

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	1

# VW AQ EOP

## Software Detailed Design Specification(2/4)

### Document Properties

Status:  Open

Version: 003

Author: Kim Minsu

Created: 2020-12-17 22:30

### Approved Versions

Current Document version 003 has **not** been approved.

Approved Versions:

- [001](#) (2021-01-06 15:50)
- [002](#) (2021-04-15 21:15)
- [002](#) (2021-04-22 10:17)

### Document Signatures

**Approved** (*Status Change Pending*)

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
	Page	Page	2

## Document Control Information

**Location:** The released versions of this document are maintained by SWE DE and managed in the following location:

[Polarion] VW AQ EOP / Documents & Pages / 02\_Engineering / 12\_SWE\_Design

Version	Date of Release	Description (Change and Reasons for Change)	Author	Reviewer	Approver
001	2020-10-28	• Initiation of draft version	Taihyun Kyung	-	-
	2020-11-30	• Add flow diagram and sequence diagram	Taihyun Kyung	Rasekar Prashant	Hyojin Ahn
002	2021-02-15	• Add evaluation criteria • Resolved defect – CR-0005	Taihyun Kyung	-	-
	2021-02-17	• Modify traceability management	Taihyun Kyung	-	-
	2021-02-26	• Change the Customer Requirement_CAN Timeout-0008 • Add the Tolerance of Voltage– CR-0009	Taihyun Kyung	-	-
	2021-03-10	• Changed low temperature warning criteria – CR-0003	Taihyun Kyung	-	-
	2021-03-12	• Change and add component – CR-0010	Taihyun Kyung	-	-
	2021-04-09	• OPU HW change to apply EMC debugging(TL81000, CE) results– CR-0012	Taihyun Kyung	-	-
	2021-04-15	• Change Target Milestone, Traceability – CR-0010 • Add description for Control Flow Diagram and Sequence Diagram	Minsu Kim	Sungjin Park	Hyojin Ahn
	2021-04-22	• Resolved problem: CMNC-0033	Minsu Kim	Sungjin Park	Hyojin Ahn
003	2021-04-30	• Change Static View Design and Interface Design	Minsu Kim	-	-
	2021-06-30	• Change Static View Design, Dynamic View and Interface Design	Minsu Kim	-	-

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	3

*Table 1 Version History*

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	4

## Table of Contents

1 Function Description .....	16
1.1 [SWDDS.2] RTE .....	16
1.1.1 [SWDDS.2.1] RteSch .....	16
1.1.1.1 [SWDDS.2.1.1] RteSch_Init .....	16
1.1.1.1.1 Detailed Design .....	16
1.1.1.1.2 Static View Design .....	17
1.1.1.1.3 Dynamic View Design .....	17
1.1.1.1.4 Interface Design .....	18
1.1.1.2 [SWDDS.2.1.2] InitializeRteSchRteSw .....	18
1.1.1.2.1 Detailed Design .....	18
1.1.1.2.2 Static View Design .....	19
1.1.1.2.3 Dynamic View Design .....	19
1.1.1.2.4 Interface Design .....	19
1.1.1.3 [SWDDS.2.1.3] InitializeRteSchAppSw .....	19
1.1.1.3.1 Detailed Design .....	20
1.1.1.3.2 Static View Design .....	21
1.1.1.3.3 Dynamic View Design .....	21
1.1.1.3.4 Interface Design .....	21
1.1.1.4 [SWDDS.2.1.5] RteSch_MainFunc .....	21
1.1.1.4.1 Detailed Design .....	21
1.1.1.4.2 Static View Design .....	22
1.1.1.4.3 Dynamic View Design .....	23
1.1.1.4.4 Interface Design .....	23
1.1.1.5 [SWDDS.2.1.6] RunRteSchBackground .....	23
1.1.1.5.1 Detailed Design .....	23
1.1.1.5.2 Static View Design .....	24
1.1.1.5.3 Dynamic View Design .....	25
1.1.1.5.4 Interface Design .....	25
1.1.1.6 [SWDDS.2.1.7] RteSch_Task1ms .....	26
1.1.1.6.1 Detailed Design .....	26
1.1.1.6.2 Static View Design .....	27
1.1.1.6.3 Dynamic View Design .....	28
1.1.1.6.4 Interface Design .....	28
1.1.1.7 [SWDDS.2.1.8] RteSch_Task5ms .....	28
1.1.1.7.1 Detailed Design .....	28
1.1.1.7.2 Static View Design .....	29
1.1.1.7.3 Dynamic View Design .....	30
1.1.1.7.4 Interface Design .....	30
1.1.1.8 [SWDDS.2.1.9] RteSch_Task10ms .....	30
1.1.1.8.1 Detailed Design .....	30
1.1.1.8.2 Static View Design .....	32
1.1.1.8.3 Dynamic View Design .....	32
1.1.1.8.4 Interface Design .....	32
1.1.1.9 [SWDDS.2.1.10] RteSch_Task20ms .....	32

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	5

1.1.1.9.1	Detailed Design .....	32
1.1.1.9.2	Static View Design .....	34
1.1.1.9.3	Dynamic View Design .....	34
1.1.1.9.4	Interface Design .....	34
1.1.1.10	[SWDDS.2.1.11] RteSch_Task50ms .....	34
1.1.1.10.1	Detailed Design .....	34
1.1.1.10.2	Static View Design .....	36
1.1.1.10.3	Dynamic View Design .....	36
1.1.1.10.4	Interface Design .....	36
1.1.1.11	[SWDDS.2.1.12] RteSch_Task100ms .....	36
1.1.1.11.1	Detailed Design .....	37
1.1.1.11.2	Static View Design .....	38
1.1.1.11.3	Dynamic View Design .....	38
1.1.1.11.4	Interface Design .....	38
1.1.1.12	[SWDDS.2.1.13] RteSch_GetOpuTimCnt .....	38
1.1.1.12.1	Detailed Design .....	38
1.1.1.12.2	Static View Design .....	38
1.1.1.12.3	Dynamic View Design .....	38
1.1.1.12.4	Interface Design .....	39
1.1.2	[SWDDS.2.2] RteApp .....	39
1.1.2.1	[SWDDS.2.2.1] RteApp_Init .....	39
1.1.2.1.1	Detailed Design .....	39
1.1.2.1.2	Static View Design .....	42
1.1.2.1.3	Dynamic View Design .....	42
1.1.2.1.4	Interface Design .....	42
1.1.2.2	[SWDDS.2.2.2] RteApp_ReadTgtSpd .....	42
1.1.2.2.1	Detailed Design .....	42
1.1.2.2.2	Static View Design .....	43
1.1.2.2.3	Dynamic View Design .....	43
1.1.2.2.4	Interface Design .....	43
1.1.2.3	[SWDDS.2.2.3] RteApp_WriteTgtSpd .....	44
1.1.2.3.1	Detailed Design .....	44
1.1.2.3.2	Static View Design .....	45
1.1.2.3.3	Dynamic View Design .....	45
1.1.2.3.4	Interface Design .....	45
1.1.2.4	[SWDDS.2.2.4] RteApp_ReadMsgSta .....	45
1.1.2.4.1	Detailed Design .....	45
1.1.2.4.2	Static View Design .....	46
1.1.2.4.3	Dynamic View Design .....	46
1.1.2.4.4	Interface Design .....	46
1.1.2.5	[SWDDS.2.2.5] RteApp_WriteMsgSta .....	46
1.1.2.5.1	Detailed Design .....	47
1.1.2.5.2	Static View Design .....	48
1.1.2.5.3	Dynamic View Design .....	48
1.1.2.5.4	Interface Design .....	48
1.1.2.6	[SWDDS.2.2.6] RteApp_ReadSpdOut .....	48

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	6

1.1.2.6.1	Detailed Design .....	48
1.1.2.6.2	Static View Design .....	49
1.1.2.6.3	Dynamic View Design .....	49
1.1.2.6.4	Interface Design .....	49
1.1.2.7	[SWDDS.2.2.7] RteApp_WriteSpdOut .....	49
1.1.2.7.1	Detailed Design .....	50
1.1.2.7.2	Static View Design .....	51
1.1.2.7.3	Dynamic View Design .....	51
1.1.2.7.4	Interface Design .....	51
1.1.2.8	[SWDDS.2.2.8] RteApp_ReadSpdFilt .....	51
1.1.2.8.1	Detailed Design .....	51
1.1.2.8.2	Static View Design .....	52
1.1.2.8.3	Dynamic View Design .....	52
1.1.2.8.4	Interface Design .....	52
1.1.2.9	[SWDDS.2.2.9] RteApp_WriteSpdFilt .....	53
1.1.2.9.1	Detailed Design .....	53
1.1.2.9.2	Static View Design .....	54
1.1.2.9.3	Dynamic View Design .....	54
1.1.2.9.4	Interface Design .....	54
1.1.2.10	[SWDDS.2.2.10] RteApp_ReadCtrState .....	54
1.1.2.10.1	Detailed Design .....	54
1.1.2.10.2	Static View Design .....	55
1.1.2.10.3	Dynamic View Design .....	55
1.1.2.10.4	Interface Design .....	55
1.1.2.11	[SWDDS.2.2.11] RteApp_WriteCtrState .....	56
1.1.2.11.1	Detailed Design .....	56
1.1.2.11.2	Static View Design .....	57
1.1.2.11.3	Dynamic View Design .....	57
1.1.2.11.4	Interface Design .....	57
1.1.2.12	[SWDDS.2.2.12] RteApp_ReadCtrFlt .....	57
1.1.2.12.1	Detailed Design .....	57
1.1.2.12.2	Static View Design .....	58
1.1.2.12.3	Dynamic View Design .....	58
1.1.2.12.4	Interface Design .....	58
1.1.2.13	[SWDDS.2.2.13] RteApp_WriteCtrFlt .....	58
1.1.2.13.1	Detailed Design .....	59
1.1.2.13.2	Static View Design .....	60
1.1.2.13.3	Dynamic View Design .....	60
1.1.2.13.4	Interface Design .....	60
1.1.2.14	[SWDDS.2.2.14] RteApp_ReadCurOut .....	60
1.1.2.14.1	Detailed Design .....	60
1.1.2.14.2	Static View Design .....	61
1.1.2.14.3	Dynamic View Design .....	61
1.1.2.14.4	Interface Design .....	61
1.1.2.15	[SWDDS.2.2.15] RteApp_WriteCurOut .....	62
1.1.2.15.1	Detailed Design .....	62

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	7

1.1.2.15.2	Static View Design .....	63
1.1.2.15.3	Dynamic View Design .....	63
1.1.2.15.4	Interface Design .....	63
1.1.2.16	[SWDDS.2.2.17] RteApp_ReadDcCur .....	63
1.1.2.16.1	Detailed Design .....	63
1.1.2.16.2	Static View Design .....	64
1.1.2.16.3	Dynamic View Design .....	64
1.1.2.16.4	Interface Design .....	64
1.1.2.17	[SWDDS.2.2.18] RteApp_WriteDcCur .....	65
1.1.2.17.1	Detailed Design .....	65
1.1.2.17.2	Static View Design .....	66
1.1.2.17.3	Dynamic View Design .....	66
1.1.2.17.4	Interface Design .....	66
1.1.2.18	[SWDDS.2.2.19] RteApp_WriteDcVolt .....	66
1.1.2.18.1	Detailed Design .....	66
1.1.2.18.2	Static View Design .....	67
1.1.2.18.3	Dynamic View Design .....	67
1.1.2.18.4	Interface Design .....	68
1.1.2.19	[SWDDS.2.2.20] RteApp_ReadPcbTemp .....	68
1.1.2.19.1	Detailed Design .....	68
1.1.2.19.2	Static View Design .....	69
1.1.2.19.3	Dynamic View Design .....	69
1.1.2.19.4	Interface Design .....	69
1.1.2.20	[SWDDS.2.2.21] RteApp_WritePcbTemp .....	69
1.1.2.20.1	Detailed Design .....	69
1.1.2.20.2	Static View Design .....	70
1.1.2.20.3	Dynamic View Design .....	70
1.1.2.20.4	Interface Design .....	70
1.1.2.21	[SWDDS.2.2.22] RteApp_ReadMtrTrq .....	71
1.1.2.21.1	Detailed Design .....	71
1.1.2.21.2	Static View Design .....	72
1.1.2.21.3	Dynamic View Design .....	72
1.1.2.21.4	Interface Design .....	72
1.1.2.22	[SWDDS.2.2.23] RteApp_WriteMtrTrq .....	72
1.1.2.22.1	Detailed Design .....	72
1.1.2.22.2	Static View Design .....	73
1.1.2.22.3	Dynamic View Design .....	73
1.1.2.22.4	Interface Design .....	74
1.1.2.23	[SWDDS.2.2.24] RteApp_ReadBatVolt .....	74
1.1.2.23.1	Detailed Design .....	74
1.1.2.23.2	Static View Design .....	75
1.1.2.23.3	Dynamic View Design .....	75
1.1.2.23.4	Interface Design .....	75
1.1.2.24	[SWDDS.2.2.25] RteApp_WriteBatVolt .....	75
1.1.2.24.1	Detailed Design .....	75
1.1.2.24.2	Static View Design .....	76

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	8

1.1.2.24.3	Dynamic View Design .....	76
1.1.2.24.4	Interface Design .....	77
1.1.2.25	[SWDDS.2.2.26] RteApp_ReadMcuSta .....	77
1.1.2.25.1	Detailed Design .....	77
1.1.2.25.2	Static View Design .....	78
1.1.2.25.3	Dynamic View Design .....	78
1.1.2.25.4	Interface Design .....	78
1.1.2.26	[SWDDS.2.2.27] RteApp_WriteMcuSta .....	78
1.1.2.26.1	Detailed Design .....	78
1.1.2.26.2	Static View Design .....	79
1.1.2.26.3	Dynamic View Design .....	79
1.1.2.26.4	Interface Design .....	80
1.1.2.27	[SWDDS.2.2.28] RteApp_ReadEopState .....	80
1.1.2.27.1	Detailed Design .....	80
1.1.2.27.2	Static View Design .....	81
1.1.2.27.3	Dynamic View Design .....	81
1.1.2.27.4	Interface Design .....	81
1.1.2.28	[SWDDS.2.2.29] RteApp_WriteEopState .....	81
1.1.2.28.1	Detailed Design .....	81
1.1.2.28.2	Static View Design .....	82
1.1.2.28.3	Dynamic View Design .....	82
1.1.2.28.4	Interface Design .....	83
1.1.2.29	[SWDDS.2.2.30] RteApp_ReadCtrEna .....	83
1.1.2.29.1	Detailed Design .....	83
1.1.2.29.2	Static View Design .....	84
1.1.2.29.3	Dynamic View Design .....	84
1.1.2.29.4	Interface Design .....	84
1.1.2.30	[SWDDS.2.2.31] RteApp_WriteCtrEna .....	84
1.1.2.30.1	Detailed Design .....	84
1.1.2.30.2	Static View Design .....	85
1.1.2.30.3	Dynamic View Design .....	85
1.1.2.30.4	Interface Design .....	86
1.1.2.31	[SWDDS.2.2.32] RteApp_ReadCtrMode .....	86
1.1.2.31.1	Detailed Design .....	86
1.1.2.31.2	Static View Design .....	87
1.1.2.31.3	Dynamic View Design .....	87
1.1.2.31.4	Interface Design .....	87
1.1.2.32	[SWDDS.2.2.33] RteApp_ReadRefCur .....	87
1.1.2.32.1	Detailed Design .....	87
1.1.2.32.2	Static View Design .....	88
1.1.2.32.3	Dynamic View Design .....	88
1.1.2.32.4	Interface Design .....	88
1.1.2.33	[SWDDS.2.2.34] RteApp_ReadRefSpd .....	89
1.1.2.33.1	Detailed Design .....	89
1.1.2.33.2	Static View Design .....	90
1.1.2.33.3	Dynamic View Design .....	90

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	9

1.1.2.33.4	Interface Design .....	90
1.1.2.34	[SWDDS.2.2.35] RteApp_WriteRefSpd .....	90
1.1.2.34.1	Detailed Design .....	90
1.1.2.34.2	Static View Design .....	91
1.1.2.34.3	Dynamic View Design .....	91
1.1.2.34.4	Interface Design .....	92
1.1.2.35	[SWDDS.2.2.36] RteApp_ReadCurLmtUpp .....	92
1.1.2.35.1	Detailed Design .....	92
1.1.2.35.2	Static View Design .....	93
1.1.2.35.3	Dynamic View Design .....	93
1.1.2.35.4	Interface Design .....	93
1.1.2.36	[SWDDS.2.2.37] RteApp_WriteCurLmtUpp .....	93
1.1.2.36.1	Detailed Design .....	93
1.1.2.36.2	Static View Design .....	94
1.1.2.36.3	Dynamic View Design .....	94
1.1.2.36.4	Interface Design .....	95
1.1.2.37	[SWDDS.2.2.38] RteApp_ReadCurLmtLow .....	95
1.1.2.37.1	Detailed Design .....	95
1.1.2.37.2	Static View Design .....	96
1.1.2.37.3	Dynamic View Design .....	96
1.1.2.37.4	Interface Design .....	96
1.1.2.38	[SWDDS.2.2.39] RteApp_WriteCurLmtLow .....	96
1.1.2.38.1	Detailed Design .....	96
1.1.2.38.2	Static View Design .....	97
1.1.2.38.3	Dynamic View Design .....	97
1.1.2.38.4	Interface Design .....	98
1.1.2.39	[SWDDS.2.2.40] RteApp_ReadSpdErr .....	98
1.1.2.39.1	Detailed Design .....	98
1.1.2.39.2	Static View Design .....	99
1.1.2.39.3	Dynamic View Design .....	99
1.1.2.39.4	Interface Design .....	99
1.1.2.40	[SWDDS.2.2.41] RteApp_ReadDrvSta .....	99
1.1.2.40.1	Detailed Design .....	99
1.1.2.40.2	Static View Design .....	100
1.1.2.40.3	Dynamic View Design .....	100
1.1.2.40.4	Interface Design .....	100
1.1.2.41	[SWDDS.2.2.42] RteApp_WriteDrvSta .....	101
1.1.2.41.1	Detailed Design .....	101
1.1.2.41.2	Static View Design .....	102
1.1.2.41.3	Dynamic View Design .....	102
1.1.2.41.4	Interface Design .....	102
1.1.2.42	[SWDDS.2.2.43] RteApp_ReadSigRng .....	102
1.1.2.42.1	Detailed Design .....	102
1.1.2.42.2	Static View Design .....	103
1.1.2.42.3	Dynamic View Design .....	103
1.1.2.42.4	Interface Design .....	103

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	10

1.1.2.43 [SWDDS.2.2.44] RteApp_WriteSigRng .....	103
1.1.2.43.1 Detailed Design .....	104
1.1.2.43.2 Static View Design .....	105
1.1.2.43.3 Dynamic View Design .....	105
1.1.2.43.4 Interface Design .....	105
1.1.2.44 [SWDDS.2.2.45] RteApp_ReadOprMode .....	105
1.1.2.44.1 Detailed Design .....	105
1.1.2.44.2 Static View Design .....	106
1.1.2.44.3 Dynamic View Design .....	106
1.1.2.44.4 Interface Design .....	106
1.1.2.45 [SWDDS.2.2.46] RteApp_WriteOprMode .....	107
1.1.2.45.1 Detailed Design .....	107
1.1.2.45.2 Static View Design .....	108
1.1.2.45.3 Dynamic View Design .....	108
1.1.2.45.4 Interface Design .....	108
1.1.2.46 [SWDDS.2.2.47] RteApp_ReadFuncMode .....	108
1.1.2.46.1 Detailed Design .....	108
1.1.2.46.2 Static View Design .....	109
1.1.2.46.3 Dynamic View Design .....	109
1.1.2.46.4 Interface Design .....	109
1.1.2.47 [SWDDS.2.2.48] RteApp_WriteFuncMode .....	109
1.1.2.47.1 Detailed Design .....	110
1.1.2.47.2 Static View Design .....	111
1.1.2.47.3 Dynamic View Design .....	111
1.1.2.47.4 Interface Design .....	111
1.1.2.48 [SWDDS.2.2.49] RteApp_ReadAppMode .....	111
1.1.2.48.1 Detailed Design .....	111
1.1.2.48.2 Static View Design .....	112
1.1.2.48.3 Dynamic View Design .....	112
1.1.2.48.4 Interface Design .....	112
1.1.2.49 [SWDDS.2.2.50] RteApp_WriteAppMode .....	112
1.1.2.49.1 Detailed Design .....	113
1.1.2.49.2 Static View Design .....	114
1.1.2.49.3 Dynamic View Design .....	114
1.1.2.49.4 Interface Design .....	114
1.1.2.50 [SWDDS.2.2.51] RteApp_ReadOpuFlt .....	114
1.1.2.50.1 Detailed Design .....	114
1.1.2.50.2 Static View Design .....	115
1.1.2.50.3 Dynamic View Design .....	115
1.1.2.50.4 Interface Design .....	115
1.1.2.51 [SWDDS.2.2.52] RteApp_WriteOpuFlt .....	115
1.1.2.51.1 Detailed Design .....	116
1.1.2.51.2 Static View Design .....	118
1.1.2.51.3 Dynamic View Design .....	118
1.1.2.51.4 Interface Design .....	118
1.1.2.52 [SWDDS.2.2.53] RteApp_ClrOpuFlt .....	118

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	11

1.1.2.52.1	Detailed Design .....	118
1.1.2.52.2	Static View Design .....	119
1.1.2.52.3	Dynamic View Design .....	120
1.1.2.52.4	Interface Design .....	120
1.1.2.53	[SWDDS.2.2.54] RteApp_GetOpuFltNo .....	120
1.1.2.53.1	Detailed Design .....	120
1.1.2.53.2	Static View Design .....	121
1.1.2.53.3	Dynamic View Design .....	121
1.1.2.53.4	Interface Design .....	121
1.1.2.54	[SWDDS.2.2.55] App_GetOpuFltStored .....	121
1.1.2.54.1	Detailed Design .....	121
1.1.2.54.2	Static View Design .....	123
1.1.2.54.3	Dynamic View Design .....	123
1.1.2.54.4	Interface Design .....	123
1.1.2.55	[SWDDS.2.2.56] RteApp_ReadCurErr .....	123
1.1.2.55.1	Detailed Design .....	123
1.1.2.55.2	Static View Design .....	123
1.1.2.55.3	Dynamic View Design .....	123
1.1.2.55.4	Interface Design .....	123
1.1.2.56	[SWDDS.2.2.57] RteApp_ReadDcVolt .....	123
1.1.2.56.1	Detailed Design .....	124
1.1.2.56.2	Static View Design .....	124
1.1.2.56.3	Dynamic View Design .....	124
1.1.2.56.4	Interface Design .....	124
1.1.2.57	[SWDDS.2.2.58] RteApp_WriteCtrMode .....	124
1.1.2.57.1	Detailed Design .....	124
1.1.2.57.2	Static View Design .....	125
1.1.2.57.3	Dynamic View Design .....	125
1.1.2.57.4	Interface Design .....	125
1.1.2.58	[SWDDS.2.2.59] RteApp_WriteRefCur .....	125
1.1.2.58.1	Detailed Design .....	125
1.1.2.58.2	Static View Design .....	125
1.1.2.58.3	Dynamic View Design .....	125
1.1.2.58.4	Interface Design .....	125
1.1.2.59	[SWDDS.2.2.60] RteApp_WriteSpdErr .....	125
1.1.2.59.1	Detailed Design .....	126
1.1.2.59.2	Static View Design .....	126
1.1.2.59.3	Dynamic View Design .....	126
1.1.2.59.4	Interface Design .....	126
1.1.3	[SWDDS.2.3] Rtelo .....	126
1.1.3.1	[SWDDS.2.3.1] Rtelo_Init .....	126
1.1.3.1.1	Detailed Design .....	126
1.1.3.1.2	Static View Design .....	128
1.1.3.1.3	Dynamic View Design .....	129
1.1.3.1.4	Interface Design .....	129
1.1.3.2	[SWDDS.2.3.2] InitializeRteloSrv .....	129

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	12

1.1.3.2.1	Detailed Design .....	129
1.1.3.2.2	Static View Design .....	130
1.1.3.2.3	Dynamic View Design .....	131
1.1.3.2.4	Interface Design .....	131
1.1.3.3	[SWDDS.2.3.3] Rtelo_EnaGlobalInterrupt .....	131
1.1.3.3.1	Detailed Design .....	131
1.1.3.3.2	Static View Design .....	132
1.1.3.3.3	Dynamic View Design .....	133
1.1.3.3.4	Interface Design .....	133
1.1.3.4	[SWDDS.2.3.4] Rtelo_DisGlobalInterrupt .....	133
1.1.3.4.1	Detailed Design .....	133
1.1.3.4.2	Static View Design .....	134
1.1.3.4.3	Dynamic View Design .....	134
1.1.3.4.4	Interface Design .....	134
1.1.3.5	[SWDDS.2.3.5] Rtelo_ChkWdtTimRdy .....	134
1.1.3.5.1	Detailed Design .....	134
1.1.3.5.2	Static View Design .....	135
1.1.3.5.3	Dynamic View Design .....	136
1.1.3.5.4	Interface Design .....	136
1.1.3.6	[SWDDS.2.3.6] Rtelo_RstWdtTim .....	136
1.1.3.6.1	Detailed Design .....	136
1.1.3.6.2	Static View Design .....	137
1.1.3.6.3	Dynamic View Design .....	138
1.1.3.6.4	Interface Design .....	138
1.1.3.7	[SWDDS.2.3.7] Rtelo_EnaTimRun .....	138
1.1.3.7.1	Detailed Design .....	138
1.1.3.7.2	Static View Design .....	139
1.1.3.7.3	Dynamic View Design .....	139
1.1.3.7.4	Interface Design .....	139
1.1.3.8	[SWDDS.2.3.8] Rtelo_GetSlFocStaDat .....	140
1.1.3.8.1	Detailed Design .....	140
1.1.3.8.2	Static View Design .....	141
1.1.3.8.3	Dynamic View Design .....	142
1.1.3.8.4	Interface Design .....	142
1.1.3.9	[SWDDS.2.3.9] Rtelo_GetCtrState .....	142
1.1.3.9.1	Detailed Design .....	143
1.1.3.9.2	Static View Design .....	144
1.1.3.9.3	Dynamic View Design .....	144
1.1.3.9.4	Interface Design .....	144
1.1.3.10	[SWDDS.2.3.10] Rtelo_GetSpdOut .....	144
1.1.3.10.1	Detailed Design .....	144
1.1.3.10.2	Static View Design .....	145
1.1.3.10.3	Dynamic View Design .....	145
1.1.3.10.4	Interface Design .....	145
1.1.3.11	[SWDDS.2.3.11] Rtelo_GetCurOut .....	146
1.1.3.11.1	Detailed Design .....	146

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	13

1.1.3.11.2 Static View Design .....	147
1.1.3.11.3 Dynamic View Design .....	147
1.1.3.11.4 Interface Design .....	147
1.1.3.12 [SWDDS.2.3.12] Rtelo_GetCurErr .....	147
1.1.3.12.1 Detailed Design .....	147
1.1.3.12.2 Static View Design .....	148
1.1.3.12.3 Dynamic View Design .....	148
1.1.3.12.4 Interface Design .....	148
1.1.3.13 [SWDDS.2.3.13] Rtelo_GetCtrFlt .....	149
1.1.3.13.1 Detailed Design .....	149
1.1.3.13.2 Static View Design .....	150
1.1.3.13.3 Dynamic View Design .....	150
1.1.3.13.4 Interface Design .....	150
1.1.3.14 [SWDDS.2.3.14] Rtelo_GetDcVolt .....	150
1.1.3.14.1 Detailed Design .....	150
1.1.3.14.2 Static View Design .....	151
1.1.3.14.3 Dynamic View Design .....	151
1.1.3.14.4 Interface Design .....	151
1.1.3.15 [SWDDS.2.3.15] Rtelo_SetSIFocCtrDat .....	151
1.1.3.15.1 Detailed Design .....	151
1.1.3.15.2 Static View Design .....	153
1.1.3.15.3 Dynamic View Design .....	153
1.1.3.15.4 Interface Design .....	153
1.1.3.16 [SWDDS.2.3.16] Rtelo_ClrSIFocFltSta .....	153
1.1.3.16.1 Detailed Design .....	154
1.1.3.16.2 Static View Design .....	155
1.1.3.16.3 Dynamic View Design .....	155
1.1.3.16.4 Interface Design .....	155
1.1.3.17 [SWDDS.2.3.17] Rtelo_PrechrgCurlIntg .....	155
1.1.3.17.1 Detailed Design .....	156
1.1.3.17.2 Static View Design .....	157
1.1.3.17.3 Dynamic View Design .....	157
1.1.3.17.4 Interface Design .....	157
1.1.3.18 [SWDDS.2.3.18] Rtelo_GetPcbTempSig .....	157
1.1.3.18.1 Detailed Design .....	157
1.1.3.18.2 Static View Design .....	158
1.1.3.18.3 Dynamic View Design .....	159
1.1.3.18.4 Interface Design .....	159
1.1.3.19 [SWDDS.2.3.19] Rtelo_GetBatVolt .....	159
1.1.3.19.1 Detailed Design .....	160
1.1.3.19.2 Static View Design .....	161
1.1.3.19.3 Dynamic View Design .....	161
1.1.3.19.4 Interface Design .....	161
1.1.3.20 [SWDDS.2.3.20] Rtelo_ChkGdrvVlsLow .....	162
1.1.3.20.1 Detailed Design .....	162
1.1.3.20.2 Static View Design .....	163

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	14

1.1.3.20.3	Dynamic View Design .....	163
1.1.3.20.4	Interface Design .....	163
1.1.3.21	[SWDDS.2.3.21] Rtelo_ChkCanReqMsg .....	164
1.1.3.21.1	Detailed Design .....	164
1.1.3.21.2	Static View Design .....	165
1.1.3.21.3	Dynamic View Design .....	165
1.1.3.21.4	Interface Design .....	165
1.1.3.22	[SWDDS.2.3.22] Rtelo_GetTgtSpd .....	165
1.1.3.22.1	Detailed Design .....	165
1.1.3.22.2	Static View Design .....	166
1.1.3.22.3	Dynamic View Design .....	167
1.1.3.22.4	Interface Design .....	167
1.1.3.23	[SWDDS.2.3.23] Rtelo_GetCanBusSta .....	167
1.1.3.23.1	Detailed Design .....	168
1.1.3.23.2	Static View Design .....	169
1.1.3.23.3	Dynamic View Design .....	169
1.1.3.23.4	Interface Design .....	169
1.1.3.24	[SWDDS.2.3.24] Rtelo_SetCanSlp .....	169
1.1.3.24.1	Detailed Design .....	170
1.1.3.24.2	Static View Design .....	171
1.1.3.24.3	Dynamic View Design .....	171
1.1.3.24.4	Interface Design .....	171
1.1.3.25	[SWDDS.2.3.25] Rtelo_SendResMsg .....	171
1.1.3.25.1	Detailed Design .....	171
1.1.3.25.2	Static View Design .....	173
1.1.3.25.3	Dynamic View Design .....	173
1.1.3.25.4	Interface Design .....	173
1.1.3.26	[SWDDS.2.3.26] Rtelo_SaveEepromDat .....	173
1.1.3.26.1	Detailed Design .....	174
1.1.3.26.2	Static View Design .....	175
1.1.3.26.3	Dynamic View Design .....	175
1.1.3.26.4	Interface Design .....	175
1.1.3.27	[SWDDS.2.3.27] Rtelo_LoadEepromLong .....	176
1.1.3.27.1	Detailed Design .....	176
1.1.3.27.2	Static View Design .....	177
1.1.3.27.3	Dynamic View Design .....	177
1.1.3.27.4	Interface Design .....	177
1.1.3.28	[SWDDS.2.3.28] Rtelo_GetCtrEna .....	178
1.1.3.28.1	Detailed Design .....	178
1.1.3.28.2	Static View Design .....	178
1.1.3.28.3	Dynamic View Design .....	178
1.1.3.28.4	Interface Design .....	178
1.1.3.29	[SWDDS.2.3.29] Rtelo_LoadEepromByte .....	178
1.1.3.29.1	Detailed Design .....	178
1.1.3.29.2	Static View Design .....	178
1.1.3.29.3	Dynamic View Design .....	178

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	15

1.1.3.29.4	Interface Design .....	178
1.1.3.30	[SWDDS.2.3.30] Rtelo_LoadEepromWord .....	178
1.1.3.30.1	Detailed Design .....	178
1.1.3.30.2	Static View Design .....	178
1.1.3.30.3	Dynamic View Design .....	179
1.1.3.30.4	Interface Design .....	179
1.1.3.31	[SWDDS.2.3.31] Rtelo_RstOpuSw .....	179
1.1.3.31.1	Detailed Design .....	179
1.1.3.31.2	Static View Design .....	179
1.1.3.31.3	Dynamic View Design .....	179
1.1.3.31.4	Interface Design .....	179
1.1.4	[SWDDS.2.4] RteDiag .....	179
1.1.4.1	[SWDDS.2.4.1] RteDiag_Init .....	179
1.1.4.1.1	Detailed Design .....	179
1.1.4.1.2	Static View Design .....	180
1.1.4.1.3	Dynamic View Design .....	180
1.1.4.1.4	Interface Design .....	180
1.2	[SWDDS.3] BSW .....	181
1.2.1	[SWDDS.3.1] SCH .....	181
1.2.1.1	[SWDDS.3.1.1] BswSch .....	181
1.2.1.1.1	[SWDDS.3.1.1.1] BswSch_Init .....	181
1.2.1.1.2	[SWDDS.3.1.1.2] BswSch_DispatchTask .....	184
1.2.1.1.3	[SWDDS.3.1.1.3] BswSch_ChkTaskCnt .....	187

## List of Tables

Table 1 Version History

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	16

## 1 Function Description

### 1.1 [SWDDS.2] RTE

#### 1.1.1 [SWDDS.2.1] RteSch

RteSch define task of EOP Software.

Tasks is divided into times such as 1ms, 5ms, 10ms, 20ms, 50ms, 100ms.

##### 1.1.1.1 [SWDDS.2.1.1] RteSch\_Init

###### 1.1.1.1.1 Detailed Design

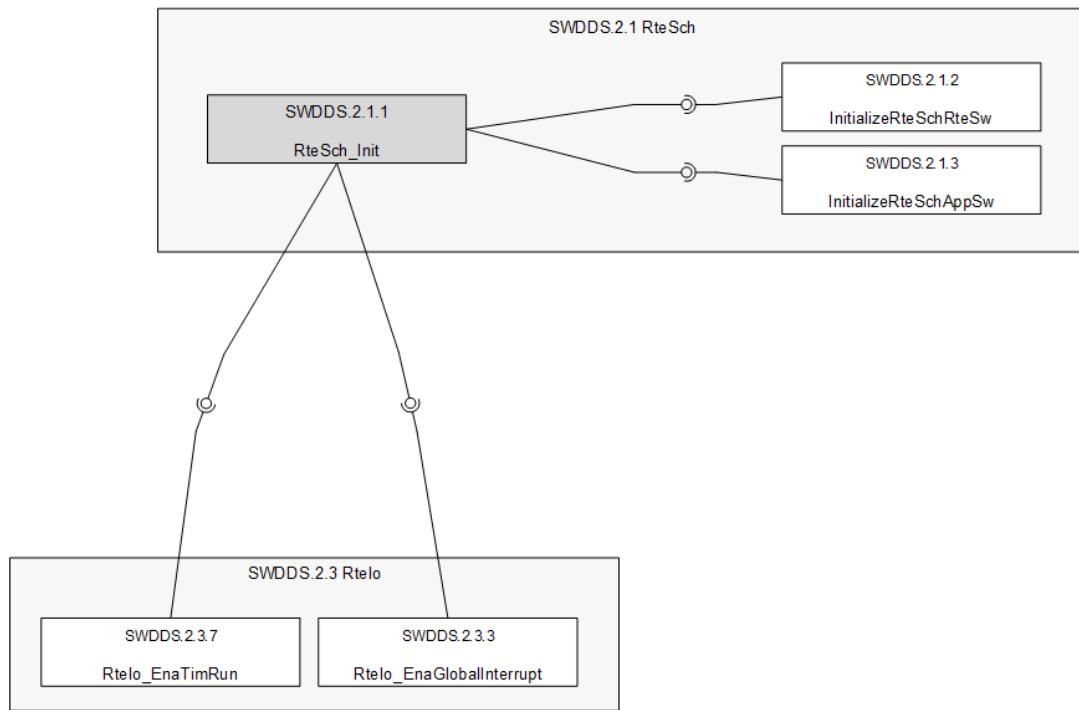
###### [SWDDS.2.1.1] RteSch\_Init

Software Unit Information					
Unit ID	SWDDS.2.1.1	Unit Name	RteSch_Init		
Architecture ID	SWADS.2.1.1	ASIL	QM		
Prototype	void RteSch_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	RTE scheduler initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.2.1.2]     InitializeRteSchRteSw();           [SWDDS.2.1.3]     InitializeRteSchAppSw();           [SWDDS.2.3.7]     Rtelo_EnaTimRun();           [SWDDS.2.3.3]     Rtelo_EnaGlobalInterrupt();           end   </pre>				
Called Function	SWDDS.5 main				
Calling Function	SWDDS.2.1.2 InitializeRteSchRteSw SWDDS.2.1.3 InitializeRteSchAppSw SWDDS.2.3.7 Rtelo_EnaTimRun SWDDS.2.3.3 Rtelo_EnaGlobalInterrupt				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	17

Requirement Id	SWDDS.2.1.1
Target Milestone	EBS2
Element	RteSch
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.2 Static View Design



#### 1.1.1.1.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	18

#### 1.1.1.1.4 Interface Design

- N/A

#### 1.1.1.2 [SWDDS.2.1.2] InitializeRteSchRteSw

##### 1.1.1.2.1 Detailed Design

###### [SWDDS.2.1.2] initializeRteSchRteSw

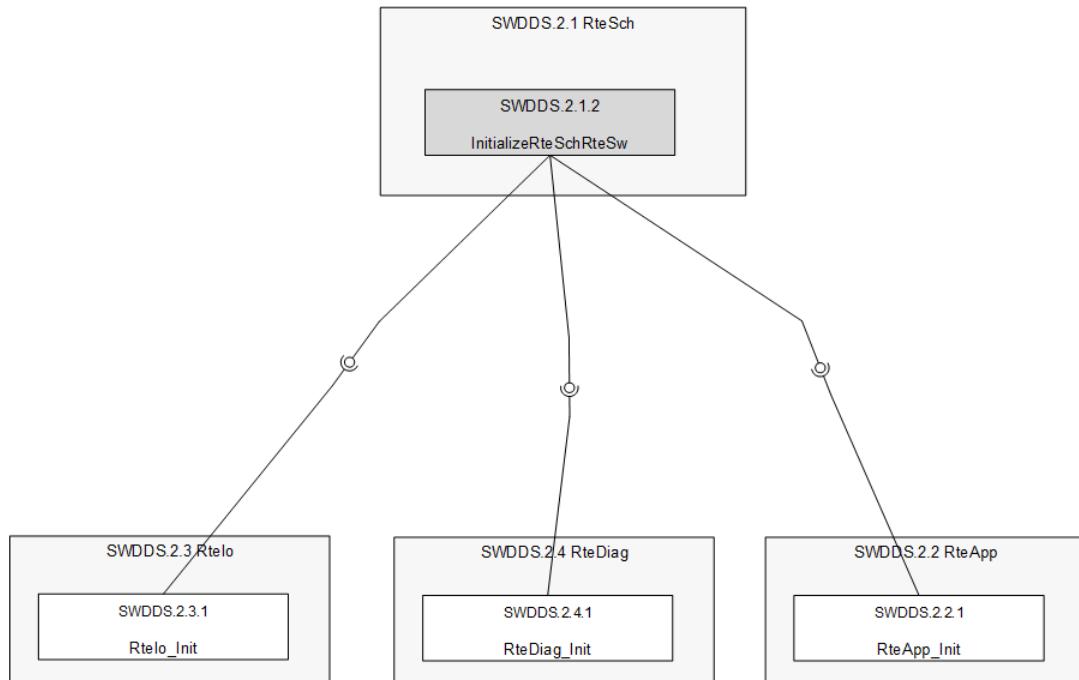
Software Unit Information					
Unit ID	SWDDS.2.1.2	Unit Name	InitializeRteSchRteSw		
Architecture ID	SWADS.2.1.2	ASIL	QM		
Prototype	void InitializeRteSchRteSw( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Run-time environment initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [SWDDS.2.3.1]     RteLo_Init();     ↓     [SWDDS.2.4.1]     RteDiag_Init();     ↓     [SWDDS.2.2.1]     RteApp_Init();     ↓     end   </pre>				
Called Function	SWDDS.2.1.1 RteSch_Init				
Calling Function	SWDDS.2.3.1 RteLo_Init				
	SWDDS.2.4.1 RteDiag_Init				
	SWDDS.2.2.1 RteApp_Init				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.2
Target Milestone	EBS2
Element	RteSch

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	19

Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

#### 1.1.1.2.2 Static View Design



#### 1.1.1.2.3 Dynamic View Design

- N/A

#### 1.1.1.2.4 Interface Design

- N/A

#### 1.1.1.3 [SWDDS.2.1.3] InitializeRteSchAppSw

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	20

### 1.1.1.3.1 Detailed Design

#### [SWDDS.2.1.3] initializeRteSchAppSw

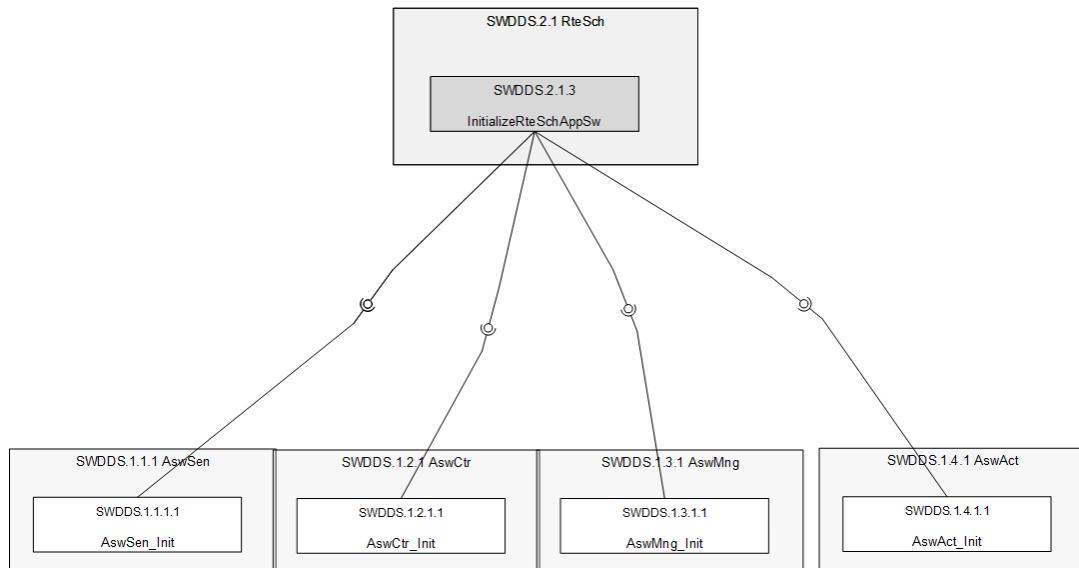
Software Unit Information					
Unit ID	SWDDS.2.1.3	Unit Name		InitializeRteSchAppSw	
Architecture ID	SWADS.2.1.3	ASIL		QM	
Prototype	void InitializeRteSchAppSw( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Application software initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.1.1.1.1]     AswSen_Init();           [SWDDS.1.2.1.1]     AswCtr_Init();           [SWDDS.1.3.1.1]     AswMng_Init();           [SWDDS.1.4.1.1]     AswAct_Init();           end   </pre>				
Called Function	SWDDS.2.1.1 RteSch_Init				
Calling Function	SWDDS.1.1.1.1 AswSen_Init				
	SWDDS.1.2.1.1 AswCtr_Init				
	SWDDS.1.3.1.1 AswMng_Init				
	SWDDS.1.4.1.1 AswAct_Init				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.3
Target Milestone	EBS2
Element	RteSch
Risk	Low
Interoperability	No
Criticality	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	21

Technical complexity	Low
Verifiability	Yes

#### 1.1.1.3.2 Static View Design



#### 1.1.1.3.3 Dynamic View Design

- N/A

#### 1.1.1.3.4 Interface Design

- N/A

[Deleted] ~~+SWDDS.2.1.4] IncreaseRteSchOpnTimCnt~~

#### 1.1.1.4 [SWDDS.2.1.5] RteSch\_MainFunc

##### 1.1.1.4.1 Detailed Design

###### [SWDDS.2.1.5] RteSch\_MainFunc

Software Unit Information					
Unit ID	SWDDS.2.1.5	Unit Name	RteSch_MainFunc		
Architecture ID	SWADS.2.1.5	ASIL	QM		
Prototype	void RteSch_MainFunc( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A

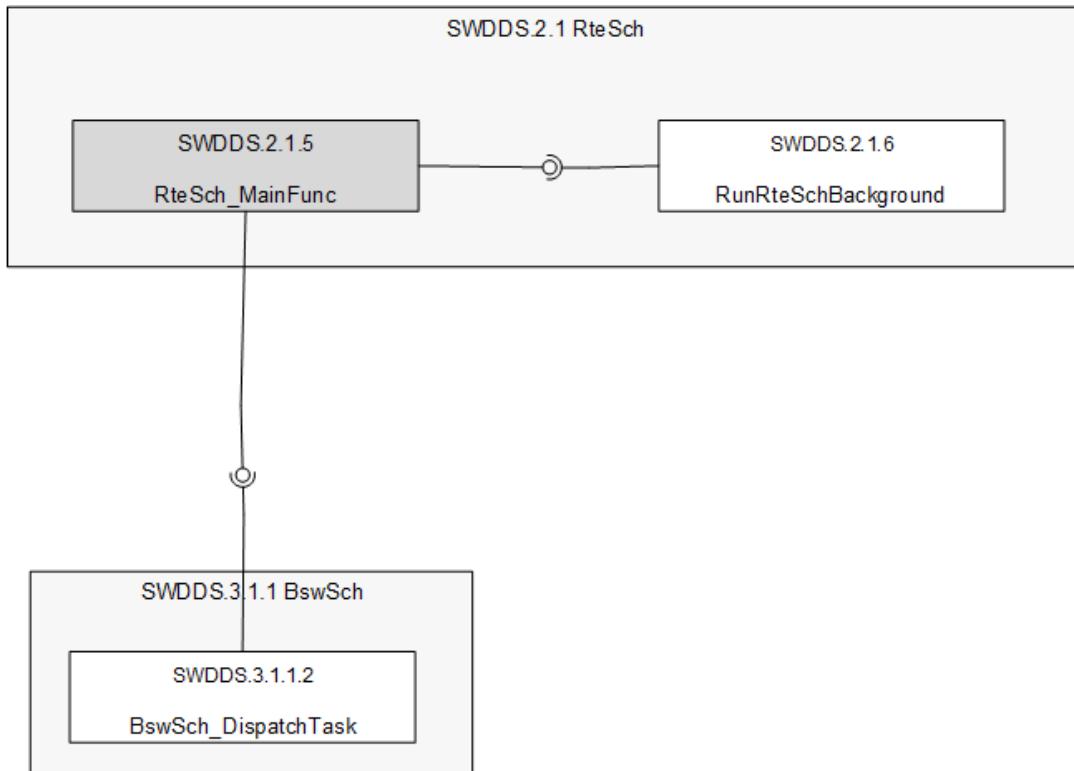
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	22

Function Call Return Value	Data Type	Possible Return Value		Description	
		N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Scheduler main function				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; BswSch_DispatchTask[SWDDS.3.1.1.2 BswSch_DispatchTask();]     BswSch_DispatchTask --&gt; RunRteSchBackground[SWDDS.2.1.6 RunRteSchBackground();]     RunRteSchBackground --&gt; end([end])     </pre>				
Called Function	SWDDS.5 main				
Calling Function	SWDDS.3.1.1.2 BswSch_DispatchTask SWDDS.2.1.6 RunRteSchBackground				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.5
Target Milestone	EBS2
Element	RteSch
Risk	Low
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

#### 1.1.1.4.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	23



#### 1.1.1.4.3 Dynamic View Design

– N/A

#### 1.1.1.4.4 Interface Design

– N/A

#### 1.1.1.5 [SWDDS.2.1.6] RunRteSchBackground

##### 1.1.1.5.1 Detailed Design

##### [SWDDS.2.1.6] RunRteSchBackground

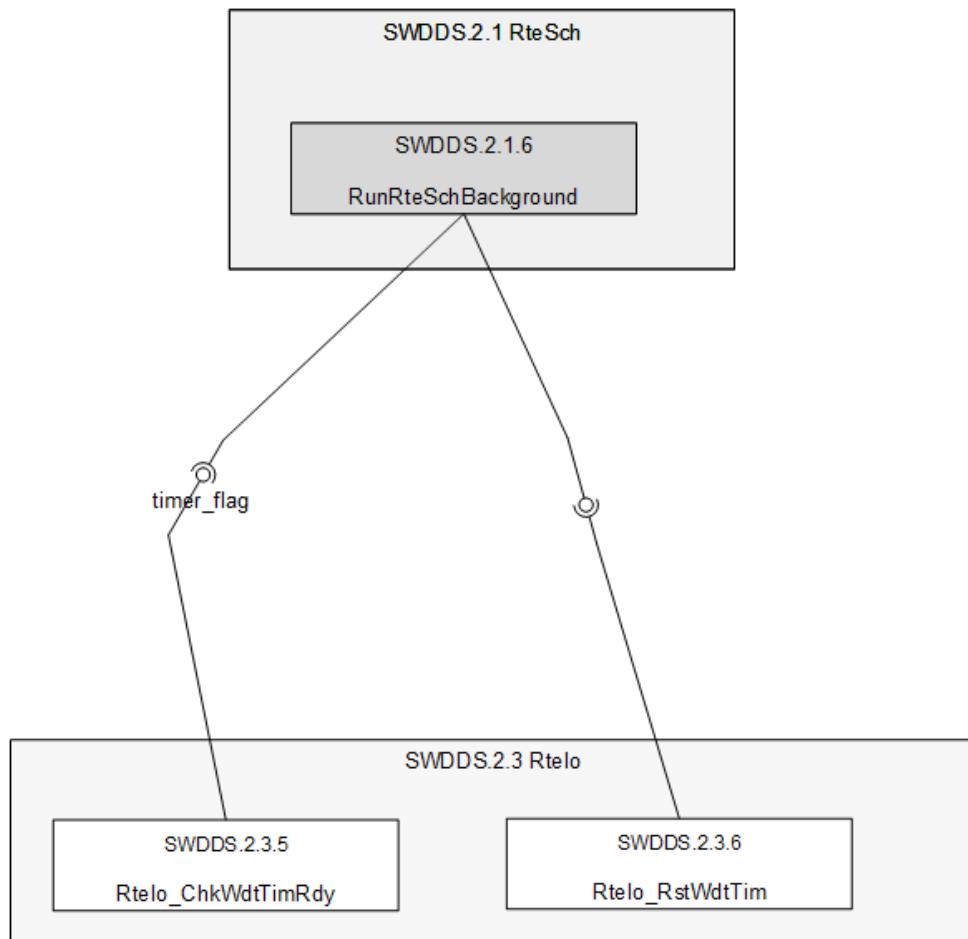
Software Unit Information					
Unit ID	SWDDS.2.1.6		Unit Name	RunRteSchBackground	
Architecture ID	SWADS.2.1.6		ASIL	QM	
Prototype	void RunRteSchBackground( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Background task running				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; decision{Rtelo_ChkWdtTimRdy() != FALSE}     decision -- yes --&gt; action1[Rtelo_RstWdtTim();]     action1 --&gt; end([end])     decision -- no --&gt; end   </pre>				
Called Function	SWDDS.2.1.5 RteSch_MainFunc				
Calling Function	SWDDS.2.3.5 Rtelo_ChkWdtTimRdy SWDDS.2.3.6 Rtelo_RstWdtTim				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.6
Target Milestone	EBS2
Element	RteSch
Risk	Low
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 1.1.1.5.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	25



#### 1.1.1.5.3 Dynamic View Design

- N/A

#### 1.1.1.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	timer_flag	SWDDS.2.3.5	IN	tBool	0	1	Watchdog timer not ready	Watchdog timer ready	FALSE – not ready, TRUE – timing ready	Timer channel 3 flag

### 1.1.1.6 [SWDDS.2.1.7] RteSch\_Task1ms

#### 1.1.1.6.1 Detailed Design

##### [SWDDS.2.1.7] RteSch\_Task1ms

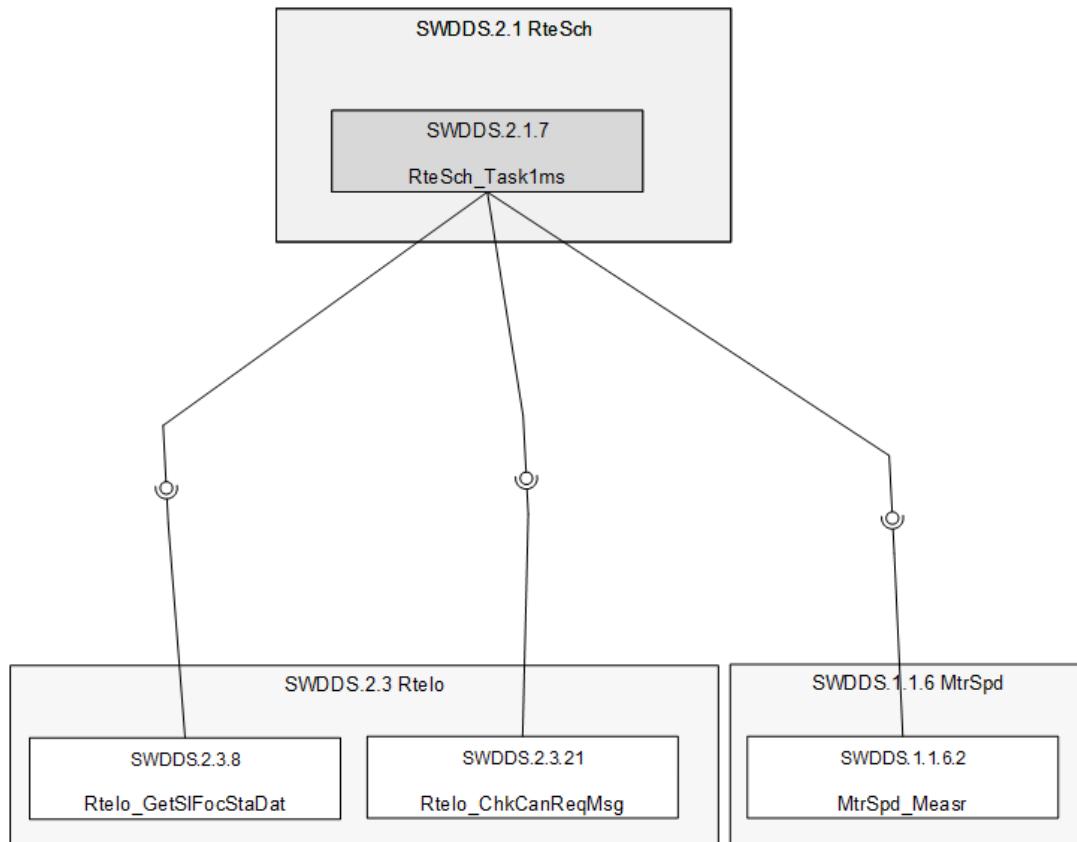
Software Unit Information					
Unit ID	SWDDS.2.1.7	Unit Name	RteSch_Task1ms		
Architecture ID	SWADS.2.1.7	ASIL	QM		
Prototype	void RteSch_Task1ms( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	1ms task called from static scheduler				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.2.3.8]     Rtelo_GetSIfoCstaDat();           {g_eRteSchOprMode == OPR_MODE_STARTUP}?         yes: [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();                   [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();     no:     {g_eRteSchOprMode == OPR_MODE_NORMAL}?         yes: [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();                   [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();     no:     {g_eRteSchOprMode == OPR_MODE_DIAGNOSIS}?         yes: [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();                   [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();     no:     {g_eRteSchOprMode == OPR_MODE_SHUTDOWN}?         yes: [SWDDS.1.1.6.2]         MtrSpd_Measr();                   [SWDDS.2.3.21]         Rtelo_ChkCanReqMsg();                   [SWDDS.1.1.6.2]         MtrSpd_Measr();     no:     end   </pre>				
Called Function	SWDDS.3.1.1.2 BswSch_DispatchTask SWDDS.2.3.8 Rtelo_GetSIfoCstaDat SWDDS.2.3.21 Rtelo_ChkCanReqMsg				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	27

Calling Function	SWDDS.1.1.6.2 MtrSpd_Measr
Function Execution Time	N/A

Requirement Id	SWDDS.2.1.7
Target Milestone	EBS2
Element	RteSch
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

#### 1.1.1.6.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	28

#### 1.1.1.6.3 Dynamic View Design

- N/A

#### 1.1.1.6.4 Interface Design

- N/A

#### 1.1.1.7 [SWDDS.2.1.8] RteSch\_Task5ms

##### 1.1.1.7.1 Detailed Design

###### [SWDDS.2.1.8] RteSch\_Task5ms

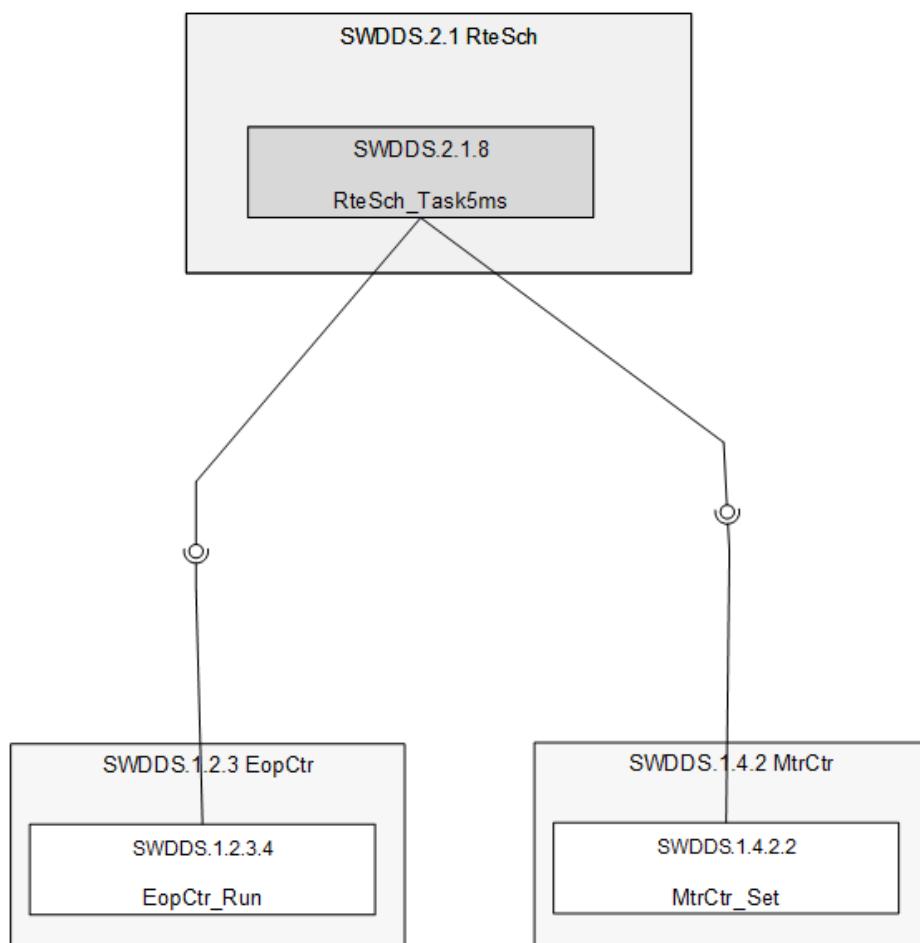
Software Unit Information					
Unit ID	SWDDS.2.1.8	Unit Name	RteSch_Task5ms		
Architecture ID	SWADS.2.1.8	ASIL	QM		
Prototype	void RteSch_Task5ms( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	5ms task called from static scheduler				

Control Flow Diagram  
(or Pseudo Code)

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; mode{g_eRteSchOprMode == OPR_MODE_STARTUP}     mode -- yes --&gt; modeNormal{g_eRteSchOprMode == OPR_MODE_NORMAL}     modeNormal -- no --&gt; modeDiagnosis{g_eRteSchOprMode == OPR_MODE_DIAGNOSIS}     modeDiagnosis -- no --&gt; modeShutdown{g_eRteSchOprMode == OPR_MODE_SHUTDOWN}     modeShutdown -- no --&gt; end((end))     modeNormal -- yes --&gt; EopCtrRun1[SWDDS.1.2.3.4 EopCtr_Run();]     EopCtrRun1 --&gt; MtrCtrSet1[SWDDS.1.4.2.2 MtrCtr_Set();]     modeDiagnosis -- yes --&gt; EopCtrRun2[SWDDS.1.2.3.4 EopCtr_Run();]     modeShutdown -- yes --&gt; EopCtrRun3[SWDDS.1.2.3.4 EopCtr_Run();]     EopCtrRun3 --&gt; MtrCtrSet3[SWDDS.1.4.2.2 MtrCtr_Set();] </pre>
	Called Function SWDDS.3.1.1.2 BswSch_DispatchTask
	Calling Function SWDDS.1.2.3.4 EopCtr_Run SWDDS.1.4.2.2 MtrCtr_Set
	Function Execution Time N/A

Requirement Id	SWDDS.2.1.8
Target Milestone	EBS2
Element	RteSch
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

### 1.1.1.7.2 Static View Design



#### 1.1.1.7.3 Dynamic View Design

- N/A

#### 1.1.1.7.4 Interface Design

- N/A

#### 1.1.1.8 [SWDDDS.2.1.9] RteSch\_Task10ms

##### 1.1.1.8.1 Detailed Design

##### [SWDDDS.2.1.9] RteSch\_Task10ms

Software Unit Information					
Unit ID	SWDDDS.2.1.9	Unit Name	RteSch_Task10ms		
Architecture ID	SWADS.2.1.9	ASIL	QM		
Prototype	void RteSch_Task10ms( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A

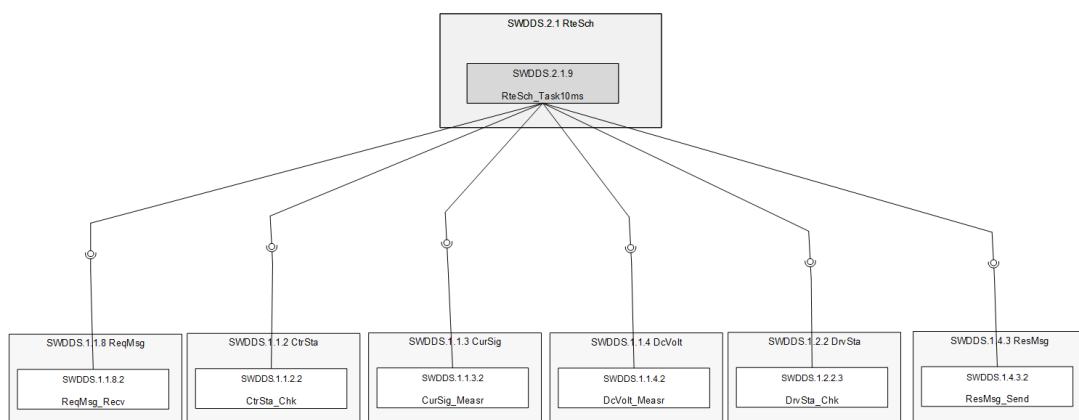
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	10ms task called from static scheduler				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     {if g_eRteSchOprMode == OPR_MODE_STARTUP}         yes     {else if g_eRteSchOprMode == OPR_MODE_NORMAL}         yes         [SWDDS.1.1.8.2] ReqMsg_Recv();         [SWDDS.1.1.2.2] CtrSta_Cchk();         [SWDDS.1.1.3.2] CurSig_Measr();         [SWDDS.1.1.4.2] DcVolt_Measr();         [SWDDS.1.2.2.3] DrvSta_Cchk();         [SWDDS.1.4.3.2] ResMsg_Send();     {else if g_eRteSchOprMode == OPR_MODE_DIAGNOSIS}         yes         [SWDDS.1.1.8.2] ReqMsg_Recv();         [SWDDS.1.1.2.2] CtrSta_Cchk();         [SWDDS.1.1.3.2] CurSig_Measr();         [SWDDS.1.1.4.2] DcVolt_Measr();         [SWDDS.1.2.2.3] DrvSta_Cchk();         [SWDDS.1.4.3.2] ResMsg_Send();     {else if g_eRteSchOprMode == OPR_MODE_SHUTDOWN}         yes         [SWDDS.1.1.2.2] CtrSta_Cchk();         [SSWDDS.1.4.3.2] ResMsg_Send();     {end if}     end   </pre>				
Called Function	SWDDS.3.1.1.2 BswSch_DispatchTask				
Calling Function	SWDDS.1.1.8.2 ReqMsg_Recv				
	SWDDS.1.1.2.2 CtrSta_Cchk				
	SWDDS.1.1.3.2 CurSig_Measr				
	SWDDS.1.1.4.2 DcVolt_Measr				
	SWDDS.1.2.2.3 DrvSta_Cchk				
	SWDDS.1.4.3.2 ResMsg_Send				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.9
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	32

Element	RteSch
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.1.8.2 Static View Design



#### 1.1.1.8.3 Dynamic View Design

- N/A

#### 1.1.1.8.4 Interface Design

- N/A

#### 1.1.1.9 [SWDDS.2.1.10] RteSch\_Task20ms

##### 1.1.1.9.1 Detailed Design

##### [SWDDS.2.1.10] RteSch\_Task20ms

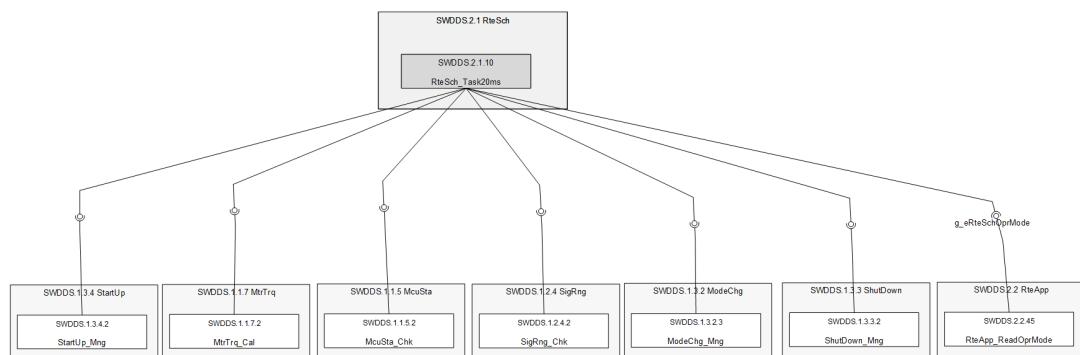
Software Unit Information				
Unit ID	SWDDS.2.1.10	Unit Name	RteSch_Task20ms	
Architecture ID	SWADS.2.1.10	ASIL	QM	
Prototype				
Function Call Parameters	Data Type	Name	Range	IN/OUT
N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description	
void	N/A	N/A	N/A	

Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read/Write	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	20ms task called from static scheduler				
Control Flow Diagram (or Pseudo Code)	<pre>     start           { g_eRteSchOprMode == OPR_MODE_STARTUP } -- yes --&gt; [SWDDS.1.3.4.2] StartUp_Mng();           { g_eRteSchOprMode == OPR_MODE_NORMAL } -- yes --&gt; [SWDDS.1.1.7.2] MtrTrq_Cal();           { g_eRteSchOprMode == OPR_MODE_DIAGNOSIS } -- yes --&gt; [SWDDS.1.1.7.2] MtrTrq_Cal();           { g_eRteSchOprMode == OPR_MODE_SHUTDOWN } -- yes --&gt; [SWDDS.1.3.3.2] ShutDown_Mng();           { g_eRteSchOprMode == OPR_MODE_SHUTDOWN } -- no --&gt; [SWDDS.1.3.3.2] ShutDown_Mng();           [SWDDS.2.2.45] g_eRteSchOprMode = RteApp_ReadOprMode();           end   </pre>				
Called Function	SWDDS.3.1.1.2 BswSch_DispatchTask				
Calling Function	SWDDS.1.3.4.2 StartUp_Mng SWDDS.1.1.7.2 MtrTrq_Cal SWDDS.1.1.5.2 McuSta_Chk SWDDS.1.2.4.2 SigRng_Chk SWDDS.1.3.2.3 ModeChg_Mng SWDDS.1.3.3.2 ShutDown_Mng SWDDS.2.2.45 RteApp_ReadOprMode				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.10
Target Milestone	EBS2
Element	RteSch
Risk	Mid

Interoperability	No
Criticality	<span style="background-color: #ccc; border: 1px solid black; padding: 2px;">Mid</span>
Technical complexity	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">Low</span>
Verifiability	Yes

#### 1.1.1.9.2 Static View Design



#### 1.1.1.9.3 Dynamic View Design

- N/A

#### 1.1.1.9.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_eRteSchOprMode	SWDDS.2.2.45	IN	tOprMode	0	5	OPR_MODE_OFF	OPR_MODE_TEST	N/A	Current operating mode

#### 1.1.1.10 [SWDDS.2.1.11] RteSch\_Task50ms

##### 1.1.1.10.1 Detailed Design

###### [SWDDS.2.1.11] RteSch\_Task50ms

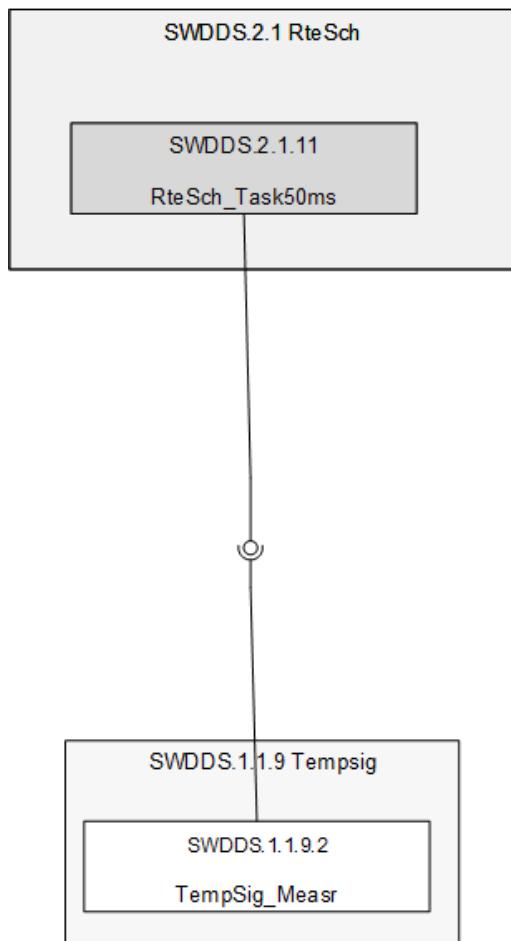
Software Unit Information					
Unit ID	SWDDS.2.1.11		Unit Name	RteSch_Task50ms	
Architecture ID	SWADS.2.1.11		ASIL	QM	
Prototype	void RteSch_Task50ms( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		

Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read/Write	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	50ms task called from static scheduler				
Control Flow Diagram (or Pseudo Code)	<pre>     start           { g_eRteSchOprMode == OPR_MODE_STARTUP } -- yes --&gt;           { g_eRteSchOprMode == OPR_MODE_NORMAL } -- yes --&gt; [SWDDS.1.1.9.2] TempSig_Measr();           { g_eRteSchOprMode == OPR_MODE_DIAGNOSIS } -- yes --&gt; [SWDDS.1.1.9.2] TempSig_Measr();           { g_eRteSchOprMode == OPR_MODE_SHUTDOWN } -- yes --&gt;           end   </pre>				
Called Function	SWDDS.3.1.1.2 BswSch_DispatchTask				
Calling Function	SWDDS.1.1.9.2 TempSig_Measr				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.11
Target Milestone	EBS2
Element	RteSch
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	36

#### 1.1.1.10.2 Static View Design



#### 1.1.1.10.3 Dynamic View Design

- N/A

#### 1.1.1.10.4 Interface Design

- N/A

#### 1.1.1.11 [SWDDS.2.1.12] RteSch\_Task100ms

### 1.1.1.11.1 Detailed Design

#### [SWDDS.2.1.12] RteSch\_Task100ms

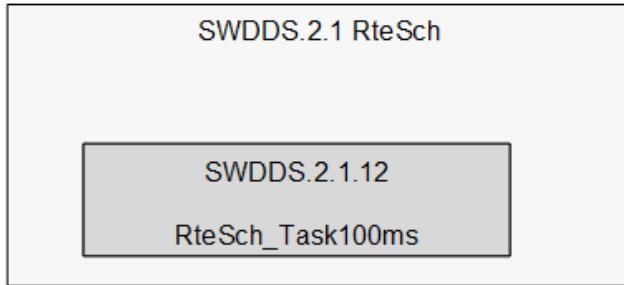
Software Unit Information					
Unit ID	SWDDS.2.1.12	Unit Name	RteSch_Task100ms		
Architecture ID	SWADS.2.1.12	ASIL	QM		
Prototype	void RteSch_Task100ms( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteSchOprMode	0 ~ 5	Read/Write	Current operating mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	100ms task called from static scheduler				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     {if g_eRteSchOprMode == OPR_MODE_STARTUP}         yes     {else if g_eRteSchOprMode == OPR_MODE_NORMAL}         yes     {else if g_eRteSchOprMode == OPR_MODE_DIAGNOSIS}         yes     {else if g_eRteSchOprMode == OPR_MODE_SHUTDOWN}         yes     {else}         no     end   </pre>				
Called Function	SWDDS.3.1.1.2 BswSch_DispatchTask				
Calling Function	SWDDS.2.1.4 IncreaseRteSchOpuTimCnt				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.1.12
----------------	--------------

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	38

Target Milestone	EBS2
Element	RteSch
Risk	<span style="color: #C8A23D;">■</span> Mid
Interoperability	No
Criticality	<span style="color: #C8A23D;">■</span> Mid
Technical complexity	<span style="color: #2ECC71;">■</span> Low
Verifiability	Yes

#### 1.1.1.11.2 Static View Design



#### 1.1.1.11.3 Dynamic View Design

– N/A

#### 1.1.1.11.4 Interface Design

– N/A

### 1.1.1.12 [SWDDS.2.1.13] RteSch\_GetOpuTimCnt

#### 1.1.1.12.1 Detailed Design

[SWDDS.2.1.13] RteSch\_GetOpuTimCnt

#### 1.1.1.12.2 Static View Design

– N/A

#### 1.1.1.12.3 Dynamic View Design

– N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
	Page	Page	39

#### 1.1.1.12.4 Interface Design

- N/A

### 1.1.2 [SWDDS.2.2] RteApp

Application data is initialized in the RteApp. And It is used to read and store obtained values in BSW. Updated Application data is also use to operate in application software Layer.

#### 1.1.2.1 [SWDDS.2.2.1] RteApp\_Init

##### 1.1.2.1.1 Detailed Design

###### [SWDDS.2.2.1] RteApp\_Init

Software Unit Information					
Unit ID	SWDDS.2.2.1		Unit Name	RteApp_Init	
Architecture ID	SWADS.2.2.1		ASIL	QM	
Prototype	void RteApp_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	ts16	g_s16RteAppTgtSpd	0 ~ 3200	Write	Target speed (rpm)
	tU16	g_u16RteAppMsgSta	0 ~ 45056	Write	Received request message status flag
	tFrac16	g_f16RteAppSpdOut	-32758 ~ 32767	Write	Speed output (PU)
	ts16	g_s16RteAppSpdFilt	-6000 ~ 6000	Write	Filtered speed (rpm)
	tCtrState	g_eRteAppCtrState	0 ~ 4	Write	Control state
	tU16	g_u16RteAppCtrFlt	0 ~ 65535	Write	Control fault flag
	tFrac16	g_f16RteAppCurOut	-32758 ~ 32767	Write	Current output (PU)
	tFrac16	g_f16RteAppCurErr	-32758 ~ 32767	Write	Current error (PU)
	tFrac16	g_f16RteAppDcCur	0 ~ 32767	Write	DC input current (PU)
	tFrac16	g_f16RteAppDcVolt	0 ~ 32767	Write	DC link voltage (PU)
	tFrac16	g_f16RteAppPcbTemp	-1311 ~ 5570	Write	PCB temperature (PU)
	tFrac16	g_f16RteAppMtrTrq	-32768 ~ 32767	Write	Motor torque output (PU)
	tFrac16	g_f16RteAppBatVolt	0 ~ 32767	Write	Battery voltage (PU)
	tU32	g_u32RteAppMcuSta	0 ~ 134217728	Write	MCU status flag
	tEopState	g_eRteAppEopState	0 ~ 4	Write	EOP control state
	tBool	g_bRteAppCtrEna	0 ~ 1	Write	Control enable
	tCtrMode	g_eRteAppCtrMode	0 ~ 1	Write	Sensorless FOC control mode
	tFrac16	g_f16RteAppRefCur	0 ~ 32767	Write	Reference current (PU)
	tFrac16	g_f16RteAppRefSpd	0 ~ 19660	Write	Reference speed (PU)
	tFrac16	g_f16RteAppCurLmtUpp	-32768 ~ 32767	Write	Current limit – upper (PU)
	tFrac16	g_f16RteAppCurLmtLow	-32768 ~ 32767	Write	Current limit – lower (PU)
			-32768 ~		

	tFrac16	g_f16RteAppSpdErr	32767	Write	Speed control error (PU)
	tU32	g_u32RteAppDrvSta	0 ~ 16776960	Write	Driving status flag
	tU32	g_u32RteAppSigRng	0 ~ 255	Write	Signal range check flag
	tOprMode	g_eRteAppOprMode	0 ~ 5	Write	Operation mode
	tFuncMode	g_eRteAppFuncMode	0 ~ 2	Write	Functional mode
	tAppMode	g_eRteAppAppMode	0 ~ 4	Write	Application mode
	tU16	g_u16RteAppOpuFlt	0 ~ 4095	Write	OPU fault
	tU16	g_u16RteAppOpuFltNo	0 ~ 65535	Write	Number of OPU fault
	tU32	g_au32RteAppFltFlagStored [RTE_APP_OPU_FLT_STORE_NO]	0 ~ 4294967295	Write	Fault flag storage
	tU32	g_u32RteAppPrevSigRng	0 ~ 255	Write	Previous signal range check flag
	tU32	g_u32RteAppPrevDrvSta	0 ~ 16776960	Write	Previous driving status check flag
	tU32	g_u32RteAppPrevMcuSta	0 ~ 134217728	Write	Previous MCU status check flag
	tU32	g_u32RteAppCombFltFlag	0 ~ 4294967295	Write	Combined fault flags
	tU32	g_u32RteAppAccumFltFlag	0 ~ 4294967295	Write	Accumulated fault flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Application data initialization				

Control Flow  
Diagram  
(or Pseudo Code)

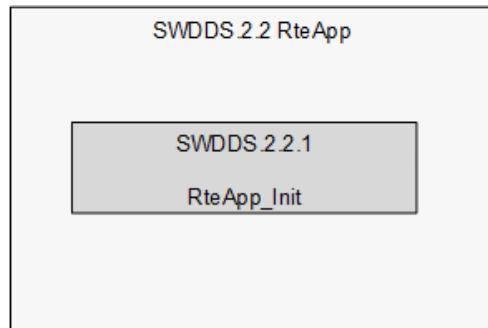
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     Volatile tu16 stored_index;     g_u16RteAppTgtSpd = 0;     g_u16RteAppMsgSta = 0x0000u;     g_f16RteAppSpdOut = FRAC16(0.0f);     g_s16RteAppSpdFilt = 0;     g_eRteAppCtrState = CTR_STATE_SWTC_OFF;     g_u16RteAppCtrFilt = 0x0000u;     g_f16RteAppCurOut = FRAC16(0.0f);     g_f16RteAppCurErr = FRAC16(0.0f);     g_f16RteAppDcCur = FRAC16(0.0f);     g_f16RteAppDcVolt = FRAC16(0.0f);     g_f16RteAppPcbTemp = FRAC16(0.0f);     g_f16RteAppMtrTrq = FRAC16(0.0f);     g_f16RteAppBattVolt = FRAC16(0.0f);     g_u32RteAppMcuSta = 0x00000000uL;     g_eRteAppEopState = EOP_STATE_DISABLED;     g_bRteAppCtrEna = FALSE;     g_eRteAppCtrMode = CTR_MODE_SPD;     g_f16RteAppRefCur = FRAC16(0.0f);     g_f16RteAppRefSpd = FRAC16(0.0f);     g_f16RteAppCurLmtUpp = FRAC16(0.0f);     g_f16RteAppCurLmtLow = FRAC16(0.0f);     g_f16RteAppSpdErr = FRAC16(0.0f);     g_u32RteAppDrvSta = 0x00000000uL;     g_u32RteAppSigRng = 0x00000000uL;     g_eRteAppOpMode = OPR_MODE_STARTUP;     g_eRteAppFuncMode = FUNC_MODE_NONE;     g_eRteAppAppMode = APP_MODE_NONE;     g_u16RteAppOpFlt = 0x0000u;     g_u16RteAppOpFltNo = 0u;   </pre>	
	stored_index = 0u;	
		stored_index++
	<pre>       stored_index &lt;       RTE_APP_OPU_FLT_STORE_NO     </pre>	<pre>       yes       g_u32RteAppFltFlagStored[stored_index] = 0x00000000uL;     </pre>
	<pre>       no       g_u32RteAppPrevSigRng = 0x00000000uL;       g_u32RteAppPrevDrvSta = 0x00000000uL;       g_u32RteAppPrevMcuSta = 0x00000000uL;       g_u32RteAppCombFltFlag = 0x00000000uL;       g_u32RteAppAccumFltFlag = 0x00000000uL;     </pre>	
		end
Called Function	SWDDS.2.1.2 InitializeRteSchRteSw	
Calling Function	N/A	
Function Execution Time	N/A	

Requirement Id	SWDDS.2.2.1
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	42

Technical complexity	Low
Verifiability	Yes

#### 1.1.2.1.2 Static View Design



#### 1.1.2.1.3 Dynamic View Design

- N/A

#### 1.1.2.1.4 Interface Design

- N/A

### 1.1.2.2 [SWDDS.2.2.2] RteApp\_ReadTgtSpd

#### 1.1.2.2.1 Detailed Design

##### [SWDDS.2.2.2] RteApp\_ReadTgtSpd

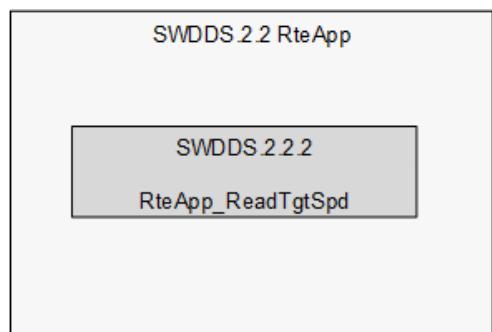
Software Unit Information					
Unit ID	SWDDS.2.2.2		Unit Name	RteApp_ReadTgtSpd	
Architecture ID	SWADS.2.2.2		ASIL	QM	
Prototype			tS16 RteApp_ReadTgtSpd( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	0 ~ 3200		Target speed (rpm)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16RteAppTgtSpd	0 ~ 3200	Read	Target speed (rpm)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Target speed reading				

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	43

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_s16RteAppTgtSpd;   </pre>
Called Function	<b>SWDDS.1.2.2.4 CheckDrvStaFlagClr</b> <b>SWDDS.1.2.3.4 EopCtr_Run</b>
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.2
Target Milestone	EBS2
Element	RteApp
Risk	 Low
Interoperability	No
Criticality	 Low
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.2.2 Static View Design



#### 1.1.2.2.3 Dynamic View Design

- N/A

#### 1.1.2.2.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	44

### 1.1.2.3 [SWDDS.2.2.3] RteApp\_WriteTgtSpd

#### 1.1.2.3.1 Detailed Design

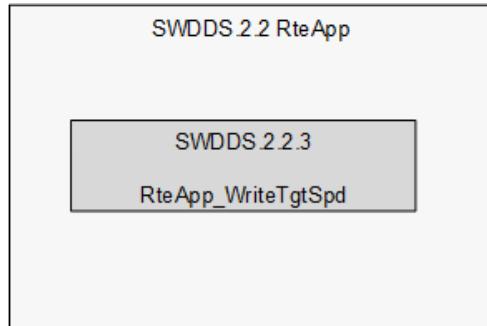
##### [SWDDS.2.2.3] RteApp\_WriteTgtSpd

Software Unit Information					
Unit ID	SWDDS.2.2.3	Unit Name	RteApp_WriteTgtSpd		
Architecture ID	SWADS.2.2.3	ASIL	QM		
Prototype	void RteApp_WriteTgtSpd( tS16 target_speed )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tS16	target_speed	0 ~ 3200	IN	target speed (rpm)
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16RteAppTgtSpd	0 ~ 3200	Write	Target speed (rpm)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Target speed writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_s16RteAppTgtSpd = target_speed;     ↓     end   </pre>				
Called Function	SWDDS.1.1.8.2 ReqMsg_Recv				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.3
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">★</span> Low
Interoperability	No
Criticality	<span style="color: green;">★</span> Low
Technical complexity	<span style="color: green;">★</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	45

#### 1.1.2.3.2 Static View Design



#### 1.1.2.3.3 Dynamic View Design

- N/A

#### 1.1.2.3.4 Interface Design

- N/A

#### 1.1.2.4 [SWDDS.2.2.4] RteApp\_ReadMsgSta

##### 1.1.2.4.1 Detailed Design

###### [SWDDS.2.2.4] RteApp\_ReadMsgSta

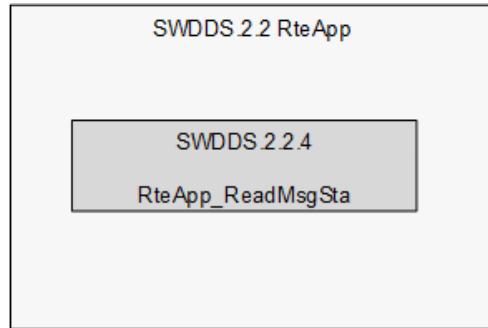
Software Unit Information					
Unit ID	SWDDS.2.2.4	Unit Name	RteApp_ReadMsgSta		
Architecture ID	SWADS.2.2.4	ASIL	QM		
Prototype	tU16 RteApp_ReadMsgSta( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 45056		Received message state flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppMsgSta	0 ~ 45056	Read	Received request message status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Received message state flag reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return[return g_u16RteAppMsgSta;]   </pre>				
Called Function	SWDDS.1.3.2.3 ModeChg_Mng				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	46

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.4
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.4.2 Static View Design



#### 1.1.2.4.3 Dynamic View Design

- N/A

#### 1.1.2.4.4 Interface Design

- N/A

#### 1.1.2.5 [SWDDS.2.2.5] RteApp\_WriteMsgSta

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	47

#### 1.1.2.5.1 Detailed Design

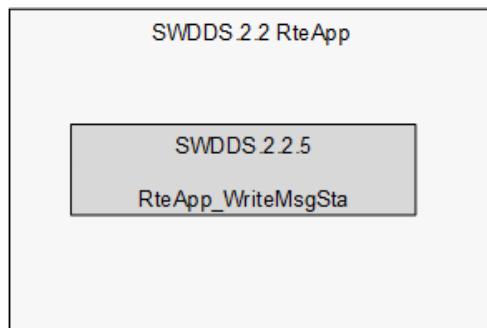
##### [SWDDS.2.2.5] RteApp\_WriteMsgSta

Software Unit Information					
Unit ID	SWDDS.2.2.5		Unit Name	RteApp_WriteMsgSta	
Architecture ID	SWADS.2.2.5		ASIL	QM	
Prototype	void RteApp_WriteMsgSta( tU16 state_flag )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	state_flag	0 ~ 45056	IN	received message state flag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppMsgSta	0 ~ 45056	Write	Received request message status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Received message state flag writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u16RteAppMsgSta = state_flag;     ↓     end   </pre>				
Called Function	SWDDS.1.1.8.2 ReqMsg_Recv				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.5
Target Milestone	SBS2.1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	48

#### 1.1.2.5.2 Static View Design



#### 1.1.2.5.3 Dynamic View Design

- N/A

#### 1.1.2.5.4 Interface Design

- N/A

### 1.1.2.6 [SWDDS.2.2.6] RteApp\_ReadSpdOut

#### 1.1.2.6.1 Detailed Design

##### [SWDDS.2.2.6] RteApp\_ReadSpdOut

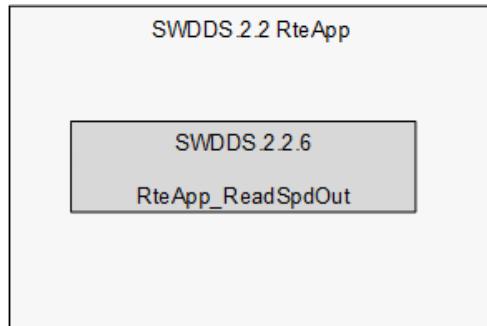
Software Unit Information					
Unit ID	SWDDS.2.2.6		Unit Name	RteApp_ReadSpdOut	
Architecture ID	SWADS.2.2.6		ASIL	QM	
Prototype	tFrac16 RteApp_ReadSpdOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32758 ~ 32767		Speed output (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppSpdOut	-32758 ~ 32767	Read	Speed output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed output reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; end((return g_f16RteAppSpdOut;))   </pre>				
Called Function	SWDDS.1.2.3.4 EopCtr_Run				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	49

SWDDS.1.2.3.12 ActEopCtrStateCurLmt	
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.6
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.6.2 Static View Design



#### 1.1.2.6.3 Dynamic View Design

- N/A

#### 1.1.2.6.4 Interface Design

- N/A

#### 1.1.2.7 [SWDDS.2.2.7] RteApp\_WriteSpdOut

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	50

#### 1.1.2.7.1 Detailed Design

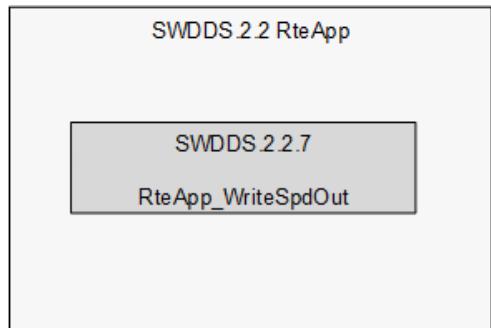
##### [SWDDS.2.2.7] RteApp\_WriteSpdOut

Software Unit Information					
Unit ID	SWDDS.2.2.7		Unit Name	RteApp_WriteSpdOut	
Architecture ID	SWADS.2.2.7		ASIL	QM	
Prototype	void RteApp_WriteSpdOut( tFrac16 speed_output )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	speed_output	-32758 ~ 32767	IN	speed output (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppSpdOut	-32758 ~ 32767	Write	Speed output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed output writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppSpdOut = speed_output;     ↓     end   </pre>				
Called Function	SWDDS.1.1.6.2 MtrSpd_Measr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.7
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	51

#### 1.1.2.7.2 Static View Design



#### 1.1.2.7.3 Dynamic View Design

- N/A

#### 1.1.2.7.4 Interface Design

- N/A

#### 1.1.2.8 [SWDDS.2.2.8] RteApp\_ReadSpdFilt

##### 1.1.2.8.1 Detailed Design

###### [SWDDS.2.2.8] RteApp\_ReadSpdFilt

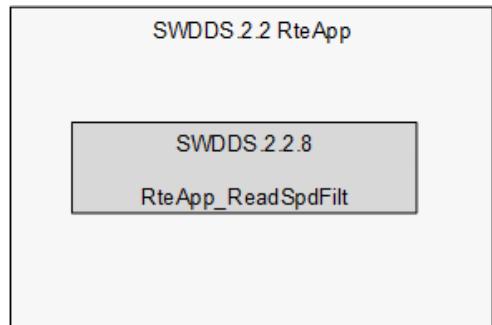
Software Unit Information					
Unit ID	SWDDS.2.2.8	Unit Name	RteApp_ReadSpdFilt		
Architecture ID	SWADS.2.2.8	ASIL	QM		
Prototype	tS16 RteApp_ReadSpdFilt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	-6000 ~ 6000		Filtered speed (rpm)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16RteAppSpdFilt	-6000 ~ 6000	Read	Filtered speed (rpm)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Filtered speed reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return[return g_s16RteAppSpdFilt;]   </pre>				
	SWDDS.1.2.2.5 CheckDrvStaAtCtrEna				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	52

Called Function	SWDDS.1.2.2.7 CheckDrvStaAtCurLmt SWDDS.1.2.3.12 ActEopCtrStateCurLmt SWDDS.1.4.3.2 ResMsg_Send
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.8
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.8.2 Static View Design



#### 1.1.2.8.3 Dynamic View Design

- N/A

#### 1.1.2.8.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	53

### 1.1.2.9 [SWDDS.2.2.9] RteApp\_WriteSpdFilt

#### 1.1.2.9.1 Detailed Design

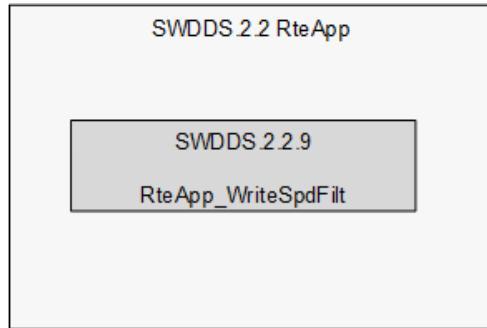
##### [SWDDS.2.2.9] RteApp\_WriteSpdFilt

Software Unit Information					
Unit ID	SWDDS.2.2.9	Unit Name	RteApp_WriteSpdFilt		
Architecture ID	SWADS.2.2.9	ASIL	QM		
Prototype	void RteApp_WriteSpdFilt( tS16 filtered_speed )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tS16	filtered_speed	-6000 ~ 6000	IN	filtered speed (rpm)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16RteAppSpdFilt	-6000 ~ 6000	Write	Filtered speed (rpm)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Filtered speed writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_s16RteAppSpdFilt = filtered_speed;     ↓     end   </pre>				
Called Function	SWDDS.1.1.6.2 MtrSpd_Measr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.9
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	54

#### 1.1.2.9.2 Static View Design



#### 1.1.2.9.3 Dynamic View Design

- N/A

#### 1.1.2.9.4 Interface Design

- N/A

#### 1.1.2.10 [SWDDS.2.2.10] RteApp\_ReadCtrState

##### 1.1.2.10.1 Detailed Design

###### [SWDDS.2.2.10] RteApp\_ReadCtrState

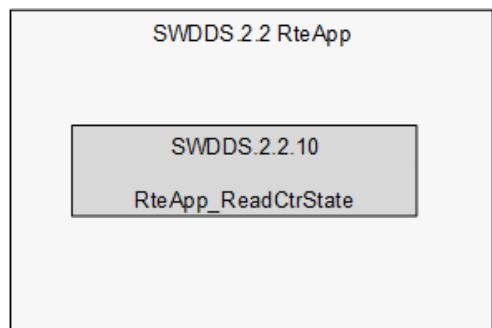
Software Unit Information					
Unit ID	SWDDS.2.2.10	Unit Name	RteApp_ReadCtrState		
Architecture ID	SWADS.2.2.10	ASIL	QM		
Prototype	tCtrState RteApp_ReadCtrState( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tCtrState	0 ~ 4		Control state	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_eRteAppCtrState	0 ~ 4	Read	Control state
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control state reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return[return g_eRteAppCtrState];     </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
	SWDDS.1.2.3.4 EopCtr_Run				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	55

	SWDDS.1.2.3.9 ActEopCtrStateMaxSpd
	SWDDS.1.3.3.2 ShutDown_Mng
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.10
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.10.2 Static View Design



#### 1.1.2.10.3 Dynamic View Design

- N/A

#### 1.1.2.10.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	56

### 1.1.2.11 [SWDDS.2.2.11] RteApp\_WriteCtrState

#### 1.1.2.11.1 Detailed Design

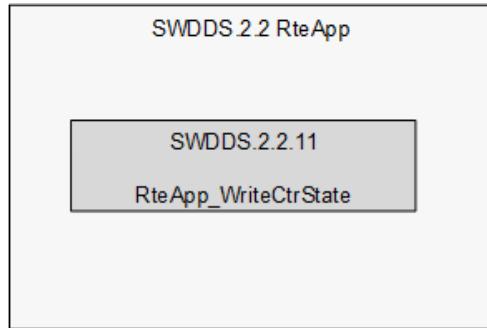
##### [SWDDS.2.2.11] RteApp\_WriteCtrState

Software Unit Information					
Unit ID	SWDDS.2.2.11		Unit Name	RteApp_WriteCtrState	
Architecture ID	SWADS.2.2.11		ASIL	QM	
Prototype	void RteApp_WriteCtrState( tCtrState control_state )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tCtrState	control_state	0 ~ 4	IN	Control state
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_eRteAppCtrState	0 ~ 4	Write	Control state
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control state writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_eRteAppCtrState = control_state;     ↓     end   </pre>				
Called Function	SWDDS.1.1.2.2 CtrSta_Clk				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.11
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	57

#### 1.1.2.11.2 Static View Design



#### 1.1.2.11.3 Dynamic View Design

- N/A

#### 1.1.2.11.4 Interface Design

- N/A

#### 1.1.2.12 [SWDDS.2.2.12] RteApp\_ReadCtrFlt

##### 1.1.2.12.1 Detailed Design

###### [SWDDS.2.2.12] RteApp\_ReadCtrFlt

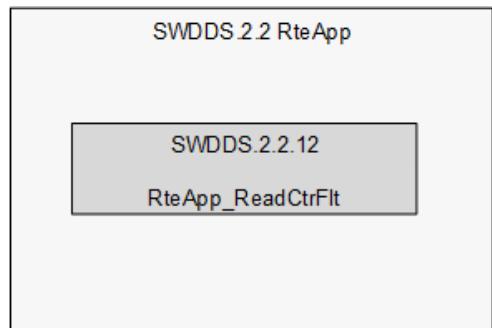
Software Unit Information					
Unit ID	SWDDS.2.2.12		Unit Name	RteApp_ReadCtrFlt	
Architecture ID	SWADS.2.2.12		ASIL	QM	
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 65535		Control fault flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppCtrFlt	0 ~ 65535	Read	Control fault flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control fault flag reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; return((return g_u16RteAppCtrFlt))   </pre>				
Called Function	SWDDS.1.2.2.9 CheckDrvStaCtrFlt				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	58

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.12
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.12.2 Static View Design



#### 1.1.2.12.3 Dynamic View Design

- N/A

#### 1.1.2.12.4 Interface Design

- N/A

#### 1.1.2.13 [SWDDS.2.2.13] RteApp\_WriteCtrFlt

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	59

### 1.1.2.13.1 Detailed Design

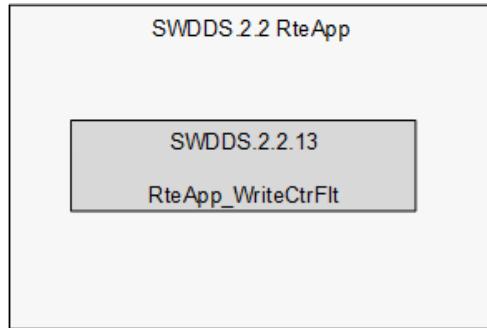
#### [SWDDS.2.2.13] RteApp\_WriteCtrFlt

Software Unit Information					
Unit ID	SWDDS.2.2.13	Unit Name	RteApp_WriteCtrFlt		
Architecture ID	SWADS.2.2.13	ASIL	QM		
Prototype	void RteApp_WriteCtrFlt( tU16 fault_flag )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	fault_flag	0 ~ 65535	IN	control fault flag
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppCtrFlt	0 ~ 65535	Write	Control fault flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control fault flag writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u16RteAppCtrFlt = fault_flag;     ↓     end   </pre>				
Called Function	SWDDS.1.1.2.2 CtrSta_Chk				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.13
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	60

#### 1.1.2.13.2 Static View Design



#### 1.1.2.13.3 Dynamic View Design

- N/A

#### 1.1.2.13.4 Interface Design

- N/A

#### 1.1.2.14 [SWDDS.2.2.14] RteApp\_ReadCurOut

##### 1.1.2.14.1 Detailed Design

###### [SWDDS.2.2.14] RteApp\_ReadCurOut

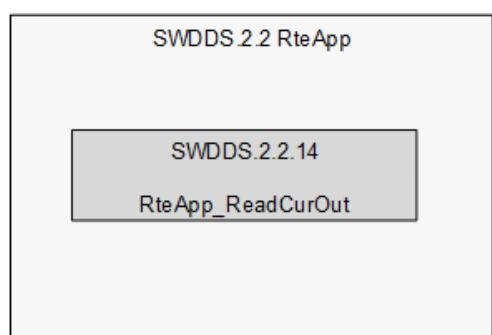
Software Unit Information					
Unit ID	SWDDS.2.2.14	Unit Name	RteApp_ReadCurOut		
Architecture ID	SWADS.2.2.14	ASIL	QM		
Prototype	tFrac16 RteApp_ReadCurOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32758 ~ 32767		q-axis current output (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppCurOut	-32758 ~ 32767	Read	q-axis current output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	q-axis current output reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; code["return g_f16RteAppCurOut;"]     </pre>				
	SWDDS.1.2.2.5 CheckDrvStaAtCtrEna				
	SWDDS.1.2.2.6 CheckDrvStaAtSIRun				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	61

Called Function	SWDDS.1.2.2.7 CheckDrvStaAtCurLmt
	SWDDS.1.2.3.10 ActEopCtrStateSpdChg
	SWDDS.1.2.3.11 ActEopCtrStateCurFilt
	SWDDS.1.2.3.16 CheckEopCtrAntiWindUp
	SWDDS.1.4.3.2 ResMsg_Send
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.14
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.14.2 Static View Design



#### 1.1.2.14.3 Dynamic View Design

- N/A

#### 1.1.2.14.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	62

### 1.1.2.15 [SWDDS.2.2.15] RteApp\_WriteCurOut

#### 1.1.2.15.1 Detailed Design

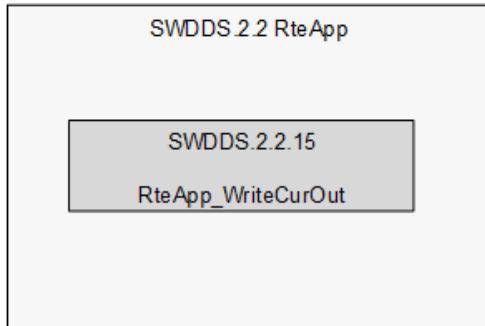
##### [SWDDS.2.2.15] RteApp\_WriteCurOut

Software Unit Information				
Unit ID	SWDDS.2.2.15		Unit Name	RteApp_WriteCurOut
Architecture ID	SWADS.2.2.15		ASIL	QM
Prototype	void RteApp_WriteCurOut( tFrac16 current_output )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tFrac16	current_output	-32758 ~ 32767	IN
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	tFrac16	g_f16RteAppCurOut	-32758 ~ 32767	Read
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	q-axis current output writing			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppCurOut = current_output;     ↓     end   </pre>			
Called Function	SWDDS.1.1.3.3 GetCurSigCurOut			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.2.2.15
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	63

#### 1.1.2.15.2 Static View Design



#### 1.1.2.15.3 Dynamic View Design

- N/A

#### 1.1.2.15.4 Interface Design

- N/A

[Deleted] [SWDDS.2.2.16] RteApp\_WriteCurEff

#### 1.1.2.16 [SWDDS.2.2.17] RteApp\_ReadDcCur

##### 1.1.2.16.1 Detailed Design

[SWDDS.2.2.17] RteApp\_ReadDcCur

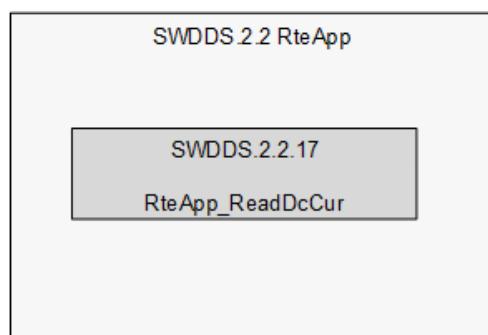
Software Unit Information				
Unit ID	SWDDS.2.2.17		Unit Name	RteApp_ReadDcCur
Architecture ID	SWADS.2.2.17		ASIL	QM
Prototype				
Function Call	Data Type	Name	Range	IN/OUT
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description
Return Value	tFrac16	0 ~ 32767		DC current input (PU)
Global Variables	Data Type	Name	Range	Read/Write
	tFrac16	g_f16RteAppDcCur	0 ~ 32767	Read
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	DC current input reading			

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	64

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppDcCur;   </pre>
Called Function	SWDDS.1.4.3.2 ResMsg_Send
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.17
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.16.2 Static View Design



#### 1.1.2.16.3 Dynamic View Design

- N/A

#### 1.1.2.16.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	65

### 1.1.2.17 [SWDDS.2.2.18] RteApp\_WriteDcCur

#### 1.1.2.17.1 Detailed Design

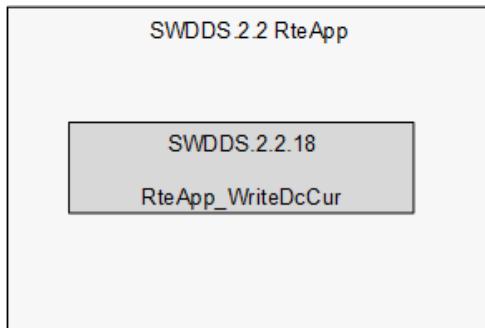
##### [SWDDS.2.2.18] RteApp\_WriteDcCur

Software Unit Information					
Unit ID	SWDDS.2.2.18		Unit Name	RteApp_WriteDcCur	
Architecture ID	SWADS.2.2.18		ASIL	QM	
Prototype	void RteApp_WriteDcCur( tFrac16 dc_current_input )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	dc_current_input	0 ~ 32767	IN	DC current input (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppDcCur	0 ~ 32767	Write	DC current input (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC current input writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppDcCur = dc_current_input;     ↓     end   </pre>				
Called Function	SWDDS.1.1.3.5 GetCurSigDcCur				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.18
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	66

#### 1.1.2.17.2 Static View Design



#### 1.1.2.17.3 Dynamic View Design

- N/A

#### 1.1.2.17.4 Interface Design

- N/A

### 1.1.2.18 [SWDDS.2.2.19] RteApp\_WriteDcVolt

#### 1.1.2.18.1 Detailed Design

##### [SWDDS.2.2.19] RteApp\_WriteDcVolt

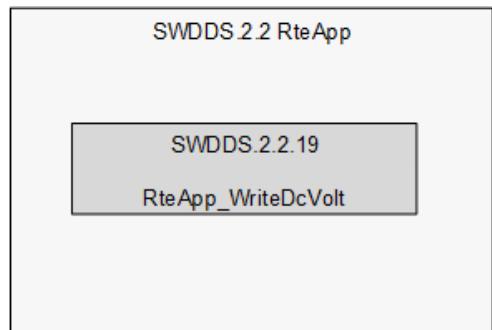
Software Unit Information					
Unit ID	SWDDS.2.2.19		Unit Name	RteApp_WriteDcVolt	
Architecture ID	SWADS.2.2.19		ASIL	QM	
Prototype	void RteApp_WriteDcVolt( tFrac16 dc_voltage )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	dc_voltage	0 ~ 32767	IN	DC link voltage (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppDcVolt	0 ~ 32767	Write	DC link voltage (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC link voltage writing				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	67

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppDcVolt = dc_voltage;     ↓     end   </pre>
Called Function	SWDDS.1.1.4.2 DcVolt_Measr
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.19
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.18.2 Static View Design



#### 1.1.2.18.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	68

#### 1.1.2.18.4 Interface Design

- N/A

#### 1.1.2.19 [SWDDS.2.2.20] RteApp\_ReadPcbTemp

##### 1.1.2.19.1 Detailed Design

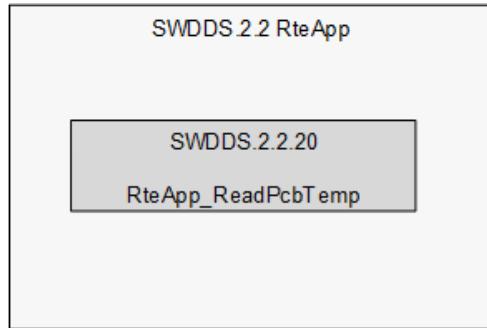
###### [SWDDS.2.2.20] RteApp\_ReadPcbTemp

Software Unit Information					
Unit ID	SWDDS.2.2.20		Unit Name	RteApp_ReadPcbTemp	
Architecture ID	SWADS.2.2.20		ASIL	QM	
Prototype	tFrac16 RteApp_ReadPcbTemp( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-1311 ~ 5570		PCB temperature (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppPcbTemp	-1311 ~ 5570	Read	PCB temperature (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; return("return g_f16RteAppPcbTemp;")     </pre>				
Called Function	SWDDS.1.2.4.6 CheckSigRngPcbTemp				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.20
Target Milestone	SBS1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	69

#### 1.1.2.19.2 Static View Design



#### 1.1.2.19.3 Dynamic View Design

- N/A

#### 1.1.2.19.4 Interface Design

- N/A

### 1.1.2.20 [SWDDS.2.2.21] RteApp\_WritePcbTemp

#### 1.1.2.20.1 Detailed Design

##### [SWDDS.2.2.21] RteApp\_WritePcbTemp

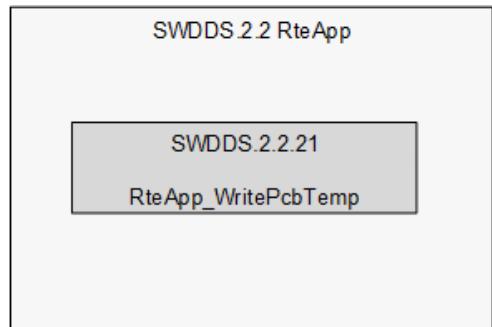
Software Unit Information				
Unit ID	SWDDS.2.2.21	Unit Name	RteApp_WritePcbTemp	
Architecture ID	SWADS.2.2.21	ASIL	QM	
Prototype	void RteApp_WritePcbTemp( tFrac16 pcb_temperature )			
Function Call Parameters	Data Type tFrac16	Name pcb_temperature	Range -1311 ~ 5570	IN PCB temperature (PU)
Function Call Return Value	Data Type void	Possible Return Value N/A		Description N/A
Global Variables	Data Type tFrac16	Name g_f16RteAppPcbTemp	Range -1311 ~ 5570	Read/Write Write PCB temperature (PU)
Parameters	Data Type N/A	Name N/A	Range N/A	Read/Write N/A Description N/A
Registers	Data Type N/A	Name N/A	Range N/A	Read/Write N/A Description N/A
Description	PCB temperature writing			
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; code[g_f16RteAppPcbTemp = pcb_temperature;]     code --&gt; end((end))   </pre>			

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	70

Called Function	SWDDS.1.1.9.2 TempSig_Measr
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.21
Target Milestone	SBS1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.20.2 Static View Design



#### 1.1.2.20.3 Dynamic View Design

- N/A

#### 1.1.2.20.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	71

### 1.1.2.21 [SWDDS.2.2.22] RteApp\_ReadMtrTrq

#### 1.1.2.21.1 Detailed Design

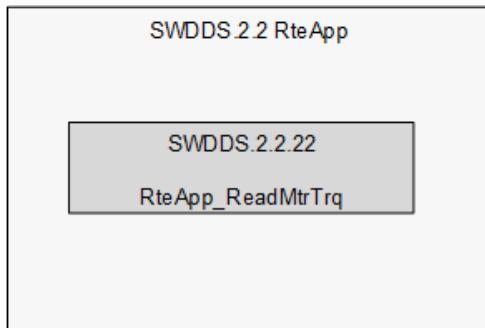
##### [SWDDS.2.2.22] RteApp\_ReadMtrTrq

Software Unit Information					
Unit ID	SWDDS.2.2.22		Unit Name	RteApp_ReadMtrTrq	
Architecture ID	SWADS.2.2.22		ASIL	QM	
Prototype	tFrac16 RteApp_ReadMtrTrq( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	tFrac16	-32768 ~ 32767			Motor torque (Nm)
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppMtrTrq	-32768 ~ 32767	Read	Motor torque output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor torque reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppMtrTrq;   </pre>				
Called Function	SWDDS.1.4.3.2 ResMsg_Send				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.22
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	72

#### 1.1.2.21.2 Static View Design



#### 1.1.2.21.3 Dynamic View Design

- N/A

#### 1.1.2.21.4 Interface Design

- N/A

### 1.1.2.22 [SWDDS.2.2.23] RteApp\_WriteMtrTrq

#### 1.1.2.22.1 Detailed Design

#### [SWDDS.2.2.23] RteApp\_WriteMtrTrq

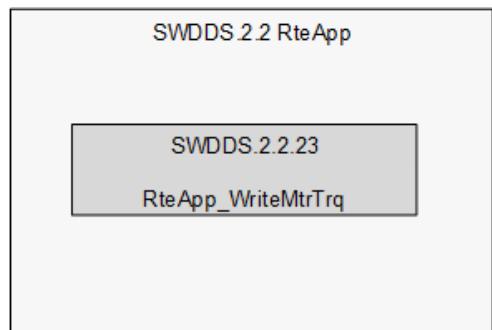
Software Unit Information					
Unit ID	SWDDS.2.2.23	Unit Name	RteApp_WriteMtrTrq		
Architecture ID	SWADS.2.2.23	ASIL	QM		
Prototype	void RteApp_WriteMtrTrq( tFrac16 motor_torque )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	motor_torque	-32768 ~ 32767	IN	motor_torque: motor torque (Nm)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppMtrTrq	-32768 ~ 32767	Write	Motor torque output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor torque writing				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	73

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppMtrTrq = motor_torque;     ↓     end   </pre>
Called Function	SWDDS.1.1.7.2 MtrTrq_Cal
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.23
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.22.2 Static View Design



#### 1.1.2.22.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	74

#### 1.1.2.22.4 Interface Design

- N/A

#### 1.1.2.23 [SWDDS.2.2.24] RteApp\_ReadBatVolt

##### 1.1.2.23.1 Detailed Design

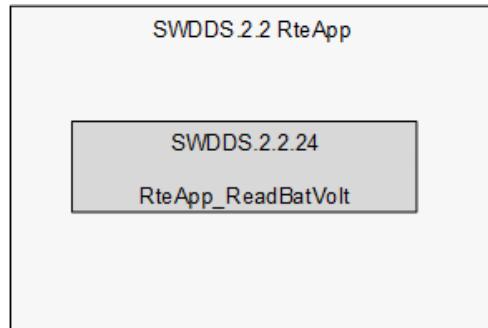
##### [SWDDS.2.2.24] RteApp\_ReadBatVolt

Software Unit Information					
Unit ID	SWDDS.2.2.24		Unit Name	RteApp_ReadBatVolt	
Architecture ID	SWADS.2.2.24		ASIL	QM	
Prototype	tFrac16 RteApp_ReadBatVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	0 ~ 32767		Battery voltage (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppBatVolt	0 ~ 32767	Read	Battery voltage (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppBatVolt;   </pre>				
Called Function	SWDDS.1.2.4.3 CheckSigRngBatVolt				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.24
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	75

#### 1.1.2.23.2 Static View Design



#### 1.1.2.23.3 Dynamic View Design

- N/A

#### 1.1.2.23.4 Interface Design

- N/A

#### 1.1.2.24 [SWDDS.2.2.25] RteApp\_WriteBatVolt

##### 1.1.2.24.1 Detailed Design

###### [SWDDS.2.2.25] RteApp\_WriteBatVolt

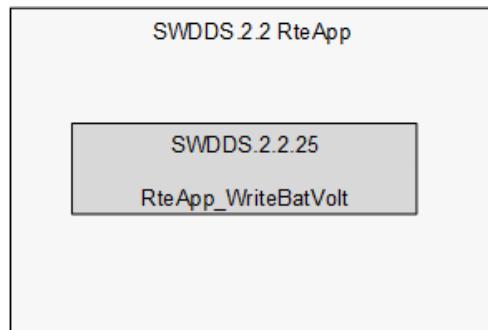
Software Unit Information					
Unit ID	SWDDS.2.2.25		Unit Name	RteApp_WriteBatVolt	
Architecture ID	SWADS.2.2.25		ASIL	QM	
Prototype					
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tFrac16	battery_voltage	0 ~ 32767	IN	battery voltage (PU)
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppBatVolt	0 ~ 32767	Write	Battery voltage (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage writing				
Control Flow Diagram					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	76

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppBatVolt = battery_voltage;     ↓     end   </pre>
Called Function	SWDDS.1.1.5.3 GetMcuStaBatVolt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.25
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.24.2 Static View Design



#### 1.1.2.24.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	77

#### 1.1.2.24.4 Interface Design

- N/A

#### 1.1.2.25 [SWDDS.2.2.26] RteApp\_ReadMcuSta

##### 1.1.2.25.1 Detailed Design

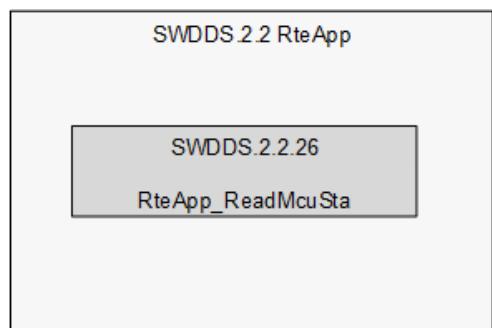
##### [SWDDS.2.2.26] RteApp\_ReadMcuSta

Software Unit Information					
Unit ID	SWDDS.2.2.26		Unit Name	RteApp_ReadMcuSta	
Architecture ID	SWADS.2.2.26		ASIL	QM	
Prototype	tU32 RteApp_ReadMcuSta( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	tU32	0 ~ 134217728		MCU status flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32RteAppMcuSta	0 ~ 134217728	Read	MCU status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	MCU status flag reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_u32RteAppMcuSta;   </pre>				
Called Function	SWDDS.1.3.2.3 ModeChg_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.26
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	78

#### 1.1.2.25.2 Static View Design



#### 1.1.2.25.3 Dynamic View Design

- N/A

#### 1.1.2.25.4 Interface Design

- N/A

#### 1.1.2.26 [SWDDS.2.2.27] RteApp\_WriteMcuSta

##### 1.1.2.26.1 Detailed Design

##### [SWDDS.2.2.27] RteApp\_WriteMcuSta

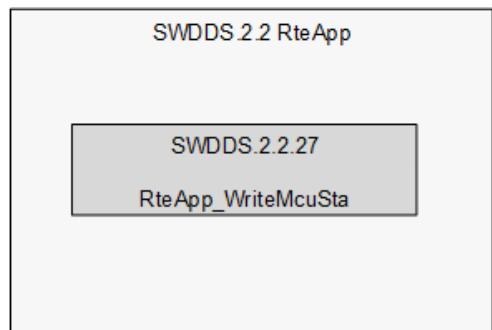
Software Unit Information					
Unit ID	SWDDS.2.2.27	Unit Name	RteApp_WriteMcuSta		
Architecture ID	SWADS.2.2.27	ASIL	QM		
Prototype	void RteApp_WriteMcuSta( tU32 status_flag )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	status_flag	0 ~ 134217728	IN	MCU status flag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32RteAppMcuSta	0 ~ 134217728	Write	MCU status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	MCU status flag writing				
Control Flow Diagram					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	79

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u32RteAppMcuSta = status_flag;     ↓     end   </pre>
Called Function	SWDDS.1.1.5.2 McuSta_Chk
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.27
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.26.2 Static View Design



#### 1.1.2.26.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	80

#### 1.1.2.26.4 Interface Design

- N/A

#### 1.1.2.27 [SWDDS.2.2.28] RteApp\_ReadEopState

##### 1.1.2.27.1 Detailed Design

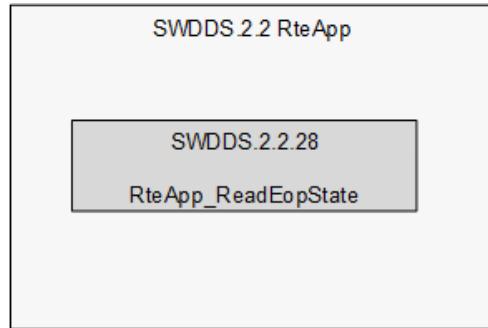
###### [SWDDS.2.2.28] RteApp\_ReadEopState

Software Unit Information					
Unit ID	SWDDS.2.2.28	Unit Name	RteApp_ReadEopState		
Architecture ID	SWADS.2.2.28	ASIL	QM		
Prototype	tEopState RteApp_ReadEopState( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tEopState	0 ~ 4		EOP control state	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tEopState	g_eRteAppEopState	0 ~ 4	Read	EOP control state
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	EOP control state reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_eRteAppEopState;   </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
	SWDDS.1.1.6.2 MtrSpd_Measr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.28
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	81

#### 1.1.2.27.2 Static View Design



#### 1.1.2.27.3 Dynamic View Design

- N/A

#### 1.1.2.27.4 Interface Design

- N/A

#### 1.1.2.28 [SWDDS.2.2.29] RteApp\_WriteEopState

##### 1.1.2.28.1 Detailed Design

##### [SWDDS.2.2.29] RteApp\_WriteEopState

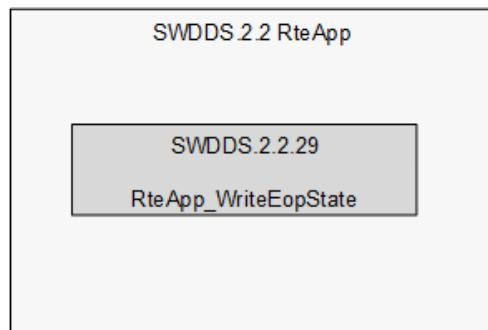
Software Unit Information					
Unit ID	SWDDS.2.2.29	Unit Name	RteApp_WriteEopState		
Architecture ID	SWADS.2.2.29	ASIL	QM		
<b>Prototype</b>					
<b>Function Call Parameters</b>	Data Type	Name	Range	IN/OUT	Description
	tEopState	eop_state	0 ~ 4	IN	eop_state: EOP control state
<b>Function Call Return Value</b>	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
<b>Global Variables</b>	Data Type	Name	Range	Read/Write	Description
	tEopState	g_eRteAppEopState	0 ~ 4	Write	EOP control state
<b>Parameters</b>	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
<b>Registers</b>	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	EOP control state writing				
<b>Control Flow Diagram</b>					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	82

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_eRteAppEopState = eop_state;     ↓     end   </pre>
Called Function	SWDDS.1.2.3.4 EopCtr_Run
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.29
Target Milestone	SBS1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.28.2 Static View Design



#### 1.1.2.28.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	83

#### 1.1.2.28.4 Interface Design

- N/A

#### 1.1.2.29 [SWDDS.2.2.30] RteApp\_ReadCtrEna

##### 1.1.2.29.1 Detailed Design

##### [SWDDS.2.2.30] RteApp\_ReadCtrEna

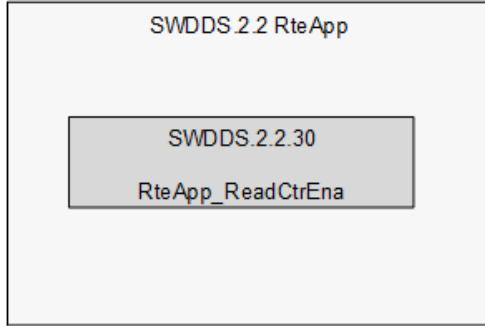
Software Unit Information					
Unit ID	SWDDS.2.2.30		Unit Name	RteApp_ReadCtrEna	
Architecture ID	SWADS.2.2.30		ASIL	QM	
Prototype	tBool RteApp_ReadCtrEna( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1		Control enable	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bRteAppCtrEna	0 ~ 1	Read	Control enable
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control enable reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_bRteAppCtrEna;   </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
	SWDDS.1.4.2.2 MtrCtr_Set				
	SWDDS.1.2.4.11 CheckSigRngProtMode				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.30
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	84

Verifiability	Yes
---------------	-----

#### 1.1.2.29.2 Static View Design



#### 1.1.2.29.3 Dynamic View Design

- N/A

#### 1.1.2.29.4 Interface Design

- N/A

#### 1.1.2.30 [SWDDS.2.2.31] RteApp\_WriteCtrEna

##### 1.1.2.30.1 Detailed Design

###### [SWDDS.2.2.31] RteApp\_WriteCtrEna

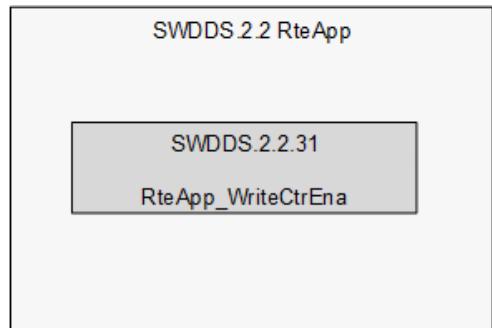
Software Unit Information					
Unit ID	SWDDS.2.2.31	Unit Name	RteApp_WriteCtrEna		
Architecture ID	SWADS.2.2.31	ASIL	QM		
Prototype	void RteApp_WriteCtrEna( tBool control_enable )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	control_enable	0 ~ 1	IN	Control enable
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bRteAppCtrEna	0 ~ 1	Write	Control enable
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control enable writing				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	85

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_bRteAppCtrEna = control_enable;     ↓     end   </pre>
Called Function	SWDDS.1.2.3.4 EopCtr_Run
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.31
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.30.2 Static View Design



#### 1.1.2.30.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	86

#### 1.1.2.30.4 Interface Design

- N/A

#### 1.1.2.31 [SWDDS.2.2.32] RteApp\_ReadCtrMode

##### 1.1.2.31.1 Detailed Design

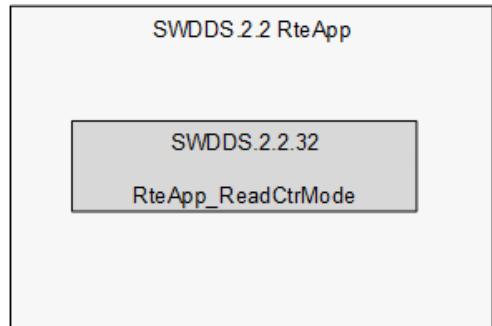
##### [SWDDS.2.2.32] RteApp\_ReadCtrMode

Software Unit Information				
Unit ID	SWDDS.2.2.32		Unit Name	RteApp_ReadCtrMode
Architecture ID	SWADS.2.2.32		ASIL	QM
Prototype	tCtrMode RteApp_ReadCtrMode( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	tCtrMode	0 ~ 1		Sensorless FOC control mode
Global Variables	Data Type	Name	Range	Read/Write
	tCtrMode	g_eRteAppCtrMode	0 ~ 1	Read
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Speed control mode reading			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_eRteAppCtrMode;   </pre>			
Called Function	SWDDS.1.4.2.2 MtrCtr_Set			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.2.2.32
Target Milestone	SBS1
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	87

#### 1.1.2.31.2 Static View Design



#### 1.1.2.31.3 Dynamic View Design

- N/A

#### 1.1.2.31.4 Interface Design

- N/A

#### 1.1.2.32 [SWDDS.2.2.33] RteApp\_ReadRefCur

##### 1.1.2.32.1 Detailed Design

##### [SWDDS.2.2.33] RteApp\_ReadRefCur

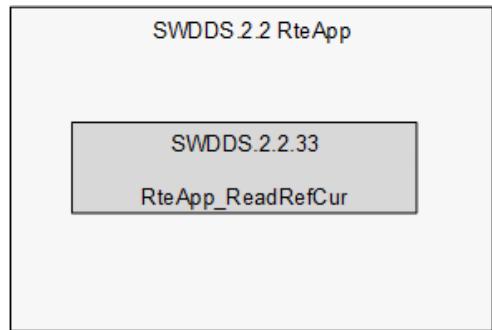
Software Unit Information					
Unit ID	SWDDS.2.2.33		Unit Name	RteApp_ReadRefCur	
Architecture ID	SWADS.2.2.33		ASIL	QM	
Prototype	tFrac16 RteApp_ReadRefCur( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	0 ~ 32767		Reference current (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppRefCur	0 ~ 32767	Read	Reference current (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Reference current reading				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	88

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppRefCur;   </pre>
Called Function	SWDDS.1.4.2.2 MtrCtr_Set
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.33
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.32.2 Static View Design



#### 1.1.2.32.3 Dynamic View Design

- N/A

#### 1.1.2.32.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	89

### 1.1.2.33 [SWDDS.2.2.34] RteApp\_ReadRefSpd

#### 1.1.2.33.1 Detailed Design

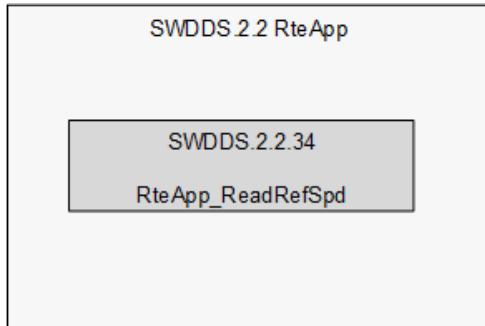
##### [SWDDS.2.2.34] RteApp\_ReadRefSpd

Software Unit Information					
Unit ID	SWDDS.2.2.34		Unit Name	RteApp_ReadRefSpd	
Architecture ID	SWADS.2.2.34		ASIL	QM	
Prototype	tFrac16 RteApp_ReadRefSpd( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	0 ~ 19660		Reference speed (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppRefSpd	0 ~ 19660	Read	Reference speed (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Reference speed reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppRefSpd;   </pre>				
Called Function	SWDDS.1.4.2.2 MtrCtr_Set				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.34
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	90

#### 1.1.2.33.2 Static View Design



#### 1.1.2.33.3 Dynamic View Design

- N/A

#### 1.1.2.33.4 Interface Design

- N/A

#### 1.1.2.34 [SWDDS.2.2.35] RteApp\_WriteRefSpd

##### 1.1.2.34.1 Detailed Design

###### [SWDDS.2.2.35] RteApp\_WriteRefSpd

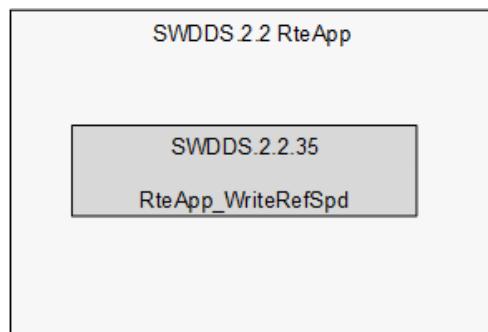
Software Unit Information					
Unit ID	SWDDS.2.2.35	Unit Name	RteApp_WriteRefSpd		
Architecture ID	SWADS.2.2.35	ASIL	QM		
Prototype	void RteApp_WriteRefSpd( tFrac16 reference_speed )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	reference_speed	0 ~ 19660	IN	reference speed (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppRefSpd	0 ~ 19660	Write	Reference speed (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Reference speed writing				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	91

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppRefSpd = reference_speed;     ↓     end   </pre>
Called Function	SWDDS.1.2.3.4 EopCtr_Runt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.35
Target Milestone	SBS1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.34.2 Static View Design



#### 1.1.2.34.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	92

#### 1.1.2.34.4 Interface Design

- N/A

#### 1.1.2.35 [SWDDS.2.2.36] RteApp\_ReadCurLmtUpp

##### 1.1.2.35.1 Detailed Design

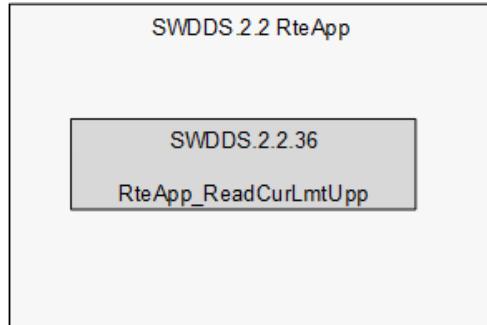
##### [SWDDS.2.2.36] RteApp\_ReadCurLmtUpp

Software Unit Information					
Unit ID	SWDDS.2.2.36		Unit Name	RteApp_ReadCurLmtUpp	
Architecture ID	SWADS.2.2.36		ASIL	QM	
Prototype	tFrac16 RteApp_ReadCurLmtUpp( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	tFrac16	-32768 ~ 32767			Current limit upper (PU)
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppCurLmtUpp	-32768 ~ 32767	Read	Current limit – upper (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current limit upper reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppCurLmtUpp;   </pre>				
Called Function	SWDDS.1.4.2.2 MtrCtr_Set				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.36
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	93

#### 1.1.2.35.2 Static View Design



#### 1.1.2.35.3 Dynamic View Design

- N/A

#### 1.1.2.35.4 Interface Design

- N/A

#### 1.1.2.36 [SWDDS.2.2.37] RteApp\_WriteCurLmtUpp

##### 1.1.2.36.1 Detailed Design

###### [SWDDS.2.2.37] RteApp\_WriteCurLmtUpp

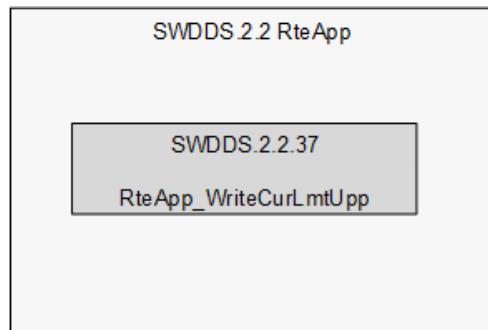
Software Unit Information					
Unit ID	SWDDS.2.2.37	Unit Name	RteApp_WriteCurLmtUpp		
Architecture ID	SWADS.2.2.37	ASIL	QM		
Prototype	void RteApp_WriteCurLmtUpp( tFrac16 current_limit )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tFrac16	current_limit	-32768 ~ 32767	IN	current limit upper (PU)
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppCurLmtUpp	-32768 ~ 32767	Write	Current limit – upper (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current limit upper writing				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	94

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppCurLmtUpp = current_limit;     ↓     end   </pre>
Called Function	SWDDS.1.2.3.17 SetEopCtrSpdCtrCurLmt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.37
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.36.2 Static View Design



#### 1.1.2.36.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	95

#### 1.1.2.36.4 Interface Design

- N/A

#### 1.1.2.37 [SWDDS.2.2.38] RteApp\_ReadCurLmtLow

##### 1.1.2.37.1 Detailed Design

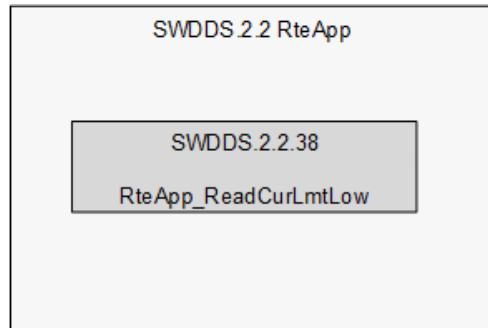
###### [SWDDS.2.2.38] RteApp\_ReadCurLmtLow

Software Unit Information					
Unit ID	SWDDS.2.2.38		Unit Name	RteApp_ReadCurLmtLow	
Architecture ID	SWADS.2.2.38		ASIL	QM	
Prototype	tFrac16 RteApp_ReadCurLmtLow( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	tFrac16	-32768 ~ 32767			Current limit lower (PU)
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppCurLmtLow	-32768 ~ 32767	Read	Current limit – lower (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current limit lower reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppCurLmtLow;   </pre>				
Called Function	SWDDS.1.4.2.2 MtrCtr_Set				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.38
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	96

#### 1.1.2.37.2 Static View Design



#### 1.1.2.37.3 Dynamic View Design

- N/A

#### 1.1.2.37.4 Interface Design

- N/A

#### 1.1.2.38 [SWDDS.2.2.39] RteApp\_WriteCurLmtLow

##### 1.1.2.38.1 Detailed Design

###### [SWDDS.2.2.39] RteApp\_WriteCurLmtLow

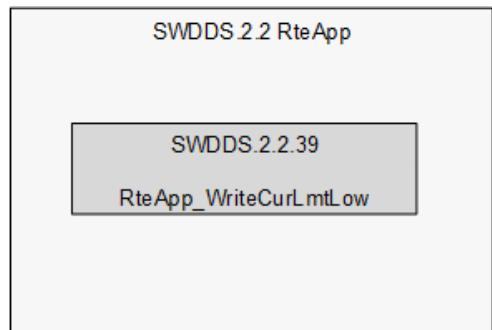
Software Unit Information					
Unit ID	SWDDS.2.2.39		Unit Name	RteApp_WriteCurLmtLow	
Architecture ID	SWADS.2.2.39		ASIL	QM	
Prototype	void RteApp_WriteCurLmtLow( tFrac16 current_limit )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tFrac16	current_limit	-32768 ~ 32767	IN	current limit lower (PU)
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppCurLmtLow	-32768 ~ 32767	Write	Current limit – lower (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current limit lower writing				
Control Flow Diagram (or Pseudo Code)					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	97

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_f16RteAppCurLmtLow= current_limit;     ↓     end   </pre>
Called Function	SWDDS.1.2.3.17 SetEopCtrSpdCtrCurLmt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.39
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.38.2 Static View Design



#### 1.1.2.38.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	98

#### 1.1.2.38.4 Interface Design

- N/A

#### 1.1.2.39 [SWDDS.2.2.40] RteApp\_ReadSpdErr

##### 1.1.2.39.1 Detailed Design

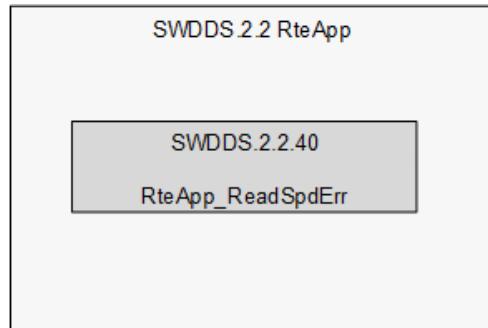
###### [SWDDS.2.2.40] RteApp\_ReadSpdErr

Software Unit Information					
Unit ID	SWDDS.2.2.40		Unit Name	RteApp_ReadSpdErr	
Architecture ID	SWADS.2.2.40		ASIL	QM	
Prototype	tFrac16 RteApp_ReadSpdErr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		Speed control error (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16RteAppSpdErr	-32768 ~ 32767	Read	Speed control error (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed control error reading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_f16RteAppSpdErr;   </pre>				
Called Function	SWDDS.1.2.4.11 CheckSigRngProtMode				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.40
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	99

#### 1.1.2.39.2 Static View Design



#### 1.1.2.39.3 Dynamic View Design

- N/A

#### 1.1.2.39.4 Interface Design

- N/A

#### 1.1.2.40 [SWDDS.2.2.41] RteApp\_ReadDrvSta

##### 1.1.2.40.1 Detailed Design

###### [SWDDS.2.2.41] RteApp\_ReadDrvSta

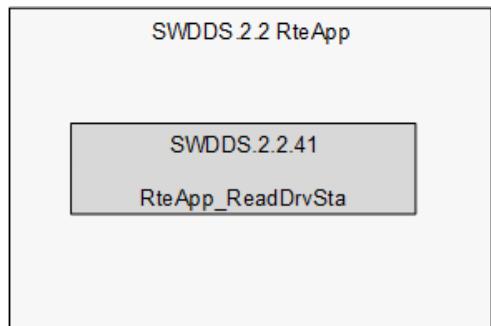
Software Unit Information					
Unit ID	SWDDS.2.2.41	Unit Name	RteApp_ReadDrvSta		
Architecture ID	SWADS.2.2.41	ASIL	QM		
Prototype	tU32 RteApp_ReadDrvSta( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	tU32	0 ~ 16776960		Driving status flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32RteAppDrvSta	0 ~ 16776960	Read	Driving status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status flag reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; end([return g_u32RteAppDrvSta;])   </pre>				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	100

Called Function	SWDDS.1.3.2.3 ModeChg_Mng
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.41
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.40.2 Static View Design



#### 1.1.2.40.3 Dynamic View Design

- N/A

#### 1.1.2.40.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	101

### 1.1.2.41 [SWDDS.2.2.42] RteApp\_WriteDrvSta

#### 1.1.2.41.1 Detailed Design

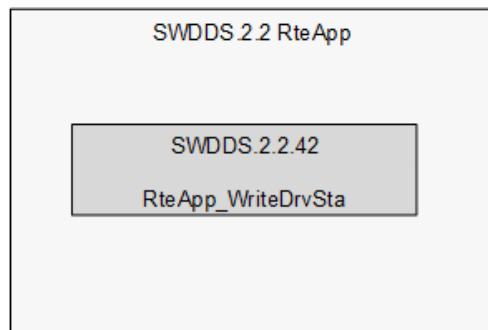
##### [SWDDS.2.2.42] RteApp\_WriteDrvSta

Software Unit Information					
Unit ID	SWDDS.2.2.42		Unit Name	RteApp_WriteDrvSta	
Architecture ID	SWADS.2.2.42		ASIL	QM	
Prototype	void RteApp_WriteDrvSta( tU32 status_flag )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	status_flag	0 ~ 16776960	IN	Driving status flag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32RteAppDrvSta	0 ~ 16776960	Write	Driving status flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status flag writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u32RteAppDrvSta = status_flag;     ↓     end   </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.42
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	102

#### 1.1.2.41.2 Static View Design



#### 1.1.2.41.3 Dynamic View Design

- N/A

#### 1.1.2.41.4 Interface Design

- N/A

#### 1.1.2.42 [SWDDS.2.2.43] RteApp\_ReadSigRng

##### 1.1.2.42.1 Detailed Design

###### [SWDDS.2.2.43] RteApp\_ReadSigRng

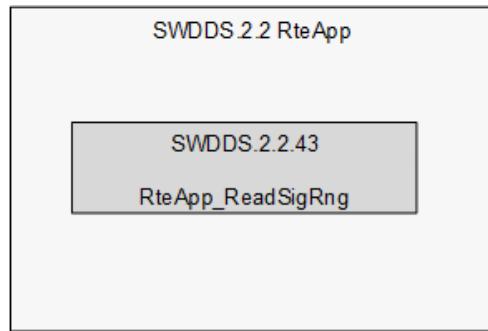
Software Unit Information					
Unit ID	SWDDS.2.2.43		Unit Name	RteApp_ReadSigRng	
Architecture ID	SWADS.2.2.43		ASIL	QM	
Prototype	tU32 RteApp_ReadSigRng( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU32	0 ~ 255		Signal range checking flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32RteAppSigRng	0 ~ 255	Read	Signal range check flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Signal range checking flag reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return("return g_u32RteAppSigRng;")     </pre>				
Called Function	SWDDS.1.3.2.3 ModeChg_Mng				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	103

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.43
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.42.2 Static View Design



#### 1.1.2.42.3 Dynamic View Design

- N/A

#### 1.1.2.42.4 Interface Design

- N/A

#### 1.1.2.43 [SWDDS.2.2.44] RteApp\_WriteSigRng

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	104

#### 1.1.2.43.1 Detailed Design

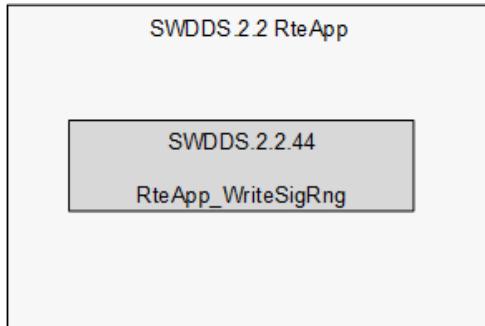
##### [SWDDS.2.2.44] RteApp\_WriteSigRng

Software Unit Information				
Unit ID	SWDDS.2.2.44		Unit Name	RteApp_WriteSigRng
Architecture ID	SWADS.2.2.44		ASIL	QM
Prototype	void RteApp_WriteSigRng( tU32 checking_flag )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tU32	checking_flag	0 ~ 255	IN
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	tU32	g_u32RteAppSigRng	0 ~ 255	Write
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Signal range checking flag writing			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u32RteAppSigRng = checking_flag;     ↓     end   </pre>			
Called Function	SWDDS.1.2.4.2 SigRng_Chk			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.2.2.44
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	105

#### 1.1.2.43.2 Static View Design



#### 1.1.2.43.3 Dynamic View Design

- N/A

#### 1.1.2.43.4 Interface Design

- N/A

#### 1.1.2.44 [SWDDS.2.2.45] RteApp\_ReadOprMode

##### 1.1.2.44.1 Detailed Design

###### [SWDDS.2.2.45] RteApp\_ReadOprMode

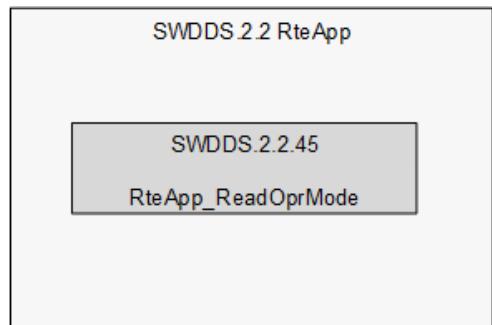
Software Unit Information					
Unit ID	SWDDS.2.2.45	Unit Name	RteApp_ReadOprMode		
Architecture ID	SWADS.2.2.45	ASIL	QM		
Prototype	tOprMode RteApp_ReadOprMode( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tOprMode	0 ~ 5		Operating mode	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteAppOprMode	0 ~ 5	Read	Operation mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Operating mode reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; end([return g_eRteAppOprMode;])   </pre>				
	SWDDS.1.2.2.12 CheckDrvStaSpdErr				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	106

Called Function	SWDDS.1.2.3.11 ActEopCtrStateCurFilt
	SWDDS.1.2.3.14 CheckEopCtrEnaEdge
	SWDDS.1.3.2.3 ModeChg_Mng
	SWDDS.2.1.10 RteSch_Task20ms
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.45
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.44.2 Static View Design



#### 1.1.2.44.3 Dynamic View Design

- N/A

#### 1.1.2.44.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	107

### 1.1.2.45 [SWDDS.2.2.46] RteApp\_WriteOprMode

#### 1.1.2.45.1 Detailed Design

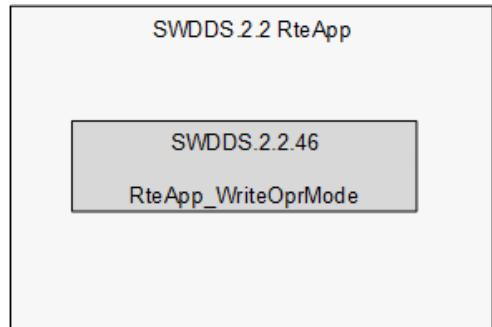
##### [SWDDS.2.2.46] RteApp\_WriteOprMode

Software Unit Information					
Unit ID	SWDDS.2.2.46	Unit Name	RteApp_WriteOprMode		
Architecture ID	SWADS.2.2.46	ASIL	QM		
Prototype	void RteApp_WriteOprMode( tOprMode operation_mode )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tOprMode	operation_mode	0 ~ 5	IN	Operation mode
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOprMode	g_eRteAppOprMode	0 ~ 5	Write	Operation mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Operation mode writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_eRteAppOprMode = operation_mode;     ↓     end   </pre>				
Called Function	SWDDS.1.3.2.4 ChangeModeChgAppMode				
	SWDDS.1.3.4.2 StartUp_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.46
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	108

#### 1.1.2.45.2 Static View Design



#### 1.1.2.45.3 Dynamic View Design

- N/A

#### 1.1.2.45.4 Interface Design

- N/A

#### 1.1.2.46 [SWDDS.2.2.47] RteApp\_ReadFuncMode

##### 1.1.2.46.1 Detailed Design

###### [SWDDS.2.2.47] RteApp\_ReadFuncMode

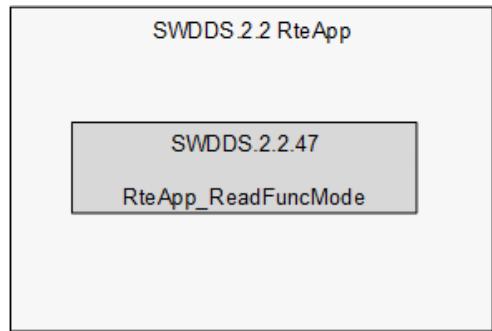
Software Unit Information					
Unit ID	SWDDS.2.2.47	Unit Name	RteApp_ReadFuncMode		
Architecture ID	SWADS.2.2.47	ASIL	QM		
Prototype	tFuncMode RteApp_ReadFuncMode( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFuncMode	0 ~ 2		Function mode	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFuncMode	g_eRteAppFuncMode	0 ~ 2	Read	Functional mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Function mode reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return["return g_eRteAppFuncMode;"]   </pre>				
Called Function	SWDDS.1.2.3.13 CheckEopCtrEnaMode				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	109

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.47
Target Milestone	SBS1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.46.2 Static View Design



#### 1.1.2.46.3 Dynamic View Design

- N/A

#### 1.1.2.46.4 Interface Design

- N/A

#### 1.1.2.47 [SWDDS.2.2.48] RteApp\_WriteFuncMode

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	110

#### 1.1.2.47.1 Detailed Design

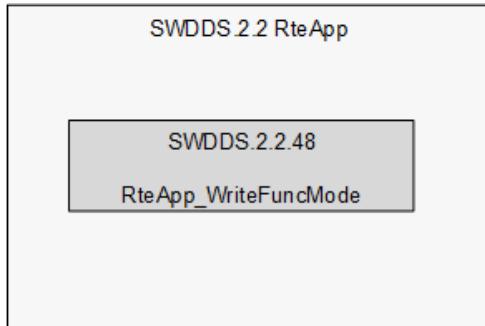
##### [SWDDS.2.2.48] RteApp\_WriteFuncMode

Software Unit Information					
Unit ID	SWDDS.2.2.48		Unit Name	RteApp_WriteFuncMode	
Architecture ID	SWADS.2.2.48		ASIL	QM	
Prototype	void RteApp_WriteFuncMode( tFuncMode function_mode )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFuncMode	function_mode	0 ~ 2	IN	Function mode
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFuncMode	g_eRteAppFuncMode	0 ~ 2	Write	Functional mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Function mode writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_eRteAppFuncMode = function_mode;     ↓     end   </pre>				
Called Function	<a href="#">SWDDS.1.3.2.9 CheckModeChgSigRng</a> <a href="#">SWDDS.1.3.4.2 StartUp_Mng</a>				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.48
Target Milestone	SBS1
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	111

#### 1.1.2.47.2 Static View Design



#### 1.1.2.47.3 Dynamic View Design

- N/A

#### 1.1.2.47.4 Interface Design

- N/A

#### 1.1.2.48 [SWDDS.2.2.49] RteApp\_ReadAppMode

##### 1.1.2.48.1 Detailed Design

###### [SWDDS.2.2.49] RteApp\_ReadAppMode

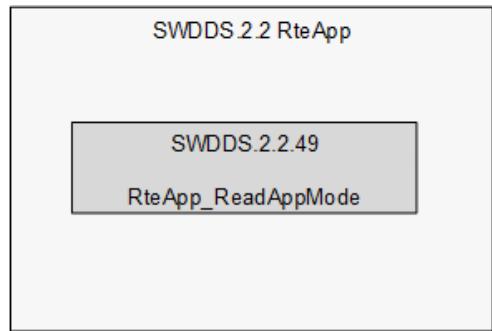
Software Unit Information					
Unit ID	SWDDS.2.2.49	Unit Name	RteApp_ReadAppMode		
Architecture ID	SWADS.2.2.49	ASIL	QM		
Prototype	tAppMode RteApp_ReadAppMode( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tAppMode	0 ~ 4		Application mode	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tAppMode	g_eRteAppAppMode	0 ~ 4	Read	Application mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Application mode reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return[return g_eRteAppAppMode;]   </pre>				
Called Function	SWDDS.1.2.3.15 CheckEopCtrEnaAppMode				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	112

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.49
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.48.2 Static View Design



#### 1.1.2.48.3 Dynamic View Design

- N/A

#### 1.1.2.48.4 Interface Design

- N/A

#### 1.1.2.49 [SWDDS.2.2.50] RteApp\_WriteAppMode

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	113

#### 1.1.2.49.1 Detailed Design

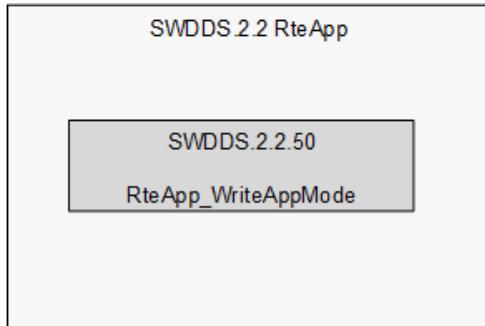
##### [SWDDS.2.2.50] RteApp\_WriteAppMode

Software Unit Information					
Unit ID	SWDDS.2.2.50	Unit Name		RteApp_WriteAppMode	
Architecture ID	SWADS.2.2.50	ASIL		QM	
Prototype	void RteApp_WriteAppMode( tAppMode application_mode )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tAppMode	application_mode	0 ~ 4	IN	Application mode
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tAppMode	g_eRteAppAppMode	0 ~ 4	Write	Application mode
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Application mode writing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_eRteAppAppMode = application_mode;     ↓     end   </pre>				
Called Function	SWDDS.1.3.2.4 ChangeModeChgAppMode				
	SWDDS.1.3.4.2 StartUp_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.50
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	114

#### 1.1.2.49.2 Static View Design



#### 1.1.2.49.3 Dynamic View Design

- N/A

#### 1.1.2.49.4 Interface Design

- N/A

#### 1.1.2.50 [SWDDS.2.2.51] RteApp\_ReadOpuFlt

##### 1.1.2.50.1 Detailed Design

###### [SWDDS.2.2.51] RteApp\_ReadOpuFlt

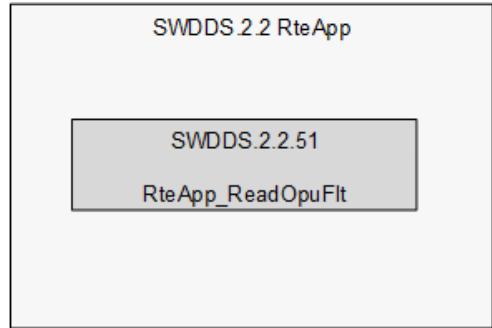
Software Unit Information					
Unit ID	SWDDS.2.2.51	Unit Name	RteApp_ReadOpuFlt		
Architecture ID	SWADS.2.2.51	ASIL	QM		
Prototype	tU16 RteApp_ReadOpuFlt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 4095		OPU fault	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppOpuFlt	0 ~ 4095	Read	OPU fault
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	OPU fault reading				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return("return g_u16RteAppOpuFlt;")     </pre>				
Called Function	SWDDS.1.4.3.2 ResMsg_Send				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	115

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.2.51
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.50.2 Static View Design



#### 1.1.2.50.3 Dynamic View Design

- N/A

#### 1.1.2.50.4 Interface Design

- N/A

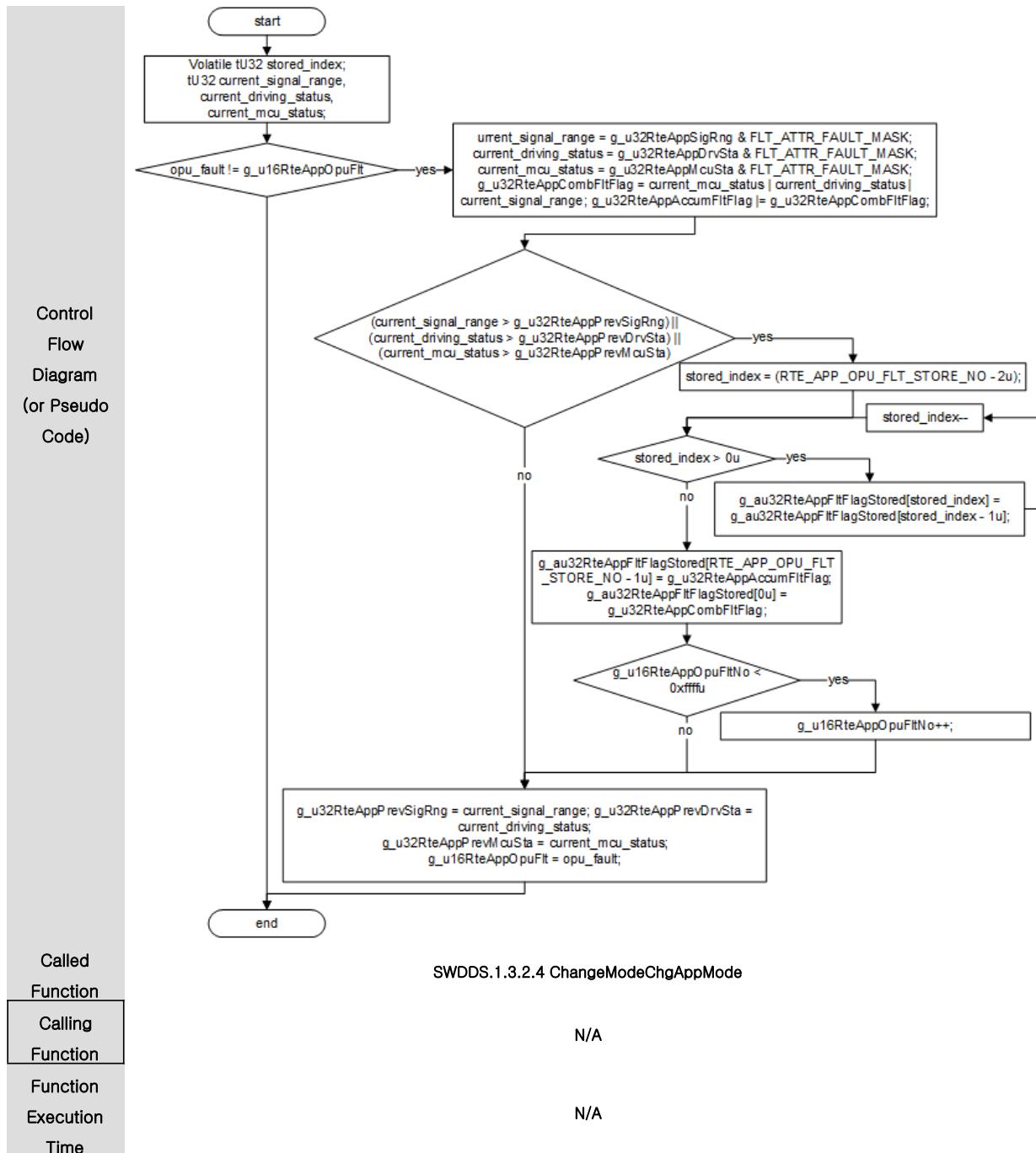
#### 1.1.2.51 [SWDDS.2.2.52] RteApp\_WriteOpuflt

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	116

### 1.1.2.51.1 Detailed Design

#### [SWDDS.2.2.52] RteApp\_WriteOpuFlt

Software Unit Information					
Unit ID	SWDDS.2.2.52	Unit Name	RteApp_WriteOpuFlt		
Architecture ID	SWADS.2.2.52	ASIL	QM		
Prototype tU16 RteApp_WriteOpuFlt( tU16 opu_fault )					
Function	Data Type	Name	Range	IN/OUT	Description
Call Parameters	tU16	opu_fault	0 ~ 4095	IN	OPU fault
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppOpuFlt	0 ~ 4095	Read/Write	OPU fault
	tU32	g_u32RteAppSigRng	0 ~ 255	Read	Signal range check flag
	tU32	g_u32RteAppDrvSta	0 ~ 16776960	Read	Driving status flag
	tU32	g_u32RteAppMcuSta	0 ~ 134217728	Read	MCU status flag
	tU32	g_u32RteAppCombFltFlag	0 ~ 4294967295	Read/Write	Combined fault flags
	tU32	g_u32RteAppAccumFltFlag	0 ~ 4294967295	Read/Write	Accumulated fault flags
	tU32	g_u32RteAppPrevSigRng	0 ~ 255	Read/Write	Previous signal range check flag
	tU32	g_u32RteAppPrevDrvSta	0 ~ 16776960	Read/Write	Previous driving status check flag
	tU32	g_u32RteAppPrevMcuSta	0 ~ 134217728	Read/Write	Previous MCU status check flag
Parameters	[RTE_APP_OPU_FLT_STORE_NO]		g_au32RteAppFltFlagStored	0 ~ 4294967295	Fault flag storage
	tU16	g_u16RteAppOpuFltNo	0 ~ 65535	Read/Write	Number of OPU fault
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
OPU fault flag writing					
- OPU flag changed checking					
- Fault flags setting					
- Fault flag increment checking					
- Stored OPU flag shifting					
- Number of fault increment					
- Fault flag updating					
					<ol style="list-style-type: none"> <li>1. RteApp_WriteOpuFlt checks if the previous OPU fault flags and current OPU fault flags are different.</li> <li>2. RteApp_WriteOpuFlt gets real fault flags and combines all the fault flags.</li> <li>3. RteApp_WriteOpuFlt checks if new fault flag is occurred(fault flag is increased).</li> <li>4. RteApp_WriteOpuFlt shifts the stored combined fault flags and enters the new fault flags at the start of the array.</li> <li>5. RteApp_WriteOpuFlt accumulates the faults flags to the end of the array.</li> <li>6. RteApp_WriteOpuFlt increases the number of fault flags.</li> <li>7. RteApp_WriteOpuFlt updates the previous fault flags.</li> </ol>

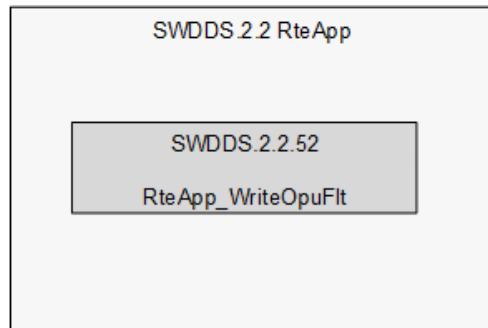


Requirement Id	SWDDS.2.2.52
Target Milestone	EBS2
Element	RteApp
Risk	Mid
Interoperability	No
Criticality	Mid

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	118

Technical complexity	<input checked="" type="checkbox"/> High
Verifiability	Yes

#### 1.1.2.51.2 Static View Design



#### 1.1.2.51.3 Dynamic View Design

- N/A

#### 1.1.2.51.4 Interface Design

- N/A

#### 1.1.2.52 [SWDDS.2.2.53] RteApp\_ClrOpuFlt

##### 1.1.2.52.1 Detailed Design

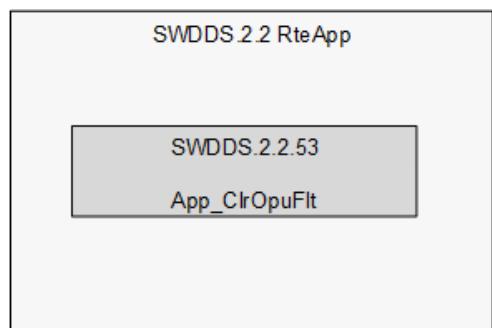
###### [SWDDS.2.2.53] RteApp\_ClrOpuFlt

Software Unit Information					
Unit ID	SWDDS.2.2.53	Unit Name	App_ClrOpuFlt		
Architecture ID	SWADS.2.2.53	ASIL	QM		
Prototype	void App_ClrOpuFlt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppOpuFlt	0 ~ 4095	Write	OPU fault
	tU32	g_u32RteAppPrevSigRng	0 ~ 255	Write	Previous signal range check flag
	tU32	g_u32RteAppPrevDrvSta	0 ~ 16776960	Write	Previous driving status check flag
	tU32	g_u32RteAppPrevMcuSta	0 ~ 134217728	Write	Previous MCU status check flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current OPU fault flag clearing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [g_u16RteAppOpufIt = 0x0000u;      g_u32RteAppPrevSigRng = 0x00000000uL;      g_u32RteAppPrevDrvSta = 0x00000000uL;      g_u32RteAppPrevMcuSta = 0x00000000uL;]     ↓     end   </pre>				
Called Function	SWDDS.1.3.4.2 StartUp_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.53
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.2.52.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	120

#### 1.1.2.52.3 Dynamic View Design

- N/A

#### 1.1.2.52.4 Interface Design

- N/A

#### 1.1.2.53 [SWDDS.2.2.54] RteApp\_GetOpuFltNo

##### 1.1.2.53.1 Detailed Design

##### [SWDDS.2.2.54] RteApp\_GetOpuFltNo

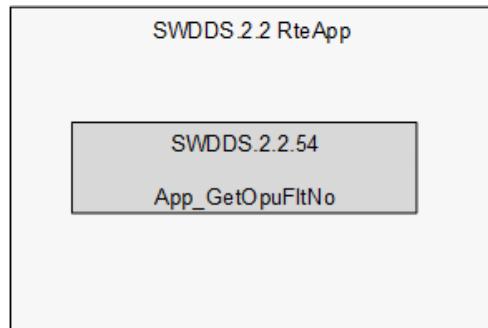
Software Unit Information					
Unit ID	SWDDS.2.2.54		Unit Name	App_GetOpuFltNo	
Architecture ID	SWADS.2.2.54		ASIL	QM	
Prototype	tU16 App_GetOpuFltNo( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 32767		Number of OPU fault	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16RteAppOpuFltNo	0 ~ 32767	Read	Number of OPU fault
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Number of OPU fault getting				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; code[return g_u16RteAppOpuFltNo;]   </pre>				
Called Function	SWDDS.1.3.3.2 ShutDown_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.54
Target Milestone	EBS2
Element	RteApp
Risk	<span style="color: green;">Low</span>
Interoperability	No

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	121

Criticality	 Low
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.53.2 Static View Design



#### 1.1.2.53.3 Dynamic View Design

- N/A

#### 1.1.2.53.4 Interface Design

- N/A

#### 1.1.2.54 [SWDDS.2.2.55] App\_GetOpuFltStored

##### 1.1.2.54.1 Detailed Design

###### [SWDDS.2.2.55] App\_getOpuFltStored

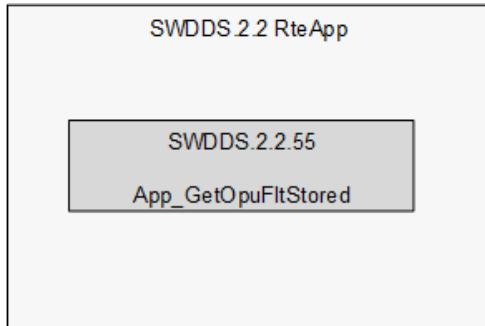
Software Unit Information					
Unit ID	SWDDS.2.2.55		Unit Name	App_GetOpuFltStored	
Architecture ID	SWADS.2.2.55		ASIL	QM	
Prototype	void App_GetOpuFltStored( tU32* flag_buffer )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32*	flag_buffer	0 ~ 4294967295	OUT	stored OPU flag getting buffer
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_au32RteAppFltFlagStored [RTE_APP_OPU_FLT_STORE_NO]	0 ~ 4294967295	Read	Fault flag storage

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current OPU fault flag clearing				
Control Flow Diagram (or Pseudo Code)	<pre>     start     Volatile tu16 stored_index;     stored_index = 0u;     loop:         if (stored_index &lt; RTE_APP_OPU_FLT_STORE_NO) {             flag_buffer[stored_index] = g_u32RteAppFltFlagStored[stored_index];             stored_index++;         } else {             end         }     }   </pre>				
Called Function	SWDDS.1.3.3.4 SaveShutdownFltFlag				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.2.55
Target Milestone	EBS2
Element	RteApp
Risk	Low
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	123

#### 1.1.2.54.2 Static View Design



#### 1.1.2.54.3 Dynamic View Design

– N/A

#### 1.1.2.54.4 Interface Design

– N/A

### 1.1.2.55 [SWDDS.2.2.56] RteApp\_ReadCurErr

#### 1.1.2.55.1 Detailed Design

[SWDDS.2.2.56] RteApp\_ReadCurErr

#### 1.1.2.55.2 Static View Design

– N/A

#### 1.1.2.55.3 Dynamic View Design

– N/A

#### 1.1.2.55.4 Interface Design

– N/A

### 1.1.2.56 [SWDDS.2.2.57] RteApp\_ReadDcVolt

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	124

#### 1.1.2.56.1 Detailed Design

[SWDDS.2.2.57] RteApp\_ReadDcVolt

Requirement Id	SWDDS.2.2.57
Target Milestone	SBS2.1
Element	RteApp
Risk	 Low
Interoperability	No
Criticality	 Low
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.56.2 Static View Design

– N/A

#### 1.1.2.56.3 Dynamic View Design

– N/A

#### 1.1.2.56.4 Interface Design

– N/A

#### 1.1.2.57 [SWDDS.2.2.58] RteApp\_WriteCtrMode

##### 1.1.2.57.1 Detailed Design

[SWDDS.2.2.58] RteApp\_WriteCtrMode

Requirement Id	SWDDS.2.2.58
Target Milestone	SBS2.1
Element	RteApp
Risk	 Low
Interoperability	No
Criticality	 Low
Technical complexity	 Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	125

#### 1.1.2.57.2 Static View Design

– N/A

#### 1.1.2.57.3 Dynamic View Design

– N/A

#### 1.1.2.57.4 Interface Design

– N/A

### 1.1.2.58 [SWDDS.2.2.59] RteApp\_WriteRefCur

#### 1.1.2.58.1 Detailed Design

[SWDDS.2.2.59] RteApp\_WriteRefCur

Requirement Id	SWDDS.2.2.59
Target Milestone	SBS2.1
Element	RteApp
Risk	 Low
Interoperability	No
Criticality	 Low
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.58.2 Static View Design

– N/A

#### 1.1.2.58.3 Dynamic View Design

– N/A

#### 1.1.2.58.4 Interface Design

– N/A

### 1.1.2.59 [SWDDS.2.2.60] RteApp\_WriteSpdErr

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	126

#### 1.1.2.59.1 Detailed Design

[SWDDS.2.2.60] RteApp\_WriteSpdErr

Requirement Id	SWDDS.2.2.60
Target Milestone	SBS2.1
Element	RteApp
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.59.2 Static View Design

– N/A

#### 1.1.2.59.3 Dynamic View Design

– N/A

#### 1.1.2.59.4 Interface Design

– N/A

### 1.1.3 [SWDDS.2.3] Rtelo

Rtelo has the functions to get values from BSW.

Typically, It is used with RteApp to store in application data.

#### 1.1.3.1 [SWDDS.2.3.1] Rtelo\_Init

##### 1.1.3.1.1 Detailed Design

[SWDDS.2.3.1] Rtelo\_Init

Software Unit Information					
Unit ID	SWDDS.2.3.1	Unit Name	Rtelo_Init		
Architecture ID	SWADS.2.3.1	ASIL	QM		
Prototype	void Rtelo_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description

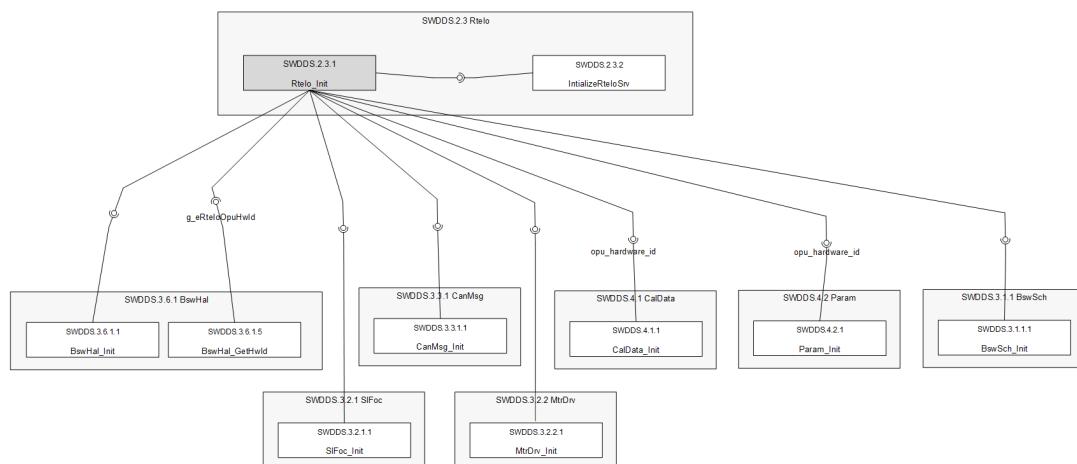
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tOpUHwId	g_eRtelOOpUHwId	0u~2u, OPU_HW_ID_UNDEFINED/ OPU_HW_ID_AQ301/ OPU_HW_ID_AQ451	Read/Write	OPU hardware ID
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	RTE IO initialization - Basic software HAL initialization - Hardware ID checking and Calibration data initialization - Basic software scheduler initialization				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; BswHalInit[SWDDS.3.6.1.1 BswHal_Init();]     BswHalInit --&gt; SifocInit[SWDDS.3.2.1.1 Sifoc_Init();]     SifocInit --&gt; CanMsgInit[SWDDS.3.3.1.1 CanMsg_Init();]     CanMsgInit --&gt; MtrDrvInit[SWDDS.3.2.2.1 MtrDrv_Init();]     MtrDrvInit --&gt; InitializeRteloSrv[SWDDS.2.3.2 InitializeRteloSrv();]     InitializeRteloSrv --&gt; BswHalGetHwId[SWDDS.3.6.1.5 g_eRtelOOpUHwId = BswHal_GetHwId();]     BswHalGetHwId --&gt; CalDataInit[SWDDS.4.1.1 CalData_Init( g_eRtelOOpUHwId );]     CalDataInit --&gt; ParamInit[SWDDS.4.2.1 Param_Init( g_eRtelOOpUHwId );]     ParamInit --&gt; BswSchInit[SWDDS.3.1.1.1 BswSch_Init();]     BswSchInit --&gt; end([end])   </pre>				
Called Function	SWDDS.2.1.2 InitializeRteSchRteSw				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	128

Calling Function	SWDDS.3.6.1.1 BswHal_Init
	SWDDS.3.2.1.1 SiFoc_Init
	SWDDS.3.3.1.1 CanMsg_Init
	SWDDS.3.2.2.1 MtrDrv_Init
	SWDDS.2.3.2 InitializeRteloSrv
	SWDDS.3.6.1.5 BswHal_GetHwId
	SWDDS.4.1.1 CalData_Init
	SWDDS.4.2.1 Param_Init
	SWDDS.3.1.1.1 BswSch_Init
Function Execution Time	N/A

Requirement Id	SWDDS.2.3.1
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.3.1.2 Static View Design



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
					Page	129

#### 1.1.3.1.3 Dynamic View Design

- N/A

#### 1.1.3.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_eRtelOpuHwId	SWDDS.3.6.1.5	IN	tOpuHwId	0	2	OPU_HW_ID_UNDEFINED	OPU_HW_ID_AQ451	N/A	OPU hardware ID
2	opu.hardware_id	SWDDS.4.1.1	OUT	tOpuHwId	0	2	OPU_HW_ID_UNDEFINED	OPU_HW_ID_AQ451	N/A	OPU hardware ID
3	opu.hardware_id	SWDDS.4.2.1	OUT	tOpuHwId	0	2	OPU_HW_ID_UNDEFINED	OPU_HW_ID_AQ451	N/A	OPU hardware ID

#### 1.1.3.2 [SWDDS.2.3.2] InitializeRteloSrv

##### 1.1.3.2.1 Detailed Design

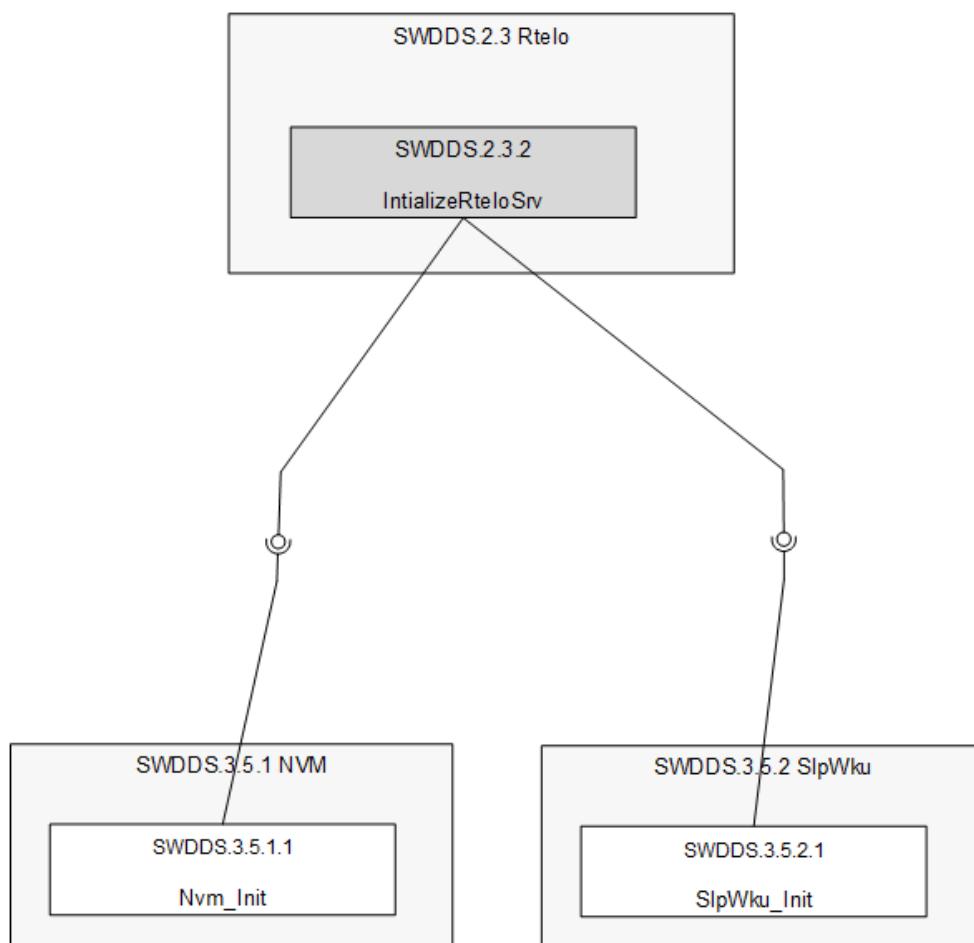
###### [SWDDS.2.3.2] InitializeRteloSrv

Software Unit Information					
Unit ID	SWDDS.2.3.2	Unit Name	InitializeRteloSrv		
Architecture ID	SWADS.2.3.2	ASIL	QM		
Prototype	void InitializeRteloSrv( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	BSW service initialization				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.3.5.1.1]     Nvm_Init();           [SWDDS.3.5.2.1]     SlpWku_Init();           end   </pre>
Called Function	SWDDS.2.3.1 Rtelo_Init
Calling Function	SWDDS.3.5.1.1 Nvm_Init SWDDS.3.5.2.1 SlpWku_Init
Function Execution Time	N/A

Requirement Id	SWDDS.2.3.2
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

### 1.1.3.2.2 Static View Design



#### 1.1.3.2.3 Dynamic View Design

- N/A

#### 1.1.3.2.4 Interface Design

- N/A

#### 1.1.3.3 [SWDDS.2.3.3] Rtel0\_EnaGlobalInterrupt

##### 1.1.3.3.1 Detailed Design

###### [SWDDS.2.3.3] Rtel0\_EnaGlobalInterrupt

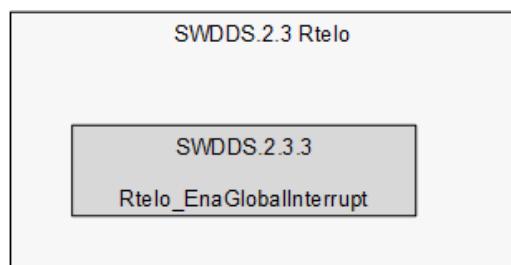
Software Unit Information					
Unit ID	SWDDS.2.3.3	Unit Name	Rtel0_EnaGlobalInterrupt		
Architecture ID	SWADS.2.3.3	ASIL	QM		
Prototype	void Rtel0_EnaGlobalInterrupt( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description

<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
					Page	132

Parameters	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Global interrupt enabling				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     EnableInterrupts;     ↓     end   </pre>				
Called Function	SWDDS.2.1.1 RteSch_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.3
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.3.3.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	133

#### 1.1.3.3.3 Dynamic View Design

- N/A

#### 1.1.3.3.4 Interface Design

- N/A

#### 1.1.3.4 [SWDDS.2.3.4] Rtelo\_DisGlobalInterrupt

##### 1.1.3.4.1 Detailed Design

##### [SWDDS.2.3.4] Rtelo\_DisGlobalInterrupt

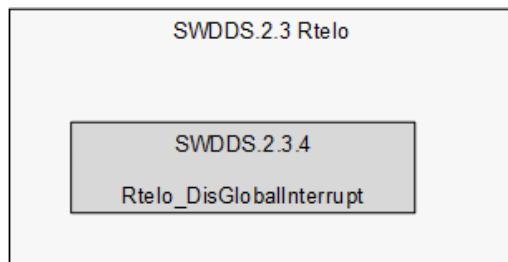
Software Unit Information					
Unit ID	SWDDS.2.3.4	Unit Name	Rtelo_DisGlobalInterrupt		
Architecture ID	SWADS.2.3.4	ASIL	QM		
Prototype	void Rtelo_DisGlobalInterrupt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Global interrupt disabling				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     DisableInterrupts;     ↓     end   </pre>				
Called Function	SWDDS.1.3.3.2 ShutDown_Mng				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.4
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">+</span> Low
Interoperability	No

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	134

Criticality	Low
Technical complexity	Low
Verifiability	Yes

#### 1.1.3.4.2 Static View Design



#### 1.1.3.4.3 Dynamic View Design

- N/A

#### 1.1.3.4.4 Interface Design

- N/A

#### 1.1.3.5 [SWDDS.2.3.5] Rtelo\_ChkWdtTimRdy

##### 1.1.3.5.1 Detailed Design

###### [SWDDS.2.3.5] Rtelo\_ChkWdtTimRdy

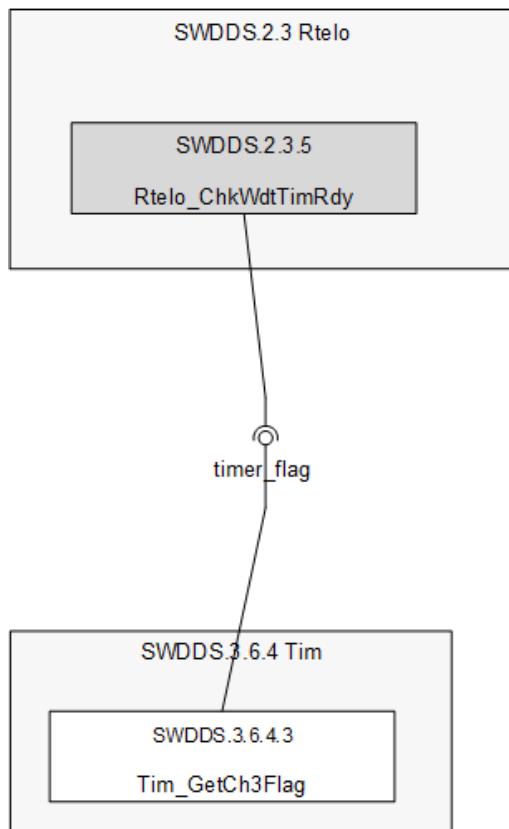
Software Unit Information					
Unit ID	SWDDS.2.3.5	Unit Name	Rtelo_ChkWdtTimRdy		
Architecture ID	SWADS.2.3.5	ASIL	QM		
<b>Prototype</b>					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0~1, FALSE/ TRUE		Timer channel 3 flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Watchdog timer reset timing ready checking				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	135

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return Tim_GetCh3Flag();   </pre>
Called Function	SWDDS.2.1.6 RunRteSchBackground
Calling Function	SWDDS.3.6.4.3 Tim_GetCh3Flag
Function Execution Time	N/A

Requirement Id	SWDDS.2.3.5
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.5.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	136

#### 1.1.3.5.3 Dynamic View Design

- N/A

#### 1.1.3.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	timer_flag	SWDDS.3.6.4.3	IN	tBool	0	1	Not ready	Watchdog timer update timing ready	True / False	Timer status flag

#### 1.1.3.6 [SWDDS.2.3.6] Rtel0\_RstWdtTim

##### 1.1.3.6.1 Detailed Design

##### [SWDDS.2.3.6] Rtel0\_RstWdtTim

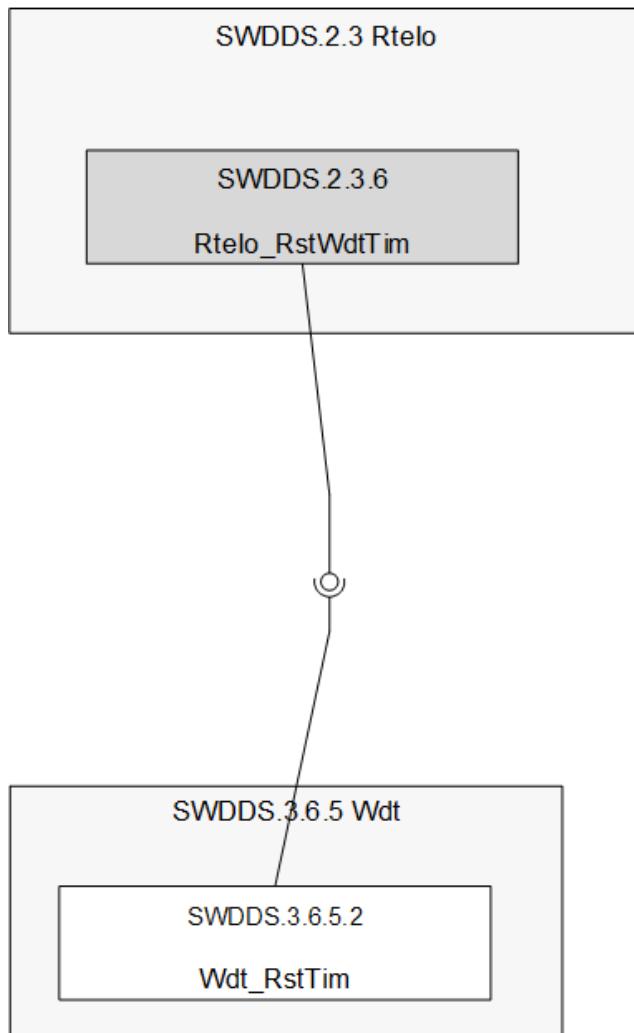
Software Unit Information					
Unit ID	SWDDS.2.3.6	Unit Name	Rtel0_RstWdtTim		
Architecture ID	SWADS.2.3.6	ASIL	QM		
Prototype	void Rtel0_RstWdtTim( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Watchdog timer resetting				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.3.6.5.2]     Wdt_RstTim();           end   </pre>				
Called Function	SWDDS.2.1.6 RunRteSchBackground SWDDS.1.3.3.2 ShutDown_Mng SWDDS.1.3.3.4 SaveShutDownFltFlag				
Calling Function	SWDDS.3.6.5.2 Wdt_RstTim				
Function Execution Time	N/A				



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	137

Requirement Id	SWDDS.2.3.6
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.6.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	138

#### 1.1.3.6.3 Dynamic View Design

- N/A

#### 1.1.3.6.4 Interface Design

- N/A

### 1.1.3.7 [SWDDS.2.3.7] Rtelo\_EnaTimRun

#### 1.1.3.7.1 Detailed Design

#### [SWDDS.2.3.7] Rtelo\_EnaTimRun

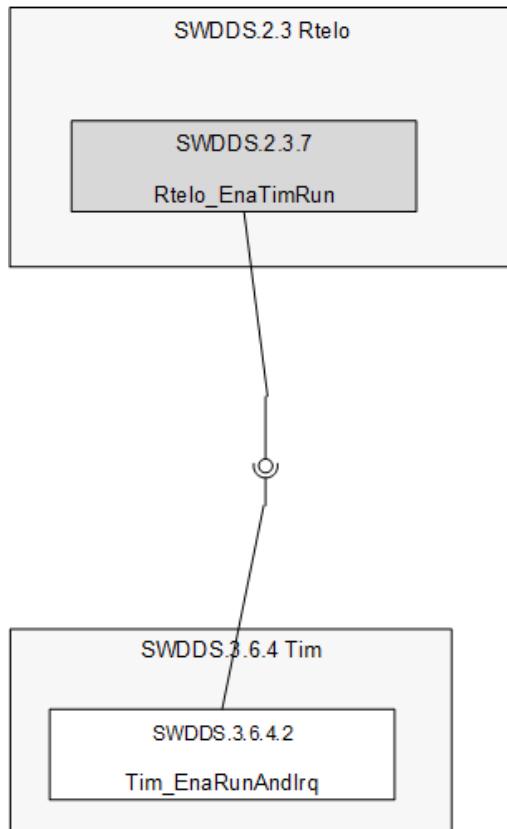
Software Unit Information					
Unit ID	SWDDS.2.3.7	Unit Name	Rtelo_EnaTimRun		
Architecture ID	SWADS.2.3.7	ASIL	QM		
Prototype	void Rtelo_EnaTimRun( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Timer running and timer interrupt enabling				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; TimEraRunAndIrq[SWDDS.3.6.4.2 Tim_EnaRunAndIrq()]     TimEraRunAndIrq --&gt; end((end))   </pre>				
Called Function	SWDDS.2.1.1 RteSch_Init				
Calling Function	SWDDS.3.6.4.2 Tim_EnaRunAndIrq				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.7
Target Milestone	EBS2
Element	Rtelo
Risk	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	139

Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.3.7.2 Static View Design



#### 1.1.3.7.3 Dynamic View Design

- N/A

#### 1.1.3.7.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	140

### 1.1.3.8 [SWDDS.2.3.8] Rtelo\_GetSIFocStaDat

#### 1.1.3.8.1 Detailed Design

##### [SWDDS.2.3.8] Rtelo\_GetSIFocStaDat

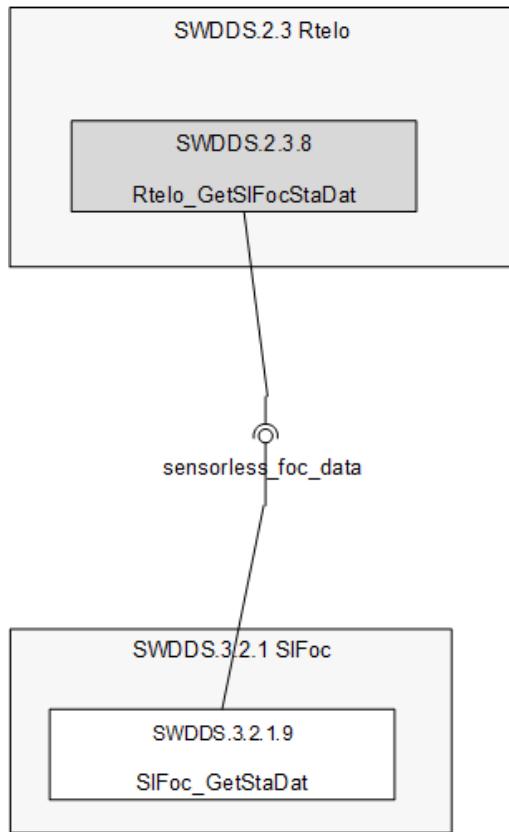
Software Unit Information					
Unit ID	SWDDS.2.3.8	Unit Name	Rtelo_GetSIFocStaDat		
Architecture ID	SWADS.2.3.8	ASIL	QM		
Prototype	void Rtelo_GetSIFocStaDat( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_stRteloSIFocStaDat.eControlState	0 ~ 4, CTR_STATE_SWTC_OFF/ CTR_STATE_OFFSET_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Control state
	tFrac16	g_stRteloSIFocStaDat.f16SpeedOutput	-32768 ~ 32767	Write	Motor revolution speed output (PU)
	tFrac16	g_stRteloSIFocStaDat.f16CurrentOutput	-32768 ~ 32767	Write	q-axis current output (PU)
	tFrac16	g_stRteloSIFocStaDat.f16CurrentError	-32768 ~ 32767	Write	q-axis current control error (PU)
	tFrac16	g_stRteloSIFocStaDat.f16DcVoltage	0 ~ 32767	Write	DC driving voltage (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC status data getting				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tSIFocStaDat sensorless_foc_data;     ↓     [SWDDS.3.2.1.9]     sensorless_foc_data = SIFoc_GetStaDat();     ↓     g_stRteloSIFocStaDat.eControlState = sensorless_foc_data.eControlState;     g_stRteloSIFocStaDat.f16SpeedOutput = sensorless_foc_data.f16SpeedOutput;     g_stRteloSIFocStaDat.f16CurrentOutput = sensorless_foc_data.f16CurrentOutput;     g_stRteloSIFocStaDat.f16CurrentError = sensorless_foc_data.f16CurrentError;     g_stRteloSIFocStaDat.f16DcVoltage = sensorless_foc_data.f16DcVoltage;     g_stRteloSIFocStaDat.u16FaultStatus = sensorless_foc_data.u16FaultStatus;     ↓     end   </pre>
	Called Function SWDDS.2.1.7 RteSch_Task1ms
	Calling Function SWDDS.3.2.1.9 SIFoc_GetStaDat
	Function Execution Time N/A

Requirement Id	SWDDS.2.3.8
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.3.8.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	142



#### 1.1.3.8.3 Dynamic View Design

– N/A

#### 1.1.3.8.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	sensorless_foc_data	SWDDS.3.2.1.9	IN	tSIFocStaDat	N/A	N/A	N/A	N/A	N/A	Sensorless FOC status data

#### 1.1.3.9 [SWDDS.2.3.9] Rtelo\_GetCtrState

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	143

### 1.1.3.9.1 Detailed Design

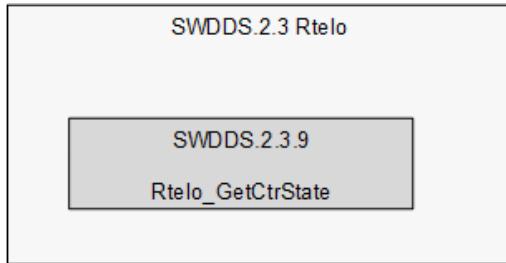
#### [SWDDS.2.3.9] Rtelo\_GetCtrState

Software Unit Information					
Unit ID	SWDDS.2.3.9		Unit Name	Rtelo_GetCtrState	
Architecture ID	SWADS.2.3.9		ASIL	QM	
Prototype	tCtrState Rtelo_GetCtrState( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tCtrState	0 ~ 4, CTR_STATE_SWTC_OFF/CTR_STATE_OFFS_CALIB/ CTR_STATE_INIT_ALIGN/CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN		Control state	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_stRteloSIFocStaDat.eControlState	0 ~ 4, CTR_STATE_SWTC_OFF/ CTR_STATE_OFFS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Read	Control state
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control state getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     g_stRteloSIFocStaDat.eControlState   </pre>				
Called Function	SWDDS.1.1.2.2 CtrSta_Chk				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.9
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	144

#### 1.1.3.9.2 Static View Design



#### 1.1.3.9.3 Dynamic View Design

- N/A

#### 1.1.3.9.4 Interface Design

- N/A

#### 1.1.3.10 [SWDDS.2.3.10] Rtelo\_GetSpdOut

##### 1.1.3.10.1 Detailed Design

###### [SWDDS.2.3.10] Rtelo\_GetSpdOut

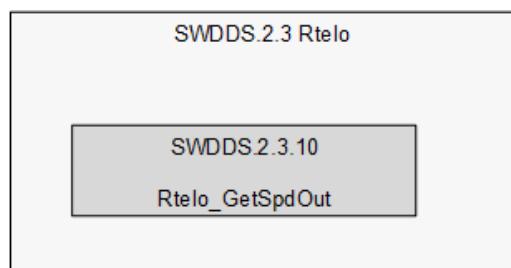
Software Unit Information					
Unit ID	SWDDS.2.3.10		Unit Name	Rtelo_GetSpdOut	
Architecture ID	SWADS.2.3.10		ASIL	QM	
Prototype	tFrac16 Rtelo_GetSpdOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		Speed output (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stRteloSIFocStaDat.f16SpeedOutput	-32768 ~ 32767	Read	Motor revolution speed output (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed output getting				
Control Flow					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	145

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     g_stRteloSIFocStaDat.f16SpeedOutput;   </pre>
Called Function	<p>SWDDS.1.1.3.6 CalculateCurSigDcCurTrqSpdVolt</p> <p>SWDDS.1.1.6.2 MtrSpd_Measr</p>
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.3.10
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.10.2 Static View Design



#### 1.1.3.10.3 Dynamic View Design

- N/A

#### 1.1.3.10.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	146

### 1.1.3.11 [SWDDS.2.3.11] Rtelo\_GetCurOut

#### 1.1.3.11.1 Detailed Design

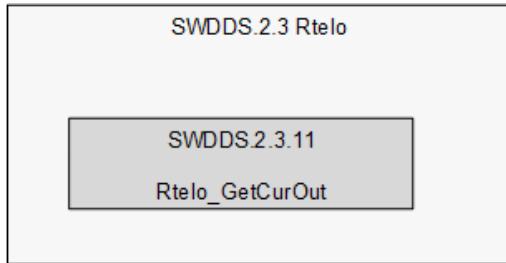
##### [SWDDS.2.3.11] Rtelo\_GetCurOut

Software Unit Information					
Unit ID	SWDDS.2.3.11		Unit Name	Rtelo_GetCurOut	
Architecture ID	SWADS.2.3.11		ASIL	QM	
Prototype	tFrac16 Rtelo_GetCurOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		q-axis current output (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stRteloSIFocStaDat.f16CurrentOutput	-32768 ~ 32767	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current output getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     g_stRteloSIFocStaDat.f16SpeedOutput;   </pre>				
Called Function	SWDDS.1.1.3.3 GetCurSigCurOut				
	SWDDS.1.1.3.6 CalculateCurSigDcCurTrqSpdVolt				
	SWDDS.1.1.7.2 MtrTrq_Cal				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.11
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	147

#### 1.1.3.11.2 Static View Design



#### 1.1.3.11.3 Dynamic View Design

- N/A

#### 1.1.3.11.4 Interface Design

- N/A

#### 1.1.3.12 [SWDDS.2.3.12] Rtelo\_GetCurErr

##### 1.1.3.12.1 Detailed Design

###### [SWDDS.2.3.12] Rtelo\_GetCurErr

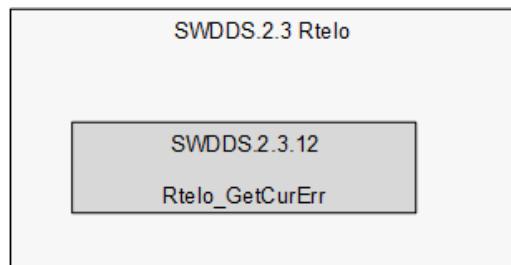
Software Unit Information					
Unit ID	SWDDS.2.3.12		Unit Name	Rtelo_GetCurErr	
Architecture ID	SWADS.2.3.12		ASIL	QM	
Prototype	tFrac16 Rtelo_GetCurErr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		q-axis current control error (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stRteloSIFocStaDat.f16CurrentError	-32768 ~ 32767	Read	q-axis current control error (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current control error getting				
Control Flow Diagram					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	148

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     g_stRteloSIFocStaD.f16CurrentError;   </pre>
Called Function	SWDDS.1.1.3.4 GetCurSigCurErr
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.2.3.12
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.12.2 Static View Design



#### 1.1.3.12.3 Dynamic View Design

- N/A

#### 1.1.3.12.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	149

### 1.1.3.13 [SWDDS.2.3.13] Rtelo\_GetCtrFlt

#### 1.1.3.13.1 Detailed Design

##### [SWDDS.2.3.13] Rtelo\_GetCtrFlt

Software Unit Information					
Unit ID	SWDDS.2.3.13		Unit Name	Rtelo_GetCtrFlt	
Architecture ID	SWADS.2.3.13		ASIL	QM	
Prototype	tU16 Rtelo_GetCtrFlt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 65535		Control fault flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_stRteloSIFocStaDat.u16FaultStatus	0 ~ 65535	Read	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control fault flag getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [ tU16 fault_status;       fault_status = g_stRteloSIFocStaDat.u16FaultStatus; ]     ↓     return fault_status;   </pre>				
Called Function	SWDDS.1.1.2.2 CtrSta_Chk				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.13
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">*</span> Low
Interoperability	No
Criticality	<span style="color: green;">*</span> Low
Technical complexity	<span style="color: green;">*</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	150

#### 1.1.3.13.2 Static View Design



#### 1.1.3.13.3 Dynamic View Design

- N/A

#### 1.1.3.13.4 Interface Design

- N/A

#### 1.1.3.14 [SWDDS.2.3.14] Rtelo\_GetDcVolt

##### 1.1.3.14.1 Detailed Design

###### [SWDDS.2.3.14] Rtelo\_GetDcVolt

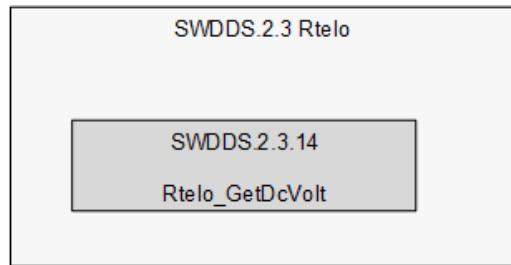
Software Unit Information					
Unit ID	SWDDS.2.3.14		Unit Name	Rtelo_GetDcVolt	
Architecture ID	SWADS.2.3.14		ASIL	QM	
Prototype	tFrac16 Rtelo_GetDcVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	0 ~ 32767		DC link voltage (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stRteloSIFocStaDat.f16DcVoltage	0 ~ 32767	Read	DC driving voltage (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC link voltage getting				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return((return))     return --&gt; code[g_stRteloSIFocStaDat.f16DcVoltage]   </pre>				
Called Function	SWDDS.1.1.3.6 CalculateCurSigDcCurTrqSpdVolt				
	SWDDS.1.1.4.2 DcVolt_Measr				
Calling Function	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	151

Function Execution Time	N/A
-------------------------	-----

Requirement Id	SWDDS.2.3.14
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.14.2 Static View Design



#### 1.1.3.14.3 Dynamic View Design

- N/A

#### 1.1.3.14.4 Interface Design

- N/A

#### 1.1.3.15 [SWDDS.2.3.15] Rtelo\_SetSIFocCtrDat

##### 1.1.3.15.1 Detailed Design

##### [SWDDS.2.3.15] Rtelo\_SetSIFocCtrDat

Software Unit Information			
Unit ID	SWDDS.2.3.15	Unit Name	Rtelo_SetSIFocCtrDat
Architecture ID	SWADS.2.3.15	ASIL	QM
Prototype	void Rtelo_SetSIFocCtrDat( tSIFocCtrDat control_data )		
	Data		

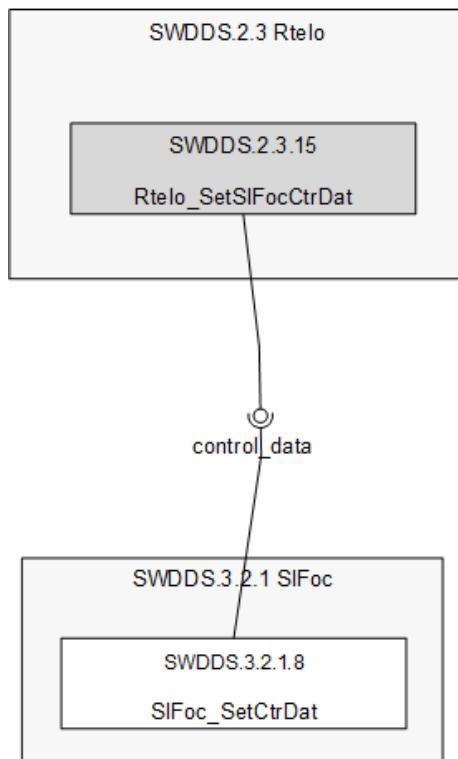
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	152

	Type	Name	Range	IN/OUT	Description
Function Call Parameters	tBool	control_data.bControlEnable	0 ~ 1, FALSE / TRUE	IN	sensorless FOC control enable
	tCtrMode	control_data.eControlMode	0 ~ 1, CTR_MODE_SPD / CTR_MODE_CUR	IN	sensorless FOC control mode
	tFrac16	control_data.f16ReferenceCurrent	0 ~ 32767	IN	Referernce current (PU)
	tFrac16	control_data.f16ReferenceSpeed	0 ~ 17476	IN	Refererence speed (PU)
	tFrac16	control_data.f16CurrentLimitUpper	-32768 ~ 32767	IN	Current limit upper (PU)
	tFrac16	control_data.f16CurrentLimitLower	-32768 ~ 32767	IN	Current limit lower (PU)
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control data setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [SWDDS.3.2.1.8]     SIFoc_SetCtrDat( control_data );     ↓     end   </pre>				
Called Function	SWDDS.1.4.2.1 MtrCtr_Init				
	SWDDS.1.4.2.2 MtrCtr_Set				
Calling Function	SWDDS.3.2.1.8 SIFoc_SetCtrDat				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.15
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	153

#### 1.1.3.15.2 Static View Design



#### 1.1.3.15.3 Dynamic View Design

- N/A

#### 1.1.3.15.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	control_data	SWDDS.3.2.1.8	OUT	tSIFocCtrDat	N/A	N/A	N/A	N/A	N/A	sensorless FOC control data

#### 1.1.3.16 [SWDDS.2.3.16] Rtelo\_ClrSIFocFltSta

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	154

### 1.1.3.16.1 Detailed Design

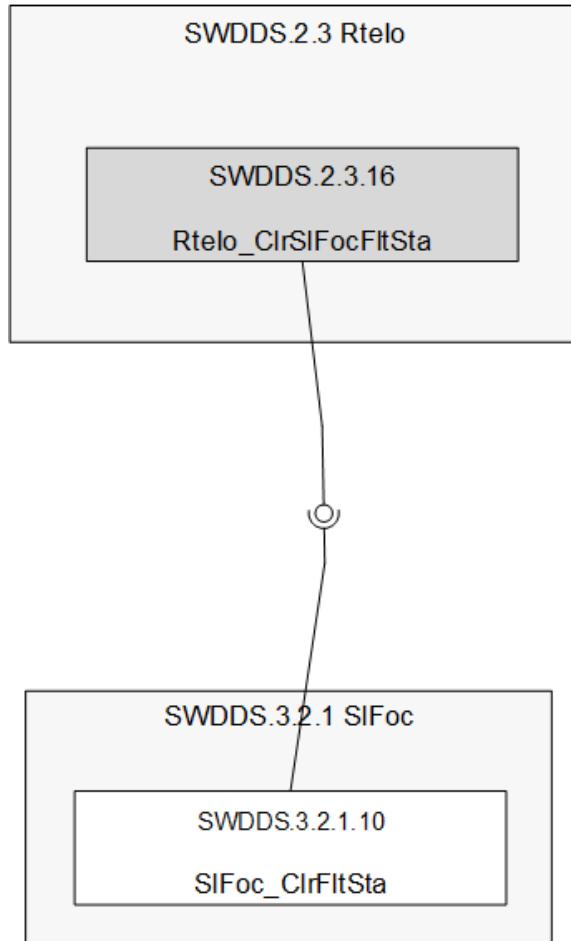
#### [SWDDS.2.3.16] Rtelo\_ClrSIFocFltSta

Software Unit Information					
Unit ID	SWDDS.2.3.16	Unit Name	Rtelo_ClrSIFocFltSta		
Architecture ID	SWADS.2.3.16	ASIL	QM		
Prototype	void Rtelo_ClrSIFocFltSta( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control fault clearing				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.3.2.1.10]     SIFoc_ClrFltSta();           end   </pre>				
Called Function	SWDDS.1.2.2.4 CheckDrvStaFlagClr				
	SWDDS.1.4.2.2 MtrCtr_Set				
	SWDDS.1.3.4.2 StartUp_Mng				
Calling Function	SWDDS.3.2.1.10 SIFoc_ClrFltSta				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.16
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	155

#### 1.1.3.16.2 Static View Design



#### 1.1.3.16.3 Dynamic View Design

- N/A

#### 1.1.3.16.4 Interface Design

- N/A

#### 1.1.3.17 [SWDDS.2.3.17] Rtelo\_PrechrgCurlIntg

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	156

### 1.1.3.17.1 Detailed Design

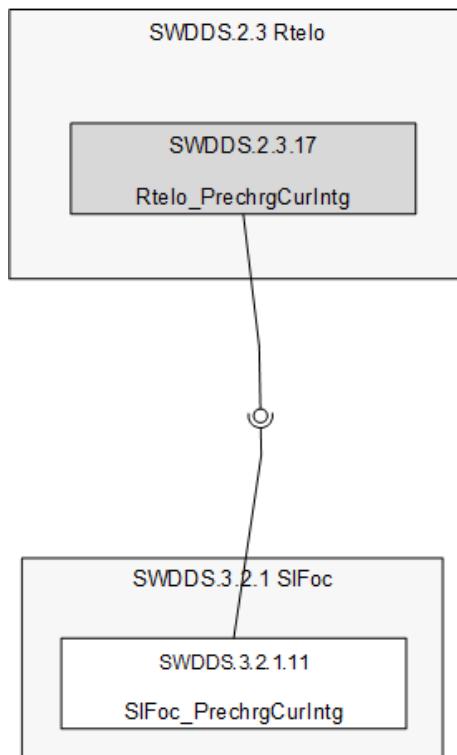
#### [SWDDS.2.3.17] Rtelo\_PrechrgCurlntg

Software Unit Information					
Unit ID	SWDDS.2.3.17	Unit Name	Rtelo_PrechrgCurlntg		
Architecture ID	SWADS.2.3.17	ASIL	QM		
Prototype	void Rtelo_PrechrgCurlntg( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC current control integrator pre-charging				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [SWDDS.3.2.1.11]     SIFoc_PrechrgCurlntg();     ↓     end   </pre>				
Called Function	SWDDS.1.2.3.16 CheckEopCtrAntiWindUp				
Calling Function	SWDDS.3.2.1.11 SIFoc_PrechrgCurlntg				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.17
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	157

#### 1.1.3.17.2 Static View Design



#### 1.1.3.17.3 Dynamic View Design

- N/A

#### 1.1.3.17.4 Interface Design

- N/A

#### 1.1.3.18 [SWDDS.2.3.18] Rtelo\_GetPcbTempSig

##### 1.1.3.18.1 Detailed Design

###### [SWDDS.2.3.18] Rtelo\_GetPcbTempSig

Software Unit Information				
Unit ID	SWDDS.2.3.18	Unit Name	Rtelo_GetPcbTempSig	
Architecture ID	SWADS.2.3.18	ASIL	QM	
Prototype	tFrac16 Rtelo_GetPcbTempSig( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	tFrac16	0 ~ 32767		PCB temperature signal (PU)

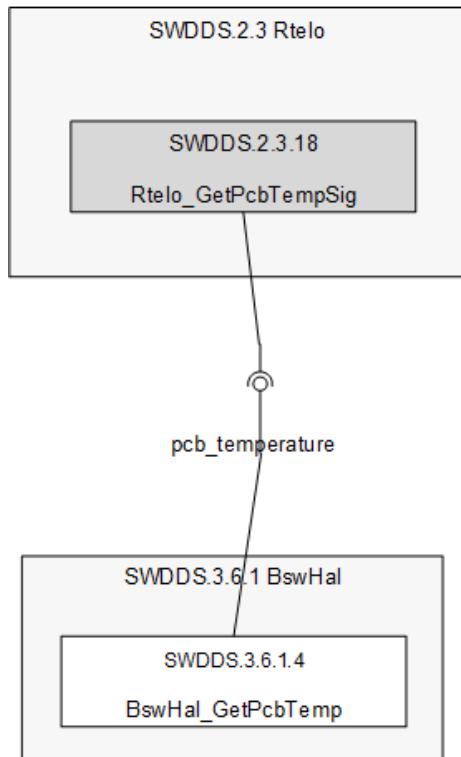
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	158

Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature signal getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     BswHal_GetPcbTemp();   </pre>				
Called Function	SWDDS.1.1.9.2 TempSig_Measr				
Calling Function	SWDDS.3.6.1.4 BswHal_GetPcbTemp				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.18
Target Milestone	SBS1
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.3.18.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	159



#### 1.1.3.18.3 Dynamic View Design

- N/A

#### 1.1.3.18.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pcb_temperature	SWDDS.3.6.1.4	IN	tFrac16	0	32767	0	4.99985	0.000152588 / Vpk	PCB temperature signal (PU)

#### 1.1.3.19 [SWDDS.2.3.19] Rtelo\_GetBatVolt

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	160

### 1.1.3.19.1 Detailed Design

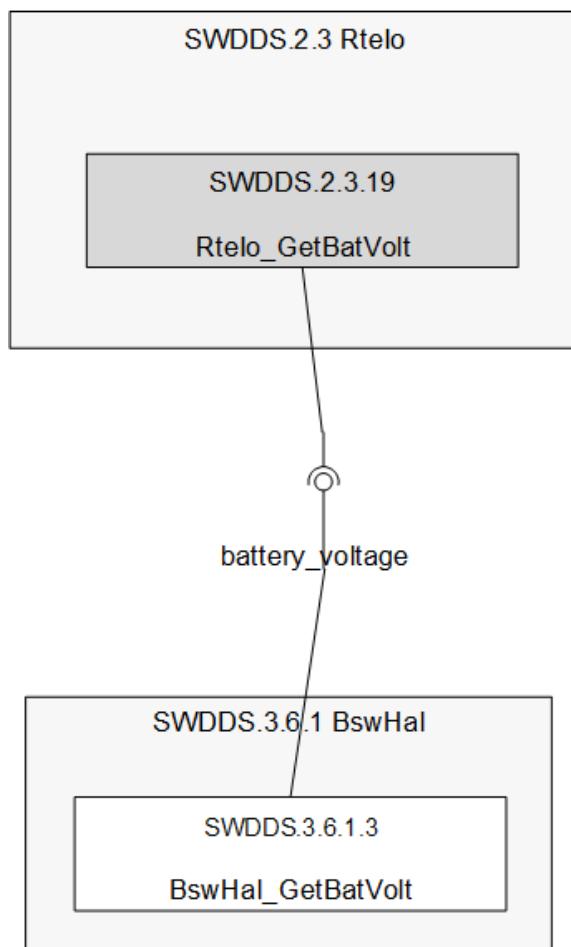
#### [SWDDS.2.3.19] Rtelo\_GetBatVolt

Software Unit Information					
Unit ID	SWDDS.2.3.19	Unit Name	Rtelo_GetBatVolt		
Architecture ID	SWADS.2.3.19	ASIL	QM		
Prototype	tFrac16 Rtelo_GetBatVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	tFrac16	0 ~ 32767	Battery voltage (PU)		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     BswHal_GetBatVolt();   </pre>				
Called Function	SWDDS.1.1.5.3 GetMcuStaBatVolt				
Calling Function	SWDDS.3.6.1.3 BswHal_GetBatVolt				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.19
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">*</span> Low
Interoperability	No
Criticality	<span style="color: green;">*</span> Low
Technical complexity	<span style="color: green;">*</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	161

#### 1.1.3.19.2 Static View Design



#### 1.1.3.19.3 Dynamic View Design

- N/A

#### 1.1.3.19.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	battery_voltage	SWDDS.3.6.1.3	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage signal (PU)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	162

### 1.1.3.20 [SWDDS.2.3.20] Rtelo\_ChkGdrvVlsLow

#### 1.1.3.20.1 Detailed Design

##### [SWDDS.2.3.20] Rtelo\_ChkGdrvVlsLow

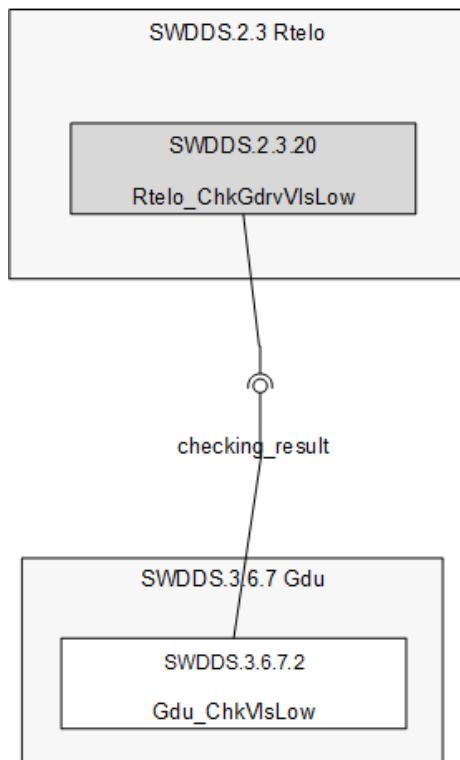
Software Unit Information					
Unit ID	SWDDS.2.3.20	Unit Name	Rtelo_ChkGdrvVlsLow		
Architecture ID	SWADS.2.3.20	ASIL	QM		
Prototype	tBool Rtelo_ChkGdrvVlsLow( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1, FALSE / TRUE			
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Gate driver VLS_OUT status checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return Gdu_ChkVlsLow();   </pre>				
Called Function	SWDDS.1.3.2.3 ModeChg_Mng				
	SWDDS.1.3.4.2 StartUp_Mng				
Calling Function	SWDDS.3.6.7.2 Gdu_ChkVlsLow				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.20
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-04-30
			Page	163	

Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.20.2 Static View Design



#### 1.1.3.20.3 Dynamic View Design

- N/A

#### 1.1.3.20.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	checking_result	SWDDS.3.6.7.2	IN	tBool	0	1	Normal	Voltage low	True / False	LVS low level: FALSE – normal, TRUE – voltage low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	164

### 1.1.3.21 [SWDDS.2.3.21] Rtelo\_ChkCanReqMsg

#### 1.1.3.21.1 Detailed Design

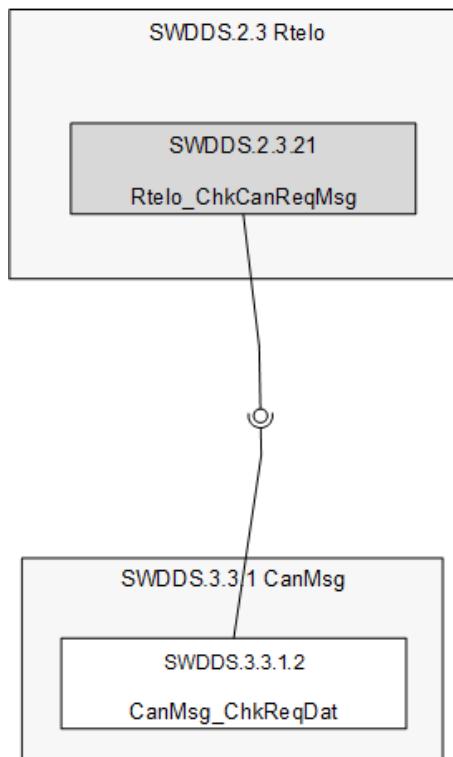
##### [SWDDS.2.3.21] Rtelo\_ChkCanReqMsg

Software Unit Information					
Unit ID	SWDDS.2.3.21	Unit Name	Rtelo_ChkCanReqMsg		
Architecture ID	SWADS.2.3.21	ASIL	QM		
Prototype	void Rtelo_ChkCanReqMsg( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN received request message checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.3.3.1.2]     CanMsg_ChkReqDat();           end   </pre>				
Called Function	SWDDS.2.1.7 RteSch_Task1ms				
Calling Function	SWDDS.3.3.1.2 CanMsg_ChkReqDat				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.21
Target Milestone	SBS2.1
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	165

#### 1.1.3.21.2 Static View Design



#### 1.1.3.21.3 Dynamic View Design

- N/A

#### 1.1.3.21.4 Interface Design

- N/A

#### 1.1.3.22 [SWDDS.2.3.22] Rtelo\_GetTgtSpd

##### 1.1.3.22.1 Detailed Design

##### [SWDDS.2.3.22] Rtelo\_GetTgtSpd

Software Unit Information					
Unit ID	SWDDS.2.3.22	Unit Name	Rtelo_GetTgtSpd		
Architecture ID	SWADS.2.3.22	ASIL	QM		
Prototype	tBool Rtelo_GetTgtSpd( tS16* target_speed, tBool* data_valid )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	tS16*	target_speed	0 ~ 5100	OUT	target speed (rpm)
Function Call	tBool*	data_valid	0 ~ 1, FALSE/TRUE	OUT	FALSE: data invalid, TRUE: data valid
	Data Type	Possible Return Value		Description	

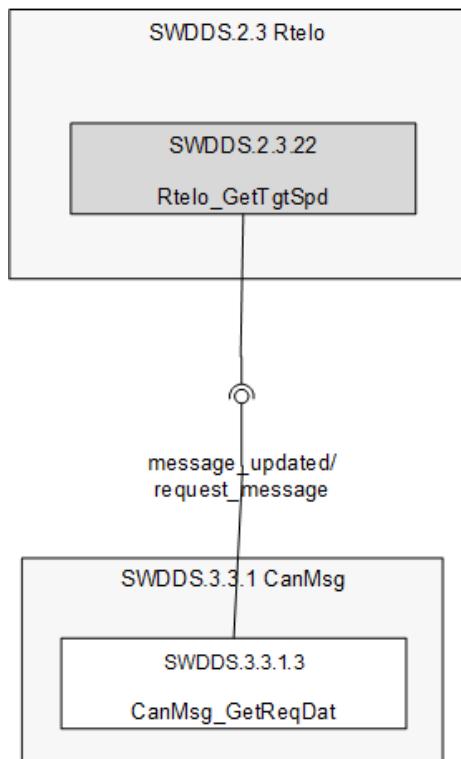
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	166

Return Value	tBool	0 ~ 1, FALSE/TRUE	FALSE: not updated, TRUE: data updated	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Target speed request getting			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tBool message_updated;     tCanMsgReq request_message;     ↓     [SWDDS.3.3.1.3]     message_updated = CanMsg_GetReqDat( &amp;request_message );     ↓     *target_speed = request_message.s16EopTargetSpeed; *data_valid = TRUE;     ↓     return message_updated;   </pre>			
Called Function	SWDDS.1.1.8.2 ReqMsg_Recv			
Calling Function	SWDDS.3.3.1.3 CanMsg_GetReqDat			
Function Execution Time	N/A			

Requirement Id	SWDDS.2.3.22
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

### 1.1.3.22.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	167



#### 1.1.3.22.3 Dynamic View Design

- N/A

#### 1.1.3.22.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	request_message	SWDDS.3.3.1.3	IN	tCanMsgReq*	N/A	N/A	N/A	N/A	N/A	Request message storage
2	message_updated	SWDDS.3.3.1.3	IN	tBool	0	1	Message not updated	Message updated	True / False	Message updated status

#### 1.1.3.23 [SWDDS.2.3.23] Rtelo\_GetCanBusSta

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	168

### 1.1.3.23.1 Detailed Design

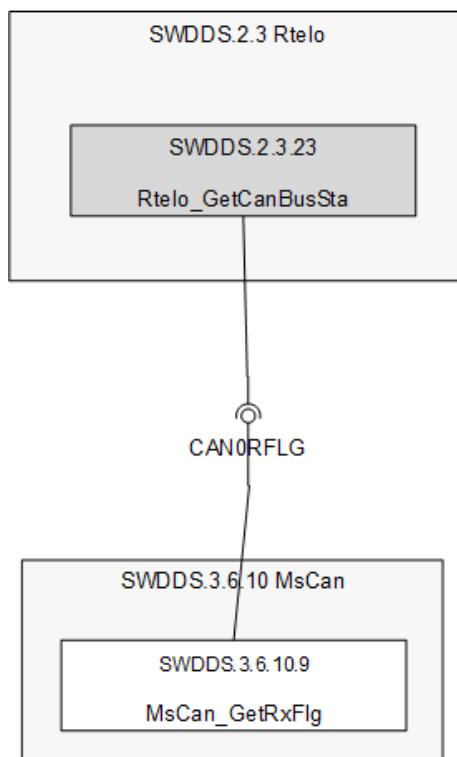
#### [SWDDS.2.3.23] Rtelo\_GetCanBusSta

Software Unit Information					
Unit ID	SWDDS.2.3.23	Unit Name	Rtelo_GetCanBusSta		
Architecture ID	SWADS.2.3.23	ASIL	QM		
Prototype	tU8 Rtelo_GetCanBusSta( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	tU8	0 ~ 255	CAN bus status flags		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN bus status getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return MsCan_GetRxFlg();   </pre>				
Called Function	SWDDS.1.1.8.5 CheckReqMsgCanBusSta				
Calling Function	SWDDS.3.6.10.9 MsCan_GetRxFlg				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.23
Target Milestone	SBS2.1
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	169

#### 1.1.3.23.2 Static View Design



#### 1.1.3.23.3 Dynamic View Design

- N/A

#### 1.1.3.23.4 Interface Design

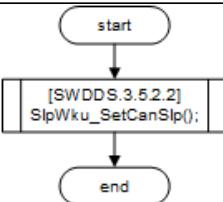
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	CAN0RFLG	SWDDS.3.6.10.9	IN	tU8	0	255	No CAN bus flag	CAN bus flag set	N/A	MSCAN data receiving flag

#### 1.1.3.24 [SWDDS.2.3.24] Rtel0\_SetCanSlp

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	170

#### 1.1.3.24.1 Detailed Design

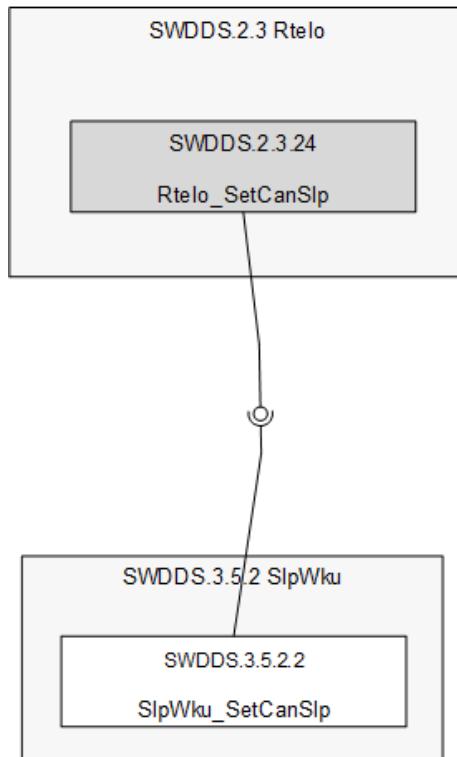
##### [SWDDS.2.3.24] Rtelo\_SetCanSlp

Software Unit Information					
Unit ID	SWDDS.2.3.24	Unit Name	Rtelo_SetCanSlp		
Architecture ID	SWADS.2.3.24	ASIL	QM		
Prototype	void Rtelo_SetCanSlp( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN transceiver sleep mode setting				
Control Flow Diagram (or Pseudo Code)	 <pre> graph TD     start((start)) --&gt; [SWDDS.3.5.2.2 SlpWku_SetCanSlp();]     [SWDDS.3.5.2.2 SlpWku_SetCanSlp();] --&gt; end((end)) </pre>				
Called Function	SWDDS.1.3.3.2 ShutDown_Mng				
Calling Function	SWDDS.3.5.2.2 SlpWku_SetCanSlp				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.24
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">★</span> Low
Interoperability	No
Criticality	<span style="color: green;">★</span> Low
Technical complexity	<span style="color: green;">★</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	171

#### 1.1.3.24.2 Static View Design



#### 1.1.3.24.3 Dynamic View Design

- N/A

#### 1.1.3.24.4 Interface Design

- N/A

#### 1.1.3.25 [SWDDS.2.3.25] Rtelo\_SendResMsg

##### 1.1.3.25.1 Detailed Design

##### [SWDDS.2.3.25] Rtelo\_SendResMsg

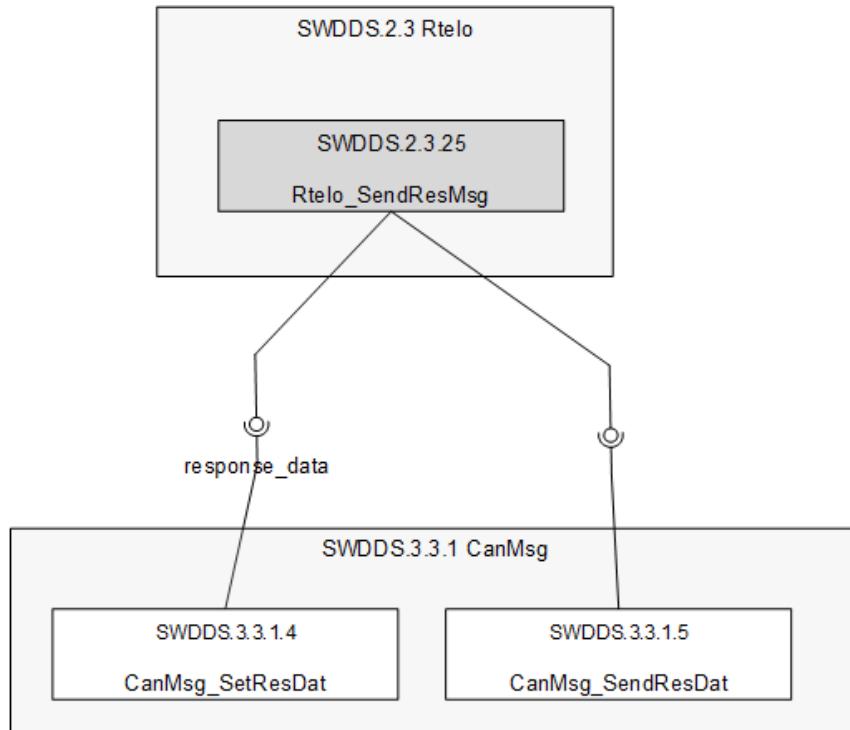
Software Unit Information					
Unit ID	SWDDS.2.3.25		Unit Name	Rtelo_SendResMsg	
Architecture ID	SWADS.2.3.25		ASIL	QM	
Prototype	void Rtelo_SendResMsg( tCanMsgRes response_message )				
	Data Type	Name	Range	IN/OUT	Description
	tS16	response_message.s16ActualRotationalSpeed	-6000 ~ 6000	IN	Actual rotational speed (rpm)
					Accumulated fault count

Function Call Parameters	tU16	response_message.u16EepromFaultCount	0 ~ 65535	IN	in EEPROM
	tFrac16	response_message.f16DcCurrentInput	0 ~ 32767	IN	DC current input (PU)
	tFrac16	response_message.f16CurrentOutputQ	-32768 ~ 32767	IN	q-axis current output (PU)
	tFrac16	response_message.f16MotorTorque	-32768 ~ 32767	IN	Motor torque (Nm)
	tU16	response_message.u16OpuFaultFlag	0 ~ 4095	IN	OPU fault flag
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Response data sending				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [SWDDS.3.3.1.4]     CanMsg_SetResDat(response_message);     ↓     [SWDDS.3.3.1.5]     CanMsg_SendResDat();     ↓     end   </pre>				
Called Function	SWDDS.1.4.3.2 ResMsg_Send				
Calling Function	SWDDS.3.3.1.4 CanMsg_SetResDat SWDDS.3.3.1.5 CanMsg_SendResDat				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.25
Target Milestone	EBS2
Element	Rtelo
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	173

#### 1.1.3.25.2 Static View Design



#### 1.1.3.25.3 Dynamic View Design

- N/A

#### 1.1.3.25.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	response_data	SWDDS.3.3.1.4	OUT	tCanMsgRes	N/A	N/A	N/A	N/A	N/A	response message

#### 1.1.3.26 [SWDDS.2.3.26] Rtelo\_SaveEepromDat

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	174

### 1.1.3.26.1 Detailed Design

#### [SWDDS.2.3.26] Rtelo\_SaveEepromDat

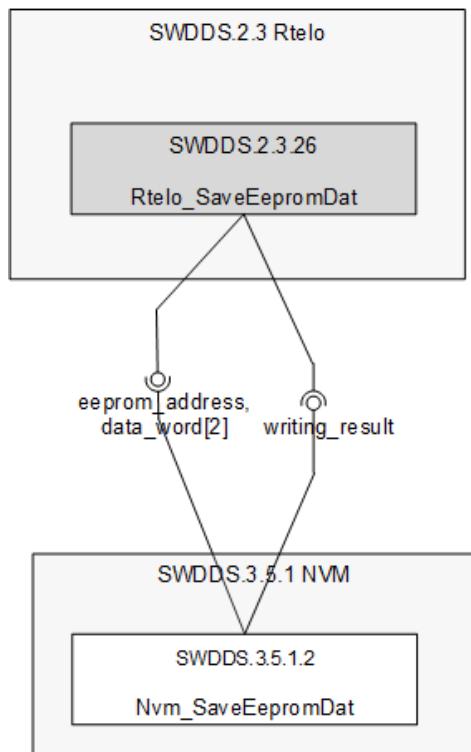
Software Unit Information					
Unit ID	SWDDS.2.3.26	Unit Name	Rtelo_SaveEepromDat		
Architecture ID	SWADS.2.3.26	ASIL	QM		
Prototype	tU8 Rtelo_SaveEepromDat( tU16 eeprom_address, tU16 data_word[2u] )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	eeprom_address	0 ~ 511	IN	EEPROM memory address (offset from EEPROM base address)
	tU16	data_word[2u]	0 ~ 65535	IN	2x 16-bit word data
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU8	0 ~ 4, EEPROM_RET_OK/EEPROM_RET_ERASED/EEPROM_RET_NOT_ERASED/EEPROM_RET_MISALIGN_ADDR/EEPROM_RET_ACC_ERR		EEPROM save result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	EEPROM data saving				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; return[Nvm_SaveEepromDat(eeprom_address, data_word)]     return --&gt; end(( ))   </pre>				
Called Function	SWDDS.1.3.3.3 SaveShutDownFltCnt SWDDS.1.3.3.4 SaveShutDownFltFlag				
Calling Function	SWDDS.3.5.1.2 Nvm_SaveEepromDat				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.26
Target Milestone	EBS2
Element	Rtelo
Risk	Low
Interoperability	No
Criticality	Low
	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	175

Technical complexity	Low
Verifiability	Yes

#### 1.1.3.26.2 Static View Design



#### 1.1.3.26.3 Dynamic View Design

- N/A

#### 1.1.3.26.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	eeprom_address	SWDDS.3.5.1.2	OUT	tU16	0	511	0	511	N/A	EEPROM memory address (offset from EEPROM base address)
2	data_word[2u]	SWDDS.3.5.1.2	OUT	tU16	0	65535	0	65535	N/A	2x 16-bit word data
3	writing_result	SWDDS.3.5.1.2	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_ACC_ERR	N/A	EEPROM save result

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	176

### 1.1.3.27 [SWDDS.2.3.27] Rteload\_EepromLong

#### 1.1.3.27.1 Detailed Design

##### [SWDDS.2.3.27] Rteload\_EepromLong

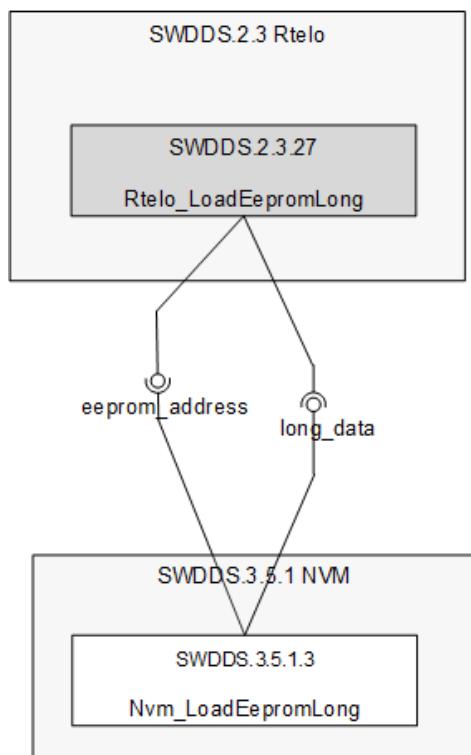
Software Unit Information					
Unit ID	SWDDS.2.3.27	Unit Name	Rteload_EepromLong		
Architecture ID	SWADS.2.3.27	ASIL	QM		
Prototype	tU32 Rteload_EepromLong( tU16 eeprom_address )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	eeprom_address	0 ~ 511	IN	EEPROM memory address (offset from EEPROM base address)
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU32	0 ~ 4294967295		32-bit EEPROM data	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	EEPROM 32-bit long word data loading				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return     Nvm_LoadEepromLong(         eeprom_address );   </pre>				
Called Function	SWDDS.1.4.3.2 ResMsg_Send				
	SWDDS.1.3.3.3 SaveShutdownFltCnt				
	SWDDS.1.3.3.4 SaveShutdownFltFlag				
Calling Function	SWDDS.3.5.1.3 Nvm_LoadEepromLong				
Function Execution Time	N/A				

Requirement Id	SWDDS.2.3.27
Target Milestone	EBS2
Element	Rteload
Risk	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	177

Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.3.27.2 Static View Design



#### 1.1.3.27.3 Dynamic View Design

- N/A

#### 1.1.3.27.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	eeprom_address	SWDDS.3.5.1.3	OUT	tU16	0	511	0	511	N/A	EEPROM memory address (offset from EEPROM base address)
2	long_data	SWDDS.3.5.1.3	IN	tU32	0	4294967295	0	4294967295	N/A	32-bit EEPROM

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	178

data

### 1.1.3.28 [SWDDS.2.3.28] Rtelo\_GetCtrEna

#### **1.1.3.28.1 Detailed Design**

### [SWDDS.2.3.28] Rtelo\_GetCtrEna

### 1.1.3.28.2 Static View Design

- N/A

### 1.1.3.28.3 Dynamic View Design

- N/A

#### 1.1.3.28.4 Interface Design

= N/A

#### 1.1.3.29 [SWDDS.2.3.29] Rtelo\_LoadEepromByte

#### 1.1.3.29.1 Detailed Design

### [SWDDS.2.3.29] Rtelo\_LoadEepromByte

### 1.1.3.29.2 Static View Design

- N/A

### 1.1.3.29.3 Dynamic View Design

- N/A

#### 1.1.3.29.4 Interface Design

- N/A

#### 1.1.3.30 [SWDDS.2.3.30] Rtel0 LoadEepromWord

### **1.1.3.30.1 Detailed Design**

[SWDDS.2.3.30] Rtel0 LoadEepromWord

### 1.1.3.30.2 Static View Design

= N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	179

#### 1.1.3.30.3 Dynamic View Design

– N/A

#### 1.1.3.30.4 Interface Design

– N/A

### 1.1.3.31 [SWDDS.2.3.31] Rtelo\_RstOpuSw

#### 1.1.3.31.1 Detailed Design

[SWDDS.2.3.31] Rtelo\_RstOpuSw

#### 1.1.3.31.2 Static View Design

– N/A

#### 1.1.3.31.3 Dynamic View Design

– N/A

#### 1.1.3.31.4 Interface Design

– N/A

### 1.1.4 [SWDDS.2.4] RteDiag

According to function of Diagonasis, Diagonasis data is defined and Initialiezed.

#### 1.1.4.1 [SWDDS.2.4.1] RteDiag\_Init

##### 1.1.4.1.1 Detailed Design

[SWDDS.2.4.1] RteDiag\_Init

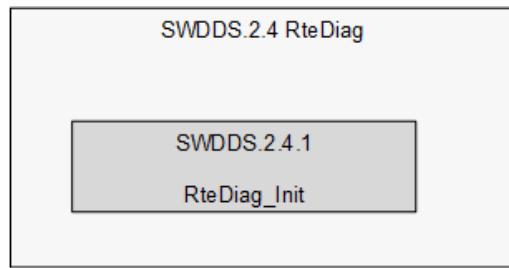
Software Unit Information					
Unit ID	SWDDS.2.4.1	Unit Name	RteDiag_Init		
Architecture ID	SWADS.2.4.1	ASIL	QM		
Prototype	void RteDiag_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	180

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
<u>Description</u>	Diagnosis data initialization				
<u>Control Flow Diagram (or Pseudo Code)</u>	<pre> graph TD     start((start)) --&gt; end((end)) </pre>				
<u>Called Function</u>	SWDDS.2.1.2 InitializeRteSchRteSw				
<u>Calling Function</u>	N/A				
<u>Function Execution Time</u>	N/A				

Requirement Id	SWDDS.2.4.1
Target Milestone	SBS2.1
Element	RteDiag
Risk	Mid
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

#### 1.1.4.1.2 Static View Design



#### 1.1.4.1.3 Dynamic View Design

- N/A

#### 1.1.4.1.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	181

## 1.2 [SWDDS.3] BSW

### 1.2.1 [SWDDS.3.1] SCH

#### 1.2.1.1 [SWDDS.3.1.1] BswSch

BswSch checks time of task using timer and define schedules in the interrupt service routine so that the tasks defined in Rtesch can be performed.

##### 1.2.1.1.1 [SWDDS.3.1.1.1] BswSch\_Init

###### 1.2.1.1.1.1 Detailed Design

###### [SWDDS.3.1.1.1] BswSch\_Init

Software Unit Information					
Unit ID	SWDDS.3.1.1.1	Unit Name	BswSch_Init		
Architecture ID	SWADS.3.1.1.1	ASIL	QM		
Prototype			void BswSch_Init( void )		
	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	N/A	N/A	N/A	N/A	N/A
	Data Type	Possible Return Value		Description	
Function Call Return Value	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
	tSchState	g_aeBswSchTaskState[0]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[0]
	tSchState	g_aeBswSchTaskState[1]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[1]
	tSchState	g_aeBswSchTaskState[2]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[2]
	tSchState	g_aeBswSchTaskState[3]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[3]
	tSchState	g_aeBswSchTaskState[4]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[4]
			0 ~ 3, SCH_STATE_BLOCKED/		

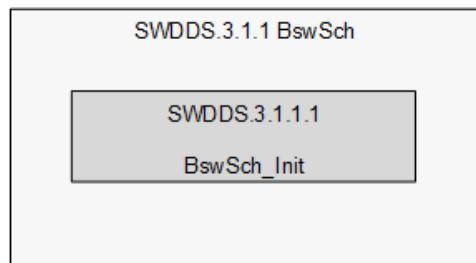
<b>Global Variables</b>	tSchState	g_aeBswSchTaskState[5]	SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[5]
	tSchErr	g_aeBswSchTaskErrors[0]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[0]
	tSchErr	g_aeBswSchTaskErrors[1]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[1]
	tSchErr	g_aeBswSchTaskErrors[2]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[2]
	tSchErr	g_aeBswSchTaskErrors[3]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[3]
	tSchErr	g_aeBswSchTaskErrors[4]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[4]
	tSchErr	g_aeBswSchTaskErrors[5]	0 ~ 2, SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[5]
	tU16	g_au16BswSchTimeCount[0]	0 ~ 1	WRITE	Task time count storage[0]
	tU16	g_au16BswSchTimeCount[1]	0 ~ 5	WRITE	Task time count storage[1]
	tU16	g_au16BswSchTimeCount[2]	0 ~ 10	WRITE	Task time count storage[2]
	tU16	g_au16BswSchTimeCount[3]	0 ~ 20	WRITE	Task time count storage[3]
	tU16	g_au16BswSchTimeCount[4]	0 ~ 50	WRITE	Task time count storage[4]
	tU16	g_au16BswSchTimeCount[5]	0 ~ 100	WRITE	Task time count storage[5]
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	BSW static scheduler initialization				

Control Flow Diagram  
(or Pseudo Code)

Control Flow Diagram (or Pseudo Code)	<pre> start Volatile tU16 task_index; task_index = 0u; if (task_index &lt; BSW_SCH_TASK_NO) {     g_aeBswSchTaskState[task_index] = SCH_STATE_DORMANT;     g_aeBswSchTaskErrors[task_index] = SCH_ERROR_NONE;     g_au16BswSchTimeCount[task_index] = BSW_SCH_OFFSETS[task_index]; } task_index++; } end </pre>
Called Function	SWDDS.2.3.1 Rtelo_Init
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.1.1.1
Target Milestone	EBS2
Element	SCH
Risk	▣ Mid
Interoperability	Yes
Criticality	▢ Low
Technical complexity	▢ Low
Verifiability	Yes

#### 1.2.1.1.1.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
	Page	Page	184

#### 1.2.1.1.3 Dynamic View Design

- N/A

#### 1.2.1.1.4 Interface Design

- N/A

#### 1.2.1.1.2 [SWDDS.3.1.1.2]BswSch\_DispatchTask

##### 1.2.1.1.2.1 Detailed Design

###### [SWDDS.3.1.1.2] BswSch\_DispatchTask

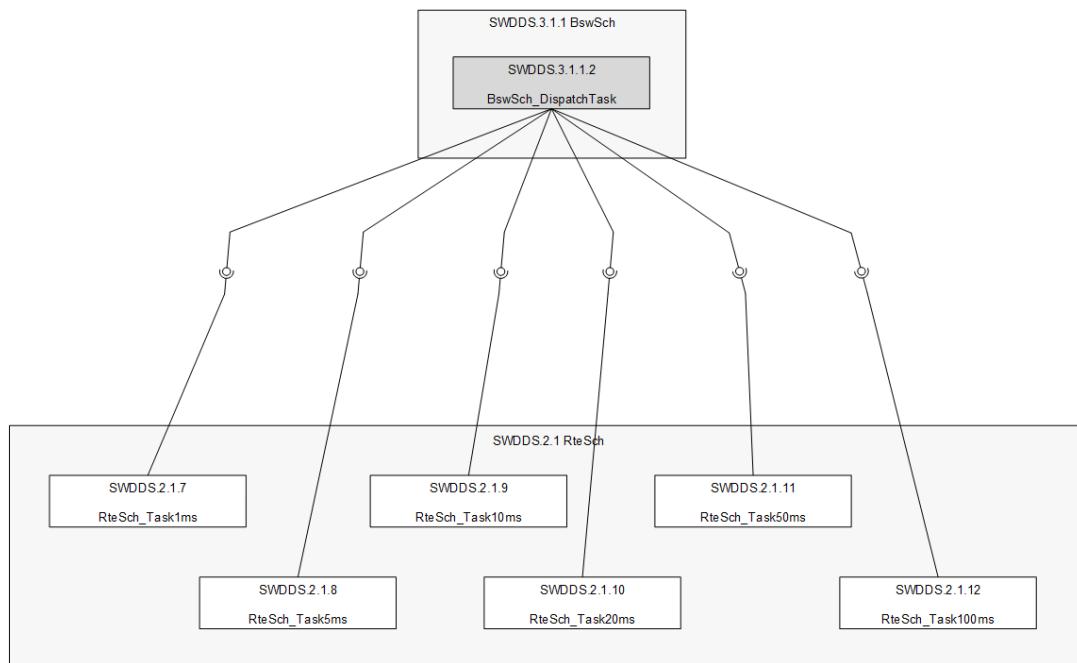
Software Unit Information					
Unit ID	SWDDS.3.1.1.2	Unit Name	BswSch_DispatchTask		
Architecture ID	SWADS.3.1.1.2	ASIL	QM		
void BswSch_DispatchTask( void )					
Function Call Parameters	Data Type	Name	Range	In/Out	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
void		N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tSchState	g_aeBswSchTaskState[0]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[0]
	tSchState	g_aeBswSchTaskState[1]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[1]
	tSchState	g_aeBswSchTaskState[2]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[2]
	tSchState	g_aeBswSchTaskState[3]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[3]
	tSchState	g_aeBswSchTaskState[4]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[4]

	tSchState	g_aeBswSchTaskState[5]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[5]
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Scheduled task dispatching				
Control Flow Diagram (or Pseudo Code)	<pre> 1. BswSch_DispatchTask runs the task if the task state is ready. 2. BswSch_DispatchTask sets the task state as running during run and sets the task state as dormant after running. 3. BswSch_DispatchTask skips the next task state checking if 1ms or 5ms task is executed.  start   Volatile tu16 task_index;   task_index = 0u;    if(task_index &lt; BSW_SCH_TASK_NO)     if(g_aeBswSchTaskState[task_index] == SCH_STATE_READY)       g_aeBswSchTaskState[task_index] = SCH_STATE_RUNNING;       [SWDDS.2.1.7]       [SWDDS.2.1.8]       [SWDDS.2.1.9]       [SWDDS.2.1.10]       [SWDDS.2.1.11]       [SWDDS.2.1.12]       (BSW_SCH_TASKS[task_index])();       g_aeBswSchTaskState[task_index] = SCH_STATE_DORMANT;     else       task_index++;   else     if((task_index == 0u)    (task_index == 1u))       task_index++;  end </pre>				
Called Function	SWDDS.2.1.5 RteSch_MainFunc				
Calling Function	SWDDS.2.1.7 RteSch_Task1ms SWDDS.2.1.8 RteSch_Task5ms SWDDS.2.1.9 RteSch_Task10ms SWDDS.2.1.10 RteSch_Task20ms SWDDS.2.1.11 RteSch_Task50ms SWDDS.2.1.12 RteSch_Task100ms				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	186

Requirement Id	SWDDS.3.1.1.2
Target Milestone	EBS2
Element	SCH
Risk	<span style="background-color: #e6eaf2; border: 1px solid black; padding: 2px;">Mid</span>
Interoperability	Yes
Criticality	<span style="background-color: #ff0000; border: 1px solid black; padding: 2px;">High</span>
Technical complexity	<span style="background-color: #e6eaf2; border: 1px solid black; padding: 2px;">Mid</span>
Verifiability	Yes

#### 1.2.1.1.2.2 Static View Design



#### 1.2.1.1.2.3 Dynamic View Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
	Page	Page	187

#### 1.2.1.1.2.4 Interface Design

- N/A

#### 1.2.1.1.3 [SWDDS.3.1.1.3] BswSch\_ChkTaskCnt

##### 1.2.1.1.3.1 Detailed Design

###### [SWDDS.3.1.1.3] BswSch\_ChkTaskCnt

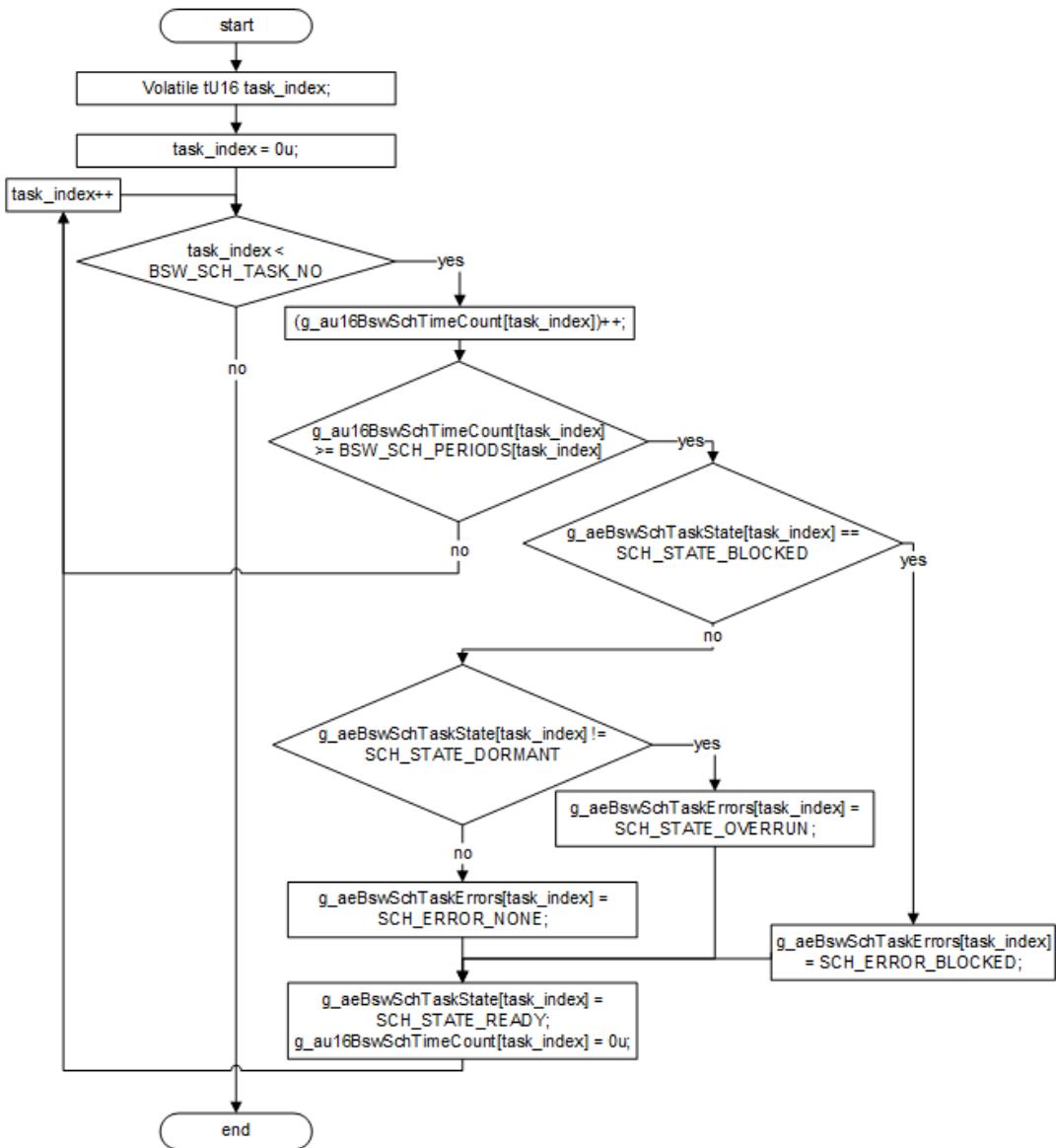
Software Unit Information					
Unit ID	SWDDS.3.1.1.3	Unit Name	BswSch_ChkTaskCnt		
Architecture ID	SWADS.3.1.1.3	ASIL	QM		
void BswSch_ChkTaskCnt( void )					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
Call	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
Return	void	N/A			N/A
Value	Data Type	Name	Range	Read/Write	Description
Global Variables	tSchState	g_aeBswSchTaskState[0]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[0]
	tSchState	g_aeBswSchTaskState[1]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[1]
	tSchState	g_aeBswSchTaskState[2]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[2]
	tSchState	g_aeBswSchTaskState[3]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[3]
	tSchState	g_aeBswSchTaskState[4]	0 ~ 3, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[4]
	tSchState	g_aeBswSchTaskState[5]	0 ~ 2, SCH_STATE_BLOCKED/ SCH_STATE_DORMANT/ SCH_STATE_READY/ SCH_STATE_RUNNING	WRITE	Task state storage[5]

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
	Page	188	

Parameters	tSchErr	g_aeBswSchTaskErrors[0]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN 0 ~ 2,	WRITE	Task error storage[0]
	tSchErr	g_aeBswSchTaskErrors[1]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN 0 ~ 2,	WRITE	Task error storage[1]
	tSchErr	g_aeBswSchTaskErrors[2]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN 0 ~ 2,	WRITE	Task error storage[2]
	tSchErr	g_aeBswSchTaskErrors[3]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN 0 ~ 2,	WRITE	Task error storage[3]
	tSchErr	g_aeBswSchTaskErrors[4]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN 0 ~ 2,	WRITE	Task error storage[4]
	tSchErr	g_aeBswSchTaskErrors[5]	SCH_ERROR_NONE/ SCH_ERROR_BLOCKED/ SCH_STATE_OVERRUN	WRITE	Task error storage[5]
	tU16	g_au16BswSchTimeCount[0]	0 ~ 1	WRITE	Task time count storage[0]
	tU16	g_au16BswSchTimeCount[1]	0 ~ 5	WRITE	Task time count storage[1]
	tU16	g_au16BswSchTimeCount[2]	0 ~ 10	WRITE	Task time count storage[2]
	tU16	g_au16BswSchTimeCount[3]	0 ~ 20	WRITE	Task time count storage[3]
	tU16	g_au16BswSchTimeCount[4]	0 ~ 50	WRITE	Task time count storage[4]
	tU16	g_au16BswSchTimeCount[5]	0 ~ 100	WRITE	Task time count storage[5]
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Scheduled task dispatching					
Control Flow Diagram	<ol style="list-style-type: none"> <li>BswSch_ChkTaskCnt increases the task time count.</li> <li>BswSch_ChkTaskCnt checks if the task time count is reached the task period.</li> <li>BswSch_ChkTaskCnt sets the task state as ready if the task is not block and running.</li> <li>BswSch_ChkTaskCnt sets the task error as block if the task is blocked.</li> <li>BswSch_ChkTaskCnt sets the task error as overrun if the task is not dormant.</li> <li>BswSch_ChkTaskCnt sets the task error as block if the task is blocked.</li> <li>BswSch_ChkTaskCnt sets the task error as none the other cases.</li> <li>BswSch_ChkTaskCnt clears the task count after the task count period reaching.</li> </ol>				

Control Flow Diagram  
(or Pseudo Code)

Called Function  
Calling Function  
Function Execution Time



SWDDS.3.6.4.4 Tim\_Ch0lsr

N/A

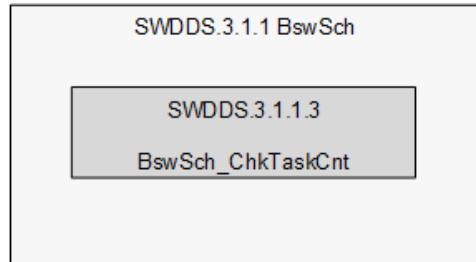
N/A

Requirement Id	SWDDS.3.1.1.3
Target Milestone	EBS2
Element	SCH
Risk	Mid
Interoperability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	190

Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input type="checkbox"/> Mid
Verifiability	Yes

#### 1.2.1.1.3.2 Static View Design



#### 1.2.1.1.3.3 Dynamic View Design

- N/A

#### 1.2.1.1.3.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	1

# VW AQ EOP

## Software Detailed Design Specification(3/4)

### Document Properties

Status:  [Open](#)

Version: **003**

Author: Kim Minsu

Created: 2020-12-17 22:33

### Approved Versions

Current Document version **003** has **not** been approved.

Approved Versions:

- [001](#) (2021-01-06 15:49)
- [002](#) (2021-04-15 21:19)
- [002](#) (2021-04-22 10:38)

### Document Signatures

**Approved** (*Status Change Pending*)

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	2

## Document Control Information

**Location:** The released versions of this document are maintained by SWE DE and managed in the following location:

[Polarion] VW AQ EOP / Documents & Pages / 02\_Engineering / 12\_SWE\_Design

Version	Date of Release	Description (Change and Reasons for Change)	Author	Reviewer	Approver
001	2020-10-28	• Initiation of draft version	Taihyun Kyung	-	-
	2020-11-30	• Add flow diagram and sequence diagram	Taihyun Kyung	Rasekar Prashant	Hyojin Ahn
002	2021-02-15	• Add evaluation criteria • Resolved defect – CR-0005	Taihyun Kyung	-	-
	2021-02-17	• Modify traceability management	Taihyun Kyung	-	-
	2021-02-26	• Change the Customer Requirement_CAN Timeout–0008 • Add the Tolerance of Voltage–CR-0009	Taihyun Kyung	-	-
	2021-03-10	• Changed low temperature warning criteria – CR-0003	Taihyun Kyung	-	-
	2021-03-12	• Change and add component – CR-0010	Taihyun Kyung	-	-
	2021-04-09	• OPU HW change to apply EMC debugging(TL81000, CE) results–CR-0012	Taihyun Kyung	-	-
	2021-04-15	• Change Target Milestone, Traceability – CR-0010 • Add Description for Control Flow and Sequence Diagram	Minsu Kim	Sungjin Park	Hyojin Ahn
003	2021-04-22	• Resolved problem: CMNC-0033	Minsu Kim	Sungjin Park	Hyojin Ahn
	2021-04-30	• Change Static View Design, Dynamic View Design and Interface Design	Minsu Kim	-	-
	2021-06-30	• Change Static View Design and Interface Design	Minsu Kim	-	-

Table 1 Version History

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	3

## Table of Contents

1 Function Description .....	7
1.1 [SWDDS.3] BSW .....	7
1.1.1 [SWDDS.3.2] MTR .....	7
1.1.1.1 [SWDDS.3.2.1] SIFoc .....	7
1.1.1.1.1 [SWDDS.3.2.1.1] SIFoc_Init .....	7
1.1.1.1.2 [SWDDS.3.2.1.2] InitializeSIFocSigFilt .....	10
1.1.1.1.3 [SWDDS.3.2.1.3] InitializeSIFocSIObserv .....	13
1.1.1.1.4 [SWDDS.3.2.1.4] InitializeSIFocCurCtr .....	18
1.1.1.1.5 [SWDDS.3.2.1.5] InitializeSIFocOplpStart .....	23
1.1.1.1.6 [SWDDS.3.2.1.6] InitializeSIFocSpdCtr .....	25
1.1.1.1.7 [SWDDS.3.2.1.7] SIFoc_MainFunc .....	28
1.1.1.1.8 [SWDDS.3.2.1.8] SIFoc_SetCtrDat .....	32
1.1.1.1.9 [SWDDS.3.2.1.9] SIFoc_GetStaDat .....	35
1.1.1.1.10 [SWDDS.3.2.1.10] SIFoc_ClrFltSta .....	37
1.1.1.1.11 [SWDDS.3.2.1.11] SIFoc_PprechrgCurlIntg .....	39
1.1.1.1.12 [SWDDS.3.2.1.12] ActSIFocStateSwtcOff .....	42
1.1.1.1.13 [SWDDS.3.2.1.13] ActSIFocStateOffsCalib .....	45
1.1.1.1.14 [SWDDS.3.2.1.14] RunSIFocStateAlignOplp .....	48
1.1.1.1.15 [SWDDS.3.2.1.15] ActSIFocStateInitAlign .....	51
1.1.1.1.16 [SWDDS.3.2.1.16] ActSIFocStateOplpStart .....	54
1.1.1.1.17 [SWDDS.3.2.1.17] actSIFocStateSIRun .....	57
1.1.1.1.18 [SWDDS.3.2.1.18] CheckSIFocStateTransInitAlign .....	61
1.1.1.1.19 [SWDDS.3.2.1.19] CheckSIFocStateTransOplpStart .....	63
1.1.1.1.20 [SWDDS.3.2.1.20] CheckSIFocStateTransSIRun .....	66
1.1.1.1.21 [SWDDS.3.2.1.21] DisableSIFocControl .....	68
1.1.1.1.22 [SWDDS.3.2.1.22] EnableSIFocControl .....	71
1.1.1.1.23 [SWDDS.3.2.1.23] SetSIFocCurCtrPreChrg .....	75
1.1.1.1.24 [SWDDS.3.2.1.24] SetSIFocAngTrackObsrvPreChrg .....	78
1.1.1.1.25 [SWDDS.3.2.1.25] CheckSIFocOffsRngErr .....	82
1.1.1.1.26 [SWDDS.3.2.1.26] CheckSIFocSITransCond .....	84
1.1.1.1.27 [SWDDS.3.2.1.27] MeasureSIFocDcVolt .....	87
1.1.1.1.28 [SWDDS.3.2.1.28] MeasureSIFocPhsCur .....	90
1.1.1.1.29 [SWDDS.3.2.1.29] CalibrateSIFocCurOffs .....	94
1.1.1.1.30 [SWDDS.3.2.1.30] ConvertSIFocClarkTrnsf .....	98
1.1.1.1.31 [SWDDS.3.2.1.31] CalculateSIFocStartCur .....	101
1.1.1.1.32 [SWDDS.3.2.1.32] CalculateSIFocStartAng .....	104
1.1.1.1.33 [SWDDS.3.2.1.33] CalculateSIFocCurErrAlbe .....	107
1.1.1.1.34 [SWDDS.3.2.1.34] RunSIFocSIObserv .....	112
1.1.1.1.35 [SWDDS.3.2.1.35] ConvertSIFocParkTrnsf .....	115
1.1.1.1.36 [SWDDS.3.2.1.36] CalculateSIFocCurErrDq .....	119
1.1.1.1.37 [SWDDS.3.2.1.37] RunSIFocCurCtrD .....	121
1.1.1.1.38 [SWDDS.3.2.1.38] RunSIFocCurCtrQ .....	125
1.1.1.1.39 [SWDDS.3.2.1.39] ConvertSIFocInvsPark .....	128
1.1.1.1.40 [SWDDS.3.2.1.40] CompensateSIFocDcVolt .....	131
1.1.1.1.41 [SWDDS.3.2.1.41] RunSIFocSpcVecPwm .....	134
1.1.1.1.42 [SWDDS.3.2.1.42] CheckSIFocFltCond .....	137
1.1.1.1.43 [SWDDS.3.2.1.43] CheckSIFocFltCur .....	142
1.1.1.1.44 [SWDDS.3.2.1.44] CheckSIFocFltDcVolt .....	144

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	4

1.1.1.1.45 [SWDDS.3.2.1.45] CheckSIFocFltRevRot .....	146
1.1.1.1.46 [SWDDS.3.2.1.46] CheckSIFocFltGateDrv .....	148
1.1.1.1.47 [SWDDS.3.2.1.47] RunSIFocSpdCtr .....	151
1.1.1.1.48 [SWDDS.3.2.1.48] SIFoc_DisSIRun .....	155
1.1.1.2 [SWDDS.3.2.2] MtrDrv .....	155
1.1.1.2.1 [SWDDS.3.2.2.1] MtrDrv_Init .....	155
1.1.1.2.2 [SWDDS.3.2.2.2] MtrDrv_GetDcVolt .....	157
1.1.1.2.3 [SWDDS.3.2.2.3] MtrDrv_GetPhsCur .....	159
1.1.1.2.4 [SWDDS.3.2.2.4] MtrDrv_GetGdrvSta .....	161
1.1.1.2.5 [SWDDS.3.2.2.5] MtrDrv_SetPwmDuty .....	164
1.1.1.2.6 [SWDDS.3.2.2.6] MtrDrv_EnaPwmOut .....	167
1.1.1.2.7 [SWDDS.3.2.2.7] MtrDrv_DisPwmOut .....	169
1.1.1.2.8 [SWDDS.3.2.2.8] MtrDrv_ClrGdrvFlt .....	170
1.1.2 [SWDDS.3.3] CAN .....	172
1.1.2.1 [SWDDS.3.3.1] CanMsg .....	172
1.1.2.1.1 [SWDDS.3.3.1.1] CanMsg_Init .....	172
1.1.2.1.2 [SWDDS.3.3.1.2] CanMsg_ChkReqDat .....	174
1.1.2.1.3 [SWDDS.3.3.1.3] CanMsg_GetReqDat .....	176
1.1.2.1.4 [SWDDS.3.3.1.4] CanMsg_SetResDat .....	178
1.1.2.1.5 [SWDDS.3.3.1.5] CanMsg_SendResDat .....	180
1.1.2.1.6 [SWDDS.3.3.1.6] SetCanMsgStaDat .....	182
1.1.2.1.7 [SWDDS.3.3.1.7] SetCanMsgDrvFltDat .....	184
1.1.2.1.8 [SWDDS.3.3.1.8] SetCanMsgSenFltDat .....	186

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	5

## List of Figures

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	6

## List of Tables

Table 1 Version History

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	7

## 1 Function Description

### 1.1 [SWDDS.3] BSW

#### 1.1.1 [SWDDS.3.2] MTR

MTR manages the input/output signals and motor drive logic related to the motor drive.

##### 1.1.1.1 [SWDDS.3.2.1] SIFoc

perform Sensorless FOC algorithm

- Sensorless estimation , Field-Oriented Control

###### 1.1.1.1.1 [SWDDS.3.2.1.1] SIFoc\_Init

###### 1.1.1.1.1.1 Detailed Design

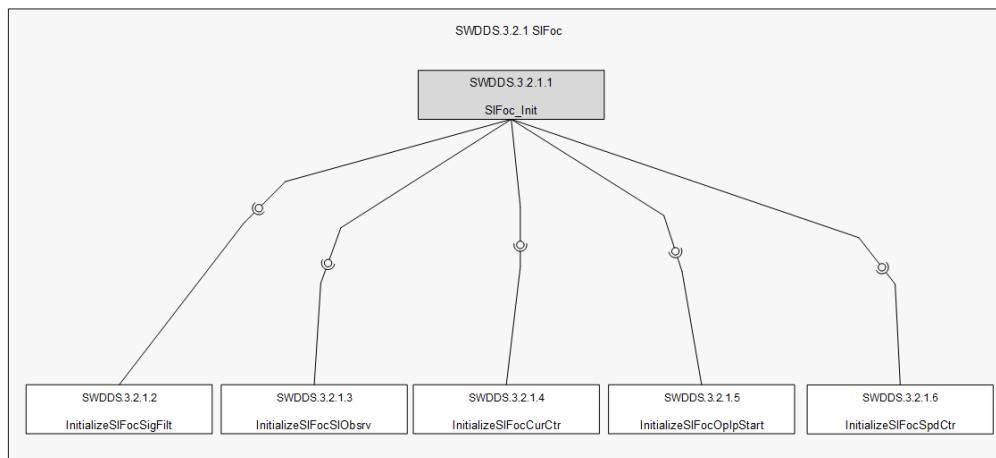
###### [SWDDS.3.2.1.1] SIFoc\_Init

Software Unit Information					
Unit ID	SWDDS.3.2.1.1		Unit Name	SIFoc_Init	
Architecture ID	SWADS.3.2.1.1		ASIL	QM	
Prototype	void SIFoc_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocFirstDcVoltMeasr	0 ~ 1, Normal / First measurement	Write	First DC driving voltage measurement
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC initialization - Control handler initialization - Variable initialization				
	1. SIFoc_Init initializes the signal filtering. 2. SIFoc_Init initializes the sensorless observer. 3. SIFoc_Init initializes the current control. 4. SIFoc_Init initializes the open-loop starting. 5. SIFoc_Init initializes the speed control.				

<b>Control Flow Diagram (or Pseudo Code)</b>	<p>6. SIFoc_Init initializes the internal variables.</p> <pre>     start           [SWDDS.3.2.1.2] InitializeSIFocSigFilt();           [SWDDS.3.2.1.3] InitializeSIFocSIObsrv();           [SWDDS.3.2.1.4] InitializeSIFocCurCtr();           [SWDDS.3.2.1.5] InitializeSIFocOplpStart();           [SWDDS.3.2.1.6] InitializeSIFocSpdCtr();           g_bSIFocFirstDcVoltMeas= TRUE;           end   </pre>	
	<b>Called Function</b>	SWDDS.2.3.1 Rtelo_Init
		SWDDS.3.2.1.2 InitializeSIFocSigFilt
		SWDDS.3.2.1.3 InitializeSIFocSIObsrv
	<b>Calling Function</b>	SWDDS.3.2.1.4 InitializeSIFocCurCtr
		SWDDS.3.2.1.5 InitializeSIFocOplpStart
		SWDDS.3.2.1.6 InitializeSIFocSpdCtr
<b>Function Execution Time</b>	N/A	

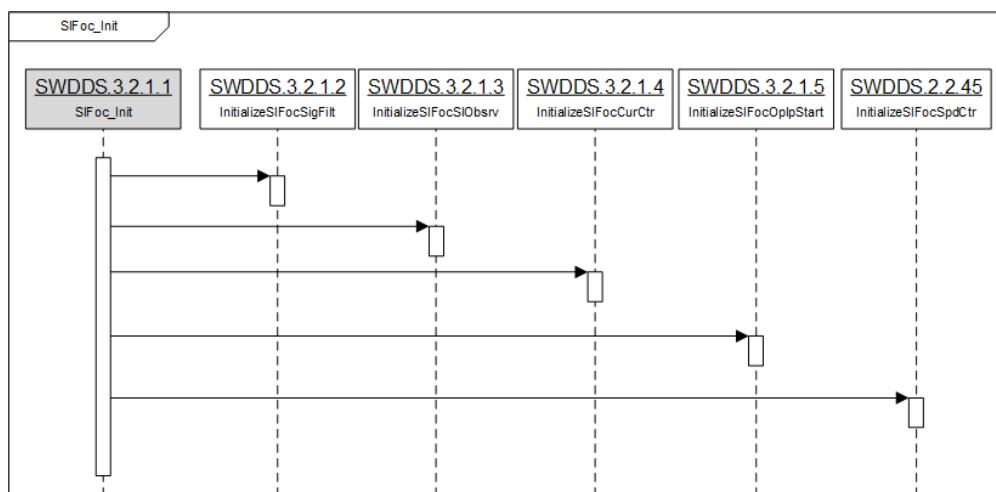
Requirement Id	SWDDS.3.2.1.1
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: green;">▢</span> Low
Interoperability	No
Criticality	<span style="color: red;">▢</span> High
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

#### 1.1.1.1.2 Static View Design



#### 1.1.1.1.3 Dynamic View Design

1. SIFoc\_Init calls the signal filtering initialization.
2. SIFoc\_Init calls the sensorless observer initialization.
3. SIFoc\_Init calls the current control initialization.
4. SIFoc\_Init calls the open-loop starting initialization.
5. SIFoc\_Init calls the speed control initialization.



#### 1.1.1.1.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	10

### 1.1.1.1.2 [SWDDS.3.2.1.2] InitializeSIFocSigFilt

#### 1.1.1.1.2.1 Detailed Design

##### [SWDDS.3.2.1.2] InitializeSIFocSigFilt

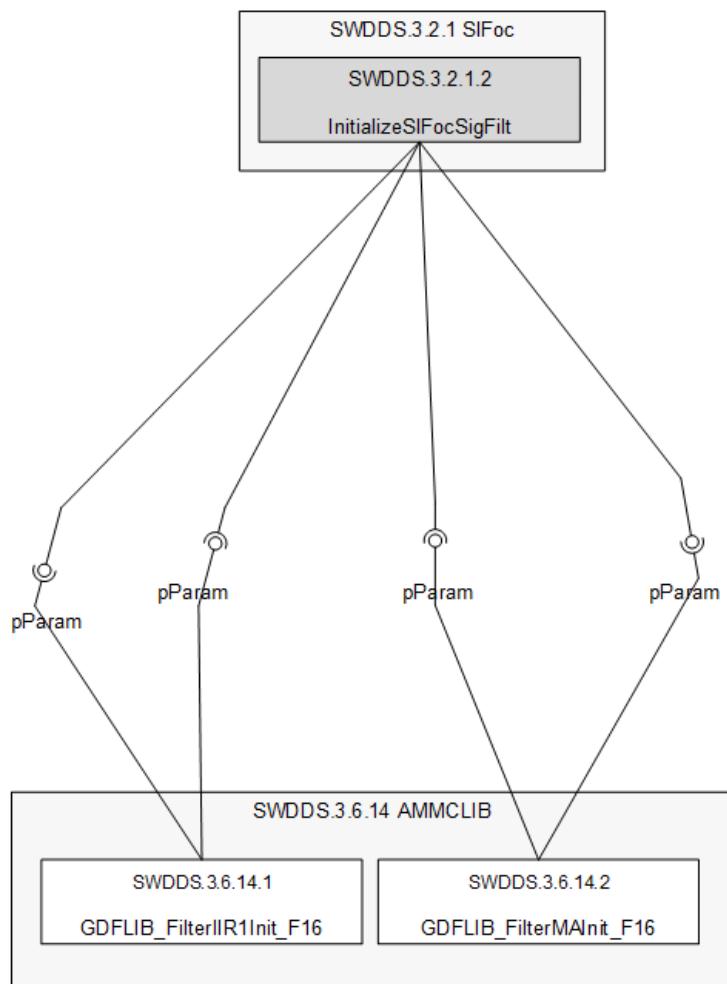
Software Unit Information					
Unit ID	SWDDS.3.2.1.2		Unit Name	InitializeSIFocSigFilt	
Architecture ID	SWADS.3.2.1.2		ASIL	QM	
Prototype	void InitializeSIFocSigFilt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_hndSIFocDcVoltFilt.trFiltCoeff.f16B0	1801 0.0549876058	Write	B0 coefficient of an IIR1 filter
	tFrac16	g_hndSIFocDcVoltFilt.trFiltCoeff.f16B1	1801 0.0549876058	Write	B1 coefficient of an IIR1 filter
	tFrac16	g_hndSIFocDcVoltFilt.trFiltCoeff.f16A1	-492 -0.0150247884	Write	A1 coefficient of an IIR1 filter
	GDFLIB_FILTER_IIR1_T_F16	g_hndSIFocDcVoltFilt.f16FiltBufferX[0]	0	Read/Write	DC driving voltage filtering handler input buffer
	GDFLIB_FILTER_IIR1_T_F16	g_hndSIFocDcVoltFilt.f16FiltBufferY[0]	0	Read/Write	DC driving voltage filtering handler output buffer
	tU16	g_hndSIFocOffsFilt0.u16NSamples	4	Write	Current sensor offset 0 filter Recalculated smoothing factor
	tFrac32	g_hndSIFocOffsFilt0.f32Acc	4	Write	Current sensor offset 0 filter accumulator
	tU16	g_hndSIFocOffsFilt1.u16NSamples	4	Write	Current sensor offset 1 filter Recalculated smoothing factor.
	tFrac32	g_hndSIFocOffsFilt1.f32Acc	0	Write	Current sensor offset 1 filter accumulator.
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16DcVoltilrB0	1801 0.0549876058	Read	DC driving voltage IIR filtering coefficient B0
	tFrac16	par_f16DcVoltilrB1	1801 0.0549876058	Read	DC driving voltage IIR filtering coefficient B1
	tFrac16	par_f16DcVoltilrA1	-492 -0.0150247884	Read	DC driving voltage IIR filtering coefficient A1
	tU16	par_u16CurSigOffsFiltNoSmpl	4	Read	Number of samples for moving average filtering of current sensor offset
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Input signal filter initialization - DC driving voltage filter setting - Current sensor offset 0 filter setting - Current sensor offset 1 filter setting				
	1. InitializeSIFocSigFilt initializes the DC driving voltage IIR filter. 2. InitializeSIFocSigFilt initializes the moving average filter for the phase current offset 0 measurement. 3. InitializeSIFocSigFilt initializes the moving average filter for the phase current offset 1 measurement.				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; Init1[GDFLIB_FilterR1Init_F16(&amp;g_hndSIFoDcVoltFilt)]     Init1 --&gt; Init2[g_hndSIFoDcOffsFilt0.u16NSamples = par_u16CurSigOffsFiltNoSmpl; g_hndSIFoDcOffsFilt0.f32Acc = FRAC32(0.0f);]     Init2 --&gt; Init3[GDFLIB_FilterMAInit_F16(&amp;g_hndSIFoOffsFilt0)]     Init3 --&gt; Init4[g_hndSIFoOffsFilt1.u16NSamples = par_u16CurSigOffsFiltNoSmpl; g_hndSIFoOffsFilt1.f32Acc = FRAC32(0.0f);]     Init4 --&gt; Init5[GDFLIB_FilterMAInit_F16(&amp;g_hndSIFoOffsFilt1)]     Init5 --&gt; end([end]) </pre>
	SWDDS.3.2.1.1 SIFoc_Init
	SWDDS.3.6.14.1 GDFLIB_FilterR1Init_F16
	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16
	N/A

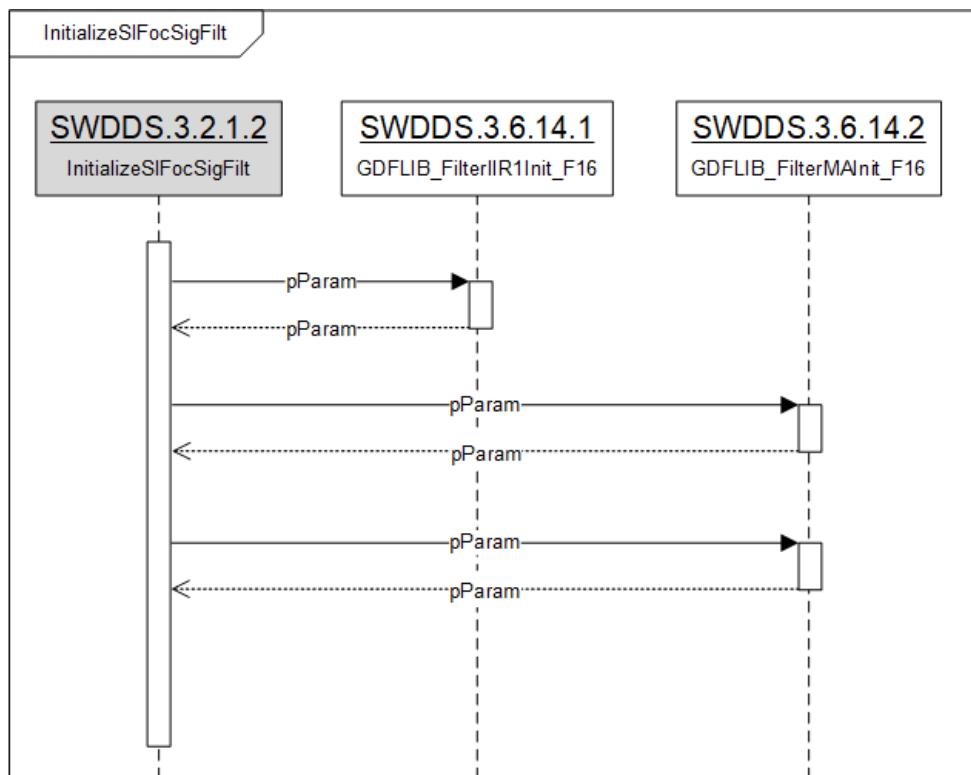
Requirement Id	SWDDS.3.2.1.2
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.2.2 Static View Design



#### 1.1.1.1.2.3 Dynamic View Design

1. InitializeSIFocSigFilt calls the IIR filter initialization for the DC driving voltage filtering.
2. InitializeSIFocSigFilt calls the moving average filter initialization for the phase current offset measurement.



#### 1.1.1.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.1	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *	N/A	N/A	N/A	N/A	N/A	DC driving voltage filtering handler
2	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Current sensor 0 offset filtering handler
3	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Current sensor 1 offset filtering handler

#### 1.1.1.3 [SWDDS.3.2.1.3] InitializeSIFocSIObsrv

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	14

#### 1.1.1.3.1 Detailed Design

##### [SWDDS.3.2.1.3] InitializeSI FocSIObsrv

Software Unit Information					
Unit ID	SWDDS.3.2.1.3		Unit Name	InitializeSI FocSIObsrv	
Architecture ID	SWADS.3.2.1.3		ASIL	QM	
Prototype	void InitializeSI FocSIObsrv( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_hndSI FocBackEmfObsrv.f16UGain	29832 0.9104477612	Write	Scaled voltage cross-coupling constant
	tFrac16	g_hndSI FocBackEmfObsrv.f16WIGain	9781 0.2985074627	Write	Scaled angular velocity cross-coupling constant
	tFrac16	g_hndSI FocBackEmfObsrv.f16EGain	4506 0.1375426866	Write	Scaled back-EMF cross-coupling constant
	tFrac16	g_hndSI FocBackEmfObsrv.f16IGain	3687 0.1125346622	Write	Scaled RL circuit constant
	tS16	g_hndSI FocBackEmfObsrv.s16Shift	0	Write	Scaling bitwise shift applied to all cross-coupling constants
	tFrac16	g_hndSI FocBackEmfObsrv.pParamD.f16CC1sc	22746 0.6941788027	Write	d-axis CC1 coefficient
	tFrac16	g_hndSI FocBackEmfObsrv.pParamD.f16CC2sc	-17693 -0.5399555240	Write	d-axis CC2 coefficient
	tFrac16	g_hndSI FocBackEmfObsrv.pParamD.f16UpperLimit	32767 0.999969	Write	d-axis Upper Limit of the controller
	tFrac16	g_hndSI FocBackEmfObsrv.pParamD.f16LowerLimit	-32768 -1.0	Write	d-axis Lower Limit of the controller
	tU16	g_hndSI FocBackEmfObsrv.pParamD.u16NShift	1	Write	d-axis Scaling bitwise shift applied to the controller coefficients
	tFrac16	g_hndSI FocBackEmfObsrv.pParamQ.f16CC1sc	22746 0.6941788027	Write	q-axis CC1 coefficient
	tFrac16	g_hndSI FocBackEmfObsrv.pParamQ.f16CC2sc	-17131 -0.5228196042	Write	q-axis CC2 coefficient
	tFrac16	g_hndSI FocBackEmfObsrv.pParamQ.f16UpperLimit	32767 64.498Apk	Write	q-axis Upper Limit of the controller
	tFrac16	g_hndSI FocBackEmfObsrv.pParamQ.f16LowerLimit	-32768 -64.5Apk	Write	q-axis Lower Limit of the controller
	tFrac16	g_hndSI FocAngTrackObsrv.pParamPI.f16CC1sc	29596 0.903246809	Write	PI CC1 coefficient
	tFrac16	g_hndSI FocAngTrackObsrv.pParamPI.f16CC2sc	-28626 -0.8736379958	Write	PI CC2 coefficient
	tFrac16	g_hndSI FocAngTrackObsrv.pParamPI.f16UpperLimit	32767 0.999969	Write	PI Upper Limit of the controller
	tFrac16	g_hndSI FocAngTrackObsrv.pParamPI.f16LowerLimit	-32768 -1.0	Write	PI Lower Limit of the controller
					PI Scaling bitwise

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	15

Parameters	tU16	g_hndSI_FocAngTrackObsrv.pParamPl.u16NShift	0	Write	shift applied to the controller coefficients
	tFrac16	g_hndSI_FocAngTrackObsrv.pParamInteg.f16C1	1228 0.0375	Write	Integrator coefficient
	tU16	g_hndSI_FocAngTrackObsrv.pParamInteg.u16NShift	0	Write	Scaling bitwise shift applied to the integrator coefficient f16C1
	tFrac32	g_hndSI_FocAngTrackObsrv.f32State	0	Read/Write	Angle tracking observer handler integrator state value
	tFrac16	g_hndSI_FocAngTrackObsrv.f16InK1	0	Read/Write	Angle tracking observer handler input value in step k-1
	tU16	g_hndSI_FocElecSpdFilt.u16NSamples	0	Write	Recalculated smoothing factor
	GDFLIB_FILTER_MA_T_F16	g_hndSI_FocElecSpdFilt.f32Acc	0	Read/Write	Electric speed filtering handler filter accumulator
	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16BemfObsrvIntgGainU	29832 0.9104477612	Read	Back-EMF observer integration gain U
	tFrac16	par_f16BemfObsrvIntgGainWI	9781 0.2985074627	Read	Back-EMF observer integration gain WI
	tFrac16	par_f16BemfObsrvIntgGainE	4506 0.1375426866	Read	Back-EMF observer integration gain E
	tFrac16	par_f16BemfObsrvIntgGainI	3687 0.1125346622	Read	Back-EMF observer integration gain I
	tS16	par_s16BemfObsrvIntgShift	0	Read	Back-EMF observer integration gain bit shift
	tFrac16	par_f16BemfObsrvGainCc1sc	22746 0.6941788027	Read	Back-EMF observer gain CC1SC
	tFrac16	par_f16BemfObsrvGainCc2sc	-17131 -0.5228196042	Read	Back-EMF observer gain CC2SC
	tU16	par_u16BemfObsrvShift	0	Read	Back-MF observer gain bit shift
	tFrac16	par_f16TrackObsrvSpdIntgCc1sc	22746 0.6941788027	Read	Electric speed integration gain CC1SC
	tFrac16	par_f16TrackObsrvSpdIntgCc2sc	-17131 -0.5228196042	Read	Electric speed integration gain CC2SC
	tU16	par_u16TrackObsrvSpdIntgShift	0	Read	Electric speed integration gain bit shift
	tFrac16	par_f16TrackObsrvAngIntgC1	1228 0.0375	Read	Electric angle integration gain C1
	tU16	par_u16TrackObsrvAngIntgShift	0	Read	Electric angle integration gain bit shift
					Number of samples for

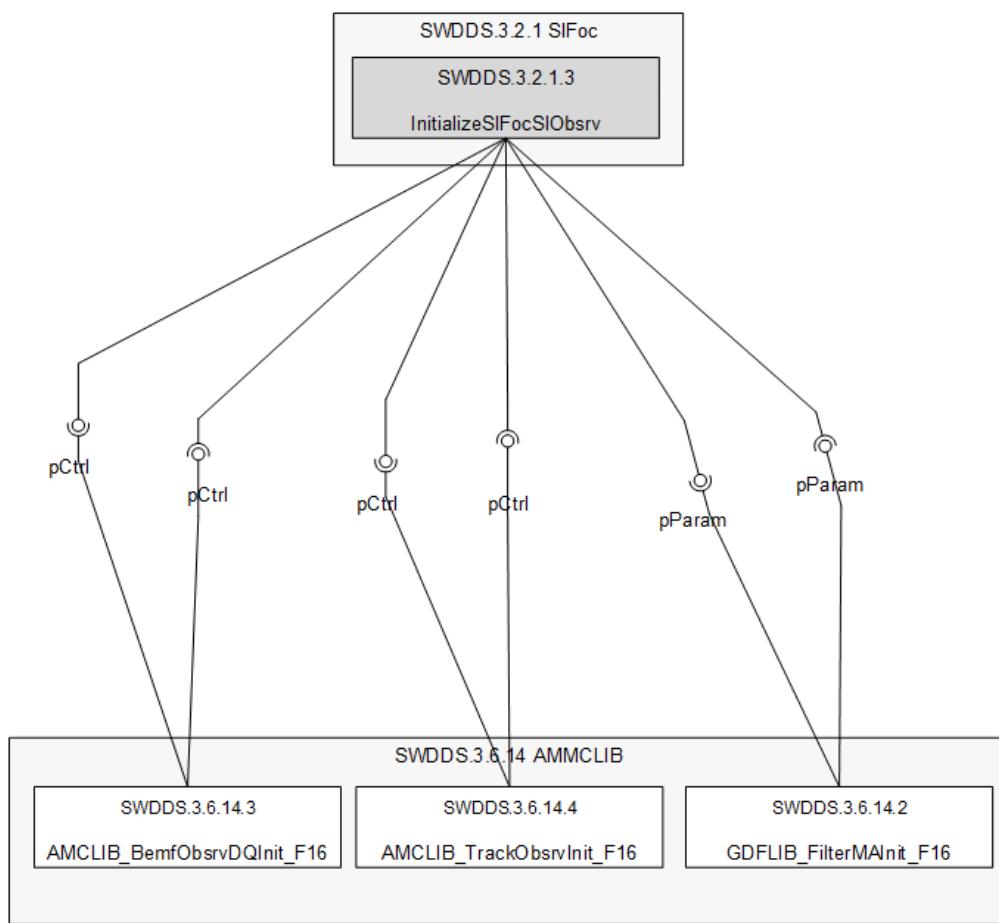
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	16

	tU16	par_u16TrackOsrVfItNoSmpl	0	Read	moving average filtering of electric speed
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless observer initialization - Back-EMF observer setting - Angle tracking observer setting - Estimated speed filter setting				
Control Flow Diagram (or Pseudo Code)	<pre> start     ↓     [SWDDS.3.6.14.3]     AMCLIB_BemfOsrvDQInit_F16( &amp;g_hndSIFocBackEmfOsrv );     ↓     [SWDDS.3.6.14.4]     AMCLIB_TrackOsrvInit_F16( &amp;g_hndSIFocAngTrackOsrv );     ↓     g_hndSIFocElecSpdFiltu16NSamples = par_u16TrackOsrVfItNoSmpl;     ↓     [SWDDS.3.6.14.2]     GDFLIB_FilterMAInit_F16( &amp;g_hndSIFocElecSpdFilt );     ↓ end </pre>				
Called Function	SWDDS.3.2.1.1 SIFoc_Init				
Calling Function	SWDDS.3.6.14.3 AMCLIB_BemfOsrvDQInit_F16 SWDDS.3.6.14.4 AMCLIB_TrackOsrvInit_F16 SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.3

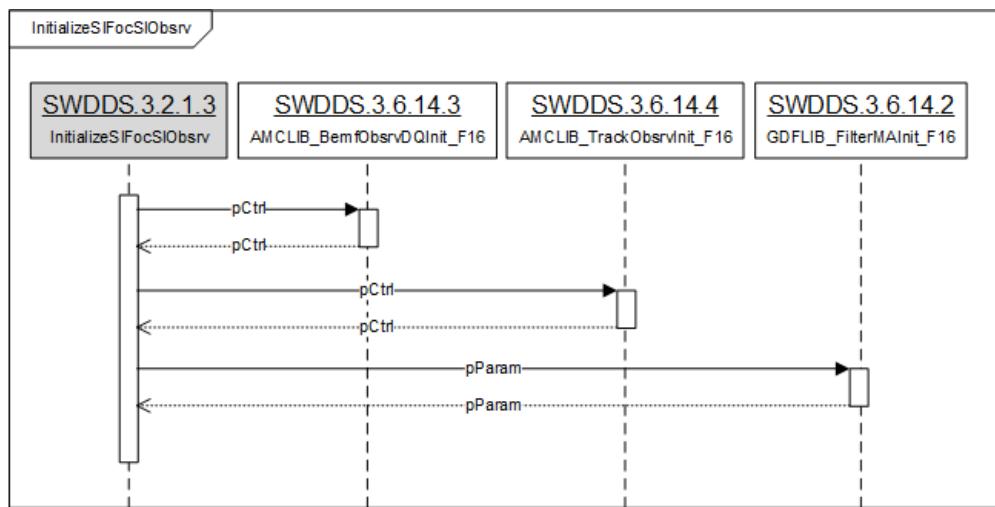
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	● High
Technical complexity	● Low
Verifiability	Yes

#### 1.1.1.1.3.2 Static View Design



#### 1.1.1.1.3.3 Dynamic View Design

1. InitializeSIFocSIObsrv calls the back EMF observer initialization.
2. InitializeSIFocSIObsrv calls the angle tracking observer initialization.
3. InitializeSIFocSIObsrv calls the moving average filter initialization.



#### 1.1.1.1.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pCtrl	SWDDS.3.6.14.3	IN/OUT	AMCLIB_BEMF_OBSRV_DQ_T_F16 *	N/A	N/A	N/A	N/A	N/A	Back-EMF observer handler
2	pCtrl	SWDDS.3.6.14.4	IN/OUT	AMCLIB_TRACK_OBSRV_T_F16 *	N/A	N/A	N/A	N/A	N/A	Angle tracking observer handler
3	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Electric speed filtering handler

#### 1.1.1.1.4 [SWDDS.3.2.1.4] InitializeSIFocCurCtr

##### 1.1.1.1.4.1 Detailed Design

#### [SWDDS.3.2.1.4] InitializeSIFocCurCtr

Software Unit Information				
Unit ID	SWDDS.3.2.1.4	Unit Name	InitializeSIFocCurCtr	
Architecture ID	SWADS.3.2.1.4	ASIL	QM	
Prototype	void InitializeSIFocCurCtr( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
	Data Type	Name	Range	Read/Write
	tFrac16	g_hndSIFocPiCurCtrD.f16CC1sc	10555 0.3221285509	Write
				d-axis PI current controller CC1 coefficient

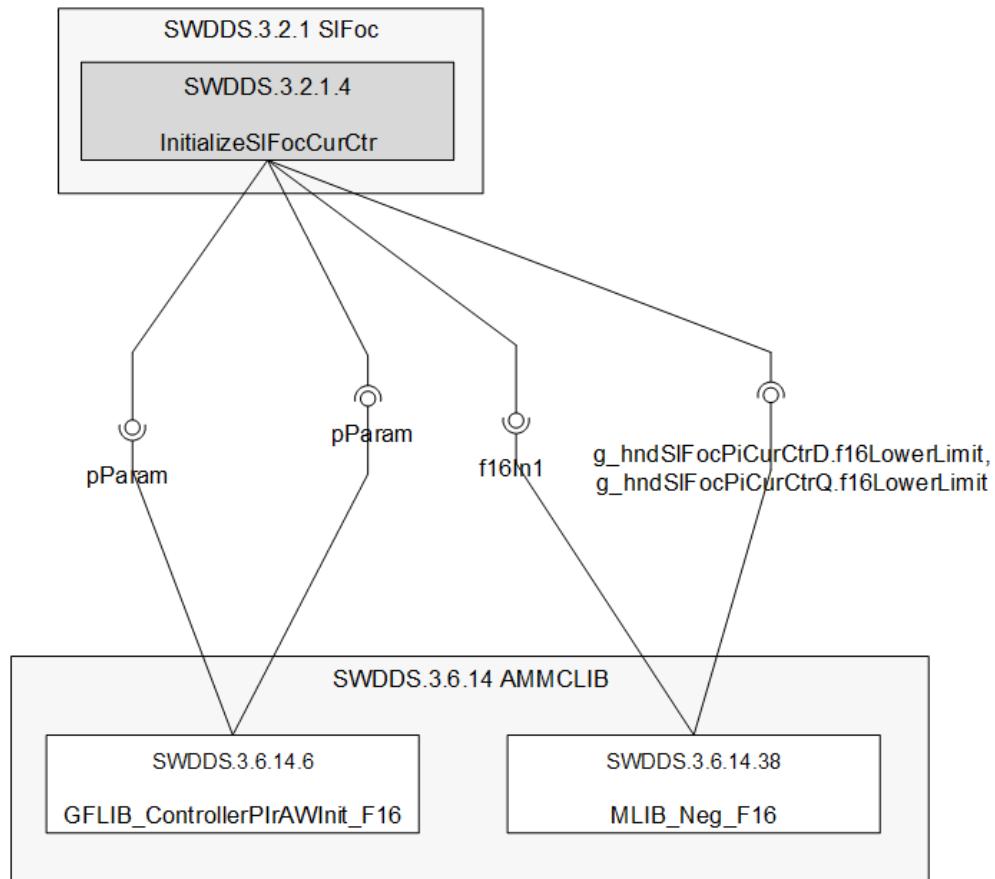


Global Variables	tFrac16	g_hndSIFocPiCurCtrD.f16CC2sc	-9261 -0.2826501333	Write	d-axis PI current controller CC2 coefficient
	tU16	g_hndSIFocPiCurCtrD.u16NShift	0	Write	d-axis PI current controller Scaling bitwise shift applied to the controller coefficients
	tFrac16	g_hndSIFocPiCurCtrD.f16InErrK1	0	Write	d-axis PI current controller controller input from the previous calculation step.
	tFrac16	g_hndSIFocPiCurCtrD.f16UpperLimit	30310 0.925	Write	d-axis PI current controller : Upper Limit
	tFrac16	g_hndSIFocPiCurCtrD.f16LowerLimit	-30310 -0.925	Write	d-axis PI current controller : Lower Limit
	tFrac16	g_hndSIFocPiCurCtrQ.f16CC1sc	10555 0.3221285509	Write	q-axis PI current controller CC1 coefficient
	tFrac16	g_hndSIFocPiCurCtrQ.f16CC2sc	-9261 -0.2826501333	Write	q-axis PI current controller CC2 coefficient
	tU16	g_hndSIFocPiCurCtrQ.u16NShift	0	Write	q-axis PI current controller Scaling bitwise shift applied to the controller coefficients
	tFrac16	g_hndSIFocPiCurCtrQ.f16InErrK1	0	Write	q-axis PI current controller controller input from the previous calculation step.
	tFrac16	g_hndSIFocPiCurCtrQ.f16UpperLimit	30310 0.925	Write	q-axis PI current controller : Upper Limit
	tFrac16	g_hndSIFocPiCurCtrQ.f16LowerLimit	-30310 -0.925	Write	q-axis PI current controller : Lower Limit
Parameters	tFrac16	g_hndSIFocDcVoltRipElim.f16ModIndex	28377 0.866	Write	Inverse Modulation Index
	tFrac16	g_hndSIFocDcVoltRipElim.f16ArgDcBusMsr	0	Write	Measured DC bus voltage
	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FocGainCc1scD	10555 0.3221285509	Read	FOC control d-axis gain CC1SC
	tFrac16	par_f16FocGainCc2scD	-9261 -0.2826501333	Read	FOC control d-axis gain CC2SC
	tU16	par_u16FocGainShiftD	0	Read	FOC control d-axis gain bit shift
	tFrac16	par_f16FocCtrlInpLmt	30310 0.925	Read	FOC control input voltage limiting factor for current sensing
	tFrac16	par_f16FocGainCc1scQ	10555 0.3221285509	Read	FOC control q-axis gain CC1SC
	tFrac16	par_f16FocGainCc2scQ	-9261 -0.2826501333	Read	FOC control q-axis gain CC2SC
	tU16	par_u16FocGainShiftQ	0	Read	FOC control q-axis gain bit shift
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PI current controller initialization - d-axis PI current controller setting - q-axis PI current controller setting - DC driving voltage ripple compensation setting				
	1. InitializeSIFocCurCtr initializes the d-axis PI current control. 2. InitializeSIFocCurCtr initializes the q-axis PI current control. 3. InitializeSIFocCurCtr initializes the DC driving voltage compensation.				

Control Flow Diagram (or Pseudo Code)	<pre> start     g_hndSIFocPiCurCtrD.f16CC1sc = par_f16FocGainCc1scD;     g_hndSIFocPiCurCtrD.f16CC2sc = par_f16FocGainCc2scD;     g_hndSIFocPiCurCtrD.u16NShift = par_u16FocGainShiftD;         g_hndSIFocPiCurCtrD.f16InErrK1 = FRAC16( 0.0f );     g_hndSIFocPiCurCtrD.f16UpperLimit = par_f16FocCtrInpLmt;      [SWDDS.3.6.14.38]     g_hndSIFocPiCurCtrD.f16LowerLimit = MLIB_Neg_F16( par_f16FocCtrInpLmt );      [SWDDS.3.6.14.6]     GFLIB_ControllerPlrAWInit_F16( &amp;g_hndSIFocPiCurCtrD );      g_hndSIFocPiCurCtrQ.f16CC1sc = par_f16FocGainCc1scQ;     g_hndSIFocPiCurCtrQ.f16CC2sc = par_f16FocGainCc2scQ;     g_hndSIFocPiCurCtrQ.u16NShift = par_u16FocGainShiftQ;         g_hndSIFocPiCurCtrQ.f16InErrK1 = FRAC16( 0.0f );     g_hndSIFocPiCurCtrQ.f16UpperLimit = par_f16FocCtrInpLmt;      [SWDDS.3.6.14.38]     g_hndSIFocPiCurCtrQ.f16LowerLimit = MLIB_Neg_F16( par_f16FocCtrInpLmt );      [SWDDS.3.6.14.6]     GFLIB_ControllerPlrAWInit_F16( &amp;g_hndSIFocPiCurCtrQ );      g_hndSIFocDcVoltRipElim.f16ModIndex = par_f16FocModulIndex;     g_hndSIFocDcVoltRipElim.f16ArgDcBusMsr = FRAC16( 0.0f );  end </pre>
Called Function	SWDDS.3.2.1.1 SIFoc_Init
Calling Function	SWDDS.3.6.14.38 MLIB_Neg_F16
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.4
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: #cc0000;">■</span> High
Technical complexity	<span style="color: #009900;">■</span> Low
Verifiability	Yes

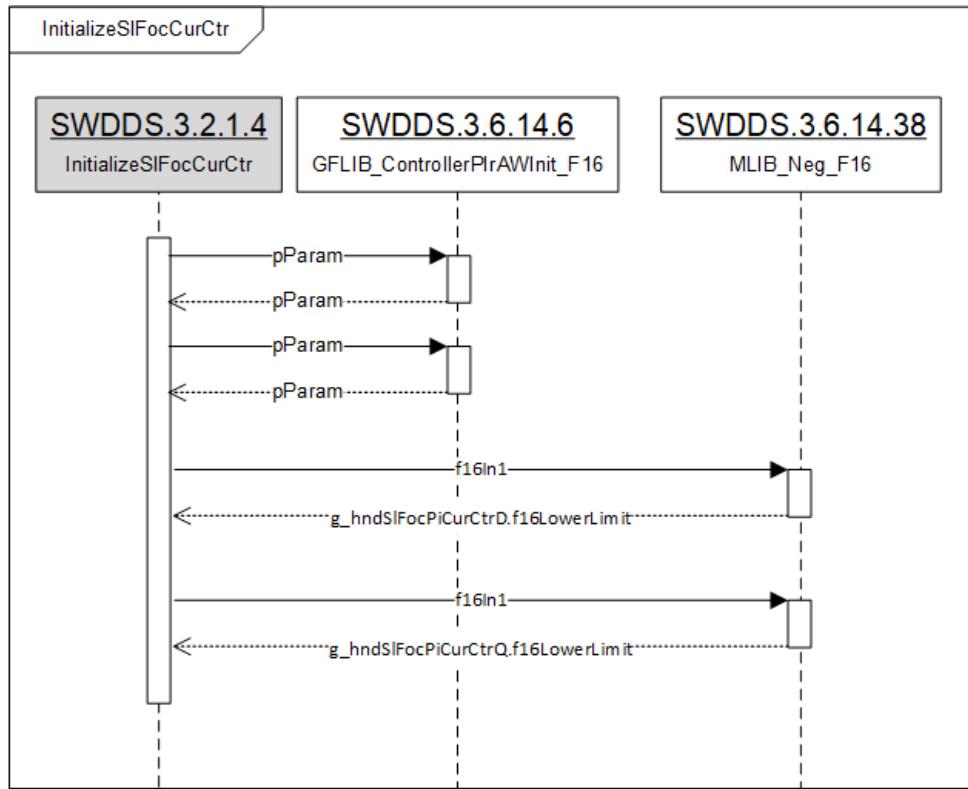
#### 1.1.1.1.4.2 Static View Design



#### 1.1.1.1.4.3 Dynamic View Design

1. `InitializeSIFocCurCtr` calls the PI control initialization to control d/q-axis current control.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	22



#### 1.1.1.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	30310	30310	0.925	0.925	N/A	FOC control input voltage limiting factor for current sensing d-axis PI current controller : Lower Limit
2	g_hndSIFocPiCurCtrD.f16LowerLimit	SWDDS.3.6.14.38	IN	tFrac16	-30310	-30310	-0.925	-0.925	N/A	d-axis PI current controller : Lower Limit
3	pParam	SWDDS.3.6.14.6	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	FOC control input voltage limiting factor for current sensing q-axis PI current controller : Lower Limit
4	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	30310	30310	0.925	0.925	N/A	q-axis PI current controller : Lower Limit
5	g_hndSIFocPiCurCtrQ.f16LowerLimit	SWDDS.3.6.14.38	IN	tFrac16	-30310	-30310	-0.925	-0.925	N/A	q-axis PI current controller : Lower Limit
6	pParam	SWDDS.3.6.14.6	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	FOC control input voltage limiting factor for current sensing q-axis PI current controller : Lower Limit

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	23

### 1.1.1.5 [SWDDS.3.2.1.5] InitializeSIFocOplpStart

#### 1.1.1.5.1 Detailed Design

##### [SWDDS.3.2.1.5] InitializeSIFocOplpStart

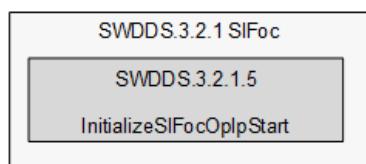
Software Unit Information					
Unit ID	SWDDS.3.2.1.5	Unit Name	InitializeSIFocOplpStart		
Architecture ID	SWADS.3.2.1.5	ASIL	QM		
Prototype	void InitializeSIFocOplpStart( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac32	g_hndSIFocStartCurRamp.f32RampUp	332943 100.0Apk/sec	Write	Open-loop starting current Ramp up increment coefficient
	tFrac32	g_hndSIFocStartCurRamp.f32RampDown	332943 100.0Apk/sec	Write	Open-loop starting current Ramp decrement coefficient.
	tFrac32	g_hndSIFocStartCurRamp.f32State	0	Write	Open-loop starting current Ramp state value
	tFrac32	g_hndSIFocStartSpdRamp.f32RampUp	107374 3000rpm/sec	Write	Open-loop starting speed Ramp up increment coefficient
	tFrac32	g_hndSIFocStartSpdRamp.f32RampDown	107374 3000rpm/sec	Write	Open-loop starting speed Ramp decrement coefficient.
	tFrac32	g_hndSIFocStartSpdRamp.f32State	0	Write	Open-loop starting speed Ramp state value
	tFrac16	g_hndSIFocStartAngIntg.f16InK1	0	Write	Open-loop starting angle integrator input value in step k-1
	tFrac32	g_hndSIFocStartAngIntg.f32State	0	Write	Open-loop starting angle integrator integrator state value
	tFrac16	g_hndSIFocStartAngIntg.f16C1	983 0.03	Write	Open-loop starting angle integrator coefficient
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac32	par_f32StartCurInc	332943 100.0Apk/sec	Read	Initial starting current increment rate (PU/step)
	tFrac32	par_f32StartSpdInc	107374 3000rpm/sec	Read	Initial starting speed increment rate (PU/step)
	tFrac16	par_f16TrackObsrvAngIntgC1	983 0.03	Read	Electric angle integration gain C1
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Open-loop starting initialization - Open-loop starting current ramp setting - Open-loop starting speed ramp setting - Open-loop starting angle integrator setting				
	1. InitializeSIFocOplpStart initializes the magnitude of the starting current ramp up. 2. InitializeSIFocOplpStart initializes the starting speed ramp up. 3. InitializeSIFocOplpStart initializes the open-loop starting electric angle integrator.				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	24

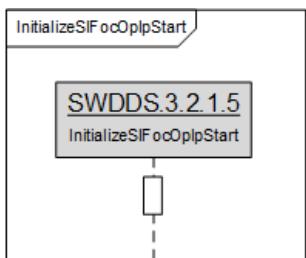
Control Flow Diagram (or Pseudo Code)	<pre> start g_hndSIFocStartCurRamp.f32RampUp = par_f32StartCurInc; g_hndSIFocStartCurRamp.f32RampDown = par_f32StartCurInc; g_hndSIFocStartCurRamp.f32State = FRAC32(0.0f); g_hndSIFocStartSpdRamp.f32RampUp = par_f32StartSpdInc; g_hndSIFocStartSpdRamp.f32RampDown = par_f32StartSpdInc; g_hndSIFocStartSpdRamp.f32State = FRAC32(0.0f); g_hndSIFocStartAnglIntg.f16InK1 = FRAC16(0.0f); g_hndSIFocStartAnglIntg.f32State = FRAC32(0.0f); g_hndSIFocStartAnglIntg.f16C1 = par_f16TrackObserAnglIntgC1; g_hndSIFocStartAnglIntg.u16NShift = 0u; </pre> end
Called Function	SWDDS.3.2.1.1 SIFoc_Init
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.5
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	★ High
Technical complexity	■ Low
Verifiability	Yes

#### 1.1.1.1.5.2 Static View Design



#### 1.1.1.1.5.3 Dynamic View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	25

#### 1.1.1.5.4 Interface Design

- N/A

#### 1.1.1.6 [SWDDS.3.2.1.6] InitializeSIFocSpdCtr

##### 1.1.1.6.1 Detailed Design

###### [SWDDS.3.2.1.6] InitializeSIFocSpdCtr

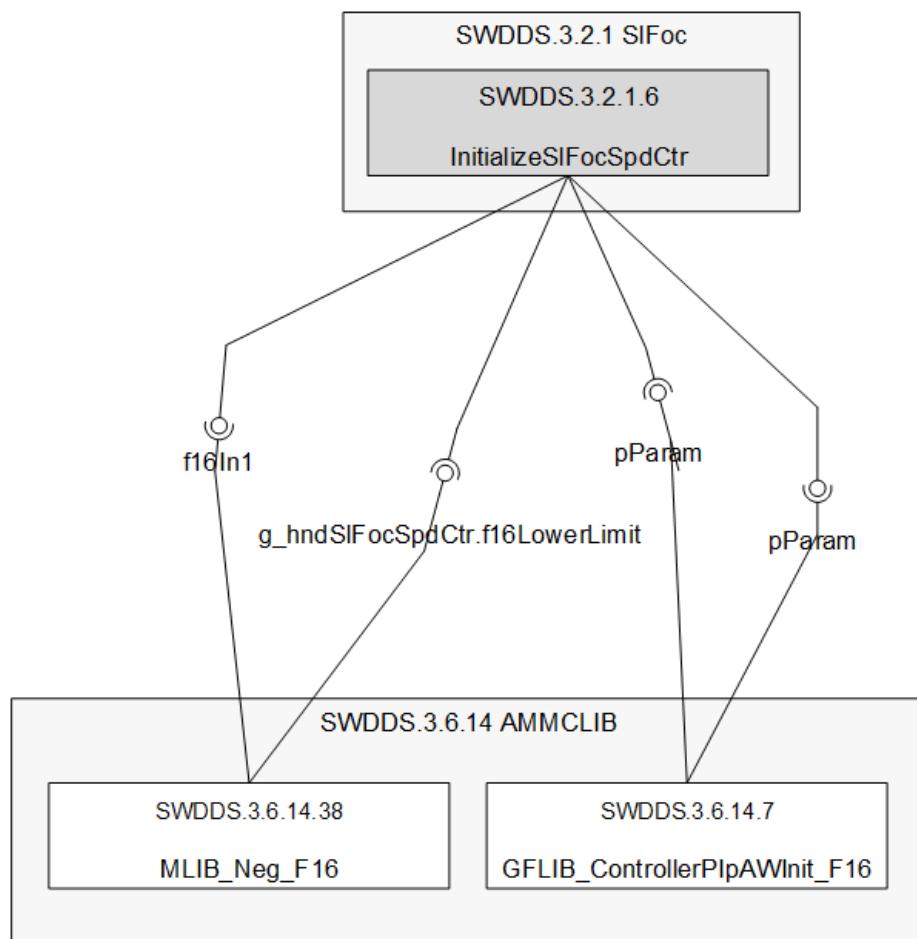
Software Unit Information					
Unit ID	SWDDS.3.2.1.6	Unit Name	InitializeSIFocSpdCtr		
Architecture ID	SWADS.3.2.1.6	ASIL	QM		
Prototype	void InitializeSIFocSpdCtr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_hndSIFocSpdCtr.f16PropGain	21808 0.6655483475	Write	PI speed controller : Proportional Gain
	tS16	g_hndSIFocSpdCtr.s16PropGainShift	-1	Write	PI speed controller : Proportional Gain Shift
	tFrac16	g_hndSIFocSpdCtr.f16IntegGain	24360 0.7434246397	Write	PI speed controller : Integral Gain
	tS16	g_hndSIFocSpdCtr.s16IntegGainShift	-8	Write	PI speed controller : Integral Gain Shift
	tFrac32	g_hndSIFocSpdCtr.f32IntegPartK_1	0	Write	PI speed controller : integral part at step k-1
	tFrac16	g_hndSIFocSpdCtr.f16UpperLimit	11430 22.5Apk	Write	PI speed controller : upper limit
	tFrac16	g_hndSIFocSpdCtr.f16LowerLimit	-11430 -22.5Apk	Write	PI speed controller : lower limit
	tFrac32	g_hndSIFocSpdCtr.f32IntegPartK_1	0	Read/Write	Speed controller handler Integral part at step k-1
	tFrac16	g_hndSIFocSpdCtr.f16InK_1	0	Read/Write	Speed controller handler input error at step k-1
	tU16	g_hndSIFocSpdCtr.u16LimitFlag	0	Read/Write	Speed controller handler Limitation flag
	tU16	g_u16SIFocSpdCtrCnt	0	Write	Speed control interval time count
	tFrac16	g_f16SIFocRefSpd	0	Write	Reference speed setting (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16SpdCtrPropGain	21808 0.6655483475	Read	Speed control proportional gain
	tS16	par_s16SpdCtrPropShift	-1	Read	Speed control proportional gain bit shift
	tFrac16	par_f16SpdCtrIntgGain	24360 0.7434246397	Read	Speed control integral gain
	tS16	par_s16SpdCtrIntgShift	-8	Read	Speed control integral gain bit shift
	tFrac16	par_f16EopCtrCurLmtMax	11430 22.5Apk	Read	Phase current limit at maximum speed (PU)
Registers	Data	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	26

Type	N/A	N/A	N/A	N/A
Description	Speed control initialization - PI speed controller handler initialization - Internal variables initialization			
Control Flow Diagram (or Pseudo Code)	<p>1. InitializeSIFocSpdCtr initializes speed control by setting control gains, current limit and internal state.</p> <p>2. InitializeSIFocSpdCtr initializes the interval time count of the speed control timing.</p> <p>3. InitializeSIFocSpdCtr initializes the reference speed.</p> <pre>     start     ↓     [Pseudo Code]     g_hndSIFocSpdCtr.f16PropGain = par_f16SpdCtrPropGain;     g_hndSIFocSpdCtr.s16PropGainShift = par_s16SpdCtrPropShift;     g_hndSIFocSpdCtr.f16IntegGain = par_f16SpdCtrIntgGain;     g_hndSIFocSpdCtr.s16IntegGainShift = par_s16SpdCtrIntgShift;     g_hndSIFocSpdCtr.B2lIntegPartK_1 = FRAC32( 0.0f );     g_hndSIFocSpdCtr.f16UpperLimit = par_f16EopCtrCurLmtMax;      [SWDDS.3.6.14.38]     g_hndSIFocSpdCtr.f16LowerLimit = MLIB_Neg_F16( par_f16EopCtrCurLmtMax );      [SWDDS.3.6.14.7]     GFLIB_ControllerPipAWInit_F16( &amp;g_hndSIFocSpdCtr );      [Pseudo Code]     g_u16SIFocSpdCtrCnt = 0u;     g_f16SIFocRefSpd = FRAC16( 0.0f );      end   </pre>			
Called Function	SWDDS.3.2.1.1 SIFoc_Init			
Calling Function	SWDDS.3.6.14.38 MLIB_Neg_F16 SWDDS.3.6.14.7 GFLIB_ControllerPipAWInit_F16			
Function Execution Time	N/A			

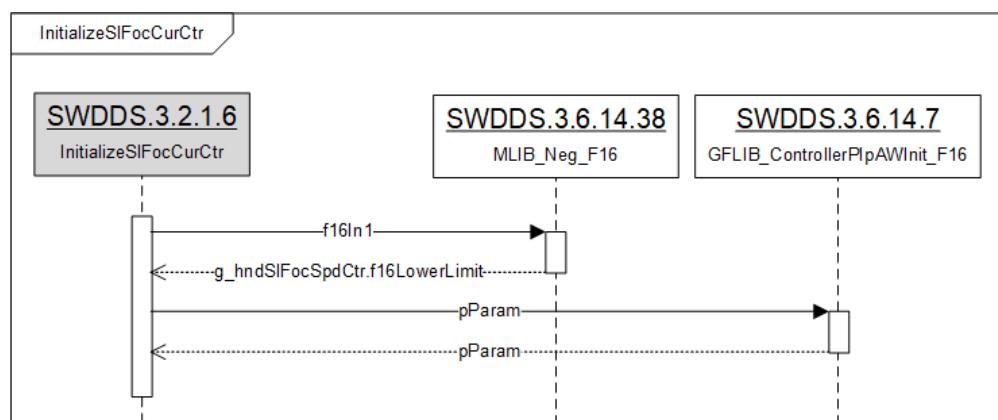
Requirement Id	SWDDS.3.2.1.6
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

#### 1.1.1.1.6.2 Static View Design



#### 1.1.1.1.6.3 Dynamic View Design

1. **InitializeSIFocSpdCtr** calls the fixed-point negative function.
2. **InitializeSIFocSpdCtr** calls the PI control for speed control.



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
					Page	28

#### 1.1.1.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Phase current limit at maximum speed (PU)
2	g_hndSIIFocSpdCtr.f16LowerLimit	SWDDS.3.6.14.38	IN	tFrac16	-11430	-11430	-22.5	-22.5	0.00196838 / Apk	PI speed controller : lower limit
3	pParam	SWDDS.3.6.14.7	IN/OUT	GFLIB_CONTROLLER_PIAW_P_T_F16 *	N/A	N/A	N/A	N/A	N/A	Speed controller handler

#### 1.1.1.7 [SWDDS.3.2.1.7] SIIFoc\_MainFunc

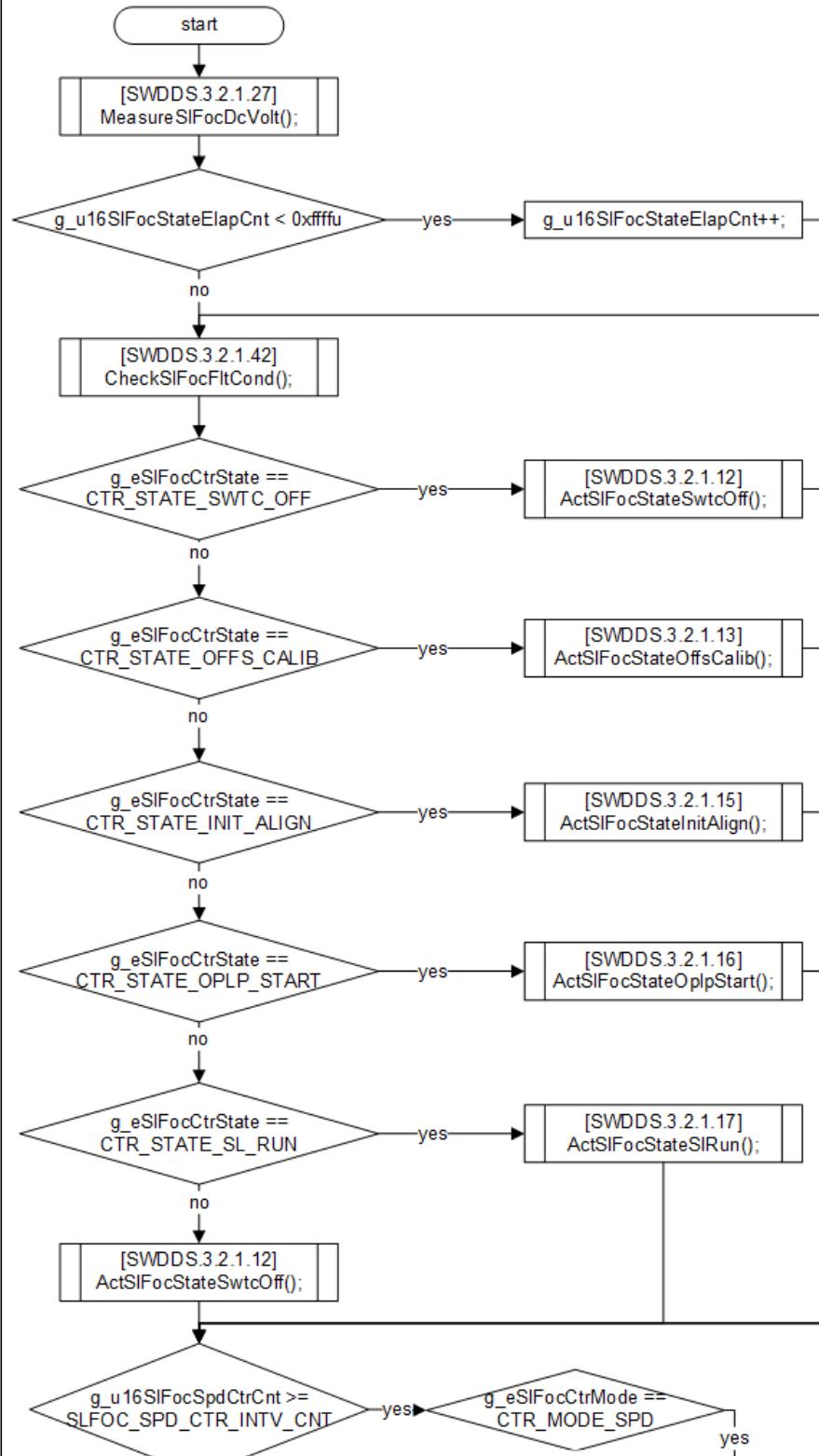
##### 1.1.1.7.1 Detailed Design

##### [SWDDS.3.2.1.7] SIIFoc\_MainFunc

Software Unit Information					
Unit ID	SWDDS.3.2.1.7	Unit Name	SIIFoc_MainFunc		
Architecture ID	SWADS.3.2.1.7	ASIL	QM		
Prototype	void SIIFoc_MainFunc( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16SIIFocStateElapCnt	0 ~ 65535	Read/Write	Elapse time count after state entered
	tCtrState	g_eSIIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFSETS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Read	Sensorless FOC state
	tBool	g_bSIIFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tBool	g_bSIIFocPrevCtrEna	0 ~ 1 Disable / Enable	Write	Previous control enabled state
	tU16	g_u16SIIFocSpdCtrCnt	0 ~ 10	Read/Write	Speed control interval time count
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC main function - Preparation for control - Sensorless FOC state handling				

- Previous control enabled state updating
- Speed control

1. SIFoc\_MainFunc measures the DC driving voltage.
2. SIFoc\_MainFunc increases the elapse time count after specific state entering.
3. SIFoc\_MainFunc checks the fault conditions.
4. SIFoc\_MainFunc runs the specific action according to Sensorless FOC control state.
5. SIFoc\_MainFunc runs the speed control if speed control time reaches the control time interval.

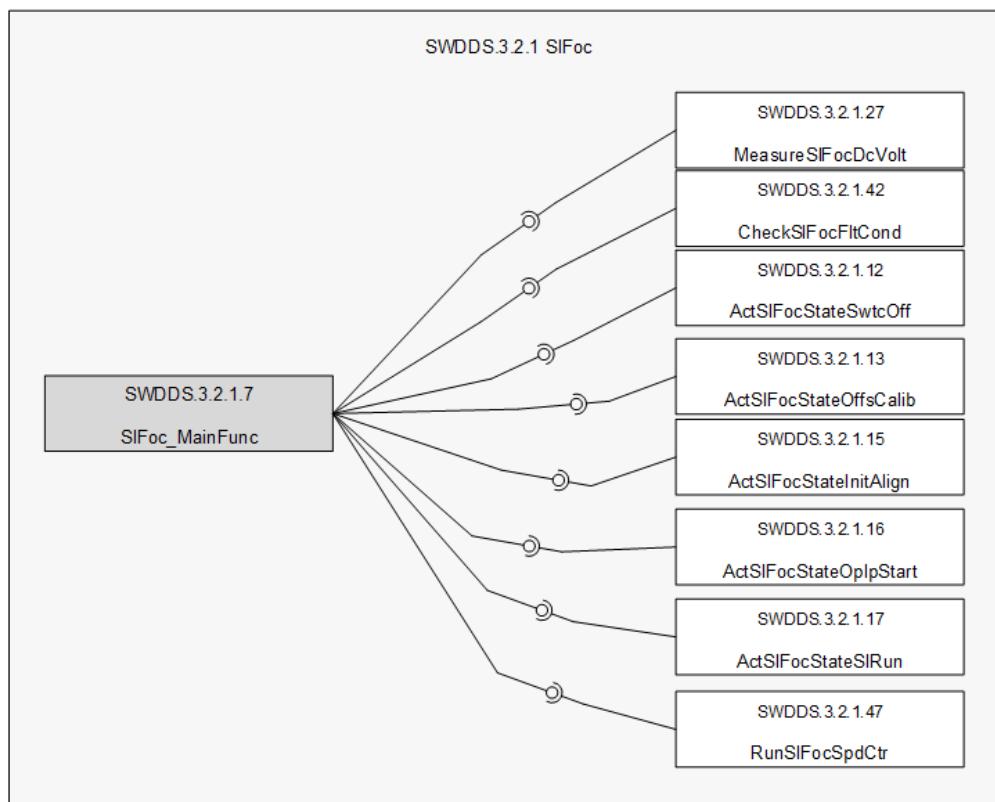


<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	30

	<pre> sequenceDiagram     participant Caller     participant SWDDS     Caller-&gt;&gt;SWDDS: [SWDDS.3.2.1.47] RunSIFocSpdCtr()     activate SWDDS     SWDDS-&gt;&gt;Caller: g_u16SIFocSpdCtrCnt = 0u;     deactivate SWDDS     end   </pre>
Called Function	
Calling Function	SWDDS.3.2.1.27 MeasureSIFocDcVolt SWDDS.3.2.1.42 CheckSIFocFltCond SWDDS.3.2.1.12 ActSIFocStateSwitOff SWDDS.3.2.1.13 ActSIFocStateOffsCalib SWDDS.3.2.1.15 ActSIFocStateInitAlign SWDDS.3.2.1.16 ActSIFocStateOplpStart SWDDS.3.2.1.17 ActSIFocStateSIRun SWDDS.3.2.1.47 RunSIFocSpdCtr
Function Execution Time	N/A

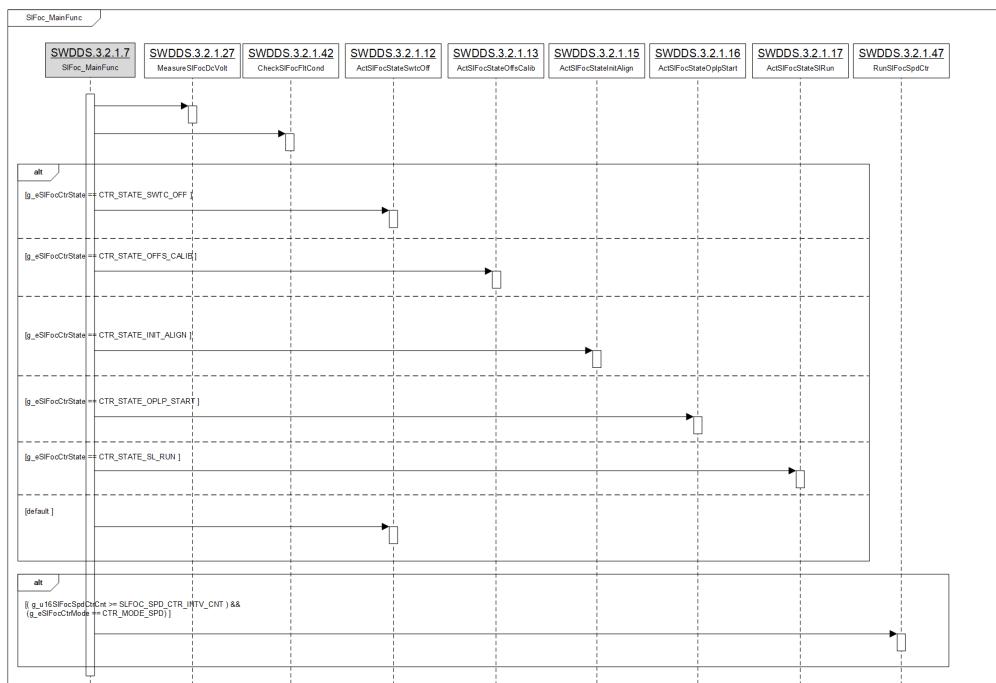
Requirement Id	SWDDS.3.2.1.7
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: #ccc;">■</span> Mid
Verifiability	Yes

#### 1.1.1.7.2 Static View Design



#### 1.1.1.7.3 Dynamic View Design

1. SIFoc\_MainFunc calls the DC driving voltage measurement function in MtrDrv.
2. SIFoc\_MainFunc calls the fault condition checking function.
3. SIFoc\_MainFunc calls the switching off state handling function at switching off state.
4. SIFoc\_MainFunc calls the phase current sensor offset handling function at current offset calibration state.
5. SIFoc\_MainFunc calls the initial alignment state handling function at initial alignment state.
6. SIFoc\_MainFunc calls the open-loop starting state handling function at open-loop starting state.
7. SIFoc\_MainFunc calls the sensorless running state handling function at sensorless running state.
8. SIFoc\_MainFunc calls the EOP motor speed control function at specific control time.



#### 1.1.1.1.7.4 Interface Design

- N/A

#### 1.1.1.1.8 [SWDDS.3.2.1.8] SIFoc\_SetCtrDat

##### 1.1.1.1.8.1 Detailed Design

###### [SWDDS.3.2.1.8] SIFoc\_SetCtrDat

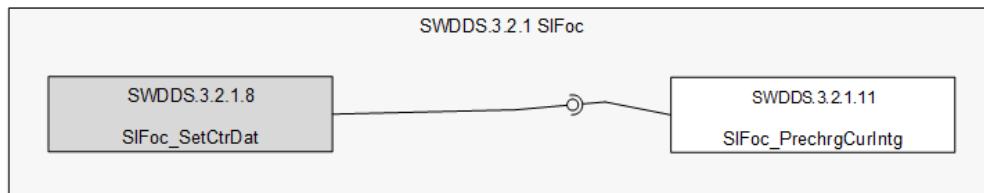
Software Unit Information				
Unit ID	SWDDS.3.2.1.8		Unit Name	SIFoc_SetCtrDat
Architecture ID	SWADS.3.2.1.8		ASIL	QM
Prototype	void SIFoc_SetCtrDat( tSIFocCtrDat control_data )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tBool	control_data.bControlEnable	0 ~ 1 Disable / Enable	IN
	tCtrMode	control_data.eControlMode	0 ~ 1 CTR_MODE_SPD/ CTR_MODE_CUR	IN
	tFrac16	control_data.f16ReferenceCurrent	0 ~ 32767 0 ~ 64.498Apk	IN
	tFrac16	control_data.f16ReferenceSpeed	-32768 ~ 32767 -6000 ~ 5999.82rpm	IN
	tFrac16	control_data.f16CurrentLimitUpper	-32768 ~ 32767 -64.5 ~ 64.498Apk	IN
	tFrac16	control_data.f16CurrentLimitLower	-32768 ~ 32767 -64.5 ~ 64.498Apk	IN
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
	Data			

	Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocCtrEna	0 ~ 1 Disable / Enable	Write	Control enable
Global Variables	tCtrMode	g_eSIFocCtrMode	0 ~ 1 CTR_MODE_SPD/ CTR_MODE_CUR	Read/Write	Control mode
	tFrac16	g_f16SIFocRefSpd	0 ~ 19660 0 ~ 3600rpm	Write	Reference speed setting (PU)
	tFrac16	g_hndSIFocSpdCtr.f16UpperLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Speed controller : Upper Limit (PU)
	tFrac16	g_hndSIFocSpdCtr.f16LowerLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Speed controller : Lower Limit PU)
	tFrac16	g_stSIFocRefCur.f16Arg1	0 0.0Apk	Write	Reference current : d-axis (PU)
	tFrac16	g_stSIFocRefCur.f16Arg2	0 ~ 11430 0 ~ 22.5Apk	Write	Reference current : q-axis (PU)
	Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control data setting - Control enable setting - Control mode change checking - Control data setting				
Control Flow Diagram (or Pseudo Code)	<p>1. SIFoc_SetCtrDat updates the sensorless FOC control enable setting.      2. SIFoc_SetCtrDat precharges the sensorless FOC control integrator if control enable input is changed.      3. SIFoc_SetCtrDat updates the sensorless FOC control mode.      4. SIFoc_SetCtrDat updates the reference speed and the current limit at speed control mode.      5. SIFoc_SetCtrDat updates the d/q-axis reference current at current control mode.</p> <pre> graph TD     start([start]) --&gt; g_bSIFocCtrEna[g_bSIFocCtrEna = control_data.bControlEnable]     g_bSIFocCtrEna --&gt; mode{g_eSIFocCtrMode != control_data.eControlMode}     mode -- yes --&gt; prechg[SIFoc_PrechgCurIntg()]     mode -- no --&gt; mode2{g_eSIFocCtrMode == CTR_MODE_SPD}     mode2 -- yes --&gt; spd[control_data.f16ReferenceSpeed; g_hndSIFocSpdCtr.f16UpperLimit = control_data.f16CurrentLimitUpper; g_hndSIFocSpdCtr.f16LowerLimit = control_data.f16CurrentLimitLower]     mode2 -- no --&gt; arg1[g_stSIFocRefCur.f16Arg1 = FRAC16(0.0f); g_stSIFocRefCur.f16Arg2 = control_data.f16ReferenceCurrent; g_f16SIFocRefSpd = FRAC16(0.0f)]     end([end])     </pre>				
Called Function	SWDDS.2.3.15 Rtelo_SetSIFocCtrDat				
Calling Function	SWDDS.3.2.1.11 SIFoc_PrechgCurIntg				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	34

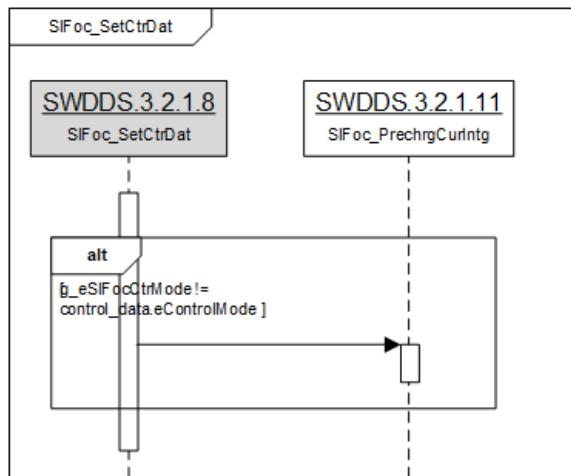
Requirement Id	SWDDS.3.2.1.8
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.1.8.2 Static View Design



#### 1.1.1.8.3 Dynamic View Design

1. SIFoc\_SetCtrDat calls the integrator precharging to set current output value to the PI current and speed control integrator.



#### 1.1.1.8.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	35

### 1.1.1.1.9 [SWDDS.3.2.1.9] SIFoc\_GetStaDat

#### 1.1.1.1.9.1 Detailed Design

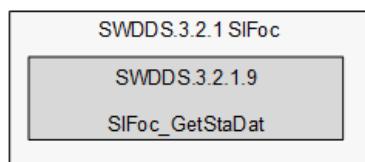
##### [SWDDS.3.2.1.9] SIFoc\_GetStaDat

Software Unit Information					
Unit ID	SWDDS.3.2.1.9	Unit Name	SIFoc_GetStaDat		
Architecture ID	SWADS.3.2.1.9	ASIL	QM		
Prototype	tSIFocStaDat SIFoc_GetStaDat( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tCtrState	.eControlState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFSS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Status data Sensorless FOC state	
	tFrac16	.f16SpeedOutput	-32768 ~ 32767 -6000 ~ 5999.82rpm	Status data Estimated electric speed (PU)	
	tFrac16	.f16CurrentOutput	-32768 ~ 32767 -64.5 ~ 64.4980Apk	Status data q-axis current output (PU)	
	tFrac16	.f16CurrentError	-32768 ~ 32767 -64.5 ~ 64.498Apk	Status data q-axis control error (PU)	
	tFrac16	.f16DcVoltage	0 ~ 32767 0 ~ 25.3992Vpk	Status data DC driving voltage (PU)	
	tU16	.u16FaultStatus	0 ~ 65535	Status data Fault status flags	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFSS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Read	Sensorless FOC state
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Read	Estimated electric speed (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.4980Apk	Read	d/q-axis current output : q-axis (PU)
	tFrac16	g_stSIFocCurErr.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	Current control error : q-axis (PU)
	tFrac16	g_f16SIFocDcVolt	0 ~ 32767 0 ~ 25.3992Vpk	Read	DC driving voltage (PU)
	tU16	g_u16SIFocFitSta	0 ~ 65535	Read	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC status data getting				
	1. SIFoc_GetStaDat updates the sensorless FOC control state. 2. SIFoc_GetStaDat updates the electric speed output, q-axis current output and q-axis current control error. 3. SIFoc_GetStaDat updates the DC driving voltage.				

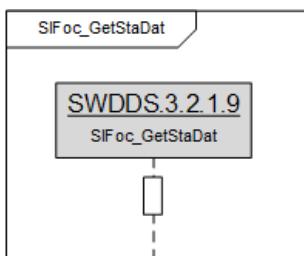
Control Flow Diagram (or Pseudo Code)	4. SIFoc_GetStaDat updates the sensorless FOC fault flags.
	<pre> start     tSIFocStaDat status_data;     status_data.eControlState = g_eSIFocCtrState;     status_data.f16SpeedOutput = g_f16SIFocElecSpd;     status_data.f16CurrentOutput = g_stSIFocCur0uIDq.f16Arg2;     status_data.f16CurrentError = g_stSIFocCurErr.f16Arg2;     status_data.f16DcVoltage = g_f16SIFocDcVolt;     status_data.u16FaultStatus = g_u16SIFocFltSta;  return status_data; </pre>
Called Function	SWDDS.2.3.8 Rtel0_GetSIFocStaDat
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.9
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	No
Criticality	<span style="color: red;">█</span> High
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

#### 1.1.1.1.9.2 Static View Design



#### 1.1.1.1.9.3 Dynamic View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	37

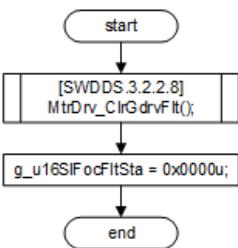
#### 1.1.1.1.9.4 Interface Design

- N/A

#### 1.1.1.1.10 [SWDDS.3.2.1.10] SIFoc\_ClrFltSta

##### 1.1.1.1.10.1 Detailed Design

###### [SWDDS.3.2.1.10] SIFoc\_ClrFltSta

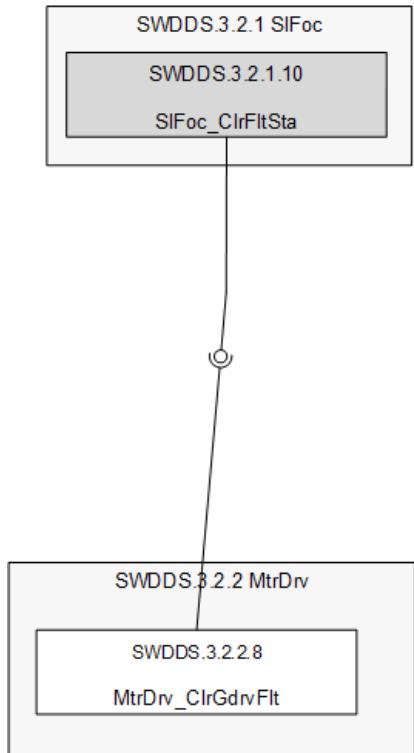
Software Unit Information					
Unit ID	SWDDS.3.2.1.10	Unit Name	SIFoc_ClrFltSta		
Architecture ID	SWADS.3.2.1.10	ASIL	QM		
Prototype	void SIFoc_ClrFltSta( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC fault clearing				
Control Flow Diagram (or Pseudo Code)	1. SIFoc_ClrFltSta clears the gate driver fault. 2. SIFoc_ClrFltSta clears the sensorless FOC fault flags.  <pre> graph TD     start([start]) --&gt; subgraph " [SWDDS.3.2.2.8] MtrDrv_ClrGdrvFlt()"         direction TB         subgraph             direction TB             A[g_u16SIFocFltSta = 0x0000u]             A --&gt; end([end])         end     end   </pre>				
Called Function	SWDDS.2.3.16 Rtel0_ClrSIFocFltSta				
Calling Function	SWDDS.3.2.2.8 MtrDrv_ClrGdrvFlt				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.10
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	■ High
Technical complexity	■ Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	38

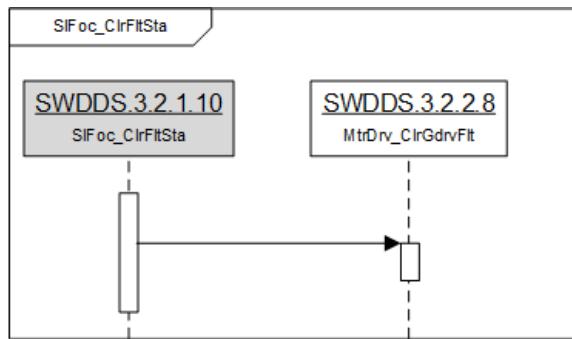
Verifiability	Yes
---------------	-----

#### 1.1.1.10.2 Static View Design



#### 1.1.1.10.3 Dynamic View Design

1. SIFoc\_ClrFltSta calls the gate driver fault clearing.



#### 1.1.1.10.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	39

#### 1.1.1.11.11 [SWDDS.3.2.1.11] SIFoc\_PrechrgCurlntg

##### 1.1.1.11.11.1 Detailed Design

#### [SWDDS.3.2.1.11] SIFoc\_PrechrgCurlntg

Software Unit Information					
Unit ID	SWDDS.3.2.1.11	Unit Name	SIFoc_PrechrgCurlntg		
Architecture ID	SWADS.3.2.1.11	ASIL	QM		
Prototype	void SIFoc_PrechrgCurlntg( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCtrlInpDq.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	d/q-axis control input : d-axis (PU)
	tFrac16	g_stSIFocCtrlInpDq.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	d/q-axis control input : q-axis (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d/q-axis current output : q-axis (PU)
	tFrac16	g_hndSIFocPiCurCtrD.f16CC1sc	10426 0.3181807092	Write	d-axis PI current controller CC1 coefficient
	tFrac16	g_hndSIFocPiCurCtrD.f16CC2sc	-9391 -0.2865979751	Write	d-axis PI current controller CC2 coefficient
	tU16	g_hndSIFocPiCurCtrD.u16NShift	0	Write	d-axis PI current controller Scaling bitwise shift applied to the controller coefficients
	tFrac16	g_hndSIFocPiCurCtrD.f16InErrK1	0	Write	d-axis PI current controller controller input from the previous calculation step.
	tFrac16	g_hndSIFocPiCurCtrD.f16UpperLimit	30310 0.925	Write	d-axis PI current controller : Upper Limit
	tFrac16	g_hndSIFocPiCurCtrD.f16LowerLimit	-30310 -0.925	Write	d-axis PI current controller : Lower Limit
	tFrac16	g_hndSIFocPiCurCtrQ.f16CC1sc	10426 0.3181807092	Write	q-axis PI current controller CC1 coefficient
	tFrac16	g_hndSIFocPiCurCtrQ.f16CC2sc	-9391 -0.2865979751	Write	q-axis PI current controller CC2 coefficient
	tU16	g_hndSIFocPiCurCtrQ.u16NShift	0	Write	q-axis PI current controller Scaling bitwise shift applied to the controller coefficients
	tFrac16	g_hndSIFocPiCurCtrQ.f16InErrK1	0	Write	q-axis PI current controller controller input from the previous calculation step.
	tFrac16	g_hndSIFocPiCurCtrQ.f16UpperLimit	30310 0.925	Write	q-axis PI current controller : Upper Limit
	tFrac16	g_hndSIFocPiCurCtrQ.f16LowerLimit	-30310 -0.925	Write	q-axis PI current controller : Lower Limit
	tFrac16	g_hndSIFocSpdCtr.f16PropGain	21808 0.6655483475	Write	PI speed controller : Proportional Gain
	tS16	g_hndSIFocSpdCtr.s16PropGainShift	-1	Write	PI speed controller : Proportional Gain Shift
	tFrac16	g_hndSIFocSpdCtr.f16IntegGain	24360	Write	PI speed controller : Integral Gain

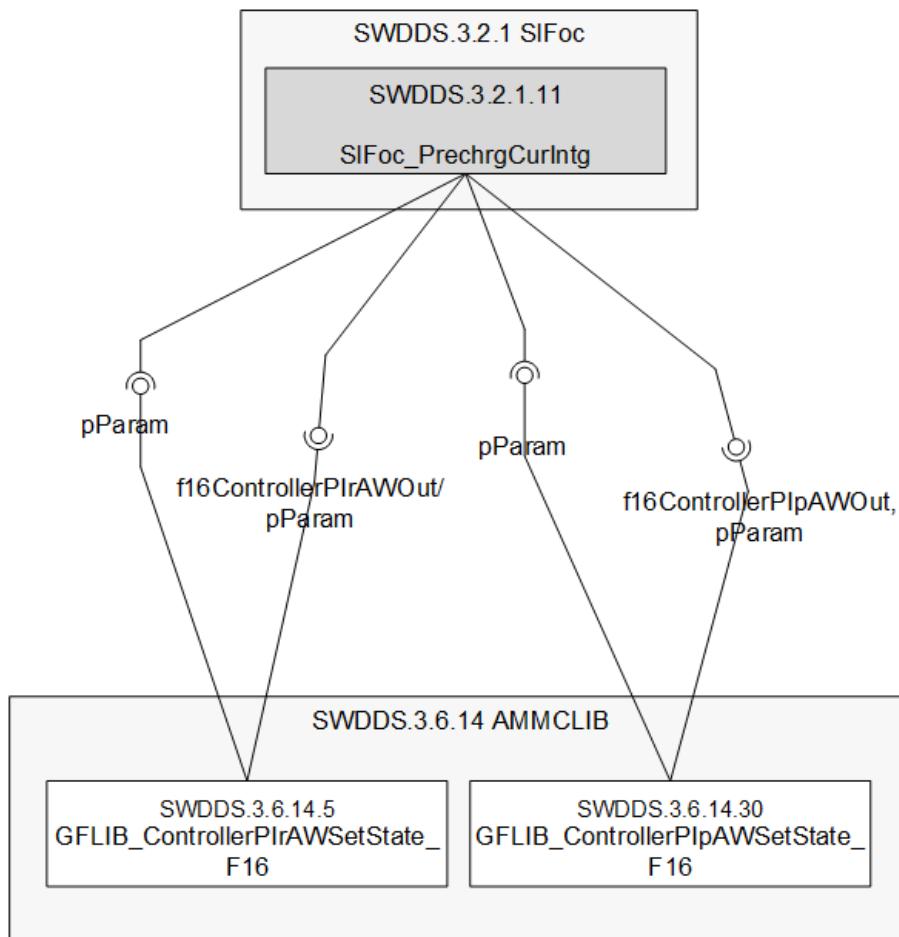
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	40

	tS16	g_hndSIFocSpdCtr.s16IntegGainShift	0.7434246397		
	tFrac32	g_hndSIFocSpdCtr.f32IntegPartK_1	-8	Write	PI speed controller : Integral Gain Shift
	tFrac16	g_hndSIFocSpdCtr.f16UpperLimit	0	Write	PI speed controller : integral part at step k-1
	tFrac16	g_hndSIFocSpdCtr.f16LowerLimit	11430 22.5Apk	Write	PI speed controller : upper limit
	tFrac32	g_hndSIFocSpdCtr.f32IntegPartK_1	-11430 -22.5Apk	Read/Write	PI speed controller : lower limit
	tFrac16	g_hndSIFocSpdCtr.u16InK_1	0	Read/Write	Speed controller handler integral part at step k-1
	tU16	g_hndSIFocSpdCtr.u16LimitFlag	0	Read/Write	Speed controller handler input error at step k-1
					Speed controller handler Limitation flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC current control integrator pre-charging				
Control Flow Diagram (or Pseudo Code)	<p>1. SIFoc_PrechrgCurIntg precharges the d/q-axis PI current control integrator with the d/q-axis control input voltage.</p> <p>2. SIFoc_PrechrgCurIntg precharges the PI speed control integrator with the q-axis current output.</p> <pre> graph TD     start([start]) --&gt; S1[GFLIB_ControllerPirAWSetState_F16&lt;br/&gt;g_stSIFocCtrlnpDq.f16Arg1, &amp;g_hndSIFocPicurCtrD]     S1 --&gt; S2[GFLIB_ControllerPirAWSetState_F16&lt;br/&gt;g_stSIFocCtrlnpDq.f16Arg2, &amp;g_hndSIFocPicurQ]     S2 --&gt; S3[GFLIB_ControllerPipAWSetState_F16&lt;br/&gt;g_stSIFocCurOutDq.f16Arg2, &amp;g_hndSIFocSpdCtr]     S3 --&gt; end([end]) </pre>				
Called Function	SWDDS.2.3.17 Rtelo_PrechrgCurIntg SWDDS.3.2.1.8 SIFoc_SetCtrDat				
Calling Function	SWDDS.3.6.14.5 GFLIB_ControllerPirAWSetState_F16 SWDDS.3.6.14.30 GFLIB_ControllerPipAWSetState_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.11
Target Milestone	SBS1
Element	MTR
Risk	Mid
Interoperability	Yes
Criticality	High
Technical complexity	Low

Verifiability	Yes
---------------	-----

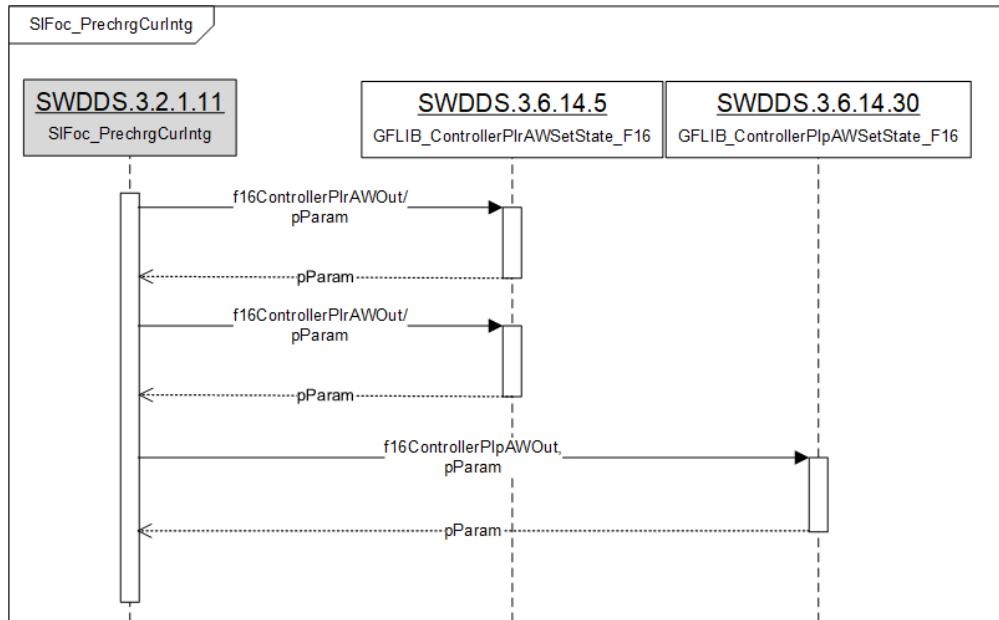
#### 1.1.1.11.2 Static View Design



#### 1.1.1.11.3 Dynamic View Design

1. `SIFoc_PrechrgCurlIntg` calls the PI state setting function to precharge d/q-axis current control.
2. `SIFoc_PrechrgCurlIntg` calls the PI state setting function to precharge speed control.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	42



#### 1.1.1.11.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	f16ControllerPlrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d/q-axis control input : Argument1
2	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	d-axis PI current control handler
3	f16ControllerPlrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d/q-axis control input : Argument2
4	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	q-axis PI current control handler
5	f16ControllerPlpAWOut	SWDDS.3.6.14.30	OUT	tFrac16	-32767	32768	-6000	5999.82	0.183105 / rpm	d/q-axis current output : Argument2
6	pParam	SWDDS.3.6.14.30	IN/OUT	GFLIB_CONTROLLER_PIAW_P_T_F16 *	N/A	N/A	N/A	N/A	N/A	Speed controller handler

#### 1.1.1.12 [SWDDS.3.2.1.12] ActSIFocStateSwtcOff

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	43

#### 1.1.1.12.1 Detailed Design

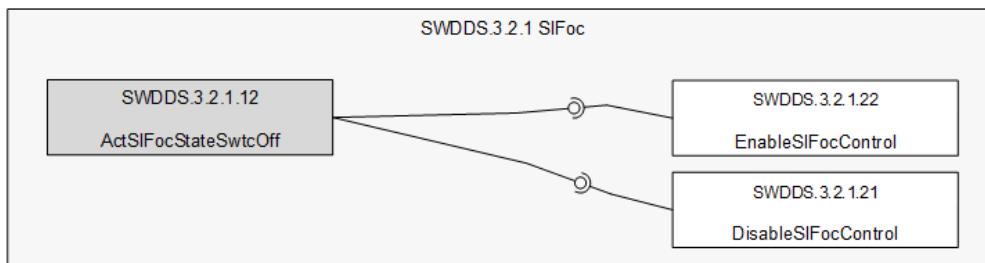
##### [SWDDS.3.2.1.12] ActSIFocStateSwtcOff

Software Unit Information					
Unit ID	SWDDS.3.2.1.12		Unit Name	ActSIFocStateSwtcOff	
Architecture ID	SWADS.3.2.1.12		ASIL	QM	
Prototype	void ActSIFocStateSwtcOff( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tBool	g_bSIFocPrevCtrEna	0 ~ 1 Disable / Enable	Read	Previous control enabled state
	tU16	g_u16SIFocStateElapCnt	0 ~ 65535	Read/Write	Elapse time count after state entered
	tBool	g_bSIFocFirstCurMeasr	0 ~ 1 FALSE / TRUE	Write	First current measurement
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFSET_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16FocEnaDlyTim	0 ~ 10	Read	FOC control enable delay time count after disabled
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Switching output off state action				
Control Flow Diagram (or Pseudo Code)	<p>1. ActSIFocStateSwtcOff checks the Sensorless FOC control enabling edge.</p> <p>2. ActSIFocStateSwtcOff sets the Sensorless FOC control state as current offset calibration state and initialize related variables if enabling delay time finished.</p> <p>3. ActSIFocStateSwtcOff sets related variables if the Sensorless FOC control disabling edge.</p>				

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; Cond1{g_bSIFocCtrEna != FALSE}     Cond1 -- no --&gt; end([end])     Cond1 -- yes --&gt; Cond2{g_bSIFocPrevCtrEna == FALSE}     Cond2 -- no --&gt; Cond3{g_bSIFocPrevCtrEna != FALSE}     Cond3 -- no --&gt; end     Cond3 -- yes --&gt; Call1[SWDDS.3.2.1.21 DisableSIFocControl()]     Call1 --&gt; End1([end])     Cond2 -- yes --&gt; Call2[SWDDS.3.2.1.22 EnableSIFocControl()]     Call2 --&gt; Update[g_bSIFocFirstCurMeas = TRUE; g_u16SIFocStateElapCnt = 0u; g_eSIFocCtrState = CTR_STATE_OFFS_CALIB;]     Update --&gt; End2([end])     Call2 --&gt; End2     </pre>
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc
Calling Function	SWDDS.3.2.1.22 EnableSIFocControl SWDDS.3.2.1.21 DisableSIFocControl
Function Execution Time	N/A

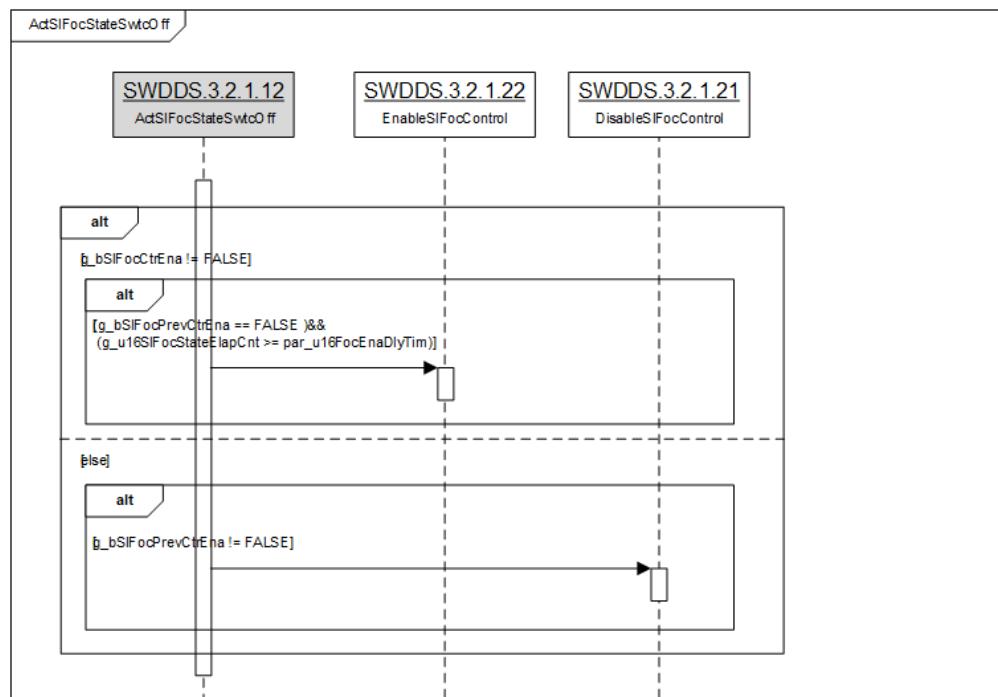
Requirement Id	SWDDS.3.2.1.12
Target Milestone	SBS1
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.1.12.2 Static View Design



#### 1.1.1.12.3 Dynamic View Design

1. ActSIFocStateSwtcOff calls Sensorless FOC enabling function to initialize related variable at the control enabling edge.
2. ActSIFocStateSwtcOff calls Sensorless FOC disabling function to initialize related variable at the control disabling edge.



#### 1.1.1.12.4 Interface Design

- N/A

#### 1.1.1.13 [SWDDS.3.2.1.13] ActSIFocStateOffsCalib

##### 1.1.1.13.1 Detailed Design

##### [SWDDS.3.2.1.13] ActSIFocStateOffsCalib

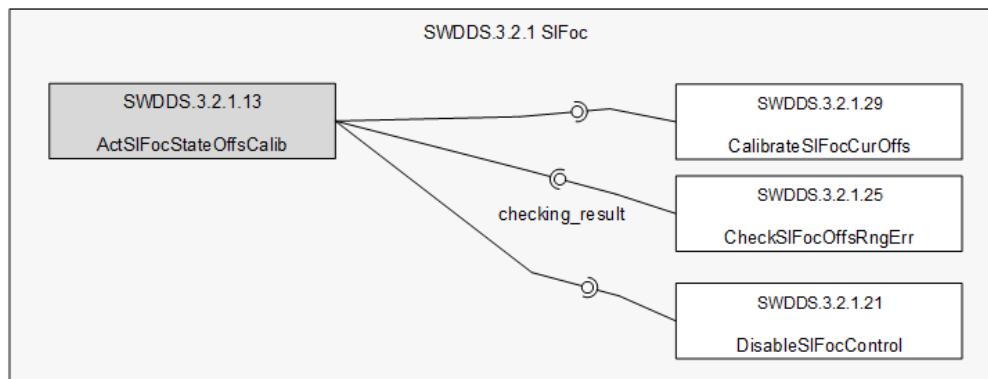
Software Unit Information					
Unit ID	SWDDS.3.2.1.13		Unit Name	ActSIFocStateOffsCalib	
Architecture ID	SWADS.3.2.1.13		ASIL	QM	
Prototype	void ActSIFocStateOffsCalib( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tU16	g_u16SIFocFltSta	0 ~ 65535	Read	Fault status flags

Global Variables	tU16	g_u16SIFocStateElapCnt	0 ~ 65535	Read/Write	Elapse time count after state entered
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFSET_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16CurSigOffsCalibCnt	0 ~ 100	Read	Current sensor offset calibration count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current sensor offset calibration state action				
Control Flow Diagram (or Pseudo Code)	<p>1. ActSIFocStateOffsCalib runs the phase current sensor offset calibration.</p> <p>2. ActSIFocStateOffsCalib checks the control enabled and no fault.</p> <p>3. ActSIFocStateOffsCalib sets the Sensorless FOC control state as initial alignment state when the calibration is finished (by checking count reached) and the current offset range is within the specific range.</p> <p>4. ActSIFocStateOffsCalib disables the control if the control is disabled or fault detected or phase current offset range is over.</p> <pre> graph TD     start([start]) --&gt; CalibrateSIFocCurOffs[CalibrateSIFocCurOffs()]     CalibrateSIFocCurOffs --&gt; Decision1{((g_bSIFocCtrEna != FALSE) &amp;&amp; (g_u16SIFocFltSta == 0x0000u))}     Decision1 -- no --&gt; DisableSIFocControl[DisableSIFocControl()]     Decision1 -- yes --&gt; Decision2{g_u16SIFocStateElapCnt &gt;= par_u16CurSigOffsCalibCnt}     Decision2 -- no --&gt; DisableSIFocControl     Decision2 -- yes --&gt; Decision3{CheckSIFocOffsRngErr() == FALSE}     Decision3 -- no --&gt; SetState[g_u16SIFocStateElapCnt = 0u; g_eSIFocCtrState = CTR_STATE_INIT_ALIGN]     SetState --&gt; DisableSIFocControl     Decision3 -- yes --&gt; DisableSIFocControl     end([end])   </pre>				
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc				
Calling Function	<a href="#">SWDDS.3.2.1.29 CalibrateSIFocCurOffs</a> <a href="#">SWDDS.3.2.1.25 CheckSIFocOffsRngErr</a> <a href="#">SWDDS.3.2.1.21 DisableSIFocControl</a>				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.13
Target Milestone	EBS2

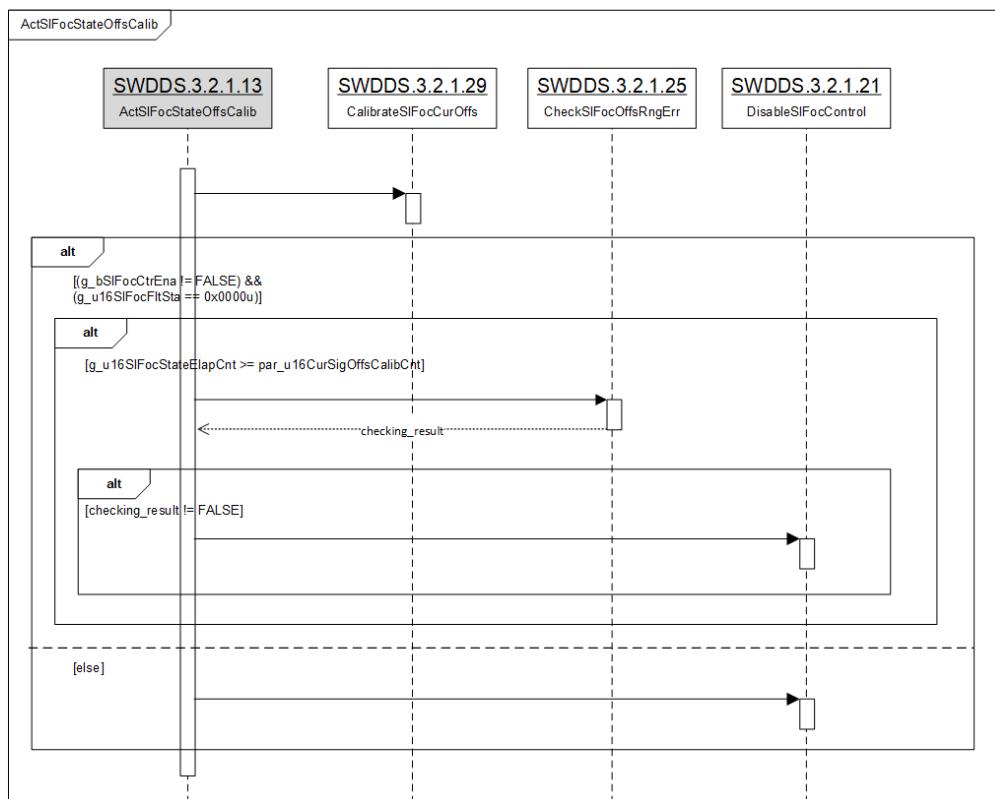
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	★ High
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.1.13.2 Static View Design



#### 1.1.1.13.3 Dynamic View Design

1. ActSIFocStateOffsCalib calls the phase current offset calibration function to filter the phase current signal during switching off.
2. ActSIFocStateOffsCalib calls the phase current offset range error function to check range of offset phase current.



#### 1.1.1.13.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	checking_result	SWDDS.3.2.1.25	IN	tBool	0	1	No error	Error (range over)	N/A	Current sensor offset range error checking

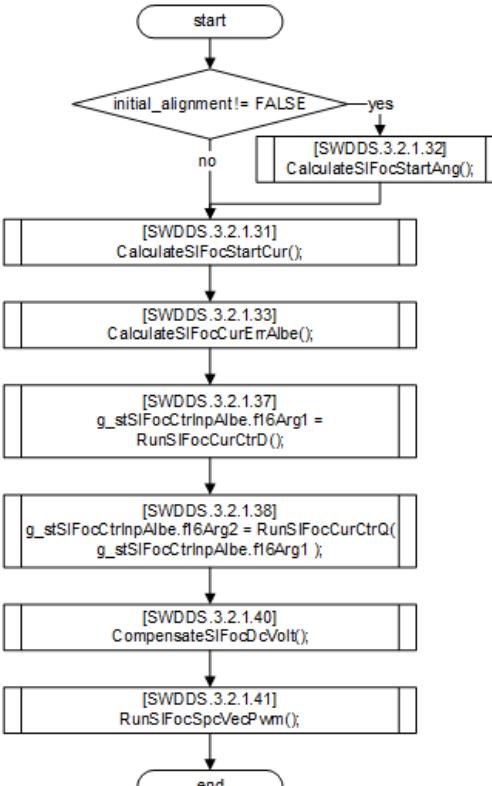
#### 1.1.1.14 [SWDDS.3.2.1.14] RunSIFocStateAlignOplp

##### 1.1.1.14.1 Detailed Design

#### [SWDDS.3.2.1.14] RunSIFocStateAlignOplp

Software Unit Information					
Unit ID	SWDDS.3.2.1.14		Unit Name	RunSIFocStateAlignOplp	
Architecture ID	SWADS.3.2.1.14		ASIL	QM	
Prototype	void RunSIFocStateAlignOplp( tBool initial_alignment )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	initial_alignment	0 ~ 1	IN	FALSE – open-loop starting, TRUE – initial alignment
Function Call	Data Type	Possible Return Value			Description

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	49

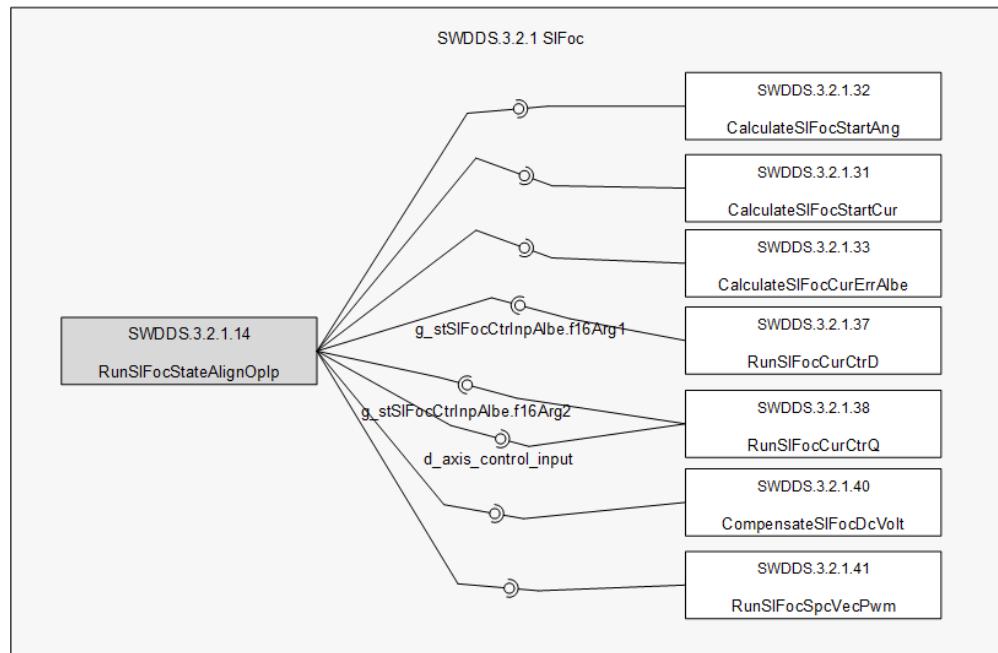
Return Value	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
Global Variables	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read/Write	alpha/beta-axis control input : d-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	alpha/beta-axis control input : q-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Initial alignment state and open-loop starting running				
Control Flow Diagram (or Pseudo Code)	<p>1. RunSIFocStateAlignOplp runs initial alignment by skipping the starting electric angel calculation if the input parameter is true.</p> <p>2. RunSIFocStateAlignOplp runs open-loop starting if the input parameter is false.</p> <p>3. RunSIFocStateAlignOplp calculates the starting electric angle and the magnitude of excitation current.</p> <p>4. RunSIFocStateAlignOplp calculates the current control error in alpha/beta-axis.</p> <p>5. RunSIFocStateAlignOplp calculates the alpha/beta-axis control input voltage using PI current control.</p> <p>6. RunSIFocStateAlignOplp compensates the DC driving voltage ripple.</p> <p>7. RunSIFocStateAlignOplp sets the PWM duty using space vector PWM.</p>  <pre> graph TD     start((start)) --&gt; decision{initial_alignment != FALSE}     decision -- no --&gt; sub1[CalculateSIFocStartAng()]     sub1 --&gt; sub2[CalculateSIFocStartCur()]     sub2 --&gt; sub3[CalculateSIFocCurErrAlbe()]     sub3 --&gt; sub4[g_stSIFocCtrlInpAlbe.f16Arg1 = RunSIFocCurCtrD()]     sub4 --&gt; sub5[g_stSIFocCtrlInpAlbe.f16Arg2 = RunSIFocCurCtrQ(g_stSIFocCtrlInpAlbe.f16Arg1)]     sub5 --&gt; sub6[CompensateSIFocDcVolt()]     sub6 --&gt; sub7[RunSIFocSpcVecPwm()]     sub7 --&gt; end((end))     decision -- yes --&gt; sub1   </pre>				
Called Function	<p>SWDDS.3.2.1.15 ActSIFocStateInitAlign</p> <p>SWDDS.3.2.1.16 ActSIFocStateOplpStart</p>				
Calling Function	<p>SWDDS.3.2.1.32 CalculateSIFocStartAng</p> <p>SWDDS.3.2.1.31 CalculateSIFocStartCur</p> <p>SWDDS.3.2.1.33 CalculateSIFocCurErrAlbe</p> <p>SWDDS.3.2.1.37 RunSIFocCurCtrD</p> <p>SWDDS.3.2.1.38 RunSIFocCurCtrQ</p> <p>SWDDS.3.2.1.40 CompensateSIFocDcVolt</p>				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	50

SWDDS.3.2.1.41 RunSIFocSpcVecPwm	
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.14
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

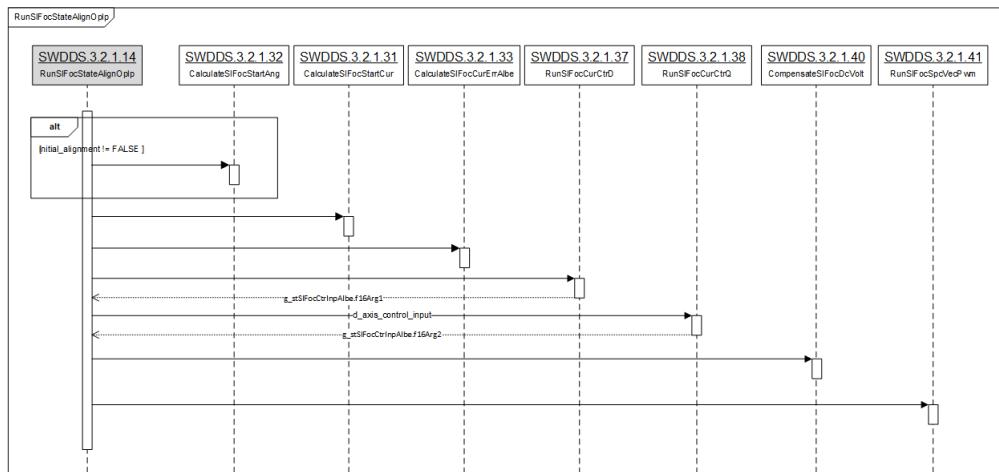
#### 1.1.1.14.2 Static View Design



#### 1.1.1.14.3 Dynamic View Design

1. RunSIFocStateAlignOplp calls the starting electric angle calculation under open-loop starting.
2. RunSIFocStateAlignOplp calls the starting current magnitude calculation.
3. RunSIFocStateAlignOplp calls the current control error calculation in alpha/beta-axis.
4. RunSIFocStateAlignOplp calls d/q-axis PI current control input voltage calculation to control alpha/beta-axis current.
5. RunSIFocStateAlignOplp calls the DC driving voltage compensation.
6. RunSIFocStateAlignOplp calls the space vector PWM and PWM duty setting.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	51



#### 1.1.1.14.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_stSIFocCtrlInpAlbe.f16Arg1	SWDDS.3.2.1.37	IN	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d-axis calculated control input (PU)
2	g_stSIFocCtrlInpAlbe.f16Arg2	SWDDS.3.2.1.38	IN	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	Calculated q-axis or beta-axis control input (PU)
3	d_axis_control_input	SWDDS.3.2.1.38	OUT	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d-axis or alpha-axis control input (PU)

#### 1.1.1.15 [SWDDS.3.2.1.15] ActSIFocStateInitAlign

##### 1.1.1.15.1 Detailed Design

##### [SWDDS.3.2.1.15] ActSIFocStateInitAlign

Software Unit Information				
Unit ID	SWDDS.3.2.1.15	Unit Name	ActSIFocStateInitAlign	
Architecture ID	SWADS.3.2.1.15	ASIL	QM	
Prototype	void ActSIFocStateInitAlign( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
void		N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
N/A	N/A	N/A	N/A	N/A

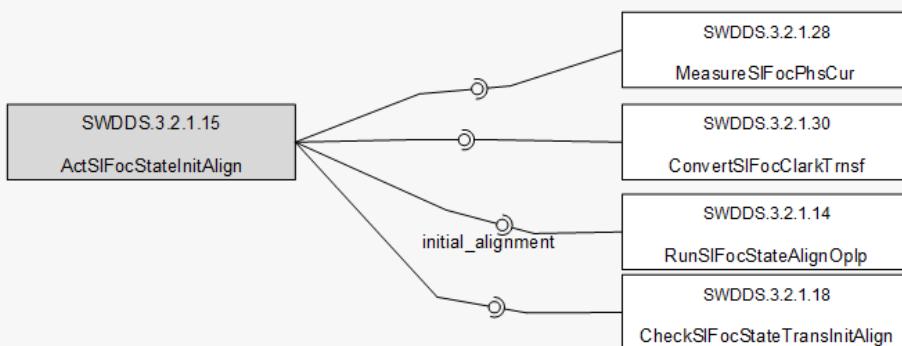
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	52

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Initial alignment state action				
Control Flow Diagram (or Pseudo Code)	<p>1. ActSIFocStateInitAlign measures the phase current and runs the Clark transformation.      2. ActSIFocStateInitAlign runs the initial alignment.      3. ActSIFocStateInitAlign checks the end of the initial alignment.</p> <pre> graph TD     start([start]) --&gt; S1[SWDDS.3.2.1.28 MeasureSIFocPhsCur();]     S1 --&gt; S2[SWDDS.3.2.1.30 ConvertSIFocClarkTrnsf();]     S2 --&gt; S3[SWDDS.3.2.1.14 RunSIFocStateAlignOplp( FALSE );]     S3 --&gt; S4[SWDDS.3.2.1.18 CheckSIFocStateTransInitAlign();]     S4 --&gt; end([end])     </pre>				
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc				
Calling Function	SWDDS.3.2.1.28 MeasureSIFocPhsCur SWDDS.3.2.1.30 ConvertSIFocClarkTrnsf SWDDS.3.2.1.14 RunSIFocStateAlignOplp SWDDS.3.2.1.18 CheckSIFocStateTransInitAlign				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.15
Target Milestone	EBS2
Element	MTR
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

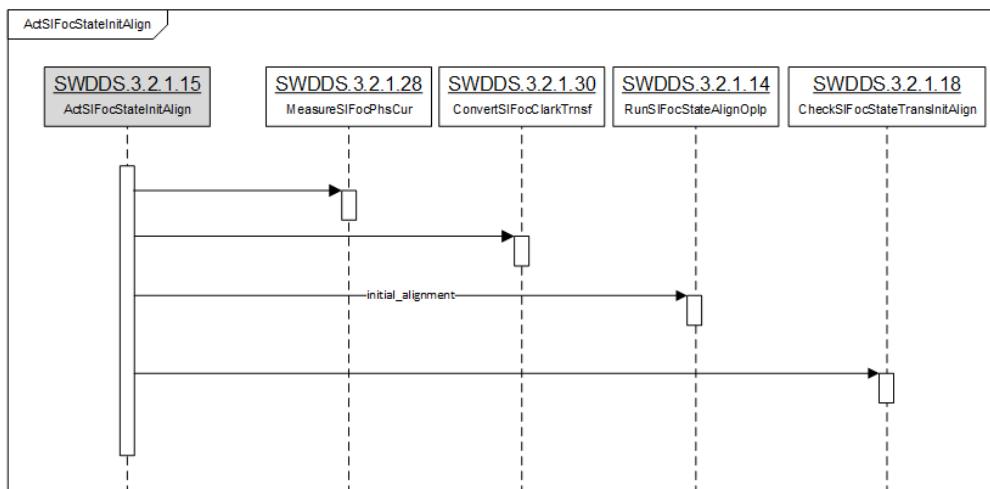
#### 1.1.1.15.2 Static View Design

### SWDDS.3.2.1 SIFoc



#### 1.1.1.15.3 Dynamic View Design

1. ActSIFocStateInitAlign calls the phase current measurement to get 3-phase current.
2. ActSIFocStateInitAlign calls Clark transformation to get alpha/beta-axis feedback current.
3. ActSIFocStateInitAlign calls the initial alignment to align the rotor to the alpha-axis.
4. ActSIFocStateInitAlign calls state transition checking to check the end of the initial alignment state.



#### 1.1.1.15.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	initial_alignment	SWDDS.3.2.1.14	OUT	tBool	0	1	Open-loop starting	Initial align	N/A	Initial alignment state

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	54

### 1.1.1.16 [SWDDS.3.2.1.16] ActSIFocStateOplpStart

#### 1.1.1.16.1 Detailed Design

##### [SWDDS.3.2.1.16] ActSIFocStateOplpStart

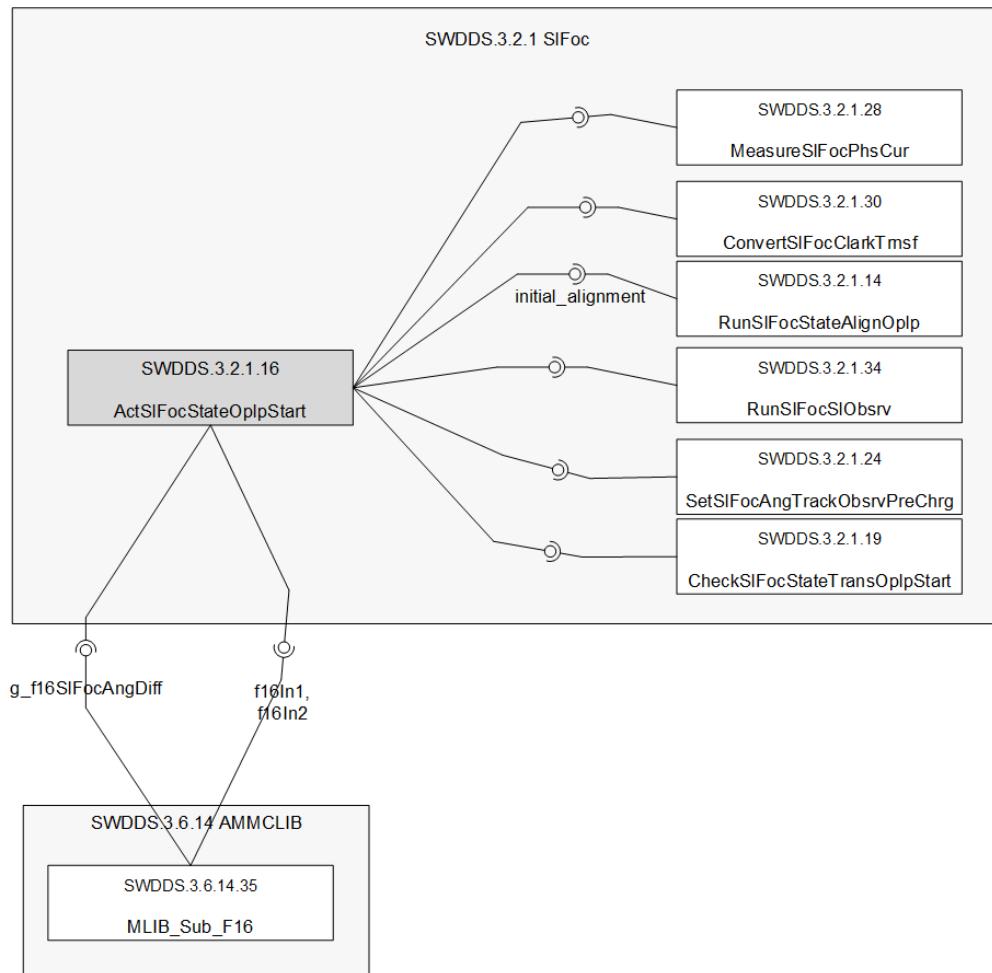
Software Unit Information					
Unit ID	SWDDS.3.2.1.16	Unit Name	ActSIFocStateOplpStart		
Architecture ID	SWADS.3.2.1.16	ASIL	QM		
Prototype	void ActSIFocStateOplpStart( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocStartSpd	0 ~ 3276 0 ~ 600rpm	Read	Open-loop starting electric speed (PU)
	tFrac16	g_f16SIFocAngDiff	-32768 ~ 32767 -180 ~ 179.995deg	Write	Starting and estimated angle difference (PU)
	tFrac16	g_f16SIFocStartAng	-32768 ~ 32767 -180 ~ 179.995deg	Read	Open-loop starting electric angle (PU)
	tFrac16	g_f16SIFocElecAng	-32768 ~ 32767 -180 ~ 179.995deg	Read	Estimated electric angle (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartEstSpdThrs	819 150rpm	Read	Sensorless estimation start speed
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Open-loop starting state action				
Control Flow Diagram (or Pseudo Code)	<ol style="list-style-type: none"> <li>ActSIFocStateOplpStart gets the 3-phase current and converts to alpha/beta-axis current.</li> <li>ActSIFocStateOplpStart runs the initial starting.</li> <li>ActSIFocStateOplpStart runs the sensorless observer if the starting speed is over the speed estimation speed threshold.</li> <li>ActSIFocStateOplpStart pre-charges the sensorless observer if the estimation angle error is negative.</li> <li>ActSIFocStateOplpStart pre-charges the sensorless observer if the starting speed is less than the threshold.</li> <li>ActSIFocStateOplpStart checks the end of the initial starting state.</li> </ol>				

Control Flow Diagram (or Pseudo Code)	
	<pre>     start     [SWDDS.3.2.1.28] MeasureSIFocPhsCur();     [SWDDS.3.2.1.30] ConvertSIFocClarkTrnsf();     [SWDDS.3.2.1.14] RunSIFocStateAlignOplp(TRUE );     if g_f16SIFocStartSpd &gt;= par_f16StartEstSpdThrs then         [SWDDS.3.2.1.34] RunSIFocSIObsrv();         [SWDDS.3.6.14.35] g_f16SIFocAngDiff = MLIB_Sub_F16(             g_f16SIFocStartAng, g_f16SIFocElecAng );     else         [SWDDS.3.2.1.24] SetSIFocAngTrackObsrvPreChrg();     end if;     if g_f16SIFocAngDiff &lt; FRAC 16( 0.0f ) then         [SWDDS.3.2.1.24] SetSIFocAngTrackObsrvPreChrg();     end if;     [SWDDS.3.2.1.19] CheckSIFocStateTransOplpStart();     end   </pre>
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc SWDDS.3.2.1.28 MeasureSIFocPhsCur SWDDS.3.2.1.30 ConvertSIFocClarkTrnsf SWDDS.3.2.1.14 RunSIFocStateAlignOplp SWDDS.3.2.1.34 RunSIFocSIObsrv SWDDS.3.6.14.35 MLIB_Sub_F16 SWDDS.3.2.1.24 SetSIFocAngTrackObsrvPreChrg SWDDS.3.2.1.19 CheckSIFocStateTransOplpStart
Calling Function	
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.16
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	56

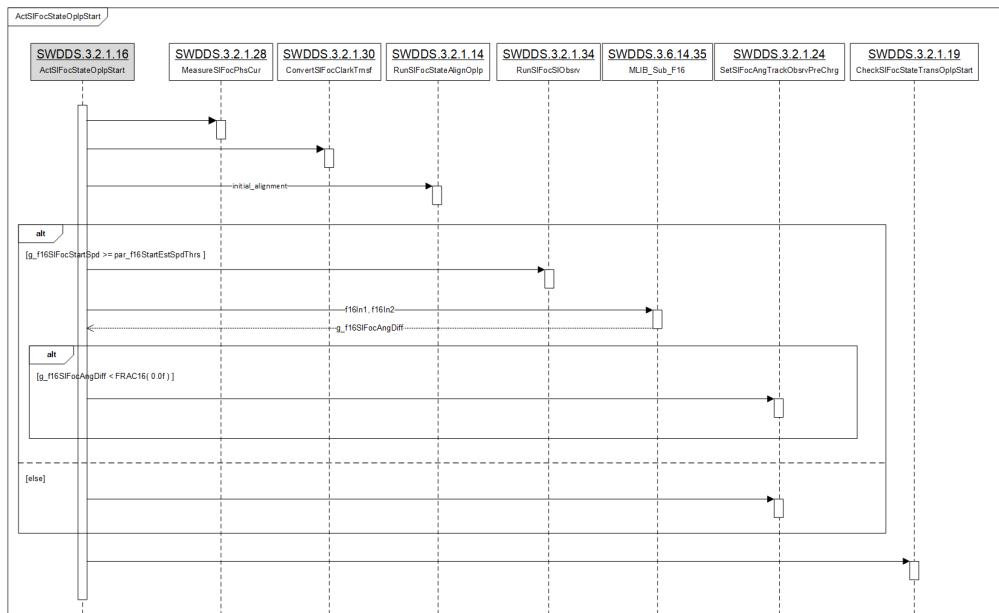
#### 1.1.1.16.2 Static View Design



#### 1.1.1.16.3 Dynamic View Design

1. **ActSIFocStateOplpStart** calls the phase current measurement.
2. **ActSIFocStateOplpStart** calls Clark transformation to get alpha/beta-axis feedback current.
3. **ActSIFocStateOplpStart** calls the initial open-loop starting.
4. **ActSIFocStateOplpStart** calls the sensorless observer to estimate the electric angle and speed during initial open-loop starting.
5. **ActSIFocStateOplpStart** calls the sensorless observer precharging.
6. **ActSIFocStateOplpStart** calls the state transition condition checking.
7. **ActSIFocStateOplpStart** calls the fixed-point arithmetic for subtraction calculation.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	57



#### 1.1.1.1.16.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	initial_alignment	SWDDS.3.2.1.14	OUT	tBool	0	1	Open-loop starting	Initial align	N/A	Initial alignment state
2	f16In1	SWDDS.3.6.14.35	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Open-loop starting electric angle
3	f16In2	SWDDS.3.6.14.35	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle
4	g_f16SIFocAngDiff	SWDDS.3.6.14.35	IN	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Starting and estimated angle difference

#### 1.1.1.1.17 [SWDDS.3.2.1.17] actSIFocStateSIRun

##### 1.1.1.1.17.1 Detailed Design

#### [SWDDS.3.2.1.17] actSIFocStateSIRun

Software Unit Information					
Unit ID	SWDDS.3.2.1.17		Unit Name	ActSIFocStateSIRun	
Architecture ID	SWADS.3.2.1.17		ASIL	QM	
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
	Data Type	Name	Range	Read/Write	Description

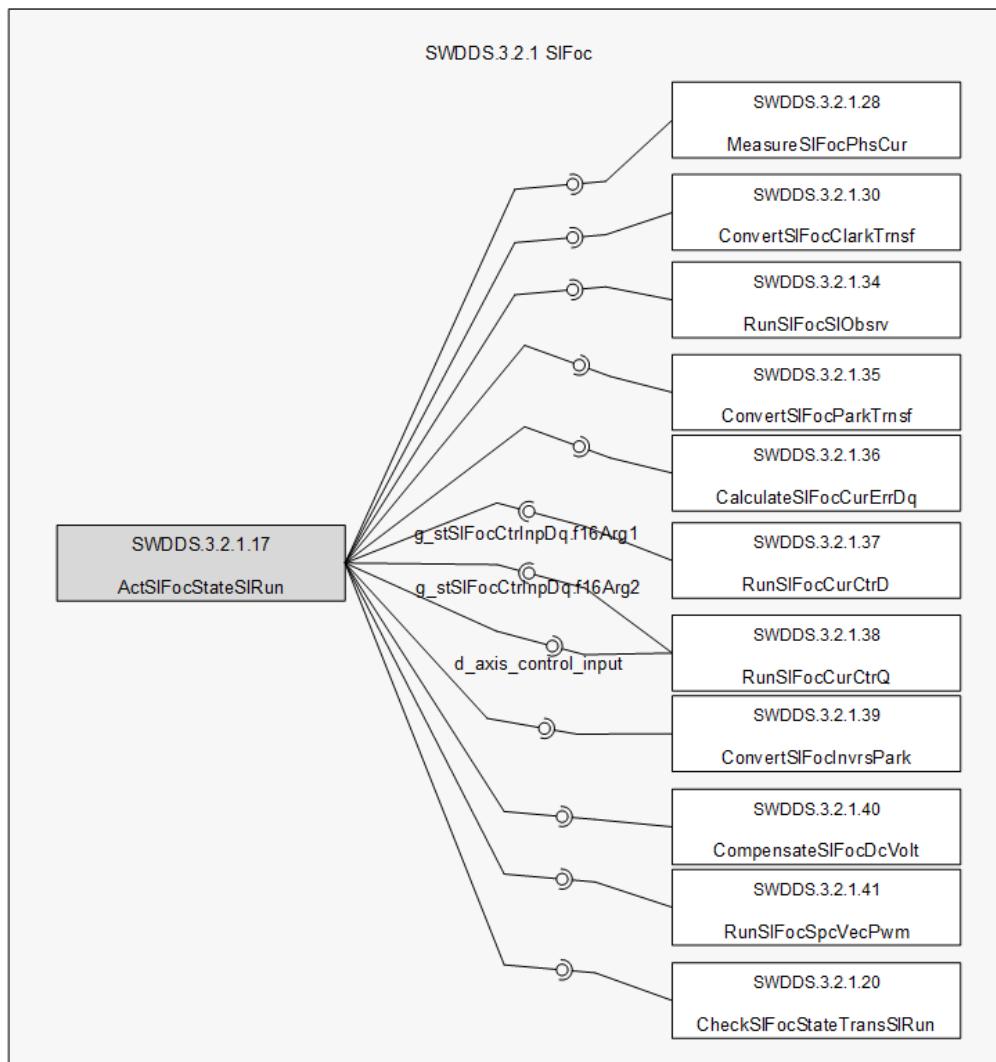
Global Variables	tFrac16	g_stSIFocCtrlInpDq.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	d/q-axis control input : d-axis (PU)
	tFrac16	g_stSIFocCtrlInpDq.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	d/q-axis control input : q-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless running state action				
Control Flow Diagram (or Pseudo Code)	<p>1. ActSIFocStateSIRun gets the 3-phase current and converts to alpha/beta-axis current.</p> <p>2. ActSIFocStateSIRun estimates the electric angle and speed using the sensorless observer.</p> <p>3. ActSIFocStateSIRun calculates the d/q-axis feedback current using Park transformation.</p> <p>4. ActSIFocStateSIRun calculates the d/q-axis current control error.</p> <p>5. ActSIFocStateSIRun calculates the d/q-axis control input voltage using the d/q-axis PI current control.</p> <p>6. ActSIFocStateSIRun calculate the alpha/beta-axis control input voltage using the inverse Park transformation.</p> <p>7. ActSIFocStateSIRun compensates the DC driving voltage ripple.</p> <p>8. ActSIFocStateSIRun calculates the PWM duty using space vector PWM and sets the PWM duty to the gate drivier.</p> <p>9. ActSIFocStateSIRun checks the end of sensorless running state.</p>				
	<pre> graph TD     start([start]) --&gt; MeasureSIFocPhsCur[SWDDS.3.2.1.28 MeasureSIFocPhsCur()]     MeasureSIFocPhsCur --&gt; ConvertSIFocClarkTrnsf[SWDDS.3.2.1.30 ConvertSIFocClarkTrnsf()]     ConvertSIFocClarkTrnsf --&gt; RunSIFocSIObsrv[SWDDS.3.2.1.34 RunSIFocSIObsrv()]     RunSIFocSIObsrv --&gt; ConvertSIFocParkTrnsf[SWDDS.3.2.1.35 ConvertSIFocParkTrnsf()]     ConvertSIFocParkTrnsf --&gt; CalculateSIFocCurErrDq[SWDDS.3.2.1.36 CalculateSIFocCurErrDq()]     CalculateSIFocCurErrDq --&gt; RunSIFocCurCtrD[SWDDS.3.2.1.37 g_stSIFocCtrlInpDq.f16Arg1 = RunSIFocCurCtrD()]     RunSIFocCurCtrD --&gt; RunSIFocCurCtrQ[SWDDS.3.2.1.38 g_stSIFocCtrlInpDq.f16Arg2 = RunSIFocCurCtrQ(g_stSIFocCtrlInpDq.f16Arg1)]     RunSIFocCurCtrQ --&gt; ConvertSIFocInvrsPark[SWDDS.3.2.1.39 ConvertSIFocInvrsPark()]     ConvertSIFocInvrsPark --&gt; CompensateSIFocDcVolt[SWDDS.3.2.1.40 CompensateSIFocDcVolt()]     CompensateSIFocDcVolt --&gt; RunSIFocSpcVedPwm[SWDDS.3.2.1.41 RunSIFocSpcVedPwm()]     RunSIFocSpcVedPwm --&gt; CheckSIFocStateTransSIRun[SWDDS.3.2.1.20 CheckSIFocStateTransSIRun()]     CheckSIFocStateTransSIRun --&gt; end([end])   </pre>				
	SWDDS.3.2.1.7 SIFoc_MainFunc				
	SWDDS.3.2.1.28 MeasureSIFocPhsCur				
	SWDDS.3.2.1.30 ConvertSIFocClarkTrnsf				
	SWDDS.3.2.1.34 RunSIFocSIObsrv				
	SWDDS.3.2.1.35 ConvertSIFocParkTrnsf				
	SWDDS.3.2.1.36 CalculateSIFocCurErrDq				
	SWDDS.3.2.1.37 RunSIFocCurCtrD				
	SWDDS.3.2.1.38 RunSIFocCurCtrQ				
Called Function					
Calling Function					

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	59

	SWDDS.3.2.1.39 ConvertSIFocInvsPark
	SWDDS.3.2.1.40 CompensateSIFocDcVolt
	SWDDS.3.2.1.41 RunSIFocSpcVecPwm
	SWDDS.3.2.1.20 CheckSIFocStateTransSIRun
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.17
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: #ccc;">■</span> Mid
Verifiability	Yes

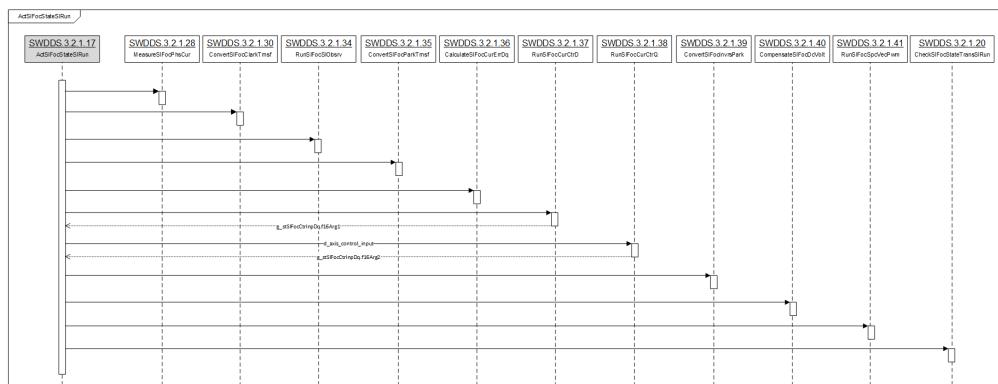
#### 1.1.1.1.17.2 Static View Design



#### 1.1.1.1.17.3 Dynamic View Design

1. **ActSiFocStateSIRun** calls the phase current measurement to get the 3-phase current.
2. **ActSiFocStateSIRun** calls the Clark transformation to calculate the alpha/beta-axis feedback current.
3. **ActSiFocStateSIRun** calls the sensorless observer to estimate the electric angle and speed.
4. **ActSiFocStateSIRun** calls the Park transformation to convert d/q-axis feedback current.
5. **ActSiFocStateSIRun** calls the d/q-axis current control error calculation.
6. **ActSiFocStateSIRun** calls the d/q-axis PI current control to calculate the d/q-axis control input voltage.
7. **ActSiFocStateSIRun** calls the inverse Park transformation to convert the alpha/beta-axis control input voltage.
8. **ActSiFocStateSIRun** calls the DC driving voltage compensation.
9. **ActSiFocStateSIRun** calls the space vector PWM to calculate the PWM duty and to set the PWM duty to the gate driver.
10. **ActSiFocStateSIRun** calls the state transition checking to check the end of the sensorless running state.

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-04-30
									Page	61



#### 1.1.1.17.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_stSIxFocCtrlInpDq.f16Arg1	SWDDS.3.2.1.37	IN	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d-axis calculated control input (PU)
2	g_stSIxFocCtrlInpDq.f16Arg2	SWDDS.3.2.1.38	IN	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	Calculated q-axis or beta-axis control input (PU)
3	d_axis_control_input	SWDDS.3.2.1.38	OUT	tFrac16	-32767	32768	-25.4	25.3992	0.000775146 / Vpk	d-axis or alpha-axis control input (PU)

#### 1.1.1.18 [SWDDS.3.2.1.18] CheckSIxFocStateTransInitAlign

##### 1.1.1.18.1 Detailed Design

#### [SWDDS.3.2.1.18] CheckSIxFocStateTransInitAlign

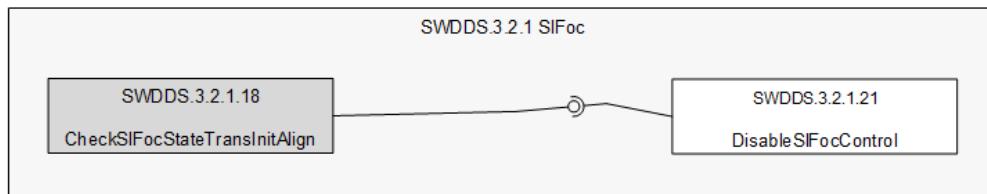
Software Unit Information					
Unit ID	SWDDS.3.2.1.18		Unit Name	CheckSIxFocStateTransInitAlign	
Architecture ID	SWADS.3.2.1.18		ASIL	QM	
Prototype	void CheckSIxFocStateTransInitAlign( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIxFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tU16	g_u16SIxFocFltSta	0 ~ 65535	Read	Fault status flags
	tU16	g_u16SIxFocStateElapCnt	0 ~ 65535	Read/Write	Elapse time count after state entered
			0 ~ 4 CTR_STATE_SWTC_OFF/		

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	62

	tCtrState	g_eSIFocCtrState	CTR_STATE_OFFSET_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16StartAlignCnt	1	Read	Initial starting alignment count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	State transition checking at initial alignment state				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocStateTransInitAlign checks if the control is enabled and fault is not detected.</p> <p>2. CheckSIFocStateTransInitAlign sets the Sensorless FOC control state as the open-loop starting state if the initial alignment time is ended.</p> <p>3. CheckSIFocStateTransInitAlign disables the control if the control is disabled or fault is detected.</p> <pre> graph TD     start((start)) --&gt; cond1{((g_bSIFocCtrEna != FALSE) &amp;&amp; (g_u16SIFocFltSta == 0x0000u))}     cond1 -- no --&gt; disable1["[SWDDS.3.2.1.21]\nDisableSIFocControl();"]     cond1 -- yes --&gt; cond2{g_u16SIFocStateElapCnt &gt;= par_u16StartAlignCnt}     cond2 -- no --&gt; disable2["[SWDDS.3.2.1.21]\nDisableSIFocControl();"]     cond2 -- yes --&gt; set["g_u16SIFocStateElapCnt = 0u;\ng_eSIFocCtrState = CTR_STATE_OPLP_START;"]     set --&gt; end((end))   </pre>				
Called Function	SWDDS.3.2.1.15 ActSIFocStateInitAlign				
Calling Function	SWDDS.3.2.1.21 DisableSIFocControl				
Function Execution Time	N/A				

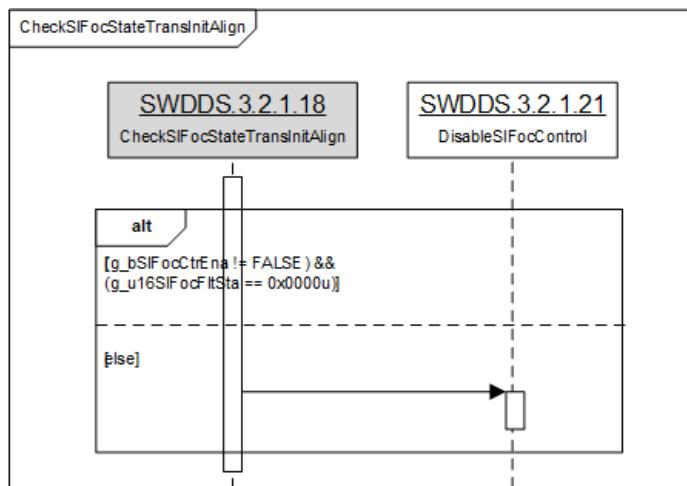
Requirement Id	SWDDS.3.2.1.18
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.1.18.2 Static View Design



#### 1.1.1.18.3 Dynamic View Design

1. CheckSiFocStateTransInitAlign calls the control disable if control disabling setting or fault is detected.



#### 1.1.1.18.4 Interface Design

- N/A

#### 1.1.1.19 [SWDDS.3.2.1.19] CheckSiFocStateTransOplpStart

##### 1.1.1.19.1 Detailed Design

##### [SWDDS.3.2.1.19] CheckSiFocStateTransOplpStart

Software Unit Information					
Unit ID	SWDDS.3.2.1.19		Unit Name	CheckSiFocStateTransOplpStart	
Architecture ID	SWADS.3.2.1.19		ASIL	QM	
Prototype	void CheckSiFocStateTransOplpStart( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	

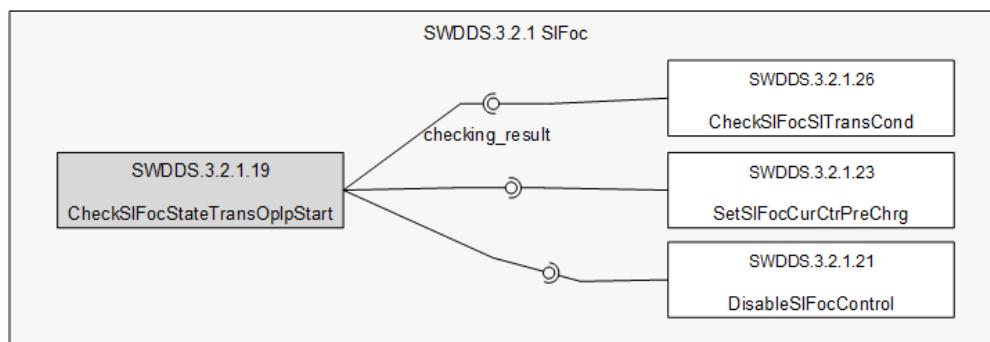
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tU16	g_u16SIFocFltSta	0 ~ 65535	Read/Write	Fault status flags
	tU16	g_u16SIFocStateElapCnt	0 ~ 65535	Read/Write	Elapse time count after state entered
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16StartTimOut	50000	Read	Initial starting time-out count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	State transition checking at open-loop starting state				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocStateTransOplpStart checks if the control is enabled and fault is not detected.</p> <p>2. CheckSIFocStateTransOplpStart checks the starting time-out if the sensorless running state transition is enabled.</p> <p>3. CheckSIFocStateTransOplpStart sets the sensorless FOC control state as the sensorless running state and precharges the current control if the sensorless running transition condition is met.</p> <p>4. CheckSIFocStateTransOplpStart disables the control if the state transition time-out is detected.</p>				
	<pre> graph TD     start([start]) --&gt; cond1{((g_bSIFocCtrEna != FALSE) &amp;&amp; (g_u16SIFocFltSta == 0x0000u))}     cond1 -- no --&gt; disable1["[SWDDS.3.2.1.21]\nDisableSIFocControl();"]     disable1 --&gt; end([end])     cond1 -- yes --&gt; cond2{g_u16SIFocStateElapCnt &lt; par_u16StartTimOut}     cond2 -- no --&gt; disable2["[SWDDS.3.2.1.21]\nDisableSIFocControl();"]     disable2 --&gt; end     cond2 -- yes --&gt; cond3{CheckSIFocSITransCond() != FALSE}     cond3 -- no --&gt; set1["[SWDDS.3.2.1.23]\nSetSIFocCurCtrPreChrg();"]     set1 --&gt; reset1["g_u16SIFocStateElapCnt = 0u;\ng_eSIFocCtrState = CTR_STATE_SL_RUN;"]     reset1 --&gt; end     cond3 -- yes --&gt; disable3["[SWDDS.3.2.1.21]\nDisableSIFocControl();"]     disable3 --&gt; end   </pre>				
Called Function	SWDDS.3.2.1.16 ActSIFocStateOplpStart				
	SWDDS.3.2.1.26 CheckSIFocSITransCond				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	65

Calling Function	SWDDS.3.2.1.23 SetSIFocCurCtrPreChrg SWDDS.3.2.1.21 DisableSIFocControl
Function Execution Time	N/A

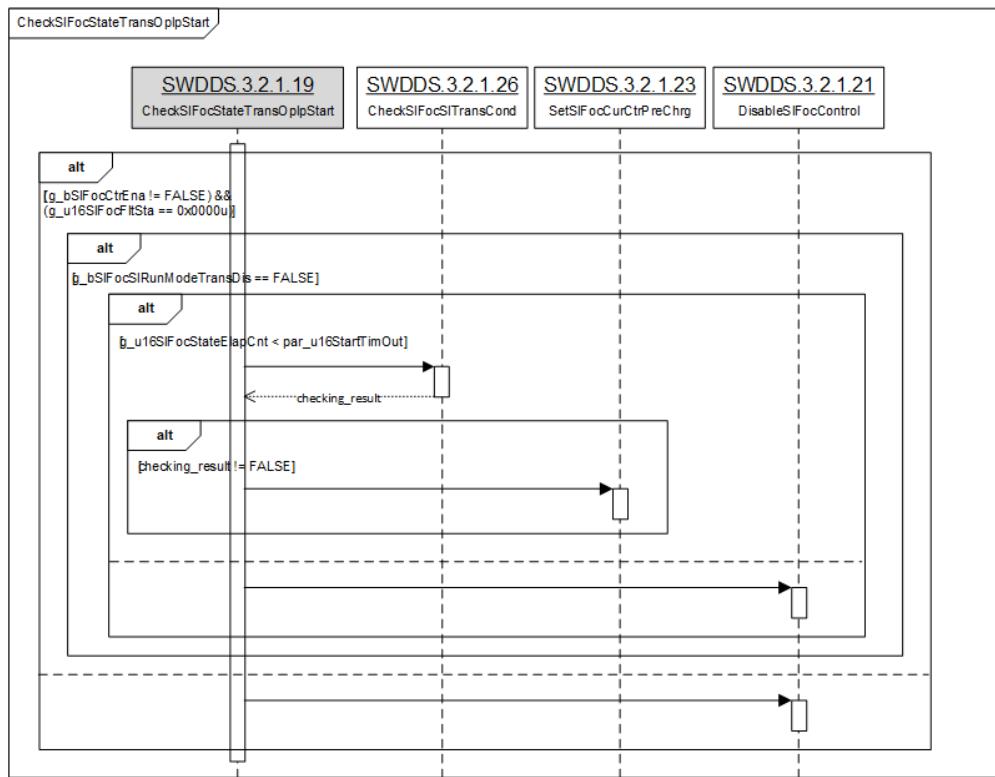
Requirement Id	SWDDS.3.2.1.19
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	● High
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.1.19.2 Static View Design



#### 1.1.1.19.3 Dynamic View Design

1. CheckSIFocStateTransOplpStart calls the sensorless running state transition condition checking.
2. CheckSIFocStateTransOplpStart calls the current control precharging at the sensorless FOC control state transition to the sensorless running state.
3. CheckSIFocStateTransOplpStart calls the control disabling if the state transition time-out is occurred.



#### 1.1.1.19.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	checking_result	SWDDS.3.2.1.26	IN	tBool	0	1	Condition does not meet	Condition meet	N/A	Sensorless control transition checking result

#### 1.1.1.20 [SWDDS.3.2.1.20] CheckSIFocStateTransSIRun

##### 1.1.1.20.1 Detailed Design

#### [SWDDS.3.2.1.20] CheckSIFocStateTransSIRun

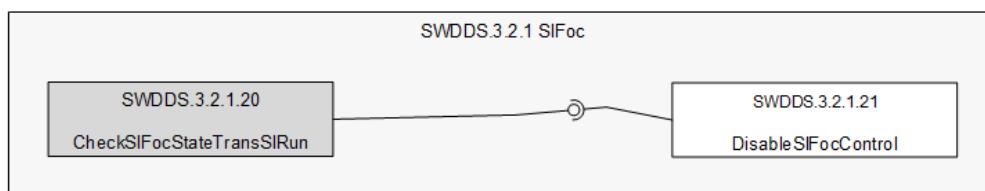
Software Unit Information					
Unit ID	SWDDS.3.2.1.20		Unit Name	CheckSIFocStateTransSIRun	
Architecture ID	SWADS.3.2.1.20		ASIL	QM	
Prototype	void CheckSIFocStateTransSIRun( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value			Description
Return Value	void	N/A			N/A
	Data Type	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	67

Global Variables	tBool	g_bSIFocCtrEna	0 ~ 1 Disable / Enable	Read	Control enable
	tU16	g_u16SIFocFltSta	0 ~ 65535	Read/Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	State transition checking at sensorless running state				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocStateTransSIRun disables the sensorless FOC control if control disabling is set or fault is detected.</p> <pre> graph TD     start((start)) --&gt; decision{if (g_bSIFocCtrEna == FALSE)    (g_u16SIFocFltSta != 0x0000u)}     decision -- no --&gt; end((end))     decision -- yes --&gt; callout[SWDDS.3.2.1.21&lt;br&gt;DisableSIFocControl();]     </pre>				
Called Function	SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.2.1.21 DisableSIFocControl				
Function Execution Time	N/A				

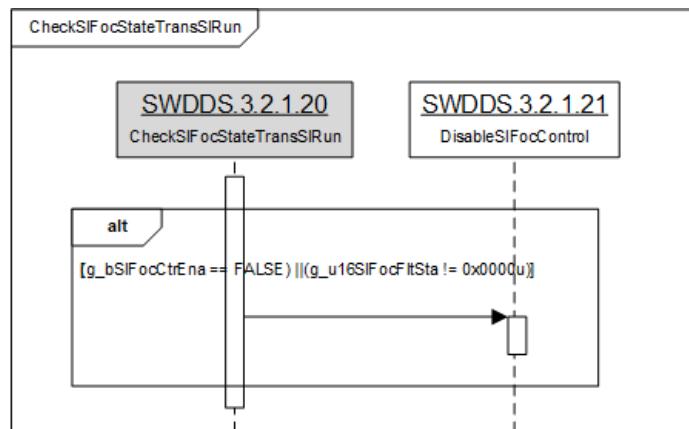
Requirement Id	SWDDS.3.2.1.20
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	★ High
Technical complexity	● Low
Verifiability	Yes

#### 1.1.1.1.20.2 Static View Design



#### 1.1.1.20.3 Dynamic View Design

- CheckSIFocStateTransSIRun calls the sensorless FOC control disabling under control disabled.



#### 1.1.1.20.4 Interface Design

- N/A

#### 1.1.1.21 [SWDDS.3.2.1.21] DisableSIFocControl

##### 1.1.1.21.1 Detailed Design

##### [SWDDS.3.2.1.21] DisableSIFocControl

Software Unit Information					
Unit ID	SWDDS.3.2.1.21	Unit Name	DisableSIFocControl		
Architecture ID	SWADS.3.2.1.21	ASIL	QM		
Prototype	void DisableSIFocControl( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	N/A	N/A	N/A	N/A	
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	
	tFrac16	g_stSIFocPwmDuty.f16Arg1	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : phase U (PU)
	tFrac16	g_stSIFocPwmDuty.f16Arg2	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : phase V (PU)
	tFrac16	g_stSIFocPwmDuty.f16Arg3	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : phase W (PU)
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Write	Estimated electric speed (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	d/q-axis current output : d-axis
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	d/q-axis current output : q-axis (PU)
	tFrac16	g_stSIFocCurOutPhs3.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	3-phase current output : phase U (PU)
	tFrac16	g_stSIFocCurOutPhs3.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	3-phase current output : phase V (PU)
			-32768 ~ 32767		3-phase current output : phase

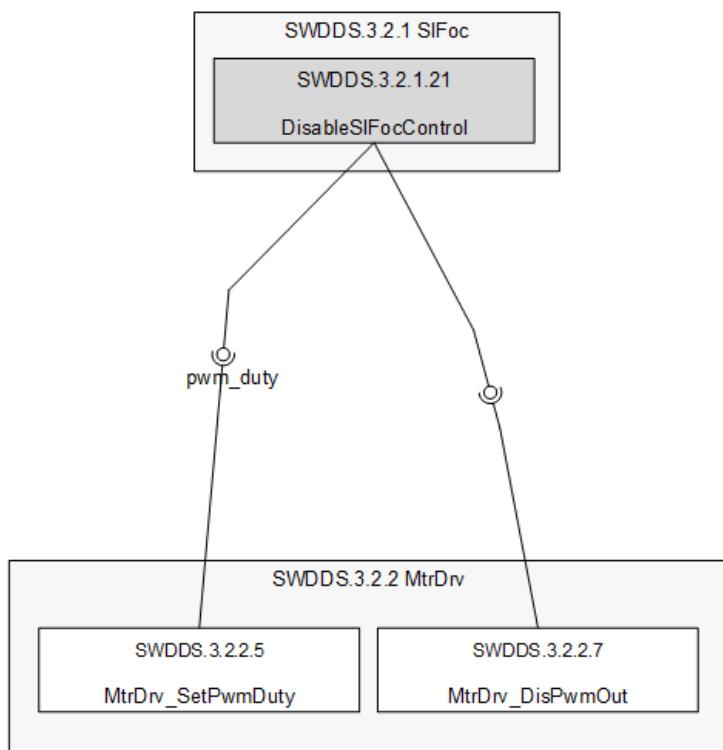
	tFrac16	g_stSIFocCurOutPhs3.f16Arg3	-64.5 ~ 64.498Apk	Write	W (PU)
	tFrac16	g_stSIFocCtrlInpDq.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	d/q-axis control input : d-axis (PU)
	tFrac16	g_stSIFocCtrlInpDq.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	d/q-axis control input : q-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	alpha/beta-axis control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	alpha/beta-axis control input : beta-axis (PU)
	tU16	g_u16SIFocStateElapCnt	0 ~ 65535	Write	Elapse time count after state entered
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control disabling - Motor driver output turning off - Variable initialization - State transition to switching output off state				
Control Flow Diagram (or Pseudo Code)	<p>1. DisableSIFocControl sets PWM duty as half value(0.5) and sets the PWM duty to output to the gate driver.</p> <p>2. DisableSIFocControl sets the estimated electric speed, d/q-axis current output, 3-phase current output, d/q-axis control input voltage and alpha/beta-axis control input voltage as 0.</p> <p>3. DisableSIFocControl sets the elapse time count as 0 and sets the sensorless FOC control state as the switching off state.</p> <pre>     start     ↓     [g_stSIFocPwmDuty.f16Arg1 = FRAC16(0.5f);      g_stSIFocPwmDuty.f16Arg2 = FRAC16(0.5f);      g_stSIFocPwmDuty.f16Arg3 = FRAC16(0.5f);]     ↓     [SWDDS.3.2.2.5]     MtrDrv_SetPwmDuty(g_stSIFocPwmDuty)     ↓     [SWDDS.3.2.2.7]     MtrDrv_DisPwmOut();     ↓     [g_f16SIFocElecSpd = FRAC16(0.0f);      g_stSIFocCurOutDq.f16Arg1 = FRAC16(0.0f);      g_stSIFocCurOutDq.f16Arg2 = FRAC16(0.0f);      g_stSIFocCurOutPhs3.f16Arg1 = FRAC16(0.0f);      g_stSIFocCurOutPhs3.f16Arg2 = FRAC16(0.0f);      g_stSIFocCurOutPhs3.f16Arg3 = FRAC16(0.0f);      g_stSIFocCtrlInpDq.f16Arg1 = FRAC16(0.0f);      g_stSIFocCtrlInpDq.f16Arg2 = FRAC16(0.0f);      g_stSIFocCtrlInpAlbe.f16Arg1 = FRAC16(0.0f);      g_stSIFocCtrlInpAlbe.f16Arg2 = FRAC16(0.0f);      g_u16SIFocStateElapCnt = 0u;      g_eSIFocCtrState = CTR_STATE_SWTC_OFF;]     ↓     end   </pre>				
Called Function	SWDDS.3.2.1.12 ActSIFocStateSwtcOff SWDDS.3.2.1.13 ActSIFocStateOffsCalib SWDDS.3.2.1.18 CheckSIFocStateTransInitAlign SWDDS.3.2.1.19 CheckSIFocStateTransOplpStart SWDDS.3.2.1.20 CheckSIFocStateTransSlRun				
Calling Function	SWDDS.3.2.2.5 MtrDrv_SetPwmDuty SWDDS.3.2.2.7 MtrDrv_DisPwmOut				
Function	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	70

#### Execution Time

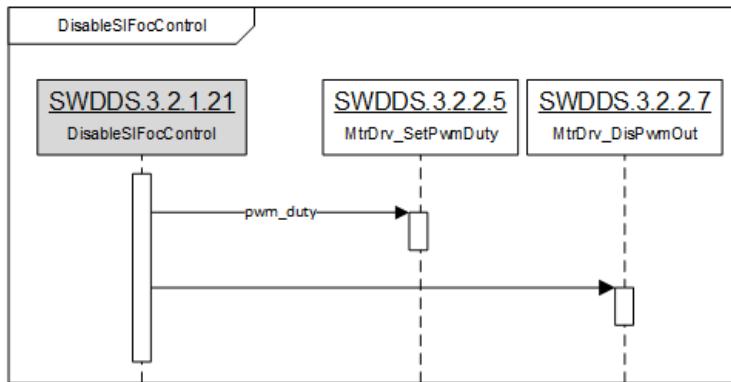
Requirement Id	SWDDS.3.2.1.21
Target Milestone	EBS2
Element	MTR
Risk	<span style="border: 1px solid black; padding: 2px;">Mid</span>
Interoperability	No
Criticality	<span style="border: 1px solid black; padding: 2px;">High</span>
Technical complexity	<span style="border: 1px solid black; padding: 2px;">Low</span>
Verifiability	Yes

#### 1.1.1.21.2 Static View Design



#### 1.1.1.21.3 Dynamic View Design

1. DisableSIFocControl calls the PWM duty setting to set the PWM duty as half value.
2. DisableSIFocControl calls the PWM output disabling.



#### 1.1.1.21.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pwm_duty	SWDDS.3.2.2.5	OUT	SWLIBS_3Syst_F16	16384	16384	0.5	0.5	0.0000305176 / N/A	PWM duty setting

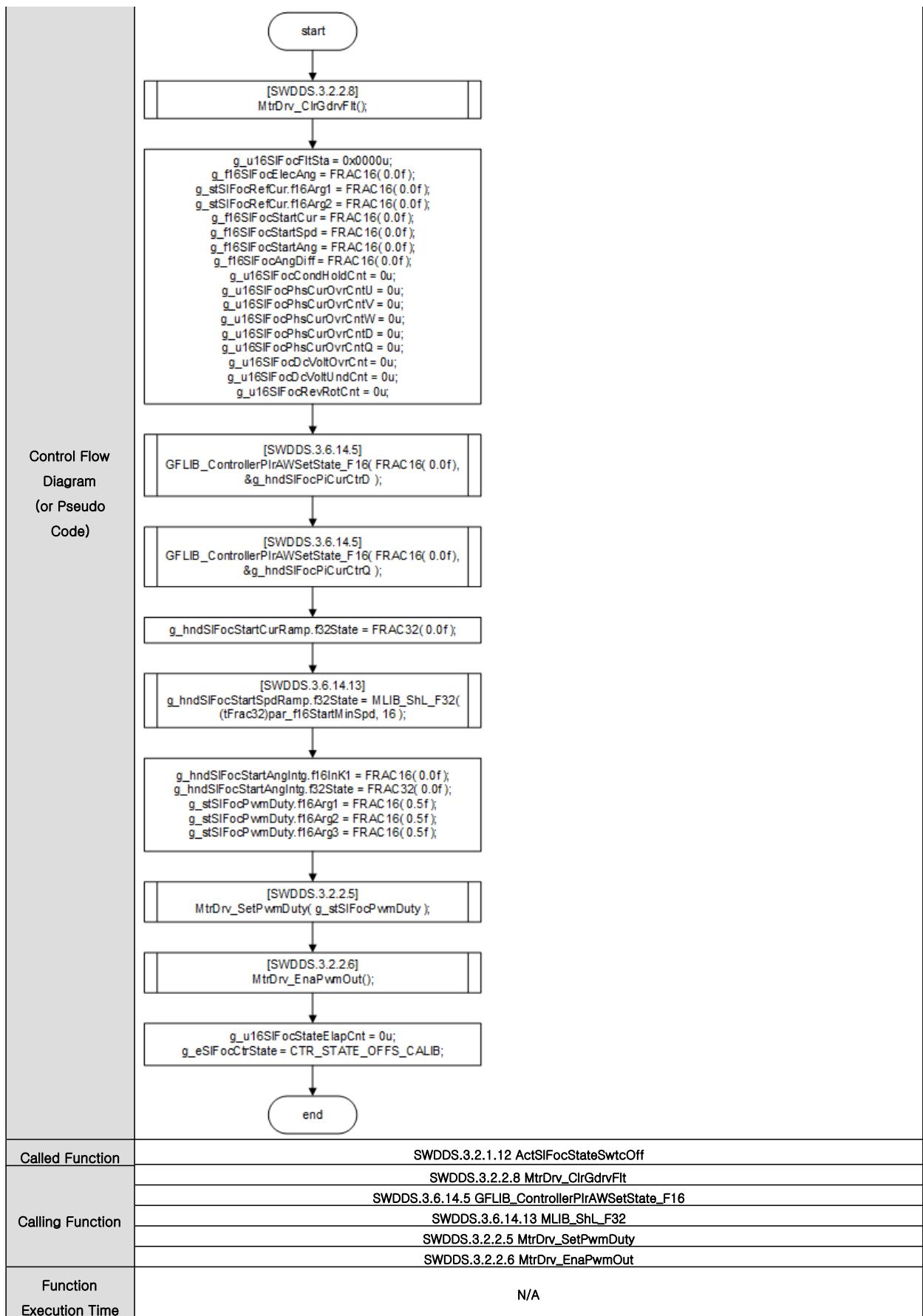
#### 1.1.1.22 [SWDDS.3.2.1.22] EnableSI\_FocControl

##### 1.1.1.22.1 Detailed Design

##### [SWDDS.3.2.1.22] EnableSI\_FocControl

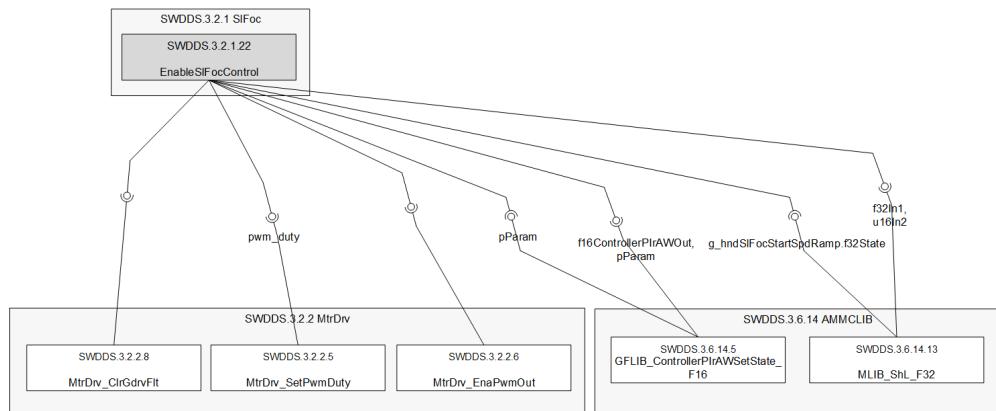
Software Unit Information					
Unit ID	SWDDS.3.2.1.22		Unit Name	EnableSI_FocControl	
Architecture ID	SWADS.3.2.1.22		ASIL	QM	
Prototype	void EnableSI_FocControl( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16SI_FocFltSta	0 ~ 65535	Write	Fault status flags
	tFrac16	g_f16SI_FocElecAng	-32768 ~ 32767 -180 ~ 179.995deg	Write	Estimated electric angle (PU)
	tFrac16	g_stSI_FocRefCur.f16Arg1	0 0Apk	Write	Reference current : d-axis (PU)
	tFrac16	g_stSI_FocRefCur.f16Arg2	-11430 ~ 11430 -22.5 ~ 22.5Apk	Write	Reference current : q-axis (PU)
	tFrac16	g_f16SI_FocStartCur	0 ~ 10160 0 ~ 20.0Apk	Write	Open-loop starting current magnitude (PU)
	tFrac16	g_f16SI_FocStartSpd	0 ~ 3276 0 ~ 600rpm	Write	Open-loop starting electric speed (PU)
	tFrac16	g_f16SI_FocStartAng	-32768 ~ 32767 -180 ~ 179.995deg	Write	Open-loop starting electric angle (PU)
	tFrac16	g_f16SI_FocAngDiff	-32768 ~ 32767	Write	Starting and estimated angle

Global Variables	tU16	g_u16SIFocCondHoldCnt	-180 ~ 179.995deg	Write	difference (PU)
	tU16	g_u16SIFocPhsCurOvrCntU	0 ~ 65535	Write	Condition hold time count
	tU16	g_u16SIFocPhsCurOvrCntV	0 ~ 65535	Write	U-phase current over count
	tU16	g_u16SIFocPhsCurOvrCntW	0 ~ 65535	Write	V-phase current over count
	tU16	g_u16SIFocPhsCurOvrCntD	0 ~ 65535	Write	W-phase current over count
	tU16	g_u16SIFocPhsCurOvrCntQ	0 ~ 65535	Write	d-axis current over count
	tU16	g_u16SIFocDcVoltOvrCnt	0 ~ 65535	Write	q-axis current over count
	tU16	g_u16SIFocDcVoltUndCnt	0 ~ 65535	Write	DC driving voltage over count
	tU16	g_u16SIFocRevRotCnt	0 ~ 65535	Write	DC driving voltage under count
	tFrac32	g_hndSIFocPiCurCtrD.f32Acc	-2147483648 ~ 2147483647	Read/Write	d-axis PI current control handler : internal controller accumulator
Registers	tFrac32	g_hndSIFocPiCurCtrQ.f32Acc	-2147483648 ~ 2147483647	Read/Write	q-axis PI current control handler : internal controller accumulator
	tFrac32	g_hndSIFocStartCurRamp.f32State	-2147483648 ~ 2147483647	Write	Open-loop starting current ramp state value
	tFrac32	g_hndSIFocStartSpdRamp.f32State	-2147483648 ~ 2147483647	Write	Open-loop starting speed ramp state value
	tFrac16	g_hndSIFocStartAngIntg.f16InK1	-32768 ~ 32767	Write	Open-loop starting angle integrator : input value in step k-1
	tFrac32	g_hndSIFocStartAngIntg.f32State	-2147483648 ~ 2147483647	Write	Open-loop starting angle integrator : state value
	tFrac16	g_stSIFocPwmDuty.f16Arg1	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : argument1
	tFrac16	g_stSIFocPwmDuty.f16Arg2	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : argument2
	tFrac16	g_stSIFocPwmDuty.f16Arg3	0 ~ 32767 0 ~ 0.999969	Write	PWM duty setting : argument3
	tU16	g_u16SIFocStateElapCnt	0 ~ 65535	Write	Elapse time count after state entered
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFS_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Write	Sensorless FOC state
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartMinSpd	546 100rpm	Read	Initial starting minimum speed
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control enabling - Fault clearing - Variable initialization - Open-loop starting ramp-up initialization - Motor driver output turning on - State transition to current sensor offset calibration state				
	1. EnableSIFocControl clears the gate driver fault. 2. EnableSIFocControl sets the estimated electric angle, reference current, open-loop starting related variables and fault checking count as 0. 3. EnableSIFocControl sets the d/q-axis PI current control integrator as 0. 4. EnableSIFocControl sets the starting current ramping, the starting speed ramping and angle integrator as 0. 5. EnableSIFocControl sets the PWM duty as half value, sets the PWM duty to the gate driver and enables the PWM output. 6. EnableSIFocControl sets the elapse time as 0 and set the sensorless FOC control state as phase current offset calibration state.				



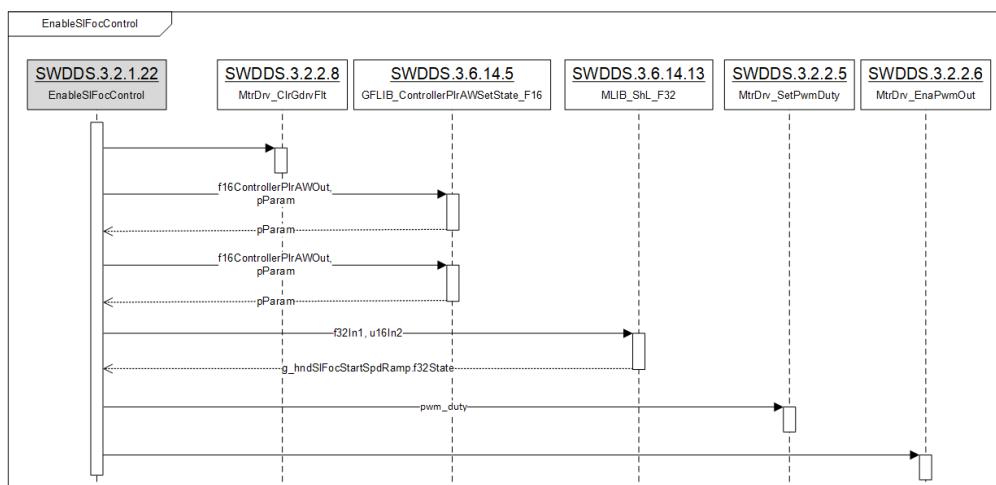
Requirement Id	SWDDS.3.2.1.22
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.1.1.22.2 Static View Design



#### 1.1.1.1.22.3 Dynamic View Design

1. EnableSIFocControl calls the gate driver fault clearing.
2. EnableSIFocControl calls PI control integrator setting to clear d/q-axis PI current control integrator.
3. EnableSIFocControl calls the PWM duty setting.
4. EnableSIFocControl calls the PWM output enabling.



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
			Page		75	

#### 1.1.1.22.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16ControllerPlrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	0	0	0.0	0.0	0.000775146 / Vpk	Required output of the GFLIB_ControllerPlrAW.
2	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	d-axis PI current control handler
3	f16ControllerPlrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	0	0	0.0	0.0	0.000775146 / Vpk	Required output of the GFLIB_ControllerPlrAW.
4	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER_PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	q-axis PI current control handler
5	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	546	546	100	100	0.183105 / rpm	Initial starting minimum speed
6	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	The shift amount value.
7	g_hndSIFocStartSpdRamp.f32State	SWDDS.3.6.14.13	IN	tFrac32	35782656	35782656	100	100	0.183105 / rpm	Open-loop starting speed ramp state value
8	pwm_duty	SWDDS.3.2.2.5	OUT	SWLIBS_3Syst_F16	0	32767	0	0.999969	0.0000305176 / N/A	PWM duty setting

#### 1.1.1.23 [SWDDS.3.2.1.23] SetSIFocCurCtrPreChrg

##### 1.1.1.23.1 Detailed Design

##### [SWDDS.3.2.1.23] SetSIFocCurCtrPreChrg

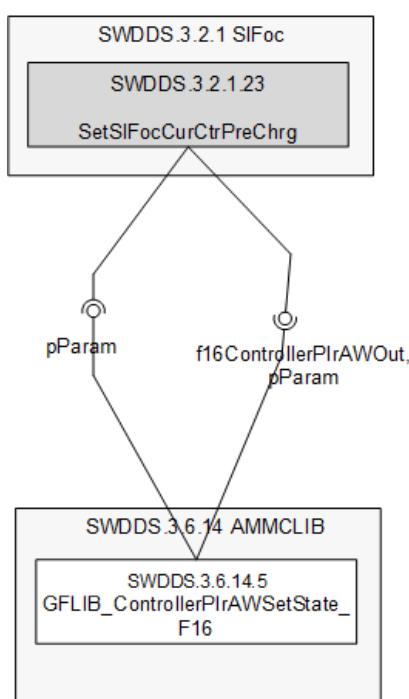
Software Unit Information					
Unit ID	SWDDS.3.2.1.23		Unit Name	SetSIFocCurCtrPreChrg	
Architecture ID	SWADS.3.2.1.23		ASIL	QM	
Prototype	void SetSIFocCurCtrPreChrg( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac32	g_hndSIFocPiCurCtrD.f32Acc	-2147483648 ~ 2147483647	Read/Write	d-axis PI current control handler : internal controller accumulator
	tFrac32	g_hndSIFocPiCurCtrQ.f32Acc	-2147483648 ~ 2147483647	Read/Write	q-axis PI current control handler : internal controller accumulator
	Data Type	Name	Range	Read/Write	Description
	tBool	par_bStartCurPreChrgEna	1	Read	Current control integrator pre-charge

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	76

Parameters			Enable		enable
	tFrac16	par_f16StartCurPreChrgD	-19 -0.0006	Read	d-axis current control integrator pre-charge
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current control integrator pre-charging at sensorless control transition				
Control Flow Diagram (or Pseudo Code)	<p>1. SetSIFocCurCtrPreChrg sets the d/q-axis PI current control integrator as precharging values if the current control precharging is enabled.</p> <pre> graph TD     start([start]) --&gt; decision{par_bStartCurPreChrgEna != FALSE}     decision -- no --&gt; end([end])     decision -- yes --&gt; call1[SWDDS.3.6.14.5 GFLIB_ControllerPlrAWSetState_F16(par_f16StartCurPreChrgD, &amp;g_hndSIFocPICurCtrD)]     call1 --&gt; call2[SWDDS.3.6.14.5 GFLIB_ControllerPlrAWSetState_F16(par_f16StartCurPreChrgQ, &amp;g_hndSIFocPICurCtrQ)]     call2 --&gt; end </pre>				
Called Function	SWDDS.3.2.1.19 CheckSIFocStateTransOplpStart				
Calling Function	SWDDS.3.6.14.5 GFLIB_ControllerPlrAWSetState_F16				
Function Execution Time	N/A				

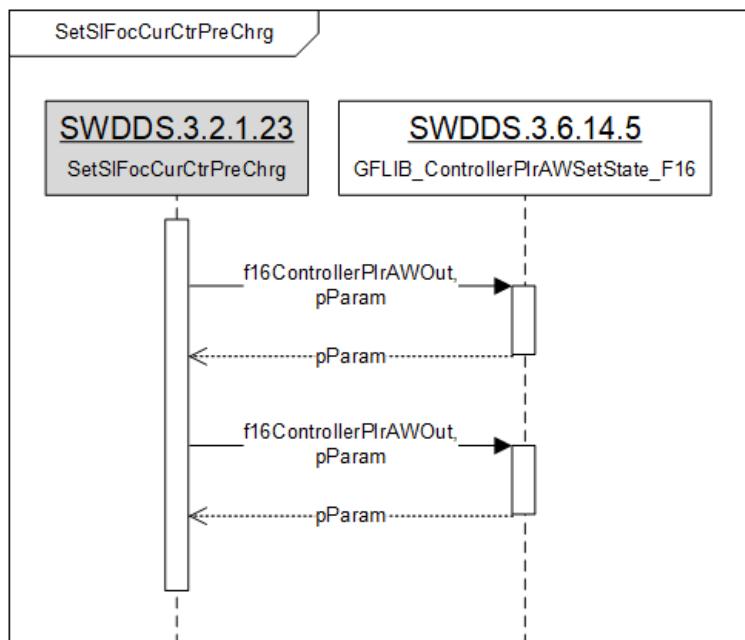
Requirement Id	SWDDS.3.2.1.23
Target Milestone	EBS2
Element	MTR
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.1.1.23.2 Static View Design



#### 1.1.1.1.23.3 Dynamic View Design

1. SetSIFocCurCtrPreChrg calls the PI control integrator setting to precharge the integrator as setting values.



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
			Page		78	

#### 1.1.1.23.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16ControllerPIrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	-19	-19	-19	-19	N/A	d-axis current control integrator pre-charge
2	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER _PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	d-axis PI current control handler
3	f16ControllerPIrAWOut	SWDDS.3.6.14.5	OUT	tFrac16	1212	1212	1212	1212	N/A	q-axis current control integrator pre-charge
4	pParam	SWDDS.3.6.14.5	IN/OUT	GFLIB_CONTROLLER _PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	q-axis PI current control handler

#### 1.1.1.24 [SWDDS.3.2.1.24] SetSIFocAngTrackObsrvPreChrg

##### 1.1.1.24.1 Detailed Design

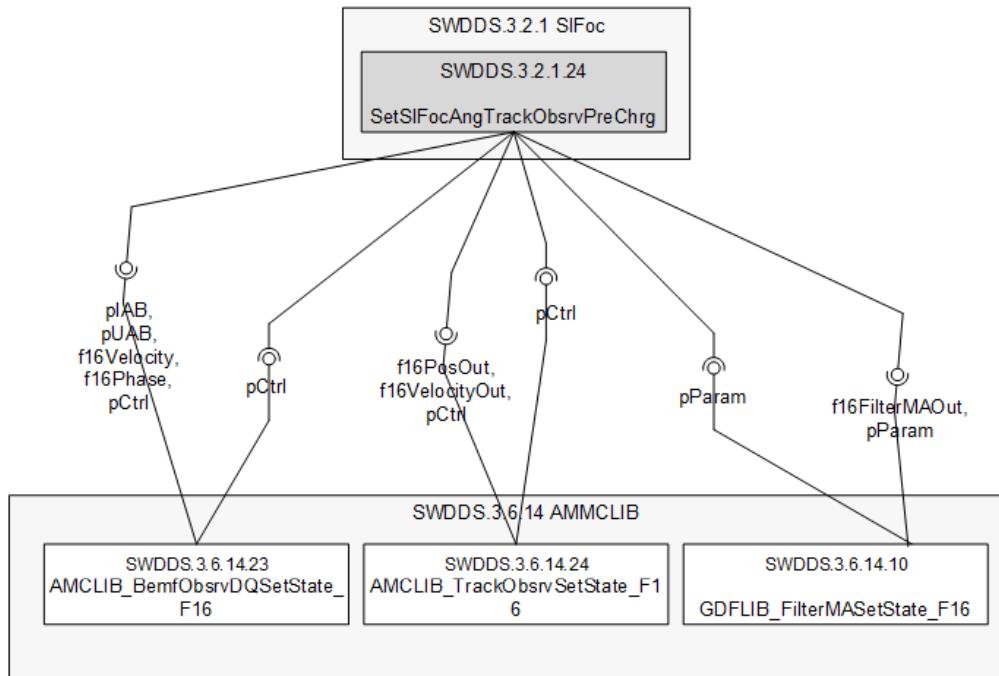
##### [SWDDS.3.2.1.24] SetSIFocAngTrackObsrvPreChrg

Software Unit Information					
Unit ID	SWDDS.3.2.1.24		Unit Name	SetSIFocAngTrackObsrvPreChrg	
Architecture ID	SWADS.3.2.1.24		ASIL	QM	
Prototype	void SetSIFocAngTrackObsrvPreChrg( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocStartSpd	0 ~ 3276 0 ~ 600rpm	Read/Write	Open-loop starting electric speed (PU)
	tFrac16	g_f16SIFocStartAng	-32768 ~ 32767 -180 ~ 179.995deg	Read/Write	Open-loop starting electric angle (PU)
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Read/Write	Estimated electric speed (PU)
	tFrac16	g_f16SIFocElecAng	-32768 ~ 32767 -180 ~ 179.995deg	Read/Write	Estimated electric angle (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	alpha/beta-axis current output : alpha-axis (PU)
			-32768 ~ 32767		alpha/beta-axis current output :

Global Variables	tFrac16	g_stSIFocCurOutAlbe.f16Arg2	-64.5 ~ 64.498Apk	Read/Write	beta axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read/Write	alpha/beta-axis control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read/Write	alpha/beta-axis control input : beta-axis (PU)
	tFrac32	g_hndSIFocBackEmfObsrv.pParamD.f32Acc	-2147483648 ~ 2147483647	Read/Write	Back-EMF observer handler : d-axis controller accumulator
	tFrac32	g_hndSIFocBackEmfObsrv.pParamQ.32Acc	-2147483648 ~ 2147483647	Read/Write	Back-EMF observer handler : q-axis integrator accumulator
	tFrac32	g_hndSIFocAngTrackObsrv.pParamPl.f32Acc	-2147483648 ~ 2147483647	Read/Write	Angle tracking observer handler : controller accumulator
	tFrac32	g_hndSIFocAngTrackObsrv.pParamInteg.32Acc	-2147483648 ~ 2147483647	Read/Write	Angle tracking observer handler : integrator accumulator
	tFrac32	g_hndSIFocElecSpdFlt.f32Acc	-2147483648 ~ 2147483647	Read/Write	Electric speed filtering handler : filter accumulator
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	<p>Estimated electric angle and speed pre-charging at open-loop starting</p> <ul style="list-style-type: none"> <li>- Estimated electric angle and speed setting with starting values</li> <li>- Back-EMF observer pre-charging</li> <li>- Angle tracking observer pre-charging</li> <li>- Electric speed filtering pre-charging</li> </ul>				
Control Flow Diagram (or Pseudo Code)	<ol style="list-style-type: none"> <li>1. SetSIFocAngTrackObsrvPreChrg sets the estimated electric angle as the starting electric angle.</li> <li>2. SetSIFocAngTrackObsrvPreChrg sets the estimated electric speed as the starting electric speed.</li> <li>3. SetSIFocAngTrackObsrvPreChrg sets the back EMF observer as the starting electric angle and speed.</li> <li>4. SetSIFocAngTrackObsrvPreChrg sets the angle tracking observer as the starting electric angle and speed.</li> <li>5. SetSIFocAngTrackObsrvPreChrg sets the speed filtering as the starting electric speed.</li> </ol> <pre>     start     ↓     [g_f16SIFocElecSpd = g_f16SIFocStartSpd;      g_f16SIFocElecAng = g_f16SIFocStartAng;]     ↓     [SWDDS.3.6.14.23]     AMCLIB_BemfObsrvDQSetState_F16(&amp;g_stSIFocCurOutAlbe,  &amp;g_stSIFocCtrlInpAlbe, g_f16SIFocStartSpd,  g_f16SIFocStartAng, &amp;g_hndSIFocBackEmfObsrv);     ↓     [SWDDS.3.6.14.24]     AMCLIB_TrackObsrvSetState_F16(g_f16SIFocElecAng,                                     g_f16SIFocElecSpd, &amp;g_hndSIFocAngTrackObsrv);     ↓     [SWDDS.3.6.14.10]     GDFLIB_FilterMASetState_F16(g_f16SIFocStartSpd,                                  &amp;g_hndSIFocElecSpdFlt);     ↓     end   </pre>				
Called Function	SWDDS.3.2.1.16 ActSIFocStateOpIpStart				
Calling Function	SWDDS.3.6.14.23 AMCLIB_BemfObsrvDQSetState_F16				
	SWDDS.3.6.14.24 AMCLIB_TrackObsrvSetState_F16				
Function Execution Time	N/A				

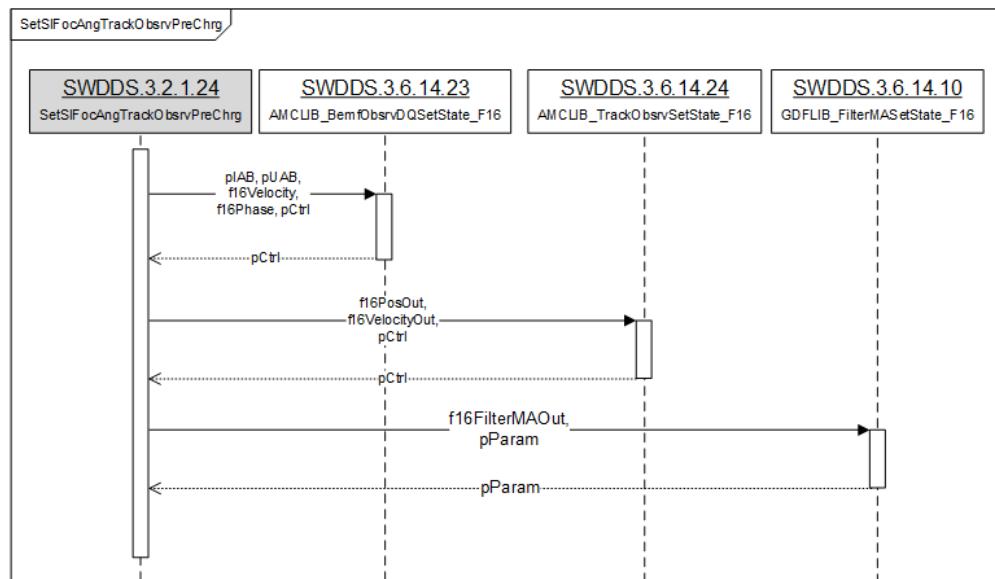
Requirement Id	SWDDS.3.2.1.24
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	■ High
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.1.1.24.2 Static View Design



#### 1.1.1.1.24.3 Dynamic View Design

1. SetSIFocAngTrackObsrvPreChrg calls the back EMF observer state setting to precharge the starting electric angle and speed.
2. SetSIFocAngTrackObsrvPreChrg calls the angle tracking observer state setting to precharge the starting electric angle and speed.
3. SetSIFocAngTrackObsrvPreChrg calls the filter state setting to precharge the starting electric speed.



#### 1.1.1.24.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pIAB	SWDDS.3.6.14.23	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis current output
2	pUAB	SWDDS.3.6.14.23	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-25.4	25.4	0.000775146 / Vpk	alpha/beta-axis control input
3	f16Velocity	SWDDS.3.6.14.23	OUT	tFrac16	0	32768	0.0	5999.82	0.183105 / rpm	Open-loop starting electric speed
4	f16Phase	SWDDS.3.6.14.23	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Open-loop starting electric angle
5	pCtrl	SWDDS.3.6.14.23	IN/OUT	AMCLIB_BEMF_OBSRV_DQ_T_F16 *	N/A	N/A	N/A	N/A	N/A	Back-EMF observer handler
6	f16PosOut	SWDDS.3.6.14.24	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle
7	f16VelocityOut	SWDDS.3.6.14.24	OUT	tFrac16	0	32768	0.0	5999.82	0.183105 / rpm	Estimated electric speed
8	pCtrl	SWDDS.3.6.14.24	IN/OUT	AMCLIB_TRACK_OBSRV_T_F16 *	N/A	N/A	N/A	N/A	N/A	Angle tracking observer handler
9	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	0	32768	0.0	5999.82	0.183105 / rpm	Open-loop starting electric speed
10	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Electric speed filtering handler

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	82

#### 1.1.1.1.25 [SWDDS.3.2.1.25] CheckSIFocOffsRngErr

##### 1.1.1.1.25.1 Detailed Design

#### [SWDDS.3.2.1.25] CheckSIFocOffsRngErr

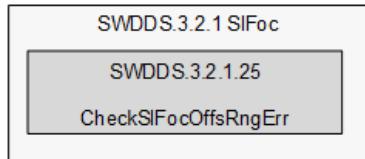
Software Unit Information					
Unit ID	SWDDS.3.2.1.25		Unit Name	CheckSIFocOffsRngErr	
Architecture ID	SWADS.3.2.1.25		ASIL	QM	
Prototype	tBool CheckSIFocOffsRngErr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	tBool	0 ~ 1 No error / Error		FALSE – no error, TRUE – error (range over)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurOffs.f16Arg1	-32767 ~ 32768 -5.0 ~ 4.99985Vpk	Read	Current sensor offset : sensor 0 (PU)
	tFrac16	g_stSIFocCurOffs.f16Arg2	-32767 ~ 32768 -5.0 ~ 4.99985Vpk	Read	Current sensor offset : sensor 1 (PU)
	tU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16CurSigOffsOvrThrs	5734 0.875Vpk	Read	Current sensor offset range over threshold (PU)
	tFrac16	par_f16CurSigOffsUndThrs	-5734 -0.875Vpk	Read	Current sensor offset range under threshold (PU)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current sensor offset range error checking				
	1. CheckSIFocOffsRngErr checks if the first phase current offset is over or under the specific range. 2. CheckSIFocOffsRngErr checks if the second phase current offset is over or under the specific range.				

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     tBool checking_result = FALSE;      if (g_stSIFocCurOffs.f16Arg1 &gt; par_f16CurSigOffsOvrThrs) {         g_u16SIFocFltSta  = CTR_FLT_CUR_OFFS_OVR_0;         checking_result = TRUE;     }      if (g_stSIFocCurOffs.f16Arg1 &lt; par_f16CurSigOffsUndThrs) {         g_u16SIFocFltSta  = CTR_FLT_CUR_OFFS_OVR_0;         checking_result = TRUE;     }      if (g_stSIFocCurOffs.f16Arg2 &gt; par_f16CurSigOffsOvrThrs) {         g_u16SIFocFltSta  = CTR_FLT_CUR_OFFS_OVR_1;         checking_result = TRUE;     }      if (g_stSIFocCurOffs.f16Arg2 &lt; par_f16CurSigOffsUndThrs) {         g_u16SIFocFltSta  = CTR_FLT_CUR_OFFS_OVR_1;         checking_result = TRUE;     }      return checking_result; </pre>
<b>Called Function</b>	SWDDS.3.2.1.13 ActSIFocStateOffsCalib
<b>Calling Function</b>	N/A
<b>Function Execution Time</b>	N/A

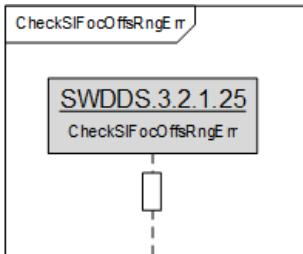
Requirement Id	SWDDS.3.2.1.25
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: #ccc;">■</span> Mid
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	84

#### 1.1.1.1.25.2 Static View Design



#### 1.1.1.1.25.3 Dynamic View Design



#### 1.1.1.1.25.4 Interface Design

- N/A

#### 1.1.1.1.26 [SWDDS.3.2.1.26] CheckSIFocSITransCond

##### 1.1.1.1.26.1 Detailed Design

##### [SWDDS.3.2.1.26] CheckSIFocSITransCond

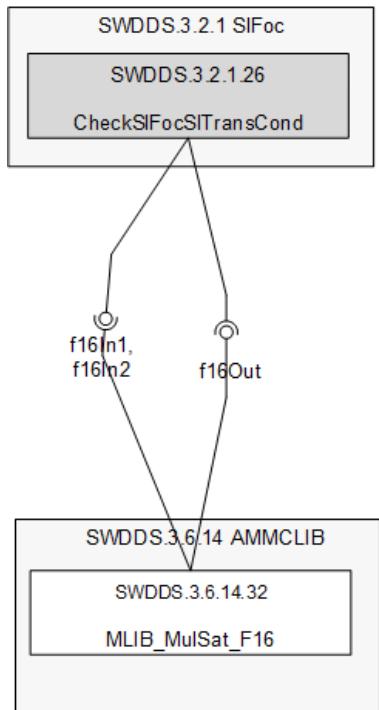
Software Unit Information					
Unit ID	SWDDS.3.2.1.26		Unit Name	CheckSIFocSITransCond	
Architecture ID	SWADS.3.2.1.26		ASIL	QM	
Prototype	tBool CheckSIFocSITransCond( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1 Condition not meet / Condition meet		FALSE – condition does not meet, TRUE – condition meet	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocStartSpd	0 ~ 3276 0 ~ 600rpm	Read	Open-loop starting electric speed (PU)
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Read	Estimated electric speed (PU)
	tU16	g_u16SIFocCondHoldCnt	0 ~ 65535	Read/Write	Condition hold time count
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartMaxSpd	3276 600rpm	Read	Initial starting maximum speed (PU)
	tFrac16	par_f16StartSICtrSpdThrs	1911 350rpm	Read	Sensorless control transition speed (PU)
	tU16	par_u16StartHoldCnt	25	Read	Condition hold time count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless control transition condition checking				

Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocSITransCond checks if the starting speed is reached to specific speed.      2. CheckSIFocSITransCond checks the estimated electric speed is continuously greater than or equal to specified threshold for given hold count.</p> <pre> graph TD     start([start]) --&gt; tBool["tBool checking_result = FALSE;"]     tBool --&gt; cond1{g_f16SIFocStartSpd &gt;= MLIB_MulSat_F16(SLFOC_MAX_SPD_REACH_RATIO, par_f16StartMaxSpd)}     cond1 -- yes --&gt; cond2{g_f16SIFocElecSpd &gt;= par_f16StartSICtrSpdThrs}     cond2 -- yes --&gt; cond3{g_u16SIFocCondHoldCnt &lt; 0xffff}     cond3 -- yes --&gt; increment[g_u16SIFocCondHoldCnt++]     increment --&gt; cond4{g_u16SIFocCondHoldCnt &gt;= par_u16StartHoldCnt}     cond4 -- yes --&gt; checkingResult["checking_result = TRUE;"]     checkingResult --&gt; return["return checking_result;"]     cond3 -- no --&gt; init["g_u16SIFocCondHoldCnt = 0u;"]     cond2 -- no --&gt; init     init --&gt; cond1     </pre>
Called Function	SWDDS.3.2.1.19 CheckSIFocStateTransOplpStart
Calling Function	SWDDS.3.6.14.32 MLIB_MulSat_F16
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.26
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

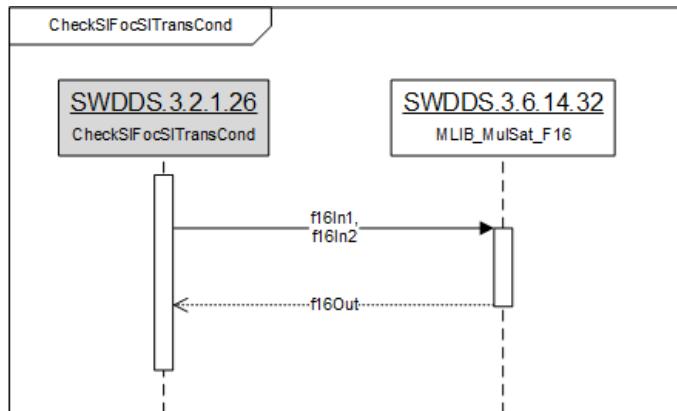
#### 1.1.1.26.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	86



#### 1.1.1.26.3 Dynamic View Design

1. CheckSIFocSITransCond calls the fixed-point arithmetic multiplication function.



#### 1.1.1.26.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	32,440	32,440	0.99	0.99	N/A	Maximum open-loop speed reaching detection speed ratio
2	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	3276	3276	600	600	0.183105 / rpm	Initial starting maximum speed

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-04-30
									Page	87

3	f16Out	SWDDS.3.6.14.32	IN	tFrac16	3233	3233	594	594	0.183105 / rpm	multiplication of the input arguments
---	--------	-----------------	----	---------	------	------	-----	-----	----------------	---------------------------------------

### 1.1.1.1.27 [SWDDS.3.2.1.27] MeasureSIFocDcVolt

#### 1.1.1.1.27.1 Detailed Design

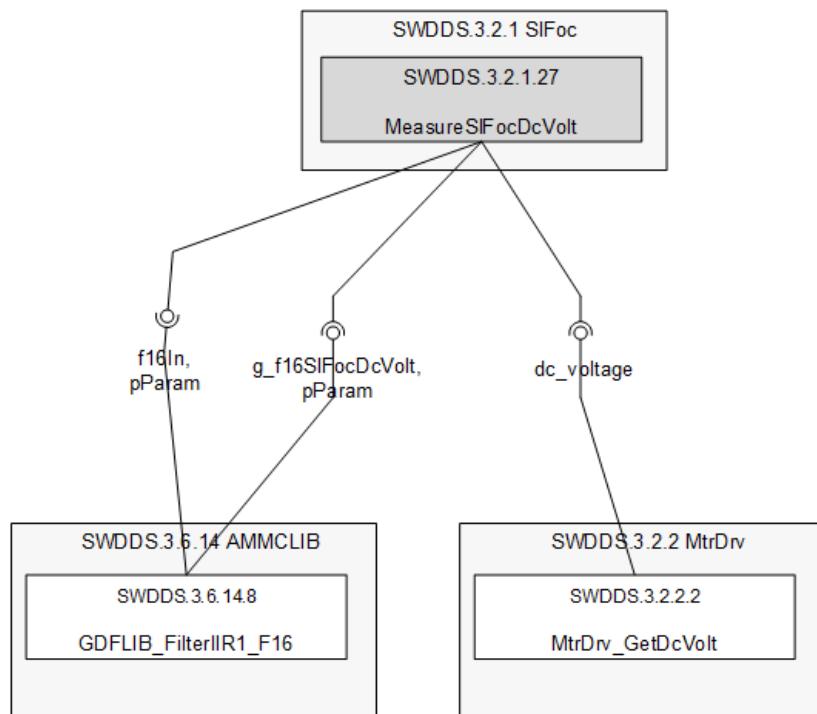
#### [SWDDS.3.2.1.27] MeasureSIFocDcVolt

Software Unit Information					
Unit ID	SWDDS.3.2.1.27		Unit Name	MeasureSIFocDcVolt	
Architecture ID	SWADS.3.2.1.27		ASIL	QM	
Prototype	void MeasureSIFocDcVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIFocFirstDcVoltMeasr	0 ~ 1 Normal / First measurement	Read/Write	First DC driving voltage measurement
	tFrac16	g_f16SIFocDcVolt	0 ~ 32767 0 ~ 25.3992Vpk	Write	DC driving voltage (PU)
	tFrac16	g_hndSIFocDcVoltFilt.f16FiltBufferX[0]	-32768 ~ 32768	Write	DC driving voltage filtering : Input buffer of an IIR1 filter
	tFrac32	g_hndSIFocDcVoltFilt.f32FiltBufferY[0]	-2147483648 ~ 2147483647	Write	DC driving voltage filtering : Internal accumulator buffer
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage measurement				
Control Flow Diagram (or Pseudo Code)	<ol style="list-style-type: none"> <li>MeasureSIFocDcVolt gets the measured DC driving voltage.</li> <li>MeasureSIFocDcVolt filters the measured DC driving voltage after the first measurement.</li> <li>MeasureSIFocDcVolt sets the internal state and output of the filter as the measured DC driving voltage at the first measurement.</li> </ol>				

Control Flow Diagram (or Pseudo Code)	<pre>     start     tFrac16 dc_voltage;     [SWDDS.3.2.2.2]     dc_voltage = MtrDrv_GetDcVolt();     if(g_bSIFocFirstDcVoltMear == FALSE)     {         yes: [SWDDS.3.6.14.8]         g_f16SIFocDcVolt = GDFLIB_FilterIR1_F16(dc_voltage, &amp;g_hndSIFocDcVoltFilt);         no: g_hndSIFocDcVoltFilt.f16FiltBufferX[0] = dc_voltage;              g_hndSIFocDcVoltFilt.f32FiltBufferY[0] = (tFrac32)dc_voltage;              g_f16SIFocDcVolt = dc_voltage; g_bSIFocFirstDcVoltMear = FALSE;     }     end   </pre>
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc
Calling Function	SWDDS.3.2.2.2 MtrDrv_GetDcVolt SWDDS.3.6.14.8 GDFLIB_FilterIR1_F16
Function Execution Time	N/A

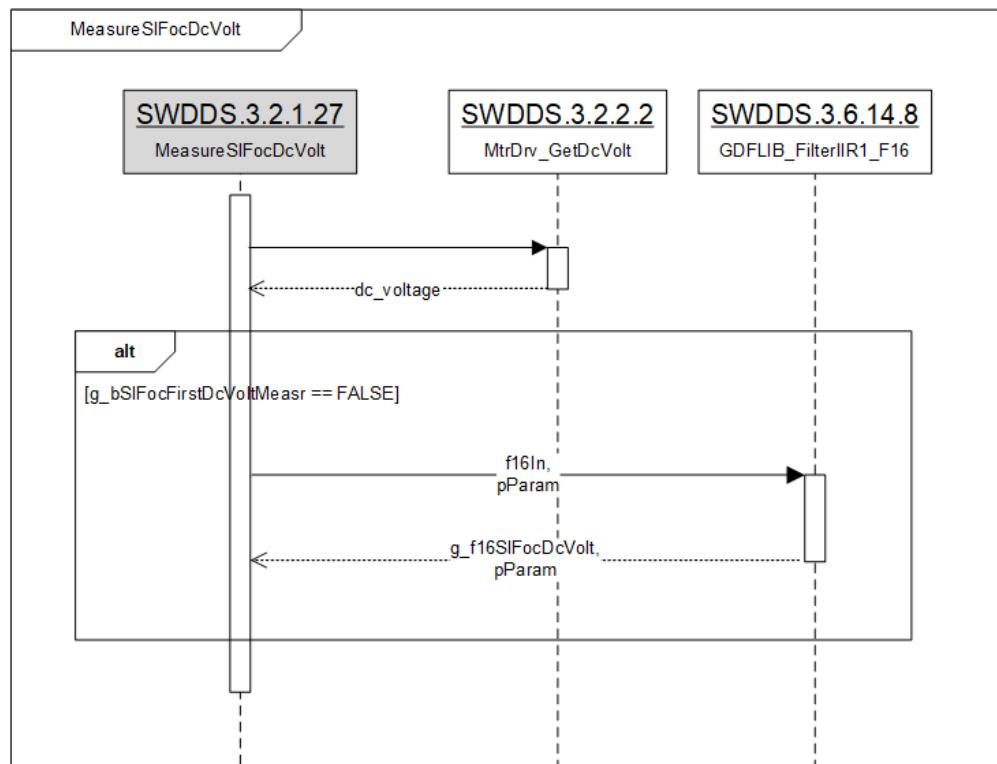
Requirement Id	SWDDS.3.2.1.27
Target Milestone	EBS2
Element	MTR
Risk	<span style="border: 1px solid black; padding: 2px;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">★</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.27.2 Static View Design



#### 1.1.1.27.3 Dynamic View Design

1. MeasureSIFocDcVolt calls the DC driving voltage measurement.
2. MeasureSIFocDcVolt calls the filter state setting to set the initial DC driving voltage to reduce filter settling time.



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	90

#### 1.1.1.27.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In	SWDDS.3.6.14.8	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Measured DC driving voltage
2	pParam	SWDDS.3.6.14.8	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *	N/A	N/A	N/A	N/A	N/A	DC driving voltage filtering handler
3	g_f16SIFocDcVolt	SWDDS.3.6.14.8	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC driving voltage
4	dc_voltage	SWDDS.3.2.2.2	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Measured DC driving voltage (PU)

#### 1.1.1.28 [SWDDS.3.2.1.28] MeasureSIFocPhsCur

##### 1.1.1.28.1 Detailed Design

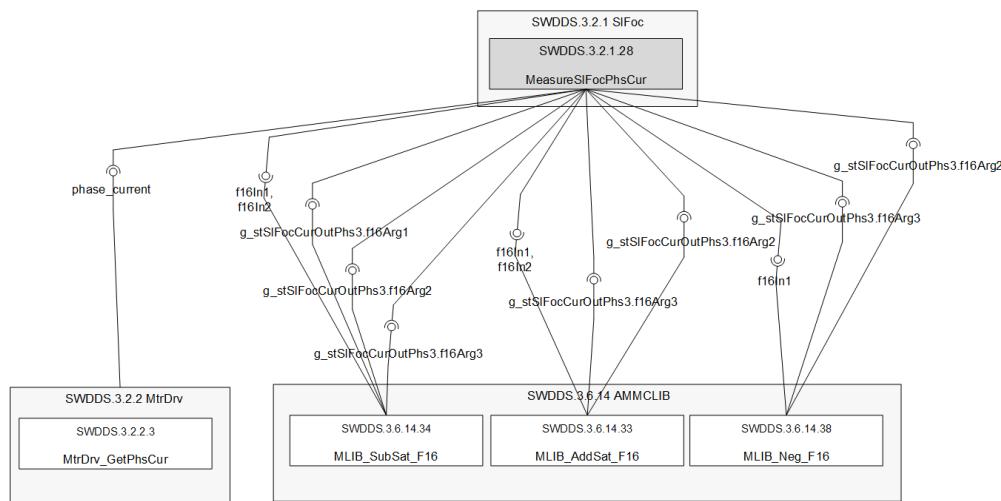
##### [SWDDS.3.2.1.28] MeasureSIFocPhsCur

Software Unit Information					
Unit ID	SWDDS.3.2.1.28		Unit Name	MeasureSIFocPhsCur	
Architecture ID	SWADS.3.2.1.28		ASIL	QM	
Prototype	void MeasureSIFocPhsCur( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurOutPhs3.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	3-phase current output : phase U (PU)
	tFrac16	g_stSIFocCurOffs.f16Arg1	-5734 ~ 5734 -0.875 ~ 0.875Vpk	Read	Current sensor offset : sensor 0
	tFrac16	g_stSIFocCurOutPhs3.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	3-phase current output : phase V (PU)
	tFrac16	g_stSIFocCurOffs.f16Arg2	-5734 ~ 5734 -0.875 ~ 0.875Vpk	Read	Current sensor offset : sensor 1
	tFrac16	g_stSIFocCurOutPhs3.f16Arg3	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	3-phase current output : phase W (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Phase current measurement - Current sense amplifier signal measurement - Current conversion from 2 sense signal to 3-phase current				
	1. MeasureSIFocPhsCur gets the 3-phase current. 2. MeasureSIFocPhsCur sets the phase U current as the first offset compensated measured current. 3. MeasureSIFocPhsCur sets the phase V current as the second offset compensated measured current if reverse direction setting is false. 4. MeasureSIFocPhsCur calculates the phase W current if reverse direction setting is false.				

<b>Control Flow Diagram (or Pseudo Code)</b>	<p>5. MeasureSI FocPhsCur sets the phase W current as the second offset compensated measured current if reverse direction setting is true.</p> <p>6. MeasureSI FocPhsCur calculates the phase V current if reverse direction setting is true.</p> <pre> graph TD     start((start)) --&gt; SWLIBS[SWLIBS_2Syst_F16 phase_current;]     SWLIBS --&gt; MtrDrv[MtrDrv_GetPhsCur();]     MtrDrv --&gt; SubSat1{[SWDDS.3.2.2.3] phase_current = MtrDrv_GetPhsCur();}     SubSat1 --&gt; SubSat2{[SWDDS.3.6.14.34] g_stSI FocCurOutPhs3.f16Arg1 = MLIB_SubSat_F16( phase_current.f16Arg1, g_stSI FocCurOffs.f16Arg1);}     SubSat2 --&gt; AddSat1{[SWDDS.3.6.14.34] g_stSI FocCurOutPhs3.f16Arg2 = MLIB_SubSat_F16( phase_current.f16Arg2, g_stSI FocCurOffs.f16Arg2);}     AddSat1 --&gt; Neg1{[SWDDS.3.6.14.38] g_stSI FocCurOutPhs3.f16Arg2 = MLIB_Neg_F16( g_stSI FocCurOutPhs3.f16Arg2);}     Neg1 --&gt; AddSat2{[SWDDS.3.6.14.33] g_stSI FocCurOutPhs3.f16Arg3 = MLIB_AddSat_F16( g_stSI FocCurOutPhs3.f16Arg1, g_stSI FocCurOutPhs3.f16Arg2);}     AddSat2 --&gt; Neg2{[SWDDS.3.6.14.38] g_stSI FocCurOutPhs3.f16Arg3 = MLIB_Neg_F16( g_stSI FocCurOutPhs3.f16Arg3);}     Neg2 --&gt; end((end))     </pre>
	SWDDS.3.2.1.15 ActSI FocStateInitAlign
	SWDDS.3.2.1.16 ActSI FocStateOpIpStart
	SWDDS.3.2.1.17 ActSI FocStateSIRun
	SWDDS.3.2.2.3 MtrDrv_GetPhsCur
	SWDDS.3.6.14.34 MLIB_SubSat_F16
	SWDDS.3.6.14.33 MLIB_AddSat_F16
SWDDS.3.6.14.38 MLIB_Neg_F16	
Called Function	N/A
Calling Function	N/A
Function Execution Time	N/A

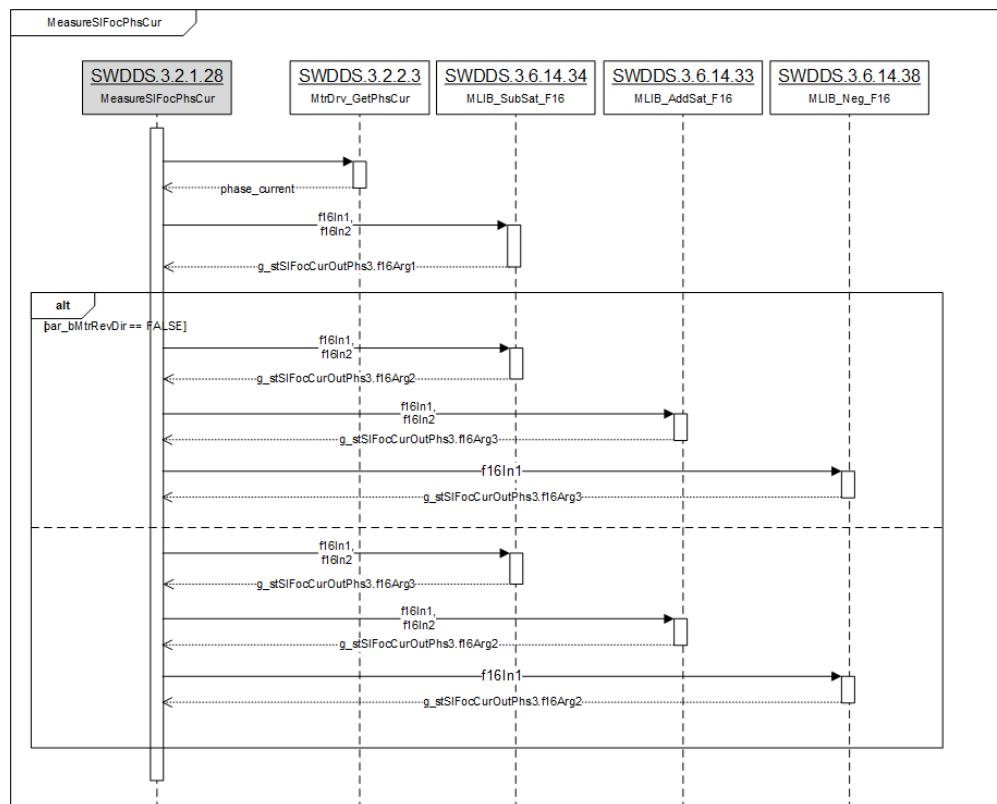
Requirement Id	SWDDS.3.2.1.28
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	■ High
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.1.1.28.2 Static View Design



#### 1.1.1.1.28.3 Dynamic View Design

1. MeasureSIFocPhsCur calls the phase current measurement.
2. MeasureSIFocPhsCur calls the fixed-point arithmetic functions for addition, subtraction and negative.



<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date		003	
	Software Detailed Design Specification				Updated Date		2021-04-30	
					Page		93	

#### 1.1.1.1.28.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	phase_current	SWDDS.3.2.2.3	IN	SWLIBS_2Syst_F16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal
2	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal : argument1
3	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor offset : argument1
4	g_stSIIFocCurOutPhs3 .f16Arg1	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument1
5	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal : argument2
6	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor offset : argument2
7	g_stSIIFocCurOutPhs3 .f16Arg2	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument2
8	f16In1	SWDDS.3.6.14.33	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument1
9	f16In2	SWDDS.3.6.14.33	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument2
10	g_stSIIFocCurOutPhs3 .f16Arg3	SWDDS.3.6.14.33	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument3
11	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument3
12	g_stSIIFocCurOutPhs3 .f16Arg3	SWDDS.3.6.14.38	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument3
13	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal : argument2
14	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor offset :

	VW AQ EOP					Baseline / Version / Date		003	
	Software Detailed Design Specification					Updated Date		2021-04-30	
						Page		94	

									argument2
15	g_stSIxFocCurOutPhs3.f16Arg3	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk
16	f16In1	SWDDS.3.6.14.33	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk
17	f16In2	SWDDS.3.6.14.33	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk
18	g_stSIxFocCurOutPhs3.f16Arg2	SWDDS.3.6.14.33	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk
19	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk
20	g_stSIxFocCurOutPhs3.f16Arg2	SWDDS.3.6.14.38	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk

#### 1.1.1.1.29 [SWDDS.3.2.1.29] CalibrateSIxFocCurOffs

##### 1.1.1.1.29.1 Detailed Design

###### [SWDDS.3.2.1.29] CalibrateSIxFocCurOffs

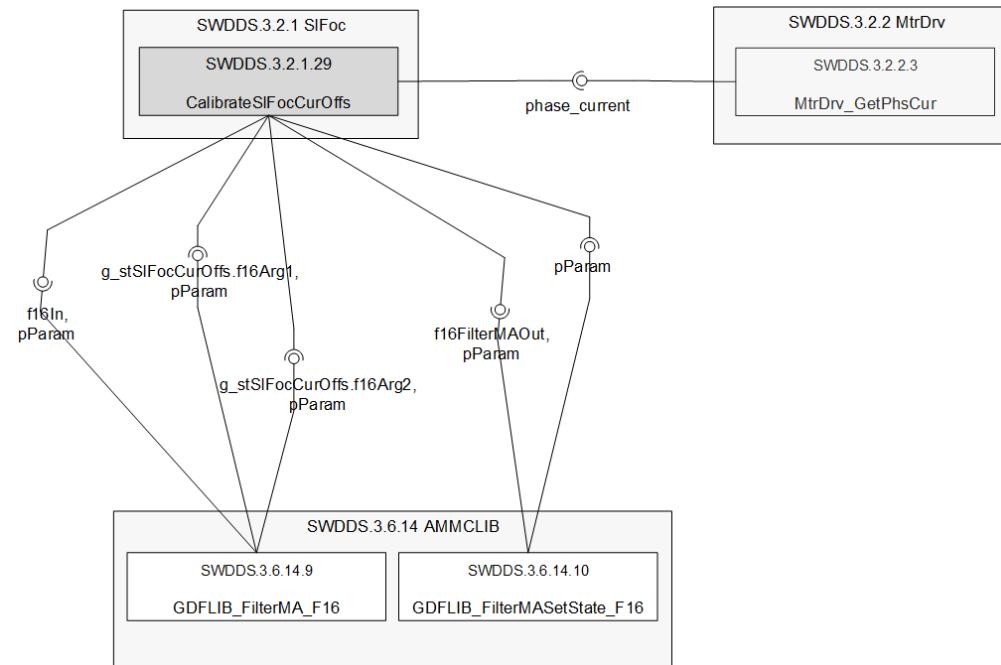
Software Unit Information					
Unit ID	SWDDS.3.2.1.29		Unit Name	CalibrateSIxFocCurOffs	
Architecture ID	SWADS.3.2.1.29		ASIL	QM	
Prototype	void CalibrateSIxFocCurOffs( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bSIxFocFirstCurMeasr	0 ~ 1 Normal / First measurement	Read/Write	First current measurement
	tFrac16	g_stSIxFocCurOffs.f16Arg1	-5734 ~ 5734	Write	Current sensor offset : sensor 0
	tFrac32	g_hndSIxFocOffsFilt0.f32Acc	-32768 ~ 32767	Read/Write	Current sensor 0 offset filtering handler : filter accumulator
	tFrac16	g_stSIxFocCurOffs.f16Arg2	-5734 ~ 5734	Write	Current sensor offset : sensor 1
	tFrac32	g_hndSIxFocOffsFilt1.f32Acc	-32768 ~ 32767	Read/Write	Current sensor 1 offset filtering handler : filter accumulator
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current sensor offset calibration - Current sense amplifier signal measurement - Current sense amplifier signal(offset) filtering				
Control Flow Diagram (or Pseudo Code)	<p>1. CalibrateSI FocCurOffs gets the measured phase current.      2. CalibrateSI FocCurOffs filters the phase current after the first measurement.      3. CalibrateSI FocCurOffs sets the filter state as the measured phase current at the first measurement.</p> <pre> graph TD     start([start]) --&gt; SWLIBS[SWLIBS_2Syst_F16 phase_current;]     SWLIBS --&gt; MtrDrv[phase_current = MtrDrv_GetPhsCur();]     MtrDrv --&gt; Decision{g_bSI FocFirstCurMeas == FALSE}     Decision -- yes --&gt; GDFLIB1[GDFLIB_FilterMASetState_F16( phase_current.f16Arg1, &amp;g_hndSI FocOffsFilt0 );]     GDFLIB1 --&gt; GDFLIB2[GDFLIB_FilterMA_F16( phase_current.f16Arg1, &amp;g_hndSI FocOffsFilt0 );]     GDFLIB2 --&gt; Update1[g_stSI FocCurOffs.f16Arg1 = phase_current.f16Arg1; g_stSI FocCurOffs.f16Arg2 = phase_current.f16Arg2; g_bSI FocFirstCurMeas = FALSE;]     Update1 --&gt; end([end])     Decision -- no --&gt; GDFLIB3[GDFLIB_FilterMASetState_F16( phase_current.f16Arg2, &amp;g_hndSI FocOffsFilt1 );]     GDFLIB3 --&gt; GDFLIB4[GDFLIB_FilterMA_F16( phase_current.f16Arg2, &amp;g_hndSI FocOffsFilt1 );]     GDFLIB4 --&gt; Update2[g_stSI FocCurOffs.f16Arg1 = phase_current.f16Arg1; g_stSI FocCurOffs.f16Arg2 = phase_current.f16Arg2; g_bSI FocFirstCurMeas = FALSE;]     Update2 --&gt; end </pre>				
Called Function	SWDDS.3.2.1.13 ActSI FocStateOffsCalib				
Calling Function	SWDDS.3.2.2.3 MtrDrv_GetPhsCur SWDDS.3.6.14.9 GDFLIB_FilterMA_F16 SWDDS.3.6.14.10 GDFLIB_FilterMASetState_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.29
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

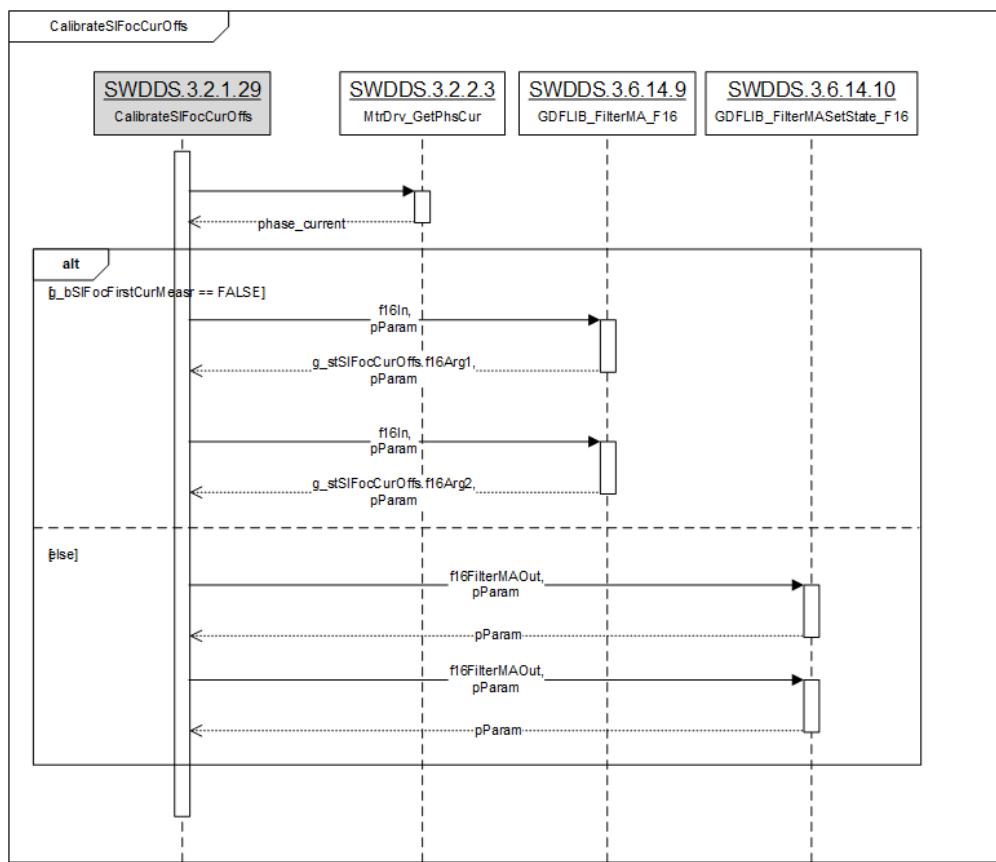
	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	96

#### 1.1.1.1.29.2 Static View Design



#### 1.1.1.1.29.3 Dynamic View Design

1. CalibrateSIFocCurOffs calls the moving average filter.
2. CalibrateSIFocCurOffs calls the moving average filter state setting to substitute the filtered output as the first measured signal.



#### 1.1.1.29.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	phase_current	SWDDS.3.2.2.3	IN	SWLIBS_2Syst_F16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal
2	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal : argument1
3	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Current sensor 0 offset filtering handler
4	g_stSI FocCurOffs .f16Arg1	SWDDS.3.6.14.9	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor offset : argument1
5	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Measured current sense amplifier signal : argument2
GDFLIB_FILTER										

	VW AQ EOP						Baseline / Version / Date	003
	Software Detailed Design Specification						Updated Date	2021-04-30
							Page	98

6	pParam	SWDDS.3.6.14.9	IN/OUT	_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	offset filtering handler
7	g_stSIFocCurOffs.f16Arg2	SWDDS.3.6.14.9	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor offset : argument2 Measured current sense amplifier signal : argument1
8	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current sensor 0 offset filtering handler
9	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER _MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Measured current
10	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	sense amplifier signal : argument2
11	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER _MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Current sensor 1 offset filtering handler

#### 1.1.1.30 [SWDDS.3.2.1.30] ConvertSIFocClarkTrnsf

##### 1.1.1.30.1 Detailed Design

##### [SWDDS.3.2.1.30] ConvertSIFocClarkTrnsf

Software Unit Information					
Unit ID	SWDDS.3.2.1.30		Unit Name	ConvertSIFocClarkTrnsf	
Architecture ID	SWADS.3.2.1.30		ASIL	QM	
Prototype	void ConvertSIFocClarkTrnsf( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurOutAlbe.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	alpha/beta-axis current output : alpha-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	alpha/beta-axis current output : beta-axis (PU)
	tFrac16	g_stSIFocCurOutPhs3.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase U (PU)

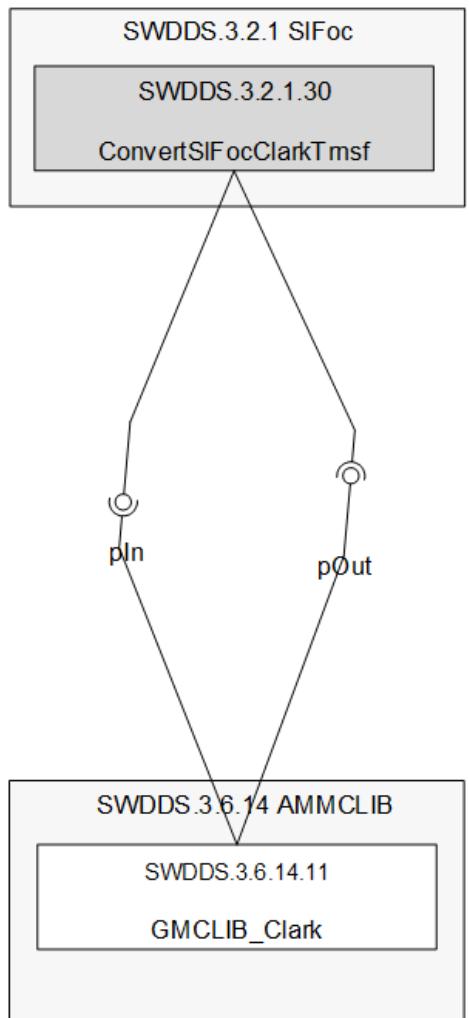
<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-04-30
			Page	99	

	tFrac16	g_stSIFocCurOutPhs3.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase V (PU)
	tFrac16	g_stSIFocCurOutPhs3.f16Arg3	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase W (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Clark transformation				
Control Flow Diagram (or Pseudo Code)	<p>1. ConvertSIFocClarkTrnsf converts the 3-phase current to the alpha/beta-axis current using Clark transformation.</p> <pre>     start     [SWDDS.3.6.14.11]     GMCLIB_Clark( &amp;g_stSIFocCurOutAlbe,     &amp;g_stSIFocCurOutPhs3 );     end   </pre>				
Called Function	SWDDS.3.2.1.15 ActSIFocStateInitAlign SWDDS.3.2.1.16 ActSIFocStateOpipStart SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.6.14.11 GMCLIB_Clark				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.30
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

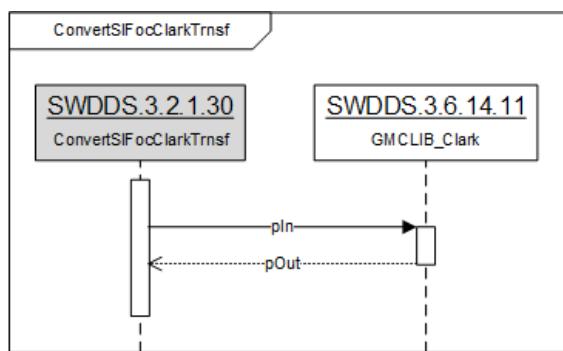
#### 1.1.1.1.30.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30



#### 1.1.1.1.30.3 Dynamic View Design

1. ConvertSIFocClarkTrnsf calls the Clark transformation.



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	101

#### 1.1.1.30.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pIn	SWDDS.3.6.14.11	OUT	const SWLIBS_3Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis current output (PU)
2	pOut	SWDDS.3.6.14.11	IN	SWLIBS_2Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output (PU)

#### 1.1.1.31 [SWDDS.3.2.1.31] CalculateSIFocStartCur

##### 1.1.1.31.1 Detailed Design

##### [SWDDS.3.2.1.31] CalculateSIFocStartCur

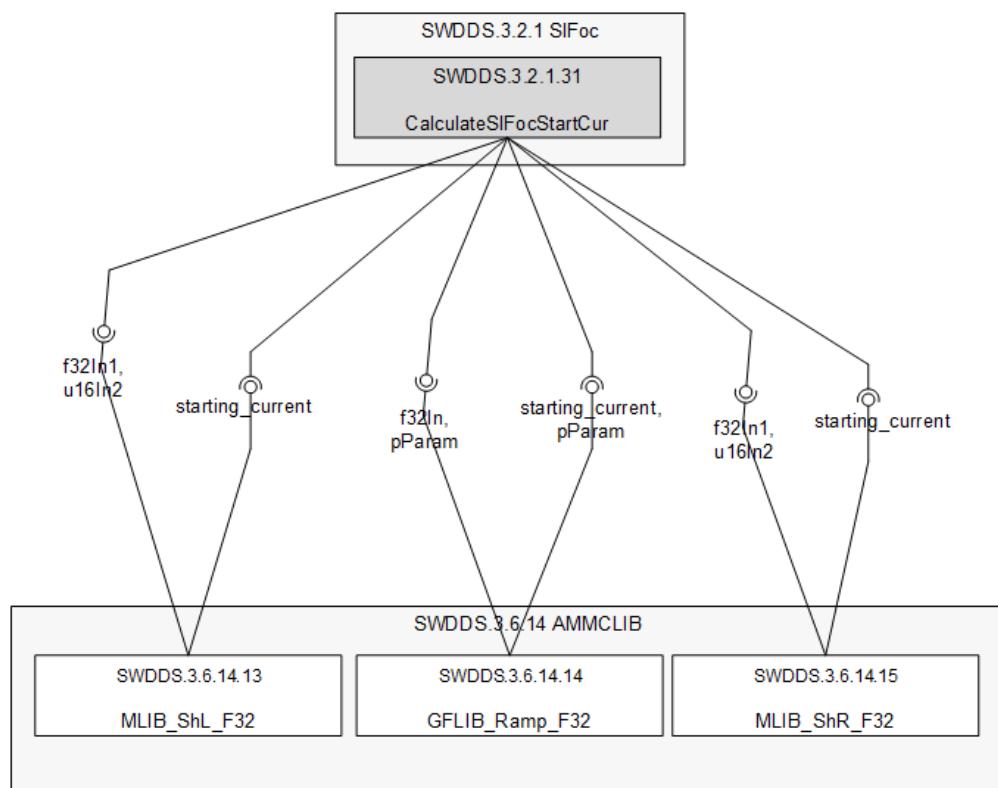
Software Unit Information					
Unit ID	SWDDS.3.2.1.31	Unit Name	CalculateSIFocStartCur		
Architecture ID	SWADS.3.2.1.31	ASIL	QM		
Prototype			void CalculateSIFocStartCur( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac32	g_hndSIFocStartCurRamp.f32State	0 ~ 665845760	Read	Open-loop starting current ramping handler : Ramp state value
	tFrac16	g_f16SIFocStartCur	0 ~ 10160 0 ~ 20.0Apk	Write	Open-loop starting current magnitude (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartExcCur	10160 20.0Apk	Read	Initial starting excitation current (PU)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Magnitude of open-loop starting current calculation - Starting current ramping up				
	1. CalculateSIFocStartCur calculates the ramped magnitude of the starting current using ramping function. 2. CalculateSIFocStartCur shifts bit by 16, before and after the ramp calculation to increase the resolution.				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac32 starting_current;     ↓     [SWDDS.3.6.14.13]     starting_current = MLIB_ShL_F32(     (tFrac32)par_f16StartExcCur, 16 );     ↓     [SWDDS.3.6.14.14]     starting_current = GFLIB_Ramp_F32(     starting_current, &amp;g_hndSIFocStartCurRamp );     ↓     [SWDDS.3.6.14.15]     starting_current = MLIB_ShR_F32(     starting_current, 16 );     ↓     g_f16SIFocStartCur = (tFrac16)starting_current;     ↓     end   </pre>	
	Called Function	SWDDS.3.2.1.14 RunSIFocStateAlignOpIp
	Calling Function	SWDDS.3.6.14.13 MLIB_ShL_F32
		SWDDS.3.6.14.14 GFLIB_Ramp_F32
		SWDDS.3.6.14.15 MLIB_ShR_F32
Function Execution Time	N/A	

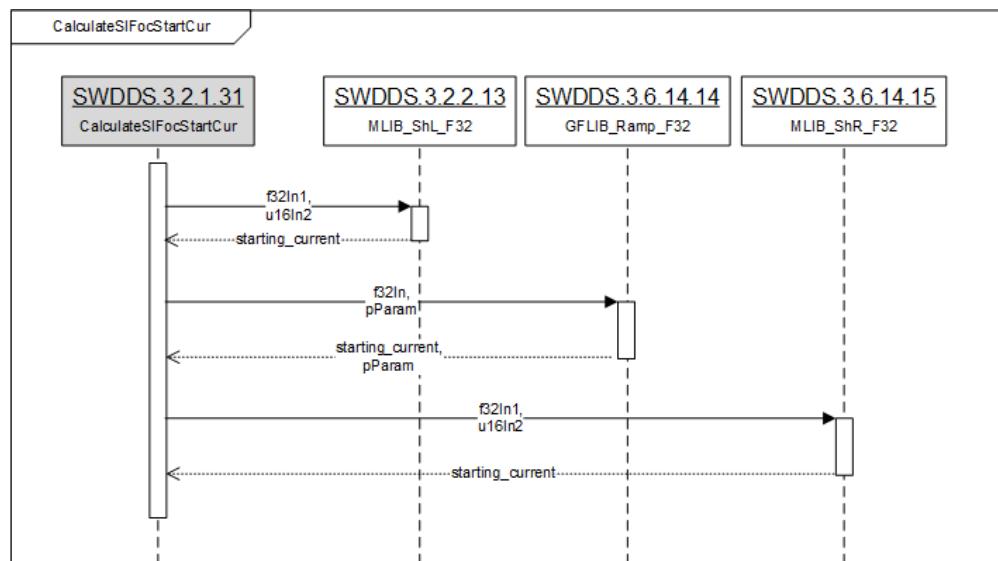
Requirement Id	SWDDS.3.2.1.31
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.31.2 Static View Design



#### 1.1.1.1.31.3 Dynamic View Design

1. CalculateSIFocStartCur calls the fixed-point arithmetic function to shift bits.
2. CalculateSIFocStartCur calls the ramp function to calculate ramped magnitude of the start current.



	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-04-30
						Page	104

#### 1.1.1.31.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	10160	10160	20.0	20.0	0.00196838 / Apk	Initial starting excitation current
2	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	The shift amount value.
3	starting_current	SWDDS.3.6.14.13	IN	tFrac32	665845760	665845760	20.0	20.0	0.00196838 / Apk	Ramped magnitude of starting current
4	f32In	SWDDS.3.6.14.14	OUT	tFrac32	665845760	665845760	20.0	20.0	0.00196838 / Apk	Ramped magnitude of starting current
5	pParam	SWDDS.3.6.14.14	IN/OUT	GFLIB_RAMP_T_F32 *	N/A	N/A	N/A	N/A	N/A	Open-loop starting current ramping handler
6	starting_current	SWDDS.3.6.14.14	IN	tFrac32	0	665845760	0.0	20.0	0.00196838 / Apk	Ramped magnitude of starting current
7	f32In1	SWDDS.3.6.14.15	OUT	tFrac32	0	665845760	0.0	20.0	0.00196838 / Apk	Ramped magnitude of starting current
8	u16In2	SWDDS.3.6.14.15	OUT	tU16	16	16	16	16	N/A	The shift amount value.
9	starting_current	SWDDS.3.6.14.15	IN	tFrac32	0	10160	0.0	20.0	0.00196838 / Apk	Ramped magnitude of starting current

#### 1.1.1.32 [SWDDS.3.2.1.32] CalculateSIFocStartAng

##### 1.1.1.32.1 Detailed Design

##### [SWDDS.3.2.1.32] CalculateSIFocStartAng

Software Unit Information					
Unit ID	SWDDS.3.2.1.32		Unit Name	CalculateSIFocStartAng	
Architecture ID	SWADS.3.2.1.32		ASIL	QM	
Prototype	void CalculateSIFocStartAng( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	N/A	N/A	N/A	N/A	N/A
	Data Type	Possible Return Value		Description	
Function Call Return Value	void	N/A		N/A	

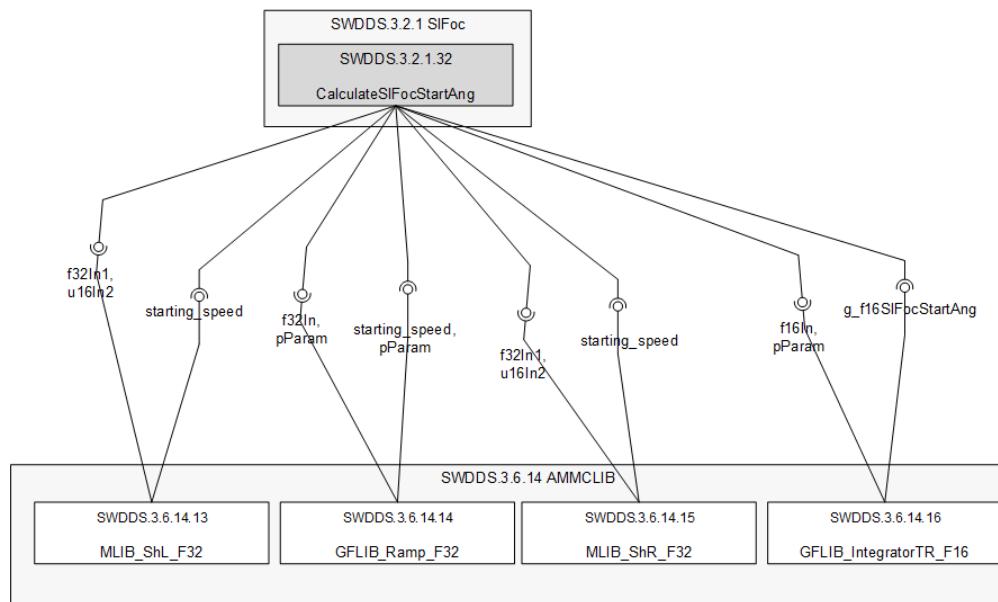
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	105

	Data Type	Name	Range	Read/Write	Description
Global Variables	tFrac32	g_hndSIFocStartSpdRamp.f32State	0 ~ 214695936	Read/Write	Open-loop starting speed ramping handler
	tFrac16	g_f16SIFocStartSpd	0 ~ 3276 0 ~ 600rpm	Read/Write	Open-loop starting electric speed (PU)
	tFrac16	g_f16SIFocStartAng	-32768 ~ 32767 -180 ~ 179.995deg	Write	Open-loop starting electric angle (PU)
	tFrac32	g_hndSIFocStartAngIntg.f32State	-2147483648 ~ 2147483647	Read/Write	Open-loop starting angle integrator handler
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartMaxSpd	3276 600rpm	Read	Initial starting maximum speed
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Open-loop starting electric speed and angle calculation				
Control Flow Diagram (or Pseudo Code)	<p>1. CalculateSIFocStartAng calculates the ramped starting electric speed using ramping function.</p> <p>2. CalculateSIFocStartAng shifts bit by 16, before and after the ramp calculation to increase the resolution.</p> <p>3. CalculateSIFocStartAng integrates the start electric speed to calculate the electric angle.</p> <pre> graph TD     start([start]) --&gt; T1[tFrac32 starting_speed]     T1 --&gt; T2["[SWDDS.3.6.14.13] starting_speed = MLIB_ShL_F32( (tFrac32)par_f16StartMaxSpd, 16);"]     T2 --&gt; T3["[SWDDS.3.6.14.14] starting_speed = GFLIB_Ramp_F32(starting_speed, &amp;g_hndSIFocStartSpdRamp);"]     T3 --&gt; T4["[SWDDS.3.6.14.15] starting_speed = MLIB_ShR_F32(starting_speed, 16);"]     T4 --&gt; T5[g_f16SIFocStartSpd = (tFrac16)starting_speed]     T5 --&gt; T6["[SWDDS.3.6.14.16] g_f16SIFocStartAng = GFLIB_IntegratorTR_F16( g_f16SIFocStartSpd, &amp;g_hndSIFocStartAngIntg);"]     T6 --&gt; end([end])   </pre>				
Called Function	<p>SWDDS.3.2.1.14 RunSIFocStateAlignOpIp</p> <p>SWDDS.3.6.14.13 MLIB_ShL_F32</p> <p>SWDDS.3.6.14.14 GFLIB_Ramp_F32</p> <p>SWDDS.3.6.14.15 MLIB_ShR_F32</p> <p>SWDDS.3.6.14.16 GFLIB_IntegratorTR_F16</p>				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.32
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No

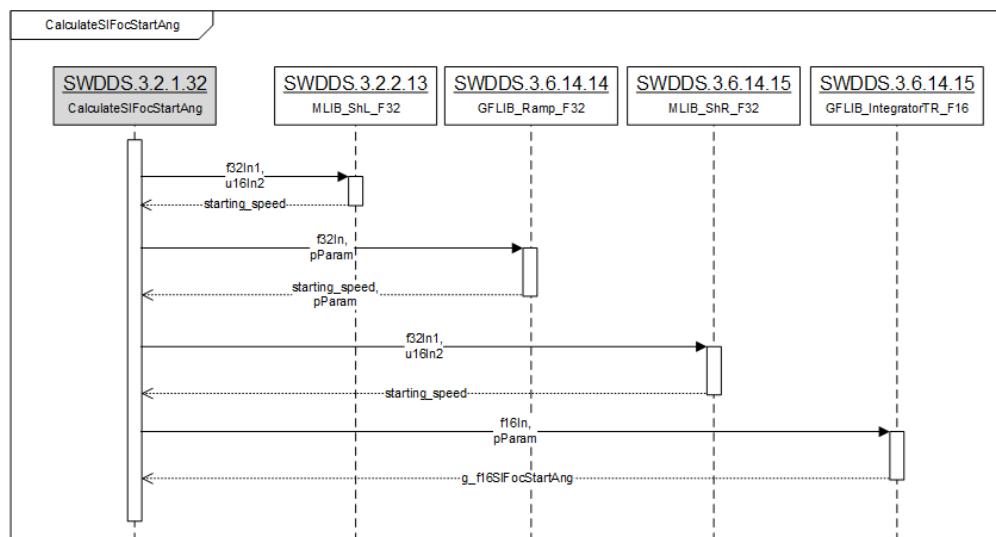
Criticality	
Technical complexity	
Verifiability	Yes

#### 1.1.1.1.32.2 Static View Design



#### 1.1.1.1.32.3 Dynamic View Design

1. CalculateSI\_FocStartAng calls the fixed-point arithmetic function to shift bits.
2. CalculateSI\_FocStartAng calls the ramping function to increase the starting electric speed gradually.
3. CalculateSI\_FocStartAng calls the integration function to calculate the starting electric angle.



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
					Page	107

#### 1.1.1.32.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	3276	3276	600	600	0.183105 / rpm	Initial starting maximum speed
2	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	The shift amount value.
3	starting_speed	SWDDS.3.6.14.13	IN	tFrac32	214695936	214695936	600	600	0.183105 / rpm	Ramped starting speed
4	f32In	SWDDS.3.6.14.14	OUT	tFrac32	214695936	214695936	600	600	0.183105 / rpm	Ramped starting speed
5	pParam	SWDDS.3.6.14.14	IN/OUT	GFLIB_RAMP_T_F32 *	N/A	N/A	N/A	N/A	N/A	Open-loop starting speed ramping handler
6	starting_speed	SWDDS.3.6.14.14	IN	tFrac32	0	214695936	0	600	0.183105 / rpm	Ramped starting speed
7	f32In1	SWDDS.3.6.14.15	OUT	tFrac32	0	214695936	0	600	0.183105 / rpm	Ramped starting speed
8	u16In2	SWDDS.3.6.14.15	OUT	tU16	16	16	16	16	N/A	The shift amount value.
9	f16In	SWDDS.3.6.14.16	OUT	tFrac16	0	3276	600	600	0.183105 / rpm	Open-loop starting electric speed
10	pParam	SWDDS.3.6.14.16	OUT	GFLIB_INTEGRATOR_T_F16 *	N/A	N/A	N/A	N/A	N/A	Open-loop starting angle integrator handler
11	g_f16SIFocStartAng	SWDDS.3.6.14.16	IN	tFrac32	-32768	32768	-180	179.995	0.00549316 / deg	Open-loop starting electric angle
12	starting_speed	SWDDS.3.6.14.15	IN	tFrac32	0	214748365	0	600	N/A	Starting speed (PU)

#### 1.1.1.33 [SWDDS.3.2.1.33] CalculateSIFocCurErrAlbe

##### 1.1.1.33.1 Detailed Design

#### [SWDDS.3.2.1.33] CalculateSIFocCurErrAlbe

Software Unit Information			
Unit ID	SWDDS.3.2.1.33	Unit Name	CalculateSIFocCurErrAlbe
Architecture ID	SWADS.3.2.1.33	ASIL	QM
Prototype	void CalculateSIFocCurErrAlbe( void )		

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	108

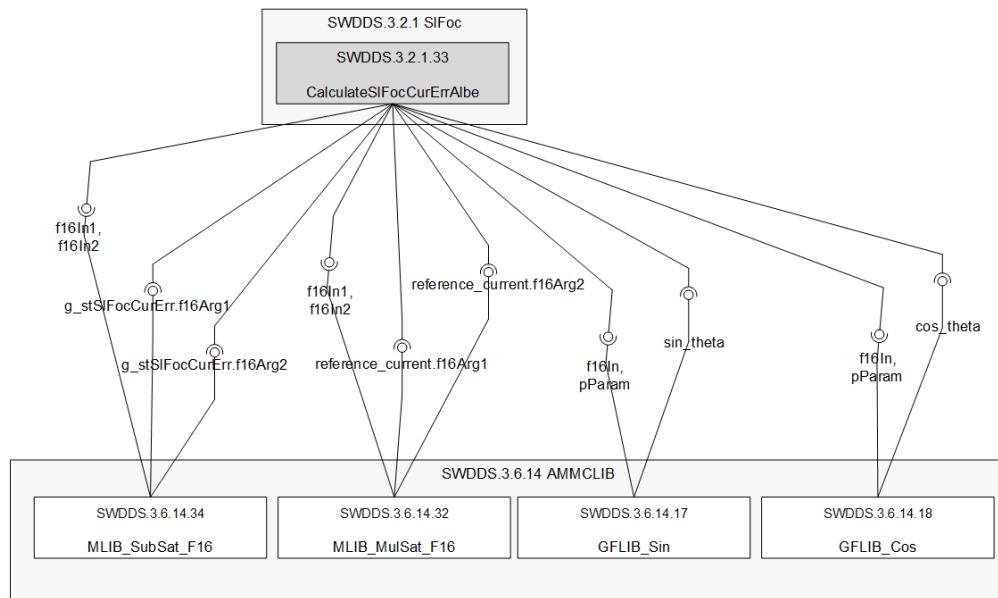
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocStartAng	-32768 ~ 32767 -180 ~ 179.995deg	Read	Open-loop starting electric angle (PU)
	tFrac16	g_f16SIFocStartCur	0 ~ 10160 0 ~ 20.0Apk	Read	Open-loop starting current magnitude (PU)
	tFrac16	g_stSIFocCurErr.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Current control error : alpha-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis current output : alpha-axis (PU)
	tFrac16	g_stSIFocCurErr.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Current control error : beta-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis current output : beta-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Alpha/beta-axis current control error calculation – sin and cos value of starting electric angle calculation – alpha/beta-axis reference current calculation – alpha/beta-axis current control error calculation				
Control Flow Diagram (or Pseudo Code)	1. CalculateSIFocCurErrAlbe calculates the sin and cos value of the starting electric angle. 2. CalculateSIFocCurErrAlbe calculates the alpha/beta-axis reference current from the sin and cos value and the magnitude of the starting current. 3. CalculateSIFocCurErrAlbe calculates the alpha/beta-axis current control error by subtracting the feedback current from the reference current.				

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 sin_theta, cos_theta; SWLIBS_2Syst_F16 reference_current;     ↓     [SWDDS.3.6.14.17]     sin_theta = GFLIB_Sin( g_f16SIFocStartAng );     ↓     [SWDDS.3.6.14.18]     cos_theta = GFLIB_Cos( g_f16SIFocStartAng );     ↓     [SWDDS.3.6.14.32]     reference_current.f16Arg1 = MLIB_MulSat_F16(         g_f16SIFocStartCur, cos_theta );     ↓     [SWDDS.3.6.14.32]     reference_current.f16Arg2 = MLIB_MulSat_F16(         g_f16SIFocStartCur, sin_theta );     ↓     [SWDDS.3.6.14.34]     g_stSIFocCurErr.f16Arg1 = MLIB_SubSat_F16(         reference_current.f16Arg1, g_stSIFocCurOutAlbe.f16Arg1 );     ↓     [SWDDS.3.6.14.34]     g_stSIFocCurErr.f16Arg2 = MLIB_SubSat_F16(         reference_current.f16Arg2, g_stSIFocCurOutAlbe.f16Arg2 );     ↓     end   </pre>
	SWDDS.3.2.1.14 RunSIFocStateAlignOplp
	SWDDS.3.6.14.17 GFLIB_Sin
	SWDDS.3.6.14.18 GFLIB_Cos
	SWDDS.3.6.14.32 MLIB_MulSat_F16
	SWDDS.3.6.14.34 MLIB_SubSat_F16
	N/A

Requirement Id	SWDDS.3.2.1.33
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

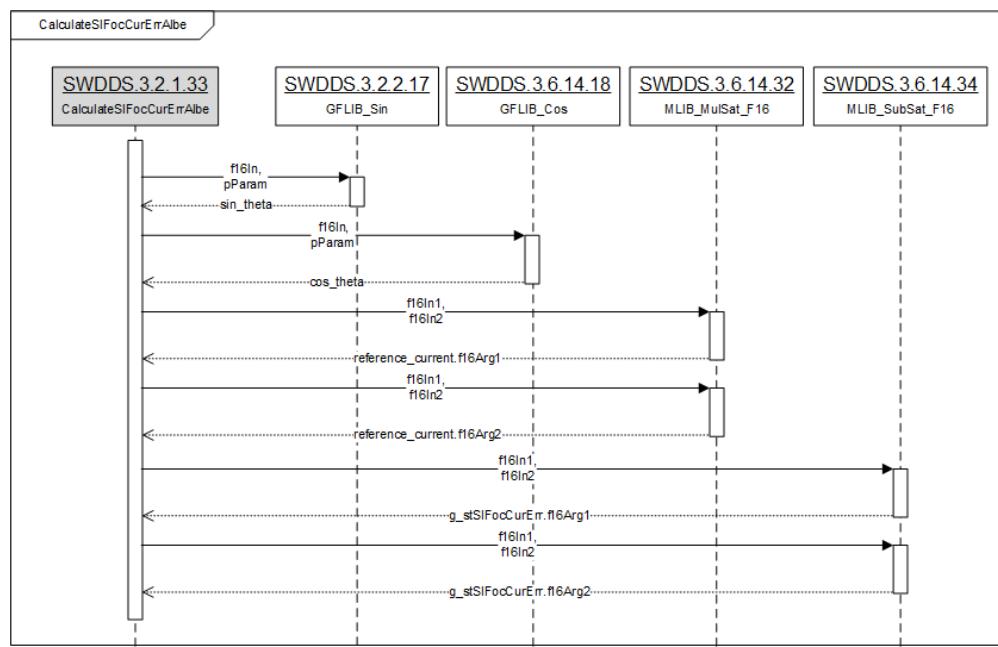
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30

#### 1.1.1.33.2 Static View Design



#### 1.1.1.33.3 Dynamic View Design

1. **CalculateSIFocCurErrAlbe** calls the fixed-point arithmetic to calculate sin and cos value of the starting electric angle.
2. **CalculateSIFocCurErrAlbe** calls the fixed-point arithmetic to calculate current control error using subtraction.



	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-04-30
						Page	111

#### 1.1.1.33.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	f16In	SWDDS.3.6.14.17	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Open-loop starting electric angle sin value of
2	sin_theta	SWDDS.3.6.14.17	IN	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	starting electric angle
3	f16In	SWDDS.3.6.14.18	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Open-loop starting electric angle cos value of
4	cos_theta	SWDDS.3.6.14.18	IN	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	starting electric angle
5	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Open-loop starting current magnitude
6	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	cos value of starting electric angle alpha/beta-axis
7	reference_current.f16Arg1	SWDDS.3.6.14.32	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	reference current : argument1
8	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Open-loop starting current magnitude
9	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	sin value of starting electric angle alpha/beta-axis
10	reference_current.f16Arg2	SWDDS.3.6.14.32	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	reference current : argument2
11	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis reference current : argument1
12	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis current output : argument1
13	g_stSIFocCurErr.f16Arg1	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument1
14	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis reference current : argument2
15	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	alpha/beta-axis current output : argument2

	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-04-30
								Page	112

16	g_stSIFocCurErr.f16Arg2	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument2 sin value of electric angle cos value of electric angle
17	pParam	SWDDS.3.6.14.17	OUT	GFLIB_SIN_T_F16 *const	-32768	32767	-1	0.999969	N/A	
18	pParam	SWDDS.3.6.14.18	OUT	GFLIB_COS_T_F16 *const	-32768	32767	-1	0.999969	N/A	

#### 1.1.1.1.34 [SWDDS.3.2.1.34] RunSIFocSIObsrv

##### 1.1.1.1.34.1 Detailed Design

#### [SWDDS.3.2.1.34] RunSIFocSIObsrv

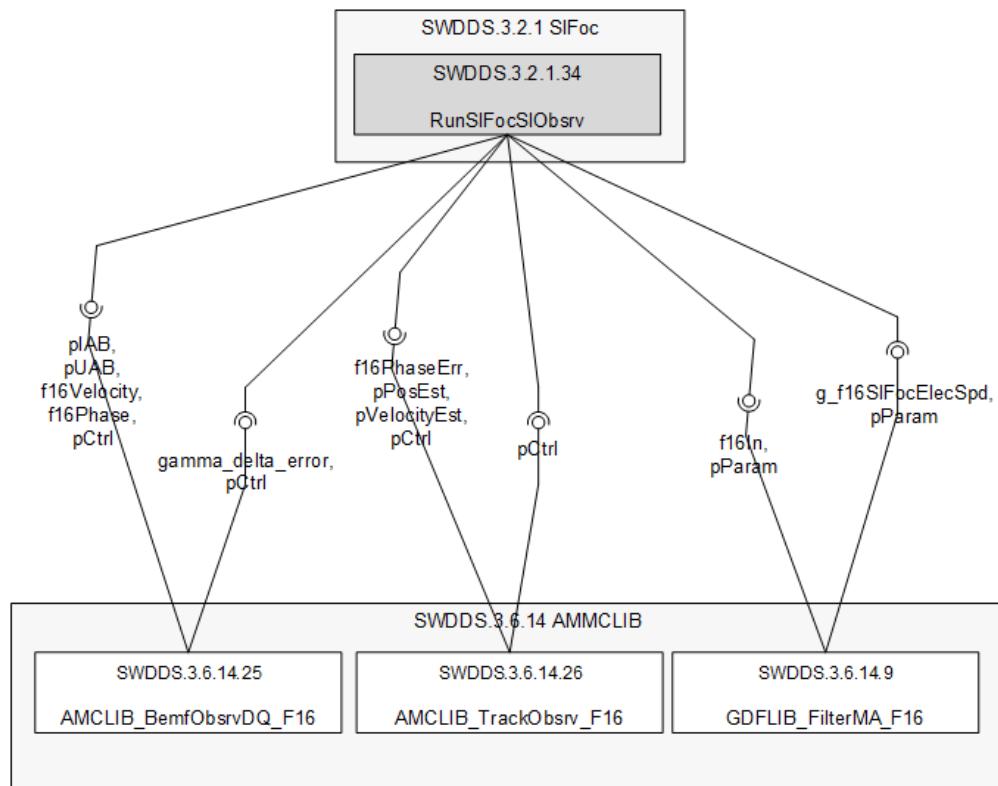
Software Unit Information					
Unit ID	SWDDS.3.2.1.34		Unit Name	RunSIFocSIObsrv	
Architecture ID	SWADS.3.2.1.34		ASIL	QM	
Prototype	void RunSIFocSIObsrv( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurOutAlbe.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	alpha/beta-axis current output : alpha-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	alpha/beta-axis current output : beta-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis control input : beta-axis (PU)
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Read	Estimated electric speed (PU)
	tFrac16	g_f16SIFocElecAng	-32768 ~ 32767 -180 ~ 179.995deg	Read	Estimated electric angle (PU)
	tFrac32	g_hndSIFocBackEmfObsrv.pParamD.f32Acc	-2147483648 ~ 2147483647	Read/Write	Back-EMF observer handler : d-axis controller accumulator
	tFrac32	g_hndSIFocBackEmfObsrv.pParamQ.32Acc	-2147483648 ~ 2147483647	Read/Write	Back-EMF observer handler : q-axis integrator accumulator
	tFrac32	g_hndSIFocAngTrackObsrv.pParamPI.f32Acc	-2147483648 ~ 2147483647	Read/Write	Angle tracking observer handler : controller accumulator
	tFrac32	g_hndSIFocAngTrackObsrv.pParamInteg.32Acc	-2147483648 ~ 2147483647	Read/Write	Angle tracking observer handler : integrator accumulator
	tFrac32	g_hndSIFocElecSpdFiltf.32Acc	-2147483648 ~ 2147483647	Read/Write	Electric speed filtering handler : filter accumulator
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	113

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless observer running - Estimation error calculation using back-EMF observer - Electric speed and angle estimation using angle tracking observer - Estimated electric speed filtering				
Control Flow Diagram (or Pseudo Code)	<p>1. RunSIFocSIObsrv calculates the estimation error using back EMF observer.</p> <p>2. RunSIFocSIObsrv estimates the electric angle and speed using the angle tracking observer.</p> <p>3. RunSIFocSIObsrv filters the estimated electric speed using the moving average filter.</p> <pre>     start     ↓     tFrac16 gamma_delta_error;     ↓     [SWDDS.3.6.14.25]     gamma_delta_error =     AMCLIB_BemfObsrvDQ_F16(     &amp;g_stSIFocCurOutAlbe, &amp;g_stSIFocCtrlInpAlbe,     g_f16SIFocElecSpd, g_f16SIFocElecAng,     &amp;g_hndSIFocBackEmfObsrv );     ↓     [SWDDS.3.6.14.26]     AMCLIB_TrackObsrv_F16( gamma_delta_error,     &amp;g_f16SIFocElecAng, &amp;g_f16SIFocElecSpd,     &amp;g_hndSIFocAngTrackObsrv );     ↓     [SWDDS.3.6.14.9]     g_f16SIFocElecSpd = GDFLIB_FilterMA_F16(     g_f16SIFocElecSpd, &amp;g_hndSIFocElecSpdFilt );     ↓     end   </pre>				
Called Function	SWDDS.3.2.1.16 ActSIFocStateOplpStart SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.6.14.25 AMCLIB_BemfObsrvDQ_F16 SWDDS.3.6.14.26 AMCLIB_TrackObsrv_F16 SWDDS.3.6.14.9 GDFLIB_FilterMA_F16				
Function Execution Time	N/A				

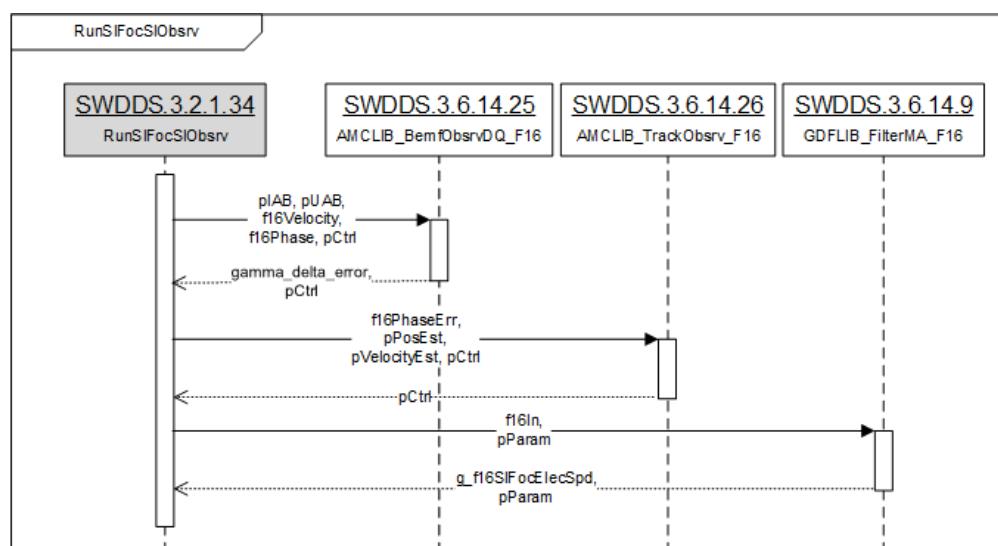
Requirement Id	SWDDS.3.2.1.34
Target Milestone	EBS2
Element	MTR
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

#### 1.1.1.1.34.2 Static View Design



#### 1.1.1.1.34.3 Dynamic View Design

1. RunSIFocSIObsrv calls the back EMF observer to calculate the estimation error.
2. RunSIFocSIObsrv calls the angle tracking observer to estimate the electric angle and electric speed.
3. RunSIFocSIObsrv calls the moving average filter to filter the estimated electric spe



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
					Page	115

#### 1.1.1.34.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	pIAB	SWDDS.3.6.14.25	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Ipha/beta-axis current output
2	pUAB	SWDDS.3.6.14.25	OUT	SWLIBS_2Syst_F16 *	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	alpha/beta-axis control input
3	f16Velocity	SWDDS.3.6.14.25	OUT	tFrac16	-32767	32768	-6000.0	5999.82	0.183105 / rpm	Estimated electric speed
4	f16Phase	SWDDS.3.6.14.25	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle
5	pCtrl	SWDDS.3.6.14.25	IN/OUT	AMCLIB_BEMF _OBSRV_DQ_T_F16 *	N/A	N/A	N/A	N/A	N/A	Back-EMF observer handler
6	gamma_delta_error	SWDDS.3.6.14.25	IN	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	Back-EMF observer estimation error
7	f16PhaseErr	SWDDS.3.6.14.26	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Back-EMF observer estimation error
8	pPosEst	SWDDS.3.6.14.26	OUT	tFrac16 *	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle
9	pVelocityEst	SWDDS.3.6.14.26	OUT	tFrac16 *	-32767	32768	-6000.0	5999.82	0.183105 / rpm	Estimated electric speed
10	pCtrl	SWDDS.3.6.14.26	IN/OUT	AMCLIB_TRACK _OBSRV_T_F16 *	N/A	N/A	N/A	N/A	N/A	Angle tracking observer handler
11	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32767	32768	-6000.0	5999.82	0.183105 / rpm	Estimated electric speed
12	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER _MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Electric speed filtering handler
13	g_f16SIFocElecSpd	SWDDS.3.6.14.9	IN	tFrac16	-32767	32768	-6000.0	5999.82	0.183105 / rpm	Estimated electric speed

#### 1.1.1.35 [SWDDS.3.2.1.35] ConvertSIFocParkTrnsf

##### 1.1.1.35.1 Detailed Design

##### [SWDDS.3.2.1.35] ConvertSIFocParkTrnsf

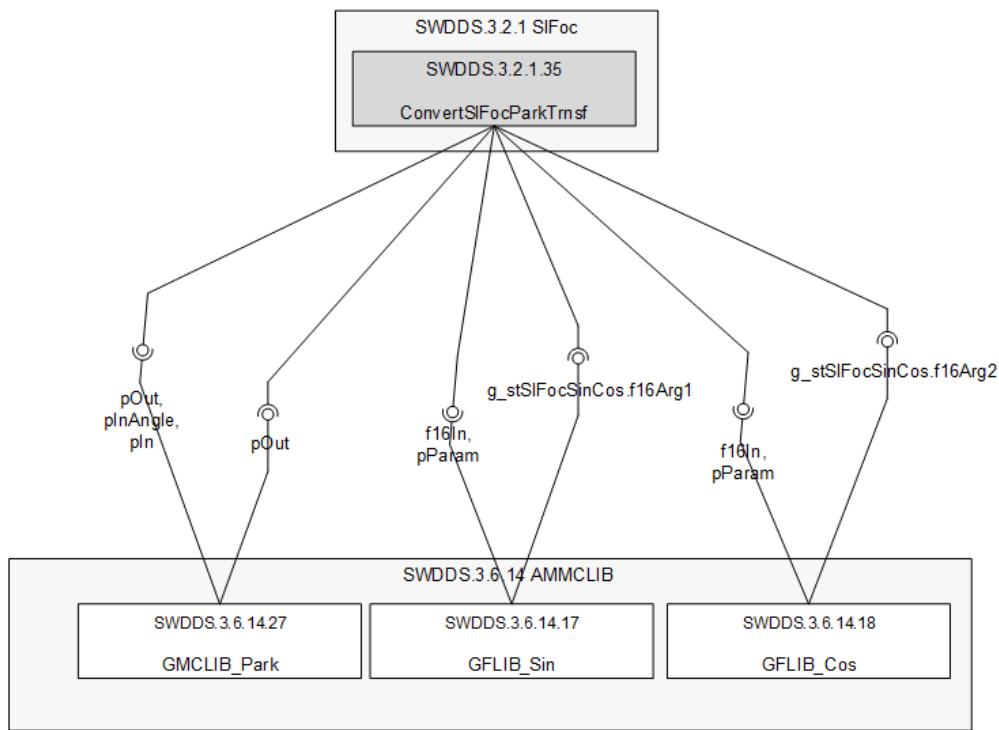
Software Unit Information			
Unit ID	SWDDS.3.2.1.35	Unit Name	ConvertSIFocParkTrnsf
Architecture ID	SWADS.3.2.1.35	ASIL	QM
Prototype	void ConvertSIFocParkTrnsf( void )		

	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-04-30
				Page	116

Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
		void		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocSinCos.f16Arg1	-32768 ~ 32767 -1.0 ~ 0.999969	Read/Write	sin and cos of electric angle for transformation : sin (PU)
	tFrac16	g_f16SIFocElecAng	-32768 ~ 32767 -180 ~ 179.995deg	Read	Estimated electric angle (PU)
	tFrac16	g_stSIFocSinCos.f16Arg2	-32768 ~ 32767 -1.0 ~ 0.999969	Read/Write	sin and cos of electric angle for transformation : cos (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	d/q-axis current output : d-axis (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	d/q-axis current output : q-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	alpha/beta-axis current output : alpha-axis (PU)
	tFrac16	g_stSIFocCurOutAlbe.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	alpha/beta-axis current output : beta-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Park transformation - sin and cos value of estimated electric angle storing - Park transformation				
Control Flow Diagram (or Pseudo Code)	<p>1. ConvertSIFocParkTrnsf calculates the sin and cos value of the estimated electric angle.</p> <p>2. ConvertSIFocParkTrnsf converts from alpha/beta-axis current to d/q-axis current using Park transformation.</p> <pre> graph TD     start([start]) --&gt; S1[SWDDS.3.6.14.17 g_stSIFocSinCos.f16Arg1 = GFLIB_Sin( g_f16SIFocElecAng);]     S1 --&gt; S2[SWDDS.3.6.14.18 g_stSIFocSinCos.f16Arg2 = GFLIB_Cos( g_f16SIFocElecAng);]     S2 --&gt; S3[SWDDS.3.6.14.27 GMCLIB_Park(&amp;g_stSIFocCurOutDq, &amp;g_stSIFocCurOutAlbe);]     S3 --&gt; end([end]) </pre>				
Called Function	SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.6.14.17 GFLIB_Sin				
	SWDDS.3.6.14.18 GFLIB_Cos				
	SWDDS.3.6.14.27 GMCLIB_Park				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.35
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	● High
Technical complexity	■ Mid
Verifiability	Yes

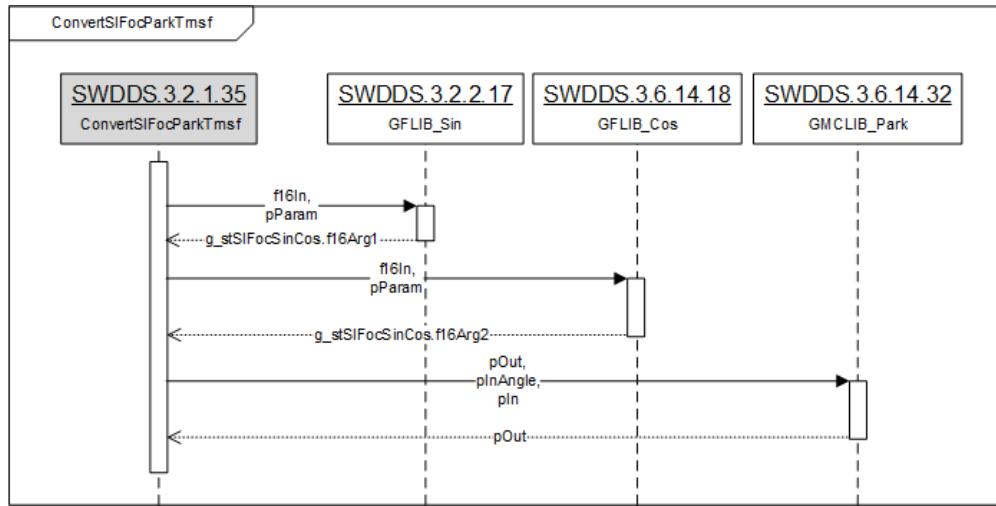
#### 1.1.1.35.2 Static View Design



#### 1.1.1.35.3 Dynamic View Design

1. ConvertSIFocParkTrnsf calls the fixed-point arithmetic sin and cos function.
2. ConvertSIFocParkTrnsf calls the Park transformation.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	118



#### 1.1.1.1.35.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	f16In	SWDDS.3.6.14.17	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle sin and cos of electric angle for transformation : argument1
2	g_stSIFocSinCos.f16Arg1	SWDDS.3.6.14.17	IN	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	Estimated electric angle sin and cos of electric angle for transformation : argument1
3	f16In	SWDDS.3.6.14.18	OUT	tFrac16	-32768	32768	-180	179.995	0.00549316 / deg	Estimated electric angle sin and cos of electric angle for transformation : argument2
4	g_stSIFocSinCos.f16Arg2	SWDDS.3.6.14.18	IN	tFrac16	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	Estimated electric angle sin and cos of electric angle for transformation : argument2
5	pOut	SWDDS.3.6.14.27	IN/OUT	SWLIBS_2Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	d/q-axis current output
6	plnAngle	SWDDS.3.6.14.27	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	Estimated electric angle alpha/beta-axis current output
7	pln	SWDDS.3.6.14.27	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Estimated electric angle alpha/beta-axis current output
8	pParam	SWDDS.3.6.14.17	OUT	const GFLIB_SIN_T_F16 *const	-32768	32767	-1	0.999969	N/A	sin value of electric angle
9	pParam	SWDDS.3.6.14.18	OUT	const GFLIB_COS_T_F16 *const	-32768	32767	-1	0.999969	N/A	cos value of electric angle

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	119

### 1.1.1.1.36 [SWDDS.3.2.1.36] CalculateSIFocCurErrDq

#### 1.1.1.1.36.1 Detailed Design

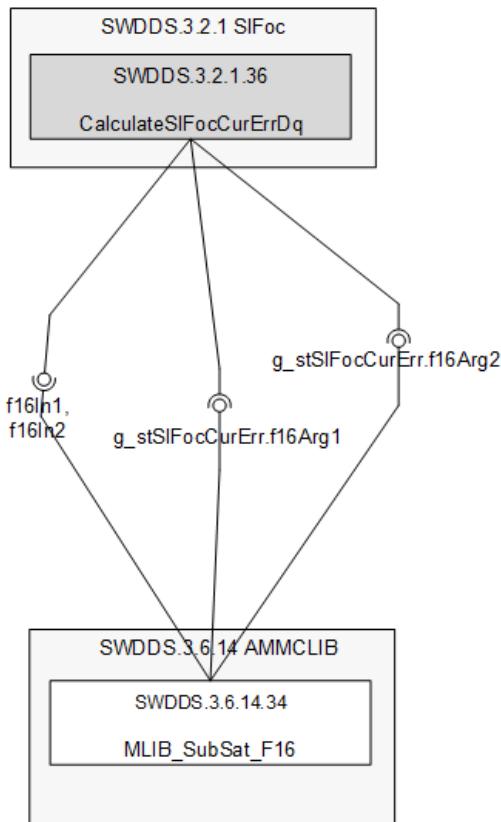
##### [SWDDS.3.2.1.36] CalculateSIFocCurErrDq

Software Unit Information					
Unit ID	SWDDS.3.2.1.36	Unit Name	CalculateSIFocCurErrDq		
Architecture ID	SWADS.3.2.1.36	ASIL	QM		
Prototype	void CalculateSIFocCurErrDq( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurErr.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Current control error : d-axis (PU)
	tFrac16	g_stSIFocCurErr.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	Current control error : q-axis (PU)
	tFrac16	g_stSIFocRefCur.f16Arg1	0 0.0Apk	Read	Reference current : d-axis (PU)
	tFrac16	g_stSIFocRefCur.f16Arg2	-11430 ~ 11430 -22.5 ~ 22.5Apk	Read	Reference current : q-axis (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d/q-axis current output : d-axis (PU)
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d/q-axis current output : q-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	d/q-axis current control error calculation - d/q-axis current control error calculation				
Control Flow Diagram (or Pseudo Code)	1. CalculateSIFocCurErrDq calculates the d/q-axis current control error.				
	<pre> start     [SWDDS.3.6.14.34]     g_stSIFocCurErr.f16Arg1 = M_LIB_SubSat_F16(         g_stSIFocRefCur.f16Arg1, g_stSIFocCurOutDq.f16Arg1 );     </pre>				
	<pre> [SWDDS.3.6.14.34]     g_stSIFocCurErr.f16Arg2 = M_LIB_SubSat_F16(         g_stSIFocRefCur.f16Arg2, g_stSIFocCurOutDq.f16Arg2 );     </pre>				
	<pre> end </pre>				
	SWDDS.3.2.1.17 ActSIFocStateSIRun				
	SWDDS.3.6.14.34 MLIB_SubSat_F16				
	N/A				

Requirement Id	SWDDS.3.2.1.36
Target Milestone	EBS2

Element	MTR
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

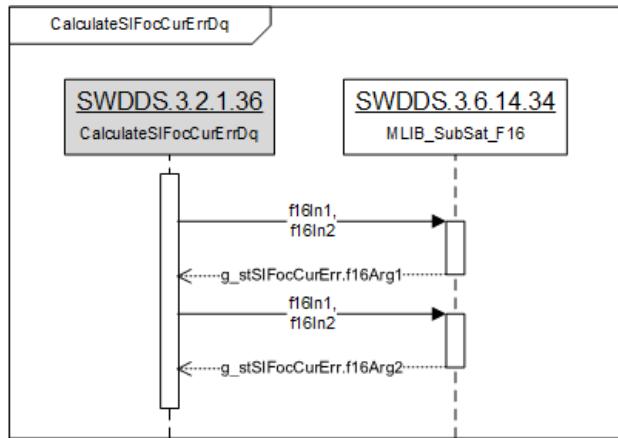
#### 1.1.1.1.36.2 Static View Design



#### 1.1.1.1.36.3 Dynamic View Design

1. `CalculateSIFocCurErrDq` calls the fixed-point arithmetic subtraction function.

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	121



#### 1.1.1.1.36.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Reference current : argument1
2	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	d/q-axis current output : argument1
3	g_stSIFocCurErr.f16Arg1	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument1
4	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Reference current : argument2
5	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	d/q-axis current output : argument2
6	g_stSIFocCurErr.f16Arg2	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument2

#### 1.1.1.1.37 [SWDDS.3.2.1.37] RunSIFocCurCtrD

##### 1.1.1.1.37.1 Detailed Design

#### [SWDDS.3.2.1.37] RunSIFocCurCtrD

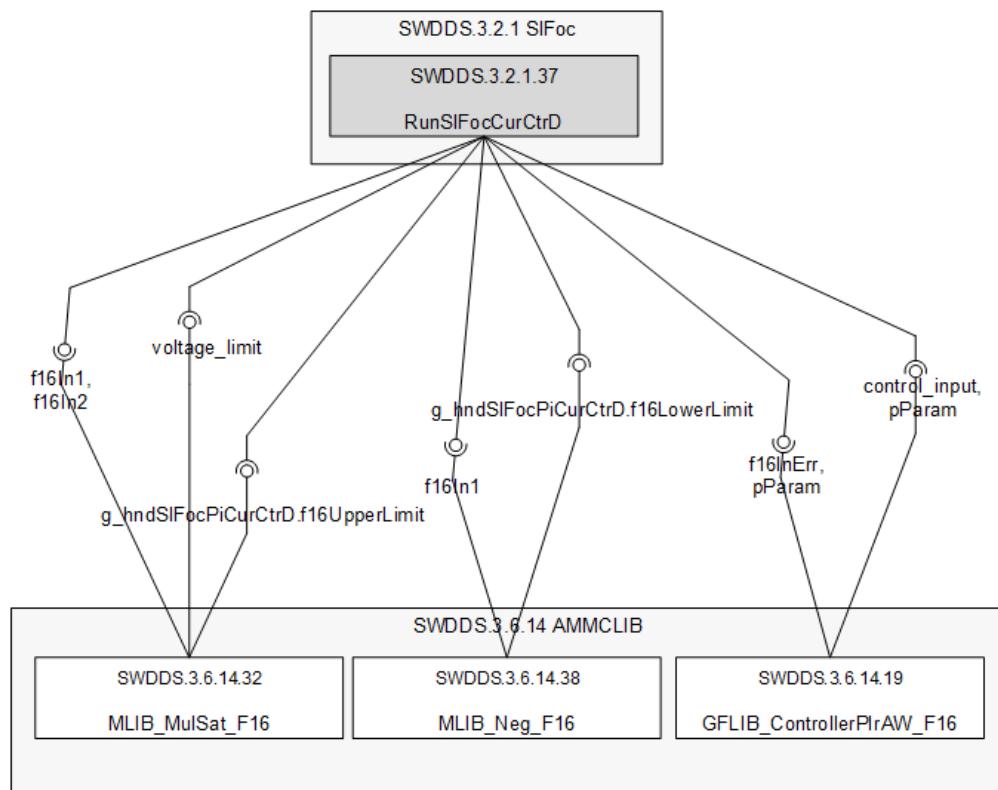
Software Unit Information					
Unit ID	SWDDS.3.2.1.37		Unit Name	RunSIFocCurCtrD	
Architecture ID	SWADS.3.2.1.37		ASIL	QM	
Prototype	tFrac16 RunSIFocCurCtrD( void )				
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data	Possible Return Value			Description

Return Value	Type				
	tFrac16	-32768 ~ 32767 -25.4 ~ 25.3992Vpk		Calculated d-axis or alpha-axis control input (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocDcVolt	0 ~ 32767 0 ~ 25.3992Vpk	Read	DC driving voltage (PU)
	tFrac16	g_hndSIFocPiCurCtrD.f16UpperLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	d-axis PI current control handler : UpperLimit (PU)
	tFrac16	g_hndSIFocPiCurCtrD.f16LowerLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	d-axis PI current control handler : LowerLimit (PU)
	tFrac16	g_stSIFocCurErr.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	Current control error : d-axis or alpha-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FocPhsVoltLmt	18919 0.577367	Read	FOC control phase voltage limiting factor
	tFrac16	par_f16FocCtrInpLmt	30310 0.925	Read	FOC control input voltage limiting factor for current sensing
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	d-axis or alpha-axis current control logic running - d-axis voltage limit calculation - d-axis control input calculation				
Control Flow Diagram (or Pseudo Code)	<p>1. RunSIFocCurCtrD calculates the maximum applicable phase voltage from DC driving voltage.            2. RunSIFocCurCtrD sets the upper and lower d-axis PI current control limits.            3. RunSIFocCurCtrD calculates the d-axis control input voltage using d-axis PI current control.</p> <pre>     graph TD       start([start]) --&gt; init[tFrac16 voltage_limit; tFrac16 control_input;]       init --&gt; calcUpperLimit[SWDDS.3.6.14.32] voltage_limit = MLIB_MulSat_F16( par_f16FocPhsVoltLmt, g_f16SIFocDcVolt );       calcUpperLimit --&gt; calcLowerLimit[SWDDS.3.6.14.32] g_hndSIFocPiCurCtrD.f16UpperLimit = MLIB_MulSat_F16(voltage_limit, par_f16FocCtrInpLmt );       calcLowerLimit --&gt; negF16[SWDDS.3.6.14.38] g_hndSIFocPiCurCtrD.f16LowerLimit = MLIB_Neg_F16( g_hndSIFocPiCurCtrD.f16UpperLimit );       negF16 --&gt; controllerPIrAW[SWDDS.3.6.14.19] control_input = GFLIB_ControllerPIrAW_F16( g_stSIFocCurErr.f16Arg1, &amp;g_hndSIFocPiCurCtrD );       controllerPIrAW --&gt; return((return control_input));     </pre>				
Called Function	SWDDS.3.2.1.14 RunSIFocStateAlignOpIp SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.6.14.32 MLIB_MulSat_F16 SWDDS.3.6.14.38 MLIB_Neg_F16				

SWDDS.3.6.14.19 GFLIB_ControllerPlrAW_F16	
Function	
Execution Time	N/A

Requirement Id	SWDDS.3.2.1.37
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.37.2 Static View Design

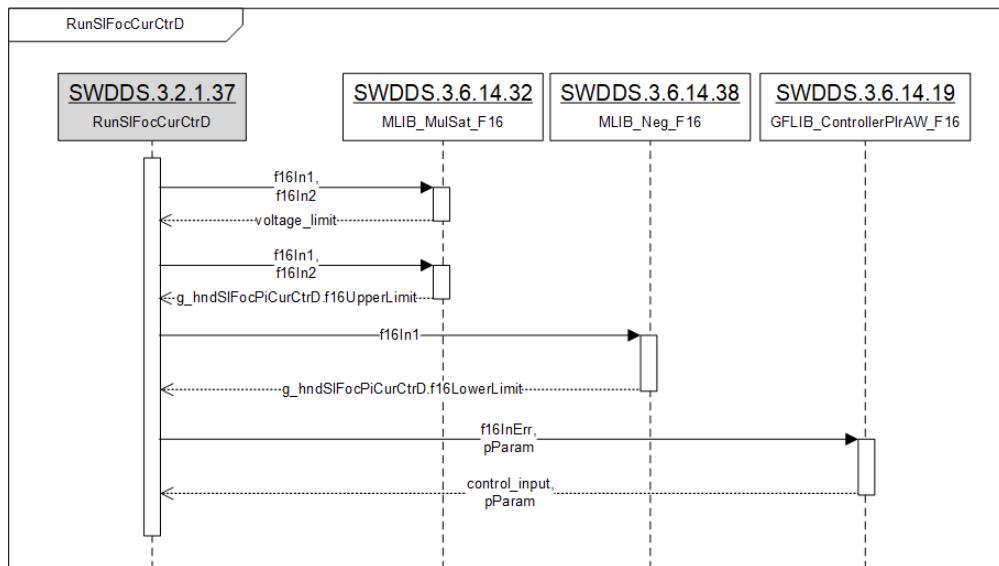


<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	124

#### 1.1.1.37.3 Dynamic View Design

1. RunSIFocCurCtrD calls the fixed-point arithmetic subtraction, multiplication and negative function to calculate DC phase voltage limit.

2. RunSIFocCurCtrD calls the PI current control.



#### 1.1.1.37.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	18919	18919	0.577367	0.577367	N/A	FOC control phase voltage limiting factor
2	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC driving voltage
3	voltage_limit	SWDDS.3.6.14.32	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis phase voltage(control input) limit
4	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis phase voltage(control input) limit
5	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	30310	30310	0.925	0.925	N/A	FOC control input voltage limiting factor for current sensing
6	g_hndSIFocPiCurCtrD.f16UpperLimit	SWDDS.3.6.14.32	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis PI current control handler : UpperLimit
7	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis PI current control handler : UpperLimit
8	g_hndSIFocPiCurCtrD.f16LowerLimit	SWDDS.3.6.14.38	IN	tFrac16	-32768	0	-25.4	0.0	0.000775146 / Vpk	d-axis PI current control handler : LowerLimit
9	f16InErr	SWDDS.3.6.14.19	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument1
GFLIB										

	VW AQ EOP						Baseline / Version / Date	003
	Software Detailed Design Specification						Updated Date	2021-04-30
							Page	125

10	pParam	SWDDS.3.6.14.19	IN/OUT	_CONTROLLER _PIAW_R_T_F16 *	N/A	N/A	N/A	N/A	N/A	current control handler
11	control_input	SWDDS.3.6.14.19	IN	tFrac16	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	d-axis calculated control input

### 1.1.1.1.38 [SWDDS.3.2.1.38] RunSIFocCurCtrQ

#### 1.1.1.1.38.1 Detailed Design

##### [SWDDS.3.2.1.38] RunSIFocCurCtrQ

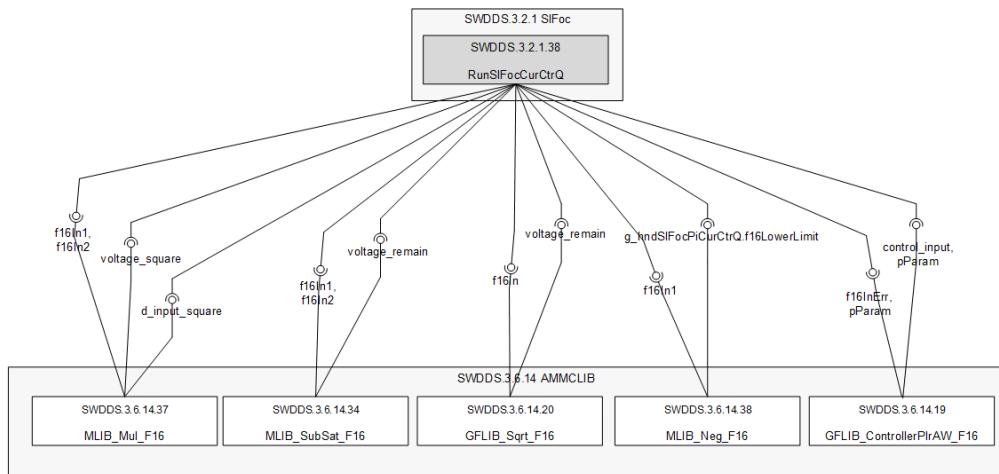
Software Unit Information					
Unit ID	SWDDS.3.2.1.38		Unit Name	RunSIFocCurCtrQ	
Architecture ID	SWADS.3.2.1.38		ASIL	QM	
Prototype	tFrac16 RunSIFocCurCtrQ( tFrac16 d_axis_control_input )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	d_axis_control_input	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	IN	d-axis or alpha-axis control input (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767 -25.4 ~ 25.3992Vpk		Calculated q-axis or beta-axis control input (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_hndSIFocPiCurCtrD.f16UpperLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d-axis PI current control handler : UpperLimit (PU)
	tFrac16	g_hndSIFocPiCurCtrQ.f16UpperLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read/Write	q-axis PI current control handler : UpperLimit (PU)
	tFrac16	g_hndSIFocPiCurCtrQ.f16LowerLimit	-32768 ~ 32767 -64.5 ~ 64.498Apk	Write	q-axis PI current control handler : LowerLimit (PU)
	tFrac16	g_stSIFocCurErr.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	Current control error : q-axis (PU)
	tFrac32	g_hndSIFocPiCurCtrQ.f32Acc	-2147483648 ~ 2147483647	Read/Write	q-axis PI current control handler : internal controller accumulator
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	q-axis or beta-axis current control logic running - q-axis voltage limit calculation - q-axis control input calculation				
	1. RunSIFocCurCtrQ calculates the q-axis applicable phase current limit. 2. RunSIFocCurCtrQ sets the upper and lower q-axis PI current control limit. 3. RunSIFocCurCtrQ calculates the q-axis control input voltage.				

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     [tFrac16 voltage_limit,      voltage_square,      d_input_square,      voltage_remain;      tFrac16 control_input;      voltage_limit = g_hndSIFocPicurCtrD.f16UpperLimit;      [SWDDS.3.6.14.37]     voltage_square = MLIB_Mul_F16( voltage_limit,                                     voltage_limit );      [SWDDS.3.6.14.37]     d_input_square = MLIB_Mul_F16( d_axis_control_input,                                     d_axis_control_input );      [SWDDS.3.6.14.34]     voltage_remain = MLIB_SubSat_F16( voltage_square,  d_input_square );      [SWDDS.3.6.14.20]     voltage_remain = GFLIB_Sqrt_F16( voltage_remain );      g_hndSIFocPicurCtrQ.f16UpperLimit = voltage_remain;      [SWDDS.3.6.14.38]     g_hndSIFocPicurCtrQ.f16LowerLimit = MLIB_Neg_F16(         g_hndSIFocPicurCtrQ.f16UpperLimit );      [SWDDS.3.6.14.19]     control_input = GFLIB_ControllerPIrAW_F16(         g_stSIFocCurErr.f16Arg2, &amp;g_hndSIFocPicurCtrQ );      return control_input;   </pre>
	SWDDS.3.2.1.14 RunSIFocStateAlignOplp
	SWDDS.3.2.1.17 ActSIFocStateSIRun
	SWDDS.3.6.14.37 MLIB_Mul_F16
	SWDDS.3.6.14.34 MLIB_SubSat_F16
	SWDDS.3.6.14.20 GFLIB_Sqrt_F16
	SWDDS.3.6.14.38 MLIB_Neg_F16
	SWDDS.3.6.14.19 GFLIB_ControllerPIrAW_F16
Called Function	N/A
Calling Function	
Function Execution Time	

Requirement Id	SWDDS.3.2.1.38
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	High
Verifiability	Yes

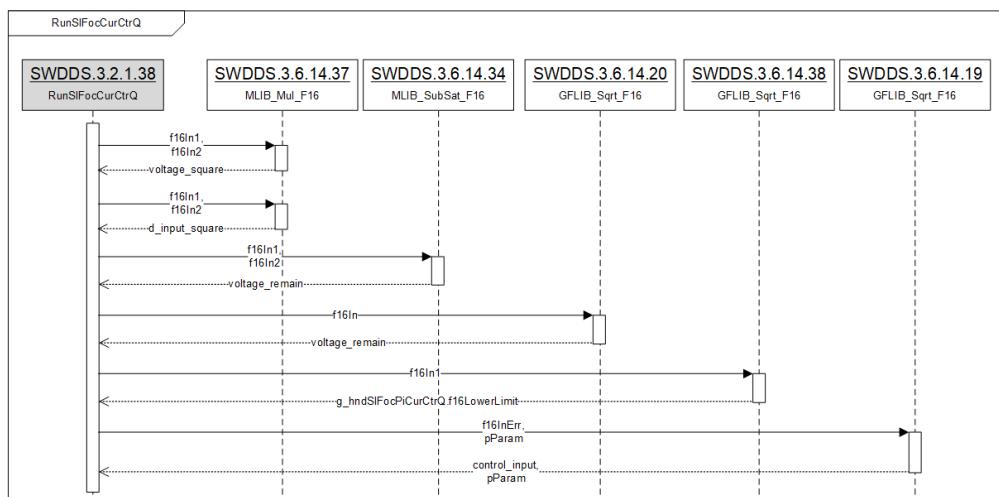
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	127

#### 1.1.1.1.38.2 Static View Design



#### 1.1.1.1.38.3 Dynamic View Design

1. RunSIFocCurCtrQ calls the fixed-point multiplication, subtraction and square root function to calculate the q-axis voltage limit.
2. RunSIFocCurCtrQ calls the fixed-point negative function.
3. RunSIFocCurCtrQ calls the PI current control.



#### 1.1.1.1.38.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Phase voltage(control input) limit
2	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Phase voltage(control input) limit
3	voltage_square	SWDDS.3.6.14.37	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Square of phase voltage input limit
4	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis control input

<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-04-30
								Page	128

5	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	d-axis control input
6	d_input_square	SWDDS.3.6.14.37	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Square of d-axis control input
7	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Square of phase voltage input limit
8	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Square of d-axis control input
9	voltage_remain	SWDDS.3.6.14.34	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	q-axis phase voltage remain
10	f16In	SWDDS.3.6.14.20	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	q-axis phase voltage remain
11	voltage_remain	SWDDS.3.6.14.20	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	q-axis phase voltage remain
12	f16In1	SWDDS.3.6.14.38	IN/OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	q-axis PI current control handler : UpperLimit
13	g_hndSIFocPiCurCtrQ .f16LowerLimit	SWDDS.3.6.14.38	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	q-axis PI current control handler : LowerLimit
14	f16InErr	SWDDS.3.6.14.19	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	Current control error : argument2
15	pParam	SWDDS.3.6.14.19	IN/OUT	GFLIB _CONTROLLER _PIAW _R_T_F16 *	N/A	N/A	N/A	N/A	N/A	q-axis PI current control handler
16	control_input	SWDDS.3.6.14.19	IN	tFrac16	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	q-axis control input with voltage limit

### 1.1.1.1.39 [SWDDS.3.2.1.39] ConvertSIFocInvsPark

#### 1.1.1.1.39.1 Detailed Design

##### [SWDDS.3.2.1.39] ConvertSIFocInvsPark

Software Unit Information					
Unit ID	SWDDS.3.2.1.39		Unit Name	ConvertSIFocInvsPark	
Architecture ID	SWADS.3.2.1.39		ASIL	QM	
Prototype	void ConvertSIFocInvsPark( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	alpha/beta-axis control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	alpha/beta-axis control input : beta-axis (PU)
			-32768 ~ 32767		sin and cos of electric angle for

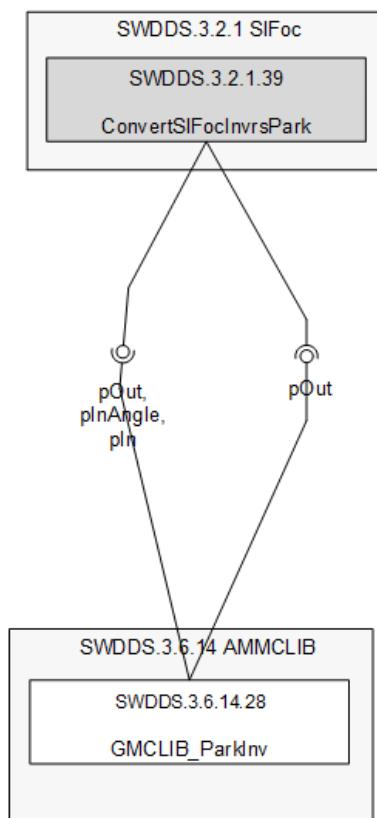
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	129

Global Variables	tFrac16	g_stSIFocSinCos.f16Arg1	-1.0 ~ 0.999969	Read	transformation : sin (PU)
	tFrac16	g_stSIFocSinCos.f16Arg2	-32768 ~ 32767 -1.0 ~ 0.999969	Read	sin and cos of electric angle for transformation : cos (PU)
	tFrac16	g_stSIFocCtrInpDq.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	d/q-axis control input : d-axis (PU)
	tFrac16	g_stSIFocCtrInpDq.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	d/q-axis control input : q-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Inverse Park transformation				
Control Flow Diagram (or Pseudo Code)	<p>1. ConvertSIFocInvrsPark converts from the d/q-axis control input voltage to the alpha/beta-axis control input voltage using inverse Park transformation with sin and cos value of the estimated electric angle.</p> <pre>     start     [SWDDS.3.6.14.28]     GMCLIB_ParkInv( &amp;g_stSIFocCtrInpAlbe,     &amp;g_stSIFocSinCos, &amp;g_stSIFocCtrInpDq );     end   </pre>				
Called Function	SWDDS.3.2.1.17 ActSIFocStateSIRun				
Calling Function	SWDDS.3.6.14.28 GMCLIB_ParkInv				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.39
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	■ High
Technical complexity	■ Low
Verifiability	Yes

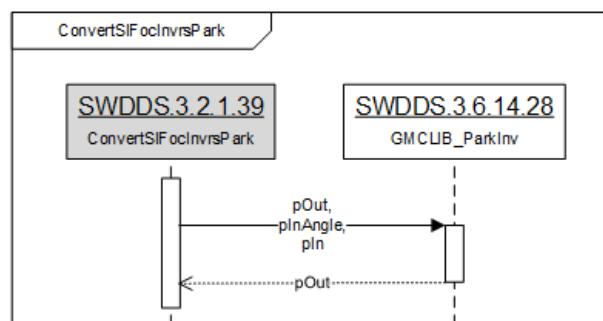
#### 1.1.1.1.39.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30



#### 1.1.1.39.3 Dynamic View Design

1. ConvertSIFocInvsPark calls the inverse Park transformation.



#### 1.1.1.39.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pOut	SWDDS.3.6.14.28	IN/OUT	SWLIBS_2Syst_F16 *	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	alpha/beta-axis control input
2	plnAngle	SWDDS.3.6.14.28	OUT	SWLIBS_2Syst_F16 *	-32767	32768	-1.0	0.999969	0.0000305176 / N/A	sin and cos of electric angle for transformation
3	pln	SWDDS.3.6.14.28	OUT	SWLIBS_2Syst_F16 *	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	d/q-axis control input

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	131

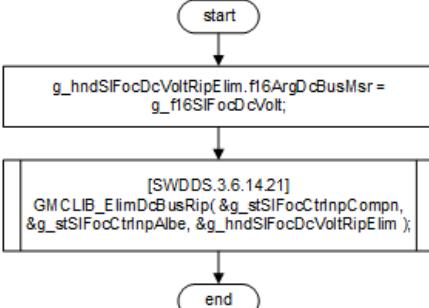
#### 1.1.1.1.40 [SWDDS.3.2.1.40] CompensateSIFocDcVolt

##### 1.1.1.1.40.1 Detailed Design

##### [SWDDS.3.2.1.40] CompensateSIFocDcVolt

Software Unit Information					
Unit ID	SWDDS.3.2.1.40	Unit Name	CompensateSIFocDcVolt		
Architecture ID	SWADS.3.2.1.40	ASIL	QM		
Prototype	void CompensateSIFocDcVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
void	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_hndSIFocDcVoltRipElim.f16ArgDcBusMsr	0 ~ 32767 0 ~ 25.3992Vpk	Read/Write	DC voltage ripple elimination handler : Measured DC bus voltage (PU)
	tFrac16	g_f16SIFocDcVolt	0 ~ 32767 0 ~ 25.3992Vpk	Read	DC driving voltage (PU)
	tFrac16	g_stSIFocCtrlInpComprn.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	DC driving voltage compensated control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpComprn.i16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Write	DC driving voltage compensated control input : beta-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpAlbe.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	alpha/beta-axis control input : alpha-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage compensation				
	1. CompensateSIFocDcVolt compensates the alpha/beta-axis control input voltage with DC driving voltage using DC driving voltage compensation function.				

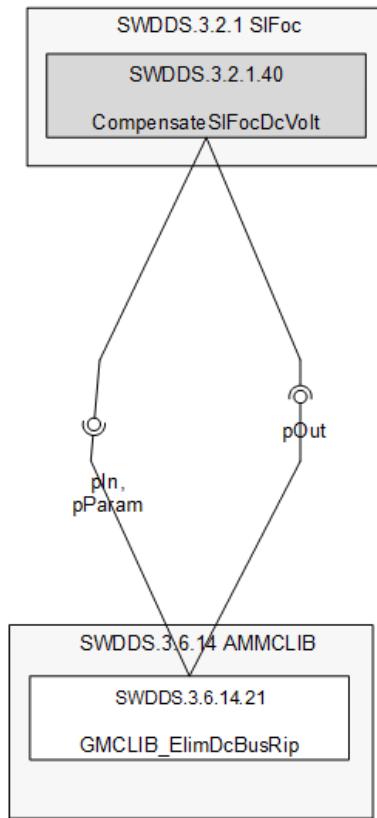
	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	132

<b>Control Flow Diagram (or Pseudo Code)</b>	 <pre> graph TD     start((start)) --&gt; S1[g_hndSIFocDcVolRipElim.f16ArgDcBusMsr = g_f16SIFocDcVolt;]     S1 --&gt; S2["[SWDDS.3.6.14.21] GMCLIB_ElimDcBusRip (&amp;g_stSIFocCtrlnpCompn, &amp;g_stSIFocCtrlnpAlbe, &amp;g_hndSIFocDcVolRipElim);"]     S2 --&gt; end((end)) </pre>
<b>Called Function</b>	SWDDS.3.2.1.14 RunSIFocStateAlignOplp SWDDS.3.2.1.17 ActSIFocStateSIRun
<b>Calling Function</b>	SWDDS.3.6.14.21 GMCLIB_ElimDcBusRip
<b>Function Execution Time</b>	N/A

Requirement Id	SWDDS.3.2.1.40
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: #f00;">■</span> High
Technical complexity	<span style="color: #090;">■</span> Low
Verifiability	Yes

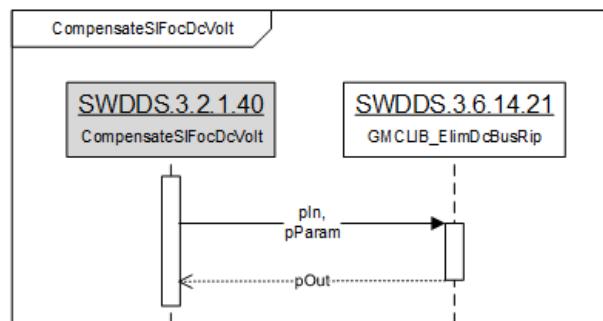
#### 1.1.1.1.40.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	133



#### 1.1.1.40.3 Dynamic View Design

1. CompensateSIFocDcVolt calls the DC driving voltage compensation.



#### 1.1.1.40.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pOut	SWDDS.3.6.14.21	IN	SWLIBS_2Syst_F16 *	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	DC driving voltage compensated control input
2	pIn	SWDDS.3.6.14.21	OUT	SWLIBS_2Syst_F16 *	-32767	32767	-25.4	25.3992	0.000775146 / Vpk	alpha/beta-axis control input
3	pParam	SWDDS.3.6.14.21	OUT	GMCLIB_ELIMDCBUSRIP_T_F16 *	N/A	N/A	N/A	N/A	N/A	DC voltage ripple elimination handler

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	134

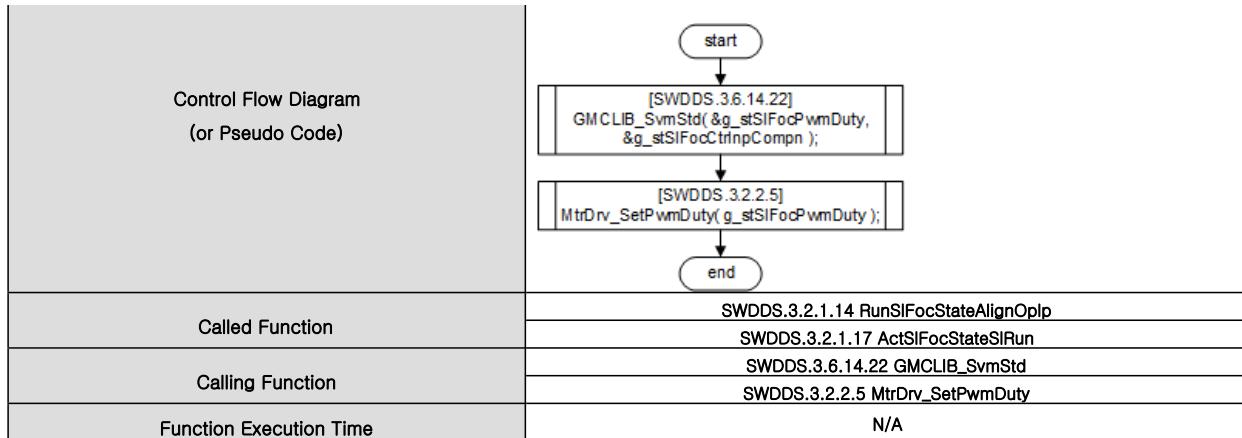
#### 1.1.1.1.41 [SWDDS.3.2.1.41] RunSIFocSpcVecPwm

##### 1.1.1.1.41.1 Detailed Design

##### [SWDDS.3.2.1.41] RunSIFocSpcVecPwm

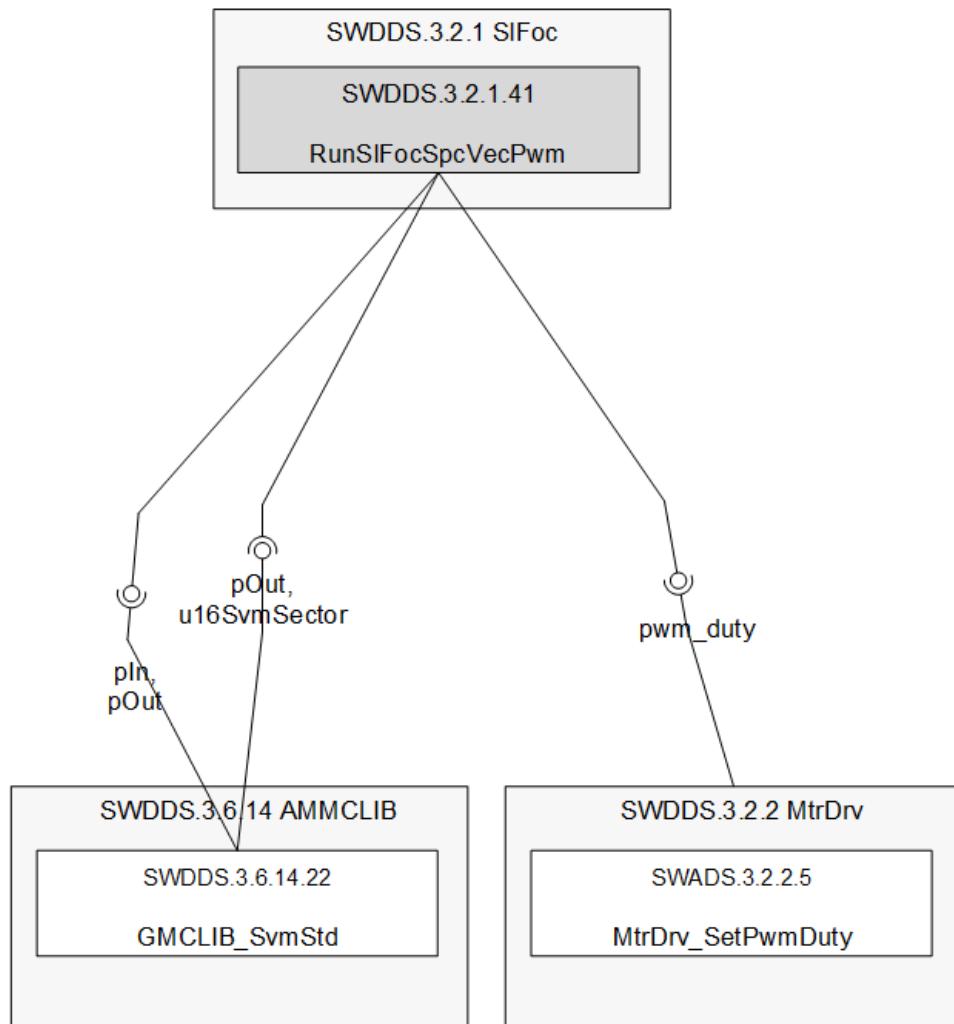
Software Unit Information					
Unit ID	SWDDS.3.2.1.41	Unit Name	RunSIFocSpcVecPwm		
Architecture ID	SWADS.3.2.1.41	ASIL	QM		
Prototype	void RunSIFocSpcVecPwm( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocPwmDuty.f16Arg1	0 ~ 32767 0 ~ 0.999969	Read/Write	PWM duty setting : phase U (PU)
	tFrac16	g_stSIFocPwmDuty.f16Arg2	0 ~ 32767 0 ~ 0.999969	Read/Write	PWM duty setting : phase V (PU)
	tFrac16	g_stSIFocPwmDuty.f16Arg3	0 ~ 32767 0 ~ 0.999969	Read/Write	PWM duty setting : phase W (PU)
	tFrac16	g_stSIFocCtrlInpCompn.f16Arg1	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	DC driving voltage compensated control input : alpha-axis (PU)
	tFrac16	g_stSIFocCtrlInpCompn.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	DC driving voltage compensated control input : beta-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Space vector PWM calculation and PWM output setting				
Control Flow Diagram (or Pseudo Code)	1. RunSIFocSpcVecPwm calculates the PWM duty using space vector PWM. 2. RunSIFocSpcVecPwm sets the PWM duty to the gate driver.				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	135



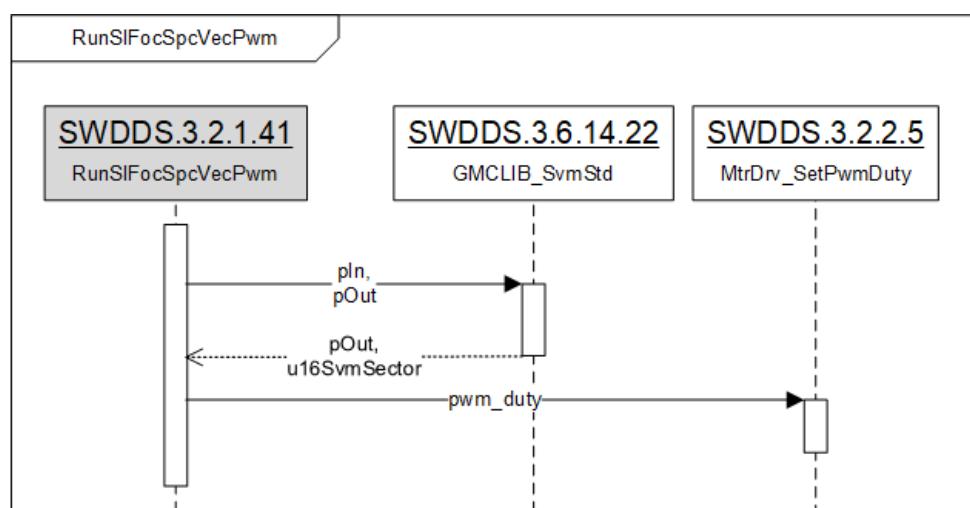
Requirement Id	SWDDS.3.2.1.41
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: orange;">□</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.1.41.2 Static View Design



#### 1.1.1.41.3 Dynamic View Design

1. RunSIFocSpcVecPwm calls space vector PWM to calculate the PWM duty.
2. RunSIFocSpcVecPwm calls the PWM duty setting function.



	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-04-30
						Page	137

#### 1.1.1.41.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range	Physical Range	Resolution /Units	Description
1	pOut	SWDDS.3.6.14.22	IN/OUT	SWLIBLES_3Syst_F16 *	0 32767	0 0.999969	0.0000305176 / N/A	PWM duty setting DC driving
2	pln	SWDDS.3.6.14.22	OUT	SWLIBLES_2Syst_F16 *	-32767 32767	-25.4 25.3992	0.000775146 / Vpk	voltage compensated control input
3	pwm_duty	SWDDS.3.2.2.5	OUT	SWLIBLES_3Syst_F16	0 32767	0 0.999969	0.0000305176 / N/A	PWM duty setting DC voltage
4	u16SvmSector	SWDDS.3.6.14.22	IN	tU16	-32768 32767	-14.6647 14.6642	0.000447531 / Vpk	compensated voltage input (PU)

#### 1.1.1.42 [SWDDS.3.2.1.42] CheckSIFocFltCond

##### 1.1.1.42.1 Detailed Design

##### [SWDDS.3.2.1.42] CheckSIFocFltCond

Software Unit Information					
Unit ID	SWDDS.3.2.1.42		Unit Name	CheckSIFocFltCond	
Architecture ID	SWADS.3.2.1.42		ASIL	QM	
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCurOutPhs3.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase U (PU)
	tU16	g_u16SIFocPhsCurOvrCntU	0 ~ 65535	Read/Write	U-phase current over count
	tFrac16	g_stSIFocCurOutPhs3.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase V (PU)
	tU16	g_u16SIFocPhsCurOvrCntV	0 ~ 65535	Read/Write	V-phase current over count
	tFrac16	g_stSIFocCurOutPhs3.f16Arg3	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	3-phase current output : phase W (PU)
	tU16	g_u16SIFocPhsCurOvrCntW	0 ~ 65535	Read/Write	W-phase current over count
	tFrac16	g_stSIFocCurOutDq.f16Arg1	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d/q-axis current output : d-axis (PU)
	tU16	g_u16SIFocPhsCurOvrCntD	0 ~ 65535	Read/Write	d-axis current over count
	tFrac16	g_stSIFocCurOutDq.f16Arg2	-32768 ~ 32767 -64.5 ~ 64.498Apk	Read	d/q-axis current output : q-axis (PU)
Parameters	tU16	g_u16SIFocPhsCurOvrCntQ	0 ~ 65535	Read/Write	q-axis current over count
	tU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Fault condition checking					
- U-phase current range checking					
- V-phase current range checking					
- W-phase current range checking					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	138

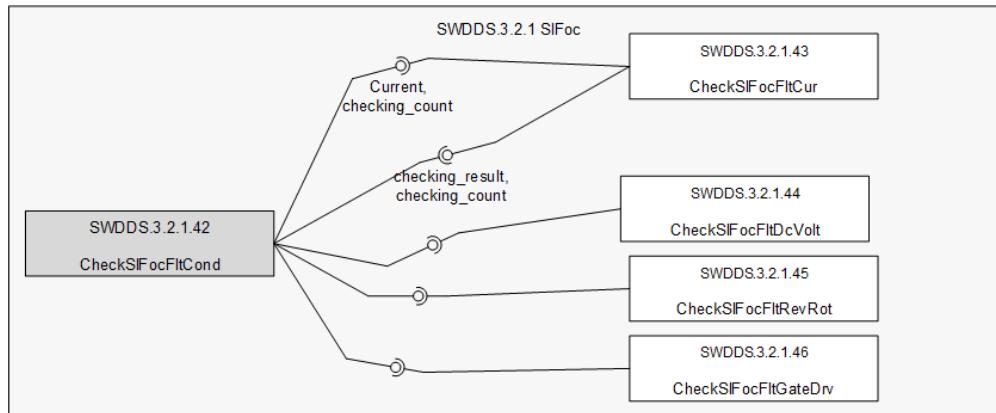
<b>Description</b>	<ul style="list-style-type: none"> <li>- d-axis current range checking</li> <li>- q-axis current range checking</li> <li>- DC driving voltage range checking</li> <li>- Reverse rotation checking</li> <li>- Gate driver fault checking</li> </ul>
	<ol style="list-style-type: none"> <li>1. CheckSIFocFitCond checks the phase U current range.</li> <li>2. CheckSIFocFitCond checks the phase V current range.</li> <li>3. CheckSIFocFitCond checks the phase W current range.</li> <li>4. CheckSIFocFitCond checks the d-axis current range.</li> <li>5. CheckSIFocFitCond checks the q-axis current range.</li> <li>6. CheckSIFocFitCond checks the DC driving voltage range.</li> <li>7. CheckSIFocFitCond checks the reverse rotation.</li> <li>8. CheckSIFocFitCond checks the gate driver fault.</li> </ol>
<b>Control Flow Diagram (or Pseudo Code)</b>	

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre> start   tBool checking_result;   [SWDDS.3.2.1.43]   checking_result = CheckSIFocFltCur(     g_stSIFocCurOutPhs3.fl6Arg1, &amp;g_u16SIFocPhsCurOvrCntU );   if( checking_result != FALSE ) {     g_u16SIFocFltSta  = CTR_FLT_PHS_CUR_OVR_U;   }   [SWDDS.3.2.1.43]   checking_result = CheckSIFocFltCur(     g_stSIFocCurOutPhs3.fl6Arg2, &amp;g_u16SIFocPhsCurOvrCntV );   if( checking_result != FALSE ) {     g_u16SIFocFltSta  = CTR_FLT_PHS_CUR_OVR_V;   }   [SWDDS.3.2.1.43]   checking_result = CheckSIFocFltCur(     g_stSIFocCurOutPhs3.fl6Arg3, &amp;g_u16SIFocPhsCurOvrCntW );   if( checking_result != FALSE ) {     g_u16SIFocFltSta  = CTR_FLT_PHS_CUR_OVR_W;   }   [SWDDS.3.2.1.43]   checking_result = CheckSIFocFltCur(     g_stSIFocCurOutDq.fl6Arg1, &amp;g_u16SIFocPhsCurOvrCntD );   if( checking_result != FALSE ) {     g_u16SIFocFltSta  = CTR_FLT_PHS_CUR_OVR_D;   }   [SWDDS.3.2.1.43]   checking_result = CheckSIFocFltCur(     g_stSIFocCurOutDq.fl6Arg2, &amp;g_u16SIFocPhsCurOvrCntQ );   if( checking_result != FALSE ) {     g_u16SIFocFltSta  = CTR_FLT_PHS_CUR_OVR_Q;   }   [SWDDS.3.2.1.44]   CheckSIFocFltDcVolt();   [SWDDS.3.2.1.45]   CheckSIFocFltRevRot();   [SWDDS.3.2.1.46]   CheckSIFocFltGateDrv(); end </pre>	
	Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc
	Calling Function	SWDDS.3.2.1.43 CheckSIFocFltCur
		SWDDS.3.2.1.44 CheckSIFocFltDcVolt
		SWDDS.3.2.1.45 CheckSIFocFltRevRot
		SWDDS.3.2.1.46 CheckSIFocFltGateDrv
	Function Execution Time	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	140

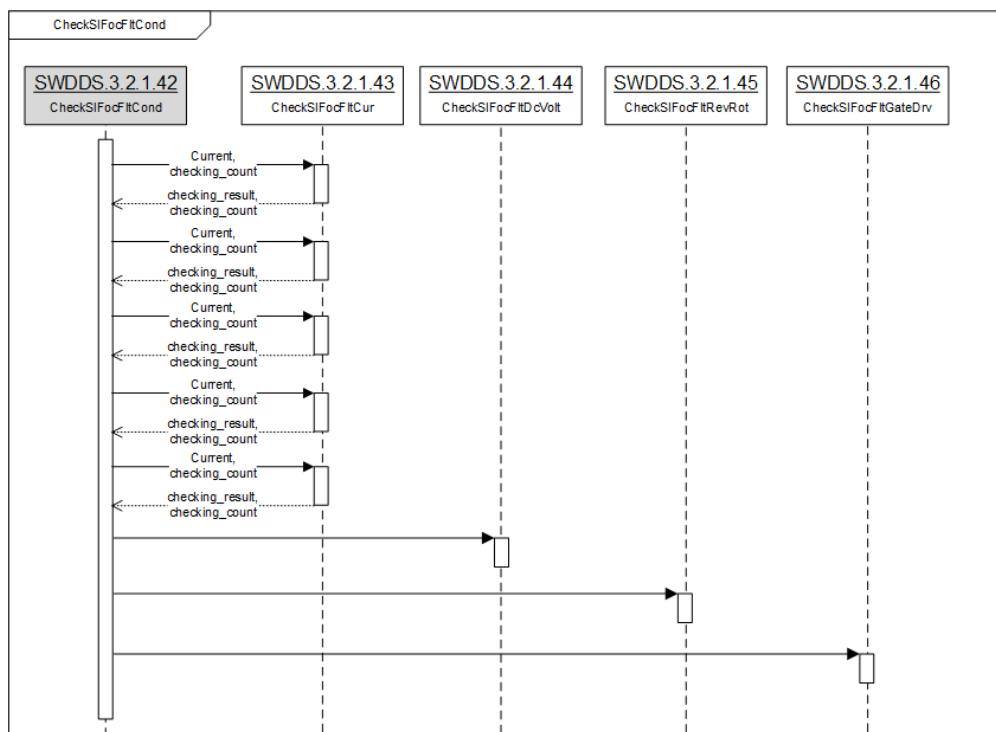
Requirement Id	SWDDS.3.2.1.42
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	High
Verifiability	Yes

#### 1.1.1.1.42.2 Static View Design



#### 1.1.1.1.42.3 Dynamic View Design

1. CheckSIFocFltCond calls the current range checking.
2. CheckSIFocFltCond calls the DC driving voltage range checking.
3. CheckSIFocFltCond calls the reverse rotation checking.
4. CheckSIFocFltCond calls the gate driver fault checking.



#### 1.1.1.42.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	current	SWDDS.3.2.1.43	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument1
2	checking_count	SWDDS.3.2.1.43	IN/OUT	tU16*	0	65535	0	65535	N/A	U-phase current over count
3	checking_result	SWDDS.3.2.1.43	IN	tBool	0	1	Normal	Fault (range over)	N/A	U-phase current range checking result
4	current	SWDDS.3.2.1.43	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument2
5	checking_count	SWDDS.3.2.1.43	IN/OUT	tU16*	0	65535	0	65535	N/A	V-phase current over count
6	checking_result	SWDDS.3.2.1.43	IN	tBool	0	1	Normal	Fault (range over)	N/A	V-phase current range checking result
7	current	SWDDS.3.2.1.43	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	3-phase current output : argument3
8	checking_count	SWDDS.3.2.1.43	IN/OUT	tU16*	0	65535	0	65535	N/A	W-phase current over count
9	checking_result	SWDDS.3.2.1.43	IN	tBool	0	1	Normal	Fault (range over)	N/A	W-phase current range

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-04-30
									Page	142

								over)		checking result
10	current	SWDDS.3.2.1.43	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	d/q-axis current output : argument1
11	checking_count	SWDDS.3.2.1.43	IN/OUT	tU16*	0	65535	0	65535	N/A	d-axis current over count
12	checking_result	SWDDS.3.2.1.43	IN	tBool	0	1	Normal	Fault (range over)	N/A	d-axis current range checking result
13	current	SWDDS.3.2.1.43	OUT	tFrac16	-32767	32768	-64.5	64.4980	0.00196838 / Apk	d/q-axis current output : argument2
14	checking_count	SWDDS.3.2.1.43	IN/OUT	tU16*	0	65535	0	65535	N/A	q-axis current over count
15	checking_result	SWDDS.3.2.1.43	IN	tBool	0	1	Normal	Fault (range over)	N/A	q-axis current range checking result

#### 1.1.1.1.43 [SWDDS.3.2.1.43] CheckSIFocFltCur

##### 1.1.1.1.43.1 Detailed Design

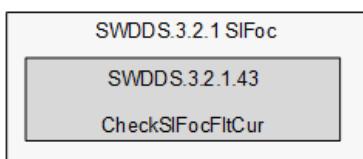
###### [SWDDS.3.2.1.43] CheckSIFocFltCur

Software Unit Information					
Unit ID	SWDDS.3.2.1.43		Unit Name	CheckSIFocFltCur	
Architecture ID	SWADS.3.2.1.43		ASIL	QM	
Prototype	tBool CheckSIFocFltCur( tFrac16 current, tU16* checking_count )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	current	-32768 ~ 32767 -64.5 ~ 64.498Apk	IN	current (PU)
	tU16*	checking_count	0 ~ 65535	IN/OUT	fault checking count
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1 Normal / Fault (range over)		FALSE – normal, TRUE – fault (range over)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16CurSigPhsPeakThrs	25401 50.0Apk	Read	Peak phase current over threshold (PU)
	tU16	par_u16CurSigPhsPeakChkCnt	5	Read	Peak phase current over detection condition hold count

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current range checking				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocFltCur checks if the absolute value of the current is continuously over the specific threshold for a given count.</p> <pre>     start     tBool checking_result = FALSE;     if ((current &gt; par_f16CurSigPhsPeakThrs)    (current &lt; -par_f16CurSigPhsPeakThrs))     {         if ((*checking_count) &lt; 0xffff)             (*checking_count)++;         if ((*checking_count) &gt;= par_u16CurSigPhsPeakChkCnt)             checking_result = TRUE;         else             (*checking_count) = 0u;     }     return checking_result; </pre>				
Called Function	SWDDS.3.2.1.42 CheckSIFocFltCond				
Calling Function	N/A				
Function Execution Time	N/A				

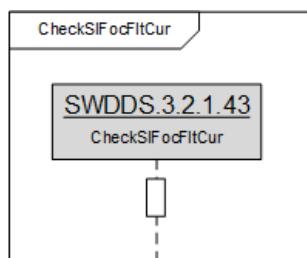
Requirement Id	SWDDS.3.2.1.43
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.1.1.43.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	144

#### 1.1.1.1.43.3 Dynamic View Design



#### 1.1.1.1.43.4 Interface Design

- N/A

#### 1.1.1.1.44 [SWDDS.3.2.1.44] CheckSIFocFltDcVolt

##### 1.1.1.1.44.1 Detailed Design

##### [SWDDS.3.2.1.44] CheckSIFocFltDcVolt

Software Unit Information					
Unit ID	SWDDS.3.2.1.44		Unit Name	CheckSIFocFltDcVolt	
Architecture ID	SWADS.3.2.1.44		ASIL	QM	
Prototype	void CheckSIFocFltDcVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16SIFocDcVolt	0 ~ 32767 0 ~ 25.3992Vpk	Read	DC driving voltage (PU)
	tU16	g_u16SIFocDcVoltOvrCnt	0 ~ 65535	Read/Write	DC driving voltage over count
	tU16	g_u16SIFocDcVoltUndCnt	0 ~ 65535	Read/Write	DC driving voltage under count
	tU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16DcVoltPeakOvrThrs	30961 24.0Vpk	Read	Peak DC voltage over threshold (PU)

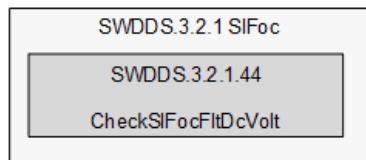
Parameters	tU16	par_u16DcVoltPeakOvrChkCnt	10	Read	Peak DC voltage over detection condition hold count
	tFrac16	par_f16DcVoltPeakUndThrs	7740 6.0Vpk	Read	Peak DC voltage under threshold (PU)
	tU16	par_u16DcVoltPeakUndChkCnt	5000	Read	Peak DC voltage under detection condition hold count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage range checking – DC driving voltage over checking – DC driving voltage under checking				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocFltDcVolt checks if the DC driving voltage is continuously over the specific threshold for a given count.</p> <p>2. CheckSIFocFltDcVolt checks if the DC driving voltage is continuously under the specific threshold for a given count.</p> <pre> graph TD     Start((start)) --&gt; CondOver{g_f16SIFocDcVolt &gt; par_f16DcVoltPeakOvrThrs}     CondOver -- yes --&gt; IncOver{g_u16SIFocDcVoltOvrCnt++}     IncOver --&gt; CondOverAgain{g_u16SIFocDcVoltOvrCnt &gt;= par_u16DcVoltPeakOvrChkCnt}     CondOverAgain -- no --&gt; InitOver{g_u16SIFocDcVoltOvrCnt = 0u}     CondOverAgain -- yes --&gt; FaultOver{g_u16SIFocFltSta  = CTR_FLT_DC_VOLT_OVR}     FaultOver --&gt; End((end))      Start --&gt; CondUnder{g_f16SIFocDcVolt &lt; par_f16DcVoltPeakUndThrs}     CondUnder -- yes --&gt; IncUnder{g_u16SIFocDcVoltUndCnt++}     IncUnder --&gt; CondUnderAgain{g_u16SIFocDcVoltUndCnt &gt;= par_u16DcVoltPeakUndChkCnt}     CondUnderAgain -- no --&gt; InitUnder{g_u16SIFocDcVoltUndCnt = 0u}     CondUnderAgain -- yes --&gt; FaultUnder{g_u16SIFocFltSta  = CTR_FLT_DC_VOLT_UND}     FaultUnder --&gt; End </pre>				
Called Function	SWDDS.3.2.1.42 CheckSIFocFltCond				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	146

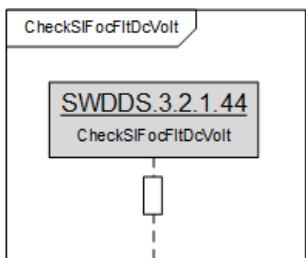
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.44
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	High
Verifiability	Yes

#### 1.1.1.1.44.2 Static View Design



#### 1.1.1.1.44.3 Dynamic View Design



#### 1.1.1.1.44.4 Interface Design

- N/A

#### 1.1.1.1.45 [SWDDS.3.2.1.45] CheckSIFocFltRevRot

##### 1.1.1.1.45.1 Detailed Design

##### [SWDDS.3.2.1.45] CheckSIFocFltRevRot

Software Unit Information			
Unit ID	SWDDS.3.2.1.45	Unit Name	CheckSIFocFltRevRot
Architecture ID	SWADS.3.2.1.45	ASIL	QM
Prototype	void CheckSIFocFltRevRot( void )		
	Data		

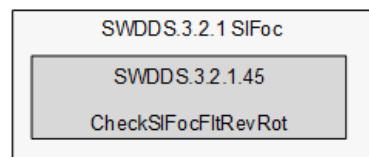
Function Call Parameters	Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_stSIFocCtrlInpDq.f16Arg2	-32768 ~ 32767 -25.4 ~ 25.3992Vpk	Read	d/q-axis control input : q-axis (PU)
	tU16	g_u16SIFocRevRotCnt	0 ~ 65535	Read/Write	Reverse rotation detection count
	tU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16MtrSpdRevRotVoltThrsQ	-3870 -3.0Vpk	Read	Reverse rotation detection q-axis voltage threshold (PU)
	tU16	par_u16MtrSpdRevRotChkCnt	100	Read	Reverse rotation detection condition hold count
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Reverse rotation checking				
Control Flow Diagram (or Pseudo Code)	<p>1. CheckSIFocFltRevRot checks if the q-axis control input voltage is continuously over the specific threshold for a given count.</p> <pre> graph TD     start((start)) --&gt; cond1{g_stSIFocCtrlInpDq.f16Arg2 &lt; par_f16MtrSpdRevRotVoltThrsQ}     cond1 -- yes --&gt; cond2{g_u16SIFocRevRotCnt &lt; 0xffffu}     cond2 -- yes --&gt; inc[g_u16SIFocRevRotCnt++]     cond2 -- no --&gt; zero[g_u16SIFocRevRotCnt = 0u]     inc --&gt; cond3{g_u16SIFocRevRotCnt &gt;= par_u16MtrSpdRevRotChkCnt}     cond3 -- yes --&gt; fault[g_u16SIFocFltSta  = CTR_FLT_MTR_REV_ROT]     cond3 -- no --&gt; end((end))     zero --&gt; end   </pre>				
Called Function	SWDDS.3.2.1.42 CheckSIFocFltCond				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.1.45
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	Yes

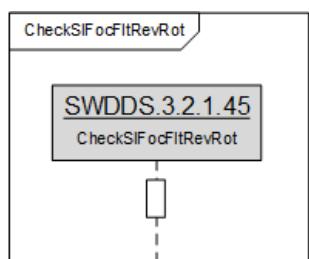
	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	148

Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input type="checkbox"/> Mid
Verifiability	Yes

#### 1.1.1.1.45.2 Static View Design



#### 1.1.1.1.45.3 Dynamic View Design



#### 1.1.1.1.45.4 Interface Design

- N/A

#### 1.1.1.1.46 [SWDDS.3.2.1.46] CheckSIFocFltGateDrv

##### 1.1.1.1.46.1 Detailed Design

###### [SWDDS.3.2.1.46] CheckSIFocFltGateDrv

Software Unit Information					
Unit ID	SWDDS.3.2.1.46		Unit Name	CheckSIFocFltGateDrv	
Architecture ID	SWADS.3.2.1.46		ASIL	QM	
Prototype	void CheckSIFocFltGateDrv( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	TU16	g_u16SIFocFltSta	0 ~ 65535	Write	Fault status flags
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description					
1. CheckSIFocFltGateDrv checks if any of the gate driver fault status flag is set.					

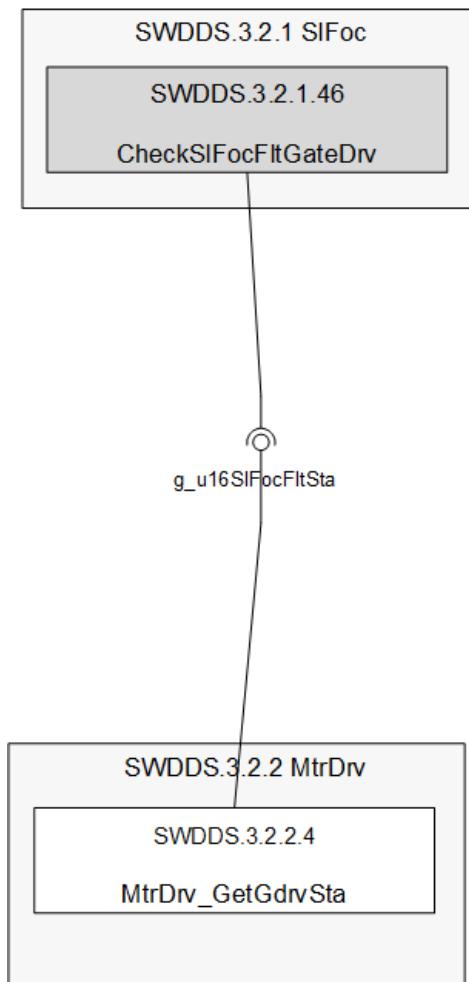
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	149

Control Flow Diagram (or Pseudo Code)	<pre>     start     [SWDDS.3.2.2.4]     g_u16SIFocFltSta=MtrDrv_GetGdrvSta();     end   </pre>
Called Function	SWDDS.3.2.1.42 CheckSIFocFltCond
Calling Function	SWDDS.3.2.2.4 MtrDrv_GetGdrvSta
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.1.46
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

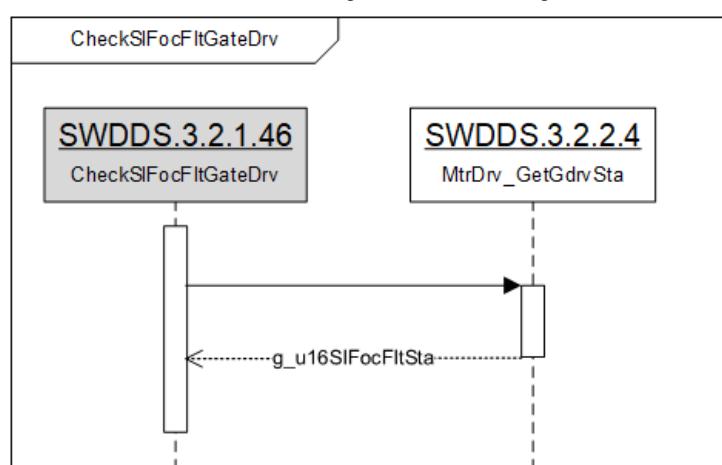
#### 1.1.1.1.46.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	150



#### 1.1.1.46.3 Dynamic View Design

1. CheckSIFocFltGateDrv calls the gate driver status flag checked.



	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-04-30
								Page	151

#### 1.1.1.1.46.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_u16SIFocFltSta	SWDDS.3.2.2.4	IN	tU16	0	15872	0	15872	N/A	Gate driver state

#### 1.1.1.1.47 [SWDDS.3.2.1.47] RunSIFocSpdCtr

##### 1.1.1.1.47.1 Detailed Design

###### [SWDDS.3.2.1.47] RunSIFocSpdCtr

Software Unit Information					
Unit ID	SWDDS.3.2.1.47		Unit Name	RunSIFocSpdCtr	
Architecture ID	SWADS.3.2.1.47		ASIL	QM	
Prototype	void RunSIFocSpdCtr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tCtrState	g_eSIFocCtrState	0 ~ 4 CTR_STATE_SWTC_OFF/ CTR_STATE_OFFSET_CALIB/ CTR_STATE_INIT_ALIGN/ CTR_STATE_OPLP_START/ CTR_STATE_SL_RUN	Read	Sensorless FOC state
	tFrac16	g_hndSIFocSpdCtr.f16InK_1	-32768 ~ 32767	Read/Write	Speed controller handler input error at step k-1
	tFrac16	g_f16SIFocRefSpd	0 ~ 19660 0 ~ 3600rpm	Read	Reference speed setting (PU)
	tFrac16	g_f16SIFocElecSpd	-32768 ~ 32767 -6000 ~ 5999.82rpm	Read	Estimated electric speed (PU)
	tFrac16	g_stSIFocRefCur.f16Arg1	0 0.0Apk	Write	Reference current : d-axis (PU)
	tFrac16	g_stSIFocRefCur.f16Arg2	-11430 ~ 11430 -22.5 ~ 22.5Apk	Write	Reference current : q-axis (PU)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16StartSpdPreChrg	1638 0.05	Read	Speed control integrator pre-charge
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed control logic running				
	1. RunSIFocSpdCtr sets the PI speed control state and the reference current as 0 if the sensorless FOC control state is switching off state. 2. RunSIFocSpdCtr sets the reference speed as 0 if the sensorless FOC control state is current offset calibration state or initial alignment state. 3. RunSIFocSpdCtr sets the PI speed control state and the reference current as precharge value if the sensorless FOC control state is open-loop starting state. 4. RunSIFocSpdCtr calculates the speed control error and the reference current using the PI speed control if the sensorless FOC control state is sensorless running state.				

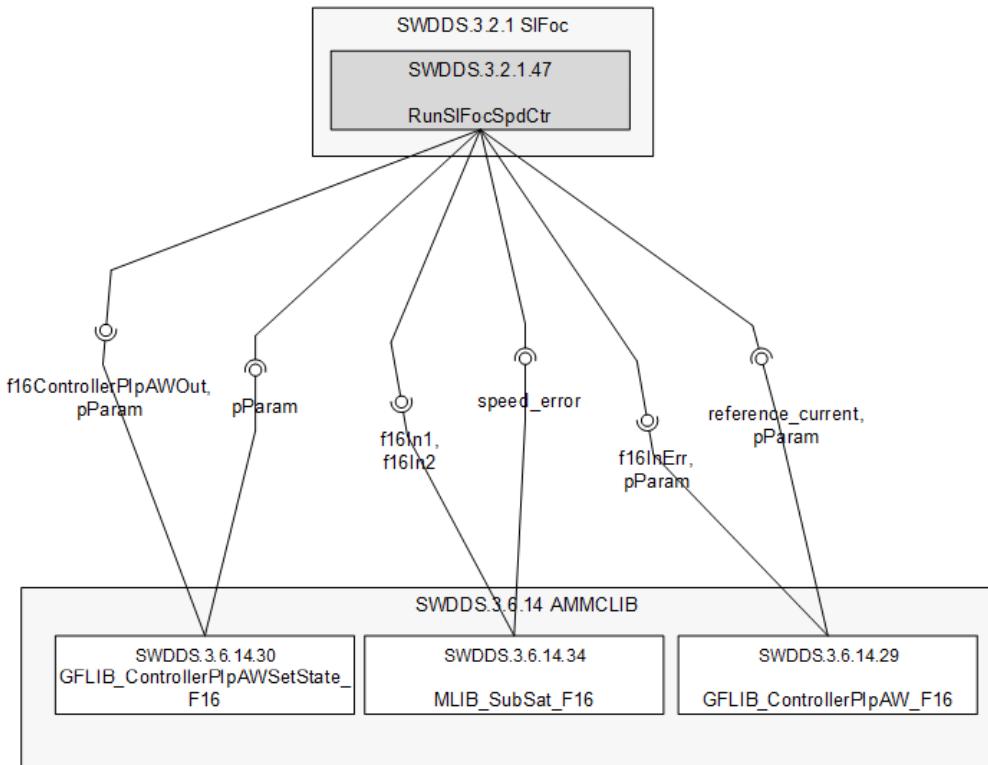
<b>Control Flow Diagram (or Pseudo Code)</b> <pre> start     tFrac16 speed_error,     reference_current = FRAC16( 0.0f );      if g_eSI FocCtrState == CTR_STATE_SWTC_OFF then         [SWDDS.3.6.14.30] GFLIB_ControllerPlpAWSetState_F16( FRAC16( 0.0f ), &amp;g_hndSI FocSpdCtr );         reference_current = FRAC16( 0.0f );     else if g_eSI FocCtrState == CTR_STATE_OFFS_CALIB then         [SWDDS.3.6.14.30] GFLIB_ControllerPlpAWSetState_F16( par_f16StartSpdPreChrg, &amp;g_hndSI FocSpdCtr );         reference_current = par_f16StartSpdPreChrg;     else if g_eSI FocCtrState == CTR_STATE_INIT_ALIGN then         [SWDDS.3.6.14.30] GFLIB_ControllerPlpAWSetState_F16( par_f16StartSpdPreChrg, &amp;g_hndSI FocSpdCtr );         reference_current = par_f16StartSpdPreChrg;     else if g_eSI FocCtrState == CTR_STATE_OPLP_START then         [SWDDS.3.6.14.34] speed_error = MLIB_SubSat_F16( g_f16SI FocRefSpd, g_f16SI FocElecSpd );     else if g_eSI FocCtrState == CTR_STATE_SL_RUN then         [SWDDS.3.6.14.29] reference_current = GFLIB_ControllerPlpAW_F16( speed_error, &amp;g_hndSI FocSpdCtr );     end     g_stSI FocRefCur.f16Arg1 = FRAC16( 0.0f );     g_stSI FocRefCur.f16Arg2 = reference_current; end </pre>	<p>The diagram illustrates the control flow for the SIFoc_MainFunc. It starts at 'start' and initializes <code>tFrac16 speed_error</code> and <code>reference_current = FRAC16( 0.0f )</code>. It then enters a loop where it checks the current state (<code>g_eSI FocCtrState</code>) against five specific states: <code>CTR_STATE_SWTC_OFF</code>, <code>CTR_STATE_OFFS_CALIB</code>, <code>CTR_STATE_INIT_ALIGN</code>, <code>CTR_STATE_OPLP_START</code>, and <code>CTR_STATE_SL_RUN</code>. If the state matches, it calls a corresponding function from the GFLIB library: <code>GFLIB_ControllerPlpAWSetState_F16</code> for <code>CTR_STATE_SWTC_OFF</code> and <code>CTR_STATE_OFFS_CALIB</code>; <code>GFLIB_ControllerPlpAWSetState_F16</code> with parameters <code>par_f16StartSpdPreChrg</code> and <code>&amp;g_hndSI FocSpdCtr</code> for <code>CTR_STATE_INIT_ALIGN</code> and <code>CTR_STATE_OPLP_START</code>; and <code>MLIB_SubSat_F16</code> with parameters <code>g_f16SI FocRefSpd</code> and <code>g_f16SI FocElecSpd</code> for <code>CTR_STATE_SL_RUN</code>. After the function call, it updates <code>reference_current</code> to the result of the function or the initial value. Finally, it updates <code>g_stSI FocRefCur.f16Arg1</code> to <code>FRAC16( 0.0f )</code> and <code>g_stSI FocRefCur.f16Arg2</code> to <code>reference_current</code>, and ends the process.</p>		
Called Function	SWDDS.3.2.1.7 SIFoc_MainFunc		
Calling Function	SWDDS.3.6.14.30 GFLIB_ControllerPlpAWSetState_F16		
	SWDDS.3.6.14.34 MLIB_SubSat_F16		
	SWDDS.3.6.14.29 GFLIB_ControllerPlpAW_F16		
Function Execution Time	N/A		

Requirement Id	SWDDS.3.2.1.47
Target Milestone	SBS1
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	153

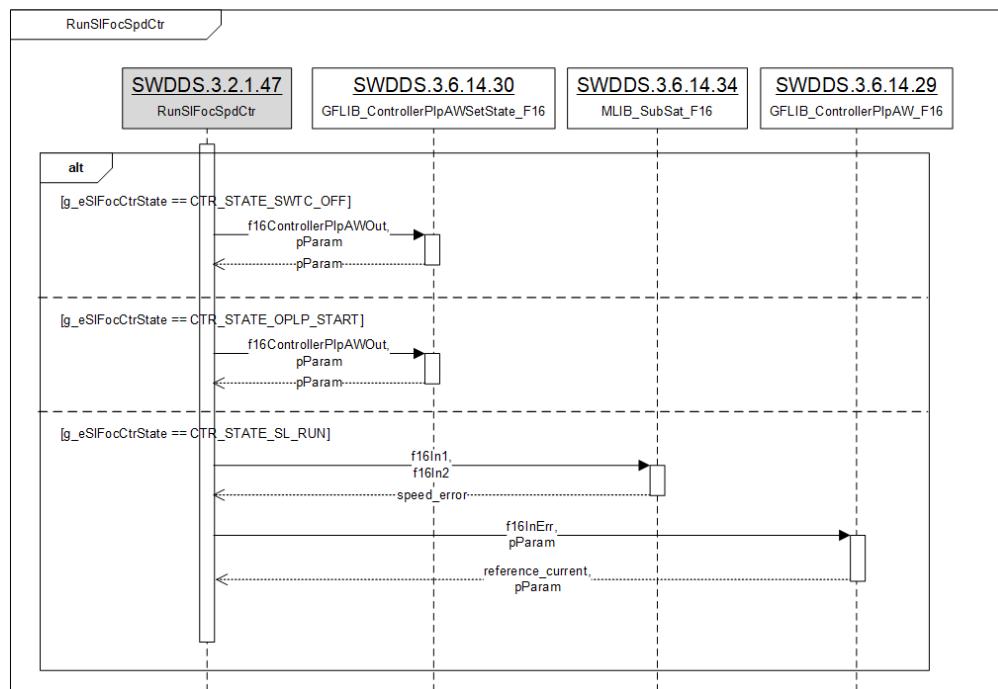
Criticality	 High
Technical complexity	 Mid
Verifiability	Yes

#### 1.1.1.1.47.2 Static View Design



#### 1.1.1.1.47.3 Dynamic View Design

1. RunSIFocSpdCtr calls the PI control state setting to clear as 0 or to precharge with the given value.
2. RunSIFocSpdCtr calls the fixed-point subtraction function to calculate the speed control error.
3. RunSIFocSpdCtr calls the PI control to calculate the reference current.



#### 1.1.1.1.47.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range	Physical Range	Resolution /Units	Description
					Min	Max	Min	Max
1	f16ControllerPipAWOut	SWDDS.3.6.14.30	OUT	tFrac16	0	0	0.0	0.0
				GFLIB_CONTROLLER_PIAW_P_T_F16			0.00196838 / Apk	Required output of the GFLIB_ControllerPipAW
2	pParam	SWDDS.3.6.14.30	IN/OUT	-	N/A	N/A	N/A	N/A
				GFLIB_CONTROLLER_PIAW_P_T_F16	*			Speed controller handler
3	f16ControllerPipAWOut	SWDDS.3.6.14.30	OUT	tFrac16	1638	1638	0.05	0.05
				GFLIB_CONTROLLER_PIAW_P_T_F16			N/A	Speed control integrator pre-charge
4	pParam	SWDDS.3.6.14.30	IN/OUT	-	N/A	N/A	N/A	N/A
				GFLIB_CONTROLLER_PIAW_P_T_F16	*			Speed controller handler
5	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	0	32768	0	5999.82
				GFLIB			0.183105 / rpm	Reference speed setting
6	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32767	32768	-6000.0	5999.82
				GFLIB			0.183105 / rpm	Estimated electric speed
7	speed_error	SWDDS.3.6.14.34	IN	tFrac16	-32767	32768	-6000.0	5999.82
				GFLIB			0.183105 / rpm	Speed control error
8	f16InErr	SWDDS.3.6.14.29	OUT	tFrac16	-32767	32768	-6000.0	5999.82
				GFLIB_CONTROLLER_PIAW_P_T_F16	*		0.183105 / rpm	Speed control error
9	pParam	SWDDS.3.6.14.29	IN/OUT	-	N/A	N/A	N/A	N/A
				GFLIB_CONTROLLER_PIAW_P_T_F16	*			Speed controller handler
10	reference_current	SWDDS.3.6.14.29	IN	tFrac16	-32767	32768	-64.5	64.4980
				GFLIB			0.00196838 / Apk	Calculated reference current

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	155

#### 1.1.1.1.48 [SWDDS.3.2.1.48] SIFoc\_DisSIRun

##### 1.1.1.1.48.1 Detailed Design

[SWDDS.3.2.1.48] SIFoc\_DisSIRun

##### 1.1.1.1.48.2 Static View Design

- N/A

##### 1.1.1.1.48.3 Dynamic View Design

- N/A

##### 1.1.1.1.48.4 Interface Design

- N/A

#### 1.1.1.2 [SWDDS.3.2.2] MtrDrv

Update measured variables in MCU Hardware relate to motor driving

- DC voltage, Phase current, Gate driver state

Set/ disable PWM duty to control motor

#### 1.1.1.2.1 [SWDDS.3.2.2.1] MtrDrv\_Init

##### 1.1.1.2.1.1 Detailed Design

[SWDDS.3.2.2.1] MtrDrv\_Init

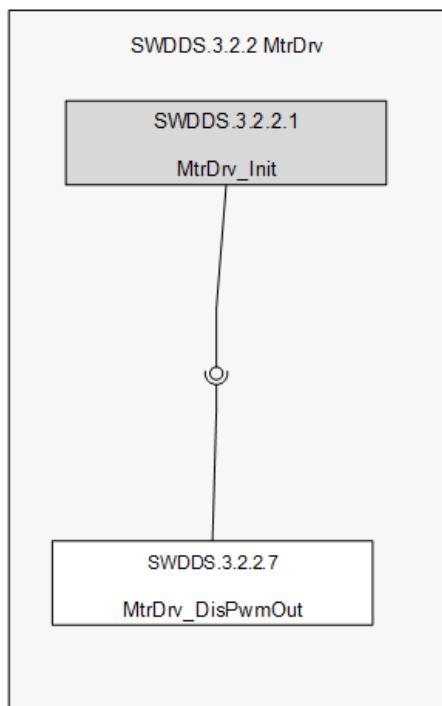
Software Unit Information					
Unit ID	SWDDS.3.2.2.1		Unit Name	MtrDrv_Init()	
Architecture ID	SWADS.3.2.2.1		ASIL	QM	
Prototype	void MtrDrv_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor driver interface initialization				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	156

Control Flow Diagram (or Pseudo Code)	<pre>     graph TD         start((start)) --&gt; [SWDDS.3.2.2.7]         [SWDDS.3.2.2.7] --- MtrDrv_DisPwmOut[MtrDrv_DisPwmOut();]         MtrDrv_DisPwmOut --&gt; end((end))     </pre>
Called Function	SWDDS.2.3.1 Rtel0_Init
Calling Function	SWDDS.3.2.2.7 MtrDrv_DisPwmOut
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.2.1
Target Milestone	SBS2.1
Element	MTR
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.2.1.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	157

#### 1.1.1.2.1.3 Dynamic View Design

- N/A

#### 1.1.1.2.1.4 Interface Design

- N/A

#### 1.1.1.2.2 [SWDDS.3.2.2.2] MtrDrv\_GetDcVolt

##### 1.1.1.2.2.1 Detailed Design

##### [SWDDS.3.2.2.2] MtrDrv\_GetDcVolt

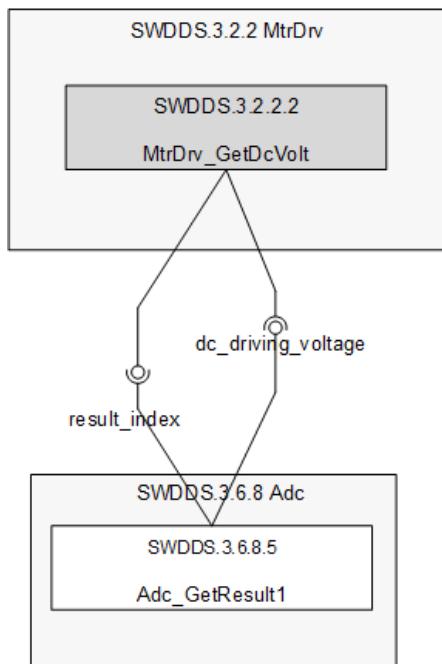
Software Unit Information				
Unit ID	SWDDS.3.2.2.2	Unit Name	MtrDrv_GetDcVolt	
Architecture ID	SWADS.3.2.2.2	ASIL	QM	
Prototype	tFrac16 MtrDrv_GetDcVolt( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description	
	tFrac16	0 ~ 32757 0.0 ~ 25,3992Vpk	DC link voltage (PU)	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	tFrac16	par_f16DcVoltOffs	0	Read
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Motor driving voltage getting			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 dc_driving_voltage;     ↓     [SWDDS.3.6.8.5]     dc_driving_voltage = (tFrac16)Adc_GetResult1( 1u );     ↓     dc_driving_voltage -= par_f16DcVoltOffs;     ↓     return dc_driving_voltage;   </pre>			
Called Function	SWDDS.3.2.1.27 MeasureSIFocDcVolt			
Calling Function	SWDDS.3.6.8.5 Adc_GetResult1			
Function Execution Time	N/A			

Requirement Id	SWDDS.3.2.2.2
Target Milestone	EBS2
Element	MTR

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	158

Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.2.2.2 Static View Design



#### 1.1.1.2.2.3 Dynamic View Design

- N/A

#### 1.1.1.2.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	result_index	SWDDS.3.6.8.5	OUT	tU16	1	1	1	1	N/A	ADC result list index
2	dc_driving_voltage	SWDDS.3.6.8.5	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC link voltage

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	159

### 1.1.1.2.3 [SWDDS.3.2.2.3] MtrDrv\_GetPhsCur

#### 1.1.1.2.3.1 Detailed Design

##### [SWDDS.3.2.2.3] MtrDrv\_GetPhsCur

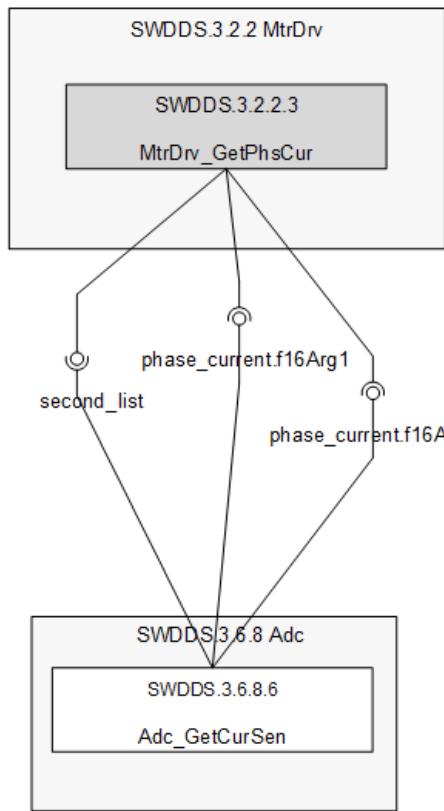
Software Unit Information					
Unit ID	SWDDS.3.2.2.3		Unit Name	MtrDrv_GetPhsCur	
Architecture ID	SWADS.3.2.2.3		ASIL	QM	
Prototype	SWLIBS_2Syst_F16 MtrDrv_GetPhsCur( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	SWLIBS_2Syst_F16	-32768 ~ 32767 -64.5 ~ 64.4980Apk		Phase current (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Phase current getting				
Control Flow Diagram (or Pseudo Code)	<p>1. MtrDrv_GetPhsCur gets the first phase current signal from ADC.  2. MtrDrv_GetPhsCur gets the second phase current signal from ADC.</p> <pre>     start     SWLIBS_2Syst_F16 phase_current;     [SWDDS.3.6.8.6]     phase_current.f16Arg1 = (tFrac16)Adc_GetCurSen( FALSE );     [SWDDS.3.6.8.6]     phase_current.f16Arg2 = (tFrac16)Adc_GetCurSen( TRUE );     return phase_current;   </pre>				
Called Function	SWDDS.3.2.1.28 MeasureSIFocPhsCur SWDDS.3.2.1.29 CalibrateSIFocCurOffs				
Calling Function	SWDDS.3.6.8.6 Adc_GetCurSen				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.2.3
Target Milestone	EBS2
Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	■ High
Technical complexity	■ Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	160

Verifiability	Yes
---------------	-----

#### 1.1.1.2.3.2 Static View Design



#### 1.1.1.2.3.3 Dynamic View Design

- N/A

#### 1.1.1.2.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
1	second_list	SWDDS.3.6.8.6	OUT	tBool	0	0	ADC list 0	0	N/A	FALSE – ADC list 0, TRUE – ADC list 1
2	phase_current.f16Arg1	SWDDS.3.6.8.6	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Dual-shunt current sense amplifier signal output : argument1
3	second_list	SWDDS.3.6.8.6	OUT	tBool	1	1	ADC list 1	1	N/A	FALSE – ADC list 0, TRUE – ADC list 1
4	phase_current.f16Arg2	SWDDS.3.6.8.6	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Dual-shunt current sense amplifier signal output : argument2

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	161

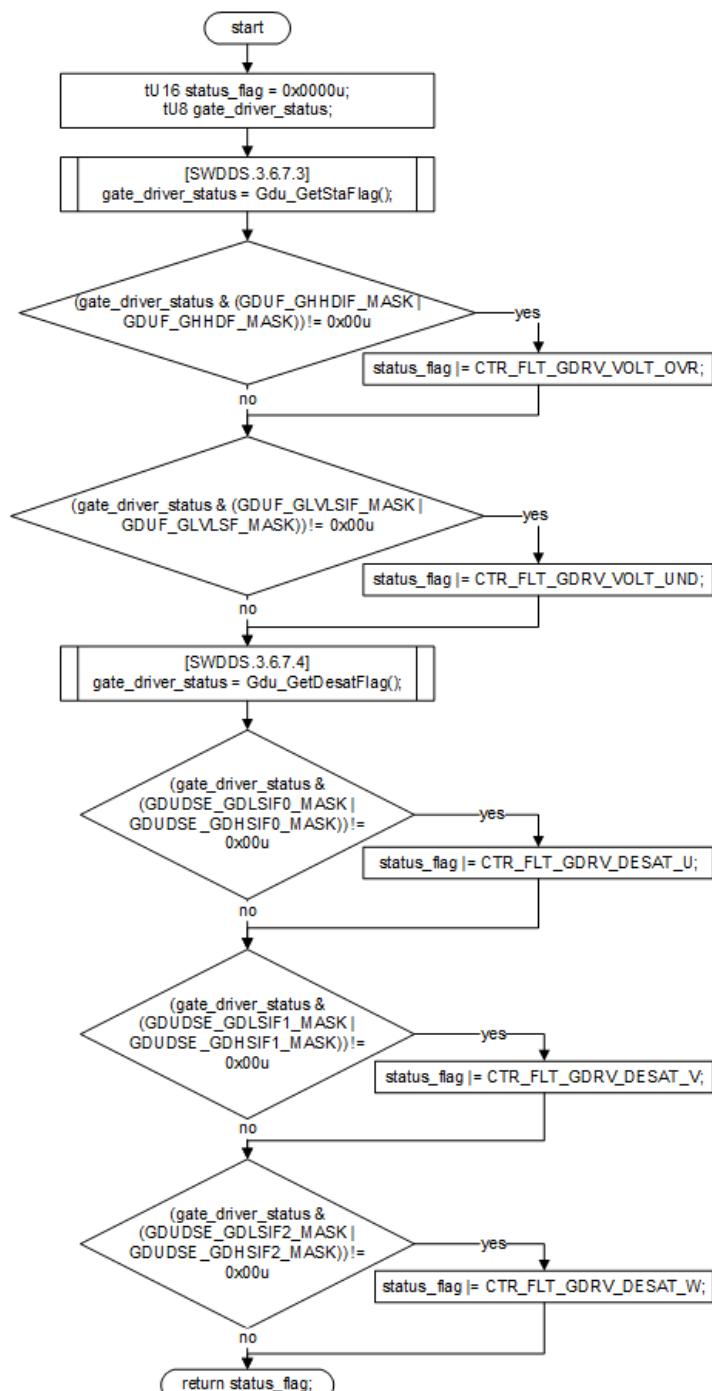
#### 1.1.1.2.4 [SWDDS.3.2.2.4] MtrDrv\_GetGdrvSta

##### 1.1.1.2.4.1 Detailed Design

#### [SWDDS.3.2.2.4] MtrDrv\_GetGdrvSta

Software Unit Information					
Unit ID	SWDDS.3.2.2.4		Unit Name	MtrDrv_GetGdrvSta	
Architecture ID	SWADS.3.2.2.4		ASIL	QM	
Prototype	tU16 MtrDrv_GetGdrvSta( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 3584		Gate driver state	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	Byte	GDUF_GHHDIF_MASK	2u	Read	GDU High VHD Supply Interrupt Flag mask
	Byte	GDUF_GHHDF_MASK	64u	Read	GDU High VHD Supply Flag mask
	Byte	GDUF_GLVLSIF_MASK	1u	Read	GDU Low VLS Supply Interrupt Flag mask
	Byte	GDUF_GLVLSF_MASK	32u	Read	GDU Low VLS Supply Flag mask
	Byte	GDUDSE_GDLSIF0_MASK	1u	Read	GDU Low-Side Driver 0 Desaturation Interrupt Flag mask
	Byte	GDUDSE_GDHHSIF0_MASK	16u	Read	GDU High-Side Driver 0 Desaturation Interrupt Flags mask
	Byte	GDUDSE_GDLSIF1_MASK	2u	Read	GDU Low-Side Driver 1 Desaturation Interrupt Flag mask
	Byte	GDUDSE_GDHHSIF1_MASK	32u	Read	GDU High-Side Driver 1 Desaturation Interrupt Flags mask
	Byte	GDUDSE_GDLSIF2_MASK	4u	Read	GDU Low-Side Driver 2 Desaturation Interrupt Flag mask
	Byte	GDUDSE_GDHHSIF2_MASK	64u	Read	GDU High-Side Driver 2 Desaturation Interrupt Flags mask
Description	Gate driver state getting - Gate driver flag register checking - Gate driver desaturation error flag register checking				
	1. MtrDrv_GetGdrvSta gets the gate driver status flags. 2. MtrDrv_GetGdrvSta checks the gate driver over voltage detection. 3. MtrDrv_GetGdrvSta checks the gate driver under voltage detection. 4. MtrDrv_GetGdrvSta get the gate driver DESAT detection flags. 5. MtrDrv_GetGdrvSta checks the DESAT detection in phase U. 6. MtrDrv_GetGdrvSta checks the DESAT detection in phase V.				

## 7. MtrDrv\_GetGdrvSta checks the DESAT detection in phase W.

Control Flow Diagram  
(or Pseudo Code)

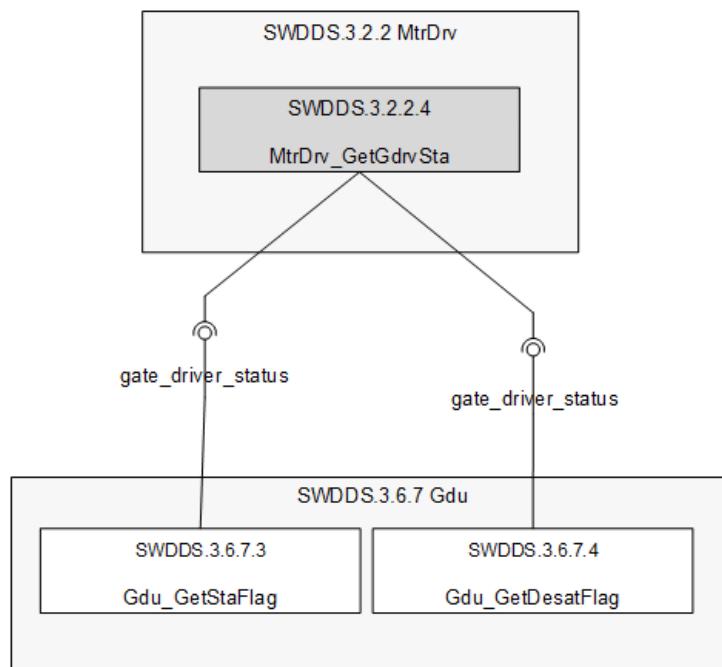
Called Function	SWDDS.3.2.1.46 CheckSIFocFltGateDrv
Calling Function	SWDDS.3.6.7.3 Gdu_GetStaFlag SWDDS.3.6.7.4 Gdu_GetDesatFlag
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.2.4
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-04-30
				Page	163

Element	MTR
Risk	■ Mid
Interoperability	No
Criticality	★ High
Technical complexity	★ High
Verifiability	Yes

#### 1.1.1.2.4.2 Static View Design



#### 1.1.1.2.4.3 Dynamic View Design

- N/A

#### 1.1.1.2.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	1		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	gate_driver_status	SWDDS.3.6.7.3	IN	tU8	0	251	0	251	N/A	Gate driver flag register checking
2	gate_driver_status	SWDDS.3.6.7.4	IN	tU8	0	119	0	119	N/A	Gate driver desaturation error flag register checking

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	164

### 1.1.1.2.5 [SWDDS.3.2.2.5] MtrDrv\_SetPwmDuty

#### 1.1.1.2.5.1 Detailed Design

##### [SWDDS.3.2.2.5] MtrDrv\_SetPwmDuty

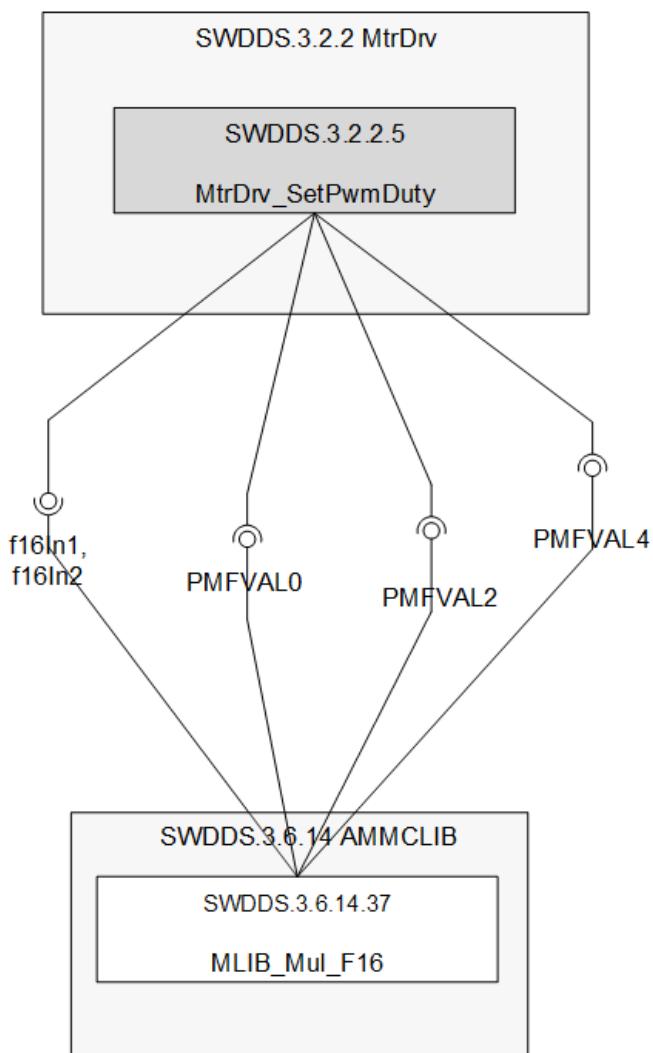
Software Unit Information					
Unit ID	SWDDS.3.2.2.5		Unit Name	MtrDrv_SetPwmDuty	
Architecture ID	SWADS.3.2.2.5		ASIL	QM	
Prototype	void MtrDrv_SetPwmDuty( SWLIBS_3Syst_F16 pwm_duty )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	SWLIBS_3Syst_F16	pwm_duty	0 ~ 32767	IN	PWM duty
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tBool	par_bMtrRevDir	0 ~ 1 Normal / Reverse direction	Read	Reverse directional driving
Registers	Data Type	Name	Range	Read/Write	Description
	Word	PMFVAL0	0 ~ 2500	Write	PMF Value 0 Register
	Word	PMFVAL2	0 ~ 2500	Write	PMF Value 2 Register
	Word	PMFVAL4	0 ~ 2500	Write	PMF Value 4 Register
	Word	PMFMODA	2500	Read	PMF modulo counter A Register
Description	Bit	PTUC_PTULDOK	0x01	Write	PTU Module Control Register
	PWM duty output setting				
Control Flow Diagram (or Pseudo Code)	<ol style="list-style-type: none"> <li>MtrDrv_SetPwmDuty sets the phase U PWM duty to PWM value 0.</li> <li>MtrDrv_SetPwmDuty sets the phase V PWM duty to PWM value 2 and the phase W PWM duty to PWM value 4 if the reverse direction setting is false.</li> <li>MtrDrv_SetPwmDuty sets the phase W PWM duty to PWM value 2 and the phase V PWM duty to PWM value 4 if the reverse direction setting is true.</li> <li>MtrDrv_SetPwmDuty sets the PWM load OK register to make the PWM duty effective.</li> </ol>				

<b>Control Flow Diagram (or Pseudo Code)</b>	
	SWDDS.3.2.2.6 MtrDrv_EnaPwmOut
	SWDDS.3.2.2.7 MtrDrv_DisPwmOut
	SWDDS.3.2.1.21 DisableSIFocControl
	SWDDS.3.2.1.22 EnableSIFocControl
	SWDDS.3.2.1.41 RunSIFocSpcVecPwm
Called Function	SWDDS.3.6.14.37 MLIB_Mul_F16
Calling Function	
Function Execution Time	N/A

Requirement Id	SWDDS.3.2.2.5
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">★</span> High
Technical complexity	<span style="color: #ccc;">■</span> Mid
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	166

#### 1.1.1.2.5.2 Static View Design



#### 1.1.1.2.5.3 Dynamic View Design

- N/A

#### 1.1.1.2.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32768	-32767	32768	N/A	PWM duty : argument1
2	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	2500	2500	2500	2500	N/A	PMF modulo counter A Register
3	PMFVAL0	SWDDS.3.6.14.37	IN	tFrac16	0	2500	0	2500	N/A	PMF Value 0 Register
4	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32768	-32767	32768	N/A	PWM duty : argument2
5	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	2500	2500	2500	2500	N/A	PMF modulo counter A Register
6	PMFVAL2	SWDDS.3.6.14.37	IN	tFrac16	0	2500	0	2500	N/A	PMF Value 2 Register
7	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32768	-32767	32768	N/A	PWM duty : argument3
8	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	2500	2500	2500	2500	N/A	PMF modulo counter A Register
9	PMFVAL4	SWDDS.3.6.14.37	IN	tFrac16	0	2500	0	2500	N/A	PMF Value 4 Register
10	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32768	-32767	32768	N/A	PWM duty : argument3

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-04-30
									Page	167

11	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	2500	2500	2500	2500	N/A	PMF modulo counter A Register
12	PMFVAL4	SWDDS.3.6.14.37	IN	tFrac16	0	2500	0	2500	N/A	PMF Value 4 Register
13	f16In1	SWDDS.3.6.14.37	OUT	tFrac16	0	32768	-32767	32768	N/A	PWM duty : argument2
14	f16In2	SWDDS.3.6.14.37	OUT	tFrac16	2500	2500	2500	2500	N/A	PMF modulo counter A Register
15	PMFVAL2	SWDDS.3.6.14.37	IN	tFrac16	0	2500	0	2500	N/A	PMF Value 2 Register

### 1.1.1.2.6 [SWDDS.3.2.2.6] MtrDrv\_EnaPwmOut

#### 1.1.1.2.6.1 Detailed Design

##### [SWDDS.3.2.2.6] MtrDrv\_EnaPwmOut

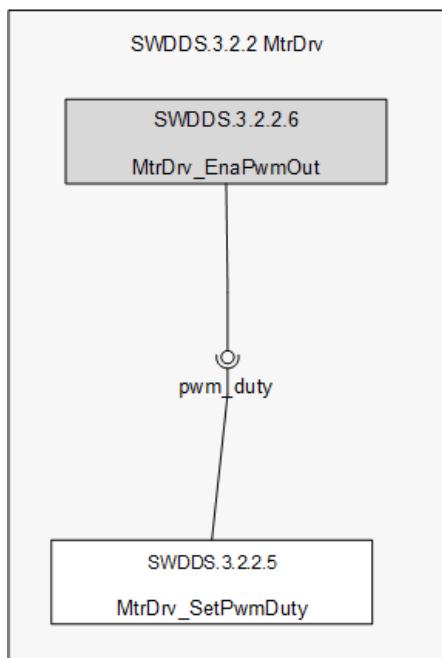
Software Unit Information					
Unit ID	SWDDS.3.2.2.6	Unit Name	MtrDrv_EnaPwmOut		
Architecture ID	SWADS.3.2.2.6	ASIL	QM		
Prototype	void MtrDrv_EnaPwmOut( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	Byte	PMFCFG2_MSK	0x00	Write	PMF Configure 2 Register mask
Description	PWM output enabling				
Control Flow Diagram (or Pseudo Code)	<pre> start     SWLIBS_3Syst_F16 pwm_output;     pwm_output.f16Arg1 = FRAC16( 0.5f );     pwm_output.f16Arg2 = FRAC16( 0.5f );     pwm_output.f16Arg3 = FRAC16( 0.5f );     PMFCFG2_MSK = 0x00u;      [SWDDS.3.2.2.5]     MtrDrv_SetPwmDuty( pwm_output ); end </pre>				
Called Function	SWDDS.3.2.1.22 EnableSIFocControl				
Calling Function	SWDDS.3.2.2.5 MtrDrv_SetPwmDuty				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.2.6
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	168

Element	MTR
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.1.2.6.2 Static View Design



#### 1.1.1.2.6.3 Dynamic View Design

- N/A

#### 1.1.1.2.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pwm_duty	SWDDS.3.2.2.5	OUT	SWLIBS_3Syst_F16	16384	16384	16384	16384	N/A	PWM output duty setting

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	169

### 1.1.1.2.7 [SWDDS.3.2.2.7] MtrDrv\_DisPwmOut

#### 1.1.1.2.7.1 Detailed Design

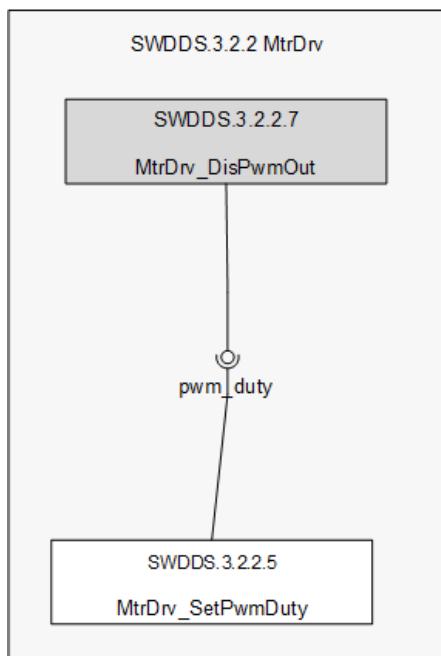
##### [SWDDS.3.2.2.7] MtrDrv\_DisPwmOut

Software Unit Information					
Unit ID	SWDDS.3.2.2.7	Unit Name	MtrDrv_DisPwmOut		
Architecture ID	SWADS.3.2.2.7	ASIL	QM		
Prototype	void MtrDrv_DisPwmOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	Byte	PMFCFG2_MSK	0x3f	Write	PMF Configure 2 Register mask
Description	PWM output disabling				
Control Flow Diagram (or Pseudo Code)	<p>1. MtrDrv_DisPwmOut sets the PWM duty as half value.  2. MtrDrv_DisPwmOut sets the PWM mask register as disabling all the PWM.  3. MtrDrv_DisPwmOut updates the PWM duty setting.</p> <pre>     start     SWLIBS_3Syst_F16 pwm_output;     pwm_output.f16Arg1 = FRAC16(0.5f);     pwm_output.f16Arg2 = FRAC16(0.5f);     pwm_output.f16Arg3 = FRAC16(0.5f);     PMFCFG2_MSK = 0x3fu;      [SWDDS.3.2.2.5]     MtrDrv_SetPwmDuty( pwm_output );     end   </pre>				
Called Function	SWDDS.3.2.1.21 DisableSIFocControl				
Calling Function	SWDDS.3.2.2.5 MtrDrv_SetPwmDuty				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.2.7
Target Milestone	EBS2
Element	MTR
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	170

#### 1.1.1.2.7.2 Static View Design



#### 1.1.1.2.7.3 Dynamic View Design

- N/A

#### 1.1.1.2.7.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pwm_duty	SWDDS.3.2.2.5	OUT	SWLIBS_3Syst_F16	16384	16384	16384	16384	N/A	PWM output duty setting

#### 1.1.1.2.8 [SWDDS.3.2.2.8] MtrDrv\_ClrGdrvFlt

##### 1.1.1.2.8.1 Detailed Design

##### [SWDDS.3.2.2.8] MtrDrv\_ClrGdrvFlt

Software Unit Information					
Unit ID	SWDDS.3.2.2.8	Unit Name	MtrDrv_ClrGdrvFlt		
Architecture ID	SWADS.3.2.2.8	ASIL	QM		
Prototype	void MtrDrv_ClrGdrvFlt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description

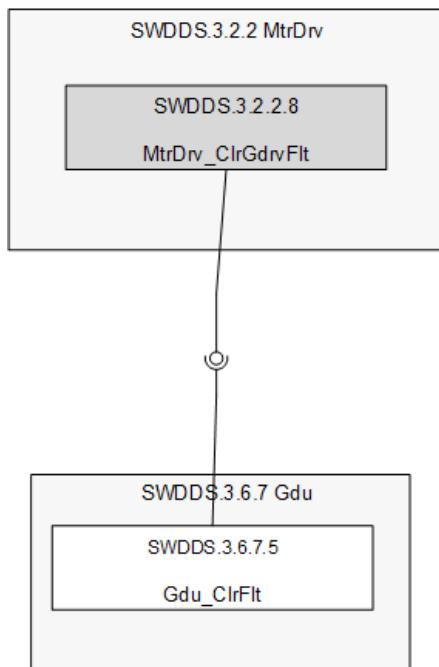
<b>SNT Motiv</b>	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-04-30
						Page	171

	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Gate driver fault clearing				
Control Flow Diagram (or Pseudo Code)	<p>1. MtrDrv_ClrGdrvFlt clears the gate driver fault flags.</p> <pre> graph TD     start((start)) --&gt; box1["[SWDDS.3.6.7.5] Gdu_ClrFlt();"]     box1 --&gt; end((end)) </pre>				
Called Function	<p>SWDDS.3.2.1.10 SIFoc_ClrFltSta SWDDS.3.2.1.22 EnableSIFocControl</p>				
Calling Function	SWDDS.3.6.7.5 Gdu_ClrFlt				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.2.2.8
Target Milestone	EBS2
Element	MTR
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	No
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

#### 1.1.1.2.8.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	172



#### 1.1.1.2.8.3 Dynamic View Design

- N/A

#### 1.1.1.2.8.4 Interface Design

- N/A

### 1.1.2 [SWDDS.3.3] CAN

CAN has a function to manage CAN communication.

#### 1.1.2.1 [SWDDS.3.3.1] CanMsg

Check received CAN ID Rearrange received CAN Message to defined data

- status data, driving fault, sensor fault

#### 1.1.2.1.1 [SWDDS.3.3.1.1] CanMsg\_Init

##### 1.1.2.1.1.1 Detailed Design

##### [SWDDS.3.3.1.1] CanMsg\_Init

Software Unit Information					
Unit ID	SWDDS.3.3.1.1	Unit Name	CanMsg_Init		
Architecture ID	SWADS.3.3.1.1	ASIL	QM		
Prototype	void CanMsg_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description

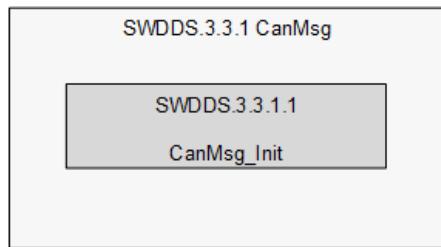
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	173

Parameters	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_aau8CanMsgReqRxData[8u]	0 ~ 255	Write	CAN received request data storage
	tU8	g_aau8CanMsgResTxData[8u]	0 ~ 255	Write	CAN response transmission data storage
	tU16	g_u16CanMsgRxDataNo	0 ~ 8	Write	CAN received data number
	tU16	g_u16CanMsgRxTimeStamp	0 ~ 65535	Write	CAN received time stamp
	tBool	g_bCanMsgUpdated	0 ~ 1 FALSE / TRUE	Write	FALSE – not updated, TRUE – updated
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN message initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     \Volatile tU16 data_index     ↓     data_index = 0u;     ↓     {data_index &lt; 8u}?         yes: g_aau8CanMsgReqRxData[data_index] = 0x00u;               g_aau8CanMsgResTxData[data_index] = 0x00u;         no:   g_u16CanMsgRxDataNo = 0u;               g_u16CanMsgRxTimeStamp = 0u;               g_bCanMsgUpdated = FALSE;     ↓     end   </pre>				
Called Function	SWDDS.2.3.1 Rtelo_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.3.1.1
Target Milestone	EBS2
Element	CAN
Risk	Mid
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	174

#### 1.1.2.1.1.2 Static View Design



#### 1.1.2.1.1.3 Dynamic View Design

- N/A

#### 1.1.2.1.1.4 Interface Design

- N/A

#### 1.1.2.1.2 [SWDDS.3.3.1.2] CanMsg\_ChkReqDat

##### 1.1.2.1.2.1 Detailed Design

###### [SWDDS.3.3.1.2] CanMsg\_ChkReqDat

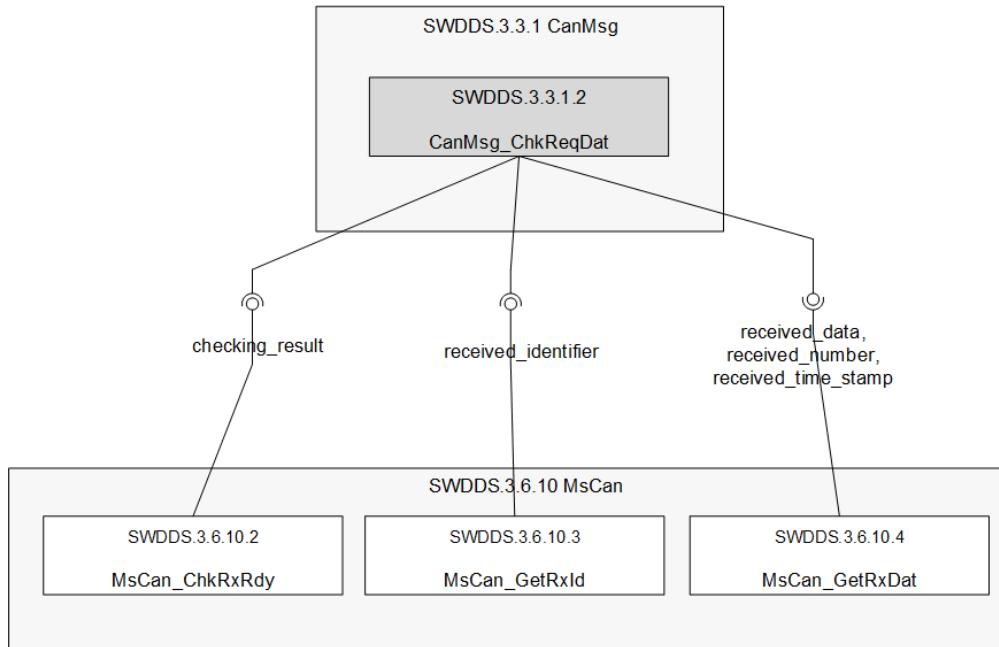
Software Unit Information					
Unit ID	SWDDS.3.3.1.2	Unit Name	CanMsg_ChkReqDat		
Architecture ID	SWADS.3.3.1.2	ASIL	QM		
Prototype	void CanMsg_ChkReqDat( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgReqRxData	0 ~ 255	Read	CAN received request data storage
	tU16	g_u16CanMsgRxDataNo	0 ~ 8	Read/Write	CAN received data number
	tU16	g_u16CanMsgRxTimeStamp	0 ~ 65535	Read/Write	CAN received time stamp
	tBool	g_bCanMsgUpdated	0 ~ 1 FALSE / TRUE	Write	FALSE – not updated, TRUE – updated
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN request message checking				

Control Flow Diagram (or Pseudo Code)	<pre>     start     tU32 received_identifier;     if MsCan_ChkRxRdy() != FALSE         if received_identifier == CAN_MSG_REQ_RX_ID             [SWDDS.3.6.10.4]             MsCan_GetRxDat(                 &amp;g_au8CanMsgReqRxData,                 &amp;g_u16CanMsgRxDataNo,                 &amp;g_u16CanMsgRxTimeStamp );             g_bCanMsgUpdated = TRUE;         end     end   </pre>
	Called Function
	SWDDS.2.3.21 Rtel0_ChkCanReqMsg
	SWDDS.3.6.10.2 MsCan_ChkRxRdy
	SWDDS.3.6.10.3 MsCan_GetRxId
Calling Function	SWDDS.3.6.10.4 MsCan_GetRxDat
	N/A

Requirement Id	SWDDS.3.3.1.2
Target Milestone	EBS2
Element	CAN
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.1.2.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	176



#### 1.1.2.1.2.3 Dynamic View Design

- N/A

#### 1.1.2.1.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Range Max	Physical Range Min	Range Max	Resolution /Units	Description
1	checking_result	SWDDS.3.6.10.2	IN	tBool	0	1	Not updated	Message updated	N/A	MSCAN data received data ready checking
2	received_identifier	SWDDS.3.6.10.3	IN	tU32	0	536870911	0	536870911	N/A	Received data identifier
3	received_data	SWDDS.3.6.10.4	OUT	tU8	0	255	0	255	N/A	CAN received request data storage
4	received_number	SWDDS.3.6.10.4	OUT	tU16*	0	8	0	8	N/A	CAN received data number
5	received_time_stamp	SWDDS.3.6.10.4	OUT	tU16*	0	65535	0	65535	N/A	CAN received time stamp

#### 1.1.2.1.3 [SWDDS.3.3.1.3] CanMsg\_GetReqDat

##### 1.1.2.1.3.1 Detailed Design

##### [SWDDS.3.3.1.3] CanMsg\_GetReqDat

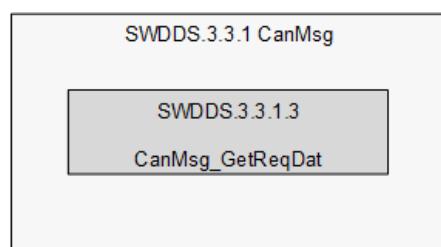
Software Unit Information					
Unit ID	SWDDS.3.3.1.3		Unit Name	CanMsg_GetReqDat	
Architecture ID	SWADS.3.3.1.3		ASIL	QM	
Prototype	tBool CanMsg_GetReqDat( tCanMsgReq* request_message )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tCanMsgReq*	request_message	N/A	OUT	request message from TCU

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	177

Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1 FALSE / TRUE		FALSE – not updated, TRUE – message updated	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgReqRxData[3]	0 ~ 255	Read	CAN received request data storage[3]
	tBool	g_bCanMsgUpdated	0 ~ 1 FALSE / TRUE	Read/Write	FALSE – not updated, TRUE – updated
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN request message getting – Target speed input getting – Received message updated checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tBool message_updated;     (*request_message).s16E optTargetSpeed =     20 * (tS16)g_au8CanMsgReqRxData[3];     message_updated = g_bCanMsgUpdated;     g_bCanMsgUpdated = FALSE;     ↓     return message_updated;   </pre>				
Called Function	SWDDS.2.3.22 Rtel0_GetTgtSpd				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.3.1.3
Target Milestone	EBS2
Element	CAN
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

#### 1.1.2.1.3.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	178

#### 1.1.2.1.3.3 Dynamic View Design

- N/A

#### 1.1.2.1.3.4 Interface Design

- N/A

#### 1.1.2.1.4 [SWDDS.3.3.1.4] CanMsg\_SetResDat

##### 1.1.2.1.4.1 Detailed Design

##### [SWDDS.3.3.1.4] CanMsg\_SetResDat

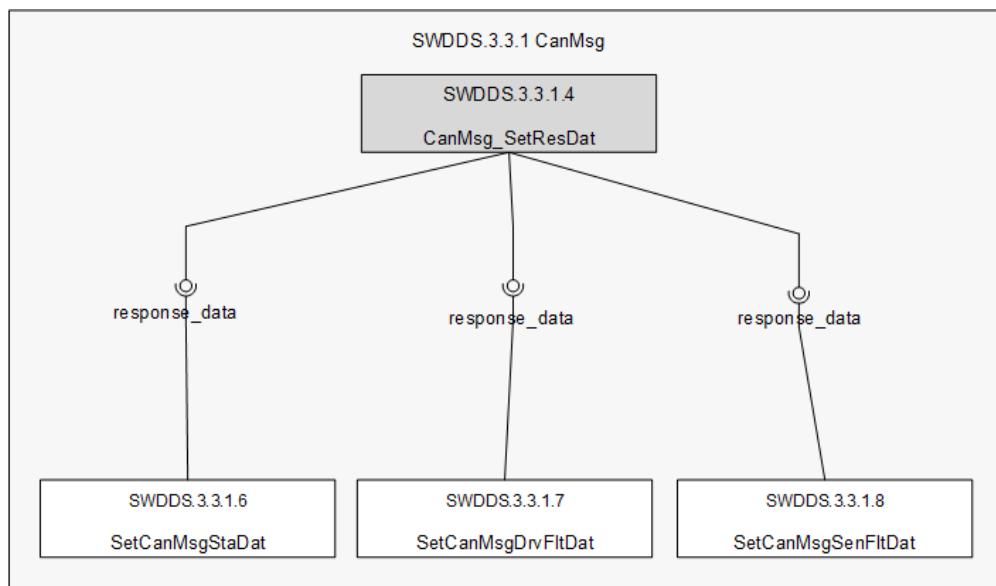
Software Unit Information					
Unit ID	SWDDS.3.3.1.4		Unit Name	CanMsg_SetResDat	
Architecture ID	SWADS.3.3.1.4		ASIL	QM	
Prototype	void CanMsg_SetResDat( tCanMsgRes response_data )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	tCanMsgRes	response_data	-6000 ~ 6000	IN	response data – s16ActualRotationalSpeed
	tCanMsgRes	response_data	0 ~ 65535	IN	response data – u16EepromFaultCount
	tCanMsgRes	response_data	0 ~ 32767	IN	response data – f16DcCurrentInput
	tCanMsgRes	response_data	-32768 ~ 32767	IN	response data – f16CurrentOutputQ
	tCanMsgRes	response_data	-32768 ~ 32767	IN	response data – f16MotorTorque
	tCanMsgRes	response_data	0 ~ 4095	IN	response data – u16OpFaultFlag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	
	tU8	g_au8CanMsgResTxData[8u]	0 ~ 255	Write	CAN response transmission data storage
Parameters	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Description	CAN response message setting				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     Volatile tU16 message_index;     message_index = 0u;     message_index++;     if message_index &lt; 8u {         g_au8CanMsgResTxData[message_index] = 0x00u;     }     [SWDDS.3.3.1.6] SetCanMsgStaDat(response_data);     [SWDDS.3.3.1.7] SetCanMsgDrvFiltDat(response_data);     [SWDDS.3.3.1.8] SetCanMsgSenFiltDat(response_data);     end   </pre>	
	Called Function	SWDDS.2.3.25 Rtelo_SendResMsg
	Calling Function	SWDDS.3.3.1.6 SetCanMsgStaDat SWDDS.3.3.1.7 SetCanMsgDrvFiltDat SWDDS.3.3.1.8 SetCanMsgSenFiltDat
	Function Execution Time	N/A

Requirement Id	SWDDS.3.3.1.4
Target Milestone	EBS2
Element	CAN
Risk	▣ Mid
Interoperability	No
Criticality	▣ Mid
Technical complexity	▢ Low
Verifiability	Yes

#### 1.1.2.1.4.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	180



#### 1.1.2.1.4.3 Dynamic View Design

- N/A

#### 1.1.2.1.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	response_data	SWDDS.3.3.1.6	OUT	tCanMsgRes	N/A	N/A	N/A	N/A	structure	response data
2	response_data	SWDDS.3.3.1.7	OUT	tCanMsgRes	N/A	N/A	N/A	N/A	structure	response data
3	response_data	SWDDS.3.3.1.8	OUT	tCanMsgRes	N/A	N/A	N/A	N/A	structure	response data

#### 1.1.2.1.5 [SWDDS.3.3.1.5] CanMsg\_SendResDat

##### 1.1.2.1.5.1 Detailed Design

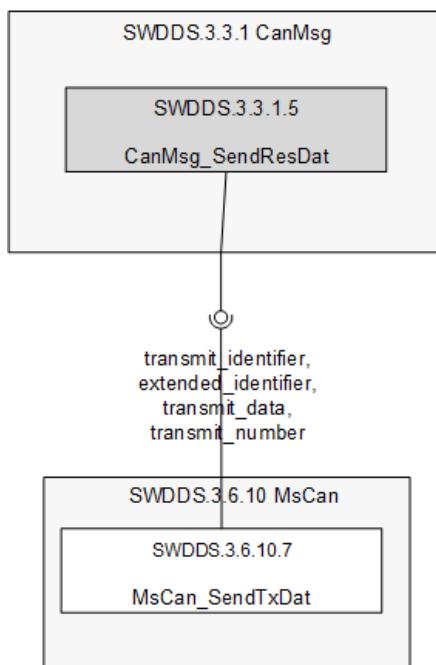
##### [SWDDS.3.3.1.5] CanMsg\_SendResDat

Software Unit Information					
Unit ID	SWDDS.3.3.1.5		Unit Name	CanMsg_SendResDat	
Architecture ID	SWADS.3.3.1.5		ASIL	QM	
Prototype	void CanMsg_SendResDat( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgResTxData	0 ~ 255	Write	CAN response transmission data storage
	Data Type	Name	Range	Read/Write	Description

Parameters	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN response message sending				
Control Flow Diagram (or Pseudo Code)	<pre> start     [SWDDS.3.6.10.7]     MsCan_SendTxDat( CAN_MSG_RES_TX_ID,     CAN_MSG_RES_TX_ID_EXT, g_au8CanMsgResTxData,     CAN_MSG_RES_TX_ID_DAT_NO ); end </pre>				
Called Function	SWDDS.2.3.25 Rtelo_SendResMsg				
Calling Function	SWDDS.3.6.10.7 MsCan_SendTxDat				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.3.1.5
Target Milestone	EBS2
Element	CAN
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

#### 1.1.2.1.5.2 Static View Design



	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-30
			Page		182	

#### 1.1.2.1.5.3 Dynamic View Design

- N/A

#### 1.1.2.1.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	transmit_identifier	SWDDS.3.6.10.7	OUT	tU32	0	536870911	0	536870911	N/A	Response transmission identifier to TCU
2	extended_identifier	SWDDS.3.6.10.7	OUT	tBool	0	1	Standard ID	Extended ID	N/A	FALSE – standard
3	transmit_data[8u]	SWDDS.3.6.10.7	OUT	tU8	0	255	0	255	N/A	CAN response transmission data storage
4	transmit_number	SWDDS.3.6.10.7	OUT	tU16	0	8	0	8	N/A	Number of response data

#### 1.1.2.1.6 [SWDDS.3.3.1.6] SetCanMsgStaDat

##### 1.1.2.1.6.1 Detailed Design

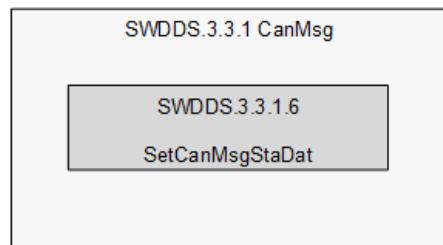
##### [SWDDS.3.3.1.6] SetCanMsgStaDat

Software Unit Information					
Unit ID	SWDDS.3.3.1.6		Unit Name	SetCanMsgStaDat	
Architecture ID	SWADS.3.3.1.6		ASIL	QM	
Prototype	void SetCanMsgStaDat( tCanMsgRes response_data )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tCanMsgRes	response_data	-6000 ~ 6000	IN	response data - s16ActualRotationalSpeed
	tCanMsgRes	response_data	0 ~ 65535	IN	response data - u16EepromFaultCount
	tCanMsgRes	response_data	0 ~ 32767	IN	response data - f16DcCurrentInput
	tCanMsgRes	response_data	-32768 ~ 32767	IN	response data - f16CurrentOutputQ
	tCanMsgRes	response_data	-32768 ~ 32767	IN	response data - f16MotorTorque
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgResTxData[1u]	0 ~ 255	Write	CAN response transmission data storage[1]
	tU8	g_au8CanMsgResTxData[2u]	0 ~ 255	Write	CAN response transmission data storage[2]
	tU8	g_au8CanMsgResTxData[3u]	0 ~ 255	Write	CAN response transmission data storage[3]
	tU8	g_au8CanMsgResTxData[4u]	0 ~ 255	Write	CAN response transmission data storage[4]
	tU8	g_au8CanMsgResTxData[5u]	0 ~ 255	Write	CAN response transmission data storage[5]
	tU8	g_au8CanMsgResTxData[6u]	0 ~ 255	Write	CAN response transmission data storage[6]
Parameters	Data Type	Name	Range	Read/Write	Description

	tU16	par_u16PrdctInfoSwVer	0 ~ 255	Read	Software version
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN response message status data setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tu16 converted_torque;     if(response_data.s16ActualRotationalSpeed &gt;= 0) {         g_aui8CanMsgResTxData[1u] = (tu8)((response_data.s16ActualRotationalSpeed / 20) &amp; 0x00ffu);     } else {         g_aui8CanMsgResTxData[1u] = (tu8)0u;     }     g_aui8CanMsgResTxData[2u] = (tu8)(par_u16PrdctInfoSwVer &amp; 0x00ffu);     g_aui8CanMsgResTxData[3u] = (tu8)((response_data.u16EepromFaultCount &amp; 0x00ffu) &amp; CAN_MSG_SCALE_DIV_DC_CUR);     g_aui8CanMsgResTxData[4u] = (tu8)((response_data.f16DccurrentInput / CAN_MSG_SCALE_DIV_DC_CUR) &amp; 0x00ffu);     g_aui8CanMsgResTxData[5u] = (tu8)((response_data.f16CurrentOutputQ / CAN_MSG_SCALE_DIV_PHS_CUR) &amp; 0x00ffu);     converted_torque = response_data.f16MotorTorque / CAN_MSG_SCALE_DIV_MTR_TRQ;     g_aui8CanMsgResTxData[6u]  = (tu8)((converted_torque &lt;&lt; 2) &amp; 0x00fau); } end </pre>				
Called Function	SWDDS.3.3.1.4 CanMsg_SetResDat				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.3.1.6
Target Milestone	EBS2
Element	CAN
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.1.6.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	184

#### 1.1.2.1.6.3 Dynamic View Design

- N/A

#### 1.1.2.1.6.4 Interface Design

- N/A

#### 1.1.2.1.7 [SWDDS.3.3.1.7] SetCanMsgDrvFltDat

##### 1.1.2.1.7.1 Detailed Design

##### [SWDDS.3.3.1.7] SetCanMsgDrvFltDat

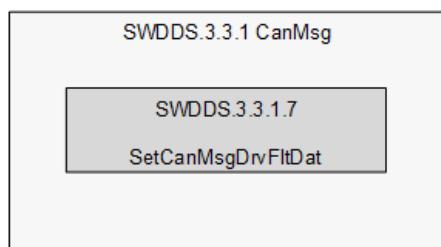
Software Unit Information					
Unit ID	SWDDS.3.3.1.7		Unit Name	SetCanMsgDrvFltDat	
Architecture ID	SWADS.3.3.1.7		ASIL	QM	
Prototype	void SetCanMsgDrvFltDat( tCanMsgRes response_data )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tCanMsgRes	response_data	0 ~ 4095	IN	response data – u16OpuFaultFlag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgResTxData[0u]	0 ~ 3	Write	CAN response transmission data storage[0]
	tU8	g_au8CanMsgResTxData[6u]	0 ~ 255	Write	CAN response transmission data storage[6]
	tU8	g_au8CanMsgResTxData[7u]	0 ~ 255	Write	CAN response transmission data storage[7]
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN response message driving fault data setting				
Control Flow Diagram	<ol style="list-style-type: none"> <li>SetCanMsgDrvFltDat checks the protect mode flag and sets ProtectMode signal the CAN message.</li> <li>SetCanMsgDrvFltDat checks the gate driver under/over voltage flag and sets GateDrv_UV_OV signal the CAN message.</li> <li>SetCanMsgDrvFltDat checks the short circuit flag and sets Short_Circuit signal the CAN message.</li> <li>SetCanMsgDrvFltDat checks the over-current flag and sets Over_current signal the CAN message.</li> <li>SetCanMsgDrvFltDat checks the low current flag and sets Low_Current signal the CAN message.</li> <li>SetCanMsgDrvFltDat checks the speed error flag and sets Speed_Error signal the CAN message.</li> </ol>				

Control Flow Diagram (or Pseudo Code)	
	<pre> start tu32 fault_flag; fault_flag = response_data.u16OpufaultFlag;  if(fault_flag &amp; OPU_FLT_PROT_MODE != 0x0000u)     g_au8CanMsgResTxData[0u]  = 0x02u;  if(fault_flag &amp; OPU_FLT_GDRV_UV_OV != 0x0000u)     g_au8CanMsgResTxData[6u]  = 0x02u;  if(fault_flag &amp; OPU_FLT_SHRT_CIR != 0x0000u)     g_au8CanMsgResTxData[6u]  = 0x01u;  if(fault_flag &amp; OPU_FLT_OVR_CUR != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x10u;  if(fault_flag &amp; OPU_FLT_LOW_CUR != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x08u;  if(fault_flag &amp; OPU_FLT_SPD_ERR != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x01u;  end </pre>
Called Function	SWDDS.3.3.1.4 CanMsg_SetResDat
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.3.1.7
Target Milestone	EBS2
Element	CAN
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	High
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	186

#### 1.1.2.1.7.2 Static View Design



#### 1.1.2.1.7.3 Dynamic View Design

- N/A

#### 1.1.2.1.7.4 Interface Design

- N/A

#### 1.1.2.1.8 [SWDDS.3.3.1.8] SetCanMsgSenFltDat

##### 1.1.2.1.8.1 Detailed Design

##### [SWDDS.3.3.1.8] SetCanMsgSenFltDat

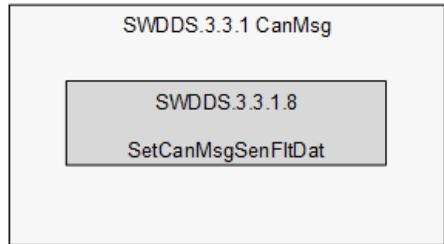
Software Unit Information					
Unit ID	SWDDS.3.3.1.8		Unit Name	SetCanMsgSenFltDat	
Architecture ID	SWADS.3.3.1.8		ASIL	QM	
Prototype	void SetCanMsgSenFltDat( tCanMsgRes response_data )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tCanMsgRes	response_data	0 ~ 4095	IN	response data - u16OpuFaultFlag
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8CanMsgResTxData[0u]	0 ~ 3	Write	CAN response transmission data storage[0]
	tU8	g_au8CanMsgResTxData[7u]	0 ~ 255	Write	CAN response transmission data storage[7]
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Sensorless FOC control data setting - Control enable setting - Control mode change checking - Control data setting				
	1. SetCanMsgSenFltDat checks if any fault flag is set and sets FaultStatus signal the CAN message. 2. SetCanMsgSenFltDat checks the over voltage flag and sets Over_Voltage signal the CAN message. 3. SetCanMsgSenFltDat checks the under voltage flag and sets Under_Voltage signal the CAN message. 4. SetCanMsgSenFltDat checks the warning temperature flag and sets Warn_Temp signal the CAN message. 5. SetCanMsgSenFltDat checks the over temperature flag and sets Over_Temp signal the CAN message.				

Control Flow Diagram (or Pseudo Code)	<pre> start tu32 fault_flag; fault_flag = response_data.u16OpufaultFlag;  if(fault_flag &amp; OPU_FLT_FLT_STA != 0x0000u)     g_au8CanMsgResTxData[0u]  = 0x01u;  if(fault_flag &amp; OPU_FLT_OVR_VOLT != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x40u;  if(fault_flag &amp; OPU_FLT_UND_VOLT != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x20u;  if(fault_flag &amp; OPU_FLT_WRN_TEMP != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x04u;  if(fault_flag &amp; OPU_FLT_OVR_TEMP != 0x0000u)     g_au8CanMsgResTxData[7u]  = 0x02u;  end </pre>
	SWDDS.3.3.1.4 CanMsg_SetResDat
Called Function	N/A
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.3.1.8
Target Milestone	EBS2
Element	CAN
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ High
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-30
		Page	188

#### 1.1.2.1.8.2 Static View Design



#### 1.1.2.1.8.3 Dynamic View Design

- N/A

#### 1.1.2.1.8.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	1

Unit ID

# VW AQ EOP

## Software Detailed Design Specification(4/4)

### Document Properties

Status:  [Open](#)

Version: **003**

Author: Kim Minsu

Created: 2020-12-17 22:39

### Approved Versions

Current Document version **003** has **not** been approved.

Approved Versions:

- [001](#) (2021-01-06 15:50)
- [002](#) (2021-04-15 21:22)
- [002](#) (2021-04-22 10:18)

### Document Signatures

**Approved** (*Status Change Pending*)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	2

## Document Control Information

**Location:** The released versions of this document are maintained by SWE DE and managed in the following location:

[Polarion] VW AQ EOP / Documents & Pages / 02\_Engineering / 12\_SWE\_Design

Version	Date of Release	Description (Change and Reasons for Change)	Author	Reviewer	Approver
001	2020-10-28	• Initiation of draft version	Taihyun Kyung	-	-
	2020-11-30	• Add flow diagram and sequence diagram	Taihyun Kyung	Rasekar Prashant	Hyojin Ahn
002	2021-02-15	• Add evaluation criteria • Resolved defect – CR-0005	Taihyun Kyung	-	-
	2021-02-17	• Modify traceability management	Taihyun Kyung	-	-
	2021-02-26	• Change the Customer Requirement_CAN Timeout-0008 • Add the Tolerance of Voltage–CR-0009	Taihyun Kyung	-	-
	2021-03-10	• Changed low temperature warning criteria – CR-0003	Taihyun Kyung	-	-
	2021-03-12	• Change and add component – CR-0010	Taihyun Kyung	-	-
	2021-04-09	• OPU HW change to apply EMC debugging(TL81000, CE) results–CR-0012	Taihyun Kyung	-	-
	2021-04-15	• Change Target Milestone, Traceability – CR-0010 • Add description for Control Flow Diagram and Sequence Diagram	Minsu Kim	Sungjin Park	Hyojin Ahn
	2021-04-22	• Resolved problem: CMNC-0033	Minsu Kim	Sungjin Park	Hyojin Ahn
003	2021-04-27	• Change Static View Design	Minsu Kim	-	-

Table 1 Version History

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	3

## Table of Contents

1 Function Description .....	8
1.1 [SWDDS.3] BSW .....	8
1.1.1 [SWDDS.3.5] SRV .....	8
1.1.1.1 [SWDDS.3.5.1] Nvm .....	8
1.1.1.1.1 [SWDDS.3.2.1.1] Nvm_Init .....	8
1.1.1.1.2 [SWDDS.3.2.1.2] Nvm_SaveEepromDat .....	9
1.1.1.1.3 [SWDDS.3.2.1.3] Nvm_LoadEepromLong .....	12
1.1.1.2 [SWDDS.3.5.2] SIpWku .....	13
1.1.1.2.1 [SWDDS.3.5.2.1] SIpWku_Init .....	13
1.1.1.2.2 [SWDDS.3.5.2.2] SIpWku_SetCanSlp .....	15
1.1.2 [SWDDS.3.6] HAL .....	16
1.1.2.1 [SWDDS.3.6.1] BswHal .....	16
1.1.2.1.1 [SWDDS.3.6.1.1] BswHal_Init .....	16
1.1.2.1.2 [SWDDS.3.6.1.2] InitializeBswHalMtrCtr .....	18
1.1.2.1.3 [SWDDS.3.6.1.3] BswHal_GetBatVolt .....	20
1.1.2.1.4 [SWDDS.3.6.1.4] BswHal_GetPcbTemp .....	23
1.1.2.1.5 [SWDDS.3.6.1.5] BswHal_GetHwld .....	24
1.1.2.2 [SWDDS.3.6.2] Cpmu .....	26
1.1.2.2.1 [SWDDS.3.6.2.1] Cpmu_Init .....	26
1.1.2.2.2 [SWDDS.3.6.2.2] Cpmu_SetCfgPrtct .....	30
1.1.2.2.3 [SWDDS.3.6.2.3] Cpmu_GetRstFlag .....	31
1.1.2.3 [SWDDS.3.6.3] Pim .....	33
1.1.2.3.1 [SWDDS.3.6.3.1] Pim_Init .....	33
1.1.2.3.2 [SWDDS.3.6.3.2] InitializePimModule .....	34
1.1.2.3.3 [SWDDS.3.6.3.3] InitializePimDioPort .....	36
1.1.2.3.4 [SWDDS.3.6.3.4] InitializePimAnaPort .....	38
1.1.2.3.5 [SWDDS.3.6.3.5] InitializePimUnusedDigPort .....	39
1.1.2.4 [SWDDS.3.6.4] Tim .....	41
1.1.2.4.1 [SWDDS.3.6.4.1] Tim_Init .....	41
1.1.2.4.2 [SWDDS.3.6.4.2] Tim_EnaRunAndIrq .....	43
1.1.2.4.3 [SWDDS.3.6.4.3] Tim_GetCh3Flag .....	44
1.1.2.4.4 [SWDDS.3.6.4.4] Tim_Ch0Isr .....	46
1.1.2.4.5 [SWDDS.3.6.4.5] Tim_Ch3Isr .....	47
1.1.2.5 [SWDDS.3.6.5] Wdt .....	49
1.1.2.5.1 [SWDDS.3.6.5.1] Wdt_Init .....	49
1.1.2.5.2 [SWDDS.3.6.5.2] Wdt_RstTim .....	50
1.1.2.6 [SWDDS.3.6.6] Pmf .....	52
1.1.2.6.1 [SWDDS.3.6.6.1] Pmf_Init .....	52
1.1.2.6.2 [SWDDS.3.6.6.2] Pmf_SetWrtPrtct .....	54
1.1.2.6.3 [SWDDS.3.6.6.3] Pmf_ClrFlt .....	56
1.1.2.7 [SWDDS.3.6.7] Gdu .....	56
1.1.2.7.1 [SWDDS.3.6.7.1] Gdu_Init .....	56
1.1.2.7.2 [SWDDS.3.6.7.2] Gdu_ChkVlsLow .....	58
1.1.2.7.3 [SWDDS.3.6.7.3] Gdu_GetStaFlag .....	60
1.1.2.7.4 [SWDDS.3.6.7.4] Gdu_GetDesatFlag .....	61
1.1.2.7.5 [SWDDS.3.6.7.5] Gdu_ClrFlt .....	62

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	4

1.1.2.7.6 [SWDDS.3.6.7.6] Gdu_SetWrtPrct .....	63
1.1.2.8 [SWDDS.3.6.8] Adc .....	65
1.1.2.8.1 [SWDDS.3.6.8.1] Adc_Init .....	65
1.1.2.8.2 [SWDDS.3.6.8.2] InitializeAdcConv0 .....	67
1.1.2.8.3 [SWDDS.3.6.8.3] InitializeAdcConv1 .....	69
1.1.2.8.4 [SWDDS.3.6.8.4] Adc_GetResult0 .....	71
1.1.2.8.5 [SWDDS.3.6.8.5] Adc_GetResult1 .....	72
1.1.2.8.6 [SWDDS.3.6.8.6] Adc_GetCurSen .....	74
1.1.2.8.7 [SWDDS.3.6.8.7] Adc_GetErrCnt1 .....	75
1.1.2.8.8 [SWDDS.3.6.8.8] Adc_DoneIsr1 .....	76
1.1.2.8.9 [SWDDS.3.6.8.9] Adc_GetErrCnt0 .....	78
1.1.2.8.10 [SWDDS.3.6.8.10] Adc_ErrIsr0 .....	79
1.1.2.8.11 [SWDDS.3.6.8.11] Adc_ErrIsr1 .....	81
1.1.2.9 [SWDDS.3.6.9] Ptu .....	83
1.1.2.9.1 [SWDDS.3.6.9.1] Ptu_Init .....	83
1.1.2.10 [SWDDS.3.6.10] MsCan .....	85
1.1.2.10.1 [SWDDS.3.6.10.1] MsCan_Init .....	85
1.1.2.10.2 [SWDDS.3.6.10.2] MsCan_ChkRxRdy .....	89
1.1.2.10.3 [SWDDS.3.6.10.3] MsCan_GetRxId .....	91
1.1.2.10.4 [SWDDS.3.6.10.4] MsCan_GetRxDat .....	93
1.1.2.10.5 [SWDDS.3.6.10.5] SetMsCanTxId .....	94
1.1.2.10.6 [SWDDS.3.6.10.6] SetMsCanTransmitDat .....	96
1.1.2.10.7 [SWDDS.3.6.10.7] MsCan_SendTxDat .....	98
1.1.2.10.8 [SWDDS.3.6.10.8] SetMsCanBaudRate .....	100
1.1.2.10.9 [SWDDS.3.6.10.9] MsCan_GetRxFlg .....	102
1.1.2.11 [SWDDS.3.6.11] Eeprom .....	103
1.1.2.11.1 [SWDDS.3.6.11.1] Eeprom_Init .....	104
1.1.2.11.2 [SWDDS.3.6.11.2] CheckEepromPrevCmd .....	105
1.1.2.11.3 [SWDDS.3.6.11.3] ExecuteEepromCmd .....	107
1.1.2.11.4 [SWDDS.3.6.11.4] Eeprom_VerifySectionErased .....	108
1.1.2.11.5 [SWDDS.3.6.11.5] Eeprom_ProgramDat .....	111
1.1.2.11.6 [SWDDS.3.6.11.6] Eeprom_EraseSector .....	114
1.2 [SWDDS.4] CFG .....	116
1.2.1 [SWDDS.4.1] CalData .....	116
1.2.1.1 [SWDDS.4.1.1] CalData_Init .....	116
1.2.1.1.1 Detailed Design .....	117
1.2.1.1.2 Static View Design .....	118
1.2.1.1.3 Dynamic View Design .....	118
1.2.1.1.4 Interface Design .....	118
1.2.2 [SWDDS.4.2] Param .....	118
1.2.2.1 [SWDDS.4.2.1] Param_Init .....	118
1.2.2.1.1 Detailed Design .....	118
1.2.2.1.2 Static View Design .....	119
1.2.2.1.3 Dynamic View Design .....	120
1.2.2.1.4 Interface Design .....	120
1.3 [SWDDS.5] Main .....	120
1.3.1 Detailed Design .....	120
1.3.2 Static View Design .....	121
1.3.3 Dynamic View Design .....	121

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	5

1.3.4 Interface Design ..... 122

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	6

## List of Figures

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	7

## List of Tables

Table 1 Version History

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	8

## 1 Function Description

### 1.1 [SWDDS.3] BSW

#### 1.1.1 [SWDDS.3.5] SRV

SRV provides various service routines such as NVM access, sleep setting, memory checking and resource usage checking.

##### 1.1.1.1 [SWDDS.3.5.1] Nvm

Save/ Load data to EEPROM

###### 1.1.1.1.1 [SWDDS.3.2.1.1] Nvm\_Init

###### 1.1.1.1.1.1 Detailed Design

###### [SWDDS.3.5.1.1] Nvm\_Init

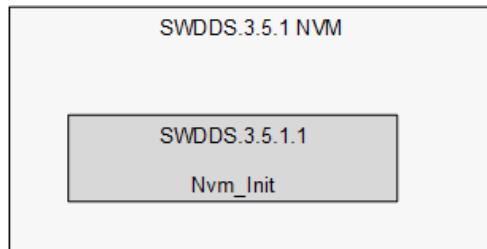
Software Unit Information				
Unit ID	SWDDS.3.5.1.1	Unit Name	Nvm_Init	
Architecture ID	SWADS.3.5.1.1	ASIL	QM	
Prototype	void Nvm_Init( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description	
	void	N/A	N/A	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Non-volatile memory initialization			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     end   </pre>			
Called Function	SWDDS.2.3.2 InitializeRteloSrv			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.3.5.1.1
Target Milestone	SBS2.1
Element	SRV
Risk	Low
Interoperability	Yes
Criticality	Mid

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	9

Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.1.1.2 Static View Design



#### 1.1.1.1.3 Dynamic View Design

- N/A

#### 1.1.1.1.4 Interface Design

- N/A

#### 1.1.1.1.2 [SWDDS.3.2.1.2] Nvm\_SaveEepromDat

##### 1.1.1.1.2.1 Detailed Design

###### [SWDDS.3.5.1.2] Nvm\_SaveEepromDat

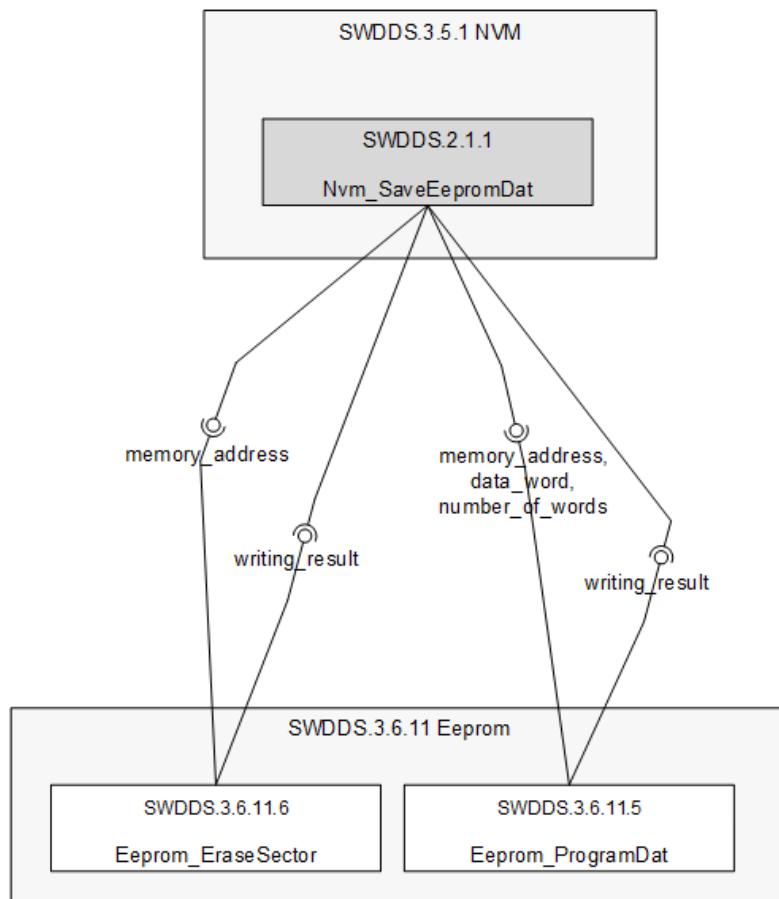
Software Unit Information					
Unit ID	SWDDS.3.5.1.2	Unit Name	Nvm_SaveEepromDat		
Architecture ID	SWADS.3.5.1.2	ASIL	QM		
Prototype	tU8 Nvm_SaveEepromDat( tU16 eeprom_address, tU16 data_word[2u] )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	tU16	eeprom_address	0 ~ 511	IN	Eeprom_address
	tU16	data_word[0u]	0 ~ 65535	IN	16-bit word data
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU8	writing_result		EEPROM Return status	
Global Variables	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Description	Non-volatile memory data saving				

Control Flow Diagram (or Pseudo Code)	<pre>     start     tu8 writing_result;     [SWDDS.3.6.11.6]     writing_result = Eeprom_EraseSector(         NVM_EEPROM_BASE_ADDR +         (tu32)eprom_address );     if(writing_result == EEPROM_RET_OK)         [SWDDS.3.6.11.5]         writing_result = Eeprom_ProgramData(             NVM_EEPROM_BASE_ADDR +             (tu32)eprom_address, data_word, 2u );     return writing_result;   </pre>
Called Function	SWDDS.2.3.26 Rtelo_SaveEepromData
Calling Function	SWDDS.3.6.11.6 Eeprom_EraseSector SWDDS.3.6.11.5 Eeprom_ProgramData
Function Execution Time	N/A

Requirement Id	SWDDS.3.5.1.2
Target Milestone	SBS2.1
Element	SRV
Risk	<span style="background-color: #e0c080; border: 1px solid black; padding: 2px;"> </span> Mid
Interoperability	Yes
Criticality	<span style="background-color: #e0c080; border: 1px solid black; padding: 2px;"> </span> Mid
Technical complexity	<span style="background-color: #a0ffa0; border: 1px solid black; padding: 2px;"> </span> Low
Verifiability	Yes

#### 1.1.1.1.2.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	11



#### 1.1.1.1.2.3 Dynamic View Design

- N/A

#### 1.1.1.1.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	memory_address	SWDDS.3.6.11.6	OUT	tU32	0	511	0	511	N/A	memory address
2	writing_result	SWDDS.3.6.11.6	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ERR	N/A	EEPROM writing result
3	memory_address	SWDDS.3.6.11.5	OUT	tU32	0	511	0	511	N/A	memory address
4	data_word	SWDDS.3.6.11.5	OUT	const tU16*	0	65535	0	65535	N/A	programmed data words (array)
5	number_of_words	SWDDS.3.6.11.5	OUT	tU16	1	4	1	4	N/A	number of data words (1 ~ 4)
6	writing_result	SWDDS.3.6.11.5	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ERR	N/A	EEPROM writing result

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	12

### 1.1.1.1.3 [SWDDS.3.2.1.3] Nvm\_LoadEepromLong

#### 1.1.1.1.3.1 Detailed Design

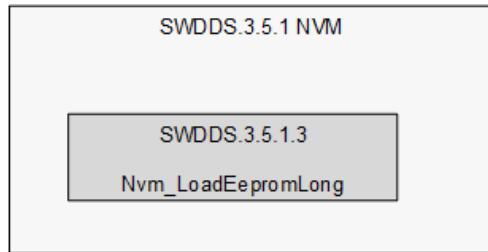
##### [SWDDS.3.5.1.3] Nvm\_LoadEepromLong

Software Unit Information				
Unit ID	SWDDS.3.5.1.3		Unit Name	Nvm_LoadEepromLong
Architecture ID	SWADS.3.5.1.3		ASIL	QM
Prototype	tU32 Nvm_LoadEepromLong( tU16 eeprom_address )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tU16	eeprom_address	0 ~ 511	IN
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	EEPROM 32-bit long word data loading			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tu32 memory_address;     tu32 long_data;     memory_address = NVM_EEPROM_BASE_ADDR     + (tU32)eeprom_address;     long_data = *((tU32*)memory_address);     ↓     return long_data;   </pre>			
Called Function	SWDDS.2.3.27 Rtelo_LoadEepromLong			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.3.5.1.3
Target Milestone	SBS2.1
Element	SRV
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: #008000;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	13

#### 1.1.1.1.3.2 Static View Design



#### 1.1.1.1.3.3 Dynamic View Design

- N/A

#### 1.1.1.1.3.4 Interface Design

- N/A

### 1.1.1.2 [SWDDS.3.5.2] SlpWku

Set sleep and wake-up

#### 1.1.1.2.1 [SWDDS.3.5.2.1] SlpWku\_Init

##### 1.1.1.2.1.1 Detailed Design

###### [SWDDS.3.5.2.1] SlpWku\_Init

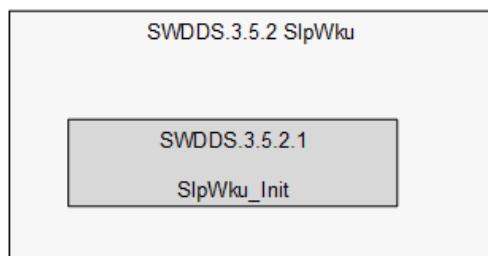
Software Unit Information					
Unit ID	SWDDS.3.5.2.1		Unit Name	SlpWku_Init	
Architecture ID	SWADS.3.5.2.1		ASIL	QM	
Prototype	void SlpWku_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	PIM_PORT_OUT_CAN_ENA	1	Write	Enable CAN transceiver
	byte	PIM_PORT_OUT_CAN_NSTB	1	Write	Disable CAN transceiver sleep mode
Description	Sleep and wake-up initialization				
Control Flow Diagram					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	14

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; PIM["PIM_PORT_OUT_CAN_ENA = 0x01u; IM_PORT_OUT_CAN_NSTB = 0x01u;"]     PIM --&gt; end((end))   </pre>
Called Function	SWDDS.2.3.2 InitializeRteloSrv
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.5.2.1
Target Milestone	EBS2
Element	SRV
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No
Criticality	<input type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.1.2.1.2 Static View Design



#### 1.1.1.2.1.3 Dynamic View Design

- N/A

#### 1.1.1.2.1.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	15

#### 1.1.1.2.2 [SWDDS.3.5.2.2] SlpWku\_SetCanSlp

##### 1.1.1.2.2.1 Detailed Design

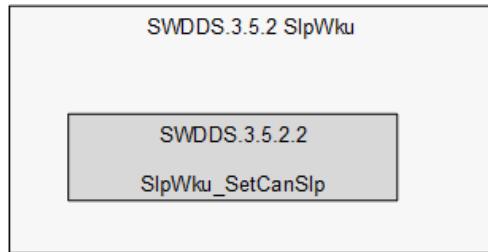
###### [SWDDS.3.5.2.2] SlpWku\_SetCanSlp

Software Unit Information					
Unit ID	SWDDS.3.5.2.2		Unit Name	SlpWku_SetCanSlp	
Architecture ID	SWADS.3.5.2.2		ASIL	QM	
Prototype	void SlpWku_SetCanSlp( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	PIM_PORT_OUT_CAN_NSTB	0	Write	Disable CAN transceiver sleep mode
Description	Entering into CAN sleep mode				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     PIM_PORT_OUT_CAN_NSTB = 0x00u;     ↓     end   </pre>				
Called Function	SWDDS.2.3.24 Rtel0_SetCanSlp				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.5.2.2
Target Milestone	EBS2
Element	SRV
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: yellow;">□</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	16

#### 1.1.1.2.2.2 Static View Design



#### 1.1.1.2.2.3 Dynamic View Design

- N/A

#### 1.1.1.2.2.4 Interface Design

- N/A

### 1.1.2 [SWDDS.3.6] HAL

HAL configures and manages peripherals such as various CPMU, PIM, TIM, MsCAN, Wdt, EEPROM, PMF, PTU, GDU, and ADC

#### 1.1.2.1 [SWDDS.3.6.1] BswHal

Initialize all register of MCU hardware Get sensing values from MCU Hardware

-Battery voltage, PCB Temperature , HW\_ID, CAN Transceiver error Set output voltage level of Test point according to input value

##### 1.1.2.1.1 [SWDDS.3.6.1.1] BswHal\_Init

###### 1.1.2.1.1.1 Detailed Design

###### [SWDDS.3.6.1.1] BswHal\_Init

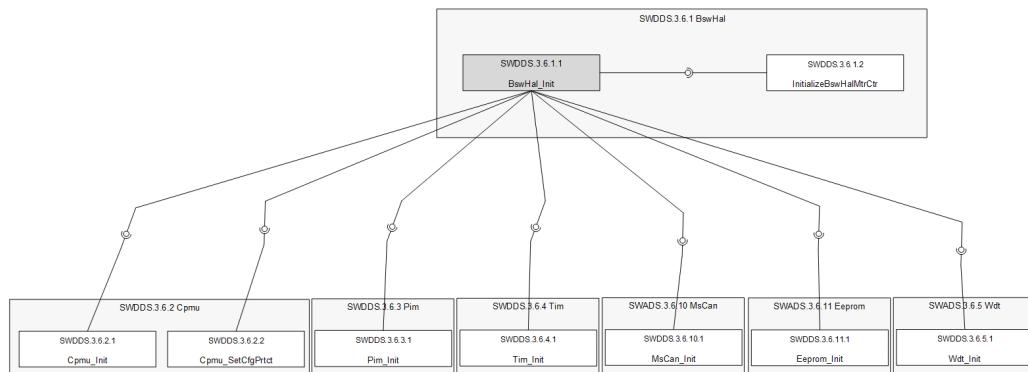
Software Unit Information				
Unit ID	SWDDS.3.6.1.1	Unit Name	BswHal_Init	
Architecture ID	SWADS.3.6.1.1	ASIL	QM	
Prototype	void BswHal_Init( void )			
Function Call	Data Type	Name	Range	In/Out
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description	
Return Value	void	N/A	N/A	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A

Registers	Data Type	Name	Range	Read/Write	Description				
	N/A	N/A	N/A	N/A	N/A				
Description	BSW HAL initialization								
Control Flow Diagram (or Pseudo Code)		<pre> graph TD     start([start]) --&gt; CpmuInit1[SWDDS.3.6.2.1 Cpmu_Init();]     CpmuInit1 --&gt; PimInit1[SWDDS.3.6.3.1 Pim_Init();]     PimInit1 --&gt; TimInit1[SWDDS.3.6.4.1 Tim_Init();]     TimInit1 --&gt; InitializeBswHalMtrCtr1[SWDDS.3.6.1.2 InitializeBswHalMtrCtr();]     InitializeBswHalMtrCtr1 --&gt; MsCanInit1[SWDDS.3.6.10.1 MsCan_Init();]     MsCanInit1 --&gt; EepromInit1[SWDDS.3.6.11.1 Eeprom_Init();]     EepromInit1 --&gt; WdtInit1[SWDDS.3.6.5.1 Wdt_Init();]     WdtInit1 --&gt; CpmuSetCfgPrtct1[SWDDS.3.6.2.2 Cpmu_SetCfgPrtct();]     CpmuSetCfgPrtct1 --&gt; end([end]) </pre>							
Called Function	SWDDS.2.3.1 Rtel0_Init								
Calling Function	SWDDS.3.6.2.1 Cpmu_Init								
	SWDDS.3.6.3.1 Pim_Init								
	SWDDS.3.6.4.1 Tim_Init								
	SWDDS.3.6.1.2 InitializeBswHalMtrCtr								
	SWDDS.3.6.10.1 MsCan_Init								
	SWDDS.3.6.11.1 Eeprom_Init								
	SWDDS.3.6.5.1 Wdt_Init								
	SWDDS.3.6.2.2 Cpmu_SetCfgPrtct								
Function Execution Time	N/A								

Requirement Id	SWDDS.3.6.1.1
Target Milestone	SBS1
Element	HAL
Risk	Low
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	18

#### 1.1.2.1.1.2 Static View Design



#### 1.1.2.1.1.3 Dynamic View Design

- N/A

#### 1.1.2.1.1.4 Interface Design

- N/A

#### 1.1.2.1.2 [SWDDS.3.6.1.2] InitializeBswHalMtrCtr

##### 1.1.2.1.2.1 Detailed Design

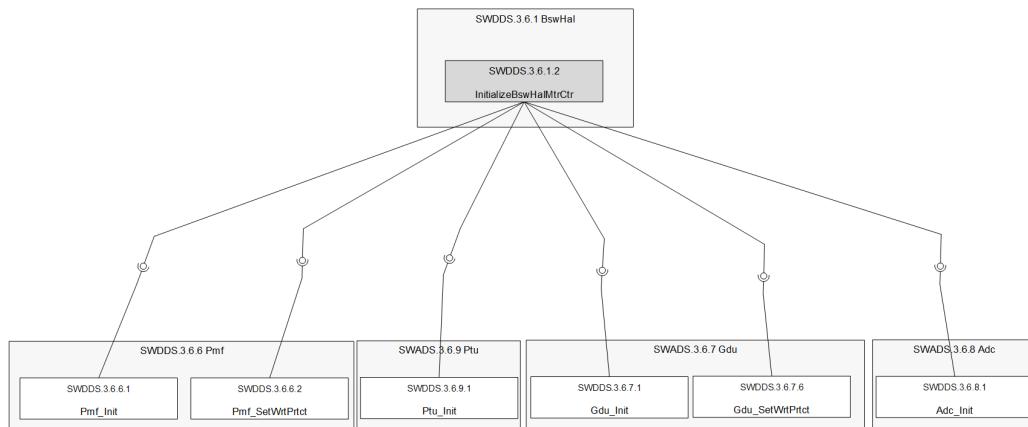
##### [SWDDS.3.6.1.2] InitializeBswHalMtrCtr

Software Unit Information				
Unit ID	SWDDS.3.6.1.2	Unit Name	InitializeBswHalMtrCtr	
Architecture ID	SWADS.3.6.1.2	ASIL	QM	
Prototype	void InitializeBswHalMtrCtr( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Motor control peripheral initialization - Peripheral initialization - Write protection setting			

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; [SWDDS.3.6.6.1 Pmf_Init()]     [SWDDS.3.6.6.1 Pmf_Init()] --&gt; [SWDDS.3.6.9.1 Ptu_Init()]     [SWDDS.3.6.9.1 Ptu_Init()] --&gt; [SWDDS.3.6.7.1 Gdu_Init()]     [SWDDS.3.6.7.1 Gdu_Init()] --&gt; [SWDDS.3.6.8.1 Adc_Init()]     [SWDDS.3.6.8.1 Adc_Init()] --&gt; [SWDDS.3.6.6.2 Pmf_SetWrtPrtct()]     [SWDDS.3.6.6.2 Pmf_SetWrtPrtct()] --&gt; [SWDDS.3.6.7.6 Gdu_SetWrtPrtct()]     [SWDDS.3.6.7.6 Gdu_SetWrtPrtct()] --&gt; end((end))   </pre>
	Called Function
	SWDDS.3.6.1.1 BswHal_Init
	SWDDS.3.6.6.1 Pmf_Init
	SWDDS.3.6.9.1 Ptu_Init
	SWDDS.3.6.7.1 Gdu_Init
	SWDDS.3.6.8.1 Adc_Init
Calling Function	SWDDS.3.6.6.2 Pmf_SetWrtPrtct
	SWDDS.3.6.7.6 Gdu_SetWrtPrtct
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.1.2
Target Milestone	SBS1
Element	HAL
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.1.2.2 Static View Design



#### 1.1.2.1.2.3 Dynamic View Design

- N/A

#### 1.1.2.1.2.4 Interface Design

- N/A

#### 1.1.2.1.3 [SWDDS.3.6.1.3] BswHal\_GetBatVolt

##### 1.1.2.1.3.1 Detailed Design

##### [SWDDS.3.6.1.3] BswHal\_GetBatVolt

Software Unit Information				
Unit ID	SWDDS.3.6.1.3		Unit Name	BswHal_GetBatVolt
Architecture ID	SWADS.3.6.1.3		ASIL	QM
Prototype	tFrac16 BswHal_GetBatVolt( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	tFrac16	0 ~ 32757 0.0 ~ 29.4991Vpk		Battery voltage signal (PU)
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	tFrac16	par_f16McuStaBatVoltOffs	-32767 ~ 32768 -29.5 ~ 29.4991Vpk	Read
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Battery voltage measurement signal getting			
Control Flow Diagram (or Pseudo Code)				

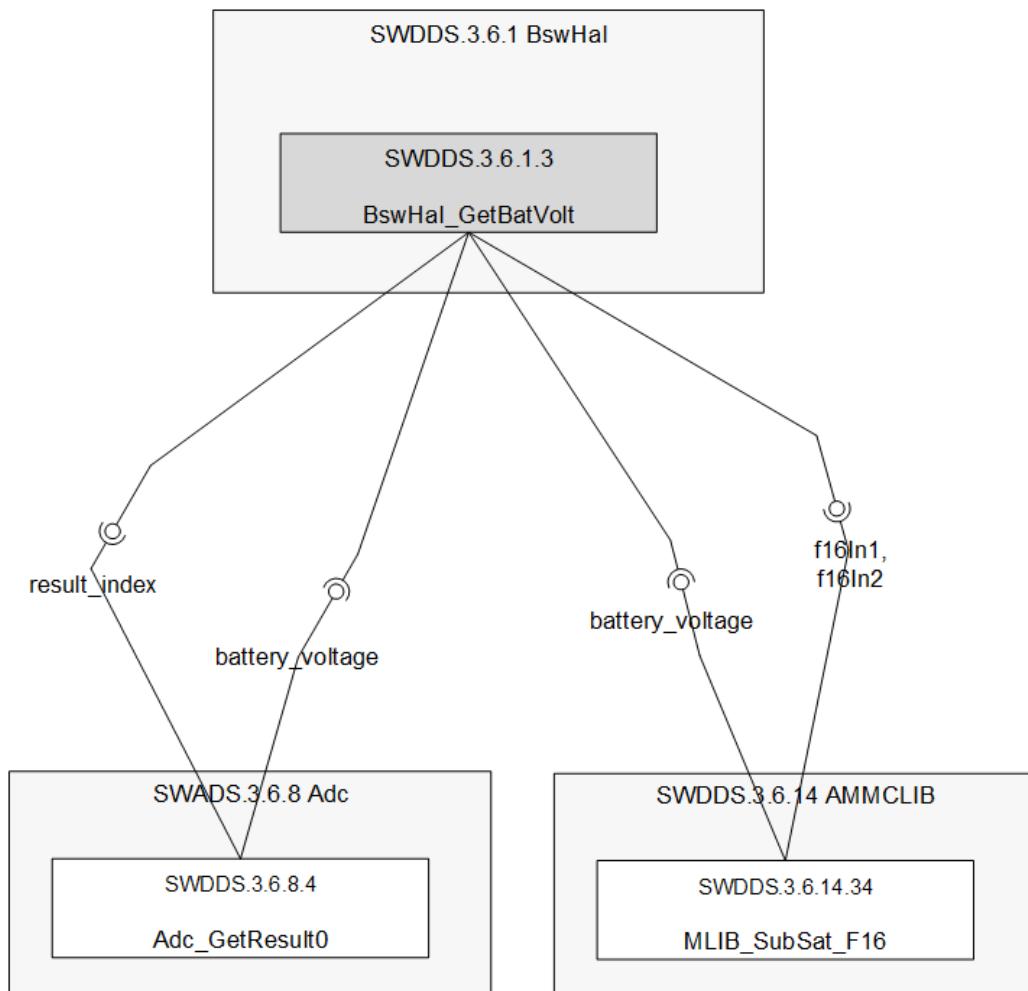
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	21

Control Flow Diagram (or Pseudo Code)	<pre>     start     tFrac16 battery_voltage;     [SWDDS.3.6.8.4]     battery_voltage = (tFrac16)Adc_GetResult0( 2u );     [SWDDS.3.6.14.34]     battery_voltage = MLIB_SubSat_F16(         battery_voltage, par_f16M cuStaBatVoltOffs );     return battery_voltage;   </pre>
Called Function	SWDDS.2.3.19 Rtelo_GetBatVolt
Calling Function	SWDDS.3.6.8.4 Adc_GetResult0 SWDDS.3.6.14.34 MLIB_SubSat_F16
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.1.3
Target Milestone	SBS1
Element	HAL
Risk	<span style="color: green;">+</span> Low
Interoperability	No
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">+</span> Low
Verifiability	Yes

#### 1.1.2.1.3.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	22



#### 1.1.2.1.3.3 Dynamic View Design

- N/A

#### 1.1.2.1.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	result_index	SWDDS.3.6.8.4	OUT	tU16	2	2	2	2	N/A	ADC result list index
2	battery_voltage	SWDDS.3.6.8.4	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)
3	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)
4	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32768	32767	-29.5	29.4991	0.000900269 / Vpk	Battery voltage offset (PU)
5	battery_voltage	SWDDS.3.6.14.34	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	23

#### 1.1.2.1.4 [SWDDS.3.6.1.4] BswHal\_GetPcbTemp

##### 1.1.2.1.4.1 Detailed Design

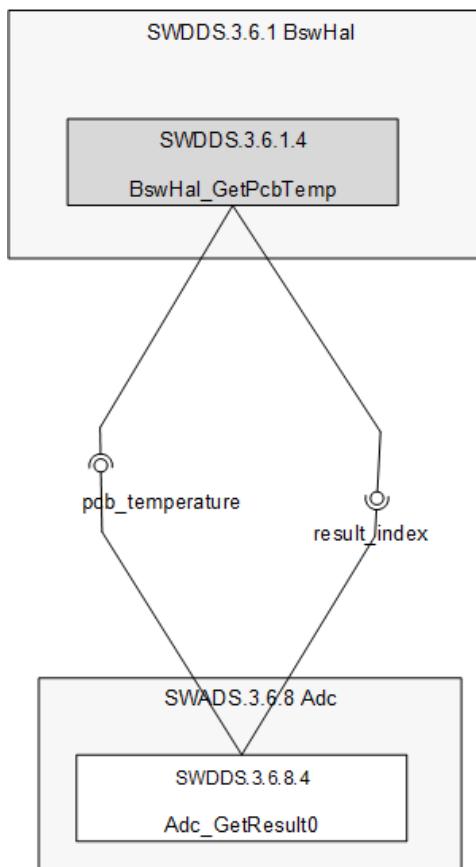
##### [SWDDS.3.6.1.4] BswHal\_GetPcbTemp

Software Unit Information					
Unit ID	SWDDS.3.6.1.4	Unit Name		BswHal_GetPcbTemp	
Architecture ID	SWADS.3.6.1.4	ASIL		QM	
Prototype	tFrac16 BswHal_GetPcbTemp( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	tFrac16	0 ~ 32767 0.0 ~ 4.99985Vpk	PCB temperature signal (PU)		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature measurement signal getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 pcb_temperature;     ↓     [SWADS.3.6.8.4]     pcb_temperature = (tFrac16)Adc_GetResult0( 1u );     ↓     return pcb_temperature;   </pre>				
Called Function	SWDDS.2.3.18 Rtel0_GetPcbTempSig				
Calling Function	SWDDS.3.6.8.4 Adc_GetResult0				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.1.4
Target Milestone	SBS1
Element	HAL
Risk	<span style="color: green;">*</span> Low
Interoperability	No
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">*</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	24

#### 1.1.2.1.4.2 Static View Design



#### 1.1.2.1.4.3 Dynamic View Design

- N/A

#### 1.1.2.1.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	result_index	SWDDS.3.6.8.4	OUT	tU16	1	1	1	1	N/A	ADC result list index
2	pcb_temperature	SWDDS.3.6.8.4	IN	tFrac16	0	32767	0.0	4.99985	0.000152588 / Vpk	PCB temperature (PU)

#### 1.1.2.1.5 [SWDDS.3.6.1.5] BswHal\_GetHwid

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27

#### 1.1.2.1.5.1 Detailed Design

##### [SWDDS.3.6.1.5] BswHal\_GetHwid

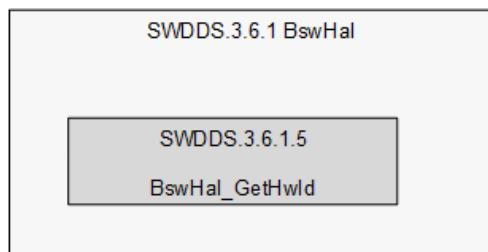
Software Unit Information					
Unit ID	SWDDS.3.6.1.5	Unit Name	BswHal_GetHwid		
Architecture ID	SWADS.3.6.1.5	ASIL	QM		
Prototype	tOpHwid BswHal_GetHwid( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	tOpHwid	0 ~ 2, OPU_HW_ID_UNDEFINED / OPU_HW_ID_AQ301 / OPU_HW_ID_AQ451			OPU hardware ID
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Hardware ID setting input status getting				
Control Flow Diagram (or Pseudo Code)	<pre> start     tOpHwid opu_hardware_id =         OPU_HW_ID_UNDEFINED;     tu8 hardware_id_0, hardware_id_1;     hardware_id_0 = PIM_PORT_INP_DI_HWID_0;     hardware_id_1 = PIM_PORT_INP_DI_HWID_1;      if ((hardware_id_0 == 0x00u) &amp;&amp;         (hardware_id_1 != 0x00u))         opu_hardware_id = OPU_HW_ID_AQ301;     else if ((hardware_id_0 != 0x00u) &amp;&amp;              (hardware_id_1 == 0x00u))         opu_hardware_id = OPU_HW_ID_AQ451;     else         opu_hardware_id = OPU_HW_ID_UNDEFINED;  return opu_hardware_id; </pre>				
Called Function	SWDDS.2.3.1 Rtelo_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.1.5
Target Milestone	SBS1
Element	HAL
Risk	■ Mid
Interoperability	No
Criticality	■ Mid

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	26

Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.2.1.5.2 Static View Design



#### 1.1.2.1.5.3 Dynamic View Design

- N/A

#### 1.1.2.1.5.4 Interface Design

- N/A

#### 1.1.2.2 [SWDDS.3.6.2] Cpmu

Set internal functionality and value of MCU Hardware

##### 1.1.2.2.1 [SWDDS.3.6.2.1] Cpmu\_Init

###### 1.1.2.2.1.1 Detailed Design

##### [SWDDS.3.6.2.1] Cpmu\_Init

Software Unit Information					
Unit ID	SWDDS.3.6.2.1		Unit Name	Cpmu_Init	
Architecture ID	SWADS.3.6.2.1		ASIL	QM	
Prototype	void Cpmu_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	27

Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CPMUVREGCTL_EXTXON	0x00u~0x01u	Write	External voltage regulator Enable for VDDX domain
	byte	CPMUVREGCTL_INTXON	0x00u~0x01u	Write	Internal voltage regulator Enable for VDDX domain
	byte	CPMUVREGCTL_EXTCON	0x00u	Write	External voltage regulator Enable for VDDC domain
	byte	CPMUPOSTDIV_POSTDIV	0x00u	Write	CPMU Post Divider Register
	byte	CPMUSYNR	0x00u	Write	CPMU Synthesizer Register
	byte	CPMUREFDIV_REFDIV	15u	Write	CPMU Reference Divider Register – Finer granularity for the IPPLL multiplier step
	byte	CPMUREFDIV_REFFRQ	0x03u	Write	CPMU Reference Divider Register – IPPLL optimal stability and lock time configuration
	byte	CPMUOSC2_OMRE	0x01u	Write	This bit enables the oscillator clock monitor reset
	byte	CPMUOSC2_OSCMOD	0x01u	Write	This bit selects the mode of the external oscillator (XOSCLCP)
	byte	CPMUOSC_OSCE	0x01u	Write	Oscillator Enable Bit
	byte	CPMUSYNR_SYNDIV	39u	Write	CPMU Synthesizer Register – Multiplication factor of the IPPLL
	byte	CPMUSYNR_VCOFRQ	0x03u	Write	CPMU Synthesizer Register – VCO

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	28

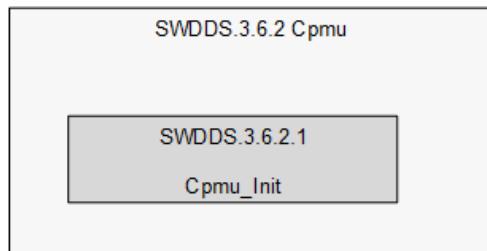
				frequency range
	byte	CPMUPLL_FM	0x03u	Write CPMU PLL Control Register – PLL Frequency Modulation Enable
	byte	CPMUIFLG	0xffu	Write CPMU Interrupt Flags Register
	byte	CPMUHTCTL_HTE	0x01u	Write High Temperature Sensor/Bandgap Voltage Enable Bit
	byte	CPMUIFLG_UPOSC	0 ~ 1 Oscillatoe not qualified/qualified	Read Oscillator Status Bit
	byte	CPMUIFLG_LOCK	0 ~ 1 VCO clock unlock / lock	Read Lock Status Bit
	byte	CPMURFLG	0x60u	Write CPMU Reset Flags Register
	byte	CPMUHTCTL_VSEL	0x01u	Write Voltage Access Select Bit
	byte	CPMUHTCTL_HTIF	0x01u	Write High Temperature Interrupt Flag
Description	CPMU initialization – External BJT turning on – Clock setting – Oscillator setting – Interrupt flag clearing – High temperature sensor enabling – Waiting for oscillator to start up and PLL to lock – Reset flag checking and clear – High temperature sensor enabling			
Control Flow Diagram				

Control Flow Diagram	<pre> start CPMUVREGCTL_EXTXON = 0x01u; CPMUVREGCTL_INTXON = 0x00u; CPMUVREGCTL_EXTCON = 0x00u; CPMUPOSTDIV_POSTDIV = CPMU_PLL_POST_DIV; CPMUSYNR = 0x00u; CPMUREFDIV_REFDIV = CPMU_PLL_REF_DIV; CPMUREFDIV_REFFRQ = CPMU_PLL_REF_FREQ; CPMUOSC2_MORE = 0x01u; CPMUOSC2_OSCMOD = 0x01u; CPMUOSC2_OSCE = 0x01u; CPMUSYNR_SYNDIV = CPMU_VCO_SYN_DIV; CPMUSYNR_VCOFRQ = CPMU_VCO_FREQ RNG; CPMUPLL_FM = CPMU_PLL_FREQ_MODUL; CPMUIFLG = 0xffff; CPMUHTCTL_HTE = 0x01u; </pre>
	<pre> CPMUIFLG_UPOSC == 0x00u no CPMUIFLG_LOCK == 0x00u yes no end </pre>

Requirement Id	SWDDS.3.6.2.1
Target Milestone	SBS2.1
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	30

#### 1.1.2.2.1.2 Static View Design



#### 1.1.2.2.1.3 Dynamic View Design

- N/A

#### 1.1.2.2.1.4 Interface Design

- N/A

#### 1.1.2.2.2 [SWDDS.3.6.2.2] Cpmu\_SetCfgPrtct

##### 1.1.2.2.2.1 Detailed Design

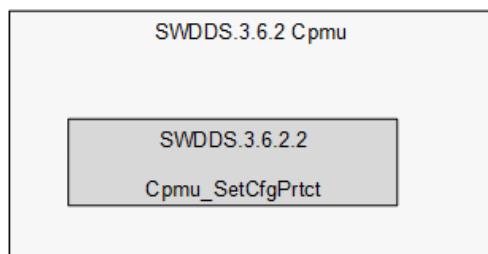
##### [SWDDS.3.6.2.2] Cpmu\_SetCfgPrtct

Software Unit Information				
Unit ID	SWDDS.3.6.2.2	Unit Name	Cpmu_SetCfgPrtct	
Architecture ID	SWADS.3.6.2.2	ASIL	QM	
Prototype	void Cpmu_SetCfgPrtct( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		
void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write
N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
byte	CPMUPROT_PROT	0x01u	Write	Clock Configuration Registers Protection Bit
Description	Clock configuration protection setting			
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; CPMUPROT_PROT[CPMUPROT_PROT = 0x01u;]     CPMUPROT_PROT --&gt; end((end))   </pre>			
Called Function	SWDDS.3.6.2.1 BswHal_Init			
Calling Function	N/A			
Function Execution Time	N/A			

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	31

Requirement Id	SWDDS.3.6.2.2
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.2.2 Static View Design



#### 1.1.2.2.3 Dynamic View Design

- N/A

#### 1.1.2.2.4 Interface Design

- N/A

#### 1.1.2.2.3 [SWDDS.3.6.2.3] Cpmu\_GetRstFlag

##### 1.1.2.2.3.1 Detailed Design

[SWDDS.3.6.2.3] Cpmu\_GetRstFlag

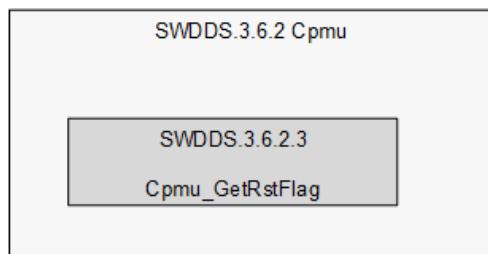
Software Unit Information					
Unit ID	SWDDS.3.6.2.3		Unit Name	Cpmu_GetRstFlag	
Architecture ID	SWADS.3.6.2.3		ASIL	QM	
Prototype	tU8 Cpmu_GetRstFlag( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU8	0 ~ 107		MCU reset flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	32

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	MCU reset flag getting				
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     return CPMURFLG;   </pre>				
<b>Called Function</b>	N/A				
<b>Calling Function</b>	N/A				
<b>Function Execution Time</b>	N/A				

Requirement Id	SWDDS.3.6.2.3
Target Milestone	SBS2.1
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	No
Criticality	<span style="color: green;">█</span> Low
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

#### 1.1.2.2.3.2 Static View Design



#### 1.1.2.2.3.3 Interface Design

N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	33

### 1.1.2.3 [SWDDS.3.6.3] Pim

Set Input/output port of MCU Hardware

- PIM Module, Digital / Analog / Unused port

#### 1.1.2.3.1 [SWDDS.3.6.3.1] Pim\_Init

##### 1.1.2.3.1.1 Detailed Design

##### [SWDDS.3.6.3.1] Pim\_Init

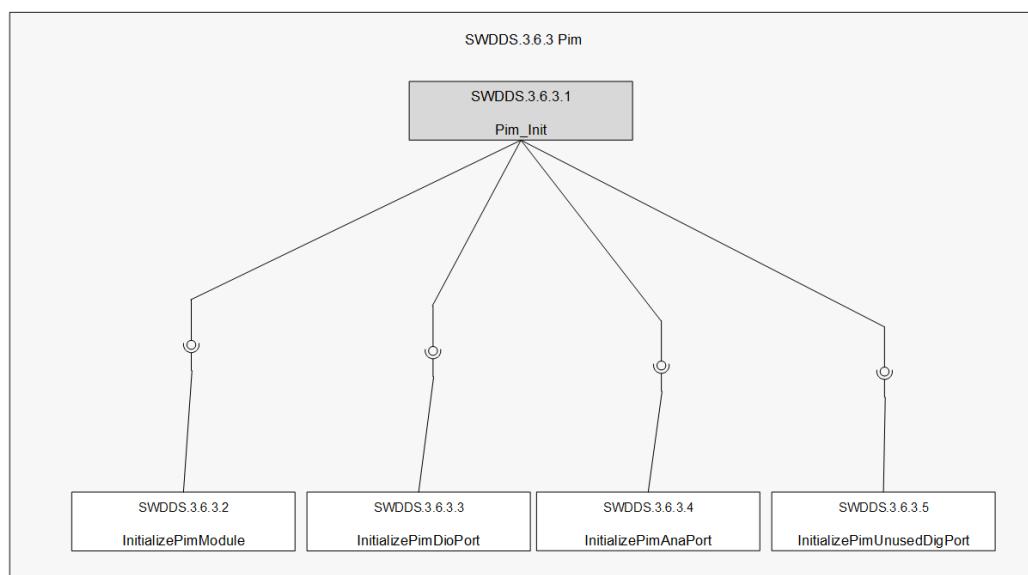
Software Unit Information				
Unit ID	SWDDS.3.6.3.1	Unit Name	Pim_Init	
Architecture ID	SWADS.3.6.3.1	ASIL		QM
Prototype	void Pim_Init( void )			
Function Call	Data Type	Name	Range	IN/OUT
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description
Return Value	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Port integration module initialization			
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.3.6.3.2]     InitializePimModule();           [SWDDS.3.6.3.3]     InitializePimDioPort();           [SWDDS.3.6.3.4]     InitializePimAnaPort();           [SWDDS.3.6.3.5]     InitializePimUnusedDigPort();           end   </pre>			
Called Function	SWDDS.3.6.1.1 BswHal_Init			
Calling Function	SWDDS.3.6.3.2 InitializePimModule SWDDS.3.6.3.3 InitializePimDioPort SWDDS.3.6.3.4 InitializePimAnaPort SWDDS.3.6.3.5 InitializePimUnusedDigPort			
Function Execution Time	N/A			

Requirement Id	SWDDS.3.6.3.1
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	34

Element	HAL
Risk	<span style="color: green;">Low</span>
Interoperability	Yes
Criticality	<span style="color: orange;">Mid</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

#### 1.1.2.3.1.2 Static View Design



#### 1.1.2.3.1.3 Dynamic View Design

- N/A

#### 1.1.2.3.1.4 Interface Design

- N/A

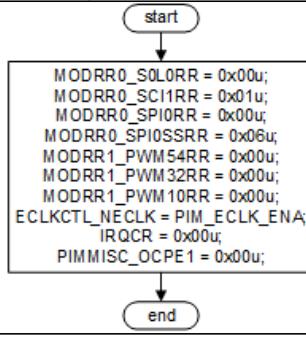
#### 1.1.2.3.2 [SWDDS.3.6.3.2] InitializePimModule

##### 1.1.2.3.2.1 Detailed Design

##### [SWDDS.3.6.3.2] InitializePimModule

Software Unit Information			
Unit ID	SWDDS.3.6.3.2	Unit Name	InitializePimModule
Architecture ID	SWADS.3.6.3.2	ASIL	QM
Prototype	void InitializePimModule( void )		

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	35

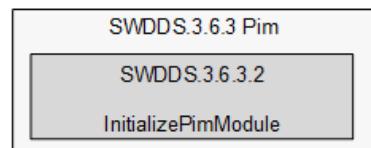
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	MODRR0_S0L0RR	0x00u	Write	SS0 based on SPI0RR
	byte	MODRR0_SCI1RR	0x01u	Write	TXD1 on PS3, RXD1 on PS2
	byte	MODRR0_SPI0RR	0x00u	Write	MISO0 on PS2, MOSI0 on PS3, SCK0 on PS4, SS0 on PS5
	byte	MODRR0_SPI0SSRR	0x06u	Write	standalone usage of SCI0 on external pins
	byte	MODRR1_PWM54RR	0x00u	Write	PWM1_4 and PWM1_5 to GDU
	byte	MODRR1_PWM32RR	0x00u	Write	PWM1_2 and PWM1_3 to GDU
	byte	MODRR1_PWM10RR	0x00u	Write	PWM1_0 and PWM1_1 to GDU
	byte	ECLKCTL_NECLK	0x00u	Write	ECLK setting
	byte	IRQCR	0x00u	Write	External IRQ pin disabled
	byte	PIMMISC_OCPE1	0x00u	Write	PP0 over-current detector disabled
Description	PIM module initialization - Module routing register 0 setting - PWM module routing register setting - ELCK port setting - External interrupt and over-current detector setting				
Control Flow Diagram (or Pseudo Code)	 <pre>     start     MODRR0_S0L0RR = 0x00u;     MODRR0_SCI1RR = 0x01u;     MODRR0_SPI0RR = 0x00u;     MODRR0_SPI0SSRR = 0x06u;     MODRR1_PWM54RR = 0x00u;     MODRR1_PWM32RR = 0x00u;     MODRR1_PWM10RR = 0x00u;     ECLKCTL_NECLK = PIM_ECLK_ENA;     IRQCR = 0x00u;     PIMMISC_OCPE1 = 0x00u;     end   </pre>				
Called Function	SWDDS.3.6.3.1 Pim_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.3.2
Target Milestone	EBS2
Element	HAL
Risk	■ Mid
Interoperability	No

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	36

Criticality	 Mid
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.3.2.2 Static View Design



#### 1.1.2.3.2.3 Dynamic View Design

- N/A

#### 1.1.2.3.2.4 Interface Design

- N/A

#### 1.1.2.3.3 [SWDDS.3.6.3.3] InitializePimDioPort

##### 1.1.2.3.3.1 Detailed Design

##### [SWDDS.3.6.3.3] InitializePimDioPort

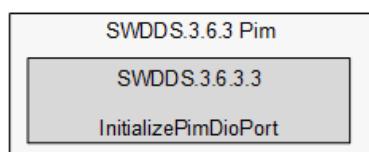
Software Unit Information					
Unit ID	SWDDS.3.6.3.3	Unit Name	InitializePimDioPort		
Architecture ID	SWADS.3.6.3.3	ASIL	QM		
Prototype	void InitializePimDioPort( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	PTS PTS2	0x01u	Write	Set initial PS2 output as high
	byte	DDRS_DDRS2	0x01u	Write	PS2 set as output
	byte	PTS PTS3	0x01u	Write	Set initial PS3 output as high
	byte	DDRS_DDRS3	0x01u	Write	PS3 set as output
	byte	DDRS_DDRS4	0x00u	Write	PS4 set as input
	byte	PERS_PERS4	0x01u	Write	PS4 set pull enable
	byte	PPSS_PPSS4	0x00u	Write	PS4 set polarity (pull-up)
	byte	DDRT_DDRT0	0x00u	Write	PT0 set as input
	byte	PERT_PERT0	0x01u	Write	PT0 set pull enable
	byte	PPST_PPST0	0x00u	Write	PT0 set polarity (pull-up)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	37

	byte	PTT_PTT1	0x00u	Write	Set initial PT1 output as low
	byte	DDRT_DDRT1	0x01u	Write	PT1 set as output
Description	Digital input and output port initialization - CAN_ENA port setting - CAN_NSTB port setting - CAN_NERR port setting - DI_HWID1 port setting - MCU_TP port setting				
Control Flow Diagram (or Pseudo Code)	<pre> start     PTS PTS2 = 0x01u;     DDRS DDRS2 = 0x01u;     PTS PTS3 = 0x01u;     DDRS DDRS3 = 0x01u;     DDRS DDRS4 = 0x00u;     PERS PERS4 = 0x01u;     PPSS_PPSS4 = 0x00u;     DDRT DDRT0 = 0x00u;     PERT PERT0 = 0x01u;     PPST_PPST0 = 0x00u;     PTT_PTT1 = 0x00u;     DDRT_DDRT1 = 0x01u; end </pre>				
Called Function	SWDDS.3.6.3.1 Pim_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.3.3
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">█</span> Mid
Interoperability	No
Criticality	<span style="color: orange;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

### 1.1.2.3.3.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	38

#### 1.1.2.3.3.3 Dynamic View Design

- N/A

#### 1.1.2.3.3.4 Interface Design

- N/A

#### 1.1.2.3.4 [SWDDS.3.6.3.4] InitializePimAnaPort

##### 1.1.2.3.4.1 Detailed Design

##### [SWDDS.3.6.3.4] InitializePimAnaPort

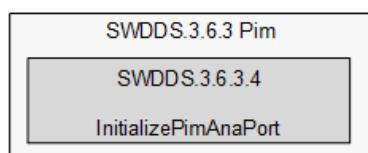
Software Unit Information					
Unit ID	SWDDS.3.6.3.4	Unit Name	InitializePimAnaPort		
Architecture ID	SWADS.3.6.3.4	ASIL	QM		
Prototype	void InitializePimAnaPort( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	DIENADL	0x00u	Write	AN0_[0..4] and AN1_[1..3] digital input enable
	byte	DDRADH_DDRADH0	0x00u	Write	AN1_3 configured as input
	byte	DIENADH_DIENADH0	0x01u	Write	AN1_3 configured as Digital input
	byte	PERADH_PERADH0	0x01u	Write	AN1_3 pull-down setting
	byte	PPSADH_PPSADH0	0x01u	Write	AN1_3 polarity select (pull-down)
Description	Analog input port initialization - AN0_[0..4] and AN1_[1..3] - DI_HWID (PAD8/KWAD8/AN1_3) port setting				
Control Flow Diagram (or Pseudo Code)	<pre> start     DIENADL = 0x00u;     DDRADH_DDRADH0 = 0x00u;     DIENADH_DIENADH0 = 0x01u;     PERADH_PERADH0 = 0x01u;     PPSADH_PPSADH0 = 0x01u; end   </pre>				
Called Function	SWDDS.3.6.3.1 Pim_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.3.4
----------------	---------------

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	39

Target Milestone	EBS2
Element	HAL
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

#### 1.1.2.3.4.2 Static View Design



#### 1.1.2.3.4.3 Dynamic View Design

- N/A

#### 1.1.2.3.4.4 Interface Design

- N/A

#### 1.1.2.3.5 [SWDDS.3.6.3.5] InitializePimUnusedDigPort

##### 1.1.2.3.5.1 Detailed Design

##### [SWDDS.3.6.3.5] InitializePimUnusedDigPort

Software Unit Information					
Unit ID	SWDDS.3.6.3.5	Unit Name	InitializePimUnusedDigPort		
Architecture ID	SWADS.3.6.3.5	ASIL	QM		
Prototype	void InitializePimUnusedDigPort( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
	byte	DDRP_DDRP0	0x00u	Write	PP0 direction setting
	byte	PERP_PERP0	0x01u	Write	PP0 pull enable

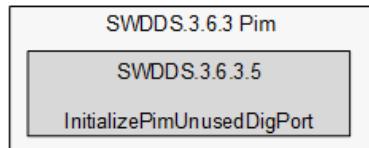
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	40

Registers	byte	PPSP_PPSP0	0x01u	Write	PP0 polarity select (pull-down)
	byte	DDRP_DDRP1	0x00u	Write	PP1 direction setting
	byte	PERP_PERP1	0x01u	Write	PP1 pull enable
	byte	PPSP_PPSP1	0x01u	Write	PP1 polarity select (pull-down)
	byte	DDRP_DDRP2	0x00u	Write	PP2 direction setting
	byte	PERP_PERP2	0x01u	Write	PP2 pull enable
	byte	PPSP_PPSP2	0x01u	Write	PP2 polarity select (pull-down)
	byte	DDRS_DDRS5	0x00u	Write	PS5 direction setting
	byte	PERS_PERS5	0x01u	Write	PS5 pull enable
	byte	PPSS_PPSS5	0x01u	Write	PS5 polarity select (pull-down)
	byte	DDRT_DDRT2	0x00u	Write	PT2 direction setting
	byte	PERT_PERT2	0x01u	Write	PT2 pull enable
	byte	PPST_PPST2	0x01u	Write	PT2 polarity select (pull-down)
	byte	DDRT_DDRT3	0x00u	Write	PT3 direction setting
	byte	PERT_PERT3	0x01u	Write	PT3 pull enable
	byte	PPST_PPST3	0x01u	Write	PT3 polarity select (pull-down)
Description	Unused digital port initialization - Port P setting - Port S setting - Port T setting				
Control Flow Diagram (or Pseudo Code)	<pre> start     DDRP_DDRP0 = PIM_UNUSED_DIG_DIR;     PERP_PERP0 = PIM_UNUSED_DIG_PULL_ENA;     PPSP_PPSP0 = PIM_UNUSED_DIG_PUL_UD;     DDRP_DDRP1 = PIM_UNUSED_DIG_DIR;     PERP_PERP1 = PIM_UNUSED_DIG_PULL_ENA;     PPSP_PPSP1 = PIM_UNUSED_DIG_PUL_UD;     DDRP_DDRP2 = PIM_UNUSED_DIG_DIR;     PERP_PERP2 = PIM_UNUSED_DIG_PULL_ENA;     PPSP_PPSP2 = PIM_UNUSED_DIG_PUL_UD;     DDRS_DDRS5 = PIM_UNUSED_DIG_DIR;     PERS_PERS5 = PIM_UNUSED_DIG_PULL_ENA;     PPSS_PPSS5 = PIM_UNUSED_DIG_PUL_UD;     DDRT_DDRT2 = PIM_UNUSED_DIG_DIR;     PERT_PERT2 = PIM_UNUSED_DIG_PULL_ENA;     PPST_PPST2 = PIM_UNUSED_DIG_PUL_UD;     DDRT_DDRT3 = PIM_UNUSED_DIG_DIR;     PERT_PERT3 = PIM_UNUSED_DIG_PULL_ENA;     PPST_PPST3 = PIM_UNUSED_DIG_PUL_UD; end </pre>				
Called Function	SWDDS.3.6.3.1 Pim_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.3.5
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: #008000;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	41

#### 1.1.2.3.5.2 Static View Design



#### 1.1.2.3.5.3 Dynamic View Design

- N/A

#### 1.1.2.3.5.4 Interface Design

- N/A

### 1.1.2.4 [SWDDS.3.6.4] Tim

Initialize timer 0 channel 0 for the static scheduler  
 Initialize timer 0 channel 3 for the watchdog update timing checking  
 Call the task counting routine of the static scheduler  
 Set the watchdog update timing flag

#### 1.1.2.4.1 [SWDDS.3.6.4.1] Tim\_Init

##### 1.1.2.4.1.1 Detailed Design

#### [SWDDS.3.6.4.1] Tim\_Init

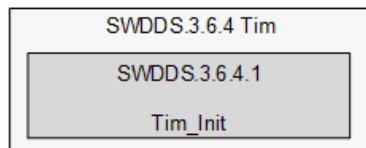
Software Unit Information					
Unit ID	SWDDS.3.6.4.1		Unit Name	Tim_Init	
Architecture ID	SWADS.3.6.4.1		ASIL	QM	
Prototype	void Tim_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bTimCh3Flag	0~1, FALSE /TRUE	Write	Timer channel 3 flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description

Registers	byte	TIM0TIOS_IOS0	0x01u	Write	Input Capture or Output Compare Channel Configuration Bit 0
	byte	TIM0OCPD_OCPD0	0x01u	Write	Output Compare Pin Disconnect Bit 0
	byte	TIM0TSCR2	0x06u	Write	Timer System Control Register 2
	Word	TIM0TC0	625u	Write	Timer Input Capture/Output Compare Register 0
	byte	TIM0TCTL2	0x01u	Write	Timer Control Register 2
	byte	INT_CFADDR_INT_CFADDR	0x0e	Write	Interrupt Request Configuration Data Register Select Bits
	byte	INT_CFDATA3_PRIOLVL	5u	Write	Interrupt Request Priority Level Bits
	byte	INT_CFDATA0_PRIOLVL	3u	Write	Interrupt Request Priority Level Bits
	byte	TIM0TIOS_IOS3	0x01u	Write	Input Capture or Output Compare Channel Configuration Bit 3
	byte	TIM0OCPD_OCPD3	0x01u	Write	Output Compare Pin Disconnect Bit 3
	Word	TIM0TC3	6250u	Write	Timer Input Capture/Output Compare Register 3
Description	S12ZVM timer module initialization – Variable initialization – Timer 0 initialization – Timer 3 initialization				
Control Flow Diagram (or Pseudo Code)	<pre> start     TIM0TIOS_IOS0 = 0x01u;     TIM0OCPD_OCPD0 = 0x01u;     TIM0TSCR2 = 0x06u;     TIM0TC0 = TIM_CH0_OUT_COMP_PERIOD;     TIM0TCTL2 = 0x01u;     INT_CFADDR_INT_CFADDR = 0x0e;     INT_CFDATA3_PRIOLVL = TIM_PRIORITY_CHANNEL_0;     INT_CFDATA0_PRIOLVL = TIM_PRIORITY_CHANNEL_3;     TIM0TIOS_IOS3 = 0x01u;     TIM0OCPD_OCPD3 = 0x01u;     TIM0TC3 = TIM_CH3_OUT_COMP_PERIOD; end </pre>				
Called Function	SWDDS.3.6.1.1 BswHal_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.4.1
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	43

#### 1.1.2.4.1.2 Static View Design



#### 1.1.2.4.1.3 Dynamic View Design

- N/A

#### 1.1.2.4.1.4 Interface Design

- N/A

#### 1.1.2.4.2 [SWDDS.3.6.4.2] Tim\_EnaRunAndIrq

##### 1.1.2.4.2.1 Detailed Design

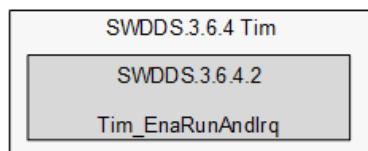
##### [SWDDS.3.6.4.2] Tim\_EnaRunAndIrq

Software Unit Information					
Unit ID	SWDDS.3.6.4.2	Unit Name	Tim_EnaRunAndIrq		
Architecture ID	SWADS.3.6.4.2	ASIL	QM		
Prototype	void Tim_EnaRunAndIrq( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	TIM0TIE_C0I	0x01u	Write	Input Capture/Output Compare Interrupt Enable Bit 0
	byte	TIM0TIE_C3I	0x01u	Write	Input Capture/Output Compare Interrupt Enable Bit 3
Description	byte	TIM0TSCR1	0x00u	Write	Timer System Control Register1
	Timer running and timer interrupt enabling - Timer interrupt enabling - timer running				
	<pre> graph TD     start((start)) --&gt; A[TIM0TIE_C0I = 0x01u; TIM0TIE_C3I = 0x01u; TIM0TSCR1 = 0xe0u;]     A --&gt; end((end))   </pre> <p>The control flow diagram shows a sequence of operations. It starts with an initial state labeled "start". An arrow points down to a box containing the assignment statements: "TIM0TIE_C0I = 0x01u; TIM0TIE_C3I = 0x01u; TIM0TSCR1 = 0xe0u;". From this box, another arrow points down to a final state labeled "end".</p>				
Control Flow Diagram (or Pseudo Code)					
Called Function	SWDDS.2.3.7 Rtel0_EnaTimRun				
Calling Function	N/A				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date 2021-04-27
			Page 44

Requirement Id	SWDDS.3.6.4.2
Target Milestone	EBS2
Element	HAL
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	Yes
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.2.4.2.2 Static View Design



#### 1.1.2.4.2.3 Dynamic View Design

- N/A

#### 1.1.2.4.2.4 Interface Design

- N/A

#### 1.1.2.4.3 [SWDDS.3.6.4.3] Tim\_GetCh3Flag

##### 1.1.2.4.3.1 Detailed Design

#### [SWDDS.3.6.4.3] Tim\_GetCh3Flag

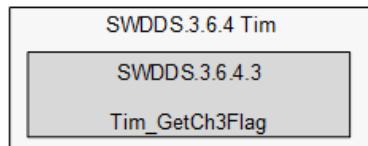
Software Unit Information					
Unit ID	SWDDS.3.6.4.3		Unit Name	Tim_GetCh3Flag	
Architecture ID	SWADS.3.6.4.3		ASIL	QM	
Prototype					
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	tBool	0~1, FALSE /TRUE		Timer channel 3 flag	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bTimCh3Flag	0~1, FALSE /TRUE	Read/Write	Timer channel 3 flag
Parameters	Data Type	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	45

	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Timer channel 3 flag getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tBool timer_flag;     timer_flag = g_bTimCh3Flag;     g_bTimCh3Flag = FALSE;     return timer_flag;   </pre>				
Called Function	SWDDS.2.3.5 Rtel0_ClkWdtTimRdy				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.4.3
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.4.3.2 Static View Design



#### 1.1.2.4.3.3 Dynamic View Design

- N/A

#### 1.1.2.4.3.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	46

#### 1.1.2.4.4 [SWDDS.3.6.4.4] Tim\_Ch0lsr

##### 1.1.2.4.4.1 Detailed Design

##### [SWDDS.3.6.4.4] Tim\_Ch0lsr

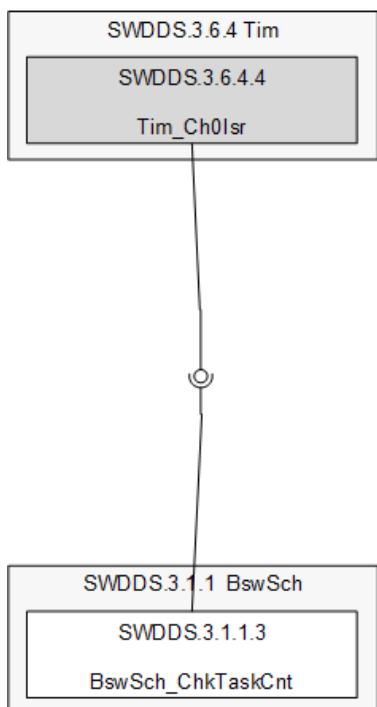
Software Unit Information					
Unit ID	SWDDS.3.6.4.4	Unit Name	Tim_Ch0lsr		
Architecture ID	SWADS.3.6.4.4	ASIL	QM		
INTERRUPT void Tim_Ch0lsr( void )					
Prototype					
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value			Description
Return Value	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
Registers	Word	TIM0TC0	0 ~ 65535	Read/Write	Timer Input Capture/Output Compare Register 0
	byte	TIM0TFLG1_C0F	0x01u	Write	Input Capture/Output Compare Channel interrupt flag 0
Description	<p>Timer channel 0 interrupt service routine</p> <p>1. Tim_Ch0lsr calls the static scheduler.</p> <p>2. Tim_Ch0lsr updates the next timer interrupt time count.</p> <p>3. Tim_Ch0lsr clears the interrupt flag.</p>				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     TIM0TC0 = (TIM0TC0 + TIM_CH0_OUT_COMP_PERIOD);     ↓     [SWDDS.3.1.1.3]     TIM_COMP_ISR_0();     ↓     Function Pointer : Called Function     - BswSch_ChkTaskCnt()     ↓     TIM0TFLG1_C0F = 0x01u;     ↓     end   </pre>				
Called Function	N/A				
Calling Function	SWDDS.3.1.1.3 BswSch_ChkTaskCnt				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.4.4
Target Milestone	EBS2
Element	HAL
Risk	Mid
Interoperability	Yes
Criticality	High

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	47

Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.2.4.4.2 Static View Design



#### 1.1.2.4.4.3 Dynamic View Design

- N/A

#### 1.1.2.4.4.4 Interface Design

- N/A

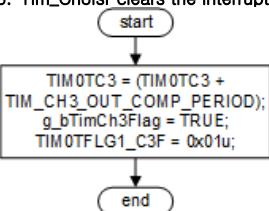
#### 1.1.2.4.5 [SWDDS.3.6.4.5] Tim\_Ch3Isr

##### 1.1.2.4.5.1 Detailed Design

##### [SWDDS.3.6.4.5] Tim\_Ch3Isr

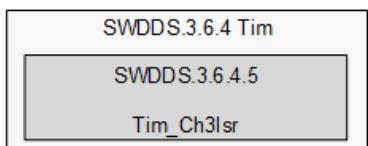
Software Unit Information					
Unit ID	SWDDS.3.6.4.5	Unit Name	Tim_Ch3Isr		
Architecture ID	SWADS.3.6.4.5	ASIL	QM		
Prototype			INTERRUPT void Tim_Ch3Isr( void )		
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	48

Function Call	Data Type	Possible Return Value			Description
Return Value	void	N/A			N/A
Global Variables	Data Type N/A	Name N/A	Range N/A	Read/Write N/A	Description N/A
Parameters	Data Type N/A	Name N/A	Range N/A	Read/Write N/A	Description N/A
Registers	Data Type Word byte	TIM0TC3 TIM0TFLG1_C3F	0 ~ 65535 0x01u	Read/Write Write	Timer Input Capture/Output Compare Register 3 Input Capture/Output Compare Channel interrupt flag 3
Description	<p>Timer channel 3 interrupt service routine</p> <p>1. Tim_Ch3Isr updates the next timer interrupt time count.  2. Tim_Ch3Isr sets the watchdog updating flag.  3. Tim_Ch3Isr clears the interrupt flag.</p>  <pre> graph TD     Start((start)) --&gt; Body[TIM0TC3 = (TIM0TC3 + TIM_CH3_OUT_COMP_PERIOD); g_bTimCh3Flag = TRUE; TIM0TFLG1_C3F = 0x01u;]     Body --&gt; End((end)) </pre>				
Control Flow Diagram (or Pseudo Code)					
Called Function	N/A				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.4.5
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #f00;">■</span> High
Technical complexity	<span style="color: #090;">■</span> Low
Verifiability	Yes

#### 1.1.2.4.5.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	49

#### 1.1.2.4.5.3 Dynamic View Design

- N/A

#### 1.1.2.4.5.4 Interface Design

- N/A

### 1.1.2.5 [SWDDS.3.6.5] Wdt

Initialize MCU internal watchdog timer

Reset the watchdog timer

#### 1.1.2.5.1 [SWDDS.3.6.5.1] Wdt\_Init

##### 1.1.2.5.1.1 Detailed Design

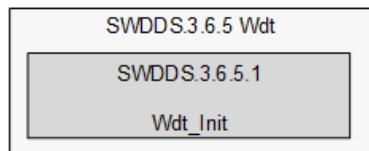
#### [SWDDS.3.6.5.1] Wdt\_Init

Software Unit Information				
Unit ID	SWDDS.3.6.5.1		Unit Name	Wdt_Init
Architecture ID	SWADS.3.6.5.1		ASIL	QM
Prototype	void Wdt_Init( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	byte	CPMUCLKS_COPOSCSEL1	0x00u	Write
	byte	CPMUCLKS_COPOSCSEL0	0x00u	Write
	byte	CPMUCOP	0 ~ 7	Write
Description	Watchdog timer initialization			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     CPMUCLKS_COPOSCSEL1 = 0x00u;     CPMUCLKS_COPOSCSEL0 = 0x00u;     CPMUCOP = CPMUCOP_CR1_MASK   CPMUCOP_CR0_MASK;     ↓     end   </pre>			
Called Function	SWDDS.3.6.1.1 BswHal_Init			
Calling Function	N/A			
Function Execution Time	N/A			

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	50

Requirement Id	SWDDS.3.6.5.1
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.5.1.2 Static View Design



#### 1.1.2.5.1.3 Dynamic View Design

- N/A

#### 1.1.2.5.1.4 Interface Design

- N/A

#### 1.1.2.5.2 [SWDDS.3.6.5.2] Wdt\_RstTim

##### 1.1.2.5.2.1 Detailed Design

##### [SWDDS.3.6.5.2] Wdt\_RstTim

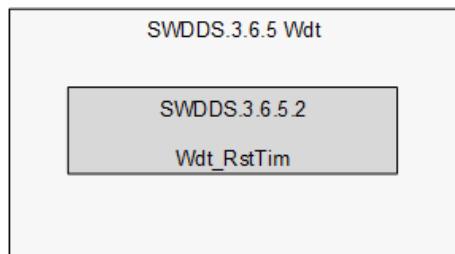
Software Unit Information					
Unit ID	SWDDS.3.6.5.2	Unit Name	Wdt_RstTim		
Architecture ID	SWADS.3.6.5.2	ASIL	QM		
Prototype	void Wdt_RstTim( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	51

Description	Watchdog timer resetting
Control Flow Diagram (or Pseudo Code)	<pre>     start     └── RESET_WATCHDOG();     └── end   </pre>
Called Function	SWDDS.2.3.6 Rtel0_RstWdtTim
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.5.2
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

#### 1.1.2.5.2.2 Static View Design



#### 1.1.2.5.2.3 Dynamic View Design

- N/A

#### 1.1.2.5.2.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	52

### 1.1.2.6 [SWDDS.3.6.6] Pmf

Initialize PMF

Get and clear PMF fault

#### 1.1.2.6.1 [SWDDS.3.6.6.1] Pmf\_Init

##### 1.1.2.6.1.1 Detailed Design

##### [SWDDS.3.6.6.1] Pmf\_Init

Software Unit Information					
Unit ID	SWDDS.3.6.6.1	Unit Name	Pmf_Init		
Architecture ID	SWADS.3.6.6.1	ASIL	QM		
Prototype	void Pmf_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	PMFCFG0_EDGEA	0x00u	Write	Edge-Aligned or Center-Aligned PWM for Pair A
	byte	PMFCFG0_EDGEB	0x00u	Write	Edge-Aligned or Center-Aligned PWM for Pair B
	byte	PMFCFG0_EDGEC	0x00u	Write	Edge-Aligned or Center-Aligned PWM for Pair C
	byte	PMFCFG0_INDEPA	0x00u	Write	Independent or Complimentary Operation for Pair A
	byte	PMFCFG0_INDEPB	0x00u	Write	Independent or Complimentary Operation for Pair B
	byte	PMFCFG0_INDEPC	0x00u	Write	Independent or Complimentary Operation for Pair C
	byte	PMFCFG1_ENCE	0x00u	Write	Enable Commutation Event
	byte	PMFCFG1_TOPNEGA	0x00u	Write	Pair A Top-Side PWM Polarity
	byte	PMFCFG1_BOTNEGA	0x00u	Write	Pair A Bottom-Side PWM Polarity
	byte	PMFCFG1_TOPNEGB	0x00u	Write	Pair B Top-Side PWM Polarity
	byte	PMFCFG1_BOTNEGB	0x00u	Write	Pair B Bottom-Side PWM Polarity
	byte	PMFCFG1_TOPNEGEC	0x00u	Write	Pair C Top-Side PWM Polarity
	byte	PMFCFG1_BOTNEGEC	0x00u	Write	Pair C Bottom-Side PWM Polarity
	byte	PMFCFG2_REV	0x01u	Write	PMF Configure 2 Register – reload event: PWM A
	byte	PMFCFG3_PMFWAI	0x00u	Write	PMF Stops While in WAIT Mode
	byte	PMFCFG3_PMFRRZ	0x00u	Write	PMF Stops While in FREEZE Mode
	byte	PMFFEN	0x00u	Write	PMF Fault Enable Register
	byte	PMFFMOD	0x00u	Write	PMF Fault Mode Register
	byte	PMFFIE	0x00u	Write	PMF Fault Interrupt Enable Register
	byte	PMFQSMP0	0x00u	Write	PMF Fault Qualifying Samples Register 0
	byte	PMFQSMP1	0x00u	Write	PMF Fault Qualifying Samples Register 1

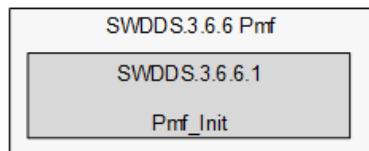
	byte	PMFOUTC	0x00u	Write	PMF Output Control Register
	byte	PMFOUTB	0x00u	Write	PMF Output Control Bit Register
	byte	PMFCCTL	0x00u	Write	PMF Correction Control Register
	byte	PMFROIE	0x00u	Write	PMF Reload Overrun Interrupt Enable Register
	byte	PMFICCTL	0x00u	Write	PMF Internal Correction Control Register
	byte	PMFCINV	0x00u	Write	PMF Compare Invert Register
	Word	PMFDTMA	20u	Write	PMF deadtime A Register
	Word	PMFVAL0	0 ~ 2500	Write	PMF Value 0 Registe
	Word	PMFVAL2	0 ~ 2500	Write	PMF Value 2 Registe
	Word	PMFVAL4	0 ~ 2500	Write	PMF Value 4 Registe
	Word	PMFMODA	2500	Read	PMF modulo counter A Register
	byte	PMFENCA_LDOKA	0x01u	Write	Load Okay A
	byte	PMFENCA_PWMENA	0x01u	Write	PWM Generator A Enable
	byte	PMFENCA_GLDOKA	0x01u	Write	Global Load Okay A
	byte	PMFFQCA_LDFQA	0x03u	Write	Load Frequency A
	byte	PMFFQCA_HALFA	0x01u	Write	Half Cycle Reload A
	byte	PMFFQCA_PRSCA	0x00u	Write	Prescaler A
Description	PMF initialization - PMF configure 0 register setting - PMF configure 1 register setting - PMF configure 2 register setting - PMF configure 3 register setting - PMF fault setting - PMF Output control setting - PMF reload overrun interrupt setting - PMF internal correction control setting - PMF compare invert setting - PWM period and output duty setting - PMF frequency control setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     {       PMFCFG0_EDGE_A = 0x00u;       PMFCFG0_EDGE_B = 0x00u;       PMFCFG0_EDGE_C = 0x00u;       PMFCFG0_INDEPA = 0x00u;       PMFCFG0_INDEPB = 0x00u;       PMFCFG0_INDEPC = 0x00u;       PMFCFG1_ENCE = 0x00u;       PMFCFG1_TOPNEGA = 0x00u;       PMFCFG1_BOTNEGA = 0x00u;       PMFCFG1_TOPNEG_B = 0x00u;       PMFCFG1_BOTNEG_B = 0x00u;       PMFCFG1_TOPNEG_C = 0x00u;       PMFCFG1_BOTNEG_C = 0x00u;       PMFCFG2_REV = 0x01u;       PMFCFG3_PMF_WAI = 0x00u;       PMFCFG3_PMFFRZ = 0x00u;       PMFFEN = 0x00u;       PMFFMOD = 0x00u;       PMFFIE = 0x00u;       PMFQSMPO = 0x00u;       PMFQSMPI = 0x00u;       PMFOUTC = 0x00u;       PMFOUTB = 0x00u;       PMFCCTL = 0x00u;       PMFROIE = 0x00u;       PMFICCTL = 0x00u;       PMFCINV = 0x00u;       PMFMODA = PMF_CNT_MODULUS_VAL;       PMFDTMA = PMF_DEADTIME_CNT;       PMFVAL0 = PMFMODA &gt;&gt; 1u;       PMFVAL2 = PMFMODA &gt;&gt; 1u;       PMFVAL4 = PMFMODA &gt;&gt; 1u;       PMFENCA_LDOKA = 0x01u;       PMFENCA_PWMENA = 0x01u;       PMFENCA_GLDOKA = 0x01u;       PMFFQCA_LDFQA = 0x03u;       PMFFQCA_HALFA = 0x01u;       PMFFQCA_PRSCA = 0x00u;     }     ↓     end   </pre>				
Called Function	SWDDS.3.6.1.2 InitializeBswHalMtrCtr				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	54

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.6.1
Target Milestone	EBS2
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.6.1.2 Static View Design



#### 1.1.2.6.1.3 Dynamic View Design

- N/A

#### 1.1.2.6.1.4 Interface Design

- N/A

#### 1.1.2.6.2 [SWDDS.3.6.6.2] Pmf\_SetWrtPrtct

##### 1.1.2.6.2.1 Detailed Design

###### [SWDDS.3.6.6.2] Pmf\_SetWrtPrtct

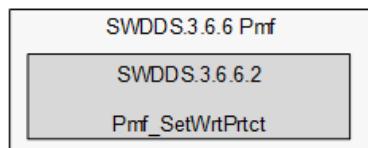
Software Unit Information					
Unit ID	SWDDS.3.6.6.2	Unit Name	Pmf_SetWrtPrtct		
Architecture ID	SWADS.3.6.6.2	ASIL	QM		
Prototype	void Pmf_SetWrtPrtct( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	55

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	PMFCFG0_WP	0x01u	Write	Write Protect
Description	PMF write protection setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     PMFCFG0_WP = 0x01u;     end   </pre>				
Called Function	SWDDS.3.6.1.2 InitializeBswHalMtrCtr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.6.2
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.6.2.2 Static View Design



#### 1.1.2.6.2.3 Dynamic View Design

- N/A

#### 1.1.2.6.2.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	56

### 1.1.2.6.3 [SWDDS.3.6.6.3] Pmf\_ClrFlt

#### 1.1.2.6.3.1 Detailed Design

[SWDDS.3.6.6.3] Pmf\_ClrFlt

#### 1.1.2.6.3.2 Static View Design

- N/A

#### 1.1.2.6.3.3 Dynamic View Design

- N/A

#### 1.1.2.6.3.4 Interface Design

- N/A

### 1.1.2.7 [SWDDS.3.6.7] Gdu

Initialize gate drive unit

Check gate driver low voltage

Check and clear GDU fault flag

#### 1.1.2.7.1 [SWDDS.3.6.7.1] Gdu\_Init

##### 1.1.2.7.1.1 Detailed Design

#### [SWDDS.3.6.7.1] Gdu\_Init

Software Unit Information					
Unit ID	SWDDS.3.6.7.1	Unit Name	Gdu_Init		
Architecture ID	SWADS.3.6.7.1	ASIL	QM		
Prototype	void Gdu_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tU8	par_u8GdrvDesatBlkTim2	0x04u	Read	GDU DESAT blank time 2
	tU8	par_u8GdrvDesatBlkTim1	0x03u	Read	GDU DESAT blank time 1
	tU8	par_u8GdrvSlewRate	0x00u	Read	MOSFET slew rate control
	tU8	par_u8GdrvDesatLvl	0x07u	Read	Gate driver DESAT level
Parameters	Data Type	Name	Range	Read/Write	Description
	byte	GDUE_GCPE	0x01u	Write	GDU Charge Pump Enable
	byte	GDUE_GCSE0	0x01u	Write	GDU Current Sense Amplifier 0 Enable
	byte	GDUE_GCSE1	0x01u	Write	GDU Current Sense Amplifier 1 Enable

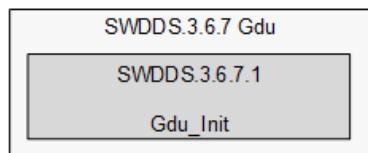
Registers	byte	GDUE_GBOE	0x00u	Write	GDU Boost Converter Enable
	byte	GDUF	0xffu	Write	GDU Flag Register
	byte	GDUCLK2_GCPCD	0x04u	Write	GDU Charge Pump Clock Divider
	byte	GDUCTR_GHHDLVL	0x01u	Write	GDU High HD Level Select
	byte	GDUCTR_GBKTM2	0x04u	Write	GDU Blanking Time
	byte	GDUCTR_GBKTM1	0x03u	Write	GDU Blanking Time
	byte	GDUIE	0x00u	Write	GDU Interrupt Enable Register
	byte	GDUSRC_GSRCLS	0x00u	Write	GDU Slew Rate Control Register – low side
	byte	GDUSRC_GSRCHS	0x00u	Write	GDU Slew Rate Control Register – high side
	byte	GDUCLK1_GBOCD	0x0au	Write	GDU Boost Option Clock Divider
	byte	GDUCLK1_GBODC	0x00u	Write	GDU Boost Option Clock Duty Cycle
	byte	GDUBCL_GBCL	0x0fu	Write	GDU Boost Current Limit Register
	byte	GDUPHMUX	0x00u	Write	GDU Phase Mux Register
	byte	GDUCSO_GCSO1	0x00u	Write	GDU Current Sense Amplifier 1 Offset
	byte	GDUCSO_GCSO0	0x00u	Write	GDU Current Sense Amplifier 0 Offset
	byte	GDUDSLVL_GDSLHS	0x07u	Write	GDU Desaturation Level for High-Side Drivers
	byte	GDUDSLVL_GDSLLS	0x07u	Write	GDU Desaturation Level for Low-Side Drivers
	byte	GDUOC0	0x00u	Write	GDU Overcurrent Register 0
	byte	GDUOC1	0x00u	Write	GDU Overcurrent Register 1
	byte	GDUDSE	0x77u	Write	GDU Desaturation Error Flag Register
Description	<p>GDU initialization</p> <ul style="list-style-type: none"> <li>- GDU module enable register setting</li> <li>- GDU flag register clearing</li> <li>- GDU charge pump clock setting</li> <li>- GDU control register setting</li> <li>- GDU interrupt enable setting</li> <li>- GDU slew rate control</li> <li>- GDU boost option clock control and current limit setting</li> <li>- GDU phase multiplexer setting</li> <li>- GDU current sense offset setting</li> <li>- GDU DESAT level setting</li> <li>- GDU over-current setting</li> <li>- GDU DESAT error clearing</li> </ul>				
Control Flow Diagram (or Pseudo Code)	<pre> start     GDUE_GCPE = 0x01u;     GDUE_GCS0 = 0x01u;     GDUE_GCS1 = 0x01u;     GDUE_GBOE = GDU_BOOST_CONV_ENA;     GDUF = 0xffu;     GDUCLK2_GCPCD = GDU_CHRG_PUMP_CLK_DIV;     GDUCTR_GHHDLVL = GDU_HD_PIN_HIGH_LVL;     GDUCTR_GBKTM2 = par_u8GdrvDesatBlkTim2;     GDUCTR_GBKTM1 = par_u8GdrvDesatBlkTim1;     GDUIE = 0x00u;     GDUSRC_GSRCLS = par_u8GdrvSlewRate;     GDUSRC_GSRCHS = par_u8GdrvSlewRate;     GDUCLK1_GBOCD = GDU_BOOST_CLK_DIV;     GDUCLK1_GBODC = GDU_BOOST_CLK_DUTY;     GDUBCL_GBCL = GDU_BOOST_CUR_LMT;     GDUPHMUX = 0x00u;     GDUCSO_GCSO1 = 0x00u;     GDUCSO_GCSO0 = 0x00u;     GDUDSLVL_GDSLHS = par_u8GdrvDesatLvl;     GDUDSLVL_GDSLLS = par_u8GdrvDesatLvl;     GDUOC0 = GDU_OVR_CUR_DETECT;     GDUOC1 = GDU_OVR_CUR_DETECT;     GDUDSE = 0x77u; end </pre>				
Called Function	SWDDS.3.6.1.2 InitializeBswHalMtrCtr				
Calling Function	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	58

Function Execution Time	N/A
-------------------------	-----

Requirement Id	SWDDS.3.6.7.1
Target Milestone	EBS2
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.7.1.2 Static View Design



#### 1.1.2.7.1.3 Dynamic View Design

- N/A

#### 1.1.2.7.1.4 Interface Design

- N/A

#### 1.1.2.7.2 [SWDDS.3.6.7.2] Gdu\_ChkVlsLow

##### 1.1.2.7.2.1 Detailed Design

##### [SWDDS.3.6.7.2] Gdu\_ChkVlsLow

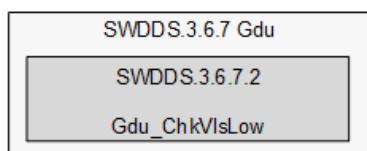
Software Unit Information					
Unit ID	SWDDS.3.6.7.2		Unit Name	Gdu_ChkVlsLow	
Architecture ID	SWADS.3.6.7.2		ASIL	QM	
Prototype			tBool Gdu_ChkVlsLow( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
tBool		0 ~ 1, Normal / Low voltage		FALSE – VLS_OUT above VVLSD, TRUE – VLS_OUT below V_LVSA	
Global Variables	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	59

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	GDUF_GLVLSF	0 ~ 1, Normal / Low voltage	Read/Write	GDU Low VLS Supply Flag
Description	VLS_OUT low voltage checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tBool checking_result = FALSE;     if(GDUF_GLVLSF != 0x00u) {         checking_result = TRUE;         GDUF_GLVLSF = 0x01u;     }     return checking_result;   </pre>				
Called Function	SWDDS.2.3.20 Rtelo_ChkGdrvVisLow				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.7.2
Target Milestone	EBS2
Element	HAL
Risk	▣ Mid
Interoperability	Yes
Criticality	▣ Mid
Technical complexity	▣ Low
Verifiability	Yes

#### 1.1.2.7.2.2 Static View Design



#### 1.1.2.7.2.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	60

#### 1.1.2.7.2.4 Interface Design

- N/A

#### 1.1.2.7.3 [SWDDS.3.6.7.3] Gdu\_GetStaFlag

##### 1.1.2.7.3.1 Detailed Design

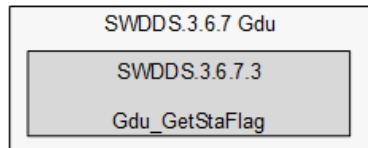
##### [SWDDS.3.6.7.3] Gdu\_GetStaFlag

Software Unit Information				
Unit ID	SWDDS.3.6.7.3	Unit Name	Gdu_GetStaFlag	
Architecture ID	SWADS.3.6.7.3	ASIL	QM	
Prototype	tU8 Gdu_GetStaFlag( void )			
Function Call	Data Type	Name	Range	IN/OUT
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description	
Return Value	tU8	N/A	GDU flag register	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	byte	GDUF	0 ~ 251	Read
Description	Gate driver state getting			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return (tU8)GD UF;   </pre>			
Called Function	SWDDS.3.2.2.4 MtrDrv_GetGdrvSta			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.3.6.7.3
Target Milestone	EBS2
Element	HAL
Risk	▣ Mid
Interoperability	Yes
Criticality	▣ Mid
Technical complexity	▢ Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	61

#### 1.1.2.7.3.2 Static View Design



#### 1.1.2.7.3.3 Dynamic View Design

- N/A

#### 1.1.2.7.3.4 Interface Design

- N/A

#### 1.1.2.7.4 [SWDDS.3.6.7.4] Gdu\_GetDesatFlag

##### 1.1.2.7.4.1 Detailed Design

##### [SWDDS.3.6.7.4] Gdu\_GetDesatFlag

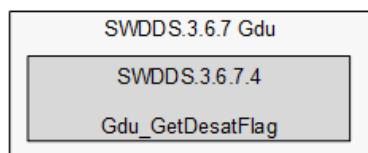
Software Unit Information					
Unit ID	SWDDS.3.6.7.4	Unit Name	Gdu_GetDesatFlag		
Architecture ID	SWADS.3.6.7.4	ASIL	QM		
Prototype	tU8 Gdu_GetDesatFlag( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	tU8	N/A		GDU DESAT error flag register	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	GDUDSE	0 ~ 119	Read	GDU Desaturation Error Flag Register
Description	Gate driver DESAT error flag getting				
Control Flow Diagram (or Pseudo Code)	<pre> start   ↓   return (tU8)GDUDSE;   </pre>				
Called Function	SWDDS.3.2.2.4 MtrDrv_GetGdrvSta				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.7.4
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	62

Element	HAL
Risk	<input type="checkbox"/> Mid
Interoperability	Yes
Criticality	<input type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.2.7.4.2 Static View Design



#### 1.1.2.7.4.3 Dynamic View Design

- N/A

#### 1.1.2.7.4.4 Interface Design

- N/A

#### 1.1.2.7.5 [SWDDS.3.6.7.5] Gdu\_ClrFlt

##### 1.1.2.7.5.1 Detailed Design

##### [SWDDS.3.6.7.5] Gdu\_ClrFlt

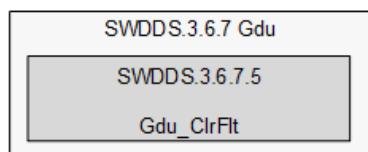
Software Unit Information					
Unit ID	SWDDS.3.6.7.5	Unit Name	Gdu_ClrFlt		
Architecture ID	SWADS.3.6.7.5	ASIL	QM		
Prototype	void Gdu_ClrFlt( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	GDUF	0xffff	Write	GDU Flag Register
	byte	GDUDSE	0xffff	Write	GDU Desaturation Error Flag Register
Description	Gate driver fault clearing				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	63

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; GDUF[GDUF = 0xffu; GDUDSE = 0xffu;]     GDUF --&gt; end((end))   </pre>
Called Function	SWDDS.3.2.2.8 MtrDrv_ClrGdrvFlt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.7.5
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">☒</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">☒</span> Mid
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

#### 1.1.2.7.5.2 Static View Design



#### 1.1.2.7.5.3 Dynamic View Design

- N/A

#### 1.1.2.7.5.4 Interface Design

- N/A

#### 1.1.2.7.6 [SWDDS.3.6.7.6] Gdu\_SetWrtPrtct

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	64

#### 1.1.2.7.6.1 Detailed Design

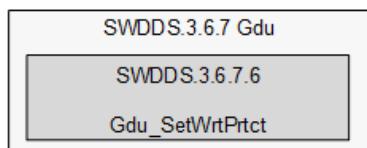
##### [SWDDS.3.6.7.6] Gdu\_SetWrtPrtct

Software Unit Information					
Unit ID	SWDDS.3.6.7.6	Unit Name	Gdu_SetWrtPrtct		
Architecture ID	SWADS.3.6.7.6	ASIL	QM		
Prototype	void Gdu_SetWrtPrtct( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	GDUE_GWP	0x01u	Write	GDU Write Protect
Description	Gate driver write protection setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     GDUE_GWP = 0x01u;     ↓     end   </pre>				
Called Function	SWDDS.3.6.1.2 InitializeBswlHalMtrCtr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.7.6
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	65

#### 1.1.2.7.6.2 Static View Design



#### 1.1.2.7.6.3 Dynamic View Design

- N/A

#### 1.1.2.7.6.4 Interface Design

- N/A

### 1.1.2.8 [SWDDS.3.6.8] Adc

Initialize ADC0 and ADC1

Get AD converted result

Run ADC error interrupt

Run ADC done interrupt

#### 1.1.2.8.1 [SWDDS.3.6.8.1] Adc\_Init

##### 1.1.2.8.1.1 Detailed Design

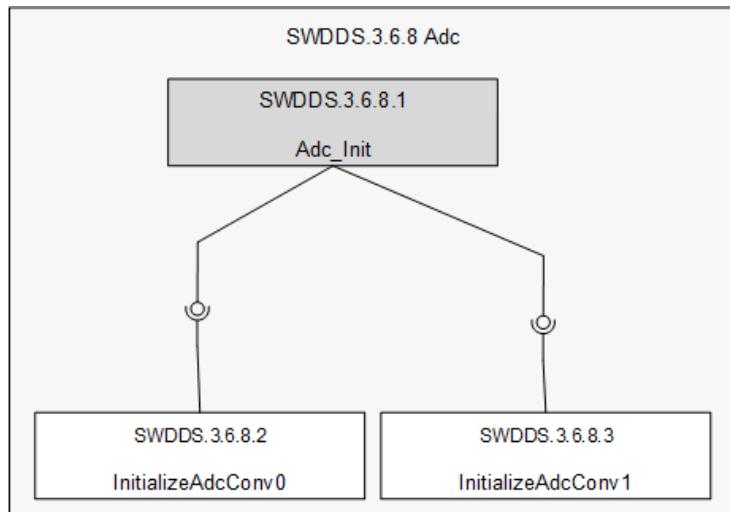
#### [SWDDS.3.6.8.1] Adc\_Init

Software Unit Information					
Unit ID	SWDDS.3.6.8.1	Unit Name	Adc_Init		
Architecture ID	SWADS.3.6.8.1	ASIL	QM		
Prototype	void Adc_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16AdcErrCnt0	0u	Write	ADC0 error count
	tU16	g_u16AdcErrCnt1	0u	Write	ADC1 error count
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	A/D converter initialization				

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u16AdcErrCnt0 = 0u;     g_u16AdcErrCnt1 = 0u;     ↓     [SWDDS.3.6.8.2]     InitializeAdcConv0();     ↓     [SWDDS.3.6.8.3]     InitializeAdcConv1();     ↓     end   </pre>
Called Function	SWDDS.3.6.1.2 InitializeBswHalMtrCtr
Calling Function	SWDDS.3.6.8.2 InitializeAdcConv0 SWDDS.3.6.8.3 InitializeAdcConv1
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.8.1
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: green;">★</span> Low
Interoperability	Yes
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">★</span> Low
Verifiability	Yes

#### 1.1.2.8.1.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	67

#### 1.1.2.8.1.3 Dynamic View Design

- N/A

#### 1.1.2.8.1.4 Interface Design

- N/A

#### 1.1.2.8.2 [SWDDS.3.6.8.2] InitializeAdcConv0

##### 1.1.2.8.2.1 Detailed Design

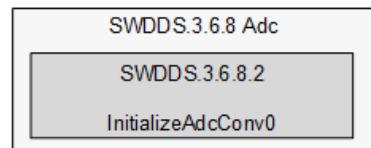
##### [SWDDS.3.6.8.2] InitializeAdcConv0

Software Unit Information					
Unit ID	SWDDS.3.6.8.2	Unit Name	InitializeAdcConv0		
Architecture ID	SWADS.3.6.8.2	ASIL	QM		
Prototype	void InitializeAdcConv0( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8AdcCommandList0	0 ~ 255	Read	ADC0 command list
	tU16	g_au16AdcResultList0	0 ~ 65520	Read	ADC0 result list
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	BATE_BSUAE	0x01u	Write	BATS VSUP ADC Connection Enable
	byte	ADC0CTL_0_ACC_CFG	0x03u	Write	ADC1 Control Register 0 – Handling Restart Requests during End Of List Command Type Execution
	byte	ADC0CTL_0_STR_SEQA	0x01u	Write	ADC1 Control Register 0 – ADCFLWCTL Register Access Configuration
	byte	ADC0TIM	0x02u	Write	ADC0 Timing Register
	byte	ADC0FMT_DJM	0x00u	Write	Result Register Data Justification
	byte	ADC0FMT_SRES	0x04u	Write	ADC Resolution Select
	pointer	ADC0CBP	g_au8AdcCommandList0	Write	ADC0 Command Base Pointer Register 0
	pointer	ADC0RBP	g_au16AdcResultList0	Write	ADC0 Result Base Pointer Register 0
	byte	ADC0CROFF1	0x00u	Write	ADC0 Command and Result Offset Register 1
	byte	INT_CFADDR_INT_CFADDR	0xc	Write	Interrupt Request Configuration Data Register Select Bits

	byte	INT_CFDATA3_PRIOLVL	2u	Write	Interrupt Request Priority Level Bits
	byte	ADC0CTL_0_ADC_EN	0x01u	Write	ADC1 Control Register 0 – ADC Enable Bit
	byte	ADC0EIE	0xeeu	Write	ADC0 Error Interrupt Enable Register
Description	A/D converter 0 initialization				
Control Flow Diagram (or Pseudo Code)	<pre> start     BATE_BSUAE = 0x01u;     ADC0CTL_0_ACC_CFG = 0x03u;     ADC0CTL_0_STR_SEQA = 0x01u;     ADC0TIM = 0x02u;     ADC0FMT_DJM = 0x00u;     ADC0FMT_SRES = 0x04u;     ADC0CBP = g_au8AdcCommandList0;     ADC0RBP = g_au16AdcResultList0;     ADC0CROFF1 = 0x00u;     INT_CFAADDR_INT_CFAADDR = 0x0c;     INT_CFDATA3_PRIOLVL =     ADC_PRIORITY_ERROR_0;     ADC0CTL_0_ADC_EN = 0x01u;     ADC0EIE = 0xeeu; end </pre>				
Called Function	SWDDS.3.6.8.1 Adc_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.2
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.8.2.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	69

#### 1.1.2.8.2.3 Dynamic View Design

- N/A

#### 1.1.2.8.2.4 Interface Design

- N/A

#### 1.1.2.8.3 [SWDDS.3.6.8.3] InitializeAdcConv1

##### 1.1.2.8.3.1 Detailed Design

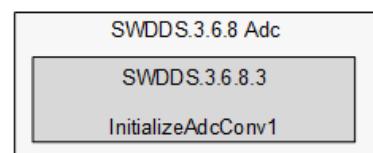
#### [SWDDS.3.6.8.3] InitializeAdcConv1

Software Unit Information					
Unit ID	SWDDS.3.6.8.3	Unit Name	InitializeAdcConv1		
Architecture ID	SWADS.3.6.8.3	ASIL	QM		
Prototype	void InitializeAdcConv1( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU8	g_au8AdcCommandList1	0 ~ 255	Read	ADC1 command list
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	ADC1CTL_0_ACC_CFG	0x03u	Write	ADC1 Control Register 1 – Handling Restart Requests during End Of List Command Type Execution
	byte	ADC1CTL_0_STR_SEQA	0x01u	Write	ADC1 Control Register 1 – ADCFLWCTL Register Access Configuration
	byte	ADC1TIM	0x02u	Write	ADC1 Timing Register
	byte	ADC1FMT_DJM	0x00u	Write	Result Register Data Justification
	byte	ADC1FMT_SRES	0x04u	Write	ADC Resolution Select
	byte	ADC1CONIE_1_CON_IE1	0x01u	Write	ADC1 Conversion Interrupt Enable Register 1 – Conversion Interrupt 1 Enable
	pointer	ADC1CBP	g_au8AdcCommandList1	Write	ADC1 Command Base Pointer Register 0
	pointer	ADC1RBP	g_au16AdcResultList1	Write	ADC1 Result Base Pointer Register
	byte	ADC1CROFF1	0x00u	Write	ADC1 Command and Result Offset Register 1
	byte	INT_CFADDR_INT_CFADDR	0x08	Write	Interrupt Request Configuration Data Register Select Bits

	byte	INT_CFDATA7_PRIOLVL	2u	Write	Interrupt Request Priority Level Bits
	byte	INT_CFADDR_INT_CFADDR	0x08	Write	Interrupt Request Configuration Data Register Select Bits
	byte	INT_CFDATA5_PRIOLVL	6u	Write	Interrupt Request Priority Level Bits
	byte	ADC1CTL_0_ADC_EN	0x01u	Write	ADC1 Control Register 0 ADC Enable Bit
	byte	ADC1EIE	0xeeu	Write	ADC1 Error Interrupt Enable Register
Description	A/D converter 1 initialization				
Control Flow Diagram (or Pseudo Code)	<pre> start ADC1CTL_0_ACC_CFG = 0x03u; ADC1CTL_0_STR_SEQA = 0x01u; ADC1TIM = 0x02u; ADC1FMT_DJM = 0x00u; ADC1FMT_SRES = 0x04u; ADC1CONIE_1_CONIE1 = 0x01u; ADC1CBP = g_au8AdcCommandList1; ADC1RBP = g_au16AdcResultList1; ADC1CROFF1 = 0x00u; INT_CFADDR_INT_CFADDR = 0x08; INT_CFDATA7_PRIOLVL = ADC_PRIORITY_ERROR_1; INT_CFDATA5_PRIOLVL = ADC_PRIORITY_DONE_1; ADC1CTL_0_ADC_EN = 0x01u; ADC1EIE = 0xeeu; end </pre>				
Called Function	SWDDS.3.6.8.1 Adc_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.3
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

### 1.1.2.8.3.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	71

#### 1.1.2.8.3.3 Dynamic View Design

- N/A

#### 1.1.2.8.3.4 Interface Design

- N/A

#### 1.1.2.8.4 [SWDDS.3.6.8.4] Adc\_GetResult0

##### 1.1.2.8.4.1 Detailed Design

##### [SWDDS.3.6.8.4] Adc\_GetResult0

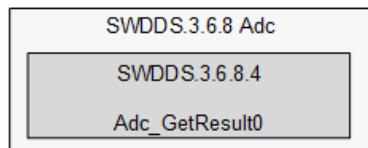
Software Unit Information					
Unit ID	SWDDS.3.6.8.4	Unit Name	Adc_GetResult0		
Architecture ID	SWADS.3.6.8.4	ASIL	QM		
Prototype	tS16 Adc_GetResult0( tU16 result_index )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	result_index	0 ~ 3	IN	ADC result list index
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	N/A		ADC0 conversion result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_au16AdcResultList0[]	0 ~ 32760	Read	ADC0 result list
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	ADC0 conversion result uni-polar value getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tU16 adc_result = 0u;     ↓     {result_index &lt; ADC_CMD_NO}       yes     ↓     adc_result = g_au16AdcResultList0[result_index] &gt;&gt; 1u;     ↓     {return (tS16)adc_result;}           no     ↓   </pre>				
Called Function	<p>SWDDS.3.6.1.3 BswHal_GetBatVolt</p> <p>SWDDS.3.6.1.4 BswHal_GetPcbTemp</p>				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.4
Target Milestone	SBS1
Element	HAL

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	72

Risk	 Mid
Interoperability	Yes
Criticality	 Mid
Technical complexity	 Low
Verifiability	Yes

#### 1.1.2.8.4.2 Static View Design



#### 1.1.2.8.4.3 Dynamic View Design

- N/A

#### 1.1.2.8.4.4 Interface Design

- N/A

#### 1.1.2.8.5 [SWDDS.3.6.8.5] Adc\_GetResult1

##### 1.1.2.8.5.1 Detailed Design

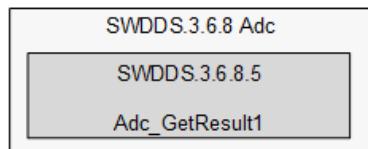
##### [SWDDS.3.6.8.5] Adc\_GetResult1

Software Unit Information					
Unit ID	SWDDS.3.6.8.5		Unit Name	Adc_GetResult1	
Architecture ID	SWADS.3.6.8.5		ASIL	QM	
Prototype	tS16 Adc_GetResult1( tU16 result_index )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	result_index	0 ~ 3	IN	ADC result list index
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	N/A		ADC1 conversion result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_au16AdcResultList1[]	0 ~ 32760	Read	ADC1 result list
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	ADC1 conversion result uni-polar value getting				

Control Flow Diagram (or Pseudo Code)	<pre>     start     tu16 adc_result = 0;     if(result_index &lt; ADC_CMD_NO)     {         adc_result = g_au16AdcResultList1[result_index] &gt;&gt; 1u;     }     return (tS16)adc_result;     </pre>
Called Function	SWDDS.3.2.2.2 MtrDrv_GetDcVolt
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.8.5
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.8.5.2 Static View Design



#### 1.1.2.8.5.3 Dynamic View Design

- N/A

#### 1.1.2.8.5.4 Interface Design

- N/A

### 1.1.2.8.6 [SWDDS.3.6.8.6] Adc\_GetCurSen

#### 1.1.2.8.6.1 Detailed Design

##### [SWDDS.3.6.8.6] Adc\_GetCurSen

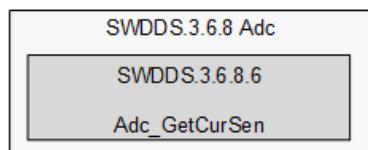
Software Unit Information					
Unit ID	SWDDS.3.6.8.6	Unit Name	Adc_GetCurSen		
Architecture ID	SWADS.3.6.8.6	ASIL	QM		
Prototype	tS16 Adc_GetCurSen( tBool second_list )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	second_list	0 ~ 1 FALSE / TRUE	IN	FALSE – ADC list 0, TRUE – ADC list 1
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	-16376 ~ 16376		Offset compensated value	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_au16AdcResultList0[]	0 ~ 32760	Read	ADC0 result list
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	ADC current sense amplifier result getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tU16 adc_result;     tS16 offset_compensated;     ↓     if second_list == FALSE then         yes: adc_result = g_au16AdcResultList0[0u] &gt;&gt; 1u;         no:   adc_result = g_au16AdcResultList1[0u] &gt;&gt; 1u;     ↓     if adc_result &gt;= 16384u then         yes: adc_result = (adc_result - 16384u) &lt;&lt; 1u;         offset_compensated = -(tS16)adc_result;         no:   adc_result = (16384u - adc_result) &lt;&lt; 1u;         offset_compensated = (tS16)adc_result;     ↓     return offset_compensated;   </pre>				
Called Function	SWDDS.3.2.2.3 MtrDrv_GetPhsCur				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.6
----------------	---------------

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date 2021-04-27
			Page 75

Target Milestone	EBS2
Element	HAL
Risk	 Mid
Interoperability	Yes
Criticality	 Mid
Technical complexity	 Mid
Verifiability	Yes

#### 1.1.2.8.6.2 Static View Design



#### 1.1.2.8.6.3 Dynamic View Design

- N/A

#### 1.1.2.8.6.4 Interface Design

- N/A

#### 1.1.2.8.7 [SWDDS.3.6.8.7] Adc\_GetErrCnt1

##### 1.1.2.8.7.1 Detailed Design

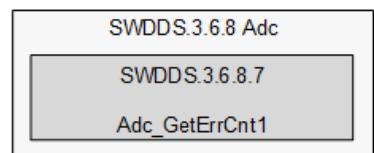
##### [SWDDS.3.6.8.7] Adc\_GetErrCnt1

Software Unit Information								
Unit ID	SWDDS.3.6.8.7	Unit Name	Adc_GetErrCnt1					
Architecture ID	SWADS.3.6.8.7	ASIL	QM					
Prototype								
	tU16 Adc_GetErrCnt1( void )							
Function Call	Data Type	Name	Range	IN/OUT	Description			
Parameters	N/A	N/A	N/A	N/A	N/A			
Function Call	Data Type	Possible Return Value		Description				
Return Value	tU16	0 ~ 65535		Error count				
Global Variables	Data Type	Name	Range	Read/Write	Description			
	tU16	g_u16AdcErrCnt1	0 ~ 65535	Read	ADC1 error count			
Parameters	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			
Registers	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	76

Description	ADC1 conversion error count getting
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return g_u16AdcErrCnt1;   </pre>
Called Function	N/A
Calling Function	N/A
Function Execution Time	N/A

#### 1.1.2.8.7.2 Static View Design



#### 1.1.2.8.7.3 Dynamic View Design

- N/A

#### 1.1.2.8.7.4 Interface Design

- N/A

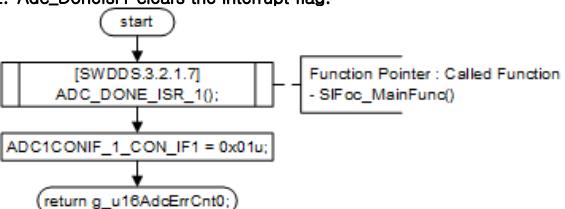
#### 1.1.2.8.8 [SWDDS.3.6.8.8] Adc\_DoneISR1

##### 1.1.2.8.8.1 Detailed Design

##### [SWDDS.3.6.8.8] Adc\_DoneISR1

Software Unit Information					
Unit ID	SWDDS.3.6.8.8	Unit Name		Adc_DoneISR1	
Architecture ID	SWADS.3.6.8.8	ASIL		QM	
Prototype			INTERRUPT void Adc_DoneISR1(void)		
Function Call Parameters	Data Type N/A	Name N/A	Range N/A	IN/OUT N/A	Description N/A
Function Call Return Value	Data Type void	Possible Return Value N/A			Description N/A
Global Variables	Data Type N/A	Name N/A	Range N/A	Read/Write N/A	Description N/A
Parameters	Data Type N/A	Name N/A	Range N/A	Read/Write N/A	Description N/A
	Data N/A	Name N/A	Range N/A	Read/Write N/A	Description N/A

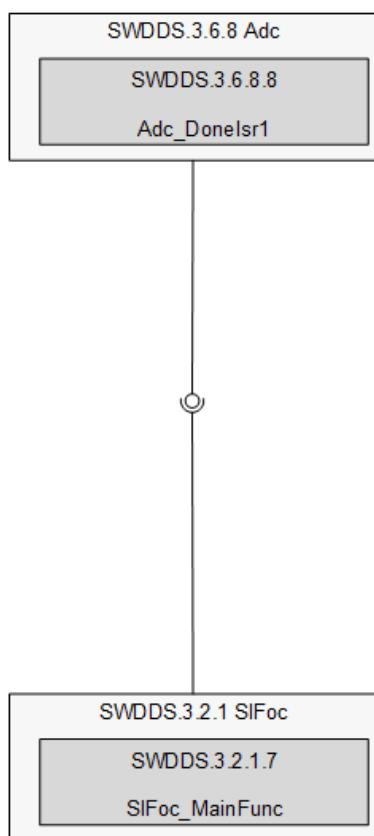
	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	77

Registers	Type				
	byte ADC1CONIF_1_CON_IF1 0x01u	Write	ADC1 Conversion Interrupt Flag Register 1 – Conversion Interrupt 1 Flag		
Description	ADC1 done interrupt service routine				
	1. Adc_DoneIsr1 calls the sensorless FOC main function. 2. Adc_DoneIsr1 clears the interrupt flag.				
Control Flow Diagram (or Pseudo Code)	 <pre> graph TD     start((start)) --&gt; ADC_DONE_ISR_10[SWDDS.3.2.1.7&lt;br/&gt;ADC_DONE_ISR_10]     ADC_DONE_ISR_10 --&gt; FunctionPointer[Function Pointer : Called Function&lt;br/&gt;- SIFoc_MainFunc()]     FunctionPointer --&gt; ADC1CONIF_1_CON_IF1[ADC1CONIF_1_CON_IF1 = 0x01u]     ADC1CONIF_1_CON_IF1 --&gt; return[return g_u16AdcErrCnt0] </pre>				
Called Function	N/A				
Calling Function	SWDDS.3.2.1.7 SIFoc_MainFunc				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.8
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.2.8.8.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	78



#### 1.1.2.8.8.3 Dynamic View Design

- N/A

#### 1.1.2.8.8.4 Interface Design

- N/A

#### 1.1.2.8.9 [SWDDS.3.6.8.9] Adc\_GetErrCnt0

##### 1.1.2.8.9.1 Detailed Design

##### [SWDDS.3.6.8.9] Adc\_GetErrCnt0

Software Unit Information					
Unit ID	SWDDS.3.6.8.9	Unit Name	Adc_GetErrCnt0		
Architecture ID	SWADS.3.6.8.9	ASIL	QM		
Prototype		tU16 Adc_GetErrCnt0( void )			
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Parameters	Data Type	Possible Return Value	Description		
	tU16	0 ~ 65535	Error count		

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	79

Value	VW AQ EOP				
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16AdcErrCnt0	0 ~ 65535	Read	ADC0 error count
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	ADC0 conversion error count getting				
Control Flow Diagram (or Pseudo Code)					
Called Function				N/A	
Calling Function				N/A	
Function Execution Time				N/A	

#### 1.1.2.8.9.2 Static View Design

- N/A

#### 1.1.2.8.9.3 Dynamic View Design

- N/A

#### 1.1.2.8.9.4 Interface Design

- N/A

#### 1.1.2.8.10 [SWDDS.3.6.8.10] Adc\_Errlsr0

##### 1.1.2.8.10.1 Detailed Design

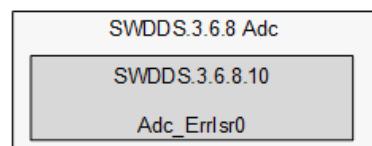
[SWDDS.3.6.8.10]Adc\_Errlsr0

Software Unit Information					
Unit ID	[SWDDS.3.6.8.10]		Unit Name	Adc_Errlsr0	
Architecture ID	[SWADS.3.6.8.10]		ASIL	QM	
Prototype	INTERRUPT void Adc_Errlsr0( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/ Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/ Write	Description
	N/A	N/A	N/A	N/A	N/A

Registers	Data Type	Name	Range	Read/ Write	Description
	tU8	ADC0EIF	0~254	Read/ Write	ADC0 Error Interrupt Flag Register
Description	ADC0 error interrupt service routine				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tu8 adc_interrupt_flag;     adc_interrupt_flag = ADC0EIF;      if(adc_interrupt_flag &amp; 0x02u) != 0x00u then         ADC0EIF = 0x02u;     else         if(adc_interrupt_flag &amp; 0x04u) != 0x00u then             ADC0EIF = 0x04u;         else             if(adc_interrupt_flag &amp; 0xe8u) != 0x00u then                 ADC0CTL_0_ADC_SR = 0x01u;             end     end   </pre>				
Called Function	N/A				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.8.10
Target Milestone	SBS2.1
Element	HAL
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> High
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

#### 1.1.2.8.10.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	81

#### 1.1.2.8.10.3 Dynamic View Design

- N/A

#### 1.1.2.8.10.4 Interface Design

- N/A

#### 1.1.2.8.11 [SWDDS.3.6.8.11] Adc\_Errlsr1

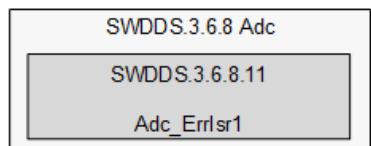
[SWDDS.3.6.8.11]Adc\_Errlsr1

Software Unit Information					
Unit ID	[SWDDS.3.6.8.11]		Unit Name	Adc_Errlsr1	
Architecture ID	[SWADS.3.6.8.11]		ASIL	QM	
Prototype	INTERRUPT void Adc_Errlsr1( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/ Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/ Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/ Write	Description
	tU8	ADC1EIF	0~254	Read/ Write	ADC1 Error Interrupt Flag Register
Description	ADC1 error interrupt service routine				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     tU8 adc_interrupt_flag;     adc_interrupt_flag = ADC1EIF;      if (adc_interrupt_flag &amp; 0x02u) != 0x00u then         ADC1EIF = 0x02;     else         if (adc_interrupt_flag &amp; 0x04u) != 0x00u then             ADC1EIF = 0x04;         else             if (adc_interrupt_flag &amp; 0xe8u) != 0x00u then                 ADC1CTL_0_ADC_SR = 0x01u;             end         end     end   </pre>
Called Function	N/A
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.8.11
Target Milestone	SBS2.1
Element	HAL
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

#### 1.1.2.8.11.1 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date 2021-04-27
			Page 83

#### 1.1.2.8.11.2 Dynamic View Design

- N/A

#### 1.1.2.8.11.3 Interface Design

- N/A

### 1.1.2.9 [SWDDS.3.6.9] Ptu

Initialize the programmable trigger unit

Get and clear PTU fault

#### 1.1.2.9.1 [SWDDS.3.6.9.1] Ptu\_Init

##### 1.1.2.9.1.1 Detailed Design

##### [SWDDS.3.6.9.1] Ptu\_Init

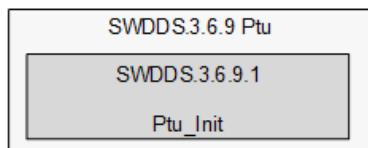
Software Unit Information					
Unit ID	SWDDS.3.6.9.1	Unit Name	Ptu_Init		
Architecture ID	SWADS.3.6.9.1	ASIL	QM		
Prototype	void Ptu_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	TU16	g_au16PtuTrigEventList	0~ 785	Read	TG0 – event list 0 and 1
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	pointer	PTUPTR	&g_au16PtuTrigEventList	Write	PTU Pointer Register
	byte	TG0L1IDX	0 ~ 255	Write	Trigger Generator 0 List 1 Index Register
	byte	TG1L0IDX	0 ~ 255	Write	Trigger Generator 1 List 0 Index Register
	byte	TG1L1IDX	0 ~ 255	Write	Trigger Generator 1 List 1 Index Register
	byte	PTUE_PTUFZRZ	0x00u	Write	PTU Stop in Freeze Mode
	byte	PTUE_TG0EN	0x01u	Write	Trigger Generator 0 Enable
	byte	PTUE_TG1EN	0x01u	Write	Trigger Generator 1 Enable
	byte	PTUC_PTULDOK	0x01u	Write	Load Okay

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	84

	byte	PTUDEBUG_PTUREPE	0x00u	Write	PTU PTURE Pin Enable
Description	PTU initialization – PTU trigger event list setting – PTU module enable setting – PTU module control setting				
Control Flow Diagram (or Pseudo Code)			<pre> start     PTUPTR = &amp;g_au16PtuTrigEventList;     TG0L1IDX = (tU8) (((tU32)(&amp;g_au16PtuTrigEventList[0][0][0])) - ((tU32)g_au16PtuTrigEventList) &gt;&gt; 1u);     TG1L0IDX = (tU8) (((tU32)(&amp;g_au16PtuTrigEventList[1][0][0])) - ((tU32)g_au16PtuTrigEventList) &gt;&gt; 1u));     TG1L1IDX = (tU8) (((tU32)(&amp;g_au16PtuTrigEventList[1][0][0])) - ((tU32)g_au16PtuTrigEventList) &gt;&gt; 1u));     PTUE_PTRFRZ = 0x00u;     PTUE_TG0EN = 0x01u;     PTUE_TG1EN = 0x01u;     PTUC_PTULDOK = 0x01u;     PTUDEBUG_PTUREPE = 0x00u; end </pre>		
Called Function					SWDDS.3.6.1.2 InitializeBswHalMtrCtr
Calling Function					N/A
Function Execution Time					N/A

Requirement Id	SWDDS.3.6.9.1
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.9.1.2 Static View Design



#### 1.1.2.9.1.3 Dynamic View Design

– N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	85

#### 1.1.2.9.1.4 Interface Design

- N/A

#### 1.1.2.10 [SWDDS.3.6.10] MsCan

Initialize the CAN port  
Receive CAN message  
Transmit CAN message

##### 1.1.2.10.1 [SWDDS.3.6.10.1] MsCan\_Init

###### 1.1.2.10.1.1 Detailed Design

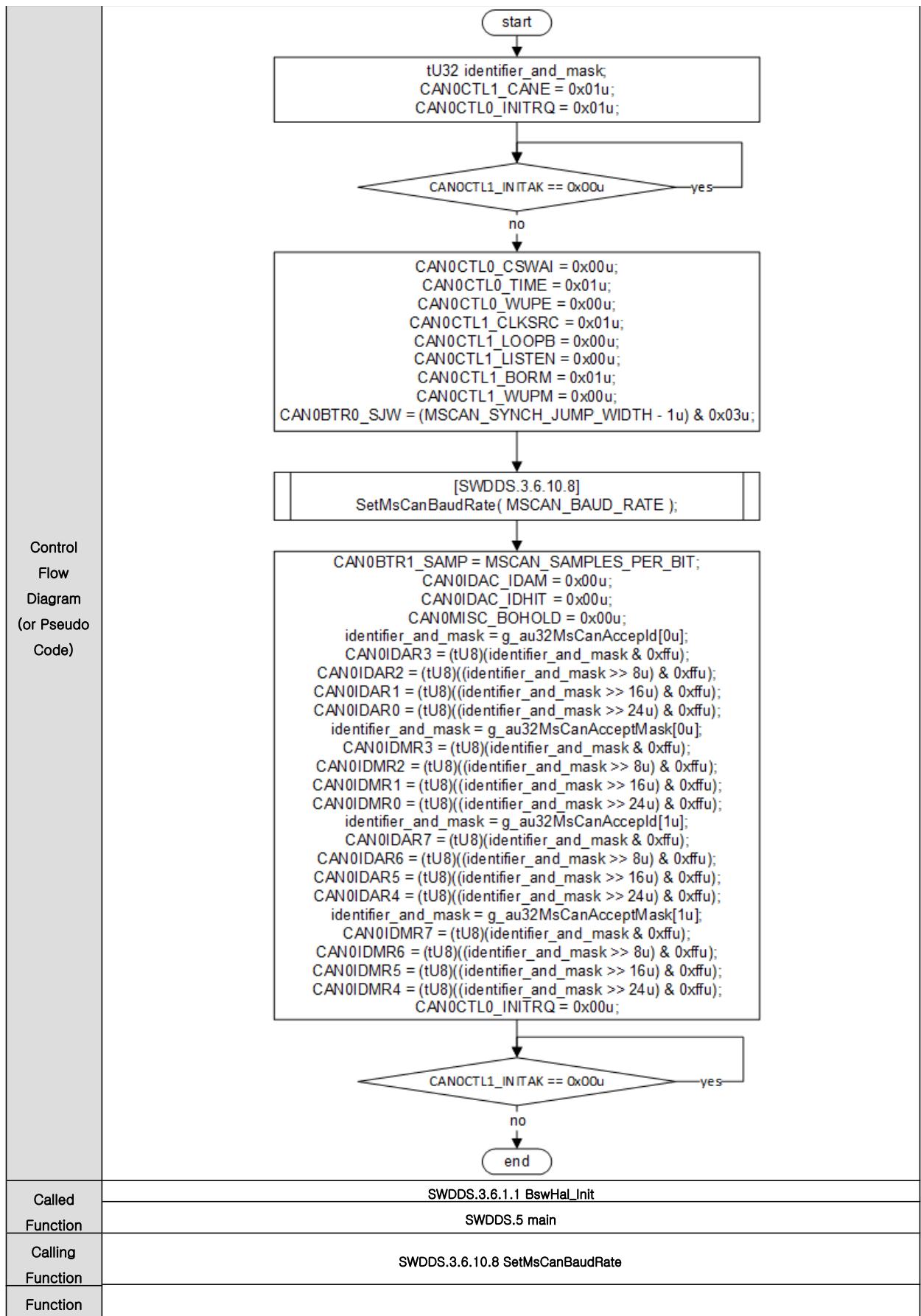
###### [SWDDS.3.6.10.1] MsCan\_Init

Software Unit Information					
Unit ID	SWDDS.3.6.10.1		Unit Name	MsCan_Init	
Architecture ID	SWADS.3.6.10.1		ASIL	QM	
Prototype	void MsCan_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_au32MsCanAcceptId	0x00000000uL, 0x00000000uL	Read	CAN acceptance identifier and mask
	tU32	g_au32MsCanAcceptMask	0xffffffffuL, 0xffffffffuL	Read	CAN acceptance mask (0 – matched, 1 – ignored)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
	byte	CAN0CTL1_CANE	0x01u	Write	MSCAN Enable
	byte	CAN0CTL0_INITRQ	0x00u~0x01u	Write	Initialization Mode Request
	byte	CAN0CTL1_INITAK	0 ~ 1 Not acknowledge / Acknowledge	Read	Initialization Mode Acknowledge

Registers	byte	CAN0CTL0_CSWAI	0x00u	Write	CAN Stops in Wait Mode
	byte	CAN0CTL0_TIME	0x01u	Write	Timer Enable
	byte	CAN0CTL0_WUPE	0x00u	Write	Wake-Up Enable
	byte	CAN0CTL1_CLKSRC	0x01u	Write	MSCAN Clock Source
	byte	CAN0CTL1_LOOPB	0x00u	Write	Loop Back Self Test Mode
	byte	CAN0CTL1_LISTEN	0x00u	Write	Listen Only Mode
	byte	CAN0CTL1_BORM	0x01u	Write	Bus-Off Recovery Mode
	byte	CAN0CTL1_WUPM	0x00u	Write	Wake-Up Mode
	byte	CAN0BTR0_SJW	0 ~ 3	Write	CAN SJW
	byte	CAN0BTR1_SAMP	1u	Write	Sampling
	byte	CAN0IDAC_IDAM	0x00u	Write	2x 16-bit acceptance filter
	byte	CAN0IDAC_IDHIT	0x00u	Write	filter 0 hit
	byte	CAN0MISC_BOHOLD	0x00u	Write	Bus-off State Hold Until User Request
	byte	CAN0IDAR3	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 3
	byte	CAN0IDAR2	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 2
	byte	CAN0IDAR1	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 1
	byte	CAN0IDAR0	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 0
	byte	CAN0IDMR3	0 ~ 255	Write	MSCAN0 Identifier Mask Register 3
	byte	CAN0IDMR2	0 ~ 255	Write	MSCAN0 Identifier Mask Register 2
	byte	CAN0IDMR1	0 ~ 255	Write	MSCAN0 Identifier Mask Register 1
	byte	CAN0IDMR0	0 ~ 255	Write	MSCAN0 Identifier Mask Register 0
	byte	CAN0IDAR7	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 7
					MSCAN0

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	87

Control Flow Diagram	byte	CAN0IDAR6	0 ~ 255	Write	Identifier Acceptance Register 6
	byte	CAN0IDAR5	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 5
	byte	CAN0IDAR4	0 ~ 255	Write	MSCAN0 Identifier Acceptance Register 4
	byte	CAN0IDMR7	0 ~ 255	Write	MSCAN0 Identifier Mask Register 7
	byte	CAN0IDMR6	0 ~ 255	Write	MSCAN0 Identifier Mask Register 6
	byte	CAN0IDMR5	0 ~ 255	Write	MSCAN0 Identifier Mask Register 5
	byte	CAN0IDMR4	0 ~ 255	Write	MSCAN0 Identifier Mask Register 4
Description	MSCAN initialization <ul style="list-style-type: none"> <li>- Assert CANE</li> <li>- Write to the configuration registers in initialization mode</li> <li>- CANCTL0 register setting</li> <li>- CANCTL1 register setting</li> <li>- Baud rate setting</li> <li>- Acceptance identifier and mask setting</li> <li>- Clear INTRQ to leave initialization mode</li> </ul>				

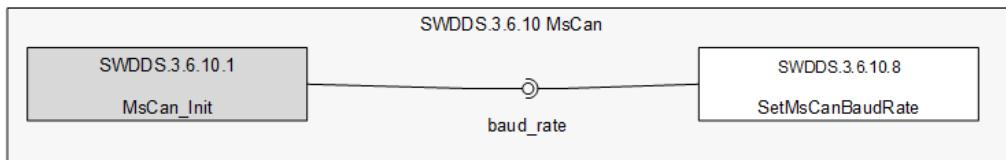


<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	89

Execution Time	N/A
----------------	-----

Requirement Id	SWDDS.3.6.10.1
Target Milestone	EBS2
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.10.1.2 Static View Design



#### 1.1.2.10.1.3 Dynamic View Design

- N/A

#### 1.1.2.10.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	baud_rate	SWDDS.3.6.10.8	OUT	tMsCanBaudRate	0	5	CAN_BAUDRATE_1MBPS	CAN_BAUDRATE_50KBPS	N/A	CAN baud rate

#### 1.1.2.10.2 [SWDDS.3.6.10.2] MsCan\_ChkRxRdy

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	90

#### 1.1.2.10.2.1 Detailed Design

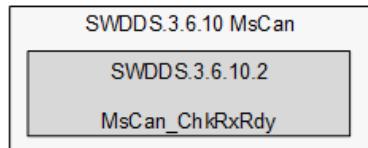
##### [SWDDS.3.6.10.2] MsCan\_ChkRxRdy

Software Unit Information					
Unit ID	SWDDS.3.6.10.2	Unit Name	MsCan_ChkRxRdy		
Architecture ID	SWADS.3.6.10.2	ASIL	QM		
Prototype	tBool MsCan_ChkRxRdy( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tBool	0 ~ 1		FALSE – not ready, TRUE – ready	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0RFLG_RXF	0 ~ 1 Not ready / Ready	Read	Receive Buffer Full
Description	MSCAN data received data ready checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tBool checking_result = FALSE;     if(CAN0RFLG_RXF != 0x00u)         checking_result = TRUE;     return checking_result;   </pre>				
Called Function	SWDDS.3.3.1.2 CanMsg_ChkReqDat				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.10.2
Target Milestone	EBS2
Element	HAL
Risk	▣ Mid
Interoperability	Yes
Criticality	▣ Mid
Technical complexity	▢ Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	91

#### 1.1.2.10.2.2 Static View Design



#### 1.1.2.10.2.3 Dynamic View Design

- N/A

#### 1.1.2.10.2.4 Interface Design

- N/A

#### 1.1.2.10.3 [SWDDS.3.6.10.3] MsCan\_GetRxId

##### 1.1.2.10.3.1 Detailed Design

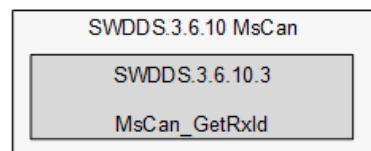
##### [SWDDS.3.6.10.3] MsCan\_GetRxId

Software Unit Information					
Unit ID	SWDDS.3.6.10.3	Unit Name	MsCan_GetRxId		
Architecture ID	SWADS.3.6.10.3	ASIL	QM		
Prototype	tU32 MsCan_GetRxId( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU32	0 ~ 536870911		Received identifier	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0RXIDR1_IDE	0 ~ 1 Standard ID / Extended ID	Read	ID Extended
	byte	CAN0RXIDR0	0 ~ 255	Read	MSCAN0 Receive Identifier Register 0
	byte	CAN0RXIDR1	0 ~ 255	Read	MSCAN0 Receive Identifier Register 1
	byte	CAN0RXIDR2	0 ~ 255	Read	MSCAN0 Receive Identifier Register 2
	byte	CAN0RXIDR3	0 ~ 255	Read	MSCAN0 Receive Identifier Register 3
Description	MSCAN Received identifier getting				
Control Flow Diagram					

Control Flow Diagram (or Pseudo Code)	<pre>     start     tU32 Identifier = 0x00000000uL;     if CAN0RXIDR1_IDE == 0x00u then         Identifier = CAN0RXIDR0;         Identifier = (Identifier &lt;&lt; 8u)   CAN0RXIDR1;         Identifier = (Identifier &gt;&gt; 5u) &amp; 0x07ffu;     else         Identifier = CAN0RXIDR1 &amp; 0x07u;         Identifier = (Identifier &lt;&lt; 8u)   CAN0RXIDR2;         Identifier = (Identifier &lt;&lt; 8u)   CAN0RXIDR3;         Identifier &gt;= 1u;     end     return Identifier;   </pre>
	SWDDS.3.3.1.2 CanMsg_ChkReqDat
	N/A
	N/A

Requirement Id	SWDDS.3.6.10.3
Target Milestone	EBS2
Element	HAL
Risk	<span style="background-color: #e0c080;">■</span> Mid
Interoperability	Yes
Criticality	<span style="background-color: #e0c080;">■</span> Mid
Technical complexity	<span style="background-color: #a0ffa0;">■</span> Low
Verifiability	Yes

#### 1.1.2.10.3.2 Static View Design



#### 1.1.2.10.3.3 Dynamic View Design

- N/A

#### 1.1.2.10.3.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	93

#### 1.1.2.10.4 [SWDDS.3.6.10.4] MsCan\_GetRxDat

##### 1.1.2.10.4.1 Detailed Design

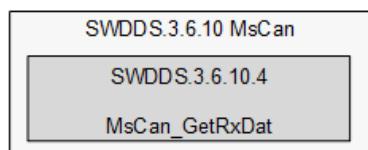
##### [SWDDS.3.6.10.4] MsCan\_GetRxDat

Software Unit Information					
Unit ID	SWDDS.3.6.10.4	Unit Name	MsCan_GetRxDat		
Architecture ID	SWADS.3.6.10.4	ASIL	QM		
Prototype	void MsCan_GetRxDat( tU8 received_data[8], tU16* received_number, tU16* received_time_stamp )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU8	received_data	0 ~ 255	OUT	received data (8 bytes)
	tU16*	received_number	0 ~ 8	OUT	number of received data
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
Global Variables	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0RXDSR0	0 ~ 255	Read	MSCANO Receive Data Segment Register 0
	byte	CAN0RXDSR1	0 ~ 255	Read	MSCANO Receive Data Segment Register 1
	byte	CAN0RXDSR2	0 ~ 255	Read	MSCANO Receive Data Segment Register 2
	byte	CAN0RXDSR3	0 ~ 255	Read	MSCANO Receive Data Segment Register 3
	byte	CAN0RXDSR4	0 ~ 255	Read	MSCANO Receive Data Segment Register 4
	byte	CAN0RXDSR5	0 ~ 255	Read	MSCANO Receive Data Segment Register 5
	byte	CAN0RXDSR6	0 ~ 255	Read	MSCANO Receive Data Segment Register 6
	byte	CAN0RXDSR7	0 ~ 255	Read	MSCANO Receive Data Segment Register 7
	Word	CAN0RXDLR_DLC	0 ~ 8	Read	received number of data
Description	byte	CAN0RXTSR	0 ~ 65535	Read	MSCANO Receive Time Stamp Register
	byte	CAN0RFLG_RXF	0x01u	Write	Receive Buffer Full
Control Flow Diagram (or Pseudo Code)	<pre> start     received_data[0] = CAN0RXDSR0;     received_data[1] = CAN0RXDSR1;     received_data[2] = CAN0RXDSR2;     received_data[3] = CAN0RXDSR3;     received_data[4] = CAN0RXDSR4;     received_data[5] = CAN0RXDSR5;     received_data[6] = CAN0RXDSR6;     received_data[7] = CAN0RXDSR7;     *received_number = CAN0RXDLR_DLC;     *received_time_stamp = CAN0RXTSR;     CAN0RFLG_RXF = 0x01u; end   </pre>				
Called Function	SWDDS.3.3.1.2 CanMsg_ClkReqDat				
Calling Function	N/A				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date 2021-04-27
	Page 94		

Requirement Id	SWDDS.3.6.10.4
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #C8A23E;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #C8A23E;">■</span> Mid
Technical complexity	<span style="color: #2ECC71;">■</span> Low
Verifiability	Yes

#### 1.1.2.10.4.2 Static View Design



#### 1.1.2.10.4.3 Dynamic View Design

- N/A

#### 1.1.2.10.4.4 Interface Design

- N/A

#### 1.1.2.10.5 [SWDDS.3.6.10.5] SetMsCanTxId

##### 1.1.2.10.5.1 Detailed Design

##### [SWDDS.3.6.10.5] SetMsCanTxId

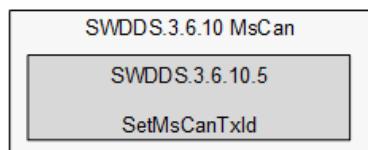
Software Unit Information					
Unit ID	SWDDS.3.6.10.5		Unit Name	SetMsCanTxId	
Architecture ID	SWADS.3.6.10.5		ASIL	QM	
Prototype	void SetMsCanTxId( tU32 transmit_identifier, tBool extended_identifier )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	transmit_identifier	0 ~ 536870911	IN	transmission identifier
Function Call Return Value	tBool	extended_identifier	0 ~ 1 Standard ID / Extended ID	IN	FALSE – standard ID, TRUE– extended ID
	Data Type	Possible Return Value		Description	
Global Variables	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0TXIDR0	0 ~ 255	Write	MSCAN0 Transmit Identifier Register 0
	byte	CAN0TXIDR1	0 ~ 255	Write	MSCAN0 Transmit Identifier Register 1
	byte	CAN0TXIDR2	0 ~ 255	Write	MSCAN0 Transmit Identifier Register 2
	byte	CAN0TXIDR3	0 ~ 255	Write	MSCAN0 Transmit Identifier Register 3
	byte	CAN0TXIDR1_IDE	0x00u~0x01u	Write	ID Extended
	byte	CAN0TXIDR1_SRR	0x00u~0x01u	Write	Substitute Remote Request
Description	MSCAN transmission identifier setting – Transmission identifier setting				
Control Flow Diagram (or Pseudo Code)	<pre>     start           {extended_identifier == FALSE}           no: CAN0TXIDR0 = (tU8)(transmit_identifier &gt;&gt; 3u);         CAN0TXIDR1 = (tU8)((transmit_identifier &lt;&lt; 5u) &amp; 0xe0u);         CAN0TXIDR2 = 0x00u;         CAN0TXIDR3 = 0x00u;         CAN0TXIDR1_IDE = 0x00u;         CAN0TXIDR1_SRR = 0x00u;           yes: CAN0TXIDR0 = (tU8)((transmit_identifier &gt;&gt; 21u) &amp; 0xffu);         CAN0TXIDR1 = (tU8)((transmit_identifier &gt;&gt; 13u) &amp; 0xe0u)   ((transmit_identifier &gt;&gt; 15u) &amp; 0x07u);         CAN0TXIDR2 = (tU8)((transmit_identifier &gt;&gt; 7u) &amp; 0xffu);         CAN0TXIDR3 = (tU8)((transmit_identifier &lt;&lt; 1u) &amp; 0xfe);         CAN0TXIDR1_IDE = 0x01u;         CAN0TXIDR1_SRR = 0x01u;           end   </pre>				
Called Function	SWDDS.3.6.10.7 MsCan_SendTxDat				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.10.5
Target Milestone	EBS2
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	96

#### 1.1.2.10.5.2 Static View Design



#### 1.1.2.10.5.3 Dynamic View Design

- N/A

#### 1.1.2.10.5.4 Interface Design

- N/A

#### 1.1.2.10.6 [SWDDS.3.6.10.6] SetMsCanTransmitDat

##### 1.1.2.10.6.1 Detailed Design

##### [SWDDS.3.6.10.6] SetMsCanTransmitDat

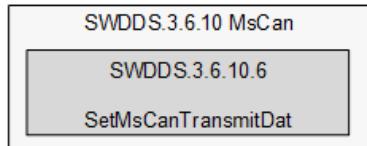
Software Unit Information					
Unit ID	SWDDS.3.6.10.6	Unit Name	SetMsCanTransmitDat		
Architecture ID	SWADS.3.6.10.6	ASIL	QM		
Prototype	void SetMsCanTransmitDat( tU8 transmit_data[8u], tU16 transmit_number )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	tU8	transmit_data	0 ~ 255	IN	transmission data (8 bytes)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0TXDSR0	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 0
	byte	CAN0TXDSR1	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 1
	byte	CAN0TXDSR2	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 2
	byte	CAN0TXDSR3	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 3
	byte	CAN0TXDSR4	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 4
	byte	CAN0TXDSR5	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 5
	byte	CAN0TXDSR6	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 6
	byte	CAN0TXDSR7	0 ~ 255	Write	MSCAN0 Transmit Data Segment Register 7
Description	MSCAN transmission data setting				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	97

- Transmission data setting	
Control Flow Diagram (or Pseudo Code)	<pre> start     CAN0TXDSR0 = transmit_data[0u];     CAN0TXDSR1 = transmit_data[1u];     CAN0TXDSR2 = transmit_data[2u];     CAN0TXDSR3 = transmit_data[3u];     CAN0TXDSR4 = transmit_data[4u];     CAN0TXDSR5 = transmit_data[5u];     CAN0TXDSR6 = transmit_data[6u];     CAN0TXDSR7 = transmit_data[7u];     CAN0TXDLR = transmit_number; end </pre>
Called Function	SWDDS.3.6.10.7 MsCan_SendTxDat
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.10.6
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: orange;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.1.2.10.6.2 Static View Design



#### 1.1.2.10.6.3 Dynamic View Design

- N/A

#### 1.1.2.10.6.4 Interface Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	98

### 1.1.2.10.7 [SWDDS.3.6.10.7] MsCan\_SendTxDat

#### 1.1.2.10.7.1 Detailed Design

##### [SWDDS.3.6.10.7] MsCan\_SendTxDat

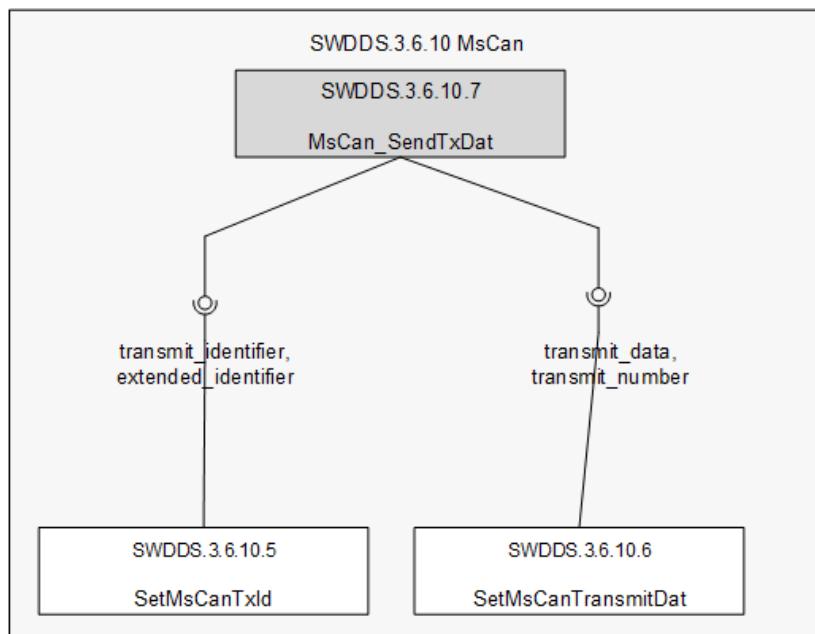
Software Unit Information				
Unit ID	SWDDS.3.6.10.7		Unit Name	MsCan_SendTxDat
Architecture ID	SWADS.3.6.10.7		ASIL	QM
Prototype	tU8 MsCan_SendTxDat( tU32 transmit_identifier, tBool extended_identifier, tU8 transmit_data[8u], tU16 transmit_number )			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tU32	transmit_identifier	0 ~ 536870911	IN
	tBool	extended_identifier	0 ~ 1 Standard ID / Extended ID	IN
	tU8	transmit_data	0 ~ 255	IN
Function Call Return Value	Data Type	Possible Return Value		Description
	tU8	N/A		Error count
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	byte	CAN0TBSEL	0 ~ 7	Read/Write
	byte	CAN0TFLG	0 ~ 7	Read/Write
	byte	CAN0TXTBPR	0x00u	Write
Description	MSCAN transmission data sending			
Control Flow Diagram (or Pseudo Code)				

Control Flow Diagram (or Pseudo Code)	<pre> start     tU8 execution_result = MSCAN_RET_OK;     tU8 selected_buffer;     CAN0TSEL = CAN0TFLG;     selected_buffer = CAN0TSEL;      if selected_buffer != 0x00u         [SWDDS.3.6.10.5]         SetMsCanTxId(transmit_identifier,                       extended_identifier);          [SWDDS.3.6.10.6]         SetMsCanTransmitDat(transmit_data,                              transmit_number);          CAN0TXTBPR = 0x00u;         CAN0TFLG = selected_buffer;          execution_result =             MSCAN_TX_BUF_NOT_AVAILABLE;     else         return execution_result;     </pre>	
Called Function	SWDDS.3.3.1.5 CanMsg_SendResDat	
Calling Function	SWDDS.3.6.10.5 SetMsCanTxId SWDDS.3.6.10.6 SetMsCanTransmitDat	
Function Execution Time	N/A	

Requirement Id	SWDDS.3.6.10.7
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">☒</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">☒</span> Mid
Technical complexity	<span style="color: #009640;">▢</span> Low
Verifiability	Yes

#### 1.1.2.10.7.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	100



#### 1.1.2.10.7.3 Dynamic View Design

– N/A

#### 1.1.2.10.7.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	transmit_identifier	SWDDS.3.6.10.5	OUT	tU32	0	536870911	0	536870911	N/A	transmission identifier
2	extended_identifier	SWDDS.3.6.10.5	OUT	tBool	0	1	Standard ID	Extended ID	N/A	Standard ID and extended ID selection
3	transmit_data[8u]	SWDDS.3.6.10.6	OUT	tU8	0	255	0	255	N/A	transmission data (8 bytes)
4	transmit_number	SWDDS.3.6.10.6	OUT	tU16	0	8	0	8	N/A	number of transmission data

#### 1.1.2.10.8 [SWDDS.3.6.10.8] SetMsCanBaudRate

##### 1.1.2.10.8.1 Detailed Design

##### [SWDDS.3.6.10.8] SetMsCanBaudRate

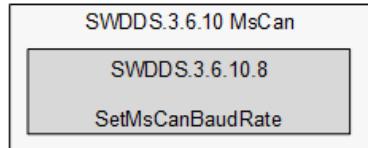
Software Unit Information				
Unit ID	SWDDS.3.6.10.8	Unit Name	SetMsCanBaudRate	
Architecture ID	SWADS.3.6.10.8	ASIL	QM	
Prototype	void SetMsCanBaudRate( tMsCanBaudRate baud_rate )			
	Data Type	Name	Range	IN/OUT
			0 ~ 5	Description

Function Call Parameters	tMsCanBaudRate	baud_rate	CAN_BAUDRATE_1MBPS/ CAN_BAUDRATE_500Kbps/ CAN_BAUDRATE_250Kbps/ CAN_BAUDRATE_100Kbps/ CAN_BAUDRATE_50Kbps	IN	baud rate setting (CAN_BAUDRATE_1MBPS ~ CAN_BAUDRATE_50Kbps)
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	CAN0BTR0_BRP	3u, 7u, 15u, 19u, 39u	Write	baud rate prescaler
	byte	CAN0BTR1_TSEG_10	6u, 14u	Write	TSEG1
	byte	CAN0BTR1_TSEG_20	1u, 3u	Write	TSEG2
Description	CAN data transmission interrupt service routine				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; baud_rate{baud_rate == CAN_BAUDRATE_1MBPS}     baud_rate -- no --&gt; baud_rate_500KBPS{baud_rate == CAN_BAUDRATE_500KBPS}     baud_rate_500KBPS -- no --&gt; baud_rate_250KBPS{baud_rate == CAN_BAUDRATE_250KBPS}     baud_rate_250KBPS -- no --&gt; baud_rate_125KBPS{baud_rate == CAN_BAUDRATE_125KBPS}     baud_rate_125KBPS -- no --&gt; baud_rate_100KBPS{baud_rate == CAN_BAUDRATE_100KBPS}     baud_rate_100KBPS -- no --&gt; baud_rate_50KBPS{baud_rate == CAN_BAUDRATE_50Kbps}     baud_rate_50KBPS -- yes --&gt; CAN0BTR0_BRP_39u["CAN0BTR0_BRP = 39u; CAN0BTR1_TSEG_10 = 14u; CAN0BTR1_TSEG_20 = 3u;"]     baud_rate_50KBPS -- no --&gt; end((end))     baud_rate_100KBPS -- yes --&gt; CAN0BTR0_BRP_19u["CAN0BTR0_BRP = 19u; CAN0BTR1_TSEG_10 = 14u; CAN0BTR1_TSEG_20 = 3u;"]     baud_rate_100KBPS -- no --&gt; end     baud_rate_250KBPS -- yes --&gt; CAN0BTR0_BRP_7u["CAN0BTR0_BRP = 7u; CAN0BTR1_TSEG_10 = 14u; CAN0BTR1_TSEG_20 = 3u;"]     baud_rate_250KBPS -- no --&gt; end     baud_rate_125KBPS -- yes --&gt; CAN0BTR0_BRP_15u["CAN0BTR0_BRP = 15u; CAN0BTR1_TSEG_10 = 14u; CAN0BTR1_TSEG_20 = 3u;"]     baud_rate_125KBPS -- no --&gt; end     baud_rate_500KBPS -- yes --&gt; CAN0BTR0_BRP_3u["CAN0BTR0_BRP = 3u; CAN0BTR1_TSEG_10 = 14u; CAN0BTR1_TSEG_20 = 1u;"]     baud_rate_500KBPS -- no --&gt; end     baud_rate_1MBPS -- yes --&gt; CAN0BTR0_BRP_3u["CAN0BTR0_BRP = 3u; CAN0BTR1_TSEG_10 = 6u; CAN0BTR1_TSEG_20 = 1u;"]     baud_rate_1MBPS -- no --&gt; end   </pre>				
Called Function	SWDDS.3.6.10.1 MsCan_Init				
Calling Function	N/A				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	102

Requirement Id	SWDDS.3.6.10.8
Target Milestone	EBS2
Element	HAL
Risk	Mid
Interoperability	Yes
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

#### 1.1.2.10.8.2 Static View Design



#### 1.1.2.10.8.3 Dynamic View Design

- N/A

#### 1.1.2.10.8.4 Interface Design

- N/A

#### 1.1.2.10.9 [SWDDS.3.6.10.9] MsCan\_GetRxFlg

##### 1.1.2.10.9.1 Detailed Design

##### [SWDDS.3.6.10.9] MsCan\_GetRxFlg

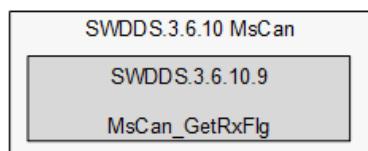
Software Unit Information					
Unit ID	SWDDS.3.6.10.9	Unit Name	MsCan_GetRxFlg		
Architecture ID	SWADS.3.6.10.9	ASIL	QM		
Prototype	tU8 MsCan_GetRxFlg( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	tU8	0 ~ 255	MSCAN data receiving flag		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	103

Registers	byte	CAN0RFLG	0 ~ 255	Read	MSCAN0 Receiver Flag Register
Description	MSCAN data receiving flag getting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     return CAN0RFLG;   </pre>				
Called Function	SWDDS.2.3.23 Rtel0_GetCanBusSta				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.10.9
Target Milestone	EBS2
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: #008000;">█</span> Low
Verifiability	Yes

#### 1.1.2.10.9.2 Static View Design



#### 1.1.2.10.9.3 Dynamic View Design

- N/A

#### 1.1.2.10.9.4 Interface Design

- N/A

#### 1.1.2.11 [SWDDS.3.6.11] Eeprom

Verify EEPROM section erased  
 Program EEPROM data  
 Erase EEPROM sector

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	104

### 1.1.2.11.1 [SWDDS.3.6.11.1] Eeprom\_Init

#### 1.1.2.11.1.1 Detailed Design

##### [SWDDS.3.6.11.1] Eeprom\_Init

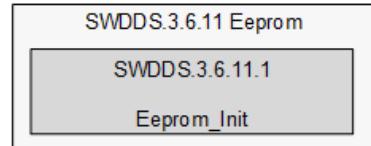
Software Unit Information					
Unit ID	SWDDS.3.6.11.1		Unit Name	Eeprom_Init	
Architecture ID	SWADS.3.6.11.1		ASIL	QM	
Prototype	void Eeprom_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	FSTAT_CCIF	0 ~ 1 Previous command in progress / done	Read	Command Complete Interrupt Flag
	byte	FCLKDIV	0x27u	Write	Flash Clock Divider Register
Description	EEPROM initialization				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; decision{FSTAT_CCIF == 0x00u}     decision -- yes --&gt; FCLKDIV[FCLKDIV = EEPROM_FCLK_DIV]     FCLKDIV --&gt; end((end))     decision -- no --&gt; end   </pre>				
Called Function	SWDDS.3.6.1.1 BswHal_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.3.6.11.1
Target Milestone	SBS2.1
Element	HAL
Risk	■ Mid
Interoperability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	105

Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

#### 1.1.2.11.1.2 Static View Design



#### 1.1.2.11.1.3 Dynamic View Design

- N/A

#### 1.1.2.11.1.4 Interface Design

- N/A

#### 1.1.2.11.2 [SWDDS.3.6.11.2] CheckEepromPrevCmd

##### 1.1.2.11.2.1 Detailed Design

##### [SWDDS.3.6.11.2] CheckEepromPrevCmd

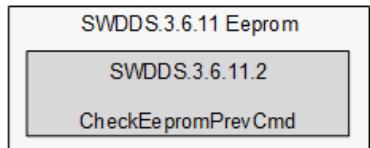
Software Unit Information					
Unit ID	SWDDS.3.6.11.2	Unit Name	CheckEepromPrevCmd		
Architecture ID	SWADS.3.6.11.2	ASIL	QM		
Prototype	void CheckEepromPrevCmd( void )				
	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	N/A	N/A	N/A	N/A	N/A
	Data Type	Possible Return Value		Description	
Function Call Return Value	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
Global Variables	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
Parameters	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
Registers	N/A	N/A	N/A	N/A	N/A
	Data Type	Name	Range	Read/Write	Description
	byte	FSTAT_CCIF	0 ~ 1 Previous command in progress / done	Read	Command Complete Interrupt Flag
	byte	FSTAT	0x30u	Write	Flash Status Register

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	106

Description	EEPROM previous command checking
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; FSTAT{FSTAT_CCIF == 0x00u}     FSTAT -- yes --&gt; end((end))     FSTAT -- no --&gt; FSTAT["FSTAT = 0x30u;"]     FSTAT --&gt; end   </pre>
Called Function	<p>SWDDS.3.6.11.4 Eeprom_VerifySectionErased</p> <p>SWDDS.3.6.11.5 Eeprom_ProgramData</p> <p>SWDDS.3.6.11.6 Eeprom_EraseSector</p>
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.11.2
Target Milestone	SBS2.1
Element	HAL
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">█</span> Mid
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

#### 1.1.2.11.2.2 Static View Design



#### 1.1.2.11.2.3 Dynamic View Design

- N/A

#### 1.1.2.11.2.4 Interface Design

- N/A

### 1.1.2.11.3 [SWDDS.3.6.11.3] ExecuteEepromCmd

#### 1.1.2.11.3.1 Detailed Design

##### [SWDDS.3.6.11.3] ExecuteEepromCmd

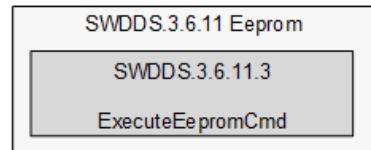
Software Unit Information					
Unit ID	SWDDS.3.6.11.3	Unit Name	ExecuteEepromCmd		
Architecture ID	SWADS.3.6.11.3	ASIL	QM		
Prototype	tU8 ExecuteEepromCmd( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU8	0 ~ 4 EEPROM_RET_OK / EEPROM_RET_ERASED / EEPROM_RET_NOT_ERASED / EEPROM_RET_MISALIGN_ADDR / EEPROM_RET_ACC_ERR		Execution result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	FSTAT_CCIF	0 ~ 1 Previous command in progress / done	Read/Write	Command Complete Interrupt Flag
	byte	FSTAT	0 ~ 187	Read	Flash Status Register
Description	EEPROM command execution – Flash command execution – Error checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tU8 execution_result = EEPROM_RET_OK;     FSTAT_CCIF = 0x01u;      if (FSTAT_CCIF == 0x00u) then         yes         if ((FSTAT &amp; (FSTAT_ACCERR_MASK   FSTAT_FPVOL_MASK)) != 0x00u) then             yes             execution_result = EEPROM_RET_ACC_ERR;         end     end </pre>				
Called Function	<a href="#">SWDDS.3.6.11.4 Eeprom_VerifySectionErased</a>				
	<a href="#">SWDDS.3.6.11.5 Eeprom_ProgramDat</a>				
	<a href="#">SWDDS.3.6.11.6 Eeprom_EraseSector</a>				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	108

Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.11.3
Target Milestone	SBS2.1
Element	HAL
Risk	<span style="background-color: #FFFFCC; border: 1px solid black; padding: 2px;">Mid</span>
Interoperability	Yes
Criticality	<span style="background-color: #FFFFCC; border: 1px solid black; padding: 2px;">Mid</span>
Technical complexity	<span style="background-color: #FFFFCC; border: 1px solid black; padding: 2px;">Mid</span>
Verifiability	Yes

#### 1.1.2.11.3.2 Static View Design



#### 1.1.2.11.3.3 Dynamic View Design

- N/A

#### 1.1.2.11.3.4 Interface Design

- N/A

#### 1.1.2.11.4 [SWDDS.3.6.11.4] Eeprom\_VerifySectionErased

##### 1.1.2.11.4.1 Detailed Design

##### [SWDDS.3.6.11.4] Eeprom\_VerifySectionErased

Software Unit Information					
Unit ID	SWDDS.3.6.11.4		Unit Name	Eeprom_VerifySectionErased	
Architecture ID	SWADS.3.6.11.4		ASIL	QM	
Prototype	tU8 Eeprom_VerifySectionErased( tU32 memory_address, tU16 number_of_words )				
Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	memory_address	0 ~ 511	IN	memory address
	tU16	number_of_words	1 ~ 4	IN	number of data words (1 ~ 4)

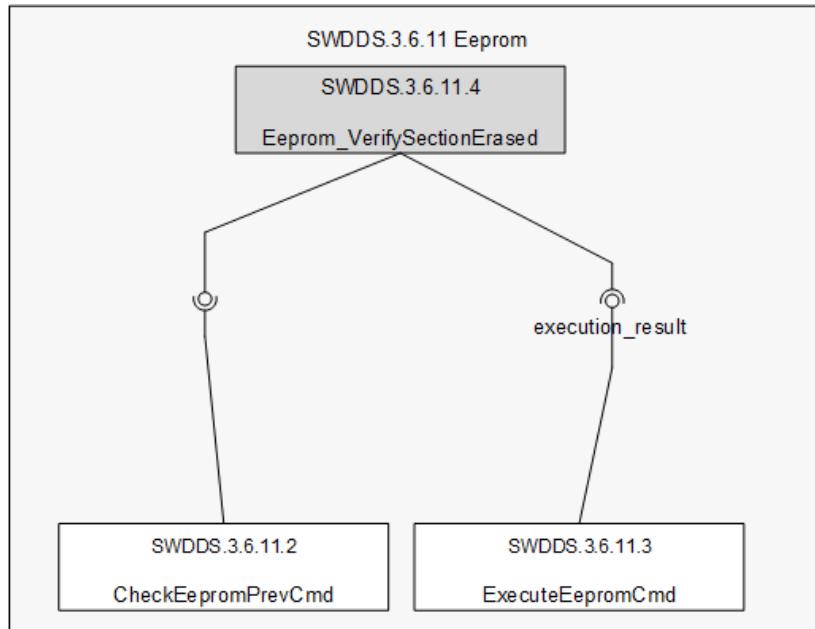
Function Call Return Value	Data Type	Possible Return Value		Description	
		0 ~ 4 EEPROM_RET_OK / EEPROM_RET_ERASED / EEPROM_RET_NOT_ERASED / EEPROM_RET_MISALIGN_ADDR / EEPROM_RET_ACC_ERR		Execution result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	FCCOBIX	0x02u	Write	Flash CCOB Index Register
	byte	FCCOB0HI	0x10u	Write	Flash Common Command Object Register High
	byte	FCCOB0LO	0 ~ 255	Write	Flash Common Command Object Register Low
	Word	FCCOB1	0 ~ 65535	Write	Flash Common Command Object Register
	Word	FCCOB2	0 ~ 65535	Write	Flash Common Command Object Register
	byte	FSTAT_MGSTAT	0 ~ 3 No error / non-correctable error / error in read or blank check / error in read or blank check	Read	Memory Controller Command Completion Status Flag
Description	EEPROM section erased checking - Address alignment checking - Previous command in progress checking - Flash common command object setting - Flash command execution - Erased checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tU8 execution_result = EEPROM_RET_OK;      if (memory_address &amp; 0x00000001uL) == 0x00000000uL         [SWDDS.3.6.11.2]         CheckEepromPrevCmd();          FCCOBIX = 0x02u;         FCCOB0HI = 0x10u;         FCCOB0LO = (tU16)((memory_address &amp; 0x00f00000uL) &gt;&gt; 16u);         FCCOB1 = (tU16)(memory_address &amp; 0x0000ffffuL);         FCCOB2 = number_of_words;          [SWDDS.3.6.11.3]         execution_result = ExecuteEepromCmd();          if FSTAT_MGSTAT != 0x00u             yes             execution_result = EEPROM_RET_MISALIGN_ADDR;         no             execution_result = EEPROM_RET_NOT_ERASED;      return execution_result;   </pre>				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	110

Called Function	SWDDS.3.6.11.5 Eeprom_ProgramData
Calling Function	SWDDS.3.6.11.2 CheckEepromPrevCmd SWDDS.3.6.11.3 ExecuteEepromCmd
Function Execution Time	N/A

Requirement Id	SWDDS.3.6.11.4
Target Milestone	SBS2.1
Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.11.4.2 Static View Design



#### 1.1.2.11.4.3 Dynamic View Design

- N/A

	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-04-27
			Page	111		

#### 1.1.2.11.4.4 Interface Design

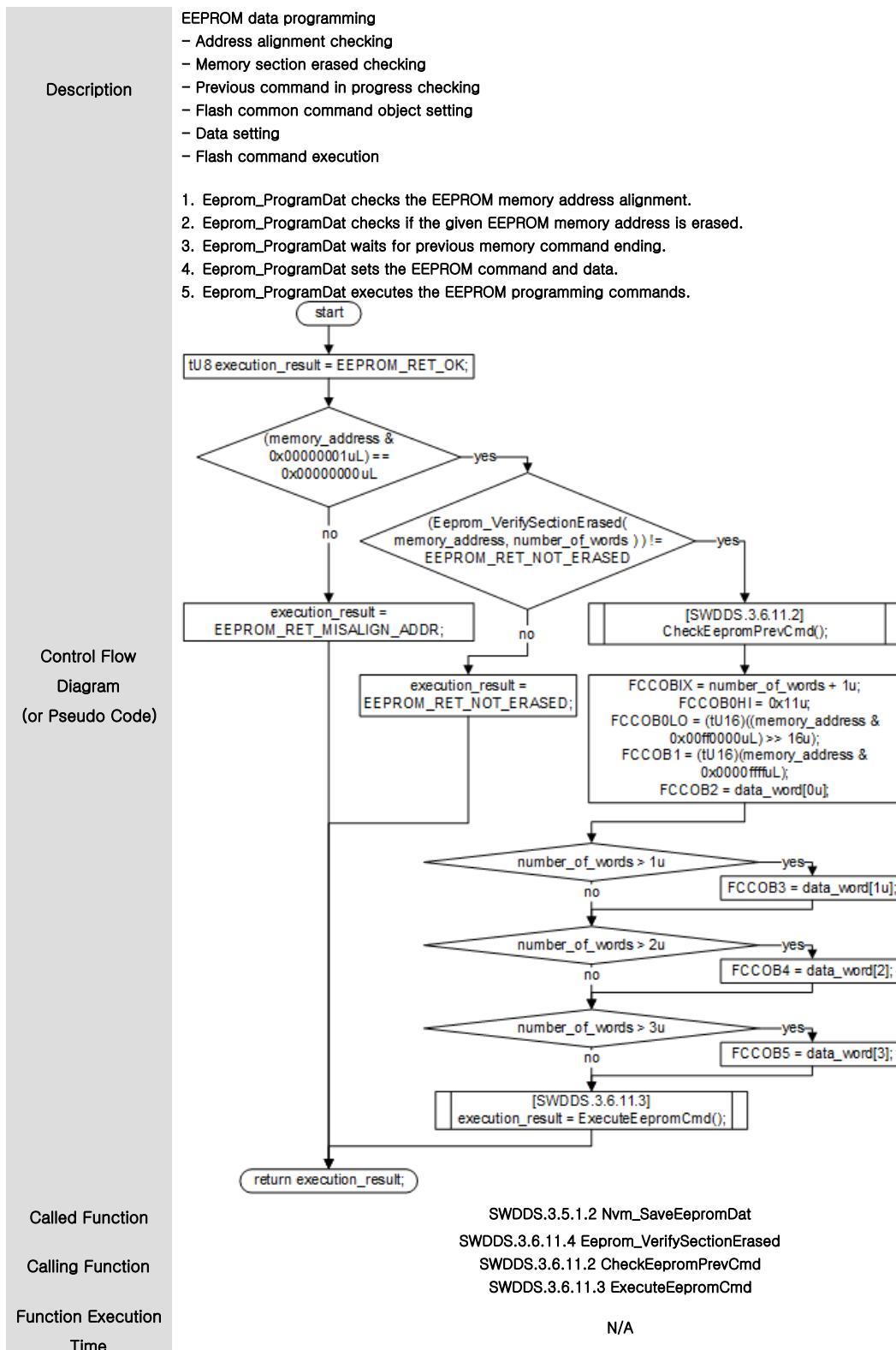
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	execution_result	SWDDS.3.6.11.3	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ERR	N/A	Execution result

#### 1.1.2.11.5 [SWDDS.3.6.11.5] Eeprom\_ProgramDat

##### 1.1.2.11.5.1 Detailed Design

##### [SWDDS.3.6.11.5] Eeprom\_ProgramDat

Software Unit Information					
Unit ID	SWDDS.3.6.11.5	Unit Name	Eeprom_ProgramDat		
Architecture ID	SWADS.3.6.11.5	ASIL	QM		
Prototype	tU8 Eeprom_ProgramDat( tU32 memory_address, const tU16* data_word, tU16 number_of_words )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	memory_address	0 ~ 511	IN	memory address
	const tU16*	data_word	0 ~ 65535	IN	programmed data words (array)
	tU16	number_of_words	1 ~ 4	IN	number of data words (1 ~ 4)
Function Call Return Value	Data Type	Possible Return Value			Description
	tU8	0 ~ 4 EEPROM_RET_OK / EEPROM_RET_ERASED / EEPROM_RET_NOT_ERASED / EEPROM_RET_MISALIGN_ADDR / EEPROM_RET_ACC_ERR			Execution result
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	FCCOBIX	2 ~ 5	Write	Flash CCOB Index Register
	byte	FCCOB0HI	0x11u	Write	Flash Common Command Object Register High
	byte	FCCOB0LO	0 ~ 255	Write	Flash Common Command Object Register Low
	Word	FCCOB1	0 ~ 65535	Write	Flash Common Command Object Register
	Word	FCCOB2	0 ~ 65535	Write	Flash Common Command Object Register
	Word	FCCOB3	0 ~ 65535	Write	Flash Common Command Object Register
	Word	FCCOB4	0 ~ 65535	Write	Flash Common Command Object Register
	Word	FCCOB5	0 ~ 65535	Write	Flash Common Command Object Register

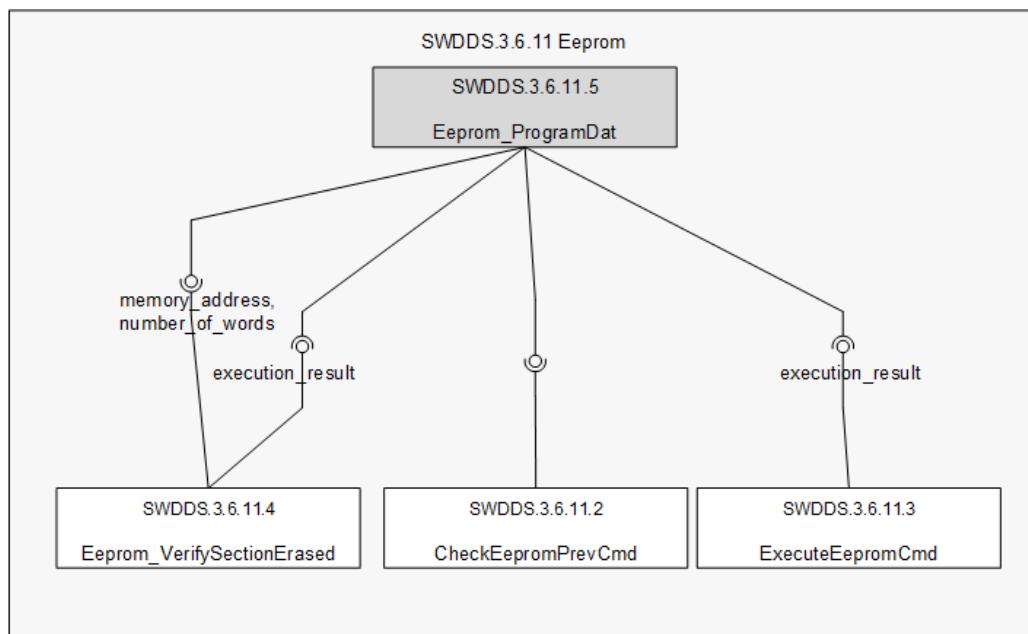


Requirement Id	SWDDS.3.6.11.5
Target Milestone	SBS2.1

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	113

Element	HAL
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

#### 1.1.2.11.5.2 Static View Design



#### 1.1.2.11.5.3 Dynamic View Design

- N/A

#### 1.1.2.11.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	memory_address	SWDDS.3.6.11.4	OUT	tU32	0	511	0	511	N/A	memory address
2	number_of_words	SWDDS.3.6.11.4	OUT	tU16	1	4	1	4	N/A	number of data words
3	execution_result	SWDDS.3.6.11.4	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ACC_ERR	N/A	Execution result
4	execution_result	SWDDS.3.6.11.3	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ACC_ERR	N/A	Execution result

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	114

### 1.1.2.11.6 [SWDDS.3.6.11.6] Eeprom\_EraseSector

#### 1.1.2.11.6.1 Detailed Design

##### [SWDDS.3.6.11.6] Eeprom\_EraseSector

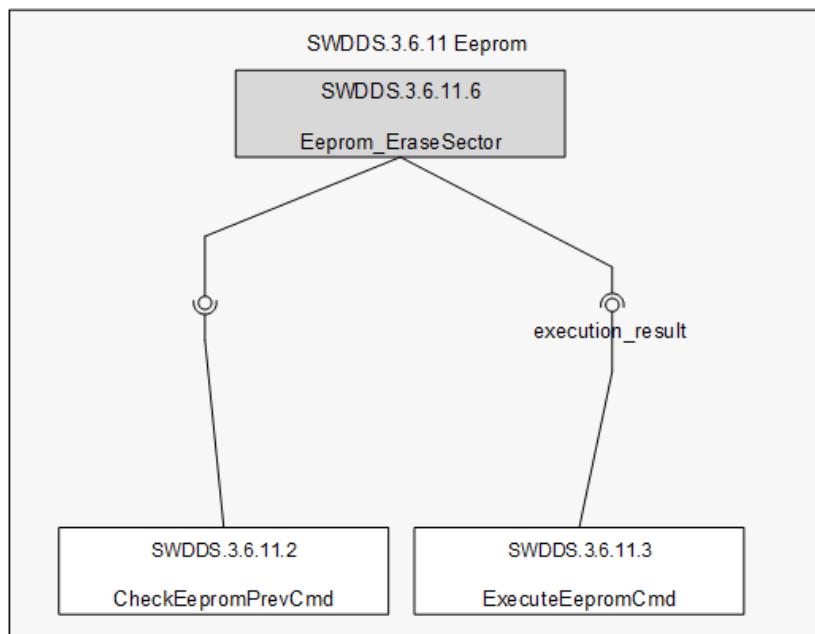
Software Unit Information					
Unit ID	SWDDS.3.6.11.6	Unit Name	Eeprom_EraseSector		
Architecture ID	SWADS.3.6.11.6	ASIL	QM		
Prototype	tU8 Eeprom_EraseSector( tU32 memory_address )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	memory_address	0 ~ 510	IN	memory address
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU8	0 ~ 4 EEPROM_RET_OK / EEPROM_RET_ERASED / EEPROM_RET_NOT_ERASED / EEPROM_RET_MISALIGN_ADDR / EEPROM_RET_ACC_ERR		Execution result	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	byte	FCCOBIX	0x01u	Write	Flash CCOB Index Register
	byte	FCCOB0HI	0x12u	Write	Flash Common Command Object Register High
	byte	FCCOB0LO	0 ~ 255	Write	Flash Common Command Object Register Low
	Word	FCCOB1	0 ~ 65535	Write	Flash Common Command Object Register
Description	EEPROM sector erasing - Address alignment checking - Previous command in progress checking - Flash common command object setting - Flash command execution				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     tu8 execution_result = EEPROM_RET_OK;      if ((memory_address &amp; 0x00000001uL) == 0x00000000uL)         yes             [SWDDS.3.6.11.2]             CheckEepromPrevCmd();              FCCOBIX = 0x01u;             FCCOB0HI = 0x12u;             FCCOB0LO = (tu16)((memory_address &amp; 0x00ff0000uL) &gt;&gt; 16u);             FCCOB1 = (tu16)(memory_address &amp; 0x0000ffffuL);              [SWDDS.3.6.11.3]             execution_result = ExecuteEepromCmd();          return execution_result;     no         execution_result = EEPROM_RET_MISALIGN_ADDR;     end     return execution_result; </pre>		
	Called Function	SWDDS.3.5.1.2 Nvm_SaveEepromDat	
	Calling Function	[SWDDS.3.6.11.2] CheckEepromPrevCmd	SWDDS.3.6.11.3 ExecuteEepromCmd
	Function Execution Time	N/A	

Requirement Id	SWDDS.3.6.11.6
Target Milestone	SBS2.1
Element	HAL
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	Yes
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 1.1.2.11.6.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	116



#### 1.1.2.11.6.3 Dynamic View Design

– N/A

#### 1.1.2.11.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	execution_result	SWDDS.3.6.11.3	IN	tU8	0	4	EEPROM_RET_OK	EEPROM_RET_ACC_ERR	N/A	Execution result

## 1.2 [SWDDS.4] CFG

### 1.2.1 [SWDDS.4.1] CalData

Initialize calibration data according to hardware ID

#### 1.2.1.1 [SWDDS.4.1.1] CalData\_Init

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	117

#### 1.2.1.1.1 Detailed Design

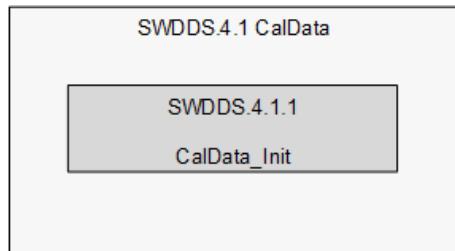
##### [SWDDS.4.1.1] CalData\_Init

Software Unit Information					
Unit ID	SWDDS.4.1.1	Unit Name	CalData_Init		
Architecture ID	SWADS.4.1.1	ASIL	QM		
Prototype	void CalData_Init( tOpuHwId opu_hardware_id )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tOpuHwId	opu_hardware_id	0 ~ 2, OPU_HW_ID_UNDEFINED/ OPU_HW_ID_AQ301/ OPU_HW_ID_AQ451	IN	OPU hardware ID setting
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Calibration data initialization depending on hardware ID				
Control Flow Diagram (or Pseudo Code)	<pre>     graph TD         start((start)) --&gt; end((end))     </pre>				
Called Function	SWDDS.2.3.1 Rtelo_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.4.1.1
Target Milestone	EBS2
Element	CalData
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	118

#### 1.2.1.1.2 Static View Design



#### 1.2.1.1.3 Dynamic View Design

- N/A

#### 1.2.1.1.4 Interface Design

- N/A

### 1.2.2 [SWDDS.4.2] Param

Define parameter data

Set direction of motor rotation according to Hardware ID

#### 1.2.2.1 [SWDDS.4.2.1] Param\_Init

##### 1.2.2.1.1 Detailed Design

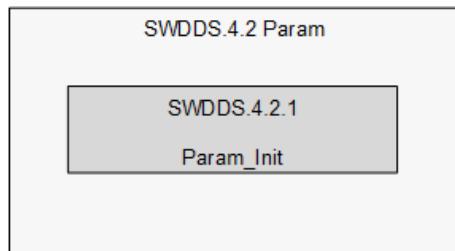
##### [SWDDS.4.2.1] Param\_Init

Software Unit Information					
Unit ID	SWDDS.4.2.1		Unit Name	Param_Init	
Architecture ID	SWADS.4.2.1		ASIL	QM	
Prototype	void Param_Init( tOpHwId opu_hardware_id )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tOpHwId	opu_hardware_id	0 ~ 2, OPU_HW_ID_UNDEFINED/ OPU_HW_ID_AQ301/ OPU_HW_ID_AQ451	IN	OPU hardware ID setting
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tBool	par_bMtrRevDir	0 ~ 1, FALSE/TRUE	Write	Reverse directional driving
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Description	Parameter initialization depending on hardware ID
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; cond1{opu_hardware_id == OPU_HW_ID_UNDEFINED}     cond1 -- yes --&gt; end((end))     cond1 -- no --&gt; cond2{opu_hardware_id == OPU_HW_ID_AQ301}     cond2 -- yes --&gt; par_bMtrRevDir[par_bMtrRevDir = PAR_MTR_REV_DIR_AQ301]     cond2 -- no --&gt; cond3{opu_hardware_id == OPU_HW_ID_AQ451}     cond3 -- yes --&gt; par_bMtrRevDir[par_bMtrRevDir = PAR_MTR_REV_DIR_AQ451]     cond3 -- no --&gt; end </pre>
Called Function	SWDDS.2.3.1 Rtelo_Init
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.4.2.1
Target Milestone	EBS2
Element	Param
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 1.2.2.1.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	120

#### 1.2.2.1.3 Dynamic View Design

- N/A

#### 1.2.2.1.4 Interface Design

- N/A

### 1.3 [SWDDS.5] Main

Main initializes OPU related peripherals, and executes Run Background routine.

#### 1.3.1 Detailed Design

##### [SWDDS.5] Main

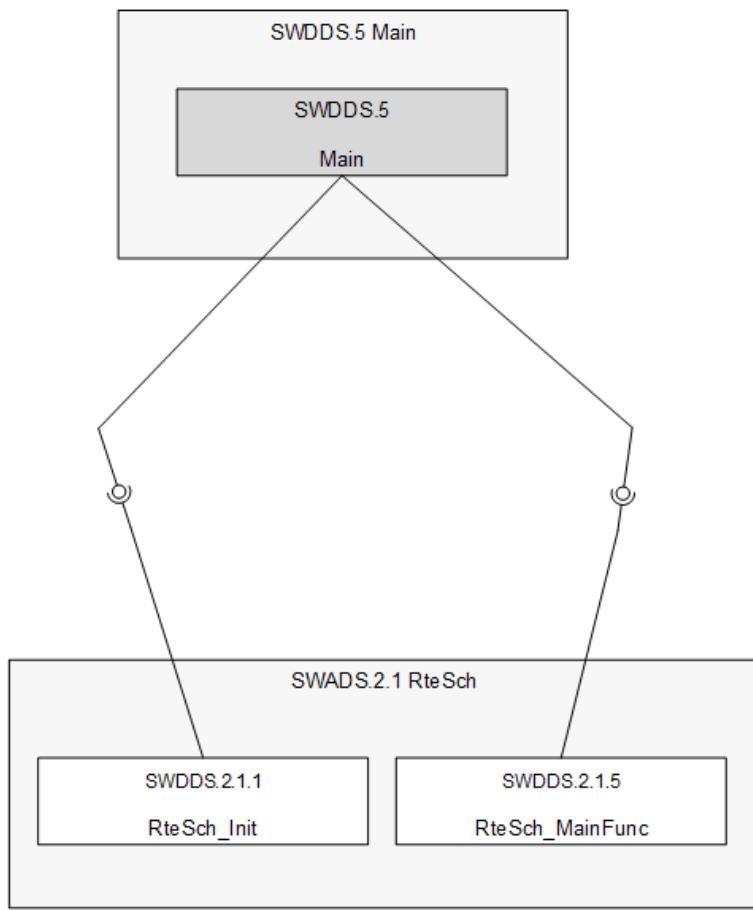
Software Unit Information					
Unit ID	SWDDS.5	Unit Name	main		
Architecture ID	SWADS.5	ASIL	QM		
Prototype	void main( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Main function - OPU initialization - Infinite loop for background processing				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; Init["[SWDDS.2.1.1] RteSch_Init()"]     Init --&gt; MainFunc["[SWDDS.2.1.5] RteSch_MainFunc()"]     MainFunc --&gt; Init   </pre>				
Called Function	N/A				
Calling Function	SWDDS.2.1.1 RteSch_Init SWDDS.2.1.5 RteSch_MainFunc				
Function Execution Time	N/A				

Requirement Id	SWDDS.5
Target Milestone	EBS2

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	121

Element	Main
Risk	<span style="color: #ccc;">█</span> Mid
Interoperability	No
Criticality	<span style="color: green;">█</span> Low
Technical complexity	<span style="color: green;">█</span> Low
Verifiability	Yes

### 1.3.2 Static View Design



### 1.3.3 Dynamic View Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-04-27
		Page	122

#### 1.3.4 Interface Design

- N/A

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	1

# VW AQ EOP

## Software Detailed Design Specification(1/4)

### Document Properties

Status:  Open

Version: 003

Author: Kim Minsu

Created: 2020-12-17 22:27

### Approved Versions

Current Document version 003 has **not** been approved.

Approved Versions:

- [001](#) (2021-01-06 15:50)
- [002](#) (2021-04-15 21:13)
- [002](#) (2021-04-22 10:16)

### Document Signatures

*Approved* (*Status Change Pending*)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	2

## Document Control Information

**Location:** The released versions of this document are maintained by SWE DE and managed in the following location:

[Polarion] VW AQ EOP / Documents & Pages / 02\_Engineering / 12\_SWE\_Design

Version	Date of Release	Description (Change and Reasons for Change)	Author	Reviewer	Approver
001	2020-10-28	• Initiation of draft version	Taihyun Kyung	-	-
	2020-11-30	• Add flow diagram and sequence diagram	Taihyun Kyung	Rasekar Prashant	Hyojin Ahn
002	2021-02-15	• Add evalution criteria • Resolved defect – CR-0005	Taihyun Kyung	-	-
	2021-02-17	• Modify traceability management	Taihyun Kyung	-	-
	2021-02-26	• Change the Customer Requirement_CAN Timeout-0008 • Add the Tolerance of Voltage– CR-0009	Taihyun Kyung	-	-
	2021-03-10	• Changed low temperature warning criteria – CR-0003	Taihyun Kyung	-	-
	2021-03-12	• Change and add component – CR-0010	Taihyun Kyung	-	-
	2021-04-09	• OPU HW change to apply EMC debugging(TL81000, CE) results– CR-0012	Taihyun Kyung	-	-
	2021-04-15	• Change Target Milestone, Traceability – CR-0010 • Add description for Control Flow Diagram and Sequence Diagram	Minsu Kim	Sungjin Park	Hyojin Ahn
	2021-04-22	• Resolved problem: CMNC-0033	Minsu Kim	Sungjin Park	Hyojin Ahn
003	2021-04-30	• Change Static View Design, Dynamic View Design and Interface Design	Minsu Kim	-	-
	2021-05-11	• Fixed typo	Minsu Kim	-	-
	2021-05-25	• Resolve defect of SWQT (Protect mode) – CR-0025	Minsu Kim	-	-
	2021-06-30	• Apply template : VW_AQ_EOP_SWDDS_Template V0.1	Minsu Kim	-	-
	2021-06-30	• Change Static View Design, Dynamic View Design and Interface Design	Minsu Kim	-	-

Table 1 Version History

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	3

## Table of Contents

1	Introduction .....	15
1.1	Purpose .....	15
1.2	Scope .....	15
1.3	Strategy .....	15
1.3.1	Traceability Management .....	15
1.3.1.1	Software detailed design identifier notation .....	15
1.3.2	Sequence Diagram .....	15
1.3.3	Diagram Notation .....	15
1.3.4	Evaluation Criteria .....	16
1.4	Terms, Acronyms and Abbreviations .....	16
1.5	References .....	16
2	Software Hierarchy .....	17
3	Function Description .....	18
3.1	[SWDDS.1.1] AswSen .....	18
3.1.1	[SWDDS.1.1.1] AswSen .....	18
3.1.1.1	Detailed Design .....	18
3.1.1.2	Static View Design .....	19
3.1.1.3	Dynamic View Design .....	19
3.1.1.4	Interface Design .....	19
3.1.1.2	[SWDDS.1.1.1.2] AswSen_FilterInpSig .....	19
3.1.1.2.1	Detailed Design .....	19
3.1.1.2.2	Static View Design .....	20
3.1.1.2.3	Dynamic View Design .....	21
3.1.1.2.4	Interface Design .....	21
3.1.2	[SWDDS.1.1.2] CtrSta .....	22
3.1.2.1	[SWDDS.1.1.2.1] CtrSta_Init .....	22
3.1.2.1.1	Detailed Design .....	22
3.1.2.1.2	Static View Design .....	22
3.1.2.1.3	Dynamic View Design .....	23
3.1.2.1.4	Interface Design .....	23
3.1.2.2	[SWDDS.1.1.2.2] CtrSta_Chk .....	23
3.1.2.2.1	Detailed Design .....	23
3.1.2.2.2	Static View Design .....	24
3.1.2.2.3	Dynamic View Design .....	24
3.1.2.2.4	Interface Design .....	24
3.1.3	[SWDDS.1.1.3] CurSig .....	25
3.1.3.1	[SWDDS.1.1.3.1] CurSig_Init .....	25
3.1.3.1.1	Detailed Design .....	25
3.1.3.1.2	Static View Design .....	27
3.1.3.1.3	Dynamic View Design .....	27
3.1.3.1.4	Interface Design .....	27
3.1.3.2	[SWDDS.1.1.3.2] CurSig_Measr .....	27
3.1.3.2.1	Detailed Design .....	27
3.1.3.2.2	Static View Design .....	28
3.1.3.2.3	Dynamic View Design .....	29
3.1.3.2.4	Interface Design .....	29
3.1.3.3	[SWDDS.1.1.3.3] GetCurSigCurOut .....	29
3.1.3.3.1	Detailed Design .....	29
3.1.3.3.2	Static View Design .....	30
3.1.3.3.3	Dynamic View Design .....	31
3.1.3.3.4	Interface Design .....	31
3.1.3.4	[SWDDS.1.1.3.5] GetCurSigDcCur .....	31
3.1.3.4.1	Detailed Design .....	31

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	4

3.1.3.4.2	Static View Design .....	33
3.1.3.4.3	Dynamic View Design .....	33
3.1.3.4.4	Interface Design .....	33
3.1.3.5	[SWDDS.1.1.3.6] CalculateCurSigDcCurTrqSpdVolt .....	33
3.1.3.5.1	Detailed Design .....	33
3.1.3.5.2	Static View Design .....	36
3.1.3.5.3	Dynamic View Design .....	36
3.1.3.5.4	Interface Design .....	36
3.1.3.6	[SWDDS.1.1.3.7] CalcCurSigDcCurCompnIntpSpd .....	37
3.1.3.6.1	Detailed Design .....	37
3.1.3.6.2	Static View Design .....	39
3.1.3.6.3	Dynamic View Design .....	39
3.1.3.6.4	Interface Design .....	39
3.1.3.7	[SWDDS.1.1.3.8] CalcCurSigDcCurCompnIntpCurQ .....	40
3.1.3.7.1	Detailed Design .....	40
3.1.3.7.2	Static View Design .....	43
3.1.3.7.3	Dynamic View Design .....	43
3.1.3.7.4	Interface Design .....	43
3.1.3.8	[SWDDS.1.1.3.9] CalculateCurSigDcCurCompn .....	44
3.1.3.8.1	Detailed Design .....	44
3.1.3.8.2	Static View Design .....	51
3.1.3.8.3	Dynamic View Design .....	51
3.1.3.8.4	Interface Design .....	51
3.1.4	[SWDDS.1.1.4] DcVolt .....	54
3.1.4.1	[SWDDS.1.1.4.1] DcVolt_Init .....	54
3.1.4.1.1	Detailed Design .....	54
3.1.4.1.2	Static View Design .....	55
3.1.4.1.3	Dynamic View Design .....	55
3.1.4.1.4	Interface Design .....	55
3.1.4.2	[SWDDS.1.1.4.2] DcVolt_Measr .....	55
3.1.4.2.1	Detailed Design .....	55
3.1.4.2.2	Static View Design .....	57
3.1.4.2.3	Dynamic View Design .....	57
3.1.4.2.4	Interface Design .....	57
3.1.5	[SWDDS.1.1.5] McuSta .....	57
3.1.5.1	[SWDDS.1.1.5.1] McuSta_Init .....	57
3.1.5.1.1	Detailed Design .....	57
3.1.5.1.2	Static View Design .....	58
3.1.5.1.3	Dynamic View Design .....	59
3.1.5.1.4	Interface Design .....	59
3.1.5.2	[SWDDS.1.1.5.2] McuSta_Chk .....	59
3.1.5.2.1	Detailed Design .....	59
3.1.5.2.2	Static View Design .....	60
3.1.5.2.3	Dynamic View Design .....	61
3.1.5.2.4	Interface Design .....	61
3.1.5.3	[SWDDS.1.1.5.3] GetMcuStaBatVolt .....	61
3.1.5.3.1	Detailed Design .....	61
3.1.5.3.2	Static View Design .....	62
3.1.5.3.3	Dynamic View Design .....	62
3.1.5.3.4	Interface Design .....	62
3.1.6	[SWDDS.1.1.6] MtrSpd .....	63
3.1.6.1	[SWDDS.1.1.6.1] MtrSpd_Init .....	63
3.1.6.1.1	Detailed Design .....	63
3.1.6.1.2	Static View Design .....	64
3.1.6.1.3	Dynamic View Design .....	65
3.1.6.1.4	Interface Design .....	65
3.1.6.2	[SWDDS.1.1.6.2] MtrSpd_Measr .....	65

3.1.6.2.1	Detailed Design .....	65
3.1.6.2.2	Static View Design .....	68
3.1.6.2.3	Dynamic View Design .....	68
3.1.6.2.4	Interface Design .....	68
3.1.7	[SWDDS.1.1.7] MtrTrq .....	69
3.1.7.1	[SWDDS.1.1.7.1] MtrTrq_Init .....	69
3.1.7.1.1	Detailed Design .....	69
3.1.7.1.2	Static View Design .....	70
3.1.7.1.3	Dynamic View Design .....	71
3.1.7.1.4	Interface Design .....	71
3.1.7.2	[SWDDS.1.1.7.2] MtrTrq_Cal .....	71
3.1.7.2.1	Detailed Design .....	71
3.1.7.2.2	Static View Design .....	72
3.1.7.2.3	Dynamic View Design .....	73
3.1.7.2.4	Interface Design .....	73
3.1.8	[SWDDS.1.1.8] ReqMsg .....	74
3.1.8.1	[SWDDS.1.1.8.1] ReqMsg_Init .....	74
3.1.8.1.1	Detailed Design .....	74
3.1.8.1.2	Static View Design .....	75
3.1.8.1.3	Dynamic View Design .....	75
3.1.8.1.4	Interface Design .....	75
3.1.8.2	[SWDDS.1.1.8.2] ReqMsg_Recv .....	75
3.1.8.2.1	Detailed Design .....	75
3.1.8.2.2	Static View Design .....	77
3.1.8.2.3	Dynamic View Design .....	77
3.1.8.2.4	Interface Design .....	77
3.1.8.3	[SWDDS.1.1.8.3] CheckReqMsgTgtSpdRng .....	77
3.1.8.3.1	Detailed Design .....	78
3.1.8.3.2	Static View Design .....	79
3.1.8.3.3	Dynamic View Design .....	79
3.1.8.3.4	Interface Design .....	79
3.1.8.4	[SWDDS.1.1.8.4] CheckReqMsgRxTimOut .....	79
3.1.8.4.1	Detailed Design .....	79
3.1.8.4.2	Static View Design .....	80
3.1.8.4.3	Dynamic View Design .....	81
3.1.8.4.4	Interface Design .....	81
3.1.8.5	[SWDDS.1.1.8.5] CheckReqMsgCanBusSta .....	81
3.1.8.5.1	Detailed Design .....	81
3.1.8.5.2	Static View Design .....	82
3.1.8.5.3	Dynamic View Design .....	82
3.1.8.5.4	Interface Design .....	82
3.1.9	[SWDDS.1.1.9] TempSig .....	82
3.1.9.1	[SWDDS.1.1.9.1] TempSig_Init .....	82
3.1.9.1.1	Detailed Design .....	82
3.1.9.1.2	Static View Design .....	83
3.1.9.1.3	Dynamic View Design .....	84
3.1.9.1.4	Interface Design .....	84
3.1.9.2	[SWDDS.1.1.9.2] TempSig_Measr .....	84
3.1.9.2.1	Detailed Design .....	84
3.1.9.2.2	Static View Design .....	86
3.1.9.2.3	Dynamic View Design .....	86
3.1.9.2.4	Interface Design .....	86
3.1.9.3	[SWDDS.1.1.9.3] InterpolateTempSigPcbTemp .....	86
3.1.9.3.1	Detailed Design .....	86
3.1.9.3.2	Static View Design .....	89
3.1.9.3.3	Dynamic View Design .....	89
3.1.9.3.4	Interface Design .....	89

3.2 [SWDDS.1.2] AswCtr .....	90
3.2.1 [SWDDS.1.2.1] AswCtr .....	90
3.2.1.1 [SWDDS.1.2.1.1] AswCtr_Init .....	90
3.2.1.1.1 Detailed Design .....	90
3.2.1.1.2 Static View Design .....	91
3.2.1.1.3 Dynamic View Design .....	91
3.2.1.1.4 Interface Design .....	91
3.2.1.2 [SWDDS.1.2.1.2] DrvSta .....	91
3.2.1.2.1 [SWDDS.1.2.1.2.1] DrvSta_Init .....	92
3.2.1.2.1.1 Detailed Design .....	92
3.2.1.2.1.2 Static View Design .....	92
3.2.1.2.1.3 Dynamic View Design .....	93
3.2.1.2.1.4 Interface Design .....	93
3.2.1.2.2 [SWDDS.1.2.1.2.2] ClearDrvStaHoldCnt .....	93
3.2.1.2.2.1 Detailed Design .....	93
3.2.1.2.2.2 Static View Design .....	95
3.2.1.2.2.3 Dynamic View Design .....	95
3.2.1.2.2.4 Interface Design .....	96
3.2.1.2.3 [SWDDS.1.2.1.2.3] DrvSta_Chk .....	96
3.2.1.2.3.1 Detailed Design .....	96
3.2.1.2.3.2 Static View Design .....	98
3.2.1.2.3.3 Dynamic View Design .....	98
3.2.1.2.3.4 Interface Design .....	99
3.2.1.2.4 [SWDDS.1.2.1.2.4] CheckDrvStaFlagClr .....	99
3.2.1.2.4.1 Detailed Design .....	99
3.2.1.2.4.2 Static View Design .....	100
3.2.1.2.4.3 Dynamic View Design .....	101
3.2.1.2.4.4 Interface Design .....	101
3.2.1.2.5 [SWDDS.1.2.1.2.5] CheckDrvStaAtCtrEna .....	101
3.2.1.2.5.1 Detailed Design .....	101
3.2.1.2.5.2 Static View Design .....	102
3.2.1.2.5.3 Dynamic View Design .....	103
3.2.1.2.5.4 Interface Design .....	103
3.2.1.2.6 [SWDDS.1.2.1.2.6] CheckDrvStaAtSlRun .....	104
3.2.1.2.6.1 Detailed Design .....	104
3.2.1.2.6.2 Static View Design .....	105
3.2.1.2.6.3 Dynamic View Design .....	105
3.2.1.2.6.4 Interface Design .....	105
3.2.1.2.7 [SWDDS.1.2.1.2.7] CheckDrvStaAtCurLmt .....	106
3.2.1.2.7.1 Detailed Design .....	106
3.2.1.2.7.2 Static View Design .....	107
3.2.1.2.7.3 Dynamic View Design .....	107
3.2.1.2.7.4 Interface Design .....	107
3.2.1.2.8 [SWDDS.1.2.1.2.8] CheckDrvStaShrtCir .....	108
3.2.1.2.8.1 Detailed Design .....	108
3.2.1.2.8.2 Static View Design .....	109
3.2.1.2.8.3 Dynamic View Design .....	109
3.2.1.2.8.4 Interface Design .....	110
3.2.1.2.9 [SWDDS.1.2.1.2.9] CheckDrvStaCtrFlt .....	110
3.2.1.2.9.1 Detailed Design .....	110
3.2.1.2.9.2 Static View Design .....	112
3.2.1.2.9.3 Dynamic View Design .....	113
3.2.1.2.9.4 Interface Design .....	113
3.2.1.2.10 [SWDDS.1.2.1.2.10] CheckDrvStaLowCur .....	113
3.2.1.2.10.1 Detailed Design .....	113
3.2.1.2.10.2 Static View Design .....	114
3.2.1.2.10.3 Dynamic View Design .....	115

3.2.2.10.4 Interface Design .....	115
3.2.2.11 [SWDDS.1.2.2.11] CheckDrvStaMtrSpdRng .....	115
3.2.2.11.1 Detailed Design .....	115
3.2.2.11.2 Static View Design .....	116
3.2.2.11.3 Dynamic View Design .....	117
3.2.2.11.4 Interface Design .....	117
3.2.2.12 [SWDDS.1.2.2.12] CheckDrvStaSpdErr .....	118
3.2.2.12.1 Detailed Design .....	118
3.2.2.12.2 Static View Design .....	120
3.2.2.12.3 Dynamic View Design .....	120
3.2.2.12.4 Interface Design .....	121
3.2.2.13 [SWDDS.1.2.2.13] CheckDrvStaCurOvr .....	121
3.2.2.13.1 Detailed Design .....	121
3.2.2.13.2 Static View Design .....	123
3.2.2.13.3 Dynamic View Design .....	124
3.2.2.13.4 Interface Design .....	124
3.2.2.14 [SWDDS.1.2.2.14] CheckDrvStaCondHoldCnt .....	125
3.2.2.14.1 Detailed Design .....	125
3.2.2.14.2 Static View Design .....	126
3.2.2.14.3 Dynamic View Design .....	126
3.2.2.14.4 Interface Design .....	127
3.2.2.15 [SWDDS.1.2.2.15] CheckDrvStaCondHoldCntWoClr .....	127
3.2.2.15.1 Detailed Design .....	127
3.2.2.15.2 Static View Design .....	128
3.2.2.15.3 Dynamic View Design .....	128
3.2.2.15.4 Interface Design .....	128
3.2.3 [SWDDS.1.2.3] EopCtr .....	128
3.2.3.1 [SWDDS.1.2.3.1] EopCtr_Init .....	128
3.2.3.1.1 Detailed Design .....	128
3.2.3.1.2 Static View Design .....	129
3.2.3.1.3 Dynamic View Design .....	129
3.2.3.1.4 Interface Design .....	130
3.2.3.2 [SWDDS.1.2.3.2] InitializeEopCtrSpdProf .....	130
3.2.3.2.1 Detailed Design .....	130
3.2.3.2.2 Static View Design .....	131
3.2.3.2.3 Dynamic View Design .....	132
3.2.3.2.4 Interface Design .....	132
3.2.3.3 [SWDDS.1.2.3.3] InitializeEopCtrSpdCtr .....	133
3.2.3.3.1 Detailed Design .....	133
3.2.3.3.2 Static View Design .....	135
3.2.3.3.3 Dynamic View Design .....	136
3.2.3.3.4 Interface Design .....	136
3.2.3.4 [SWDDS.1.2.3.4] EopCtr_Run .....	137
3.2.3.4.1 Detailed Design .....	137
3.2.3.4.2 Static View Design .....	139
3.2.3.4.3 Dynamic View Design .....	140
3.2.3.4.4 Interface Design .....	140
3.2.3.5 [SWDDS.1.2.3.5] ConvertEopCtrSpdUnitToPu .....	141
3.2.3.5.1 Detailed Design .....	141
3.2.3.5.2 Static View Design .....	142
3.2.3.5.3 Dynamic View Design .....	142
3.2.3.5.4 Interface Design .....	143
3.2.3.6 [SWDDS.1.2.3.6] ConvertEopCtrSpdUnitToRpm .....	143
3.2.3.6.1 Detailed Design .....	143
3.2.3.6.2 Static View Design .....	144
3.2.3.6.3 Dynamic View Design .....	144

3.2.3.6.4	Interface Design .....	144
3.2.3.7	[SWDDS.1.2.3.7] CheckEopCtrEopStop .....	144
3.2.3.7.1	Detailed Design .....	144
3.2.3.7.2	Static View Design .....	145
3.2.3.7.3	Dynamic View Design .....	146
3.2.3.7.4	Interface Design .....	146
3.2.3.8	[SWDDS.1.2.3.8] CheckEopCtrTgtSpdChg .....	146
3.2.3.8.1	Detailed Design .....	147
3.2.3.8.2	Static View Design .....	148
3.2.3.8.3	Dynamic View Design .....	149
3.2.3.8.4	Interface Design .....	149
3.2.3.9	[SWDDS.1.2.3.9] ActEopCtrStateMaxSpd .....	150
3.2.3.9.1	Detailed Design .....	150
3.2.3.9.2	Static View Design .....	152
3.2.3.9.3	Dynamic View Design .....	152
3.2.3.9.4	Interface Design .....	152
3.2.3.10	[SWDDS.1.2.3.10] ActEopCtrStateSpdChg .....	153
3.2.3.10.1	Detailed Design .....	153
3.2.3.10.2	Static View Design .....	155
3.2.3.10.3	Dynamic View Design .....	155
3.2.3.10.4	Interface Design .....	155
3.2.3.11	[SWDDS.1.2.3.11] ActEopCirStateCurFilt .....	156
3.2.3.11.1	Detailed Design .....	156
3.2.3.11.2	Static View Design .....	158
3.2.3.11.3	Dynamic View Design .....	158
3.2.3.11.4	Interface Design .....	159
3.2.3.12	[SWDDS.1.2.3.12] ActEopCtrStateCurLmt .....	159
3.2.3.12.1	Detailed Design .....	159
3.2.3.12.2	Static View Design .....	162
3.2.3.12.3	Dynamic View Design .....	162
3.2.3.12.4	Interface Design .....	163
3.2.3.13	[SWDDS.1.2.3.13] CheckEopCtrEnaMode .....	163
3.2.3.13.1	Detailed Design .....	163
3.2.3.13.2	Static View Design .....	164
3.2.3.13.3	Dynamic View Design .....	165
3.2.3.13.4	Interface Design .....	165
3.2.3.14	[SWDDS.1.2.3.14] CheckEopCtrEnaEdge .....	166
3.2.3.14.1	Detailed Design .....	166
3.2.3.14.2	Static View Design .....	168
3.2.3.14.3	Dynamic View Design .....	168
3.2.3.14.4	Interface Design .....	169
3.2.3.15	[SWDDS.1.2.3.15] CheckEopCtrEnaAppMode .....	169
3.2.3.15.1	Detailed Design .....	169
3.2.3.15.2	Static View Design .....	171
3.2.3.15.3	Dynamic View Design .....	171
3.2.3.15.4	Interface Design .....	171
3.2.3.16	[SWDDS.1.2.3.16] CheckEopCtrAntiWindUp .....	172
3.2.3.16.1	Detailed Design .....	172
3.2.3.16.2	Static View Design .....	173
3.2.3.16.3	Dynamic View Design .....	173
3.2.3.16.4	Interface Design .....	174
3.2.3.17	[SWDDS.1.2.3.17] SetEopCtrSpdCtrCurLmt .....	174
3.2.3.17.1	Detailed Design .....	174
3.2.3.17.2	Static View Design .....	175
3.2.3.17.3	Dynamic View Design .....	176
3.2.3.17.4	Interface Design .....	176
3.2.3.18	[SWDDS.1.2.3.18] CalculateEopCtrRefSpd .....	177

3.2.3.18.1	Detailed Design .....	177
3.2.3.18.2	Static View Design .....	179
3.2.3.18.3	Dynamic View Design .....	179
3.2.3.18.4	Interface Design .....	179
3.2.4	[SWDDS.1.2.4] SigRng .....	180
3.2.4.1	[SWDDS.1.2.4.1] SigRng_Init .....	180
3.2.4.1.1	Detailed Design .....	180
3.2.4.1.2	Static View Design .....	182
3.2.4.1.3	Dynamic View Design .....	182
3.2.4.1.4	Interface Design .....	182
3.2.4.2	[SWDDS.1.2.4.2] SigRng_Chk .....	182
3.2.4.2.1	Detailed Design .....	182
3.2.4.2.2	Static View Design .....	183
3.2.4.2.3	Dynamic View Design .....	184
3.2.4.2.4	Interface Design .....	184
3.2.4.3	[SWDDS.1.2.4.3] CheckSigRngBatVolt .....	185
3.2.4.3.1	Detailed Design .....	185
3.2.4.3.2	Static View Design .....	186
3.2.4.3.3	Dynamic View Design .....	186
3.2.4.3.4	Interface Design .....	186
3.2.4.4	[SWDDS.1.2.4.4] CheckSigRngBatVoltRngOvr .....	187
3.2.4.4.1	Detailed Design .....	187
3.2.4.4.2	Static View Design .....	188
3.2.4.4.3	Dynamic View Design .....	189
3.2.4.4.4	Interface Design .....	189
3.2.4.5	[SWDDS.1.2.4.5] CheckSigRngBatVoltRngUnd .....	190
3.2.4.5.1	Detailed Design .....	190
3.2.4.5.2	Static View Design .....	192
3.2.4.5.3	Dynamic View Design .....	192
3.2.4.5.4	Interface Design .....	192
3.2.4.6	[SWDDS.1.2.4.6] CheckSigRngPcbTemp .....	193
3.2.4.6.1	Detailed Design .....	193
3.2.4.6.2	Static View Design .....	194
3.2.4.6.3	Dynamic View Design .....	194
3.2.4.6.4	Interface Design .....	195
3.2.4.7	[SWDDS.1.2.4.7] CheckSigRngPcbTempRngOvr .....	195
3.2.4.7.1	Detailed Design .....	195
3.2.4.7.2	Static View Design .....	197
3.2.4.7.3	Dynamic View Design .....	197
3.2.4.7.4	Interface Design .....	198
3.2.4.8	[SWDDS.1.2.4.8] CheckSigRngPcbTempRngWrn .....	198
3.2.4.8.1	Detailed Design .....	198
3.2.4.8.2	Static View Design .....	200
3.2.4.8.3	Dynamic View Design .....	201
3.2.4.8.4	Interface Design .....	201
3.2.4.9	[SWDDS.1.2.4.9] CheckSigRngBatVoltRngHigh .....	202
3.2.4.9.1	Detailed Design .....	202
3.2.4.9.2	Static View Design .....	204
3.2.4.9.3	Dynamic View Design .....	204
3.2.4.9.4	Interface Design .....	204
3.2.4.10	[SWDDS.1.2.4.10] CheckSigRngBatVoltRngLow .....	205
3.2.4.10.1	Detailed Design .....	205
3.2.4.10.2	Static View Design .....	207
3.2.4.10.3	Dynamic View Design .....	207
3.2.4.10.4	Interface Design .....	207
3.2.4.11	[SWDDS.1.2.4.11] CheckSigRngProtMode .....	208
3.2.4.11.1	Detailed Design .....	208

3.2.4.11.2 Static View Design .....	209
3.2.4.11.3 Dynamic View Design .....	210
3.2.4.11.4 Interface Design .....	210
3.2.4.12 [SWDDS.1.2.4.12] SetSigRngCondHoldCntFlag .....	211
3.2.4.12.1 Detailed Design .....	211
3.2.4.12.2 Static View Design .....	212
3.2.4.12.3 Dynamic View Design .....	212
3.2.4.12.4 Interface Design .....	213
3.2.4.13 [SWDDS.1.2.4.13] ClrSigRngCondHoldCntFlag .....	213
3.2.4.13.1 Detailed Design .....	213
3.2.4.13.2 Static View Design .....	214
3.2.4.13.3 Dynamic View Design .....	214
3.2.4.13.4 Interface Design .....	214
3.3 [SWDDS.1.3] AswMng .....	214
3.3.1 [SWDDS.1.3.1] AswMng .....	214
3.3.1.1 [SWDDS.1.3.1.1] AswMng_Init .....	214
3.3.1.1.1 Detailed Design .....	214
3.3.1.1.2 Static View Design .....	215
3.3.1.1.3 Dynamic View Design .....	216
3.3.1.1.4 Interface Design .....	216
3.3.2 [SWDDS.1.3.2] ModeChg .....	216
3.3.2.1 [SWDDS.1.3.2.1] ModeChg_Init .....	216
3.3.2.1.1 Detailed Design .....	216
3.3.2.1.2 Static View Design .....	217
3.3.2.1.3 Dynamic View Design .....	217
3.3.2.1.4 Interface Design .....	217
3.3.2.2 [SWDDS.1.3.2.2] InitializeModeChgChkVar .....	217
3.3.2.2.1 Detailed Design .....	217
3.3.2.2.2 Static View Design .....	218
3.3.2.2.3 Dynamic View Design .....	218
3.3.2.2.4 Interface Design .....	218
3.3.2.3 [SWDDS.1.3.2.3] ModeChg_Mng .....	218
3.3.2.3.1 Detailed Design .....	218
3.3.2.3.2 Static View Design .....	220
3.3.2.3.3 Dynamic View Design .....	220
3.3.2.3.4 Interface Design .....	220
3.3.2.4 [SWDDS.1.3.2.4] ChangeModeChgAppMode .....	221
3.3.2.4.1 Detailed Design .....	221
3.3.2.4.2 Static View Design .....	222
3.3.2.4.3 Dynamic View Design .....	222
3.3.2.4.4 Interface Design .....	222
3.3.2.5 [SWDDS.1.3.2.5] CheckModeChgStaFlg .....	222
3.3.2.5.1 Detailed Design .....	223
3.3.2.5.2 Static View Design .....	224
3.3.2.5.3 Dynamic View Design .....	224
3.3.2.5.4 Interface Design .....	224
3.3.2.6 [SWDDS.1.3.2.6] CheckModeChgMsgSta .....	224
3.3.2.6.1 Detailed Design .....	224
3.3.2.6.2 Static View Design .....	225
3.3.2.6.3 Dynamic View Design .....	226
3.3.2.6.4 Interface Design .....	226
3.3.2.7 [SWDDS.1.3.2.7] CheckModeChgMcuSta .....	226
3.3.2.7.1 Detailed Design .....	226
3.3.2.7.2 Static View Design .....	227
3.3.2.7.3 Dynamic View Design .....	228
3.3.2.7.4 Interface Design .....	228
3.3.2.8 [SWDDS.1.3.2.8] CheckModeChgDrvSta .....	228

3.3.2.8.1	Detailed Design .....	228
3.3.2.8.2	Static View Design .....	230
3.3.2.8.3	Dynamic View Design .....	230
3.3.2.8.4	Interface Design .....	230
3.3.2.9	[SWDDS.1.3.2.9] CheckModeChgSigRng .....	230
3.3.2.9.1	Detailed Design .....	230
3.3.2.9.2	Static View Design .....	233
3.3.2.9.3	Dynamic View Design .....	233
3.3.2.9.4	Interface Design .....	233
3.3.3	[SWDDS.1.3.3] ShutDown .....	233
3.3.3.1	[SWDDS.1.3.3.1] ShutDown_Init .....	233
3.3.3.1.1	Detailed Design .....	233
3.3.3.1.2	Static View Design .....	234
3.3.3.1.3	Dynamic View Design .....	234
3.3.3.1.4	Interface Design .....	235
3.3.3.2	[SWDDS.1.3.3.2] ShutDown_Mng .....	235
3.3.3.2.1	Detailed Design .....	235
3.3.3.2.2	Static View Design .....	237
3.3.3.2.3	Dynamic View Design .....	237
3.3.3.2.4	Interface Design .....	237
3.3.3.3	[SWDDS.1.3.3.3] SaveShutDownFltCnt .....	237
3.3.3.3.1	Detailed Design .....	237
3.3.3.3.2	Static View Design .....	238
3.3.3.3.3	Dynamic View Design .....	239
3.3.3.3.4	Interface Design .....	239
3.3.3.4	[SWDDS.1.3.3.4] SaveShutDownFltFlag .....	239
3.3.3.4.1	Detailed Design .....	239
3.3.3.4.2	Static View Design .....	240
3.3.3.4.3	Dynamic View Design .....	241
3.3.3.4.4	Interface Design .....	241
3.3.4	[SWDDS.1.3.4] StartUp .....	241
3.3.4.1	[SWDDS.1.3.4.1] StartUp_Init .....	241
3.3.4.1.1	Detailed Design .....	241
3.3.4.1.2	Static View Design .....	242
3.3.4.1.3	Dynamic View Design .....	242
3.3.4.1.4	Interface Design .....	242
3.3.4.2	[SWDDS.1.3.4.2] StartUp_Mng .....	243
3.3.4.2.1	Detailed Design .....	243
3.3.4.2.2	Static View Design .....	245
3.3.4.2.3	Dynamic View Design .....	245
3.3.4.2.4	Interface Design .....	245
3.4	[SWDDS.1.4] AswAct .....	245
3.4.1	[SWDDS.1.4.1] AswAct .....	245
3.4.1.1	[SWDDS.1.4.1.1] AswAct_Init .....	245
3.4.1.1.1	Detailed Design .....	245
3.4.1.1.2	Static View Design .....	246
3.4.1.1.3	Dynamic View Design .....	247
3.4.1.1.4	Interface Design .....	247
3.4.2	[SWDDS.1.4.2] MtrCtr .....	247
3.4.2.1	[SWDDS.1.4.2.1] MtrCtr_Init .....	247
3.4.2.1.1	Detailed Design .....	247
3.4.2.1.2	Static View Design .....	248
3.4.2.1.3	Dynamic View Design .....	249
3.4.2.1.4	Interface Design .....	249
3.4.2.2	[SWDDS.1.4.2.2] MtrCtr_Set .....	249
3.4.2.2.1	Detailed Design .....	249

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	12

3.4.2.2.2 Static View Design .....	251
3.4.2.2.3 Dynamic View Design .....	251
3.4.2.2.4 Interface Design .....	251
3.4.3 [SWDDS.1.4.3] ResMsg .....	252
3.4.3.1 [SWDDS.1.4.3.1] ResMsg_Init .....	252
3.4.3.1.1 Detailed Design .....	252
3.4.3.1.2 Static View Design .....	252
3.4.3.1.3 Dynamic View Design .....	253
3.4.3.1.4 Interface Design .....	253
3.4.3.2 [SWDDS.1.4.3.2] ResMsg_Send .....	253
3.4.3.2.1 Detailed Design .....	253
3.4.3.2.2 Static View Design .....	255
3.4.3.2.3 Dynamic View Design .....	255
3.4.3.2.4 Interface Design .....	255

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	13

## List of Figures

Figure 1 Software Hierarchy of WV\_AQ\_EOP

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	14

## List of Tables

Table 1 Version History

Table 2 References

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	15

## 1 Introduction

### 1.1 Purpose

The purpose of this document is to provide the following information and explanation on software unit functions for the software development of VW\_AQ\_EOP.

- Provides a software implementation information
- Provides a standard for software unit testing
- Used as data for impact analysis on software changes

### 1.2 Scope

This document is applicable to the software development related to VW\_AQ\_EOP project.

### 1.3 Strategy

#### 1.3.1 Traceability Management

For traceability between the software units and the software architecture and software requirements, a unique ID is assigned to each software unit.

##### 1.3.1.1 Software detailed design identifier notation

The ID in the software detailed design document is defined as follows.

**SWDDS.[Unit Category1].[Unit Category2]..[Unit CategoryN]**

- Unit Category1

<List the category by referring to SWADS.>

- Unit Category2 ... Unit CategoryN

Depth of unit

- Use '.'(dot)' as a delimiter between depth

The category indices of a unit ID are kept the same as those of the corresponding unit ID identified in the software architectural design.

- SWADS.1.2.3 (ID in SWADS) → SWDDS.1.2.3 (ID in SWDDS)

#### 1.3.2 Sequence Diagram

Sequence diagrams are not drawn on all units, but only on control-related units. (e.g. AswCtr and SIFoc)

#### 1.3.3 Diagram Notation

The notation applied to SW unit design follows "Software Design Guideline [Ref.4]".

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	16

#### 1.3.4 Evaluation Criteria

Evaluation criteria of the SW units are as follow.

Aspect	Rating	Criteria	Remark
Interoperability	Yes	The unit can be used multiple (can be reused).	
	No	Only one instance of the unit is used (unique function).	
Criticality	High	The unit is an interrupt service routine or called from that. The unit is scheduler.	ISR
	Mid	The unit is called from task. The unit is a HW accessing driver.	Asw, RteSch, BswHal
	Low	The unit is a simple wrapper. The other cases	RteApp, RteHal
Technical complexity	High	The unit has a number of decision points which is greater than or equal to 5. The unit is a control and management related one. The unit uses complex mathematical calculation.	AswCtr, AswMng, Sensorless FOC
	Mid	The unit has a number of decision points is greater than or equal to 2 The unit uses a simple mathematical calculation The unit is HW accessing driver with logic	
	Low	The unit is a simple wrapper (get/set, read/write) The unit is a HW accessing driver without logic (simple setting or getting)	RteApp, RteHal
Testability (Verifiability)	Yes	The unit can be verified by software unit test	
	No	The unit cannot be verified by software unit test but by review.	
Risk	High	The unit needs a new technology which is never applied before.	NOTE1
	Mid	The unit can be implemented by technology which is used in the previous EOP advance project. The unit can be implemented by modified technology used in mass production.	
	Low	The unit is a simple wrapper. The unit can be implemented by technology without modification used in mass production	RteApp, RteHal

(NOTE1) In this case, risk assessment is needed.

#### 1.4 Terms, Acronyms and Abbreviations

The terms, acronyms and abbreviations which are required to correctly understand this document are explained in "VW\_AQ\_EOP\_Voca [Ref.2]" document and it is managed in the following location:

[Polarion] VW AQ EOP / Documents & Pages / 04\_Others

#### 1.5 References

All documents which are referred to to prepare this document are listed in the table below. The document name, version, and date of reference document shall be described. If the Version is not specified, the latest version shall be referred to.

No.	Document Name [Location]	Baseline, Version, or Date	Remark
1.	Automotive SPICE: Process Reference Model / Process Assessment Model	3.1	
2.	VW_AQ_EOP_Voca	20210420	
3.	VW_AQ_EOP_SWADS	003	
4.	VW_AQ_EOP_SWDG	1.3	
5.	VW_AQ_EOP_SWCG	1.3	
6.	LAH.893.909 Group Basic Software Requirements ; Development, General Project-Independent Performance Specification	3.4	KGAS
7.	VW_AQ_EOP_SWDD	2.0	

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	17

Table 2 References

\* If the Version is not specified, the latest version is referred to.

## 2 Software Hierarchy

The software hierarchy of VW\_AQ\_EOP is as follows.

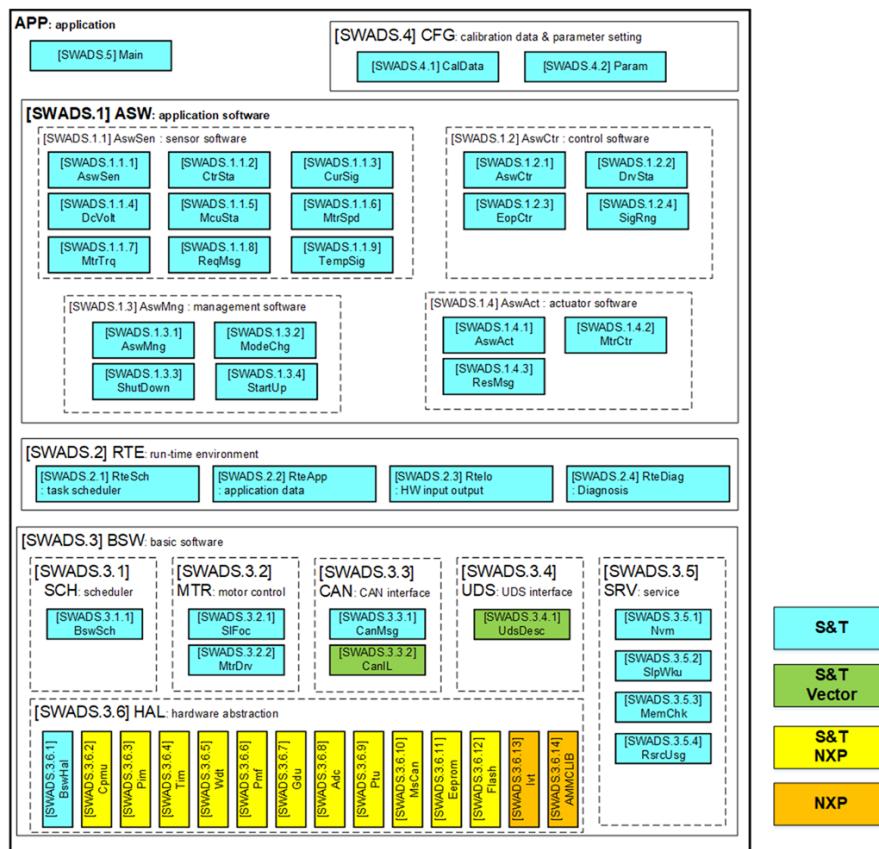


Figure 1 Software Hierarchy of VW\_AQ\_EOP

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	18

### 3 Function Description

#### 3.1 [SWDDS.1.1] AswSen

AswSen updates input/output values such as Target speed, Output Current, DC Current, DC Voltage, Temperature, Motor torque and Battery Voltage. It also checks status of Target speed range, Message-receiving time-out, CAN Bus, Current control and OPU.

##### 3.1.1 [SWDDS.1.1.1] AswSen

###### 3.1.1.1 [SWDDS.1.1.1.1] AswSen\_Init

###### 3.1.1.1.1 Detailed Design

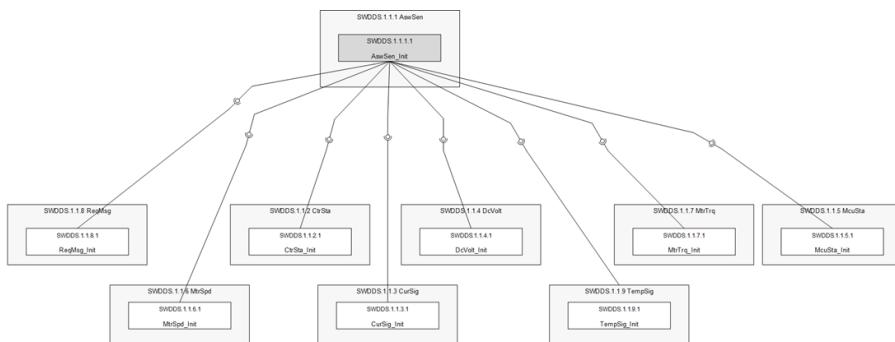
###### [SWDDS.1.1.1.1] AswSen\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.1.1	Unit Name	AswSen_Init		
Architecture ID	SWADS.1.1.1.1	ASIL	QM		
Prototype	void AswSen_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
void	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Description	Sensor software initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.1.1.8.1] ReqMsg_Init();           [SWDDS.1.1.6.1] MtrSpd_Init();           [SWDDS.1.1.2.1] CtrSta_Init();           [SWDDS.1.1.3.1] CurSig_Init();           [SWDDS.1.1.4.1] DcVolt_Init();           [SWDDS.1.1.9.1] TempSig_Init();           [SWDDS.1.1.7.1] MtrTrq_Init();           [SWDDS.1.1.5.1] McuSta_Init();           end   </pre>				
Called Function	SWDDS.2.1.3 InitializeRteSchAppSw				
	SWDDS.1.1.8.1 ReqMsg_Init				
	SWDDS.1.1.6.1 MtrSpd_Init				
	SWDDS.1.1.2.1 CtrSta_Init				
	SWDDS.1.1.3.1 CurSig_Init				

<b>Calling Function</b>	SWDDS.1.1.4.1 DcVolt_Init
	SWDDS.1.1.9.1 TempSig_Init
	SWDDS.1.1.7.1 MtrTrq_Init
	SWDDS.1.1.5.1 McuSta_Init
<b>Function Execution Time</b>	N/A

Requirement Id	SWDDS.1.1.1.1
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">Low</span>
Interoperability	No
Criticality	<span style="color: green;">Low</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

### 3.1.1.1.2 Static View Design



### 3.1.1.1.3 Dynamic View Design

- N/A

### 3.1.1.1.4 Interface Design

- N/A

### 3.1.1.2 [SWDDS.1.1.1.2] AswSen\_FilterInpSig

#### 3.1.1.2.1 Detailed Design

##### [SWDDS.1.1.1.2] AswSen\_FilterInpSig

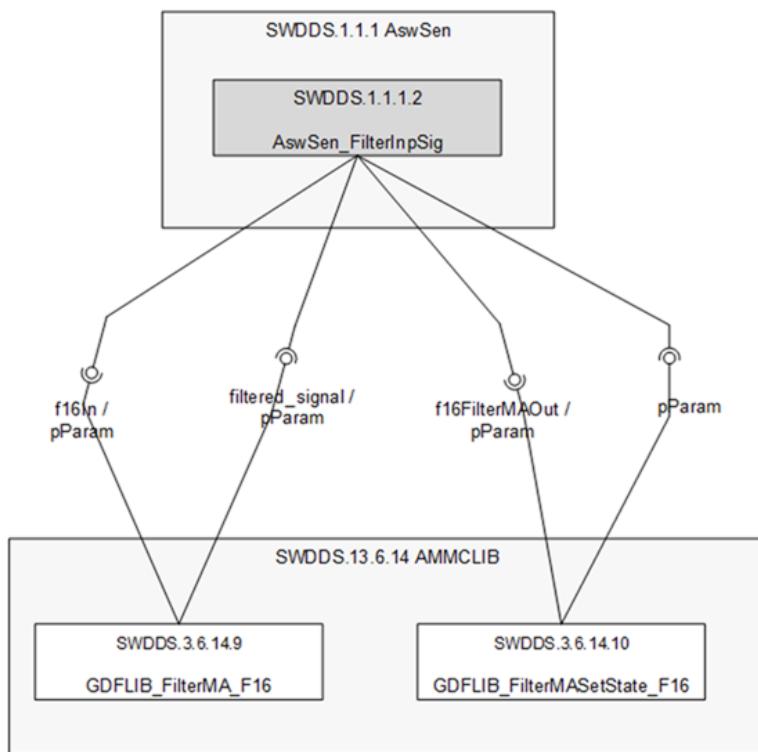
###### Software Unit Information

Unit ID	SWDDS.1.1.1.2	Unit Name	AswSen_FilterInpSig		
Architecture ID	SWADS.1.1.1.2	ASIL	QM		
Prototype	tFrac16 AswSen_FilterInpSig( tFrac16 input_signal, tBool* p_first_measurement, GDFLIB_FILTER_MA_T_F16* p_filter_handle )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	
	tFrac16	input_signal	-32768 ~ 32767	IN	input signal for filtering
	tBool*	p_first_measurement	True / False	IN/OUT	first measurement flag pointer
	GDFLIB_FILTER_MA_T_F16*	p_filter_handle	-2147483648 ~	IN/OUT	filter handler pointer

			2147483647		(f32Acc)
Function Call Return Value	Data Type	Possible Return Value			
	tFrac16	-32768 ~ 32767			Filtered value
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Input signal filtering				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 filtered_signal;     ↓     {&lt;*&gt;p_first_measurement == FALSE}      ---Yes         [SWDDS.3.6.14.10] GDFLIB_FilterMASetState_F16(         input_signal, p_filter_handle );         ↓         filtered_signal = input_signal;         (*p_first_measurement) = FALSE;         ↓         {&lt;*&gt;SWDDS.3.6.14.9] filtered_signal = GDFLIB_FilterMA_F16(         input_signal, p_filter_handle );         ↓         return         filtered_signal;            ---No         [SWDDS.3.6.14.10] GDFLIB_FilterMASetState_F16(         input_signal, p_filter_handle );         ↓         filtered_signal = input_signal;         (*p_first_measurement) = FALSE;         ↓         {&lt;*&gt;SWDDS.3.6.14.9] filtered_signal = GDFLIB_FilterMA_F16(         input_signal, p_filter_handle );         ↓         return         filtered_signal;               return         filtered_signal;   </pre>				
Called Function	SWDDS.1.1.4.2 DcVolt_Meas SWDDS.1.1.5.3 GetMcuStaBatVolt SWDDS.1.1.6.2 MtrSpd_Meas SWDDS.1.1.9.2 TempSig_Meas				
Calling Function	SWDDS.3.6.14.9 GDFLIB_FilterMA_F16 SWDDS.3.6.14.10 GDFLIB_FilterMASetState_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.1.2
Target Milestone	SBS1
Element	AswSen
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	Yes
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.1.1.2.2 Static View Design



### 3.1.1.2.3 Dynamic View Design

- N/A

### 3.1.1.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	Input signal for filtering
2	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of a filtering handler
3	filtered_signal	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	N/A	N/A	N/A	Filtered output signal
4	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	Filtered output signal
5	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of a filtering handler

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	22

### 3.1.2 [SWDDS.1.1.2] CtrSta

#### 3.1.2.1 [SWDDS.1.1.2.1] CtrSta\_Init

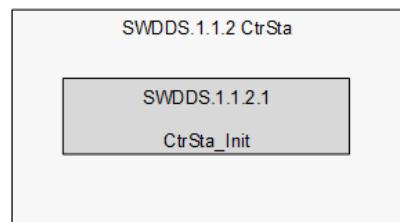
##### 3.1.2.1.1 Detailed Design

###### [SWDDS.1.1.2.1] CtrSta\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.2.1	Unit Name	CtrSta_Init		
Architecture ID	SWADS.1.1.2.1	ASIL	QM		
Prototype	void CtrSta_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control status checking initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     end   </pre>				
Called Function	SWDDS.1.1.1 AswSen_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.2.1
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

##### 3.1.2.1.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	23

### 3.1.2.1.3 Dynamic View Design

- N/A

### 3.1.2.1.4 Interface Design

- N/A

## 3.1.2.2 [SWDDS.1.1.2.2] CtrSta\_Chk

### 3.1.2.2.1 Detailed Design

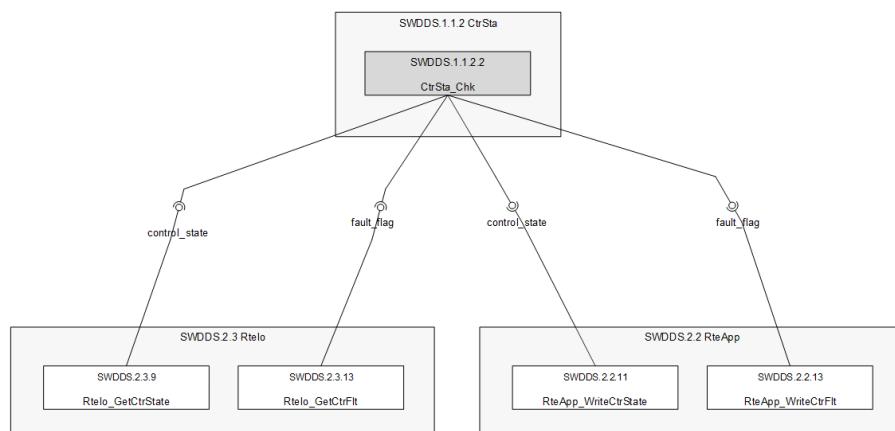
#### [SWDDS.1.1.2.2] CtrSta\_Chk

Software Unit Information					
Unit ID	SWDDS.1.1.2.2	Unit Name	CtrSta_Chk		
Architecture ID	SWADS.1.1.2.2	ASIL	QM		
Prototype	void CtrSta_Chk( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control status checking - Data getting - Application data updating				
Control Flow Diagram (or Pseudo Code)	<pre>     graph TD       start((start)) --&gt; Decl[tCtrState control_state; TU16 fault_flag;]       Decl --&gt; GetState[control_state = Rtelo_GetCtrState();]       GetState --&gt; GetFlt[fault_flag = Rtelo_GetCtrFlt();]       GetFlt --&gt; WriteState[RteApp_WriteCtrState( control_state )]       WriteState --&gt; WriteFlt[RteApp_WriteCtrFlt( fault_flag )]       WriteFlt --&gt; end((end))     </pre>				
Called Function	SWDDS.2.1.9 RteSch_Task10ms				
Calling Function	SWDDS.2.3.9 Rtelo_GetCtrState				
	SWDDS.2.3.13 Rtelo_GetCtrFlt				
	SWDDS.2.2.11 RteApp_WriteCtrState				
	SWDDS.2.2.13 RteApp_WriteCtrFlt				
Function Execution Time	N/A				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	24

Requirement Id	SWDDS.1.1.2.2
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.1.2.2.2 Static View Design



### 3.1.2.2.3 Dynamic View Design

- N/A

### 3.1.2.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	control_state	SWDDS.2.3.9	IN	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Current control state
2	fault_flag	SWDDS.2.3.13	IN	tU16	0	65535	0x0000	0xffff	N/A	Current control fault flags
3	control_state	SWDDS.2.2.11	OUT	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Current control state
4	fault_flag	SWDDS.2.2.13	OUT	tU16	0	65535	0x0000	0xffff	N/A	Current control fault flags

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	25

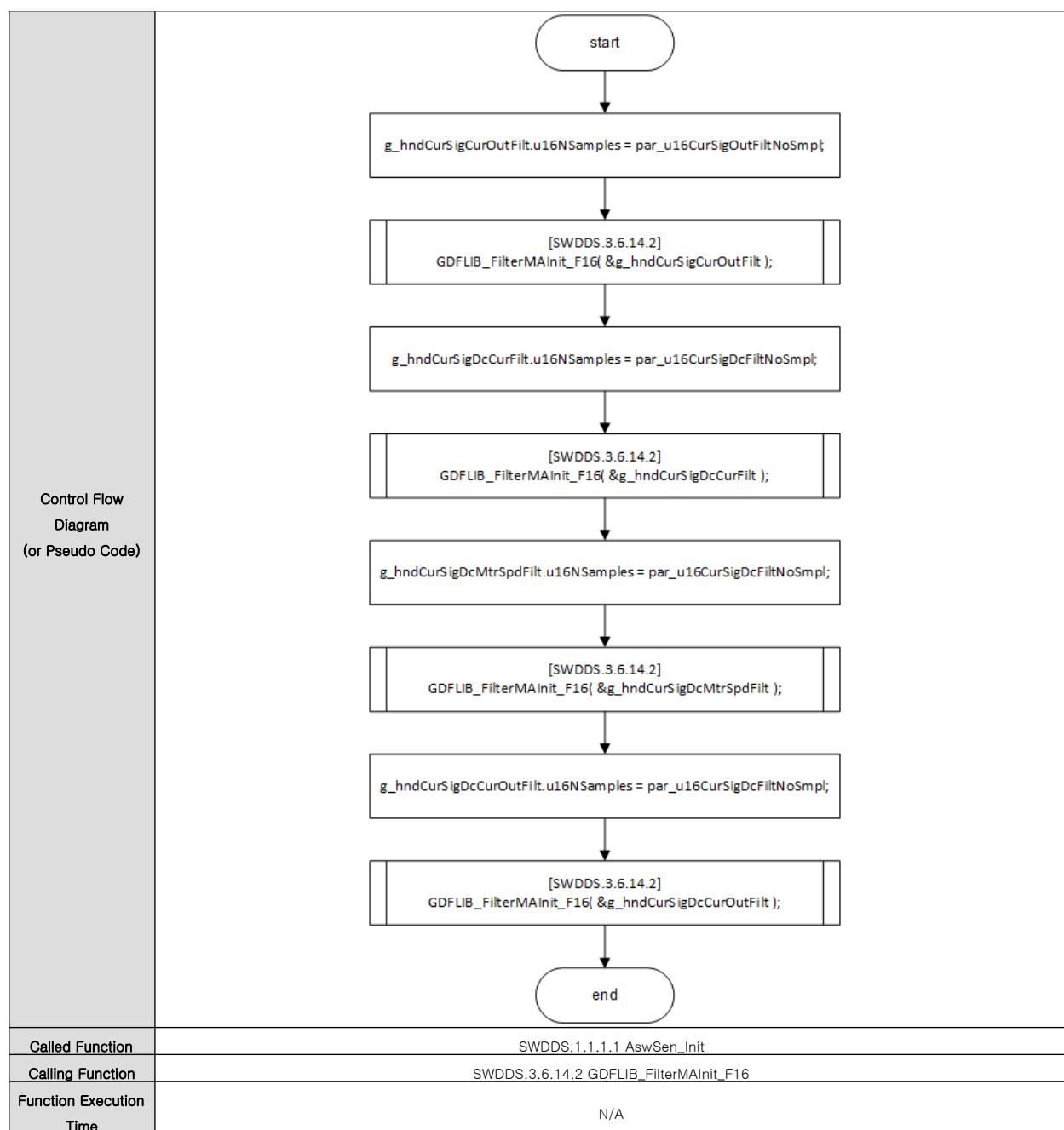
### 3.1.3 [SWDDS.1.1.3] CurSig

#### 3.1.3.1 [SWDDS.1.1.3.1] CurSig\_Init

##### 3.1.3.1.1 Detailed Design

###### [SWDDS.1.1.3.1] CurSig\_Init

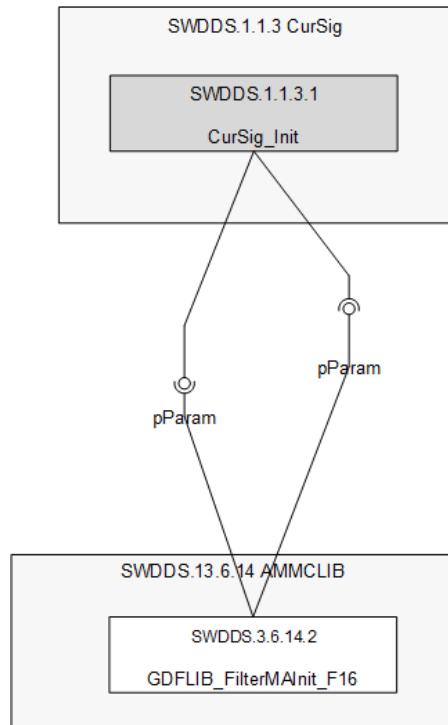
Software Unit Information					
Unit ID	SWDDS.1.1.3.1		Unit Name	CurSig_Init	
Architecture ID	SWADS.1.1.3.1		ASIL	QM	
Prototype	void CurSig_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigCurOutFilt	0 ~ 15	Read/Write	q-axis current output filtering handler (u16NSamples)
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigCurErrFilt	0 ~ 15	Read/Write	q-axis current error filtering handler (u16NSamples)
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigDcCurFilt	0 ~ 15	Read/Write	DC input current filtering handler (u16NSamples)
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigDcMtrSpdFilt	0 ~ 15	Read/Write	Motor speed filtering handler for DC current calculation (u16NSamples)
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigDcCurOutFilt	0 ~ 15	Read/Write	Current output filtering handler for DC current calculation (u16NSamples)
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16CurSigOutFiltNoSmpl	3	Read	Number of samples for moving average filtering of current output
	tU16	par_u16CurSigErrFiltNoSmpl	5	Read	Number of samples for moving average filtering of current error
Registers	tU16	par_u16CurSigDcFiltNoSmpl	4	Read	Number of samples for moving average filtering DC input current
	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current signal measurement initialization				



Requirement Id	SWDDS.1.1.3.1
Target Milestone	SBS1
Element	AswSen
Risk	<span style="color: green;">Low</span>
Interoperability	No
Criticality	<span style="color: green;">Low</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	27

### 3.1.3.1.2 Static View Design



### 3.1.3.1.3 Dynamic View Design

- N/A

### 3.1.3.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.3.2 [SWDDS.1.1.3.2] CurSig\_Measr

#### 3.1.3.2.1 Detailed Design

##### [SWDDS.1.1.3.2] CurSig\_Measr

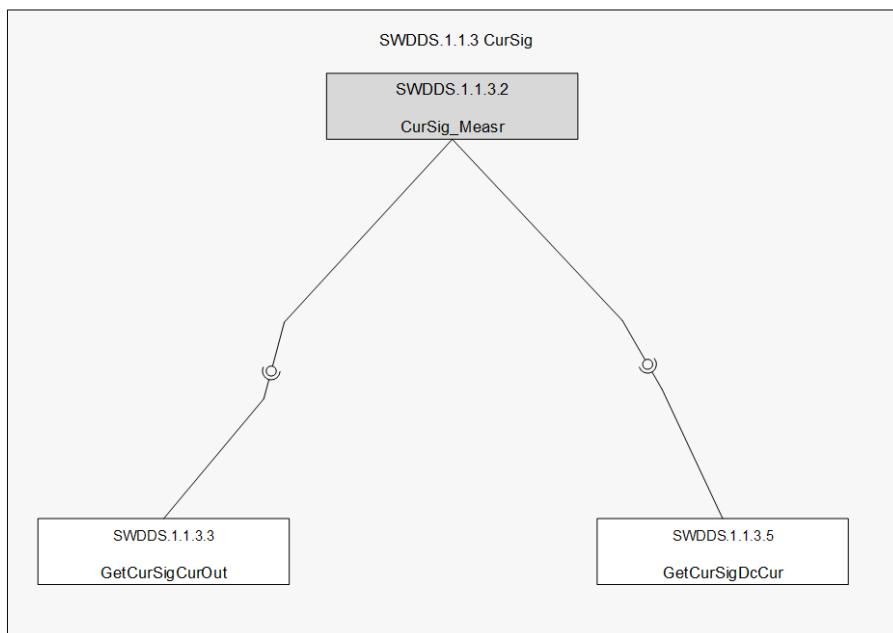
Software Unit Information					
Unit ID	SWDDS.1.1.3.2	Unit Name	CurSig_Measr		
Architecture ID	SWADS.1.1.3.2	ASIL	QM		
Prototype	void CurSig_Measr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global	Data Type	Name	Range	Read/Write	Description

Variables	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
Registers	N/A	N/A	N/A	N/A	N/A
Description	Current signal measurement – Current output getting – DC input current calculation				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [SWDDS.1.1.3.3]     GetCurSigCurOut();     ↓     [SWDDS.1.1.3.5]     GetCurSigDcCur();     ↓     end   </pre>				
Called Function	SWDDS.2.1.9 RteSch_Task10ms				
Calling Function	SWDDS.1.1.3.3 GetCurSigCurOut SWDDS.1.1.3.5 GetCurSigDcCur				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.3.2
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">▢</span> Low
Interoperability	No
Criticality	<span style="color: orange;">▢</span> Mid
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

### 3.1.3.2.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	29



### 3.1.3.2.3 Dynamic View Design

- N/A

### 3.1.3.2.4 Interface Design

- N/A

### 3.1.3.3 [SWDDS.1.1.3.3] GetCurSigCurOut

#### 3.1.3.3.1 Detailed Design

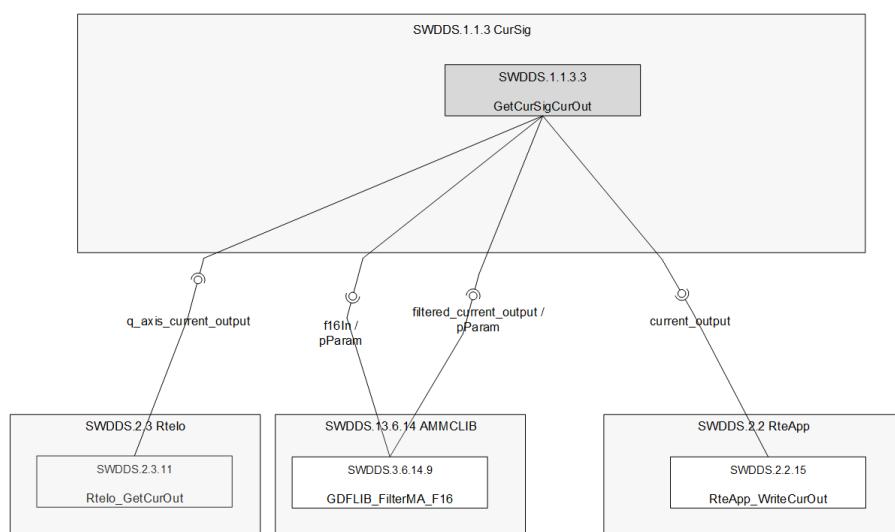
##### [SWDDS.1.1.3.3] GetCurSigCurOut

Software Unit Information					
Unit ID	SWDDS.1.1.3.3	Unit Name	GetCurSigCurOut		
Architecture ID	SWADS.1.1.3.3	ASIL	QM		
Prototype	void GetCurSigCurOut( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigCurOutFilt	-2147483648 ~ 2147483647	Read/Write	q-axis current output filtering handler (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current output getting - Current output getting - q-axis current filtering - Application data updating				

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 q_axis_current_output,     filtered_current_output;     ↓     [SWDDS.2.3.11]     q_axis_current_output = RteIo_GetCurOut();     ↓     [SWDDS.3.6.14.9]     filtered_current_output = GDFLIB_FilterMA_F16(     q_axis_current_output, &amp;g_hndCurSigCurOutFilt );     ↓     [SWDDS.2.2.15]     RteApp_WriteCurOut( filtered_current_output );     ↓     end   </pre>
	SWDDS.1.1.3.2_CurSig_Meas
	SWDDS.2.3.11_RteIo_GetCurOut
	SWDDS.3.6.14.9_GDFLIB_FilterMA_F16
	SWDDS.2.2.15_RteApp_WriteCurOut
Called Function	N/A
Calling Function	
Function Execution Time	N/A

Requirement Id	SWDDS.1.1.3.3
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.1.3.3.2 Static View Design



### 3.1.3.3.3 Dynamic View Design

- N/A

### 3.1.3.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	q_axis_current_output	SWDDS.2.3.11	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Input signal for filtering
3	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
4	filtered_current_output	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered signal
5	current_output	SWDDS.2.2.15	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)

[Deleted] [SWDDS.1.1.3.4] GetCurSigCurErr

### 3.1.3.4 [SWDDS.1.1.3.5] GetCurSigDcCur

#### 3.1.3.4.1 Detailed Design

##### [SWDDS.1.1.3.5] GetCurSigDcCur

Software Unit Information					
Unit ID	SWDDS.1.1.3.5		Unit Name	GetCurSigDcCur	
Architecture ID	SWADS.1.1.3.5		ASIL	QM	
Prototype	void GetCurSigDcCur( void )				
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	

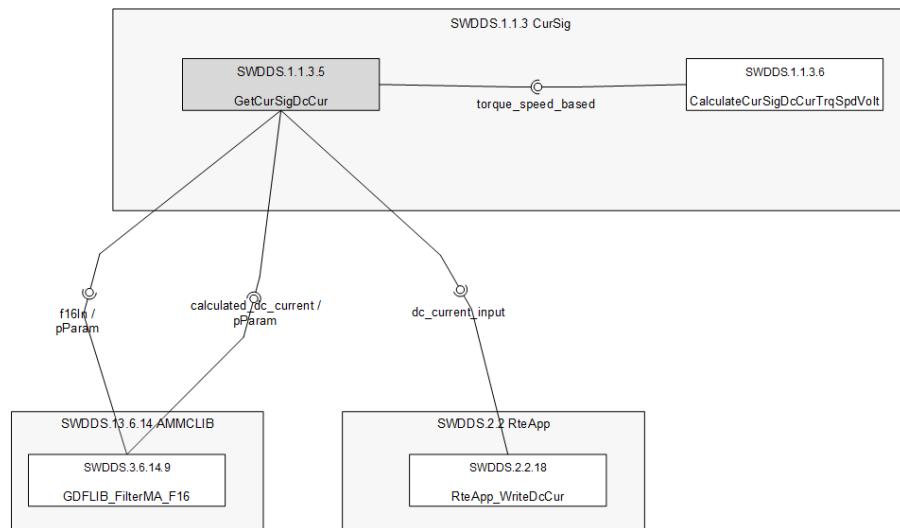
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	32

Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigDcCurFilt	-2147483648 ~ 2147483647	Read/Write	DC input current filtering handler (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC input current getting - DC current calculation - DC current averaging - DC input current filtering and application data updating				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 torque_speed_based;filtered_current_error;     tFrac16 calculated_dc_current;     ↓     [SWDDS.1.1.3.6]     torque_speed_based = CalculateCurSigDcCurTrqSpdVolt();     ↓     calculated_dc_current = torque_speed_based;     ↓     [SWDDS.3.6.14.9]     calculated_dc_current = GDFLIB_FilterMA_F16(     calculated_dc_current, &amp;g_hndCurSigDcCurFilt );     ↓     [SWDDS.2.2.18]     RteApp_WriteDcCur( calculated_dc_current );     ↓     end   </pre>				
Called Function	SWDDS.1.1.3.2 CurSig_Measr				
Calling Function	SWDDS.1.1.3.6 CalculateCurSigDcCurTrqSpdVolt				
	SWDDS.3.6.14.9 GDFLIB_FilterMA_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.3.5
Target Milestone	SBS2.1
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	33

### 3.1.3.4.2 Static View Design



### 3.1.3.4.3 Dynamic View Design

- N/A

### 3.1.3.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	torque _speed _based	SWDDS.1.1.3.6	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Motor torque and speed based DC current (PU)
2	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Input signal for filtering
3	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
5	calculated_dc_current	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered signal
6	dc_current _input	SWDDS.2.2.18	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	DC current input (PU)

### 3.1.3.5 [SWDDS.1.1.3.6] CalculateCurSigDcCurTrqSpdVolt

#### 3.1.3.5.1 Detailed Design

##### [SWDDS.1.1.3.6] CalculateCurSigDcCurTrqSpdVolt

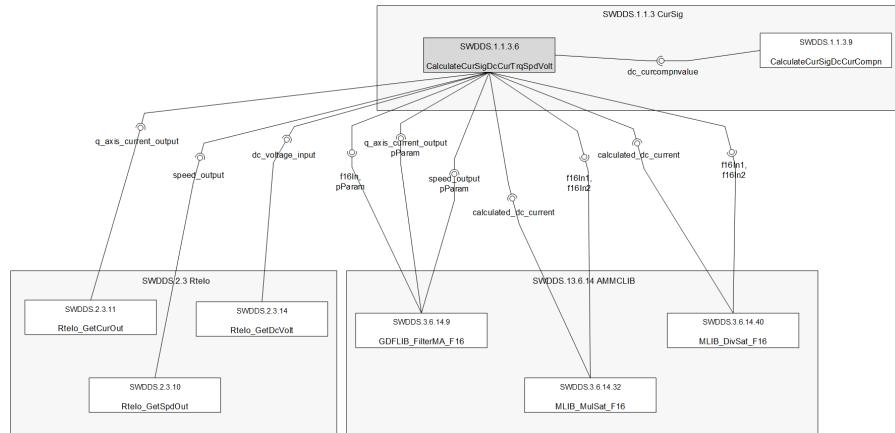
Software Unit Information					
Unit ID	SWDDS.1.1.3.6		Unit Name	CalculateCurSigDcCurTrqSpdVolt	
Architecture ID	SWADS.1.1.3.6		ASIL	QM	
Prototype	tFrac16 CalculateCurSigDcCurTrqSpdVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A

Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		Calculated DC current (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndCurSigDcCurOutFilt	-2147483648 ~ 2147483647	Read/Write	Current output filtering handler for DC current calculation (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC input current calculation based on motor torque, speed and DC voltage – q-axis current output getting – Calculated DC current input – Negative value limiting				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 q_axis_current_output,     speed_output,     dc_voltage_input,     dc_curcompnvalue;     tFrac16 calculated_dc_current;      [SWDDS.2.3.11]     q_axis_current_output = RteIo_GetCurOut();      [SWDDS.2.3.10]     speed_output = RteIo_GetSpdOut();      [SWDDS.2.3.14]     dc_voltage_input = RteIo_GetDcVolt();      [SWDDS.1.1.3.9]     dc_curcompnvalue = CalculateCurSigDcCurCompn();      [SWDDS.3.6.14.9]     q_axis_current_output = GDFLIB_FilterMA_F16( q_axis_current_output,   &amp;g_hndCurSigDcCurOutFilt );      [SWDDS.3.6.14.9]     speed_output = GDFLIB_FilterMA_F16( speed_output,  &amp;g_hndCurSigDcMtrSpdFilt );      [SWDDS.3.6.14.32]   </pre>				

<pre> calculated_dc_current = MLIB_MulSat_F16( q_axis_current_output,  speed_output ); </pre>		
<p style="text-align: center;">↓</p>		
<pre> [SWDDS.3.6.14.32] calculated_dc_current = MLIB_MulSat_F16( CUR_SIG_DC_CUR_COMPN,  calculated_dc_current ); </pre>		
<p style="text-align: center;">↓</p>		
<pre> [SWDDS.3.6.14.40] calculated_dc_current = MLIB_DivSat_F16( calculated_dc_current,  dc_voltage_input ); </pre>	<pre> [SWDDS.3.6.14.40] calculated_dc_current = MLIB_DivSat_F16( calculated_dc_current,  dc_curecompnvalue ); </pre>	
<p style="text-align: center;">↓</p>		
<pre> calculated_dc_current &lt; FRAC16( 0.0f ) </pre>	<pre> yes calculated_dc_current = FRAC16( 0.0f ); </pre>	
<p style="text-align: center;">no</p>		
<p style="text-align: center;">↓</p>		
<pre> return calculated_dc_current; </pre>		
Called Function	SWDDS.1.1.3.5 GetCurSigDcCur	
Calling Function	SWDDS.2.3.11 Rtelo_GetCurOut	
	SWDDS.2.3.10 Rtelo_GetSpdOut	
	SWDDS.2.3.14 Rtelo_GetDcVolt	
	SWDDS.1.1.3.9 CalculateCurSigDcCurCompn	
	SWDDS.3.6.14.9 GDFLIB_FilterMA_F16	
	SWDDS.3.6.14.32 MLIB_MulSat_F16	
	SWDDS.3.6.14.40 MLIB_DivSat_F16	
Function Execution Time	N/A	

Requirement Id	SWDDS.1.1.3.6
Target Milestone	EBS2
Element	AswSen
Risk	▣ Mid
Interoperability	No
Criticality	▣ Mid
Technical complexity	▣ Mid
Verifiability	Yes

### 3.1.3.5.2 Static View Design



### 3.1.3.5.3 Dynamic View Design

- N/A

### 3.1.3.5.4 Interface Design

No	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	q_axis_current_output	SWDDS.2.3.11	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	speed_output	SWDDS.2.3.10	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
3	dc_voltage_input	SWDDS.2.3.14	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC driving voltage (PU)
4	dc_cucomppvalue	SWDDS.1.1.3.9	IN	tFrac16	-32768	32767	N/A	N/A	N/A	Calculated DC current Compensation(PU)
5	f16ln	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Input q-axis current signal for filtering
6	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
7	q_axis_current_output	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered q-axis current output
8	speed_output	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output
9	f16ln1	SWDDS.3.6.14.32	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered q-axis current output
10	f16ln2	SWDDS.3.6.14.32	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output
11	calculated_dc_current	SWDDS.3.6.14.32	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Calculated DC input current (PU)
12	f16ln1	SWDDS.	OUT	tFrac16	-32768	32767	0.0	64.4980	0.00196838 /	Calculated DC

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	37

		3.6.14.40							Apk	input current (PU)
13	f16ln2	SWDDS. 3.6.14.40	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC driving voltage (PU)
14	calculated_dc_current	SWDDS. 3.6.14.40	IN	tFrac16	0	32767	0.0	64.4980	0.00196838 / Apk	Calculated DC input current (PU)
15	f16ln1	SWDDS. 3.6.14.40	OUT	tFrac16	0	32767	0.0	64.4980	0.00196838 / Apk	Calculated DC input current (PU)
16	f16ln2	SWDDS. 3.6.14.40	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	Calculated DC current Compensation(PU)
17	calculated_dc_current	SWDDS. 3.6.14.40	IN	tFrac16	0	32767	0.0	64.4980	0.00196838 / Apk	Calculated DC input current (PU)

### 3.1.3.6 [SWDDS.1.1.3.7] CalcCurSigDcCurCompnIntpSpd

#### 3.1.3.6.1 Detailed Design

##### [SWDDS.1.1.3.7] CalcCurSigDcCurCompnIntpSpd

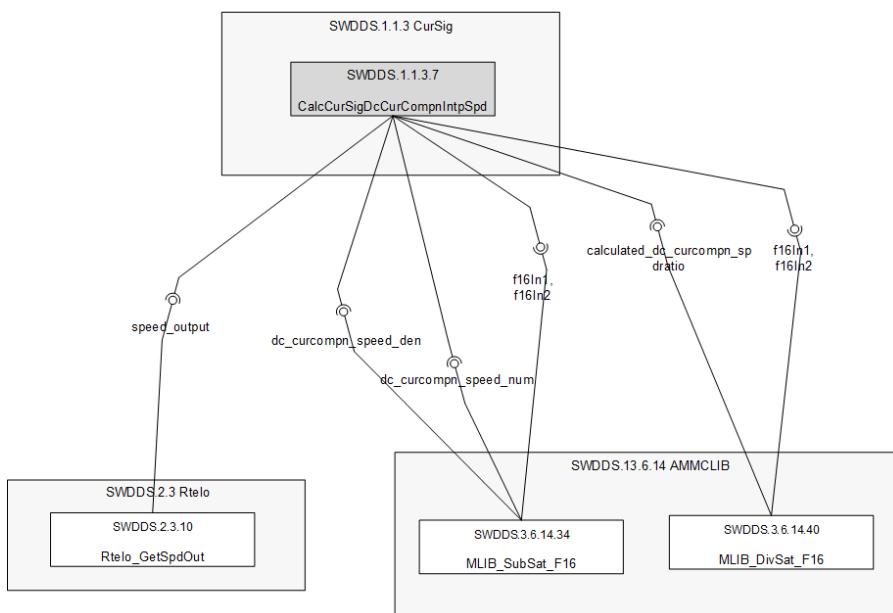
Software Unit Information					
Unit ID	SWDDS.1.1.3.7		Unit Name	CalcCurSigDcCurCompnIntpSpd	
Architecture ID	SWADS.1.1.3.7		ASIL	QM	
Prototype	tFrac16 CalcCurSigDcCurCompnIntpSpd( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		calculated dc current compensation speed ratio(PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16SpeedNodeFirstIndex	0 ~ 7	Write	Speed output of 1st. node index
	tU16	g_u16SpeedNodeSecondIndex	0 ~ 7	Write	Speed output of 2nd. node index
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_af16CurSigDcCurSpdNodeLut[0]	2730.5 500rpm	Read	Speed Ratio for DC Current compensation : < 500rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[1]	4914.9 900rpm	Read	Speed Ratio for DC Current compensation : < 900rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[2]	7099.3 1300rpm	Read	Speed Ratio for DC Current compensation : < 1300rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[3]	9283.7 1700rpm	Read	Speed Ratio for DC Current compensation : < 1700rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[4]	11648.1 1700rpm	Read	Speed Ratio for DC Current compensation : <1700rpm

	tFrac16	par_af16CurSigDcCurSpdNodeLut[5]	13652.5 2500rpm	Read	Speed Ratio for DC Current compensation : < 2500rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[6]	15836.9 2900rpm	Read	Speed Ratio for DC Current compensation : < 2900rpm
	tFrac16	par_af16CurSigDcCurSpdNodeLut[7]	18021.3 3300rpm	Read	Speed Ratio for DC Current compensation : < 3300rpm
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	<p>Finding speed output node indexes, calculating DC current compensation speed ratio</p> <ol style="list-style-type: none"> <li>1. Speed_output getting</li> <li>2. Speed output range under checking</li> <li>3. Speed output range over checking</li> <li>4. search a node of speed output index</li> <li>5. Calculate Speed Ratio for DC Current compensation</li> <li>6. return DC current compensation speed ratio</li> </ol>				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; Init["tFrac16 speed_output; Volatile u16 speednode_index; tFrac16 dc_curcompn_speed_num, dc_curcompn_speed_den; tFrac16 calculated_dc_curcompn_spdroatio;"]     Init --&gt; GetSpdOut["[SWDDS 2.3.10] speed_output = RteLo_GetSpdOut();"]     GetSpdOut --&gt; NodeLut0{"speed_output &lt;= par_af16CurSigDcCurSpdNodeLut[0u]"}     NodeLut0 -- yes --&gt; Node0["speed_output = par_af16CurSigDcCurSpdNodeLut[0u];"]     NodeLut0 -- no --&gt; NodeLutDE["speed_output &gt;= par_af16CurSigDcCurSpdNodeLut[PARAM_DC_CUR_LUT_SPD_NO - DE_NO - 1u]"]     NodeLutDE -- yes --&gt; NodeDE["speed_output = par_af16CurSigDcCurSpdNodeLut[PARAM_DC_CUR_LUT_SPD_NODE_NO - 1u];"]     NodeLutDE -- no --&gt; Node0     Node0 --&gt; SpeedIndex0["speednode_index = 0;"]     SpeedIndex0 --&gt; NodeLutIndex["speednode_index &lt; PARAM_DC_CUR_LUT_SPD_NODE_NO ;"]     NodeLutIndex -- yes --&gt; NodeIndex["speed_output &lt; par_af16CurSigDcCurSpdNodeLut[speednode_index]"]     NodeIndex -- yes --&gt; IndexCalc["g_u16SpeedNodeFirstIndex = speednode_index - 1u; g_u16SpeedNodeSecondIndex = speednode_index;"]     NodeIndex -- no --&gt; SpeedIndex0     IndexCalc --&gt; MULB1["[SWDDS 3.6.14.34] dc_curcompn_speed_num = MULB_SubSat_F16(speed_output, par_af16CurSigDcCurSpdNodeLut[g_u16SpeedNodeFirstIndex]);"]     MULB1 --&gt; MULB2["[SWDDS 3.6.14.34] dc_curcompn_speed_den = MULB_SubSat_F16( par_af16CurSigDcCurSpdNodeLut[g_u16SpeedNodeSecondIndex], par_af16CurSigDcCurSpdNodeLut[g_u16SpeedNodeFirstIndex]);"]     MULB2 --&gt; DivSat["[SWDDS 3.6.14.40] calculated_dc_curcompn_spdroatio = MULB_DivSat_F16( dc_curcompn_speed_num, dc_curcompn_speed_den);"]     DivSat --&gt; Return["return calculated_dc_curcompn_spdroatio;"]   </pre>				
Called Function	SWDDS.1.1.3.9 CalculateCurSigDcCurCompn				

Calling Function	SWDDS.2.3.10 Rtel0_GetSpdOut
	SWDDS.3.6.14.34 MLIB_SubSat_F16
	SWDDS.3.6.14.40 MLIB_DivSat_F16
Function Execution Time	N/A

Requirement Id	SWDDS.1.1.3.7
Target Milestone	SBS2.1
Element	AswSen
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.1.3.6.2 Static View Design



### 3.1.3.6.3 Dynamic View Design

- N/A

### 3.1.3.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	speed_output	SWDDS.2.3.10	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
2	f16ln1	SWDDS.3.6.14.34	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
										First node of

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	40

3	f16In2	SWDDS. 3.6.14.34	OUT	tFrac16	2730	18021	499.89	3299.84	0.183105 / rpm	speed for DC current Compansation(PU)
4	dc_curcompn_speed_num	SWDDS. 3.6.14.34	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Numerator of DC current compensation speed ratio
5	f16In1	SWDDS. 3.6.14.34	OUT	tFrac16	2730	18021	499.89	3299.84	0.183105 / rpm	Second node of speed for DC current Compansation(PU)
6	f16In2	SWDDS. 3.6.14.34	OUT	tFrac16	2730	18021	499.89	3299.84	0.183105 / rpm	First node of speed for DC current Compansation(PU)
7	dc_curcompn_speed_den	SWDDS. 3.6.14.34	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Denomenator of DC current compensation speed ratio
8	f16In1	SWDDS. 3.6.14.40	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Numerator of DC current compensation speed ratio
9	f16In2	SWDDS. 3.6.14.40	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Denomenator of DC current compensation speed ratio
10	calculated_dc_curcompn_spdratio	SWDDS. 3.6.14.40	IN	tFrac16	-32768	32767	N/A	N/A	N/A	DC current compensation speed ratio (PU)

### 3.1.3.7 [SWDDS.1.1.3.8] CalcCurSigDcCurCompnIntpCurQ

#### 3.1.3.7.1 Detailed Design

[SWDDS.1.1.3.8] CalcCurSigDcCurCompnIntpCurQ

Software Unit Information					
Unit ID	SWDDS.1.1.3.8		Unit Name	CalcCurSigDcCurCompnIntpCurQ	
Architecture ID	SWADS.1.1.3.8		ASIL	QM	
Prototype	tFrac16 CalcCurSigDcCurCompnIntpCurQ( void )				
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		calculated dc current compensation current ratio(PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16QaxisNodeFirstIndex	0 ~ 7	Write	q_axis current of 1st. node index
	tU16	g_u16QaxisNodeFirstIndex	0 ~ 7	Write	q_axis current of 2nd. node index
	Data Type	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-06-30
			Page		41

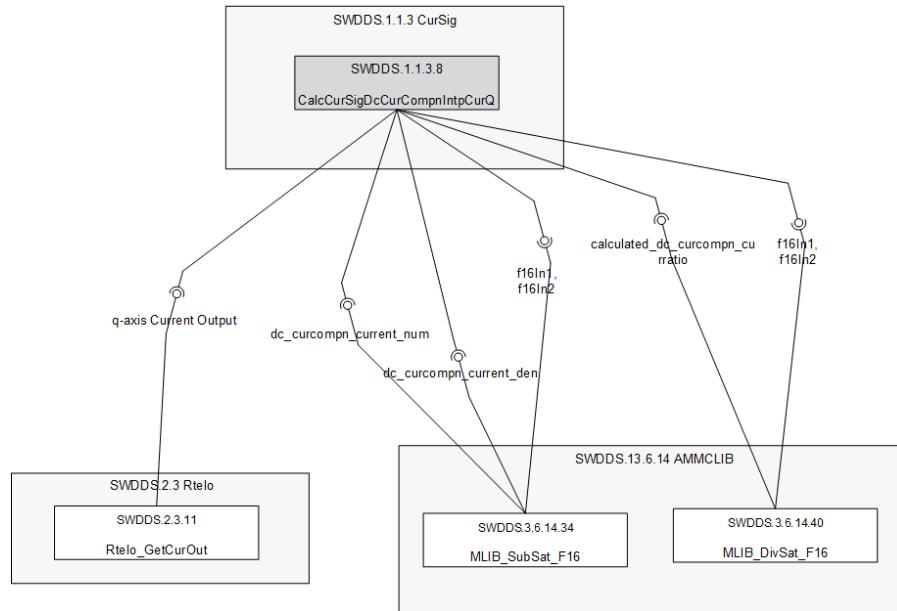
<b>Parameters</b>	tFrac16	par_af16CurSigDcCurCurNodeLut[0]	0 0.0Apk	Read	Current Ratio for DC Current compensation : < 0.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[1]	1524 3.0Apk	Read	Current Ratio for DC Current compensation : < 3.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[2]	3048 6.0Apk	Read	Current Ratio for DC Current compensation : < 6.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[3]	4572 9.0Apk	Read	Current Ratio for DC Current compensation : < 9.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[4]	6096 12.0Apk	Read	Current Ratio for DC Current compensation : < 12.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[5]	7620 15.0Apk	Read	Current Ratio for DC Current compensation : < 15.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[6]	9144 18.0Apk	Read	Current Ratio for DC Current compensation : < 18.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[7]	10668 21.0Apk	Read	Current Ratio for DC Current compensation : < 21.0A
	tFrac16	par_af16CurSigDcCurCurNodeLut[8]	12192 24.0Apk	Read	Current Ratio for DC Current compensation : < 24.0A
<b>Registers</b>	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	finding q-axis current output node indexes, calculating DC current compensation current ratio 1. q-axis current output getting 2. q-axis current output range under checking 3. q-axis current output range over checking 4. search a node of q-axis current output index 5. Calculate Current Ratio for DC Current compensation 6. return DC current compensation current ratio				
<b>Control Flow</b>					

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     tFrac16 q_axis_current_output;     Volatile tU16q_axisnode_index;     tFrac16 dc_curcompn_current_num;     dc_curcompn_current_den;     tFrac16 calculated_dc_curcompn_curren;      [SWDDS.2.3.11]     q_axis_current_output = Rtel0_GetCurOut();      if (q_axis_current_output &lt;= par_af16CurSigDcCurNodeLut[0u])         q_axis_current_output = par_af16CurSigDcCurNodeLut[0u];     else if (q_axis_current_output &gt;=             par_af16CurSigDcCurNodeLut[PARAM_DC_CUR_LUT_CUR_NO - 1u])         q_axis_current_output =             par_af16CurSigDcCurNodeLut[PARAM_DC_CUR_LUT_CUR_NO - 1u];      q_axisnode_index = 0;      if (q_axisnode_index &lt; PARAM_DC_CUR_LUT_CUR_NODE_NO)         if (q_axis_current_output &lt; par_af16CurSigDcCurNodeLut[q_axisnode_index])             q_axisnode_index++;         else             g_u16QaxisNodeFirstIndex = q_axisnode_index - 1u;             g_u16QaxisNodeSecondIndex = q_axisnode_index;     end;      [SWDDS.3.6.14.34]     dc_curcompn_current_num = MLIB_SubSat_F16(q_axis_current_output,   par_af16CurSigDcCurNodeLut[g_u16QaxisNodeFirstIndex]);      [SWDDS.3.6.14.34]     dc_curcompn_current_den = MLIB_SubSat_F16(         par_af16CurSigDcCurNodeLut[g_u16QaxisNodeSecondIndex],         par_af16CurSigDcCurNodeLut[g_u16QaxisNodeFirstIndex]);      [SWDDS.3.6.14.40]     calculated_dc_curcompn_curren = MLIB_DivSat_F16(         dc_curcompn_current_num, dc_curcompn_current_den);      return calculated_dc_curcompn_curren; </pre>	
	Called Function	SWDDS.1.1.3.9 CalculateCurSigDcCurCompn
	Calling Function	SWDDS.2.3.11 Rtel0_GetCurOut
		SWDDS.3.6.14.34 MLIB_SubSat_F16
		SWDDS.3.6.14.40 MLIB_DivSat_F16
	Function Execution Time	N/A

Requirement Id	SWDDS.1.1.3.8
Target Milestone	SBS2.1
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	43

### 3.1.3.7.2 Static View Design



### 3.1.3.7.3 Dynamic View Design

- N/A

### 3.1.3.7.4 Interface Design

No	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/ Units	Description
					Min	Max	Min	Max		
1	q_axis_current_output	SWDDS.2.3.11	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	f16ln1	SWDDS.3.6.14.34	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
3	f16ln2	SWDDS.3.6.14.34	OUT	tFrac16	0	12192	0	23.9993	0.00196838 / Apk	First node of q-axis current for DC current compensation (PU)
4	dc_curcompn_current_num	SWDDS.3.6.14.34	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Numerator of q-axis current ratio for DC current compensation (PU)
5	f16ln1	SWDDS.3.6.14.34	OUT	tFrac16	0	12192	0	23.9993	0.00196838 / Apk	Second node of q-axis current for DC current compensation (PU)
6	f16ln2	SWDDS.3.6.14.34	OUT	tFrac16	0	12192	0	23.9993	0.00196838 / Apk	First node of q-axis current for DC current

<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	44

										compansation (PU)
7	dc_curcompn_current_den	SWDDS. 3.6.14.34	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Denominator of q-axis current ratio for DC current compensation (PU)
8	f16In1	SWDDS. 3.6.14.40	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Numerator of q-axis current ratio for DC current compensation (PU)
9	f16In2	SWDDS. 3.6.14.40	OUT	tFrac16	0	12192	0	23.9993	0.00196838 / Apk	Denominator of q-axis current ratio for DC current compensation (PU)
10	calculated_dc_curcompn_curratio	SWDDS. 3.6.14.40	IN	tFrac16	-32768	32767	N/A	N/A	N/A	DC current compensation current ratio (PU)

### 3.1.3.8 [SWDDS.1.1.3.9] CalculateCurSigDcCurCompn

#### 3.1.3.8.1 Detailed Design

[SWDDS.1.1.3.9] CalculateCurSigDcCurCompn

Software Unit Information					
Unit ID	SWDDS.1.1.3.9		Unit Name	CalculateCurSigDcCurCompn	
Architecture ID	SWADS.1.1.3.9		ASIL	QM	
Prototype	tFrac16 CalculateCurSigDcCurCompn( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	-32768 ~ 32767		Calculated DC current Compensation(PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16QaxisNodeFirstIndex	0 ~ 7	Read	q_axis current of 1st. node index
	tU16	g_u16SpeedNodeFirstIndex	0 ~ 8	Read	Speed output of 1st. node index
	tU16	g_u16QaxisNodeSecondIndex	0 ~ 7	Read	q_axis current of 2nd. node index
	tU16	g_u16SpeedNodeSecondIndex	0 ~ 8	Read	Speed output of 2nd. node index
	Data Type	Name	Range	Read/Write	Description
					DC current compensation

	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date	2021-06-30	
		Page		45	

	tFrac16	par_af16CurSigDcCurCompnLut[0][0]	32766	Read	value : < 0.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][1]	32766	Read	DC current compensation value : < 0.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][2]	32766	Read	DC current compensation value : < 0.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][3]	32766	Read	DC current compensation value : < 0.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][4]	32766	Read	DC current compensation value : < 0.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][5]	32766	Read	DC current compensation value : < 0.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][6]	32766	Read	DC current compensation value : < 0.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[0][7]	32766	Read	DC current compensation value : < 0.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][0]	31193.232	Read	DC current compensation value : < 3.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][1]	31193.232	Read	DC current compensation value : < 3.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][2]	31193.232	Read	DC current compensation value : < 3.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][3]	31946.85	Read	DC current compensation value : < 3.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][4]	32766	Read	DC current compensation value : < 3.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][5]	32766	Read	DC current compensation value : < 3.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][6]	32766	Read	DC current compensation value : < 3.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[1][7]	32766	Read	DC current compensation value : < 3.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][0]	29784.294	Read	DC current compensation value : < 6.0A / < 500rpm
					DC current compensation

	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date	2021-06-30	
		Page		46	

	tFrac16	par_af16CurSigDcCurCompnLut[2][1]	29784.294	Read	value : < 6.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][2]	29784.294	Read	DC current compensation value : < 6.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][3]	31193.232	Read	DC current compensation value : < 6.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][4]	31946.85	Read	DC current compensation value : < 6.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][5]	32766	Read	DC current compensation value : < 6.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][6]	32766	Read	DC current compensation value : < 6.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[2][7]	32766	Read	DC current compensation value : < 6.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][0]	28473.654	Read	DC current compensation value : < 9.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][1]	28473.654	Read	DC current compensation value : < 9.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][2]	28473.654	Read	DC current compensation value : < 9.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][3]	29784.294	Read	DC current compensation value : < 9.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][4]	31193.232	Read	DC current compensation value : < 9.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][5]	31946.85	Read	DC current compensation value : < 9.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][6]	32766	Read	DC current compensation value : < 9.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[3][7]	32766	Read	DC current compensation value : < 9.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][0]	26212.8	Read	DC current compensation value : < 12.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][1]	27294.078	Read	DC current compensation value : < 12.0A / < 900rpm
					DC current compensation

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-06-30
			Page		47

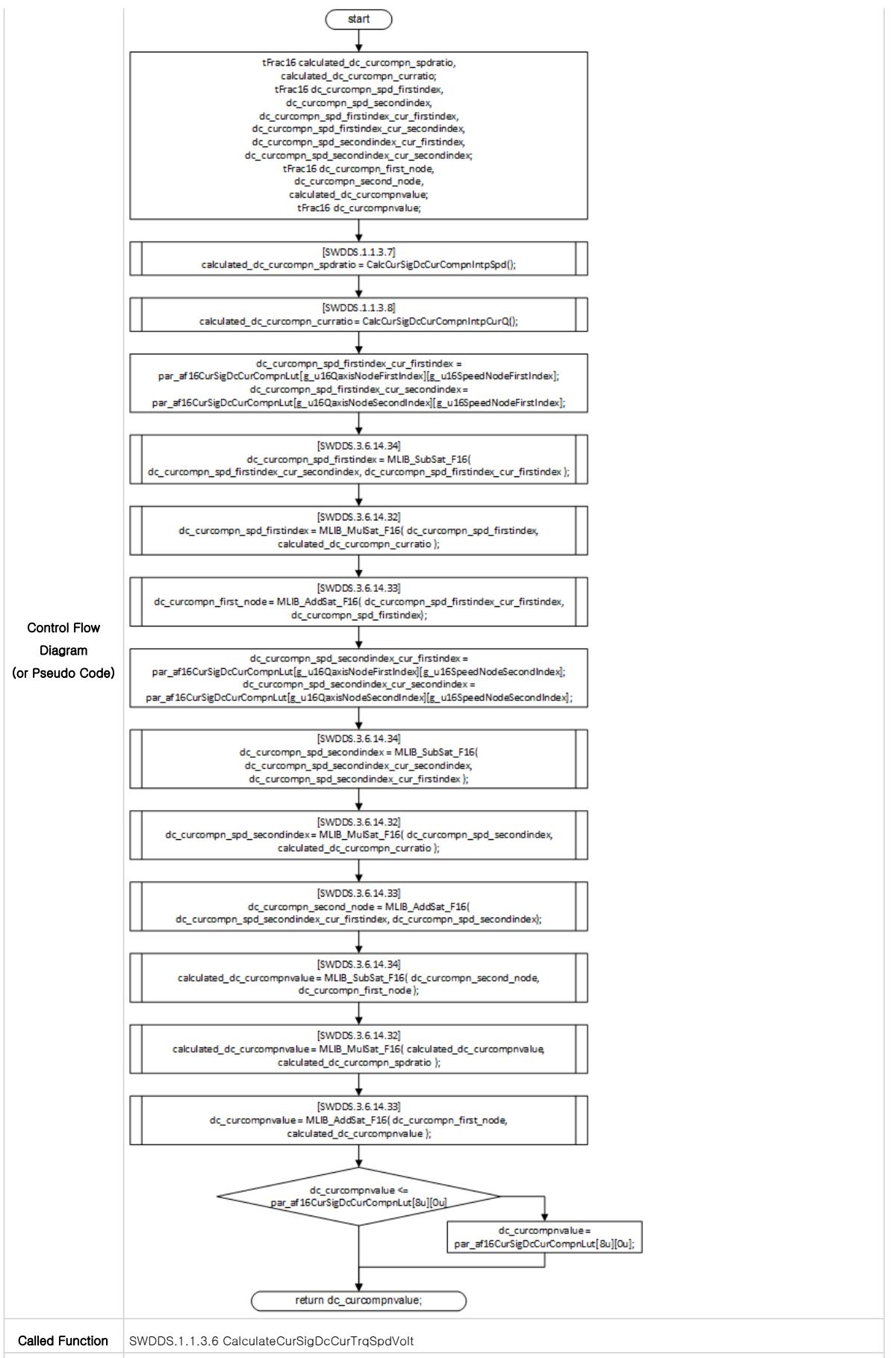
Parameters	tFrac16	par_af16CurSigDcCurCompnLut[4][2]	27294.078	Read	value : < 12.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][3]	28473.654	Read	DC current compensation value : < 12.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][4]	29784.294	Read	DC current compensation value : < 12.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][5]	31193.232	Read	DC current compensation value : < 12.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][6]	32766	Read	DC current compensation value : < 12.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[4][7]	32766	Read	DC current compensation value : < 12.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][0]	24607.266	Read	DC current compensation value : < 15.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][1]	26212.8	Read	DC current compensation value : < 15.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][2]	26212.8	Read	DC current compensation value : < 15.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][3]	27294.078	Read	DC current compensation value : < 15.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][4]	28473.654	Read	DC current compensation value : < 15.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][5]	29784.294	Read	DC current compensation value : < 15.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][6]	31946.85	Read	DC current compensation value : < 15.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[5][7]	32766	Read	DC current compensation value : < 15.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][0]	22575.774	Read	DC current compensation value : < 18.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][1]	24607.266	Read	DC current compensation value : < 18.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][2]	25197.054	Read	DC current compensation value : < 18.0A / < 1300rpm
					DC current compensation

	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification		Updated Date	2021-06-30	
		Page		48	

	tFrac16	par_af16CurSigDcCurCompnLut[6][3]	26212.8	Read	value : < 18.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][4]	27294.078	Read	DC current compensation value : < 18.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][5]	28473.654	Read	DC current compensation value : < 18.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][6]	31193.232	Read	DC current compensation value : < 18.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[6][7]	31946.85	Read	DC current compensation value : < 18.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][0]	20708.112	Read	DC current compensation value : < 21.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][1]	22575.774	Read	DC current compensation value : < 21.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][2]	24607.266	Read	DC current compensation value : < 21.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][3]	25197.054	Read	DC current compensation value : < 21.0A / < 1700rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][4]	26212.8	Read	DC current compensation value : < 21.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][5]	27294.078	Read	DC current compensation value : < 21.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][6]	29784.294	Read	DC current compensation value : < 21.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[7][7]	31193.232	Read	DC current compensation value : < 21.0A / < 3300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][0]	19659.6	Read	DC current compensation value : < 24.0A / < 500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][1]	20708.112	Read	DC current compensation value : < 24.0A / < 900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][2]	23394.924	Read	DC current compensation value : < 24.0A / < 1300rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][3]	24607.266	Read	DC current compensation value : < 24.0A / < 1700rpm
					DC current compensation

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-06-30
			Page	49	

	tFrac16	par_af16CurSigDcCurCompnLut[8][4]	25197.054	Read	value : < 24.0A / < 2100rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][5]	26212.8	Read	DC current compensation value : < 24.0A / < 2500rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][6]	28473.654	Read	DC current compensation value : < 24.0A / < 2900rpm
	tFrac16	par_af16CurSigDcCurCompnLut[8][7]	29784.294	Read	DC current compensation value : < 24.0A / < 3300rpm
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	<p>Calculating DC input current beta value by interpolation of Compensation LUT</p> <ol style="list-style-type: none"> <li>1. get a DC current compensation speed ratio</li> <li>2. get a DC current compensation current ratio</li> <li>3. get a DC current compensation value( q-axis current output first/second index, speed first index in LUT )</li> <li>4. calculate DC current compensation first node</li> <li>5. get a DC current compensation value( q-axis current output first/second index, speed second index in LUT )</li> <li>6. calculate DC current compensation second node</li> <li>7. Calculate DC current compensation value</li> <li>8. Check DC current compensation value under limit</li> </ol>				
<b>Control Flow Diagram (or Pseudo Code)</b>					



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	51

Calling Function	SWDDS.3.6.14.34 MLIB_SubSat_F16
	SWDDS.3.6.14.32 MLIB_MulSat_F16
	SWDDS.3.6.14.33 MLIB_AddSat_F16
Function Execution Time	N/A

Requirement Id	SWDDS.1.1.3.9
Target Milestone	SBS2.1
Element	AswSen
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.1.3.8.2 Static View Design

### 3.1.3.8.3 Dynamic View Design

- N/A

### 3.1.3.8.4 Interface Design

No	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/ Units	Description
					Min	Max	Min	Max		
1	calculated_dc_curcompn_spdratio	SWDDS.1.1.3.7	IN	tFrac16	-32768	32767	N/A	N/A	N/A	DC current compensation speed ratio (PU)
2	calculated_dc_curcompn_curratio	SWDDS.1.1.3.8	IN	tFrac16	-32768	32767	N/A	N/A	N/A	DC current compensation q-axis current ratio (PU)
3	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	19660	32767	N/A	N/A	N/A	Speed output of 1st., q-axis current output of 2nd node value in DC Current Compensation LUT(PU)
4	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	19660	32767	N/A	N/A	N/A	Speed output of 1st., q-axis current output of 1st node value in DC Current Compensation LUT(PU)
5	dc_curcompn_	SWDDS.	IN	tFrac16	-32768	32767	N/A	N/A	N/A	Speed output of 1st. node value in DC Current

<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	52

	spd_firstindex	3.6.14.34							Compensation LUT(PU)
6	f16In1	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	N/A
7	f16In2	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	DC current compensation q-axis current ratio (PU)
8	dc_curcompn_spd_firstindex	SWDDS. 3.6.14.32	IN	tFrac16	-32768	32767	N/A	N/A	N/A
9	f16In1	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A
10	f16In2	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A
11	dc_curcompn_first_node	SWDDS. 3.6.14.33	IN	tFrac16	-32768	32767	N/A	N/A	N/A
12	f16In1	SWDDS. 3.6.14.34	OUT	tFrac16	-32768	32767	N/A	N/A	N/A
13	f16In2	SWDDS. 3.6.14.34	OUT	tFrac16	-32768	32767	N/A	N/A	N/A
14	dc_curcompn_spd_secondindex	SWDDS. 3.6.14.34	IN	tFrac16	-32768	32767	N/A	N/A	N/A
15	f16In1	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	53

16	f16In2	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	DC current compensation q-axis current ratio (PU)
17	dc_curcompn_spd_secondindex	SWDDS. 3.6.14.32	IN	tFrac16	-32768	32767	N/A	N/A	N/A	Speed output of 2nd. node value in DC Current Compensation LUT(PU)
18	f16In1	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	Speed output of 2nd., q-axis current output of 1st node value in DC Current Compensation LUT(PU)
19	f16In2	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	Speed output of 2nd. node value in DC Current Compensation LUT(PU)
20	dc_curcompn_second_node	SWDDS. 3.6.14.33	IN	tFrac16	-32768	32767	N/A	N/A	N/A	2nd. node value in DC Current Compensation LUT(PU)
21	f16In1	SWDDS. 3.6.14.34	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	2nd. node value in DC Current Compensation LUT(PU)
22	f16In2	SWDDS. 3.6.14.34	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	1st. node value in DC Current Compensation LUT(PU)
23	calculated_dc_curcompnvalue	SWDDS. 3.6.14.34	IN	tFrac16	-32768	32767	N/A	N/A	N/A	calculated dc current compensation value(PU)
24	f16In1	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	calculated dc current compensation value(PU)
25	f16In2	SWDDS. 3.6.14.32	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	calculated DC current compensation speed ratio
26	calculated_dc_curcompnvalue	SWDDS. 3.6.14.32	IN	tFrac16	-32768	32767	N/A	N/A	N/A	calculated dc current compensation value(PU)
27	f16In1	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	1st. node value in DC Current Compensation LUT(PU)
28	f16In2	SWDDS. 3.6.14.33	OUT	tFrac16	-32768	32767	N/A	N/A	N/A	calculated dc current compensation

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	54

29	dc_curcompnvalue	SWDDS.3.6.14.33	IN	tFrac16	-32768	32767	N/A	N/A	N/A	value(PU)
										dc current compensation value(PU)

### 3.1.4 [SWDDS.1.1.4] DcVolt

#### 3.1.4.1 [SWDDS.1.1.4.1] DcVolt\_Init

##### 3.1.4.1.1 Detailed Design

###### [SWDDS.1.1.4.1] DcVolt\_Init

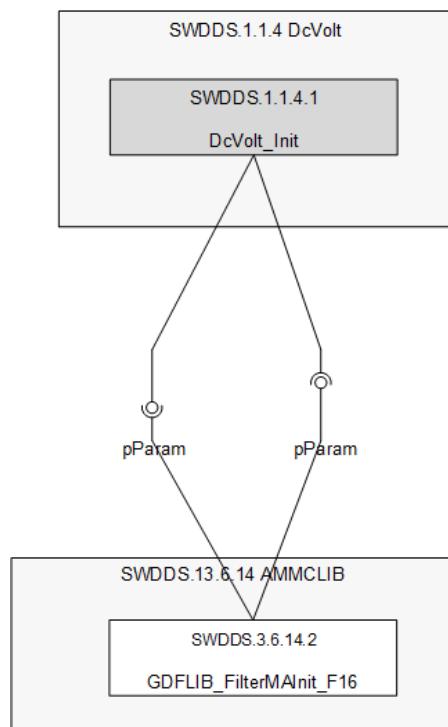
Software Unit Information					
Unit ID	SWDDS.1.1.4.1	Unit Name	DcVolt_Init		
Architecture ID	SWADS.1.1.4.1	ASIL	QM		
Prototype	void DcVolt_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndDcVoltFilt	0 ~ 15	Read/Write	DC driving voltage filtering handle (u16NSamples)
	tBool	g_bDcVoltFirstMeasr	0 ~ 1	Write	DC driving voltage first measurement flag
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16DcVoltFiltNoSmpl	4	Read	Number of samples for moving average filtering of DC driving voltage
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage measurement initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_hndDcVoltFilt.u16NSamples = par_u16DcVoltFiltNoSmpl;     ↓     [SWDDS.3.6.14.2]     GDFLIB_FilterMAInit_F16( &amp;g_hndDcVoltFilt );     ↓     g_bDcVoltFirstMeasr = TRUE;     ↓     end   </pre>				
Called Function	SWDDS.1.1.1 AswSen_Init				
Calling Function	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.4.1
Target Milestone	EBS2
Element	AswSen
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	55

Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.1.4.1.2 Static View Design



### 3.1.4.1.3 Dynamic View Design

- N/A

### 3.1.4.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.4.2 [SWDDS.1.1.4.2] DcVolt\_Measr

#### 3.1.4.2.1 Detailed Design

##### [SWDDS.1.1.4.2] DcVolt\_Measr

Software Unit Information					
Unit ID	SWDDS.1.1.4.2	Unit Name	DcVolt_Measr		
Architecture ID	SWADS.1.1.4.2	ASIL	QM		
Prototype	void DcVolt_Measr( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A

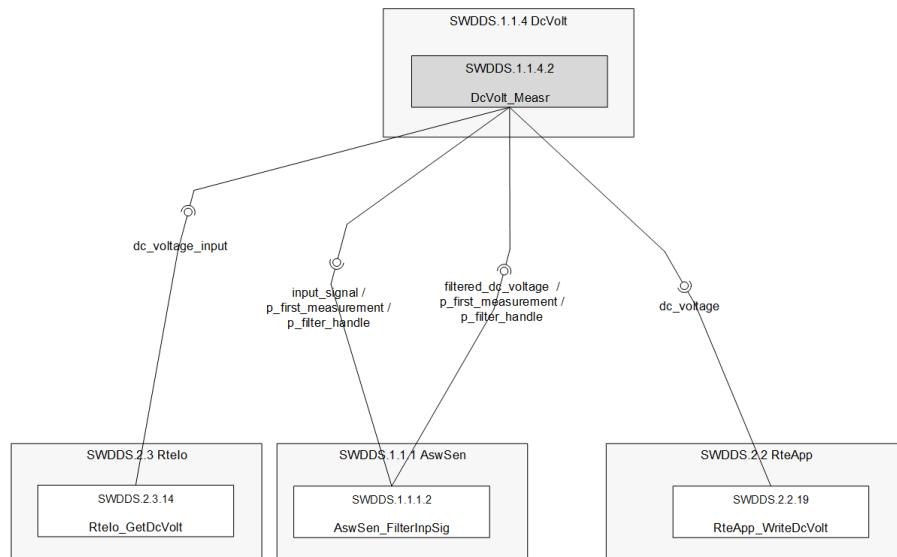
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	56

Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndDcVoltFilt	-2147483648 ~ 2147483647	Read/Write	DC driving voltage filtering handle (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage measurement – DC driving voltage getting – DC driving voltage filtering – Application data updating				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 dc_voltage_input,     filtered_dc_voltage;     ↓     [SWDDS.2.3.14]     dc_voltage_input = Rtel0_GetDcVolt();     ↓     [SWDDS.1.1.1.2]     filtered_dc_voltage = AswSen_FilterInpSig( dc_voltage_input,     &amp;g_bDcVoltFirstMeasr, &amp;g_hndDcVoltFilt );     ↓     [SWDDS.2.2.19]     RteApp_WriteDcVolt( filtered_dc_voltage );     ↓     end   </pre>				
Called Function	SWDDS.2.1.9 RteSch_Task10ms				
Calling Function	SWDDS.2.3.14 Rtel0_GetDcVolt				
	SWDDS.1.1.1.2 AswSen_FilterInpSig				
Function Execution Time	SWDDS.2.2.19 RteApp_WriteDcVolt				
	N/A				

Requirement Id	SWDDS.1.1.4.2
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	57

### 3.1.4.2.2 Static View Design



### 3.1.4.2.3 Dynamic View Design

- N/A

### 3.1.4.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	dc_voltage_input	SWDDS.2.3.14	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC driving voltage input (PU)
2	filtered_dc_voltage	SWDDS.1.1.1.2	IN	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	Filtered DC driving voltage (PU)
3	input_signal	SWDDS.1.1.1.2	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	input signal for filtering
4	p_first_measurement	SWDDS.1.1.1.2	IN/OUT	tBool*	0	1	Normal filtering	First filtering	True / False	first measurement flag pointer
5	p_filter_handle	SWDDS.1.1.1.2	IN/OUT	GDFLIB_FILTER_MA_T_F16*	N/A	N/A	N/A	N/A	N/A	filter handler pointer
6	dc_voltage	SWDDS.2.2.19	OUT	tFrac16	0	32767	0.0	25.3992	0.000775146 / Vpk	DC link voltage (PU)

## 3.1.5 [SWDDS.1.1.5] McuSta

### 3.1.5.1 [SWDDS.1.1.5.1] McuSta\_Init

#### 3.1.5.1.1 Detailed Design

##### [SWDDS.1.1.5.1] McuSta\_Init

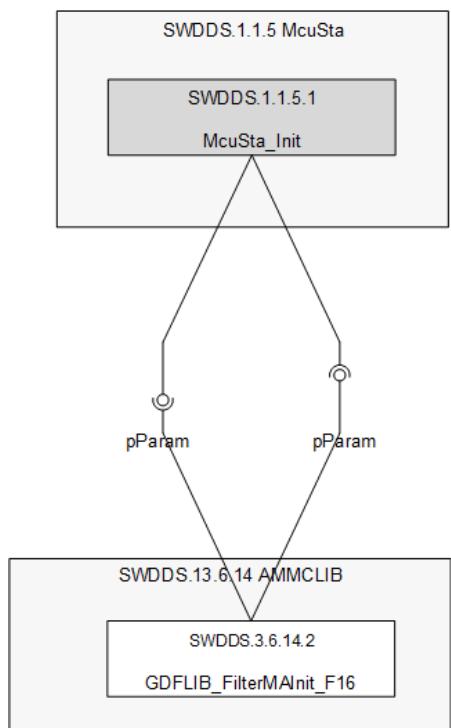
Software Unit Information					
Unit ID	SWDDS.1.1.5.1		Unit Name	McuSta_Init	
Architecture ID	SWADS.1.1.5.1		ASIL	QM	
Prototype	void McuSta_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description

Parameters	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndMcuStaBatVoltFilt	0 ~ 15	Read/Write	Battery voltage filtering handler (u16NSamples)
	tBool	g_bMcuStaBatVoltFirstMeasr	0 ~ 1	Write	Battery voltage first measurement flag
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16McuStaBatVoltFiltNoSmpl	4	Read	Number of samples for moving average filtering battery voltage
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	MCU status checking initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [g_hndMcuStaBatVoltFilt.u16NSamples = par_u16McuStaBatVoltFiltNoSmpl;]     ↓     [SWDDS.3.6.14.2]     [GDFLIB_FilterMAInit_F16( &amp;g_hndMcuStaBatVoltFilt );]     ↓     [g_bMcuStaBatVoltFirstMeasr = TRUE;]     ↓     end   </pre>				
Called Function	SWDDS.1.1.1.1 AswSen_Init				
Calling Function	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.5.1
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 3.1.5.1.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	59



### 3.1.5.1.3 Dynamic View Design

- N/A

### 3.1.5.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.5.2 [SWDDS.1.1.5.2] McuSta\_Chk

#### 3.1.5.2.1 Detailed Design

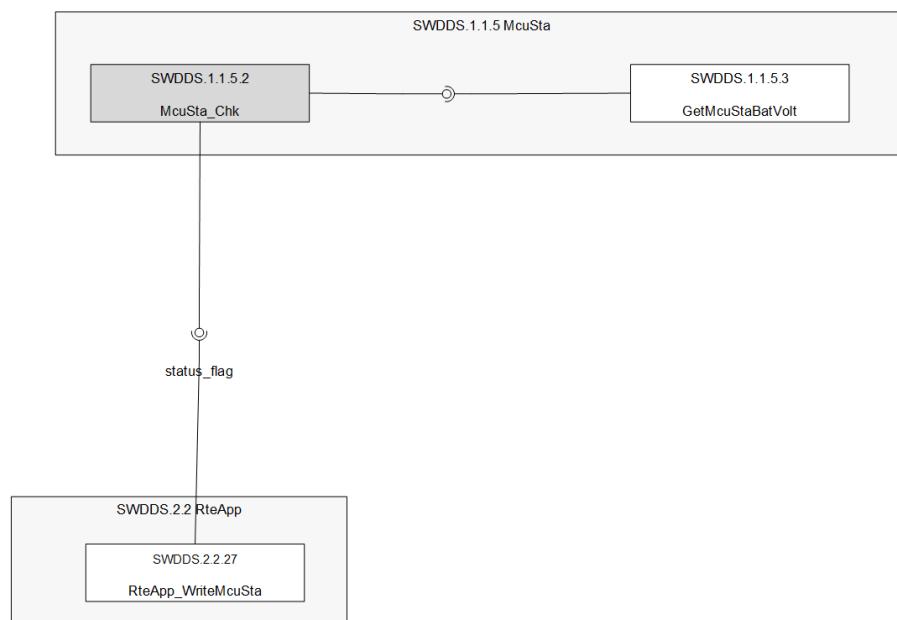
##### [SWDDS.1.1.5.2] McuSta\_Chk

Software Unit Information					
Unit ID	SWDDS.1.1.5.2	Unit Name	McuSta_Chk		
Architecture ID	SWADS.1.1.5.2	ASIL	QM		
Prototype	void McuSta_Chk( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

Description	MCU status checking – Battery voltage getting – MCU status checking – Application data updating
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tU32 checking_flag = 0x00000000uL;     ↓     [SWDDS.1.1.5.3] GetMcuStaBatVolt();     ↓     [SWDDS.2.2.27] RteApp_WriteMcuSta( checking_flag );     ↓     end   </pre>
Called Function	SWDDS.2.1.10 RteSch_Task20ms
Calling Function	SWDDS.1.1.5.3 GetMcuStaBatVolt SWDDS.2.2.27 RteApp_WriteMcuSta
Function Execution Time	N/A

Requirement Id	SWDDS.1.1.5.2
Target Milestone	EBS2
Element	AswSen
Risk	Low
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.1.5.2.2 Static View Design



### 3.1.5.2.3 Dynamic View Design

- N/A

### 3.1.5.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	status_flag	SWDDS.2.2.27	OUT	tU32	0	134217728	0x00000000	0x08000000	N/A	Checking flag

### 3.1.5.3 [SWDDS.1.1.5.3] GetMcuStaBatVolt

#### 3.1.5.3.1 Detailed Design

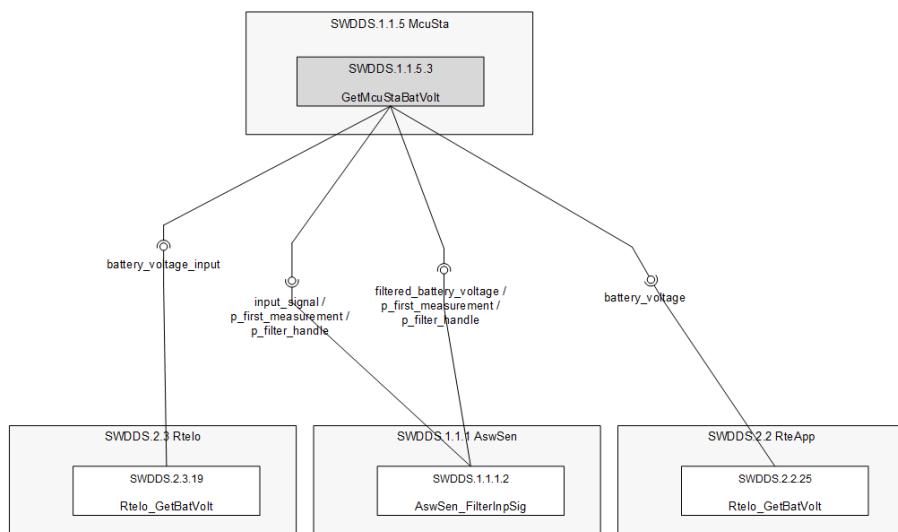
##### [SWDDS.1.1.5.3] GetMcuStaBatVolt

Software Unit Information					
Unit ID	SWDDS.1.1.5.3		Unit Name	GetMcuStaBatVolt	
Architecture ID	SWADS.1.1.5.3		ASIL	QM	
Prototype	void GetMcuStaBatVolt( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bMcuStaBatVoltFirstMeasr	0 ~ 1	Read/Write	Battery voltage first measurement flag
	GDFLIB_FILTER_MA_T_F16	g_hndMcuStaBatVoltFilt	-2147483648 ~ 2147483647	Read/Write	Battery voltage filtering handler (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage getting and filtering - Battery voltage getting - Battery voltage filtering - Application data updating				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 battery_voltage_input,     filtered_battery_voltage;     ↓     [SWDDS.2.3.19]     battery_voltage_input = Rtelo_GetBatVolt();     ↓     [SWDDS.1.1.1.2]     filtered_battery_voltage = AswSen_FilterInpSig( battery_voltage_input,     &amp;g_bMcuStaBatVoltFirstMeasr, &amp;g_hndMcuStaBatVoltFilt );     ↓     [SWDDS.2.2.25]     RteApp_WriteBatVolt( filtered_battery_voltage );     ↓     end   </pre>				
Called Function	SWDDS.1.1.5.2 McuSta_Chk				
	SWDDS.2.3.19 Rtelo_GetBatVolt				

Calling Function	SWDDS.1.1.1.2 AswSen_FilterInpSig SWDDS.2.2.25 RteApp_WriteBatVolt
Function Execution Time	N/A

Requirement Id	SWDDS.1.1.5.3
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.1.5.3.2 Static View Design



### 3.1.5.3.3 Dynamic View Design

- N/A

### 3.1.5.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	battery_voltage_input	SWDDS.2.3.19	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage input (PU)
2	filtered_battery_voltage	SWDDS.1.1.1.2	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Filtered battery voltage (PU)
3	input_signal	SWDDS.1.1.1.2	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	input signal for filtering
4	p_first_measurement	SWDDS.1.1.1.2	IN/OUT	tBool*	0	1	Normal filtering	First filtering	True / False	first measurement flag pointer
5	p_filter_handle	SWDDS.1.1.1.2	IN/OUT	GDFLIB_FILTER_MA_T_F16*	N/A	N/A	N/A	N/A	N/A	filter handler pointer
	battery								0.000900269 /	Filtered battery voltage

<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	63

6	_voltage	SWDDS.2.2.25	OUT	tFrac16	0	32767	0.0	29.4991	Vpk	(PU)
---	----------	--------------	-----	---------	---	-------	-----	---------	-----	------

### 3.1.6 [SWDDS.1.1.6] MtrSpd

#### 3.1.6.1 [SWDDS.1.1.6.1] MtrSpd\_Init

##### 3.1.6.1.1 Detailed Design

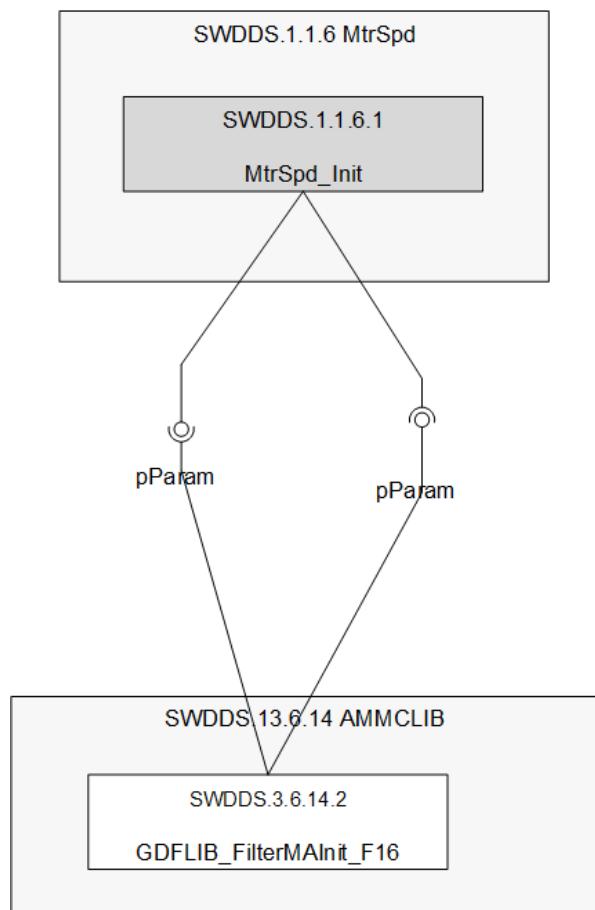
##### [SWDDS.1.1.6.1] MtrSpd\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.6.1		Unit Name	MtrSpd_Init	
Architecture ID	SWADS.1.1.6.1		ASIL	QM	
Prototype	void MtrSpd_Init( void )				
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndMtrSpdOutFilt	0 ~ 15	Read/Write	Motor speed output filtering handler (u16NSamples)
	GDFLIB_FILTER_MA_T_F16	g_hndMtrSpdRpmFilt	0 ~ 15	Read/Write	Motor speed rpm filtering handler (u16NSamples)
	tFrac16	g_f16MtrSpdFilt	-32768 ~ 32767	Write	Filtered motor speed (PU)
	tBool	g_bMtrSpdFirstMeasr	0~1 (FALSE, TRUE)	Write	Motor speed first measurement flag
	tEopState	g_eMtrSpdPrevEopState	0~4 (EOP_STATE_DISABLED, EOP_STATE_MAX_SPD, EOP_STATE_SPD_CHG, EOP_STATE_CUR_FILT, EOP_STATE_CUR_LMT)	Write	Previous EOP control state
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16MtrSpdOutFiltNoSmpl	2	Write	Number of samples for moving average filtering of motor speed output
Registers	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16MtrSpdRpmFiltNoSmpl	4	Write	Number of samples for moving average filtering of motor speed rpm
Description	Motor speed measurement initialization				
Control Flow Diagram					

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_hndMtrSpdRpmFilt.u16NSamples = par_u16MtrSpdOutFiltNoSmpl;     ↓     [SWDDS.3.6.14.2]     GDFLIB_FilterMAInit_F16( &amp;g_hndMtrSpdOutFilt );     ↓     g_hndMtrSpdRpmFilt.u16NSamples = par_u16MtrSpdRpmFiltNoSmpl;     ↓     [SWADS.3.6.14.2]     GDFLIB_FilterMAInit_F16( &amp;g_hndMtrSpdRpmFilt );     ↓     g_f16MtrSpdFilt = FRAC16( 0.0f );     g_bMtrSpdFirstMeasr = TRUE;     g_eMtrSpdPrevEopState = EOP_STATE_DISABLED;     ↓     end   </pre>
	SWDDS.1.1.1.1 AswSen_Init
	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16
	N/A

Requirement Id	SWDDS.1.1.6.1
Target Milestone	SBS1
Element	AswSen
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.1.6.1.2 Static View Design



### 3.1.6.1.3 Dynamic View Design

- N/A

### 3.1.6.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.6.2 [SWDDS.1.1.6.2] MtrSpd\_Measr

#### 3.1.6.2.1 Detailed Design

#### [SWDDS.1.1.6.2] MtrSpd\_Measr

Software Unit Information					
Unit ID	SWDDS.1.1.6.2	Unit Name		MtrSpd_Measr	
Architecture ID	SWADS.1.1.6.2	ASIL		QM	
Prototype	void MtrSpd_Measr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	66

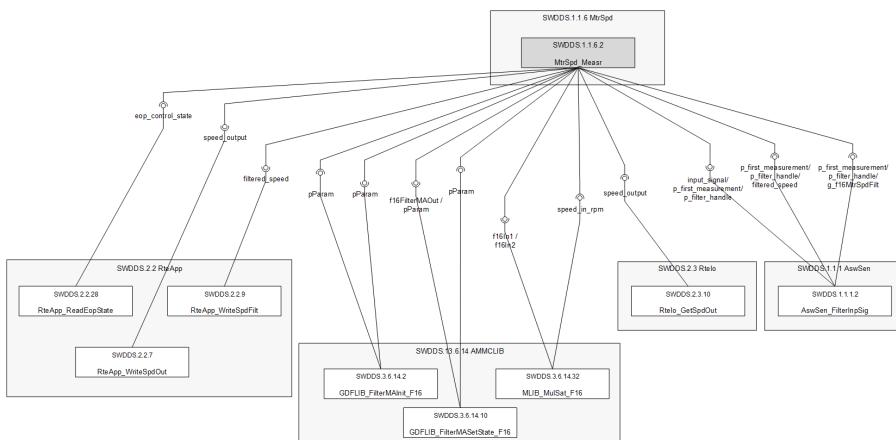
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
Global Variables	tEopState	g_eMtrSpdPrevEopState	0~4 (EOP_STATE_DISABLED, EOP_STATE_MAX_SPD, EOP_STATE_SPD_CHG, EOP_STATE_CUR_FILT, EOP_STATE_CUR_LMT)	Read/Write	Previous EOP control state
	GDFLIB_FILTER_MA_T_F16	g_hndMtrSpdRpmFilt	-2147483648 ~ 2147483647	Read/Write	Motor speed rpm filtering handler (f32Acc)
	tFrac16	g_f16MtrSpdFilt	-32768 ~ 32767	Write	Filtered motor speed (PU)
	tBool	g_bMtrSpdFirstMeasr	0~1 (FALSE, TRUE)	Read/Write	Motor speed first measurement flag
	GDFLIB_FILTER_MA_T_F16	g_hndMtrSpdOutFilt	-2147483648 ~ 2147483647	Read/Write	Motor speed output filtering handler (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16MtrSpdRpmFiltNoSmpl	4	Read	Number of samples for moving average filtering of motor speed rpm
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor speed measurement - Filtering coefficient setting - Speed output getting and filtering - Speed filtering and unit conversion				

Control Flow  
Diagram  
(or Pseudo  
Code)

Control Flow Diagram (or Pseudo Code)	<p>VW AQ EOP</p> <p>Baseline / Version / Date</p> <p>Updated Date Page</p> <p>003 2021-06-30 67</p>		
	<pre> graph TD     Start((start)) --&gt; Init["tEopState eop_control_state; tFract16 speed_output; filtered_speed; t16 speed_in_rpm;"]     Init --&gt; ReadEopState["[SWDDS.2.2.28] eop_control_state = RteApp_ReadEopState();"]     ReadEopState --&gt; Cond1{eop_control_state == EOP_STATE_CUR_LMT &amp;&amp; g_eMtrSpdPrevEopState != EOP_STATE_CUR_LMT}     Cond1 -- yes --&gt; Update1["g_hndMtrSpdRpmFilt.u16NSamples = par_u16MtrSpdRpmFitNoSmpl;"]     Update1 --&gt; InitF16_1["[SWDDS.3.6.14.2] GDFLIB_FilterMAInit_F16(&amp;g_hndMtrSpdRpmFilt);"]     InitF16_1 --&gt; SetState1["[SWDDS.3.6.14.10] GDFLIB_FilterMASetState_F16(g_f16MtrSpdFilt, &amp;g_hndMtrSpdRpmFilt);"]     Cond1 -- no --&gt; Update2["g_hndMtrSpdRpmFilt.u16NSamples = par_u16MtrSpdRpmFitNoSmpl + MTR_SPD_FILTER_NO_SMPL_STABLE;"]     Update2 --&gt; InitF16_2["[SWDDS.3.6.14.2] GDFLIB_FilterMAInit_F16(&amp;g_hndMtrSpdRpmFilt);"]     InitF16_2 --&gt; SetState2["[SWDDS.3.6.14.10] GDFLIB_FilterMASetState_F16(g_f16MtrSpdFilt, &amp;g_hndMtrSpdRpmFilt);"]     Update1 --&gt; EopStateUpdate["g_eMtrSpdPrevEopState = eop_control_state;"]     EopStateUpdate --&gt; SpeedOutput["[SWDDS.2.3.10] speed_output = RteIo_GetSpdOut();"]     SpeedOutput --&gt; FilterInpSig["[SWDDS.1.1.1.2] filtered_speed = AswSen_FilterInpSig(speed_output, &amp;g_bMtrSpdFirstMeas, &amp;g_hndMtrSpdOutFilt);"]     FilterInpSig --&gt; WriteSpdOut["[SWDDS.2.2.7] RteApp_WriteSpdOut(filtered_speed);"]     WriteSpdOut --&gt; FilterF16["[SWDDS.1.1.1.2] g_f16MtrSpdFilt = AswSen_FilterInpSig(speed_output, &amp;g_bMtrSpdFirstMeas, &amp;g_hndMtrSpdRpmFilt);"]     FilterF16 --&gt; MulSat["[SWDDS.3.6.14.32] speed_in_rpm = MLIB_MulSat_F16(g_f16MtrSpdFilt, (t16)PARAM_PU_BASE_MECH_SPD);"]     MulSat --&gt; WriteSpdFilt["[SWDDS.2.2.9] RteApp_WriteSpdFilt(speed_in_rpm);"]     WriteSpdFilt --&gt; End((end)) </pre>		
	SWDDS.2.1.7 RteSch_Task1ms		
	SWDDS.2.2.28 RteApp_ReadEopState		
	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16		
	SWDDS.3.6.14.10 GDFLIB_FilterMASetState_F16		
	SWDDS.2.3.10 RteIo_GetSpdOut		
	SWDDS.1.1.1.2 AswSen_FilterInpSig		
	SWDDS.2.2.7 RteApp_WriteSpdOut		
	SWDDS.3.6.14.32 MLIB_MulSat_F16		
	SWDDS.2.2.9 RteApp_WriteSpdFilt		
Called Function	N/A		
Calling Function			
Function Execution Time			

Requirement Id	SWDDS.1.1.6.2
Target Milestone	SBS1
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.1.6.2.2 Static View Design



### 3.1.6.2.3 Dynamic View Design

- N/A

### 3.1.6.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
1	eop_control_state	SWDDS.2.2.28	IN	tEopState	0	4	EOP_STATE_DISABLED	EOP_STATE_CUR_LMT	N/A	EOP control state
2	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
3	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output (PU)
4	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER_MA_T_F16*	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
5	speed_output	SWDDS.2.3.10	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Motor speed input (PU)
6	filtered_speed	SWDDS.1.1.1.2	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered motor speed (PU)
7	input_signal	SWDDS.1.1.1.2	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	input signal for filtering

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	69

8	p_first_measurement	SWDDS .1.1.1.2	IN/OUT	tBool*	0	1	Normal filtering	First filtering	True / False	first measurement flag pointer
9	p_filter_handle	SWDDS .1.1.1.2	IN/OUT	GDFLIB _FILTER _MA_T _F16*	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
10	g_f16MtrSpdFilt	SWDDS .1.1.1.2	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered motor speed (PU)
11	speed_output	SWDDS .2.2.7	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered motor speed (PU)
12	f16In1	SWDDS .3.6.14.32	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered motor speed (PU)
13	f16In2	SWDDS .3.6.14.32	OUT	tFrac16	6000.0	6000.0	6000.0	6000.0	rpm	Mechanical speed base value
14	speed_in_rpm	SWDDS .3.6.14.32	IN	ts16	-6000	6000	-6000	6000	1 / rpm	Unit converted speed (rpm)
15	filtered_speed	SWDDS .2.2.9	OUT	ts16	-6000	6000	-6000	6000	1 / rpm	filtered_speed: filtered speed (rpm)

### 3.1.7 [SWDDS.1.1.7] MtrTrq

#### 3.1.7.1 [SWDDS.1.1.7.1] MtrTrq\_Init

##### 3.1.7.1.1 Detailed Design

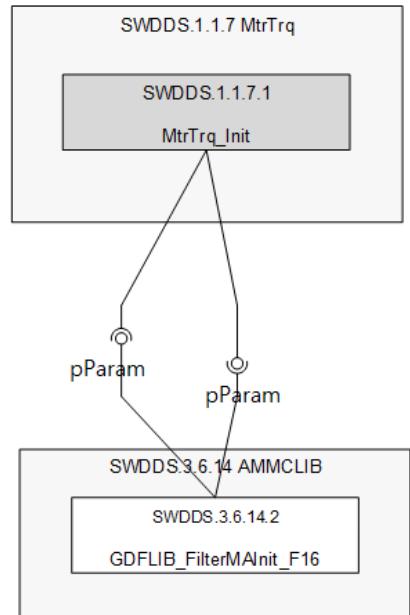
###### [SWDDS.1.1.7.1] MtrTrq\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.7.1		Unit Name	MtrTrq_Init	
Architecture ID	SWADS.1.1.7.1		ASIL	QM	
Prototype	void MtrTrq_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndMtrTrqFilt	0 ~ 15	Read/Write	Motor torque filtering handler (u16NSamples)
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16MtrTrqFiltNoSmpl	5	Read	Number of samples for moving average filtering of motor torque
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor torque calculation initialization				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     g_hndMtrTrqFilt.u16NSamples = par_u16MtrTrqFiltNoSmpl;     [SWDDS.3.6.14.2]     GDFLIB_FilterMAInit_F16(&amp;g_hndMtrTrqFilt);     end   </pre>
	Called Function SWDDS.1.1.1.1 AswSen_Init
	Calling Function SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16
	Function Execution Time N/A

Requirement Id	SWDDS.1.1.7.1
Target Milestone	EBS2
Element	AswSen
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.1.7.1.2 Static View Design



	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	71

### 3.1.7.1.3 Dynamic View Design

- N/A

### 3.1.7.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.7.2 [SWDDS.1.1.7.2] MtrTrq\_Cal

#### 3.1.7.2.1 Detailed Design

##### [SWDDS.1.1.7.2] MtrTrq\_Cal

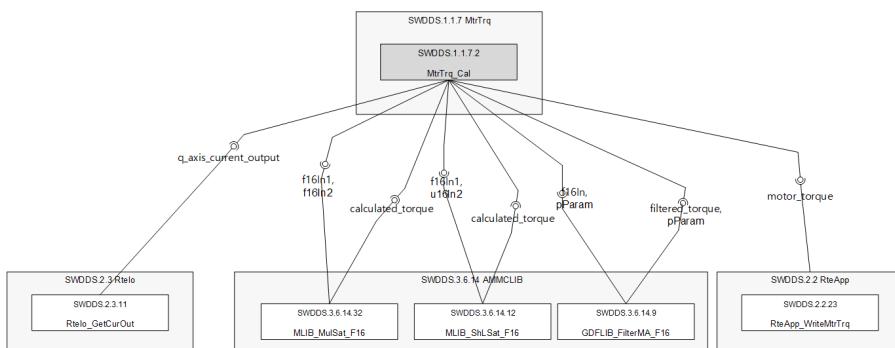
Software Unit Information					
Unit ID	SWDDS.1.1.7.2		Unit Name	MtrTrq_Cal	
Architecture ID	SWADS.1.1.7.2		ASIL	QM	
Prototype			void MtrTrq_Cal( void )		
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	GDFLIB_FILTER_MA_T_F16	g_hndMtrTrqFilt	-2147483648 ~ 2147483647	Read/Write	Motor torque filtering handler (f32Acc)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16MtrTrqConst	21662.42	Read	Motor torque constant (current range x2 Nm/Apk)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor torque calculation - q-axis current output getting - Motor torque calculation and filtering - Application data updating				

Control Flow Diagram  
(or Pseudo Code)

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     tFrac16 q_axis_current_output,     calculated_torque,     filtered_torque;      ↓     [SWDDS.2.3.11]     q_axis_current_output = Rtelo_GetCurOut();      ↓     [SWDDS.3.6.14.32]     calculated_torque = MLIB_MulSat_F16(         par_f16MtrTrqConst, q_axis_current_output);      ↓     [SWDDS.3.6.14.12]     calculated_torque = MLIB_ShLSat_F16(         calculated_torque, 1u);      ↓     [SWDDS.3.6.14.9]     filtered_torque = GDFLIB_FilterMA_F16(         calculated_torque, &amp;g_hndMtrTrqFilt);      ↓     [SWDDS.2.2.23]     RteApp_WriteMtrTrq( filtered_torque );      ↓     end   </pre>	
	Called Function	SWDDS.2.1.10 RteSch_Task20ms
	Calling Function	SWDDS.2.3.11 Rtelo_GetCurOut
		SWDDS.3.6.14.32 MLIB_MulSat_F16
		SWDDS.3.6.14.12 MLIB_ShLSat_F16
		SWDDS.3.6.14.9 GDFLIB_FilterMA_F16
		SWDDS.2.2.23 RteApp_WriteMtrTrq
Function Execution Time	N/A	

Requirement Id	SWDDS.1.1.7.2
Target Milestone	EBS2
Element	AswSen
Risk	▣ Mid
Interoperability	No
Criticality	▣ Mid
Technical complexity	▣ Mid
Verifiability	Yes

### 3.1.7.2.2 Static View Design



### 3.1.7.2.3 Dynamic View Design

- N/A

### 3.1.7.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	q_axis_current_output	SWDDS.2.3.11	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	( 0.0205 * PARAM_PU _BASE_PHS _CUR / 2.0f )		0.0103		Nm/Apk	Torque constant
3	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
4	calculated_torque	SWDDS.3.6.14.32	IN	tFrac16	-32768	32767	-0.5	0.4999845	0.0000152588 / Nm	Calculated motor torque (Nm)
5	f16In1	SWDDS.3.6.14.12	OUT	tFrac16	-32768	32767	-0.5	0.4999845	0.0000152588 / Nm	Calculated motor torque (Nm)
6	u16In2	SWDDS.3.6.14.12	OUT	tU16	1		1		N/A	Bit shift
7	calculated_torque	SWDDS.3.6.14.12	IN	tFrac16	-32768	32767	-1.0	0.999969	0.0000305176 / Nm	Calculated motor torque (Nm)
8	f16In	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	-1.0	0.999969	0.0000305176 / Nm	Calculated motor torque (Nm)
9	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB _FILTER _MA_T _F16*	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
10	filtered_torque	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-1.0	0.999969	0.0000305176 / Nm	Filtered motor torque (Nm)
11	motor	SWDDS.2.2.23	OUT	tFrac16	-32768	32767	-1.0	0.999969	0.0000305176 / Nm	Filtered motor

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	74

\_torque

torque  
(Nm)

### 3.1.8 [SWDDS.1.1.8] ReqMsg

#### 3.1.8.1 [SWDDS.1.1.8.1] ReqMsg\_Init

##### 3.1.8.1.1 Detailed Design

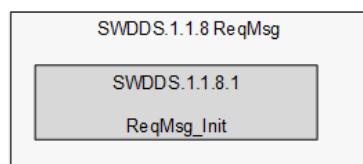
###### [SWDDS.1.1.8.1] ReqMsg\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.8.1	Unit Name	ReqMsg_Init		
Architecture ID	SWADS.1.1.8.1	ASIL	QM		
Prototype	void ReqMsg_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16ReqMsgTgtSpd	0 ~ 5100	Write	Target speed input (rpm)
	tU16	g_u16ReqMsgTimOutCnt	0 ~ 60000	Write	RX message time-out count
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Request message sending initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [ g_s16ReqMsgTgtSpd = 0;       g_u16ReqMsgTimOutCnt = 0; ]     ↓     end   </pre>				
Called Function	SWDDS.1.1.1.1 AswSen_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.8.1
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	75

### 3.1.8.1.2 Static View Design



### 3.1.8.1.3 Dynamic View Design

- N/A

### 3.1.8.1.4 Interface Design

- N/A

## 3.1.8.2 [SWDDS.1.1.8.2] ReqMsg\_Recv

### 3.1.8.2.1 Detailed Design

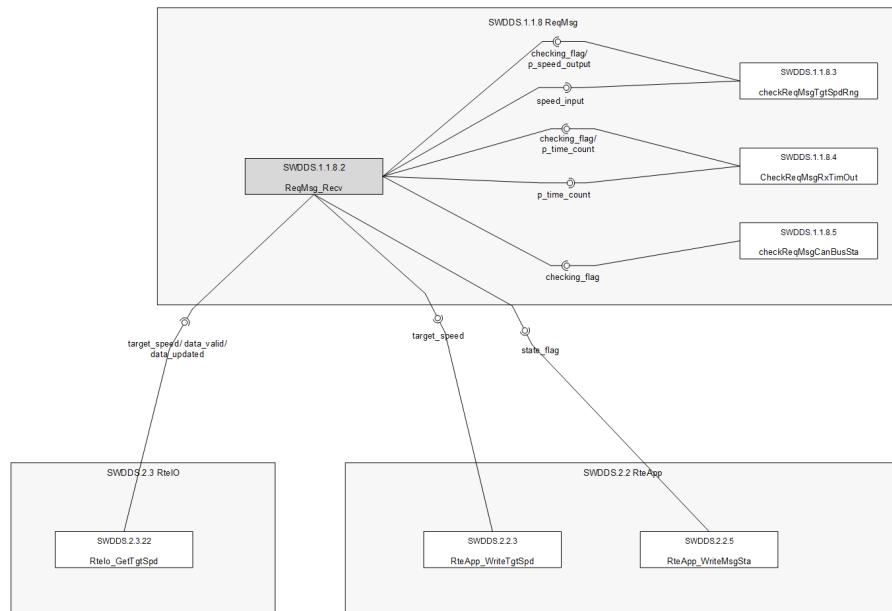
#### [SWDDS.1.1.8.2] ReqMsg\_Recv

Software Unit Information					
Unit ID	SWDDS.1.1.8.2	Unit Name	ReqMsg_Recv		
Architecture ID	SWADS.1.1.8.2	ASIL	QM		
Prototype	void ReqMsg_Recv( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
void		N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tS16	g_s16ReqMsgTgtSpd	0 ~ 5100	Read/Write	Target speed input (rpm)
	tU16	g_u16ReqMsgTimOutCnt	0 ~ 60000	Read/Write	RX message time-out count
Parameters	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
N/A	N/A	N/A	N/A	N/A	N/A
Description	Request message receiving - Target speed input getting - Speed range checking and time-out checking - CAN bus status checking - Application data updating				

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre> start     tU16 checking_flag = 0x0000u;     tS16 target_speed;     tBool data_valid,     data_updated;      [SWDDS.2.3.22]     data_updated = RteLo_GetTgtSpd( &amp;target_speed, &amp;data_valid );      if( data_updated != FALSE )         if( data_valid != FALSE )             checking_flag  = MSG_STA_RX_CRC_ERR;              [SWDDS.1.1.8.3]             checking_flag  = CheckReqMsgTgtSpdRng(                 target_speed, &amp;g_s16ReqMsgTgtSpd );              if( CONFIG_PARAMETER_ADJUST == DISABLE )                 [SWDDS.1.1.8.4]                 checking_flag  = CheckReqMsgRxTimOut(                     &amp;g_u16ReqMsgTimOutCnt );                 g_u16ReqMsgTimOutCnt = 0u;              [SWDDS.1.1.8.5]             checking_flag  = CheckReqMsgCanBusSta();              [SWDDS.2.2.3]             RteApp_WriteTgtSpd(g_s16ReqMsgTgtSpd);              [SWDDS.2.2.5]             RteApp_WriteMsgSta( checking_flag );         end     end end </pre>	
	Called Function	SWDDS.2.1.9 RteSch_Task10ms
	Calling Function	SWDDS.2.3.22 RteLo_GetTgtSpd
		SWDDS.1.1.8.3 CheckReqMsgTgtSpdRng
		SWDDS.1.1.8.4 CheckReqMsgRxTimOut
		SWDDS.1.1.8.5 CheckReqMsgCanBusSta
		SWDDS.2.2.3 RteApp_WriteTgtSpd
		SWDDS.2.2.5 RteApp_WriteMsgSta
Function Execution Time	N/A	

Requirement Id	SWDDS.1.1.8.2
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.1.8.2.2 Static View Design



### 3.1.8.2.3 Dynamic View Design

- N/A

### 3.1.8.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/Units	Description
					Min	Max	Min	Max		
1	target_speed	SWDDS.2.3.22	IN	tS16*	0	5100	0	5100	1 / rpm	Target speed (rpm)
2	data_valid	SWDDS.2.3.22	IN	tBool*	0	1	Data invalid	Data valid	True / False	Data validity
3	data_updated	SWDDS.2.3.22	IN	tBool	0	1	Did not updated	Data updated	True / False	Data updated status
4	speed_input	SWDDS.1.1.8.3	OUT	tS16	0	5100	0	5100	1 / rpm	Target speed (rpm)
5	p_speed_output	SWDDS.1.1.8.3	IN	tS16*	0	3200	0	3200	1 / rpm	Target speed input (rpm)
6	checking_flag	SWDDS.1.1.8.3	IN	tU16	0	2	0x0000	0x0002	N/A	Checking flag
7	p_time_count	SWDDS.1.1.8.4	IN/OUT	tU16*	0	60000	0	60000	1 / msec	RX message time-out count
8	checking_flag	SWDDS.1.1.8.4	IN	tU16	0	32	0x0000	0x0020	N/A	Checking flag
9	checking_flag	SWDDS.1.1.8.5	IN	tU16	0	45056	0x0000	0xb000	N/A	Checking flag
10	target_speed	SWDDS.2.2.3	OUT	tS16	0	3200	0	3200	1 / rpm	Target speed input (rpm)
11	state_flag	SWDDS.2.2.5	OUT	tU16	0	65535	0x0000	0xffff	N/A	Checking flag

### 3.1.8.3 [SWDDS.1.1.8.3] CheckReqMsgTgtSpdRng

### 3.1.8.3.1 Detailed Design

#### [SWDDS.1.1.8.3] CheckReqMsgTgtSpdRng

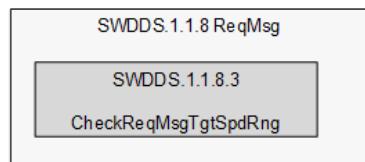
Software Unit Information					
Unit ID	SWDDS.1.1.8.3	Unit Name	CheckReqMsgTgtSpdRng		
Architecture ID	SWADS.1.1.8.3	ASIL	QM		
Prototype	<pre>tU16 CheckReqMsgTgtSpdRng(     tS16 speed_input,     tS16* p_speed_output )</pre>				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tS16	speed_input	0 ~ 5100	IN	target speed input (rpm)
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 2		Checking flags	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tS16	par_s16ReqMsgSpdOvrThrs	3200	Read	Target speed range over threshold (rpm)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Target speed range checking and range limiting				
Control Flow Diagram (or Pseudo Code)	<pre> start tU16 checking_flag = 0x0000u; if speed_input &gt; par_s16ReqMsgSpdOvrThrs then     if speed_input &lt; par_s16ReqMsgSpdUndThrs then         *p_speed_output = speed_input;         *p_speed_output = par_s16ReqMsgSpdUndThrs;         checking_flag  = MSG_STA_TGT_SPD_UND;     else         *p_speed_output = par_s16ReqMsgSpdOvrThrs;         checking_flag  = MSG_STA_TGT_SPD_OVR;     end if; else     *p_speed_output = speed_input; end if; return checking_flag;</pre>				
Called Function	SWDDS.1.1.8.2 ReqMsg_Recv				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.8.3
Target Milestone	SBS1
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	79

Verifiability	Yes
---------------	-----

### 3.1.8.3.2 Static View Design



### 3.1.8.3.3 Dynamic View Design

- N/A

### 3.1.8.3.4 Interface Design

- N/A

### 3.1.8.4 [SWDDS.1.1.8.4] CheckReqMsgRxTimOut

#### 3.1.8.4.1 Detailed Design

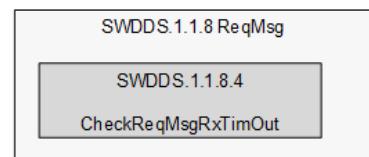
##### [SWDDS.1.1.8.4] CheckReqMsgRxTimOut

Software Unit Information					
Unit ID	SWDDS.1.1.8.4	Unit Name	CheckReqMsgRxTimOut		
Architecture ID	SWADS.1.1.8.4	ASIL	QM		
Prototype	tU16 CheckReqMsgRxTimOut( TU16* p_time_count )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16*	p_time_count	0 ~ 60000	IN/OUT	time count pointer
Function Call Return Value	Data Type	Possible Return Value		Description	
	tU16	0 ~ 32		Checking flags	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16ReqMsgRxTimOut	2000	Read	RX message time-out duration threshold (ms)
	tU16	par_u16ReqMsgRxTimWrn	1000	Read	RX message time warning duration threshold (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Message receiving time-out checking				
Control Flow Diagram					

Control Flow Diagram (or Pseudo Code)	<pre>     start     tU16 checking_flag = 0x0000u;     if (*p_time_count) &lt; 60000u         then (*p_time_count) += REQ_MSG_TIM_INC_PER_STEP;     if (*p_time_count) &gt; par_u16ReqMsgRxTimOut         then checking_flag  = MSG_STA_RX_TIM_OUT;     if (*p_time_count) &gt; par_u16ReqMsgRxTimWrn         then checking_flag  = MSG_STA_RX_TIM_OUT;     return checking_flag;     </pre>	
	Called Function	SWDDS.1.1.8.2 ReqMsg_Recv
	Calling Function	N/A
	Function Execution Time	N/A

Requirement Id	SWDDS.1.1.8.4
Target Milestone	EBS2
Element	AswSen
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

### 3.1.8.4.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	81

### 3.1.8.4.3 Dynamic View Design

- N/A

### 3.1.8.4.4 Interface Design

- N/A

### 3.1.8.5 [SWDDS.1.1.8.5] CheckReqMsgCanBusSta

#### 3.1.8.5.1 Detailed Design

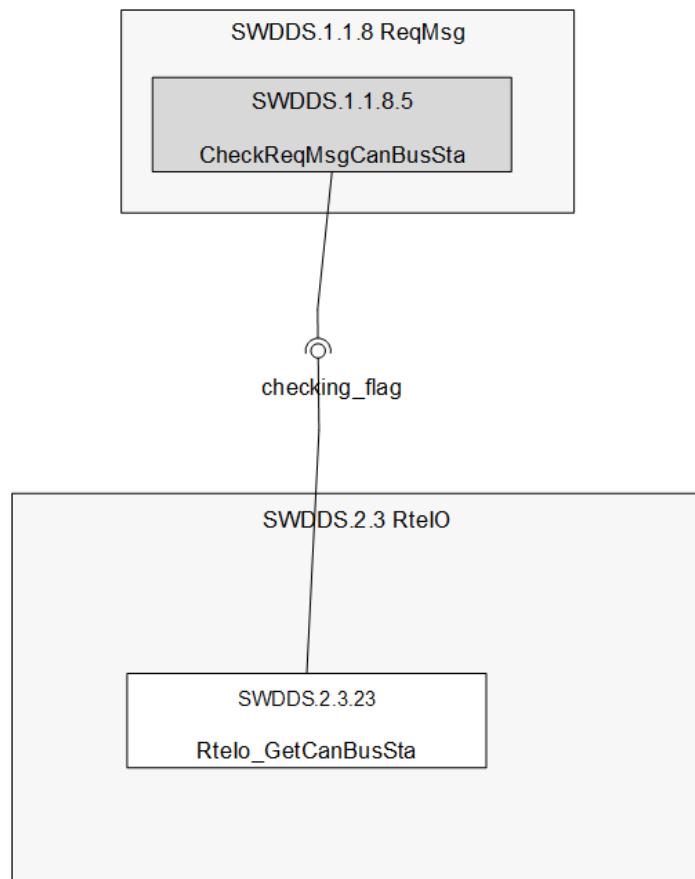
##### [SWDDS.1.1.8.5] CheckReqMsgCanBusSta

Software Unit Information				
Unit ID	SWDDS.1.1.8.5	Unit Name	CheckReqMsgCanBusSta	
Architecture ID	SWADS.1.1.8.5	ASIL	QM	
Prototype	tU16 CheckReqMsgCanBusSta( void )			
Function Call	Data Type	Name	Range	IN/OUT
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description	
Return Value	tU16	0 ~ 45056	Checking flags	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	CAN bus status checking			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tU16 checking_flag;     ↓     [SWDDS.2.3.23]     checking_flag = Rtelo_GetCanBusSta();     ↓     return     checking_flag;   </pre>			
Called Function	SWDDS.1.1.8.2 ReqMsg_Recv			
Calling Function	SWDDS.2.3.23 Rtelo_GetCanBusSta			
Function Execution Time	N/A			

Requirement Id	SWDDS.1.1.8.5
Target Milestone	SBS2.1
Element	AswSen
Risk	<span style="color: green;">Low</span>
Interoperability	No
Criticality	<span style="color: yellow;">Mid</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	82

### 3.1.8.5.2 Static View Design



### 3.1.8.5.3 Dynamic View Design

- N/A

### 3.1.8.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/Units	Description
					Min	Max	Min	Max		
1	checking_flag	SWDDS.2.3.23	IN	tU16	0	45056	0x0000	0xb000	N/A	Checking flag

## 3.1.9 [SWDDS.1.1.9] TempSig

### 3.1.9.1 [SWDDS.1.1.9.1] TempSig\_Init

#### 3.1.9.1.1 Detailed Design

#### [SWDDS.1.1.9.1] TempSig\_Init

Software Unit Information					
Unit ID	SWDDS.1.1.9.1		Unit Name	TempSig_Init	
Architecture ID	SWADS.1.1.9.1		ASIL	QM	
Prototype	void TempSig_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	

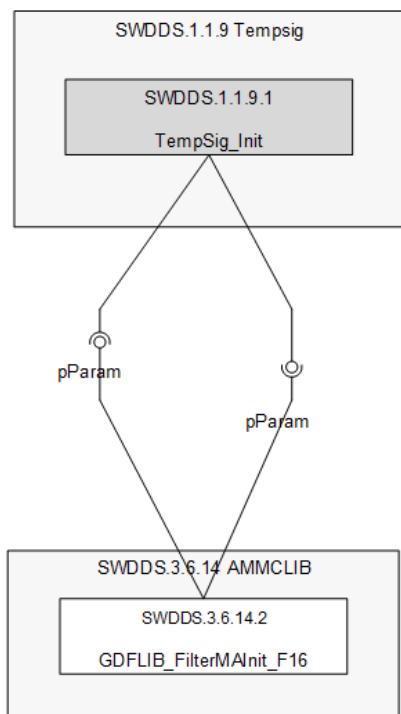
<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-06-30
			Page	83	

	Data Type	Name	Range	Read/Write	Description
Global Variables	GDFLIB_FILTER_MA_T_F16	g_hndTempSigPcbTempFilt	0 ~ 15	Read/Write	PCB temperature filtering handler (u16NSamples)
	tBool	g_bTempSigPcbTempFirstMeasr	0~1, FALSE / TRUE	Write	PCB temperature first measurement flag
Parameters	Data Type	Name	Range	Read/Write	Description
	tu16	par_u16TempPcbFiltNoSmpl	5	Read	Number of samples for moving average filtering PCB temperature
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Temperature signal measurement initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_hndTempSigPcbTempFilt.u16NSamples =         par_u16TempPcbFiltNoSmpl;     ↓     [SWDDS.3.6.14.2]     GDFLIB_FilterMAInit_F16(         &amp;g_hndTempSigPcbTempFilt );     ↓     g_bTempSigPcbTempFirstMeasr = TRUE;     ↓     end   </pre>				
Called Function	SWDDS.1.1.1.1 AswSen_Init				
Calling Function	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.1.9.1
Target Milestone	EBS2
Element	AswSen
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 3.1.9.1.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	84



### 3.1.9.1.3 Dynamic View Design

- N/A

### 3.1.9.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/Units	Description
					Min	Max	Min	Max		
1	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler

### 3.1.9.2 [SWDDS.1.1.9.2] TempSig\_Measr

#### 3.1.9.2.1 Detailed Design

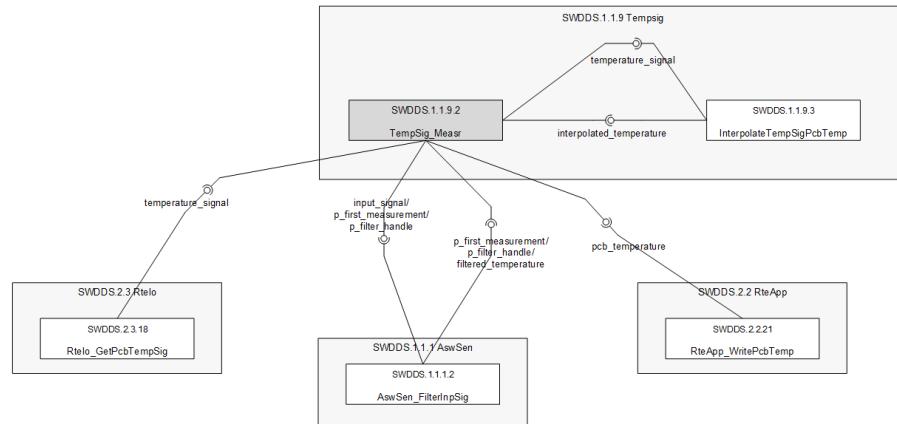
##### [SWDDS.1.1.9.2] TempSig\_Measr

Software Unit Information					
Unit ID	SWDDS.1.1.9.2		Unit Name	TempSig_Measr	
Architecture ID	SWADS.1.1.9.2		ASIL	QM	
Prototype			void TempSig_Measr( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bTempSigPcbTempFirstMeasr	0~1, FALSE / TRUE	Read/Write	PCB temperature first measurement flag
	GDFLIB_FILTER_MA_T_F16	g_hndTempSigPcbTempFilt	85899346 ~ 365072220	Read/Write	PCB temperature filtering handler (f32Acc)

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Temperature signal measurement – PCB temperature signal input – Temperature signal interpolation and filtering – Application data updating				
Control Flow Diagram (or Pseudo Code)	<pre>     start           +-- tFrac16 temperature_signal,         interpolated_temperature,         filtered_temperature;           +-- [SWDDS.2.3.18]         temperature_signal = RteIo_GetPcbTempSig();           +-- [SWDDS.1.1.9.3]         interpolated_temperature =         InterpolateTempSigPcbTemp(temperature_signal );           +-- [SWDDS.1.1.1.2]         filtered_temperature = AswSen_FilterInpSig(             interpolated_temperature,             &amp;g_bTempSigPcbTempFirstMeasr,             &amp;g_hndTempSigPcbTempFit );           +-- [SWDDS.2.2.21]         RteApp_WritePcbTemp( filtered_temperature );           end   </pre>				
Called Function	SWDDS.2.1.11 RteSch_Task50ms				
Calling Function	SWDDS.2.3.18 RteIo_GetPcbTempSig				
	SWDDS.1.1.9.3 InterpolateTempSigPcbTemp				
Function Execution Time	SWDDS.1.1.1.2 AswSen_FilterInpSig				
	SWDDS.2.2.21 RteApp_WritePcbTemp				

Requirement Id	SWDDS.1.1.9.2
Target Milestone	EBS2
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.1.9.2.2 Static View Design



### 3.1.9.2.3 Dynamic View Design

- N/A

### 3.1.9.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	temperature_signal	SWDDS.2.3.18	IN	tFrac16	0	32767	0.0	4.99985	0.000152588 / Vpk	Temperature signal input (PU)
2	temperature_signal	SWDDS.1.1.9.3	OUT	tFrac16	0	32767	0.0	4.99985	0.000152588 / Vpk	Temperature signal input (PU)
3	interpolated_temperature	SWDDS.1.1.9.3	IN	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	Interpolated temperature (PU)
4	filtered_temperature	SWDDS.1.1.1.2	IN	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	Filtered temperature (PU)
5	input_signal	SWDDS.1.1.1.2	OUT	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	Input signal for filtering
6	p_first_measurement	SWDDS.1.1.1.2	IN/OUT	tBool*	0	1	Normal filtering	First filtering	True / False	First measurement flag pointer
7	p_filter_handle	SWDDS.1.1.1.2	IN/OUT	GDFLIB_FILTER_MA_T_F16*	N/A	N/A	N/A	N/A	N/A	Filter handle pointer
8	pcb_temperature	SWDDS.2.2.21	OUT	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	Filtered temperature (PU)

### 3.1.9.3 [SWDDS.1.1.9.3] InterpolateTempSigPcbTemp

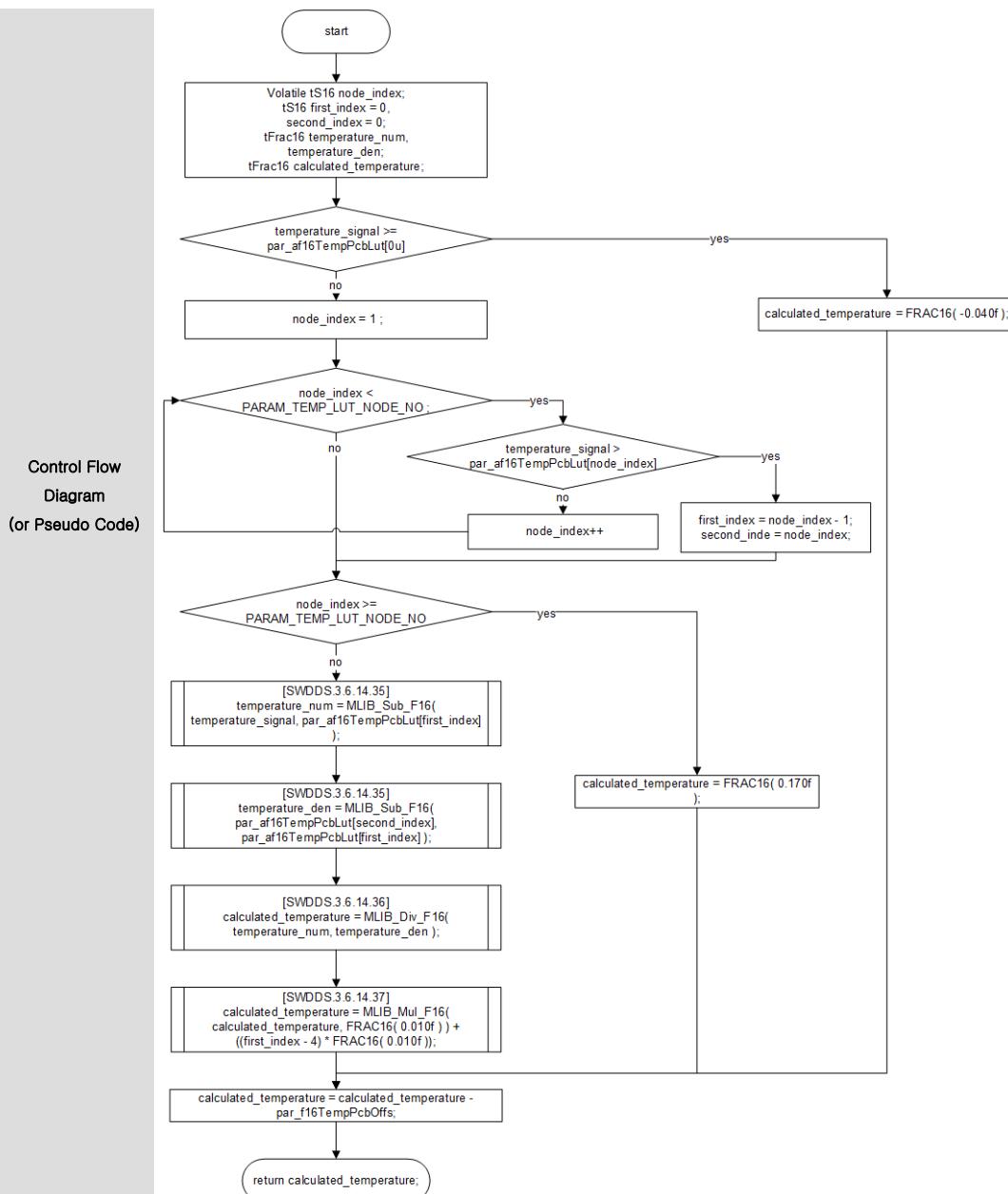
#### 3.1.9.3.1 Detailed Design

##### [SWDDS.1.1.9.3] InterpolateTempSigPcbTemp

Software Unit Information					
Unit ID	SWDDS.1.1.9.3	Unit Name	InterpolateTempSigPcbTemp		
Architecture ID	SWADS.1.1.9.3	ASIL	QM		
Prototype			tFrac16	InterpolateTempSigPcbTemp( tFrac16 temperature_signal )	
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	temperature_signal	0 ~ 32767	IN	temperature signal input (PU)

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	87

Function Call Return Value		Possible Return Value			Description
		tFrac16 -1311 ~ 5570			Interpolated PCB temperature (PU)
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_af16TempPcbLut	0 ~ 32767	Read	PCB temperature signal voltage LUT (PU)
Registers	tFrac16	par_f16TempPcbOffs	163.83	Read	PCB temperature offset (PU)
	Data Type	Name	Range	Read/Write	Description
		N/A	N/A	N/A	N/A
PCB temperature interpolation in temperature LUT					
<ul style="list-style-type: none"> <li>- Lowest temperature range under checking</li> <li>- Node searching</li> <li>- Highest temperature range over checking</li> <li>- Temperature calculation (linear interpolation)</li> </ul>					
<ol style="list-style-type: none"> <li>1. InterpolateTempSigPcbTemp sets the minimum temperature if the temperature signal is below than the minimum voltage.</li> <li>2. InterpolateTempSigPcbTemp searches node in the temperature loo-up table in which the temperature signal is lying between the temperature signals.</li> <li>3. InterpolateTempSigPcbTemp sets the maximum temperature if the searched index is the last one.</li> <li>4. InterpolateTempSigPcbTemp sets the first and the second nodes to interpolate temperature.</li> <li>5. InterpolateTempSigPcbTemp calculates the temperature using linear interpolation</li> </ol>					
<b>Control Flow</b> <b>Diagram</b> <b>(or Pseudo Code)</b>					

**Called Function**

SWDDDS.1.1.9.2 TempSig\_Measr

**Calling Function**

SWDDDS.3.6.14.35 MLIB\_Sub\_F16

**Function**

SWDDDS.3.6.14.36 MLIB\_Div\_F16

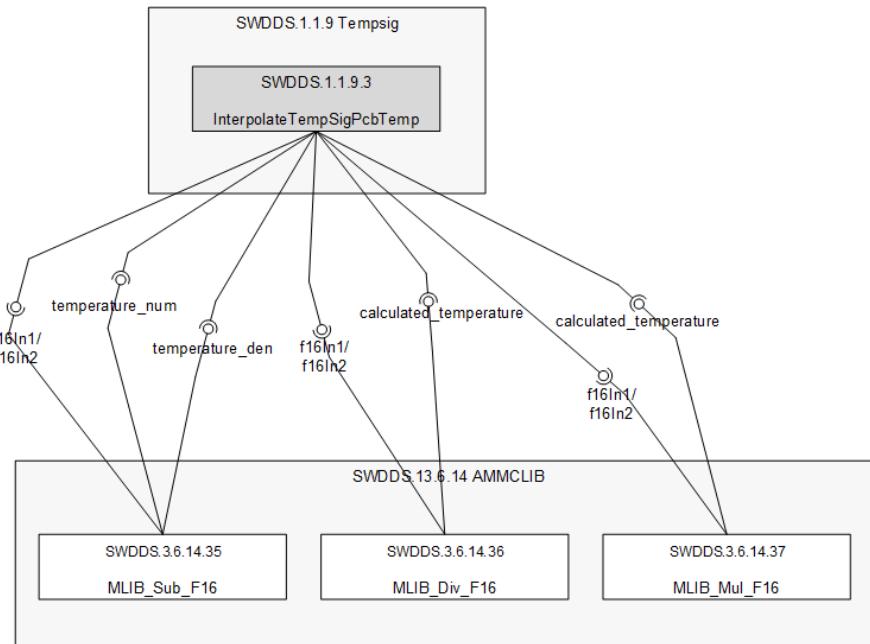
**Execution Time**

N/A

Requirement Id	SWDDDS.1.1.9.3
Target Milestone	SBS1
Element	AswSen
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	High

Verifiability	Yes
---------------	-----

### 3.1.9.3.2 Static View Design



### 3.1.9.3.3 Dynamic View Design

- N/A

### 3.1.9.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16ln1	SWDDS.3.6.14.35	OUT	tFrac16	0	32767	0.0	4.99985	0.000152588 / Vpk	Temperature signal input (PU)
2	f16ln2	SWDDS.3.6.14.35	OUT	tFrac16	0	32767	0.0	4.99985	0.000152588 / Vpk	Temperature signal in LUT
3	temperature_num	SWDDS.3.6.14.35	IN	tFrac16	-32768	32767	-1.0	1.0	N/A	Temperature numerator
4	temperature_den	SWDDS.3.6.14.35	IN	tFrac16	-32768	32767	-1.0	1.0	N/A	Temperature denominator
5	f16ln1	SWDDS.3.6.14.36	OUT	tFrac16	-32768	32767	-1.0	1.0	N/A	Temperature numerator
6	f16ln2	SWDDS.3.6.14.36	OUT	tFrac16	-32768	32767	-1.0	1.0	N/A	Temperature denominator
7	calculated_temperature	SWDDS.3.6.14.36	IN	tFrac16	-32768	32767	-1.0	1.0	N/A	Calculated temperature
8	f16ln1	SWDDS.3.6.14.37	OUT	tFrac16	-32768	32767	-1.0	1.0	N/A	calculated value
9	f16ln2	SWDDS.3.6.14.37	OUT	tFrac16	FRAC16( 0.010 )		0.010		N/A	Temperature interval
10	calculated_temperature	SWDDS.3.6.14.37	IN	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	Calculated temperature (PU)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	90

### 3.2 [SWDDS.1.2] AswCtr

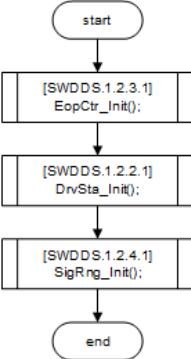
AswSen updates input/output values such as Target speed, Output Current, DC Current, DC Voltage, Temperature, Motor torque and Battery Voltage. It also checks status of Target speed range, Message-receiving time-out, CAN Bus, Current control and OPU.

#### 3.2.1 [SWDDS.1.2.1] AswCtr

##### 3.2.1.1 [SWDDS.1.2.1.1] AswCtr\_Init

###### 3.2.1.1.1 Detailed Design

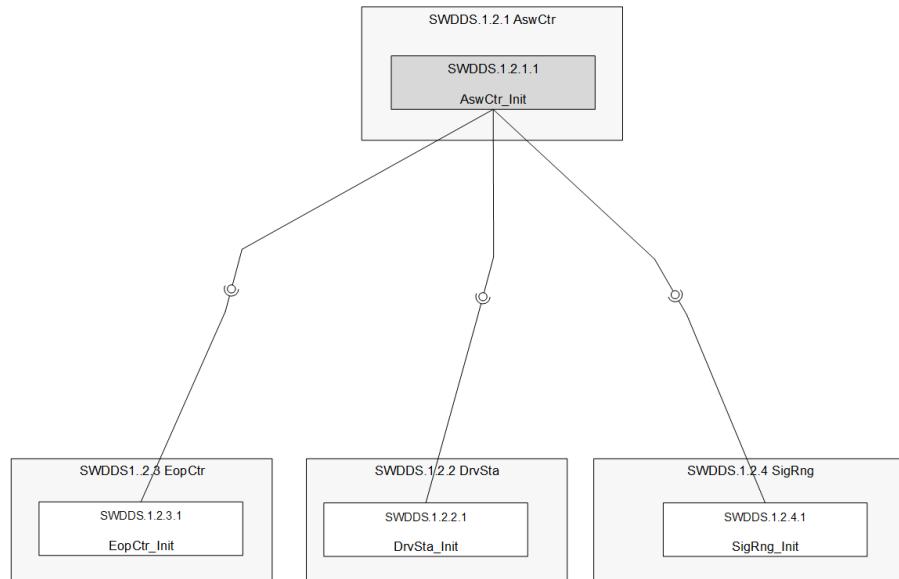
###### [SWDDS.1.2.1.1] AswCtr\_Init

Software Unit Information					
Unit ID	SWDDS.1.2.1.1	Unit Name	AswCtr_Init		
Architecture ID	SWADS.1.2.1.1	ASIL	QM		
Prototype	void AswCtr_Init( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Control software initialization - EOP control initialization - Driving status checking initialization - Signal range checking initialization				
Control Flow Diagram (or Pseudo Code)	 <pre> graph TD     start((start)) --&gt; EopCtr[SWDDS.1.2.3.1&lt;br&gt;EopCtr_Init()]     EopCtr --&gt; DrvSta[SWDDS.1.2.2.1&lt;br&gt;DrvSta_Init()]     DrvSta --&gt; SigRng[SWDDS.1.2.4.1&lt;br&gt;SigRng_Init()]     SigRng --&gt; end((end))   </pre>				
Called Function	SWDDS.2.1.3 InitializeRteSchAppSw				
Calling Function	SWDDS.1.2.3.1 EopCtr_Init SWDDS.1.2.2.1 DrvSta_Init SWDDS.1.2.4.1 SigRng_Init				
Function Execution Time	N/A				

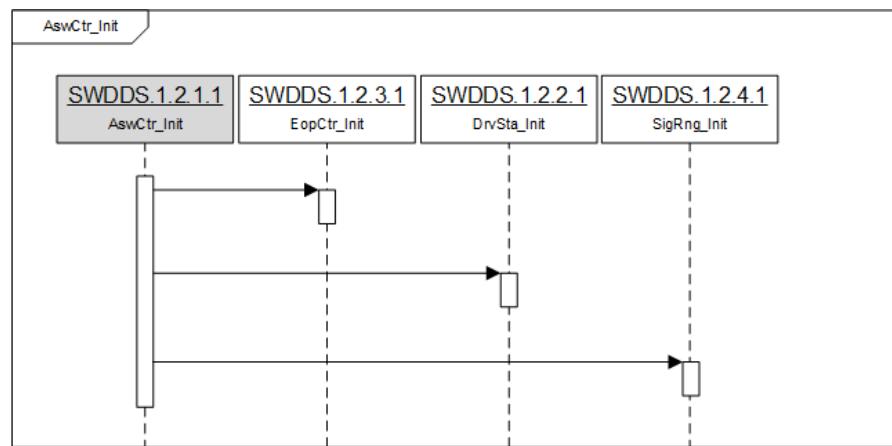
Requirement Id	SWDDS.1.2.1.1
Target Milestone	EBS2
Element	AswCtr
Risk	Low
Interoperability	No
Criticality	Low

Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.2.1.1.2 Static View Design



### 3.2.1.1.3 Dynamic View Design



### 3.2.1.1.4 Interface Design

- N/A

### 3.2.2 [SWDDS.1.2.2] DrvSta

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	92

### 3.2.2.1 [SWDDS.1.2.2.1] DrvSta\_Init

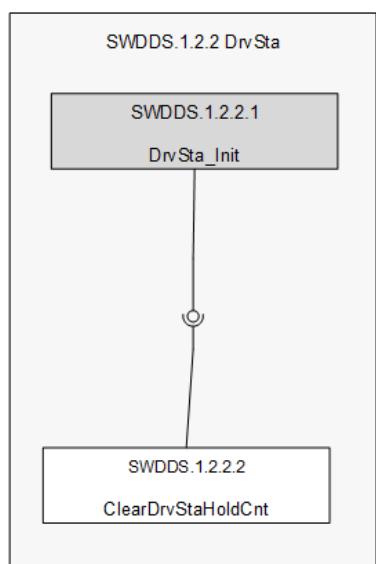
#### 3.2.2.1.1 Detailed Design

##### [SWDDS.1.2.2.1] DrvSta\_Init

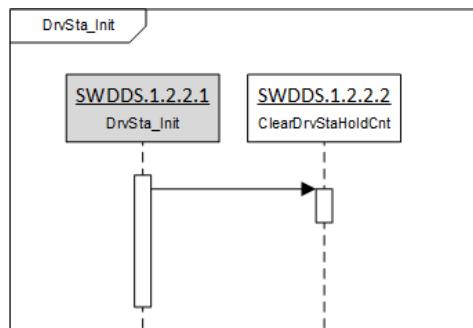
Software Unit Information					
Unit ID	SWDDS.1.2.2.1	Unit Name	DrvSta_Init		
Architecture ID	SWADS.1.2.2.1	ASIL	QM		
Prototype	void DrvSta_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.1.2.2.2]     ClearDrvStaHoldCnt();           end   </pre>				
Called Function	SWDDS.1.2.1.1 AswCtr_Init				
Calling Function	SWDDS.1.2.2.2 ClearDrvStaHoldCnt				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.2.1
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

#### 3.2.2.1.2 Static View Design



### 3.2.2.1.3 Dynamic View Design



### 3.2.2.1.4 Interface Design

- N/A

### 3.2.2.2 [SWDDS.1.2.2.2] ClearDrvStaHoldCnt

#### 3.2.2.2.1 Detailed Design

##### [SWDDS.1.2.2.2] ClearDrvStaHoldCnt

Software Unit Information					
Unit ID	SWDDS.1.2.2.2		Unit Name	ClearDrvStaHoldCnt	
Architecture ID	SWADS.1.2.2.2		ASIL	QM	
Prototype			void ClearDrvStaHoldCnt( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32DrvStaChkFlag	0 ~ 16776960	Write	Driving status checking flag

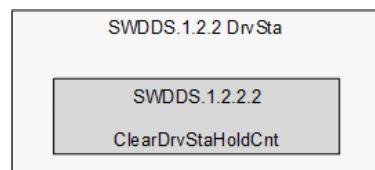
<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-06-30
					Page	94

<b>Global Variables</b>	tU16	g_u16DrvStaMtrSpdOvrCnt	0 ~ 60000	Write	Motor speed over condition hold time count (ms)			
	tU16	g_u16DrvStaMtrSpdUndCnt	0 ~ 60000	Write	Motor speed under condition hold time count (ms)			
	tU16	g_u16DrvStaSpdErrOvrCnt	0 ~ 60000	Write	Speed control error over condition hold time count (ms)			
	tU16	g_u16DrvStaSpdErrUndCnt	0 ~ 60000	Write	Speed control error under condition hold time count (ms)			
	tU16	g_u16DrvStaCurErrOvrCnt	0 ~ 60000	Write	Current control error over condition hold time count (ms)			
	tU16	g_u16DrvStaCurErrUndCnt	0 ~ 60000	Write	Current control error under condition hold time count (ms)			
	tU16	g_u16DrvStaCurOutOvrCnt	0 ~ 60000	Write	Current output over condition hold time count (ms)			
	tU16	g_u16DrvStaCurOutUndCnt	0 ~ 60000	Write	Current output under condition hold time count (ms)			
	tU16	g_u16DrvStaShrtCirCnt	0 ~ 60000	Write	Short circuit condition hold time count (ms)			
	tU16	g_u16DrvStaLowCurCnt	0 ~ 60000	Write	Low current condition hold time count (ms)			
	tU16	g_u16DrvStaSpdErrCnt1	0 ~ 60000	Write	Speed error condition 1 hold time count (ms)			
	tU16	g_u16DrvStaSpdErrCnt2	0 ~ 60000	Write	Speed error condition 2 hold time count (ms)			
	tU16	g_u16DrvStaCurOvrCnt1	0 ~ 60000	Write	Current over condition 1 hold time count (ms)			
	tU16	g_u16DrvStaCurOvrCnt21	0 ~ 60000	Write	Current over condition 21 hold time count (ms)			
	tU16	g_u16DrvStaCurOvrCnt22	0 ~ 60000	Write	Current over condition 22 hold time count (ms)			
	tU16	g_u16DrvStaCurOvrCnt3	0 ~ 60000	Write	Current over condition 3 hold time count (ms)			
	tU16	g_u16DrvStaDcVoltUndCnt	0 ~ 60000	Write	DC driving voltage under fault count			
	tU16	g_u16DrvStaGdrvUvOvCnt	0 ~ 60000	Write	Gate driver under/over voltage fault count			
	tU16	g_u16DrvStaGdrvDesatCnt	0 ~ 60000	Write	Gate driver DESAT fault count			
	tU16	g_u16DrvStaCurOffsCnt	0 ~ 60000	Write	Current sensor offset fault count			
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>			
	N/A	N/A	N/A	N/A	N/A			
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>			
	N/A	N/A	N/A	N/A	N/A			
<b>Description</b>	Driving status checking hold count clearing							
<b>Control Flow Diagram (or Pseudo Code)</b>								

Control Flow Diagram (or Pseudo Code)	<pre> start     g_u32DrvStaChkFlag = 0x00000000uL;     g_u16DrvStaMtrSpdOvrCnt = 0u;     g_u16DrvStaMtrSpdUndCnt = 0u;     g_u16DrvStaSpdErrOvrCnt = 0u;     g_u16DrvStaSpdErrUndCnt = 0u;     g_u16DrvStaCurErrOvrCnt = 0u;     g_u16DrvStaCurErrUndCnt = 0u;     g_u16DrvStaCurOutOvrCnt = 0u;     g_u16DrvStaCurOutUndCnt = 0u;     g_u16DrvStaShrtCirCnt = 0u;     g_u16DrvStaLowCurCnt = 0u;     g_u16DrvStaSpdErrCnt1 = 0u;     g_u16DrvStaSpdErrCnt2 = 0u;     g_u16DrvStaCurOvrCnt1 = 0u;     g_u16DrvStaCurOvrCnt21 = 0u;     g_u16DrvStaCurOvrCnt22 = 0u;     g_u16DrvStaCurOvrCnt3 = 0u;     g_u16DrvStaGdrvUvOvCnt = 0u;     g_u16DrvStaGdrvOesatCnt = 0u;     g_u16DrvStaCurOffsCnt = 0u; end </pre>
Called Function	SWDDS.1.2.2.1 DrvSta_Init SWDDS.1.2.2.4 CheckDrvStaFlagClr
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.2.2
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="color: orange;">□</span> Mid
Interoperability	No
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

### 3.2.2.2.2 Static View Design



### 3.2.2.2.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	96

### 3.2.2.2.4 Interface Design

- N/A

### 3.2.2.3 [SWDDS.1.2.2.3] DrvSta\_Chk

#### 3.2.2.3.1 Detailed Design

##### [SWDDS.1.2.2.3] DrvSta\_Chk

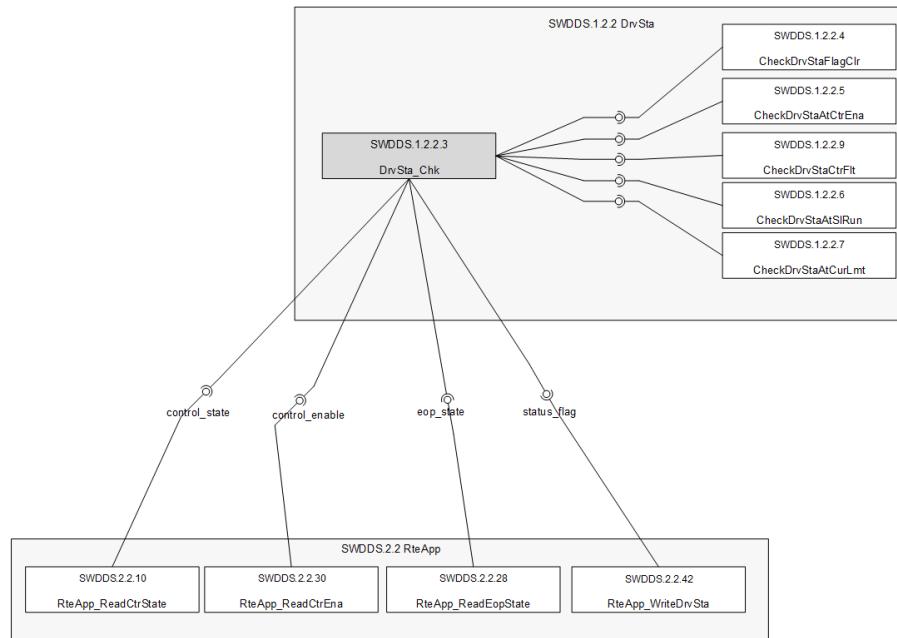
Software Unit Information					
Unit ID	SWDDS.1.2.2.3		Unit Name	DrvSta_Chk	
Architecture ID	SWADS.1.2.2.3		ASIL	QM	
Prototype	void DrvSta_Chk( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32DrvStaChkFlag	0 ~ 16776960	Read	Driving status checking flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking -.. Control enabling edge checking -.. EOP control disabling edge checking -.. Fault checking during control enabled -.. Data updating				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	
	<pre> start     tCtrState control_state;     tBool control_enable;     tEopState eop_state;      [SWDDS.2.2.10] control_state = RteApp_ReadCtrState();     [SWDDS.2.2.30] control_enable = RteApp_ReadCtrEna();     [SWDDS.2.2.28] eop_state = RteApp_ReadEopState();     [SWDDS.1.2.2.4] CheckDrvStaFlagClr();      if control_enable != FALSE         if control_state == CTR_STATE_SL_RUN             if op_state == EOP_STATE_CUR_LMT                 [SWDDS.1.2.2.5] CheckDrvStaAtCtrEna();                 [SWDDS.1.2.2.6] CheckDrvStaAtSIRun();                 [SWDDS.1.2.2.7] CheckDrvStaAtCurLmt();         else             [SWDDS.1.2.2.9] CheckDrvStaCtrFlt();     else         [SWDDS.2.2.42] RteApp_WriteDrvSta(g_u32DrvStaChkFlag);  end </pre>
Called Function	SWDDS.2.1.9 RteSch_Task10ms SWDDS.2.2.10 RteApp_ReadCtrState SWDDS.2.2.30 RteApp_ReadCtrEna SWDDS.2.2.28 RteApp_ReadEopState SWDDS.2.2.42 RteApp_WriteDrvSta SWDDS.1.2.2.4 CheckDrvStaFlagClr SWDDS.1.2.2.5 CheckDrvStaAtCtrEna SWDDS.1.2.2.9 CheckDrvStaCtrFlt SWDDS.1.2.2.6 CheckDrvStaAtSIRun SWDDS.1.2.2.7 CheckDrvStaAtCurLmt
Calling Function	
Function Execution Time	N/A

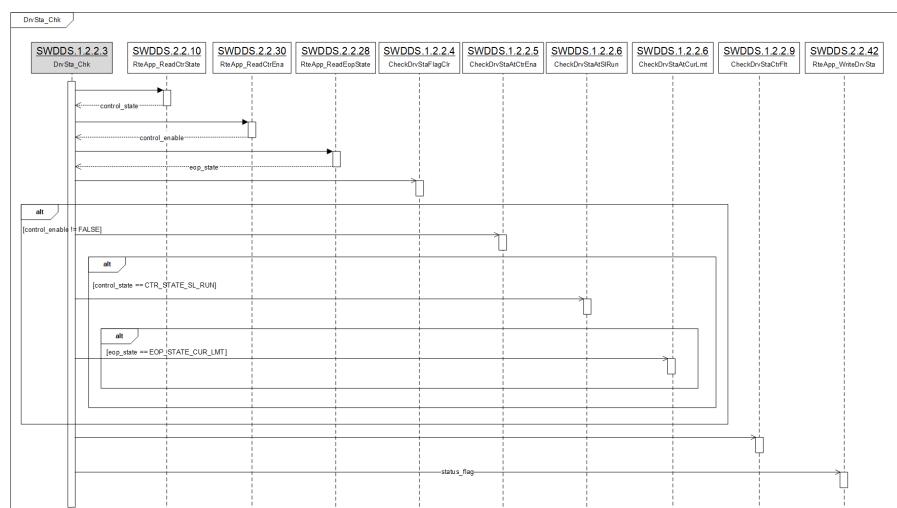
Requirement Id	SWDDS.1.2.2.3
Target Milestone	EBS2

Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.2.3.2 Static View Design



### 3.2.2.3.3 Dynamic View Design



	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-06-30
						Page	99

#### 3.2.2.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	control_state	SWDDS.2.2.10	IN	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Current control state
2	control_enable	SWDDS.2.2.30	IN	tBool	0	1	Control disable	Control enable	True / False	EOP control enabled status
3	eop_state	SWDDS.2.2.28	IN	tEopState	0	4	EOP_STATE_DISABLED	EOP_STATE_CUR_LMT	N/A	EOP control state
4	status_flag	SWDDS.2.2.42	OUT	tU32	0	8388608	0x00000000	0x00800000	N/A	Driving status checking flag

#### 3.2.2.4 [SWDDS.1.2.2.4] CheckDrvStaFlagClr

##### 3.2.2.4.1 Detailed Design

##### [SWDDS.1.2.2.4] CheckDrvStaFlagClr

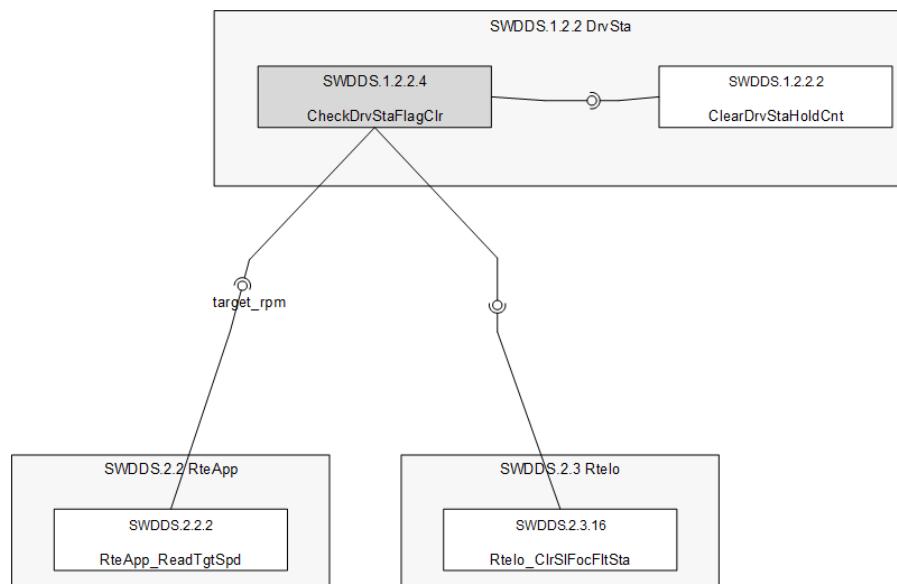
Software Unit Information					
Unit ID	SWDDS.1.2.2.4		Unit Name	CheckDrvStaFlagClr	
Architecture ID	SWADS.1.2.2.4		ASIL	QM	
Prototype	void CheckDrvStaFlagClr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	tS16	par_s16RefSpdOffThrs	500	Read	Control disabling(off) target speed threshold (rpm)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking flag clearing condition checking				

Control Flow Diagram  
(or Pseudo Code)

Control Flow Diagram (or Pseudo Code)	<pre>     start     tS16 target_rpm;     [SWDDS.2.2.2]     target_rpm = RteApp_ReadTgtSpd();     if target_rpm &lt; par_s16RspdOffThrs         [SWDDS.1.2.2.2]         ClearDrvStaHoldCnt();         [SWDDS.2.3.16]         Rtelo_ClrSIFocFltSta();     end   </pre>
Called Function	SWDDS.1.2.2.3 DrvSta_Chk
Calling Function	SWDDS.1.2.2.2 ClearDrvStaHoldCnt SWDDS.2.2.2 RteApp_ReadTgtSpd SWDDS.2.3.16 Rtelo_ClrSIFocFltSta
Function Execution Time	N/A

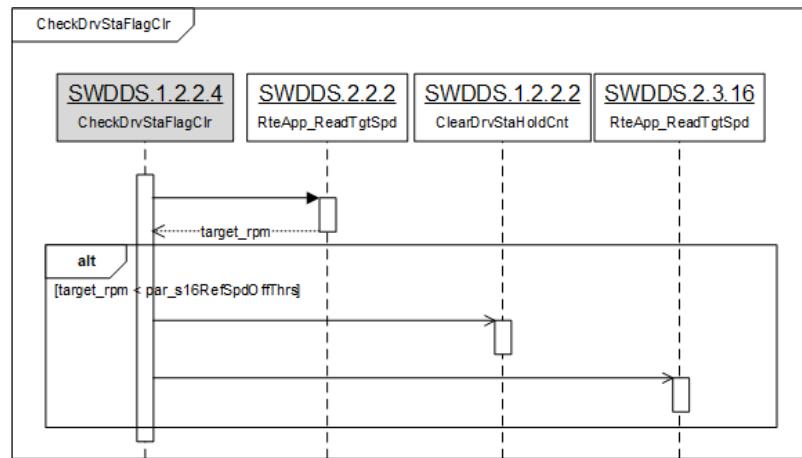
Requirement Id	SWDDS.1.2.2.4
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.2.2.4.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	101

### 3.2.2.4.3 Dynamic View Design



### 3.2.2.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	target_rpm	SWDDS.2.2.2	IN	tS16	N/A	N/A	N/A	N/A	N/A	Target speed setting (rpm)

### 3.2.2.5 [SWDDS.1.2.2.5] CheckDrvStaAtCtrEna

#### 3.2.2.5.1 Detailed Design

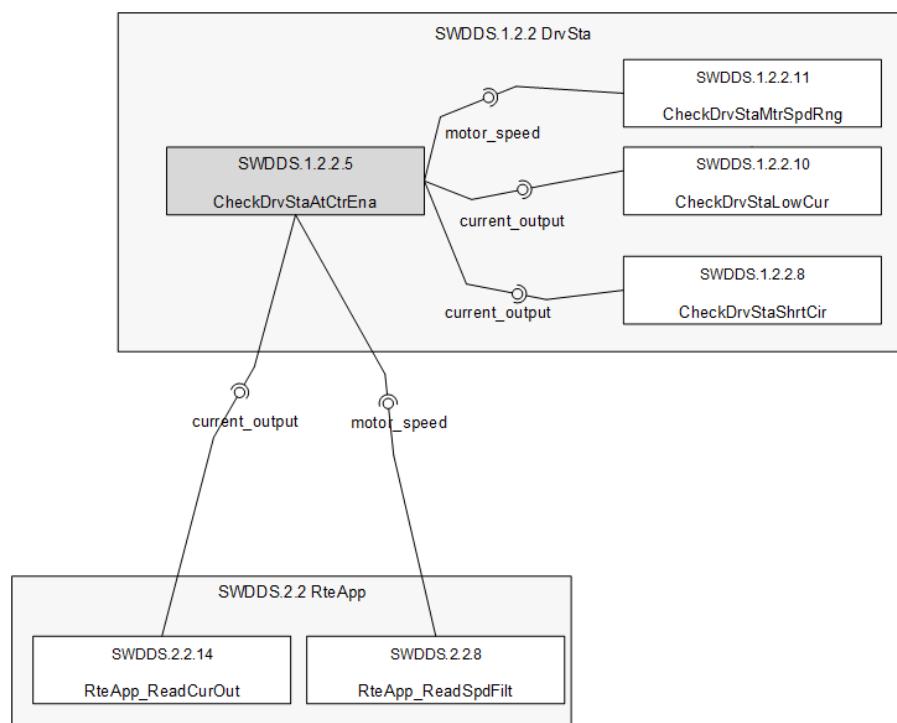
##### [SWDDS.1.2.2.5] CheckDrvStaAtCtrEna

Software Unit Information					
Unit ID			SWDDS.1.2.2.5	Unit Name	CheckDrvStaAtCtrEna
Architecture ID			SWADS.1.2.2.5	ASIL	QM
Prototype			void CheckDrvStaAtCtrEna( void )		
Function Call Parameters			Data Type	Name	Range
			N/A	N/A	N/A
Function Call Return Value			Data Type	Possible Return Value	Description
			N/A	N/A	N/A
Global Variables			Data Type	Name	Range
			N/A	N/A	N/A
Parameters			Data Type	Name	Range
			N/A	N/A	N/A
Registers			Data Type	Name	Range
			N/A	N/A	N/A
Driving status checking at EOP control enabled status					

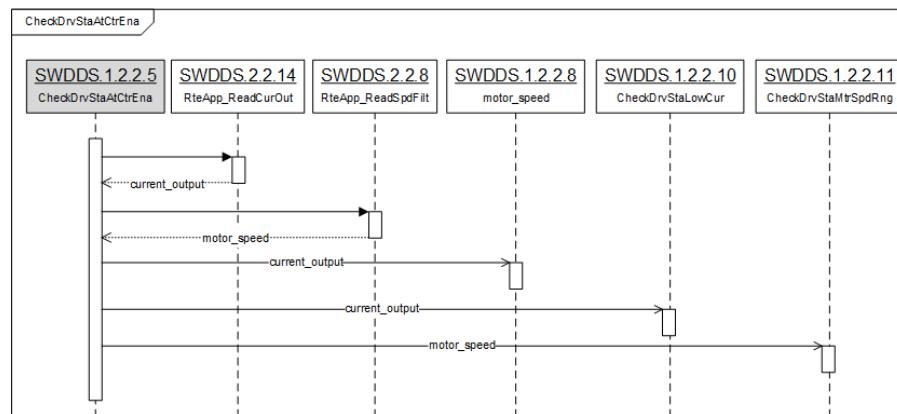
<b>Description</b>  <b>Control Flow Diagram (or Pseudo Code)</b>	<ul style="list-style-type: none"> <li>- . Data getting</li> <li>- . Status checking</li> </ul> <pre>     start     ↓     tFrac16 current_output,     motor_speed;     ↓     [SWDDS.2.2.14]     current_output = RteApp_ReadCurOut();     ↓     [SWDDS.2.2.8]     motor_speed = RteApp_ReadSpdFilt();     ↓     [SWDDS.1.2.2.8]     CheckDrvStaShrtCir( current_output );     ↓     [SWDDS.1.2.2.10]     CheckDrvStaLowCur( current_output );     ↓     [SWDDS.1.2.2.11]     CheckDrvStaMtrSpdRng( motor_speed );     ↓     end   </pre>
<b>Called Function</b>  <b>Calling Function</b>	<b>SWDDS.1.2.2.3 DrvSta_Chk</b> <b>SWDDS.1.2.2.11 CheckDrvStaMtrSpdRng</b> <b>SWDDS.1.2.2.10 CheckDrvStaLowCur</b> <b>SWDDS.1.2.2.8 CheckDrvStaShrtCir</b> <b>SWDDS.2.2.14 RteApp_ReadCurOut</b> <b>SWDDS.2.2.8 RteApp_ReadSpdFilt</b>
<b>Function Execution Time</b>	N/A

Requirement Id	SWDDS.1.2.2.5
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="color: #ccc;">■</span> Mid
Interoperability	No
Criticality	<span style="color: #ccc;">■</span> Mid
Technical complexity	<span style="color: #009640;">■</span> Low
Verifiability	Yes

### 3.2.2.5.2 Static View Design



### 3.2.2.5.3 Dynamic View Design



### 3.2.2.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	current_output	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	motor_speed	SWDDS.2.2.8	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output (rpm)
3	current_output	SWDDS.1.2.2.8	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
										q-axis

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	104

4	current_output	SWDDS.1.2.2.10	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	current output (PU)
5	motor_speed	SWDDS.1.2.2.11	OUT	ts16	-6000	6000	-6000	6000	1 / rpm	Filtered speed output (rpm)

### 3.2.2.6 [SWDDS.1.2.2.6] CheckDrvStaAtSIRun

#### 3.2.2.6.1 Detailed Design

##### [SWDDS.1.2.2.6] CheckDrvStaAtSIRun

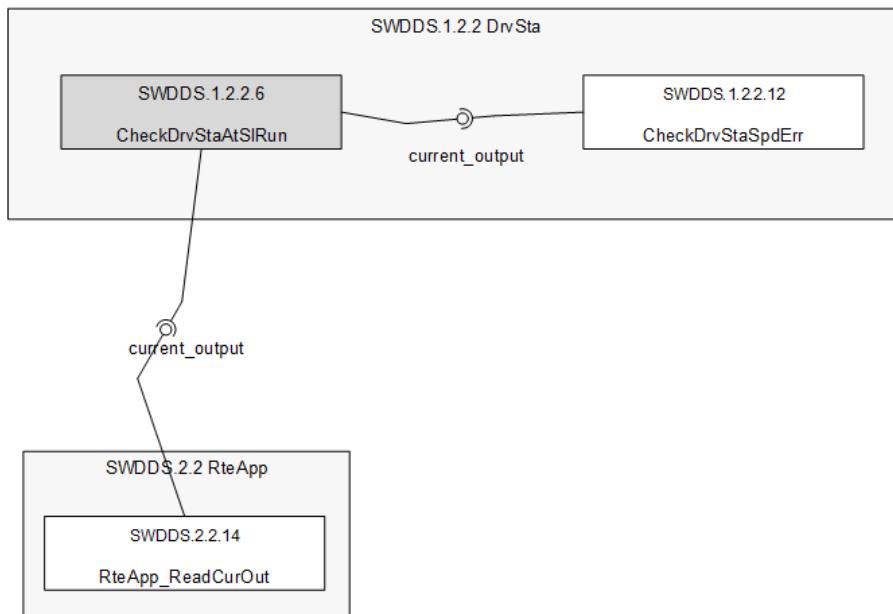
Software Unit Information					
Unit ID	SWDDS.1.2.2.6	Unit Name	CheckDrvStaAtSIRun		
Architecture ID	SWADS.1.2.2.6	ASIL	QM		
Prototype	void CheckDrvStaAtSIRun( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking at sensorless running state -. Data getting -. Status checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 current_output;     ↓     [SWDDS.2.2.14]     current_output = RteApp_ReadCurOut();     ↓     [SWDDS.1.2.2.12]     CheckDrvStaSpdErr( current_output );     ↓     end   </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
Calling Function	SWDDS.1.2.2.12 CheckDrvStaSpdErr				
Function Execution Time	SWDDS.2.2.14 RteApp_ReadCurOut				

Requirement Id	SWDDS.1.2.2.6
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="color: #ccc;">□</span> Mid
Interoperability	No
Criticality	<span style="color: #ccc;">□</span> Mid

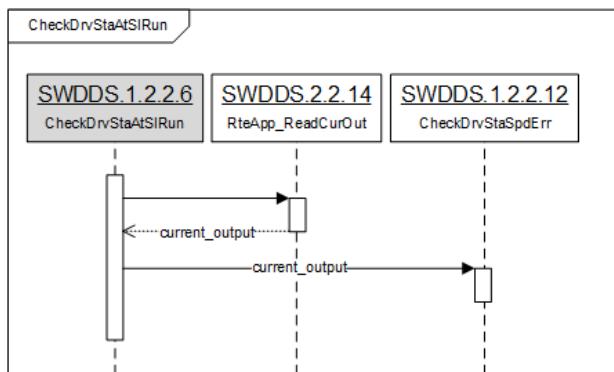
<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-06-30
					Page	105

Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.2.2.6.2 Static View Design



### 3.2.2.6.3 Dynamic View Design



### 3.2.2.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	current_output	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	current_output	SWDDS.1.2.2.12	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	106

### 3.2.2.7 [SWDDS.1.2.2.7] CheckDrvStaAtCurLmt

#### 3.2.2.7.1 Detailed Design

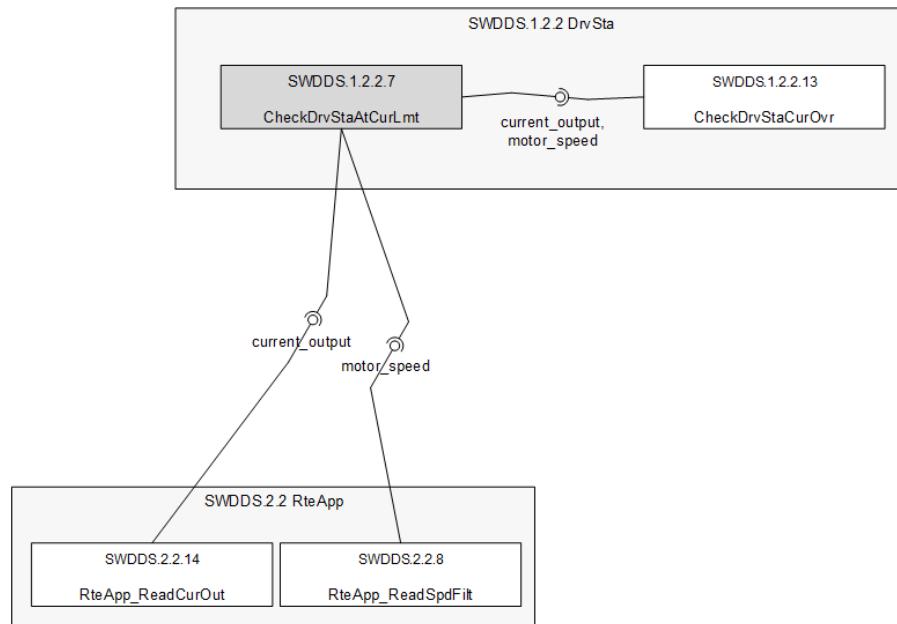
##### [SWDDS.1.2.2.7] CheckDrvStaAtCurLmt

Software Unit Information					
Unit ID	SWDDS.1.2.2.7	Unit Name	CheckDrvStaAtCurLmt		
Architecture ID	SWADS.1.2.2.7	ASIL	QM		
Prototype	void CheckDrvStaAtCurLmt( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking at current limiting state - Data getting - Status checking				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; decl[tFrac16 current_output, motor_speed;]     decl --&gt; step1["[SWDDS.2.2.14] current_output = RteApp_ReadCurOut();"]     step1 --&gt; step2["[SWDDS.2.2.8] motor_speed = RteApp_ReadSpdFilt();"]     step2 --&gt; step3["[SWDDS.1.2.2.13] CheckDrvStaCurOvr( current_output, motor_speed );"]     step3 --&gt; end([end])   </pre>				
Called Function	SWDDS.1.2.2.3 DrvSta_Chk				
Calling Function	SWDDS.1.2.2.13 CheckDrvStaCurOvr SWDDS.2.2.14 RteApp_ReadCurOut SWDDS.2.2.8 RteApp_ReadSpdFilt				
Function Execution Time	N/A				

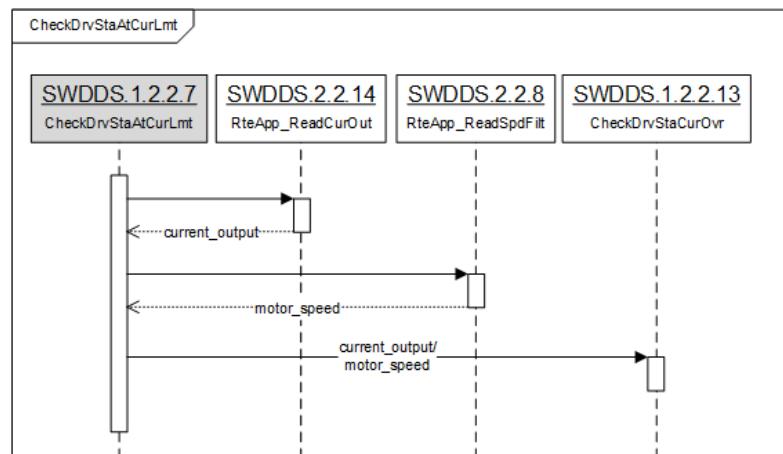
Requirement Id	SWDDS.1.2.2.7
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low

Verifiability	Yes
---------------	-----

### 3.2.2.7.2 Static View Design



### 3.2.2.7.3 Dynamic View Design



### 3.2.2.7.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	current_output	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	motor_speed	SWDDS.2.2.8	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output (rpm)

<b>SNT Motiv</b>	VW AQ EOP										Baseline / Version / Date	003
	Software Detailed Design Specification										Updated Date	2021-06-30
											Page	108

3	current_output	SWDDS.1.2.2.13	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	current output (PU)	
4	motor_speed	SWDDS.1.2.2.13	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Filtered speed output (rpm)	

### 3.2.2.8 [SWDDS.1.2.2.8] CheckDrvStaShrtCir

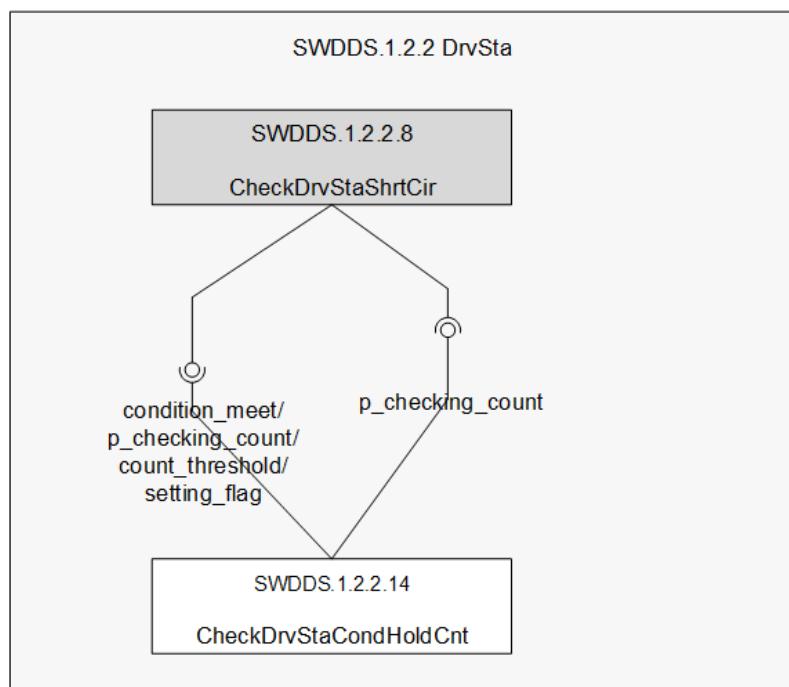
#### 3.2.2.8.1 Detailed Design

##### [SWDDS.1.2.2.8] CheckDrvStaShrtCir

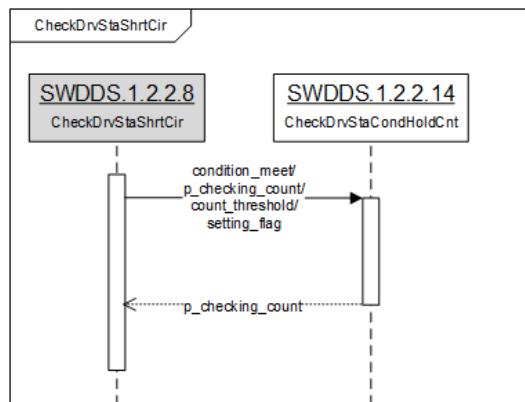
Software Unit Information					
Unit ID	SWDDS.1.2.2.8	Unit Name	CheckDrvStaShrtCir		
Architecture ID	SWADS.1.2.2.8	ASIL	QM		
Prototype	void CheckDrvStaShrtCir( tFrac16 current_output )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	current_output	-32768 ~ 32767	IN	current output
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16DrvStaShrtCirCnt	0 ~ 60000	Read	Short circuit condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltShrtCirCurThrs	FRAC16( 35.0f / PARAM_PU_BASE_PHS_CUR )	Read	Short circuit detection current threshold (PU)
	tU16	par_u16FltShrtCirHoldTim	1000	Read	Short circuit detection condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Short circuit condition checking -. Short circuit condition over checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start           +-- tBool condition_meet;         condition_meet = ( current_output &gt; par_f16FltShrtCirCurThrs ) ? TRUE : FALSE;           +-- [SWDDS.1.2.2.14]         CheckDrvStaCondHoldCnt( condition_meet,         &amp;g_u16DrvStaShrtCirCnt, par_u16FltShrtCirHoldTim,         DRV_STA_SHRT_CIR );           end   </pre>				
Called Function	SWDDS.1.2.2.5 CheckDrvStaAtCtrEna				
Calling Function	SWDDS.1.2.2.14 CheckDrvStaCondHoldCnt				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.2.8
Target Milestone	EBS2
Element	AswCtr
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Low
Verifiability	Yes

### 3.2.2.8.2 Static View Design



### 3.2.2.8.3 Dynamic View Design



	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	110

#### 3.2.2.8.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Short circuit condition hold time count (ms)
3	count_threshold	SWDDS.1.2.2.14	OUT	tU16	1000	1000	1000	1000	1 / msec	Short circuit detection condition hold time (ms)
4	setting_flag	SWDDS.1.2.2.14	OUT	tU32	131072	131072	0x00020000	0x00020000	N/A	Short circuit fault flag

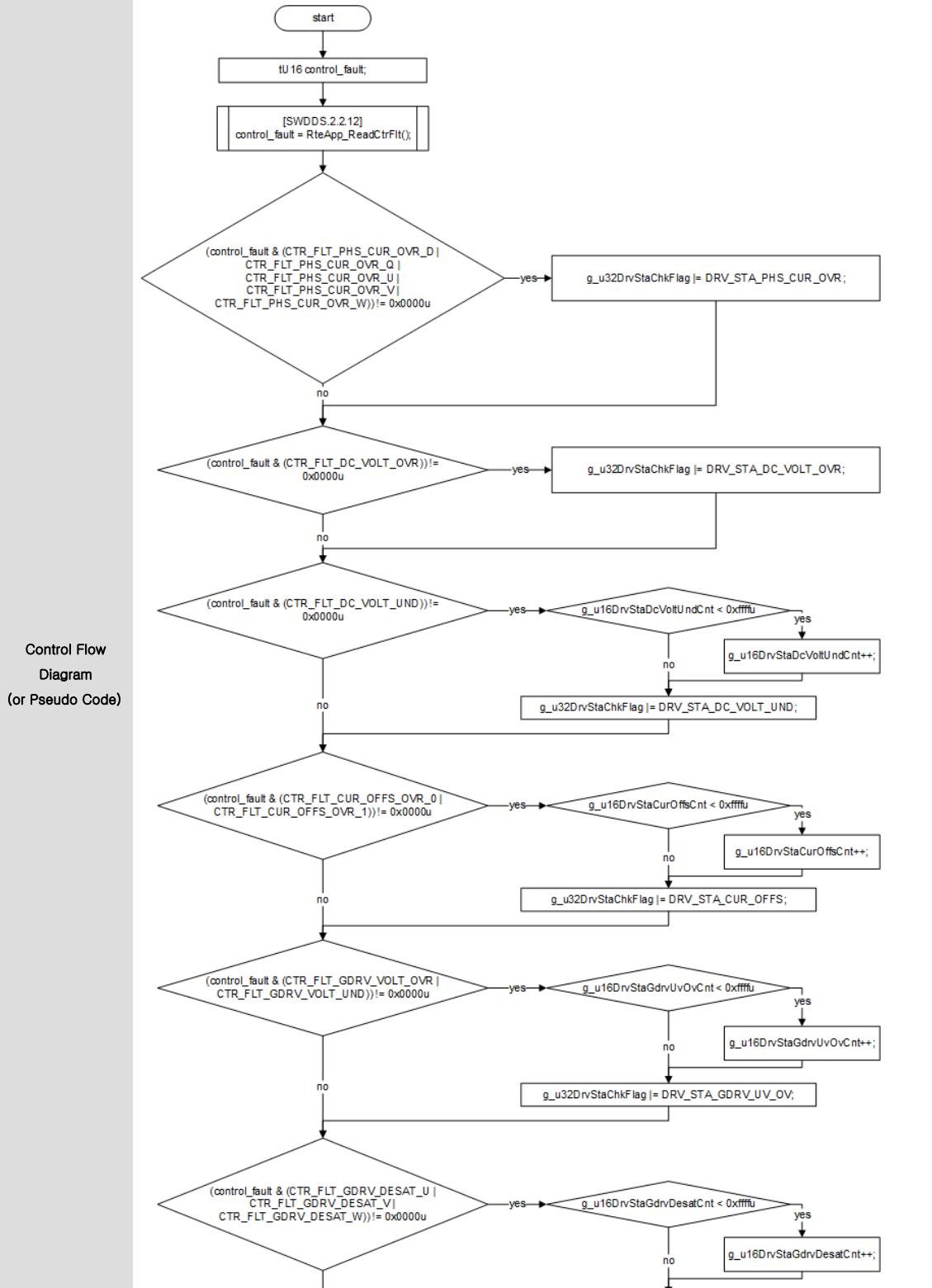
#### 3.2.2.9 [SWDDS.1.2.2.9] CheckDrvStaCtrFlt

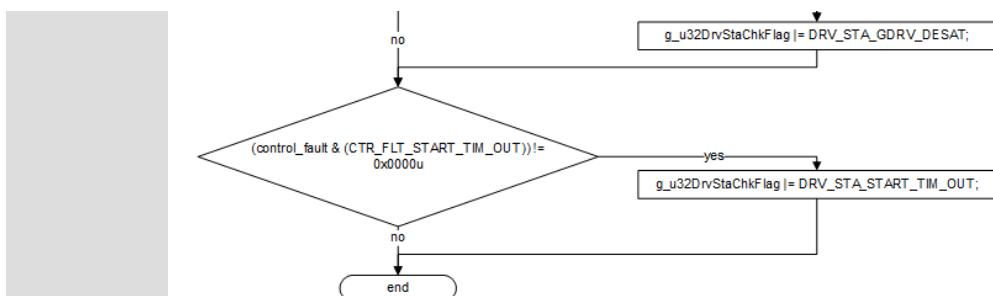
##### 3.2.2.9.1 Detailed Design

##### [SWDDS.1.2.2.9] CheckDrvStaCtrFlt

Software Unit Information					
Unit ID	SWDDS.1.2.2.9		Unit Name	CheckDrvStaCtrFlt	
Architecture ID	SWADS.1.2.2.9		ASIL	QM	
void CheckDrvStaCtrFlt( void )					
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value			Description
Return Value	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32DrvStaChkFlag	0 ~ 16776960	Write	Driving status checking flag
	tU16	g_u16DrvStaDcVoltUndCnt	0 ~ 60000	Read/Write	DC driving voltage under fault count
	tU16	g_u16DrvStaCurOffsCnt	0 ~ 60000	Read/Write	Current sensor offset fault count
	tU16	g_u16DrvStaGdrvUvOvCnt	0 ~ 60000	Read/Write	Gate driver under/over voltage fault count
	tU16	g_u16DrvStaGdrvDesatCnt	0 ~ 60000	Read/Write	Gate driver DESAT fault count
Parameters	Data Type	Name	Range	Read/Write	Description
Registers	N/A	N/A	N/A	N/A	N/A
Description	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	Current control status checking				
	- current control fault getting				
	- Peak over-current checking				
	- Peak over-voltage checking				
	- Peak under-voltage checking				
	- Current offset checking				
- Gate driver under-voltage or over-voltage checking					
- Gate driver DESAT detection checking					

- Initial starting time-out checking
1. CheckDrvStaCtrFlt sets the over current flag if d/q-axis or 3-phase current is over.
  2. CheckDrvStaCtrFlt sets the DC voltage over flag if DC driving voltage is over.
  3. CheckDrvStaCtrFlt sets the DC voltage under flag and increases the DC voltage under count if DC driving voltage is under.
  4. CheckDrvStaCtrFlt sets the gate driver under/over voltage flag and increases the gate driver under/over voltage count if gate driver under/over voltage is set.
  5. CheckDrvStaCtrFlt sets the DESAT flag and increases the DESAT count if the gate driver DESAT is detected.
  6. CheckDrvStaCtrFlt sets the starting time-out flag if the Sensorless FOC starting time-out is occurred.





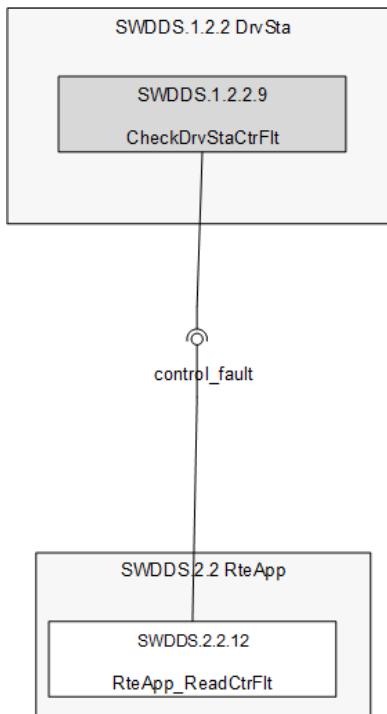
Called Function  
Calling Function  
Function  
Execution Time

SWDDS.1.2.2.3 DrvSta\_Chk  
SWDDS.2.2.12 RteApp\_ReadCtrFilt

N/A

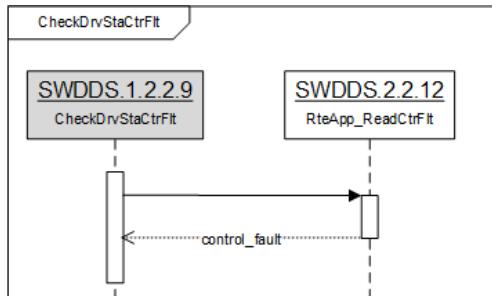
Requirement Id	SWDDS.1.2.2.9
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	High
Verifiability	Yes

### 3.2.2.9.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	113

### 3.2.2.9.3 Dynamic View Design



### 3.2.2.9.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/Units	Description
					Min	Max	Min	Max		
1	control_fault	SWDDS.2.2.12	IN	tU16	0	65535	0x0000	0xffff	N/A	Current control fault flags

### 3.2.2.10 [SWDDS.1.2.2.10] CheckDrvStaLowCur

#### 3.2.2.10.1 Detailed Design

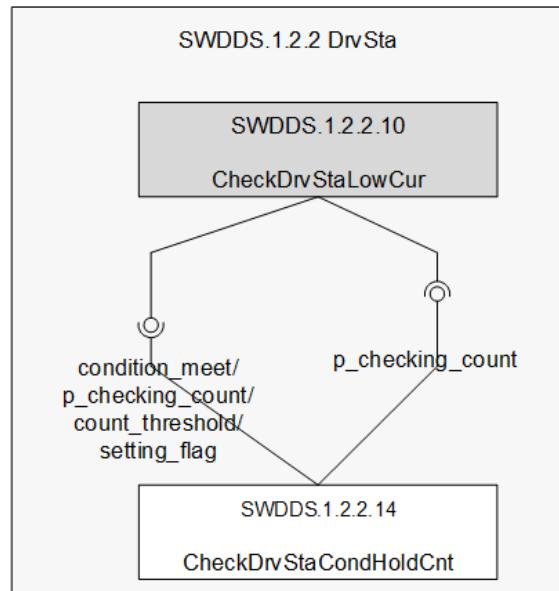
##### [SWDDS.1.2.2.10] CheckDrvStaLowCur

Software Unit Information					
Unit ID	SWDDS.1.2.2.10		Unit Name	CheckDrvStaLowCur	
Architecture ID	SWADS.1.2.2.10		ASIL	QM	
Prototype			void CheckDrvStaLowCur( tFrac16 current_output )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	current_output	-32768 ~ 32767	IN	current output
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16DrvStaLowCurCnt	0 ~ 60000	Read	Low current condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltLowCurCurThrs	FRAC16( 0.2f / PARAM_PU_BASE_PHS_CUR )	Read	Low current detection current threshold (PU)
	tU16	par_u16FltLowCurHoldTim	5000	Read	Low current detection condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Low current condition checking				
Control Flow					

Control Flow Diagram (or Pseudo Code)	<pre> start tBool condition_meet; condition_meet = ( current_output &lt; par_f16FltLowCurThrs )? TRUE : FALSE;  [SWDDS.1.2.2.14] CheckDrvStaCondHoldCnt( condition_meet, &amp;_g_u16DrvStaLowCurCntr, par_u16FltLowCurHoldTim, DRV_STA_LOW_CUR );  end </pre>
Called Function	SWDDS.1.2.2.5 CheckDrvStaAtCtrEna
Calling Function	SWDDS.1.2.2.14 CheckDrvStaCondHoldCnt
Function Execution Time	N/A

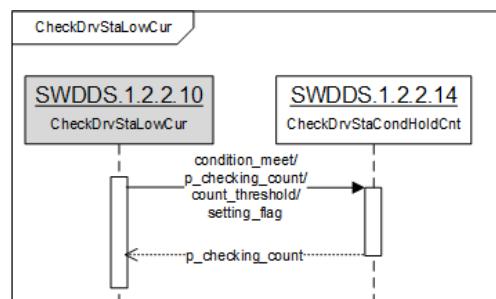
Requirement Id	SWDDS.1.2.2.10
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.2.2.10.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	115

### 3.2.2.10.3 Dynamic View Design



### 3.2.2.10.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Low current condition hold time count (ms)
3	count_threshold	SWDDS.1.2.2.14	OUT	tU16	5000	5000	5000	5000	1 / msec	Low current detection condition hold time (ms)
4	setting_flag	SWDDS.1.2.2.14	OUT	tU32	262144	262144	0x00040000	0x00040000	N/A	Low current fault flag

### 3.2.2.11 [SWDDS.1.2.2.11] CheckDrvStaMtrSpdRng

#### 3.2.2.11.1 Detailed Design

##### [SWDDS.1.2.2.11] CheckDrvStaMtrSpdRng

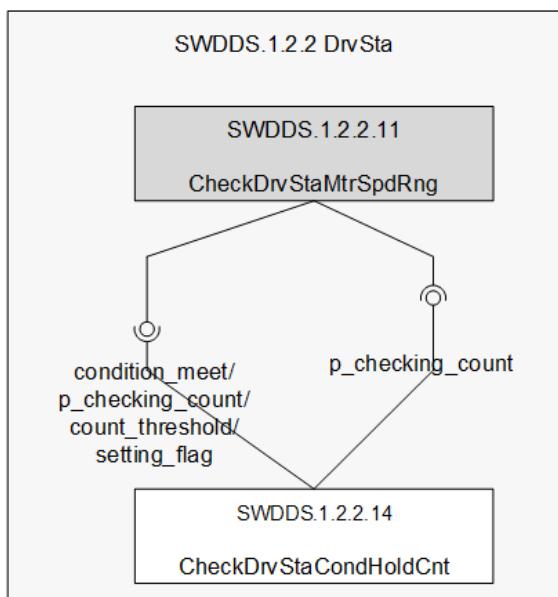
Software Unit Information					
Unit ID	SWDDS.1.2.2.11	Unit Name	CheckDrvStaMtrSpdRng		
Architecture ID	SWADS.1.2.2.11	ASIL	QM		
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tS16	motor_speed	-32768 ~ 32767	IN	motor speed(rpm)
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16DrvStaMtrSpdOvrCnt	0 ~ 60000	Read	Motor speed over condition hold time count (ms)
	tU16	g_u16DrvStaMtrSpdUndCnt	0 ~ 60000	Read	Motor speed under condition hold time count (ms)
	Data Type	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-06-30
					Page	116

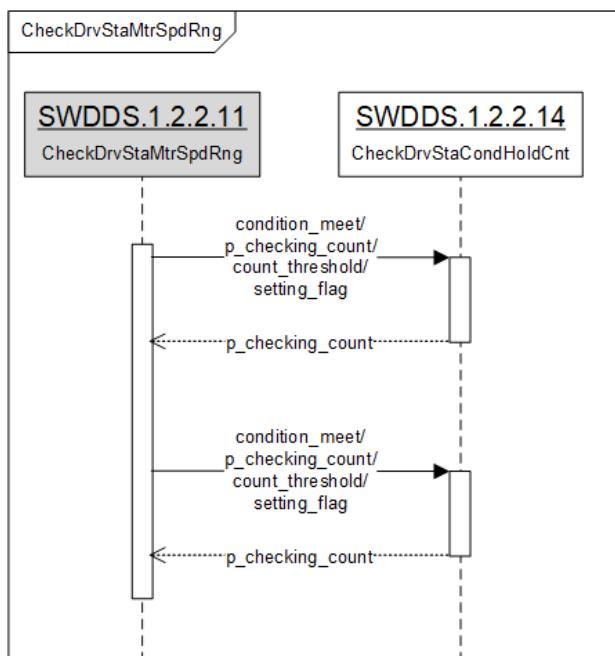
<b>Parameters</b>	tS16	par_s16MtrSpdOvrThrs	5500	Read	Motor speed range over threshold (rpm)
	tS16	par_s16MtrSpdUndThrs	-500	Read	Motor speed range under threshold (rpm)
	tU16	par_u16MtrSpdHoldTim	200	Read	Speed range over detection condition hold time (ms)
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	Motor speed range checking - Motor speed range over checking - Motor speed range under checking				
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     tBool condition_meet;     condition_meet = ( motor_speed &gt; par_s16MtrSpdOvrThrs )? TRUE : FALSE;      [SWDDS.1.2.2.14]     CheckDrvStaCondHoldCnt( condition_meet,     &amp;_u16DrvStaMtrSpdOvrCnt,     par_u16MtrSpdHoldTim,     DRV_STA_MTR_SPD_OVR );      ↓     condition_meet = ( motor_speed &lt; par_s16MtrSpdUndThrs )? TRUE : FALSE;      [SWDDS.1.2.2.14]     CheckDrvStaCondHoldCnt( condition_meet,     &amp;_u16DrvStaMtrSpdUndCnt,     par_u16MtrSpdHoldTim,     DRV_STA_MTR_SPD_UND );      ↓     end   </pre>				
<b>Called Function</b>	SWDDS.1.2.2.5 CheckDrvStaAtCtrEna				
<b>Calling Function</b>	SWDDS.1.2.2.14 CheckDrvStaCondHoldCnt				
<b>Function Execution Time</b>	N/A				

Requirement Id	SWDDS.1.2.2.11
Target Milestone	EBS2
Element	AswCtr
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.2.2.11.2 Static View Design



### 3.2.2.11.3 Dynamic View Design



### 3.2.2.11.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Motor speed over condition hold time count (ms)
	count									Speed range over detection

	VW AQ EOP										Baseline / Version / Date	003
	Software Detailed Design Specification										Updated Date	2021-06-30
											Page	118

3	_threshold	SWDDS.1.2.2.14	OUT	tU16	200	200	200	200	1 / msec	condition hold time (ms)		
4	setting_flag	SWDDS.1.2.2.14	OUT	tU32	1024	1024	0x00000400	0x00000400	N/A	Motor speed range over fault flag		
5	condition _meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet		
6	p_checking _count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Motor speed under condition hold time count (ms)		
7	count _threshold	SWDDS.1.2.2.14	OUT	tU16	200	200	200	200	1 / msec	Speed range over detection condition hold time (ms)		
8	setting_flag	SWDDS.1.2.2.14	OUT	tU32	2048	2048	0x00000800	0x00000800	N/A	Motor speed range under fault flag		

### 3.2.2.12 [SWDDS.1.2.2.12] CheckDrvStaSpdErr

#### 3.2.2.12.1 Detailed Design

##### [SWDDS.1.2.2.12] CheckDrvStaSpdErr

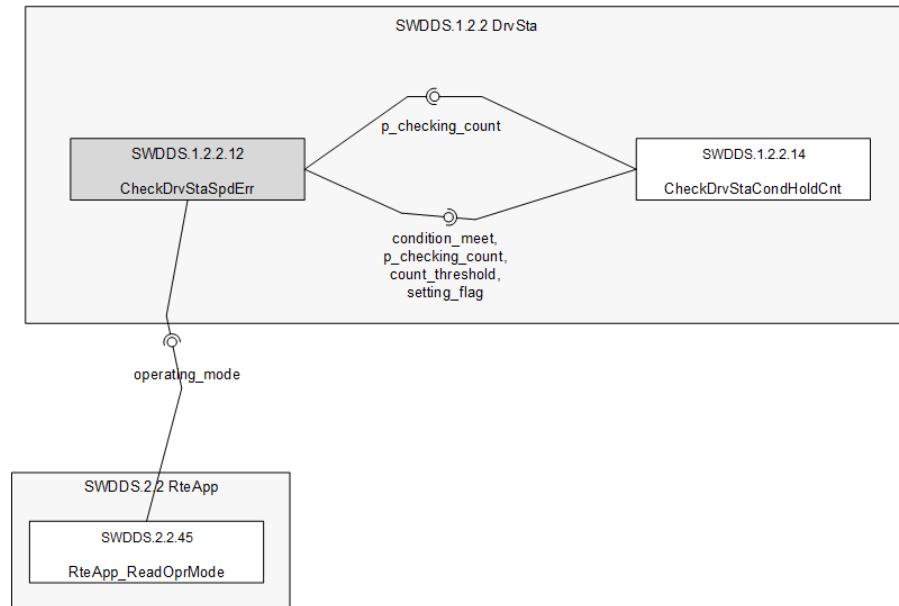
Software Unit Information					
Unit ID	SWDDS.1.2.2.12	Unit Name	CheckDrvStaSpdErr		
Architecture ID	SWADS.1.2.2.12	ASIL	QM		
Prototype	void CheckDrvStaSpdErr( tFrac16 current_output )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	current_output	-32768 ~ 32767	IN	current output
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16DrvStaSpdErrCnt1	0 ~ 60000	Read	Speed error condition 1 hold time count (ms)
	tU16	g_u16DrvStaSpdErrCnt2	0 ~ 60000	Read	Speed error condition 2 hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FitSpdErrCurThrs1	FRAC16( 1.5f / PARAM_PU_BASE_PHS_CUR )	Read	Speed error detection current threshold 1 (PU)
	tU16	par_u16FitSpdErrHoldTim1	10000	Read	Speed error detection condition hold

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	119

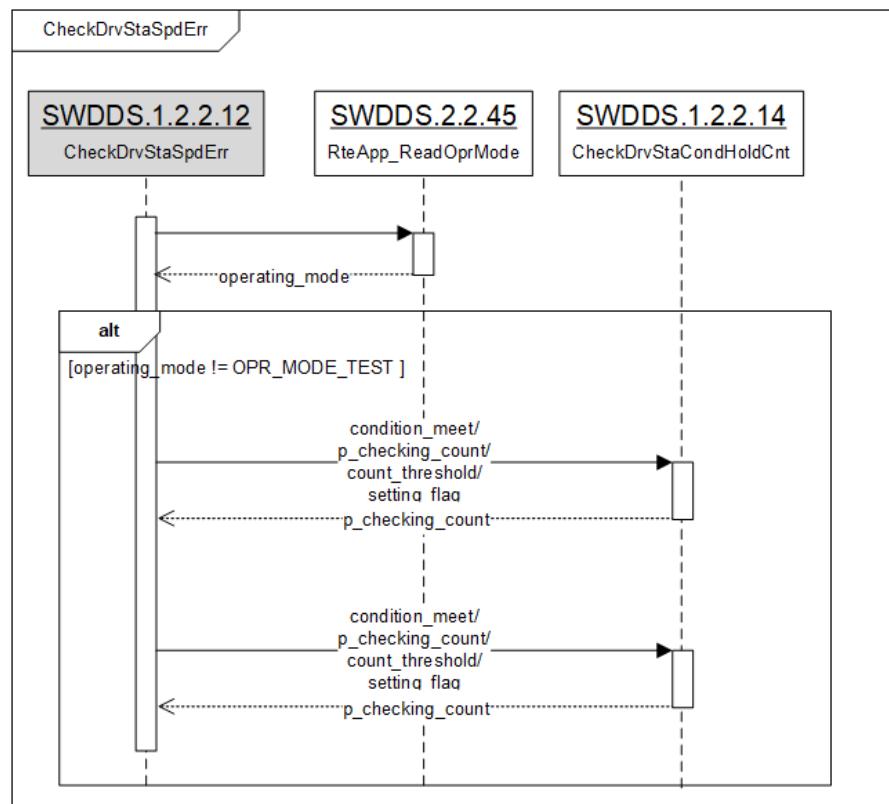
Registers	Data Type	Name	Range	time 1 (ms)	
				Read	Speed error detection current threshold 2 (PU)
				Read	Speed error detection condition hold time 2 (ms)
N/A	N/A	N/A	N/A	N/A	N/A
Description	Speed error condition checking - Operating mode getting and checking - Speed error condition 1 checking - Speed error condition 2 checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tOprMode operating_mode;     tBool condition_meet;      [SWDDS.2.2.45]     operating_mode = RteApp_ReadOprMode();      if(operating_mode != OPR_MODE_TEST)     {         condition_meet = (current_output &lt; par_f16FltSpdErrCurThrs1)?TRUE:FALSE;          [SWDDS.1.2.2.14]         CheckDrvStaCondHoldCntr(condition_meet,         &amp;g_u16DrvStaSpdErrCnt1,         par_u16FltSpdErrHoldTim1,         DRV_STA_SPD_ERR_1);          condition_meet = (current_output &lt; par_f16FltSpdErrCurThrs2)?TRUE:FALSE;          [SWDDS.1.2.2.14]         CheckDrvStaCondHoldCntr(condition_meet,         &amp;g_u16DrvStaSpdErrCnt2,         par_u16FltSpdErrHoldTim2,         DRV_STA_SPD_ERR_2);     }     end   </pre>				
Called Function	SWDDS.1.2.2.6 CheckDrvStaAtSIRun				
Calling Function	SWDDS.1.2.2.14 CheckDrvStaCondHoldCntr				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.2.12
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.2.12.2 Static View Design



### 3.2.2.12.3 Dynamic View Design



<b>SNT Motiv</b>	VW AQ EOP						Baseline / Version / Date	003
	Software Detailed Design Specification						Updated Date	2021-06-30
							Page	121

### 3.2.2.12.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	operating_mode	SWDDS.2.2.45	IN	tOprMode	0	5	OPR_MODE_OFF	OPR_MODE_TEST	N/A	Operating mode
2	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
3	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Speed error condition 1 hold time count (ms)
4	count_threshold	SWDDS.1.2.2.14	OUT	tU16	10000	10000	10000	10000	1 / msec	Speed error detection condition hold time 1 (ms)
5	setting_flag	SWDDS.1.2.2.14	OUT	tU32	256	256	0x00000100	0x00000100		Speed error 1 fault flag
6	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
7	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Speed error condition 2 hold time count (ms)
8	count_threshold	SWDDS.1.2.2.14	OUT	tU16	4000	4000	4000	4000	1 / msec	Speed error detection condition hold time 2 (ms)
9	setting_flag	SWDDS.1.2.2.14	OUT	tU32	512	512	0x00000200	0x00000200	N/A	Speed error 2 fault flag

### 3.2.2.13 [SWDDS.1.2.2.13] CheckDrvStaCurOvr

#### 3.2.2.13.1 Detailed Design

##### [SWDDS.1.2.2.13] CheckDrvStaCurOvr

Software Unit Information							
Unit ID	SWDDS.1.2.2.13		Unit Name	CheckDrvStaCurOvr			
Architecture ID	SWADS.1.2.2.13		ASIL	QM			
Prototype	void CheckDrvStaCurOvr(tFrac16 current_output, tFrac16 motor_speed )						
Function Call Parameters	Data Type	Name	Range		IN/OUT		
	tFrac16	current_output	-32768 ~ 32767		IN	current output	
	tFrac16	motor_speed	-32768 ~ 32767		IN	motor speed(rpm)	

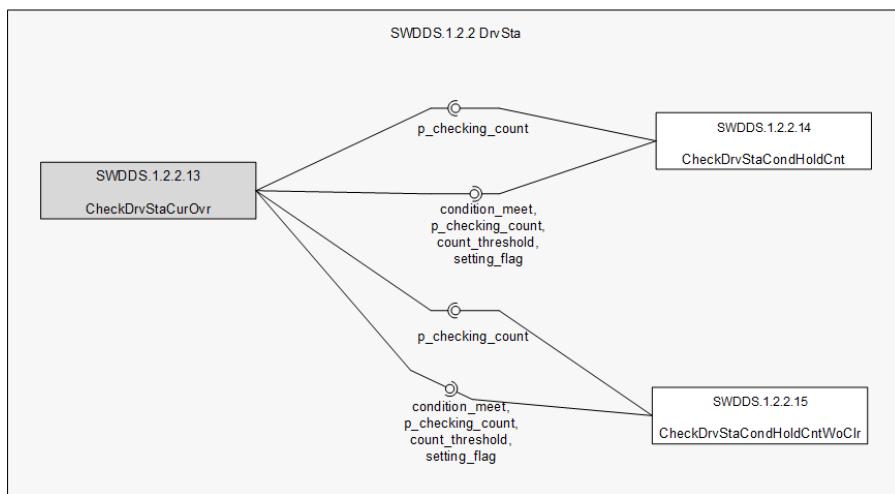
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	122

Function Call Return Value	Data Type	Possible Return Value		Description	
N/A		N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16DrvStaCurOvrCnt1	0 ~ 60000	Read	Current over condition 1 hold time count (ms)
	tU16	g_u16DrvStaCurOvrCnt21	0 ~ 60000	Read	Current over condition 21 hold time count (ms)
	tU16	g_u16DrvStaCurOvrCnt22	0 ~ 60000	Read	Current over condition 22 hold time count (ms)
	tU16	g_u16DrvStaCurOvrCnt3	0 ~ 60000	Read	Current over condition 3 hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltCurOvrCurThrs1	FRAC16( 25.0f / PARAM_PU_BASE_PHS_CUR )	Read	Over current detection current threshold 1 (PU)
	tFrac16	par_f16FltCurOvrSpdThrs1	FRAC16( 600.0f / PARAM_PU_BASE_MECH_SPD )	Read	Over current detection speed threshold 1 (PU)
	tU16	par_u16FltCurOvrHoldTim1	3000	Read	Over current detection condition hold time 1 (ms)
	tBool	par_bEopCtrCurLmtEna	0 ~ 1	Read	Current limiting enable
	tFrac16	par_f16FltCurOvrCurThrs2	FRAC16( 25.0f / PARAM_PU_BASE_PHS_CUR )	Read	Over current detection current threshold 2 (PU)
	tU16	par_u16FltCurOvrAkHoldTim2	3000	Read	Over current detection condition AK hold time 2 (ms)
	tU16	par_u16FltCurOvrCkHoldTim2	10000	Read	Over current detection condition CK hold time 2 (ms)
	tFrac16	par_f16FltCurOvrCurThrs3	FRAC16( 25.0f / PARAM_PU_BASE_PHS_CUR )	Read	Over current detection current threshold 3 (PU)
	tU16	par_u16FltCurOvrHoldTim3	10000	Read	Over current detection condition hold time 3 (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Current over condition checking - Current over condition 1 checking - Current over condition 2 checking at current limiting - Current over condition 3 checking at speed control				
Control Flow Diagram (or Pseudo Code)					

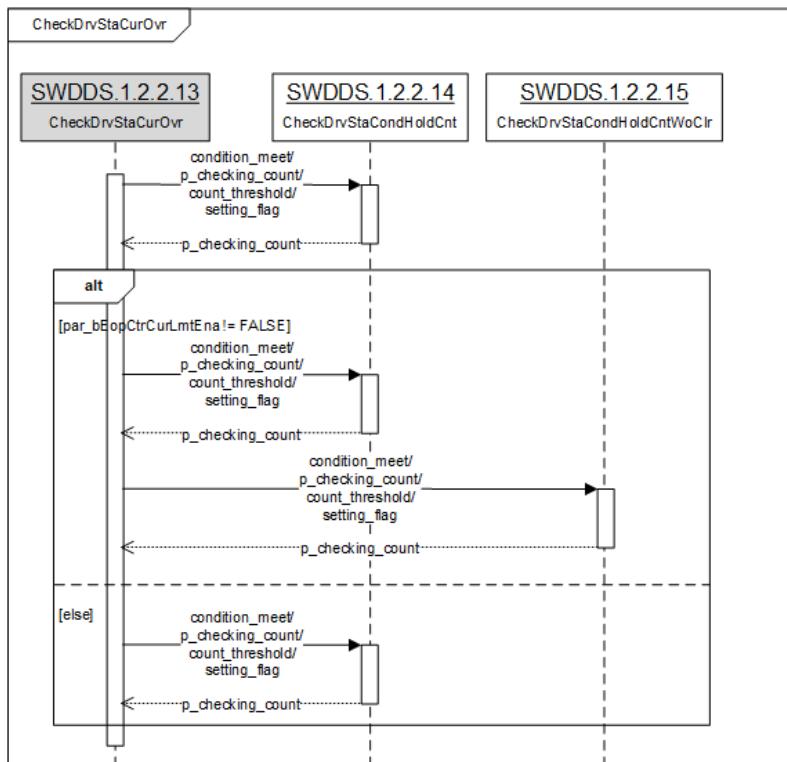
Control Flow Diagram (or Pseudo Code)	<pre> start   tBool condition_meet;   condition_meet = ( current_output &gt; par_f16FltCurOvrCurThrs1 ) &amp;&amp; ( motor_speed &lt; par_f16FltCurOvrSpdThrs1 )? TRUE : FALSE;    [SWDDS.12.2.14]   CheckDrvStaCondHoldCnt( condition_meet,   &amp;g_u16DrvStaCurOvrCnt1,   par_u16FltCurOvrHoldTim1,   DRV_STA_CUR_OVR_1 );    if( par_bEopCtrCurLmtEna != FALSE )     {       if( condition_meet = ( current_output &gt; par_f16FltCurOvrCurThrs2 )? TRUE : FALSE; )         [SWDDS.12.2.14]         CheckDrvStaCondHoldCnt( condition_meet,         &amp;g_u16DrvStaCurOvrCnt21, par_u16FltCurOvrAkHoldTim2,         DRV_STA_CUR_OVR_2 );       else         [SWDDS.12.2.14]         CheckDrvStaCondHoldCnt( condition_meet,         &amp;g_u16DrvStaCurOvrCnt3, par_u16FltCurOvrHoldTim3,         DRV_STA_CUR_OVR_3 );     }   end </pre>		
	Called Function	SWDDS.1.2.2.7 CheckDrvStaAtCurLmt	
	Calling Function	SWDDS.1.2.2.14 CheckDrvStaCondHoldCnt	
	Function Execution Time	N/A	

Requirement Id	SWDDS.1.2.2.13
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.2.13.2 Static View Design



### 3.2.2.13.3 Dynamic View Design



#### 3.2.2.13.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Current over condition 1 hold time count (ms)
3	count_threshold	SWDDS.1.2.2.14	OUT	tU16	3000	3000	3000	3000	1 / msec	Over current detection condition hold time 1 (ms)
4	setting_flag	SWDDS.1.2.2.14	OUT	tU32	4096	4096	0x00001000	0x00001000	N/A	Current over 1 fault flag
5	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	125

6	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Current over condition 21 hold time count (ms)
7	count_threshold	SWDDS.1.2.2.14	OUT	tU16	3000	3000	3000	3000	1 / msec	Over current detection condition AK hold time 2 (ms)
8	setting_flag	SWDDS.1.2.2.14	OUT	tU32	8192	8192	0x00002000	0x00002000	N/A	Current over 2 fault flag
9	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
10	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Current over condition 22 hold time count (ms)
11	count_threshold	SWDDS.1.2.2.14	OUT	tU16	10000	10000	10000	10000	1 / msec	Over current detection condition CK hold time 2 (ms)
12	setting_flag	SWDDS.1.2.2.14	OUT	tU32	8192	8192	0x00002000	0x00002000	N/A	Current over 2 fault flag
13	condition_meet	SWDDS.1.2.2.14	OUT	tBool	0	1	Did not meet	Condition meet	True / False	Checking condition meet
14	p_checking_count	SWDDS.1.2.2.14	IN/OUT	tU16*	0	60000	0	60000	10 / msec	Current over condition 3 hold time count (ms)
15	count_threshold	SWDDS.1.2.2.14	OUT	tU16	10000	10000	10000	10000	1 / msec	Over current detection condition hold time 3 (ms)
16	setting_flag	SWDDS.1.2.2.14	OUT	tU32	16384	16384	0x00004000	0x00004000	N/A	Current over 3 fault flag

### 3.2.2.14 [SWDDS.1.2.2.14] CheckDrvStaCondHoldCnt

#### 3.2.2.14.1 Detailed Design

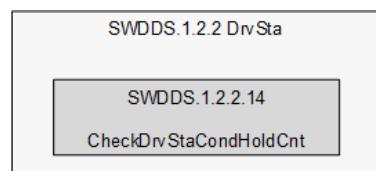
##### [SWDDS.1.2.2.14] CheckDrvStaCondHoldCnt

Software Unit Information					
Unit ID	SWDDS.1.2.2.14	Unit Name	CheckDrvStaCondHoldCnt		
Architecture ID	SWADS.1.2.2.14	ASIL	QM		
void CheckDrvStaCondHoldCnt( tBool condition_meet, tU16* p_checking_count, tU16 count_threshold, tU32 setting_flag )					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	condition_meet	0 ~ 1	IN	Condition meet
	tU16*	p_checking_count	0 ~ 60000	IN/OUT	Pointer of condition Hold checking time count
	tU16	count_threshold	0 ~ 60000	IN	condition hold checking time count threshold
	tU32	setting_flag	256 ~ 8388608	IN	setting flag if hold count is reached
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32DrvStaChkFlag	0 ~ 16776960	Read	Driving status checking flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Condition hold count checking				

Control Flow Diagram (or Pseudo Code)	<pre>     start     condition_meet != FALSE       yes         (*p_checking_count) &lt; 60000u           yes             (*p_checking_count) += DRV_STA_TIM_INC_PER_STEP;             (*p_checking_count) &gt;= count_threshold               yes                 g_u32DrvStaChkFlag  = setting_flag;               no             no           no         no       no         (*p_checking_count) = 0u;       end     </pre>
Called Function	SWDDS.1.2.2.8 CheckDrvStaShrtCir SWDDS.1.2.2.10 CheckDrvStaLowCur SWDDS.1.2.2.11 CheckDrvStaMtrSpdRng SWDDS.1.2.2.12 CheckDrvStaSpdErr SWDDS.1.2.2.13 CheckDrvStaCurOvr
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.2.14
Target Milestone	EBS2
Element	AswCtr
Risk	▣ Mid
Interoperability	Yes
Criticality	▣ Mid
Technical complexity	▣ Mid
Verifiability	Yes

### 3.2.2.14.2 Static View Design



### 3.2.2.14.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	127

### 3.2.2.14.4 Interface Design

- N/A

### 3.2.2.15 [SWDDS.1.2.2.15] CheckDrvStaCondHoldCntWoClr

#### 3.2.2.15.1 Detailed Design

##### [SWDDS.1.2.2.15] CheckDrvStaCondHoldCntWoClr

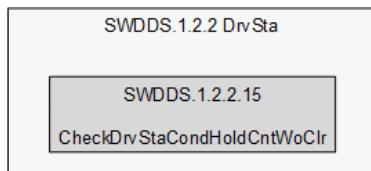
Software Unit Information					
Unit ID	SWDDS.1.2.2.15	Unit Name	CheckDrvStaCondHoldCntWoClr		
Architecture ID	SWADS.1.2.2.15	ASIL	QM		
void CheckDrvStaCondHoldCntWoClr( tBool condition_meet, tU16* p_checking_count, tU16 count_threshold, tU32 setting_flag )					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	condition_meet	0 ~ 1	IN	Condition meet
	tU16*	p_checking_count	0 ~ 60000	IN/OUT	Pointer of condition Hold checking time count
	tU16	count_threshold	0 ~ 60000	IN	condition hold checking time count threshold
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32DrvStaChkFlag	0 ~ 16776960	Read	Driving status checking flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description					
Condition hold count checking without count clearing					
Control Flow Diagram (or Pseudo Code)	<pre>     start           { condition_meet != FALSE }       yes       { (*p_checking_count) &lt; 60000u }         yes         { (*p_checking_count) += DRV_STA_TIM_INC_PER_STEP; }         { (*p_checking_count) &gt;= count_threshold }           yes           { g_u32DrvStaChkFlag  = setting_flag; }       no           end   </pre>				
Called Function	SWDDS.1.2.2.13 CheckDrvStaCurOvr				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.2.15
Target Milestone	EBS2
Element	AswCtr

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	128

Risk	<input checked="" type="checkbox"/> Mid
Interoperability	Yes
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

### 3.2.2.15.2 Static View Design



### 3.2.2.15.3 Dynamic View Design

- N/A

### 3.2.2.15.4 Interface Design

- N/A

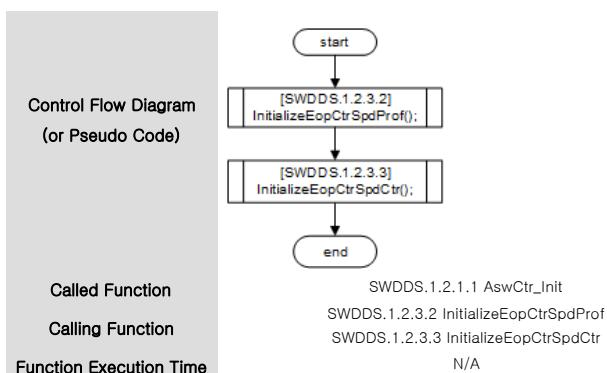
## 3.2.3 [SWDDS.1.2.3] EopCtr

### 3.2.3.1 [SWDDS.1.2.3.1] EopCtr\_Init

#### 3.2.3.1.1 Detailed Design

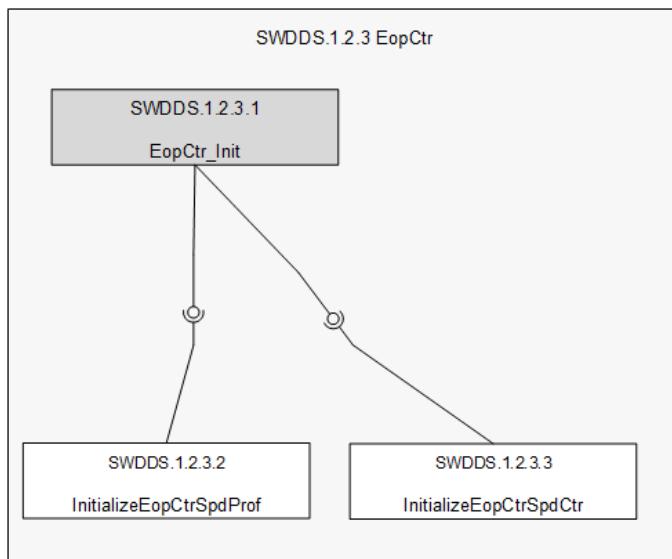
##### [SWDDS.1.2.3.1] EopCtr\_Init

Software Unit Information										
Unit ID	SWDDS.1.2.3.1	Unit Name	EopCtr_Init							
Architecture ID	SWADS.1.2.3.1	ASIL	QM							
<code>void EopCtr_Init( void )</code>										
Function Call	Data Type	Name	Range	IN/OUT	Description					
Parameters	N/A	N/A	N/A	N/A	N/A					
Function Call	Data Type	Possible Return Value		Description						
Return Value	void	N/A		N/A						
Global Variables	Data Type	Name	Range	Read/Write	Description					
Parameters	N/A	N/A	N/A	N/A	N/A					
Registers	Data Type	Name	Range	Read/Write	Description					
Return Value	N/A	N/A	N/A	N/A	N/A					
Description	EOP speed profile control initialization									
1. EopCtr_Init initializes the speed profile generation. 2. EopCtr_Init initializes speed control.										
Control Flow Diagram (or Pseudo Code)										



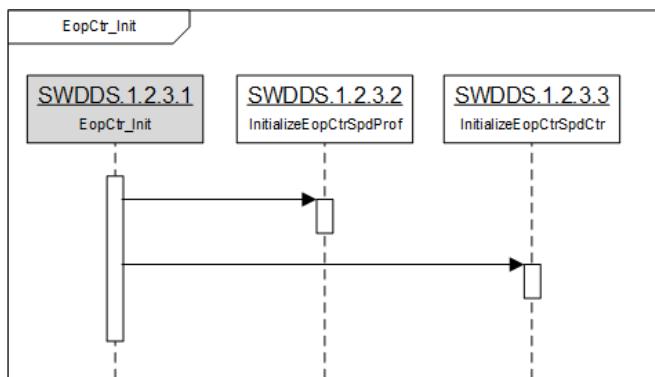
Requirement Id	SWDDS.1.2.3.1
Target Milestone	SBS1
Element	AswCtr
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 3.2.3.1.2 Static View Design



### 3.2.3.1.3 Dynamic View Design

1. EopCtr\_Init calls the speed profile generation initialization.
2. EopCtr\_Init calls the speed control initialization.



### 3.2.3.1.4 Interface Design

- N/A

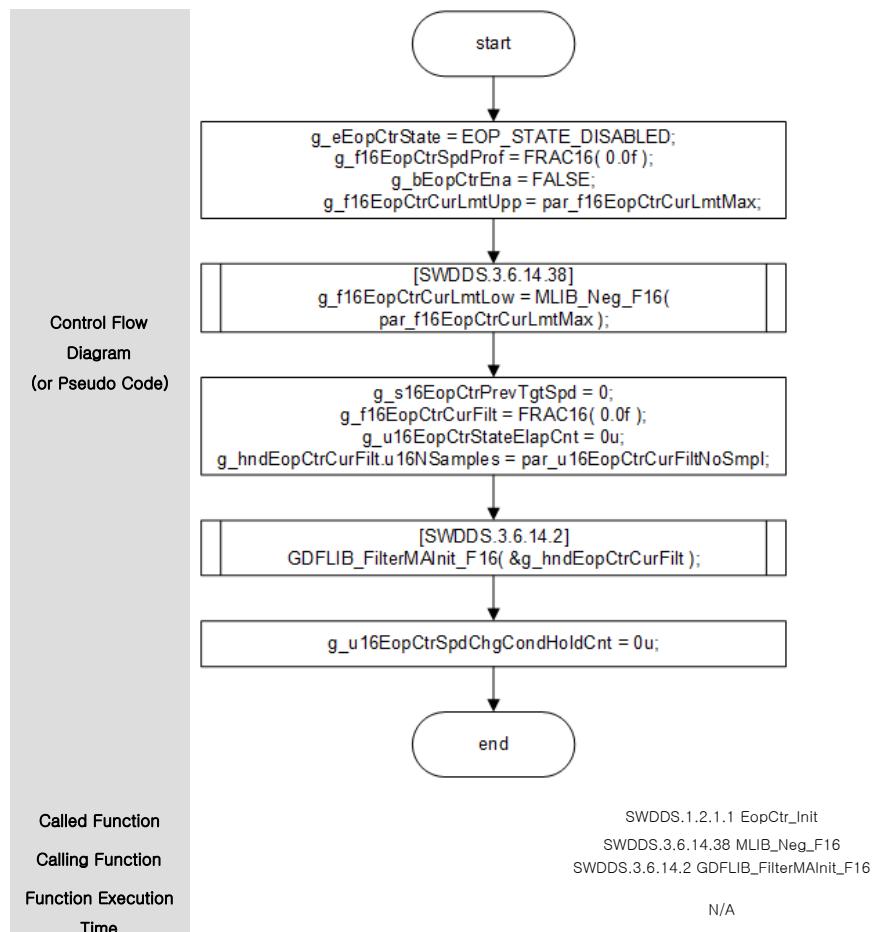
### 3.2.3.2 [SWDDS.1.2.3.2] InitializeEopCtrSpdProf

#### 3.2.3.2.1 Detailed Design

##### [SWDDS.1.2.3.2] InitializeEopCtrSpdProf

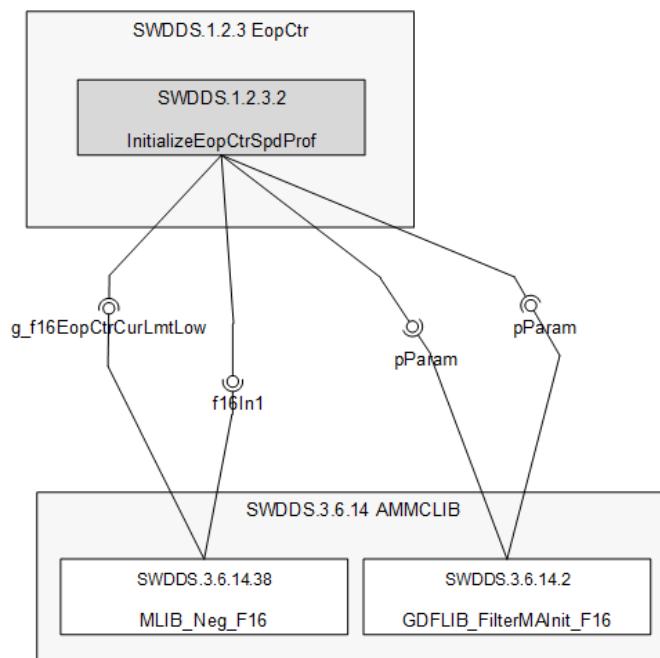
Software Unit Information					
Unit ID	SWDDS.1.2.3.2	Unit Name	InitializeEopCtrSpdProf		
Architecture ID	SWADS.1.2.3.2	ASIL	QM		
Prototype	void InitializeEopCtrSpdProf( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value			Description
Return Value	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19661	Write	EOP speed profile (PU)
	tBool	g_bEopCtrEna	0 ~ 1	Write	EOP control enable (FALSE - disabled, TRUE - enabled)
	tFrac16	g_f16EopCtrCurLmtUpp	-32768 ~ 32767	Write	Speed control current limit upper (PU)
	tFrac16	g_f16EopCtrCurLmtLow	-32768 ~ 32767	Write	Speed control current limit lower (PU)
	ts16	g_s16EopCtrPrevTgtSpd	0 ~ 3200	Write	Previous target speed setting (rpm)
	tFrac16	g_f16EopCtrCurFilt	-32768 ~ 32767	Write	Filtered current (PU)
	tu16	g_u16EopCtrStateElapCnt	0 ~ 60000	Write	Elapse time count after state entered
	GDFLIB_FILTER_MA_T_F16	g_hndEopCtrCurFilt	0 ~ 15	Read/Write	Current output filtering handler (u16NSamples)
Parameters	tu16	g_u16EopCtrSpdChgCondHoldCnt	0 ~ 60000	Write	Speed changing mode entering condition hold time count (ms)
	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16EopCtrCurLmtMax	11430	Read	Phase current limit at maximum speed (PU)
Registers	tu16	par_u16EopCtrCurFiltNoSmpl	5	Read	Number of samples for moving average filtering of phase current
	Data Type	Name	Range	Read/Write	Description
Description	N/A	N/A	N/A	N/A	N/A
	Speed profile generation initialization – Internal variables initialization				
1. InitializeEopCtrSpdProf sets the EOP control state and EOP control enable as disabled. 2. InitializeEopCtrSpdProf sets the upper and lower current limits as maximum current limit setting. 3. InitializeEopCtrSpdProf initializes the internal variables related to the speed profile generation. 4. InitializeEopCtrSpdProf initializes the phase current filter.					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	131

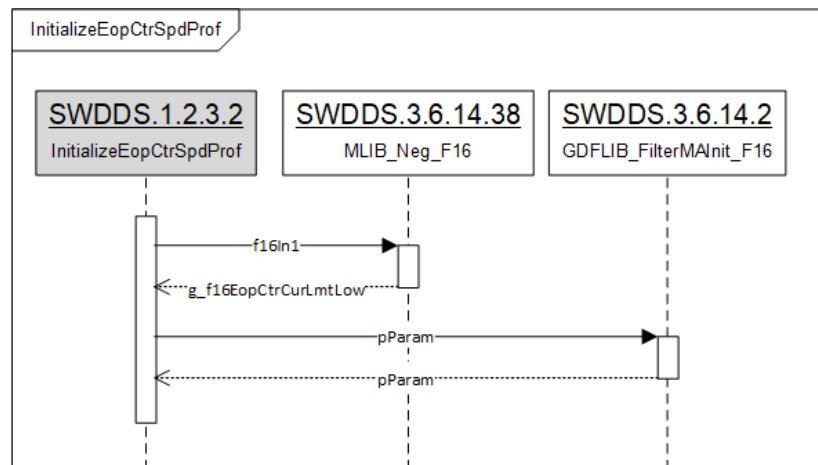


Requirement Id	SWDDS.1.2.3.2
Target Milestone	EBS2
Element	AswCtr
Risk	Low
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

### 3.2.3.2.2 Static View Design



### 3.2.3.2.3 Dynamic View Design



### 3.2.3.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Phase current limit at maximum speed (PU)
2	g_f16EopCtrCurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)
3	pParam	SWDDS.3.6.14.2	IN/OUT	GDFLIB_FILTER_MA_T_F16 *	N/A	N/A	N/A	N/A	N/A	Current output filtering handler

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	133

### 3.2.3.3 [SWDDS.1.2.3.3] InitializeEopCtrSpdCtr

#### 3.2.3.3.1 Detailed Design

##### [SWDDS.1.2.3.3] InitializeEopCtrSpdCtr

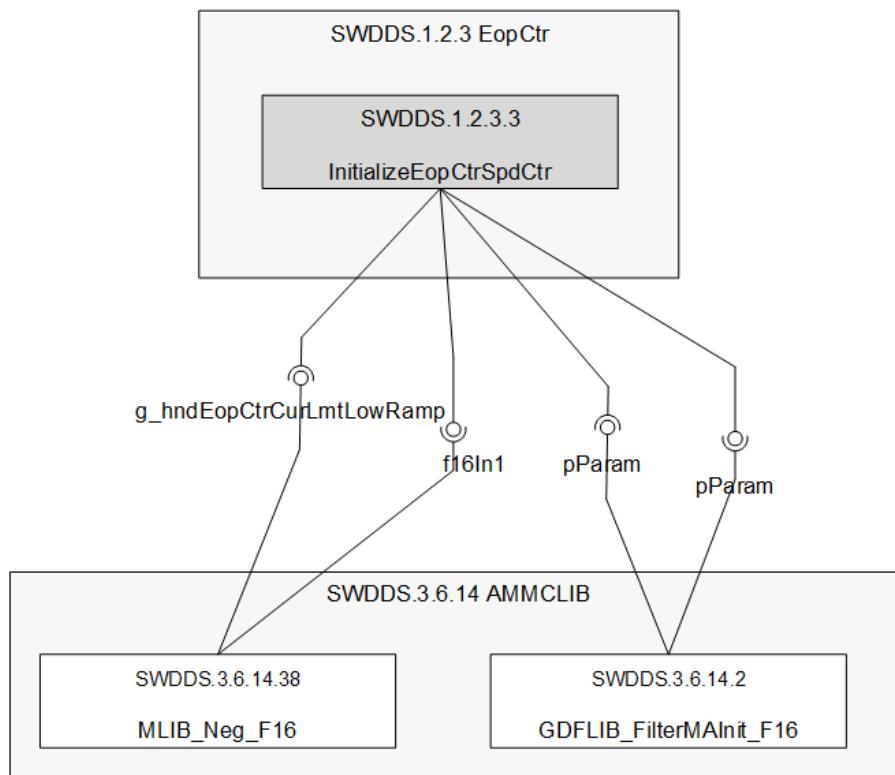
Software Unit Information					
Unit ID	SWDDS.1.2.3.3	Unit Name	InitializeEopCtrSpdCtr		
Architecture ID	SWADS.1.2.3.3	ASIL	QM		
Prototype	void InitializeEopCtrSpdCtr( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp.f32State	0 ~ 1288490189	Write	Reference speed ramping handler (f32State)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtUppRamp	0 ~ 457	Write	Current limit upper ramping handler (f16RampUp)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtUppRamp	0 ~ 457	Write	Current limit upper ramping handler (f16RampDown)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtUppRamp	-11430 ~ 11430	Write	Current limit upper ramping handler (f16State)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtLowRamp.f16RampUp	0 ~ 609	Write	Current limit lower ramping handler (f16RampUp)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtLowRamp.f16RampDown	0 ~ 609	Write	Current limit lower ramping handler (f16RampDown)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtLowRamp.f16State	-11430 ~ 11430	Write	Current limit lower ramping handler (f16State)
	tFrac16	g_f16EopCtrPrevSpdProf	0 ~ 19660	Write	Previous speed profile setting (PU)
	tFrac16	g_f16EopCtrRefSpd	0 ~ 19660	Write	Reference speed setting (PU)
	GDFLIB_FILTER_MA_T_F16	g_hndEopCtrSpdErrFilt	0 ~ 15	Read/Write	Speed control error filtering handler

Parameters	tFrac16	g_f16EopCtrSpdErr	-32768 ~ 32767	Write	Speed control error (PU)
	Data Type	Name	Range	Read/Write	Description
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)
	tFrac16	par_f16EopCtrCurLmtRateUpp	457	Read	Phase current limit upper increment/decrement rate (PU/step)
	tFrac16	par_f16EopCtrCurLmtMax	11430	Read	Phase current limit at maximum speed (PU)
	tU16	par_u16EopCtrSpdErrFiltNoSmpl	5	Read	Number of samples for moving average filtering of Speed control error
	Frac16	par_f16EopCtrCurLmtRateLow	609	Read	Phase current limit lower increment/decrement rate (PU/step)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	<p>Speed control initialization</p> <ul style="list-style-type: none"> <li>– Reference speed ramping handler initialization</li> <li>– Current limit ramping handler initialization</li> <li>– Internal variables initialization</li> <li>– InitializeEopCtrSpdCtr initializes the speed control error filter.</li> </ul>				
Control Flow Diagram(or Pseudo Code)	<ol style="list-style-type: none"> <li>1. InitializeEopCtrSpdCtr sets the increment and decrement rates of the reference speed.</li> <li>2. InitializeEopCtrSpdCtr sets the increment and decrement rates of the upper and lower current limits.</li> <li>3. InitializeEopCtrSpdCtr sets the initial upper and lower current limits.</li> <li>4. InitializeEopCtrSpdCtr initializes the internal variables related to the speed control.</li> </ol>				

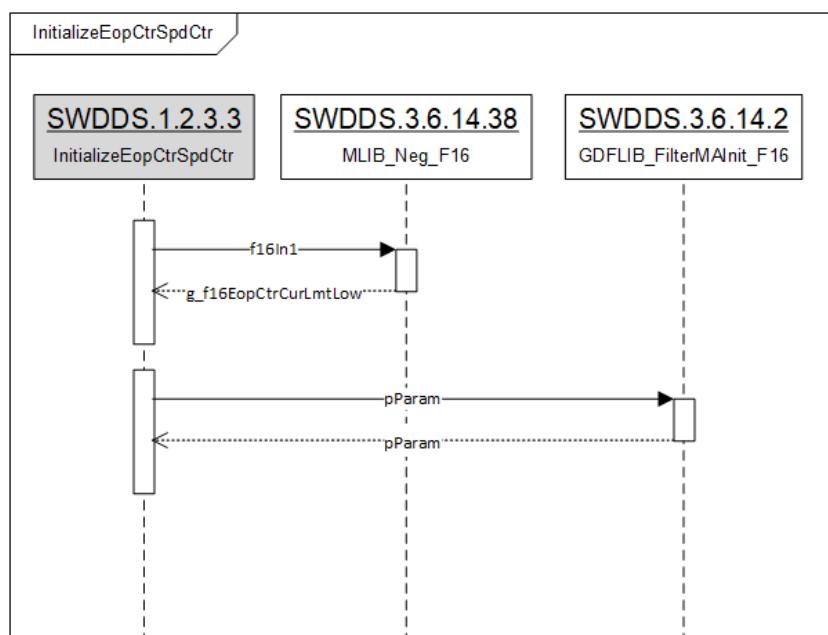
<b>Control Flow Diagram(or Pseudo Code)</b>	<pre>     start     g_hndEopCtrRefSpdRamp.f32RampUp = par_f32RefSpdIncRate;     g_hndEopCtrRefSpdRamp.f32RampDown = par_f32RefSpdDecRate;     g_hndEopCtrRefSpdRamp.f32State = FRAC32(0.0f);     g_hndEopCtrCurLmtUppRamp.f16RampUp = par_f16EopCtrCurLmtRateUp;     g_hndEopCtrCurLmtUppRamp.f16RampDown = par_f16EopCtrCurLmtRateUp;     g_hndEopCtrCurLmtLowRamp.f16RampUp = par_f16EopCtrCurLmtRateLow;     g_hndEopCtrCurLmtLowRamp.f16RampDown = par_f16EopCtrCurLmtRateLow;   </pre>	
	<p>[SWDDS.3.6.14.38]</p> <pre>     g_hndEopCtrCurLmtLowRamp.f16State = MLIB_Neg_F16( par_f16EopCtrCurLmtMax );   </pre>	
	<pre>     g_f16EopCtrPrevSpdProf = FRAC16( 0.0f );     g_f16EopCtrRefSpd = FRAC16( 0.0f );     g_f16EopCtrSpdErr = FRAC16( 0.0f );     g_hndEopCtrSpdErrFilt.u16NSamples = par_u16EopCtrSpdErrFiltNoSmp;   </pre>	
	<p>[SWDDS.3.6.14.2]</p> <pre>     GDFLIB_FilterMAInit_F16(&amp;g_hndEopCtrSpdErrFilt );   </pre>	
		end
Called Function	SWDDS.1.2.1.1 EopCtr_Init	
Calling Function	SWDDS.3.6.14.38 MLIB_Neg_F16	
Calling Function	SWDDS.3.6.14.2 GDFLIB_FilterMAInit_F16	
Function Execution Time	N/A	

Requirement Id	SWDDS.1.2.3.3
Target Milestone	SBS2.1
Element	AswCtr
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: red;">■</span> High
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 3.2.3.3.2 Static View Design



### 3.2.3.3.3 Dynamic View Design



### 3.2.3.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	FRAC16 ( 22.5f / PARAM_PU _BASE_PHS _CUR )	FRAC16 ( 22.5f / PARAM_PU _BASE_PHS _CUR )	22.5	22.5	0.00196838 / Apk	Phase current limit at maximum speed (PU)
2	g_hndEopCtrCurLmtLowRamp	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	137

.f16State

upper (PU)

3	pParam	SWDDS.3.6.14.6	IN/OUT	GDFLIB_FILTER_MA_T_F16	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
---	--------	----------------	--------	------------------------	-----	-----	-----	-----	-----	------------------------------

### 3.2.3.4 [SWDDS.1.2.3.4] EopCtr\_Run

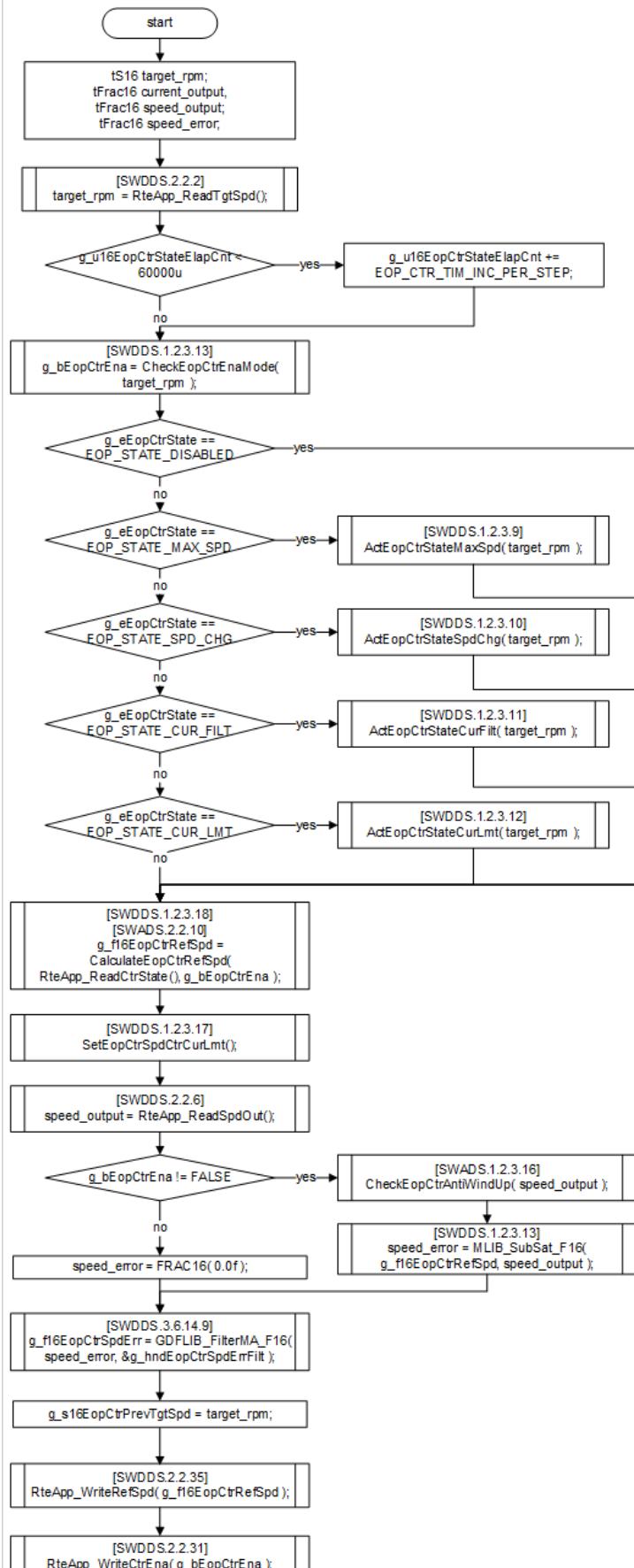
#### 3.2.3.4.1 Detailed Design

##### [SWDDS.1.2.3.4] EopCtr\_Run

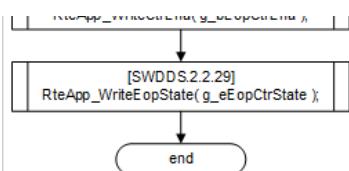
Software Unit Information					
Unit ID	SWDDS.1.2.3.4		Unit Name	EopCtr_Run	
Architecture ID	SWADS.1.2.3.4		ASIL	QM	
Prototype	void EopCtr_Run( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Read/Write	Elapse time count after state entered
	tBool	g_bEopCtrEna	0 ~ 1	Read/Write	EOP control enable
	tEopState	g_eEopCtrState	0 ~ 4	Read	EOP control state
	tFrac16	g_f16EopCtrRefSpd	0 ~ 19660	Read/Write	Reference speed setting (PU)
	tFrac16	g_f16EopCtrSpdErr	-32768 ~ 32767	Write	Speed control error (PU)
	GDFLIB_FILTER_MA_T_F16	g_hndEopCtrSpdErrFilt	0 ~ 15	Read/Write	Speed control error filtering handler
Parameters	tS16	g_s16EopCtrPrevTgtSpd	0 ~ 3200	Write	Previous target speed setting (rpm)
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	EOP control - Input data getting - Elapse time counting - Control enabling checking - EOP control state handling - Reference speed calculation and speed control anti-windup - Data updating - The speed control error filter				
	1. EopCtr_Run gets the target speed input. 2. EopCtr_Run increases the elapse time count of EOP control state. 3. EopCtr_Run checks the EOP control enable according to the target speed, functional mode and application mode. 4. EopCtr_Run handles action and state transition according to the EOP control states. 5. EopCtr_Run calculates the reference speed. 6. EopCtr_Run sets the upper and lower current limits. 7. EopCtr_Run handles the anti-windup logic.				

8. EopCtr\_Run updates the application data related to EOP control.

**Control Flow  
Diagram  
(or Pseudo  
Code)**



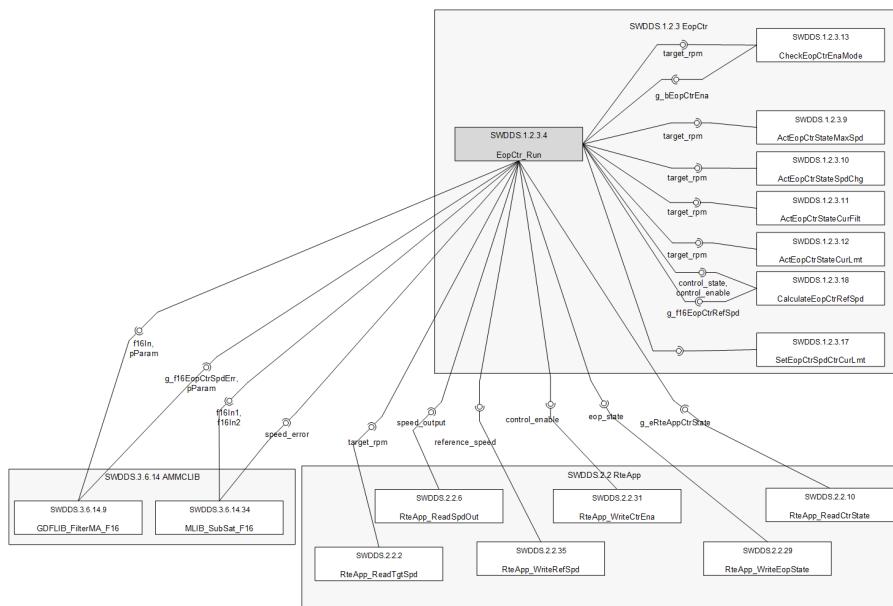
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	139



Called Function	SWDDS.2.1.8 RteSch_Task5ms
Calling Function	SWDDS.2.2.2 RteApp_ReadTgtSpd
	SWDDS.1.2.3.13 CheckEopCrtEnaMode
	SWDDS.1.2.3.9 ActEopCrtStateMaxSpd
	SWDDS.1.2.3.10 ActEopCrtStateSpdChg
	SWDDS.1.2.3.11 ActEopCrtStateCurFilt
	SWDDS.1.2.3.12 ActEopCrtStateCurLmt
	SWDDS.1.2.3.18 CalculateEopCrtRefSpd
	SWDDS.2.2.10 RteApp_ReadCrtState
	SWDDS.1.2.3.17 SetEopCrtSpdCrtCurLmt
	SWDDS.2.2.6 RteApp_ReadSpdOut
	SWDDS.1.2.3.16 CheckEopCrtAntiWindUp
	SWDDS.3.6.14.34 MLIB_SubSat_F16
	SWDDS.2.2.35 RteApp_WriteRefSpd
	SWDDS.2.2.31 RteApp_WriteCrtEna
	SWDDS.2.2.29 RteApp_WriteEopState
	SWDDS.3.6.14.9 GDFLIB_FilterMA_F16
	SWDDS.2.2.59 RteApp_WriteSpdErr
Function Execution Time	N/A

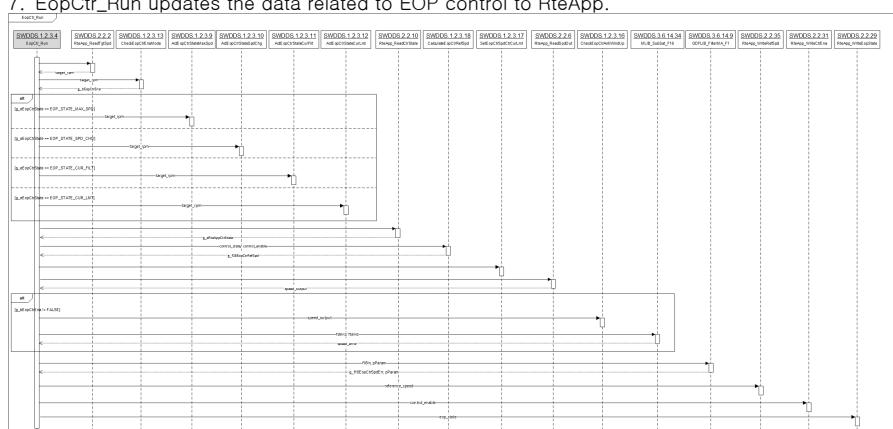
Requirement Id	SWDDS.1.2.3.4
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="border: 1px solid orange; padding: 2px;">□</span> Mid
Interoperability	No
Criticality	<span style="color: red;">★</span> High
Technical complexity	<span style="border: 1px solid orange; padding: 2px;">□</span> Mid
Verifiability	Yes

### 3.2.3.4.2 Static View Design



#### 3.2.3.4.3 Dynamic View Design

1. EopCtr\_Run gets the target speed from RteApp.
  2. EopCtr\_Run calls CheckEopCtrEnaMode to check the EOP control enable according to the target speed, functional mode and application mode.
  3. EopCtr\_Run handles action and state transition according to the EOP control states by calling ActEopCtrStateMaxSpd, ActEopCtrStateSpdChg, ActEopCtrStateCurFilt and ActEopCtrStateCurLmt.
  4. EopCtr\_Run calls CalculateEopCtrRefSpd to calculate the reference speed.
  5. EopCtr\_Run calls SetEopCtrSpdCtrCurLmt to set the upper and lower current limits.
  6. EopCtr\_Run calls CheckEopCtrAntiWindUp to handle the anti-windup logic.
  7. EopCtr\_Run updates the data related to EOP control to RteApp.



#### 3.2.3.4.4 Interface Design

	VW AQ EOP							Baseline / Version / Date	003	
	Software Detailed Design Specification							Updated Date	2021-06-30	
								Page	141	

5	target_rpm	SWDDS.1.2.3.10	OUT	tS16	0	3200	0	3200	1 / rpm	setting (rpm)
6	target_rpm	SWDDS.1.2.3.11	OUT	tS16	0	3200	0	3200	1 / rpm	Target speed setting (rpm)
7	target_rpm	SWDDS.1.2.3.12	OUT	tS16	0	3200	0	3200	1 / rpm	Target speed setting (rpm)
8	control_state	SWDDS.1.2.3.18	OUT	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Control state
9	control_enable	SWDDS.1.2.3.18	OUT	tBool	0	1	Control disable	Control enable	True / False	EOP control enable
10	g_f16EopCtrRefSpd	SWDDS.1.2.3.18	IN	tFrac16	0	32767	0.0	5999.82	0.183105 / rpm	Reference speed setting (PU)
11	g_eRteAppCtrState	SWDDS.2.2.10	IN	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Control state
12	speed_output	SWDDS.2.2.6	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
13	speed_output	SWDDS.1.2.3.16	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	speed output feedback (PU)
14	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	0	17476	0.0	3200.0	0.183105 / rpm	Reference speed (PU)
15	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
16	speed_error	SWDDS.3.6.14.34	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed control error(PU)
17	reference_speed	SWDDS.2.2.35	OUT	tFrac16	0	32767	0.0	5999.82	0.183105 / rpm	Reference speed setting (PU)
18	control_enable	SWDDS.2.2.31	OUT	tBool	0	1	Control disable	Control enable	True / False	EOP control enable
19	eop_state	SWDDS.2.2.29	OUT	tEopState	0	4	EOP_STATE_DISABLED	EOP_STATE_CUR_LMT	N/A	EOP control state
20	speed_error	SWDDS.2.2.59	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed control error(PU)
21	f16In	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed control error(PU)
22	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_MA_T_16	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
23	g_f16EopCtrSpdErr	SWDDS.3.6.14.9	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed control error(PU)

### 3.2.3.5 [SWDDS.1.2.3.5] ConvertEopCtrSpdUnitToPu

#### 3.2.3.5.1 Detailed Design

##### [SWDDS.1.2.3.5] ConvertEopCtrSpdUnitToPu

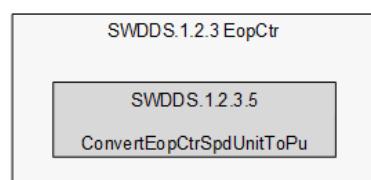
Software Unit Information					
Unit ID	SWDDS.1.2.3.5		Unit Name	ConvertEopCtrSpdUnitToPu	
Architecture ID	SWADS.1.2.3.5		ASIL	QM	
Prototype			tFrac16 ConvertEopCtrSpdUnitToPu( tS16 speed_rpm )		
	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	tS16	speed_rpm	-6000 ~ 6000	IN	speed input (rpm)
	Data Type	Possible Return Value		Description	
Function Call					

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	142

<b>Return Value</b>	tFrac16	-32768 ~ 32767	Speed output in PU	
<b>Global Variables</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>
	N/A	N/A	N/A	N/A
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>
	N/A	N/A	N/A	N/A
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>
	N/A	N/A	N/A	N/A
<b>Description</b>	Speed unit conversion from rpm to PU			
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     [tFrac32 expanded_speed;      expanded_speed = (tFrac32)speed_rpm;      expanded_speed = (expanded_speed * 32768L) /      ((tS32)PARAM_PU_BASE_MECH_SPD);     ]     ↓     return     (tFrac16)expanded_speed;   </pre>			
<b>Called Function</b>	SWDDS.1.2.3.8 CheckEopCtrTglSpdChg SWDDS.1.2.3.9 ActEopCtrStateMaxSpd SWDDS.1.2.3.10 ActEopCtrStateSpdChg SWDDS.1.2.3.14 CheckEopCtrEnaEdge			
<b>Calling Function</b>				
<b>Function Execution Time</b>	N/A			

Requirement Id	SWDDS.1.2.3.5
Target Milestone	SBS1
Element	AswCtr
Risk	<span style="color: orange;">□</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

### 3.2.3.5.2 Static View Design



### 3.2.3.5.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	143

### 3.2.3.5.4 Interface Design

- N/A

### 3.2.3.6 [SWDDS.1.2.3.6] ConvertEopCtrSpdUnitToRpm

#### 3.2.3.6.1 Detailed Design

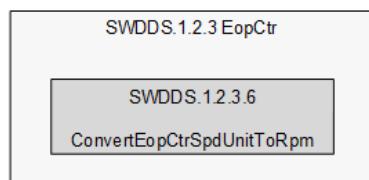
##### [SWDDS.1.2.3.6] ConvertEopCtrSpdUnitToRpm

Software Unit Information					
Unit ID	SWDDS.1.2.3.6		Unit Name	ConvertEopCtrSpdUnitToRpm	
Architecture ID	SWADS.1.2.3.6		ASIL	QM	
Prototype	tS16 ConvertEopCtrSpdUnitToRpm( tFrac16 speed_pu )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	speed_pu	-32768 ~ 32767	IN	speed input (PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	tS16	-6000 ~ 6000		Speed output in PU	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed unit conversion from PU to rpm				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     [ tS32 expanded_speed;       expanded_speed = (tS32)speed_pu;       expanded_speed = (expanded_speed *       (tS32)PARAM_PU_BASE_MECH_SPD) / 32768L;     ]     ↓     return (tS16)expanded_speed;   </pre>				
Called Function	SWDDS.1.2.3.15 CheckEopCtrEnaAppMode				
Calling Function					
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.3.6
Target Milestone	EBS2
Element	AswCtr
Risk	<span style="color: orange;">□</span> Mid
Interoperability	Yes
Criticality	<span style="color: orange;">□</span> Mid
Technical complexity	<span style="color: green;">▢</span> Low
Verifiability	Yes

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	144

### 3.2.3.6.2 Static View Design



### 3.2.3.6.3 Dynamic View Design

- N/A

### 3.2.3.6.4 Interface Design

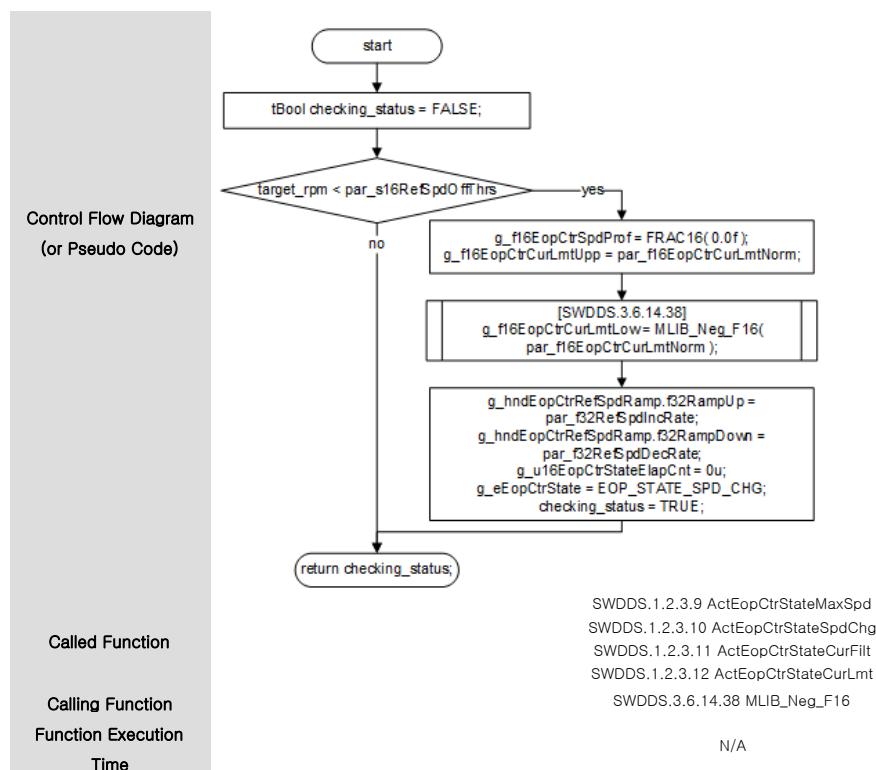
- N/A

### 3.2.3.7 [SWDDS.1.2.3.7] CheckEopCtrEopStop

#### 3.2.3.7.1 Detailed Design

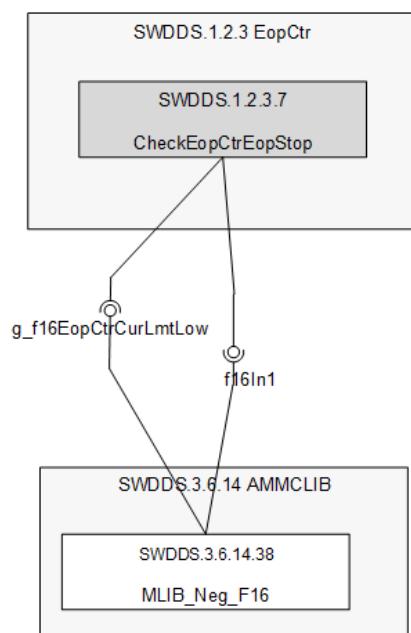
##### [SWDDS.1.2.3.7] CheckEopCtrEopStop

Software Unit Information					
Unit ID	SWDDS.1.2.3.7	Unit Name	CheckEopCtrEopStop		
Architecture ID	SWADS.1.2.3.7	ASIL	QM		
Prototype			tBool CheckEopCtrEopStop( tS16 target_rpm )		
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)
Function Call	Data Type	Possible Return Value		Description	
Return Value	tBool	0 ~ 1		FALSE – stop condition not occurred, TRUE – stop condition occurred	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660	Write	EOP speed profile (PU)
	tFrac16	g_f16EopCtrCurLmtUpp	-32768 ~ 32767	Write	Speed control current limit upper (PU)
	tFrac16	g_f16EopCtrCurLmtLow	-32768 ~ 32767	Write	Speed control current limit lower (PU)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Write	Elapse time count after state entered
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state
Parameters	Data Type	Name	Range	Read/Write	Description
	tS16	par_s16RefSpdOffThrs	500	Read	Control disabling(off) target speed threshold (rpm)
	tFrac16	par_f16EopCtrCurLmtNorm	11430	Read	Phase current limit at normal speed (PU)
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
	EOP control stop condition checking				
Description	<ul style="list-style-type: none"> <li>- Target speed range checking</li> <li>- Speed profile setting for stop and speed changing state transition</li> </ul> <ol style="list-style-type: none"> <li>1. CheckEopCtrStop checks if the target speed is lower than the off threshold speed.</li> <li>2. CheckEopCtrStop sets the EOP control state as speed changing state and sets the related variables for stopping if the stop condition meets.</li> <li>2-1. CheckEopCtrStop sets the speed profile as 0.</li> <li>2-2. CheckEopCtrStop sets the upper and lower current limit as normal value.</li> <li>2-3. CheckEopCtrStop sets the reference speed increment and decrement rates as normal.</li> <li>3. CheckEopCtrStop returns the result of the stop condition checking.</li> </ol>				

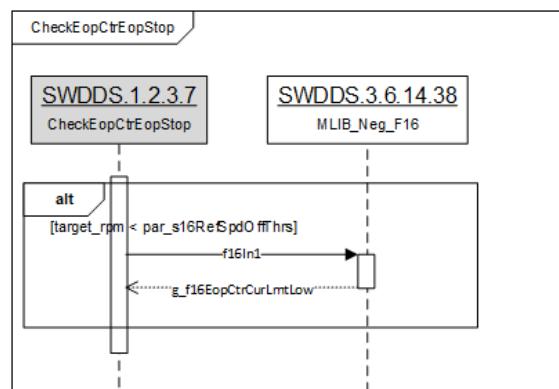


Requirement Id	SWDDS.1.2.3.7
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

### 3.2.3.7.2 Static View Design



### 3.2.3.7.3 Dynamic View Design



### 3.2.3.7.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Phase current limit at normal speed (PU)
2	g_f16EopCtrCurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)

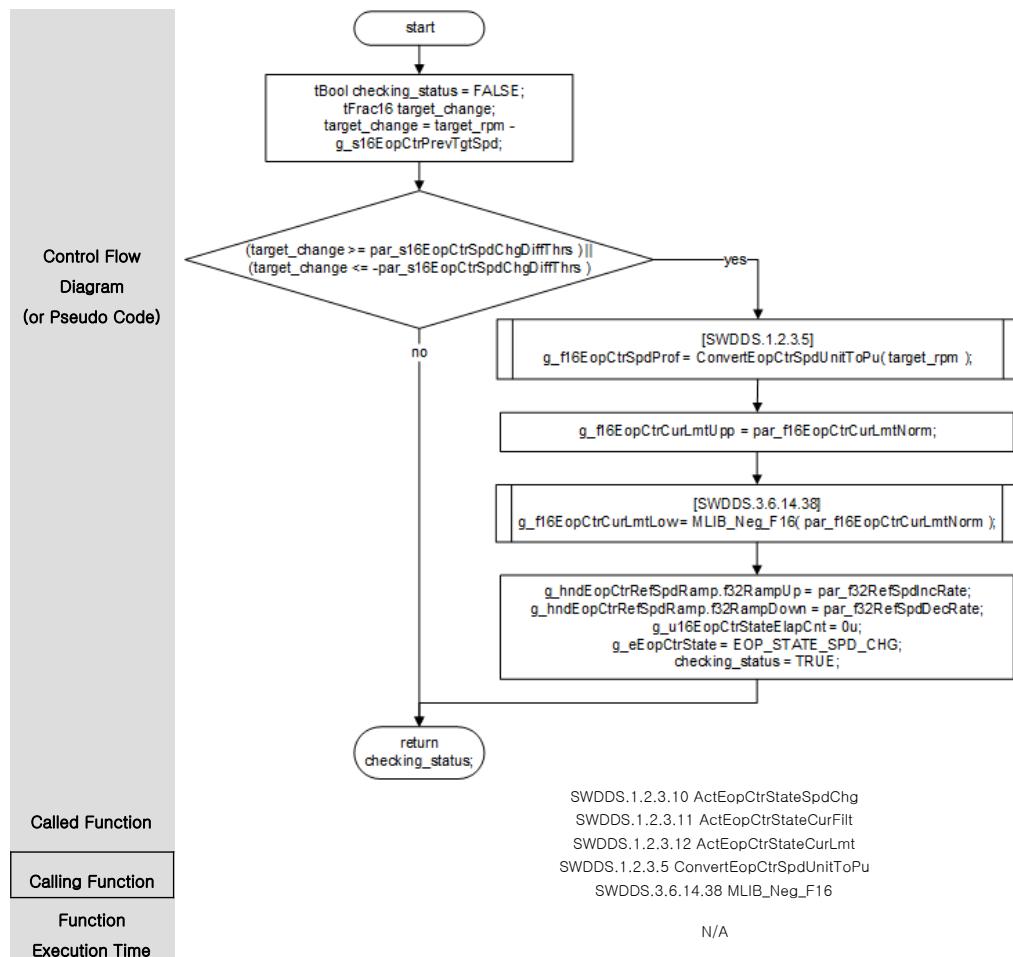
### 3.2.3.8 [SWDDS.1.2.3.8] CheckEopCtrTgtSpdChg

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	147

### 3.2.3.8.1 Detailed Design

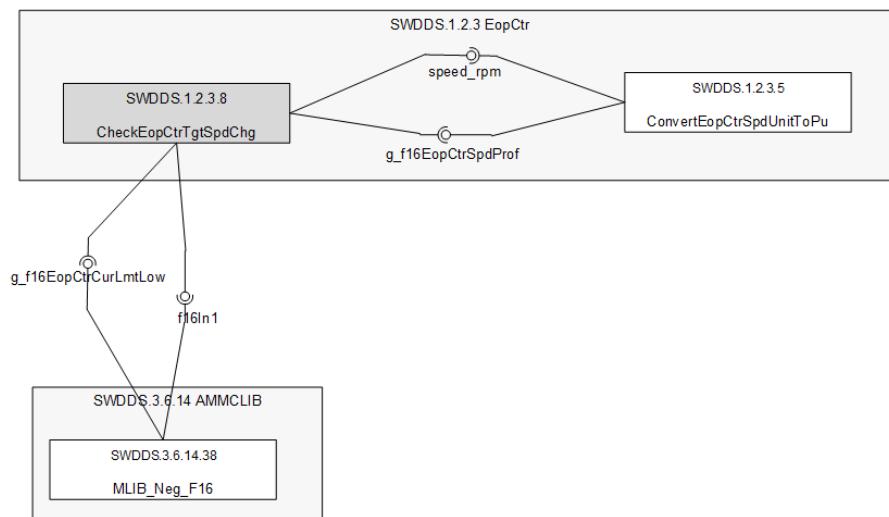
#### [SWDDS.1.2.3.8] CheckEopCtrTgtSpdChg

Software Unit Information					
Unit ID	SWDDS.1.2.3.8	Unit Name	CheckEopCtrTgtSpdChg		
Architecture ID	SWADS.1.2.3.8	ASIL	QM		
tBool CheckEopCtrEopStop( tS16 target_rpm )					
Prototype	Data Type	Name	Range	IN/OUT	Description
Function Call	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)
Parameters	Data Type	Possible Return Value	Description		
Function Call	tBool	0 ~ 1	FALSE – target speed not changed, TRUE – target speed changed		
Return Value	Data Type	Name	Range	Read/Write	Description
Global Variables	tS16	g_s16EopCtrPrevTgtSpd	0 ~ 3200	Read	Previous target speed setting (rpm)
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660	Write	EOP speed profile (PU)
	tFrac16	g_f16EopCtrCurlmtUpp	0 ~ 11430	Write	Speed control current limit upper (PU)
	tFrac16	g_f16EopCtrCurlmtLow	-11430 ~ 0	Write	Speed control current limit lower (PU)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Write	Elapsed time count after state entered
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state
Parameters	Data Type	Name	Range	Read/Write	Description
Parameters	tS16	par_s16EopCtrSpdChgDiffThrs	5	Read	Speed changing mode entering speed difference threshold (rpm)
	tFrac16	par_f16EopCtrCurLmtNorm	11430	Read	Phase current limit at normal speed (PU)
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)
Registers	Data Type	Name	Range	Read/Write	Description
Registers	N/A	N/A	N/A	N/A	N/A
	EOP control target speed changed checking – Amount of target speed change calculation – Target speed change range checking – Speed changing state transition				
Description	1. CheckEopCtrTgtSpdChg calculates the target speed change. 2. CheckEopCtrTgtSpdChg checks if the absolute value of the target speed change is greater than the speed change difference threshold. 3. CheckEopCtrTgtSpdChg sets the EOP control state as speed changing state and sets the related variables for speed changing if the target speed changing condition meets. 3-1. CheckEopCtrTgtSpdChg sets the speed profile as the target speed. 3-2. CheckEopCtrTgtSpdChg sets the upper and lower current limit as normal value. 3-3. CheckEopCtrTgtSpdChg sets the reference speed increment and decrement rates as normal. 4. CheckEopCtrTgtSpdChg returns the result of the target speed changing condition checking.				
Control Flow Diagram (or Pseudo Code)					



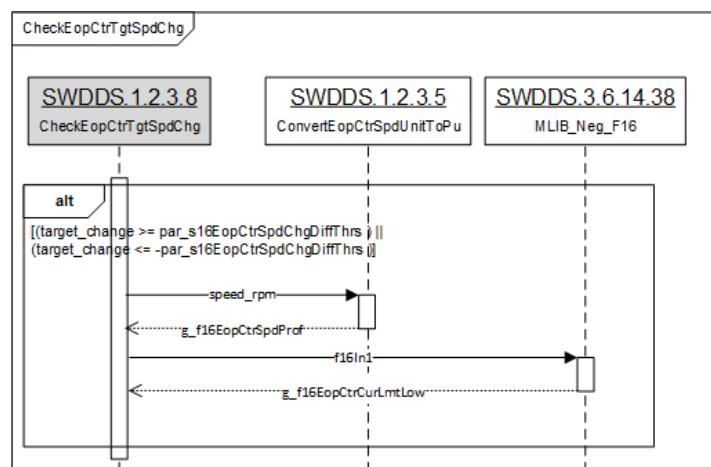
Requirement Id	SWDDS.1.2.3.8
Target Milestone	SBS1
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

### 3.2.3.8.2 Static View Design



### 3.2.3.8.3 Dynamic View Design

1. CheckEopCtrTgtSpdChg calls the target speed unit conversion.
2. CheckEopCtrTgtSpdChg calls the fixed-point negative function.



### 3.2.3.8.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	speed_rpm	SWDDS.1.2.3.5	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
2	g_f16EopCtrSpdProf	SWDDS.1.2.3.5	IN	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	EOP speed profile (PU)
3	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at normal speed (PU)
4	g_f16EopCtrCurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	150

### 3.2.3.9 [SWDDS.1.2.3.9] ActEopCtrStateMaxSpd

#### 3.2.3.9.1 Detailed Design

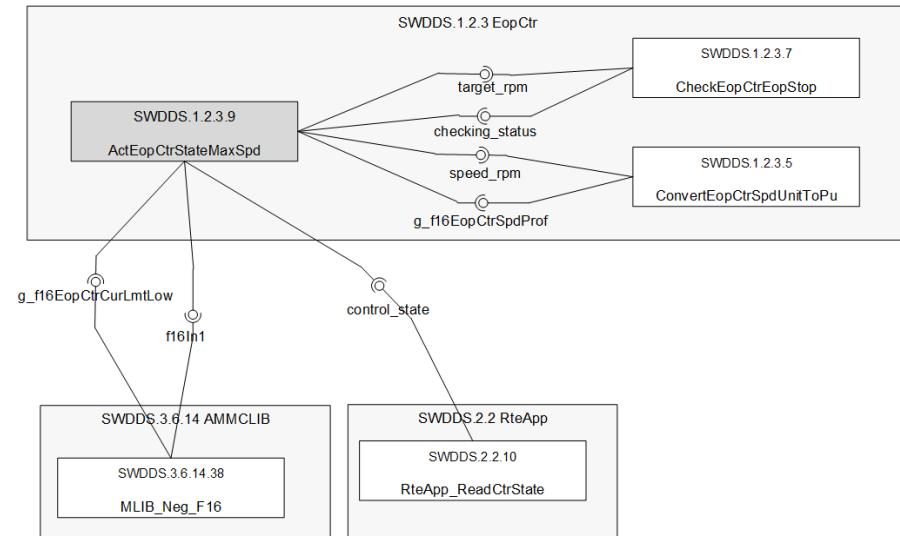
##### [SWDDS.1.2.3.9] ActEopCtrStateMaxSpd

Software Unit Information										
Unit ID	SWDDS.1.2.3.9	Unit Name	ActEopCtrStateMaxSpd							
Architecture ID	SWADS.1.2.3.9	ASIL	QM							
void ActEopCtrStateMaxSpd( tS16 target_rpm )										
Prototype										
Function Call	Data Type	Name	Range	IN/OUT	Description					
Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)					
Function Call	Data Type	Possible Return Value		Description						
Return Value	void	N/A		N/A						
Global Variables										
Global Variables	Data Type	Name	Range	Read/Write	Description					
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Read/Write	Elapse time count after state entered					
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660	Write	EOP speed profile (PU)					
	tFrac16	g_f16EopCtrCurlmtUpp	0 ~ 11430	Write	Speed control current limit upper (PU)					
	tFrac16	g_f16EopCtrCurlmtLow	-11430 ~ 0	Write	Speed control current limit lower (PU)					
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)					
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)					
Parameters										
Parameters	Data Type	Name	Range	Read/Write	Description					
	tU16	par_u16EopCtrMaxSpdTim	1000	Read	Maximum speed holding time duration (ms)					
	tFrac16	par_f16EopCtrCurLmtNorm	11430	Read	Phase current limit at normal speed (PU)					
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)					
Registers	Data Type	Name	Range	Read/Write	Description					
	N/A	N/A	N/A	N/A	N/A					
Description										
Description	EOP control maximum speed holding state reaction									
	- Stop condition checking									
	- Current control state checking									
	- Speed changing state transition condition checking									
	1. ActEopCtrStateMaxSpd checks if the stopping condition does not meet.									
	2. ActEopCtrStateMaxSpd sets the elapse time count as 0 when Sensorless FOC state is not sensorless running.									
	3. ActEopCtrStateMaxSpd checks if the elapse time count reaches the maximum speed acceleration ending time.									
Control Flow Diagram (or Pseudo Code)										
4. ActEopCtrStateMaxSpd sets the EOP control state as speed changing state and sets related variables.										
4-1. ActEopCtrStateMaxSpd sets the speed profile as the target speed.										
4-2. ActEopCtrStateMaxSpd sets the upper and lower current limit as normal value.										
4-3. ActEopCtrStateMaxSpd sets the reference speed increment and decrement rates as normal.										



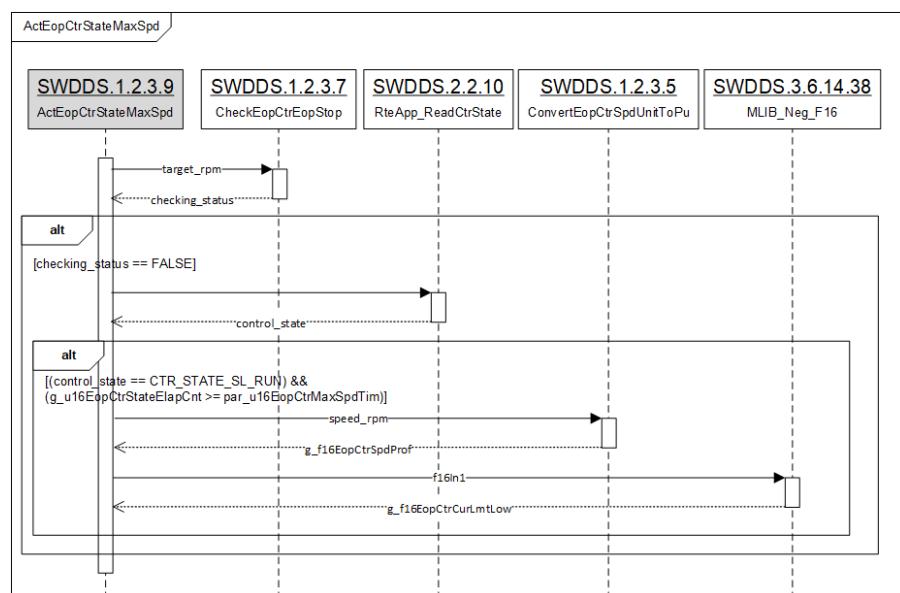
Requirement Id	SWDDS.1.2.3.9
Target Milestone	EBS2
Element	AswCtr
Risk	 Mid
Interoperability	No
Criticality	 High
Technical complexity	 Mid
Verifiability	Yes

### 3.2.3.9.2 Static View Design



### 3.2.3.9.3 Dynamic View Design

1. ActEopCtrStateMaxSpd calls the stop condition checking.
2. ActEopCtrStateMaxSpd calls the sensorless FOC control state.
3. ActEopCtrStateMaxSpd calls the target speed unit conversion.
4. ActEopCtrStateMaxSpd calls the fixed-point negative function.



### 3.2.3.9.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	target_rpm	SWDDS.1.2.3.7	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
2	checking_status	SWDDS.1.2.3.7	IN	tBool	0	1	Not stop condition	Stop condition	True / False	Stop condition checking status
3	control_state	SWDDS.2.2.10	IN	tCtrState	0	4	CTR_STATE_SWTC_OFF	CTR_STATE_SL_RUN	N/A	Current control state
4	speed_rpm	SWDDS.1.2.3.5	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	153

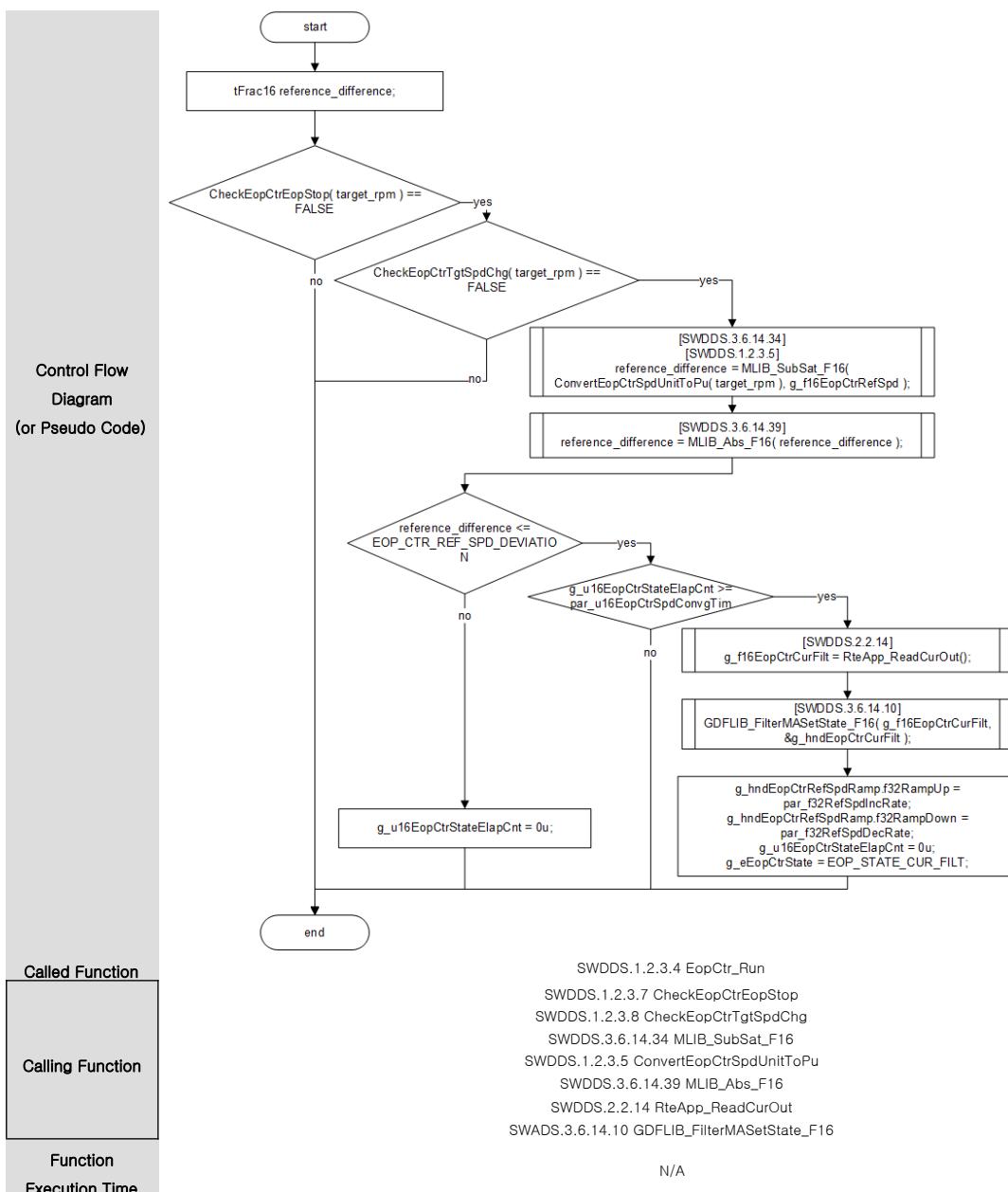
5	g_f16EopCtr_SpdProf	SWDDS.1.2.3.5	IN	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	EOP speed profile (PU)
6	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at normal speed (PU)
7	g_f16EopCtr_CurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)

### 3.2.3.10 [SWDDS.1.2.3.10] ActEopCtrStateSpdChg

#### 3.2.3.10.1 Detailed Design

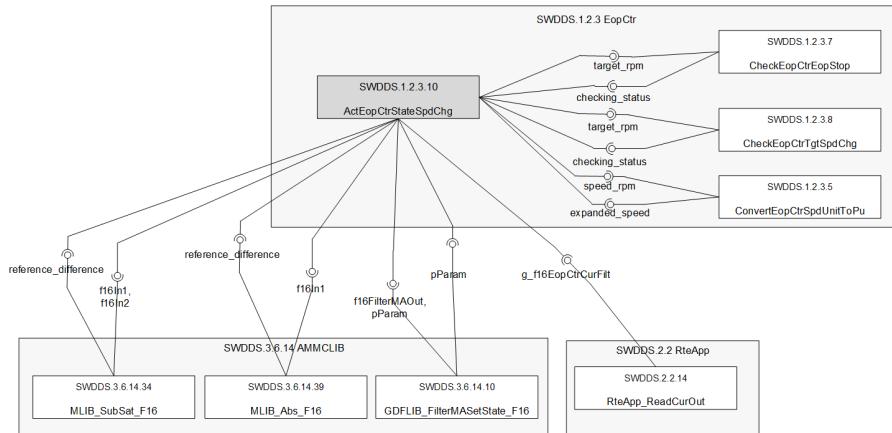
##### [SWDDS.1.2.3.10] ActEopCtrStateSpdChg

Software Unit Information																													
Unit ID	SWDDS.1.2.3.10			Unit Name	ActEopCtrStateSpdChg																								
Architecture ID	SWADS.1.2.3.10			ASIL	QM																								
Prototype	void ActEopCtrStateSpdChg( tS16 target_rpm )																												
Function Call	Data Type	Name	Range	IN/OUT	Description																								
Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)																								
Function Call	Data Type	Possible Return Value				Description																							
Return Value	void	N/A				N/A																							
Global Variables	Data Type	Name	Range	Read/Write	Description																								
	tFrac16	g_f16EopCtrRefSpd	0 ~ 19660	Read	Reference speed setting (PU)																								
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Read/Write	Elapsed time count after state entered																								
	tFrac16	g_f16EopCtrCurFilt	-32768 ~ 32767	Read/Write	Filtered current (PU)																								
	GFLIB_FILTER_MA_T_F16	g_hndEopCtrCurFilt	-2147483648 ~ 2147483647	Read/Write	Current output filtering handler (f32Acc)																								
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)																								
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)																								
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state																								
	Data Type	Name	Range	Read/Write	Description																								
	tU16	par_u16EopCtrSpdConvgTim	250	Read	Speed convergence time duration (ms)																								
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)																								
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)																								
	Registers	Data Type	Name	Range	Read/Write	Description																							
	N/A	N/A	N/A	N/A	N/A	N/A																							
	EOP control speed changing state reaction																												
	- Stop and speed changing condition checking																												
	- Reference speed convergence checking																												
	- Current filtering state transition																												
	1. ActEopCtrStateSpdChg checks if the stopping condition and speed changing condition do not meet.																												
2. ActEopCtrStateSpdChg calculates the target speed and the reference speed difference.																													
3. ActEopCtrStateSpdChg checks if the speed difference is very small (target speed reached).																													
4. ActEopCtrStateSpdChg waits for the convergence time.																													
5. ActEopCtrStateSpdChg sets the EOP control state as current filtering state and sets related variables.																													
5-1. ActEopCtrStateSpdChg substitutes the current filter output as current output.																													
5-2. ActEopCtrStateSpdChg sets the reference speed increment and decrement rate as normal value.																													



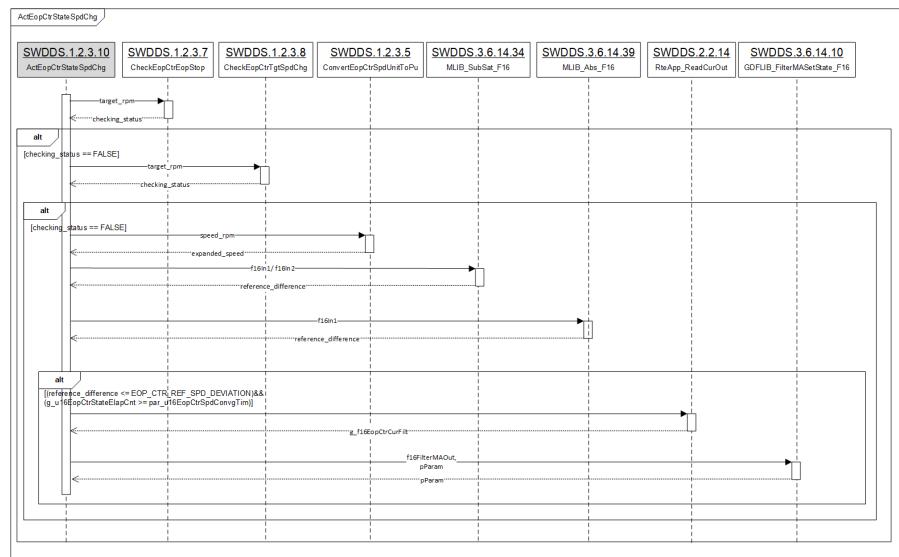
Requirement Id	SWDDDS.1.2.3.10
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

### 3.2.3.10.2 Static View Design



### 3.2.3.10.3 Dynamic View Design

1. ActEopCtrStateSpdChg calls checkEopCtrEopStop to check if the stopping condition meet.
2. ActEopCtrStateSpdChg calls checkEopCtrTgtSpdChg to check if the target speed changed.
3. ActEopCtrStateSpdChg calls RteApp\_ReadCurOut to get q-axis current output.
4. ActEopCtrStateSpdChg call fixed arithmetic functions and filtering function in AMMCLIB.



### 3.2.3.10.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	target_rpm	SWDDS.1.2.3.7	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
2	checking_status	SWDDS.1.2.3.7	IN	tBool	0	1	Not stop condition	Stop condition	True / False	condition checking status
3	target_rpm	SWDDS.1.2.3.8	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
4	checking_status	SWDDS.1.2.3.8	IN	tBool	0	1	Target speed not changed	Target speed changed	True / False	Target speed changing checking status
5	f16ln1	SWDDS.3.6.14.34	OUT	tFrac16	0	17476	0.0	3200.0	0.183105 / rpm	Target speed (PU)
6	f16ln2	SWDDS.3.6.14.34	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	Reference speed (PU)

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	156

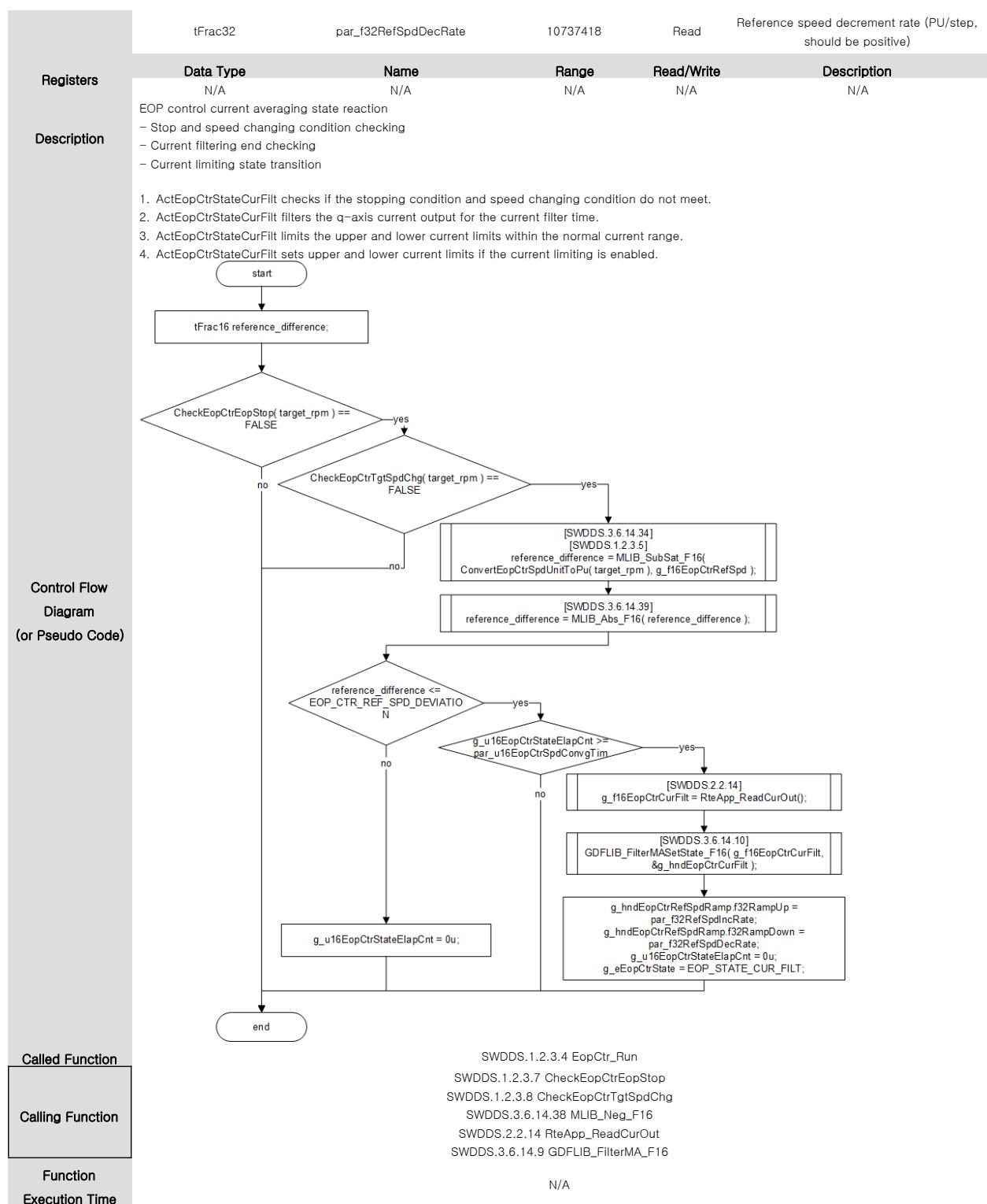
7	reference_difference	SWDDS.3.6.14.34	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Reference speed difference (PU)
8	f16In1	SWDDS.3.6.14.39	OUT	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Reference speed difference (PU)
9	reference_difference	SWDDS.3.6.14.39	IN	tFrac16	0	32767	0.0	5999.82	0.183105 / rpm	Absolute reference speed difference (PU)
10	g_f16EopCtrCurFilt	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered current (PU)
11	f16FilterMAOut	SWDDS.3.6.14.10	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered current (PU)
12	pParam	SWDDS.3.6.14.10	IN/OUT	GDFLIB_FILTER_MA_T_F16*	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
13	speed_rpm	SWDDS.1.2.3.5	OUT	tS16	0	3200	0	3200	1 / rpm	Target speed input (rpm) Unit
14	expanded_speed	SWDDS.1.2.3.5	IN	tFrac32	0	17476	0	3200	1 / rpm	converted target speed (PU)

### 3.2.3.11 [SWDDS.1.2.3.11] ActEopCtrStateCurFilt

#### 3.2.3.11.1 Detailed Design

##### [SWDDS.1.2.3.11] ActEopCtrStateCurFilt

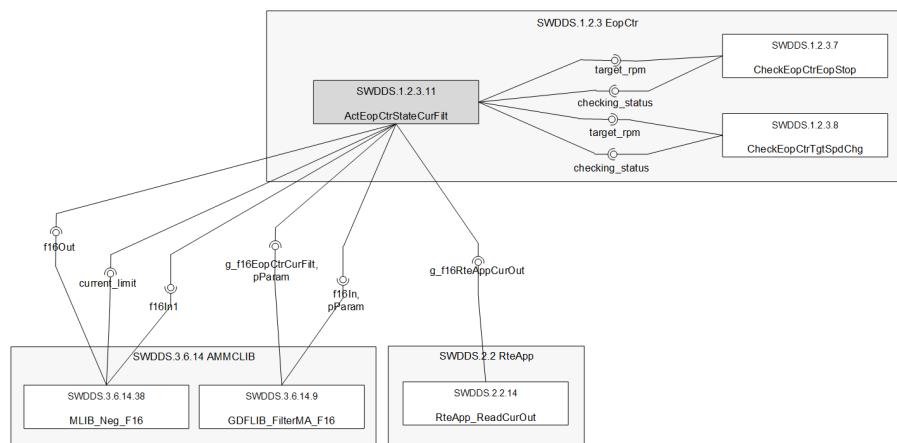
Software Unit Information						
Unit ID	SWDDS.1.2.3.11	Unit Name	ActEopCtrStateCurFilt			
Architecture ID	SWADS.1.2.3.11	ASIL	QM			
void ActEopCtrStateCurFilt( tS16 target_rpm )						
Prototype	Data Type	Name	Range	IN/OUT	Description	
Function Call Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)	
Function Call Return Value	Data Type	Possible Return Value			Description	
	void	N/A			N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description	
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Read/Write	Elapsed time count after state entered	
	tFrac16	g_f16EopCtrCurFilt	-32768 ~ 32767	Read/Write	Filtered current (PU)	
	tFrac16	g_f16EopCtrCurLmtUpp	-11430 ~ 11430	Write	Speed control current limit upper (PU)	
	tFrac16	g_f16EopCtrCurLmtLow	-11430 ~ 11430	Write	Speed control current limit lower (PU)	
	tU16	g_u16EopCtrSpdChgCondHoldCnt	0 ~ 60000	Write	Speed changing mode entering condition hold time count (ms)	
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)	
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)	
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state	
	GDFLIB_FILTER_MA_T_F16	g_hndEopCtrCurFilt	-2147483648 ~ 2147483647	Read/Write	Current output filtering handler (f32Acc)	
Parameters	Data Type	Name	Range	Read/Write	Description	
	tU16	par_u16EopCtrCurFiltTim	100	Read	Phase current filtering time duration (ms)	
	tBool	par_bEopCtrCurLmtEna	0	Read	Current limiting enable	
	tFrac16	par_f16EopCtrCurLmtUpp	508	Read	Phase current limit upper increment width (PU)	
	tFrac16	par_f16EopCtrCurLmtNorm	11430	Read	Phase current limit at normal speed (PU)	
	tFrac16	par_f16EopCtrCurLmtLow	508	Read	Phase current limit lower decrement width (PU)	
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)	



Requirement Id	SWDDS.1.2.3.11
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No

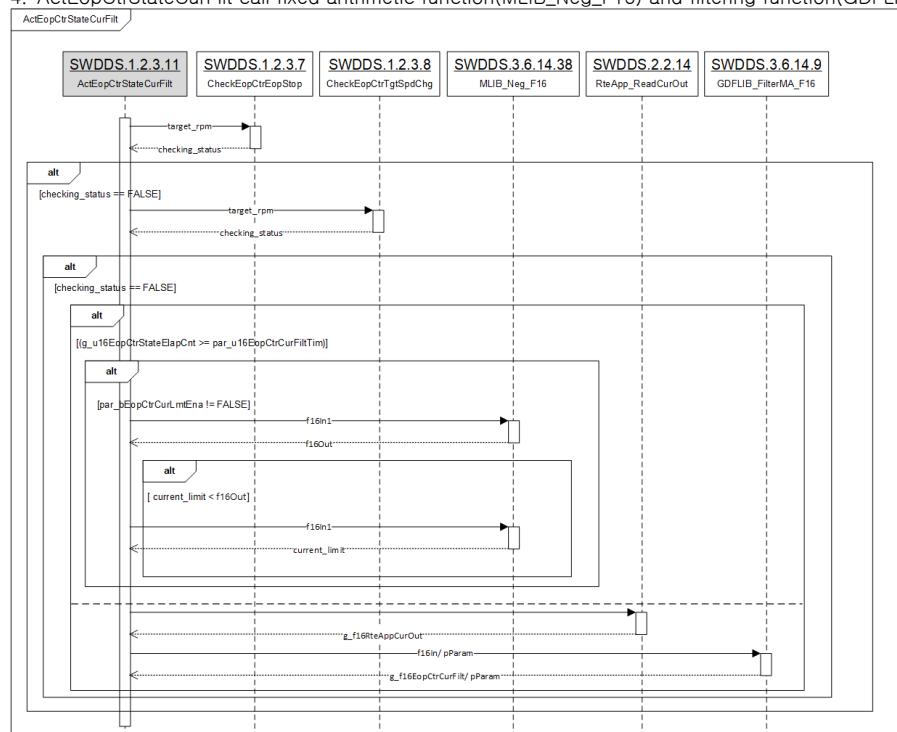
Criticality	
Technical complexity	
Verifiability	Yes

### 3.2.3.11.2 Static View Design



### 3.2.3.11.3 Dynamic View Design

- ActEopCtrStateCurFilt calls checkEopCtrEopStop to check if the stopping condition meet.
- ActEopCtrStateCurFilt calls checkEopCtrTgtSpdChg to check if the target speed changed.
- ActEopCtrStateCurFilt calls RteApp\_ReadCurOut to get q-axis current output.
- ActEopCtrStateCurFilt call fixed arithmetic function(MLIB\_Neg\_F16) and filtering function(GDFLIB\_FilterMA\_F16) in AMMCLIB.



	VW AQ EOP						Baseline / Version / Date	003
	Software Detailed Design Specification						Updated Date	2021-06-30
							Page	159

### 3.2.3.11.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	target_rpm	SWDDS.1.2.3.7	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
2	checking_status	SWDDS.1.2.3.7	IN	tBool	0	1	Not stop condition	Stop condition	True / False	Stop condition checking status
3	target_rpm	SWDDS.1.2.3.8	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
4	checking_status	SWDDS.1.2.3.8	IN	tBool	0	1	Target speed not changed	Target speed changed	True / False	Target speed changing checking status
5	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at normal speed (PU)
6	current_limit	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit upper (PU)
7	f16In	SWDDS.3.6.14.9	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at normal speed (PU)
8	pParam	SWDDS.3.6.14.9	IN/OUT	GDFLIB_FILTER_IIR1_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of filtering handler
9	g_f16EopCtrCurFilt	SWDDS.3.6.14.9	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Filtered current (PU)
10	f16Out	SWDDS.3.6.14.38	IN	tFrac16	-32768	0	-64.5	0	0.00196834 / Apk	Negative current limit (PU)
11	g_f16RteAppCurOut	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.498	0.00196838 / Apk	Current output (PU)

### 3.2.3.12 [SWDDS.1.2.3.12] ActEopCtrStateCurLmt

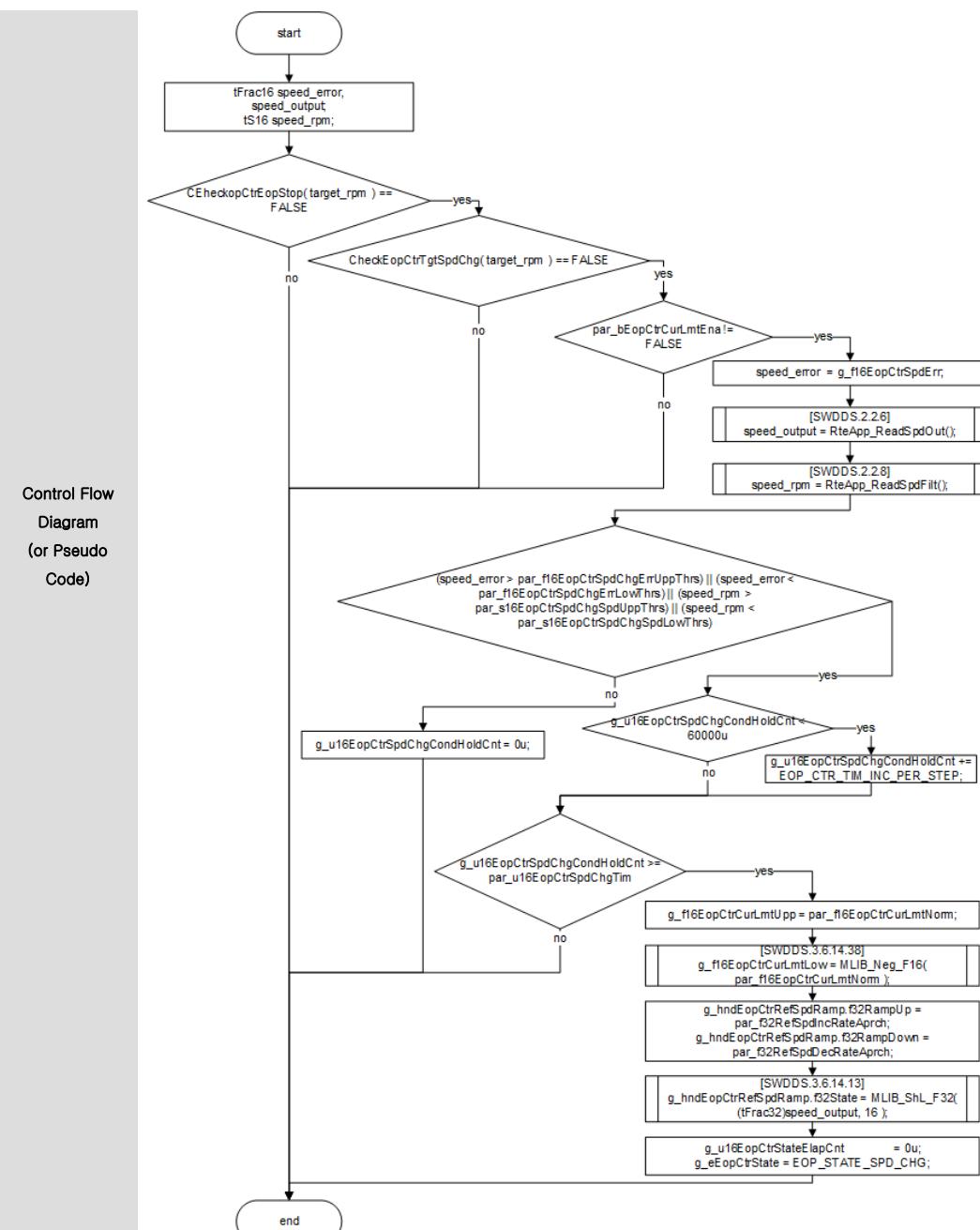
#### 3.2.3.12.1 Detailed Design

##### [SWDDS.1.2.3.12] ActEopCtrStateCurLmt

Software Unit Information					
Unit ID	SWDDS.1.2.3.12	Unit Name	ActEopCtrStateCurLmt		
Architecture ID	SWADS.1.2.3.12	ASIL	QM		
void ActEopCtrStateCurLmt( tS16 target_rpm )					
Prototype	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)
Function Call Return Value	Data Type	Possible Return Value			Description
Global Variables	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16EopCtrSpdErr	-32768 ~ 32767	Read	Speed control error (PU)
	tU16	g_u16EopCtrSpdChgCondHoldCnt	0 ~ 60000	Read/Write	Speed changing mode entering condition hold time count (ms)
	tFrac16	g_f16EopCtrCurLmtUpp	0 ~ 11430	Write	Speed control current limit upper (PU)
	tFrac16	g_f16EopCtrCurLmtLow	-11430 ~ 0	Write	Speed control current limit lower (PU)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 715826	Write	Reference speed ramping handler (f32RampUp)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 715826	Write	Reference speed ramping handler (f32RampDown)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	-2147483648 ~ 2147483647	Write	Reference speed ramping handler (f32State)
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Write	Elapse time count after state entered
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	par_bEopCtrCurLmtEna	0	Read	Current limiting enable

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	160

Parameters	tFrac16	par_f16EopCtrSpdChgErrUppThrs	2730	Read	Speed changing mode entering speed error upper threshold (PU)
	tFrac16	par_f16EopCtrSpdChgErrLowThrs	-2730	Read	Speed changing mode entering speed error lower threshold (PU, should be negative)
	tS16	par_s16EopCtrSpdChgSpdUppThrs	3400	Read	Speed changing mode entering speed upper threshold (rpm)
	tS16	par_s16EopCtrSpdChgSpdLowThrs	500	Read	Speed changing mode entering speed upper threshold (rpm)
	tU16	par_u16EopCtrSpdChgTim	500	Read	Speed changing mode entering time duration (ms)
	tFrac16	par_f16EopCtrCurLmtNorm	11430	Read	Phase current limit at normal speed (PU)
	tFrac32	par_f32RefSpdIncRateAprch	357913	Read	Reference speed increment rate at approaching (PU/step)
	tFrac32	par_f32RefSpdDecRateAprch	357913	Read	Reference speed decrement rate at approaching (PU/step, should be positive)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
EOP control current limiting state reaction					
<ul style="list-style-type: none"> <li>- Stop and speed changing condition checking</li> <li>- Speed error checking</li> <li>- Speed changing state transition</li> </ul>					
<ol style="list-style-type: none"> <li>1. ActEopCtrStateCurLmt checks if the stopping condition and speed changing condition do not meet.</li> <li>2. ActEopCtrStateCurLmt checks if the current limiting parameter is enabled.</li> <li>3. ActEopCtrStateCurLmt gets the speed control error and speed output.</li> <li>4. ActEopCtrStateCurLmt checks if the absolute values of the speed control error or speed output is over the specific threshold for given hold time.</li> <li>5. ActEopCtrStateCurLmt sets the EOP control state as speed changing state and sets related variables.</li> <li>5-1. ActEopCtrStateCurLmt sets the current limits as normal value.</li> <li>5-2. ActEopCtrStateCurLmt sets the reference speed increment and decrement rate as approaching value.</li> </ol>					
Control Flow Diagram (or Pseudo Code)					


**Called Function**
**Calling Function**
**Function Execution Time**

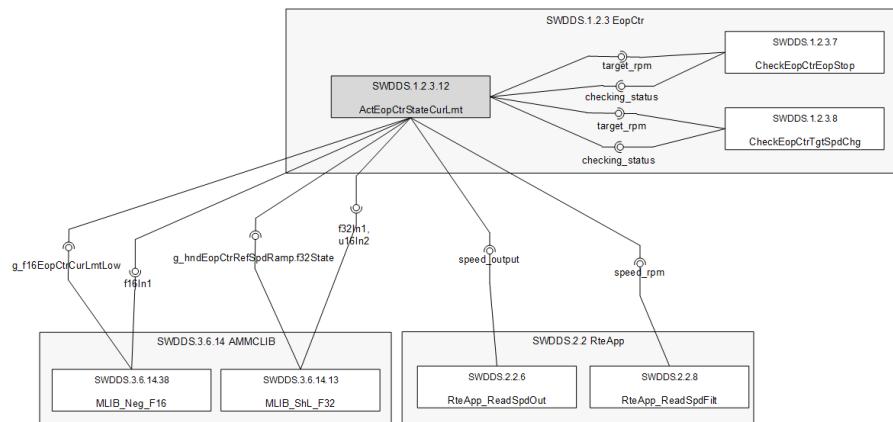
SWDDS.1.2.3.4 EopCtr\_Run  
 SWDDS.1.2.3.7 CheckEopCtrEopStop  
 SWDDS.1.2.3.8 CheckEopCtrTgtSpdChg  
 SWDDS.2.2.6 RteApp\_ReadSpdOut  
 SWDDS.2.2.8 RteApp\_ReadSpdFilt  
 SWDDS.3.6.14.38 MLIB\_Neg\_F16  
 SWDDS.3.6.14.13 MLIB\_ShL\_F32

N/A

Requirement Id	SWDDS.1.2.3.12
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No

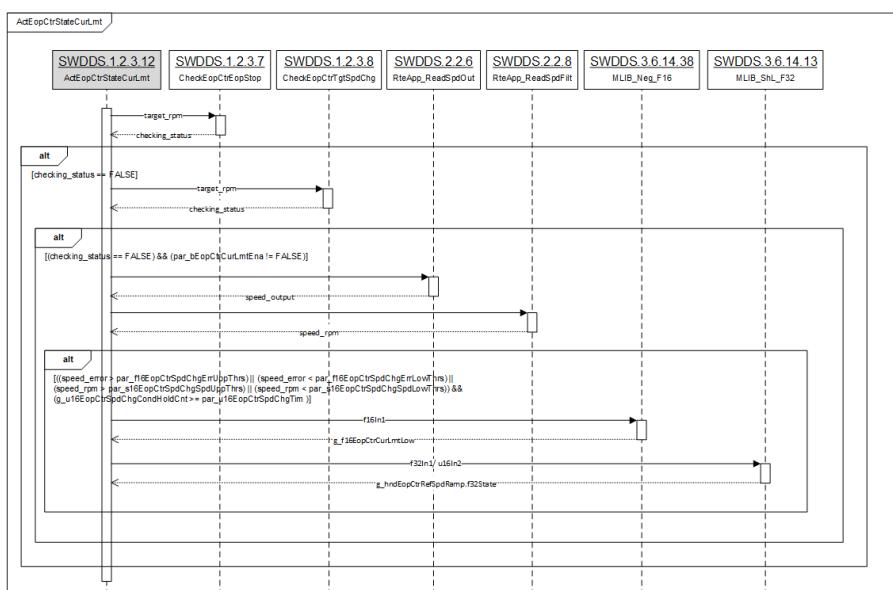
Criticality	
Technical complexity	
Verifiability	Yes

### 3.2.3.12.2 Static View Design



### 3.2.3.12.3 Dynamic View Design

1. ActEopCtrStateCurLmt calls the stop condition checking.
2. ActEopCtrStateCurLmt calls the target speed changing checking.
3. ActEopCtrStateCurLmt calls the motor speed output.
4. ActEopCtrStateCurLmt calls the filtered speed.
5. ActEopCtrStateCurLmt calls the fixed-point negative and bit shift function.



	VW AQ EOP					Baseline / Version / Date	003
	Software Detailed Design Specification					Updated Date	2021-06-30
						Page	163

### 3.2.3.12.4 Interface Design

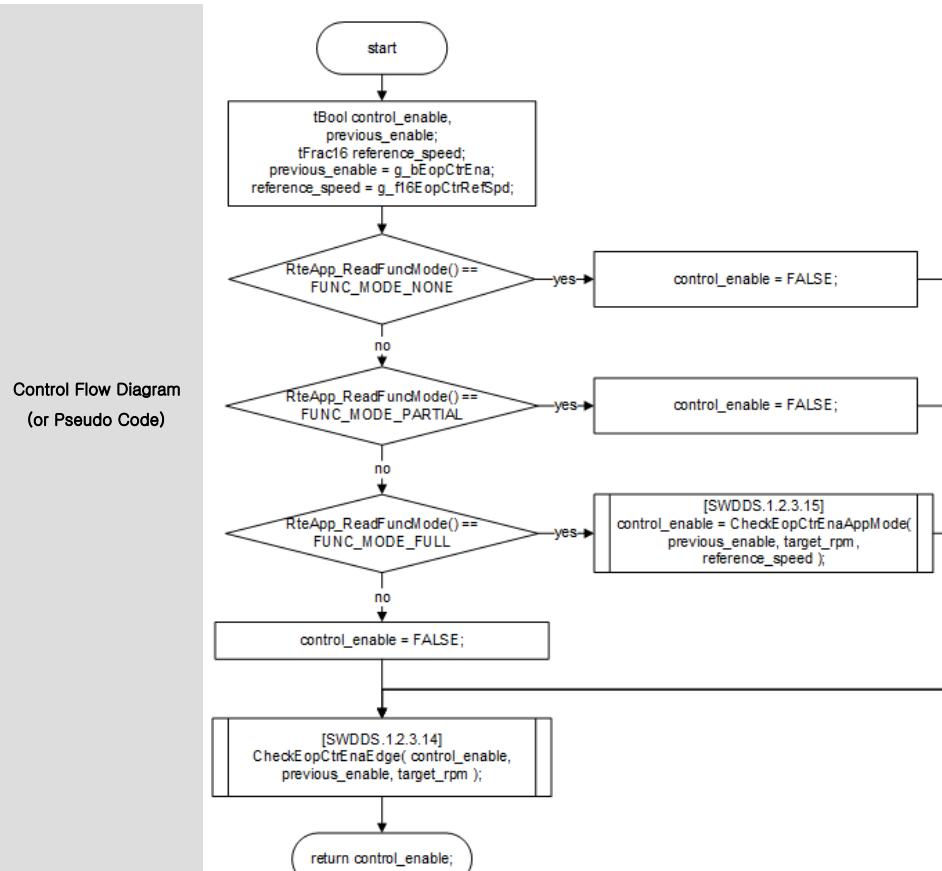
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	target_rpm	SWDDS.1.2.3.7	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)
2	checking_status	SWDDS.1.2.3.7	IN	tBool	0	1	Not stop condition	Stop condition	True / False	Stop condition checking status
3	target_rpm	SWDDS.1.2.3.8	OUT	tS16	0	17476	0.0	3200.0	0.183105 / rpm	target speed (rpm)
4	checking_status	SWDDS.1.2.3.8	IN	tBool	0	1	Target speed not changed	Target speed changed	True / False	Target speed changing checking status
5	speed_output	SWDDS.2.2.6	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
6	speed_rpm	SWDDS.2.2.8	IN	tS16	-6000	6000	-6000	6000	1 / rpm	Filtered speed (rpm)
7	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at normal speed (PU)
8	g_f16EopCtr CurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)
9	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	-2147483648	2147483647	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
10	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	Bit shift
11	g_hndEopCtr RefSpdRamp .f32State	SWDDS.3.6.14.13	IN	tFrac32	-2147483648	2147483647	-6000.0	5999.82	0.183105 / rpm	Current speed ramp state (PU)

### 3.2.3.13 [SWDDS.1.2.3.13] CheckEopCtrEnaMode

#### 3.2.3.13.1 Detailed Design

##### [SWDDS.1.2.3.13] CheckEopCtrEnaMode

Software Unit Information								
Unit ID	SWDDS.1.2.3.13	Unit Name		CheckEopCtrEnaMode				
Architecture ID	SWADS.1.2.3.13	ASIL		QM				
Prototype		tBool CheckEopCtrEnaMode( tS16 target_rpm )						
Function Call	Data Type	Name	Range	IN/OUT	Description			
Parameters	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)			
Function Call	Data Type	Possible Return Value			Description			
Return Value	tBool	0 ~ 1			FALSE – control disable, TRUE – control enable			
Global Variables	Data Type	Name	Range	Read/Write	Description			
	tBool	g_bEopCtrEna	0 ~ 1	Read	EOP control enable (FALSE – disabled, TRUE – enabled)			
	tFrac16	g_f16EopCtrRefSpd	0 ~ 19660	Read	Reference speed setting (PU)			
Parameters	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			
Registers	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			
Description	Control enable checking with respect to functional mode - Data getting - Control enable setting with respect to functional and application modes - Control enabling edge checking							
	1. CheckEopCtrEnaMode sets the control enabling as disable if the functional mode is none or partial. 2. CheckEopCtrEnaMode sets the control enabling according to the checking result of the application mode. 3. CheckEopCtrEnaMode checks the control enabling edge.							

**Called Function****Calling Function****Function Execution Time**

SWDDS.1.2.3.4 EopCtr\_Run

SWDDS.2.2.47 RteApp\_ReadFuncMode

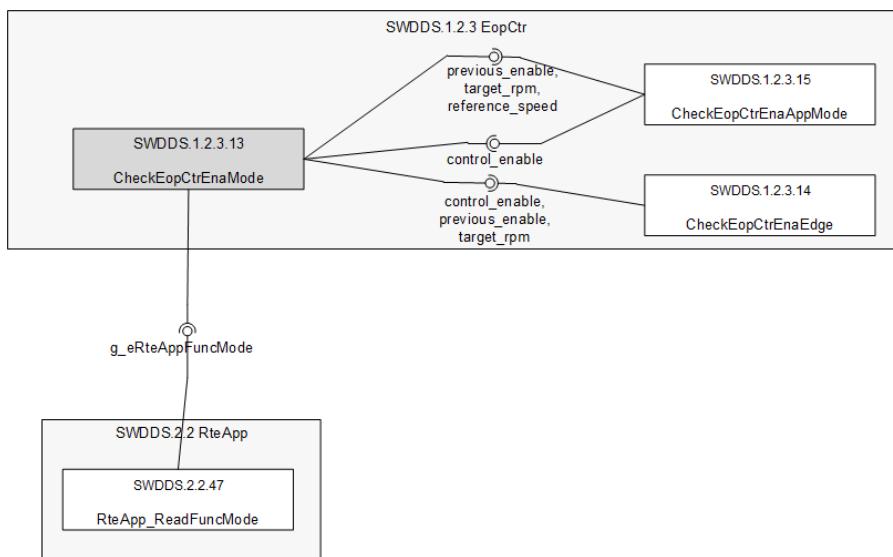
SWDDS.1.2.3.15 CheckEopCtrEnaAppMode

SWDDS.1.2.3.14 CheckEopCtrEnaEdge

N/A

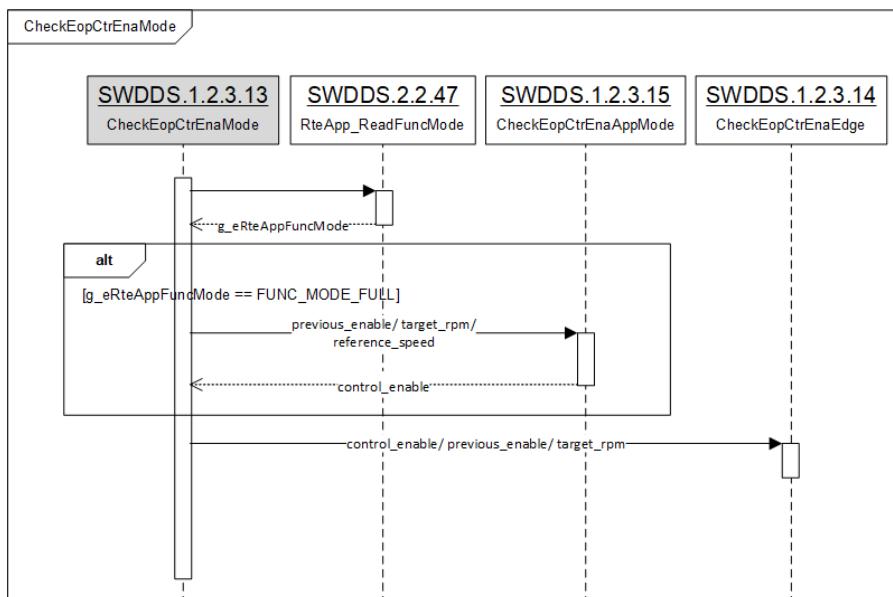
Requirement Id	SWDDS.1.2.3.13
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

### 3.2.3.13.2 Static View Design



### 3.2.3.13.3 Dynamic View Design

1. CheckEopCtrEnaMode calls the functional mode setting.
2. CheckEopCtrEnaMode calls the control enabling checking according to the application mode.
3. CheckEopCtrEnaMode calls the control enabling edge checking.



### 3.2.3.13.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_eRteAppFuncMode	SWDDS.2.2.47	IN	tFuncMode	0	2	FUNC_MODE_NONE	FUNC_MODE_FULL	N/A	Functional mode
2	previous_enable	SWDDS.1.2.3.15	OUT	tBool	0	1	Control disable	Control enable	True / False	Previous control enabled status
3	target_rpm	SWDDS.1.2.3.15	OUT	tS16	0	17476	0.0	3200.0	0.183105 / rpm	target speed (rpm)

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	166

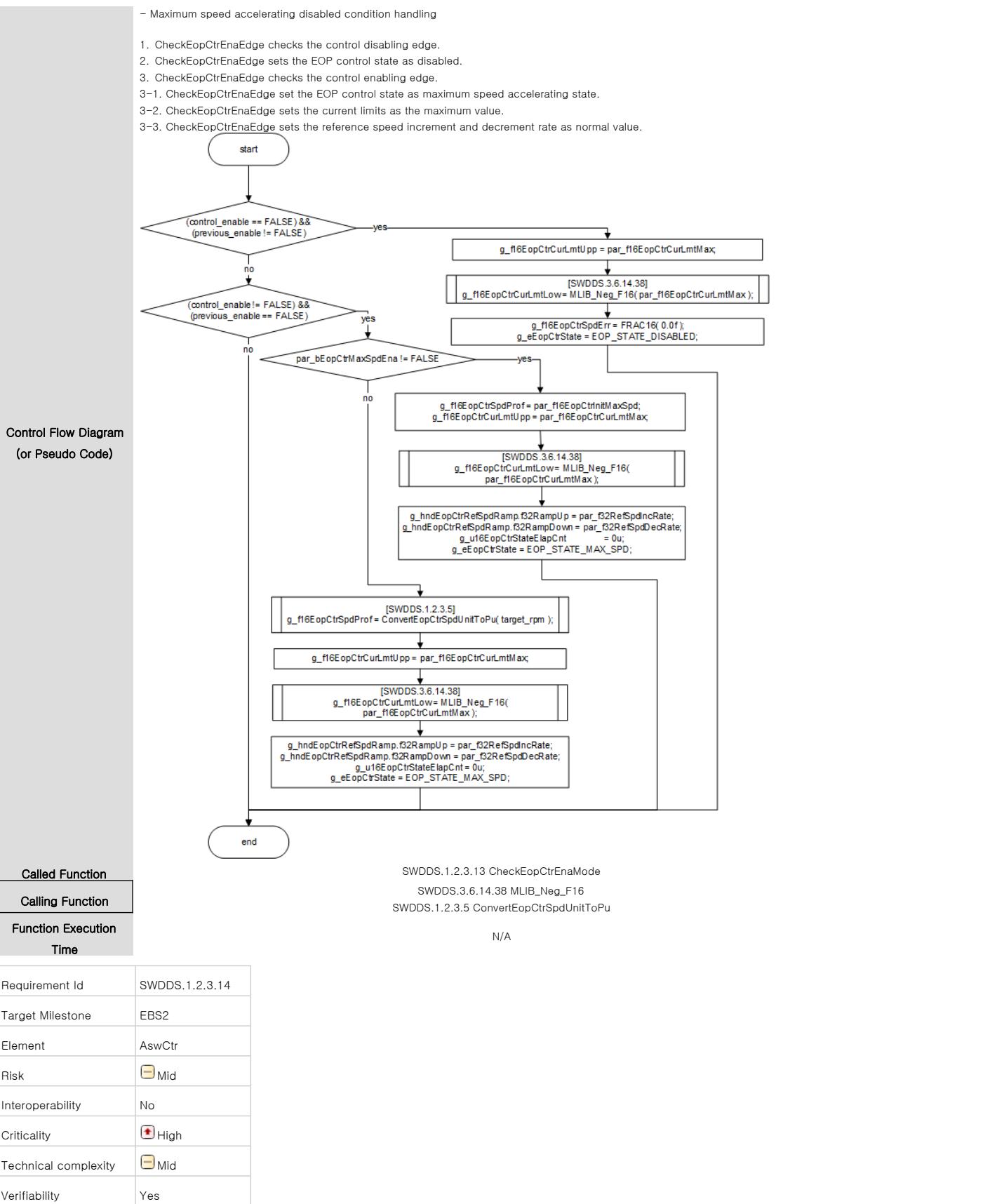
4	reference_speed	SWDDS.1.2.3.15	OUT	tFrac16	0	17476	0.0	3200.0	0.183105 / rpm	Reference speed setting (PU)
5	control_enable	SWDDS.1.2.3.15	IN	tBool	0	1	Control disable	Control enable	True / False	Checked control enabling status
6	control_enable	SWDDS.1.2.3.14	OUT	tBool	0	1	Control disable	Control enable	True / False	Checked control enabling status
7	previous_enable	SWDDS.1.2.3.14	OUT	tBool	0	1	Control disable	Control enable	True / False	Previous control enabled status
8	target_rpm	SWDDS.1.2.3.14	OUT	tS16	0	3200	0	3200	1 / rpm	target speed (rpm)

### 3.2.3.14 [SWDDS.1.2.3.14] CheckEopCtrEnaEdge

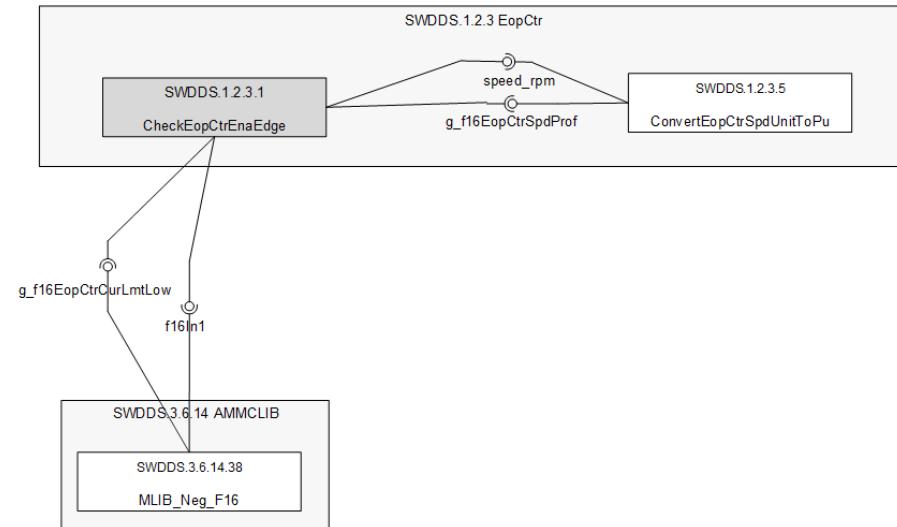
#### 3.2.3.14.1 Detailed Design

##### [SWDDS.1.2.3.14] CheckEopCtrEnaEdge

Software Unit Information													
Unit ID	SWDDS.1.2.3.14			Unit Name	CheckEopCtrEnaEdge								
Architecture ID	SWADS.1.2.3.14			ASIL	QM								
Prototype													
void CheckEopCtrEnaEdge( tBool control_enable, tBool previous_enable, tS16 target_rpm )													
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description								
Function Call	tBool	control_enable	0 ~ 1	IN	current control enable status								
Parameters	tBool	previous_enable	0 ~ 1	IN	previous control enabled status								
	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)								
Function Call Return Value	Data Type	Possible Return Value			Description								
	void	N/A			N/A								
Global Variables	Data Type	Name	Range	Read/Write	Description								
	tFrac16	g_f16EopCtrCurLmtUpp	0 ~ 11430	Write	Speed control current limit upper (PU)								
	tFrac16	g_f16EopCtrCurLmtLow	-11430 ~ 0	Write	Speed control current limit lower (PU)								
	tFrac16	g_f16EopCtrSpdErr	-32768 ~ 32767	Write	Speed control error (PU)								
	tEopState	g_eEopCtrState	0 ~ 4	Write	EOP control state								
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660	Write	EOP speed profile (PU)								
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampUp)								
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp	0 ~ 10737418	Write	Reference speed ramping handler (f32RampDown)								
	tU16	g_u16EopCtrStateElapCnt	0 ~ 60000	Write	Elapse time count after state entered								
Parameters	Data Type	Name	Range	Read/Write	Description								
	tFrac16	par_f16EopCtrCurLmtMax	11430	Read	Phase current limit at maximum speed (PU)								
	tBool	par_bEopCtrMaxSpdEna	0	Read	Initial maximum speed acceleration enable								
	tFrac16	par_f16EopCtrInitMaxSpd	19660	Read	EOP control maximum speed (rpm)								
	tFrac32	par_f32RefSpdIncrRate	10737418	Read	Reference speed increment rate (PU/step)								
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)								
Registers	Data Type	Name	Range	Read/Write	Description								
	N/A	N/A	N/A	N/A	N/A								
Description	Control enabling edge checking - Control disabling edge checking - Control enabling edge checking												

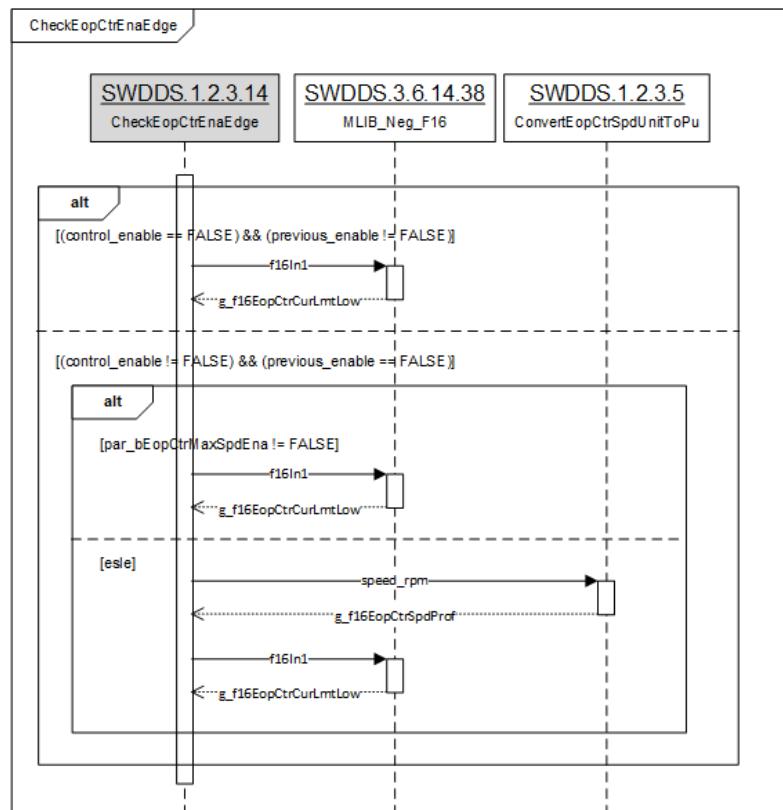


### 3.2.3.14.2 Static View Design



### 3.2.3.14.3 Dynamic View Design

1. CheckEopCtrEnaEdge calls the fixed-point negative function.
2. CheckEopCtrEnaEdge calls target speed unit conversion function.



	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	169

### 3.2.3.14.4 Interface Design

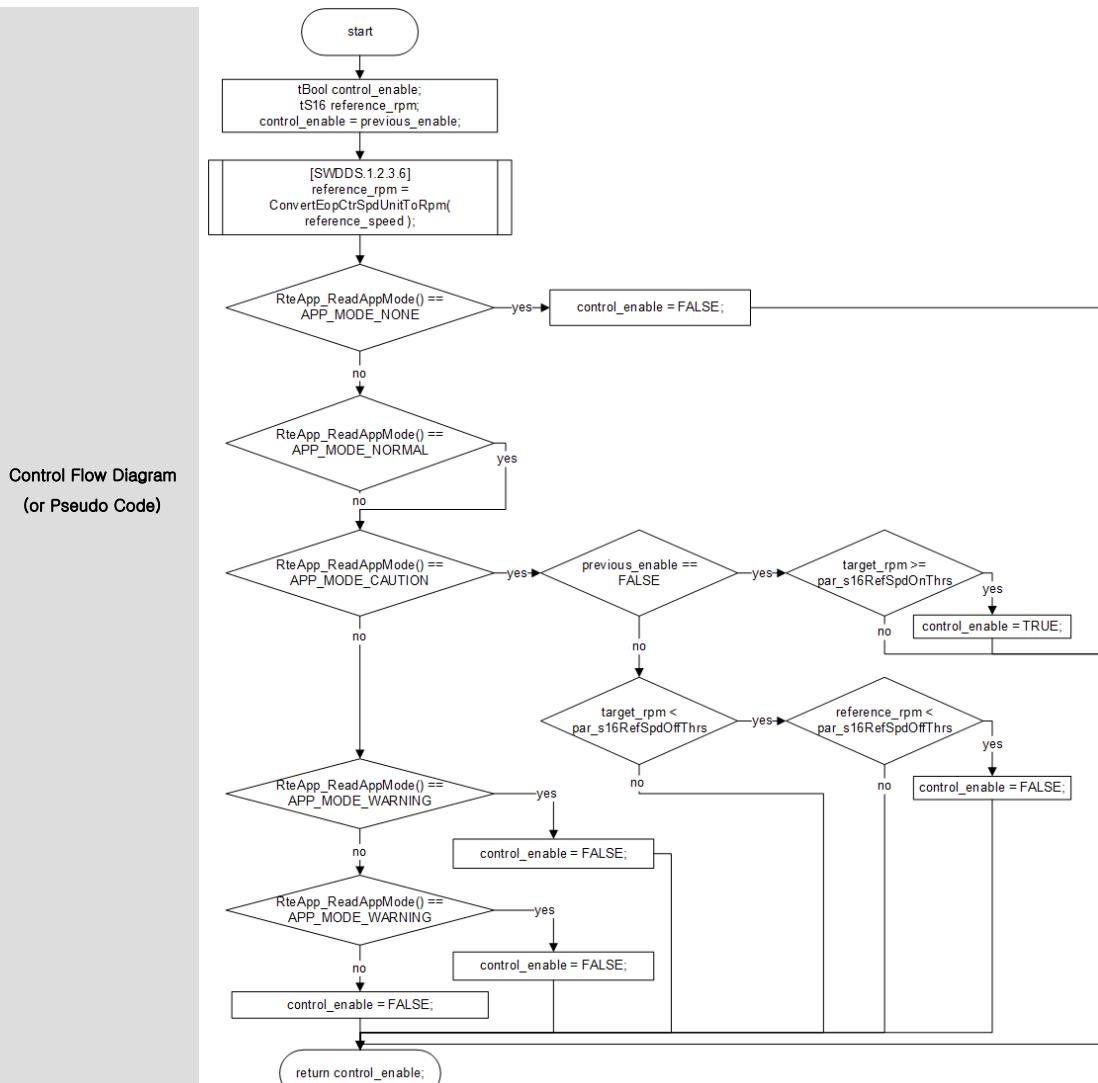
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In1	SWDDS.3.6.14.38	OUT	tFrac16	11430	11430	22.5	22.5	0.00196838 / Apk	Current limit at maximum speed (PU)
2	g_f16EopCtrCurLmtLow	SWDDS.3.6.14.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Speed control current limit lower (PU)
3	speed_rpm	SWDDS.1.2.3.5	OUT	tFrac32	0	3200	0	3200	1 / rpm	Target speed input (rpm)
4	g_f16EopCtrSpdProf	SWDDS.1.2.3.5	IN	tFrac16	0	17476	0	3200	1 / rpm	EOP speed profile setting (PU)

### 3.2.3.15 [SWDDS.1.2.3.15] CheckEopCtrEnaAppMode

#### 3.2.3.15.1 Detailed Design

##### [SWDDS.1.2.3.15] CheckEopCtrEnaAppMode

Software Unit Information								
Unit ID	SWDDS.1.2.3.15	Unit Name	CheckEopCtrEnaAppMode					
Architecture ID	SWADS.1.2.3.15	ASIL	QM					
Prototype								
Function Call			tBool CheckEopCtrEnaAppMode( tBool previous_enable, tS16 target_rpm, tFrac16 reference_speed )					
Parameters	Data Type	Name	Range	IN/OUT	Description			
	tBool	previous_enable	0 ~ 1	IN	previous control enabled status			
	tS16	target_rpm	0 ~ 3200	IN	target speed (rpm)			
	tFrac16	reference_speed	0 ~ 19660	IN	reference speed (PU)			
Function Call	Data Type	Possible Return Value			Description			
Return Value	tBool	0 ~ 1			FALSE – control disable, TRUE – control enable			
Global Variables	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			
Parameters	Data Type	Name	Range	Read/Write	Description			
	tS16	par_s16RefSpdOnThrs	500	Read	Control enabling(on) target speed threshold (rpm)			
	tS16	par_s16RefSpdOffThrs	500	Read	Control disabling(off) target speed threshold (rpm)			
Registers	Data Type	Name	Range	Read/Write	Description			
	N/A	N/A	N/A	N/A	N/A			
Description	Control enable checking with respect to application mode - Control enable initialization and reference speed unit conversion to rpm - Control enable checking under application mode - Control enable with respect to speed							
	1. CheckEopCtrEnaAppMode checks the application mode. 2. CheckEopCtrEnaAppMode disables control if the application mode is none or warning or failure. 3. CheckEopCtrEnaAppMode checks the control enable and disable condition if the application mode is normal or caution. 4. CheckEopCtrEnaAppMode enables control if the target speed is greater than or equal to the on threshold. 5. CheckEopCtrEnaAppMode disables control if the target speed and the reference speed are less than the off threshold.							

**Called Function**

SWDDS.1.2.3.13 CheckEopCtrEnaMode

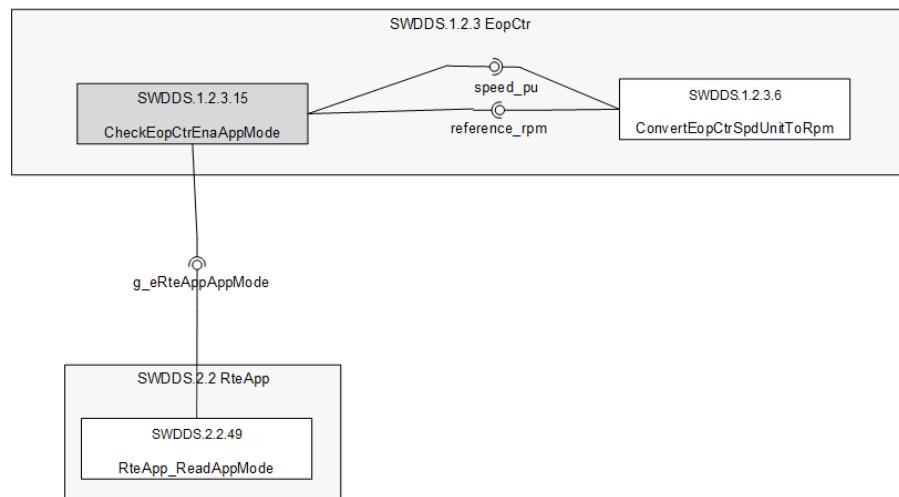
**Calling Function**SWDDS.1.2.3.6 ConvertEopCtrSpdUnitToRpm  
SWDDS.2.2.49 RteApp\_ReadAppMode

N/A

**Function Execution Time**

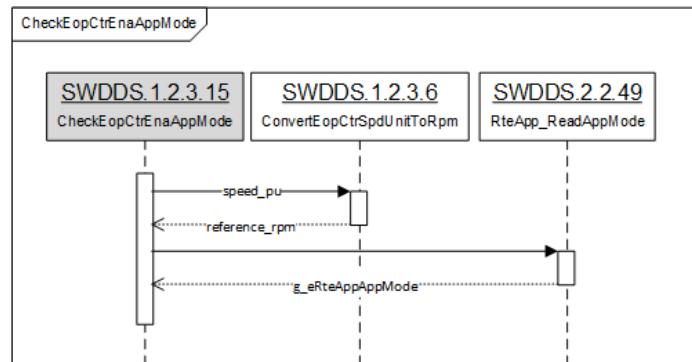
Requirement Id	SWDDS.1.2.3.15
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Mid
Verifiability	Yes

### 3.2.3.15.2 Static View Design



### 3.2.3.15.3 Dynamic View Design

1. CheckEopCtrEnaAppMode calls target speed unit conversion.
2. CheckEopCtrEnaAppMode calls the application mode setting.



### 3.2.3.15.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	speed_pu	SWDDS.1.2.3.6	OUT	tFrac16	0	32767	0.0	5999.82	0.183105 / rpm	Reference speed (PU)
2	reference_rpm	SWDDS.1.2.3.6	IN	tS16	0	3200	0	3200	1 / rpm	Reference speed (rpm)
3	g_eRteAppAppMode	SWDDS.2.2.49	IN	tAppMode	0	4	APP_MODE_NONE	APP_MODE_FAILURE	N/A	Application mode

### 3.2.3.16 [SWDDS.1.2.3.16] CheckEopCtrAntiWindUp

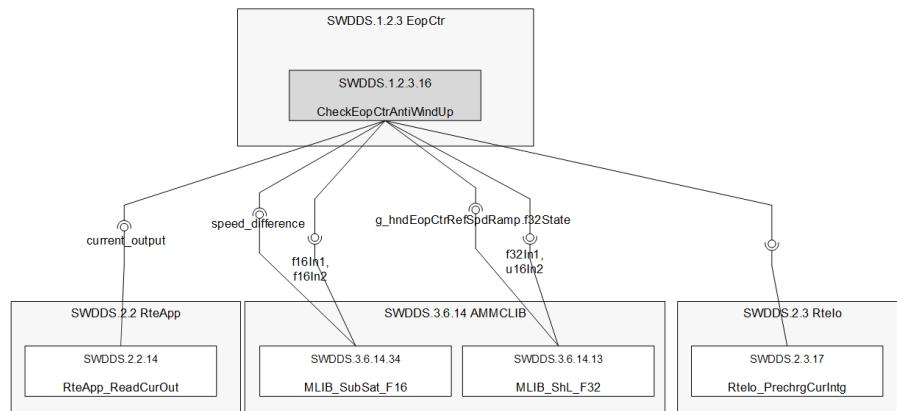
#### 3.2.3.16.1 Detailed Design

##### [SWDDS.1.2.3.16] CheckEopCtrAntiWindUp

Software Unit Information					
Unit ID	SWDDS.1.2.3.16	Unit Name	CheckEopCtrAntiWindUp		
Architecture ID	SWADS.1.2.3.16	ASIL	QM		
Prototype	void CheckEopCtrAntiWindUp( tFrac16 speed_output )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	speed_output	N/A	IN	speed output feedback (PU)
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660	Read	EOP speed profile (PU)
	tFrac16	g_f16EopCtrPrevSpdProf	0 ~ 19660	Read/Write	Previous speed profile setting (PU)
	GFLIB_RAMP_T_F32	g_hndEopCtrRefSpdRamp.f32State	-2147483648 ~ 2147483647	Write	Reference speed ramping handler (f32State)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16SpdCtrAwuSpdDiffThrs	54	Read	Speed control anti-windup speed difference threshold (PU)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Speed control anti-windup checking – Data getting – Speed profile decrement checking – Speed and current control integrator pre-charging – Previous speed profile updating				
1. CheckEopCtrAntiWindUp calculates speed profile decrement difference. 2. CheckEopCtrAntiWindUp checks if the speed profile decrement difference is greater than specific threshold. 3. CheckEopCtrAntiWindUp sets the reference ramping state as current speed output. 4. CheckEopCtrAntiWindUp precharges the sensorless FOC current control and speed control.					
Control Flow Diagram (or Pseudo Code)	<pre>     start           +--&gt; [tFrac16 speed_profile,            current_output,            speed_difference;            speed_profile = g_f16EopCtrSpdProf]           +--&gt; [SWDDS.2.2.14]            current_output = RteApp_ReadCurOut();           +--&gt; [SWDDS.3.6.14.34]            speed_difference = MLIB_SubSat_F16(                g_f16EopCtrPrevSpdProf, speed_profile );           +--&gt; {speed_difference &gt; par_f16SpdCtrAwuSpdDiffThrs}         no         +--&gt; [SWDDS.3.6.14.13]                 g_hndEopCtrRefSpdRamp.f32State =                 MLIB_ShL_F32( (tFrac32)speed_output, 16u );         +--&gt; [SWDDS.2.3.17]                 Rtel_PreqrgCurnt();           +--&gt; g_f16EopCtrPrevSpdProf = speed_profile;           end   </pre>				
Called Function	<p>SWDDS.1.2.3.4 EopCtr_Run    SWDDS.2.2.14 RteApp_ReadCurOut    SWDDS.3.6.14.34 MLIB_SubSat_F16</p>				

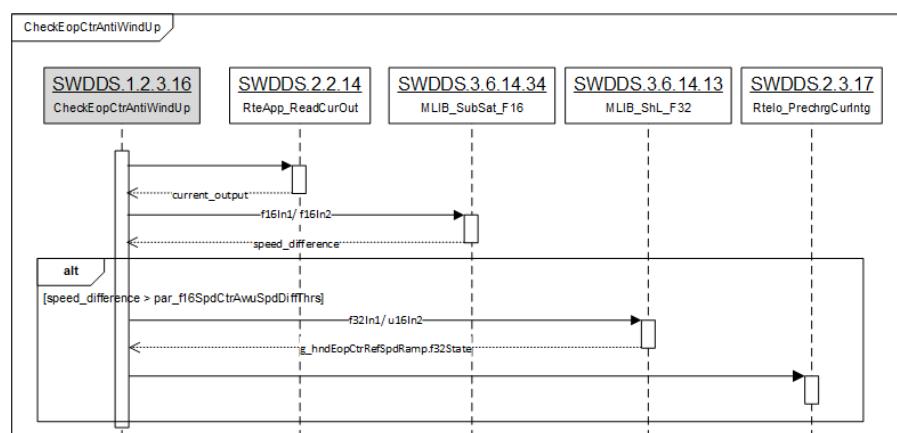
Calling Function	SWDDS.3.6.14.13 MLIB_ShL_F32 SWDDS.2.3.17 RteIo_PrechrgCurIntg
Function Execution Time	N/A
Requirement Id	SWDDS.1.2.3.16
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	Low
Verifiability	Yes

### 3.2.3.16.2 Static View Design



### 3.2.3.16.3 Dynamic View Design

1. CheckEopCtrAntiWindUp calls the fixed-point subtraction and bit shift function.
2. CheckEopCtrAntiWindUp calls the sensorless FOC precharging.



	VW AQ EOP						Baseline / Version / Date	003
	Software Detailed Design Specification						Updated Date	2021-06-30
							Page	174

### 3.2.3.16.4 Interface Design

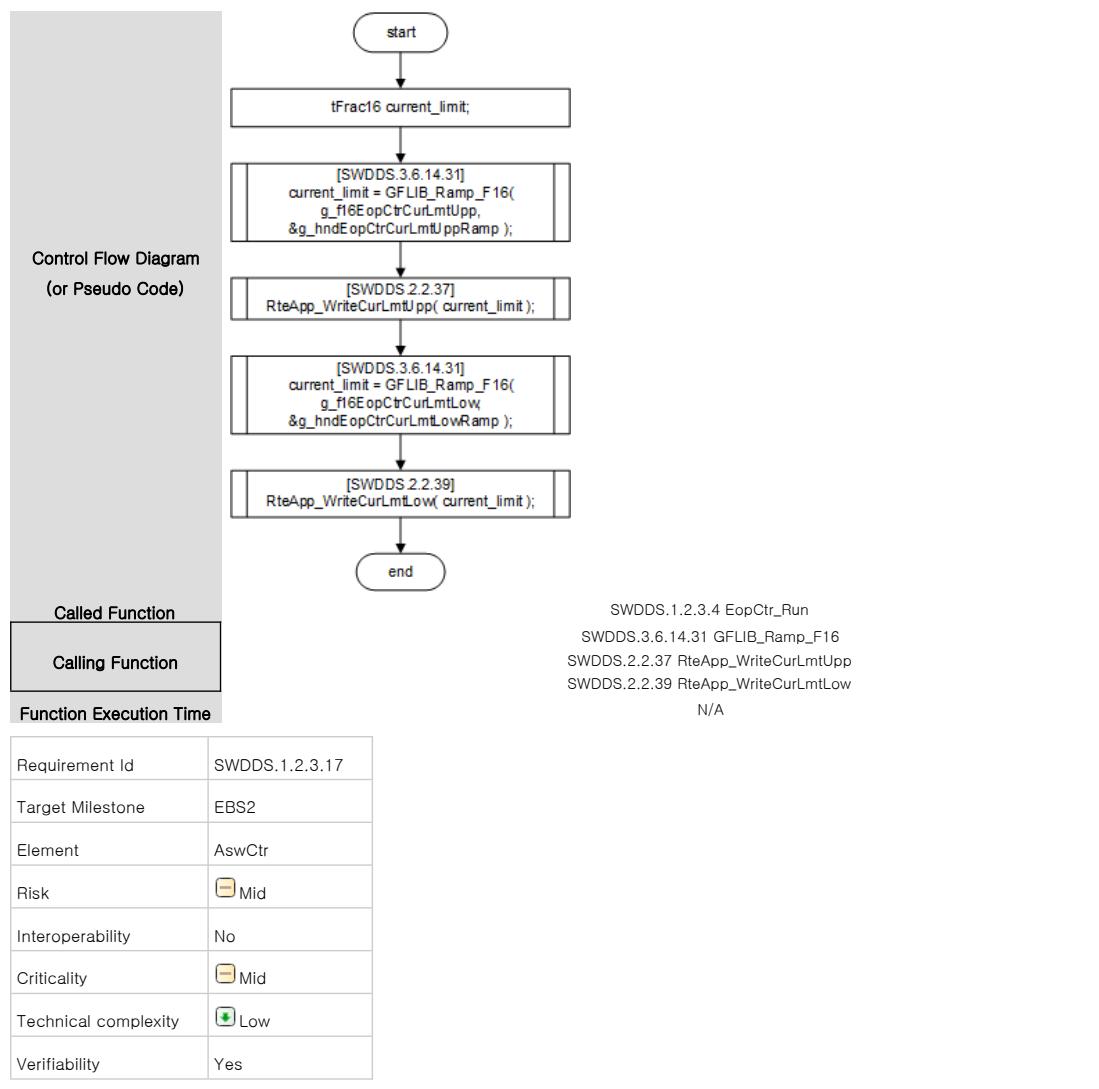
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	current_output	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	q-axis current output (PU)
2	f16In1	SWDDS.3.6.14.34	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	Previous EOP speed profile (PU)
3	f16In2	SWDDS.3.6.14.34	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	EOP speed profile (PU)
4	speed_difference	SWDDS.3.6.14.34	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Target speed difference (PU)
5	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	-2147483648	2147483647	-6000.0	5999.82	0.183105 / rpm	Speed output (PU)
6	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	Bit shift Current
7	g_hndEopCtr RefSpdRamp .f32State	SWDDS.3.6.14.13	IN	GFLIB_RAMP_T_F32	0	1145324612	0.0	5999.82	0.183105 / rpm	speed ramp state (PU)

### 3.2.3.17 [SWDDS.1.2.3.17] SetEopCtrSpdCtrCurLmt

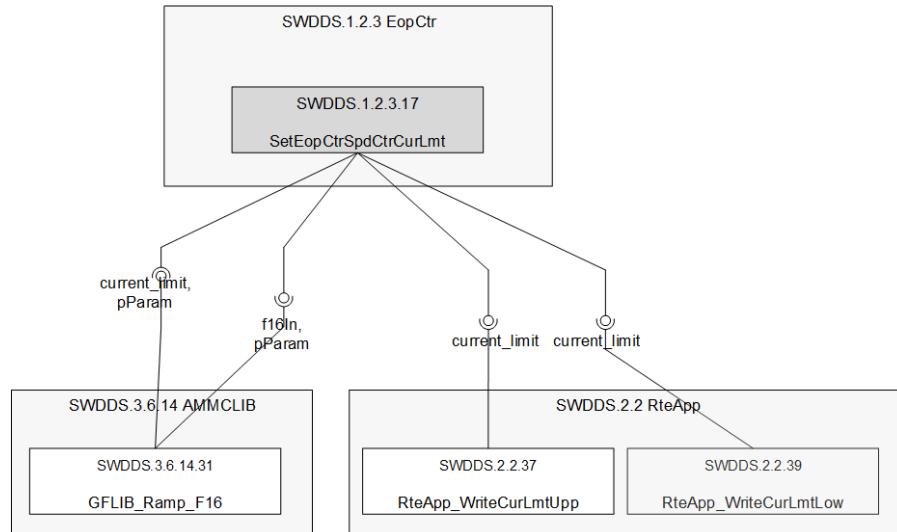
#### 3.2.3.17.1 Detailed Design

##### [SWDDS.1.2.3.17] SetEopCtrSpdCtrCurLmt

Software Unit Information					
Unit ID	SWDDS.1.2.3.17	Unit Name	SetEopCtrSpdCtrCurLmt		
Architecture ID	SWADS.1.2.3.17	ASIL	QM		
void SetEopCtrSpdCtrCurLmt( void )					
Prototype	Data Type	Name	Range	IN/OUT	Description
Function Call Parameters	void	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Data Type Name Range Read/Write Description					
Global Variables	tFrac16	g_f16EopCtrCurLmtUpp	-11430 ~ 11430	Write	Speed control current limit upper (PU)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtUppRamp	-11430 ~ 11430	Read/Write	Current limit upper ramping handler (f16State)
	tFrac16	g_f16EopCtrCurLmtLow	-11430 ~ 11430	Write	Speed control current limit lower (PU)
	GFLIB_RAMP_T_F16	g_hndEopCtrCurLmtLowRamp	-11430 ~ 11430	Read/Write	Current limit lower ramping handler (f16State)
Parameters	Data Type	Name	Range	Read/Write	Description
Registers	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
Description	N/A	N/A	N/A	N/A	N/A
Speed control current limit setting - Upper current limit ramping - Lower current limit ramping					
1. SetEopCtrSpdCtrCurLmt calculates the upper current limit with ramping and set the upper current limit. 2. SetEopCtrSpdCtrCurLmt calculates the lower current limit with ramping and set the lower current limit.					

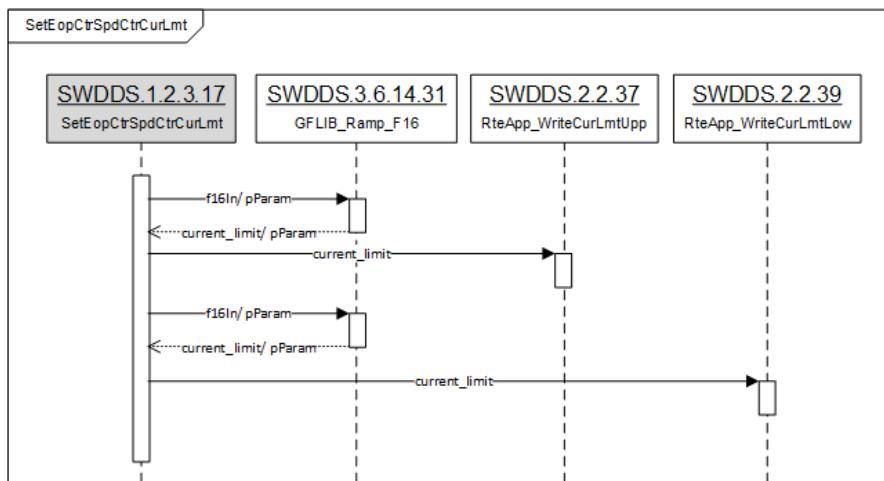


### 3.2.3.17.2 Static View Design



### 3.2.3.17.3 Dynamic View Design

1. SetEopCtrSpdCtrCurLmt calls the ramping function to calculate upper and lower current limit.
2. SetEopCtrSpdCtrCurLmt calls the upper and lower current limit setting



### 3.2.3.17.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In	SWDDS.3.6.14.31	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Current limit upper of speed control (PU)
2	pParam	SWDDS.3.6.14.31	IN/OUT	GFLIB_RAMP_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of current limit upper
3	current_limit	SWDDS.3.6.14.31	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Ramped current limit upper of speed control (PU)
4	current_limit	SWDDS.2.2.37	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Current limit lower of speed control (PU)
5	pParam	SWDDS.3.6.14.31	IN/OUT	GFLIB_RAMP_T_F16 *const	N/A	N/A	N/A	N/A	N/A	Pointer of current limit lower
6	current_limit	SWDDS.2.2.39	OUT	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Ramped current limit lower of speed control (PU)

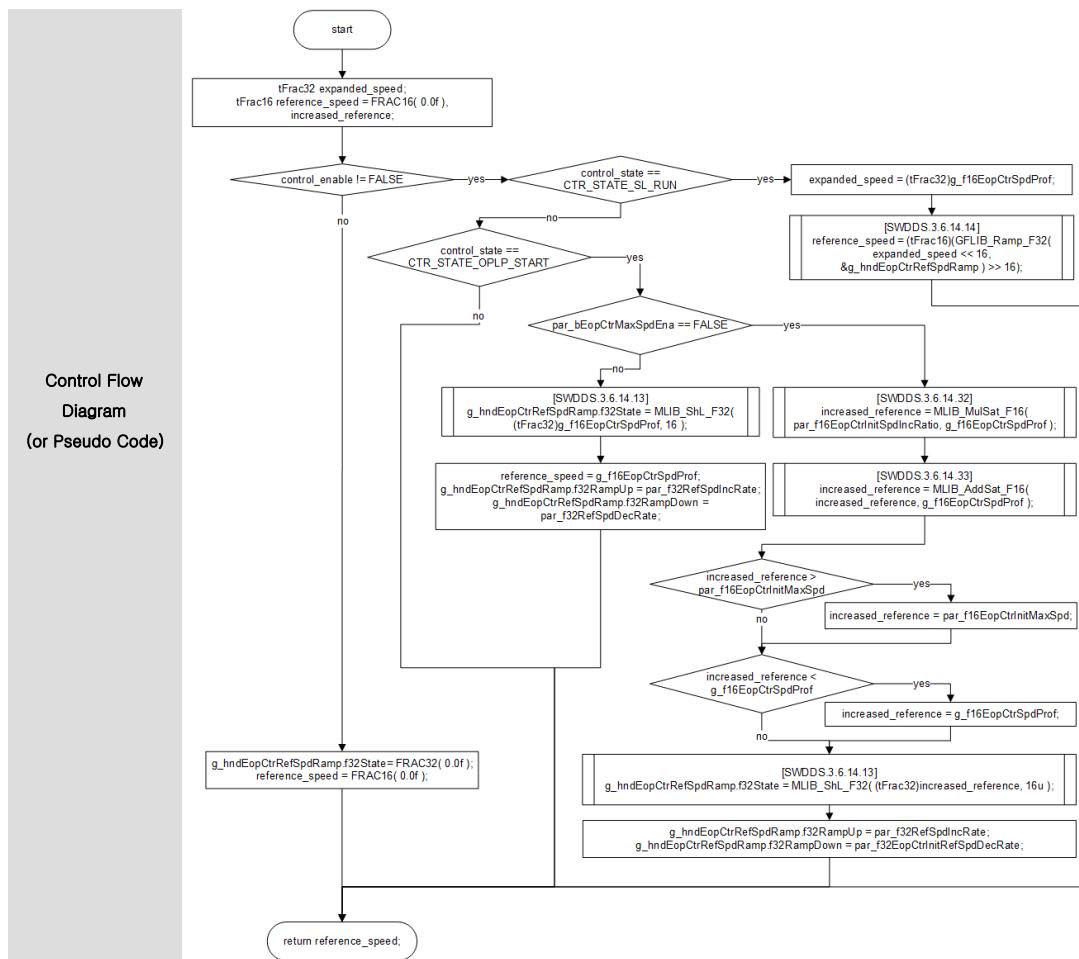
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	177

### 3.2.3.18 [SWDDS.1.2.3.18] CalculateEopCtrRefSpd

#### 3.2.3.18.1 Detailed Design

##### [SWDDS.1.2.3.18] CalculateEopCtrRefSpd

Software Unit Information					
Unit ID	SWDDS.1.2.3.18	Unit Name	CalculateEopCtrRefSpd		
Architecture ID	SWADS.1.2.3.18	ASIL	QM		
Prototype	tFrac16 CalculateEopCtrRefSpd( tCtrState control_state, tBool control_enable )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tCtrState	control_state	0 ~ 4	IN	current control state
	tBool	control_enable	0 ~ 1	IN	FALSE – control disable, TRUE – control enable
Function Call Return Value	Data Type	Possible Return Value		Description	
	tFrac16	0 ~ 19660		Reference speed (PU)	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tFrac16	g_f16EopCtrSpdProf	0 ~ 19660 0 ~ 1288490189	Read Read/Write	EOP speed profile (PU) Reference speed ramping handler (f32State)
Parameters	Data Type	Name	Range	Read/Write	Description
	tBool	par_bEopCtrMaxSpdEna	0	Read	Initial maximum speed acceleration enable
	tFrac16	par_f16EopCtrInitSpdIncRatio	8192	Read	Initial reference speed increment ratio
	tFrac16	par_f16EopCtrInitMaxSpd	19660	Read	EOP control maximum speed (rpm)
	tFrac32	par_f32RefSpdIncRate	10737418	Read	Reference speed increment rate (PU/step)
	tFrac32	par_f32RefSpdDecRate	10737418	Read	Reference speed decrement rate (PU/step, should be positive)
	tFrac32	par_f32EopCtrInitRefSpdDecRate	1789569	Read	Initial reference speed decrement rate (PU/step, should be positive)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Reference speed calculation - Reference speed calculation with ramp up/down - Increased reference speed calculation at initial maximum speed acceleration disabled - Reference speed calculation at initial maximum speed acceleration enabled - Reference speed calculation at control enabled				
	1. CalculateEopCtrRefSpd checks if control is enabled. 2. CalculateEopCtrRefSpd calculates the reference speed with ramping if the control state is sensorless running. 3. CalculateEopCtrRefSpd calculates the initial reference speed if the control state is open-loop starting. 4. CalculateEopCtrRefSpd sets the reference speed as the given amount of overshoot speed if initial maximum speed acceleration is disabled. 5. CalculateEopCtrRefSpd sets the reference speed as the initial maximum speed if initial maximum speed acceleration is enabled. 6. CalculateEopCtrRefSpd sets the reference speed as 0 if control is disabled.				
Control Flow Diagram (or Pseudo Code)					



Called Function

Calling Function

**Function Execution Time**

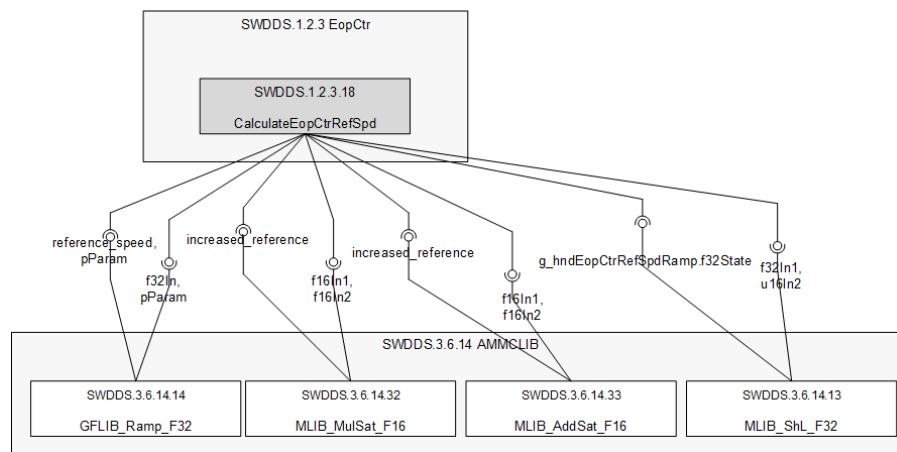
SWDDDS.1.2.3.4 EopCtr\_Run

 SWDDDS.3.6.14.14 GFLIB\_Ramp\_F32  
 SWDDDS.3.6.14.32 MLIB\_MulSat\_F16  
 SWDDDS.3.6.14.33 MLIB\_AddSat\_F16  
 SWDDDS.3.6.14.13 MLIB\_ShL\_F32

N/A

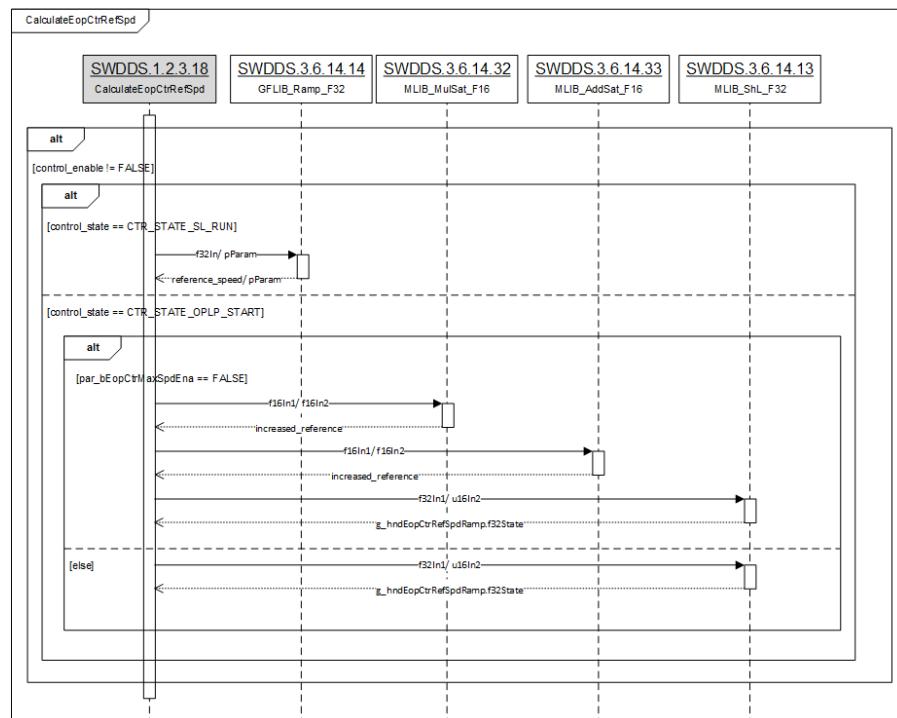
Requirement Id	SWDDDS.1.2.3.18
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	High
Technical complexity	High
Verifiability	Yes

### 3.2.3.18.2 Static View Design



### 3.2.3.18.3 Dynamic View Design

1. CalculateEopCtrRefSpd calls the ramping function to calculate the reference speed with ramp.
2. CalculateEopCtrRefSpd calls the fixed-point multiplication, addition and bit shift function.



### 3.2.3.18.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f32In	SWDDS.3.6.14.14	OUT	tFrac32	0	1288490189	0.0	3600.0	0.183105 / rpm	Bit expanded speed profile (PU)
2	pParam	SWDDS.3.6.14.14	IN/OUT	GFLIB_RAMP_T_F32 *const	N/A	N/A	N/A	N/A	N/A	Pointer of ramping handler
	reference								0.183105 /	

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	180

3	_speed	SWDDS.3.6.14.14	IN	tFrac16	0	19661	0.0	3600.0	rpm	Reference speed (PU)
4	f16In1	SWDDS.3.6.14.32	OUT	tFrac16	8192	8192	0.25	0.25	N/A	Initial reference speed increment ratio
5	f16In2	SWDDS.3.6.14.32	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	EOP speed profile (PU)
6	increased _reference	SWDDS.3.6.14.32	IN	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	Increased reference speed (PU)
7	f16In1	SWDDS.3.6.14.33	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	Increased reference speed (PU)
8	f16In2	SWDDS.3.6.14.33	OUT	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	EOP speed profile (PU)
9	increased _reference	SWDDS.3.6.14.33	IN	tFrac16	0	19660	0.0	3600.0	0.183105 / rpm	Increased reference speed (PU)
10	f32In1	SWDDS.3.6.14.13	OUT	tFrac32	0	1288490189	0.0	3600.0	0.183105 / rpm	Current speed ramp state (PU)
11	u16In2	SWDDS.3.6.14.13	OUT	tU16	16	16	16	16	N/A	Bit shift
12	g_hndEopCtr	SWDDS.3.6.14.13	IN	tFrac32	0	1145324612	0.0	5999.82	0.183105 / rpm	Current speed ramp state (PU)

### 3.2.4 [SWDDS.1.2.4] SigRng

#### 3.2.4.1 [SWDDS.1.2.4.1] SigRng\_Init

##### 3.2.4.1.1 Detailed Design

###### [SWDDS.1.2.4.1] SigRng\_Init

Software Unit Information					
Unit ID	SWDDS.1.2.4.1		Unit Name	SigRng_Init	
Architecture ID	SWADS.1.2.4.1		ASIL	QM	
Prototype	void SigRng_Init( void )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngBatVoltOvr1CntSet	0 ~ 60000	Read	Battery voltage over setting condition 1 hold time count (ms)
	tU16	g_u16SigRngBatVoltOvr2CntSet	0 ~ 60000	Read	Battery voltage over setting condition 2 hold time count (ms)
	tU16	g_u16SigRngBatVoltOvrCntClr	0 ~ 60000	Read	Battery voltage over clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltUndCntSet	0 ~ 60000	Read	Battery voltage under setting condition hold time count (ms)
	tU16	g_u16SigRngBatVoltUndCntClr	0 ~ 60000	Read	Battery voltage under clearing condition hold time count (ms)

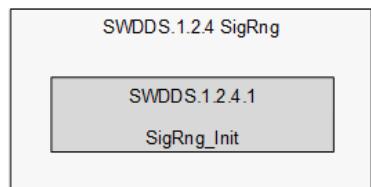
<b>Global Variables</b>	tU16	g_u16SigRngPcbTempOvrCntSet	0 ~ 60000	Read	PCB temperature over setting condition hold time count (ms)
	tU16	g_u16SigRngPcbTempOvrCntClr	0 ~ 60000	Read	PCB temperature over clearing condition hold time count (ms)
	tU16	g_u16SigRngPcbTempWrnCntSet	0 ~ 60000	Read	PCB temperature warning setting condition hold time count (ms)
	tU16	g_u16SigRngPcbTempWrnCntClr	0 ~ 60000	Read	PCB temperature warning clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltHighCntSet	0 ~ 60000	Read	Battery voltage high setting condition hold time count (ms)
	tU16	g_u16SigRngBatVoltHighCntClr	0 ~ 60000	Read	Battery voltage high clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltLowCntSet	0 ~ 60000	Read	Battery voltage low setting condition hold time count (ms)
	tU16	g_u16SigRngBatVoltLowCntClr	0 ~ 60000	Read	Battery voltage low clearing condition hold time count (ms)
	tU16	g_u16SigRngProtModeCntSet	0 ~ 60000	Read	Protect mode setting condition hold time count (ms)
	tU16	g_u16SigRngProtModeCntClr	0 ~ 60000	Read	Protect mode clearing condition hold time count (ms)
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	Signal range checking initialization				
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre> start     ↓     g_u32SigRngChkFlag = 0x00000000uL;     g_u16SigRngBatVolOvr1CntSet = 0u;     g_u16SigRngBatVolOvr2CntSet = 0u;     g_u16SigRngBatVolOvrCntClr = 0u;     g_u16SigRngBatVolUndCntSet = 0u;     g_u16SigRngBatVolUndCntClr = 0u;     g_u16SigRngPcbTempOvrCntSet = 0u;     g_u16SigRngPcbTempOvrCntClr = 0u;     g_u16SigRngPcbTempWrnCntSet = 0u;     g_u16SigRngPcbTempWrnCntClr = 0u;     g_u16SigRngBatVolHighCntSet = 0u;     g_u16SigRngBatVolHighCntClr = 0u;     g_u16SigRngBatVolLowCntSet = 0u;     g_u16SigRngBatVolLowCntClr = 0u;     g_u16SigRngProtModeCntSet = 0u;     g_u16SigRngProtModeCntClr = 0u; end     </pre>				
<b>Called Function</b>	SWDDS.1.2.1.1 AswCtr_Init				
<b>Calling Function</b>	N/A				
<b>Function Execution Time</b>	N/A				

Requirement Id	SWDDS.1.2.4.1
Target Milestone	EBS2
Element	AswCtr
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	182

Verifiability	Yes
---------------	-----

#### 3.2.4.1.2 Static View Design



#### 3.2.4.1.3 Dynamic View Design

- N/A

#### 3.2.4.1.4 Interface Design

- N/A

#### 3.2.4.2 [SWDDS.1.2.4.2] SigRng\_Chk

##### 3.2.4.2.1 Detailed Design

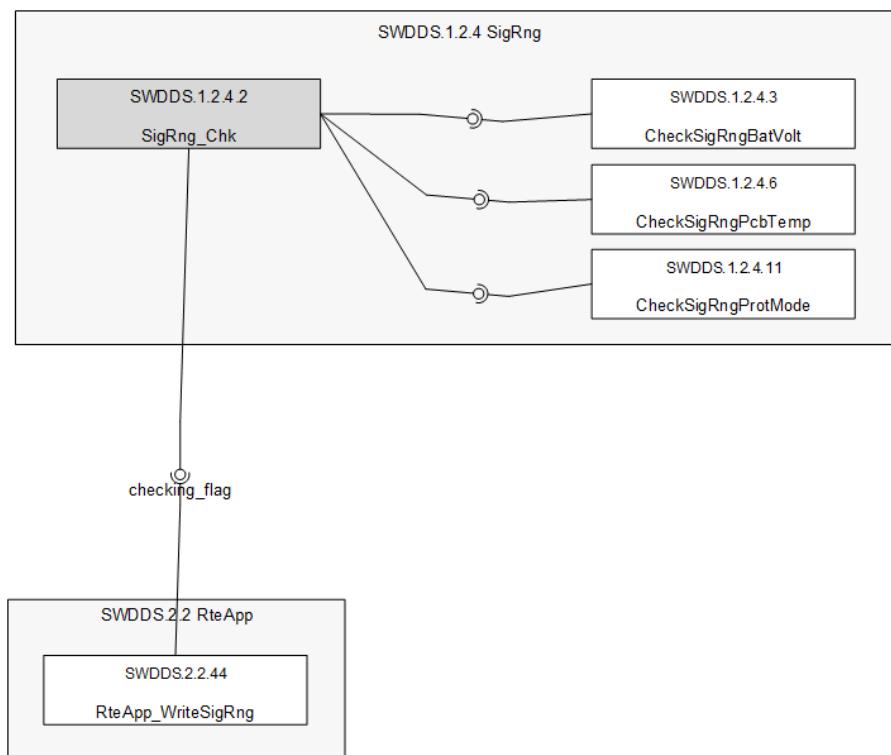
###### [SWDDS.1.2.4.2] SigRng\_Chk

Software Unit Information					
Unit ID	SWDDS.1.2.4.2	Unit Name	SigRng_Chk		
Architecture ID	SWADS.1.2.4.2	ASIL	QM		
Prototype	void SigRng_Chk( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Signal range checking -.. Battery voltage range checking -.. PCB temperature range checking -.. Protect mode checking -.. Application data updating				
Control Flow Diagram (or Pseudo Code)					

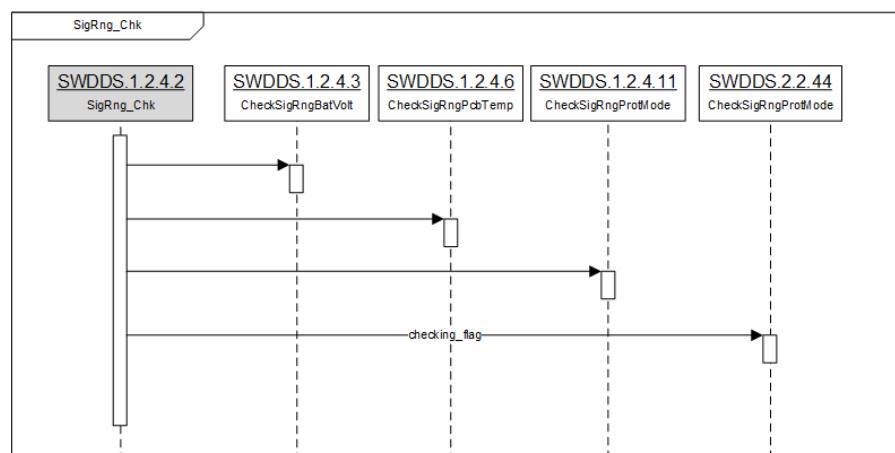
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.1.2.4.3]     CheckSigRngBatVolt();           [SWDDS.1.2.4.6]     CheckSigRngPcbTemp();           [SWDDS.1.2.4.11]     CheckSigRngProtMode();           [SWDDS.2.2.44]     RteApp_WriteSigRng( g_u32SigRngChkFlag );           end   </pre>
	Called Function
	SWDDS.2.1.10 RteSch_Task20ms
	SWDDS.1.2.4.3 CheckSigRngBatVolt
	SWDDS.1.2.4.6 CheckSigRngPcbTemp
Calling Function	SWDDS.1.2.4.11 CheckSigRngProtMode
	SWDDS.2.2.44 RteApp_WriteSigRng
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.4.2
Target Milestone	EBS2
Element	AswCtr
Risk	▣ Mid
Interoperability	No
Criticality	▣ Mid
Technical complexity	▣ Low
Verifiability	Yes

### 3.2.4.2.2 Static View Design



### 3.2.4.2.3 Dynamic View Design



### 3.2.4.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	checking_flag	SWDDS.2.2.44	OUT	tU32	N/A	N/A	N/A	N/A	N/A	Signal range checking flag

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	185

### 3.2.4.3 [SWDDS.1.2.4.3] CheckSigRngBatVolt

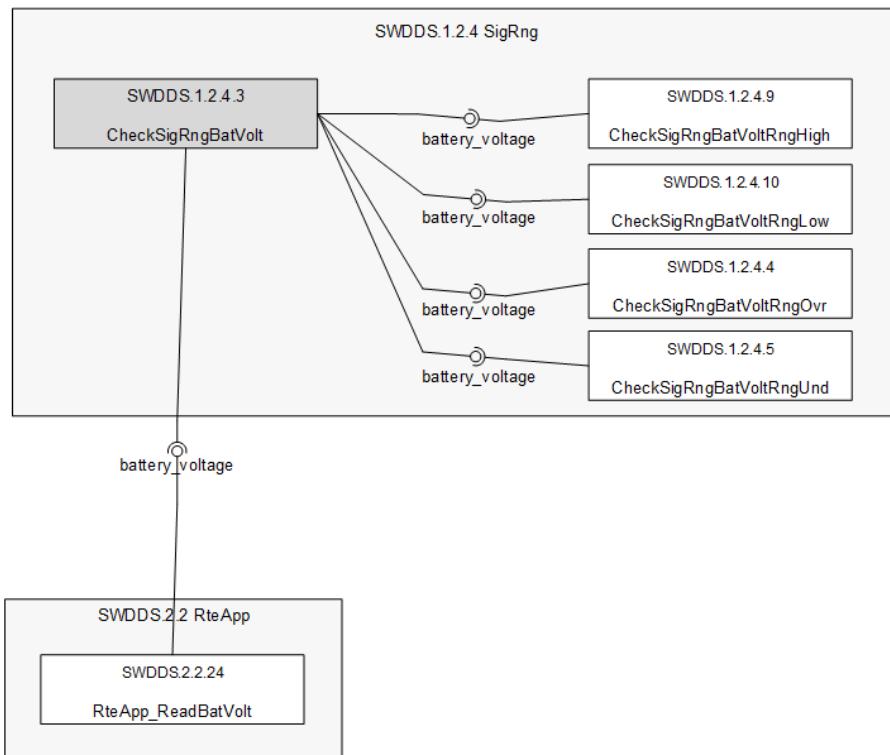
#### 3.2.4.3.1 Detailed Design

##### [SWDDS.1.2.4.3] CheckSigRngBatVolt

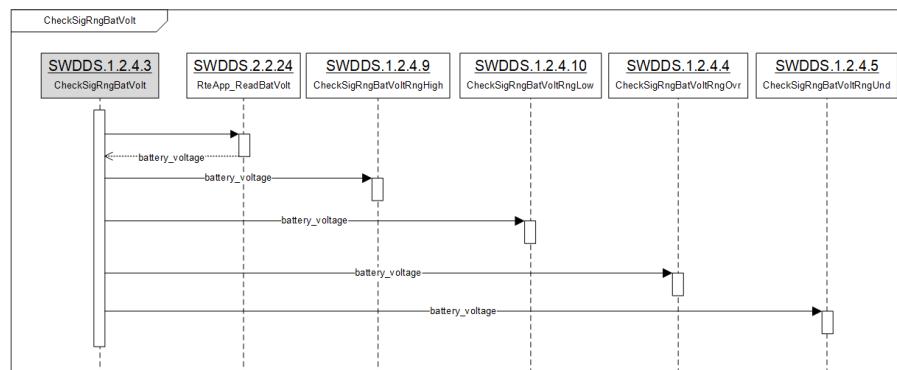
Software Unit Information					
Unit ID	SWDDS.1.2.4.3	Unit Name	CheckSigRngBatVolt		
Architecture ID	SWADS.1.2.4.3	ASIL	QM		
Prototype	void CheckSigRngBatVolt( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage range checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tFrac16 battery_voltage;     ↓     [SWDDS.2.2.24] battery_voltage = RteApp_ReadBatVolt();     ↓     [SWDDS.1.2.4.9] CheckSigRngBatVoltRngHigh( battery_voltage );     ↓     [SWDDS.1.2.4.10] CheckSigRngBatVoltRngLow( battery_voltage );     ↓     [SWDDS.1.2.4.4] CheckSigRngBatVoltRngOvr( battery_voltage );     ↓     [SWDDS.1.2.4.5] CheckSigRngBatVoltRngUnd( battery_voltage );     ↓     end   </pre>				
Called Function	SWDDS.1.2.4.2 SigRng_Chk				
Calling Function	SWDDS.1.2.4.9 CheckSigRngBatVoltRngHigh SWDDS.1.2.4.10 CheckSigRngBatVoltRngLow SWDDS.1.2.4.4 CheckSigRngBatVoltRngOvr SWDDS.1.2.4.5 CheckSigRngBatVoltRngUnd SWDDS.2.2.24 RteApp_ReadBatVolt				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.4.3
Target Milestone	EBS2
Element	AswCtr
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.2.4.3.2 Static View Design



### 3.2.4.3.3 Dynamic View Design



### 3.2.4.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	battery_voltage	SWDDS.2.2.24	IN	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)
2	battery_voltage	SWDDS.1.2.4.9	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)
3	battery_voltage	SWDDS.1.2.4.10	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)
										Battery

<b>SNT Motiv</b>	VW AQ EOP										Baseline / Version / Date	003
	Software Detailed Design Specification										Updated Date	2021-06-30
											Page	187

4	battery_voltage	SWDDS.1.2.4.4	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	voltage (PU)	
5	battery_voltage	SWDDS.1.2.4.5	OUT	tFrac16	0	32767	0.0	29.4991	0.000900269 / Vpk	Battery voltage (PU)	

### 3.2.4.4 [SWDDS.1.2.4.4] CheckSigRngBatVoltRngOvr

#### 3.2.4.4.1 Detailed Design

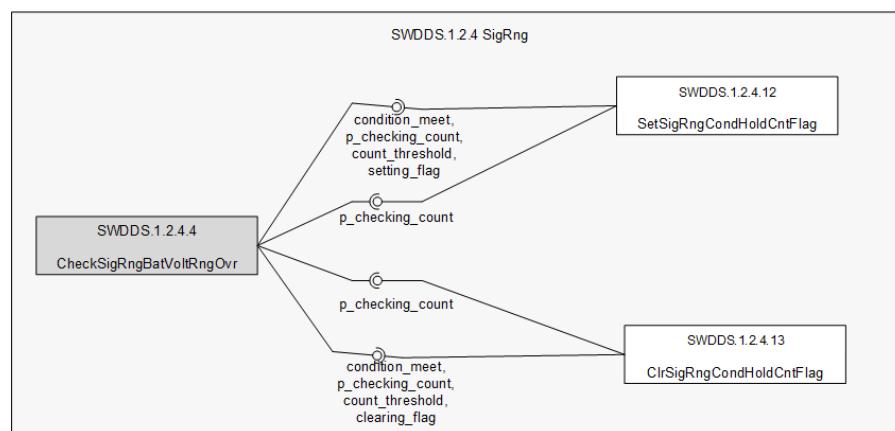
##### [SWDDS.1.2.4.4] CheckSigRngBatVoltRngOvr

Software Unit Information					
Unit ID	SWDDS.1.2.4.4		Unit Name	CheckSigRngBatVoltRngOvr	
Architecture ID	SWADS.1.2.4.4		ASIL	QM	
Prototype	void CheckSigRngBatVoltRngOvr( tFrac16 battery_voltage )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	battery_voltage	0 ~ 32767	IN	Batter Voltage(PU)
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngBatVoltOvrCntClr	0 ~ 600000	Read/Write	Battery voltage over clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltOvr1CntSet	0 ~ 600000	Read/Write	Battery voltage over setting condition 1 hold time count (ms)
	tU16	g_u16SigRngBatVoltOvr2CntSet	0 ~ 600000	Read/Write	Battery voltage over setting condition 2 hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltBatVoltOvrSetThrs1	FRAC16( 17.6f / PARAM_PU_BASE_BAT_VOLT )	Read	Battery voltage over detection setting voltage threshold 1 (PU)
	tU16	par_u16FltBatVoltOvrSetTim1	1500	Read	Battery voltage over detection setting condition hold time 1 (ms)
	tFrac16	par_f16FltBatVoltOvrSetThrs2	FRAC16( 20.4f / PARAM_PU_BASE_BAT_VOLT )	Read	Battery voltage over detection setting voltage threshold 2 (PU)
	tU16	par_u16FltBatVoltOvrSetTim2	1	Read	Battery voltage over detection setting condition hold time 2 (ms)
	tFrac16	par_f16FltBatVoltOvrClrThrs	FRAC16( 17.0f / PARAM_PU_BASE_BAT_VOLT )	Read	Battery voltage over detection clearing voltage threshold (PU)
	tU16	par_u16FltBatVoltOvrClrTim	300	Read	Battery voltage over detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage range over checking - Battery voltage range over setting checking - Battery voltage over 1 checking - Battery voltage over 2 checking - Battery voltage range over clearing checking				

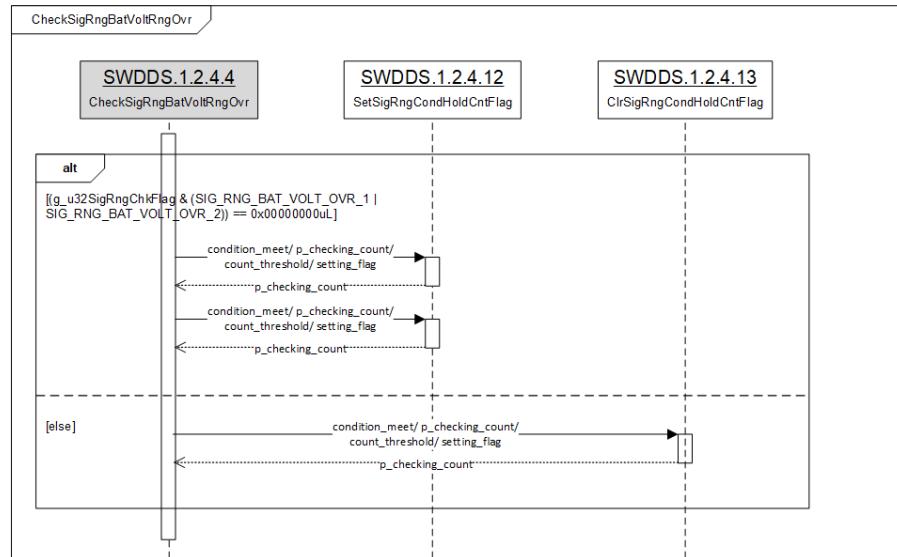
<b>Control Flow Diagram (or Pseudo Code)</b>	
Called Function	SWDDS.1.2.4.3 CheckSigRngBatVolt
Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntFlag
Function Execution Time	N/A
Requirement Id	SWDDS.1.2.4.4
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid

Requirement Id	SWDDS.1.2.4.4
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	High
Verifiability	Yes

### 3.2.4.4.2 Static View Design



### 3.2.4.4.3 Dynamic View Design



### 3.2.4.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage over setting condition 1 hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1	1500	1	1500	1 / msec	Battery voltage over detection setting condition hold time 1 (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	4	12	0x00000004	0x0000000b	N/A	Battery voltage over 1 fault flag
5	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
6	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage over setting condition 2 hold time count (ms)
7	count_threshold	SWDDS.1.2.4.12	OUT	tU16	0	1	0	1	1 / msec	Battery voltage over detection setting condition hold time 2 (ms)
8	setting_flag	SWDDS.1.2.4.12	OUT	tU32	4	12	0x00000004	0x0000000b	N/A	Battery voltage over 2 fault flag
9	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
10	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage over clearing

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	190

									condition hold time count (ms)	
11	count_threshold	SWDDS.1.2.4.13	OUT	tU16	300	300	300	300	1 / msec	Battery voltage over detection clearing condition hold time (ms)
12	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	4	12	0x00000004	0x0000000b	N/A	Battery voltage over 1 and Battery voltage over 2

### 3.2.4.5 [SWDDS.1.2.4.5] CheckSigRngBatVoltRngUnd

#### 3.2.4.5.1 Detailed Design

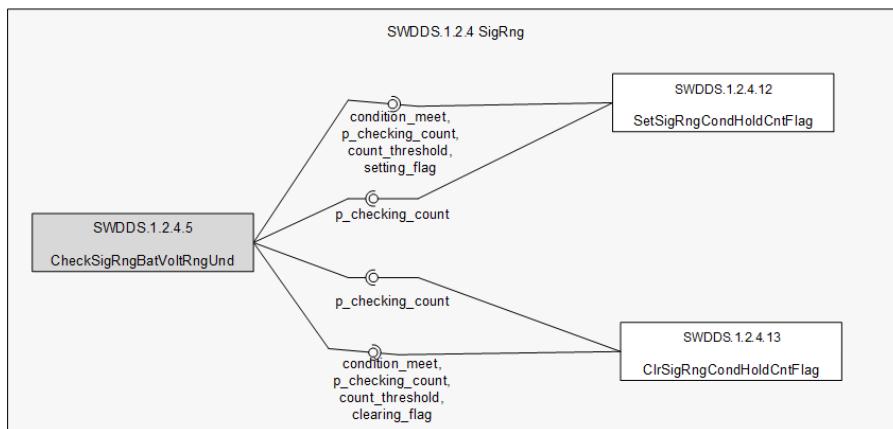
##### [SWDDS.1.2.4.5] CheckSigRngBatVoltRngUnd

Software Unit Information					
Unit ID	SWDDS.1.2.4.5		Unit Name	CheckSigRngBatVoltRngUnd	
Architecture ID	SWADS.1.2.4.5		ASIL	QM	
Prototype	void CheckSigRngBatVoltRngUnd( tFrac16 battery_voltage )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	battery_voltage		IN	Batter Voltage(PU)
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngBatVoltUndCntClr	0 ~ 60000	Read/Write	Battery voltage under clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltUndCntSet	0 ~ 60000	Read/Write	Battery voltage under setting condition hold time count (ms)
	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltBatVoltUndSetThrs	FRAC16( 8.0f / PARAM_PU_BASE_BAT_VOLT )	Read	Battery voltage under detection setting voltage threshold (PU)
	tU16	par_u16FltBatVoltUndSetTim	1500	Read	Battery voltage under detection setting condition hold

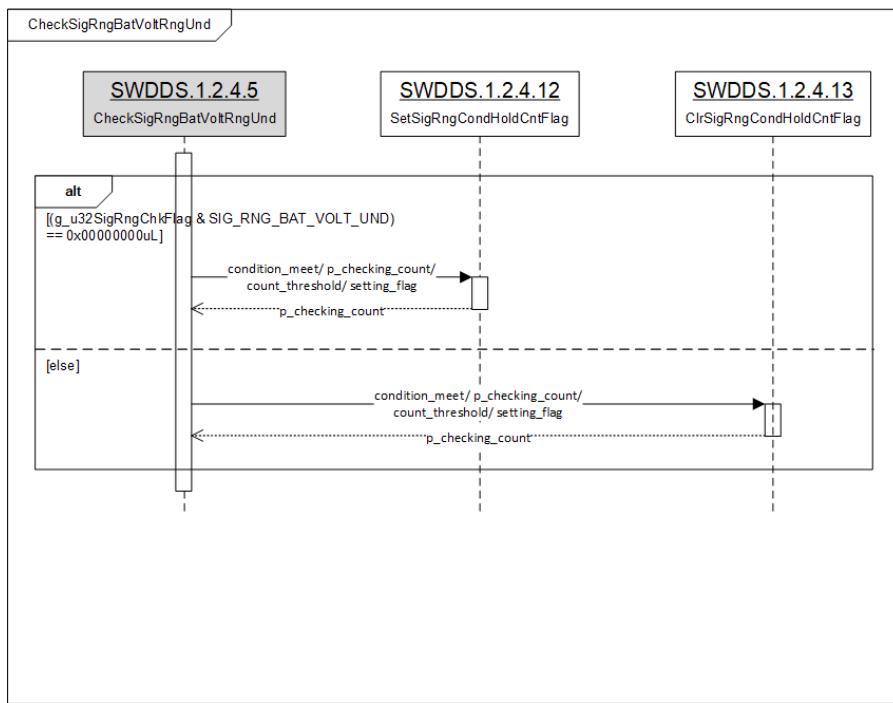
Parameters					time (ms)
	tFrac16	par_f16FltBatVoltUndClrThrs	FRAC16( 8.6f / PARAM_PU_BASE_BAT_VOLT )	Read	
	tU16	par_u16FltBatVoltUndClrTim	300		Battery voltage under detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage range under checking -.. Battery voltage range under setting checking -.. Battery voltage range under clearing checking				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; condition[tBool condition_meet]     condition -- yes --&gt; setPath[g_u16SigRngBatVoltUndCntSet = 0u; condition_meet = (battery_voltage &gt; par_f16FltBatVoltUndClrThrs) ? TRUE : FALSE;]     condition -- no --&gt; clearPath[g_u16SigRngBatVoltUndCntClr = 0u; condition_meet = (battery_voltage &lt; par_f16FltBatVoltUndSetThrs) ? TRUE : FALSE;]     setPath --&gt; SWDDS1[SWDDS.1.2.4.13 ClrSigRngCondHoldCntFlag(condition_meet, &amp;g_u16SigRngBatVoltUndCntClr, par_u16FltBatVoltUndClrTim, SIG_RNG_BAT_VOLT_UND );]     clearPath --&gt; SWDDS2[SWDDS.1.2.4.12 SetSigRngCondHoldCntFlag(condition_meet, &amp;g_u16SigRngBatVoltUndCntSet, par_u16FltBatVoltUndSetTim, SIG_RNG_BAT_VOLT_UND );]     SWDDS1 --&gt; end([end])     SWDDS2 --&gt; end   </pre>				
Called Function	SWDDS.1.2.4.3 CheckSigRngBatVolt				
Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntFlag				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.4.5
Target Milestone	EBS2
Element	AswCtr
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.2.4.5.2 Static View Design



### 3.2.4.5.3 Dynamic View Design



### 3.2.4.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage under setting condition hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1500	1500	1500	1500	1 / msec	Battery voltage under detection setting

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	193

									condition hold time (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	16	16	0x00000010	0x00000010	N/A
5	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False
6	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec
7	count_threshold	SWDDS.1.2.4.13	OUT	tU16	300	300	300	300	1 / msec
8	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	16	16	0x00000010	0x00000010	N/A

### 3.2.4.6 [SWDDS.1.2.4.6] CheckSigRngPcbTemp

#### 3.2.4.6.1 Detailed Design

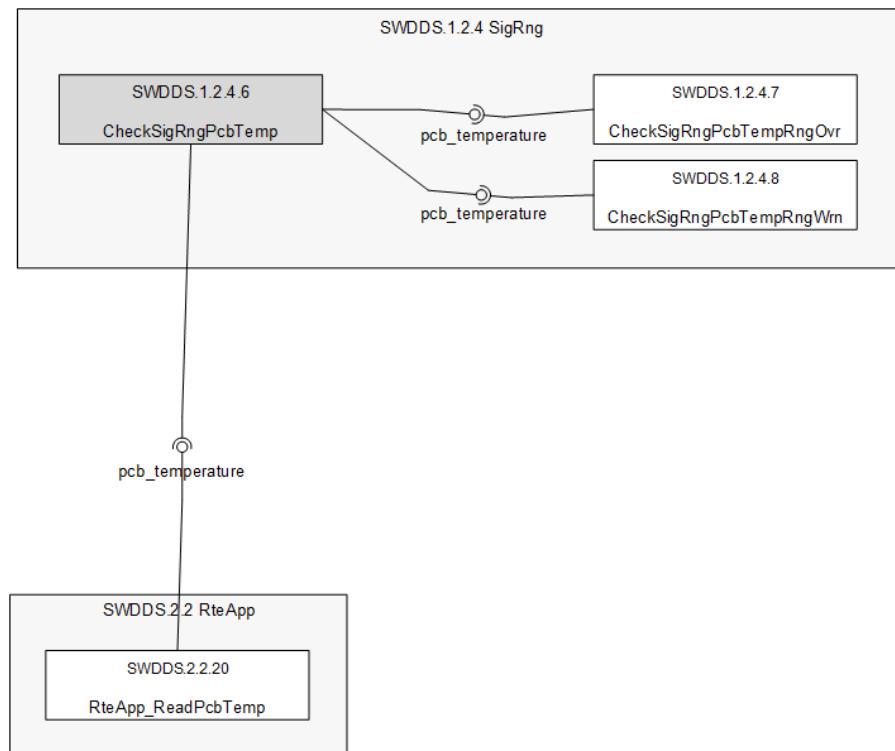
##### [SWDDS.1.2.4.6] CheckSigRngPcbTemp

Software Unit Information					
Unit ID	SWDDS.1.2.4.6	Unit Name	CheckSigRngPcbTemp		
Architecture ID	SWADS.1.2.4.6	ASIL	QM		
Prototype	void CheckSigRngPcbTemp( void )				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		
Return Value	N/A	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature range checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start           tFrac16 pcb_temperature;           [SWDDS 2.2.20]     pcb_temperature = RteApp_ReadPcbTemp();           [SWDDS.1.2.4.7]     CheckSigRngPcbTempRngOvr( pcb_temperature );           [SWDDS.1.2.4.8]     CheckSigRngPcbTempRngWm( pcb_temperature );           end   </pre>				

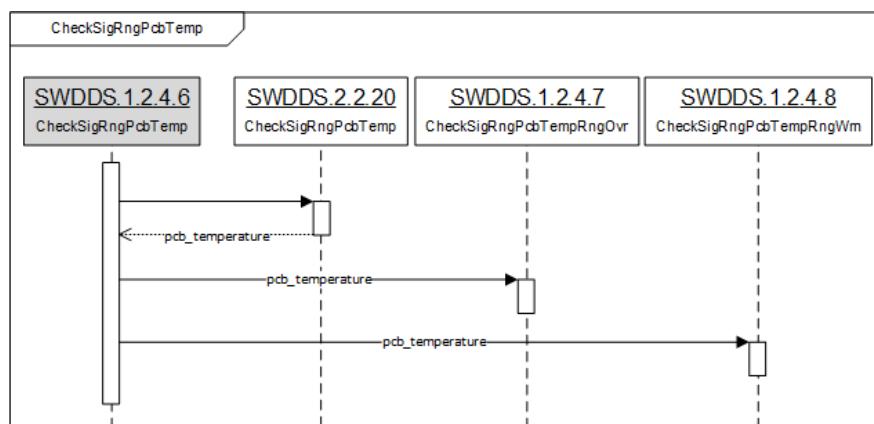
Called Function	SWDDS.1.2.4.2 SigRng_Chk
Calling Function	SWDDS.1.2.4.7 CheckSigRngPcbTempRngOvr
	SWDDS.1.2.4.8 CheckSigRngPcbTempRngWrn
	SWDDS.2.2.20 RteApp_ReadPcbTemp
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.4.6
Target Milestone	SBS1
Element	AswCtr
Risk	<span style="color: green;">Low</span>
Interoperability	No
Criticality	<span style="color: orange;">Mid</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

### 3.2.4.6.2 Static View Design



### 3.2.4.6.3 Dynamic View Design



#### 3.2.4.6.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	pcb_temperature	SWDDS.2.2.20	IN	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	PCB temperature (PU)
2	pcb_temperature	SWDDS.1.2.4.7	OUT	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	PCB temperature (PU)
3	pcb_temperature	SWDDS.1.2.4.8	OUT	tFrac16	-1311	5570	-40.0	170.0	0.0305176 / degC	PCB temperature (PU)

#### 3.2.4.7 [SWDDS.1.2.4.7] CheckSigRngPcbTempRngOvr

##### 3.2.4.7.1 Detailed Design

###### [SWDDS.1.2.4.7] CheckSigRngPcbTempRngOvr

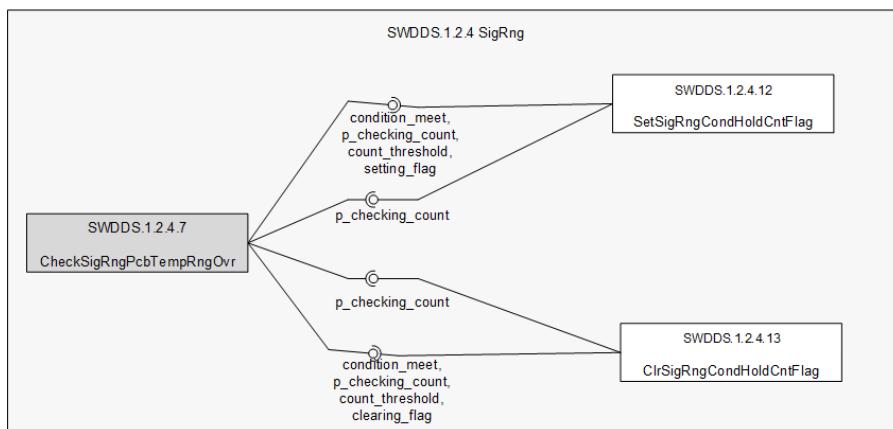
Software Unit Information							
Unit ID	SWDDS.1.2.4.7		Unit Name		CheckSigRngPcbTempRngOvr		
Architecture ID	SWADS.1.2.4.7		ASIL		QM		
Prototype	void CheckSigRngPcbTempRngOvr( tFrac16 pcb_temperature )						
Function Call Parameters	Data Type	Name	Range		IN/OUT		
	tFrac16	pcb_temperature			IN		
					PCB temperature(PU)		
Function Call Return Value	Data Type	Possible Return Value			Description		
	N/A	N/A			N/A		
Global Variables	Data Type	Name	Range		Read/Write		
	tU32	g_u32SigRngChkFlag	0 ~ 255		Read		
	tU16	g_u16SigRngPcbTempOvrCntClr	0 ~ 60000		Read/Write		
					PCB temperature over clearing condition hold time count (ms)		
					PCB temperature		

	tU16	g_u16SigRngPcbTempOvrCntSet	0 ~ 60000	Read/Write	over setting condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltPcbTempOvrSetThrs	FRAC16( 140.0f / PARAM_PU_BASE_TEMP )	Read	PCB temperature over detection setting temperature threshold (PU)
	tU16	par_u16FltPcbTempOvrSetTim	1000	Read	PCB temperature over detection setting condition hold time (ms)
	tFrac16	par_f16FltPcbTempOvrClrThrs	FRAC16( 125.0f / PARAM_PU_BASE_TEMP )	Read	PCB temperature over detection clearing temperature threshold (PU)
	tU16	par_u16FltPcbTempOvrClrTim	1000	Read	PCB temperature over detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature range over checking -, PCB temperature range over setting checking -, PCB temperature range over clearing checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start           tBool condition_meet;           if (g_u32SigRngChkFlag &amp; SIG RNG PCB TEMP_OVR) == 0x00000000uL         yes: g_u16SigRngPcbTempOvrCntClr = 0u;                   if (g_u32SigRngChkFlag &amp; (SIG RNG BAT_VOLT_OVR_1   SIG RNG BAT_VOLT_OVR_2   SIG RNG BAT_VOLT_UND   SIG RNG BAT_VOLT_HIGH   SIG RNG BAT_VOLT_LOW)) == 0x00000000uL             yes: condition_meet = (pcb_temperature &gt; par_f16FltPcbTempOvrThrs) ? TRUE : FALSE;                           [SWDDS.1.2.4.13]             ClrSigRngCondHoldCntrFlag(condition_meet,                 &amp;g_u16SigRngPcbTempOvrCntClr,                 par_u16FltPcbTempOvrClrTim,                 SIG RNG PCB TEMP_OVR);                           [SWDDS.1.2.4.12]             SetSigRngCondHoldCntrFlag(condition_meet,                 &amp;g_u16SigRngPcbTempOvrCntSet,                 par_u16FltPcbTempOvrSetTim,                 SIG RNG PCB TEMP_OVR);                           end         no:         g_u16SigRngPcbTempOvrCntSet = 0u;         condition_meet = (pcb_temperature &lt; par_f16FltPcbTempOvrThrs) ? TRUE : FALSE;                   [SWDDS.1.2.4.13]         ClrSigRngCondHoldCntrFlag(condition_meet,             &amp;g_u16SigRngPcbTempOvrCntClr,             par_u16FltPcbTempOvrClrTim,             SIG RNG PCB TEMP_OVR);                   [SWDDS.1.2.4.12]         SetSigRngCondHoldCntrFlag(condition_meet,             &amp;g_u16SigRngPcbTempOvrCntSet,             par_u16FltPcbTempOvrSetTim,             SIG RNG PCB TEMP_OVR);                   end     no:     </pre>				
Called Function	SWDDS.1.2.4.6 CheckSigRngPcbTemp				
Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntrFlag SWDDS.1.2.4.13 ClrSigRngCondHoldCntrFlag				

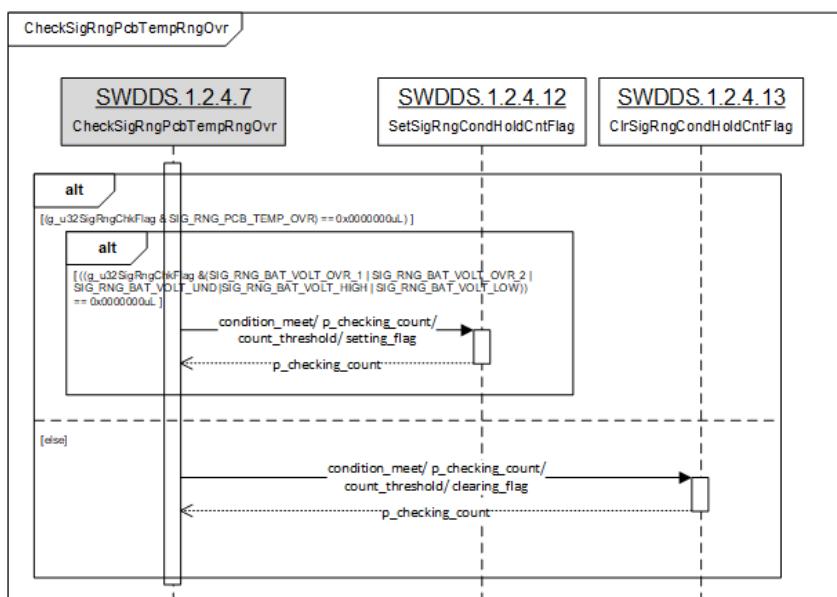
Function Execution Time	N/A
-------------------------	-----

Requirement Id	SWDDS.1.2.4.7
Target Milestone	SBS1
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.4.7.2 Static View Design



### 3.2.4.7.3 Dynamic View Design



<b>SNT Motiv</b>	VW AQ EOP							Baseline / Version / Date	003
	Software Detailed Design Specification							Updated Date	2021-06-30
								Page	198

#### 3.2.4.7.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution/Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	PCB temperature over setting condition hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1000	1000	1000	1000	1 / msec	PCB temperature over detection setting condition hold time (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	32	32	0x00000020	0x00000020	N/A	PCB temperature over fault flag
5	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
6	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	PCB temperature over clearing condition hold time count (ms)
7	count_threshold	SWDDS.1.2.4.13	OUT	tU16	1000	1000	1000	1000	1 / msec	PCB temperature over detection clearing condition hold time (ms)
8	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	32	32	0x00000020	0x00000020	N/A	PCB temperature over fault flag

#### 3.2.4.8 [SWDDS.1.2.4.8] CheckSigRngPcbTempRngWrn

##### 3.2.4.8.1 Detailed Design

###### [SWDDS.1.2.4.8] CheckSigRngPcbTempRngWrn

Software Unit Information							
Unit ID	SWDDS.1.2.4.8		Unit Name	CheckSigRngPcbTempRngWrn			
Architecture ID	SWADS.1.2.4.8		ASIL	QM			
Prototype	void CheckSigRngPcbTempRngWrn( tFrac16 pcb_temperature )						
Function Call Parameters	Data Type	Name	Range		IN/OUT		
	tFrac16	pcb_temperature			IN		
Function Call Return Value	Data Type	Possible Return Value			Description		
	N/A	N/A			N/A		
Data							

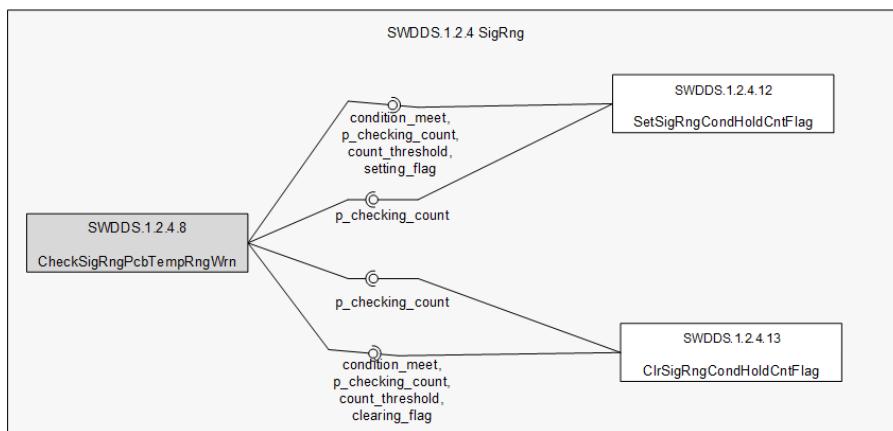
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	199

Global Variables	Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngPcbTempWrnCntClr	0 ~ 60000	Read/Write	PCB temperature warning clearing condition hold time count (ms)
	tU16	g_u16SigRngPcbTempWrnCntSet	0 ~ 60000	Read/Write	PCB temperature warning setting condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltPcbTempWrnSetThrs	FRAC16( -30.0f / PARAM_PU_BASE_TEMP )	Read	PCB temperature warning detection setting temperature threshold (PU)
	tU16	par_u16FltPcbTempWrnSetTim	1000	Read	PCB temperature warning detection setting condition hold time (ms)
	tFrac16	par_f16FltPcbTempWrnClrThrs	FRAC16( -25.0f / PARAM_PU_BASE_TEMP )	Read	PCB temperature warning detection clearing temperature threshold (PU)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	PCB temperature range warning checking -, PCB temperature range warning setting checking -, PCB temperature range warning clearing checking				
Control Flow Diagram (or Pseudo Code)					

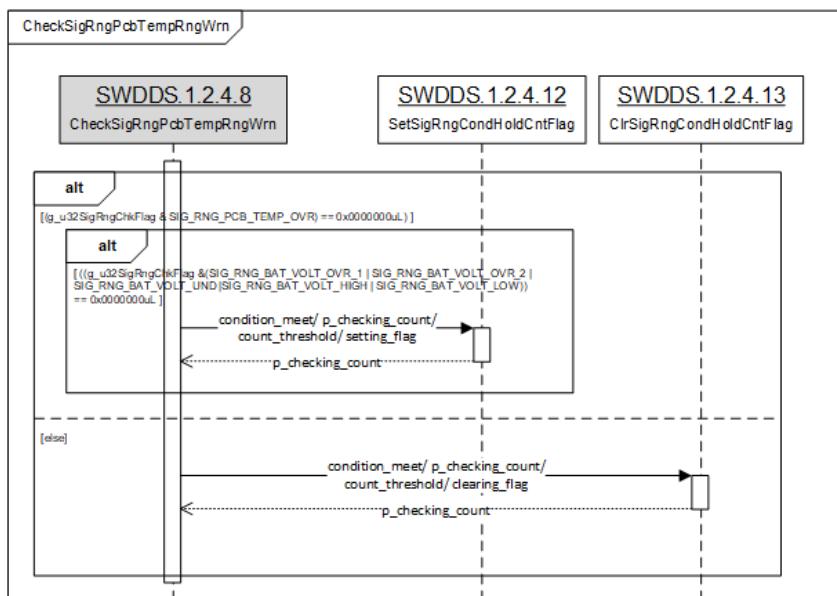
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; tBool[tBool condition_meet]     tBool --&gt; cond1{((g_u32SigRngChkFlag &amp; SIG RNG PCB TEMP WRN) == 0x00000000uL)}     cond1 -- yes --&gt; g_u16SigRngPcbTempWrnCntClr[0u]     cond1 -- no --&gt; cond2{((g_u32SigRngChkFlag &amp; (SIG RNG BAT_VOLT_OVR_1   SIG RNG BAT_VOLT_OVR_2   SIG RNG BAT_VOLT_UND   SIG RNG BAT_VOLT_HIGH   SIG RNG BAT_VOLT_LOW)) == 0x00000000uL)}     cond2 -- yes --&gt; conditionMeet[condition_meet = (pcb_temperature &lt; par_f16FltPcbTempWrnSetThrs) ? TRUE : FALSE]     cond2 -- no --&gt; end((end))     g_u16SigRngPcbTempWrnCntClr --&gt; conditionMeet     conditionMeet --&gt; [SWDDS.1.2.4.13] ClrSigRngCondHoldCntFlag[ClrSigRngCondHoldCntFlag(condition_meet, &amp;g_u16SigRngPcbTempWrnCntClr, par_u16FltPcbTempWrnClrTim, SIG RNG PCB TEMP WRN)]     [SWDDS.1.2.4.13] ClrSigRngCondHoldCntFlag --&gt; end     conditionMeet --&gt; [SWDDS.1.2.4.12] SetSigRngCondHoldCntFlag[SetSigRngCondHoldCntFlag(condition_meet, &amp;g_u16SigRngPcbTempWrnCntSet, par_u16FltPcbTempWrnSetTim, SIG RNG PCB TEMP WRN)]     [SWDDS.1.2.4.12] SetSigRngCondHoldCntFlag --&gt; end </pre>
	SWDDS.1.2.4.6 CheckSigRngPcbTemp

Requirement Id	SWDDS.1.2.4.8
Target Milestone	SBS1
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.4.8.2 Static View Design



### 3.2.4.8.3 Dynamic View Design



### 3.2.4.8.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	PCB temperature warning setting condition hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1000	1000	1000	1000	1 / msec	PCB temperature warning detection setting condition hold time (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	64	64	0x00000040	0x00000040	N/A	PCB temperature warning fault flag

<b>SNT Motiv</b>	VW AQ EOP									Baseline / Version / Date	003
	Software Detailed Design Specification									Updated Date	2021-06-30
										Page	202

5	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet	
6	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	PCB temperature warning clearing condition hold time count (ms)	
7	count_threshold	SWDDS.1.2.4.13	OUT	tU16	1000	1000	1000	1000	1 / msec	PCB temperature warning detection clearing condition hold time (ms)	
8	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	64	64	0x00000040	0x00000040	N/A	PCB temperature warning fault flag	

### 3.2.4.9 [SWDDS.1.2.4.9] CheckSigRngBatVoltRngHigh

#### 3.2.4.9.1 Detailed Design

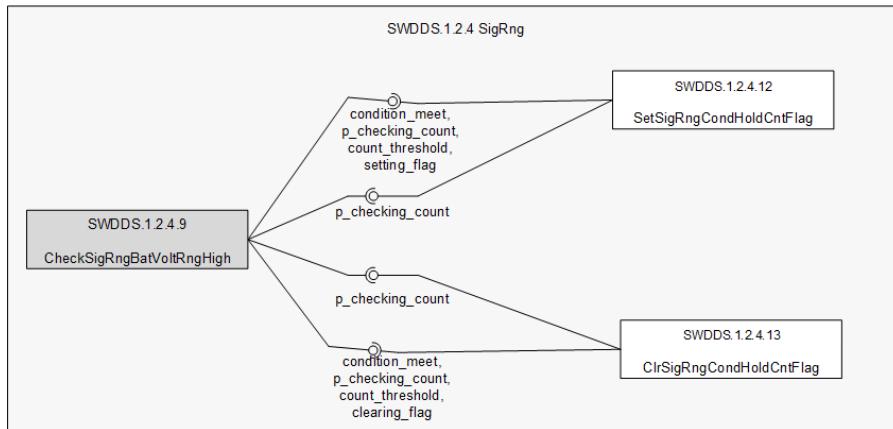
##### [SWDDS.1.2.4.9] CheckSigRngBatVoltRngHigh

Software Unit Information					
Unit ID	SWDDS.1.2.4.9		Unit Name	CheckSigRngBatVoltRngHigh	
Architecture ID	SWADS.1.2.4.9		ASIL	QM	
Prototype	void CheckSigRngBatVoltRngHigh( tFrac16 battery_voltage )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	battery_voltage	0~32767	IN	battery voltage(PU)
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngBatVolthighCntClr	0 ~ 60000	Read/Write	Battery voltage high clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVolthighCntSet	0 ~ 60000	Read/Write	Battery voltage high setting condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltBatVoltHighSetThrs	FRAC16( 26.9f / PARAM_PU_BASE_BAT_VOLT)	Read	Battery voltage high detection setting voltage threshold (PU)
	tU16	par_u16FltBatVoltHighSetTim	1000	Read	Battery voltage high detection setting condition hold time (ms)

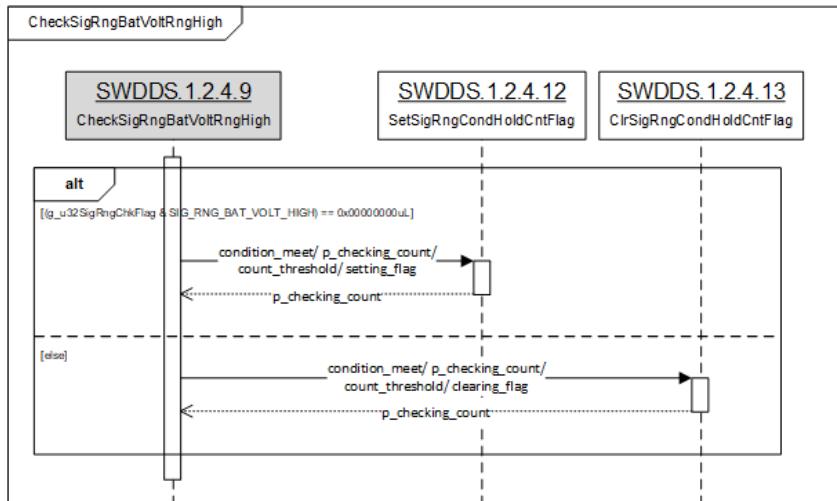
	tFrac16	par_f16FltBatVoltHighClrThrs	FRAC16( 26.5f / PARAM_PU_BASE_BAT_VOLT)	Read	Battery voltage high detection clearing voltage threshold (PU)
	tU16	par_u16FltBatVoltHighClrTim	1000	Read	Battery voltage high detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage range high checking – DC driving voltage range over setting checking – DC driving voltage range over clearing checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tBool condition_meet;     ↓     if (g_u32SigRngChkFlag &amp; SIG RNG BAT VOLT HIGH) == 0x00000000uL     then         g_u16SigRngBatVoltHighCntSet = 0u;         condition_meet = (battery_voltage &lt; par_f16FltBatVoltHighClrThrs)? TRUE : FALSE;         [SWDDS.1.2.4.13] ClrSigRngCondHoldCntrFlag(condition_meet,             &amp;g_u16SigRngBatVoltHighCntClr,             par_u16FltBatVoltHighClrTim,             SIG RNG BAT VOLT HIGH );     else         g_u16SigRngBatVoltHighCntClr = 0u;         condition_meet = (battery_voltage &gt; par_f16FltBatVoltHighSetThrs)? TRUE : FALSE;         [SWDDS.1.2.4.12] SetSigRngCondHldCntrFlag(condition_meet,             &amp;g_u16SigRngBatVoltHighCntSet,             par_u16FltBatVoltHighSetTim,             SIG RNG BAT VOLT HIGH );     end   </pre>				
Called Function	SWDDS.1.2.4.3 CheckSigRngBatVolt				
Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntrFlag SWDDS.1.2.4.13 ClrSigRngCondHoldCntrFlag				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.4.9
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.4.9.2 Static View Design



### 3.2.4.9.3 Dynamic View Design



### 3.2.4.9.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage high setting condition hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1000	1000	1000	1000	1 / msec	Battery voltage high detection setting condition hold time (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	1	1	0x00000001	0x00000001	N/A	Battery voltage high fault flag
5	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
										Battery

	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	205

6	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	voltage high clearing condition hold time count (ms)
7	count_threshold	SWDDS.1.2.4.13	OUT	tU16	1000	1000	1000	1000	1 / msec	Battery voltage high detection clearing condition hold time (ms)
8	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	1	1	0x00000001	0x00000010	N/A	Battery voltage high fault flag

### 3.2.4.10 [SWDDS.1.2.4.10] CheckSigRngBatVoltRngLow

#### 3.2.4.10.1 Detailed Design

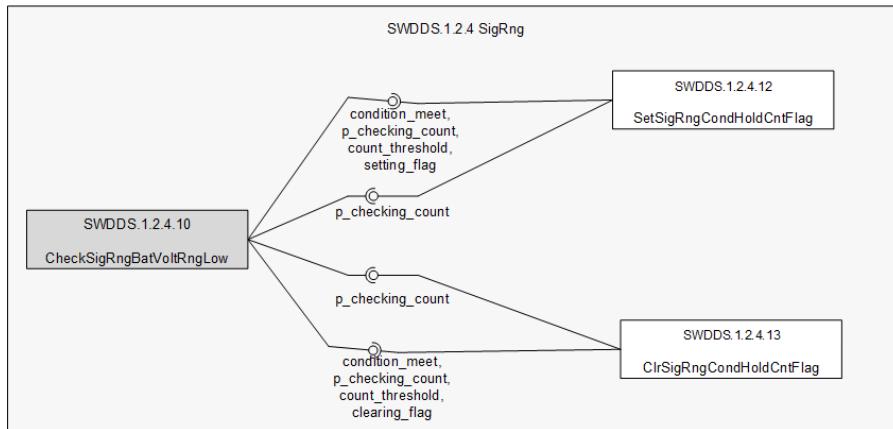
##### [SWDDS.1.2.4.10] CheckSigRngBatVoltRngLow

Software Unit Information					
Unit ID	SWDDS.1.2.4.10		Unit Name	CheckSigRngBatVoltRngLow	
Architecture ID	SWADS.1.2.4.10		ASIL	QM	
Prototype	void CheckSigRngBatVoltRngLow( tFrac16 battery_voltage )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tFrac16	battery_voltage	0~32767	IN	battery voltage(PU)
Function Call Return Value	Data Type	Possible Return Value			Description
	N/A	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
	tU16	g_u16SigRngBatVoltLowCntClr	0 ~ 60000	Read/Write	Battery voltage low clearing condition hold time count (ms)
	tU16	g_u16SigRngBatVoltLowCntSet	0 ~ 60000	Read/Write	Battery voltage low setting condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16FltBatVoltLowSetThrs	FRAC16( 5.6f / PARAM_PU_BASE_BAT_VOLT )	Read	Battery voltage low detection setting voltage threshold (PU)
	tU16	par_u16FltBatVoltLowSetTim	1000	Read	Battery voltage low detection setting condition hold time (ms)
			FRAC16( 6.0f / )		Battery voltage low detection clearing

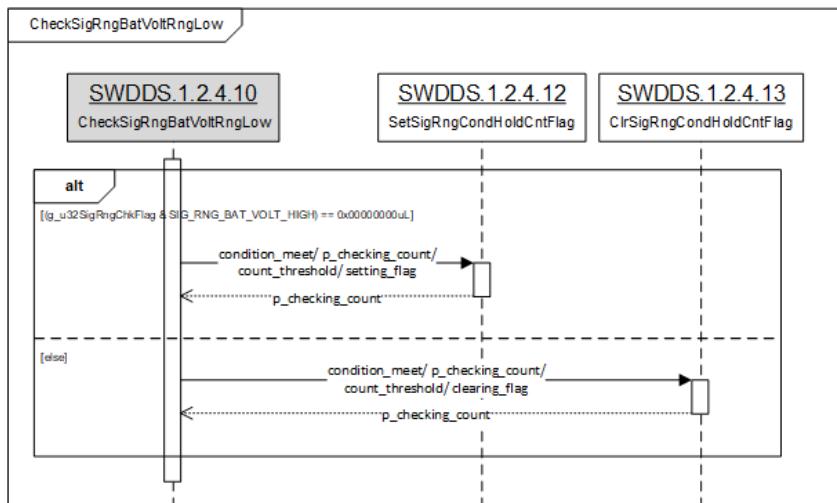
	tFrac16	par_f16FltBatVoltLowClrThrs	PARAM_PU_BASE_BAT_VOLT)	Read	voltage threshold (PU)
	tU16	par_u16FltBatVoltLowClrTim	1000	Read	Battery voltage low detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Battery voltage range low checking - DC driving voltage under setting checking - DC driving voltage under clearing checking				
Control Flow Diagram (or Pseudo Code)	<pre>     start     tBool condition_meet;     if(g_u32SigRngChkFlag &amp; SIG RNG BAT VOLT LOW == 0x00000000uL) {         if(battery_voltage &gt; par_f16FltBatVoltLowClrThrs) {             g_u16SigRngBatVoltLowCntSet = 0u;             condition_meet = (battery_voltage &gt; par_f16FltBatVoltLowClrThrs)? TRUE : FALSE;             ClrSigRngCondHoldCntrFlag( condition_meet,  &amp;g_u16SigRngBatVoltLowCntClr,  par_u16FltBatVoltLowClrTim,  SIG RNG BAT VOLT LOW );         } else {             g_u16SigRngBatVoltLowCntClr = 0u;             condition_meet = (battery_voltage &lt; par_f16FltBatVoltLowSetThrs)? TRUE : FALSE;             SetSigRngCondHoldCntrFlag( condition_meet,  &amp;g_u16SigRngBatVoltLowCntSet,  par_u16FltBatVoltLowSetTim,  SIG RNG BAT VOLT LOW );         }     }     end   </pre>				
Called Function	SWDDS.1.2.4.3 CheckSigRngBatVolt				
Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntrFlag SWDDS.1.2.4.13 ClrSigRngCondHoldCntrFlag				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.2.4.10
Target Milestone	EBS2
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.4.10.2 Static View Design



### 3.2.4.10.3 Dynamic View Design



### 3.2.4.10.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
2	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Battery voltage low setting condition hold time count (ms)
3	count_threshold	SWDDS.1.2.4.12	OUT	tU16	1000	1000	1000	1000	1 / msec	Battery voltage low detection setting condition hold time (ms)
4	setting_flag	SWDDS.1.2.4.12	OUT	tU32	2	2	0x00000002	0x00000002	N/A	Battery voltage low fault flag
5	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
										Battery

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	208

6	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	voltage low clearing condition hold time count (ms)
7	count_threshold	SWDDS.1.2.4.13	OUT	tU16	1000	1000	1000	1000	1 / msec	Battery voltage low detection clearing condition hold time (ms)
8	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	2	2	0x00000002	0x00000002	N/A	Battery voltage low fault flag

### 3.2.4.11 [SWDDS.1.2.4.11] CheckSigRngProtMode

#### 3.2.4.11.1 Detailed Design

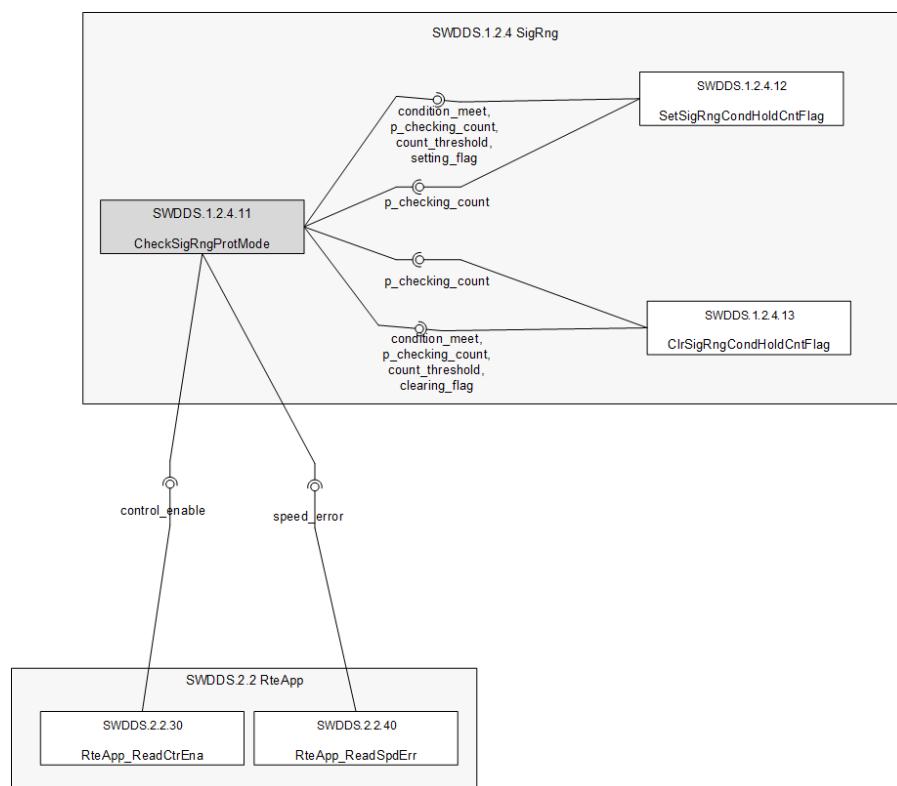
##### [SWDDS.1.2.4.11] CheckSigRngProtMode

Software Unit Information					
Unit ID	SWDDS.1.2.4.11	Unit Name	CheckSigRngProtMode		
Architecture ID	SWADS.1.2.4.11	ASIL	QM		
Prototype			void CheckSigRngProtMode( void )		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read/Write	Signal range checking flag
	tU16	g_u16SigRngProtModeCntClr	0 ~ 60000	Read/Write	Protect mode clearing condition hold time count (ms)
	tU16	g_u16SigRngProtModeCntSet	0 ~ 60000	Read/Write	Protect mode setting condition hold time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16ProtModeSpdErrSetThrs	FRAC16( 500.0f / PARAM_PU_BASE_MECH_SPD )	Read	Protect mode detection setting speed error threshold (PU)
	tU16	par_u16ProtModeSetTim	2500	Read	Protect mode detection setting condition hold time (ms)
	tFrac16	par_f16ProtModeSpdErrClrThrs	FRAC16( 200.0f / PARAM_PU_BASE_MECH_SPD )	Read	Protect mode detection clearing speed error threshold (PU)
	tU16	par_u16ProtModeClrTim	1000	Read	Protect mode detection clearing condition hold time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	DC driving voltage range under checking - Data getting - Control enable checking - Protect mode setting checking - Protect mode clearing checking - Protect mode checking inactive condition				

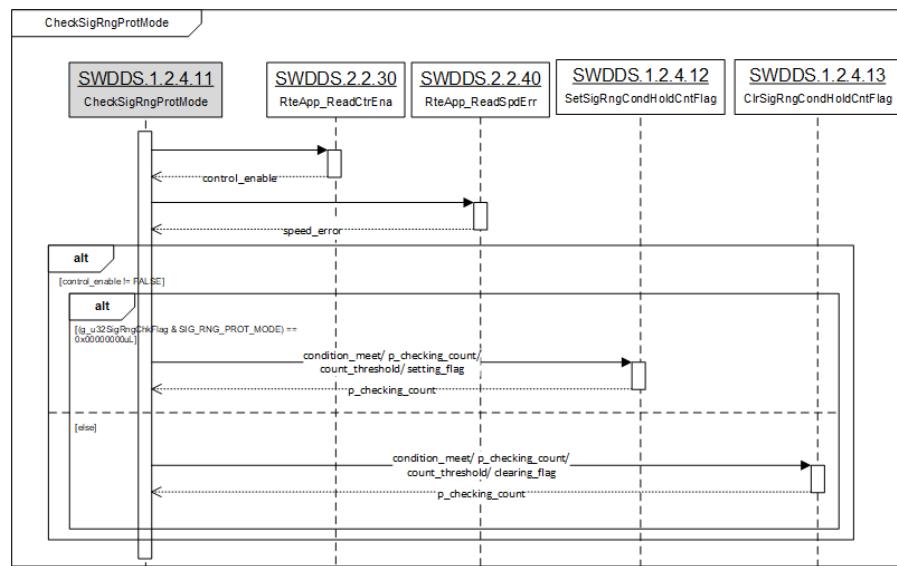
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     tBool control_enable;     tFrac16 speed_error;     tBool condition_meet;      [SWDDS.2.2.30]     control_enable = RteApp_ReadCtrEna();      [SWDDS.2.2.40]     speed_error = RteApp_ReadSpdErr();      if control_enable != FALSE         if (g_u32SigRngChkFlag &amp; SIG RNG PROT MODE) == 0x00000000uL             g_u16SigRngProtModeCntSet = 0u;             g_u16SigRngProtModeCntClr = 0u;             g_u32SigRngChkFlag &amp;= (tU32)(~SIG RNG PROT MODE);              if g_u16SigRngProtModeCntSet &lt; par_f16ProtModeSpdErrCntrThrs                 condition_meet = TRUE;             else                 condition_meet = FALSE;              [SWDDS.1.2.4.13]             ClrSigRngCondHoldCntFlag(                 condition_meet,                 &amp;g_u16SigRngProtModeCntClr,                 par_u16ProtModeCntrTim,                 SIG RNG PROT MODE );              [SWDDS.1.2.4.12]             SetSigRngCondHoldCntFlag(                 condition_meet,                 &amp;g_u16SigRngProtModeCntSet,                 par_u16ProtModeSetTim,                 SIG RNG PROT MODE );         end     end </pre>		
	Called Function	SWDDS.1.2.4.2 SigRng_Chk	
	Calling Function	SWDDS.1.2.4.12 SetSigRngCondHoldCntFlag	
		SWDDS.1.2.4.13 ClrSigRngCondHoldCntFlag	
		SWDDS.2.2.30 RteApp_ReadCtrEna	
		SWDDS.2.2.40 RteApp_ReadSpdErr	
Function Execution Time	N/A		

Requirement Id	SWDDS.1.2.4.11
Target Milestone	SBS2.1
Element	AswCtr
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.2.4.11.2 Static View Design



### 3.2.4.11.3 Dynamic View Design



### 3.2.4.11.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	control_enable	SWDDS.2.2.30	IN	tBool	0	1	Control disable	Control enable	True / False	EOP control enable
2	speed_error	SWDDS.2.2.40	IN	tFrac16	-32768	32767	-6000.0	5999.82	0.183105 / rpm	Speed control error (PU)
3	condition_meet	SWDDS.1.2.4.12	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet

<b>SNT Motiv</b>	VW AQ EOP								Baseline / Version / Date	003
	Software Detailed Design Specification								Updated Date	2021-06-30
									Page	211

4	p_checking_count	SWDDS.1.2.4.12	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Protect mode setting condition hold time count (ms)
5	count_threshold	SWDDS.1.2.4.12	OUT	tU16	2500	2500	2500	2500	1 / msec	Protect mode detection setting condition hold time (ms)
6	setting_flag	SWDDS.1.2.4.12	OUT	tU32	128	128	0x00000080	0x00000080	N/A	Protection mode flag
7	condition_meet	SWDDS.1.2.4.13	OUT	tBool	0	1	Condition not meet	Condition meet	True / False	Checking condition meet
8	p_checking_count	SWDDS.1.2.4.13	IN/OUT	tU16*	0	60000	0	60000	20 / msec	Protect mode clearing condition hold time count (ms)
9	count_threshold	SWDDS.1.2.4.13	OUT	tU16	2500	2500	2500	2500	1 / msec	Protect mode detection clearing condition hold time (ms)
10	clearing_flag	SWDDS.1.2.4.13	OUT	tU32	128	128	0x00000080	0x00000080	N/A	Protection mode flag

### 3.2.4.12 [SWDDS.1.2.4.12] SetSigRngCondHoldCntFlag

#### 3.2.4.12.1 Detailed Design

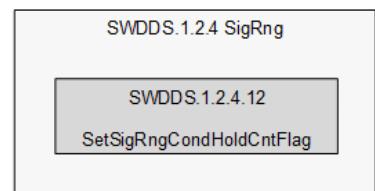
##### [SWDDS.1.2.4.12] SetSigRngCondHoldCntFlag

Software Unit Information					
Unit ID	SWDDS.1.2.4.12	Unit Name	SetSigRngCondHoldCntFlag		
Architecture ID	SWADS.1.2.4.12	ASIL	QM		
Prototype		<pre>void SetSigRngCondHoldCntFlag( tBool condition_meet,                                tU16* p_checking_count,                                tU16 count_threshold,                                tU32 setting_flag )</pre>			
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tBool	condition_meet	0 ~ 1	IN	FALSE – condition does not meet, TRUE – condition meet
	tU16*	p_checking_count	0 ~ 60000	IN/OUT	pointer of condition hold checking time count
	tU16	count_threshold	0 ~ 60000	IN	condition hold checking time count threshold
	tFrac16	setting_flag	1 ~ 128	IN	setting flag if hold time count is reached
Function Call Return Value	Data Type	Possible Return Value		Description	
	N/A	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read	Signal range checking flag
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Condition hold time count checking and the flag setting				

Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; cond1{condition_meet != FALSE}     cond1 -- no --&gt; init["(*p_checking_count) = 0u;"]     init --&gt; end((end))     cond1 -- yes --&gt; cond2{(*p_checking_count) &lt; 60000u}     cond2 -- no --&gt; inc["(*p_checking_count) += SIG_RNG_TIM_INC_PER_STEP;"]     inc --&gt; cond3{(*p_checking_count) &gt;= count_threshold}     cond3 -- no --&gt; set["g_u32SigRngChkFlag  = setting_flag;"]     set --&gt; end     cond3 -- yes --&gt; end </pre>
Called Function	SWDDS.1.2.4.4 CheckSigRngBatVoltRngOvr SWDDS.1.2.4.5 CheckSigRngBatVoltRngUnd SWDDS.1.2.4.7 CheckSigRngPcbTempRngOvr SWDDS.1.2.4.8 CheckSigRngPcbTempRngWrn SWDDS.1.2.4.9 CheckSigRngBatVoltRngHigh SWDDS.1.2.4.10 CheckSigRngBatVoltRngLow SWDDS.1.2.4.11 CheckSigRngProtMode
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.4.12
Target Milestone	EBS2
Element	AswCtr
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	Yes
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

### 3.2.4.12.2 Static View Design



### 3.2.4.12.3 Dynamic View Design

- N/A

### 3.2.4.12.4 Interface Design

- N/A

### 3.2.4.13 [SWDDS.1.2.4.13] ClrSigRngCondHoldCntFlag

#### 3.2.4.13.1 Detailed Design

##### [SWDDS.1.2.4.13] ClrSigRngCondHoldCntFlag

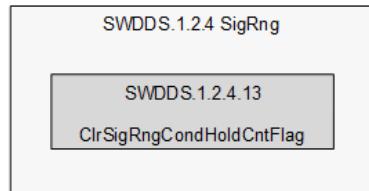
Software Unit Information				
Unit ID	SWDDS.1.2.4.13	Unit Name	ClrSigRngCondHoldCntFlag	
Architecture ID	SWADS.1.2.4.13	ASIL	QM	
<b>Prototype</b>				void ClrSigRngCondHoldCntFlag( tBool condition_meet, tU16* p_checking_count, tU16 count_threshold, tU32 clearing_flag )
Function Call Parameters	Data Type	Name	Range	IN/OUT
	tBool	condition_meet	0 ~ 1	IN
	tU16*	p_checking_count	0 ~ 60000	IN/OUT
	tU16	count_threshold	0 ~ 60000	IN
Function Call Return Value	Data Type	Possible Return Value	Description	
	N/A	N/A	N/A	
	Data Type	Name	Range	Read/Write
	tU32	g_u32SigRngChkFlag	0 ~ 255	Read
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
<b>Description</b>				
Condition hold time count checking and the flag clearing				
Control Flow Diagram (or Pseudo Code)	<pre> start   ↓   {condition_meet != FALSE}   yes: ↓     {(*p_checking_count) &lt; 60000u}     yes: ↓       (*p_checking_count) += SIG RNG TIM INC PER STEP;     no: ↓       {(*p_checking_count) ≥ count_threshold}       yes: ↓         g_u32SigRngChkFlag &amp;= (tU32)(~clearing_flag);       no: ↓     end   no: ↓     (*p_checking_count) = 0u;   end end </pre>			
	SWDDS.1.2.4.4 CheckSigRngBatVoltRngOvr			
	SWDDS.1.2.4.5 CheckSigRngBatVoltRngUnd			
	SWDDS.1.2.4.7 CheckSigRngPcbTempRngOvr			
	SWDDS.1.2.4.8 CheckSigRngPcbTempRngWrn			
	SWDDS.1.2.4.9 CheckSigRngBatVoltRngHigh			
	SWDDS.1.2.4.10 CheckSigRngBatVoltRngLow			
<b>Called Function</b>				

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	214

	SWDDS.1.2.4.11 CheckSigRngProtMode
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.2.4.13
Target Milestone	EBS2
Element	AswCtr
Risk	■ Mid
Interoperability	Yes
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.2.4.13.2 Static View Design



### 3.2.4.13.3 Dynamic View Design

- N/A

### 3.2.4.13.4 Interface Design

- N/A

## 3.3 [SWDDS.1.3] AswMng

### 3.3.1 [SWDDS.1.3.1] AswMng

#### 3.3.1.1 [SWDDS.1.3.1.1] AswMng\_Init

##### 3.3.1.1.1 Detailed Design

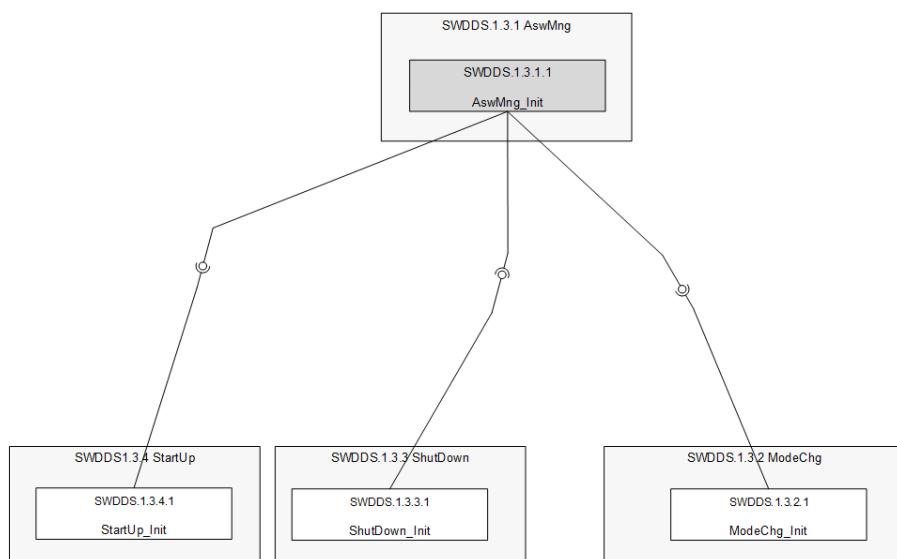
###### [SWDDS.1.3.1.1] AswMng\_Init

Software Unit Information				
Unit ID	SWDDS.1.3.1.1	Unit Name	AswMng_Init	
Architecture ID	SWADS.1.3.1.1	ASIL	QM	
Prototype	void AswMng_Init (void)			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description	
	void	N/A	N/A	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A

Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Initial start-up mode initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           [SWDDS.1.3.4.1] StartUp_Init();           [SWDDS.1.3.3.1] ShutDown_Init();           [SWDDS.1.3.2.1] ModeChg_Init();           end   </pre>				
Called Function	SWDDS.2.1.3 InitializeRteSchAppSw()				
Calling Function	SWDDS.1.3.4.1 StartUp_Init				
	SWDDS.1.3.3.1 ShutDown_Init				
Function Execution Time		N/A			

Requirement Id	SWDDS.1.3.1.1
Target Milestone	EBS2
Element	AswMng
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

### 3.3.1.1.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	216

### 3.3.1.1.3 Dynamic View Design

- N/A

### 3.3.1.1.4 Interface Design

- N/A

## 3.3.2 [SWDDS.1.3.2] ModeChg

### 3.3.2.1 [SWDDS.1.3.2.1] ModeChg\_Init

#### 3.3.2.1.1 Detailed Design

##### [SWDDS.1.3.2.1] ModeChg\_Init

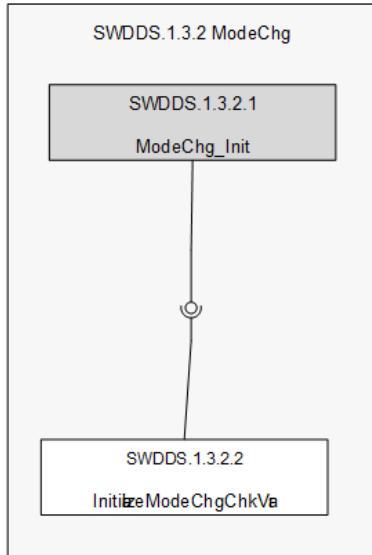
Software Unit Information					
Unit ID	SWDDS.1.3.2.1	Unit Name	ModeChg_Init		
Architecture ID	SWADS.1.3.2.1	ASIL	QM		
Prototype	void ModeChg_Init (void)				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bModeChgVisLow	True /False	Write	Low voltage
	tBool	g_bModeChgFitEdgeTrig	True /False	Write	Edge triggered fault occurred
	tBool	g_bModeChgFitLvlTrig	True /False	Write	Level triggered fault occurred
	tBool	g_bModeChgFitLvlDuringEna	True /False	Write	Level triggered fault occurred during enabled
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Mode changing initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start           +-- g_bModeChgVisLow= TRUE;       g_bModeChgFitEdgeTrig = FALSE;       g_bModeChgFitLvlTrig = FALSE;       g_bModeChgFitLvlDuringEna = FALSE;           +-- [SWDDS.1.3.2.2]         InitializeModeChgChkVar();           end   </pre>				
Called Function	SWDDS.1.3.1.1 AswMng_Init				
Calling Function	SWDDS.1.3.2.2 InitializeModeChgChkVar				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.3.2.1
Target Milestone	EBS2
Element	AswMng
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	217

Verifiability	Yes
---------------	-----

### 3.3.2.1.2 Static View Design



### 3.3.2.1.3 Dynamic View Design

- N/A

### 3.3.2.1.4 Interface Design

- N/A

### 3.3.2.2 [SWDDS.1.3.2.2] InitializeModeChgChkVar

#### 3.3.2.2.1 Detailed Design

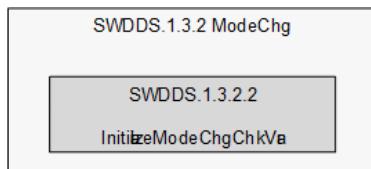
##### [SWDDS.1.3.2.2] InitializeModeChgChkVar

Software Unit Information					
Unit ID	SWDDS.1.3.2.2	Unit Name	InitializeModeChgChkVar		
Architecture ID	SWADS.1.3.2.2	ASIL	QM		
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16ModeChgOpuFlt	0 ~ 4095	Write	Current OPU fault flag status
	tBool	g_bModeChgShutDown	True /False	Write	Shutdown condition storing
	tBool	g_bModeChgAppCaution	True /False	Write	Application caution storing
	tBool	g_bModeChgAppWarning	True /False	Write	Application warning storing
	tBool	g_bModeChgAppFailure	True /False	Write	Application failure storing
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Checking variables initialization				

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     g_u16ModeChgOpnFlt = 0x0000u;     g_bModeChgShutDown = FALSE;     g_bModeChgAppCaution = FALSE;     g_bModeChgAppWarning = FALSE;     g_bModeChgAppFailure = FALSE;     ↓     end   </pre>
Called Function	SWDDS.1.3.2.1 ModeChg_Init
Calling Function	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.3.2.2
Target Milestone	EBS2
Element	AswMng
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.3.2.2.2 Static View Design



### 3.3.2.2.3 Dynamic View Design

- N/A

### 3.3.2.2.4 Interface Design

- N/A

### 3.3.2.3 [SWDDS.1.3.2.3] ModeChg\_Mng

#### 3.3.2.3.1 Detailed Design

##### [SWDDS.1.3.2.3] ModeChg\_Mng

Software Unit Information					
Unit ID	SWDDS.1.3.2.3		Unit Name	ModeChg_Mng	
Architecture ID	SWADS.1.3.2.3		ASIL	QM	
Prototype	void ModeChg_Mng (void)		Description		
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bModeChgVIsLow	True / False	Read/Write	Low voltage
Parameters	Data Type	Name	Range	Read/Write	Description

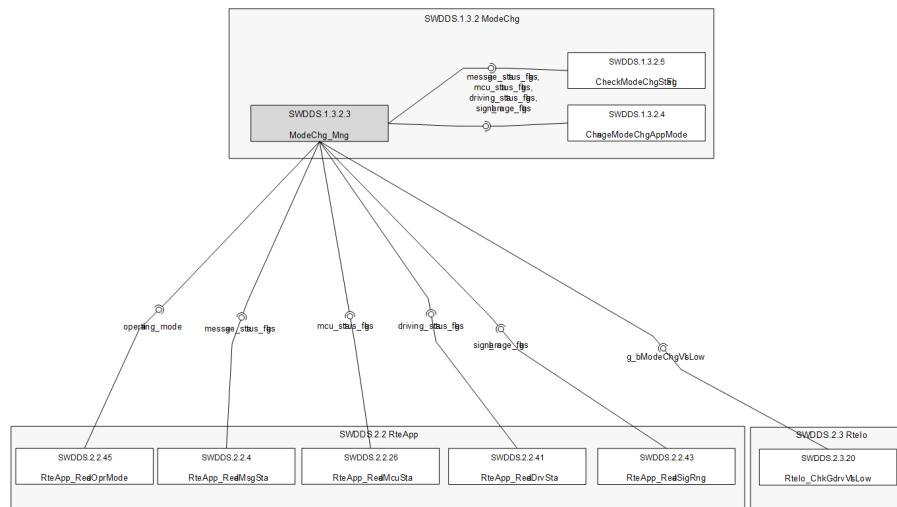
Registers	N/A	N/A	N/A	N/A	N/A
Description	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Mode changing management - Input data getting - Status flags checking - Mode changing with respect to operating mode					
<pre> graph TD     start([start]) --&gt; Decl[tOprMode operating_mode; tU16 message_status_flags; tU32 mcu_status_flags; driving_status_flags; signal_range_flags;]     Decl --&gt; ReadOprMode[SWDDS 2.2.45 RteApp_ReadOprMode();]     ReadOprMode --&gt; ReadMsgSta[SWDDS 2.2.4 RteApp_ReadMsgSta();]     ReadMsgSta --&gt; ReadMcuSta[SWDDS 2.2.26 RteApp_ReadMcuSta();]     ReadMcuSta --&gt; ReadDrvSta[SWDDS 2.2.41 RteApp_ReadDrvSta();]     ReadDrvSta --&gt; ReadSigRng[SWDDS 2.2.43 RteApp_ReadSigRng();]     ReadSigRng --&gt; CheckModeChgStaFlag[SWDDS.1.3.2.5 CheckModeChgStaFlag(message_status_flags, mcu_status_flags, driving_status_flags, signal_range_flags);]     CheckModeChgStaFlag --&gt; ModeNormal1{operating_mode == OPR_MODE_NORMAL}     ModeNormal1 -- yes --&gt; ModeNormal2{operating_mode == OPR_MODE_NORMAL}     ModeNormal2 -- yes --&gt; g_bModeChgVlsLowTrue{g_bModeChgVlsLow == TRUE}     g_bModeChgVlsLowTrue -- yes --&gt; RteLoChkGdrvVlsLow[SWDDS 2.3.20 RteLo_ChkGdrvVlsLow();]     RteLoChkGdrvVlsLow --&gt; ChangeModeChgAppMode1[SWDDS 1.3.2.4 ChangeModeChgAppMode();]     ChangeModeChgAppMode1 --&gt; ModeNormal3{operating_mode == OPR_MODE_NORMAL}     ModeNormal3 -- yes --&gt; ChangeModeChgAppMode2[SWDDS 1.3.2.4 ChangeModeChgAppMode();]     ChangeModeChgAppMode2 --&gt; end([end])     ModeNormal2 -- no --&gt; ChangeModeChgAppMode1     g_bModeChgVlsLowTrue -- no --&gt; ChangeModeChgAppMode1     ModeNormal1 -- no --&gt; ChangeModeChgAppMode1     </pre>					
Control Flow Diagram (or Pseudo Code)					
Called Function	SWDDS.2.1.10 RteSch_Task20ms				
Calling Function	SWDDS.2.2.45 RteApp_ReadOprMode SWDDS.2.2.4 RteApp_ReadMsgSta SWDDS.2.2.26 RteApp_ReadMcuSta SWDDS.2.2.41 RteApp_ReadDrvSta SWDDS.2.2.43 RteApp_ReadSigRng SWDDS.1.3.2.5 CheckModeChgStaFlag SWDDS.2.3.20 RteLo_ChkGdrvVlsLow SWDDS.1.3.2.4 ChangeModeChgAppMode				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.3.2.3
Target Milestone	EBS2
Element	AswMng
Risk	Mid
Interoperability	No

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	220

Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.3.2.3.2 Static View Design



### 3.3.2.3.3 Dynamic View Design

- N/A

### 3.3.2.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Raw Range Max	Physical Range Min	Physical Range Max	Resolution /Units	Description
1	operating_mode	SWDDS.2.2.45	IN	tOprMode	2	5	OPR_MODE_NORMAL	OPR_MODE_TEST	N/A	Current operating mode CAN
2	message_status_flags	SWDDS.2.2.4	IN	tU16	0	32768	0x0000	0x8000	N/A	message status flags
3	mcu_status_flags	SWDDS.2.2.26	IN	tU32	0	134217728	0x00000000	0x08000000	N/A	MCU status flags
4	driving_status_flags	SWDDS.2.2.41	IN	tU32	0	8388608	0x00000000	0x00800000	N/A	Driving status flags
5	signal_range_flags	SWDDS.2.2.43	IN	tU32	0	128	0x00000000	0x00000080	N/A	Signal range checking flags CAN
6	message_status_flags	SWDDS.1.3.2.5	OUT	tU16	0	32768	0x0000	0x8000	N/A	message status flags
7	mcu_status_flags	SWDDS.1.3.2.5	OUT	tU32	0	134217728	0x00000000	0x08000000	N/A	MCU status flags
8	driving_status_flags	SWDDS.1.3.2.5	OUT	tU32	0	8388608	0x00000000	0x00800000	N/A	Driving status flags
9	signal_range_flags	SWDDS.1.3.2.5	OUT	tU32	0	128	0x00000000	0x00000080	N/A	Signal range checking flags LVS low level: FALSE - normal, TRUE - voltage low
10	g_bModeChgVlsLow	SWDDS.2.3.20	IN	tBool	0	1	FALSE_VLS_OUT_above_VLVLSD	TRUE_VLS_OUT_below_V_LVLSA	N/A	

## 3.3.2.4 [SWDDS.1.3.2.4] ChangeModeChgAppMode

## 3.3.2.4.1 Detailed Design

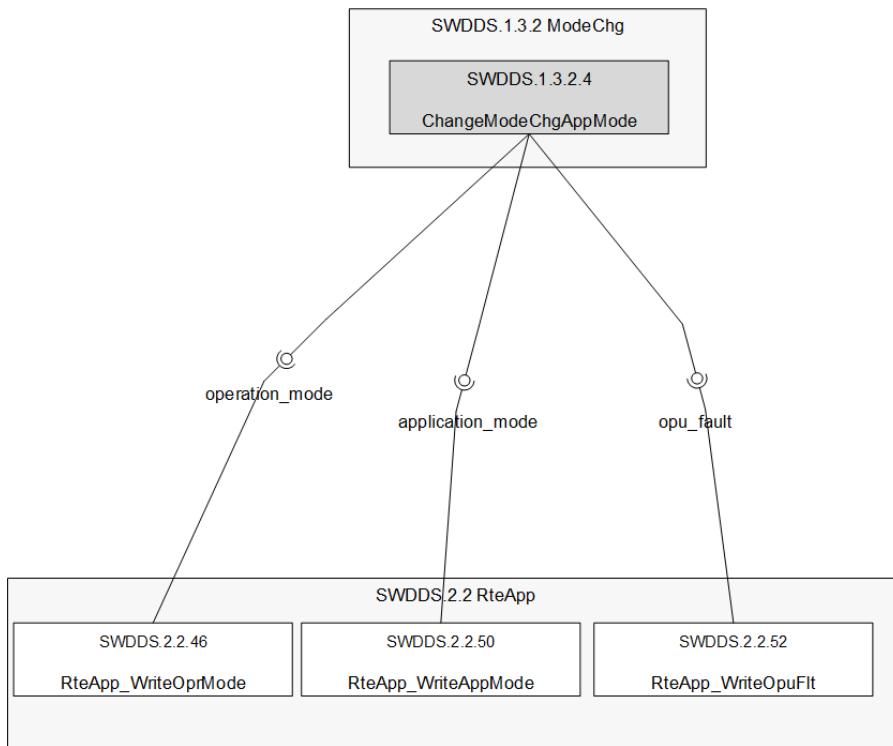
## [SWDDS.1.3.2.4] ChangeModeChgAppMode

Software Unit Information				
Unit ID	SWDDS.1.3.2.4	Unit Name	ChangeModeChgAppMode	
Architecture ID	SWADS.1.3.2.4	ASIL	QM	
Prototype	void ChangeModeChgAppMode (void)			
Function Call Parameters	Data Type	Name	Range	In/Out
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description
	void	N/A		N/A
Global Variables	Data Type	Name	Range	Read/Write
	tBool	g_bModeChgShutdown	True /False	Read
	tBool	g_bModeChgAppFailure	True /False	Read
	tBool	g_bModeChgAppWarning	True /False	Read
	tBool	g_bModeChgAppCaution	True /False	Read
	tU16	g_u16ModeChgOpuFlt	0 ~ 4095	Read
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Application mode changing - Mode transition - Application data updating			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     {if g_bModeChgShutdown != FALSE}         yes → [SWDDS.2.2.46] RteApp_WriteOprMode( OPR_MODE_SHUTDOWN );     no     {if g_bModeChgAppFailure != FALSE}         yes → [SWDDS.2.2.50] RteApp_WriteAppMode( APP_MODE_FAILURE );     no     {if g_bModeChgAppWarning != FALSE}         yes → [SWDDS.2.2.50] RteApp_WriteAppMode( APP_MODE_WARNING );     no     {if g_bModeChgAppCaution != FALSE}         yes → [SWDDS.2.2.50] RteApp_WriteAppMode( APP_MODE_FAILURE );     no         [SWDDS.2.2.50] RteApp_WriteAppMode( APP_MODE_NORMAL );         [SWDDS.2.2.50] RteApp_WriteAppMode( APP_MODE_CAUTION );     ↓     [SWDDS.2.2.52] RteApp_WriteOpuFlt( g_u16ModeChgOpuFlt );     ↓     end   </pre>			
Called Function	SWDDS.1.3.2.3 ModeChg_Mng			
Calling Function	[SWDDS.2.2.46] RteApp_WriteOprMode [SWDDS.2.2.50] RteApp_WriteAppMode [SWDDS.2.2.52] RteApp_WriteOpuFlt			
Function Execution Time	N/A			
Requirement Id	SWDDS.1.3.2.4			
Target Milestone	EBS2			
Element	AswMng			

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	222

Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

### 3.3.2.4.2 Static View Design



### 3.3.2.4.3 Dynamic View Design

- N/A

### 3.3.2.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
1	operation_mode	SWDDS.2.2.46	OUT	tOprMode	4	4	OPR_MODE _SHUTDOWN	OPR_MODE _SHUTDOWN	N/A	Shutdown mode
2	application_mode	SWDDS.2.2.50	OUT	tAppMode	1	4	APP_MODE _NORMAL	APP_MODE _FAILURE	N/A	Normal, Warning and Failure mode
3	opu_fault	SWDDS.2.2.52	OUT	tU16	0	65535	0	65535	N/A	OPU fault flags

### 3.3.2.5 [SWDDS.1.3.2.5] CheckModeChgStaFlg

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	223

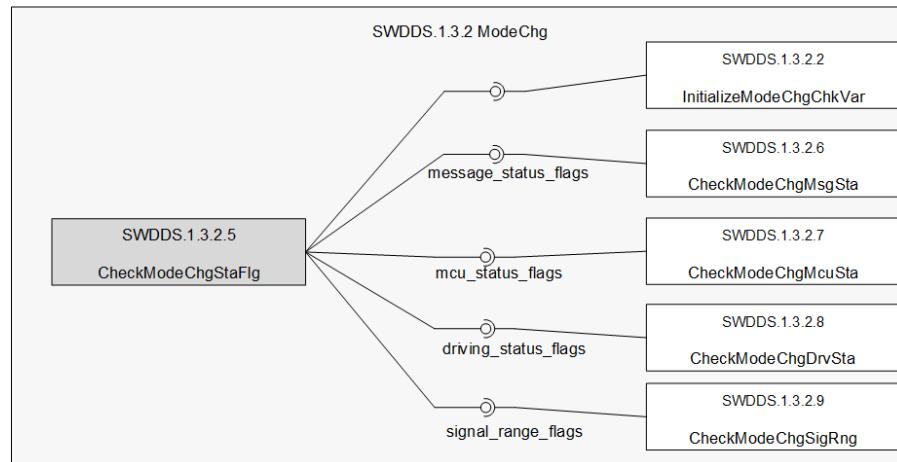
### 3.3.2.5.1 Detailed Design

#### [SWDDS.1.3.2.5] CheckModeChgStaFlg

Software Unit Information					
Unit ID	SWDDS.1.3.2.5		Unit Name	CheckModeChgStaFlg	
Architecture ID	SWADS.1.3.2.5		ASIL	QM	
Prototype	<pre>void CheckModeChgStaFlg (tU16 message_status_flags,                          tU32 mcu_status_flags,                          tU32 driving_status_flags,                          tU32 signal_range_flags)</pre>				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	message_status_flags	0 ~ 32768	IN	CAN message status flags
	tU32	mcu_status_flags	0 ~ 134217728	IN	MCU status flags
	tU32	driving_status_flags	0 ~ 8388608	IN	Driving status flags
Function Call Return Value	Data Type	Possible Return Value	Description		
	void	N/A	N/A		
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Status flags checking for mode transition - Checking variables clearing - Status flags checking				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start([start]) --&gt; subgraph "SWDDS.1.3.2.2"     subgraph "SWDDS.1.3.2.2"         direction TB         A[InitializeModeChgChkVar()]     end     A --&gt; subgraph "SWDDS.1.3.2.6"     subgraph "SWDDS.1.3.2.6"         direction TB         B[CheckModeChgMsgSta(message_status_flags)]     end     B --&gt; subgraph "SWDDS.1.3.2.7"     subgraph "SWDDS.1.3.2.7"         direction TB         C[CheckModeChgMcuSta(mcu_status_flags)]     end     C --&gt; subgraph "SWDDS.1.3.2.8"     subgraph "SWDDS.1.3.2.8"         direction TB         D[CheckModeChgDrvSta(driving_status_flags)]     end     D --&gt; subgraph "SWDDS.1.3.2.9"     subgraph "SWDDS.1.3.2.9"         direction TB         E[CheckModeChgSigRng(signal_range_flags)]     end     E --&gt; end([end])   </pre>				
Called Function	SWDDS.1.3.2.3 ModeChg_Mng				
Calling Function	SWDDS.1.3.2.2 InitializeModeChgChkVar				
	SWDDS.1.3.2.6 CheckModeChgMsgSta				
	SWDDS.1.3.2.7 CheckModeChgMcuSta				
	SWDDS.1.3.2.8 CheckModeChgDrvSta				
	SWDDS.1.3.2.9 CheckModeChgSigRng				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.3.2.5
Target Milestone	EBS2
Element	AswMng
Risk	<span style="color: green;">Low</span>
Interoperability	No
Criticality	<span style="color: orange;">Mid</span>
Technical complexity	<span style="color: green;">Low</span>
Verifiability	Yes

### 3.3.2.5.2 Static View Design



### 3.3.2.5.3 Dynamic View Design

- N/A

### 3.3.2.5.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	message_status_flags	SWDDS.1.3.2.6	OUT	tU16	0	32768	0x0000	0x8000	N/A	CAN message status flags
2	mcu_status_flags	SWDDS.1.3.2.7	OUT	tU32	0	134217728	0x00000000	0x08000000	N/A	MCU status flags
3	driving_status_flags	SWDDS.1.3.2.8	OUT	tU32	0	8388608	0x00000000	0x08000000	N/A	Driving status flags
4	signal_range_flags	SWDDS.1.3.2.9	OUT	tU32	0	128	0x00000000	0x00000080	N/A	Signal range checking flags

### 3.3.2.6 [SWDDS.1.3.2.6] CheckModeChgMsgSta

#### 3.3.2.6.1 Detailed Design

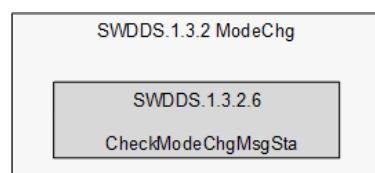
##### [SWDDS.1.3.2.6] CheckModeChgMsgSta

Software Unit Information					
Unit ID	SWDDS.1.3.2.6	Unit Name	CheckModeChgMsgSta		
Architecture ID	SWADS.1.3.2.6	ASIL	QM		
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	message_status_flags	0 ~ 32768	IN	CAN message status flags
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tBool	g_bModeChgAppCaution	True /False	Write	Application caution storing
	tBool	g_bModeChgShutDown	True /False	Write	ShutDown condition storing
	tBool	g_bModeChgAppFailure	True /False	Write	Application failure storing
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	CAN message status checking - Request message status checking - CAN bus status checking - CAN data receiving time-out and bus-off checking - CAN received data CRC error checking				

Control Flow Diagram (or Pseudo Code)	<pre>     start           {message_status_flags &amp; (MSG_STA_TGT_SPD_OVR   MSG_STA_TGT_SPD_UND))!= 0x0000u     yes: g_bModeChgAppCaution = TRUE;     no:     {message_status_flags &amp; (MSG_STA_RX_TIM_WRN   MSG_STA_CAN_RX_ERR   MSG_STA_CAN_TX_ERR))!= 0x0000u     yes: g_bModeChgAppCaution = TRUE;     no:     {message_status_flags &amp; (MSG_STA_RX_TIM_OUT   MSG_STA_CAN_BUS_OFF))!= 0x0000u     yes: g_bModeChgShutDown= TRUE; g_bModeChgAppFailure = TRUE;     no:     {message_status_flags &amp; (MSG_STA_RX_CRC_ERR))!= 0x0000u     yes: g_u16ModeChgOpuflt = OPU_FLT_RXD_INVLD; g_bModeChgAppCaution = TRUE;     no:     end   </pre>
	Called Function
	SWDDS.1.3.2.5 CheckModeChgStaFig
	Calling Function
	N/A
Function Execution Time	N/A

Requirement Id	SWDDS.1.3.2.6
Target Milestone	EBS2
Element	AswMng
Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Mid
Verifiability	Yes

### 3.3.2.6.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	226

### 3.3.2.6.3 Dynamic View Design

- N/A

### 3.3.2.6.4 Interface Design

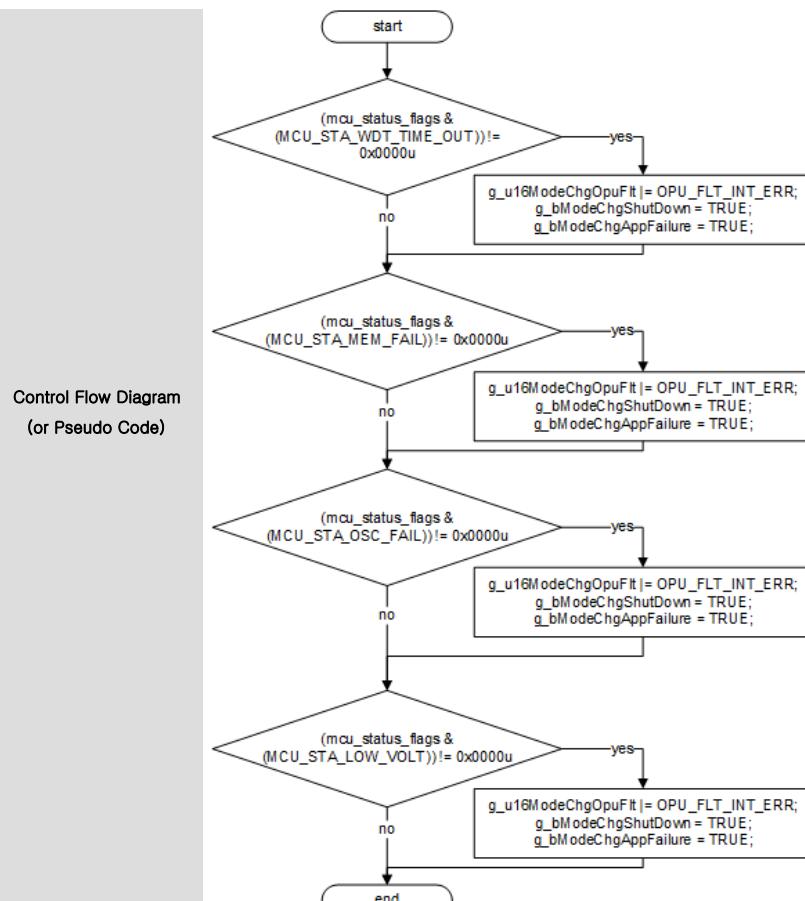
- N/A

### 3.3.2.7 [SWDDS.1.3.2.7] CheckModeChgMcuSta

#### 3.3.2.7.1 Detailed Design

##### [SWDDS.1.3.2.7] CheckModeChgMcuSta

Software Unit Information					
Unit ID	SWDDS.1.3.2.7	Unit Name		CheckModeChgMcuSta	
Architecture ID	SWADS.1.3.2.7	ASIL		QM	
<b>Prototype</b>					
Function Call		Data Type	Name	Range	IN/OUT
Parameters		tU32	mcu_status_flags	0 ~ 134217728	IN
Function Call		Possible Return Value		Description	
Return Value		void		N/A	
<b>Global Variables</b>					
Parameters		Data Type	Name	Range	Read/Write
		tU16	g_u16ModeChgOpuFlt	0 ~ 4095	Read
		tBool	g_bModeChgShutDown	True /False	Write
		tBool	g_bModeChgAppFailure	True /False	Write
<b>Registers</b>					
Registers		Data Type	Name	Range	Read/Write
		N/A	N/A	N/A	N/A
<b>Description</b>					
OPU status checking - Watchdog timer status checking - Memory failure status checking - Oscillator failure status checking - Low voltage detection status checking					
1. CheckModeChgMcuSta sets shutdown mode if the watchdog time-out is occurred. 2. CheckModeChgMcuSta sets shutdown mode if the memory failure is occurred. 3. CheckModeChgMcuSta sets shutdown mode if the oscillator failure is occurred. 4. CheckModeChgMcuSta sets shutdown mode if the low voltage is detected.					
<b>Control Flow Diagram (or Pseudo Code)</b>					



**Called Function**  
**Calling Function**  
**Function Execution Time**

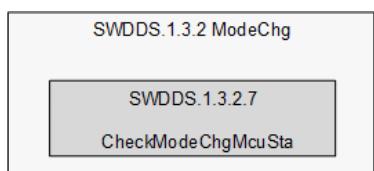
SWDDS.1.3.2.5 CheckModeChgStaFlg

N/A

N/A

Requirement Id	SWDDS.1.3.2.7
Target Milestone	EBS2
Element	AswMng
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.3.2.7.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	228

### 3.3.2.7.3 Dynamic View Design

- N/A

### 3.3.2.7.4 Interface Design

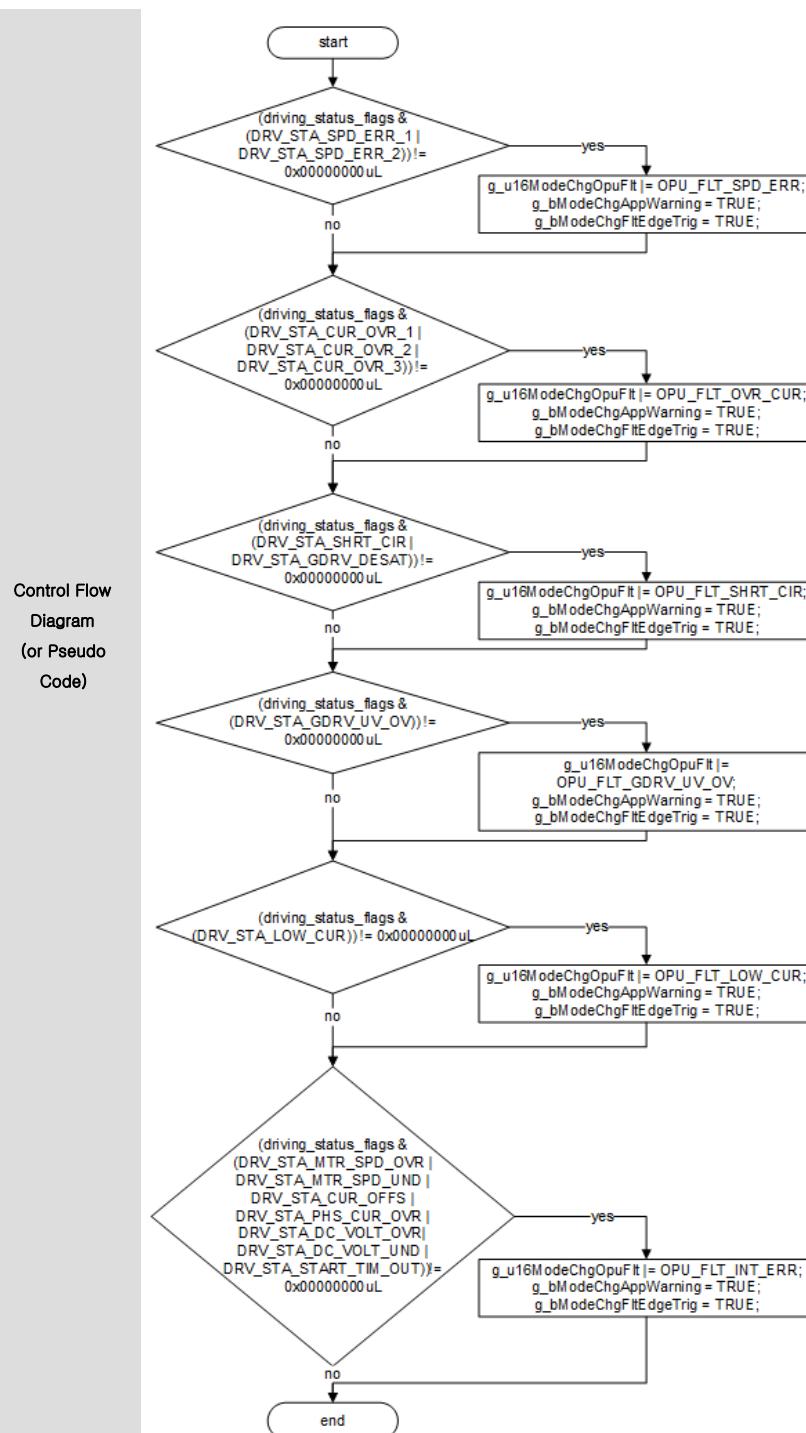
- N/A

## 3.3.2.8 [SWDDS.1.3.2.8] CheckModeChgDrvSta

### 3.3.2.8.1 Detailed Design

#### [SWDDS.1.3.2.8] CheckModeChgDrvSta

Software Unit Information					
Unit ID	SWDDS.1.3.2.8	Unit Name	CheckModeChgDrvSta		
Architecture ID	SWADS.1.3.2.8	ASIL	QM		
Prototype		void CheckModeChgDrvSta ( tu32 driving_status_flags)			
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	tu32	driving_status_flags	0 ~ 8388608	IN	Driving status checked flags
Function Call	Data Type	Possible Return Value			Description
Return Value	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tu16	g_u16ModeChgOpuFlt	0 ~ 4095	Read	Current OPU fault flag status
	tBool	g_bModeChgAppWarning	True / False	Write	Application warning storing
	tBool	g_bModeChgFltEdgeTrig	True / False	Write	Edge triggered fault occurred
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Driving status checking - Speed error checking - Over-current checking - Short circuit checking - Gate drive under or over-voltage checking - Low current checking - Internal error checking				
	1. CheckModeChgDrvSta sets the application mode as warning and speed error flag if speed error is detected. 2. CheckModeChgDrvSta sets the application mode as warning and over-current flag if over-current is detected. 3. CheckModeChgDrvSta sets the application mode as warning and short circuit flag if short circuit or the gate driver DESAT is detected. 4. CheckModeChgDrvSta sets the application mode as warning and gate driver under or over-voltage flag if the gate driver under or over-voltage is detected. 5. CheckModeChgDrvSta sets the application mode as warning and low current flag if low current is detected. 6. CheckModeChgDrvSta sets the application mode as warning and internal error flag if motor speed range over or current offset error or phase current over or DC driving voltage over/under or starting time-out is detected.				



**Called Function**  
**Calling Function**  
**Function**  
**Execution Time**

SWDDS.1.3.2.5 CheckModeChgStaFlg

N/A

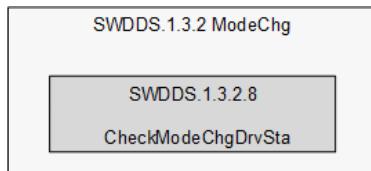
N/A

Requirement Id	SWDDS.1.3.2.8
Target Milestone	EBS2
Element	AswMng
Risk	Mid
Interoperability	No

	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	230

Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> High
Verifiability	Yes

### 3.3.2.8.2 Static View Design



### 3.3.2.8.3 Dynamic View Design

- N/A

### 3.3.2.8.4 Interface Design

- N/A

### 3.3.2.9 [SWDDS.1.3.2.9] CheckModeChgSigRng

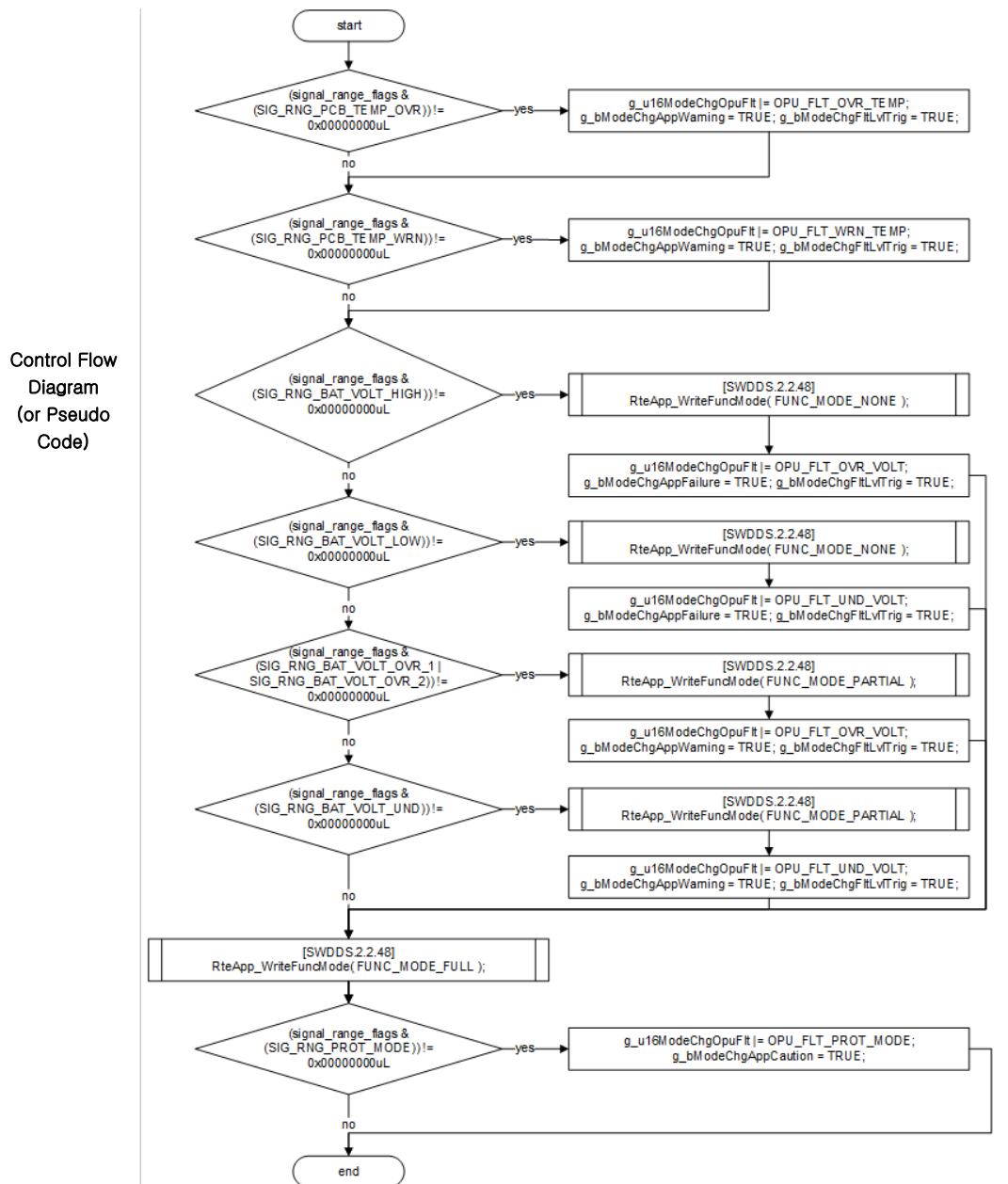
#### 3.3.2.9.1 Detailed Design

##### [SWDDS.1.3.2.9] CheckModeChgSigRng

Software Unit Information					
Unit ID	SWDDS.1.3.2.9		Unit Name	CheckModeChgSigRng	
Architecture ID	SWADS.1.3.2.9		ASIL	QM	
Prototype	void CheckModeChgSigRng( tU32 signal_range_flags )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU32	signal_range_flags	0 ~ 128	IN	Signal range checked flags
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16ModeChgOpuFlt	0 ~ 4095	Read	Current OPU fault flag status
	tBool	g_bModeChgAppWarning	True / False	Write	Application warning storing
	tBool	g_bModeChgAppFailure	True / False	Write	Application failure storing
	tBool	g_bModeChgFltLvlTrig	True / False	Write	Level triggered fault occurred
	tBool	g_bModeChgAppCaution	True / False	Write	Application caution storing
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	231

Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description		Signal range checking – Over-temperature checking – Warning temperature checking – Over voltage range checking – Under voltage range checking – Normal voltage range checking – Protect mode checking			
		1. CheckModeChgSigRng sets the application mode as warning and over temperature flag if over temperature is detected. 2. CheckModeChgSigRng sets the application mode as warning and warning temperature flag if warning temperature is detected. 3. CheckModeChgSigRng sets the application mode as failure, the functional mode as none and high voltage flag if over voltage is detected. 4. CheckModeChgSigRng sets the application mode as failure, the functional mode as none and low voltage flag if under voltage is detected. 5. CheckModeChgSigRng sets the application mode as warning, the functional mode as partial and over voltage flag if over voltage is detected. 6. CheckModeChgSigRng sets the application mode as warning, the functional mode as partial and under voltage flag if under voltage is detected. 7. CheckModeChgSigRng sets the functional mode as full flag if voltage range is normal. 8. CheckModeChgSigRng sets the application mode as caution if protect mode is detected.			
Control Flow Diagram (or Pseudo Code)					



Called Function	SWDDS.1.3.2.5 CheckModeChgStaFlg
-----------------	----------------------------------

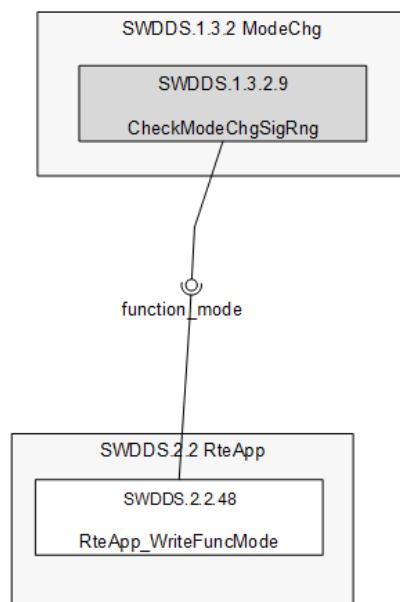
Calling Function	SWDDS.2.2.48 RteApp_WriteFuncMode
------------------	-----------------------------------

Function Execution Time	N/A
-------------------------	-----

Requirement Id	SWDDS.1.3.2.9
Target Milestone	SBS2.1
Element	AswMng
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	High
Verifiability	Yes

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	233

### 3.3.2.9.2 Static View Design



### 3.3.2.9.3 Dynamic View Design

- N/A

### 3.3.2.9.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	function_mode	SWDDS.2.2.48	OUT	tFuncMode	0	2	FUNC_MODE_NONE	FUNC_MODE_FULL	N/A	Non / Partial / Full functional mode

## 3.3.3 [SWDDS.1.3.3] ShutDown

### 3.3.3.1 [SWDDS.1.3.3.1] ShutDown\_Init

#### 3.3.3.1.1 Detailed Design

##### [SWDDS.1.3.3.1] ShutDown\_Init

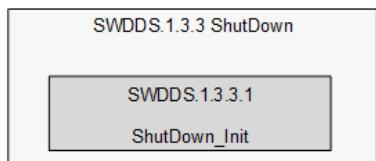
Software Unit Information					
Unit ID	SWDDS.1.3.3.1	Unit Name	ShutDown_Init		
Architecture ID	SWADS.1.3.3.1	ASIL	QM		
Prototype	void ShutDown_Init (void)				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description		

<b>SNT Motiv</b>	VW AQ EOP				Baseline / Version / Date	003
	Software Detailed Design Specification				Updated Date	2021-06-30
					Page	234

<b>Return Value</b>	void	N/A	N/A		N/A			
<b>Global Variables</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>			
	tU16	g_u16ShutDownWaitCnt	0 ~ 250	Write	Shut-down mode waiting time count (ms)			
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>			
	N/A	N/A	N/A	N/A	N/A			
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>			
	N/A	N/A	N/A	N/A	N/A			
<b>Description</b>	Shut-down mode initialization							
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     g_u16ShutDownWaitCnt = 0u;     ↓     end   </pre>							
<b>Called Function</b>	SWDDS.1.3.1.1 AswMng_Init							
<b>Calling Function</b>	N/A							
<b>Function Execution Time</b>	N/A							

Requirement Id	SWDDS.1.3.3.1
Target Milestone	EBS2
Element	AswMng
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

### 3.3.3.1.2 Static View Design



### 3.3.3.1.3 Dynamic View Design

- N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	235

### 3.3.3.1.4 Interface Design

- N/A

### 3.3.3.2 [SWDDS.1.3.3.2] ShutDown\_Mng

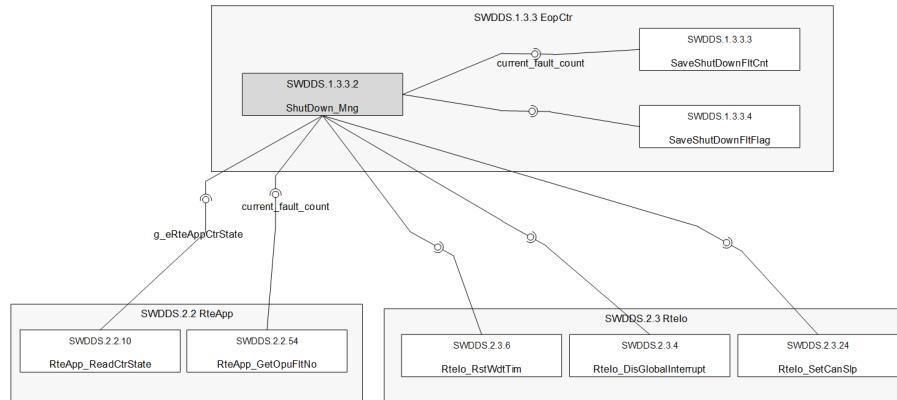
#### 3.3.3.2.1 Detailed Design

##### [SWDDS.1.3.3.2] ShutDown\_Mng

Software Unit Information					
Unit ID	SWDDS.1.3.3.2	Unit Name	ShutDown_Mng		
Architecture ID	SWADS.1.3.3.2	ASIL	QM		
Prototype	void ShutDown_Mng (void)				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16ShutDownWaitCnt	0 ~ 250	Read	Shut-down mode waiting time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16ModeMngShutDownTim	250u	Read	Shutdown mode waiting time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Shutdown mode management - Waiting for shutdown time - EOP motor stop checking - Fault flag saving - CAN sleep mode entering				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     tU16 current_fault_count;     if(g_u16ShutDownWaitCnt &lt; par_u16ModeMngShutDownTim) {         g_u16ShutDownWaitCnt += SHUT_DOWN_TIM_INC_PER_STEP;     }     if(RteApp_ReadCtrState() == CTR_STATE_SWTC_OFF) {         [SWDDS.2.3.6] Rtel0_RstWdtTim();         [SWDDS.2.2.54] current_fault_count = RteApp_GetOpnFltNo();         if(current_fault_count &gt; 0u) {             [SWDDS.1.3.3.3] SaveShutDownFltCntr(current_fault_count);             [SWDDS.1.3.3.4] SaveShutDownFltFlag();         }         [SWDDS.2.3.4] Rtel0_DisGlobalInterrupt();         [SWDDS.2.3.24] Rtel0_SetCanSlp();         [SWDDS.2.3.6] Rtel0_RstWdtTim();     }     end   </pre>	
	Called Function	SWDDS.2.1.10 RteSch_Task20ms
	Calling Function	SWDDS.2.2.10 RteApp_ReadCtrState SWDDS.2.2.54 RteApp_GetOpnFltNo SWDDS.2.3.6 Rtel0_RstWdtTim SWDDS.2.3.4 Rtel0_DisGlobalInterrupt SWDDS.2.3.24 Rtel0_SetCanSlp SWDDS.1.3.3.3 SaveShutDownFltCntr SWDDS.1.3.3.4 SaveShutDownFltFlag
	Function Execution Time	N/A
	Requirement Id	SWDDS.1.3.3.2
	Target Milestone	EBS2
	Element	AswMng
	Risk	■ Mid
	Interoperability	No
	Criticality	■ Mid
	Technical complexity	■ Mid
	Verifiability	Yes

### 3.3.3.2.2 Static View Design



### 3.3.3.2.3 Dynamic View Design

- N/A

### 3.3.3.2.4 Interface Design

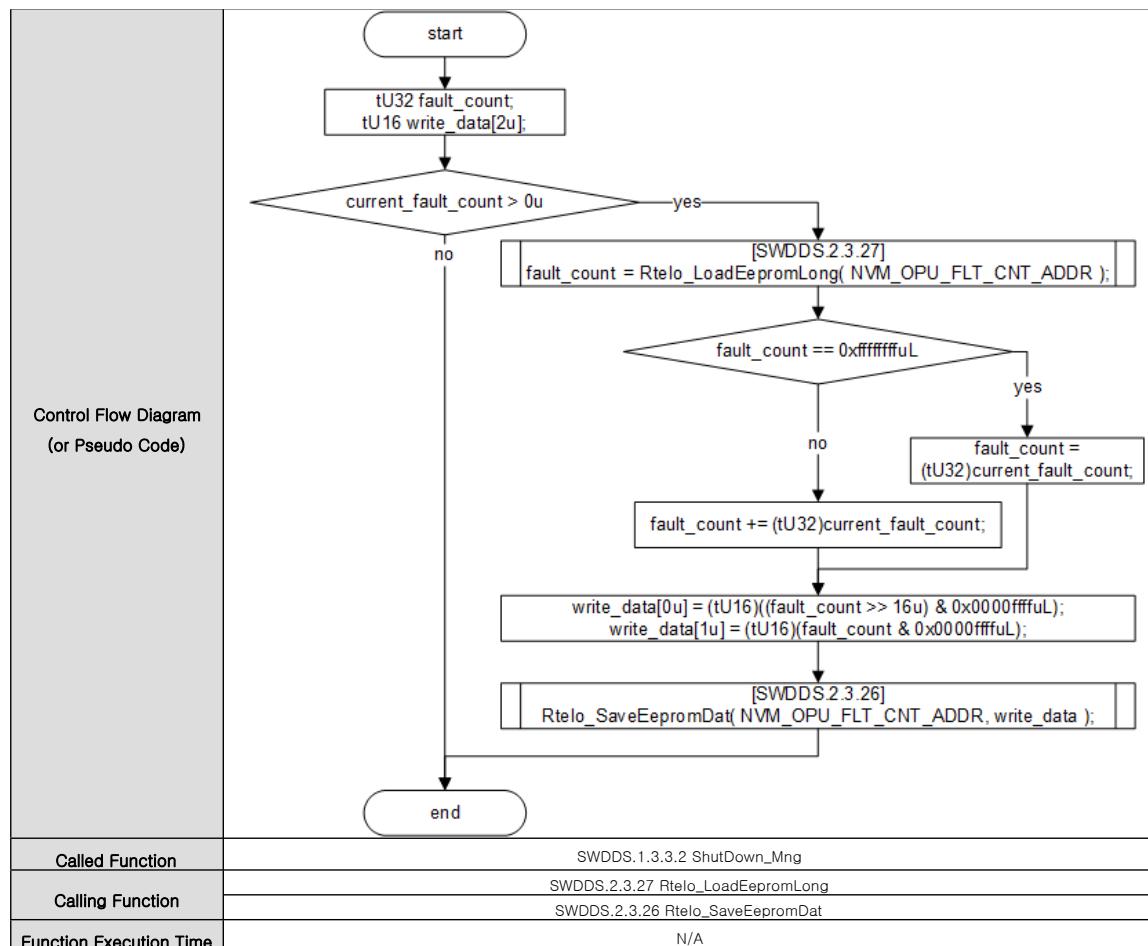
no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_eRteAppCtrState	SWDDS.2.2.10	IN	tCtrState	N/A	N/A	N/A	N/A	N/A	Control state
2	current_fault_count	SWDDS.2.2.54	IN	tU16	0	65535	0	65535	N/A	Current fault count
3	current_fault_count	SWDDS.1.3.3.3	OUT	tU16	0	65535	0	65535	N/A	Current fault count

### 3.3.3.3 [SWDDS.1.3.3.3] SaveShutdownFltCnt

#### 3.3.3.3.1 Detailed Design

##### [SWDDS.1.3.3.3] SaveShutdownFltCnt

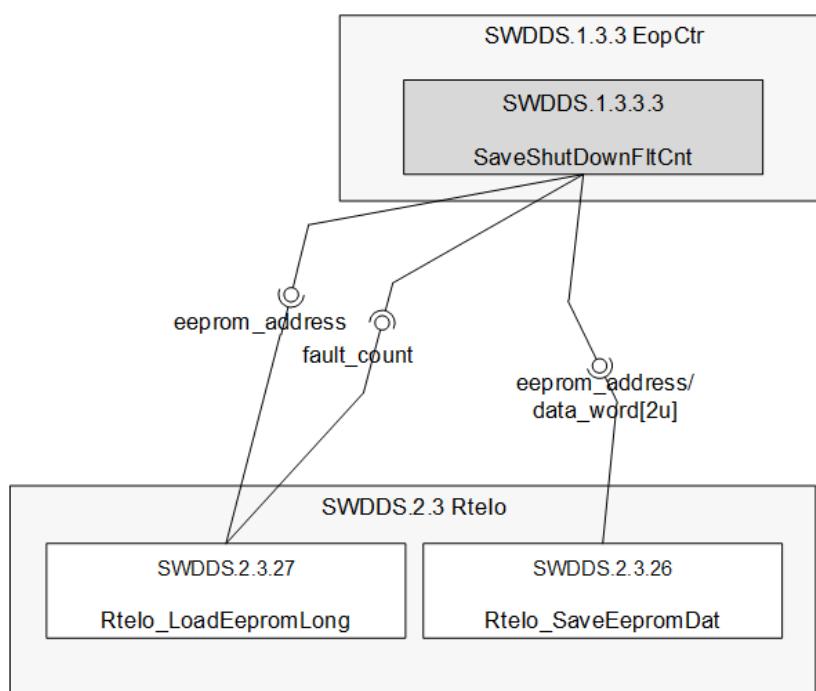
Software Unit Information					
Unit ID	SWDDS.1.3.3.3	Unit Name	SaveShutdownFltCnt		
Architecture ID	SWADS.1.3.3.3	ASIL	QM		
Prototype	void SaveShutdownFltCnt( tU16 current_fault_count )				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	tU16	current_fault_count	0 ~ 65535	IN	current fault count
Function Call Return Value	Data Type	Possible Return Value			Description
	void	N/A			N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Fault count saving - Current fault existence checking - Stored previous fault count and current fault count adding - Fault count storing				



Called Function	SWDDS.1.3.3.2 ShutDown_Mng
Calling Function	SWDDS.2.3.27 Rtelo_LoadEepromLong SWDDS.2.3.26 Rtelo_SaveEepromData
Function Execution Time	N/A

Requirement Id	SWDDS.1.3.3.3
Target Milestone	EBS2
Element	AswMng
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.3.3.3.2 Static View Design



### 3.3.3.3.3 Dynamic View Design

- N/A

### 3.3.3.3.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	eeprom_address	SWDDS.2.3.27	OUT	tu16	32	32	0x0020	0x0020	N/A	OPU fault count address
2	fault_count	SWDDS.2.3.27	IN	tu32	0	4294967295	0	4294967295	N/A	Previous and calculated fault count
3	eeprom_address	SWDDS.2.3.26	OUT	tu16	32	32	0x0020	0x0020	N/A	OPU fault count address
4	data_word[2u]	SWDDS.2.3.26	OUT	tu16	0	65535	0x0000	0xffff	N/A	Writing data buffer

### 3.3.3.4 [SWDDS.1.3.3.4] SaveShutDownFltFlag

#### 3.3.3.4.1 Detailed Design

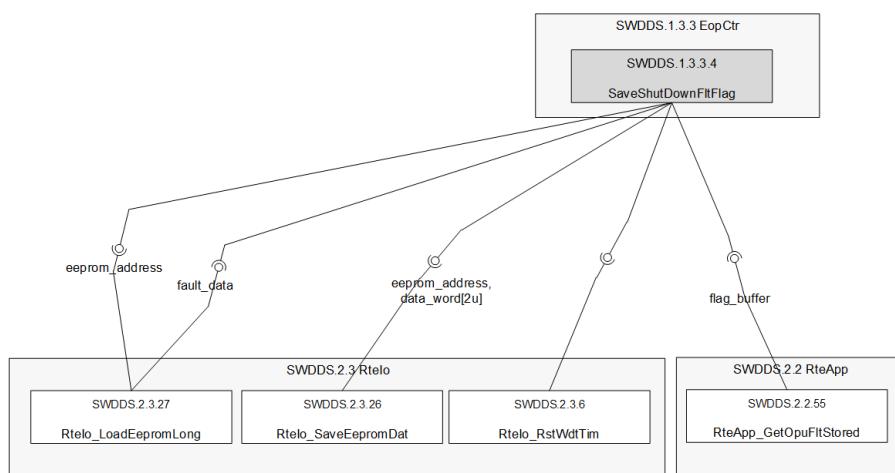
##### [SWDDS.1.3.3.4] SaveShutDownFltFlag

Software Unit Information					
Unit ID	SWDDS.1.3.3.4	Unit Name	SaveShutDownFltFlag		
Architecture ID	SWADS.1.3.3.4	ASIL	QM		
Prototype					
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Fault flag saving - Previous fault flag in EEPROM shifting - Current fault flag storing				

<b>Control Flow Diagram (or Pseudo Code)</b>	<pre> start Volatile TU16 address_offset; TU32 current_fault[RTE_APP_OPU_FLT_STORE_NO]; TU32 fault_data; TU16 write_data[2u];  address_offset = 0u;  if address_offset &lt; RTE_APP_OPU_FLT_STORE_NO     then         [SWDDS.2.3.27]         fault_data = Rtelo_LoadEepromLong(             NVM_OPU_FLT_FLAG_ADDR + 4u * address_offset);          write_data[0u] = (TU16)((fault_data &gt;&gt; 16u) &amp; 0x0000ffffL);         write_data[1u] = (TU16)(fault_data &amp; 0x0000ffffL);          [SWDDS.2.3.26]         Rtelo_SaveEepromData(NVM_OPU_FLT_FLAG_ADDR +             0x10u + 4u * address_offset, write_data);          address_offset++;      else         [SWDDS.2.3.6]         Rtelo_RstWdtTim();          [SWDDS.2.2.55]         RteApp_GetOpufStored(current_fault);          address_offset = 0u;          if address_offset &lt; RTE_APP_OPU_FLT_STORE_NO             then                 [SWDDS.2.3.27]                 fault_data = Rtelo_LoadEepromLong(                     NVM_OPU_FLT_FLAG_ADDR + 4u * address_offset);                  write_data[0u] = (TU16)((current_fault[address_offset] &gt;&gt; 16u) &amp; 0x0000ffffL);                 write_data[1u] = (TU16)(current_fault[address_offset] &amp; 0x0000ffffL);                  [SWDDS.2.3.26]                 Rtelo_SaveEepromData(NVM_OPU_FLT_FLAG_ADDR + 4u * address_offset, write_data);                  address_offset++;              else                 [SWDDS.2.3.6]                 Rtelo_RstWdtTim();          end     end end </pre>
	SWDDS.1.3.3.2 ShutDown_Mng
	SWDDS.2.3.27 Rtelo_LoadEepromLong
	SWDDS.2.3.26 Rtelo_SaveEepromData
	N/A

Requirement Id	SWDDS.1.3.3.4
Target Milestone	EBS2
Element	AswMng
Risk	■ Mid
Interoperability	No
Criticality	■ Mid
Technical complexity	■ Mid
Verifiability	Yes

### 3.3.3.4.2 Static View Design



### 3.3.3.4.3 Dynamic View Design

- N/A

### 3.3.3.4.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range Min	Physical Range Min	Resolution /Units	Description
1	eeprom_address	SWDDS.2.3.27	OUT	tU16	0	31	0x0000	0x001f
2	fault_data	SWDDS.2.3.27	IN	tU32	0	268435455	0x00000000	0xffffffff
3	eeprom_address	SWDDS.2.3.26	OUT	tU16	0	31	0x0000	0x001f
4	data_word[2u]	SWDDS.2.3.26	OUT	tU16	0	65535	0x0000	0xffff
5	flag_buffer	SWDDS.2.2.55	IN	tU32	0	268435455	0x00000000	0xffffffff
								N/A
								Current fault flag

## 3.3.4 [SWDDS.1.3.4] StartUp

### 3.3.4.1 [SWDDS.1.3.4.1] StartUp\_Init

#### 3.3.4.1.1 Detailed Design

##### [SWDDS.1.3.4.1] StartUp\_Init

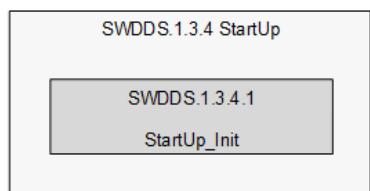
Software Unit Information					
Unit ID	SWDDS.1.3.4.1		Unit Name	StartUp_Init	
Architecture ID	SWADS.1.3.4.1		ASIL	QM	
Prototype			void StartUp_Init (void)		
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16StartUpWaitCnt	0 ~ 200	Write	Start-up mode waiting time count (ms)
					LVS low level: FALSE

<b>SNT Motiv</b>	VW AQ EOP			Baseline / Version / Date	003
	Software Detailed Design Specification			Updated Date	2021-06-30
				Page	242

	tBool	g_bStartUpVIsLow	True/False	Write	- normal, TRUE – voltage low
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Start-up mode initialization				
Control Flow Diagram (or Pseudo Code)	<pre> graph TD     start((start)) --&gt; code[g_u16StartUpWaitCnt = 0u; g_bStartUpVIsLow = TRUE;]     code --&gt; end((end)) </pre>				
Called Function	SWDDS.1.3.1.1 AswMng_Init				
Calling Function	N/A				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.3.4.1
Target Milestone	EBS2
Element	AswMng
Risk	<input checked="" type="checkbox"/> Low
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Low
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.3.4.1.2 Static View Design



### 3.3.4.1.3 Dynamic View Design

– N/A

### 3.3.4.1.4 Interface Design

– N/A

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	243

### 3.3.4.2 [SWDDS.1.3.4.2] StartUp\_Mng

#### 3.3.4.2.1 Detailed Design

##### [SWDDS.1.3.4.2] StartUp\_Mng

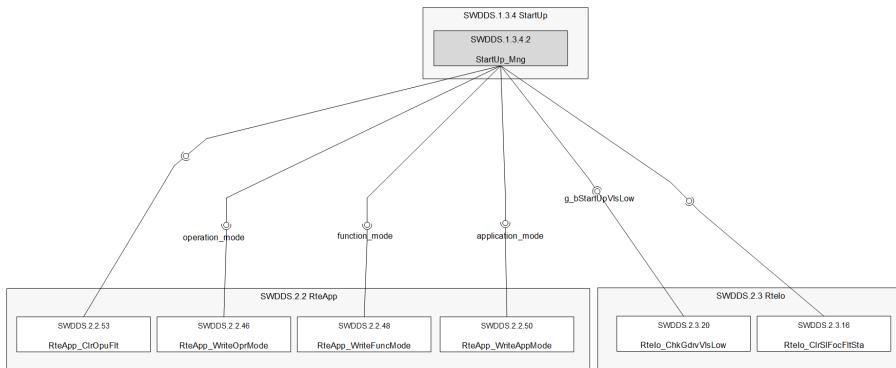
Software Unit Information					
Unit ID	SWDDS.1.3.4.2	Unit Name	StartUp_Mng		
Architecture ID	SWADS.1.3.4.2	ASIL	QM		
Prototype	void StartUp_Mng (void)				
Function Call Parameters	Data Type	Name	Range	In/Out	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	N/A
Global Variables	Data Type	Name	Range	Read/Write	Description
	tU16	g_u16StartUpWaitCnt	0 ~ 200	Read/Write	Start-up mode waiting time count (ms)
Parameters	Data Type	Name	Range	Read/Write	Description
	tU16	par_u16ModeMngStartUpTim	200u	Read	Start-up mode waiting time (ms)
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Initial start-up mode management – Waiting for initial start-up time – Fault clearing and mode changing				
Control Flow Diagram (or Pseudo Code)					

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tSIFocCtrDat control_data;     tBool control_enable;      [SWDDS.2.2.30]     control_enable = RteApp_ReadCtrEna();      [SWDDS.2.2.32]     control_data.eControlMode = RteApp_ReadCtrMode();      [SWDDS.2.2.33]     control_data.f16ReferenceCurrent = RteApp_ReadRefCur();      [SWDDS.2.2.34]     control_data.f16ReferenceSpeed = RteApp_ReadRefSpd();      [SWDDS.2.2.36]     control_data.f16CurrentLimitUpper =     RteApp_ReadCurLmtUpp();      [SWDDS.2.2.38]     control_data.f16CurrentLimitLower =     RteApp_ReadCurLmtLow();      control_data.bControlEnable = control_enable;      if (control_enable != FALSE) &amp;&amp; (g_bMtrCtrEna == FALSE)         yes: [SWDDS.2.3.16]         Rtel0_ClrSIFocFltSta();      g_bMtrCtrEna = control_enable;      [SWDDS.2.3.15]     Rtel0_SetSIFocCtrDat( control_data );      end   </pre>								
	Called Function	SWDDS.2.1.10 RteSch_Task20ms							
	Calling Function	SWDDS.2.2.53 App_ClrOpnFlt SWDDS.2.2.46 RteApp_WriteOprMode SWDDS.2.2.48 RteApp_WriteFuncMode SWDDS.2.2.50 RteApp_WriteAppMode SWDDS.2.3.20 Rtel0_ChkGdrvVlsLow SWDDS.2.3.16 Rtel0_ClrSIFocFltSta							
	Function Execution Time	N/A							
<table border="1"> <tr> <td>Requirement Id</td><td>SWDDS.1.3.4.2</td></tr> <tr> <td>Target Milestone</td><td>EBS2</td></tr> <tr> <td>Element</td><td>AswMng</td></tr> <tr> <td>Risk</td><td>Mid</td></tr> </table>		Requirement Id	SWDDS.1.3.4.2	Target Milestone	EBS2	Element	AswMng	Risk	Mid
Requirement Id	SWDDS.1.3.4.2								
Target Milestone	EBS2								
Element	AswMng								
Risk	Mid								

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	245

Interoperability	No
Criticality	Mid
Technical complexity	Low
Verifiability	Yes

### 3.3.4.2.2 Static View Design



### 3.3.4.2.3 Dynamic View Design

- N/A

### 3.3.4.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	g_bStartUpVsLow	SWDDS.2.3.20	IN	tBool	0	1	Normal	Voltage low	True / False	LVS low level: FALSE – normal, TRUE – voltage low
2	operation_mode	SWDDS.2.2.46	OUT	tOprMode	2	2	OPR_MODE_NORMAL	OPR_MODE_NORMAL	N/A	Normal mode
3	function_mode	SWDDS.2.2.48	OUT	tFuncMode	2	2	FUNC_MODE_NONE	FUNC_MODE_FULL	N/A	Full functional mode: EOP – active, CAN – active
4	application_mode	SWDDS.2.2.50	OUT	tAppMode	1	1	APP_MODE_NONE	APP_MODE_FAILURE	N/A	Normal mode

## 3.4 [SWDDS.1.4] AswAct

### 3.4.1 [SWDDS.1.4.1] AswAct

#### 3.4.1.1 [SWDDS.1.4.1.1] AswAct\_Init

##### 3.4.1.1.1 Detailed Design

##### [SWDDS.1.4.1.1] AswAct\_Init

Software Unit Information				
Unit ID	SWDDS.1.4.1.1	Unit Name	AswAct_Init	
Architecture ID	SWADS.1.4.1.1	ASIL	QM	
Prototype	void AswAct_Init (void)			
Function Call	Data Type	Name	Range	IN/OUT
Parameters	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value	Description	
Return Value	void	N/A	N/A	

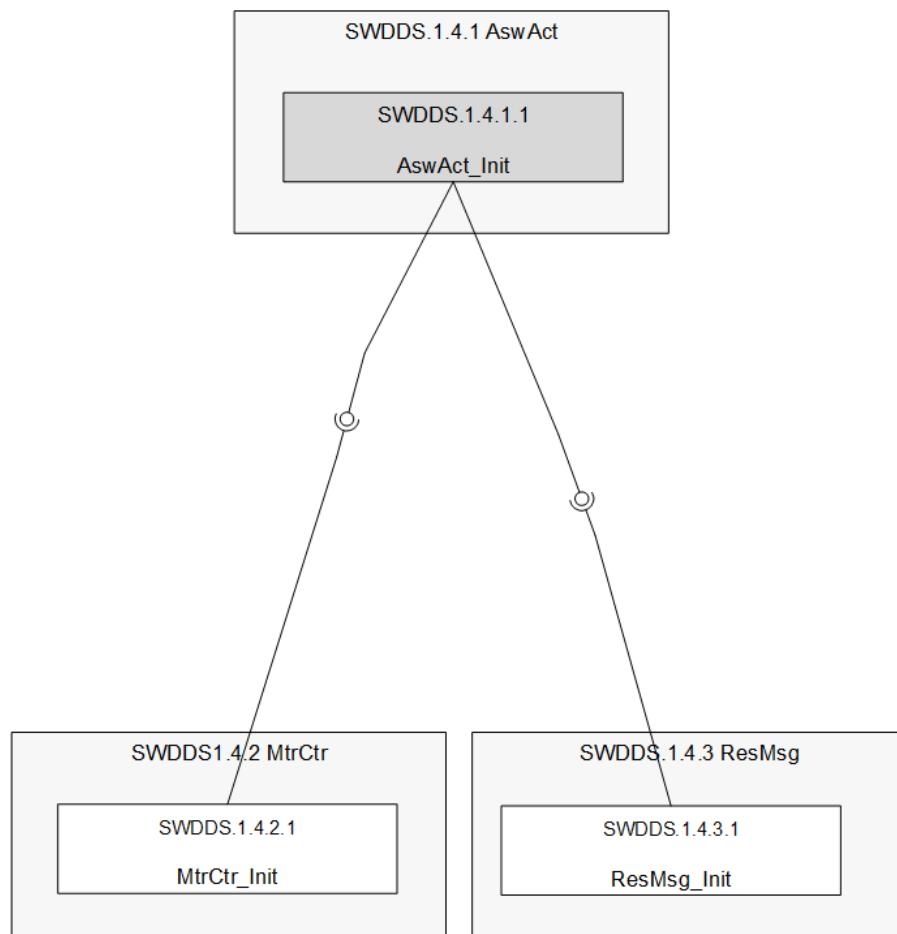
<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	246

Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Actuator software initialization				
Control Flow Diagram (or Pseudo Code)	<pre>     start     [SWDDS.1.4.2.1] MtrCtr_Init();     [SWDDS.1.4.3.1] ResMsg_Init();     end   </pre>				
Called Function	SWDDS.2.1.3 InitializeRteSchAppSw()				
Calling Function	SWDDS.1.4.2.1 MtrCtr_Init() SWDDS.1.4.3.1 ResMsg_Init()				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.4.1.1
Target Milestone	EBS2
Element	AswAct
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

### 3.4.1.1.2 Static View Design

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	247



### 3.4.1.1.3 Dynamic View Design

- N/A

### 3.4.1.1.4 Interface Design

## 3.4.2 [SWDDS.1.4.2] MtrCtr

### 3.4.2.1 [SWDDS.1.4.2.1] MtrCtr\_Init

#### 3.4.2.1.1 Detailed Design

##### [SWDDS.1.4.2.1] MtrCtr\_Init

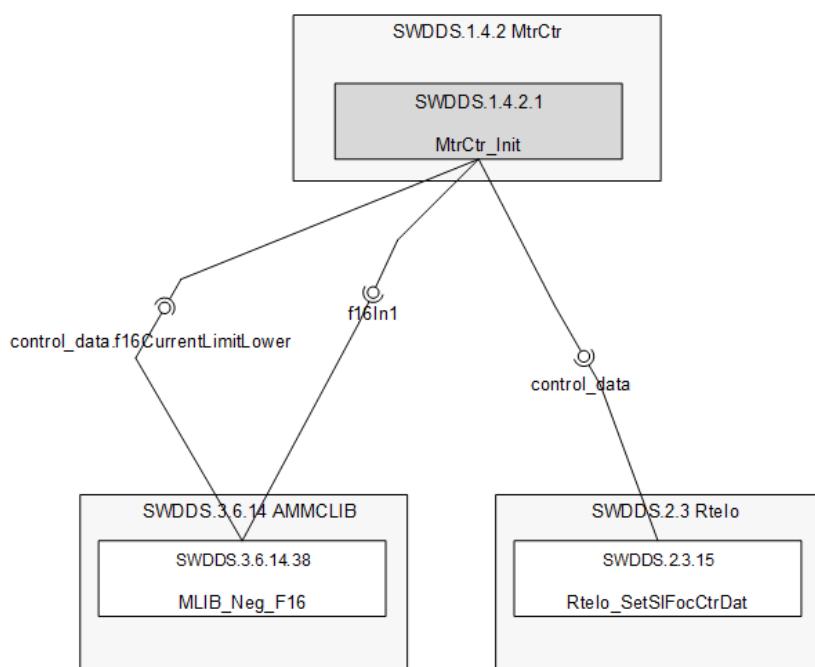
Software Unit Information					
Unit ID	SWDDS.1.4.2.1		Unit Name	MtrCtr_Init	
Architecture ID	SWADS.1.4.2.1		ASIL	QM	
Prototype			void MtrCtr_Init (void)		
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value		Description	
	void	N/A		N/A	
	Data	Name	Range	Read/Write	Description

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	248

Global Variables	Type				
	tBool	g_bMtrCtrEna	True / False	Write	Stored motor control enabled status
Parameters	Data Type	Name	Range	Read/Write	Description
	tFrac16	par_f16EopCtrCurLmtMax	FRAC16 (22.5f / PARAM_PU_BASE_PHS_CUR)	Write	Phase current limit at maximum speed
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Motor control initialization				
Control Flow Diagram (or Pseudo Code)	<pre> start     TSIFocCtrDat control_data;     g_bMtrCtrEna = FALSE;     control_data.bControlEnable = FALSE;     control_data.eControlMode = CTR_MODE_SPD;     control_data.f16ReferenceCurrent = FRAC16(0.0f);     control_data.f16ReferenceSpeed = FRAC16(0.0f);     control_data.f16CurrentLimitUpper = par_f16EopCtrCurLmtMax;      [SWDDS.3.6.14.38]     control_data.f16CurrentLimitLower = MLIB_Neg_F16(         par_f16EopCtrCurLmtMax );     [SWDDS.2.3.15]     Rtelo_SetSIFocCtrDat( control_data );  end </pre>				
Called Function	SWDDS.1.4.1.1 AswAct_Init				
Calling Function	SWDDS.3.6.14.38 MLIB_Neg_F16				
Function Execution Time	N/A				

Requirement Id	SWDDS.1.4.2.1
Target Milestone	EBS2
Element	AswAct
Risk	Low
Interoperability	No
Criticality	Low
Technical complexity	Low
Verifiability	Yes

### 3.4.2.1.2 Static View Design



### 3.4.2.1.3 Dynamic View Design

- N/A

### 3.4.2.1.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	f16In	SWDDS.3.6.14.38	OUT	tFrac16	FRAC16 (22.5f / PARAM_PU_BASE _PHS_CUR)		22.5		Apk	Phase current limit at maximum speed
2	control_data.f16CurrentLimitLower	SWDDS.3.6.14.38	IN	tFrac16	-FRAC16 (22.5f / PARAM_PU_BASE _PHS_CUR)		-22.5		Apk	Phase current lower limit at maximum speed
3	control_data	SWDDS.2.3.15	OUT	tSIFocCtrDat	N/A	N/A	N/A	N/A	N/A	Sensorless FOC control data

### 3.4.2.2 [SWDDS.1.4.2.2] MtrCtr\_Set

#### 3.4.2.2.1 Detailed Design

##### [SWDDS.1.4.2.2] MtrCtr\_Set

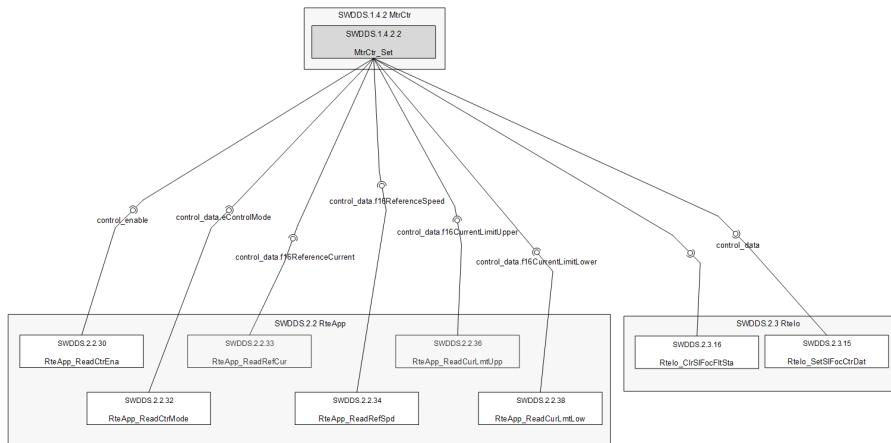
Software Unit Information					
Unit ID	SWDDS.1.4.2.2	Unit Name	MtrCtr_Set		
Architecture ID	SWADS.1.4.2.2	ASIL	QM		
Prototype	void MtrCtr_Set (void)				
Function Call Parameters	Data Type	Name	Range	IN/OUT	Description
N/A	N/A	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description		
void	N/A	N/A	N/A		
	Data Type	Name	Range	Read/Write	Description

<b>Global Variables</b>	tBool	g_bMtrCtrEna	True / False	Read/Write	Stored motor control enabled status
<b>Parameters</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Registers</b>	<b>Data Type</b>	<b>Name</b>	<b>Range</b>	<b>Read/Write</b>	<b>Description</b>
	N/A	N/A	N/A	N/A	N/A
<b>Description</b>	Motor control data setting -Control data getting -Control enabling edge checking -Current control data setting				
<b>Control Flow Diagram (or Pseudo Code)</b>	<pre>     start     ↓     tSI FocCtrData control_data;     tBool control_enable;      [SWDDS.2.2.30]     control_enable = RteApp_ReadCtrEna();      [SWDDS.2.2.32]     control_data.eControlMode = RteApp_ReadCtrMode();      [SWDDS.2.2.33]     control_data.f16ReferenceCurrent = RteApp_ReadRefCur();      [SWDDS.2.2.34]     control_data.f16ReferenceSpeed = RteApp_ReadRefSpd();      [SWDDS.2.2.36]     control_data.f16CurrentLimitUpper = RteApp_ReadCurLmtUpp();      [SWDDS.2.2.38]     control_data.f16CurrentLimitLower = RteApp_ReadCurLmtLow();      control_data.bControlEnable = control_enable;      if control_enable != FALSE &amp;&amp; (g_bMtrCtrEna == FALSE)         [SWDDS.2.3.16]         RteIo_ClrSI FocFltSta();      g_bMtrCtrEna = control_enable;      [SWDDS.2.3.15]     RteIo_SetSI FocCtrData( control_data );      end   </pre>				
<b>Called Function</b>	SWDDS.2.1.8 RteSch_Task5ms				
<b>Calling Function</b>	SWDDS.2.2.30 RteApp_ReadCtrEna				
	SWDDS.2.2.32 RteApp_ReadCtrMode				
	SWDDS.2.2.33 RteApp_ReadRefCur				
	SWDDS.2.2.34 RteApp_ReadRefSpd				
	SWDDS.2.2.36 RteApp_ReadCurLmtUpp				
	SWDDS.2.3.16 RteIo_ClrSI FocFltSta				
	SWDDS.2.3.15 RteIo_SetSI FocCtrData				
	SWDDS.2.2.38 RteApp_ReadCurLmtLow				
<b>Function Execution Time</b>	N/A				

Requirement Id	SWDDS.1.4.2.2
Target Milestone	EBS2
Element	AswAct

Risk	<input checked="" type="checkbox"/> Mid
Interoperability	No
Criticality	<input checked="" type="checkbox"/> Mid
Technical complexity	<input checked="" type="checkbox"/> Low
Verifiability	Yes

### 3.4.2.2.2 Static View Design



### 3.4.2.2.3 Dynamic View Design

- N/A

### 3.4.2.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	control_enable	SWDDS.2.2.30	IN	tBool	0	1	Control disable	Control enable	True/ False	Control enable
2	control_data.eControlMode	SWDDS.2.2.32	IN	tCtrMode	N/A	N/A	N/A	N/A	N/A	Speed control mode / Current control mode
3	control_data.f16ReferenceCurrent	SWDDS.2.2.33	IN	tFrac16	0	32767	0.0	64.4980	0.00196838 / Apk	Reference current
4	control_data.f16ReferenceSpeed	SWDDS.2.2.34	IN	tFrac16	0	32767	0.0	5999.82	0.183105 / rpm	Reference speed
5	control_data.f16CurrentLimitUpper	SWDDS.2.2.36	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Current limit upper
6	control_data.f16CurrentLimitLower	SWDDS.2.2.38	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	Current limit lower
7	control_data	SWDDS.2.3.15	OUT	tSifFocCtrDat	N/A	N/A	N/A	N/A	N/A	Sensorless FOC control data

<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	252

### 3.4.3 [SWDDS.1.4.3] ResMsg

#### 3.4.3.1 [SWDDS.1.4.3.1] ResMsg\_Init

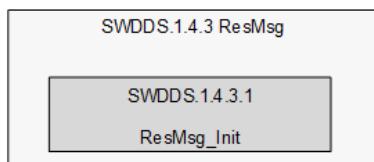
##### 3.4.3.1.1 Detailed Design

###### [SWDDS.1.4.3.1] ResMsg\_Init

Software Unit Information				
Unit ID	SWDDS.1.4.3.1	Unit Name	ResMsg_Init	
Architecture ID	SWADS.1.4.3.1	ASIL	QM	
Prototype	void ResMsg_Init (void)			
Function Call Parameters	Data Type	Name	Range	IN/OUT
	N/A	N/A	N/A	N/A
Function Call Return Value	Data Type	Possible Return Value	Description	
	void	N/A	N/A	
Global Variables	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write
	N/A	N/A	N/A	N/A
Description	Response message sending initialization			
Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     end   </pre>			
Called Function	SWDDS.1.4.1.1 AswAct_Init			
Calling Function	N/A			
Function Execution Time	N/A			

Requirement Id	SWDDS.1.4.3.1
Target Milestone	EBS2
Element	AswAct
Risk	<span style="color: green;">■</span> Low
Interoperability	No
Criticality	<span style="color: green;">■</span> Low
Technical complexity	<span style="color: green;">■</span> Low
Verifiability	Yes

##### 3.4.3.1.2 Static View Design



<b>SNT Motiv</b>	VW AQ EOP	Baseline / Version / Date	003
	Software Detailed Design Specification	Updated Date	2021-06-30
		Page	253

### 3.4.3.1.3 Dynamic View Design

- N/A

### 3.4.3.1.4 Interface Design

- N/A

### 3.4.3.2 [SWDDS.1.4.3.2] ResMsg\_Send

#### 3.4.3.2.1 Detailed Design

##### [SWDDS.1.4.3.2] ResMsg\_Send

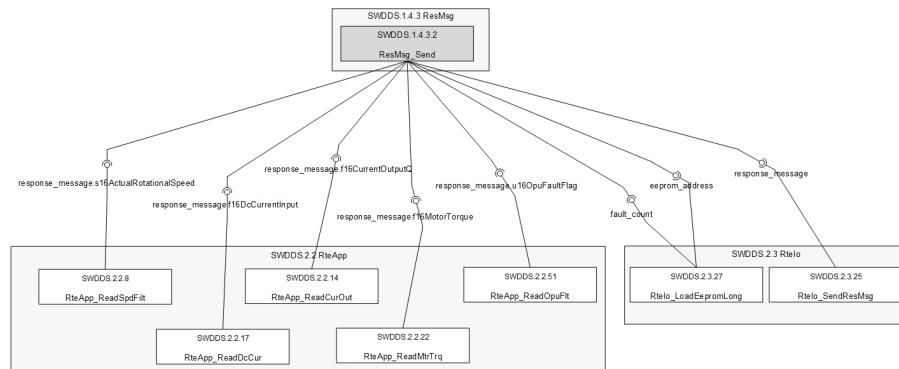
Software Unit Information					
Unit ID	SWDDS.1.4.3.2	Unit Name	ResMsg_Send		
Architecture ID	SWADS.1.4.3.2	ASIL	QM		
Prototype	void ResMsg_Send (void)				
Function Call	Data Type	Name	Range	IN/OUT	Description
Parameters	N/A	N/A	N/A	N/A	N/A
Function Call	Data Type	Possible Return Value		Description	
Return Value	void	N/A		N/A	
Global Variables	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Parameters	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Registers	Data Type	Name	Range	Read/Write	Description
	N/A	N/A	N/A	N/A	N/A
Description	Response message sending - Status data setting - EEPROM fault count loading - Response message sending				

Control Flow Diagram  
(or Pseudo Code)

Control Flow Diagram (or Pseudo Code)	<pre>     start     ↓     tCanMsgRes response_message;     tU32 fault_count;      [SWDDS.2.2.8]     response_message.s16ActualRotationalSpeed = RteApp_ReadSpdFilt();      [SWDDS.2.2.17]     response_message.f16DcCurrentInput = RteApp_ReadDcCur();      [SWDDS.2.2.14]     response_message.f16CurrentOutputQ = RteApp_ReadCurOut();      [SWDDS.2.2.22]     response_message.f16MotorTorque = RteApp_ReadMtrTrq();      [SWDDS.2.2.51]     response_message.u16OpufaultFlag = RteApp_ReadOpufilt();      [SWDDS.2.3.27]     fault_count = Rtelo_LoadEepromLong(NVM_OPU_FLT_CNT_ADDR);      if(fault_count == 0xffffffffUL)         fault_count = 0UL;     else if(fault_count &gt; 0x0000ffffUL)         fault_count = 0UL;      response_message.u16EpromFaultCount = (tU16)fault_count;      [SWDDS.2.3.25]     Rtelo_SendResMsg(response_message);      end   </pre>
	Called Function
	SWDDS.2.1.9 RteSch_Task10ms
	SWDDS.2.2.8 RteApp_ReadSpdFilt
	SWDDS.2.2.17 RteApp_ReadDcCur
	SWDDS.2.2.14 RteApp_ReadCurOut
	SWDDS.2.2.22 RteApp_ReadMtrTrq
	SWDDS.2.2.51 RteApp_ReadOpufilt
	SWDDS.2.3.27 Rtelo_LoadEepromLong
	SWDDS.2.3.25 Rtelo_SendResMsg
Function Execution Time	N/A

Requirement Id	SWDDS.1.4.3.2
Target Milestone	EBS2
Element	AswAct
Risk	Mid
Interoperability	No
Criticality	Mid
Technical complexity	Mid
Verifiability	Yes

### 3.4.3.2.2 Static View Design



### 3.4.3.2.3 Dynamic View Design

- N/A

### 3.4.3.2.4 Interface Design

no	Name	Related SWDDS ID	Direction	Data Type	Raw Range		Physical Range		Resolution /Units	Description
					Min	Max	Min	Max		
1	response_message_s16ActualRotationalSpeed	SWDDS.2.2.8	IN	tS16	-6000	6000	-6000	6000	1 / rpm	Actual rotational speed
2	response_message_f16DcCurrentInput	SWDDS.2.2.17	IN	tFrac16	0	32767	0.0	64.4980	0.00196838 / Apk	DC current input q-axis current
3	response_message_f16CurrentOutputQ	SWDDS.2.2.14	IN	tFrac16	-32768	32767	-64.5	64.4980	0.00196838 / Apk	output
4	response_message_f16MotorTorque	SWDDS.2.2.22	IN	tFrac16	-32768	32767	-1.0	0.999969	0.0000305176 / Nm	Motor torque
5	response_message_u16OpufaultFlag	SWDDS.2.2.25	IN	tU16	0	4095	0x0000	0x0fff	N/A	OPU fault flag
6	eeprom_address	SWDDS.2.3.27	OUT	tU16	32	32	0x0020	0x0020	N/A	EEPROM memory address 32-bit
7	fault_count	SWDDS.2.3.27	IN	tU32	0	4294967295	0	4294967295	N/A	EEPROM data CAN
8	response_message	SWDDS.2.3.25	OUT	tCanMsgRes	N/A	N/A	N/A	N/A	N/A	response message to TCU