## 1.1 Battery State Control (BSC)

**1.1.1 Feature Objective:**

The objective of designing the battery state control (BSC) system is to monitor the wake-up signals for the Battery Management System and send appropriate commands to Contactor Control. It also monitors if any feature raises a fault and takes appropriate action according to type of fault. BSC makes sure that the contactors are engaged only in the case when there is no fault and makes sure the key is cycled once a fault is cleared.

**1.1.2 Functional Description:**

BSC cycles through following functions at every timestep:

1) Fault Check : Monitors if any subsystem has raised a fault. If a fault is raised then it is classified into Low, Medium or Severe Fault.

2) Key cycle after a Medium Fault : Checks if the key has been cycled after a medium fault is cleared.

3) Sleep Mode Check : A sleep flag is raised when the battery is being charged through socket charging and crosses max State of Charge percentage set as a calibration.

4) Contactor Command to Contactor Control :

Main Contactor Command to Contactor Control : The signal to engage Main Contactor is sent to Contactor Control when :

1. BMS Power is ON &
2. Vehicle wake up signal is HIGH &
3. Key has been cycled after Medium Fault

Signal to disengage the Main Contactor is sent to Contactor Control when :

1. Vehicle wake up signal is LOW or
2. Medium/Severe Fault occurs

Charger Contactor Command to Contactor Control : The signal to engage Main Contactor is sent to Contactor Control when :

1. BMS Power is ON &
2. Charger wake up signal is HIGH &
3. Key has been cycled after Medium Fault

Signal to disengage the Main Contactor is sent to Contactor Control when :

1. Charger wake up signal is LOW OR
2. Sleep flag is raised for the battery OR
3. Medium/Severe Fault occurs

Incase of a low fault and indicator is given to the user. Incase of a medium fault the contactors are disengaged. The contactors are not engaged unless the key cycled after the fault is cleared. Incase of Severe fault the contactors are disengaged and cannot be engaged again.

5) Incase of a fault which leads to the command of opening the contactor, the fault which caused it is broadcasted.

6) CVTN supply signal command is high whenever Vehicle or Charger wake up signal is high.

**1.1.3 I/O description:**

The BSC feature requires the dynamic I/O shown in the following table

|  |  |  |  |
| --- | --- | --- | --- |
| **Signal(s)** | **I/O** | **Description** | **Units/comments** |
| vehicle\_PSR | Input | Vehicle wake-up signal | state |
| charger\_PSR | Input | Charger wake-up signal | state |
| key | Input | Vehicle key signal to check key cycle | state |
| soc\_pack\_actual | Input | Actual SOC of the battery | percentage |
| faults | Input | Faults from different sub-systems | State |
| bsc\_CVTN\_supply\_signal | Output | Supply signal for slave module of BMS | State |
| bsc\_main\_cc\_cmd | Output | Main Contactor signal to Contactor Control | state |
| bsc\_chg\_cc\_cmd | Output | Charger Contactor signal to Contactor Control | State |
| bsc\_sleep\_status | Output | Sleep status of battery for battery mode feature | State |
| bsc\_reason\_to\_open\_CAN | Output | Fault number which opened which commanded to open the contactors | State |
| bsc\_severemed\_fault | Output | Is high if a severe or medium fault occurs | State |
| bsc\_low\_fault | Output | Is high if a low fault occurs | State |
| bsc\_fault\_type | Output | Fault number incase of a fault | State |
|  |  |  |  |

**1.1.4 Fault Management:**

Currently BSC accept the faults given in the table below. This can be increased to as many faults as needed, though each fault has to be given a unique number and should be calibrated as low, medium or high fault.

|  |  |  |
| --- | --- | --- |
| Fault | Type | Condition |
| Severe\_User\_Induced | 1 | Severe |
| Medium\_User\_Induced | 2 | Medium |
| Low\_User\_Induced | 3 | Low |
| VITM\_CellsTemperaturesLow | 4 | Low |
| VITM\_CellsTemperaturesHigh | 5 | Low |
| VITM\_CellsVoltagesLow | 6 | Low |
| VITM\_CellsVoltagesHigh | 7 | Low |
| VITM\_PackVoltage | 8 | Low |
| VITM\_PackCurrent | 9 | Low |
| VITM\_HVIL | 10 | Medium |
| CC\_Precharge | 11 | Medium |

Type 1,2,3 can be induced manually as a signal to test functionality of BSC in case of each fault