**Module Design Document**

**For**

**‘MotCurrRegVltgLimr’**

**VERSION: 5.0**

**DATE: 08-Nov-2017**

**Prepared By:**

**TATA ELXSI,**

**TRIVANDRUM, INDIA**

**Location:** The official version of this document is stored in the Nexteer Configuration Management System.

**Revision History**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Description** | **Author** | **Version** | **Date** |
| 1 | Initial Version | Selva Sengottaiyan | 1.0 | 26-May-2015 |
| 2 | Updated graphical representation and added local function information | Nick Saxton | 2.0 | 13-Apr-2016 |
| 3 | Updated for FDD v2.1.0 | Matthew Leser | 3.0 | 7-Nov-2016 |
| 4 | Updated to fix Anomaly EA4#9045 | Matthew Leser | 4.0 | 04-Jan-2017 |
| 5 | Updated for FDD v3.0.0 | TATA | 5.0 | 08-Nov-2017 |

**Table of Contents**

[1 Abbrevations And Acronyms 5](#_Toc497913771)

[2 References 6](#_Toc497913772)

[3 High-Level Description 7](#_Toc497913773)

[4 Design details of software module 8](#_Toc497913774)

[4.1 Graphical representation 8](#_Toc497913775)

[4.2 Data Flow Diagram 8](#_Toc497913776)

[4.2.1 Module level DFD 8](#_Toc497913777)

[4.2.2 Sub-Module level DFD 8](#_Toc497913778)

[4.3 COMPONENT FLOW DIAGRAM 8](#_Toc497913779)

[5 Variable Data Dictionary 9](#_Toc497913780)

[5.1 User defined typedef definition/declaration 9](#_Toc497913781)

[5.2 Variable definition for enumerated types 9](#_Toc497913782)

[6 Constant Data Dictionary 10](#_Toc497913783)

[6.1 Program(fixed) Constants 10](#_Toc497913784)

[6.1.1 Embedded Constants 10](#_Toc497913785)

[6.1.1.1 Local 10](#_Toc497913786)

[6.1.1.2 Global 10](#_Toc497913787)

[6.1.2 Module specific Lookup Tables Constants 10](#_Toc497913788)

[7 Software Module Implementation 11](#_Toc497913789)

[7.1 Sub-Module Functions 11](#_Toc497913790)

[7.1.1 Initialization Functions 11](#_Toc497913791)

[7.1.1.1 INIT: MotCurrRegVltgLimrInit1 11](#_Toc497913792)

[7.1.1.1.1 Design Rationale 11](#_Toc497913793)

[7.1.1.1.2 Module Outputs 11](#_Toc497913794)

[7.1.1.1.3 Module Internal 11](#_Toc497913795)

[7.1.2 PERIODIC FUNCTIONS 11](#_Toc497913796)

[7.1.2.1 INIT: MotCurrRegVltgLimrPER1 11](#_Toc497913797)

[7.1.2.1.1 Design Rationale 11](#_Toc497913798)

[7.1.2.1.2 Module Outputs 11](#_Toc497913799)

[7.1.3 Interrupt Functions 11](#_Toc497913800)

[7.1.4 Server runnables 12](#_Toc497913801)

[7.1.4.1.1 Store Local copy of outputs into Module Outputs 12](#_Toc497913802)

[7.1.5 Local Function/Macro Definitions 12](#_Toc497913803)

[7.1.5.1.1 Local function #1 12](#_Toc497913804)

[7.1.5.1.2 Local function #2 12](#_Toc497913805)

[7.1.5.1.3 Local function #3 12](#_Toc497913806)

[7.1.5.1.4 Local function #4 13](#_Toc497913807)

[7.1.5.1.5 Local function #5 13](#_Toc497913808)

[7.1.6 GLObAL Function/Macro Definitions 13](#_Toc497913809)

[7.1.7 Tranisition FUNCTIONS 13](#_Toc497913810)

[8 Known Limitations With Design 14](#_Toc497913811)

[9 UNIT TEST CONSIDERATION 15](#_Toc497913812)

[10 Appendix 16](#_Toc497913813)

# Abbrevations And Acronyms

|  |  |
| --- | --- |
| Abbreviation | Description |
| DFD | Design functional diagram |
| MDD | Module design Document |
| FDD | Functional Design Document |

# References

This section lists the title & version of all the documents that are referred for development of this document

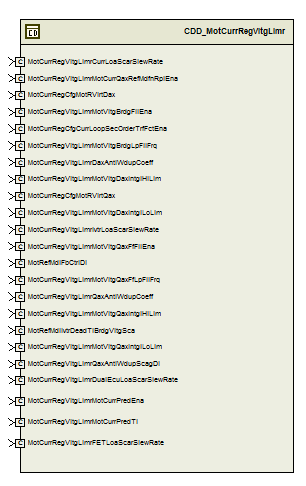
|  |  |  |
| --- | --- | --- |
| Sr. No. | Title | Version |
| 1 | MDD Guidelines | Process 4.02.01 |
| 2 | Software Naming Conventions | Process 4.02.01 |
| 3 | Software Design and Coding standards | 2.1 |
| 4 | FDD – SF105A\_MotCurrRegVltgLimr\_Design | See Synergy sub project version |
|  |  |  |

# High-Level Description

*None*

# Design details of software module

## Graphical representation



## Data Flow Diagram

*Refer FDD*

## Module level DFD

*Refer FDD*

## Sub-Module level DFD

*Refer FDD*

## COMPONENT FLOW DIAGRAM

*Refer FDD*

# Variable Data Dictionary

## User defined typedef definition/declaration

*<This section documents any user types uniquely used for the module.>*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Typedef Name | Element Name | User Defined Type | Legal Range  (min) | Legal Range  (max) |
| None |  |  |  |  |
|  |  |  |  |  |

## Variable definition for enumerated types

|  |  |  |
| --- | --- | --- |
| Enum Name | Element Name | Value |
| None |  |  |

# Constant Data Dictionary

## Program(fixed) Constants

## Embedded Constants

## Local

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
| MODIDXHILIM\_VOLT\_F32 | Single precision float | Volt | 1 |
| MODIDXLOLIM\_VOLT\_F32 | Single precision float | Volt | 0 |
| BITMASK1\_CNT\_U08 | Uint8 | CNT | 1U |
| BITMASK2\_CNT\_U08 | Uint8 | CNT | 2U |
| BITMASK4\_CNT\_U08 | Uint8 | CNT | 4U |

## Global

|  |
| --- |
| Constant Name |
|  |

## Module specific Lookup Tables Constants

*None*

# Software Module Implementation

## Sub-Module Functions

## Initialization Functions

*MotCurrRegVltgLimrInit1*

## INIT: MotCurrRegVltgLimrInit1

## Design Rationale

*Design follows implemenetation in FDD.*

## Module Outputs

*Refer ‘MotCurrRegVltgLimrInit’ block in FDD*

## Module Internal

None

## PERIODIC FUNCTIONS

## INIT: MotCurrRegVltgLimrPER1

## Design Rationale

## *As per FDD, dMotCurrRegVltgLimrMotVltgDecouplFbDax, dMotCurrRegVltgLimrMotVltgDecouplFbQax renamed with dMotCurrRegVltgLimrMotVltgDecoupldFbDax, dMotCurrRegVltgLimrMotVltgDecouplFbQax in the source file. And also dMotCurrRegVltgLimrMotCurrCmdErr(display variable) is nowhere used in source file. That variable davinci definition is removed.* Module Outputs

*Design follows implemenetation in FDD.*

## Interrupt Functions

*None*

## Server runnables

*None*

## Store Local copy of outputs into Module Outputs

*None*

## Local Function/Macro Definitions

## Local function #1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | KpKiCtrl | Type | Min | Max |
| **Arguments Passed** | MotPropGain\_Ohm\_T\_f32 | Float32 | 0 | 2.25 |
|  | MotIntglGain\_Ohm\_T\_f32 | Float32 | 0 | 3.6 |
|  | SysSt\_Cnt\_T\_enum | Enum | SYSST\_DI | SYSST\_WRMININ |
|  | CmdErr\_Ampr\_T\_f32 | Float32 | -200 | 400 |
|  | \*MotVltgIntglCmdPrev\_Volt\_T\_f32 | Float32 | -1000 | 1000 |
|  | \*MotCurrRegVltgLimrMotVltgPropCmd\_Volt\_T\_f32 | Float32 | -26.5 | 26.5 |
|  | \*MotCurrRegVltgLimrMotVltgIntglPreLim\_Volt\_T\_f32 | Float32 | -26.5 | 26.5 |
|  | MotVltgIntglLoLim\_Volt\_T\_f32 | Float32 | -31 | 0 |
|  | MotVltgIntglHiLim\_Volt\_T\_f32 | Float32 | 0 | 31 |
|  | \*MotVltgPropCmd\_Volt\_T\_f32 | Float32 | -26.5 | 26.5 |
|  | \*MotVltgIntglCmd\_Volt\_T\_f32 | Float32 | 6 | 26.5 |

\* MotVltgPropCmd\_Volt\_T\_f32 and \* MotVltgIntglCmd\_Volt\_T\_f32 are outputs of this function.

## Local function #2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | ErrorCalcQax | Type | Min | Max |
| **Arguments Passed** | QaxCurrCmd\_Ampr\_T\_f32 | Float32 | -200 | 200 |
|  | QaxRplCmd\_Ampr\_T\_f32 | Float32 | -29 | 29 |
|  | QaxCoggCmd\_Ampr\_T\_f32 | Float32 | -6 | 6 |
|  | QaxCurrModif\_Ampr\_T\_f32 | Float32 | -200 | 200 |
|  | \* QaxCmdFinal\_Ampr\_T\_f32 | Float32 | -200 | 200 |
| **Returns** | CmdErrQax\_Ampr\_T\_f32 | Float32 | -200 | 400 |

\*QaxCmdFinal\_Ampr\_T\_f32 is also an output of this function.

## Local function #3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | LoaScaFac | Type | Min | Max |
| **Arguments Passed** | CurrLoaMtgtnEn\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | IvtrLoaMtgtnEn\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | MotCtrlDualEcuMotCtrlMtgtnEna\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | FetLoaMtgtnEna\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | \*CurrLoaScaFac\_Uls\_T\_f32 | Float32 | 0 | 1 |
|  | \*IvtrLoaScaFac\_Uls\_T\_f32 | Float32 | 0 | 1 |
|  | \*DualEcuScaFac\_Uls\_T\_f32 | Float32 | 0 | 1 |
|  | \*FetScaFac\_Uls\_T\_f32 | Float32 | 0.0F | 1.0F |

\*CurrLoaScaFac\_Uls\_T\_f32, \*IvtrLoaScaFac\_Uls\_T\_f32, and \*DualEcuScaFac\_Uls\_T\_f32 are outputs of this function.

## Local function #4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | MotCurr\_Pred | Type | Min | Max |
| **Arguments Passed** | MotInduQaxEstimdIvs\_IvsHenry\_T\_f32 | Float32 | 2240 | 33334 |
|  | MotREstimd\_Ohm\_T\_f32 | Float32 | 0.005 | 0.12565 |
|  | CurrQax\_Ampr\_T\_f32 | Float32 | -200 | 200 |
|  | MotVltgQaxPrev\_Volt\_T\_f32 | Float32 | -26.5 | 26.5 |
|  | CurrDax\_Ampr\_T\_f32 | Float32 | -200 | 200 |
|  | MotVltgDaxPrev\_Volt\_T\_f32 | Float32 | -26.5 | 26.5 |
|  | MotBackEmfVltg\_Volt\_T\_f32 | Float32 | -101.25 | 101.25 |
|  | ReacncQax\_Ohm\_T\_f32 | Float32 | -0.5 | 0.5 |
|  | ReacncDax\_Ohm\_T\_f32 | Float32 | -0.5 | 0.5 |
|  | MotInduDaxEstimdIvs\_IvsHenry\_T\_f32 | Float32 | 2240 | 33334 |
|  | MotCurrRegVltgLimrMotCurrPredEna\_Cnt\_T\_f32 | Boolean | FALSE | TRUE |
|  | MotCtrlCurrPredTi\_NanoSec\_T\_f32 | Float32 | 0 | 125000 |
|  | \*MotCurrQaxPred\_Ampr\_T\_f32 | Float32 | -200 | 200 |
|  | \*MotCurrDaxPred\_Ampr\_T\_f32 | Float32 | -200 | 200 |

\*MotCurrQaxPred\_Ampr\_T\_f32 and \*MotCurrDaxPred\_Ampr\_T\_f32 are outputs of this function.

## Local function #5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | Decoder | Type | Min | Max |
| **Arguments Passed** | MotAndThermProtnLoaMod\_Cnt\_T\_u08 | Uint8 | OU | 255U |
|  | CurrMeasLoaMtgtnEna\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | IvtrLoaMtgtnEna\_Cnt\_T\_logl | Boolean | FALSE | TRUE |
|  | FetLoaMtgtnEna\_Cnt\_T\_logl | Boolean | FALSE | TRUE |

\* CurrMeasLoaMtgtnEna\_Cnt\_T\_logl, \*IvtrLoaMtgtnEna\_Cnt\_T\_logl, \*FetLoaMtgtnEna\_Cnt\_T\_logl are outputs of this function.

## GLObAL Function/Macro Definitions

None

## Tranisition FUNCTIONS

None

# Known Limitations With Design

None

# UNIT TEST CONSIDERATION

None

# Appendix

*None*