**Module Design Document**

**For**

**PSASH**

**May 11, 2016**

**Prepared For:**

**Software Engineering**

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**Saginaw, MI, USAChange History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Author** | **Version** | **Date** |
| Initial Version | Sankardu Varadapureddi | 1.0 | 5/11/2016 |
| FDD deviation for ‘PSASH\_ApaEnaRgln\_Cnt\_M\_lgc’ usage is described | Sankardu Varadapureddi | 2.0 | 5/20/2016 |
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# Introduction

## Purpose

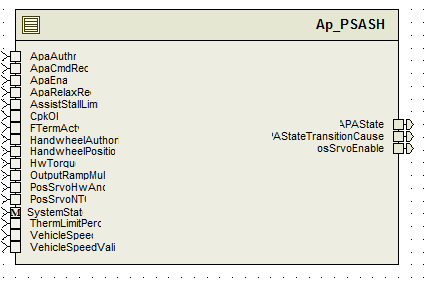
## Scope

# PSASH High-Level Description

# Design details of software module

*Refer FDD.*

## Graphical representation of PSASH



## Data Flow Diagram

Refer FDD

### Module level DFD

### Sub-Module level DFD

## Component diagram

*Refer FDD*

## Variable Data Dictionary

### User defined ‘typedef’ definition/declaration

None

### Variable definition for enumerated types

None

## Constant Data Dictionary

### Program Constants

#### Local Constants

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
|  |  |  |  |
|  |  |  |  |

#### Global Constants

Refer .m file

### Module Specific Lookup Tables

None

## Software Module Implementation

### Sub-Module Functions

#### Initialization sub-module {PSASH\_Init1()}

Refer FDD for the functionality.

#### Periodic sub-module {PSASH\_Per1 ()}

Refer FDD for the functionality.

Following deviations are done in the SW implementation:

1. In FDD, 'PSASH\_ApaEnaRgln\_Cnt\_M\_lgc' flag is set within ‘PSASH\_CONTROL\_PROGRESS entry' sub block. In SW implementation, 'PSASH\_ApaEnaRgln\_Cnt\_M\_lgc' is set to TRUE in main periodic function. Entire logic corresponds to 'PSASH\_ApaEnaRgln\_Cnt\_M\_lgc' in FDD need to be updated to be in line with SW implementation.
2. In ‘Determine Apa Allowed’ block, float variable ‘OutputRampMult\_Uls\_f32’ is compared to ‘D\_ONE\_ULS\_F32’ for equality. This float equality operation is not allowed. So in SW implementation, this float variable is converted to fixed integer before comparison.
3. ‘SystemState\_Cnt\_enum’ range should be ‘0’ to ‘4’ and initial value should be ‘3’ in .m file
4. Requirement traceability to be corrected in FDD.

Above deviations confirmed with FDD owner and FDD will be updated inline with current SW implementation in next FDD updates.

#### Non Periodic sub-module {\_NONPer()}

None

### Interrupt Service Routines

None

### \_SCOMM () Functions

None

### Module Internal (Local) Functions

## Local Function #1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | Chk\_Progs\_Exit\_Conds | Type | Min | Max |
| **Arguments Passed** | FaultActv\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ThrmlLmtReached\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | VehSpdTooHigh\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | HwActionMaxReached\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaCmdReq\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaAllowed\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaRelaxReq\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | HwPosCmdErr\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | MtrStalled\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
| **Return Value** | N/A |  |  |  |

## Description

Checks all exit paths from 'PSASH\_PROGRESS entry' state.

## Local Function #2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | Chk\_Available\_Exit\_Conds | Type | Min | Max |
| **Arguments Passed** | ApaAllowed\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaCmdReq\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | VehSpdTooHigh\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | MtrStalled\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | HwActionMinReached\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
| **Return Value** | None |  |  |  |

## Description

Checks all exit paths from 'PSASH\_AVAILABLE\_READY / PSASH\_AVAILABLE\_TRANSITIONCAUSE entry' states.

## Local Function #3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | Chk\_UnAvailableReady\_Exit\_Conds | Type | Min | Max |
| **Arguments Passed** | FaultActv\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaEna\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | ApaAllowed\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
| **Return Value** | None |  |  |  |

## Description

Checks all exit paths from 'PSASH\_Unavailable\_ready' state.

## Local Function #4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | IsVehicleSpeedAbvThd | Type | Min | Max |
| **Arguments Passed** | Sig\_Uls\_T\_f32 | float32 | 0 | 511 |
|  | Thd\_Uls\_T\_f32 | float32 | 0 | 10000 |
| **Return Value** | ThdExcdd\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

If 'Sig\_Uls\_T\_f32' is greater than 'Thd\_Uls\_T\_f32', return TRUE.

## Local Function #5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | IsThermLimitAbvThd | Type | Min | Max |
| **Arguments Passed** | Sig\_Uls\_T\_f32 | float32 | 0 | 1 |
|  | Thd\_Uls\_T\_f32 | float32 | 0 | 10000 |
| **Return Value** | ThdExcdd\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

If 'Sig\_Uls\_T\_f32' is greater than or equal to 'Thd\_Uls\_T\_f32', return TRUE.

## Local Function #6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | IsAssistStallBlwThd | Type | Min | Max |
| **Arguments Passed** | Sig\_Uls\_T\_f32 | float32 | 0 | 8.8 |
|  | Thd\_Uls\_T\_f32 | float32 | 0 | 10000 |
| **Return Value** | ThdExcdd\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

If 'Sig\_Uls\_T\_f32' is less than or equal 'Thd\_Uls\_T\_f32', return TRUE.

## Local Function #7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | DtrmnApaAllwd | Type | Min | Max |
| **Arguments Passed** | ApaAuthn\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | HandwheelAuthority\_Uls\_T\_f32 | float32 | 0 | 1 |
|  | OutputRampMult\_Uls\_T\_f32 | float32 | 0 | 1 |
| **Return Value** | ApaAllowed\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

Implementation of "Determine Apa Allowed" block.

## Local Function #8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | DtrmnRglnErr | Type | Min | Max |
| **Arguments Passed** | HandwheelPosition\_HwDeg\_T\_f32 | float32 | -1440 | 1440 |
|  | PosSrvoHwAngle\_HwDeg\_T\_f32 | float32 | -780 | 780 |
| **Return Value** | HwPosCmdErr\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

Implementation of "Determine Regulation Errors" block.

## Local Function #9

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | HwIntv | Type | Min | Max |
| **Arguments Passed** | HwTorque\_HwNm\_T\_f32 | float32 | -10 | 10 |
|  | \*HwActionMinReached\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | \*HwActionMaxReached\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
| **Return Value** | None |  |  |  |

## Description

Implementation of "Handwheel intervention" block. ‘HwActionMinReached\_Cnt\_T\_lgc’ and ‘HwActionMaxReached\_Cnt\_T\_lgc’ are the

outputs of this function.

## Local Function #10

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Name** | DtrmnSysFlt | Type | Min | Max |
| **Arguments Passed** | VehicleSpeedValid\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | CpkOk\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | PosSrvoNTC\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
|  | FTermActv\_Cnt\_T\_lgc | boolean | FALSE | TRUE |
| **Return Value** | FaultActv\_Cnt\_T\_lgc | boolean | FALSE | TRUE |

## Description

Implementation of "Determine Regulation Errors" block.

### Transition Functions

None

# Known Limitations with Design

None

# UNIT TEST CONSIDERATION

None

Abbreviations and Acronyms

| **Abbreviation or Acronym** | **Description** |
| --- | --- |
|  |  |
|  |  |

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 |  |

References

| **Ref. #** | **Title** | **Version** |
| --- | --- | --- |
| 1 | AUTOSAR Specification of Memory Mapping (Link:[AUTOSAR\_SWS\_MemoryMapping.pdf](http://www.autosar.org/download/R4.0/AUTOSAR_SWS_MemoryMapping.pdf)) | v1.3.0 R4.0 Rev 2 |
| 2 | MDD Guideline | EA3 01.04.00 |
| 3 | [Software Naming Conventions.doc](http://misagweb01.nexteer.com/eRoomReq/Files/erooms8/NextGeneration/0_fc55f/Software%20Naming%20Conventions%2003x(In%20Work).doc) | 2.0 |
| 4 | [Software Design and Coding Standards.doc](http://eroom1.nexteer.com/eRoomReq/Files/erooms8/NextGeneration/0_1a67a9/Software%20Design%20and%20Coding%20Standards.doc) | 2.1 |
| 5 | CF013B\_PSASH\_Design | 1.1.0 |