**Module Design Document**

**For**

**BmwDrvgDynStMac**

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**Prepared For:**

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**Table of Contents**

[1 Introduction 5](#_Toc511741466)

[1.1 Purpose 5](#_Toc511741467)

[1.2 Scope 5](#_Toc511741468)

[2 BmwDrvgDynStMac & High-Level Description 6](#_Toc511741469)

[3 Design details of software module 7](#_Toc511741470)

[3.1 Graphical representation of BmwDrvgDynStMac 7](#_Toc511741471)

[3.2 Data Flow Diagram 7](#_Toc511741472)

[3.2.1 Component level DFD 7](#_Toc511741473)

[3.2.2 Function level DFD 7](#_Toc511741474)

[4 Constant Data Dictionary 8](#_Toc511741475)

[4.1 Program (fixed) Constants 8](#_Toc511741476)

[4.1.1 Embedded Constants 8](#_Toc511741477)

[5 Software Component Implementation 9](#_Toc511741478)

[5.1 Sub-Module Functions 9](#_Toc511741479)

[5.1.1 Init: BmwDrvgDynStMacInit1 9](#_Toc511741480)

[5.1.2 Per: BmwDrvgDynStMacPer1 9](#_Toc511741481)

[5.2 Server Runables 9](#_Toc511741482)

[5.3 Interrupt Functions 9](#_Toc511741483)

[5.4 Module Internal (Local) Functions 10](#_Toc511741484)

[5.4.1 Local Function DetermineErrorMode 10](#_Toc511741485)

[5.4.2 Local Function Fac 10](#_Toc511741486)

[5.4.3 Local Function AssiLvlCnd 11](#_Toc511741487)

[5.4.4 Local Function CheckActivityTime 11](#_Toc511741488)

[5.4.5 Local Function CheckDeactivateTime 11](#_Toc511741489)

[5.4.6 Local Function ErrorIfTi 12](#_Toc511741490)

[5.4.7 Local Function StateMachine 12](#_Toc511741491)

[5.4.8 Local Function StateMachineInit 13](#_Toc511741492)

[5.4.9 Local Function StateMachineIfAvl 13](#_Toc511741493)

[5.4.10 Local Function StateMachineIfActv 14](#_Toc511741494)

[5.4.11 Local Function StateMachineStbEpsSts 14](#_Toc511741495)

[5.4.12 Local Function StateMachineEntry 15](#_Toc511741496)

[5.5 GLOBAL Function/Macro Definitions 16](#_Toc511741497)

[6 Known Limitations with Design 17](#_Toc511741498)

[7 UNIT TEST CONSIDERATION 18](#_Toc511741499)

[Appendix A Abbreviations and Acronyms 19](#_Toc511741500)

[Appendix B Glossary 20](#_Toc511741501)

[Appendix C References 21](#_Toc511741502)

# Introduction

## Purpose

Model Deign Document for CF089A\_BmwDrvgDynStMac\_Impl.

## Scope

The following definitions are used throughout this document:

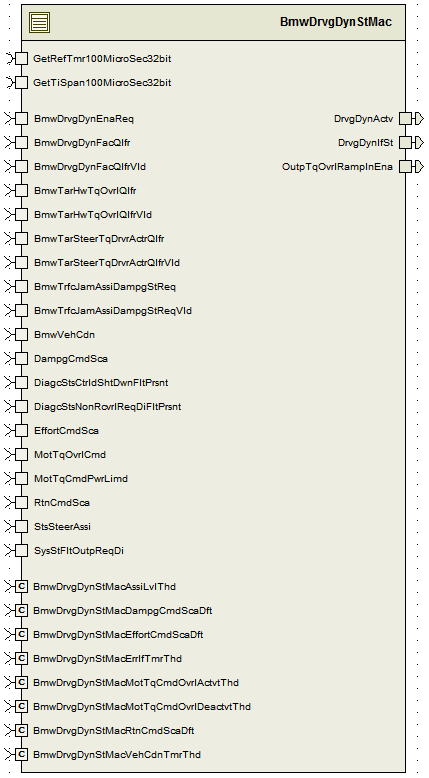
* **Shall**: indicates a mandatory requirement without exception in compliance.
* **Should**: indicates a mandatory requirement; exceptions allowed only with documented justification.
* **May**: indicates an optional action.

# BmwDrvgDynStMac & High-Level Description

The component implements the functionality of Driving Dynamics State Machine. It is based on requirements for DD State Machine in LH10716411 starting from ID\_6159. It outputs signals for CF083A and CF040A.

# Design details of software module

## Graphical representation of BmwDrvgDynStMac



## Data Flow Diagram

Refer FDD

### Component level DFD

None

### Function level DFD

None

# Constant Data Dictionary

## Program (fixed) Constants

### Embedded Constants

#### Local Constants

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
| \* |  |  |  |

\*Refer FDD for local constants

# Software Component Implementation

## Sub-Module Functions

The sub-module functions are grouped based on similar functionality that needs to be executed in a given “State” of the system (refer States and Modes). For a given module, the MDD will identify the type and number of sub-modules required. The sub-module types are described below.

### Init: BmwDrvgDynStMacInit1

#### Design Rationale

Refer FDD

#### Module Outputs

None

### Per: BmwDrvgDynStMacPer1

#### Design Rationale

Refer FDD

#### Store Module Inputs to Local copies

Refer FDD

#### (Processing of function)………

Refer FDD

#### Store Local copy of outputs into Module Outputs

Refer FDD

## Server Runables

None

## Interrupt Functions

None

## Module Internal (Local) Functions

### Local Function DetermineErrorMode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | DetermineErrorMode | Type | Min | Max |
| **Arguments Passed** | SysStFltOutpReqDi\_Cnt\_T\_logl | boolean | 0 | 1 |
|  | DiagcStsNonRcvrlReqDiFltPrsnt\_Cnt\_T\_logl | boolean | 0 | 1 |
|  | DiagcStsCtrldShtDwnFltPrsnt\_Cnt\_T\_logl | boolean | 0 | 1 |
|  | StsSteerAssi\_Cnt\_T\_enum | enum | 0 | 1 |
|  | BmwVehCdn\_Cnt\_T\_enum | enum | 1 | 15 |
| **Return Value** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "DetermineErrorMode" Simulink block

#### Processing

Refer FDD

### Local Function Fac

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | Fac | Type | Min | Max |
| **Arguments Passed** | EffortCmdSca\_Uls\_T\_f32 | float32 | 1 | 2 |
|  | DampgCmdSca\_Uls\_T\_f32 | float32 | 0 | 1 |
|  | RtnCmdSca\_Uls\_T\_f32 | float32 | 0 | 1 |
| **Return Value** | Fac\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "Fac" Simulink block

#### Processing

Refer FDD

### Local Function AssiLvlCnd

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | AssiLvlCnd | Type | Min | Max |
| **Arguments Passed** | MotTqCmdPwrLimd\_MotNwtMtr\_T\_f32 | float32 | -8.8 | 8.8 |
| **Return Value** | MotTqCmdPwrLimdActvtUppr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdPwrLimdActvtLowr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdPwrLimdDeactvtLowr\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "AssiLvlCnd" Simulink block

#### Processing

Refer FDD

### Local Function CheckActivityTime

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | CheckActivityTime | Type | Min | Max |
| **Arguments Passed** | MotTqCmdPwrLimdCdnActvt\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | MotTqCmdPwrLimdActvt\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "CheckActivity Time" Simulink block

#### Processing

Refer FDD

### Local Function CheckDeactivateTime

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | CheckDeactivateTime | Type | Min | Max |
| **Arguments Passed** | MotTqCmdPwrLimdCdnDeactvt\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | MotTqCmdPwrLimdDeactvt\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "CheckDeactivate Time" Simulink block

#### Processing

Refer FDD

### Local Function ErrorIfTi

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | ErrorIfTi | Type | Min | Max |
| **Arguments Passed** | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | ErrIfTi\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "ErrorIfTi" Simulink block

#### Processing

Refer FDD

### Local Function StateMachine

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateMachine | Type | Min | Max |
| **Arguments Passed** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | AllwTran\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | BmwTarHwTqOvrlQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwDrvgDynFacQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTarSteerTqDrvrActrQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTrfcJamAssiDampgStReq\_Cnt\_T\_enum | enum | 1 | 15 |
|  | Fac\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdOvrlEquZero\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdPwrLimd\_MotNwtMtr\_T\_f32 | float32 | -8.8 | 8.8 |
| **Return Value** | N/A |  |  |  |

#### Design Rationale

Implementation of "StateMachine" Simulink state machine

#### Processing

Refer FDD

### Local Function StateMachineInit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateMachineInit | Type | Min | Max |
| **Arguments Passed** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | AllwTran\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | BmwTarHwTqOvrlQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwDrvgDynFacQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTarSteerTqDrvrActrQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTrfcJamAssiDampgStReq\_Cnt\_T\_enum | enum | 1 | 15 |
|  | MotTqCmdPwrLimdActvtUppr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdPwrLimdActvtLowr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | N/A |  |  |  |

#### Design Rationale

Implementation of INIT State

#### Processing

Refer FDD

### Local Function StateMachineIfAvl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateMachineIfAvl | Type | Min | Max |
| **Arguments Passed** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | AllwTran\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | BmwTarHwTqOvrlQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwDrvgDynFacQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTarSteerTqDrvrActrQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTrfcJamAssiDampgStReq\_Cnt\_T\_enum | enum | 1 | 15 |
|  | MotTqCmdPwrLimdDeactvtLowr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | N/A |  |  |  |

#### Design Rationale

Implementation of IF\_AVL State

#### Processing

Refer FDD

### Local Function StateMachineIfActv

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateMachineIfActv | Type | Min | Max |
| **Arguments Passed** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | AllwTran\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | BmwTarHwTqOvrlQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwDrvgDynFacQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTarSteerTqDrvrActrQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTrfcJamAssiDampgStReq\_Cnt\_T\_enum | enum | 1 | 15 |
|  | ErrIfTi\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | N/A |  |  |  |

#### Design Rationale

Implementation of IF\_ACTV State

#### Processing

Refer FDD

### Local Function StateMachineStbEpsSts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateMachineStbEpsSts | Type | Min | Max |
| **Arguments Passed** | ErrMod\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | AllwTran\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | ErrIf\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | BmwTarHwTqOvrlQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwDrvgDynFacQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTarSteerTqDrvrActrQlfr\_Cnt\_T\_enum | enum | 2 | 15 |
|  | BmwTrfcJamAssiDampgStReq\_Cnt\_T\_enum | enum | 1 | 15 |
|  | Fac\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdOvrlEquZero\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | MotTqCmdPwrLimdActvtUppr\_Cnt\_T\_logl | boolean | FALSE | TRUE |
| **Return Value** | N/A |  |  |  |

#### Design Rationale

Implementation of STB\_EPS\_STS State

#### Processing

Refer FDD

### Local Function StateMachineEntry

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | StateSrvNotAvlStbEpsSts | Type | Min | Max |
| **Arguments Passed** | N/A |  |  |  |
| **Return Value** | DrvgDynActv\_Cnt\_T\_logl | boolean | FALSE | TRUE |
|  | DrvgDynIfSt\_Cnt\_T\_enum | enum | 32 | 255 |
|  | OutpTqOvrlRampInEna\_Cnt\_T\_logl | boolean | FALSE | TRUE |

#### Design Rationale

Implementation of "StateMachine" Entry sections

#### Processing

Refer FDD

## GLOBAL Function/Macro Definitions

None

# Known Limitations with Design

None

# UNIT TEST CONSIDERATION

None

1. Abbreviations and Acronyms

| **Abbreviation or Acronym** | **Description** |
| --- | --- |
| FDD | Functional Design Document. (See references) |

1. Glossary

**Note**: Terms and definitions from the source “Nexteer Automotive” take precedence over all other definitions of the same term. Terms and definitions from the source “Nexteer Automotive” are formulated from multiple sources, including the following:

* ISO 9000
* ISO/IEC 12207
* ISO/IEC 15504
* Automotive SPICE® Process Reference Model (PRM)
* Automotive SPICE® Process Assessment Model (PAM)
* ISO/IEC 15288
* ISO 26262
* IEEE Standards
* SWEBOK
* PMBOK
* Existing Nexteer Automotive documentation

| **Term** | **Definition** | **Source** |
| --- | --- | --- |
| MDD | Module Design Document |  |
| DFD | Data Flow Diagram |  |

1. References

| **Ref. #** | **Title** | **Version** |
| --- | --- | --- |
| 1 | AUTOSAR Specification of Memory Mapping (Link:[AUTOSAR\_SWS\_MemoryMapping.pdf](https://www.autosar.org/fileadmin/files/standards/classic/4-0/software-architecture/implementation-integration/standard/AUTOSAR_SWS_MemoryMapping.pdf)) | v1.4.0 R4.0 Rev 3 |
| 2 | MDD Guideline EA4 | 1.02 |
| 3 | EA4 Software Naming Conventions | 1.01 |
| 4 | Software Design and Coding Standards | 2.01 |
| 5 | CF089A\_BmwDrvgDynStMac\_Design | See Synergy Sub Project Version |