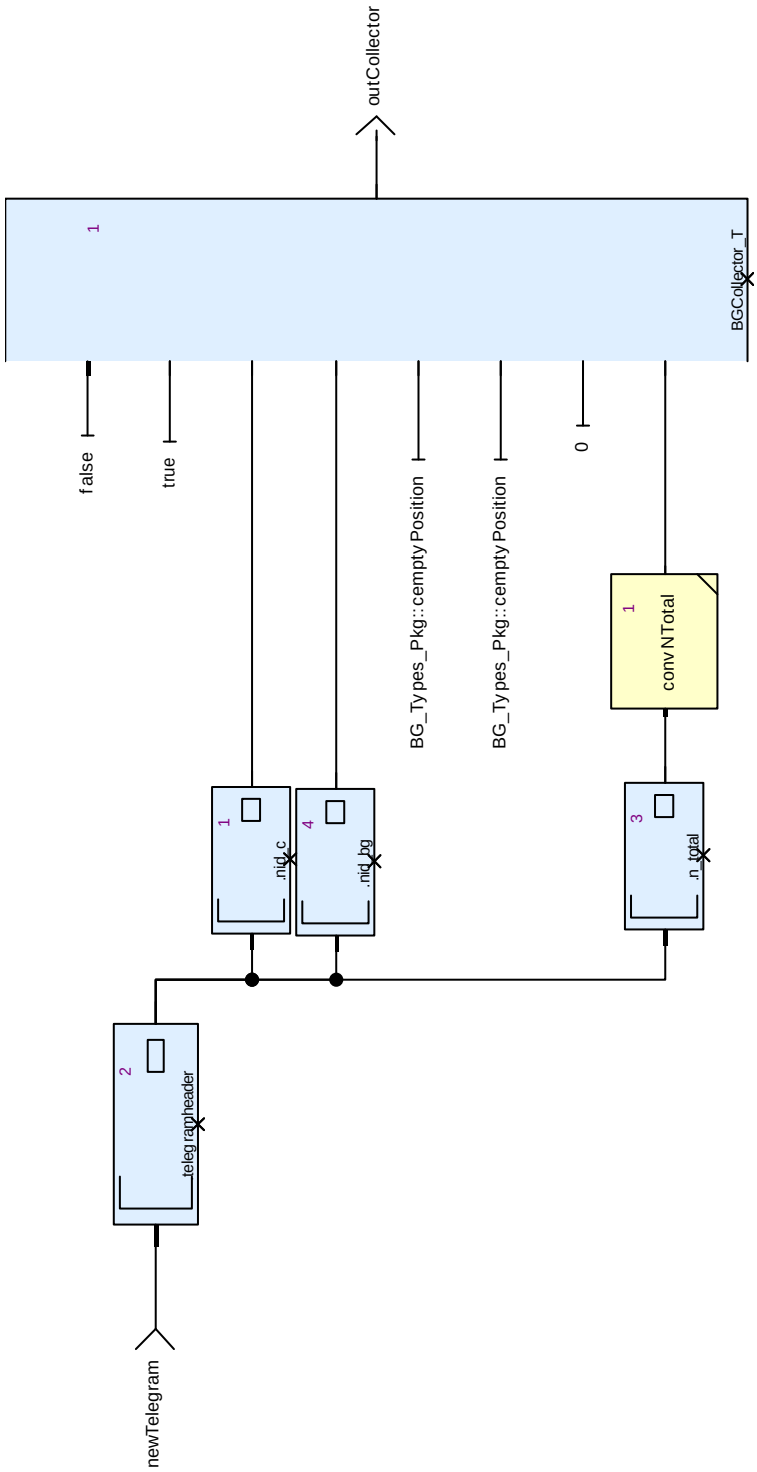


Figure 15: View of diagram_initCollector_1 (initCollector)

7.2.5. mergeAddInfo Operator

Declared as **`public function`**

7.2.5.1. Comments and Information

mergeAddInfo Comments:

- This function combines packets received in the telegrams of a balise group.
- The function is limited to the packets used in the respective scope of the model:
- - linking packet (5).
-
- The behaviour is according to the subset 26, section
- - 8.4.2 (rules for balise telegrams) and
- - 8.4.1 (multiplicity of packets in a balise group message).
- We interpret the term "message" in this context as a balise message consisting of several telegrams. This implies in general, only single packets are to be expected for the whole balise group message (respecting documented exeptions.

7.2.5.2. Interface

Table 60: Inputs of mergeAddInfo

Name	Type	Comments and Information
newAddInfo	BG_Types_Pkg::AdditionalInformation_T	
oldAddInfo	BG_Types_Pkg::AdditionalInformation_T	

Table 61: Outputs of mergeAddInfo

Name	Type	Comments and Information
mergedlAddInfo	BG_Types_Pkg::AdditionalInformation_T	

7.2.5.3. Operator Hierarchy

diagram : diagram_mergeAddInfo_1

7.2.5.4. Graphical and Textual Diagrams

7.2.5.4.1. View of diagram_mergeAddInfo_1 (mergeAddInfo)

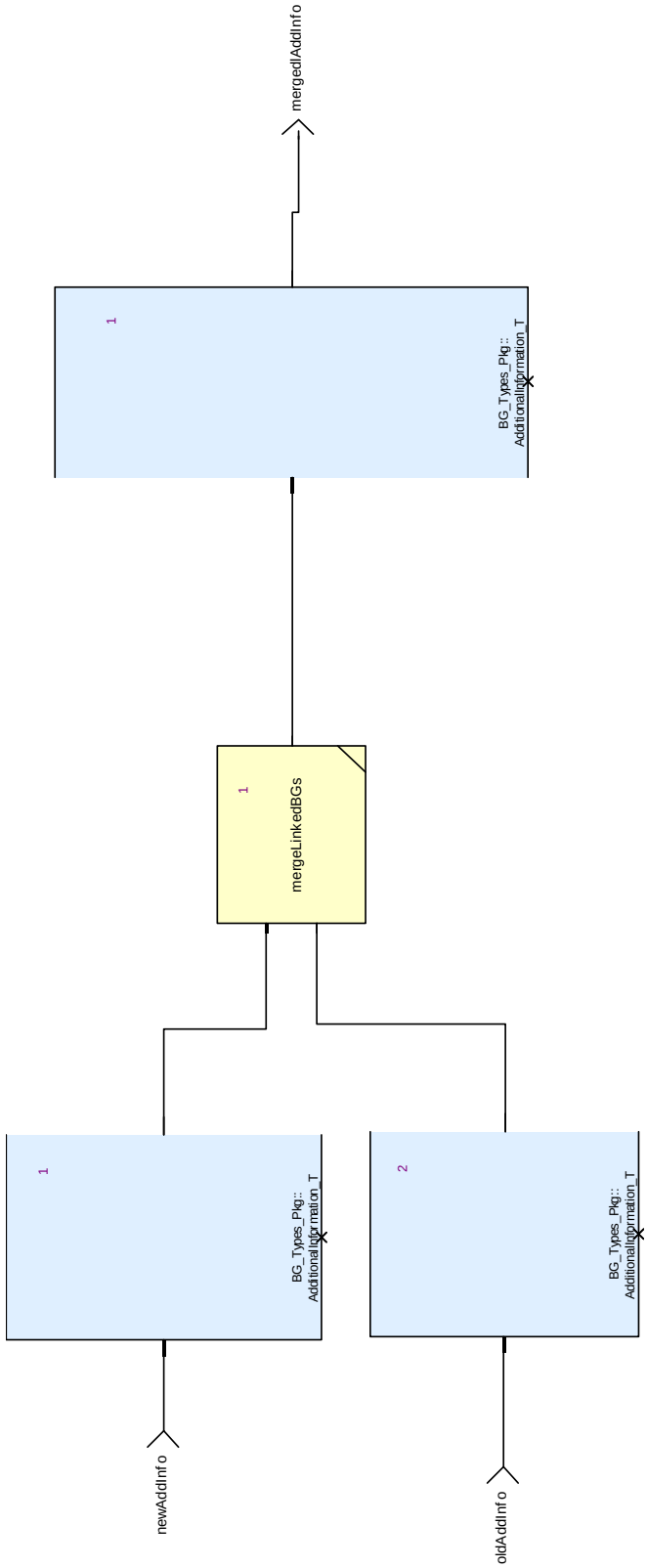


Figure 16: View of diagram_mergeAddInfo_1 (mergeAddInfo)

7.2.6. mergeLinkedBGs Operator

Declared as **`public function`**

7.2.6.1. Comments and Information

mergeLinkedBGs Comments:

- This information is made up of the linkiing packet (5) of the btm
- The linking is a list of variable size.
- According to my understanding of the standard the package only appears once in a message and is nmot allowed to be split accross telegrams.
- Therefore, no special procedure for copiing is needed.
- (only replace whole list if already received entry is not valid).

7.2.6.2. Interface

Table 62: Inputs of mergeLinkedBGs

Name	Type	Comments and Information
newLinkedBGs	BG_Types_Pkg::LinkedBGs_T	
oldLinkedBGs	BG_Types_Pkg::LinkedBGs_T	

Table 63: Outputs of mergeLinkedBGs

Name	Type	Comments and Information
mergedLinkedBGs	BG_Types_Pkg::LinkedBGs_T	

7.2.6.3. Operator Hierarchy

diagram : diagram_mergeLinkedBGs_1

7.2.6.4. Graphical and Textual Diagrams

7.2.6.4.1. View of diagram_mergeLinkedBGs_1 (mergeLinkedBGs)

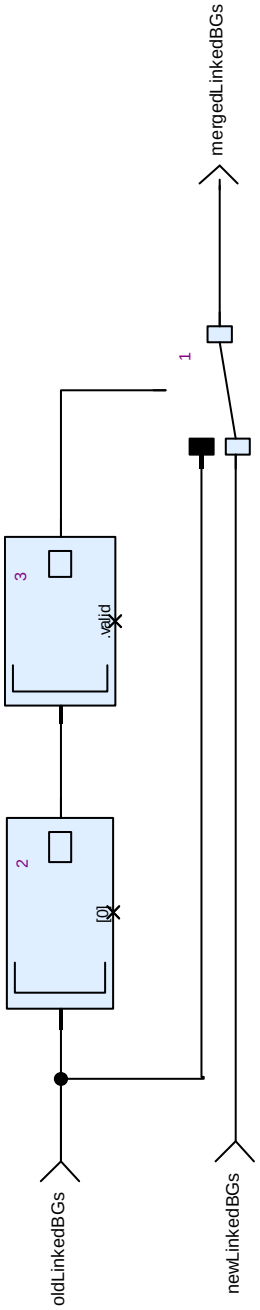


Figure 17: View of diagram_mergeLinkedBGs_1 (mergeLinkedBGs)

7.2.7. replaceTelegram Operator

Declared as **`public function`**

7.2.7.1. Comments and Information

replaceTelegram Comments:

- If sending of the telegram is repeated the later data are valid. (SRS subset ??)

- Therefore, if a telegram is already in the bg-array the data will be replaced.

7.2.7.2. Interface

Table 64: Inputs of replaceTelegram

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: new telegram to be added
inTelegramArray	BG_Types_Pkg::Telegram_T	**Comments:** Array of already collected telegrams of the Balisegrouzp. The routine searches this array.

Table 65: Outputs of replaceTelegram

Name	Type	Comments and Information
cont	bool	**Comments:** output: search result
outTelegrams	BG_Types_Pkg::Telegram_T	**Comments:** output: updated array of telegrams.

7.2.7.3. Operator Hierarchy

diagram : diagram_replaceTelegram_1

7.2.7.4. Graphical and Textual Diagrams

7.2.7.4.1. View of diagram_replaceTelegram_1 (replaceTelegram)

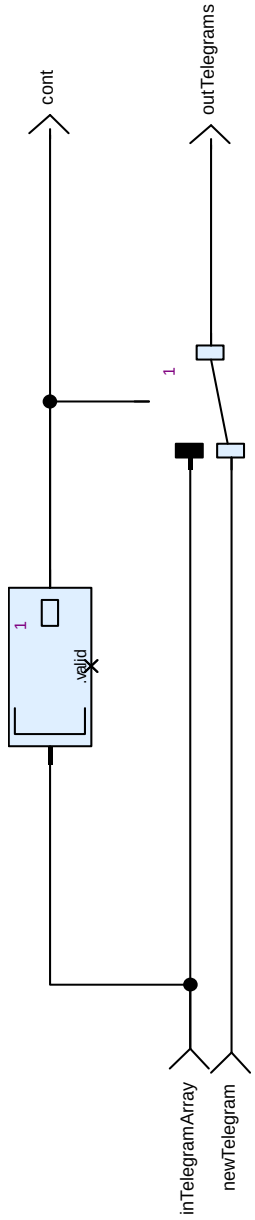


Figure 18: View of diagram_replaceTelegram_1 (replaceTelegram)

7.2.8. setFirstFree Operator

Declared as **`public function`**

7.2.8.1. Comments and Information

setFirstFree Comments:

- adds the telegram in the next available slot. Used as a parameter in the mapw function of routine addTelegram.

7.2.8.2. Interface

Table 66: Inputs of setFirstFree

Name	Type	Comments and Information
newTelegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: new telegram to be added
inTelegramArray	BG_Types_Pkg::Telegram_T	**Comments:** Array of already collected telegrams of the Balisegrouzp. The routine searches this array.

Table 67: Outputs of setFirstFree

Name	Type	Comments and Information
cont	bool	**Comments:** output: search result
outTelegrams	BG_Types_Pkg::Telegram_T	**Comments:** output: updated array of telegrams.

7.2.8.3. Operator Hierarchy

diagram : diagram_setFirstFree_1

7.2.8.4. Graphical and Textual Diagrams

7.2.8.4.1. View of diagram_setFirstFree_1 (setFirstFree)

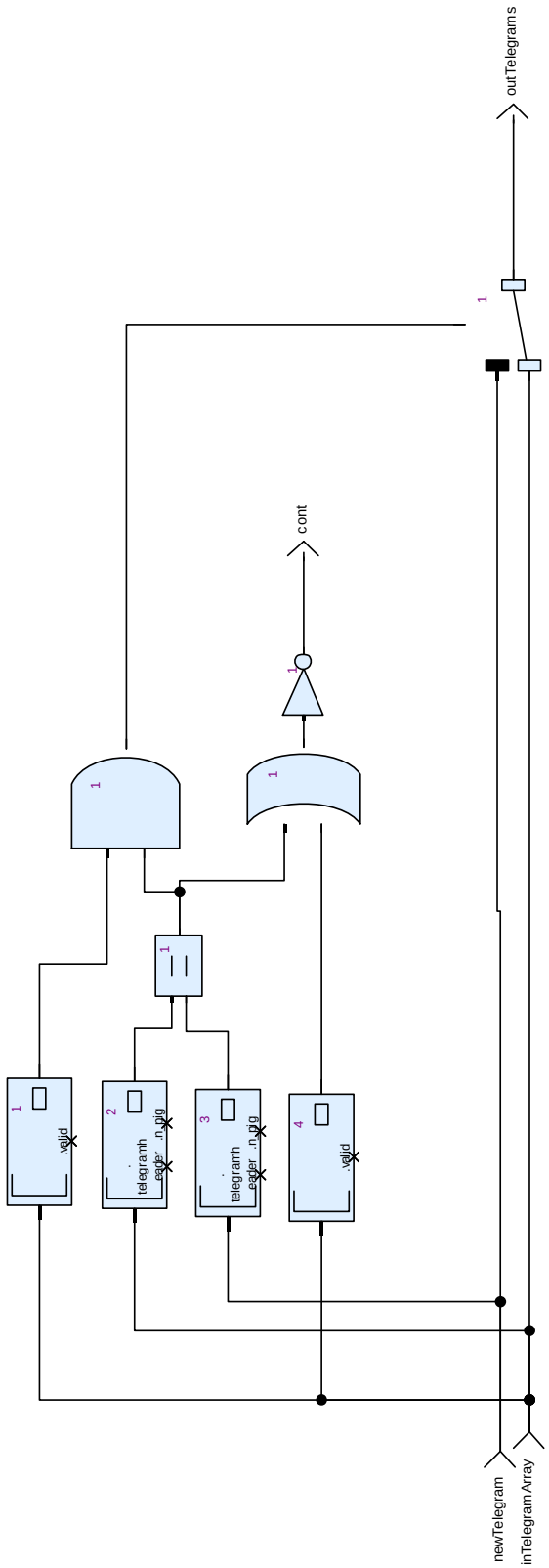


Figure 19: View of diagram_setFirstFree_1 (setFirstFree)

7.2.9. simpleTelegramCheck Operator

Declared as **`public function`**

7.2.9.1. Comments and Information

simpleTelegramCheck Comments:

- Used in find telegram (parameter of the foldwi operator).
- Checks pig and valid flag

7.2.9.2. Interface

Table 68: Inputs of simpleTelegramCheck

Name	Type	Comments and Information
iteratorIndex	int	**Comments:** Input: needed by Scade for generating the loop.
accu	bool	**Comments:** Input: needed by Scade for generating the loop.
telegram	BG_Types_Pkg::Telegram_T	**Comments:** Input: telegram from the BG array
which_pig	N_PIG	**Comments:** Input: identifies the poition in group of the balise telegram.

Table 69: Outputs of simpleTelegramCheck

Name	Type	Comments and Information
cont	bool	**Comments:** Output: needed by Scade for generating the loop.
telegramAlreadyInGroup	bool	**Comments:** Output: Result of the check.

7.2.9.3. Operator Hierarchy

diagram : diagram_simpleTelegramCheck_1

7.2.9.4. Graphical and Textual Diagrams

7.2.9.4.1. View of diagram_simpleTelegramCheck_1 (simpleTelegramCheck)

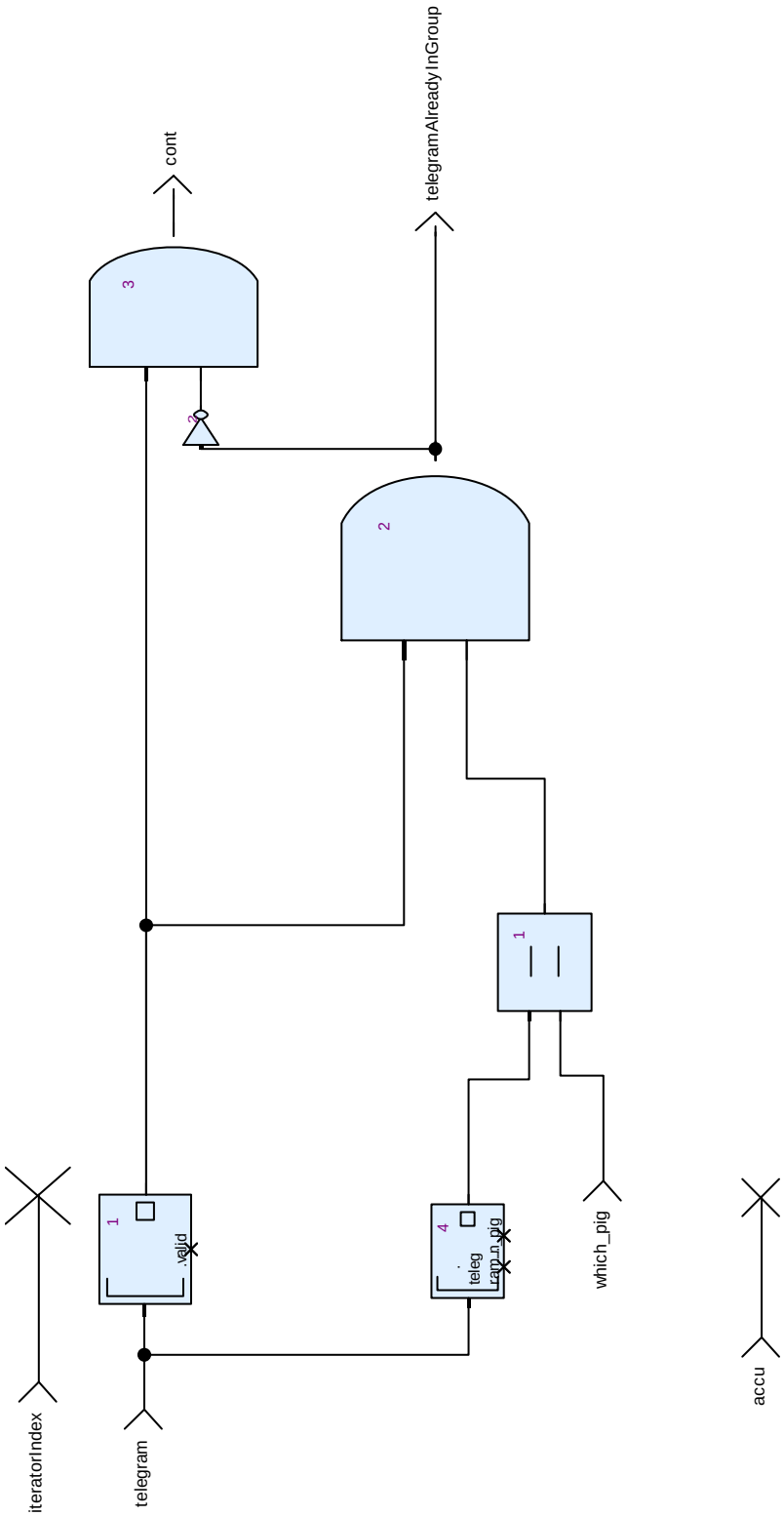


Figure 20: View of diagram_simpleTelegramCheck_1 (simpleTelegramCheck)

7.2.10. updateCollectorSendMessage Operator

Declared as **`public function`**

7.2.10.1. Comments and Information

updateCollectorSendMessage Comments:

- Copy Function for the Collector. The SendMessage flag is set to true.

7.2.10.2. Interface

Table 70: Inputs of updateCollectorSendMessage

Name	Type	Comments and Information
inCollector	BuildBGMessage_Pkg:: BGCollector_T	**Comments:** input: the actual collector

Table 71: Outputs of updateCollectorSendMessage

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg:: BGCollector_T	**Comments:** output: updated collector

7.2.10.3. Operator Hierarchy

diagram : diagram_updateCollectorSendMessage_1

7.2.10.4. Graphical and Textual Diagrams

7.2.10.4.1. View of diagram_updateCollectorSendMessage_1 (updateCollectorSendMessage)

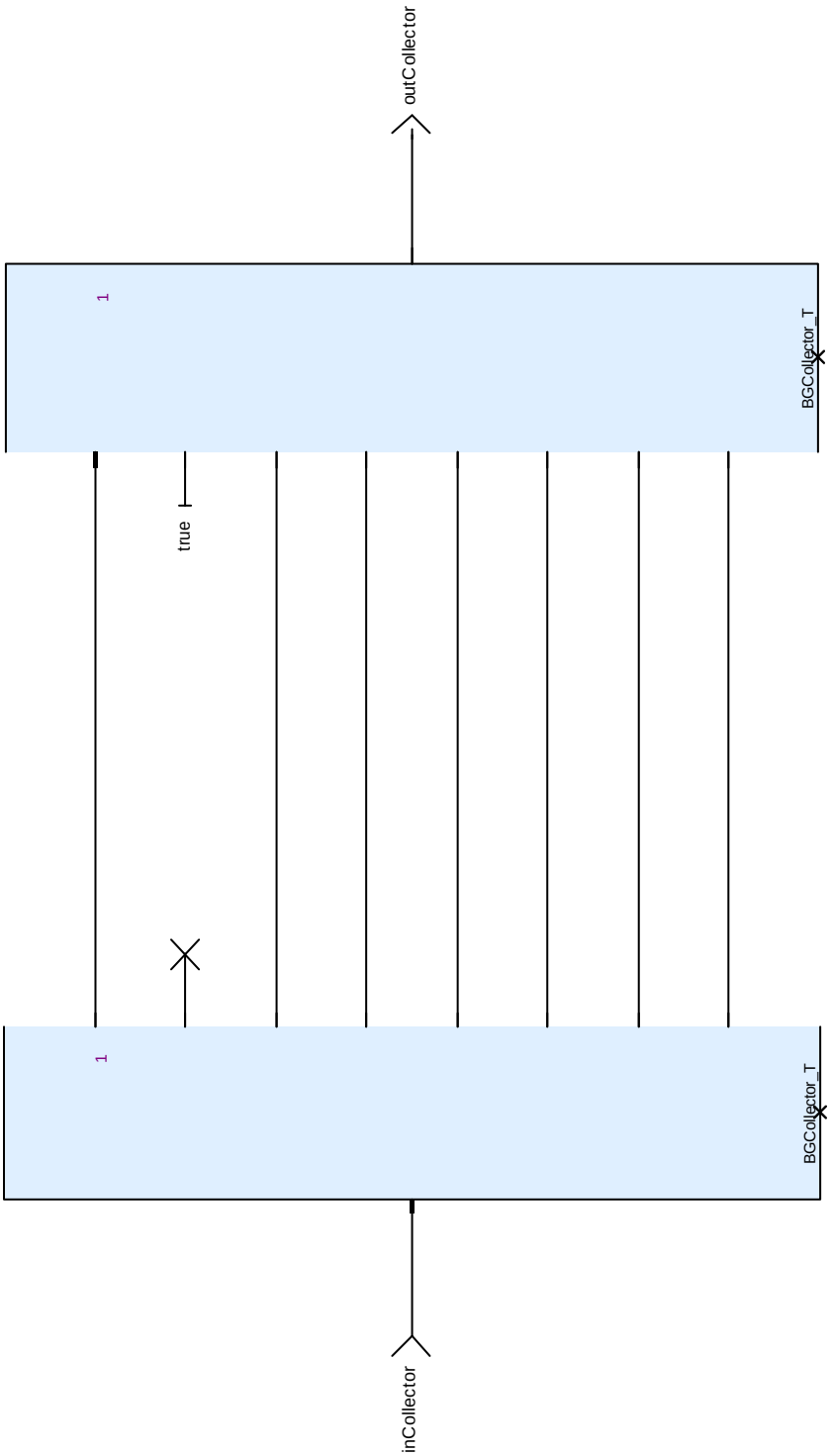


Figure 21: View of diagram_updateCollectorSendMessage_1 (updateCollectorSendMessage)

7.2.11. updateCollectorSingleBB Operator

Declared as **`public function`**

7.2.11.1. Comments and Information

updateCollectorSingleBB Comments:

- copy function for the collector.
- The bad balises flag is set to false iff the output bad balise is set to true.

7.2.11.2. Interface

Table 72: Inputs of updateCollectorSingleBB

Name	Type	Comments and Information
inSingleBadBalise	bool	**Comments:** out: the odometry indicates the train has left the range of the balise group and the bg telegrams are not fully received.
inCollector	BuildBGMessage_Pkg:: BGCollector_T	**Comments:** input: the actual collector

Table 73: Outputs of updateCollectorSingleBB

Name	Type	Comments and Information
outCollector	BuildBGMessage_Pkg:: BGCollector_T	**Comments:** output: updated collector

7.2.11.3. Operator Hierarchy

diagram : diagram_updateCollectorSingleBB_1

7.2.11.4. Graphical and Textual Diagrams

7.2.11.4.1. View of diagram_updateCollectorSingleBB_1 (updateCollectorSingleBB)

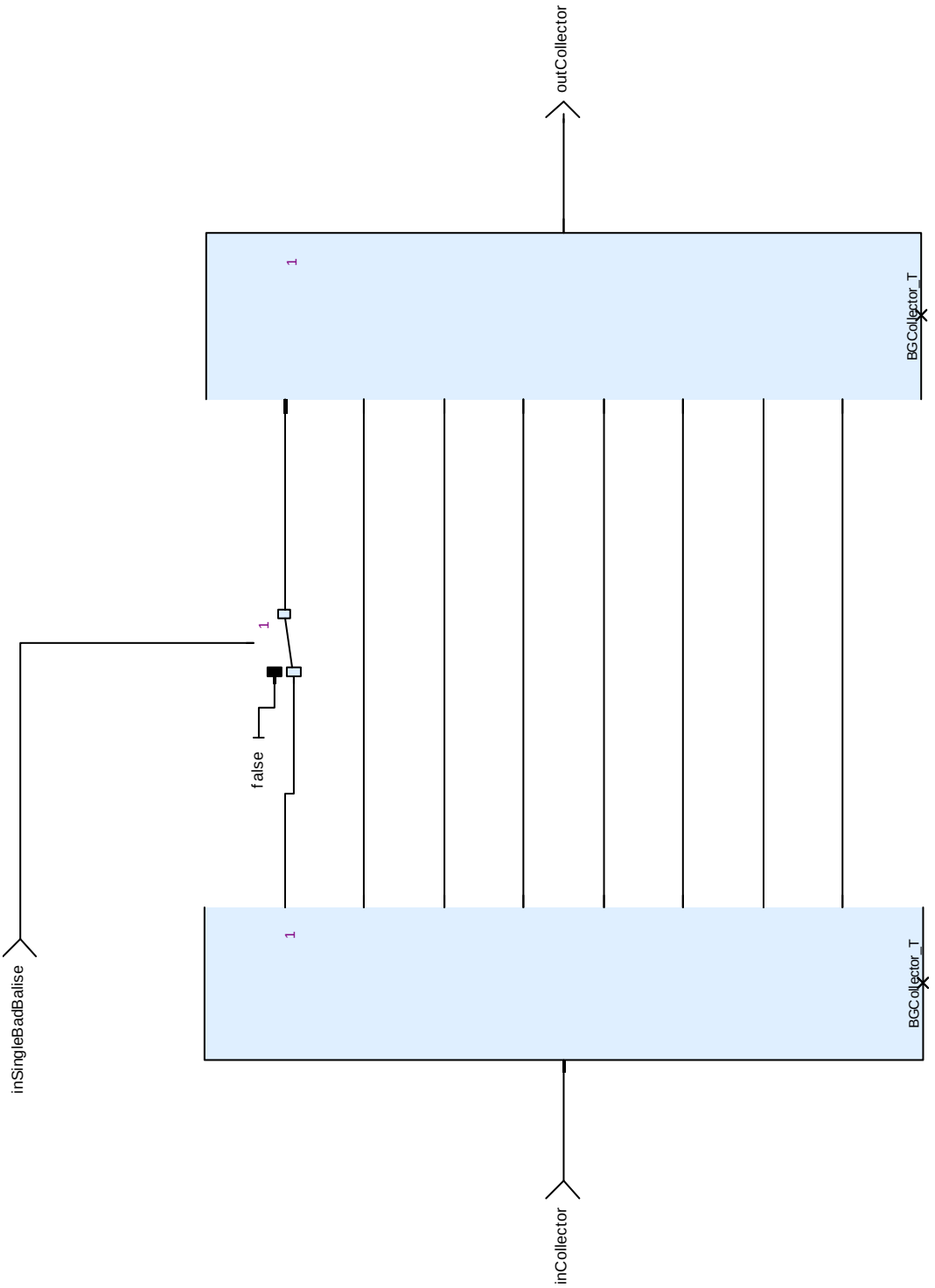


Figure 22: View of diagram_updateCollectorSingleBB_1 (updateCollectorSingleBB)

8. Project Library: TrainPosition_Types

8.1. TrainPosition_Types_Pck Package

8.1.1. Comments and Information

TrainPosition_Types_Pck Comments:

- This library provides the data type definitions used in train position calculations

Table 74: 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

8.1.2. Types

Table 75: 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_notFoundWhereExpected : bool, positionCalculation_inconsistent : bool, BG_LinkingConsistencyError : bool, DoubleLinkingError : bool, DoubleRepositioningError : bool}	**outOfMemSpace Comments:** Memory overrun: a passed or announced BG could not be stored **passedBG_notFoundWhereExpected Comments:** The currently passed linked BG location does not match the expected location **positionCalculation_inconsistent Comments:** A consistency problem arised during position calculation **BG_LinkingConsistencyError Comments:** Balise group: linking consistency error (ref. 3.16.2.3) **DoubleLinkingError Comments:** Double linking error (3.16.2.7.1) **DoubleRepositioningError Comments:** Double repositioning error (3.16.2.7.2)

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, lastPassedLinkedBG : TrainPosition_Types_Pck::positionedBG_T, lastPassedUnlinkedBG : TrainPosition_Types_Pck::positionedBG_T, speed : Obu_BasicTypes_Pkg::Speed_T}	**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 **lastPassedLinkedBG Comments:** The last passed linked BG **lastPassedUnlinkedBG Comments:** The last passed unlinked BG **speed Comments:** Actual train speed
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

8.1.3. Constants

Table 76: 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)

Name	Type	Value	Comments and Information
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)

9. Project Library: BasicLocationFunctions

9.1. BasicLocationFunctions_Pkg Package

9.1.1. 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 77: 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

9.1.2. add_2_Distances Operator

Declared as **`public function`**

9.1.2.1. Comments and Information

add_2_Distances Comments:

- Calculates the sum of 2 distances dist_2 + dist_1

Table 78: 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

9.1.2.2. Interface

Table 79: 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 80: Outputs of add_2_Distances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg::LocWithInAcc_T	

9.1.2.3. Operator Hierarchy

diagram : diagram_add_2_Distances_1

9.1.2.4. Graphical and Textual Diagrams

9.1.2.4.1. View of diagram_add_2_Distances_1 (add_2_Distances)

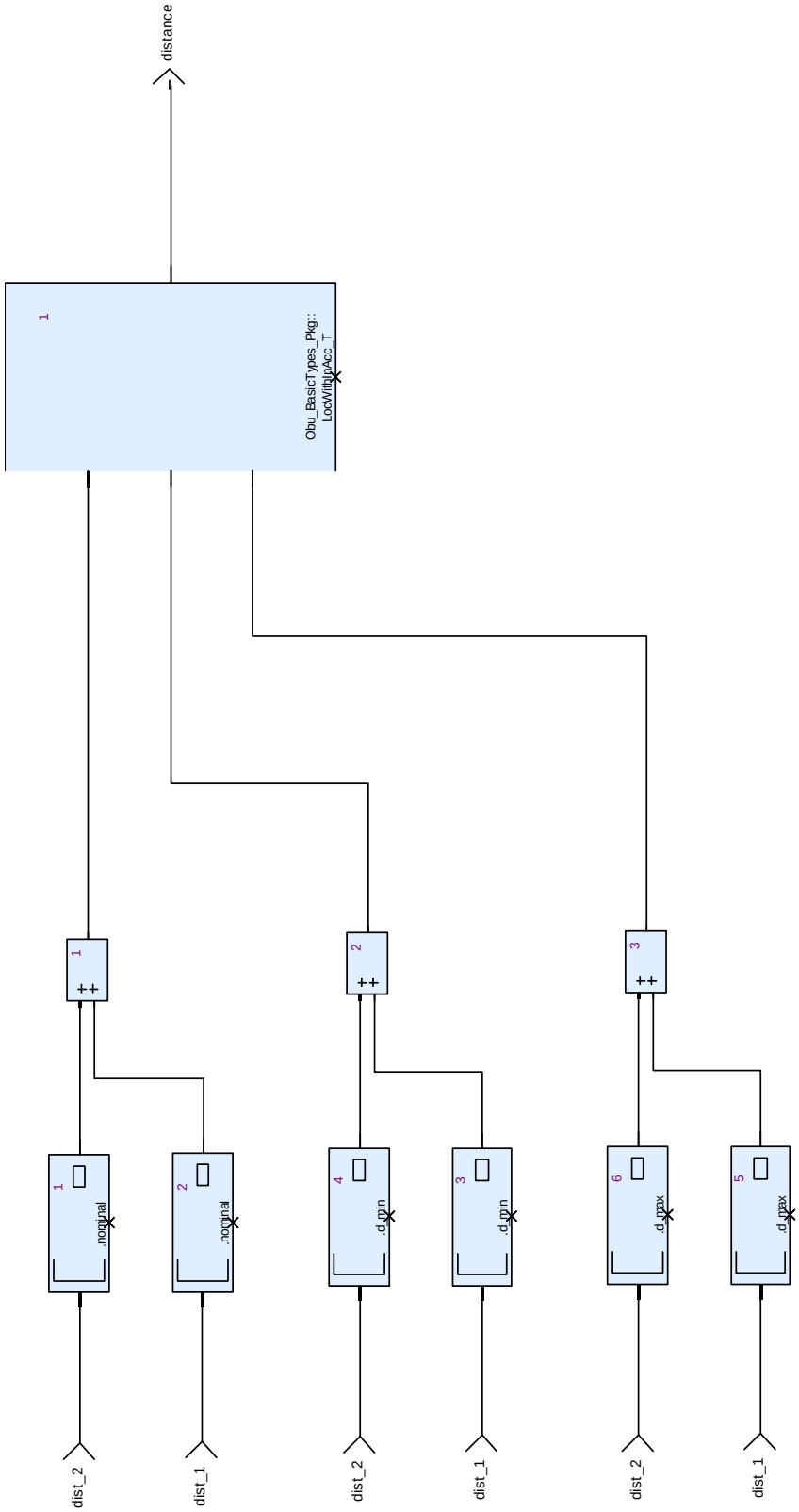


Figure 23: View of diagram_add_2_Distances_1 (add_2_Distances)

9.1.3. add_odo_2_Location Operator

Declared as **`public function`**

9.1.3.1. 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 81: 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

9.1.3.2. Interface

Table 82: 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 83: Outputs of add_odo_2_Location

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

9.1.3.3. Operator Hierarchy

diagram : diagram_add_odo_2_Location_1

9.1.3.4. Graphical and Textual Diagrams

9.1.3.4.1. View of diagram_add_odo_2_Location_1 (add_odo_2_Location)

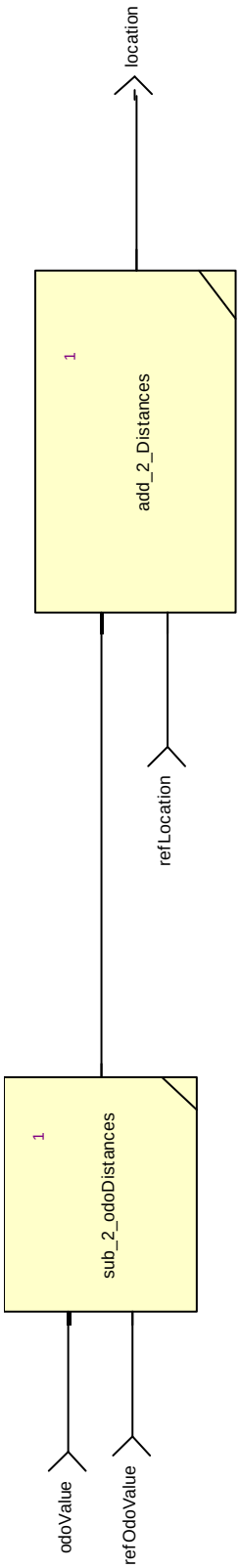


Figure 24: View of diagram_add_odo_2_Location_1 (add_odo_2_Location)

9.1.4. addDistances Operator

Declared as **`public function`**

9.1.4.1. Comments and Information

addDistances Comments:

- Calculates the sum of an array of distances

Table 84: 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/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

9.1.4.2. Interface

Table 85: Inputs of addDistances

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

Table 86: Outputs of addDistances

Name	Type	Comments and Information
sum	Obu_BasicTypes_Pkg::LocWithInAcc_T	

Table 87: Size Parameters of addDistances

Name	Comments and Information
noOfSummands	**Comments:** Number of summands

9.1.4.3. Operator Hierarchy

diagram : diagram_sumOfDistances_1

9.1.4.4. Graphical and Textual Diagrams

9.1.4.4.1. View of diagram_sumOfDistances_1 (addDistances)

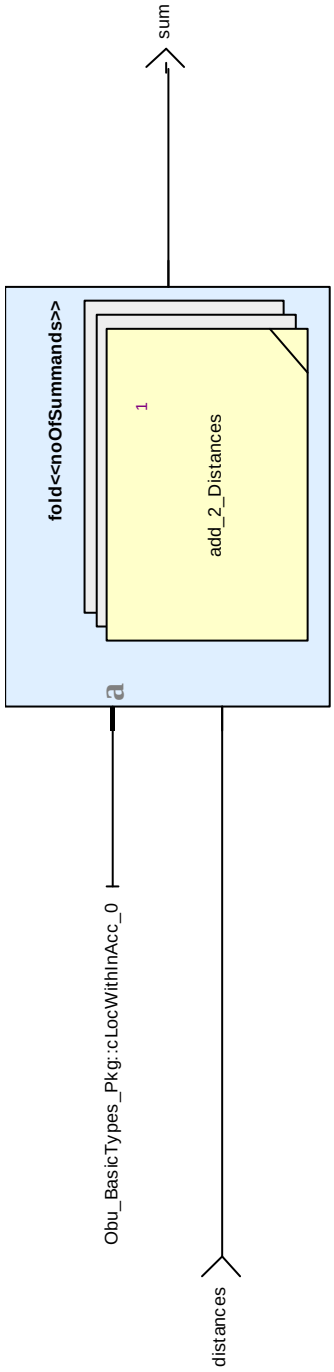


Figure 25: View of diagram_sumOfDistances_1 (addDistances)

9.1.5. addDistancesBetwLinkedElements Operator

Declared as **`public function`**

9.1.5.1. 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 88: 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

9.1.5.2. Interface

Table 89: Inputs of addDistancesBetwLinkedElements

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

Table 90: Outputs of addDistancesBetwLinkedElements

Name	Type	Comments and Information
sumOfDistances	Obu_BasicTypes_Pkg::LocWithInAcc_T	

Table 91: Size Parameters of addDistancesBetwLinkedElements

Name	Comments and Information
noOfLinkedElements	

9.1.5.3. Operator Hierarchy

diagram : diagram_distanceBetweenLinkedElements_1

9.1.5.4. Graphical and Textual Diagrams

9.1.5.4.1. View of diagram_distanceBetweenLinkedElements_1 (addDistancesBetwLinkedElements)

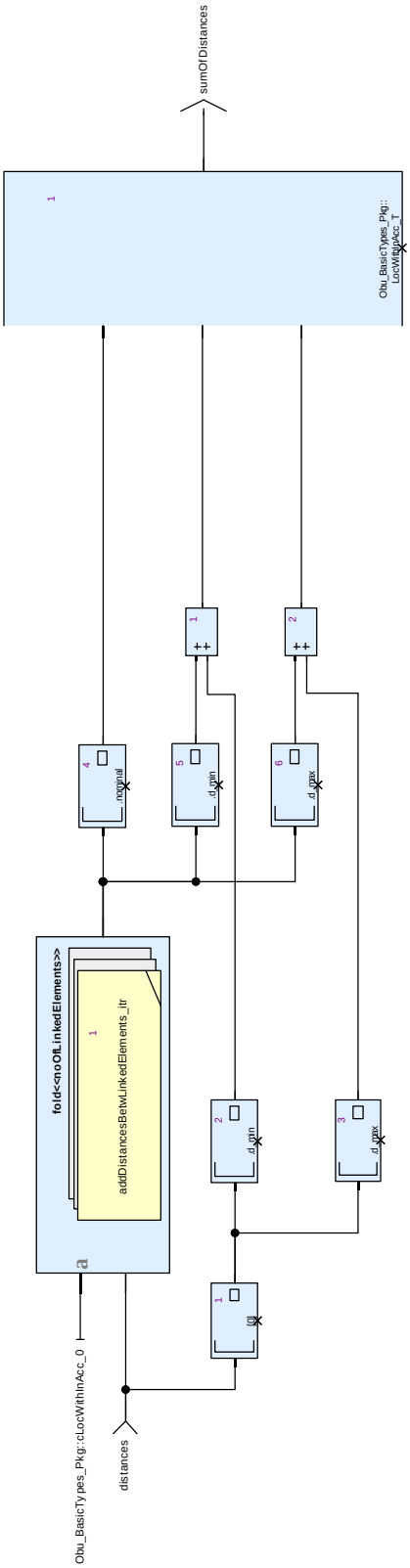


Figure 26: View of diagram_distanceBetweenLinkedElements_1 (addDistancesBetwLinkedElements)

9.1.6. addDistancesBetwLinkedElements_itr Operator

Declared as **`private function`**

9.1.6.1. 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 92: 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

9.1.6.2. Interface

Table 93: Inputs of addDistancesBetwLinkedElements_itr

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

Table 94: Outputs of addDistancesBetwLinkedElements_itr

Name	Type	Comments and Information
sum_out	Obu_BasicTypes_Pkg::LocWithInAcc_T	

9.1.6.3. Operator Hierarchy

diagram : diagram_addDistancesBetwLinkedElements_itr_1

9.1.6.4. Graphical and Textual Diagrams

9.1.6.4.1. View of diagram_addDistancesBetwLinkedElements_itr_1 (addDistancesBetwLinkedElements_itr)

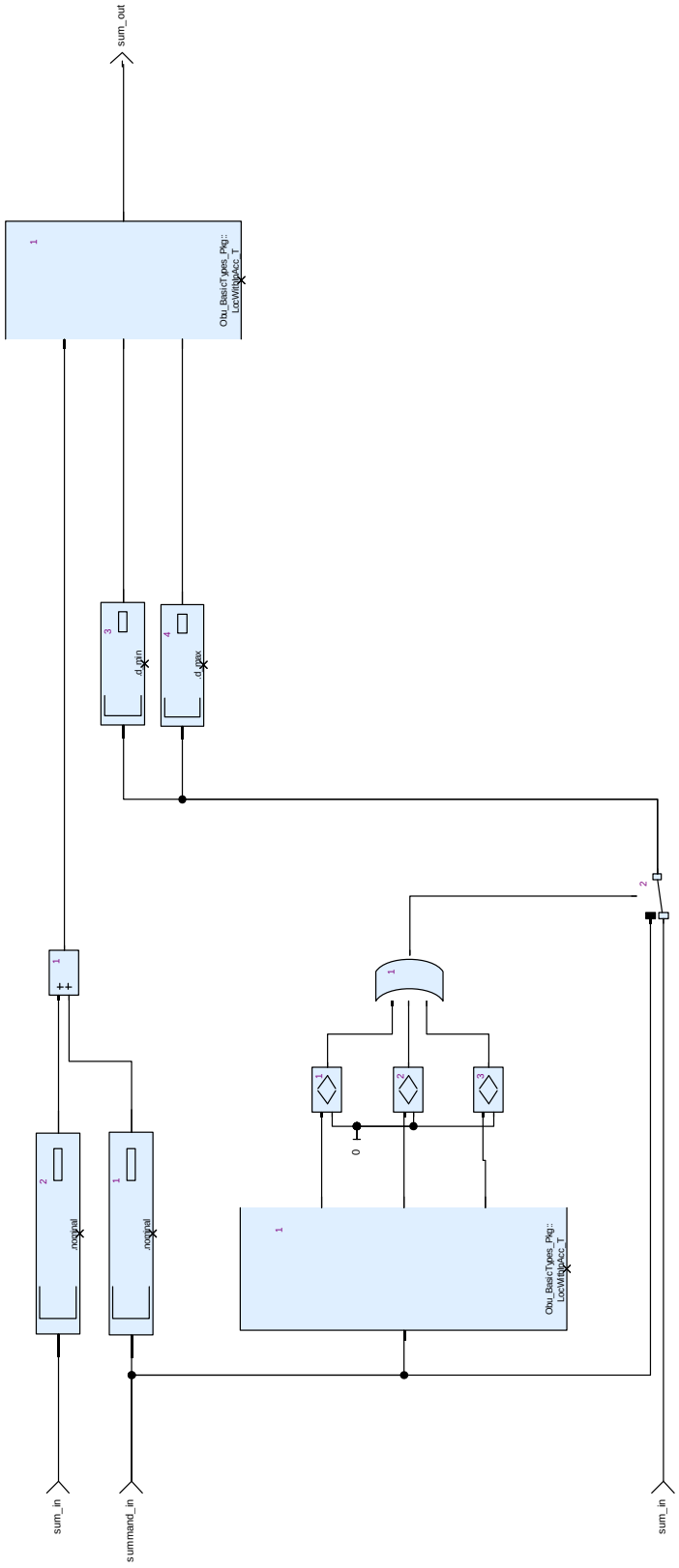


Figure 27: View of diagram_addDistancesBetwLinkedElements_itr_1 (addDistancesBetwLinkedElements_itr)

9.1.7. checkMaxAbsOdoDistance Operator

Declared as **`public function`**

9.1.7.1. 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!

9.1.7.2. Interface

Table 95: 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 96: Outputs of checkMaxAbsOdoDistance

Name	Type	Comments and Information
isLessThanOrEqual	bool	

9.1.7.3. Operator Hierarchy

diagram : diagram_checkMaxAbsOdoDistance_1

9.1.7.4. Graphical and Textual Diagrams

9.1.7.4.1. View of diagram_checkMaxAbsOdoDistance_1 (checkMaxAbsOdoDistance)

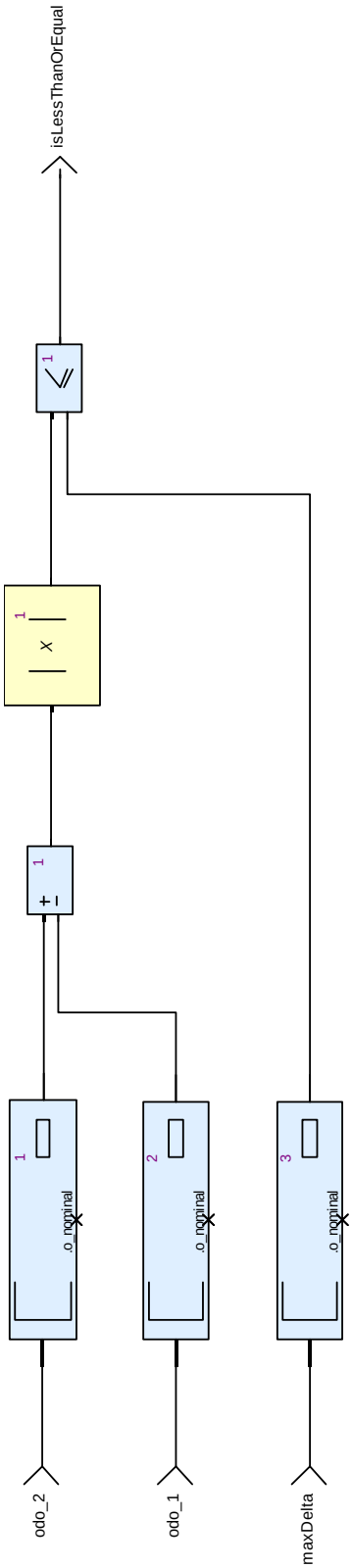


Figure 28: View of diagram_checkMaxAbsOdoDistance_1 (checkMaxAbsOdoDistance)

9.1.8. dTrain2Trackelem_unlinkedBG Operator

Declared as **`public function`**

9.1.8.1. 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 97: 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/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

9.1.8.2. Interface

Table 98: 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

Name	Type	Comments and Information
loc_unlinkedBG	Obu_BasicTypes_Pkg::LocWithInAcc_T	**Comments:** Location of a previously passed unlinked balise group
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 99: 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

9.1.8.3. Operator Hierarchy

diagram : diagram_dTrain2Trackelem_unlinkedBG_1

9.1.8.4. Graphical and Textual Diagrams

9.1.8.4.1. View of diagram_dTrain2Trackelem_unlinkedBG_1 (dTrain2Trackelem_unlinkedBG)

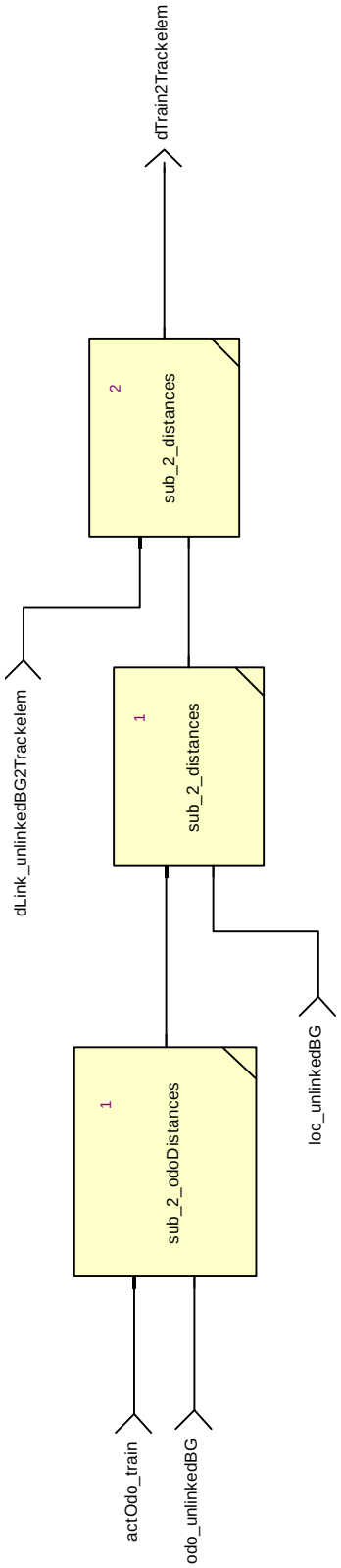


Figure 29: View of diagram_dTrain2Trackelem_unlinkedBG_1 (dTrain2Trackelem_unlinkedBG)

9.1.9. odoLoc_2_refLocations Operator

Declared as **`public function`**

9.1.9.1. 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 100: 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

9.1.9.2. Interface

Table 101: 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

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 102: Outputs of odoLoc_2_refLocations

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

9.1.9.3. Operator Hierarchy

diagram : diagram_odoLoc_2_refLocations_1

9.1.9.4. Graphical and Textual Diagrams

9.1.9.4.1. View of diagram_odoLoc_2_refLocations_1 (odoLoc_2_refLocations)

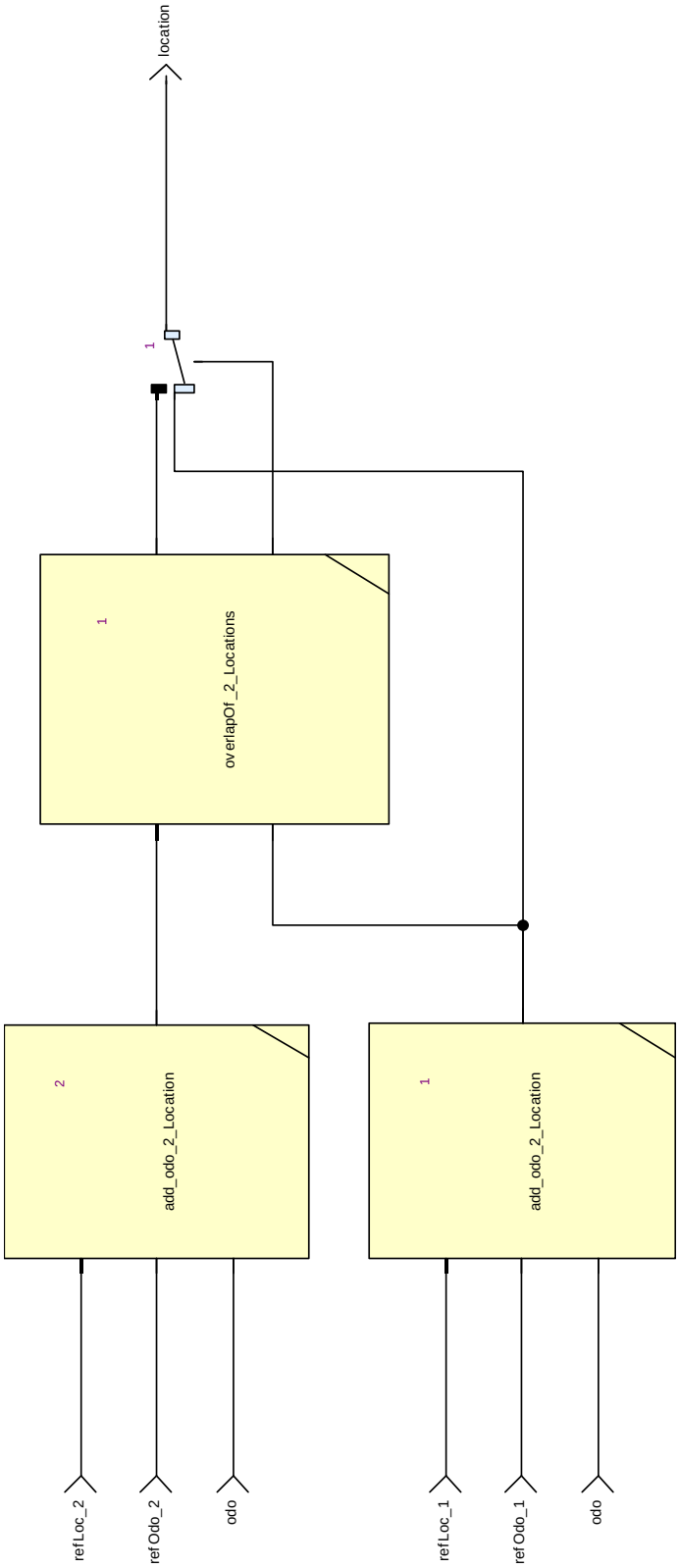


Figure 30: View of diagram_odoLoc_2_refLocations_1 (odoLoc_2_refLocations)

9.1.10. overlapOf_2_Locations Operator

Declared as **`public function`**

9.1.10.1. 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 103: 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/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

9.1.10.2. Interface

Table 104: 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 105: Outputs of overlapOf_2_Locations

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

9.1.10.3. Operator Hierarchy

diagram : diagram_overlapOf_2_Locations_1

9.1.10.4. Graphical and Textual Diagrams

9.1.10.4.1. View of diagram_overlapOf_2_Locations_1 (overlapOf_2_Locations)

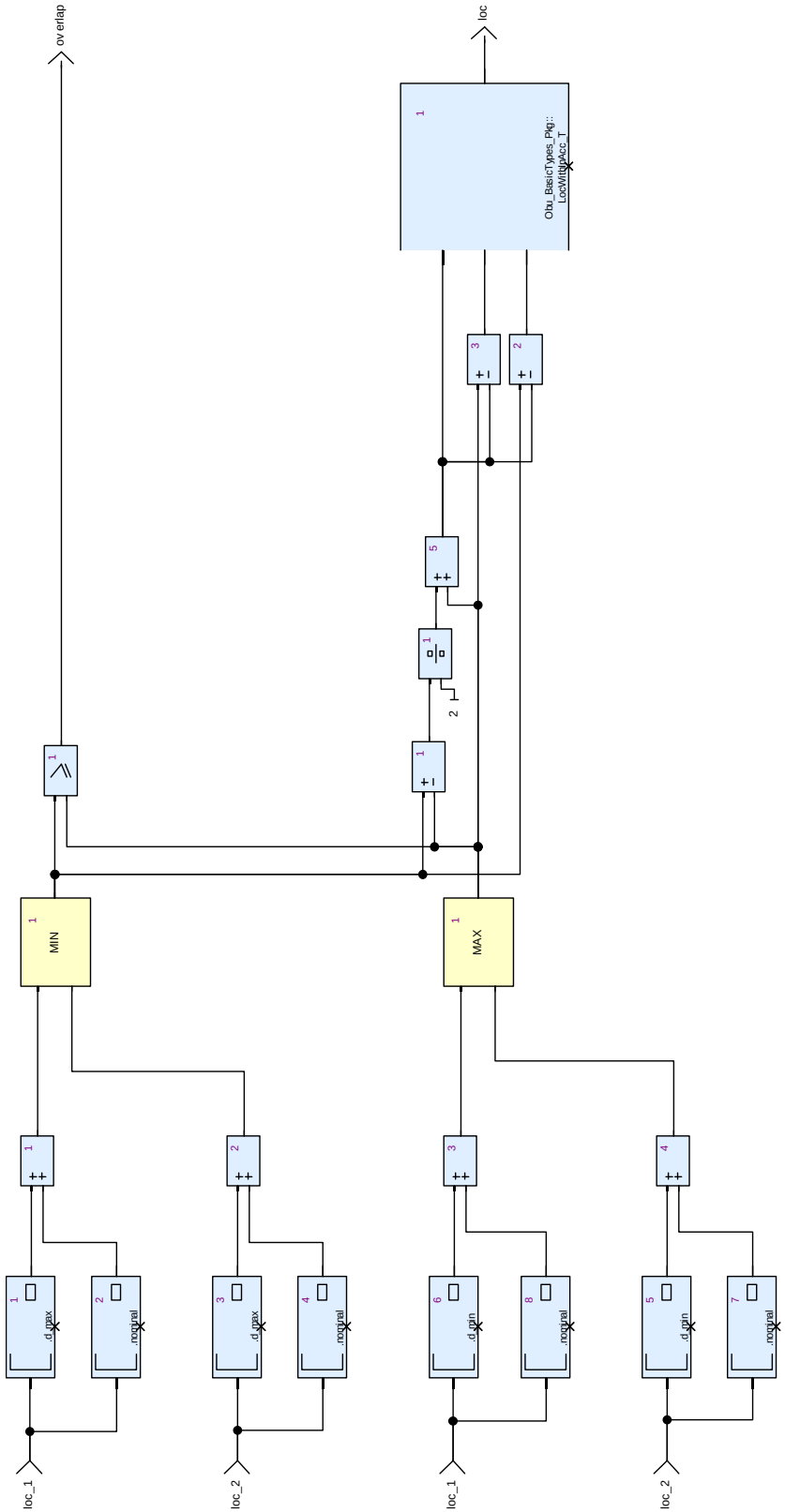


Figure 31: View of diagram_overlapOf_2_Locations_1 (overlapOf_2_Locations)

9.1.11. scaledDLINK_2_dlink Operator

Declared as **`public function`**

9.1.11.1. Comments and Information

scaledDLINK_2_dlink Comments:

- Converts the linking distance variables into the uniform distance type.

Table 106: 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

9.1.11.2. Interface

Table 107: Inputs of scaledDLINK_2_dlink

Name	Type	Comments and Information
q_scale	Q_SCALE	
d_link	D_LINK	
q_locacc	Q_LOCACC	

Table 108: Outputs of scaledDLINK_2_dlink

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg::LocWithInAcc_T	

9.1.11.3. Operator Hierarchy

diagram : diagram_scaledDLINK_2_dlink_1

9.1.11.4. Graphical and Textual Diagrams

9.1.11.4.1. View of diagram_scaledDLINK_2_dlink_1 (scaledDLINK_2_dlink)

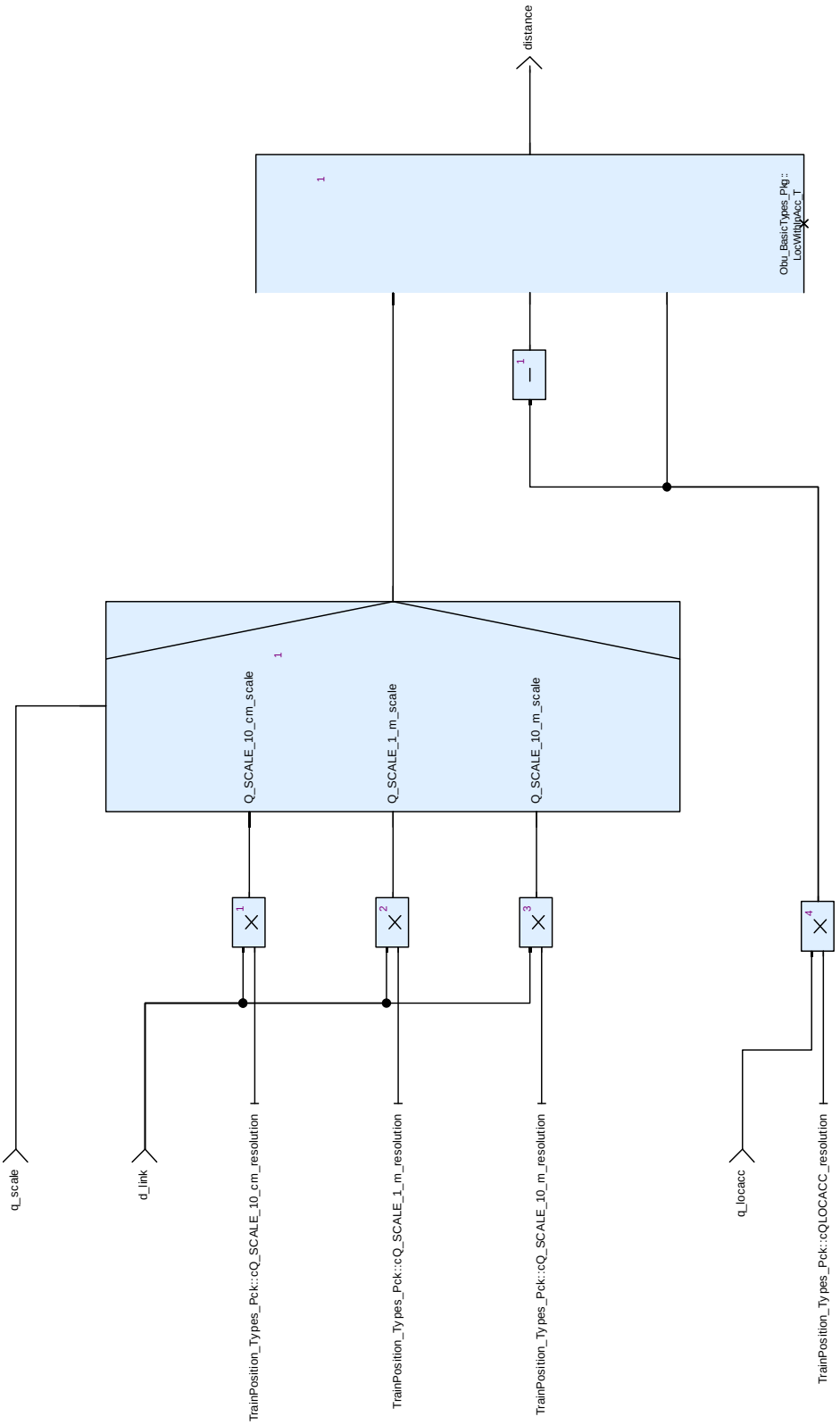


Figure 32: View of diagram_scaledDLINK_2_dlink_1 (scaledDLINK_2_dlink)

9.1.12. sub_2_distances Operator

Declared as **`public function`**

9.1.12.1. Comments and Information

sub_2_distances Comments:

- Calculates the distance loc_2 - loc_1 between two locations

Table 109: 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

9.1.12.2. Interface

Table 110: 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 111: Outputs of sub_2_distances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg::LocWithInAcc_T	

9.1.12.3. Operator Hierarchy

diagram : diagram_sub_2_distances_1

9.1.12.4. Graphical and Textual Diagrams

9.1.12.4.1. View of diagram_sub_2_distances_1 (sub_2_distances)

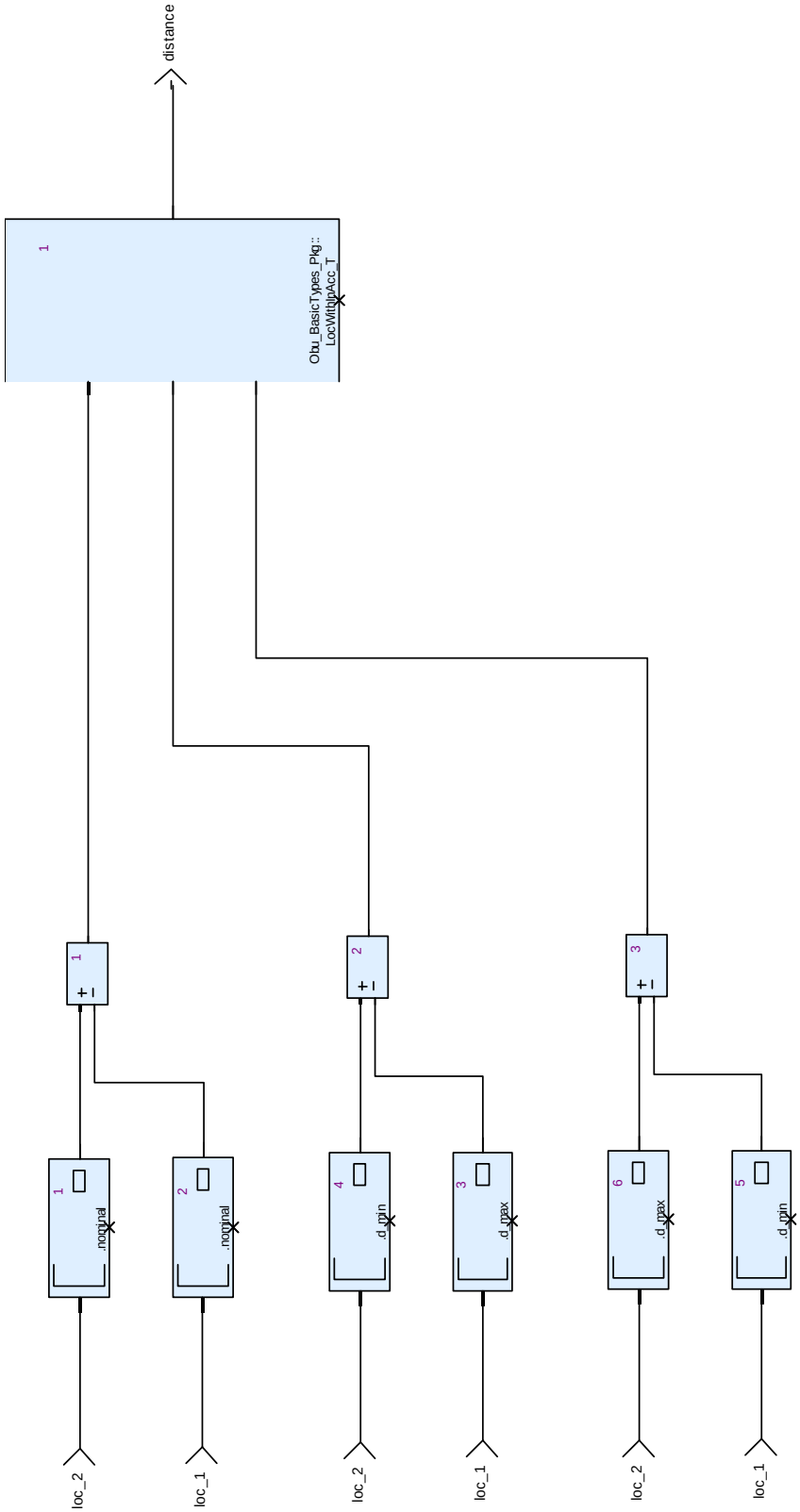


Figure 33: View of diagram_sub_2_distances_1 (sub_2_distances)

9.1.13. sub_2_odoDistances Operator

Declared as **`public function`**

9.1.13.1. Comments and Information

sub_2_odoDistances Comments:

- Calculates the distance o2 - o1 based on odometry data

Table 112: 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

9.1.13.2. Interface

Table 113: 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 114: Outputs of sub_2_odoDistances

Name	Type	Comments and Information
distance	Obu_BasicTypes_Pkg::LocWithInAcc_T	

9.1.13.3. Operator Hierarchy

diagram : diagram_sub_2_odoDistances_1

9.1.13.4. Graphical and Textual Diagrams

9.1.13.4.1. View of diagram_sub_2_odoDistances_1 (sub_2_odoDistances)

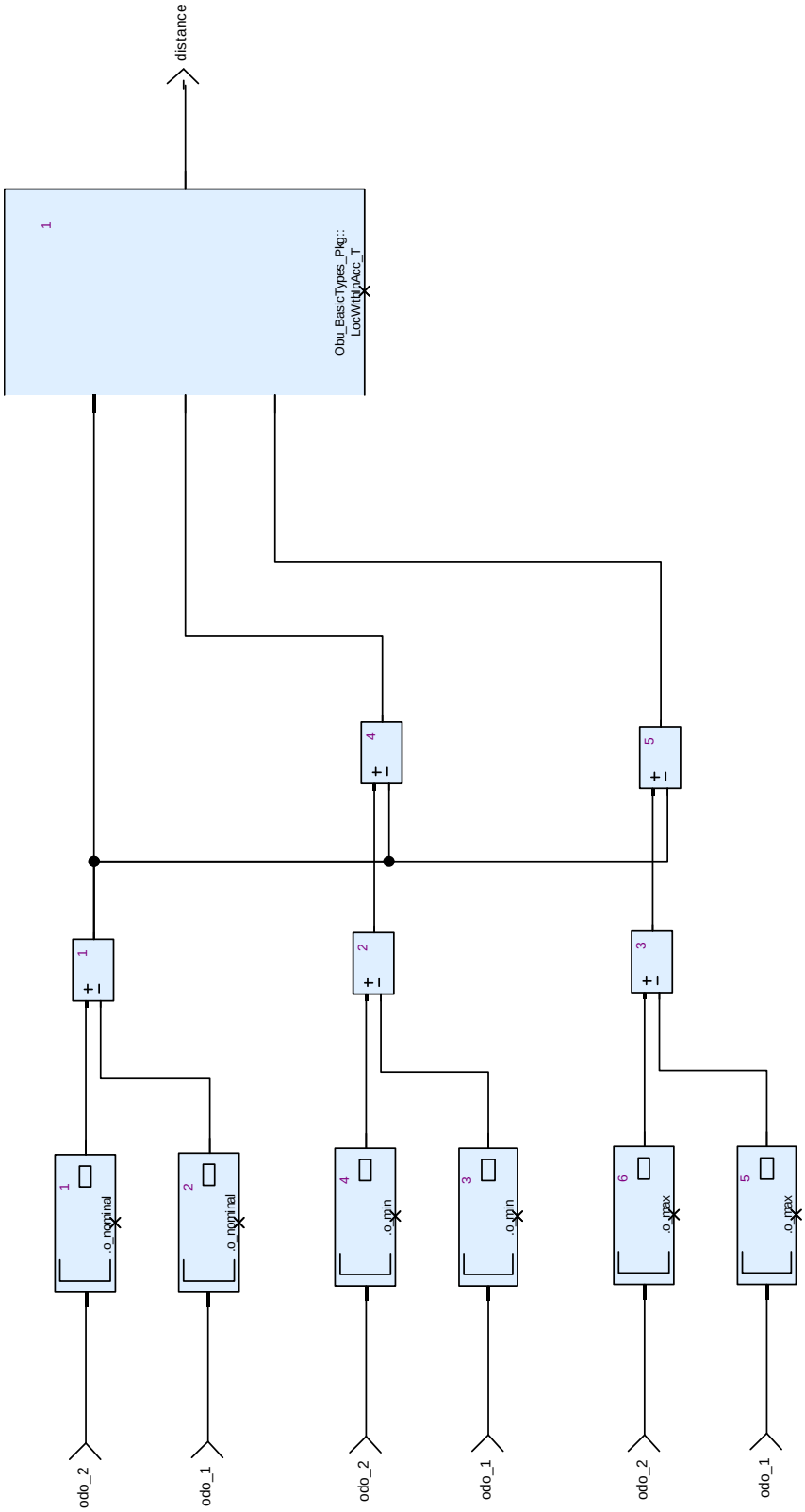


Figure 34: View of diagram_sub_2_odoDistances_1 (sub_2_odoDistances)

10. Project Library: CheckBGConsistency

10.1. CheckBGConsistency_Pkg Package

10.1.1. Constants

Table 115: Public Constants of CheckBGConsistency_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
InConsistentTelegram1	BG_Types_Pkg::Telegram_T	{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 : {linkingPackets : [{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 :	

Name	Type	Value	Comments and Information
NoLinkedBG	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
		{valid : false, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, BG_Header : {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}, 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_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_S	

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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

Name	Type	Value	Comments and Information
theTelegramFitsWithAll	int	255	
theTelegramNeverFitsAnyMessage	int	254	

10.1.2. CaseLinkingInUse Operator

Declared as **`public function`**

10.1.2.1. Comments and Information

CaseLinkingInUse Comments:

- Balise group message consistency subset 26: 3.16.2.3 Linking Consistency
- This function can not be fully realized at the moment, because
- - Not all packets are processed now.(q_dir can not be read)
- - RBC is not realized.

10.1.2.2. Interface

Table 116: Inputs of CaseLinkingInUse

Name	Type	Comments and Information
bgMessage	BG_Types_Pkg::BG_Message_T	
storedBGs	TrainPosition_Types_Pck::positionedBGs_T	

Table 117: Outputs of CaseLinkingInUse

Name	Type	Properties		Comments and Information
passedBG_out	BG_Types_Pkg::passedBG_T	default	NoPassedBG	
errorLinkedBG	bool	default	false	

10.1.2.3. Locals

Table 118: Locals of CaseLinkingInUse

Name	Type	Comments and Information
isAnnounced	bool	
isComplete	bool	
isSingle	bool	
lastTelegram	BG_Types_Pkg::Telegram_T	
passedBGlocal	BG_Types_Pkg::passedBG_T	
q_linkorientation_local	Q_LINKORIENTATION	

10.1.2.4. Operator Hierarchy

diagram : diagram_CaseLinkingInUse_1
- *activate if* : IfBlock1
  - branch : then
  - branch : else
    - branch : then
    - branch : else

10.1.2.5. Graphical and Textual Diagrams

10.1.2.5.1. View of diagram_CaseLinkingInUse_1 (CaseLinkingInUse)

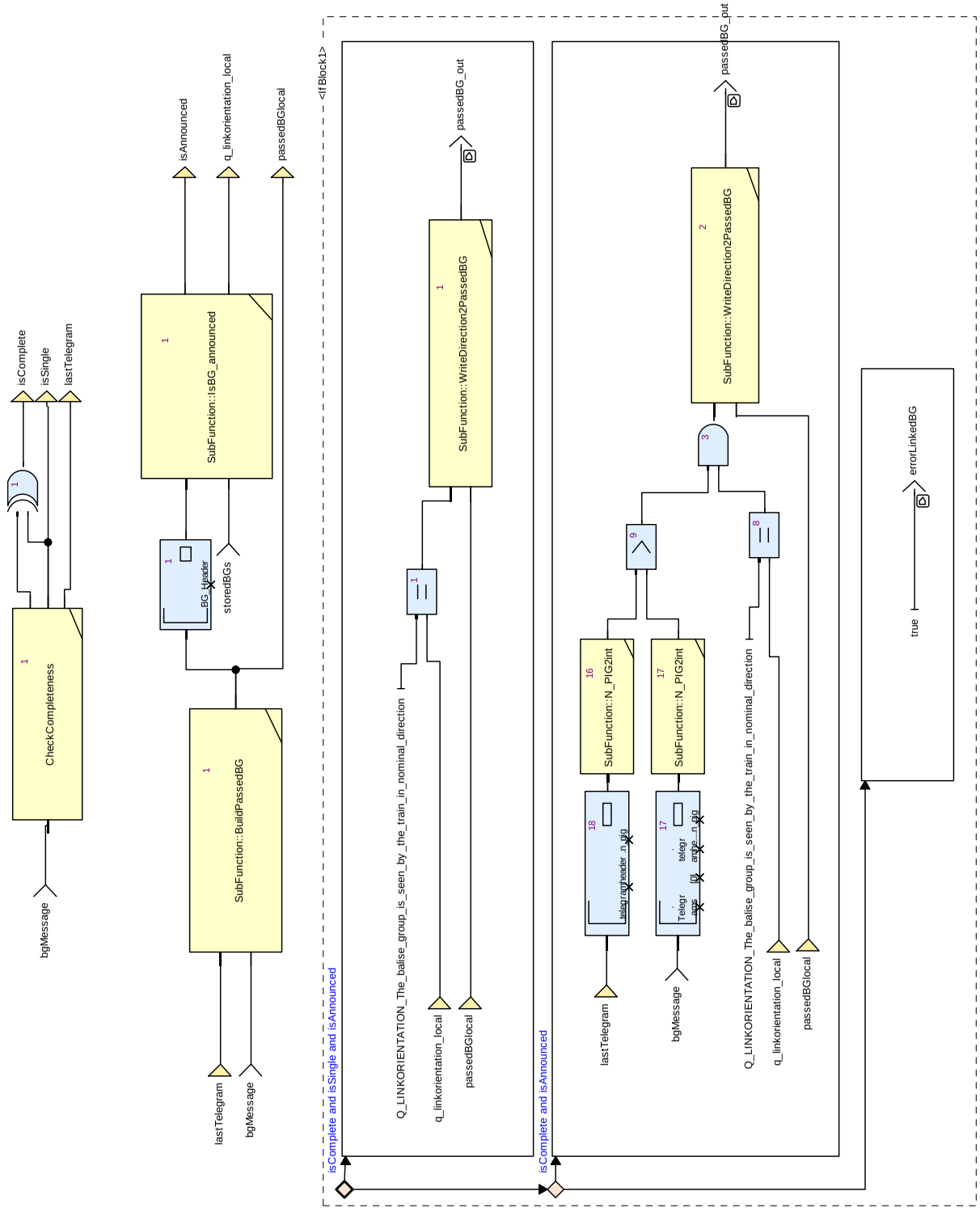


Figure 35: View of diagram_CaseLinkingInUse_1 (CaseLinkingInUse)

Table 119: Conditional Blocks of diagram_CaseLinkingInUse_1

Conditional Block	Comments and Information
IfBlock1	

Table 120: Actions of diagram_CaseLinkingInUse_1

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

10.1.3. CaseLinkingNotInUse Operator

Declared as **`public function`**

10.1.3.1. Comments and Information

CaseLinkingNotInUse Comments:

- unlinked Balise group message consistency subset 26: 3.16.2.5
- This function can not be fully realized at the moment, because
- - Not all packets are processed now.(q_dir can not be read)
- - RBC is not realized.

10.1.3.2. Interface

Table 121: Inputs of CaseLinkingNotInUse

Name	Type	Comments and Information
bgMessage	BG_Types_Pkg::BG_Message_T	

Table 122: Outputs of CaseLinkingNotInUse

Name	Type	Properties		Comments and Information
applyServiceBrake	bool	default	false	
badBaliseMessageToDMI	bool	default	false	
passedBG_out	BG_Types_Pkg::passedBG_T	default	NoPassedBG	
errorUnlinkedBG	bool	default	false	

10.1.3.3. Locals

Table 123: Locals of CaseLinkingNotInUse

Name	Type	Comments and Information
isComplete	bool	
isSingle	bool	
lastTelegram	BG_Types_Pkg::Telegram_T	

10.1.3.4. Operator Hierarchy

diagram : diagram_CaseLinkingNotInUse_1
    activate if : IfBlock1
        branch : then

branch : else
branch : then
branch : else

10.1.3.5. Graphical and Textual Diagrams

10.1.3.5.1. View of diagram_CaseLinkingNotInUse_1 (CaseLinkingNotInUse)

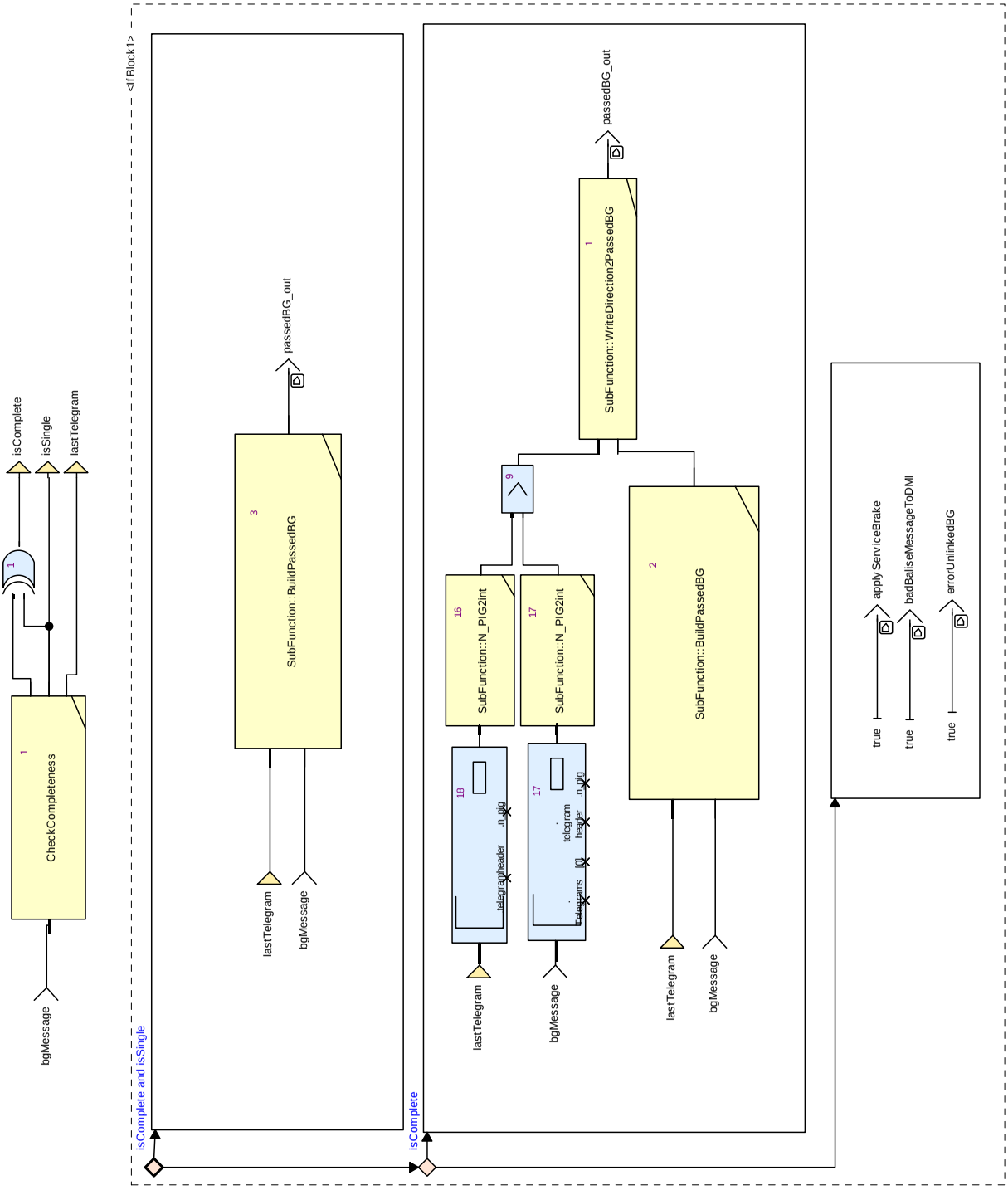


Figure 36: View of diagram_CaseLinkingNotInUse_1 (CaseLinkingNotInUse)

Table 124: Conditional Blocks of diagram_CaseLinkingNotInUse_1

Conditional Block	Comments and Information
IfBlock1	

Table 125: Actions of diagram_CaseLinkingNotInUse_1

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

10.1.4. CheckBGConsistency Operator

Declared as **`public function`**

10.1.4.1. Comments and Information

CheckBGConsistency Comments:

- 3.16.2.4 Balise Group Message Consistency
- a) A balise is missed inside the group.
- b) A balise is detected but no telegram is decoded (e.g. wrong CRC,...).
- c) Variables in the balise group message have invalid values.
- d) Message counters do not match (see 3.16.2.4.7)
- This function can not be fully realized at the moment, because
- - Not all packets are processed now.(q_dir can not be read)
- - RBC is not realized.

10.1.4.2. Interface

Table 126: Inputs of CheckBGConsistency

Name	Type	Comments and Information
bgMessage	BG_Types_Pkg::BG_Message_T	
storedBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPosition	TrainPosition_Types_Pck::trainPosition_T	
trainStatus	BG_Types_Pkg::TrainToTrackStatus_T	

Table 127: Outputs of CheckBGConsistency

Name	Type	Properties		Comments and Information
passedBG_out	BG_Types_Pkg::passedBG_T	default	NoPassedBG	
applyServiceBrake	bool	default	false	
badBaliseMessageToDMI	bool	default	false	
errorLinkedBG	bool	default	false	
errorUnlinkedBG	bool	default	false	

10.1.4.3. Locals

Table 128: Locals of CheckBGConsistency

Name	Type	Comments and Information
isLinked	bool	
linkingInUse	bool	
startTheCheck	bool	

10.1.4.4. Operator Hierarchy

diagram : diagram_CheckBGConsistency_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else

10.1.4.5. Graphical and Textual Diagrams

10.1.4.5.1. View of diagram_CheckBGConsistency_1 (CheckBGConsistency)

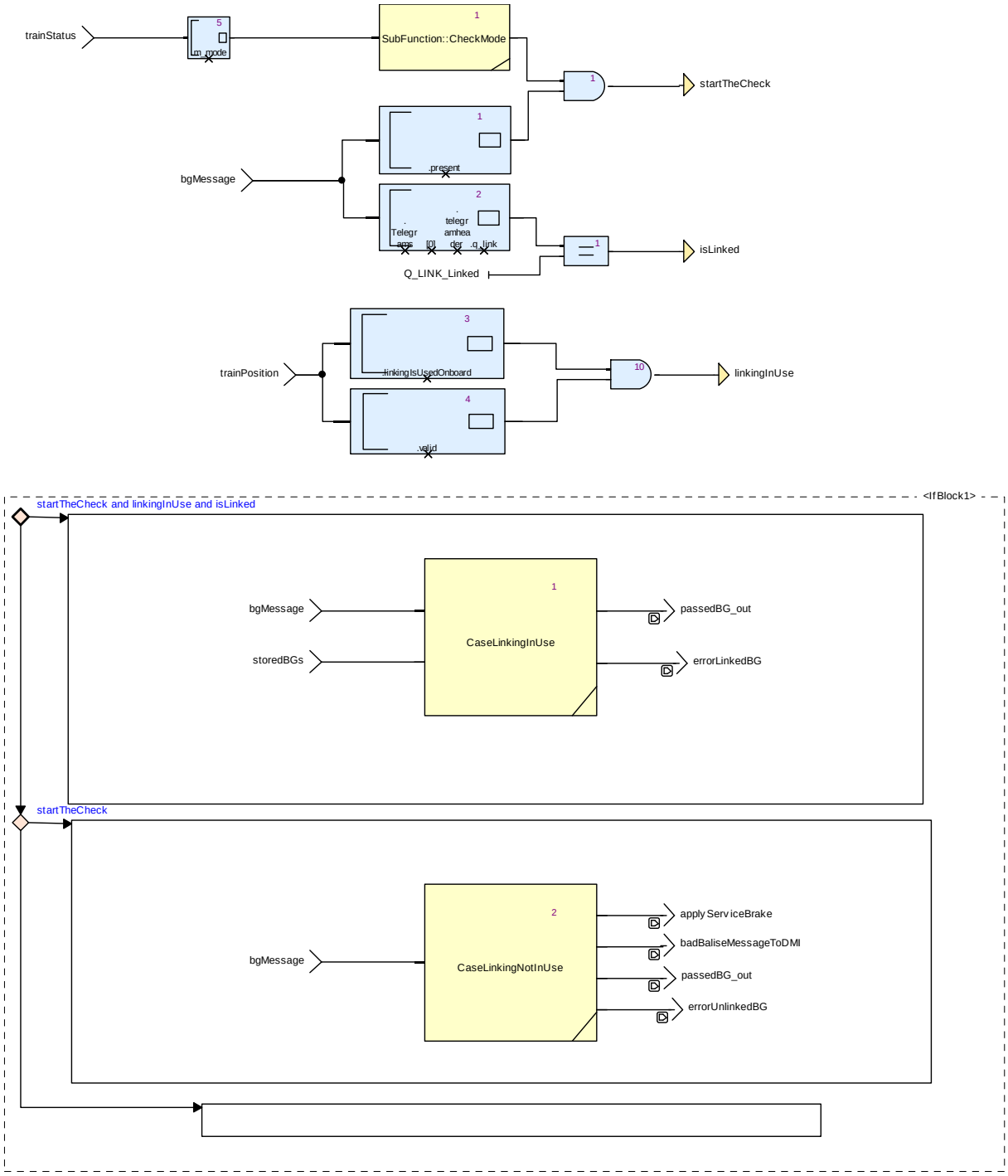


Figure 37: View of diagram_CheckBGConsistency_1 (CheckBGConsistency)

Table 129: Conditional Blocks of diagram_CheckBGConsistency_1

Conditional Block	Comments and Information
IfBlock1	

Table 130: Actions of diagram_CheckBGConsistency_1

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

10.1.5. CheckCompleteness Operator

Declared as **`public function`**

10.1.5.1. Interface

Table 131: Inputs of CheckCompleteness

Name	Type	Comments and Information
bgMessage	BG_Types_Pkg::BG_Message_T	

Table 132: Outputs of CheckCompleteness

Name	Type	Properties		Comments and Information
isComplete	bool	default	false	
isSingleBG	bool	default	false	
lastTelegram	BG_Types_Pkg::Telegram_T			

10.1.5.2. Locals

Table 133: Locals of CheckCompleteness

Name	Type	Comments and Information
numberOfBalises	int	

10.1.5.3. Operator Hierarchy

diagram : diagram_CheckCompleteness_1
activate if : IfBlock1
branch : then
branch : else

10.1.5.4. Graphical and Textual Diagrams

10.1.5.4.1. View of diagram_CheckCompleteness_1 (CheckCompleteness)

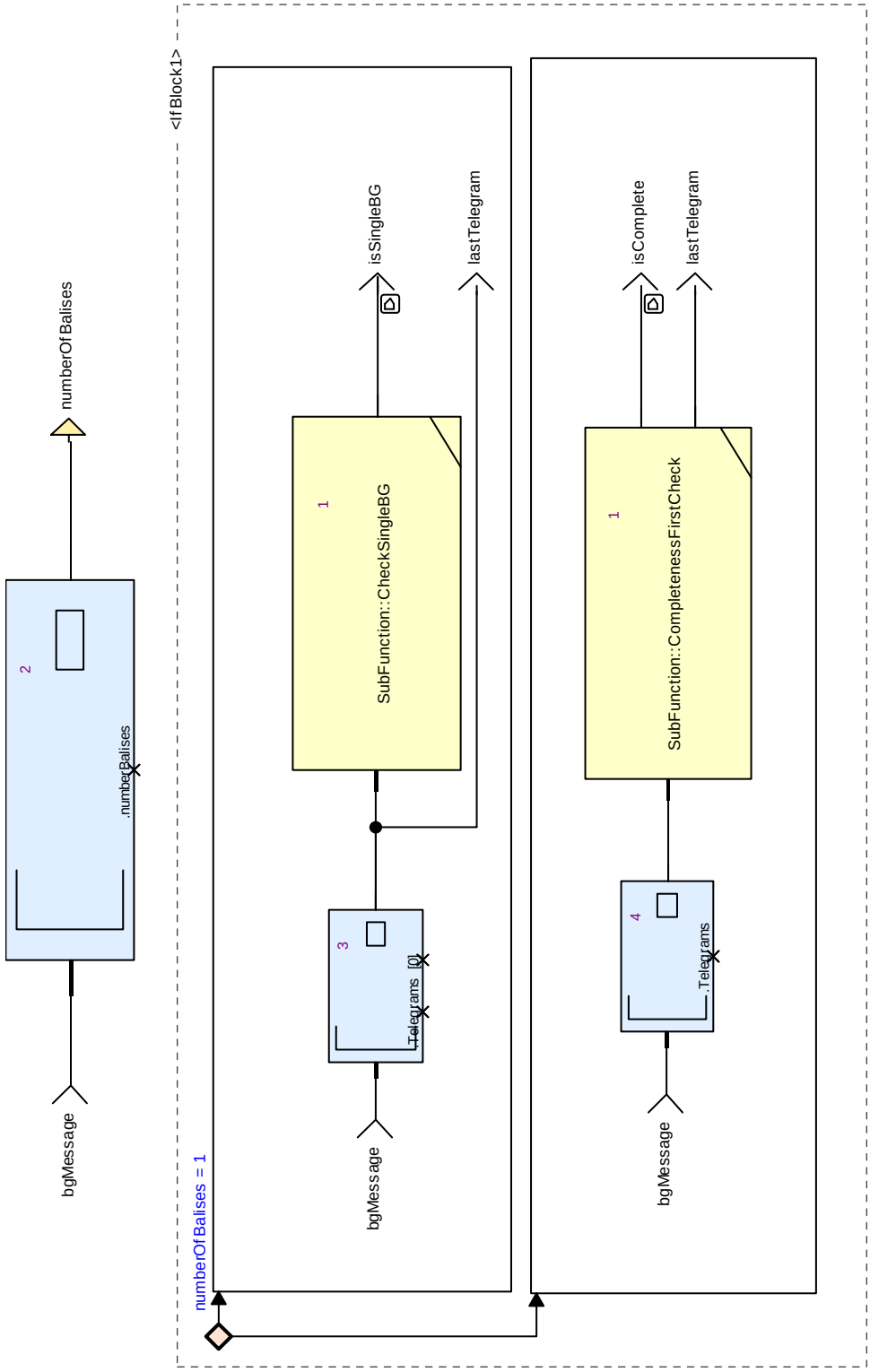


Figure 38: View of diagram_CheckCompleteness_1 (CheckCompleteness)

Table 134: Conditional Blocks of diagram_CheckCompleteness_1

Conditional Block	Comments and Information
IfBlock1	

Table 135: Actions of diagram_CheckCompleteness_1

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

10.1.6. CheckSingleTelegram Operator

Declared as **`public function`**

10.1.6.1. Interface

Table 136: Inputs of CheckSingleTelegram

Name	Type	Comments and Information
telegram_in	BG_Types_Pkg::Telegram_T	

Table 137: Outputs of CheckSingleTelegram

Name	Type	Comments and Information
isConsistent	bool	

10.1.6.2. Operator Hierarchy

diagram : diagram_CheckSingleTelegram_1

10.1.6.3. Graphical and Textual Diagrams

10.1.6.3.1. View of diagram_CheckSingleTelegram_1 (CheckSingleTelegram)

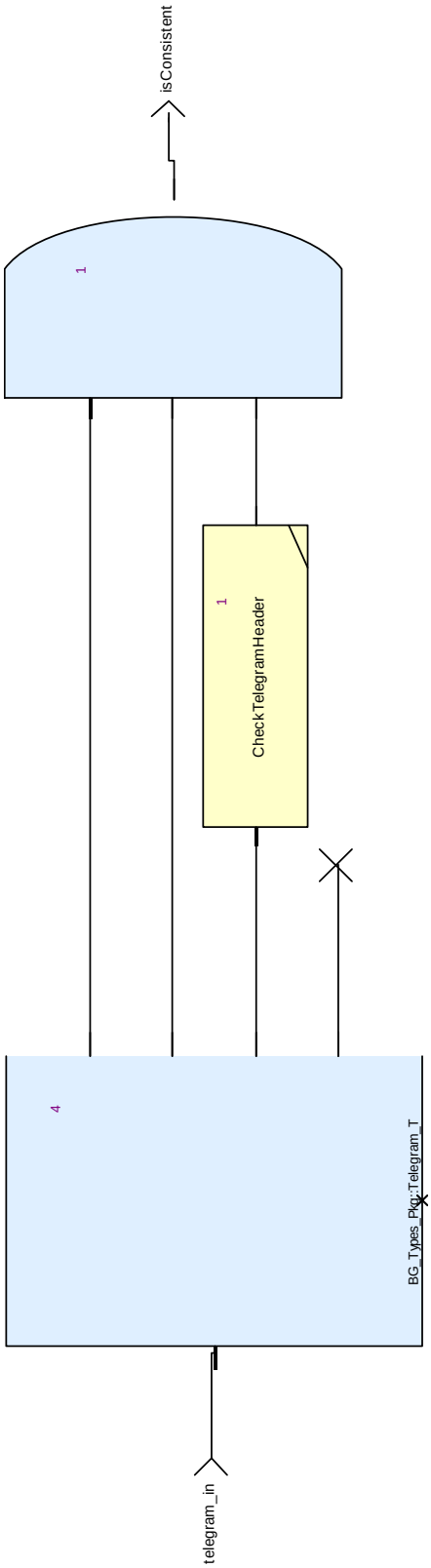


Figure 39: View of diagram_CheckSingleTelegram_1 (CheckSingleTelegram)

diagram_CheckSingleTelegram_1 Comments:

- check one telegram

10.1.7. CheckTelegramHeader Operator

Declared as **`public function`**

10.1.7.1. Interface

Table 138: Inputs of CheckTelegramHeader

Name	Type	Comments and Information
telegramHeader_in	BG_Types_Pkg::TelegramHeader_T	

Table 139: Outputs of CheckTelegramHeader

Name	Type	Comments and Information
isConsistent	bool	

10.1.7.2. Operator Hierarchy

diagram : diagram_CheckTelegramHeader_1

10.1.7.3. Graphical and Textual Diagrams

10.1.7.3.1. View of diagram_CheckTelegramHeader_1 (CheckTelegramHeader)

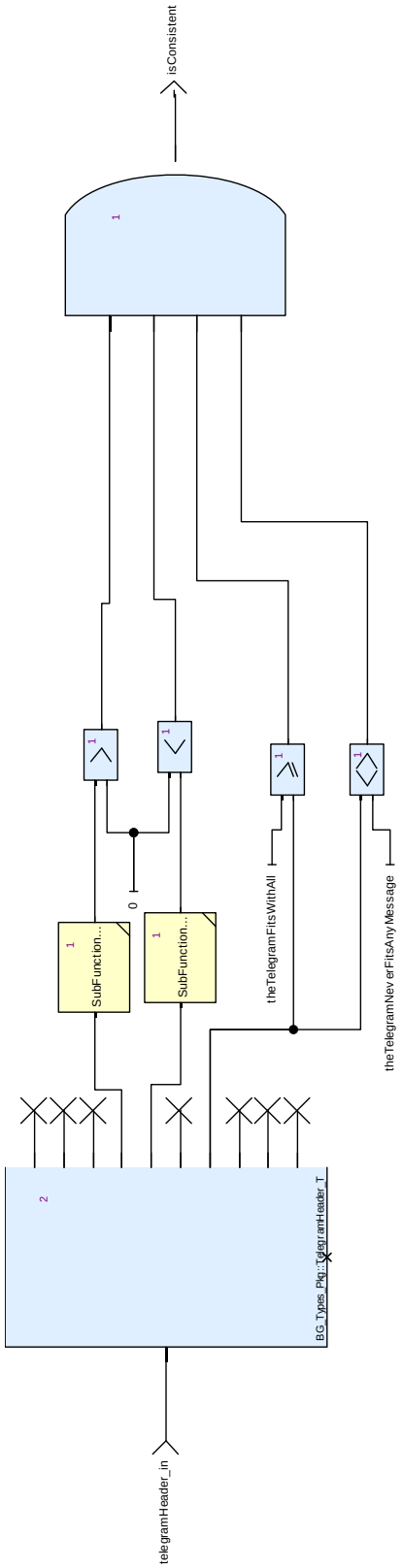


Figure 40: View of diagram_CheckTelegramHeader_1 (CheckTelegramHeader)

diagram_CheckTelegramHeader_1 Comments:

- check one telegram

10.2. CheckBGConsistency_Pkg::SubFunction Package

10.2.1. BuildBGheader Operator

Declared as **`public function`**

10.2.1.1. Comments and Information

BuildBGheader Comments:

- Auxiliary function for Build PassedBG

10.2.1.2. Interface

Table 140: Inputs of BuildBGheader

Name	Type	Comments and Information
telegramHeader	BG_Types_Pkg::TelegramHeader_T	

Table 141: Outputs of BuildBGheader

Name	Type	Comments and Information
bgHeader	BG_Types_Pkg::BG_Header_T	

10.2.1.3. Operator Hierarchy

diagram : diagram_BuildBGheader_1

10.2.1.4. Graphical and Textual Diagrams

10.2.1.4.1. View of diagram_BuildBGheader_1 (BuildBGheader)

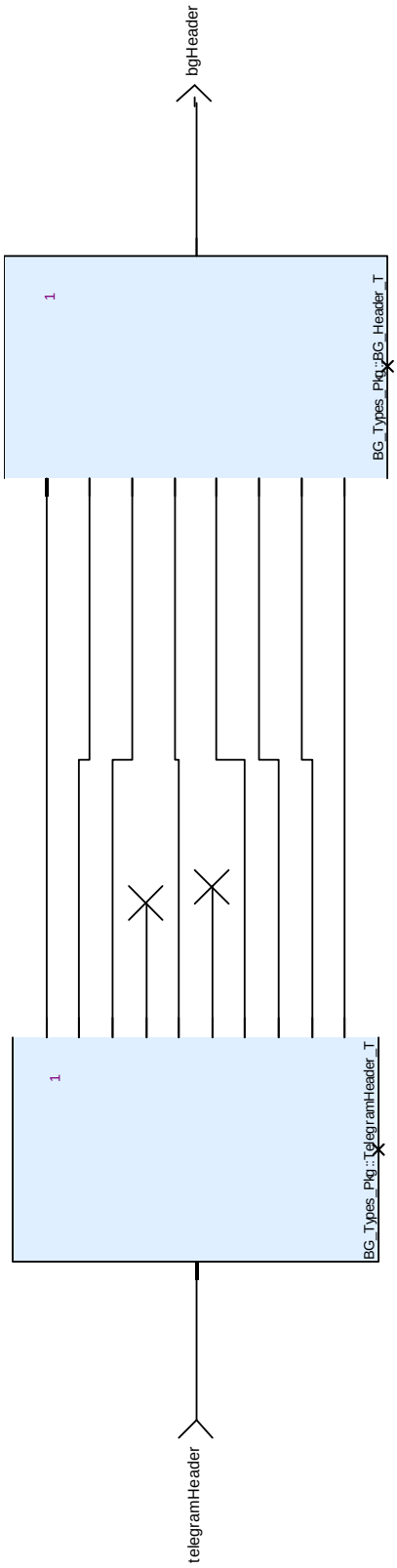


Figure 41: View of diagram_BuildBGheader_1 (BuildBGheader)

diagram_BuildBGheader_1 Comments:

- need to be implemented

10.2.2. BuildPassedBG Operator

Declared as **`public function`**

10.2.2.1. Comments and Information

BuildPassedBG Comments:

- Filter the bg_telegrams and build the bg_message

10.2.2.2. Interface

Table 142: Inputs of BuildPassedBG

Name	Type	Comments and Information
telegram_in	BG_Types_Pkg::Telegram_T	
bgMessage	BG_Types_Pkg::BG_Message_T	

Table 143: Outputs of BuildPassedBG

Name	Type	Comments and Information
passedBG_out	BG_Types_Pkg::passedBG_T	

10.2.2.3. Operator Hierarchy

diagram : diagram_BuildPassedBG_1

10.2.2.4. Graphical and Textual Diagrams

10.2.2.4.1. View of diagram_BuildPassedBG_1 (BuildPassedBG)

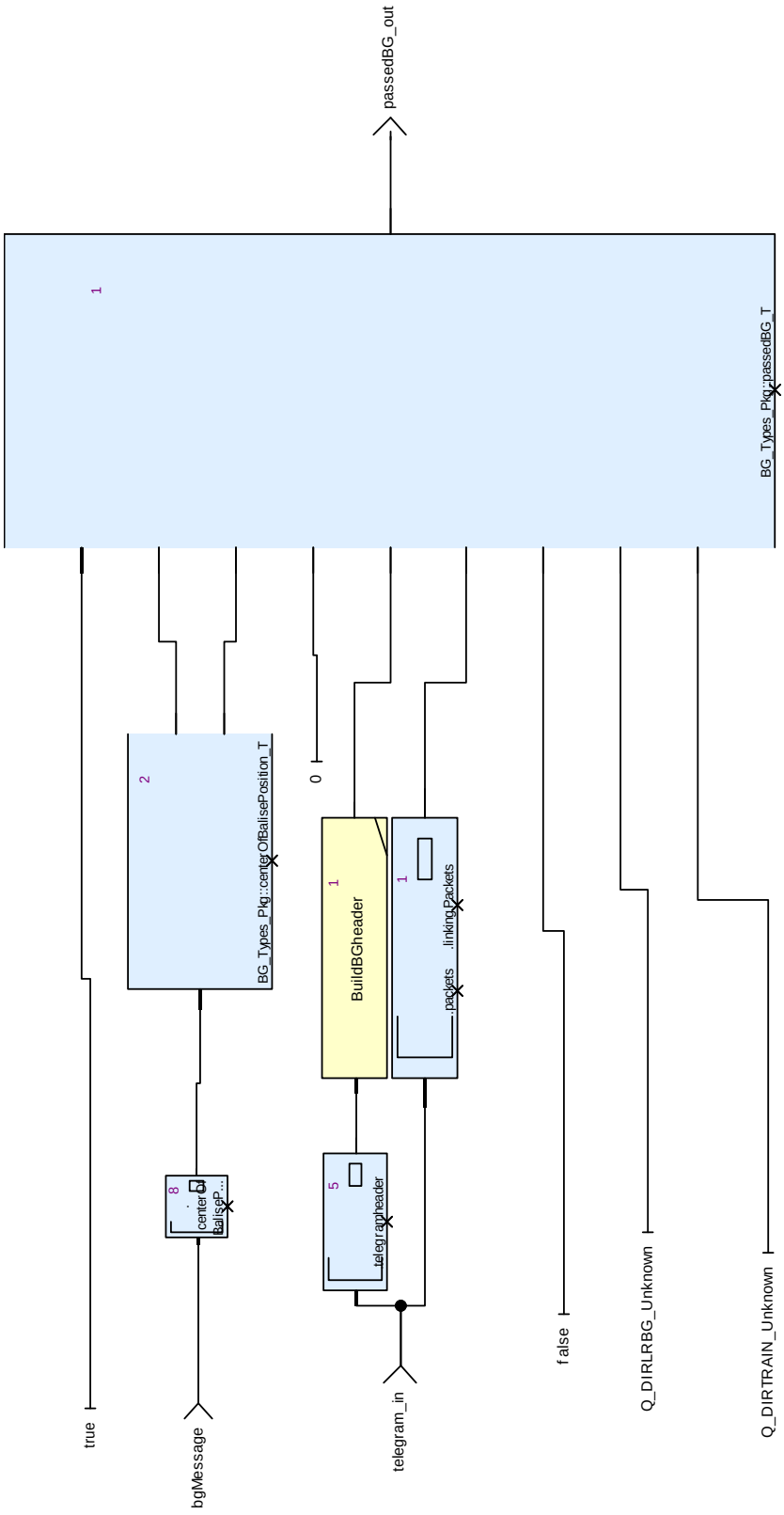


Figure 42: View of diagram_BuildPassedBG_1 (BuildPassedBG)

10.2.3. Check2Headers Operator

Declared as **`public function`**

10.2.3.1. Interface

Table 144: Inputs of Check2Headers

Name	Type	Comments and Information
header_1	BG_Types_Pkg::TelegramHeader_T	
crcCheck_1	bool	
header_2	BG_Types_Pkg::TelegramHeader_T	
crcCheck_2	bool	

Table 145: Outputs of Check2Headers

Name	Type	Comments and Information
isConsistent	bool	

10.2.3.2. Locals

Table 146: Locals of Check2Headers

Name	Type	Comments and Information
m_dup_1	M_DUP	
m_dup_2	M_DUP	
n_pig_1	N_PIG	
n_pig_2	N_PIG	

10.2.3.3. Operator Hierarchy

diagram : diagram_Check2Headers_1

10.2.3.4. Graphical and Textual Diagrams

10.2.3.4.1. View of diagram_Check2Headers_1 (Check2Headers)

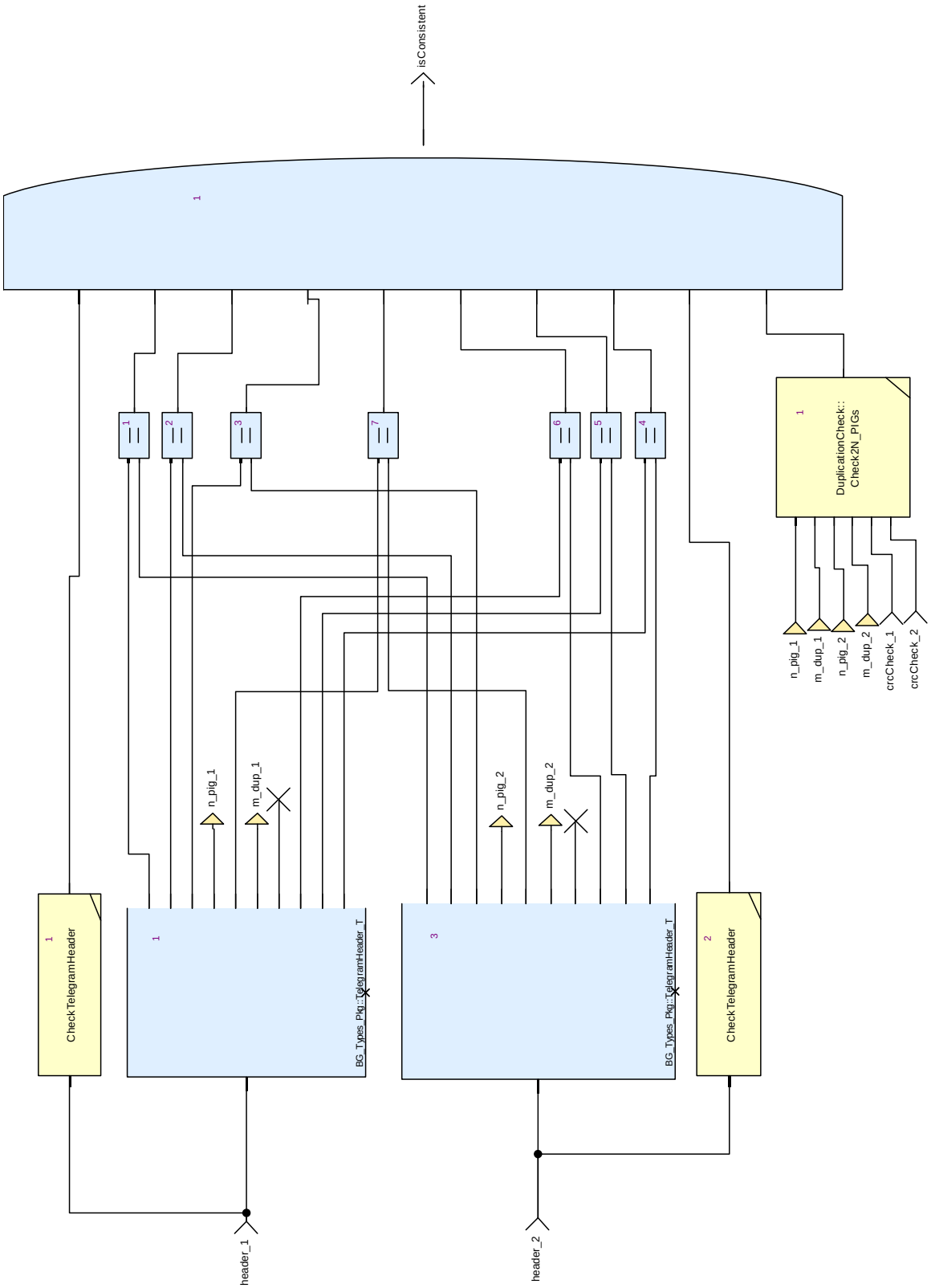


Figure 43: View of diagram_Check2Headers_1 (Check2Headers)

10.2.4. Check2Telegrams Operator

Declared as **`public function`**

10.2.4.1. Interface

Table 147: Inputs of Check2Telegrams

Name	Type	Comments and Information
telegram1	BG_Types_Pkg::Telegram_T	
telegram2	BG_Types_Pkg::Telegram_T	

Table 148: Outputs of Check2Telegrams

Name	Type	Comments and Information
isConsistent	bool	
telegram_out	BG_Types_Pkg::Telegram_T	

10.2.4.2. Locals

Table 149: Locals of Check2Telegrams

Name	Type	Comments and Information
crc1	bool	
crc2	bool	

10.2.4.3. Operator Hierarchy

diagram : diagram_Check2Telegrams_1
activate if : IfBlock1
branch : then
branch : else

10.2.4.4. Graphical and Textual Diagrams

10.2.4.4.1. View of diagram_Check2Telegrams_1 (Check2Telegrams)

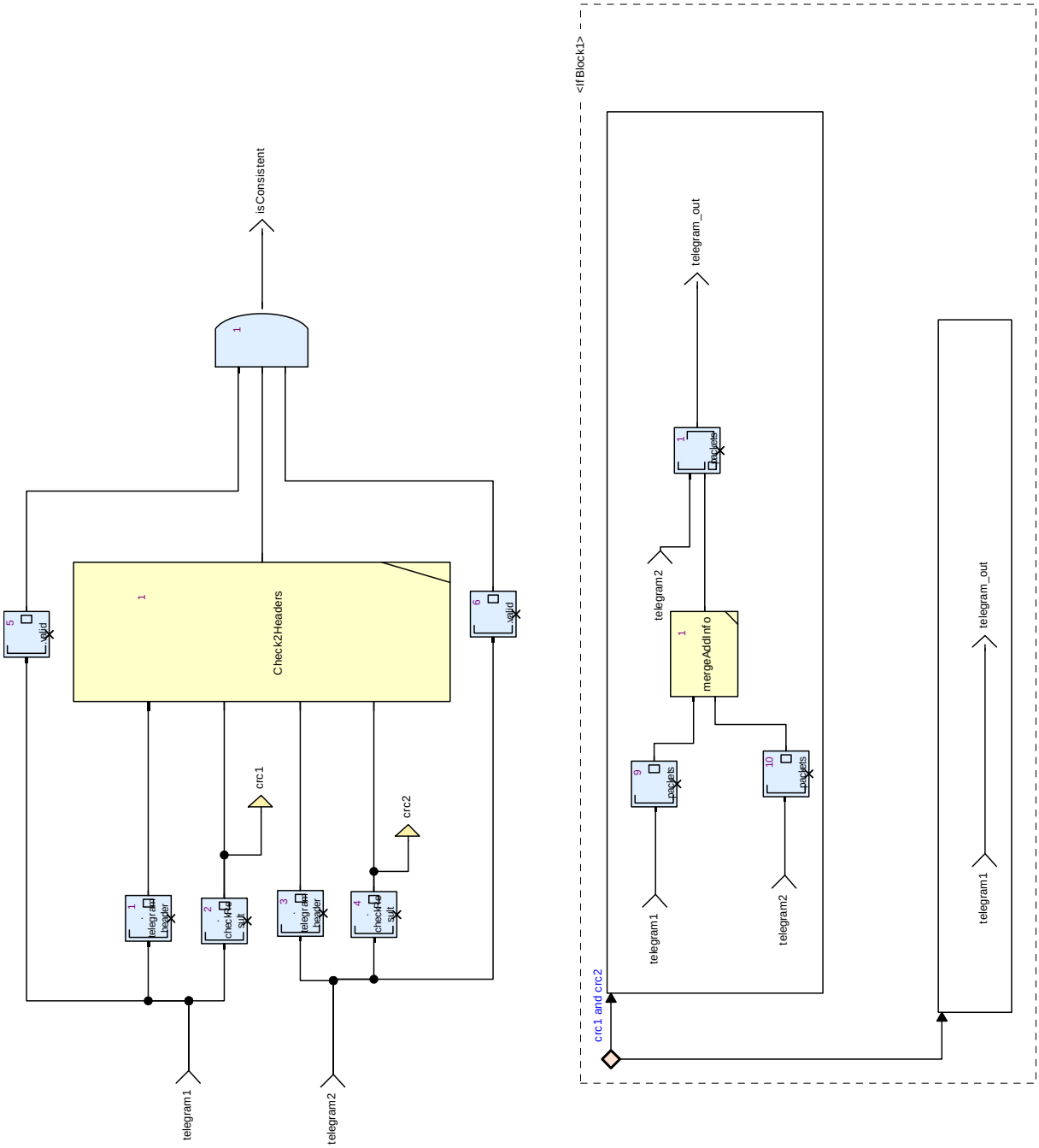


Figure 44: View of diagram_Check2Telegrams_1 (Check2Telegrams)

Table 150: Conditional Blocks of diagram_Check2Telegrams_1

Conditional Block	Comments and Information
IfBlock1	

Table 151: Actions of diagram_Check2Telegrams_1

Conditional Block Action	Comments and Information
IfBlock1:then	

Conditional Block Action	Comments and Information
IfBlock1:else	

10.2.5. CheckMode Operator

Declared as **`public function`**

10.2.5.1. Comments and Information

CheckMode Comments:

- subset 26: 4.5.2
- when should be BG-Consistency active.

10.2.5.2. Interface

Table 152: Inputs of CheckMode

Name	Type	Comments and Information
currentMode	M_MODE	

Table 153: Outputs of CheckMode

Name	Type	Comments and Information
bgConsistansyIsActive	bool	

10.2.5.3. Operator Hierarchy

diagram : diagram_CheckMode_1

10.2.5.4. Graphical and Textual Diagrams

10.2.5.4.1. View of diagram_CheckMode_1 (CheckMode)

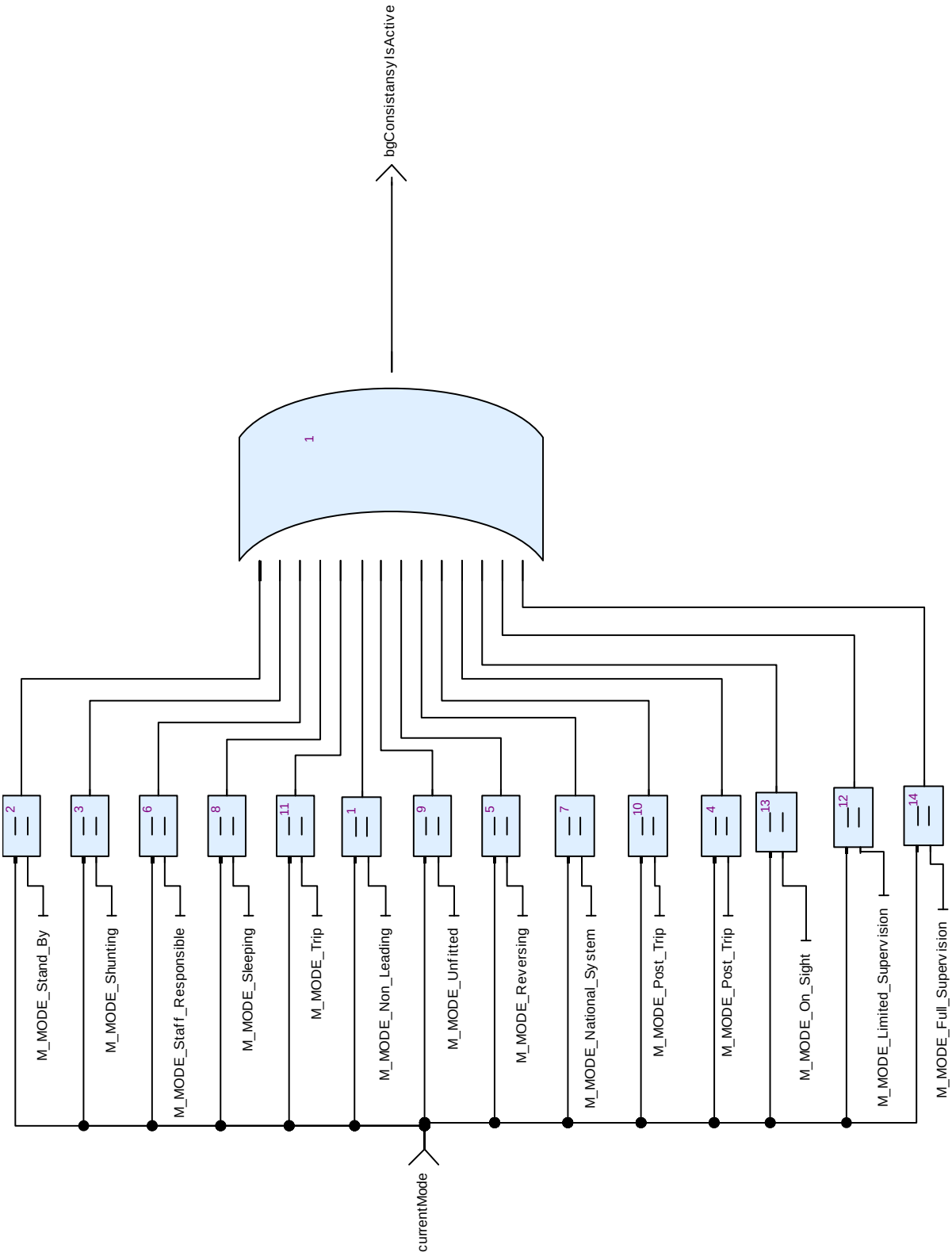


Figure 45: View of diagram_CheckMode_1 (CheckMode)

10.2.6. CheckOneTelegram Operator

Declared as **`public function`**

10.2.6.1. Interface

Table 154: Inputs of CheckOneTelegram

Name	Type	Comments and Information
telegram_in	BG_Types_Pkg::Telegram_T	

Table 155: Outputs of CheckOneTelegram

Name	Type	Comments and Information
isConsistent	bool	

10.2.6.2. Operator Hierarchy

diagram : diagram_CheckOneTelegram_1

10.2.6.3. Graphical and Textual Diagrams

10.2.6.3.1. View of diagram_CheckOneTelegram_1 (CheckOneTelegram)

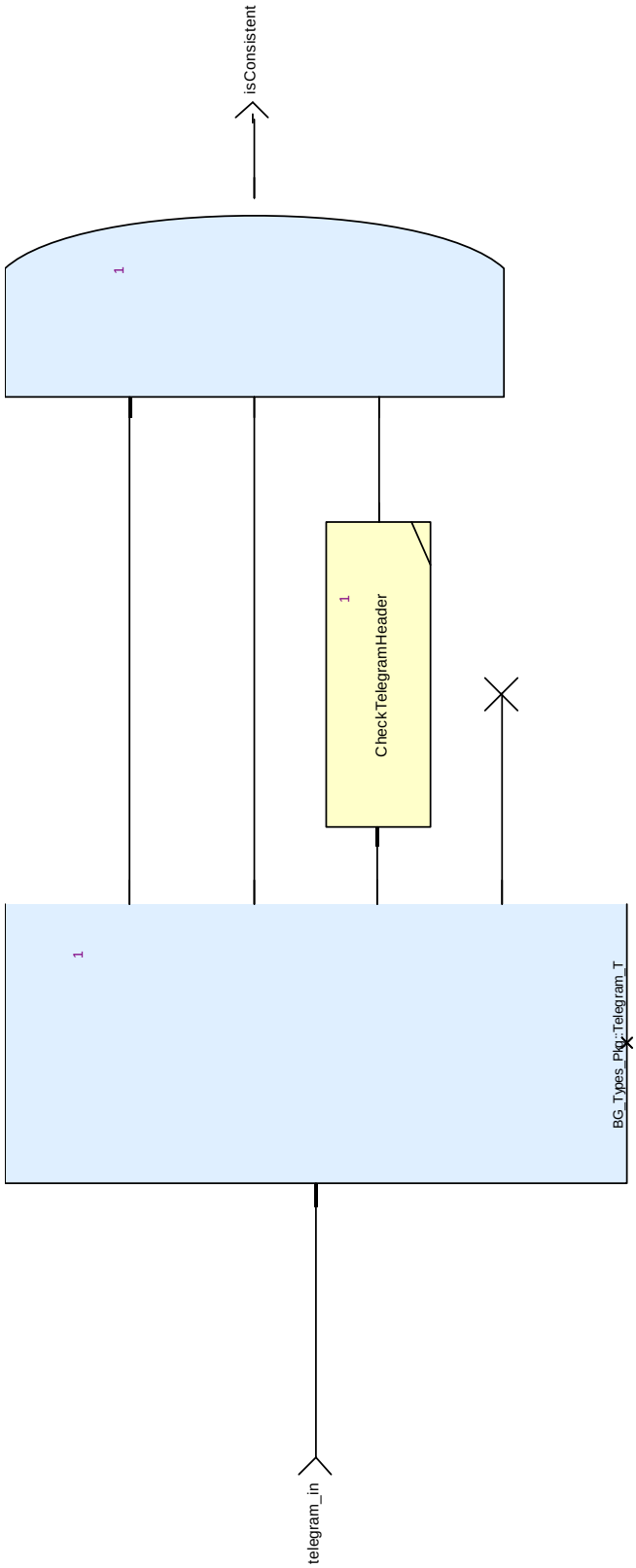


Figure 46: View of diagram_CheckOneTelegram_1 (CheckOneTelegram)

diagram_CheckOneTelegram_1 Comments:

- check one telegram

10.2.7. CheckSingleBG Operator

Declared as **`public function`**

10.2.7.1. Interface

Table 156: Inputs of CheckSingleBG

Name	Type	Comments and Information
telegram_in	BG_Types_Pkg::Telegram_T	

Table 157: Outputs of CheckSingleBG

Name	Type	Comments and Information
isSingleBG	bool	

10.2.7.2. Locals

Table 158: Locals of CheckSingleBG

Name	Type	Comments and Information
n_total	N_TOTAL	

10.2.7.3. Operator Hierarchy

diagram : diagram_CheckSingleBG_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else

10.2.7.4. Graphical and Textual Diagrams

10.2.7.4.1. View of diagram_CheckSingleBG_1 (CheckSingleBG)

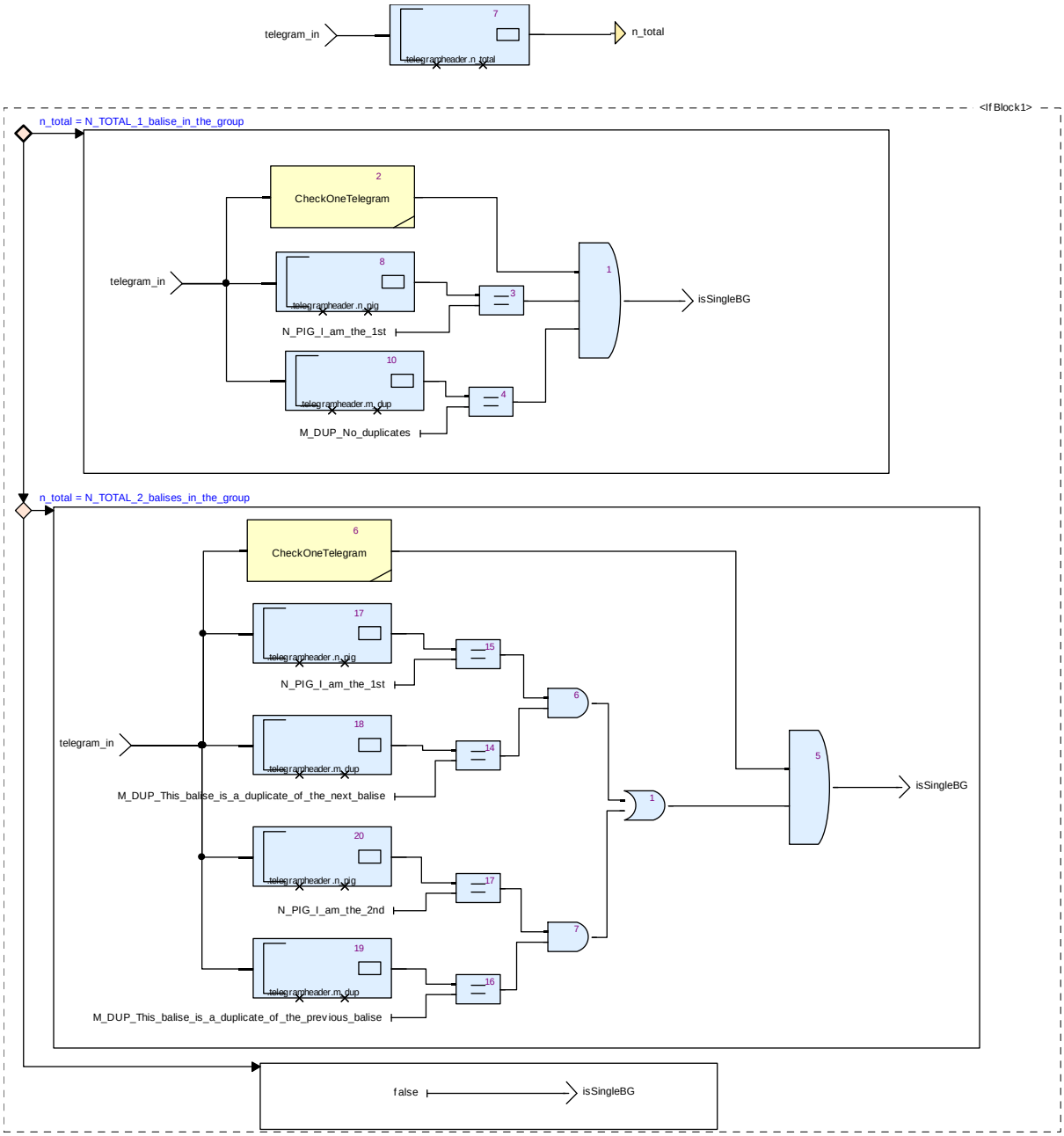


Figure 47: View of diagram_CheckSingleBG_1 (CheckSingleBG)

Table 159: Conditional Blocks of diagram_CheckSingleBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 160: Actions of diagram_CheckSingleBG_1

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

10.2.8. CheckTelegramHeader Operator

Declared as **`public function`**

10.2.8.1. Interface

Table 161: Inputs of CheckTelegramHeader

Name	Type	Comments and Information
telegramHeader_in	BG_Types_Pkg::TelegramHeader_T	

Table 162: Outputs of CheckTelegramHeader

Name	Type	Comments and Information
isConsistent	bool	

10.2.8.2. Operator Hierarchy

diagram : diagram_CheckTelegramHeader_1

10.2.8.3. Graphical and Textual Diagrams

10.2.8.3.1. View of diagram_CheckTelegramHeader_1 (CheckTelegramHeader)

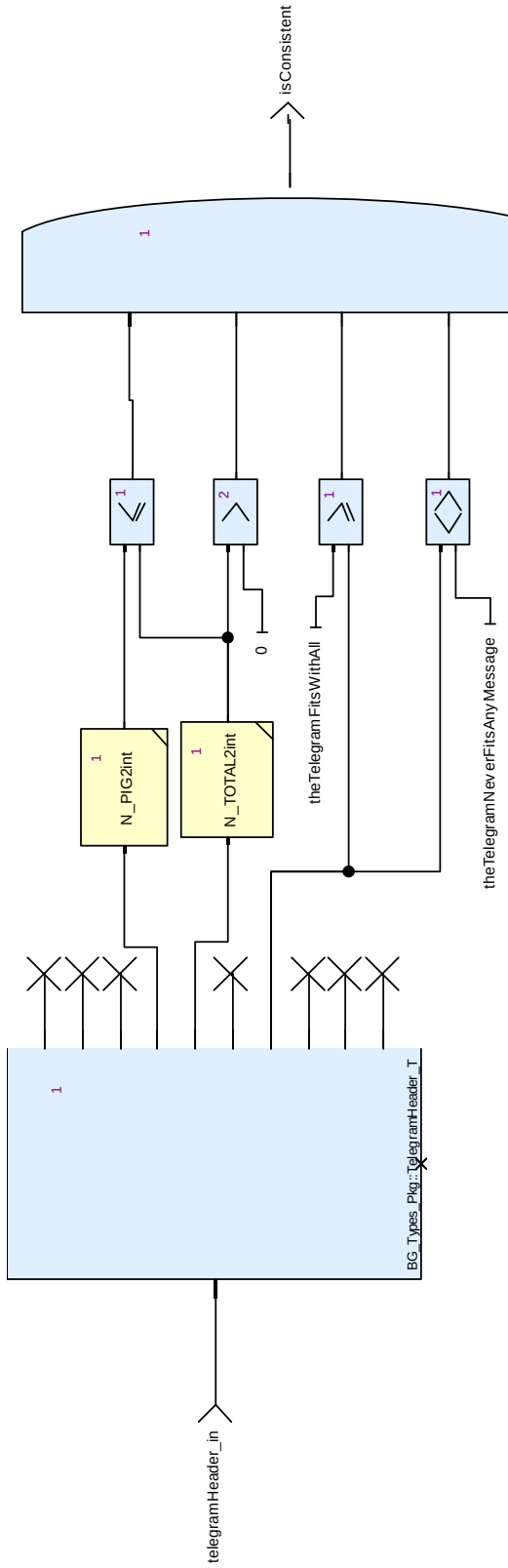


Figure 48: View of diagram_CheckTelegramHeader_1 (CheckTelegramHeader)

diagram_CheckTelegramHeader_1 Comments:

- check one telegram

10.2.9. CompletenessFirstCheck Operator

Declared as **`public function`**

10.2.9.1. Interface

Table 163: Inputs of CompletenessFirstCheck

Name	Type	Comments and Information
telegramarray_in	BG_Types_Pkg::TelegramArray_T	

Table 164: Outputs of CompletenessFirstCheck

Name	Type	Properties		Comments and Information
isComplete	bool			
lastTelegram	BG_Types_Pkg::Telegram_T	default	InConsistentTelegram1	

10.2.9.2. Locals

Table 165: Locals of CompletenessFirstCheck

Name	Type	Comments and Information
firstTelegramIsValid	bool	

10.2.9.3. Operator Hierarchy

diagram : diagram_CompletenessFirstCheck_1
activate if : IfBlock1
branch : then
branch : else

10.2.9.4. Graphical and Textual Diagrams

10.2.9.4.1. View of diagram_CompletenessFirstCheck_1 (CompletenessFirstCheck)

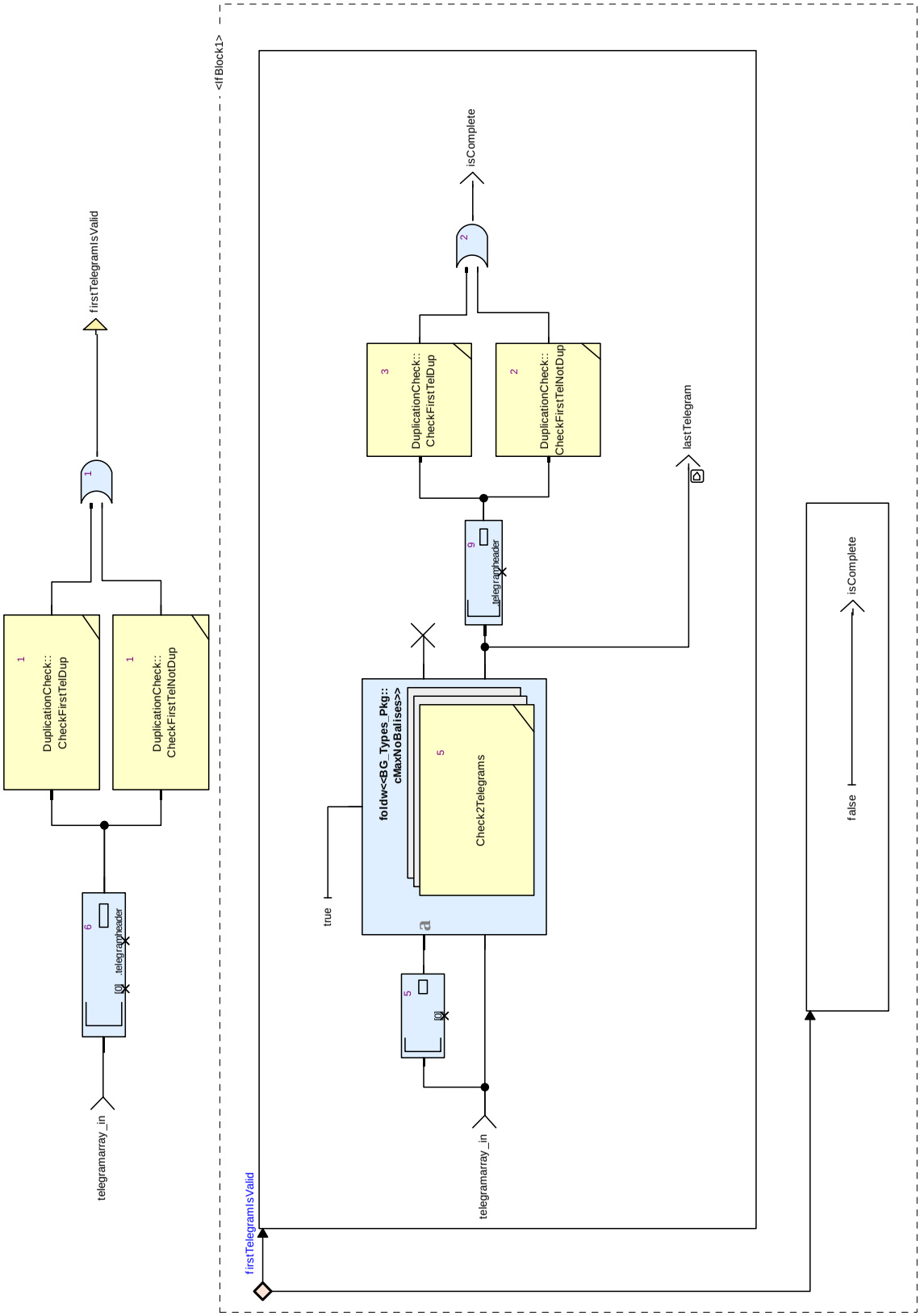


Figure 49: View of diagram_CompletenessFirstCheck_1 (CompletenessFirstCheck)

Table 166: Conditional Blocks of diagram_CompletenessFirstCheck_1

Conditional Block	Comments and Information
IfBlock1	

Table 167: Actions of diagram_CompletenessFirstCheck_1

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

10.2.10. IsBG_announced Operator

Declared as **`public function`**

10.2.10.1. Comments and Information

IsBG_announced Comments:

- check if the recived BG is in the annonced BG list

10.2.10.2. Interface

Table 168: Inputs of IsBG_announced

Name	Type	Comments and Information
recivedBG_header	BG_Types_Pkg::BG_Header_T	
storedBGs	TrainPosition_Types_Pck::positionedBGs_T	

Table 169: Outputs of IsBG_announced

Name	Type	Comments and Information
isAnnounced	bool	
q_linkorintation	Q_LINKORIENTATION	

10.2.10.3. Locals

Table 170: Locals of IsBG_announced

Name	Type	Comments and Information
indexLocal	int	
isStored	bool	

10.2.10.4. Operator Hierarchy

diagram : diagram_IsBG_announced_1
    activate if : IfBlock1
        branch : then
        branch : else

10.2.10.5. Graphical and Textual Diagrams

10.2.10.5.1. View of diagram_IsBG_announced_1 (IsBG_announced)

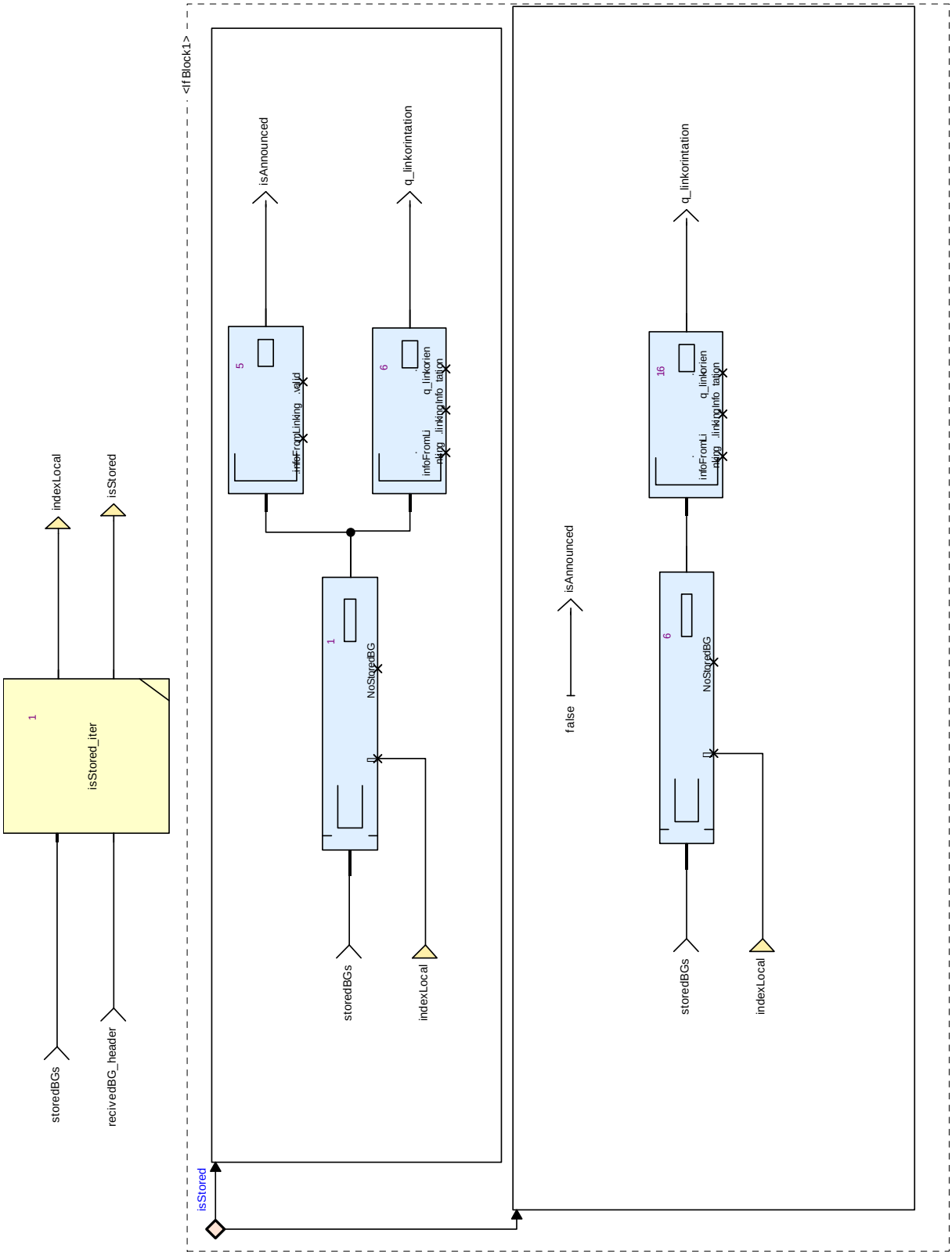


Figure 50: View of diagram_IsBG_announced_1 (IsBG_announced)

Table 171: Conditional Blocks of diagram_IsBG_announced_1

Conditional Block	Comments and Information
IfBlock1	

Table 172: Actions of diagram_IsBG_announced_1

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

10.2.11. isStored Operator

Declared as **`public function`**

10.2.11.1. Comments and Information

isStored Comments:

- check if the recived BG is in the annonced BG list

10.2.11.2. Interface

Table 173: Inputs of isStored

Name	Type	Comments and Information
recivedBG_header	BG_Types_Pkg::BG_Header_T	
storedBG	TrainPosition_Types_Pck::positionedBG_T	

Table 174: Outputs of isStored

Name	Type	Comments and Information
go_on	bool	
acc_out	BG_Types_Pkg::BG_Header_T	

10.2.11.3. Operator Hierarchy

diagram : diagram_isStored_1

10.2.11.4. Graphical and Textual Diagrams

10.2.11.4.1. View of diagram_isStored_1 (isStored)

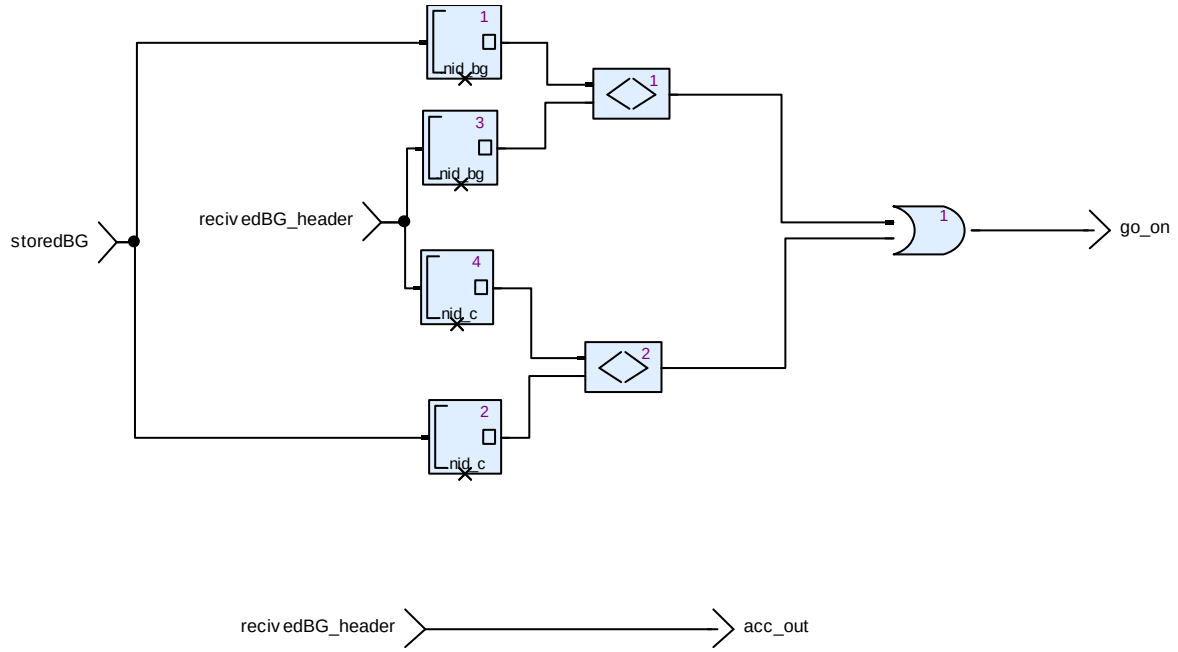


Figure 51: View of diagram_isStored_1 (isStored)

10.2.12. isStored_iter Operator

Declared as **`public function`**

10.2.12.1. Comments and Information

isStored_iter Comments:

- check if the recived BG is in the annonced BG list

10.2.12.2. Interface

Table 175: Inputs of isStored_iter

Name	Type	Comments and Information
storedBGs	TrainPosition_Types_Pck::positionedBGs_T	
bgHeader	BG_Types_Pkg::BG_Header_T	

Table 176: Outputs of isStored_iter

Name	Type	Comments and Information
index	int	
isStored	bool	

10.2.12.3. Operator Hierarchy

diagram : diagram_isStored_iter_1

10.2.12.4. Graphical and Textual Diagrams

10.2.12.4.1. View of diagram_isStored_iter_1 (isStored_iter)

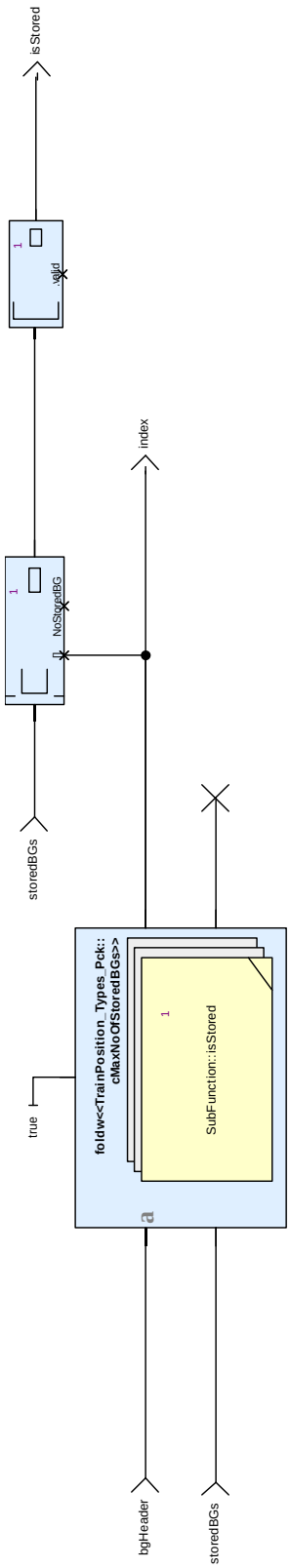


Figure 52: View of diagram_isStored_iter_1 (isStored_iter)

10.2.13. mergeAddInfo Operator

Declared as **`public function`**

10.2.13.1. Comments and Information

mergeAddInfo Comments:

- This function combines packets received in the telegrams of a balise group.
- The function is limited to the packets used in the respective scope of the model:
- - linking packet (5).
-
- The behaviour is according to the subset 26, section
- - 8.4.2 (rules for balise telegrams) and
- - 8.4.1 (multiplicity of packets in a balise group message).
- We interpret the term "message" in this context as a balise message consisting of several telegrams. This implies in general, only single packets are to be expected for the whole balise group message (respecting documented exeptions.

10.2.13.2. Interface

Table 177: Inputs of mergeAddInfo

Name	Type	Comments and Information
newAddInfo	BG_Types_Pkg::AdditionalInformation_T	
oldAddInfo	BG_Types_Pkg::AdditionalInformation_T	

Table 178: Outputs of mergeAddInfo

Name	Type	Comments and Information
mergedlAddInfo	BG_Types_Pkg::AdditionalInformation_T	

10.2.13.3. Operator Hierarchy

diagram : diagram_mergeAddInfo_1

10.2.13.4. Graphical and Textual Diagrams

10.2.13.4.1. View of diagram_mergeAddInfo_1 (mergeAddInfo)

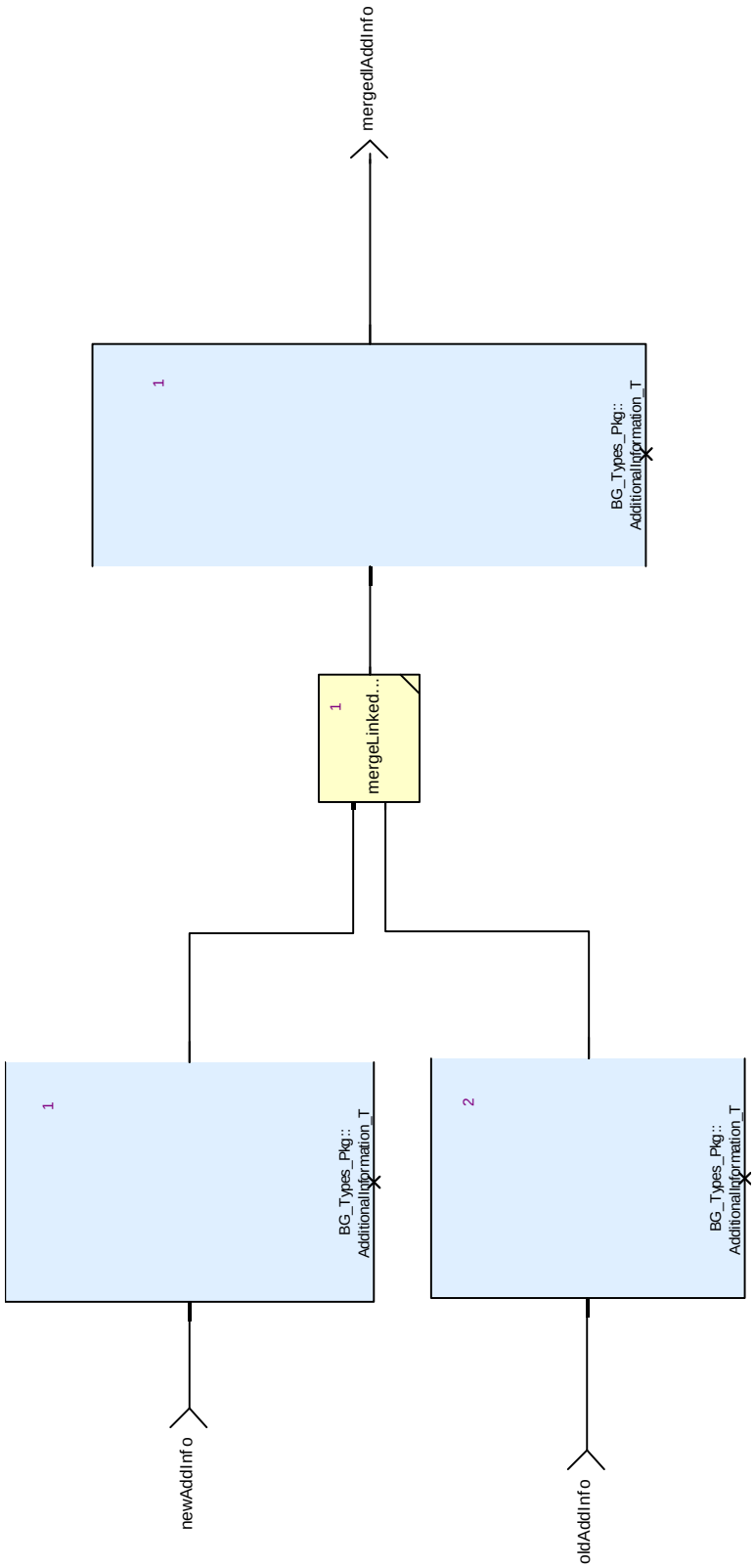


Figure 53: View of diagram_mergeAddInfo_1 (mergeAddInfo)

10.2.14. mergeLinkedBGs Operator

Declared as **`public function`**

10.2.14.1. Comments and Information

mergeLinkedBGs Comments:

- This information is made up of the linkiing packet (5) of the btm
- The linking is a list of variable size.
- According to my understanding of the standard the package only appears once in a message and is nmot allowed to be split accross telegrams.
- Therefore, no special procedure for copiing is needed.
- (only replace whole list if already received entry is not valid).

10.2.14.2. Interface

Table 179: Inputs of mergeLinkedBGs

Name	Type	Comments and Information
newLinkedBGs	BG_Types_Pkg::LinkedBGs_T	
oldLinkedBGs	BG_Types_Pkg::LinkedBGs_T	

Table 180: Outputs of mergeLinkedBGs

Name	Type	Comments and Information
mergedLinkedBGs	BG_Types_Pkg::LinkedBGs_T	

10.2.14.3. Operator Hierarchy

diagram : diagram_mergeLinkedBGs_1

10.2.14.4. Graphical and Textual Diagrams

10.2.14.4.1. View of diagram_mergeLinkedBGs_1 (mergeLinkedBGs)

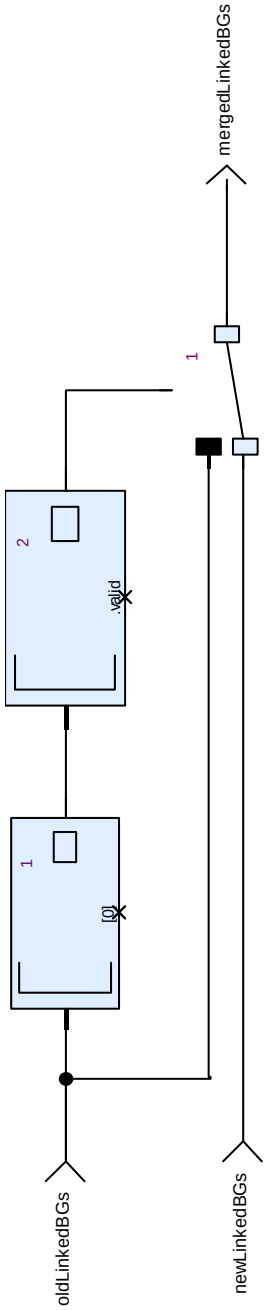


Figure 54: View of diagram_mergeLinkedBGs_1 (mergeLinkedBGs)

10.2.15. N_PIG2int Operator

Declared as **`public function`**

10.2.15.1. Comments and Information

N_PIG2int Comments:

- convert n_pig to intager

10.2.15.2. Interface

Table 181: Inputs of N_PIG2int

Name	Type	Comments and Information
n_pig	N_PIG	

Table 182: Outputs of N_PIG2int

Name	Type	Comments and Information
n_pig2int	int	

10.2.15.3. Operator Hierarchy

diagram : diagram_N_PIG2int_1

10.2.15.4. Graphical and Textual Diagrams

10.2.15.4.1. View of diagram_N_PIG2int_1 (N_PIG2int)

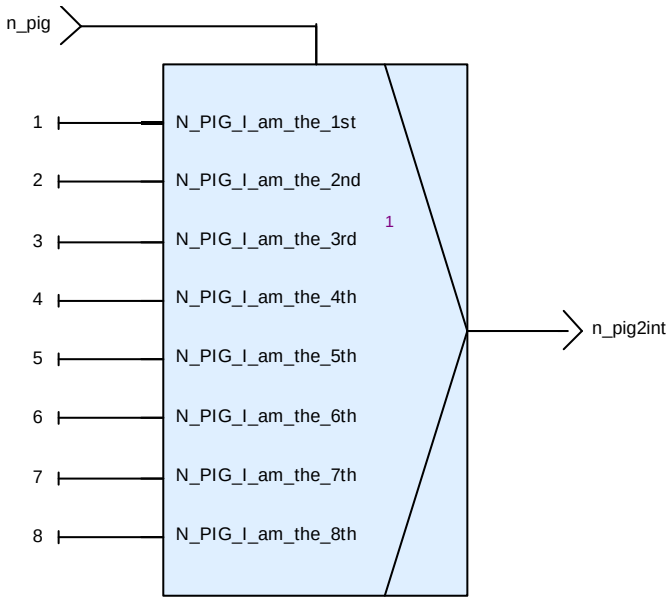


Figure 55: View of diagram_N_PIG2int_1 (N_PIG2int)

10.2.16. N_TOTAL2int Operator

Declared as **`public function`**

10.2.16.1. Comments and Information

N_TOTAL2int Comments:

- convert n_total (enumeration) to intager

10.2.16.2. Interface

Table 183: Inputs of N_TOTAL2int

Name	Type	Comments and Information
n_total	N_TOTAL	

Table 184: Outputs of N_TOTAL2int

Name	Type	Comments and Information
n_total2int	int	

10.2.16.3. Operator Hierarchy

diagram : diagram_N_TOTAL2int_1

10.2.16.4. Graphical and Textual Diagrams

10.2.16.4.1. View of diagram_N_TOTAL2int_1 (N_TOTAL2int)

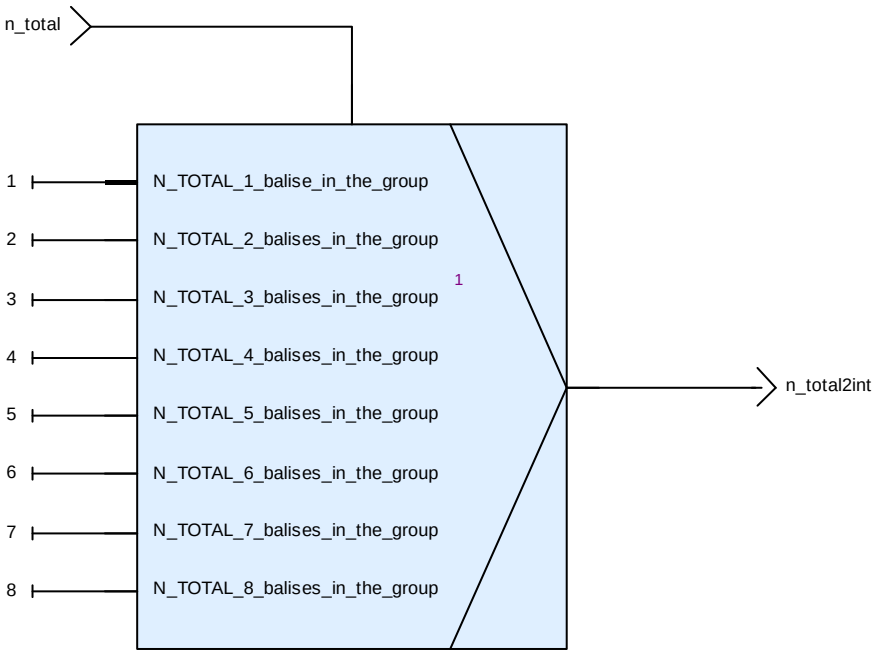


Figure 56: View of diagram_N_TOTAL2int_1 (N_TOTAL2int)

10.2.17. WriteDirection2PassedBG Operator

Declared as **`public function`**

10.2.17.1. Interface

Table 185: Inputs of WriteDirection2PassedBG

Name	Type	Comments and Information
isNominal	bool	
passedBG_in	BG_Types_Pkg::passedBG_T	

Table 186: Outputs of WriteDirection2PassedBG

Name	Type	Comments and Information
passedBG_out	BG_Types_Pkg::passedBG_T	

10.2.17.2. Operator Hierarchy

diagram : diagram_WriteDirection2PassedBG_1

10.2.17.3. Graphical and Textual Diagrams

10.2.17.3.1. View of diagram_WriteDirection2PassedBG_1 (WriteDirection2PassedBG)

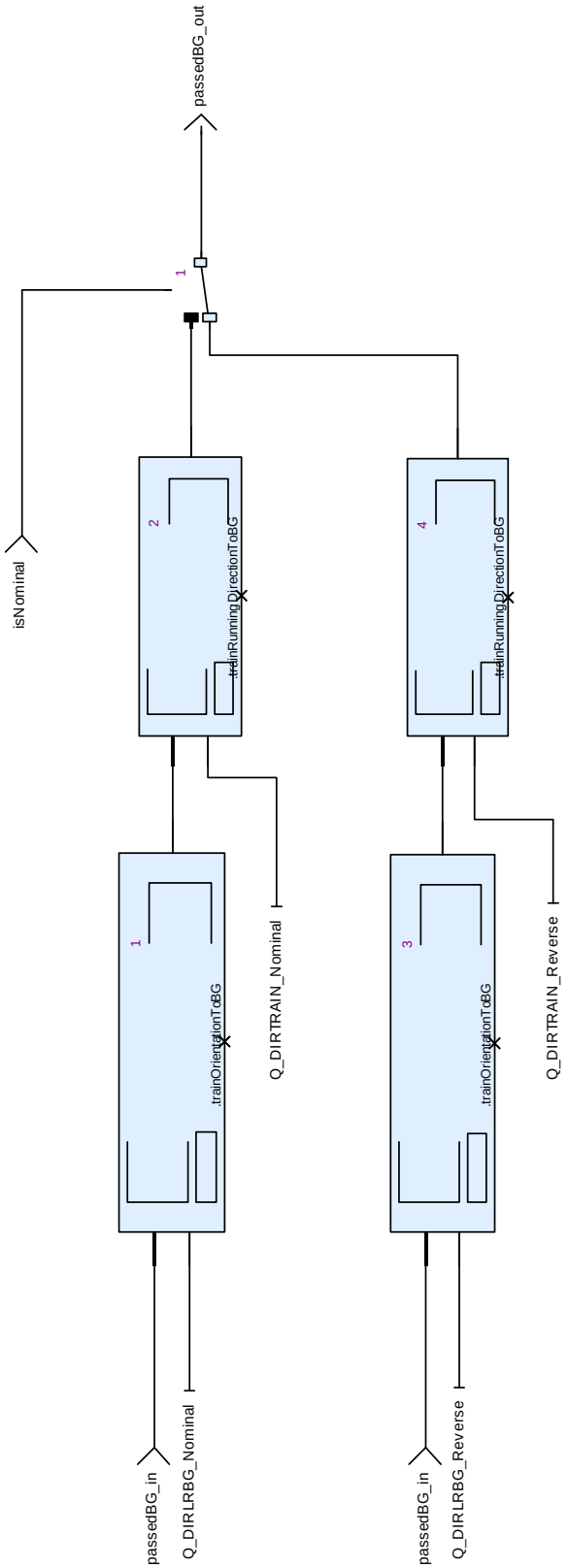


Figure 57: View of diagram_WriteDirection2PassedBG_1 (WriteDirection2PassedBG)

10.3. CheckBGConsistency_Pkg::SubFunction::DuplicationCheck Package

10.3.1. Check2N_PIGs Operator

Declared as **`public function`**

10.3.1.1. Interface

Table 187: Inputs of Check2N_PIGs

Name	Type	Comments and Information
n_pig_1	N_PIG	
m_dup_1	M_DUP	
n_pig_2	N_PIG	
m_dup_2	M_DUP	
crcCheck_1	bool	
crcCheck_2	bool	

Table 188: Outputs of Check2N_PIGs

Name	Type	Comments and Information
valid	bool	

10.3.1.2. Operator Hierarchy

diagram : diagram_Check2N_PIGs_1

10.3.1.3. Graphical and Textual Diagrams

10.3.1.3.1. View of diagram_Check2N_PIGs_1 (Check2N_PIGs)

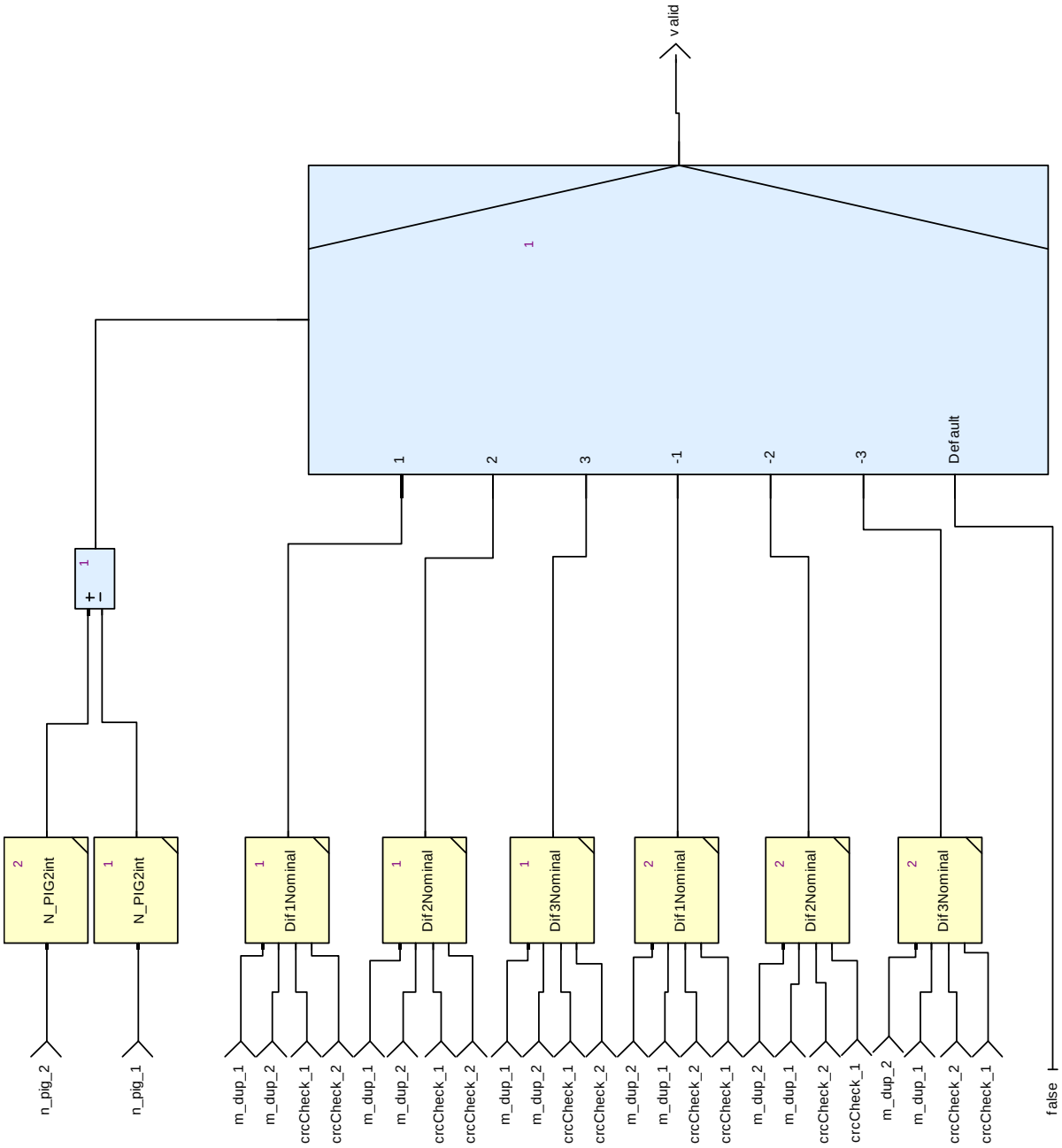


Figure 58: View of diagram_Check2N_PIGs_1 (Check2N_PIGs)

10.3.2. CheckFirstTelDup Operator

Declared as **`public function`**

10.3.2.1. Interface

Table 189: Inputs of CheckFirstTelDup

Name	Type	Comments and Information
telegramHeader_in	BG_Types_Pkg::TelegramHeader_T	

Table 190: Outputs of CheckFirstTelDup

Name	Type	Comments and Information
isTheFirst	bool	

10.3.2.2. Operator Hierarchy

diagram : diagram_CheckFirstTelDup_1

10.3.2.3. Graphical and Textual Diagrams

10.3.2.3.1. View of diagram_CheckFirstTelDup_1 (CheckFirstTelDup)

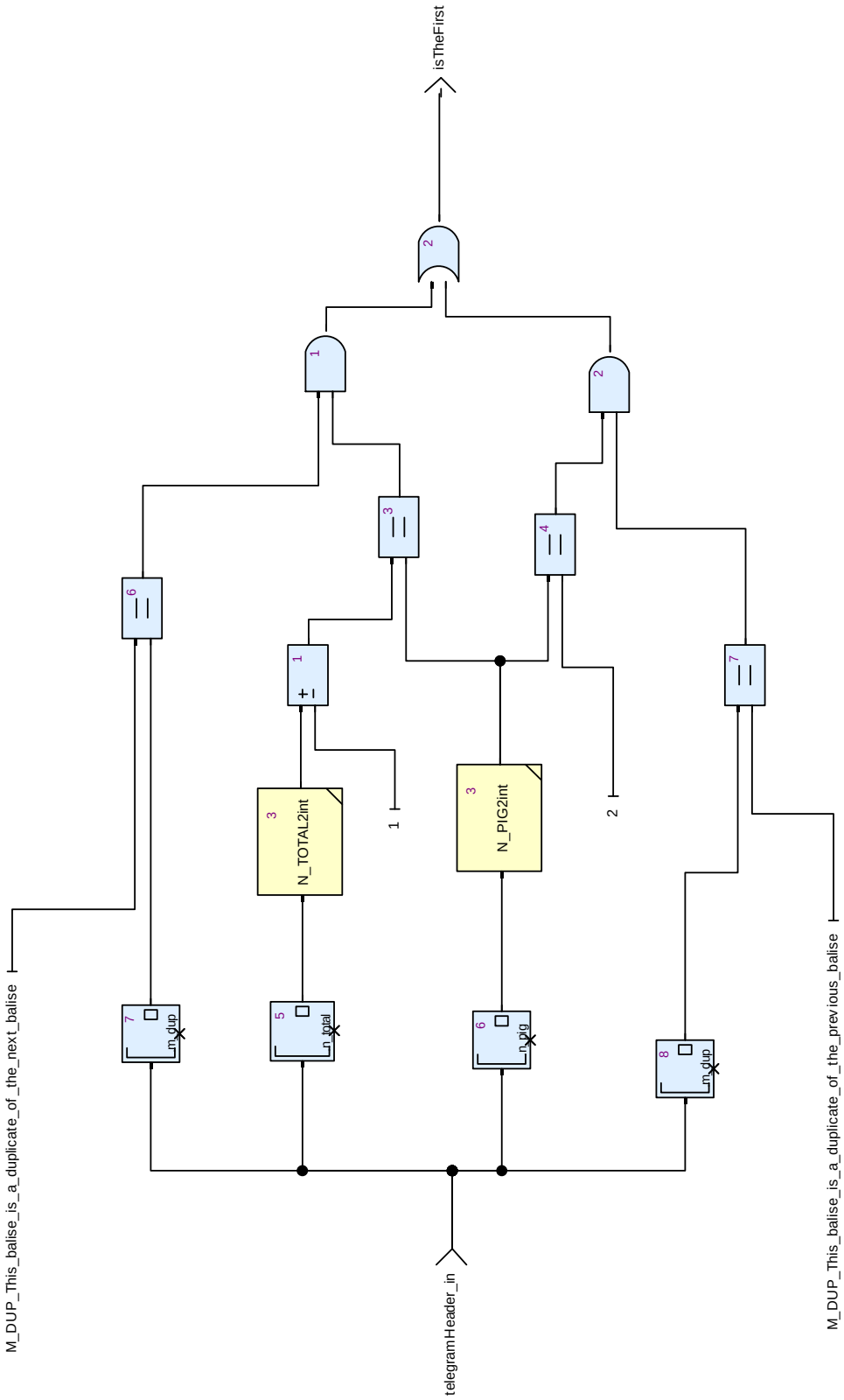


Figure 59: View of diagram_CheckFirstTelDup_1 (CheckFirstTelDup)

10.3.3. CheckFirstTelNotDup Operator

Declared as **`public function`**

10.3.3.1. Comments and Information

CheckFirstTelNotDup Comments:

- a first telegram in the balise gruppe if it is not duplicated can be the

10.3.3.2. Interface

Table 191: Inputs of CheckFirstTelNotDup

Name	Type	Comments and Information
telegramHeader_in	BG_Types_Pkg::TelegramHeader_T	

Table 192: Outputs of CheckFirstTelNotDup

Name	Type	Comments and Information
isTheFirst	bool	

10.3.3.3. Operator Hierarchy

diagram : diagram_CheckFirstTelNotDup_1

10.3.3.4. Graphical and Textual Diagrams

10.3.3.4.1. View of diagram_CheckFirstTelNotDup_1 (CheckFirstTelNotDup)

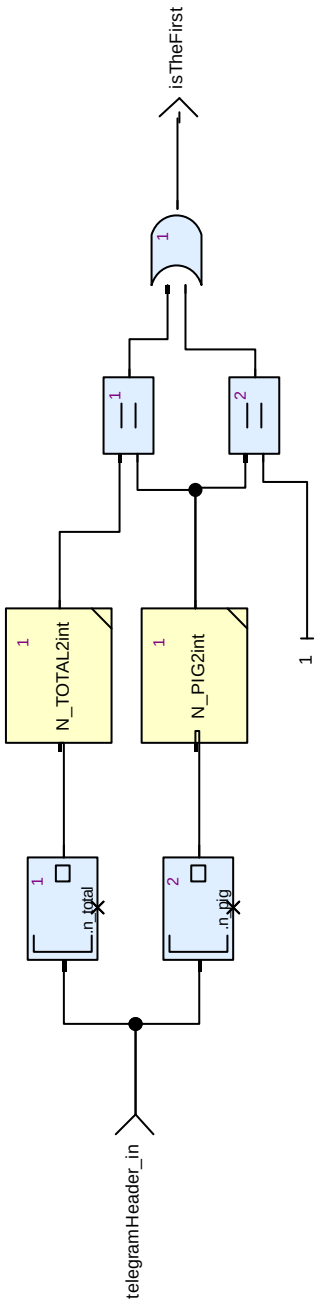


Figure 60: View of diagram_CheckFirstTelNotDup_1 (CheckFirstTelNotDup)

10.3.4. Dif1Nominal Operator

Declared as **`public function`**

10.3.4.1. Comments and Information

Dif1Nominal Comments:

- 3.16.2.4.2 Exception: Concerning a) and b) above, the ERTMS/ETCS on-board equipment shall

- not reject the message and shall not apply the linking reaction if the balise not found,
- or not decoded, is duplicated within the balise group and the duplicating one is
- correctly read.

10.3.4.2. Interface

Table 193: Inputs of Dif1Nominal

Name	Type	Comments and Information
m_dup_1	M_DUP	
m_dup_2	M_DUP	
crcCheck_1	bool	
crcCheck_2	bool	

Table 194: Outputs of Dif1Nominal

Name	Type	Comments and Information
valid	bool	

10.3.4.3. Operator Hierarchy

diagram : diagram_Dif1Nominal_1

10.3.4.4. Graphical and Textual Diagrams

10.3.4.4.1. View of diagram_Dif1Nominal_1 (Dif1Nominal)

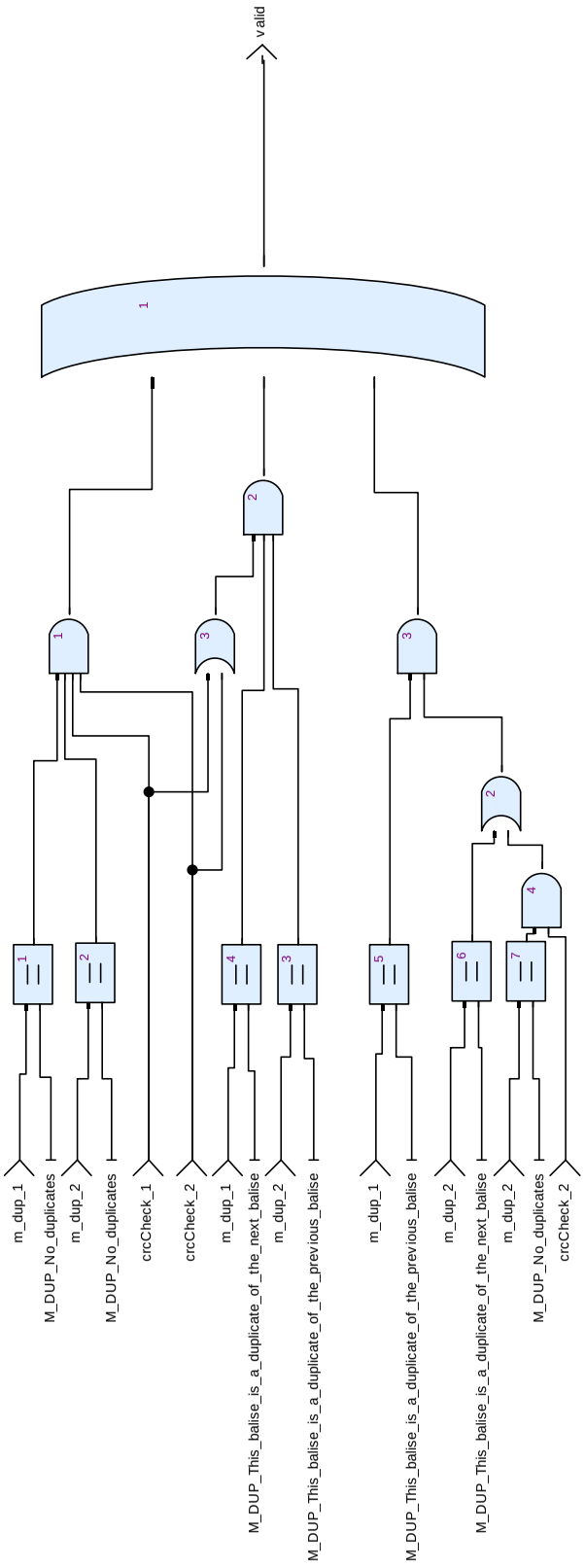


Figure 61: View of diagram_Dif1Nominal_1 (Dif1Nominal)

10.3.5. Dif2Nominal Operator

Declared as **`public function`**

10.3.5.1. Comments and Information

Dif2Nominal Comments:

- a message is still valid if {t1, t3} and (t1 is dup to t2 or t2 is dup to t3)
- 3.16.2.4.2 Exception: Concerning a) and b) above, the ERTMS/ETCS on-board equipment shall
- not reject the message and shall not apply the linking reaction if the balise not found,
- or not decoded, is duplicated within the balise group and the duplicating one is
- correctly read.

10.3.5.2. Interface

Table 195: Inputs of Dif2Nominal

Name	Type	Comments and Information
m_dup_1	M_DUP	
m_dup_2	M_DUP	
crcCheck_1	bool	
crcCheck_2	bool	

Table 196: Outputs of Dif2Nominal

Name	Type	Comments and Information
valid	bool	

10.3.5.3. Operator Hierarchy

diagram : diagram_Dif2Nominal_1

10.3.5.4. Graphical and Textual Diagrams

10.3.5.4.1. View of diagram_Dif2Nominal_1 (Dif2Nominal)

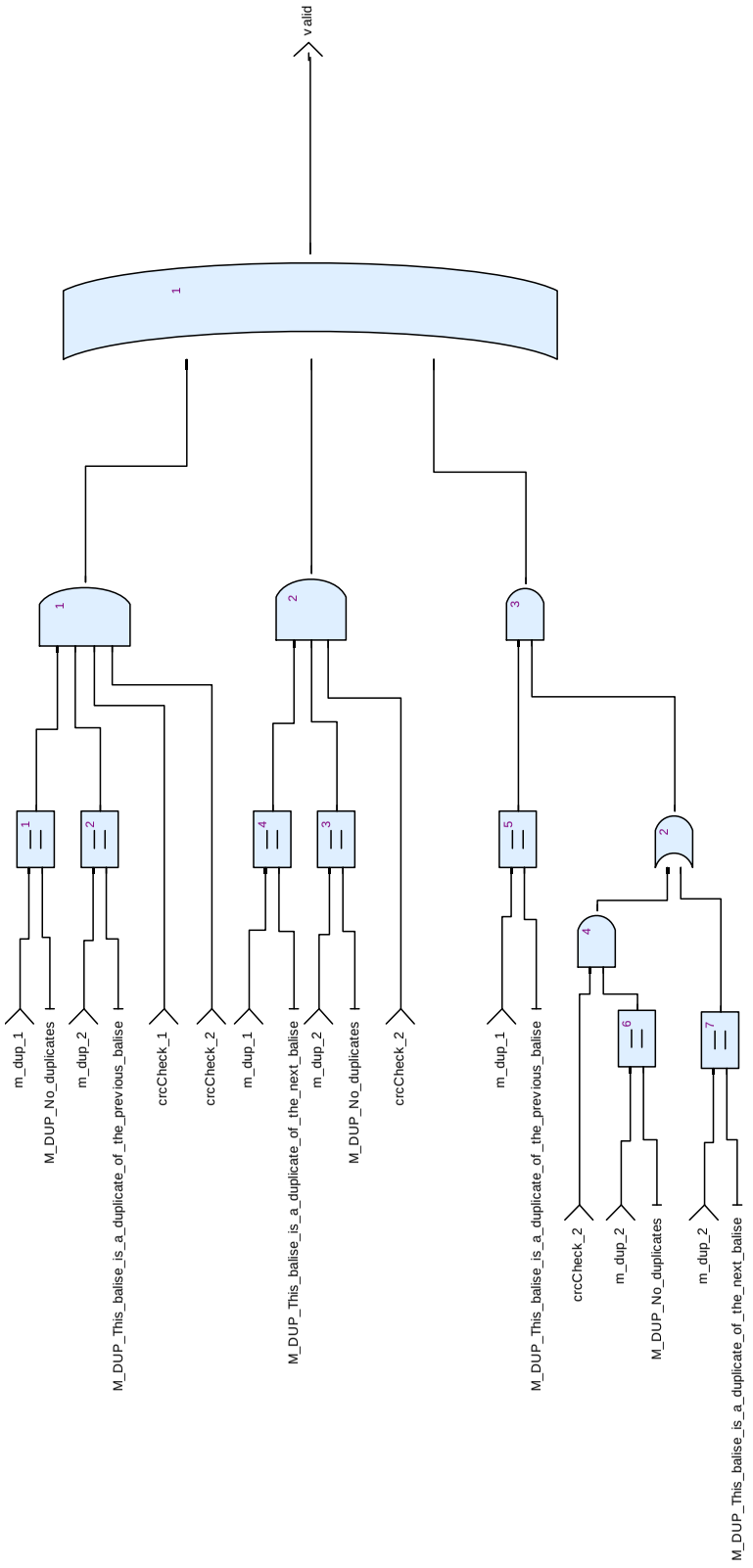


Figure 62: View of diagram_Dif2Nominal_1 (Dif2Nominal)

10.3.6. Dif3Nominal Operator

Declared as **`public function`**

10.3.6.1. Comments and Information

Dif3Nominal Comments:

- a message is still valid if {t1, t4} and t1 is dup to t2 and t3 is dup to t4
- 3.16.2.4.2 Exception: Concerning a) and b) above, the ERTMS/ETCS on-board equipment shall
- not reject the message and shall not apply the linking reaction if the balise not found,
- or not decoded, is duplicated within the balise group and the duplicating one is
- correctly read.

10.3.6.2. Interface

Table 197: Inputs of Dif3Nominal

Name	Type	Comments and Information
m_dup_1	M_DUP	
m_dup_2	M_DUP	
crcCheck_1	bool	
crcCheck_2	bool	

Table 198: Outputs of Dif3Nominal

Name	Type	Comments and Information
valid	bool	

10.3.6.3. Operator Hierarchy

diagram : diagram_Dif3Nominal_1

10.3.6.4. Graphical and Textual Diagrams

10.3.6.4.1. View of diagram_Dif3Nominal_1 (Dif3Nominal)

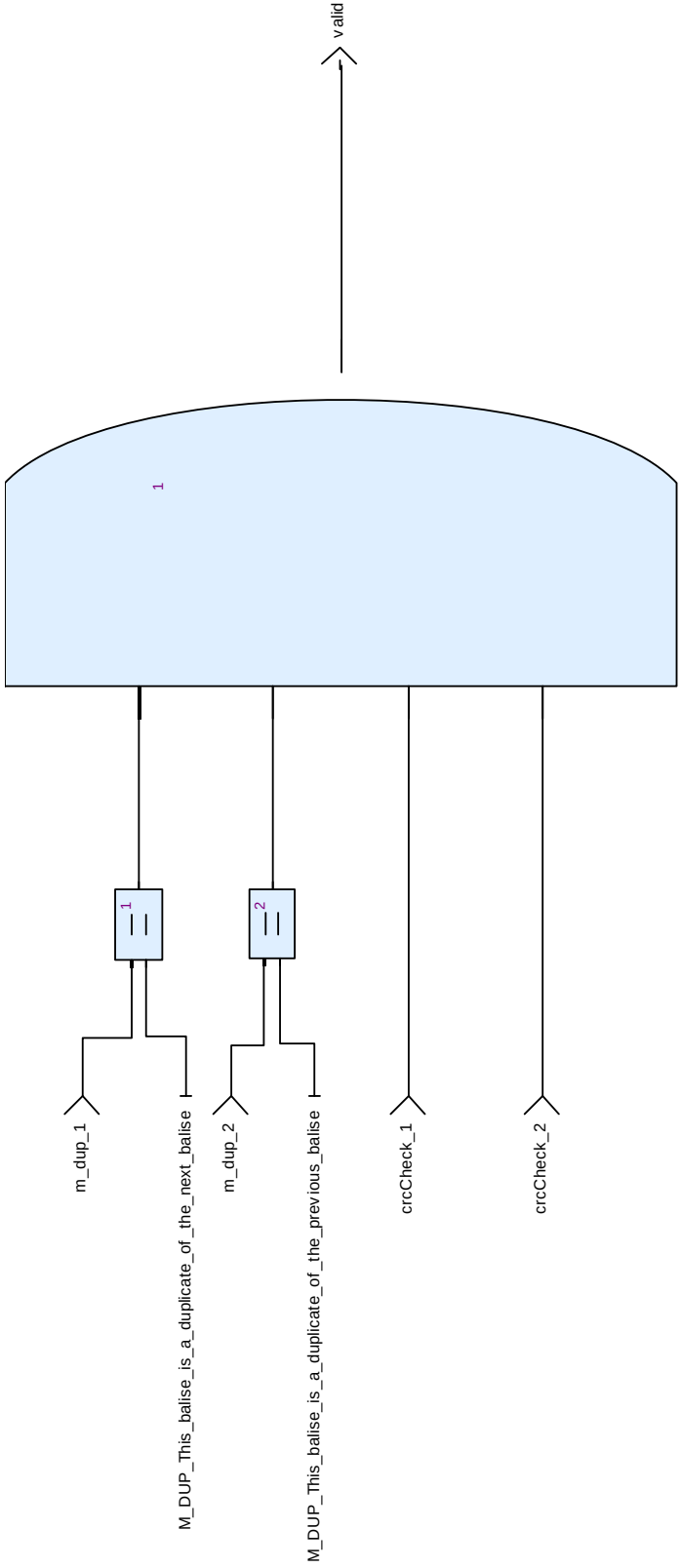


Figure 63: View of diagram_Dif3Nominal_1 (Dif3Nominal)

11. Project Library: ReceiveEuroBaliseFromAPI

11.1. btmSupportPkg Package

11.1.1. transferPackets Operator

Declared as **`public function`**

11.1.1.1. Comments and Information

transferPackets Comments:

- Transfers of packets of the telegram received via the API interface into a telegram to be used for handling balises of balise groups. The format is defined to fit to the BTM interface.defined in section .8.4.2 of the SRS.
- However, it is assumed the decoding of telegrams is task of the API. This implies:
- - no fields of the telegram on bit-boundary
- - variant size information is mapped to arrays wherever visible.
- In the scope of the first iteration only packet 5 is relevant (linking).
- Other packets are not considered.

11.1.1.2. Interface

Table 199: Inputs of transferPackets

Name	Type	Comments and Information
api_packets	API_Msg_Pkg::API_addInfo_T	

Table 200: Outputs of transferPackets

Name	Type	Comments and Information
out_AddInfo	BG_Types_Pkg::AdditionalInformation_T	

11.1.1.3. Operator Hierarchy

diagram : diagram_transferPackets_1

11.1.1.4. Graphical and Textual Diagrams

11.1.1.4.1. View of diagram_transferPackets_1 (transferPackets)

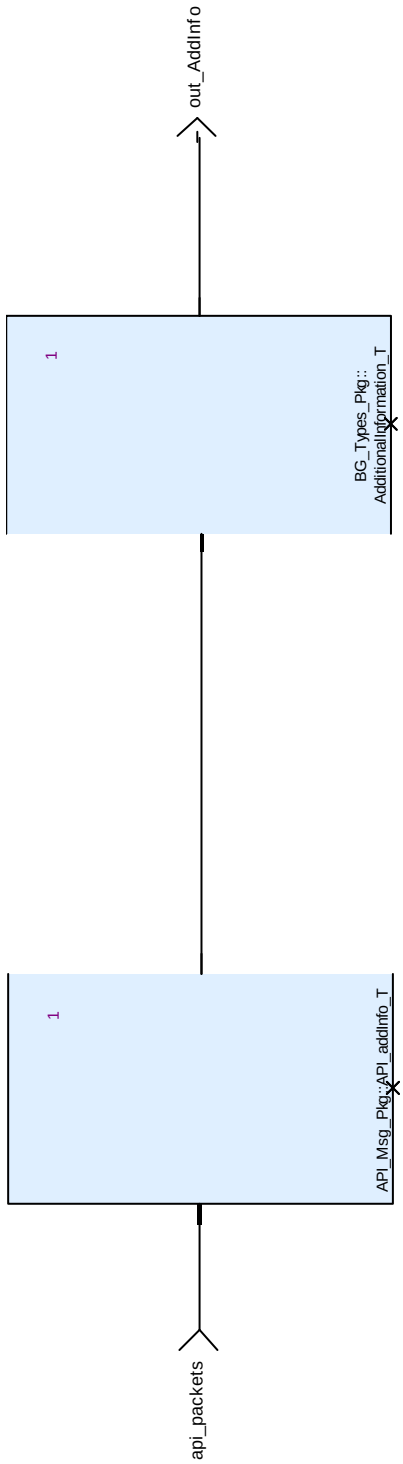


Figure 64: View of diagram_transferPackets_1 (transferPackets)

11.1.2. transferTelegram Operator

Declared as **`public function`**

11.1.2.1. Comments and Information

transferTelegram Comments:

- Transfers a telegram received via the API interface into a telegram to be used for handling balises of balise groups. The format is defined to fit to the BTM interface.defined in section .8.4.2 of the SRS.
- However, it is assumed the decoding of telegrams is task of the API. This implies:
- - no fields of the telegram on bit-boundary
- - variant size information is mapped to arrays wherever visible.

11.1.2.2. Interface

Table 201: Inputs of transferTelegram

Name	Type	Comments and Information
API_balise	API_Msg_Pkg::API_Telegram_T	

Table 202: Outputs of transferTelegram

Name	Type	Comments and Information
outDecodedTelegram	BG_Types_Pkg::Telegram_T	
outCenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	

11.1.2.3. Operator Hierarchy

diagram : diagram_transferTelegram_1

11.1.2.4. Graphical and Textual Diagrams

11.1.2.4.1. View of diagram_transferTelegram_1 (transferTelegram)

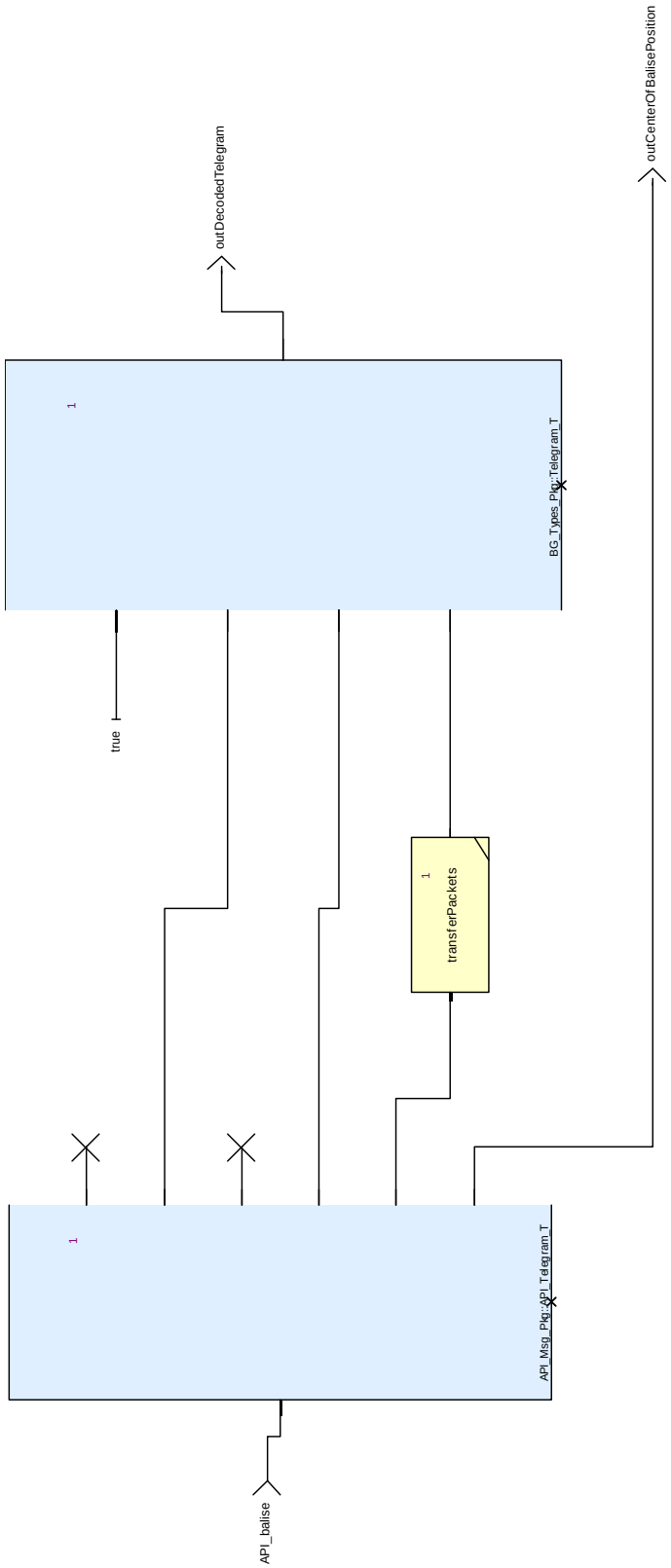


Figure 65: View of diagram_transferTelegram_1 (transferTelegram)

diagram_transferTelegram_1 Comments:

- Transfer of the telegram from api to openETCS model structure.

11.2. ReceiveEuroBaliseFromAPI_Pkg Package

11.2.1. ReceiveEuroBaliseFromAPI Operator

Declared as **`public function`**

11.2.1.1. Comments and Information

ReceiveEuroBaliseFromAPI Comments:

- This module defines the interface to the API.
- Assumption is we do not perform a decoding in scade. we get proper decoded telegrams from the API.
- Preferred Interface : (Header + Flag + odometry) + addInf

11.2.1.2. Interface

Table 203: Inputs of ReceiveEuroBaliseFromAPI

Name	Type	Comments and Information
API_balise	API_Msg_Pkg::API_Telegram_T	**Comments:** Input: The balise information received via the API. It is assumed there is at most one telegram passed with this interface. The present flag indicates the input whether the input is availabe for processing.

Table 204: Outputs of ReceiveEuroBaliseFromAPI

Name	Type	Properties	Comments and Information
outTelegramPresent	bool		**Comments:** Presence indicatio for the output

Name	Type	Properties		Comments and Information
outDecodedTelegram	BG_Types_Pkg::Telegram_T	default	BG_Types_Pkg::cEmpty_BaliseTlg	**Comments:** Decoded Telegram passed to the balise group message. The present flag indicates output is available. The valid flag being part of the telegram has at this interface an additional meaning: - present = false -> ignore telegram, no input - present = true and valid = true: a proper telegram ha been received via btm. - present = true and valid = false: BTM has indicated reception of an invalid telegram (e.g., CRC failure).
outcenterOfBalisePosition	BG_Types_Pkg::centerOfBalisePosition_T	default	BG_Types_Pkg::cemptyPosition	**Comments:** Position reported by the antenna where the telegram has been received.

11.2.1.3. Locals

Table 205: Locals of ReceiveEuroBaliseFromAPI

Name	Type	Comments and Information
bad_balise	bool	
is_present	bool	

11.2.1.4. Operator Hierarchy

diagram : diagram_ReceiveEuroBaliseFromAPI_1
activate if : is_present_blk
branch : then
activate if : has_fresh_data_blk
branch : then
branch : else
branch : else

11.2.1.5. Graphical and Textual Diagrams

11.2.1.5.1. View of diagram_ReceiveEuroBaliseFromAPI_1 (ReceiveEuroBaliseFromAPI)

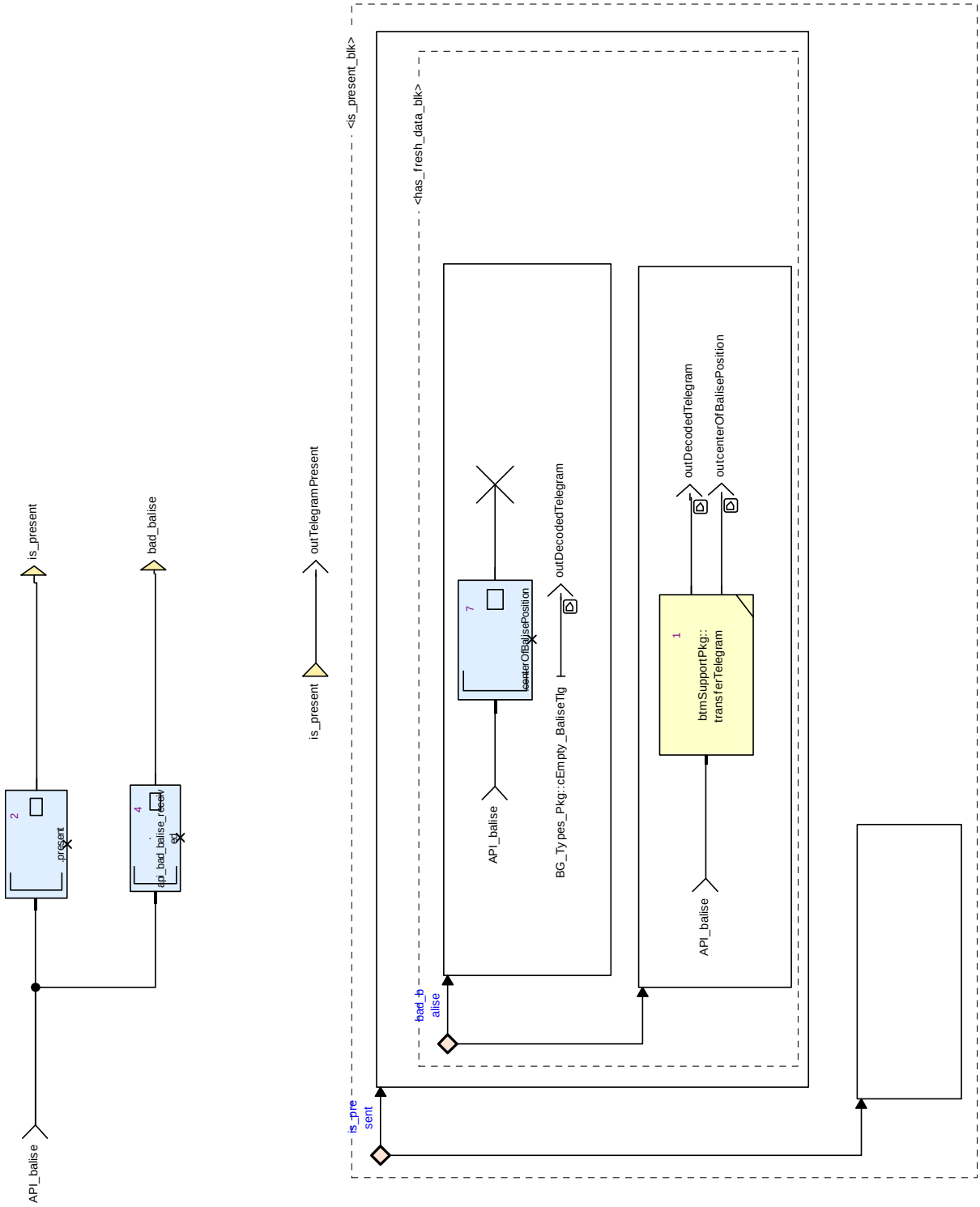


Figure 66: View of diagram_ReceiveEuroBaliseFromAPI_1 (ReceiveEuroBaliseFromAPI)

Table 206: Conditional Blocks of diagram_ReceiveEuroBaliseFromAPI_1

Conditional Block	Comments and Information
is_present_blk	

Conditional Block	Comments and Information
is_present_blk:then:has_fresh_data_blk	

Table 207: Actions of diagram_ReceiveEuroBaliseFromAPI_1

Conditional Block Action	Comments and Information
is_present_blk:then	
is_present_blk:then:has_fresh_data_blk:then	
is_present_blk:then:has_fresh_data_blk:else	
is_present_blk:else	

12. Project Library: SelectUsableInfo

12.1. SelectUsableInfo_Pkg Package

12.1.1. Types

Table 208: Public Types of SelectUsableInfo_Pkg

Name	Definition	Comments and Information
indRej_T	enum {IND_REJ_Not_Relevant, IND_REJ_Accepted, IND_REJ_Rejected}	**Comments:** 4.8: Indicates in the section 4.8 how information has to be treated: **IND_REJ_Not_Relevant** **Comments:** Situation is not relevant **IND_REJ_Accepted** **Comments:** Information has to be rejected in this scenario **IND_REJ_Rejected** **Comments:** Information has to be accepted in this scenario

12.1.2. FirstFilter Operator

Declared as **`public function`**

12.1.2.1. Comments and Information

FirstFilter Comments:

- 4.8.3 Filter for accepting information depending on the level
- In the first iteration of work only linking information is processed and the level is fixed to ETCS level 1.
- Thus, the information will always be accepted.

12.1.2.2. Interface

Table 209: Inputs of FirstFilter

Name	Type	Comments and Information
TrainInfo_	BG_Types_Pkg::TrainToTrackStatus_T	
passedBG	BG_Types_Pkg::passedBG_T	

Table 210: Outputs of FirstFilter

Name	Type	Comments and Information
Indicator_Reject	SelectUsableInfo_Pkg::indRej_T	

12.1.2.3. Operator Hierarchy

diagram : diagram_FirstFilter_1

12.1.2.4. Graphical and Textual Diagrams

12.1.2.4.1. View of diagram_FirstFilter_1 (FirstFilter)

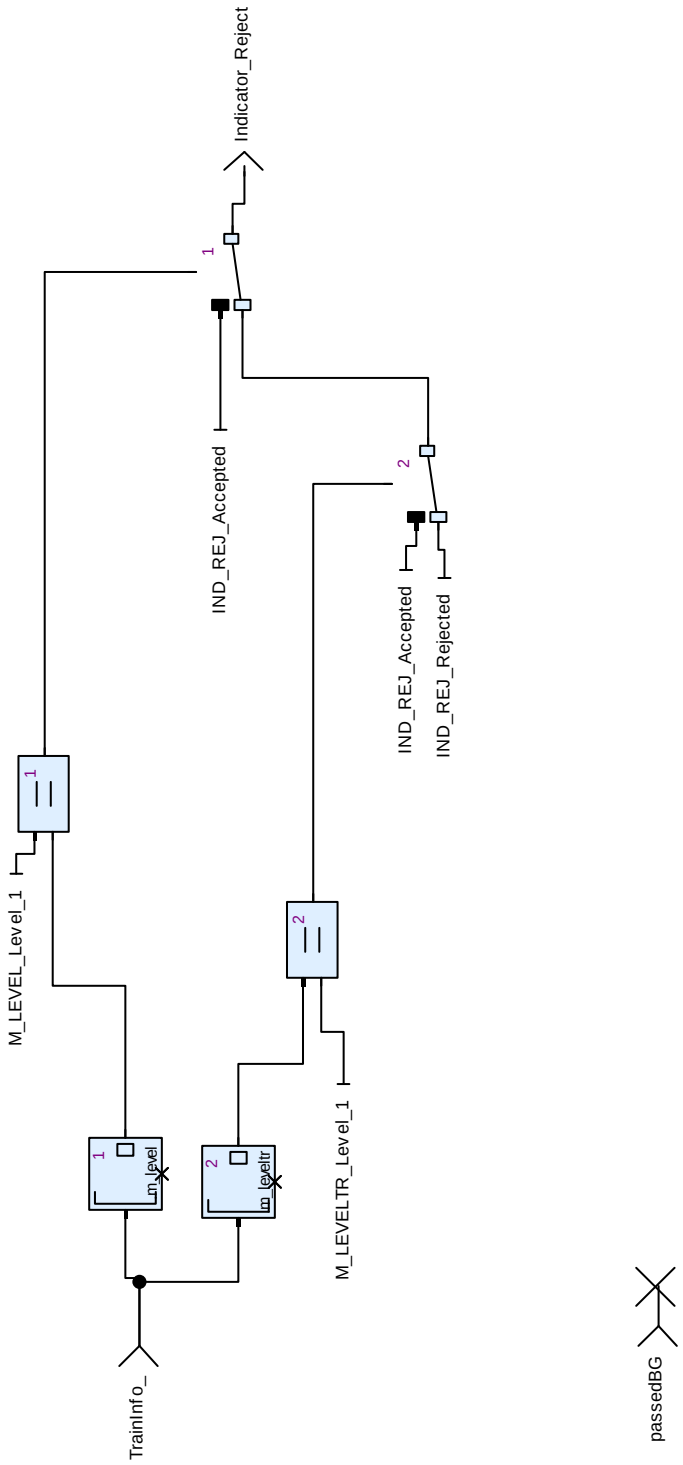


Figure 67: View of diagram_FirstFilter_1 (FirstFilter)

12.1.3. SecondFilter Operator

Declared as **`public function`**

12.1.3.1. Comments and Information

SecondFilter Comments:

- This filter is not relevant for the first iteration since radio messages are not part of the model.

12.1.3.2. Interface

Table 211: Inputs of SecondFilter

Name	Type	Comments and Information
TrainInfo_	BG_Types_Pkg::TrainToTrackStatus_T	
passedBG	BG_Types_Pkg::passedBG_T	
in_Indicator_Reject	SelectUsableInfo_Pkg::indRej_T	

Table 212: Outputs of SecondFilter

Name	Type	Comments and Information
Indicator_Reject	SelectUsableInfo_Pkg::indRej_T	

12.1.3.3. Operator Hierarchy

diagram : diagram_SecondFilter_1

12.1.3.4. Graphical and Textual Diagrams

12.1.3.4.1. View of diagram_SecondFilter_1 (SecondFilter)

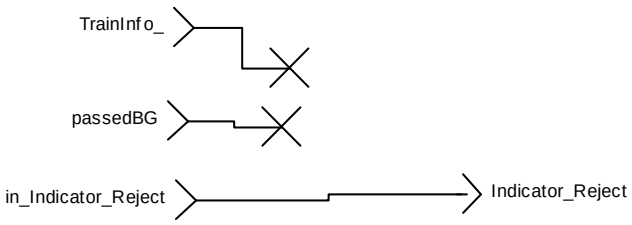


Figure 68: View of diagram_SecondFilter_1 (SecondFilter)

12.1.4. SelectUsableInfo Operator

Declared as **`public function`**

12.1.4.1. Comments and Information

SelectUsableInfo Comments:

- 4.8 acceptance of received information
- In the first iteration of work only linking packages are relvant.
- Moreover, RBC messages are not part of the model, modes are not processed, and the level is limited to ETCS level 1.
- Thus, the second and third filters functionality is not needed in the first iteration.

12.1.4.2. Interface

Table 213: Inputs of SelectUsableInfo

Name	Type	Comments and Information
TrainInfo_	BG_Types_Pkg::TrainToTrackStatus_T	
passedBG	BG_Types_Pkg::passedBG_T	
Train_Data	TIU_Types_Pkg::trainData_T	

Table 214: Outputs of SelectUsableInfo

Name	Type	Properties		Comments and Information
out_passedBG	BG_Types_Pkg::passedBG_T	default	BG_Types_Pkg::cEmptyPassedBG	

12.1.4.3. Locals

Table 215: Locals of SelectUsableInfo

Name	Type	Comments and Information
Indicator_RE	SelectUsableInfo_Pkg::indRej_T	

12.1.4.4. Operator Hierarchy

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

12.1.4.5. Graphical and Textual Diagrams

12.1.4.5.1. View of diagram_SelectUsableInfo (SelectUsableInfo)

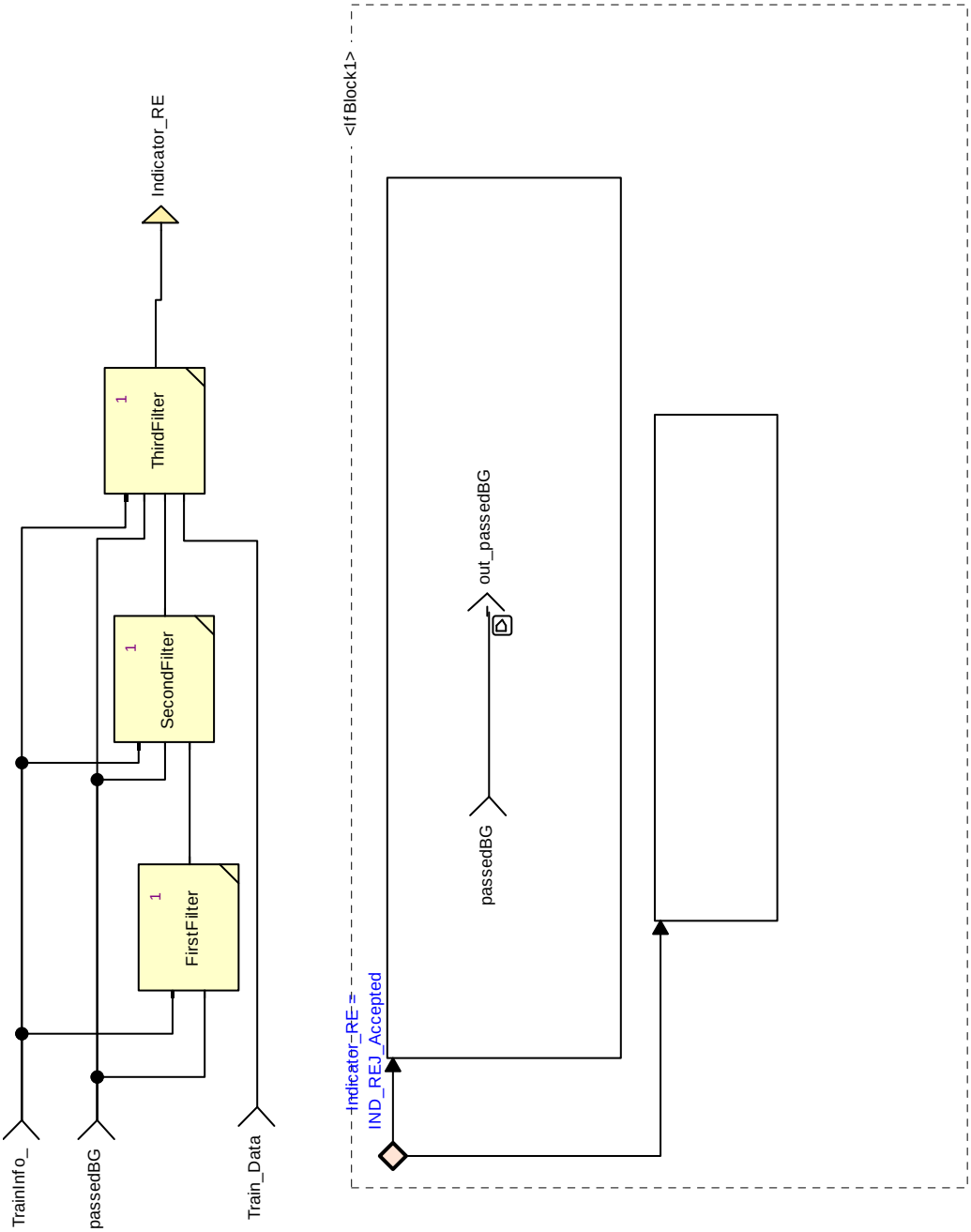


Figure 69: View of diagram_SelectUsableInfo (SelectUsableInfo)

Table 216: Conditional Blocks of diagram_SelectUsableInfo

Conditional Block	Comments and Information
IfBlock1	

Table 217: Actions of diagram_SelectUsableInfo

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

12.1.5. ThirdFilter Operator

Declared as **`public function`**

12.1.5.1. Comments and Information

ThirdFilter Comments:

- 4.8.4 Filter for accepting information depending on the modes
- Filter is not relevant currently since modes are not processed in the first iteration of work.

12.1.5.2. Interface

Table 218: Inputs of ThirdFilter

Name	Type	Comments and Information
TrainInfo_	BG_Types_Pkg::TrainToTrackStatus_T	
passedBG	BG_Types_Pkg::passedBG_T	
in_Indicator_Reject	SelectUsableInfo_Pkg::indRej_T	
Train_Data	TIU_Types_Pkg::trainData_T	

Table 219: Outputs of ThirdFilter

Name	Type	Comments and Information
Indicator_Reject	SelectUsableInfo_Pkg::indRej_T	

12.1.5.3. Operator Hierarchy

diagram : diagram_ThirdFilter

12.1.5.4. Graphical and Textual Diagrams

12.1.5.4.1. View of diagram_ThirdFilter (ThirdFilter)

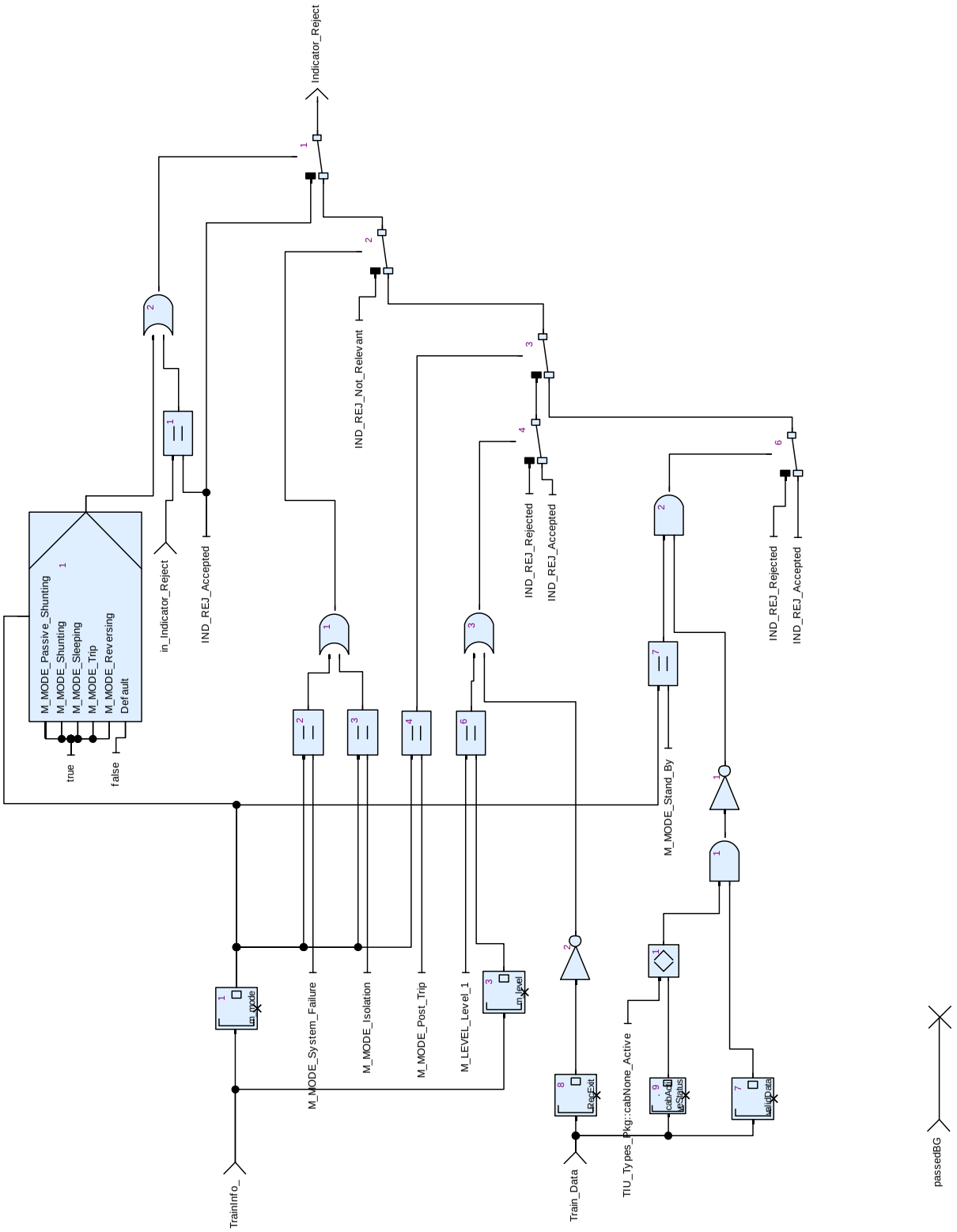


Figure 70: View of diagram_ThirdFilter (ThirdFilter)

13. Project Library: TrainPosition_Integration

13.1. TrainPosition_Integration_Pkg Package

13.1.1. Constants

Table 220: Public Constants of TrainPosition_Integration_Pkg

Name	Type	Value	Comments and Information

Name	Type	Value	Comments and Information
		{valid : false, timestamp : 0, trainPosition : {nominal : 0, d_min : 0, d_max : 0}, trainPositionDerivedFromLastLinkedBG : {nominal : 0, d_min : 0, d_max : 0}, trainPositionDerivedFromLastUnlinkedBG : {nominal : 0, d_min : 0, d_max : 0}, lastPassedLinkedBG : {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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState :	

13.1.2. ManageTrainPosition Operator

Declared as **`public node`**

13.1.2.1. Interface

Table 221: Inputs of ManageTrainPosition

Name	Type	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T	**Comments:** The current odometry values
passedBG	BG_Types_Pkg::passedBG_T	**Comments:** Input event reporting a balise group during its passage, if there is one.
LRBG	TrainPosition_Types_Pck::positionedBG_T	**Comments:** The LRBG used for RBC communication.
systemTime	ProvidePositionReport_Pkg::SystemTime_T	
posRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
locationbasedEvents	ProvidePositionReport_Pkg::LocationBasedEvents_T	
trainProps	TrainPosition_Types_Pck::trainProperties_T	
rcbComm	ProvidePositionReport_Pkg::RBC_Communication_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
directionLRBG	ProvidePositionReport_Pkg::BG_Orientation_T	
prvDirTrain	Q_DIRTRAIN	
BG_LinkingConsistencyError	bool	
LinkedBG_MessageConsistencyError	bool	
UnlinkedBG_MessageConsistencyError	bool	
RadioMessageConsistencyError	bool	
RadioSequenceError	bool	
RadioSafeRadioConnectionError	bool	
SafetyCriticalFailure	bool	
DoubleLinkingError	bool	
DoubleRepositioningError	bool	
reset	bool	

Table 222: Outputs of ManageTrainPosition

Name	Type	Comments and Information
posRep	ProvidePositionReport_Pkg::PositionReport_T	
trainPosition	TrainPosition_Types_Pck::trainPosition_T	
trainPosErrors	TrainPosition_Types_Pck::positionErrors_T	**Comments:** The resulting train position with reference to the LRBG
BGs	TrainPosition_Types_Pck::positionedBGs_T	**Comments:** The collection of currently known BGs.

13.1.2.2. Locals

Table 223: Locals of ManageTrainPosition

Name	Type	Properties		Comments and Information
trainPosition_loc	TrainPosition_Types_Pck::trainPosition_T	last	CalculateTrainPosition_Pkg::cTrainPosition_0	

13.1.2.3. Operator Hierarchy

diagram : diagram_ManageTrainPosition_1

13.1.2.4. Graphical and Textual Diagrams

13.1.2.4.1. View of diagram_ManageTrainPosition_1 (ManageTrainPosition)

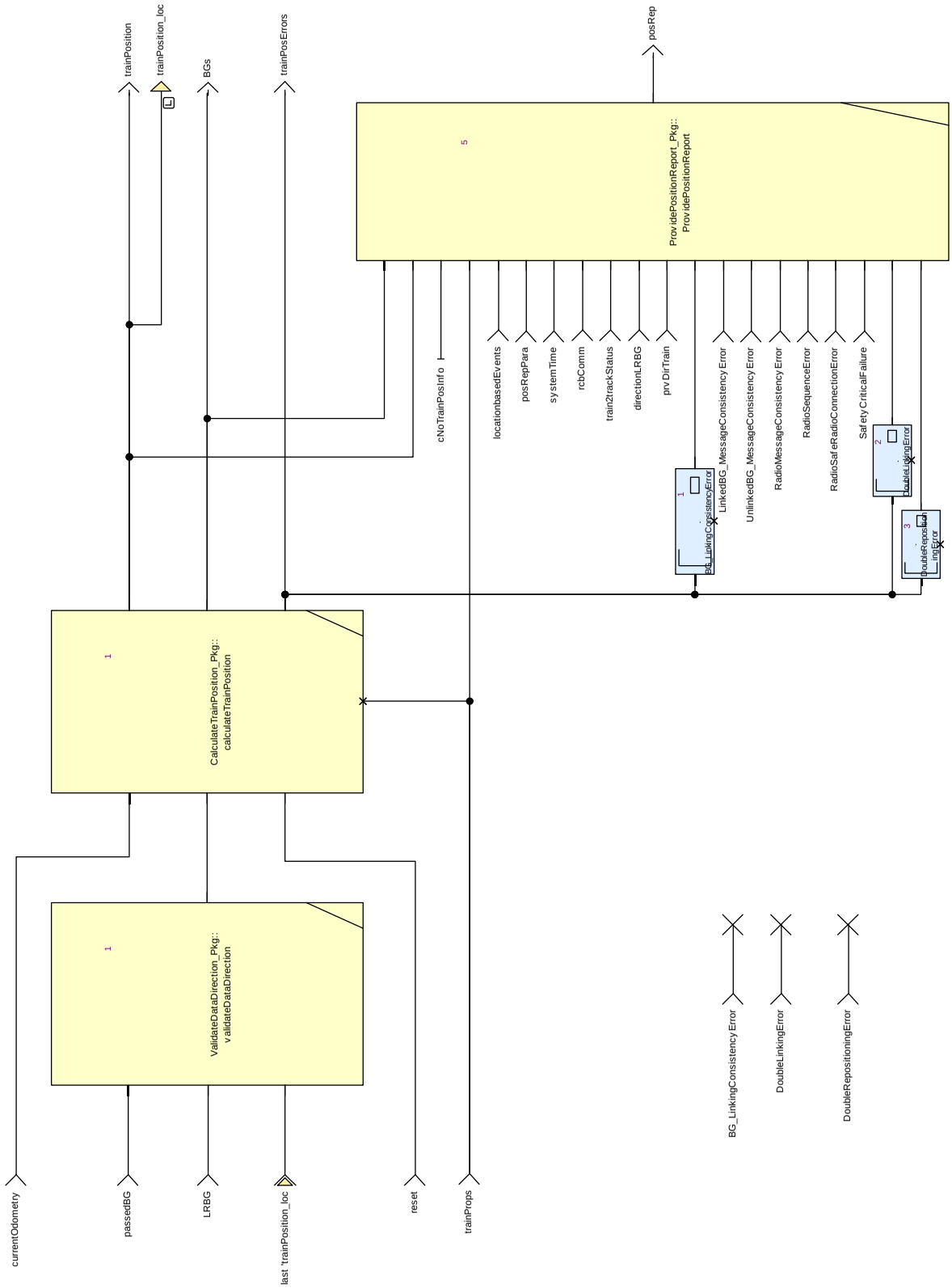


Figure 71: View of diagram_ManageTrainPosition_1 (ManageTrainPosition)

14. Project Library: CalculateTrainPosition

14.1. CalculateTrainPosition_Pkg Package

14.1.1. Comments and Information

CalculateTrainPosition_Pkg Comments:

- Incorporates the functions to calculate the balise group locations and the actual train position.

Table 224: CalculateTrainPosition_Pkg Annotations

Note Name	Attribute	Value
GdC_1	Author	Uwe Steinke
	DateC	Created : 2014-05-22
	DateM	Modified : 2014-09-01
	Version	00.09.0
	to_c	True
Remark_1	Description	CalculateTrainPosition - 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

14.1.2. Types

Table 225: Public Types of CalculateTrainPosition_Pkg

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

14.1.3. Constants

Table 226: 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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}, BG_centerDetection Inaccuraccuracies : {nominal : 0, d_min : 0, d_max : 0}, q_nvlocacc : 0, BG_Header : {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}, 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_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_S	

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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

Name	Type	Value	Comments and Information
cNoPositionErrors	TrainPosition_Types_Pck::positionErrors_T	{outOfMemSpace : false, passedBG_notFoundWhereExpected : false, positionCalculation_inconsistent : false, BG_LinkingConsistencyError : false, DoubleLinkingError : false, DoubleRepositioningError : false}	
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, bgPosition : {valid : false, timestamp : 0, d_d : {d_nominal : 0, d_min : 0, d_max : 0}, o : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration :	

14.1.4. calculateBGLocations Operator

Declared as **`private node`**

14.1.4.1. Comments and Information

calculateBGLocations Comments:

- Calculation of the locations of passed and announced BGs

Table 227: 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

14.1.4.2. Interface

Table 228: 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.
lastBGs	TrainPosition_Types_Pck::positionedBGs_T		**Comments:** The last collection of currently known BGs.

Name	Type	Properties	Comments and Information
reset	bool		**Comments:** Resets all to an initials state and deletes all stored BGs.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden	**Comments:** The trains properties required for train position calculation.

Table 229: 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	

14.1.4.3. Locals

Table 230: Locals of calculateBGLocations

Name	Type	Comments and Information
outOfMemSpace	bool	
passedBG_notFoundWhereExpected	bool	

14.1.4.4. Operator Hierarchy

diagram : diagram_errorReporting
diagram : diagram_passing_a_BG

14.1.4.5. Graphical and Textual Diagrams

14.1.4.5.1. View of diagram_errorReporting (calculateBGLocations)

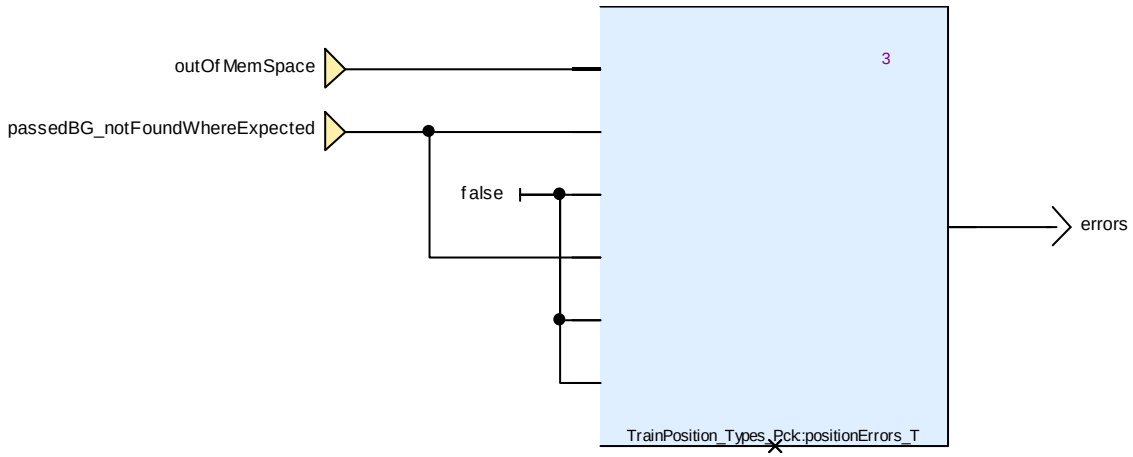


Figure 72: View of diagram_errorReporting (calculateBGLocations)

14.1.4.5.2. View of diagram_passing_a_BG (calculateBGLocations)

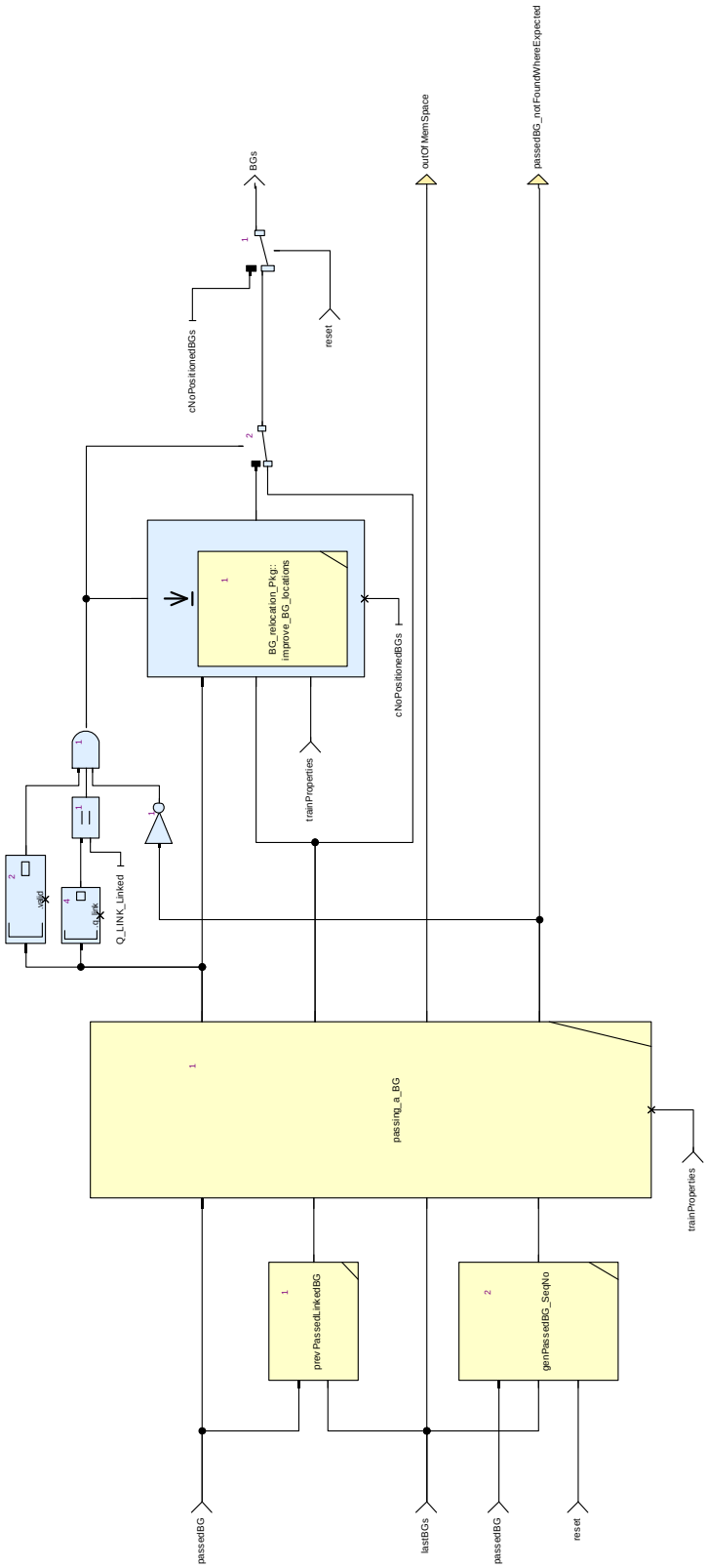


Figure 73: View of diagram_passing_a_BG (calculateBGLocations)

14.1.5. calculateTrainPosition Operator

Declared as **`public node`**

14.1.5.1. Comments and Information

calculateTrainPosition Comments:

- The main function calculating the locations of balise groups and the actual train position.

Table 231: calculateTrainPosition 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

14.1.5.2. Interface

Table 232: Inputs of calculateTrainPosition

Name	Type	Properties	Comments and Information
currentOdometry	Obu_BasicTypes_Pkg::odometry_T		**Comments:** The current odometry values
passedBG	BG_Types_Pkg::passedBG_T		**Comments:** Input event reporting a balise group during its passage, if there is one.
reset	bool		**Comments:** Resets all to an initials state and deletes all stored BGs.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden	**Comments:** The trains properties required for train position calculation.

Table 233: Outputs of calculateTrainPosition

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

14.1.5.3. Locals

Table 234: Locals of calculateTrainPosition

Name	Type	Properties		Comments and Information
BGs_loc	TrainPosition_Types_Pck::positionedBGs_T	last	cNoPositionedBGs	

14.1.5.4. Operator Hierarchy

diagram : diagram_calculateTrainPosition

14.1.5.5. Graphical and Textual Diagrams

14.1.5.5.1. View of diagram_calculateTrainPosition (calculateTrainPosition)

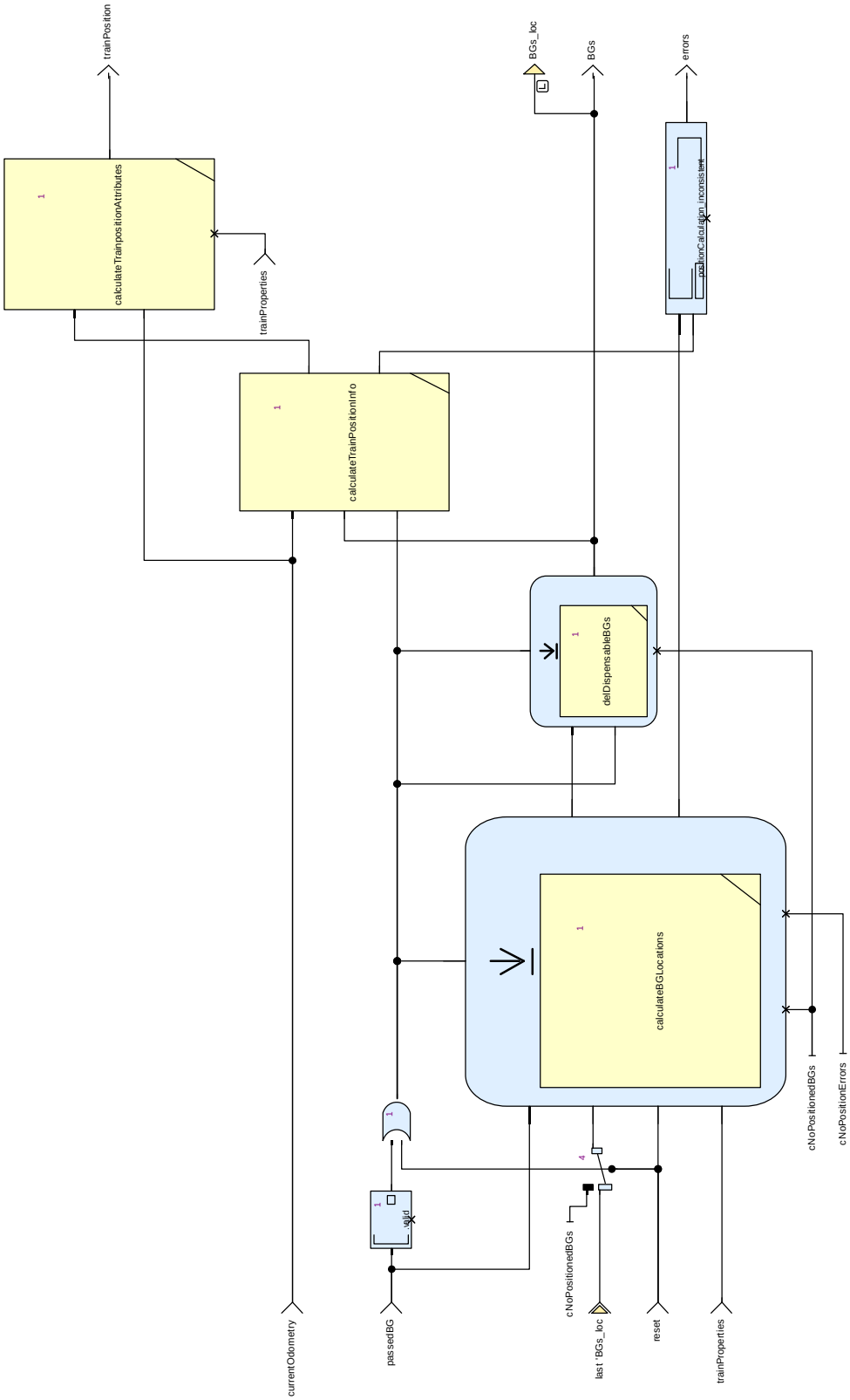


Figure 74: View of diagram_calculateTrainPosition (calculateTrainPosition)

14.1.6. calculateTrainpositionAttributes Operator

Declared as **`private node`**

14.1.6.1. Comments and Information

calculateTrainpositionAttributes Comments:

- Figures out the attributes of the current train position with reference to a given LRBG.

Table 235: 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

14.1.6.2. Interface

Table 236: 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

Name	Type	Properties	Comments and Information
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden	**Comments:** The trains properties required for train position calculation.

Table 237: Outputs of calculateTrainpositionAttributes

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

14.1.6.3. Locals

Table 238: Locals of calculateTrainpositionAttributes

Name	Type	Comments and Information
LRBG_loc	TrainPosition_Types_Pck::positionedBG_T	

14.1.6.4. Operator Hierarchy

diagram : diagram_calculateTrainpositionAttributes

14.1.6.5. Graphical and Textual Diagrams

14.1.6.5.1. View of diagram_calculateTrainpositionAttributes (calculateTrainpositionAttributes)

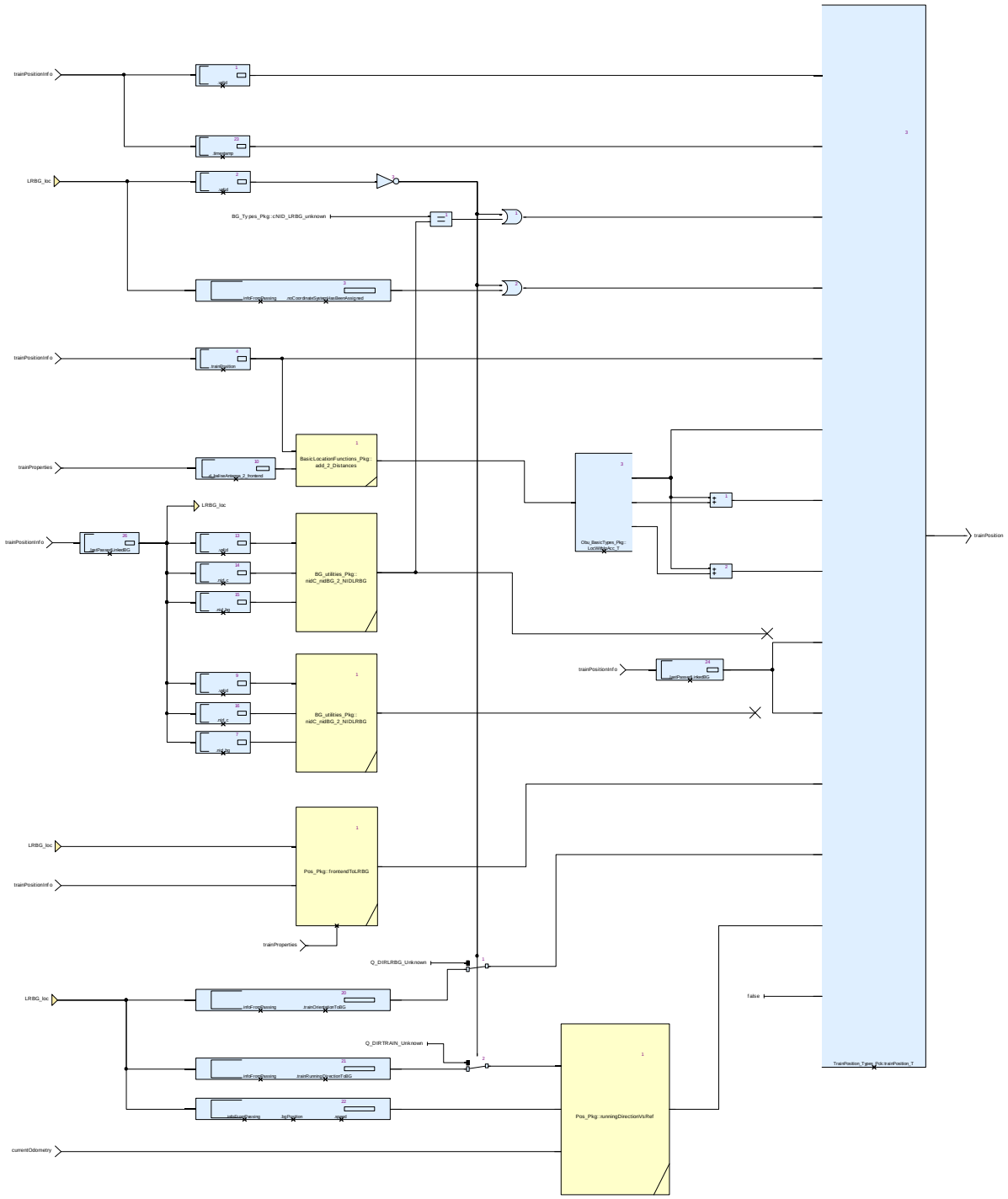


Figure 75: View of diagram_calculateTrainpositionAttributes (calculateTrainpositionAttributes)

14.1.7. calculateTrainPositionInfo Operator

Declared as **`private node`**

14.1.7.1. Comments and Information

calculateTrainPositionInfo Comments:

- Provides the train position information.

14.1.7.2. Interface

Table 239: Inputs of calculateTrainPositionInfo

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 240: 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.
positionCalculationNotConsistent	bool	

14.1.7.3. Operator Hierarchy

diagram : diagram_calculateTrainPositionInfo_1

14.1.7.4. Graphical and Textual Diagrams

14.1.7.4.1. View of diagram_calculateTrainPositionInfo_1 (calculateTrainPositionInfo)

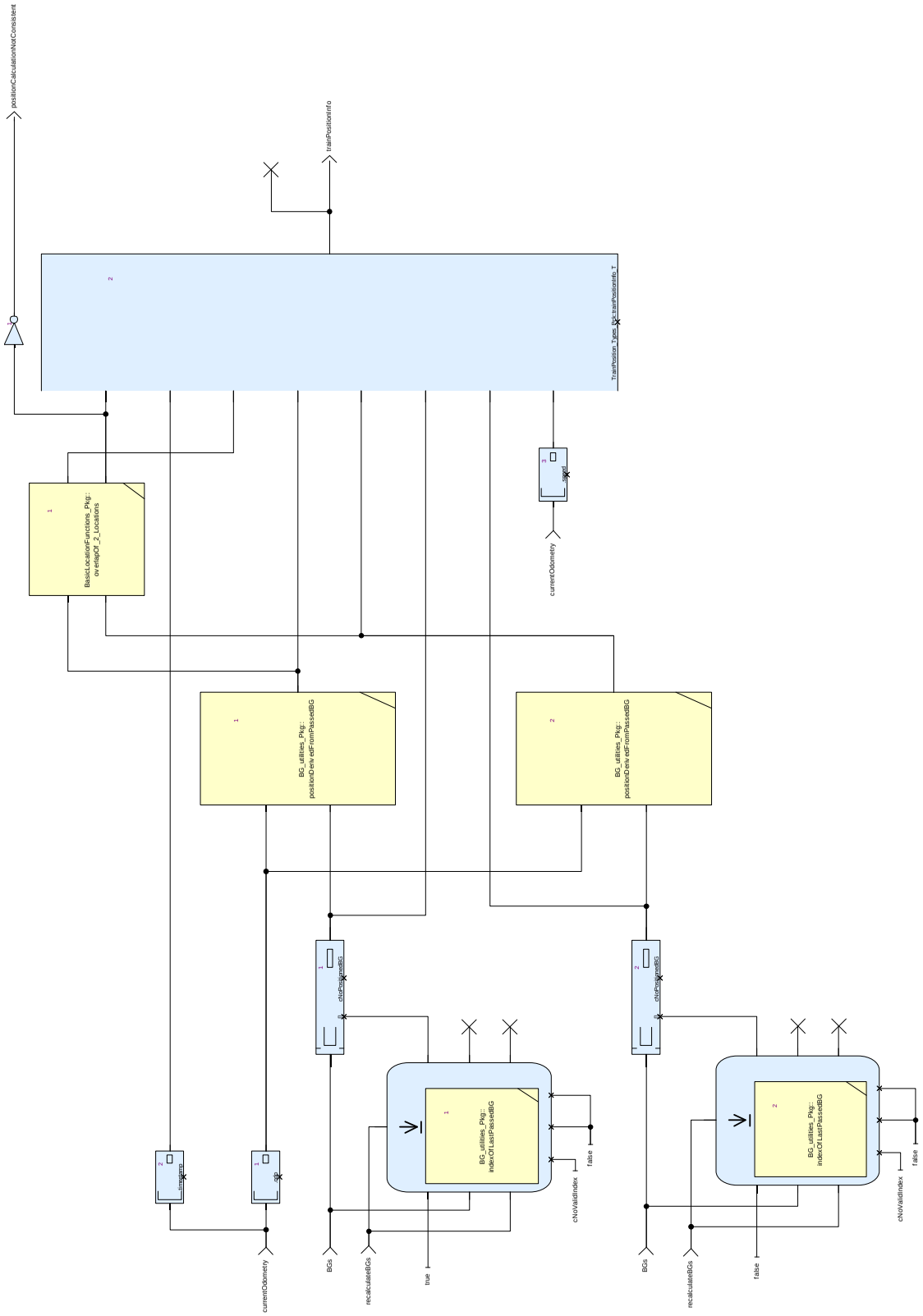


Figure 76: View of diagram_calculateTrainPositionInfo_1 (calculateTrainPositionInfo)

14.1.8. delDispensableBGs Operator

Declared as **`private function`**

14.1.8.1. 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.

14.1.8.2. Interface

Table 241: 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 242: 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.

14.1.8.3. Locals

Table 243: Locals of delDispensableBGs

Name	Type	Comments and Information
passedLinkedBGsCount	int	
passedUnlinkedBGsCount	int	

14.1.8.4. Operator Hierarchy

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

14.1.8.5. Graphical and Textual Diagrams

14.1.8.5.1. View of diagram_delDispensableBGs_1 (delDispensableBGs)

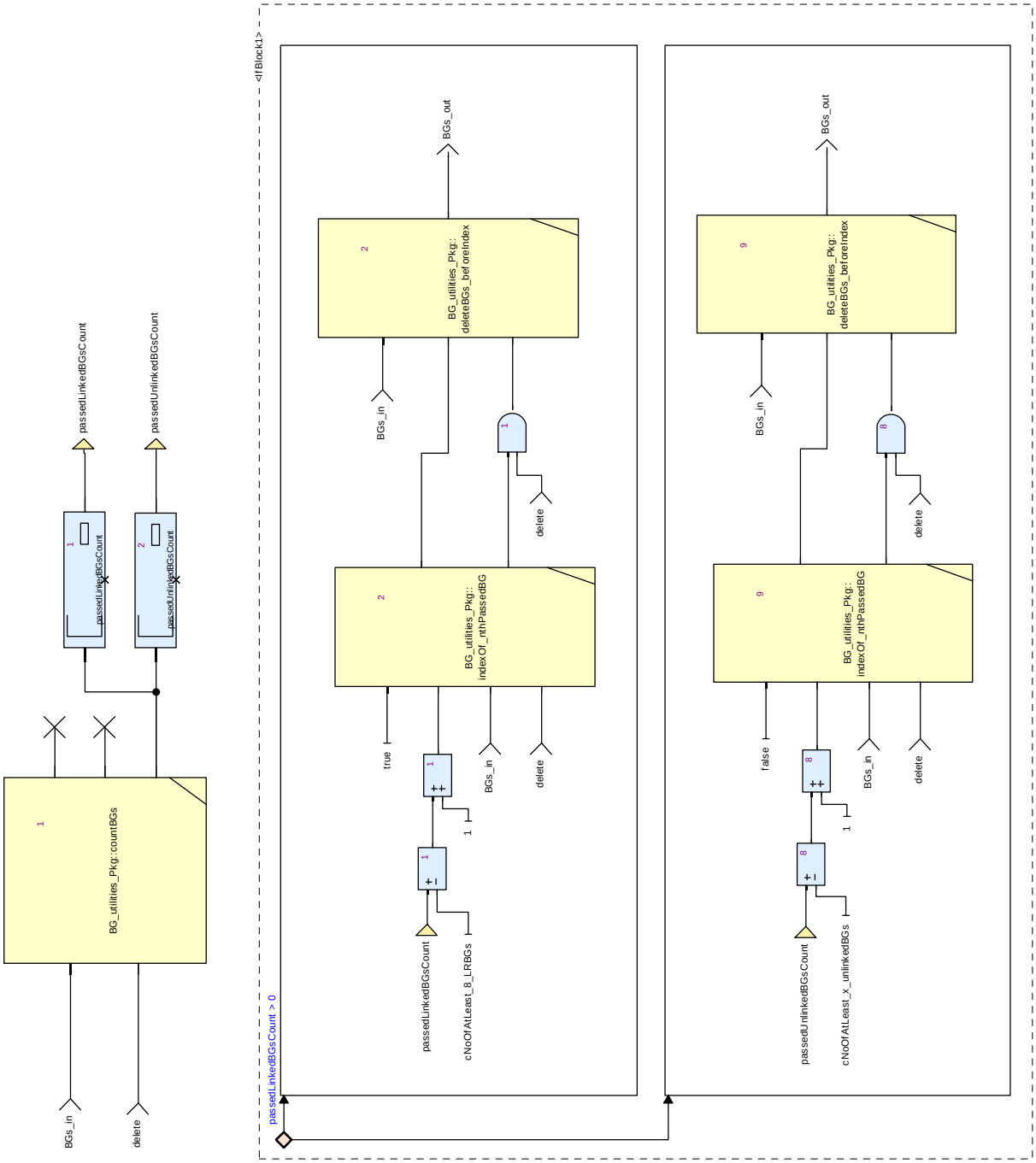


Figure 77: View of diagram_delDispensableBGs_1 (delDispensableBGs)

Table 244: Conditional Blocks of diagram_delDispensableBGs_1

Conditional Block	Comments and Information
IfBlock1	

Table 245: Actions of diagram_delDispensableBGs_1

Conditional Block Action	Comments and Information
IfBlock1:then	

Conditional Block Action	Comments and Information
IfBlock1:else	

14.1.9. genPassedBG_SeqNo Operator

Declared as **`private node`**

14.1.9.1. 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.

14.1.9.2. Interface

Table 246: 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 247: Outputs of genPassedBG_SeqNo

Name	Type	Comments and Information
seqNo	int	

14.1.9.3. Locals

Table 248: Locals of genPassedBG_SeqNo

Name	Type	Comments and Information
incrPassedBGSeqNo	bool	
keepPassedBGSeqNo	bool	

14.1.9.4. Operator Hierarchy

diagram : diagram_genPassedBG_SeqNo_1

14.1.9.5. Graphical and Textual Diagrams

14.1.9.5.1. View of diagram_genPassedBG_SeqNo_1 (genPassedBG_SeqNo)

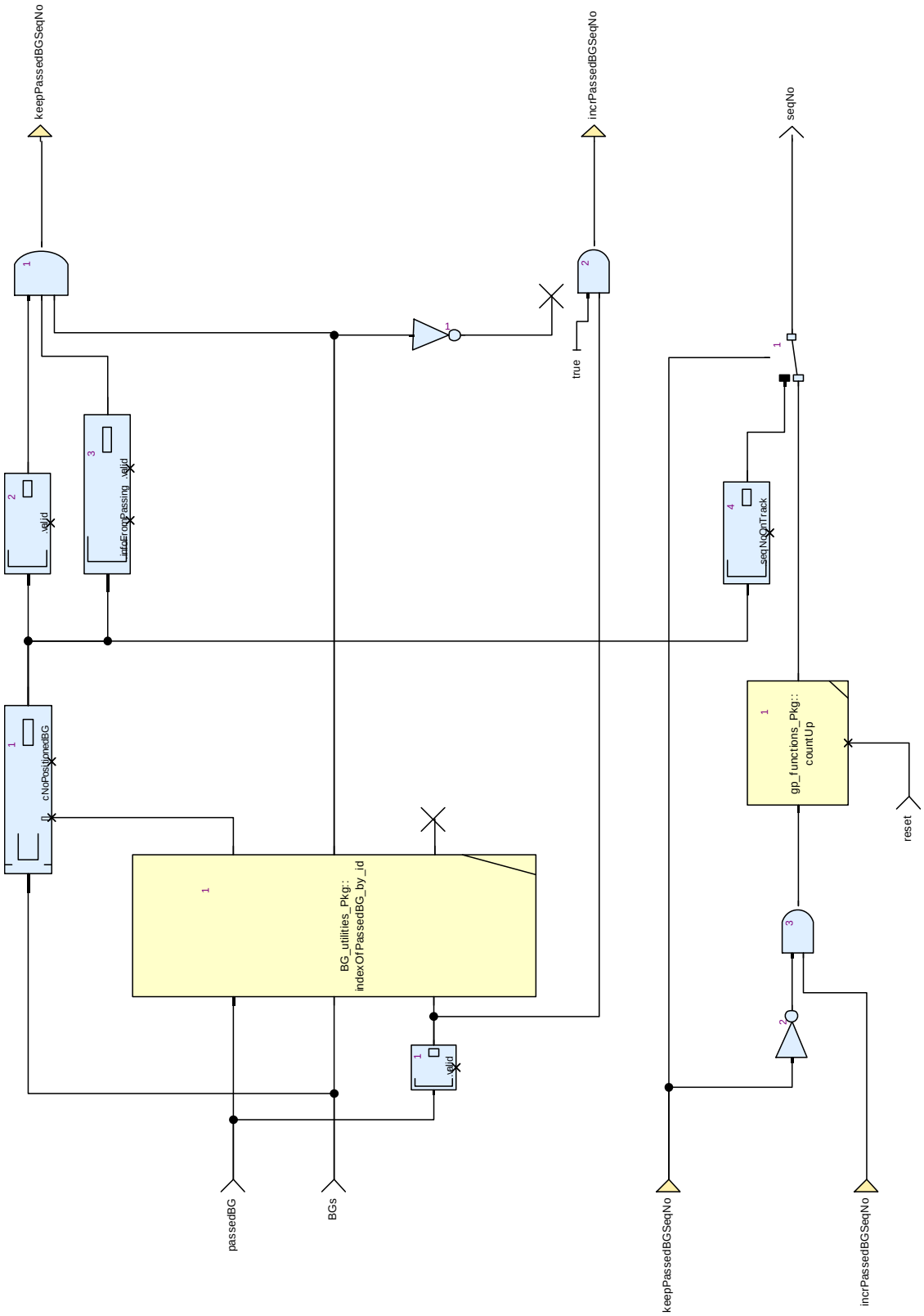


Figure 78: View of diagram_genPassedBG_SeqNo_1 (genPassedBG_SeqNo)

14.1.10. memPassedBG Operator

Declared as **`private node`**

14.1.10.1. Comments and Information

memPassedBG Comments:

- Memorizes the passed linked and unlinked BG

Table 249: 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/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

14.1.10.2. Interface

Table 250: 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 251: Outputs of memPassedBG

Name	Type	Comments and Information
passedLinkedBG	TrainPosition_Types_Pck::positionedBG_T	

Name	Type	Comments and Information
passedUnlinkedBG	TrainPosition_Types_Pck::positionedBG_T	

14.1.10.3. Locals

Table 252: Locals of memPassedBG

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

14.1.10.4. Operator Hierarchy

diagram : diagram_memPassedBG_1

14.1.10.5. Graphical and Textual Diagrams

14.1.10.5.1. View of diagram_memPassedBG_1 (memPassedBG)

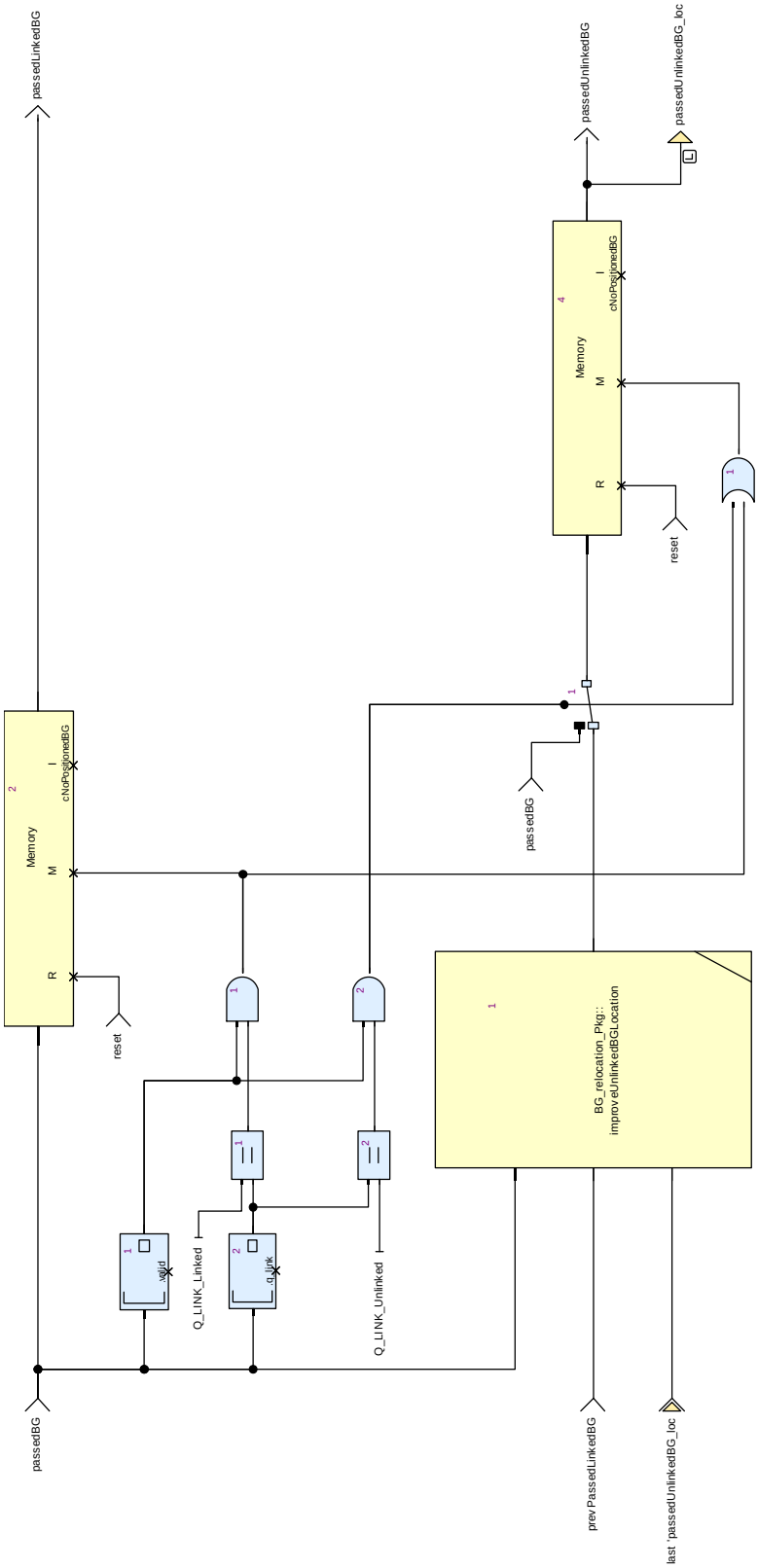


Figure 79: View of diagram_memPassedBG_1 (memPassedBG)

14.1.11. passedBG_2_positionedBG Operator

Declared as **`private function`**

14.1.11.1. 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 253: 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

14.1.11.2. Interface

Table 254: 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.

Name	Type	Properties	Comments and Information
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	**Comments:** The trains properties required for train position calculation.

Table 255: 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.
notFoundWhereAnnounced	bool	default	false	**Comments:** Indicates that the location of the passed BG does not fit into the range, where it was expected by the linking information.
linkedBGs	TrainPosition_Types_Pck::linkedBGs_asPositionedBGs_T			**Comments:** The balise groups linked with the passed BG.

14.1.11.3. Locals

Table 256: 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.
location	Obu_BasicTypes_Pkg::LocWithInAcc_T		

Name	Type	Properties		Comments and Information
notFoundWhereAnnounced_loc	bool	default	false	
passedPositionedBG_loc	TrainPosition_Types_Pck::positionedBG_T			

14.1.11.4. 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_passedBG_2_positionedBG
diagram : diagram_positionLinkedBGs

14.1.11.5. Graphical and Textual Diagrams

14.1.11.5.1. View of diagram_calculateDistance (passedBG_2_positionedBG)

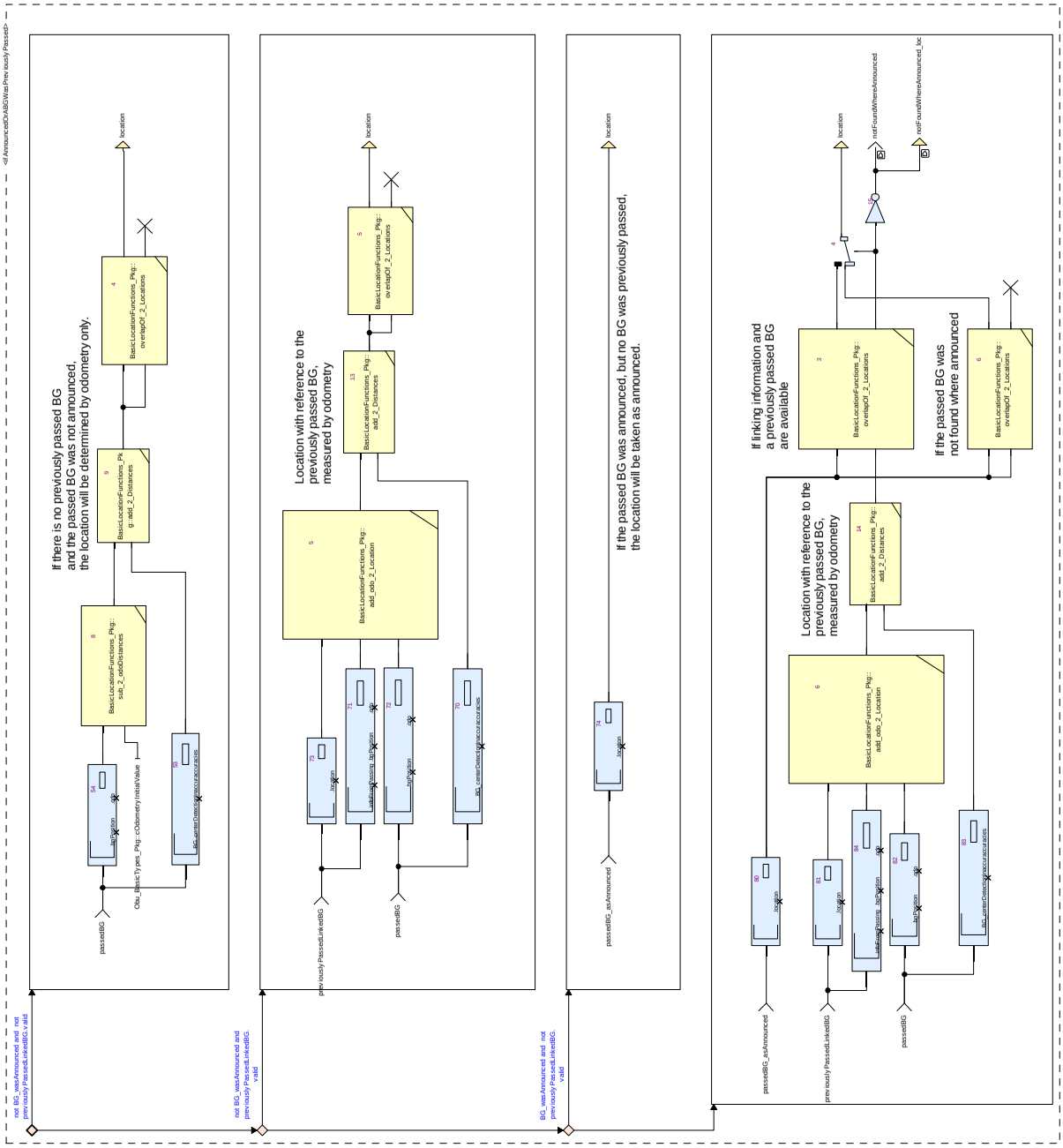


Figure 80: View of diagram_calculateDistance (passedBG_2_positionedBG)

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 257: Conditional Blocks of diagram_calculateDistance

Conditional Block	Comments and Information
ifAnnouncedOrABGWasPreviouslyPassed	

Table 258: Actions of diagram_calculateDistance

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

14.1.11.5.2. View of diagram_checkAnnouncedInfo (passedBG_2_positionedBG)

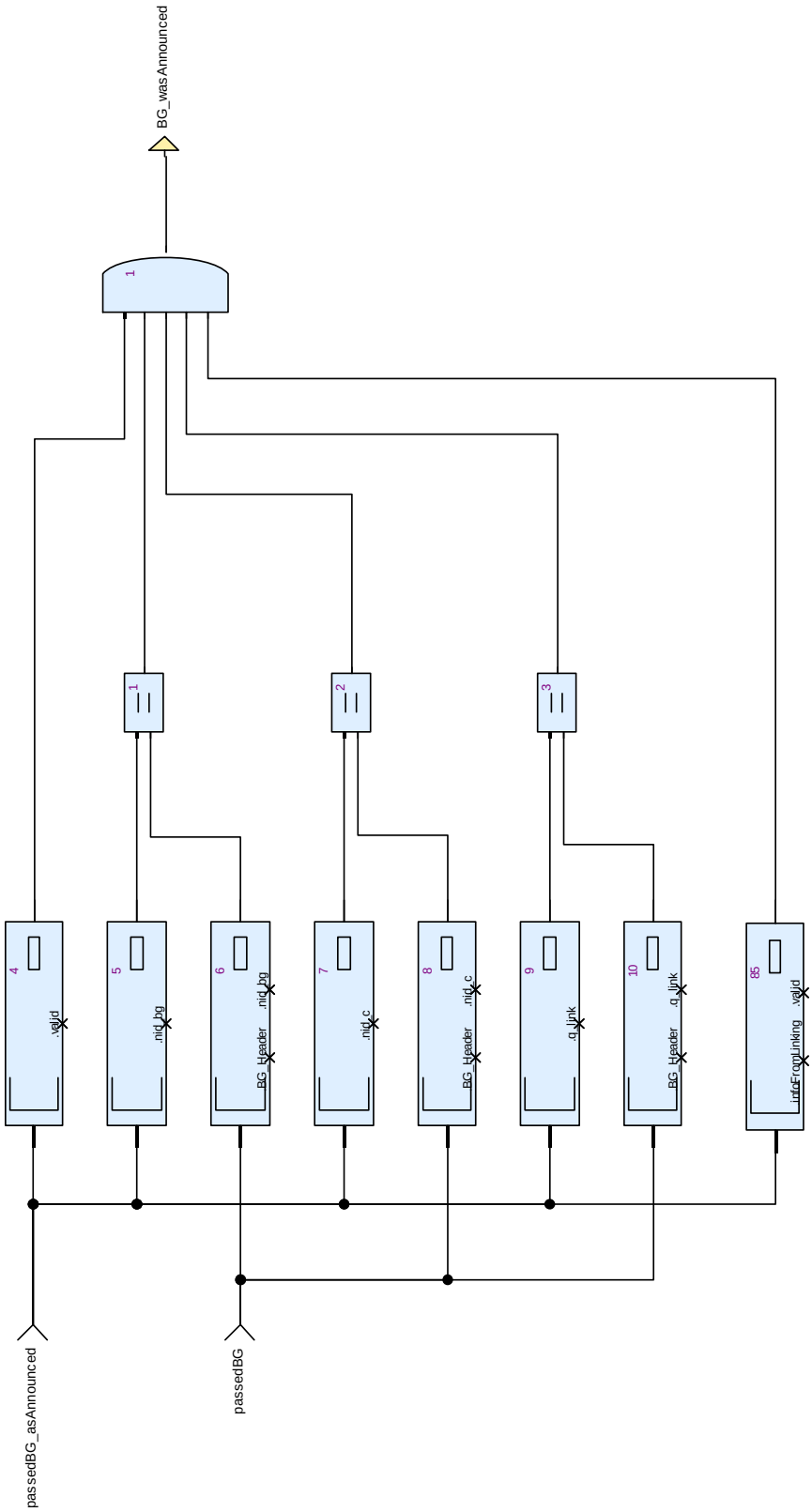


Figure 81: View of diagram_checkAnnouncedInfo (passedBG_2_positionedBG)

diagram_checkAnnouncedInfo Comments:

- Checks if the passed BG was announced with linking information.

14.1.11.5.3. View of diagram_passedBG_2_positionedBG (passedBG_2_positionedBG)

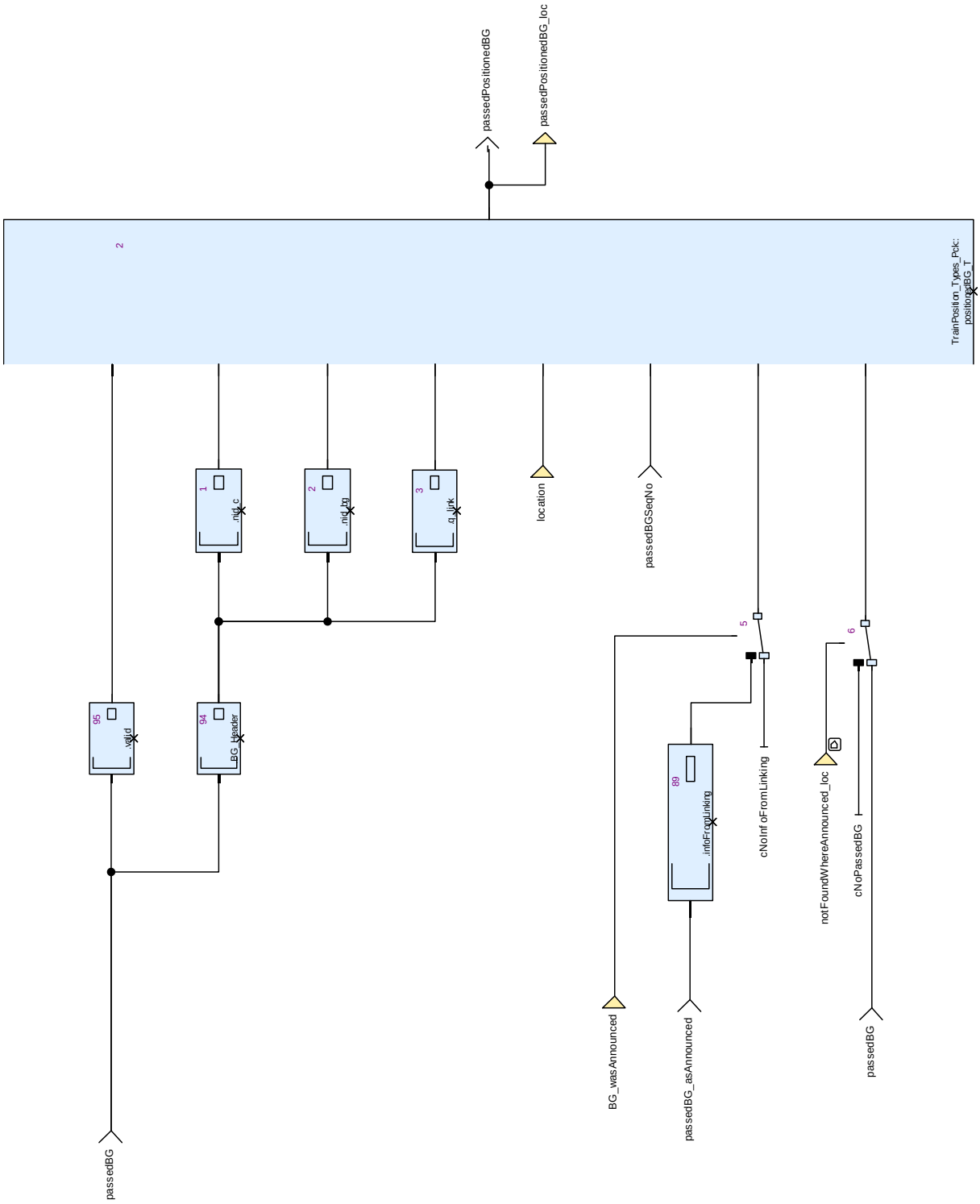


Figure 82: View of diagram_passedBG_2_positionedBG (passedBG_2_positionedBG)

14.1.11.5.4. View of diagram_positionLinkedBGs (passedBG_2_positionedBG)

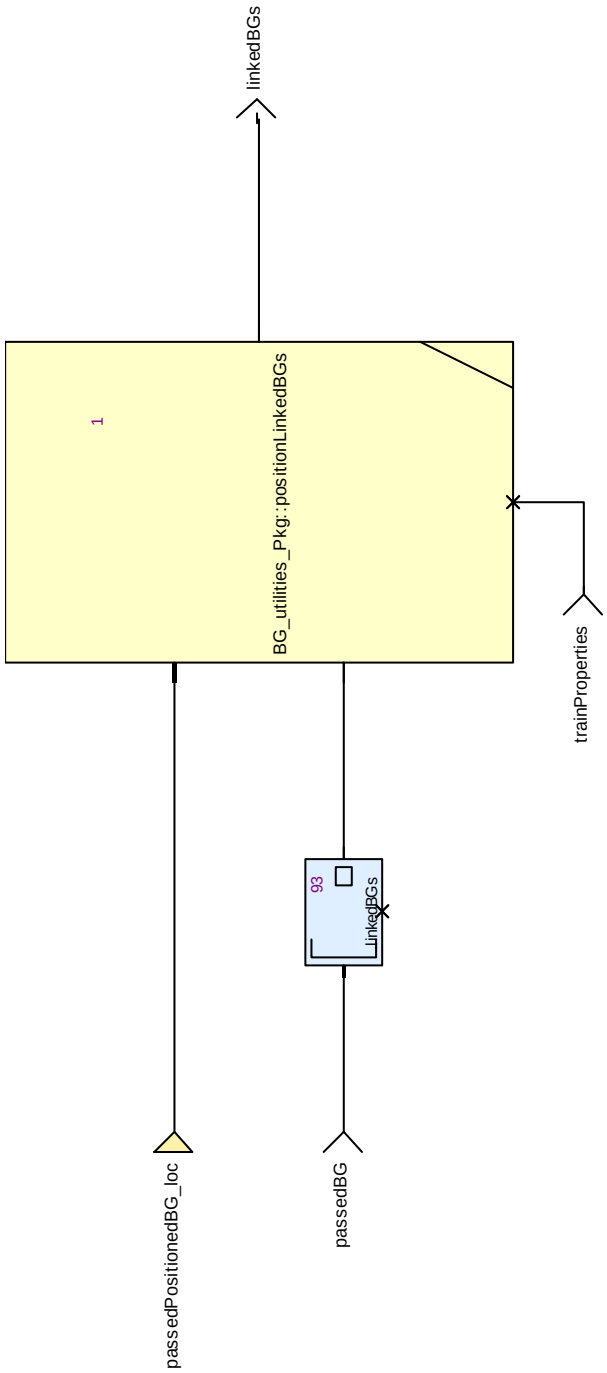


Figure 83: View of diagram_positionLinkedBGs (passedBG_2_positionedBG)

14.1.12. passing_a_BG Operator

Declared as **`private function`**

14.1.12.1. Comments and Information

passing_a_BG Comments:

- Provides the location calculations while passing a BG

Table 259: 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

14.1.12.2. Interface

Table 260: 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	**Comments:** The trains properties required for train position calculation.

Table 261: 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.
notFoundWhereAnnounced	bool	**Comments:** Indicates that the location of the passed BG does not fit into the range, where it was expected by the linking information.

14.1.12.3. Operator Hierarchy

diagram : diagram_passing_a_BG_1

14.1.12.4. Graphical and Textual Diagrams

14.1.12.4.1. View of diagram_passing_a_BG_1 (passing_a_BG)

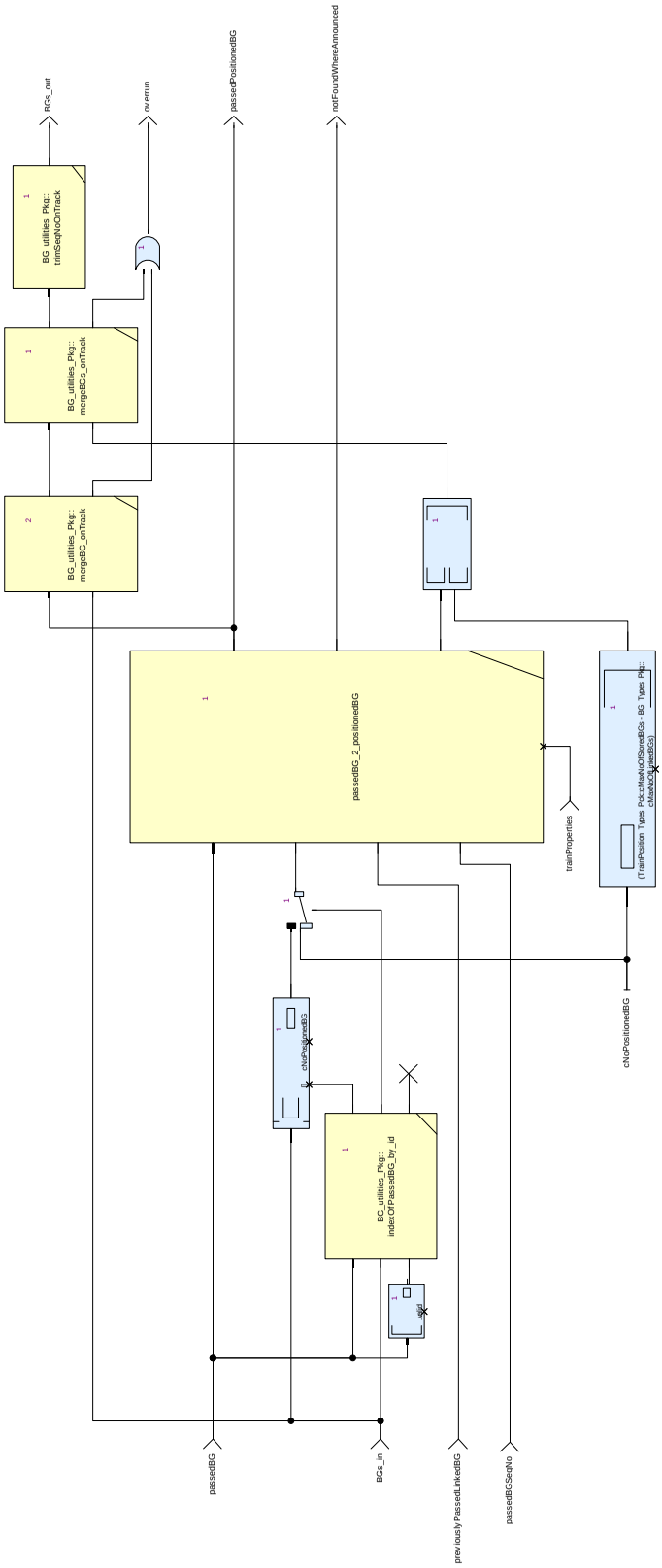


Figure 84: View of diagram_passing_a_BG_1 (passing_a_BG)

14.1.13. prevPassedLinkedBG Operator

Declared as **`private function`**

14.1.13.1. Comments and Information

prevPassedLinkedBG Comments:

- Memorizes the previously passed BG when a new BG is passed and the IDs are different

Table 262: 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

14.1.13.2. Interface

Table 263: 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 264: Outputs of prevPassedLinkedBG

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

14.1.13.3. Operator Hierarchy

diagram : diagram_prevPassedLinkedBG_1

14.1.13.4. Graphical and Textual Diagrams

14.1.13.4.1. View of diagram_prevPassedLinkedBG_1 (prevPassedLinkedBG)

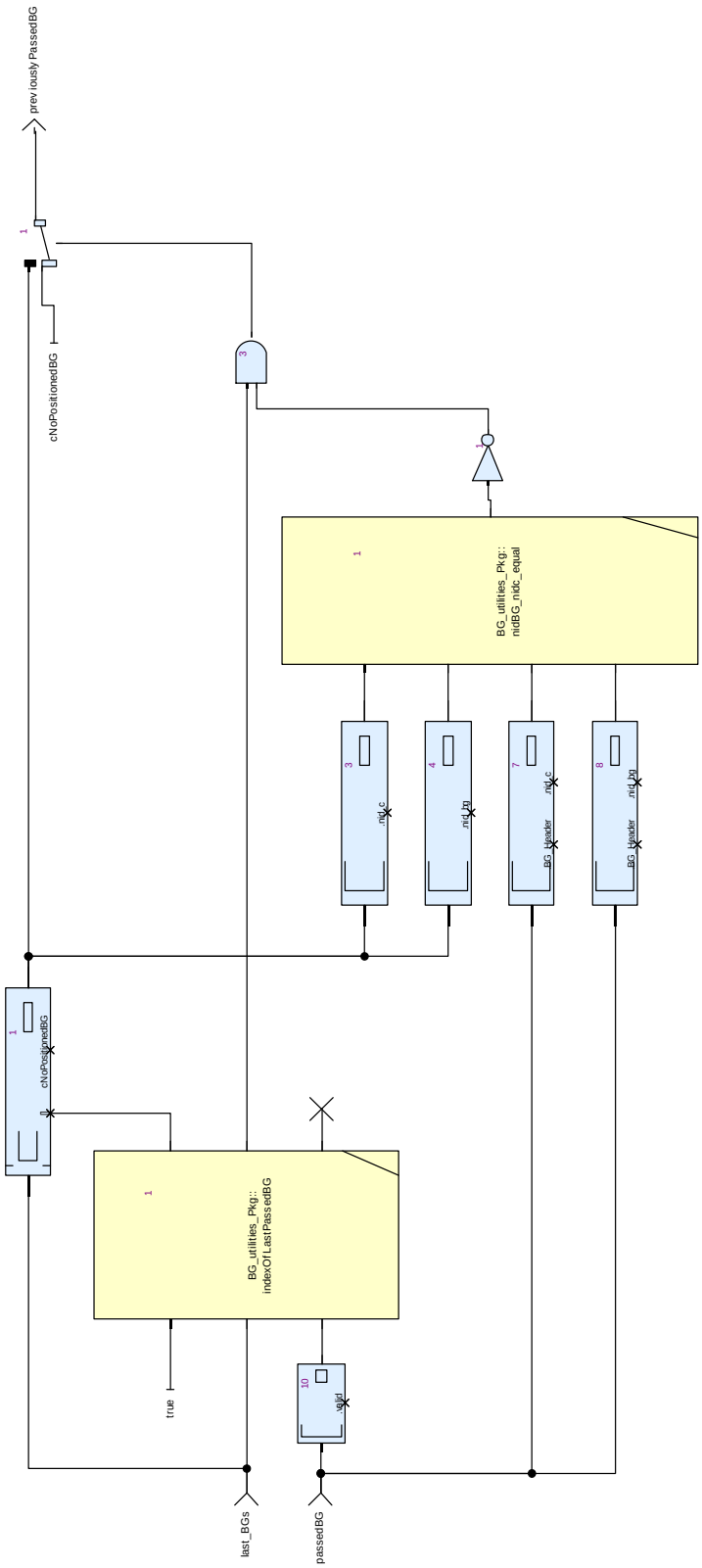


Figure 85: View of diagram_prevPassedLinkedBG_1 (prevPassedLinkedBG)

14.2. CalculateTrainPosition_Pkg::BG_relocation_Pkg Package

14.2.1. Types

Table 265: 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.

14.2.2. Constants

Table 266: 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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

14.2.3. calculateLocalBGInaccuracies Operator

Declared as **`private function`**

14.2.3.1. Comments and Information

calculateLocalBGInaccuracies Comments:

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

14.2.3.2. Interface

Table 267: 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	**Comments:** The trains properties required for train position calculation.

Table 268: Outputs of calculateLocalBGInaccuracies

Name	Type	Comments and Information
localInaccuracies	Obu_BasicTypes_Pkg::LocWithInAcc_T	

14.2.3.3. Operator Hierarchy

diagram : diagram_calculateLocalBGInaccuracies_1

14.2.3.4. Graphical and Textual Diagrams

14.2.3.4.1. View of diagram_calculateLocalBGInaccuracies_1 (calculateLocalBGInaccuracies)

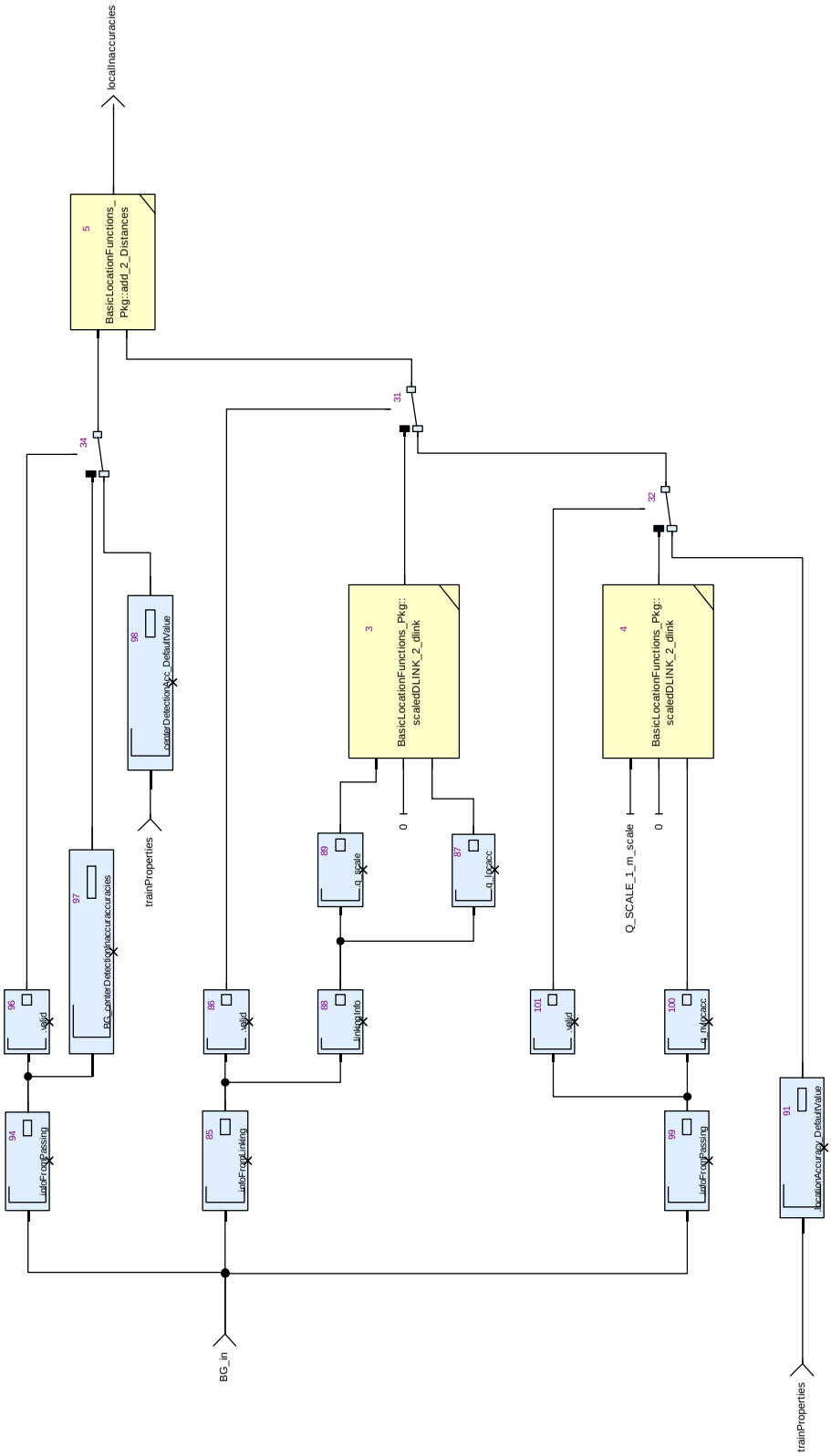


Figure 86: View of diagram_calculateLocalBGInaccuracies_1 (calculateLocalBGInaccuracies)

14.2.4. findLinkedBG_bckwd_itr Operator

Declared as **`private function`**

14.2.4.1. 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.

14.2.4.2. Interface

Table 269: 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 270: 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	

14.2.4.3. Operator Hierarchy

diagram : diagram_findLinkedBG_bckwd_itr_1

14.2.4.4. Graphical and Textual Diagrams

14.2.4.4.1. View of diagram_findLinkedBG_bckwd_itr_1 (findLinkedBG_bckwd_itr)

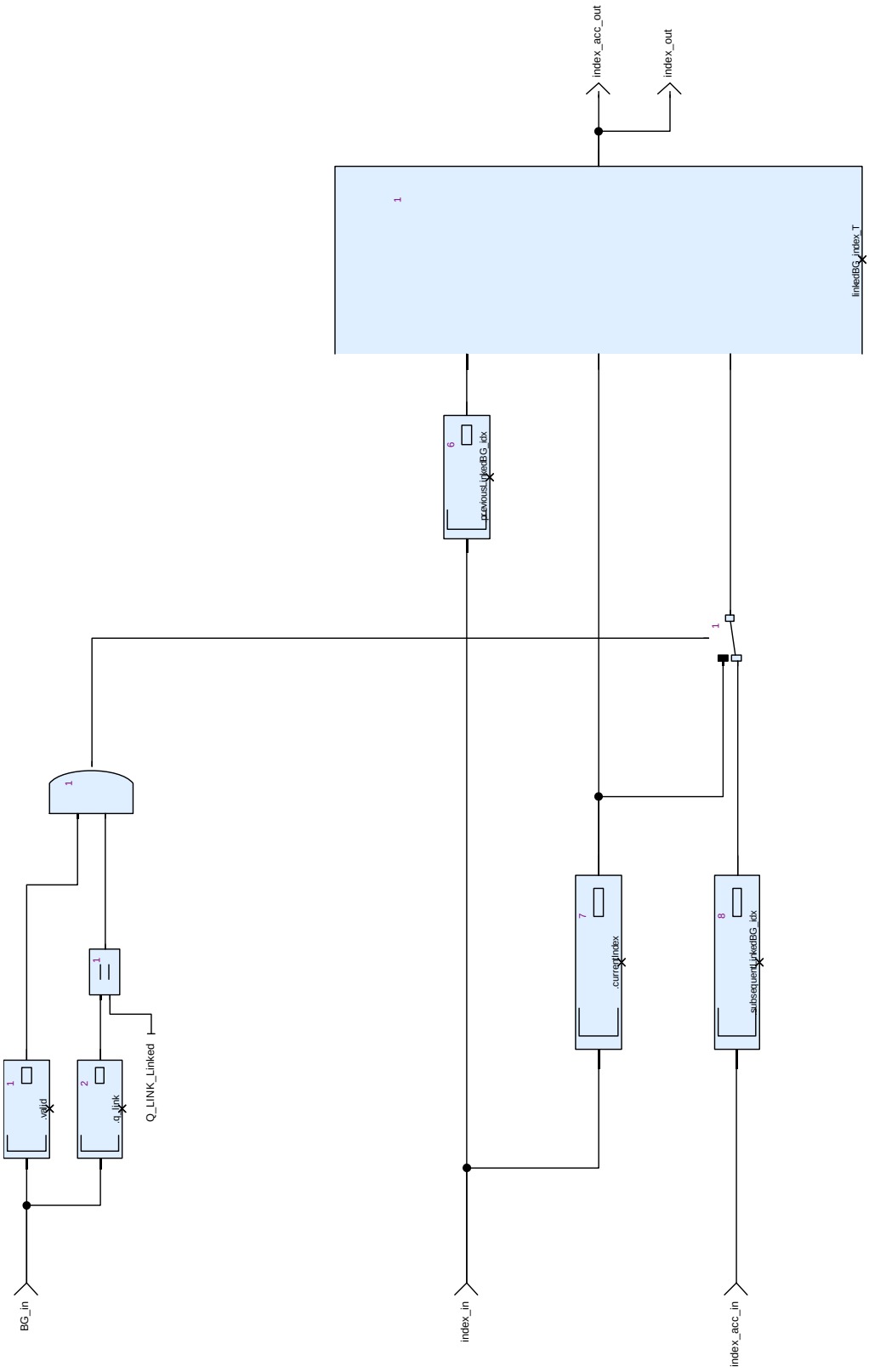


Figure 87: View of diagram_findLinkedBG_bckwd_itr_1 (findLinkedBG_bckwd_itr)

14.2.5. findLinkedBG_fwd_itr Operator

Declared as **`private function`**

14.2.5.1. 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.

14.2.5.2. Interface

Table 271: 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 272: 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

14.2.5.3. Operator Hierarchy

diagram : diagram_findLinkedBG_fwd_itr_1

14.2.5.4. Graphical and Textual Diagrams

14.2.5.4.1. View of diagram_findLinkedBG_fwd_itr_1 (findLinkedBG_fwd_itr)

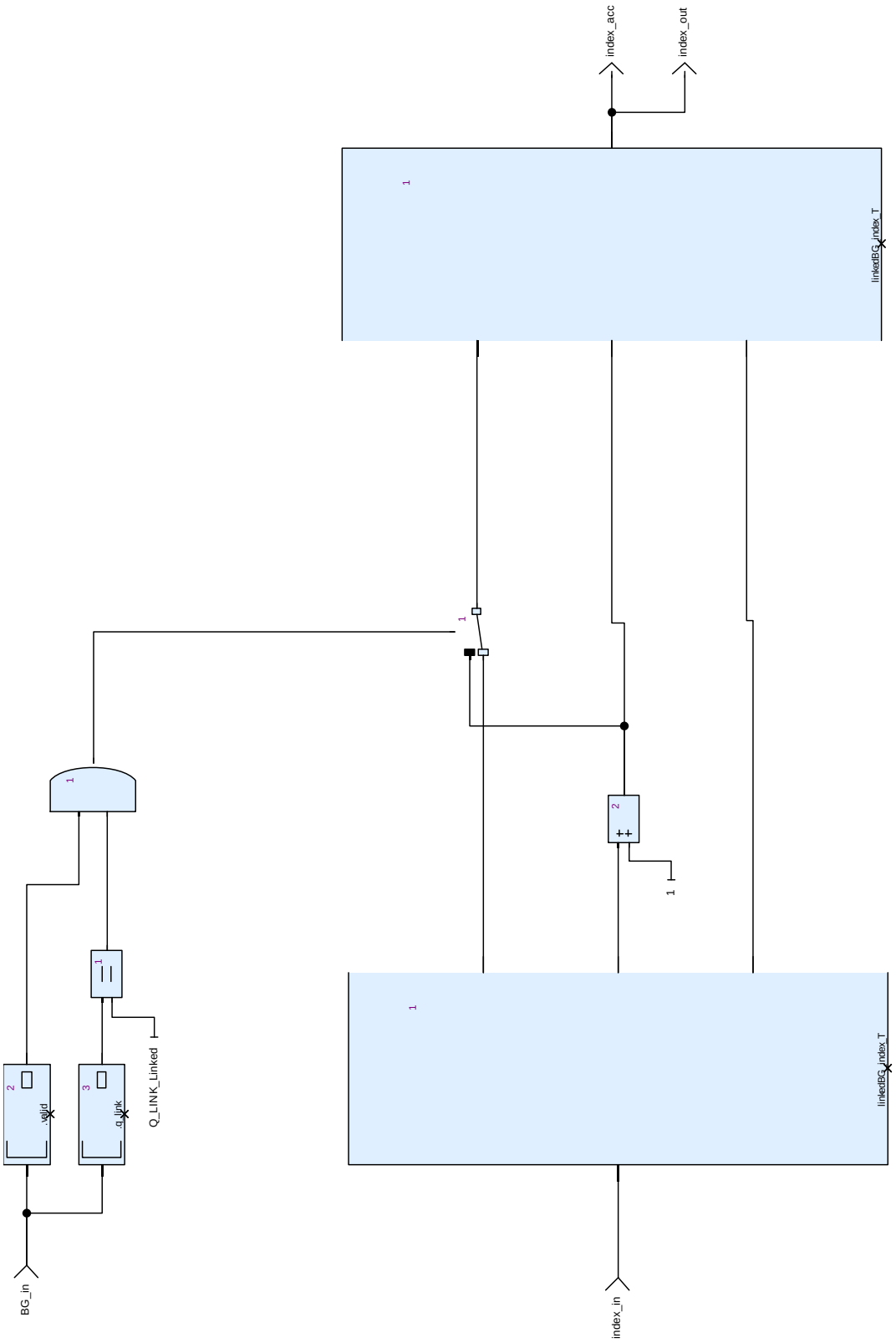


Figure 88: View of diagram_findLinkedBG_fwd_itr_1 (findLinkedBG_fwd_itr)

14.2.6. findLinkedBGs Operator

Declared as **`private function`**

14.2.6.1. 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.

14.2.6.2. Interface

Table 273: Inputs of findLinkedBGs

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

Table 274: Outputs of findLinkedBGs

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

14.2.6.3. Operator Hierarchy

diagram : diagram_findLinkedBGs_1

14.2.6.4. Graphical and Textual Diagrams

14.2.6.4.1. View of diagram_findLinkedBGs_1 (findLinkedBGs)

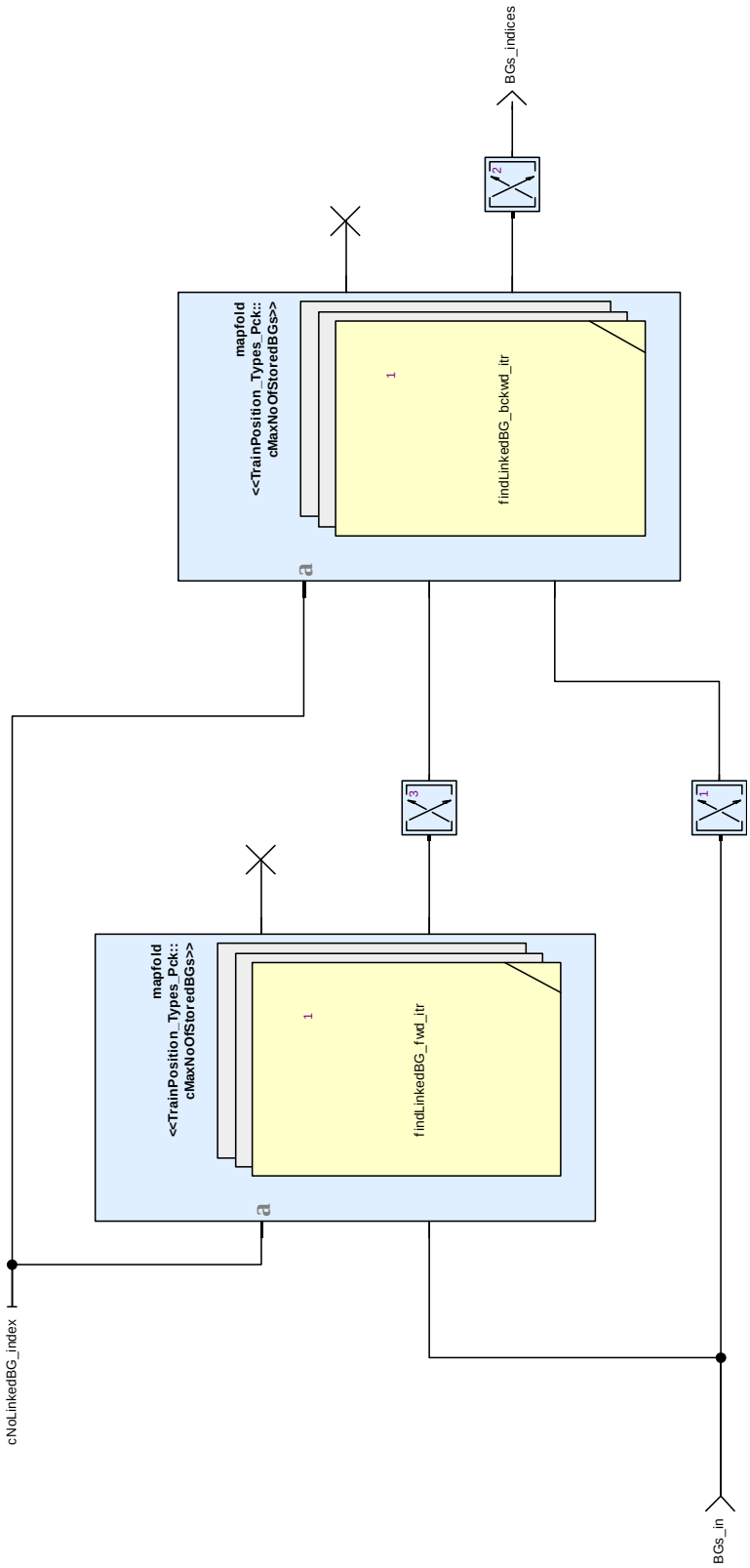


Figure 89: View of diagram_findLinkedBGs_1 (findLinkedBGs)

14.2.7. improve_BG_locations Operator

Declared as **`public function`**

14.2.7.1. Interface

Table 275: 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	**Comments:** The trains properties required for train position calculation.

Table 276: Outputs of improve_BG_locations

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.2.7.2. Operator Hierarchy

diagram : diagram_recalculate_refBG_location

14.2.7.3. Graphical and Textual Diagrams

14.2.7.3.1. View of diagram_recalculate_refBG_location (improve_BG_locations)

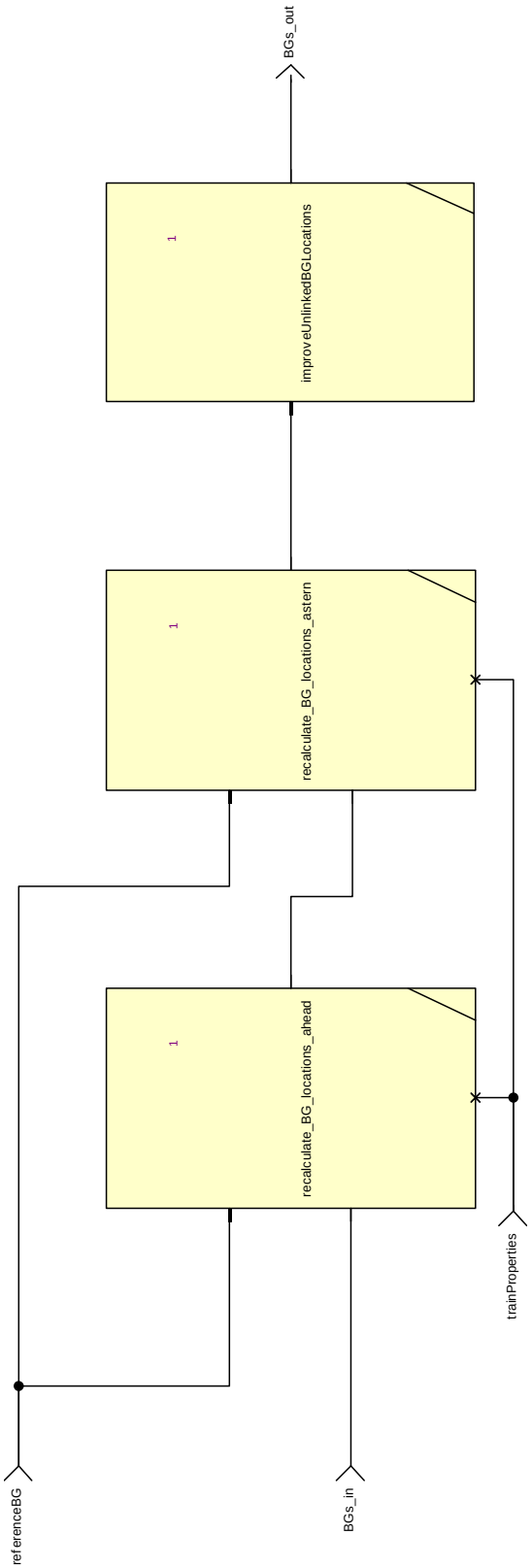


Figure 90: View of diagram_recalculate_refBG_location (improve_BG_locations)

14.2.8. improveUnlinkedBGLocation Operator

Declared as **`public function`**

14.2.8.1. 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.

14.2.8.2. Interface

Table 277: 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 278: 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

14.2.8.3. Operator Hierarchy

diagram : diagram_improveUnlinkedBGLocation_1

14.2.8.4. Graphical and Textual Diagrams

14.2.8.4.1. View of diagram_improveUnlinkedBGLocation_1 (improveUnlinkedBGLocation)

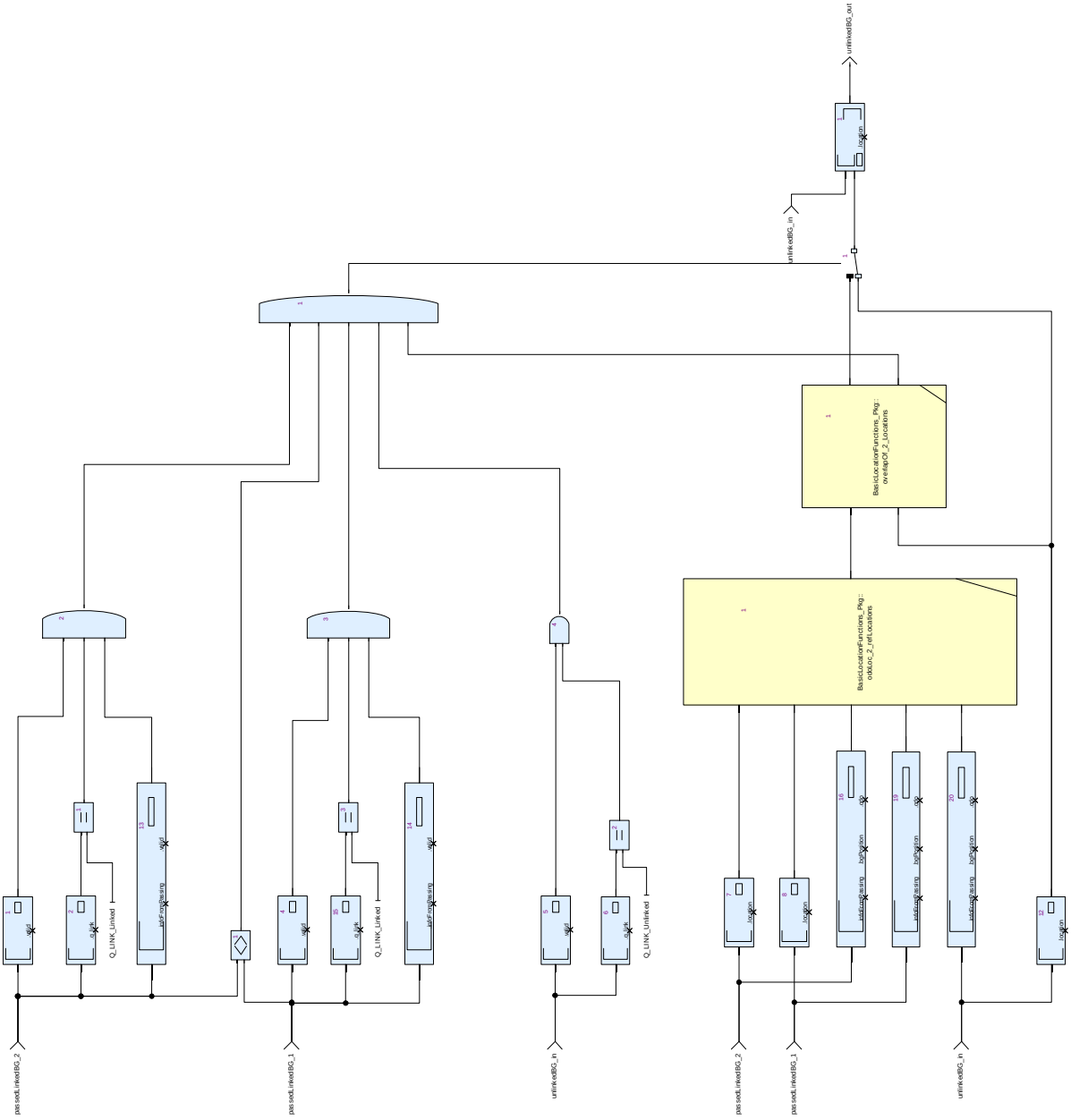


Figure 91: View of diagram_improveUnlinkedBGLocation_1 (improveUnlinkedBGLocation)

14.2.9. improveUnlinkedBGLocations Operator

Declared as **`private function`**

14.2.9.1. Interface

Table 279: Inputs of improveUnlinkedBGLocations

Name	Type	Comments and Information
BGs_in	TrainPosition_Types_Pck::positionedBGs_T	

Table 280: Outputs of improveUnlinkedBGLocations

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.2.9.2. Operator Hierarchy

diagram : diagram_improveUnlinkedBGLocations_1

14.2.9.3. Graphical and Textual Diagrams

14.2.9.3.1. View of diagram_improveUnlinkedBGLocations_1 (improveUnlinkedBGLocations)

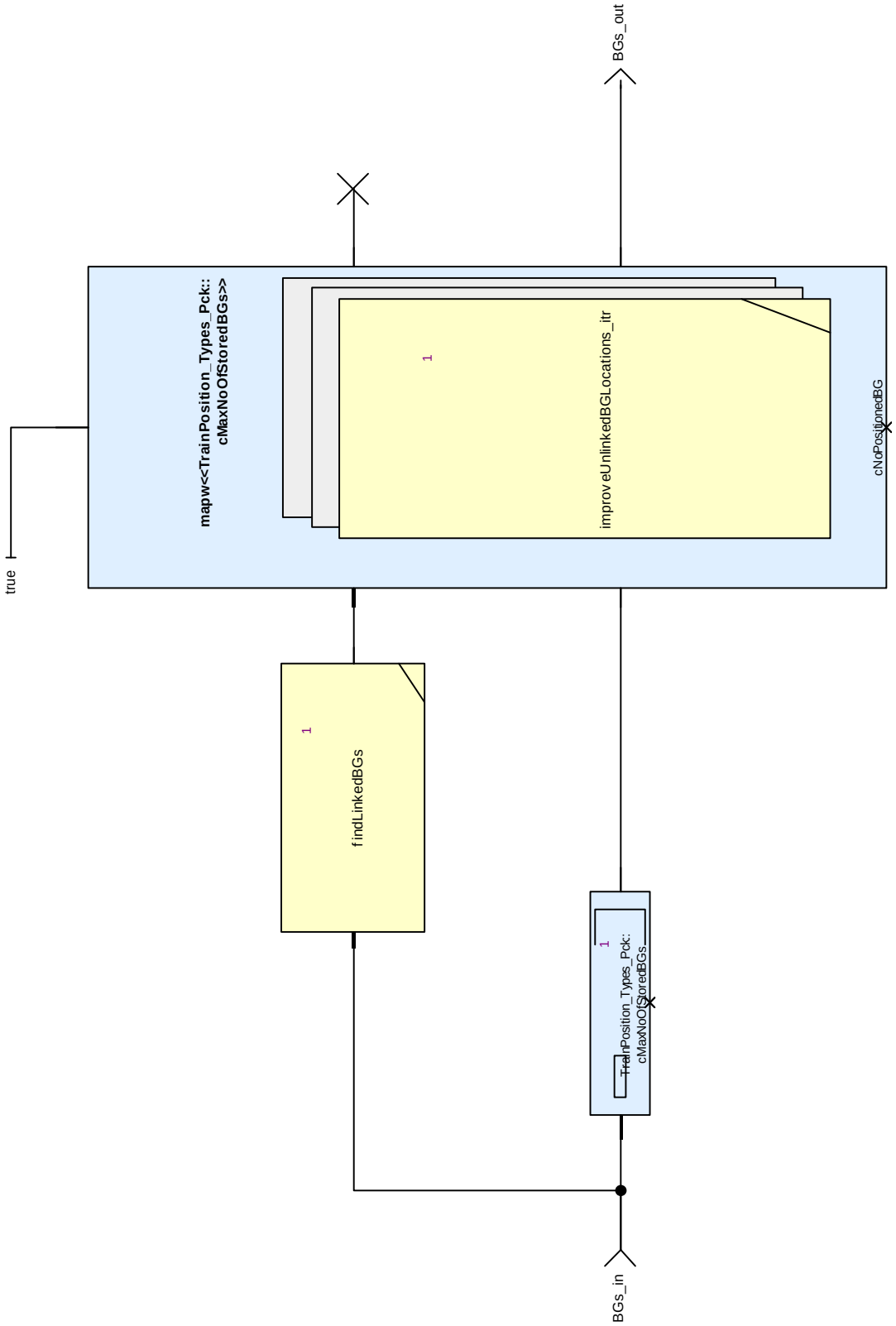


Figure 92: View of diagram_improveUnlinkedBGLocations_1 (improveUnlinkedBGLocations)

14.2.10. improveUnlinkedBGLocations_itr Operator

Declared as **`private function`**

14.2.10.1. Interface

Table 281: 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 282: 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.

14.2.10.2. Operator Hierarchy

diagram : diagram_improveUnlinkedBGLocations_itr_1

14.2.10.3. Graphical and Textual Diagrams

14.2.10.3.1. View of diagram_improveUnlinkedBGLocations_itr_1 (improveUnlinkedBGLocations_itr)

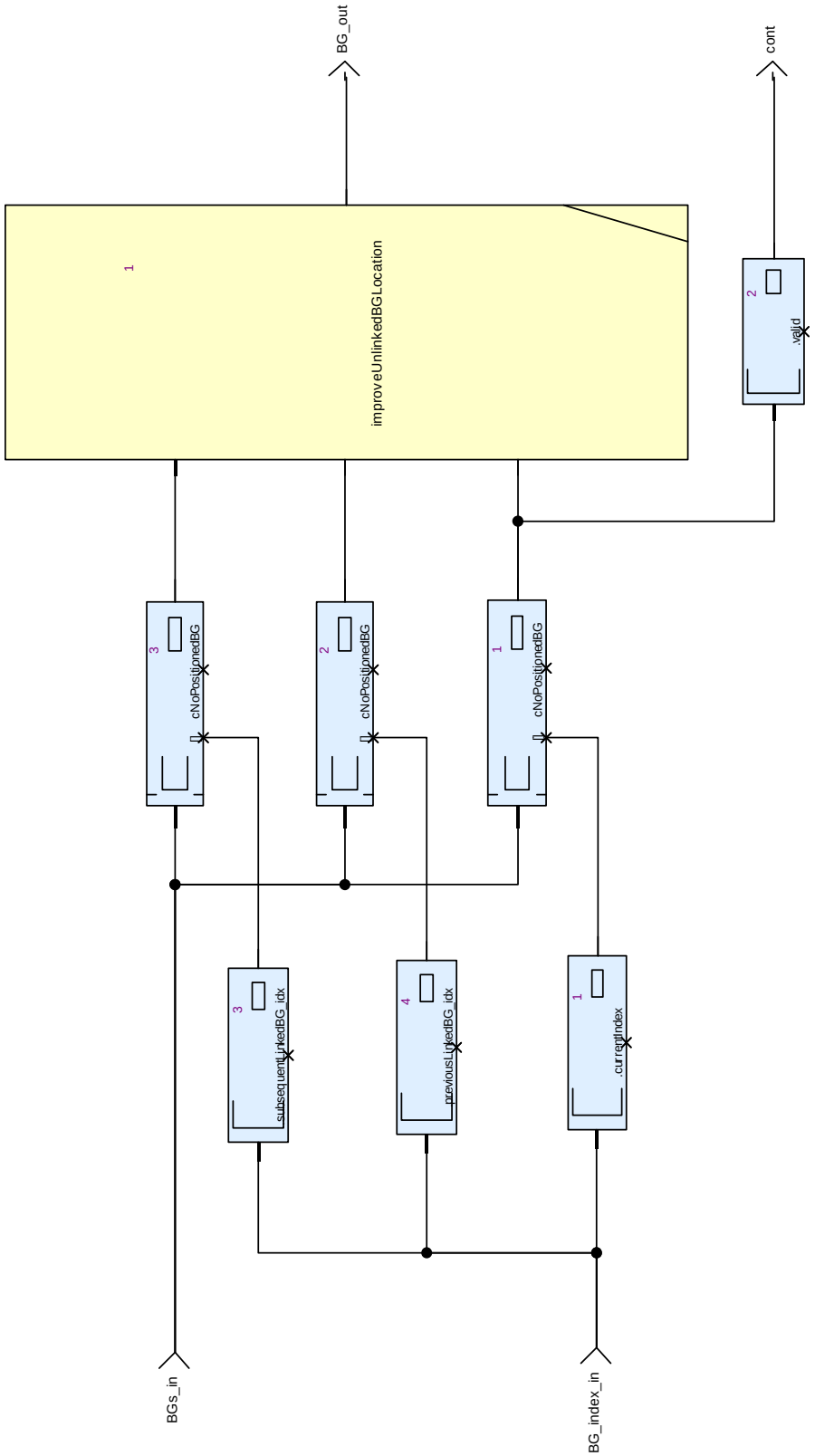


Figure 93: View of diagram_improveUnlinkedBGLocations_itr_1 (improveUnlinkedBGLocations_itr)

14.2.11. recalculate_BG_location_ahead Operator

Declared as **`private function`**

14.2.11.1. 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.

14.2.11.2. Interface

Table 283: 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	**Comments:** The trains properties required for train position calculation.

Table 284: 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.

14.2.11.3. Operator Hierarchy

diagram : diagram_recalculate_BG_location

14.2.11.4. Graphical and Textual Diagrams

14.2.11.4.1. View of diagram_recalculate_BG_location (recalculate_BG_location_ahead)

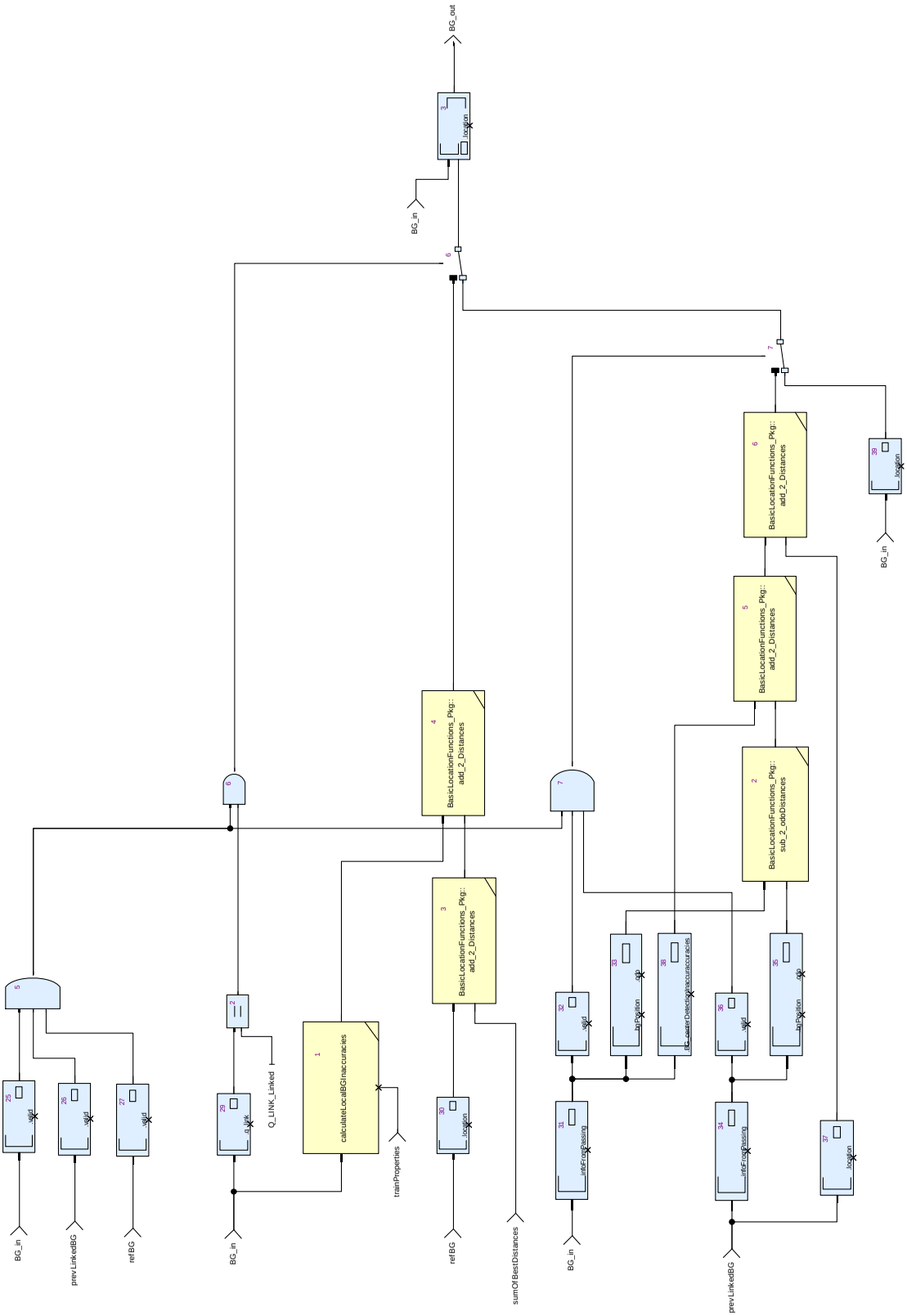


Figure 94: View of diagram_recalculate_BG_location (recalculate_BG_location_ahead)

14.2.12. recalculate_BG_location_astern Operator

Declared as **`private function`**

14.2.12.1. 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.

14.2.12.2. Interface

Table 285: 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	**Comments:** The trains properties required for train position calculation.

Table 286: 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.

14.2.12.3. Operator Hierarchy

diagram : diagram_recalculate_BG_location

14.2.12.4. Graphical and Textual Diagrams

14.2.12.4.1. View of diagram_recalculate_BG_location (recalculate_BG_location_astern)

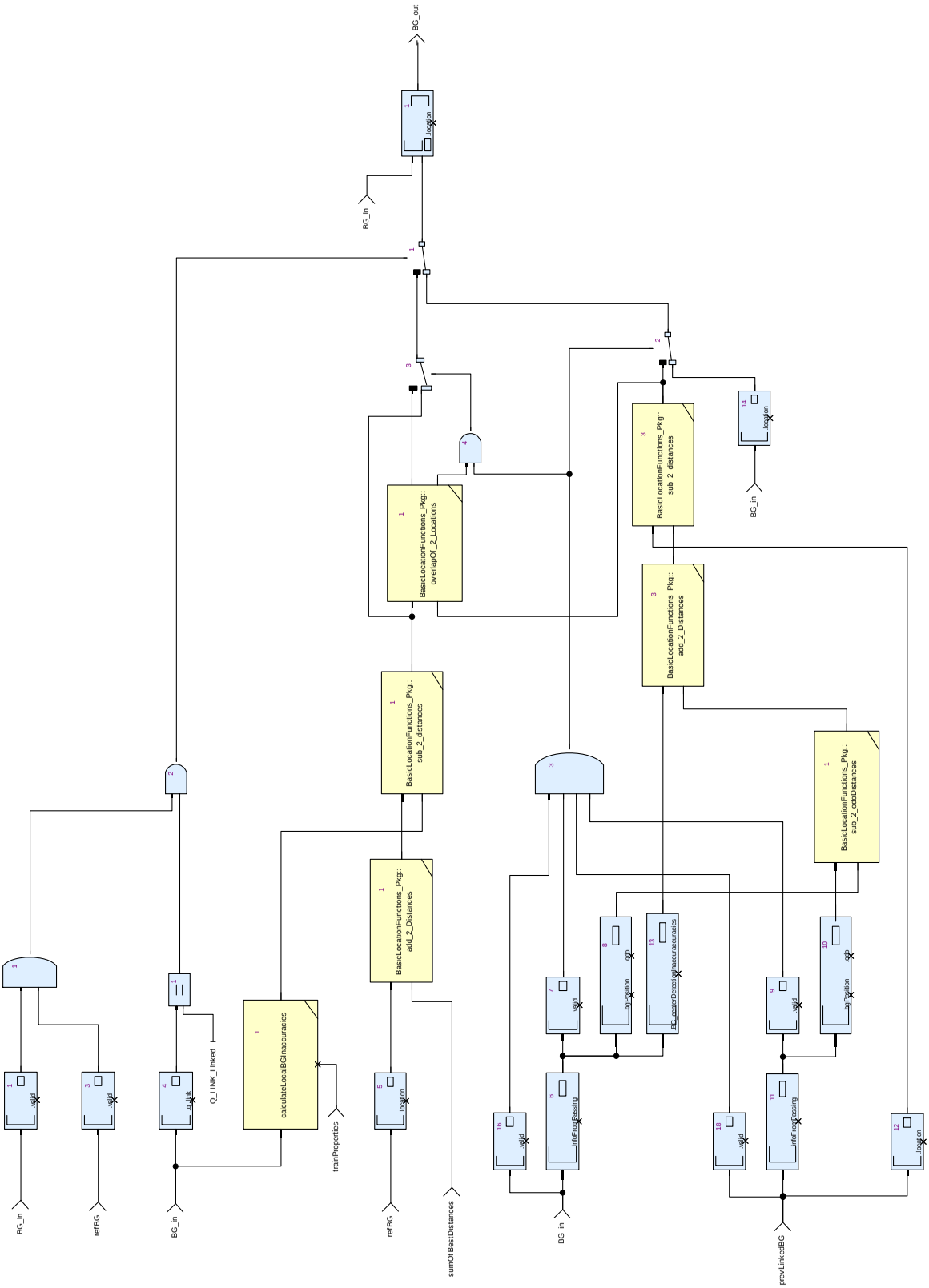


Figure 95: View of diagram_recalculate_BG_location (recalculate_BG_location_astern)

14.2.13. recalculate_BG_locations_ahead Operator

Declared as **`private function`**

14.2.13.1. 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.

14.2.13.2. Interface

Table 287: 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	**Comments:** The trains properties required for train position calculation.

Table 288: Outputs of recalculate_BG_locations_ahead

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.2.13.3. Operator Hierarchy

diagram : diagram_recalculate_BG_locations_ahead_1

14.2.13.4. Graphical and Textual Diagrams

14.2.13.4.1. View of diagram_recalculate_BG_locations_ahead_1 (recalculate_BG_locations_ahead)

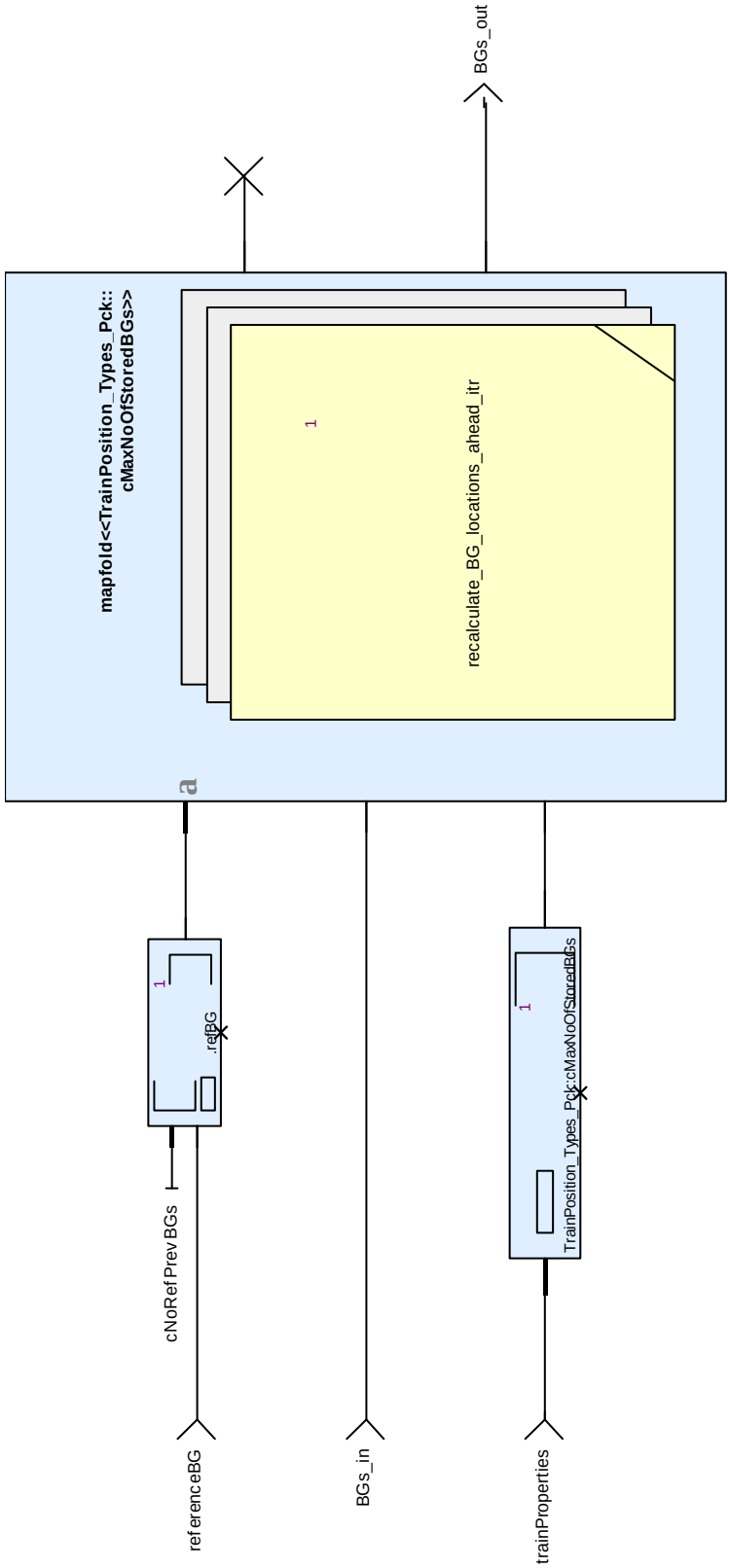


Figure 96: View of diagram_recalculate_BG_locations_ahead_1 (recalculate_BG_locations_ahead)

14.2.14. recalculate_BG_locations_ahead_itr Operator

Declared as **`private function`**

14.2.14.1. 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.

14.2.14.2. Interface

Table 289: 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	**Comments:** The trains properties required for train position calculation.

Table 290: 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.

14.2.14.3. Locals

Table 291: Locals of recalculate_BG_locations_ahead_itr

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

Name	Type	Comments and Information
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.

14.2.14.4. 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

14.2.14.5. Graphical and Textual Diagrams

14.2.14.5.1. View of diagram_assembleResults (recalculate_BG_locations_ahead_itr)

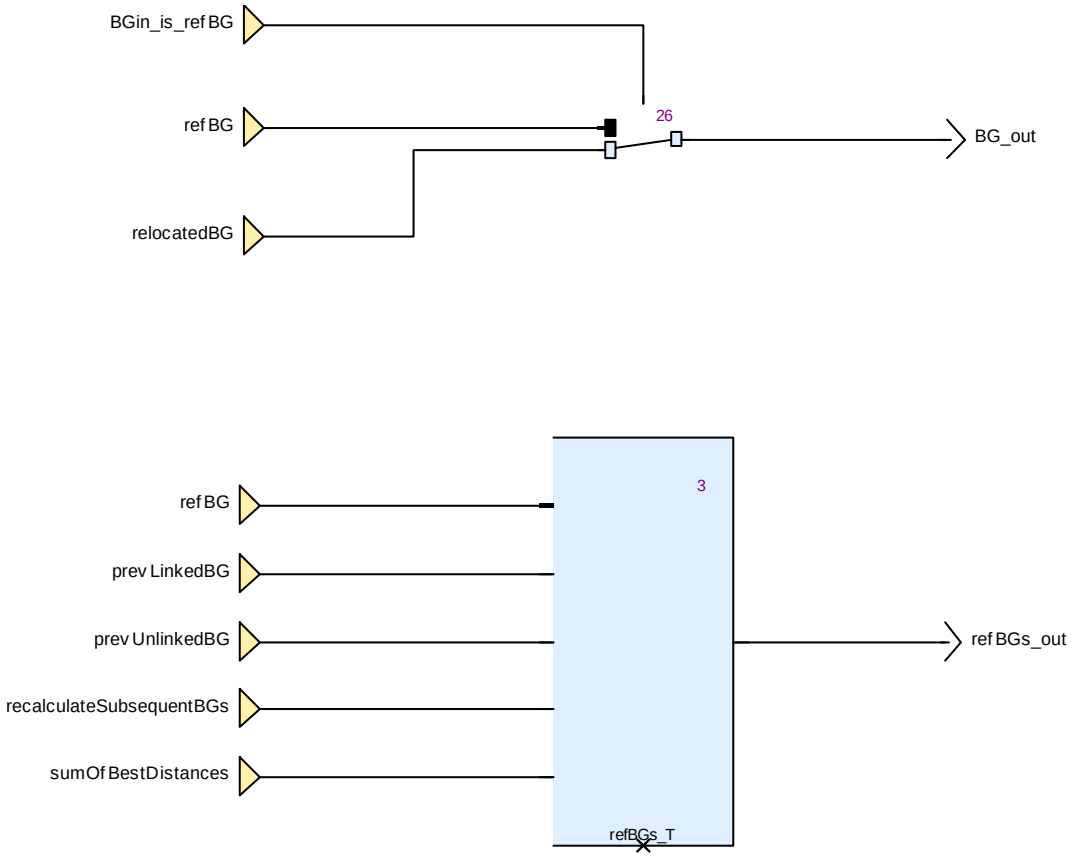


Figure 97: View of diagram_assembleResults (recalculate_BG_locations_ahead_itr)

diagram_assembleResults Comments:

- Assembles the outputs.

14.2.14.5.2. View of diagram_assign_refBG (recalculate_BG_locations_ahead_itr)

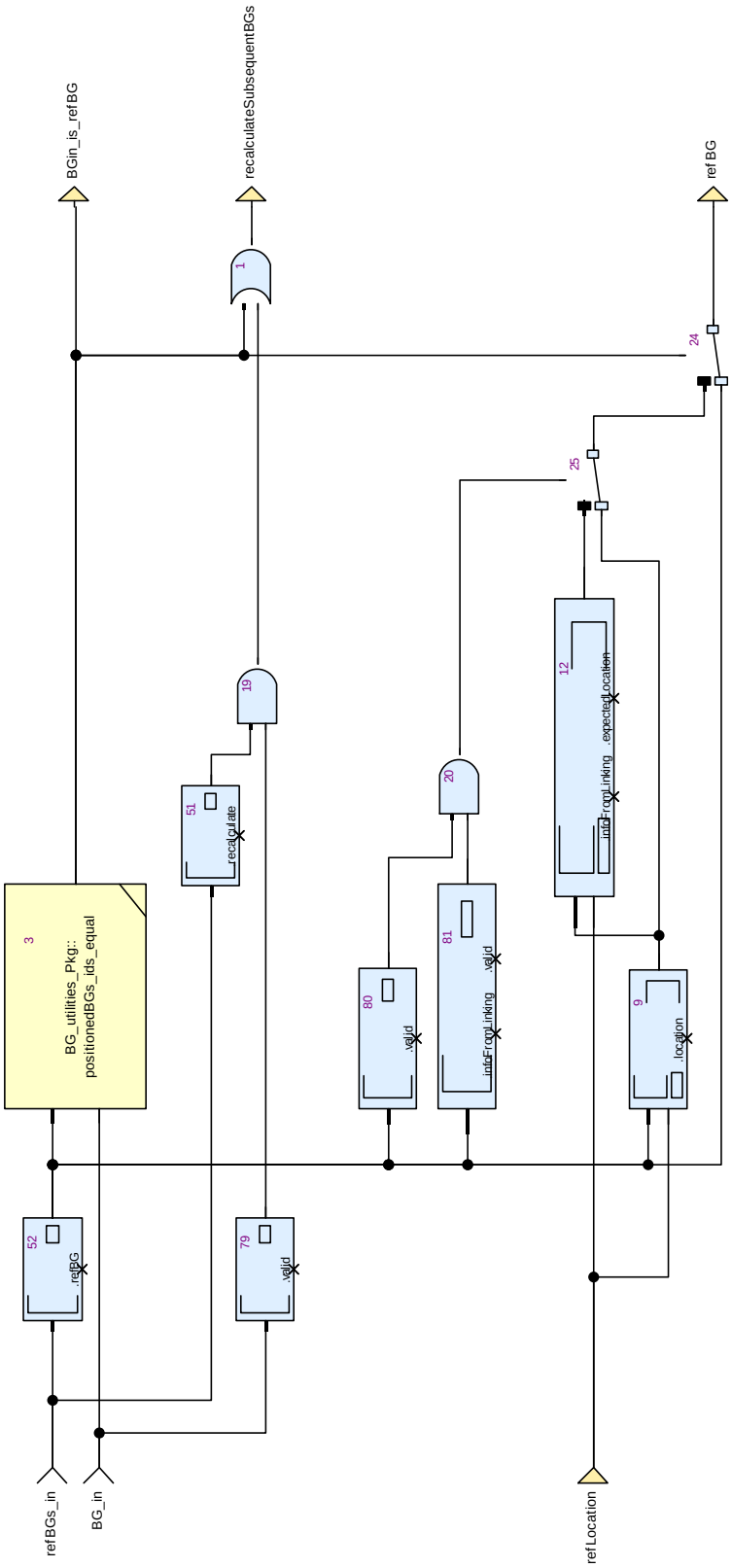


Figure 98: View of diagram_assign_refBG (recalculate_BG_locations_ahead_itr)

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.

14.2.14.5.3. View of diagram_calculate_BGin_inaccuracies (recalculate_BG_locations_ahead_itr)

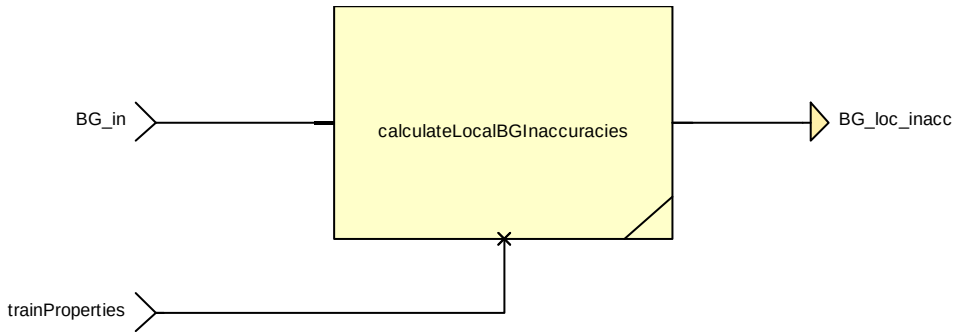


Figure 99: View of diagram_calculate_BGin_inaccuracies (recalculate_BG_locations_ahead_itr)

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.

14.2.14.5.4. View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_ahead_itr)

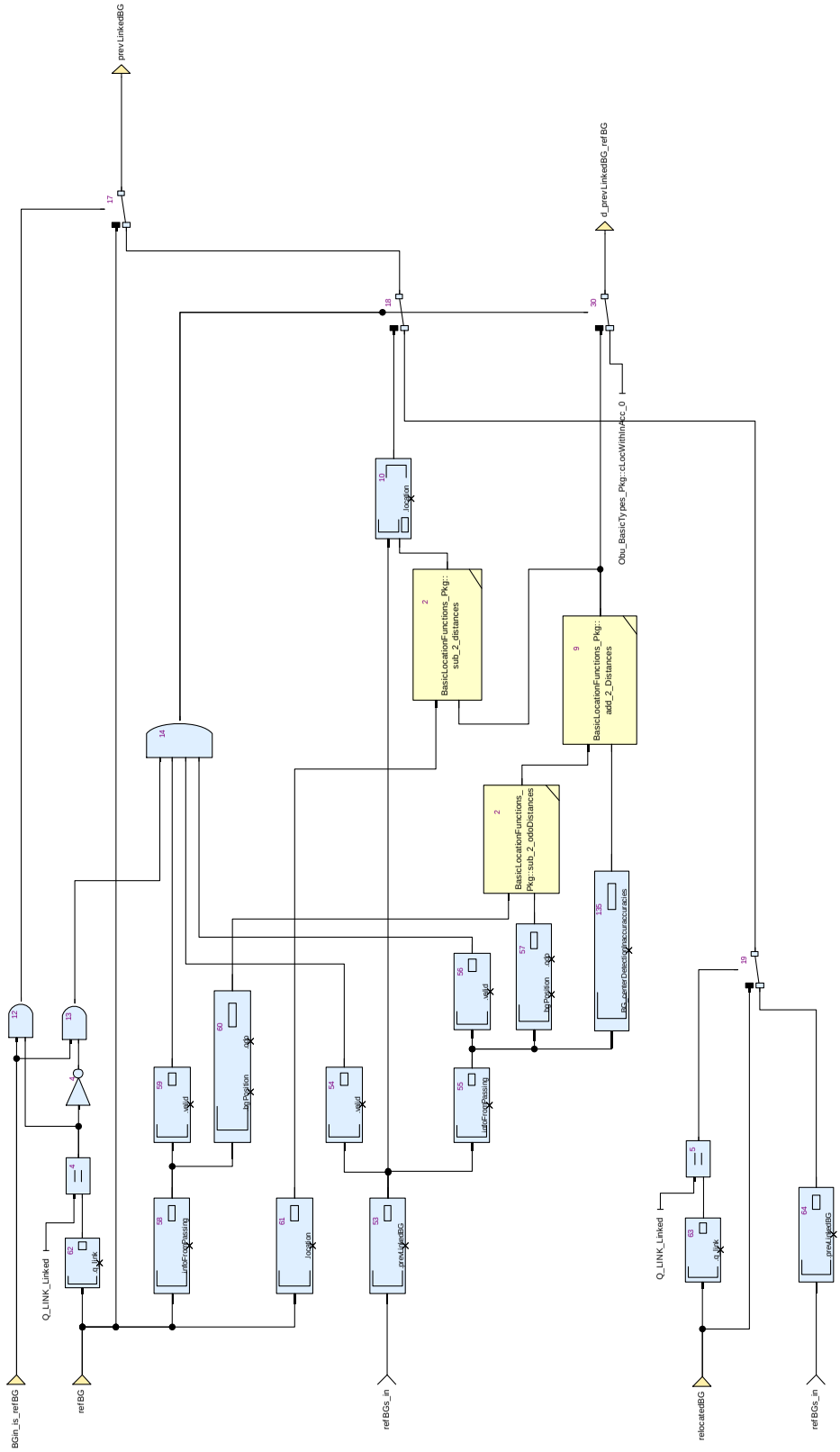


Figure 100: View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_ahead_itr)

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, 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.

14.2.14.5.5. View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_ahead_itr)

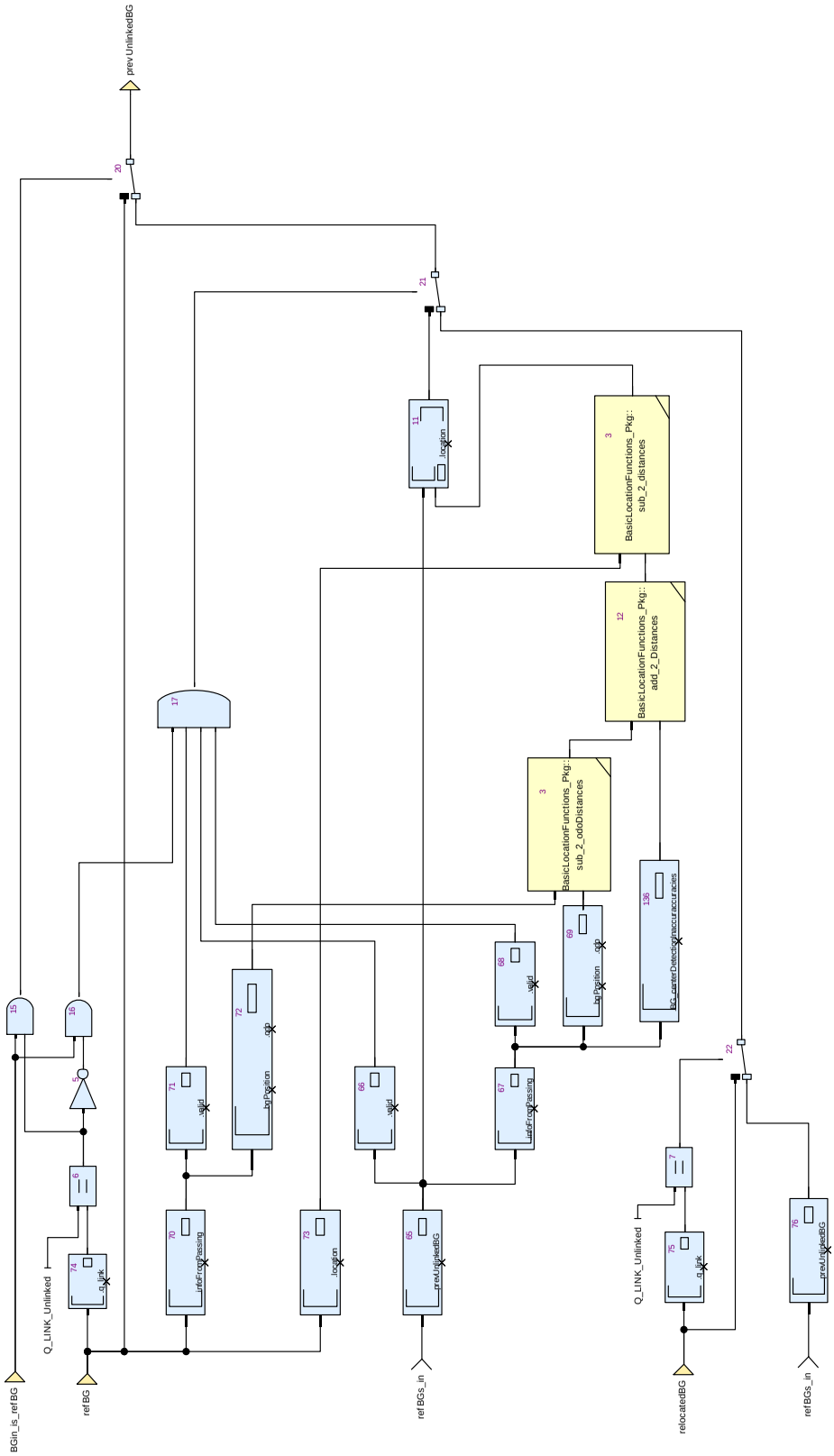


Figure 101: View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_ahead_itr)

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.

14.2.14.5.6. View of diagram_recalculate_BG_location (recalculate_BG_locations_ahead_itr)

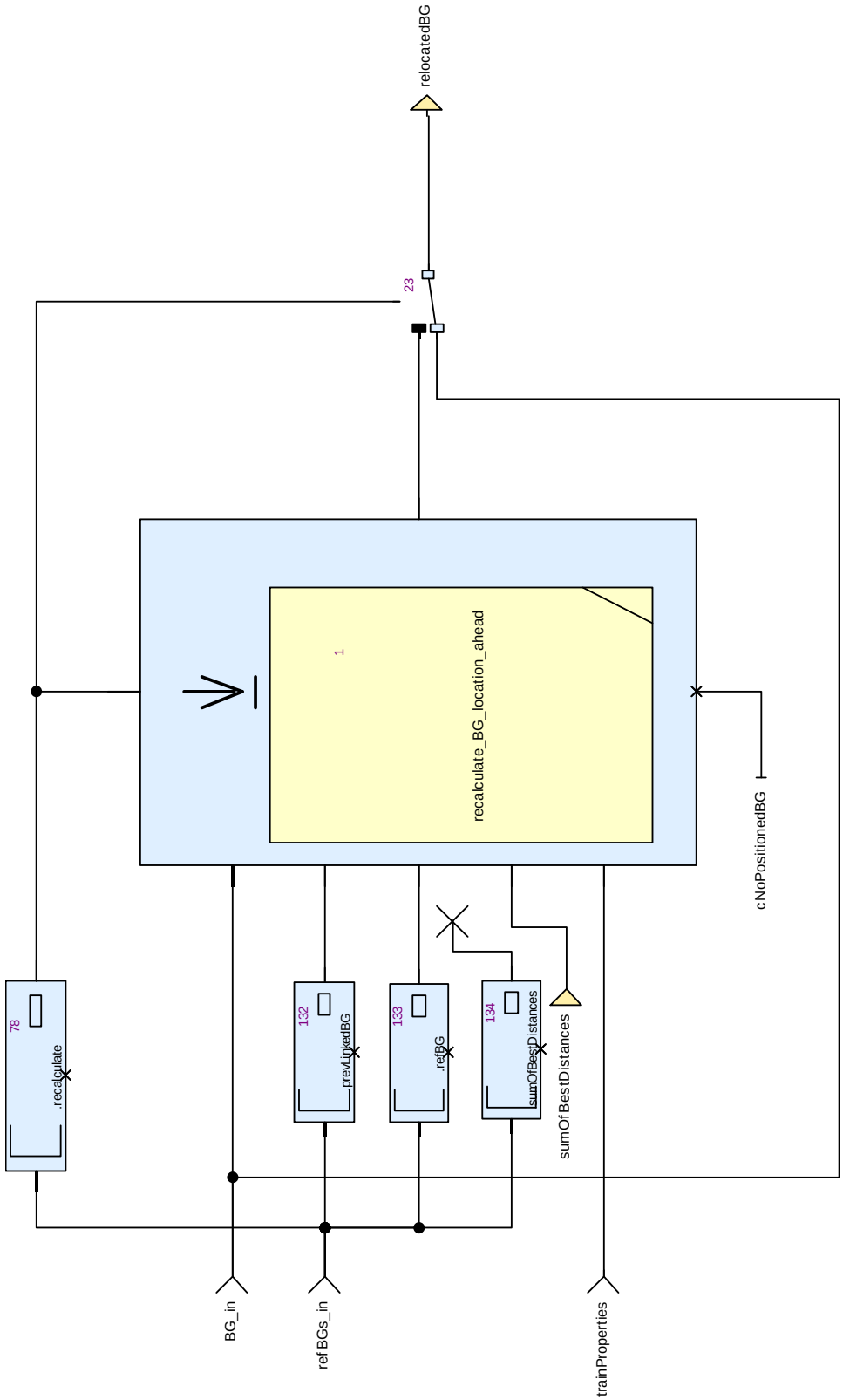


Figure 102: View of diagram_recalculate_BG_location (recalculate_BG_locations_ahead_itr)

14.2.14.5.7. View of diagram_recalculate_refBG_location (recalculate_BG_locations_ahead_itr)

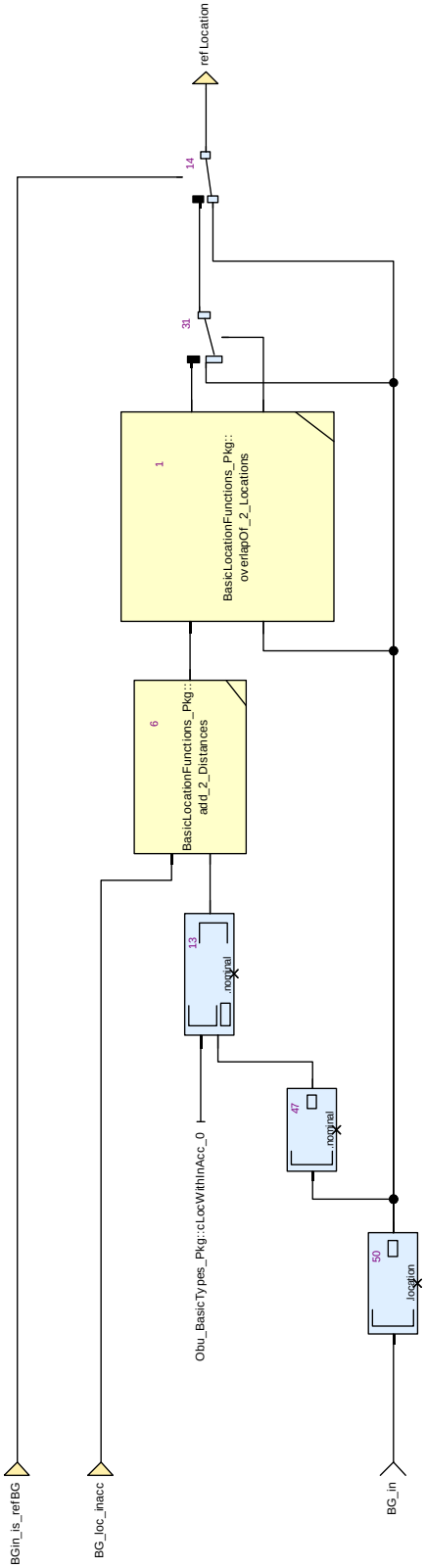


Figure 103: View of diagram_recalculate_refBG_location (recalculate_BG_locations_ahead_itr)

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.

14.2.14.5.8. View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_ahead_itr)

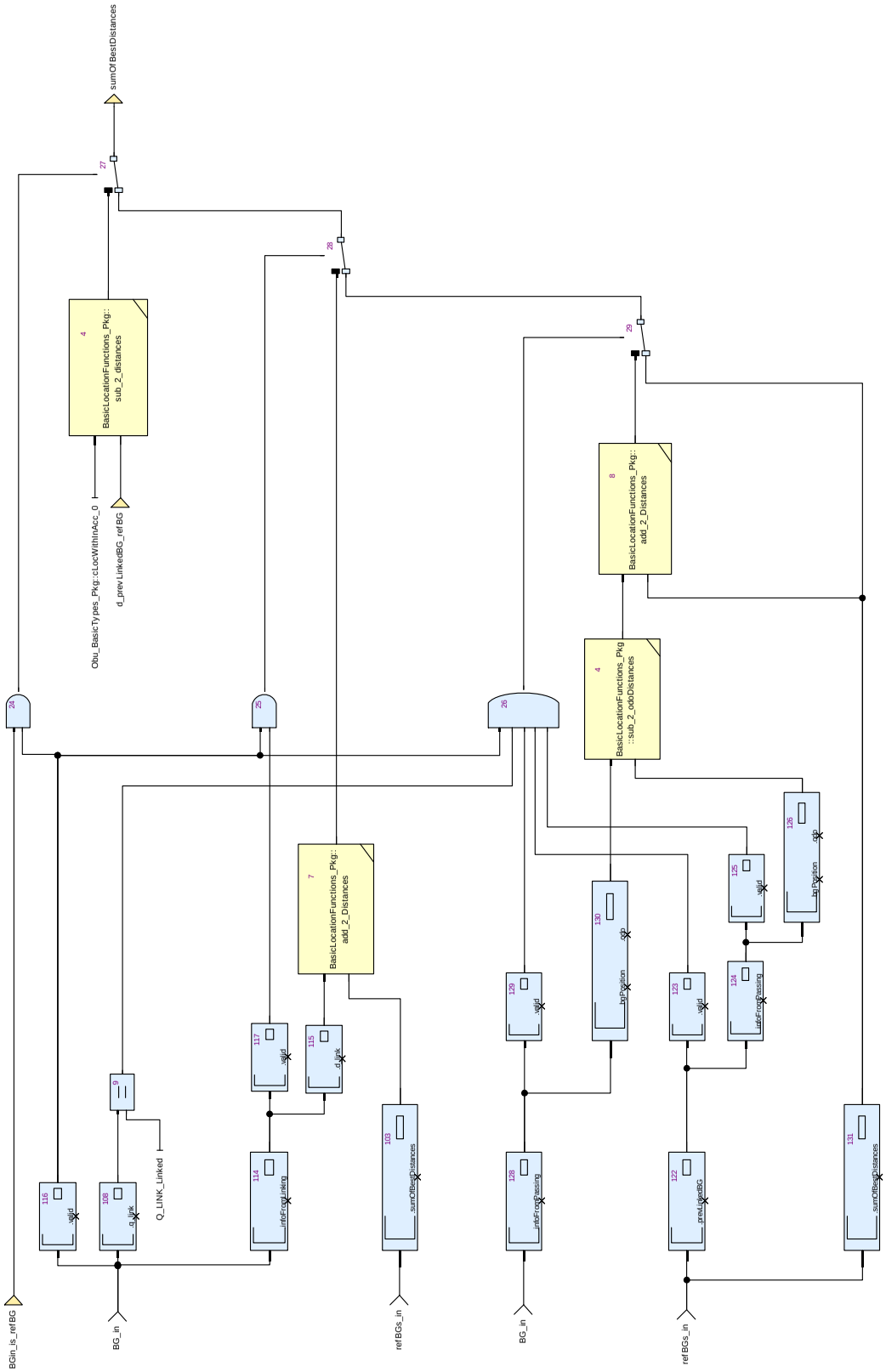


Figure 104: View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_ahead_itr)

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.

14.2.15. recalculate_BG_locations_astern Operator

Declared as **`private function`**

14.2.15.1. 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.

14.2.15.2. Interface

Table 292: 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	**Comments:** The trains properties required for train position calculation.

Table 293: Outputs of recalculate_BG_locations_astern

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.2.15.3. Operator Hierarchy

diagram : diagram_recalculate_BG_locations_astern_1

14.2.15.4. Graphical and Textual Diagrams

14.2.15.4.1. View of diagram_recalculate_BG_locations_astern_1 (recalculate_BG_locations_astern)

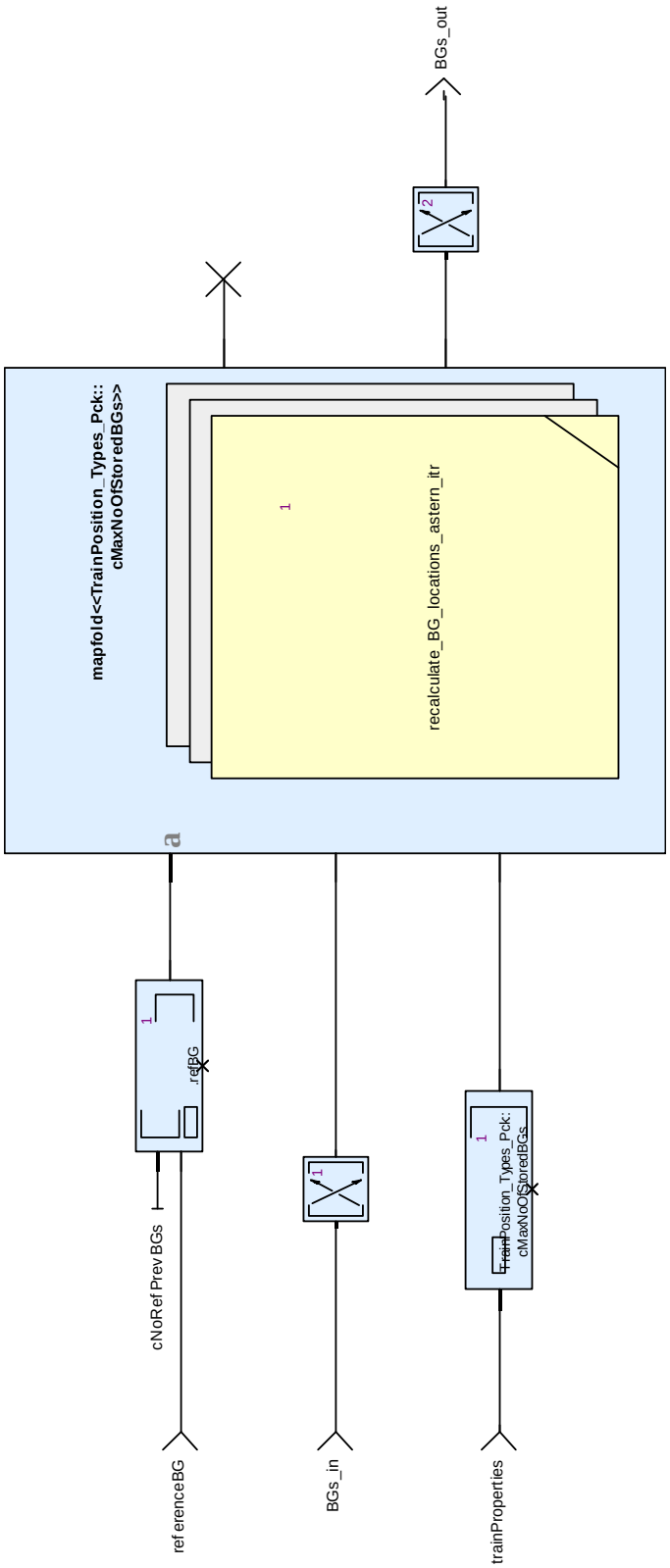


Figure 105: View of diagram_recalculate_BG_locations_astern_1 (recalculate_BG_locations_astern)

14.2.16. recalculate_BG_locations_astern_itr Operator

Declared as **`private function`**

14.2.16.1. 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.

14.2.16.2. Interface

Table 294: 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	**Comments:** The trains properties required for train position calculation.

Table 295: 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.

14.2.16.3. Locals

Table 296: Locals of recalculate_BG_locations_astern_itr

Name	Type	Comments and Information
BGin_is_refBG	bool	
prevLinkedBG	TrainPosition_Types_Pck::positionedBG_T	
prevUnlinkedBG	TrainPosition_Types_Pck::positionedBG_T	

Name	Type	Comments and Information
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.

14.2.16.4. Operator Hierarchy

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

14.2.16.5. Graphical and Textual Diagrams

14.2.16.5.1. View of diagram_assembleResults (recalculate_BG_locations_astern_itr)

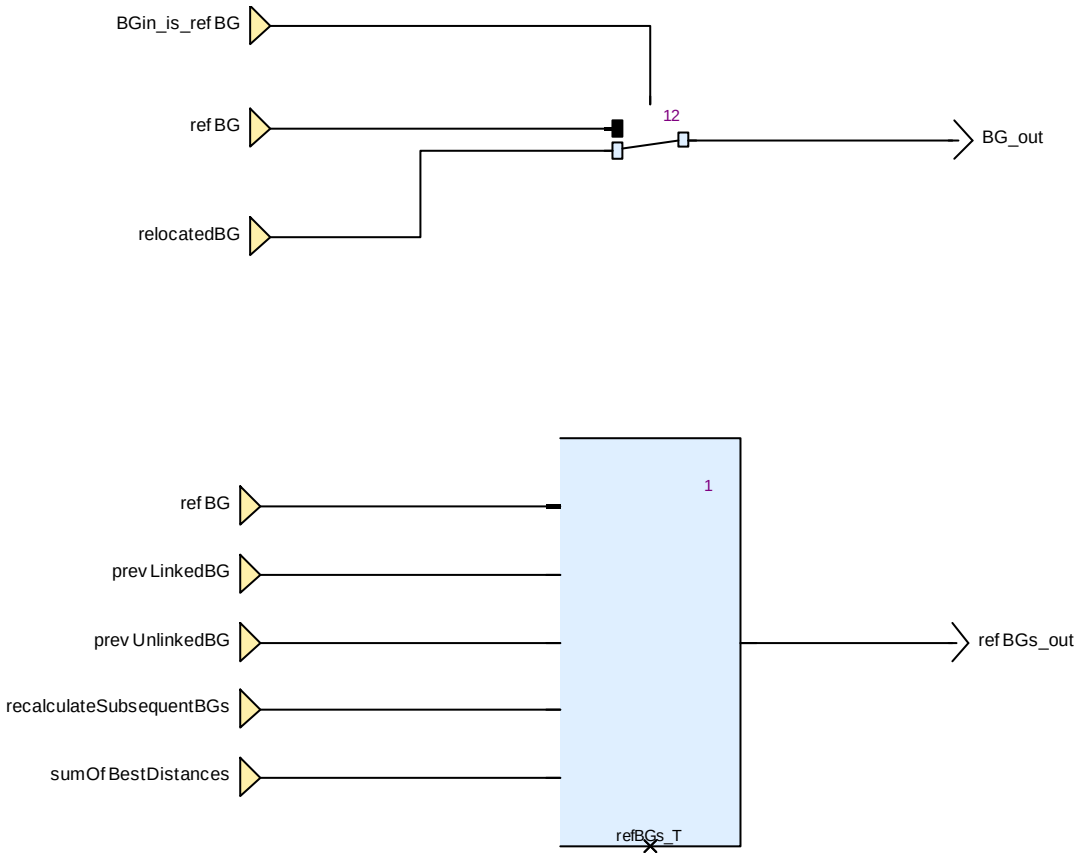


Figure 106: View of diagram_assembleResults (recalculate_BG_locations_astern_itr)

diagram_assembleResults Comments:

- Assembles the outputs.

14.2.16.5.2. View of diagram_assign_refBG (recalculate_BG_locations_astern_itr)

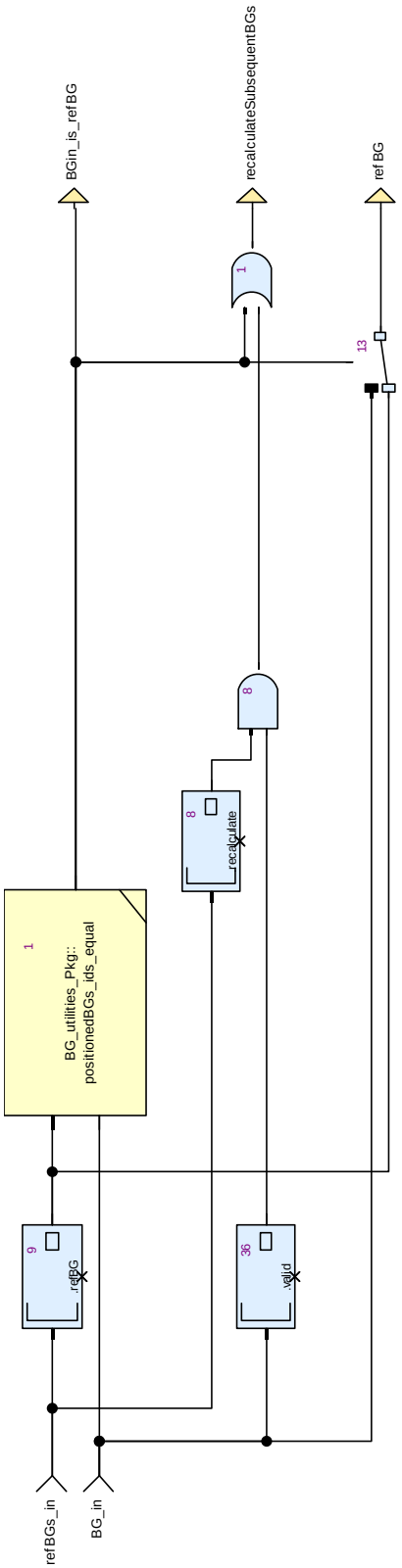


Figure 107: View of diagram_assign_refBG (recalculate_BG_locations_astern_itr)

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.

14.2.16.5.3. View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_astern_itr)

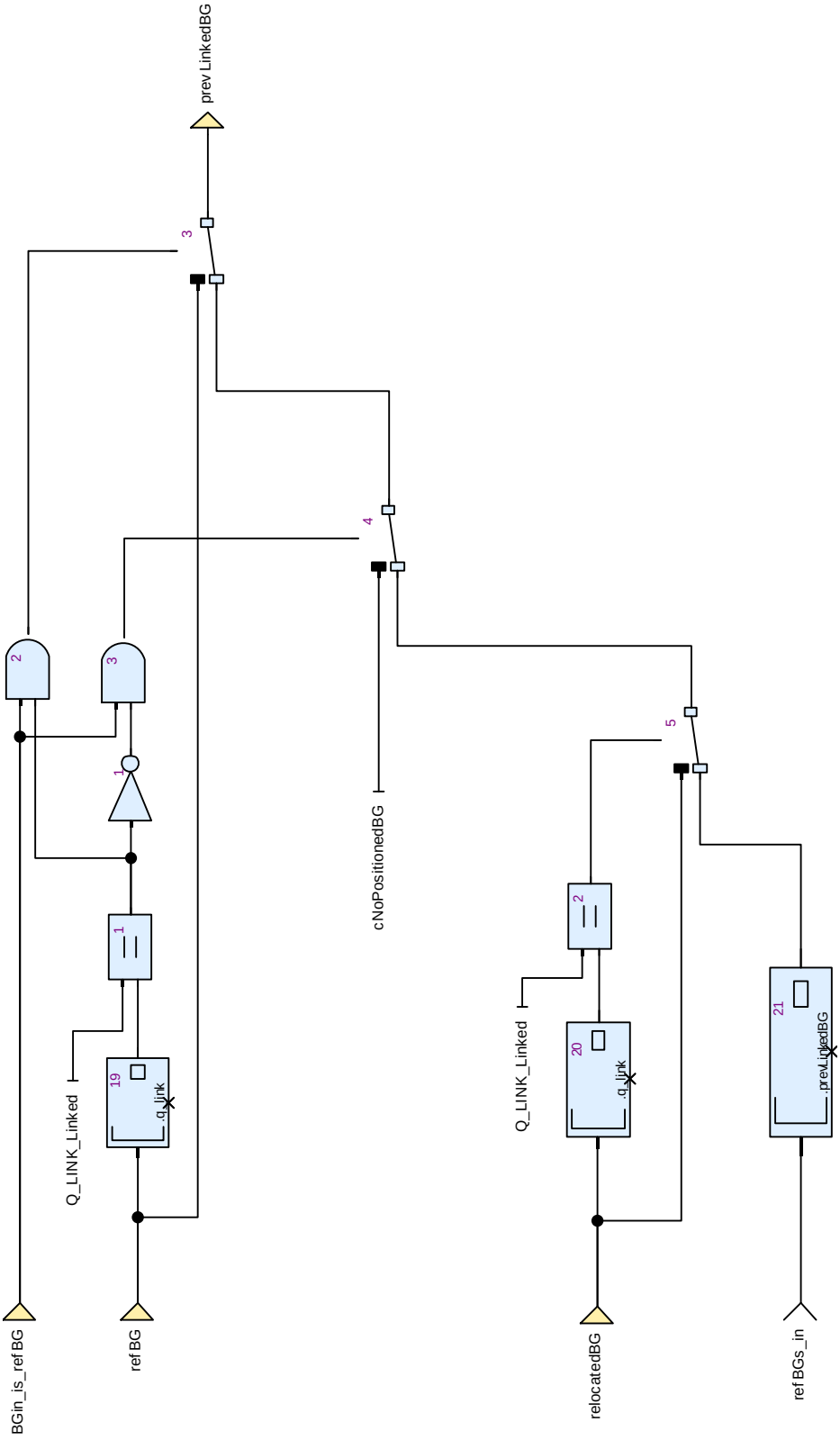


Figure 108: View of diagram_determinePreviousLinkedBG (recalculate_BG_locations_astern_itr)

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.

14.2.16.5.4. View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_astern_itr)

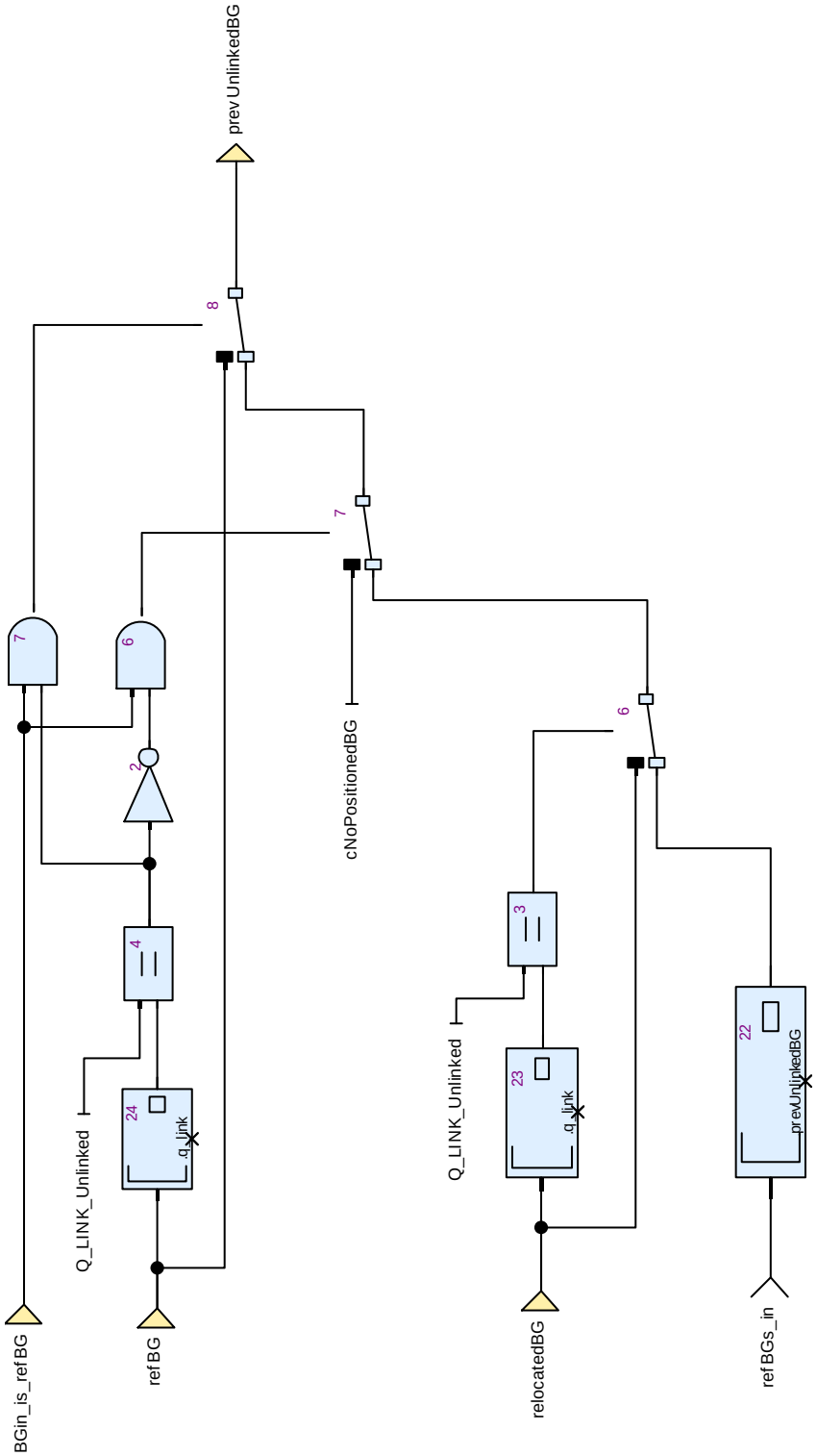


Figure 109: View of diagram_determinePreviousUnlinkedBG (recalculate_BG_locations_astern_itr)

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.

14.2.16.5.5. View of diagram_recalculate_BG_location (recalculate_BG_locations_astern_itr)

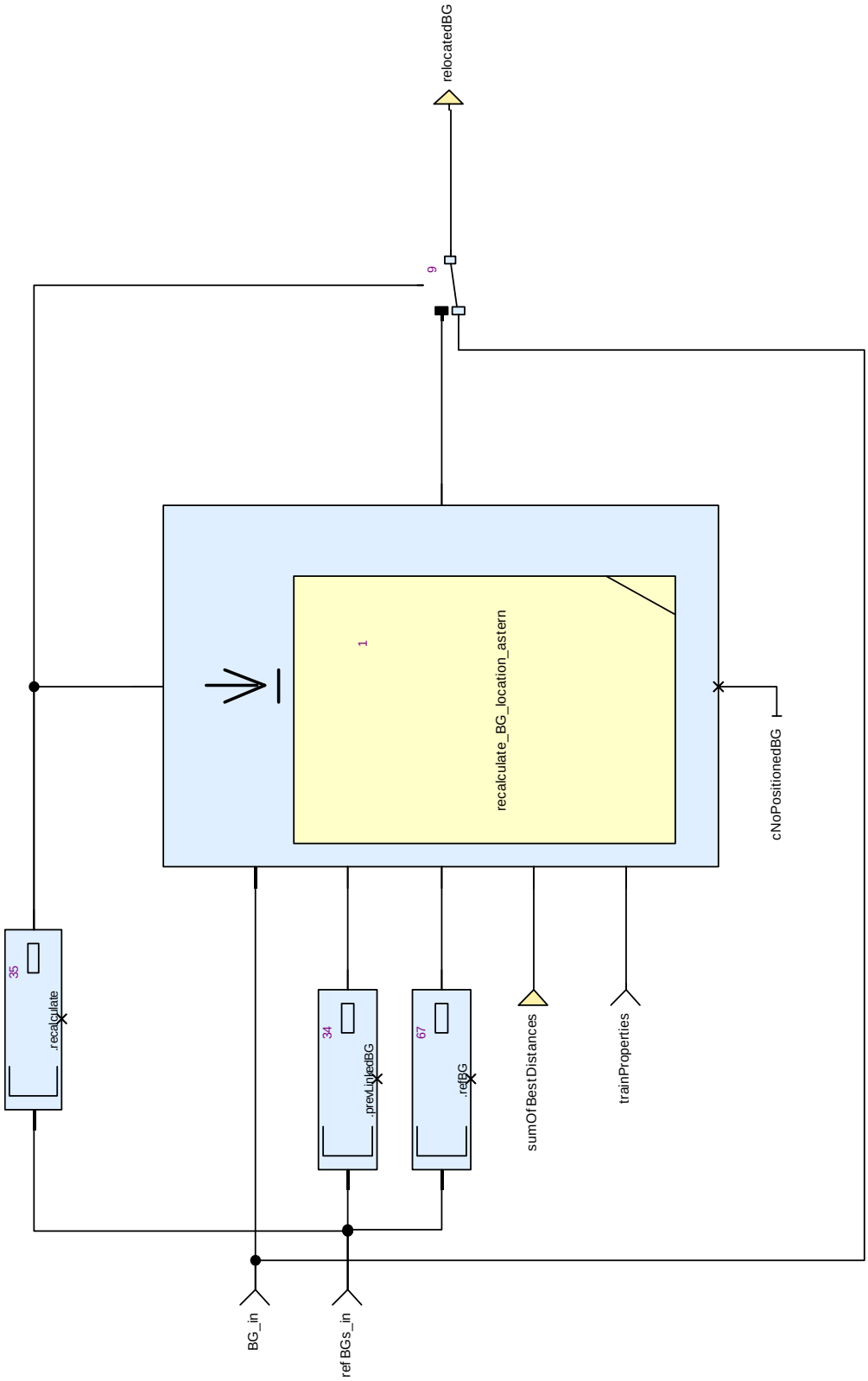


Figure 110: View of diagram_recalculate_BG_location (recalculate_BG_locations_astern_itr)

diagram_recalculate_BG_location Comments:

- Recalculates the location of BG_in.

14.2.16.5.6. View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_astern_itr)

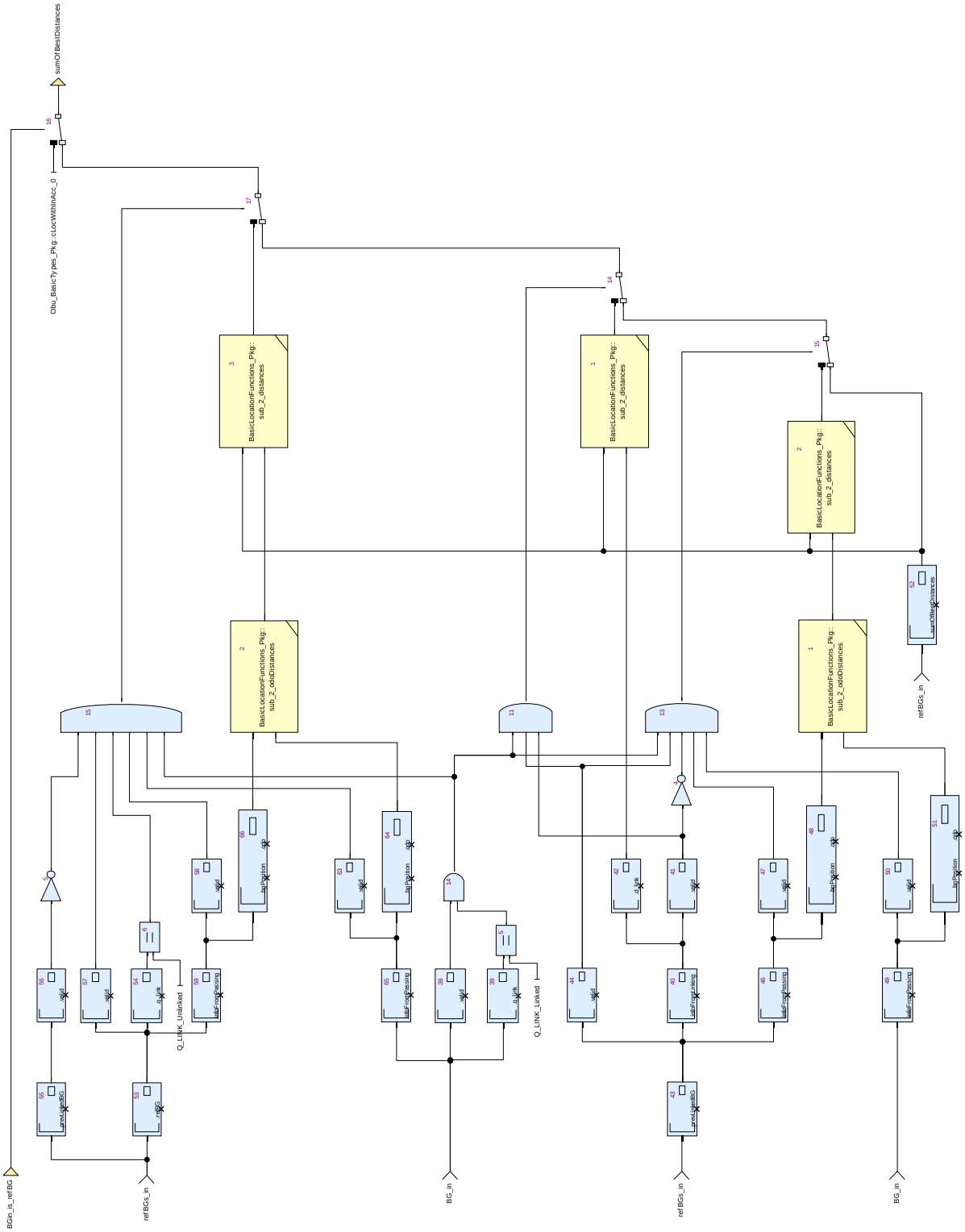


Figure 111: View of diagram_sumOfPrevBestDistances (recalculate_BG_locations_astern_itr)

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.

14.3. CalculateTrainPosition_Pkg::BG_utilities_Pkg Package

14.3.1. Types

Table 297: 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

14.3.2. Constants

Table 298: 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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

14.3.3. countBGs Operator

Declared as **`public function`**

14.3.3.1. Comments and Information

countBGs Comments:

- Determines the linked, unlinked and total number of BGs in BG_in.

14.3.3.2. Interface

Table 299: Inputs of countBGs

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

Table 300: 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	

14.3.3.3. Operator Hierarchy

diagram : diagram_countBGs_1

14.3.3.4. Graphical and Textual Diagrams

14.3.3.4.1. View of diagram_countBGs_1 (countBGs)

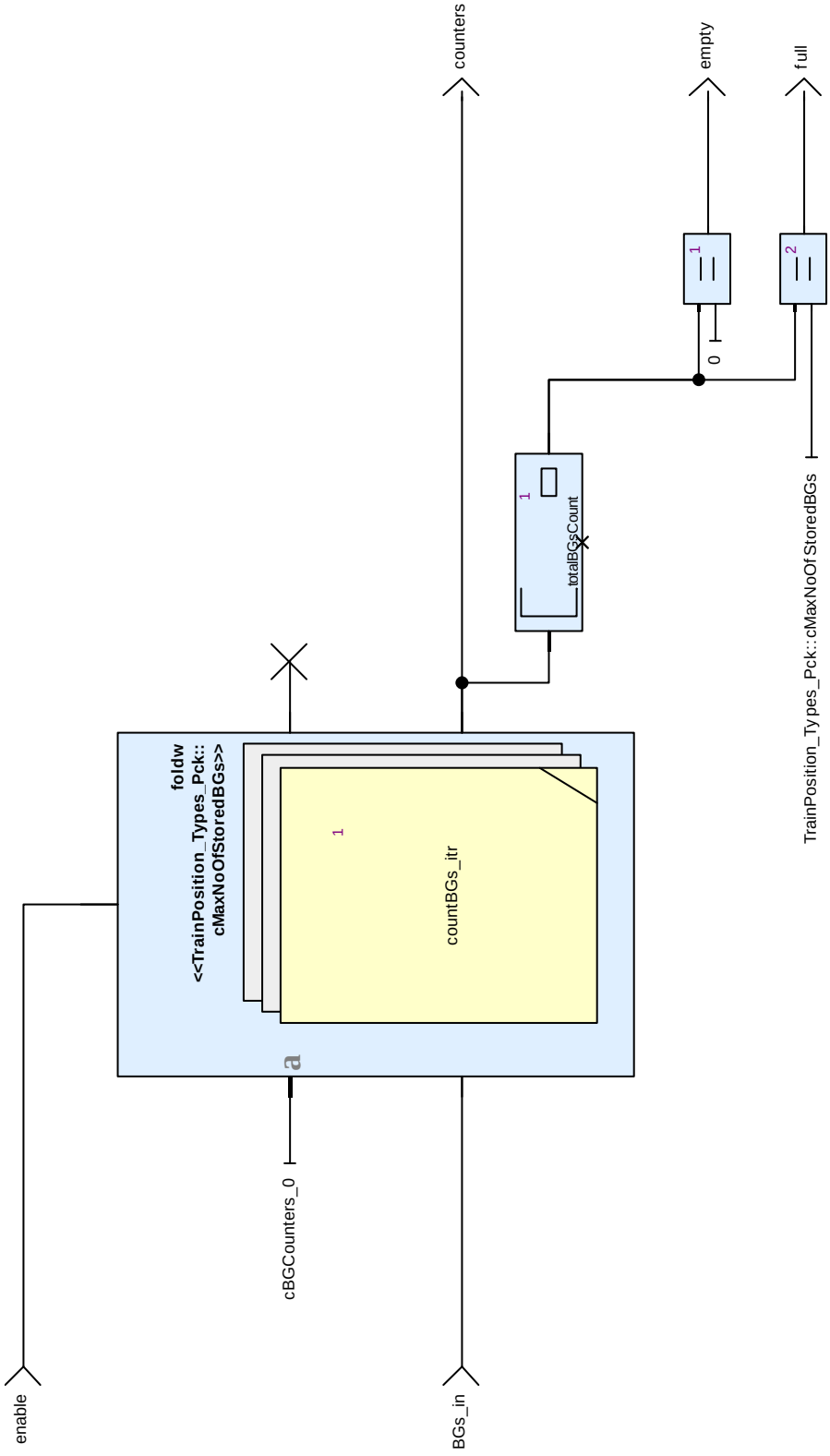


Figure 112: View of diagram_countBGs_1 (countBGs)

14.3.4. countBGs_itr Operator

Declared as **`private function`**

14.3.4.1. Comments and Information

countBGs_itr Comments:

- Iterated function for countBGs

14.3.4.2. Interface

Table 301: 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 302: Outputs of countBGs_itr

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

14.3.4.3. Operator Hierarchy

diagram : diagram_countBGs_itr_1

14.3.4.4. Graphical and Textual Diagrams

14.3.4.4.1. View of diagram_countBGs_itr_1 (countBGs_itr)

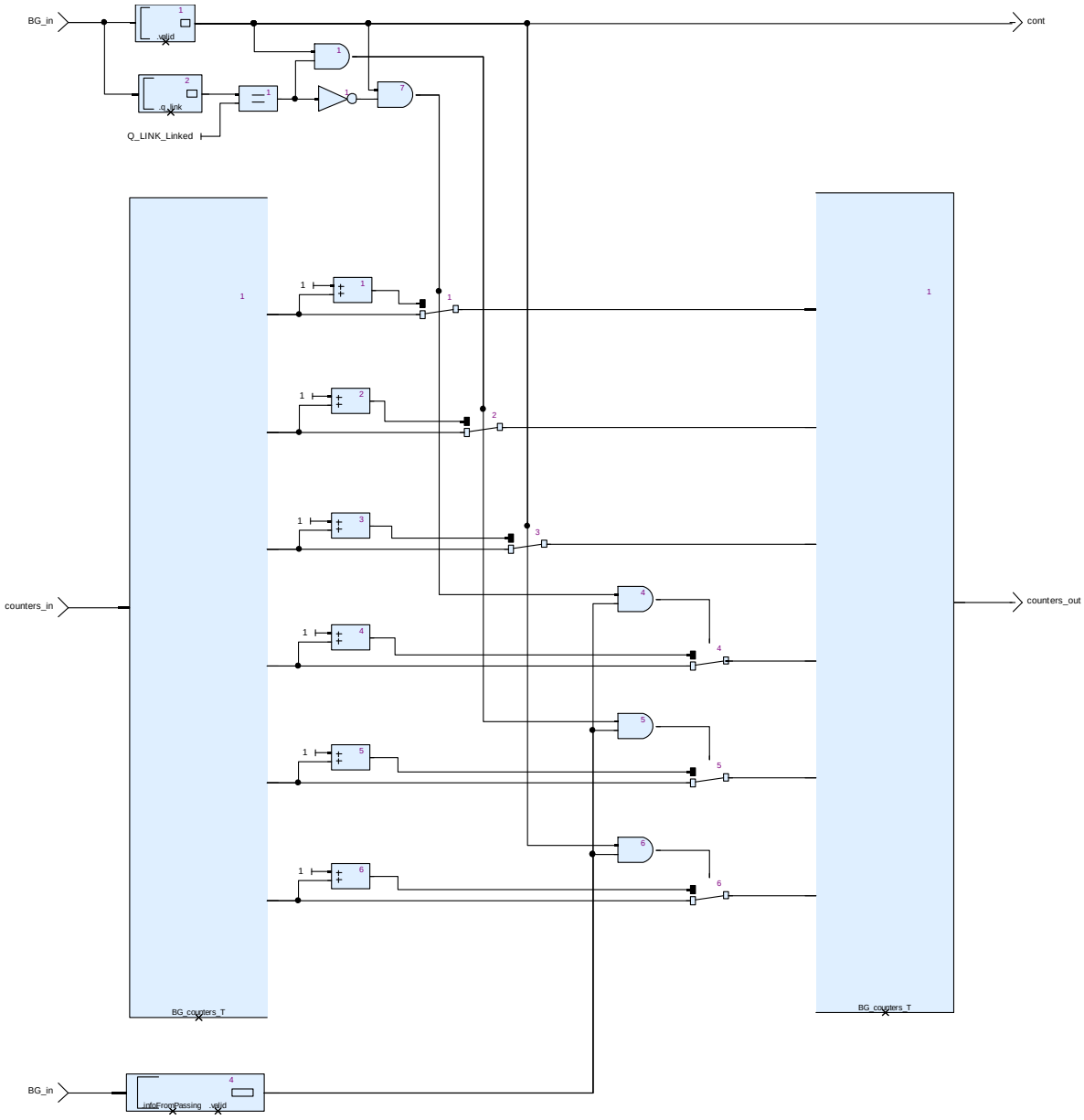


Figure 113: View of diagram_countBGs_itr_1 (countBGs_itr)

14.3.5. deleteBG_atIndex Operator

Declared as **`public function`**

14.3.5.1. 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.

14.3.5.2. Interface

Table 303: 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 304: Outputs of deleteBG_atIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.3.5.3. Operator Hierarchy

diagram : diagram_deleteBG_atIndex_1

14.3.5.4. Graphical and Textual Diagrams

14.3.5.4.1. View of diagram_deleteBG_atIndex_1 (deleteBG_atIndex)

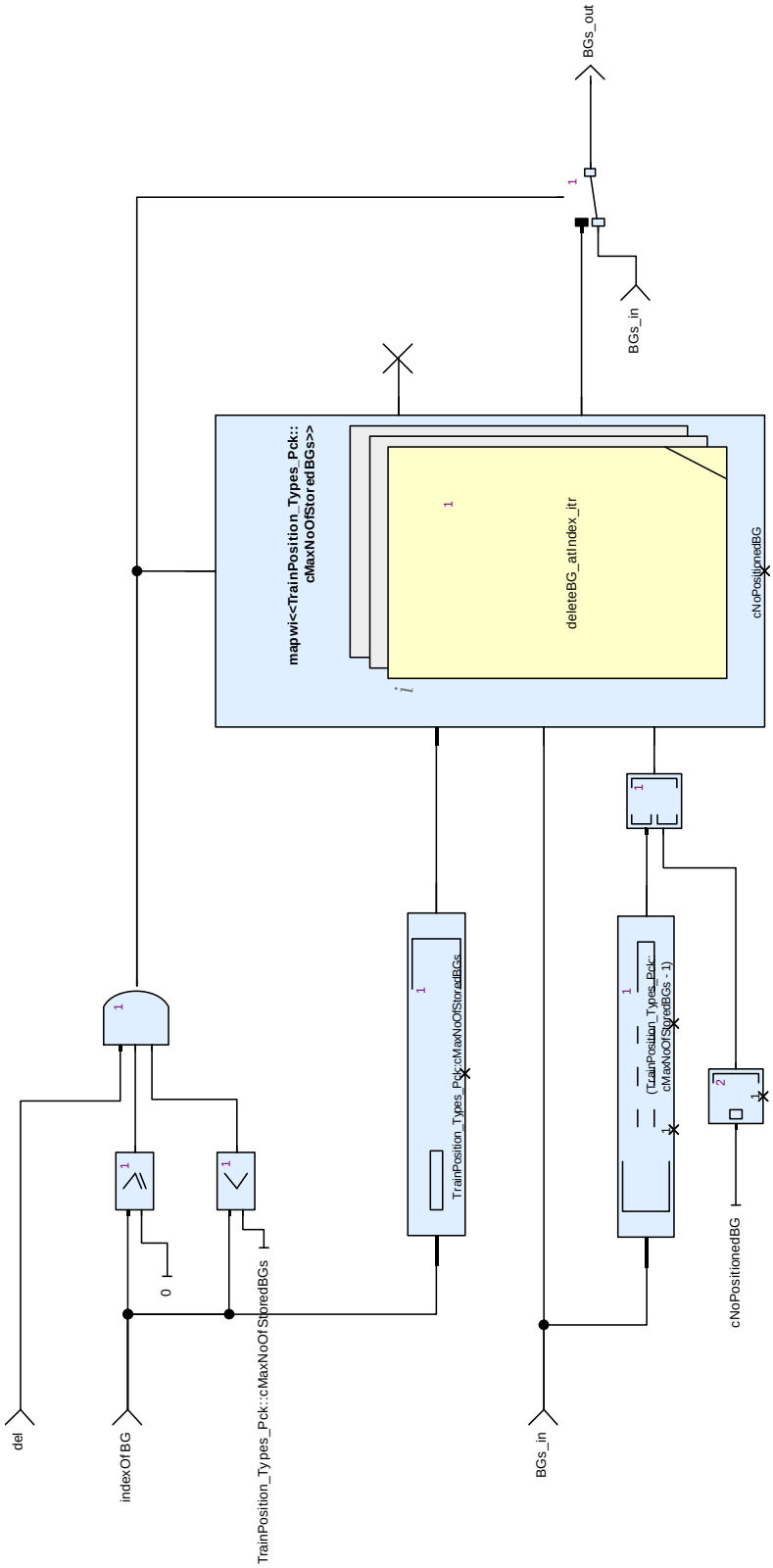


Figure 114: View of diagram_deleteBG_atIndex_1 (deleteBG_atIndex)

14.3.6. deleteBG_atIndex_itr Operator

Declared as **`private function`**

14.3.6.1. Comments and Information

deleteBG_atIndex_itr Comments:

- Iterated function used by deleteBG_atIndex

14.3.6.2. Interface

Table 305: 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 306: Outputs of deleteBG_atIndex_itr

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

14.3.6.3. Operator Hierarchy

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

14.3.6.4. Graphical and Textual Diagrams

14.3.6.4.1. View of diagram_deleteBG_atIndex_itr_1 (deleteBG_atIndex_itr)

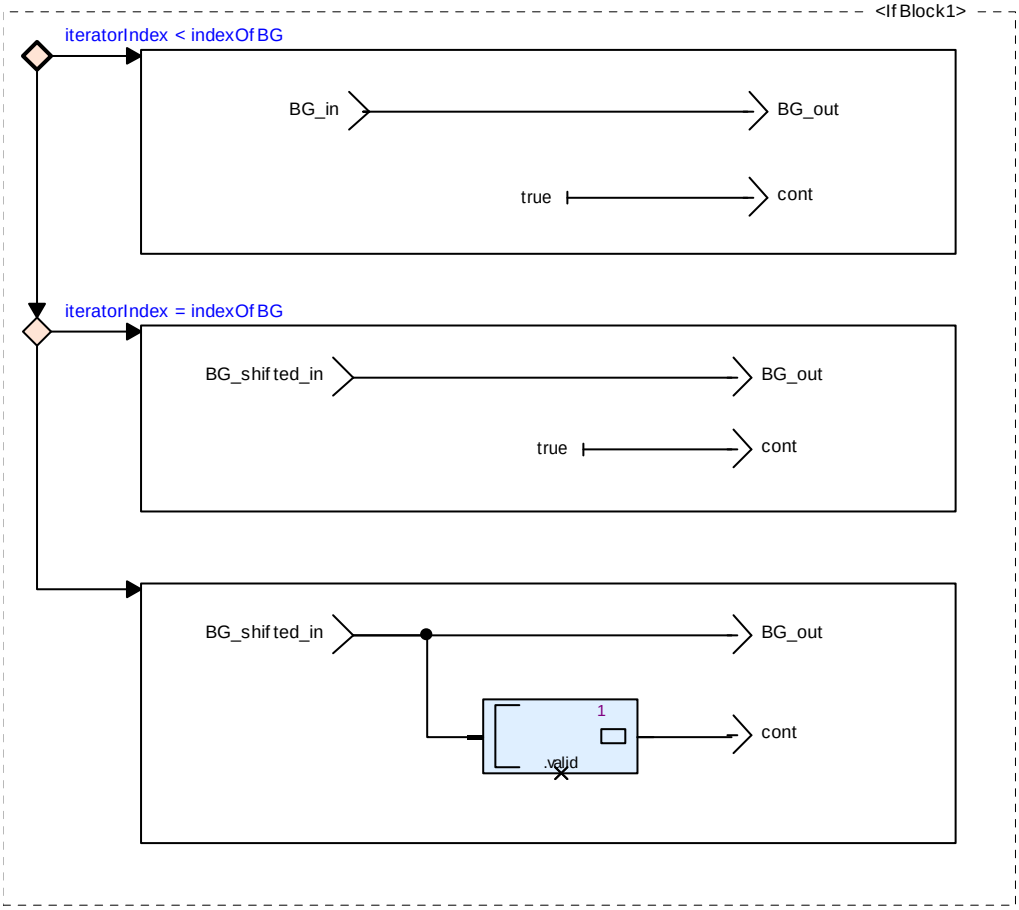


Figure 115: View of diagram_deleteBG_atIndex_itr_1 (deleteBG_atIndex_itr)

Table 307: Conditional Blocks of diagram_deleteBG_atIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 308: Actions of diagram_deleteBG_atIndex_itr_1

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

14.3.7. deleteBGs_beforeIndex Operator

Declared as **`public function`**

14.3.7.1. Comments and Information

deleteBGs_beforeIndex Comments:

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

14.3.7.2. Interface

Table 309: 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 310: Outputs of deleteBGs_beforeIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.3.7.3. Operator Hierarchy

diagram : diagram_deleteBGs_beforeIndex_1

14.3.7.4. Graphical and Textual Diagrams

14.3.7.4.1. View of diagram_deleteBGs_beforeIndex_1 (deleteBGs_beforeIndex)

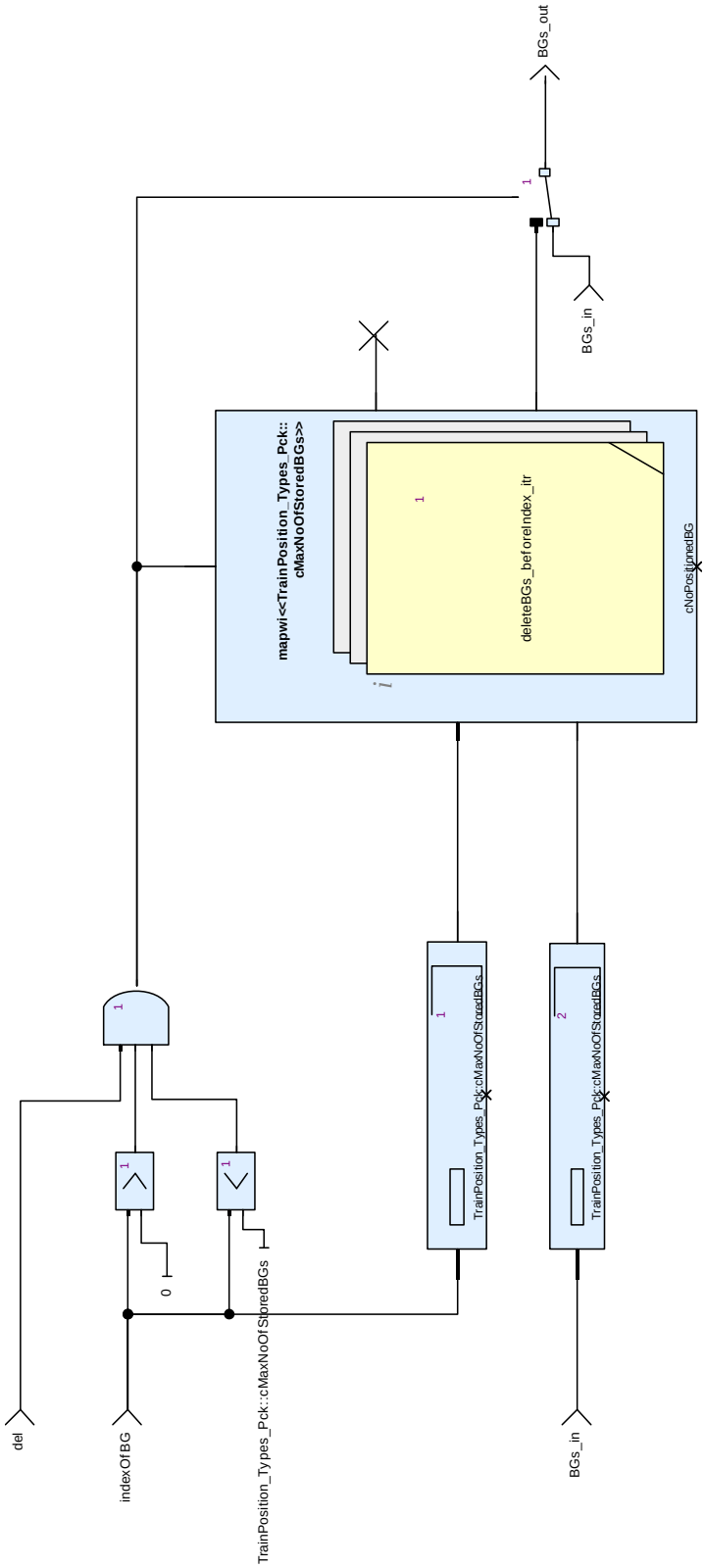


Figure 116: View of diagram_deleteBGs_beforeIndex_1 (deleteBGs_beforeIndex)

14.3.8. deleteBGs_beforeIndex_itr Operator

Declared as **`private function`**

14.3.8.1. Comments and Information

deleteBGs_beforeIndex_itr Comments:

- Iterated function used by deleteBGs_beforeIndex

14.3.8.2. Interface

Table 311: Inputs of deleteBGs_beforeIndex_itr

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

Table 312: Outputs of deleteBGs_beforeIndex_itr

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

14.3.8.3. Operator Hierarchy

diagram : diagram_deleteBGs_beforeIndex_itr_1

14.3.8.4. Graphical and Textual Diagrams

14.3.8.4.1. View of diagram_deleteBGs_beforeIndex_itr_1 (deleteBGs_beforeIndex_itr)

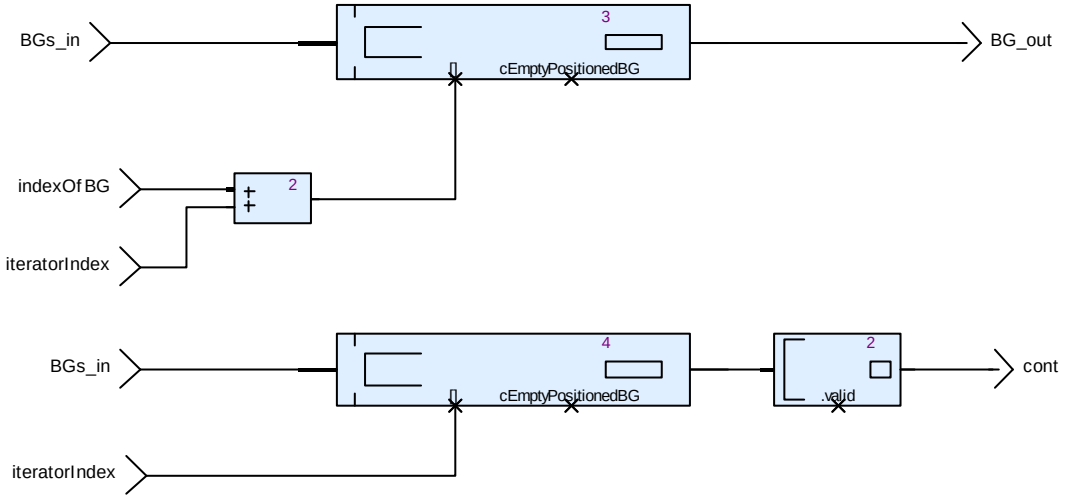


Figure 117: View of diagram_deleteBGs_beforeIndex_itr_1 (deleteBGs_beforeIndex_itr)

14.3.9. deleteBGs_fromIndex Operator

Declared as **`public function`**

14.3.9.1. Comments and Information

deleteBGs_fromIndex Comments:

- Deletes all BGs in BGs, starting with indexOfBG until the end of the list.

14.3.9.2. Interface

Table 313: 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 314: Outputs of deleteBGs_fromIndex

Name	Type	Comments and Information
BGs_out	TrainPosition_Types_Pck::positionedBGs_T	

14.3.9.3. Operator Hierarchy

diagram : diagram_deleteBGs_fromIndex_1

14.3.9.4. Graphical and Textual Diagrams

14.3.9.4.1. View of diagram_deleteBGs_fromIndex_1 (deleteBGs_fromIndex)

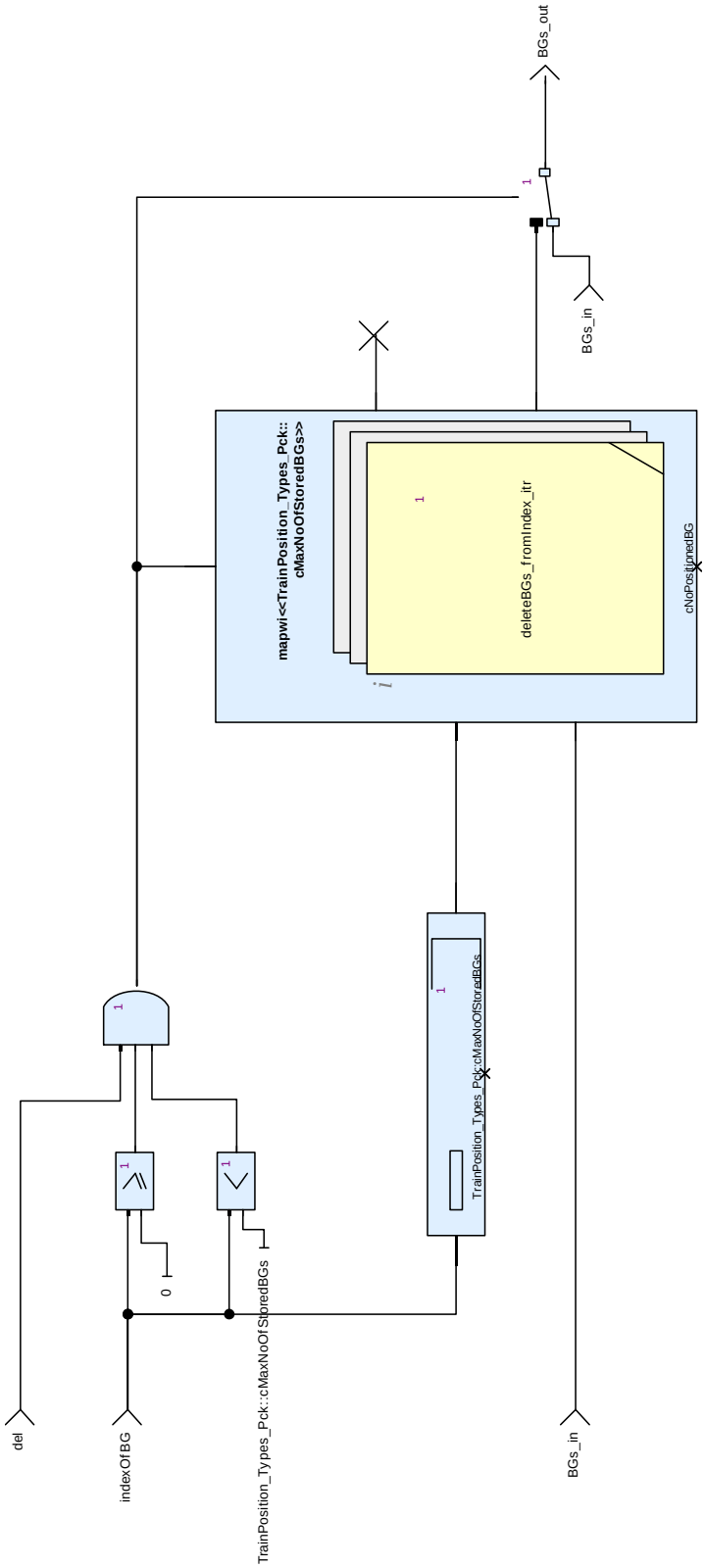


Figure 118: View of diagram_deleteBGs_fromIndex_1 (deleteBGs_fromIndex)

14.3.10. deleteBGs_fromIndex_itr Operator

Declared as **`private function`**

14.3.10.1. Comments and Information

deleteBGs_fromIndex_itr Comments:

- Iterated function used by deleteBGs_fromIndex

14.3.10.2. Interface

Table 315: Inputs of deleteBGs_fromIndex_itr

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

Table 316: Outputs of deleteBGs_fromIndex_itr

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

14.3.10.3. Operator Hierarchy

diagram : diagram_deleteBGs_fromIndex_itr_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else

14.3.10.4. Graphical and Textual Diagrams

14.3.10.4.1. View of diagram_deleteBGs_fromIndex_itr_1 (deleteBGs_fromIndex_itr)

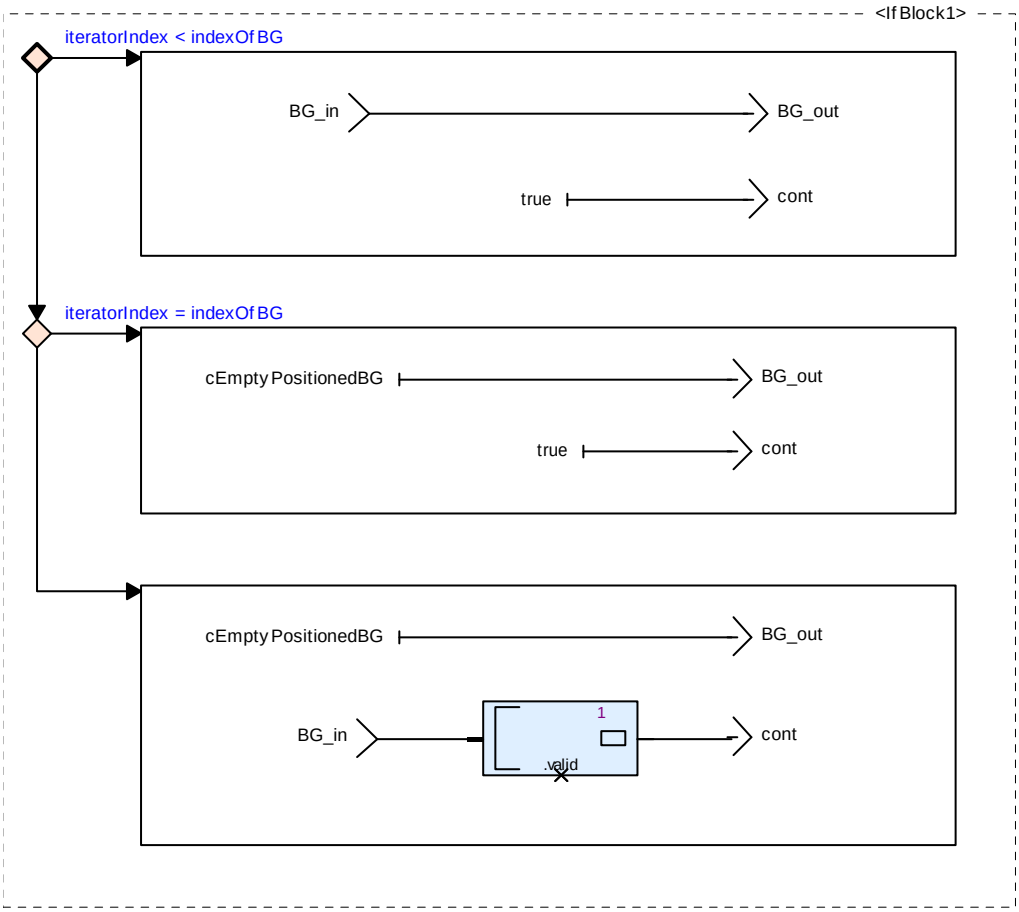


Figure 119: View of diagram_deleteBGs_fromIndex_itr_1 (deleteBGs_fromIndex_itr)

Table 317: Conditional Blocks of diagram_deleteBGs_fromIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 318: Actions of diagram_deleteBGs_fromIndex_itr_1

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

14.3.11. indexOf_nthPassedBG Operator

Declared as **`public function`**

14.3.11.1. Comments and Information

indexOf_nthPassedBG Comments:

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

14.3.11.2. Interface

Table 319: 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 320: Outputs of indexOf_nthPassedBG

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

14.3.11.3. Operator Hierarchy

diagram : diagram_indexOf_nthPassedBG_1

14.3.11.4. Graphical and Textual Diagrams

14.3.11.4.1. View of diagram_indexOf_nthPassedBG_1 (indexOf_nthPassedBG)

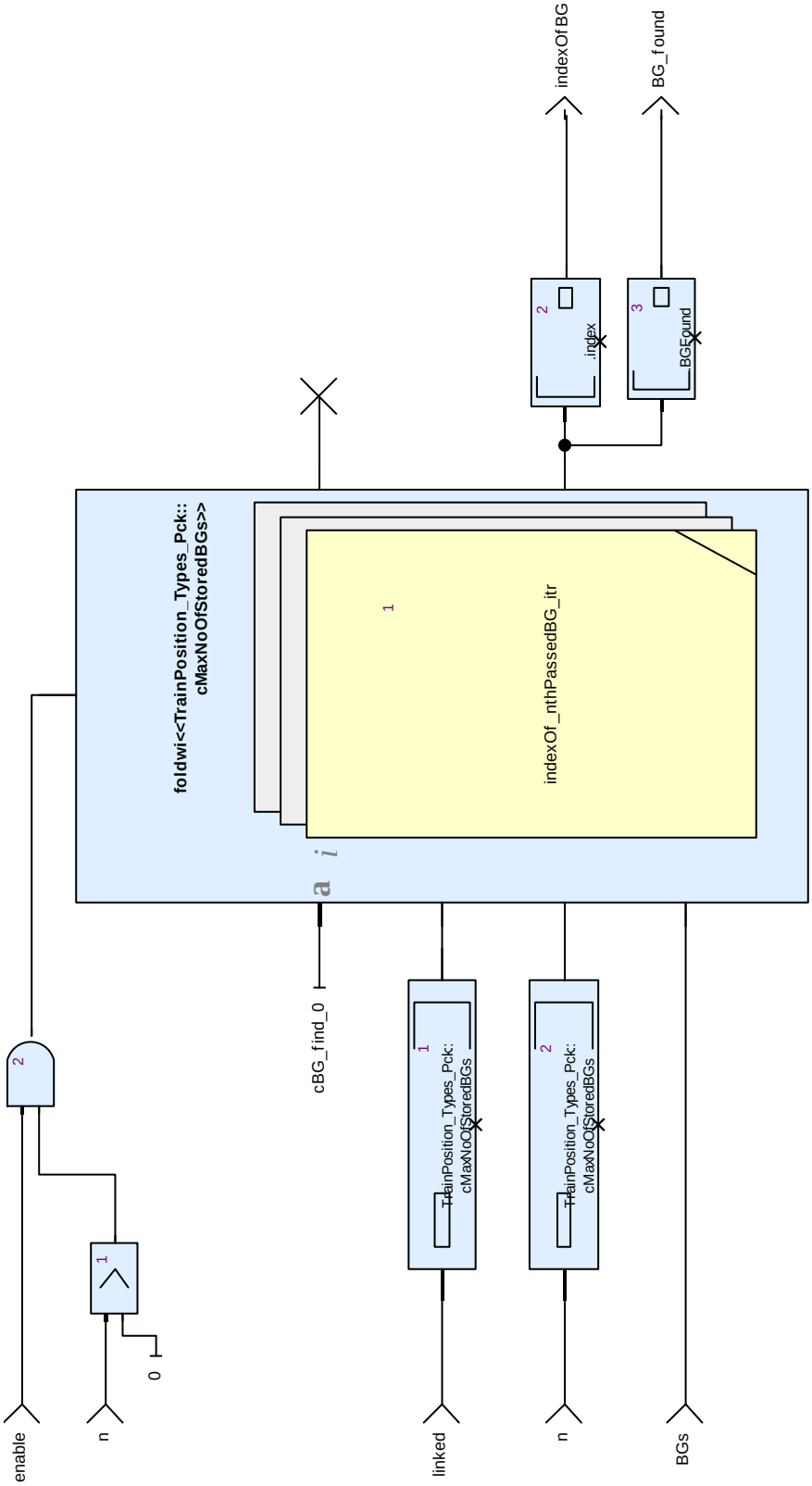


Figure 120: View of diagram_indexOf_nthPassedBG_1 (indexOf_nthPassedBG)

14.3.12. indexOf_nthPassedBG_itr Operator

Declared as **`private function`**

14.3.12.1. Comments and Information

indexOf_nthPassedBG_itr Comments:

- Iterated function for indexOf_nthPassedBG

Table 321: 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

14.3.12.2. Interface

Table 322: 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 323: Outputs of indexOf_nthPassedBG_itr

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

14.3.12.3. Operator Hierarchy

diagram : diagram_indexOf_nthPassedBG_itr_1

14.3.12.4. Graphical and Textual Diagrams

14.3.12.4.1. View of diagram_indexOf_nthPassedBG_itr_1 (indexOf_nthPassedBG_itr)

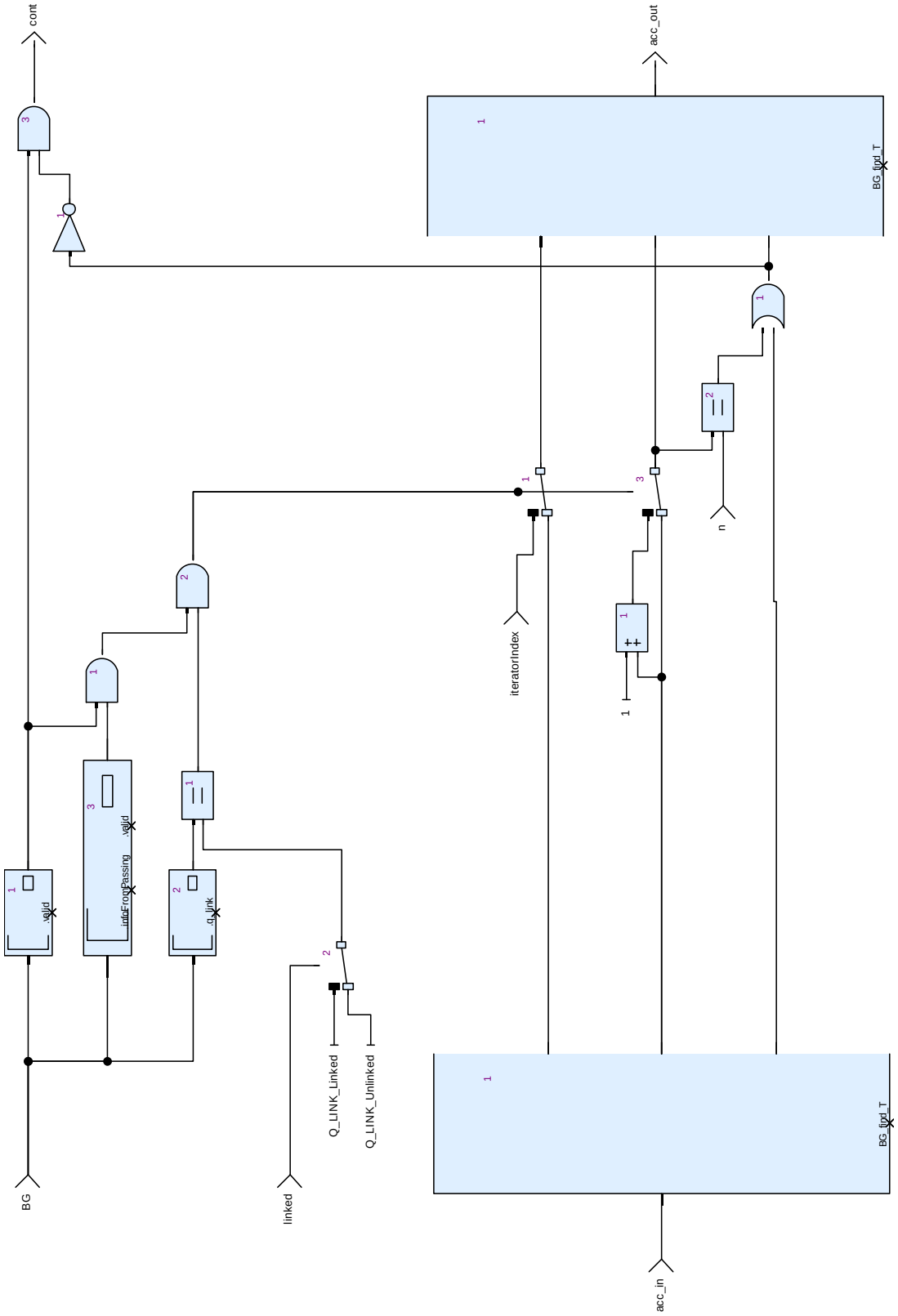


Figure 121: View of diagram_indexOf_nthPassedBG_itr_1 (indexOf_nthPassedBG_itr)

14.3.13. indexOfBG_by_id Operator

Declared as **`public function`**

14.3.13.1. 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 324: 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

14.3.13.2. Interface

Table 325: 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 326: Outputs of indexOfBG_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.

14.3.13.3. Operator Hierarchy

diagram : diagram_indexOfBG_by_id_1

14.3.13.4. Graphical and Textual Diagrams

14.3.13.4.1. View of diagram_indexOfBG_by_id_1 (indexOfBG_by_id)

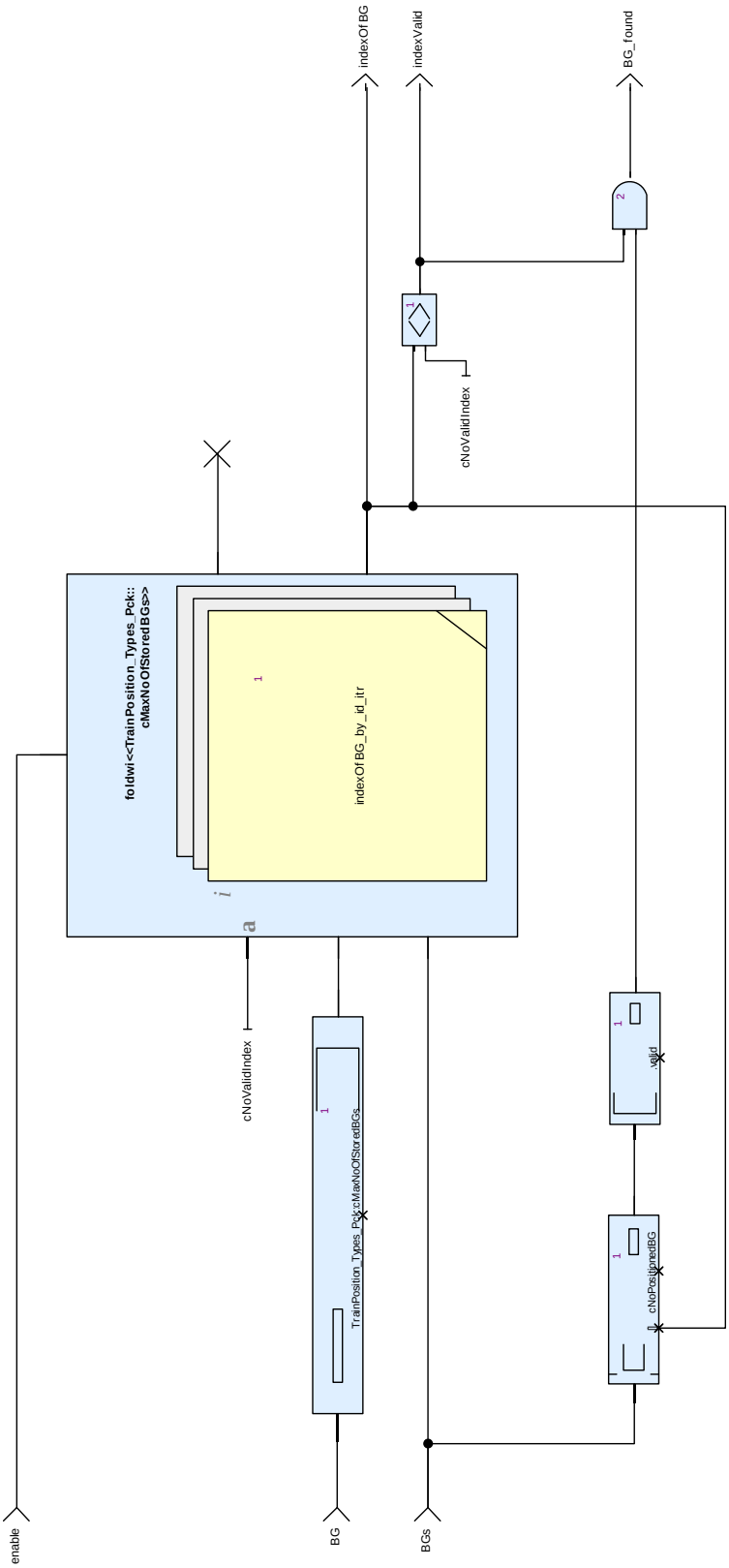


Figure 122: View of diagram_indexOfBG_by_id_1 (indexOfBG_by_id)

14.3.14. indexOfBG_by_id_itr Operator

Declared as **`private function`**

14.3.14.1. Comments and Information

indexOfBG_by_id_itr Comments:

- Iterated function for determing the index of BG in BGs

Table 327: 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

14.3.14.2. Interface

Table 328: 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 329: Outputs of indexOfBG_by_id_itr

Name	Type	Comments and Information
cont	bool	

Name	Type	Comments and Information
indexOfBG	int	

14.3.14.3. Operator Hierarchy

diagram : diagram_indexOfBG_by_id_itr_1

14.3.14.4. Graphical and Textual Diagrams

14.3.14.4.1. View of diagram_indexOfBG_by_id_itr_1 (indexOfBG_by_id_itr)

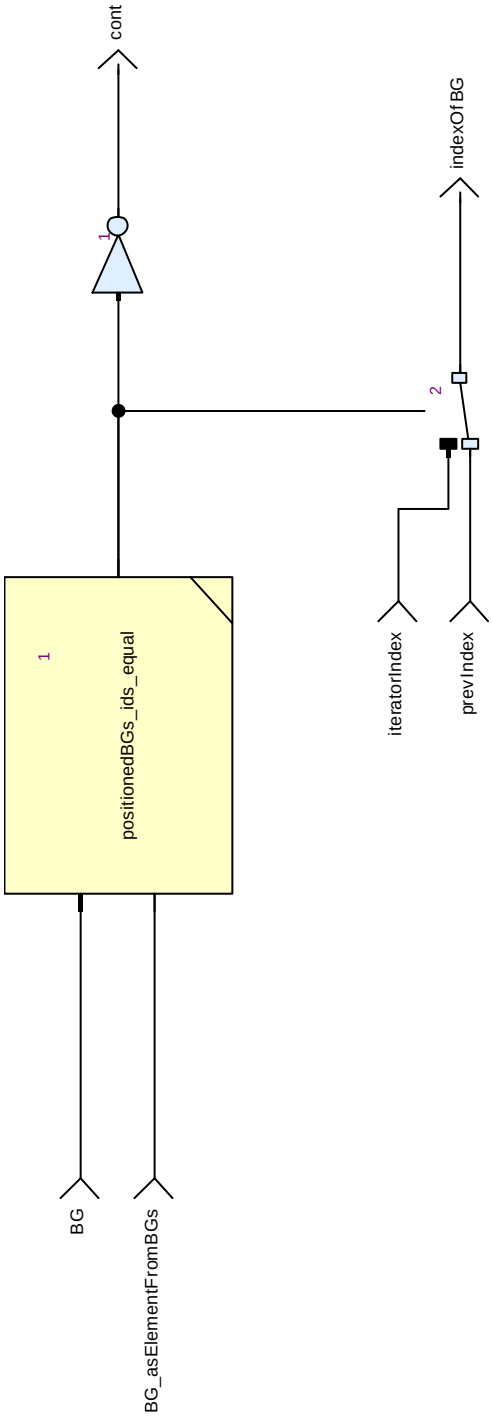


Figure 123: View of diagram_indexOfBG_by_id_itr_1 (indexOfBG_by_id_itr)

14.3.15. indexOfBG_onTrack Operator

Declared as **`public function`**

14.3.15.1. 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 330: 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

14.3.15.2. Interface

Table 331: Inputs of indexOfBG_onTrack

Name	Type	Comments and Information
BG	TrainPosition_Types_Pck::positionedBG_T	

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

Table 332: 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.

14.3.15.3. Operator Hierarchy

diagram : diagram_indexOfBG_onTrack_1

14.3.15.4. Graphical and Textual Diagrams

14.3.15.4.1. View of diagram_indexOfBG_onTrack_1 (indexOfBG_onTrack)

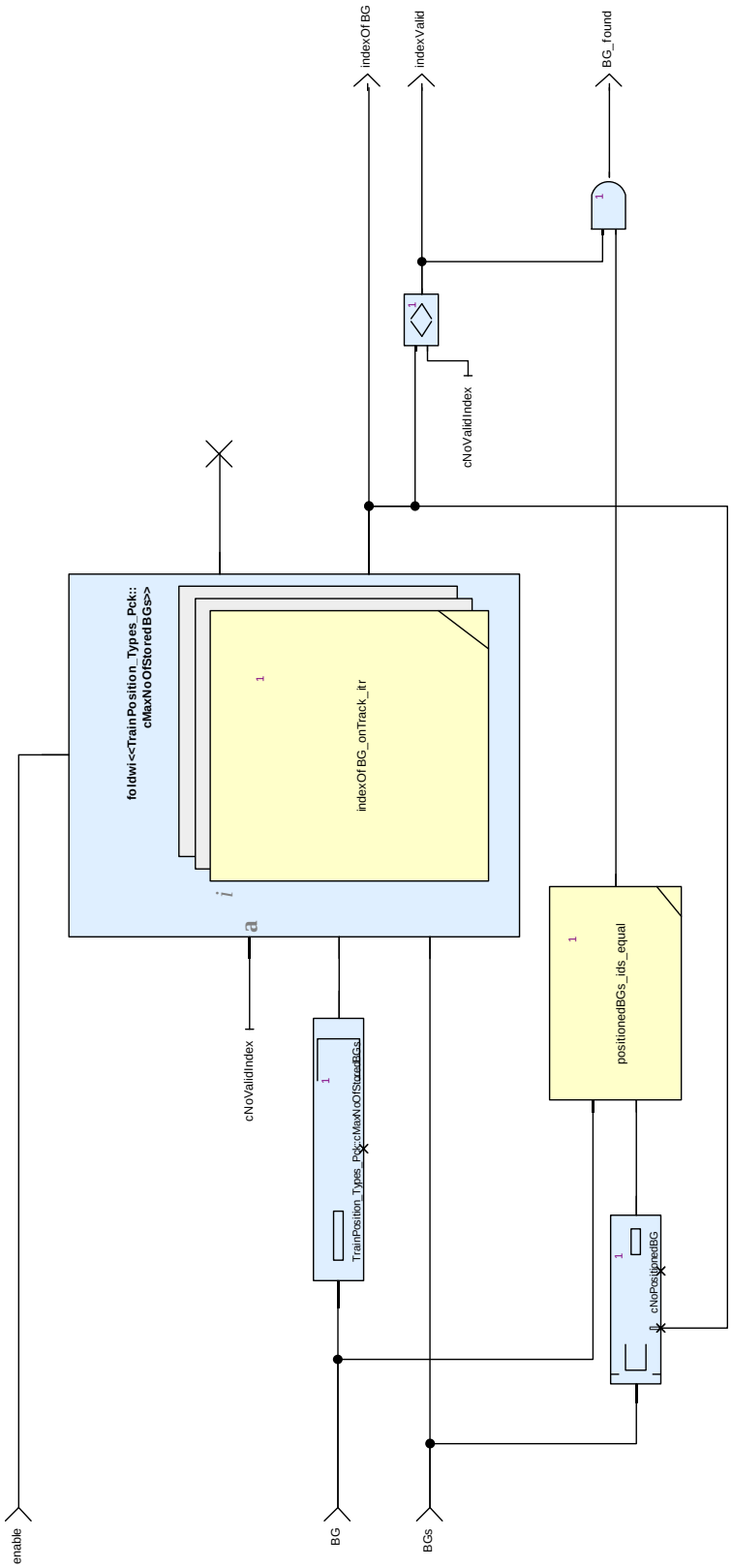


Figure 124: View of diagram_indexOfBG_onTrack_1 (indexOfBG_onTrack)

14.3.16. indexOfBG_onTrack_itr Operator

Declared as **`private function`**

14.3.16.1. Comments and Information

indexOfBG_onTrack_itr Comments:

- Iterated function for determing the index of BG in BGs

Table 333: 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

14.3.16.2. Interface

Table 334: 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 335: Outputs of indexOfBG_onTrack_itr

Name	Type	Comments and Information
cont	bool	

Name	Type	Comments and Information
indexOfBG	int	

14.3.16.3. Locals

Table 336: Locals of indexOfBG_onTrack_itr

Name	Type	Comments and Information
invalidateIndex	bool	
stopIteration	bool	

14.3.16.4. Operator Hierarchy

diagram : diagram_setIndex
diagram : diagram_stopIteration

14.3.16.5. Graphical and Textual Diagrams

14.3.16.5.1. View of diagram_setIndex (indexOfBG_onTrack_itr)

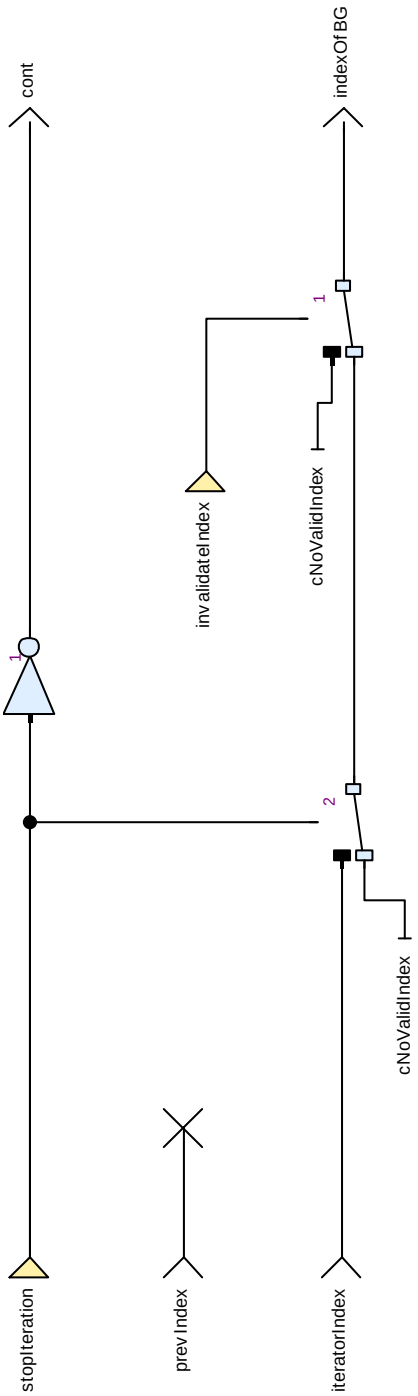


Figure 125: View of diagram_setIndex (indexOfBG_onTrack_itr)

14.3.16.5.2. View of diagram_stopIteration (indexOfBG_onTrack_itr)

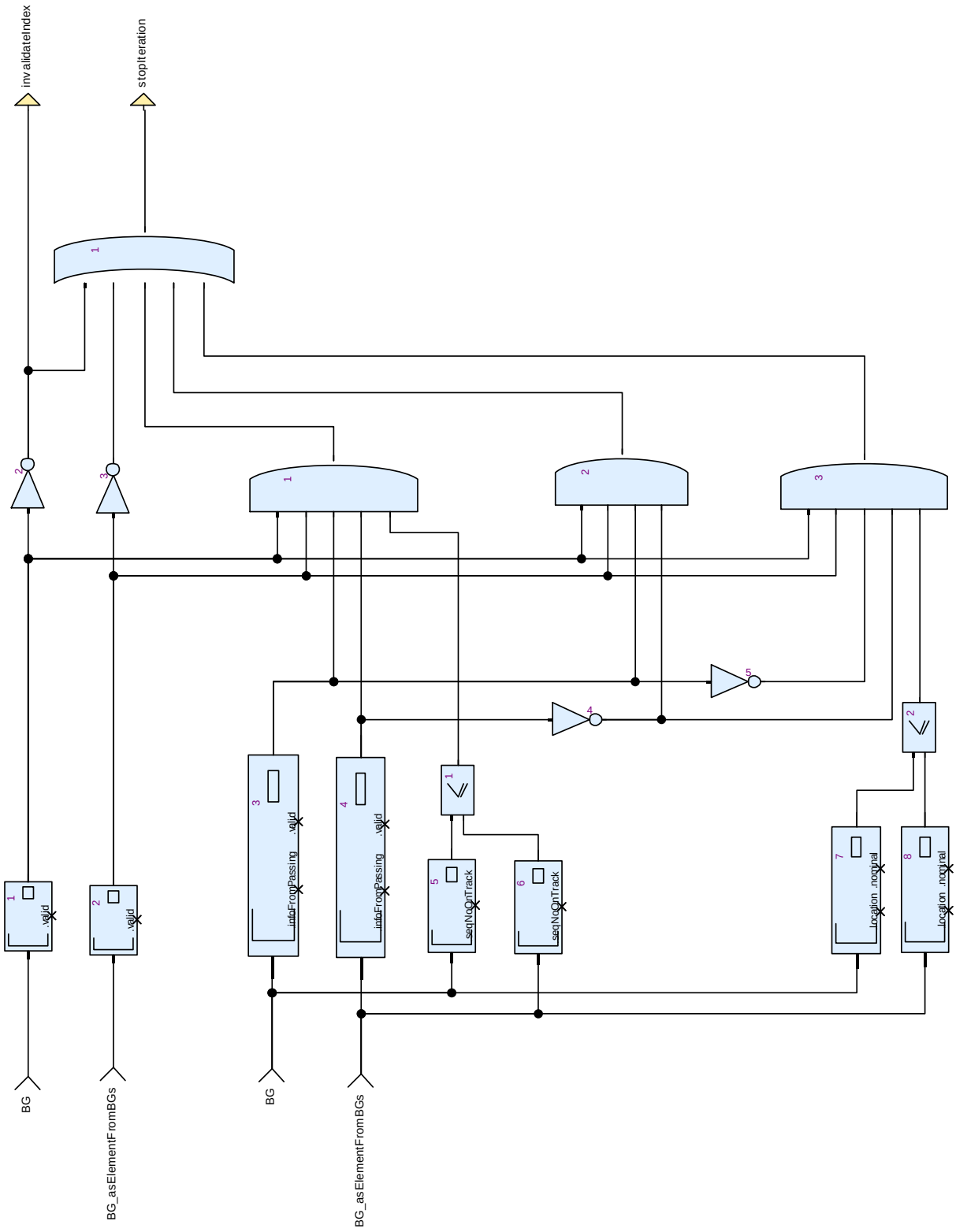


Figure 126: View of diagram_stopIteration (indexOfBG_onTrack_itr)

14.3.17. indexOfLastPassedBG Operator

Declared as **`public function`**

14.3.17.1. Comments and Information

indexOfLastPassedBG Comments:

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

14.3.17.2. Interface

Table 337: 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 338: 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.

14.3.17.3. Operator Hierarchy

diagram : diagram_indexOfLastPassedBG_1

14.3.17.4. Graphical and Textual Diagrams

14.3.17.4.1. View of diagram_indexOfLastPassedBG_1 (indexOfLastPassedBG)

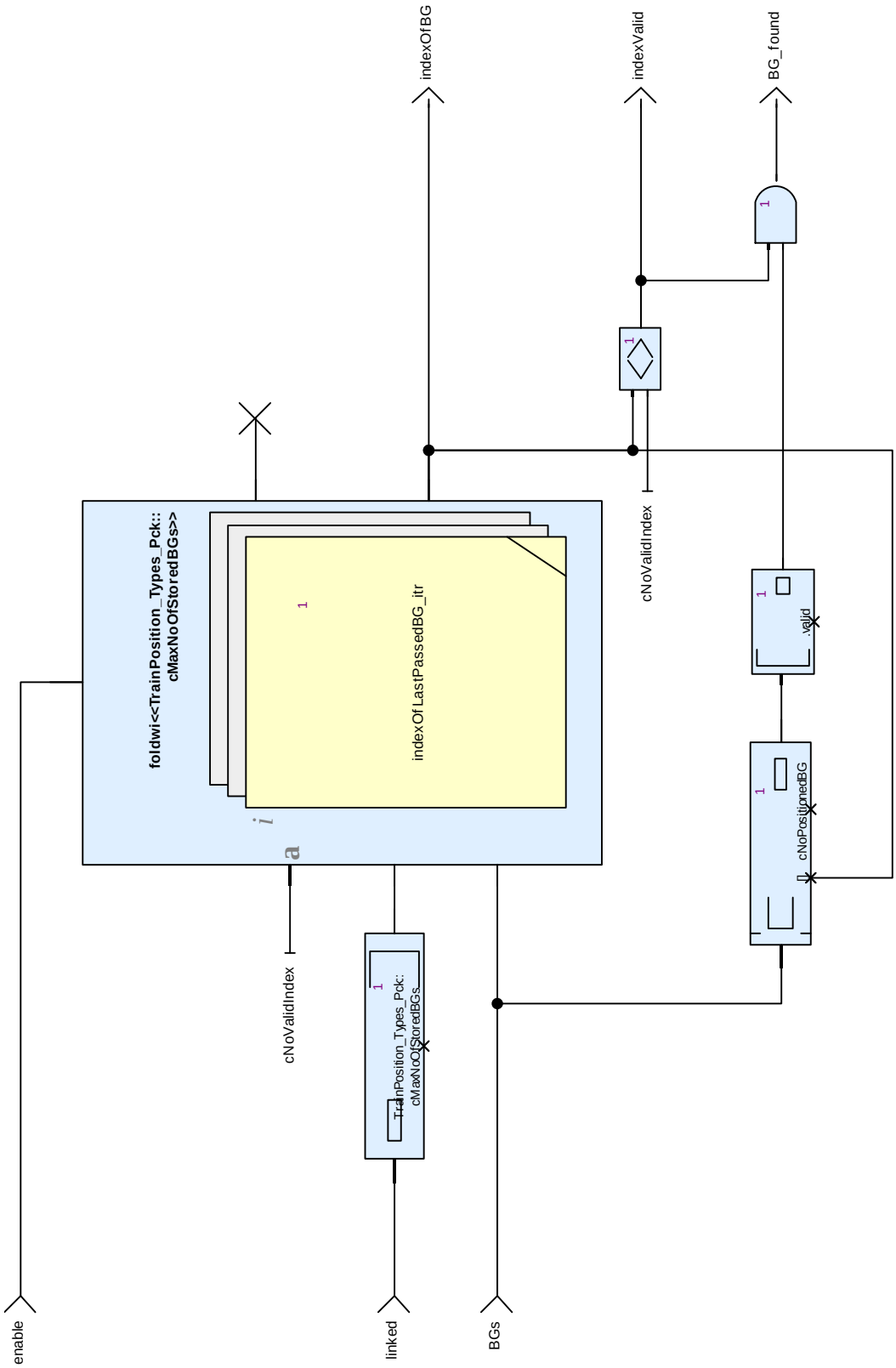


Figure 127: View of diagram_indexOfLastPassedBG_1 (indexOfLastPassedBG)

14.3.18. indexOfLastPassedBG_itr Operator

Declared as **`private function`**

14.3.18.1. Comments and Information

indexOfLastPassedBG_itr Comments:

- Iterated function for indexOfLastPassedBG

Table 339: 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/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

14.3.18.2. Interface

Table 340: 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_Pck::positionedBG_T	

Table 341: Outputs of indexOfLastPassedBG_itr

Name	Type	Comments and Information
cont	bool	
indexOfBG	int	

14.3.18.3. Operator Hierarchy

diagram : diagram_indexOfLastPassedBG_itr_1

14.3.18.4. Graphical and Textual Diagrams

14.3.18.4.1. View of diagram_indexOfLastPassedBG_itr_1 (indexOfLastPassedBG_itr)

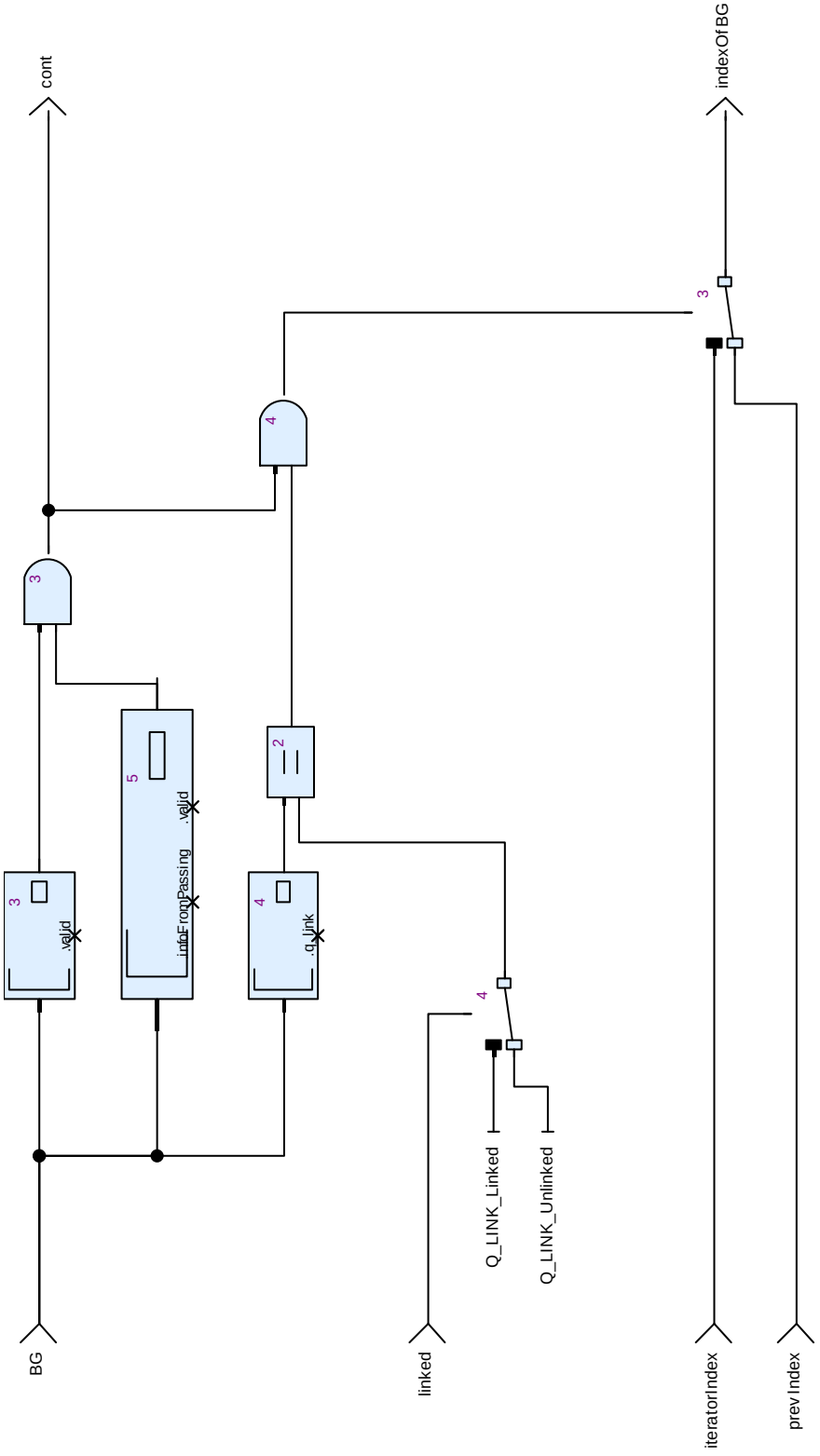


Figure 128: View of diagram_indexOfLastPassedBG_itr_1 (indexOfLastPassedBG_itr)

14.3.19. indexOfPassedBG_by_id Operator

Declared as **`public function`**

14.3.19.1. Comments and Information

indexOfPassedBG_by_id Comments:

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

Table 342: 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/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

14.3.19.2. Interface

Table 343: 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 344: Outputs of indexOfPassedBG_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.

14.3.19.3. Operator Hierarchy

diagram : diagram_indexOfPassedBG_by_id_1

14.3.19.4. Graphical and Textual Diagrams

14.3.19.4.1. View of diagram_indexOfPassedBG_by_id_1 (indexOfPassedBG_by_id)

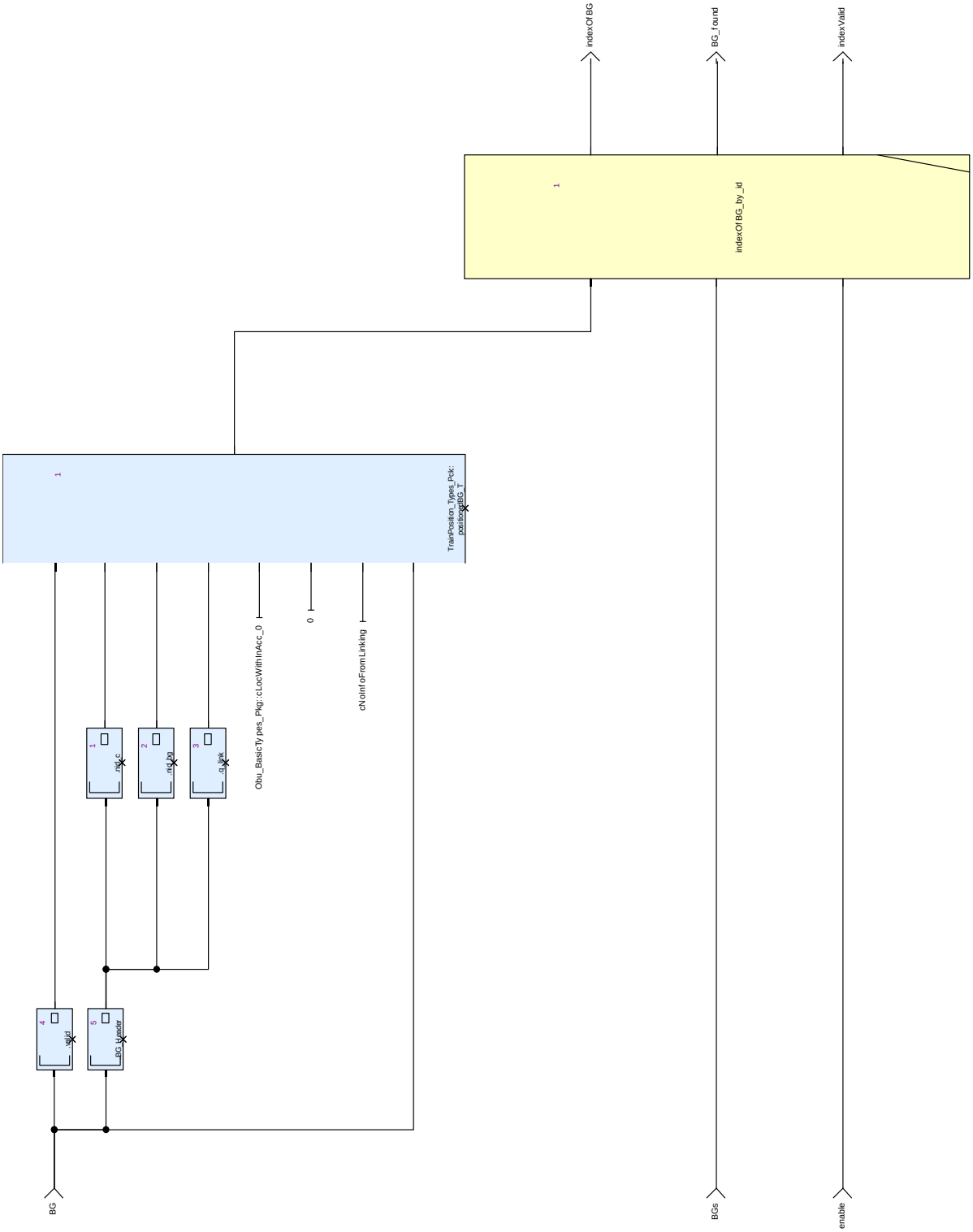


Figure 129: View of diagram_indexOfPassedBG_by_id_1 (indexOfPassedBG_by_id)

14.3.20. insertBG_atIndex Operator

Declared as **`public function`**

14.3.20.1. 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.

14.3.20.2. Interface

Table 345: 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 346: 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.

14.3.20.3. Operator Hierarchy

diagram : diagram_insertBG_atIndex_1

14.3.20.4. Graphical and Textual Diagrams

14.3.20.4.1. View of diagram_insertBG_atIndex_1 (insertBG_atIndex)

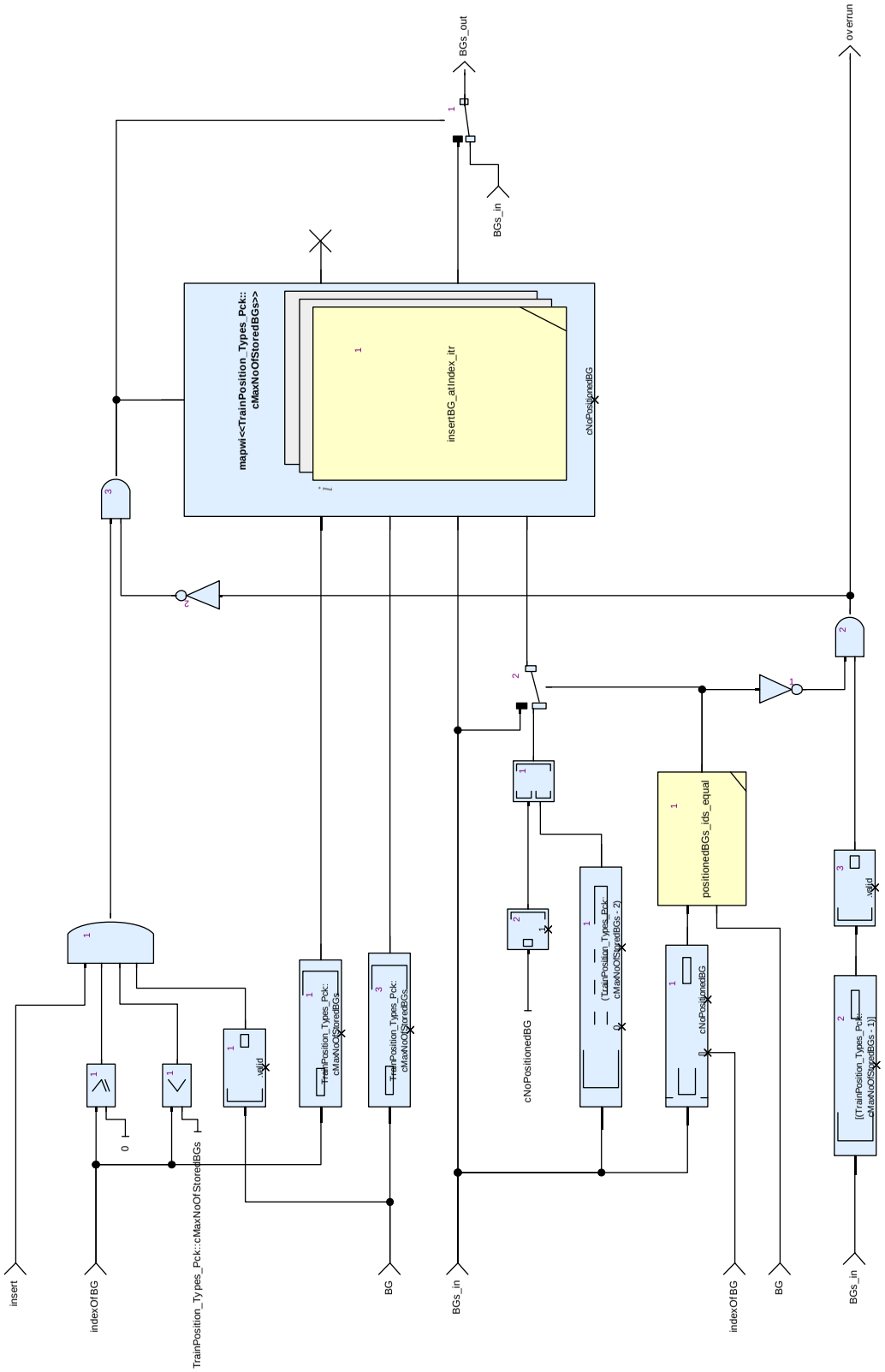


Figure 130: View of diagram_insertBG_atIndex_1 (insertBG_atIndex)

14.3.21. insertBG_atIndex_itr Operator

Declared as **`private function`**

14.3.21.1. Comments and Information

insertBG_atIndex_itr Comments:

- Iterated function for insertBG_atIndex.

14.3.21.2. Interface

Table 347: 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 348: Outputs of insertBG_atIndex_itr

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

14.3.21.3. Operator Hierarchy

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

14.3.21.4. Graphical and Textual Diagrams

14.3.21.4.1. View of diagram_insertBG_atIndex_itr_1 (insertBG_atIndex_itr)

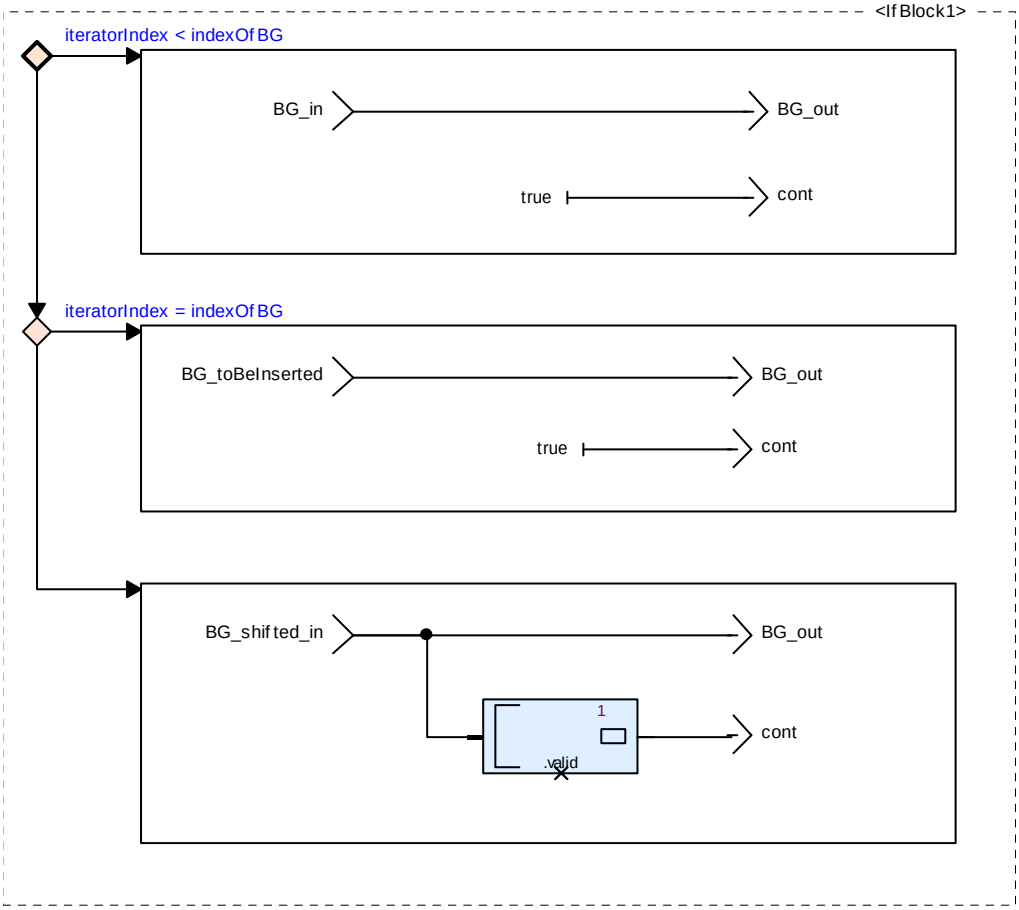


Figure 131: View of diagram_insertBG_atIndex_itr_1 (insertBG_atIndex_itr)

Table 349: Conditional Blocks of diagram_insertBG_atIndex_itr_1

Conditional Block	Comments and Information
IfBlock1	

Table 350: Actions of diagram_insertBG_atIndex_itr_1

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

14.3.22. mergeBG_by_id Operator

Declared as **`private function`**

14.3.22.1. 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 351: 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

14.3.22.2. Interface

Table 352: 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 353: 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.

14.3.22.3. Operator Hierarchy

diagram : diagram_mergeBG_by_id_1

14.3.22.4. Graphical and Textual Diagrams

14.3.22.4.1. View of diagram_mergeBG_by_id_1 (mergeBG_by_id)

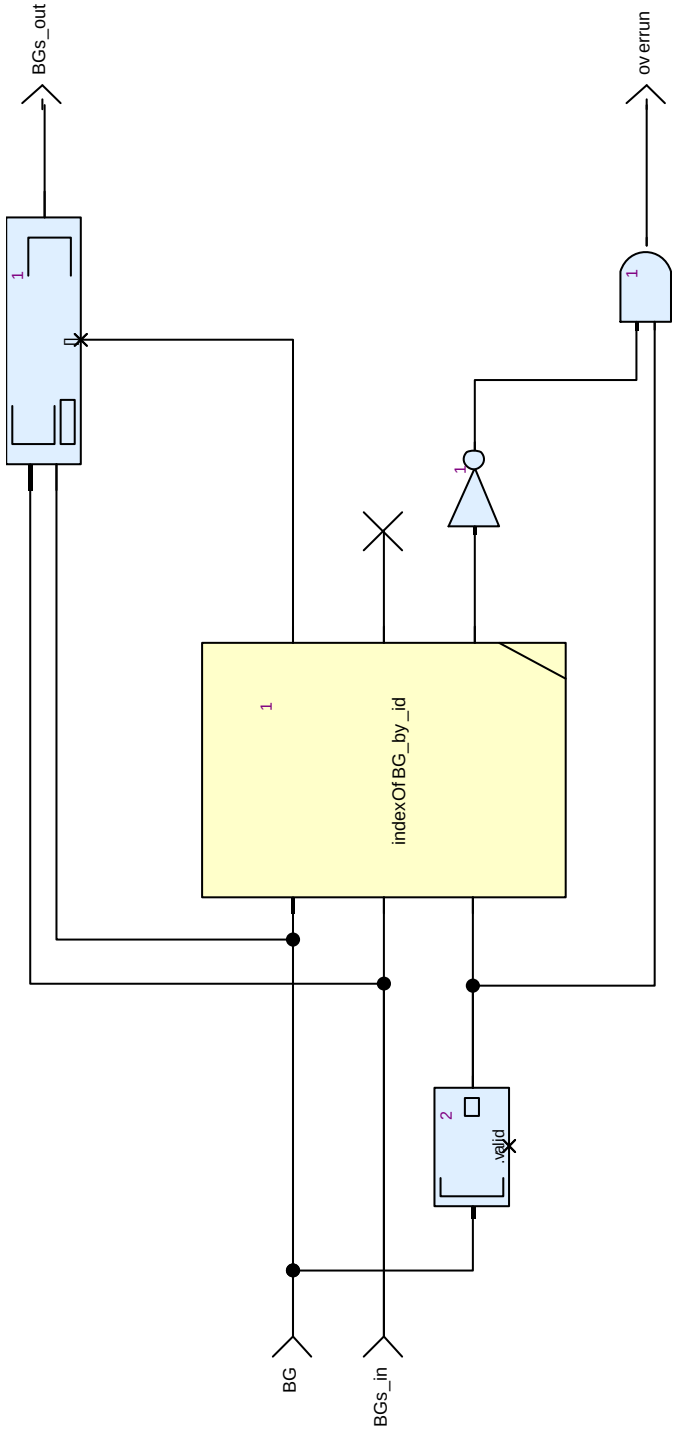


Figure 132: View of diagram_mergeBG_by_id_1 (mergeBG_by_id)

14.3.23. mergeBG_onTrack Operator

Declared as **`public function`**

14.3.23.1. 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.

14.3.23.2. Interface

Table 354: 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 355: 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.

14.3.23.3. Operator Hierarchy

diagram : diagram_mergeBG_onTrack_1

14.3.23.4. Graphical and Textual Diagrams

14.3.23.4.1. View of diagram_mergeBG_onTrack_1 (mergeBG_onTrack)

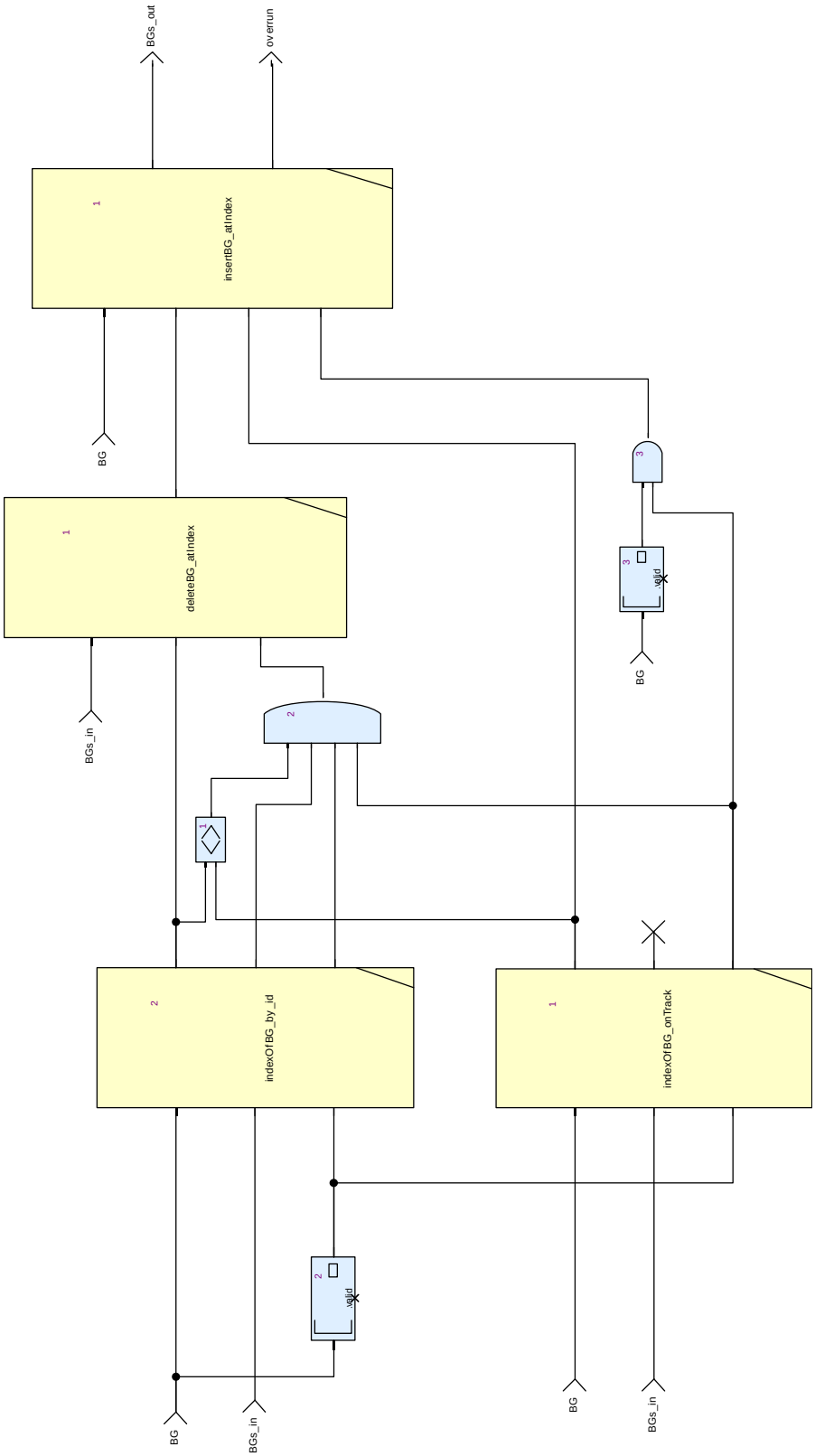


Figure 133: View of diagram_mergeBG_onTrack_1 (mergeBG_onTrack)

14.3.24. mergeBGs_by_id Operator

Declared as **`public function`**

14.3.24.1. 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 356: 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/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

14.3.24.2. Interface

Table 357: 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 358: Outputs of mergeBGs_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 not all of the elements of BGs_2 could be merged into BGs_out, due to not enough space in BGs_out.

14.3.24.3. Operator Hierarchy

diagram : diagram_mergeBGs_by_id_1

14.3.24.4. Graphical and Textual Diagrams

14.3.24.4.1. View of diagram_mergeBGs_by_id_1 (mergeBGs_by_id)

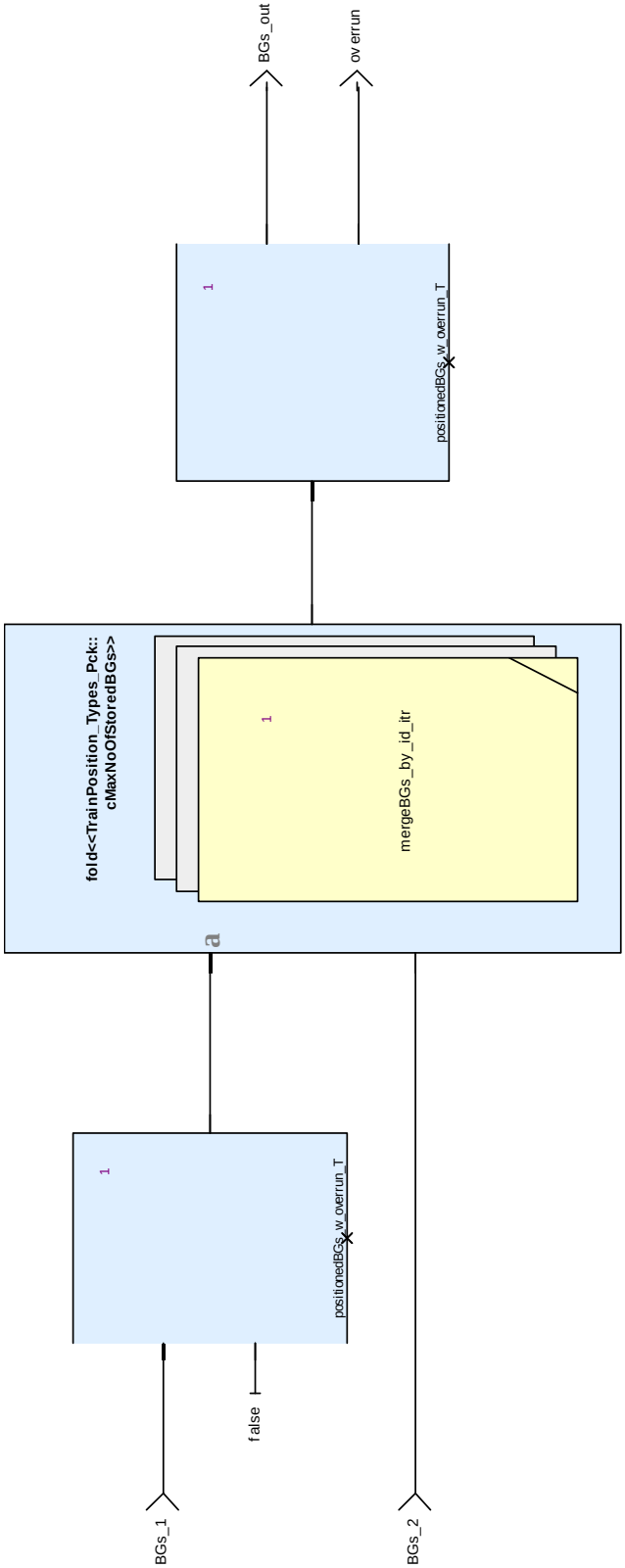


Figure 134: View of diagram_mergeBGs_by_id_1 (mergeBGs_by_id)

14.3.25. mergeBGs_by_id_itr Operator

Declared as **`private function`**

14.3.25.1. Comments and Information

mergeBGs_by_id_itr Comments:

- Iterated function for the merge of a BG into an array of BGs.

Table 359: 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

14.3.25.2. Interface

Table 360: 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 361: 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.

14.3.25.3. Operator Hierarchy

diagram : diagram_mergeBGs_by_id_itr_1

14.3.25.4. Graphical and Textual Diagrams

14.3.25.4.1. View of diagram_mergeBGs_by_id_itr_1 (mergeBGs_by_id_itr)

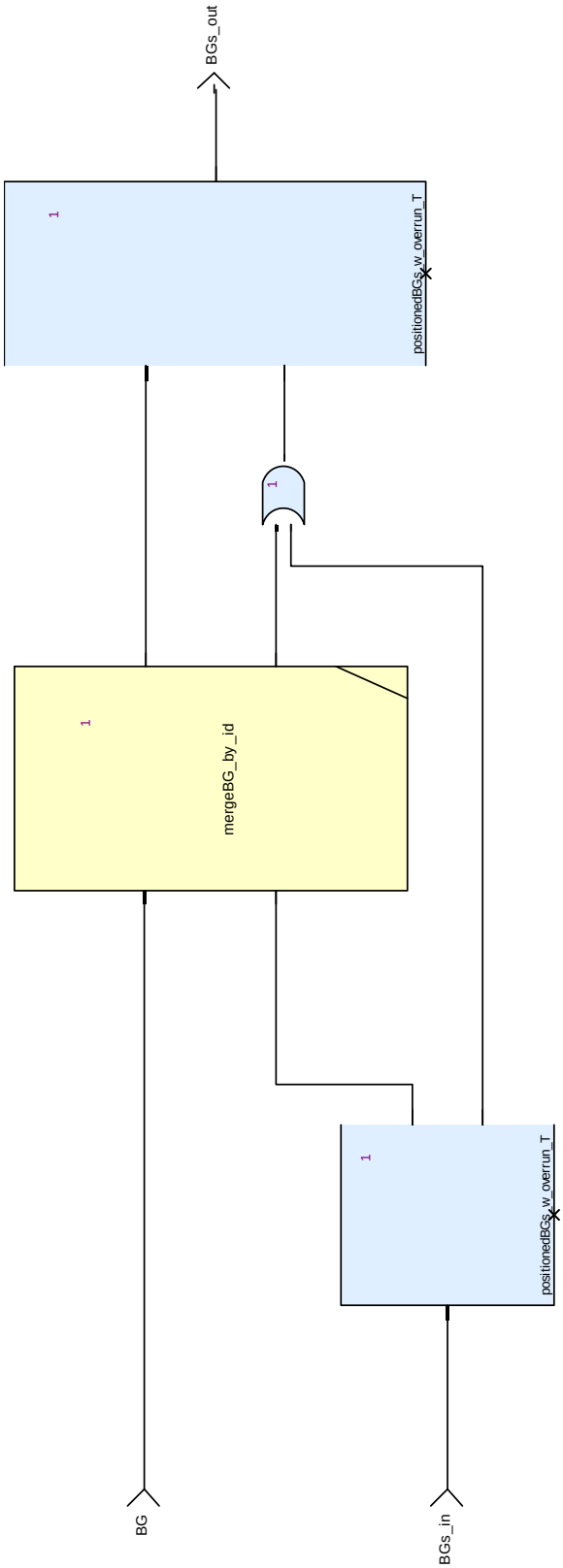


Figure 135: View of diagram_mergeBGs_by_id_itr_1 (mergeBGs_by_id_itr)

14.3.26. mergeBGs_onTrack Operator

Declared as **`public function`**

14.3.26.1. 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 362: 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

14.3.26.2. Interface

Table 363: 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 364: 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.

14.3.26.3. Operator Hierarchy

diagram : diagram_mergeBGs_onTrack_1

14.3.26.4. Graphical and Textual Diagrams

14.3.26.4.1. View of diagram_mergeBGs_onTrack_1 (mergeBGs_onTrack)

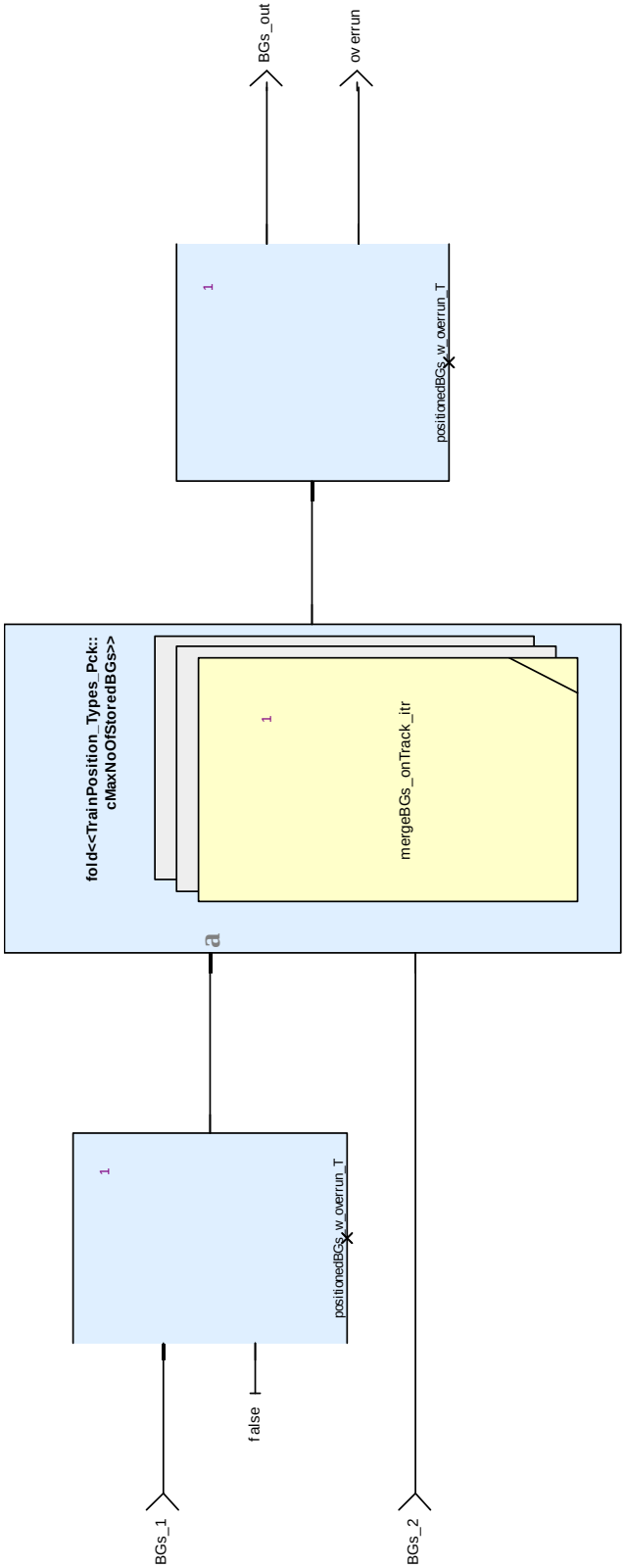


Figure 136: View of diagram_mergeBGs_onTrack_1 (mergeBGs_onTrack)

14.3.27. mergeBGs_onTrack_itr Operator

Declared as **`private function`**

14.3.27.1. Comments and Information

mergeBGs_onTrack_itr Comments:

- Iterated function for the merge of a BG into a sorted array of BGs.

Table 365: 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/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

14.3.27.2. Interface

Table 366: 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 367: 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.

14.3.27.3. Operator Hierarchy

diagram : diagram_mergeBGs_onTrack_itr_1

14.3.27.4. Graphical and Textual Diagrams

14.3.27.4.1. View of diagram_mergeBGs_onTrack_itr_1 (mergeBGs_onTrack_itr)

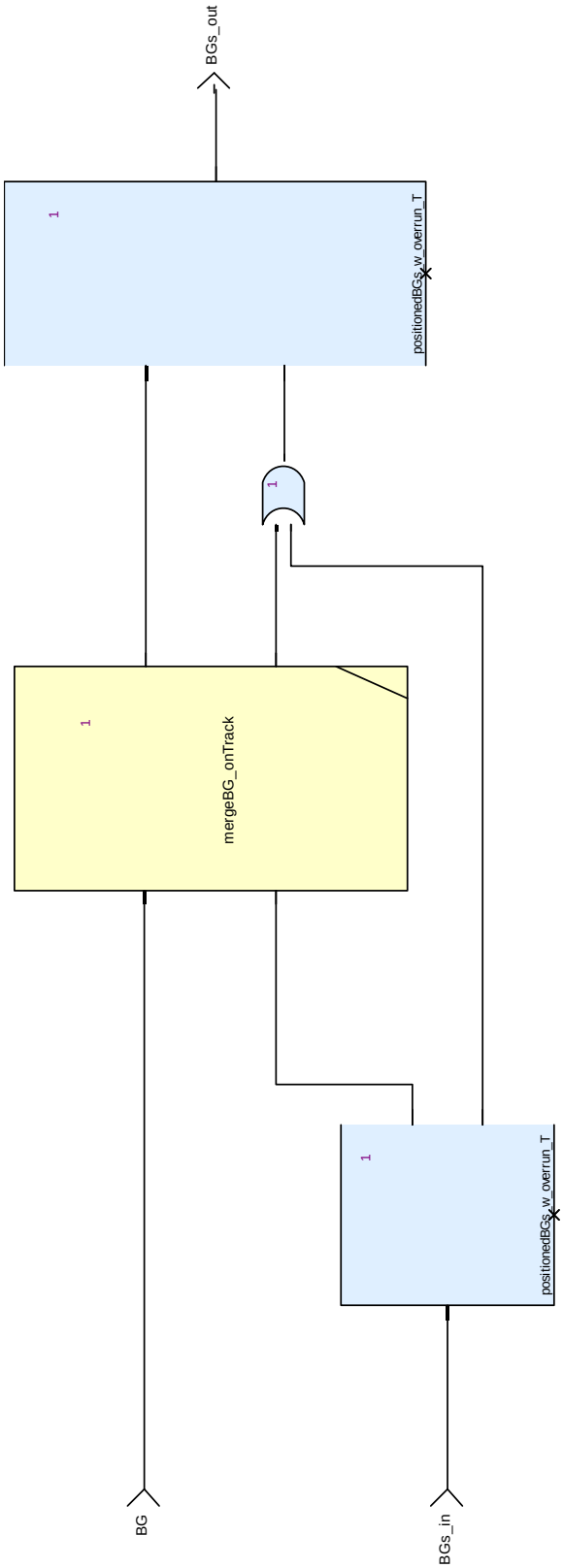


Figure 137: View of diagram_mergeBGs_onTrack_itr_1 (mergeBGs_onTrack_itr)

14.3.28. nidBG_nidc_equal Operator

Declared as **`public function`**

14.3.28.1. 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 368: 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

14.3.28.2. Interface

Table 369: 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 370: Outputs of nidBG_nidc_equal

Name	Type	Comments and Information
isEqual	bool	

14.3.28.3. Operator Hierarchy

diagram : diagram_nidBG_nidc_equal_1

14.3.28.4. Graphical and Textual Diagrams

14.3.28.4.1. View of diagram_nidBG_nidc_equal_1 (nidBG_nidc_equal)

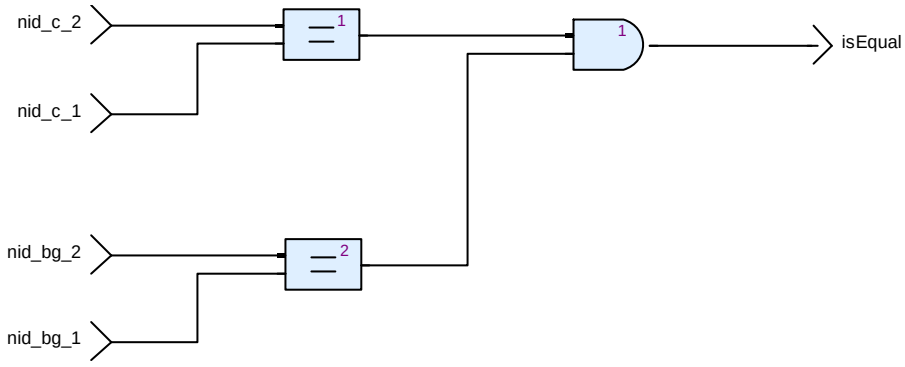


Figure 138: View of diagram_nidBG_nidc_equal_1 (nidBG_nidc_equal)

14.3.29. nidC_nidBG_2_NIDLRBG Operator

Declared as **`public function`**

14.3.29.1. Comments and Information

nidC_nidBG_2_NIDLRBG Comments:

- Constructs an NID_LRBG value from NID_C and NID_BG

14.3.29.2. Interface

Table 371: Inputs of nidC_nidBG_2_NIDLRBG

Name	Type	Comments and Information
valid	bool	
nidC	NID_C	
nidBG	NID_BG	

Table 372: Outputs of nidC_nidBG_2_NIDLRBG

Name	Type	Comments and Information
nidLRBG	NID_LRBG	

14.3.29.3. Operator Hierarchy

diagram : diagram_nidC_nidBG_2_NIDLRBG_1

14.3.29.4. Graphical and Textual Diagrams

14.3.29.4.1. View of diagram_nidC_nidBG_2_NIDLRBG_1 (nidC_nidBG_2_NIDLRBG)

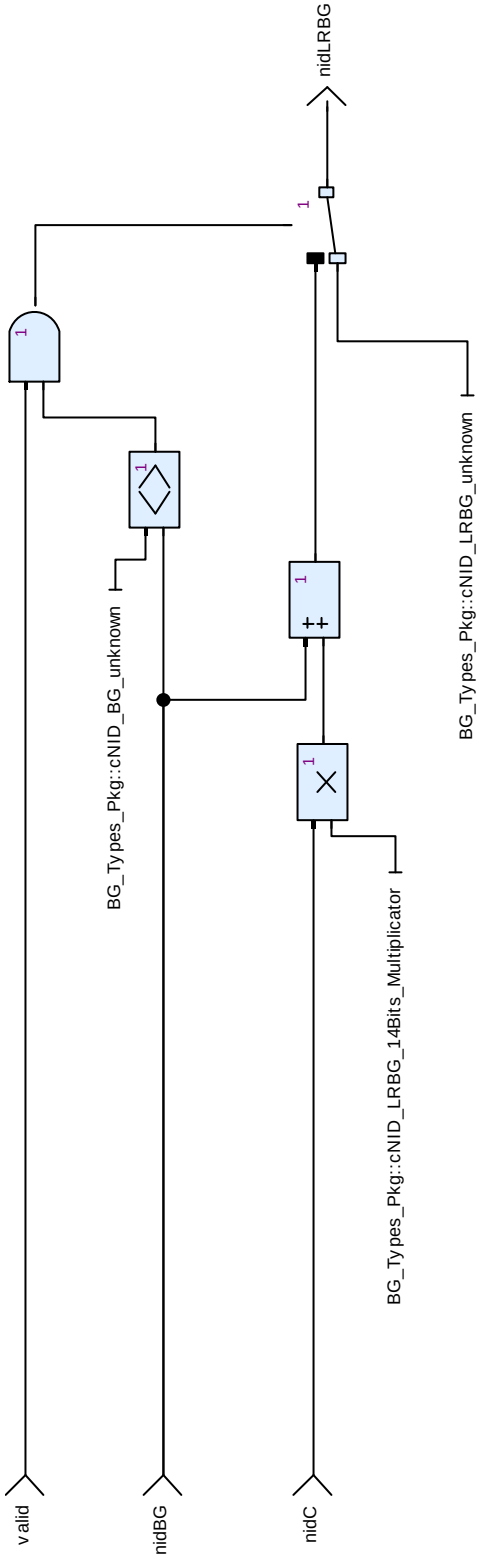


Figure 139: View of diagram_nidC_nidBG_2_NIDLRBG_1 (nidC_nidBG_2_NIDLRBG)

14.3.30. passedBGs_ids_equal Operator

Declared as **`public function`**

14.3.30.1. 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 373: 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

14.3.30.2. Interface

Table 374: 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 375: Outputs of passedBGs_ids_equal

Name	Type	Comments and Information
idsEqual	bool	
idsDifferent	bool	

14.3.30.3. Operator Hierarchy

diagram : diagram_passedBGs_ids_equal_1

14.3.30.4. Graphical and Textual Diagrams

14.3.30.4.1. View of diagram_passedBGs_ids_equal_1 (passedBGs_ids_equal)

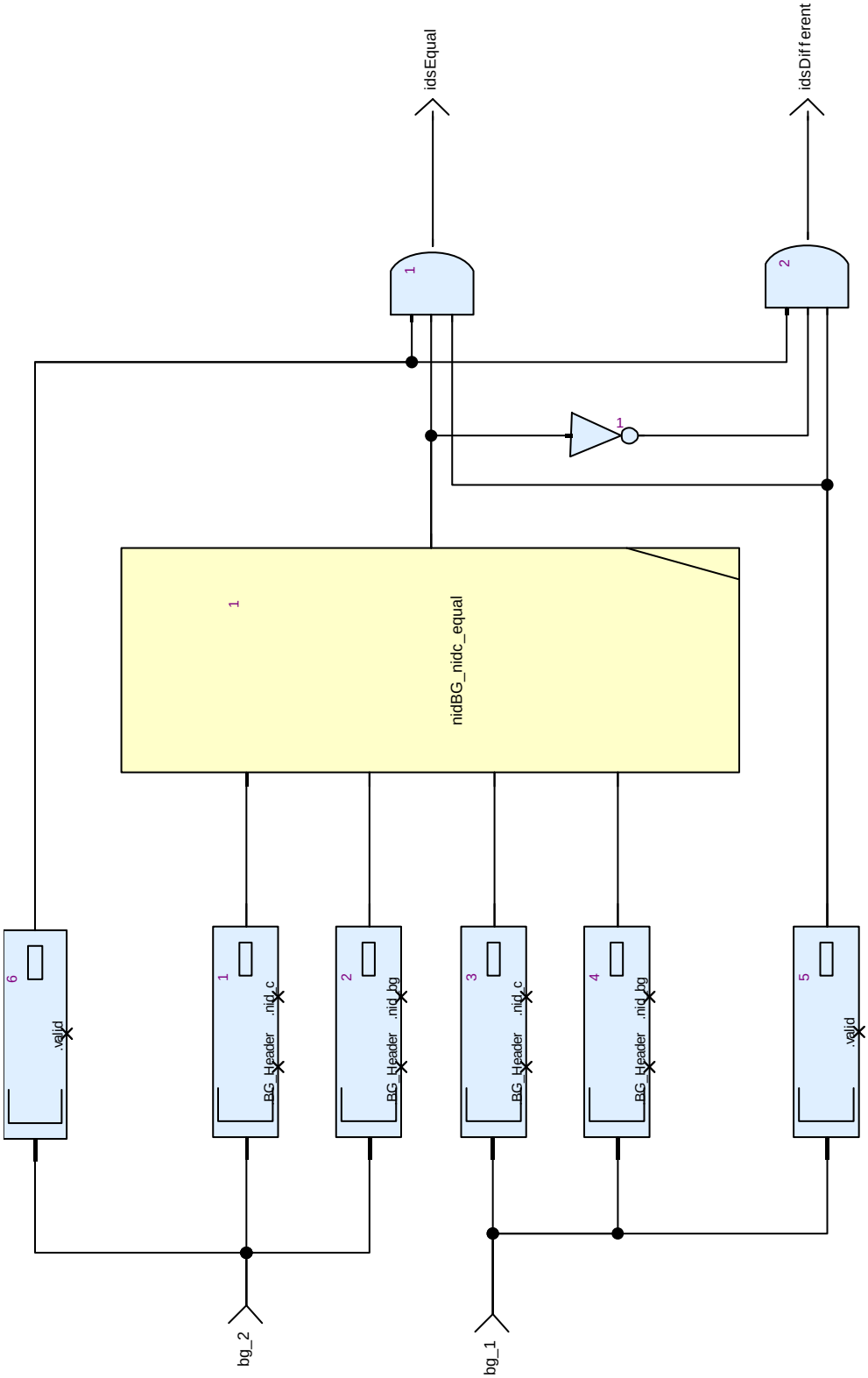


Figure 140: View of diagram_passedBGs_ids_equal_1 (passedBGs_ids_equal)

14.3.31. positionDerivedFromPassedBG Operator

Declared as **`public function`**

14.3.31.1. 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 376: 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

14.3.31.2. Interface

Table 377: 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 378: Outputs of positionDerivedFromPassedBG

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

14.3.31.3. Operator Hierarchy

diagram : diagram_positionDerivedFromPassedBG_1
activate if : IfBlock1
branch : then
branch : else

14.3.31.4. Graphical and Textual Diagrams

14.3.31.4.1. View of diagram_positionDerivedFromPassedBG_1 (positionDerivedFromPassedBG)

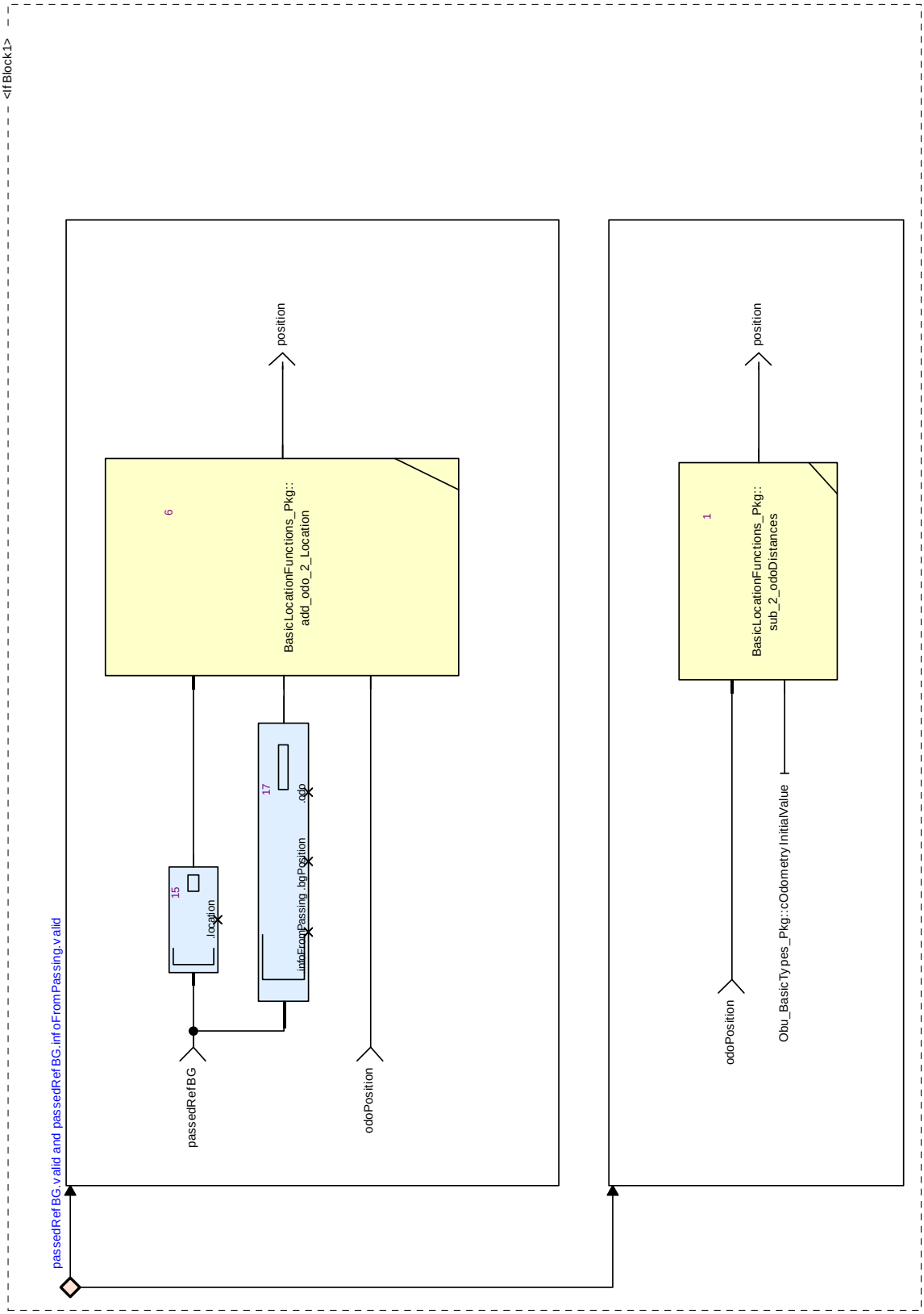


Figure 141: View of diagram_positionDerivedFromPassedBG_1 (positionDerivedFromPassedBG)

Table 379: Conditional Blocks of diagram_positionDerivedFromPassedBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 380: Actions of diagram_positionDerivedFromPassedBG_1

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

14.3.32. positionedBGs_ids_equal Operator

Declared as **`public function`**

14.3.32.1. 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 381: 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

14.3.32.2. Interface

Table 382: 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 383: Outputs of positionedBGs_ids_equal

Name	Type	Comments and Information
idsEqual	bool	

14.3.32.3. Operator Hierarchy

diagram : diagram_positionedBGs_ids_equal_1

14.3.32.4. Graphical and Textual Diagrams

14.3.32.4.1. View of diagram_positionedBGs_ids_equal_1 (positionedBGs_ids_equal)

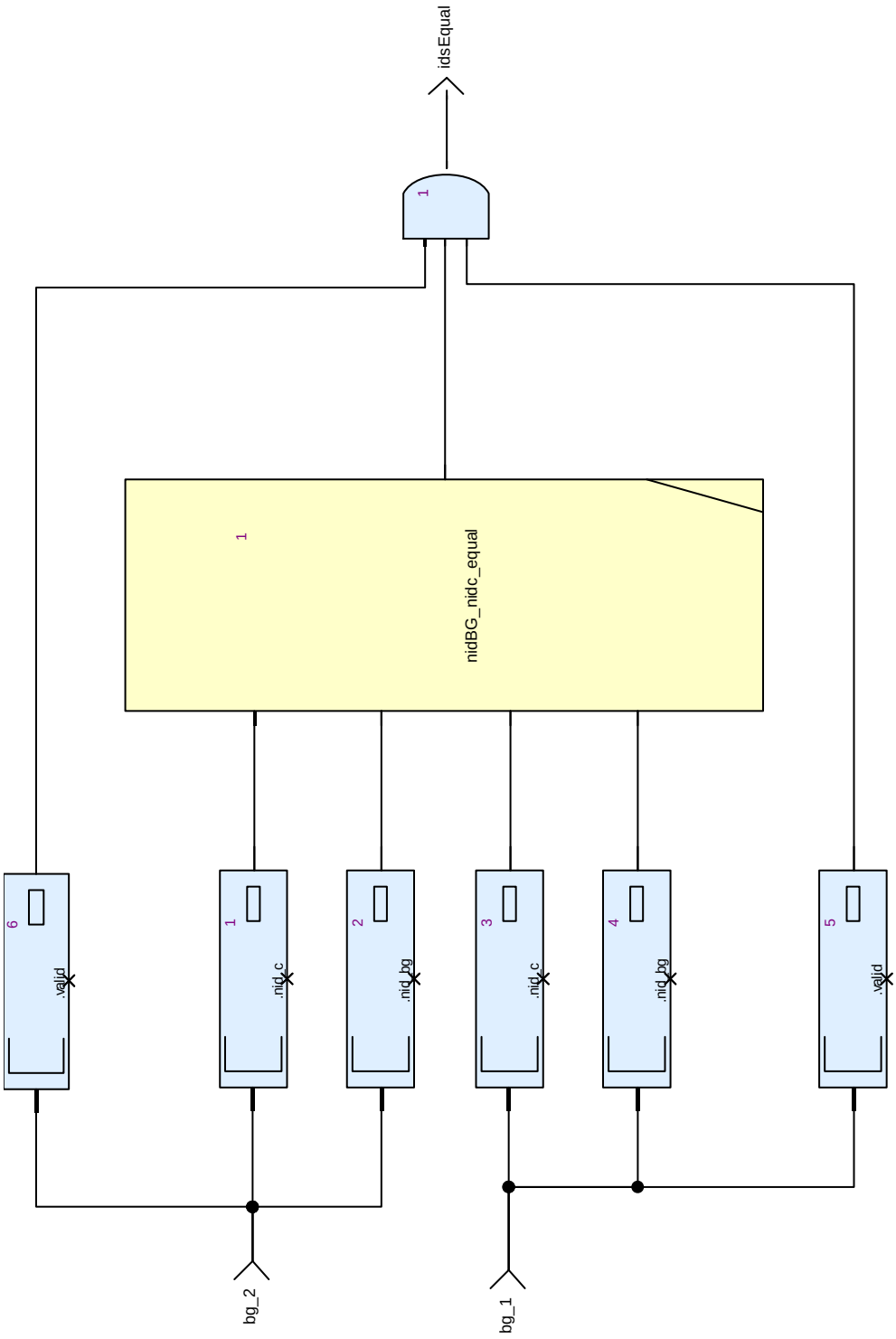


Figure 142: View of diagram_positionedBGs_ids_equal_1 (positionedBGs_ids_equal)

14.3.33. positionLinkedBGs Operator

Declared as **`public function`**

14.3.33.1. Comments and Information

positionLinkedBGs Comments:

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

Table 384: 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

14.3.33.2. Interface

Table 385: 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	**Comments:** The trains properties required for train position calculation.

Table 386: Outputs of positionLinkedBGs

Name	Type	Comments and Information
linkedPositionedBGs	TrainPosition_Types_Pck::linkedBGs_asPositionedBGs_T	

14.3.33.3. Operator Hierarchy

diagram : diagram_positionLinkedBGs_1

14.3.33.4. Graphical and Textual Diagrams

14.3.33.4.1. View of diagram_positionLinkedBGs_1 (positionLinkedBGs)

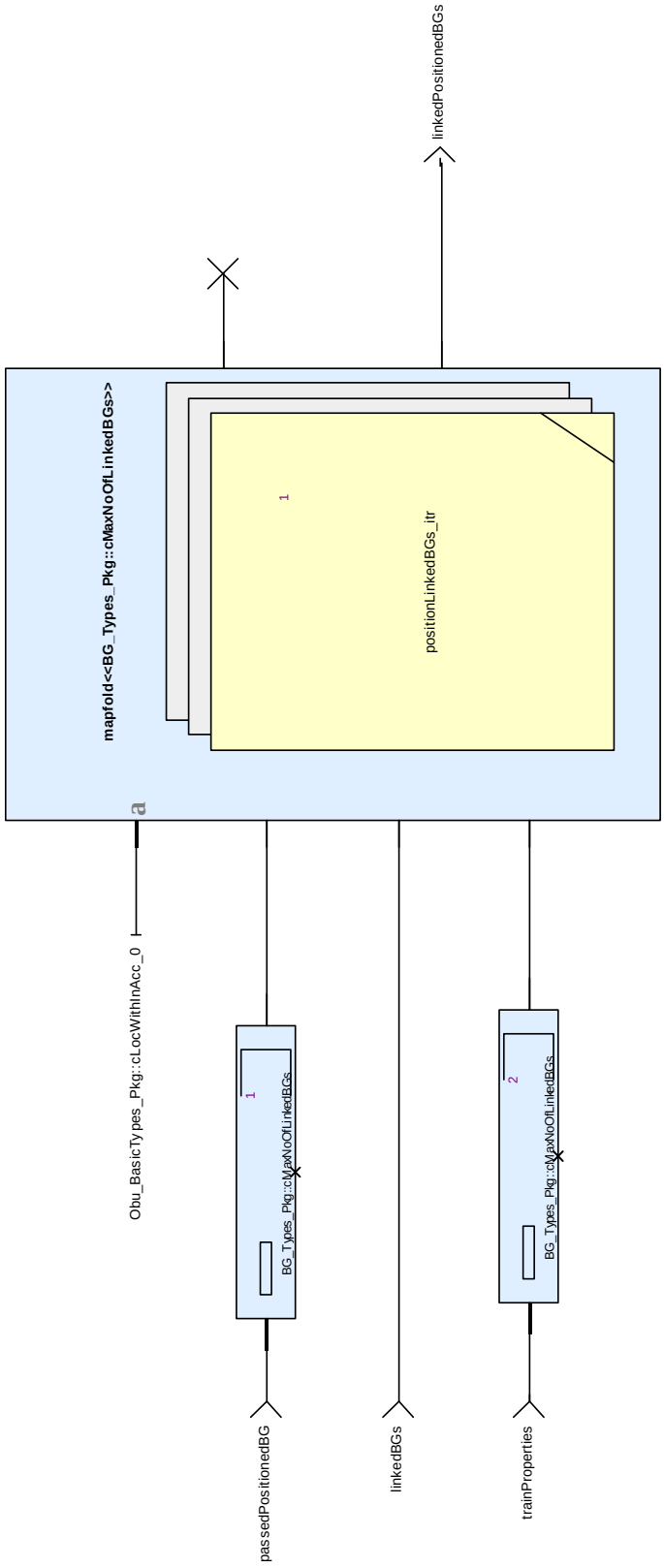


Figure 143: View of diagram_positionLinkedBGs_1 (positionLinkedBGs)

14.3.34. positionLinkedBGs_itr Operator

Declared as **`private function`**

14.3.34.1. 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 387: 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

14.3.34.2. Interface

Table 388: 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.
passedPositionedBG	TrainPosition_Types_Pck::positionedBG_T		**Comments:** The actually passed BG, where the linking information originates from.

Name	Type	Properties	Comments and Information
linkedBG	BG_Types_Pkg::LinkedBG_T		**Comments:** One of the linked BG, announced by the passed BG.
trainProperties	TrainPosition_Types_Pck::trainProperties_T	hidden	**Comments:** The trains properties required for train position calculation.

Table 389: 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	

14.3.34.3. Operator Hierarchy

diagram : diagram_positionLinkedBGs_itr_1

14.3.34.4. Graphical and Textual Diagrams

14.3.34.4.1. View of diagram_positionLinkedBGs_itr_1 (positionLinkedBGs_itr)

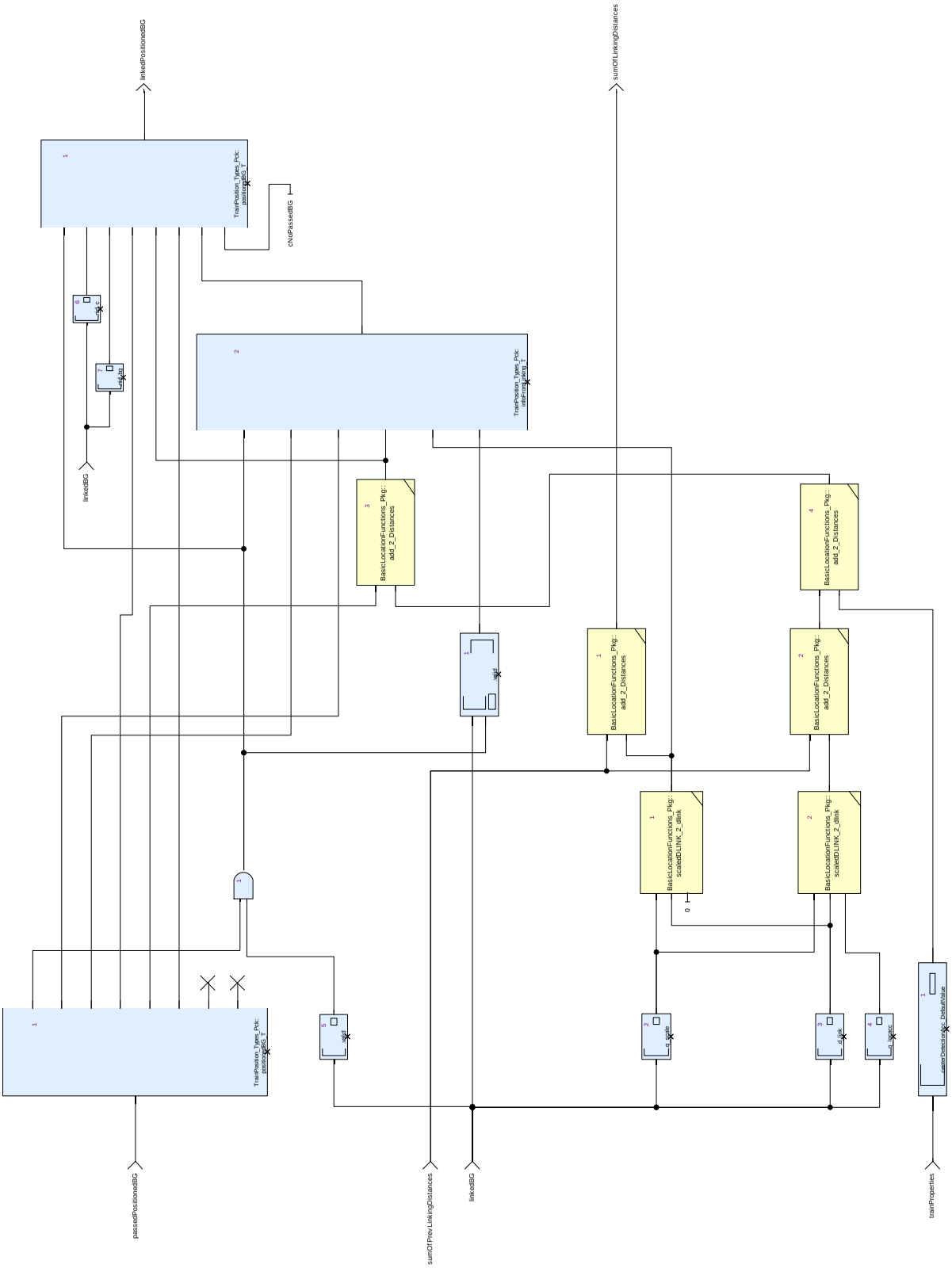


Figure 144: View of diagram_positionLinkedBGs_itr_1 (positionLinkedBGs_itr)

14.3.35. trimSeqNoOnTrack Operator

Declared as **`public function`**

14.3.35.1. Comments and Information

trimSeqNoOnTrack Comments:

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

14.3.35.2. Interface

Table 390: 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 391: Outputs of trimSeqNoOnTrack

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

14.3.35.3. Operator Hierarchy

diagram : diagram_trimSeqNoOnTrack_1

14.3.35.4. Graphical and Textual Diagrams

14.3.35.4.1. View of diagram_trimSeqNoOnTrack_1 (trimSeqNoOnTrack)

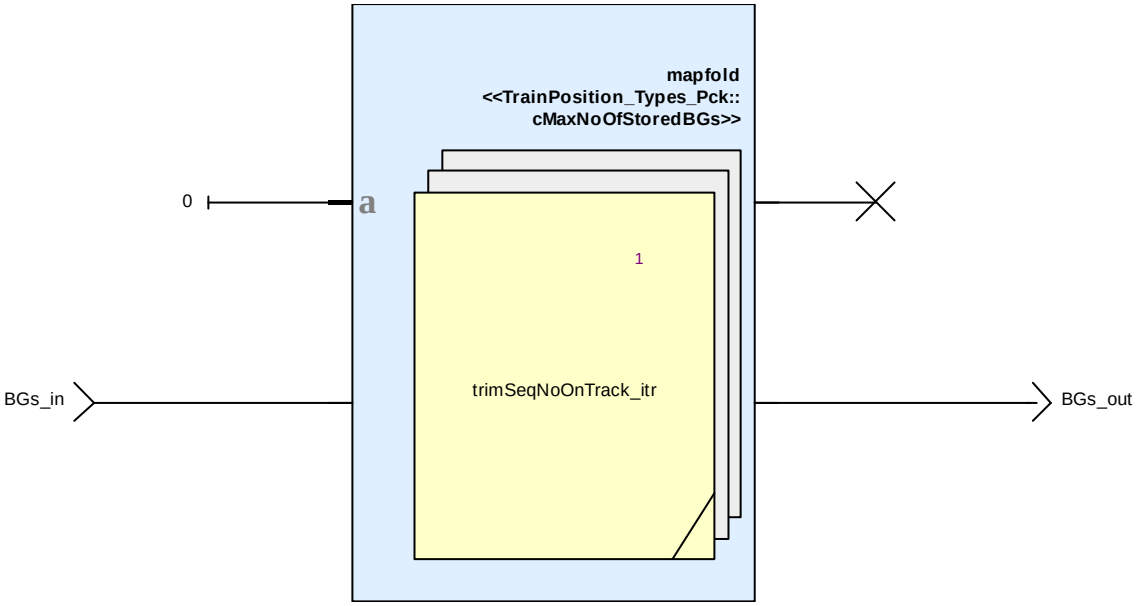


Figure 145: View of diagram_trimSeqNoOnTrack_1 (trimSeqNoOnTrack)

14.3.36. trimSeqNoOnTrack_itr Operator

Declared as **`private function`**

14.3.36.1. Comments and Information

trimSeqNoOnTrack_itr Comments:

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

14.3.36.2. Interface

Table 392: 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 393: Outputs of trimSeqNoOnTrack_itr

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

14.3.36.3. Operator Hierarchy

diagram : diagram_trimSeqNoOnTrack_itr_1

14.3.36.4. Graphical and Textual Diagrams

14.3.36.4.1. View of diagram_trimSeqNoOnTrack_itr_1 (trimSeqNoOnTrack_itr)

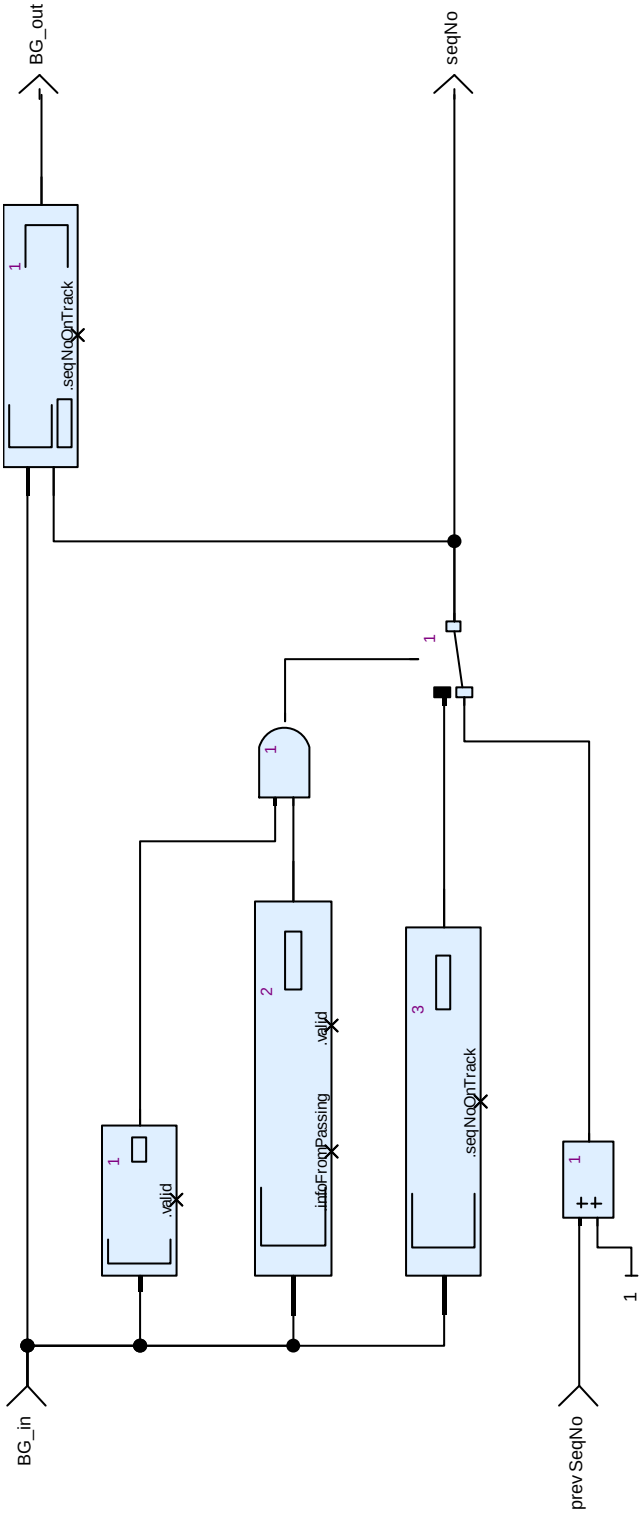


Figure 146: View of diagram_trimSeqNoOnTrack_itr_1 (trimSeqNoOnTrack_itr)

14.4. CalculateTrainPosition_Pkg::gp_functions_Pkg Package

14.4.1. Constants

Table 394: Public Constants of gp_functions_Pkg

Name	Type	Value	Comments and Information
noValidIndex	int	-1	

14.4.2. countUp Operator

Declared as **`public node`**

14.4.2.1. Comments and Information

countUp Comments:

- Counter counting upwards by one.

14.4.2.2. Interface

Table 395: Inputs of countUp

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

Table 396: Outputs of countUp

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

14.4.2.3. Operator Hierarchy

diagram : diagram_countUp_1

14.4.2.4. Graphical and Textual Diagrams

14.4.2.4.1. View of diagram_countUp_1 (countUp)

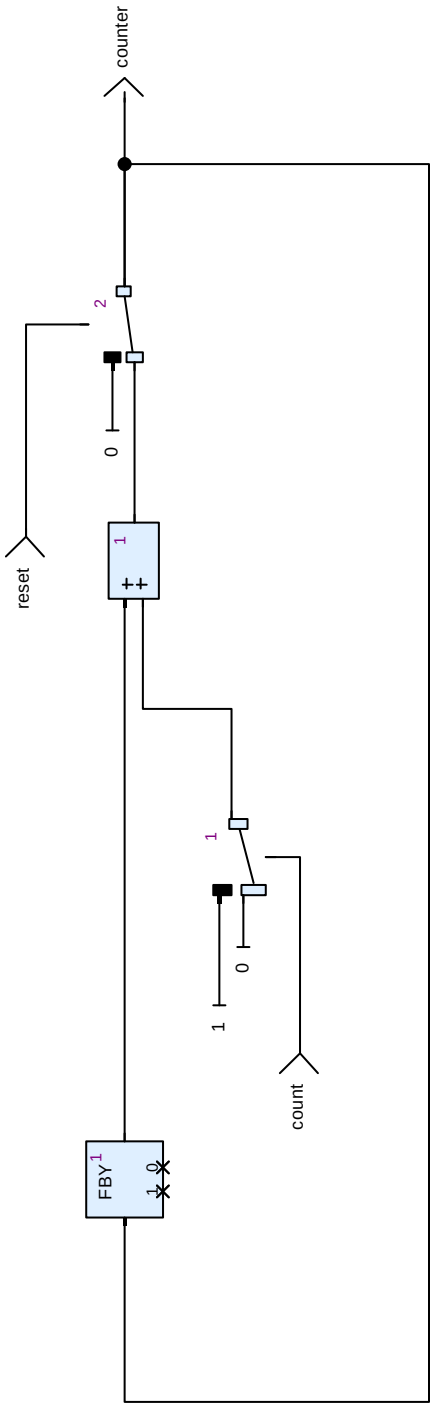


Figure 147: View of diagram_countUp_1 (countUp)

14.5. CalculateTrainPosition_Pkg::Pos_Pkg Package

14.5.1. Types

Table 397: 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

14.5.2. Constants

Table 398: 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 : 0, acceleration : 0, motionState : Obu_BasicTypes_Pkg::noMotion, motionDirection : Obu_BasicTypes_Pkg::unknownDirection}	
cSpeed_0	Obu_BasicTypes_Pkg::Speed_T	0	

14.5.3. frontendToLRBG Operator

Declared as **`public function`**

14.5.3.1. Comments and Information

frontendToLRBG Comments:

- Calculates on which side of the LRBG the estimated front end is

14.5.3.2. Interface

Table 399: 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	**Comments:** The trains properties required for train position calculation.

Table 400: Outputs of frontendToLRBG

Name	Type	Comments and Information
nominalOrReverseToLRBG	Q_DLRBG	

14.5.3.3. Locals

Table 401: 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	

14.5.3.4. Operator Hierarchy

diagram : diagram_frontendToLRBG_1
activate if : IfBlock1
branch : then
branch : else
branch : then
branch : else

14.5.3.5. Graphical and Textual Diagrams

14.5.3.5.1. View of diagram_frontendToLRBG_1 (frontendToLRBG)

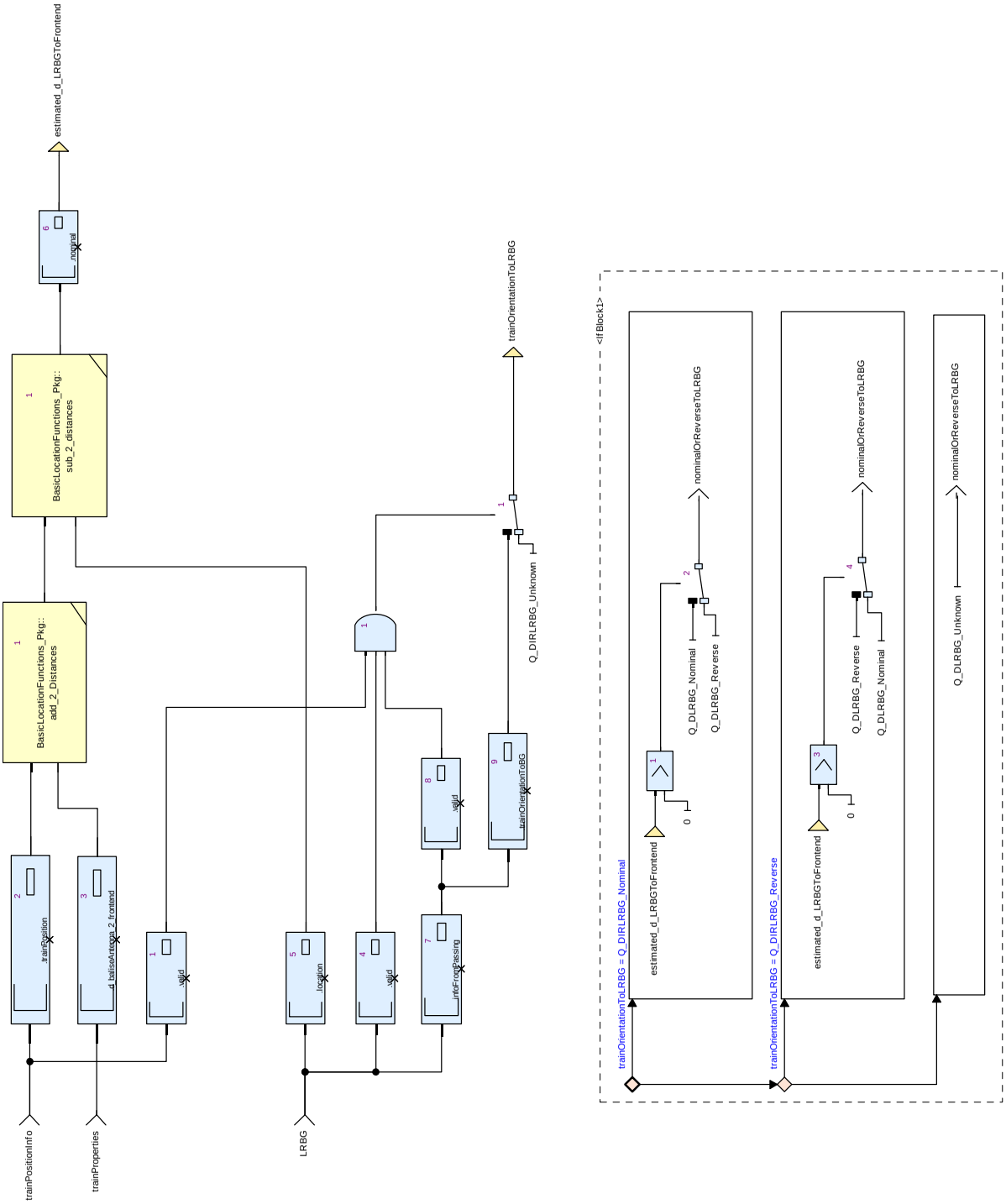


Figure 148: View of diagram_frontendToLRBG_1 (frontendToLRBG)

Table 402: Conditional Blocks of diagram_frontendToLRBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 403: Actions of diagram_frontendToLRBG_1

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

14.5.4. runningDirectionVsRef Operator

Declared as **`public node`**

14.5.4.1. Comments and Information

runningDirectionVsRef Comments:

- Determines the current train running direction compared to a known reference running direction and speed.

14.5.4.2. Interface

Table 404: Inputs of runningDirectionVsRef

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 405: Outputs of runningDirectionVsRef

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

14.5.4.3. Locals

Table 406: Locals of runningDirectionVsRef

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

14.5.4.4. Operator Hierarchy

diagram : diagram_runningDirectionVsRef_1
activate if : IfBlock1
branch : then
branch : else
branch : then
branch : else

activate if : IfBlock2
branch : then
branch : else
branch : then
branch : else

14.5.4.5. Graphical and Textual Diagrams

14.5.4.5.1. View of diagram_runningDirectionVsRef_1 (runningDirectionVsRef)

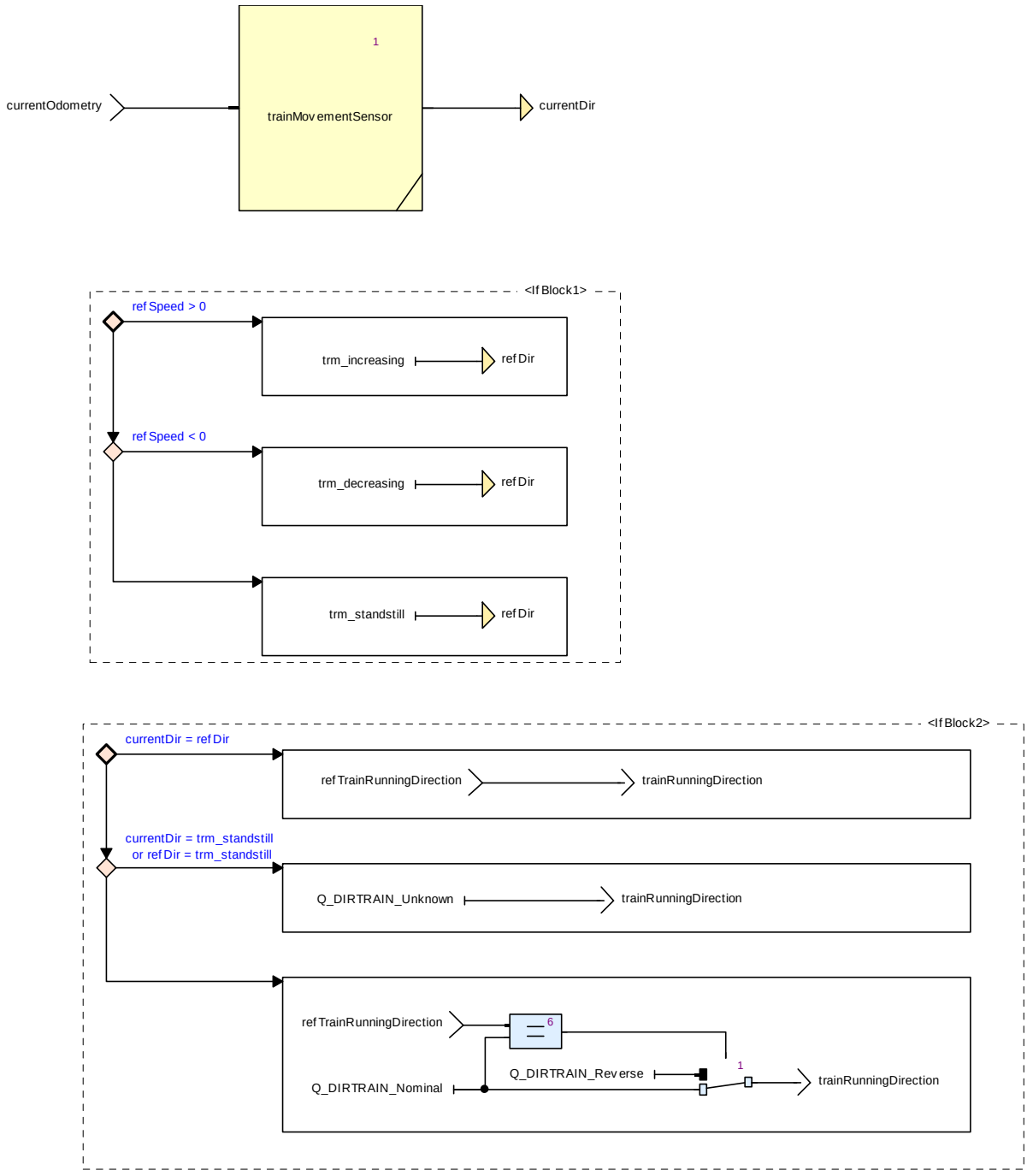


Figure 149: View of diagram_runningDirectionVsRef_1 (runningDirectionVsRef)

Table 407: Conditional Blocks of diagram_runningDirectionVsRef_1

Conditional Block	Comments and Information
IfBlock1	
IfBlock2	

Table 408: Actions of diagram_runningDirectionVsRef_1

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

14.5.5. trainMovementSensor Operator

Declared as **`private node`**

14.5.5.1. Comments and Information

trainMovementSensor Comments:

- Determines the movement direction of the train based on odometry.

14.5.5.2. Interface

Table 409: Inputs of trainMovementSensor

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

Table 410: Outputs of trainMovementSensor

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

14.5.5.3. Locals

Table 411: Locals of trainMovementSensor

Name	Type	Comments and Information
direction_loc	CalculateTrainPosition_Pkg::Pos_Pkg::trainMovementDir_T	
standstillDetected	bool	

14.5.5.4. Operator Hierarchy

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

14.5.5.5. Graphical and Textual Diagrams

14.5.5.5.1. View of diagram_trainMovementSensor_1 (trainMovementSensor)

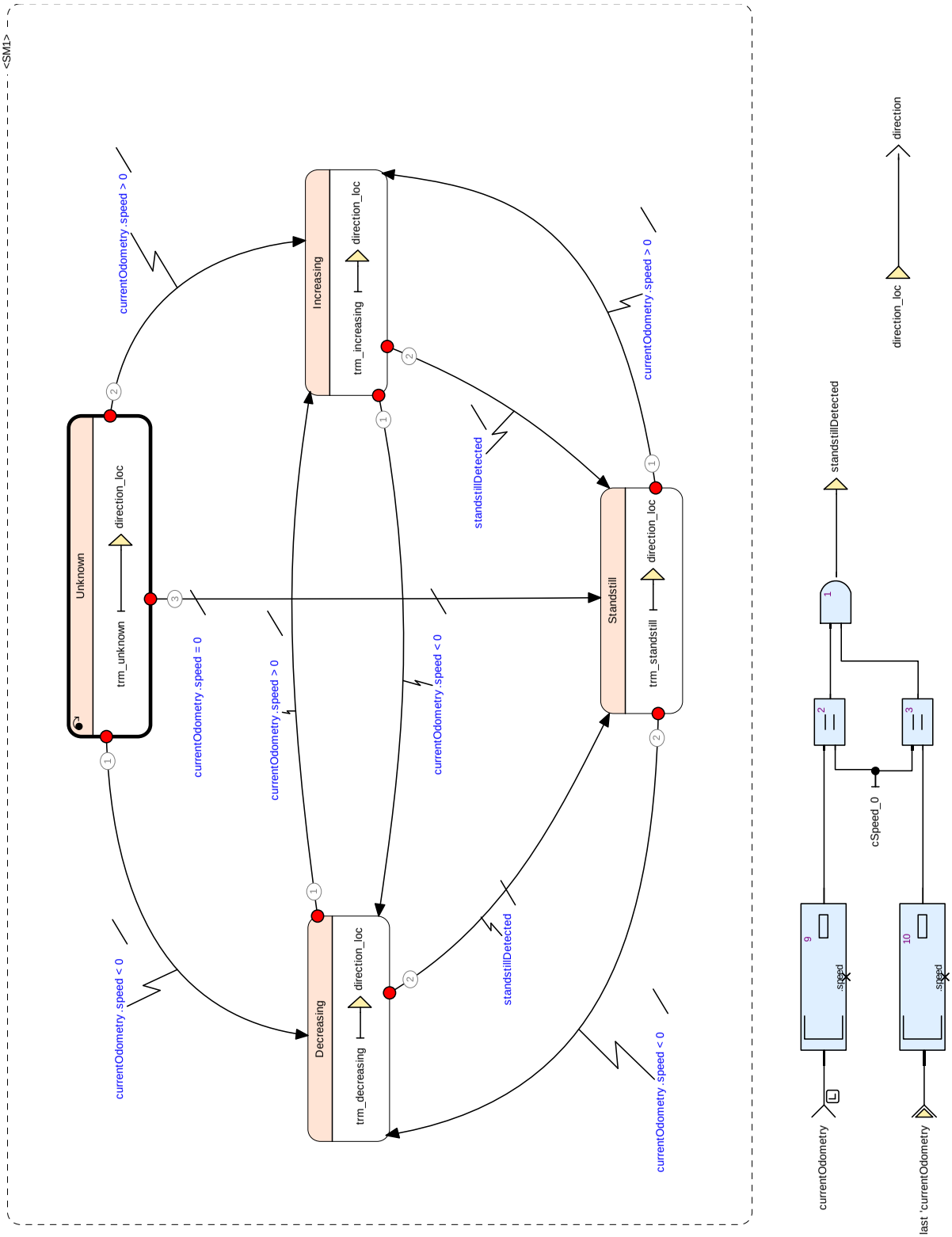


Figure 150: View of diagram_trainMovementSensor_1 (trainMovementSensor)

Table 412: State Machines of diagram_trainMovementSensor_1

State Machine	Comments and Information
SM1	

Table 413: States of diagram_trainMovementSensor_1

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

Table 414: Transitions of diagram_trainMovementSensor_1

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

15. Project Library: ProvidePositionReport

15.1. ProvidePositionReport_Pkg Package

15.1.1. Types

Table 415: Public Types of ProvidePositionReport_Pkg

Name	Definition	Comments and Information
BG_Orientation_T	enum {orientation_reverse, orientation_nominal, orientation_unknown}	**Comments:** Orientation of a balise group (needed for 3.4.2.3.3.2)
ErrorMessage_T	{present : bool, errorType : M_ERROR}	**Comments:** Combining M_ERROR and the present flag. **errorType Comments:** Identifier of the type of error (7.5.1.64)
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	ProvidePositionReport_Pkg::IterPacket58_T ^cIterPacket58	
LinkingInfoUsedOnBoard	bool	**Comments:** Defined in 3.4.4.2.1.1; probably added to PositionedBG_T
LocationBasedEvents_T	{minSafeRearEndPassed : bool, maxSafeFrontEndPassed : bool, levelTransitionBorderPassed : bool}	**Comments:** Information necessary to calculate whether event triggering the sending of a position report evaluates to true. **minSafeRearEndPassed Comments:** to decide 3.6.5.1.4.e **maxSafeFrontEndPassed Comments:** to decide 3.6.5.1.4.k **levelTransitionBorderPassed Comments:** to decide 3.6.5.1.4.f

Name	Definition	Comments and Information
M_Error_T	{valid : bool, M_ERROR_Balise_group_linking_consistency_error : bool, M_ERROR_Linked_balise_group_message_consistency_error : bool, M_ERROR_Unlinked_balise_group_message_consistency_error : bool, M_ERROR_Radio_message_consistency_error : bool, M_ERROR_Radio_sequence_error : bool, M_ERROR_Radio_safe_radio_connection_error : bool, M_ERROR_Safety_critical_failure : bool, M_ERROR_Double_linking_error : bool, M_ERROR_Double_repositioning_error : bool}	**Comments:** Structure string all current errors (i.e., of all possible values of M_ERROR)
MemorizedErrorMsg_T	{valid : bool, errorType : M_ERROR}	**Comments:** internal data structre
Packet0_T	{valid : bool, packet0 : TrainToTrack::Position_Report}	**Comments:** Adding a valid flag to Packet 0
Packet1_T	{valid : bool, packet1 : TrainToTrack::Position_Report_based_on_two_balise_groups}	**Comments:** Adding a valid flag to packet 1.
Packet4_T	{valid : bool, packet4 : TrainToTrack::Error_reporting}	**Comments:** Adding a valid flag to packet 4.
Packet58_T	{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 : ProvidePositionReport_Pkg::IterPacket58List_T}	**Comments:** Position Report Parameters **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
Packet5_T	{valid : bool, packet5 : TrainToTrack::Train_running_number}	**Comments:** Adding a valid flag to packet 5.

Name	Definition	Comments and Information
PositionReport_T	{valid : bool, header : ProvidePositionReport_Pkg::PositionReportHeader_T, packet0 : ProvidePositionReport_Pkg::Packet0_T, packet1 : ProvidePositionReport_Pkg::Packet1_T, packet4 : ProvidePositionReport_Pkg::Packet4_T, packet5 : ProvidePositionReport_Pkg::Packet5_T}	**Comments:** Position report: either packet 0 or packet 1 has valid flag set to true.
PositionReportHeader_T	{nid_message : NID_MESSAGE, l_message : L_MESSAGE, t_train : T_TRAIN, nid_engine : NID_ENGINE}	**Comments:** Position report header **nid_message Comments:** Message ID number **l_message Comments:** Message length **t_train Comments:** time stamp from train **nid_engine Comments:** Engine ID number
PositionReportParameter_T	{present : bool, nidBG : NID_BG, bgLocation : Obu_BasicTypes_Pkg::Location_T, packet58 : ProvidePositionReport_Pkg::Packet58_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
PresentxMLOC_T	{present : bool, m_loc : M_LOC}	**Comments:** Crossproduct of present flag and M_LOC; internal memory representation **m_loc Comments:** Special location/moment where the train has to report its position
RBC_Communication_T	{newSessionEstablished : bool}	**Comments:** variables necessary for the communication with the RBC **newSessionEstablished Comments:** to decide 3.6.5.1.4.h
SystemTime_T	Obu_BasicTypes_Pkg::T_internal_Type	**Comments:** global system time

15.1.2. Constants

Table 416: Public Constants of ProvidePositionReport_Pkg

Name	Type	Value	Comments and Information
cErrorMessage	ProvidePositionReport_Pkg::ErrorMessage_T	{present : false, errorType : M_ERROR_Balise_group_linking_consistency_error}	
cIterPacket58	int	2	**Comments:** value is bound to 32
cL_MESSAGE	L_MESSAGE	0	

Name	Type	Value	Comments and Information
cMinSafeRearEnd	int	0	
cNITER_List	ProvidePositionReport_Pkg::IterPacket58List_T	[{d_loc : 0, q_lgtloc : Q_LGTLOC_Min_safe_rear_end}, {d_loc : 0, q_lgtloc : Q_LGTLOC_Min_safe_rear_end}]	
cNITER_Pair	ProvidePositionReport_Pkg::IterPacket58_T	{d_loc : 0, q_lgtloc : Q_LGTLOC_Min_safe_rear_end}	

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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 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, BG_Header : {q_updown : Q_UPDOWN_Down_link_telegram,	

Name	Type	Value	Comments and Information
cPresentxM_LOC	ProvidePositionReport_Pkg::PresentxMLOC_T	{present : false, m_loc : M_LOC_Now}	
cQ_SCALE	Q_SCALE	Q_SCALE_10_cm_scale	
cT_TRAIN	T_TRAIN	0.0	
cTrack2TrainStatus	BG_Types_Pkg::TrainToTrackStatus_T	{m_mode : M_MODE_Full_Supervision, m_level : M_LEVEL_Level_0, m_leveltr : M_LEVELTR_Level_0, nid_ntc : 0, q_length : Q_LENGTH_No_train_integrity_information_available}	**Comments:** used as intial value

Name	Type	Value	Comments and Information
		{valid : false, timestamp : 0, trainPosition : {nominal : 0, d_min : 0, d_max : 0}, trainPositionDerivedFromLastLinkedBG : {nominal : 0, d_min : 0, d_max : 0}, trainPositionDerivedFromLastUnlinkedBG : {nominal : 0, d_min : 0, d_max : 0}, lastPassedLinkedBG : {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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration : 0, motionState :	

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, bgPosition : {valid : false, timestamp : 0, odo : {o_nominal : 0, o_min : 0, o_max : 0}, speed : 0, acceleration :	

Name	Type	Value	Comments and Information
cTrigger	bool	false	
cUnknownLRBG	int	16777215	

15.1.3. AggregateHeader Operator

Declared as **`public function`**

15.1.3.1. Comments and Information

AggregateHeader Comments:

- Aggregates values necessary for the position report header. Used default value for L_MESSAGE and T_TRAIN.

15.1.3.2. Interface

Table 417: Inputs of AggregateHeader

Name	Type	Comments and Information
trainProps	TrainPosition_Types_Pck::trainProperties_T	

Table 418: Outputs of AggregateHeader

Name	Type	Comments and Information
posRepHeader	ProvidePositionReport_Pkg::PositionReportHeader_T	

15.1.3.3. Operator Hierarchy

diagram : diagram_AggregateHeader_1

15.1.3.4. Graphical and Textual Diagrams

15.1.3.4.1. View of diagram_AggregateHeader_1 (AggregateHeader)

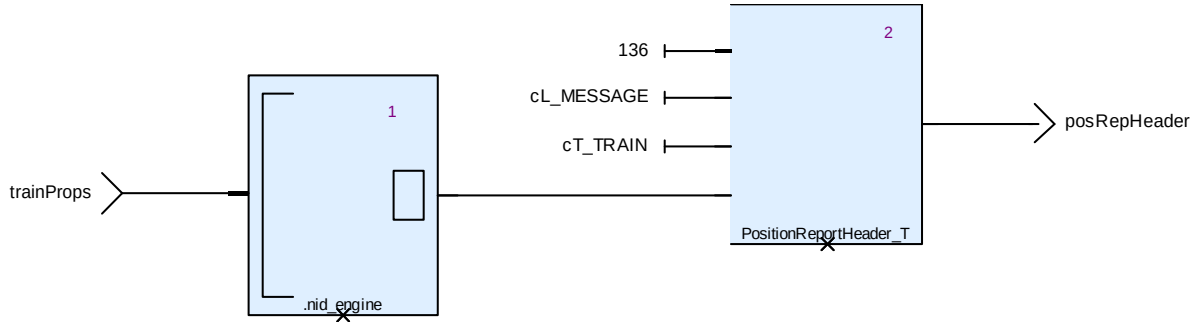


Figure 151: View of diagram_AggregateHeader_1 (AggregateHeader)

15.1.4. AggregatePacket_0 Operator

Declared as **`public function`**

15.1.4.1. Comments and Information

AggregatePacket_0 Comments:

- Aggregates all values necessary for report packet 0.

15.1.4.2. Interface

Table 419: Inputs of AggregatePacket_0

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
TrainRearEndPos3	L_TRAININT	
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	

Table 420: Outputs of AggregatePacket_0

Name	Type	Comments and Information
packet0	ProvidePositionReport_Pkg::Packet0_T	

15.1.4.3. Operator Hierarchy

diagram : diagram_AggregatePacket_0_1

15.1.4.4. Graphical and Textual Diagrams

15.1.4.4.1. View of diagram_AggregatePacket_0_1 (AggregatePacket_0)

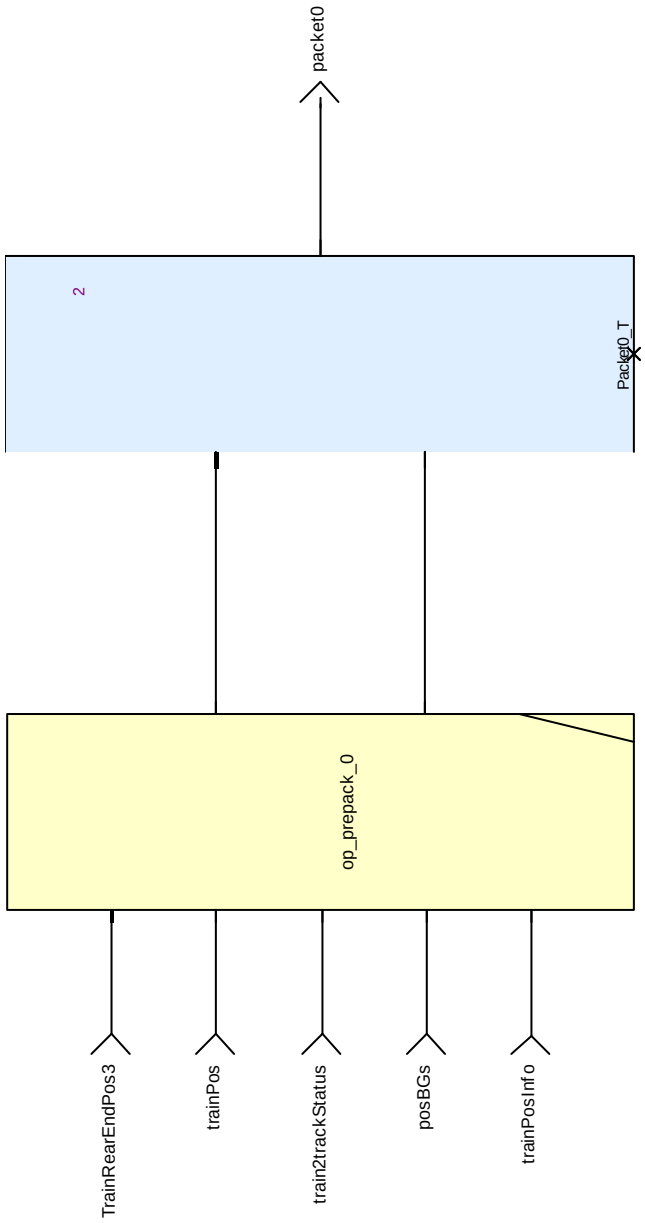


Figure 152: View of diagram_AggregatePacket_0_1 (AggregatePacket_0)

15.1.5. AggregatePacket_1 Operator

Declared as **`public function`**

15.1.5.1. Comments and Information

AggregatePacket_1 Comments:

- Aggregates all values necessary for report packet 1.

15.1.5.2. Interface

Table 421: Inputs of AggregatePacket_1

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
TrainRearEndPos4	L_TRAININT	
directionLRBG	ProvidePositionReport_Pkg::BG_Orientation_T	
prvDirTrain	Q_DIRTRAIN	
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	

Table 422: Outputs of AggregatePacket_1

Name	Type	Comments and Information
sendNoReport	bool	**Comments:** Models condition 3.4.2.3.3.5; in this case, no report shall be sent to the RBC.
packet1	ProvidePositionReport_Pkg::Packet1_T	

15.1.5.3. Locals

Table 423: Locals of AggregatePacket_1

Name	Type	Properties		Comments and Information
cond_3_4_2_3_3_2	bool			
cond_3_4_2_3_3_3	bool			
cond_3_4_2_3_3_4	bool			
dirLRBG	ProvidePositionReport_Pkg::BG_Orientation_T			
in_dirlrbg	Q_DIRLRBG	default	Q_DIRLRBG_Unknown	
in_dirtrain	Q_DIRTRAIN	default	Q_DIRTRAIN_Unknown	
in_dlrbg	Q_DLRBG	default	Q_DLRBG_Unknown	

15.1.5.4. Operator Hierarchy

diagram : diagram_AggregatePacket_1_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else
                branch : then
                branch : else

15.1.5.5. Graphical and Textual Diagrams

15.1.5.5.1. View of diagram_AggregatePacket_1_1 (AggregatePacket_1)

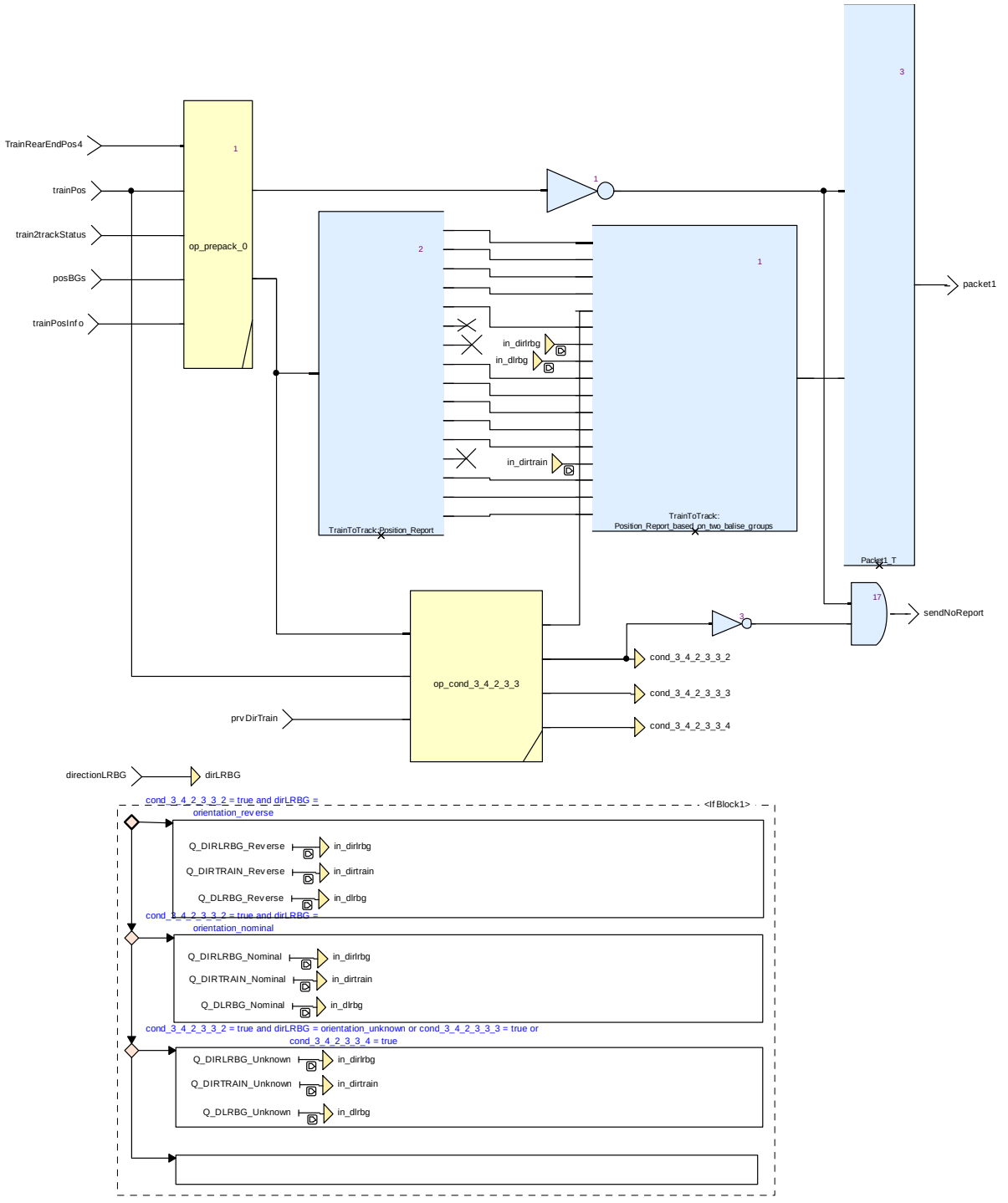


Figure 153: View of diagram_AggregatePacket_1_1 (AggregatePacket_1)

Table 424: Conditional Blocks of diagram_AggregatePacket_1_1

Conditional Block	Comments and Information
IfBlock1	

Table 425: Actions of diagram_AggregatePacket_1_1

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

15.1.6. AggregatePacket_4 Operator

Declared as **`public node`**

15.1.6.1. Comments and Information

AggregatePacket_4 Comments:

- Aggregates all values necessary for report packet 4.
- The memory stores one error. If another error is reported before the position report has been sent,
- the first error is overwritten by the last error. The error is stored until a position report is sent (trigger=true)
- or it is overwritten.
- With the help of the state machine, we can ensure that a stored error is reported with the next trigger message.

15.1.6.2. Interface

Table 426: Inputs of AggregatePacket_4

Name	Type	Properties		Comments and Information
errorMsg	ProvidePositionReport_Pkg::ErrorMessage_T	last	cErrorMessage	
trigger	bool	last	cTrigger	

Table 427: Outputs of AggregatePacket_4

Name	Type	Comments and Information
packet4	ProvidePositionReport_Pkg::Packet4_T	

15.1.6.3. Locals

Table 428: Locals of AggregatePacket_4

Name	Type	Properties		Comments and Information
empty	bool	default	true	
intermediate	bool	default	false	
valid	bool			

15.1.6.4. Operator Hierarchy

diagram : diagram_AggregatePacket_4_1
state-machine : SM1
state : emptyStorage
state : filledStorage
state : init
state : intermediate

15.1.6.5. Graphical and Textual Diagrams

15.1.6.5.1. View of diagram_AggregatePacket_4_1 (AggregatePacket_4)

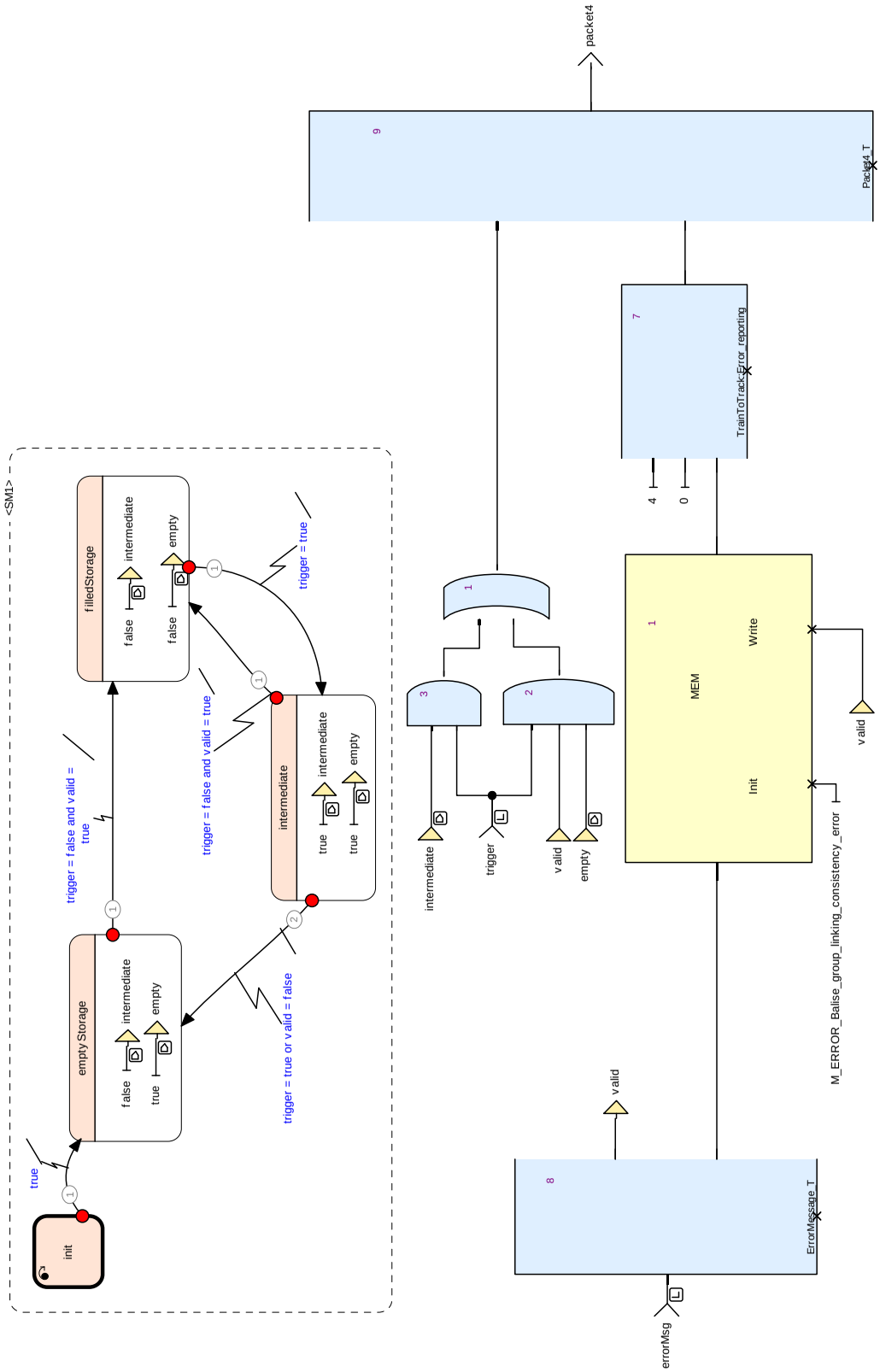


Figure 154: View of diagram_AggregatePacket_4_1 (AggregatePacket_4)

Table 429: State Machines of diagram_AggregatePacket_4_1

State Machine	Comments and Information
SM1	

Table 430: States of diagram_AggregatePacket_4_1

State	Comments and Information
SM1:emptyStorage	
SM1:filledStorage	
SM1:init	
SM1:intermediate	

Table 431: Transitions of diagram_AggregatePacket_4_1

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:emptyStorage **Target:** SM1:filledStorage	1	**Condition:** trigger = false and valid = true	
Source: SM1:filledStorage **Target:** SM1:intermediate	1	**Condition:** trigger = true	
Source: SM1:init **Target:** SM1:emptyStorage	1	**Condition:** true	
Source: SM1:intermediate **Target:** SM1:filledStorage	1	**Condition:** trigger = false and valid = true	
Source: SM1:intermediate **Target:** SM1:emptyStorage	2	**Condition:** trigger = true or valid = false	

15.1.7. AggregatePacket_5 Operator

Declared as **`public function`**

15.1.7.1. Comments and Information

AggregatePacket_5 Comments:

- Aggregates all values necessary for report packet 5. As train information data is
- always avaliable, the valid flag is always set to true.

15.1.7.2. Interface

Table 432: Inputs of AggregatePacket_5

Name	Type	Comments and Information
trainProps	TrainPosition_Types_Pck::trainProperties_T	

Table 433: Outputs of AggregatePacket_5

Name	Type	Comments and Information
packet5	ProvidePositionReport_Pkg::Packet5_T	

15.1.7.3. Operator Hierarchy

diagram : diagram_AggregatePacket_5_1

15.1.7.4. Graphical and Textual Diagrams

15.1.7.4.1. View of diagram_AggregatePacket_5_1 (AggregatePacket_5)

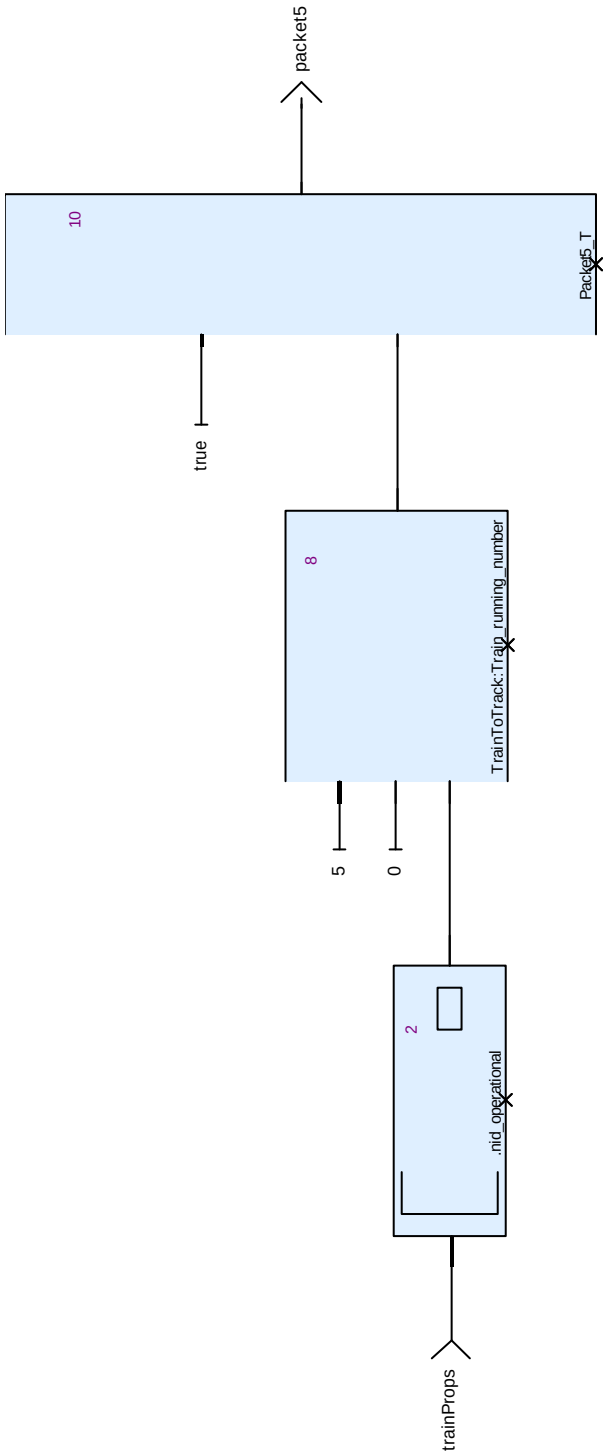


Figure 155: View of diagram_AggregatePacket_5_1 (AggregatePacket_5)

15.1.8. CalculateSafeTrainLength Operator

Declared as **`public node`**

15.1.8.1. Comments and Information

CalculateSafeTrainLength Comments:

- Calculates the the safeTrainLength according to 3.6.5.2.4/5 and the MinSafeRearEnd.
- safeTrainLength = absolute(EstimatedFrontEndPosition - MinSafeRearEnd) , where
- MinSafeRearEnd = minSafeFrontEndPosition - L_TRAIN

15.1.8.2. Interface

Table 434: Inputs of CalculateSafeTrainLength

Name	Type	Comments and Information
trainProps	TrainPosition_Types_Pck::trainProperties_T	
trainPosition	TrainPosition_Types_Pck::trainPosition_T	

Table 435: Outputs of CalculateSafeTrainLength

Name	Type	Comments and Information
safeTrainLength	L_TRAININT	
minSafeRearEnd	int	

15.1.8.3. Operator Hierarchy

diagram : diagram_CalculateSafeTrainLength_1

15.1.8.4. Graphical and Textual Diagrams

15.1.8.4.1. View of diagram_CalculateSafeTrainLength_1 (CalculateSafeTrainLength)

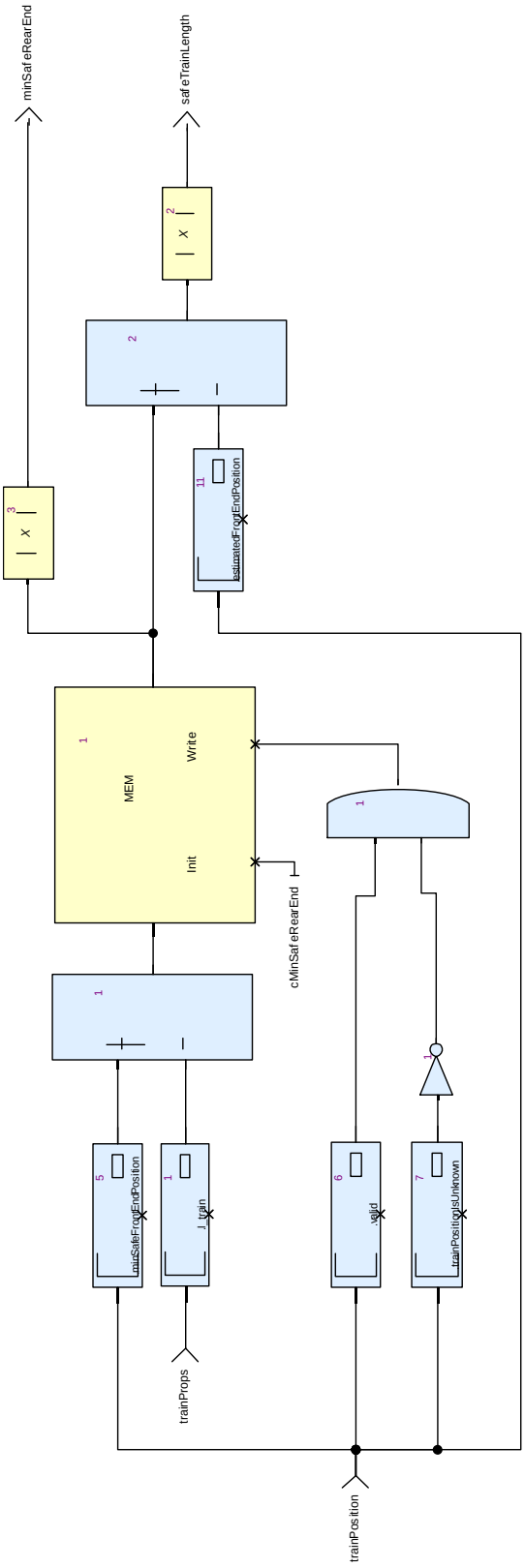


Figure 156: View of diagram_CalculateSafeTrainLength_1 (CalculateSafeTrainLength)

15.1.9. CollectData Operator

Declared as **`public node`**

15.1.9.1. Comments and Information

CollectData Comments:

- In this operation, data of packets 0 -5 and the header is aggregated to a position report.

15.1.9.2. Interface

Table 436: Inputs of CollectData

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
trainProps	TrainPosition_Types_Pck::trainProperties_T	
TrainRearEndPos	L_TRAININT	
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	
trigger	bool	
errorMsg	ProvidePositionReport_Pkg::ErrorMessage_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
directionLRBG	ProvidePositionReport_Pkg::BG_Orientation_T	
prvDirTrain	Q_DIRTRAIN	

Table 437: Outputs of CollectData

Name	Type	Comments and Information
posRep	ProvidePositionReport_Pkg::PositionReport_T	

15.1.9.3. Operator Hierarchy

diagram : diagram_CollectData_1

15.1.9.4. Graphical and Textual Diagrams

15.1.9.4.1. View of diagram_CollectData_1 (CollectData)

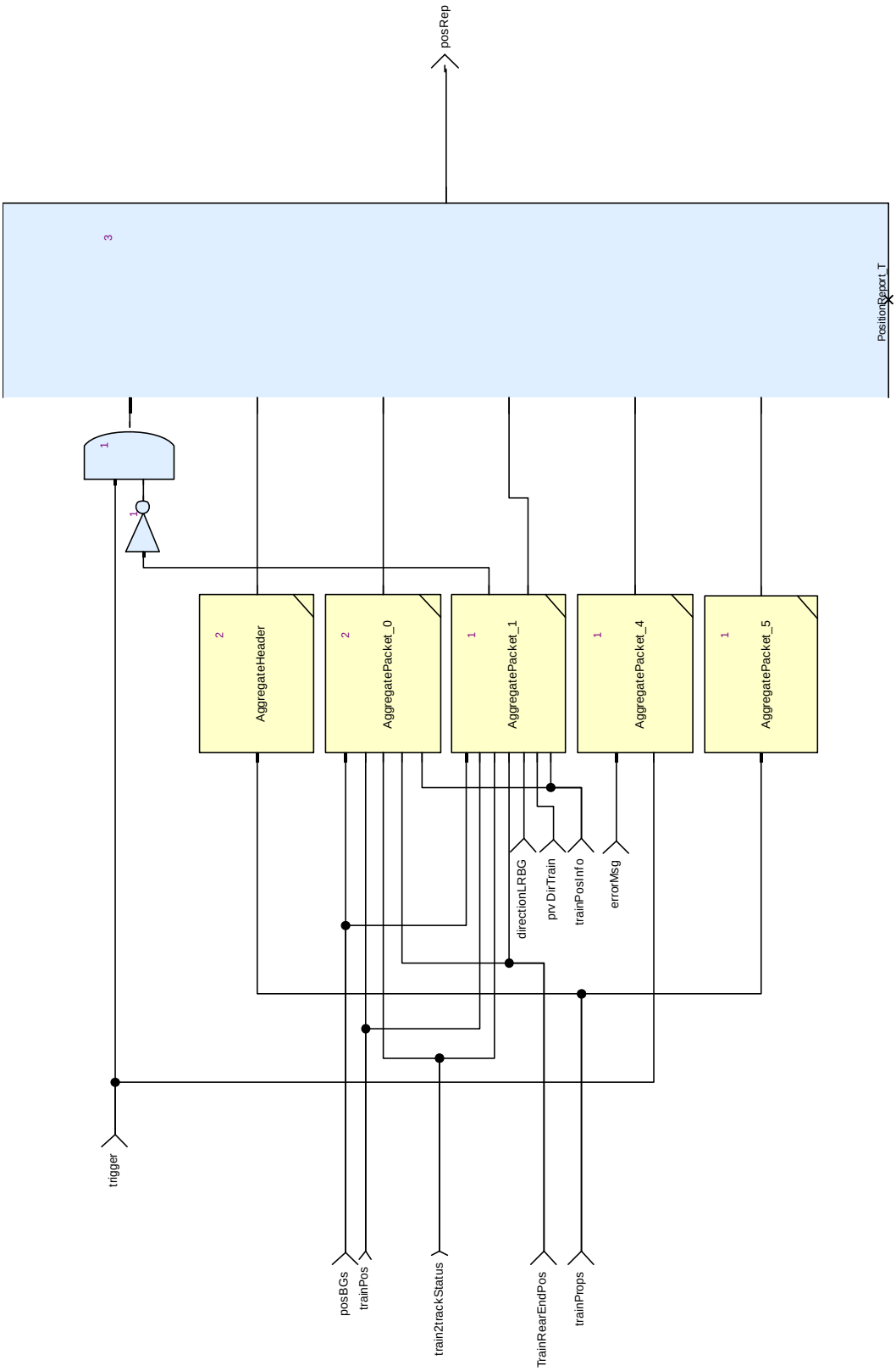


Figure 157: View of diagram_CollectData_1 (CollectData)

15.1.10. EvaluateEvents Operator

Declared as **`public node`**

15.1.10.1. Comments and Information

EvaluateEvents Comments:

- Evaluates whether one of the events described in 3.6.5.1.4 holds.

15.1.10.2. Interface

Table 438: Inputs of EvaluateEvents

Name	Type	Properties		Comments and Information
trackInfo	ProvidePositionReport_Pkg::LocationBasedEvents_T			
trainPos	TrainPosition_Types_Pck::trainPosition_T			
posBGs	TrainPosition_Types_Pck::positionedBGs_T			
rbcComm	ProvidePositionReport_Pkg::RBC_Communication_T			
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T			
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	last	cTrainPosInfo	

Table 439: Outputs of EvaluateEvents

Name	Type	Comments and Information
result	bool	

15.1.10.3. Operator Hierarchy

diagram : diagram_EvaluateEvents_1

15.1.10.4. Graphical and Textual Diagrams

15.1.10.4.1. View of diagram_EvaluateEvents_1 (EvaluateEvents)

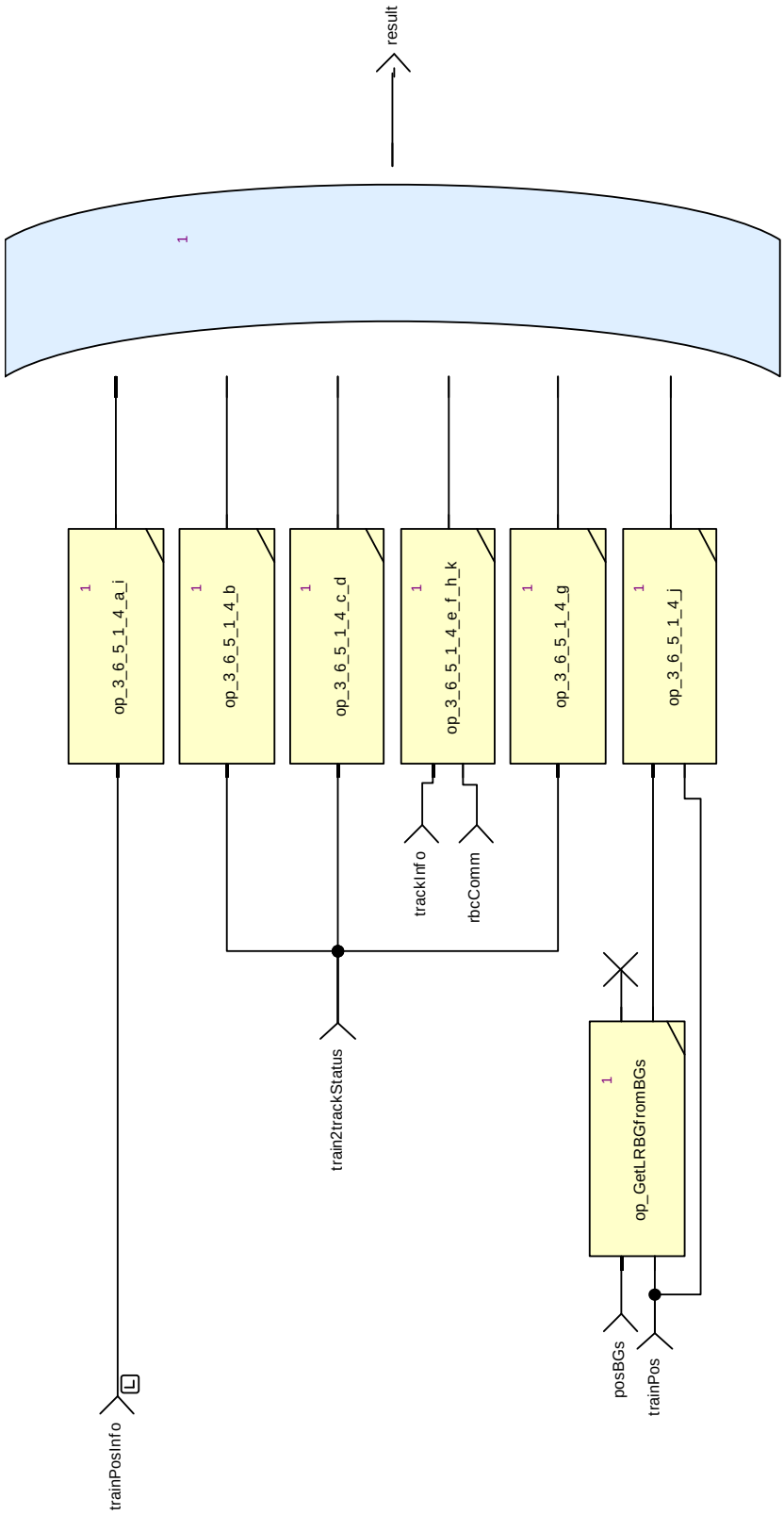


Figure 158: View of diagram_EvaluateEvents_1 (EvaluateEvents)

15.1.11. EvaluateTrigger Operator

Declared as **`public node`**

15.1.11.1. Comments and Information

EvaluateTrigger Comments:

- Evaluates whether one of the triggers as specified by the trigger parameters evaluates to true.
- Trigger parameters are sent by the RBC using packet 58.

15.1.11.2. Interface

Table 440: Inputs of EvaluateTrigger

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
posRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
systemTime	ProvidePositionReport_Pkg::SystemTime_T	
minSafeRearEnd	int	

Table 441: Outputs of EvaluateTrigger

Name	Type	Comments and Information
result	bool	

15.1.11.3. Operator Hierarchy

diagram : diagram_EvaluateTrigger_1

15.1.11.4. Graphical and Textual Diagrams

15.1.11.4.1. View of diagram_EvaluateTrigger_1 (EvaluateTrigger)

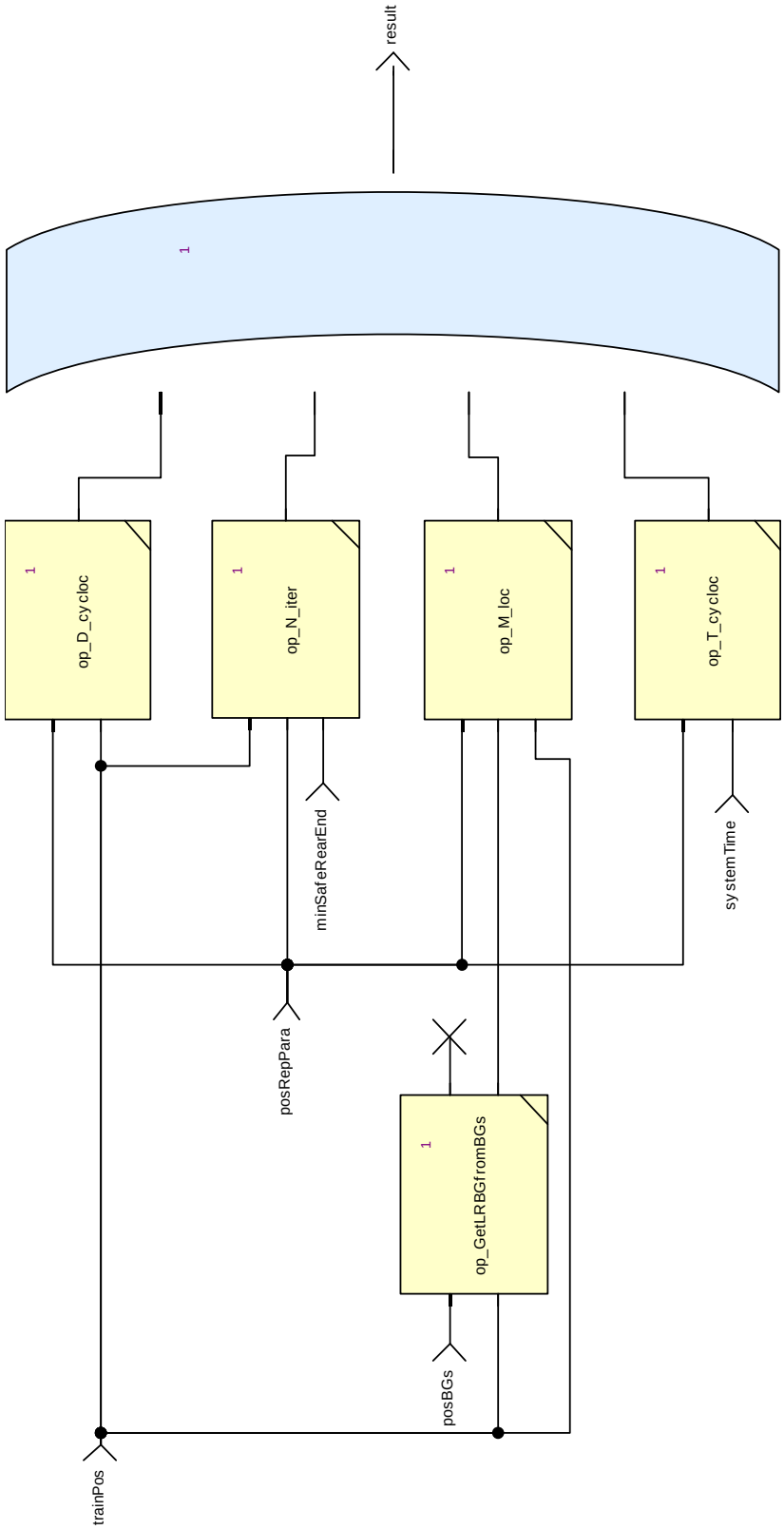


Figure 159: View of diagram_EvaluateTrigger_1 (EvaluateTrigger)

15.1.12. EvaluateTriggerAndEvents Operator

Declared as **`public node`**

15.1.12.1. Comments and Information

EvaluateTriggerAndEvents Comments:

- concjunction of the evaluation of triggers and events.

15.1.12.2. Interface

Table 442: Inputs of EvaluateTriggerAndEvents

Name	Type	Properties		Comments and Information
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	last	cTrainPosInfo	
trainPos	TrainPosition_Types_Pck::trainPosition_T			
posRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T			
posBGs	TrainPosition_Types_Pck::positionedBGs_T			
systemTime	ProvidePositionReport_Pkg::SystemTime_T			
rbcComm	ProvidePositionReport_Pkg::RBC_Communication_T			
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T			
minSafeRearEnd	int			
trackInfo	ProvidePositionReport_Pkg::LocationBasedEvents_T			

Table 443: Outputs of EvaluateTriggerAndEvents

Name	Type	Comments and Information
trigger	bool	

15.1.12.3. Operator Hierarchy

diagram : diagram_EvaluateTriggerAndEvents_1

15.1.12.4. Graphical and Textual Diagrams

15.1.12.4.1. View of diagram_EvaluateTriggerAndEvents_1 (EvaluateTriggerAndEvents)

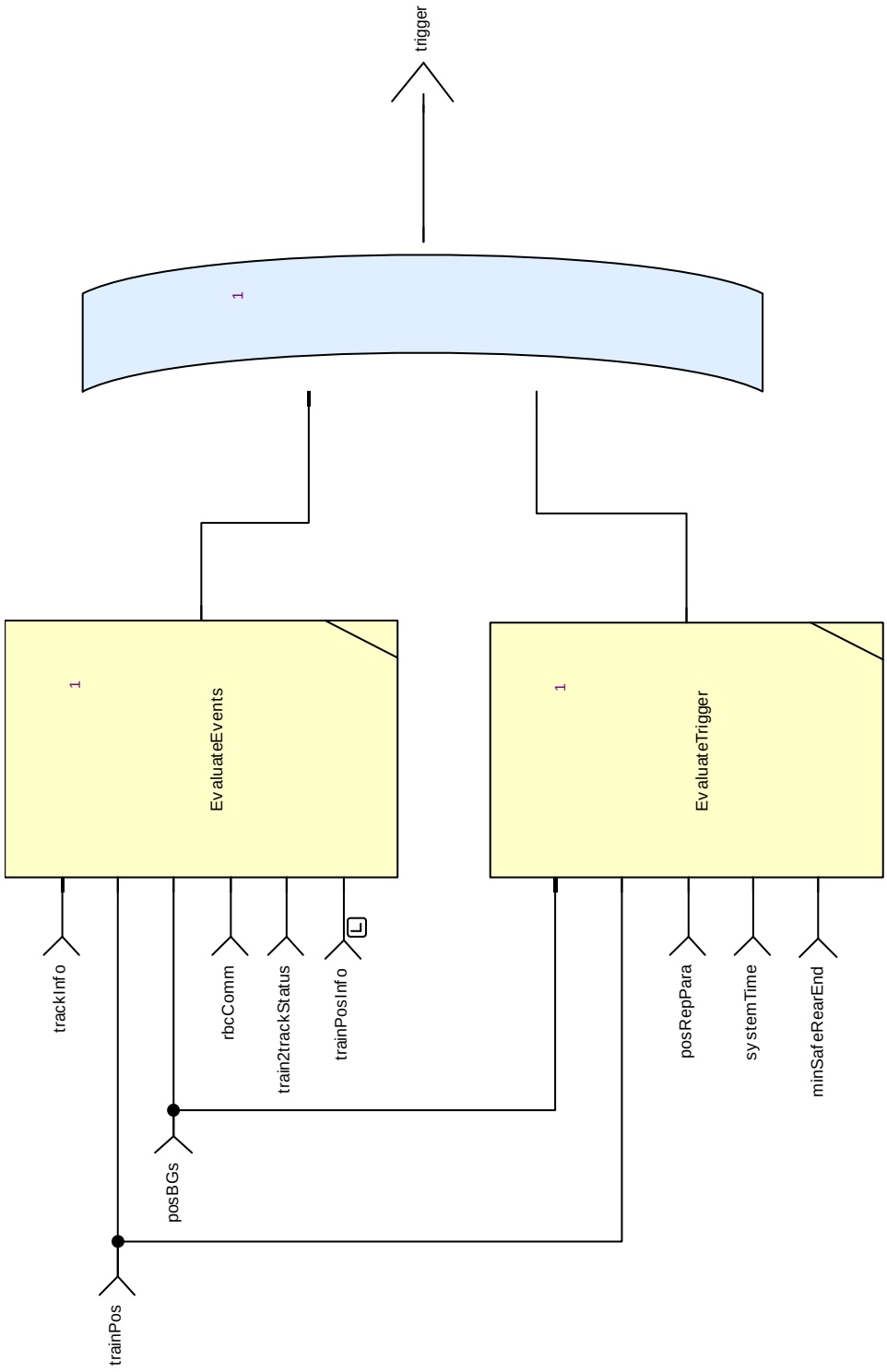


Figure 160: View of diagram_EvaluateTriggerAndEvents_1 (EvaluateTriggerAndEvents)

15.1.13. op_3_6_5_1_4_a_i Operator

Declared as **`public node`**

15.1.13.1. Comments and Information

op_3_6_5_1_4_a_i Comments:

- Models events as listed in 3.6.5.1.4 a) and i),

15.1.13.2. Interface

Table 444: Inputs of op_3_6_5_1_4_a_i

Name	Type	Properties		Comments and Information
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	last	cTrainPosInfo	

Table 445: Outputs of op_3_6_5_1_4_a_i

Name	Type	Comments and Information
b	bool	

15.1.13.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_a_i_1

15.1.13.4. Graphical and Textual Diagrams

15.1.13.4.1. View of diagram_op_3_6_5_1_4_a_i_1 (op_3_6_5_1_4_a_i)

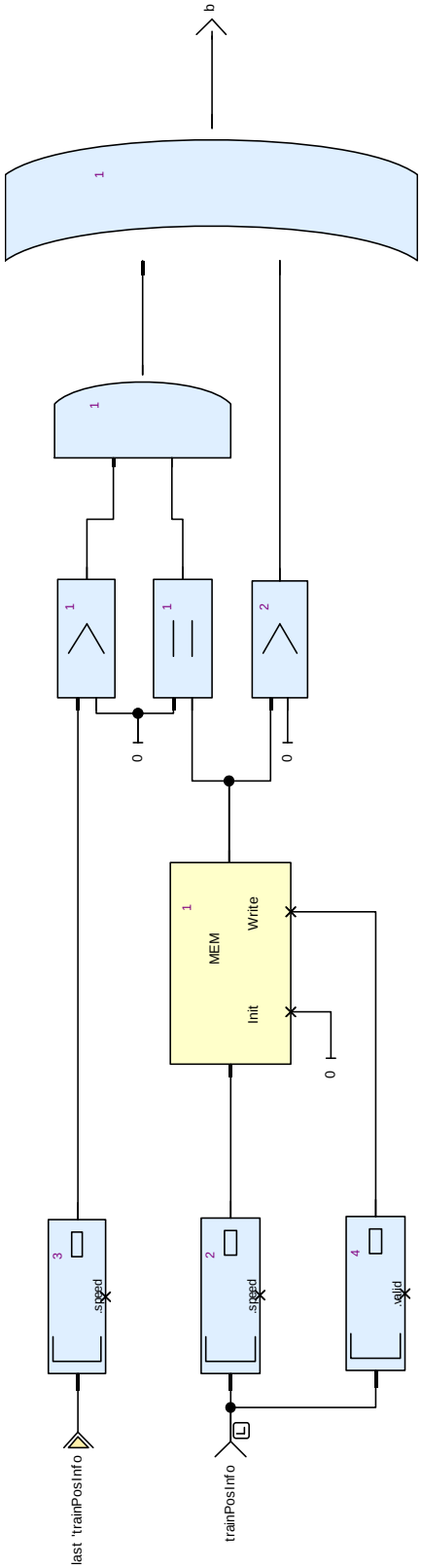


Figure 161: View of diagram_op_3_6_5_1_4_a_i_1 (op_3_6_5_1_4_a_i)

15.1.14. op_3_6_5_1_4_b Operator

Declared as **`public node`**

15.1.14.1. Comments and Information

op_3_6_5_1_4_b Comments:

- Models event as listed in 3.6.5.1.4 b),

15.1.14.2. Interface

Table 446: Inputs of op_3_6_5_1_4_b

Name	Type	Properties		Comments and Information
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	last	cTrack2TrainStatus	

Table 447: Outputs of op_3_6_5_1_4_b

Name	Type	Comments and Information
b	bool	

15.1.14.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_b_1

15.1.14.4. Graphical and Textual Diagrams

15.1.14.4.1. View of diagram_op_3_6_5_1_4_b_1 (op_3_6_5_1_4_b)

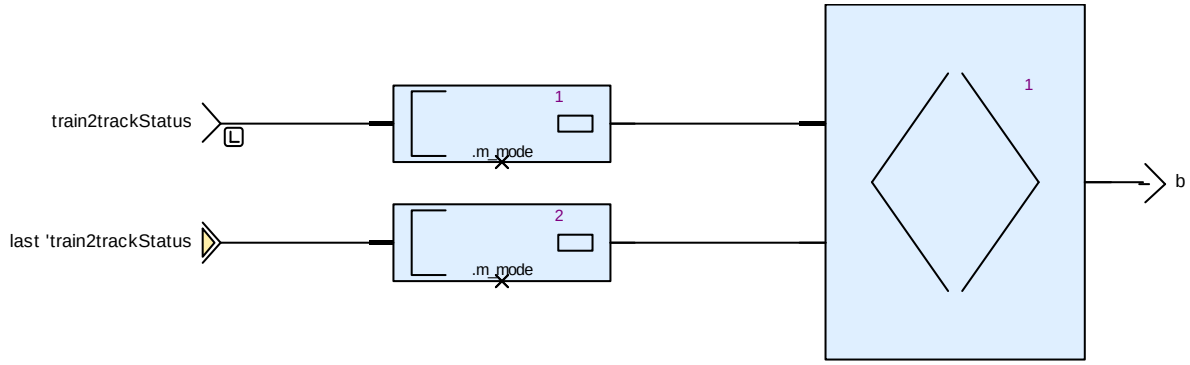


Figure 162: View of diagram_op_3_6_5_1_4_b_1 (op_3_6_5_1_4_b)

15.1.15. op_3_6_5_1_4_c_d Operator

Declared as **`public function`**

15.1.15.1. Comments and Information

op_3_6_5_1_4_c_d Comments:

- Models events as listed in 3.6.5.1.4 c) and d),

15.1.15.2. Interface

Table 448: Inputs of op_3_6_5_1_4_c_d

Name	Type	Comments and Information
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	

Table 449: Outputs of op_3_6_5_1_4_c_d

Name	Type	Comments and Information
b	bool	

15.1.15.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_c_d_1

15.1.15.4. Graphical and Textual Diagrams

15.1.15.4.1. View of diagram_op_3_6_5_1_4_c_d_1 (op_3_6_5_1_4_c_d)

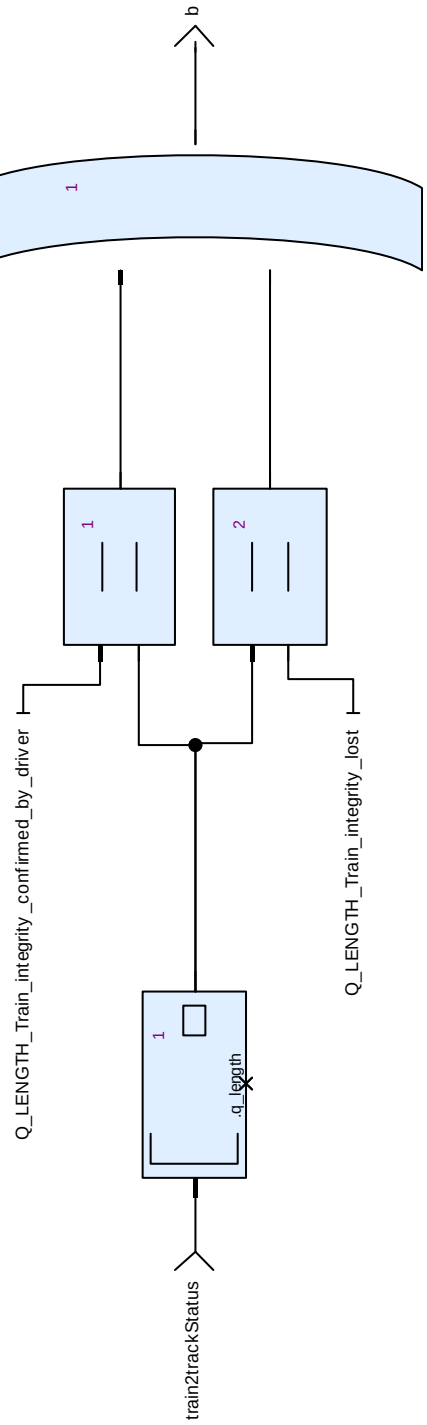


Figure 163: View of diagram_op_3_6_5_1_4_c_d_1 (op_3_6_5_1_4_c_d)

15.1.16. op_3_6_5_1_4_e_f_h_k Operator

Declared as **`public function`**

15.1.16.1. Comments and Information

op_3_6_5_1_4_e_f_h_k Comments:

- Models events as listed in 3.6.5.1.4 e), f), h) and k),

15.1.16.2. Interface

Table 450: Inputs of op_3_6_5_1_4_e_f_h_k

Name	Type	Comments and Information
trackInfo	ProvidePositionReport_Pkg::LocationBasedEvents_T	
rbcComm	ProvidePositionReport_Pkg::RBC_Communication_T	

Table 451: Outputs of op_3_6_5_1_4_e_f_h_k

Name	Type	Comments and Information
b	bool	

15.1.16.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_e_f_h_k_1

15.1.16.4. Graphical and Textual Diagrams

15.1.16.4.1. View of diagram_op_3_6_5_1_4_e_f_h_k_1 (op_3_6_5_1_4_e_f_h_k)

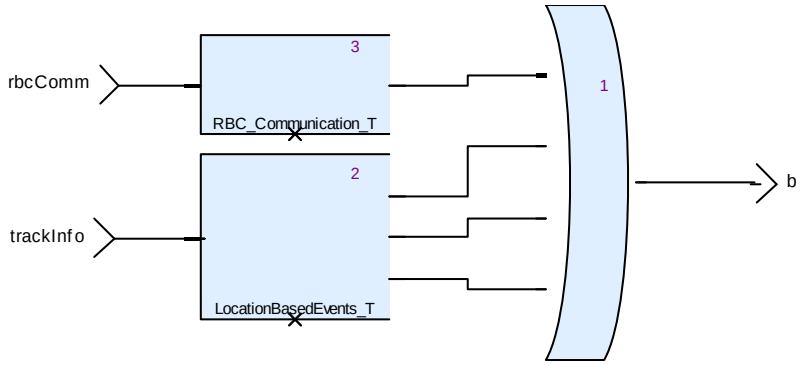


Figure 164: View of diagram_op_3_6_5_1_4_e_f_h_k_1 (op_3_6_5_1_4_e_f_h_k)

15.1.17. op_3_6_5_1_4_g Operator

Declared as **`public node`**

15.1.17.1. Comments and Information

op_3_6_5_1_4_g Comments:

- Models the event as listed in 3.6.5.1.4 g),

15.1.17.2. Interface

Table 452: Inputs of op_3_6_5_1_4_g

Name	Type	Properties		Comments and Information
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	last	cTrack2TrainStatus	

Table 453: Outputs of op_3_6_5_1_4_g

Name	Type	Comments and Information
b	bool	

15.1.17.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_g_1

15.1.17.4. Graphical and Textual Diagrams

15.1.17.4.1. View of diagram_op_3_6_5_1_4_g_1 (op_3_6_5_1_4_g)

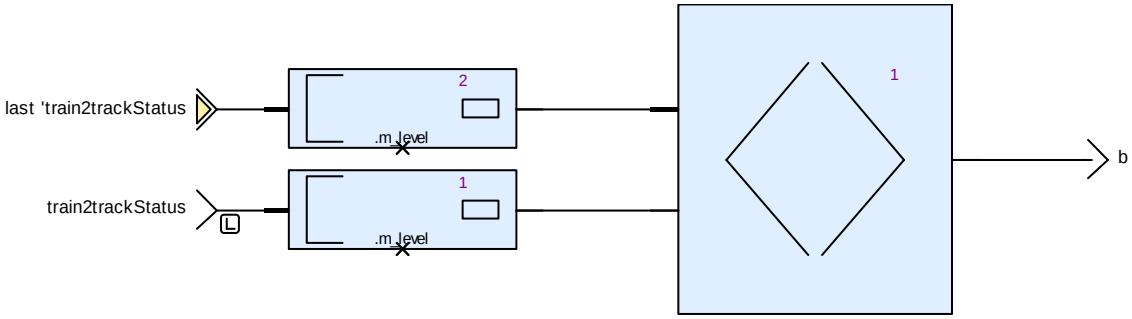


Figure 165: View of diagram_op_3_6_5_1_4_g_1 (op_3_6_5_1_4_g)

15.1.18. op_3_6_5_1_4_j Operator

Declared as **`public function`**

15.1.18.1. Comments and Information

op_3_6_5_1_4_j Comments:

- Models the event as listed in 3.6.5.1.4 j),
- A balise group is compliant according tothe definition in 3.6.2.2.2.a

15.1.18.2. Interface

Table 454: Inputs of op_3_6_5_1_4_j

Name	Type	Comments and Information
LRBG	TrainPosition_Types_Pck::positionedBG_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 455: Outputs of op_3_6_5_1_4_j

Name	Type	Comments and Information
b	bool	

15.1.18.3. Operator Hierarchy

diagram : diagram_op_3_6_5_1_4_j_1

15.1.18.4. Graphical and Textual Diagrams

15.1.18.4.1. View of diagram_op_3_6_5_1_4_j_1 (op_3_6_5_1_4_j)

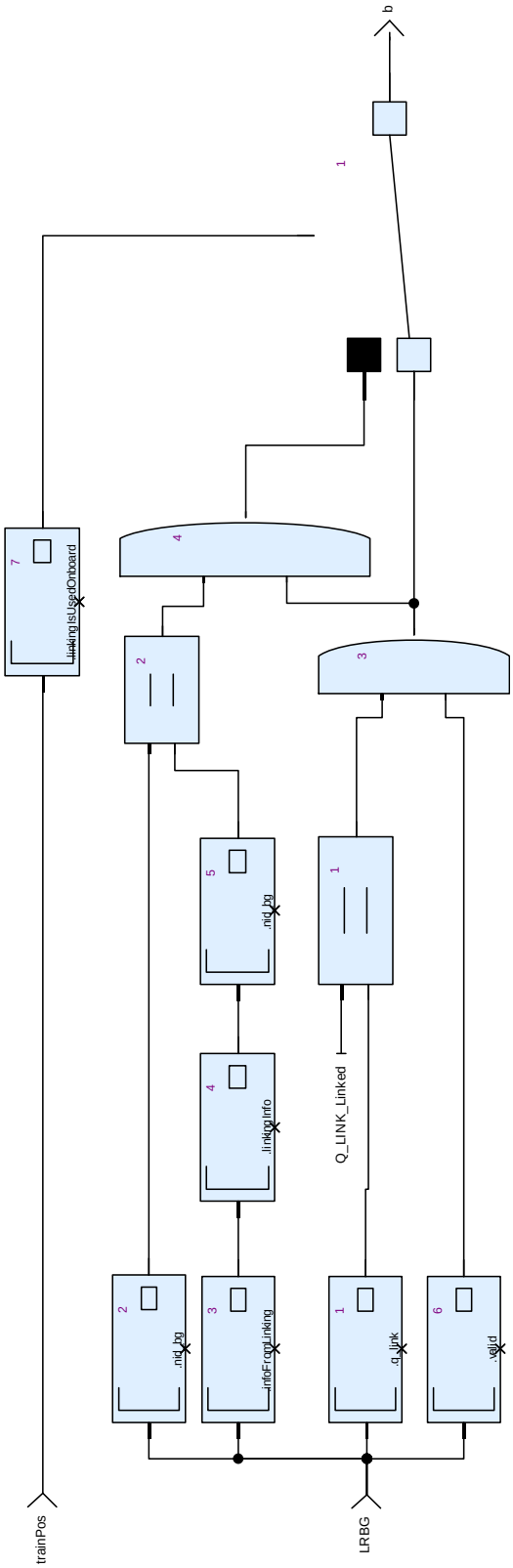


Figure 166: View of diagram_op_3_6_5_1_4_j_1 (op_3_6_5_1_4_j)

15.1.19. op_cond_3_4_2_3_3 Operator

Declared as **`public function`**

15.1.19.1. Comments and Information

op_cond_3_4_2_3_3 Comments:

- This block calculates the preconditions specified in 3.4.2.3.3.2 - 3.4.2.3.3.4.

15.1.19.2. Interface

Table 456: Inputs of op_cond_3_4_2_3_3

Name	Type	Comments and Information
posRep	TrainToTrack::Position_Report	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
prvDirTrain	Q_DIRTRAIN	

Table 457: Outputs of op_cond_3_4_2_3_3

Name	Type	Comments and Information
nidPrvLrbg	int	
cond_3_4_2_3_3_2	bool	
cond_3_4_2_3_3_3	bool	
cond_3_4_2_3_3_4	bool	

15.1.19.3. Operator Hierarchy

diagram : diagram_op_cond_3_4_2_3_3_1

15.1.19.4. Graphical and Textual Diagrams

15.1.19.4.1. View of diagram_op_cond_3_4_2_3_3_1 (op_cond_3_4_2_3_3)

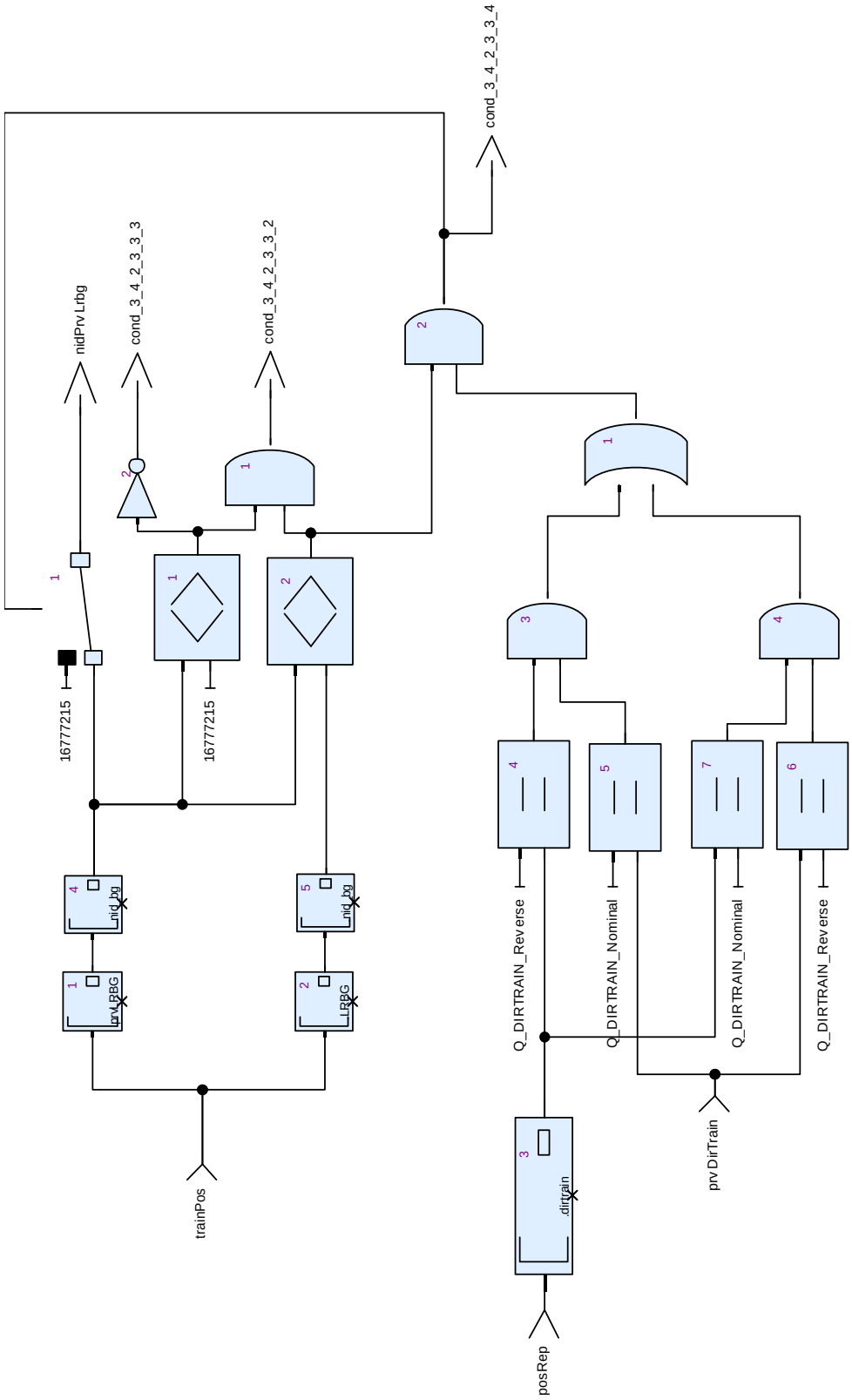


Figure 167: View of diagram_op_cond_3_4_2_3_3_1 (op_cond_3_4_2_3_3)

15.1.20. op_D_cycloc Operator

Declared as **`public node`**

15.1.20.1. Comments and Information

op_D_cycloc Comments:

- Models parameter D_CYCLOC that specifies a distance between two position reports.
- The model:
- - Mem1 stores the value of D_CYCLOC
- - Mem2 stores the position relative to interval goven by D_CYCLOC when the last report has been sent.
- If the clock is too slow and D_CYCLOC too small, too few reports will be sent.
- A value is written into Mem2:
- - if present \wedge D_CYCLOC \neq 32766 \wedge valid \wedge \neq unknownPosition
- \wedge in_state_SimpleCase then write trainPosition into Mem2
- (i.e., at the occurence of a new PositionReportParameter, the current train position is written into Mem2)
- - if \neg present \wedge D_CYCLOC \neq 32766 \wedge valid \wedge \neq unknownPosition \wedge
- trainPosition \geq currDistiance + D_CYCLOC \wedge in_state_SimpleCase, then write
- currDistance + D_CYCLOC into Mem2
- (i.e., if the train has passed the next level of the interval--currDistance + D_CYCLOC--increment currDistance
- by D_CYCLOC)
- - if \neg present \wedge D_CYCLOC \neq 32766 \wedge valid \wedge \neq unknownPosition \wedge
- in_state_Intermediate, then write trainPosition into Mem2
- (i.e., the first time we have a trainPosition after a PositionReportParameter has been received, we initialize
- Mem2 with trainPosition)
- From these three conditions, we derive he following condition when Mem2 must be written:
- - D_CYCLOC \neq 32766 \wedge valid \wedge \neq unknownPosition \wedge \new in_state_SpecialCase
- \wedge trainPosition \geq input(Mem2) (i.e., we only write currDistance + D_CYCLOC into Mem2 iff it is \leq
- the trainPosition))

15.1.20.2. Interface

Table 458: Inputs of op_D_cycloc

Name	Type	Comments and Information
pRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 459: Outputs of op_D_cycloc

Name	Type	Comments and Information
b	bool	

15.1.20.3. Locals

Table 460: Locals of op_D_cycloc

Name	Type	Properties		Comments and Information
currTriggerDistance	int	last	0	
intermediate	bool	default	false	
mem2Locked	bool	default	false	
presentReport	bool			
validPositionData	bool			

15.1.20.4. Operator Hierarchy

diagram : diagram_op_D_cycloc_1
state-machine : SM1
state : Init
state : Intermediate
state : SimpleCase
state : SpecialCase

15.1.20.5. Graphical and Textual Diagrams

15.1.20.5.1. View of diagram_op_D_cycloc_1 (op_D_cycloc)

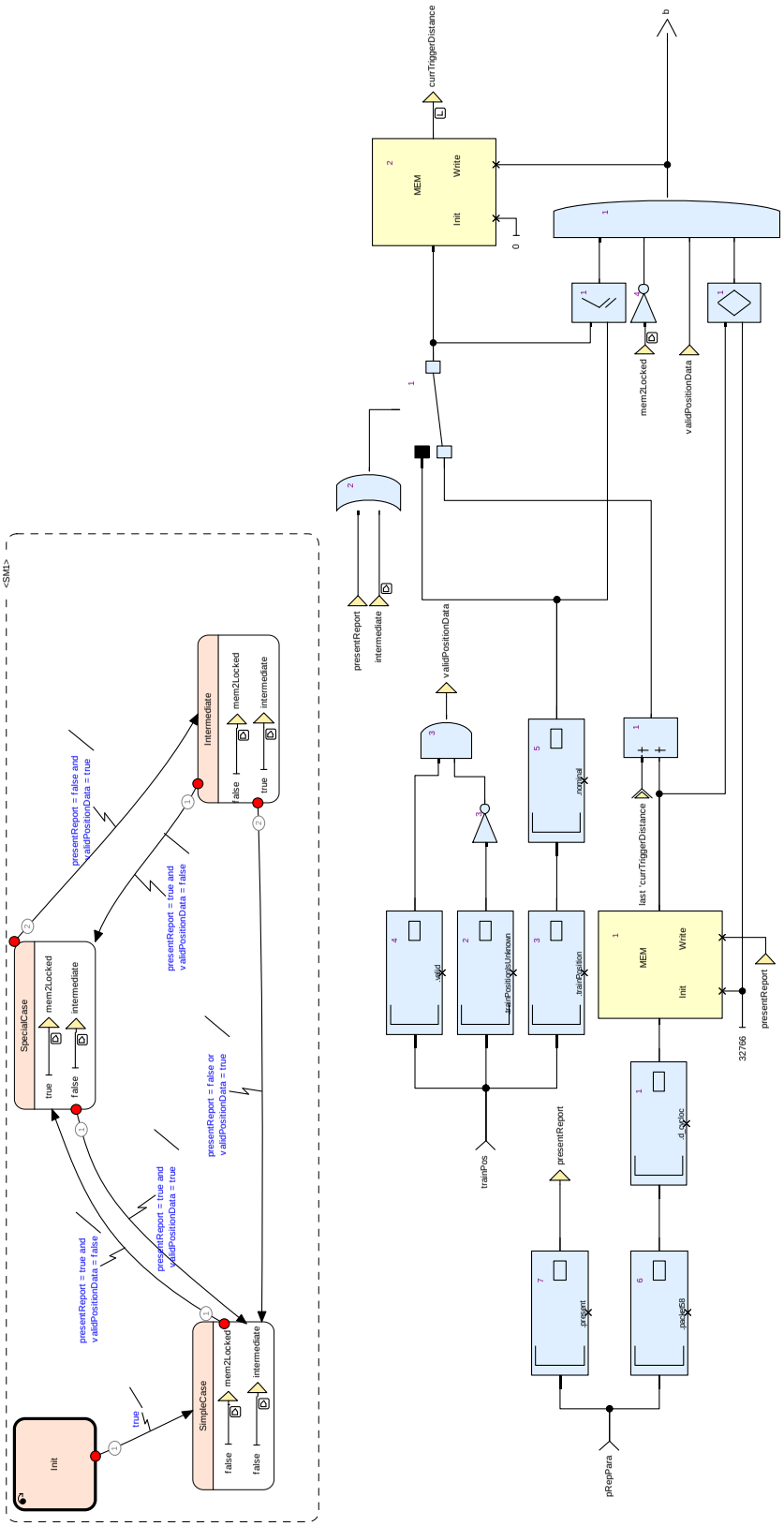


Figure 168: View of diagram_op_D_cycloc_1 (op_D_cycloc)

Table 461: State Machines of diagram_op_D_cycloc_1

State Machine	Comments and Information
SM1	

Table 462: States of diagram_op_D_cycloc_1

State	Comments and Information
SM1:Init	
SM1:Intermediate	
SM1:SimpleCase	
SM1:SpecialCase	

Table 463: Transitions of diagram_op_D_cycloc_1

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Init **Target:** SM1:SimpleCase	1	**Condition:** true	
Source: SM1:Intermediate **Target:** SM1:SpecialCase	1	**Condition:** presentReport = true and validPositionData = false	
Source: SM1:Intermediate **Target:** SM1:SimpleCase	2	**Condition:** presentReport = false or validPositionData = true	
Source: SM1:SimpleCase **Target:** SM1:SpecialCase	1	**Condition:** presentReport = true and validPositionData = false	
Source: SM1:SpecialCase **Target:** SM1:SimpleCase	1	**Condition:** presentReport = true and validPositionData = true	
Source: SM1:SpecialCase **Target:** SM1:Intermediate	2	**Condition:** presentReport = false and validPositionData = true	

15.1.21. op_DOUBTOVER Operator

Declared as **`public function`**

15.1.21.1. Comments and Information

op_DOUBTOVER Comments:

- Calculates L_DOUBTOVER = absolute(estimated front end - min safe front end)

15.1.21.2. Interface

Table 464: Inputs of op_DOUBTOVER

Name	Type	Comments and Information
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 465: Outputs of op_DOUBTOVER

Name	Type	Comments and Information
l_doubtover	L_DOUBTOVER	

15.1.21.3. Operator Hierarchy

diagram : diagram_op_DOUBTOVER_1

15.1.21.4. Graphical and Textual Diagrams

15.1.21.4.1. View of diagram_op_DOUBTOVER_1 (op_DOUBTOVER)

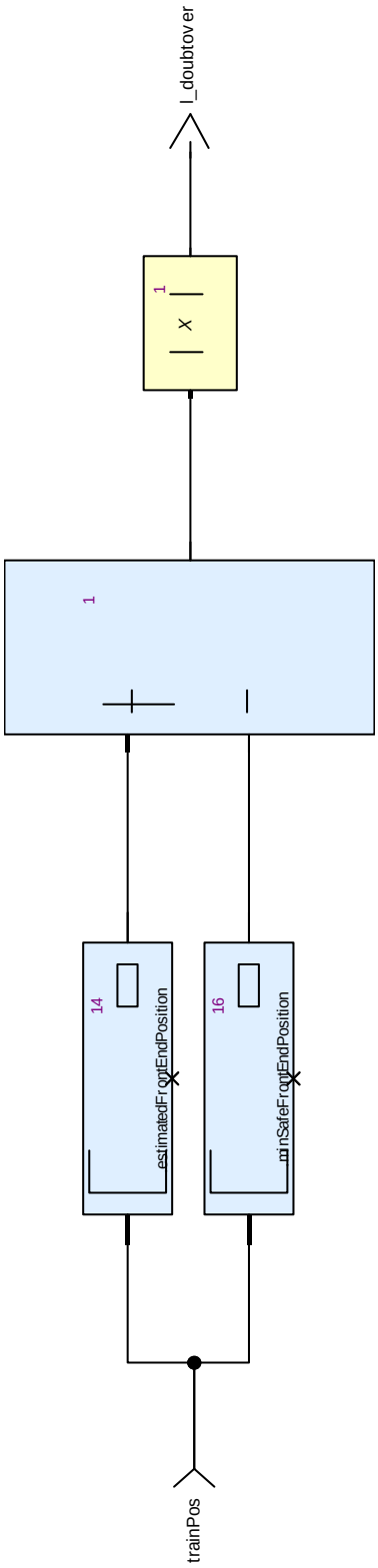


Figure 169: View of diagram_op_DOUBTOVER_1 (op_DOUBTOVER)

15.1.22. op_DOUBTUNDER Operator

Declared as **`public function`**

15.1.22.1. Comments and Information

op_DOUBTUNDER Comments:

- Calculates L_DOUBTUNDER = absolute(max safe front end - estimimated front end)

15.1.22.2. Interface

Table 466: Inputs of op_DOUBTUNDER

Name	Type	Comments and Information
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 467: Outputs of op_DOUBTUNDER

Name	Type	Comments and Information
l_doubtunder	L_DOUBTUNDER	

15.1.22.3. Operator Hierarchy

diagram : diagram_op_DOUBTUNDER_1

15.1.22.4. Graphical and Textual Diagrams

15.1.22.4.1. View of diagram_op_DOUBTUNDER_1 (op_DOUBTUNDER)

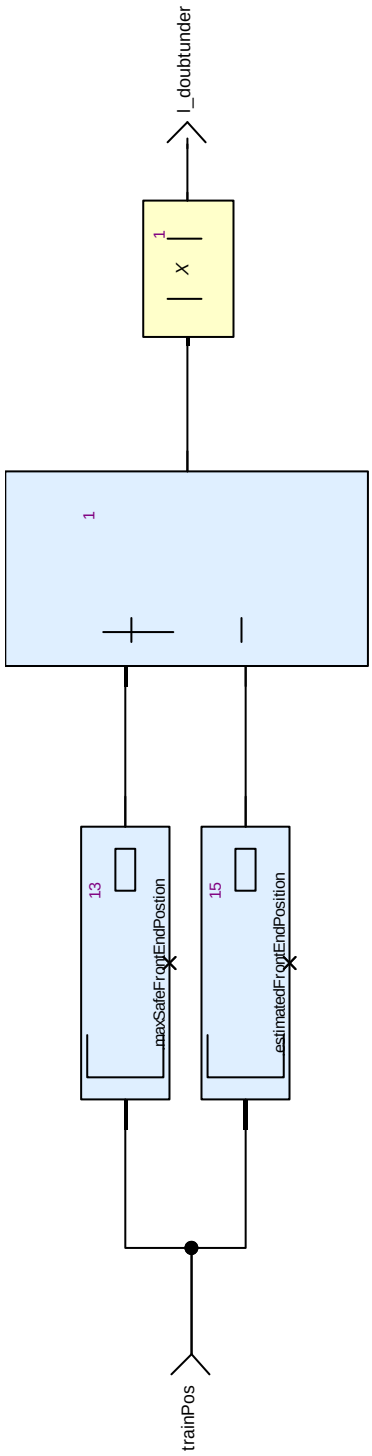


Figure 170: View of diagram_op_DOUBTUNDER_1 (op_DOUBTUNDER)

15.1.23. op_findBG Operator

Declared as **`public function`**

15.1.23.1. Interface

Table 468: Inputs of op_findBG

Name	Type	Comments and Information
acc	bool	
Input_BG	TrainPosition_Types_Pck::positionedBG_T	
Input_BG_IDToCheck	NID_BG	

Table 469: Outputs of op_findBG

Name	Type	Comments and Information
fd	bool	
cond	bool	

15.1.23.2. Operator Hierarchy

diagram : diagram_op_findBG_1

15.1.23.3. Graphical and Textual Diagrams

15.1.23.3.1. View of diagram_op_findBG_1 (op_findBG)

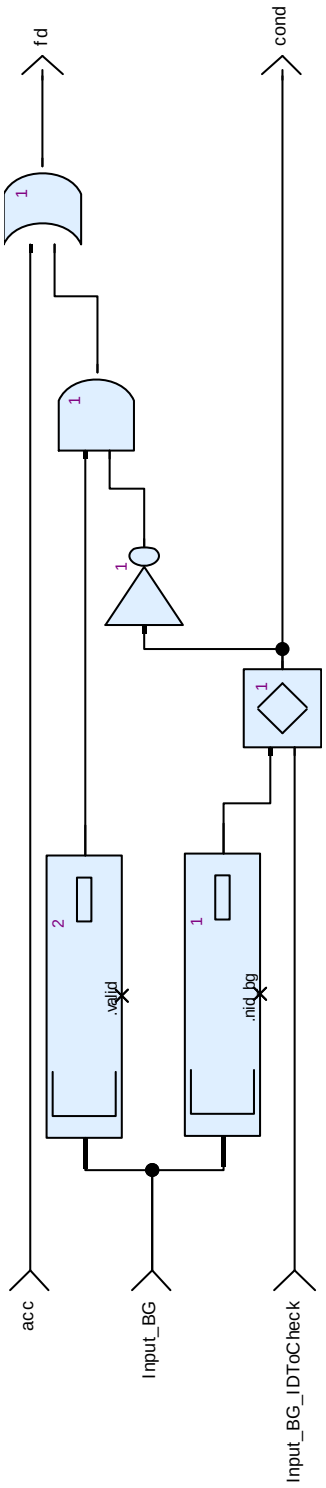


Figure 171: View of diagram_op_findBG_1 (op_findBG)

15.1.24. op_GetLRBGfromBGs Operator

Declared as **`public function`**

15.1.24.1. Interface

Table 470: Inputs of op_GetLRBGfromBGs

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 471: Outputs of op_GetLRBGfromBGs

Name	Type	Comments and Information
found	bool	
lrbg	TrainPosition_Types_Pck::positionedBG_T	

15.1.24.2. Operator Hierarchy

diagram : diagram_op_GetLRBGfromBGs_1

15.1.24.3. Graphical and Textual Diagrams

15.1.24.3.1. View of diagram_op_GetLRBGfromBGs_1 (op_GetLRBGfromBGs)

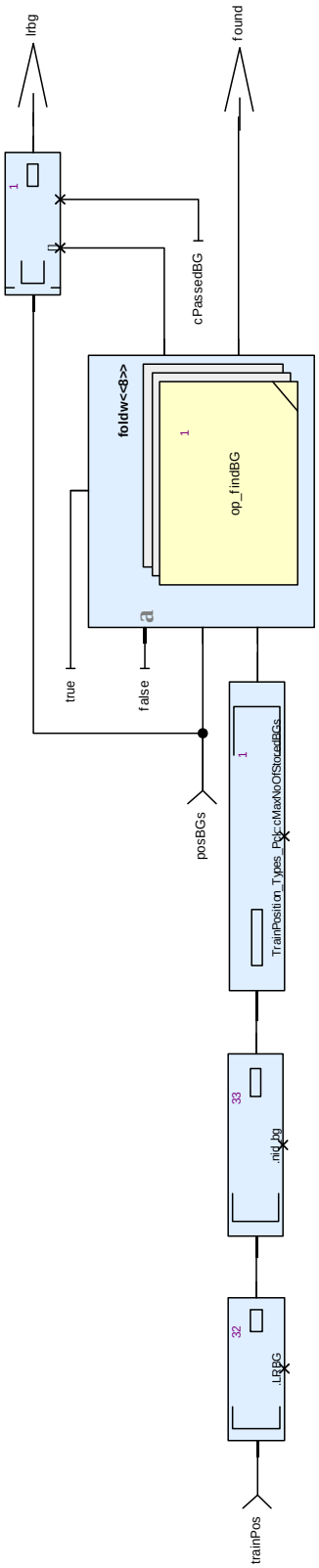


Figure 172: View of diagram_op_GetLRBGfromBGs_1 (op_GetLRBGfromBGs)

15.1.25. op_LRBG Operator

Declared as **`public function`**

15.1.25.1. Comments and Information

op_LRBG Comments:

- Calculate D_LRBG:
- tPosition.valid \wedge tPosition.trainPositionUnknown= false \wedge we find in positionedBGs_T
- an BG with NID_BG=tPosition.NID_LRBG,
- then calculate |estimatedFrontEndPosition-positionedBG.location|.nominal;
- otherwise unknown is assigned to D_LRBG

15.1.25.2. Interface

Table 472: Inputs of op_LRBG

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 473: Outputs of op_LRBG

Name	Type	Comments and Information
d_lrbg	int	

15.1.25.3. Operator Hierarchy

diagram : diagram_op_LRBG_1

15.1.25.4. Graphical and Textual Diagrams

15.1.25.4.1. View of diagram_op_LRBG_1 (op_LRBG)

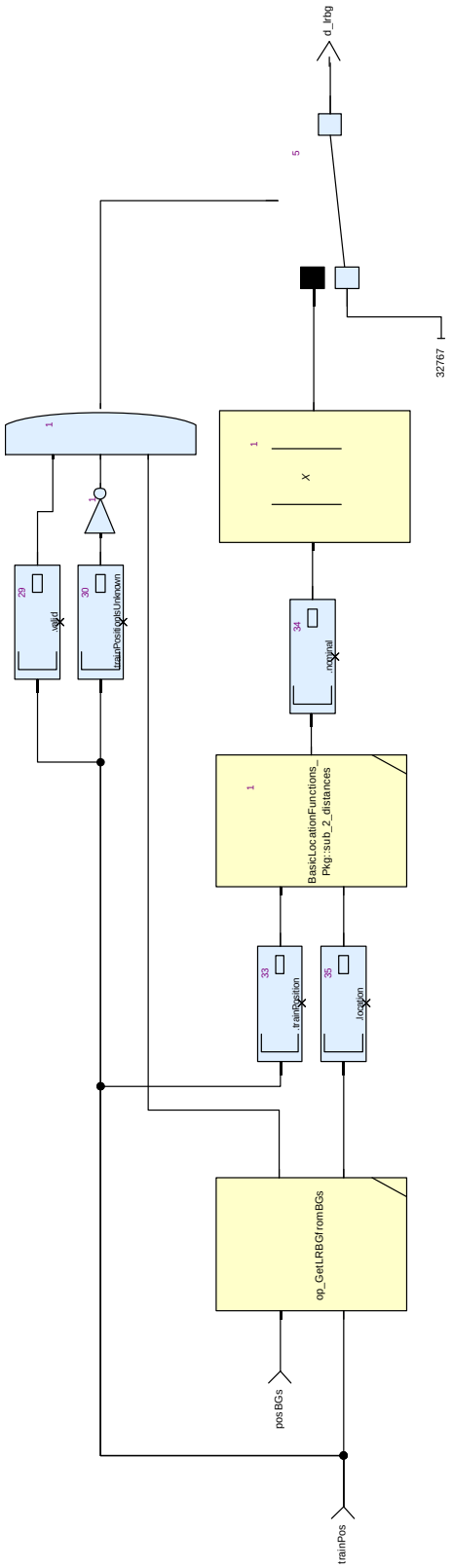


Figure 173: View of diagram_op_LRBG_1 (op_LRBG)

15.1.26. op_M_loc Operator

Declared as **`public node`**

15.1.26.1. Comments and Information

op_M_loc Comments:

- Models trigger based on parameter M_LOC; that is, locations and situations
- where the train has to report its position.

15.1.26.2. Interface

Table 474: Inputs of op_M_loc

Name	Type	Comments and Information
pRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
posBGs	TrainPosition_Types_Pck::positionedBG_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	

Table 475: Outputs of op_M_loc

Name	Type	Comments and Information
b	bool	

15.1.26.3. Operator Hierarchy

diagram : diagram_op_M_loc_1

15.1.26.4. Graphical and Textual Diagrams

15.1.26.4.1. View of diagram_op_M_loc_1 (op_M_loc)

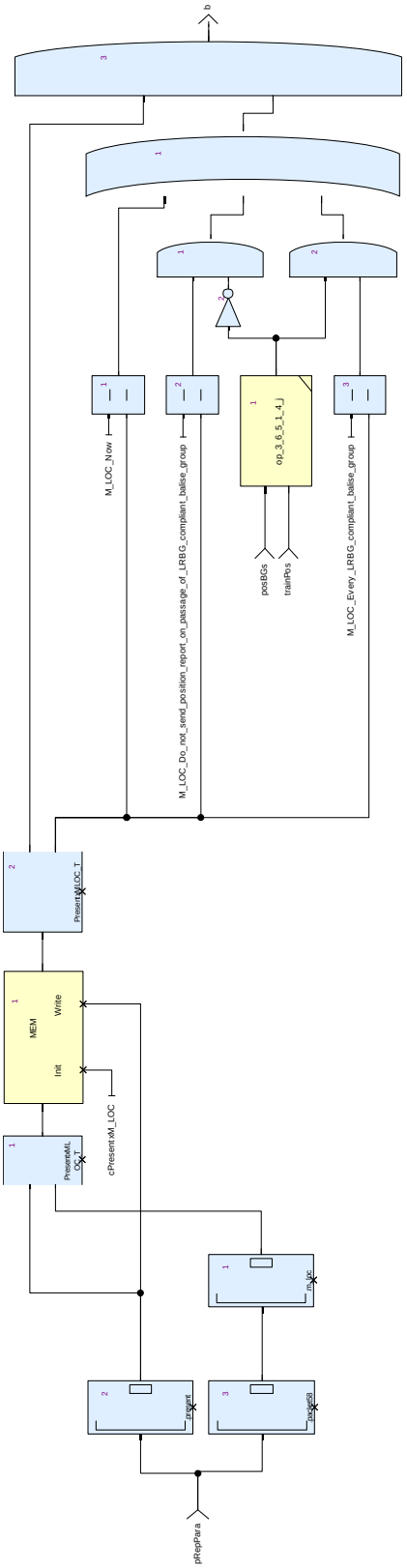


Figure 174: View of diagram_op_M_loc_1 (op_M_loc)

15.1.27. op_N_iter Operator

Declared as **`public node`**

15.1.27.1. Comments and Information

op_N_iter Comments:

- Models trigger based on parameter N_ITER; that is, a list of of pairs (distance, trainPosition) where the distance
- is specified wrt. to a reference point. We calculate
- ref + LOC(1) + LOC(2) + ... where ref is the location of the reference BG and LOC(i) is the distance
- at position i of the list
- The model is similar to the one in op_D_cycloc. The memory stores the current trigger distance.
- The first trigger is at ref + LOC(1). As soon as we know ref, the value is written into the memory. With the passing
- of ref + LOC(1) + ... + LOC(i) the respective value is written into the memory (if the train position and thus
- the minSafeRearEnd is known and valid and the current list index is not out of bound).

15.1.27.2. Interface

Table 476: Inputs of op_N_iter

Name	Type	Comments and Information
trainPosition	TrainPosition_Types_Pck::trainPosition_T	
pRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
minSafeRearEnd	int	

Table 477: Outputs of op_N_iter

Name	Type	Comments and Information
b	bool	

15.1.27.3. Locals

Table 478: Locals of op_N_iter

Name	Type	Properties		Comments and Information
counterToBeIncremented	bool	last	false	
currTriggerDistance	int	default	0	
		last	0	

15.1.27.4. Operator Hierarchy

diagram : diagram_op_N_iter_1

15.1.27.5. Graphical and Textual Diagrams

15.1.27.5.1. View of diagram_op_N_iter_1 (op_N_iter)

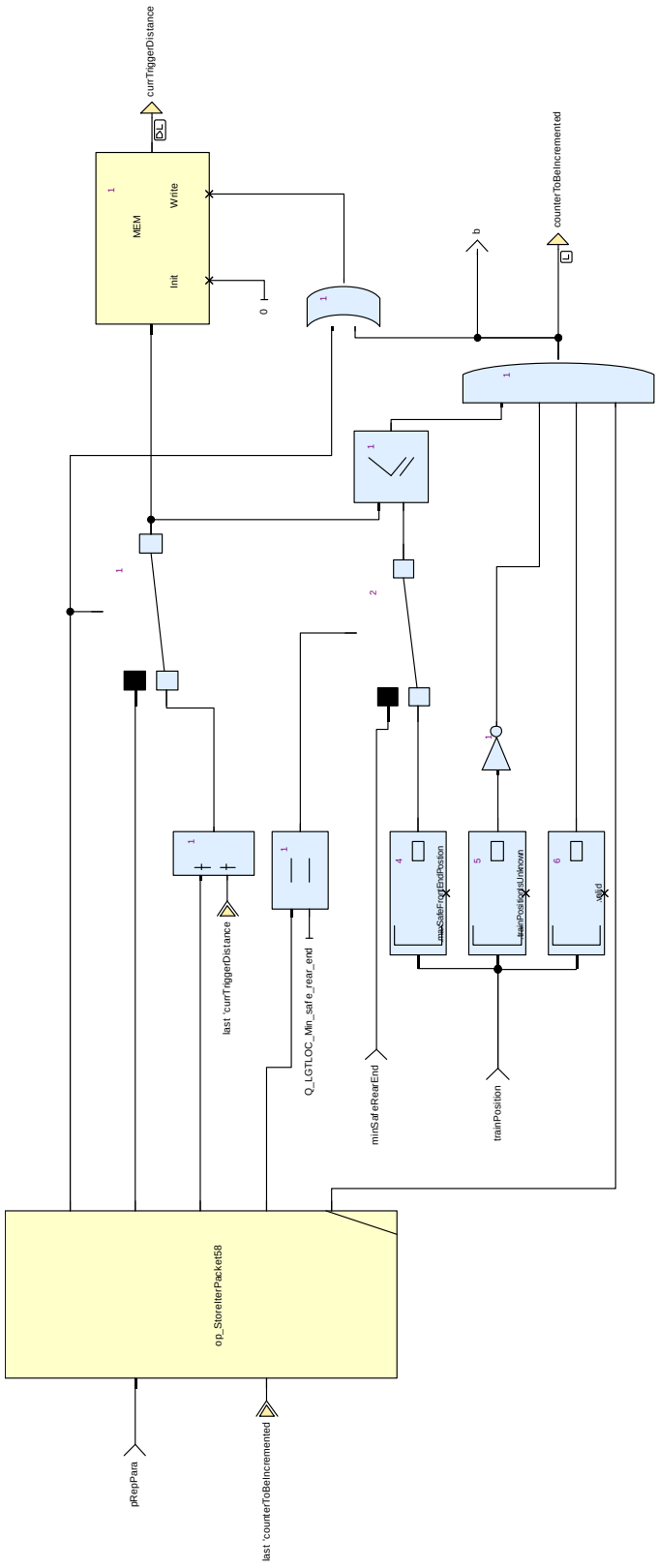


Figure 175: View of diagram_op_N_iter_1 (op_N_iter)

15.1.28. op_prepack_0 Operator

Declared as **`public function`**

15.1.28.1. Interface

Table 479: Inputs of op_prepack_0

Name	Type	Comments and Information
TrainRearEndPos3	L_TRAININT	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	

Table 480: Outputs of op_prepack_0

Name	Type	Comments and Information
valid	bool	
posRep	TrainToTrack::Position_Report	

15.1.28.2. Operator Hierarchy

diagram : diagram_op_prepack_0_1

15.1.28.3. Graphical and Textual Diagrams

15.1.28.3.1. View of diagram_op_prepack_0_1 (op_prepack_0)

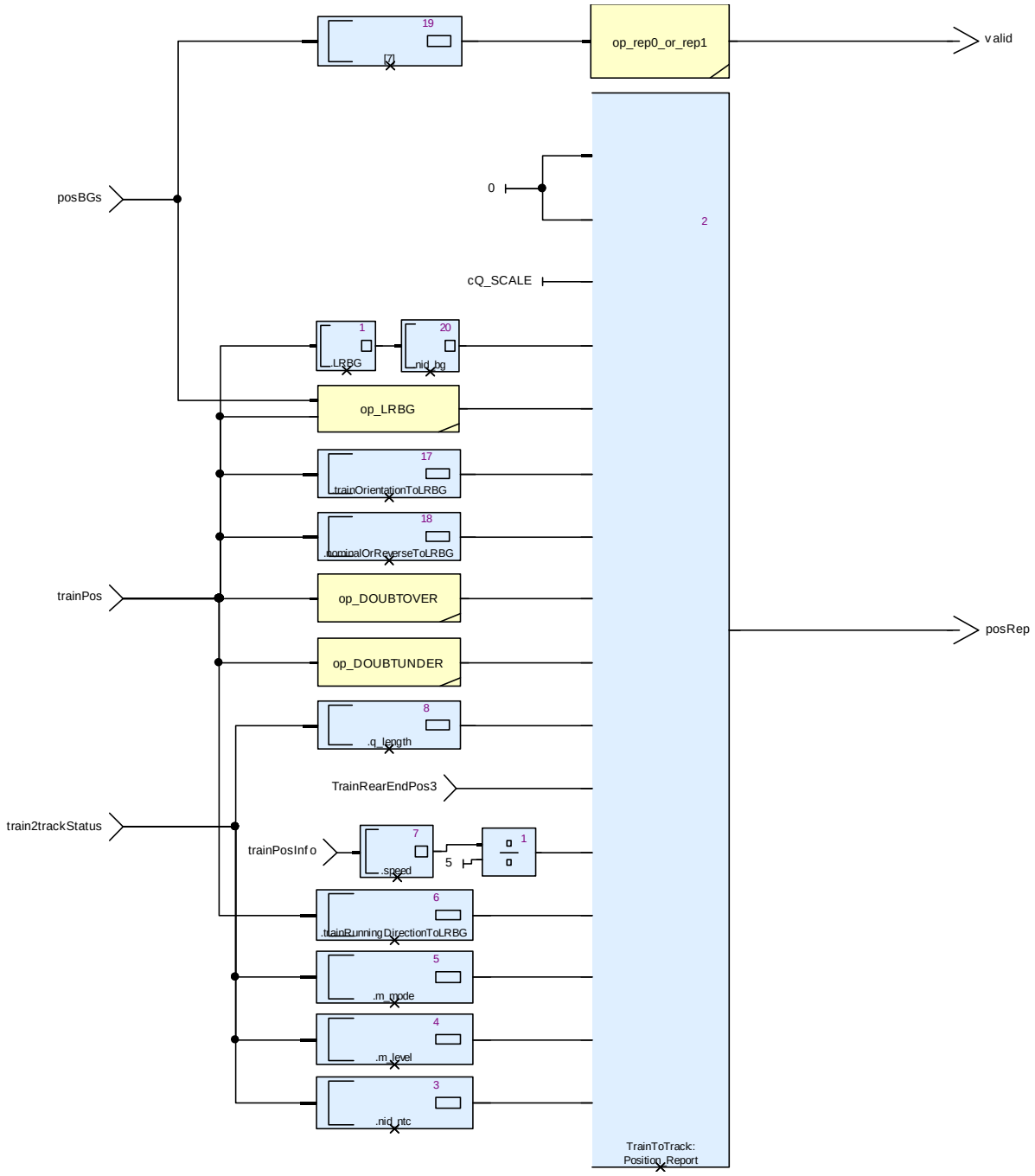


Figure 176: View of diagram_op_prepack_0_1 (op_prepack_0)

15.1.29. op_rep0_or_rep1 Operator

Declared as **`public function`**

15.1.29.1. Comments and Information

op_rep0_or_rep1 Comments:

- returns true if packet 0 has to be contained in the position report and false if packet 1 has to be contained.
- Decision based on 3.6.2.2.2.a; currently only 3.6.2.2.2.a.i is modeled.

15.1.29.2. Interface

Table 481: Inputs of op_rep0_or_rep1

Name	Type	Comments and Information
posBG	TrainPosition_Types_Pck::positionedBG_T	

Table 482: Outputs of op_rep0_or_rep1

Name	Type	Comments and Information
b	bool	

15.1.29.3. Operator Hierarchy

diagram : diagram_op_rep0_or_rep1_1

15.1.29.4. Graphical and Textual Diagrams

15.1.29.4.1. View of diagram_op_rep0_or_rep1_1 (op_rep0_or_rep1)

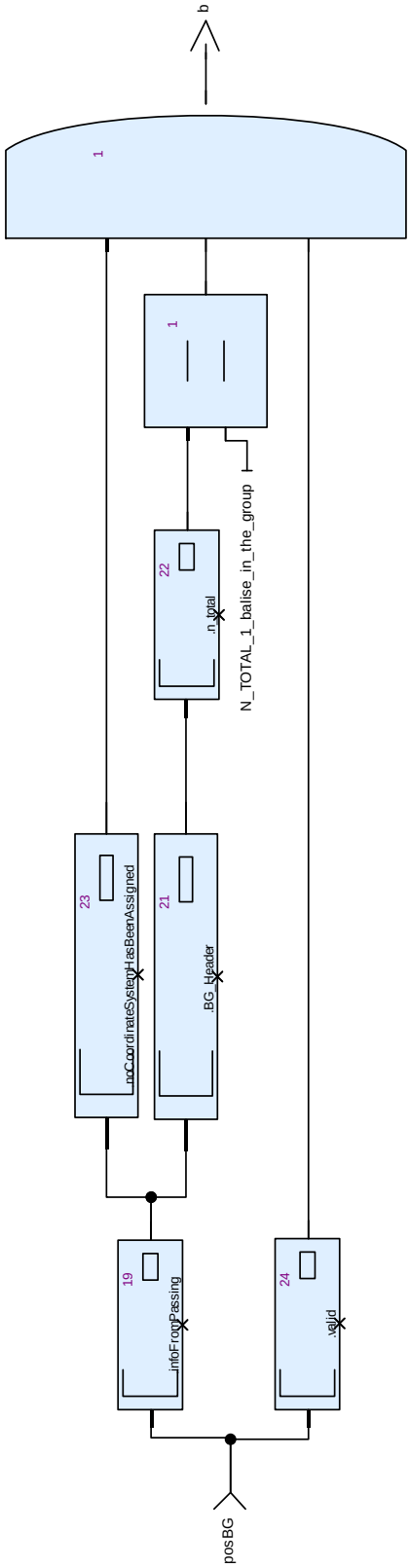


Figure 177: View of diagram_op_rep0_or_rep1_1 (op_rep0_or_rep1)

15.1.30. op_StoreIterPacket58 Operator

Declared as **`public node`**

15.1.30.1. Comments and Information

op_StoreIterPacket58 Comments:

- This operation stores the list of pairs (D_LOC, D_LGTLOC) in a memory. With a second memory, we store the
- the current list position; that is, the pair that has to be handled next. Using a reset, the latter memory can be
- set to 0 if the next packet58 is received.

15.1.30.2. Interface

Table 483: Inputs of op_StoreIterPacket58

Name	Type	Properties		Comments and Information
pRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T			
incrCounter	bool	last	false	**Comments:** true if in the last cycle a position according to an element n of the list has been passed implying the counter of the NITER list has to be incremented and the next pair has to be considered

Table 484: Outputs of op_StoreIterPacket58

Name	Type	Comments and Information
newN_ITER	bool	**Comments:** true if a new packet58 has been received and N_ITER>0
initialLocation	Obu_BasicTypes_Pkg::Location_T	**Comments:** gives the reference point for the calculation; that is, the location of the reference BG
currDLOC	D_LOC	**Comments:** current D_LOC
currLGTLOC	Q_LGTLOC	**Comments:** current LGTLOC
valid	bool	**Comments:** true if current array index <= N_ITER (i.e., index is valid); otherwise false

15.1.30.3. Locals

Table 485: Locals of op_StoreIterPacket58

Name	Type	Properties		Comments and Information
counter	int	last	0	

15.1.30.4. Operator Hierarchy

diagram : diagram_op_StoreIterPacket58_1

15.1.30.5. Graphical and Textual Diagrams

15.1.30.5.1. View of diagram_op_StoreIterPacket58_1 (op_StoreIterPacket58)

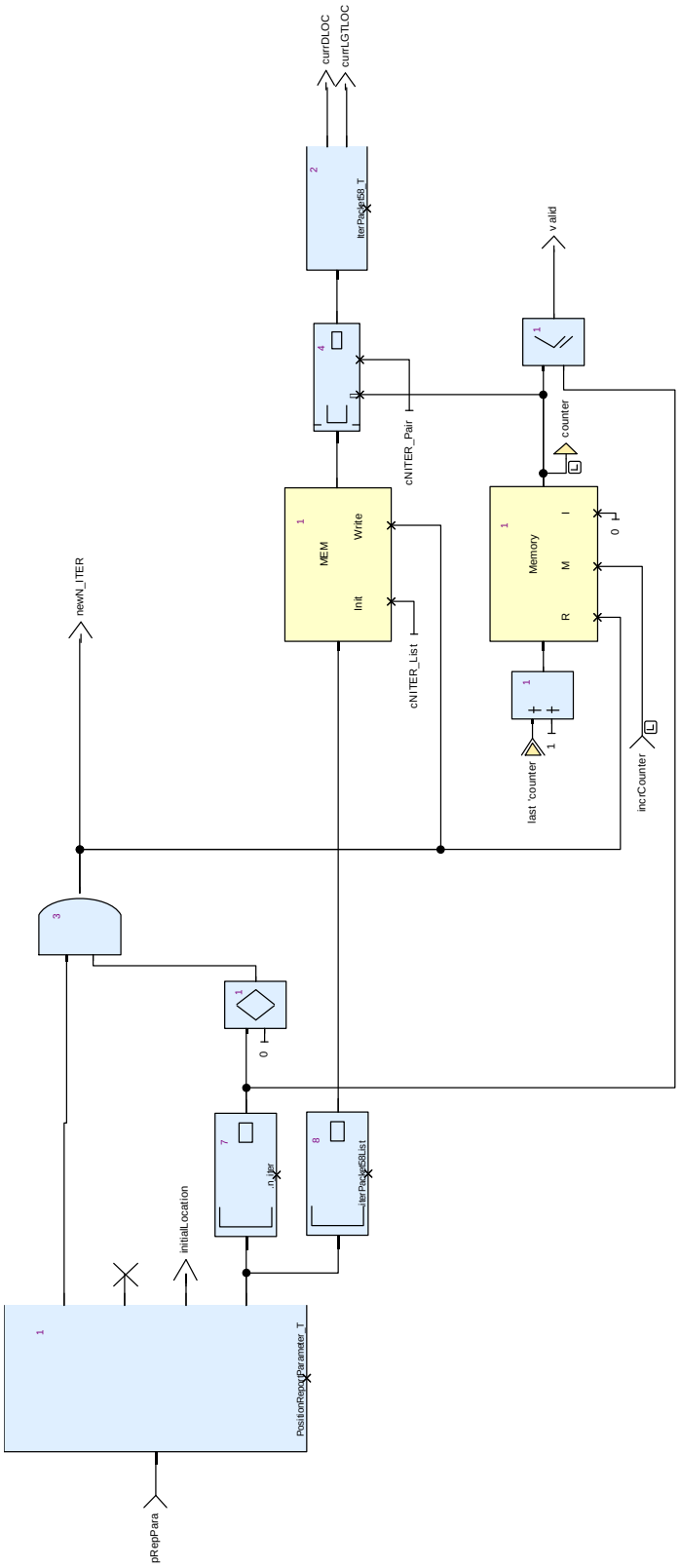


Figure 178: View of diagram_op_StoreIterPacket58_1 (op_StoreIterPacket58)

15.1.31. op_T_cycloc Operator

Declared as **`public node`**

15.1.31.1. Comments and Information

op_T_cycloc Comments:

- Models parameter T_CYCLOC which specifies a time interval
- between two position reports to be sent
- Output is equal to T_CYCLOC < 255 AND (present or last local1 + T_CYCLOC)
- This implies that the output is true when a valid posRepPara appears.
- If present = true, then we store the current time in the memory; otherwise, the stored value is incremented by
- T_CYCLOC.

15.1.31.2. Interface

Table 486: Inputs of op_T_cycloc

Name	Type	Comments and Information
pRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
systemTime	ProvidePositionReport_Pkg::SystemTime_T	

Table 487: Outputs of op_T_cycloc

Name	Type	Comments and Information
b	bool	

15.1.31.3. Locals

Table 488: Locals of op_T_cycloc

Name	Type	Properties		Comments and Information
Local1	int	last	0	

15.1.31.4. Operator Hierarchy

diagram : diagram_op_T_cycloc_1

15.1.31.5. Graphical and Textual Diagrams

15.1.31.5.1. View of diagram_op_T_cycloc_1 (op_T_cycloc)

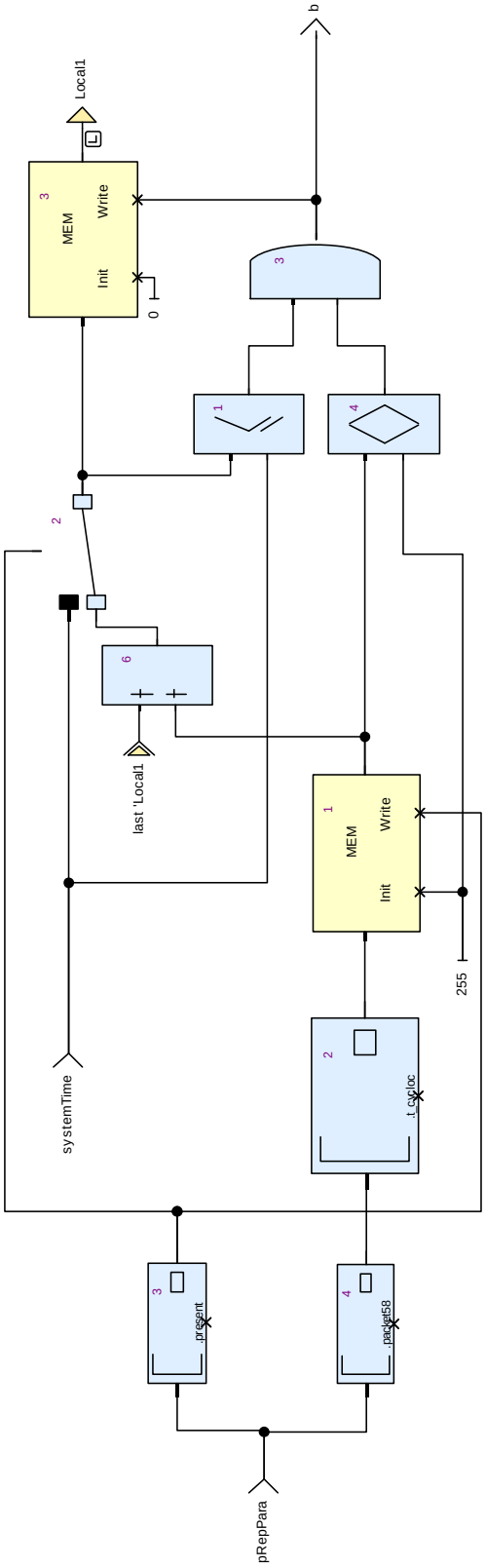


Figure 179: View of diagram_op_T_cycloc_1 (op_T_cycloc)

15.1.32. ProvidePositionReport Operator

Declared as **`public node`**

15.1.32.1. Comments and Information

ProvidePositionReport Comments:

- Assumption: BGs in PositionedBGs_T are ordered with the last seen BG being the first element of the arry.

15.1.32.2. Interface

Table 489: Inputs of ProvidePositionReport

Name	Type	Comments and Information
posBGs	TrainPosition_Types_Pck::positionedBGs_T	
trainPos	TrainPosition_Types_Pck::trainPosition_T	
trainPosInfo	TrainPosition_Types_Pck::trainPositionInfo_T	
trainProps	TrainPosition_Types_Pck::trainProperties_T	
trackInfo	ProvidePositionReport_Pkg::LocationBasedEvents_T	
posRepPara	ProvidePositionReport_Pkg::PositionReportParameter_T	
systemTime	ProvidePositionReport_Pkg::SystemTime_T	
rcbComm	ProvidePositionReport_Pkg::RBC_Communication_T	
train2trackStatus	BG_Types_Pkg::TrainToTrackStatus_T	
directionLRBG	ProvidePositionReport_Pkg::BG_Orientation_T	
prvDirTrain	Q_DIRTRAIN	
BG_LinkingConsistencyError	bool	
LinkedBG_MessageConsistencyError	bool	
UnlinkedBG_MessageConsistencyError	bool	
RadioMessageConsistencyError	bool	
RadioSequenceError	bool	
RadioSafeRadioConnectionError	bool	
SafetyCriticalFailure	bool	
DoubleLinkingError	bool	
DoubleRepositioningError	bool	

Table 490: Outputs of ProvidePositionReport

Name	Type	Comments and Information
posRep	ProvidePositionReport_ Pkg::PositionReport_T	

15.1.32.3. Operator Hierarchy

diagram : diagram_ProvidePositionReport_1

15.1.32.4. Graphical and Textual Diagrams

15.1.32.4.1. View of diagram_ProvidePositionReport_1 (ProvidePositionReport)

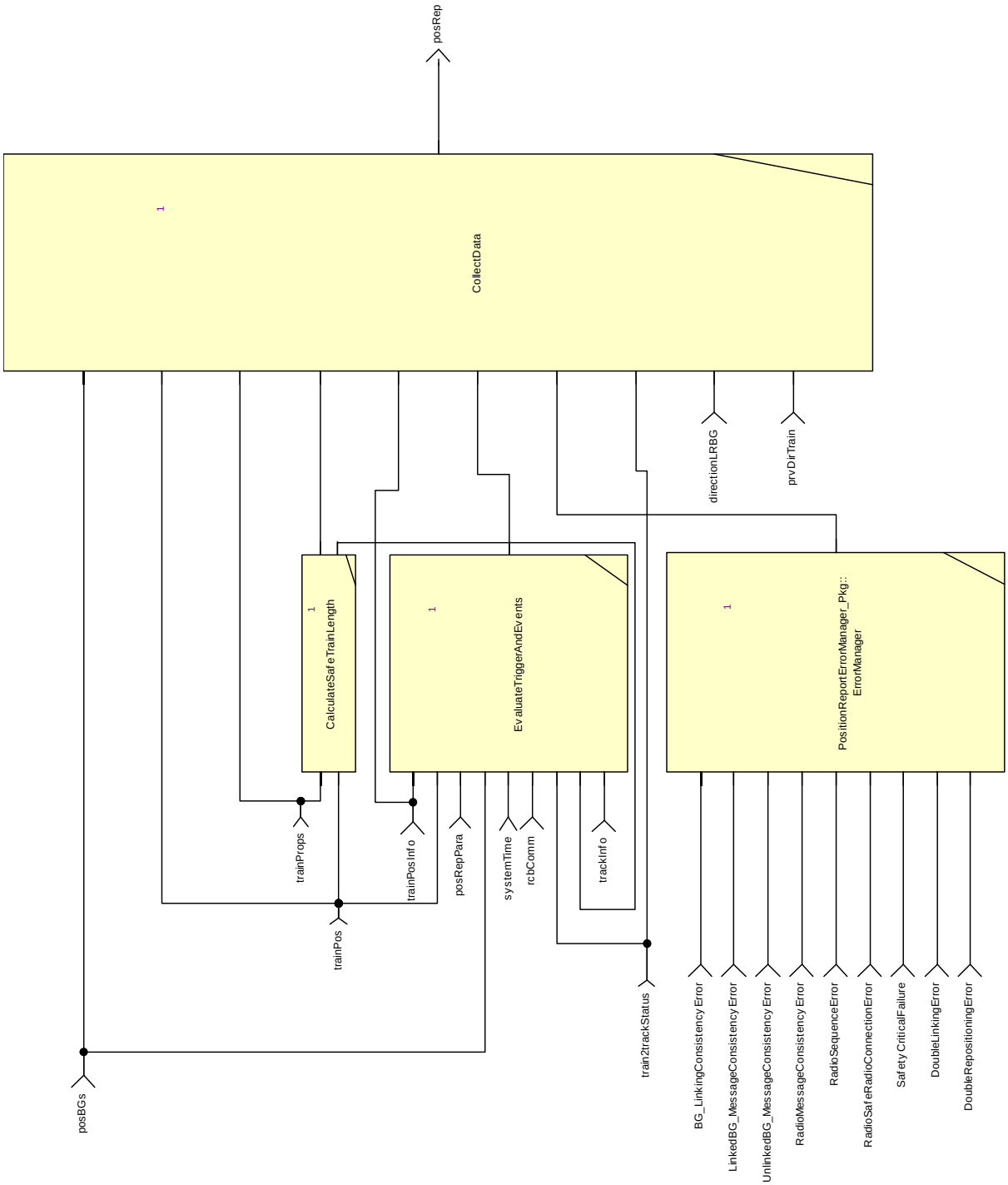


Figure 180: View of diagram_ProvidePositionReport_1 (ProvidePositionReport)

15.2. ProvidePositionReport_Pkg::PositionReportErrorManager_Pkg Package

15.2.1. ErrorManager Operator

Declared as **`public function`**

15.2.1.1. Interface

Table 491: Inputs of ErrorManager

Name	Type	Comments and Information
BG_LinkingConsistencyError	bool	
LinkedBG_MessageConsistencyError	bool	
UnlinkedBG_MessageConsistencyError	bool	
RadioMessageConsistencyError	bool	
RadioSequenceError	bool	
RadioSafeRadioConnectionError	bool	
SafetyCriticalFailure	bool	
DoubleLinkingError	bool	
DoubleRepositioningError	bool	

Table 492: Outputs of ErrorManager

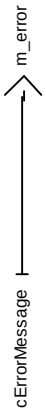
Name	Type	Comments and Information
m_error	ProvidePositionReport_Pkg::ErrorMessage_T	

15.2.1.2. Operator Hierarchy

diagram : diagram_ErrorManager_1

15.2.1.3. Graphical and Textual Diagrams

15.2.1.3.1. View of diagram_ErrorManager_1 (ErrorManager)



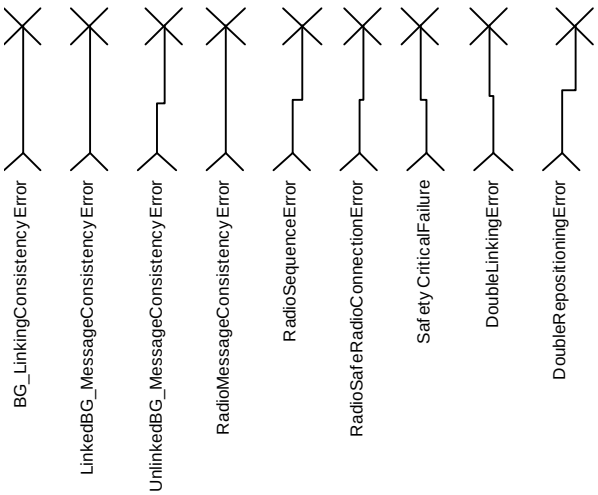


Figure 181: View of diagram_ErrorManager_1 (ErrorManager)

16. Project Library: ValidateDataDirection

16.1. ValidateDataDirection_Pkg Package

16.1.1. modifyLinkedBG Operator

Declared as **`public function`**

16.1.1.1. Interface

Table 493: Inputs of modifyLinkedBG

Name	Type	Comments and Information
singleDirectionInvalid	bool	**Comments:** encode the cases described in 3.6.3.1.3.1 and 3.6.3.1.4 where the direction of the packets needs to be be valid for both directions
linkedBG	BG_Types_Pkg::LinkedBG_T	
bgOrientation	BG_Types_Pkg::BG_Orientation_T	

Table 494: Outputs of modifyLinkedBG

Name	Type	Comments and Information
modifiedLinkedBG	BG_Types_Pkg::LinkedBG_T	

16.1.1.2. Locals

Table 495: Locals of modifyLinkedBG

Name	Type	Comments and Information
orientation	BG_Types_Pkg::BG_Orientation_T	
qdir	Q_DIR	
singleDirInvalid	bool	
valid	bool	

16.1.1.3. Operator Hierarchy

diagram : diagram_modifyLinkedBG_1
    activate if : IfBlock1
        branch : then
        branch : else
            branch : then
            branch : else
                branch : then
                branch : else

16.1.1.4. Graphical and Textual Diagrams

16.1.1.4.1. View of diagram_modifyLinkedBG_1 (modifyLinkedBG)

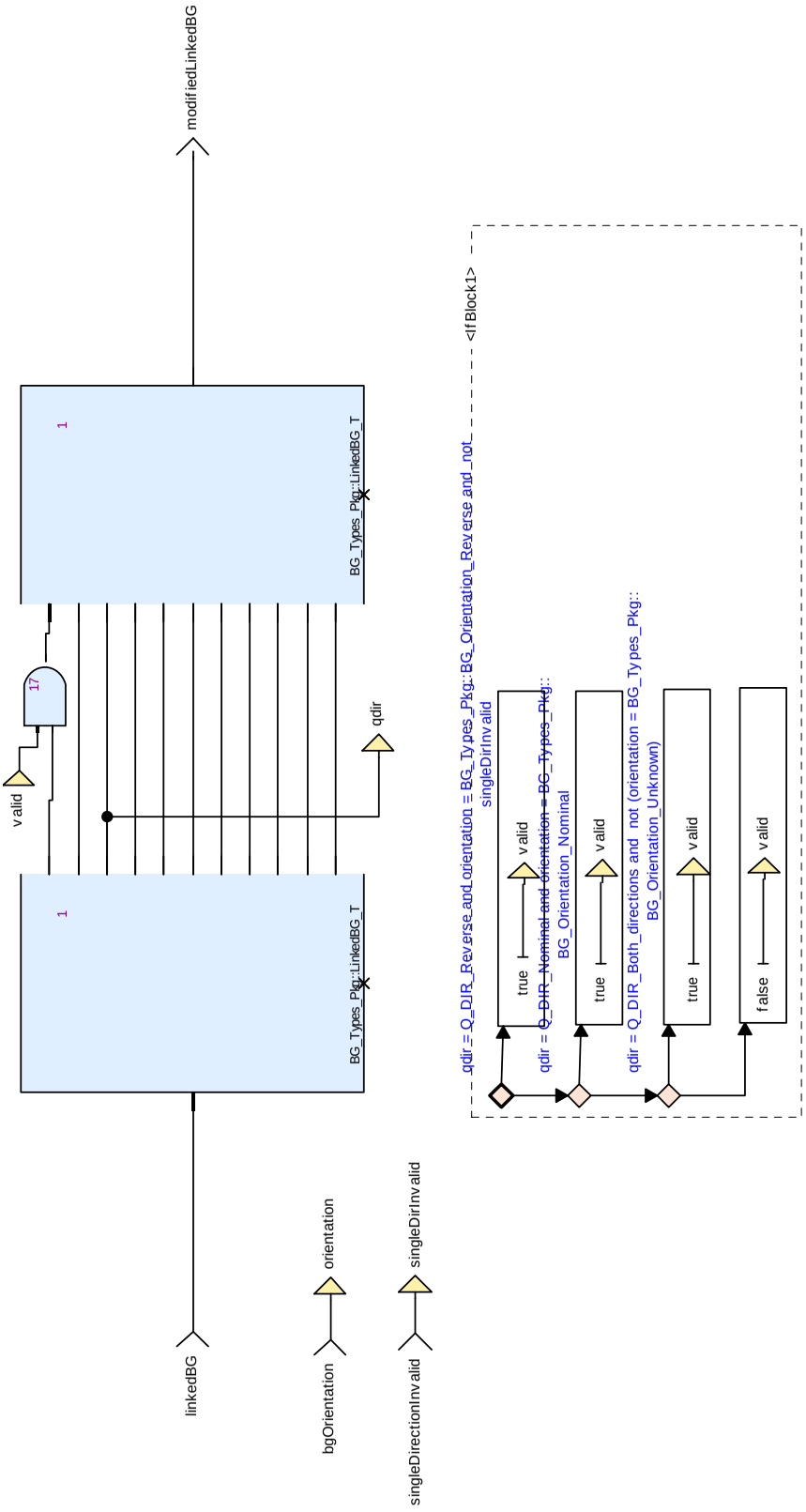


Figure 182: View of diagram_modifyLinkedBG_1 (modifyLinkedBG)

Table 496: Conditional Blocks of diagram_modifyLinkedBG_1

Conditional Block	Comments and Information
IfBlock1	

Table 497: Actions of diagram_modifyLinkedBG_1

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

16.1.2. validateDataDirection Operator

Declared as **`public function`**

16.1.2.1. Interface

Table 498: Inputs of validateDataDirection

Name	Type	Comments and Information
passedBG_in	BG_Types_Pkg::passedBG_T	**Comments:** Input event reporting a balise group during its passage, if there is one.
LRBG	TrainPosition_Types_Pck::positionedBG_T	**Comments:** The LRBG used for RBC communication.
trainPosition	TrainPosition_Types_Pck::trainPosition_T	**Comments:** The resulting train position with reference to the LRBG

Table 499: Outputs of validateDataDirection

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

16.1.2.2. Operator Hierarchy

diagram : diagram_validateDataDirection_1

16.1.2.3. Graphical and Textual Diagrams

16.1.2.3.1. View of diagram_validateDataDirection_1 (validateDataDirection)

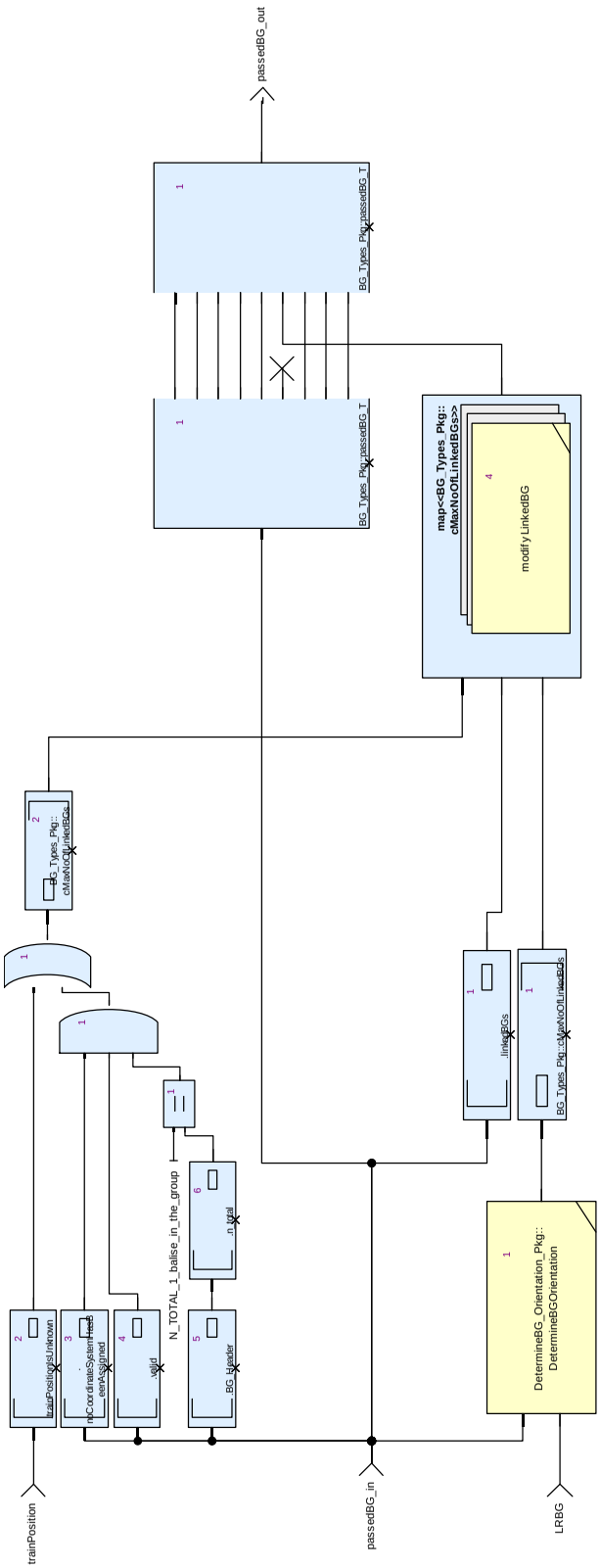


Figure 183: View of diagram_validateDataDirection_1 (validateDataDirection)

16.2. ValidateDataDirection_Pkg::DetermineBG_Orientation _Pkg Package

16.2.1. DetermineBGOrientation Operator

Declared as **`public function`**

16.2.1.1. Interface

Table 500: Inputs of DetermineBGOrientation

Name	Type	Comments and Information
passedBG_in	BG_Types_Pkg::passedBG_T	**Comments:** Input event reporting a balise group during its passage, if there is one.
lrbg	TrainPosition_Types_Pck::positionedBG_T	**Comments:** The LRBG used for RBC communication.

Table 501: Outputs of DetermineBGOrientation

Name	Type	Comments and Information
bgOrientation	BG_Types_Pkg::BG_Orientation_T	

16.2.1.2. Locals

Table 502: Locals of DetermineBGOrientation

Name	Type	Comments and Information
BGIsLinked	bool	
Down	bool	
linkOrientation	Q_LINKORIENTATION	
NoSingleBG	bool	
orientation	BG_Types_Pkg::BG_Orientation_T	

16.2.1.3. Operator Hierarchy

diagram : diagram_DetermineBGOrientation_1
activate if : IfBlock1
branch : then
branch : else
branch : then
branch : else

16.2.1.4. Graphical and Textual Diagrams

16.2.1.4.1. View of diagram_DetermineBGOrientation_1 (DetermineBGOrientation)

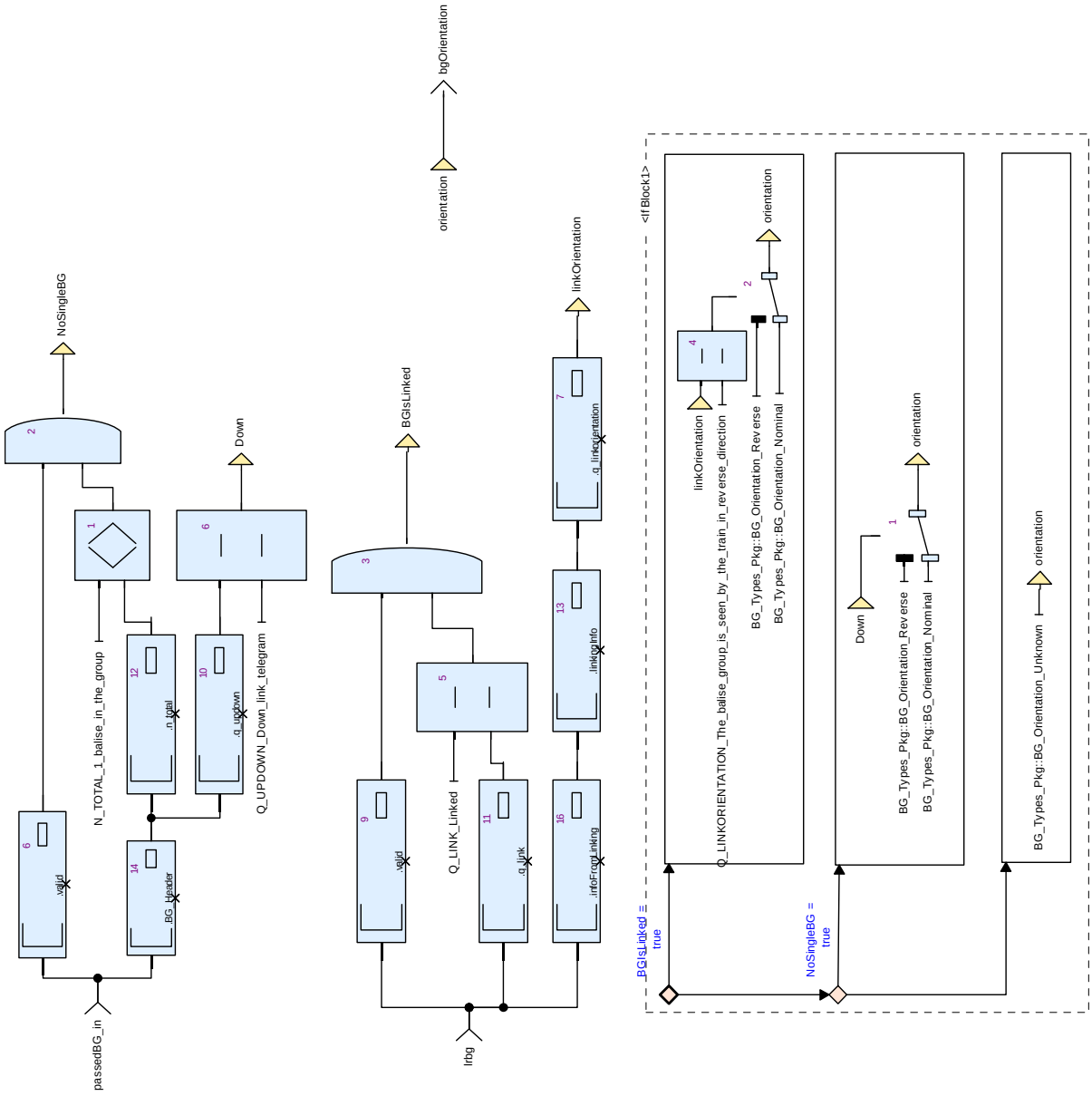


Figure 184: View of diagram_DetermineBGOrientation_1 (DetermineBGOrientation)

Table 503: Conditional Blocks of diagram_DetermineBGOrientation_1

Conditional Block	Comments and Information
IfBlock1	

Table 504: Actions of diagram_DetermineBGOrientation_1

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

End of document.