2 AIRM
Air motion

2.1 AIRM Configuration data

Configuration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
NC_PORT_NR	-	0... 2H	0 ...2	1	-
Number of port flap sensors					
NC_PORTPWM	-	0... 2H	0 ...2	1	-
Number of port flap actuators					

General Information

The following describes the general rules for determination of the configuration data.

Global Configuration Data:

Here are listed the configuration data, which can be used in other aggregates:

Configuration Item	Range	Value	Comment
NC_PORT_NR *Number of port flap sensors*	0 ...2 0... 2H	1 [-] 0x1	
NC_PORTPWM *Number of port flap actuators*	0 ...2 0... 2H	1 [-] 0x1	

2.2 Port flap variables

Data Definition

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
FAC_PORT_DEAC [NC_PORT_NR]	O/V	0... FFFFH	0... 0.999984741211	15.2588e-6	-
Actual position (Feedback) of port flaps (flap closed = 1)					
FAC_PORT_DEAC_MV	O/V	0... FFFFH	0... 0.999984741211	15.2588e-6	-
Average of FAC_PORT_DEAC[NC_PORT_NR]					
STATE_EL_FAC_MVB_PORT	O/V	0... FH	0... 15	1	-
State of the actual sensor position(feedback) of port flap					
STATE_EL_MVB_PORT	O/V	0... FH	0... 15	1	-
State of the setpoint position of port flap					
STATE_MVB_PORT_AV	O/V	0... FFFFH	0... 655.35	0.01	%
Intake manifold runner actual value					
STATE_MVB_PORT_SP	O/V	0... FFFFH	0... 655.35	0.01	%
Intake manifold runner commanded value					

Input Data

LV_PORT_DEAC {p. 1073}	NC_FID_PORT_FB_EL	NC_PORT_NR {p. 1065}	V_PORT_1 {p. 1061}
V_PORT_2 {p. 1061}	V_PORT_AD_CLOSE [NC_PORT_NR] {p. 1087}	V_PORT_AD_OPEN [NC_PORT_NR] {p. 1087}	

Calibration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
C_CRLC_FAC_PORT_DEAC_MV	V	0... FFH	0... 0.99609375	0.00390625	-
Correlation constant for FAC_PORT_DEAC_MV filter					
C_FAC_PORT_DEAC_SUB	V	0... FFFFH	0... 0.999984741211	15.2588e-6	-
Initialisation of FAC_PORT_DEAC					
C_V_PORT_BOL_HYS	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Hysteresis of V_PORT_AD_BOL					
C_V_PORT_TOL_HYS	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Hysteresis of V_PORT_AD_OPEN					

Import actions:

ACTION_FARM_GetPermission(**IN** <PRM_FID>, **OUT** <PRM_LV_PRMS>)

General Information

For engines with more than one port flap, it is necessary to calculate for each bank separate input values (FAC_PORT_DEAC[i]), according to the number of port flaps (NC_PORT_NR). The quantity of the actual position (V_PORT_1, V_PORT_2; feedback signal of potis) is the input for the FAC_PORT_DEAC[i] (0...1) calculation. In case of more than one port flap the average of FAC_PORT_DEAC[i], which is named FAC_PORT_DEAC_MV is used for further calculations in the ECU. The values 0 and 1 point out the full closed or full opened fort flap position.

The measured voltages at the potis are V_PORT_1, V_PORT_2. These voltages are adapted to the rising and falling characteristic of the port flaps in the function " Standard analog inputs". With the two adapted limitation stop voltages (V_PORT_AD_OPEN/CLOSE), V_PORT_1, V_PORT_2 is transferred into FAC_PORT_DEAC[i].

If V_PORT_1, V_PORT_2 is within the two applicated hysteresis C_V_PORT_BOL_HYS and C_V_PORT_TOL_HYS, FAC_PORT_DEAC[i] is set to 0 or 1.

To adapt the model closer to the reality during a switch of the flaps, a PT 1 filter imitate the delay.

Definition of port flap numbers:

For engines with one port flap, V_PORT_1 value is used for the FAC_PORT_DEAC calculation. Furthermore the FAC_PORT_DEAC_MV value is the same as FAC_PORT_DEAC_1. For engines with two port flaps (NC_PORT_NR = 2) two calculation bows of FAC_PORT_DEAC_1/_2 (i=2) are necessary.

▶ Application Conditions

Initialisation:	`RST`
Activation:	`always`
Deactivation:	`never`
Recurrence:	`10MS`

▶ Function Description

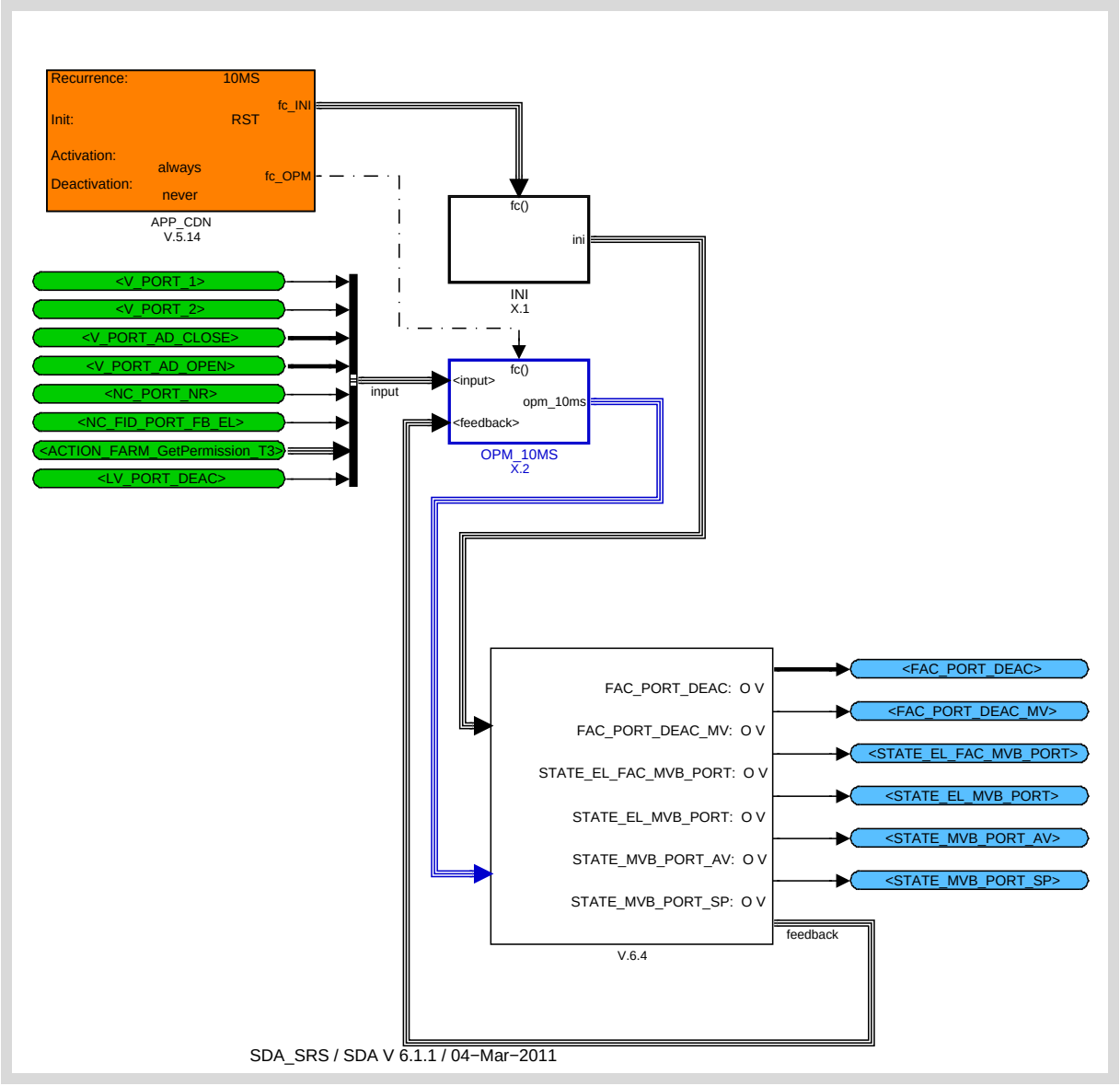

Figure 2.2.1: AIRM_M4055

2.2.1 Initialization

2.2.1.1 Calculation of initialization

The variables are initialized at LV_IGK = 0 - -> 1

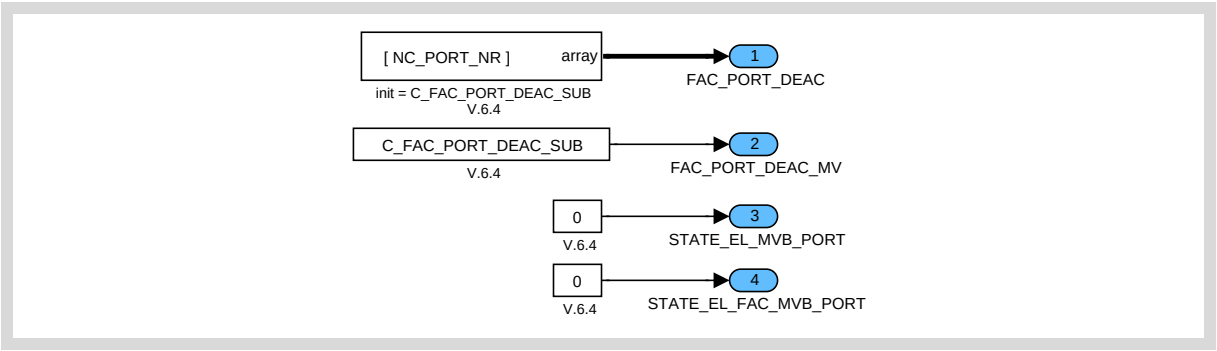

Figure 2.2.2: AIRM_M4055/INI/CLC_INI

2.2.2 Recurrence 10 ms

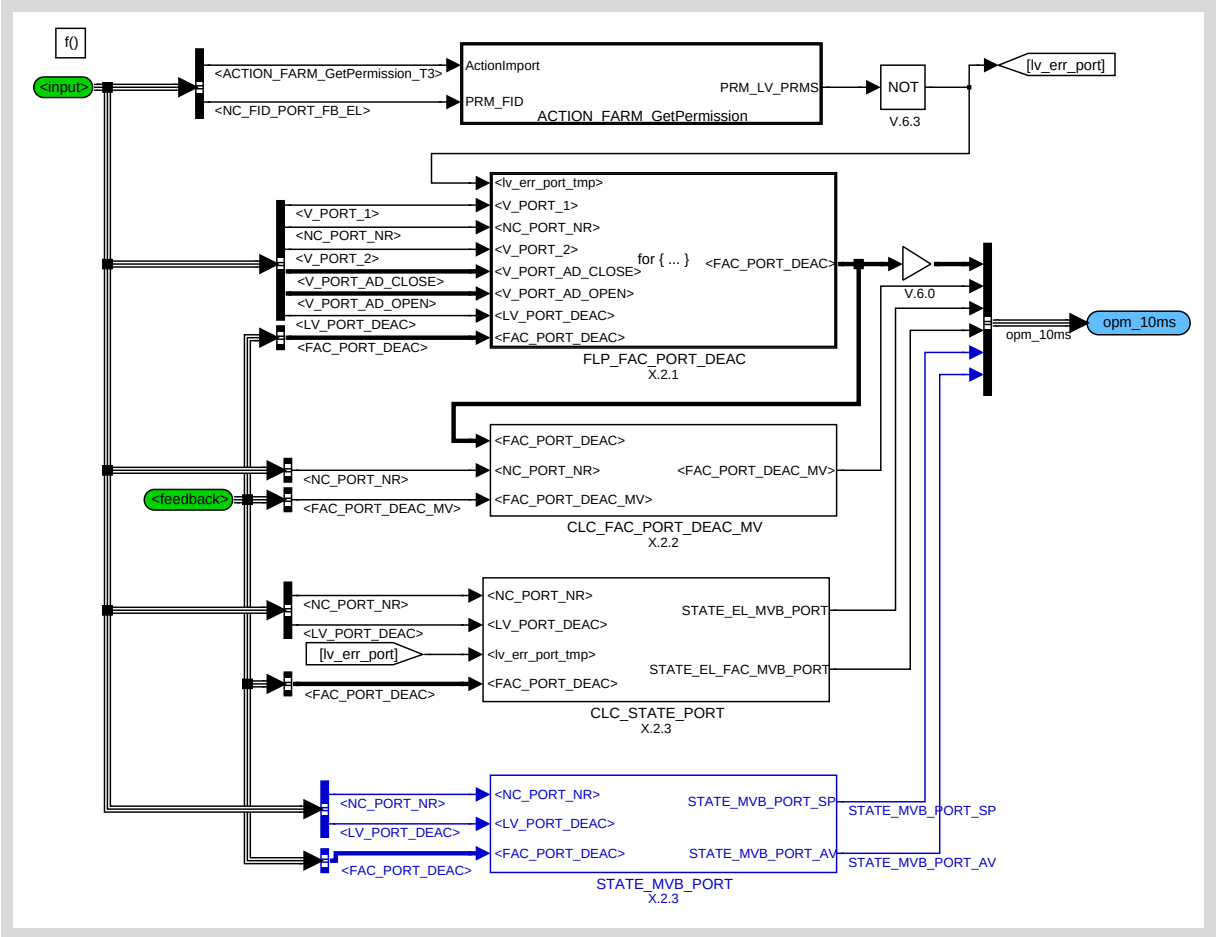

Figure 2.2.3: AIRM_M4055/OPM_10MS

2.2.2.1 For-Loop for calculation of FAC_PORT_DEAC

2.2.2.1.1 Calculation of FAC_PORT_DEAC

Calculation of FAC_PORT_DEAC[i] with falling characteristic.
If an port flap error is pendig, regardless which port flap (lv_err_port_temp = 1),
the calculation of FAC_PORT_DEAC is executed depending on port flap setpoint
.

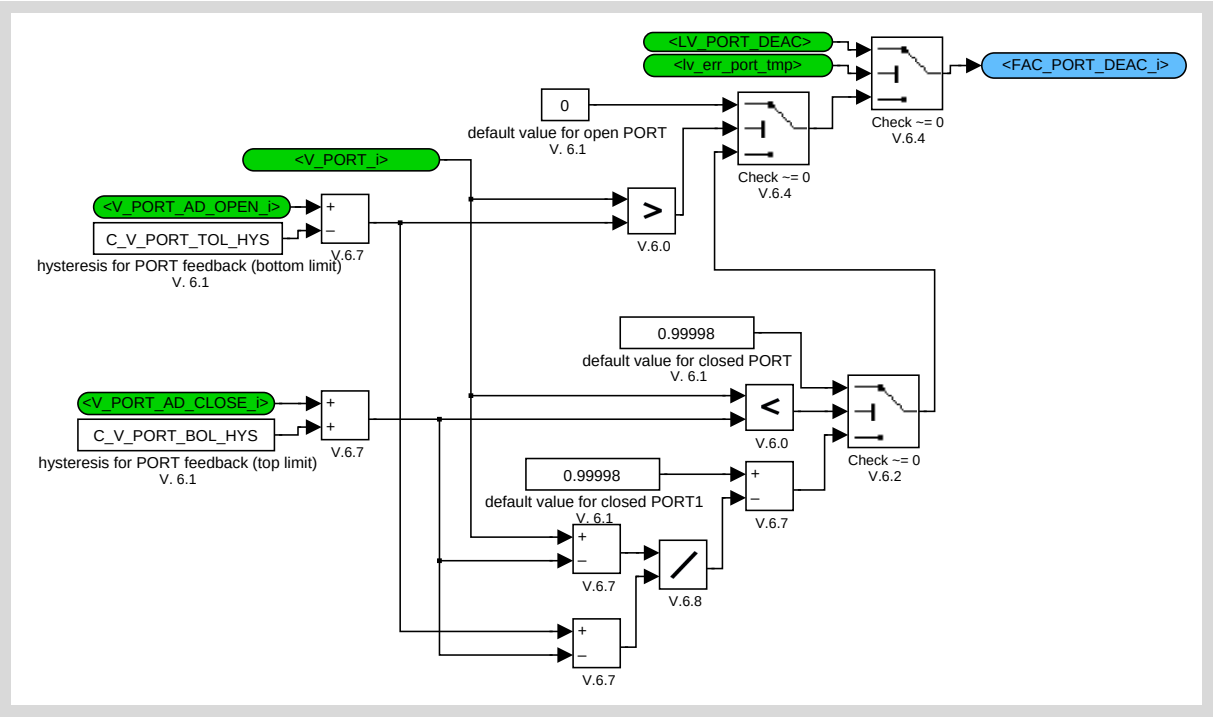

Figure 2.2.4: AIRM_M4055/OPM_10MS/FLP_FAC_PORT_DEAC/CLC_FAC_PORT_DEAC

2.2.2.2 Calculation of FAC_PORT_DEAC_MV

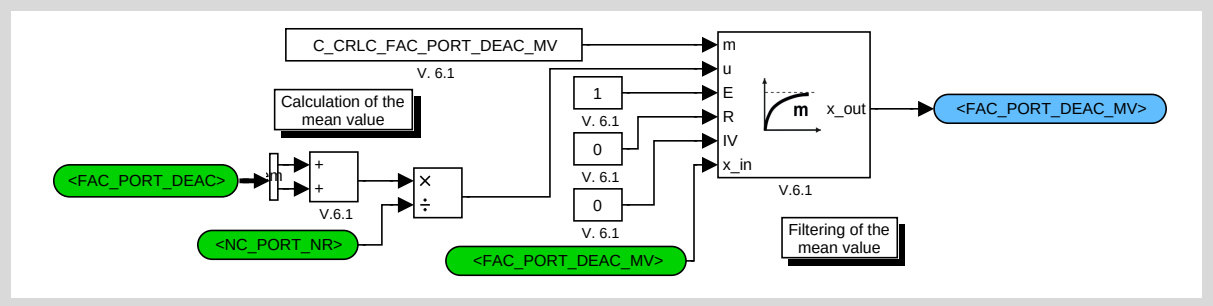

Figure 2.2.5: AIRM_M4055/OPM_10MS/CLC_FAC_PORT_DEAC_MV

2.2.2.3 State of port flaps

Check if there is a error present in the exhaust flap or if the flap is opened or closed.

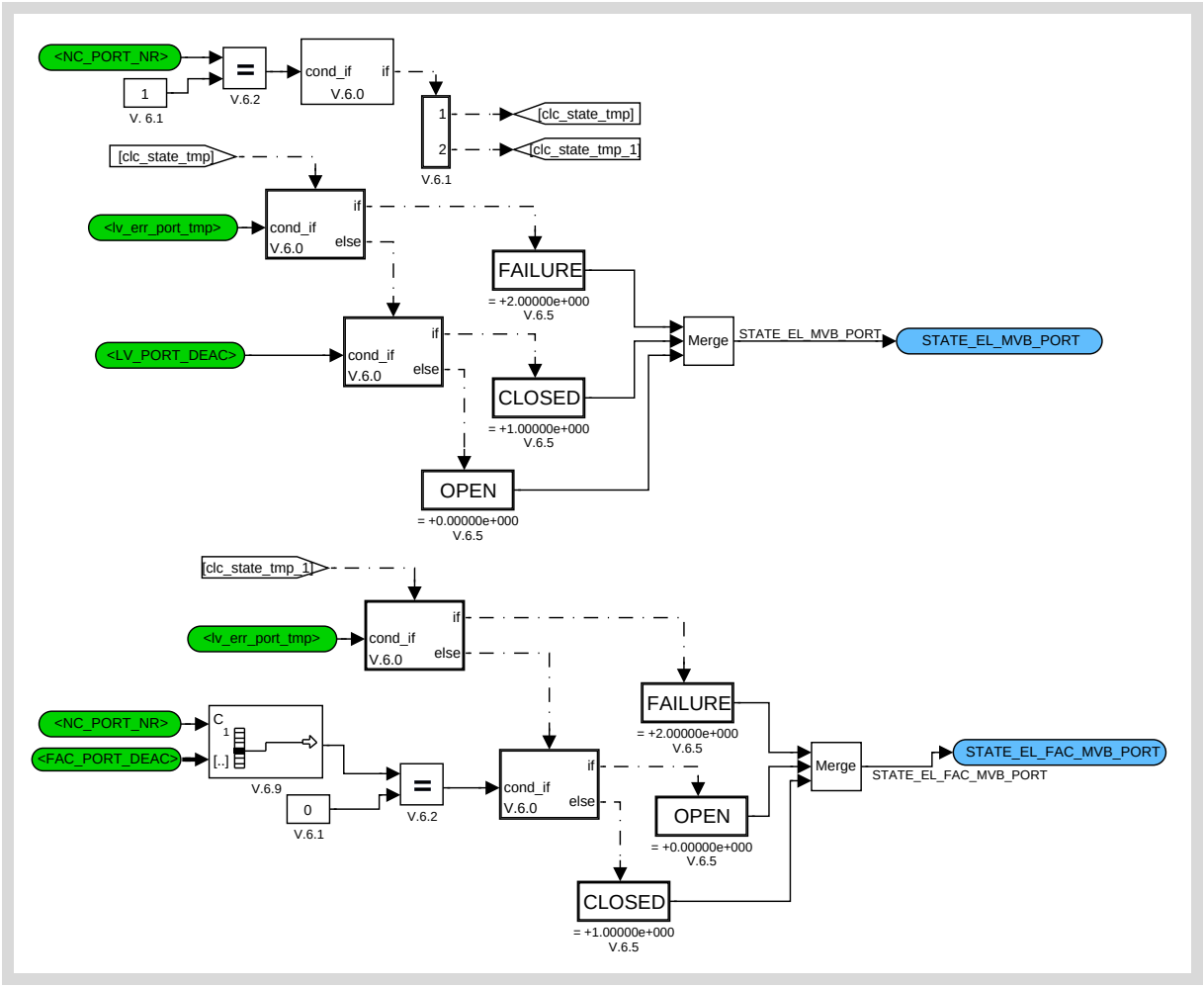

Figure 2.2.6:

2.2.2.4 State of intake manifold

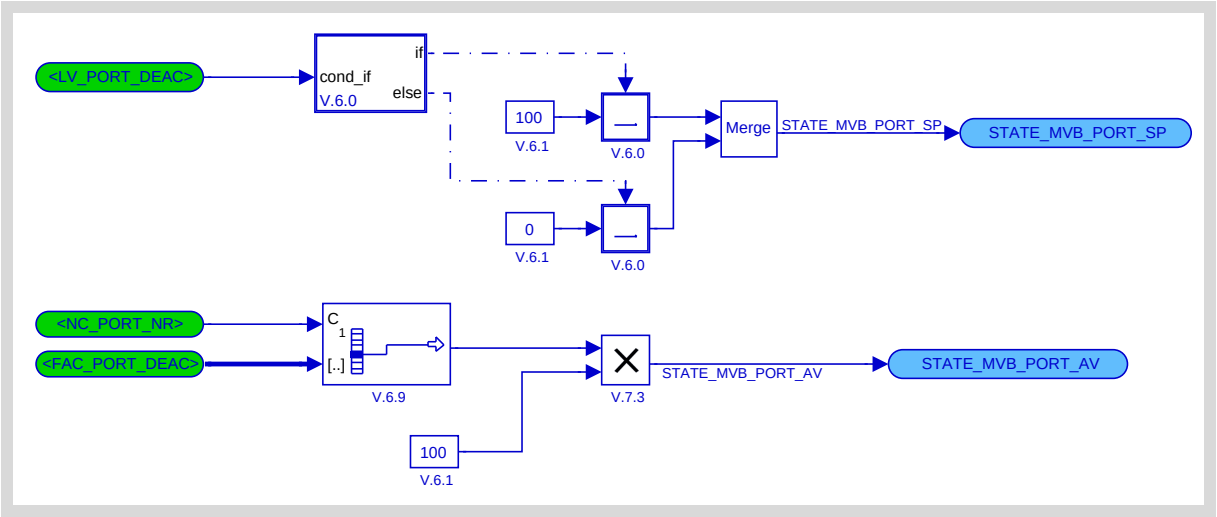

Figure 2.2.7: AIRM_M4055/OPM_1OMS/STATE_MVB_PORT

2.3 Port flap position set point actuation signal processing

▶ Data Definition

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
LV_PORT_CMB_CH_ACT	V	0... 1H	0 ...1	1	-
Multi pulse operation is active while catalyst heating for port set point					
LV_PORT_CMB_OPP_1_NOT	V	0... 1H	0 ...1	1	-
Multi pulse operation is available except OPP 1 for port set point					
LV_PORT_CMB_SCAV_REQ	V	0... 1H	0 ...1	1	-
Scavenging request active for port set point					
LV_PORT_DEAC	O/V	0... 1H	0 ...1	1	-
Setpoint of port flap (1 = port closed, 0 = port open)					
LV_PORT_DEAC_RAW_BAS	V	0... 1H	0 ...1	1	-
Temporary value of basis port flap setpoint					
LV_PORT_DEAC_RAW_DYN	V	0... 1H	0 ...1	1	-
Temporary value of dynamic port flap setpoint					
LV_PORT_DEAC_RAW_SCAV	V	0... 1H	0 ...1	1	-
Temporary value of scavenching port flap setpoint					
MAF_STK_SP_TQI_TMP	V	0... FFFFH	0... 2778	0.04238956	mg/stk
mass air flow setpoint for torque intervention					
MAP_SP_GRD_PORT_DYN	V	0... FFFFH	0... 5434	0.08291752	hPa
MAP setpoint gradient for dynamic determination					
N_32_TMP	V	0... FFH	0... 8160	32	rpm
Engine speed with hysteresis for port flap setpoint					
N_GRD_MMV_PORT_SCAV	V	80... 7FH	-4096 ...4064	32	rpm/s
The moving mean value of engine speed gradient					
T_PORT_SCAV	V	0... 3FFH	0... 10.23	0.01	s
The time to active the port during the scavenging					
T_PORT_SCAV_INI	V	0... 3FFH	0... 10.23	0.01	s
The initialization time of T_PORT_SCAV					
T_PORT_SP_DYN_ACT	V	0... FFFFH	0... 655.35	0.01	s
Actual time port flap dynamic determination					
T_PORT_SP_DYN_MAX	V	0... FFFFH	0... 655.35	0.01	s
Maximum time for dynamic set point determination					
T_PRED_PORT_SCAV	V	0... 3FFH	0... 10.23	0.01	s
The predicted time to reach the maximum N threshold for activating of port					

▶ Input Data

GEAR {p. 25859}	IDX_CMB_MOD_CUR {p. 1721}	IDX_CMB_MOD_REQ {p. 1745}	LV_ACT_PORT_DEAC_EXT_ADJ {p. 12373}
LV_CH {p. 10962}	LV_ENG_LST_ST_STST {p. 8499}	LV_ES {p. 7530}	LV_PORT_AD_ACT {p. 1087}
LV_PORT_AD_REQ_OPEN {p. 1087}	LV_PORT_DEAC_EXT_ADJ {p. 12374}	LV_ST {p. 7530}	MAF_STK_SP_TQI {p. 25371}
MAP_SP {p. 13894}	N_32 {p. 8079}	N_GRD {p. 8079}	NC_IDX_CH_2 {p. 1660}

NC_IDX_CH_2_S_1 {p. 1660}	NC_IDX_CH_3_S_2 {p. 1660}	NC_IDX_CH_MPI_2_S {p. 1660}	NC_IDX_CH_SA_2_S_1 {p. 1660}
NC_IDX_CH_SA_3_S_1 {p. 1660}	NC_IDX_CH_SA_MPI_2 {p. 1661}	NC_IDX_CH_SA_MPI_3_S_1 {p. 1661}	NC_IDX_OPP_2 {p. 1662}
NC_IDX_OPP_2_S_1 {p. 1662}	NC_IDX_OPP_3_HOMS_S {p. 1663}	NC_IDX_OPP_MPI_2 {p. 1663}	NC_IDX_OPP_MPI_2_S {p. 1663}
NC_IDX_OPP_MPI_3 {p. 1663}	NC_IDX_OPP_MPI_3_S_1 {p. 1663}	NC_IDX_OPP_MPI_4_S_2 {p. 1663}	NC_IDX_SCAV_OPP_1 {p. 23089}
NC_IDX_SCAV_OPP_2 {p. 23089}	NC_IDX_SCAV_OPP_2_S_1 {p. 23089}	NC_IDX_SCAV_OPP_3_HOMS_S {p. 23089}	PV_AV {p. 4450}
T_AST {p. 8436}	TCO {p. 8846}	TCO_ST {p. 8846}	TIA_IM {p. 1143}

Calibration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
C_CRLC_N_GRD_MMV_PORT_SCAV	V	0... FFH	0... 0.99609375	0.00390625	-
Filter constant for N_GRD_MMV_PORT_SCAV					
C_MAF_SP_TQI_MIN_PORT_SCAV	V	0... FFFFH	0... 2778	0.04238956	mg/stk
Minimum threshold of engine load setpoint for switching between dynamic or scavenching setpoint regarding MAF_STK_SP_TQI input					
C_N_THD_PORT_SCAV	V	80... 7FH	-4096 ...4064	32	rpm
Maximum N threshold to active the port					
C_NR_BUF_MAP_SP_GRD_PORT_DYN	V	0... AH	0... 10	1	-
Buffer number gradient port dynamic					
C_PORT_DEAC_MAN	V	0... 1H	0 ...1	1	-
Value for manual port flap control					
C_PORT_DEAC_SUB	V	0... 1H	0 ...1	1	-
Initialisation value of port flap control					
C_PV_THD_STST	V	0... 3FFH	0... 99.90234375	0.09765625	%
Pedal threshold for stop start					
C_T_AST_MIN_PORT	V	0... FFFFH	0... 6553.5	0.1	s
Minimum time after start to enable the port flap control					
C_T_MAX_PORT_SP_DYN	V	0... FFFFH	0... 655.35	0.01	s
Maximum time of port flaps open on dynamic					
C_T_MIN_PORT_SP_DYN	V	0... FFFFH	0... 655.35	0.01	s
Minimum time of port flaps open on dynamic					
C_TIA_PORT_HYS	V	0... FEH	-48... 142.5	0.75	°C
Intake air temperature hysteresis for port flap					
C_TIA_PORT_SCAV_ENA	V	0... FEH	-48... 142.5	0.75	°C
TIA-threshold for release of scavenging set point determination					
C_TIA_PORT_SCAV_ENA_HYS	V	0... FEH	-48... 142.5	0.75	°C
TIA-threshold-hysteresis for release of scavenging set point determination					
ID_FAC_PORT_TCO	V	0... 1H	0 ...1	1	-
LDP_TCO_FAC_PORT_TCO	4	0... FEH	-48... 142.5	0.75	°C
Correction map of port flap setpoint					
ID_IDX_GEAR_PORT	V	0... 1H	0 ...1	1	-
LDPM_GEAR_PORT_1_AIRM	8	0... FFH	0... 255	1	-

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
Gear dependency of port set point for OPP 1					
ID_IDX_GEAR_PORT_OPP_1_NOT	V	0... 1H	0 ...1	1	-
LDPM_GEAR_PORT_1_AIRM	8	0... FFH	0... 255	1	-
Gear dependency of port set point outside OPP 1					
ID_PORT_SP	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point map for port flap					
ID_PORT_SP_CH	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP_CH	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP_CH	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point for port flap while catalyst heating for OPP 1					
ID_PORT_SP_CMB_CH	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP_CH	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP_CH	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point for port flap while catalyst heating outside OPP 1					
ID_PORT_SP_GEAR	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point map for port flap depending on gear					
ID_PORT_SP_GEAR_OPP_1_NOT	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point map for port flap depending on gear outside OPP 1					
ID_PORT_SP_GEAR_TIA	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point for port flap depending on gear and intake air temperature for OPP 1					
ID_PORT_SP_GEAR_TIA_OPP_NOT	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point for port flap depending on gear and intake air temperature outside OPP 1					
ID_PORT_SP_OPP_1_NOT	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point map for port flap while OPP 1					
ID_TCO_PORT_SP	V	0... 1H	0 ...1	1	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAF_STK_SP_TQI_PORT_SP	10	0... FFFFH	0... 2778	0.04238956	mg/stk
Set point map for port flap incase of cold start					
ID_TCO_ST_PORT_ENA	V	0... 1H	0 ...1	1	-
LDP_ID_TCO_PORT_ENA	4	0... FEH	-48... 142.5	0.75	°C
LDP_ID_TCO_ST_PORT_ENA	4	0... FEH	-48... 142.5	0.75	°C
Enable basic setpoint determination at definite TCO/TCO_ST thresholds					
ID_TIA_PORT_SP	V	0... FEH	-48... 142.5	0.75	°C
LDPM_GEAR_PORT_1_AIRM	8	0... FFH	0... 255	1	-

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
Intake air temperature map for port flap					
IP_MAF_SP_TQI_PORT_HYS	V	0... FFFFH	0... 2778	0.04238956	mg/stk
LDP_N_32_PORT_HYS	6	0... FFH	0... 8160	32	rpm
Engine load hysteresis to switch port flap					
IP_MAP_SP_GRD_PORT_DYN_ACT	V	0... FFFFH	0... 5434	0.08291752	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAP_SP_GRD_PORT_DYN	10	0... FFFFH	0... 5434	0.08291752	hPa
Set point for port flap while dynamic mode active regarding gradient					
IP_MAP_SP_GRD_PORT_DYN_DEAC	V	0... FFFFH	0... 5434	0.08291752	-
LDPM_N_32_PORT_SP	10	0... FFH	0... 8160	32	rpm
LDPM_MAP_SP_GRD_PORT_DYN	10	0... FFFFH	0... 5434	0.08291752	hPa
Set point for port flap deactivation while dynamic mode active regarding gradient					
IP_N_32_PORT_HYS	V	0... FFH	0... 8160	32	rpm
LDP_MAF_STK_SP_TQI_PORT_HYS	6	0... FFFFH	0... 2778	0.04238956	mg/stk
Engine speed hysteresis to switch port flap					
IP_T_DLY_PORT_SCAV	V	0... 3FFH	0... 10.23	0.01	s
LDP_TIA_IP_T_DLY_SCAV_DEAC_PORT	6	0... FEH	-48... 142.5	0.75	°C
The port scavenging time depending on TIA					
IP_T_DLY_SCAV_DEAC_PORT	V	0... 3FFH	0... 10.23	0.01	s
LDP_TIA_IP_T_DLY_SCAV_DEAC_PORT	6	0... FEH	-48... 142.5	0.75	°C
Maximum time for scavenging active					
LC_PORT_DEAC_MAN_ACT	V	0... 1H	0 ...1	1	-
Activation bit for manual port flap control; default value = 0					

Import actions:

ACTION_INFR_SetPortDeac(**IN** <PRM_PORT_DEAC>)

General Information

Due to different reasons - for example to improve the lean burn ability of a spark ignition engine - it is possible to deactivate one of the two intake ports of each cylinder. With one of the intake ports deactivated the swirl or tumble rate is higher than for both ports active.

Depending on engine operating point, engine temperature, double injection active or inactive and catalyst heating active or inactive the set point of the port flap is calculated. The port flap is vacuum-controlled. In case of no vacuum the port flap (inlet port) is closed. For that reason a continuous adjustment of the port flap is not possible.

Depending on the port flap set point or the adaptation request the control of the port flap is executed as described:
LV_PORT_DEAC = 1 port flap (inlet port) closed
LV_PORT_DEAC = 0 port flap (inlet port) open

If LV_PORT_DEAC = 1 the port flap is closed (default position) and the power stage must be inactive. If LV_PORT_DEAC = 0 the port flap is open and the power stage must be active.

In case of a port flap error the calculation of FAC_PORT_DEAC is executed depending on port flap set point.

▶ Application Conditions

Initialisation: `RST, IGKON`

Activation: `always`

Deactivation: `never`

Recurrence: `10MS`

▶ Function Description

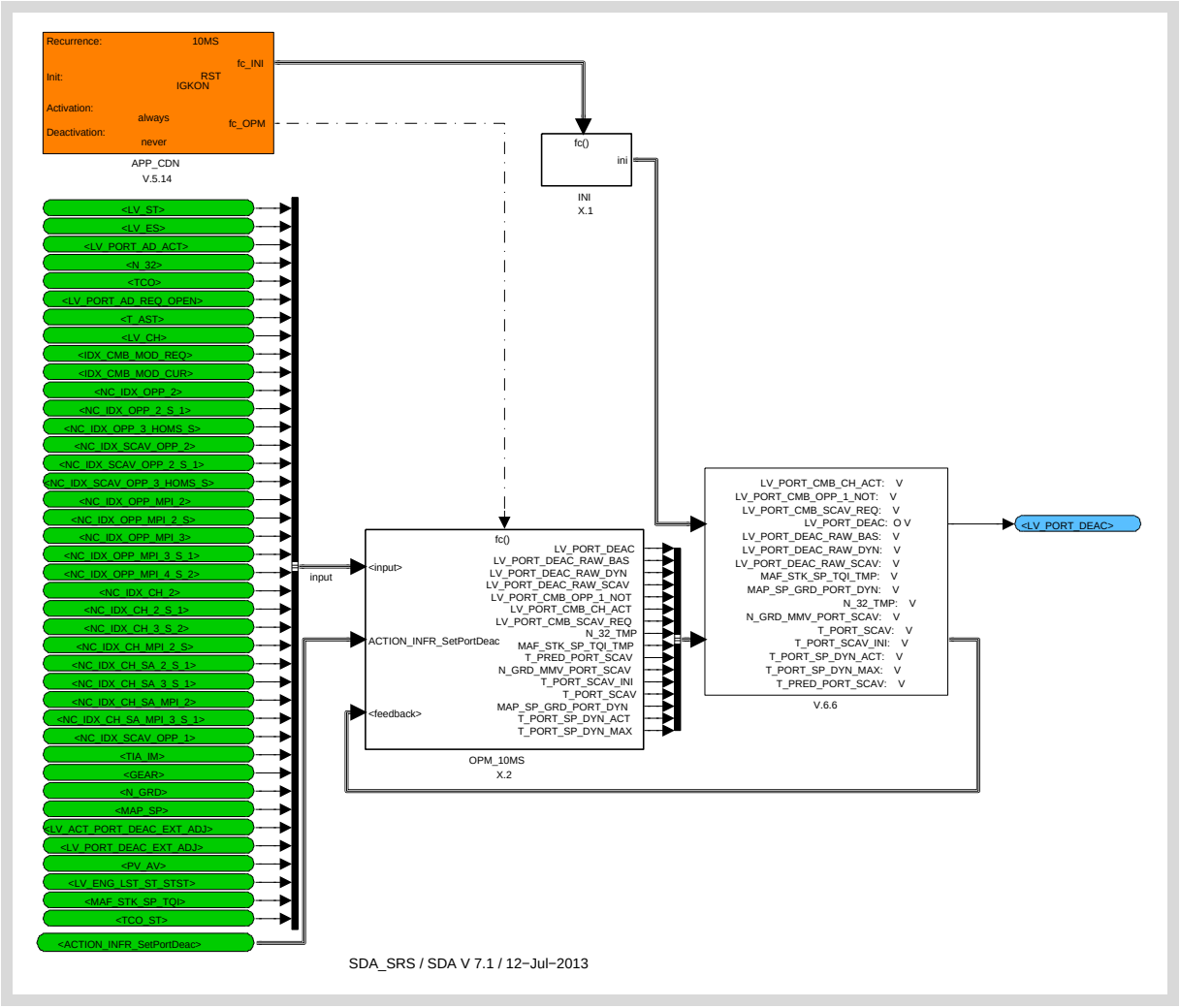

Figure 2.3.1: PORT flap set point selection overview

2.3.1 Initialization

2.3.1.1 Calculation of initialization

The variables are initialized at reset and LV_IGK = 0 - -> 1

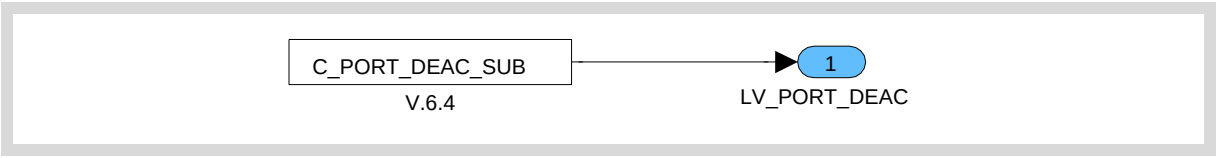

Figure 2.3.2:

2.3.2 Calculation 10 ms

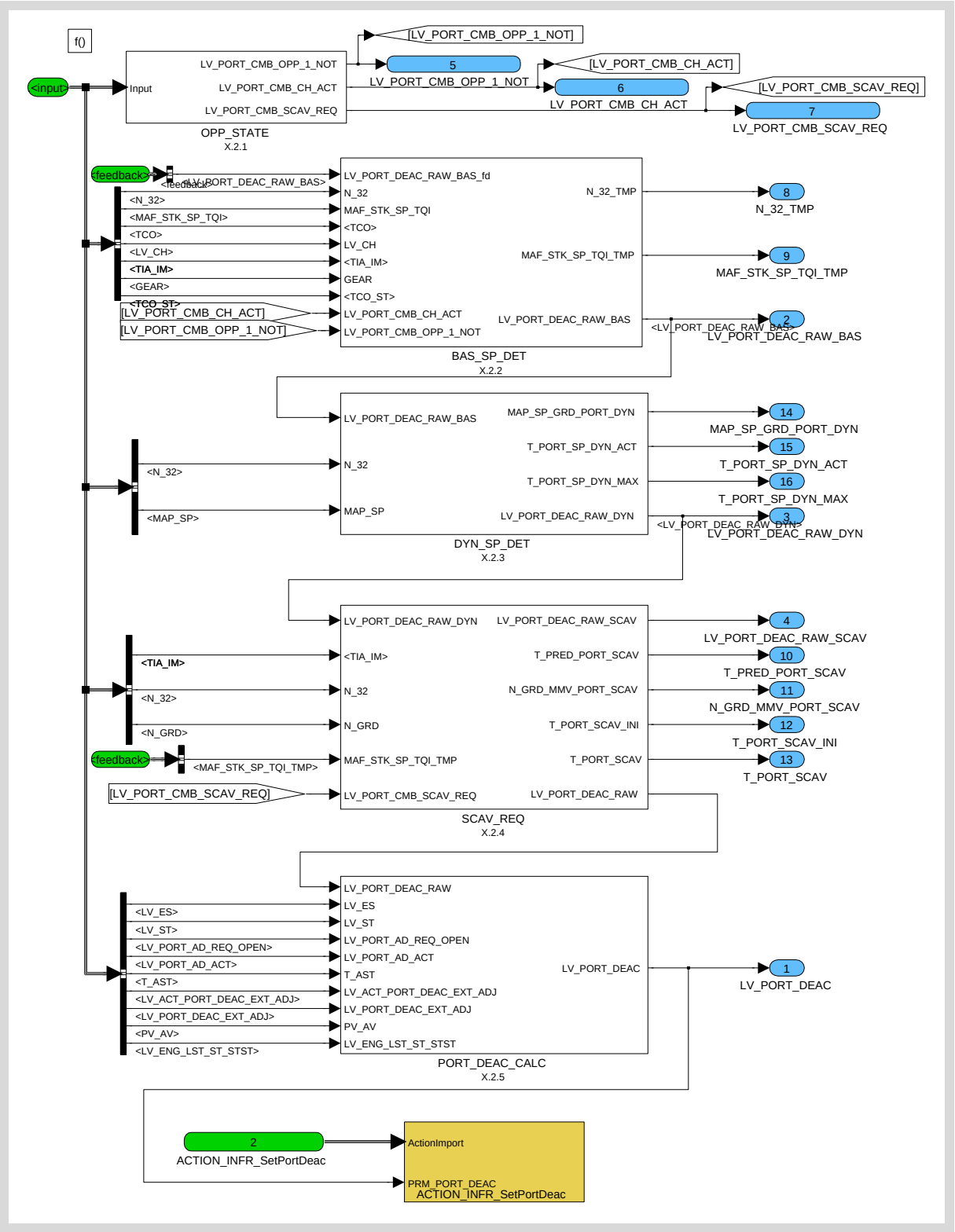

Figure 2.3.3: AIRM_M9022/OPM_10MS

2.3.2.1 Operating state detection

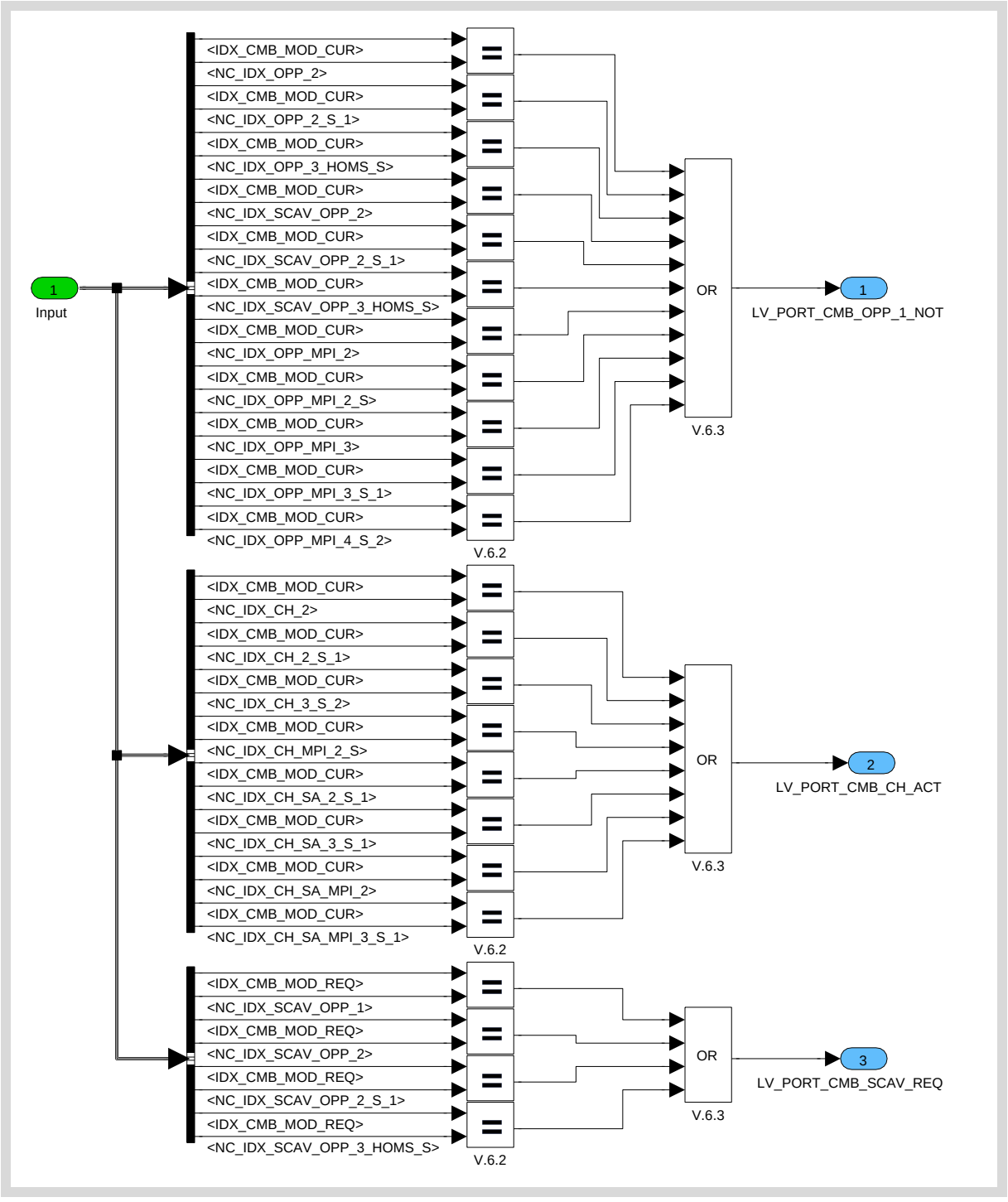

Figure 2.3.4: AIRM_M9022/OPM_10MS/OPP_STATE

2.3.2.2 Basic set point determination

In the basic set point determination the calculation of the set point is done depending on the gear, TIA_IM, N32 and MAF_SP. There is a general activation condition for the output value depending on the value of

TCO. Further the switching between the different modes of calculation depends on the operating state of the engine.
To avoid toggling of the port flap, in the basic set point determination a hysteresis for the input variables of the maps is implemented.
For cold start's it is possible to set the flap via IP_TCP_PORT_SP to a definite position.

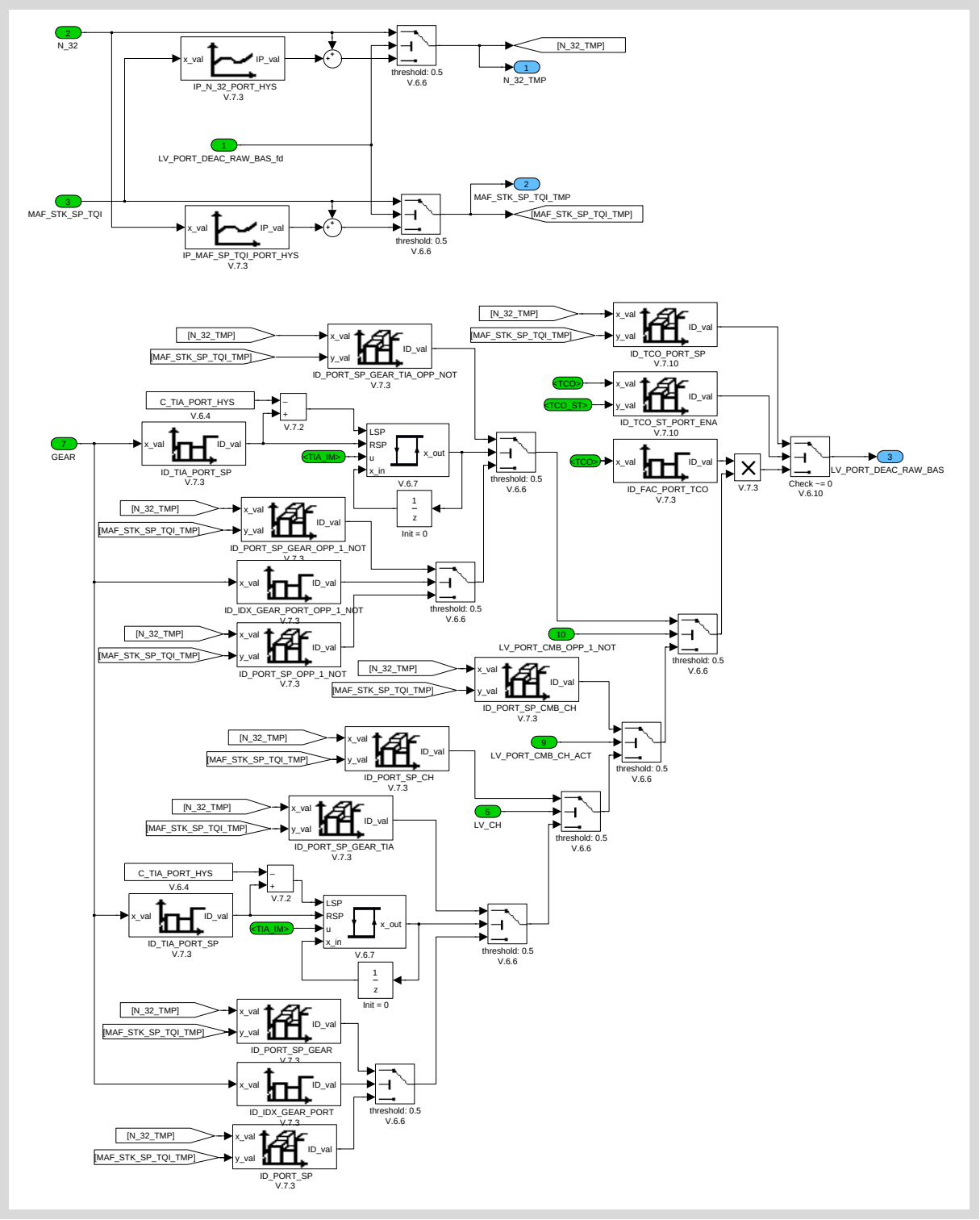

Figure 2.3.5: AIRM_ISPCLO/OPM_10MS/BAS_SP_DET

2.3.2.3 Dynamic set point determination

The dynamic set point determination should prevent drivability problems due to switching of the port flaps and the engine load changes with high gradients.

Dynamics is recognized over MAP_SP_GRD_PORT DYN and the flaps are opened fro a certain time.

After a stationary point is achieved, the port flaps should be from the normal hazard maps.

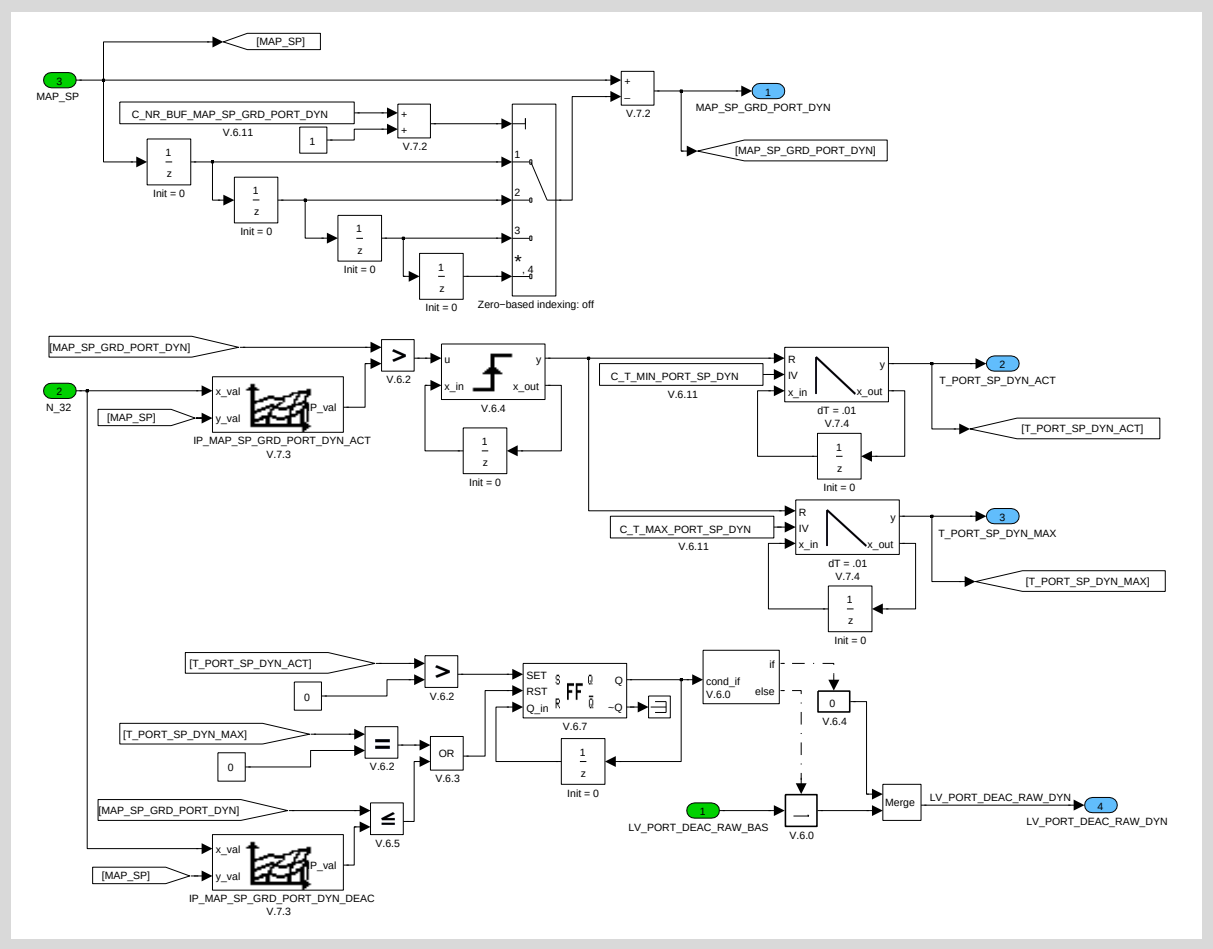

Figure 2.3.6: AIRM_M9022/OPM_10MS/DYN_SP_DET

2.3.2.4 Set point determination for scavenging

For scavenging mode at low engine speeds and high loads the port flap must be set to open state (LV_PORT_DEAC=0). If scavenging is requested the control of LV_PORT_DEAC is switched to this set point calculation. Therefore basic and dynamic set point determination have no effect in case of scavenging request.
The scavenging mode could be also released over a TIA_IM-threshold (over a temperature threshold the mixture should not be influence via a open flap).

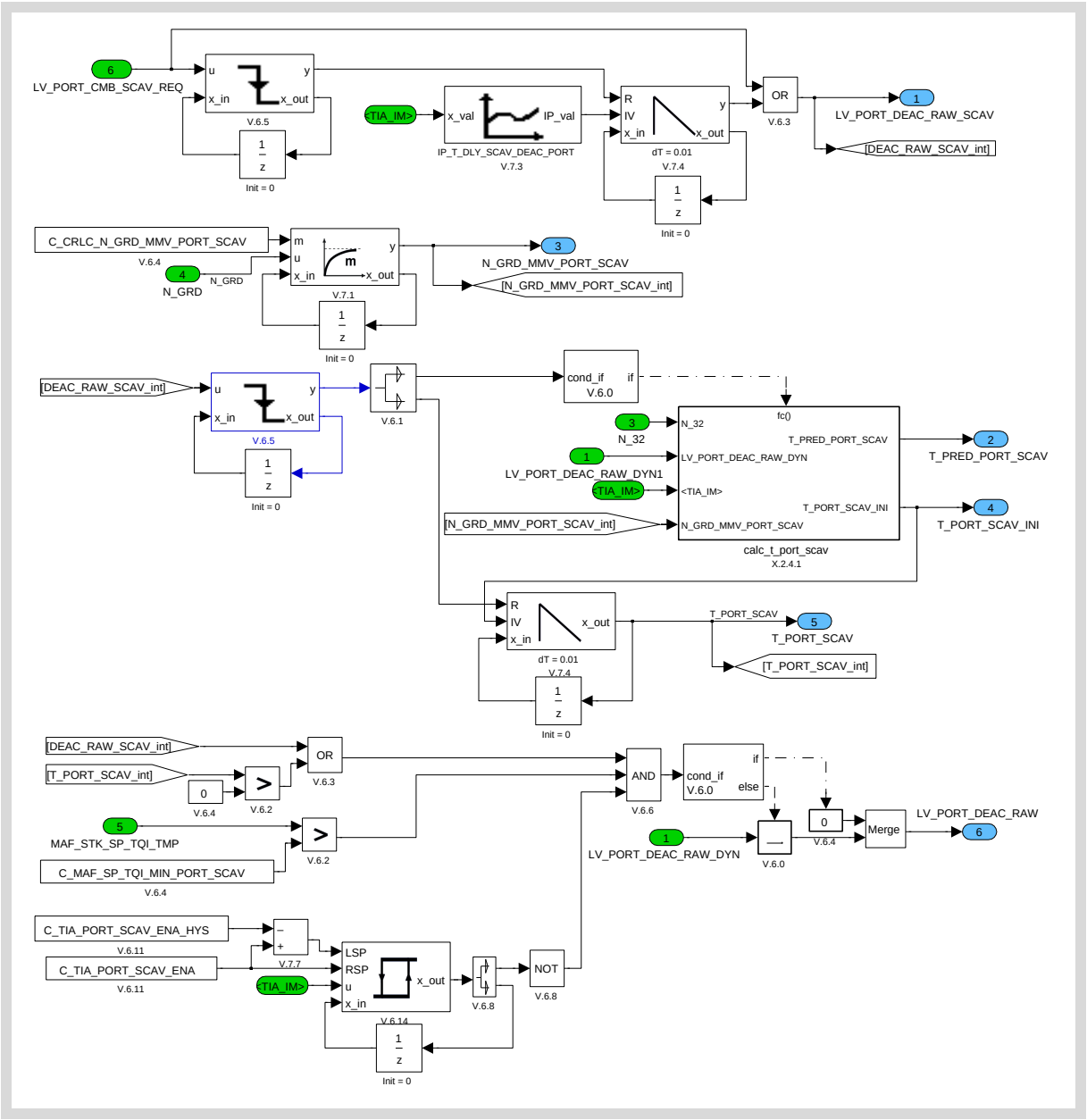

Figure 2.3.7: AIRM_M9022/OPM_10MS/SCAV_REQ

2.3.2.4.1 Calculation of the activating time of port flap during scavenging

The predicted time to reach the maximum engine speed threshold for activating of port is calculated regarding the moving mean value of engine speed gradient and the engine speed.

The initialization time of T_PORT_SCAV is obtain from the port scavenging time map depending on intake air temperature at throttle.

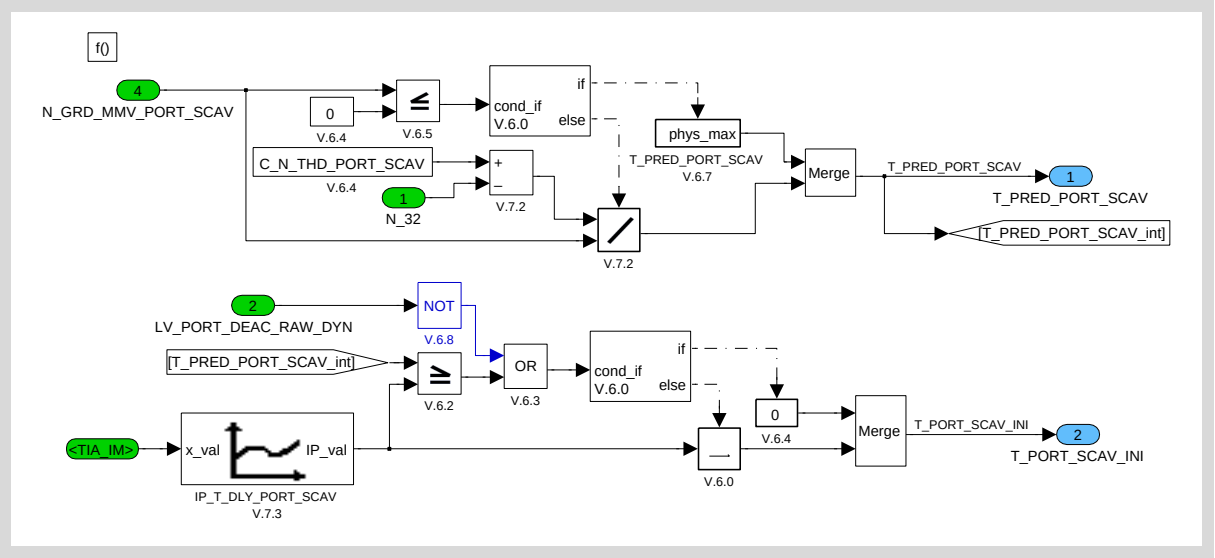

Figure 2.3.8: Calculation of the activating time of port flap during scavenging

2.3.2.5 Final set point calculation

The final set point LV_PORT_DEAC is calculated depending on the engine state (e.g. engine stopped), external and adaptation requests and time elapsed after engine start.

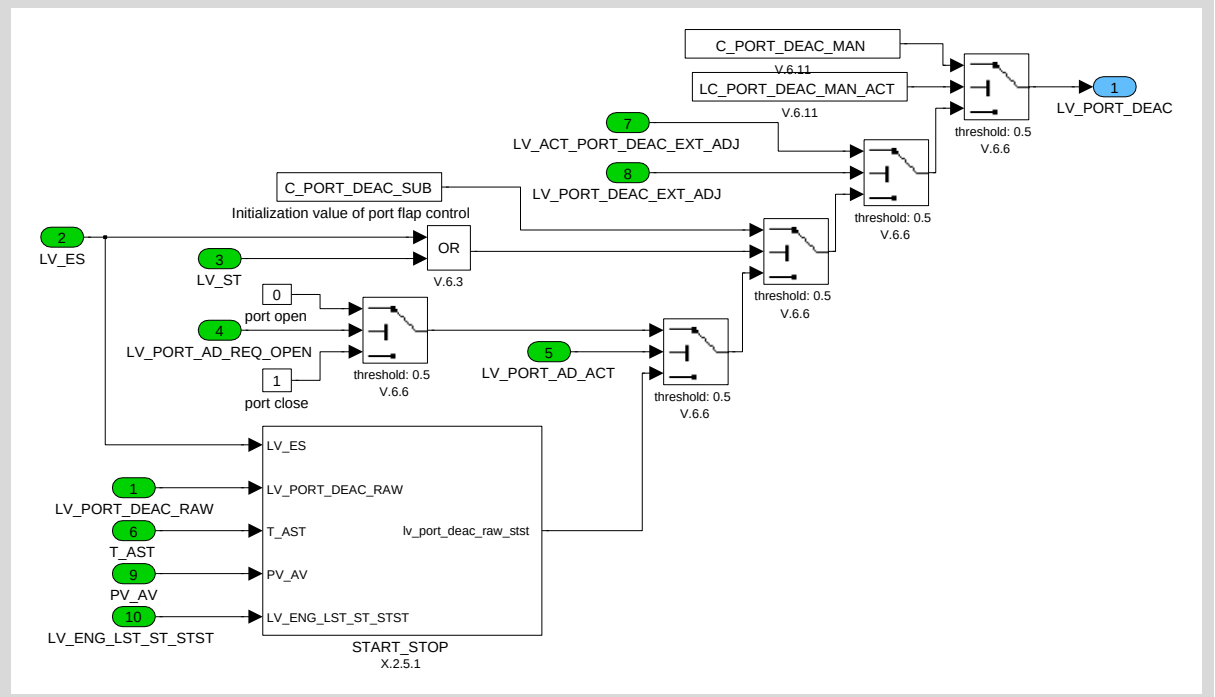

Figure 2.3.9: AIRM_ISPCL0/OPM_10MS/PORT_DEAC_CALC

2.3.2.5.1 Start Stop system

In case of Start Stop the deactivation of the port flap should be aborted via PV threshold to avoid a noticeable jump in torque.

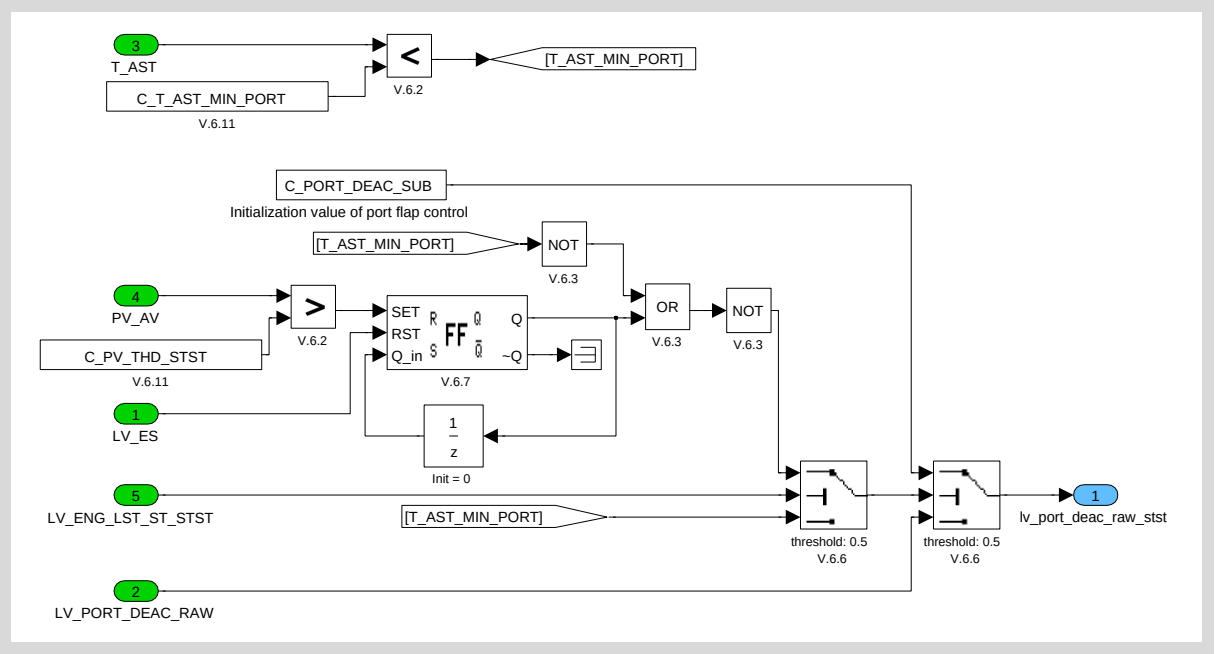

Figure 2.3.10: AIRM_ISPCLO/OPM_1OMS/PORT_DEAC_CALC/START_STOP_PORT_DEAC_RAW

2.4 Port flap adaptation

▶ Data Definition

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
LV_PORT_AD_ACT	O/V	0... 1H	0 ...1	1	-
Logical variable for activation the adaptation of port flap					
LV_PORT_AD_REQ_OPEN	O/V	0... 1H	0 ...1	1	-
Logical variable for request to open the PORT-flap					
LV_PORT_AD_VLD [NC_PORT_NR]	O/V/S	0... 1H	0 ...1	1	-
Logical variable for "adaptation values valid and adaptation successful"					
PORT_AD_ERR_CTR	V	0... FFH	0... 255	1	-
Counter for failed port adaptation					
STATE_EL_MVB_AD_PORT	O/V	0... FH	0... 15	1	-
State of the adaptation of port flap					
STATE_PORT_AD	O	0H 1H 2H 3H 4H 5H	PORT_AD_WAIT PORT_AD_BOL PORT_AD_TOL PORT_AD_PLAUS PORT_AD_ERR PORT_AD_OK	-	-
State of PORT-Adaptation					
T_HLD_PORT_AD	V	0... FFH	0... 10.2	0.04	s
Time to hold the PORT flap in a defined end position before adaptation is started					
T_PORT_AD	V	0... FFH	0... 10.2	0.04	s
Time of PORT- adaptation					
V_PORT_AD_CLOSE [NC_PORT_NR]	O/V/S	0... 3FFH	0... 4.9951171875	0.00488281	V
Saved value of V_PORT_i adaptation for closed port flap					
V_PORT_AD_OPEN [NC_PORT_NR]	O/V/S	0... 3FFH	0... 4.9951171875	0.00488281	V
Saved value of V_PORT_i adaptation for open port flap					
V_PORT_CLOSE [NC_PORT_NR]	O/V	0... 3FFH	0... 4.9951171875	0.00488281	V
Measured value of V_PORT_i for closed port flap					
V_PORT_OPEN [NC_PORT_NR]	O/V	0... 3FFH	0... 4.9951171875	0.00488281	V
Measured value of V_PORT_i for open port flap					

▶ Input Data

LV_PORT_AD_EXT_REQ {p. 23187}	LV_ST_END {p. 7530}	N_32 {p. 8079}	NC_FID_PORT_AD_ACT
NC_FID_PORT_AD_VLD	PQ {p. 13895}	TCO {p. 8846}	V_PORT_1 {p. 1061}
V_PORT_2 {p. 1061}	VB_MMV {p. 24055}		

Calibration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
C_CRLC_V_PORT	V	0... FFH	0... 0.99609375	0.00390625	-
Correlation constant for adaptation value evaluation					
C_N_MAX_PORT_AD	V	0... FFH	0... 8160	32	rpm
Maximum engine speed for adaptation of port flap					
C_N_MIN_PORT_AD	V	0... FFH	0... 8160	32	rpm
Minimum engine speed for adaptation of port flap					
C_PORT_AD_ERR_CTR_MAX	V	0... FFH	0... 255	1	-
Maximum number of failed portflap adaptation before entering PORT_AD_ERR-State					
C_PQ_MAX_PORT_AD	V	0... FFFFH	0... 0.999984741211	15.2588e-6	-
Maximum PQ for adaptation of port flap					
C_T_HLD_PORT_AD	V	0... FFH	0... 10.2	0.04	s
Time to hold PORT position before adaptation starts					
C_T_PORT_AD	V	0... FFH	0... 10.2	0.04	s
Time of adaptation mean value calculation					
C_TCO_MIN_PORT_AD	V	0... FEH	-48... 142.5	0.75	°C
Minimum coolant temperature for adaptation of port flap					
C_V_PORT_AD_CLOSE_HYS	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Hysteresis on C_V_PORT_CLOSE_I_INI to detect a valid adaptation value					
C_V_PORT_AD_OPEN_HYS	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Hysteresis on C_V_PORT_OPEN_I_INI to detect a valid adaptation value					
C_V_PORT_CLOSE_INI	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Default value for port poti output for closed port flap					
C_V_PORT_OPEN_INI	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Default value for port poti output for open port flap					
C_VB_MIN_PORT_AD	V	0... FFH	0... 25.8984375	0.1015625	V
Minimum battery voltage for adaptation of port flap					

Import actions:

ACTION_FARM_GetPermission(**IN** <PRM_FID>, **OUT** <PRM_LV_PRMS>)

General Information

The delivered voltage from the PORT-poti indicates the degree of the port flap position. Because of the electrical and the mechanical tolerances, the lower and higher stop of the poti must be adapted once.
The learned values are stored as „non-volatile“.

Description:

If no PORT adaptation was fulfilled for the whole engine life or the adaptation values were lost (LV_PORT_AD_VLD[i] = 0) the values V_PORT_AD_CLOSE/OPEN_i are set to default values. Otherwise these values are stored in the non volatile memory of the ECU and are valid till the next adaptation was successful.
While adaptation is active and STATE_PORT_AD = PORT_AD_BOL LV_PORT_AD_REQ_OPEN is set to 0 (port flap is closed). After a calibratable hold time (C_T_HLD_PORT_AD) V_PORT_CLOSE[i] is calculated as an average of V_PORT_1, V_PORT_2 (starting with V_PORT_AD_CLOSE[i]) for C_T_PORT_AD seconds.

Then the port flap is open (STATE_PORT_AD = PORT_AD_TOL) (LV_PORT_AD_REQ_OPEN is set to 1) and after the same hold time V_PORT_OPEN[i] is calculated as an average of V_PORT_1, V_PORT_2 (starting with V_PORT_AD_OPEN[i]) for C_T_PORT_AD seconds.
If these values V_PORT_CLOSE[i] and V_PORT_OPEN[i] are within a valid range, these values are copied into V_PORT_AD_CLOSE/OPEN_i and saved (together with LV_PORT_AD_VLD[i]) in the non volatile memory of the ECU.
For VR or R engines, which are using only one port flap, the value of V_PORT_1, V_PORT_2 is set to 1 (V_PORT_1).
Remark: LV_ERR_PORT[i] (i: meaning: number of actuators)
output data (i: meaning: number of ports)
The adaptation has to be calculated immediately before adaptation diagnosis.

STATE_EL_MVB_AD_PORT shows the state of the adaptation of flap:
0: adaptation is running
1: adaptation finished, system is ok
2: adaptation finished, system is not ok
3: adaptation canceled, because the prerequisites are not met
4: adaptation canceled because of external request
5: adaptation is not started

Application Conditions

Initialisation:

```
        with LV_IGK = 0 → 1 or reset
        PORT_AD_ERR_CTR = 0

If      at least one port adaptation took successfully place
        for whole engine life
  and   no checksum error was detected
  and   |   V_PORT_1, V_PORT_2   -   V_PORT_AD_CLOSE[i]   |
≤
C_V_PORT_AD_CLOSE_HYS
  Then  LV_PORT_AD_VLD[i] = 1      ;adaptation values available

  Else  LV_PORT_AD_VLD[i] = 0      ;no adaptation values are
                                    available
Endif

    If  LV_PORT_AD_VLD[i]     =     1
  Then  V_PORT_OPEN[i]        =     V_PORT_AD_OPEN[i]
        V_PORT_CLOSE[i]       =     V_PORT_AD_CLOSE[i]
        STATE_PORT_AD         =     PORT_AD_OK
        STATE_EL_MVB_AD_PORT  =     5    ;adaptation is not
started

  Else  V_PORT_AD_OPEN[i] = C_V_PORT_OPEN_INI  ;never a
        successful adaptation fulfilled, no adaptation values
        available
        V_PORT_OPEN[i]        = C_V_PORT_OPEN_INI
        V_PORT_AD_CLOSE[i]    = C_V_PORT_CLOSE_INI
        V_PORT_CLOSE[i]       = C_V_PORT_CLOSE_INI
        STATE_PORT_AD         = PORT_AD_WAIT
        STATE_EL_MVB_AD_PORT = 5    ;adaptation is not started
Endif
LV_PORT_AD_REQ_OPEN     =    0

Activation of adaptation:   external request
```

```
                    If          LV_PORT_AD_EXT_REQ = 0 -> 1
                    and         STATE_PORT_AD ≠ PORT_AD_ERR
                    Then        LV_PORT_AD_VLD[i] = 0 ;both set to 0
                                PORT_AD_ERR_CTR = 0
                                STATE_PORT_AD = PORT_AD_WAIT
                                STATE_EL_MVB_AD_PORT = 5    ;adaptation is not
                    started
                    Endif
```

Activation: all engine operating states

Recurrence: 40 ms

▶ Function Description

Activation of adaptation:

```
If      LV_PORT_AD_VLD[i] = 0 ;LV_PORT_AD_VLD_1= 0 OR LV_PORT_AD_VLD_2 = 0
and     ACTION_FARM_GetPermission(IN<NC_FID_PORT_AD_VLD>)
and     STATE_PORT_AD ≠ PORT_AD_ERR
Then    If    PQ < C_PQ_MAX_PORT_AD
        and   LV_ST_END = 1
        and   N_32 < C_N_MAX_PORT_AD
        and   N_32 ≥ C_N_MIN_PORT_AD
        and   TCO > C_TCO_MIN_PORT_AD
        and   VB_MMV > C_VB_MIN_PORT_AD
        and   ACTION_FARM_GetPermission(IN<NC_FID_PORT_AD_ACT>)
        and   LV_PORT_AD_EXT_REQ ≠ 1 -> 0
        Then  LV_PORT_AD_ACT = 1
              If    STATE_PORT_AD = PORT_AD_WAIT
              Then  STATE_PORT_AD = PORT_AD_BOL
                    STATE_EL_MVB_AD_PORT = 0 ;adaptation is running
                    T_HLD_PORT_AD is initialised with C_T_HLD_PORT_AD
                    T_PORT_AD is initialised with C_T_PORT_AD
              Endif
        Else
              If    LV_PORT_AD_EXT_REQ = 1 -> 0
              Then  STATE_EL_MVB_AD_PORT = 4 ;adaptation canceled
              because of external request
              Endif
              LV_PORT_AD_ACT = 0
              PORT_AD_ERR_CTR = 0
              STATE_PORT_AD = PORT_AD_WAIT
        Endif
Else    LV_PORT_AD_ACT = 0
        STATE_EL_MVB_AD_PORT = 3 ;adaptation canceled, because
        the prerequisites are not met
Endif
```

Adaptation algorithm (this is a sequence of actions to do in this order):

Adaptation of lower stop:

```
If      STATE_PORT_AD = PORT_AD_BOL
Then    LV_PORT_AD_REQ_OPEN = 0       ;PORT closed
        timer T_HLD_PORT_AD is decremented
Endif
If      timer T_HLD_PORT_AD = 0       ;enough time in closed position
Then    timer T_PORT_AD is decremented
Endif
```

```
If       T_PORT_AD > 0          ;adaptation value calculation active
Then
   If    LV_PORT_AD_VLD[i] = 0  ; calculation has only to be done if
                                ; adaptation is not vld for that port
   Then  V_PORT_CLOSE[i]N = V_PORT_CLOSE[i]N-1 • (1 – C_CRLC_V_PORT) +
                                        V_PORT_1,       V_PORT_2N    •
                                      C_CRLC_V_PORT
   Endif
Else     STATE_PORT_AD = PORT_AD_TOL         T_HLD_PORT_AD is initialised with
C_T_HLD_PORT_AD
         T_PORT_AD is initialised with C_T_PORT_AD
         ;adaptation of lower stop finished, switch to next adaptation step
Endif
```

Adaptation of upper stop:

```
If       STATE_PORT_AD = PORT_AD_TOL
Then     LV_PORT_AD_REQ_OPEN = 1            ;switching to PORT open
         timer T_HLD_PORT_AD is decremented
Endif
If       timer T_HLD_PORT_AD = 0            ;enough time in open position
Then     timer T_PORT_AD is decremented
Endif
If       T_PORT_AD      > 0            ;adaptation value calculation active
Then
   If    LV_PORT_AD_VLD[i] = 0          ; calculation has only to be done if
                                        ; adaptation is not vld for that port
   Then  V_PORT_OPEN[i]N = V_PORT_OPEN[i]N-1  • (1 – C_CRLC_V_PORT) +
                                          V_PORT_1,      V_PORT_2N      •
                                        C_CRLC_V_PORT
   Endif
Else     STATE_PORT_AD = PORT_AD_PLAUS         ;adaptation of upper
         stop finished, switch to next adaptation step
         LV_PORT_AD_REQ_OPEN = 0
Endif
```

Plausibility check:

```
If     STATE_PORT_AD = PORT_AD_PLAUS
                    ; following determination has to be done separately for
                    ; PORT 1 and PORT 2
Then   If
       LV_PORT_AD_VLD[i] = 0
       And
       |V_PORT_CLOSE[i] – C_V_PORT_CLOSE_INI|  ≤  C_V_PORT_AD_CLOSE_HYS
       And
          |V_PORT_OPEN[i] – C_V_PORT_OPEN_INI| ≤ C_V_PORT_AD_OPEN_HYS
       Then   V_PORT_AD_CLOSE[i]   = V_PORT_CLOSE[i] ;new adaptation value to
              V_PORT_AD_OPEN[i]    = V_PORT_OPEN[i]  be saved in EEPROM
              LV_PORT_AD_VLD[i] = 1          ;adaptation values are valid;
              STATE_EL_MVB_AD_PORT = 1 ;adaptation finished, system is ok
       Endif

       If     LV_PORT_AD_VLD[i] = 0      ; LV_PORT_AD_VLD_1 = 0 OR
                                        ; LV_PORT_AD_VLD_2 = 0
       Then
            If          PORT_AD_ERR_CTR  ≥ C_PORT_AD_ERR_CTR_MAX
            Then        STATE_PORT_AD = PORT_AD_ERR
                        STATE_EL_MVB_AD_PORT = 2 ;adaptation finished,
                        system is not ok
```

```
            Else        PORT_AD_ERR_CTR = PORT_AD_ERR_CTR_n-1  +  1
                        STATE_PORT_AD = PORT_AD_WAIT
            Endif
        Else STATE_PORT_AD = PORT_AD_OK           ;adaptation finished and ok.
             STATE_EL_MVB_AD_PORT = 1      ;adaptation finished, system is ok
        Endif
Endif
```

Adaptation finished:

```
IF              STATE_PORT_AD_i = PORT_AD_OK
        or      STATE_PORT_AD_i = PORT_AD_ERR

        Then    LV_PORT_AD_ACT = 0
Endif
```

2.5 Port flap actuator diagnosis

▶ Data Definition

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
LF_STATE_DGO_PORT_MEC_DOWN [NC_PORT_NR]	O/V	0... FFFFH	0... 65535	1	-
State diagnosis of for port flap PORT_MEC_DOWN					
LF_STATE_DGO_PORT_MEC_DOWN_OVER [NC_PORT_NR]	O/V	0... FFFFH	0... 65535	1	-
State diagnosis of for port flap PORT_MEC_DOWN_OVER					
LF_STATE_DGO_PORT_MEC_UP [NC_PORT_NR]	O/V	0... FFFFH	0... 65535	1	-
State diagnosis of for port flap PORT_MEC_UP					
LF_STATE_DGO_PORT_MEC_UP_OVER [NC_PORT_NR]	O/V	0... FFFFH	0... 65535	1	-
State diagnosis of for port flap PORT_MEC_UP_OVER					
LV_V_PORT_MEM [NC_PORT_NR]	O/V	0... 1H	0 ...1	1	-
Memory value status flag for overtravel port-flap diagnosis					
T_PORT_DIAG_MEC_DOWN [NC_PORT_NR]	O/V	0... FFFFH	0... 2621.4	0.04	s
Timer for port-flap has not reached its lower stop					
T_PORT_DIAG_MEC_DOWN_OVER [NC_PORT_NR]	O/V	0... FFFFH	0... 2621.4	0.04	s
Timer for port-flap has reached its stop for port-flap overtravel down diagnosis					
T_PORT_DIAG_MEC_UP [NC_PORT_NR]	O/V	0... FFFFH	0... 2621.4	0.04	s
Timer for port-flap has not reached its upper stop					
T_PORT_DIAG_MEC_UP_OVER [NC_PORT_NR]	O/V	0... FFFFH	0... 2621.4	0.04	s
Timer for port-flap has reached its stop for port-flap overtravel up diagnosis					
V_PORT_MEM [NC_PORT_NR]	O/V	0... 3FFH	0... 4.9951171875	0.00488281	V
Memory value for port-flap overtravel diagnosis					

▶ Input Data

C_V_PORT_AD_CLOSE_HYS {p. 1088}	C_V_PORT_AD_OPEN_HYS {p. 1088}	LC_PORT_AD_DIAG_ENA	LV_IGK {p. 24082}
LV_IS {p. 7530}	LV_PL {p. 7530}	LV_PORT_AD_ACT {p. 1087}	LV_PORT_AD_VLD [NC_PORT_NR] {p. 1087}
LV_PORT_DEAC {p. 1073}	LV_ST {p. 7530}	LV_ST_END {p. 7530}	NC_FID_ERR_PORT_FB_EL_H [NC_PORT_NR]
NC_FID_ERR_PORT_FB_EL_L [NC_PORT_NR]	NC_FID_ERR_PORT_MEC_DOWN [NC_PORT_NR]	NC_FID_ERR_PORT_MEC_DOWN_OVER [NC_PORT_NR]	NC_FID_ERR_PORT_MEC_UP [NC_PORT_NR]
NC_FID_ERR_PORT_MEC_UP_OVER [NC_PORT_NR]	NC_PORT_NR {p. 1065}	STATE_PORT_AD {p. 1087}	T_AST {p. 8436}
TCO {p. 8846}	TIA_IM {p. 1143}	V_PORT_1 {p. 1061}	V_PORT_1_RAW {p. 1061}
V_PORT_2 {p. 1061}	V_PORT_2_RAW {p. 1061}	V_PORT_AD_CLOSE [NC_PORT_NR] {p. 1087}	V_PORT_AD_OPEN [NC_PORT_NR] {p. 1087}

Calibration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
C_T_AST_MIN_PORT_DIAG	V	0... FFFFH	0... 6553.5	0.1	s
minimum time after start to activate port-flap mechanical diagnosis					
C_T_PORT_DIAG_MEC_DOWN	V	0... FFFFH	0... 2621.4	0.04	s
timer for mechanical port-flap diagnosis down					
C_T_PORT_DIAG_MEC_DOWN_OVER	V	0... FFFFH	0... 2621.4	0.04	s
timer for port-flap overtravel down diagnosis					
C_T_PORT_DIAG_MEC_UP	V	0... FFFFH	0... 2621.4	0.04	s
timer for mechanical port-flap diagnosis up					
C_T_PORT_DIAG_MEC_UP_OVER	V	0... FFFFH	0... 2621.4	0.04	s
timer for port-flap overtravel up diagnosis					
C_TCO_MIN_DIAG_PORT_MEC_OVER	V	0... FEH	-48... 142.5	0.75	°C
minimum threshold of intake air temperature for overtravel diagnosis					
C_TIA_MIN_DIAG_PORT_MEC_OVER	V	0... FEH	-48... 142.5	0.75	°C
minimum threshold of coolant temperature for overtravel diagnosis					
C_V_PORT_DIF_UP_DOWN_OVER	V	0... 3FFH	0... 4.9951171875	0.00488281	V
Apllication difference for port-flap overtravel diagnosis					
C_V_PORT_DOWN_OVER	V	0... 3FFH	0... 4.9951171875	0.00488281	V
port-flap poti value to detect a mechanical overtravel symptom					
C_V_PORT_MAX_DIAG	V	0... 3FFH	0... 4.9951171875	0.00488281	V
maximum port-flap poti value for electrical diagnosis					
C_V_PORT_MIN_DIAG	V	0... 3FFH	0... 4.9951171875	0.00488281	V
minimum port-flap poti value for electrical diagnosis					

Configuration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
NC_IDX_ERR_PORT_AD [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_AD					
NC_IDX_ERR_PORT_FB_EL_H [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_FB_EL_H					
NC_IDX_ERR_PORT_FB_EL_L [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_FB_EL_L					
NC_IDX_ERR_PORT_MEC_DOWN [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_MEC_DOWN					
NC_IDX_ERR_PORT_MEC_DOWN_OVER [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_MEC_DOWN_OVER					
NC_IDX_ERR_PORT_MEC_UP [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_MEC_UP					
NC_IDX_ERR_PORT_MEC_UP_OVER [NC_PORT_NR]	V	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_MEC_UP_OVER					

Action Definitions

ACTION_AIRM_ResetDiagPortMecDn(IN <PRM_STATE_INI>, **IN** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	IN	0H 1H	CLR REST	-	-
Type of initialization to manage splitting of diagnostic initialization					
PRM_NR_CONF	IN	0... FFH	0... 255	1	-
Additional Configuration Information for the action					

ACTION_AIRM_ResetDiagPortMecUp(IN <PRM_STATE_INI>, **IN** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	IN	0H 1H	CLR REST	-	-
Type of initialization to manage splitting of diagnostic initialization					
PRM_NR_CONF	IN	0... FFH	0... 255	1	-
Additional Configuration Information for the action					

ACTION_AIRM_ResetDiagPortMeDnO(IN <PRM_STATE_INI>, **IN** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	IN	0H 1H	CLR REST	-	-
Type of initialization to manage splitting of diagnostic initialization					
PRM_NR_CONF	IN	0... FFH	0... 255	1	-
Additional Configuration Information for the action					

ACTION_AIRM_ResetDiagPortMeUpO(IN <PRM_STATE_INI>, **IN** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	IN	0H 1H	CLR REST	-	-
Type of initialization to manage splitting of diagnostic initialization					
PRM_NR_CONF	IN	0... FFH	0... 255	1	-
Additional Configuration Information for the action					

Import actions:

ACTION_ERRM_ResultDiag(**IN** <PRM_IDX_ERR>, **IN** <PRM_STATE_DGO>, **OUT** <PRM_STATE_FIL>)

ACTION_FARM_GetPermission(**IN** <PRM_FID>, **OUT** <PRM_LV_PRMS>)

General Information

Error treatment

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
Diagnostic description				
PORT_MEC_DOWN_OVER_i	ACTION_AIRM_ResetDiagPortMeDnO	1...NC_ PORT_NR	CC	
Port flap overtravel diagnosis				
Definition of the behavior of the initialization				

ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**
		YES	YES	NO
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**
	ABC	NO	NO	NO

Description of the implementation				
	prestore FRF	**RBM**		
	NO	NO		

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
Diagnostic description				
PORT_MEC_UP_OVER_i	ACTION_AIRM_ResetDiagPortMeUpO	1...NC_ PORT_NR	CC	
Port flap overtravel diagnosis				
Definition of the behavior of the initialization				

ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**
		YES	YES	NO
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**
	ABC	NO	NO	NO

Description of the implementation				
	prestore FRF	**RBM**		
	NO	NO		

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
PORT_FB_EL_H_i	UNUSED	UNUSED	CC	
Definition of the behavior of the initialization				

ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**
		YES	YES	NO
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**
	NO-FIL	NO	NO	NO

Description of the implementation				
	prestore FRF	**RBM**		
	NO	NO		

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
PORT_FB_EL_L_i	UNUSED	UNUSED	CC	
Definition of the behavior of the initialization				

ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**
		YES	YES	NO
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**
	NO-FIL	NO	NO	NO

Continued on next page

Description of the implementation					
	prestore FRF	**RBM**			
	NO	NO			
Diagnostic Identifier	**Diagnostic initialization function**			**NR_CONF**	**CARB class**	**OBD DTC**
PORT_AD_i	UNUSED			UNUSED	CC	
Definition of the behavior of the initialization					
ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**	
		YES	YES	NO	
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**	
	NO-FIL	NO	NO	NO	
Description of the implementation					
	prestore FRF	**RBM**			
	NO	NO			
Diagnostic Identifier	**Diagnostic initialization function**			**NR_CONF**	**CARB class**	**OBD DTC**
PORT_MEC_DOWN_i	ACTION_AIRM_ResetDiagPortMecDn			1...NC_ PORT_NR	CC	
Definition of the behavior of the initialization					
ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**	
		YES	YES	NO	
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**	
	ABC	NO	NO	NO	
Description of the implementation					
	prestore FRF	**RBM**			
	NO	NO			
Diagnostic Identifier	**Diagnostic initialization function**			**NR_CONF**	**CARB class**	**OBD DTC**
PORT_MEC_UP_i	ACTION_AIRM_ResetDiagPortMecUp			1...NC_ PORT_NR	CC	
Definition of the behavior of the initialization					
ERR-Flag		**Reset at ECU Reset**	**reset at Key ON**	**Latch error on fail**	
		YES	YES	NO	
ABC	**ABC-class**	**MAX-INC after Failure**	**No Reset at NEWDC**	**Init on Condition Loss**	
	ABC	NO	NO	NO	
Description of the implementation					
	prestore FRF	**RBM**			
	NO	NO			

General information

This functionality serves several diagnosis for an on/off Port-flap with a feed-back potentiometer and adaptation.

For diagnosis the adaptation, the switching time and the electrical value of the feed back potentiometer can be used.

For Systems with two Port flaps (NC_PORT_NR = 2) "[i]" stands for Port flap No. 1 or 2, whereas "[i]" is always "_1" for NC_PORT_NR = 1.

Application Conditions

Initialisation: `RST, IGKON`

Activation: `always`

Deactivation: `never`

Recurrence: `40MS`

Function Description

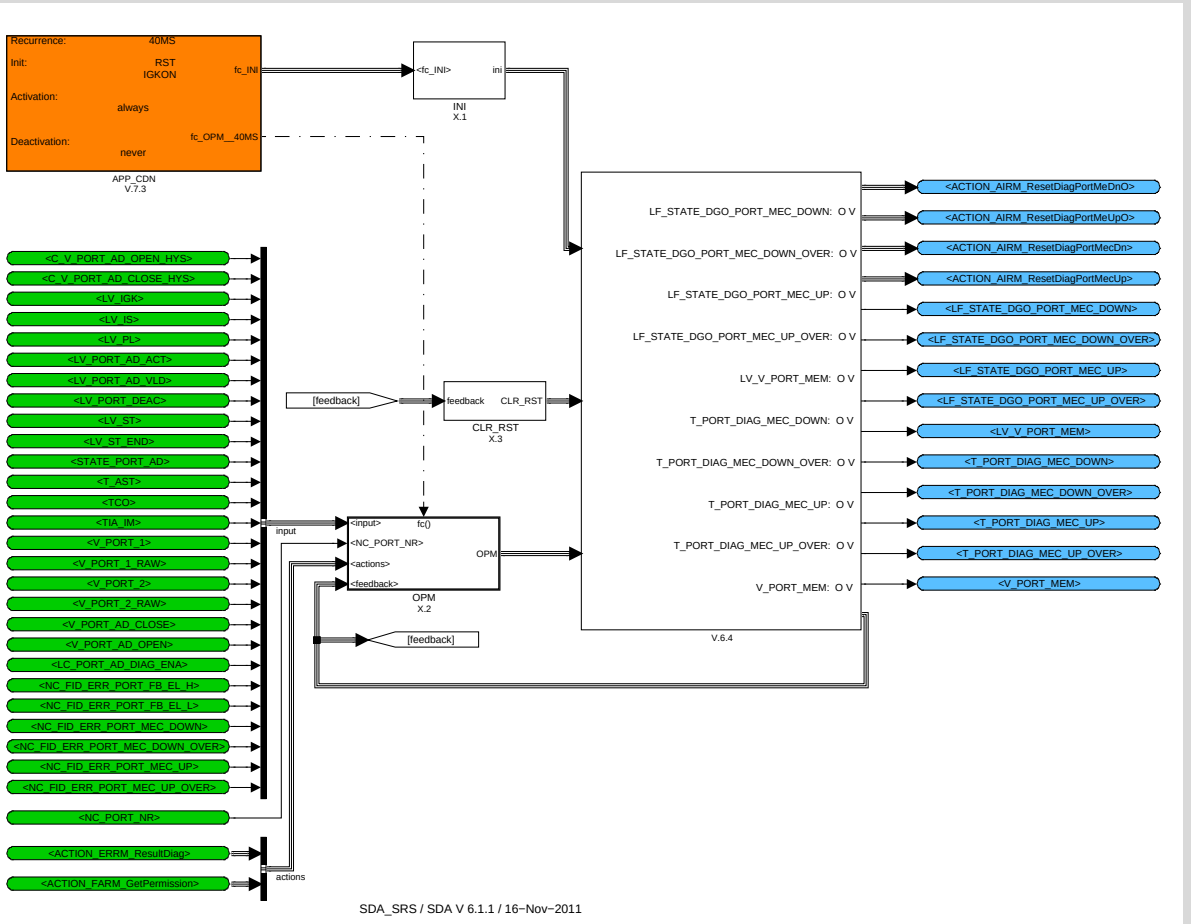

Figure 2.5.1:

2.5.1 Initialization

2.5.1.1 Initialization at RST

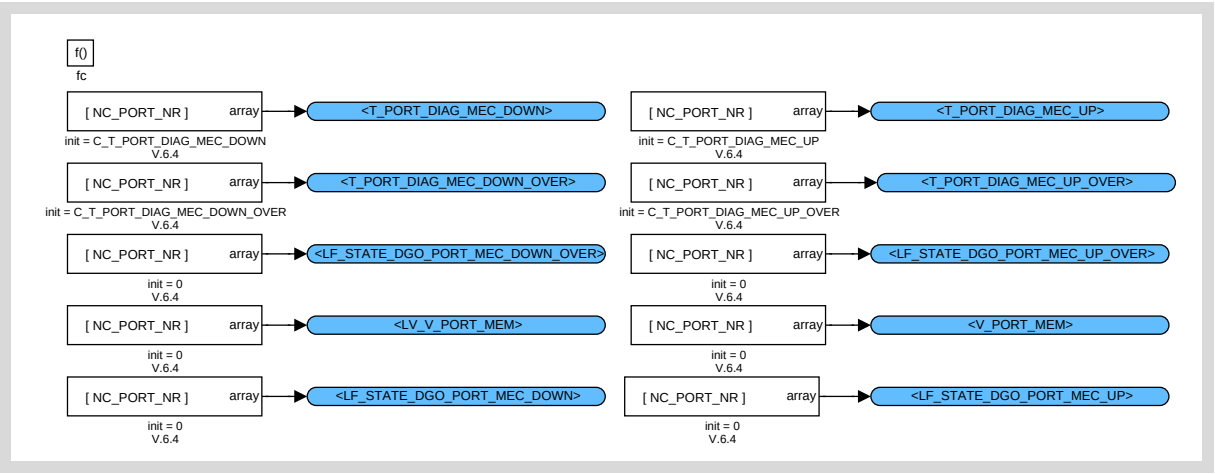

Figure 2.5.2:

2.5.1.2 Initialization at IGKON

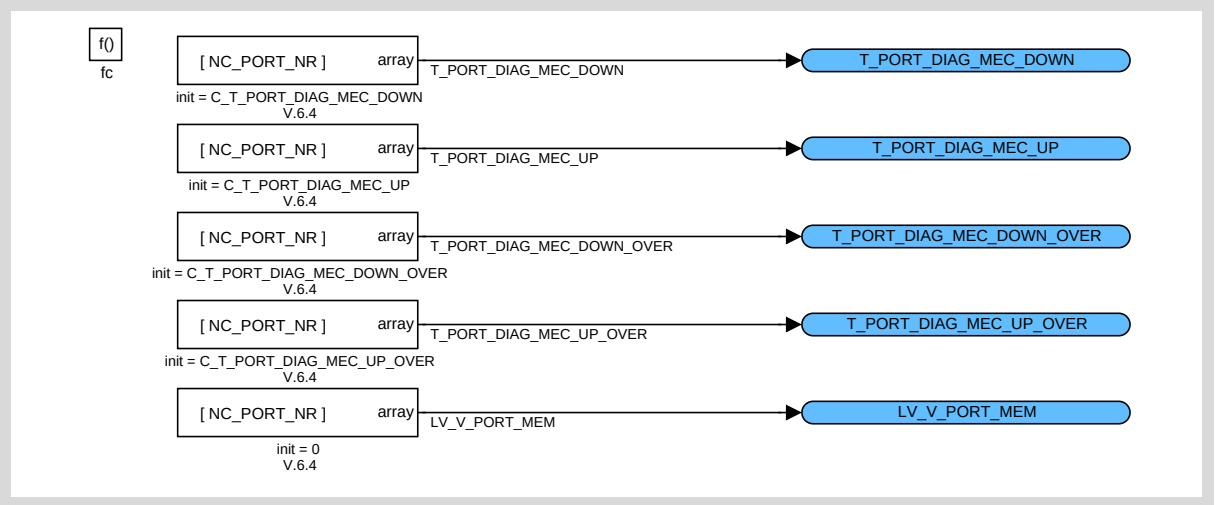

Figure 2.5.3:

2.5.2 Operation mode (OPM)

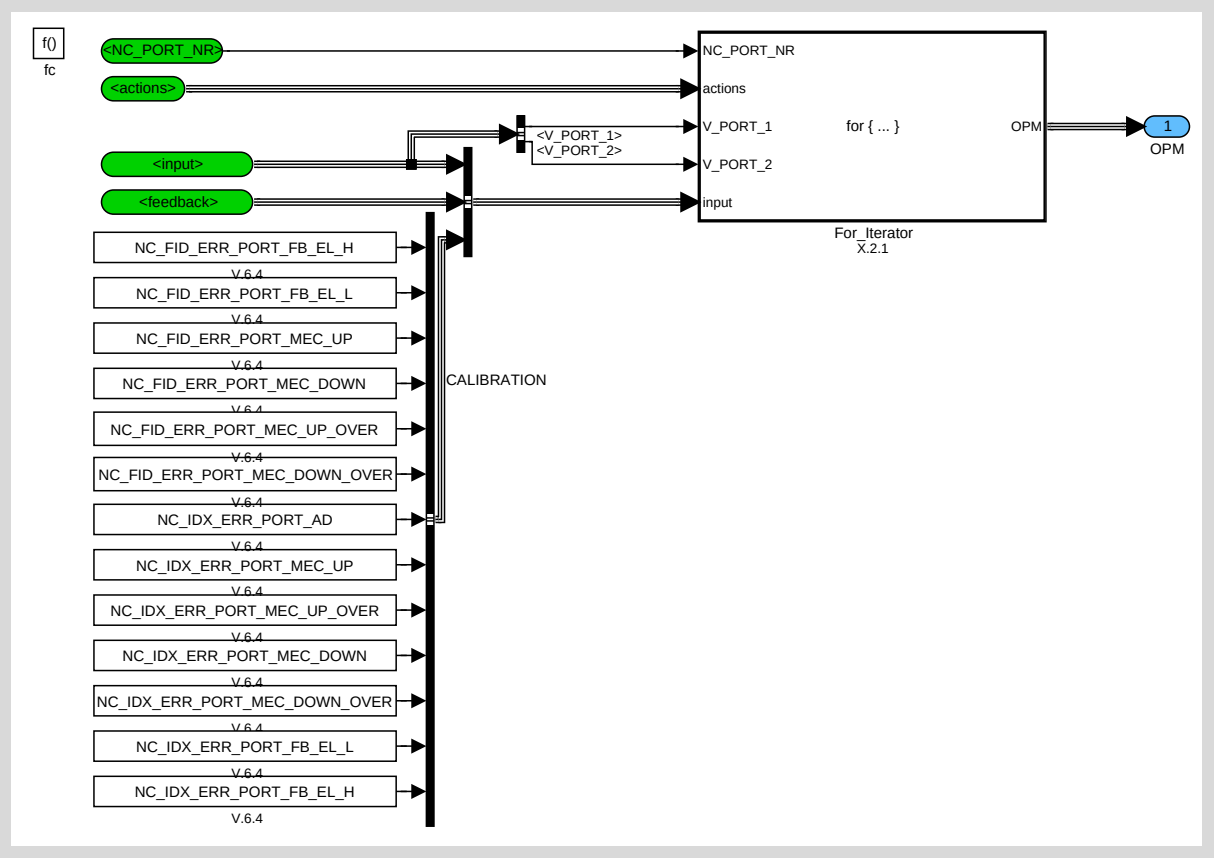

Figure 2.5.4:

2.5.2.1 For iterator subsystem

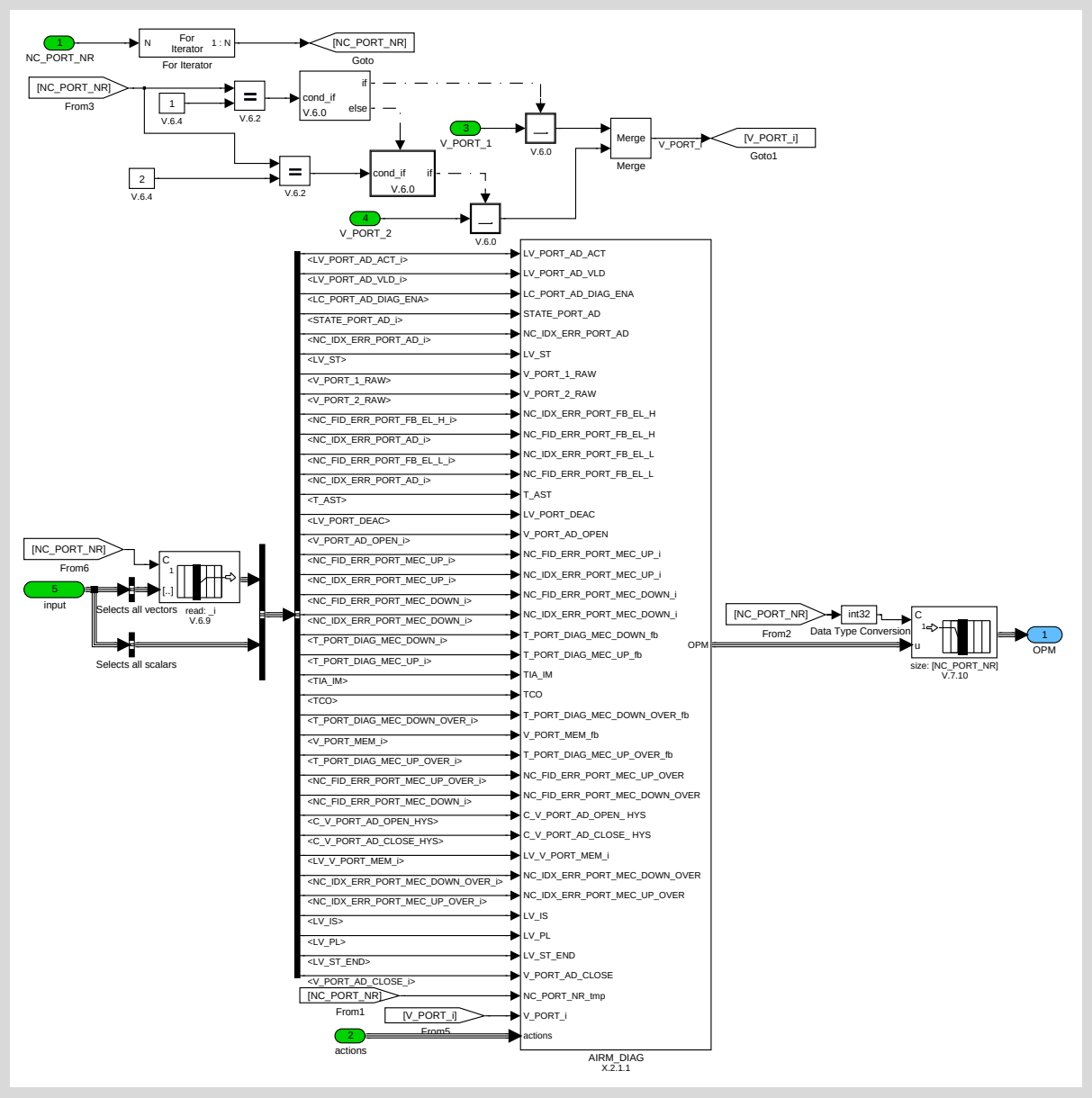

Figure 2.5.5:

2.5.2.1.1 AIRM diagnosis

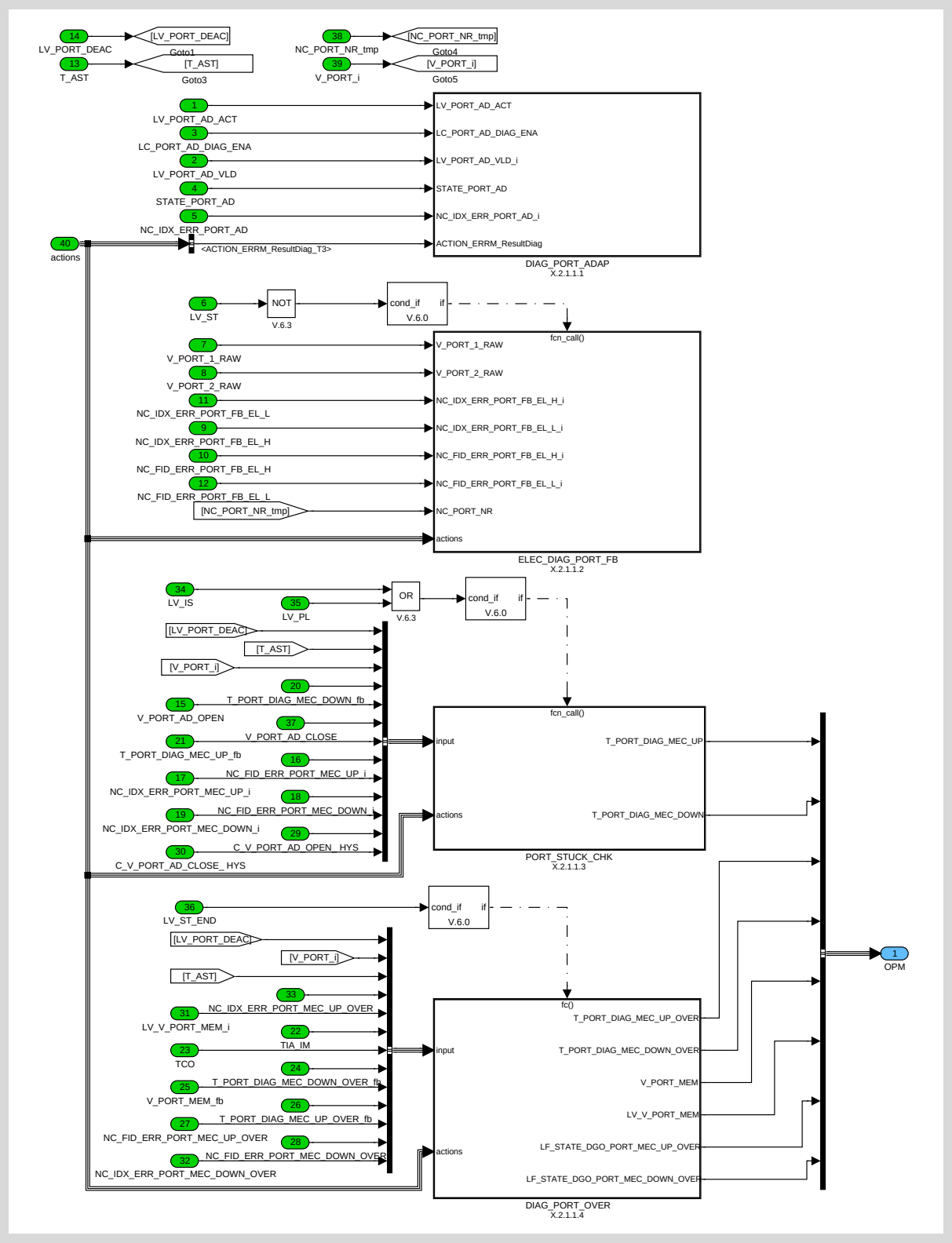

Figure 2.5.6:

2.5.2.1.1.1 Diagnosis of port-flap adaptation

The diagnosis of adaptation (see chapter “adaptation of an port flap with closed default position”).

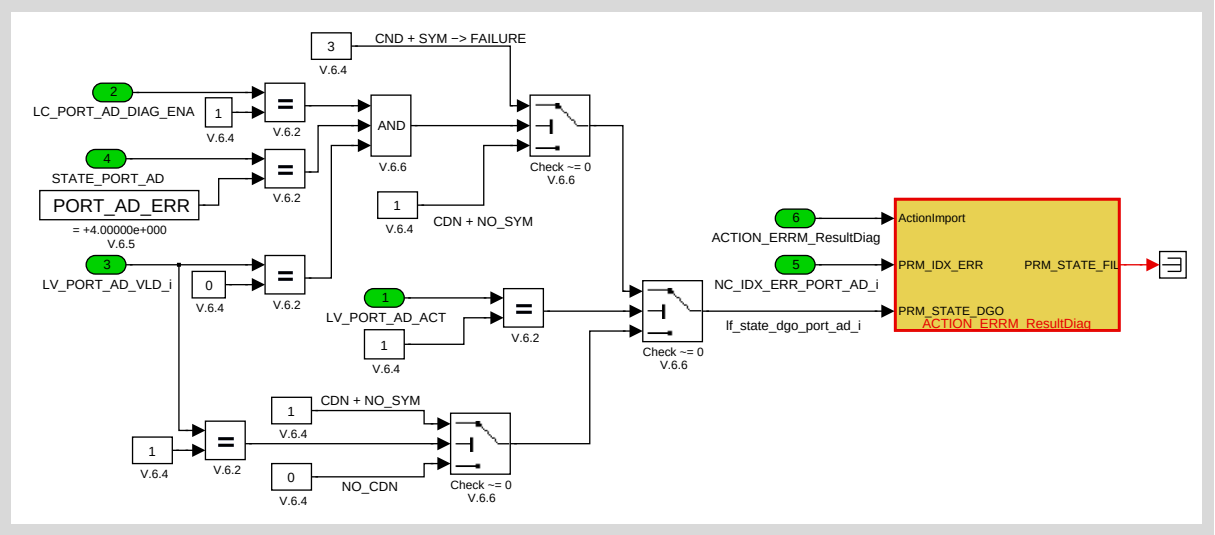

Figure 2.5.7:

2.5.2.1.1.2 Electrical diagnosis of port-flap feed-back

The feed-back value of the potentiometer can be observed if it is within sense full electrical range.

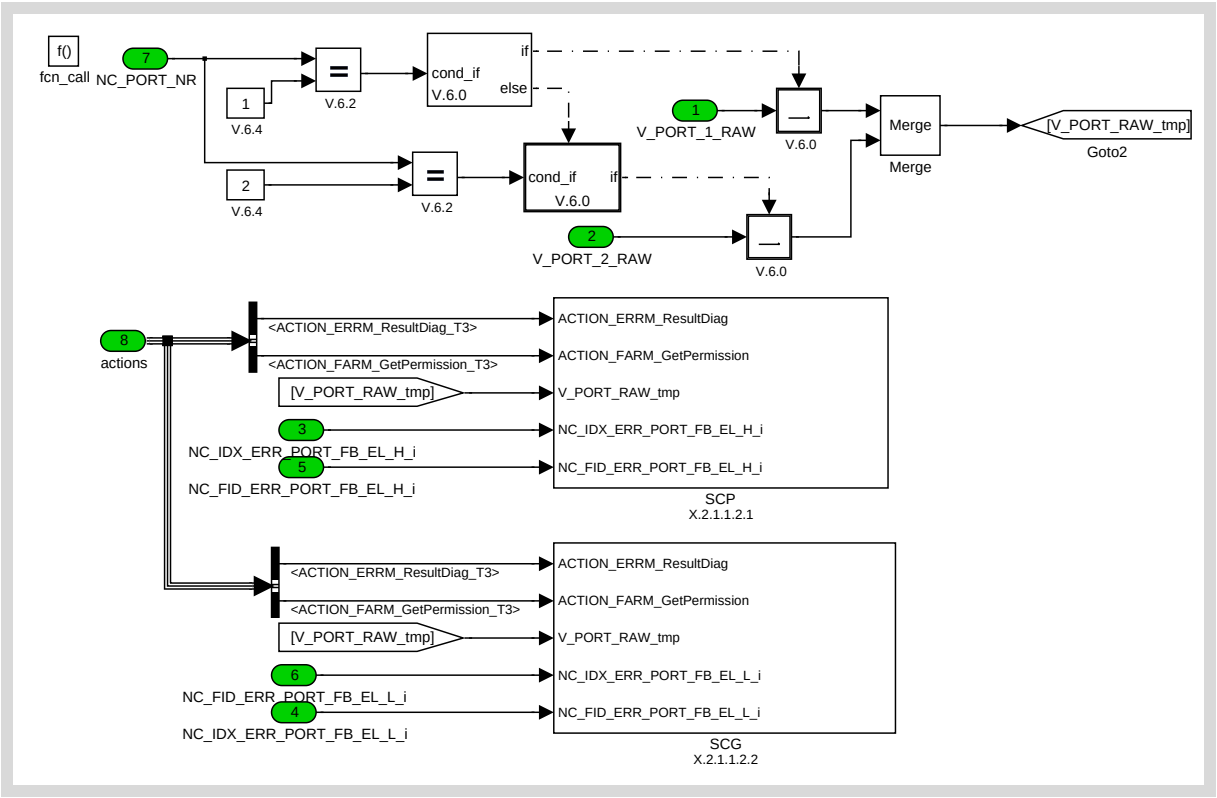

Figure 2.5.8:

2.5.2.1.1.2.1 Short cut to battery

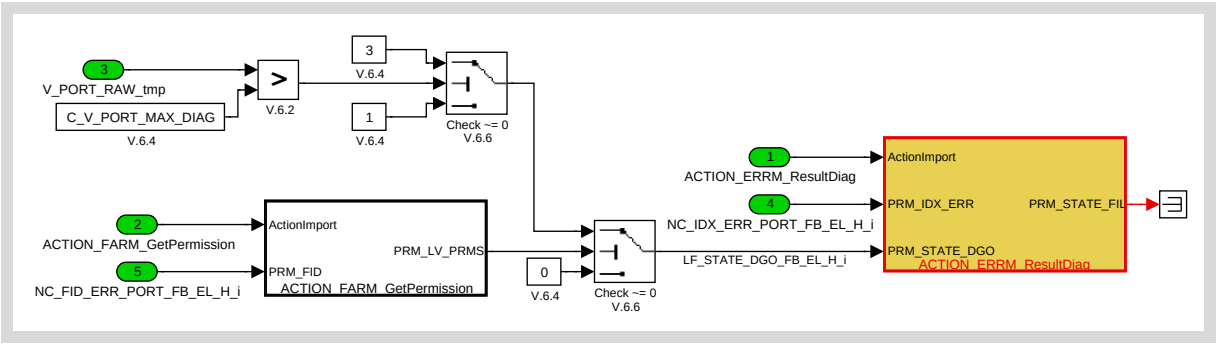

Figure 2.5.9:

2.5.2.1.1.2.2 Short cut to ground or open loop

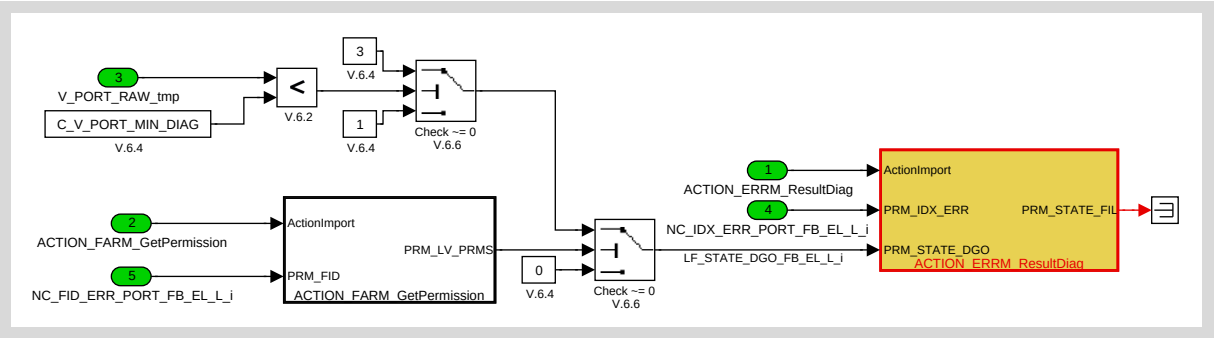

Figure 2.5.10:

2.5.2.1.1.3 Port flap stuck check

Usually the port flap switches from open to closed and reverse in a very short time. If the pneumatic system is not o.k. or the port-flap has too much friction or even stuck, the switching time becomes too long or the port does not switch at all. This leads to a failure entry with symptom “mechanical failure”, “upper stop not reached” or “lower stop not reached”.

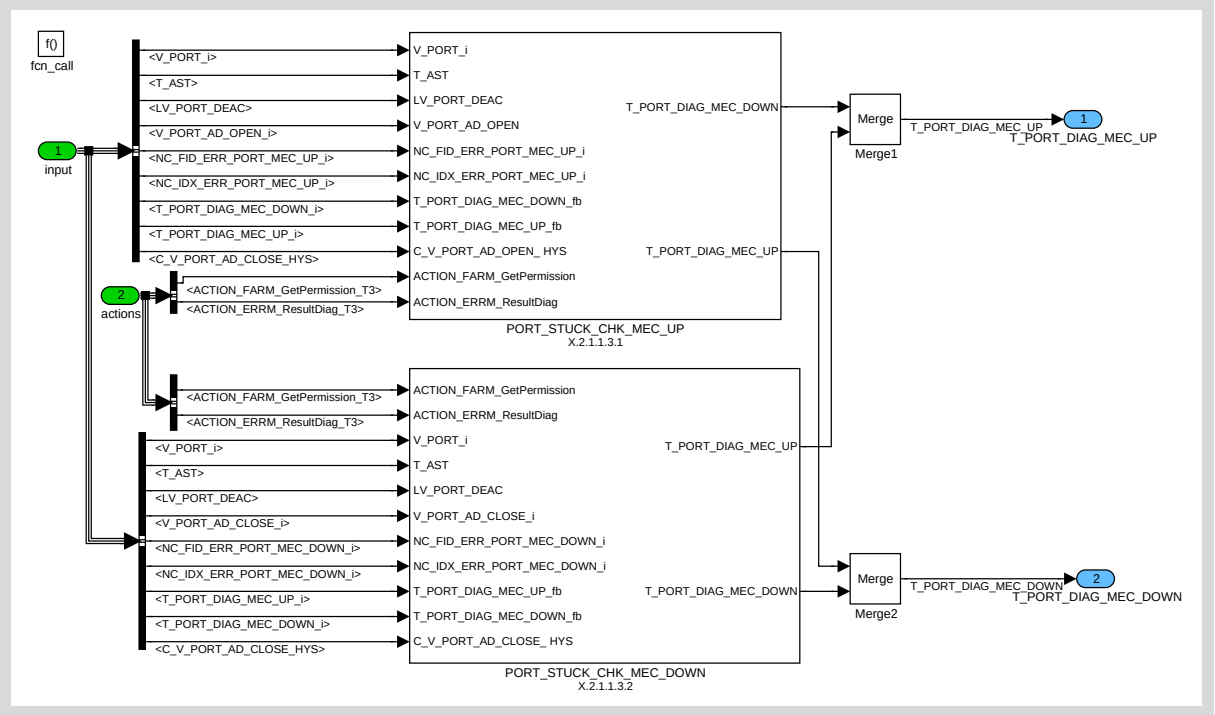

Figure 2.5.11:

2.5.2.1.1.3.1 Mechanical failure - Upper stop not reached

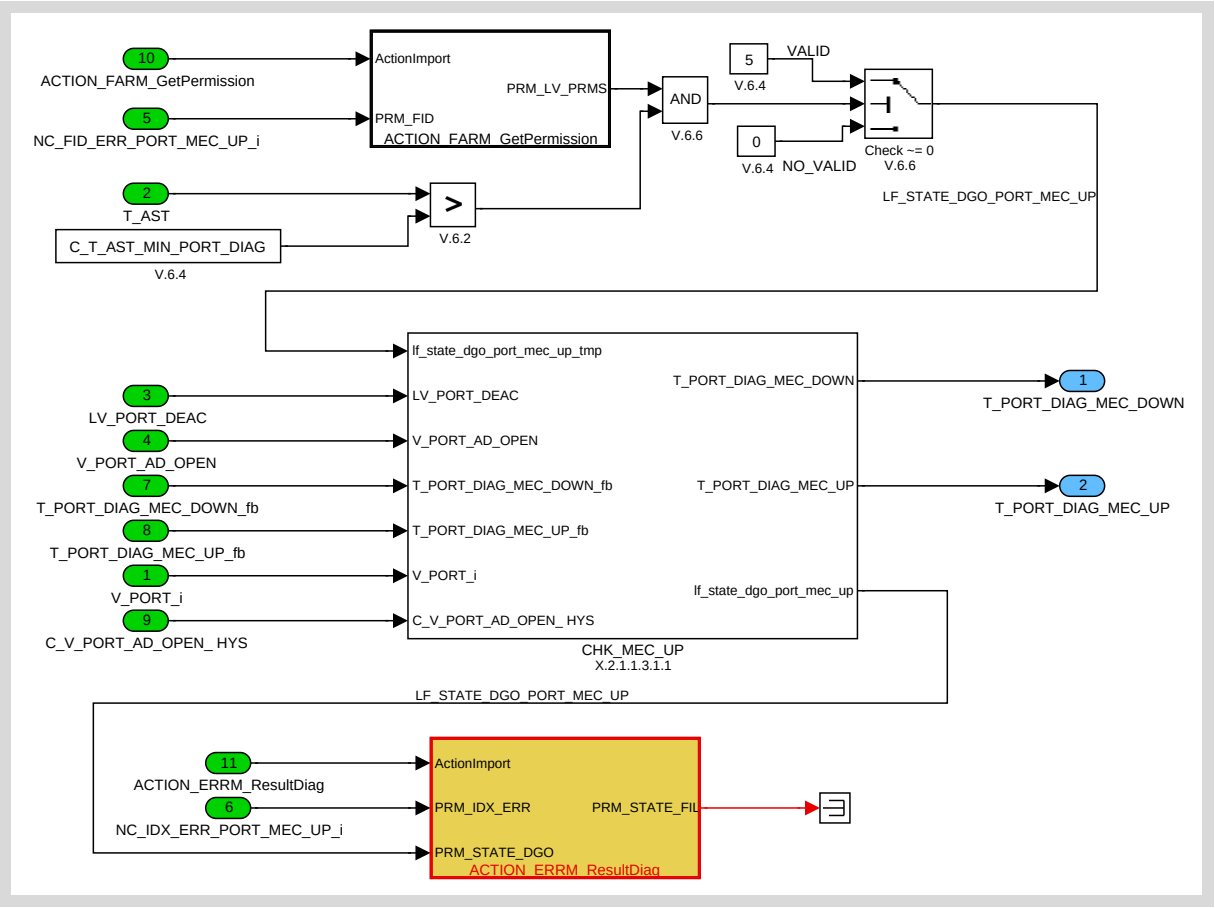

Figure 2.5.12:

2.5.2.1.1.3.1.1 CHK_MEC_UP

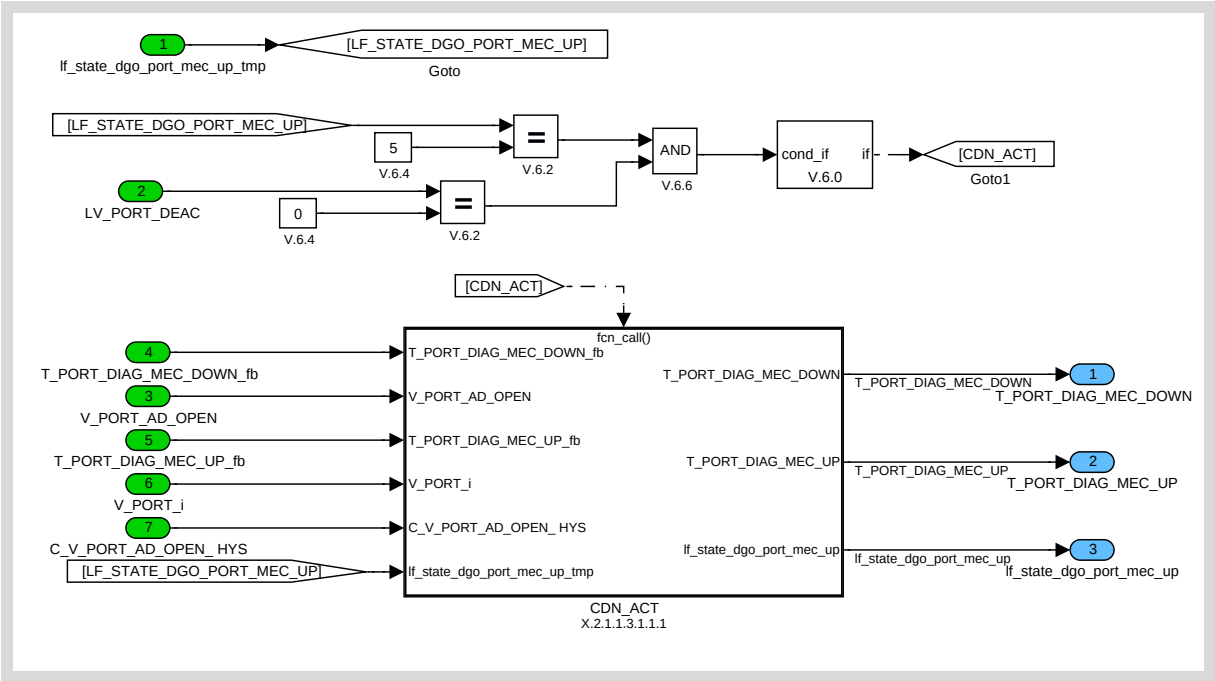

Figure 2.5.13:

2.5.2.1.1.3.1.1.1 Condition active and not yet de-bounced

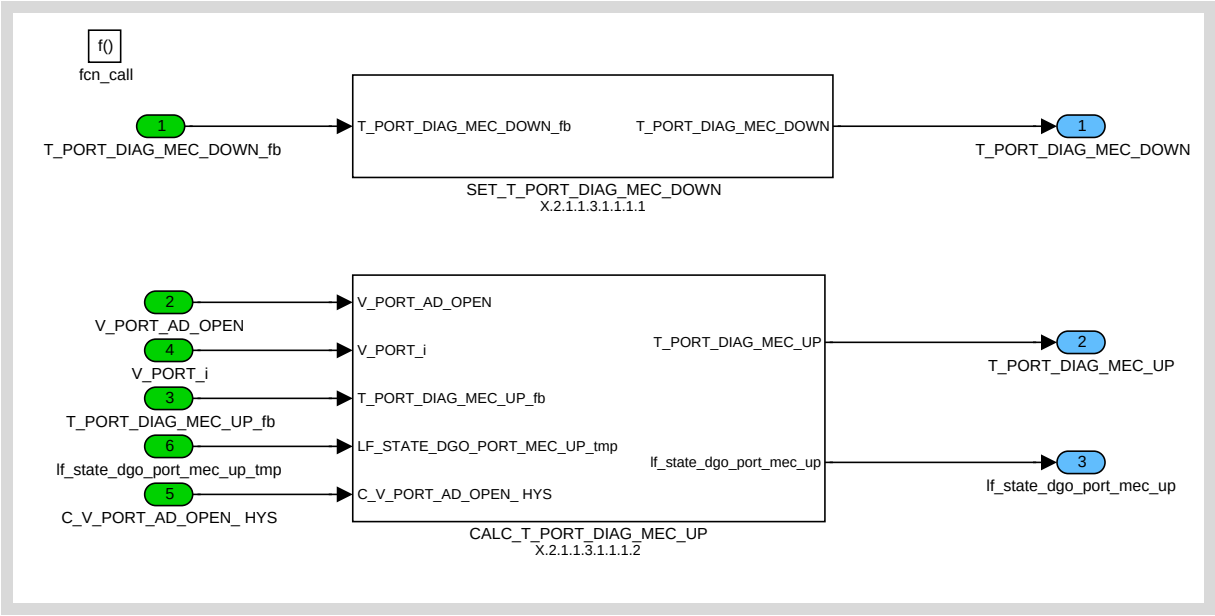

Figure 2.5.14:

2.5.2.1.1.3.1.1.1.1 SET T_PORT_DIAG_MEC_DOWN

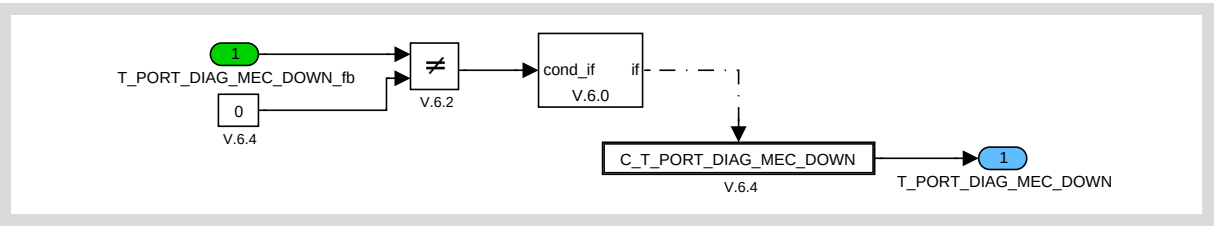

Figure 2.5.15:

2.5.2.1.1.3.1.1.1.2 Calculate T_PORT_DIAG_MEC_UP

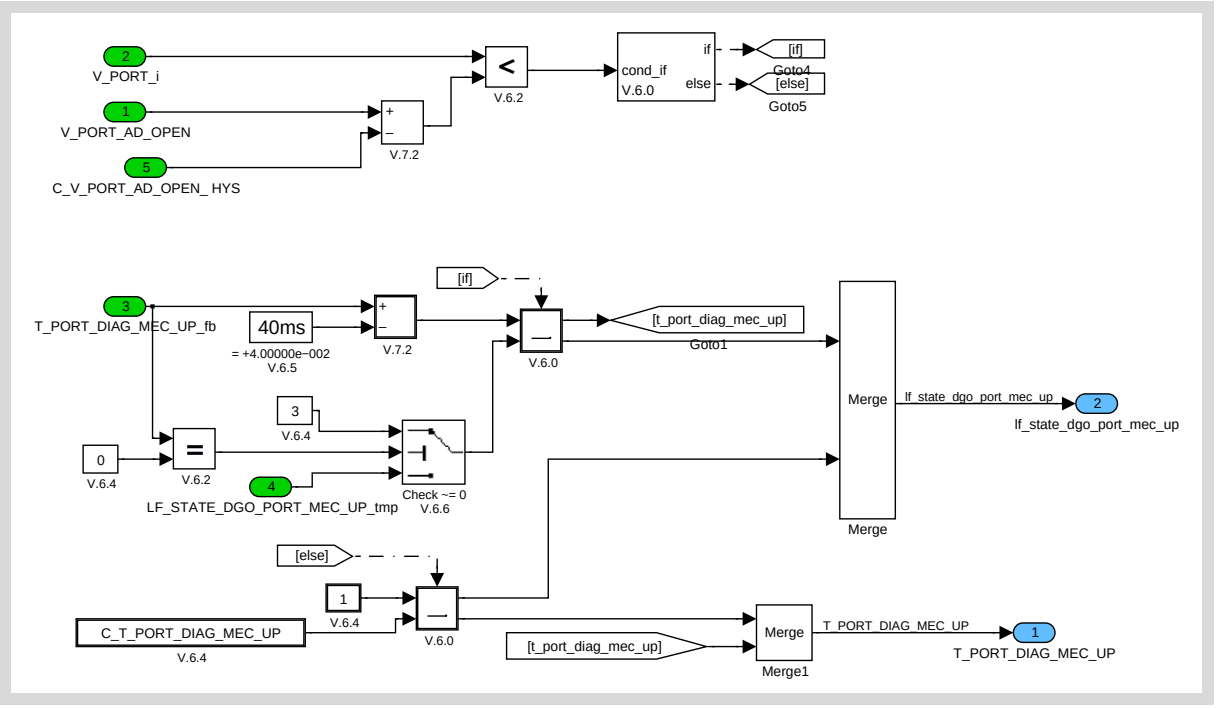

Figure 2.5.16:

2.5.2.1.1.3.2 Mechanical failure - Lower stop not reached

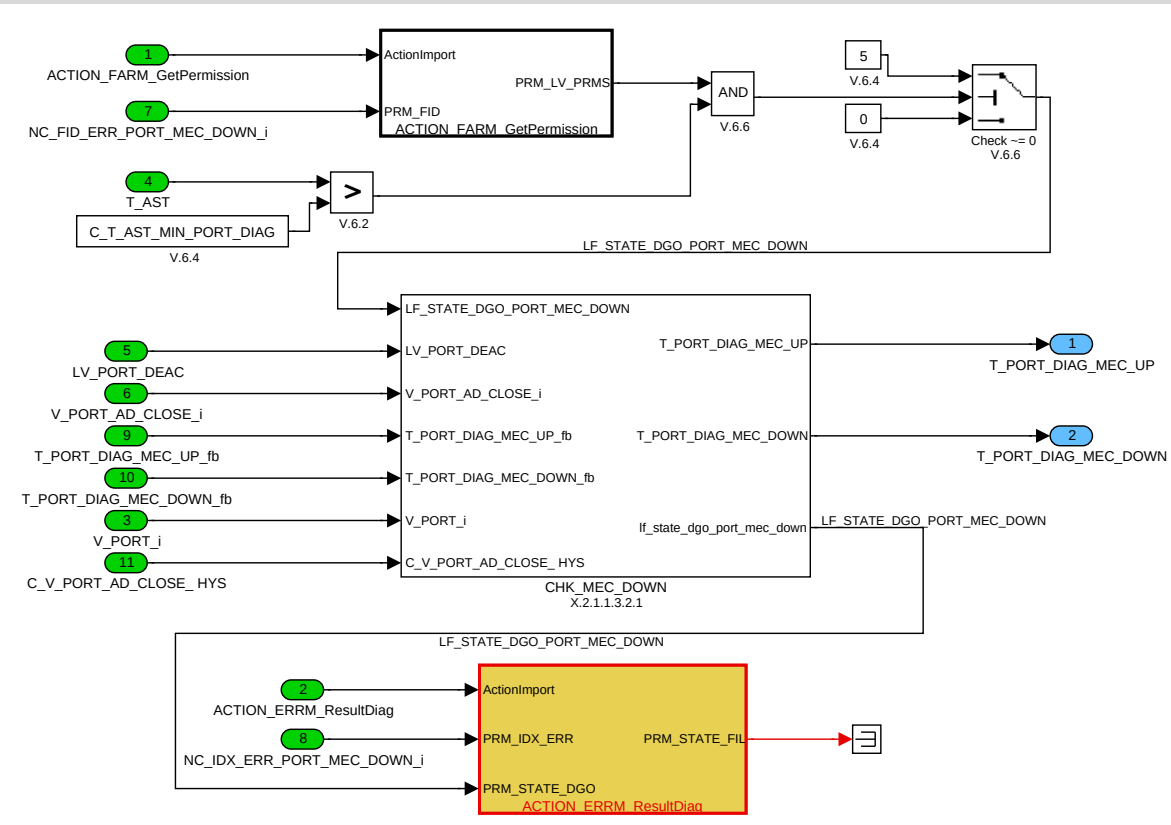

Figure 2.5.17:

2.5.2.1.1.3.2.1 CHK_MEC_DOWN

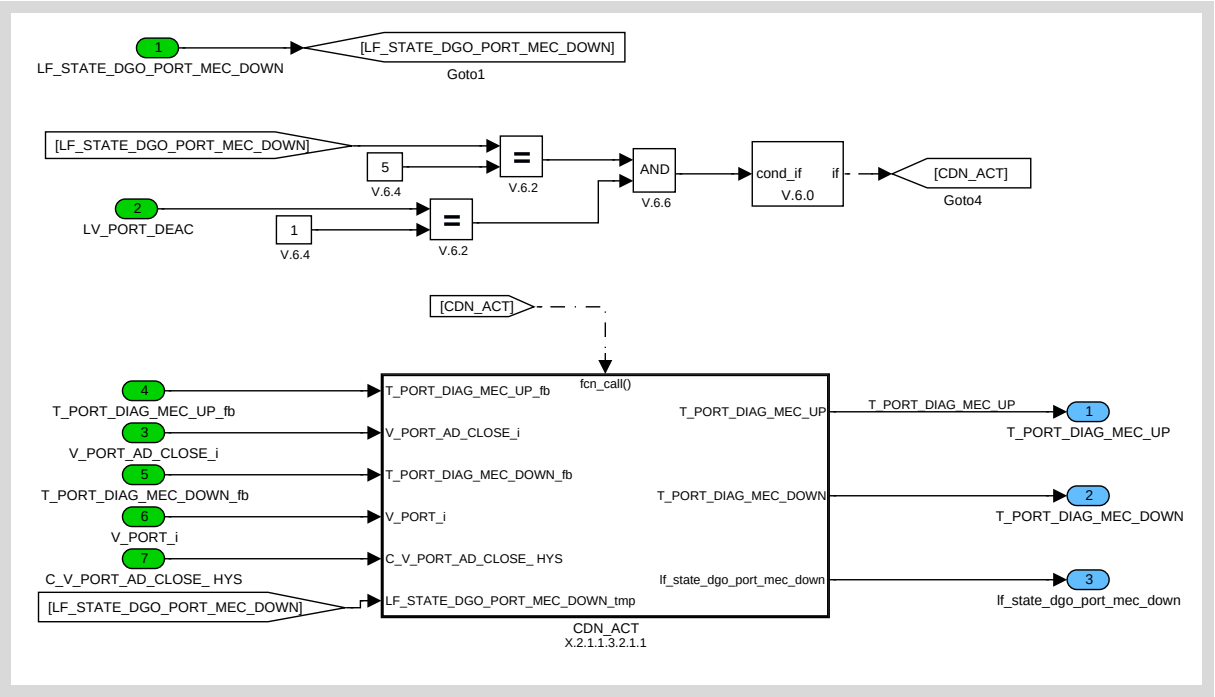

Figure 2.5.18:

2.5.2.1.1.3.2.1.1 Condition active and not yet de-bounced

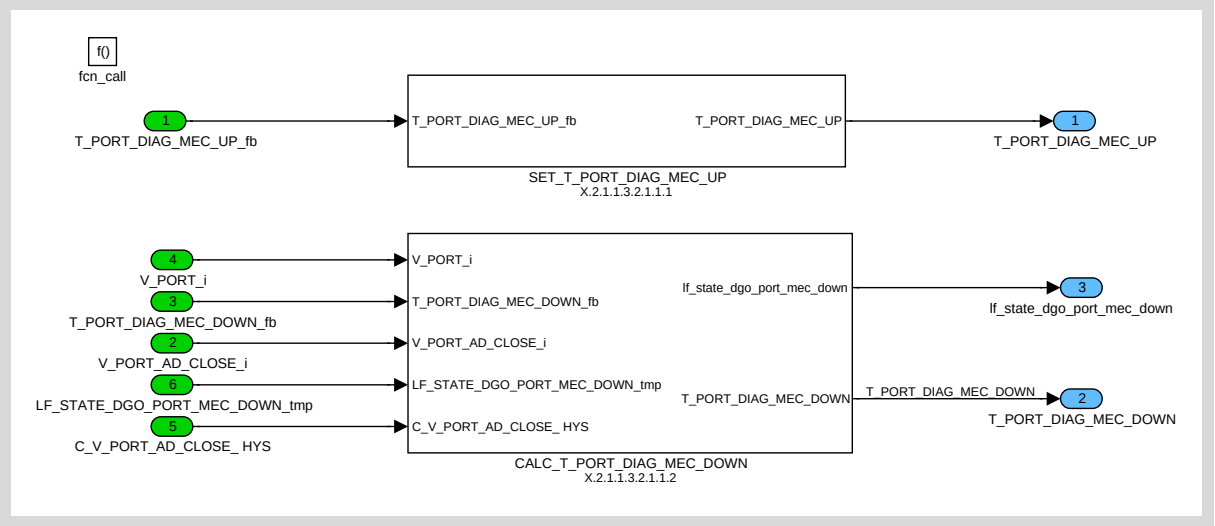

Figure 2.5.19:

2.5.2.1.1.3.2.1.1.1 Set T_PORT_DIAG_MEC_UP

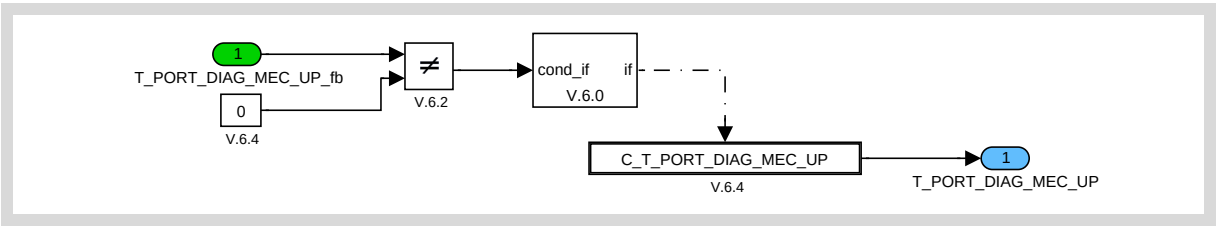

Figure 2.5.20:

2.5.2.1.1.3.2.1.1.2 Calculate T_PORT_DIAG_MEC_DOWN

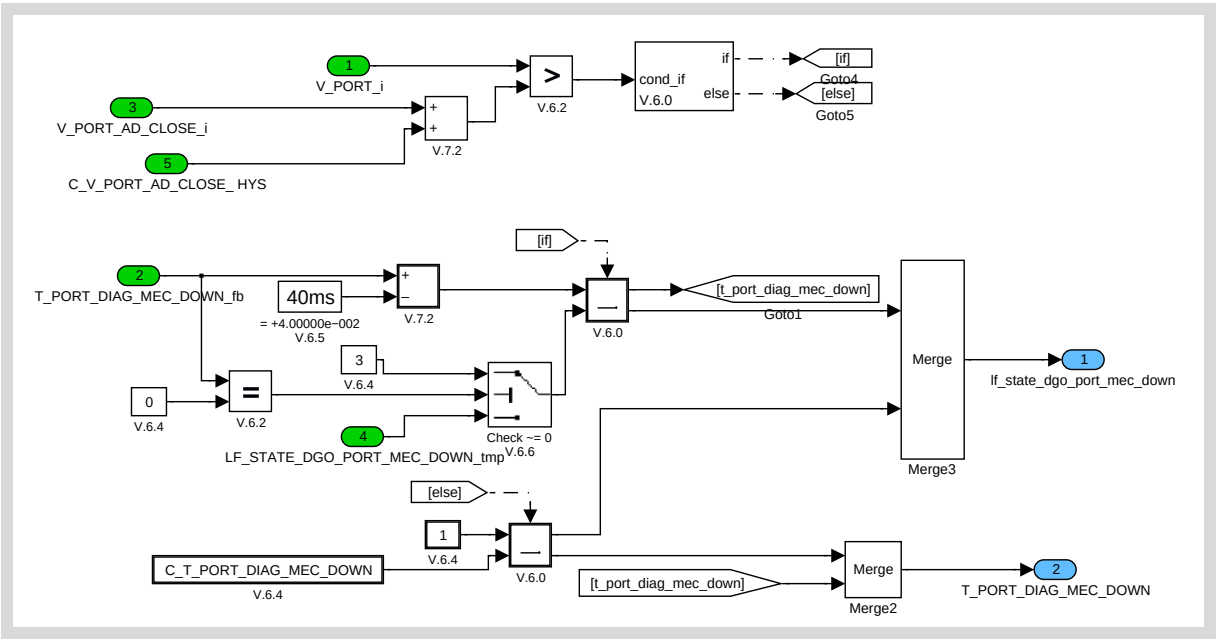

Figure 2.5.21:

2.5.2.1.1.4 Port flap over-travel diagnosis

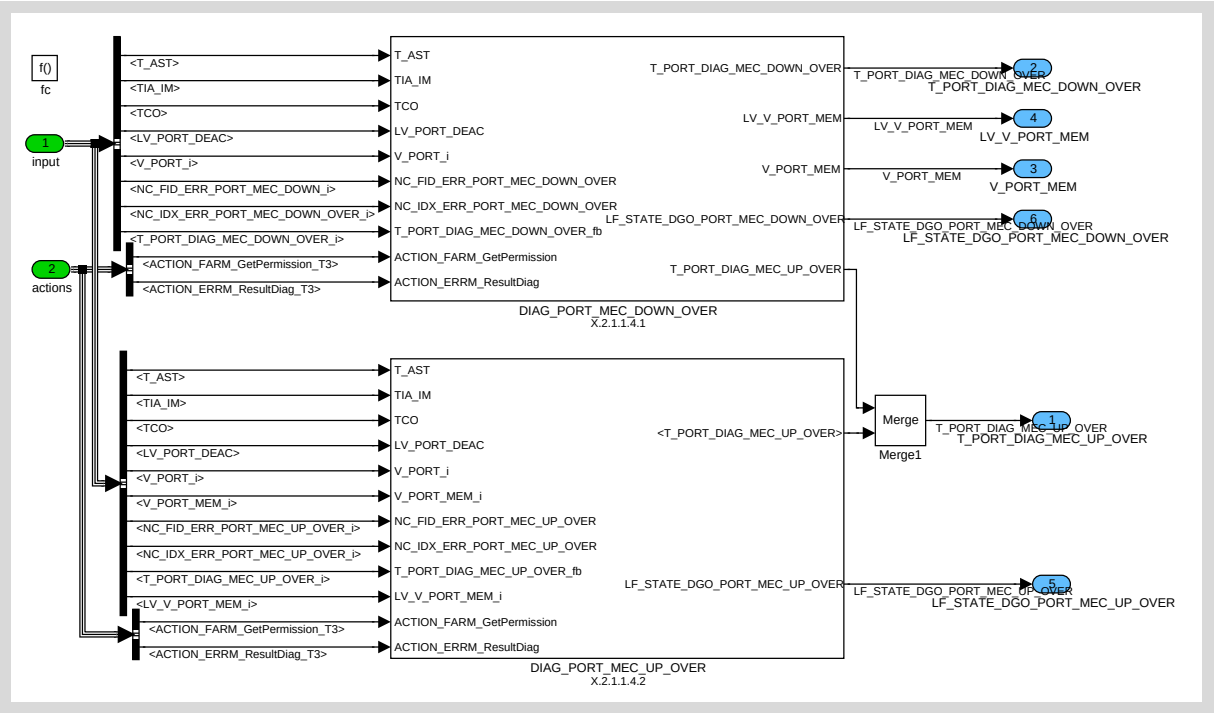

Figure 2.5.22:

2.5.2.1.1.4.1 Over-travel check lower stop

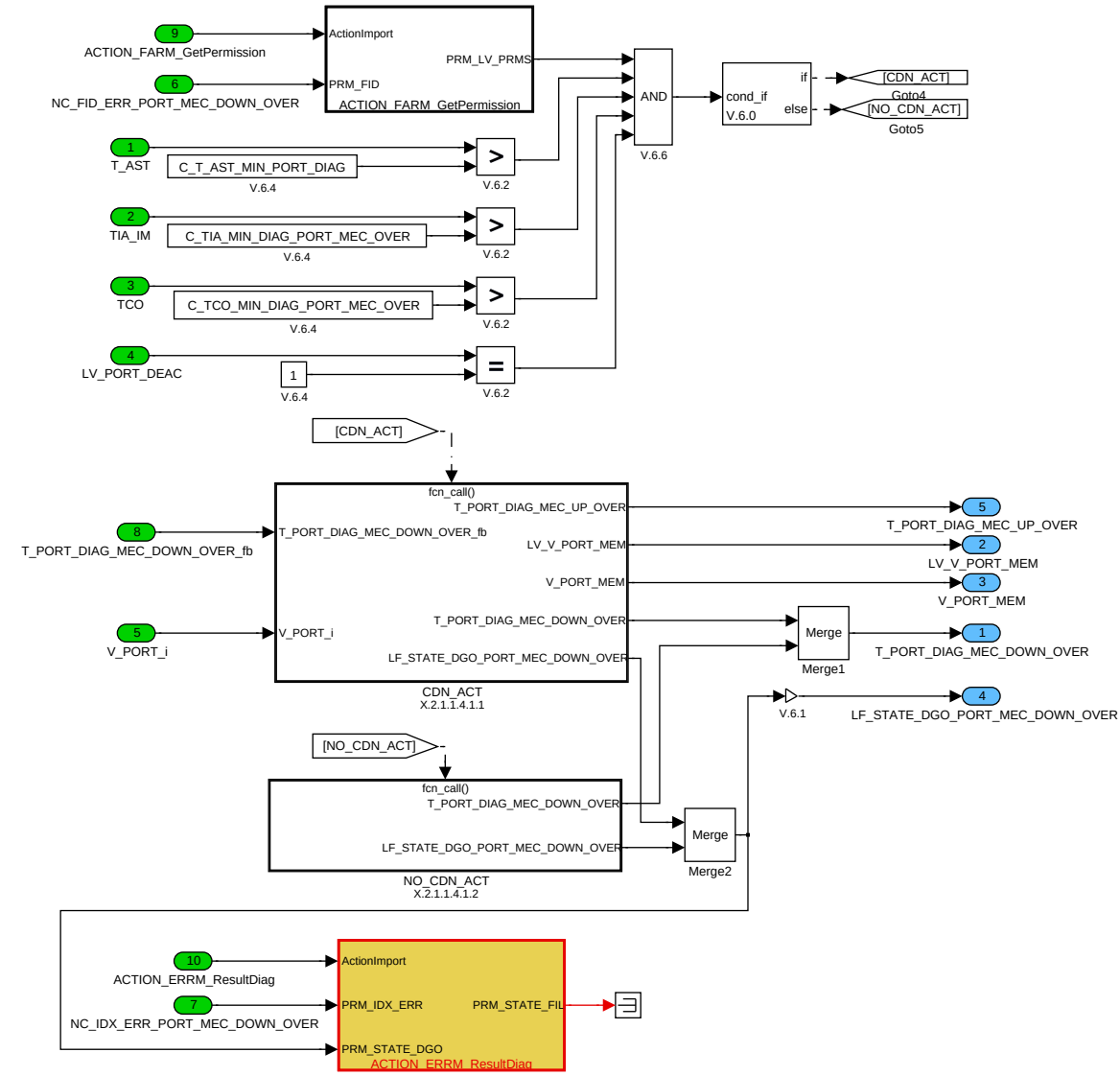

Figure 2.5.23:

2.5.2.1.1.4.1.1 Condition active and not yet de-bounced

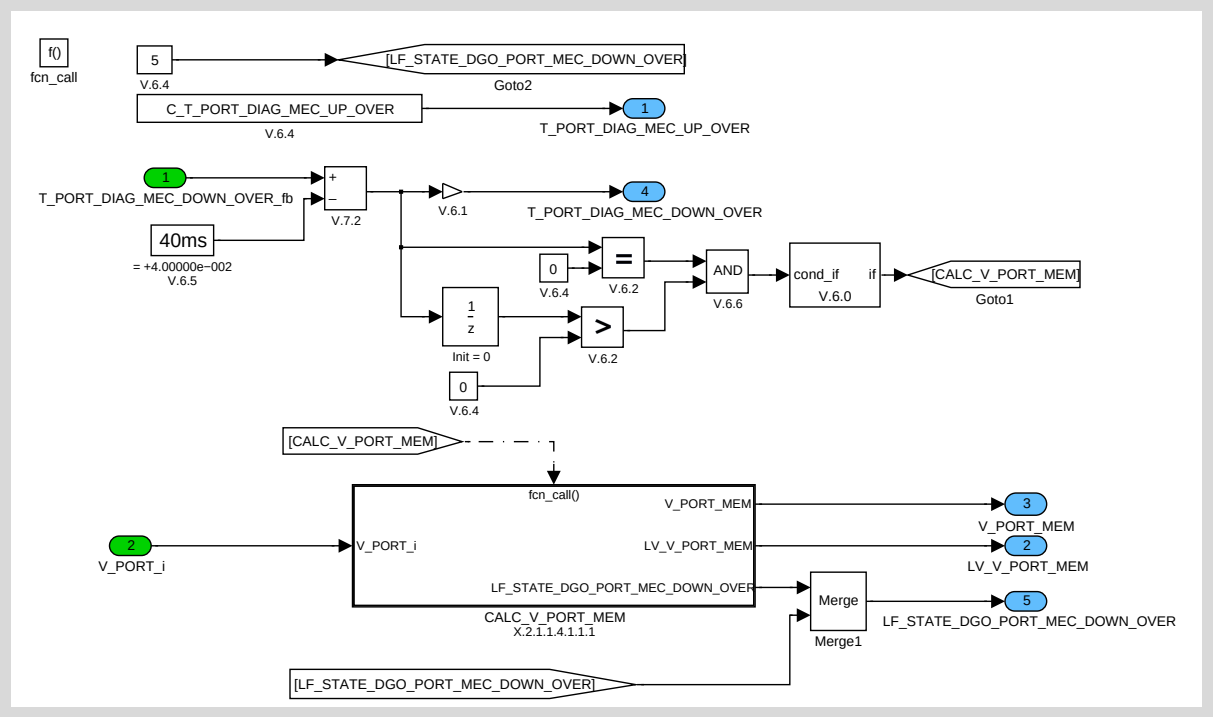

Figure 2.5.24:

2.5.2.1.1.4.1.1.1 Diagnostic status: condition valid with or without symptom

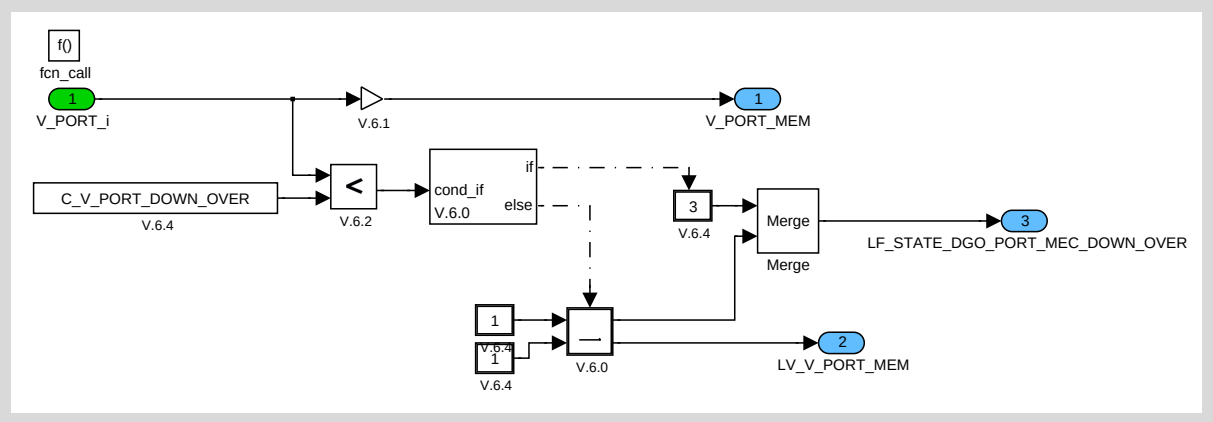

Figure 2.5.25:

2.5.2.1.1.4.1.2 Invalid condition

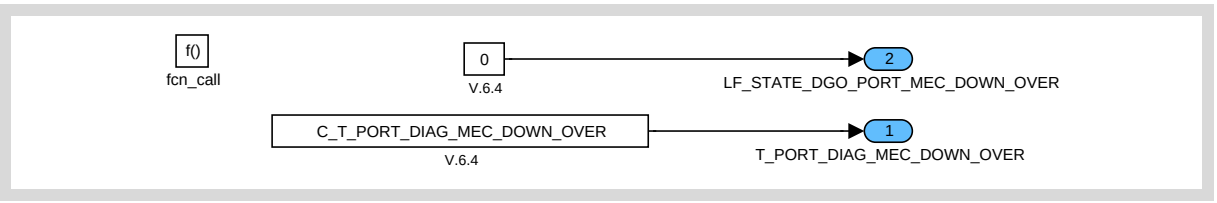

Figure 2.5.26:

2.5.2.1.1.4.2 Over-travel check upper stop

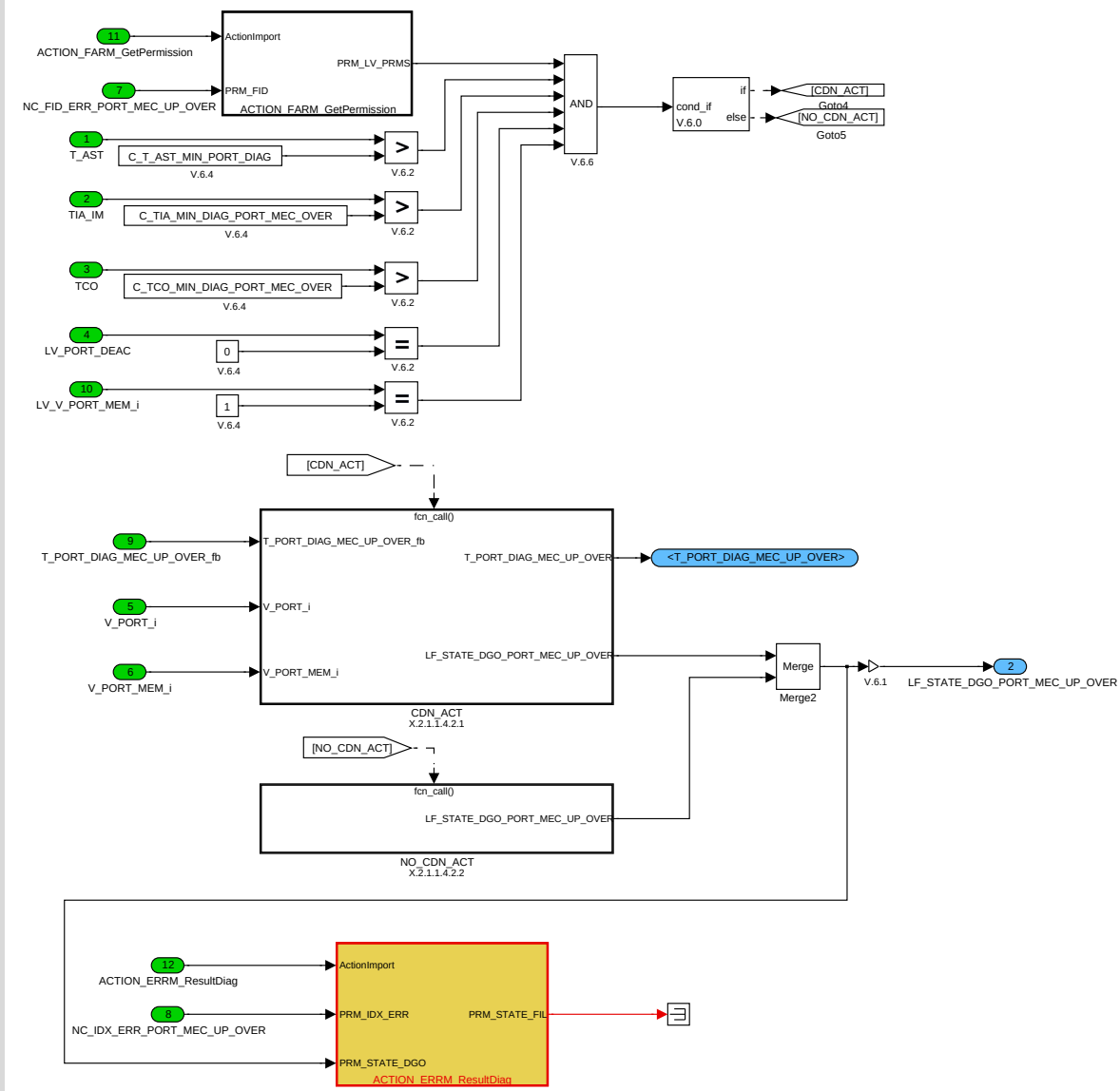

Figure 2.5.27:

2.5.2.1.1.4.2.1 Valid condition

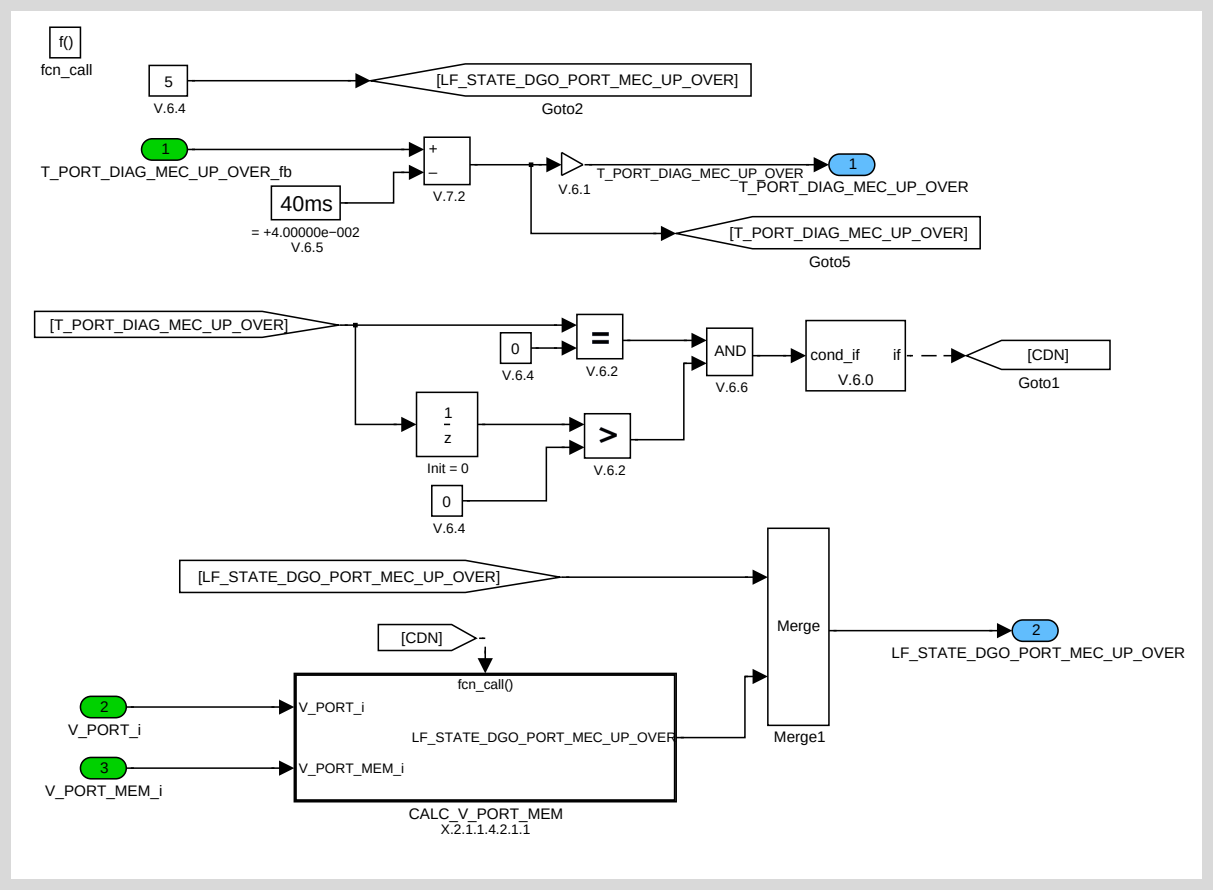

Figure 2.5.28:

2.5.2.1.1.4.2.1.1 Diagnostic status: condition valid with or without symptom

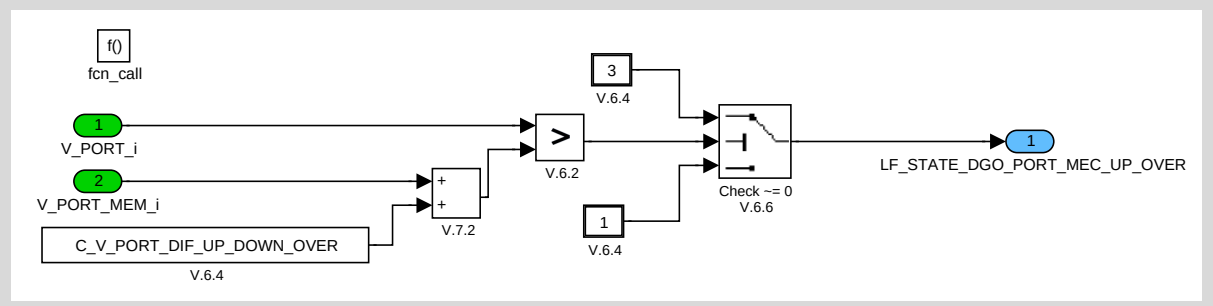

Figure 2.5.29:

2.5.2.1.1.4.2.2 Invalid condition

Figure 2.5.30:

2.5.3 CLR_RST

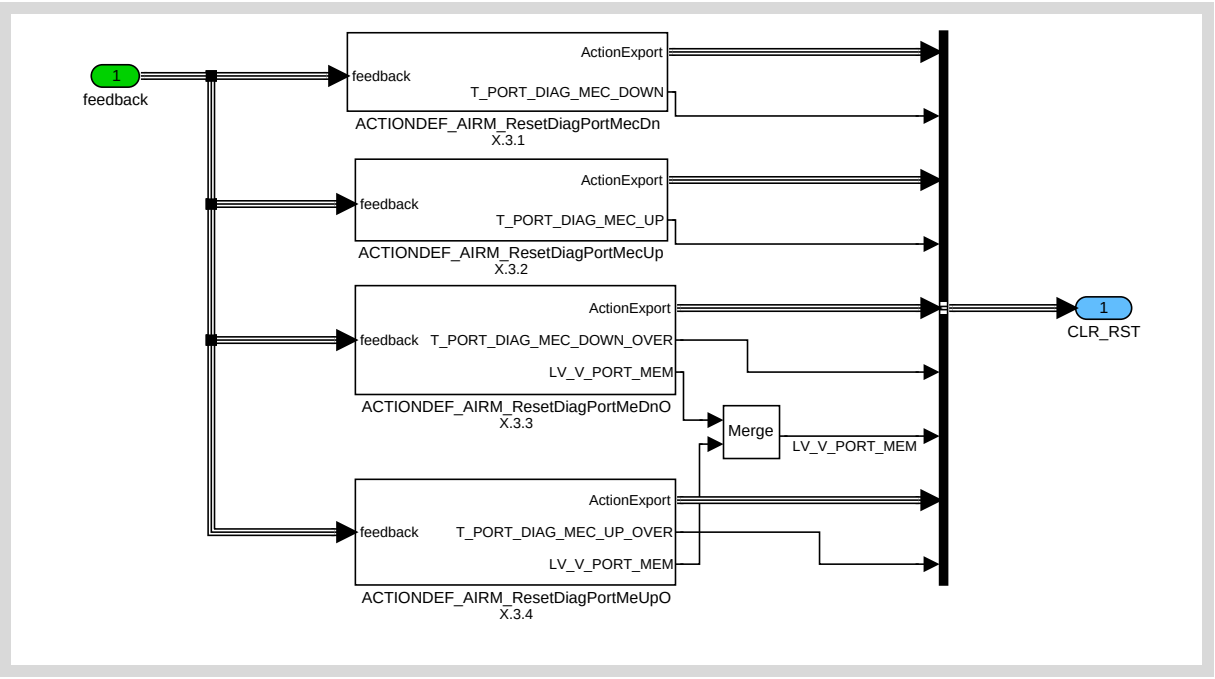

Figure 2.5.31:

2.5.3.1 ACTION_AIRM_ResetDiagPortMecDn

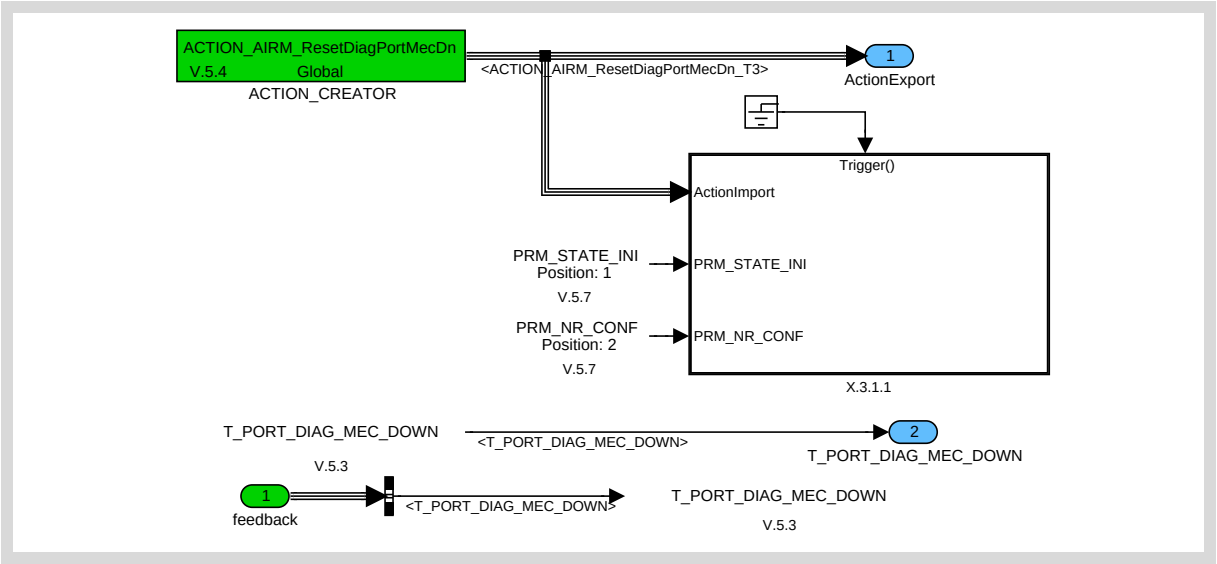

Figure 2.5.32:

2.5.3.1.1 PortMecDown diagnosis information in case of failure memory clear (CLR) or new driving cycle (RST)

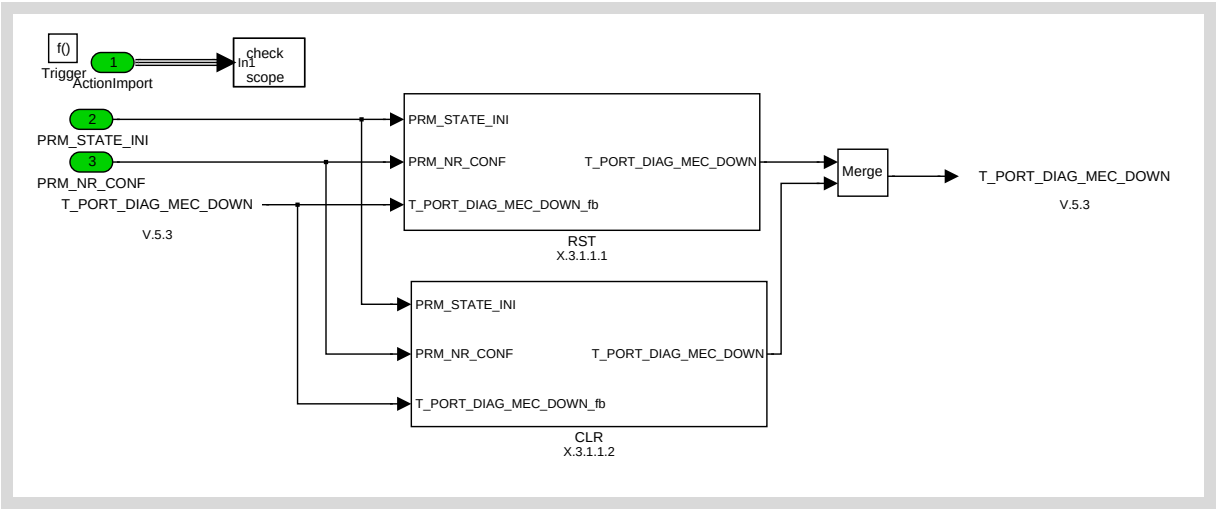

Figure 2.5.33:

2.5.3.1.1.1 RST

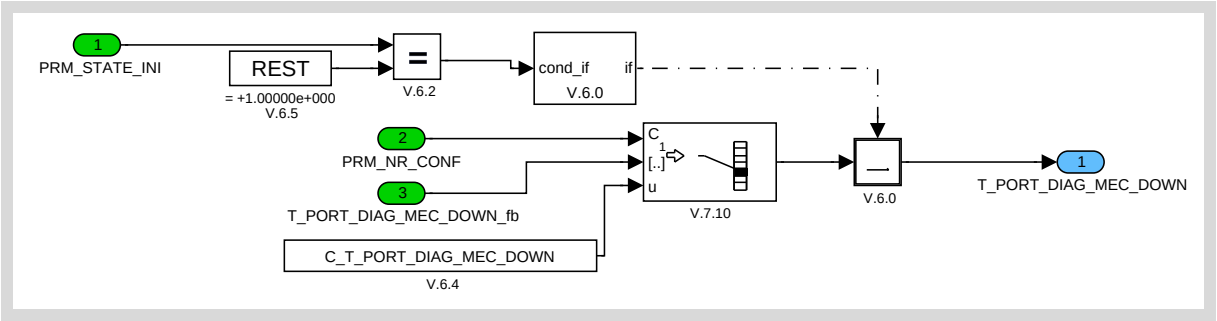

Figure 2.5.34:

2.5.3.1.1.2 CLR

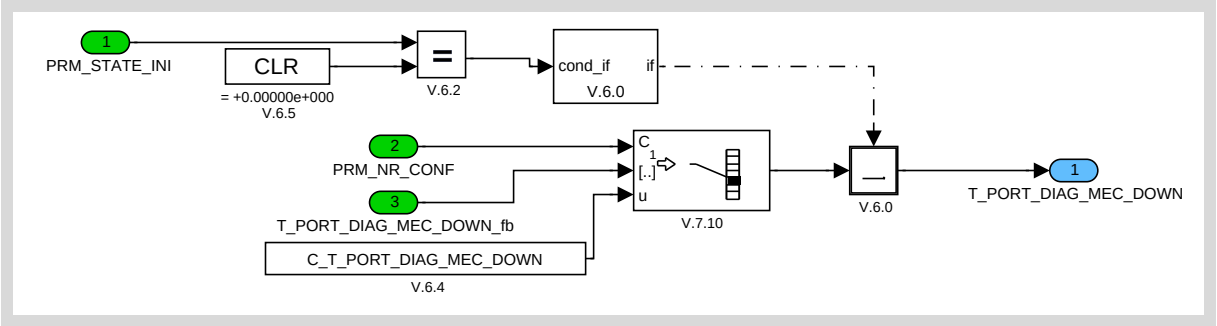

Figure 2.5.35:

2.5.3.2 ACTION_AIRM_ResetDiagPortMecUp

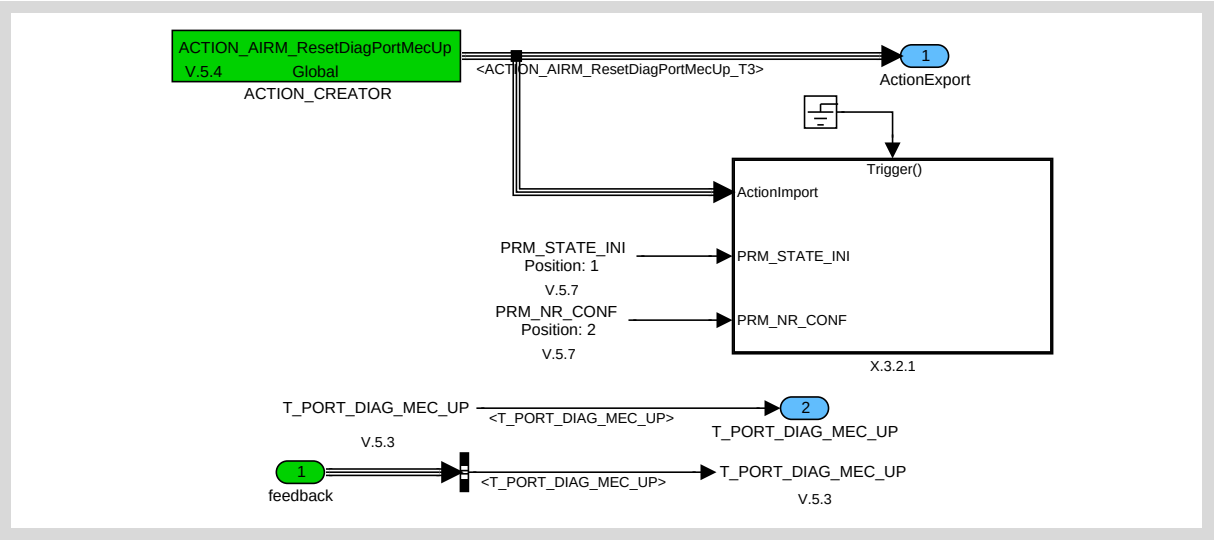

Figure 2.5.36:

2.5.3.2.1 PortMecUp diagnosis information in case of failure memory clear (CLR) or new driving cycle (RST)

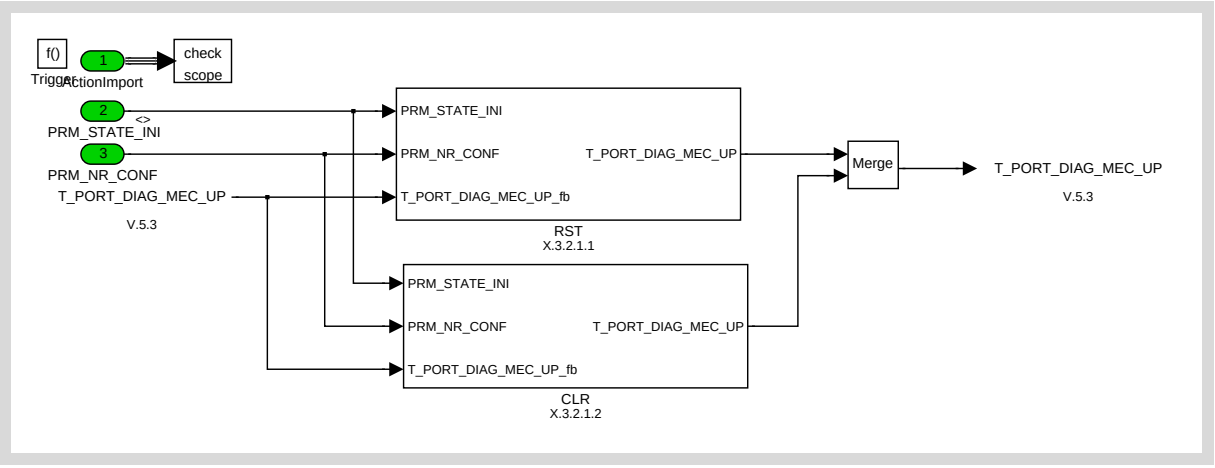

Figure 2.5.37:

2.5.3.2.1.1 RST

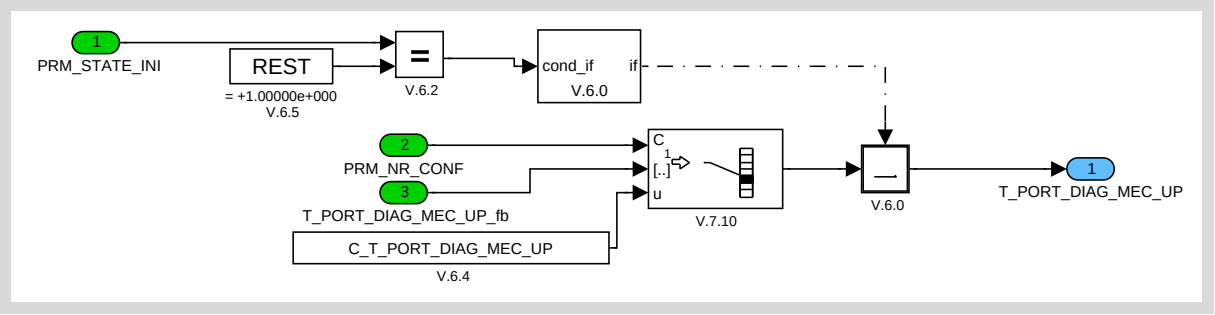

Figure 2.5.38:

2.5.3.2.1.2 CLR

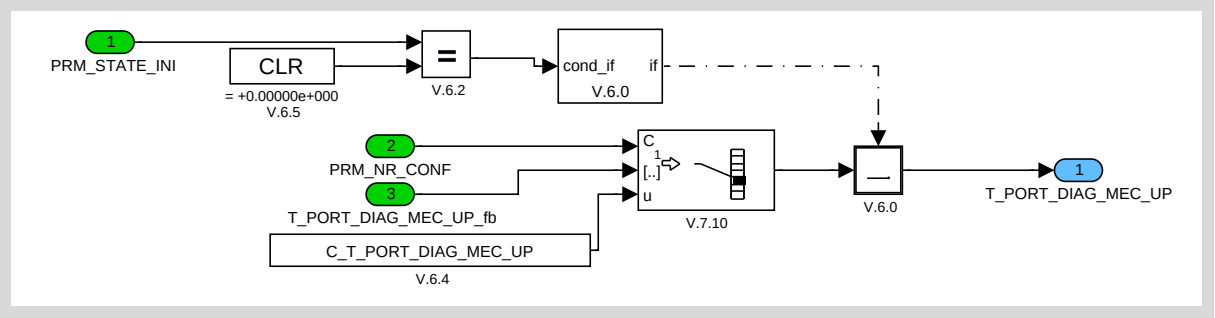

Figure 2.5.39:

2.5.3.3 ACTION_AIRM_ResetDiagPortMeDnO

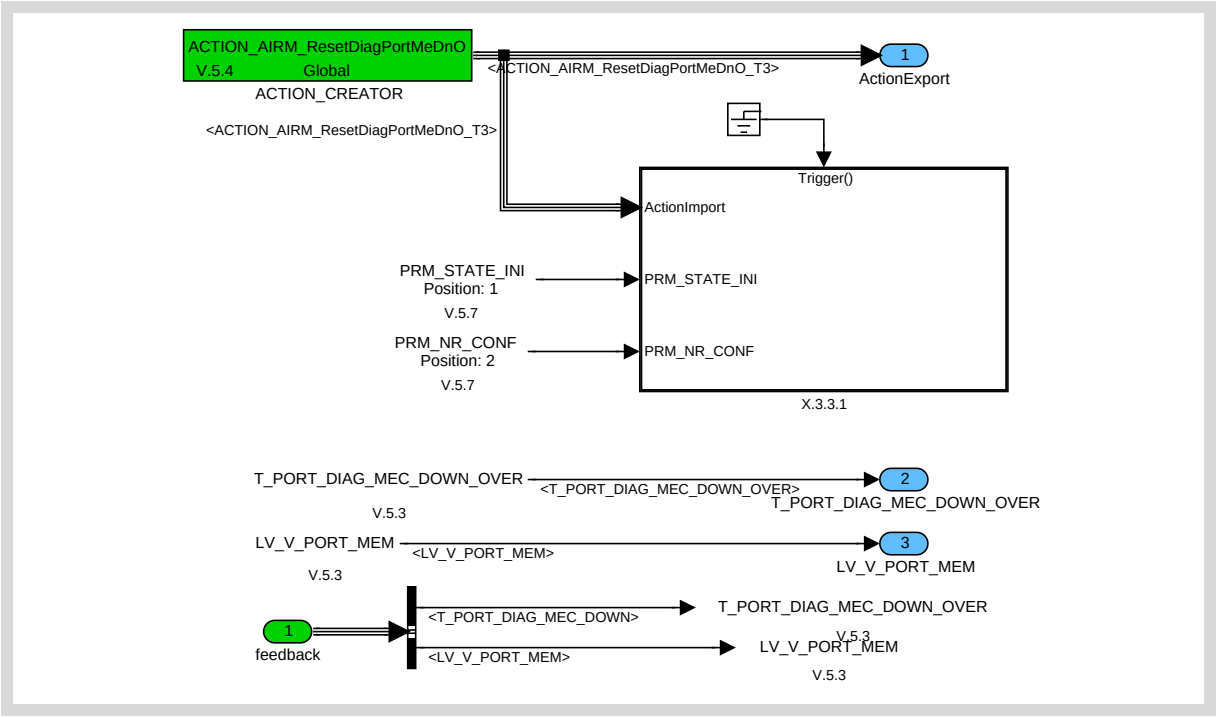

Figure 2.5.40:

2.5.3.3.1 PortMecDownOver diagnosis information in case of failure memory clear (CLR) or new driving cycle (RST)

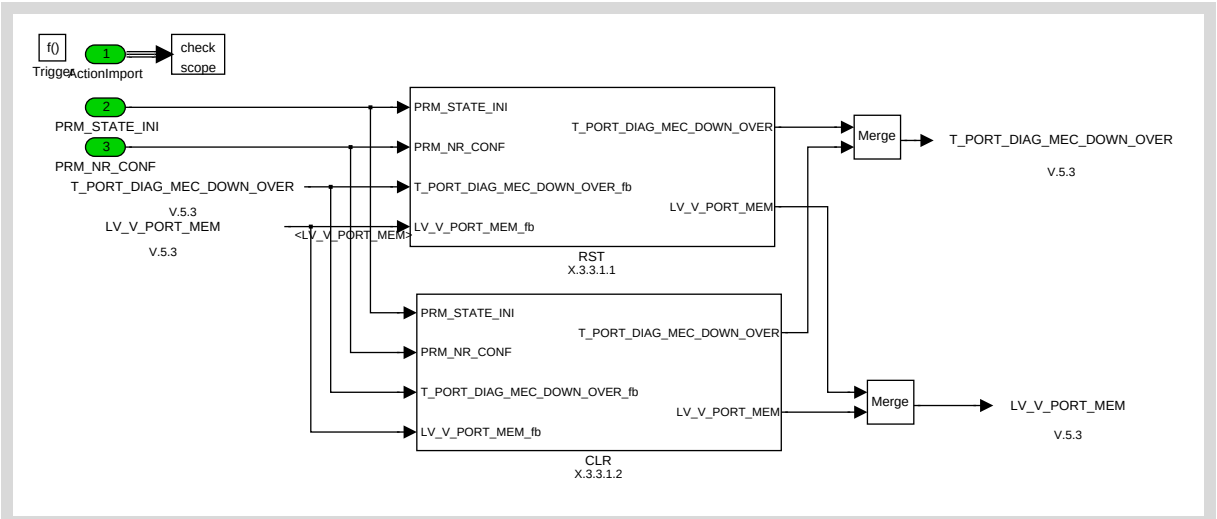

Figure 2.5.41:

2.5.3.3.1.1 RST

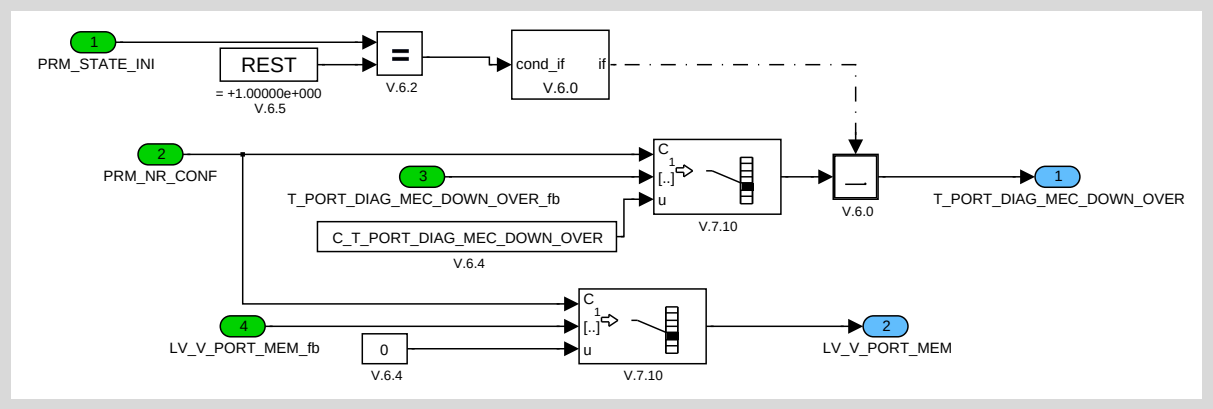

Figure 2.5.42:

2.5.3.3.1.2 CLR

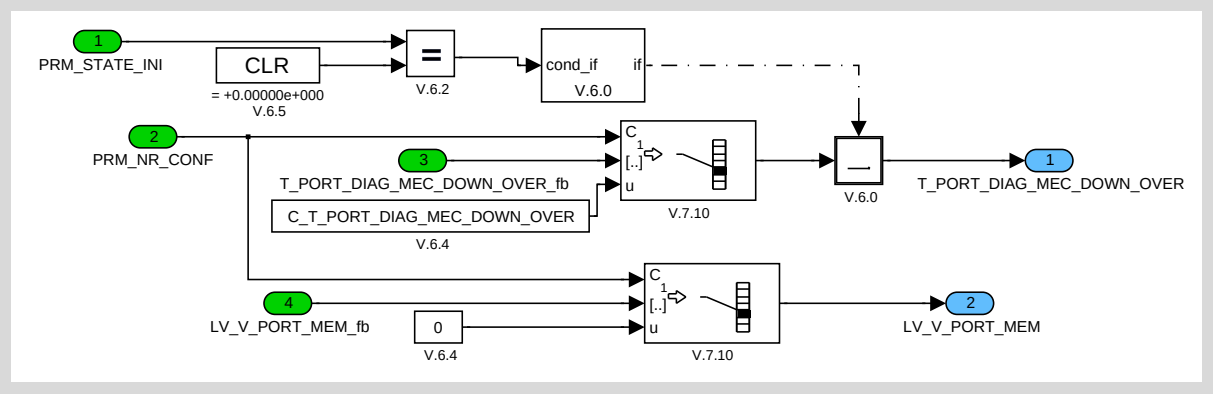

Figure 2.5.43:

2.5.3.4 ACTION_AIRM_ResetDiagPortMeUpO

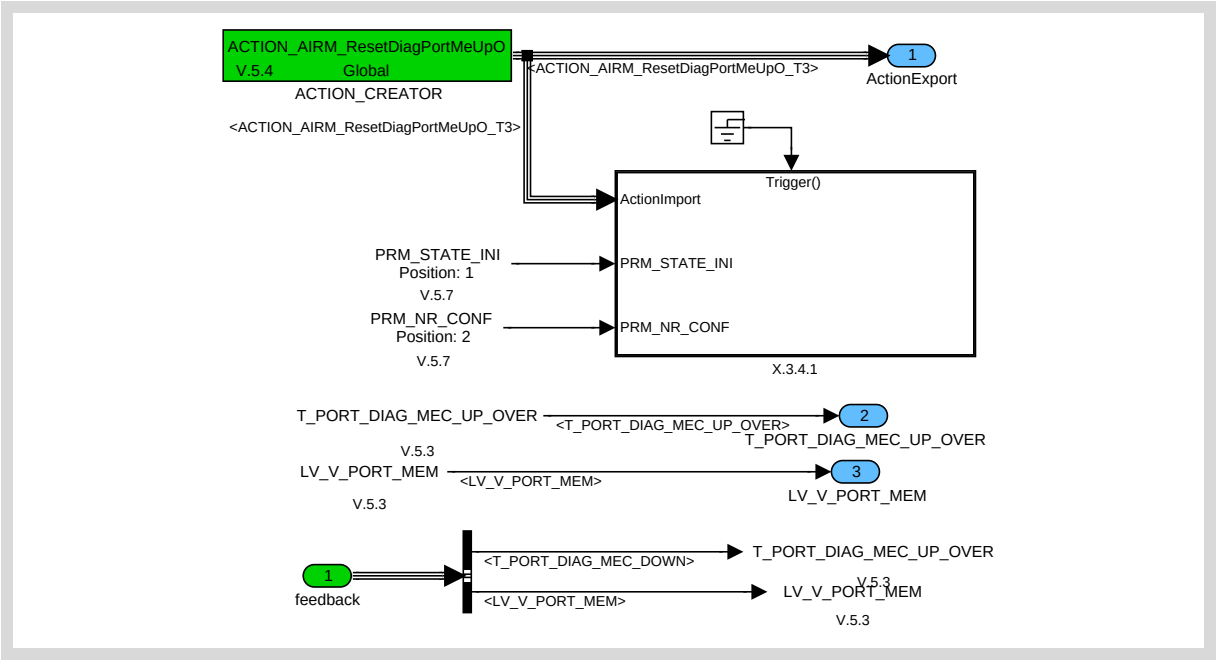

Figure 2.5.44:

2.5.3.4.1 PortMecUpOver diagnosis information in case of failure memory clear (CLR) or new driving cycle (RST)

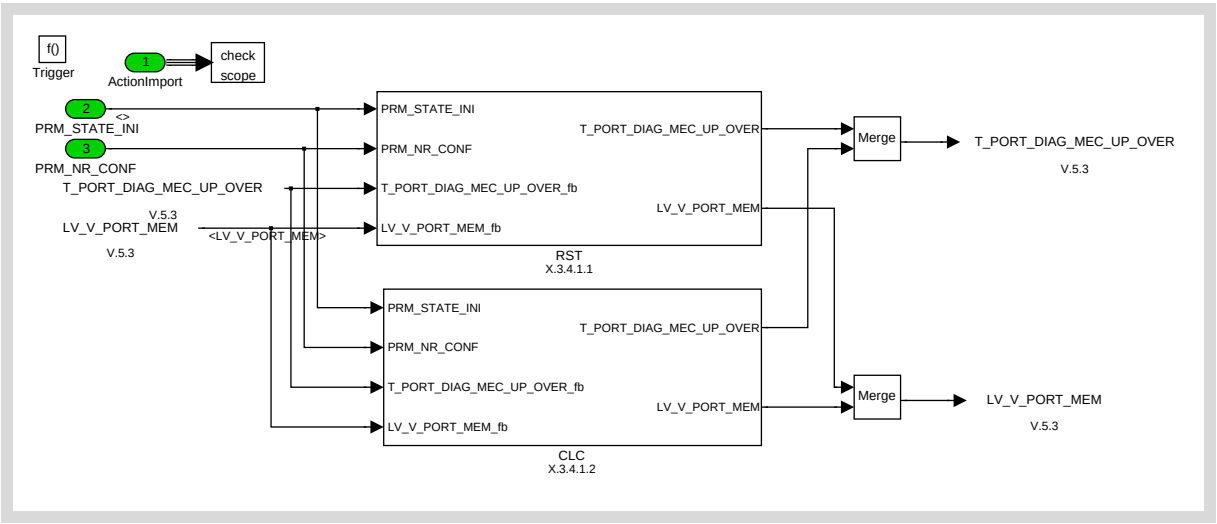

Figure 2.5.45:

2.5.3.4.1.1 RST

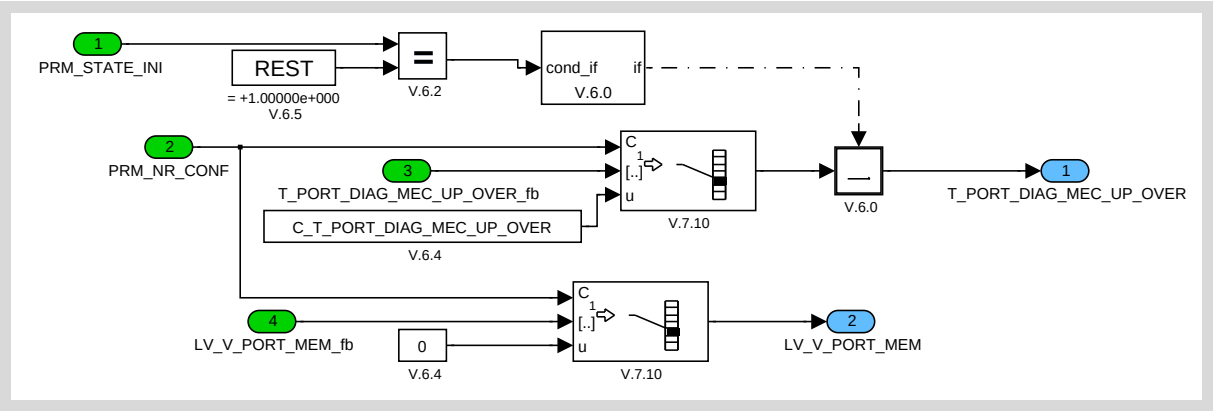

Figure 2.5.46:

2.5.3.4.1.2 CLR

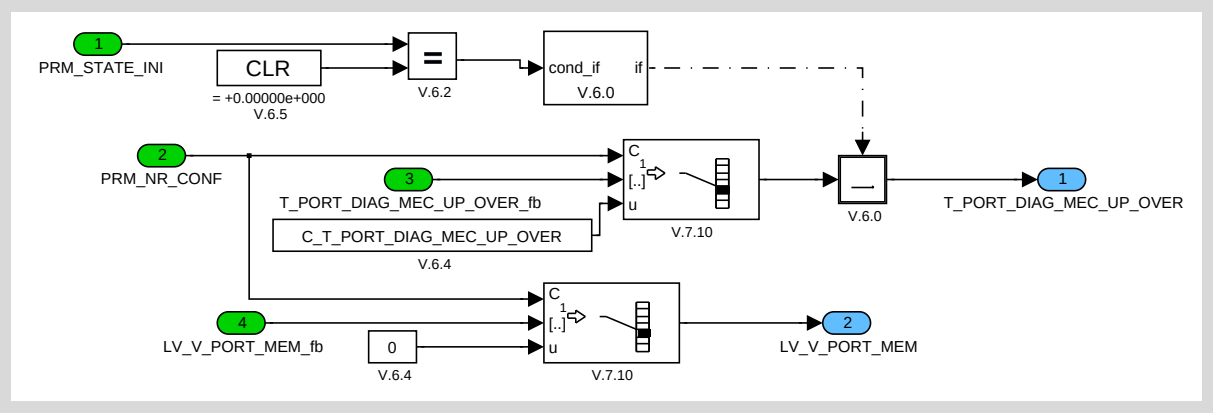

Figure 2.5.47:

2.6 Port flap power stage diagnosis

▶ Input Data

LV_INH_DIAG_PORT_OC {p. 1130}	LV_INH_DIAG_PORT_SCG {p. 1130}	LV_INH_DIAG_PORT_SCP {p. 1130}	

▶ Configuration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
NC_IDX_ERR_PORT_OC	-	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_OC					
NC_IDX_ERR_PORT_SCG	-	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_SCG					
NC_IDX_ERR_PORT_SCP	-	0... FFFFH	0... 65535	1	-
Failure index for diagnostic instance PORT_SCP					

▶ Action Definitions

ACTION_AIRM_ResetDiagPortOc(OUT <PRM_STATE_INI>, **OUT** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	out	0H 1H	CLR REST	-	-
Type of initialization (Clear: CLR; restart: REST)					
PRM_NR_CONF	out	0... FFH	0... 255	1	-
Additional configuration information for the action					

ACTION_AIRM_ResetDiagPortScg(OUT <PRM_STATE_INI>, **OUT** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	out	0H 1H	CLR REST	-	-
Type of initialization (Clear: CLR; restart: REST)					
PRM_NR_CONF	out	0... FFH	0... 255	1	-
Additional configuration information for the action					

ACTION_AIRM_ResetDiagPortScp(OUT <PRM_STATE_INI>, **OUT** <PRM_NR_CONF>)					**Mode: O**
Action to erase or restart the diagnostics					
Parameter	**Type**	**Hex.Limits**	**Phys.Limits**	**Resol.**	**Unit**
PRM_STATE_INI	out	0H 1H	CLR REST	-	-
Type of initialization (Clear: CLR; restart: REST)					
PRM_NR_CONF	out	0... FFH	0... 255	1	-
Additional configuration information for the action					

Import actions:

ACTION_ERRM_ResultDiag(**IN** <PRM_IDX_ERR>, **IN** <PRM_STATE_DGO>, **OUT** <PRM_STATE_FIL>)

ACTION_FARM_GetPermission(**IN** <PRM_FID>, **OUT** <PRM_LV_PRMS>)

ACTION_INFR_GetDiagPortEl(**OUT** <PRM_ERR_DIAG>, **OUT** <PRM_CDN_DIAG>)

Error treatment

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
PORT_SCP	ACTION_Air motion_ResetDiagPortScp	UNUSED	CC	

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
PORT_SCG	ACTION_Air motion_ResetDiagPortScg	UNUSED	CC	

Diagnostic Identifier	Diagnostic initialization function	NR_CONF	CARB class	OBD DTC
PORT_OC	ACTION_Air motion_ResetDiagPortOc	UNUSED	CC	

General Information

The on/off Port-flap pneumatic valve is driven by the ECU. The failure detection is done by ECU Hardware.

Application Conditions

Activation: always

Deactivation: never

Recurrence: 100 ms

Function Description

```
ERR_DIAG_PORT_EL = ACTION_INFR_GetDiagPortEl(OUT   <PRM_ERR_DIAG>)
CDN_DIAG_PORT_EL = ACTION_INFR_GetDiagPortEl(OUT   <PRM_CDN_DIAG>)

Short cut to plus detection of port flap power stage
if     LV_INH_DIAG_PORT_SCP == 0
then
      if CDN_DIAG_PORT_EL.bit0 == 0
      LF_STATE_DGO_PORT_SCP = 0 (NO_CDN)
      elseif CDN_DIAG_PORT_EL.bit0 == 1 and  ERR_DIAG_PORT_EL.bit0 == 1
            then LF_STATE_DGO_PORT_SCP = 3 (CDN + SYM)
            else LF_STATE_DGO_PORT_SCP = 1 (CDN + NO_SYM)
      endif
endif

ACTION_ERRM_ResultDiag(IN <NC_IDX_ERR_PORT_SCP>, IN <LF_STATE_DGO_PORT_SCP>, OUT
<STATE_FIL>)

Short cut to ground detection of port flap power stage
```

```
if    LV_INH_DIAG_PORT_SCG == 0
then
      if CDN_DIAG_PORT_EL.bit1 == 0
      LF_STATE_DGO_PORT_SCG = 0 (NO_CDN)
      elseif CDN_DIAG_PORT_EL.bit1 == 1 and ERR_DIAG_PORT_EL.bit1 == 1
            then LF_STATE_DGO_PORT_SCG = 3 (CDN + SYM)
            else LF_STATE_DGO_PORT_SCG = 1 (CDN + NO_SYM)
      endif
endif

ACTION_ERRM_ResultDiag(IN <NC_IDX_ERR_PORT_SCG>, IN <LF_STATE_DGO_PORT_SCG>, OUT
<STATE_FIL>)

Open load to plus detection of port flap power stage
if    LV_INH_DIAG_PORT_OC == 0
then
      if CDN_DIAG_PORT_EL.bit2 == 0
      LF_STATE_DGO_PORT_OC = 0 (NO_CDN)
      elseif CDN_DIAG_PORT_EL.bit2 == 1  and  ERR_DIAG_PORT_EL.bit2 == 1
            then LF_STATE_DGO_PORT_OC = 3 (CDN + SYM)
            else LF_STATE_DGO_PORT_OC = 1 (CDN + NO_SYM)
      endif
endif

ACTION_ERRM_ResultDiag(IN <NC_IDX_ERR_PORT_OC>, IN <LF_STATE_DGO_PORT_OC>, OUT
<STATE_FIL>)
```

2.6.1 ACTION_AIRM_ResetDiagPortScp

Formula section:

If PRM_STATE_INI == CLR
then LV_INH_DIAG_PORT_SCP = 1
else if PRM_STATE_INI = REST
then LV_INH_DIAG_PORT_SCP = 1
else do nothing
endif

2.6.2 ACTION_AIRM_ResetDiagPortScg

Formula section:

If PRM_STATE_INI == CLR
then LV_INH_DIAG_PORT_SCG = 1
else if PRM_STATE_INI = REST
then LV_INH_DIAG_PORT_SCG = 1
else do nothing
endif

2.6.3 ACTION_AIRM_ResetDiagPortOc

Formula section:

If PRM_STATE_INI == CLR
then LV_INH_DIAG_PORT_OC = 1
else if PRM_STATE_INI = REST
then LV_INH_DIAG_PORT_OC = 1
else do nothing
endif

2.7 Port flap power stage diagnosis (Appl. Inc.)

▶ Data Definition

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
LV_INH_DIAG_PORT_OC	O	0... 1H	0 ...1	1	-
Inhibition condition for open load detection of power stage diagnosis					
LV_INH_DIAG_PORT_SCG	O	0... 1H	0 ...1	1	-
Inhibition condition for short cut to ground detection of power stage diagnosis					
LV_INH_DIAG_PORT_SCP	O	0... 1H	0 ...1	1	-
Inhibition condition for short cut to plus detection of power stage diagnosis					

▶ Input Data

LV_CDN_VB_OBD1 {p. 24053}	LV_ES {p. 7530}	LV_IGK {p. 24082}	LV_PWR_RLY [NC_NR_PWR_RLY] {p. 24148}
LV_VAR_PORT {p. 24740}	NC_IDX_ENG_RLY {p. 23204}		

▶ Configuration Data

Name	Mode	Coded Limits	Display Limits	Resolution	Unit
NC_FID_ERR_PORT_OC	-	0... FFFFH	0... 65535	1	-
FARM Identifier for PORT_OC					
NC_FID_ERR_PORT_SCG	-	0... FFFFH	0... 65535	1	-
Failure index for PORT_SCG					
NC_FID_ERR_PORT_SCP	-	0... FFFFH	0... 65535	1	-
Failure index for PORT_SCP					

▶ Import actions:

ACTION_FARM_GetPermission(**IN** <PRM_FID>, **OUT** <PRM_LV_PRMS>)

▶ General Information

The diagnosis is inhibited if no port flaps is available, project specific conditions are not fulfilled or there is no permission to run the diagnostics (usually due to other errors).

▶ Application Conditions

Initialisation:

```
with LV_IGK = 0 -> 1          and
with reset                    and
with reset of failure memory
LV_INH_DIAG_PORT_SCP    = 0
LV_INH_DIAG_PORT_SCG    = 0
LV_INH_DIAG_PORT_OC     = 0
```

Activation: always

Deactivation: never

Recurrence: 100ms

▶ Function Description

```
if      LV_IGK              == 1        and
        LV_VAR_PORT         == 1        and
        LV_ES               == 0        and
        LV_CDN_VB_OBD1      == 1        and
        (LV_PWR_RLY[0]      == 1 or
        #if  NC_IDX_ENG_RLY ==2
        LV_PWR_RLY[1]    == 1
        #endif)
then
        if ACTION_FARM_GetPermission(NC_FID_ERR_PORT_SCP) == 1
              then  LV_INH_DIAG_PORT_SCP    = 0
              else  LV_INH_DIAG_PORT_SCP    = 1
        endif


        if ACTION_FARM_GetPermission(NC_FID_ERR_PORT_SCG) == 1
              then  LV_INH_DIAG_PORT_SCG    = 0
              else  LV_INH_DIAG_PORT_SCG    = 1
        endif


        if ACTION_FARM_GetPermission(NC_FID_ERR_PORT_OC)  == 1
              then  LV_INH_DIAG_PORT_OC     = 0
              else  LV_INH_DIAG_PORT_OC     = 1
        endif


else
        LV_INH_DIAG_PORT_SCP    = 1
        LV_INH_DIAG_PORT_SCG    = 1
        LV_INH_DIAG_PORT_OC     = 1
endif
```