**Module Design Document**

**For**

**AssiHiFrq**

**February 15, 2017**

**Prepared For:**

**Software Engineering**

**Nexteer Automotive,**

**Saginaw, MI, USA**

**Prepared By:**

**Matthew Leser,**

**Nexteer Automotive,**

**Saginaw, MI, USA**

**Change History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Author** | **Version** | **Date** |
| Initial Version | Kathleen Creager | 01.00.00 | 04-Aug-2015 |
| Updated per design vers. 1.1.0 | Matthew Leser | 2.0 | 09-Feb-2017 |
| Updated to include Unit Test Consideration | Matthew Leser | 3.0 | 15-Feb-2017 |

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# AssiHiFrq High-Level Description

Implements the SF028A\_AssiHiFrq\_Design FDD. This function provides a means of compensating for system

inertia and road feedback. It is tunable over both vehicle speed and handwheel torque to obtain the desired

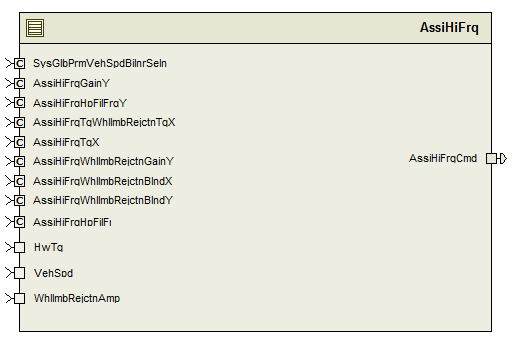
level of disturbance rejection under various operating conditions. It passes handwheel torque through a high-pass

filter and multiplies the resulting signal by a tunable gain factor. The output is known as high-frequency assist

and is simply added to the usual assist calculated elsewhere

# Design details of software module

## Graphical representation of AssiHiFrq



## Data Flow Diagram

### Component level DFD

### Function level DFD

# Constant Data Dictionary

## Program (fixed) Constants

### Embedded Constants

#### Local Constants

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
| None | <Refer MDD guidelines [1]> | <Refer MDD guidelines [1]> | <Refer MDD guidelines [1]> |

# Software Component Implementation

## Sub-Module Functions

## Init: AssiHiFrqInit1

## Design Rationale

Init function is present in DataDict.m file but not shown in FDD model, and no initialization logic is needed. This is implemented as an empty function.

## Module Outputs

None

## Per: AssiHiFrqPer1

## Design Rationale

FDD model does not contain a block named AssiHiFrqPer1; this function implements the AssiHiFrq block.

BilnrIntrpnWithRound\_u16\_u16MplXu16MplY function from NxtrIntrpn library used to implement the 2-D Lookup tables in the SF028A\_AssiHiFrq/AssiHiFrq/AssiHiFrq/Determine Gain model block.

Blnd\_f32 function from NxtrMath library used to implement the part of the model that computes GainVal\_MtrNmpHwNm from the outputs of the three bilinear interpolation functions in the SF028A\_AssiHiFrq/AssiHiFrq/AssiHiFrq/Determine Gain model block.

FilHpUpdGain and FilHpUpdOutp\_f32 functions from the NxtrFil library used to implement HP-CF Filter block in the SF028A\_AssiHiFrq/AssiHiFrq/AssiHiFrq model block.

A note in the model mentions that the frequency lookup table for the high pass filter cutoff frequency could be converted to the filter gain values at initialization. This was not done because the DataDict.m file did not contain the necessary IRV for the converted table, and the FilHpUpdGain library function expects frequency in Hz; if this throughput improvement (converting the frequency table once in initialization) is made in the future, a new version of FilHpUpdGain will be needed.

LnrIntrpn\_u16\_u16VariXu16VariY function from NxtrIntrpn library used to implement the “freq lookup” block in the SF028A\_AssiHiFrq/AssiHiFrq/AssiHiFrq model block.

## Store Module Inputs to Local copies

See FDD

## (Processing of function)………

See FDD, and design rationale noted above.

## Store Local copy of outputs into Module Outputs

See FDD

## Server Runables

None

## Interrupt Functions

None

## Module Internal (Local) Functions

None

## GLOBAL Function/Macro Definitions

None

# Known Limitations with Design

None

# UNIT TEST CONSIDERATION

PIL Testers: Do not use MIL vectors which have input signals outside the range +/- one billion because these vectors are not per the current MIL test guidelines.

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 | EA4 01.00.00 |
| 3 | EA4 [Software Naming Conventions.doc](http://misagweb01.nexteer.com/eRoomReq/Files/erooms8/NextGeneration/0_fc55f/Software%20Naming%20Conventions%2003x(In%20Work).doc) | 01.00.00 |
| 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 | SF028A\_AssiHiFrq\_Design | See Synergy subproject version |