**Module Design Document**

**For**

**Customer Battery Voltage Diagnostics**

**VERSION: 3**

**DATE: 09-April-2018**

**Revision History**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Description** | **Author** | **Version** | **Date** |
| 1 | Initial version | Steve Horwath | 1 | 15-Oct-2014 |
| 2 | Input update, cleanup | Owen Tosh | 2 | 14-Jan-2015 |
| 3 | Updates for SCIR 003B | Owen Tosh | 3 | 20-Jul-2015 |
| 4 | Corrected E8 timer conditions | Owen Tosh | 4 | 14-Sept-2015 |
| 5 | Implemented NTC E9 | Owen Tosh | 5 | 24-Nov-2015 |
| 6 | Update for EA3#15023 (bat diag window) | Robert Konieczny | 2 | 09-Jan-2018 |
| 7 | Update for EA3#18862 (UnitTest low path coverage) | Mateusz Bartocha | 3 | 09-April-2018 |

Watch out those revision numbers. After copy from BMPV it wasn't reset as it was in Synergy

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# Abbrevations And Acronyms

|  |  |
| --- | --- |
| Abbreviation | Description |
| MDD | Module design Document |

# References

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

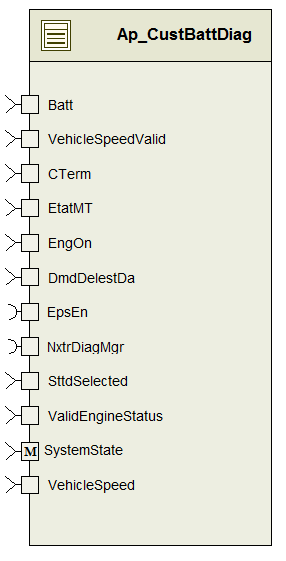
|  |  |  |
| --- | --- | --- |
| Sr. No. | Title | Version |
| 1 | MDD Guidelines | 1 |
| 2 | Software Naming Conventions | 1 |
| 3 | Coding Standands | 1 |
| 4 | PSA CMP SCIR | 002H |

# Battery Voltage Diagnostic High-Level Description

This module is responsible for applying voltage and time based hysteresis to the battery voltage to determine customer specific over voltage and low voltage faults. Requirements for all these faults are detailed in the SCIR.

# Design details of software module

## Graphical representation of CustBattDiag



## Data Flow Diagram

None

## Module level DFD

None

## Sub-Module level DFD

None

## COMPONENT FLOW DIAGRAM

None

# Variable Data Dictionary

## User defined typedef definition/declaration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Typedef Name | Element Name | User Defined Type | Legal Range  (min) | Legal Range  (max) |
| CustBattDiagNtcConfig\_T | upperWindowThresh\_Cnt\_u16  upperVoltage\_volt\_u10p6  lowerWindowThresh\_Cnt\_u16  lowerVoltage\_volt\_u10p6  NtcNum  upperStatus  lowerStatus | Const uint16\*  Const u10p6\_T\*  Const uint16\*  Const u10p6\_T\*  Const NTCNumber  Const NxtrDiagMgrStatus  Const NxtrDiagMgrStatus | 0x00000000u  0x00000000u  0x00000000u  0x00000000u  0  0  0 | 0xFFFFFFFFu  0xFFFFFFFFu  0xFFFFFFFFu  0xFFFFFFFFu  511  255  255 |
| CustBattDiagNtcTimer\_T | detectWindow\_Cnt\_M\_u32  notDetectWindow\_Cnt\_M\_u32 | uint32  uint32 | 0x00000000u  0x00000000u | 0xFFFFFFFFu  0xFFFFFFFFu |

## Variable definition for enumerated types

|  |  |  |
| --- | --- | --- |
| Enum Name | Element Name | Value |
| CustBattDiagNtc\_T | CustBattDiagNtc\_E0  CustBattDiagNtc\_E1  CustBattDiagNtc\_E2  CustBattDiagNtc\_E5  CustBattDiagNtc\_E6  CustBattDiagNtc\_E7  CustBattDiagNtc\_E8  CustBattDiagNtc\_E9  CustBattDiagNtc\_No | 0  1  2  3  4  5  6  7  8 |

# Constant Data Dictionary

## Program(fixed) Constants

## Embedded Constants

## Local

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
| D\_TESTFAILED\_CNT\_U08 | 1 | Count | 0 |
| D\_TESTPASSED\_CNT\_U08 | 1 | Count | 1 |
| D\_INDEADBAND\_CNT\_U08 | 1 | Count | 2 |
| D\_NTC\_E0\_FAILURE\_ETAT\_MT\_FLAG\_CNT\_U16 | 1 | Bitfield | 0x2464u |
| D\_NTC\_E1\_FAILURE\_ETAT\_MT\_FLAG\_CNT\_U16 | 1 | Bitfield | 0x000Au |
| D\_NTC\_E2\_FAILURE\_ETAT\_MT\_FLAG\_CNT\_U16 | 1 | Bitfield | 0x207Au |
| D\_NTC\_E6\_FAILURE\_ETAT\_MT\_FLAG\_CNT\_U16 | 1 | Bitfield | 0x0010u |
| D\_NTC\_E9\_FAILURE\_ETAT\_MT\_FLAG\_CNT\_U16 | 1 | Bitfield | 0x001Au |
| D\_IMAGINARY\_IGN\_ON\_VOLTS\_U10P6 | 1 | Count | 12\*(2^6) |
| D\_IMAGINARY\_IGN\_ON\_VOLTS\_THRESH\_U10P6 | 1 | Count | 8\*(2^6) |
| D\_IMAGINARY\_IGN\_UNKNWN\_VOLTS\_U10P6 | 1 | Count | 6\*(2^6) |
| D\_IMAGINARY\_IGN\_OFF\_VOLTS\_THRESH\_U10P6 | 1 | Count | 4\*(2^6) |
| D\_IMAGINARY\_IGN\_OFF\_VOLTS\_U10P6 | 1 | Count | 0\*(2^6) |
| k\_LOINotDetect\_Volts\_u10p6 | 1 | Count | D\_IMAGINARY\_IGN\_ON\_VOLTS\_THRESH\_U10P6 |
| k\_LOIDetect\_Volts\_u10p6 | 1 | Count | D\_IMAGINARY\_IGN\_OFF\_VOLTS\_THRESH\_U10P6 |
| CustBattDiagNtcConfig\_Str |  | Struct | { /\* CustBattDiagNtc\_E0 \*/  &k\_LVCNotDetect\_ms\_u16p0,  &k\_LVCNotDetect\_Volts\_u10p6,  &k\_LVCDetect\_ms\_u16p0,  &k\_LVCDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_00,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E1 \*/  &k\_LVHSNotDetect\_ms\_u16p0,  &k\_LVHSNotDetect\_Volts\_u10p6,  &k\_LVHSDetect\_ms\_u16p0,  &k\_LVHSDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_01,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E2 \*/  &k\_LVLSNotDetect\_ms\_u16p0,  &k\_LVLSNotDetect\_Volts\_u10p6,  &k\_LVLSDetect\_ms\_u16p0,  &k\_LVLSDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_02,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E5 \*/  &k\_CBDiagc\_UnderVltgNotDetd\_mS\_u16p0,  &k\_UVNotDetect\_Volts\_u10p6,  &k\_CBDiagc\_UnderVltgDetd\_mS\_u16p0,  &k\_UVDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_05,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E6 \*/  &k\_LVSMNotDetect\_ms\_u16p0,  &k\_LVSMNotDetect\_Volts\_u10p6,  &k\_LVSMDetect\_ms\_u16p0,  &k\_LVSMDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_06,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E7 \*/  &k\_CBDiagc\_OverVltgDetd\_mS\_u16p0,  &k\_CBDiagc\_OverVltgDetd\_Volt\_u10p6,  &k\_CBDiagc\_OverVltgNotDetd\_mS\_u16p0,  &k\_CBDiagc\_OverVltgNotDetd\_Volt\_u10p6,  NTC\_Num\_VLF\_07,  NTC\_STATUS\_FAILED,  NTC\_STATUS\_PASSED  },  { /\* CustBattDiagNtc\_E8 \*/  &k\_LOINotDetect\_ms\_u16p0,  &k\_LOINotDetect\_Volts\_u10p6,  &k\_LOIDetect\_ms\_u16p0,  &k\_LOIDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_08,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  },  { /\* CustBattDiagNtc\_E9 \*/  &k\_LVNNotDetect\_ms\_u16p0,  &k\_LVNNotDetect\_Volts\_u10p6,  &k\_LVNDetect\_ms\_u16p0,  &k\_LVNDetect\_Volts\_u10p6,  NTC\_Num\_VLF\_09,  NTC\_STATUS\_PASSED,  NTC\_STATUS\_FAILED  } |

## Global

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Units | Value |
| kDMD\_DELEST\_DA\_Not\_Requested | 1 | count | 0 |
| kETAT\_MT\_Autonomous\_Restart | 1 | count | 13 |
| kETAT\_MT\_Autonomous\_Starting | 1 | count | 10 |
| kETAT\_MT\_Cut | 1 | count | 1 |
| kETAT\_MT\_Degraded\_Restart | 1 | count | 6 |
| kETAT\_MT\_Driven\_Restart | 1 | count | 5 |
| kETAT\_MT\_Engine\_Running | 1 | count | 3 |
| kETAT\_MT\_Starting | 1 | count | 2 |
| kETAT\_MT\_Stopped | 1 | count | 4 |
| NTC\_Num\_DataOtherFltMsg\_Q | 1 | count | 326 |
| NTC\_Num\_InvalidMsg\_Q | 1 | count | 320 |
| NTC\_Num\_MissingMsg\_Q | 1 | count | 321 |
| NTC\_Num\_VLF\_00 | 1 | count | 224 |
| NTC\_Num\_VLF\_01 | 1 | count | 225 |
| NTC\_Num\_VLF\_02 | 1 | count | 226 |
| NTC\_Num\_VLF\_05 | 1 | count | 229 |
| NTC\_Num\_VLF\_06 | 1 | count | 230 |
| NTC\_Num\_VLF\_07 | 1 | count | 231 |
| NTC\_Num\_VLF\_08 | 1 | count | 232 |
| NTC\_Num\_VLF\_09 | 1 | count | 233 |
| NTC\_STATUS\_FAILED | 1 | count | 1 |
| NTC\_STATUS\_PASSED | 1 | count | 0 |
| RTE\_MODE\_StaMd\_Mode\_OPERATE | 1 | count | 2 |
| FALSE | 1 | bool | 0 |
| TRUE | 1 | bool | 1 |



## Module specific Lookup Tables Constants

|  |  |  |  |
| --- | --- | --- | --- |
| Constant Name | Resolution | Value | Software Segment |
| None |  |  |  |

## Library Functions / Macros

FPM\_InitFixedPoint\_m()

FPM\_FloatToFixed\_m()

## Data Hiding Functions

None

# Software Module Implementation

## Initialization Functions

None

## PERIODIC FUNCTIONS

## Per: CustBattDiag\_Per1

## Design Rationale

The under voltage and over voltage diagnostics(NTC 0xE5 and 0xE7) are specified to run in all states and at a 10ms rate. Due to the faster diagnostic timing and different enable conditions, these two NTCs were moved into their own periodic.

## Store Module Inputs to Local copies

Rte\_Call\_SystemTime\_GetSystemTime\_mS\_u32(&SystemTime\_mS\_T\_u32);

BattVoltage\_Volts\_T\_f32 = Rte\_IRead\_CustBattDiag\_Per1\_Batt\_Volt\_f32();

## Ntc 0xE5 and 0xE7 Diagnostics



## Store Local copy of outputs into Module Outputs

None

## Per: CustBattDiag\_Per2

## Design Rationale

The battery voltage diagnostics were split into two periodics. Per1 handles the faster 10ms diagnostics while Per2 handles the res, on 100ms rate.

## Store Module Inputs to Local copies

BattVoltage\_Volts\_T\_f32 = Rte\_IRead\_CustBattDiag\_Per2\_Batt\_Volt\_f32();

BattVoltage\_Volts\_T\_u10p6 = FPM\_FloatToFixed\_m(BattVoltage\_Volts\_T\_f32, u10p6\_T);

VehSpd\_Kph\_T\_f32 = Rte\_IRead\_CustBattDiag\_Per2\_VehicleSpeed\_Kph\_f32();

EngOn\_Cnt\_T\_lgc = Rte\_IRead\_CustBattDiag\_Per2\_EngOn\_Cnt\_lgc();

EtatMtBitfield\_Cnt\_T\_u16 = (uint16)1u << Rte\_IRead\_CustBattDiag\_Per2\_EtatMT\_Cnt\_u08();

SttdSelcted\_Cnt\_T\_lgc = Rte\_IRead\_CustBattDiag\_Per2\_SttdSelected\_Cnt\_lgc();

ValidEngineStatus\_Cnt\_T\_lgc = Rte\_IRead\_CustBattDiag\_Per2\_ValidEngineStatus\_Cnt\_lgc();

VehSpdValid\_Cnt\_T\_lgc = Rte\_IRead\_CustBattDiag\_Per2\_VehicleSpeedValid\_Cnt\_lgc();

CTerm\_Cnt\_T\_lgc = Rte\_IRead\_CustBattDiag\_Per2\_CTerm\_Cnt\_lgc();

DmdDelest\_Cnt\_T\_u08 = Rte\_IRead\_CustBattDiag\_Per2\_DmdDelestDa\_Cnt\_u08();

SystemState\_Cnt\_T\_enum = Rte\_Mode\_SystemState\_Mode();

(void)Rte\_Call\_SystemTime\_GetSystemTime\_mS\_u32(&SystemTime\_mS\_T\_u32);

(void)Rte\_Call\_NxtrDiagMgr\_GetNTCFailed(NTC\_Num\_InvalidMsg\_Q, &InvalidMsg\_Cnt\_T\_u08);

(void)Rte\_Call\_NxtrDiagMgr\_GetNTCFailed(NTC\_Num\_MissingMsg\_Q, &MissingMsg\_Cnt\_T\_u08);

(void)Rte\_Call\_NxtrDiagMgr\_GetNTCFailed(NTC\_Num\_DataOtherFltMsg\_Q, &InvalidPwrCutReq\_Cnt\_T\_u08);

## Battery Voltage Diagnostics



## Store Local copy of outputs into Module Outputs

None

## Interrupt Functions

None

## TRANSIENT FUNCTIONS

None

## Serial Communication Functions

None

## Local Function/Macro Definitions

## CustBattDiag\_GetImaginaryIgnVoltage

## Description

Function converts high level logic signal conditions given on input to artificial ignition voltage level which later can be qualified by generic functionality of this component.



## CustBattDiag\_ReportFaultWithHisteresis



## Description

For given NTC, basing on given conditions and voltage level, function qualifies/dequalifies fault applying hysteresis on voltage and taking conditions straight (no hysteresis).



## GLObAL Function/Macro Definitions

FPM\_InitFixedPoint\_m()

FPM\_FloatToFixed\_m()

Rte\_Call\_SystemTime\_GetSystemTime\_mS\_u32()

Rte\_Call\_SystemTime\_DtrmnElapsedTime\_mS\_u16()

Rte\_Call\_NxtrDiagMgr\_GetNTCFailed()

Rte\_Call\_NxtrDiagMgr\_SetNTCStatus()

# Known Limitations With Design

# UNIT TEST CONSIDERATION

Path coverage issues caused by Nexteer library macros are allowed in EA3.

# Appendix A – Configuration Schemes